

CMFRI

bulletin 44

Part Two

MARCH 1990



NATIONAL SYMPOSIUM ON RESEARCH AND DEVELOPMENT IN MARINE FISHERIES

MANDAPAM CAMP
16-18 September 1987

Papers Presented
Sessions III & IV

CENTRAL MARINE FISHERIES RESEARCH INSTITUTE
(Indian Council of Agricultural Research)
P. B. No. 2704, E. R. G. Road, Cochin-682 031, India

Central Marine Fisheries Research Institute
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CMFRI

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E. R. G. Road

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SUITABILITY OF KILLAI BACKWATERS FOR PRAWN FARMING—A PRELIMINARY MICROLEVEL SURVEY

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ABSTRACT

Brackishwater areas have been given much importance for prawn farming. No information was available on the Killai backwaters about factors like water quality, topography, contour, extent of the area, tidal amplitude, seed potential and possibilities of flooding etc. Hence during 1982-'84 Killai area was thoroughly surveyed on the above aspects and the results have been discussed in this paper. From this it is inferred that a total area of about 155 ha is readily available for undertaking both pond and pen culture in this backwater.

INTRODUCTION

In our country, prawn farming is identified as a major component of the brackishwater fish culture. Besides its role in augmenting food production, prawn culture is vitally important for improving the rural economy and for providing gainfull self-employment for large number of fishermen, fish farmers and other entrepreneurs of coastal regions. Following the identification of enormous potential available for prawn farming and also in view of the urgent need for developing indigenous expertise, intensive researches are being carried out by several organisations in our country. The modern aquaculture has emerged as a multidisciplinary science covering various aspects such as selection of species, survey and location of sites, construction of farm, feed development, culture techniques, control of diseases, maintenance of water quality, harvesting, processing and marketing. Suitability of Porto Novo waters for prawn farming has already been brought to light (Sriraman and Ananthan Narayanan, 1986) and many works have been carried out in Porto Novo waters (Anon. 1987). But studies pertaining to Killai area especially with reference to its suitability for prawn farming (both in Pond & in Pen) are lacking and hence the present study.

DESCRIPTION OF STUDY AREA

The Killai backwater system is situated in the Chidambaram taluk of South Arcot District in Tamil Nadu. (Long. 79°45'-79°50'E and Lat. 11°20'-11°30'N). This is connected to Vellar river in the north and Coleroon river in the South. This has many connecting channels which harbour luxuriant growth of mangrove vegetations and a very rich fauna. Thus it presents an ideal site for prawn culture ventures.

MATERIALS AND METHODS

Four stations were fixed in the study area and a micro level survey covering the following aspects viz., survey of land areas, accessibility, water qualities like salinity, dissolved oxygen, pH and temperature, fertility, soil type, barmouth conditions, tidal levels, land elevation, ground water table, rainfall and seed resources, was carried out. Other details regarding feed resources, availability of power, marketing, cold storage, transport, availability of labour and socio economic status were also covered during the survey and presented in this paper.

RESULTS AND DISCUSSION

1. Survey of land areas

The Killai backwater comes under two revenue villages namely Killai and T. V. S.

Table 1: Land details of Killai and T.V.S. Pettai area

S. No.	Survey No.	Gross potential area suitable for farming in ha.	Net water spread area for farming ha.	Classification
1	R. S No. 406	48.00	25 to 30	River poromboke (Revenue)
2	R. F. No. 142	65.00	25 to 30	Reserve forest
3	R. F. No. 143	30.00	20.00	Reserve forest
Total		143.00	70-80	

Pettai. In Killai village part of the area is under survey No. 406 (Revenue Poromboke) and part under Reserve forest (R. F. No. 142). The TVS pettai area comes under reserve forest (R. F. 143). Two stations each were fixed to analyse the water quality at Killai and T.V.S. Pettai. The land areas of Killai and T.V.S. Pettai are given in the Table 1.

Location: R. S. No. 406 lies along both sides of the channel connecting Vellar and Killai backwaters with Mudasodai hamlets in the north and Muzhukkuthurai - M. G. R. Thittu in the South.

R. F. No. 142 lies mostly in the southern sides of Killai-Muzhukkuthurai road. The land areas lie in between the finger shaped water tips.

The site R. F. No. 143 lies on the northern side of the road leading to the ferry site from T.V.S. Pettai village.

2. Water quality

Water samples collected during fullmoon, newmoon and halfmoon periods were analysed for salinity, oxygen, temperature, pH and fertility. Data for Killai area (from October 1982 to September 1983) and for T.V.S. Pettai area (from March 1984 to February 1985) are given in the Figure 1.

Salinity: Salinity of the Killai area was fluctuating between 5 and 37.6‰. The salinity was low during the monsoon and high during summer.

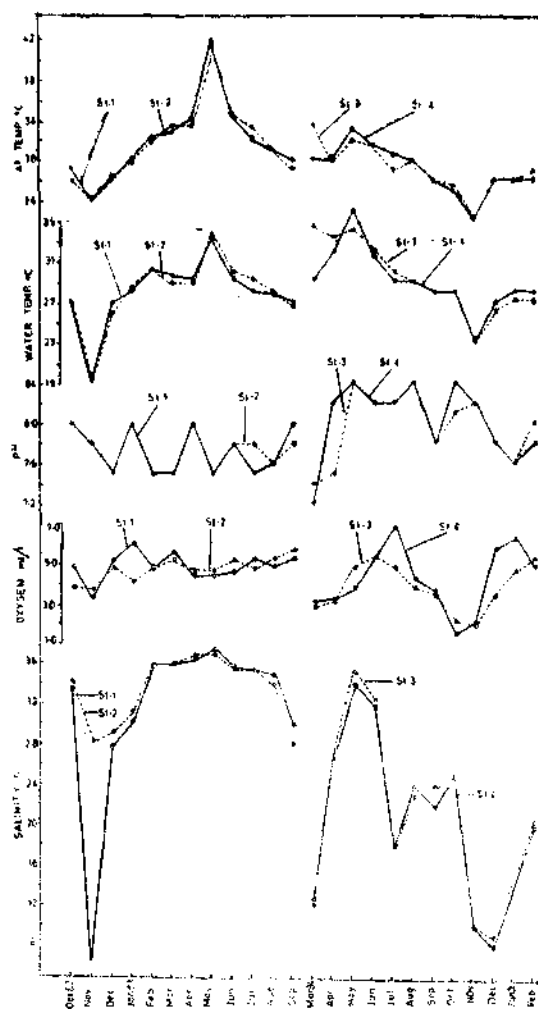


Figure 1. Hydrographical conditions of the four stations of the study area.

Salinity of T.V.S. Pettai area fluctuated between 8 (December '84) and 35.4‰ (May 1984).

Dissolved Oxygen: Dissolved oxygen of Killai varied from 3.4 (November 1982) to 6.1 ml/l (January 1983). Similarly the D.O₂ of T.V.S. pottai varied from 1.6 (October 1984) to 6.8 ml/l (July 1984).

Temperature: The atmospheric temperature of Killai area was from 26 (November 1982) to 42°C (May 1983) whereas the atmospheric temperature of T.V.S. pottai was from 24 (November 1984) to 33.6°C (March 1984).

The water temperature of T.V.S. pottai area was from 23 (November 1984) to 36°C (May 1984). In Killai area it was from 19.2 (November 1982) to 33.7°C (May 1983).

pH: The pH of Killai area varied from 7.5 to 8 whereas the pH of T.V.S. pottai area was from 7.2 to 8.4.

Fertility: This system is comparatively more fertile than many other systems in Tamilnadu. The water is nutrient rich and harbours many aquatic fauna and flora. The planktonic sediments vary from 0.3 ml/50 l to 0.9 ml/50 l. The common representative phytoplanktonic organisms were *Coscinodiscus* sp., *Sketonema* sp., *Biddulphia* sp., *Navicula* sp., *Pleurosigma* sp., *Rhizosolenia* sp., *Planktoniella* sp., *Nitzschia* sp., *Trichodesmium* sp., and *Ceratium* sp. Among the Zooplankters, *Oithona* sp., Lucifer, calanus, other copepods, fish eggs and mysis stage of prawns are the dominant forms.

Pollution: Many studies carried out in this area on pollution (Anon, 1987) reveal that this area is free from pollution.

3. Soil Type

R. S. No. 406: The top soil to the depth varying from 20 to 30 cm is clay while the bottom soil is predominantly sandy. The particle size analysis done in soil engineering research station, P.W.D. Chepauk for the top soil revealed the following.

Sand = 10% Liquid Limit = 59%
Silt = 33% Plastic index = 37
Clay = 57%

R. F. No. 142: The soil profile for 1 m depth is sandy from the top to the bottom.

Clay matting has to be given to minimise percolation and seepage losses through the bed and bunds.

R. F. No. 143: A trail pit of 90 cm depth shows that the soil is clayey throughout the depth and the same nature appears to extend down below also. The particle size analysis revealed the following.

Sand = 0% Liquid limit = 76%
Silt = 38% Plastic index = 42
Clay = 62%

4. Bar Mouth Conditions

The Killai area is influenced by 3 bar mouths namely (1) Vellar barmouth (2) Chinnavaikkal barmouth and (3) Coleroon barmouth. The Vellar and Coleroon barmouths are perennial ones whereas the Chinnavaikkal is a seasonal one. The Chinnavaikkal barmouth is located in between Vellar and Coleroon barmouths and is about 6 km from the Vellar barmouth, opens during the monsoon periods and closes in the remaining periods of year. The Vellar and Coleroon barmouths are always open even during summer months, though at times the barmouth narrows down and becomes shallow.

The T.V.S. pottai area is influenced by the barmouth of river coleroon, which is about 7-8 km from the side and it remains open throughout the year.

5. Tidal Levels

The tidal levels are correlated to the nearest Port Nagapattinam taking the spring tidal level occurring at the site to be equal to the level in the tide chart for the particular day and the other levels are accordingly deduced giving necessary correction. The deduced tidal levels are:

R. S. No. 406

MHWL (Spring)	+ 0.82 m
MHWL (Neap)	+ 0.58 m
MLWL (Neap)	+ 0.23 m
MLWL (Spring)	+ 0.00 m
MFL	+ 1.70 m
Ground level	+ 0.67 to + 0.82 m (average)

R. S. No. 143

MHWL (Spring)	+ 0.86 m
MHWL (Neap)	+ 0.61 m
MLWL (Neap)	+ 0.23 m
MLWL (Spring)	+ 0.00 m
MFL	+ 1.70 m
Ground level	+ 0.75 m (average).

A working sheet for the correlation of levels is given in Table 2.

6. Land Elevation

Ground level varies from +0.67 near the fringes of the water course to + 0.82 m in the interior side with a maximum of +1.17m in some pockets of Killai area.

Table 2. Working sheet for the correlation of tidal levels against standard port Nagapattinam

Standard port - Nagapattinam				Site : R. S. No. 406 of Killai		
Date	Time	Tidal level	Range	Time	Gauge reading	Range
28.6.84	0809	0.55	0.38	0900	0.72	0.50
(Newmoon)	1500	0.17		1600	0.22	

Tidal levels of Nagapattinam port	Correction factors	Corresponding levels at R. S. No. 406 of Killai	Taking MLWL (S) as 0.00 the corresponding levels at R. S No. 406 of Killai
MHWL (S) +0.65	- nil-	+0.65	+0.82
MHWL (N) +0.47	$\frac{0.50}{0.38} \times 0.18 = 0.24$	+0.41	+0.58
MLWL (N) +0.20	$\frac{0.50}{0.38} \times 0.45 = 0.59$	+0.06	+0.23
MLWL (S) +0.03	$\frac{0.50}{0.38} \times 0.62 = 0.82$	-0.17	0.00

Standard port - Nagapattinam				Site : R. S. No. 143 of T.V.S.Pettai		
Date	Time	Tidal level	Range	Time	Gauge reading	Range
13.6.84	0839	0.60		0930	0.80	
(Fullmoon)	1532	0.14	0.64	1545	0.16	0.46

Tidal levels of Nagapattinam port	Correction factors	Corresponding levels at RS No. 143 site	Taking MLWL (S) as 0.00 the corresponding levels at RS No. 143 site
MHWL (S) = +0.65	- nil-	+0.65	+0.80
MHWL (N) = +0.47	$\frac{0.64}{0.46} \times 0.18 = 0.25$	+0.40	+0.61
MLWL (N) = +0.20	$\frac{0.64}{0.46} \times 0.45 = 0.63$	+0.02	+0.23
MLWL (S) = +0.86	$\frac{0.64}{0.46} \times 0.62 = 0.86$	-0.21	0.00

Table 3. *Rainfall particulars of Porto Novo station (in mm)*

Months	1970	1971	1972	1973	1974	1975	1976
January	7.0	90.4	—	—	—	—	—
February	—	—	—	—	28.7	—	—
March	—	69.4	9.2	4.3	—	68.7	—
April	28.0	—	—	—	17.2	—	—
May	80.4	27.2	46.9	40.5	25.0	29.3	11.2
June	13.0	40.7	7.3	40.0	41.1	13.3	1.1
July	88.1	39.5	86.7	29.0	48.7	149.9	92.1
August	131.4	17.6	86.4	79.1	43.6	149.3	172.9
September	111.3	105.8	52.0	123.8	118.2	70.8	59.9
October	63.1	158.4	512.4	312.8	245.9	220.5	272.5
November	788.3	107.0	347.8	141.5	67.6	391.5	556.8
December	94.5	479.8	380.3	94.9	125.4	112.5	196.6
Total	1405.1	1335.8	1529.0	865.9	761.4	1205.8	1363.1

Months	1977	1978	1979	1980	1981	1982	1983	1984
January	9.9	—	1.0	—	67.5	—	—	54.0
February	12.4	—	5.5	—	—	—	—	291.0
March	—	—	10.0	—	0.2	—	—	255.0
April	62.5	—	—	10.0	0.1	—	—	43.0
May	35.0	10.4	11.0	—	77.8	—	25.0	—
June	48.0	51.5	23.5	15.5	22.5	14.4	—	37.5
July	19.3	37.0	12.5	31.5	199.6	43.0	91.5	194.0
August	140.8	54.8	18.5	72.0	140.3	23.0	174.0	67.0
September	173.5	253.1	300.1	57.0	44.1	93.5	178.0	268.0
October	661.6	212.0	310.4	191.5	538.5	11.7	237.6	68.0
November	702.1	435.9	667.2	233.2	276.1	358.9	101.6	416.0
December	56.5	503.9	212.6	61.4	149.7	150.0	503.5	59.0
Total	1921.6	1558.6	1572.3	672.1	1614.4	794.5	1311.2	1752.5

In T.V.S. pettai area the ground level varies from + 0.70 near the estuary to + 0.80m at the farther end. The average ground level may be taken as + 0.75 m. During MHWL (Spring) conditions the land is getting submerged to a depth of 5-10cm.

7. Ground Water Table

In Killai area, on 28th June 1984 the ground water table was found to exist at +0.30 m i.e about 50 cm below the average ground level of +0.80 m whereas in T.V.S. pettai the ground level did not appear at all even at 1 m depth-may be due to the nature of soil, being highly plastic clay which does not form an aquifer.

8. Rainfall

Rainfall being an important factor controlling the salinity, its data for the 15 years duration from 1970 to 1984 was collected from the nearest meteorological station at Porto Novo and given in Table 3. This gives a fair idea of the rainfall distribution over months of different years.

9. Exposures To Flood And Cyclone

Floods do occur in Vellar and the ordinary flood level (OFL) is about 50 to 60 cm over the average ground level. The highest recorded storm surge level on 1-12-1984 was 1.65 m over the average lower low water level and this has submerged the land area to a depth of about 1.0 m. This may be taken as the highest water level, either due to floods or due to storm surge.

T.V.S. pettai site is not directly exposed to flood currents since they are far away from the main rivers. However, the flood water level will rise and the MFL at site is observed to be +1.70 m.

10. Fauna and Flora

Fauna: The productive and fertile complex of Killai area harbours many aquatic fauna. The predominant fishes found in the system are *Mugil* sp., *Chanos chanos*, *Lates calcarifer*,

Sciaenids, *Therapon* sp., *Tachysurus* sp., *Plotosus* sp., *Congresox* sp., *Muraena* sp., *Johnius* sp., *Polynemus* sp., *Gerres* sp., *Belone* sp., *Etroplus* sp., *Platycephalus* sp., *Scatophagus* sp., *Thryssa* sp., *Ambassis* sp., *Epinephelus* sp., *Syngnathus* sp., *Sphyræna* sp. and puffer fishes.

The predominant shrimp species are *Penaeus indicus*, *P. monodon*, *P. semisulcatus*, *Metapenaeus* sp. and *Macrobrachium* sp.

The crab fishery of this complex involves *Scylla serrata*, *Portunus pelagicus*, *P. sanguinolentus*, *Uca* sp., *Ocypoda* sp., *Thalamitta* sp., and *Calappa* sp.

The molluscan fauna includes *Crassostrea madrasensis*, *Catalysia opima*, *Arca* sp., *Anadara* sp., *Tonodolium* sp., *Clython* sp.

The main representative of the benthic organisms include *Apsudes* sp., Amphipods, Isopods, Nereids, Polychaetes and Nematodes.

Flora: Both micro and macro vegetations are abundant in this backwater. The micro vegetations include the phytoplankton and the macro vegetation comprises the mangrove plants and marine algae. The important mangrove vegetations are *Rhizophora micronota*, *Avicennia* sp., *Sonneratia apetala*, *Suaeda* sp., *Bruguiera* sp., *Excoecaria* sp., *Salicornia* sp., and *Serruvium* sp etc.

The algal forms include the following viz. *Halophila ovalis*, *Gracilaria edulis*, *Enteromorpha* sp., *Chaetomorpha* sp and the seagrass *Cymodocea isodiphollium*.

11. Seed Resources

The Killai backwater system is a potential area for shrimp seed collections. The most common seeds occurring here belong to *Penaeus indicus*, *P. monodon*, *P. semisulcatus*, *Metapenaeus* sp. and *Macrobrachium* sp. Of the above forms *P. indicus* is the most abundant and could be collected in all the seasons. The month wise collection (average catch per man per hour) of prawn seeds are given in the Tables 4 & 5.

Table 4. Seed resources of Killai (Dragnet collection) (catch/man/hour)

Station	<i>P.indicus</i>	<i>P.monodon</i>	<i>P. semi-sulcatus</i>	<i>M. monoceros</i>	<i>Macrobrachium</i> sp.	Mullet
October '82						
Station 1	64	—	58	—	—	5
Station 2	14	—	40	—	—	—
November '82						
Station 1	27	15	—	—	1	—
Station 2	4	—	—	—	—	—
December '82						
Station 1	1	—	51	14	—	—
Station 2	4	—	70	16	—	4
January '83						
Station 1	34	—	74	—	28	156
Station 2	42	—	90	—	—	165
February '83						
Station 1	1215	—	135	—	12	—
Station 2	1177	—	27	—	—	—
March '83						
Station 1	126	—	63	46	—	—
Station 2	241	—	58	11	—	—
April '83						
Station 1	64	—	122	241	—	—
Station 2	50	—	39	—	—	—
May '83						
Station 1	—	3	46	36	—	—
Station 2	2	—	86	50	—	—
June '83						
Station 1	8	—	100	21	5	1
Station 2	3	—	94	36	8	—
July '83						
Station 1	37	—	44	20	—	—
Station 2	31	—	46	25	—	—
August '83						
Station 1	60	—	50	25	10	—
Station 2	40	—	30	15	5	—
September '83						
Station 1	50	4	15	20	28	—
Station 2	30	—	10	10	24	—

Table 5. Seed resources of T.V.S. Pettai (Dragnet collection) catch/man/hour

Months	<i>P. indicus</i>	<i>P. monodon</i>	<i>P. semi-sulcatus</i>	<i>M. monoceros</i>	<i>Macrobrachium</i>	Mullet
March '84	21	0	0	24	9	—
April	676	18	15	99	150	—
May	180	—	9	111	51	—
June	30	—	—	33	9	—
July	42	—	69	36	21	—
August	150	12	48	6	42	—
September	132	0	51	27	30	—
October	45	—	—	156	36	—
November	45	—	—	33	129	—
December	48	—	—	36	111	—
January '85	54	12	—	42	42	30
February '85	60	10	—	30	25	20

The identified potential seed grounds in the Killai area are (1) Vadakku Kuttai (2) Naduthittu (3) Chinnavaikkal (4) M.G.R. Thittu (5) Pattarayadi (6) Killai Karithurai and (7) Muzhukkuthurai.

Similarly (1) Adalnthakutti (2) Oorkidavu (3) T.V.S. Pettai, Karithurai and (4) Pillumedai are some of the identified seed grounds of T.V.S. Pettai area. The above said areas are muddy with profuse growth of vegetations like *Halophila* sp, *Chaetomorpha* sp, and *Enteromorpha* sp which serve as the ideal nursery ground for the post larvae and juvenile shrimps. Various gears such as velon screen, drag net, cast net and push net were tried for seed collection and among them the push net is the most efficient gear for shrimp seed collection.

Apart from this, culturable fish seeds such as *Chanos chanos* and *Mugil* sp. are also available in plenty.

12. Feed Resources

Part of the feed demand can be met by the squids, prawn heads, and trash fishes available in the nearby landing centre at Porto Novo (for Killai area), and Pazhayar landing centre (for T.V.S. Pettai area). For

large scale operation artificial feeding has to be resorted to.

13. Power Supply

Three phase power supply is available in the nearby hamlets, Ponnanthittu and Killai about 1 to 2 km from the site. For T.V.S. Pettai area also power supply is available within a distance of 1-2 km at T.V.S. Pettai village.

14. Marketing

Marketing facilities are available in the nearby towns, Porto Novo, Chidambaram and Cuddalore.

15. Cold Storage

At present there is no cold storage facility available at Killai and T.V.S. Pettai area.

16. Transport

There is a motorable road upto the farm site connecting all the nearby towns and railway station. The nearby landing centre Porto Novo can be reached easily by water ways from Killai area.

In T.V.S. Pettai area also there is road connecting the towns and railway station. The nearby landing centre pazhayar can be reached by water ways.

17. Availability Of Labour

Both skilled and unskilled labours are available in the nearby villages.

18. Socio Economic Impact

The implementation of brackish water farming schemes will go a long way in improving the socio economic status of the poor fisherman in these area.

WATER AREA SURVAY

Killai backwater system has an approximate extent of 1000 - 1300 ha of water

spread area. A technical microsuryay with the aim of identifying and qualifying suitable water areas for penculture mainly of shrimps was conducted in collaboration with BOBP/FAO.

Water areas having a minimum depth of 30 cm and a maximum of 80 cm during the lowest tide were considered suitable for the purpose. The lower limit of depth was decided in view of the shrimps minimum ecological needs particularly temperature and light. The higher limit was decided keeping in view the construction cost and management aspects.

Table 6. Tidal amplitudes, flood levels and potential areas for pen culture in Killai backwater area.

Sl. No.	Location	Gross potential area (ha)	Net area available (ha)	Min. depth range during average lower low tide (m)	Av. tidal amplitude (m)	Max. water depth during floods, over the av. lower low water level (M)	Remarks
1.	Vellar bridge-Porto Novo jetty	1.373	1.375	0.30-0.70	0.40-0.70	2.70	—
2.	Porto Novo Jetty-Fish Landing Centre	2.650	2.650	0.30-0.70	0.40-0.80	1.70	—
3.	Vellar Barmouth Kuttal	2.050	2.050	0.30-0.80	0.40-0.80	1.70	—
4.	Muzhukku Thurai	20.200	10.100	0.30-0.80	0.15-0.40	1.60	50% of gross potential area allowed for water ways.
5.	Water course leading to Chinna vaikkal barmouth	3.500	3.500	0.30-0.80	0.15-0.40	1.60	—
6.	Chillan Kuttai	2.200	2.200	0.30-0.40	0.15-0.30	1.60	—
7.	Vadaku Kuttai	3.100	3.100	0.30-0.60	0.15-0.30	1.60	—
8.	Thalakkidavu	19.400	19.400	0.30-0.70	0.15-0.30	1.60	BOBP Pen culture project included
9.	Pattaraiedi	16.150	8.080	0.30-0.80	0.15-0.30	1.60	50% of gross potential area allowed for water ways.
10.	Karithurai	4.450	2.230	0.30-0.60	0.15-0.30	1.60	as above
11.	Karithurai-Jetty-Kuchipalayam	7.900	3.950	0.30-0.70	0.15-0.30	2.00	as above
12.	Periaakidavu	2.400	2.400	0.30-0.60	0.15-0.30	1.60	—
13.	Sethu Kollidam	38.500	19.250	0.30-0.60	0.30-0.70	1.70	50% of gross potential area allowed for water ways.
14.	Adaincha Kuttai	1.450	1.450	0.20-0.30	0.40-0.80	1.70	
15.	Kodiampalayam Oorkidavu	2.800	2.800	0.20-0.25	0.40-0.80	1.70	
Total		128.125	84.535				

Depth soundings were taken and the lowest low water depths were arrived and plotted. Then isobathic lines were drawn for 30 cm and 80 cm depths and the area bounded by these lines were computed. Out of the total estimated backwater area of about 1000-1300 ha the gross potential area is computed to be 128 ha only. Which included ferry sites, regular water ways used by canoes and boats. If they are excluded net area likely to be available for pen culture may be in the range of 80-90 ha.

The outcome of bathymetric survey with the identified area and average tidal amplitude are given in Table 6.

The studies carried out revealed that a total extent of about 155 ha (85 ha for pen culture and 70 ha for pond culture) of potential

area are available for undertaking both pond and pen culture in these backwaters.

ACKNOWLEDGEMENTS

The authors are grateful to the Director of Fisheries, Tamilnadu for giving permission to present this paper in the Symposium.

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