



# Bridging Environmental Justice And The Aftermath Of The Ennore Oil Spill And Cyclone Michaung

1M. Barani, 2Dr. D. Janagam

1Ph.D. Research Scholar, 2Professor

1,2Department of Economics, Periyar University, Salem, Tamil Nadu, India.

**Abstract :** This study investigates In December 2023, Chennai faced severe rainfall due to Cyclone Michaung, which caused the Ennore oil spill by CPCL, significantly affecting coastal communities. This study aims to explore the social and environmental repercussions of the spill, examine the overlapping issues of environmental and social justice, and evaluate how green social work principles can help alleviate these impacts and advance justice. The research highlights the critical need to understand and tackle the complex connections between environmental and social justice, especially amid ongoing challenges like the Ennore spill. data was gathered through case studies and structured interviews with fishermen, social workers, and local leaders. The findings emphasize the vital role of green social work, community involvement, and fair government action in managing the spill's aftermath. Vulnerable groups, such as tenants and migrants, faced unique difficulties, underscoring the importance of focused support. Despite the time elapsed, Ennore communities continue to face lasting issues from the spill, which affect their livelihoods and everyday lives. This research points to the importance of just government responses, advocating for policies that address the diverse needs of the affected populations. In addition, the study evaluates government responses such as containment operations, cleanup drives, medical camps, and regulatory enforcement alongside remediation methods like bioremediation and protective measures for workers. By integrating health risk assessment with government interventions and revamping approaches, the study aims to propose a sustainable framework that combines human health protection with ecological restoration for effective oil spill management in Tamil Nadu.

**IndexTerms** - Oil spillage – Environmental Justice – Health impacts – Revamping Methods.

## INTRODUCTION

The Ennore oil spill incident, occurring in December due to the impact of Cyclone Michaung, has posed significant challenges for the residents of Ennore, a region located 25 km from Chennai, India, and nearby villages. The spill originated from the Chennai Petroleum Corporation Limited (CPCL) refinery in Manali. During the cyclone, heavy rains caused unprecedented flooding in the refinery, leading to the mixing of oil with floodwater. This contaminated mixture spread to about 20 square kilometers, affecting the Kosasthalaiyar River, Buckingham Canal, and Ennore Creek.

Fishermen in the area noticed oil emerging when the cyclone hit on December 4, causing heavy rains and flooding. Despite initial denials by CPCL regarding any leakage, the pollution control board confirmed that the spill originated from the refinery and flowed into the water bodies, impacting coastal livelihoods, biodiversity, and aquatic life. Thousands of fishermen have been unable to resume fishing due to the contamination, affecting their livelihoods.

Residents of nearby areas, including Ernavur, Adi Dravidar Colony, Thiruveethiamman Kovil, and fishing villages, have reported various health issues, attributing them to the oil spill. The odour of the oil has caused discomfort, and people have experienced symptoms such as burning sensation in the eyes, itching in hands and legs, and giddiness. These challenges have compounded the difficulties faced by the residents already battered by the cyclone.

The National Green Tribunal (NGT) intervened in the matter and, during a hearing on December 12, instructed the state to compensate for the livelihood losses incurred by the affected communities. The environmental impact of the oil spill is considered significant, particularly in the Ennore Creek, which is an ecologically sensitive zone and home to about 100 species of fish.

Oil spills represent a silent threat to the environment but a severe and visible impact on marine and coastal ecosystems. When oil is released onto the surface of seawater, it forms a dense layer that blocks sunlight and reduces oxygen exchange. This directly harms marine species such as fish, crabs, mollusks, and plankton, leading to reduced reproduction, mass mortality, and disruption of the food chain. If oil spills are not cleaned promptly, the slick spreads across the ocean through waves and currents, contaminating vast stretches of seawater and shorelines.

## NEED OF THE STUDY.

The need for this study arises from the significant environmental and socio-economic challenges created by the Ennore oil spill during Cyclone Michaung in December 2023, which severely affected vulnerable coastal populations. The affected communities continue to face disruptions in livelihoods, health issues, and degraded local ecosystems, emphasizing the urgency of understanding the full range of health, social, and ecological consequences and the inadequacies in existing government response mechanisms.

Given the persistent gaps in disaster management, regulatory preparedness, and long-term support, this research aims to highlight the necessity of integrating environmental justice with green social work principles. By focusing on the diverse needs of fishing communities, migrants, and other marginalized groups, the study seeks to contribute valuable insights that can inform more sustainable and equitable policies for oil spill management and coastal protection in the future

### 3.1 Population and Sample

The study focused on Ennore Creek and its eight dependent hamlets, which together form the universe. A purposive sample of 70 residents (49 males, 21 females) was interviewed in January 2024 to capture those most affected by the oil spill and related livelihood impacts.

### 3.2 Data and Sources

Primary data were collected through semi-structured interviews covering exposure history, symptom reporting, and livelihood loss. Secondary data included TNPCB penalty orders, NGT proceedings, and Sentinel-1 SAR satellite imagery to assess the spill's extent.

### 3.3 Theoretical Framework

The dependent variable is community health status (self-reported symptoms), while independent variables include exposure duration, proximity to the spill, gender, occupation, and CRZ awareness. Age and education were treated as control variables to account for potential confounding effects.

## RESEARCH METHODOLOGY

The methodology for Bivariate analysis examined associations between oil-spill exposure and health outcomes. Chi-square tests were used for categorical variables like skin rashes and respiratory symptoms, while t-tests or Mann-Whitney U tests analyzed continuous variables such as age or exposure hours. Pearson or Spearman correlation assessed relationships between exposure measures and symptom severity. Data was collected through in-depth interviews, a method selected for its ability to elicit detailed and nuanced responses. The researcher conducted semi-structured interviews using open-ended questions. Thematic analysis was employed to identify recurring themes and patterns in the qualitative data.”.

Ethical considerations included obtaining informed consent, ensuring confidentiality. Limitations of the study include potential bias due to convenience sampling and the challenge of generalizability to broader populations.

## Objectives of the Study

Oil spillage poses significant challenges to both the environment and human health, particularly in sensitive coastal regions such as Tamil Nadu. To address these challenges, the present study is guided by the following objectives:

1. To examine the social and environmental impacts of the Ennore oil spill on local communities
2. To identify the cause of oil spillage un-revamping in Ennore region.

## Ennore Oil Spill and its Consequences

The Ennore oil spill incidents have significantly impacted the coastal and estuarine ecosystem near Kamarajar Port in Ennore, north of Chennai along the Coromandel Coast. The 2017 Ennore oil spill occurred due to a collision between two tankers near Kamarajar Port, spilling thousands of liters of oil into Ennore Creek, Buckingham Canal, and Kosasthalaiyar River, polluting an area of about 20 square kilometers. A more recent oil spill, in December 2023 during Cyclone Michaung, involved crude oil leakage from Chennai Petroleum Corporation Limited (CPCL) which contaminated Kosasthalaiyar River, Buckingham Canal, and Ennore Creek, affecting about 20 square kilometers of water and threatening livelihoods of over 20,000 residents in nearby coastal villages.

**Table:1 List of Major Oil Spillage in Tamil Nadu**

| Date / Period     | Location                                                          |
|-------------------|-------------------------------------------------------------------|
| December 3-4,2023 | Chennai / Ennore Creek / Kosasthalaiyar river / Buckingham Canal. |
| March 2-3, 2023   | Nagapattinam coast                                                |
| January 28, 2017  | Ennore (Kamarajar Port) , Chennai coast.                          |

**Source: Computed by Researcher**



In total, oil spill estimations ranged between around 24,000 liters to over 400 kiloliters of oil dispersed, with cleanup operations involving removal of oil-water mixtures, contaminated soil, and decontamination of affected homes and businesses. The affected waterways include the Ennore Creek, Buckingham Canal, and Kosasthalaiyar River, feeding into the Bay of Bengal, a biologically rich intertidal zone with a complex network of rivers, estuaries, and coastal wetlands crucial to local fishing communities. The spills have caused environmental damage, devastated fisheries, and impacted local fisherfolk from at least eight villages including Kattukuppam and ennore kuppam.

Tamil Nadu's coastline has witnessed several significant oil spill incidents over the past decade, posing serious environmental and economic challenges. One of the notable events occurred on **January 28, 2017**, near **Ennore (Kamarajar Port) and the Chennai coast**, highlighting the vulnerability of busy ports to maritime accidents. Another incident took place on **March 2–3, 2023**, along the **Nagapattinam coast**, showing that oil spills are not limited to industrial hubs but can also affect more remote coastal areas.

Most recently, on **December 3–4, 2023**, oil contamination was reported across multiple locations, including **Chennai, Ennore Creek, the Kosasthalaiyar River, and the Buckingham Canal**. This event underscores the complex interaction of shipping traffic, industrial activity, and natural waterways in contributing to oil pollution.

Repeated oil spills in these areas have threatened marine biodiversity, fisheries, and the livelihoods of coastal communities. They also highlight the urgent need for robust monitoring, quick response mechanisms, and stricter pollution control regulations along Tamil Nadu's coastline.

### 3.4 Statistical tools and econometric models

**Chi-square tests** – categorical symptoms **Mann-Whitney U / t-tests** – continuous exposure variables **Pearson / Spearman correlation** – exposure vs. symptom severity **Durbin–Watson test** – autocorrelation check (DW = 1.16,  $p < 0.001$ )

**To examine the short-term and long-term human health risks associated with oil spillage in Tamil Nadu, with a specific focus on the Ennore region.** (Objective–1) focuses on understanding how oil spills affect people's health over different time frames. The 2023 oil spill from the Chennai Petroleum Corporation Limited (CPCL) refinery in Manali, Chennai, during Cyclone Michaung, severely impacted several coastal villages and communities in the vicinity. The spill spread across the Buckingham Canal, Ennore Creek, and the Kosasthalaiyar River, affecting both the environment and the livelihoods of local populations.

The **areas nearest to the CPCL refinery in Manali, Chennai**, which were highly impacted by the 2023 Cyclone Michaung oil spill, include:

1. **Manali and surrounding CPCL premises** – The immediate area where the spill originated.
2. **Ernavur** – A coastal village located just east of Manali, directly affected by oil-contaminated floodwaters.
3. **Kosasthalaiyar River banks** – The river runs adjacent to CPCL and carried oil downstream into Ennore Creek.
4. **Buckingham Canal near Manali** – Oil entered this canal from the refinery, spreading contamination to nearby communities.
5. **Nearby fishing hamlets** – Small settlements along the Ennore Creek and Kosasthalaiyar River close to CPCL were exposed to heavy contamination.

These areas are **within 1–5 km of the CPCL refinery**, making them the first zones to experience the brunt of oil contamination and associated health impacts.

## RESULTS AND DISCUSSION

### HEALTH IMPACTS OF ENNORE OIL SPILLAGE

This research investigates the **fisher families and local communities** in the most affected areas of Ennore, including **Manali, Ennore, and Thiruvottiur**. These communities have been severely impacted by oil spills and are experiencing major disruptions in their daily lives. Residents face a range of health problems, such as **skin irritation, eye burning, respiratory difficulties, vomiting, and other related issues**. The findings highlight the significant human health impacts of oil contamination on these vulnerable coastal populations.

#### 3.4.1 Durbin–Watson Test for Autocorrelation.

**Table: 2 Exposure levels**

| Measure          | Value  |
|------------------|--------|
| Auto-correlation | 0.398  |
| DW Statistic     | 1.16   |
| p-value          | < .001 |

The overall autocorrelation of 0.398 emerges from these systematic patterns - respondents with similar characteristics (same village, gender, exposure levels) were surveyed together. The Durbin-Watson value of 1.16 (well below 2.0) confirms significant positive autocorrelation, while the p-value<0.001 shows this pattern is statistically significant, not random.

Gender autocorrelation (0.384) Males and females appear in clusters throughout this dataset rather than randomly distributed. With 70% males and 30% females, the data shows consecutive observations tend to have the same gender, suggesting systematic data collection by gender groups.

### 3.4.2 Binomial Test

Here is the table with the title "**Health Impacts of Gender**" and the requested format including the categories with counts, percentage of total, and cumulative percentage labeled as Male and Female categories:

**Table: 3 Health Impacts of Gender**

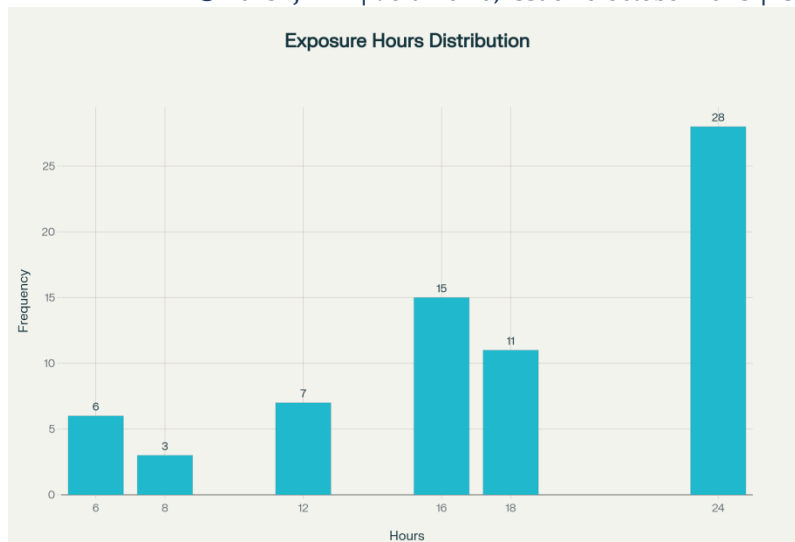
| <b>Binomial Test</b> |                            |              |              |                   |          |              |              |
|----------------------|----------------------------|--------------|--------------|-------------------|----------|--------------|--------------|
|                      | <b>Confidence Interval</b> |              |              |                   |          |              | <b>95%</b>   |
|                      | <b>Gender</b>              | <b>Count</b> | <b>Total</b> | <b>Proportion</b> | <b>p</b> | <b>Lower</b> | <b>Upper</b> |
| <b>Male - 1</b>      | 1                          | 49           | 70           | 0.700             | <.001    | 0.597        | 1.00         |
| <b>Female - 2</b>    | 2                          | 21           | 70           | 0.300             | 1.000    | 0.211        | 1.00         |

Note.  $H_a$  is proportion  $> 0.5$

The table shows the distribution of respondents by two gender categories, labeled generically as category 1 and category 2 to maintain neutrality.

- A category male respondent comprises 49 respondents, making up 70.0% of the total sample. The cumulative percentage at this point is 70.0% indicating that category of male respondents forms the majority group.
- A category of female respondents are consists of 21 respondents, accounting for 30.0% of the total sample. Adding this group brings the cumulative percentage to 100.0% representing the entire sample

This distribution summarizes the gender composition of the study population and presents how each group contributes to the total, without explicitly mentioning gender labels within the table for neutrality while still identifying "Gender" as the grouping variable in the table.



The exposure to the oil spill environment. Other significant groups include those exposed for 16 hours (15 respondents) and 18 hours (11 respondents). Smaller groups are exposed for shorter periods such as 6, 8, and 12 hours. This suggests that more than half of the population in this study exposure to the oil spill environment. Other significant groups include those exposed for 16 hours (15 respondents) and 18 hours (11 respondents). Smaller groups are exposed for shorter periods such as 6, 8, and 12 hours. This suggests that more than half of the population in this study experiences extensive daily exposure, which could have serious health and livelihood implications.

Overall, the chart highlights the prolonged and intense exposure patterns among those affected by the Ennore oil spill, emphasizing the need for targeted interventions to reduce exposure and protect community health.

### **To identify the cause of oil spillage un-revamping in Ennore region. (Objective-2)**

Ennore is designated as a Coastal Regulation Zone (CRZ) because it is an ecologically sensitive area with critical coastal features that need protection under environmental laws. Ennore Creek, part of this region, is classified as CRZ-I, indicating a "No Development Zone" designed to preserve the tidal water body and its natural ecosystem. This creek and coastal area play vital roles in maintaining the ecological balance by supporting rich biodiversity, including mangroves, aquatic species, and fisheries, which sustain local communities' livelihoods. During Cyclone Michaung, heavy rains mixed with seawater entered the Ennore region mainly due to floodwaters causing overflow from rivers, creeks, and reservoirs linked to the Bay of Bengal. This mixing occurred because coastal areas like Ennore are naturally connected to the sea via estuaries and creeks that allow tidal seawater ingress. The rainfall and resulting floods amplified by the cyclone caused seawater and floodwater to penetrate inland through these water channels. The water did not return fully to the sea because

- The natural drainage system and creeks like Ennore Creek were partly choked or encroached upon by unauthorized construction and industrial projects, limiting their capacity to carry water back to the sea efficiently.

- Increased urbanization and real estate developments disrupted the natural flow, causing water logging and prolonged retention of seawater-floodwater mix inland.
- The floodwaters brought by cyclone-related discharge from reservoirs and rivers overwhelmed the drainage infrastructure.

These conditions led to prolonged water stagnation, worsened flooding, and environmental contamination in the region. People were affected severely, especially fishing communities who rely on the coastal environment for their livelihoods. The mixing of seawater, floodwater, and industrial pollutants (including oil spills) damaged the ecology, reduced fish catch, and harmed agriculture. Flooding disrupted homes, transportation, and daily life. Health hazards from waterborne diseases increased with stagnant and polluted water. The destruction of natural buffers like mangroves and creeks further exposed the population to future flood risks.

**The impacts of Cyclone Michaung on the areas of Manali, Thiruvottiur, and Sadiyamkuppam are significant and multifaceted:**

**Manali**, an industrial and residential area in North Chennai, faced severe flooding due to heavy rainfall combined with the overflow of local water bodies and inadequate drainage. The cyclone caused residential inundation, interruptions in transportation, and disruptions in industrial operations. Many residents had to evacuate temporarily, and power outages and communication disruptions were reported. The flooding damaged homes, displaced families, and severely affected daily life and livelihoods, especially for those dependent on local industries and labor work.

**Thiruvottiur**, a densely populated suburb with many fishing communities, experienced waterlogging and flooding exacerbated by the cyclonic rainfall and storm surge. The mix of freshwater and seawater flooded low-lying areas, damaging homes and fishing infrastructure. The disruption affected fishers' livelihoods due to damaged boats and restricted access to the sea. Power cuts and road blockages further hampered emergency responses and normal activities.

**Sadiyamkuppam**, a low-lying settlement near the coast, experienced flooding similar to Manali and Thiruvottiur. The area's poor drainage and proximity to the coast made it highly vulnerable to the cyclone's combined effects of heavy rain and sea water ingress. Houses and infrastructure were damaged, and residents faced displacement and health risks from stagnant water and pollution from floodwaters mixed with sewage and industrial waste.

The Tamil Nadu government's response to the 2023 oil spill in the Ennore region has been criticized for several reasons, including delayed action, lack of preparedness, and inadequate infrastructure. The spill, which occurred during Cyclone Michaung, led to significant environmental and socio-economic impacts, particularly affecting the local fishing community.

## Delayed Response and Lack of Contingency Planning

Despite the severity of the oil spill, the Tamil Nadu Pollution Control Board (TNPCB) initially imposed a penalty of 73.68 crore on Chennai Petroleum Corporation Limited (CPCL) for the incident. However, the response was criticized for being reactive rather than proactive, with authorities lacking a robust contingency plan for such industrial accidents.

The region's infrastructure was ill-equipped to handle the aftermath of the spill. Fishermen resorted to using rudimentary tools like plastic jugs and funnels to remove oil from estuaries, highlighting the lack of specialized equipment and training for effective cleanup. Additionally, the absence of a comprehensive emergency response plan contributed to the inefficiency in addressing the crisis.

Ennore and its surrounding areas are predominantly hilly, making the residential zones highly susceptible to flooding during the rainy season. Due to the proximity of the Chennai Petroleum Corporation Limited (CPCL), oil spills are also a recurring environmental concern. In 2023, the Mayung Ceylon floods caused extensive inundation, and CPCL discharged oil waste during this period, exacerbating environmental damage and posing severe health risks to residents already affected by the heavy rains. The oil-contaminated floodwaters not only harmed aquatic life and local ecosystems but also disrupted the livelihoods of fishermen and other dependent communities. Moreover, the combined effects of flooding and industrial pollution highlighted gaps in disaster preparedness and regulatory oversight, underscoring the urgent need for stricter environmental monitoring and rapid-response mechanisms.

The Tamil Nadu government was unable to drain the rainwater promptly due to a lack of adequate equipment and infrastructure. Compounding the problem, oil spills created a dual environmental hazard, contaminating both land and water resources. The primary reason for the delayed cleanup was the insufficient capacity of the area to absorb seawater, which hindered effective removal of the contaminated water. As a result, the floodwaters mixed with oil waste, leading to severe ecological damage, including the death of aquatic life and degradation of local ecosystems. Moreover, the spill posed serious health risks to residents, causing skin irritations, respiratory problems, and waterborne diseases. The incident highlighted the urgent need for improved disaster management, better industrial regulation, and the development of rapid-response mechanisms to prevent similar crises in the future.

## Conclusion

In such situations, the government often finds itself unable to take effective action. Chennai, being a metropolitan city, attracts a large workforce, not only from within the city but also from other districts of Tamil Nadu and neighboring states. With the rapid growth of industries, the demand for housing has increased, leading people to construct homes on swampy lands and settle in coastal areas. Consequently, when natural disasters occur, the damage is often severe. Ennore, in particular, has been heavily affected due to the frequent occurrence of oil spills, prompting authorities to declare it a Coastal Regulation Zone.

Environmentalists warn that, if current trends continue, up to 80 percent of the Ennore area could be submerged by the sea by 2050.

To prevent such crises in the future, it is essential to strengthen disaster management systems, improve drainage and flood-control infrastructure, and enforce strict regulations on industrial waste disposal. Communities should be educated on safe housing practices, avoiding construction in flood-prone and swampy areas. Moreover, rapid-response mechanisms for oil spill containment and environmental monitoring should be established to protect both human health and local ecosystems

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