alappuzha - sherthalai canal for aquaculture development

Ajith Bhaskar, Rafi

Fisheries development is one of the vital backward linkages of the micro-enterprise development programme being proposed for Aryad and Kanjikuzhy blocks. The fisheries development in the project area has three main components a) Fisheries Conservation and fish aggregating interventions in the marine sector b) Fisheries rejuvenation and eco-restoration interventions in the Vembanad Lake System and promotion of cage and pisciculture and c) aquaculture in the ponds and canals of the project area. Given the limitations for local level interventions in the short term period in the first two components in the strategy for fisheries development, the third components of aquaculture assumes special importance. Efforts will have to be made to identify new and hither to unutilised water areas for balanced, socially responsible and sustainable development of aquaculture. It is in this context that we are proposing renovation of Alleppey-Sherthala canal for aquaculture.

Geographical Location of the Alappuzha – Cherthala Canal

The 22 km long canal lies in the North South direction connecting a southern arm of the Vembanad Lake at Cherthala and Vadai Canal at the South end at the Alappuzha. Canal runs through Alappuzha Municipality, Aryad Grama Panchayat, Mannancherry Grama Panchayat, Kanjikuzhy constructed in quick succession. These bunds also functioned as bridges for road transport network. Now there are 20 bunds across the canal compartmentalizing it into 22 segments. Transportation needs in future may call for construction of new bunds, this calls for proper design of cross drainage works and it requires some kind of regulations.

Present State of the Canal

The canal was originally used for navigation and transportation of goods. There were resting places, small restaurants and amenities for such transportation previously. Canal bore a good stock of fish colonies. The local community depended on canal as an important source of water for irrigation and domestic use. For some years even after the construction of bunds the canal continued to be used for agricultural purposes. Coconut and paddy are the main crops. The water plants in the canal were used as a bio-fertilizer and the process in turn kept the canal clean. The decline in the price of coconut and the emergence of disease in coconut trees has reduced the interest of farmers towards the collection of aquatic weeds as fertilizers.

The reduction in discharge through the vents of the bunds and the lowering of the side bunds has resulted in the occurrence of flooding of banks. The depth of the canal got reduced through the accumulation of the decayed organic matter. This also resulted in the reduction of percolation rate and became the reason for increased magnitude of the flood. The frequent floods resulted in loss of property and prevalence of unhygienic conditions and emergence of wheels disease. Most of the canal area today is covered by dense aquatic plants. There is high level of decaying organic matter. Though fish population exists in several segments, their number and variety has been limited by the existence of adverse aquatic condition.

Annual floods are occurring in the canal area for the past few years. Reduction in the depth of the canal due to accumulation of organic waste and sealing of the canal by decaying organic matter resulting in infiltration rate has aggravated the gravels of flood. Lateral more meet of water across cross drainage

work has also considerably reduced due to the faulty design of cross drainage wastes. Stagnation of water resulted in the development of surface weeds. The southern section of the canal in Alappuzha municipality is being used as open toilet. There are 169 toilets opening into the canal. 75% of them are in the first three sections.

The canal has today become a major environmental and health hazard. It is one of the biggest sources of breeding mosquitos and rats. The water in most stretches is too polluted for use and its contact generates severe irritation to skin.

Search for alternative use

With development of widespread road network, rejuvenation of the canal for the original transportation purpose has lost its relevance, besides, without major technical corrections the opening up of the canal will result in the repetition of the hydrological imbalances in the region. On the other hand, if left to degenerate in the present state, the canal overtime will become a marshy waterway and eventually encroached and converted for cultivation and settlement. But in the process for years to come its adverse impact on regional environment health and sanitation will continue to be severe. Available alternative will be to desilt and clean the canal for fish culture.

A team of engineers and technicians conducted a detailed survey of the water body during the month of September 2001. Measurements were made for every metre of the canal length. In this paper we are presenting only summary results of the observations and calculations.

Aquaculture in AS Canal

The AS Canal originally constituted for water transportation is 22 kilometers long (Table 1). The canal is divided into 23 sectors and the length depth area and water depth of the different sections are mentioned in Table 1. As can be noted in Table 1, the average depth of the canal ranges from 1.1 m to 6 meter and is suitable for fish farming. The bunds of the sections are strong enough to allow dewatering and preparation for farming.

The canal was not used for any purpose for the last few years and because of this any of aquatic plants like Eichornia, Savenia, Pistia, Trapa, Ipomea, Myriophylum, Najas, Sciprus, Sagittaria and Marselia exist in the water logged segment (Table 2). A bed of sediment is formed and on thus terrestrial plants has also developed. The color of the water is naturally brown to dark brown in section 1 – 14 and colorless in the rest of the sections. The color of water is natural to the respective areas where fish farm has been successfully established. On the banks of the canal, mangrove vegetation like kaitha have been established and these adds to the strength of the adjointly bunds. Certain pollutant discharges have been identified in certain section of the canal.

Ameliorative measures for these pollutants needs to be done before undertaking fish culture in the respective segments.

The fish available in the different sections include clarias batrachus (Kari), channa striatus (varal), glossogobius sp, Lutijunus sp (chemballi), saurobrangusp, Etroplus suratenius (karimeen), Heteroneustis fossils (muzhi), Macrobrachium rosenbergii (konchu), cater calcarifer (kalanchi), chanos chanos (pumeen) tilapir.

There are six canals connected with AS Canal and sluice gates for regulating water flow and screening the entry of the undesirable aquatic fauna.

Table 1: Physical Parameters of Canal

Name of Unit	Length	Breadth	Min. Depth of Water	Max Depth ofWater	Average Water Depth
X	3050	16.50	0.40	2.30	1.25
1	560	16.00	1.20	2.50	1.50
2	640	15.00	0.30	1.90	1.10
3	590	27.00	0.70	1.10	1.60
4	872	30.00	1.20	2.50	1.80
5	852	23.00	1.50	2.00	1.75
6	500	29.00	5.00	5.80	5.40
7	420	30.00	4.70	4.70	4.70
8	400	25.00	4.00	4.00	4.00
9	1042	31.00	6.00	6.00	6.00
10	638	29.00	5.50	6.00	5.75
11	1235	29.50	4.25	7.00	6.00
12	392	31.00	4.25	5.50	4.80
13	543	28.50	3.25	4.00	3.50
14	1143	26.00	0.80	3.50	2.00
15	330	22.00	1.20	4.25	2.70
16	381	23.00	2.70	4.50	3.60
17	2046	26.00	2.85	5.00	3.90
18	200	18.00	3.20	4.10	3.60
19	320	19.00	3.00	5.00	3.00
20	250	23.00	0.50	3.00	2.00
21	2174	17.00	0.50	3.70	1.30
Y	2426	21.50	0.50	2.50	1.40

Proposal for Composite fish culture

Farming of Indian major carps viz, catla cafla, Labeo rohita and Cirhinus mrigala and the Chinese carps. Hyopthalamicthys molutrix (Silver carp), Ctenopharyngodon idella (grass carps) and common carp cyprinus carpio is in vogue in the state. The Kanjikuzhy Block has acquired facilities for aquaculture by constructing a fish hatchery at the Block. The soil condition and water quantity in the proposed area is suitable for farming fish.

The canal is divided by bunds strong enough to facilitate dewatering of the segments. The plant animal complex occupying the top layer of water will be removed and will be used in compost pits for farming manure. The area will be dewatered and the weed fish and predatory fish will be eliminated. Excess loose clay also will be removed and used as fertilizer for canal crops. Participation of local community will be utilized for this purpose. The existing embankment will be strengthened to resist flood. Water flow existing in the canal will be allowed and the pipes will be fitted with screen to control the aquatic fauna. Lime will be applied at appropriate quantity and fish of catla rohu mrigal, silver carps, grass carps and common carp will be stocked @ 6000/ ha. and prawns @ 20000/ ha. Fertilization with cow dung @ 10,000/ha. urea @ 50kg/ ha and super phosphate @ 50 kg/ha will be done after evaluating the fertility and plantation development of the area. Supplementary feeding will be done using locally available rice bran, oil cake and waste from chicken and butcher shops.

Table 2: Pollution in AS Canal

Pollution Unit	No. of Industries on the Bank of the Canal	Location & Distance	Type of Industry	Type of Effluent	Aquatic plants	Color of Water
X	1 Ch 1950	West	Coir	Bleach, Dye	Weed	Brown
1	Nil	-	-	-	Weed	Brown
2	Nil	-	-	-	Weed, Grass	Brown
3	Nil	-	-	-	Grass	Brown
4	1	West Ch 5280	Glass	Oil, Waste	-	Dark Brown
5	2	West Ch 6000 East Ch 6390	Coir	Bleach, Dye	Weed, Grass	Brown
6	1	West Ch 7067	Coir	Bleach, Dye	Grass	Brown
7	Nil	-	-	-	Weed, Grass	Brown
8	Nil	-	-	-	Weed	Brown
9	Nil	-	-	-	Grass	Brown
10	1	West Ch 9318	Coir	Bleach, Dye Organic waste	Weed, Grass	Brown
11	Nil	-	-	-	Weed, Grass	Brown
12	Nil	-	-	-	Weed	Brown
13	Nil	-	-	-	Weed, Grass	Brown
14	Nil	-	-	-	Weed, Grass	Brown
15	Nil	-	-	-	Grass	Colourless
16	Nil	-	-	-	Grass	Colourless
17	1	East Ch 15172	Steel	-	Grass	Colourless
18	Nil	-	-	-	Grass	Colourless
19	Nil	-	-	-	-	Colourless
20	Nil	-	-	-	Weed	Colourless
21	Nil	-	-	-	Weed	Colourless
Y	Nil	-	-	-	-	Colourless

The entire operation will be carried out under scientific vigilance and management. The giant freshwater presence Macrobrachium rosenbergii will be added to the culture @ 20,000 / ha. after avoiding common carps and mrigal.

Sampling fish for health, and growth will be carried out once in a month. The culture will be harvested after a year and the expected production is 200 kg / ha of fish and 500 kg / ha.

Establishment of Aqua Culture System

Removal of Weeds

Almost entire length of canal is infested with variety of weeds, grass and other vegetation. Even marginal plants like Pandulas and terrestrial plants like Acacia are found in abundance in the canal. Trees of age two and more years can also been seen near North Aryad Colony River Bund.

Water surface is covered with the above said vegetation except where it is removed by the public. Canal segment near Ponnittassery paddy field in an example.

At many places the floating vegetation has a thickness not less than 45 cm and strong enough to support human weight. The underneath side of the floating vegetation is in a decayed state but is strong enough because of interlocked roots.

To initiate aqua farming, the biggest task is to remove the floating vegetation and other weeds in all the identified units where fish farming is proposed. This task becomes daunting due to several reasons. Earlier times people inhabiting on both banks of the canal used to clean the canal periodically. This was at a time when the canal weeds were used as a fertilizer for land crops. Cropping has been considerably reduced due to many anthropogenic factors and has resulted in the accumulation of waste and organic pollutants. The water in the canal is potent enough to cause skin irritation even through limited contact.

Canal surface infested with weeds is a safe haven for rodents like mice and venomous snakes. Wide spread occurrence of *'Elipani'* transmitted through aquatic media and snake bites are major redundant in using manual labour for weeds removal. Manual labour can only be used till the canal is cleaned and disinfected.

Moreover, the difficulty of the removal of weeds through manual labour and economic non-feasibility forces us to think about making use of other methods.

Excavators can be efficiently used to collect surface weeds and vegetation operating from both banks. The out-turn of this is more than the manual labour and is more economical considering the huge quantity of work. But the major obstacle is the reach of the excavator into the canal when operating from the banks. Removal of weeds operating the machine from the banks is feasible only where the canal is narrow. But where the width is more than 12 meters, this method is not operative. For this suitable other methods are to be adopted. An excavator operating from a floating platform or a vessel is an ideal answer. Similar methods are adopted for cleaning canals in Cochin Corporation and Parvathy Puthanar in Thiruvananthapuram district.

Ideal yards have been located throughout the banks for temporary dumping, processing and storage of organic manure. The organic manure can be distributed among well-established vegetable farms in Kanjikuzhy and Aryad panchayat.

Removal of Clay

Soil composition in the canal basin shows that clay, organic detritus and other wastes at the bottom occupies the canal with thickness varying from 30 cm to 100 cm at different places. These waste materials may inhibit or restrain the growth and survival of farmed aquatic species and may limit the dissolved oxygen content of the water. Hence to facilitate smooth farming of fishes and prawns, these layers of waste materials may be removed as per

Table 3: Quantum of Weeds, Clay and Water to be Removed

Unit	Qty of Weeds (M^2)	Qty of Caly (M^3)	Water (M^3)
X			
1	10030	900	11648
2	9490	750	4842
3	15585	1900	18116
4	25496	2250	32895
5	20181	2100	17483
6	13920	13725	23215
7	12600	12548	43970
8	11000	6810	23810
9	31677	31844	65582
10	17226	9525	48839
11	38491	24001	85424
12	Nil	2710	25256
13	17376	2742	25847
14	30290	4349	32866
15	7112	3002	12236
16	8541	4038	14186
17	45348	19763	180806
18	Nil	602	7566
19	5840	720	8746
20	7625	1440	15638
21	2700	3623	23041
Y			

specifications. Table No. 3 which shows the quantity of the clay and other waste shows the present state of the canal.

Removal of waste materials and excessive clay has to be done to launch scientific aqua farming in the canal segments.

Average length of each identified units varies from 300 to 1200 meters and the quantity of clay and waste varies from 700 m^3 to 20000 m^3. Removal of clay using manual labours cannot be considered because of the reason cited earlier. Mechanical removal of clay has been found economic in the canal segments as observed in the survey.

Pumping out of clay by means of conventional dredgers cannot be used as these dredgers has to be tugged from unit to unit and cannot be transported by any other means. But the movement of dredgers from units to units cannot be done because of the presence of cross bunds at regular intervals. This again points to the possibility of exploring the suitability of excavators. The mounted or floating excavators will again fit the job considering the circumstances.

Construction of embankment can be done utilizing the clay drugged out from the canal segment to minimize the construction cost and provide a free board of 50 cm from the water level.

Excess clay if any can be disposed as fertilizer to farmers of the area through the identified storage spots and transportation facilities.

Dewatering

Dewatering is carried out to facilitate the removal of weed fishes and to promote mineralisation of soil for fish culture. If 10 HP pumps will be used to pump the water to adjacent land. Cross bunds defining

each units are tested for no water condition when floodwater condition exist in the adjoining units one found to be safe. To prevent the escape of fish and the entry of undesirable aquatic stock from outside, adequate filter nets will be provided at the connection points between canal segments and connected canals.

Vent ways presently provided through the bunds for the regulation of water during the flood season are grossly inadequate. Discharge area provided for the flow of water above the presently fixed level of water column for storage of water in the canal segments is only 5% of the wetted area. This may be increased to a minimum of 20% for the regulation of floodwater for smooth aqua farming.

Most of the cross bunds are provided with 3 Nos. of 600 MM diameters RCC pipes for the water regulation. This may be improved by adding another 6 or 8 pipes at each bund.

Compost Formation

The large quantity of aquatic weeds collected for the canals can be converted into organic manure in manure pits. Pits of 1 m x 2 m will be dug at the selected points on the canal bank weeds will be mixed with urea and cow dung and stacked in the compact pit 15 layers. The available plant nutrients will be increased when these are collected and distributed after one month.

Vermi compost methodology can also be used for effective mineralisation of collected aquatic weeds and detritus.

Utilization of Bottom Clay

The bottom clay of the canal is rich in organic matter and can be used as a fertilizer for the vegetable crops.

Steps on Aqua-farming

1. **Preparation of Units:** The water will be pumped out to lower the water level and *mahuva* oil cake will be applied at a rate of 250 ppm to eliminate the unwanted fishes. Adequate lime will be applied for correcting the PH. Cow dung will be applied at the rate of 10000 kg/ ha and chemical fertilizer at the rate 50 kg/ha.
2. **Stocking:** Indian major carp, Chinese carps and local verities of fishes will be stocked at a rate of 6000/ ha. Giant fresh water prawn will be stocked at the rate of 20000/ ha.
3. **Management :** Water quality management will be undertaken. Feeding will be carried out using local available feed materials like oil cake, rice to vran and chicken waste or butcher waste. The health of the fish will be watched once in a month by sample netting.
4. **Harvesting:** The fish will be harvested towards the end of the culture by netting after reducing the water level.

Infrastructure Requirement of Fish Farming

Bunds: The design of bunds has to become to resist floodwater and to enable retention of sufficient quantity of water through the period of fresh culture.

Pumps *:* Pumps are designed to dewater and fill the segments during pond preparation, harvesting and during emergency situations.

Feed Trays : Feed trays are used to understand the feed consumption in farming.

Nets & Hapa : Several nets are used on fish farming for sampling, harvesting. Hapa is used for temporary storage of fish seeds and temporary short storage of table fish. Proximate availability of fish hatchery in Kanjikuzhi Block will facilitate the stocking and harvesting of fish from canal segments.

Strengths

1. The selected area is suitable for fish farming. The canal is already constructed. Intermediate bunds also have been constructed.
2. A hatchery has been established in Kanjikuzhy Block, which can be used for procurement of seed.
3. Seed of Indian mayor carps and Chinese carps are available in plenty.
4. The local community is socially sensitive and developmental for effective implementation of plans.
5. The technology of composit fish farming is available.

Weaknesses

1. Canals are too deep for catching fish atleast at some points.
2. Pollution exists in some segments of the canal.
3. Local latrine outlets need to be removed before undertaking fish culture.
4. The initial cost of cleaning the canal may be high.
5. There are encroachments in certain areas of the canal.
6. Aquatic weeds needs to be regularly removed.

Opportunities

1. Production of 60000kg of fish and scampi 15000kg are possible
2. Fish cultivation and local fish processing generates employment
3. The area may be utilized for farming any freshwater species without much structural modifications.

Threats

1. The area is prone to flood and this can result in the loss of fish.
2. Introduction of banned species like African catfish can result in the destruction of aquatic farms.
3. Excessive organic matter in the system can cause problems in some areas.
4. Aquatic plants and ill fouling loose clay may be a limitation atleast at some points.
5. The flow pattern of the canal needs to be ensured to avoid flood.

Table 4: Economics of Composite Fish and Prawn Farming in the AS Canal

	1	2	3	4	5	6	7	8	9	10	11
Area Construction	0.89	0.96	1.59	2.62	1.97	1.45	1.26	1	3.2	1.8	3.5
II Recurring Cost Preparation	2670	2880	4770	7860	5910	4350	3780	3000	9600	5400	10500
Mahua Oil Cake	2670	2880	4770	7860	5910	4350	3780	3000	9600	5400	10500
Lime	3560	3840	6360	10480	7880	5800	5040	4000	12800	7200	14000
Organic Fertilizer	2225	2400	3975	6550	4925	3625	3150	2500	8000	4500	8750
	445	480	795	1310	985	725	630	500	1600	900	1750
Fish Seed 6000 / ha	2403	2592	4293	7074	5319	3915	3402	2700	8640	4860	9450
Prawn Seed 20000 / ha	10680	11520	19080	31440	23640	17400	15120	12000	38400	21600	42000
Feed	26700	28800	47700	78600	59100	43500	37800	30000	96000	54000	105000
Medicine / Other	1780	1920	3180	5240	3940	2900	2520	2000	6400	3600	7000
Total expenditure	53133	27312	94923	156414	117609	86565	75222	59700	191040	107460	208950
Depreciation											
Recurring Cost Total	164650	177600	294150	484700	364450	268250	233100	185000	592000	333000	647500
Income											
Fish / Local Fishes	53400	57600	95400	157200	118200	87000	75600	60000	192000	108000	210000
Prawn	111250	120000	198750	327500	246250	181250	157500	125000	400000	225000	437500

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	12	13	14	15	16	17	18	19	20	21	22
Area Construction	1.2	1.5	2.9	0.73	0.87	0.62	0.36	0.61	0.57	0.37	0.52
II Recurring Cost Preparation	3600	4500	4800	2190	2610	1860	1080	1830	1710	1110	2670
Mahua Oil Cake	3600	4500	4800	2190	2610	1860	1080	1830	1710	1110	2670
Lime	4800	6000	6400	2920	3480	2480	1440	2440	2280	1480	3560
Organic Fertilizer	3000	3750	4000	1825	2175	1550	900	1525	1425	925	2225
	600	750	800	365	435	310	180	305	285	185	445

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Fish Seed 6000 / ha	3240	4050	4320	1971	2349	1674	972	1647	1539	999	2403
Prawn Seed 20000 / ha	14400	18000	19200	8760	10440	7440	4320	7320	6840	4440	10680
Feed	36000	45000	48000	21900	26100	18600	10800	18300	17100	11100	26700
Medicine /	2400	3000	2300	1460	1740	1240	720	1220	1140	740	1780
Other											
Total	71640	89550	95520	43581	51939	37014	21492	36417	34029	22089	53133
Total expenditure Depreciation Recurring Cost	71640	89550	95520	43581	51939	37014	21492	36417	34029	22089	53133
Total Income	222000	277500	296000	135050	160950	114700	66600	112850	105450	68450	164650
Fish / Local	72000	90000	96000	43800	52200	37200	21600	36600	34200	22200	53400
Fishes											
Prawn	150000	187500	200000	91250	108750	7500	45000	76250	71250	46250	111250

Cost and Benefit of the Project

The Engineering cost of developing the AS Canal for aquaculture is estimated as Rs. 1.6 crores (Table 5). The recurring expenditure for fish culture / year is Rs. 17.91 lakhs. The total production of 60,000 kg of fish and 15,000 kg of giant fresh water prawn is expected from the area. An amount of Rs. 24 lakhs will be realised from sales of fish and Rs. 30 lakhs from the sales of prawn annually. Total benefit per year is 54 lakhs. Considering a depreciation of 10% Rs. 16 lakhs, the gross profit per year is 38 lakhs. The initial investment will be recovered by the sixth year of operation.

Table 5: Cost Estimate of Engineering Works: Alappuzha-Shertalai Canal

Unit	Weeds Removal	Clay removal	De-watering	Forming & raising of side bunds	Providing Addl. Drainage	Raising Cross bunds	Total
1	36058	58192	66888	173683	48387	-	383208
2	34117	39677	27784	102166	48387	-	252131
3	56028	60837	103419	107640	48387	-	376311
4	91658	119030	188314	139202	48387	-	586591
5	72551	111094	100331	187183	48387	-	519546
6	50042	726080	132746	94321	48387		1051576
7	45297	663814	251600	76625	48387	28612	1114335
8	5005	360263	136348	63854	48387	38150	652007
9	113879	1684611	375085	218654	48387	28612	2469228
10	61927	503891	279384	96055	48387	20744	1010388
11	138375	1269701	488794	202873	48387	31473	2179603
12	--	143364	144580	49624	48387	-	385955
13	62467	154057	148182	81733	48387	-	485826
14	108893	230070	188314	156351	48387	-	732015
15	25568	158811	69975	--	48387	25751	328492
16	30705	213618	81294	--	48387	28612	402616
17	163026	1045524	862336	--	48387	-	2119273
18	--	31847	43734	--	48387	-	123968
19	2657	38090	50423	--	48387	-	139557
20	3469	76179	89526	--	48387	-	217561
21	9707	190870	131717	--	48387	-	380681
Total	1111429	7870620	3960774	1749964	1016127	201954	15910868