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AQUACULTURE DEVELOPMENT IN SINGAPORE

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ABSTRACT

Aquaculture production in Singapore is mainly from Seafarming and is about 2% of total fish consumed. At present, there are 79 licensed floating fish farms located in the East and West Johor Straits that culture popular species like sea bass (*Lates calcarifer*) and estuarine grouper (*Epinephelus tauvina*). Aquaculture development is geared towards the establishment of highly intensive fish farms such as land-based systems in agrotechnology parks, smaller brackishwater pond systems, and large-scale floating systems in designated sea areas. Research and development on improvement of farming techniques are on-going.

Freshwater aquaculture is focused on ornamental fish production. This is a high value trade with yearly growth of 11 % in 1986-1990. Development of intensive farming systems, improvements in water quality management, disease control, and quarantine are considered important. Research concentrates on breeding and genetics.

INTRODUCTION

Aquaculture production presently contributes about 2% of the total fresh fish supply and 14% of local fish supply. Coastal Seafarming accounted for 94.5% or 1,856 tons of Singapore's total aquaculture food fish production of 1965 tons in 1990, the rest being 48.8 tons (2.5%) of shrimp and 60 tons (3.1%) of freshwater food fish from ponds. Total value was about S\$12 million. At present, there are 79 licensed floating fish farms covering 44 hectares of coastal waters of the East and West Johor Straits.

Freshwater aquaculture is mainly on production of ornamental fish. Singapore is a major global exporter of ornamental fish. Three hundred million fish, valued at S\$72.6 million were exported in 1990. Singapore's exports account for about 15% of the world trade of S\$500 million. The annual growth rate of Singapore's export was 11% for the period 1986-1990. To date, there are 60 licensed ornamental fish farms and 120 licensed exporters of ornamental fish.

AQUACULTURE DEVELOPMENT (INCLUDING TECHNOLOGY DEVELOPMENT) (1988-1991)

Coastal farming, which started in the late 1970s, is mainly the culture of fish in floating net cages. By 1988, there were 70 licensed floating fish farms and in 1991, there were 79 floating farms covering 44 hectares. The annual yield from coastal farming activity accounts for the bulk of aquaculture production. Floating fish farms, previously distributed in the four designated farming areas off Palau Ubin, Serangoon, and Ponggol in the East Johor Strait and Lim Chu Kang area of the West Johor Strait, are now mainly located in the Pulau Ubin and Lim Chu Kang areas because of more optimal water conditions and accessibility.

In Singapore, land-based farming is limited by availability of land. In 1987, only 3,300 hectares of land were used for farming. Only 50 hectares now remain as brackishwater shrimp ponds, about half the area previously utilized for this purpose. Less than 10 hectares are freshwater food fish ponds. Some 47 hectares of the 300 hectares aside for ornamental fish culture are now in use. In 1985, the Government introduced the concept of agrotechnology, which is the application of technology in large-scale intensive farming systems to achieve yields that are higher than those from conventional farming systems. The Primary Production Department (PPD) promotes and initiates the development of farmlands into agrotechnology parks.

MARINE AQUACULTURE

Green mussel (*Perna viridis*) farming on ropes suspended from wooden floating rafts is concentrated in the West Johor Strait because of more suitable conditions, i.e., slower water current and the presence of plankton. Production was 1,191 tons in 1988 and 1,014 tons in 1990. Spatfall is now less frequent and abundant and growth is slower because of the decrease in the nutrient load of the waters.

Research and development on the improvement of farming methods for marine food fishes is undertaken by the PPD's Marine Aquaculture Section (MAS). A preliminary study has been done on the use of deep net cages as a means of increasing yield within the same water surface area, and results show that sea bass (*Lates calcarifer*) yield is 4 times that which can be expected from conventional cages for the equivalent area. Trials on automatic feeding of dry formulated diet to sea bass in floating net cages gave encouraging results. With

the correct adjustments in feeding frequency and feed amounts, they can be further improved. The culture of brown-marbled grouper (*Epinephelus fuscoguttatus*), a possible new species for introduction in floating net cages, has also been studied. Growth rate (from 30-600 grams in 10 months) was 70-80% slower than that of estuarine grouper (*E. tauvina*) from 30 to 600 grams in 7-8 months).

There is one sea bass hatchery in Singapore. In 1990, about 1.3 million sea bass fry and fingerlings valued at S\$0.26 million were produced. Four shrimp hatcheries, mainly for the banana shrimp (*Penaeus merguensis*), produced 141 million fry in 1990 valued at S\$1.9 million. Only banana shrimp is cultured in Singapore. Most food fish fingerlings are imported. About 50,000-60,000 fry valued at about S\$100,000-120,000 are imported each year. These are mainly sea bass, estuarine grouper and rabbitfish (*Siganus canaliculatus*) fry. The MAS successfully bred the brown marbled grouper in 1990 and is now looking into fry production aspects. Studies on the feasibility of using enriched diets to improve estuarine grouper broodstock performance and larval survival are also being conducted.

Trash fish is still the main feed for fish while dry formulated feeds for the tiger shrimp (*P. monodon*) which are commercially available are being used in banana shrimp culture. Five commercial companies are now producing shrimp feeds in Singapore. One company is also producing encapsulated Vitamin C and shrimp larval feed. The MAS is looking into the preparation and application of fish silage as an alternative to fresh chilled trash fish and studying the nutritional requirements and feedstuff digestibility in sea bass to develop suitable least cost formulations. The MAS also assisted two commercial companies to develop practical feed formulations for banana, tiger, and kuruma (*P. japonicus*) shrimps, and the information gained has been marketed by the commercial parties concerned.

The PPD provides fish disease and fish health management services to the industry. Common diseases and their methods of treatment have been identified and handbooks for farmers published. Farmers are also now able to recognize such diseases and apply prophylactic and therapeutic treatments with minimal supervision. A scheme for marine food fish health inspection was developed and introduced in 1990. Exporters of fish requiring health certification are subjected to a system of fish health inspection aimed at monitoring the health status of fish and management practices at export premises.

ORNAMENTAL FISH CULTURE

The aquarium fish farms have intensified production and are applying more scientific methods in fish breeding. Species that are bred and cultured locally are the live bearers, guppy (*Poecilia reticulata*), platys (*Xiphophorus maculatus*, *X. variatus*, *X. reticulata*), mollies (*P. velifera*, *P. sphenops*, *P. latipinna*), swordtail (*X. helleri*), the egg layers, angelfish (*Pterophyllum scalare*), and the tetras of the family Characidae. Farming systems used are ponds, net cages in ponds, and tanks.

Imported freshwater ornamental fish are quarantined by importers at their premises if the consignments are meant for re-export. The Freshwater Fisheries Section (FFS) of the PPD provides fish health certification services and has an accreditation scheme for exporters. This encourages them to upgrade the quality of their fish exports through management improvements. As for the marine foodfish, the PPD also provides health certification services for ornamental fish to facilitate export.

FUTURE DIRECTION

Singapore plans to increase productivity through the promotion of better management of existing farms, encouragement of large scale farming, and the application of agro technology. The private sector is given incentives to participate in the development of the aquaculture industry, such as investing in the setting up of services for the industry and in the establishment of farming systems that are demonstration models of technology application. Agrotechnology parks are being developed for this purpose. In order to operate at this level, farm units are likely to be smaller and better controlled in the future. Fish farming in floating structures are developing towards large-scale and highly intensive production systems. New species, if found to be feasible for farming and breeding, are introduced. Examples of these are gibbus snapper (*Lutjanus gibbus*) and brown-marbled grouper, blue shrimp (*P. stylirostris*), and flower or tiger shrimp (*P. semisulcatus*). Research will focus on high value productive species in the areas of breeding, farming, feed development, and disease control. Health status assessment (e.g. diagnostic kits) and the development of environmentally controlled and automated hatchery and production systems will also be addressed.

In ornamental fish culture, areas for development are in intensive farming systems that maximize production, water quality management, and automation. Other important considerations are the strict enforcement of hygiene standards and regulations, disease control, and quarantine procedures. Research will focus on the development of breeding techniques for popular species for the conservation of wild stocks and in selective breeding and genetics to improve strains such as disease resistance.

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