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Making Penang A Major Fisheries Hub

Introduction

Fisheries is considered an important sector under the 3rd National Agricultural Policy as the per capita consumption of fish products is expected to rise from 39 kg (1995) to 56kg in the year 2010. Malaysia was only 89% self sufficient in fish products in 2000 and this is expected to rise to 90% self sufficiency in 2005 and 94.3% in 2010[1]. This shows that there is a lot of potential in the sector for further expansion in order to reduce import of fishery products. Ironically, Malaysia exports most of its high value fish to other countries and import lower grade fish from its neighbours such as Thailand. The agriculture value added in 2000 for the food commodity group is 22%, with fisheries (13.1%) being most important, followed by livestock (6.1%) and paddy (2.9%). Fish is also clearly the largest expenditure, accounting for almost 20% of the food budget in the pattern of household expenditure.[2]

This information paper on the fisheries sector in Penang is an attempt to show how this sector can be one of the major contributors to Penang's GDP and its vast potential for further development.

Import and export figures of fish and fishery products for the country further indicated the potential of the fisheries sector to expand to meet national self-sufficiency. In 1999, it exported RM1, 155.15 million of fish and fish products and imported RM1, 019.91 million worth. This makes Malaysia 88.3% self sufficient in fish and fish products for 1999.

Table 1: Export and Import of Fishery Commodities, Malaysia - 1999

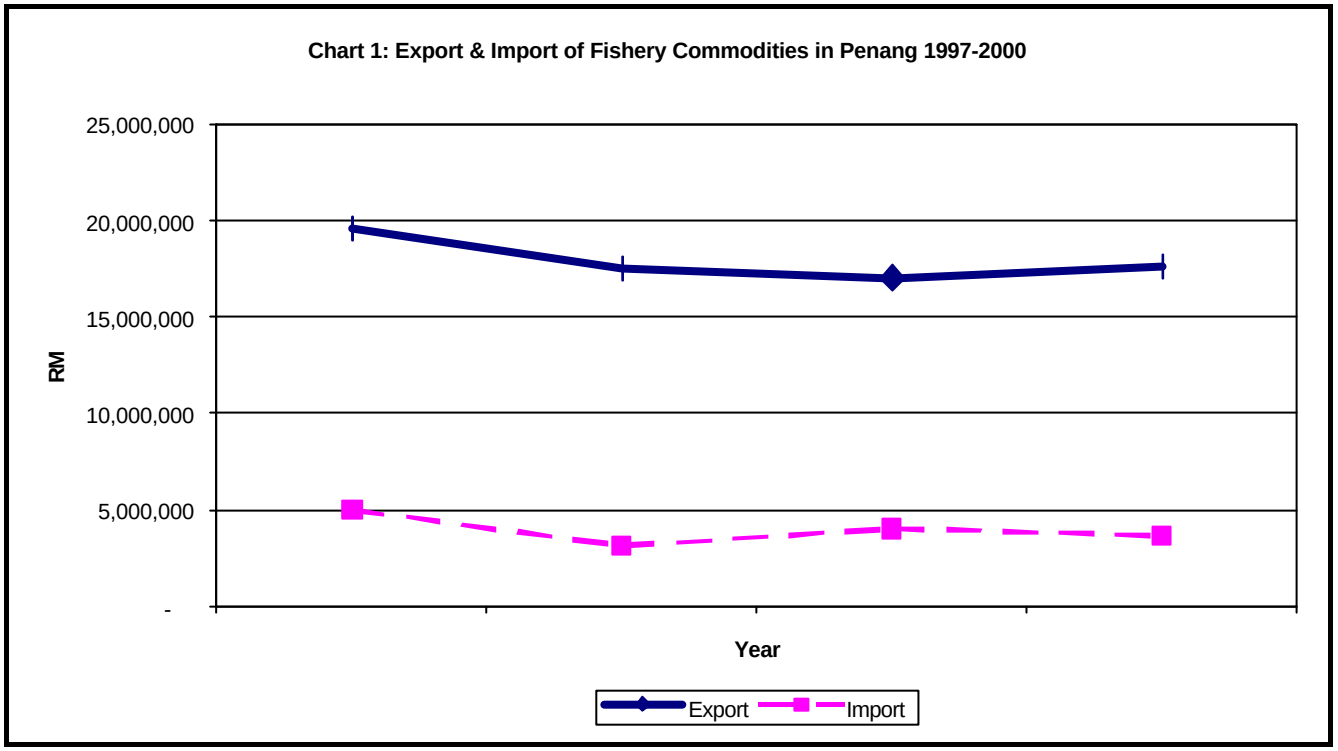
Commodity	Exports (RM Million)	Imports (RM Million)
Live fish	98.20	33.33
Fish - Fresh, Chilled or Frozen	84.92	611.09
Fish - Dried, Salted or in Brine: smoked Fish	8.82	43.62
Crustaceans & Molluscs - Fresh, Chilled, Frozen, Salted, Dried	646.02	194.26
Fish, Crustaceans & Molluscs: Prepared Or Preserved	284.69	78.50
Fats & Oils & Their Fractions of Fish or Marine mammals Not Chemically Modified	1.20	1.95
Flours, Meals & Pellets of fish or of Crustaceans, Molluscs or Other Aquatic Invertebrates Unfit for Human consumption	14.23	18.10
Miscellaneous	17.07	39.06
Total	**1,155.15**	**1,019.91**

Source: Annual Fisheries Statistics 1999

In terms of high value fishery commodities, Malaysia exported crustaceans and molluscs such as shrimps, prawns – fresh and frozen, fish, prepared or preserved, canned crustaceans and molluscs which amounted to 81 % of total exports in 1999. Live Fish and fish that are fresh or chilled constituted 16% of total exports.

The bulk of fishery commodities were exported to traditional countries like Thailand, China, Singapore, Japan, Hong Kong, Indonesia, Italy, and the Netherlands. Other non-traditional markets include countries such as Cameroon, Croatia, Laos, Monaco, Nepal, New Caledonia, Romania, Senegal, Seychelles, Syria and Yemen. However, these constitute only about 20% of total exports. Japan is the top importer, followed by Singapore, Italy, the Netherlands, and Hong Kong.

Chart 1 shows the export and import values of fishery commodities in Penang from 1997-2000. The chart illustrates that Penang is a net exporter of fish products and exported RM17.6 mil worth of fishery products in 2000 but only imported RM3.7 mil. Total value of exports has risen slightly from 1999. This also shows that Penang is self sufficient in fish commodities.



Source: Derived from Dept. of Fisheries, Penang 2002

Fish commodities that are exported from Penang include ornamental fish, crustaceans, cockles, fish for the table, bait fish for tuna fishing, fish fries and fingerlings for culture. Ornamental fish constitutes 34% of exports followed by Crustaceans (27%), cockles (14%), fish (14%) and bait fish (11%). These figures indicate the importance of ornamental fish in the fisheries sector in Penang and thus a potential for further development in production and R&D activities.

Import figures again gave prominence to ornamental fish placing it first on the list. Ornamental fish are probably imported from other states for the export market. Whilst higher quality fish are exported to other countries, Penang in turn imports lower grade fish from Thailand for its domestic market. Fish fries and fingerlings are imported primarily for the purposes of aquaculture. Included in this category are also cockle spats that are imported for cultivation in Penang.

Penang – an Important Fisheries Hub

The State of Penang suffers from a lack of land and natural resources, however, it is bounded by the sea and its waters is suitable for fish culture. Blessed with this only natural resource in abundance, it would be prudent to investigate how we can exploit the fisheries sector to Penang's advantage.

Penang is well positioned in the fisheries sector with the presence of the WorldFish Centre – formerly known as the International Center for Living Aquatic Resources Management (ICLARM), Fisheries Research Institute, Centre for Marine & Coastal Studies (CEMACS) Universiti Sains Malaysia (USM). Penang should thus take full advantage of these institutions as well as its well-equipped ports, which are already popular tuna fish landing places for international fishing vessels.

Table 2: Value of Export & Import of Fish Commodities in Penang (1999-2000)

EXPORTS	YEAR			
Commodity	**1997**	**1998**	**1999**	**2000**
Ornamental Fish	6,477,001	7,761,114	7,327,085	5,996,976
Crustaceans	1,077,682	2,003,737	2,106,874	4,735,794
Molluscs (Cockles)	4,418,717	1,226,027	2,652,825	2,536,790
Fish	6,071,170	5,605,175	3,861,128	2,385,357
Bait Fish	1,540,000	749,000	957,000	1,874,000
Fish Fries & Fingerlings	600	141,029	131,250	50,401
Total	**19,585,170**	**17,486,082**	**17,036,162**	**17,579,318**
IMPORTS				
Ornamental Fish	449,569	1,131,462	2,007,806	1,561,434
Crustaceans	1,506,447	525,918	866,712	829,145
Fish	280,620	184,948	52,870	7,300
Fish Fries & Fingerlings	2,797,541	1,306,393	1,126,115	1,282,560
Total	**5,034,177**	**3,148,721**	**4,053,503**	**3,680,439**

Source: Dept. of Fisheries, Penang 2001

Table 3: Value & Growth Per Annum of Fisheries Sub-Sectors, 2001

No.	Activity	Value (RM Mil)	% Growth p.a.
1	Marine Fish	145.27	5
2	Brackishwater Cage Culture	28.28	11
3	Brackishwater Pond Culture	12.74	26
4	Cockle Culture	8.12	10
5	Ornamental Fish	7.66	2
6	Freshwater Pond Culture	0.60	15
	Total	**202.67**	

Source: Dept. of Fisheries, Penang 2001

Penang's Fishery Achievements in Malaysia

Brackishwater Cage Culture	#3
Cockle Culture	#3
Ornamental Fish	#3
Tuna Fish Landing Port for Region	

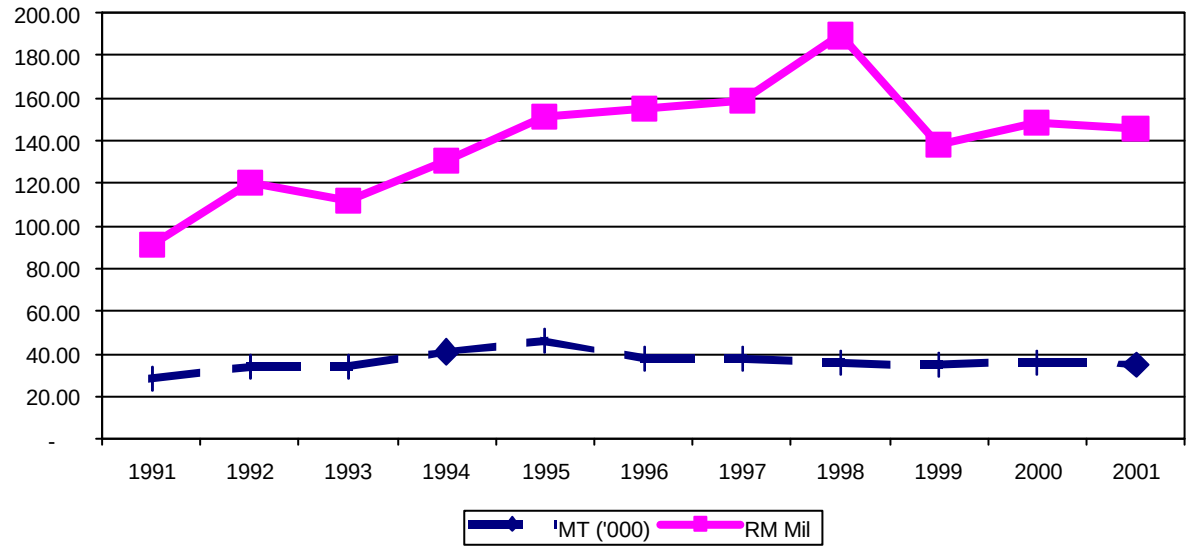
In 2001, the fisheries sector in Penang contributed RM202.67 million to the State's GDP. The marine fisheries sub-sector remains the main revenue earner, followed by Brackishwater Cage and Pond Culture, Cockle culture, Ornamental Fish and Freshwater Pond Culture. (Refer Table 3.) This paper shall briefly discuss each of these sub-sectors' contribution to the fisheries sector in Penang.

Marine Fisheries

In 2001, marine fisheries also known as capture fisheries, contributed up to 35.7 metric tons (mt) of fish estimated at RM145 million in Penang. This makes it the largest sub-sector in terms of value for Penang. Marine fisheries in Penang involve 1,143 fishing vessels and provide employment for 2,134 persons who work aboard these vessels. Out of the 1,143 licensed fishing vessels, 484 vessels are inboard powered and 657 vessels are outboard powered. Out of these the 484 inboard powered vessels, 367 use traditional nets, 95 use the trawl nets and 22 use the purse seine nets. All outboard powered vessels in Penang use traditional nets such as drift nets, bag nets, seine nets, hooks and lines.

Most of the inboard powered vessels operate along the coastal zone because they are small and use traditional nets. However, there are 95 inboard motor fishing vessels that trawl off the coastal waters in the commercial fishing zones using purse seine nets. The State of Penang has 40 jetties and the main ones are found in Batu Maung, in the Northeast District, Teluk Bahang in the Southwest District, Sungai Udang in the Southern District and Kuala Muda in the Northern District.

Chart 2: Value and Quantity of Marine Fishery In Penang 1991 - 2001



Source: Dept. of Fisheries, Penang 2001

Chart 2 shows the trend for both the value and quantity of marine fisheries in Penang from 1991-2001. The annual growth rates for the quantity and value for marine fisheries are 2% and 5% respectively.

Penang is a strategically positioned between the Indian Ocean and Japan. This makes it an important port of call for the landing of tuna fish by foreign vessels from Taiwan, China and Japan. The catches are frozen and then exported to Japan, Taiwan, USA, Europe and other countries.

The marine fishery sub-sector is fraught with issues and problems of its own, which must be resolved in order to further expand it. These can be briefly categorized into the following:

Individual fishermen and small-scale companies using traditional equipment and small vessels are no longer productive and efficient in the modern fishing industry. Local fishermen are also not willing to spend long periods at sea nor willing to venture into deep-sea fishing beyond our coastal waters. Many fishermen have other part time jobs, which bring in lucrative income such as small businessmen, pasar malam traders, taxi drivers etc.

The destruction of mangrove swamps along the coastlines of Penang affects the survival of fish fries and hence, fish stocks and other marine resources. Land reclamation and over exploitation of fishery resources are also major contributing factors to dwindling resources. One of the strategies on sustainable agriculture under the Second Penang Strategic Development (PSDP2) calls for strict control on the use of mangrove swamps to protect the ecological balance.

Pollution of rivers and waterways that drain into the surrounding coastal waters of Penang also affects the survival of marine life. This in turn reduces fish stocks and fish landings. In order to prevent this, strict pollution control measures such as the minimum control of BOD and COD discharge should be enforced on industries operating in upstream rivers.

There is potential for the construction of artificial reefs and development of surrounding islands such as Pulau Rimau and Pulau Kendi to maintain and conserve marine life. These islands provide an ideal breeding places for fish and other marine life.

The potential of marine fisheries hinges on the conversion of the small-scale companies to medium-scale companies and the development of deep-sea fisheries with fishermen willing to venture out further into international waters. Large-scale companies need to be developed for distant-fishing. Strategies under the PSDP2 include improving existing fish landing complexes and the upgrading and establishment of integrated fish landing complexes equipped with key supporting industries such as cold storage, vessel maintenance and repairs as well as providing a "fish-processing industrial park" in Penang.

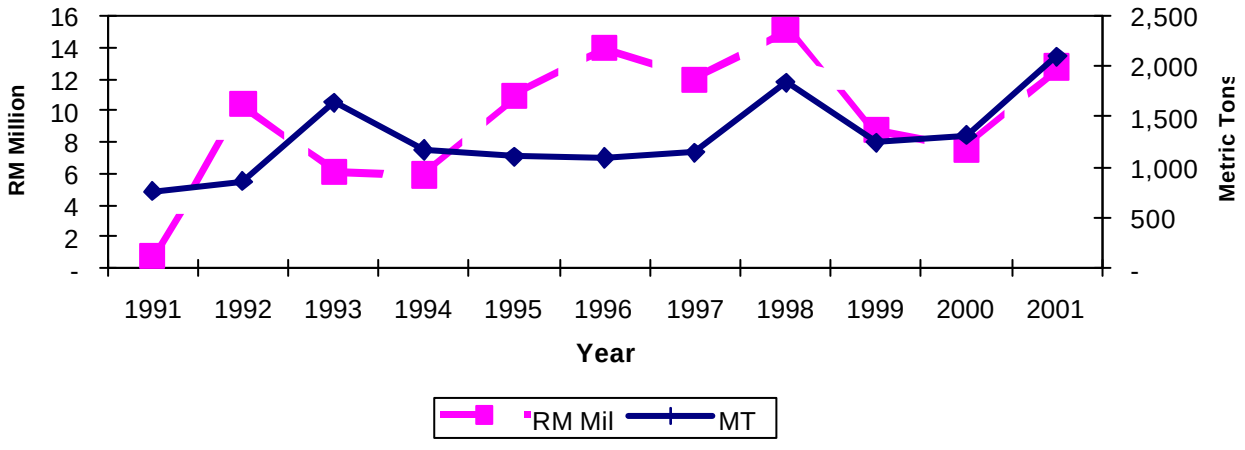
Aquaculture

According to the 2001 Annual Report of the Penang Fisheries Department, aquaculture brought in 16,000 metric tons valued at RM48 million in 2001. Aquaculture activities in Penang consist of brackish water cage culture, brackish water pond culture, freshwater pond culture and cockle rearing.

a) Brackishwater Cage culture.

Brackishwater cage culture in Penang produced 2,093.25 metric tons, worth RM28.84 million in 2001. This makes it the second largest income earner after capture fisheries. Penang is also the third largest producer after Johore and Selangor. This activity is mostly concentrated in the Southwest District (mainly around the offshores of Batu Maung, Batu Uban and Jelutong) and Southern District (around the waters of Pulau Aman/ Batu Kawan) in Penang. Among the popular types of fish preferred by rearers are siakap, siakap merah, kerapu and jenahak.

Chart 3 : Quantiy and Value of Brackishwater Cage Culture Production In Penang (1991-2001)



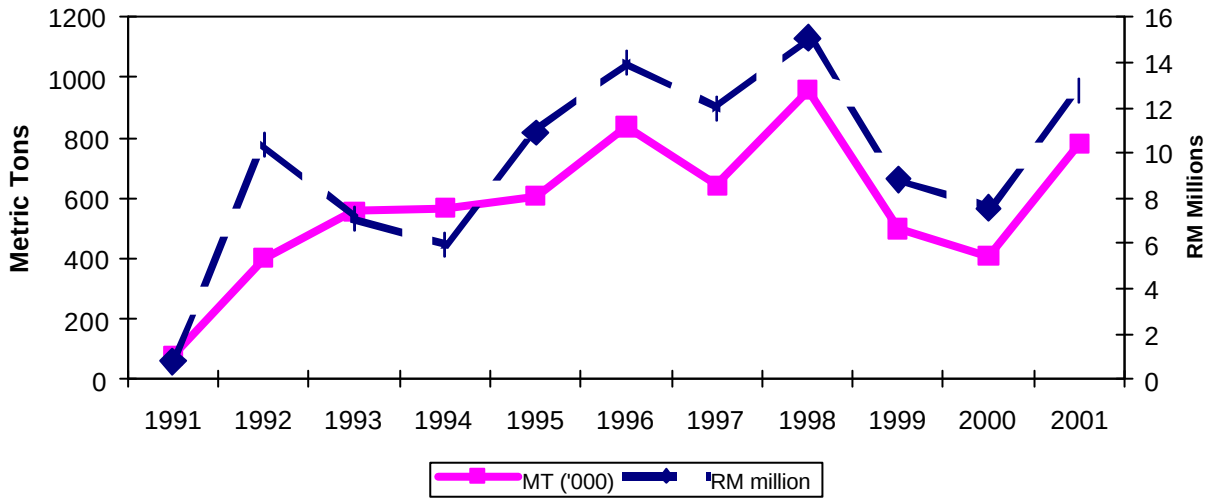
The produce is often sold to local restaurants and exported to foreign countries such as Taiwan and Hong Kong.

b) Brackishwater pond culture

Brackishwater pond culture yielded 778.02 metric tons valued at RM12.7 million in 2001 for Penang and takes third place as income earner for the fishery sector. This activity had the fastest growth rate per annum of 26% from 1991-2001.

This activity is found in the mainly in the Southwest District. Penshrimp Sdn. Bhd. set up in 1994, is one of the biggest operators with 40.47 hectares at Kuala Sungai Pinang. The Department of Fisheries, Penang has further identified other potential areas around Kuala Sungai Pinang and has encouraged the local people to take up aquaculture.

Chart 4: Quantity and Value of Brackishwater Pond Culture in Penang (1999-2001)



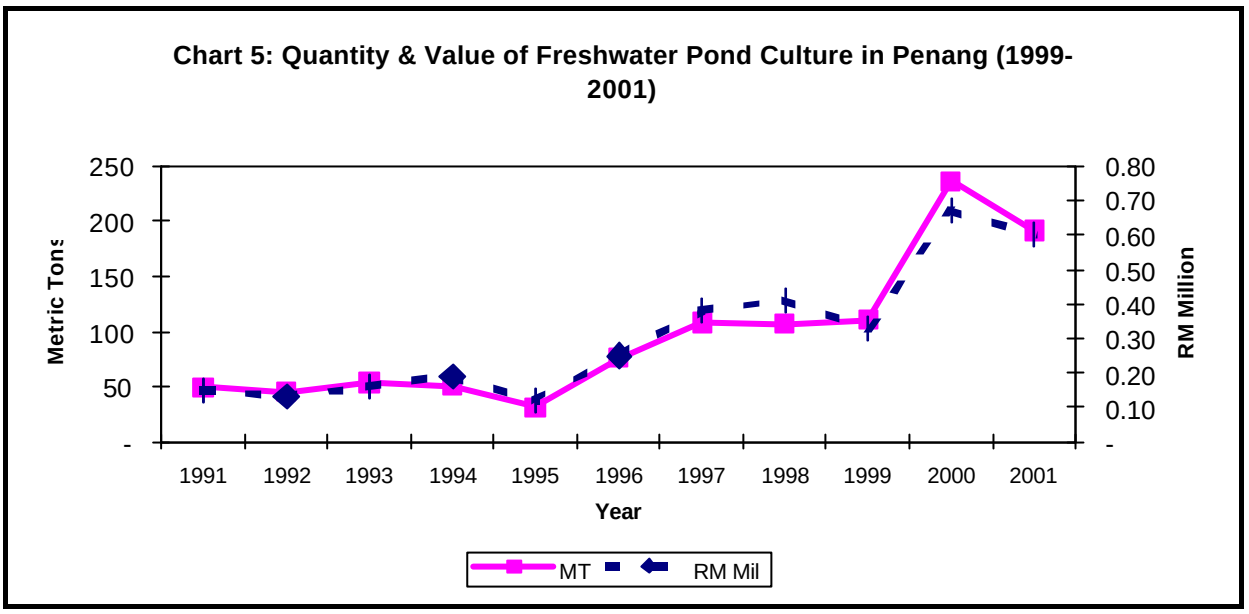
Popular species that are reared include Tiger Prawns, udang galah, kerapu and crabs. Production has been on the rise after dipping in 2000 due the aftermath of the Asian economic crisis.

Potential areas for the Brackishwater pond culture include the stretch from Balik Pulau to Kuala Sungai Pinang and also old coconut plantations and other idle land in the area.

c) Freshwater Pond Culture

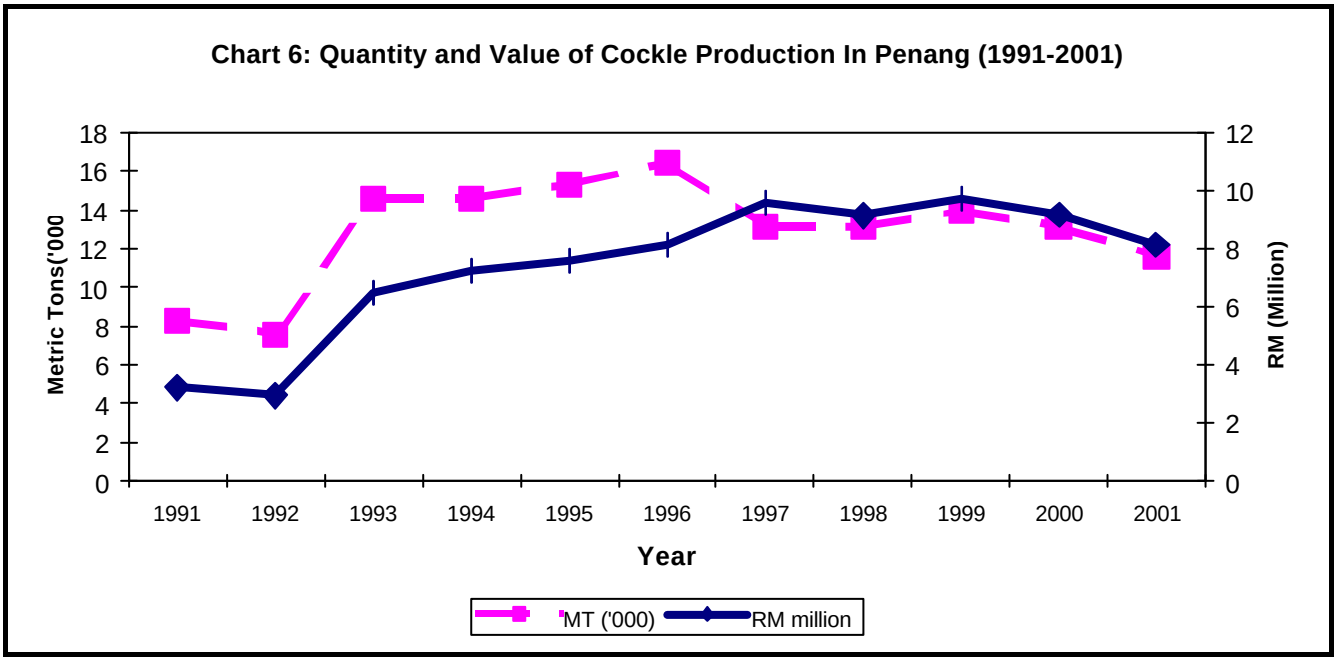
Freshwater pond culture is also another aspect of aquaculture that has gained popularity over the years. It has been growing at a rate of 15% annually since 1991. In the year 2001, it yielded 191.39 tons valued at RM0.6 million. Freshwater pond culture is found mainly in the Northern and Central Districts in Penang. Cement ponds are also being utilized in addition to existing freshwater bodies. The main species cultivated are catfish and tilapia.

Areas for further development of this industry include Tasek Pantai Kameloon and Tasek Tanjung Rambai in the Northern District, other freshwater bodies including lakes, dams and paddy fields. Conversion from other land-duse such as pig farming may be a future potential for this activity.



d) Cockle culture

Cockle rearing in Penang is the third largest in the country after Perak and Selangor. This industry yielded 11,599.46 metric tons valued at RM8.12 million in 2001 for Penang. Cockle culture is the fourth largest income for the fishery industry in Penang. Chart 6 shows that cockle production is on a declining trend after 1999. Water pollution is the prime suspect for this decline. This situation will further degenerate if our coastal waters are being continually polluted from effluents from other industries.



The main areas of cockle cultivation in Penang are Kuala Juru, Sg. Chenaam, Sungai Semilang and Sungai Belanak.

Cockle spats are obtained from Selangor, Perak, Melaka and Johor where they occur naturally. The spat pro-

duction in Penang is both unreliable and lesser in quantity compared to that of other States. These are usually acquired in kerosene tins costing from RM80 – RM150 each depending on size and quality of spats. The spats take almost 10-12 months to mature. Matured cockles are exported mainly to Thailand. The annual growth rate of this activity is 10%.

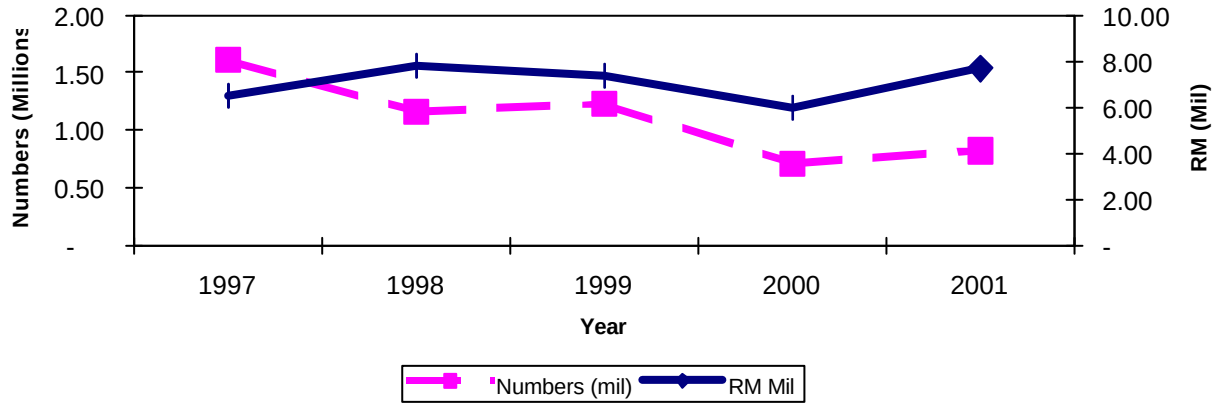
Presently, individual operators and small-scale companies operate the aquaculture sector. There is however, much potential for these to be developed into medium to large-scale companies or entities. Future potential products include tilapia, milk fish, golden snapper, red snapper, mullet, lobster, blue crab, giant clams and squids. Seaweed products and functional food products such as fish oil, reformulated fish products, fish protein concentrate are possible options for the fish product industries. Other by-products that may be looked into include skin leather and pet food.

Ornamental Fish

The global demand for ornamental fish is increasing at about 10-15% per annum with major markets in the USA, Japan, United Kingdom, Germany and the Netherlands. There are about 700-800 varieties of aquarium fish traded in the world market with 60% coming from Asian countries followed by South America, Africa and the Caribbean. The largest producers of ornamental fish in the country are Johore, followed by Selangor and Penang. About 96% of the ornamental fish produced in Malaysia are exported via Singapore. This trade also includes aquatic plants and organisms, tanks and accessory systems such as water filters, pumps, aerators, lighting and heating systems, decorations etc. Other supporting products like aquarium feed medications, publications and natural substrates such as drift wood.

In 2001, 820,000 fishes valued at RM7.66 mil were produced, making it the sixth income earner for the fishery sector in Penang. Chart 7, shows that although the quantity produced in Penang has gone down the value has risen. The rearing of aquarium fish in Penang is viable and possesses good export potential, given the wide scope of products in the trade, the expanding overseas market and the attractive income it generates for producers. The rearing of aquarium fishes is also one of the strategies of developing new agricultural industries under the PSPD2.

Chart 7: Quantity & Value of Ornamental Fish Production in Penang (1997-2001)



The aquarium fish that are reared in Penang includes the more popular species; Arowana, Discus and Flower Horn. Other species includes, black mollies, guppies, swordtails, angelfish, etc.

Issues that are faced by this sector in the area of technology include the lack of professionalism in the industry as the majority of rearers are minor individual operators. The rearing of this fish requires good knowledge of biology and ecology of species, competency in husbandry and breeding practices, which demands high levels of expertise, and skill in addition to aesthetic sense.

In the area of human resource development, there is presently, no dedicated training centre for rearers and existing training is too general and not related to any specific requirement. There is also a lack of attention by institutions of higher learning which prefer to focus on food aquaculture instead of this "pet" sector. Dedicated training centres should be set up with appropriate staff. There is a need to provide quality applied training to existing and new operatives in breeding to nursery, grow-out, feed and disease management.

Research and development are also undertaken by private individuals and there is little institutional input. There is also a lack of funding sources for such research. Efforts are also centred on traditional genetic selection breeding techniques based on Mendelian principles rather than biotechnology. Malaysia is also unable to tap its attractive indigenous ichthyofaunal resources due to the lack of research and knowledge. In order to be competitive with our neighbours, Indonesia, Thailand and Philippines, Malaysia must position itself as a high quality producer and focus on high value signature species eg. the Albino Arowana fetches RM600,000 in Japan or (Yen 20 mil) and the Platinum Arowana half of that. Research must also identify and develop indigenous species with potential market value. New variants must be created through genetic engineering, physiological and environmental manipulation. There must be increase in funding to finance such a research. There should also be better networking among research workers in this field and incentives must be provided to operatives who undertake R&D. The Government can also help by giving more grants and tax incentives to private enterprises.

Malaysia also lacks the infrastructure for collecting and handling fish at production centres. The lack of infrastructure and institutional support from the national airlines to facilitate trade also aggravates the problem. Most of the ornamental fish are exported through Singapore as there are no dedicated cargo space provided. The export of aquarium fish requires a 24 hour delivery period to prevent mortality. Holding and packing centres should be established at major airports to facilitate export. A network of collecting centres to promote production and where producers and traders can interact must be set up. Cargo space needs to be allotted and air routes and destinations expanded.

Institutionally, there is also no clear focus and direction on the industry. Market information and promotion is also poor. There is also a lack of support from financing and development agencies. Aquarium fishes do not come under the Fund for Food (3F) Scheme.

In order for the aquarium industry to surge ahead, a lead agency must be designated to spearhead the development of the industry and also provide information and promote markets. Incentives can also be provided for direct export and overseas distribution. There are plenty of opportunities for the Government and private sector to collaborate to make Malaysia a hub for ornamental fish.

Penang can play a key role in the area of R&D in the area of biotechnology, information collection, market research and promotion in this area of ornamental fish.

Marine Food Processing Industries

Penang has also been well-known for its marine product processing industries since the 60's. The experience and expertise developed in this field has made this industry one of the largest in Asia. The processing industries mainly focus on canning of products such as sardines, tuna, mackerel, cuttlefish, crab meat, oysters etc and the frozen product industries on products such as prawns, cuttlefish, shelled prawns and value added surimi (like filament sticks, crab claws etc.) Annually, an estimated 5,000 metric tons of canned products valued at RM70 million and 13,000 metric tons of frozen products worth RM250 million are produced for export to countries like the European Union, USA, Japan, France and Singapore.

The presence of canning companies like Rex Industry and Tropical Consolidated Corp. Sdn. Bhd; and the frozen products industries such as Seapack Food Sdn. Bhd., Butterworth Iceworks Sdn. Bhd., Barkath Marine Products Sdn. Bhd. And N.T. Huat Kee fisheries Sdn. Bhd have yielded the much needed experience and R&D over the years. These companies began as labour intensive industries but have converted to semi automated lines. They are equipped with modern equipment such as cold rooms, prawn/shrimp grading machines, steam cookers, seaming machines etc. They have also implemented the Hazard analysis Critical Control Point (HACCP) System and the Good Manufacturing Practice (GMP) as these are requirements are a necessity for export to foreign countries es-

pecially the EU. Penang has comparative advantage for the processing industries due to the presence of its good infrastructure, port and airport. The FTZ has also attracted a lot of foreign investment.

Other local products that can be further developed include fish ball, fish cake, belacan and keropok. These traditional local fish products have yet to be fully exploited for the export market.

The main issues that are faced by the marine products processing industries include the lack of raw material for processing. Additional raw materials have to be imported from neighbouring countries. It is very crucial that the fishermen and aquaculture operators maintain and ensure a constant supply of raw material to these industries for further expansion and development.

Insufficient local labour has also forced companies to employ foreigners from Bangladesh, Indonesia and Nepal to overcome for the shortage. The manufacturing sector has also drawn local labour away from the marine processing industries.

TOWS Matrix Analysis

The TOWS Matrix Analysis for the Fisheries industries in Penang takes into account the combination of external factors and those internal to the enterprise, and the strategies based on these variables. It facilitates the matching of the external threats and opportunities with the internal weaknesses and strengths of the industry.

Diagram 1 below shows the TOWS analysis of the fisheries sector in Penang taking into account only the more important factors that influence the sector in general. Strategies are then derived in response to the combination of the variables.

The TOWS Analysis from the diagram belbw shows that are several strategies that Penang can take to further enhance its competitiveness in the area of fisheries. Good market intelligence and promotion by expanding products lines is one good strategy to break into new markets. R&D plays a major role in the matter of further enhancing the capabilities of this sector. Private sector participation in R&D should be intensified on both upstream and downstream activities. Developing niche markets by developing quality species through R&D is one way of forging ahead of other competitors. This is especially so for aquarium fishes. One of the complaints of the aquaculture industry is the high cost of feed and this can be overcomed by R&D into using local materials in feed development. Similarly, to cut post harvest loss and further enhance processing of fishery products, hi-tech automation and mechanization to improve production and labour should be considered seriously. R&D knowledge obtained must however, be transmitted to the local operators though an efficient extension service

In the area of human resource development, focus should be given to training and upgrading of the skills of local people to encourage professionalism and also venture into modern methods of fishing.

Surrounding islands and water bodies should be taken into consideration as potential areas for aquaculture to overcome scarcity of land. However, we should continue to adopt and implement environmental conservation plans to manage and conserve our natural resources.

On the monetary side, financial incentives and support should be provided to the fishery industry. Lastly, infrastructure must be in place for an efficient marketing system and this include dedicated cargo space for fishery products by our national airlines.

The Way Ahead - Role of R&D

The fisheries industry has undergone rapid development in the last ten years with remarkable improvements in fish production. The gradual shift from artisanal fishing to one that is commercially oriented has been made possible by the introduction of new technological advances in satellite imagery and fish surveillance techniques and also active participation of the private sector. This has led to the rapid development of deep-sea fishing and commercial aquaculture in other parts of the world contributing towards an increase in fish production. At the same time, through prudent management measures, inshore fishery is still the major contributor to fish production.

Diagram 1: TOWS Matrix Analysis of the Fisheries Sector In Penang

FISHERIES SECTOR IN PENANG	**STRENGTHS** S1. Strategically placed between the Indian Ocean and the South China Sea. S2. Good Infrastructure such as good port and airport facilities. S3. Presence of strong R&D Institutions eg. ICLARM, FRI, USM S4. Good institutional support from Government S5. Presence of experienced marine product processing industries S6. Rich natural fisheries biodiversity	**WEAKNESSES** W1. Lack of market intelligence and promotion W2. Low technology use by operators W3. Small-scale coastal fishermen W4. High cost of feed for aquaculture W5. Inadequate R&D on development of new species, product quality and downstream processing W6. Lack of skilled and semi-skilled workers W7. Lack of institutional support for financing ornamental fish industry W8. Lack of cargo space for export of ornamental fish and products W9. Inadequate private setor participation in R&D
OPPORTUNITIES O1. Good export market for marine products O2. Product diversification by improving value added in the processing industries. Q3. Opportunities for R&D to develop local feed meals for aquaculture, processing, postharvest handling, O4. Surrounding islands available for increase production O5. Opportunities for developing signature species in ornamental fish	**SO:** 1. Develop and expand new markets (O1, S2, S3, S4, S5) 2. Expand product line through R&D (O2, S3, S4, S5, S6) 3. Develop R&D on producing feed meals using local material, processing, postharvest handling, better hybrids and equipment (O3, S3, S4, S6) 4. Use surrounding islands for the fisheries industry (O4, S4, S6) 5. Develop high value signature species (O5, S3, S4, S6)	**WO:** 1. Expand market through market intelligence and promotion (O1, W1, W5) 2. Encourage use of hi-tech automation and mechanisation to improve production and reduce labour requirement (O2, W2, W3, W4, W6) 3. Provide financial incentives for ornamental fish industry (O5, W7) 4. Dedicate cargo space for fisheries exports (O1, W8) 5. Intensify private sector participation in R&D on upstream and downstream activities (O3, W5, W9)
THREATS T1. Competition from neighbouring countries T2. Dependency on foreign labour T3. Dwindling fish stocks due to land reclamation, water pollution, over exploitation and destruction of mangrove swamps T4. Competition for labour from manufacturing sector T5. Competition for landuse for land-based aquaculture from other sectors T6. Inadequate transfer of technology from research institutions to operators	**ST:** 1. Develop niche markets and high quality species through R&D (T1, S3, S4, S6) 2. Enhance HRD development through training and recruitment of foreign expertise (T2, S4, S5) 3. Adopt and Implement Penang's environmental conservation plan to manage and conserve fisheries resources (T3,S3,S4, S6) 4. Encourage professionalism in industry through training (T4, S4) 5. Convert suitable land from other uses to aquaculture (T5, S4) 6. Strengthen extensions services and system in the Dept of Fisheries (T6, S4)	**WT:** 1. Improve extension system for transfer of technology to grass-roots level (T6, W6)

Malaysia has the potential and the necessary resources to further increase supply to meet domestic and export demand. Considering the availability of fisheries resources in Penang's surrounding waters, the deep sea fishing industry can be further developed on a sustainable basis. It is estimated that about 434,000 tonnes of fish can be exploited annually from this source. By 2010, the inshore fisheries' contribution will be sustained at about 900,000 tonnes annually through prudent and systematic sustainable management measures.

There are suitable lands and water bodies available for further development of the aquaculture industry along the coastlines of Penang. It is anticipated, nationally, that the contribution of aquaculture production to total national fish supply will increase from 11 per cent in 1995 to more than 30 percent by 2010. This will provide opportunities for the development of supporting industries including the production of feed and fish fry. There is also tremendous opportunity in ornamental fish culture and its expansion will be supported with infrastructure facilities and services to facilitate exports.

The imperative need to increase food supply for the nation has to take cognizance of the increasing scarcity of water and farmland, which is especially true in the case of Penang. This can be done through the integrated approach to water based production and services. There is significant scope for better integration of agriculture, aquaculture and inland fisheries practices. Programmes on approaches of co-management and community-based management of common property resources must be given increasing attention to boost our fisheries production.

At the micro production level, integration will need to focus on production technologies, such as by-product recycling and improved space-utilisation. At the macro-level, an integrated economy needs to be organized and structured so that constituent units function co-operatively. Integration needs to be pursued at all levels, should be interdisciplinary, and has to take into account the socio-cultural context of the locality and region. In this regard, human resources development and institutional strengthening will be the primary requirements for achieving better integration at the level of individual farms and communities, in river basin and coastal area management. Pollution control and reduction is also an imperative measure to be taken in order to check and reduce the damage to our riverine and coastal resources.

There is also an increasing global and domestic need for natural ingredients for manufacturing of nutriceuticals, supplements, health food, pharmaceuticals, cosmetics and toiletries. Marine flora and fauna around Penang can be future sources of these natural ingredients. These opportunities provide a conducive atmosphere for successful industries that utilise our rich biodiversity.

However, our aspirations can only be achieved through intensive R&D, which is the key to technological advancement. R&D should develop and expand in tandem with the desire to expand the fisheries industry in Penang. Without the vital role of R&D, we cannot produce better quality breeds and stocks, have better management and production techniques, develop more efficient and competitive ways of marketing our marine products and also develop downstream industries for our products in terms of food processing, developing nutriceutical and pharmaceutical products from our rich biodiversity resources. However, most R&D activities in agriculture are inclined towards production-oriented research rather than post-production or marketing research. Technology developed for these purposes have been minimal or not available. In view of the advent of globalisation, efficient post harvest handling and marketing is a necessity. Private sector research has been problem oriented in nature seeking to solve present production/ processing and marketing problems in order to maximize profits. However, public research institutions like Fisheries Research Institute (FRI), Universiti Sains Malaysia (USM), the WorldFish Centre need to be geared not only towards problem solving but also for social, economic and environmental well-being.

Any R&D result, however, should be transferred from such institutions to the farm or operator level. This calls for public sector commitments to conduct adaptive R&D in the development of technology suited for small farmers.

Penang Poised To Become A Major R&D Centre for Fisheries

Penang, is however, uniquely well positioned and has a comparative advantage over other States in that it can utilize its existing R&D institutions such as the Fisheries Research Institute, USM and ICLARM for the carrying out its R&D activities for the fisheries sector. Penang can play its role in terms of R&D and gain prominence in this area for the nation although its production capability for freshwater aquaculture and ponds may be limited by the scar-

city of land. In order to become the Fish Center for the region, Penang should exploit its intellectual capital to the fullest through the existing institutions.

Some of the research that these 3 institutions are currently conducting are described briefly below.

Fisheries Research Institute (FRI), Penang

The Fisheries Research Institute (FRI) is one of six branches within the organisation of the Department of Fisheries Malaysia. It was formally established in 1957 in tandem with the physical development of its premise at Gelugor, Penang and later relocated to its new site at Batu Maung. At present, FRI focuses on four major disciplines of research, namely fisheries resources, aquaculture, aquatic ecology and Biotechnology and fisheries product research section.

Major research programmes under the aquaculture section include:

- *Development of new species for aquaculture*
- *Nutrition and feed formulation for marine finfish*
- *Development and refinement of marine finfish hatchery technology*
- *Open sea cage culture*
- *Culture of shrimp and marine finfish in Brackishwater ponds*
- *Development and refinement of hatchery technology for shrimps and other crustaceans*
- *Development and refinement of mollusc breeding and culture technology*
- *Seaweed culture and processing*
- *Propagation in captivity of threatened species*
- *Development and refinement of hatchery technology for freshwater fishes*
- *Breeding and culture of ornamental fish and plants*
- *Freshwater fish health management*
- *Inland fisheries*
- *Freshwater fish nutrition and feed formulation*
- *Application of remote sensing/GIS techniques in aquaculture*
- *Molecular Analysis to Identify Fish Genetic Stocks*

The Biotechnology and Fisheries Products Research Section was set up in 1995 as a new arm of theFisheries Research Institute. As a relatively new section, the research capability and capacity are still being developed. Two main fields of research carried out are bioextraction from aquatic organisms and seafood safety. Research on bioremediation in controlling aquatic pollution is also being pursued. Funding for the research project planned is sourced from the central government and the Intensification of Research in Priority Areas (IRPA) programme.

The objectives of this section are :

- To screen and identify marine organisms that have potential to be exploited for nutriceutical, pharmaceutical and other value added products.
- To identify appropriate technologies for aquatic-based nutriceuticals and other value added products. To pro-

vide scientific information for the management of the seafood industry and to serve as the 'National Reference Laboratory' especially in terms of seafood safety and quality assurance.

- To develop technologies for bioremediation.

Plans are being drawn up to undertake research on extraction of nutriceutical compounds (e.g. unsaturated fatty acid such as EPA, DHA, enzymes, bioflavourant etc) and pharmaceutical compound (vitamin, anticancer, anti-fungal, antibacteria, antimicrobial, drug etc) from aquatic organisms and also by-products of the fish processing industry. At present research on extraction of bioactive compounds (antifungal, antibacterial and anticancer) from seaweeds and sea cucumber is on going.

The FRI's Seafood Safety and Quality Assurance research is to address national and international requirements for food safety and to assist seafood trade. At the moment research is being conducted to assess the extent of chemical and biological contaminants (biotoxin, microorganisms, pathogens, histamine, formaldehyde and harmful dinoflagellates) in seafood, seafood product, culturing and harvesting waters. The results from this research programme will assist in assuring the safety of food from water.

The FRI's future direction will also focus on research in the following areas:

- Genomics & proteomics for fisheries industry
- Transgenetic research on ornamental fish to produce new hybrids
- Biotechnology for seafood safety
- Biotech applications on oysters & abalone

The FRI recently scored another success in the multiplication and cultivation of tropical abalone for commercial purposes. It is hoped that with this new discovery local operators will take up the enterprise extensively and make Malaysia the leading abalone producer..

Universiti Sains Malaysia (USM)

The key departments of USM that will play an important role in marine biotech research include Centre for Marine & Coastal Studies (CEMACS), Biotech Group, National Poison Centre, School of Pharmaceutical Sciences and School of Medical Sciences. USM possesses both the experience and expertise to embark on research that may be targeted specifically at enhancing Penang's position as a major fisheries R&D Centre. USM has already made some breakthroughs such as using corals for bone replacement and cultivation of giant clams.

USM is also equipped with the right R&D Infrastructure such as a computerized marine research vessel, DNA sequencers and x-ray diffractors and has also facilities for full clinical trials. USM also boasts of being the oldest in terms of marine science in the country. It has already been serving as a hub of R&D for Malaysia and has conducted projects in Sabah and the East Coast. R&D activities of USM's marine science department takes advantage of Penang's strategic location in the Straits of Malacca. To the north are the Andaman Sea and Indian Ocean which offer a very rich biodiversity in marine flora and fauna for research.

The ongoing projects undertaken by the Mariculture and Reef Research Group (MRRG) under CEMACS are; Oysterseed (Malaysia), Seed production in commercially important Bivalves, Reproduction and Seed Production in Marine Fishes with Aquaculture Potential, Reproductive Biology of the Longtail Shad (Hilsa toli), Aquaculture of Sea cucumbers (Stichopus sp. and Holothuria sp.), Development of Automated Phytoplankton Culture Systems and Production of Giant Clam Seeds (Johor State Government). The Giant Clam (Kima) Seed Production project is recognised as the First Giant Clam Conservation Project in this country by the Malaysian Book of Records.

The WorldFish Centre (formerly known as ICLARM)

The Centre's work focuses on tropical developing countries in both inland aquatic (mainly ponds and rice flood-

waters) and marine (coastal and coral reef) systems - in which research is carried out on their dynamics, on investigating alternative management schemes, and on improving the productivity of key species. The work includes cooperative research with institutions in developing countries, and supporting activities in information and training. The priority areas of the WorldFish Centre are poverty alleviation and research programmes including Biodiversity & Biotech for fisheries are linked to that goal. The WorldFish Centre has moved to Penang in 2000 and has projects in 21 countries and networks in 52 countries.

Its research is carried out and disseminated through 5 main programs: Biodiversity and Genetic Resources Research Program (BGRRP), Coastal And Marine Resources Research Program (CMRRP), Freshwater Resources Research Program (FRRP), Policy Research and Impact Assessment Program (PRIAP) and Partnerships, Information and Training Program (PITP).

Although its research may not be particularly target for Penang's purposes, some of its research does have implications for Penang such as; Genetic Improvement of Tilapia, Selection of Tilapia in Low Input Farming systems, Mangrove Initiatives, Development of New Artisanal Fisheries Based on the Capture and Culture of Postlarval Coral Reef Fish, Tropical Fish Stock Assessment, Modeling of Multispecies Fisheries, and Regional Technical Assistance on Sustainable Management of Coastal Fish Stocks in Asia. The WorldFish Centre is also collaborating with FRI on Tilapia research.

The WorldFish Centre is able to conduct specific research if it receives funding for that specific purpose and if the goals of the proposed project converge with those of the Centre's mandate. It can also assists in capacity building in their core competency areas. The State Government may need to consider this possibility as a means of enhancing Penang's R&D efforts.

Future Areas Of Focus For Marine Biotech Research & Industry

Future areas of focus for research and development in marine biotechnology and industry that may be relevant to Penang include the following:

- Aquarium fish research - eg. creation of new hybrids and signature species through biotechnology
- Genomics for developing improved fish varieties for aquaculture
- Use of cement ponds for brackishwater and freshwater aquaculture
- Improving competency and efficiency in production techniques for industry operators such as local materials for cage design using local materials
- Locally produced fishmeals as food for cage and pond culture to reduce import dependency.
- Better post harvest handling and cold storage facilities for transportation of marine products
- Handling and packaging of marine products for export such especially for molluscs and crustaceans.
- Pharmaceuticals from marine compounds such as seaweed
- Functional foods from fish such as fish oil, reformulated fish products, fish protein concentrate.
- DNA markers for better hatchery seeds & managing fisheries
- Mortality reduction of fish fries.
- Production of fish fries and shrimp.
- International training unit for marine biotechnology

The *National Centre For Marine Biotech Research & Industry (MABRI)* in Penang which is proposed by the State Government will not only integrate the research activities of the various institutions but also provide the much needed impetus for R&D for the Fishery sector. The State Government through MABRI can also propose its research

agenda and guide research activities towards a more pragmatic approach for the fishermen and operators of capture fisheries, aquaculture and ornamental fish industry.

These R&D institutions can become centres of excellence in tropical marine fisheries and aquaculture and can be further strengthened through institutions-industries linkages via public-private sector research collaboration and contract research.

There is also the need to enhance the skills of local fishermen to provide skilled manpower and professionals needed by the industry. In view of the present needs, the possibility of recruiting foreign expertise such a skippers, master fishermen and gear technologies to train locals should be considered.

However, one of the major concerns with regard to R&D is the transfer of knowledge and technology from the laboratory to the practitioners on the ground. In order to maximize efforts of our research findings and results there must be an efficient mechanism to disseminate this information to grassroots practitioners and operators.

In summary, it is clear that Penang possesses good potential to develop the fisheries industry and achieve its aspirations of becoming a leading Fish Centre in the region given its, comparative advantage provided by its existing R&D institutions. R&D institutions must collaboratively work towards a common agenda to complement each other's research. These institutions should also form smart partnerships with the private sector so that adaptive research that takes into account the needs of the fisheries enterprises and market demand can be conducted towards further technological advancement. R&D conducted on fisheries should not be confined only to the State of Penang but also cross border to serve the northern states of Perlis, Kedah and Perak. Such R&D can also extend collaboration to IMTGT universities for exchange knowledge and expertise.

Penang too has good infrastructure, ports and airports to support the industry. Its marine food processing industries have the experience and expertise to embark on the production of a wider range of products. With careful planning and clear directions, Penang can complement the Biovalley in Selangor in R&D for the marine aspect in Biotechnology. It is thus prudent that the Penang State Government initiates a council for Marine Biotech Research & Industry similar to the KICT Council ; comprising of R&D Institutions, Department of Fisheries with representatives from the various northern states, LKIM, marine food processing and aquaculture operators to spearhead this biotechnology initiative. ***§ Khor Hung Teik***

Footnotes

1. 3rd National Agriculture Policy
2. Eighth Malaysia Plan, 2001-2005

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Special thanks to Ms. Choo Poh Tze for going through this information paper.

Seminar on Asian Competitiveness

Ask experts from across Asia about what makes the countries there competitive and we wonder whether we would get similar answers. As we would expect, there will be many agreements for a number of critical issues. For instance, for decades, development planning, foreign direct investments, exports of manufactures and the expansion of the financial sector have brought about economic growth to most Asian countries. However, the last ten years have seen a significant shift in the so-called international division of labour *aka* globalisation when China began opening up its borders to foreign companies to utilize its labour force and to tap its huge market. This change culminated with China's entry into the *WTO* soon after the turn of the century. What would be the implications from such a shift? Would Asian countries have to adopt very different strategies from the ones they have been pursuing in order to remain competitive?

At SERI's seminar on *Asian Competitiveness* organized for the Penang State Government in September, papers were presented for China (Warwick J McKibbin and Wing Thye Woo; Shi-Ji Gao), Korea (Yoo Soo Hong), Thailand (Peter Brimble), Philippines (Cherry Lyn S Rodolfo) and Singapore (Manu Bhaskaran).

The Warwick-Woo paper on the *Fallout from China's WTO Accession* drew much reservation in a seminar room dominated by industry managers, policy makers and government officials. These are business and industry practitioners and tend to be hands-on in their response to changing conditions. In contrast, the paper is full of conviction about how quote, "Southeast Asia should respond" based on the results produced by computer model simulations.

The model in question is the G-Cubed Asia Pacific Model developed by the McKibbin Software Group in Australia.[1] It currently encompasses 18 countries and in each, the model has 6 sectors: energy, mining, agriculture, durable and non-durable manufactures and services. Households, government and macroeconomic characteristics, particularly the financial sector, drive the model through 7400 equations. Impressive? Without doubt, but only because no effort has been spared in building such an enormous model and then plugging in the hundreds of data items obtained from all 18 countries to work it.

Does such a model really work accurately? Probably not. First, modeling in the social sciences follows a different philosophy from those in the physical sciences. In the social sciences, we are still quite far away from the ability to built huge models like the *General Circulation Model,* which has been successfully used to analyse impacts from climate change and weather phenomena like *el nino* and *la nina*. The properties of physics, chemistry and biology are much better understood. Furthermore, governed by natural laws, these properties do not change with time. Thus a computer representation is less difficult to develop for physical science models compared to processes involving less consistent and ever changing investment behavior by people or other business decisions found in economic models. Second, physical data is more accurately collected through the use of scientific instrumentations. With these data, the model's accuracy can be validated. Unfortunately, no measuring instrumentation exist to record social science behaviour and administrative record keeping of economic data is cumbersome, untimely and error prone.

The modeling philosophy in the social sciences is thus one of parsimony. Simple models, containing only a handful of variables, have found to be more useful. The few data items needed, can be more painstakingly gathered to ensure accuracy. At the end of the day we can say that these few variables account for say 60% of the total variation based on the regression R-square statistics. This would have been an achievement, as out of all the complexities that might result in the decision behavior being examined, these few variables have been found to be the important ones. Knowing them would help guide policy and identify response strategies.

About a decade ago, MIER published a book on *Models of the Malaysian Economy* (Imaoka, 1990) that revealed the contents and the processes for several macroeconomic models for Malaysia's economy.[2] They include models built by scholars writing their Ph.D. theses as well as large ones used by the government for planning. Despite being in existence all these years we hardly hear about the results these models produced. Although the models do say something helpful, they have not been totally satisfactory. How could they? Those of us who worked on models are well aware that the needed data are not that easily obtained, and then being time series there is

the problem of finding stationarity properties for each data item so that spurious regressions could be avoided. Put together side by side in an equation, we have to deal with multicollinearity and then when we string many equations together we have the so-called identification problem that can only be achieved when the number of the equations are consistent with the number of endogenous variables. All that for one country, and dealing with a fairly parsimonious model. Imagine how the errors will compound when we extend the same approach to deal with 18 countries, thousands of equations and a few hundred variables. No, the world is not yet ready for huge simulation models in the social sciences.

So, back to the lessons resulting from China's workforce forming part of the international division of labor. Professor Woo's paper tells us that if China becomes a major producer of manufactures, production in ASEAN has to move into more specialized niches and thus putting more pressure on ASEAN countries to improve their technological capacities. The model simulation does not say this, but the paper suggests that market compatible economic policies such as economic openness, meritocracy, adequate infrastructure, efficiency and incorruptibility of the government, quality financial institutions and astute macroeconomic management, for example emulating American *laissez*-faire oriented government, would be the correct response.

The point is there isn't anything really new that has been discovered from the sophisticated model sort of approach to the Asian competitiveness forum. The recommended solutions are similar to those that both government and industry have been struggling with for years. Changes in the same direction are taking place at a speed that is set to balance between internal priorities faced by individual nations in ASEAN and external pressures from competition by neighbouring producers. The modeling route taken by the paper has been long and tedious but it led to the same findings that others have made.

Shi-Ji Gao's paper *The Competitive Advantage of China* has the same starting point, which is the consequence of China's 2001 entry into the *WTO*, but without computer simulations of sophisticated models. Like other countries, Dr.Gao said that China too has been moving up the technology barrier and this is similarly boosted through economic reforms that basically redefine the government to private enterprise relationship. These reforms affect the competitiveness levels of production enterprises, say how effectively these enterprises could innovate technologies and shorten product life-cycles. In turn such reforms result in the competitiveness of the country.

Side by side, the two China papers meant that the competitiveness game traditionally played across Asia during the past few decades have basically remained the same. The only difference is that the pace of the game has just gotten many times faster, because both the number of players involved in production as well as the market have expanded to potentially include the participation of all of China's huge population. What countries other than China wants to know is, for them, does this mean that there will be more business because of the bigger market or more competition because of Chinese enterprises entering the game? The papers seem to suggest that the answer lies in how willing individual governments are to undertake reforms alongside those already taking place in China and that those that do it faster will get ahead of the game.

This finding is further confirmed by Yoo Soo Hong's paper on the *International Competitiveness of SMEs in Korea*. The country's advancements during the past few decades are well known. How then did everything come tumbling down in 1997? Growth fell to negative 6.7% the following year. Dr. Hong cited issues like lack of financial prudence and transparency that during post-crisis years required very painful micro level structural adjustments in the corporate and public sectors as well as in the labour market. The extensive liberalization programmes that were undertaken actually paid off, because by 1999 signs of recovery could be seen in Korea's macroeconomic indicators. By 2000, exports became buoyant reversing the fall, experienced for the first time in 1998 after 20 years.

Competitiveness appears therefore to be driven by both macro and micro factors. Peter Brimble pointed this out in his paper *Thailand's Competitiveness Drive: Meeting Global Business Challenges?* All the talk about a macroeconomic and policy environment conducive for doing business at the macro level is important but it is only a necessary condition, which will not guarantee results unless it is backed by the sufficient condition at the micro level. The micro or firm level foundations to competitiveness are similar to those cited in most other papers: technology, innovativeness, creativeness, skill levels etc. But more than that Dr. Brimble reminds us that these factors do not exist in isolation. Instead, steps must be taken to benchmark the many different key indicators: labour quality, education and training, R&D spending, investment trends, supply chains and their management, production technology, mar-

keting and so on. Only then, will we know where we are, as a firm and as a nation, and which direction to take as we step into the future.

Addressing such factors was what Cherry Lyn S Rodolfo did in her paper, the *Competitiveness of Philippine Industries.* She divided competitiveness between macro level and micro level factors. Although since the 1997 crisis, the Philippines have found its macro factors eroded, her study managed to look into various aspects that helped identify how various industries "benchmarked." As a result she found that *factor driven* industries which are resource based and labour intensive such as furniture are competitive but the market is slow growing. This is compared with *investment driven* industries one step up the technology ladder requiring intermediate skill levels and possessing stable or growing markets such as is found for electronics and in which the Philippines is improving in its level of competitiveness. There are also the *innovation driven* such as IT services as well as *trend-opportunity driven* industries such as hardware and software solutions that remain at the frontier that become natural directions to move as industries on the decline recede from importance. These include processed foods, wood based industries, textiles and garments. Competitiveness in a country is a two-front battle: dealing with issues like better competition policies at the macro level and micro level factors such as resource utilization and inter-industry support linkages.

Manu Bhaskaran's *Assessment of Singapore's Competitiveness* similarly emphasized the importance of doing benchmarks. The island nation and city state has had an edge over its neighbours over most of the macro and micro factors but it is quickly realized that in the new global economy doing as well is no longer enough to remain competitive. Today competition comes from everywhere, not just the immediate neighbours and this means extending the scope when doing performance benchmarks. The conclusion that Dr. Manu has drawn is somewhat sobering. Others may be envious of what Singapore has achieved thus far but even so its competitiveness as a knowledge-based economy requires still faster progress than what many of us thought to be already at a dazzling pace. One wonders whether there is actually hope for the rest of us as the globalisation game shifts into overdrive speeds. ***§Chan Huan Chiang***

Footnotes:

1. See www.msgpl.com.au/msgpl/apgcubed46n/model.htm for details on the model
2. Hideki Imaoka, Muthi Semudram,Sahathavan Meyanathan, Kevin Chew (1990) *Models of the Malaysian Economy,* Malayisan Institute of Economic Research, Kuala Lumpur.

COMING SOON!

Penang Economic Outlook Talk on December 13, 2002 at Cititel Penang.