# Knowing Asian aquaculture and fisheries

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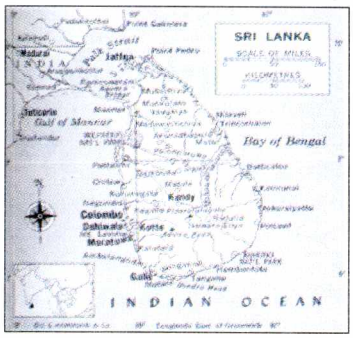


## SRI LANKA

Sri Lanka has a land area of 65,600 km$^2$ (including an inland water area of 1,156 km$^2$) and has a coastline of 1,700 km including that of the islets. It has economic rights over 223,000 km$^2$ of coastal waters. The continental shelf is narrow with an average width of around 22 km.

The population is 18 million with an average population density of 280 persons per km$^2$. Nearly 70% of the population live in rural areas and engage in agriculture.

The fisheries sector of Sri Lanka provides livelihood to about 80,000 fishers in the marine and 14,000 in the inland fisheries sector while another 18,500 is engaged in ancillary activities. The total fishing population in Sri Lanka is about 470,000.

The national fish production in 1996 was 228,500 tons and the sector contribution 2.8% (Rs. 15,000 million at 1996 market price) to the Gross Domestic Product (GDP). Despite the small contribution of the Fisheries Sector to the GDP, it still plays an important role in the national economy in view of its contribution of 65% of the animal protein consumed by the people, providing employment to about 120,000 people and high export earnings (Rs. 3,655.5 million in 1996).

There is no traditional practice of aquaculture in Sri Lanka. At present most of the aquaculture practices except shrimp farming and ornamental fish cultures are limited to small-scale farming and experimental trials.

The total fish production in 1989 was 205,286 tons; 39,720 tons or 20% was from inland fisheries. Contribution from aquaculture was estimated at 2,000 tons of farmed shrimps and 50 tons of freshwater fish produced from seasonal village tanks. Fish productions from major subsectors are given in the following table.

In 1994, the production from inland fisheries dropped to 12,000 tons. Termination of subsidies, among others, by the government are the major factors that affect aquaculture and inland fish production.

**TABLE 1** **Annual production of Inland Fisheries and Shrimp in Sri Lanka**

| Year | Inland fish production (tons) | Shrimp production (tons) | Value (Rs. million) |
|---|---|---|---|
| 1989 | 39,720 | | |
| 1990 | 31,265 | 1,885 | 485 |
| 1991 | 23,823 | 943 | 454 |
| 1992 | 21,000 | 1,246 | 613 |
| 1993 | 18,000 | 1,426 | 808 |
| 1994 | 12,000 | 2,300 | 1,650 |
| 1995 | 16,000 | 2,780 | 2,153 |
| 1996 | 17,550 | 2,200 | 2,000 |

### Brackishwater shrimp farming

Shrimp farming (*Penaeus monodon*) was started by the private sector entrepreneurs recently. Shrimp is cultured in ponds adopting semi-intensive methods using hatchery produced post-larvae. There are approximately 900 shrimp farms with a pond area of 2,500 ha. Over 60% of the land allocated for shrimp farming is managed by large farms of over 4 ha. The pond size varies from 0.5-1.5 ha in well-managed farms. Culture period is 4-5 months. An average production of 3,000 kg per ha is achieved per one culture cycle. Feeding is done with imported formulated feed.

About 300 million shrimp post-larvae are produced in 55 hatcheries. The total annual requirement of post-larvae is around 500 million. The annual shrimp production of Sri Lanka is about 2,500 tons. Shrimp exports contribute to 50% of the fisheries/ exports in Sri Lanka, but these days, the industry has virtually collapsed due to "white spot" disease caused by a virus.

### Pond culture of milkfish

Milkfish (*Chanos chanos*) is the only brackishwater fish species cultured in Sri Lanka. Milkfish fry are available from March to June in the coastal mud flats in the Kalpitiya-manner area. The collected fry are acclimatized in nursery tanks and are raised up to fingerlings. Fingerlings are used for pond culture and stocking of freshwater bodies in the inland areas.

### Seaweed and mollusc culture

Seaweed culture is still at an experimental stage. More attention has been given to the culture of *Gracilaria* sp. which is also considered as overexploited. In experimental trials, it has been recorded that plants grew to an average length of 12 cm in 18 weeks culture period.

Mollusc culture is also carried out on an experimental scale. Raft culture of brown mussel (*Perna perna*) and green mussel (*Perna viridis*) has been carried out and a growth of 60-70 cm has been achieved within a period of 6-7 months.

### *Artemia* production

*Artemia* has become a high demand commodity for shrimp hatchery production and ornamental fish culture. It has been recognized that more than 2,000 ha of land are suitable for salt production and the salt pans could be made available for *Artemia* production. Presently, yields of 3-3.5 kg per ha each season are achieved. The experimental culture yields were in the range of 10-12 kg per ha.

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## VIETNAM

The population of the Socialist Republic of Vietnam is 77 million, with 2.65 million involved in fisheries and aquaculture. The industry directly employs about 200,000 people yearly.

An aquaculture household has an average of 4.85 members. The educational level is low, with members reaching only Grade 4 or 5 of the 12-year educational program.

Fishery products supply 35% of the protein consumed. The fishery consumption rate of Vietnam is estimated at 23.21 kg per person per year.

Vietnam has 3,200 km long coastline, covering 13 latitudes from the north to the south, hence, the marked difference between climatic zones, in weather and hydrological conditions, and fish cropping patterns. The coastal areas, surrounded by islands and bays which provide favorable breeding grounds, have many commercially valued species.

Exclusive Economic Zone (EEZ) of Vietnam is established at around 1.2 million square kilometers. Tongkin Bay and West Southern Bay cover 50% of seawater and are less than 50 m deep.

Southern seawater mainly ranged 30-60 m deep. Seawater of central Vietnam is very deep. Within 3-10 nautical miles from the shore are areas 30-50 m deep.

There exists about 3,000 islands and islets in the East Sea of Vietnam, which lay an important foundation for the development of fisheries and aquaculture, and support services.

Reefs serve as a collection place of many highly commercial species, namely seabass, grouper, snapper, growler, lobsters, etc.

### Marine resources

There is a wide variety of marine species, about 2,000 species, out of which 100 species are highly commercial. There are 1,647 species of crustaceans, in which shrimp plays an important part. In addition, there are 2,500 molluscan species; more than 600 seaweeds; and sea cucumbers, abalones, scallops, cockerels, clams, etc.

*Identified marine species in Vietnam*

| | |
|---|---|
| Phytoplankton | 573 species |
| Hard coral | 298 species |
| Zooplankton | 468 species |
| Marine fish | 2,038 species |
| Benthic fauna | 6,377 species |
| Sea turtle | 4 species |
| Shrimp | 75 species |
| Sea-snake and serpent | 12 species |
| Squid and cuttlefish | 5 species |
| Marine algae | 635 species |

### Marine fisheries

In coastal waters, the fishing is confined to the designated depth of under 20 m. The production of pelagic fish is estimated at 200,000 tons per year. Although marine surveys have been conducted for years, it is only possible to obtain the preliminary data, especially of migratory pelagic fish, and of benthic fish. There is a lack of specialized surveys to serve the immediate needs of production, and resource conservation for long-term production as well as an intensive study on biological and ecological characteristics of the existing sea waters.

### Production and area under aquaculture

Total annual production of fisheries/aquaculture: 1,400,000 tons
Coastal aquaculture production: 342,000 tons, accounting for 25%
Export value: US$680 million per year
The growth rate of the industry: 8%
Coastal area under culture: 56,000 ha
Tidal coverage:290,200 ha

### Coastal aquaculture in Vietnam

About 56,000 ha have been developed for aquaculture, mainly involving black tiger prawn, banana prawn, seabass, milkfish, Dumeril's amberjack (*Seriola rivoliana*), crab, unisexed tilapia, etc. The annual production is 18,000 tons, with an average pond yield of 320 kg per ha per year. Besides, there are more than 1,800 shrimp hatcheries set up in central Vietnam, which annually supply approximately 2 billion postlarvae of black tiger prawn and banana prawn.

There are 3,500 fish cages in coastal waters -- for seabass, snapper, Dumeril's amberjack, lobster -- with a production capacity of 15 kg fish per $m^3$ of cage.

A total of 1,720 ha of tidal areas is used to culture bivalves, namely blood cockle, clam, and oyster. Production is highly satisfactory, and the industry has a good prospect of long-term development.

Seaweeds of various species and cartilage aquatic plants are cultured in shrimp or fish ponds, in tidal grounds and around islets (raft or buoy culture) where they are well-sheltered from strong winds. Seaweed production is estimated at 150,000 tons per year.

Joint ventures sought with Japan and Australia for pearl culture are being undertaken in three parts of the country and have gained initial success.

The establishment of formulated feed manufacture is growing rapidly to meet the needs of the fishery/aquaculture industry. It also aims to ensure an adequate supply of shrimp/fish feed for the aquaculture sector, and also to improve the feed quality.

Pearl culture and other cage culture ventures have been initiated and many farmers are encouraged to join. Integrated culture is being encouraged to reduce the rearing density and the intervention of antibiotics, and eventually control the ecological balance of the production pond.

### Problems facing the aquaculture industry in Vietnam

Major causes of diseased shrimp identified by Vietnamese fishery biologists are as follows:

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effect on mictic female production. Lorica length increased by 9.6% and 4.4% in rotifers treated with JH (0.05 mg $l^{-1}$) and GABA (5 mg $l^{-1}$), respectively. Correspondingly, lorica width increased by 8.9% and 2.6% in these treatments. In comparison, 20-HE-, T-3-, and hCG-treated rotifers were smaller (3.9-8.2%) and GH, 5-HT and E-2 had no effect on rotifer body size.

Doi M, **JD Toledo, MSN Golez, M de los Santos**, and A Ohno. 1997. Preliminary investigation of feeding performance of larvae of early red-spotted grouper, *Epinehphelus coioides*, reared with mixed zooplankton. Hydrobiologia 358:259-263

*Abstract.* Larvae of red-spotted grouper, *Epinephelus coioides,* were reared in outdoor tanks with nauplii of copepods (mainly *Pseudodiaptomus annandalei* and *Acartia tsuensis*) and/or rotifers, *Brachionus rotundiformis*. Grouper larvae successfully started feeding on early stage nauplii even though their abundance was as low as approximately 100 individuals $l^{-1}$ and showed better survival and growth thereafter compared to those fed with rotifers only. Incidence of feeding reached 100% on day 4 when nauplii were available and only on day 9 when rotifers were given alone. Larvae seemed to be poor feeders at the onset of feeding, attempting to capture any food organisms in the tank water. Selective feeding ability of larvae started from day 4 and the larvae then preferred to feed on medium- and large-size nauplii rather than on rotifers as they grew. Larvae appeared to have a better chance at surviving in the presence of early stage nauplii, which were probably caught more easily than rotifers.

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- The pond water is getting more and more polluted with industrial waste chemicals and agricultural pesticides, along with the accumulated sedimentation.
- Most of the shrimp farms in Vietnam rely heavily on tidal water for the supply and drainage of pond water, thus, it is difficult to improve the water quality of the pond. Consequently, it is impossible to control pond pollution.
- Shrimp commonly contract viral diseases such as red body and black gill, accompanied by rapid transmission of viruses. The infected farm shrimp suffers a mortality and the stock die out within 5-7 days.

LIST OF REFERENCES WILL BE PROVIDED UPON REQUEST

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tween government and industry, economic and social incentives for the industry to comply, and commitment by the government to enforce where necessary.

The last identified aquaculture stakeholder was research organizations. Dr. Williams said that research provides basic knowledge, identifies problems, resolves conflicts, and suggests options and solutions to problems, thus many stakeholders' needs cannot be met without the assistance of relevant research. Citing AQD's research on the giant tiger prawn that greatly improved farming methods, Dr. Williams emphasized research as the vehicle for increasing supply when wild catch are already fully utilized. Research in biotechnology will also play a bigger role in aquaculture in the future while research organizations will have to adapt to new research funding strategies. Policies for determining the ownership of intellectual property created will have to be developed. The ownership of fish genetic resources will also become an issue between countries, said Dr. Williams.

Dr. Williams further said that since research organizations are not the users of their own research, research staff should have extra skills -- skills that make them look at the practical and applied aspects of their research. Working closely with those that would use the research will ensure that the work has a high chance for successful application and is available to the end-user.

Dr. Meryl Williams is the Director - General of the International Center for Living Aquatic Resources Management (ICLARM), an international research organization based in Manila, Philipines. She holds a Doctor of Philosophy degree in Zoology and a Master's degree in Literary Studies in Mathematical Statistics.

She was previously director of the Australian Institute of Marine Science and Executive Director of the former Bureau of Rural Resources in the Department of Primary Industries and Energy, Canberra (Australia). Dr. Williams also worked as a fisheries scientist with the Queensland government and with the South Pacific Commission in New Caledonia.

In Australia, she was a member of several fisheries management advisory committees and scientific review committees. In November 1997, she became a member of the FAO Advisory Committee on Fisheries Research and in 1998 she was appointed Chief of the FAO Director-General's High Level Panel of External Experts in Fisheries.