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Coracle: the living heritage of migratory fishermen of Kerala

Swetha K C[a], Jayalakshmi K J[b,*] & Sreekanth G B[c]

[a]Faculty of Ocean Science and Technology, [b]Dept. of Fisheries Resource Management, Faculty of Fisheries, Kerala University of Fisheries and Ocean Studies, Cochin 682 506, Kerala

[c]ICAR-Central Coastal Agricultural Research Institute, Old Goa, Goa 403 402, India

[*]E-mail: jayalakshmi.kj@kufos.ac.in

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The coracle is a traditional fishing craft used by migratory fishermen in Kerala for estuarine and riverine fishing. This paper attempts to document and report for the first time, the use of such unique fishing boats in the Valapattanam (VAL) and Dharmadam (DHA) estuaries in North Kerala. An exploratory study was conducted among the migrated coracle fishermen operating at the VAL and DHA estuary from January 2021 – December 2022. The main objective of the study was to explore the nature of crafts, the catch composition, and to assess the socioeconomic condition of migratory fishermen using the Garrette ranking method. Primary data were collected from 20 coracle fishermen chosen randomly, representing approximately 90% of the total migrant coracle fishermen operating in the area. The major species caught in these crafts are *Etroplus suratensis, Sillago sihama, Mystus gulio, Mugil cephalus, and Arius arius.* Decades ago, the main reasons for migration to the Kerala coast were unemployment and competitiveness in their native place. The major constraint in the workplace was the risk in the operation of the coracle and competition. Fishermen achieved betterment in socioeconomic conditions with their migration to Kerala. The study also emphasizes the need to balance traditional coracle fishing practices with resource conservation, regulatory compliance, and fisher safety.

Keywords: Artisanal fisheries, Estuaries, Migration, Management measures, North Kerala

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The coracles are traditional, cost-effective fishing practiced in various Indian inland fisheries[1-4]. The usage of crafts and gears for fisheries is mainly based on the topography, ecology, and habitat of the available resources[5]. Coracles are keel-less, bowl-shaped boats made from materials like bamboo, wood, and hide. These small and lightweight watercrafts are ideal for navigating in shallow waters and fast-flowing streams, making them well-suited for estuarine fishing[6]. Coracles are typically operated by a single fisherman who paddles or rows using a single oar.

Coracles are exclusively used in all rivers in Kerala by migratory fishermen from Karnataka[7]. Coracle fishing is considered an eco-friendly approach, as it has a minimal environmental impact and allows for selective harvesting of fish. These primitive non-motorized crafts are nowadays used extensively for fishing as well as tourism. Locally referred to as Kottavanchi or Vattathonni, the migratory fishermen in Kerala have only been observed operating this craft in a few estuaries.

Although Jenikrishna and Jaysawal[8] have recently documented the general labour migration trends into Kerala's fisheries and Nusaiba and Shibinu[9] have described the socio-economic precarity of the migratory fishers, little is known about the highly specialized operational niche of migratory coracle fishers. Earlier studies related to migratory fishermen in estuaries were only concentrated on major estuaries such as Vembanad[5], Nethravathi and Guripur estuaries[1]. So here we provide the fisheries and socio-economic assessment of the migratory fisherfolk of lesser-known tropical estuaries, *viz.*, Valapattanam (VAL) and Dharmadam (DHA) of the North Kerala, Western coast of India.

Materials and Methods

Study area

An exploratory study was conducted among the migrated coracle fishermen operating in the two permanently opened estuaries, VAL and DHA of Kannur district, North Kerala. The coracles were

[*]Corresponding author

found to operate around an area of 6.27 km^2 at Kalloori Kadavu, Mangadavu, Paarakkal, Pamburuthi, and Narathu of the VAL estuary and around 1 km^2 at Melur and Parapram Bridge of the DHA estuary. The location map of the study area is indicated in (Fig. 1 a-b). The coracles started appearing in these estuaries only two decades ago, as part of the migration of fishermen from nearby states.

Catch data

The catch composition was prepared based on a taxonomic investigation of specimens collected from the VAL and DHA estuaries by regular sampling and field surveys. The landing centre-based data collection, followed by Kurup *et al.*[10,11] was adopted in this study. Fish and shellfish fauna were identified by following the published references[12] and online

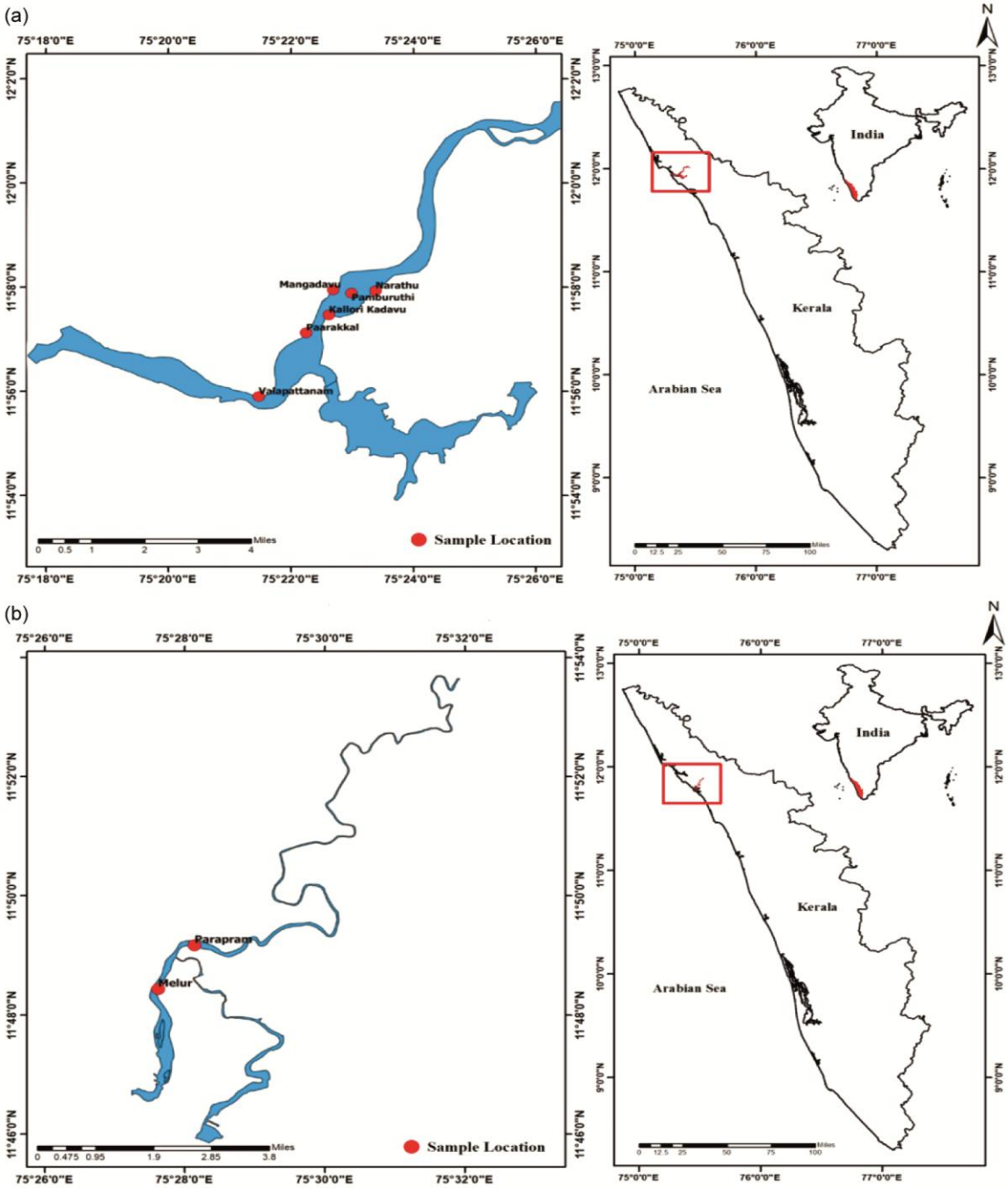

Fig. 1 — Maps of the study area: (a) Valapattanam Estuary, (b) Dharmadam Estuary (Source: Maps were derived from Landsat 8 image and used ArcMap 10.3)

resources such as Fish Base[13] and World Register of Marine Species[14]. The daily landings of the individual species from the gill net were calculated following Kurup *et al.*[10,11] by applying the formula,

$$W = (w/n) \times N$$

Where N = Total number of similar gears in operation, n = Number of gears sampled, W = Total weight of species, w = Total weight of species recorded from gear sampled

The month-wise fish catch was calculated by multiplying the average catch during the days of the survey by the total number of fishing days in a month. The annual landings from each estuary were calculated by adding the monthly data for a period of 24 months from January 2021 to December 2022.

Socio-economic analysis

A total sample of 20 coracle fisherfolk was selected randomly, which forms around 90% of the total coracle fishermen operating in the Estuary, and were personally interviewed using a semi-structured interview. A systematic, semi-structured farmer participatory approach that uses a combination of methods to assess and understand a community's situation or a particular problem with the participation of the local people was used for documenting the details of the boat and fishing operations undertaken. Besides, a focus group discussion, which is a research strategy that involves intensive discussion and interviewing of small groups of people on a given issue, was also applied. The Garette ranking technique is used to analyse the rankings given by the respondents for both reasons and problems of migration. Garrett's ranking technique is usually used to rank preferences indicated by the respondents on different factors. Ranks assigned by respondents for different factors are converted into scores. The factor with the highest mean Value or Garrett score was considered to be the most important factor. The major parameters considered in the study include personal as well as family details, education status, average income, asset particulars, savings, indebtedness, expenditure pattern, details of migration, reasons for migration, problems during migration, and major socio-economic achievements through migration.

Calculation of Garrett Mean Score

The Garrett Ranking Technique[15] was adopted to identify the most important problems.

The formula for calculating the Garrett Ranking Technique is

$$\text{Present Position} = 100\ (R_{ij} - 0.5)\ /N_j$$

Where R_{ij} – Rank given for the i^{th} reason by j^{th} respondent and N_j – Number of factors ranked by jth respondent.

The present position was then converted into scores by referring to the table given by Garrett (Supplementary Table S1). Following this procedure, the order of merit given by each of the respondents as the problems was converted into scores. Then, for each reason, the scores of individual respondents were added together and divided by the total number of respondents. These mean scores for all reasons were arranged in descending order, and ranks were given. By this method, the accuracy in determining the preference was obtained.

Estimation of the total score given by sample respondents

The total score of each factor rank will be estimated by multiplying the Garrett Value by the respective given Value. Hence, the total score is essential to calculate the average score given by the total respondents under different factors of a particular phenomenon.

Estimation of average score

Under the Garrett Value ranking techniques, the average score will be calculated by dividing the total score by the total number of respondents in the selected sample. The highest percentage average score indicates the 1^{st} rank, whereas the lowest percentage average score indicates the last rank of the total estimated factors rank.

Results and Discussion

Coracle fishing operation

The Coracle fishing units are found to be operated at Kaluri Kadavu along the VAL estuary and Parapram bridge along the DHA estuary, Kannur. Speaking Tamil, Malayalam, and Kannada, the traditional fisherman who uses this gear moved from Hosur, Mysore district of Karnataka, 35 years ago. They live in improvised tents constructed of tarpaulin and supported by wooden poles along the banks of the estuary. They reside in modest rental homes built of asbestos near riverbanks during the monsoon season. The bamboo strips that make up the basket-shaped Coracle typically have a diameter of 2-2.5 m, and on the bottom of the basket, there are thick plastic bags that are woven together, roughly 10 to 12 bags total. Coal tar is lightly applied to the plastic bags to make the boat watertight. Coracles made of FRP have

also been used in the VAL estuary. Accurate dimensions, robust construction, flawless finish, and affordability are some of the main characteristics that drive the demand for FRP Coracle.

Since the bamboo strips are not locally available, these fishermen procure readymade boats from the Bhadravathi town of Shimoga district, where some traditional fishermen from Tamil Nadu fabricate this type of boat. The ready-built boats are transported by bus or lorry. On reaching the destination, the exterior of the boats is covered with woven plastic bags and coated with tar. A variety of woods is used for this type of construction. Commonly used woods are Mango wood and Sal wood. The total cost of a boat is close to Rs. 2500/-. The gear used in these crafts are monofilament gillnets of mesh size 40- 150 mm, and each boat has 3-5 sets of nets.

About 12 feet in length and 3.5 feet in depth make up each net panel. According to the needs of fishing, the net panels are connected. The net's operating length is roughly around 8 km in the DHA estuary and around 15-20 km in the VAL estuary, with a depth of 3 to 8 feet. The net cost around three thousand rupees in total. Coracle fishing is possible throughout the year, even during the rainy season, because it is operated in calm Estuaries.

Normally, two people operate a coracle. The one to control the net and the other to haul the net. Migratory fisherfolk operate bottom-set gill nets using a coracle. A stick is attached to one end of the net for locating the net while hauling. The stick is thrown, and the coracle will be sailed in a zig-zag manner so that the net is operated similarly. The net will be hauled back within 1 h. Throughout the survey, it was noted that 20 coracles were functioning at Kalloori Kadavu, Mangadavu, Paarakkal, Pamburuthi, and Narathu of the VAL estuary, and 5 were operating at Melur and Parapram of the DHA estuary. The coracle fishermen in the VAL estuary live there year-round, whereas the local fishermen in the DHA estuary drive them out after a week every month (Fig. 2).

The best times to go fishing are during spring or neap tides, which are high. Even though they run the boats all year round, July to November is their busiest period. The coracle has a diameter of three to seven meters. Conventional preservatives such as tar, cashew nutshell oil, and fish oil are utilized for preservation. A medium-sized canoe can be purchased for somewhere between Rs.10,000-20,000 altogether. Details of fishing operations are given in (Table 1).

Table 1 — Details of fishing operations

	Valapattanam Estuary (20 families)	Dharmadam Estuary (5 families)
Fishing details	Coracle	
No. of Coracle Operated	18	5
Average cost per coracle	10,000-15000	10,000
Diameter of the craft	2-2.5m	2-2.5m
Type of gear used	Bottom set and drift gill net	Bottom set and drift gill net
The average cost of gear	5000 to 6000	5000 to 6000
No. of Nets used in Coracle	5 set	3 set
Mesh size of the gill net	40-150 mm	40- 150 mm
The average weight of each net used	3-5 kg	3-5 kg
The average length of the net	7000 m	1000-2000 m
Average life span of a coracle	1-2 years	3 years
Material of the coracle	FRP	FRP, Bamboo
Average fishing trips per day	2	1to 2
Time of operation	4 h (4 am-8 am) (3 pm-7 pm)	3-4 h (5 am-9 am) (4 pm-7 pm)
Area of operation km 2	6-7 km^2	0.5-1 km^2
Permanent/Temporary Fishing	Permanent (around the year)	Temporary (Fishing only for a few days)
No of people in each coracle	3	3
Major species caught in fishing	*Arius arius, Arius subrostratus, Sillago sihama Scylla serrata, Mugil cephalus, Lutjanus argentimaculatus, Gerres filamentosus*	*Etroplus suratensis Arius arius, Lutjanus argentimaculatus, Mugil cephalus, Scylla serrata, Sillago sihama, Liza subviridis, Gerres filamentosus*
Average catch per day	40-80	10-35
Maximum catch obtained	170 kg	80 kg
Average price per kg	200-280	200-250
Average fishing days	25-27	7
Average daily income	500-1500	1000
Average needs monthly	25000-30000	20000
Maintenance cost	2000-2500	2000

Fig. 2 — Social picture of Coracle fishing

Each coracle is operated by (a) family (b) The catch, (c) An inside view of the Coracle with woven bamboo strips at the bottom and a paddle, (d) & (e). The temporary homes of the coracle Fishermen (f) Homes built of asbestos near riverbanks during the monsoon season (g) Monofilament gill nets used in Coracle, (h). Infant cradles set by coracle fishermen, (i) Gathered firewood for cooking, (j) woman doing domestic tasks (k) Outside view of coracle showing the tar coating, (l) FRP coracles (m) Coracle fishing community

Total annual fish production

Migratory fishermen leave for their fishing grounds between 4:00 and 8:00 in the morning, returning before 9:00 am. They operate in the evening once again if the weather and tides are favourable. The majority of the time, the catch is delivered to the homes and sold straight to the residents. The local market sells the remaining catch. If the weather is favourable, fishing takes place all month long. A total of 9.94 t of fish constitutes the landings in VAL, whereas 1.21 t of fish landings occur in the DHA estuary. The major fish species caught in these crafts are *Etroplus suratensis, Arius arius, Arius subrostratus, Sillago sihama, Caranax heberi, Mugil cephalus, Gerres filamentosus, Lutjanus argentimaculatus, Horabagrus brachysoma Leiognathus splendens, Cynoglossus macrostomus, Platycephalus indicus, Nematalosa nassus, Portunus pelagicus, Scylla serrata, and Thryssa mystax*. The results coincide with the earlier study conducted at

various estuaries in India, such as Nethravathi Gurupur Estuary[1] and Vembanad Lake[1,3]

Among the finfish, *Etroplus suratensis* contributes the most (36.7%) in the DHA estuary, and *Arius arius* contributes the most (33.3%) in the VAL estuary. Among the shellfish, *Scylla serrata* contributes the most in estuaries, 32.7% in DHA and 12.5% in VAL, respectively. Species-wise landings of the major species are given in (Fig. 3). The data demonstrate that even though annual production was higher in VAL than in DHA, significant species landings were higher in DHA than in VAL. This could be because of the shorter harvest intervals in the DHA estuary, where coracle fishermen only fish for a week, compared to the VAL estuary, where it is permanent. This allows for stock replenishment.

It was found that the peak season of the catch was during the post-monsoon (Avg. Catch VAL-2.1 t, DHA- 0.4 t), followed by Pre-monsoon (VAL-1.5 t, DHA-0.25 t) and Monsoon (VAL-1.2 t, DHA-0.19 t). During the peak months, these fishermen earn an income of Rs. 1000/-per day, and the catch varies between 60-100 kg at the VAL estuary and 30-40 kg at the DHA estuary. During the other months, the fish catch will vary between 5 to 10 kg, and the income also reduces to Rs. 200 to 500/ per day.

Socioeconomics

A survey on socio-economic characteristics was carried out among the heads of households who are fishermen. The majority of respondents (50%) were discovered to be between the ages of 20 and 40, with 30% coming from that age group and 15% from the under-20 age group. In the meantime, it was discovered that they moved along with entire families, including kids as young as four months old to fourteen years old. Less than three members make up 40% of families, followed by seven members (35%), three to five members (25%), and less than three members (45%). The families were discovered residing in groups beneath makeshift tents. The residences were found to be less hygienic and to lack essential facilities. It was also noted that 30% of the respondents had only completed elementary school, and more than half were illiterate. They were all interested in migrating and continued in their usual careers. Therefore, it was not the least bit of concern to provide the kids with even fundamental schooling.

Reasons for migration

Reason analysis was done using the Garrett ranking technique based on opinions provided by respondents as the reasons for their migration. Garrett's ranking technique is usually used to rank preferences indicated by the respondents on different factors. Ranks assigned by respondents for different factors are converted into scores. The factor with the highest mean Value or Garrett score was considered to be the most important factor. Accordingly, the most important reason for migration, as conceived by respondents from both the estuaries, was debt and financial constraints, with the highest Garrett score of 20.4 (VAL) and 40.8 (DHA), as depicted in (Fig. 4). The second most given reason was unemployment, 11.5 (VAL), 23.5 (DHA), followed by low income (40.69), etc. Drought, as well as lack of alternative jobs, was also reported as a major reason. Small land

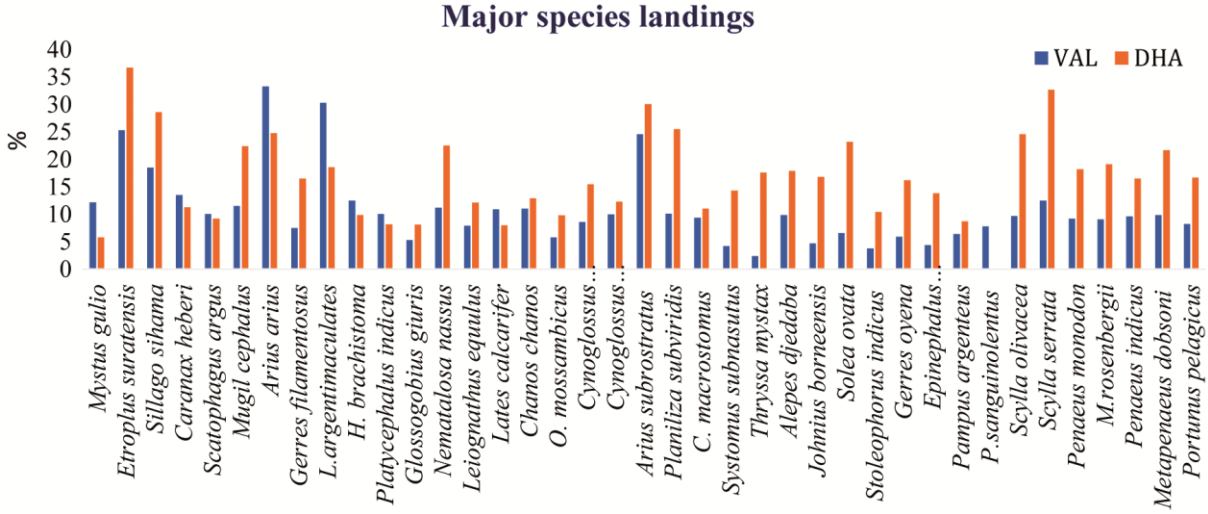

Fig. 3 — Total landings of major species from Valapattanam (VAL) and Dharmadam (DHA) estuaries during the study period

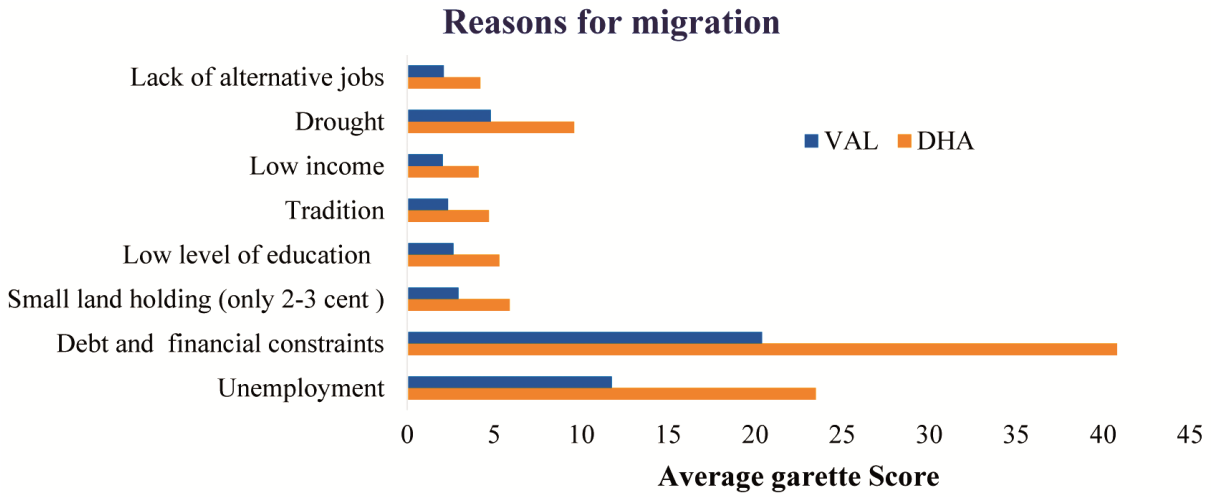

Fig. 4 — Major reasons for migration by Coracle fisherfolks

holdings, low level of education, and a tradition of migration were also mentioned by the respondents.

Problems encountered during the operation

Analysis were done on the extensive problems and constraints proposed by the fishermen through the Garrett ranking technique. As a coracle is very light and moves according to the wind pattern, only an efficient paddler can ride it; even in bad climates is highly dangerous. So, the major constraint in the workplace is the risk of operation VAL 27.3 and DHA 54.6. This finding runs counter to the problems encountered in significant estuaries, like the Vembanad, where pollution poses a serious risk to coracle fishermen[5]. The second barrier was the strong competition with native fisherfolk, with a Garrett score of 16.5 at VAL and 33 at DHA. A comparatively good number of consumers are found for coracle-caught fish due to its freshness and low prices compared to the catch from native fisherfolk. The language barrier was found to be the third constraint for coracle fishermen from DHA (15), but a reduction in fish species was the third barrier for coracle fishermen from VAL (7.5). This may be because the migratory fishermen was forced to move from the place within 4-5 days by the local people at DHA. Fish were first sold to village people nearby and were later taken to the markets. Marketing and seasonality were also expressed as one of the major issues. Also, the respondents were not worried about the cultural lag, as it seldom affects their lives. The third obstacle for coracle fishermen in DHA (15) was determined to be the linguistic barrier, whereas for those from VAL (7.5), it was a decline in fish species. This might be the case since the DHA locals compelled the migratory fishermen to leave the area within four to five days. The fish were first sold to the local villagers and then taken to the markets. One of the main concerns mentioned was seasonality and marketing. Furthermore, since cultural lag rarely interferes with their life, the respondents were unconcerned about it (Fig. 5). The internal migration of coracle fishers in India represents a specialised adaptive strategy within small-scale fisheries. Driven by localised resource depletion and territorial marginalisation in their native waters (push factors), these fishers utilise the high geographic mobility and low capital requirements of the coracle[5]. The unique structural architecture of the craft, specifically its flat bottom and shallow draft (pull factors), allows migratory operators to exploit ecological niches in destined estuaries[16,17].

Benefits of migration on socioeconomic status

According to the respondents, their socioeconomic status has improved through migration, which can be ascertained. Overall, the families had earned well enough to meet their daily needs. Nearly 50% of the respondents of both the VAL and DHA estuaries claim that they have a better income. Followed by repayment of debt (VAL-30%, DHA-33.6%). Through migration, they could provide better education to children (Both estuaries 16-17%). The rest of the amount was set aside as savings (Both Estuaries 8-9.3%). Srikanth *et al.*[18] studied the techno-analysis of migratory fishermen and local fishermen of Cochin backwaters and found that migratory fisherfolk get more catch than local fishermen and benefit economically through less capital investment.

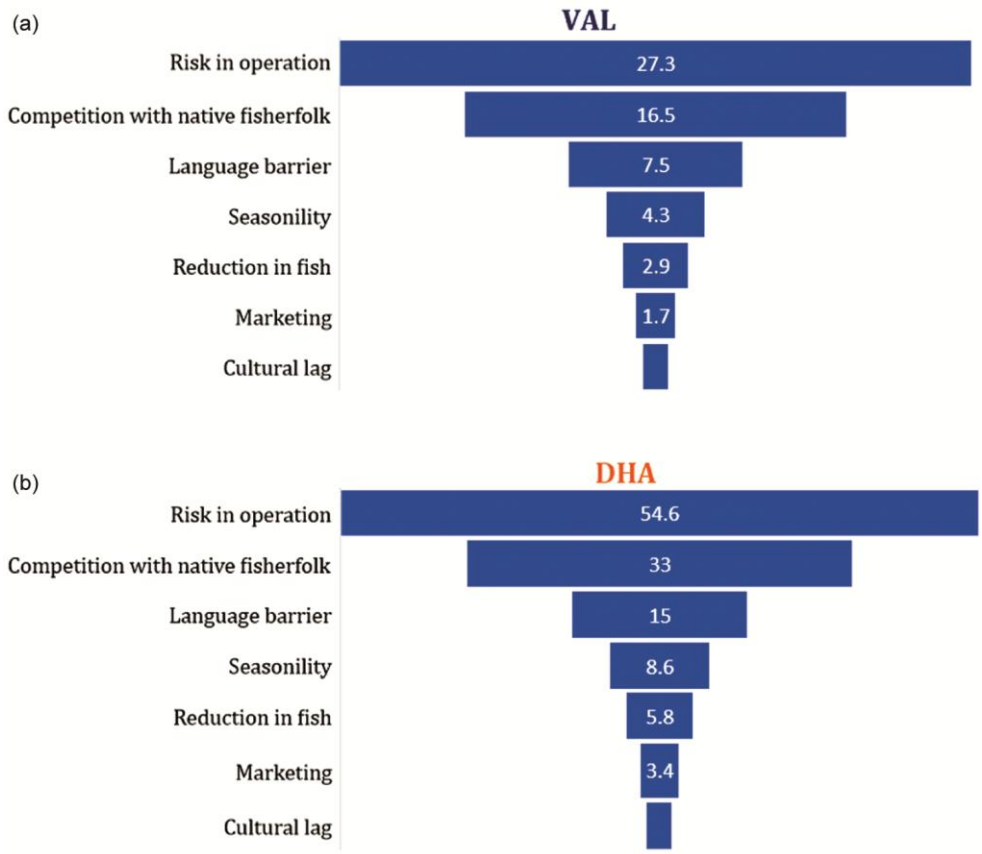

Fig. 5 — Major constraints in operation faced by coracle fisherfolk based on the Garette score

Challenges associated with coracle fishing

Despite the traditional significance and low operational cost, coracle fishing faces several challenges in its operational and management aspects. According to the Kerala Inland Fisheries Act 2010, the use of fishing nets exceeding the prescribed legal length (500 m) is prohibited. However, the use of longer nets (1000 m) by some migratory fishermen may increase fishing effort and contribute to conflicts over resource use, potentially affecting the livelihoods of local fishing communities. In addition, discarded fishing nets and other plastic debris can contribute to environmental pollution within estuarine ecosystems. Safety is another important concern, as coracle fishing often involves family members, including young children, in open water. The Kerala Inland Vessels Act, 2010, mandates the use of appropriate personal flotation devices during boating and fishing activities, underscoring the importance of adhering to safety regulations while preserving this traditional fishing practice. Also, cooperative-based management is the most viable path toward securing long-term inland fishery sustainability[19]. To resolve these issues, structured dialogue between the fishers and the local governing bodies is advisable. Interventions like awareness programmes implemented at panchayath or district level can help to encourage cooperation, improve compliance with regulations, and strengthen community-based management for long-term sustainability.

Conclusion

The above study shows the life of coracle fisherfolk operating near the VAL and DHA estuaries of North Kerala. The catch data were compiled based on the monthly sampling, and socioeconomics were assessed using the questionnaire method by the Garrette scoring technique. From the study, it was found that debts and financial constraints were the major reasons for the migration of these fisherfolk to nearby states in search of better opportunities. Even though they encounter a lot of constraints in their path, their socioeconomic status has been elevated after migrating to Kerala. The only concern about coracle fishing is the fishing strategies. The migratory fishermen was found to cast the nets in a zig-zag

manner along the course of a river two times per day for 2-4 h. This results in more catches, which can cause depletion of fish stocks, habitat degradation, and changes in regulations if left unnoticed. This also affects the native fishermen, which results in an ultimate conflict between the two. So, coracle fishing is possible, but only in limited circumstances. Governing authorities should monitor and regulate the coracle fishing activities regularly.

Supplementary Data

Supplementary data associated with this article is available in the electronic form at https://nopr.niscpr.res.in/jinfo/ijtk/IJTK_25(8)(2026)826-835_SupplData.pdf

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Conflict of Interest

The authors declare that they have no conflicts of interest

Author Contributions

SKC-Conceptualization, Drafting, Review & Editing; JKJ- Conceptualization, Supervision, Review & Editing; SGB- Review & Editing.

Ethics Approval

Not applicable

Informed Consent

Authors declare that prior informed consent was obtained from all the participants including the individuals whose images are presented in this study

Declaration on the Use of Artificial Intelligence (AI)

The authors declare that Artificial Intelligence (AI) assisted tools were not used for the generation, analysis, interpretation of research data, nor for drawing scientific conclusions. The authors have carefully reviewed, verified, and edited the article and accept full responsibility and accountability for the accuracy, originality, and integrity of the manuscript.

Data Availability

The data are available upon reasonable request from the corresponding author

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