

Research report

Insights on the cold chain needs of fisherman and traders in Homa Bay County in Kenya

Insights from Keep IT Cool, Kenya

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Cover photo: Insulated cool boxes stocked with a sack of ice currently used to keep fish cool ©Keep IT Cool

Executive Summary

Kenya's fisheries contribute an estimated 0.6% of gross domestic product (GDP) and largely comprise of freshwater fish.¹ Over 70% of freshwater fish tonnage is derived from the country's 6% portion of Lake Victoria.^{2,3} Lake Victoria fisheries are dominated by small-scale artisanal fisheries and are confronted with a plethora of issues that confine the fisherfolk in poverty amidst declining fish resources. One of the main issues is lack of cold storage in fish handling that Keep IT Cool (KIC), a social enterprise based in Kenya, is attempting to address.

KIC provides technology-enabled solutions to fisherfolk with its main product being solar refrigeration. The company has supported over 2000 fisherfolk and linked them to over 500 urban markets through their cold chain powered market access platform. The company aggregates online fish orders from up-country markets and relays them to representatives of fishermen and fish traders based at Mbita Fish Banda in Homa Bay County (Southwestern Kenya). KIC then dispatches a company-operated cold truck to fetch the aggregated orders. Upon arrival, contracted traders and fishermen deliver fresh fish to the truck and are paid in cash based on previously agreed prices. Since the truck is refrigerated, the duration of delivery of fresh produce can last up to 24 hours allowing more traders and fishermen to deliver their fish up until the required tonnage is accomplished. The purchased fish produce is then transported in the cold truck to up-country customers, ensuring that the produce reaches these consumers in a fresh state. This research aims to better understand cold chain needs of fishermen and traders and the impact KIC is making towards fulfilling these needs.

The main research questions are outlined below:

1. What are the ongoing challenges in the first mile connectivity, specifically with respect to the application of cold chain? How has KIC sought to address these challenges through existing small-scale interventions?
2. What are the future opportunities for KIC to address wider challenges in the cold chain logistics of the fish industry in Lake Victoria?

This report is a result of a study commissioned by KIC in partnership with Shell Foundation (SF) (UK Registered Charity) and funded by the Foreign Commonwealth and Development Office (FCDO) under the Catalysing Agriculture by Scaling Energy Ecosystems (CASEE) Programme. The objective of this research is to assess the cold storage needs of first mile consumers and understand to what extent KIC is addressing them. **Data was collected from 74 fishermen and traders during a 2-day survey in Mbita Banda landing site in Homa Bay County.** While the survey target was 150 respondents, KIC faced challenges in obtaining more valid responses due to the busy schedules of fishermen and fish traders at the landing site. The landing site was chosen for pragmatic reasons, i.e., the limited research timeframe did not allow KIC to accompany respondents to fishing grounds or several other fish vending destinations. The descriptive analysis and narratives obtained from the respondents form the basis of the findings.

The research finds that **the main cold chain needs of fishermen arise from the duration that they spend on the fishing ground sourcing for fish.** They have to sustain the fish under cool conditions for the entire duration of the fishing expedition (including transporting the fish from the fishing ground to the landing site), which can range from a few hours to half a night. Thus, they need reliable cold storage that can ensure produce remains at ambient temperature over distances. Currently, most fishermen use makeshift cool boxes, which represents a considerable portion of daily cost for them and leads to significant post-harvest losses. While KIC offers cold chain facility at the landing site for produce destined for faraway markets, the cold truck comes only twice a week. Furthermore, it is only available to fishermen who sell their catch to KIC's aggregative agents at the landing site.

The main cold chain needs of fish traders, on the other hand, arise from the process of evacuating the fish to domestic (local and faraway) markets once fishermen have delivered the produce. Similarly to

¹ Kenya National Bureau of Statistics (2022). <https://www.knbs.or.ke/wp-content/uploads/2022/05/2022-Economic-Survey1.pdf>.

² Ibid.

³ Nyamweya et al (2018). https://www.kmfri.co.ke/images/pdf/Status_of_Fisheries_Report_New_31-10-2019.pdf.

fishermen, traders use makeshift cool boxes to keep fish cool and negotiate a favorable price in the market but suffer post-harvest losses and ice replenishment expenses. Furthermore, in the absence of reliable cold storage, traders cannot hold onto their stock for long enough to negotiate better prices. The KIC cold truck has limited off-take capacity which means that fish cannot be aggregated upfront, which limits trading opportunities. Fish aggregated by KIC is also only destined for faraway markets, which means that traders distributing fish in local markets operate largely without any formal cold storage.

The findings above show that **KIC is currently meeting only a part of the cold storage needs of fishermen and traders**, whose fish is destined for faraway markets. There are unmet cold storage needs when fishermen and traders aren't surrendering fish to KIC: fisherfolk are, in these instances, left to using inconvenient makeshift cold storage. The unmet needs for cold storage have been linked to post-harvest losses running into thousands of kilograms of fish every season. Despite the limitations, there are potential impacts that the company is creating among fishermen and fish traders that have been documented in a separate study. Respondents have reported being able to access cold transportation for the first time, perceived an increase in income by being able to hire an additional employee, as well as experienced a reduction in post-harvest losses.

In a bid to understand future opportunities in providing more cold chain solutions, the study elicited responses on capacity and willingness-to-pay for modern cold storage to replace makeshift cool boxes. The median desired storage capacity for traders is at 350 kg with smallest desired storage capacity of 40 kg, and 5,000 kg on the higher side. The median storage capacity that the traders desire exceeds the current daily transacted weight, suggesting unmet cold storage needs. This supports the discussion that the lack of cold storage solutions might have limited the volume of fish that traders might have been able to handle a day.

There is also positive willingness-to-pay for the desired solar-powered cold solutions. the median trader quoted a value of KES 300 per day. Lower quotes of KES 50 and KES 100 and upper quotes of KES 400, 500 and 1,000 per day were given by traders in the lower and upper centiles, respectively. The study did not explore whether the WTP was practical within the current market prices for these boxes: KIC will continue this discussion with fishermen and farmers in a future engagement.

Based on the current intervention of the company and the impacts and gaps around first mile cold chain needs, **the study identifies opportunities for KIC to address challenges in cold chain logistics of the fish industry in Lake Victoria and recommends the following:**

1. **Construction of a solar-based aggregation and cold storage hubs** preferably with ice-making line in the location of the study (Mbita Fish Banda) to preserve fish stocks while awaiting evacuation to local or faraway markets. This will help fishermen and traders negotiate for better price and gain better revenue as produce will remain at optimal quantity and conditions before sale to the next handler in the value chain.
2. **Provision of mobile solar-powered cool boxes for use by fishermen while at the Lake** to aid in keeping fish at ambient temperatures on board boats and at the landing site; Specifications of how that provision can be met (such as prices or mode of provision via renting or sharing) will need further discussion with fishermen.
3. **Provision of solar-powered cool boxes to traders for purposes of cold handling of fish while selling to local markets.** Specifications of how that provision can be met (such as prices or mode of provision such as via renting or sharing) will need further discussion with traders.
4. **Expansion of KIC up-country fish market to permit evacuation of higher tonnages.** Fishermen and traders feel they can gain more from a higher guaranteed offtake of fish than the current weekly limit of 5,000 tonnes per week by KIC. Expanding KIC services to up-country markets will create more demand for fish.
5. Prior to the dispatch of the cold truck to Mbita, KIC will **continue with the current practice of issuing a 2-day prior notice of the required tonnage to the aggregators** who in turn use this notice to mobilise adequate fishermen and traders to deliver fresh produce on the day of collection. This is to give ample time for aggregators to mobilize enough fish stock from the fishermen and traders on the particular day, since there is no cold store to hold stocks at the moment. In other instances, the stock mobilisation relies on fishermen to return from the Lake straight to the landing site for deliveries. This means longer turnaround time for the cold truck.

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List of Abbreviations

BMU	Beach Management Unit
CASEE	Catalysing Agriculture by Scaling Energy Ecosystems
GDP	Gross Domestic Product
KEMFRI	Kenya Marine and Fisheries Research Institute
KES	Kenya Shilling
KIC	Keep IT Cool
KNBS	Kenya National Bureau of Statistics
SF	Shell Foundation
SME	Small and Medium-Sized Enterprises
USD	United States Dollar
WTP	Willingness to Pay

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1 Introduction

Kenya's fisheries account for 0.6% of gross domestic product (GDP) and are largely comprised of capture fisheries (fresh water fish, marine fish and aquaculture).⁴ The official recorded quantity of total fish landed in 2021 is estimated at 163,605 metric tonnes, with a value of Kenyan Shillings (KES) 30,383 million or United States Dollar (USD) 251 million.⁵ Fresh water fish is the mainstay of Kenya's fisheries, accounting for 77% of total value of fish landed in 2021.⁶ About 70% or 94,349 metric tonnes of fresh water fish is derived from Kenya's small jurisdiction over Lake Victoria estimated to be about only 6% of the entire Lake.^{7,8} This is a signal of over-dependence on the Lake for fish production. The Kenya Marine and Fisheries Research Institute (KEMFRI) cite increasing fishing effort and decreasing catch in the assessment of the status of the resource in 2018.⁹

Capture fisheries in Lake Victoria are dominated by small-scale fishermen estimated to be about 44,000 in the last census of 2016.¹⁰ The number of small-scale traders and those who depend on fisheries around the Lake make participants in the fisheries value chain even higher. For example, it has been estimated that while 82% of participants in a fishery sampling unit are fishers, 8 % are traders while 10% are fish processors.¹¹ This translates to an additional 9,660 people that depend on the fisheries sector for livelihoods.

As a result of the small-scale and rudimentary nature of operations, fishermen and traders face a lot of challenges relating to their trade. The cited problems include a lack of proper physical and financial capital, climate-change vulnerabilities, scarcity of fish, geo-political security issues, a lack of fish-handling infrastructure, and poor marketing channels among others.¹² Our recent research confirms that the lack of fish-handling infrastructure, especially cold storage, has been highlighted as a major shortcoming to the fish value chain, leading to quality and quantity losses of already scarce fish resources.¹³

Homa Bay County is the largest among the five riparian counties of Lake Victoria by surface area and accounts for about 63% of all fish catches in the Lake.^{14,15} A large proportion of families in Homa Bay rely on fisheries with an estimated 64% of households observed to be closely linked to the Lake Victoria fishery as either fishers, traders or both.¹⁶ By extension, the population in this part of Kenya is likely to be the most affected by challenges facing small scale fisheries.

2 Research Objectives and Methodology

Keep IT Cool (KIC) offers cold storage transport of fish (Tilapia and Nile Perch) from Homa Bay County for distribution to faraway markets located about 500 km away. The company aggregates online fish orders from up-country markets and relays them to representatives of fishermen and fish traders based at Mbita Fish Banda in Homa Bay County (Southwestern Kenya). KIC then dispatches a company-operated cold truck to fetch the aggregated orders. Upon arrival, contracted traders and fishermen deliver fresh fish to the truck and are paid in cash based on previously agreed prices. Since the truck is refrigerated, the duration of delivery of fresh produce can last up to 24 hours allowing more traders and fishermen to deliver their fish up until the required tonnage is accomplished. The purchased fish produce is then transported in the cold truck to up-country customers, ensuring that the produce reaches these consumers in a fresh state. Although KIC meets part of the cold chain needs, unmet needs require a better understanding. As such, support can be given appropriately. To better

⁴ KNBS. (2022). <https://www.knbs.or.ke/wp-content/uploads/2022/05/2022-Economic-Survey1.pdf>.

⁵ Ibid

⁶ Ibid.

⁷ Ibid.

⁸ Nyamweya et al. (2018). https://www.kmfri.co.ke/images/pdf/Status_of_Fisheries_Report_New_31-10-2019.pdf.

⁹ Ibid.

¹⁰ This is the current available estimate of fishers by Lake Victoria Fishers Organization available in the 2016 Frame Survey cited by Onyango et al (2021).

¹¹ Onyango et al (2021). <https://www.sciencedirect.com/science/article/pii/S2590291121001170>.

¹² Nyamweya et al. (2018).

¹³ KIC (2022). <https://shellfoundation.org/app/uploads/2022/03/IMPACT1.pdf>.

¹⁴ The other four counties are Busia, Kisumu, Migori and Siaya.

¹⁵ Onyango et al (2021).

¹⁶ Fiorella et al. (2021).

understand the needs of first mile customers in the cold chain, KIC, in partnership with Shell Foundation (SF) and with funding by FCDO, commissioned a researcher to conduct a study under the Catalysing Agriculture by Scaling Energy Ecosystems (CASEE) programme.

The study seeks to answer the following research questions:

- What are the ongoing challenges in the first mile connectivity, specifically with respect to the application of cold chain? How has KIC sought to address these challenges through existing small-scale interventions?
- What are the future opportunities for KIC to address wider challenges in the cold chain logistics of the fish industry in Lake Victoria?

The CASEE programme is a £30m seven-year partnership launched by SF and the UK Government to accelerate access to energy-enabled solutions for smallholder farmers and agricultural small and medium-sized enterprises (SMEs) in sub-Saharan Africa and South Asia. The programme's ecosystem approach is based on SF's experience catalysing the household energy sector, which has demonstrated the need to directly support complementary issues facing the sector, such as consumer financing and last mile distribution.

To answer these questions, a small survey was designed by the research team in conjunction with a representative of KIC to elicit the current and prospective cold chain needs of first mile participants in the fish value chain.

The primary target of the study were artisanal fishermen and traders who buy or sell fish from Mbita Fish Banda, which is also the aggregation base for KIC. Survey data was collected using a questionnaire, administered by employees of KIC during a 2-day stock-fetching mission at the fish landing site in Homa Bay County on the 1st and 2nd September 2022. The respondents had not been forewarned about the questionnaire and

were selected based on their arrival at the landing site for their normal daily activities.

The survey targeted 150 respondents, due to the largely similar experiences of fishermen and limited budget. However, only **about 74 valid responses were obtained** due to the quick conduct of business at the landing site.¹⁷ **Among respondents, 30 were fishermen and 65 were traders.** It is important to note that 21 respondents reported being engaged in fishing and fish trading at the same time, and therefore were interviewed on both accounts. There were more men (74%) than women (26%) traders on the day of the survey.¹⁸ Analysis of the resultant data largely comprised of descriptive tools (measures of central tendencies), frequencies and coding of main themes from the narratives by fishermen and fish traders. Due to the large variation of data and the few observations, the most preferred measure of central tendency in the analysis was the median. The variation is due to the fact that fishermen and traders have different advantages (including skills and other unobserved factors that affect their operations).

Lastly, the study sought interviews from leaders of the group that hosts fishermen and traders.¹⁹ This information is aimed to complement the data from the survey. This is to cross-check the validity or explanations behind the patterns observed in the data from individual responses. The interviews with the leaders were conducted at the landing site on day 2 of the survey. The information related to the fishing and trading environment such as distance from facilities like ice shops among other general conditions related to cold chain services. Supplementary material was also sought from past studies by the [Kenya Marine and Fisheries Research Institute \(KEMFRI\)](#).

¹⁷ It is hard to get fishermen and fish traders since they are busy conveyancing produce in race against time and temperature deterioration.

¹⁸ There is minimal participation of women in the fish value chain for reasons stated by Abwao & Awour (2019) & other studies.

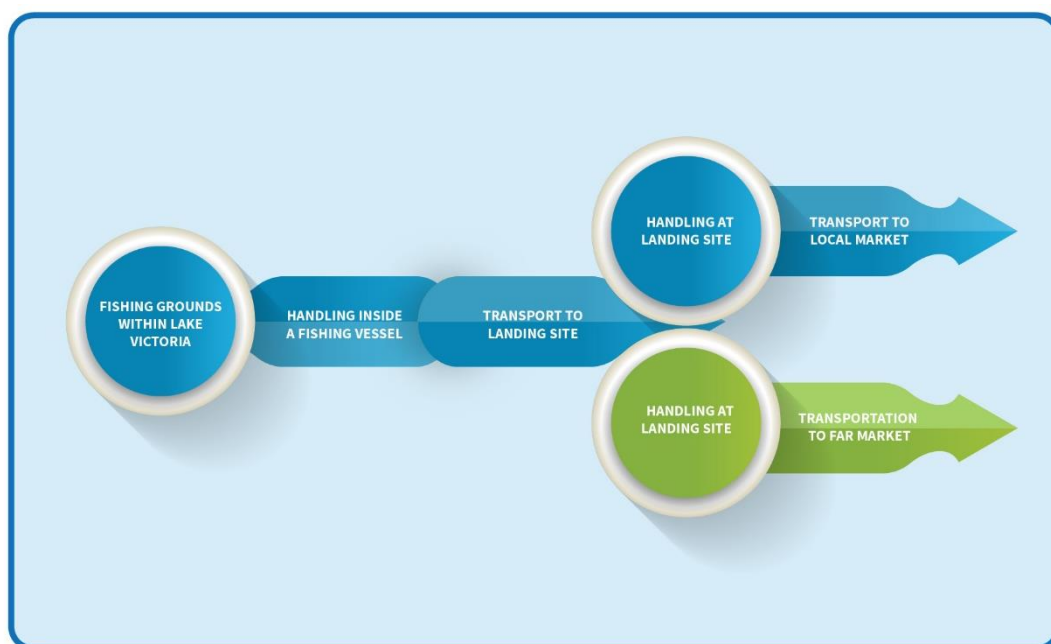
¹⁹ Banda is an organized (registered) group or fish cooperative that has leaders, who represent the group's interests.

3 Findings

3.1 Cold storage needs of fishermen and how KIC is currently meeting them

The first mile cold chain needs of fishermen arise from the unpredicted duration that they spend on the fishing ground sourcing for fish. The average time spent in a fishing expedition cannot be pre-determined upfront, as it depends on daily decisions of fisherman regarding the craft available and the type of fish of interest. The fisherman then has to sustain the caught fish under cool conditions for the entire duration of the fishing expedition. Fishermen can spend the whole night on fishing grounds (including travelling time), or a few hours depending on the distance to the fishing grounds and availability of fish. A typical first mile value chain as far as cold storage is concerned is summarized in **Figure 1**.

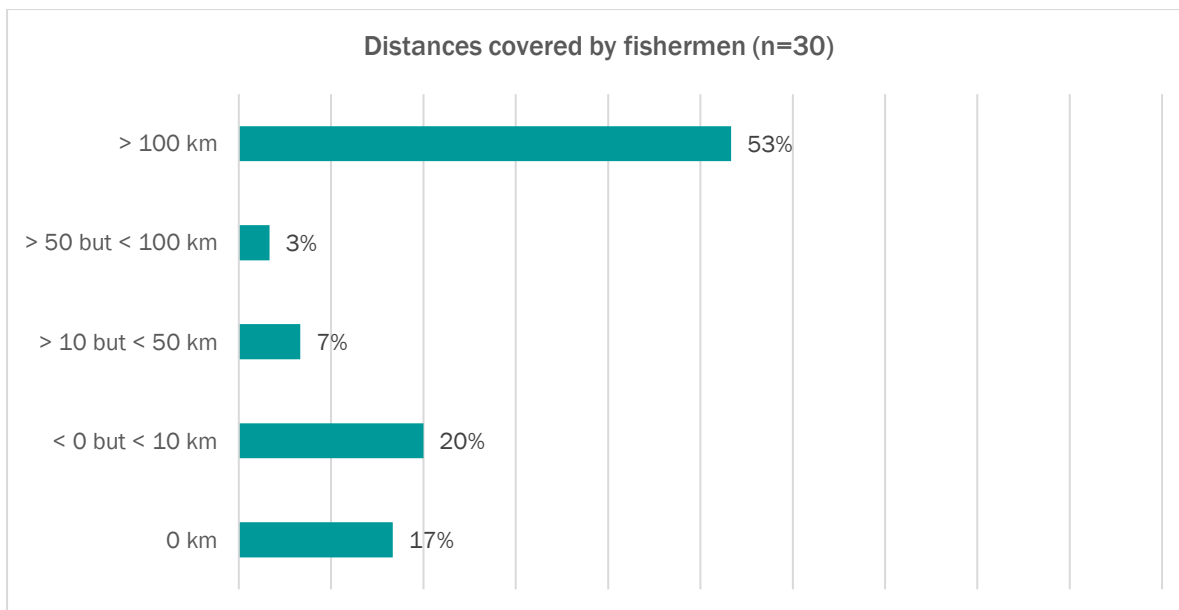
Figure 1: The cold chain needs at the first mile vs. what KIC is currently addressing (Source: KIC, 2022)



Fishermen require reliable cold storage that can ensure produce remains at ambient temperature over distances before handing the produce over to the next in the value chain. Based on survey responses, fifty-three (53) percent of those who practice fishing reported covering a distance of over 100 km before handing in fish to the next agent in the value chain. The distances covered by fishermen with their catch is shown in **Figure 2**.

Figure 2: Distances that produce covers as reported by fishermen (Source: KIC, 2022)²⁰

²⁰ 'n' = number of respondents.



The fishing business is dominated by males in Lake Victoria. The median fisherman handles about 30 kg and 100 kg of fish during the low and high catch seasons, respectively.¹¹ These are largely small-scale fishermen, with the lowest and largest volume of fish recorded being 2 kg – 250 kg and 20 kg to 600 kg per day in the low and high catch seasons, respectively. The first point of need of cold solutions is the fishermen, for purposes of preserving their catch while on the fishing expedition.

The fishermen reported that when weather conditions change abruptly, it can lengthen the duration of time spent on fishing grounds.²¹ This is because their boats are mostly unequipped for navigation during adverse weather and they are normally left with the option of waiting for the adverse conditions to subside before embarking on the journey back to the landing sites.²² Often times, the fish will deteriorate since the ice will have melted during the additional waiting period.

Based on the survey responses, most fishermen use ice placed in makeshift boxes for cooling fish

(70%), while another 30% indicated that they do not currently use any cooling facility to preserve fish while in the Lake.²³ This category of respondents indicated that they store the fish in the fishing nets or in the lower surface of the wooden boats. For the majority who reported using any cooling mechanism, they indicated that they were using ‘freezers’ and ‘ice’. The last two terms refer to makeshift cool boxes comprising of a metallic insulated box with a sack of ice positioned at the center as shown in **Figure 3**.

Figure 3: Insulated cool boxes stocked with a sack of ice currently used to keep fish cool (Source: KIC, 2022)

²¹ Similar sentiments are reflected in Woodhams et al. (2019) and other studies.

²² Based on Catch Assessment Surveys by KEMFRI, the most used vehicle is a Sesse boat with a paddle or outboard engines (Owili et al., (2018)).

²³ We note that some respondents were citing ‘freezer’ or ‘cooler’ when asked what they used to preserve fish after catching. However, when asked further questions regarding the details of the freezer, the interviewer discovered that these words were used loosely to mean the metallic insulated box used as the cool box.



Due to the design of the makeshift cool boxes, it means that the fishermen have to keep replenishing ice to keep the temperature in the container as low as possible and make it fit for fish storage.

About 65% of fishermen who reported using the makeshift cool box actually own them. Sharing of cooling boxes is widespread, with about half (55%) of those using the boxes reporting to share the space with another fisherman. Sharing was reported by even those who own the boxes, largely attributed to the fact that even boats are shared.

Buying ice therefore forms a significant portion of daily cooling cost for the fisherman. The median fisherman using the cool box in the case study spends KES 400 or USD 3.3 on ice per day.²⁴ The smallest daily expenditure on ice reported is between KES 50 and 150 (between USD 0.4 and 1.2), while the largest reported expenditure is between KES 500 and 1,000 (between USD 4.1 and 8.3) per day. This expense can drastically change if temperatures change, leading to a higher rate of ice melting and thereby increasing the replenishment cost. The survey found that the use of the cool box is also not convenient as 94% of fishermen who used cool boxes reported suffering post-harvest losses.

3.2 Post-fishing cold storage needs of fish traders and how KIC is currently meeting them

The first mile cold chain needs of fish traders arise from the process of evacuating fish destined to domestic markets (local and faraway), once the fishermen have delivered the produce. At the landing site, most fishermen (70%) indicated that they sell the produce immediately to traders while others (30%) don't. Once the traders obtain the fish from the fishermen at the landing site, they start the process of conveyancing it to either domestic or export markets. The cold chain process of the export market is largely well organized, due to export standard requirements. This is not the area that KIC focuses its support to fishermen and traders. However, the cold chain conveyance for fish destined for domestic markets is lagging behind, which is the area that KIC targets.

To understand the opportunity for cold storage, the study obtained data on the weight of fish and the method of cooling currently used by the traders. Data from **Table 1** shows that **the median fish trader handles 100 kg of fish per day during the high catch season**, with the smallest catch being 10 to 20

²⁴ 1 USD is equivalent to KES 121.0306 according to the official mean rate published at <https://www.centralbank.go.ke/forex/> on 18/10/2022.

kg, while the largest catch reported is 1,000 to 5,000 kg per day. During the low catch season, the median trader handles 30 kg per day, with lowest volume of 2 kg per day and highs of between 450 to 1,000 kg per day.

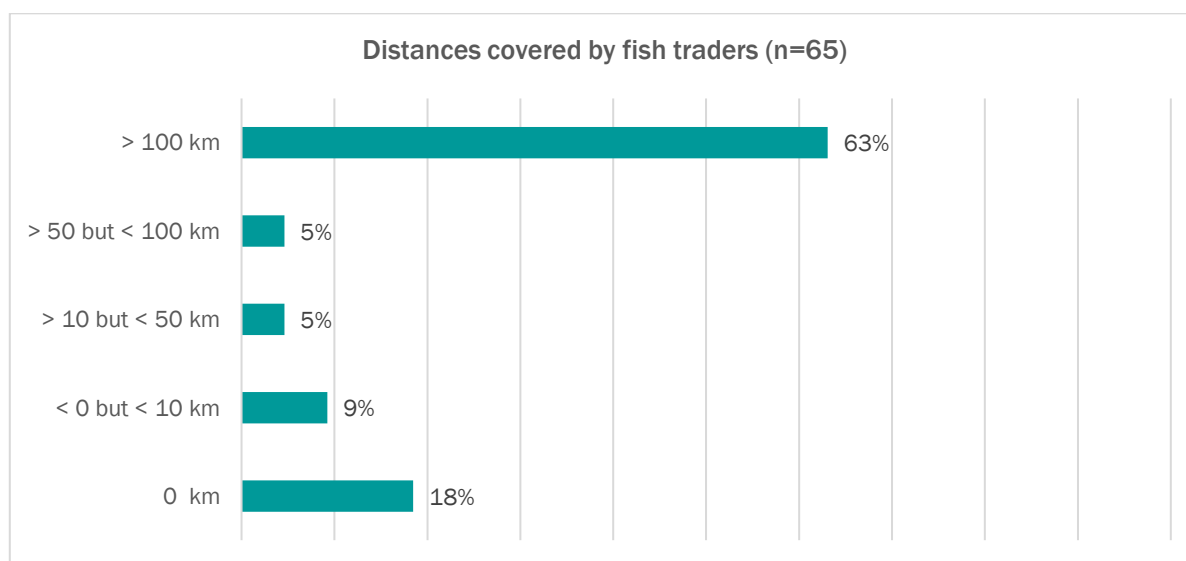
Table 1: Fish weight handled by traders during low and high catch seasons

	Low Catch Season (kg)	High Catch Season (kg)
Observations (n)	65	65
Median (50 th percentile)	30	100
Smallest (1 st to 25 th percentiles)	2	10-20
Largest (75 th to 99 th percentiles)	450 - 1,000	1,000 - 5,000

Source: KIC (2022)

Traders largely use insulated metal boxes with ice for cooling fish, similar to that observed among fishermen. This is for purposes of ensuring that fish remains cool so as to fetch a favorable price in the market. To keep the boxes cool, the traders keep buying and replenishing the ice up until they sell their fish. Among traders using ice in the boxes, the median spending on ice purchases per day is KES 400 (USD 3.3) with lowest amounts of KES 50 (USD 0.41) per day and highest amounts recorded being KES 5,000 (USD 41) per day. However, ice is inconvenient especially for longer distances since it keeps melting and would need replenishing. Just like the case with fishermen, the survey found that 90% of traders using cool boxes also reported that they suffer post-harvest losses.

Figure 4: Distances that produce covers as reported by fishermen and fish traders (Source: KIC, 2022)



Some traders do not use any cooling solutions, partly attributed to the fact that some of them dispose their produce at the landing site (see Figure 1). However, most traders (63%) reported that their produce covered a distance of more than 100 km before reaching the final destination (see Figure 4). Even for those who sell in markets within short distances, lack of cooling solutions imposes limitations in terms of the volume traded. Moreover, in the absence of cold storage, fishermen and traders cannot hold onto their stock for long in order to negotiate better prices.²⁵

²⁵ Odoli et al (2019).

3.3 What KIC has done and will do to address the cold storage gaps for both fishermen and fish traders

With identified challenges in mind, this section discusses how KIC has addressed some of these challenges (through offering cold storage transport of fish from the landing site for distribution to faraway markets) and will propose how to go about other challenges.

At the landing site, **KIC provides cold chain facility (cold truck) for produce destined for faraway markets** (green section in **Figure 1**) twice a week. The cold truck is only available to fishermen who sell their catch to KIC's aggregating agents at the landing site, based on prior arrangements between the agents and the beach management unit (BMU). Upon arrival, their fish is then sorted and loaded in a waiting KIC cold truck (see **Figure 1**). They do not bear the cold storage costs of the portion of fish they have surrendered to KIC. **However, for the other days of the week when KIC is not picking up fish, the fishermen have to seek means of preserving their produce as they wait for buyers. The cold chain needs are therefore not fully met for all fishermen all the time.** KIC does not currently offer any cold storage solution for fishermen while they are fishing in the Lake or transporting produce to the landing site.

Furthermore, KIC has appointed agents, who are also fish traders, to secure quotas sufficient to satisfy the orders (mostly 2,500 kg/a trip) that the company will have aggregated from its end customers in faraway markets around Nairobi County (about 500 km away). The task of the fish traders (agents) is to sequence the orders and sourcing of fish in required quantities and qualities, for which they are paid a price difference. There is no cold facility at the landing site apart from KIC's cold truck, which has limited off-take capacity. This means that fish cannot be aggregated upfront in the absence of the truck, thereby limiting trading opportunities for fish traders. Further, KIC only aggregates fish for faraway markets, implying that traders distributing fish in local markets largely operate without a formal cold storage.

These limitations affect the ability of fish traders to get a better price and reduce their revenue due to post-harvest (physical) fish losses. This is a perverse problem affecting almost all (92%) the respondents. The median post-harvest physical fish losses reported by fishermen is 50 kg per season with highest reported loss of 400 kg and lowest reported loss of 2 kg per season. The median loss among traders is also 50 kg, lowest recorded loss is 2 kg and highest reported losses per season can go up to 2,000 kg. The monetary value of the median post-harvest loss for fishermen and traders is approximately USD 150. The lowest and highest value of loss for fishermen is USD 6, and USD 1,200, respectively while the lowest and highest value of loss for traders is USD 6, and USD 6,000 per season.²⁶

Although KIC is not fulfilling all the cooling needs of its clients, there is some impact already being felt by its customers in the first mile. A study by KIC that covered 40 respondents and attempted to identify the impact that KIC is having on fish traders in Homa Bay found that the cold truck transportation service is a first-time experience for half (50%) of the respondents.²⁷ Another 39% of the respondents indicated that they have been able to reduce wastage upon accessing the cold truck facility. Sales also increased for 31% of the respondents, attributed to the guaranteed off-take capacity provided by KIC. Further, 45% of the respondents in the same study reported a perceived increase in income after enlisting sale of their fish to KIC. Finally, both fishermen and traders in the study indicated an average increase in the number of employees by one (1) person after enlisting in KIC services. Although these may be indicators of increased income on the surface, the impact is likely to be confounded by effects of post-Covid recovery. This implies that the apparent rise in income of fishermen and traders may not be purely attributable to enlisting in KIC services. Future comprehensive studies will be needed to address the apparent gaps.

Based on the apparent impacts that the firm is making from its current intervention in the first mile and the identified gaps in this research, there are opportunities for creating deeper impacts among its customers. The following discusses what the future opportunities for KIC to address wider challenges in cold chain logistics are. KIC estimates that out of the total annual offtake of 130 tonnes in the year 2021, transportation efficiency from the use of cold trucks reduced post-harvest fish losses from 27.8%

²⁶ This is based on current fish prices of about USD 3 per kg given by KIC.

²⁷ Keep IT Cool (2022) Insights Deck. 60 Decibels.

to 0.6% (from a loss of 36.14 tonnes to 0.78 tonnes per year).²⁸ **This saving in fish physical wastage is estimated to eliminate emissions to the tune of 65.7 tonnes of carbon dioxide equivalent (tCO₂e) per year.** Deployment of coolers to traders and fishermen in addition to the current intervention of cold transportation will further boost the savings on post-harvest losses, and lead to extended reduction in emissions in line with the country's climate adaptation agenda. **To facilitate trading of fish and minimise post-harvest losses, KIC intends to deploy cold chain solutions at Mbita fish Banda.**

The above points out two opportunities that KIC can explore to help fishermen and fish traders to address the cold storage challenges in the future. **The first opportunity lies in shared cold chain facilities. The survey found that there is a clear need for additional ice-making factory and a cold store at the landing site. The two facilities should be powered by alternative energy sources to increase their reliability and convenience, given the cited unreliability of grid electricity.**

The second opportunity lies in the provision of mobile cool boxes that are powered by solar energy for fishermen and local traders, to ensure fish is kept at recommended temperatures as it's transported from one local point to the other. Fabricated cool boxes that are currently used by fishermen are inefficient and ineffective as they are dependent on the ability to replenish ice and have no power source when both fishermen and traders are on the move. To assess whether and how KIC can directly address the above cooling needs using solar-powered cooling boxes, understanding about the size of solar-powered cooling boxes and willingness to pay (WTP) are also explored with fishermen and traders.

The survey also asked fishermen and traders to state their desired volume of solar cooling boxes and their WTP for these boxes. Please see **Annex 2** for more information.

The median desired storage capacity for traders is at 350 kg. Their smallest desired storage capacities are 40, 60 and 80 kg, while on the higher side, the capacities are 1,000 kg and 5,000 kg (see **Table 2** in **Annex 2** for categorization). Notably, the median storage capacity that the traders wish for exceeds the current daily transacted weight, suggesting unmet cold storage needs. This supports the discussion that the lack of cold storage solutions might have limited the volume of fish that traders might have been able to handle a day.

When asked how much they would be willing to pay for solar-powered cold solutions, the median trader quoted a value of KES 300 per day. Lower quotes of KES 50 and KES 100 and upper quotes of KES 400, 500 and 1,000 per day were given by traders in the lower and upper centiles, respectively. The range of prices the traders are willing to pay for each category of cold storage is as shown in **Table 2**. However, these are plain prices as the study did not present the respondents with all the features of the suggested cold storage. The study also did not explore whether the WTP was practical with the current market prices for these boxes. KIC will continue this discussion with fishermen and farmers in a future engagement.

4 Conclusion and recommendations

This study sought to understand (a) the current situation of first mile connectivity of fish, (b) interventions implemented by KIC to address some of the challenges, and (c) opportunities for KIC to expand its services to address the large-scale challenges faced by the fish industry in Lake Victoria. From an analysis of primary data collected from fishermen (n=30) and traders (n=65) (a total of 74 survey respondents), **it is clear that there are unmet cold storage needs and first-mile actors are suffering post-harvest fish losses.** KIC is currently meeting cold storage needs through a cold truck that evacuates limited stock of fish to up-country markets, with gaps in other parts of the first mile cold chain.

The first challenges for cold storage are experienced by fishermen who do not have reliable cold storage during fishing and transportation to landing sites. Second, fish traders lack timely market access and access to cold storage on the days they are not aggregating their produce for evacuation by KIC. Further, there is lack of cold storage facility for traders who sell their produce in local markets. Use of ice in fabricated boxes is ineffective and inefficient, especially in the absence of electricity back-ups in the area. The study identifies opportunities for KIC to address wider challenges in the cold chain logistics

²⁸ This is a separate study by KIC that estimated green-house gas (GHG) emissions attributable to operations of the Company.

of the fish industry in Lake Victoria, based on the desired volume of solar-powered cool boxes and the WTP for these cool boxes by fishermen and traders.

From the above findings, the study recommends the following.

- 1. Construction of a solar-based aggregation and cold storage hubs** preferably with ice-making line in the location of the study (Mbita Fish Banda) to preserve fish stocks while awaiting evacuation to local or faraway markets. This will help fishermen and traders negotiate for better price and gain better revenue as produce will remain at optimal quantity and conditions before sale to the next handler in the value chain.
- 2. Provision of mobile solar-powered cool boxes for use by fishermen while at the Lake** to aid in keeping fish at ambient temperatures on board boats and at the landing site; Specifications of how that provision can be met (such as prices or mode of provision via renting or sharing) will need further discussion with fishermen.
- 3. Provision of solar-powered cool boxes to traders for purposes of cold handling of fish while selling to local markets.** Specifications of how that provision can be met (such as prices or mode of provision such as via renting or sharing) will need further discussion with traders.
- 4. Expansion of KIC up-country fish market to permit evacuation of higher tonnages.** Fishermen and traders feel they can gain more from a higher guaranteed offtake of fish than the current weekly limit of 5,000 tonnes per week by KIC. Expanding KIC services to up-country markets will create more demand for fish.
- 5. Prior to the dispatch of the cold truck to Mbita, KIC will continue with the current practice of issuing a 2-day prior notice of the required tonnage to the aggregators** who in turn use this notice to mobilise adequate fishermen and traders to deliver fresh produce on the day of collection. This is to give ample time for aggregators to mobilize enough fish stock from the fishermen and traders on the particular day, since there is no cold store to hold stocks at the moment. In other instances, the stock mobilisation relies on fishermen to return from the Lake straight to the landing site for deliveries. This means longer turnaround time for the cold truck.

Annex 1. References

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Annex 2. Data on capacity of cold box and willingness to pay

The median capacity of a cool box required by fishermen is 500 kg, with smallest and largest desired capacity of 40 kg and 1,000 kg, respectively. The categories of weight limits in the desired storage are as shown in [Table 1](#).

The researcher analysed data from the survey and benchmarked WTP for alternative cool boxes against the cost of ice. Interviewees did not know the price of the boxes when discussing their WTP. The median WTP by fishermen is KES 300 (USD 2.5) per day for a solar-powered cool box and with the lowest recorded WTP of KES 50 (USD 0.4) and highest recorded WTP of KES 1,000 (USD 8.3).

Table 2: Categories of cold storage needs (capacity of cool box)

Cold storage need	% of respondents	WTP (Minimum-maximum) in KES (USD)
Fishermen (n=26)		
< than 200 kg	23	100 (0.83) - 1,000 (8.26)
> 200 kg <= 500 kg	33	100 (0.83) - 400 (3.3)
> 500 kg <= 1,000 kg	30	50 (0.4) - 500 (4.13)
> 1,000 kg	13	N/A ²⁹
Fish Traders (n=65)		
< than 200 kg	37	50 (0.41) - 1,000 (8.26)
> 200 kg <= 500 kg	37	70 (0.58) - 500 (4.13)
> 500 kg <= 1,000 kg	15	100 (0.83) - 500 (4.13)
> 1,000 kg	11	400 (3.3) - 5,000 (41.3)

Source: KIC, 2022

²⁹ No WTP answer was given by the 3 respondents.