Status of Resource Management and Aquaculture in Malaysia

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Abstract

Malaysia is a maritime nation and its fishing industry is a source of income for 134,000 fishermen. In 2012, the fisheries sector produced 1.7 million tons of fish valued at RM10.8 billion and generated trade worth RM6 billion. The landings from capture fisheries are expected to increase from 1.32 million tons in 2010 to 1.76 million tons in 2020 at an annual growth rate of 2.9%. In 2012, 65% of total catch was contributed by the coastal fisheries as compared to 35% from deep sea fishing. Landing from deep sea fishing is expected to rise from 381,000 tons in 2012 to 620,000 tons in 2020. Deep sea fishing has been identified for its potential to contribute to the increase in the country's fish production. With a growing population and an increasing preference for fish as a healthy source of animal protein, the National Agro-food Policy (2011-2020) estimated that the annual demand for fish will increase to 1.93 million tons by the year 2020. The Department of Fisheries (DOF) has developed the Capture Fisheries Strategic Management Plan (2011-2020) based on three main documents i.e.; National Agro-food Policy (NAP, 2011-2020), Department of Fisheries Strategic Management Plan (2011-2020), and Malaysia National Plan of Action on Sustainable Fisheries for Food Security towards 2020.

Aquaculture is now being promoted in Malaysia as an important engine of growth and eventually to become the mainstay of the nation's economy. Situated in a region with abundant supply of land and water, two determinant factors for aquaculture activities, Malaysia has always strived to ensure that this sector is not sidelined in their development efforts. With a growing population and an increasing preference for fish as a healthy source of animal protein, it has been estimated that the annual demand for fish will increase to 1.7 million tons in 2011 and further to 1.93 million tons by 2020. From the present annual aquaculture production of about 525,000 tons, this output would need to be raised to 790,000 tons to meet the projected demand by 2020. In a move to develop the aquaculture industry, the DOF, has initiated the Aquaculture Industrial Zone (AIZ) Program involving the development of 49 zones, located across Malaysia, which will be used for culture of various types of high value aquatic species. The DOF has identified several strategic areas that would be developed for downstream activities such as fish seed production, feed mills, fish processing plants, and other supporting industries. Aquaculture is also currently listed amongst the 16 Agro-food's Entry Point Projects (EPP) of the National Key Economic Area (NKEA). The government aims to double the Agro-food sector's contribution to Gross National Income (GNI) from Malaysian Ringgit (RM) 20.2 billion in the year 2010 to RM49.1 billion by 2020, or an increase of RM28.9 billion.

Keywords : Malaysia, resource, aquaculture

Country Profile

Malaysia is a federal constitutional monarchy in Southeast Asia. It consists of thirteen states and three federal territories and has a total landmass of 329,847 sq km separated by the South China Sea into two similarly sized regions, Peninsular Malaysia and Malaysian Borneo. Land borders are shared with Thailand, Indonesia, and Brunei, and maritime borders exist with Singapore, Viet Nam, and the Philippines. From the total land area, 1,200 sq km or 0.37% is made up of water such as lakes, rivers, or other inland waters. Malaysia has a total coastline of 4,675 km, whereby Peninsular Malaysia has 2,068 km, while East Malaysia has 2,607 km of coastline. The capital city is Kuala Lumpur, while Putrajaya is the seat of the federal government. In 2012 the population was 28.6 million, with 22.6 million living in the Peninsula. Since independence, Malaysia has had one of the best economic records in Asia, with GDP growing on average at 6.5% for almost 50 years. The economy has traditionally been fueled by its natural resources, but is expanding in the sectors of science, tourism, commerce and medical tourism.

Figure 1. Map of Malaysia.

Overview of the Fish Industry

Trend in Fish Demand

Malaysia is surrounded by sea and blessed with rivers and lakes. These fundamental ecosystems provide natural sources of fish and other aquatic resources for its inhabitants. Hence, fish has been in the daily diet of Malaysians and a main protein source. Until now the trend does not indicate much change despite the availability of many other animal protein sources at competitive prices. There is indeed a preference for fish among Malaysians and it seems it has no replacement. This is well indicated in the household spending on fish and consumption pattern. An average family spends about 20 percent of their food expenditure on fish. Fish consumption index increased from 53.1 kg in 2011 and is expected to be 61.1 kg in 2020. This has put Malaysia among the highest consumers of fish in the world. Given this situation and along with an increasing population,

the supply of fish indeed needs to be outsourced. Current records indicate that domestic landing supplies only about 85% of the demand for its 28.9 million population plus another 2 to 4 million foreign workers in the country.

Fish Resources

Fish landed in Malaysia mainly comes from the sea. Freshwater fish at the moment comprises only less than 5 percent of the total landed volume (DoF, 2012) while catch from the sea in 2012 contributed about 1.6 to 1.8 million metric ton annually. The pattern will not improve further as most of the catch are from coastal zone which indicated declining trend. At this stage, the government encourages and provides incentives for deep-sea fishing venture and emphasizes the need to expand aquaculture activities.

Fish resources in Malaysian waters do not only provide food supply to its population but small percentages are being exported for income and foreign exchange. The fish species for export consisted mainly of high-value fish such as grouper, snapper, shrimp and few species of molluscs. At present, exports brought in significant income. In fact, the return always indicate surplus even after taking into account the expenditures to import other fish species to supplement domestic needs. Fish commodity indeed continues to cushion Malaysian deficit in agricultural food product for some time and also during global economic crisis such as in 1997.

Fisheries Profile

In 2012, the fisheries sector comprised of food fish and non-food fish contributed RM11,440 million to the economy. The food fish sector which is comprised of the marine capture fisheries, inland fisheries and aquaculture (excluding seaweed) produced 1,780,168 tonnes with a value of RM10,598 million. For the non-food fish sector, seaweeds, ornamental fish and aquatic plants contributed RM843 million. Fish production from the fisheries sector contributed 1.1% to the GDP in 2012.

The marine capture fisheries sub-sector which is comprised of inshore and deep-sea fisheries is still the major contributor, producing 1,472,240 tonnes (82.70%), valued at RM7,982 million (73.98%). On the other hand, aquaculture sub-sector produced 302,886 tonnes (17.01%) of fish valued at RM2,599 million (24.15%). The total contribution from both sub-sectors have exceeded the target of 1,356,600 tonnes and RM6,805 million set under the National Agro-Food Policy for 2012.

In the non-food fish sector, ornamental fish sub-sector is the major contributor with a value of RM632 million (74.94%), followed by seaweed at RM 199 million (23.61%) and aquatic plants at RM12.3 million (1.45%). The total workforce of the fisheries sector consisted of 136,514 fishermen working on licensed fishing vessels and 29,494 fish culturists engaged in various aquaculture systems.

Table 1. Production and Value of the Fisheries Sector, Malaysia, 2012.

Fisheries Sector		2012	
		Quantity Tonnes	Value (RM Million)
Food Fish	Marine Capture Fisheries	1,472,240	7,981.66
	Inshore	1,136,182	6,310.05
	Deep Sea	336,057	1,671.61
	Aquaculture	302,886.32	2,559.17
	Freshwater	163,756.81	992.39
	Brackishwater	139,129.51	1,566.78
	Public Water Bodies	5,041.90	56.78
	Total Food Fish	1,780,168.22	10,597.60
Non-Food Fish	Seaweed	331,490.06	198.94
	Ornamental Fish	376,679,177	631.51
	Aquatic Plants	114,453,668	12.26
	Total Non-Food Fish	na	842.71
Grand Total		**na**	**11,440.31**

Aquaculture Production

In 2012, a total of 29,494 fish farmers and culturists were involved in the aquaculture industry. The majority (77.23%) of the 22,779 workforce were involved in the freshwater aquaculture sub-sector. The remaining 22.77% or 6,715 fish farmers/culturists were involved in the brackishwater aquaculture industry.

In 2012, freshwater aquaculture contributed 163,757 tonnes valued at RM992 million. The main cultured species were freshwater catfish (*Clarias* sp.), black and red tilapia (*Oreochromis* spp.), riverine catfish (*Pangasius* sp.), and freshwater giant prawn (*Macrobrachium rosenbergii*). Brackishwater aquaculture production in 2012 contributed 139,129.51 tonnes valued at RM1,566.78 million. The main cultured species were marine prawns (*P. monodon* and *P. vannamei*), cockles (A*nadara granosa*), marine finfish, mussels (*Perna viridis*), other crustaceans and other species.

The seaweed (wet weight) production in 2012 was 331,490 tonnes valued at RM198.94 million. The total area for seaweed culture is 12,897 hectares. The production of ornamental fish in 2012 was 376,679,177 pieces valued at RM550.41 million.

In 2012, a total of 9,658 million pieces of freshwater and brackishwater fish hatchlings/fries were produced by government and private hatcheries. Meanwhile, the total production of brackishwater and freshwater prawn nauplii/fries produced by government and private hatcheries was 12,518 million pieces.

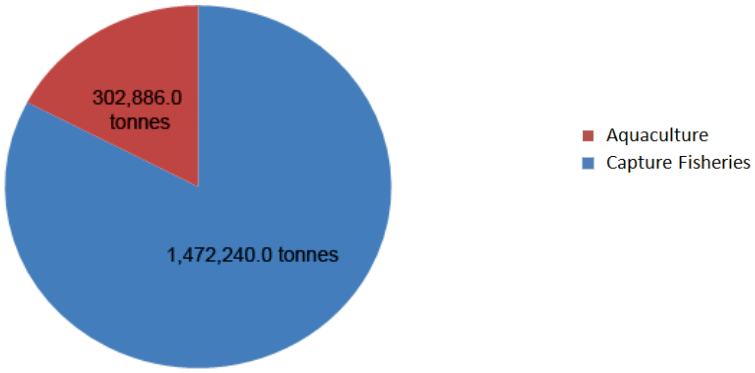

Figure 2. Production of food fish in Malaysia in 2012.

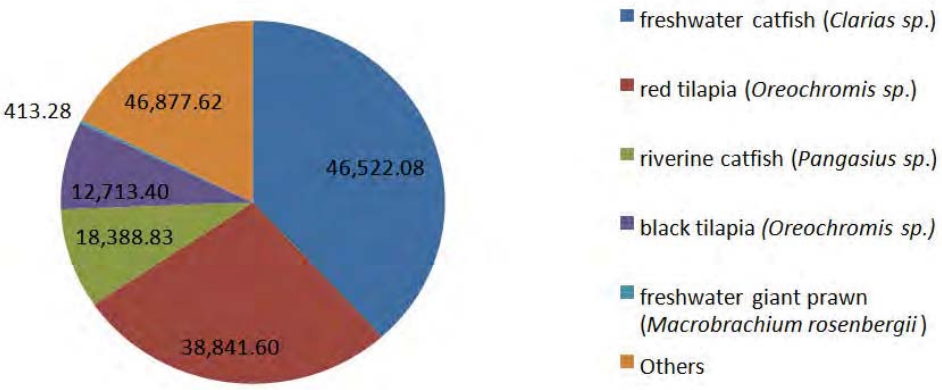

Figure 3. Production of freshwater species (tonnes) in Malaysia in 2012.

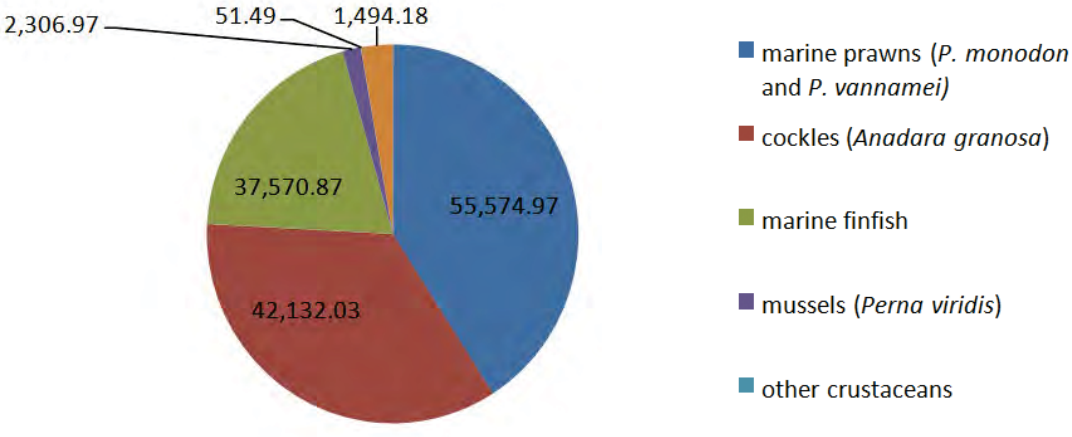

Figure 4. Production of brackishwater species (tonnes) in Malaysia in 2012.

Status of Aquaculture Development

Production System

The aquaculture production system in Malaysia has recently undergone moderate transformation. The industry adapted the traditional and conventional systems to meet the requirements of the bio-secure indoor recirculating aquaculture system (RAS) to cater to modern needs and for productivity improvement.

Within the freshwater environment, there are six common categories of production systems employed. These are ponds, used-mining pools, tanks, cages and pen culture systems (Table 2). The pond system is traditional and still the preferred system used to produce aquaculture commodities in freshwater. The next preferred system is the floating cages. The modern polyethylene cages are getting popular in many aquaculture operations in lake environment. The other common production system is tank, mainly made of cement, followed by canvas and polyethylene materials. The production from this sector has gained impact mainly in catfish production.

In the brackishwater/marine environment the production systems employed are ponds, cages, and raft system for mussel and oyster, bottom culture for cockle and long line for seaweed. One good aspect of pond operation in brackishwater environment is quick to respond to innovation and changes. The common system that is used next to ponds are floating cages and rafts. Floating cages as well has undergone kind of transformation. Poly cages material is now commonly found in cage farming areas. Fish are mainly produced in cages. Tank system is fast getting popular for indoor fish production. Imported modules and system from overseas and varieties of modules introduced by locals are being used extensively now. Raft is another system applied in marine aquaculture production. It is used for mussel and oyster production. Another system employed is the seaweed long line intended for propagation and cultivation.

Table 2. Aquaculture production systems in Malaysia (2012).

Brackishwater	Area	Culturists (No.)	Freshwater	Area	Culturists (No.)
Ponds (ha)	7,525.43	1,174	Ponds (ha)	5,642.31	18,875
Cages (m^2 x1000)	2,374.8	1,984	Cages (m^2 x 1000)	404.0	1,357
Bottom culture (ha)	10,740.2	1,004	Ex-mining pools	1,794.34	211
Raft culture (m^2 x 1000)	65.4	793	Tanks	430.5	1,485
Long line (ha)	1259	12,896.8	Pen culture	28.36	205

Current Development in Aquaculture Production and Technology

Commodity of Interest

Similar with many countries in the region, aquaculture in Malaysia serves to provide supplementary fish for national food security and production of high value fish for foreign exchange earnings. For freshwater or inland aquaculture, the priority species are tilapia, catfish, clarias and carps. For coastal and marine aquaculture, the priority species are giant seabass, grouper, snapper, shrimp/ crustaceans (*Penaeus vannamei* and *P. monodon*), bivalves (cockle, mussel, oyster) and seaweed.

Aquaculture food production in the country continues to show an increasing trend. Again, the trend (Figure 5) highlighted the freshwater sector as a major contributor. This is expected following incentives and encouragement by the government towards production for export market, monetary gain and food security. Based on these production trends and guided by improved technology and disease management control, Malaysia will be able to produce more fish through aquaculture within the next few years.

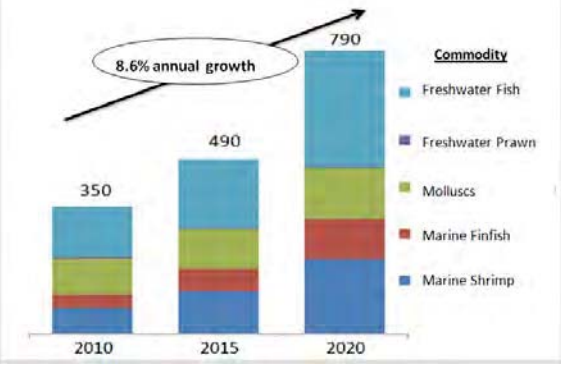

Figure 5. Aquaculture targeted production for 2010-2020 ('000 mt).

Fisheries Development Policy

In conjunction with the 10th Malaysian Plan (2011-2015), various policies were introduced to promote and develop aquaculture. One of the policies is to create a pro-business environment with various specific initiatives such as tax exemption. This will encourage more investment from local and foreign companies. Next is to upgrade the delivery system and support services of government agencies such as basic infrastructure, training and capacity building, marketing and distribution, as well as research and development institutions to facilitate in developing a sustainable aquaculture. The third policy is to identify and zoning of strategic areas or activities for aquaculture and deep sea fishing, downstream processing, halal food hub and agro-biotechnology. With specified zoning, planning for developing a project is easier, faster and more focused. The fourth policy is to ensure food security in the country. Under the National Agro-food Policy (NAP 2011-2020), various steps such as enhancing the production capacity, is taken to reduce import and increase self-sufficiency level. The NAP strategic directions are: 1) ensure adequate food safety and security, 2) increase the contribution of agro-food industry, 3) empower human capital, 4) strengthen R&D activities, innovation and use of technology, 5) create the environment for private sector-led businesses, and 6) strengthen the delivery system.

The three-pronged objectives of the Fisheries Development Policy are: 1) change the mindset of traditional farmers to adopt a commercial approach and operate as business entity that minimize cost and maximize profits to be more viable and competitive in the industry; 2) attract graduates to become modern farmers

and remove the stigma that associate agriculture with poverty by highlighting that agriculture is a business venture like any other market-driven businesses; and 3) attract local entrepreneurs and investors to invest and develop the agro-food and downstream processing commercially.

Meanwhile, the following are the strategies to promote private investments: 1) macro planning for sectoral development such as establishment of Aquaculture Industrial Zones; 2) provide infrastructure and common facilities for cluster development projects in rural areas; 3) research and development support; 4) training and human resource development; 5) market access including international promotions by involving and promoting the product in international arena; 6) international and domestic market standards and certification such as the Malaysian Aquaculture Farm Certification Scheme (SPLAM) and Good Aquaculture Practices (GAqP); 7) credit facilities from local bank for industry players to expand their business; and 8) technical support services and good regulatory frameworks for the industry.

Prospectus of Aquaculture in Malaysia

Aquaculture Master Plan

In 1997, following the Asian economic turmoil, the Malaysian government saw the important contribution of fish in the national economy. The commodity was never given a focus in any of the country's earlier development plans. Following the outcomes, the commodity was prioritized and set in place in the Third Agricultural Development Plan (NAP3) 1998-2010 (MOA, 1999). This is highlighted in Article 32 of NAP3 master plan (NAP3, 2006). The plan mentions the need to increase production of fish through deep sea fishing and aquaculture.

During the implementation of the ninth Malaysian Plan (RMK9) (2006-2010), the Ministry of Agriculture came out with figures and strategies to increase fish production. In the list, coastal landing is to be maintained at 900,000 metric tonnes, deep sea landing was targeted to land 500,000 metric tonnes and aquaculture to produce 508,000 metric tonnes annually after the year 2010 (Othman, 2008) (Table 3). Aside from food security, the target is set out with the aim to create an income of RM3.4 billion to cushion the deficit in trading of agricultural food-based products. The portion from aquaculture is RM0.32 billion. The strategy aims to strengthen aquaculture production along with the development of the Aquaculture Industry Zone (AIZ) and the Corridor Economic Region Plan.

Corridor Economic Region (CER) Plan

The CER development strategy aims to expand the economic contribution from selected economic activities where the region has the potential to excel. Accordingly, the key economic sectors identified for promotion are agriculture, manufacturing, tourism and logistic services. The government, through its link companies (GLC), will initiate and promote the development of these sectors. Toward this initiative, GLCs will execute by providing incentives for private sector investment, identifying anchor investor and addressing key enablers that would create a conducive business environment including developing the required human capital, furnishing technologies, and enhancing infrastructure. In the transformation of

the agricultural sector, financial incentives will be given to encourage corporations to coordinate the local communities to achieve the optimum level of scale. CER has the vision to become a modern food zone for Malaysia. It will assist the nation to increase its food production. CER will encourage commercial scale farming which finally increase productivity and embark in downstream agriculture activities.

The Aquaculture Industrial Zone (AIZ)

AIZ or Aquaculture Industrial Zone is a zoning programme of identified suitable lands and water bodies to be developed at commercial scales dedicated for aquaculture projects with the purpose of increasing the output of fishes under the NAP3. The programme is part and parcel of the government initiative through the Department of Fisheries Malaysia to develop aquaculture per se into a massive industry in line with overall government vision to transplant agriculture sector to become the third engine of economic growth.

The importance of the formation of AIZ ventures is to address several key problems or issues encountered by the aquaculture sector as a whole, namely, the continuous increasing demand for fish consumption, reduction in supply of fish from catches due to 'overfishing' and to drive the economy in achieving positive balance of trade or surplus of payment of agricultural food based commodity. All of these will need the AIZ so that aquaculture can produce 217,000 metric tonnes valued at RM2.07 billion to supplement existing production from traditional areas. In total, the target set was 508,000 metric tonnes valued at RM 3.3 billion to be achieved annually by 2010. In order to come close to the production target, DOF has allocated 39 sites under AIZ with selected aquatic species to be cultured. These are species which are at present high in demand and high in market value. The 39 sites and projects are listed as high impact projects (HIP). The portion allocated for cultivation of designated species and income expected to be generated following the full scale operation are indicated in Table 4.

The establishment of AIZ and high impact projects is a long-term production plan and involves the set-up of approaches that will finally offer necessary incentives and support. In the beginning it involves the roll-out of specific development strategies on AIZ sites by both the federal and state governments. Upon approval, the land or water bodies are then offered on site to the private sectors.

The establishment of AIZ is one aspect of strategy to realize the government objective towards food security, balance of trade surplus, income earnings and job opportunities (Table 5). Details of the business prospectus are available now at the Department of Fisheries.

Table 3. Projected figures for aquaculture production under the Third Agricultural Development Plan (NAP3).

Commodity	Production (mt)	(RM million)
Freshwater fish/prawn	230,000	863
Marine shrimp	120,000	4,500
Marine finfish	100,000	860
Bivalves	100,000	102
TOTAL	508,000	6,325

Table 4. Area and figures projected within AIZ, 2009.

Subject	Shrimp pond	Grouper cage	Seabass cage	Snapper cage	Mussel ropes	Seaweed raft
Area (ha)	5,428	693	693	693	55	5,600
Volume (mt)	52,923	92,252	208,000	183,456	1,833	153,216
RM' billions	0.95	3.69	2.70	2.75	0.004	0.38

Subject	Tilapia cage	Patin cage	Keli tank	Arowana aquarium	Discus aquarium	Goldfish aquarium
Area (ha)	1561	1561	1561	135	135	135
Volume (mt)	699,179	1,098,709	126,363	23	27	72,720
RM' billions	3.50	3.85	0.57	0.02	0.00011	0.02

Table 5. Summary of objectives on the development of AIZ and HIP, 2008.

Item	Objective	Description
1.	Contribution to gross domestic product, GDP	Increase the output of fishes and raw material used in processing of fish products
2.	Balance of Trade, BOT	Increase exports of fishes and high-value fish products; and reduce import of low-value fish for consumption and raw materials used in processing of fish products
3.	Private sector involvement	Increase investments from both local and foreign companies
4.	Increasing the income of aquaculture farmers and entrepreneurs	Increase income of aquaculture farmers/ entrepreneurs to a minimum of RM3,000/month and create new business opportunities and employment
5.	Innovation and technology capability	Introduce new technologies suited for the aquaculture industry
6	Enhancing the value chain	Establish new hatcheries, livestock field, farm food factory, processing factory and effective marketing systems to support the value chain of the aquaculture industry
7	Efficient aquaculture development	Certification of farms in accordance with SPLAM / SAAB

Factors that Promote the Growth of the Aquaculture Industry in Malaysia

According to survey conducted after the compilation of the business prospectus for HIP in AIZ (Anon., 2009), the market drivers are as tabulated in Table 6. These drivers likely contribute to the development of aquaculture business in Malaysia from the marketing perspective.

Continuous Government Support

The government of Malaysia realized the importance of aquaculture as a food security sector and for generating income to balance out the deficit in the agro-food sector. Accordingly, the government mapped out the development of the aquaculture industry in its 9MP (2006-2010) and NAP3 (1998-2010) with the target to spur fish production to 1.93 million tonnes or more than RM9.36 billion in revenue.

Declining Level of Wild Fish Catch

The pressure on the global demand for fish caused mainly by China and India which are undergoing economic improvement has resulted to severe depletion of landings from wild. Another factor is the contribution of pollution and the impact of climate change; wherein close environments such as lagoons and lakes are more susceptible.

Population Growth

The demand for food is directly linked with the increase in population and the demand further increase due to the growing affluence in developing countries such as in the Asia-Pacific region where fish is a food of choice. These driving factors will end up with growing pressure to step up production of fish worldwide. Malaysia which still has vast resources to develop should capture this opportunity for future economic gain.

Growing Consumers Health Consciousness

The move towards consumption of fish for healthier lifestyle is prevalent in developed countries only, but it has become a global concern. In Malaysia, the trend is presented in yearly per capita consumption and fish production. With more scientific findings and consensus that fish is the better food for the future, it will likely play a significant role in driving the growth of aquaculture.

Table 6. Market-driven factors that contribute to aquaculture development in Malaysia.

Rank	Market Drivers	Impact (years)		
		1-2	3-4	5-7
1.	Continuous government support	High	High	High
2.	Declining level of wild fish catch	Medium	High	High
3.	Population growth	Medium	Medium	Medium
4.	Growing intra-regional trade	Medium	Medium	Medium
5.	Growing consumer health consciousness	Medium	Medium	Medium
6.	Cultural significance of consuming seafood-marine fish	Medium	Medium	Medium
7.	Innovation in seafood products	Medium	Medium	Medium

Growing Intra-Regional Trade

Aquaculture in the region in the coming years will not only cater to the traditional market but also supply the domestic and intra-regional needs following the improved standard of living of the population. This will allow bigger aquaculture production.

Cultural Significance of Consuming Fish

Fish consuming countries and ethnicity such as China and other countries in the Asia Pacific region is projected to achieve better economic development. Hence, these countries are expected to be a big market for fish especially for shrimp, grouper and other high-value seafood. Although fisheries and aquaculture are highly developed in these countries, the demand for seafood consistently outstrip supply.

Conclusion

Various policies and plans are established for the development of Malaysia's aquaculture industry. With strategic planning, the Department of Fisheries hopes that the aquaculture industry will be more competitive in the local and international market.

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