



International Journal of Fisheries and Aquatic Studies

E-ISSN: 2347-5129
P-ISSN: 2394-0506
(ICV-Poland) Impact Value: 5.62
(GIF) Impact Factor: 0.549
IJFAS 2017; 5(4): 272-278
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www.fisheriesjournal.com
Received: 08-05-2017
Accepted: 10-06-2017

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Aquaculture Development in Chhattisgarh, India: What, why and how?

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Abstract

Aquaculture development has been in a rapid phase and many of the states in India have progressed showing way for sustainable livelihoods for rural and urban communities. In the recent years the state Chhattisgarh has shown an unprecedented growth in terms of production and productivity in aquaculture. There has been several studies on the growth of Indian fisheries and its contribution to GDP and as a livelihood option for millions of Indians. Very few studies has been attempted to analyze what, why and how of aquaculture development in a prominent state like Chhattisgarh. This paper is an attempt taken by ICAR-Central Institute of Freshwater Aquaculture, Bhubaneswar, Odisha to study the prominence of aquaculture in the state of Chhattisgarh. The study concludes that use of viable technologies coupled with robust fisheries policies have been the key for success of the state fisheries. The productivity in community ponds is 3055 kg/ha/year against the national average of 2200kg/ha/year and the average production of reservoir is 202 kg/ha/year against the national average of 48 kg/ha/year. The state has brought fish culture to about 90% of the total area suitable for aquaculture. Centrally sponsored scheme Rashtriya Krishi Vikas Yojana (RKVY) had a clear impact which was implemented in 2007 and during that period the growth in Chhattisgarh fisheries was 13.8% in 2008-09 which was only 1.2% in 2007-08 and then all time growth rate of 30.97% was observed during 2010-11. The paper also lists out several such reasons that have been a prime mover for flourishing aquaculture in the state.

Keywords: Chhattisgarh aquaculture, cage culture, production, productivity

Introduction

India is the world's second largest producer of farmed fish, with production totalling 4.39 million ton in 2014 (DAHDF, 2017 and FAO, 2016) [18, 5]. Fish as a food in India preferred by many have made the industry to expand and large number farmers to enter into aquaculture for their livelihood and as a business enterprise (Kumar *et al.*, 2005 and Dey *et al.*, 2004) [6, 7]. It is estimated that in India about 300 million people consume fish (NSSO, 2014) [8]. The fish production in India are from varied resources like marine and inland comprising of tanks, ponds, lakes, reservoirs, rivers, backwaters and many other forms of water structures. The country also accommodates a rich diversity in fish species that are edible for human consumption satisfying the local and international market. India is one of the mega biodiversity countries in the world and occupies the ninth position in terms of freshwater mega biodiversity (Mittermeier and Mittermeier, 1997) [13].

Farming of the three Indian major carps (IMC), *viz.*, catla, rohu, mrigal and the three exotic carps *viz.*, silver carp, grass carp and common carp under composite culture system is in vogue in the south Asian countries and the same is true with India (Das and Mishra 2016) [9]. The other prominent species cultured in India are minor carps, murels, catfishes and cold water fishes. Through these cultured species, fish production has increased from 41.57 lakh ton (24.47 lakh ton for marine and 17.10 lakh ton for inland fisheries) in 1991-92 to 107.90 lakh ton (35.8 lakh ton for marine and 72.10 lakh ton for inland fisheries) in 2015-16 (DAHDF, 2017) [18]. The state of Andhra Pradesh supplied an estimated 38% of India's farmed fish in 2012; almost 1.5 million ton, with a farm gate value of Rs. 95.2 billion (\$1.73 billion) (Padiyar *et al.*, 2014) [10].

There are other states too that are promising in aquaculture and one amongst them is Chhattisgarh constituted as 26th state of the Indian Republic in 2000. The state is located in the heart of India and shares its borders with six states of India and is the 10th largest with an area of 135,190 Sq km (DAHDF, 2017) [18].

The state Chhattisgarh is the most water resourceful state in the central India and it is estimated that 1.64 lakh ha water area is available for fish culture. Besides the state has major riverine system and their tributaries forming a network of 3573 km (DAHDF, 2017)^[18]. Fish production in the mineral-rich Chhattisgarh had registered a growth of more than 130 per cent over a period of a decade (Anon, 2015). A grey literature shares that more than 94% of the total freshwater bodies are under fish culture in the state.

Chhattisgarh is situated in the middle part of the country and there are enormous potential for fisheries development and the climate and meteorological condition is favourable for fisheries (Singh *et al.*, 2013)^[12]. Over the years there has been an interest in the state of art in aquaculture and many converse that Chhattisgarh is progressing and an analysis on this is still pending and there is a urgent need to substantiate. The reason being so that the fish production in the state is estimated to be above the national average in tanks/ponds and riverine systems. It is also worth to mention that there is no comprehensive literature on the state of art of fisheries of this state. With this above background a study was conducted with the following objectives and presented in this paper are as follows:

1. Understanding the resources of the state for aquaculture
2. Production and productivity of aquaculture, culture systems and species diversification of the state
3. Best practices adopted and the factors responsible for the prominence of aquaculture in the state

Research Methodology

The present study is based on the primary and secondary data collected from different stakeholders from the state of Chhattisgarh (CG). The study comprises mostly with secondary data and a primary survey comprising with stakeholders and key informants. A pre tested interview schedule was administered to collect data from the members of the primary Fisheries Cooperative Societies and other key stakeholders viz. progressive farmers (recommended by Department of Fisheries, CG), seed producers and others. Data were collected from different districts in the state covering all types of aquatic resources like village ponds, irrigation tank and reservoir and its users. Personal interactions with government officials, academicians, officials from the Cooperative Fisheries Federation and Panchayat Raj institutions at Gram Panchayat and block levels. Apart from this secondary information was collected from the annual reports and other documents published by the Department of Fisheries, CG, the Department of Panchayat and Rural Development of GoCG Articles (leasing Policy for panchayat pond/community tank given in site), scientific communication, water resources department and Department of Animal Husbandry Dairying and Fisheries (DAHDF), Govt. of India. The present study was conducted during 2016-17 supported by Indian Council for Agricultural Research, New Delhi and conducted by ICAR-Central Institute of Freshwater Aquaculture, Bhubaneswar, Odisha

Results and Discussions

Fisheries resources of the state

As indicated in the introductory part Chhattisgarh is the most water resourceful state in the central India gifted with vast aquatic resources comprising village tanks, reservoirs and

ponds in addition to the four major river basins with their tributaries. The state has about 1.64 lakh ha water area available for fish culture. Besides the state have major riverine system and their tributaries with an area of 3573 km (Table 1)

Table 1: Chhattisgarh Inland Fishery Resources at a Glance

SI No.	Resources	Area
1.	Total inland water bodies (ha)	1,64,000
2.	Rivers and canals (km)	3573
3.	Reservoirs (ha)	89,000
4.	Tanks and ponds (lakh Ha)	75,000

Source: Department of Fisheries, Govt. of CG, 2016

Reservoirs are the prime inland fisheries resources of India and there is a wide gap between the potential and the actual fish yield which could be easily mitigated through scientific management approaches (Jhingran, 1988, Sugunan and Sinha, 2000)^[14, 15]. The total number of reservoir in the state is 1770 covering an area of 0.89 lakh ha. Although 99% reservoir belongs to small category but they account for about 54% of total reservoir area in the state^[22]. The area under medium and large reservoirs is 25% and 21% respectively. The state has 59591 rural/village ponds covering 0.75 lakh ha. Accounting to all these resources the total water area in the state is 1.64 lakh ha water area available for fisheries development during 2013-14. Remarkably out of the available water resources 0.68 lakh ha rural pond area and 0.86 lakh ha irrigation reservoir water area, thus totalling 1.54 lakh ha water has already been brought under fish culture by 2015-16^[22]

The total area under fish culture developed in state is 1.54 lakh ha against the available 1.64 lakh ha. This indicates that there is still scope to expand the area under fish culture in the state. However, in spite of various schemes implemented through Fisheries Department and other organizations the resources are yet to be fully exploited. Small reservoirs (Dubri) have a greater potential for production of fish. As per new policy of the government in the state all the water bodies have been leased out under the panchayat (60%), fish federation (3%), Fisheries Department (26%) and private (11%).

The northern part of the state lies on the edge of the great Indo Gangetic plain and the southern part of the lies on the Deccan plateau, in the watershed of Godavari river and its tributary Indravati river. The Mahanadi is the chief river of the state, other main rivers are Shivrath, Hasdo, Rihand, Indravati, Jonk and Arpa. The state is crisscrossed by several rivers, rivulets, streams and streamlets run 3573 km. The state situated is situated amidst lush green hills and plateaus, is interspersed. Due to the presence of natural drainage systems, Chhattisgarh is blessed abundantly with prolific and fertile plains.

Seed Production resources of the state

Seed is one of the critical input for development of any system and the same is true for aquaculture. The requirement of fish seed in the state with standard fry is 610 million annually and the state has 69 hatcheries to satisfy the demand. Majority of the hatcheries are under the state department followed by the private and fish federations (Table 2).

Table 2: Fish seed production unit in Chhattisgarh

Sl No	Particulars	Circular hatchery		Fish seed farm		Rearing pond	
		Number	Water area (ha)	Number	Water area (ha)	No.	Water area (ha)
1	State Department	34	77.02	38	46.63	589	153.29
2	Fish Federation	9	39.69	01	0.50	05	1.0
3	Private sector	26	78.00	21	28.93	127	53.29
	Total	69	194.41	60	76.06	721	207.58

Source: Department of Fisheries, Govt. of CG, 2016

From the data collected it was concluded that there are 66 carp hatcheries, six magur hatcheries, two pangasius hatcheries, one monosex tilapia hatchery under all categories. On an average 66 % of the spawn produced from the hatchery are sold out and the rest are reared (34%). Numerous private carp hatcheries were established in Andhra Pradesh during the 1990's, to meet the state's growing demand for fish seed (Belton *et al.*, 2017) [16] which is a symbol for a state to prosper in aquaculture. The State Government of Chhattisgarh has encouraged to construct small ponds on private land under "Drought relief programme" which has been a move for increasing the area under fish production. It is expected that this additional water area will prove a boon to fish seed rearing and fish culture programmes. Data sources indicate that the government is supporting to establish more circular hatcheries in public and private sector to exploit the fullest potential. Interestingly like any other part of the country the private sector and in the state contributes to more than 61% of the total spawn production. The state ranks sixth in India producing 14,689 lakh fry during 2015-16. There has been an incremental change in fish seed production since 2000-01 to 2015-16 as the production of seed has been from 2867 to 14689 lakh fry [22]. A report informs that about 25 crore fish seeds were produced in 2001-02, which has gone up to 135 crore fish seeds in the year 2015-16 (Anon, 2016 b). A comparative analysis with the other states is presented to indicate the boon in the state fish seed production

Table 3: Comparison of Seed Production with neighbouring states (2013-14) in Crores

State	Odisha	Madhya Pradesh	Jharkhand	Chhattisgarh
Seed Production	65.18	96.38	107.18	120.20

Source: DAHDF, 2014

The vision document of Chhattisgarh fisheries indicates that at present demand of fish seeds is placed at 97.52 crore against production of 149.15 crore seeds. Table 3 above indicate that now state has achieved deficiate to surplus position in terms of fish seed production and also head of the neighbouring states.

Species cultured

Indian major carps are predominantly cultured, however minor carps, barbs and catfish categories of fishes also find a place. Major species cultured are rohu (*Labeo rohita*), catla (*Catla catla*), mrigal (*Cirrhinus mrigala*), grass carp (*Ctenopharyngodon idellus*), common carp (*Cyprinus carpio*), silver carp (*Hypophthalmichthys molitrix*). In recent years, attempts have been to develop the culture of fish like Pangassius, Climbing perch (*Anabas testudineus*) and Murrels (*Channa sp.*). The other species cultured is monosex tilapia (hybrid of *O. hornorum* with *O. mossambicus* or *O.*

niloticus).

Prevailing culture systems

Like any other states in the country, the culture systems adopted in the Chhattisgarh vary depending on the resources available with the farmer. Composite carp culture with three Indian major carps and three exotic carps viz. common carp, silver carp and grass carp forms the basis for carp polyculture system practiced by farmers in the state. From the study it could be inferred that due to the progressiveness of farmer in the state the culture system has been gradually changed by using diversified species and their composition ratios. Monosex and monoculture of tilapia was initiated by the Department of Fisheries (DoF), in Motitalav of Jagdalpur district on trial basis. DoF initiative cultured monosex tilapia species is a hybrid of *O. hornorum* with *O. mossambicus* or *O. niloticus*. In grow out ponds the stocking density maintained is 4-5 nos/ sq mt targeting a production level 5-6 mt/ha/crop without aeration. M. K. Fisheries, Raipur have established the tilapia hatchery and the farming has not yet picked up at commercial scale as per the initial expectations due to the non availability seeds. In India, cage culture is an emerging technology through which fishes are reared from fry to fingerling, fingerling to table size, or table size to marketable size while captive in an enclosed. The state has also adopted the cage culture technology and firstly started at Sarodha reservoir in Kabirdham district in 2011-12 under National Mission for Protein Supplements Scheme.

Production and Productivity

Fish production

Chhattisgarh is now the sixth largest producer of inland fish and the fifth largest producer of fish seed in the India [22]. Fish production has increased from 0.09 lakh tonnes in 2000-01 to 3.42 lakh tones in 2015-16 and all the district have shown an improved performance in fish production. States like Andhra Pradesh, West Bengal, Kerala and Gujarat are considered to be major inland fish producing states in the country. Chattisgarh also contributes almost 2% of country's fresh water fish production [18]. FAO's report estimates that an additional 40 million ton of aquatic food will be required by 2030 just for to maintain current levels of consumption. The top ten districts in the state contributes 69% of the total fish production are Janjgir, Mahasamund, Rajanandgaon, Raigarh, Balodabajar, Raipur, Bilaspur, Dhamtari, Korba, Balod. The districts with poor production are Bijapur, Sukama, Dhantwera and Narayanpur (Table:4). The total fish production in the state has been 342.29 lakh ton.

Across the literature from the Department of fisheries indicates that the Rashtriya Krishi Vikas Yojana (RKVY) project had a clear impact which was implemented in 2007 and the growth in Chhattisgarh fisheries was 13.8% in 2008-09 which was only 1.2% in 2007-08 and then all time growth rate of 30.97% was observed during 2010-11. Creation of new

water bodies under the state schemes and financial support from banks were the reasons for flourishing fisheries in the state. An analysis of the fish production in the neighbouring states of Chhattisgarh is presented as a comparison to understand the progression (Table 5)

Table 4: Trends in Fisheries Production

Year	Fish production ('000 tons)	Growth rate (%)
2004-05	120.07	8.1
2005-06	131.75	9.7
2006-07	137.75	4.5
2007-08	139.37	1.2
2008-09	158.70	13.8
2009-10	174.24	9.79
2010-11	228.21	30.97
2011-12	250.69	9.85
2012-13	255.61	1.96
2013-14	284.96	11.48
2014-15	314.16	10.24
2015-16	342.29	8.95

Source: DAHDF, 2017

Table 5: Comparison of Fish Production with neighbouring states (2013-14)

State	Odisha	Madhya Pradesh	Jharkhand	Chhattisgarh
Production (lakh MT)	104.02	96.26	104.82	284.96

Source: DAHDF, 2014

Fish Productivity

Data sources from the state indicate that the average fish production in rural/village ponds is 3055 kg/ha/year against the national average of 2200kg/ha/year and the average production of reservoir is 202 kg/ha/year against the national average of 48 kg/ha/year. In addition to that the state is near to the potential yield of reservoir at national level being 250 kg/ha/year (DAHDF, 2017) [18]. The reason for such an increment in fish productivity is that the state Chhattisgarh has a well structured organizational network to manage freshwater aquaculture in the village ponds, irrigation tanks and reservoirs. The state has a two-tier cooperative structure to manage and develop freshwater aquaculture (Marothia, 2012) [11].

Table 6: Aquaculture productivity in Chhattisgarh

Sl No.	Particular	Productivity				
		Village ponds	Large reservoirs	Medium reservoir	Small reservoir	Average reservoir
1	National	2200	33	94	174	30
2	State	3055	61.64	94.82	349.80	168.80

Source: Department of Fisheries, Govt. of CG, 2016

Comparing the national average the productivity of fish in the state is higher than the national average and with many other states in the country. However, there have been records of production 8,000 to 12,000 kg/ha by progressive farmers and up to 70t/ha by commercial farming which also cannot be uncared for. Implications of the leasing policies, implementation of RKVY, participation of public are all the reasons for the state to be prominent in the aquaculture of the state.

Cage culture

As indicated earlier, the state is progressing in adoption of cage culture. In this sub section the authors wanted to emphasise on the status of cage culture which is likely to be a prominent culture system that can take the state forward in the sector. Sharma *et al.*, (2015) [19] opines that recent success of cage farming in Jharkhand and Chhattisgarh has set a benchmark and proved the potential of cage culture in India. The district wise are under cage culture (Table 7)

Table 7: District wise cage culture in Chhattisgarh

Sl No.	Reservoir	District	Area (ha)
1	Saroda Sagar	Kabirdham	232
2	Kshirpani	Kabirdham	259
3	Ghongha	Bilaspur	436
4	Torenga	Raipur	339
5	Jhumka	Koriya	551
6	Gondli	Durg	1118
7	Ghunghutta	Sarguja	762
8	Bango	Korba	11500

Source: Department of Fisheries, Govt. of CG, 2016

A Case of Cage culture practices in Sarodha and Chhirpani reservoirs

Raising *Pangasiodon sp.* fingerlings in cages generally

requires 6-8 month to harvest 1 kg table size fish. It also depends on the natural productivity of water body and the quality of supplementary feed. The stocking density per cage was 4000 fingerling with seed sources from Bharat Fekar fish farm, Tarpongi, Raipur. The cages are shifted late in the day or early in the evening for conditioning at the site of procurement and acclimatization at the site of release in cages. Conditioning is required to transport the fry with empty stomachs, as the ammonia and carbon dioxide generated by fish waste may prove lethal to fry during transport. The oxygen packets transported with the fry (1,000 fry in 4 litres of water in a polythene packet 2/3 filled with oxygen) are kept inside cages for at least an hour before the fry are released. Feeding is essential for carp/ *Pangasiodon* fry in captivity, as the natural food in many Indian reservoirs may not be sufficient for their growth even to fingerling size. Therefore supplementary feed is crucial important factor in cage culture. The total *Pangasiodon* production from Saroda and Chhirpani reservoirs were 233 ton and 311 ton in the year 2015-16 respectively. A report from the Department of Fisheries indicates that in Chhirpani Waters of Kabirdam district there are 96 fish rearing cages, Bilaspur district, Gonga waters 48 cages, Jhumka Waters in Korea district 96 cages, Tauranga Waters in Gariyaband district with 48 cages, Korba district Bango Waters 48 cages and Ambikapur district Gunghuta Waters with 48 fish rearing cages. The production has been 3500 kg from each cage culture. There is a gain of Rs 70,000 to the farmer after deducting all expenses.

Leasing policy for Aquaculture in the state

Leasing policy has a better say in aquaculture and Mishra (2012) says that it is understood that although in many states in order to have secured access over water bodies by the fisher communities lease period has been mentioned as 5

years, in practice it varies widely [21]. In many cases it was found to be for one to three years. Leasing amount also varies from state to state and it depends on the Fish Catch, Water Spread Area, Effective Water Spread areas etc. Lease value is dependent on the water spread area and the assessment of water spread area is not being carried out to fix the lease value. The state Chhattisgarh has a unique leasing policy

which has been supportive for the fisheries development of the state. The lease period for all type of water bodies from size less than 10 ha to more than 5000 ha is 10 years. In the state of Odisha Minor Irrigation Projects (MIP) below 40 ha water area/ Gram Panchayat (GP)/ Revenue tanks shall be uniformly leased for a period of not less than five years for aquaculture (FARDD, 2015) [20].

Table 8: Leasing policy of the state

Sl No.	Water resources with area (ha)	Authority to lease out	Duration
1	Less than 10 ha water bodies	Gram Panchayat	10 years
2	10 – 100 ha water bodies	Janpad Panchayat	10 years
3	100 – 200 ha water bodies	Zila Panchayat	10 years
4	200 – 1000 ha water bodies	Dept. of Fisheries	10 years
5	1000 – 5000 ha water bodies	Fisheries Federation	10 years
6	Larger than 5000 ha water bodies	Dept. of Fisheries	10 years

Source: Department of Fisheries, Govt. of CG, 2016

The above table elicits information that lease for village ponds less than 10 ha is Rs. 1500 and more than 10 ha it is Rs. 3000 and for irrigation reservoir it ranges from Rs. 500 (10-50 ha) to Rs.1000 (200-1000 ha). In a move aimed to invite corporate sector in fish production the state government has amended its fishery policy and announced to lease out barrages and annicuts small dams [1]. The government is taking into consideration of the villagers needs that one tank in every village will be identified and left free for multiple uses and no fisheries development will be taken up in such tanks. The document also infers that royalty will not be charged for minnows extracted from irrigation reservoirs which are under the department. Above all under the leasing policy government decided that the existing departmental hatcheries running in loss to be leased out.

3.5.5 Why Prominence in Chhattisgarh Aquaculture

Aquaculture being state subject respective governments have a greater role to play and an analysis of reports and the primary data generated there are certain definite reasons identified for the aquaculture development in the state. It is also evident that technology adoption has also carried out the state in rolling its production and productivity along with a robust fisheries policy. The Vision 2030 document states that the reasons for the fisheries development in the state are manifold and the discussions made with stakeholders by the authors are presented in this section.

There has been a huge jump of fish seed production in the state and to be self-sufficient which is due to the spurt of private entrepreneurs who have entered into the business. Government policy to lease out the public hatcheries under loss was also another factor. The floating fish feed will save 10% - 20% material than sinking fish feed, even if some of the feed left, can be picked up to dry, which can highly limit to control feed waste. The adoption of floating feeds in ponds and tanks, use fertilizers and high density of seed stocking are some of the reasons for the increment in production fish in Chhattisgarh. Input based aquaculture across the culture systems (tanks, ponds and reservoirs) prevails in the state. Feed is one of the critical inputs that boosts fish production and Barik (2016) indicates that application of feed was the lowest in multiple aquaculture resources in Odisha [4]. In the case of Chhattisgarh use of balanced nutritious float feed has been one of key input with high density stocking. The country faces problems in supply of fingerlings and especially stocking of large size fingerlings (75 mm and above) in

selected reservoirs and ponds supplied by the government has been a boon for the state. It is true in the case of Andhra Pradesh that the innovation of producing extremely large size fingerlings (200-300 g) reduced the production cycle 2 to 3 months and by the way even farmers achieved a production up to 20 t/ha in commercial fish farming (Padiyar *et al.* 2014) [10].

Capacity building is another important input for scientific farming and the government has imparted skill training to fish farmers engaged in reservoirs and ponds for fisheries development. The government has provided assistance to fish farmers for equipping them with net and boats for increasing fishing efforts. The potential of seasonal ponds for fish seed rearing has been harnessed by the state. The government has established demonstration units for farmers to imbibe best practices. The extension workers of the Department of fisheries have been trained in the latest scientific management practice which is also a key factor for providing advices to farmers.

The implementation of Rastriya Krishi Vikas Yojana (creation of new water bodies, establishment of hatcheries, strengthening the government owned hatcheries, expanding seed rearing areas and increasing fishing efforts) has been the main moot for the aquaculture development of the state. In addition to that the best practices adopted in the state were cage culture in reservoirs, establishment of cold chains, Pangasius and tilapia culture in ponds, construction of new ponds, seed production in seasonal ponds and mapping of small water bodies for fish culture. Belton *et al.*, (2017) [16] says that freshwater aquaculture has boomed in Andhra Pradesh since the late 1970s, first with carps, then pangasius catfish. The state banks are providing loans worth rupees one lakh at one per cent interest rate to the farmers to boost fish production (Anon, 2016 a). The state Andhra Pradesh was supported by NABARD for expanding aquaculture and it is estimated that more than 29 banks have extended credit services (Belton *et al.*, 2017) [16]. A similar trend of development is found to be in the state of Chattisgarh as analysed with the state of Andhra Pradesh.

In 2016-17, the assistance given by Central government to the state was Rs. 2010 crores and the expenditure being close to the target with Rs.1660 crores which is 82%. Remarkably the fish seed stocking target in 2016-17 was 9816 lakh standard fry and the achievements have been above the target with 10975 lakh fry. These inference again support to that statements that state government has been proactive in

promotion of aquaculture in the state.

3.6 Factors Responsible for the prominence of Aquaculture in Chhattisgarh

1. Resources that can be used for aquaculture is effectively utilized (94%)
2. Species diversification (Introduction and culture of high valued species)
3. Intra state export potential (Surplus are exported)
4. Water resources suitable for aquaculture below 1 ha is allotted to individual fish farmer for fish culture (Popular government scheme)
5. Strong institutional mechanism for use of common property resources (Federations and Cooperatives)
6. Increased lease period of community ponds (Minimum 10 years)
7. Interest and involvement of private sector (Dominant in seed production and adoption of best practices)
8. The culture and marketing system adopted in the Pakhanjore region is an innovative approach and it makes a difference from other state like Road side live fish seed vendors (traces of innovations in approaches that can bloom)
9. Department of Fisheries has instituted many ways to appreciate through recognizing with prize and awards to individual or Fishermen Co-operative society which has done extraordinary work (Incentives and support)
10. Robust Fisheries Policy and friendly climate for investment to expand aquaculture

4. Conclusion

The paper concludes that adoption of scientific management coupled with government support has made Chhattisgarh fisheries prominent in the country. Expansion of area under aquaculture in the state has been in a progression, self-sufficiency in seed production, adoption of best practices as indicated above have all been the key factors for the development of fisheries in the state. Significantly, at present more than 2.10 lakh fish farmers in the state are involved in various fisheries activities generating 150.14 lakh mandays employment annually fisheries development has set up a target to scale up the number of fish farmer to 2.25 lakh providing employment 160 lakh man days by the end XII five year plan. The popular scheme “construction of new pond in own land” has been a popular scheme in rural pockets of the state. Constraints in terms of inputs, technology and disease incidence has to be sorted for further progressing is perceived from the study. Along with this the state is also aiming to implement non-food fisheries activities specifically pearl farming and ornamental fish farming.

5. Acknowledgement

Authors are duly thankful to the Department of Fisheries, Government of Chhattisgarh for providing necessary data and information.

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