



Working Group Report
on
**Fisheries Development
in Haryana :**
Status, Prospects and Options

Haryana Kisan Ayog

**CCS HAU Campus, Hisar-125004
Government of Haryana**



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Working Group on Fisheries

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About the Document

This document is the final report of the Working Group on Fisheries Development in Haryana constituted by the Haryana Kisan Ayog, Hisar in March 2011 with a broad mandate to assess the present scenario and prepare a road map for future development. The report is a culmination of extensive consultations with various stakeholders – farmers, staff of Fisheries Department, experts from ICAR institutions and Universities, and field visits across Haryana, Delhi and Mumbai besides detailed review of various secondary data sourced from DOF and others. Comments and suggestions on the report may kindly be sent to Chairman, HKA at chairman@haryanakisanayog.org.



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FOREWORD

Since its inception, the State of Haryana has made significant strides in all sectors of agriculture. However, in the present scenario of decreasing land holdings and climate change, there is need to have a relook at the present agricultural practices to ensure accelerated and sustained agricultural growth. The State has large areas with brackish ground water in inland basin. Introduction of canal irrigation with poor on-farm water management has resulted in the rise of water table, salinization, resodification, water logged conditions and soil degradation. We now need innovations that can cut cost on inputs and help in increasing the overall income of resource poor farmers.

Haryana has made impressive progress in the field of inland fishery in recent years. Currently, the state occupies second place in productivity (5600 kg/ha) in the country and has good potential for fishery development through diversified farming to enhance farmers' income and thus ensure nutritional security. Fish production in Haryana can be enhanced 4-5 times from present 1 lakh tonnes in the next five years by adopting innovative practices, new technologies and enabling policies. About 47% of the area in the arid region, having mostly the underground brackish water, can be a potential region for fishery development. The water resources can also be expanded with riverine fishery and utilization of canal banks for fish production. In addition, fish production in field ponds using good quality canal water can help in improving productivity. Re-circulatory water system needs to be adopted for high yielding and high value species like Sea bass, Tilapia, Shrimp and Prawn.

It gives me immense pleasure that the Working Group Report on Fisheries Development in Haryana led by Dr. W.S. Lakra, has done a SWOT (strengths, weaknesses, opportunities and threats) analysis of fisheries in the State, identified key issues and suggested policy intervention for fishery development as a component of integrated diversified agricultural practices for higher income to the farmers. The Working Group conducted series of meetings with fish farmers, entrepreneurs, researchers, field functionaries, line departments and policy makers for framing these recommendations. I congratulate Dr. Lakra and his team for their sincere efforts and timely action in bringing out this valuable report entitled “Working Group Report on Fisheries Development in Haryana: Status, Prospects and Options”. I am sure, the Department of Fisheries, Govt. of Haryana, Lala Lajpat Rai University of Veterinary & Animal Sciences, Hisar and Farm Advisory Agencies and farmers will take full advantage of these recommendations. Through its recommendations, this important publication will be of immense use to the planners, administrators, scientists, and other stakeholders, for betterment of resource poor small farm holders through sustainable & profitable agriculture by making best use of brackish, saline/sodic water resources and waste lands unfit for crop agriculture.



(R. S. Paroda)

**DIRECTOR/VICE CHANCELLOR
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DEVELOPMENT IN HARYANA**



PREFACE

Fisheries and aquaculture are vibrant economic activities and have been one of the fastest growing food production systems during the last three decades in India. With about 8 million tonnes of fish production, India ranks second in global capture and culture fisheries production. Its significance and contribution towards agricultural GDP (5.4 per cent) and national economies (1.1 per cent GDP), livelihood and nutritional security, employment generation (14.5 million people) and foreign exchange earnings (over Rs.12000 crores in 2011-12) have been enormous, though understated so far.

Haryana is one of the main engines of growth propelling Indian aquaculture forward with 58,436 ha of potential water resources, 18,000 ha of culture area and about one lakh tonnes of fish production. Though it contributes only 2.1% in inland fish production of India, the productivity (5.5 tonnes/ha) is twice the national average and has been growing faster (11.4%) than the rest of India (8%) during the last two decades. With the pond resources fully exploited in Haryana, the unutilized salt affected and waterlogged areas hold the maximum potential for fisheries development in the immediate future. As the report underlies, the fish production can become 3.5 lakh tonnes by 2022 if these resources are harnessed through appropriate technological and managerial interventions.

This report of the Working Group on Fisheries assesses the present status of fisheries development in Haryana, identifies the opportunities as well as challenges for further development and provides appropriate technological, developmental and

policy options for the next two plan periods (2012-22) to achieve the targeted fish production of 1,45,250 tonnes by 2017 and 3,50,730 tonnes by 2022. For the State whose farmers are among the most progressive in the country and whose visionary leader's foster entrepreneurship and innovation, achieving the targeted fish production would not be a difficult task.

This exercise has been an enriching and rewarding experience for the Working Group. The report has strived to meet the high standards and the expectations of Padma Bhusan Dr. R.S. Paroda, Chairman, Haryana Kisan Ayog. We hope that this report would help, guide and further facilitate the process of fisheries development in Haryana with improved productivity, sustainability and profitability.



(W.S. Lakra)

ACKNOWLEDGEMENTS

We are highly grateful to Padma Bhusan Dr. R.S. Paroda, Chairman, Haryana Kisan Ayog whose vision was instrumental in identifying fisheries as one of the sunrise sector for generating rural livelihoods and overall agricultural growth in Haryana. Constitution of a separate Working Group on Fisheries for detailed sectoral study and preparation of road map for development is an instance of his foresight. The study of this magnitude and scope would not have been possible without the invaluable support of Dr. P. V. Singh Director, Fisheries, Haryana and staff of Fisheries Department whose assistance is gratefully acknowledged.

We are grateful for the guidance received from Dr. S. Ayyappan, Secretary, DARE and Director General, ICAR. We thankfully acknowledge the inputs received from Shri N. K. Jain, IAS, Secretary, Fisheries, Govt. of Haryana; Dr. B. Meenakumari, DDG, Fisheries, ICAR; Dr. Dilip Kumar, former Director, CIFE; Dr. A. K. Srivastava, Director, NDRI and Dr. D.K. Sharma, Director CSSRI; Dr. B. S. Saharan and Dr. S. C. Aggarwal, former Directors, DoF, Haryana; Dr. Asha Dhawan, Dean, CoF, Ludhiana; Dr. M.A. Upare, retd. DGM, NABARD; Dr. A.K. Sharma, Dr. A.K. Reddy and several progressive farmer cum entrepreneurs during the consultation process.

All the participants in the consultative workshops held in Hisar, Karnal, Rohtak, Chandigarh, Delhi and Mumbai consisting of fish farmers, DoF staff, CIFE faculty, fishing contractors, industry representatives, bankers, and experts have contributed immensely to the study report in terms of varied perspectives and critical suggestions which is duly acknowledged.

Special thanks are due to Dr. R.S. Dalal, Member Secretary, and Dr. M.P. Yadav, Consultant, HKA and the entire team at Haryana Kisan Ayog for effective organization of consultative meetings and providing necessary logistic support.

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ABBREVIATIONS

ADOs	Agriculture Development Officers
ARTI	Aquaculture Research and Training Institute
AUC	Area under Culture
BFSc	Bachelor of Fisheries Science
CCSHAU	Chaudhary Charan Singh Haryana Agricultural University
CIBA	Central Institute of Brackish water Aquaculture
CIFA	Central Institute of Freshwater Aquaculture
CIFE	Central Institute of Fisheries Education
CIFRI	Central Inland Fisheries Research Institute
CSSRI	Central Soil Salinity Research Institute
DAHDF	Department of Animal Husbandry, Dairying and Fisheries
DFO	District Fisheries Officer
DoF	Department of Fisheries
FDC	Fisheries Development Commissioner
FDO	Fisheries Development Officer
FEO	Fisheries Extension Officer
FFDA	Fish Farmers Development Agency
FO	Fisheries Officer
FY	Financial Year
FYP	Five Year Plan
GDP	Gross Domestic Product
GIC	General Insurance Corporation
GoH	Government of Haryana
GoI	Government of India
HFC	Haryana Farmers' Commission
HQ	Head Quarter

HRD	Human Resource Development
ICAR	Indian Council of Agricultural Research
IMC	Indian Major Carps
KCC	Kisan Credit Card
KVKs	Krishi Vigyan Kendras
LLRUVAS	Lala Lajpat Rai University of Veterinary and Animal Sciences
MFSc	Master of Fisheries Science
MGNREGS	Mahatma Gandhi National Rural Employment Guarantee Scheme
MNC	Multi National Corporation
NCR	National Capital Region
NFDB	National Fisheries Development Board
NGO	Non-Governmental Organization
NSSO	National Sample Survey Organisation
PPP	Public Private Partnership
PWD	Public Works Department
R&D	Research and Development
RAS	Recirculating Aquaculture Systems
RKVY	Rashtriya Krishi Vikas Yojana
SHG	Shelf Help Group
SWOT	Strengths, Weaknesses, Opportunities and Threats
TOR	Terms of Reference
WA	Water Logged Area
SA	Salt Affected Area
CGR	Compounded Growth rate
TAAS	Trust for Advancement of Agricultural Sciences
NDRI	National Dairy Research Institute

EXECUTIVE SUMMARY

Haryana is one of the most progressive agricultural states. In recent years the State has successfully integrated fisheries in its basket of agrarian goods. It ranks second in fish productivity which is twice the national average. This report is an effort to take stock of the present status of fisheries resource use, identify the potential opportunities and indicate the action points for the next ten years for fisheries development in Haryana. This has been done through extensive consultations with various stakeholders including farmers, personnel of Fisheries Dept., experts from fisheries institutes and Universities.

The report is presented in four chapters. A brief introduction to the historical development of fish culture in Haryana is presented in the first chapter. Second chapter examines the present status of fisheries in detail. Third chapter elaborates the prospects and strategies for fisheries development in Haryana while the fourth chapter concludes with discussions on the policy, development and technology related issues as well as on the options and action plan for overcoming the same. Salient features of the report are summarised below:

- Total available water resource of Haryana is 58,436 ha as on 2009-10 reported by DoF. These include Lakes, Rivers & Canals (21%), and Pond resources including both common property resources (village ponds) and private ponds (32%) and Unutilized Saline and Waterlogged areas with potential for Aquaculture (47%).
- As per distribution of water resources the districts Hisar, Sonapat, Jhajjar, Sirsa, Bhiwani, Kaithal, Jind, Mewat & Mahendergarh each have > 1000 ha of ponds and together contribute > 60% of pond area while, Palwal, Mewat, Hisar, Karnal and Rohtak contribute nearly 60% of the private pond resources. Currently, 95 per cent of the total fish production in Haryana is from village ponds. Only 66% of 1205 ha of private ponds are under culture.
- Rivers and rivulets are mainly under capture fisheries and have been exploited

to the maximum extent without any efforts of stock enhancement leading to decline in productivity. As almost 91 per cent of the village ponds are under fish culture, further increase in the area under fish culture would be possible by effective utilization of saline and waterlogged areas.

- Mewat, Palwal, Hisar, Sirsa, Rohtak, Fatehabad and Bhiwani districts constitute nearly 80% of the salt affected/water logged areas with the potential for fish culture. At present only 123 ha (0.52%) of salt affected area and 104 ha (6.2%) of waterlogged area have been brought under culture whereas the actual potential area under these categories is 20,000 ha & 2,000 ha respectively.
- Total fish production was 96,814 tonnes during 2010-11 with an average productivity of 5.5 tonnes/ha. The growth in production, area and productivity was 11.41, 8.29 & 2.23 per cent, respectively during 1997-98 to 2010-11, thus recording a tremendous overall performance. However, the growth momentum has slowed down during the XI plan as compared to X plan period especially in terms of productivity.
- The Centrally Sponsored Scheme on Fish Farmers Development Agency (FFDA) implemented in the state has had only a limited impact as it reported lower productivity of 4.96 tonnes/ha/year as compared to 5.55 tonnes/ha/year of non FFDA ponds..
- Fish production from natural water bodies is declining and accounts for only 4 per cent in the total production. The riverine and lake ecosystems are at threat due to shrinkage, siltation and encroachment for anthropogenic activities. The number of aquatic species has declined from 77 in the year 1980 to 60 during the year 2006-07. Introduction of exotic fishes like African Magur, Tilapia, Silver Carp and Common Carp are believed to have played major role in this as they have become invasive in natural water bodies while the overall habitat degradation, abstraction of water, and pollution leading to loss of breeding grounds might be equally responsible.
- Presently there is no problem of market as there is a good demand for fish in Delhi, Punjab / NCR market. However, there is a need to improve the post-

harvest handling practices, storage, transportation and value addition. The first processing plant, set up in private sector with NFDB assistance, is yet to function to its full capacity owing to marketing related issues.

- The total fish yield can be projected to reach 1,45,250 tonnes by 2017 in a scenario where one fourth of salt affected areas and all the identified water logged areas are brought under aquaculture. Proposed growth rate of fish production would be 10 per cent. In the second scenario, assuming that the highly productive species like *Pangasianodon hypophthalmus* finds greater consumer and grower acceptance resulting in high productivity gains in the immediate future and on the other hand considering greater technological success of shrimp culture in salt affected areas leading to positive trends in area and productivity, expected fish production will be 3,50,730 tonnes by the end of XII Plan (2017-22).
- For capture fisheries the focus should be restoration of biodiversity and fisheries enhancement in the natural bodies keeping in view the supply of quality brood stock as well as the very sustainability of fisheries. Declaring fish sanctuaries and ranching of endemic species could be some of the strategies in this regard. Intensive cage culture would also contribute significantly to the overall production.
- Though existing regulations sufficiently provide for development and prohibit exploitative fishing in natural water bodies; their compliance is far from satisfactory. Moving towards community based management of these water bodies with necessary policy and regulation support can be the only viable long term option to avoid habitat degradation and sustain fish production.
- Fishers / farmers living in the periphery of these common property resources should be the primary stakeholders in their management. Suitable location specific plan needs to be developed taking into account their potential for eco-tourism, fish sanctuaries, sports fisheries, fish production potential, etc.
- Community ponds which are the major water resources for fish production are highly polluted due to village garbage and domestic sewage. Awareness need

to be created among the public and leasers/farmers to maintain soil and water quality by application of eco-friendly chemicals, probiotics, etc.

- Developing a comprehensive and reliable data base on soil and water profiles is the primary need to plan resource use strategies. Agriculture Department, Haryana has prepared soil and ground water maps up to block level for the State which need to be vetted and customized after adequate ground-truthing and field studies with respect to its suitability for fisheries and aquaculture.
- Diversification and intensification will ensure economic viability as well as ecological sustainability of fish culture in the State. In this direction, Pangasianodon, Scampi, and Indian Magur could be some of the candidate species that can be added to the input basket. It would also diversify people's diet and open up opportunities for a range of value added products. Intensification especially on private ponds would increase the yield levels. Multiple stocking and multiple harvesting, stocking of stunted fingerlings, feed based culture in village ponds, introduction of re-circulatory aquaculture systems, and polyculture are the ways of intensification.
- The resource use strategy should be based on long term sustainability rather than on profit maximization in the short run at the cost of ecosystem integrity. With the availability of technologies for culture of high value candidate species like Tiger Shrimp, White leg shrimp, Sea bass and Scampi; field demonstrations, promotion of adoption by farmers augmented by supply of quality seed and feed, credit availability and technical support are essential for effective utilization of saline/waterlogged areas.
- Fish seed production was reported to be 277 million fry at the end of X plan. Though the number of seed producing units under public and private sectors is almost same, 80 per cent of the total seed production is accounted to private firms while one third of total seed requirement is met from other States.
- Seed is critical input in production. Hence, it is very important to ensure adequate and timely supply of quality seed. Indian Major Carps are still the predominant species being cultured in Haryana. In the recently days, the quality of seed is deteriorating and farmers are getting either low quality seed

or undersized weak seed. Inbreeding depression could adversely affect the quality seed production. Existing brood stocks in the state hatcheries need to be replaced by new brood stocks from the natural resources such as rivers to revive the genetic potential.

- Private investment should be encouraged in the seed production sector to achieve self-sufficiency. This would create additional employment opportunities locally rather than depending on supply from other states. This would also reduce the cost of transportation. The State should not indulge in commercial scale seed production any further due to structural limitations and inherent inefficiencies.
- Feed is an important input and accounts for almost 50 per cent of the recurring cost of production. It is important to develop local feed plants which would meet the feed requirements of the growing culture activities. At least one feed mill should be established in the State with financial assistance in private sector or in PPP mode.
- Researchable issues are studies on pond bottom sediments, soil and water quality, and studies on ameliorative methods using probiotics and chemicals for improvement of pond bottom condition and water quality.
- Technologies to undertake aquaculture in inland saline soils by using ground saline water have been developed by CIFE. Farmers need to be encouraged to adopt these in salt affected fields by providing subsidy for construction of ponds and inputs; training of farmers and monitoring of farmers' ponds by fishery experts and Officials. Further R&D efforts need to be directed towards refinement of technologies for seed production and grow-out of *Clarias batrachus*, *Pangasianodon hypophthalmus*, *Mugilcephalus*, *Lates calcalifer*, *Tiger shrimp* and *White leg Shrimps*.
- Integrated farming systems with fishery as a component are still in a pre-adoption stage in Haryana. The State Government may establish model integrated farming units with various combinations (of aquaculture, animal husbandry, poultry, piggery, horticulture, etc.) which complement one another and effectively utilize available resources. The farmers may be

incentivized to opt for integrated farming systems.

- Adoption of recirculating aquaculture system (RAS) needs to be encouraged to produce fish on round the year basis. The economic returns can make it worth the increased investment. Re-circulatory systems should be established in saline areas by using low saline ground water for culture of shrimp, sea bass, grey mullet, etc. Developing a cost-effective indigenous version of RAS as against importing the complete systems should be a priority in R&D. As RAS is capital intensive subsidies should be provided to encourage its adoption.
- Ornamental fish having good demand in the urban markets and can be a viable livelihood option for rural women and youth. It can be encouraged in clusters around the urban markets. Identification of local species, establishment of backyard breeding and rearing units with subsidy; training of women and small scale entrepreneurs for establishment of aquaria shops; and Establishing State of the Art Aquaria at Gurgaon, Hisar, Panchkula and Sonapat for both Freshwater and Marine fishes with focus on public awareness and education need consideration.
- Structured and customized training programs should be arranged for farmers to develop a trained cadre of fish producers. Training / capacity building of DoF staff at all levels consisting of initial post induction training as well as regular in service training/refresher courses and training of trainers should become integral part. .
- Aquaculture Research and Training Institute (ARTI) under DoF at Hisar needs to be restructured and adequately staffed in collaboration with CIFE Rohtak Centre and Fisheries Faculty at CCSHAU/LLRUVAS.
- DoF needs to be restructured into a development and service / extension oriented agency. Fish farmers should be organized into farmer groups, SHGs or aqua clubs for promoting Best Management Practices having a separate wing for Extension within DoF. Harnessing ICT applications, an integrating specialized web based mobile advisory services for fish farmers (kisansanchar) needs to be developed jointly by NGOs, DoF, KVKs & CIFE / ICAR institutions for effective technology transfer and effective two way

communication between farming community and development agencies / research organizations.

- Field oriented extension and service delivery with farmers as extension agents (*matsyamitras*) needs to be a thrust area. Institutional linkages and coordination between R&D/ Extension System should be strengthened as there appears to a very weak link between these.
- One of the critical requirements is establishment of College of Fisheries under the newly established Haryana Veterinary & Animal Sciences University. As of now there is neither a Faculty of Fisheries nor a department of Fisheries in the University. It may be noted that Hon'able Chief Minister of Haryana has indicated the need for College of Fisheries in Haryana and has announced its creation.
- To steer aquaculture development, presence of competent professionals is very essential. Hence, there is a need for changes in the present DoF recruitment policy. Among others, fisheries professionals (BFSc/MFSc) should be given preference in recruitment at technical positions.
- A Fisheries Mission / Aquaculture Development Mission needs to be promoted as a part of Livestock Mission on the lines of Horticulture Mission. Since performance of State Seed Farms is dismal, the functional farms should be strengthened further while leasing the rest to private entrepreneurs in PPP mode. Also, some innovative schemes for establishment of Seed farms in private sector with support from RKVY / NFDB need to be initiated.
- Infrastructure and institutional support for marketing need to be improved on priority. Cold storage facilities along with live fish marketing should be encouraged with subsidies on transport. PPP model should be developed for establishing fish retail outlets in Delhi, Chandigarh, Gurgaon and Faridabad by linking producers and traders.
- Educational and promotional campaigns are required for highlighting the nutritional and health benefits of fish to increase fish consumption among the public. This would create internal demand and expand the local market. The

State government can explore possibilities of opening fish retail outlets in and around Delhi with NFDB support for sale of fresh and live fish as that would help offer higher profits for farmers.

- Calamity relief measures need to be provided against floods, cyclones, diseases, etc. for fisheries and aquaculture to reduce the risk and economic losses. Government of Haryana should have its own comprehensive agricultural insurance scheme to cover major crops, all milching animals and farmed fish produce. DoF should work out the modalities with NFDB's assistance.
- Developing a comprehensive and enabling Fisheries and Aquaculture Development Policy for Haryana, addressing all issues, through a consultative process followed by appropriate legislative reforms and budgetary provisions for all the programs is suggested. Aquaculture should be treated on par with agriculture in respect to water charges, electricity tariff, farm loan interest, income tax exemptions, export promotion and cargo charges.

1.0 INTRODUCTION

Fisheries and aquaculture, directly and indirectly, play an essential role in earning the livelihoods for millions of people-almost 540 million people, or nearly 8 percent of the world population. Indian fisheries with production of 8 million tonnes (2009-10) occupies second position globally with overall annual growth rate of 4.7% and 6.2% growth in inland sector, thereby contributing 1.1% to total GDP and 5.3% to agricultural GDP. The sector engages 14 million people across the country and earns more than Rs.10,000 crores annually through exports.

Haryana is primarily an agrarian land locked State with 75% of its population engaged in agriculture and allied activities. Its land resources, which one gradually declining, are the most important and scarce resource. It is characterized by arid and semi-arid climatic condition with scanty average rain fall (455 mm/year), high seepage and evaporation rate. With the total seasonal/long seasonal water area of mere 85,900 ha constituting only 2% of the total geographical area of the State, fish culture would only seem rather a difficult proposition at first. Besides, the fact that Haryana has a culturally predominant vegetarian population further has made fish farming one of the least preferred occupational choice. This is attested by the fact that, unlike other States, Haryana has no traditional fishing communities who derive their livelihood primarily from fishing.

However, as the saying goes, money has neither colour nor creed. The economic viability and profitability were the prime factors that motivated a few enterprising farmers to adopt fish culture in early 1980s, though it was a struggle convincing them during initial years. Considering this, fisheries development has made significant progress in the last three decades, feeding mainly the Delhi market. At the time of creation of Haryana in 1966, only 58 hectare of village ponds were under fish culture while total fish production was 600 tonnes, while India's inland production was 5 lakh tonnes. Fish production shot up to 23,200 tonnes by 1990, 33,040 tonnes by 2000 and nearly 1 lakh tonnes by 2010, more than 4 times during the last two decades constituting 2.1% of India's inland fish production, which is no mean achievement considering that the overall Indian inland production grew only

three times during the same period. While area under fish culture has grown, there has been higher growth in productivity with average State yield being 4914 kg/ha/year which is twice of national average and is next only to Punjab. Fisheries sector sustains about 10,585 fish farmers directly, with another 22,595 persons engaged in fisheries trade.

The State cannot remain complacent given the emerging set of challenges. With 91% of the readily available village ponds been already brought under fish culture, and very little scope for increasing productivity given the prevailing practices, fish production would soon reach a plateau and become stagnant. The per capita availability of the land has been decreasing progressively over the years and is likely to decrease further due to exists population pressure, urbanization and the industrial expansion. Hence, very little scope for increasing fish culture area through private ponds with good quality freshwater sources.

This scenario poses mainly two sets of challenges: sustaining and increasing the productivity gains from already utilized village ponds on one hand, and bringing new areas especially waterlogged and salt affected areas suitable for fish culture under scientific, productive aquaculture practices requiring innovative technological solutions and strategies. Conserving the remaining aquatic biodiversity, diversification of aquaculture practices, ensuring adequate availability of timely inputs through requisite infrastructure and effective service delivery system while linking the farmers with market, investing in R&D, and providing an enabling policy and regulatory environment for further aquaculture development are attendant issues required to be addressed comprehensively.

2.0 STATUS OF FISHERIES DEVELOPMENT

2.1. Status of Fisheries: Resources, Production and Productivity

Available Water Resources

The aquatic resources from fisheries perspective in the State are given in the Table 2.1. Given the observed variability in the extent of available areas during different years, partly due to different amount of rainfall received during different years and the subsequent difference in water spread areas across years, it is only prudent to go by the minimal area available for fisheries with respect to planning and policy formulation. As the table below indicates, the total available resource area for fisheries in Haryana is 58,436 ha including rivers, canals and drains as on 2009-10 as reported by DoF.

Table 2.1. Resource availability for fisheries in Haryana, 2009-2010

S.No.	Resource Type	No.	Area (ha)
1.	Village ponds(natural)	6000	17,225
2.	Private ponds (man-made)	2000	1,840
3.	Natural lakes	9	4,147
4.	Man-made lakes	10	443.5
5.	Marshy area	-	2,000
6.	Salt affected water area	-	20,000
7.	Critical waterlogged area	-	2,000
8.	Micro-watershed	189	3,780
9.	Natural flowing water (2 Rivers, 12 rivulets and 94 drains)	108	3406.8 km
10.	Effective length for fisheries from 3 major canals & tributaries (total length - 16647.3 km)	3	3789.9 km
	Total Resource Area including rivers/rivulets and canals		58,632 ha
	Total Resource Area excluding rivers/rivulets and canals		51,436 ha

Source: Compiled from multiple sources originating from DoF, Haryana. Nomenclature of resource types are as described in Fisheries Dept. records and many are rather specific to Haryana.

It is suggested that the available resources may be categorized into three broad but distinct groups for better understanding and planning purposes as follows:

- a) Lakes, Rivers & Canals dominated by Capture Fisheries: (21%)
- b) Pond resources dominated by Culture Fisheries / Aquaculture (32%)
- c) Unutilised Saline and Waterlogged areas with potential for Aquaculture (47%)

The proportion of individual resources is given in the pie diagram (fig. 2.1). The capture fisheries resources consist of lakes (8%), rivers and rivulets (6%), and canals and drains (7%). Although there are 14 rivers and rivulets, yet the Yamuna and Ghaggar are the only potential sources from the fisheries point of view. While Yamuna flows along the north-eastern and eastern part of Haryana forming a border, Ghaggar drains across the northern and central Haryana. The remaining rivulets pour water into these two rivers. The state has three main canal systems namely The Western Jamuna Canal System, Bhakra Canal System, and the Lift

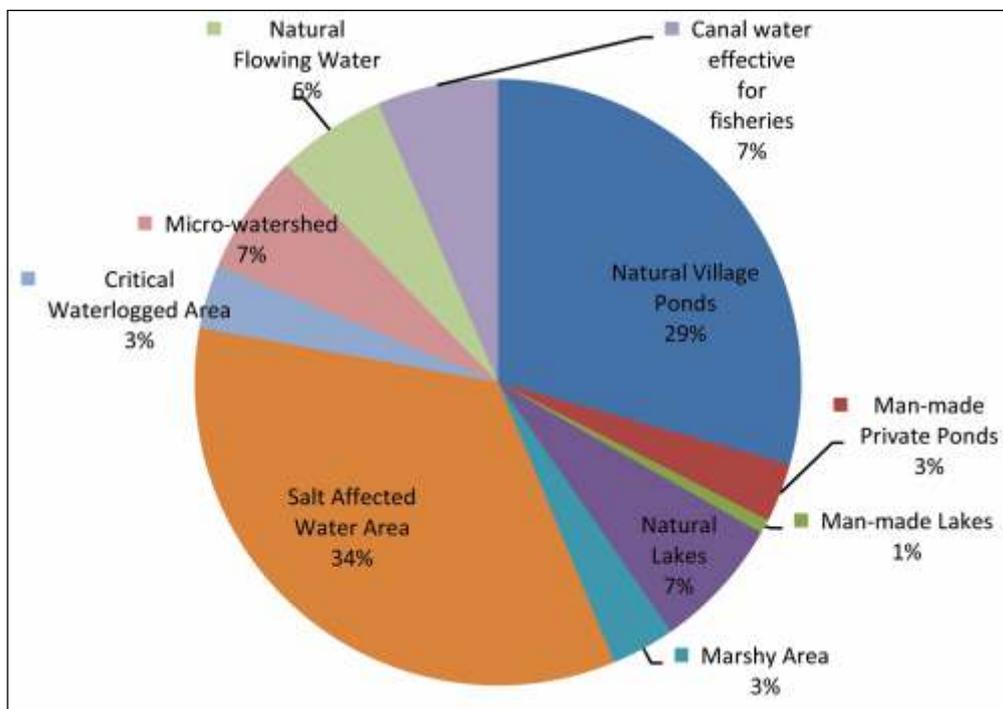


Fig 2.1. Percent distribution of resources available for fisheries in Haryana

Canal System cutting across the State irrigating mainly the semi-arid and arid plains. The lakes, both natural and man-made are mainly located in the north-eastern and south-eastern parts of the State in the districts of Gurgaon, Faridabad, Ambala, and Panchkula. These common property resources constitute the 'declining' type of resources as they have already been fished to the maximum without commensurate stock enhancement and sustainability measures.

The second category of pond resources constitute nearly one third of the total area (32%), and consist of both the Panchayat owned common property natural village ponds (29%) and the privately owned man-made farm ponds (3%). These culture based fishery resources are the most important ones from fisheries point of view, as > 95% of present fish production is coming from them. There are about 8000 such resources located across the State though some districts have greater share of them.

The third category, that of unproductive agricultural lands in the form of waterlogged areas, salt affected areas (both saline and sodic), marshy lands and micro-watersheds constitutes almost half of the total available resource (47%). Though they remain largely unutilised as of now, they remain the only and largest potential source for aquaculture in future. They are variously categorized as 'problem' soils as they require certain ameliorative measures to make them suitable for crop cultivation, or 'fragile' areas due to their precarious ground water and surface soil regimes, or 'unproductive' lands from crop production perspective. Though the extent of such salt affected areas is vast in Haryana, only a minimum area of 20,000 ha has been considered suitable by Fisheries Dept. from fisheries / aquaculture point of view.

The Table 2.2 below provides the division wise availability of resources suitable for fish culture (District wise resource details are given in the fig 2.2). It may be noted that district/division wise areas for rivers/rivulets, canals, lakes, and micro-watersheds were not available and hence they have been discussed separately.

Table 2.2.Division Wise Share of Resources Suitable for Aquaculture in Haryana (2009-10)

Sr. No.	District Name	Village Ponds %	Private Ponds %	Waterlogged Areas %	Salt Affected Areas (%)	Total Resource Areas (%)
1.	Hisar Division	38	20	40	46	41
2.	Gurgaon Division	26	50	30	31	30
3.	Rohtak Division	28	17.5	30	22	24
4.	Ambala Division	8	12.5	0	1	4.5
	Total Haryana (ha)	17,225	1,840	2,000	20,000	41,065

As far as village ponds are concerned, Hisar, Sonapat, Jhajjar, Sirsa, Bhiwani, Kaithal, Jind, Mewat & Mahindergarh districts each have more than 1000 ha of ponds and together contribute > 60% of pond area. Where private ponds are concerned, five districts viz; Palwal, Mewat, Hisar, Karnal and Rohtak alone contribute nearly 60%. In terms of the 'problem soils' suitable for fisheries (salt affected and waterlogged), Mewat, Palwal, Hisar, Sirsa, Rohtak, Fatehabad and Bhiwani districts constitute nearly 80% of these areas.

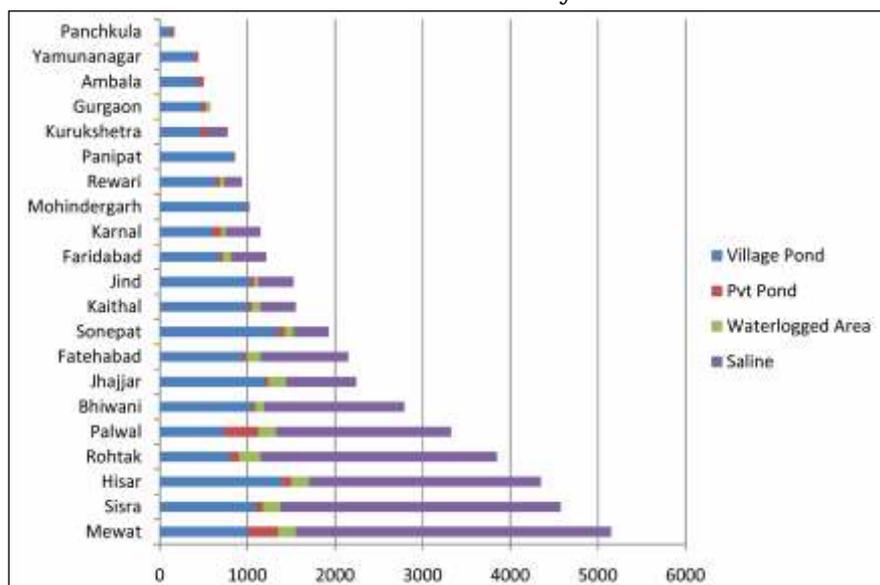


Figure 2.2 District wise resource area (ha) suitable for fish culture in Haryana

Considering the total area in each district, the top six districts in terms of available area are Mewat, Sirsa, Hisar, Rohtak, Palwal and Bhiwani in that order making up nearly 60% of total area in the State. Considering Division wise, Hisar has 41% of all resources in the State followed by Gurgaon with 30% and Rohtak with 24%. Ambala is least important from fisheries perspective except for its larger share of canal and lake resources (fig 2.3).

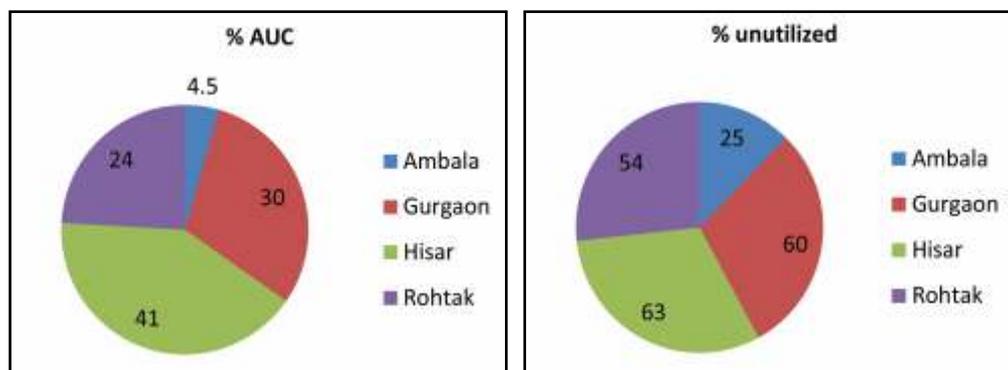


Figure 2.3 Division wise Area Under Culture (AUC) and Unutilised Area (%)

Extent of utilisation of water resources for fisheries

The extent and type of utilisation of various resources for fish culture purposes varies by resource types as well as geographic and agro-climatic conditions.

Utilisation of pond resources for Aquaculture: Pond resources especially the common property village ponds are most highly exploited (91%) among all the resources and are perhaps the mainstay of aquaculture at present. It is understandable that in a non-traditional fish farming State, village ponds require minimum investment and pose a little risk while they render themselves readily for fish farming practices for the new comers with little or no experience. Farmers, however, have adopted various culture practices and even innovated with species and management practices leading to relatively higher productivity.

Here, 50-60% of area is stocked with Indian Major Carps (IMC) especially rohu and catla along with common carp whose seeds are available as early as march/April. While IMC seed, mainly in the form of advanced fry, is available usually in June/July. Common carp is stocked in about 15-20% of ponds. Around 25-30% of

the ponds are stocked with the exotic and carnivorous African Catfish though it is a prohibited species for culture. At least about 5% of ponds are infested with tilapia fish which breeds frequently and auto-stocks in perennial un-drainable ponds. The grow-out season is 8-10 months though it varies due to seasonality of water availability in village ponds in different regions. Though the majority farmers stock once and harvest once, multiple stocking and multiple harvesting are being practised by many innovative farmers especially in perennial ponds extracting maximum benefit from per unit area.

It is important to note that only 66% of 1205 ha private ponds are under culture though the presently underutilized ponds were once made and utilized for fish culture. DoF attributes the changing land use pattern to urbanization, industrialization and resultant real estate development. Farmers complain about the economic unviability of carp culture in privately owned ponds and call for more remunerative high value candidate species for culture. As compared to village ponds, private ponds are less productive and hence require additional input use in the form of fertilisers and feed leading to high input cost. Village ponds are enriched regularly by the cattle manure and washings thereby having higher productivity and require little input except fish seed. Besides, erratic power supply and higher power tariff lead to greater pumping and water charges which is almost nil in case of village ponds. Weak extension support system is also another reason. It was noticed that most of the farmers who once practiced fish culture in private ponds have leased in more village ponds, and have either reduced culture area in their own ponds or abandoned it altogether, affirming the continued profitability of fish culture in village ponds and its opposite in private ponds.

Utilisation of Salt affected and waterlogged areas for aquaculture

Of the 20,000 ha of salt affected areas and 2000 ha of waterlogged areas available and suitable for fish culture in 15 districts, only 123 ha (0.52%) of salt affected areas and 104 ha (6.2%) of waterlogged area have been brought under culture so far. These little efforts / initiatives have happened only in the districts of Mewat, Palwal, Hisar, Rohtak and Sirsa which together account for almost 100% of

area under culture in this category. Mainly carp culture is being practiced in these marginal / problem soils. Lack of any major program or scheme targeted toward these areas; and that of technological backstopping through adaptive trials and demonstrations were major reasons for the dismal state. However, these soils were identified and considered as potential areas for fish culture only during the last 10-15 years. However given the fruitful R&D efforts at CIFE Rohtak Centre demonstrating the technological feasibility and economic viability for aquaculture in such areas, these must be brought in focus for fisheries development in immediate future.

Utilisation of Lakes, Rivers & Canals for Fisheries

Data on detailed utilisation status of capture fisheries resources namely lakes, rivers, canals are not available from DoF. However, their status has been assessed based on limited literature and personal interaction with DoF staff. The man-made (10 no. 443.5 ha) and natural (9 no. 4147 ha) lakes are being utilised for fisheries but not upto their potential, whereas fisheries in rivers, rivulets and drains (3406.8 km) is on decline. The irrigation canals along with their numerous distributaries (16647.3 km) are hardly exploited for their fisheries potential except for exploitative fishing practices.

The lakes / reservoirs are leased out to either fisheries cooperative societies or private contractors through auction under the Haryana Fisheries Rule 1996 framed under Punjab Fisheries Act 1914. Though all lakes are leased out and fishing is practiced, fisheries management both from production and biodiversity conservation perspective is very poor. Stocking of fish seed is said to be inadequate while indiscriminate / destructive fishing is widely practiced leading to poor production and decline in species over the years. It is reported that contribution of total fish landing from natural water resources was almost 80% upto 1980-81, but has decreased to mere 4% by 2006-07 i.e. about 2000 tonnes / year. While 77 species were reported in 1980-81, only 55 were found by 2003-04 though it has slightly increased to 60 in 2006-07.

Rivers, canals and drains are the other major sources for capture fisheries in Haryana. Although, there are 14 rivers and rivulets, yet the Yamuna and Ghaggar rivers are the only potential sources from fisheries point of view. The remaining

rivulets pour water into these two rivers. There are 94 drains in the state which collect the over-flow water from fields and join rivulets and rivers. The state has 3 main canal systems i.e. Western Jamuna Canal System, Bhakra Canal System and Lift Canal System. It is reported that 55 species of fish are available in these natural water bodies. Fish production from the natural water bodies is declining fast. Fisheries Department, Haryana regulates the fisheries in natural water bodies under Indian Fisheries Act 1897 and Punjab Fisheries Act 1914 and Haryana Fisheries Rule, 1996 framed there under. The present fish production from these waters is 120 kg per km per year.

Mahseer is the prime angling fish in upper reaches of river Yamuna in district Yamuna Nagar. Angling / sports fisheries is promoted to limited extent through awareness camps with conservation focus as upper area of river Yamuna is banned for commercial fishing using nets. Mahseer and Indian major carp fish seed is stocked in natural waters for sustaining fisheries. Close season during Monsoon is said to be observed for development of fisheries in natural waters.

Fish Production and Productivity during IX, X & XI Plan Periods (1997-2011)

Total fish production of Haryana during 2010-11 was 93,950 tonnes from 17,094 ha of culture area with average productivity of 5.5 tonnes / ha. In addition, 2500-3000 tonnes is produced every year from 4,590 ha of lakes and 7,197 km of rivers and canals with average productivity of 435 kg/ha and 120 kg/km respectively. Thus the total estimated fish production of Haryana from all sources was 96,814 tonnes in 2010-11. Comparing this with the scenario two decades ago, the growth in aquaculture development seems tremendous. To put it in perspective the production was 600 tonnes and culture area was only 58 ha with average productivity of 1600 kg/ha while total production from all sources rose to 23,200 tonnes in 1990-91.

As shown in the fig 2.4, the fish production during the last three plan periods (1997-2011) has grown three times from 32,050 tonnes in 1997-98 to 96,814 tonnes in 2010-11 with an impressive annual compounded growth rate of 11.41% while the national average inland fish production grew two times

by about 6% annually. For the same period the culture area has grown 8.29% /year while productivity has grown 2.23% annually.

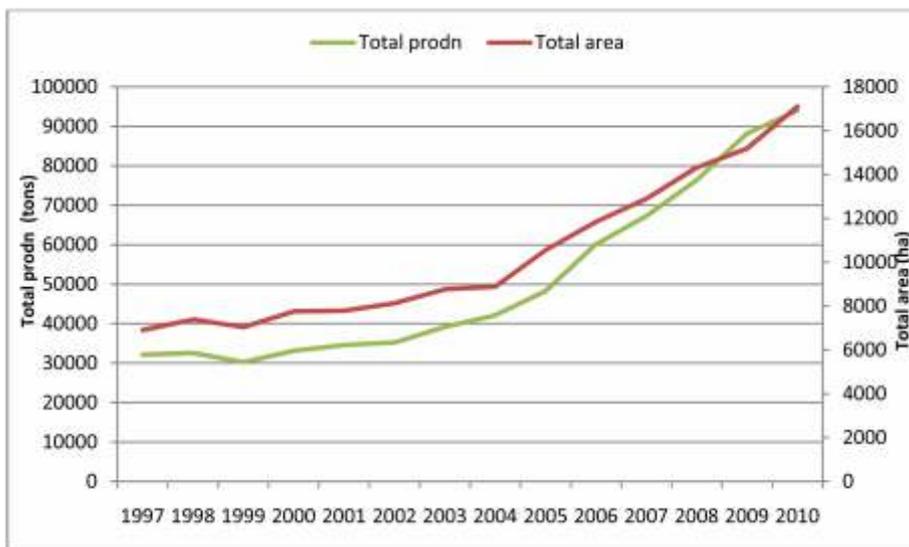


Fig. 2.4 Total area under fish culture (ha) and fish production (tonnes) in Haryana (1997 to 2010)

Closer examination of growth during different plan periods (Table 2.3) reveals certain interesting features. Overall the growth performance during X Plan period was the most impressive in terms of area (10.3%), production (14.6%) and

Table 2.3 Growth Rate (Plan Period wise) of Area, Fish Production and Productivity during 1997-98 to 2009-10, Haryana

S. No.	District Name	Area CGR%	Production CGR%	Yield CGR%
1.	IX Plan 1997-98 to 2001-02	2.94	1.75	-1.25
2.	X Plan 2002-03 to 2006-07	10.34	14.61	3.55
3.	X1 Plan 2007-08 to 2010-11	9.57	11.84	2.39
4.	1997-98 to 2010-11	8.29	11.41	2.23

productivity (3.55%) while the growth was minimal during IX Plan. What is worrying is that the momentum seemed to have dissipated during XI plan especially in terms of productivity gains when growth dropped by almost one third compared to X plan. With almost 91% of pond resources having been brought under culture, growth in area can happen only if innovative programs are designed for bringing waterlogged and salt affected areas under aquaculture.

When growth is reviewed district wise, fish production has grown much faster than the State average in Sirsa, Kaithal, Hisar, Panipat and Fatehabad districts while productivity grew faster than average in the major culture districts of Gurgaon, Karnal, Hisar, Rohtak, and Mewat. That the growth in productivity has been almost negligible or negative in the districts of Sirsa, Faridabad, Jind, Jhajjar, Kaithal and Yamunanagar needs further investigation and attention.

Growth performance of fisheries sector is more impressive during XI Plan (Table 2.4) as compared to other sectors of agriculture, a trend noticed across many of the States establishing fisheries as a growing sector with large untapped potential. However, this higher growth has not been able to make much dent in overall agriculture growth rate due to minor contribution to State agricultural GDP in Haryana.

Table 2.4 Growth of Agriculture and Allied Sectors in 11th Plan, Haryana

Sectors	2007-08	2008-09	2009-10	2010-11	2011-12	Overall
Agriculture	-0.3	7.5	-1.6	6.3	5.1	3.4
Forestry	3.3	2.7	2.4	2.9	3.1	2.9
Fishing	11.9	13.3	15.5	6.6	11.9	11.8
Agriculture & Allied (Haryana)	0	7.3	-1.3	6.1	5.1	3.4
Agriculture & Allied (All India)	5.8	0.1	1.0	7.0	2.5	3.3

Source: Economic Survey 2011-12, GoH

Performance of Fish Farmers Development Agency (FFDA) Program

The Centrally Sponsored Scheme on Fish Farmers Development Agency (FFDA) has been the single most important flagship freshwater aquaculture development program in the country during the last three decades. The program was implemented in Haryana as well. Under the program an autonomous agency FFDA was set up in each district (18 in all), except in newly created districts of Panchkula, Mewat and Palwal. Creation of awareness and popularization of modern fish farming, providing training, technical support and financial assistance to farmers in the form of subsidy for construction/renovation of ponds and input subsidies for fish seed and feed were primary activities under the programme.

Since inception of the scheme in 1976 till 2010-11, FFDA program has brought 1,05,060 ha area across India under fish culture and has benefitted about 13,85,177 farmers (DAHDF Annual Report 2010-11) i.e. an average of 3,500 ha and 39,500 farmers every year. According to the data provided by DoF, Haryana, a total of 26,857 ha i.e. an average of 1918 ha/year has been covered under the program FFDA program during last three plan periods (1997-98 to 2010-11) which is, in fact, rather very high. However, the FFDA program was implemented differently in Haryana as compared to many States, owing perhaps to certain unique resource characteristics in the State and hence comparison with national average and other States may be misleading. While elsewhere, FFDA program was mainly focused on bringing potential new privately owned areas under aquaculture by training new farmers, in Haryana, almost two third of the area under the program is accounted by Panchayat owned village ponds and beneficiaries covered were mainly lease holders of these ponds who are only provided monetary assistance under FFDA during the lease period. No data is available as to the extent of new area-village ponds or private ponds that was brought under fish culture through FFDA program in Haryana though that proportion would be minimal considering that total culture area in 2010-11 itself was only 17,094 ha.

Had the FFDA program focused more on bringing hitherto uncultured areas including the potential waterlogged areas in some districts, the total area and production would have gone up further. It is also intriguing to note that productivity

in FFDA covered ponds (4.96 tonnes/ha/year) were lower than the non-FFDA ponds (5.55 tonnes/ha/year) in Haryana (see Fig.2.5), though the overall productivity of Haryana is about two times higher than the national average. This is contrary to the national scenario where FFDA ponds (2.6 tonnes/ha/year) were reported to be more productive than non-FFDA ponds (< 2 tonnes/ha/year) though. Two possible reasons may explain this: FFDA program has not made any significant contribution in terms of improving productivity in ponds through training and technical support to the farmers. Secondly, majority of non-FFDA ponds in Haryana have intrinsically higher productivity being largely fertile village ponds while FFDA ponds are intrinsically less productive due to many being newly constructed private ponds. However, productivity of FFDA ponds were consistently less during all the plan periods indicating the systemic failure in the way the program is designed and implemented in the State. However, the redeeming feature is that this yield gap between FFDA & non-FFDA ponds is reducing over the Plan periods.

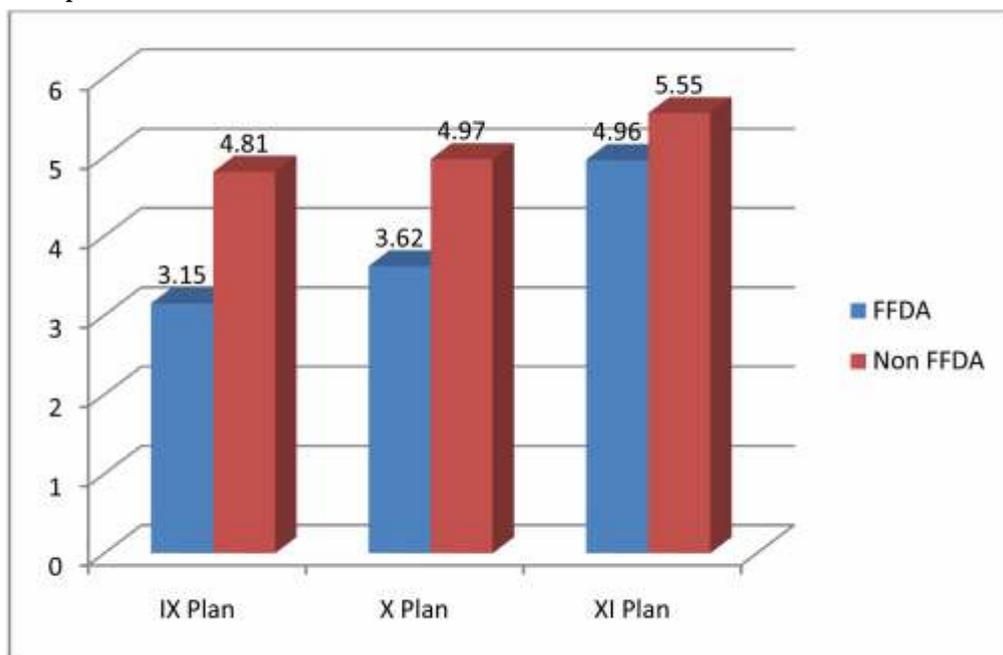


Fig 2.5 Comparison of fish productivity in FFDA and Non-FFDA aquaculture ponds during IX, X and XI Plan Periods, Haryana (tonnes/ha)

Fish seed production and hatcheries

Detailed seed production data is not available, and what is available in the public domain from DoF, Haryana and DAHDF, GoI is rather scanty and in many cases lack clarity as to seed production vs. seed stocking, seed production from private vs. public hatcheries, seed produced from within Haryana vs. produced from other States, and as to the size of fish seed namely fish spawn, fry and fingerling. However, the existing data from multiple sources have been compiled to get some ideas about the status.

At the end of X Plan (2006-07), fish seed production was reported to be 277million fry while the total fish seed stocked was 331 million fry. It is reported that fish seed stocking rose to 346 million fry in 2008-09, 430 million fry in 2010 (till December) and 459 million fry in 2011 (till December) has been stocked table 2.5. Given the reported fish production of 93,950 tonnes in 2010-11 and assuming 30% survival rate from fish fry stage to harvestable size of 700 gm. in pond environment, the seed stocking of fish fry should have been about 450 million fry, which is almost the same as reported stocking.

Table 2.5 Fish seed (million fry) production of Haryana (IX, X & XI Plan)

Years	Fish Seed Production (Million Fry)			Total India Seed Production
	Public DoF Seed Farms (15 No.)	Private Seed Farms (16 No.)	Total Haryana	
1997-98	NA	NA	151.7	15,904
1998-99	NA	NA	168	15,156
1999-00	NA	NA	177	16,589
2000-01	NA	NA	177.6	15,608
2001-02	NA	NA	180.5	15,758
2002-03	36.3	168.8	205.1	16,333
2003-04	41.2	205.9	247.1	19,231
2004-05	NA	NA	249.6	20,790
2005-06	NA	NA	282.1	22,614
2006-07	NA	NA	276	31,688
2007-08	NA	NA	308	24,143
2008-09	NA	NA	332.2	32,177
2009-10	NA	NA	430*	32,254
2010-11	100^	300^	459*	NA

Source: Compiled from several sources of DoF, Haryana, Haryana State Gazetteer 2005, Haryana Economic Survey 2010-11 & 2011-12 and Annual Reports of DADHF, GoI.

*Figures for 2009-10 & 2010-11 refer to 'seed stocking' as against 'seed production' which may not necessarily be same.

^ Report presented by Director, Fisheries, Haryana in Hisar stakeholder Workshop (30/7/2011)

It is not clearly evident as to what proportion of the 450 million fry was actually produced from within Haryana by private and public hatcheries in order to understand the performance of existing seed production infrastructure in Haryana. In 2007-08, there were 15 functional hatcheries / fish seed farms under DoF, 16 fish seed hatcheries & 45 rearing units in private sector, (though their respective production details are not available except for two years,) besides one Ornamental fish hatchery at Saidpura, Karnal and desi Magur fish hatchery at Badkhal, Faridabad.

The Table 2.8 above shows that Haryana produces roughly 1% of fish seed though it's share in table fish production is about 2%. The seed production doubled between 1997-98 and 2008-09 mirroring the all India trend. Importantly, 15 public seed farms under DoF produced only 20% of State's seed while 80% came from 16 private sector farms during 2002-03 & 2004-05 indicating abysmal performance of public sector seed farms. Scenario did not change in 2010-11 as public sector contribution remained almost same at 22%. Field visits and interaction with DoF staff and private hatchery operators further confirmed almost defunct nature of all but one public sector hatchery in Kurukshetra. Most of the DoF seed farms / hatcheries primarily buy spawn from either nearby private hatcheries or from other States, rear them in nurseries to fry stage for 2-3 weeks and distribute them to beneficiary farmers at subsidized rates under FFDA and other programs. Contrary to what has been reported, at least one third of State's seed requirement is being met by seed supply from Uttar Pradesh and West Bengal. It may be noted that the four States of West Bengal (42%), Andhra Pradesh (31%), Assam (6.5%) and Uttar Pradesh (3.5%) together produce 83% of total carp seed requirement in the country and the surplus seed from West Bengal meets nearly 25% of India's total seed requirement.

Though the structural constraints like water scarcity, seepage and faulty layout / designs did play havoc in (non)performance of many DOF hatcheries, management problems like lack of adequate brooder fish, lack of adequate technical staff, in appropriate working time, procedural bottlenecks in meting out contingent but petty day to day expenditure, lack of interest among staff are the main culprits for malfunctioning of most of the public sector hatcheries and seed farms. The story is similar in various other States like Rajasthan, Bihar, Maharashtra and even Andhra Pradesh.

In short, commercial activities like carp seed production for which technology has been perfected and available freely for long should not be in the domain of public sector DoF as the private sector has been doing it more efficiently not only in Haryana but also in most of the States.

2.2. Fish Markets and Consumption

Fish markets and marketing

Of the total fish production of about one lakh tonnes, approximately 20-25% is being consumed in the State while the rest is marketed outside the State mainly in Delhi markets (60-65%) and Punjab (15-20%). In order to provide marketing support to fish producers, DOF has established modern fish markets at three places in Faridabad, Yamuna Nagar and Panipat while two more markets are established with a total cost of 84 lakhs in Gurgaon and Bahadurgarh in order to strengthen the post-harvest infrastructure in the State. The superintending and supervision work of these 3 fish markets has been given to the Haryana State Agriculture Marketing Board. There is a provision of vehicles in these markets which are provided to fish farmers for transportation of their produce from pond site to the markets at the concessional rates.

Under the Centrally Sponsored Scheme on Strengthening of Post-Harvest Infrastructure, GoI provides assistance to Govt. undertakings, NGO's/Cooperatives/Joint Sector/Assisted Sector/Private Sector for establishing marketing infrastructure in the State. So far it is not evident that anyone has benefitted from the scheme. However, a processing plant has come up near

Nilokheri, Karnal in private sector with NFDB assistance which is a first of its kind in India for processing freshwater fish and preparation of value added products. It became operational in 2011 and produces ready to eat and cooked fish products with the brand name 'Fish Bite'. Recently, a modern retail outlet cum eatery has been opened with same brand name near Karnal by the enterprising farmer.

Since there is enough demand from the large and growing Delhi/NCR market and Haryana being in close proximity to Delhi, marketing of fish would not face any major problem. However, training on post-harvest practices such as handling, sorting, packaging, storage and transportation, and establishing/sharing cold storage infrastructure for fish are elementary but critical requirements for getting greater unit value. Besides, strengthening / modernising local urban markets would help increase consumption within the State.

Fish consumption

Haryanvi population is predominantly vegetarian. Till early 1980s, farmers were unwilling to farm fish primarily due to general cultural non-preference to eat non-vegetarian food. Fish consumption in States like Haryana, Rajasthan, Gujarat, Punjab, Himachal Pradesh, Madhya Pradesh had been negligible historically with average consumption of < 2 kg / household / year on average, according to NSSO surveys. However, the trend seems to be changing during the past two decades across the so called vegetarian States due to changing food consumption patterns fuelled by urbanization, migration, increasing purchasing power, easy availability of fish and lower prices, health consciousness, etc. According to an article in Outlook magazine, based on 61st NSSO survey for 2004-05, Haryana, Himachal Pradesh, Punjab report a seven-fold increase in fish-eating households in the past few years where the consumption in urban households has gone up significantly in the last decade. For example, 54 out of 1,000 eat fish now, compared to only 16 a decade ago in Haryana. Fuelling the trend, the MNC retail major Walmart-Bharti has opened more than two dozen retail outlets selling fish, chicken and meat in Haryana and Punjab in the last few years and insiders say the sales are picking up with major share of fish being sold during winter months.

However, per capita fish consumption would continue to be low for a long time in

Haryana as compared to the national average of 9 kg that is increasing much faster, though Haryana has the highest per capita income in the country. More than income, cultural factors seem to play a far more determining role in terms of food habits. The change may only be incremental and slow that can become discernible only after a decade or two. So the main market in the near future would continue to be outside the State, mainly Delhi which is growing fast and is emerging as one of the largest market for fresh water fishes.

2.3. Directorate of Fisheries, Extension System and Budget Support

Fisheries Department in joint Punjab is one of the oldest departments of the country that was established in 1912, though a little later it was merged with Agriculture due to economy expenditure during World War I. However, the post of Director/Warden, Fisheries was retained. Later on in 1966 after State reorganization, Haryana Fisheries Department came into existence. During the last 45 years, Dept. of Fisheries (DoF) has grown in terms of its scope, objectives, programs and activities along with human resource (technical and non-technical staff), budget provisions, etc. Its major focus has shifted from capture fisheries two decades ago to aquaculture with its own vast seed production infrastructure, and freshwater development programs.

Presently, the DoF has redrawn its main objectives and activities that are very precise and focused, as under:

- i. To manage and conserve the natural fisheries in rivers, canals, drains and other water bodies.
- ii. To utilize available village ponds and tanks for fish farming.
- iii. To provide technical and financial assistance to fish farmers through Fish Farmers Development Agencies.
- iv. To create a class of trained fish farmers in the state.
- v. To increase the production of quality fish seeds of all species.
- vi. To utilize unused waste agricultural land for fish farming.
- vii. To create additional employment opportunity in rural area.

According to the Director, Fisheries, the DoF till now has brought about 18,000 ha area under fish culture while it was 58 ha in 1966 with nearly 1 lakh tonnes of fish production and has crossed the target kept for XI FYP (2007-2012). He indicated the following infrastructure available with DOF for fisheries development: 15 State govt. seed farms and equal number of hatcheries; 18 number of FFDAs, One Training Institute (ARTI) at Hisar, 114 Field officers with DoF. Higher land price in the State has led to decline in private ponds i.e. from 2000 ha earlier to 1200 ha as of now. Major resource is village community ponds that are very high yielding without external inputs as they are washed by good no. of cattle population and hence 90% of village ponds are on lease earning > 25 crores of lease money / year. There is one Health Care Centre each in all 21 districts though very few diseases are reported. Fifteen poly clinic aqua shops are available at every seed farm while a full- fledged State diagnostic lab has been set up at ARTI, Hisar. Ornamental fish hatchery is established at Karnal. There are 13000 fish farmers on roll with each being assisted by 2-3 labours / partners (Elsewhere in DoF website it is indicated that the no. of fish farmers were to be increased to 20,000 by 2011-2012, while persons engaged in fisheries trade were to be increased to 60,000 by 2011-2012).

However, fish farmers from Hisar, Karnal and Rohtak during interaction meetings expressed ignorance of any health care centres / aqua poly clinics being availed by them while they tried in vain to resolve their practical problem of fish mortality in over stocked and polluted village ponds with high organic load. The lack of detailed information from DoF side does not let reasonably assess the utility of public sector seed farms, health care centres and activities of its training centre at Hisar.

DoF Staff Position

As of 2010-11, the total staff strength i.e. in position with Dept. of Fisheries, Haryana (Table 2.6) was 532 out of which 141 belonged to technical cadre including senior officers/management, 131 belonged to administrative cadre and 260 were supporting staff. The sanctioned strength was 707, which means nearly 25% vacancy existed, though the vacancy among middle and lower level technical cadre was as high as 34%. Probably, vacancy level may be similar to other development departments in Haryana or Fisheries Departments of

other States given the moratorium on fresh recruitment, but higher proportion of shortage of technical staff in the fastest growing food production sector would mean a premature death knell.

Table 2.6 Status of Human Resources available with DoF, Haryana 2010-11

Sl. No.	DoF Staff Cadre	Sanction Position	Filled up position	Vacancy	Percent Vacancy
1.	Senior Officer (A)	10	7	3	30.00
2.	Officers (B)	39	32	7	17.95
3.	Technical Staff (C)	155	102	53	34.19
	Total Technical Cadre Strength	204	141	63	30.88
4.	Administrative Staff (C)	185	131	54	29.19
5.	Supporting Staff (D)	318	260	58	18.24
	Total DoF Staff Strength	707	532	175	24.75

But, what is more worrying is the placement of technical staff in Head Quarters vs. Field Offices, and the lower proportion of staff in fisheries important districts. Closer scrutiny of the staff position provided by DoF, Haryana (fig 2.6) reveals that of the total filled in position (141) in the technical cadre, 64% only are in the district level posting while 36% are in HQ and 8% are in fish farms and the Hisar training institute (ARTI).

Thus, for instance while Ambala Division has only 4.6% water resource area suitable for fish culture in the State, it has nearly 17% of technical staff posted, (fig. 2.7) while Gurgaon and Hisar Division have far less proportion of posting of the existing staff than their water resource area demands and only in Rohtak Division the staff strength and resource area seem to match.

From another perspective, on an average a single technical staff has to cover only 121 ha of resource/culture area in his district as of now which is very low

compared to most of the other States, where effective services can easily be delivered. This catchment area has to increase to 284 ha if the total available area in each district is to be brought under aquaculture.



Fig.2.6 Status of Human Resources available with DoF, Haryana 2010-11

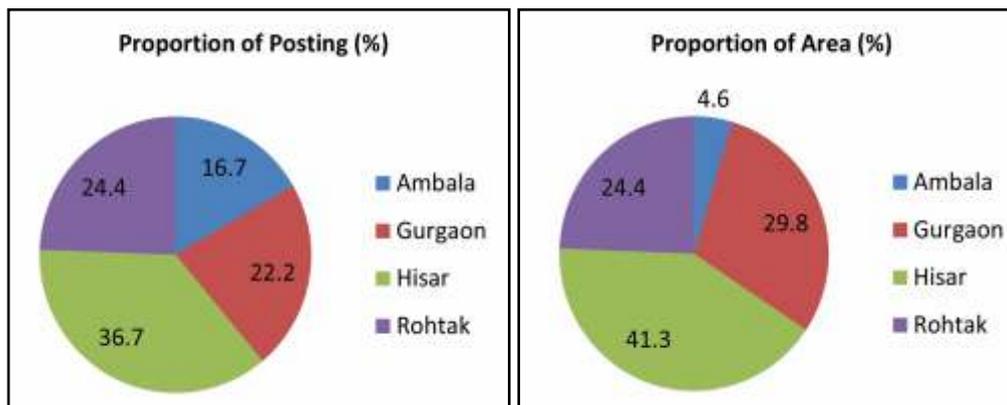


Fig 2.7 Division wise DoF Staff posting and Water Resource Area (%)

Human Resource Development

Recognising the importance of HRD, especially for a non-traditional fish farming state, training Centre namely Aquaculture Research & Training Institute (ARTI) at Hisar has been established under the World Bank Project with objectives to impart in-service training of the departmental officers as well as hands-on training to fish farmers. The Plan Schemes of Education, Training & Extension, and Utilization of Saline Ground Water have been merged with the scheme. During X and XI Plan period almost 2000-2500 farmers were reported to have been trained every year on modern fish farming by DoF at ARTI and other programs. It's not known, though, how many of the trainees have actually taken to fish farming subsequently. Similarly, no information is available on how many DoF staff had been trained during last five years at ARTI or elsewhere. Farmers' feedback did suggest technical inability of many of the DoF staff to resolve their field level problems. There exists neither any incentive nor disincentive for undergoing capacity development program for DoF staff.

DoF implements many developmental programs. The Table 2.7 below provides comprehensive list of Plan schemes, both State and Central, which were in force during X Plan, and probably have been continued during XI plan as well. While the programs cover the entire gamut of fisheries development, for a small State with limited fisheries resources, there appears to be too many programs, a few of which are overlapping. For example, there are three freshwater aquaculture development programs, two programs for aquaculture in saline areas, three programs on seed production, and two programs on capture fisheries. It would only lead to diffused effort while piling up more paperwork and thus higher transaction cost leaving little time for technical support.

Table 2.7 Fisheries Development Programs during 2005-06 (X Plan)(in lakhs)

S.No	Program Description	Annual Budget
A	Non-Plan Schemes	388.82
1.	Direction & Administration a. Head Quarter Staff & b. District Staff	30.39 + 124.31
2.	Scheme for the Establishment of Fish Seed Farm	72.27
3.	Development of Fisheries in Lake, Reservoirs and Reverine	23.05
4.	Fish culture of Carps	89.19
5.	Intensive Fisheries Development Programme	44.30
6.	Establishment of Research & Investigation	5.31
B	State Plan Schemes	429
7.	Intensive Fisheries Development Programme (To sustain fish culture)	177
8.	National Fish Seed Programme (To produce fish seed)	182
9.	Development of Fisheries in running water (To develop fisheries in natural waters)	3
10.	Agriculture Human Resources Development (Training & extension)	57
11.	Development of Fisheries in Marshy Area, Cat Fish and Sewage Fed Fish Culture (Mobilization of resources & introduction of new species)	10
C	Centrally Sponsored Schemes on Sharing Basis	460.2
12.	Estt. of Fish Farmers Agencies-(75:25 basis) (Providing technical & financial assistance for fish culture)	376
13.	Fisheries Education, Training and Extension (80:20 basis) (Preparation of extension material, manual & training)	32.5
14.	Development of Fisheries in Water Logged Area (75:25 basis) (Mobilizing of water logged areas along canals system for fish culture)	14.1
15.	Utilization of Saline/ alkaline Soil/Water for (75:25 basis) (Mobilizing of saline/ alkaline soil for fish culture)	18
16.	Development of Inland Capture Fisheries (75:25 basis) (River/ Reservoirs) (To sustain fisheries in natural water bodies and assistance for boat and nets to the fisherman)	19.6
17.	D. 100 % Centrally Sponsored Scheme: Strengthening of Database and Information Networking for Fisheries (To develop information networking at district level)	26.35
E.	New Centrally Sponsored Schemes	120
18.	Development of Cold Water Fisheries (75:25 basis) (To develop low attitude cold water fishes)	14
19.	Establishment of Ornamental Fish Hatchery (75:25 basis) (To develop ornamental fish-a new avocation of employment)	6
20.	Post-Harvest Infrastructure-(100% basis) (To construction two new Fish Market-a new avocation for unemployed youth)	100
21.	F. Pilot Projecton Freshwater Prawn Farming (100% basis) (for promotion of prawn farming-implementation from 2003-2004)	275
	Total DoF budget outlay for 2005-06 (Rs. In Lakhs)	1699.37*

*However, actual budget allocation for 2005-06 was Rs. 1426 lakhs & expenditure Rs. 1410 lakhs

Linkages with Development Departments

Fisheries resources are primarily agricultural resources in Haryana, be it village ponds, canals and waterlogged areas, or saline soils. Agriculture Department has strengthened its Extension Network by inducting 143 new ADOs during 2010-11 with 2 Months' mandatory training, and has been strengthening electronic and print media like distributing the monthly magazine Krishi Samvad free of cost in all villages of the State. It is not known whether any functional linkages / collaboration exist between Fisheries and Agriculture Departments as some of their functions and areas overlap while both target often the same group of farmers.

Similarly, under National Horticulture Mission, besides increasing area under horticulture crops and productivity, Haryana claims to have created/constructed 1886 water ponds covering a total catchment area of approx. 7,000 ha ensuring 100% plant survivability (Haryana Annual plan 2010-11). However, these water resources have not been considered as a potential resource for fish farming. It was evident during the consultative meetings that some of the KVKs are keen to utilise these resources for fish culture.

Budget Support and Utilisation

Started with a paltry Rs.3.15 lakh non-plan only budget in 1966, the total DoF budget has reached a whopping Rs. 9,040 lakhs during XI Plan (2007-12), an increase of 2.7 times from IX Plan (1997-2002).

Table 2.8 Budget allocation and expenditure during IX, X & XI Plan Periods

Plan Periods	Budget Allocation (Lakhs)				Expenditure (Lakhs)				% Utilization			
	Plan	Non-Plan	C.S.S.	Total	Plan	Non-Plan	C.S.S.	Total	Plan	Non-Plan	C.S.S.	Total
IX FYP	1373	1428 (35%)	1343	4144	1513	1382 (32%)	1390	4285	110	97	104	103
X FYP	2645	1849 (33%)	1058	5552	2561	1850 (34%)	963	5374	97	100	91	97
XI FYP (2007-11)	3010	5308 (59%)	722	9040	2827	5182 (60%)	587	8597	94	98	81	95
% increase IX to XI FYP (annualised)	274%	465%	67%	273%	234%	465%	53%	251%				

The budget expenditure / utilisation is satisfactory across Plan and Non-Plan budgets with 95% overall utilisation during XI Plan (till 2010-11), though it is a decline from 103% during IX Plan. Interestingly, there has been a sharp decline in utilisation of Central assistance (only 81%), and it requires explanation. More importantly, the hike in budget provision has more to do with increase in Non-Plan expenditure associated with Sixth pay Commission, than with any notable increase in Plan spending. Table 2.8 reveals the proportion of Non-Plan allocation and utilisation in total budget has almost doubled up from 32-35% in IX Plan to 59-60% in XI Plan, which is a cause of concern as increasingly less and less is available for development expenditure. Perhaps, in real terms it is possible that Plan spending might have in fact declined over the years or at best has remained stagnant.

According to DoF, revenue from different types of water bodies has increased to an average of Rs.70 lakhs a year during XI plan, from an average of Rs.40 lakhs during IX Plan years mainly from leasing and licensing of rivers, canals, lakes for fishing and disposal of illegally caught fishing. Besides, the Gram Panchayats earned about Rs.250 lakhs during 2010-11 from lease of village ponds for fish culture which has shot up in recent years due to increasing competition to lease the ponds indicating both the increasing profitability and popularity of fish culture in the State.

2.4. SWOT Analysis of Haryana Fisheries

a) Strengths

- Proximity of Haryana to the Delhi National Capital Region provides a huge and perennial market advantage to its fish given the limited consumption of fish within the State. It also provides excellent opportunities for sale of live fish and fresh from pond. Even now, about two thirds of fish produced in the State is said to be sold in Delhi NCR markets.
- Highest density of cattle especially buffaloes in the State provides natural fertilisation of village ponds, major fisheries resource, and other aquatic resources leading to perhaps highest per unit fish yield in the country from natural ponds.

- The human capital of Haryana in the form of highly progressive and innovative farmers is perhaps its biggest strength. It is evident from great strides made in agricultural crop production, dairying, and poultry. It may explain the fast growth in fish production during the last two decades in an otherwise traditionally non-fish farming and consuming State.
- Good road connectivity across the State helps in easy and cost-effective transportation of both table fish and fish seed.

b) Weaknesses

- Limited availability of readily utilizable aquatic / fisheries resources in the State is one of the main drawback. Village pond resources still constitute the only such resource which is almost fully exploited, while the lakes and rivers are in a State of decline. The remaining resources may involve considerable development cost to make them suitable for fish culture.
- Haryanvis are predominantly vegetarian and this cultural preference indicates that the State has to depend on external markets to sell its increasing fish production. While this is not a weakness per se as evidences show increasing fish consumption in urban areas and among the youth, it brings market related uncertainties into play.
- Extreme climatic and weather conditions of the State restrict active fish growing season to 7-8 months as fish growth is adversely affected by severe summer and winter temperatures and wind conditions. This often forces farmers to sell undersized fishes at less than competitive prices.
- Fisheries has been treated as a poor cousin to agriculture especially with respect to subsidization of electricity tariff, water use tax, income tax, transport subsidy, budget allocation, development priority etc. In a nutshell though aquaculture has similarities with agriculture as occupation and its importance in ensuring nutritional security, sadly it has not been treated at par with agriculture so far.
- There is inadequate field level technically competent extension staff to provide practical know-how to fish farmers as well as create awareness

among larger farming community about the profitability of aquaculture.

- Multiple ownership and management rights of water bodies, by Village Panchayats, PWD, Irrigation Department, Fisheries Department, with often conflicting interests are a deterrent for fisheries development. Though multiple ownerships inevitable in the era of decentralization and may even be beneficial in the larger interests, fisheries management rights should be vested with Fisheries Department.

c) Opportunities

- Unutilised but potential resources in the form of waterlogged and saline areas suitable for fish culture are available across the State. Since other existing resources are already fully exploited, these resources provide tangible opportunity in the near future. The area is only likely to increase in the State as 54% of ground-water is brackish and the freshwater is depleting 0.33 meter every year in the fresh water zone, while 50% of 113 blocks are considered over-exploited. Paradoxically, what is the bane of agriculture has to be converted into a boon for the fisheries.
- Present Haryana Government is positively disposed towards concerns of fisheries and aquaculture development. Recently, it has reduced the electricity tariff from Rs. 4.28/unit to Rs. 2/unit and waived off VAT on feed. Similarly, computerization and networking of all DoF offices across the State, upgrading and updating of the DoF website for effective communication are welcome initiatives. The very act of constituting Farmers Commission and then the Working Group on Fisheries Development under it indicates the emphasis on the sun rise sector.
- R&D backstopping from CIFE Rohtak Centre, Haryana Agriculture and Animal Sciences Universities, CIFA, CIBA, CIFRI, CSSRI and other ICAR institutions working in fisheries related research is an opportunity yet to be fully exploited.

d) Threats

- Increasing and competing demand for land and water resources due to growing urbanization and industrialization in the State aided by its proximity to Delhi NCR implies escalating cost of increasingly scarce land and water resources in the State and the subsequent unavailability of them for fish culture. The challenge lies in using marginal land and water areas for aquaculture profitable through innovative technologies and management.
- Exotic fishes like African Magur, Tilapia, Silver Carp and Common Carp have entered the natural water bodies of Haryana and have contributed to the depletion of aquatic biodiversity. Their continued presence is likely to further colonise the waterbodies and reduce the habitat for indigenous fishes.
- Possibility of technological failures in fragile areas: Since the technologies for inland saline areas are being perfected and demonstrated, it is necessary to have adequate safeguards and sustainable management practices in place during the adoption and diffusion phase so that the salt accretion / accumulation expected from a large scale saline aquaculture farming does not further deteriorate the delicate ground water balance.
- Governance and management failures: Many of the development bottlenecks are governance and management related rather than technology oriented and hence, require reforms in governance including effective input and services delivery system, putting transparent, fair and monitor able processes in place, developing necessary infrastructure and human capital, etc. Hence, the success or failure of new programs and strategies would hinge on them as much as, if not more, on the technological aspects.
- Market anomalies and failures: The input costs especially in the form of labour, fertiliser and quality feed have risen steadily while the market prices of food fish have risen only marginally during the last decade. This implies lower profitability unless productivity rises significantly or high market value fish species is opted for aquaculture. Labour shortage due to programs like MGNREGS is already affecting the primary labour intensive sector.

3.0 PROSPECTS AND STRATEGIES FOR FISHERIES DEVELOPMENT

3.1. Haryana Fisheries 2022

Based on the assessment of resource status, anticipated technological out flow and possible management interventions, two sets of fish production targets for the next 10 years, one for the XII Plan Period of 2012-17 and another for the XII Plan Period of 2017-22 have been visualised and presented in the table 3.1.

Table 3.1 Haryana Fish Production Targets 2017 and 2022

Sl. No.	Resource Type	No.	Area Available (ha)	Fish Production Targets 2017			Fish Production Targets 2022		
				Target AUC	Target Yield (kg/ha)	Target Production (tonnes)	Target AUC	Target Yield (kg/ha)	Target Production (tonnes)
1.	Village ponds (natural)	6000	17,225	17,225	6000	1,03,350	17,225	10,000	1,72,250
2.	Private ponds (man-made)	2000	1,840	2000	6000	12,000	2000	12,000	24,000
3.	Marshy area	-	2,000	1000	2500	2,500	2000	5,000	10,000
4.	Salt Affected water area	-	20,000	5000	2500	12,500	10000	10,000	1,00,000
5.	Critical waterlogged area	-	2,000	2000	2500	5,000	2000	10,000	20,000
6.	Micro-watershed	189	3,780	3780	2500	9,450	3780	6,000	22,680
7.	Effective length for fisheries from major canals & tributaries (total length-16647km)	-	3790 km	1500 km	300 kg/km	450	3000 km	600	1800
8.	Man-made lakes	10	444	-	-	-	-	-	-
9.	Natural Lakes	9	4,147	-	-	-	-	-	-
10.	Natural flowing water (2 Rivers, 12 rivulets & 94 drains)	108	3407	-	-	-	-	-	-
	Total Resource Area, Targeted AUC, Productivity & Production		58,632 ha	32,505 ha	4,468 kg/ha	1,45,250 tonnes	40,005 ha	8,767 ha	3,50,730 tonnes

AUC= Area Under Culture

A perspective plan is often a heuristic exercise in spite of detailed empirical basis, and hence the targets shall be considered more as guiding posts rather than as fixed mantras. It is estimated, on the conservative side, that the total fish production from Haryana can be enhanced to 1,45,250 tonnes by 2017 from the present

one lakh tonnes with expected annual growth rate of about 10%. The increase would come primarily from bringing one fourth of suitable salt affected areas and the all the identified water logged areas under aquaculture. Technology being new, the productivity expectation from these resources is kept at the minimal 2500 kg/ha. In addition, it is assumed that the productivity gain from existing pond resources would be marginal as they are already fully exploited.

However, if new candidate species with high growth rate like *Pangasianodon hypophthalmus* finds greater consumer and grower acceptance in the immediate future, the productivity gain will be significant as visualised during XII Plan. Similarly, greater technological success of shrimp culture (either tiger or white leg shrimp) in salt affected areas would witness a quantum jump in both areas under culture as well as unit area productivity as visualised during XII Plan. Hence, under such a scenario the expected fish production (3,50,730 tonnes) by the end of XII Plan (2017-22) would be nearly two and a half times that of XII plan target.

It must be evident that in both Plan periods nil production is expected from the natural capture based fisheries resources (lake and rivers) as they shall be earmarked exclusively for biodiversity conservation purposes and be out of bounds for commercial exploitation. Also, it is assumed that requisite input support in the form of quality seed, feed, credit / financial support, technological backstopping, policy support and budgetary support as outlined below would be forthcoming to make the targets feasible.

The major approach for each of the approach during the next ten years is briefly outlined below while the individual issues and options in the form of action points are discussed in the next Chapter.

3.2. Enhanced and Conservation Oriented Fisheries in Lakes, Rivers and Canals

Restoration of biodiversity and fisheries enhancement shall be the twin strategy for the natural water bodies (lakes and rivers) in the State for the next 10 years. All the lakes and rivers shall be declared as fish sanctuaries and commercial fishing prohibited through regulation. Ranching of endemic fish species would help in

slowly restoring the aquatic biodiversity. Gradually these resources shall be helped to become source of quality brood stock and fish seed supply in the State.

Pen culture and cage culture programs for seed rearing can be taken up in the lakes, even riverine and canal resources. Unobtrusive and non-consumptive running water aquaculture systems for utilizing the extensive canal networks for fish culture shall be put in place. High intensity cage culture systems may be another option in canal systems.

3.3. Diversification and Intensification in Pond Resources

Common property village ponds and privately owned farm ponds shall diversify the candidate culture species in the coming years in order to ensure continued economic profitability and ecological viability. In addition to the Indian major Carps, potential new species like Pangasianodon, Scampi, and Indian Magur be added to the basket. Simultaneously, the culture systems shall become more intensified especially in the privately owned ponds in order to maximize the yield / returns from unit area. Multiple stocking and multiple harvesting, stocking of stunted fingerlings, feed based culture in village ponds, introduction of re-circulatory aquaculture systems, polyculture are ways of intensification. These are discussed in some detail in the next Chapter.

3.4. Sustainable Aquaculture in Waterlogged and Salt affected Areas

The overall approach in the ecologically sensitive new resources shall be long term resource sustainability and optimal economic returns as against short term maximization of monetary gains at the cost of ecosystem collapse. As the technologies for culture of high value candidate species like Tiger Shrimp, White leg shrimp, Sea bass and Scampi are very promising, their field demonstration and large scale adoption by farmers shall be done following a mission mode approach wherein provisions for seed supply, feed supply, credit support, continued technical support, market support and training shall be bundled and their delivery effective.

3.5. Self-sufficiency in Quality Seed Production

The most critical input for achieving the target production is timely availability of adequate and quality seed of required candidate species at an affordable price. The

present infrastructure in the State, both in public sector and private sector, is woefully inadequate to meet the expected demands. Though the seed can be procured from other States, doing so would mean losing an opportunity to create additional employment on one hand and uncertainties in ensuring quality seed supply. Hence, the approach shall be to attain self-sufficiency in seed production by giving incentives to private investment in seed production. State shall not indulge in commercial scale seed production any further due to structural limitations and inherent inefficiencies.

4.0 ISSUES, OPTIONS AND ACTION PLAN

4.1. Resource related Issues and Options

Declining fish production

Fish production from natural water bodies namely rivers and lakes has continued to decline and now constitutes only 4% of total fish production. This is partly due to depletion of riverine fish resources (Yamuna and Ghaggar) as well as shrinkage, siltation and even disappearance of some lake resources due to several anthropogenic activities.

Declining aquatic biodiversity

In 1980, 77 fish species were reported while it came down to 60 species by 2006-07. The introduction of exotic fishes like African Magur, Tilapia, Silver Carp and Common Carp are said to have played major role in this as they have become invasive in natural water bodies while the overall habitat degradation, abstraction of water, and pollution leading to loss of breeding grounds might be equally responsible.

Lack of compliance of conservation oriented regulations

Though existing regulations sufficiently provide for and prohibit exploitative fishing in natural water bodies, their compliance is far from satisfactory due to lack of voluntary efforts on part of the farmers as well as absence of effective monitor able mechanism. Every year, DoF reports confiscation of several fishing gears and illegally caught fish from these water bodies. However, these measures have not been able to asset the decline both in terms of fish production and habitat destruction.

Moving towards community based management of these water bodies with necessary policy and regulation support would be the only viable long term option. Fishers / farmers living in the periphery shall become primary stakeholders in their management and suitable location specific plan needs to be developed taking into account their potential for eco-tourism, fish sanctuaries, sports fisheries, fish production potential, etc.

4.2. Technological Issues and Options

Database of soil and water profiles

Comprehensive survey of different soil and water resources (surface and ground water) across the States from aquaculture perspective is a prime requisite. Agriculture Department, Haryana has prepared soil and ground water maps upto block level for the State which needs to be vetted and customized after adequate ground truth and field studies with respect to its suitability for fisheries and aquaculture

Water Quality Management in Community Ponds

Haryana has large number of (6000) community/village ponds as compared to constructed ponds for aquaculture. As these ponds are deep and highly polluted due to village garbage and domestic sewage, it needs certain steps to control water quality suitable for fish culture. Certain ponds contain sludge up to a height of 7-8 feet from the bottom.

As the community ponds are leased by village authorities, the bottom sludge should be removed at regular intervals of every 2-3 years. For this purpose village authorities should spend certain lease amount. Awareness has to be created among leases/farmers to maintain soil and water quality by application of eco-friendly chemicals, probiotics, etc. Researchable Issues are studies on pond bottom sediments, soil and water quality, and studies on ameliorative methods using probiotics and chemicals for improvement of pond bottom condition and water quality.

Quality carp seed

Indian Major Carps are still the predominant species being cultured in Haryana. Seed quality plays major role in the production of table size fish. In the recent days the quality of seed has been deteriorating and farmers are getting either low quality seed or under size weak seed. While certain studies indicate inbreeding depression, the issue requires further investigation. Meanwhile efforts shall be made to replace the existing brood stock from the hatcheries in the State. This has to be done by

procuring natural carp seed from various riverine resources both within and outside the State and their maintenance up to maturation for subsequent breeding programs.

The developmental aspects include supplying farmers at least 10 cm size seed to stock in grow out ponds. If it is difficult to transport bigger size seed, the farmers should be encouraged to rear the fry up to fingerling stage in small rearing ponds following a cluster approach wherein network of seed growers caters to the seed demand. Some Government and private farms are to be identified in different regions of the state for the development of brood stock and to produce quality seed. The grow-out farmers should be linked with seed producers. A committee may be formed at the State level to prepare guidelines for maintaining seed quality and certification.

Aqua Feed

In aquaculture feed contributes more than 50% of the total recurring cost. Therefore, it is essential to develop cost effective feed with locally available ingredients particularly when the demand grows as new areas are brought under fish farming. However, no feed plants are available in the State as of now. Hence, feed manufacturing units need to be established in the State to meet local demand. Initially cattle feed manufacturing entrepreneurs may be encouraged to start manufacturing of fish feed with additional attachment for making pellets. Fish feed manufacturers should be encouraged by providing subsidy. Large scale fish farmers may be encouraged to establish mini-feed plants by providing subsidy.

The researchable issues are studying the nutritional aspects of locally available ingredients and formulation of nutritionally balanced feeds for various fish species, and testing the efficiency of locally prepared formulated feeds on various species.

Diversification of Aquaculture Practices through new candidate species

Aquaculture in the State, as elsewhere in India, is still dominated by culture of Indian major Carps. The productivity has not been improving while the profitability is declining due to increasing input costs and almost stable market prices. In order to provide more profitable options for farmers, species diversification is very essential.

R&D options are developing and strengthening the field based research programs on *Clarias batrachus*, *Scampi*, and *Pangasianodon hypophthalmus* for seed production; and refinement of captive maturation, breeding, seed production and grows out technology for *Mugilcephalus*, *Lates calalifer*, *Tiger shrimp* and *White leg Shrimps*.

The attendant developmental Issues are to establish hatcheries, preferably in the private sector or through PPP mode for *Clarias batrachus*, *Scampi*, and *Pangasianodon hypophthalmus* to produce adequate and quality fish seed.

Integrated Farming Systems

Integrated farming systems with fisheries components are still in a pre-adoption stage in Haryana/India except in pockets of North Eastern and Eastern States though the research has established maximum profitability of these systems resulting from higher unit area productivity besides high resource use efficiency. State Government may establish model integrated farming units with various combinations (aquaculture, animal husbandry, poultry, piggery, horticulture, etc.) which complement one another and effectively utilize available resources. The farmers may be incentivized to opt for integrated farming systems.

Aquaculture in inland saline areas

Though various technologies have been developed and perfected by CIFE to undertake aquaculture in inland saline soils by using ground saline water, it is yet to reach farmers for adoption. Various developmental issues need to be addressed to: Farmers have to be encouraged to take up proven aquaculture in their salt affected fields by providing substantial subsidy for construction of ponds and inputs. Training should be imparted to farmers and monitoring of farmers ponds regularly should be done by the Officials. As the farmers are new, the Officials should help in getting seed, feed, etc. and monitor one complete crop to inculcate confidence in the farmers.

While the culture of freshwater fish and prawn may be adopted in low saline (< 5 ppt) water areas, brackish water fish and shrimp may be cultured in high saline (> 5 ppt) water areas. Technology demonstration, refinement and popularization programs should be conducted in a mission mode in the districts with large tracts of

suitable areas. They should be held in the farmers' fields by involving farmers in day to day farming activities and showing the feasibility of technology. Research shall address the issues of suitable species selection for inland saline aquaculture along with the feasibility of making the seed locally available.

Recirculating Aquaculture Systems

Recirculating aquaculture systems (RAS) are the newest form of fish farming production system. RAS are typically an indoor system that allows for farmers to control environmental conditions all the year round. While the costs associated with constructing an RAS are typically higher than either pond or cage culture, if the system is managed properly to produce fish on round the year basis, the economic returns can make it worth the increased investment.

Given the limitation of land and water resources in the State, RAS can be a viable option for growing high value fishes. It is still at an experimental stage in India. It is completely dependent on nutritious artificial diet. It needs round the clock power supply to run various machineries such as pumps, air blowers, aerators, automatic feeders, temperature control system, etc. As it's a capital intensive system, Government shall provide financial support and easy credits. Re-circulatory systems should be established in saline areas by using low saline ground water for culture of shrimp, sea bass, grey mullet, etc. On the R&D side, developing a cost-effective indigenous version of RAS as against importing the complete systems shall be given priority. Similarly, developing nutritious and cost-effective feeds for various species need to be given adequate attention.

Re-circulatory systems may be established with existing knowledge for demonstration of sea bass culture in low saline water on a pilot scale. Initially demonstration units should or to be established in the Government, farms for training and demonstration to the progressive farmers.

Ornamental fish production

In recent times/of late ornamental fish trade is gaining immense popularity in different parts of the country. Thus can become a viable livelihood option for rural women and youth in Haryana. It can be developed in clusters around urban

markets through a network of women centric SHGs. This would require Identification of locally available ornamental fish species; studies on breeding and rearing methods of locally available ornamental fish species; establishment of backyard breeding and rearing units with government subsidy; training local women in ornamental fish culture; encouraging small scale entrepreneurs for establishment of sale counters for fish, fish tanks and its accessories; and establishing State of the Art Aquaria at Gurgaon, Hisar, Panchkula and Sonapat for both Freshwater and Marine fishes with focus on public awareness and education.

4.3. Developmental Issues and Options

Capacity Building and Training

Farmers: In order to strengthen and create a cadre of trained farmers, there shall be structured and customized training programs on different areas / new opportunities. Training is to be conducted preferably in lean period as only then farmers would come. But the constraint is that funds are often disbursed during end of FY which is the peak season for farmers. It was felt some districts are forthcoming and fulfil targeted training programs for farmers while many don't take interest necessitating the, need for incentive based uniform policy.

DoF Staff: It was strongly felt that training / capacity building of DoF staff at all levels from FEOs to Secretaries consisting of initial post induction training as well as regular in service training/refresher courses should become an integral part of. Training of Trainers (Master Trainers) at institutions like CIFE shall be an essential component in this endeavour.

In this context, it was felt that Aquaculture Research and Training Institute (ARTI) under DoF at Hisar need to be restructured considering its performance and limitations on the one hand and the expectations and requirements on the other. It shall be adequately staffed with competent instructors and it shall develop strong collaboration with CIFE Rohtak Centre and Fisheries Faculty at CCSHAU/LLRAVSU. It shall develop detailed custom made training modules with assistance from CIFE and arrange for field / practice oriented training for farmers. Budgetary provision shall be enhanced.

Strengthening Extension System

The need to reorient the entire DoF from desk oriented bureaucracy to development and service / extension oriented agency remains one of the critical issue as well as a challenge. The challenge is to create an institutional mechanism to provide services at the village / farm level through a combination of DoF staff, network of farmer agents / matsyamis and NGOs. Fish farmers shall be organized into farmer groups, SHGs or aqua clubs for promoting Best Management Practices and the possibility / need for having a separate wing for Extension within DoF. Efforts will be made for developing / integrating specialized web based mobile advisory services for fish farmers (kisansanchar) jointly by NGOs, DoF, KVKs and CIFE/ICAR institutions for effective technology transfer and helping create a farmers network and enabling regular two way effective communication between farming community and development agencies / research organizations.

Strengthening field oriented extension and service delivery with farmers as extension agents (matsyamis) shall be a thrust area. Such successful programs have been implemented in States like Assam, Jharkhand and Bihar.

Strengthening institutional linkages and coordination between Research & Development / Extension System through Institutional mechanisms at District and State levels is one of the weakest in State and needs to be rectified and strengthened.

Research & Education

For strengthening research and education in the State, the need of the hour is establishment of College of Fisheries under the newly established Haryana Veterinary & Animal Sciences University. As of now there is neither a Faculty of Fisheries nor a Dept. of Fisheries in the University though a few people are working on fisheries. Neighbouring Punjab provides an example wherein 4 Faculty from Department of Zoology were shifted to Livestock Production Management Department under the Veterinary University in 2002 Later on Fisheries Unit was established in 2007 leading to full-fledged College of Fisheries with 10 faculty (sanctioned positions are 14) offering BFSc/MFSc programs from 2008 onwards with Rs. 3 crores as budgetary support. This would go a long way in development of fisheries in the state.

Aquaculture Development Mission

The idea of initiating a Fisheries Mission / Aquaculture Development Mission on the similar lines of Horticulture Mission was mooted. The FDC however informed that it was difficult to project fisheries as a key area demanding such a mission due to frequent ups and downs in last two decades. Some farmers were of the opinion that if institutional support is provided along with credit facility and training, there will not be much demand for subsidies.

Restructuring State Seed Farms

The state of State seed farms / hatcheries was examined, 15 of which contribute only 25% of seed requirement with many producing less than half the capacity. Since performance of State seed farms in many States is dismal, it was suggested that the functional farms should be strengthened further while leasing the rest to private entrepreneurs on PPP mode. Also, some innovative schemes for establishment of Seed farms in private sector with support from RKVY / NFDB shall be initiated as in Rajasthan.

Market Interventions

There shall be two pronged strategy to improve the fish markets and marketing in the State. Firstly, the infrastructure and institutional support for marketing shall be strengthened including the following aspects: Encouraging cold storage in major production centers to hold fish for longer duration before transporting to major markets as per the demand to get better price; Encouraging marketing of live fish by subsidizing its transportation, lease of retail space in major markets; PPP model for establishing fish retail outlets in Delhi, Chandigarh, Gurgaon, Faridabad, etc. by linking producers and traders; Provisions for fish to be sold in all regulated agricultural produce mandis within State; Small scale processing units to be established in different regions for the development of value added products as per consumers' demand; Training to local women in preparation of various value added products.

Secondly, there shall be educational and promotional campaigns highlighting the nutritional and health benefits of fish to increase fish consumption among the public especially the youth.

It was reported that there are entry level issues / harassment at check posts for trucks from Haryana at the Delhi border on their way to Gazipur mandi, Jehangirpur mandi, etc. HFC can take up this issue with authorities concerned. In consultation meetings, it was suggested that Haryana Government should explore opening up of fish retail outlets in Delhi with NFDB support for sale of fresh and live fish as that would help offer higher margins for farmers. DoF official informed that the wholesalers / traders were unwilling to shift from present markets to new modern markets space, and hence there were no buyers at Gurgaon though DoF had budget and was willing to establish a major market.

Besides, a more detailed study of existing wholesale and retail marketing structure understanding the consumer demand and preference for certain species/product in urban and rural areas through consumer survey would help in further addressing the marketing related issues.

Natural calamity relief measures for fish farmers

Calamity relief measures against floods, cyclones, diseases, etc. are not available for fisheries and aquaculture unlike crops and livestock at present and this need to be rectified.

Insurance for Fish Farming

The present provision of crop and livestock insurance under the Central Government sponsored scheme covers only few crops and indigenous/crossbred milch cattle and buffaloes. Government of Haryana should have its own comprehensive agricultural insurance scheme to cover major crops, all milching animals and farmed fish produce. Insurance should be farmer friendly as premium is high at present while incidences of disease are not covered by the recent GIC scheme. It was suggested that NFDB / DoF may bear part of the premium as in livestock sector where 50-75% premium is borne by State and Centre.

Kisan Credit Cards (KCC) to Fish farmers

Irrespective of farm size/land holding, all farmers, including fish farmers shall be issued with Kisan Credit Cards at the earliest possible. This has to be a State priority and the procedures need to be simplified to ensure that all farmers get their KCC

within one year period. Therefore, it calls for a simplified procedure for granting short term loans, to the farmers, especially against their produce at concessional 3-4% interest rates, ensuring availability of credit at low interest rates

Hassle free credit provisions

According to present procedure, the entire land of a farmer has to be mortgaged as collateral security for taking the loan from the financial institutions. This procedure deprives him from a chance to apply for another loan, when needed. To overcome this problem, the mortgage of land should be regulated as per the value of land and amount of loan requested by the farmers.

4.4. Policy Issues and Options

Comprehensive Fisheries and Aquaculture Development Policy for Haryana

Developing a comprehensive and enabling fisheries and aquaculture development policy for Haryana, addressing all issues, through a consultative process followed by appropriate legislative reforms and budgetary provisions for all the programs suggested herein shall be put in place. This would create a more conducive environment for development. This shall be followed by replacing the existing Fisheries Acts in the State with new comprehensive Act modelled on the Centre's Model Bill on Inland Fisheries and Aquaculture and the recommendations given in this report.

Aquaculture on par with agriculture

As discussed elsewhere, aquaculture is not being treated fully at par with agriculture with respect to water charges, electricity tariff, farm loan interest, cargo charges and income tax exemptions. Water and energy charges for fish farming are much higher (almost 4 times) than those for agriculture use by farmers. Aquaculture is allied to agriculture and hence needs to be treated at par with agriculture in terms of credit, taxation of income, energy charges, water tariff and land allocation owing to similar characteristics of the two sectors (primary, rural and small scale), resource use pattern and its importance in providing food and livelihood to the rural poor.

There is also a need to remove double taxation of Panchayat water bodies for fisheries wherein lease rent is being paid to Panchayats after competitive bidding

and in addition water charges are being collected by the Irrigation Department for the same resource. States like Bihar and Orissa have already initiated these reforms.

However, commercial scale aquaculture activities, as in commercial plantations or industry scale agriculture, may be differentially treated and taxed.

Comprehensive water bodies leasing policy for fisheries and aquaculture development

Only a maximum lease period is prescribed, as against a minimum period, in Panchayat Act for lease of village ponds. This has led to different leasing practices in different villages based on whims of Panchayats, which may harm the lessee's interest. Though the State has recently agreed for 5 years minimum lease, this needs to be followed by amendment.

A comprehensive leasing policy for the leasing of all public water bodies for fisheries irrespective of ownership (whether Panchayats, Irrigation Department, Revenue Department., etc.) shall be developed in Haryana. The policy shall balance the competing objectives of livelihood / welfare on the one hand and revenue generation on the other with lower priority to the latter. The minimum lease period for all types of resources shall be for seven years in order to ensure long term development of resource and providing sustainable livelihood. First priority of lease shall be given to group of individuals from communities living in close proximity to the resource.

Special policy provision on use of saline and waterlogged areas for aquaculture

Haryana has huge tracts of saline / salt affected area (45000 ha) and waterlogged area (2.75 lakh ha) most of which have become unfit / unproductive for crop based farming. But, they are potential resources for both fresh water and salt water fish culture. Technologies for the same are already available for demonstration at CIFE Rohtak Centre. However, to popularize them, policy support would be required.

Certification of fish seed and fish feed quality

Quality seed and feed are the most critical inputs in aquaculture and it is still a major limiting factor in States like Haryana.

Lack of product as well as process standards has given rise to sub-standard and dubious seed and feed in market. Policy and legal instruments shall be put in place with mandatory provisions for registration of all the seed producers (hatcheries, seed rearers/growers), feed manufacturers and suppliers / traders as well as certification of the seed and feed quality.

Government shall facilitate development of seed banks in private sector / public - private partnership mode for ensuring round the year availability of quality seed at local level. Incentives shall be given for yearling production within overall policy of attaining self- sufficiency in seed production in Haryana.

Introduction and regulation of exotic species

There shall be a clearly defined policy statement on introduction of exotics as well as regulation of its culture. Precautionary principle and scientific evidence shall inform regulatory decisions while reconciling aquaculture developmental needs as well as biodiversity conservation requirements

Changes in DoF's Recruitment policy

At present, the eligibility for entry level FEO/FO position (100% direct recruitment) and DFO/FDOs (50% through direct recruitment and 50 % by promotion) is B.Sc. Zoology with or without specialization in fisheries and BFSc degree is not being given any weightage. This requires to be changed on the lines of Punjab and most other States for two reasons. To steer aquaculture development, presence of competent professionals in DoF is very essential. Besides, unlike earlier days, now professional BFSc fisheries graduates are available. Hence, BFSc professionals should be given preference in recruitment.

Epilogue

The agriculture in Haryana is at cross-roads on account of several contradictory scenarios being faced in recent years. Though the State has done exceedingly well in crop and livestock production, it is confronted with serious problems of soil degradation, water resource imbalance, decrease in factor productivity, low returns to farmers due to high cost of cultivation, besides the looming threat of climate change and soil and water resource base deterioration. More than 2/3rd ground water being of poor quality is a major handicap in crop agriculture productivity and sustainability of major cropping systems in the State. Soil salinization and water logging due to inadequate drainage in canal irrigated areas having underground brackish aquifers and decreasing land holdings as a result of ever increasing population pressure, coupled with lack of non-farm employment warrant the need for diversified agriculture while adopting suitable region/location specific farming systems.

Under the diversified agriculture, horticulture, livestock and fisheries are alternative options which can enhance the income of small holder and marginal farmers on sustainable basis, while also strengthening nutritional security, and helping employment generation and gender empowerment. Though fisheries in Haryana has made notable progress in the recent past, limited and declining water resources and the less than favourable dietary preferences for fish, make fisheries development a challenging proposition. Fish culture in Haryana has progressed mainly on account of economic benefits it brings by utilizing community ponds with little investment. The State has about 47% Unutilized Saline and Waterlogged areas having potential for Aquaculture.

The growth of 11.41 per cent in fish production, and 2.23 per cent in productivity witnessed during 1997-98 to 2010-11 has slowed down during the XI plan as compared to X plan period especially in terms of productivity. The present Report has outlined a number of policy, technological and developmental measures which can boost up fish production to reach 1,45,250 tonnes by 2017 which can go further up to 3,50,730 tonnes by 2022 if highly productive species like *Pangasianodon hypophthalmus* finds greater consumer and grower acceptance and shrimp culture in salt affected areas becomes a commercial success.

The State should focus on reviving the capture fisheries through restoration of biodiversity. Community based management of these water bodies with necessary policy and regulation support would be viable long term option. Diversification and intensification in culture fisheries with *Pangasianodon*, *Scampi*, and *Indian Magur* may ensure economic viability as well as ecological sustainability of fish culture in Haryana.

Awareness has to be created among the public and lessee/farmers to maintain soil and water quality by application of eco-friendly chemicals, probiotics etc. Developing a comprehensive and reliable data base on soil and water profiles from aquaculture perspective is one of the primary needs to plan the resource use strategies. Multiple stocking and harvesting, stocking of stunted fingerlings, feed based culture, introduction of re-circulatory aquaculture systems, and poly-culture are suggested for enhancing fish production in village ponds.

With the availability of technologies for culture of high value candidate species like Tiger Shrimp, White leg shrimp, Sea bass and Scampi, a mission mode approach with seed, feed, credit and market support shall ensure that potential resources are optimally utilized for fish culture. Farmers should be encouraged to take up proven aquaculture in their salt affected fields by providing incentives for construction of ponds and inputs and importing training to farmers with sufficient land holding. Further R&D efforts have to be directed towards refinement of technologies for cost effective feed and seed production, and grow-out of *Clarias batrachus*, *Pangasianodon hypophthalmus*, *Mugilcephalus*, *Lates calcalifer*, *Tiger shrimp* and *White leg Shrimps*.

State Government may establish model integrated demonstration units with aquaculture as one of the component along with animal husbandry, poultry, piggery, horticulture, etc. The farmers should be given adequate incentives to opt for integrated farming systems.

Other measures suggested for fisheries development in Haryana include adoption of Re-circulatory aquaculture systems (RAS), particularly in saline areas by using low saline ground water for culture of shrimp, sea bass, grey mullet, etc; ornamental fish production; establishing State of the Art Aquaria at Gurgaon, Hisar, Panchkula and

Sonepat for both Freshwater and Marine fishes with focus on public awareness and education; establishment of backyard breeding and rearing units; training of women and unemployed youth; encouraging small scale entrepreneurs for establishment of aquaria shops; structured and customized training programs for farmers and entrepreneurs; training and capacity building of the fishery staff at all levels; formation of fish farmers SHGs /Aqua Clubs, ICT applications including integrated web based mobile advisory services for fish farmers; strengthening field oriented extension and service delivery with farmers as extension agents (*matsyamitras*), *establishing College of Fisheries and Fisheries Mission in the State*; establishing fish retail outlets in Delhi, Chandigarh, Gurgaon and Faridabad by linking producers and traders; preference to BFSc/MFSc in recruitment to technical positions; encouraging PPP model for production of fish seed and feed; infrastructure development, cold storage facilities for marketing including live fish are some of the measures recommended.

A comprehensive and enabling Fisheries and Aquaculture Development Policy, as a part of Haryana Agriculture Policy, supported by appropriate legislative reforms and budgetary provisions needs to be in place. Aquaculture should be treated at par with agriculture for water charges, electricity tariff, and interest on loan, export promotion, cargo charges and income tax exemptions.

Annexure I

Haryana Kisan Ayog headed by Dr. R. S. Paroda constituted a Working Group on Fisheries Development in Haryana in March 2011 consisting of Dr. W.S. Lakra, Dr. K.K. Vaas and Dr. V. Bhat with ToR of conducting SWOT analysis of fisheries sector of Haryana, identifying to integrate fisheries with other farming systems, strengthening of marketing system, and recommending policy measures and incentive schemes required for fisheries development among others. The first briefing meeting of the Working Group was held with Dr. R.S. Paroda at TAAS Office, Pusa Campus, New Delhi on 26/04/11 at 10.30 AM. Besides the Members of Working Group, Dr. M.P. Yadav, Technical Advisor with HFC, Dr. Ananthan, P.S. Scientist, CIFE and Dr. Ravi Kant, RF, HKA attended the meeting. Dr. R.S. Paroda, in his opening remarks highlighted that the Fisheries development in Haryana is of relatively recent origin as majority of Haryanvis are non-fish eaters, and recent developments are due mainly to the economic profitability of fish culture. He stressed that in the proposed Agricultural Policy for Haryana being prepared by another Working Group headed by Dr. Mruthyunjaya, the annual agriculture growth rate target for next two decades is kept as 4-5% for which development of allied sectors including fisheries is very crucial.

Dr. Parodha emphasised that successful Seabass culture in Israel's Black Sea, success story of Tilapia in Philippines, integrated farming system models in adjacent Punjab may offer lessons for planning appropriate aquaculture options in water logged, semi-arid and salt affected districts of Haryana, while stressing that CIFE's Centre at Lahli, Rohtak provides perfect institutional base to realize these options.

He remarked that with 20-30 progressive farmers in many districts already taking lead, popularization of inland aquaculture will become easier, (While underscoring the need to diversify fish culture through high yielding new species, ornamental and sport fisheries, establishment of large aquariums etc.) For this purpose, the need of full-fledged Faculty / Department in the Fisheries College under State Veterinary University is the need of the hour.

Dr. Paroda called upon the working Group to develop an enabling fisheries policy for Haryana including treating fish farming at par with crop farming / agriculture,

indicate infrastructural requirement for sustained fisheries development, conservation / judicious use of water, etc.

1. Working Group on Fisheries Development in Haryana

Dr. W.S. Lakra Director/Vice Chancellor Central Institute of Fisheries Education, ICAR	Chairman
Dr. Vishnu Bhat Fisheries Development Commissioner, Department of Animal Husbandry, Govt of India	Member
Dr. K.K. Vass, Ex-Director Central Inland Fisheries Research Institute	Member

2. Terms of Reference (ToR):

- To make SWOT analysis of Fishery sector in the State of Haryana and propose suitable measures to promote and integrate fishery in the farming system.
- To study the problems and constraints of fish farmers in Haryana and suggest measures to overcome their difficulties.
- To examine the support presently available to promote fishery through State/Central government schemes and to suggest suitable policies/incentives for further growth of this sector.
- To examine and suggest measures for value addition of fish products through processing, fortification, preservation, packaging, cold chain etc. for higher income, including exports.
- To examine the scope and suggest ways and means for diversification of the
- Fishery Sector in Haryana based on availability of water resources and water quality in different parts of the State.
- To review the current policy support for insurance, financing, subsidy and marketing of fish and fish products and suggesting measures for further improvement.

3. Meetings Held

Date	Venue	Remark
26 Apr 2011	Pusa Campus, New Delhi	1st Meeting of Working Group on Fisheries Development in Haryana
30 Jul 2011	HKA, CCSHAU, Hisar	Stakeholder Workshop on Fisheries Development in Haryana: Challenges and Opportunities
23 Sep 2011	Karnal	Interaction meeting with Fish Farmers of Haryana
03 Oct 2011	Chandigarh	Meetings with Senior Officers of the Department of Fisheries, Government of Haryana
15 May 2012	TAAS Office, New Delhi	Experts Meetings
29 Aug 2012	New Delhi	Brainstorming Session

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