

**BEFORE THE NATIONAL GREEN TRIBUNAL  
SOUTHERN ZONE, CHENNAI  
Original Application No.152 of 2023 (SZ)**

**In the matter of:**

Thiru. Kumaresan Sooluran  
Thiruvallur.

... Applicant(s)

Versus

The Tamil Nadu Coastal Zone  
Management Authority,  
Rep by its Member Secretary,  
Chennai and ors.

... Respondent(s)

**REPORT FILED BY 4<sup>TH</sup> RESPONDENT-  
TAMILNADU STATE WETLAND AUTHORITY  
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Through  
Dr. D. Shanmuganathan  
Standing Counsel for Government of Tamil Nadu  
National Green Tribunal  
Southern Zone, Chennai

**DATE: 06.06.2025**

**BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL****SOUTHERN ZONE, CHENNAI****Original Application No. 152 of 2023 (SZ)****IN THE MATTER OF:**

Kumaresan Sooluran

Aged about 44 Years,

Kathivakkam,

Ennore Thermal Station,

Thiruvallur-600057.

...Applicant(s)

-Vs-

The Tamil Nadu Coastal Zone Management Authority,

Rep by its Member Secretary,

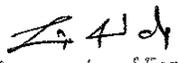
Chennai and others.

...Respondent(s)

**REPORT FILED BY THE 4<sup>th</sup> RESPONDENT/MEMBER****SECRETARY TAMIL NADU STATE WETLAND AUTHORITY**

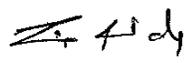
I, Srinivas R.Reddy, S/o Late T. Ramachandran Reddy, aged about 58 years, working as the Principal Chief Conservator of Forests (Head of Forest Force) and Member Secretary, Tamil Nadu State Wetland Authority at Panagal Maligai, Saidapet Chennai-600 015 (FAC) do hereby solemnly affirm and sincerely state as follows: -

1. It is humbly submitted that I am the 4<sup>th</sup> respondent herein and as such I am well acquainted with the facts and circumstances

  
Principal Chief Conservator of Forests and  
Member Secretary  
Tamil Nadu State Wetland Authority  
Chennai-15

of the case on the basis of official records, and as such, authorized and competent to swear this affidavit.

2. It is submitted that this office has sent the letter (**Annexure -1**) to Water Resource Department (WRD) and Fisheries Department requesting information such as completion date of dredging, machinery and man power utilized, disposal methodology and also the current status of dredging proposal in Kattupalli and Puzhuthivakkam Village for 1700 m. This office received a letter from Water Resource Department (WRD) on 29.05.2025 (**Annexure-2**), reporting that 1,050 meters of the 1,700-meter stretch in Atthipattu village have been dredged, with 2,60,000 cubic meters of mixed sediment (fly ash and mussels) removed. Fifteen workers were employed, and dredging is expected to be completed by the last week of August 2025. It is reported that as per this Hon'ble Tribunal's directive in O.A. No.08/2016, disposal of dredged material falls under TANGEDCO's scope. It is further reported that dredging estimates for 1,700 meters in Kattupalli and 500 meters in Puzhuthivakkam, costing Rs. 20.85 crore, have been prepared by Water Resource Department (WRD), and TNPCB and TANGEDCO have been approached for funding.
3. It is humbly submitted that the work for the "Mapping of invasive Charru Mussel (*Mytella strigata*) in Ennore Creek" for an amount of Rs. 6,73,000/- has been awarded to National

  
Principal Chief Conservator of Forests and  
Member Secretary  
Tamil Nadu State Wetland Authority  
Chennai-15

Centre for Sustainable Coastal Management (NCSCM), Chennai by this office. This office received the 1<sup>st</sup> progress report by NCSCM (**Annexure-3**) and it is reported that community mapping exercise was conducted on 02.05.2025 in which local fishermen participated to identify infested areas. Sampling at 148 locations along a 20-km stretch of Ennore Creek and Kosasthalaiyar River was carried out based on local inputs and scientific methods to map infestation hotspots and density. The final report is expected by September 2025.

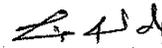
4. It is humbly submitted that the work for the “Controlling the spread of Invasive Mussel, *Mytella strigata* in Dredged Areas of Ennore Creek” for an amount of Rs. 22,63,000/- has been awarded to Dr. M.G.R. Fisheries College, Ponneri. This office received a progress report from the Institute on 30.05.2025 (Copy enclosed as **Annexure-4**), informing that the dredged areas showed a notable absence or minimal presence of *Mytella strigata*, likely due to recent dredging. It is also reported that larval stages of native competitors & bio-indicator species such as: yellow mussel, gastropods, *Nerita* sp. and fish larvae were found in dredged plots, highlighting the possibility of restoration of Ennore-creek ecosystem, after dredging and removal of invasive mussel.
5. It is humbly submitted that the work for the “Research Study on “Value Addition of Invasive Charru Mussel from Ennore Creek as Biofertilizer and Mineral Mix” for an amount of

  
Principal Chief Conservator of Forests and  
Member Secretary  
Tamil Nadu State Wetland Authority  
Chennai-15

Rs.11,11,000/- has been awarded to Dr. M.G.R. Fisheries College, Ponneri. This office received a progress report from the Institute on 27.05.2025 (**Annexure-5**), stating that laboratory trials on the muscle meat, shell, and byssus thread of the invasive Charru Mussel have been completed. The findings confirm its potential as a sustainable source for high-quality biofertilizers and mineral mixes for agriculture and aquaculture respectively. A review meeting was held on 26.05.2025 (**Annexure-6**), wherein directions were issued to initiate heavy metal testing, standardization, and machinery procurement to expedite project completion. Instructions were also given to develop a commercial plan for local fishermen to enable sustainable harvesting and value addition.

I therefore humbly submitted that the above said fact may kindly be taken into consideration by this Hon'ble National Green Tribunal (SZ), Chennai and pass necessary orders as it deems fit and thus render justice.

**DEPONENT**



Principal Chief Conservator of Forests and  
Member Secretary  
Tamil Nadu State Wetland Authority  
Chennai-15

**VERIFICATION**

I Srinivas R.Reddy, S/o Late T. Ramachandran Reddy the above named deponent do hereby verify that the contents of the above affidavit are true and correct on the basis of official record maintained by the respondent no.4, no part of it is false and nothing material has been concealed there from.

**Verified at Chennai on this the 04<sup>th</sup> day June, 2025.**

**DEPONENT**

Principal Chief Conservator of Forests and  
Member Secretary  
Tamil Nadu State Wetland Authority  
Chennai-15





தமிழ்நாடு மாநில ஈரநில ஆணையம்  
TAMIL NADU STATE WETLAND AUTHORITY



**From**

Thiru.Srinivas R.Reddy, I.F.S.,  
Principal Chief Conservator of Forests  
(HoFF) and Member Secretary,  
Tamil Nadu State Wetland Authority (FAC),  
Panagal Maaligai, Saidapet,  
Chennai - 600 015.

**To**

The Director of Fisheries,  
Fisheries and Fishermen Welfare  
Department, Nandanam,  
Chennai - 600 035.

**Ref.No.TNSWA2/236/2024, Dated21-05-2025**

Sir / Madam,

Sub: Wetlands - Tamil Nadu Wetlands Mission - OA No 152 of 2023 in  
National Green Tribunal (SZ) - Control / eradication of *Mytella*  
*strigata* (Kaaka Aazhi) in Ennore Creek - Status report requested -  
Regarding.

- Ref: i. Orders of the Hon'ble National Green Tribunal (SZ) in  
O.A.No.152 of 2023, dated 18.03.2025.  
ii. Government Letter No.18960/FR.7/2022-83, Environment,  
Climate Change and Forests (FR.7) Department, Dated:  
15.05.2025.

\*\*\*\*

With reference to the above, it is informed that the next hearing for the case in  
O.A. No.152 of 2023 before the Hon'ble National Green Tribunal (Southern Zone), Chennai  
has been listed on 06.06.2025 and the Additional Chief Secretary to Government,  
Environment, Climate Change and Forests Department has desired to conduct a review  
meeting on 27.05.2025 regarding to control / eradication of *Mystella Strigata* (Kaka Aazhi)  
in Ennore creek vide reference cited (ii) above.

2) Further, the Hon'ble National Green Tribunal (Southern Zone), Chennai has  
issued a direction and the active portion of the direction is as follows:

***"The Fisheries Department has yet to file its report in this regard.***

**Additionally, the learned counsel for the applicant on record is not available today"**

2) In view of the above, it is requested that the detailed study report for the removal / eradication of Kaaka Aazhi (Charu mussel) may be sent to this office at the earliest so that the same may be discussed in the above said meeting and the status report on removal of Kakka Aazhi (Charu mussel) from the Kosasthalaiyar River may be filed before the Hon'ble National Green Tribunal (Southern Zone) in the next hearing on 06.06.2025. This may be treated as most urgent.

Yours faithfully,

Digitally signed by

Srinivas R Reddy

Date: 21-05-2025

10:22:47  
Principal Chief Conservator of Forests (HoFF)

and Member Secretary

Tamil Nadu State Wetland Authority (FAC)

**Copy to:**

The Additional Chief Secretary to Government, Environment, Climate Change and Forest Department, Secretariat, Chennai for favour of kind information.

The Superintending Engineer, Water Resources Department, Palar basin circle, Chepauk, Chennai - 05 for kind information and necessary action.



தமிழ்நாடு மாநில ஈரநில ஆணையம்  
TAMIL NADU STATE WETLAND AUTHORITY



From

To

Thiru.Srinivas R.Reddy, I.F.S.,  
Principal Chief Conservator of Forests  
(HoFF) and Member Secretary,  
Tamil Nadu State Wetland Authority (FAC),  
Panagal Maaligai, Saidapet,  
Chennai – 600 015.

The Chief Engineer,  
Water Resource Department,  
Chennai Region,  
Chepauk,  
Chennai – 05.

**Ref.No.TNSWA2/236/2024, Dated 23.05.2025**

Sir,

Sub: Wetlands - Tamil Nadu Wetlands Mission - OA No 152  
of 2023 in National Green Tribunal (SZ) control  
eradication of *Mytella strigata* (Kaaka Aazhi) in Ennore  
Creek - status report requested – Regarding.

Ref: i. Orders of the Hon'ble National Green Tribunal  
(SZ) in O.A.No.152 of 2023, dated 18.03.2025.  
ii. Government Letter No.18960/FR.7/2022-83,  
Environment, Climate Change and Forests (fr.7)  
Department, Dated: 15.05.2025.  
iii. Letter received from the Superintending Engineer,  
Water Resource Department, Letter No. A1[NGT-  
113/639/25]/1996/2024, dated 11.03.2025

\*\*\*\*

With reference to the above, it is informed that the Hon'ble National  
Green Tribunal (Southern Zone), Chennai has posted the next hearing for the case  
in O.A. No.152 of 2023 on 06.06.2025 vide reference cited (i) above and also the  
Additional Chief Secretary to Government, Environment Climate Change and  
Forest Department has desired to conduct a review meeting on 27.05.2025 for  
control / eradication of *Mystella Strigata* (Kaka Aazhi) in Ennore creek vide  
reference cited (ii) above.

2) In this regard, it is requested that the detailed report of current dredging work for 1700m at Atthipattu village (near NCTPS bridge) with information such as tentative completion date of dredging, machinery and man power utilized, disposal methodology of charru mussel shells after removal and other relevant information with photographs may kindly be provided to this office. Moreover, the current status of dredging proposal in Kattupulli and puzhuthivakkam Village for 1700m vide reference cited (iii) above may also be included in the status report.

3) Since the above-mentioned status report has to be filed before the Hon'ble National Green Tribunal (SZ) in O.A.No.152 of 2023 prior to final hearing on 06.06.2025, this may be treated as most urgent.

Yours faithfully,

Principal Chief Conservator of Forests (HoFF)  
and Member Secretary  
Tamil Nadu State Wetland Authority (FAC)

**Copy to:**

The Additional Chief Secretary to Government, Environment, Climate Change and Forest Department, Secretariat, Chennai for favour of kind information.

The Superintending Engineer, Water Resources Department, Palar Basin Circle, Chepauk, Chennai- 05 for information and necessary action.



**WATER RESOURCES DEPARTMENT**

From,  
**Er.M.Magesh Nagarajan, B.E.,M.S.,**  
 Superintending Engineer,(WRD).,  
 Palar Basin Circle,  
 Chepauk, Chennai – 600 005.

To,  
**The Member Secretary.,**  
 Tamilnadu State Wetland Authority,  
 Panagal Maaligai, Saidapet,  
 Chennai – 600 015

**Letter No.AEE(T)/AE/F.CharruMussels/2025/Dated: 29.05.2025**

Sir,

**Sub :** WRD- NGT (SZ) O.A.No.152/2023- Detailed Report - submitted -Regarding.

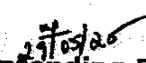
**Ref :** 1) The Principal Chief Conservator of Forest and Member Secretary, Tamilnadu State Wetland Authority in is letter.TNSWA2/236/2024/dt.23.05.2025.

2) The Executive Engineer,WRD, Araniyar Basin Division in his letter Lr.DB/JDO-1/F-Court case/2025 Dated:29.05.2025

\*~\*~\*~\*

The detailed report regarding removal of charru mussels from the Kosasthalaiyar Backwater area, adopting the inputs submitted by the Executive Engineer, WRD, Araniyar Basin Division in the letter 2<sup>nd</sup> cited. This report is for a status update to the National Green Tribunal Southern Zone regarding O.A 152/2023, with a final hearing scheduled for June 6, 2025

Encl: Detailed Report

  
**Superintending Engineer**  
**Palar Basin Circle,**  
**Chepauk, Chennai – 600 005.**

Copy Submitted to

1. The Chief Engineer, WRD, Chennai Region, Chepauk, Chennai-05 for kind information.
2. The Executive Engineer, WRD Araniyar Basin Division, Chepauk, Chennai-05 for necessary information

## **Inputs to Charru mussel O.A 152/2023 for Detailed Report on Ennore Creek Dredging Operations**

1. The Ennore Creek and Kosasthalaiyar Backwater ecosystems are under severe distress, confronting the intertwined issues of accumulated fly ash deposits and the rapid proliferation of the invasive Charru mussel, a species originating from South America.
2. Recognizing the spreading of Charru mussel infestation, which initially manifested in Kattupalli and subsequently spread to Athipattu, backwards a strategic decision was made to commence dredging operations in Athipattu, i.e from the spreading point/Area. This approach allows for controlled, localized trials in an area with a relatively lower mussel density, enabling more precise observation and interpretation of biological control results.
3. Dredging activities in the Athipattu village stretch (LS 0m to 1700m), located near the NCTPS bridge along the Kosasthalaiyar backwater, are currently ongoing. As of 4<sup>th</sup> week of May 2025 a total length of 1050m in backwater stretch has been dredged. It is expected to complete the entire stretch by 4<sup>th</sup> week of August 2025.
4. The operation has resulted in the removal of approximately 2,60,000 cubic meters of heterogeneous material, which includes a substantial mix of fly ash and aggregated *Charru mussels*. Based on systematic sampling and sediment analysis, it is estimated that mussel biomass constitutes nearly 8% of the total dredged volume, particularly concentrated in the upper strata of the riverbed.
5. The dredging operation is being executed using one cutter suction dredger mounted on a pontoon arrangement, supported by four Poclair excavators and a dedicated workforce comprising 15 personnel.

6. As per the directive of the Hon'ble NGT in O.A. No.08/2016, it is clarified that the responsibility for the removal, transportation, and appropriate disposal of all dredged materials within the 1700-meter Kosasthalaiyar Backwater stretch falls under the scope of TANGEDCO.
7. The removal of charru mussel work is being carried out from spreading point (i.e Athipattu) and moving towards Kattupalli based on the further fund allocation. Hence, a comprehensive proposal, with an estimated cost of Rs. 20.85 crores, has been formulated for intervention in the 1.70 km stretch in backwater area from Ls.6300m to L.8000m in Kattupalli village encompassing branch channel of 500m Puzhuthivakkam village. This intervention will commence upon obtaining approval and allocation of necessary funds. Following a meeting held by the Principal Chief Conservator of Forests on 06.03.2025, it was decided that funding estimates will be submitted to Tamil Nadu State Wetland Mission, TNPCB and TANGEDCO to secure the necessary financial resources for the project's continuation.

This report is submitted for onward submission before the Hon'ble National Green Tribunal (Southern Zone) in O.A. No.152 of 2023, whose next hearing is scheduled for 06.06.2025

7.04.2025/05/25 ✓  
**Superintending Engineer**  
**Palar Basin Circle,**  
**Chepauk, Chennai - 600 005**





**First Progress Report**  
**on the project**

**MAPPING OF INVASIVE CHARRU MUSSEL  
(MYTELLA STRIGATA)  
IN ENNORE CREEK, TAMIL NADU**

Prepared by



National Centre for Sustainable Coastal Management (NCSCM)  
Ministry of Environment, Forest and Climate Change  
Government of India

### DOCUMENTATION SHEET

1	Authorized Institute with Letter No. & Date	National Centre for Sustainable Coastal Management (TNSWA2/35/2025, dated 12.03.2025)
2	Report No.	TBD
3	Client's/Institute Name	Tamil Nadu State Wetland Authority, Government of Tamil Nadu
4	Project Overall Coordinator	Dr. Purvaja Ramachandran, Director
5	Principal Investigator	Dr. V. Deepak Samuel, Scientist - E
6	Co-Investigator(s)	Dr. K. R. Abhilash, Scientist - C Dr. R. Robin, Scientist - C
7	Scientist(s)	Dr. R. Muruganandam, Scientist - C
8	Technical Team	Mr. K. K. Manodheepan, Junior Application Engineer
9	Project Staff	Mr. J. Joyson Joe Jeevamani, Project Scientist - II Mr. Nitul Kumar Gogoi, Project Scientist - I
10	Type of Report	Mapping Report
11	Title of Report	Mapping of invasive Charru Mussel ( <i>Mytella strigata</i> ) in Ennore Creek, Tamil Nadu
12	Keywords	Invasion, <i>Mytella strigata</i> , Mapping, Ennore Creek

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## LIST OF ABBREVIATIONS

CBD	-	Convention on Biological Diversity
CRZ	-	Coastal Regulation Zone
CZMP	-	Coastal Zone Management Plan
EDRR	-	Early Detection and Rapid Response
ESA	-	Ecologically Sensitive Areas
GIS	-	Geographic Information System
GPS	-	Global Positioning System
IAS	-	Invasive Alien Species
LEK	-	Local Ecological Knowledge
MoEFCC	-	Ministry of Environment, Forest and Climate Change
NCSCM	-	National Centre for Sustainable Coastal Management
NCTPS	-	North Chennai Thermal Power Station
NGT	-	National Green Tribunal
TNJFU	-	Tamil Nadu Dr. J. Jayalalithaa Fisheries University
TNSWA	-	Tamil Nadu State Wetland Authority
WRD	-	Water Resources Department

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The list of participants in the community mapping meeting is as follows:

1. Mr. [Name] - [Title]

2. Mr. [Name] - [Title]

3. Mr. [Name] - [Title]

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## Introduction

Biological invasion is the process by which species are intentionally or unintentionally transported beyond their natural geographic range through human activities, and subsequently introduced into new environments where they may establish, spread, and become invasive. Species introduced to regions outside their native range are referred to as alien species. A subset of these, known as invasive alien species (IAS), includes animals, plants, and other organisms that cause significant negative impacts on biodiversity, ecosystems, and native species<sup>1</sup>.

IAS can originate from any taxonomic group and can affect all types of ecosystems. Their impacts on native biodiversity are wide-ranging, including competition for resources, hybridization, transmission of diseases, predation, and herbivory. These pressures not only threaten species survival and ecosystem integrity but also affect ecosystem services and human well-being. While some IAS may provide perceived anthropogenic benefits<sup>2</sup>, the ecological, economic, and social costs of invasions often far outweigh these advantages. In some cases, the changes they cause are irreversible.

Invasive alien species are now recognized as one of the “five horsemen” of the global biodiversity crisis alongside land- and sea-use change, overexploitation, climate change, and pollution<sup>1</sup>. Unlike the other drivers, however, biological invasions remain relatively underexplored, with persistent knowledge gaps regarding invasion pathways, ecological impacts, and long-term outcomes.

Globalization has accelerated the spread of alien species through increased international trade, travel, and transport, creating new and often unintentional introduction pathways. More than 37,000 alien species have established themselves across all regions and biomes of the world, with new species being introduced at an unprecedented rate of around 200 per year<sup>1</sup>.

Recognizing the urgent need to address the threat posed by IAS, international efforts have been mobilized to prevent introductions, ensure early detection, and implement effective control and mitigation strategies. Notably, Target 6 of the Kunming-Montreal Global Biodiversity Framework<sup>3</sup>, adopted by the Conference of the Parties to the Convention on Biological Diversity (CBD), aims to:

*Eliminate, minimize, reduce, and/or mitigate the impacts of invasive alien species on biodiversity and ecosystem services by identifying and managing pathways for introduction; preventing the establishment of priority IAS; reducing the rate of introduction and establishment of other known or potential IAS by at least 50% by 2030; and eradicating or controlling IAS, particularly in priority areas such as islands.*

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<sup>1</sup> IPBES (2023). Summary for Policymakers of the Thematic Assessment Report on Invasive Alien Species and their Control of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. Roy HE, Pauchard A, Stoett P, Truong TR, Bacher S, Galil BS, Hulme PE, Ikeda T, Sankaran KV, McGeoch MA, Meyerson LA, Nuñez MA, Ordoñez A, Rahliou SJ, Schwindt E, Seebens H, Sheppard AW and Vandvik V (eds.). IPBES secretariat, Bonn, Germany.

<sup>2</sup> Sax, Dov F, Schlaepfer MA, Olden JD (2022). Valuing the contributions of non-native species to people and nature. *Trends in Ecology & Evolution*, 37(12): 1058–1066.

<sup>3</sup> <https://www.cbd.int/gbftargets/6>

Management of IAS is most effective when it prioritizes prevention. However, early detection, eradication, containment, and control can also be successful when implemented appropriately. Effective responses require multi-stakeholder engagement, including the active participation of indigenous peoples and local communities. Once invasive species and priority sites are identified, tailored management strategies must be developed based on the species involved, the ecosystems affected, and the scale of impact. This typically involves a combination of modern and traditional methodologies adapted to local contexts.

Global assessments demonstrate that, with adequate resources, strong political will, and sustained commitment, the prevention and control of invasive alien species are achievable goals. Success in this area can yield long-term benefits for both biodiversity conservation and human well-being.

## Project Background

Marine mussels are among the most widespread and successful invasive taxa globally. Their ability to cross biogeographical boundaries - whether through intentional introductions or unintentional transport - and establish viable populations in non-native environments highlights their evolutionary resilience, dating back to their origins in the Ordovician period<sup>4</sup>.

The mytilid mussel *Mytella strigata* (Hanley, 1843), formerly referred to as *M. charruana* (d'Orbigny, 1842), is one such species that has become invasive beyond its native range, causing ecological, economic, and social impacts in the regions it has colonized. This mussel, commonly known as the Charru Mussel, is indigenous to the Atlantic coast of South America and the Pacific coasts of Central and South America, from Mexico to Ecuador<sup>5</sup>. Beyond its native distribution, *M. strigata* has been reported in United States of America, as well as in several Asian countries including the Philippines, Singapore, Thailand, China, India, Taiwan, and Hong Kong (Figure 1). The species is characterized by high fecundity, rapid growth, and a broad tolerance to varying environmental conditions, all of which contribute to its invasive potential<sup>6</sup>.

The species has already been reported from India, where it has caused notable ecological disruption and adverse impacts on local livelihoods. *Mytella strigata* was first recorded in Indian waters from Vembanad Lake in Kerala<sup>7</sup> and has since spread rapidly to other regions,

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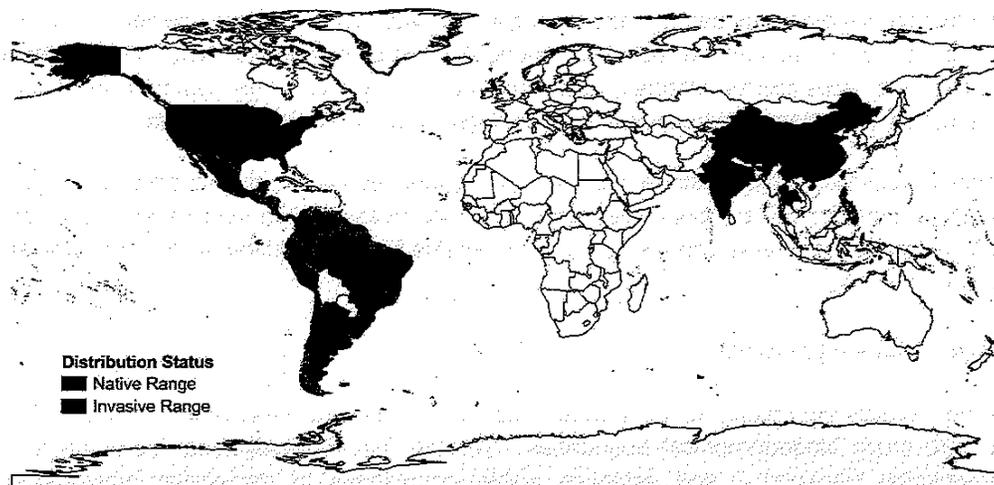
<sup>4</sup> Lim JY, Tay TS, Lim CS, Lee SSC, Teo SL, Tan KS (2018). *Mytella strigata* (Bivalvia: Mytilidae): an alien mussel recently introduced to Singapore and spreading rapidly. *Molluscan Research*, 38(3): 170–186.

<sup>5</sup> Kumar AB, Ravinesh R, Oliver PG, Tan SK, Sadasivan K (2019). Rapid bioinvasion of alien mussel *Mytella strigata* (Hanley, 1843) (Bivalvia: Mytilidae) along Kerala coast, India: Will this impact the livelihood of fishers in Ashtamudi Lake. *Journal of Aquatic Biology & Fisheries*, 7: 31–45.

<sup>6</sup> Rice MA, Rawson PD, Salinas AD, Rosario WR (2016). Identification and salinity tolerance of the Western Hemisphere mussel *Mytella charruana* (d'Orbigny, 1842) in the Philippines. *Journal of Shellfish Research*, 35(4): 865–873.

<sup>7</sup> Jayachandran PR, Aneesh BP, Oliver PG, Philomina J, Jima M, Harikrishnan K, Nandan SB (2019). First record of the alien invasive biofouling mussel *Mytella strigata* (Hanley, 1843) (Mollusca: Mytilidae) from Indian waters. *BioInvasions Records*, 8(4): 828–837.

including Ashtamudi Lake<sup>5</sup>, Kayamkulam and the Padanna Backwaters<sup>8</sup> in Kerala, the Gulf of Mannar<sup>9</sup> and the Ennore-Pulicat stretch<sup>10</sup> in Tamil Nadu.



**Figure 1** Map showing the native and invasive range distribution of *Mytella strigata*, with highlighted countries indicating occurrence restricted to their coastal regions (country data sourced from literature<sup>5,9,11,12</sup>)

The expansion of *Mytella strigata* in Tamil Nadu's Pulicat and Ennore regions is believed to be facilitated by ballast water discharge from ships<sup>13</sup>. In this stretch, local fishers report that *M. strigata* - known locally as *kaaka aazhi* - is causing significant ecological disruption. The species has been observed driving prawns to burrow into silt or graze in atypical patterns, while simultaneously displacing commercially valuable and regionally abundant bivalves such as the yellow clams (*Meretrix meretrix*, *M. casta*, and *Marcia opima*, collectively called as *manja matti*) and the green mussel (*Perna viridis*, or *pachai aazhi*). A thick, foot-deep layer of black, foul-smelling, and slimy excrement now covers parts of the lakebed, further degrading

<sup>8</sup> CMFRI (2020). Identifying and managing *Mytella strigata*: The invasive mussel species reported from Kerala. Indian Council of Agricultural Research – Central Marine Fisheries Research Institute, Kerala. Available at: [https://eprints.cmfri.org.in/14302/1/Mytella%20strigata\\_2020\\_Brochure\\_N%20K%20Sanil.pdf](https://eprints.cmfri.org.in/14302/1/Mytella%20strigata_2020_Brochure_N%20K%20Sanil.pdf) (accessed on 21 May 2025).

<sup>9</sup> Ravinesh R, Laju RL, Edward JKP, Kumar AB (2023). Invasion of alien mussel *Mytella strigata* (Bivalvia: Mytilidae) in the Gulf of Mannar, India and possible threats to the native biodiversity. *Journal of Aquatic Biology & Fisheries*, 11(1): 28–34.

<sup>10</sup> Raju N (2022). Alien mussel invasion in TN's Ennore, Pulicat wetlands threaten fisher livelihoods. *The News Minute*, December 28. Available at: <https://www.thenewsminute.com/tamil-nadu/alien-mussel-invasion-tn-s-ennore-pulicat-wetlands-threaten-fisher-livelihoods-171380> (accessed on 21 May 2025).

<sup>11</sup> Yu Y, Gao Q, Liu M, Li J, Wang S, Zhang J (2023). Report on the invasive American brackish-water mussel *Mytella strigata* (Hanley, 1843) (Mollusca: Mytilidae) in Beibu Gulf. *BioInvasions Record*, 12(1).

<sup>12</sup> Nisin KMMN, Sreenath NR, Sreeram MP (2024). Muscling mussels: Understanding the invasive potential of the South American bivalve *Mytella strigata* (Hanley, 1843) in the Northern Indian Ocean. *Science of the Total Environment*, 916: 170243.

<sup>13</sup> The Hindu Bureau (2022). Fishermen raise concern over invasive species of mussel in Ennore and Pulicat. *The Hindu*, December 28. Available at: <https://www.thehindu.com/news/cities/chennai/fishermen-raise-concern-over-invasive-species-of-mussel-in-ennore-and-pulicat/article66311515.ece> (accessed on 21 May 2025).

habitat quality<sup>14</sup>. Moreover, dense aggregations of the mussel are reportedly obstructing the movement of fishing boats, directly impacting the livelihoods of local fishing communities<sup>15</sup>.

Scientific studies have been called for to recommend both short-term and long-term strategies for controlling and eventually eradicating the invasive mussel species in the affected regions<sup>16</sup>. In response to directives issued by the Southern Bench of the National Green Tribunal (NGT), dredging operations were proposed in the Kosasthalaiyar backwater area and Ennore Creek to remove accumulated fly ash slurry and slushy silt deposits from the creek beds. Accordingly, the Water Resources Department (WRD), Government of Tamil Nadu proposed dredging activities in the Kosasthalaiyar River backwaters, extending over a length of 1.7 km. This stretch includes the confluence of the Kosasthalaiyar River with the backwater region between the Ennore Railway Bridge and Road Bridge, as well as the dredging of a link channel connecting the North Buckingham Canal with the Kosasthalaiyar River and Ennore Creek. The Tamil Nadu State Wetland Authority (TNSWA), in collaboration with the WRD, has initiated the removal of dredged materials including fly ash deposits and invasive *Mytella strigata* (charru mussels) from the designated sections of the Kosasthalaiyar River in Ennore<sup>17</sup>.

In addition to dredging, which serves as a physical removal strategy for *M. strigata* in Ennore Creek, further studies are being proposed to support a comprehensive management approach. These include mapping the current distribution of *M. strigata* along the creek, conducting pilot studies to develop effective methods for preventing recolonization in dredged areas, and exploring the potential for value addition using the harvested mussels<sup>17</sup>. The latter



aims to assess whether the invasive biomass can be repurposed to create alternative livelihood opportunities for local communities, thereby integrating ecological restoration with socio-economic benefits.

In this context, the National Centre for Sustainable Coastal Management (NCSCM), Chennai, was involved in the baseline study since November 2024 to identify and map areas affected by the invasive mussel in Ennore Creek and the Pulicat region.

<sup>14</sup> The Hindu Bureau (2023). NGT seeks report on removal of invasive mussel species from Ennore-Pulicat wetland. *The Hindu*, October 06. Available at: <https://www.thehindu.com/sci-tech/energy-and-environment/ngt-seeks-report-on-removal-of-invasive-mussel-species-from-ennore-pulicat-wetland/article67388521.ece> (accessed on 21 May 2025).

<sup>15</sup> Kalyanaraman M (2024). Does India have laws against invasive species from ballast water? *The Hindu*, August. Available at: <https://www.thehindu.com/news/national/does-india-have-laws-against-invasive-species-from-ballast-water/article68522092.ece> (accessed on 21 May 2025).

<sup>16</sup> NGT (2024). Minutes of the meeting convened under the Chairpersonship of the Chief Secretary to Government, for discussion on O.A.No. 152 of 2023 (SZ) in the Hon'ble National Green Tribunal on 22.08.2024 at Chief Secretary Conference Hall, 2nd Floor, Secretariat, Chennai. Available at: [https://greentribunal.gov.in/sites/default/files/news\\_updates/OA%20152%20of%202023.pdf](https://greentribunal.gov.in/sites/default/files/news_updates/OA%20152%20of%202023.pdf) (accessed on 21 May 2025).

<sup>17</sup> The Hindu Bureau (2025). T.N. Water Resources Department seeks ₹20 crore from Tangedco for removal of invasive mussels in Ennore. *The Hindu*, March 26. Available at: <https://www.thehindu.com/news/cities/chennai/wrd-seeks-20-crore-from-tangedco-for-removal-of-invasive-mussels-in-ennore/article69373308.ece> (accessed on 21 May 2025).

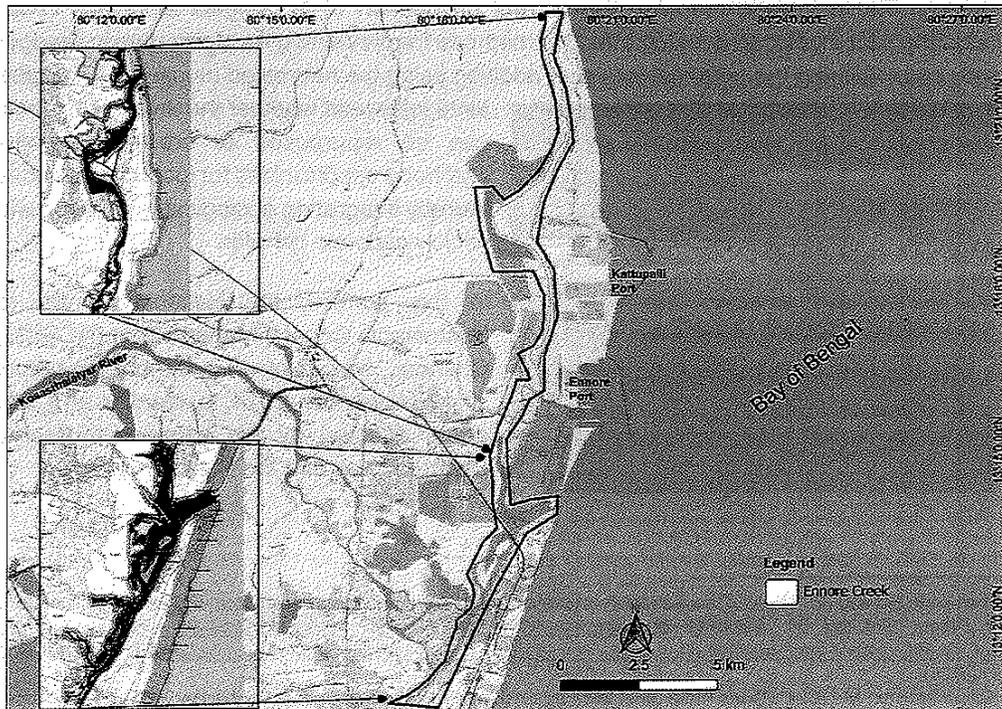
## Objectives of the Project

The rapid spread of the invasive mussel *M. strigata* in Ennore Creek poses a serious threat to the ecological balance of the region, necessitating an integrated approach that includes monitoring, eradication, and ecosystem restoration. This project aims to develop comprehensive spatial maps detailing the distribution of the species within the creek, providing a critical foundation for targeted scientific interventions and management strategies.

The following are the specific objectives:

- Locating and delineating area(s) in the Ennore Creek affected by *M. strigata*, development of spatial maps using Geographic Information System (GIS), and assessing the density and biomass of populations across the identified zones.
- Identifying regions with high vulnerability to further invasion, based on hydrodynamic connectivity, human activities, and ecological conditions, and mapping infested areas in relation to dredging sites, industrial outfalls, and fishing zones to evaluate potential anthropogenic influences on mussel spread.

## Area of Assessment



**Figure 2** Map showing the study area, Ennore Creek, along the Bay of Bengal. Boundary delineated based on the Tamil Nadu CZMP approved maps. Top inset: CZMP Sheet No. D44O7/SW, Map No. TN111<sup>18</sup>; Bottom inset: CZMP Sheet No. D44O8/NW, Map No. TN110<sup>19</sup>

<sup>18</sup> <https://environment.tn.gov.in/assets/czmpmap/TN111.pdf>

<sup>19</sup> <https://environment.tn.gov.in/assets/czmpmap/TN110.pdf>

In this assessment, the boundary of Ennore Creek was delineated based on the Coastal Regulation Zone (CRZ) classification as per the approved Coastal Zone Management Plans (CZMP) of Tamil Nadu. Accordingly, Ennore Creek extends from the tidal-influenced waters near Sathya Moorthi Nagar in Tiruvottiyur (to the south) up to Thangalperumbalam in the north, both situated within Thiruvallur district, Tamil Nadu (Figure 2). This stretch spans approximately 26 km linearly along the course of the creek.

Ennore Creek is a shallow backwater system situated in Ennore, within Thiruvallur district of Tamil Nadu, along the Coromandel Coast of the Bay of Bengal. The creek receives freshwater inflow predominantly from the Kosasthalaiyar River, especially during the northeast monsoon (October–December), driven by heavy rainfall and surplus discharge from Puzhal Lake<sup>20</sup>. The mouth of the creek is highly dynamic, influenced by natural processes such as cyclones, floods, tidal fluctuations, and intensified by anthropogenic interventions<sup>21</sup>. Seasonal current reversals - northward from March to October and southward from November to February - also influence sediment transport, contributing to shoreline accretion and erosion<sup>22</sup>. Additionally, coastal infrastructure such as jetties and breakwaters associated with Ennore Port has led to sediment deposition and sandbar formation, necessitating periodic dredging<sup>22</sup>.

Historically, the creek supported a rich diversity of flora and fauna, including mangroves, reptiles, tortoises, and various fish species. It served as an important ecological zone and a natural green belt. However, urbanization and industrialization have severely degraded its ecological integrity. The disposal of untreated sewage and industrial effluents has significantly altered the creek's water quality, leading to a drastic reduction in biodiversity and biological productivity<sup>22</sup>. The region now suffers from eutrophication due to continuous discharges of domestic and industrial wastewaters, with frequent occurrences of algal blooms. Thermal pollution from the North Chennai Thermal Power Station (NCTPS) has elevated creek water temperatures by 5°–9 °C above ambient seawater levels<sup>23</sup>. Heavy metal accumulation (chromium, copper, nickel, cobalt, lead, zinc and cadmium) in aquatic organisms such as polychaetes, fish, and green mussels has been widely reported<sup>20</sup>.

The creek plays a critical role in sustaining the livelihoods of local communities, particularly traditional fishing families residing in adjacent villages. Fishing remains the primary occupation, with household incomes directly dependent on fin and shellfish availability. However, recent socio-economic survey reveals that a majority of the population belongs to economically weaker sections, living below the poverty line<sup>22</sup>. The degradation of water quality and fish habitat due to industrial effluents, thermal discharges, and mouth closure has resulted in reduced fish catch and declining income. Fish species that were once abundant - including white prawns (*Vellai Iral*), black prawns (*Karuppu Iral*), sand prawns (*Mann Iral*), tiger prawns (*Singi Iral*), green crab, *Irun Kezhuthi*, mullets (*Madavai*), *Oodan*, *Kezhangam*, *Uppathi*,

<sup>20</sup> Savurirajan M, Barathkumar S, Karthikeyan P, Marigoudar SR, Sharma KV, Murthy MVR (2022). Assessment of ecological quality status using macrobenthic faunal diversity as tools in anthropogenically disturbed Ennore estuary, Tamil Nadu, India. *Regional Studies in Marine Science*, 56: 102629.

<sup>21</sup> Raj N, Gurugnanam B, Sudhakar V, Francis PG (2019). Estuarine shoreline change analysis along The Ennore river mouth, south east coast of India, using digital shoreline analysis system. *Geodesy and Geodynamics*, 10(3): 205–212.

<sup>22</sup> Krishnaveni M, Kalaivani K, Priya KV, Jagadish C (2023). Coastal morphodynamics and environmental variables of Ennore Creek: An integrated approach. In: Jayaraju N, Sreenivasulu G, Madakka M, Manjulatha M (eds.), *Coasts, Estuaries and Lakes*, Springer Nature, Switzerland AG, pp. 445–457.

<sup>23</sup> Buvaneshwari S, Ravichandran V, Mudgal BV (2014). Thermal pollution modeling of cooling water discharge into a closed creek system. *Indian Journal of Geo-Marine Sciences*, 43(7): 1415–1421.

*Keechan*, *Panna* and *Koduvaare* -have declined since the 1960s, following large-scale infrastructure developments and pollution<sup>22</sup>.

The creek hosts a unique and deeply rooted community-based fishery governance system known as the *paadu* system. This customary practice, evolved over generations, divides the creek into 52 designated fishing grounds or *paadus*<sup>24</sup>, each named after a distinguishing feature of the landscape whether geographic, biological, or human-made. These *paadus* are managed collectively and are critical to the cultural and economic fabric of the local fishing communities, particularly those from the villages of Mugatwarakuppam and Kattukuppam. Under this system, only stake-net fishers recognized by the community are permitted to fish in a *paadu*, and access is rotated daily between the two villages. Each fisher has the right to set nets only within the assigned *paadu*, ensuring a form of spatial and temporal equity, while leaving the rest of the creek accessible to fishers using different gear types. The *paadu* system is a prime example of traditional resource management that balances sustainability with community livelihoods. The *paadu* system represents more than a fishing technique; it reflects a relational, place-based knowledge system deeply embedded in the seasonal, tidal, and monsoonal rhythms of the estuary.

The creek faces multiple, interlinked environmental challenges. Important among them is the closure of the creek mouth, which restricts tidal exchange and disrupts ecological functioning. This closure is driven by sedimentation, reduced river discharge, and sandbar formation often worsened by coastal development activities such as the construction of ports and breakwaters. Water pollution is another significant concern, with large volumes of untreated domestic sewage and industrial effluents entering the creek through the Kosasthalaiyar River. The creek's limited flushing capacity leads to pollutant accumulation, altering water chemistry and degrading habitat quality. The resulting eutrophication, sediment contamination, and thermal stress have significantly impacted aquatic biodiversity and fisheries. Furthermore, shoreline erosion, irregular tidal flows, and morphological alterations due to recent construction activities have compounded the degradation of the estuarine environment<sup>20,22</sup>.

### Mapping of *M. strigata* Distribution

Mapping the distribution of invasive species such as the Charru mussel is critical for understanding the extent of their spread and for guiding effective management strategies. Spatial distribution maps serve as powerful tools for visualizing and communicating the scope of the invasion to stakeholders, including policymakers, environmental managers, and local communities<sup>25</sup>. Geographic Information Systems (GIS) was used in identifying population hotspots, assessing the temporal progression of the invasion, and facilitating coordinated responses across administrative and ecological boundaries. Furthermore, GIS-based mapping supports adaptive management by tracking the effectiveness of various control measures such as physical removal or habitat restoration - and their ecological consequences, including impacts on water quality and native biodiversity<sup>26</sup>. In the case of

<sup>24</sup> Jayaraman, N., Bremner, L., Coelho, K., Kumar, P. and Kasinathan, S. (2025). Counter-mapping, counter-histories, and insurgencies of subjugated knowledges in the fisher struggle for Ennore Creek. *Antipode*, 57: 259–281.

<sup>25</sup> Bradley BA, Marvin DC (2011). Using expert knowledge to satisfy data needs: Mapping invasive plant distributions in the Western United States. *Western North American Naturalist*, 71(3): 302–315.

<sup>26</sup> Biggerstaff MS, Beck CW (2007). Effects of method of English ivy removal and seed addition on regeneration of vegetation in a southeastern piedmont forest. *The American Midland Naturalist*, 158(1): 206–220.

aquatic invasive like mussels, which may proliferate rapidly in inaccessible or turbid environments, robust spatial data are indispensable for long-term monitoring, risk assessment, and prioritization of intervention efforts. With advancements in remote sensing, GIS, and spatial analytics, researchers and environmental managers can now track the spread of invasive species like the Charru mussel at unprecedented spatial and temporal resolutions. Together, these tools strengthen Early Detection and Rapid Response (EDRR) frameworks, support long-term ecological monitoring, and guide the evaluation of control and restoration efforts<sup>27</sup>.

Mapping the distribution of invasive mussels not only informs ecological management but also contributes to broader sustainability goals. Protecting native biodiversity, maintaining ecosystem services, and preventing the collapse of aquatic food webs are essential for ecological resilience. From an economic perspective, timely and informed action reduces the financial burden on fisheries, water infrastructure, and coastal industries. Furthermore, mitigating the spread of invasive species that can alter water quality or serve as vectors for disease supports public health and enhances community well-being. In this context, geospatial mapping is not just a scientific exercise but a critical step toward integrated, informed, and sustainable environmental stewardship.

### Approach

Considering the significance of remote sensing applications in mapping IAS, mapping the distribution of the invasive mussel species in Ennore Creek posed significant challenges due to limitations in the use of satellite imagery. Although significant advancements have been made in remote sensing applications for coastal monitoring, several limitations restrict their effectiveness in the current study area. The spatial resolution of satellite imagery remains a constraint, especially for detecting fine-scale features such as the patchy distribution of invasive mussels in narrow, shallow estuarine systems<sup>28</sup>. Furthermore, consistent cloud-free imagery is required to obtain reliable data coverage, which is often difficult to achieve in coastal regions influenced by seasonal weather patterns<sup>29,30</sup>.

Most existing algorithms are optimized for clear-water conditions<sup>31</sup>, whereas the waters of Ennore Creek are highly turbid due to suspended sediments, industrial discharge, and limited flushing. This turbidity significantly affects light penetration, leading to poor image contrast and reduced accuracy in detecting shallow features, as suspended and dissolved substances in the water column attenuate light and distort spectral signals. Given these environmental limitations, remote sensing was deemed unsuitable for reliably mapping the mussel distribution. Alternatively, a combination of community mapping and random field surveys was adopted to overcome these challenges. These approaches not only provided ground-truthed,

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<sup>27</sup> Halmy MWA (2024). Importance of geospatial data for monitoring and managing invasive species for sustainable development: A semantic review. *Annals of Library and Information Studies*, 71: 417–434.

<sup>28</sup> Casella E, Scicchitano G, Rovere A (2024). Accuracy and Precision of shallow-water photogrammetry from the sea surface. *Remote Sensing*, 16(22): 4321.

<sup>29</sup> Jagalingam P, Akshaya BJ, Hegde AV (2015). Bathymetry mapping using Landsat 8 satellite imagery. *Procedia Engineering*, 116: 560–566.

<sup>30</sup> Daly C, Baba W, Bergsma E, Thoumyre G, Almar R, Garland T (2022). The new era of regional coastal bathymetry from space: A showcase for West Africa using optical Sentinel-2 imagery. *Remote Sensing of Environment*, 278: 113084.

<sup>31</sup> Bramante JF, Raju DK, Sin TM (2012). Multispectral derivation of bathymetry in Singapore's shallow, turbid waters. *International Journal of Remote Sensing*, 34(6): 2070–2088.

location-specific data but also facilitated the incorporation of local ecological knowledge, ensuring more accurate and inclusive spatial documentation of the invasive mussel's spread in the creek.

## Community Mapping

In this assessment, participatory mapping was adopted as a primary method to map the distribution of invasive mussels in the estuarine environment. Participatory mapping encompasses a diverse set of methodologies aimed at involving local communities particularly those with close ecological ties to the environment in the process of spatial data generation<sup>32</sup>. Unlike conventional cartographic methods that rely solely on field instruments and satellite data, participatory mapping leverages local ecological knowledge (LEK) to generate spatially relevant insights<sup>33</sup> that are both timely and contextually grounded.

This method is increasingly recognized as a powerful tool across natural resource management, biodiversity conservation, and ecosystem monitoring<sup>34</sup>. In situations where scientific data is scarce or delayed, such as during the early spread of aquatic invasive species, participatory mapping can provide real-time, location-specific information that supports early detection and rapid response<sup>35,36</sup>. The involvement of local fishers and residents, who observe environmental changes regularly and interact closely with the estuarine ecosystem, enabled the identification of mussel hotspots and spread patterns that might otherwise be overlooked in ecological surveys constrained by time, funding, or accessibility.

LEK has already been successfully used in a variety of ecological contexts to estimate species abundance, identify biological parameters, and track invasion histories<sup>37</sup>. In particular, it offers significant advantages in aquatic systems, where traditional surveys are logistically challenging and often fail to keep pace with the rapid spread of invasive organisms<sup>38,39</sup>. Despite its growing recognition, participatory mapping remains underutilized in the context of

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<sup>32</sup> Loerzel JL, Goedeke TL, Dillard MK, Brown G (2017). SCUBA divers above the waterline: using participatory mapping of coral reef conditions to inform reef management. *Marine Policy*, 76: 79–89.

<sup>33</sup> Luizza MW, Wakie T, Evangelista PH, Jarmovich CS (2016). Integrating local pastoral knowledge, participatory mapping, and species distribution modeling for risk assessment of invasive rubber vine (*Cryptostegia grandiflora*) in Ethiopia's Afar region. *Ecology and Society*, 21(2): 22.

<sup>34</sup> IFAD (2009). Good practices in participatory mapping: A review prepared for the International Fund for Agricultural Development (IFAD). *International Fund for Agricultural Development*. Available at: [https://www.ifad.org/documents/38714170/39144386/PM\\_web.pdf/7c1eda69-8205-4c31-8912-3c25d6f90055](https://www.ifad.org/documents/38714170/39144386/PM_web.pdf/7c1eda69-8205-4c31-8912-3c25d6f90055) (accessed on 22 May 2025)

<sup>35</sup> Brown G, McAlpine C, Rhodes J, Lunney D, Goldingay R, Fielding K, Hetherington S, Hopkins M, Manning C, Wood M, Brace A, Vass L (2018). Assessing the validity of crowdsourced wildlife observations for conservation using public participatory mapping methods. *Biological Conservation*, 227: 141–151.

<sup>36</sup> Sousa R, Nogueira JG, Miranda F, Teixeira A (2020). Time travelling through local ecological knowledge regarding an endangered species. *Science of the Total Environment*, 739: 140047.

<sup>37</sup> Azzurro E, Cerri J (2021). Participatory mapping of invasive species: A demonstration in a coastal lagoon. *Marine Policy*, 126: 104412.

<sup>38</sup> Azzurro E, Sbragaglia V, Cerri J, et al (2019). Climate change, biological invasions, and the shifting distribution of Mediterranean fishes: A large-scale survey based on local ecological knowledge. *Global Change Biology*, 25: 2779–2792.

<sup>39</sup> Azzurro E, Bolognini L, Dragičević B, Drakulović D, Dulčić J, Fanelli E, Grati F, Kolutari J, Lipej L, Magaletti E, Marković O (2019). Detecting the occurrence of indigenous and non-indigenous megafauna through fishermen knowledge: A complementary tool to coastal and port surveys. *Marine Pollution Bulletin*, 147: 229–236.

aquatic invasive species, possibly due to persistent skepticism around the objectivity of LEK and the need for interdisciplinary expertise in both ecological and social science methods<sup>40,41</sup>.

However, when properly facilitated, participatory mapping can yield high-quality spatial data that not only complements but sometimes surpasses traditional sampling in relevance and immediacy. Simple tasks, such as drawing boundaries on printed maps, have proven to be intuitive and effective even in low-literacy settings, thus making the method widely accessible<sup>42</sup>. Furthermore, the active involvement of local stakeholders in the mapping process fosters a sense of ownership, trust, and co-production of knowledge principles that are increasingly recognized as essential to community-based conservation and adaptive co-management<sup>43,44</sup>.

Given the difficulty in tracking invasive mussels using remote sensing due to turbidity, shallow waters, and spectral limitations, participatory mapping coupled with random field sampling offered a pragmatic and inclusive alternative. It not only enabled us to collect reliable, localized distribution data but also promoted community engagement, contributing to the broader goals of resilience, stewardship, and ecosystem governance in the estuarine environment.

### **Community Mapping – Secondary Source**

Prior to initiating the community mapping process to identify mussel-invaded sites, we utilized baseline data on the locations of *paadus* and mussel-infested areas along the creek. This data was sourced from a recent study conducted in July 2024. The mapped locations of the *paadus* and mussel invasion zones are presented in

Figure 3.

### **Primary Community Mapping**

A participatory mapping meeting was organized with the local communities of Ennore to generate spatially explicit information on the distribution of *M. strigata* within the Ennore Creek. The one-day participatory meeting was held on 2<sup>nd</sup> May 2025 in Kattukuppam village (Figure 4), with a total of 30 participants, of whom 19 were local residents, accounting for 63% of the total. Attendees included the village leader and fishers from Kattukuppam and Mugatwarakuppam, activists and volunteers from the Save Ennore Creek Campaign, officials from the TNSWA, and staff from the NCSCM. The complete list of participants is provided in Annexure 1.

<sup>40</sup> Crowley SL, Hinchliffe S, McDonald RA (2017). Invasive species management will benefit from social impact assessment. *Journal of Applied Ecology*, 54: 351–357.

<sup>41</sup> Shackleton RT, Adriaens T, Brundu G, Dehnen-Schmutz K, Estévez RA, Fried J, Larson BM, Liu S, Marchante E, Marchante H, Moshobane MC (2019). Stakeholder engagement in the study and management of invasive alien species. *Journal of Environmental Management*, 229: 88–101.

<sup>42</sup> Aranda NR, Waegemaeker J, Weghe NV (2023). The evolution of public participation GIS (PPGIS) barriers in spatial planning practice. *Applied Geography*, 155: 102940.

<sup>43</sup> Holm P, Soma K (2016). Fishers' information in governance – a matter of trust. *Current Opinion in Environmental Sustainability*, 18: 115–121.

<sup>44</sup> Mackinson S, Wilson DC, Galiay P, Deas B (2011). Engaging stakeholders in fisheries and marine research, *Marine Policy*, 35(1): 18–24.

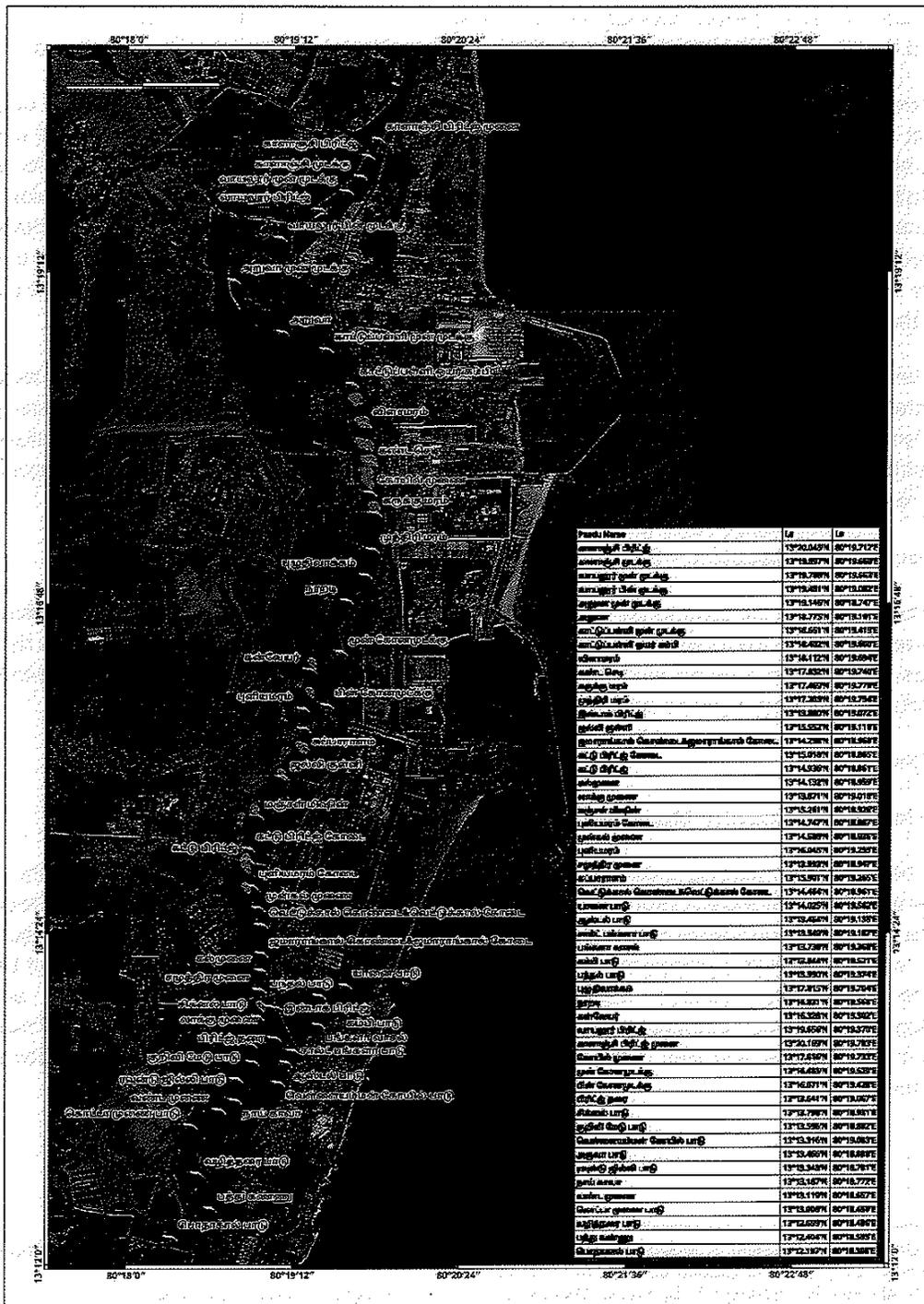


Figure 3 Map<sup>45</sup> showing the locations of fishing grounds (*paadus* – prawn icons) and mussel invaded areas (blue color icons) in the Ennore Creek

<sup>45</sup> Map obtained and reproduced by permission from Mr. Saravanan, Save Ennore Creek Campaign



**Figure 4** Discussion with participants in Kattukuppam, Ennore

The purpose of the meeting was explained in the local language (Tamil) to the community. They were informed that the objective was to map and locate the fishing grounds along the Ennore Creek. It also aimed to identify the areas invaded by the Charru mussel, based on their LEK. Once the purpose was understood, the participants shared their knowledge. They spoke about how the mussel may have entered the creek. They described the impacts of the invasion on fishing, fishing practices, and their livelihoods. They also explained the actions they had taken, such as reporting the issue, conducting their own study, identifying the infested areas, and removing the mussels. In addition, they shared their expectations from the Government. They requested immediate action from the relevant departments to help eradicate the mussel invasion.

After the initial discussion, a selected group of willing participants was organized into two teams to conduct the community mapping exercise. The composition and profile of the two participant groups are presented in Table 1. Each group was provided with printed A0-sized satellite maps (sourced from Google Earth) of the Ennore Creek. To facilitate easier identification and minimize space constraints, the creek was split into two sections, northern and southern, each assigned to one group. The maps were pre-labelled with key place marks to aid in the identification of local features and landmarks. Leveraging their detailed knowledge of the local landscape, participants manually annotated the maps using colour-coded sketch pens to differentiate between fishing grounds, mussel-infested zones, and areas with high infestation intensity (Figure 5). First, they identified and marked traditional fishing areas. Next, they indicated zones where Charru mussel infestations were observed. Finally, within these zones, they highlighted the areas perceived to have the highest infestation levels. The process was facilitated by the participants' strong spatial knowledge of the creek, which enabled accurate and confident mapping of key areas directly on the provided maps. Participants also shared the locations of *paadus* along the creek, which were subsequently plotted on the CRZ

map. These locations closely coincided with those identified in the previously obtained map<sup>45</sup>, thereby validating the spatial accuracy of both sources.



**Figure 5** Participatory community mapping exercise in Kattukuppam, Ennore

Following the mapping exercise, a questionnaire was administered to document participants' observations, experiences, and perceptions regarding the presence and impact of the invasive mussel in the creek. The questions focused on both ecological and livelihood-related aspects of the invasion and included the following:

1. "What do you call this mussel in Tamil? (vernacular name)"

(இந்த மட்டி/ஆழியை வேறு எந்த பெயர்களில் அறிவீர்கள்?)

2. "When did you first notice this mussel? (year/season if possible)"

(இந்த ஆழியை நீங்கள் முதன்முதலாக எப்போது கவனித்தீர்கள்? (வருடம் அல்லது பருவம் குறிப்பிடவும்))

3. "Is its abundance increasing or decreasing?"  
இந்த ஆழியின் பரவல் அதிகரிக்கிறதா அல்லது குறைகிறதா?
4. "In what types of habitats do you find these mussels (e.g., mangroves, mudflats, intertidal salt pans, structures, riverbed, etc)?"  
எந்த வகையான வாழ்விடங்களில் நீங்கள் இதை பார்த்திருக்கிறீர்கள்? (எ.டு. அலையாத்தி காடுகள், உப்பளங்கள், சேற்று நிலங்கள் பாலங்கள்)
5. "Do you see these mussels more during a particular season or tidal cycle?"  
ஒரு குறிப்பிட்ட பருவத்தில் அல்லது அலை சுழற்சியில் மட்டுமே இதை நீங்கள் அதிகம் பார்க்கிறீர்களா?
6. "Has the presence of this mussel affected your fishing in any way?"  
இந்த ஆழியின் இருப்பு உங்கள் மீன்பிடி தொழிலை எந்த வகையில் எல்லாம் பாதிக்கிறது?
7. "Do you think it has affected native shellfish or fish catch? If yes, how?"  
இந்த ஆழி ஏற்கனவேயிருந்த பூர்வீக இனங்களை பாதிப்பதாக எண்ணுகிறீர்களா? ஆம் எனில், எப்படி?

**Table 1** Summary of the group wise participants in the community mapping

Group	No. of participants	Age in years*	Fishing experience in years*	Primary fishing gear used
Group A	3	35 ± 9	19 ± 16	<i>Suthu valai</i>
Group B	5	52 ± 6	42 ± 12	<i>Suthu valai, Nandu katcha, Ara valai</i>
<b>Total</b>	<b>8</b>	<b>46 ± 11</b>	<b>33 ± 17</b>	<b><i>Suthu valai, Nandu katcha, Ara valai</i></b>

All participants are males

\*mean ± standard deviation

Despite the relatively small proportion (42%, 8 out of 19) of local participants directly involved in the mapping activity, the reliability and representativeness of the outcomes were strengthened by their considerable age and in-depth fishing knowledge acquired through years of experience in the Ennore Creek (Table 1). Group wise perceived information is presented below:

#### **Group A:**

This group identified the invasive mussel *Mytella strigata* by its vernacular name "*kakka aazhi*." According to their collective knowledge, the species was first observed in 2019 near Lock Munai. Since its initial appearance, its abundance has been steadily increasing across the Ennore Creek. The mussel is commonly found in mudflats and layered along the riverbed, indicating a preference for soft sediment habitats.

Participants reported a seasonal decline in mussel abundance during the rainy season, as the organisms tend to die off in response to changes in salinity and water conditions. Despite this seasonal reprieve, the species has had significant negative impacts on local fishing practices and livelihoods. Fisher folk frequently sustain injuries to their legs (occupational hazard) while wading through mussel-infested areas, and fishing nets are often damaged by the sharp shells. The dense mussel beds also disrupt boat navigation during low tides, further hampering

fishing efforts. These challenges have led to reduced economic returns, with some participants noting that fishing is only marginally viable during the rainy season when mussel abundance is low.

In addition to economic effects, the mussel invasion has also altered the local aquatic biodiversity. Participants observed an increase in crab populations, which, while ecologically notable, has led to more frequent net damage. Moreover, the mussel's filter-feeding behavior has resulted in clearer water, enabling fish to detect and escape from cast nets more easily, thereby reducing fish catch efficiency. Collectively, these insights underscore the significant ecological and socioeconomic disruptions caused by the *Mytella strigata* invasion in Ennore Creek.

#### **Group B:**

Participants in Group B also identified the invasive mussel *Mytella strigata* by its local name "kakka aazhi" and reported its first appearance in 2018 near the estuary mouth, which was recognized as the initial site of infestation. According to their observations, the mussel population has been increasing steadily since its emergence. It now commonly inhabits estuarine zones, the edges of mangrove stand, structural elements such as pillars, and cemented substrates indicating its adaptability to a range of aquatic microhabitats.

Group B noted that the mussel shows seasonal variation, with peak growth occurring in the post-monsoon period, while its presence is comparatively reduced during the rainy season. However, this decline is temporary, as the population tends to replenish quickly after the monsoon.

The economic impact reported by this group was substantial. Fishers highlighted a sharp decline in catch and income, with earnings per *paadu* dropping from Rs. 10,000–15,000 to just Rs. 600–1,000. This decline has placed severe pressure on local livelihoods. Moreover, the participants reported widespread depletion of native fish and shellfish species, including seabass (*koduva*), silver silago (*kilangan*), tilapia (*jalebi*), groupers (*kalava*), large-headed prawns, lobsters (*singi iraal*), cat fish (*keluthi*), sardines (*salai meen*), carps (*kendai*), and crabs. This loss of biodiversity, coupled with falling income, reflects the serious ecological and socio-economic consequences of the mussel's spread in the estuarine ecosystem.

#### **Overall findings/perceptions from the community mapping:**

The community mapping exercise revealed deep local insights into the origin, spread, and impact of the invasive mussel *Mytella strigata* (locally known as *kakka aazhi*) in the Ennore Creek and Kosasthalaiyar estuary. According to participants, the infestation began in 2018 near the estuary mouth, a location they accurately plotted during the session. However, an earlier report suggests that the community had first noticed small patches of mussels attached to the bridge columns as early as 2015<sup>10</sup>. The primary reason for the invasion, as perceived by the fishers, is the release of ballast water from ships associated with harbour and port activities, a cause reportedly acknowledged by port authorities. Additionally, the construction waste from bridge projects and the cement and chemical pollution discharged by nearby industries have created favorable substrates for mussel colonization and spread.

Fishers observed that *M. strigata* is highly opportunistic, capable of growing on a variety of substrates and consuming a wide range of organic matter. As a result, the mussel has proliferated rapidly, contributing to the drastic shallowing of the estuary, with depth reducing from 20-m to just two feet in some areas. This has severely hampered navigation and fishing

operations, especially as fishers from Kattukuppam and Mugatwarakuppam operate in neck-deep waters, and cannot function in areas where manual dredging has exceeded a man's height. In contrast, deeper fishing by communities such as those in Sivan Padai (10-m depth) is less affected.

The economic impact on local livelihoods has been severe. The estuary, which sustains approximately 380 families, has seen 150 households shift to alternative livelihoods. Those who continue to fish report a sharp income decline, from ₹30,000–₹50,000/month earlier to only ₹5,000–₹10,000/month now. In some instances, ₹1,000 worth of effort yields only ₹500 in return. This economic downturn is compounded by the *Paadu* fishing system, wherein each village fishes on alternate days, limiting access to just 180 days a year. Now, due to the infestation, only a few families manage to catch fish even during their allotted *paadu* periods.

The community emphasized the need for inclusive management, urging authorities to consult and involve local fishers in eradication planning and operations, especially in manual removal efforts. They also called for compensation from responsible agencies, given the severe economic and ecological damages sustained. As both estuarine and coastal fisheries experience declining catches, estuary-dependent communities, who are already on the frontline of impact, have clearly articulated the urgent need for targeted, participatory management of the invasive mussel problem.

### **Integration of Primary and Secondary Community Mapping**

The locations of *paadus* and mussel-infested areas, as depicted in the secondary data map and manually identified by the community during the participatory mapping meeting, were integrated into a unified spatial layer using ArcGIS Desktop 10.8.2<sup>46</sup> for comprehensive visualization across the study area. The consolidated map is presented in Figure 6.

### **Field Sampling (after LEK)**

To map the spatial distribution and density gradient of the invasive mussel *M. strigata* within Ennore Creek, spatial interpolation technique was employed. Field sampling was strategically conducted based on the locations identified in the community mapping consolidation map, which integrated local ecological knowledge and previously documented infestation sites. Given the practical constraints of limited visibility, and the non-exhaustive nature of GPS-based presence data, spatial interpolation was selected as the most suitable method to generate a continuous distribution surface. This approach enables the projection of mussel presence across unsampled areas by analyzing spatial relationships between known sample points. Specifically, interpolation methods such as Inverse Distance Weighting (IDW) and Natural Neighbor<sup>47</sup> will be considered for generating raster-based maps that visualize both the extent and intensity of infestation. These techniques help overcome the logistical and financial challenges of conducting exhaustive field surveys while still providing spatially explicit, easily interpretable outputs<sup>48</sup>. The resulting maps offer critical insights into mussel spread patterns and serve as decision-support tools for targeted management and control efforts.

<sup>46</sup> ESRI. *ArcGIS Desktop: Release 10.8.2*. Environmental Systems Research Institute, 2020. Software.

<sup>47</sup> Roberts EA, Sheley RL, Lawrence RL (2004). Using sampling and inverse distance weighted modeling for mapping invasive plants. *Western North American Naturalist*, 64: 312e323.

<sup>48</sup> Hawthorne TL, Elmore V, Strong A, Bennett-Martin P, Finnie J, Parkman J, Harris T, Singh J, Edwards L, Reed J (2015). Mapping non-native invasive species and accessibility in an urban forest: A case study of participatory mapping and citizen science in Atlanta, Georgia. *Applied Geography*, 56: 187–198.



**Figure 6** Consolidated map depicting community-identified fishing areas (*paadus*) and Charru mussel-invaded sites along the Ennore Creek

## Preprocessing

Prior to conducting the field sampling, a set of spatially distributed sampling points was generated within the Ennore Creek environment using the Research Tools option in open-source GIS software QGIS 3.38.2-Grenoble. A shapefile delineating the extent of Ennore Creek was first uploaded, and the 'Create Grid' algorithm was applied to generate a grid of points over the study area. A grid size of 250 m × 250 m was selected, corresponding to approximately 0.002306° horizontal and 0.002246° vertical spacing. This resolution was chosen to balance spatial coverage with the practical constraints of time and field effort while ensuring a randomized and systematic sampling framework.

The initial grid contained a total of 2,136 points, uniformly spaced across the broader landscape. However, this included areas outside the aquatic ecosystem of interest, such as terrestrial zones, industrial and port regions, and coastal waters. To refine the sampling framework to include only points within the creek boundaries, a spatial clipping operation was performed. Using the 'Clip' tool under the Geoprocessing Toolbox, the grid layer was intersected with the Ennore Creek polygon layer. This process retained only those sampling points that spatially coincided with the creek environment, resulting in a pre-final set of points that were confined exclusively to the waterbody for subsequent field investigations.

The pre-final set of sampling points, derived from the clipped grid within Ennore Creek, was further refined through a visual inspection process using Google Earth. This involved overlaying the generated points with spatial layers representing fishing grounds and mussel-invaded areas, as identified during the participatory community mapping exercise (Figure 6). Based on this visual assessment, a subset of points was manually repositioned to align with known locations of fishing activity or mussel infestation to enhance spatial representativeness and support targeted field verification.

As a result of this manual adjustment, the uniform 250-m grid spacing was slightly compromised at certain locations. These modifications were necessary to avoid redundant sampling and to optimize field efforts within the constraints of limited time and available manpower. Nonetheless, this approach ensured that the revised sampling framework remained both spatially meaningful and logistically feasible for assessing the current status of mussel invasion within the creek ecosystem. The finalized survey points (233 locations) established for field sampling are illustrated in Figure 7. These points included locations situated either within or in close proximity to identified fishing zones, mussel-invaded areas, and additional randomly selected sites generated using the grid-based algorithm.

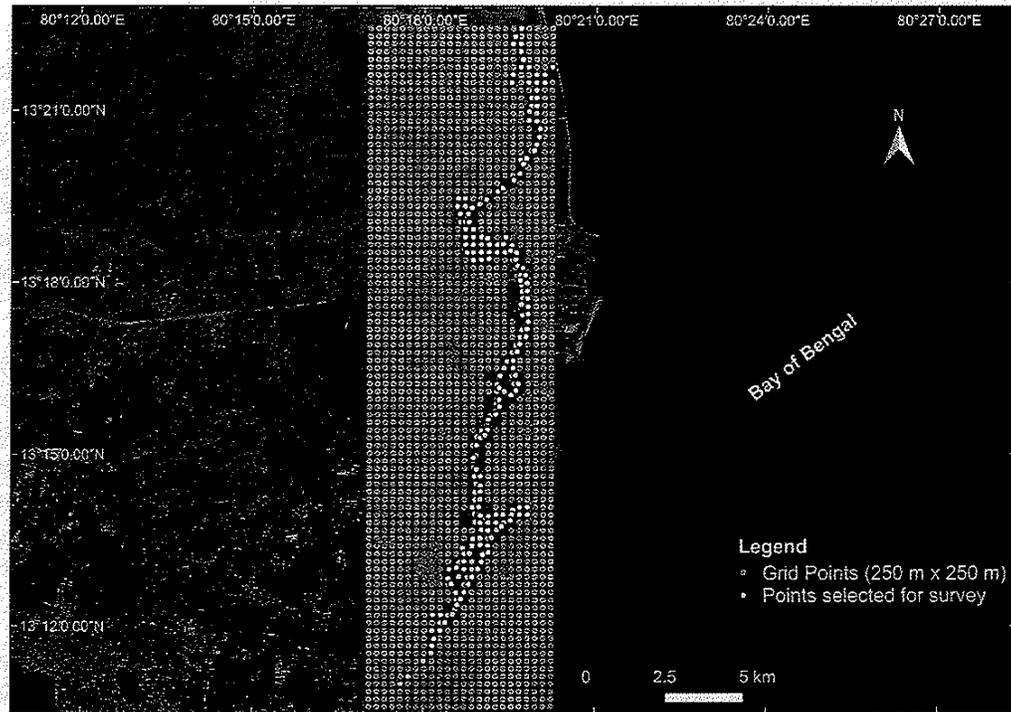


Figure 7 Finalized survey points used for field sampling across Ennore Creek

### Survey

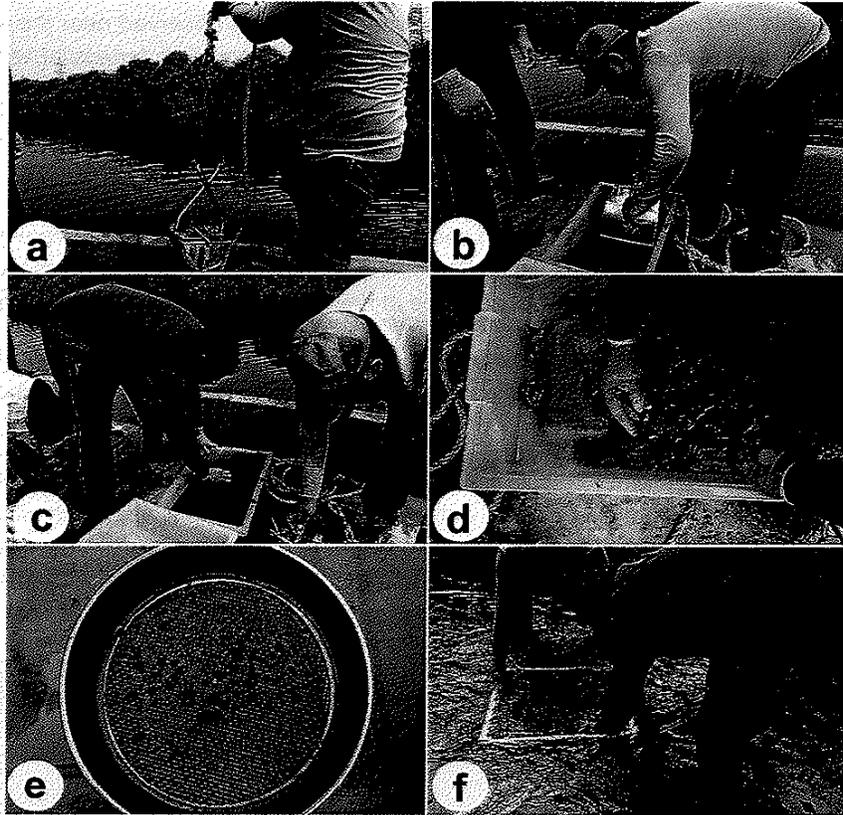
Field sampling along Ennore Creek was conducted on the 16<sup>th</sup> and 17<sup>th</sup> of May, 2025, using predetermined survey points (Figure 7). Although the sampling period fell within the summer season, the weather during the two-day survey was marked by cloudy skies and light rainfall. According to local fishers, rainfall had also occurred in the month preceding the survey. The survey points were imported into Google Earth on a smartphone, which was used for navigation to the locations using a fibre boat measuring 8.8 m in length, 1.6 m in breadth, and 0.6 m in height.

At each sampling point, either a Van Veen grab sampler (with a catch area of 0.03 m<sup>2</sup>) or a PVC quadrat (0.25 m<sup>2</sup>) was employed to assess the presence and density of the Charru mussel (Figure 8). The selection between the grab sampler and quadrat was based on site-specific conditions. Similar methods have been applied in other studies to estimate the density and biomass of invasive mussel species<sup>49,50</sup>. Quadrats were used exclusively in shallow areas where deploying the grab sampler from the boat was not feasible. The depth of the sampling locations varied from 0.5 m to 3.5 m. For grab samples, the collected sediments were transferred into a transparent plastic tray, mixed with seawater, and then passed through a stainless steel sieve with a 2-mm mesh to separate the macrofauna from the sediment. In the

<sup>49</sup> Zaiko A, Daunys D, Olenin S (2009). Habitat engineering by the invasive zebra mussel *Dreissena polymorpha* (Pallas) in a boreal coastal lagoon: impact on biodiversity. *Helgoland Marine Research*, 63: 85–94.

<sup>50</sup> Kelley TE, Hopper GW, González IS, Bucholz JR, Atkinson CL (2022). Identifying potential drivers of distribution patterns of invasive *Corbicula fluminea* relative to native freshwater mussels (Unionidae) across spatial scales. *Ecology and Evolution*, 12: e8737.

case of quadrat sampling, all mussels and sediments within the quadrat area were manually excavated to a depth of 10 cm using gloved hands.



**Figure 8** Field sampling activities in Ennore Creek (a) Deployment of a grab sampler to collect benthic samples, (b) Transfer of the collected sediment sample from the grab into a sorting tray, (c) Visual examination of macrofauna within the sample, (d) Sorting of the Charru mussel (*M. strigata*), (e) Sieved macrofaunal sample post-processing, and (f) Quadrat sampling for assessing the distribution of Charru mussel populations.

For each sample event, the following data were recorded:

- Type of sampling method used (grab or quadrat)
- GPS coordinates of the sampling location
- Presence or absence of the Charru mussel (*M. strigata*)
- Abundance of Charru mussels, including separate counts of live and dead individuals (if present)
- Associated flora and fauna observed
- Water depth at the sampling point
- Substrate type, based on visual observation of the sediment
- Nearby land use characteristics based on visual observation

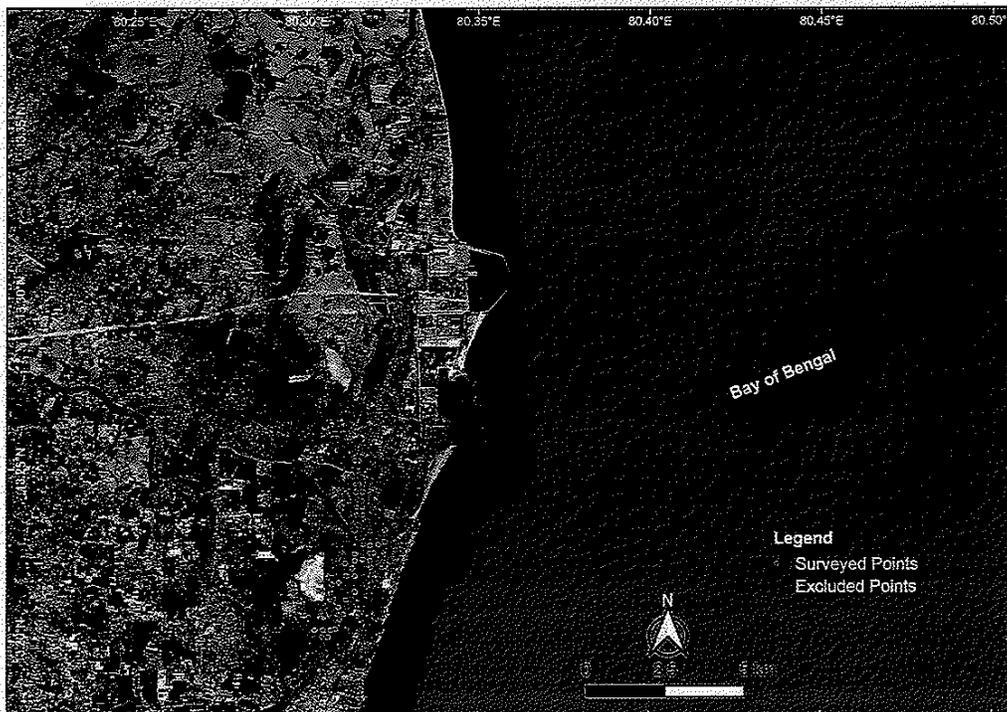
At locations where Charru mussels were found in dense clumps, samples were collected, thoroughly rinsed to remove mud, and stored in zip-lock pouches for enumeration in the

laboratory. All samples were preserved at  $-4^{\circ}\text{C}$  for subsequent analysis. In the laboratory, the collected mussels were measured for shell dimensions and wet biomass. Macrofauna (including molluscs, bivalves, crabs, and fish) and algal samples retained in the sieve were photographed in the field for identification purposes. Mangroves observed near the sampling sites were primarily *Avicennia marina* and *Rhizophora* sp., along with terrestrial vegetation, including the exotic species *Nelumbo juliflora*.

Due to field constraints, it was not possible to survey all the predetermined sampling points (233 points; Figure 7). The following factors contributed to this limitation:

- In both the northern and southern sections of the creek, some points were excluded based on reports from local fishers indicating the absence of Charru mussels, as well as prior observations of mussel absence in nearby predetermined sampling points.
- Certain areas were inaccessible due to ongoing bridge construction, low tide conditions that hindered boat navigation, the presence of fishing nets, and challenging substrate conditions that made walking difficult.

However, in areas that were inaccessible, alternative sampling points were selected in locations where navigation by boat or walking was feasible. This approach allowed for continued assessment rather than complete omission of those regions. The final set of surveyed points (148 out of 233 points, 63.5%) used for spatial interpolation of Charru mussel distribution along Ennore Creek is presented in Figure 9.



**Figure 9** Map showing surveyed points for spatial interpolation of Charru mussel distribution in Ennore Creek

## Next Steps

The forthcoming phases of this study are designed to build upon the field data collected and deliver comprehensive spatial and ecological insights into the distribution of the invasive Charru mussel in Ennore Creek. The next steps are as follows:

- (1) estimation of population density and biomass of the Charru mussel across the assessment sites.
- (2) spatial interpolation techniques will be employed to visualize the distribution patterns of the species throughout the creek.
- (3) The interpolated data will be integrated into geospatial maps along with critical environmental layers, including CRZ boundaries, ecologically sensitive areas (ESAs), and other relevant spatial features.
- (4) This integrated approach will aid in identifying vulnerable zones within Ennore Creek that are at high risk of mussel colonization.
- (5) A draft report will be prepared and submitted for review, followed by the incorporation of feedback from the TNSWA.
- (6) The final report will be submitted upon revision.
- (7) A detailed timeline outlining completed and planned activities, along with corresponding deadlines, has been presented in Table 2 to ensure the successful completion of the study by September 2025.

**Table 2** Timeline of completed and upcoming activities for the mapping of Charru mussel study in Ennore Creek

S. No.	Deliverables	Phase 1		Phase 2		Phase 3	
		M 1 Apr 25	M 2 May 25	M 3 Jun 25	M 4 Jul 25	M 5 Aug 25	M 6 Sep 25
1	Community based participatory mapping						
2	Field assessment for population estimations						
3	Integration of data into maps (field data, CRZ, ESA, etc)						
4	Identification of vulnerable regions for recolonization/colonization						
5	Stakeholder consultation						
6	Draft report submission						
7	Final report submission						

## Annexure 1 List of participants in the community mapping meeting



**NATIONAL CENTRE FOR SUSTAINABLE COASTAL MANAGEMENT**  
Ministry of Environment, Forest & Climate Change, Government of India

**PARTICIPANTS**

**Community-involved mapping of the invasive Charru Mussel  
*Mytella strigata* distribution in Ennore Creek**

Venue: Kattukuppam Community Hall

Date &amp; Time: 02.05.25 (11.00 am)

S. No.	Name	Designation/ Occupation	Village/ Org/ Inst.	Contact No.
1.	Karunakaran	Village President	Kattukuppam	9080836444
2.	B.R. Eeswari	Civil Engineer	Tamilnadu wetlands Mission	9629329834
3.	Pandi Meera	Legal expert	Tamilnadu wetlands Mission	8832060809
4.	M. Peradoss	Fishermen	Kattukuppam	994619833
5.	Saravanan .P	Fishermen	Kattukuppam	7258436468
6.	Sasi kumar .R	Fishermen	Kattukuppam	9094419928
7.	Dhas . S	Fisherman	Mugadhuar Kuppam	979149801
8.	K. Angamuthu	Fisherman	Mugadhuar Kuppam	9840154308



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www.ncscm.res.in

S. No.	Name	Designation/ Occupation	Village/ Org./ Inst.	Contact No.
9	P. Marikandan	Fishermen	Mugathuvai Kuppam	9444420940
10	P. Bharathi	Fishermen	Mugathuvai Kuppam	9841164637
11	Gunasakaran	Fishermen	Kattukuppam	97845634498
12	Prakash	Fishermen	Kattukuppam	9840293098
13	S. Rajendran	Fishermen	Kattukuppam	733880777
14	Palanikarasu	Fishermen	Kattukuppam	9840883068
15	Vignesh	Fishermen	Kattukuppam	701088484
16	Devakumar	Fishermen	Kattukuppam	9092474367
17	M. Ramar	Fishermen	Kattukuppam	9677095909
18	M. A. Bharathi	Nirwaji	Mugathuvai Kuppam	9840347420

S. No.	Name	Designation	Village/ Org/ Inst.	Contact No.
27	J. Jeyan Joe	Project Scientist-II	NCSM	7708871254
26	Bhagat Singh	Activist	Singaperumal	9444153558
25	S. Palayam	Volunteer	Saive Enmale Campaign	9940544314
24	Ashwanya	Volunteer	Saive Enmale Campaign	8220706117
23	Durga	Volunteer	Saive Enmale Campaign	9364687523
22	Nadharanagopal	Fisherman	Kattukuppam	9087571398
21	Saravanan	Fisherman	Saive Kuppam	9176331717
20	Kuppusamy	Fisherman	Kattukuppam	7499154417
19	Rajkumar	Fisherman	Kattukuppam	9551515428



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**A Pilot Study on Controlling the spread of Invasive Mussel, *Mytella strigata* (Hanley, 1843) in Dredged Areas of Ennore Creek, Chennai through Recurrence assessment, Eradication strategies and Ecosystem restoration**

**PROGRESS REPORT AND PLAN OF ACTION**

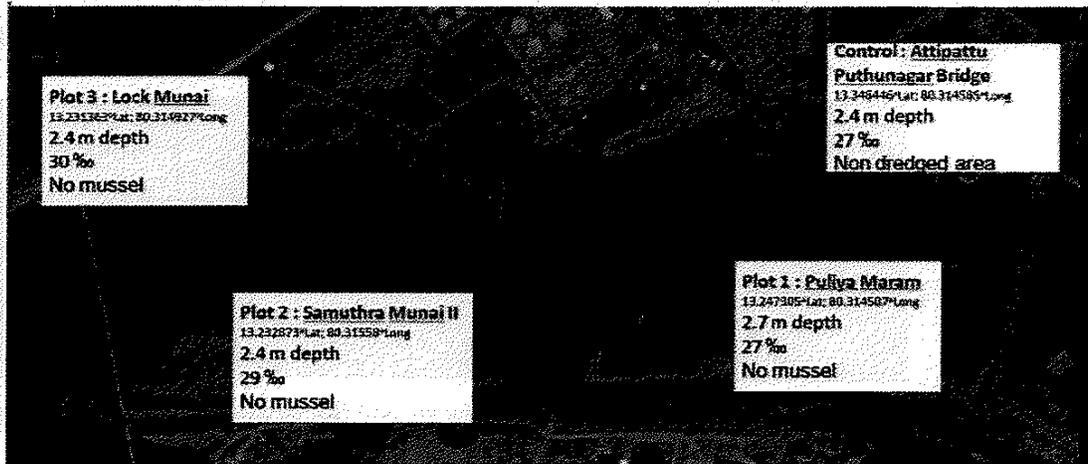
**Progress Report**

**1. Administrative and Financial Status**

- The project received sanction for Rs. 22.63 lakh; first instalment of Rs. 10.61 lakh has been received.
- Proposal for administrative sanction obtained from the university; however bank account opening and fund release are pending.

**2. Site Selection for Monitoring**

- Three sampling plots (1- PuliyaMaram; 2- Samuthra Munai II; 3 – Lock Munai) and one control plot (Attipattu Puthunagar Bridge) were identified for long-term monitoring, covering dredged and non-dredged areas for comparative ecological assessment.



**3. Dredging Impact and Spatial Variability**

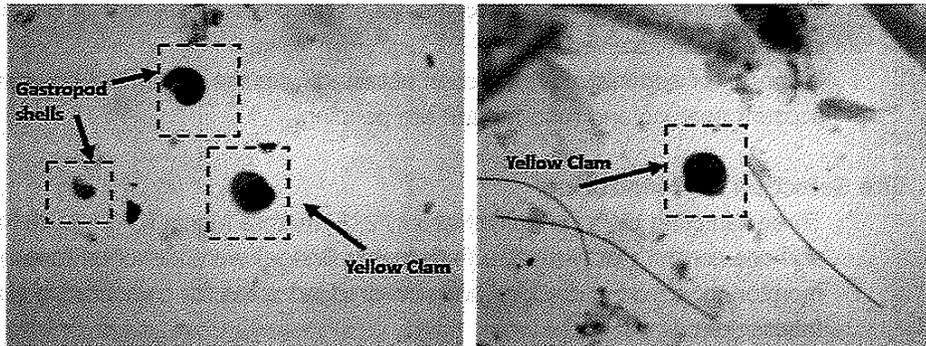
- Uneven dredging across the study area was noted, with sites like Jabarangal only partially dredged.
- Shell remnants at Samuthra Munai II indicate past colonization of *Mytella strigata* before dredging.
- At Dredger 1, dredging was incomplete due to the presence of a traditional fishing padu, hindering eradication and restoration activities.

#### 4. Presence and Distribution of *Mytella strigata*

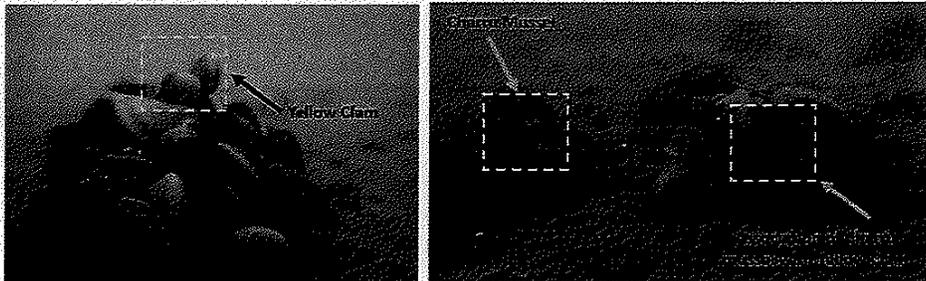
- The invasive mussel *Mytella strigata* was predominantly found in non-dredged areas, especially in Kalmunai, where it coexisted with Manja Matti (Yellow Mussel).
- **Dredged areas** showed a notable absence or minimal presence of *Mytella strigata*, likely due to recent sediment removal.

#### 5. Larval and Associated Species Diversity

- Larval stages of yellow mussel and gastropods were found in dredged plots.



- Clusters of invasive mussels were found in association with yellow mussels in control plots.

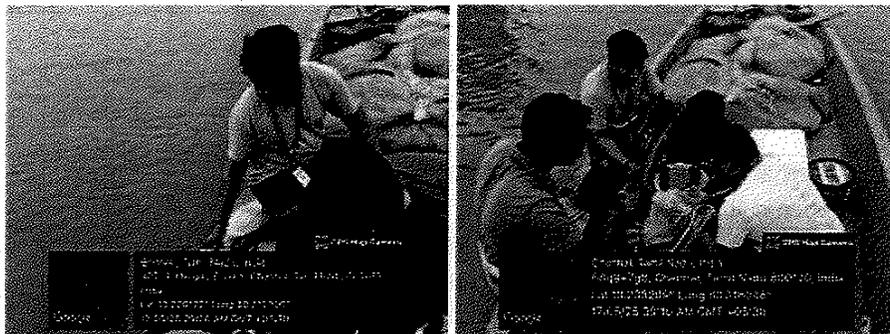


- Bioindicator species such as *Nerita sp.* and fish larvae were observed across dredged plots.



**6. Environmental Parameter Analysis**

- o No significant difference was detected in water and sediment quality parameters between dredged and control plots (refer Tables 1).
- o Salinity ranged from 30 ppt to 36 ppt, with the highest salinity at Lock Munai and lower salinity in deeper zones, suggesting freshwater mixing.

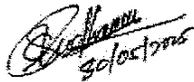


**Table 1: Water & Sediment quality parameters**

S. No.	Parameters	Control Site	Plot 1	Plot 2	Plot 3
<b>Water parameters</b>					
1.	pH	7.82	7.85	7.93	7.96
2.	Calcium (mg/l)	360	360	360	360
3.	Hardness (mg/l)	6050	6150	6050	6100
4.	Carbonate (mg/l)	0	0	0	0
5.	Total Alkalinity	160	160	160	160
6.	Salinity (Ppt)	35	36	35	32
7.	Ammonia (mg/l)	0.868	0.815	0.758	0.567
8.	Nitrite (mg/l)	0.552	0.328	0.375	0.344
9.	Nitrate (mg/l)	0.716	0.691	0.777	0.796
10.	Magnesium (mg/l)	1236	1260	1236	1256
11.	TDS (g/l)	34.2	35.06	35.36	35.89
12.	TS (g/l)	39.12	40.26	40.12	42.89
13.	TSS (g/l)	4.92	5.2	4.76	4.78
<b>Soil Parameters</b>					
14.	pH	8.1	8.06	7.96	8.68
15.	EC (mS/cm)	0.474	0.636	0.499	0.534
16.	Organic carbon (%)	0.55	0.55	0.63	0.67

**Work Plan for next 6 months**

S. No.	Activities	1	2	3	4	5	6
1.	Bathymetry survey: Using echosounder to finalize four sampling plots based on depth and site suitability						
2.	Enclosure set up for sampling plots: Establish boundary fencing using wooden poles (10m x 10m x 4m) and polyethylene webbing in all four sampling plots						
3.	Install Internal fencing within the boundary to facilitate pen culture trials						
4.	Environmental parameters monitoring : Regular monitoring of hydrodynamic parameters viz. tidal flow, current velocity, water column depth across sampling plots						
5.	Environmental parameters monitoring : Periodical analysis of water and sediment quality parameters including salinity, pH, ammonia, hardness, organic carbon, etc.						
6.	Biodiversity and Biological Sampling : Routine sampling to assess plankton (including larvae) and species diversity (eg. mussels) in each sampling plot.						
7.	Biodiversity and Biological Sampling : Observation of mussel bed formation across various substrates, with documentation of reoccurrence and spread patterns						
8.	Species Translocation and Pen Culture Trials: Collection of native species such as green mussel, mud crab and white shrimp, followed by translocation into pen culture enclosures using different species combinations.						
9.	Protocol Development : Formulation of a standardized protocol for eradication strategies specific to <i>Mytella strigata</i>						
10.	Documentation : Preparation of a comprehensive Standard Operating Procedure (SOP). Compilation of finding and submission of technical reports to Wetland Authority.						



**Principal Investigator**



**DEAN**

### **Research Study on "Value Addition of Invasive Charru Mussel from Ennore Creek as Biofertilizer and Mineral Mix"**

A pilot research project titled "*Value Addition of Invasive Charru Mussel from Ennore Creek as Biofertilizer and Mineral Mix*" was launched with financial support from the Tamil Nadu State Wetland Authority. The project was sanctioned on 27.02.2025, with a total grant of Rs. 11.11 lakh. The first instalment of Rs. 8.65 lakh was received by the Finance Officer, TNJFU on 13.03.2025, and administrative sanction was granted by the University on 21.05.2025. Administrative processes are underway, including the opening of a dedicated project bank account in Ponneri and initiating the formal requisition for fund release.

Scientifically, the project has made significant strides in evaluating the bio-nutritional properties of various components of the invasive Charru mussel. Preliminary analyses indicate:

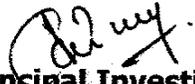
1. Mussel meat powder consists of organic matter: 82.73%, total nitrogen: 10.88% and notable levels of phosphate, potash, manganese, and magnesium
2. Mussel Shell powder consists of calcium: 26.37% and contains phosphorus and trace minerals
3. Mussel Byssus thread powder consists of organic matter: 86.53% and nitrogen: 14.15% (highest among components)

These findings validate the potential of Charru mussel biomass as a sustainable source for producing high-quality biofertilizers and mineral mixes for agriculture and aquaculture.

The 12-month project work plan includes:

- Biochemical profiling of mussel components
- Formulation and testing of biofertilizers and mineral mixes
- Field trials in agriculture and shrimp aquaculture systems
- Final report compilation and submission

This project offers an innovative, scientifically backed, and environmentally responsible approach to managing the Charru mussel invasion, converting ecological challenges into value-added opportunities for sustainable development. \*

  
**Principal Investigator**

  
**Dean**  
21/05/25  
**Dr. M.G.R. FC&RI, Ponneri**

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தமிழ்நாடு மாநில ஈரநில ஆணையம்  
TAMIL NADU STATE WETLAND AUTHORITY



**From**

Thiru. Srinivas R. Reddy, I.F.S.,  
Principal Chief Conservator of Forests  
(HoFF) and Member Secretary,  
Tamil Nadu State Wetland Authority (FAC),  
No.1, Jeenis Road, Panagal Maaligai,  
Saidapet,  
Chennai - 600 015.

**To**

The Dean,  
Dr.MGR Fisheries College &  
Research Institute,  
Ponneri - 601204.

**Ref.No.TNSWA2/37/2025, Dated29-05-2025**

**Sir / Madam,**

**Sub:** Wetlands - O.A.No.152 of 2023 filed before the Hon'ble Green Tribunal (SZ) - Value addition of Invasive Charru Mussels (*Mytella Strigata*) in Ennore Creek in dredged area by Water Resource Department - Review Meeting convened on 26.05.2025-Minutes of the meeting -communicated - Regarding.

**Ref:** i) Principal Chief Conservator of Forests and Member Secretary, Tamil Nadu State Wetland Authority Ref.No.TNSWA2/37/2025, Dated 27.02.2025.

ii) Review meeting convened on 26.05.2025 by the Assistant Mission Director, Tamil Nadu Wetlands Mission.

\*\*\*\*\*

With reference to the above, it is informed that the minutes of the review meeting on the work "Value addition of Invasive Charru Mussels (*Mytella Strigata*) in Ennore Creek", conducted by the Assistant Mission Director, Tamil Nadu Wetlands Mission on 26.05.2025, is enclosed herewith. Hence, it is requested to undertake the actions as outlined in the minutes.

**Encl: As above**

Digitally signed by  
Srinivas R Reddy  
Date: 29-05-2025  
20:31:09

Principal Chief Conservator of Forests (HoFF)  
and Member Secretary  
Tamil Nadu State Wetland Authority (FAC)

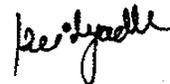


**Minutes of the Review Meeting by the Assistant Mission Director, Tamil Nadu Wetlands Mission, regarding the progress in the value addition of Invasive Mussel (Mytella strigata) by Dr. MGR Fisheries College, Ponneri on 26.05.2025 at the Mini Conference Hall, Office of the Principal Chief Conservator of Forest (HoFF) and Member Secretary, Tamil Nadu State Wetland Authority (FAC), 8<sup>th</sup> floor, Panagal Maaligai**

The Assistant Mission Director, Tamil Nadu Wetlands Mission convened a meeting to review the progress in the value addition of invasive mussel (Mytella strigata) by Dr. MGR Fisheries College, Ponneri and after detailed deliberation the following instructions were issued: -

1. Instead of procuring equipment before establishing effectiveness through field trials, possibilities of outsourcing the service of necessary equipment can be checked within 1 week time. Based on the success of field trials, equipment can be purchased later. However, if there is no possibility of outsourcing available, only the essential machineries i.e. Pulveriser & Granulator can be purchased before initiating the field trials, as these are necessary for standardization process.
2. The levels of heavy metals in both the shell and meat components will be analyzed. All values shall comply with the standards prescribed under the Fertilizer Control Order (FCO), 1985, World Health Organization (WHO) & other applicable standards, as these will be used as bio-fertilizer and mineral mixture.
3. The Standardization of composition of the fertilizer shall be finalized at the earliest to ensure timely commencement of production.
4. The mineral mixture and fertilizer produced by the value addition of invasive mussel (Mytella strigata) shall be developed with a focus on potential application in the Ennore region.
5. After establishing effectiveness of Bio-fertilizer & Mineral mixture, machineries procured will be used by the local fishermen through models such as SHGs, VFMC, EDCs, or others as applicable, and necessary handholding, business model creation and capacity building will be necessary.
6. An action taken report (ATR) detailing the progress made in the project shall be submitted to this office at the earliest, as the next date of hearing is scheduled for 06.06.2025.

The meeting ended with the thanks to and from the chair.



(R. Vidyadhar. IFS)  
Assistant Mission Director  
Tamil Nadu Wetlands Mission

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**BEFORE THE HON'BLE NATIONAL**

**GREEN TRIBUNAL**

**SOUTHERN ZONE, CHENNAI**

**Original Application No. 152 of 2023 (SZ)**

Kumaresan Sooluran

Aged about 44 Years,

Kathivakkam,

Ennore Thermal Station,

Thiruvallur-600057.

...Applicant(s)

-Vs-

The Tamil Nadu Coastal Zone Management  
Authority,

Rep by its Member Secretary,

Chennai and others.

...Respondent(s)

REPORT FILED BY THE 4<sup>th</sup>  
RESPONDENT/MEMBER

SECRETARY TAMIL NADU STATE  
WETLAND AUTHORITY

Dr.D.SHANMUGANATHAN

**COUNSEL FOR 4<sup>TH</sup> RESPONDENT**