

Oil Spill and Socioeconomic Impacts on Riverine Fishing Communities in Bayelsa State, Nigeria

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How to cite this paper: Ojile, M.O. and George, V.T. (2026) Oil Spill and Socioeconomic Impacts on Riverine Fishing Communities in Bayelsa State, Nigeria. *Journal of Environmental Protection*, 17, 261-280. <https://doi.org/10.4236/jep.2026.175013>

Received: April 9, 2026

Accepted: May 9, 2026

Published: May 12, 2026

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Abstract

Bayelsa State hosts some of the most resource-dependent riverine fishing communities in West Africa, yet its wetland ecosystems and artisanal livelihoods are chronically threatened by recurring crude oil spill incidents. Despite the high frequency of such events, empirical post-spill socioeconomic impact assessments (PSIAs) remain rare. This paper addresses that gap, using the Aiteo Eastern Exploration and Production Company's Santa Barbara South Well-1 wellhead blowout of 5 November 2021, in Oil Mining Lease (OML) 29, Nembe Local Government Area, as a case study. A post-spill impact assessment was conducted in April 2022, employing participatory rural appraisal (PRA) methods comprising focus group discussions (FGDs), key informant interviews (KIIs), community-wide meetings, and structured questionnaires (n = 81) across eight purposively selected spill-impacted communities. Three socioeconomic indicators were assessed: livelihood and fisheries activities, income derived from fisheries, and visible environmental damage. Results reveal that 93.5% of the resident population depended on artisanal fisheries as the primary livelihood activity, with the majority (46.6%) earning above ₦50,000 monthly from fishing operations prior to the spill. The incident was associated with a universally reported collapse of fish catch per unit effort (CPUE) across all surveyed communities, with respondents describing either a total inability to fish in contaminated waters or a severe reduction in returns per fishing trip, alongside reported destruction of fishing gear and boats, contamination of periwinkle and shellfish beds, and severe income losses across the entire fisheries supply chain. The study confirms that the spill severely undermined livelihoods and fisheries income, and that respondents reported substantial food-security strain and psychosocial distress in the communities surveyed, which already faced acute deficits in social infrastructure. A structured compensation

framework, with clear eligibility criteria, transparent valuation methodologies, and enforceable timelines, is urgently recommended.

Keywords

Post-Spill Impact Assessment, Oil Wellhead Blowout, Artisanal Fisheries, Socioeconomic Impacts, Niger Delta, Nembe, Bayelsa State, Livelihood Disruption, Compensation, OML 29

1. Introduction

Oil spills are among the most destructive environmental hazards confronting petroleum-producing communities in sub-Saharan Africa. In the Niger Delta, where commercial hydrocarbon extraction has continued since 1956, the cumulative toll on freshwater and coastal ecosystems is well documented: fisheries have been destroyed, livelihoods eroded, and the lives of millions of rural inhabitants quietly dismantled by recurring spill events [1] [2]. The damage does not end at the water's edge. Lost income, food insecurity, psychosocial distress, and long-term displacement ripple outward from the physical spill zone in ways that are difficult to measure and even harder to reverse [3] [4].

Bayelsa State sits in the heart of the Niger Delta, covering approximately 9415 km² of predominantly wetland terrain. Its intricate network of rivers, creeks, and creeklets, flanked by mangrove swamp forests and freshwater rainforest ecosystems, sustains one of the most productive artisanal fisheries environments in West Africa. Over 82% of the state's estimated 2.6 million residents (2021 projection) live in rural areas, with their livelihoods built almost entirely around fishing, fish processing, and subsistence agriculture [5] [6]. The state also hosts several of Nigeria's major oil and gas assets, with multinational and indigenous petroleum companies operating across various Oil Mining Leases. This co-location of intensive petroleum extraction with densely populated, resource-dependent riverine communities creates a persistent vulnerability, one in which oil spill incidents are not exceptional events but routine hazards with immediate and severe socioeconomic consequences.

Between 2011 and 2022, the National Oil Spill Detection and Response Agency (NOSDRA) recorded 10,463 oil spill incidents across the Niger Delta, with Bayelsa State accounting for a disproportionate share of both incidents and affected areas [7] [8]. In 2020 and 2021 alone, NOSDRA documented 822 incidents across the region. Yet despite this frequency, post-spill impact assessments that rigorously document the socioeconomic dimensions of individual spill events, including baseline community conditions, livelihood disruption, income loss, and community perceptions, remain uncommon in the peer-reviewed literature. This scarcity of empirical evidence not only limits the development of compensation frameworks but also impedes evidence-based environmental governance in oil-producing communities [2] [9].

Artisanal fishing communities in Bayelsa State's riverine interior are particularly exposed. They have no formal employment safety nets, minimal access to social infrastructure, and rely almost entirely on the productivity of aquatic ecosystems for food and income. When an oil spill occurs, the cascade of socioeconomic impacts is rapid and comprehensive: fishing gear and boats are destroyed or rendered unusable; fishing grounds and shellfish beds are contaminated; fish catch per unit effort collapses; the fish processing and trading supply chain, predominantly managed by women, is disrupted; and income losses propagate across entire household economies [1] [10]. These impacts are particularly difficult to quantify where pre-spill baseline data are absent, a gap that is unfortunately the norm rather than the exception in the Niger Delta context.

The Aiteo Santa Barbara South Well-1 wellhead blowout of 5 November 2021, in Nembe Local Government Area (LGA), Bayelsa State, illustrates these broader challenges with unusual clarity. The incident involved the uncontrolled discharge of crude oil from Oil Mining Lease (OML) 29 into the Santa Barbara River and adjacent creeks for approximately 33 days before the wellhead was sealed on 8 December 2021, representing one of the most significant onshore well-control incidents in the Nigerian petroleum industry in recent years [11]. The blowout affected numerous riverine fishing settlements in Nembe LGA, triggering widespread claims of livelihood destruction and demands for compensation from the operator, Aiteo Eastern Exploration and Production Company (AEEPCO). In response, the Bayelsa State Government, in compliance with statutory environmental regulations and terms of reference developed through a Joint Inspection Visit (JIV), commissioned a Post-Spill Impact Assessment (PSIA) to determine the extent of damage to the biophysical and socioeconomic environment and to establish the basis for clean-up and compensation. This paper presents the findings of the socioeconomic/Social Impact Assessment (SIA) component of that PSIA, conducted in April 2022.

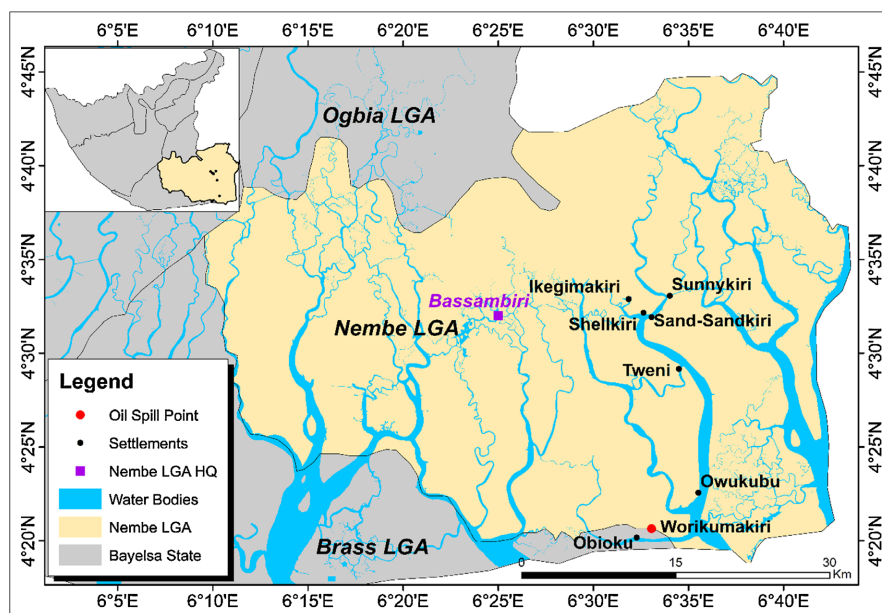
The study contributes empirical evidence to the growing literature on post-spill socioeconomic impact assessment in the Niger Delta. Specifically, it aims to: (i) document the baseline socioeconomic characteristics of affected communities; (ii) assess the livelihood, fisheries, and income impacts of the blowout; (iii) evaluate the state of social infrastructure and community well-being in the spill-affected zone; and (iv) propose evidence-grounded recommendations for recovery, remediation, and compensation. The findings are intended to inform policy and practice for the Bayelsa State Government, NOSDRA, and oil operating companies, and to enrich the regional literature on socioeconomic vulnerability and oil spill response in the Niger Delta.

2. Study Area

The study was conducted in the riverine fishing settlements, camps, and ports of the Santa Barbara South Well-1 spill-affected area, situated in the Nembe Local Government Area (LGA), Bayelsa State, south-south Nigeria. The wellhead spill

origin point is geographically located at latitude 4° 31'N and longitude 6° 33'E, adjacent to the Santa Barbara River (**Figure 1**), within the Niger Delta's mangrove swamp ecosystem. Nembe LGA recorded a population of 130,966 in the 2006 National Population Census [6], with a projected population of approximately 201,505 by 2021 based on the state's exponential growth rate of 2.9% per annum. The LGA covers a land area of approximately 763.877 km², yielding a population density of 171.5 persons per km².

The setting is a typical riverine deltaic landscape, with rivers, creeks, and creek-lets threading through mangrove swamp and freshwater forest. The area is subject to both tidal and seasonal flooding; habitable land is confined to elevated riverbank levees, and settlement patterns are consequently linear and nucleated. There are no roads into the riverine interior. Motorised speed boats and fibre-engine boats are the primary means of transportation, with journey times of 45 minutes to over an hour between communities and the nearest urban centre, Nembe town (Bassambiri).



Source: Department of Geography and Environmental Sustainability, Niger Delta University.

Figure 1. Map of the study area: Nembe LGA, Bayelsa state.

Spill-Affected Communities and Settlements

The Bayelsa State Government identified 41 fishing camps, ports, and communities as being within the spill-affected zone, classifying them into 17 “heavily impacted” and 24 “impacted” settlements. Heavily impacted camps and ports are those located within an estimated 5 km radius of the Aiteo Santa Barbara South Well-1 wellhead along the Santa Barbara River and adjacent creeks; impacted communities lie beyond this boundary but within the broader spill influence zone. The full classification is presented in **Table 1**, contextualized within the study's community selection framework.

It should be noted that the classification criteria were implied rather than formally stated. The wellhead spill point at Worikumakiri was deserted at the time of assessment, as was the Pipeline settlement across the Santa Barbara River. Several settlements listed by the government were found to be misspelled, absent from National Population Commission census records, or abandoned following the spill. Of the 41 identified settlements, eight were ultimately surveyed during the field assessment, selected as representative of the biophysical and human environment within the spill-affected zone.

Table 1. Classification of spill-impacted fishing camps, ports, and communities in the Santa Barbara well-1 spill area, Nembe LGA, as provided by the bayelsa state government.

Heavily Impacted Camps/Ports	Impacted Camps/Ports
Warikumakiri*	Sangapiri
Inara-kiri	Okirika-kiri
Sand-Sandkiri Village	Dankiri+
Sunnykiri	Ndatiri 2
Shellkiri	Bolo
Frankiri	Bonny-Kiri
Orugbanikiri+	Ijekiri
Gloryland	Ekpaikakiri
Sibegbene	Bokubokiri
Wilsonkiri	Davidsonkiri
Owangakiri	Allisonkiri
Pipeline**	Okoma
Tweni I & II	Owukubo
Charlykiri	Adumama
Seriakiri	Pukokiri
Ndatiri	Ikirigo
Angbakiri	Egenebugu

Source: Bayelsa State Government list, 2022. Note: *Wellhead site, deserted at the time of study; **Uninhabited/deserted.

3. Methodology

3.1. Research Design

The study adopted a mixed-methods research design within the participatory rural appraisal (PRA) framework, combining qualitative and quantitative data collection techniques. This approach is well-established in socioeconomic baseline and social impact assessment (SIA) studies, particularly in complex riverine envi-

ronments where structured questionnaires alone cannot adequately capture the nuances of livelihood systems and community experiences [9] [12] [13].

3.2. Data Collection

Field data collection covered eight fishing camps, ports, and communities. Four motorised fibre boats with 75 HP engines were deployed for site access. The structured questionnaire comprised five thematic sections: 1) respondent sociodemographic characteristics (age, sex, marital status, education, household size); 2) occupation, fishing experience, gear ownership, and pre-spill income and expenditure; 3) access to social infrastructure (water, electricity, education, health); 4) reported post-spill impacts on fisheries, income, and assets; and 5) observations on environmental conditions and community responses. It used a mix of closed-ended (multiple-choice, Likert-scale) and short open-ended items. The following PRA techniques were employed:

a) Focus Group Discussions (FGDs): Ten FGDs were conducted across the eight communities, targeting fishers, women traders, community leaders, and mixed groups. These discussions provided detailed qualitative data on livelihood systems, spill impacts, coping strategies, and community perceptions.

b) Key Informant Interviews (KIIs): Semi-structured KIIs were conducted with community heads, women leaders, youth representatives, and local traditional rulers to capture expert community perspectives on pre- and post-spill conditions.

c) Community-wide meetings: Six community-wide meetings combined general interaction sessions with information verification exercises.

d) Structured questionnaire administration: Eighty-two (82) copies of a structured questionnaire were administered to adult residents across the surveyed communities using clustered and simple random sampling. Within each settlement, households were approached along the linear riverbank settlement pattern at a fixed skip interval set by the field team in proportion to the visible household count. Where the selected household was absent or declined, the immediately adjacent household was substituted. One adult respondent per household, preferably the household head or, in their absence, the most senior adult present, was interviewed. Eighty-one (81) were retrieved and usable; one was discarded for incomplete data.

e) Transect walks and ground-truthing: These were used to corroborate community claims, document environmental conditions photographically, and verify the presence of infrastructure, facilities, and spill evidence.

It is important to note that fieldwork was conducted in April 2022, approximately five months after the 5 November 2021 blowout. Consequently, pre-spill income, catch volumes, gear values, and asset holdings were reconstructed from respondent recall rather than measured against contemporaneous baseline records. This recall basis is revisited where relevant in the results and discussion.

3.3. Spatial Coverage and Community Selection

The Bayelsa State Government provided a list of the spill-affected areas at the pre-field briefing, identifying 41 fishing camps, ports, and communities within the spill influence zone, classified into 17 “heavily impacted” and 24 “impacted” settlements (Table 1). This classification served as the primary basis for defining the study’s spatial scope and guided community selection. The eight surveyed communities were selected purposively from the 41-settlement list using the following explicit criteria: 1) classification by the Bayelsa State Government as “heavily impacted”, with priority given to settlements within the 5 km radius of the wellhead; 2) physical accessibility at the time of fieldwork, as several listed settlements had been abandoned following the spill and could not be reached safely by the field boats; 3) continued habitation, evidenced by the presence of residents available to participate in interviews, FGDs, and community meetings; 4) coverage of the gradient from the wellhead outward along the Santa Barbara River, from Worikumakiri at the wellhead to the more seaward settlements of Owukubu and Obioku, so that the sample captured both the most heavily contaminated zone and the wider spill influence area; and 5) verifiable identity against census and administrative records, since several settlements on the government list were misspelled or absent from National Population Commission records. A minimum community-wide meeting and at least one FGD were held in every selected settlement, and questionnaire numbers per community (Table 2) were set in rough proportion to the adult resident population encountered on arrival, which explains why Shellkiri (26) and Obioku (15) account for the largest shares, while the deserted Worikumakiri yielded only a single opportunistic interview.

Table 2. Questionnaire coverage of the surveyed communities.

S/N	Community/Settlement	Questionnaires Administered
1	Worikumakiri	1
2	Shellkiri	26
3	Ikegimakiri	2
4	Sunnykiri	11
5	Sand-Sandkiri	10
6	Tweni Community	11
7	Owukubu	6
8	Obioku	15
Total	8	81

Source: Field Survey, 2022.

3.4. Secondary Data

Secondary data were obtained from the 1991 and 2006 National Population Commission (NPC) census reports, National Bureau of Statistics (NBS) publications,

Niger Delta Development Commission (NDDC) reports, and established socio-economic literature on the Niger Delta. Population projections to 2021 were calculated using the exponential growth model: $P_n = P_o \times (1 + r)^n$, where P_o is the base population (1996 figures derived from the 1991 census), r is the annual growth rate (2.9%), and n is the number of years elapsed. This approach is consistent with widely used population projection methods for sub-national planning in Nigeria [5] [6].

3.5. Socioeconomic Indicators and Data Analysis

Following the social impact assessment indicator framework advocated by Vanclay [14] and subsequently operationalized in resource development assessment contexts [15], three primary socioeconomic indicators were assessed, selected for their definitional clarity, data availability, robustness, scalability, and inclusiveness: 1) livelihood and fisheries activities; 2) income derived from fisheries; and 3) visual, aesthetic, and other observable environmental damage. These criteria ensure that each indicator has an unambiguous, measurable definition; that it is spatially and temporally stable; that data can be collected at multiple geographical levels; and that diverse community groups, including women, indigenous fisherfolk, and non-fishing members of the fisheries supply chain, are captured [16].

Descriptive statistical methods, which include means, percentages, and frequency distributions, were used to analyse quantitative questionnaire data. Qualitative data from the FGDs and KIIs were transcribed from field notebooks and audio notes into expanded written transcripts immediately after each session. Transcripts were coded manually using an inductive-then-deductive thematic analysis: an initial read generated open codes around recurring topics (e.g., “catch decline”, “gear damage”, “shellfish loss”, “market disruption”, “emotional strain”), which were then grouped under the three pre-specified indicator domains—livelihood/fisheries, income, and observable damage. Data triangulation was pursued across three tracks: 1) convergence between questionnaire percentages and themes arising in FGDs and KIIs; 2) corroboration of community reports through transect walks and photographic ground-truthing at affected sites; and 3) cross-checking of population and demographic figures against NPC and NBS records. Where questionnaire, FGD, and field-observation data diverged on a given point, that divergence is flagged in the results and discussion rather than resolved by fiat. Six levels of aggregation were employed: national, regional (Niger Delta), state, LGA, settlement, and household.

3.6. Limitations of the Study

Several limitations of this assessment should be acknowledged. First, the questionnaire sample of 81 respondents was drawn from only eight of the 41 settlements on the Bayelsa State Government list, and community selection was purposive rather than probabilistic; the quantitative findings are therefore indicative of condi-

tions in the surveyed communities rather than statistically representative of the entire spill-affected zone. Second, several listed settlements, notably Worikumakiri at the wellhead and the Pipeline settlement, had been abandoned by the time of fieldwork, which means the most acutely impacted populations are under-represented in, or wholly absent from, the dataset. Third, the assessment lacked an independent pre-spill baseline; pre-spill income, catch volumes, gear values, and asset holdings were reconstructed from respondent recall five months after the incident and were not verified against independent fisheries landing records, bank transaction data, or asset registers. Fourth, the income figures presented are self-reported field estimates, and some cells combine data from separate sub-questions (e.g., primary versus secondary occupation earnings), which limits their direct comparability. Fifth, environmental-damage observations were made visually at the surveyed locations and were not paired with laboratory analysis of water, sediment, or tissue samples within this SIA component of the PSIA. These limitations shape the claims this paper can legitimately support and are reflected in the framing of the results, discussion, and recommendations.

4. Results and Discussion

4.1. Socioeconomic Characteristics of the Study Communities

The study communities are predominantly inhabited by the Nembe Ijaw, an ethnic group whose culture, governance systems, and livelihoods are deeply rooted in riverine and coastal ecosystems. Christianity is the dominant religion, with approximately 97% of surveyed respondents identifying as Christian; the remainder practiced traditional religion. Traditional governance is structured hierarchically, from the Amanyabo (paramount king) through the Council of Chiefs to community-level Village Heads, Community Development Committees, and youth and women's wings. Land tenure follows a patrilineal system, with communal land managed by community elders and family lands distributed among compound members for the limited farming practiced in the area.

Social amenities across the riverine communities are severely deficient, which is a reflection of the broader infrastructure deficit in Bayelsa State's rural interior. Educational facilities are limited to poorly equipped primary schools in a few communities, with secondary schools only accessible in the mainland towns of Ogbolomabiri and Bassambiri; only six secondary schools serve the entire Nembe LGA. No electricity supply exists in any of the riverine settlements, and households depend on hurricane lamps and private generators. Potable water is effectively unavailable for most: 53.1% of respondents rely on rainwater harvesting, and approximately one-third source water from uncovered, shallow, hand-dug wells. Healthcare is restricted to a single Primary Health Centre at Obioku with no resident doctor, supplemented by the Nembe Comprehensive Health Centre and General Hospital serving the broader LGA population. A 12-passenger speedboat from the riverine communities to Nembe town costs up to ₦2000 and takes between 45 minutes and an hour. The picture that emerges is one of marginalised

communities with very limited capacity to absorb the additional shock of a major oil spill on their resource base.

4.2. Population and Demographic Characteristics

The 2006 National Population Census recorded Bayelsa State's total population at 1,704,515, with Nembe LGA contributing 130,966 persons (approximately 7.7% of the state total). Based on the state's inter-census growth rate of 2.9% per annum [6], Nembe LGA's population was projected to be approximately 201,505 by 2021, and Bayelsa State's at approximately 2,627,987 [5]. **Table 3** presents the population profile of the spill-affected communities.

Table 3. Population estimates for selected spill-affected communities in Nembe LGA (1991-2021 projection).

S/N	Settlement/Community	1991 Census	1996 (base year)	2021 Projection (2.9% p.a.)	Status
1.	Sunkiri*	245	290	593	Visited
2.	Ikirika-Kiri	1263	1495	3055	Adjacent
3.	Shell-Kiri*	1230	1456	2975	Visited
4.	Tweni*	496	587	1200	Visited
5.	Iniateri (Inara-Kiri)**	691	818	1672	Adjacent
6.	Owukubu*	475	562	1149	Visited
7.	Obioku*	2574	3046	6225	Visited
8.	Odioma	5726	6777	13,849	Not visited
Nembe LGA (Total)		153,821	130,966	201,505	2006 census: 130,966

Sources: NPC [6] [18] [20]; NBS [5]. Note: Projection using exponential growth model at 2.9% p.a. from 1996 base. *Communities visited during PSIA fieldwork; **Name may be a variant of a listed settlement.

The age-sex structure of household populations in the surveyed communities conforms to the broad-based pyramidal pattern typical of the Niger Delta and Nigeria more broadly. Children aged 0 - 18 years comprised approximately 48.6% of household members; those in the productive age bracket (19 - 59 years) constituted 47.8%; and the elderly (60+ years) accounted for 3.4%. The dependency ratio is 1.08, meaning that on average each working adult supports at least one dependent. This young, growing population has significant implications for education, employment, and the long-term productivity of households impacted by the spill.

The sex distribution among respondents showed a slight male preponderance (56.2% male, 43.8% female), with males constituting 55.4% of the overall household population. In 1991, the state-wide sex ratio was nearly equal; a marginal increase in male representation in recent decades may reflect outward female migration to market centres for fish trading.

4.3. Sociodemographic Profile of Respondents

Table 4 summarises the key sociodemographic characteristics of respondents and their households. The majority of respondents (47.1%) were married, with 47.8% of adult males in polygamous households, a pattern consistent with the Nembe tradition of augmenting household labour for fishing through family size. The average number of children born to married women was six, with household sizes predominantly in the 11 - 15-member range, consistent with the well-documented pattern of large household sizes in Bayelsa State [17] [18].

Table 4. Sociodemographic profile of respondents.

S/N	Variable	Category	Percentage (%)
1	Marital Status	Married	47.1
		Single	43.6
		Divorced/Widowed	9.3
2	Age Distribution	20 - 39 years	46.1
		40 - 59 years	19.0
		60 years and above	>30.0
3	Educational Attainment	Secondary education	37.8
		Primary education	23.3
		Tertiary education	13.3
		No formal education	~9.0
4	Household Size	1 - 5 members	20.9
		6 - 10 members	20.0
		11 - 15 members (predominant)	>25.0

Source: Field Survey, 2022.

Educational attainment in the study area was modest but not negligible. Approximately 37.8% of respondents had secondary education, 23.3% primary education, 13.3% tertiary qualifications, and about 9% had no formal education at all. Among respondents' children, 48.8% were enrolled in primary school and 31.1% in secondary school, with the majority attending institutions in the Nembe mainland towns, and parents bearing the costs of accommodation and commuting. This education-access burden compounds the economic vulnerability of households already reliant on volatile fisheries incomes.

The closure of the Shellkiri community primary school following the spill, with teachers still drawing salaries while absent from their posts, is a telling detail. It typifies the systemic neglect of educational infrastructure in spill-affected riverine communities and represents a measurable non-income cost of the incident that rarely appears in impact assessments.

Housing quality across the surveyed settlements is predominantly poor: 43.8%

of respondents live in wooden or plank-built houses, 25% in bamboo or stick-framed dwellings, with only a minority in concrete block structures. Two-thirds own their homes; one-third rent, which is notable given the remoteness of these communities. Savings behaviour is severely constrained, with over 51.9% of respondents reporting no savings at all, a consequence of large household sizes, high food expenditure (consuming 64.6% of the weekly budget), and the complete absence of banking facilities in the riverine settlements.

4.4. Livelihood and Economic Activities

4.4.1. Occupation and Fisheries Dependence

Artisanal fisheries are the near-total economic base of the study communities. Over 93.5% of the resident population was engaged in fishing and fisheries-related activities, including direct capture fishing, fish processing, fish trading, canoe carving, and net repair. This level of fisheries dependence is consistent with findings from comparable studies in coastal Niger Delta communities [7] [10]. The artisanal fisheries system relies on wooden and fiber canoes (6 - 13 m long), motorized with 25 - 75 HP outboard engines, and operated with gill nets, cast nets, beach seines, hooks, and traps. Fishing is conducted year-round, with the dry season (September-May) being the more productive period. Deep-sea fishing excursions extended 10 - 25 fathoms (approximately 5 - 15 km) into the Atlantic Ocean, particularly from the more seaward communities of Sunnykiri, Sandkiri, Tweni, Owukubu, and Obioku.

The gender division of labour is clearly defined. Men carry out capture fishing; women and older children process, dry, smoke, and trade fish in urban markets at Nembe Waterside, Creek Road Market in Port Harcourt, and Swali Market in Yenagoa. This integration of women into the supply chain means they are directly and immediately exposed to any reduction in male fishing output, which is precisely what happened after the spill. Fishing experience among respondents was substantial: 53.5% had been in the occupation for over 20 years, and a further 29.4% for 16 - 20 years.

4.4.2. Income Levels and Household Expenditure

Pre-spill income data, gathered through self-reported recall during FGDs and KIIs approximately five months after the spill and therefore subject to the limitations of retrospective estimation, reveals significant but variable earnings from the fisheries sector. In the Tweni community, fishers reported making approximately ₦30,000 from a single morning expedition, with the potential to earn ₦60,000 on a good day. At Sunnykiri, a three-man crew on a single deep-sea trip could bring in up to ₦70,000. Fishers at Sandkiri reported potential monthly earnings of up to ₦200,000 from big-net fishing, while at Owukubu, nearest the ocean, individual landings reportedly reached ₦100,000 on good days. **Table 5** presents the broader income distribution.

Household expenditure was dominated by food, which consumed approximately 64.6% of the weekly family budget, followed by shelter/accommodation

(10.5%) and education (9.4%). These figures closely align with national NBS data reporting 57.2% of household spending devoted to food in the 2009/10 period [19]. The high food expenditure, combined with large household sizes and the complete absence of local banking, explains why over half of all respondents reported no savings, a financial fragility that makes these communities acutely vulnerable to the kind of sudden income shock that oil spills deliver [2].

Table 5. Monthly income distribution of respondents.

S/N	Monthly Income Range (₦)	Percentage of Respondents (%)
1	Less than ₦5000	Low minority
2	₦5000 - ₦20,000	Moderate proportion
3	₦20,000 - ₦25,000	16.8
4	Above ₦50,000 (primary occupation)	46.6
5	Above ₦50,000 (secondary occupation)	26.7
6	Annual gross income ≥ ₦500,000	35.8

Source: Field Survey, 2022. Note: The majority (87.5%) of household heads spend over ₦5000 weekly on family needs. Over 51.9% have no savings. Data are self-reported estimates from field interviews.

4.5. Impacts of the Oil Spill on the Socioeconomic Environment

4.5.1. Impact on Fisheries and Livelihoods

The Aiteo Santa Barbara South Well-1 blowout contaminated the Santa Barbara River, adjacent creeks, and the inshore coastal zone with crude oil over 33 days. In all eight surveyed communities, 100% of respondents reported a significant reduction in fish catch per unit effort (CPUE) following the incident. This 100% figure reflects a uniform respondent-reported perception of severe decline in returns per fishing trip relative to pre-spill conditions, rather than a measured zero-catch outcome. In the immediate weeks after the blowout, FGD participants described two overlapping experiences that together make up this figure: (i) an outright inability to fish in heavily contaminated stretches of water and oiled creek mouths, and (ii) substantially reduced catches per trip in the less-affected areas where fishing continued. CPUE was not measured here through standardized fisheries landing logs; rather, it was captured through respondent comparison between pre- and post-spill trip outcomes, triangulated with community meeting accounts and direct observation of oiled nets and idle canoes. This is consistent with Nwosu *et al.* [10], who demonstrated a statistically significant negative relationship between oil spill volume and fish production in the Niger Delta over a 35-year period (1981-2015), and echoes what Elum *et al.* [1] documented on fisheries productivity decline as a dominant socioeconomic impact of oil exploitation in the region.

What community discussants described in the field made the numbers concrete. Younger fishers now travel further out to sea and spend longer hours in the

water just to bring home catches that once required far less effort. At Carltonkiri (Shellkiri), respondents stated that sardines, once the most plentiful catch in local waters, have entirely disappeared. At Tweni, fishers who once hauled 25 or more scores of fish per trip (with a score being 20 cards, each worth approximately ₦6,000) were now returning with considerably less. Taken together, these accounts point to a serious decline in nearshore fish populations and the degradation of spawning and feeding habitats due to crude oil contamination, a pattern widely reported across the Niger Delta oil spill literature [2] [4].

The women's livelihoods were also severely disrupted. The women's leader of Carltonkiri, Mrs. Dio Jackson, stated that she and other women processors typically purchased 20 scores (or "casa") or 18 - 30 cards of fish and generated up to ₦100,000 gross monthly income from trading in Nembe, Yenagoa, and Port Harcourt. Following the spill, she reported that even ₦20,000 was no longer feasible. The collection of periwinkles and other shellfish from mangrove creek beds, which was a critical supplementary income source for women and children, was rendered impossible by oil contamination of the mangrove zones.

4.5.2. Impact on Income

The income impacts of the wellhead blowout are multidimensional. Direct income loss arose from the inability to fish in contaminated waters, reduced CPUE in less-affected areas, and the destruction of fishing gear and equipment. Indirect income loss came from the interruption of the fish processing and trading supply chain, the contamination of shellfish beds, and the psychological impact on fishers' willingness to continue operating in spill-affected zones.

A formally established pre-spill income baseline is essential for accurately measuring losses attributable to an oil spill. The absence of such data is, as Sam *et al.* [2] and Elum *et al.* [1] have both noted, a recurring shortcoming in post-impact assessments across Nigeria, and it is a shortcoming that demands systematic correction. It should be emphasised that the pre-spill income, catch, and asset figures reported here were reconstructed from respondent recall several months after the blowout, in the absence of independent verification against fisheries landing logs, bank records, or asset registers. As a result, the values are best read as indicative orders of magnitude for respondent-reported earnings rather than as validated loss estimates. What the field data did establish was that before the spill, the majority of respondents (46.6%) were earning above ₦50,000 per month from their primary occupations, and 35.8% reported annual gross earnings exceeding ₦500,000. These are not marginal figures. They are well above Nigeria's recently revised minimum wage of ₦30,000, which offers some sense of the economic losses involved. The destruction of livelihoods at this income level has hit these communities considerably harder than national poverty benchmarks alone would suggest.

4.5.3. Visual and Aesthetic Impacts and Other Observable Damages

Table 6 summarizes the visible and reported impacts of the oil spill on the socio-

economic environment, as documented through community interactions, direct observation, and photographic evidence during the April 2022 fieldwork.

Table 6. Reported socioeconomic and environmental impacts of the Aiteo Santa Barbara South well-1 oil spill.

S/N	Reported Impact	Affected Domain
1	Discoloration of the water surface (darkening)	Environment/Aesthetics
2	Death of fish and aquatic organisms floating on the water surface	Fisheries/Livelihood
3	Destruction or oiling of fishing gear (nets, canoes, boats, engines)	Livelihood/Assets
4	Disruption of fishing activities and reduced catch per unit effort	Livelihood/Income
5	Contamination of periwinkle and shellfish beds in mangrove creeks	Fisheries/Food security
6	Slippery and dangerous riverbanks and shorelines	Safety/Aesthetics
7	Damage to physical structures adjacent to water	Infrastructure/Property
8	Psychological distress and reduced well-being of residents	Social/Mental Health
9	Contamination of drinking water sources and reduced access to potable water	Water/Health
10	Abandonment of the Worikumakiri wellhead camp and pipeline settlement by inhabitants	Settlement/Displacement

Sources: Field Survey, 2022; Community FGDs and KIIs.

Physical evidence of persistent crude oil contamination was documented at Worikumakiri (the wellhead location), where spilled oil remained visible five months after the incident. Oiled net samples shown by community members and oil-stained ponds observed at Sunnykiri, Tweni, and Inara-Kiri provided material corroboration of community claims. Psychosocial strain was captured in this assessment through two specific threads of the dataset rather than a clinical mental-health instrument: 1) questionnaire and FGD items on community well-being, worry about the future of fishing, and perceived fairness of the compensation process; and 2) recurring KII themes of anger, anxiety, resignation, and a sense of abandonment, which converged with the reported delay of compensation and the operator's denial of claims. Food-security concerns, similarly, were derived from the combination of reported CPUE collapse, contamination of shellfish beds that ordinarily supplement household protein intake, and the 64.6% weekly household budget share already devoted to food. The claims made in this paper are deliberately limited to these reported and observed dimensions. This aligns with the broader literature on the psychosocial consequences of oil spill incidents in affected communities [3]. What the numbers cannot fully capture is the weight that came through in these conversations: a deep sense of abandonment felt by people

who had already been marginalised long before the spill occurred.

5. Way Forward

The findings of this assessment point to critical gaps in preparedness, response, and recovery that must be urgently addressed to protect the livelihoods and well-being of riverine fishing communities in Bayelsa State and across the Niger Delta. The following recommendations are grounded strictly in the evidence gathered during this study.

5.1. Socioeconomic Baseline Databases

The absence of a pre-spill socioeconomic baseline, including community-level income records, fisheries productivity indices, and asset registers, severely constrained this assessment's ability to produce monetized estimates of income and livelihood losses. The Bayelsa State Government, NOSDRA, and oil operating companies should urgently establish and regularly update community-level socioeconomic baseline databases for all oil-bearing communities within active operating areas in OML 29 and adjacent leases. This is consistent with global best practice in environmental and social impact assessment [2] [9].

5.2. Compensation Framework

The current compensation claims process was reported by community members to be delayed, opaque, and inadequate. A structured compensation framework should be developed and implemented, with clear eligibility criteria, transparent valuation methodologies, and enforceable timelines. The framework must extend beyond direct fishers to encompass women processors, net menders, canoe carvers, and traders within the fisheries supply chain, all of whom were demonstrably impacted by the spill. Compensation frameworks from comparable jurisdictions, including Canada's Gulf of Mexico regime, offer useful reference points for developing a context-appropriate Nigerian model [1].

5.3. Environmental Remediation

At the time of this assessment (April 2022, five months post-incident), visible crude oil contamination persisted at the wellhead site and adjacent areas. This represents an ongoing source of fisheries and livelihood damage and poses serious public health risks. Emergency and sustained remediation of contaminated water bodies, mangrove zones, and shorelines must be treated as a precondition for the recovery of fisheries and the restoration of community livelihoods. NOSDRA and the Nigeria Upstream Petroleum Regulatory Commission (NUPRC) should enforce compliance with the Environmental Guidelines and Standards for the Petroleum Industry in Nigeria (EGASPIN) remediation standards.

5.4. Socioeconomic Recovery Plan

A comprehensive socioeconomic recovery plan must be developed for the spill-

affected communities, addressing the multiple dimensions of livelihood disruption documented in this study. The plan should include: (i) short-term food security and income support for affected fishing households; (ii) replacement or compensation for destroyed fishing gear and equipment; (iii) restoration of educational and healthcare infrastructure disrupted by the spill; (iv) provision of alternative livelihood options during the fisheries recovery period; and (v) mental health and psychosocial support for community members experiencing distress. The plan should be developed with the meaningful participation of affected communities, including women's groups, and implemented through a multi-stakeholder body comprising the Bayelsa State Government, NOSDRA, Aiteo, civil society organisations, and community representatives.

5.5. Regulatory Frameworks

The Petroleum Industry Act (PIA) 2021, though providing an updated legislative framework for the Nigerian petroleum sector, requires robust implementing regulations that specifically address oil spill response, community compensation, and environmental remediation in the onshore Niger Delta. The Bayelsa State Government should advocate, through appropriate legislative and regulatory channels, for bespoke regulations that mandate pre-spill baseline assessments, enforce rapid JIV processes, and establish independent community compensation panels.

6. Conclusions

This paper has examined the socioeconomic impacts of a crude oil wellhead blowout on riverine fishing communities in Bayelsa State, Nigeria, using the Aiteo Eastern Exploration and Production Company's Santa Barbara South Well-1 blowout of 5 November 2021 in Nembe LGA as the case study. The incident, which resulted in an uncontrolled discharge of crude oil for approximately 33 days before the wellhead was sealed on 8 December 2021, triggered a Post-Spill Impact Assessment commissioned by the Bayelsa State Government. The socioeconomic/SIA component of that PSIA, presented in this paper, was conducted in April 2022, employing participatory rural appraisal methods across eight spill-affected fishing camps, ports, and communities in the Santa Barbara area of Nembe LGA.

The affected communities are characterized by near-total dependence on artisanal fisheries (93.5% of the population), large household sizes (predominantly 11 - 15 members), severely deficient social infrastructure, and acute financial vulnerability (51.9% of respondents reported no savings). Across all eight surveyed communities, every respondent reported a severe post-spill collapse in fish catch per unit effort, experienced as either an inability to fish in contaminated waters or a substantial reduction in returns per trip, alongside damage to fishing gear and equipment, contamination of mangrove shellfish beds, and disruption of the fish processing and trading supply chain, which is predominantly managed by women. Five months post-incident, physical evidence of crude oil contamination persisted

at multiple sites, and educational, economic, and community life in the spill-affected zone had yet to recover.

These findings carry implications that extend beyond this specific case. Bayelsa State's 9415 km² of wetland terrain, its estimated population of 2.6 million of whom over 82% are rural, and its concentration of active OMLs across Nembe, Southern Ijaw, Sagbama, Ekeremor, and Kolokuma/Opokuma LGAs create a systemic pattern of exposure in which any wellhead or pipeline incident has the potential to replicate the scale of livelihood destruction documented here. The absence of pre-spill socioeconomic baseline data, which severely constrained the quantification of income losses in this assessment, is a state-wide gap that must be urgently closed. The Bayelsa State Government, the PIA 2021 implementation machinery, NOSDRA, and the Nigeria Upstream Petroleum Regulatory Commission (NUPRC) must act collectively to ensure that community-level socioeconomic baselines are established and maintained as a legal precondition for petroleum operations across all active leases in Bayelsa State.

The absence of a transparent and timely compensation process and the continuation of oil spill attribution disputes that deny affected communities access to remediation constitute a governance failure that compounds the initial economic damage of spill events with prolonged institutional injustice. A structured, legally enforceable compensation framework that covers the full fisheries supply chain, including women processors, traders, net repairers, and canoe builders, is an urgent policy priority. Such a framework must be grounded in pre-established baseline data, independently verified, and subject to community oversight.

Future research should employ longitudinal designs to track post-spill recovery trajectories, including changes in fisheries productivity, household income, savings behaviour, and children's school attendance, across comparable spill-affected communities in Bayelsa State. Comparative studies across different spill types (wellhead blowouts, pipeline ruptures, and tanker incidents) and different LGAs would further enrich the evidence base for state-level policy. The present study, grounded strictly in primary field data from the 2022 PSIA, provides a replicable methodological template for such future assessments.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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