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# Perceptions, Causes, and Socioeconomic Effects of Drowning in Artisanal Fishing Communities

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**ABSTRACT**

Drowning is an under-recognized occupational hazard in Ghana's marine and inland fishing communities. This study examined the perceptions, causes, and effects of drowning in these sectors through a cross-sectional survey of 151 respondents, utilizing structured questionnaires with a 5-point Likert scale. Data were analyzed using descriptive statistics, independent sample t-test, Mann-Whitney U-test, Kruskal-Wallis test, and One-Way ANOVA. The results indicated that perceptions and causes of drowning were significantly higher in inland fisheries (MSP = 3.2 ± 0.2; MSC = 4.1 ± 0.1) compared to marine fisheries (MSP = 2.7 ± 0.1; MSC = 3.6 ± 0.2) (Mann-Whitney U-test, $p < 0.05$). In the marinefisheries, the primary causes of drowning were poor swimming decisions (MSC = 3.49), overloaded boats (MSC = 3.73), and extreme weather conditions (MSC = 3.15). Conversely, in inland fisheries, the significant causes were poor swimming decisions (MS = 4.58), overloaded boats (MSC = 4.56), poor knowledge of wave patterns (MSC = 4.31), submerged tree stumps (MSC = 4.15), and extreme weather conditions (MSC = 4.08). Regarding the effects of drowning, the main effects of drowning from both inland and marine fisheries were death (MSinland = 4.63 and MSmarine = 4.08) and financial stress (MSinland = 4.31 and MSmarine = 3.51). Based on these findings, it is recommended that fisheries-specific strategies, including awareness programs and infrastructure development, such as tree stump removal, be urgently implemented to reduce drowning incidents in Ghanaian fishing communities.

**Keywords:** *Artisanal fisheries, Inland, Ghana, Marine, Occupational safety*

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## INTRODUCTION

Drowning is a critical but under-recognized global public health issue, accounting for an estimated 235,000 deaths annually (No et al., 2026). It ranks as the third leading cause of unintentional injury-related death globally, with the burden disproportionately concentrated in low- and middle-income countries. In Asia, specifically in Southeast Asian countries, drowning is viewed as a significant health issue with numerous socioeconomic impacts; children under 15 years of age account for 33% of all drowning incidents (WHO, 2022). According to Linnan et al. (2012), drowning is more prevalent in males than in females. The main causes of drowning in this region include extreme weather events such as typhoons, cyclones, and floods, as well as water transportation (Uebelhoer et al., 2022). In addition, beachgoers often either ignore beach hazard signage (e.g., rip currents) or have difficulty interpreting pictorial representations of beach hazards, which also facilitates drowning (Segura et al., 2022; Ménard et al., 2018). To reduce drowning in Asian countries such as Nepal, Bangladesh, and Sri Lanka, initiatives including swimming and water safety training have been implemented (WHO, 2022; Rahman et al., 2012). In Costa Rica, the use of lifejackets is considered one of the most effective strategies to reduce drowning (Koon et al., 2021). However, because the drowning burden cannot be precisely quantified, government institutions in these countries have demonstrated inadequate resolve in addressing the issue (Peden et al., 2024). According to Peden and McGee (2003), 97% of drownings are recorded in low-and middle-income countries, with the Western Pacific region accounting for 38% of all drowning deaths. Africa has the highest drowning-related mortality rate worldwide, with the rate twice as high as in America, reflecting systemic vulnerabilities such as limited safety infrastructure, poor enforcement of regulations, and occupational exposure to water bodies (Peden et al., 2008). Fishing communities are particularly vulnerable because their livelihoods require daily interaction with aquatic environments, often under unsafe conditions. Many fishers

live below the poverty threshold and rely heavily on fishing as their primary source of income, limiting their ability to invest in safety equipment and training (Oracion et al., 2013).

Drowning is a major but under-recognized public health and occupational hazard in Ghana, particularly in fishing communities along Lake Volta and in coastal regions. Recent studies report that many people continue to die annually from drowning in Ghana, with fisherfolk disproportionately affected due to their daily dependence on water bodies for their livelihoods (Kushitor et al., 2023). Community perceptions strongly influence how risks are understood and addressed. In Ghana, drowning is often attributed to cultural and spiritual causes, such as curses or religious neglect (Dawson, 2018). These perceptions reduce the emphasis on practical safety measures like swimming training, life jackets, and vessel safety checks. The causes of drowning in Ghanaian fishing communities are multifaceted, including alcohol use, panic, low swimming confidence, poor vessel construction, boat overloading, floods, poor awareness of water safety, beliefs in curses, and the absence of customary rites (Wissing, 2019). The effects of drowning extend beyond mortality. For instance, the mean annual catch and profit per artisanal fisherman in Ghana are estimated to be 15,204.6 kg and 27.6 USD (Mensah and Antwi, 2002; Nunoo and Asiedu, 2013); consequently, an artisanal fisherman generates a total of 419,696.6 USD annually. Thus, losing a fisherman to drowning is likely to cost the artisanal fisheries in Ghana an estimated 419,696.6 USD. Families experience psychological trauma, financial stress, and the loss of breadwinners, while communities face the disruption of fishing activities, reduced productivity, and economic decline (Meddings et al., 2021). Drowning persists in Ghana because many cases remain undocumented, especially in rural and artisanal fishing contexts (WHO, 2021). In addition, national health and fisheries frameworks rarely prioritize drowning prevention. Furthermore, there is limited access to rescue infrastructure, swimming training, and safety equipment. These risks are exacerbated by the increasingly unpredictable weather patterns (Beri et al., 2024).

Despite the magnitude of the problem, drowning remains under-researched and under-reported in Ghana. Additionally, the drowning of fishermen reduces the revenue of artisanal fisheries in Ghana by an estimated 419,696.6 USD. Most available data are anecdotal or hospital-based, failing to capture community-level perceptions, root causes, and socioeconomic effects. This paucity of data limits policymakers, researchers, and practitioners' ability to design evidence-based interventions tailored to the realities of Ghanaian fishing communities. A sensitivity measurement approach using structured questionnaires and statistical analysis offers a systematic way to assess community risk perceptions, identify perceived causes, and evaluate socioeconomic impacts. Such evidence is essential for developing context-specific prevention strategies, enhancing awareness, and informing national policy frameworks in line with the WHO's global drowning prevention agenda (WHO, 2021). Given this context, the study aims to generate empirical evidence on the perceptions, causes, and effects of drowning in Ghana. Insights from the study will facilitate data-driven recommendations for safety training, governance reforms, and climate adaptation strategies. In addition, the knowledge gained from the current study will strengthen resilience in fishing communities by transforming anecdotal information into actionable evidence for community leaders, researchers, and policymakers.

## MATERIALS AND METHODS

### Description of the study area

The study was conducted in six fishing communities, namely Bui, Yeji, Dzemeni, Tema, Denu, and Dixcove, representing both inland and marine fisheries (Figure 1). Bui (8°14'21.64"N, 2°16'35.45"W) is located along the Black

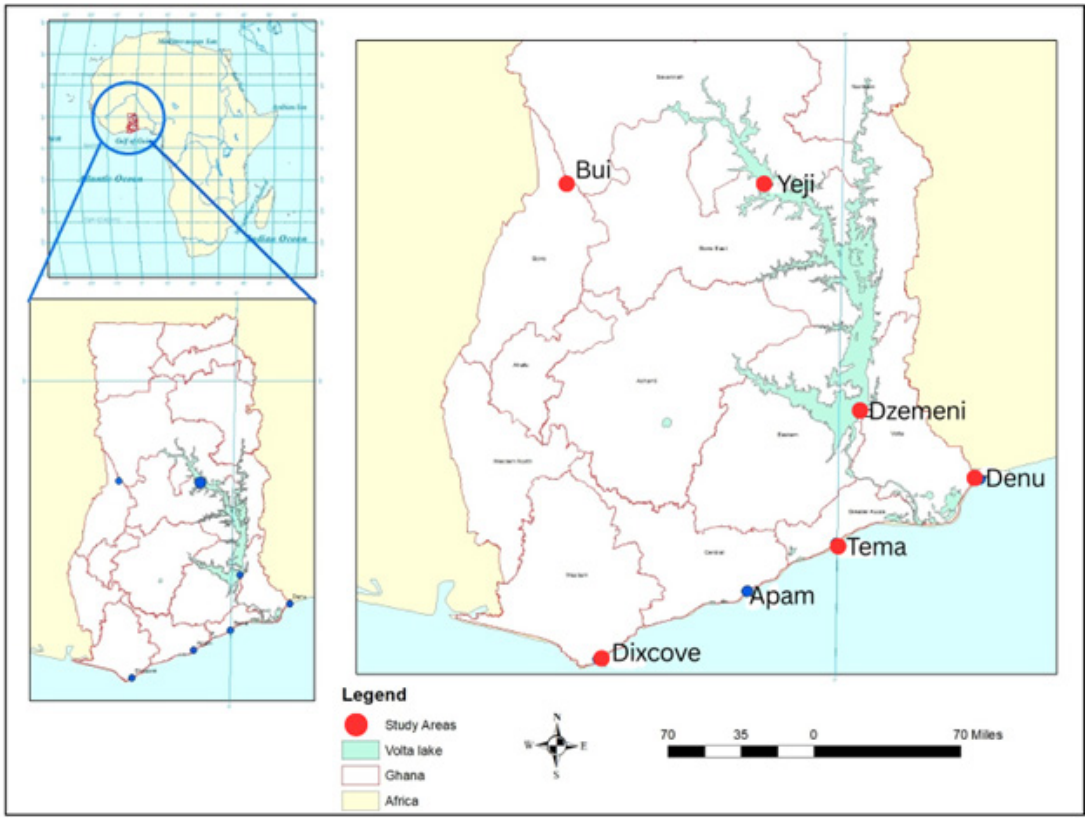


**Figure 1.** Map of the study areas.

Volta River within the Bono and Savannah Regions, influenced by the Bui Dam reservoir. The area is characterized by savannah woodland and strong river currents, with fishing and small-scale agriculture as dominant livelihoods. The impoundment of the Black Volta has altered fish stocks and hydrology, increasing drowning risks for artisanal fishers (Ofori-Danson et al., 2021). Yeji (8°14'1.61"N, 0°38'46.58"W) is situated on the eastern shore of Lake Volta in the Bono East Region, and it is a major fishing and trading hub. Livelihoods include canoe fishing, fish marketing, and ferry transport (Amponsah, 2024). Its population exceeds 30,000, and people from different ethnic groups are engaged in fisheries. The dependence on waterborne transport and artisanal fishing facilitates drowning vulnerability (Agodzo et al., 2023). Dzemeni (6°36'0.29"N, 0° 9'40.61" E) is a lakeside settlement in the South Dayi District of the Volta Region, which is home to one of the busiest fish markets along Lake Volta. Fishing and fish trading are primary occupations. The exposure of the community to lake transport hazards makes drowning incidents recurrent (Amu-Mensah et al., 2013). Tema (5°38'40.55"N, 0° 1'3.79" E) is the location for the largest industrial fishing harbor in Ghana. It integrates artisanal and industrial fisheries, with a population exceeding 290,000, representing occupational drowning risks in industrial-scale fisheries (Atta-Mills et al., 2004). Denu, located on 6°5'23.02"N, 1° 8'44.43"E, is located in the Ketu South Municipality of the Volta Region. It lies near the Ghana–Togo border, with lagoon and marine fishing, as well as cross-border trade dominating livelihoods (Amponsah et al., 2016). The lagoon-sea interface creates unique drowning hazards (Mensah and Antwi, 2004). Dixcove (4°47'38.35"N, 1°56'49.35"W) is a fishing village in the Western Region, known for canoe fishing and fish processing, with its population heavily reliant on artisanal fisheries (Seidu et al., 2022). The selection of these communities was centered on the following factors: (i) reliance on fishing and water transport, (ii) historical prevalence of drowning issues,and (iii) socioeconomic importance to fisheries in Ghana.

**Data collection**

The study employed a multi-stage sampling technique to ensure representativeness across Ghana's fishing communities. At the community level, purposive sampling was used to select fishing communities along Lake Volta and the coastal regions, as these areas record the highest drowning incidences. At the household level, random sampling was applied to select individuals engaged in fishing and water transport activities. The combination of purposive and random sampling ensured that the study captured both high-risk communities and individual-level diversity (Gibbs et al., 2013). The research instrument used for the study was a structured questionnaire, which was categorized into three thematic sections, namely i) perceptions of drowning incidences; ii) causes of drowning incidences; and iv) effects of drowning incidences. A 5-point Likert-scale questionnaire was used to measure sensitivity levels for variables including perceptions, causes, and effects of drowning, as shown in Table 1 (Harada et al., 2015). The Likert scale included the following categories: strongly disagree (SD), disagree (D), moderate economic effects on communities (M), agree (A), and strongly agree (SA), with ratings 1.0, 2.0, 3.0, 4.0, and 5.0, respectively. Pre-testing involving 20 respondents (i.e., 10 in each community) was conducted in one marine and one inland fishing community (i.e., Dixcove and Yeji, respectively) to refine clarity, reliability, and validity. Reliability was assessed using Cronbach's alpha, with a threshold of ≥ 0.70 considered to be acceptable (Nunnally and Bernstein, 1994).

**Table 1.** Questions on perceptions, causes and effects of drowning outline in the questionnaire.

| Perception | Causes | Effects |
|---|---|---|
| Occurs more frequently among fishers than non-fishers | Alcohol while fishing or swimming | Death |
| Leading cause of death | Poor boat construction | Bodily injuries |
| More frequent among males than females | Extreme weather events | Financial stress |
| Common in the study area | Overloaded ferries or boats | Disrupts fishing activities |
| More frequent among adults than children | Scattered logs found underwater | Disrupts the router of Motor Banka |
| Occurs more often during festive seasons | Failure to check weather conditions before fishing or swimming | Economic impacts |
| Frequently recorded | Encounters with furious animals | Reduced fishing effort |
| More frequent in artisanal than in industrial fisheries | Illegal fishermen escaping arrest while fishing | Disrupts fishing activities |
| More strongly associated with fishing than with industrial fisheries | Poor knowledge about sea waves and tides | Poor seawater navigation |
| More among the poor than the rich | Low levels of swimming experience | Inadequate training/bodily injuries |
| Believed to have religious linkages | Inability to make safe swimming decisions | Death/bodily injuries |
| Associated with climate change | Inability to signal for help | Financial stress |
| Occurs more among those living close to water bodies than those farther away | Low levels of swimming confidence | Inadequate training/bodily injuries |
| Sometimes attributed to curses | Poor knowledge of sea safety | Panic during swimming |

Sampling criteria for selection of respondents included: i) 18 years or older, ii) resident of the fishing community for at least 12 months, iii) actively engaged in fishing or related activities and iv) willing to participate and provide informed consent. The study's targeted respondents included artisanal fishers (n = 94), fish processors and traders (n = 50), and community leaders and elders (n = 7). These diverse respondents ensured that both direct occupational risks and indirect socioeconomic impacts were adequately recorded. The study's sample size was 151 respondents, estimated using Yamane's (1967) formula. Overall, the sample comprised 52 respondents from inland fishing communities and 99 from marine fishing communities. Cronbach's alpha was used to assess the internal consistency of the perception items (threshold > 0.70).

### Data analysis

Data obtained from the study were coded and entered into the Statistical Package for the Social Sciences (SPSS) version 27 for analysis. Mean scores were calculated from the Likert-scale data for the variables perceptions, causes, and effects. The analysis conducted for the study included descriptive statistics on demographics, perceptions, and the causes and effects of drowning. A chi-square goodness-of-fit test was performed on demographic data to assess the equality of proportions in a categorical dataset (Shankar, 2019). The Anderson-Darling test was performed to assess the normality of the continuous dataset (i.e., $p > 0.05$; Razali et al., 2011). A Mann-Whitney test was used to assess significant differences in mean scores for perceptions, causes, and effects of drowning between marine and inland fishing communities (Nachar, 2008). The Kruskal-Wallis test was used to assess significant differences among the six sampling locations in the causes and effects of drowning (Ostertagova et al., 2014). A one-way ANOVA was used to test for significant differences among the six sampling locations in perceptions of drowning (Pajo, 1999). A significant difference was taken at $p < 0.05$ with a 95 % confidence interval. Results were presented in charts and tables for easy understanding.

## RESULTS

### Demographics of respondents

Table 2 presents the demographics of the study's respondents. The majority of respondents (n = 148 out of 151) were Christian, while the remaining 3 were Muslim. Of the 151 respondents, 119 were educated, with the majority (n = 59) having Junior High School (JHS) education. Regarding marital status, most respondents (n = 115 of 151) were married. Overall, 52 respondents were from inland fishing communities, while 99 respondents were from marine fishing communities. The chi-square goodness-of-fit test showed significant variation ($p < 0.05$), except for religion (Table 2).

**Table 2.** Demographics of respondents recorded during the study period.

| Demographics | | Dixcove (n) | Keta (n) | Tema (n) | Yeji (n) | Bui (n) | Dzemeni (n) | Total | Chi-square |
|---|---|---|---|---|---|---|---|---|---|
| Religion | | 20 | 29 | 49 | 15 | 17 | 18 | 148 | 8.92 |
| | Christian | 0 | 1 | 0 | 0 | 0 | 2 | 3 | |
| | Muslim | | | | | | | | |
| Education | | 6 | 4 | 9 | 12 | 1 | 0 | 32 | 41.10 |
| | No | 14 | 26 | 40 | 3 | 16 | 20 | 119 | |
| | Yes | | | | | | | | |
| Marital status | | 9 | 19 | 48 | 13 | 14 | 12 | 115 | 41.28 |
| | Married | 11 | 11 | 1 | 1 | 3 | 8 | 35 | |
| | Single | 0 | 0 | 0 | 1 | 0 | 0 | 1 | |
| | Divorce | | | | | | | | |
| Education level | | 0 | 7 | 5 | 2 | 3 | 2 | 19 | 60.68 |
| | Primary | 8 | 9 | 25 | 1 | 7 | 9 | 59 | |
| | Junoir High School | 2 | 4 | 9 | 0 | 5 | 4 | 24 | |
| | Senior High School | 4 | 5 | 1 | 0 | 1 | 6 | 17 | |
| | Tertiary | 6 | 5 | 9 | 11 | 1 | 0 | 32 | |
| | No | | | | | | | | |
| Fisheries type | | 0 | 0 | 0 | 15 | 17 | 20 | 52 | 151 |
| | Inland | 20 | 30 | 49 | 0 | 0 | 0 | 99 | |
| | Marine | | | | | | | | |

### Perception about drowning in marine and inland fisheries

The mean scores for perceptions of drowning were 3.2 ± 0.2 and 2.7 ± 0.1 for respondents from inland and marine fishing communities, respectively (Figure 2). The Mann-Whitney U test showed a significant difference in the mean scores for perceptions of drowning between marine and inland fishing communities ($U = 44$, $p = 0.01$).

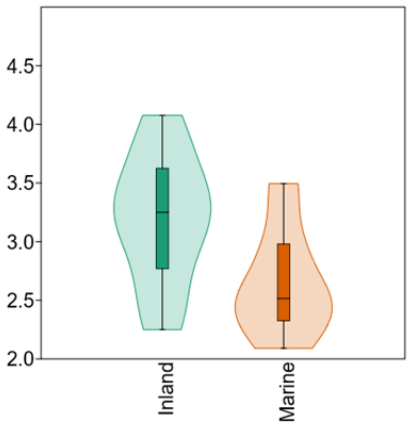


**Figure 2.** Mean scores for perceptions of drowning among respondent from marine and inland fisheries.

Mean scores of perceptions about drowning that showed a significant difference between marine and inland fishing communities are shown in Figure 3. Significantly, respondents from marine fisheries reported a higher mean score for 'drowning is strongly associated with fishing' (MS = 3.49). Respondents from inland fisheries recorded a higher mean score for 'drowning is strongly associated with cures' (MS = 4.08) and 'drowning is strongly associated with climate change (MS = 3.92).

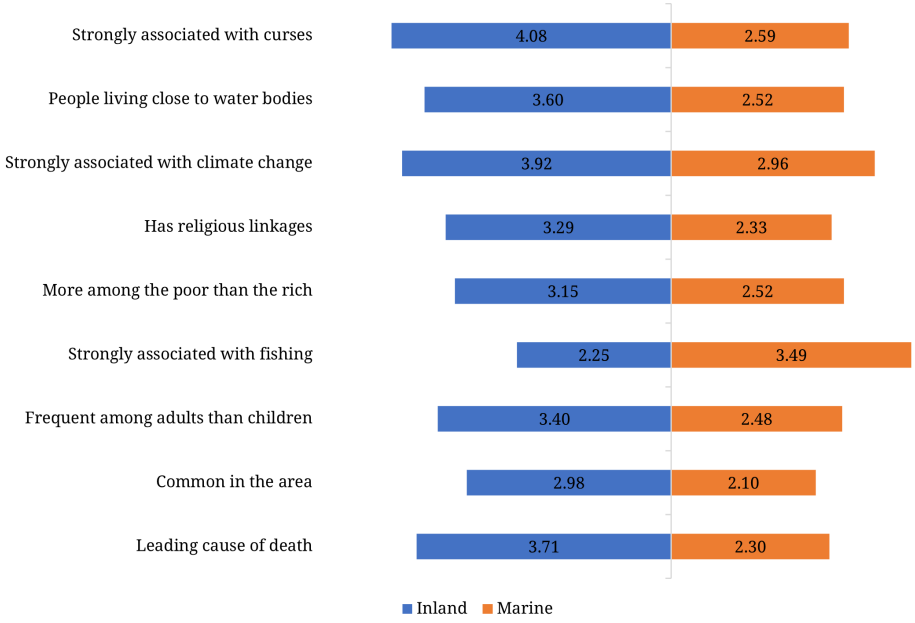


**Figure 3.** Mean scores of perceptions about drowning between marine and inland fisheries that revelaed significant difference.

The mean score for perceptions about drowning in Dzemeni, Yeji, Bui, Dixcove, Tema and Keta fishing communities was 3.6 ± 0.3, 2.5 ± 0.2, 3.3 ± 0.1, 3.6 ± 0.1, 2.0 ± 0.3 and 3.4 ± 0.2. respectively (Figure 4). One-way ANOVA showed a significant difference in the mean scores of perceptions about drowning among respondents from the sampling communities (One-Way ANOVA, df = 5, *p*-value = < 0.001).

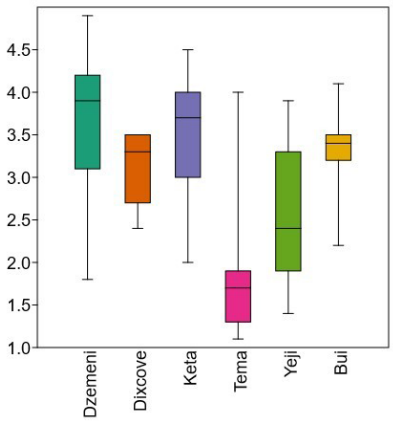


**Figure 4.** Mean scores for perceptions of drowning among respondent from fishing communities during the study period.

**Causes of drowning in marine and inland fisheries**

The mean scores for perceived causes of drowning were 4.1 ± 0.1 and 3.6 ± 0.2 for respondents from inland and marine fishing communities, respectively (Figure 5). The Mann-Whitney U test showed a significant difference in the mean score for perceived causes of drowning between marine and inland fishing communities (U = 103, $p$ = 0.02).

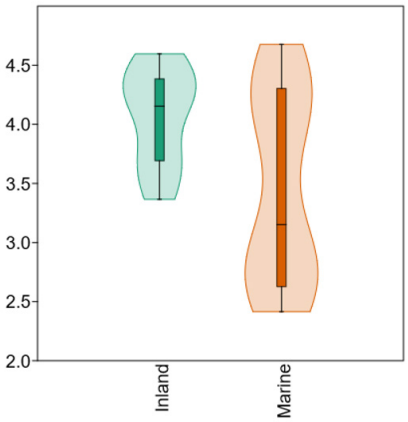


**Figure 5.** Mean scores for perceived causes of drowning among respondent from marine and inland fisheries

Mean scores of causes of drowning that showed a significant difference between marine and inland fishing communities are shown in Figure 6. Significantly, respondents from marine fisheries recorded higher mean scores for the causes, 'poor swimming decisions (MS = 3.49); overloaded boats (MS = 3.73) and extreme weather conditions (MS = 3.15). However, respondents from inland fisheries reported a higher mean score for the causes: 'poor swimming decisions (MS = 4.58); overloaded boats (MS = 4.56), poor knowledge about waves (MS = 4.31), submerged tree stumps (MS = 4.15) and extreme weather conditions (MS = 4.08).

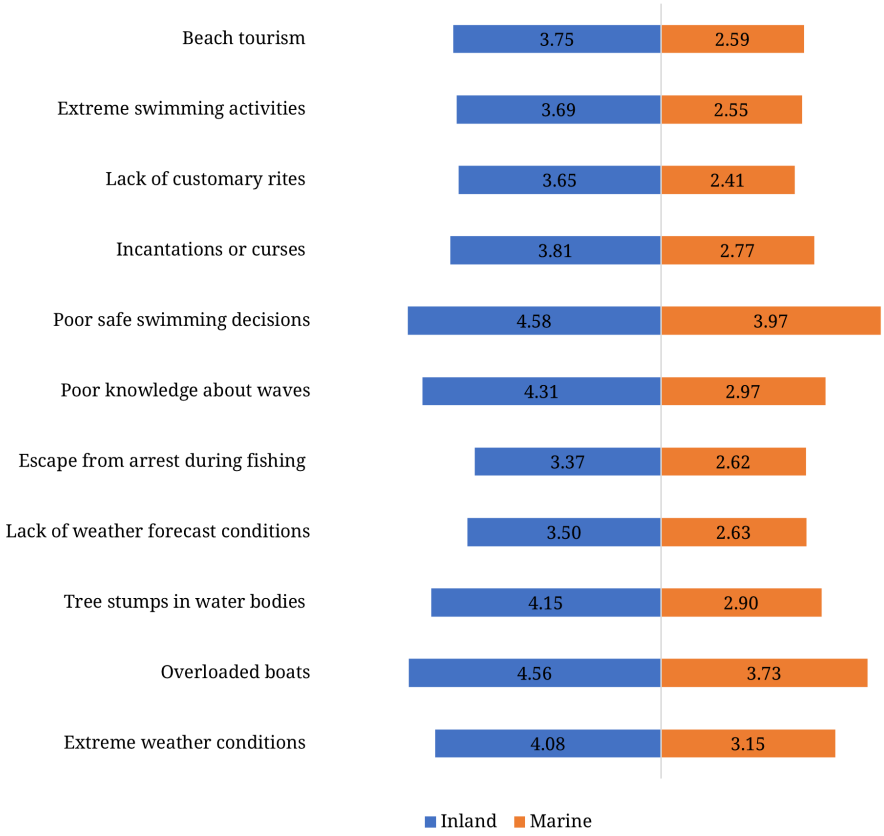


**Figure 6.** Mean scores for perceived causes of drowning between marine and inland fisheries that revelaed significant difference.

The mean score for causes of drowning in Dixcove, Keta, Tema, Yeji, Bui and Dzemeni fishing communities was 3.7 ± 0.1, 4.3 ± 0.1, 2.8 ± 0.3, 3.5 ± 0.2, 4.0 ± 0.1 and 4.5 ± 0.1. respectively (Figure 7). The Kruskal-Wallis test showed a significant difference in the mean scores for causes of drowning among respondents from the sampling communities (Kruskal-Wallis test = 37.58, $p$-value < 0.001).

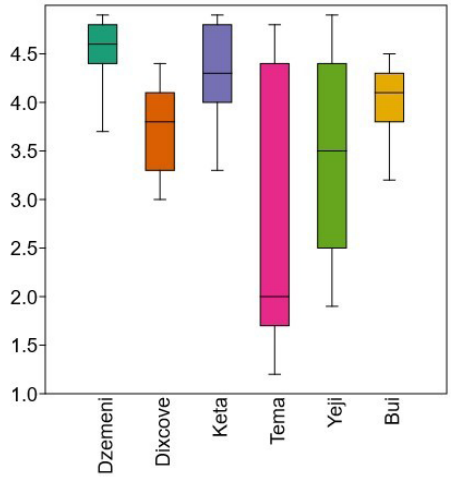


**Figure 7.** Mean scores for perceived causes of drowning among respondents from fishing communities during the study period.

**Effects of drowning in marine and inland fisheries**

The mean score of perceived effects of drowning was 4.0 ± 0.1 and 3.2 ± 0.3 for respondents from inland and marine fishing communities, respectively (Figure 8). Mann-Whitney U test showed no significant difference in the mean scores of perceived effects of drowning in marine and inland fishing communities (Mann-Whitney U-test = 9, *p*-value = 0.06).

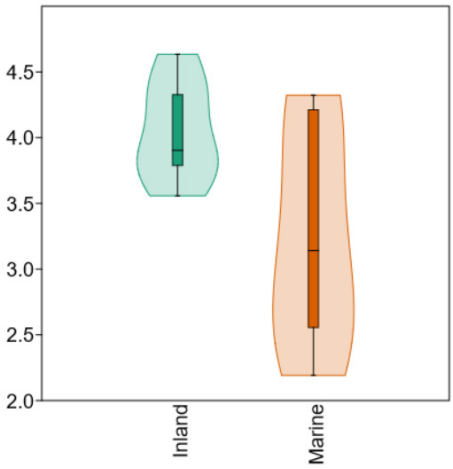


**Figure 8.** Mean scores for perceived effects of drowning among respondent from marine and inland fisheries.

Although not significantly different, the mean scores for individual drowning effects in marine and inland fishing communities are shown in Figure 9. Respondents from inland fisheries reported a higher mean score for the effects, 'drowning leads to death (MS = 4.63) and drowning leads to financial stress (MS = 4.31)'. However, respondents from marine fisheries reported higher mean scores for the effects 'drowning leads to death' (MS = 4.08) and 'drowning leads to financial stress' (MS = 3.51).

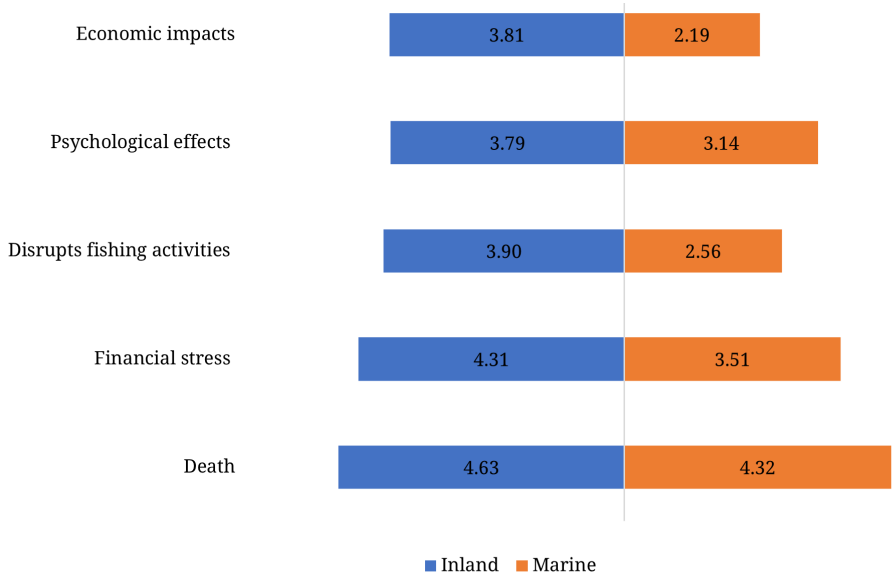


**Figure 9.** Mean scores of effects of drowning between marine and inland fisheries that revelaed significant difference.

In terms of fishing communities, the mean score for perceived effects of drowning in Dixcove, Keta, Tema, Yeji, Bui and Dzemeni fishing communities was 3.3 ± 0.2, 4.5 ± 0.2, 2.4 ± 0.5, 3.1 ± 0.3, 4.4 ± 0.1 and 4.5 ± 0.1. respectively (Figure 10). The Kruskal-Wallis test showed a significant difference in the mean scores for perceived effects of drowning among respondents from the various fishing communities (Kruskal-Wallis test = 27.19, *p*-value = < 0.001).

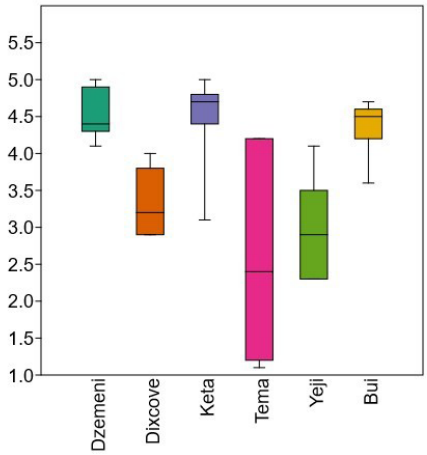


**Figure 10.** Mean scores for perceived effects of drowning among respondents from fishing communities during the study period.

## DISCUSSION

Marine fisheries recorded a lower mean score for perceptions of drowning than those in inland fisheries. This may suggest that marine fishers associate drowning more closely with specific fishing operations than with environmental or spiritual factors. Factors such as entanglement with gear and use of alcohol, with the fishing boats typically serving as the primary vector for drowning incidents in marine fisheries, may constitute operational hazards (Miller et al., 2019). In contrast, inland fishers frequently link drowning to cultural and environmental variables, such as spiritual curses and the effects of climate change (Adjei and Sika-Bright, 2019; Kushitor et al., 2022). This orientation between inland drowning risks and cultural beliefs reinforces findings that traditional perspectives significantly shape safety perceptions in inland fishing communities (Adjei and Sika-Bright, 2019).

The high mean scores for perceptions of drowning in communities such as Dzemeni, Dixcove, and Keta suggest strong attachment to these perceptions, driven by frequent exposure to flooding and rough water, and by a lack of safety infrastructure, such as fishing harbors (Sindall et al., 2022). Conversely, the moderate mean scores at the Bui fishing area indicate that drowning is recognized as a risk but less acute than in coastal fishing communities, potentially due to the presence of warning signs and reservoir flood control systems (Bugeja and Franklin, 2005; Nirmal and Shekapure, 2025). The lowest mean scores were recorded in the Yeji and Tema fishing communities. In inland communities like Yeji, drowning is viewed through a spiritual lens, where incidents may be highly attributed to supernatural causes rather than occupational hazards (Adjei and Sika-Bright, 2019). In contrast, in an urbanized port city like Tema, drowning may not be viewed as a primary occupational hazard due to modern fishing infrastructure and more stringent safety measures, which facilitate better adherence to safety protocols among fishermen (Jagnoor et al., 2019; Jalalifar et al., 2024). Based on perceived causes of drowning, inland fisheries recorded significantly higher mean scores than marine fisheries, suggesting that they perceived these causes as more pressing and more closely linked to drowning. Specifically, inland fisheries identified unsafe swimming, overloaded boats, submerged tree stumps, poor knowledge of waves, and extreme weather as the dominant causes of drowning, findings that parallel those in other regional studies (Miller et al., 2019; Whitworth et al., 2019). Conversely, marine fisheries identified unsafe swimming, boat overloading, and adverse weather as primary factors (Kobusingye et al., 2017). Higher mean scores in inland communities, such as Dzemeni, which is known for informal boat operations on the Volta Lake, may imply greater exposure to drowning incidents (Obeng et al., 2025). In contrast, reduced exposure to drowning due to improved safety practices and more robust urban infrastructure could have accounted for the low mean scores recorded in marine communities such as Dixcove and Tema (Kobusingye et al., 2017).

For both marine and inland fisheries, poor swimming decisions, overloaded boats, and extreme weather conditions were significant causes of drowning in the current study. In many fishing communities, the drive for higher profits pushes fishermen to grounds far from shore, where they may be trapped during extreme weather events, increasing their risk of drowning (Byard, 2013; Malakar et al., 2018). Poor swimming skills, especially among novices involved in fishing and other boating activities, often lead to fatal outcomes when boats are damaged and begin to sink (Brenner et al., 2003; Taylor et al., 2020). Overloaded boats, frequently caused by excessive passenger numbers or heavy fish harvests, significantly reduce the freeboard of boats and increase their instability (Obeng et al., 2025; O'Connor and O'Connor, 2005). This dangerous practice leads to the capsizing of boats, exposing users to the risk of drowning as some victims get trapped in the sinking boat (Brooks et al., 2025; Adepoju, 2022). Consistent with the high mean scores for inland fisheries, other significant causes of drowning in this study included extreme weather, traditional curses, a lack of incantation rites, and submerged tree stumps (Kushitor et al., 2022). The low patronage of weather forecast systems often leads to undertaking fishing or boating activities in hazardous conditions (Kobusingye et al., 2016). Furthermore, swimming at unpatrolled beach sections and the consumption of alcohol, which is often associated with beach tourism, heighten vulnerability to drowning (Miller et al., 2019). A lack of awareness programs on wave dynamics further contributes to the poor knowledge that leaves fishers and stewards of boating activities prone to drowning (Rahman et al., 2021).

Physical hazards are particularly relevant in Volta Lake, where, after encountering submerged tree stumps, boats often get damaged and sink, leading to the drowning of trapped victims (Kushitor et al., 2022). Cultural factors also play a critical role, as most ethnic groups in Ghana perceive water bodies as deities (Boateng et al., 2024; Karakara et al., 2023). Violating these cultural practices associated with the sea or lake leads to curses in these fishing communities (Adjei and Sika-Bright, 2019). Fishers who are known to be cursed are thought to be at risk of drowning in the water through accidents. Additionally, attempting to escape arrest for engaging in illegal fishing practices occasionally results in drowning during confrontations with enforcement officers. Finally, incantations are often performed to appease water spirits, especially in the presence of unburied dead bodies in seas, rivers or lakes (Adjei and Sika-Bright, 2019). However, failure to perform these rites under these circumstances is perceived by some communities as a cause of turbulent conditions in the sea, river, or lake, which may lead to further accidents (Oloko et al., 2026).

Results from the current study indicated a higher mean score for perceived effects of drowning in inland fisheries than in marine fisheries. The fatal consequences and economic burdens of drowning are more acutely experienced in inland fisheries than in marine communities, which could explain the higher mean score for inland fisheries. Similarly, Dzemeni and Keta, both inland fishing communities, recorded the highest mean scores, indicating a strong perception of the effects of drowning. In contrast, the lower mean scores observed in marine fishing communities, such as Dixcove and Tema, reflect a comparatively low perception of these impacts. Inland fishing communities may experience more frequent drowning incidents due to recurring floods and a lack of infrastructure, which heightens the collective awareness of drowning risks (Sindall et al., 2022). Conversely, the presence of modernized infrastructure, such as ports and diversified livelihoods in many marine-fishing communities, tends to mitigate the perceived impact of drowning (Jagnoor et al., 2019). Specifically, for both marine and inland fishing communities, the most significant effects of drowning identified were death and subsequent financial stress. Research in other contexts similarly indicates that drowning-related fatalities impose a high financial strain on families and local communities (Lucas and Case, 2018; Rahman et al., 2021). This financial burden is most severely felt by families that depend solely on fishing. Furthermore, other significant effects common to both inland and marine fishing communities have been documented by scholars studying similar contexts in Tanzania and Bangladesh: reduced productivity, psychological distress, and economic disruption (Rahman et al., 2012; Whitworth et al., 2019).

**Mitigations strategies by government**

To encourage behavioral change and the adoption of drowning prevention strategies among fisherfolk, government agencies could implement targeted incentive mechanisms. One effective approach is to provide subsidies or tax relief for the purchase of safety equipment, such as lifejackets and communication devices. Microcredit schemes that provide financial support to artisanal fishers could be directly linked to safety compliance. By requiring proof of safety training or the use of safety gear as a condition for loan approval, authorities can reduce the financial barriers to adopting life-saving practices. Implementing peer-led training programs could increase the use of lifejackets among occupational boaters and fishermen. Instituting compulsory or subsidized fisherman insurance can protect against the loss of life or income while incentivizing higher safety standards. Establishing recognition and certification schemes for communities that demonstrate a strong safety culture can leverage social norms and behavioral science to foster long-term compliance. Collectively, these mechanisms strengthen the socio-ecological resilience of small-scale fishing communities and significantly reduce the incidence of occupational drowning.

**Limitations and future research**

While this study offers valuable insights into the perceptions, causes, and effects of drowning among workers in inland and marine fisheries, several limitations must be acknowledged. First, reliance on self-reported Likert-scale data may introduce response bias, as participants may understate or overstate their perceptions due to social desirability or prevailing cultural norms. Future research should adopt mixed-methods approaches, combining quantitative surveys with qualitative interviews to more effectively capture the lived experiences and socio-cultural nuances of fisherfolk. Finally, assessing the role of policy frameworks and institutional support in shaping an occupational safety culture, particularly for informal water transport services, could provide actionable insights to strengthen the resilience of small-scale fishing communities.

**Implications for policy and practice**

In Ghana, government agencies should prioritize investments in shoreline safety infrastructure, community-based rescue services, and the strict enforcement of lifejacket use in inland fishing communities. In marine fisheries, educational campaigns must be prioritized to increase awareness of drowning hazards. Integrating safety modules into fisheries cooperatives and extension services ensures that both literate and non-literate fishers benefit from structured training. Finally, establishing and enforcing minimum safety requirements through monitoring mechanisms will help institutionalize drowning prevention as a standard occupational practice. At the international level, community-based training and literacy-sensitive safety campaigns can enhance the recognition of drowning risks across diverse contexts while ensuring inclusivity for those with varying educational levels. Investing in coastal and inland rescue stations and training of local volunteers will lower drowning fatalities. Additionally, governments can ensure behavioral change by linking subsidies, microcredit, or insurance benefits to compliance with safety practices. Traditional leaders, fishing cooperatives, and fishers' groups must be involved in formulating policies to ensure that interventions are socially acceptable and sustainable in the long term.

## CONCLUSION

This study assessed the perceptions, causes, and effects of drowning within Ghanaian fishing communities. The findings showed that inland fishing communities place a strong emphasis on the causes, effects, and perceptions of drowning, whereas marine fishing communities attribute less importance to drowning-related issues. Consequently, addressing drowning in both inland and marine contexts in Ghana requires context-specific interventions, strengthened governance, and improved infrastructure. Furthermore, drowning prevention strategies should be integrated into fisheries policy frameworks to protect livelihoods and enhance resilience.

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## AUTHOR CONTRIBUTIONS

S. K, K. A: Writing, conceptualization, methodology, data gathering, analysis, and revision. G. B: Data gathering, analysis, and revision.

## DECLARATION

### Informed consent statement

None needed for this study.

### Conflict of Interest

Authors express no conflict of interest.

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