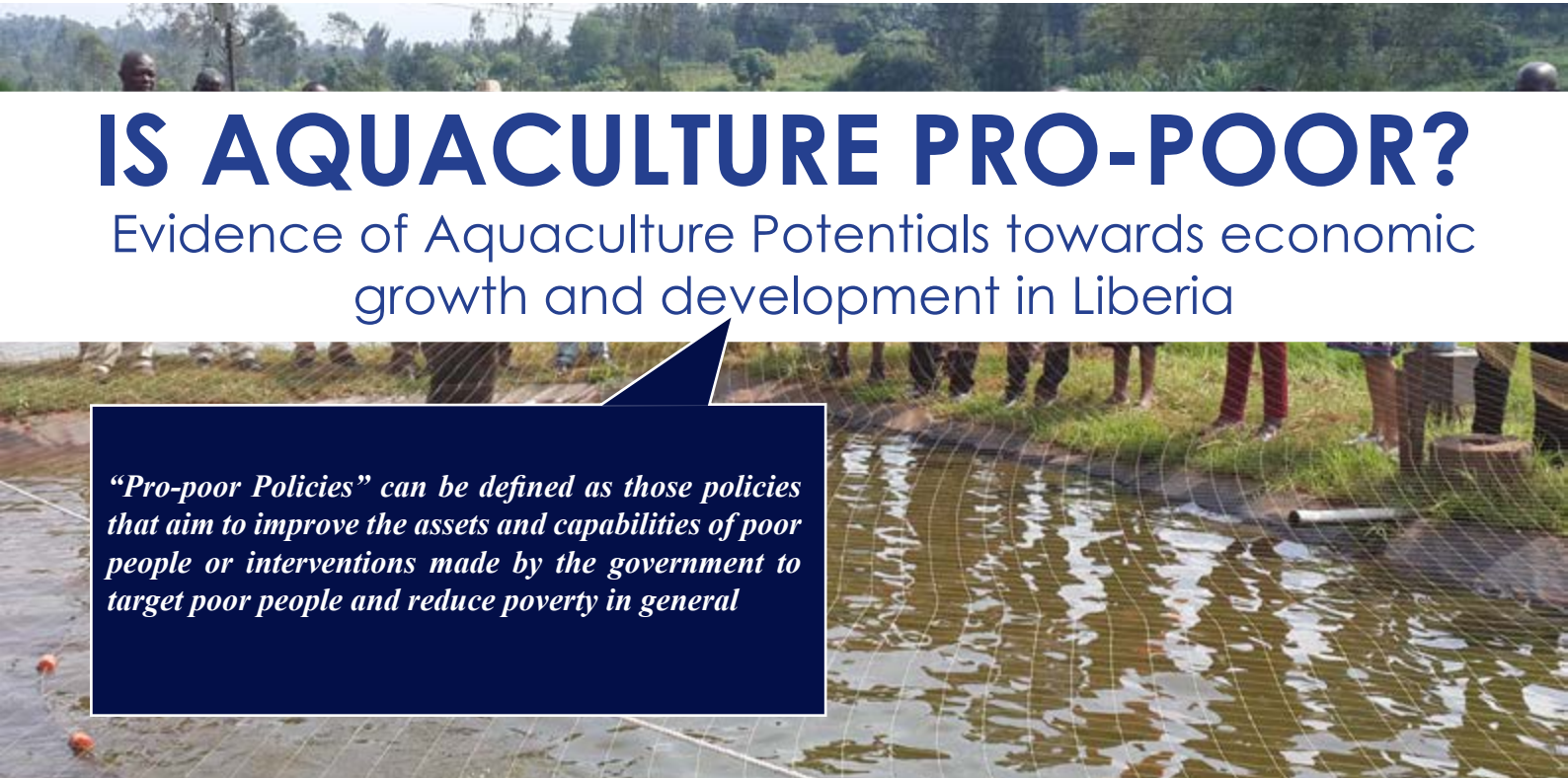


IS AQUACULTURE PRO-POOR?

Evidence of Aquaculture Potentials towards economic growth and development in Liberia



“Pro-poor Policies” can be defined as those policies that aim to improve the assets and capabilities of poor people or interventions made by the government to target poor people and reduce poverty in general

Primarily, it is fundamental to define the terms Aquaculture and “Pro-poor Policies”. Aquaculture refers to breeding, raising, and harvesting fish, shellfish, and aquatic plants. Basically, it is farming in water. Aquaculture is an environmentally responsible source of food and commercial products that helps to create healthier habitat, and is used to rebuild stocks of threatened or endangered species.¹ On the other hand, “Pro-poor Policies” can be defined as those policies that aim to improve the assets and capabilities of poor people or interventions made by the government to target poor people and reduce poverty reduction in general (Busse, 2006).

Poverty headcount in Liberia as at 2017 is about 50.9 percent and is more prevalent in rural areas than urban areas, 71.6 percent and 31.5 percent respectively.² The enhancement of aquaculture activities can be linked to the priority of the Pro-poor Policies of the Liberian Government. Most of the poor live in slums

and rural areas where there are fresh bodies and inland water. By that implication, it does not cost much to start an aquaculture project. It is easily accessible to get into the sector by the poor, meaning, it is more labor Intensive than capital intensive. Rigorous and costly academic training are not necessarily required rather practical training that can be comprehended by anyone. Since Aquaculture remains practicably a low-key sector in Liberia, an immediate investment into this sector has very huge potentials to dissipate poverty mainly rural dweller when the sector is fully jump-started based on its derivatives: Contribution to employment, Contribution to healthcare, Contribution to income and poverty in general, etc.

Today, as the world population is expected to increase to 9 billion, it is essential that food-producing sectors secure food for the growing population before 2050 (FISH, 2013). Interestingly, fisheries and aquaculture can help address such issue, in terms of: sourcing food, providing nutrition and income to millions

¹<https://oceanservice.noaa.gov/facts/aquaculture.html>

²<http://pubdocs.worldbank.org/en/733441492188161968/mpo-lbr.pdf>

of people around the world. In 2014, global fish harvested amounted to 73.8 million tonnes with total value of 160.2 billion to fish farmers, while its total production globally accounted for 44.1% as compared to production in 2012 at 42.1 percent. Countries ranked as top five producers during this period were: China, India, Viet Nam, Bangladesh and Egypt. Productively also, countries like Greece, The Czech Republic, Hungary, Lao and Nepal were classified as countries with well-developed aquaculture system (José Graziano da Silva, 2016).

In Africa, aquaculture has long been introduced over 50 years ago in many countries (Moehl, 2001). At the close of the 20th century, Nigeria was ranked as the largest producer, followed by Madagascar and Zambia respectively (pp344). Despite several establishments being done within the continent, series of challenges in terms no reliable production statistics; credit availability limited for small-scale farmers; very low technical level of fish farmers; unavailability of local feed ingredients; lack of well-trained senior personnel; prohibitive transport costs; and lack of juvenile fish for pond re-stocking (pp341). The dawn of the 21st century witnessed Egypt making significant gains in aquaculture. Egypt leapfrogged Nigeria as Nigeria dwindled to the second largest producer in aquaculture followed by Madagascar respectively.³ In recent years, production from the region reflects a 60% increase over the previous decade as this indicates only 2 % of the world total aquaculture with 1% value to total fish farmers (Brown, 2012).

Prior to the civil war, the Liberian economy was also supported by the agriculture sector which contributed largely to the country's economic growth in addition through the exportation of principal products such as: Iron Ore, Diamond, Gold, rubber etc. Since the peaceful resolution of the civil conflict, many returns have not been generated due to its lower demand consumed within the global market. During the last five years from 2012 to 2016, exports of Liberia increased at an annualized rate USD\$1.92Billion.⁴ From 2006 to 2016, aggregate import amounted to US\$10.7 billion while export amounted US\$3.315 billion. The difference of import over export represents

more than 2.4 times the amount received from export for the same period. Import increased from US\$466.7 million in 2006 to US\$1.2 billion at end 2016 while export despite increasing to US\$543.7 million in 2013 declined to US\$279.3 at end 2016 (Del-Francis Wreh and Mansaray Mabintu, 2018). This indicate that majority of the consumable goods are imported making the country vulnerable to global food price volatility.

Notably, Liberia is a country well endowed with abundant of natural resources especially for aquaculture production. Liberia total fresh water summed up to 15,050 km² that constitutes 14% of the total land area of the country.⁵ Much has not been done comparatively to other countries amidst our access to creeks, rivers, lagoons, swamplands, streams, lakes, inlands, etc. These attributes can be used as tools to expedite aquaculture in Liberia as well as to signal the need to prioritize aquaculture on the agenda of the government in terms of making robust policies to match their counterparts regionally and continentally. From the current growth rate, the population of Liberia is expected to increase to 35.8% from 4.8 million in 2018 to 6.5 million in 2030.⁶ By this, it is important that total performance of the economy must remain steadfast in providing essential needs to maintain the livelihood of the general population. The poor unemployed population can engage in aquaculture and in return use their harvests for commercial purposes to increase food security and livelihood.

For the purpose of this research, the paper will focus only on the breeding, rising, and thus fish harvesting, and its potentials towards economic growth and development in Liberia. The paper is structure as follows: (1) Literature Review from other findings on its impact towards growth within an economy", (2)" Success (es) of Aquaculture Production from other countries", (3)" Historical production trend of fish Aquaculture in Liberia (4)"What has been done towards the sector", (5)" What are the challenges", (6)"Mechanism of how aquaculture promotes economic growth", (7)"Conclusion" and Policy Recommendation for promoting aquaculture activities.

³<http://www.un.org/africarenewal/magazine/april-2006/africa-starts-fishing-%E2%80%98revolution%E2%80%99>

⁴Central Bank Annual Report 2012-2016

⁵<http://www.fao.org/fi/oldsite/FCP/en/LBR/profile.htm>

⁶<http://www.worldometers.info/world-population/liberia-population/>

LITERATURE REVIEW



In order to identify the advantage and impact that aquaculture has on economic growth, the research review other empirical findings.

From the research analysis on aquaculture development project in Bangladesh on food security, with particular emphasis on the poor Jahan et al (Belton, 2010) depicted that providing equitable measures to promote aquaculture serve as an impetus for employment, income and consumption. Aquaculture can also be classified as a global economic powerhouse that enhances livelihood through the process of allocating jobs to isolated and underprivileged areas in developing nations and giving access to food in terms of: societal benefit, education and healthcare (Stevenson, 2009). In relation to this idea, positive aquaculture production do not only improve the livelihoods of people but is also an attractive entry point for the poor especially through rural development programs which include

exceptional nutritional characteristics to alleviate under nutrition, promote relatively high value and marketability to generate income, and increase the prospects for agricultural diversification through construction of ponds as on-farm reservoir (Edwards, 2000). With respect to gender, aquaculture provides jobs for most women which enable them to earn income and build financial ability and household. This is reflected through stronger purchasing power and better access to resources within rural areas (Mun, 2017). However, aquaculture also benefits rural development mostly related to health and nutrition, employment, income, reduction of vulnerability and farm sustainability than urban development. It provides high quality animal protein and essential nutrients especially for nutritionally vulnerable groups, such as: pregnant and lactating women, infants and pre-school children. It creates 'own enterprise' and provides income through sale of what can be relatively high value products (Halwart M, 2003).

SUCCESS(ES) OF AQUACULTURE PRODUCTIONS FROM OTHER COUNTRIES.



Fish farming is a major source of livelihood and income generation for some countries in Africa and the World Over. The practice of fish farming (aquaculture) in these countries has become a significant instrument for revamping their economic growth and development of their nation as well as a source of healthy food for humanity at large. Below are highlights of some African Countries and other countries that showcased success story relative aquaculture on a plausible pedestal:

Aquaculture has been known in Egypt since the beginning of written history; tomb friezes date back to 2500 B.C. and illustrate the harvest of tilapia from ponds (Bardach et al, 1972). Modern aquaculture began in the mid 1930s following the introduction of the common carp at two research farms, from then until the early 1960s, the carp was kept purely for research purposes. Most aquaculture activities are located in the Nile Delta Region. Aquaculture is currently the largest source of fish supply in Egypt accounting for almost 65 % of the total fish production of the country with over 99 % produced from privately owned farms.

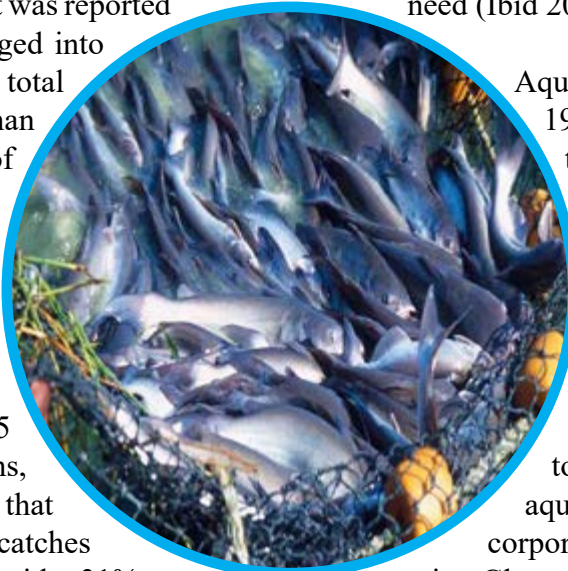
The expansion of modern aquaculture started two decades ago and has witnessed a significant and rapid development over the last few years that have led to a sharp increase in production. Aquaculture is being considered as the only viable option for reducing the gap between production and consumption of fish in Egypt. This sector has exhibited the strongest growth of any fisheries related activity and has become very sophisticated and diverse due to the rapid expansion in support activities of local feed mills and hatcheries. The number of fish hatcheries has increased from 14 in 1998 to over 300. More than 16 fish feed manufacturing companies have been established during the course of the last ten years. Its annual aquaculture production had jumped from a mere 17 000 tonnes to 45 000 tonnes. There are different types of employment into the sector. Landowners of aquaculture sight are estimated between 37 000 and 43 000. However, people working in fish hatcheries, cage farms and intensive pond aquaculture can be estimated at 25,000 persons. Also those that are working as staff at government run hatcheries, fry collection stations, juvenile production facilities and

fish farms can be estimated at 1,000 persons. Other group of workers includes consultants, feed mill staff, engineers, transport, processing and other support activities summed to 228 and the number of people working in fish feed production is estimated to be 540 persons. The Ministry of Agriculture and Land Reclamation in 2017 planed to increase Egypt's total fish production to 1.5 million tonnes by targeting a harvest of 1 million tonnes from aquaculture but the sector has been growing at levels exceeding as plan (Overview, National Aquaculture Sector FAO, 2010) The consumption of Fish has become an important dietary and nutritional element for many Nigerians since 2013, which have become a major source of their livelihood. However, it has being climax as one the largest aquaculture producer in Sub-Saharan Africa and this importance, is steadily increasing. Total fish imports in 2013 amounted to 1.2 million while export was value at 2,84390 million with catfish being the most farmed species. By 2014, it was reported that 713,036 people were engaged into fish farming, where 21% of the total number were female higher than 2012 of 13,627 consisting of 2% female. Artisanal small-scale fishers, from coastal, inshore, creeks of the Niger Delta, lagoons, inland rivers and lakes, generated more than 80% of its domestic production. Total production of fish in 2015 was estimated at 1027.000 tons, which entails marine catches that contributed 36% inland waters catches with 33% and aquaculture with 31%.

During the same year, the fishery sector contributed 0.5% to national GDP. Comparatively according to the government report, aquaculture production has grown steadily from 21,700 tons in 1999 to 316,700 tons in 2015 (Ibid 2010).

The fisheries sector in Madagascar is divided into three sub sectors, Inland fisheries (freshwater fishing in streams and lakes); Marine fisheries (structured in three main segments: traditional fisheries, artisanal fisheries and industrial fisheries); and Aquaculture (marine aquaculture and freshwater aquaculture). Marine aquaculture includes the culture of shrimp, seaweed and collect of sea cucumber. Freshwater aquaculture is dominated by the culture of Tilapia and Carp. It has become the fast important activity in the

fight against mal-nutrition. The estimated potential for captures over the years both fisheries and aquaculture is 480,000 tonnes. Aquaculture has become one of the alternatives projects in Madagascar to reduce poverty and to contribute to social well being of the population. The project is mostly sponsor by USAID .The project encourages rural people to culture fish in rice fields and the establishment of a fish nursery for constant supply of fingerlings. At the moment there are 210 commercial fingerlings centers producing some 6 000 0000 fingerlings for local rural fish farmers. About 40 percent of the farmers raise royal carp directly in rice fields. After each season, they dig out the manure rich mud and use this to fertilize garden plots or small plots of land devoted to intensive rice production. Farmers report that the yields on these plots have increased significantly. It is worthy to note that fish culture is helping to reduce pressure on natural resources and providing local families with food and income they need (Ibid 2010).



Aquaculture in Ghana started since 1953 by former fishes department in the northern part of the country as a way of supplementing national demand for fish and increasing livelihood opportunities. This initiative has grown substantially at an average rate of 9% that have attracted policy planners in various departments to direct their energies to aquaculture. The government, corporate bodies and individuals in Ghana have considered aquaculture

production as a major sustainable economic activity as fish notably accounts for as much as 60 percent of animal protein in the average Ghanaian diet, and 22.4 percent of household food expenditures. From 2005 to 2010, production in aquaculture has increased from 1,200 tones to 10,200 tones. This production trend has been increasing year on year making a massive production in 2016 at 52,470 tones.⁷ The growth of production in aquaculture was due to the higher price of tilapia and its expanding cage farming in the Volta Basin and the high level of government interest and commitment. Over the years Tilapias has constituted 90% of total aquaculture harvest in the region. About 58,000 people or 0.22 % of Ghana's population of

⁷https://www.bahamas.gov.bs/.../Session_2_FINAL+STATUS+OF+AQUACULTURE+I...

26.4 million are actively engaged in aquaculture as an economic activity (FAO 2016). Interestingly, the country has a Good climatic conditions, Good investment climate, Soils with high water retention etc, High national fish requirement (1,000,000 mt), High deficit in fish supply (500,000 mt), availability of quality fish feed and fish seed which importation of fish feed is tax free, has a capable labor force and availability of appropriate technology of which all of this enable fish farming nationwide (Ibid 2010)

Buttressing the success story from the few African Countries above, the global front showcases that lessons learned from Greece, Hungary, Czech Republic, Lao and Nepal, have placed Greece to be the highest supplier of national seafood production in the European Union (EU) region. Its major production source from marine fish farming which contribute 19% of total Greek exports. The reason for its large production depend on several factors such as: environmental and climatic conditions, the availability of adequate sea and inland areas, the longstanding experience and scientific know-how, the existing infrastructures and the skilled human resources.

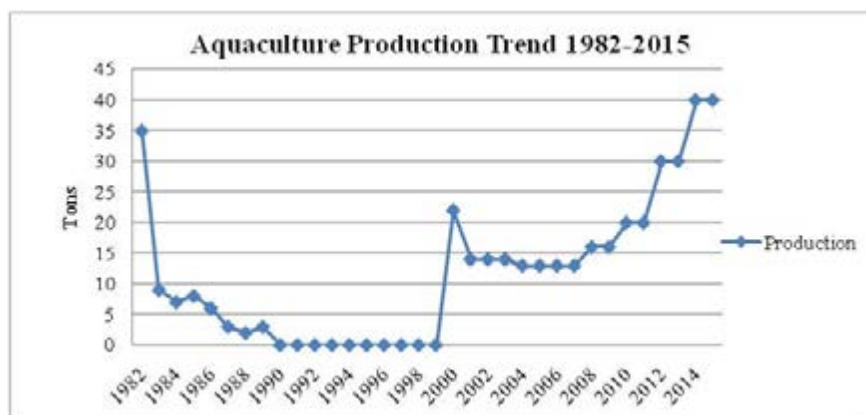
On the issue of accomplishment, the sector has provided the country with competitive advantage and dynamic potential for economic growth in the framework of smart specialization strategies. In the year 2004, total yield from aquaculture amounted to 105,650 tons couple with 6,600 employees. By 2006, aquaculture accounted for close to 60% of total fish produce during this year. In 2012, the number of enterprises that were involved into aquaculture production total to 1,051 producing a total volume of 114,000 tones that was seen lower than 2011 but later increased by 4% before the end of the period. This period also accounted for 4,900 employees.

However, it is estimated that by 2023, aquaculture is expected to be a leading primary sector within Greece providing a high level of environmental protection and a significant contributions towards the economy growth. Total budget for aquaculture in 2012 summed to \$109.76 million United States Dollars (European Maritime and Fisheries Fund (EMFF) Greece, 2013). For Hungary, fish farming was practiced since 1890. Total fish produced from aquaculture in 2002 sum to 63 %(11,574 tones). In Hungary, fish produced from aquaculture depends on both extensive and semi-extensive technologies that wholesomely involved the utilization of natural food. Majority of fish farming comes from fishpond, which constitutes 91% of total fish export, by which 7% source from intensive system.

The country has a total of 25 to 2600 registered fishpond ha, and out of this number, only 18,000 (67%) has been used for fish utilization. The aquaculture sector in Hungary contributes 0.03% towards the country's GDP providing jobs for 1,500 people per year. Moreover, each year, total production in aquaculture amounts to 22,000 tons of which 15,000 tones are consumed by humans that represent a total value of \$357.6 million United States Dollars. For 2012, the number of registered fish farmers observed within the country sum to 350 which majority are small and medium-sized enterprises. The total budget for aquaculture production account-for \$105.9 million United States Dollars with \$25.77 million dollars being issued by European Maritime Fisheries Funds (EMFF) in support of aquaculture production in Hungary (European Maritime and Fisheries Fund (EMFF) Hungary, 2012).

HISTORICAL AQUACULTURE (FISH) PRODUCTION TREND IN LIBERIA

Figure 1: Liberia aquaculture (Fish) production 1982-2015



Aquaculture production (metric tons)(world bank 1982-2015)

Since the activities of aquaculture practiced in 1950, prior to the early 80's was the only period which aquaculture production reached a higher peak of 35 tonnes, that later plummeted in 1983. By 1985, production outcrop became pretty steep but later subsided in 1988. During the year 1989, production saw a little increase but came to a standstill between the years 1990 and 1999. The year 2000 was seen to be a sudden jump which fish production amounted to 22 tons due to the reconstruction by the EU-support towards the hatcheries at Klay (Bomi County), Douyee Town (Grand Gedeh County) and Salayea (Lofa County), which supplied the necessary fish fingerlings to farmers but shortly reduced to a stagnated amount of 14 tons between 2001 and 2003. By 2004, a slight decrease was seen in products at 13 tons from 2004 to 2008 as the number of fish farmers roused from 350 to 1,050. This also took account of subsistence farming. During the same year, the fish sector contributed to 3.2% of total GDP. Comparatively, between 1980-2002 most countries that were very productive in aquaculture consume

16kg per person for a year while Liberia per-capital consumption decline to 4.33kg per person from 14Kg for a year, which constitute a total demand gap of 11.67 kg per person.⁸ From 2008 to 2015, production in aquaculture made a number of improvement but not as impressive as compared to other countries around the world.

In Liberia, aquaculture production is mostly consumed by rural dwellers.

Total fishponds within the country summed up to 1,704, which is equivalent to 113.9 hectares. These fishponds are distributed in 160 rural communities of which only 1,125 (73.3 hectares) are in use for farming tilapia and catfish. This practice has partly contributed to the employment, income earning and livelihood for about 1,050 fish farmers in Liberia, with some engaged on a full-time basis and hundreds of thousands more on a part-time basis within the country (The Republic of Liberia General Economic Data, 2007). Unfortunately, those that are mostly into the aquaculture development in Liberia are International Non- Governmental Organizations (NGO), Local non-Governmental Organizations and some private individuals (Kpadeh, 2011). Presently, there are seven NGOs operating in the aquaculture sector under the thematic framework of food security in Liberia. These NGOs include: Concern Worldwide, Samaritan Purse, APDRA, Africare, German Agro Action (Welt Hunger Hilfe), Care International, Faimba Fisheries Development Cooperative (FFDC), and Solidarities International (pp10).

WHAT HAS BEEN DONE?

Interestingly, there have been several aids provided to promote growth on aquaculture within the country from overseas. In 2013, the National Fisheries Aquaculture Authority (NAFAA) received a grant to develop the National Aquaculture Strategy and Development plan (NAS) from FAO-Rome in order to train farmers and for the enhancement of farming techniques.

Some topics covered were: pond construction, fish pond fertilization, Fish feed production, feeding, fish predator and competitor's prevention, good fingerlings production and monitoring record and marketing, etc. This initiative served as the most significant capacity building projects towards the sustainability of the development of aquaculture within Liberia.⁹

⁸Kpadeh(2011)

⁹<https://thefishsite.com/articles/a-developing-sector-aquaculture-in-liberia>

During the same year, the FAO also hosted a workshop on the framework of the South-South Cooperation (SSC) project funded by the Government of Japan as part of its commitment to Aid for Trade. This process aimed at integrating developing countries into the multilateral trading system. The workshop mostly focused on promoting aquaculture and rice production in Sub-Saharan Africa especially in Liberia through capacity development.¹⁰

Another significant aquaculture intervention commenced in Grand Gedeh and River Gee counties through the support of a FFP project, and HANDS. The HANDS team also rehabilitated the largest National Fisheries Aquaculture Authority (NAFAA) hatchery in Liberia in Duoyee Town, Grand Gedeh County; in 2013 which was originally constructed by the European Union in the 1980s. The team constructed a fish-processing shed at the hatchery to gut, clean, sort out males and females fish, package fish for transport and composting for organic fish feed. They also installed a solar dryer for fish preservation and trained workers and government staff on its uses. Total beneficiaries were 108 farmers who were introduced to pond and feed record keeping, ways to determine the sex of tilapia, fish transportation methods, general pond maintenance, composting, processing local fish feed, and cooking demonstrations (USAID office of Food for Peace Food Security Desk Review for Liberia, 2016–2020, 2016).

In 2015, cabinet ministers adopted the first fisheries and aquaculture sector policy and strategy to provide guidance towards the realization of fisheries sector¹¹

(Fisheries & Aquaculture Policy and Strategy). In 2016, through a collaborative effort from the government of Liberia (Ministry of Agriculture and Ministry of Youth and Sport), Food and Agriculture Organization (FAO) and other United Nations Agencies, a 10-days seminar was held to enlighten 40 Liberian youths on how aquaculture can help develop Liberia's economic growth through the enhancement on entrepreneurship, rural sustainability and alleviation of poverty in Liberia. The amount of \$492,000 U.S. dollars was provided by the FAO under its technical cooperation with the GOL.¹²

In terms of restrictions, the Bureau of National Fisheries executed restriction on importation of exotic species into fish farming in Liberia. There were also a halt to the introduction of the African Bony tongue (*Heterotis niloticus*) by APDRA, a French NGO, for implementing inland fishing in 2009 which was later accepted in 2010 after a thorough investigation on its biology and impacts on countries being nurtured.¹³ Their technical work substantially occurs between 2010 and 2013 through a World Bank-funded initiative. This project provided technical assistance to 143 fish farmers in Bong, Nimba, and Lofa on 30 hectares of ponds (Fisheries & Aquaculture Policy and Strategy) pp7.

However, on Feb 27, 2018, a capacity building training targeting 60 fish farmers and technicians on the introduction of new techniques and methods in fish farming were conducted by a team of aquaculture experts from Israel.¹⁴

WHAT ARE THE CHALLENGES?

From several interventions, aquaculture production in Liberia is vastly underutilized and inefficient compared to the pre-war period. Majority of the projects implemented between 1995 and 2008 have failed because of the unavailability of first-hand information on feasible regions for aquaculture development.¹⁵ One of the key issues is that, funds are not specifically being allocated to the aquaculture sector within the national budget of Liberia. There

is also absence of a well-prepared hatchery for the production of quality feed. Most Ponds constructed by NGO have had a drainage problem and very shallow, as management are very low. The quality of water has also been tested low in total alkalinity and total hardness, as infrastructure tends to be very poor for the breeding fish species and the lack of technical training needs to revamp human capacity (Woyea, 2012).

¹⁰<https://reliefweb.int/report/liberia/government-liberia-and-fao-hold-national-seminar-rice-and-aquaculture>

¹¹<https://www.liberianobserver.com/columns/agriculture/govt-to-boost-fisheries-aquaculture-sector/>

¹²<http://www.borgenmagazine.com/aquaculture-poverty-in-liberia/>

¹³<https://thefishsite.com/articles/a-developing-sector-aquaculture-in-liberia>

¹⁴<http://www.liberianobserver.com/news/isreal-to-boost-aquaculture-production-in-liberia/>

¹⁵<http://www.unuftp.is/static/fellows/document/zizi11prf.pdf>

MECHANISM OF HOW AQUACULTURE CAN PROMOTES ECONOMIC GROWTH AND DEVELOPMENT



From the experiences of other countries, aquaculture has taken an upward trend in growth, which has also positively impacted their economies. These upward trends in aquaculture helped to promote economic growth and development through several economic indicators, such as: Employment, Income, Education, and Healthcare. Below are the relationships of aquaculture with these indicators aforementioned.

Employment and Aquaculture: Employment is one of the key factors, which portrays a country's economic growth and development. Being employed, one has the potential to put into practice what he/she has acquired thereby inspiring or molding others for productive work and positive output subsequently with ripple effect. Employment also creates the avenue for one to earn income. The more people get employed and earned income, it pinpoints that the economy is undergoing economic growth geared towards Development. Consequently, the fourteen (14) years of civil unrest in Liberia plunged the country into fragility, characterized by high rate of unemployment, which has been a stumping block towards the nation's effort for achieving its developmental goals. This problem normally exists among youth 18 to 35 years, as these ages constitute 65% of the total labor force of Liberia's population¹⁶ as many are seen disconnected from both the labor market and opportunities that promote future employability.

Aquaculture has the tendency of creating employment, which automatically enhances economic growth and improves the livelihoods of the beneficial population. Aquaculture benefits and empowers the population through the employment of individuals for the processing of fish, hatchery (gathering eggs from brood fish for spawning, feeding, cleaning and maintaining holding tanks, water quality, and other fish health diagnostics), fish farming sight such as fish farm technicians etc. As aquaculture improves, it attracts and expands the labor force in this sector. This eventually enhances the productivity of fish for consumption and trade, which contributes largely to the growth of an economy.

Income and Aquaculture: Comparatively, Liberia has been classified among countries of lower income per-capita. The (Household Income Expenditure Survey LISGIS 2010) buttresses this finding; 45% of Liberians who are employed receive a monthly salary between 6,000(\$41) to 15,000(\$111) Liberian Dollars. The percentage of monthly salaries earned in the urban area is larger than the earnings received in the rural area. In this context, increment of investment into aquaculture mostly in the richly-endowed rural area serves as a catalyst for generating income from the sales of increased fish output and eventually attracts more foreign currencies from exports as well as reducing the outflow of scarce foreign currencies spent on fish importation. This usually creates income-earning jobs for rural dwellers mostly and promotes per-capita income growth. The commercialization of fish and provision of employment through aquaculture will trigger a boost to National Income. Moreover, some of the remunerations or returns generated within the aquaculture sector by fish farmers can also be used to facilitate the enrolment of their dependents in schools as well as to enhance their technical knowledge on aquaculture production.

Healthcare and Aquaculture: The health care system in Liberia has long been faced with series of challenges especially in terms of an evidence-based nutritional development. The incident of under-nutrition and macro-nutritional within the country have been a severe public health problem by which about 230,000 children below the age of five (5) fall short of such circumstances. Without adequate support, chronic malnutrition leads to a long-term negative effect on the physical and cognitive development as well as the overall human capacity of the country.¹⁷ Fish is normally known for its function towards the human development. Between the periods 1980-2002 up till present, total per-capital consumption of fish by the population has been very low. This has led to a 65% large dependency of animal protein consumption (FAO 2011). Consequently, this buttresses the need for massive investment in aquaculture which will trigger Large production and consumption of fish within the

¹⁶[http://www.ilo.org/wcmsp5/groups/public/---africa/---ro-addis_ababa/---ilo \] abuja/documents/publication/wcms_466864.pdf](http://www.ilo.org/wcmsp5/groups/public/---africa/---ro-addis_ababa/---ilo%20abuja/documents/publication/wcms_466864.pdf)

¹⁷<https://www.unicef.org/liberia/nutrition.html>



economy and provide a range of health benefit such as: protein and nutrition which enhances the human life span; helps to build and repair body tissues, fine-tone complexion and fight against bacteria. It will also reduce the risk of various diseases such as: heart disease, toothaches (by contributing to the formation of healthy teeth and gum), etc. This gives the human more energy and fitness to perform well within the society.

Poverty and Aquaculture: Generally, aquaculture plays a pivotal role in the alleviation of poverty based on the various economic indicators mentioned above. The aftermath of Liberia 14 year's civil conflict led to series of inadequate management within the public and private sector, which has affected majority of the population. The issue of poverty has been an alarming rate in Liberia. According to WHO, Liberia is ranked 182nd out of 182 countries in the world. It is estimated that 62% of Liberians lived below the

poverty line of which 1.3 million lived in extreme poverty (Draft Country Programme Liberia 2003-95, 2013–2017). Even though the agriculture sector have been improving in recent time, but sub-sectors like aquaculture also play an important role in providing food in many developing nations. From the amount of fish provided from aquaculture this can contribute largely to the reduction of poverty and the saving of million lives through interlinked pathways that is nutritional benefits from the consumption of fish; income to those employed in the sector, multiplier and spillover effects in fishery-dependent regions; through generation of revenues from exports, taxation, license fees and from payment for access to resources (Aquaculture, Fisheries, Poverty and Food Security Working Paper 2011-65). With these positive characteristics provided, those who find themselves living in poverty, once engage in such activities, this expand maximum benefits as this improved the living conditions of millions.

CONCLUSION

Aquaculture has long been practiced in Liberia since 1950 but has been the less talk about sector since after the civil war. Hence, the research investigates aquaculture potentials towards pro-poor economic growth and development within the Liberian Economy.

From the findings, aquaculture has a lot of potential to create more jobs and contribute to the achievement of the Pro-Poor Agenda but the sector has been faced with numerous challenges even with the support of external stakeholder in collaboration with the government of Liberia. These challenges are seen within the context of poor policy design for implementation an efficient aquaculture environment. It is compounded by an inadequate infrastructure, low scale trained specialize expertise, low quality of water, lack of accurate data information, no allocation of funds in the national budget and limitation in logistics. These negative factors have caused severe destruction on the level of aquaculture production.

Despite the challenges, aquaculture has positively succeeded in employing 1,050 fish farmer with some engaged on a full-time basis and hundreds of thousands more on a part-time basis within the country utilizing only 1,125 (73.3 hectares) out of 1,704 that is equivalent to 113.9 hectares distributed in 160 rural communities.

Judging from this achievement that Liberia is endowed with, more economic benefit can be harness from aquaculture if more investment and concentrations are provided to promote aquaculture like is done in other countries.

REFERENCE

- The NAFAA should prevail on the Liberian Government through the Ministry of Finance and Development Planning to prioritize budgetary support to aquaculture by making aquaculture a line item in the national budget. This initiative shall buttress the insufficient funding provided by NGO's towards the enhancement of aquaculture which will lead to increased production in the quality and quantity of fish and by extension a reduction in both the price of fish domestically and imported can-fish consumed. However, this could also contribute to the country's economic growth by generating income from the export of fish to near-by neighbors and overtime potentially give Liberia comparative advantage within the Mano River Union Basin (MRU).
- The NAFAA should establish a research and innovation unit to conduct sustained and robust research to improve aquaculture production in Liberia. The outcome or findings from the forecast on production could be used for inter-temporal comparison from successful aquaculture producing countries to assess our strength and weakness geared toward improving the output of aquaculture on a competitive scale.
- Since aquaculture production can be impeded by the lack of access to fresh body waters, there is a need for the NAFAA to encourage the usage of Circular Culture Tanks for aquaculture where rivers, streams, creeks, etc. are not available¹⁸. ¹⁹Circular culture tanks have many positive impacts on fish production especially in terms of having a lucid drainage system, which entails a center outlet removal system for waste. These processes tend to help improve fish health condition. Therefore, tax incentives by the Liberian Government to importers of Circular Cultural Tanks and fish feed, will automatically reduce cost of Circular Cultural Tanks for farmers and increase aquaculture production. Also government should provide subsidies to fish farmers as this will lead to lower price per unit of fish on the market.

¹⁸<https://www.sciencedirect.com/science/article/pii/S0144860916300097>

¹⁹https://www.researchgate.net/publication/256974166_Flow_pattern_in_aquaculture_circular_tanks_Influence_of_flow_rate_water_depth_and_water_inlet_outlet_features

- The NAFAA should institute massive publicity or awareness about aquaculture production on a decentralized scale. This will showcase the gains generated from aquaculture production, which will inspire more farmer to engage in fish farming and potentially lead to economic growth.
 - The NAFAA should provide an effective training program for all eligible farmers and key stakeholders on the management process for promoting sustainable aquaculture. This process will help build capacity and enlighten farmers to have indebt knowledge on the significant approach of aquaculture towards the environment and human growth and by extension will also enhance their ability to formulate solutions to overcome constraint from extreme hazard that might affect the real functioning of production process.
 - In order for the aquaculture sector in Liberia to be a part of fish contribution worldwide, the NAFAA should immediately revitalize and upgrade the only hatchery in Zewdru to a level of efficiency for the production of qualitative and quantitative feed to enhance aquaculture production as well as undertake initiatives to build the capacity of fish farmers and potential fish farmer technically to fully jump-start Aquaculture. Additionally, the NAFAA should also prioritize the building of standardized hatcheries to buttress the only hatchery in Zewdru, Grand Gedeh. This will allow farmers to have readily fingerling (feed) when needed which could foster the productivity of the five main species commonly cultured in Liberia, notably: Nile tilapia, African catfish, Sampa, Mango tilapia and Red belly tilapia. Subsequently, by extension this will lead to sustained food security, improved utilization of farmland and trigger additional income for farmers.
 - The NAFAA should collaborate with the Environmental Protection Agency (EPA) in regulations with their Environmental Impact Assessment (EIA) regarding aquaculture projects in the country, Municipalities, The Liberia Water and Sewer Corporation (LWSC) and the Ministry of public works to ensure that the natural ecosystem between aquaculture and the environment is met. Therefore, this will create an opportunity for retaining aquatic resources to support effective breeding of fish.
- It will substantially provide a fresh aquatic ecosystem that will yield maximum production in terms of fish aquaculture, safety fish production sustainability, rehabilitation and enhancement of the environment from extreme hazard.
- The NAFAA should prevail on key stakeholders of aquaculture within the counties to make full use of available freshwater and explore practicable means to maintain the fish biomass with necessary support from local and central government in terms of investment capital, feed and fertilizers and equipment.
 - The Liberian Government through NAFAA should effect monitoring and evaluation (M&E) on aquaculture production as a means of safeguarding aquaculture production to influence growth and development geared towards poverty reduction throughout the country. This process should be fully regulated with license(s) on an affordable basis to influence and sustain fresh aquatic ecosystem for maximum yields in terms of fish aquaculture and safety.
 - In terms of farm management process a good practice of aquaculture husbandry is essential especially in administering chemicals and fertilizers in the breeding of fish. This will helps provide proper feed and growth for the availability of fish production and the maintenance of a healthy environment. Therefore it is necessary that NAFAA provide available training to farmers and corporate companies with vast knowledge in the general principles of bio-security to be implemented in case of epidemics endangering public health and fish production.
 - For improvement within the aquaculture sector holistically, NAFFA should develop a structural blueprint for effective governance and transparency on the day-to-day activities within the sector. The absence of this fundamental leads to the misused of resources, funds and the environment, which might cause stagnation within the aquaculture production circle.

REFERENCE

Busse, K. B. (2006). Pro-poor Policy Overview

Fish, P. f. (2013). (World Bank Report Number 83177-GLB) From <http://www.fao.org/docrep/019/i3640e/i3640e>.

José Graziano da Silva. (2016). From The State of World Fisheries and Aquaculture: <http://www.fao.org/3/a-i5555e.pdf>

Moehl2, C. M. (2001). African Aquaculture: A Regional Summary with Emphasis on Sub-Saharan Africa.

Brown, W. Y. (2012). Aquaculture Priorities: Expansion in Africa and Standards for Global Sustainability Standards for Global Sustainability

Del-Francis Wreh and Mansaray Mabintu (2018). Determinant and effects of Exchange Rate Volatility in Liberia. Vol.2.

Belton, K. M.-J. (2010). The impacts of aquaculture development on food security: lessons from Bangladesh. Wiley Online Library , Volume41 (Issue4), Pages 481-495

Stevenson, J. R. (2009). Is aquaculture development an effective tool for poverty alleviation. A review of theory and evidence. 18:292–299

Edwards, P. (2000). Aquaculture, Poverty Impacts and Livelihoods .

Mun, O. R. (2017). Impact of aquaculture on the livelihoods and food and security or rural communities. International Journal of Fisheries and Aquatic Studies , 5(2) , : 278-283.

Halwart M, F.-S. S. (2003). The role of aquaculture in rural development. Review of the state of World Aquaculture, FAO, Rome. 47-58.

Bardach, J.E.Ryther, J.H., & McLarney, W.O. 1972. Aquaculture – the farming and husbandry of freshwater and marine organisms. John Wiley & Sons, INC. 351 pp.

Overview, National Aquaculture Sector FAO. (2010).

European Maritime and Fisheries Fund (EMFF) Greece(2013).

European Maritime and Fisheries Fund (EMFF) Hungary(2012)

The Republic of Liberia General Economic Data . Food and Agriculture Organization of the United Nations(2007).

USAID Office of Food For Peace Food Security Desk Review For Liberia, 2016–2020. USAID (2016). Fisheries & Aquaculture Policy and Strategy (2014)

Woyea, K. L. (2012). Liberia Aquaculture Assesment With reference to Grand Gedeh and River Gee.

Household Income Expenditure Survey LISGIS 2010

Kpadeh, Z. A. (2011). The Potential of Aquaculture in Liberia

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