

INLAND CULTURE FISHERIES IN VILLAGE TANKS AND PONDS: A MULTI-LOCATION STUDY IN INDIA

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ABSTRACT

The inland culture fishery sector in India has seen quantum growth over the last few decades from 0.67 MT in 1970-71 to 3.2 MT in 2002-2003 and is expected to further grow at a rate of 6% per annum. This is facilitated by the shift in focus from capture fisheries in open water bodies like rivers and lakes to intensive freshwater aquaculture in village water bodies (VWB) across the country. Aquaculture in Village water bodies (VWB) in India, in general, utilizes poly carp culture and is practised with the utilisation of low to moderate levels of inputs, especially organic-based fertilisers and feed. The main problems faced by fish farmers are poaching, water availability and credit. Even then, there has been a marked shift in the intensity of fisheries in some states. This change is charged by the entrepreneurial acumen of individuals who with the help of innovative management practices shaped the way fishing is practiced in the multi use and multi ownership VWB across India. The need for higher investments and the need for building relations to establish ones fishing right have led to the entry of the economically and politically influential people in this profession, who see this as an opportunity for economic gains. But this strengthening of fishing rights of few fishing contractors and increase in production have come at a cost of the traditional fishing communities who have been relegated to providing labour for these fish contractors. The government in many states have formed fisherman co-operatives and given priority rights for fishing in the VWB. But the functioning of these co-operatives have been found wanting. The study tries to map the changing institutional structure of the aquaculture sector in India.

Key Words: culture fishery, aquaculture, fishing community, leasing policy,

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1. INTRODUCTION

The total fish production in the country has grown nearly six-fold over the last three decades, from 0.76 MT in 1950-51 to 6.1 MT in 2002-2003. The share of fisheries in total agricultural GDP has increased impressively during the last five years, from 0.84% in 1950-51 to 4.19% in 1999-2000 (Anjani Kumar, 2003). In recent years, bulk of this production is being met by the rapid growth in inland fish production. Experts have predicted that marine fish production, which had driven growth in the sector for the initial decades after independence would show marginal growth in the coming years and would reach a plateau around 3.5 MT by 2010. More than 50% of the production in the fishery sector comes from the inland fishery sector, which has grown nearly fivefold from 0.67 MT in 1970-71 to 3.2 MT in 2002-2003 and is expected to further grow at a rate of 6% per annum.

The inland fisheries resources of India include a length of 0.17 million kilometers rivers and canals, 2.05 million ha of reservoir area, 2.86 million ha area of ponds and tanks and 0.8 million ha of beels, oxbow lakes and derelict water. Two decades back most of the inland fish production was obtained in the capture fishing mode, concentrated along rivers, reservoirs and lakes. Traditional fishing communities engaged in capture fishery. But, the fish production from natural waters like rivers, lakes, canals, etc., followed a declining trend, primarily due to proliferation of water control structures, indiscriminate fishing and habitat degradation (Katiha 2000). Over the years, there has been a shift in focus from capture fisheries in open water bodies like rivers and lakes to intensive freshwater aquaculture in village water bodies (VWB) across the country. Aquaculture in VWB in India, in general, is practiced with low to moderate levels of inputs, especially organic-based fertilisers and feed. The most prevalent technology is three carp culture. Carp culture is based around the 'polyculture' of the three Indian major carps (catla, rohu and mrigal) as well as 'composite carp culture' of the three Indian major carps with the three exotic carps (silver, grass and common carp).

India utilizes only about 40% of the available 2.86 million hectares of ponds and tanks for freshwater aquaculture and 13% of a total potential brackish water resource of 1.2 million hectares. The technologies and management practices involved in carp culture have raised the average Indian production from still-water village ponds and tanks from 600 kg/ha/year in 1970s to over 2 200 kg/ha/year by 1999-2000. There is potential for further increase in production to 5000 kg/ha/year in the coming years. Only 20% of the overall potential has been utilized in freshwater aquaculture, thus having potential for both vertical and horizontal expansion in the coming years (Krishnan, 1998).

Aquaculture contributed over one third of the country's total fish production of 6.1 million MT in 2003. The total aquaculture production of 2.2 million MT was valued at US\$ 2.5 billion of which carp alone was responsible for as much as 1.87 million MT. Aquaculture production is expected to grow at a rate of 9.6% per annum and contribute nearly two thirds of the country's total production of 8 million MT by 2020 (FAO Fish 2020 Report, See Table 1 in annex). With the consumption of fish rising steadily, the rising demand for fish can be met only if the growth in aquaculture occurring in the VWB is sustained.

Since inland fishery is a state subject, the states decide on the policies regarding utilization of the resources. The state governments prepare policies keeping in mind the livelihoods of the rural poor. The state governments prefer handing over the fishing resources to co-operatives of the local communities. Leasing policy is the main instrument in the hands of the government to effect any change in the sector. Most of the initial funding for propagating culture fishery in inland water bodies came from the Fish Farmer's Development Agency (FFDA) program of the central government with an initial World Bank Assistance. It provides technical, financial and extension support to fish farmers for taking up culture fishery in village ponds and tanks. The network of 422 FFDA's has brought about 0.456 million ha of water under modern fish culture operations benefiting approximately 830 000 people.

This freshwater aquaculture sector is poised for a quantum jump in the next few decades, if the FAO Fish 2020 projections are to be believed. This has implications for improving the productivity of the village water resources and further improving the livelihood opportunities and food security of the poor. With the change in the property regimes from open access to common property resource to partially private ownership and intensification of fishery practices, it is pertinent to study the institutional changes occurring in the sector. It is essential to know the people being left out and the people benefiting as a change in property regimes occur in the sector. This will throw light on the policies necessary to make the process of growth more equitable and sustainable in the long run.

2. RESEARCH METHODOLOGY

The study of Inland Culture Fishery in India was one of the themes conducted under the Multi Location research plan of the IWMI-TATA programme in 2005. The study instruments were designed and tested centrally in Gujarat. Identical instruments of data collection and selecting sample households was done in other sites. Data collection in the other sites was done by the partners collaborating with the ITP in each site.

Table 2 in Annex shows the site locations and the sample size. The unit of study was a pond. In all, the study was done in 11 sites in the country representing different agro-climatic zones of India. Table 2 shows the locations and the agro climatic zones to which it belongs to. The total sample size was 360 respondents in 201 villages across 18 districts. The sample size varied from 60 in J&K to 17 in Haryana depending upon the convenience of the site custodians, as many of them used it as an opportunity to gain more knowledge about the subject. The size of the ponds as sample was to be kept less than 50 hec. The ponds chosen were specifically used for fishing for more than two years. The average size of the surveyed ponds varies from 0.25 hec in Jharkhand to 14.88 hec in AP.

Survey was done using a structured questionnaire which was pre-tested in Gujarat before being used by the respective site custodians in their individual locations. The questionnaire was divided into sections pertaining to socio-economic profile of fish farmers, problems faced by fish farmers, physical characteristics and economy of fishing

ponds, existing property regimes, source of inputs, management of ponds and fishing as a part of village economy. The data was entered in data sheets using commonly agreed codes. The paper is based on the simple analysis of the coded data across sites. The site custodians assembled for a post research discussion workshop in January 2006. Discussions of this workshop are used as qualitative inputs for the study.

3. QUALITATIVE OBSERVATIONS FROM DIFFERENT SITES

3.1 Gujarat – Anand, Kheda, Bharuch, Surat:

Gujarat has traditionally been a vegetarian state. Though it is ranked second in marine fish production, inland water resources came under culture fishery in the eighties due to the efforts of the FFDA. Initially there was stiff resistance to any sort of intensification of fishery in the ponds. But as the business has become lucrative over the years due to increase in demand for fish from nearby cities, smart entrepreneurs have devised ways to tackle problems like poaching and resistance from villagers. The village ponds in south and central Gujarat which were traditionally used for livestock and domestic use were slowly brought under culture fishery over the last few decades. The pond size varies from 0.5 hec to 15hec, and water is available till the end of March. Most of these ponds are canal fed. This gives 6 months for the fish farmer to harvest his catch when fingerlings are used as seed. As the intensity has increased over the years the lease amounts have risen proportionately well above the upset price. Many of the fish contractors belong to the lower caste and use it as a livelihood option to diversify their income. Over the last 20 years the leasing policy has changed number of times and has moved away from being protective to being more competitive. This has also given rise to high lease rates. These lease amounts in some cases provide for more than 90% of the total budget of the concerned village panchayats. Also this has attracted smart entrepreneurs who have developed an image of a *Good Samaritan* or a *village toughie* in order to establish their fishing rights and reduce poaching. Before 2003, the leasing policy gave preferences to co-operatives and people falling in below the poverty line (BPL) category. The traditional fishing community of *Kahars* who had formed their own co-operatives to bid for fishing rights is now reduced to provide labour for the rich fishing contractors or marketing of fish in cities.

3.2 Haryana – Hissar:

Most of the water bodies are dug up common village ponds and canal fed. The main use of these ponds was for livestock and domestic use. But slowly over the last few years these ponds have come under culture fishery. Initially there was strong opposition from the Vishnoi community to fishing in these ponds. But slowly this opposition is fading. The consumption of fish in the region is increasing, and also there is an increasing demand for fresh fish from nearby cities and Delhi. This demand has led to sudden rise in the number of persons bidding for these ponds in the area, which is seen in the dramatic rise in the lease amounts. The lease amounts in some cases have risen to 2 lakh per hec. The panchayats take care of these ponds and are responsible for leasing out the ponds through open bidding process. The panchayat also takes care of the maintenance of the pond and maintaining minimum water level so that fishing can be done. The canal water

is reliable. This is the reason why panchayat ponds are preferred over the private ponds. FFDA are only concerned with their targets of training 100 fishermen and bringing 100 ponds under fishery in a year.

There are numerous complaints of nepotism and collusion between the fishing contractors and authorities during the leasing procedure undertaken by the panchayats. Some bidders jack up bid prices to defeat others. A good return after taking the pond at a higher lease price is difficult. Arthia (money-lenders) give money for investing in these ponds. They are found to be influencing the leasing procedure in a big way. Jats who are the influential persons in the village and who are able to build good social contacts within the village and the sarpanch, usually lease in the ponds for fishing. Many enterprising persons from Valmiks and chamar community are also entering the profession. It has been found that the persons taking the lease are young and have less experience in the fishing business. They also have strong political connections and use them effectively to lease in the ponds for fishing. Many retired defence personnel are also entering the business. The harvesting and netting is done by the migrant Bihari fisherman. Guarding of the ponds is usually entrusted with the local villagers.

3.3 Kashmir – Baramulla , Kupwara, Shrinagar:

Culture fishery has taken off in Kashmir in the last decade. It was traditionally practiced in the lakes and village common water bodies also called *Sars*. Water is available in these common village water bodies throughout the summer season and the chief source of water is the snow in winter. The FFDA stocks fish in these ponds. Government has the role in development of fisheries in Kashmir whereas Panchayat has no role in culture fisheries development. Fisheries departments provide information to the interested persons. They put advertisements in local papers as the notice of lease declaration. The lease fee is usually Rs 1200/- per hect for a 50-60 ha size of a community pond. The lease right is for one year. It also issues licenses to fisherman to fish in the lakes and leases out the fishing rights in the village water bodies to the highest bidder. A number of private ponds being set up which culture Trout fish. These are usually set up by rich influential people of higher caste, who have access to credit and market contacts which is required to set up the fish farms. The people from the higher rung of society are taking to fishing as it has become a lucrative profession. Hajis are the traditional fishing community in Kashmir. They belong to the lower rung of society. They are relegated to offer their services as labour for fishing for the persons who take lease of these ponds and private fish farms. Kashmir is famous for Trout fishing and the government and FFDA are trying to encourage the culture fishing of Trout. The government has also set up a scheme under which 1600 private ponds owners will be given a package of Rs 1.20 lac per owner from the Prime Minister's Fish Farmers' Scheme. Community ponds are not well managed; their productivity is decreasing while those of private fish farms are very high.

3.4 Bihar – East Champaharan:

The demand for inland fish is high, but the production has not been able to meet the increasing demand. Fish has to be imported all the way from AP. There are 1217 government ponds and tanks in East Champaharan district. The FFDA plays an important part in leasing out the water bodies. There is open bidding for lease, but those are on only

paper. Minimum set price is very high for big ponds so traditional fish farmers can not bid individually for it. Big water bodies are leased to co-op societies. FFDA develops the ponds and then give on lease with co-op, which are of Mullahs (fish farmer) families. The investment is to be returned within 10 years.

The size of the village water bodies vary from 1.0 to 100 ha and many of them are perennial. They follow the practice of 3-carp culture. Intensive practice of fishing is found in private ponds, however, the size of the pond being small they can not produce in large quantity. The demand-supply gap is solved by importing fish from Andhra Pradesh. Government has kept a target of 13500 mt of production. Now Champaharan is growing 10000 mt fish per year and the production trend is going upward.

East Champaharan district has the highest concentration of Mullahs. They are a marginalised community and due to their dismal conditions they form the cadres for radical outfits. In practice the fish farmers' co-op societies of SC and Mullahs are handed over to upper cast group. They manage the big ponds. The entire trade is on the market-oriented design.

There are government tanks and lakes are given on three types of settlements: (1) short term settlement, which is for a 3 years – (2) long term for 10 years (3) for 100 acres beels with World bank and FFDA is settled for 5 years. FFDA also have some schemes for welfare for the fish farmers' families like construction of houses etc.

3.5 Kerala – Trichur, Palakkad:

In Kerala, the consumption of marine fish is higher than that of inland fish. People call inland fish as 'non-vegetarian' fish as they take poultry feeds. There are numerous village ponds in Pallakad and Trichur, but the practice of carp culture in these ponds has not still caught up. But there is immense potential for further growth which needs to be tapped. Many minor reservoirs are stocked with fish by the irrigation department and they issue licenses to local fishermen to fish in them. Culture of scampi (large prawns) for the export market is picking up in a large way. These scampi cost anything between Rs 300-350 per kg and is a extremely remunerative technology. The fish seeds of scampi are grown in the Trichur district, near the coast in brackish water and transferred to Palakkad district where they are cultured in village ponds. The panchayat doesn't take any interest in fishing in these village ponds and there is no written leasing policy in place. Paddy cum fish culture is being propagated by the fishery department as a viable technology in the coastal areas.

3.6 Assam – Barpeta:

In Assam 95 % people consume fish. Demand far exceeds supply. The ponds are of small size from 0.1 to 0.2 ha in general. Ninety percent of these small ponds are privately owned and situated near homestead. People like small fishes in Assam. These are easily produced in small ponds – without much of intensive fishing practice. These ponds are clustered in rows along the two sides of roads and some times in circles in the village.

Recently production of these ponds has increased due to introduction of new mixed carp culture practice, whereas the production per hectare has reduced in beels. The small ponds were not used for commercial production earlier, however now they are trying to do commercial production to increase their income. They now have marketing association. Through the association they can send their product to the distance market like Guwahati, which is 150 kms away. Big farmers who have large ponds of 7 ha size are also coming in to the commercial production. Now many private ponds are given on lease. The lease is conducted by Simanta Sankardev Satra of Barpeta, an organization of Vaishnav. Only village people are given the ponds on lease. They do not give to people from outside. Satra use this lease money for Puja and other cultural festivals.

Muslims immigrants from Bangladesh are taking up the fishing activities. They have organized an Association as an Apex to market fish of their members – mentioned above. They are not from traditional fish farmers. These people do the culture fishery in ponds, which are generally rain fed. FFDA have no hold on them, however conducts the training to the fish farmers.

These Muslims came from Bangladesh and have very small of land, which was not giving sufficient amount of income to run their family. Hence they started learning fishery and converted paddy land in to fishpond to earn more. They do not think fishing as a lowly activity and have taken fishery as a business. They follow intensive cultivation of fishery and earn Rs 1.5 lac per ha of pond.

3.7 Orissa – Angul, Dhenkanal:

The people of Orissa also consume fish. About 80% of them consume fish, and fishery is one of the most important rural livelihoods. Culture fisheries take place in panchayat, private and community ponds. Ponds are mainly rain fed. There are also some reservoirs. All these water bodies are used for multiple purposes but social and domestic use has the first priority, second is for livestock, third is for crisis irrigation and the last is for fisheries. The fish farmers follow three-carp and exotic and prawn mixed polyculture. Rules and regulations change according to ownership. There are 90,000 ponds but no rules have been set up so far. There are several types of institutional arrangements (1) Personal ponds, (2) Individuals taking other ponds on lease, (3) Panchayat ponds, (4) Village ponds leased out to individuals sharing the profit, (5) Panchayat ponds given to individual, (6) SHG taking village or individual ponds or Village ponds sharing with SHG, (7) the reservoir given to Co-op, (8) Reservoir given to private contractors. Operators in categories (1) and (2) do the intensive cultivation and harvesting, 3 to 4 times in a year and in categories (3) and (4) do the non-intensive or semi-intensive culture.

Orissa's inland culture fishery has a complex system. The total production is not much, as the size of the ponds is small usually between 0.2 to 0.4 ha. The fish farmers generally sell the produce at the local markets. The Keuta caste is the traditional fishermen community in Orissa. Poisoning and poaching are two big problems. Substantial amounts of money are spent on watch and ward to solve these problems. Recently higher class people are coming in this trade, the stigma of fishing being a lowly trade is gradually

fading. Fisheries are acquiring the character of an economic enterprise run by the people who have better political connection. Keuta people are now being marginalised from their trade and are doing netting and other related labour work. They weave and sell fishing net etc.

An approval is required from Fisheries department for getting bank loan and receiving subsidies. Fisheries officials provide technical know-how to the fish farmers. No formal leasing policy exists in Orissa. Panchayat ponds have some kind of leasing policy, say Rs 700 to to Rs 1000 as the minimum and maximum upset price per acre for a duration of 2-3 years, which is to be approved by the sub-collector. If leasing is for more than 5 years it is to approved by the District Collector. Women SHGs are taking lease of the Panchayat ponds and Keuta men folk do the labour and receive 5% of the total catch each day as the sole compensation. Department of Fisheries gives subsidies for digging ponds. There is an unwritten understanding that the village pond will not be given on lease to any outsider from the village. Return is very low from these ponds.

3.8 West Bengal – North 24 Parganas:

West Bengal is traditionally a ‘non-vegetarian’ state, 95% people consume fish. As such, there is a very good market. The demand-supply gap is mitigated by importing fish from AP. Small fish from carp and wild fish are have more in demand. Government is taking interest in developing fisheries for the last 20 years. Small village ponds having less than 1 ha size are the largest in number. Up to 12 ponds may be seen in a village. Water is available through out the year in all these private small ponds. People are now changing over to culture fisheries. Of late these private ponds are being given to contractors on lease as the owners are unable to continue this trade. Another trend of converting yielding paddy fields into fish ponds is also discernible. It is locally called “Bhery”. Here they generally cultivate prawns. Big contractors from Kolkata buy them. Ox-bow lakes and beels are managed by co-operatives. There are some ponds in the land belonging to the railways, which are situated along the side of railway lines and are managed by informal associations (not co-operatives). Central Marine and Inland Fisheries Research Institute (CMIFRI) at Barrackpore is engaged in research in seed production. The Extension Officers of State Fisheries department help for securing finance and other loans transactions for fisher men. FFDA and Brackish Water Fisheries Development Authority (BFDA) are two government institutions extending their services for training to fisher folks and encouraging Co-operatives and Private contractors for taking more ponds and Bheries for fisheries.

Of late, higher caste people are entering in this trade. Many city people have invested in bhery for getting high profit, taking a high risk too. Fisher men are benefiting from co-operatives and not facing many problems. In Bengal there are not many common ponds. Hence there is no formal leasing policy. A formal leasing policy exists for regulating government ponds, and it prescribes some rules for upset price. The private ponds are leased out through negotiations at personal level. Many bheries have turned into co-op bhery. Politically powerful and rich people are entering in to the fish trade. In some places such as Midnapore, paddy and fish culture is practiced.

3.9 UP – Barabanki:

In UP, we find capture fishery in rivers and culture fishery in common property multi use village ponds. The trend of culture fisheries in village ponds has been growing in the last few years as more and more people are taking to it as a livelihood option, though the intensity of production is low. Fisheries in rivers are preferentially allocated to the co-operatives of the traditional fishing community of kahars. But over time these co-operatives have converted into “one man co-operatives” run by an individual who is usually a powerful politician from the area. Also with the rivers getting polluted and more dams built across them the catch from the rivers is decreasing.

There are village common ponds, of average size of 2 hec, which are leased out by the panchayats with the help from the FFDA. In the leasing policy, first preference is given to the individual from the fishing community, followed by individual from SC in the village followed by anyone who bids the highest for these ponds. Marketing of fish is not a problem. Netting is done once in a year and they do not follow intensive culture of fishing. The three carp culture is the prominent technology and the usual size of fish is around 0.5-1 kg. The fish seeds come from West Bengal. Some fish farmers are trying to produce seeds in the area. FFDA’s seed hatcheries are not working. The major problem is the quality of seed. The big size fish are sold mostly to West Bengal. Poaching and poisoning are the two main problems cited by fish farmers.

3.10 Jharkhand – Dumka:

Culture fishery is a recent phenomenon in Jharkhand. The consumption of fish is high but the production is low, so most of the fish is imported from West Bengal and AP. The fishing ponds are backyard ponds and have an average size of 0.25 hec. Though the region receives heavy rainfall in monsoon the ponds dry up in summer. Water level which is up to 12 ft in monsoon reaches 2 ft in summer, making year long fishing difficult. The ponds were used mostly for domestic and livestock uses and in rare cases to provide supplementary irrigation to the kharif crop. There are also some community tanks in the region which are leased out to private individuals for fishing. The three carp culture is the prominent technology but is semi-intensive in nature. Fishing provides livelihood opportunities for the fishing community from October to March. These communities travel from pond to pond and make themselves available as labour for fishing activities. People from outside the village also take ponds on lease, in which case the produce is shared on a 50-50 basis. On an average a typical fish farmer earns Rs 20,000 per annum. FFDA has been trying to bring more and more ponds under culture fishery. Seeds come all the way from West Bengal. Market is not a problem for the fish harvested.

3.11 AP – Prakasam:

Prakasam is a coastal district of AP. This part of the country is battered by cyclones every year. There is a presence of minor irrigation tanks and village ponds. The average size of the ponds is 4 hec, while minor irrigation tanks are larger than 100 hec. Tanks are

generally leased out to co-operatives. But some tanks have been leased out to a MLA and ex-MLA of the region. After securing the lease, the co-operatives sub-contract these tanks benami to a private fishing contractor. This contractor brings the much needed credit, thus shares a part of the risk. Many of the co-operatives have become defunct. The smaller size ponds are canal fed. Carp culture is the prominent technology, but over the last few years freshwater prawn culture is picking up as it is more lucrative. The traditional rights of fishing belonged to the Mudiraj community. But over the years, the influential and risk taking Reddy community have captured the ownership of the ponds. The Mudiraj community has been relegated to working in these ponds on daily wages. There is an increasing trend towards enterprising SC and ST's taking it up as a livelihood option. There is an increasing trend towards use of groundwater to maintain the level of water in the ponds. Large size fish is sent all the way to Kolkata where it fetches a better price than the local market.

From qualitative discussions we find some patterns developing across regions.

Fig 1: Varying patterns of culture fishery across regions matrix

	Tradition of Inland Fishery	No Tradition of Inland Fishery
High Production	Zone 1	Zone 3
Low Production	Zone 2	Zone 4

Table 3 in Annex gives the varying patterns of culture fishery across regions. In terms of inland culture fishery, India could be divided into four zones:

Zone 1- This zone has areas which have a tradition of inland fishery and have shown high production. The Eastern states of Assam, West Bengal, Orissa and the coastal areas of the country fall under this category. Most of the ponds are perennial and rain fed having size smaller than 1 hec. Almost each household has a pond which is privately owned and which also provides water for domestic purposes. In the deltaic regions, oxbow lakes are used for fishing by the co-operatives of the fishing communities residing nearby. Production is mostly for own consumption and for local markets as the demand for fish is very high, with 95% of the population consuming fish.

Zone 2- This zone has areas which have a tradition of inland fishery and show low production. The states of Bihar, Maharashtra, Karnataka, Tamil Nadu and Jharkhand fall under this category. The pond size is large ranging from 10 hec to over 100 hec. These water bodies are both perennial and seasonal and mostly cater to irrigation for rabi crop. Pond bed agriculture is also practiced during the lean season. The people living close to the water bodies or traditional fishing communities utilize it for fishing. In most cases the hands over the fishing rights for these water bodies to the co-operatives of local

fisherman while the stocking of the pond is done by the government. The production from these tanks is less than 1 t/hect.

Zone 3- This zone has areas which do not have any traditional inland fishery and show high production. The states of Haryana and Gujarat fall under this category. The water bodies are common property multi use village ponds or dug up ponds which were mainly used for domestic and livestock use. The average size is around 4 hectares and is canal fed. The consumption of fish is low in these areas and there is opposition from villagers to fishing in these ponds. These ponds usually cater to the demand of nearby cities and thus follow intensive fishing practices to supply fish throughout the year. The average production from these ponds is around 3.5 t/hect.

Zone 4- This zone has areas which did not have any traditional inland fishery and show low production. The states of M.P, Rajasthan, J&K, U.P and Kerala fall under this category. The water bodies in this zone are multi use village ponds size ranging from 1 hectare to 10 hectares. These ponds were traditionally used for livestock and domestic purposes and are seasonal in nature drying up in the lean season. Consumption of fish is low in these areas. The intensity of fishing is low with production of 1.5 t/hect. The production is mostly for local markets and self consumption and restricted to leasing out ponds to individuals by village panchayats or fishery departments. There is opposition to culture fishery in the water bodies by local communities which act as a hindrance to bring more and more ponds under culture fishery.

4. PHYSICAL FEATURES OF THE PONDS

(See Table 4 in Annex) The ponds in the Eastern states Orissa, West Bengal, Assam, Bihar and Jharkhand are rain fed while ponds in other regions like J&K, Kerala, AP, Haryana and Gujarat are connected to canals. The smaller size ponds (less than 1 hect) in all the regions are seasonal in nature having water in it up to the end of March and drying up in summer or having level of water so low that fishing cannot be continued. The large ponds don't dry out completely in summer, but the overall decrease in area is more than 50% of the maximum water spread area. Ponds in the Eastern states show larger decrease (more than 50%) in surface areas as compared to the other regions, due to their smaller size and their rain fed nature. While ponds in other regions are larger and connected to canals hence show lesser decrease (less than 30%) in surface area. This has implications on the fishing period, stocking density and intensity of fishery in the regions.

The original use of the VWB were for the domestic use by village woman, providing livestock water in the lean season and in rare cases providing supplemental irrigation to the kharif crop in a bad rainfall year. But over the years, with most of the ponds seen as a good income source for the village by leasing it out to fisherman, fishing is seen as a main use of these ponds. This trend is visible across all the sites. In Gujarat, the main use of the ponds was for livestock use followed by domestic use and then fishing. Irrigation was the main use in Orissa and Jharkhand, where the ponds are used for irrigating paddy in kharif and then for fishing for the rest of the year.

5. EXISTING PROPERTY REGIMES

(See Table 5 in Annex) Out of the total sample, 41.90% belong to common village ponds whereas the rest 59.10% are private ownership ponds. 71.50% ponds in the sample are leased out ponds. Of the Eastern states, the states of West Bengal, Jharkhand and Assam have majority of private ownership ponds whereas Bihar and Orissa have common property multi use village ponds in a majority. But overall the Eastern states have privately owned ponds. In West Bengal almost 90% of these private homestead ponds are leased out to private individuals for fishing. In Bihar the government leases out the ponds to the co-operatives of local fisherman community, whereas in Orissa the village panchayats and FFDA lease the ponds out mostly to private individuals. Private ownership is common in J&K and Kerala, while multi use village ponds are common in Gujarat and Haryana. AP and UP have mix of both the types. In states where village ponds are leased out the village panchayat leases them out. In Gujarat the FFDA and in Bihar the state fishery department play a leading role in leasing the ponds out. In 82.66% cases, the leased out ponds are given to a private individual or a group of individuals for fishing. Only in the case of Bihar, 82% of the ponds are leased out to co-operatives.

6. ECONOMICS OF CULTURE FISHERY ACROSS REGION

(See Table 6 in Annex) The productivity of ponds is high in the Eastern states of West Bengal, Assam and Orissa having average productivities ranging from 3.54 t/hect to 2.36 t/hect. These states have small ponds, private regimes and water available throughout the year for fishing. But the highest productivity of multi use village ponds is found in Haryana with average production of 4.35 t/hect. States like Gujarat which never had a tradition of Inland fishery have shown significant increase in average productivities of more than 2 t/hect over the last few decades. Intensity of fishing is considered to be high if high productivity is observed along with high stocking density, multiple harvestings, high total cost of production and high cost of manure per hectare. With this criteria, states like West Bengal, Assam and Orissa in the Eastern side and states of Haryana and Gujarat show high intensity of fishing. High fishing intensity is observed in privately owned ponds as compared to co-operative ponds. This is true in the case J&K where the private trout farms are doing better than *Sars*.

The lease cost varies around 27% of total cost in West Bengal and 20% of the total cost in states of Orissa, J&K, Gujarat and Haryana, whereas it is lower than 10% of the total cost in the states of Bihar and Assam. Fish farmers in Bihar, Orissa, Haryana and Gujarat spend higher proportion of their total cost on watch and ward. In case of states like Assam and Wst Bengal fish farmers usually prefer to do their own watch and ward. The average price of fish also varies significantly from state to state depending on the type and size of fish harvested. In J&K, the fish farmers receive high price for trout, whereas in Kerala the fish farmers receive high price by exporting the scampi harvested in their ponds. Among carp fish, the price received for fish in the Eastern states was comparatively higher for the Eastern states, due to the high demand. Big size fish from AP, Haryana and Gujarat are exported to Kolkatta where it receives a very good price.

7. PROBLEMS FACED BY FISH FARMERS

(See Table 7 in Annex) The main problem perceived by fish farmers was poaching. This problem was the main problem in West Bengal, Kerala, UP, Gujarat and Haryana. It was a secondary problem in many other sites like Orissa, Bihar, Jharkhand and J&K. Water availability to maintain a minimum level of water in the ponds for the fish to survive during the lean months was the second main problem. This problem was prevalent not only in the arid areas like Gujarat and Haryana but also in states like Assam and West Bengal. This problem is common where the intensity of fishing is high and fish farmers have more stakes to maintain a minimum level of water for the fish to survive throughout the year. Capital was the third main problem in most of the sites. This was one of the most important hindrances for intensifying culture fishery. Similarly the problem of poisoning of ponds was common in West Bengal, UP, Kerala and Orissa. In Bihar and UP, the recurrent floods was mentioned to be one of the main problems for taking up intensive fishery. The problems like market access, labour, disease to fish and resistance from villagers got the less weightage across all the sites.

Fish farmers tackle poaching in various ways. (See Table 8 in Annex) Most of the fish farmers own fish ponds close to their home, while many stay close to the pond to prevent poaching. This trend is particularly common in Eastern states of Orissa, Jharkhand, Assam, West Bengal and UP. Also in most of these Eastern states, the cost of poaching is minimal because of the high pond density and their small size. The small size of the ponds allows for more control regarding protection from thieves who try to steal the catch. But with large size of the ponds the cost to prevent poaching becomes large and a single person is unable to guard a pond.

In case of large ponds the fish farmers resort to prevent poaching by hiring security for the ponds or by settling a migrant fisherman near the pond. He takes care of the day to day management of the ponds as well as guards it from poachers. As was seen in Gujarat the fish farmer builds a reputation of a being good Samaritan in the village by donating for local festivals and village welfare to build up his reputation. Alternately, he may deliberately build the image of a village toughie who strikes the fear of God in anybody who tries to steal fish from his pond. Bribing the Sarpanch, panchayat members or influential persons from the village with cash and kind is another way to tackle the poaching menace. Such practices are common in states like Haryana, Gujarat, AP, Kerala and Bihar which have low percentage of fish farmers living close to their fish ponds and also the size of the ponds are larger.

As the culture fishery practices intensify, the stakes to maintain a minimum 3 feet depth of water and minimum water spread area for the growth of the fish becomes high. With fast depleting pond, the growth of fish is slow and also the mortality of fish is high. This is the main reason why, fish farmers prefer to culture fish in ponds which do not dry up in the lean season and which do not show significant reductions in water spread area during the lean season. (See Table 9 in Annex) In the Eastern states where the ponds are rain fed, the problem is to control the excess water coming into the pond during monsoon as it can flow away the catch. But in states like Assam, we find some fish farmers pumping

groundwater with the help of pumps to maintain the level of water in the ponds during summer. In states of Gujarat and Haryana, majority of the ponds are connected to a canal network, while similar patterns are found in the states of J&k, AP, Kerala and UP. In the states where culture fishery is found to be intensifying i.e. Gujarat, Haryana, West Bengal and Assam the trend towards achieving some water security in the lean season is a major concern and entrepreneurs are investing capital to tide over this problem.

As aquaculture intensifies, the input costs increase thus making credit availability one of the main constraints. Banks do not lend to fish farmers due to the following reasons:

- ? High risk nature of the fishing business which can wipe out entire investments during natural calamities like floods and droughts or due to poaching
- ? Insecure property rights in case of leased out ponds due to the multi use and multi ownership of ponds. Also lease periods of less than 3 years do not encourage banks to offer loans.
- ? No collateral on basis of which poor fish farmers could obtain loans
- ? Dispersed nature of the economy which leads to high transaction costs for banks to lend to the fish farmers
- ? Cumbersome banking procedures which do not encourage fish farmers to take loans

(See Table 10 in Annex) Thus we find that only 10% of the fish farmers availed of loans from banks for credit. Presence of banks for credit is seen in the states of Orissa, A.P and Kerala. Majority of the fish farmers relied on their own funds and borrowings from friends or relatives for credit. It is evident that in the states of Gujarat, Haryana, West Bengal and Assam, the role of local money lenders and middlemen in provision of credit has increased. In Haryana, the *ardhiyas* who are the local money lenders provide credit for the business and also act as suppliers of fish to big cities. Lack of credit is a main deterrent for poor fisherman to lease out ponds as the lease amounts increase with increasing competition for leasing in productive ponds for fishing.

8. PROFILE OF FISH FARMERS

Table 11 in Annex describes the socio-economic profile of a fish farmer in India. A typical fish farmer has studied less than up to 10th standard, has a family size of 7 members and having experience of 10 years in the profession. His annual income is less than Rs 50 thousand, with more than half of his income coming from fishery. 60 % of the fish farmers own farm land having an average size of 4 hec, indicating that fishery is taken up as option to diversify agricultural income.

In states of Bihar, Jharkhand, UP and J&K the majority of fisherman had no education while in states like AP and Haryana the fisherman were better educated . In states of Gujarat, Haryana and Assam more than 50% of the fish farmers earn annual income of more than Rs. 1 lac. These were also the states where the intensity of fishery has seen tremendous increase over the years. In these states, fish income accounts for over half the total household income of the fish farmer. In Orissa, Jharkhand, J&K and UP more than 70% of the fish farmers earn less than Rs 50 thousand per annum.

Except the states of UP and Gujarat, most of the fish farmers in other states are agriculturists owning their own lands.

9. CHANGING DIMENSIONS IN CULTURE FISHERY IN INDIA

The inferences from the multi-location study can be summed up as:

- ? India can be divided into four zones divided across productivity of water bodies and history of inland fishery in the state.
- ? The ownership of fish ponds is slowly changing hands to rich, influential persons who have access to credit and also the power to protect their fishing rights. With the intensification of culture fishery, the traditional fishing communities are being relegated to providing labour to rich influential owners of fish ponds.
- ? Pond size is smaller and private ownership is common in the eastern states. Non-eastern states have multi use common village ponds where fishing is practiced. These ponds were previously mainly used for livestock and domestic purposes. These ponds are leased out by village panchayats or irrigation department. Larger ponds are leased out to co-operatives and the smaller ones to private individuals.
- ? The intensity of fishing is high in the states of West Bengal, Assam, Gujarat and Haryana. High intensity is due to the application of manure, high stocking density and multiple stocking in the ponds. The productivity is the highest in Haryana.
- ? The main problems faced by Fish Farmers are Poaching, Water availability and Credit.
- ? To tackle poaching fish farmers prefer to own ponds near their house or have ponds close to their home. Some use a combination of security, a carefully built image of a Good Samaritan or a village toughie. The cost of poaching is low in eastern states where the size of ponds is small and the pond density is high, which allows for greater control on poaching.
- ? The use of canal water is prevalent in Non-Eastern states. The use of groundwater to maintain level in ponds is increasing in states where the intensity of fisheries has increased.
- ? Most of the credit for culture fishery is own funds or borrowing from relatives. Banks lending is few and far between. Lending by money lenders is showing a growing trend in states where fishery has intensified.

Till the seventies, inland fishery in India was capture in nature concentrated in open water bodies practiced by traditional fisherman communities. Most of the inland water resources were open access regimes with traditional rights for fishing with these fishing communities. These fisherman communities like the Mallah community in Bihar, Hajis in Kashmir, Mudiraj community in AP, Keuta community in Orissa, Bhoi community in Maharashtra or the Kahar community in UP and Gujarat were the marginalized sections of society.

The growth phenomenon of aquaculture in VWB is a story that is barely a twenty years old. The introduction of poly-carp culture, ever increasing demand for fish and the role of the FFDA to propagate it across the country are the factors that have played a significant part to fuel this growth. In the coming years, the growth is going to multiply both by bringing more water bodies under culture fishery and also intensifying culture

practices in existing fish ponds. The whole country can be divided into our zones based on the type of intensity of fishing and existence of traditional inland fishery. These zones vary across types of ponds, productivity of ponds and the existing property regimes. The growth patterns and issues of concern differ across the zones requiring different policy prescriptions across these zones.

The study showed that the states of West Bengal, Assam, Haryana and Gujarat have moved towards intensive fisheries. There still exist numerous constraints for further growth in this sector. The three main constraints faced by the fish farmers were poaching, water availability and credit. The risks associated with these problems act as an entry barrier. This has prompted the entry of smart breed of entrepreneurs who are able to protect their fishing rights effectively and also bring with them the much needed credit to intensify effort of fishing. Thus the profile of a fisherman has changed considerably with the new entrants coming from all walks of life encouraged by the opportunity of better livelihoods. These entrepreneurs usually were the influential people who were able to build social contacts to counter the opposition from villagers to fish in these ponds and prevent poaching with a strong hand. With the banks unable to provide credit due to the insecure property rights on the fishing ponds, moneylenders and middlemen are taking their place. As in the case of Haryana, they have started influencing the leasing procedure for the ponds.

In order to utilize these resources efficiently and form property rights on these resources the government started handing over these resources to the irrigation department in case of irrigation tanks and village panchayats in case of the village ponds. These institutions further leased out the fishing rights of these water bodies. While leasing out these ponds the institutions were guided by the policies of the state governments. With the introduction of the three carp culture technology, doors were thrown open to intensive fisheries and efficient use of the resources. Numerous constraints like seed, feed, training, markets and labour were taken care by the government by setting up the FFDA which provided technical assistance for growth of fishery. But with the entry of the new breed of entrepreneurs, the fishing community was relegated to providing labour in these fishing ponds.

The need for higher investments and the need for building relations to establish ones fishing right have resulted in a new breed of entrepreneurs who can bring in the required capital and entry of the upper powerful caste, which see this as an opportunity for economic gains. The traditional community has been relegated to that of managing ponds. The government's effort to enhance the capabilities of these fishing communities was in the form of formation of co-operatives and giving them priority in the leasing of these ponds. But most of these co-operatives have become defunct or become one man co-operatives. Many co-operatives have further sub contracted these ponds to fishing contractors who bring in the much needed credit and share the risk of the co-operative. As the new fishing entrepreneurs devise innovative ways to tackle the obstacles for further intensification of culture fishery, the lack of innovation and stagnation of the co-operative sector in fishery is a concern, mainly because it deals with the livelihoods of the marginalized community who seem to be left out from the growth of the sector.

10. REFERENCES

Anjani, K., Joshi, P.K. & Pratap, S.B. (2003), Fisheries Sector in India: An Overview of Performance, Policies and Programmes. In: Anjani, K., Pradeep, K.K. & Joshi, P.K. (Eds.), A Profile of People, Technologies and Policies in Fisheries Sector in India. pp.1-16.

Anonymous 1996a. *Handbook on Fisheries Statistics*. Ministry of Agriculture (Department of Agriculture and Co-operation, Fisheries Division), Government of India.

Economic Survey, (2000-2001).

FAO. (2005), Aquaculture production, 2003. Yearbook of Fishery Statistics - Vol.96/2. Food and Agriculture organization of the United Nations, Rome, Italy.
(Also available at [Fishstat Plus, Version 2.3](#))

Government of India 2000-2001, Economic Survey, Ministry of Finance, Government of India.

Indu, Rajnarayan and Ghosh, Santanu, (2005), Inland Fishery in a Traditionally Vegetarian State: A Gujarat Story, IWMI-TATA Programme, Vallabh Vidyanagar, (Unpublished)

Katiha, Pradeep K. , (2000) Freshwater Aquaculture in India: Status, Potential and Constraints. In Krishnan, M. and Birthal, P.S. (eds) *Aquacultural Development of India: Problems and Prospects*.

Sinha, M and Pradeep K Katiha (2002), "Management of Inland Fisheries Resources under Different Property Regimes" in Dinesh Marothia (ed.) *Institutionalising Common Pool Resources*, Concept Publishing Company, New Delhi.

11. ANNEXURE

Table 1: Growth of aquaculture

	Total production (million metric tones)	Production from capture fishery (million metric tones)	Production from aquaculture (million metric tones)	Total Consumption (million metric tones)	Total per capita Consumption (kg/capita/year)
1973	1.9	1.7	0.2	1.8	3.1
1985	2.7	2.1	0.6	2.8	3.6
1997	4.8	2.9	1.9	4.5	4.7
2020	8	3.6	4.4	7.5	5.8
Growth Rate	4.8%	2.8%	9.6%	4.3%	2.3%

Source: FAO Fish 2020 Report, FAO

Table 2: Site details and Sample size

Sr No	State Name	Districts	Climate	Rainfall (mm)	Number of villages	Sample size
1	Orissa	Dhenkanal, Angul	Dry sub humid	1271	8	28
2	West Bengal	24 Paraganas (north)	Humid	1607	11	40
3	Assam	Barpeta	Humid	1840	14	46
4	Bihar	East Champaran	Dry to moist sub humid	1275	28	28
5	Jharkhand	Dumka	Moist sub Humid	1315	2	30
6	J&K	Baramulla, Kupwara, Shrinagar	Dry sub humid	1200	48	60
7	Kerala	Pallakad, Thrissur	Humid	2392	15	41
8	UP	Barabanki	Dry sub humid to semi-arid	979	6	20
9	AP	Prakasam	Semi- Arid to Sub Humid	940	7	17
10	Haryana	Hissar	Extreme Arid	320	20	20
11	Gujarat	Anand, Baruch, Surat, Kheda	Semi-arid Dry Sub Humid	974	42	50
	Total				201	360

Table 3: Varying Patterns of culture fishery across regions

Characteristics	Zone 1	Zone 2	Zone 3	Zone 4
Type of Growth Pattern	Areas with traditional fishery and coastal areas /high production	Areas with traditional fishery/Low production	Areas without traditional fishery/low production	Areas without traditional fishery/high production
States	West Bengal, Assam, Orissa, A. P, coastal areas of India	Maharashtra, TamilNadu, Karnataka, Bihar, Jharkhand,	Rajasthan, U.P, MP, J&K, Kerala	Punjab, Haryana, Gujarat
Type of water bodies	Small backyard ponds size usually smaller than 2 hectares, oxbow lakes	Malgujari Tanks size ranging from 10 hectares to 100 hectares	Multi use Village ponds size ranging from 1 hectare to 10 hectares	Dug up ponds and village ponds mostly canal fed
Average productivity	3.5 t/hec	1 t/hec	1.5t/hec	4 t/hec
Production effort focus	Own consumption	Own consumption and selling in local markets	Selling in local markets	Selling in centralized markets and export
Management type	Pvt/owned ponds, co-operatives of traditional fisherman community	Co-operatives of fisherman community or displaced people	Fishing Contractors	Individual farmer ponds on agricultural land and fishing contractors

Table 4: Size of ponds and Use of ponds

State	Size of the pond (Hectares)	% min water spread in a year (sq mt)	Average depth in Mts	% volume of water in a pond in a year (in sq mt)	Main use	Secondary use	Tertiary use
Orissa	1.23	57.50	1.41	15.43	Irrigation	Fishing	Domestic
W. Bengal	0.73	71.32	2.68	38.53	Fishing	Domestic	Livestock
Assam	2.4	65.7	3.01	17.14	Fishing	Domestic	Livestock
Bihar	13.61	75.18	4.63	46.43	Fishing	Livestock	Irrigation
Jharkhand	0.25	36.67	1.73	10.85	Irrigation	Fishing	Domestic
JK	1.54	81.21	1.91	55.24	Fishing	Livestock	Domestic
Kerala	4.40	98.63	1.69	55.47	Fishing	Irrigation	Livestock
UP	0.63	61.29	2.03	31.69	Fishing	Domestic	Livestock
AP	14.88	75.00	1.96	53.10	Fishing	Domestic	Livestock
Haryana	7.72	68.33	1.46	34.17	Fishing	Livestock	Domestic
Gujarat	4.83	60.01	2.48	27.16	Livestock	Domestic	Fishing

Table 5: Existing property regimes across sites

	Property regime type		% of leased ponds	Lessor type				Lessee type		
	% of multi use common village pond	% of private ponds		% lessor as panchayat	% lessor as FFDA/Govt dept	% lessor as pvt party	% lessor as others	% lessee as Co-op or SHG	% lessee as Pvt party	% lessee as others
Orissa	64.29	35.71	75.00	76.19	0.00	9.52	14.29	0.00	100.00	0.00
W. Bengal	12.50	87.50	90.00	0.00	8.82	85.29	5.88	8.33	86.11	5.56
Assam	6.52	93.48	30.43	0.00	0.00	78.57	21.43	14.29	85.71	0.00
Jharkhand	6.67	93.33	6.67	0.00	33.33	66.67	0.00	0.00	100.00	0.00
Bihar	82.14	17.86	100.00	0.00	82.14	17.86	0.00	82.14	17.86	0.00
J&K	20.00	80.00	100.00	0.00	20.00	80.00	0.00	0.00	100.00	0.00
Kerala	14.58	85.42	29.17	0.00	0.00	87.50	12.50	50.00	50.00	0.00
UP	82.35	17.65	100.00	50.00	20.00	20.00	10.00	0.00	100.00	0.00
AP	52.94	47.06	100.00	23.53	29.41	11.76	35.29	17.65	47.06	35.29
Gujarat	98.00	2.00	94.00	41.30	56.52	2.17	0.00	0.00	100.00	0.00
Haryana	86.67	13.33	100.00	92.86	0.00	7.14	0.00	0.00	93.33	6.67
Total	41.90	59.10	71.50	23.40	27.92	42.26	6.42	14.02	82.66	3.32

Table 6: Economics of fishing

	West Bengal	Assam	Orissa	Bihar	Jharkhand
Sample size	32	43	28	24	30
Pond size (Hec)	0.46	2.55	0.58	7.13	0.25
Maintenance cost (Rs)	1.44	3.80	0.00	0.00	0.31
Cost of water (Rs)	0.76	1.71	0.26	6.33	0.31
Seed Cost (Rs)	32.46	19.79	31.24	7.13	50.35
Labour Cost (Rs)	10.33	11.47	15.99	27.96	41.21
Lease Cost (Rs)	27.76	9.04	17.88	8.45	4.28
Watch n ward cost (Rs)	1.62	8.03	22.14	31.29	0.00
Manure cost (Rs)	18.54	42.74	6.23	12.47	2.02
Misc Cost (Rs)	7.09	3.41	6.26	6.37	1.52
Total Cost (Rs)	92149.01	107339.95	41911.72	32632.17	7978.62
Total Sale (Rs)	192562.83	183289.31	88747.00	52582.84	13203.33
Total Profit (Rs)	100413.82	75949.36	46835.28	19950.67	5224.71
% Profit	108.97	70.76	111.75	61.14	65.48
Average price (Rs/kg)	45.50	55.70	37.90	57.27	42.23
Yield per Hec(MT/hect)	3.54	3.28	2.36	0.78	0.31

	J&K		Kerala		Gujarat	Haryana
	Sars	private	Thrissur	Pallakad		
Sample size	11	48	13	20	34	15
Pond size (Hec)	7.51	0.08	4.54	3.55	2.96	3.12
Maintenance cost (Rs)	0.21	2.35	15.37	11.92	0.62	1.26
Cost of water (Rs)	0.21	34.65	22.96	12.94	2.89	4.96
Seed Cost (Rs)	0.00	8.19	5.98	11.81	18.68	27.22
Labour Cost (Rs)	75.18	8.22	16.85	9.93	12.38	22.57
Lease Cost (Rs)	21.07	0.00	0.00	0.49	20.51	19.14
Watch n ward cost (Rs)	0.00	1.30	11.27	7.80	12.96	14.59
Manure cost (Rs)	0.00	43.11	24.30	44.98	26.97	7.01
Misc Cost (Rs)	3.33	2.17	3.26	0.14	4.99	3.23
Total Cost (Rs)	6065.12	102299.2	110053	37034.2	31585.49	72802.2
Total Sale (Rs)	9120	410754.2	270853.9	97061.3	61909.38	121297
Total Profit (Rs)	3054.88	308455	160800.9	60027.2	30323.89	48494.8
% Profit	50.37	301.52	434.20	162.09	96.01	66.61
Average price (Rs/kg)	63.18	67.60	164.44	267.69	30.29	43.54
Yield per Hec(MT/hect)	0.15	5.90	0.97	1.18	2.04	4.35

Table 7: Problems Faced by fish farmers

Severe problems	Rank 1	Rank 2	Rank 3
Orissa	Water availability	Capital	Poaching
W. Bengal	Poaching	Poisoning	Water availability
Assam	Capital	Water availability	Disease
Bihar	Floods	Poaching	Capital
Jharkhand	Water availability	Poaching	Labour
J&K	Water Quality	Water availability	Poaching
Kerala	Poaching	Poisoning	Water availability
UP	Poaching	Poisoning	Floods
AP	Labour	Capital	Village opposition
Gujarat	Poaching	Water availability	Capital
Haryana	Poaching	Water availability	Labour
Total	Poaching	Water availability	Capital

Table 8: Watch n ward costs

	% persons doing own watch n ward	Average watch n ward costs per month per hec
Orissa	89.29	1461.11
W. Bengal	75.00	909.36
Assam	63.04	1816.64
Bihar	7.14	807.19
Jharkhand	100.00	0.00
J&K	95.00	5333.33
Kerala	53.66	1109.45
UP	90.00	1667.39
AP	47.06	203.81
Gujarat	60.00	2481.02
Haryana	0.00	384.09
Total	61.84	1470.31

Table 9: Source of water and water control costs

	% farmers spending on water in %	Average Water Control Cost (Rs)	% wise dominant source of water for water bodies				
			Rain fed	Canal	Own Tube-well	Hired Tube-well	Others
Assam	36.96	4846.39	73.02	0	26.98	0	0
West Bengal	22.5	2495.63	78	8	6	0	2
Orissa	14.29	304.17	100	0	0	0	0
Bihar	17.86	9916.67	82.14	0	17.86	0	0
Jharkhand	3.33	750	100	0	0	0	0
J&K	68.33	2471.43	13	43	5	0	39
AP	76.47	3030.57	64.71	35.29	0	0	0
Kerala	80.49	13824.11	61.19	32.84	5.97	0	0
UP	85	3541.69	52.94	35.29	8.82	2.94	0
Gujarat	34.69	1984.45	14.55	70.91	0	12.73	0
Haryana	93.33	1567.83	0	100	0	0	0
Total	48.48	4066.63	58.14	29.58	6.42	1.42	3.73

Table 10: Source of credit

States	Source of credit					
	Own Funds	Bank loan	Relatives/Friends	Money Lenders	Govt subsidy	Others
Orissa	82.14	14.29	7.14	0.00	0.00	7.14
W. Bengal	92.50	2.50	2.50	15.00	0.00	0.00
Assam	100.00	0.00	0.00	31.82	0.00	0.00
Bihar	10.71	7.14	3.57	0.00	0.00	82.14
Jharkhand	94.12	0.00	41.18	5.88	11.76	11.76
J&K	100.00	0.00	26.67	0.00	3.33	0.00
Kerala	97.56	24.39	2.44	2.44	12.20	0.00
UP	80.00	25.00	25.00	0.00	0.00	5.00
AP	17.65	29.41	23.53	0.00	0.00	5.88
Gujarat	89.58	12.50	33.33	2.08	4.17	0.00
Haryana	93.33	0.00	80.00	6.67	0.00	33.33
Total	77.96	10.48	22.31	5.81	2.86	13.21

Table 11: Socio-economics of fish farmers

States	Total Family Size	Modal value of education of fish farmer	Years of Experience in Culture Fisheries (In years)	% people in a income group				
				Less than Rs 50 thousand	Rs.50 thousand to 1 Lac	Rs.1 Lac to 2 Lac	Rs.2 Lac to 4 Lac	Above Rs 4 Lacs
Orissa	7.25	<10	7.82	70.37	29.63	0.00	0.00	0.00
W. Bengal	5.35	<10	14.95	58.33	36.11	5.56	0.00	0.00
Assam	7.46	<10	11.39	27.91	20.93	27.91	9.30	13.95
Bihar	11.32	Nil	8.04	0.00	40.00	40.00	20.00	0.00
Jharkhand	5.77	Nil	18.57	100.00	0.00	0.00	0.00	0.00
J&K	7.52	Nil	5.62	80.00	20.00	0.00	0.00	0.00
Kerala	4.41	<10	11.17	53.66	34.15	7.32	2.44	2.44
UP	7.5	Nil	5.75	100.00	0.00	0.00	0.00	0.00
AP	4.94	10 -12	9.18	53.85	23.08	15.38	0.00	7.69
Gujarat	7.34	<10	10.06	10.00	28.00	48.00	12.00	2.00
Haryana	9.00	10 -12	9.83	7.14	0.00	50.00	35.71	7.14
Total	7.08	<10	10.22	51.02	21.08	17.65	7.22	3.02

States	% Income from different sources							% persons owning land	Agricultural Land Owned (Hec)
	Fisheries	Agr.	Ag Lab	Dairy	Service	Other Business			
Orissa	22	31	0	3	18	26	82	1.40	
W. Bengal	48.82	25.44	7.85	51.43	60.70	57.70	25.00	0.89	
Assam	55.63	16.18	6.95	26.08	48.09	3.39	56.81	2.00	
Bihar	67	33	0	0	0	0	100	3.8	
Jharkhand	6.47	90.26	1.00	0.00	1.76	0.88	88.23	1.38	
J&K	30.15	32.67	1.00	2.87	17.50	16.15	96.66	0.55	
Kerala	71.83	7.20	0.00	0.00	0.00	8.78			
UP	61.39	10.30	12.76	0.00	0.00	6.89	15.00	0.19	
AP	63.62	35.38	0.00	0.40	0.00	50.00	53.84	28.86	
Gujarat	72.51	3.83	8.50	1.07	1.18	12.74	6.50	1.07	
Haryana	67.57	30.08	0.00	18.50	20.00	33.75	80.00	2.97	
Total	52.00	29.00	3.00	9.00	15.00	20.00	60.00	4.00	