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Short Communication

Aquaculture in Sri Lanka: History, current status and future potential

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Introduction

The World Food and Agriculture Organisation (FAO) [1] predict that the world's population will reach over 9 billion within 2050, which is approximately 34% higher than today. Nearly all this population increase is expected to occur in developing countries. Urbanization will also continue at an accelerated pace, and about 70% of the world's population will become urban over next 3 decades (compared to 49% today). In addition, income levels in 2050 will be many multiples of what they are now. Hence, the biggest challenge in the future will be to find ways to feed this larger, more urban, and richer population. FAO has forecasted sea catches to stop growing at 85 – 90 million tonnes a year and all incremental demands would have to be met by culturing. By 2030 aquaculture production is estimated to reach more than 90 – 95 million tonnes, a prognosis based on 3% annual growth. Moreover, to support projected food demands in 2050, production must rise an estimated 70% above current values to allow the global population to continue to consume seafood products at the current rate. Thus, the expected deficits in food supply the next decades are currently being targeted by several stakeholders, NGOs, and Governments around the world.

Compared to other industries, aquaculture has proven to be an efficient catalyst for production of seafood world-wide. Moreover, aquaculture has arisen as the major mode of food production to maintain the current *per capita* consumption with an average annual growth rate of 11% since 1984. Thus, aquaculture is expected to increase rapidly in volumes and diversity of cultured species, and thereby become the main source to food and protein supply in the future. However, the success rate will, among others, be influenced by development of adequate technical innovations, availability on feed ingredients, cooperation between Governments, and sharing of technology and know-how between aquapreneurs.

Sri Lanka is now in the process of embarking on a very ambitious aquaculture development plan, targeting doubling of the current aquaculture production to approximately 90,000 metric tonnes (Figure 1). Major markets for Srilankan fish product and total value in 2019 is shown in Figure 2. This goal will be met through sustainable aquaculture development, addressing technology transfer, training programmes, food safety and quality, and environmental integrity.

Srilankan aquaculture - history

Sri Lanka is more or less designed for aquaculture with a total coastline of approximately 1,700 km. The total extent of lagoons and estuaries has been estimated to be 121,000 hectare (ha). Adjoining these estuaries and lagoons are extensive area of low-laying delta lands estimated at 70,000 hectares.

The aquaculture industry in Sri Lanka started in the early

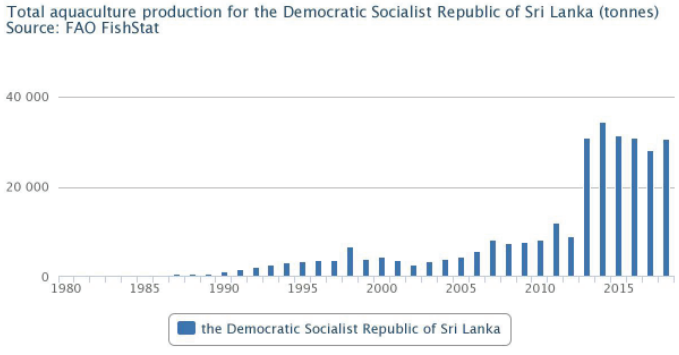

Figure 1: Total aquaculture production between 1980 to 2018 [1].

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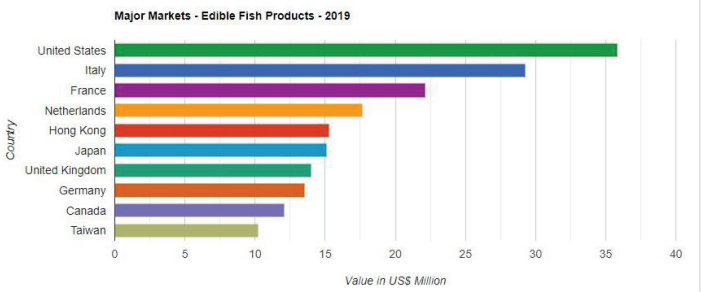

Figure 2: Major export markets for fish products origin from Sri Lanka [2].

1980's with few large multinational companies and few medium scale entrepreneurs embarked on shrimp farming. Due to political unrest, the pioneer period developed slowly up to early 1990's. However, during the period 1992 – 1996 there was a rapid, and uncontrolled, development in the shrimp farming industry due to attractive public investment incentives and high economic return. In this period, they produced 8,000 – 9,000 kg/ha/year (stocked at 30 – 40 shrimps m^{-2}) in classical earthen ponds. Small-scale farm of around 0.5 – 1.0 ha were developed in clusters mainly encroaching lagoons, reservations and in ecologically sensitive areas (mangroves, salt marshes, inter tidal mud flats, coconut plantations). The total number of farms amounted close to 1,400 with over 70 hatcheries, and a total area of 4,500 ha was allocated for shrimp farming including areas used for reservoir purposes. However, due to a lack of proper law enforcement and poor environmental planning, the rapid development culminated in close to 47% of all farms being illegal establishments operating without proper licences. Moreover, the lack of coastal zone management and infrastructure development lead the industry into the so-called "self-pollution effect". Thus, from 1996 the industry started to suffer due to disease outbreaks and environmental problems, and almost all the farming activities became restricted to a narrow coastal belt of approximately 120 km by 10 km in the North Western Province Table 1.

Between 1998 and 2004, the industry was characterised by volatile boom-and-boosts, with unsure conditions caused by multiple disease outbreaks. The number of farmers was dramatically reduced, and the vast coastal belt area undertaken to aquaculture became unsuitable for farming. After 2004, Sri Lanka has slowly been developing the aquaculture industry in a positive direction, learned from the lessons done. The industry started in 2005 to develop closed and semi-closed production systems as well as fully recirculated systems for shrimp and finfish aquaculture.

Srilankan aquaculture – current status

Nowadays Sri Lanka has a limited, but stable, shrimp production and a growing aquaculture production of finfish. So far, the main focus has been to start in small scale where fish farming is aiming to support smaller local communities with income and food supply. During the last few years, numerous trial projects have been established in different regions of the country including sea cages and land-based installations from fish and shrimps. Based on the current experience with cage farming, there is a growing interest to install bigger sea cages with circumference up to 60 meters in the northeast areas of the island. Sri Lanka is only 7 degrees north of the equator and thus the seas are calmer and not exposed to nature disasters (typhoons, storms, etc) similar to many other countries in Asia. Maximum wave height varies between 3.5 – 4.0 meters, and hence sea cage farming has a great potential.

The land-based farming sector in Sri Lanka is also receiving increased attention. Traditional earthen pond farming of shrimp and finfish is slowly increasing, and farmers are now following a strict coastal zone management plan regulating the time for stocking and harvest in different farming regions. Stocking densities are steadily increasing with good environmental monitoring and control. In addition, several international technology suppliers, including companies from Norway, have in the recent years initiated and established larger commercial production units for Barramundi or Asian sea bass (locally referred to as Modha in Sri Lanka) and Tilapia in recirculating aquaculture systems (RAS).

The commonly applied technology level is also subject to major improvements at the moment, including introduction of bio-floc systems. Mitigating measures like real-time environmental alerts have been tried out during this decade. Shrimp farmers in Chilaw, the main shrimp-farming centre in the North-Western Province, successfully tried a new

Table 1: Export quantity and value of shrimps and ornamental fish 1999 – 2019. (Source the National Aquaculture Development Authority, NAQDA, Sri Lanka).

Export quantity and value of shrimp			Experiment value of ornamental fish	
Year	Quantity(Mt)	value(Rs.Mn)	Year	Value(Rs. Mn)
1999	2716	2275	1999	560
2000	4855	5041	2000	593
2001	3941	4300	2001	545
2002	3368	3286	2002	529
2003	4467	4165	2003	624
2004	2462	2359	2004	745
2005	1800	1769	2005	756
2006	1837	1987	2006	888
2007	2023	2487	2007	906
2008	854	1082	2008	973
2009	1432	1627	2009	979
2010	1262	1521	2010	919,5
2011	1380	1799	2011	1112
2012	1056	1618	2012	865
2013	1625	2511	2013	1383
2014	2001	3375	2014	1636
2015	1341	1971	2015	2392
2016	1667	2464	2016	1847
2017	1844	3213	2017	2288
2018	1984	3485	2018	2626
2019	2115	352	2019	2913

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remote alarm solution to avoid or minimise negative effects on production from adjacent areas/farmers.

Investigations done by the National Aquaculture Development Authority (NAQDA) [2] revealed that over 8,500 ha in Sri Lanka can be developed into aquaculture. At present only 25% of these areas are used for aquaculture of various species, and feasibility studies have documented that aquaculture can be undertaken in these areas with reduced biological risks. NAQDA also evaluated the water quality at several new locations in the Northern Province showing acceptable levels of dissolved oxygen, pH, salinity, and alkalinity. Sri Lanka has developed a good infrastructure in the fishery sector which is suitable for large quantity export to markets willing to pay a surplus price for high quality seafood products.

At present, Sri Lanka is emerging as a target country for foreign investment in aquaculture. During the last decade, investments have been made from countries like Norway, Scotland, Vietnam, Japan, USA, and Canada. Investments are directed into hatcheries, land-based on-growing systems, sea cages, and development of infrastructure facilities such as roads, common inlet/outlet canals for water intake and release, sedimentation canals, ponds, electricity, etc. This reflects the strong beliefs from the Government of Sri Lanka, investors and aquapreneurs that aquaculture in Sri Lanka has the potential to generate substantial foreign exchange earnings and profits. Moreover, with the support of the Sri Lankan government, linkages have been established between government, breeders, farm-zone managers, and academic experts. This allows for effective sharing of information between farmers where feedback from farmers is providing the Ministry of Fisheries with relevant and practical information utilised to transform generic Best-Management-Practices into local policies, plans and actions.

Srilankan aquaculture – future potential

Sri Lanka wants to strengthen their value-chain in aquaculture including brood-stock/domestication, juvenile production, feed development/production, on-growing and marketing. With the unique geographical location in South-East Asia, Sri Lanka aims to become a major player within the growing aquaculture industry in the region. The current development going on in the northern areas of the island, generates new opportunities by enabling access to many virgin areas well suited for aquaculture of brackish as well as marine species.

According to FAO, about 50% of seafood now comes from aquaculture, yet 90% of Sri Lanka's seafood is still wild caught. This represents a good business opportunity for international aquaculture technology suppliers, investors and distributors. Aquaculture is now changing from a subsector into a concentrated commodity production, aiming for advanced technology level with development towards a sustainable industry in all water bodies (freshwater, brackish water and at sea). The future potential for aquaculture in Sri Lanka is of course unique in Asia which can reduce wild caught supply from 90% to 10% and where aquaculture can fill the gap. Thus, the timing has never been better to start commercial business ventures on a bilateral level in Sri Lanka. Moreover, the *L. vannamei* high-yield prawn variety, also known as pacific white or whiteleg shrimp, was introduced to Sri Lanka in 2018, and is in higher demand globally. In the European Union, *L. vannamei* imports are around 85 percent, with the remaining volumes from black tiger (*P. monodon*). The industry is simultaneously recommended to adapt into Critical Better Management Practices (CBMP), which among others, include zero water exchange (Biofloc technology).

Final remarks

The past 20 years, many Norwegian initiatives has been initiated in order to transfer Norwegian technologies and know-how to Sri Lanka [3-10]. In the coming years it is vital for Sri Lanka to develop a complete and well-functioning value chain for a secure scale-up to industrial aquaculture level. This includes B2B, G2B, B2G and G2G cooperation domestically and internationally. With assistance from Norway, a model has been developed for this purpose (Figure 3), and creates a roadmap for both NGOs, businessmen and Government agencies (see references below).

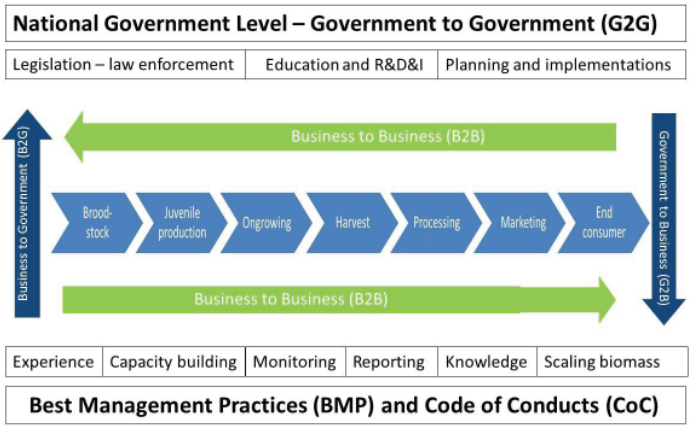

Figure 3: Model for development of industrial aquaculture in developing countries [9].

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