National Aquaculture Sector Overview

Pakistan

Characteristics, structure and resources of the sector

Summary

Aquaculture is a rather recent activity in Pakistan and is still in its infancy; nevertheless there is immense potential for development of the sector. Despite its vast fresh, brackish and marine water resources only carp culture is practiced in inland waters and only on a limited scale, carp are cultured in earthen ponds, using mostly extensive farming practices with very little inputs. In Pakistan, the fish fauna is rich but only seven warm water species and two cold water species are cultivated on a commercial scale. Trials experimenting with shrimp culture have been carried out in the Indus delta region but it did not succeed due to the non-availability of hatchery-produced seed.

The fisheries sector as a whole contributes to about 1percent to the country's GDP and provides jobs for about 1percent of the country's labour force. Freshwater carp farming is the major aquaculture activity in three of the country's four provinces (Punjab, Sindh and North West Frontier Province [NWFP]). The northern mountains of Pakistan have good potential for trout culture but production in these colder regions is still very small.

Aquaculture in Pakistan is basically a provincial responsibility; at the central level fisheries is the responsibility of the office of the Fisheries Development Commissioner (FDC) working under the Ministry of Food, Agriculture and Livestock (MINFAL). The office of the FDC is responsible for policy, planning and coordination with provincial fisheries departments and other national and international agencies. The Pakistan Agricultural Research Council (PARC) is the country's largest research organisation and is responsible to MINFAL. Some universities in the country are also involved in basic fisheries research.

History and general overview

Aquaculture in Pakistan is a recent development and in many parts of the country the management of the sector is still poor with culture practices varying across the different provinces. Two Asian Development Bank (ADB) assisted projects have assisted in strengthening the institutional structure, with infrastructure

development such as the development of hatcheries and juvenile production, model farms, transfer of technology, human resource development as well as the strengthening of extension services.

Aquaculture has also received a substantial amount of government investment over the past decades and facilities are now in place that can provide the basis for a major future expansion in aquaculture production.

With the exception of trout culture in NWFP and the northern region, virtually all aquaculture currently carried out in Pakistan is pond culture of various carp species. Pakistan has not yet begun any coastal aquaculture operations although there is good potential all along Pakistan's 1 100 km coastline. Efforts have been made in the past to start shrimp farming along Sindh coast, which did not succeed, the main constraints being the non-availability of hatchery produced seed and a lack of expertise.

Freshwater fish culture in earthen ponds, both small and large reservoirs as well as community ponds was initiated in late 1960s by the provincial fisheries departments. From 1980 onwards the polyculture of Indian major carps and Chinese carps has been carried out in Punjab, Sindh and to some extent in NWFP.

According to the latest estimates, the total area covered by fish ponds across all provinces is about 60 470 ha, with Sindh having 49 170 ha, Punjab 10 500 ha, NWFP 560 ha and the other provinces (Balochistan, Azad Jammun Kashmir [AJK] and Northern Area [NA]) 240 ha.1.2Human resources:About 13 000 fish farms have so far been established across Pakistan, the size of these farms varies considerably, however, the average farm size ranges form 5-10 ha. No direct data on the number of fish farmers employed in this sector is available as fish farming in most parts of the country is carried out as an integral part of crop farming. According to a best estimates, about 50 000 people are either directly or indirectly employed in the sector.

Human resources

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Farming systems distribution and characteristics

Pakistan has substantial areas of inland waters as a result of its location as the drainage basin for the Himalayas. The region between 33 º N and 20 º N consists of a network of rivers, canals, reservoirs, lakes, waterlogged areas and village ponds, etc. with a total area of about 8.6 million ha. Of this total, some 30 000 ha correspond to the area utilized for cold-water trout production and other commercially important sport fishes such as mahseer (*Tor tor*) and snow trout (*Schizothorax richardsonii*).

About 110 000 ha comprise the warm water natural lakes found in Pakistan of which the majority (101 000 ha) are found in Sindh Province, which has a mix of both freshwater and saline lakes. In some of these saline lakes, the salinity levels are higher than sea water thereby limiting their potential for fisheries production.

While these resources possess great development potential to help meet the increasing demand for protein from the population, fish farming has never been a major economic activity neither have freshwater fish ever been a major food source for the inland population. The per capita consumption of fish products is currently around 1.9 kg which is amongst the lowest in the world.

The provinces with the greatest potential for development are Punjab, Sindh and to a lesser extent NWFP, the total number of farms in all provinces being approximately 13 000. Although the fish farming through culture in ponds and other natural water bodies has been practiced for several decades, it is only during the last two decades that any impetus for further development can be seen with about 60 470 ha of freshwater ponds being used for fish culture.

In Sindh Province, the majority of the farms are located in Thatta, Badin and Dadu, the three districts through which the River Indus passes. Badin and Thatta have water logged floodplain areas which are suitable for fish farming. In Punjab Province, farms are located mostly in irrigated areas or where there is abundant rain and the soil is alluvial. As a result, Sheikhpura, Gujranwala, and Attock districts have larger number of farms and constitute around three quarters of the total number of farms in Punjab.

The NWFP has comparatively fewer farms, because of the cold climate in the mountainous areas. Trout farms are located in Chitral, Swat, Dir, Malakand, Mansehra, Federally Administered Tribal Area (FATA) and other parts of NA. Carp culture is practiced in Dera Ismail Khan, Kohat, Mardan, Swabi and the Abbotabad districts of NWFP.

Inland fish farming is under the control of the provincial governments, who supply seed, operate hatcheries, provide extension services, collect primary data and promote fisheries through extension manuals, brochures and by arranging seminars, etc. Existing farming methods have not developed. However, as a result of a steady stream of newcomers to the sector, there is a slow but steady improvement in technology over time.

Cultured species

In the past, most fish farmers stocked their ponds only with indigenous species such as catla (*Catla catla*), rohu (*Labeo rohita*), mrigal (*Cirrhinus mrigala*) and common carp (*Cyprinus carpio*). More recently, two fast growing species, the grass carp (*Ctenopharyngodon idellus*) and silver carp (*Hypophthalmichthys molitrix*), have been introduced for culture under modern polyculture systems to increase the fish yield per unit area. These two species have good economic values; have gained a reputation and became popular amongst the producers as well as consumers. Two species of trout namely brown trout (*Salmo trutta*) and rainbow trout (*Oncorhynchus mykiss*) are cultured in NWFP, AJK and NA.

Practices/systems of culture

The organisation of the Provincial Fisheries Departments was very poor at the beginning of aquaculture activities during 1980s and to some extent is still in a similar position in Balochistan and NWFP provinces. With the exception of a pilot shrimp farm in Sindh and one pilot trout culture facility in NWFP, virtually all aquaculture in Pakistan consists of pond culture of various carp species.

The quality of carp pond design and construction is highly variable, some commercial farms are well built and managed, however, many more are in need of technical and management assistance.

Carp are cultured in earthen ponds utilising extensive polyculture farming systems with very little inputs; in some farms semi-intensive culture has also been adopted. A combination of five or six of the three indigenous species of major Indian carps as well as 3 exotic species of Chinese carps are cultivated in the ponds. On a typical farm in Pakistan, the ratio of the warm water species stocked on the farm is as follows: catla (10-20 percent), rohu (30-35 percent), mrigal (15-20 percent), grass carp (15-20 percent) and silver carp (15-20 percent).

The intensive culture of these species has not yet been adopted so far, the major impediment to this development being the non-availability of low cost feed and to some extent the non-availability of intensive fish farming technology. The productivity of carp farms show marked differences across the various provinces with Punjab having the highest per unit production followed by Sindh and NWFP.

Cold water aquaculture provides a unique opportunity in the mountainous areas of NWFP, Balochistan, AJK and NA. Presently two species, brown trout and rainbow trout, are being produced and cultured successfully for use in sport fishing activities. The intensive rearing of trout is practiced in commercial raceways in Swat, Dir, Chitral and Hazara in NWFP and in AJK and NA.

Sector performance

Production

There has been a decreasing trend in inland fish production during the period between 2001 and 2003 resulting from severe drought and degradation of natural resources through pollution. Production from the inland capture fisheries has been affected most, inland aquaculture has, however, witnessed a relatively rapid increase.

The graph below shows total aquaculture production in Pakistan according to FAO statistics:

Market and trade

The marketing chain for fish is more or less similar to those of other agricultural commodities. Products are sold into the market to wholesalers and then onto retailers and end consumers through agents working on commission basis. Farmed fish tend to be marketed either at the farm gate, through middle men or during open auction where ice-packed fish sent to fish markets after harvest were sold. Buyers can be members of the public, retailers, wholesalers, agents for processing plants or exporters. Fish markets are very common in Sindh, at selected locations in Punjab; all markets are under the control of the local administrations.

Most fish markets have inadequate facilities, usually they lack cold storage facilities, have poor hygienic conditions and inadequate communication links, etc. Most aquaculture product is consumed locally with only a small portion being exported.

Rohu (*Labeo rohita*) has a substantial local market; good market size is usually 2 kg+ up to a maximum of 3 kg. Prices tend to decline when the fish is more than 3 kg in weight; other factors include freshness of the fish and the supply/demand situation in the market. Best prices are achieved during the winter months. Carp price ranges from US$ 1.5 - 2.0 per kg in local markets.

Local consumers generally prefer freshwater fish over marine fish because of their familiarity with river and inland farmed fish as well as the fresh condition of the product. This difference is reflected in both wholesale and retail prices where freshwater fish sell at a higher price than marine fish.

Contribution to the economy

The contribution of the fisheries sector to the country's export earnings is quite substantial. In 2003 - 2004, total fish production both from marine and inland fisheries was 564 105 tonnes out of which 400 702 tonnes were contributed from marine sector and 163 393 tonnes from inland waters. Among the inland production about 70 000 tonnes of fish was contributed from aquaculture.

During 2003 - 2004, 104 937 tonnes of fish and fishery products valued at US$ 156 254 millions were exported from Pakistan. No data is available for the production and export of aquaculture only product but fish produced from aquaculture are exported to Middle Eastern countries where a substantial number of Indian, Pakistani and Bangladeshi workers are based.

The biodiversity of natural water bodies and coastal areas has been seriously affected as a result of overfishing, pollution and environmental degradation. There is a need therefore to develop the aquaculture sector in a sustainable and responsible manner. Although fisheries play a modest role in the national economy of Pakistan, the main objectives for aquaculture development have been based around food security, improvement of farm incomes from marginal lands not suitable for agriculture, poverty alleviation, increased export earnings and employment generation especially as a means to absorb excess rural labour. Aquaculture is also seen as a means of filling the gap between supply and demand for fish products that cannot be met by the fisheries sector which is either stagnant or in decline.

Inland fish production is mostly consumed locally and during the next decade the same trend is expected to continue, the inland population of the country is expected to consume any increased fish production achieved through aquaculture. However, any production as a result of the coastal aquaculture of high value shrimp and finfish species would be expected to contribute towards the export earnings of the country.

Promotion and management of the sector

The institutional framework

In Pakistan, aquaculture is a provincial responsibility, the Provincial Departments of Fisheries (DOF) in Punjab, NWFP and Sindh are working actively towards the conservation and management of inland waters and the development of aquaculture in their respective provinces. In Balochistan, the DOF is involved mainly in marine fisheries but also has a component responsible for inland fisheries. The fisheries departments in the FATA, NA and AJK are relatively small and mainly aimed at the management of the trout fisheries.

At the central level, fisheries is overseen by the office of the Fisheries Development Commissioner (FDC) working under the Ministry of Food, Agriculture and Livestock (MINFAL). The office of the FDC is responsible for policy making, planning and coordination with the provincial fisheries departments as well as other national and international agencies. The Marine Fisheries Department (MFD) Karachi, an attached department of MINFAL, is responsible for the implementation of Deep Sea Fishing Policy and the regulation of exports of fish and fishery products.

The Water and Power Development Authority (WAPDA) working under the Ministry of Water and Power also has a fisheries department responsible for the regulation and auction of fisheries rights in the large reservoirs found in Pakistan. There is a fisheries research unit at the National Agricultural Research Center (NARC) of PARC, the country's biggest research organisations established under the MINFAL. Some universities in the country are also involved in basic fisheries research.

Freshwater carp farming which is by far the mainstay of aquaculture activity in the country is practiced widely in the two provinces of Punjab and Sindh and to a lesser extent in the province of NWFP. In Punjab, 74 fish hatcheries are operated by the private sector while 14 hatcheries and nurseries are operated by the public sector. There are 5 hatcheries in Sindh, located at Chilya (Thatta), Mirpur Sacro and Sukkar. In Balochistan, there are only a couple of hatcheries; 8 warm water fish hatcheries and about 30 trout farm cum hatcheries are operating in the NWFP. The DOFs provide technical guidance, juveniles at subsidised rates to farmers as well as other extension services which have resulted in the establishment of a number of trout hatcheries/farms under private ownership. The government has also successfully transferred the technology gained by the Provincial Fisheries Departments to the private sector and as a result the number of farms is increasing.

Efforts toward the establishment of shrimp farming in Pakistan begun in the early 1980s when the Government of Sindh began the establishment of a pilot scale farming at Garho in Mirpur Sakro District. At the same time the Sindh government allocated 17 000 acres of land in the area to about 80 prospective shrimp farmers. However, because there was no local production of seed in Pakistan, all those involved had to import seed from Sri Lanka and Malaysia resulting to high mortalities experienced. Due to the lack of expertise, none of the pilot farms managed to continue in operation and all shrimp farming activities ceased by 1990.

The government, however, took note of the potential importance of shrimp farming and again initiated efforts to establish a shrimp hatchery complex at Hawks Bay which started operation in 2001. Successful rearing of post-larvae was achieved at this hatchery in 2002. A privately run enterprise has successfully cultured the seed from this hatchery and subsequently produced about 3.0 tonnes of shrimp that were later exported. The government of Sindh and the National Institute of Oceanography have since taken over operation of the hatcheries established at Hawks Bay and another at Clifton near Karachi and very recently seed has been produced which is now being reared at the Sindh government's facilities located in the Garho area. With the success in seed production using indigenous species, it is expected that commercial scale shrimp farming will

begin in the near future.

The national government has also taken a number of additional steps aimed at supporting the development of commercial scale shrimp farming in Pakistan. In this context, the MFD conducted a survey of the coastal areas of Makran and identified potential areas where shrimp farming could be established. The Government of Sindh has also proposed potential areas for the development of shrimp farming.

The governing regulations

West Pakistan fisheries ordinances and supporting legislation and regulation promulgated by the provincial DOFs provide rules and regulations for the marketing, handling, transportation, processing and storage of fish and shrimp for commercial purposes and the sale of fish used for domestic and inter-provincial trade. Contravention of this ordinance is punishable by imprisonment of up to six months or fines of up 10 000 rupees or both. A provision has also been made for a total ban on the use of destructive fishing gears as well as a closed season for the catching of shrimp during June and July.

The MINFAL has formulated policies from time to time according to prevailing requirements. It has granted concessions and incentives pertaining to credit and financing facilities, import and export policies and the provision of fishing gears and equipment such as navigational and electronic fishing aids. However, the emphasis of the government has been on the qualitative aspects of fishing development.

Applied research, education and training

The Punjab DOF has a Fisheries Research and Training Institute located at Manawan in Lahore, which offers training programmes in warmwater fish farming for private sector fish farmers, in-service personnel of DOF and staff from other provinces. The NWFP DOF also has a training institute at Sherabad in Peshawar, while the Sindh DOF has a training institute at Thatta. The NWFP DOF also has a pilot commercial trout farming and training center located in Madyan in Swat. This facility is the largest commercial trout production unit in the country and is also used as a demonstration and training facility.

The various departments provide training to the participants both from within Pakistan and from neighbouring Afghanistan. The PARC has established the Aquaculture and Fisheries Research Institute (AFRI) which conducts production technology-oriented research in aquaculture and reservoir fisheries. The center has also established a trout breeding and production unit near Gilgit in the NA of Pakistan.

Several universities engaged in academic aquaculture research include the Bahuddin Zakariya University at Multan, the Agriculture University at Faisalabad, the Sindh University at Jamshoro and Karachi University.

Trends, issues and development

Pakistan's economic recovery has gained further momentum during the fiscal year 2004 - 2005 when its GDP grew by 8.4 percent with the economy expanding at its fastest rate in two decades. The exceptionally strong growth was due underpinned by factors such as macro-economic policies, a growing domestic demand, renewed confidence from the private sector, fiscal discipline and competitive exchange rates.

The aquaculture sector has received a substantial amount of government investment over the past decade and facilities are now in place that can provide the basis for a major expansion of aquaculture production.

Aquaculture development programmes funded by ADB have supported the development of the aquaculture infrastructure in Pakistan with a particular impact in Punjab where mass production of eggs and juvenile fish provided the basis for major expansion. The total production of fish seed by Punjab FOD was 74.5 million during 2003 - 2004.

Despite several attempts by both the private and public sectors, aquaculture in the coastal areas of Pakistan has not yet been successful despite good potential. In almost all maritime countries, marine aquaculture has proliferated and became a major source of raw material for the export of seafood commodities. In the absence of a major aquaculture sector in Pakistan it has not been possible to compete with nations which have this alternative and dependable source of raw material for export.

No commercial fish feeds are currently being produced in Pakistan, however, some experimental feeds have been prepared and utilised very effectively. Small pelagics caught as a by-catch from shrimp trawlers as well as fish offal are used for the production of fish meal on an industrial scale. About 189 134 tonnes of small pelagic were landed, yielding 42 230 tonnes of fish meal according to the latest reports. Some progressive fish farmers are using fish meal and or trash fish in aquaculture operations but it is not a common practice.

Aquaculture began in Pakistan as a small-scale side line of crop farmers, however, with the emergence of fish hatcheries operated by the public sector, there is a movement towards larger fish farms particularly with the entry of business men into this sector. This effect, however, is area specific and confined to areas close to big cities such as Lahore and Multan as well as in Sindh where people have large land holdings, the management of large water bodies and the construction of large farms are now common here.

In Pakistan, the participation of women in fisheries is common among the fishing communities but among fish farmers women usually do not participate in the business when it is an independent company. However, women are engaged in aquaculture activities when it is part of a family enterprise and help is required in feeding, planting grasses in the ponds and guarding the ponds when the farm is close to the house.

References

Bibliography

FAO publications related to aquaculture for Pakistan.

FAO . 2005 . Aquaculture production, 2004. Year book of Fishery Statistics - Vol.96/2. Food and Agriculture organization of the United Nations, Rome, Italy.

Akhtar, N.2001 . Strategic Planning for inland fisheries and aquaculture sector in Pakistan. In proceeding of National Seminar on strategic planning for Fisheries and Aquaculture to face the challenges of new Millennium. May 28, 2001 Karachi.

Melba, R.2005 . Coastal Areas of Sindh- Assistance for Project Formulation. Unpublished report.

FAO.2003 . Investment potential on inland fisheries and freshwater aquaculture project (UTF/PAK/ 092). Report No. 03/063 CP-PAK.

Government of Pakistan. 2005 . Overview: Medium Term Development Framework 2005-10.

Sultana, G.2004 . Strengthening of fish handling, processing and quality assurance. FAO, TCP/PAK/ 2904-A.

Yaqoob, M.1994 .The aquaculture of freshwater prawns, Macrobrachium malcolmsonii (Milne Edwards), at farmers' level in Pakistan. Aquaculture and fisheries management 25, 355-361.

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