NFDB GUIDELINES FOR ESTABLISHMENT OF FISH BROOD BANK

National Fisheries Development Board
Department of Fisheries
Ministry of Fisheries, Animal Husbandry & Dairying, Govt. of India

Pattern of Assistance for Brood Banks- Beneficiary Oriented Projects										
Sl No	Region & Category of Beneficiaries	Unit Cost in crores	Govt of India Share		State/ UT share		Beneficiary Share		Total	
			%	Amt in Crores	%	Amt in Crores	%	Amt in Crores	%	Amt in Crores
I	**Fresh Water Fish Broodbank**	5.00								
1	**Other States**									
i	General Category		24%	1.20	16%	0.80	60%	3.00	100%	**5.00**
ii	SC/ST/women & their Cooperatives		36%	1.80	24%	1.20	40%	2.00	100%	**5.00**
2	**North East & Hilly States**									
i	General Category		36%	1.80	4%	0.20	60%	3.00	100%	**5.00**
ii	SC/ST/women & their Cooperatives		54%	2.70	6%	0.30	40%	2.00	100%	**5.00**
3	**Union Territories**									
i	General Category		40%	2.00	0%	0.00	60%	3.00	100%	**5.00**
ii	SC/ST/women & their Cooperatives		60%	3.00	0%	0.00	40%	2.00	100%	**5.00**
II	**Marine Fin Fish Broodbank**	7.50								
1	**Other States**									
i	General Category		24%	1.80	16%	1.20	60%	4.50	100%	**7.50**
ii	SC/ST/women & their Cooperatives		36%	2.70	24%	1.80	40%	3.00	100%	**7.50**
2	**North East & Hilly States**									
i	General Category		36%	2.70	4%	0.30	60%	4.50	100%	**7.50**
ii	SC/ST/women & their Cooperatives		54%	4.05	6%	0.45	40%	3.00	100%	**7.50**
3	**Union Territories**									
i	General Category		40%	3.00	0%	0.00	60%	4.50	100%	**7.50**
ii	SC/ST/women & their Cooperatives		60%	4.50	0%	0.00	40%	3.00	100%	**7.50**
III	**Mahseer Fish Broodbank**	4.50								
1	**Other States**									
i	General Category		24%	1.08	16%	0.72	60%	2.70	100%	**4.50**
ii	SC/ST/women & their Cooperatives		36%	1.62	24%	1.08	40%	1.80	100%	**4.50**
2	**North East & Hilly States**									
i	General Category		36%	1.62	4%	0.18	60%	2.70	100%	**4.50**
ii	SC/ST/women & their Cooperatives		54%	2.43	6%	0.27	40%	1.80	100%	**4.50**
3	**Union Territories**									
i	General Category		40%	1.80	0%	0.00	60%	2.70	100%	**4.50**

ii	SC/ST/women & their Cooperatives		60%	2.70	0%	0.00	40%	1.80	100%	**4.50**
IV	**Trout Fish Broodbank**	3.00								
1	**Other States**									
i	General Category		24%	0.72	16%	0.48	60%	1.80	100%	**3.00**
ii	SC/ST/women & their Cooperatives		36%	1.08	24%	0.72	40%	1.20	100%	**3.00**
2	**North East & Hilly States**									
i	General Category		36%	1.08	4%	0.12	60%	1.80	100%	**3.00**
ii	SC/ST/women & their Cooperatives		54%	1.62	6%	0.18	40%	1.20	100%	**3.00**
3	**Union Territories**									
i	General Category		40%	1.20	0%	0.00	60%	1.80	100%	**3.00**
ii	SC/ST/women & their Cooperatives		60%	1.80	0%	0.00	40%	1.20	100%	**3.00**

Guidelines for Brood Bank

Background:

The Objective of establishing Species Specific/Multispecies Brood Banks in the States/UTs, is to primarily source, select, raise and maintain Quality Brood Fish and/or develop Improved Varieties/Strains through Selective Breeding/ Genetic Improvement Programmes. A State Brood Bank would produce and supply Breeder Seed of the Improved Varieties/Strains to a network of Registered Seed Multiplication Centres in the respective State/UT, to rear, grow and manage them as Brood Stock/Brood Fish.

Essentially, a State Brood Bank would not supply Breeder Seed to Fish Farmers. It would rather supply Breeder Seed to Govt./Private Fish Seed Farms/Hatcheries (Seed Multiplication Centres) to raise them as Brood Fish, produce and supply Quality Fish Seed to Fish Farmers. Without a Selective Breeding /Genetic Improvement Programme in place, a Fish Brood Bank would merely be a Fish Seed Farm. In a Selective Breeding/Genetic Improvement Programme, Major Costs would involve engaging Scientific/Technical Manpower, developing and maintaining a Breeding Programme, Record Keeping, managing the growth and health of the precious fish stock, bio-security, etc. Therefore, it would be economical to select a suitable, existing, good, large and conveniently located Govt. Fish Seed Farm in each State/UT and develop it into a Fish Brood Bank by renovating/restructuring it, to undertake the Selective Breeding/ Genetic Improvement Programmes.

Freshwater Fish Brood Bank (IMC)

1. Introduction

1.1. Brood stock or brood fish are base materials on which the growth of aquaculture industry depends. Brood stock fish are parent fish from which fry and fingerlings are produced. The quality and reliable supply of healthy fry and fingerlings having sound genetic base is largely depending on the successful stocking and rearing of brood fish. Brood fish collection, rearing and management are the most important parts of aquaculture activities. Importance of brood fish management is to ensure quality of eggs and sperm; increase fecundity; produce stronger and disease free larvae and fry; spontaneous and timely supply of seeds; removal of the inbreeding problem; endanger fish from extinction; and successful aquaculture with high production potentiality.

1.2. Since the success of the induced breeding of carps depends mainly on healthy and mature brood stock, the establishment of IMC brood bank with required infrastructure facilities will ensure produce of quality fish seeds. To rear, raise and supply quality brood fish seed/ stock size fishes / genetically improved brood stocks to the department / commercial private hatcheries is required to be given top priority in the inland aquaculture sector to sustain the level of IMC production in the country.

1.3. The Blue Revolution lays emphasis on holistic development of fisheries and aquaculture sector keeping in view the emerging demand. The NFDB proposes to implement the component of integrated brood bank establishment with main **objectives to**:

- Ensure supply of quality breeder seeds/brood stock for seed production
- Enhance species diversity in seed production
- Evolve and adopt scientific brood stock management and breeding protocols to maintain the genetic quality of the seed
- Overcome inbreeding problems and improve traits through genetic improvement programs
- Improve existing seed chain across the production systems and species
- Capacity building of all those involved in seed supply chain
- Facilitate for better economic and environmental benefits

2. Justification

2.1. Enhancing fisheries and aquaculture production through use of quality seed material and introduction of improved varieties is gaining increased importance in the country. In general, seed is regarded as one of the most critical input for the development of open water resources (stock enhancement/stocking / biodiversity conservation) and aquaculture. Use of quality fish seed in most instances, determines the profitability of production systems. Production and supply of quality seed is hence regarded as an important activity and is expected to contribute 15-30% of incremental output in the ongoing production systems.

2.2. The rapidly expanding activities of fisheries and aquaculture sector have enhanced the seed requirement and increased dependence on the hatchery-bred seed. The paucity of quality seed of cultivable species and also of genetically improved strains in the supply chain are regarded as a major impediment for the sector growth.

2.3. This has necessitated for the establishment brood banks for wide range of fresh/brackish water and marine species of fish, prawn and other aquatic species of commercial and conservation importance across the country.

2.4. Considering the limitations, NFDB proposes to support establishment of species specific brood banks that have regional or State priorities depending on the nature of environment (inland/cold water, brackish water, marine etc) and multi species brood banks for commercial species of cultivable importance across the country on project mode approach. The breeder seeds produced could be supplied to all the States across the country in support of further multiplication and production of quality seed. The Central financial assistance and facilitation of NFDB in implementation of Brood bank component under the BR Mission is expected to provide new opportunities for enhancing quality seed production and positively impact availability of genetically improved breeder seeds and brood stock for seed production activities in the country.

3. Site Selection

Ideal site of the establishment of brood bank required elevated land with regular, copious, uninterrupted, and reasonably transparent water supply facilities- preferably the area of impact of southwest monsoon – proper approach and electricity supply.

a. Soil condition: - A site may be considered suitable for earthen ponds if the soil will ensure:
    a. Good water retention such as clay or sandy clay soils;
    b. Good pond fertility such as clay loam or silty clay loams.
    c. Clay/silty clay (40-50% clay content) with pH between 7-8.

b. Water: -Good ponds should be inexpensive to construct, easy to maintain and efficient in allowing good water and fish management. Turbidity less than 20ppm, hardness 20-180ppm, total alkalinity <100pm, salinity 0-0.5ppt, free Co2 less than 3 ppm, DO 5-8ppm and temperature 24-31˚C and pH 7-8.

4. Source of Broodstock: Broodstock shall be procured from reliable sources from wild populations/natural stocks where they are harvested/collected and genetically improved brood stocks from authentic hatcheries whose pedigree information is available. Still we have some pure stocks in the natural habitat, in rivers, reservoirs, lakes and beels. These broodstock should be maintained scientifically so that ripe broods could be obtained during the whole breeding season.

5. Components in the Brood Bank Complex: The complex generally consists of 5 ha total land area to accommodate 3ha built in area.

Infrastructure facilities for Fresh Water Fish Brood Bank (5 Ha area)

Sl. No.	Particulars/Components	No. of Units	Size	Approximate Amount in lakhs	Land area required
1	Brood fish stock pond (Earthen)	4	50m X 30m X 2m	18	0.6
2	Spawning pool (RCC)	1	5 m dia	1.6	0.05
3	Incubation pool (RCC)	3	3m dia (outer), 1.5m (inner) average depth-1.2m	1.92	0.003
4	Spawn lifting cistern (Brick work)	1	3m X 2m X 1.2m	0.36	0.006
5	Nursery tanks (RCC)	50	20 m X 10m X 1.2m	178	1.2
6	Rearing tanks (Earthern)	5	100 m X 10m X 1.5m	25	0.05
7	Brood stock raising ponds (Earthen / RCC)	5	100 m X 15m X 2m	37.5	0.75
8	Quarantine tanks	2	20m X 5m X 1.50m	16	0.02
9	Wild brood stock pond (Earthern)	2	50 m X 20m X 1.5	10	0.2
10	Overhead tank (RCC) (5-HP motor)	1	50,000 litres	12	0.01
11	Office cum Laboratory (RCC)	1	10m X 6m	15	0.006

12	Store Room (RCC)	1	3m X3m	2.25	0.009
13	Vehicle parking area	600 sqm	30m X 20m	36	0.06
14	Residential quarters (watchmen)(RCC)	100 Sqm	10m X10m	25	0.01
15	Electricity (11 kV sub-station)	1		10	0.4
16	Generator room	1	3mX3m	2.25	0.002
17	Approach Roads/Internal roads	1800m		36	1.2
18	Boundary Wall (Bio-security)	1000m		45	0.01
19	Bore well & Pumping System ,pipeline	4		8	0.002
20	Sump facility	1	50000 litres	6	0.05
21	Water purification system	1		5	0.05
22	Culvert &Drainage Facility	2000m		9.12	0.312
			TOTAL COST	**500**	**5.000**
				5 Crores	

Indicative cost

5.1.Water Supply System: The letting in of freshwater into brood fish rearing ponds can keep water quality good which makes fish comfortable and is beneficial to growth of fish. The stimulation of running water has a marvelous effects on the development of gonads. Water supply may be from river, lake, reservoir, and ground water. The water supply from other than ground water is required to be allowed to pass through sedimentation/filtration system. The water supply to the hatchery / nurseries should be regulated through Over Head Tank (OHT 5- HP motor) with the capacity of 50,000 litres.

5.2. Hatchery unit: The Brood bank has to witness self-sustenance in internal production of both quality seed as well as of breeder seed to produce a capacity of 10 million fry (2.5cm) per annum.

5.3.Brood fish stock pond:

Earthen based pond having 100m X 15m X 2m size. Require 4 number of ponds covering 6000m^2 (0.6 ha) area. The stocking density of brood fish is 2000kg/hectare.

5.4.Chinese circular hatchery: Made up of reinforced cement concrete (RCC) in an area of 500m^2 on 0.05 ha

Spawning pool (RCC) –for breeding purpose 5m dia, average depth-1.4m- 1 nos.
Incubation pool (RCC) - 3m dia (outer), 1.5m (inner) average depth-1.2m- 2 or 3 nos.
Spawn lifting cistern (brick work) – 1 no. size 3m X 2m X 1.2m

5.5.Rearing Unit:

Nursery tanks (Earthen & RCC): To rear spawn to fry (upto 2.5 cm) 50 tanks are required. Size of each tank is 20 m X 10m X 1.2m which covers a total area of 1 ha. Stocking density is 60 lakh spawn/ha) and possible harvest is 4 times in a year.

Rearing tanks (RCC): To rear fry to fingerling (upto 10 cm) 5 tanks are required. Size of each tank is 100 m X 10m X 1.5m which covers a total area of 0.5 ha. Stocking density is 5 lakh fry/ha) and possible harvest is 4 times in a year.

5.6. Brood stock raising ponds (Earthen ponds): To rear and raise the pre-matured brood stock of different sizes / ages, to select for local breeding as a replacement of the existing stock and to supply to private hatcheries these ponds are essential. 5 tanks are required with a size of each tank bears 100 m X 15m X 2m covering a total area of 0.75 ha. Stocking density is 2-3 nos./sq.mt.

a. **Note:** The supply from the brood bank can be made at different stages i.e., fry, fingerlings, advanced fingerlings, maturing, matured depending on the need from department or private hatcheries.

5.7. Quarantine Facility: To quarantine the wild brood stock collected from the rivers, lakes and reservoirs and allow to stock separately for domestication after genetic study. Building with different cement cisterns, FRP tanks (circular/rectangular) etc. and water supply system with proper aeration. The size of each tank is 20m X 5m X 1.5m covering 100m^2 and 2 tanks are required one for male and other for female brood fish separately.

5.8. Wild brood stock pond is also required after quarantine to separate both sexes with a size of 100m X 10m X 1.5m – 2 nos., covering 0.2 ha.

5.9. Other sub components:

a. Packing shed (brick work) (12m X 3 m) with conditioning cistern (RCC) size of 5m X 1.5m X 1.2m covering an area of 50m^2
b. Office-cum-Lab room: 50m^2area
c. Store room/ feed room: 50m^2area
d. Vehicle parking 12m X 5m with 60m^2 area
e. Brood seed/ Brood fish transport vehicle – 2 units
f. Approach road with vehicle moving facility
g. Watchmen quarter room covering an area 20m^2
h. Electricity and illumination facility
i. Generator (7.5 HP) room (2m X 1m) for standby electric provision

5.10 Biosecurity: The Brrodbank facility should be free of any environment and pollution problem. It will have no harmful impact over the surroundings. So as to create biosecure conditions the following facilities are essential;

a. Fencing: Brick built / Link chain fencing around the brood bank complex to avoid domestic animals.
b. Drainage facility (earthen): For better management of broodstock, the drainage facilities are essential so that the desired water level in the ponds can be accomplished.

6. Risk Management: The proposed brood bank facility is allowed for inspection to identify the site proposed is out of disaster zone. It should not have possibility of adverse effects on people and environment.

7. Expected outcome: With the establishment of specialized Brood banks for targeted species, there will be multiple benefits- both tangible and intangible. The main among them are:

- Emergence of new brood banks and multiplication centers at national, regional and state level
- Proactive R&D in support for genetic improvement of stocks across the country
- Systematic breeding programmes to improve quality of seed production
- Strengthened capacities of government and private seed multiplication farms
- Emergence of skilled technical personnel especially in the genetic management of brood stock and breeding
- Positive growth in farming of diversified species of demand
- Better resource productivity, production and profitability

LAYOUT PLAN OF FRESH WATER FISH BROOD BANK (IMC)

250.00

200.00

COMPOUND WALL

COMPOUND WALL

COMPOUND WALL

COMPOUND WALL

INTERNAL ROAD

INTERNAL ROAD

INTERNAL ROAD

INTERNAL ROAD

INTERNAL ROAD

INTERNAL ROAD

NP (20M X 10M)

WILD BROOD STOCK POND (50M X 20M)

OFFICE & LAB

STORE ROOM (5M X 3M)

WASH ROOM (5M X 3M)

OHT 50000 LTRS (4M RADIOUS)

SUMP (5M X5M)

VEHICLE PARKING AREA (30M X 20M)

WATER PURIFICATION SYSTEM (20M X 20M)

QUARANTINE TANKS (20M X 5M)

WILD BROOD STOCK POND (50M X 20M)

(3 DIA)

SP

(3 DIA)

(3 DIA)

1P

IP

(CISTERN 3M X 2M)

BROOD FISH TANK (50M X 30M)

BROOD FISH TANK (50M X 30M)

BROOD FISH TANK (50M X 30M)

BROOD FISH TANK (50M X 30M)

RESIDENTIAL QUATRESS (10M X 10M)

REARING TANK(EARTHERN) (100M X 10M)

ELECTRICITY 11KV SUB STATION(100M X 20M)

BROOD STOCK RAISING PONDS (EARTHERN /R.C.C) (100M X 15M)

Mahseer Brood Bank

Introduction

Mahseer is a world-famous fish and an outstanding game and food fish of India. There are various species of mahseer which are distributed all over India, particularly in the rivers, streams and lakes of Indian Himalayan region. It is known as 'Tiger in waters' because of its fight during angling and sport fishing. As a food fish, it is highly esteemed and fetches the highest market price in north and northeast of India. But the population of mahseer is decreasing day-by-day due to several factors like illegal methods of fishing, climatic alterations, habit destruction/modification etc. Non-availability of good quality brooders and stocking materials are also one of the several reasons for decreasing the population status of the species.

Good quality brood stocks are the base material for successful propagation and culture of any species. Good quality offspring like spawn, fry and fingerlings are produced from improved quality brooders. The brood fishes are need to be collected/procured from reliable sources and reared with improved management practices to make any aquaculture activity successful. The brood stocks are reared and managed with optimum conditions to increase reproductive performance viz. fecundity, good quality sperm and egg, production of disease-free healthy larvae and fry. Timely supply of seeds to farmers including other stakeholders to overcome from inbreeding depression, endangered fish species from extinction and successful aquaculture activities with higher production.

The success of mahseer breeding and seed production mainly depends on healthy good quality mature brood stocks. The establishment of Mahseer brood bank with required facilities will solve the problem with production of good quality improved variety seeds. The produced seeds can be supplied to the farmers or any government/private agencies or can be ranched in natural systems to revive their population in wild ecosystems.

B. Objectives

- To produce good quality healthy brood stocks of mahseer for breeding or to supply to commercial hatcheries
- To produce improved quality mahseer seeds
- To overcome the inbreeding depression and to maintain genetic heterozygosity of mahseer brooders

 To augment the culture of mahseer scientifically in the underutilized and unutilized water bodies.

C. Site selection

Good potential site should be selected for the development of mahseer brood bank. The site should be in the range of optimal thermal regime for culture and growth of mahseer. The site should have well connectivity to road, continuous supply of electricity and uninterrupted water supply with good and turbidity free water round the year as the mahseer stocks will be cultured in the flow-through systems. Water flow of 50-100L/m is optimally required for maintenance of healthy brood stock.

i. Soil characteristics

As the mahseer stocks are to be cultured in earthen ponds, the soil composition and texture should be in such a condition that, the sand, silt and clay percentage are in optimum ratio. A good quality clayey loam soil with organic carbon 1.5-2.5% and pH between 7.5-8.5 is preferred for the culture and brood stock development of mahseer.

ii. Water parameters

The water should be in flowing condition for the brood stock development of mahseer. The optimum range of water parameters are: Dissolved oxygen 6-8ppm, dissolved free carbon dioxide <3ppm, water temperature 20-25 °C, pH 7.5-8.5, turbidity <20ppm, hardness 50-150ppm, total alkalinity <100ppm, ammonia < 0.01 ppm and nitrite <0.1 ppm.

D. Source of mahseer brood stock

Improved quality disease free healthy brood stocks should be collected/procured from certified/reliable sources. The collected brood stocks shall be in matured condition with optimum size for successful conduction of breeding and seed production program in mass scale to produce healthy larvae/fry in large numbers. The brood stock rearing and
management should be done in scientific manner with adoption of improved management practices.

Brood stock diet

The brood stock should be provided with 40% protein and 8% lipid diet containing other maturation inducing amino acids and micro nutrients @ 2% of body weight on daily basis**.**

E. Components of Mahseer Brood Bank Complex

Infrastructure facilities for Mahseer Brood Bank (2 Ha area)

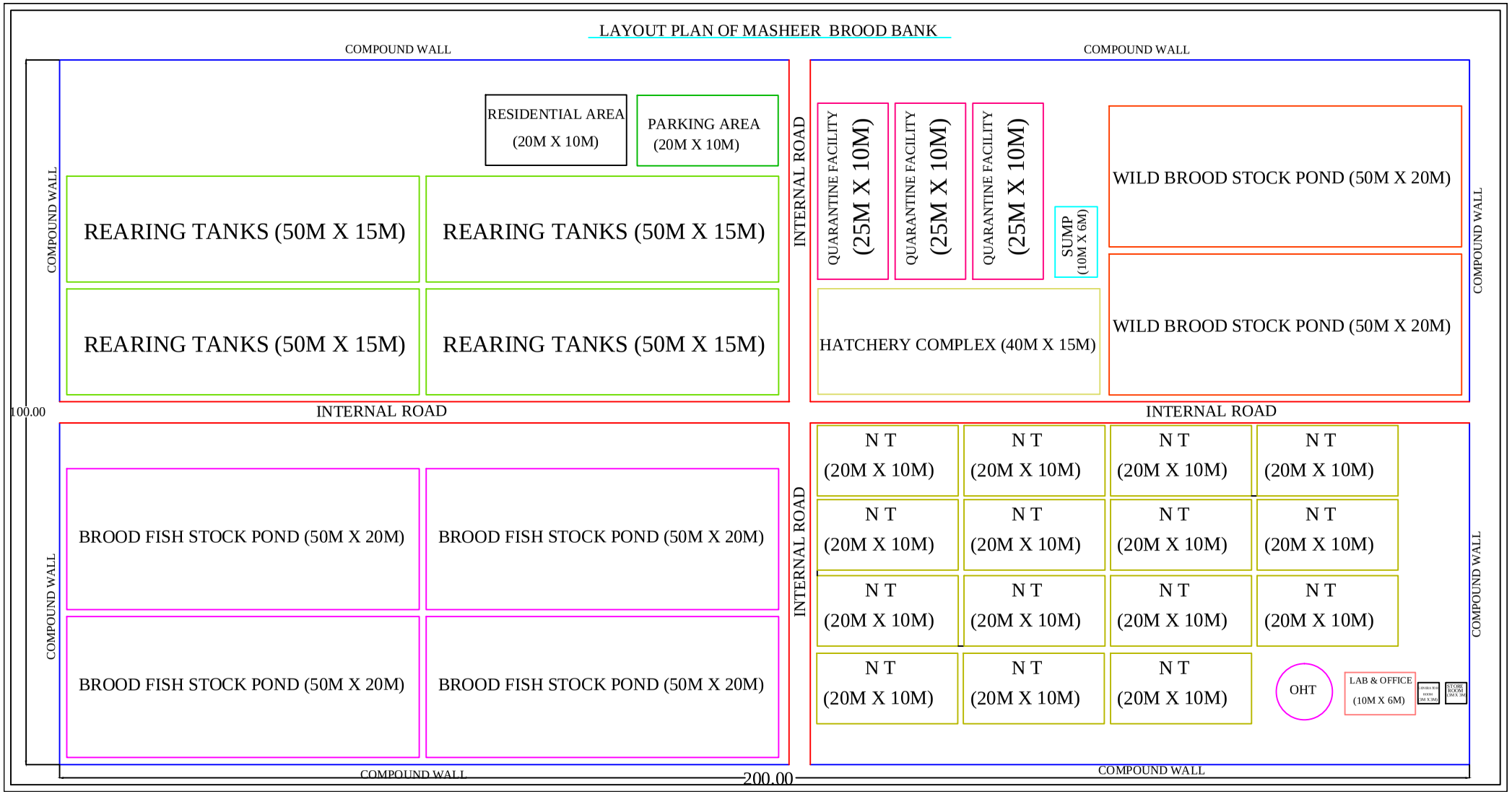
Infrastructure facilities for Mahseer Fish Broodbank (2 Ha area)					
Sl. No.	**Particulars/Components**	**No. of Units**	**Size**	**Approximate Amount in lakhs**	**Land area Required**
1	Brood fish stock pond	4	50m X 20m X 1.5m	20	0.4
2	Hatchery complex with packing unit	1	40m X 15m	60	0.006
3	Nursery tanks	15	20 m X 10m X 1.0 m	33	0.3
4	Rearing tanks	4	50 m X 15m X 1.5m	15	0.3
5	Brood stock raising ponds	4	50 m X 10m X 1.5m	10	0.4
6	Quarantine Facility and Hospital Tanks	3	25m X 10m X 2.5m	60	0.075
7	Wild brood stock pond (Earthern)	2	50m X 20m X 1.5	10	0.2
8	Overhead tank (RCC) (5-HP motor)	2	60000 litres	24	0.001
9	Office cum Laboratory (RCC)	1	10m X 6m	15	0.006
10	Store Room (RCC)	1	3m X3m	2.25	0.001
11	Vehicle parking area	200 sqm	20m X 10m	10	0.02
12	Residential quarters (watchmen)(RCC)	200 Sqm	20m X10m	50	0.02
13	Electricity (11 kV sub-station)	1		10	0.0002
14	Generator room	1	3mX3m	2.25	0.0002
15	Approach Roads / Internal Roads	1000m		50	0.1
16	Boundary Wall (Bio-security)	1000m		30	0.05
17	Bore well & Pumping System ,pipeline	4		8	0.001
18	Water purification system	1		10	0.03
19	Sump facility	1	10m X 6m	6	0.03
20	Culvert &Drainage Facility	1000m		20	0.05
		TOTAL COST		445.5	1.9904
				4.50 Crores	2.00 Ha
					Indicative cost

Biosecurity

The mahseer brood bank should be protected from any extraneous elements with proper fencing. Cemented or iron wire mesh fencing should be erected around the brood bank complex to prevent the entry of any domestic/wild animals including snakes, rodents, otters etc. The top of the brood bank complex may also be provided with bird fencing with nylon net or iron wire mesh to prevent the entry of fish predating birds.

Expected output: With the establishment of specialized Brood banks for targeted species, there will be multiple benefits- both tangible and intangible. The main among them are:

- Emergence of new brood banks and multiplication centres at national, regional and state level
- Proactive R&D in support for genetic improvement of stocks across the country
- Systematic breeding programmes to improve quality of seed production
- Strengthened capacities of government and private seed multiplication farms
- Emergence of skilled technical personnel especially in the genetic management of brood stock and breeding
- Positive growth in farming of diversified species of demand
- Better resource productivity, production and profitability


LAYOUT PLAN OF MASHEER BROOD BANK
COMPOUND WALL
COMPOUND WALL
RESIDENTIAL AREA (20M X 10M)
PARKING AREA (20M X 10M)
REARING TANKS (50M X 15M)
REARING TANKS (50M X 15M)
REARING TANKS (50M X 15M)
REARING TANKS (50M X 15M)
INTERNAL ROAD
QUARANTINE FACILITY (25M X 10M)
QUARANTINE FACILITY (25M X 10M)
QUARANTINE FACILITY (25M X 10M)
SUMP (10M X 6M)
WILD BROOD STOCK POND (50M X 20M)
WILD BROOD STOCK POND (50M X 20M)
HATCHERY COMPLEX (40M X 15M)
COMPOUND WALL
COMPOUND WALL
100.00
INTERNAL ROAD
INTERNAL ROAD
BROOD FISH STOCK POND (50M X 20M)
BROOD FISH STOCK POND (50M X 20M)
BROOD FISH STOCK POND (50M X 20M)
BROOD FISH STOCK POND (50M X 20M)
INTERNAL ROAD
N T (20M X 10M)
OHT
LAB & OFFICE (10M X 6M)
COMPOUND WALL
COMPOUND WALL
COMPOUND WALL
200.00

Rainbow Trout Brood Bank

1. Introduction

Rainbow trout is an exotic freshwater salmonid, which is one of the promising cultivable fish species in cold water and has considerable scope for its expansion in uplands region. This is a candidate species for Coldwater aquaculture due to its fast growth rate, consumer's preference, nutritional significance, good taste etc. This species is native to the Pacific drainages of North America, ranging from Alaska to Mexico. In global scenario, rainbow trout is now cultured by several countries and Chile is the leading producer of the species. In India, rainbow trout is cultured by various Northern, Southern and North-eastern states viz. Jammu & Kashmir, Himachal Pradesh, Sikkim, Arunachal Pradesh, Nagaland, Uttarakhand, Tamil Nadu, Kerala etc. As per the production status of our country, Jammu & Kashmir is the leading producer of this species followed by Himachal Pradesh and Sikkim.

Healthy brood stock of improved variety is required for quality seed production. Healthy brood stocks are the base materials for successful propagation and culture of any species, hence there should not be any compromise regarding the quality of the brooders. Good quality off springs like spawn, fry and fingerlings are produced from improved quality brooders. Generally, good quality eyed ova of rainbow trout are procured from certified hatcheries and reared up to table size for consumption/sale or raised up to brooders stage for further breeding and seed production program. The brood stocks are reared and managed with optimum condition to increase fecundity, good quality sperm and egg, production of disease-free healthy larvae and fry, spontaneous and timely supply of seeds to farmers including other agencies, overcome from inbreeding depression and successful aquaculture activities with higher production.

As the success of rainbow trout breeding and seed production program mainly depends on healthy good quality mature brood stocks, the establishment of rainbow trout brood bank with required facilities will solve the problem with production of good quality improved variety seeds. The produced seeds can be supplied to the farmers or any government/private agencies or can be reared in the farm itself for revenue generation/consumption.

Objectives

 To produce good quality healthy brood stocks of rainbow trout for breeding and seed production program or to supply to commercial hatcheries

 To produce improved quality rainbow trout eyed ova and seeds

 To overcome the inbreeding depression and to maintain genetic heterozygosity of rainbow trout brooders

 To augment the scientific farming of rainbow trout.

2. Justification:

3. Site Selection

The site should have a perennial water source free from pollution and silt and a proper approach road. Water should have higher dissolved oxygen preferably above 7 mg/l, pH 6.5-8.0 and temperature range of 0-20 0 C round the year. However, thermal regime of 13-18 0 C is optimum for better survival and growth. Water temperature above 18 0 C for longer duration creates environmental stress and mortality in the growing-stock. Rectangular concrete raceway (RCC) with an area of 30 m2 (length-width ratio 15:2) and water depth of 80-90 cm having 3% bottom slope is mostly preferred. Single or a battery of parallel raceways may be constructed in a Trout Farm, each with separate inlet and outlet facility.

The physico-chemical parameters responsible for the successful culture of trout are temperature, dissolved oxygen, pH and turbidity.

Temperature: The fish thrives well within the temperature range of 5 to 18^{o}C, but it has been found to tolerate the water temperature upto 25^{o}C in the region without any mortality. However, the maximum growth is obtained within the temperature range of 10 to 18^{o}C.

Dissolved oxygen: The oxygen concentration range is from 5.8 to 9.5 mg/L. If the oxygen concentration is 5 mg/L, it is better to increase the flow of water.

pH: A neutral or slightly alkaline pH is best for the trout. The tolerable minimum and maximum pH values are 4.5 and 9.2, respectively. However, pH range is ideal for the growth of this fish.

Turbidity: The crystal clear water is required and there should not be any contamination. The turbidity should not be more than 25 cm.

Stocking density: It is related with the water supply, water temperature, quality/water and types of feed. If water temperature is above 20^{o}C, the stocking density should be less than the recommended density. The fry fingerlings (5 to 50 g) is stocked at the rate of 20 kg fish per cubic meter of water surface area.

4. **Source of Brood stock**:

The brood stock obtained from natural grounds in rivers, lakes and reservoirs are stripped of their eggs and milt and fertilized eggs are incubated in specially developed flow through hatchery.

5. **Components in the Brood Bank Complex:** The complex generally consists of 5 ha total land area to accommodate 3ha built area.

Infrastructure facilities for Trout Fish Broodbank (2.00 Ha area)					
Sl. No.	**Particulars/Components**	**No. of Units**	**Size**	**Approximate Amount in lakhs**	**Land area Required**
1	Brood Rearing Raceway units	30	30m X 2 m X 1.5m	9	0.3
2	Nursery Rearing Raceway units	50	15m X 2m X 1.5m	7.5	0.3
3	Grow out Raceway unit	20	20m x 2m X 1.50m	4	0.1
4	Civil works for the water supply in the hatchery	1		10	0.2
5	Trough	125	2170mmX420mmX170 mm	6.25	0.02
6	Hatching Trays	500	470mmX420mmX170m m	15	0.1
7	Feeding Trough	30	1050mmX1050mmX170 mm	1.2	0.05
8	Filtration Tank	2		10	0.05
9	Stand for Trough, Tray & Indoor fitting & shed	1	100m X 10m	40	0.1
10	Electrification & electric motor 5 Hp	5		10	0.05
11	Laboratory cum Feed store	1	10m X 6m	15	0.01
12	Quarantine tanks	2	20m x 5m x 3m	16	0.02
13	Office cum Laboratory	1	10m X 6m	15	0.005
14	Store Room	1	3m X 3m	2.25	0.005
15	Vehicle parking Area	1	12m X 5m	15	0.006
16	Residential Quarters	1	20m X 10m	50	0.002
17	Electricity (11 kV sub-station)	1		10	0.002
18	Generator room	1	3mX3m	2.25	0.002
19	Approach / internal Roads	1000 m		20	0.5
20	Boundary Wall (Bio-security)	600m		18	0.1
22	Culvert &Drainage Facility	1000 m		24	0.08
			TOTAL COST	300.45	2.002
				3.00 Crores	2.00 Ha
					Indicative cost

Trout fish requires cold, clean and highly oxygenated water for ripening of brooder, successful breeding and hatchery activities. It breeds during November to February and attains maturity after 3 years' age. The whole process of breeding includes brood stock rearing, stripping of females and males, mixing of eggs and milt, incubation of eggs in trays fitted in the troughs with continuous flowing water, and rearing sac-fry and swim-up fry in FRP tanks.

A Trout Hatchery with flowing water system is known as Ova House, where incubation and hatching of eggs takes place. An Ova House comprises of indoor structures such as hatching trays, troughs, nursery tanks and rearing tanks, with continuous water flow and following dimensions:

Brood Stock:

- Males and females are segregated 2 months prior to spawning and held in separate raceways at a density of 5-10 kg/ m3 .
- Generally, two males to one female are deemed a satisfactory sex ratio for brood stock. During breeding season, female has round body appearance, bloated and soft belly with swollen and reddened vent, while male has dark and dull appearance, large pointed snout with hooked lower jaw and oozing milt (seminal fluid). Food and feeding significantly influences fecundity.
- Healthy and large sized brooders are preferred for quality seed production.

Spawning and Egg Incubation:

- Dry stripping method is practiced for spawning Rainbow Trout.
- Fertilized eggs are lemon yellow or light green in colour and measure 4-5 mm. A mature female Trout of 1 kg body weight can produce 1500 – 1800 mature eggs.
- Fertilized eggs are incubated undisturbed, until the Eyed-ova stage, in hatching troughs with meshed trays or in vertical flow incubators or hatching jars. When hatching troughs are used, eggs are placed in meshed hatching trays (mesh size 1.5-2.5 mm); each tray can hold a layer of 2000-3000 fertilized eggs. Mesh of the tray is made up of stainless steel or aluminum. The meshed trays are placed 10 cm above the bottom of hatching troughs, and water passes through the meshes of trays from bottom of troughs to the top across the trays.
- The hatching trays are covered with lids as hatching always takes place in the dark. Unlike carps and catfishes, Trout have prolonged incubation period lasting several days (40-60 days). Duration of incubation depends on the water temperature.
- There are four distinct stages during incubation, namely: 1. Green-eggs (fertilized eggs) 2. Eyed-eggs 3. Alevin or Sac-fry 4. Swim-up Fry Transportation of eggs can be done only at Eyed-egg stage, 5 days prior to hatching. As the eggs hatch (95% hatching rate), the Sac-fry drop through mesh of the hatching tray to the bottom of rectangular trough.
- Sac-fry can remain in hatching trough for 10 to 14 days after hatching, until swim-up stage. Initially hatchlings of Trout, called Alevin or Sac-fry (size 1.5 -1.8 cm, weight 45-50 mg), feed on reserve food in the yolk sac (which lasts for 2-4 weeks).
- Hatching of a batch of eggs usually takes 2-3 days, during which time all egg shells as well as dead and deformed Sac-fry should be removed regularly.

- Upon hatching, Alevin/ Sac-fry are carefully removed from the meshed trays and put into the mesh cage arranged in the rectangular troughs wherein running water flow is maintained @ 0.3-0.5 litre per minute per 1000 larvae.
- The Sac-fry are protected from bright light and retained in the trough until absorption of the yolk sac and attain the Swim-up Fry stage.
- Free-swimming fry are fed 10 times a day @ 5-10% of biomass with Starter-feed I. After one week, feeding frequency is reduced to 3-4 times a day and fry are transferred into rearing tanks.

Fry and Fingerlings

- Rearing Fry are reared in fiberglass or concrete nursery and rearing tanks, preferably circular in shape to maintain a regular water current and uniform distribution of the fry.
- Fry are stocked at density of 1000 numbers/m2 and provided Starter-feed II. Fry attain the Fingerling stage (2-5 g) at the end of 3 months rearing.
- These 3-month old fingerlings can be stocked in raceways. For production of 1 lakh fingerlings, 400 kg brooders are required, which produce 2 lakh fertilized eggs, 1.5 lakh fry with a cumulative survival of 50% from eggs to fingerlings.

4.1.Other sub components:

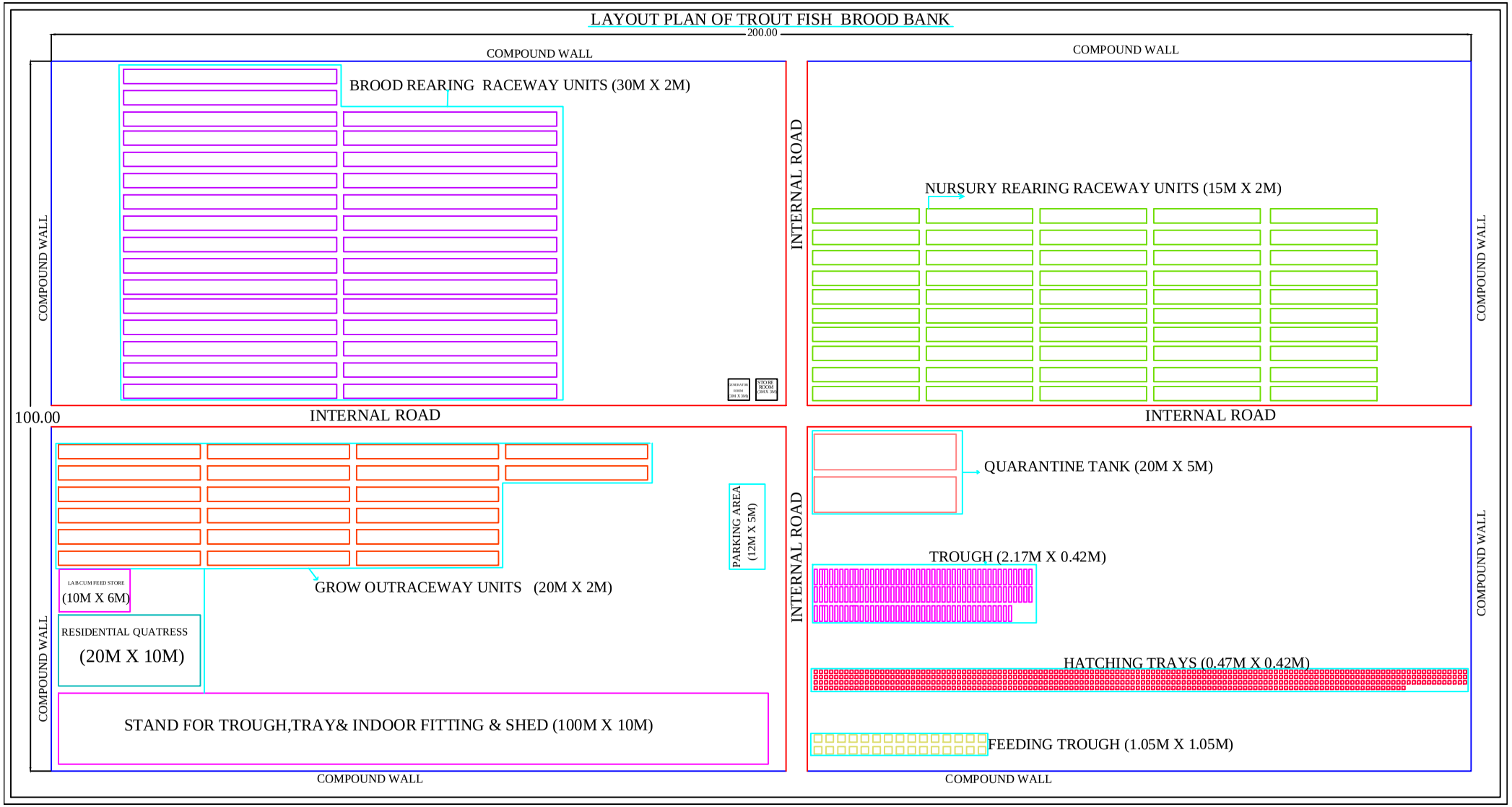
a. Packing shed (brick work) (12m X 3 m) with conditioning cistern (RCC) size of 5m X 1.5m X 1.2m covering an area of 50m^2
b. Office-cum-Lab room: 50m^2area
c. Store room/ feed room: 50m^2area
d. Vehicle parking 12m X 5m with 60m^2 area
e. Brood seed/ Brood fish transport vehicle – 2 units
f. Approach road with vehicle moving facility
g. Watchmen quarter room covering an area 20m^2
h. Electricity and illumination facility
i. Generator (7.5 HP) room (2m X 1m) for standby electric provision

4.10. Biosecurity: The Brrodbank facility should be free of any environment and pollution problem. It will have no harmful impact over the surroundings. So as to create biosecure conditions the following facilities are essential;

c. Fencing: Brick built / Link chain fencing around the brood bank complex to avoid domestic animals.
d. Drainage facility (earthen): For better management of broodstock, the drainage facilities are essential so that the desired water level in the ponds can be accomplished.

6. **Risk Management:** The proposed brood bank facility is allowed for inspection to identify the site proposed is out of disaster zone. It should not have possibility of adverse effects on people and environment.
7. **Expected outcome:** With the establishment of specialized Brood banks for targeted species, there will be multiple benefits- both tangible and intangible. The main among them are:

- Emergence of new brood banks and multiplication centers at national, regional and state level
- Proactive R&D in support for genetic improvement of stocks across the country
- Systematic breeding programmes to improve quality of seed production
- Strengthened capacities of government and private seed multiplication farms
- Emergence of skilled technical personnel especially in the genetic management of brood stock and breeding
- Positive growth in farming of diversified species of demand
- Better resource productivity, production and profitability


LAYOUT PLAN OF TROUT FISH BROOD BANK
200.00
COMPOUND WALL
COMPOUND WALL
BROOD REARING RACEWAY UNITS (30M X 2M)
NURSURY REARING RACEWAY UNITS (15M X 2M)
INTERNAL ROAD
COMPOUND WALL
COMPOUND WALL
100.00
INTERNAL ROAD
INTERNAL ROAD
QUARANTINE TANK (20M X 5M)
PARKING AREA (12M X 5M)
GROW OUTRACEWAY UNITS (20M X 2M)
TROUGH (2.17M X 0.42M)
LAB CUM FEED STORE (10M X 6M)
RESIDENTIAL QUATRESS (20M X 10M)
HATCHING TRAYS (0.47M X 0.42M)
STAND FOR TROUGH,TRAY& INDOOR FITTING & SHED (100M X 10M)
FEEDING TROUGH (1.05M X 1.05M)
COMPOUND WALL
COMPOUND WALL

Guidelines for Marine Fin Fish Brood Bank

Cobia (*Rachycentron canadum*) and Silver pompano (*Trachinotus blochii*)

1.Introduction

1.1 Availability of quality seed is a major concern for the expansion and commercialization of sea farming in India. The growing mariculture activities especially the open sea cage farming has enhanced the fin fish seed requirement of hatchery bred seed. Among many high value marine fin fishes, cobia and silver pompano are lucrative species for farming in India due to its fast growth, acceptability in domestic markets and better farm gate price. The Mandapam Regional Centre of CMFRI has succeeded in developing protocols for captive breeding, larval production and pond/cage farming of Cobia and Silver pompano and breeding and seed production experiments are continued successfully.

1.2. The first and foremost requirement to achieve sustainable year round seed production is controlled reproductive maturation under bio-secure conditions. This can be achieved only by establishment of brood stock holding facility or Brood bank equipped with re -circulatory aquaculture systems (RAS) and photo thermal control etc.

2. Objectives

- To meet out the growing demand of quality seeds of Cobia and Silver pompano in the mariculture sector.
- To augment the marine fin fish production through mariculture.
- To disseminate the seed production and culture technologies to the entrepreneurs/ farmers /fishermen to venture mariculture activities in an integrated approach.
- To cause employment generation and social and economic upliftment.

3. **Justification**

3.1. India has vast coastal saline soil lands, which are currently being used for culture of shrimps. The shrimp farmers are encountering frequent outbreaks of viral diseases during culture and are incurring heavy loss leading to abandonment of ponds.

3.2. The techno-economic viability of open sea cage farming and coastal pond farming of Cobia and Silver pompano demonstrated by the CMFRI, has created awareness and interest among farmers/fishermen/entrepreneurs to take up farming of Cobia and Silver pompano in cages and ponds.

3.3. This has warranted the establishment of specific Brood bank for Cobia and Silver pompano both by the public and private sectors to produce, rear and supply the quality seed of marine fin fishes for the success of coastal aquaculture and mariculture and enhance the marine fish production.

4. Site selection

4.1. The site for the establishment of Brood bank should be the area of sea front free from pollution and with the facility to draw copious amount of clear sea water. Area of stable water quality parameters is preferable. Salinity- 31-35 ppt. Temp 28-30^{o} C.

5. **Source of Brood stock.**

Brood stock fish are generally collected from the wild, conditioned and matured in captivity. Marine fin fish brood stock availability is highly seasonal and location specific in nature. It is advantageous to collect sub-adults for brood stock development. Larger fishes would have crossed the reproductive age and very small fishes will take longer time to sexually mature. Cobia weighing between 8-15 kg and Silver pompano weighing 750 gram to 1.5 kg can be collected for brood stock development. Adequate care should be taken to ensure genetic variability in the brooders for which the collection shall be undertaken from different geographical locations. Also collection of fishes from trap nets or hook and lines rather than trawls would be preferred to minimize stress.

6. **Components of Brood Bank complex- Total land area -1 .20 ha. (Approx)**

Infrastructure facilities for Marine Fish Broodbank (1.20 Ha area)					
Sl. No.	**Particulars/Components**	**No. of Units**	**Size**	**Approximate Amount in lakhs**	**Land Area Required**
I	**COBIA**				
1	Quarantine Facility- FRP Tanks -20Ton	3	5m X 4m X 1.5m	9	0.006
2	Brood fish stock holding Tanks (RCC)-100 Ton. With RAS facility with its components Drum Filter, Fluidized bed bioreactor, protrin skimmer, UV sterilizer, photo period control unit and Thermal control unit.	5	8m DiaX 2.3m	51	0.1
3	Spawning Tank RCC -50 Ton	2	8m Dia X 1.2m	10.2	0.02
4	Incubation and Hatching Tank -RCC-5Ton	5	3m Dia X 1.20m	3.5	0.01
5	Larviculture Tanks-RCC-3 to 5 ton	20	4.5 m X 1.5m X 1.2m	13.5	0.05
6	Fry-Fingerlings-sub adult Rearing Tanks (RCC)- 200 Ton	5	20m X 10m X 2m	80	0.15
II	**SILVER POMPANO**				
7	Quarantine Facility- FRP Tanks -10Ton	2	4m X 2m X 1.5m	6	0.002
8	Brood fish stock holding Tanks (RCC)-10 Ton. With RAS facility with its components Drum Filter, Fluidized bed bioreactor, protrin skimmer, UV sterilizer, photo period control unit and Thermal control unit.	10	3m DiaX 1.7m	14	0.05
9	Spawning Tank FRP -7 Ton	5	3m Dia X 1.2m	15	0.05
10	Incubation and Hatching Tank -FRP-3Ton	2	1m Dia X 1.20m	6	0.001

Sl. No.	Particulars/Components	No. of Units	Size	Approximate Amount in lakhs	Land Area Required
11	Larviculture Tanks-FRP -2 Ton	20	2 m X 1m X 1.2m	60	0.01
12	Fry-Fingerlings-sub adult Rearing Tanks (RCC)- 200 Ton	3	20m X 10m X 2m	48	0.1
III	**COMMON INFRASTRUCTURE**				
13	Algae culture - FRP- 1 Ton	30	1.2m dia X 1m	3	0.005
14	Rotifier/ Copepod culture-FRP-2Ton	70	1.80m dia X 1m	7	0.02
15	OHT with Bore well & Pumping System ,pipeline	1	50000 litres	12.5	0.03
16	Sump facility 20 Ton	1	15m X 6m X 1.5m	6	0.01
17	Sedimentation Tank - RCC	2	6m X 4M X 1.50m	4.8	0.005
18	Rapid Sand Filtration	2		6	0.01
19	UV Filtration	4		12	0.01
20	Laboratory-PCR	1	10m X 6m	15	0.006
21	Water Distillation unit	1		5	0.05
22	Office cum Store Room	1	10 mX3m	7.5	0.003
23	Vehicle Parking area	600 sqm	30m X 20m	30	0.06
24	Approach Roads/ Internal Roads	1000m		40	0.34
25	Culvert &Drainage Facility	2000m		30	0.1
26	Generator room	1	3mX3m	2.25	0.002
27	Boundary Wall (Bio-security)	600m		18	0.001
28	Shelter area for Hatchery Units	6000 sqm		230	
29	Toilets 2.5m X 1.5m	1	2.5m X 1.5m	3.75	0.001
		TOTAL COST		**745.25**	**1.201**
				7.50 Crores	**1.20 Ha**
					Indicative cost

7. **Bio- secure Brood bank facility.**

The building construction shall ensure physically separate facilities for various sections of the brood bank such as quarantine, brood stock development, laboratory, incubation, stores for chemicals and consumables and packing etc. The design of the buildings shall ensure proper work flow besides avoiding any chance of cross contamination between the sections. The complete brood bank facility shall be securely covered by a fence or wall to prevent the entry of unauthorized persons/animals. The main entrance of the brood bank facility should be provided with a wheel dip facility filled with disinfectant solution for sterilization of wheels of vehicles seeking entry into the premises. The brood stock holding and incubation tanks would be coated with epoxy paint to ensure easy cleaning/disinfection.

8. **Production capacity.**

Cobia – Minimum of 50 Million newly hatched larvae /year could be produced from 10 pairs of brooders at 80% breeding success, 80% fertilization of eggs and 90% hatching at an average fecundity of 1.5 Million per pair with 6 cycles of breeding per year. Fingerlings production at average 8% survival -4 Million. Silver pompano- Minimum of 50 Million newly hatched larvae /year could be produced from 100 pairs of brooders at 80% success, 80% fertilization of eggs and 80% hatching at an average fecundity of 0.1 Million per pair with 8 cycles of breeding per year. Fingerlings production at average 20% survival -10Million.

9. **Prospects of Cobia and Silver pompano culture.**

- The cobia species can be grown in salinity as low as 15ppt and survival and growth is comparable to that of sea water.
- The Silver pompano can be grown even at lower salinity of about 10ppt and hence suitable for farming in the vast low saline waters.
- Trial earthen pond culture is also encouraging.
- Both the species are ideal candidate species for cage farming and expected to play a great role in the mariculture sector.
- Cobia is found to grow 2.5 kg and Silver pompano 0.5 kg in 6 months' period.

10. Risk Management.

The project is fully operated under bio-secured Re-Circulated Aquaculture System and therefore will have no adverse impact on the environment.

11. Expected outcome.

- Emergence of new brood banks and brood stock multiplication centres at National, Regional and State level.
- Proactive R& D in support for genetic improvement of stocks across the country.
- Systematic breeding programmes to improve quality of seed production.
- Emergence of skilled technical personnel especially in the genetic management of brood stock and breeding.
- Positive growth in farming of diversified species in the mariculture sector.
- Better resource productivity, production and profitability.

LAYOUT PLAN OF MARINE FIN FISH BROOD BANK

100.00

COMPOUND WALL

COMPOUND WALL

COMPOUND WALL

COBIA HATCHERY

SPAWNING TANK (8M DIA)

SEDIMENTATION TANK (6M X 4M)

SUMP (15M X 6M)

OHT

INCUBATION CUM HATCHING TANK (3M DIA)

SILVER POMPANO HATCHERY

40.00

BROOD STOCK HOLDING TANKS (3M DIA)

BROOD STOCK HOLDING TANKS (8M DIA)

SPAWNING TANK FRP (3M DIA)

50.00

LABORATORY (10M X 6M)

BROOD STOCK RAISING TANKS (20M X 10M)

QUARANTINE FRP TANKS (4M X 2M)

QUARANTINE FRP TANKS (4M X 2M)

INTERNAL ROAD

INTERNAL ROAD

COMPOUND WALL

COMPOUND WALL

120.00

115.00

BROOD STOCK RAISING TANKS (20M X 10M)

BROOD STOCK RAISING TANKS (20M X 10M)

INCUBATION CUM HATCHING TANK (1M DIA)

OFFICE (10M X 3M)

GENERATOR ROOM (3M X 3M)

TOILET(3.5M X 3.5M)

TOILET(3.5M X 3.5M)

QUARANTINE FACILITY(5M X 4M)

LAVICULTURE TANKS (4.5M X 1.5M)

LAVICULTURE TANKS (2M X 1M)

BROOD STOCK RAISING TANKS (20M X 10M)

BROOD STOCK RAISING TANKS (20M X 10M)

BROOD STOCK RAISING TANKS (20M X 10M)

BROOD STOCK RAISING TANKS (20M X 10M)

VEHICLE PARKING AREA

(30M X 20M)

ROTIFER COPEPOD(1.8M DIA)

ALGAE CULTURE (1.2M DIA)

COMPOUND WALL

COMPOUND WALL

40.00

COMPOUND WALL

COMPOUND WALL

COMPOUND WALL