An Analysis of the Influence of Fisher-Folks' Perceptions on Uptake of Impact-Based Forecasting Weather Information for Adaptation to Nocturnal Storms

Owuor John Ochieng[1]*, Michael Omondi Owiso[2], Dominic Kniventon[3], Barack Omondi Calvince[4]
[1]*Department of Development studies, Maseno University, P. O. Box 333-40100 Maseno, Kenya
[2]Department of Political Science and International Relations and Diplomacy, Maseno University, P. O. Box 333-40100 Maseno, Kenya
[3]Climate Science and Society School of Global Studies, University of Sussex
[4]Department of Political Science and International Relations and Diplomacy, Maseno University, P. O. Box 333-40100 Maseno, Kenya
DOI: https://dx.doi.org/10.47772/IJRISS.2023.701112
Received: 15 September 2023; Revised: 11 October 2023; Accepted: 16 October 2023; Published: 10 November 2023

ABSTRACT

One key hindrance to successful adaptation to climate change in poor-low-resourced regions is the continued use of traditional weather prediction methods. To change this story and enhance adaptation in the fisheries dependent villages of Suba-North sub-County in Kenya, The High Impact Weather Lake System (HIGHWAY) project was initiated in 2017 and launched an early warning system called impact-based weather forecasting. Nonetheless, academically sound analyses remain dearth particularly as regards the extent to which current perceptions are pro-or-against uptake of IBF. In the face of continued death toll – 1500 to 5000 casualties annually – due to high incidences of storms, this study, focusing on six beaches where the HIGHWAY WISER Project was implemented, undertook an analysis of the influence of fisherfolks' perception on IBF on the innovation's uptake. Four perception variables, awareness, accuracy, relevance, probabilistic dimensions, and spatial/geographic coverage of IBF, were examined. Data was gathered from 412 fisherfolk through semi-structured questionnaires, supplemented by interviews with 30 key informants among policy makers and beach management unit leaders, and further enriched by six Focus Group Discussions with fisherfolk. While the study revealed that 73% of respondents were aware of IBF's existence, 75% perceived it as accurate, very accurate, or extremely accurate, these varied with category of fisherfolk, type of boat owned, gender of fisherfolk, and type of fishing undertaken. Even more strikingly, knowledge gaps persisted, particularly concerning the probability and spatial-temporal specificity dimensions of IBF. Study revealed more need for intentional multi-sectorial, and fisher-folk targeted interventions in dissemination of storms and other related extreme weather event information. Traditionalism remains a key hindrance but change is a process and with sustained interventions, the story will change for the better. Sustained efforts in awareness raising and training, emphasizing the importance of tailoring weather forecasts to the specific needs of vulnerable fisherfolk populations. Ultimately, the HIGHWAY project represents a promising step towards mitigating the perils posed by Lake Victoria's treacherous weather conditions.

INTRODUCTION

There is a growing recognition of the risk and opportunities that extreme weather events present, the uptake of scientific weather information in decision making, policy and planning is becoming crucial in adaptation, mitigation and disaster risk reduction. Scientific weather information services are anticipated to have important societal benefits manifesting at the individual and community levels such as increased awareness of extreme weather impacts, better decisions, improved safety, and reduction of damages in extreme weather events vulnerable economic sector (Daron et al.,2022; Findlater et al., 2021). As result governments and international weather-related entities are investing in weather services development and supporting

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS |Volume VII Issue X October 2023

infrastructures to foster climate change adaptation. There is a general concern in both literature and practice that the uptake of scientific weather services has not matched the expectation among user groups (Parrels et al., 2020). This has led to a shift from weather service that are scientific driven to services that are user driven and informed by science (European Commission, 2015; Larosa and Mysiak, 2019). In this regard, practices such as co-production and tailoring weather services to user context are suggested to increase the uptake of weather services (see Lemos et al., 2012, Lorenz et al, 2015). In the fisheries sector, extreme weather events manifest as a decline in fishing yields, damage to fishing equipment, and tragic loss of lives during extreme weather occurrences on Lake Victoria. However, various perceptions that exist around what makes weather information usable (see Lemos et al. 2012). Systematic exploration on the influence of users' perceptions on scientific weather services and its uptake is limited among fisher folk.

To elevate awareness levels among fisherfolk regarding IBF and foster a more constructive pro-climate science perspective, the High Impact Weather Lake System (HIGHWAY) project was launched in 2017. This initiative sought to address the formidable challenges posed by Lake Victoria, situated in East Africa, notorious for its high incidence of fatal storms leading to an annual casualty count ranging from 1500 to 5000 (Roberts et al., 2022). Recognizing the inadequacy of generalized weather forecasts to meet the specific needs of the local fishing communities, whose safety and livelihoods depend on Lake Victoria's conditions, the HIGHWAY project was conceived to revolutionize weather forecasting through the implementation of Impact-Based Forecasting (IBF).

Fussell and Klein (2006) emphasize that adaptation strategies to climate change necessitate interventions beyond the mere provision of climate information. These strategies encompass raising awareness and building capacity among affected communities. Users' perceptions of climate information, encompassing its salience, credibility, and legitimacy, are pivotal factors influencing its uptake (Cash et al., 2003; Lindsey et al., 2017). Salience pertains to the relevance of the information to users' specific requirements, credibility reflects the reliability of the information, and legitimacy signifies users' trust in the information provider. Furthermore, users' perceptions of the benefits derived from climate information can significantly influence its adoption (Dilling & Lemos, 2011). Notably, the uptake of IBF for storm adaptation hinges on fisherfolk's perceptions of its reliability and impact on their production systems (Lindsey et al., 2017). The accuracy, credibility, and trustworthiness of IBF are pivotal factors motivating individuals to take action (Cash et al., 2003; Lindsey et al., 2017). A nuanced understanding of user groups' perceptions of IBF can facilitate the identification of opportunities and constraints across diverse attributes, such as gender and socioeconomic status (Carr et al., 2016). Furthermore, knowledge of user perceptions aids in deciphering the drivers and barriers to IBF adoption and uptake (Nkiaka et al., 2019; Carr et al., 2020), thereby bridging users' needs and activities with IBF.

Nonetheless, it is important to note that knowledge of user perceptions may not invariably lead to IBF uptake in the presence of other constraints (Rasmussen et al., 2017) such as pressing financial needs, lack of capacity to take decisions. Peacock et al. (2005) that public and scientific risk perceptions may differ due to social and cultural contexts, and research on risk perceptions can vary in terms of measurement. Despite the launch of IBF, there exists a dearth of literature on this subject, underscoring the need to explore how fisherfolk groups' perceptions of IBF influence its adoption along the Lake Victoria region. This study seeks to examine fisherfolk's perceptions of IBF to tailor IBF services to meet their decision-making needs, ultimately mitigating the impact of storms on lives and livelihoods around Lake Victoria.

MATERIALS AND METHODS

The choice of methods for this study, which examines the influence of fisherfolk's perception on the adoption of impact-based forecasting (IBF) for storm adaptation in Suba North Sub- County, Homa Bay County, Kenya, was carefully considered and is outlined below in an expanded narrative.

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS |Volume VII Issue X October 2023

Research Design

To comprehensively investigate the role of fisherfolk perception in the adoption of IBF for storm adaptation, this study employed a case study design. This approach was chosen because it allows for an in-depth exploration of the phenomenon within a specific context. The study used a mixed-methods approach, integrating both quantitative and qualitative data collection and analysis techniques. This combination was chosen to gain a holistic understanding of the influence of fisherfolk's perceptions on IBF adoption and its effectiveness in storm adaptation.

Area of Study

The study was conducted over a five-month period, from December 2022 to April 2023, in Suba North Sub-County, which is situated within Homa Bay County, Kenya. Homa Bay County is geographically located in South Western Kenya, bordering several other counties and Lake Victoria to the west. It covers a substantial area of 4,267.1 square kilometres, including a water surface area of 1,227 square kilometres. The area is characterized by a dominant fishing industry, engaging a significant population of over 200,000 people and contributing substantially to the local economy (HBCIDP, 2014).

The main types of fish harvested in the area include Nile perch, tilapia, and clarias (Omena). To manage fishing activities, there are 151 landing beaches in the county, overseen by 133 beach management units (BMUs). Suba North Sub- County was selected as the study site due to its participation in impact-based weather forecasting piloting by the Kenya Meteorological Department and Highway Project since 2017. Additionally, the area's extensive fishing activities and exposure to extreme weather events make it particularly relevant for studying fisher-folk's adaptation to storms (HBCIDP, 2014).

Sampling and Data Collection Methods

The study employed simple random sampling strategy to select six out of ten beaches in Suba North Sub-County where IBF had been piloted. According to data from the Lake Victoria Organization Regional Frame Survey Report (RFSR) in 2015, these sampled beaches had a total population of 5,760, with 422 individuals selected as the study sample.

To ensure representation across different levels of engagement in the fishing industry and varying levels of weather risk exposure, stratified sampling was used. Participants were categorized into groups such as boat owners, crew members, transporters, fishmongers, and auxiliary service providers. Proportionate stratified sampling was applied to determine the number of participants from each category, with percentages allocated based on the distribution of fisherfolk in each group.

The selection of participants for focus group discussions (FGDs) was guided by their knowledge of IBF. The research team, in collaboration with beach management units (BMUs), identified individuals with in-depth knowledge of the subject. Snowball sampling was then used to identify additional participants in each landing beach, considering factors such as their roles, experience, and gender. In total, six FGDs and 30 in-depth interviews were conducted, following the saturation principle, ensuring that data collection continued until no new insights emerged.

The study followed a sequential mixed-methods research design, starting with quantitative data collection through semi-structured questionnaires. The survey aimed to assess fisher-folk's perceptions of IBF in terms of its accuracy, credibility, legitimacy, and reliability. Additionally, secondary data were gathered through desktop and library reviews of existing literature. The questionnaire featured a combination of open and closed-ended questions to capture both factual information and respondents' opinions.

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS |Volume VII Issue X October 2023

Data Analysis

Quantitative data analysis began with the coding of open-ended questionnaire responses and the identification and removal of outliers. The Statistical Package for Social Sciences (SPSS) version 26 was used to conduct descriptive statistical analyses on the quantitative data. Qualitative data analysis encompassed inscription, description, and transcription processes. Content analysis was employed, with codes created to capture emerging themes and patterns that aligned with the constructs being investigated. The findings from both quantitative and qualitative data analyses were triangulated to provide a comprehensive and well-rounded understanding of the role of IBF within the context of the study. This approach allowed for a more nuanced exploration of fisher-folk's perceptions and their impact on the adoption of IBF for storm adaptation.

RESULTS

This study's objective explored the influence of fisher-folk's perceptions of impact-based forecast on its uptake in adaptation to storms in Lake Victoria, Suba North Subcounty. Extreme weather events have become significant issues for vital sectors in the context of climate change adaptation. In fisheries, particularly, the effects of extreme weather events are reflected in the decline of fishing yield, damage to fishing equipment, and loss of lives during extreme weather events on Lake Victoria. Very recent research (Roberts et al., 2022) worry that despite the significant loss of life caused by severe weather events, Lake Victoria Basin (LVB) has not yet implemented an effective advisory and warning system to protect the population that heavily relies on the lake for their livelihoods. It was upon the recognition of this critical gap, argues the scholars, that the World Meteorological Organization (WMO) initiated a 3.5-year project, known as the High Impact Weather Lake System (HIGHWAY). This ran from September 2017 to March 2021 (*Ibid*). The primary objective of this project was to enhance resilience and mitigate the loss of life and property damage in East Africa (EA) by promoting the increased utilization of impact-based weather information – information which shows to weather information consumers the magnitude of the dangers an impeding weather event would have to enable them make rational decisions as to whether they go to the Lake or postpone. The initiative was experimented with by Kenya Meteorology Department and Beach Management Units of respective landing sites, aimed at providing fisher folk with salient weather and climate services that are essential for informed and conscious decision-making. The weather forecasts communicated to fishing communities through WhatsApp are wind events, waves, visibility, rainfall events, and the condition of the sky.

Awareness of Impact-based Forecasting among Fisher-folk

The level of awareness among fisher-folk regarding impact-based forecasting (IBF) emerges as a crucial factor in understanding the adoption of this new technology. Previous studies have emphasized that the level of awareness plays a pivotal role in determining the uptake of various initiatives and technologies. For instance, when examining the uptake of the Kenya Youth Enterprise Development Fund (YEDF), Amenya, Onsongo, & Guyo (2010) highlighted that a significant challenge faced by the empowerment program was the lack of awareness among the target audience. Similarly, in the context of emerging technologies like Synthetic Biology, Kasera, Mburu & Owiso (2019) found that a majority of expert respondents noted that the actual beneficiaries of Synthetic Biology were largely unaware of related issues. Consequently, the government had to invest in targeted public education and awareness strategies to increase uptake and dispel associated myths and misconceptions.

Given that IBF is a relatively new technology that was piloted in Kenya from 2017 to 2021, the level of awareness among the target population is a critical determinant of its adoption. It is imperative to establish

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS |Volume VII Issue X October 2023

empirical evidence in Kenya to illustrate how awareness, or the lack thereof, interacts with the uptake of IBF. Such awareness serves an important purpose for policymakers, as it points to the needed investments to ensure IBF fulfils its aim of creating resilience and safety for fisher-folk and their livelihoods. As Fussell & Klein (2006) noted, adaptation strategies to climate change require interventions that go beyond the mere provision of climate information; they must also include awareness-raising and capacity-building efforts.

In the context of this study, it is noteworthy that the level of awareness regarding IBF among fisher-folk was well towards 73%, with only 27% indicating that they were unaware of its existence. This statistic suggests a growing awareness of IBF among fisher-folk, which is a promising trend. This increased awareness could serve as a valuable foundation for policymakers and stakeholders to build upon. It indicates that efforts to disseminate information about IBF have made substantial progress, but there is still room for improvement. Further analysis is required to understand the specific factors contributing to this increased awareness and how it relates to the adoption of IBF among fisher-folk.

Table 1: Showing fisher folk's levels of awareness of IBF

level of awareness	Frequency	percentage	cumulative percent
Yes	302	73	73
No	112	27	100

Source: Field data 2023

The study conducted a further investigation on the theme of awareness through in-depth interviews and focus group discussions. This exploration was considered crucial because awareness is often a significant determinant of the adoption and utilization of new technologies or practices. Drawing parallels with previous studies that highlighted the role of awareness in program uptake, the researchers aimed to shed light on how fisher-folk's awareness of IBF might influence their adaptation to storms, ultimately contributing to their safety and livelihood resilience.

Innovatively and informed by the low levels of literacy of study participants, the study employed a participatory method involving the use of 100 beans to estimate the level of IBF awareness in each landing site. The findings revealed a spectrum of awareness levels across the sites, providing valuable insights into the dynamics of IBF adoption. For instance, Remba Island exhibited an average estimation of 60% awareness. Fisher-folk here emphasized the importance of the Beach Management Unit (BMU) in raising weather flags and maintaining notice boards as key awareness tools. Despite facing challenges, these visual aids played a significant role in creating awareness.

In contrast, Ringiti Island demonstrated a slightly higher awareness level, estimated at 65%. Fishers on this island primarily relied on sources like radio, TV, and the internet for weather information. Kiumba, a smaller landing site, recorded an impressive 81% awareness level, attributed to the widespread ownership of radios and TVs within the community. Tabla and Koguna also exhibited high levels of awareness, estimated at 70% and 80%, respectively. These sites benefited from training and sensitization efforts by BMUs and the Highway team, along with the effective use of flags and notice boards for awareness campaigns. However, Lwanda Nyamasare lagged slightly behind with an estimated awareness level of 63%, as fisher-folk here continued to rely on traditional weather forecasting methods.

The key informant interviews delved deeper into the factors contributing to varying awareness levels. Respondents highlighted the pivotal roles of weather signals and BMU leadership. Additionally, increased training efforts in specific landing sites, such as Kiumba, Koguna, and Lwanda Nyasare, were found to enhance awareness. The study emphasized that fisher-folk in Suba North were not only aware of weather

information provided by the Kenya Meteorological Department (KMD) but also recognized the importance of parameters like wind direction and speed, visibility, rainfall intensity, and sunshine. However, an essential challenge emerged regarding the condition of weather flags, which were often in poor shape or non-existent at many landing sites, except for Kiumba, Lwanda Nyamasare, and Koguna beaches.

Overall, the discussions with key informants and FGD participants highlighted a collective awareness among fisher-folk regarding the high risks posed by storms, including loss of life, boat destruction, and the loss of fishing equipment. This is consistent with findings of (Dubois et al, 2013; Nkiaka et al., 2019; Damm et al., 2022) which highlighted the user group awareness of weather risk contributing to uptake of weather services in adaptation. The study underscored the importance of effective communication of KMD forecasts and the need for further training to help fisher-folk interpret and utilize these forecasts. Sensitizing BMUs on the localization and communication of KMD forecasts was seen as crucial for the benefit of all community members (see Nkiaka et al., 2019). In summary, the study's comprehensive examination of IBF awareness levels across different landing sites in Suba North provided nuanced insights into the complex relationship between awareness and adaptation to storms among fisher-folk. The findings underscored the significance of tailored awareness campaigns and training initiatives to enhance the adoption of IBF and, consequently, the safety and resilience of fisher-folk in the face of extreme weather events.

Fisher-folk's Perceptions of Level Accuracy of Impact-Based Forecasting

The study delved into the critical aspect of the accuracy of Impact-based Forecasting (IBF) from the perspective of fisher-folk, recognizing that for these communities, perception on accuracy holds significant implications for their safety and decision-making as it helps them decide to use traditional or modern method. The accuracy of weather forecasting, as Oloo (2019) points out, is often evaluated based on two key dimensions: geographical coverage and the time gap between the predicted occurrence and the actual incidence of weather events.

During Key Informant Interviews (KIIs) and Focus Group Discussions (FGDs), the study sought to explore how fisher-folk perceive the accuracy of IBF in terms of these dimensions. An intriguing finding emerged – fisher-folk did not necessarily grasp the intricacies of geographical coverage and time in assessing the accuracy of IBF. This is in tandem with the findings of (Bruno, Soares & Dessai 2016) which noted poor communication and user group lack of understanding weather information and lack of downscaling weather services as key challenges hindering the uptake of weather services. Fisher folk evaluation seemed to be more localized and immediate. For many fisher-folk, if they did not directly witness a storm incidence at their specific beach location, it did not significantly matter to them whether the prediction covered a slightly distant location where the storm actually occurred. This perspective indicated a gap in their understanding of the broader spatial and temporal context in which IBF operates. Consequently, their assessments of accuracy appeared to lack a well-informed basis.

However, it's crucial to recognize the potential influence of fisher-folk's perceptions of IBF accuracy on its uptake for storm adaptation. As highlighted by Kijazi et al., (2018), these perceptions may vary among fisher-folk based on factors such as landing sites, gender, age, years of fishing experience, boat sizes used, and the specific roles or categories within the fishing community. To provide a quantitative snapshot of fisher-folk's perceptions of IBF accuracy, the study presented a frequency table. This table likely reveals variations in how different groups within the fisher-folk community rate the accuracy of IBF predictions. Such variations may have implications for the acceptance and utilization of IBF as an effective tool for storm adaptation among these communities.

In essence, the study's findings underscore the need for targeted educational and awareness efforts to enhance fisher-folk's understanding of the geographical and temporal aspects of IBF accuracy. Bridging this knowledge gap could lead to more informed perceptions and, in turn, greater trust in IBF as a valuable resource for enhancing the safety and resilience of fisher-folk in the face of unpredictable weather events.

This information in summed below.

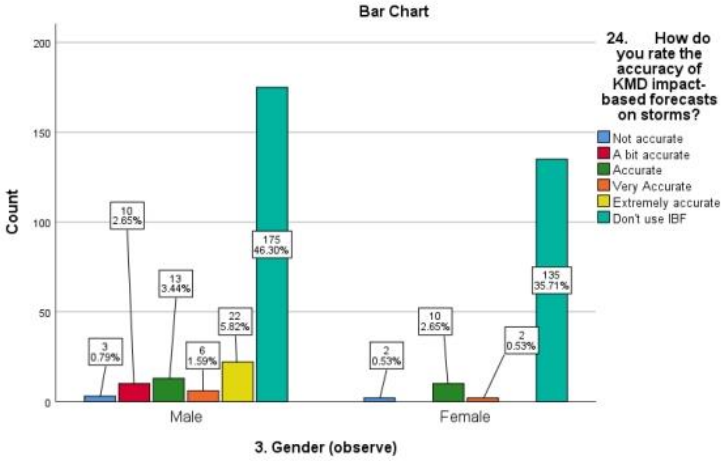
Table 2: Showing how fisher folk rate the accuracy of impact-based forecasts on storms

	Frequency	Percent	Cumulative Percent
Not accurate	5	1.3	1.3
A bit accurate	10	2.6	4
Accurate	23	6.1	10.1
Very Accurate	8	2.1	12.2
Extremely accurate	22	5.8	18
Don't use IBF	310	82	100
Total	378	100	

Source: Field data 2023

The frequency table 2 provides a clear picture of fisher-folk's utilization of Impact-based Forecasting (IBF) and their corresponding perceptions of its accuracy. Among the fisher-folk surveyed, a substantial majority, amounting to 82%, reported that they did not use IBF as a tool for weather prediction and storm adaptation. In contrast, 18% of the respondents indicated that they did utilize IBF in some capacity. Within the group of fisher-folk who employed IBF (18%), a breakdown of their perceptions regarding its accuracy was observed. Among this subset, approximately 5.8% perceived IBF to be extremely accurate, indicating a high level of trust in its predictions. Another 2.1% considered IBF to be very accurate, while 6.1% rated it as simply accurate. A smaller proportion, about 2.6%, viewed IBF as somewhat accurate, suggesting a moderate level of confidence, and 1.3% found it to be not accurate. It's particularly noteworthy that within the group of fisher-folk who employed IBF, approximately 14% perceived it to be accurate and above. This observation suggests that a significant portion of those who chose to utilize IBF did so because they perceived it as a reliable and effective tool for weather prediction and storm adaptation. To further explore potential variations in perceptions, the study conducted a cross-tabulation by gender, as indicated in the accompanying bar chart. This analysis could shed light on whether gender plays a role in how fisher-folk perceive the accuracy of IBF. Such insights are valuable for understanding the factors that influence the adoption and trust in IBF within this specific community. The data from the frequency table and the subsequent analysis provide a nuanced understanding of fisher-folk's utilization and perceptions of IBF. It highlights the importance of perceived accuracy as a determinant of IBF adoption and suggests that a notable proportion of users find it to be a reliable tool for weather forecasting and storm adaptation. These findings are consistent with the McNie, (2007) and Kijazi et al (2018) who singled out user group perceptions of IBF as accurate is one key determinants to its adoption among farmers.

Figure 1: Fisher-folk Rating of Impact-Based Forecasting accuracy by Gender



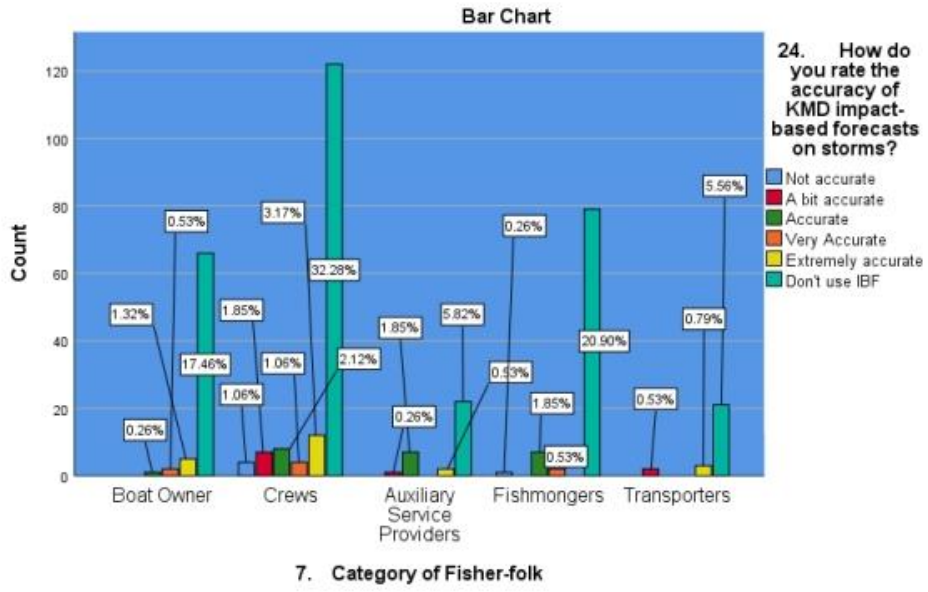
Source: Field data 2023

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS |Volume VII Issue X October 2023

The study's examination of IBF usage and perceptions revealed intriguing gender-based differences. Among the surveyed fisher-folk, 46.3% of men and 35.7% of women reported that they didn't integrate IBF into their fishing practices. Within the 18% of fisher-folk who did use IBF, distinct gender variations in their perceptions of its accuracy emerged. Among male IBF users, 5.8% found IBF extremely accurate, 1.6% very accurate, and 3.4% accurate, while 2.7% considered it somewhat accurate, and 0.8% found it not accurate. In contrast, female IBF users had a different perspective with 0.5%perceiving it as very accurate and 0.5% as somewhat accurate. The high proportion of male users (10.8%) perceiving it as accurate, very accurate or extremely accurate suggest that gender plays a role in how fisher folk perceive IBF's accuracy, potentially contributing to its high uptake among men. This finding is in tandem with Muema et al., (2018) who found that perceptions of weather information accuracy varied across gender among farmers in Makweni County.

Furthermore, the study explored the views of KMD policymakers responsible for IBF on its accuracy. Surprisingly, their assessment of IBF's accuracy, averaging at 70%, significantly differed from the perceptions of fisher-folk who use IBF. This disparity underscores the need to bridge the gap between information providers and users, possibly stemming from variations in the understanding of geographical and time-related factors in IBF predictions. Beyond gender, the study also delved into the accuracy perceptions of IBF across various categories of fisher-folk in Suba-North, including fishing crews and auxiliary service providers. These findings provide valuable insights for tailoring future programs to specific groups and improving the effectiveness of IBF dissemination.

Figure 2: Fisher folk's Rating of IBF Accuracy by Category of fisher-folk



Source: Field Data 2023

Among the 18% of fisher-folk who utilized IBF, a detailed breakdown reveals varying perceptions of accuracy within different roles. Specifically, within the subset of boat owners, constituting 2.1% of IBF users, 1.3% regarded IBF as extremely accurate, 0.5% as very accurate, and 0.3% as accurate. On the other hand, among the crews who relied on IBF, a notable 6.4% perceived IBF to be extremely accurate, very accurate, or accurate, while only 3% considered IBF to be somewhat accurate or not accurate. This highlights that a significant proportion of fishing crews found IBF to be accurate, which potentially contributes to its adoption among fisher-folk. One respondent's assertion further underscores the significance of this perception in influencing IBF uptake within the fisher community. A woman participant succinctly summed this notion, thus:

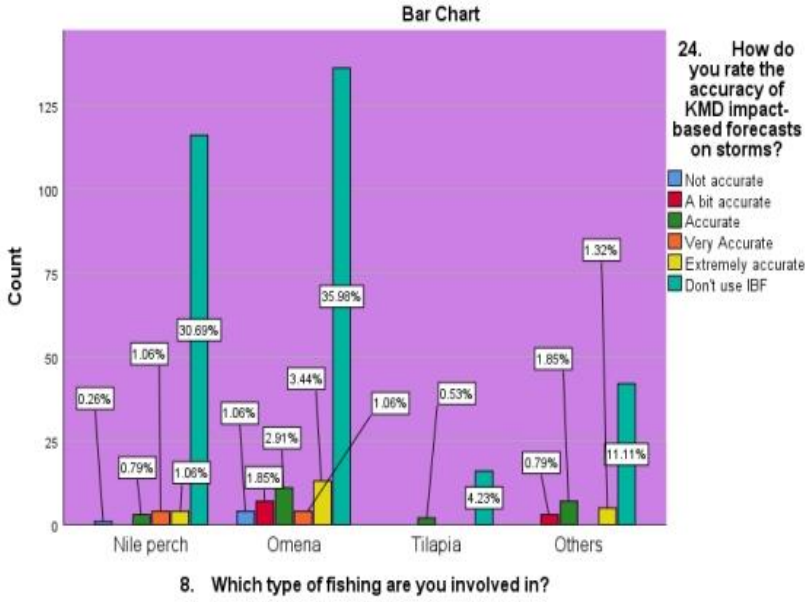
ISSN No. 2454-6186 | DOI: 10.47772/IJRISS |Volume VII Issue X October 2023

"…*Us women we generally operate out of the Lake, buying and selling fish, and may not feel the sense of not knowing the accuracy of IBF at all compared to men who go fishing.*" (FGD at Kiumba Beach March, 2023).

In the context of auxiliary service providers and fishmongers who were IBF users, a comparative analysis indicates that 2.4% in each category perceived the forecasts as extremely accurate (0.53%) and accurate (1.85%), with only 0.3% considering them somewhat accurate. For transporters, 0.8% saw IBF as extremely accurate, while 0.5% considered it somewhat accurate. These variations in perceptions, while not uniform, still demonstrate a notable proportion of respondents perceiving IBF as accurate or extremely accurate, which is promising for IBF adoption. This is consistent with findings of Orlove, Broad & Petty (2014) the users perception of weather forecasts as accurate increase the uptake of scientific weather information.

Furthermore, the study delved into the accuracy rating based on the type of fishing activities engaged in by fisher-folk. Among the 18% of fisher-folk using IBF, those involved in Nile perch fishing had 3% who perceived IBF as extremely accurate (1.06%), very accurate (1.06%), and accurate (0.79%), with only 0.26% finding it somewhat accurate. In contrast, Omena fishers displayed a higher percentage, with 7.4% considering IBF as extremely accurate (3.44%), very accurate (1.06%), and accurate (2.91%), while 1.85% perceived it as somewhat accurate, and 1.06% as not accurate. Lastly, only 0.5% of Tilapia fishers perceived IBF as accurate. These findings showcase varying levels of perceived accuracy based on the type of fishing, with Omena fishers expressing higher confidence in IBF's accuracy compared to other fishing categories.

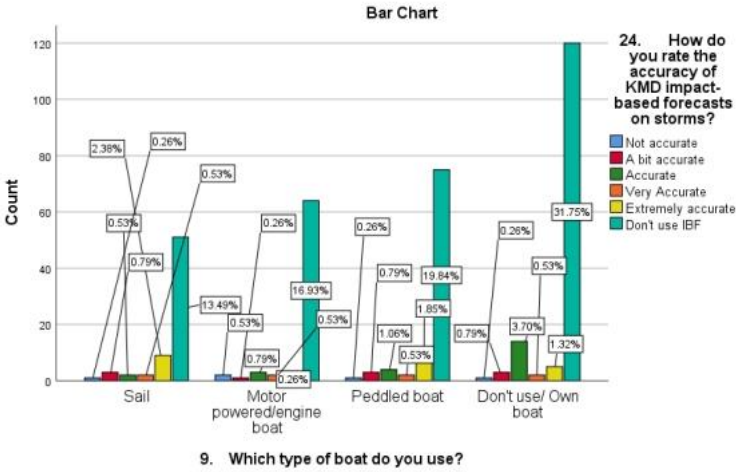
Figure 3: Fisher folk's Rating of IBF Accuracy by Category



Source: Field data

The study also investigated the relationship between the source of energy used to propel boats and the perceived accuracy of IBF. This exploration is crucial because the choice of energy source may influence fisher-folk's perceptions and adoption of IBF, as each source carries different levels of risk. For instance, those using traditionally wind-propelled boats, whether sailors or owners, might view IBF differently, given their dependency on nature for survival. They may exercise more caution in relying on IBF predictions compared to fisher-folk with larger engine-powered boats. The study identified three primary sources of energy used for boat propulsion: engines, sails, and paddles.

Figure 4: Respondents Rating of Impact-based forecasting Accuracy by type of Boat



Source: Field Data 2023

The study's findings regarding fisher-folk's (by type of boat) perceptions of IBF accuracy shed light on the factors that could influence their adoption of weather information. The survey results revealed that 2.4% of sailboat users perceived IBF accuracy as extremely accurate, with 0.5% considering it very accurate, 0.8% as a bit accurate, and 0.3% not accurate. Sailboats heavily rely on wind speed and direction for navigation, which might explain the higher interest in IBF among this group. Among the users of paddle-powered boats, 1.9% perceived IBF as extremely accurate, 0.5% as very accurate, 0.8% as accurate, and 0.3% as a bit accurate or not accurate. For those using engine-powered boats, 0.5% considered IBF very accurate, 0.8% as accurate, and 0.3% as a bit accurate or not accurate. These variations in perceptions indicate that the size and energy source of boats may influence fisher-folk's interest in IBF, with smaller boats showing greater interest.

Paddlers and sailors, who rely on wind for their fishing expeditions, expressed concerns about their safety during strong storms. They emphasized the need for extra caution because their small boats could be easily destroyed putting their lives at risk. These sentiments highlighted the potential impact of weather forecasts on the safety and decision making of fisher folk.

Key informant interviews further corroborated the survey findings. Participants who believed IBF was "not at all accurate" often cited limited access to weather information as a reason. Those who perceived forecasts as a bit accurate mentioned that forecasts sometimes succeeded and sometimes failed, leading to their mixed views. Some participants with a positive or moderate perception of forecast accuracy understood the probabilistic nature of forecasts, while others were just beginning to grasp scientific forecasting concepts. A few participants expressed trust in KMD forecasts, citing reduced risks and deaths on the lake as evidence of their reliability. Those who viewed KMD forecasts as extremely accurate believed that the events predicted often occurred as expected with some acknowledging the probabilistic nature of forecasts.

Interestingly, the perceptions of IBF accuracy among purposively recruited participants in Remba Island differed from the survey results. They considered IBF very accurate, stating that most IBF forecasts tended to be accurate. However, this perspective was inconsistent with the low usage of IBF in the same area, suggesting a gap between perception and behavior. In Ringiti and Tabla, participants noted that IBF was accurate because its predictions sometimes aligned with reality. They recognized the geographical and probabilistic nature of IBF, which was a unique and valuable observation. Similarly, in Kiumba, Koguna, and Lwanda Nyamasare, participants reported very accurate weather predictions, aligning with the producers' view that impact-based forecasts were 70% accurate. However, this perspective did not fully reflect the majority of users' perceptions across Suba North sub-county. Overall, the fisher-folk's

perceptions of IBF accuracy are multifaceted and can be influenced by factors such as boat size, energy source, and understanding of forecasting concepts. These perceptions may have implications for the adoption and utilization of weather information among fisher-folk in the study area.

Fisher-folks' perceptions of relevance of Impact-based forecasting to their needs

The relevance of Impact-based Forecasting (IBF) to fisher-folk communities is a critical aspect of ensuring the effectiveness of weather information dissemination. This relevance is influenced by various factors, as noted by Goddard et al. (2010) and elaborated upon in this study. The table 3 below shows the fisher-folks perceptions on relevance of the IBF to their needs for adaptation to storms.

Table 3: Showing fisher folk perception of relevance of Impact-based forecasting to their needs

Responses	Frequency	Percent	Cumulative Percent
Not relevant	3	0.8	0.8
A bit relevant	25	6.6	7.4
Relevant	9	2.4	9.8
Very relevant	15	4	13.8
Extremely relevant	16	4.2	18
Don't use IBF	310	82	100
	378	100	

Source: Field Data 2023

Among the fisher-folk who had been using Impact-based Forecasting (IBF), 4.2% perceived it as extremely relevant, 4% as very relevant, and 2.4% as relevant for their decision-making needs, highlighting the importance of perceived relevance in the adoption of IBF for storm adaptation. Participants noted that the storm information provided by IBF, such as wave height, wind speed, and direction, was pertinent to their decision-making processes. For instance, in Remba Island, the color-coded flag and notice board were used to convey critical storm information, but their limited accessibility across the vast landing sites posed challenges. In contrast, in Ringiti Island, the utility of IBF was compromised due to its perceived inferiority compared to traditional observational techniques, and the wide radio coverage made it challenging to relate the weather information to local occurrences. Fisher-folk's perceptions of IBF's relevance are pivotal in determining its effectiveness in aiding their storm adaptation strategies.

In-depth interviews revealed further nuances about the dynamics of relevance. One key factor is the lack of spatial-temporal and element specificity in weather information. Traditional seasonal total forecasts often provide data for broad geographical areas, making it challenging for fisher-folk to obtain information tailored to their specific locations and operational timelines (Onyango, 2021). Fisher-folk require localized and detailed weather forecasts to make informed decisions regarding their fishing activities.

Effective communication plays a pivotal role in bridging the gap between weather information providers and users. The timing of information dissemination, the content shared, the language used, and the phrasing employed all influence users' ability to understand and act upon the information (Muita et a., 2021; Sivle et al., 2022; Owuor et al., 2023). Late-night information releases and limited access to communication tools like WhatsApp can hinder the effectiveness of IBF. Ensuring that weather information is communicated in a manner that aligns with daily routines and preferences of fisher folk is essential for enhancing its relevance.

The means of delivering weather information also impacts its relevance to fisher-folk. While traditional

channels such as radio and television have been used for information dissemination, modern digital platforms offer more accessible and convenient options (Sivle et al., 2022; Owuor et al., 2023). Access to these platforms can significantly improve the reach and relevance of IBF to fisher-folk. Providing weather updates through channels that cater to their lifestyles and accessibility is essential for enhancing the utility of weather information. Gender sensitivity is another crucial aspect of weather information relevance.Fisher-folk communities comprise both men and women, each with distinct roles and needs related to weather information (Owuor et al., 2023). Excluding or neglecting the concerns of women in climate information discussions can lead to information gaps and reduced effectiveness. Recognizing that climate change and storms impact individuals of all genders is vital for providing inclusive and relevant weather information.

Overall, enhancing the relevance of IBF to fisher-folk communities necessitates addressing these multifaceted challenges. Tailoring weather information to local contexts, improving communication strategies, leveraging modern communication tools, and adopting a gender-sensitive approach are all essential steps. By doing so, IBF can better serve the needs of fisher-folk and contribute to their resilience in the face of weather-related challenges (Owuor et al., 2023).

Fisher-folk understanding of probabilistic nature of Impact-Based Forecasts

Understanding the probabilistic nature of Impact-Based Forecasts (IBF) is a crucial aspect of how fisher-folk perceive and utilize this weather information (Sivle et al. 2022, Hansen et al., 2019, Bruno, Soares and Dessai, 2015; Goddard et al. 2010). As highlighted by Oloo (2019), when fisher-folk comprehend that IBF provides forecasts with a degree of likelihood rather than absolute certainty, it can lead to a shift in their mindset towards embracing this emerging technology more effectively. This understanding encourages them to use IBF more appropriately and without discouragement when predictions do not align precisely with actual weather event. According to the frequency table 4 presented below, a significant portion of fisher-folk using IBF, about 9.5% out of the total 18%, indicated that they understood that weather forecasts, including IBF, are probabilistic in nature. Conversely, 8.5% answered negatively, implying that they perceived IBF as deterministic, which could potentially erode trust in IBF and hinder its effective utilization.

The concept of probability in weather forecasts introduces a layer of complexity in decision-making. Probability is often communicated using terms such as “high,” “medium,” and “low,” which can pose challenges for fisher-folk’s comprehension. During FGDs in Remba, Ringiti, Kiumba, Koguna, and Lwanda Nyamasare, participants acknowledged that IBF predictions are based on probability. However, they struggled to grasp the nuances of different probability levels due to a lack of explanation. In Tabla, participants had varying opinions about their knowledge of IBF’s probability communication, highlighting the need for improved clarity in conveying probabilistic information to ensure effective decision making in storm adaptation strategies. The findings of this study are in tandem with the Sivle et al., (2022) who suggested that user understanding and interpretation of forecast determine the rate of its uptake.

Table 4:

Responses	Frequency	Percent	cumulative percent
Yes	36	9.5	9.5
No	32	8.5	18
Don’t use IBF	310	82	100
Total	378	100	

Source: Field Data 2023

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS |Volume VII Issue X October 2023

Fisher folk's understanding of spatial and temporal coverage of Impact- based Forecasts

Understanding the spatial and temporal coverage of Impact-Based Forecasts (IBF) is a crucial factor influencing its adoption and utilization among fisher-folk. The provided table reveals that 8.7% of fisher-folk using IBF understood the geographical areas covered by IBF information, while 9.3% knew about its temporal aspects. This understanding directly impacts the extent to which fisher-folk incorporate IBF into their fishing operations. Those who were uncertain about the geographical coverage were less inclined to use IBF information.

During FGDs, participants expressed varying levels of comprehension regarding the spatial and temporal aspects of IBF. Participants noted that IBF accessed through the internet tended to be more specific in terms of spatial and temporal scale, unlike KMD information directed to the beaches. Many participants pointed out that KMD's weather information often covered the entire county, which was problematic considering the vast and varied nature of Homa Bay County. Regarding the temporal dimension, respondents indicated that determining the exact time for weather event was challenging.

In Ringiti Island, FGD participants mentioned their difficulty in understanding the spatial scale of IBF, as forecasters typically used broader geographical references such as Lake Victoria Basin or Homa Bay County, making it hard to relate predictions to the specific conditions in Ringiti Island. In Kiumba and Remba Island, participants noted that weather information from the internet provided more specific spatial and temporal details, while radio and TV broadcasts were more general and covered wider geographical areas. In Tabla, participants believed that weather information from radio and TV was too broad in coverage and lacked specificity in timing. In Koguna and Lwanda Nyamasare, participants expressed understanding of the geographical coverage but found the temporal aspects less clear. Collectively, the FGD participants conveyed that KMD forecasts were often too general and not adequately localized for their specific needs, highlighting the importance of improving both spatial and temporal clarity in weather forecasts to enhance their utility among fisher folk. Studies have indicated that lack of understanding of spatial and temporal aspects of focus as key impediment to adoption of scientific weather services among user groups (Guido et al 2016; Hansen et al., 2019; Ouedraogo et al., 2018; Sivle et al., 2022)

Table 5: Frequency table showing fisher folk's understanding of the area covered by IBF

	Frequency	Percent	Cumulative Percent
Yes	33	8.7	8.7
No	35	9.3	18
Don't use IBF	310	82	100
Total	378	100	

Source: Field Data 2023

Fisher-folk perceptions on IBF credibility

Fisher-folk's perceptions of the credibility of Impact-Based Forecasts (IBF) play a significant role in determining the adoption and utilization of IBF. Credibility, in this context, refers to the level of trust that fisher-folk place in IBF and its information sources. It's important to note that fisher-folk's perception of IBF credibility varies among different landing sites.

In Remba Island, for instance, participants estimated the credibility level of IBF to be around 60%. This relatively lower credibility rating was attributed to limited access to IBF information and a prevalent

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS |Volume VII Issue X October 2023

reliance on traditional weather forecasts among the fisher-folk in this area. In contrast, in landing sites like Koguna, Lwanda Nyamasare, and Kiumba, where there was active mobilization and awareness efforts by the Highway project, IBF's credibility level was higher. Fisher-folk in these areas perceived IBF as more trustworthy, likely due to their increased exposure to and understanding of the technology.

However, in Ringiti and Tabla, where fisher-folk still heavily relied on personal weather observations and where the timing of IBF information was considered inconvenient for many, the credibility level of IBF was rated at 50%. This suggests that the perceived credibility of IBF can be influenced by the existing weather information sources and the practicality of IBF information delivery. Overall, the credibility of IBF is a critical factor in its acceptance and utilization among fisher-folk, and efforts to enhance this credibility should consider the specific needs and practices of each landing site to effectively promote IBF adoption. Literature showed that user's perception of IBF as credible contribute to its uptake in their decision making in adaptation to extreme weather events (Bruno, Soares and Dessai, 2015; Boon et al., 2022; Warner, Moonsammy & Joseph 2022).

DISCUSSION

The perceptions of fisher-folk play a crucial role in the uptake of Impact-Based Forecasting (IBF) for adaptation to nocturnal storms. The study reveals several key aspects that impact the adoption of IBF, including awareness, accuracy, relevance, the probabilistic nature of IBF, and spatial/geographic coverage.

Literature on uptake of new technologies show that existence of awareness among users is the first step (Amenya, Onsongo & Guyo, 2010; Fussell & Klein 2006; Kasera, Mburu & Owiso, 2019; Chiptwa et al., 2020; Boon et al., 2022). According to this study, 73% of fisher folk in Homa Bay county were aware of the existence of IBF. However, the level of awareness differed among landing sites. Kiumba, Koguna, and Lwanda Nyamasare had the highest level of awareness of IBF at an average of 80%. FGDs participants attributed a high level of IBF awareness among fisher folk on these landing sites as a result of the Highway project that was implemented on these beaches. The high level of IBF awareness among fisher folk was partly due to the sensitization of fisher folk by BMU officials about IBF and the application of marine flags and notice boards in predicting lake conditions. The key informants also noted that IBF is disseminated to fisher-folk by diverse channels such as radio, television, WhatsApps, BMUs assembly, and the internet. The study revealed that fisherfolk had a high level of awareness of risks caused by storms on the lake. FGDs participants mentioned that storms contribute to the loss of lives, damage of boats, loss of fishing opportunities as well as loss of budget (expenditure during fishing operations). This is confirmed the findings many studies in weather service uptake (Dubois et al., 2013; Nkiaka et al., 2019; Damm et al., 2021) However, despite the high level of fisher-folk awareness of IBF a considerable number of fisher folk were not accessing IBF because of their laxity, long years of experience with traditional weather forecasting, and lack of training on the relevance of IBF on their fishing decisions making and other factors concerned with perception as discussed (Fussell & Klein, 2006). In this regard, fisher-folk's high level of awareness of IBF has not translated to high uptake. In-depth interviews pointed out that fisher-folk require training on the interpretation and application of IBF, BMUs on IBF communication, and emphasis on the benefits of applying IBF in their fishing decisions, and support with WhatsApp as well remuneration to the flag and notice board in-charge personnel. There emerged a positive feeling that use of marine flags and notice boards coupled with elementary training on their interpretation would make it easy for fisher-folk to use IBF in their fishing decisions.

This study places the fisher folk perceptions of IBF accuracy at the center to its uptake. This study established that IBF accuracy perceptions matter a lot if fisher-folk will begin using it as informed users. For many years' weather forecasts contained some inherent uncertainty. Hence both weather information service providers and user groups are interested in the accuracy and reliability of weather forecasts (Sivle,

2016). The forecast should be of the highest possible accuracy. The condition of accuracy implies how the forecast is calibrated and used (Challinor, 2009; Rautenbach &Blair, 2021; Sivle et al., 2022). An important finding in this regard is that perceptions on accuracy vary from information providers and actual users, as well as BMU members and the majority fisher-folk. Information providers have a positive view of the accuracy of IBF (rating it at 70% on average) and think that things on the ground translate theory at KMD offices into reality at beaches levels. For example, they think that information reaches the people at the twice a day expected time, and that this information reaches someone with a smart phone who then circulates it to the others. But this is completely the opposite of the perception on accuracy on the ground at the landing sites level. For example, the study established that in some beaches, people expected to have smart phones and serve as the contact persons between the KMD information providers and fisher-folk do not even have functional phones. Moreover, information is sent irregularly and most often the receivers do not have a full capacity to interpret the information. Even worse, majority of the fisher-folk do not have smart phones which means they cannot be added into the theorized IBF-based WhatsApp groups. The BMU members who somewhat have the onus of responsibility to see into it that IBF work, and because partly they were the ones trained during the launch of the IBF, have a rather positive perception of IBF, leaning to toward those of the KMD officers and differ with the perspectives of the majority fisher-folk.

A second and important revelation concerning accuracy is that this differed by gender, category of fisher-folk, the type of fishing one does, among other socio-demographic and fisheries-based variables. This consistent with the findings of other studies (Rautenbach &Blair 2021; Sivle et al., 2022). This points to the need for actors to bring targeted interventions in terms of capacity building and informational packaging rather than a one-size-fits-all approach which is currently the case. This study sought to understand the fisher folk's perceptions of the accuracy of IBF through surveys and focus group discussions.

This study also sought to understand user group perspectives on the salience of IBF they received from KMD. From literature, the user groups perceptions of IBF as salient is one of the factors that promotes its uptake. This qualifies fisher folk to effectively integrate IBF into their societal decision-making processes. This is significant in building user group resilience to weather shocks across Africa (Jones et al., 2015; Nkiaka et al., 2019). It is noted that the development of fit-for-purpose IBF is crucial for managing weather risks in climate-sensitive sectors such as agriculture and water resources (WMO, 2017). Evaluating fisher folk's perceptions of the salience of IBF is therefore of critical importance in understanding the uptake of IBF among fishers in Homa Bay county. However, improving the quality of IBF to match user groups' needs and context has been highlighted as a key challenge for the successful uptake of weather services (Hewitt et al., 2012). Goddard et al. (2010) noted that gaps still exist between the information provided and the information desired. Thus, the providers of climate forecasts do not always understand the user's needs hence seasonal forecasts may not be understood by their possible users. The commonly perceived gaps between the provision of weather information and its use primarily concerned with: a lack of spatial-temporal and element specificity, given the typical format of seasonal totals forecasts, applicable to relatively large areas for just mean temperature and rainfall totals; how information is communicated such as timing, content, phrasing, and language and even means of delivery all which can influence the effectiveness of the uptake (Lindsey et al., 2017). Thus, the forecasts should be tailored to the weather information needs of target users (Challinor, 2009) Thirdly, for the practice of adaptation, the decision-makers need not only to have access to the forecast but also to see the benefits of using the forecasts. One of the key factors that may influence the uptake of IBF is fisher perception of its relevance to their fishing decision needs. The participants noted that the storm information given to them is relevant to their decision-making needs. In Remba Island participants noted that IBF gives them information about wave height and wind speed and direction which are key ingredients of stormy weather. This information is given depending on the color of the flag and notice board. The participants noted that the green flag color implies calm weather which favors fishing activities whereas the amber is challenging to interpret because it means the forecast is uncertain. Whereas the red flag color implies that the weather is stormy and the lake will be

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS |Volume VII Issue X October 2023

rough and not safe for fishing activities. These are what they need to make the fishing decision. However, the participants reported that the flag and notice board were used for a short time and were not accessible to all populations on the island because of the vast nature of landing sites. Weather information such as storms, wind systems, and temperature is relevant to our decision needs. In Ringiti Island participants reported that weather information given to them is a bit relevant to their fishing operation. This is because most of the population receives weather information via Radio that covers wide geographical areas. The participants reiterated that it is hard to relate the weather information to what is happening around them. It is important to recognize that weather flags and notice boards have not been used on Ringiti island. In Kiumba, Tabla, and Koguna landing sites like Remba indicated that the weather information is highly relevant to their fishing decision-making needs.

It is presumed that fisher folk's understanding of spatial coverage of IBF is vital for its uptake among fishers. The survey findings revealed that 8.7% out of 18% of fisherfolk using IBF were understanding the spatial coverage of IBF information, whereas 9.3% out of 18% of fisherfolk using IBF did not have a clear understanding of the spatial coverage of the information given by KMD. The participants of focus group discussions indicated that IBF from the internet is more specific on the spatial and temporal scale. On contrary, they noted that IBF from radio and TV are not geographical and temporal specific. On the spatial scale, the weather information given is for the Whole County yet Homa Bay County which is vast and varied. According to FGD participants, the temporal dimension of weather information provided is hard to know the exact time for weather occurrence. Participants of focus group discussions indicated KMD forecasts are too general and therefore are not localized enough to help in decision-making. This confirmed the findings of other studies (see Damm et al. 2020; Fujisaki-Manome et al., 2022). They also suggested that weather informational needs are different for different fishing activities; one suggested those involved in onshore fishing rarely use KMD forecast and another suggested that traders do not care about weather information. One participant suggested that some simply ignore forecasts because they enjoy taking risks.

Close to fisher folk's understanding of the spatial and temporal scale of IBF is the fisher folk's understanding of the uncertainty inherent in probability communication of storm risks. According to this study, 9.5% out of 18% of fisher folk who have applied IBF in their fishing decision reported that they understand that IBF communication is probabilistic in nature. Whereas 8.5% out of 18% of fisher folk using IBF were not aware of their probabilistic nature. A good number of key informants across landing sites lamented the use of probability in communicating storm risks has been blamed for the low uptake of IBF among fisher folk in Homa Bay County (see Sivle et al. 2022, Hansen et al., 2019, Bruno, Soares and Dessai, 2015; Goddard et al. 2010). They noted that forecasts use probability terms such as high, medium, and low is complex to apply in their decision-making context. They noted a few fisher folks understand the probability language making it hard for them to make appropriate fishing decisions. In Remba, Ringiti, Kiumba, Koguna, and Lwanda Nyamasare the FGDs participants reported that fisher folk understands that IBF predictions are based on probability. They stated that it is only God that gives excellent weather predictions. However, they were not able to understand differences in the probability levels. However, in Tabla participants were of different opinions. They noted fisher folk do not understand the probability of IBF communication. They observed that fisher folk usually complain in the event that the weather happening differs from the predicted and blame officials for wrong forecasts.

Credibility implies the trust of information issued. The credibility of IBF has been found to have mixed outcomes with respect to the uptake of IBF researcher (Cash et al. 2003). The fisher folk's perception of IBF's level of credibility differs from one landing site to another. FGDs participants estimated the credibility level at 50-60%. The main reason given for the low level of credibility is the low level of access to IBF and overreliance on traditional weather forecasts (see Bruno, Soares and Dessai, 2015; Boon et al., 2022; Warner, Moonsammy & Joseph 2022). They noted whether flags and notice boards were being used sparingly and whether WhatsApp platforms to share IBF were among cronies. They noted that the

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS |Volume VII Issue X October 2023

timing of IBF is not convenient for a large proportion of fisher folk. It seemed that in landing sites where there was high mobilization by Highway project and awareness the level of credibility of IBF is high, such as Koguna, Lwanda Nyamasare, and Kiumba, the participants reported the continuous use of flag and notice and leaders of IBF sensitization programs in the beach.

CONCLUSIONS

In conclusion, the fisheries sector in Homa Bay County is grappling with numerous challenges related to weather and climate change. The HIGHWAY WISER Project implemented between 2017 and 2021 had done tremendously good job to familiarize modern weather information in poor rural-villages along Lake Victoria depending on fishing as their primary lifeline. However, to sustainably enhance fisherfolk's to the vagaries of storms that continue to cause unimaginable death tolls, much need to be done and this study has highlighted where gaps exist. This study delved into the influence of fisherfolk's perceptions on the uptake of Impact-Based Forecasting (IBF). Four considerable grounds: awareness, accuracy, relevance, temporal and specific element, and geographical coverage, all of which have received attention as perception grounds as regards the nexus between climate change information and place (poor traditionally isolated areas) (Altieri et al., 2015; Altieri et al., 2012; Byan et al. 2021; Nyong & Elasha, 2007).

The study revealed that a significant majority (73%) of the fisherfolk were aware of the existence of IBF and recognized the high risks posed by storms in their region. However, this high level of awareness had not translated into a commensurate uptake of IBF among fishers. Many fisherfolk acknowledged the need for training in interpreting and applying IBF to enhance its adoption. Perceptions regarding the accuracy of IBF emerged as a critical factor influencing its uptake, with a substantial proportion (75%) of those IBF considering it accurate, very accurate or extremely accurate. This suggest that with adequate training there is potential for increased IBF adoption among fisher folk.

Regarding relevance, while certain groups of fisherfolk acknowledged the relevance of the information provided by IBF to their decision-making needs citing the presence and occasional use of marine flags and notice boards had proven effective in facilitating the practical application of IBF among fisherfolk, a notable portion of fisherfolk still lacked a comprehensive understanding of the probabilistic and geographic specificity dynamics of communication of weather forecasts by the Kenya Meteorological Department and the spatial and temporal scales of weather prediction, which hindered the broader adoption of IBF.

Regarding credibility and reliability, fisherfolk perceived IBF information to be moderately trustworthy, although many expressed dissatisfactions with the format and content of IBF. Participants suggested that the incorporation of marine flags and notice boards, alongside basic training in their interpretation, would significantly enhance the usability of IBF in their fishing decisions. Such measures could potentially lead to a substantial improvement in IBF uptake among fishers.

In light of these findings, the study underscores the importance of continuous efforts in awareness raising and training on IBF to enhance its adoption among fisherfolk. Tailoring IBF to meet specific needs of this vulnerable community can significantly contribute to their safety and livelihoods by improving their capacity to adapt to extreme weather events.

ACKNOWLEDGEMENTS

We appreciate the officials of KMD, BMUs and fisher folk of Suba North -Homa Bay County for taking part in the data collection process. We also acknowledge the participation of Alphonce Kasera and Wycliff Akello in editing this report.

REFERENCE

1. Altieri, M. A., Funes-Monzote, F. R., & Petersen, P. (2012). Agroecologically efficient agricultural systems for smallholder farmers: contributions to food sovereignty. Agronomy for sustainable development, 32, 1-13.
2. Altieri, M. A., Nicholls, C. I., Henao, A., & Lana, M. A. (2015). Agroecology and the design of climate change-resilient farming systems. Agronomy for sustainable development, 35(3), 869-890.
3. Boon, E., Wright, S. J., Biesbroek, R., Goosen, H., & Ludwig, F. (2022). Successful climate services for adaptation: What we know, don't know and need to know. Climate Services, 27, 100314.
4. Bruno Soares, M., and Dessai, S. (2016). Barriers and enablers to the use of seasonal climate forecasts amongst organisations in Europe. *Clim. Change* 137, 89–103. doi:10.1007/s10584-016-1671-8
5. Bryan, E., Deressa, T. T., Gbetibouo, G. A., & Ringler, C. (2009). Adaptation to climate change in Ethiopia and South Africa: options and constraints. Environmental science & policy, 12(4), 413-426.
6. Carr, E. R., Fleming, G., & Kalala, T. (2016).Understanding women's needs for weather and climate information in agrarian settings: The case of Ngetou Maleck, Senegal. Weather, Climate, and Society, 8(3), 247–264. https://doi.org/10.1175/WCAS-D-15-0075.1
7. Cash, D. W., W. C. Clark, F. Alcock, N. M. Dickson, N. Eckley, D. H. Guston, J. Jager, and R. B. Michell. 2003. Proceedings of the National academy of Sciences of the United States (PNAS) 100(14): 8086-8091.
8. Challinor, A. (2009). Towards the development of adaptation options using climate & crop yield forecasting at seasonal to multi-decadal time scales. Environmental Science and Policy 12 (4), 453-465.
9. Chiputwa, B., Wainaina, P., Nakelse, T., Makui, P., Zougmoré, R. B., Ndiaye, O., & Minang, P. A. (2020). Transforming climate science into usable services: The effectiveness of co-production in promoting uptake of climate information by smallholder farmers in Senegal. Climate Services, 20, 100203.
10. Damm, A., Köberl, J., Stegmaier, P., Alonso, E. J., & Harjanne, A. (2020). The market for climate services in the tourism sector–An analysis of Austrian stakeholders' perceptions. Climate Services, 17, 100094.
11. Daron, J., Bruno Soares, M., Janes, T., Colledge, F., Srinivasan, G., Agarwal, A., Hewitt, C., Richardson, K., Nepal, S., Singh Shrestha, M., Rasul, G., Suckall, N., Harrison, B., Oakes, R.L., Corbelli, D., 2022. Advancing climate services in South Asia. Clim. Serv. 26, 100295. doi:10.1016/j.cliser.2022.100295
12. Dash, N., & Morrow, B.H. (2000). Return delays and evacuation order compliance: The case of Hurricane Georges and the Florida KeysGlob. Environ. Change Part B: Environ. Hazards, 2 (3) (2000), pp. 119-128.
13. Dilling, L., & Lemos, M. C. (2011). Creating usable science: Opportunities and constraints for climate knowledge use and their implications for science policy. Global Environmental Change, 21, 680 –689.
14. European Commission, DG for Research and Innovation, 2015. A European research and innovation Roadmap for Climate Services.
15. Findlater, K., Webber, S., Kandlikar, M., Donner, S., 2021. Climate services promise better decisions but mainly focus on better data. Nat. Clim. Chang. 11, 731–737. https://doi.org/10.1038/s41558-021-01125-3
16. Fujisaki-Manome, A., Gill, D., Channell, K., Graves, V., Jagannathan, K. A., Anderson, E. J., & Lemos, M. C. (2022). Scaling-up Stakeholder Engagement Efforts to Inform Better Communication & Uptake of NOAA Great Lakes Ice Forecast Information.
17. Fussel, Hans-Martin, and Richard J. T. Klein. 2006. Climate Change Vulnerability Assessments: An Evolution in Conceptual Thinking. Climate Change 75: 301-329.
18. Gladwin, C.H., & Gladwin, W.G.H. (2001). Peacock modeling hurricane evacuation decisions with ethnographic methods Int. J. Mass Emerg. Disasters, 19 (2), pp. 117-143.

19. Goddard, L., Aitchellouche, Y., Baethgen, W., Dettinger, M., Graham, R., Hayman, P., … Conrad, E. (2010). Providing Seasonal-to-interannual climate information for risk management and decision-making. (Vol. 1, pp. 81–101). Elsevier B.V. https://doi.org/10.1016/j.proenv.2010.09.007
20. Guido, Z., Lopus, S., Waldman, K., Hannah, C., Zimmer, A., Krell, N., et al. (2021). Perceived links between climate change and weather forecast accuracy: New barriers to tools for agricultural decision-making. *Clim. Change* 168, 9–20. doi:10.1007/s10584-021-03207-9
21. HBCIDP (2014). Homa Bay County Integrated development plan 2013-2017. Government of Kenya.
22. Larosa, F., Mysiak, J., 2019. Mapping the landscape of climate services. Environ. Res. Lett. 14 https://doi.org/10.1088/1748-9326/ab304d.
23. LVFO (2014). Regional status report on Lake Victoria 2012 frame surveys Report
24. Mani, J. K., and Mukherjee, D. (2016). Accuracy of weather forecast for hill zone of West Bengal for better agriculture management practices. *Indian J. Res.* 5, 325–328.
25. Marshall, B., Cardon, P., Poddar, A. and Fontenot, R. (2013), "Does sample size matter in qualitative research?: a review of qualitative interviews in IS research", Journal of Computer Information Systems, Vol. 54 No. 1, pp. 11-22
26. Muita, R., Dougill, A., Mutemi, J. et al. (6 more authors) (2021) Understanding the role of user needs and perceptions related to sub-seasonal and seasonal forecasts on farmers' decisions in Kenya: a systematic review. Frontiers in Climate, 3. 580556. ISSN 2624-9553 https://doi.org/10.3389/fclim.2021.580556
27. Nkiaka, E., Taylor, A., Dougill, A. J., Antwi-Agyei, P., Fournier, N., Bosire, E. N. Warnaars, T. (2019, November 19)
28. Nyong, A., Adesina, F., & Osman Elasha, B. (2007). The value of indigenous knowledge in climate change mitigation and adaptation strategies in the African Sahel. Mitigation and Adaptation strategies for global Change, 12, 787-797.
29. Oloo, P. (2019). Towards developing a sustainable early warning system for the Lake Victoria basin. Kisumu: WMO HIGHWAY Project -Kenya .
30. Onyango, L., Owuor, J., Oloo, P., Kiprop, J., Kniveton, D., Visman, E., & Carswell, O. (2021). WISER HIGHWAY.
31. Owuor, J.O., Owiso, M. O., Kniventon, D., & Calvince, B. O. (2023). Fisheries-based Determinants of Fisherfolks' and their Influence on Access to Impact-based Weather Forecasting in Suba-North sub-County, Homabay County, Kenya. African Journal of Climate Change and Resource Sustainability, 2(1), 171-183.
32. Parker, D. J., Blyth, A. M., Woolnough, S. J., Dougill, A. J., Bain, C. L., de Coning, E., et al. (2021). The african SWIFT project: Growing science capability to bring about a revolution in weather prediction. *Bull. Am. Meteorological Soc.* 103 (2), E349–E369.
33. Peacock W.G., Brody S.D., & Highfield, W. (2005) Hurricane risk perceptions among Florida's single family homeowners
34. Perrels, A., Le, T.-T., Cortekar, J., Hoa, E., Stegmaier, P., 2020. How much unnoticed merit is there in climate services? Clim. Serv. 17 https://doi.org/10.1016/j. cliser.2020.100153.
35. Rautenbach, C., & Blair, B. (2021). Marine meteorological forecasts for coastal ocean users–perceptions, usability and uptake. Geoscience Communication, 4(3), 361-381.
36. Roberts, R.D., Goodman, S.J., Wilson, J.N., Watkiss, P., Powell, R., Petersen, R.A., Bain, C., Faragher, J., Chang'a, L. B., Kapkwoma, J. K.,Oloo, P. N., Sebeziga, J. N., Hartley, T. D., Mittermaier, M, Crona, L., & Virts K.S., (2022). Taking the HIGHWAY to Save Lives on Lake Victoria. https://doi.org/10.1175/BAMS-20-0290.1. American Meteorological Society.
37. Singh, Joseph Daron, Amir Bazaz, Gina Ziervogel, Dian Spear, Modathir Zaroug & Evans Kituyi (2018) The utility of weather and climate information for adaptation decision-making: current uses and future prospects in Africa and India, Climate and Development, 10:5, 389-405, DOI: 10.1080/17565529.2017
38. Sivle, A. D., Agersten, S., Schmid, F., & Simon, A. (2022). Use and perception of weather forecast information across Europe. Meteorological Applications, 29(2), e2053.

39. Stake, R.E. (2000), Case Studies, in Denzin, N.K. and Lincoln, Y.S. (Eds), Handbook of Qualitative Research, Sage, London, pp. 425-454.
40. Tarchiani, V., Coulibaly, H., Baki, G., Sia, C., Burrone, S., Nikiema, P. M., … & Camacho, J. (2021). Access, uptake, use and impacts of agrometeorological services in sahelian rural areas: the case of burkina faso. Agronomy, 11(12), 2431.
41. Warner, D., Moonsammy, S., & Joseph, J. (2022). Factors that influence the use of climate information services for agriculture: A systematic review. Climate Services, 28, 100336.
42. WMO (2015) Guidelines on multi-hazard impact-based forecast and warning services. WMO-No. 1150. Geneva, Switzerland.
43. WMO, 2016 Guidelines on Multi-Hazard Impact based Forecast and Warning Services, WMO No.1150. https://www.wmo.int/pages/prog/www/DPFS/Meetings/ET-OWFPS_Montreal 2016.