

The State of Aquaculture in Kwazulu Natal

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Abstract

The increasing world population growth, rising standard of living in developing countries, diminishing wild fish stocks and global commitment to sustainable fisheries development, together with the growing need for cheap sources of high-quality protein have raised awareness of the need for a sustainable source of capture fish to meet this rising need. Aquaculture development in Asian countries has filled this need for generations. In addition to aquaculture development, inland fisheries have also played a role in providing an alternative to land-based protein sources. Within the African context, it has also been the most popular means of obtaining fish-based protein. Within the South African context, aquaculture development is still in its infancy, even though it has been used by the different provinces to create fishing stocks for sports fishing. Although aquaculture and inland fisheries development is an Operation Phakisa: Oceans Economy goal, the development of the sector is still in its infancy. The legislative framework needed for the development of the sector is explained in this paper, together with the challenges facing the growth of both sectors, with recommendations being provided for sector advancement. One of the objectives of the Operation Phakisa: Oceans Economy aquaculture development goals was the use of aquaculture development for the upliftment of the underprivileged populations. The reality of the achievement of this goal has also been discussed within the context of the paper.

Keywords

Fisheries Development, South African, Aquaculture Development, Inland Fisheries, Rural Development, Aquaculture Legislation, Mariculture

1. Introduction

The aquaculture and fisheries sector is one of the six sectors which has been identified by the 2014 Operation Phakisa: Oceans Economy document as important for the economic development of the rural and former disenfranchised communities. Within the fisheries sector, the [Marine Living Resources Act 18 of](#)

1998 had not catered for small-scale and artisanal fishers. This matter was addressed in the Small-scale Fisheries Policy of 2014, which provided for the recognition of fishing communities and allocated rights to these communities, together with their own exclusive fishing areas. The Department of Environment, Forestry and Fisheries (DFFE) has been mandated to assist the communities with the registration of primary and secondary fishing Cooperatives and the recognition and registration of historical fishing communities as small-scale fishers. While the process has been slow, there has been progress as these former marginalized fishing communities have already had their fishermen registered as small-scale fishers, formed primary Cooperatives and have been allocated community fishing grounds. They are now in the process of forming secondary fishing Cooperatives. Through the change in legislation and the targeting of the rural fishing communities, they have hope, even though the road ahead is still long and requires complete dedication on the part of both government and the communities if the gains envisaged by government and the communities are to be realized.

The situation with the aquaculture sector is not as stable or organized as that of the small-scale fisheries sector. In South Africa the aquaculture sector is still in its infancy, contributing only 0.8 percent of the local fish production and injecting 0.7 billion rand (0.2 percent) to the country's gross domestic product (GDP). (DAFF, 2016) Operation Phakisa estimated that aquaculture has potential to support approximately 15,000 jobs by 2033, injecting approximately R3 billion into the Oceans economy (DAFF, 2017). The movement towards increased demand for aquaculture is influenced by multiple factors. The driving factor, according to the International Food Policy Research Institute (IFPRI, 2015) is the increased demand for fish due to increased population growth, expanding urbanisation and rising incomes in the developing world. Overfishing and global warming have led to changes in the spawning patterns of fish as well as the depletion of global wild fish stocks. Aquaculture has therefore been seen as a means of meeting the rising demand for fish globally and providing food security and an alternative to wild fishing, thus enabling the ocean fish population and the oceans themselves to recover. Making reference to the report Fish to 2030, it noted that aquaculture would be responsible for most of the fish sold on the global market. In addition, China is projected to be responsible for about fifty percent of this increase, with the Asian region being responsible for about ninety percent of the increase in global aquaculture output. While aquacultural output is projected to increase in Asia, data shows that the average fish consumption for Africa and Latin America during the period 2010 to 2030 will decrease by 1.00 percent and 0.6 percent, respectively.

Despite the negative projections, these figures must be read in the light of the projected African population growth. The current African population is 1.34 billion, while that of China is 1.408 billion. (Statistica, 2021) The estimated population growth for Africa in 2050 is 2.5 billion while Anderson (2020) estimated that the population of China will have halved by 2100, to 732 million people.

Given that the demand for fish is driven by human demand and economics, especially the rising incomes of the developing world, the increasing African population will require more protein. According to Spears (2020) the combined economy of Africa will be worth 29 trillion by 2050, which is ten times more than its current value. In addition, it pointed out that about 60 percent of the African population was under the age of 25, in 2020. In 2050 Africa will have a much larger economically active population than the rest of the world's economies, thus contributing towards the increased buying power of these nations. At the same time, as the economic buying power and population of Africa multiplies, the crisis of food scarcity and climate change will become more real. The demand for aquaculture, at this time, will increase to meet the rising need for protein and fish on the African Subcontinent. With these facts as a backdrop, it is clear why there is a need for the growth and development of the aquacultural sector in South Africa. In this paper, the state of aquaculture in KwaZulu Natal will be discussed, looking at the current condition of aquaculture, the strengths and weaknesses of the sector as well as the requirements for the stability and future growth of the sector.

2. Literature Review

2.1. Global Aquaculture Development

The Food and Agriculture Organisation of the United Nations Report on the State of Aquaculture and Fisheries 2022, contains the latest data on aquaculture and fisheries globally. According to the report, using 2020 figures, Asian countries were the main producers, accounting for 70 percent of the total fisheries and aquaculture production of aquatic animals, followed by countries in the Americas (12 percent), Europe (10 percent), Africa (7 percent) and Oceania (1 percent).

Figure 1 and **Figure 2** both refer to the status of capture fisheries and aquaculture production. Capture fisheries contributed 90 million tonnes in 2020. Of the total fish production, 63 percent (112 million tonnes) was harvested in marine waters (70 percent from capture fisheries and 30 percent from aquaculture). The remaining 37 percent (66 million tonnes) was from inland waters (83 percent from aquaculture and 17 percent from capture fisheries). The total global fish sale value was estimated at USD 406 billion, comprising USD 141 billion for capture fisheries and USD 265 billion for aquaculture.

In the period 2018 to 2020, aquaculture grew faster than capture fisheries. Its share of total fisheries was therefore further increased. Of the 178 million tonnes produced in 2020, 51 percent (90 million tonnes) was from capture fisheries and 49 percent (88 million tonnes) from aquaculture. The FAO Report predicted that trade in aquatic products will continue to expand, but at a slower pace than in the previous decade. Decreased momentum reflects the slowdown in production growth, higher prices impacting on overall demand and consumption, and increasing domestic demand in some of the major producing and exporting countries, such as China. It is predicted that 36 percent of total fish production will be

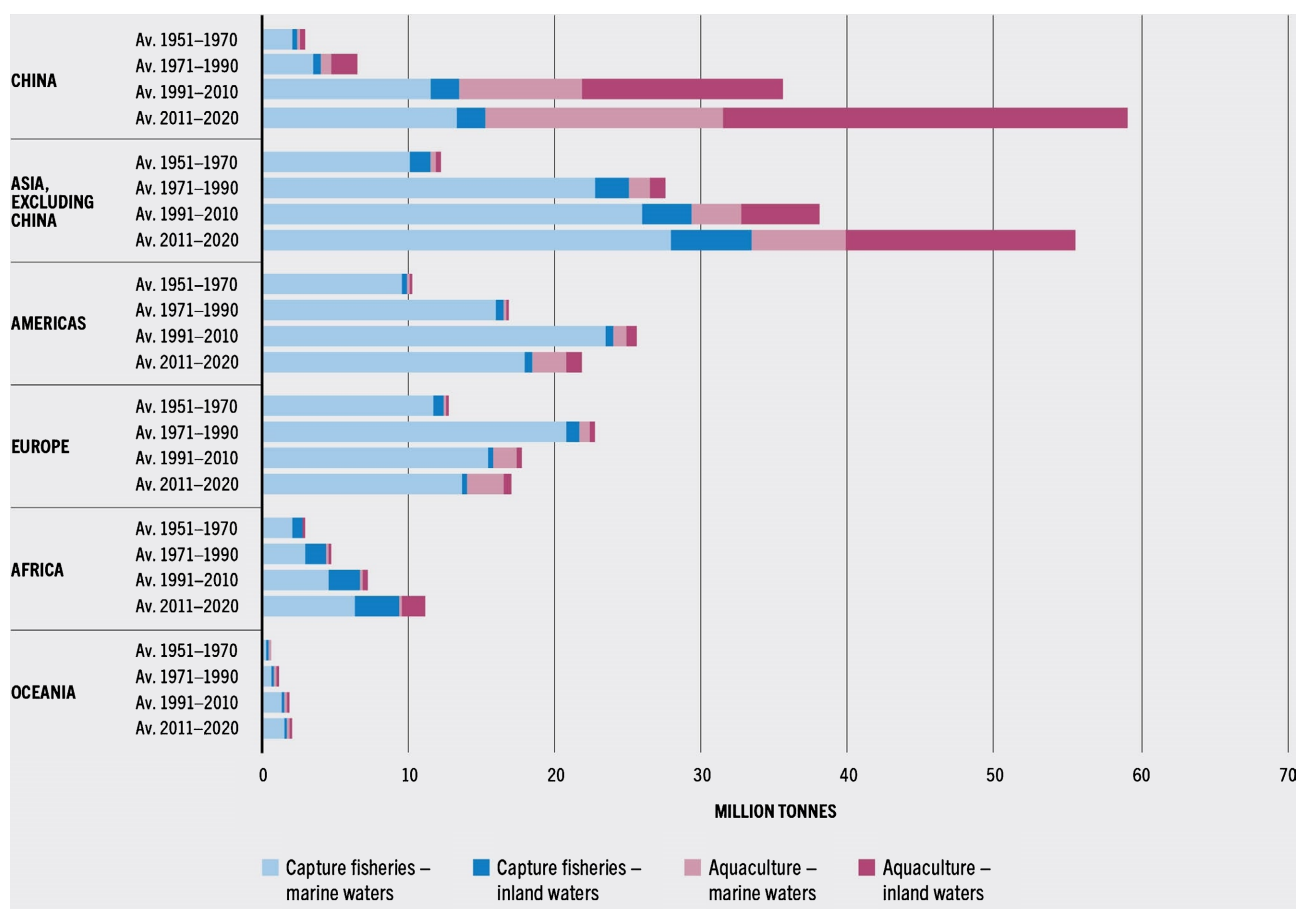


Figure 1. Regional Contribution to World Capture Fisheries and Aquaculture Production (FAO, 2022).

https://www.fao.org/3/cc0461en/online/sofia/img/CC0461EN_SOFIA_fig5.jpg

exported in 2030 with an increasing contribution from aquaculture. China will continue to be the major exporter of aquatic food, followed by Viet Nam and Norway. The European Union, Japan and the United States of America will account for 39 percent of total imported volumes of aquatic food consumption in 2030 (FAO, 2022).

At the global level, Africa accounts for over 25 percent of inland captures with ten African countries being included in the top 25 inland fisheries producing nations. In order of preference, these include Uganda, Tanzania, Nigeria, Egypt, Democratic Republic of the Congo, Malawi, Mali, Chad, Zambia and Mozambique. Within the African context, inland fisheries represent an important source of food security, particularly the landlocked and low-income countries. The combined catches for Europe and the Americas account for around 8 percent of total inland captures, while in Oceania catches are negligible, The remaining sixty five percent is attributable to the Asian countries, including India, China, Bangladesh, the Philippines, Indonesia, Cambodia, Viet Nam, Pakistan, and Myanmar. Inland fisheries catches include three main groups: carps, barbels and other cyprinids, tilapias and other cichlids, and freshwater crustaceans (FAO, 2022).

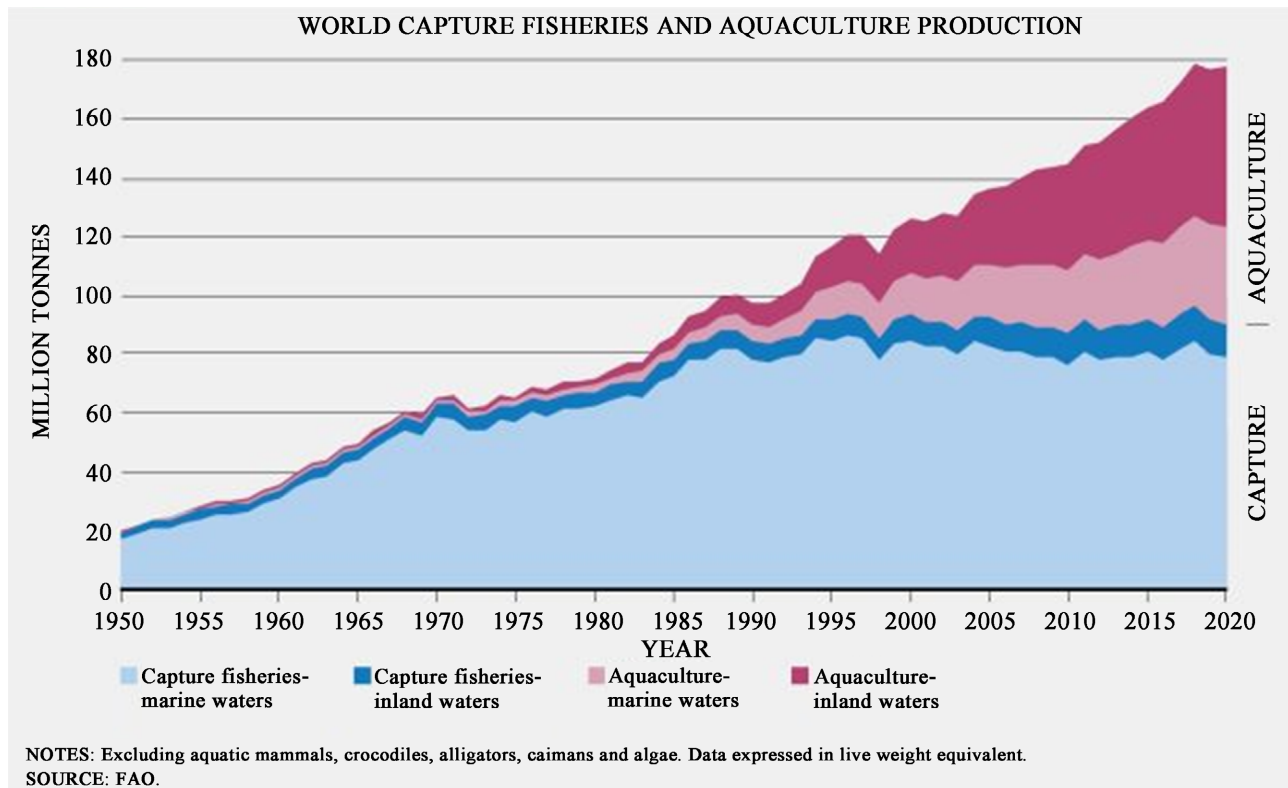


Figure 2. World Capture Fisheries and aquaculture production 2022 (FAO, 2022).

<https://effop.org/wp-content/uploads/2022/07/FAOSOFIA2022Fig1-600x400.jpg>

While aquaculture production increased globally for the 2020 period, at a regional level, African aquaculture (excluding algae) suffered from a slight contraction in its annual output. Production decreased by 1.2 percent in 2020 compared with 2019. This was mainly the result of the drop in production in Egypt, Africa's major producer. In Nigeria, the largest producer in sub-Saharan Africa, aquaculture production has been decreasing since 2016. This worsened in 2020 with a sharp decrease of 9.6 percent. Aquaculture production in the rest of Africa has increased by 14.5 percent growing from 346,400 tonnes in 2019 to 396,700 tonnes in 2020. This increased growth was not enough to offset the losses experienced by the major African producers. Chile, China and Norway are the top producers in the Americas, Asia and Europe, respectively, all experienced growth in 2020. This offset the decreased output that occurred in some countries in their respective regions. Egypt's contribution to the total aquaculture production in Africa, including algae production, for 2022, was sixty seven point six percent. Without Egypt's contribution, the total contribution made by African countries to global aquaculture production was 6.6 percent. (FAO, 2022) In 2020, 84 percent of all fishers and fish farmers were in Asia, followed by Africa (10 percent) and Latin America and the Caribbean (4 percent). More than 20 million were engaged in aquaculture, concentrated primarily in Asia (93.5 percent), followed by Africa (3.1 percent) and Latin America and the Caribbean (nearly 3 percent). Europe, North America and

Oceania each had less than 1 percent of the global population engaged as fishers or fish farmers.

The report stressed the importance of aquaculture development for food security purposes and looked at predicted regional aquaculture development for the next ten years. Except for eleven countries in Africa which had a higher consumption of aquatic foods than the world average, consumption of aquatic foods in Africa was generally low. These eleven countries include some small island developing States (SIDS) in addition to Gabon, Congo, the Gambia, Sierra Leone, Ghana, Egypt and Côte d'Ivoire. The relatively low consumption of aquatic foods was caused by: (FAO, 2022)

- 1) high population growth, which in most cases outpaced the growth of capture fisheries production;
- 2) the relatively small aquaculture sector, which reduced the potential for increasing production in the near future;
- 3) poor landing, road and market infrastructures, which limit the movement of good quality aquatic products across borders within the continent;
- 4) high post-harvest losses due to underdeveloped cold chains.

The situation is expected to worsen in Africa, with consumption per capita projected to decline in the next ten years. This would represent a serious threat in terms of food security given the high prevalence of undernourishment in the region and the key role played by aquatic foods in terms of contribution to total intake of animal proteins across many African countries.

Despite the negative forecast for Africa, aquatic food production, particularly aquaculture, is forecast to increase by a further 15 percent by 2030. There are concerns that this growth must not come at the cost of aquatic ecosystem health, increased pollution, animal welfare, biodiversity or social equality. New, sustainable and equitable aquaculture development strategies are therefore deemed necessary. Recognition of the many perils of fisheries and the need for sustainable fisheries and fisheries management led to the adoption of the 1995 FAO Code of Sustainable Fisheries. The provisions of the Code, while voluntary, provided clear guidelines for sustainable fisheries development. Some of the main provisions of the Code are found in Articles 6 and 7, which provide the general principles of fisheries management (FAO, 1995). The fisheries management objectives are provided below.

2.2. Management Objectives

- 1) Recognizing that long-term sustainable use of fisheries resources is the overriding objective of conservation and management, States and subregional or regional fisheries management organizations and arrangements should, inter alia, adopt appropriate measures, based on the best scientific evidence available, which are designed to maintain or restore stocks at levels capable of producing maximum sustainable yield, as qualified by relevant environmental and economic factors, including the special requirements of developing countries (FAO, 1995).

2) Such measures should provide inter alia that:

- a) excess fishing capacity is avoided and exploitation of the stocks remains economically viable;
- b) the economic conditions under which fishing industries operate promote responsible fisheries;
- c) the interests of fishers, including those engaged in subsistence, small-scale and artisanal fisheries, are taken into account;
- d) biodiversity of aquatic habitats and ecosystems is conserved and endangered species are protected;
- e) depleted stocks are allowed to recover or, where appropriate, are actively restored;
- f) adverse environmental impacts on the resources from human activities are assessed and, where appropriate, corrected;
- g) pollution, waste, discards, catch by lost or abandoned gear, catch of non-target species, both fish and non-fish species, and impacts on associated or dependent species are minimized, through measures including, to the extent practicable, the development and use of selective, environmentally safe and cost-effective fishing gear and techniques.

3) States should assess the impacts of environmental factors on target stocks and species belonging to the same ecosystem or associated with or dependent upon the target stocks and assess the relationship among the populations in the ecosystem. ‘

Despite the age of these measures, they encapsulate the fundamental principles required for sustainable fisheries management. The above provisions are important guidelines which ensure that countries seeking to embark on sustainable fisheries and aquaculture development already have direction for their legislative frameworks terms of reference for future policy and monitoring and evaluation. The 2021 COFI Declaration for Sustainable Fisheries and Aquaculture (FAO, 2021) acknowledged the 1995 Code goals with participants recognizing that change has not occurred fast enough and committing themselves to increase the speed with which sustainable fisheries and aquaculture will be adopted.

In alignment with these documents, the 2022 FAO Report provided three objectives for Blue transformation:

- 1) Sustainable aquaculture expansion and intensification—to support global food security targets and satisfy global demand for nutritious aquatic food and equitable distribution of the benefits.
- 2) Effective management of all fisheries—to deliver healthy stocks and secure livelihoods.
- 3) Upgraded value chains—to ensure the social, economic and environmental viability of aquatic food systems, and secure nutritional outcomes.

These objectives will need increased buy-in by African governments who, according to the report, are lacking in all three of the above objectives. The prediction of decreasing market share and decreasing aquaculture and fisheries devel-

opment in African countries in the next decade will mean that, in the light of the above global undertakings for increased food security, workable plans and intervention are urgently required.

2.3. South African Aquaculture Development

While global aquaculture development is entrenched, aquaculture and inland fisheries development in South Africa is still in its infancy, with both aquaculture and inland fisheries lacking governing legislative documentation. An AgriSeta survey showed that there were 1049 aquaculture farms registered with SARS in 2017, of which 56 percent were situated in the Western Cape, 17 percent in the Eastern Cape, 10 percent in Mpumalanga Province and only 5 percent in Kwa-Zulu Natal. (Mmonwa, 2020) There was also a big difference in the number of fish species which were cultivated in the different provinces.

The nature, challenges and characteristics of South Africa's fledgeling aquaculture market were outlined in the 2019 Strategic Environmental Assessment for Aquaculture Development report. According to this report, South Africa's local aquaculture market movement is mostly influenced by market price, consumer awareness, ease of accessibility and species availability. Growing awareness of environmental sustainability and increasing health concerns by consumers have resulted in increased demand for aquaculture products. South Africa has a dual strategy towards the marketing and purchasing of aquaculture products. To satisfy the local market, South Africa imports low value species at cheaper tariffs. However, high value species, including abalone, are exported due to higher returns from the international market (CSIR, 2019).

In 2015, South Africa exported approximately 1399 tonnes of aquaculture products with an estimated value of about R 488 million. Hong Kong was the leading importer of aquaculture products, followed by Botswana and Taiwan. In the same year, South Africa imported a total of 6968 tonnes of aquaculture products with an estimated value of R 268 million. Norway was the leading supplier, with Norwegian aquaculture products accounting for imports worth R 205 million. China was the second leading supplier (CSIR, 2019). Aquaculture products destined for human consumption are subject to rigorous food safety regulations and require implementation of regular monitoring and control measures to ensure compliance. South African aquaculture farms, especially those cultivating molluscan shellfish species, are inspected and monitored for hazardous substances and harmful micro-organisms such as *Escherichia coli*, *Salmonella* species and *Vibrio* species. Given the severity of the risk to human life, monitoring is constant and strictly administered. Bio-toxins that are monitored include Paralytic Shellfish Poisoning (PSP) toxins, Diarrhetic Shellfish Poisoning (DSP) toxins and Amnesic Shellfish Poisoning (ASP) toxins. Other hazardous substances which are monitored include heavy metals like lead, mercury, inorganic arsenic and cadmium, pesticides, drug residues, dioxins, polycyclic aromatic hydrocarbons (PAH), dyes and polychlorinated biphenyls (PCBs) (CSIR, 2019). Compliances and other regulatory legislation, due to the risks to the environ-

ment, animal and human health, are necessities. Due to the costs related to these compliances, barriers to entry into the sector are high, with costs and compliances being ongoing. This has made it difficult for new entrants into the market.

While the Western Cape farms at least five species of fish, in KZN the number of farmed species is unknown. In an interview with a DARD official, he pointed out that while Mozambican Tilapia is commonly farmed, there has been much interest in the farming of Nile Tilapia, a much bigger fish, as the expected returns and market are greater. Because it is an alien species, Ezemvelo has continually rejected its cultivation in KZN, regardless of the cultivation methodology proposed, because of fears of the impact it would have on wild fish in local rivers and dams, were it to be accidentally released into the ecosystem. The state of aquaculture in KwaZulu Natal is not desirable and there is need for greater interventions to ensure that the correct information is obtained so that strategic interventions are possible. In preparation for this paper, information was sourced from the Rhodes University Ichthyology Department, The Department of Agriculture and Rural Development (DARD), The Department of Environment, Fisheries and Forestry (DFFE) and the Tilapia Farmers Association who were responsible for feasibility studies, pricing models and in-depth surveys on the state of aquaculture and the feasibility of farming different types of fish within the KwaZulu Natal context. The Tilapia Farmers Association has also done in-depth research on the cost price of imported aquacultural produce into the KZN market and its impacts. As the country imports low value, low-cost fish for human consumption, it has been difficult for emerging farmers to compete. Within the KZN context, emerging aquaculture farmers could only sell their fish at double the going market rate. Giving the availability of cheaper imported alternatives, they could not compete and eventually closed.

3. Problem Statement

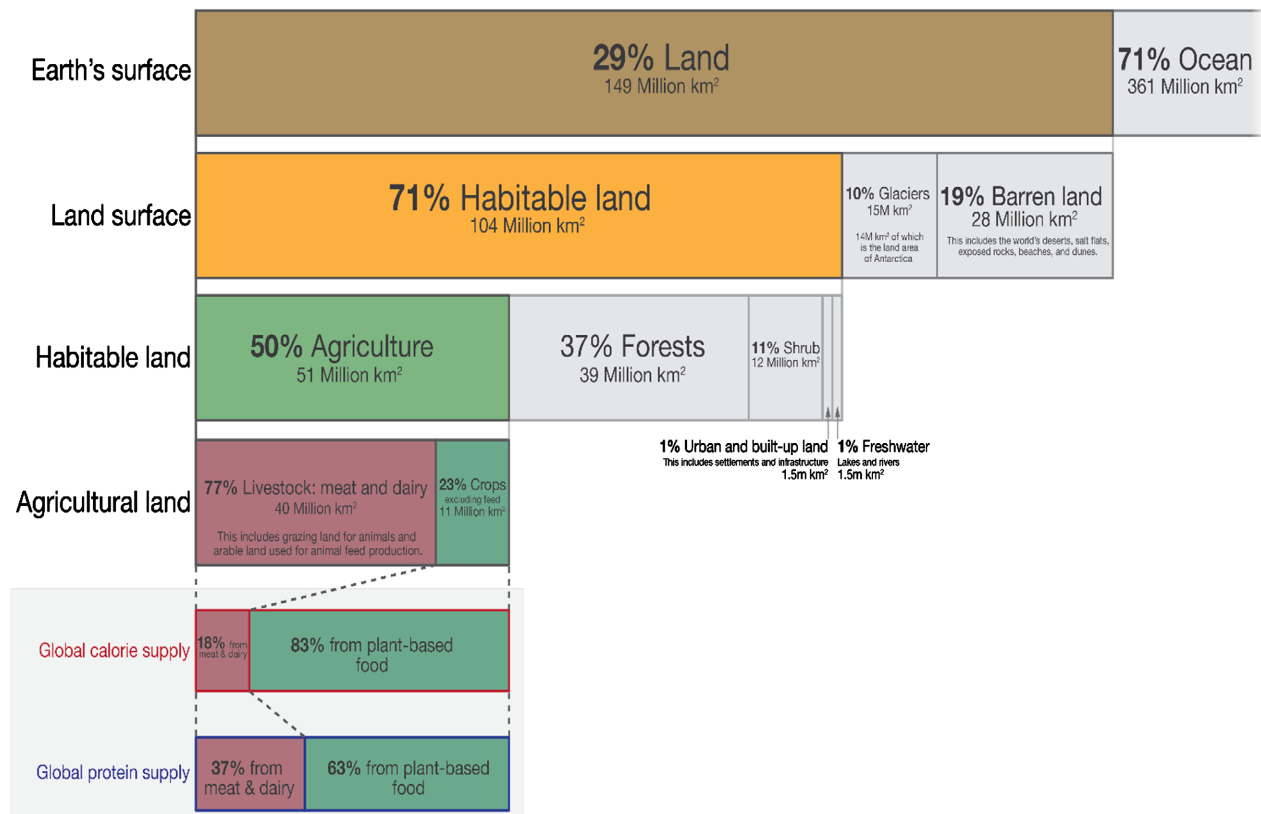
Aquaculture is currently being done on a large scale, where it has been introduced, making it very expensive to begin and putting it beyond the reach of most emerging rural black farmers. Questions have thus been raised about the accessibility of aquaculture as a tool for rural upliftment and empowerment, if the communities are to go beyond working on large scale aquaculture farms and become initiators and direct beneficiaries of aquaculture farming profits.

4. Rationale of the Study

The movement towards increased aquaculture is not just a goal set by the Operation Phakisa document but also an urgent and increasing necessity. Given the projected future growth prospects of the African population and the impact of climate change on fisheries, with the migration of ocean fish towards colder waters due to the increasing sea temperatures and the need for greater food security, especially cheap and land intensive protein sources, aquaculture has become increasingly important. Unlike other government development goals which may

Global land use for food production

Our World
in Data



Data source: UN Food and Agriculture Organization (FAO)

OurWorldinData.org – Research and data to make progress against the world's largest problems.

Licensed under CC-BY by the authors Hannah Ritchie and Max Roser in 2019.

Figure 3. Global land use for food production; Source: Our World in Data (2019).

or may not be realized due to internal and external economic pressures, with the issue of aquaculture and food security, both environmental and population pressures will require that action be taken speedily. Given the current estimates for population growth and the pressures that this will place on the land, both for the provision of land for living and food pressures, provision must be made in advance to deal with these expected pressures. According to a 2019 Our World in Data article (Richie, 2017), there is a highly unequal distribution of land used for livestock and that used for human consumption. The combined percentage of land used to graze livestock and land used to feed livestock counted for 77 percent of global arable land usage. Aquaculture, with its unique cultivation requirements, is a solution.

Within **Figure 3** above, there are the following facts:

- 1) With regards to the land surface, 10% are glaciers, 14 M km squared of which is the land area of Antarctica;
- 2) Nineteen percent barren land, this includes the worlds desserts, salt flats, exposed rocks, beaches and dunes;
- 3) Of the habitable land, there was 1 percent urban and built-up land, which

includes settlements and infrastructure 1.5 M km squared, and 1 percent fresh-water, which includes lakes and rivers 1.5 M km squared;

4) Agricultural land: 77 percent was used for livestock, meat and dairy (40 M km squared). This included grazing land for animals and arable land use for animal land use. Twenty-three percent was used for crop production, excluding feed (11 million Km squared).

5. Objectives

Given the current state of aquaculture in KZN, the objectives of this paper are as follows:

- 1) Provide a brief history of aquaculture in KZN, with emphasis on enabling and limiting factors;
- 2) Determine the factors which are currently limiting the expansion of aquaculture in KZN;
- 3) Discuss the changes which will be required to incorporate rural communities into the aquaculture value chain.

6. Research Methodology

The development of the aquaculture sector in KZN has been the topic of considerable academic research in recent years. In this paper both primary and secondary data sources were used, with primary data being sorted through interviews with the officials responsible for aquaculture development.

Questions which have been asked include the following:

- 1) Why is inland fisheries seen as a better option for rural communities?
- 2) What are the current impediments to inland fisheries and aquaculture development and what steps have already been taken to remove the legal bottlenecks?
- 3) How can the existing fish stocks be protected to prevent overfishing?
- 4) Is the current approach to rural aquaculture development sustainable?

In preparation for this paper, it became clear that sector development was still in its infancy. Legislation to grow and regulate the sector was also still developmental, with both the aquaculture and inland fisheries sectors being at the policy stage, without legislation to support it. The Department of Environment, Forestry and Fisheries has been mandated to lead sector development and has been active in placing together a regulatory framework. Without the Act, however, regulation of the sector is still fragmented, with provisions falling within different sectors and departments. The first step to understanding the issues facing the development of the sector lies in an in-depth analysis of the legislation governing the sector, concessions made to development and the impacts of such legislation and policy undertakings.

7. Legislation and Background

The legislation governing the aquaculture and fisheries sector is diverse and complicated, as many factors impact on the governance thereof. Historically, the

governance of fisheries fell under the jurisdiction of the different provincial authorities. This led to the development of fisheries at different paces, according to the individual provincial fisheries goals. This separate policy has contributed to the current fragmented state of fisheries and aquaculture policy. While legislation made provision for inland and marine fisheries, aquaculture development was not mentioned in the earlier legislation. Instead, government fisheries raised fish for the stocking of dams used for angling. Legislation is discussed briefly to show the evolution from provincial to national jurisdiction of the sector and indicate the current gaps.

7.1. The Union of South Africa Act of 1909

While the provisions of this Act have been mostly replaced by the Constitution of South Africa and later legislation, its effects on the fisheries sector remain and its impacts are still felt in the fisheries development sphere. According to Section 85(x) of the Act, fisheries and game preservation fell under the jurisdiction of the provincial councils. Section 85(iv), agriculture also fell under the control of the provincial councils, subject to limitations placed by parliament.

The impact of these provisions was that provinces were able to act autonomously, with each Council enacting legislation, as it deemed fit, to protect its natural resources and promote fisheries development (McCafferty et al., 2007). Within the context of KwaZulu Natal, this resulted in the promulgation of two main provincial Acts:

- 1) The Freshwater Fish Protection Ordinance No 9 of 1955;
- 2) The Natal Nature Conservation Ordinance No 18 of 1974.

7.2. The Natal Nature Conservation Ordinance No 18 of 1974

Chapter IV, Provisions 137 to 157 of the Act dealt with freshwater fish within the province of Natal. The Ordinance had several key provisions relating to both water and fisheries management. These Acts and Ordinances were significant in that they placed both fisheries and water affairs governance under the jurisdiction of the different provinces and outside of the control of national government. The situation changed with the introduction of the National Water Act 36 of 1998.

7.3. The National Water Act No 36 of 1998

The relevance of this Act is that it places all national water under the jurisdiction of national government. Provision 3(3) of the Act provides that National government, through the Minister, has the right to regulate the use, flow and control of all water in the republic.

While the schedule to the Act did not provide for water-related aquaculture or mariculture activities, later legislation permitting aquaculture overrides the limitations placed by this Act. Portions of this Act were amended by the National Water amendment Bill Act No 27 of 2014. The most significant aspect of these

Amendments, for purposes of this paper, was the placement of all water-related issues with environmental implications, under the auspices of the National Environmental Management Act of 1998. While amendment 5(2) made specific reference to the Mineral and Petroleum Resources Development Act of 2002, the central point of this provision remains. Section 5(2) provides that all environment-related aspects would be regulated through one environmental system which is the National Environmental Management Act, 1998 Act No 107 of 1998 and that all environmental provisions would be repealed from the Mineral and Petroleum Resources Development Act No 28 of 2002.

From the above provision, although no mention has been made of aquaculture as a viable use of national water, it could only be assumed that, due to the possible negative environmental impacts of aquaculture development, such water usage cannot be given as a bona-fide right, but will have to be evaluated under NEMA and its regulatory structures. The second implication of this provision is that all other environmental regulatory bodies operating outside of the NEMA Framework would lose their authority to act. By placing all environmental aspects under NEMA, this amendment provided clarity and certainty, ensuring that environmental regulation within South Africa fell under national government.

The next step was the transfer of governance of fish stocks and provincial waters to national government. While the Natal Nature Conservation Act of 1974 gave the provincial government jurisdiction over all fish stocks and provincial waters, the Marine Living Resources Act No 18 of 1998 transferred the governance of all marine resources to National government.

7.4. The Marine Living Resources Act No 18 of 1998

Section 3 of the Marine Living Resources Act dealt with the application of the Act and provided that the Act applied to all persons, foreign and South African persons, and to all fishing vessels and aircraft, including foreign fishing vessels and aircraft, on, in or in the airspace above South African waters. It also applied to fishing activities carried out by means of local fishing vessels or South African aircraft in, on, or in the airspace above waters outside South African waters, including waters under the jurisdiction of another state. It did not apply to fish found in inland waters within South Africa.

As the national government has jurisdiction of the marine environment, any provincial plans that may affect the marine environment in any way must be aligned with the national government and consider future national fisheries development and protection plans. With the formation of Marine Protection Areas, any activities which impact negatively on the mandate of that maritime protected zone will be prohibited. It stands to reason that no mariculture, aquaculture or fisheries may be undertaken in these protected zones. Where fishing and mariculture is allowed, this must be done under the ambit of the minister as well.

The Act also provides for the application of permits and although the fees for the application of a mariculture permit were not specified, from the above provisions of the MLRA, any person seeking to enter the mariculture sector will need to be ready to provide the Minister or his appointed representative with an environmental impact assessment (EIA) report, make an application for a permit application which will last only a year, pending proof of compliance and payment of fees, which do not guarantee that the applicant will be successful. While part of the development mandate is to include preciously disadvantaged communities in the aquaculture and mariculture value chains, the legislative provisions mentioned already provide legislative and financial barriers to entry. Given the sensitivity of marine resources and the challenges placed on the fishing sector by overfishing and climate change, the environmental safeguards within the Act cannot be relaxed for reasons of rural development. Other methods would be required to assist the previously disadvantaged communities enter the sector. While the MLRA made provision for subsistence fishing and recreational fishing, both these categories of fishers are non-commercial, in a highly regulated sector. With fisheries (both inland and marine) as well as mariculture (defined as the culture or husbandry of fish in sea water) and aquaculture (the culture or husbandry of fish in fresh water) the aim is the culture or the capture of fish for commercial purposes. The original MLRA did not provide for commercial fishing on a small scale, as would be required by small-scale fishing communities. A later amendment of the MLRA, the Marine Living Resources Amendment Act No 68 of 2000 extended the period allowable for permits to 3 years. It still did not provide for small-scale fishers. The Marine Living Resources Amendment Act No 5 of 2014 made provision for small-scale fishers.

7.5. The Marine Living Resources Amendment Act No 5 of 2014

To make provision for the small-scale fishing community, the Act defined small-scale fishers, and the small-scale community, making provision for the community to act together as a cooperative. In terms of the Amendment, the Act also made provision for the application for permits by Cooperative structures, by including Cooperatives under the definitions sections of persons permitted to apply for permits, as per Article or Section 18 of the MLRA of 1998.

The Department of Environment, Fisheries and Forestry was responsible for the drafting of the Small-scale Fishers legislation, which provided for the formation of primary and secondary Cooperatives, provided quotas for the number, type and season of fish catches while demarcating the allocated fishing areas per community (Gazette, 2016). This legislation also made provision for the creation of primary and secondary Cooperatives, putting into place the requirements and time periods for creation and qualification and the functions of these bodies. To date, most fishing communities have formed primary cooperatives, and are in the process of creating secondary Cooperative structures.

While the Marine Living Resources Act speaks into the issue of marine fisheries, inland fisheries have been ignored. The status of Inland Fisheries, policy

objectives and initiatives were discussed only in the later Draft National Freshwater Inland Wild Fisheries Capture Policy of 2021 (DFFE, 2021a).

7.6. Inland Fisheries as per the Draft National Freshwater Inland Wild Fisheries Policy of 2021

According to the above policy paper, South Africa has a long history of stocking inland waters with fish species from government and private hatcheries. This was done to promote recreational and consumptive fisheries, aquaculture and the conservation of threatened species. Government hatcheries stopped stocking public waters with alien fish species in the 1980s because of a policy change focussed on the conservation of indigenous fauna and flora. Prior to this change, alien fish species were introduced into inland waters through government hatcheries. The trout recreational fisheries subsector is an outcome of the stocking of private hatcheries and creates substantial value through its linkage to the tourism value chain in rural areas. It is hoped that existing state hatcheries can be further developed to provide support for the development of viable culture-based fisheries. Despite the development of the recreational angling inland waters tourism sector, no large-scale, commercial fishing equivalent to South Africa's marine fisheries sector exists on South African inland waters because the productivity of inland waters is deemed too low to support such operations. The few existing permitted fisheries are in really small-scale fisheries employing simple, manually operated gears such as treknets or gillnets (DFFE, 2021a).

The recreational angling sector is the most economically viable inland waters sector, with a participation rate estimated to be around 1.5 million participants. It is diverse, and includes bank and boat angling, fly fishing and informal recreational/food fish angling. It is a popular activity on dams and rivers. Angling is also organised as a sporting code, which is affiliated to the South African Sports Confederation and Olympic Committee (SASCOC). Most recreational anglers are not affiliated to any angling organisation. The management of recreational fishing activities on public dams is in the process of being formalised by the Department of Human Settlements, Water and Sanitation (DHSWS), through the compilation of resource management plans for the major public dams. Many recreational angling clubs currently enjoy rights of access to land and water-based activities on public dams through historical leases and contracts with the DHSWS.

The economic potential of the angling sector cannot be underestimated as it has a significant economic impact through the tourism sector and related angling supply value chains. Recreational anglers can therefore be recognised as important stakeholders in South African inland fisheries and their interests recognised in future fisheries development initiatives. The value-chain associated with the recreational fishing sector has the potential to support rural food security through job creation, entrepreneurship and participation in the fishing-linked tourism service sector. According to DFFE, more can be done to ensure that this sector contributes to transformation and equitable socio-economic benefits from

inland fish resources (DFFE, 2021a).

Small-scale fishing is another sector present and growing on most inland waterbodies. It contributes to the food security and livelihoods of many rural communities. It is, however, largely an informal activity which lacks formalised governance arrangements and institutions for stakeholder representation, despite legislation providing small-scale fishers such access. Most small-scale fishers are impoverished, with fishing ranging from being a part-time activity for food security to a full-time commercial occupation. Value chains for freshwater fish are short, with little value addition. The fish are generally sold fresh informally or consumed by the fishers. Indigenous knowledge relating to traditional and customary fishing culture, gear, and common pool resource governance is present in some communities but adapted to modern circumstances. Small scale fishers have often expressed concerns that their fishing rights, traditional and customary fishing practices and contributions to rural livelihoods are not recognised by the government and other stakeholders. Resource user-conflicts are present in certain water bodies, arising from a lack of recognition of customary common pool rights and the lack of capacity of communities to participate meaningfully in governance structures. This has resulted in small-scale fisher access to public waters and fish resources being marginalised at many waterbodies. Even though small-scale fishing is tolerated and, in some instances, actively supported, by governance structures, in the absence of defined user-rights, small-scale fishers remain vulnerable. Some communities experience conflicts with recreational anglers around their illegal use of gill netting. According to the policy makers, the small-scale fishers' lack of capacity to participate in governance institutions and to know and assert their resource access rights highlights the need for a developmental approach to small-scale inland fisheries (DFFE, 2021a).

Unlike other fishing sectors which now fall under national government jurisdiction, inland fishing activities are currently regulated by the provincial departments responsible for environmental management in terms of their environmental Acts, ordinances and regulations. This has led to a fragmented, non-aligned approach to inland fisheries management. The provincially legislated system of inland fishing permits or angling licences has fallen into disuse in most provinces. Resource users are nonetheless still subject to provincially determined harvest and gear restrictions. Because of the lack of consistency with the issuing of fishing permits and angling licences across the provinces, there is a need for a national policy to harmonise the permitting system.

In addition to the above structural inefficiencies, it is recognised that legacies of inequity persist in terms of access to inland fisheries resources and associated opportunities because of historical and current exclusion of historically disadvantaged communities. These include:

- 1) the lack of rights of access to fishing waters and fish resources;
- 2) conservation-based environmental management regulations which may result in the exclusion of access by historically disadvantaged communities;
- 3) insufficient information and education;

- 4) insufficient access to value chains and markets related to inland fisheries;
- 5) insufficient resources and capacity to participate in associated value chains;
- 6) lack of capacity to participate in fisheries and aquatic resource governance institutions.

As a result of the above issues with the inland fisheries sector, the focus of future policy interventions, as per the draft policy, include:

- 1) the drafting of national inland fisheries legislation under the Department's mandate;
- 2) the reform and harmonisation of provincial legislation in respect of fisheries;
- 3) transitional arrangements.

Until national legislation is promulgated, inland fisheries will continue to be governed in terms of the cooperative governance provisions of the NEMA and the provincial environmental Acts, Ordinances and Regulations. DFFE will negotiate cooperative governance arrangements with the department responsible for the management of inland waters and provincial environmental departments to harmonise existing environmental legislation with this fisheries policy's goals, fishing rights, fisheries management, research, monitoring and compliance.

8. Aquaculture Development

8.1. Aquaculture Development Related Policy and Legislation

The National Aquaculture Policy Framework of South Africa (NAPF) of 2013 speaks into the promotion of aquaculture within South Africa ([Gazette, 2013](#)). There are multiple goals for aquaculture development. One of the most pressing reasons is the reduction of wild fish stocks and the need to find suitable fish stock alternatives ([FAO, 2007](#)). Climate change, marine pollution, overfishing and rapid global population growth have all contributed towards diminishing fish stocks ([Vince, 2012](#)). The increased global demand for wild fish together with modern trawlers advanced technology which enables them to trawl the ocean bed has led to devastation of the marine ecology. Another issue raised by Vince is the fact that global waters remain unregulated and unprotected, so fishing trawlers can harvest in all waters. Within the European Union, fishing is highly subsidized, so fishermen can fish without carrying the full costs of their operations. This has contributed to the overfishing of world fish stocks. Diminishing large fish stocks has resulted in many fishermen fishing down the fish food chain, with smaller and smaller, as well as younger and younger fish being caught ([Vince, 2012](#)). There is also the fact that mercury content of global waters is fast making some wild fish species unsafe for human consumption ([Water Science School, 2018](#)). As wild fish stocks have decreased, countries have moved more towards capture fish production.

Within the East, especially countries like China, and Southeast Asian countries, aquaculture has long been practiced, with fish being farmed within the rice paddies. It is no surprise that Asian countries are the biggest contributors of

captured fish stocks. Besides the global business opportunities presented by aquaculture, there is also the issue of food security (Yarmoshuk, 1994). Fish is viewed as one of the cheapest forms of animal protein, where it is efficiently and sustainably farmed. Unfortunately, within the South African context, aquaculture development is in its infancy, having been introduced in the 1980s, with this sector lagging far behind the global practice (Gazette, 2013). Given the implications for both food security and employment, with countries like Indonesia having adopted aquaculture as a means of uplifting its poor rural communities, the development of aquaculture and aquaculture development zones has been prioritized in the NAPF.

8.2. The National Aquaculture Policy Framework for South Africa 2013

Where there were gaps in understanding, the National Aquaculture Policy Framework for South Africa stands as a bridging document, laying the foundation for future legislation and development.

The governing structure for aquacultural activities, which, according to the NAPF include both freshwater and marine species farming, was also decided, with the Department of Environment, Fisheries and Forestry (DFFE) being designated as the lead national agency for aquaculture development. This is significant, as it has placed the jurisdiction of aquaculture under national government.

DAFF (now DFFE) subsequently compiled a Legal Guide for Aquaculture Sector in South Africa (DFFE, 2013), which, although it has no legal force, proved guidelines for all stakeholders pursuant to the adoption of an Aquaculture Act, as required by the NAPF.

Within the Legal Guide for the Aquaculture Sector in South Africa (2013) hereinafter called the Legal Framework, the definition of aquaculture within the NAPF was discussed. According to this document, the aspect of intervention, as found in the definition of aquaculture in the NAPF, is important because aquaculture does not include the operation of fisheries which entail the harvesting of aquatic organisms in circumstances where no attempt has been made to manage or otherwise influence the organisms by containment, feeding or the application of any other husbandry techniques. In South Africa, there is no single legal definition of aquaculture, though the term mariculture is referred to in the Marine Living Resources Act (MLRA) and other laws. Because the Policy Framework is not legislation per se, the definition contained therein provides guidance until the term is officially defined in the forthcoming Aquaculture legislation.

The relevance of the Legal Framework is that it lists all procedures and processes to be followed at each stage, together, with the legislation, which is still applicable within the different sectors. These include the provincial Ordinances, food, health, safety and environmental provisions under NEMA, the Zoning Laws, and stakeholder engagement obligations, amongst others. The document contains 57 pages of legal references, showing how fragmented the legislation governing the sector really is. Because aquaculture development extends into

many different areas, including environmental protection, water safety and soil health, animal feed, food safety, zoning and protection of protected areas, types of fish that can be safely farmed, monitoring and evaluation, protection of natural environments against alien fish invasions (like the Nile Tilapia and the Nile crocodile), prevention of diseases and prevention of spread of disease, alignment with international sanitary and phytosanitary legislation, competition laws, dumping and infant industry controls as well as basic business principles, it is not easy to align all these segments, especially as they fall under different governance structures and sectors and work on differing legal principles and goals, which cannot be overlooked and discarded. For this reason, entry into the sector is extremely cumbersome.

8.3. Aquaculture Development Zones

The recalled Aquaculture Development Bill of 2018 defined ADZs as areas dedicated for the development of aquaculture as per Section 21. Section 21 deals with aquaculture development zones in greater depth (Gazette, 2018). Within South Africa, a few areas have been demarcated as aquaculture development zones. Unfortunately, to date, no ADZ has been identified in KwaZulu Natal.

The Aquaculture Development bill has been withdrawn by the Minister, however, due to complaints by stakeholders relating to the licencing provisions contained in the Bill. There have, therefore, been no notices from the Minister regarding the criteria and methodology to be utilised, leaving a vacuum which must be filled. In the interim, without specific guidelines, it remains likely that any feasibility study done outside of ministerial guidelines will fall short and must be redone. No rules have been put into place to address this. In addition to the criteria and methodology, the Act placed the onus of finding suitable areas for aquaculture on the Minister. The issue of identifying areas suitable for ADZs was there for the responsibility of the relevant Government Department. Now that the Act has been withdrawn, it remains to be seen whether this will change.

8.4. Current Status of Aquaculture Development

The discussion of the basic legislative requirements for aquaculture development does not end with the white papers. Since the 2013 National Aquaculture Policy Framework, the DFFE has worked hard to simplify the sector and put into place aquaculture development zones throughout the country. There is also the issuer of permits which is being dealt with. To understand the current situation, DFFE officials were interviewed to receive the most up to date information about developments in the sector.

When asked whether aquaculture development is limited to ADZs and whether there were any concessions made for community development, given that EIAs were very costly, DFFE stated that

Most of the monitoring that they undertake is largely linked to the ADZs at this point in time as it allows them to focus their time and energy in an area that covers more than just one operator. The business model for the ADZ is such that

the DFFE is undertaking the BA process which is costly and so the Department is covering this cost to create that enabling environment.

Aquaculture can occur in areas outside of an ADZ, but the applicant would have to undertake the cost of the EIA in order to set up a farm. DFFE have also undertaken an SEA process for freshwater and marine zones nationally. There is also a pro bono project that the DFFE has been undertaking where they, as the Department have contracted companies to undertake the EIA on behalf of communities. Essentially the EIA is done on behalf of the proponent, and this facilitates development of this very costly process to get operators into the industry.

On the question about the extent of provincial interaction and inclusion in decision making, DFFE provided that the provinces are invited to sit on their Bid specifications committees when they are conducting their internal processes for the appointment of a service provider for undertaking the EIA. They also consult the provinces at forums and meetings regarding their needs and assistance. For example, they are pursuing an ADZ EIA in Mossel Bay due to a request from the municipality to assist with the development of the industry.

With regards ADZ development in KZN, DFFE had undertaken an EIA for an ADZ in KZN at Amatikulu, but the EA was refused and after they appealed the decision their appeal was dismissed. They are now pursuing other ADZ areas in KZN and looking for sites.

DFFE also provided information in the form of a maritime aquaculture awareness brochure. Besides legislation, an important aspect of aquaculture development is the acquisition of rights to engage in aquaculture development. According to the DFFE brochure, a “right to engage in marine aquaculture” is required when undertaking any commercial marine aquaculture activity, in terms of the Marine Living Resources Act No 18 of 1998 (MLRA). An Exemption is granted in terms of section 81 of “the Act” if in the opinion of the Minister there are sound reasons for doing so, for example, in the absence of a rights allocation process. No person shall exercise any right granted in terms of Section 18 of “the Act” or perform any such activity without a valid permit granted in terms of Section 13 of “the Act”. A “right to engage in marine aquaculture” is valid for 15 years and a marine aquaculture permit is renewable and valid for 12 months.

The different kinds of permits include the following: (DFFE, 2021b)

- 1) Integrated marine aquaculture grow out permit:
- 2) Integrated marine aquaculture hatchery permit:
- 3) Permit to transport marine aquaculture fish and fish product(s)
- 4) Permit to operate a marine aquaculture Fish Processing Establishment (FPE).
- 5) Permit for the purposes of diving and possession of prohibited gear in the listed areas
- 6) Permit for marine aquaculture scientific investigations and practical experiments
- 7) Permit to import marine aquaculture fish and fish product(s).

8) Permit to export marine aquaculture fish and fish product(s)

An Exemption is currently implemented by the Department of Forestry, Fisheries and the Environment (DFFE) for the local sale of undersized cultured abalone products. A marine aquaculture Right Holder supplying undersized cultured abalone product to a retailer/wholesaler/ or restaurant, is required to have traceability in place for the local sale of undersized cultured abalone products, in terms of regulations applicable to the MLRA. Traceability is also important for ensuring food safety in the case of contaminated products sold on the market as there should be a mechanism in place to recall products unsuitable for human consumption.

In addition to the types of permits required, the brochure provides information on the impacts of aquaculture on the environment, the types of environmental interventions required and the legislation pertaining to the monitoring of aquaculture-related activities.

The primary impacts of marine aquaculture are as follows: (DFFE, 2021b)

- 1) Destruction of indigenous vegetation and habitat loss;
- 2) Genetic impacts;
- 3) Effluents;
- 4) Disease;
- 5) Enrichment of sediments with organic matter;
- 6) Feed waste and fish sites;
- 7) Anti-fouling products for cages;
- 8) Medication, antibiotics and pesticides;
- 9) Genetic impact of escapees on wild fish populations;
- 10) Pathogens;
- 11) Interaction with large marine fauna;
- 12) Social and spatial conflicts related to cages;
- 13) Human health.

8.5. Analysis

It is clear from the above inputs that while the will for aquaculture production exists, there is still much work and planning that needs to be done before the sector can develop and grow. Because of the complexity and sensitivity of the sector, it cannot be approached rashly or haphazardly, but strategically. In the light of South Africa's current strategy of exporting high-end niche aquaculture products for which it has a comparative advantage, and importing low-end products which are found at a much cheaper price on the global market, it appears necessary to seriously consider how aquaculture development will be approached. Within the KwaZulu Natal context, without the identification of ADZs, apart from private operators willing to carry the costs of all compliances, aquaculture development will be hindered. Another issue that is specific to the province is the restriction on importing restricted species as found in the KwaZulu-Natal Nature Conservation Ordinance 15 of 1974. The law enforcement provisions of this Ordinance still apply in KZN because no regulations in terms of the later KwaZulu

Natal Nature Conservation Act No 29 of 1994 have been passed.

Within the body of this paper, many aspects relating to aquaculture development and monitoring have been raised. Legislation is available at all stages of sector development. It is not really necessary to delve in-depth at issues other than inception issues because, though much has been said about growth of the sector, it has not yet taken off and cannot, outside of the identification of suitable areas for ADZ development. Before the sector can be developed, it is clear that the following actions are required:

1) The development of an Aquaculture Bill, which simplifies many of the cumbersome, fragmented processes.

2) The development of a Single window for aquaculture development, to simplify applications for permits, monitoring of compliances, testing of outputs.

3) Proper training of all those who want to participate in aquaculture development. This will mean that a degree or diploma in aquaculture studies be taught through the various tertiary institutions. A bursary or funding programme may need to be made available for all students from previously disadvantaged communities who want to enter the sector.

4) Awareness of the complexity of aquaculture and the different legislative compliances. This can be done through workshops, seminars etc.

5) Proper marine spatial planning and thorough market research to be done on the feasibility of farming different fish crops, for both the local and domestic markets. This is important because, despite the food security element thereof, there is also the competitiveness aspect that needs to be addressed. A cursory glance at the EIA, permit and monitoring and reporting compliances indicates that the barriers to entry to the segment are high, together with the risks attached to the sector, due to wrong feeding and disease that can impact heavily on both captive and wild fish stocks. Even though DFFE has put into place measures to assist with community entrance into the sector; compliance standards cannot be dropped to assist these communities. They are also subject to the same market pressures as all other farmers or businesses in the same sector.

6) The question of infant industry protection will also be raised. If the government decides to subsidise the sector, what types of protections will be adopted? Another question that will then need to be addressed is whether these subsidies align with our obligations under the different international trade agreements.

7) South Africa is currently importing most of the fish sold in its markets because of the price and quality of these imports. Questions of dumping have already been raised by domestic producers who cannot compete with the more established international producers, who have the economies of scale and comparative advantage. How then will South Africa address this issue with its current trading partners?

8) One of the objective of the paper was to determine how suitable the sector is for community entrants and which would be the better option for these communities. At present, there are many fishing communities invested in the process of developing into bona-fides fishing communities, as per the provisions of

the small-scale fishing legislation. Without established ADZs within KZN, it is better for these communities to continue to develop as small-scale fishers. For those determined to enter the aquaculture sector, this is a time for them to learn more about the sector, both from a business perspective as well as a legislative perspective. In this way they can determine both the opportunities available to them, as well as the risks that they will encounter when they do enter into the sector.

9) Until an area is found which can be deemed feasible for aquaculture development and an EIA passed, we cannot determine the types of species that can be fished, given the sensitivity of fish to weather, cold and heat as well as altitude and the methods used for fish farming. While parties may speculate about the adoption of Nile tilapia, given that the species requires warm water, such speculation will be a moot point if the only sites for ADZ development within KZN are found inland, in the cold Drakensburg, where trout is plentiful, and Tilapia may struggle to breed.

9. Recommended Future Studies

Given that the South African aquaculture and inland fisheries sectors are both emerging sectors, there is still much to be learned about the development of these sectors within the South African context. As an emerging sector in the developed global aquaculture sector, especially that of the Asian economies, there is much that South Africa can learn from these economies. Studies that are recommended include:

- 1) Efficient single window for aquaculture and fisheries: which are the most effective and efficient models.
- 2) The most efficient global models for developing aquaculture in rural areas; looking at global examples with similar demographics to South Africa;
- 3) Given current market trends and countries with absolute and comparative advantage, which species would be most suitable for comparative niche farming in South Africa;
- 4) A cost benefit analysis of inland fisheries development versus angling for tourism development.
- 5) The potential impacts of aquaculture development on capture wild fish within a closed system such as dams and lakes.

10. Conclusion

Regardless of the nature of the endeavor, economic considerations come first. With aquaculture development, there may be ways to balance the food security issue with the economic considerations. Ultimately, where there must be a choice between the two, very hard decisions will have to be made. From the above factors and the growing body of research on the environmental impacts of aquaculture, the determination of a site has to be done with environmental impacts in mind. As such, there will need to be clear guiding principles followed when selecting a suitable site. Within the KZN context, this will not only mean that

protected zones are avoided, but aquaculture should not be done in catchment areas for dams, rivers and streams used for human consumption unless it can be shown that the impact on drinking water is negligible. In addition, land that is rezoned for aquaculture purposes cannot be taken from productive agricultural and grazing land because of the negative impacts which it would have on the land thereafter. What is ultimately important to realise is that the relevant facts are intertwined and cannot be dealt with in a vacuum. With regards to inland fisheries development, a decision needs to be made regarding the best way to preserve the current tourism-related angling economic advantage while increasing the value-added of inland fisheries. It may be that some dams and water bodies are more suitable for one activity whereas others have sufficient capacity to do both. Only with increased research and understanding of the carrying capacity of the different dams and lakes will accurate decisions be made. There is still room for intensive research into the sector, prior to the promulgation of binding national legislation.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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