ISSN: 2312-0134
African Research Journal of Education and Social Sciences, 12 (1), 2025 | Website: www.arjess.org

EXAMINING MARITIME RISK MITIGATION MEASURES AND SMALL VESSEL SAFETY IN KILIFI COUNTY, KENYA

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ABSTRACT: *The Kenyan Coastline is 536km long, with 197 landing sites. Study findings indicate that over 1300 small vessels go in and out of Kilifi County's coastal shores for various purposes of economic value, including artisanal fishing, small-scale transportation, and recreation. Further, reports indicate that there have been 38 incidents between 2021 and 2023, with 40 fatalities and 140 rescued at sea, making this study necessary. The study, therefore, sought to identify the risks to small vessel safety. The study employed a convergent parallel research design. The target population in this study included small vessel owners, operators and seafarers in Kilifi County, Kenya Maritime Authority as the lead agency on maritime safety, other enforcement agencies such as Kenya Navy, Kenya Marine Fisheries and Research Institute, Kenya Coastguard Service and Beach Management Units. Purposive sampling method was used for top management in the various agencies identified in the target population, while Cluster sampling was used for small vessel operators and seafarers to select a sample of 369 respondents from a population of 4772. The study employed questionnaires and structured interviews to collect data. Qualitative data analysis was done through narrative analysis, and quantitative data was analysed using descriptive statistics. Study findings indicated that small vessel safety levels in Kilifi County were low. Most respondents reported machinery damage and equipment failure as the main hazard characteristic at sea. At the same time, bad weather or non-adherence to weather warnings was a major vulnerability point that led to maritime accidents of small vessel in Kilifi County. The study recommends that small vessel operators have adequate safety equipment before proceeding to sea, maritime safety enforcers increase the frequency of safety training to small vessel users and seafarers to inculcate safety culture at sea, maritime enforcers be well resourced to increase presence at sea, and the introduction of billboards at all landing sites detailing daily weather and tidal information at sea to enable small vessel operators and seafarers determine their safety at sea.*

Keywords: *Maritime Domain, Maritime safety, Maritime Risk Mitigation measures, Small Vessel*

ISSN: 2312-0134
African Research Journal of Education and Social Sciences, 12 (1), 2025 | Website: www.arjess.org

INTRODUCTION

Maritime accidents have been on the rise over the years. These accidents can be attributed to natural and human elements (Batalden & Sydnes, 2017). Maritime accidents onboard the vessel can quickly escalate from a simple incident, such as minor leakage to a full-blown crisis in which the vessel sinks if not adequately addressed in time. These crises, therefore, require quick decision-making processes to eliminate the threat to passengers, crew and the vessel. Continuous observance of maritime safety by vessel owners, operators and seafarers is one way to mitigate risks attributed to maritime accidents (Batalden & Sydnes, 2017).

Globally, the context of maritime safety has developed over the years. Maritime Safety was not considered a matter of public apprehension, and accidents were regarded as an inevitable act of the gods (Mukherjee, 2002). Further, various maritime accidents with huge death tolls, such as the "s/s Titanic" in 1912, hastened the need to develop international maritime safety standards. The first international conference on the safety of human life at sea was convened, resulting in the first International Maritime Convention, Safety of Life at Sea (SOLAS), 1914 enforced in 1919. A United Nations Conference held in Geneva in 1948 led to the development of the International Maritime Organisation (IMO). This was a major landmark in maritime regulations. The Convention was enacted in 1958, and the IMO was inaugurated in 1959. (IMO,2019b)

Since then, progress on maritime regulations has been realized. There are challenges to IMO member States in implementing legislation of maritime safety and, by extension, small vessel safety in totality, especially in developing countries. Aiken (2023) alludes to challenges such as insufficient training of lawyers and legislative drafters, conflict between various agencies in the national, regional, and local government, inadequate capacity and resources, lengthy process required, among others, hindering developing countries' member states of IMO from implementing the legislation.

In Africa, other than the ratification of IMO legislative frameworks by African states, the African Union (AU) has come up with the African Charter on Maritime security, safety, and Development, adopted in 2016 to emphasize aspects of maritime safety. However, maritime safety has suffered significant setbacks in recent years due to the Europe migrant crisis a case in point is the Lampedusa tragedy. According to Bertoglio et al. (2020) On October 3rd, 2013, a small boat carrying more than 500 migrants from the Horn of Africa (Eritrea, Somalia, Ethiopia) sank near Lampedusa, with 366 dead and 155 surviving. Some of the causes of this disaster included overcrowding, machinery failure and navigational hazards. Therefore, to enhance maritime safety Aguire (2021) asserted that life-saving appliances should be always in boats, ships and even small vessels so as to reduce the severity of marine accidents if it occurs (Aguire, 2021).

Regionally, the African Integrated Maritime (AIM) strategy 2050 emphasizes the rapid establishment of standardized Regional Maritime Headquarters (MHQ) with Maritime Operations Centre (MOC) for mutualized response capabilities to maritime security threats, maritime safety, and search and rescue in all Regions. Despite the operationalization of these

ISSN: 2312-0134
African Research Journal of Education and Social Sciences, 12 (1), 2025 | Website: www.arjess.org

regional centres, accidents still happen. More recent surveys of inhabitants along the lake suggest that the majority of drownings happened to fishermen and small-boat lake travellers (Whitworth et al., 2019). The most frequently cited factors that cause boats to capsize are Stormy weather and lightning, strong winds and waves, and boat overloading (Tushemereirwe et al., 2017). Thus, to avoid accidents such as those in Uganda, Wilks (2021) notes maritime safety measures such as compliance to marine safety regulations, sensitization of seafarers and other stakeholders on marine safety regulations and monitoring weather patterns.

Kenya has formulated various legislative acts, such as the Kenya Maritime and Shipping (Small Vessel Safety Regulations) Act of 2012, to protect and safeguard small vessel activities at sea. Various organisations have been mandated to uphold maritime safety at sea (GoK,2012). The Kenya Maritime Authority (KMA), an organisation created in 2004 through an act of parliament to oversee maritime affairs, is the lead agency on maritime safety in Kenyan coastal and inland waters (KMA, 20210. Various other Government agencies also participate in enhancing maritime safety enforcement either individually or in a multiagency setup, such as the Kenya Navy (KN), Kenya Coastguard Services (KCGS), Kenya Fisheries Services (KEFS), and Kenya Wildlife Services (KWS), among others.

Small vessels transit in and out of various landing sites in Kilifi County conduct artisanal fishing, transportation and recreational purposes. To facilitate safe and sustainable maritime resource exploitation and use, Kilifi County government has a department on Agriculture, Livestock Development, Fisheries and Blue Economy, cascaded down to sub county offices and further down to various Beach Management Units (BMU). The Directorate of Blue Economy in Kilifi County foresee all maritime related activities ensuring adherence to safety regulations to all proceeding to and out of sea. In addition, various government agencies responsible for maritime safety enforcement are also stationed in Kilifi County and play their roles to enhance safety. Despite these concerted efforts, maritime accidents still occur. Reports by KMA indicate an increase in maritime accidents in which 242 people have lost their lives and over 300 people rescued from the various accidents associated with small vessels operations (KMA,2021b). In Kilifi County, major incidences such as one in which four people died after the boat they were sailing in capsized in Watamu. The boat had 29 passengers with 15 being foreigners. The Watamu Beach Management Unit (BMU) Chairman attributed the accident to strong waves leading to the boat experiencing engine malfunction before sinking (Kalama & Ongala, 2023. The increase in small vessel operations poses a greater risk of maritime accidents if maritime safety measures are not adhered to by small vessel operators. The implications of these accidents are loss of lives, property and environmental degradation. The study therefore seeks to determine maritime risks mitigation measures to small vessel safety in Kilifi County, Kenya.

ISSN: 2312-0134
African Research Journal of Education and Social Sciences, 12 (1), 2025 | Website: www.arjess.org

METHODOLOGY

The study employed a mixed-methods approach and further a convergent parallel research design. According to George (2021), a convergent parallel design method is an approach where researchers collect and analyse both quantitative and qualitative data simultaneously but separately and the findings from both data sets are compared or combined to draw comprehensive conclusions. This research design was suitable for the study as it integrated the advantages of both quantitative and qualitative studies. For instance, quantitative data assessed the major maritime risks of small vessel safety measures while the qualitative data enhanced the data through explanation on how these risks occur and if maritime safety measures were adhered to.

The study site was in Kilifi County, Kenya, primarily focusing on the towns of Mtwapa, Kilifi, Watamu, and Malindi. These towns were selected for the study as they border the sea fronts and are known to have good landing sites facilitating large numbers of small vessel operations within Kilifi County. Further, various offices and camps for maritime safety enforcers are located in these towns.

This study's targeted population included small vessel owners and operators in Kilifi County as they are central to the study since they are the implementers of maritime safety measures. The County government staff, especially those in the Department of Livestock, Fisheries, and Blue Economy, personnel from various Kenyan government agencies, specifically the KMA, as lead on maritime safety, others are KN, KEMFRI, and KCGS. BMU's were considered pivotal to this study as they were the link to various small boat operators and owners as well as the seafarers. Tabulated is the target population,

Table 1*: Target Population*

TARGET POPULATION	***POPULATION SIZE***
Director KMA	01
Director Maritime Safety Department KMA and Staff	04
MRCC staff	03
Director Blue economy Kilifi County	01
KEMFRI, Kilifi County	03
Director Fleet and Maritime affairs, KCGS	01
Officer Commanding KCGS units, Kilifi County	04
Commander Kenya Navy Fleet	01
Officer Commanding Special Boat Units, Kenya Navy Fleet	07
KRCS Malindi office staff	05
Chairmen BMU's (Mtwapa, Kilifi, Watamu & Malindi)	04
Seafarers and Small vessel operators(Kilifi North& South, Malindi)	4772
Total	4806

Source: Adapted from KMA (2021), Kilifi County (2021), BMU Records (2023)

The study employed a mixture of probability and non-probability sampling. In non-probability sampling, purposive sampling was used for top management in the various agencies relevant to this study. From the target population table above, the respondents identified for this sampling

ISSN: 2312-0134
African Research Journal of Education and Social Sciences, 12 (1), 2025 | Website: www.arjess.org

method were 34. Probability sampling was used for the rest of the participants, and specifically, cluster sampling was utilised for the small vessel operators, owners, and seafarers. Clusters of respondents were based on geographical location (Mtwapa, Kilifi, Watamu, and Malindi) and economic activity (maritime enforcement, fishing, transportation, and tourism). To determine sample size for small vessel operators and sea farers the study employed Taro Yamane (1967) statistical formula of sample size determination. Given the population (N) is 4772 and margin of error of 0.05 associated with 95% confidence interval, the final sample will be:

$$Sample\ size = \frac{4772}{1 + 4772(0.05^2)} = 369$$

This study employed structured questionnaires and interviews to gather data. Questionnaires was presented in the Google Form format targeting 369 small vessel operators and seafarers while interviews targeted for 34 respondents from top management. The study employed quantitative and qualitative analysis techniques. The quantitative data was analysed using descriptive statistics in the form of tables, charts and figures while Qualitative data was analysed using narrative analysis presented by the use of in-text citations and narratives to generate meaning of data collected.

In adherence to ethics, the respondents' confidentiality and anonymity were essential. The researcher also sought informed consent from respondents. The respondents participated voluntarily, and authority was sought by the relevant agencies before subjecting their members to the study. People's rights, dignity, and diversity were observed while carrying out the study.

RESULTS

Demographic Information

The total responses from the questionnaires were 330, while 29 were from interviews generating a response rate of 89.4%. Out of this, 62% were male, while 38% were female. Similarly, most of the participants were between 28 and 48 years old, approximately 69%. With regards to employment status, 55% were self-employed, while 40% were employed. Nevertheless, 35% of participants were working in the fishing industry, which operated small vessels. Additionally, the majority of the participants who responded to the questionnaire have been in the maritime industry between 5 and 15 years.

Maritime Risks

This objective examined the Maritime risks associated with small vessel operations in Kilifi County. The three sub-variables selected for the study enable an accurate analysis of the cause of maritime accidents, the severity and the coping mechanisms of the small vessel and their operators. Therefore, the study assessed maritime risks alongside hazard characteristics, vulnerability points, and small vessel capacity.

ISSN: 2312-0134
African Research Journal of Education and Social Sciences, 12 (1), 2025 | Website: www.arjess.org

Maritime Risks Hazard Characteristics

The common hazard characteristics outlined by IMO include collision, stranding or grounding, hull failure or water-tight doors, machinery damage, fire or explosion, and capsizing. All these pose different kinds of risks to small vessels. To clearly identify the hazard, Respondents were asked to rate the frequency of the hazard on a five-point Likert scale where 5 represented very often, 4 represented often, 3 represented neutral, 2 represented not often, and 1 represented never.

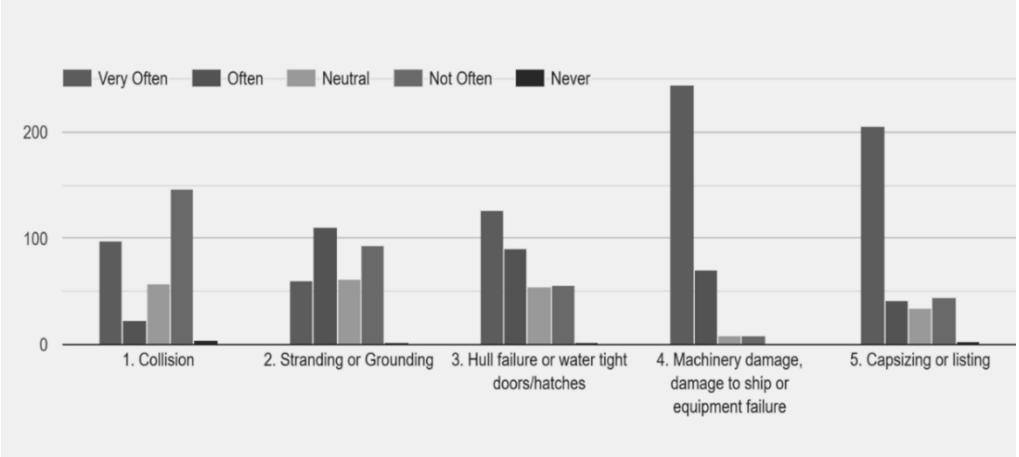

Figure 1: *Rating of Hazard characteristics*

Figure 1 shows that most of the study participants noted machinery damage, damage to ship or equipment failure as the key hazard contributing to maritime accidents in small vessels. Qualitative findings indicated machinery damage as a key hazard characteristic for example interviewee 1 noted that;

> …Most small boat operators maintain their boats to optimal standards to acquire annual licensing. However, once given, maintenance becomes a bit expensive for them, such as servicing engines and hull structures. This causes machinery problems at sea leading to accidents… (Interviewee 1, 2024)

Risk Vulnerability

The study sought to establish vulnerable points to further understand the severity of maritime risks associated with small vessel operations. In this study, respondents were asked to rate the common vulnerability areas associated with maritime accidents on a five-point Likert scale: five represents very high, four represents high, three represents neutral, two represents low, and one represents very low.

ISSN: 2312-0134
African Research Journal of Education and Social Sciences, 12 (1), 2025 | Website: www.arjess.org

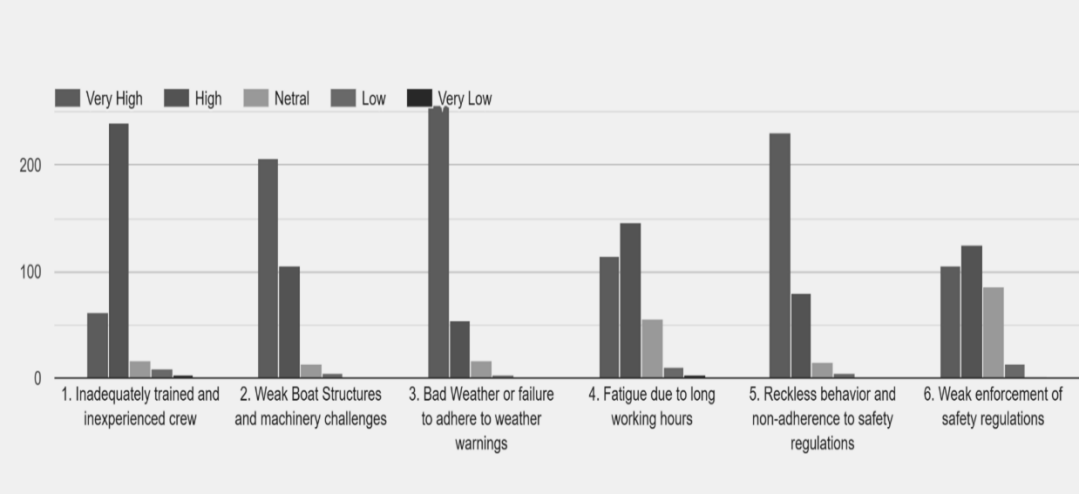

Figure 2: *Rating of vulnerability assessment*

Figure 2 indicates that Participants rated bad weather or failure to adhere to weather warnings, as the top vulnerability points contributing to maritime accidents of small vessel. Qualitatively bad weather or failure to adhere to weather warnings was also identified as a major vulnerability point. Interviewee 3 associated adverse weather as a vulnerability point where he opined that:

> "…Rough seas and strong winds are also a contributing factor. Weather warnings are usually given but not shared with the last fishermen or small vessel users. Some fishermen and small vessel users go to sea for extended periods and lack communication to shore. Once weather warnings are given, they may not receive them, leading to maritime accidents…" (Interviewee 3, 2024)

Small vessel Capacity Assessment

Small vessel capacity assessment refers to examining the ability to withstand identified maritime risks once they occur either institutional or infrastructural (UNDRR, 2017). The study explored small vessel capacity assessment to maritime risks by measuring various key sub-variable factors essential in every small vessel's operation to withstand the severity of maritime risk. These sub-variables are discussed in the sections below.

Pre-Sea Safety Checks by Small Vessels Operators

Small vessel operators and owners are responsible for conducting proper safety checks as per the maritime regulations before proceeding to sea. Safety checks include: checking whether all the safety equipment and supplies are available onboard as per the code list, physical confirmation of the small vessel being in good condition, especially the hull, and any mechanical verification, including fuel and associated lubricants. Other aspects include ensuring communication equipment works effectively (Maritime and Coast Agency, 2018).

ISSN: 2312-0134
African Research Journal of Education and Social Sciences, 12 (1), 2025 | Website: www.arjess.org

To understand whether small vessel operators conduct proper pre-sea safety checks, the study asked the respondents to rate the frequency of performing safety checks by small vessel operators. The responses were rated on a five-point Likert scale where five represented Always, four represented often, three represented sometimes, two represented rarely, and one represented Never.

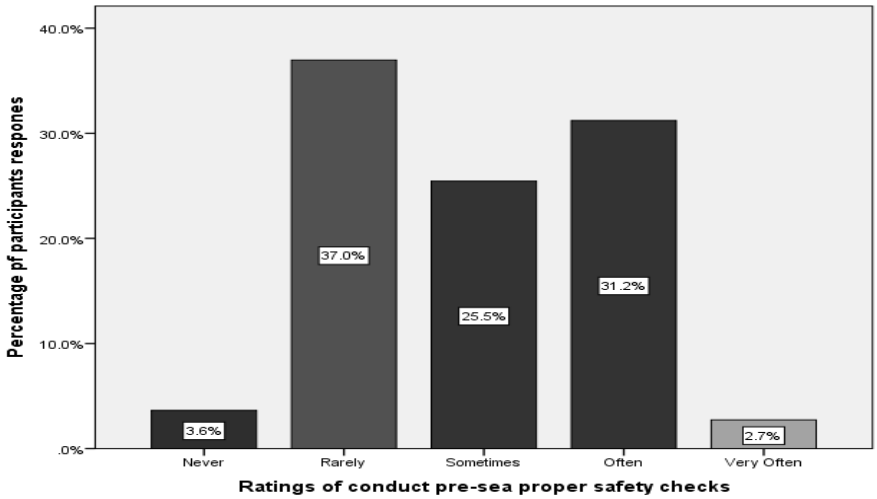

Figure 3: *Rating of conduct of pre-sea proper safety checks*

Figure 3 indicates that only 2.7% of small vessel operators conduct pre-sea checks before proceeding to sea, while the remaining 97.3% range from not performing pre-sea checks at all to often conducting Pre-sea checks. Such findings show that most of the participants are aware that small vessel operators and owners do not conduct proper safety checks as per the maritime regulations before proceeding to sea, which may render them more prone to maritime accidents.

Training and certification by small vessels' operators

Usually, small vessel operators are expected to have trained and obtained certification in basic sea survival courses, basic first aid, and small boat operator courses (KMA, 2012). Therefore, the study sought to ascertain whether small vessel operators have been trained, certified and have relevant skills in maritime safety. Respondents were required to indicate their level of agreement using a five-point Likert scale where five represented strongly agree, four represented agree, three represented indifferent, two represented disagree, and one represented strongly disagree.

ISSN: 2312-0134
African Research Journal of Education and Social Sciences, 12 (1), 2025 | Website: www.arjess.org

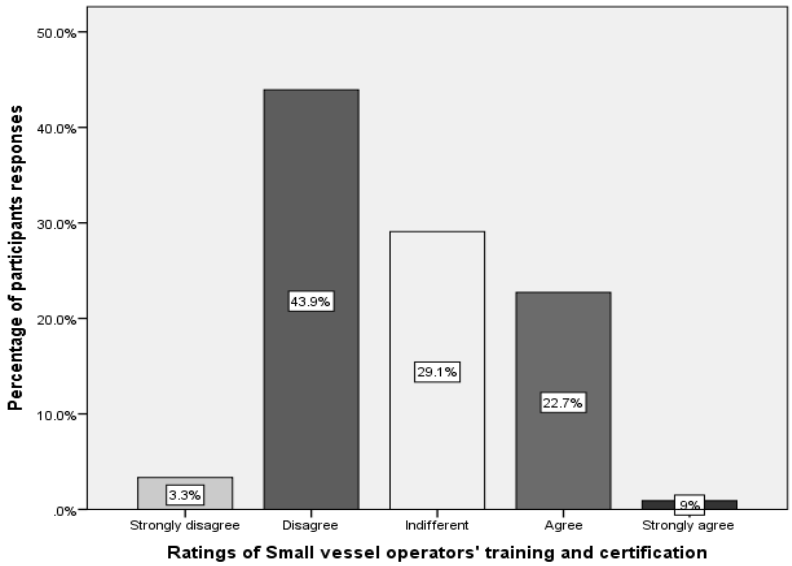

Figure 4: *Rating of small vessel operators' training and certification*

Figure 4 indicates that most participants disagreed and strongly disagreed that small vessel operators have undergone adequate training and certification on maritime regulations and practices (47.2%). One of the reasons given why they do not have adequate certification is that it is costly to get certified. In contrast, others claimed they have ancestral first-hand experience and hence can operate at sea and may not require certification or training. Qualitatively, varied responses were given. interviewee 4 opined that:

> …Poorly trained operators on safety in small vessel operations lead to maritime accidents. The small vessel operators have not acquired optimum certification and normally rely on experience gained over time, which may not be adequate, leading to high casualties and fatalities… (Interviewee 4,2024)

DISCUSSION

Maritime risks

Maritime risks in this study are the identification of hazards to small vessel safety, the vulnerability points of these vessels and the capacity that the small vessel have to withstand the hazards. These are discussed below:

ISSN: 2312-0134
African Research Journal of Education and Social Sciences, 12 (1), 2025 | Website: www.arjess.org

Maritime Risks Hazard Characteristics

Machinery damage, being a key hazard characteristic in small vessel safety means that a small vessel can suddenly lose propulsion, steering capability, or stability, leading to maritime accidents through scenarios such as collisions, groundings, or even capsizing, mainly because small vessels typically have less redundancy and fewer backup systems compared to larger ships (Australian Maritime Authority, 2023).

According to report by Allianz Commercial (2024) on recent safety review noted that machinery damage accounts for a significant percentage of maritime incidents globally which aligns to the findings of the study. As a key hazard characteristic, Small vessel operators must continuously have robust maintenance systems, conduct regular machinery inspections as well as have top tier machinery operator training to mitigate and prevent such failures and enhance overall vessel safety.

Risk Vulnerability Assessment

Bad weather or failure to adhere to weather warnings by small vessel operators has been identified as a key vulnerable point to safety risk. Small vessels are inherently less stable and more susceptible to rapid changes in sea conditions and, therefore, limited safety margins. When small vessel operators ignore or underestimate weather warnings, they expose themselves, their passengers, and their vessels to conditions that can quickly overwhelm them. According to lksa (2024) on weather conditions at sea, noted that weather is dynamic and ever-changing. During these events, vessel operators and seafarers are exposed to risks that can result in serious injury and even death.

Small vessel owners and operators in Kilifi County are encouraged to adjust plans or seek shelter when advised of bad weather so that they do not expose themselves and their passengers to conditions that can quickly escalate to maritime accidents, which can be life-threatening. Consistent monitoring of weather forecasts and strict adherence to advisories are essential steps in mitigating these risks and enhancing small vessel safety.

Small Vessel Capacity Assessment

Small vessel capacity in this research is defined as measures which are employed by the small vessel stakeholders to cab maritime accidents. Some of those identified in this study are discussed below:

Pre-Sea Safety Checks by Small Vessel Operators

Pre-sea checks are a requirement by small vessel operator to enhance their safety. It serves as a final opportunity to assess and ascertain the vessel's operational requirements before proceeding out to sea. A thorough pre-sea check is a procedure that enforces a safety culture and provides the

ISSN: 2312-0134
African Research Journal of Education and Social Sciences, 12 (1), 2025 | Website: www.arjess.org

crew with a structured process to follow, which helps ensure that everyone is aware of their roles and the procedures to follow in upholding vessel safety, thereby reducing the risk of an emergency.

Huntington et al. (2020), in their study of the Bering Strait, insisted in their article on the need for preparedness. One of the preparation modalities is to conduct proper safety checks beyond what is required by law since shipping in the Bering Strait (the Gateway to the Arctic) is considered a dangerous adventure prone to marine accidents (Huntington et al., 2020). Though study findings indicate that a mere 2.7% conduct Pre-sea safety checks very often, small vessel operators in Kilifi County must be encouraged to prepare adequately before proceeding to sea. The study findings, therefore, align with Huntington et al. (2020) on the importance of conducting proper safety checks per maritime regulations.

Training and certification by small vessels' operators

One key STCW Convention provision requires Parties to provide information to allow checks on the validity and authenticity of seafarers' certificates of competency. This is important as seafarers holding fraudulent certificates of competency are a clear danger to themselves, others on board and the marine environment (IMO, 2019). Inadequate training of small vessel operators on safety regulation measures makes the small vessels vulnerable to accidents, leading to fatalities. Such findings are in coherence with IMO (2019) in which most small vessel operators in Kilifi have inadequate training on safety regulation practices, thereby increasing the risks of maritime accidents.

CONCLUSION

In Kenya, small vessel operations contribute to significant income as well as employment opportunities for most Kenyans living in the coastal regions. However, with the recent increase in maritime accidents associated with small vessel operations, has dented the gains achieved over the years. Understanding of maritime risk profile in terms of the hazard characteristics, the vulnerability assessment and the small vessel safety capacity is essential to identify strategies that can inform policy hence enhancing small vessel safety in Kilifi County.

In order to reduce the number of maritime accidents, there is a need for solutions to hazard characteristics, vulnerable points, safety capacity. The study indicated that severe weather conditions at sea are a Key Vulnerability point in maritime accidents. It, therefore, recommended that the Kilifi County government, under the directorate of Blue economy, in collaboration with BMUs, erect standard Billboards with daily meteorological and weather updates received from RMRCC and KMD on all landing sites. This is vital for all seafarers and small vessel operators to be able to read before proceeding out to sea. The local community should also be sensitized to its effective use. Peg-in and peg-out boards should also be placed under each BMU where small vessel operators peg in before going out to sea and peg out when back to enable quick accountability of small vessels at sea in case of an emergency at sea. In terms of small vessel safety capacity, Enforcement agencies mainly KMA and KCGS should also conduct periodic sensitization programs and training to encourage sea worthy vessels at sea and proper conduct of pre-sea checks which ultimately inculcate safety culture among small vessel operators. These agencies should

ISSN: 2312-0134
African Research Journal of Education and Social Sciences, 12 (1), 2025 | Website: www.arjess.org

also be properly resourced to ensure they maintain presence at sea to ensure maritime regulations related to sea worthiness and certification of small vessel operators are adhered to.

ABOUT AUTHOR

Brian Lekarie Twalah is a student pursuing Masters of Arts in Crisis Response and Disaster Management at National Defence University- Kenya. The academic paper presented here is an extract of the first objective of his master's thesis titled "Maritime Risk Mitigation Measures and Small Vessel Safety

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