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SUSTAINABLE FISHERIES MANAGEMENT PROJECT (SFMP)

Assessment of the Introduction of Insulated Fish Containers in Ghana

JANUARY, 2019

THE UNIVERSITY OF RHODE ISLAND
GRADUATE SCHOOL OF OCEANOGRAPHY
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Citation: Beran, K. (2019). Assessment of the Introduction of Insulated Fish Containers in Ghana. The USAID/Ghana Sustainable Fisheries Management Project (SFMP). Narragansett, RI: Coastal Resources Center, Graduate School of Oceanography, University of Rhode Island. GH2014_ACT243_CRC. 23 pp.

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Prepared for USAID/Ghana under Cooperative Agreement (AID-641-A-15-00001), awarded on October 22, 2014 to the University of Rhode Island, and entitled the USAID/Ghana Sustainable Fisheries Management Project (SFMP).

This document is made possible by the support of the American People through the United States Agency for International Development (USAID). The views expressed and opinions contained in this report are those of the SFMP team and are not intended as statements of policy of either USAID or the cooperating organizations. As such, the contents of this report are the sole responsibility of the SFMP team and do not necessarily reflect the views of USAID or the United States Government.

Cover photo: Three-dimensional design of insulated containers (Credit: Wofa-tee Designs)

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ACRONYMS

CEWEFIA	Central and Western Region Fishmongers Improvement Association
CRC	Coastal Resource Center
DAA	Development Action Association
FC	Fisheries Commission
MOFAD	Ministry of Fisheries and Aquaculture Development
NAFPTA	National Fish Processors and Traders Association
SFMP	Sustainable Fisheries Management Project
URI	University of Rhode Island
USAID	United States Agency for International Development

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ACKNOWLEDGEMENTS

The author wishes to thank Samuel Manu of the Post-Harvest Unit at the Fisheries Commission in the Ministry of Fisheries and Aquaculture Development for initially proposing to pilot the use of insulated containers among fishermen at-sea and at select fish processing sites to improve the cold chain process. The author acknowledges and also thanks Dr. Margaret Ottah Atikpo for her role and evaluation of this pilot funded by the United States Agency for International Development/Ghana Sustainable Fisheries Management Project (USAID/SFMP). The Monitoring and Evaluation (M&E) unit at the USAID/Ghana SFMP led by Bakari Hardi Nyari, Samuel Fant Kombian and Mary Asare provided routine monitoring visits that contributed to a better understanding of the outcomes, lessons learned, and recommendations for future implementation of post-harvest interventions. The author thanks Justice Mensah from Hen Mpoano for creating maps to indicate the location each insulated container, and Wofa-Tee Designs for creating the three-dimensional graphics of the insulated containers in this report.

EXECUTIVE SUMMARY

The purpose behind the introduction of insulated fish containers in Ghana was to improve the cold chain process for high-value demersal species along the value chain. Twenty insulated containers were distributed to fish processor and trader associations. The insulated containers were group-owned by members of each association. An assessment was conducted to determine if the insulated containers are being used to improve the cold chain process for demersal and other fish species, as well as deliver economic benefits to traders and processors using them. The model behind group ownership of containers was also examined. A qualitative assessment guided by a semi-structured questionnaire that included key informant interviews and focus group discussion was carried out in four coastal regions in Ghana. The assessment concluded that the containers are generally not in use because the majority of the beneficiaries were fish processors smoking small pelagic fish species. Those who smoke fish demonstrated little to no need for insulated containers or ice because they either buy frozen blocks of fish from a cold storage, or there is simply not enough fish being landed to justify storage for any significant length of time before its processed, even during a bumper or high season. There is also a perception among processors that small pelagic species, or such as herring and anchovies should not be iced and immediately smoked. Hence, there is no economic incentive for fish processors smoking these types of species to use insulated containers with ice.

Fresh fish traders demonstrated the most need for insulated containers, however, only four of the twenty associations received these containers. Both fresh fish traders and fishermen catching higher-value demersal species already use ice to preserve fish, albeit in wooden crates or straw baskets. Fresh fish traders sell high-value species to higher-end markets and restaurants, therefore, they demonstrate the greatest need and incentive to preserve fish, especially when landings of fish are high, for example. Properly iced fish has a shelf-life of 7 days in an insulated container. Extending the shelf-life for up to 7 days gives traders more options, for example, they can sell their fish at higher prices on the weekend or on certain market days. They can also buy more fish (i.e. as opposed to rejecting it) because they know they have a place to store it. Traders also avoid paying for cold storage if they use their own container which is an immediate, and potential economic benefit. Economic benefits were difficult to quantify based on the evidence provided which was primarily anecdotal.

The model behind group-ownership is not effective due to group size, access to and location of the container, and the potential for conflict between members. The average group size was 50 members per container. Members' access to the container is restricted because of its location and rules surrounding its use established and enforced by the group leader. The current design and cost of insulated containers is inconsistent with the needs of its users. Smaller containers are recommended for individual ownership because they require using less ice, whereas, group-owned containers should be larger so that more members can use it. The recommended group size is 4-5 members.

Future interventions should be informed and designed based on a needs assessment and value chain analysis. A needs assessment identifies specific gaps between the current type of container used in the cold chain process, and what it seeks to improve upon or replace. A needs assessment can also identify key stakeholders from the beginning which might facilitate implementation and lead to adoption of containers. A value chain analysis determines which actors and fish species along the chain will most likely economically benefit from using insulated containers. Future interventions intended to improve the cold chain process should begin with fishermen and end with those identified by a value chain analysis to achieve benefits system-wide.

1. BACKGROUND

The idea of using insulated containers to preserve fish was initially proposed by the Post-Harvest Unit at the Fisheries Commission and planned in Year 3 (CRC, 2016) to improve the cold chain process from catch to consumption for high-value demersal species[1] harvested and sold in Ghana. The original intention was to pilot the use of insulated containers on-board fishing boats and at selected fish trading and processing sites in Tema, Ghana's largest fishing port. A pilot was conducted in Year 4 with support from the USAID/Ghana SFMP to understand the benefits of icing fish and determine if group ownership (versus individual ownership) of insulted containers is a viable option before scaling-up to meet larger demands for insulated containers.

Twenty insulated containers were provisioned to fish processing associations in January, 2018 (Year 4). Fishermen catching high-value species were not provisioned with insulated containers due to changes that occurred between the design and implementation stage. Originally, the Post-Harvest Unit at the Fisheries Commission envisioned a two-chamber insulated container used by fishermen; one chamber would be used for ice that is gradually added to fish stored in the other chamber. However, adjustments were made by the manufacturer and donor agency to the original design that resulted in the creation of a one-chamber container, typically used for storage by processors. Hence, insulted containers were issued to fish trading and processing associations instead of fishermen. Most of the associations represent processors that smoke small pelagic species, or low-value fish primarily sold at markets in Ghana. Only four associations focus on fresh fish sold to higher-value markets. Despite the changes that occurred from the design to implementation of the insulated containers, the objective of this pilot was to still improve the cold chain process using a different entry point along the value chain. Fish traders and processors are positioned further along the value chain, whereas fishers are positioned at the beginning of the chain.

After the insulated containers were distributed, there were two visits to select sites to assess use of the containers by the USAID/Ghana SFMP team. After both visits, it was generally realized the insulated containers were not in use due to lack of fish, size and location of insulated containers (in relation to fish landing sites and other processors), and lack of security (no padlock).

In November, 2018 (Year 5), an assessment was conducted with support from the M&E team at USAID/Ghana SFMP. There were multiple reasons for conducting an independent evaluation. First, it was important to capture how beneficiaries of insulated containers experienced the pilot, and determine if the pilot was implemented as envisioned by the Post-Harvest Unit at the Fisheries Commission. Second, to determine if the insulated containers deliver economic benefits for traders and processors based on perceptions, practices, and use of insulated containers to-date, and third, to determine the effectiveness of the implementation strategy of group ownership of insulated containers versus individual ownership.

1.1 Objectives of the Assessment

The objectives of the assessment were to:

- Document current perceptions and practices regarding use of the insulated containers among fish traders and processors.

[1] Hook and line fishery targeting primarily grouper and barracuda.

- Assess the economic viability of the insulated containers to preserve fish, and determine if there is an economic incentive to use ice.
- Evaluate the effectiveness of the implementation strategy of group ownership versus individual ownership.

1.2 Expected outcomes of the Assessment

Expected outcomes of the assessment included:

- Lessons learned from "design to implementation" of the insulated containers.
- Recommendations for future designs and interventions of insulated containers in Ghana.

2. METHODOLOGY

This is a qualitative assessment guided by a semi-structured questionnaire (Appendix A), direct observation and an in-depth interview with the Post-Harvest Unit at the Fisheries Commission. The questionnaire guided the focus group discussions and key informant interviews. The post-pilot interview was conducted with the Director of the Post-Harvest Unit at the Fisheries Commission (see Appendix B for a summary of the interview). The location of each container was marked using a global positioning system unit.

2.1 Insulated ice container pilot sites

The location of insulated containers is shown in Figure 1.

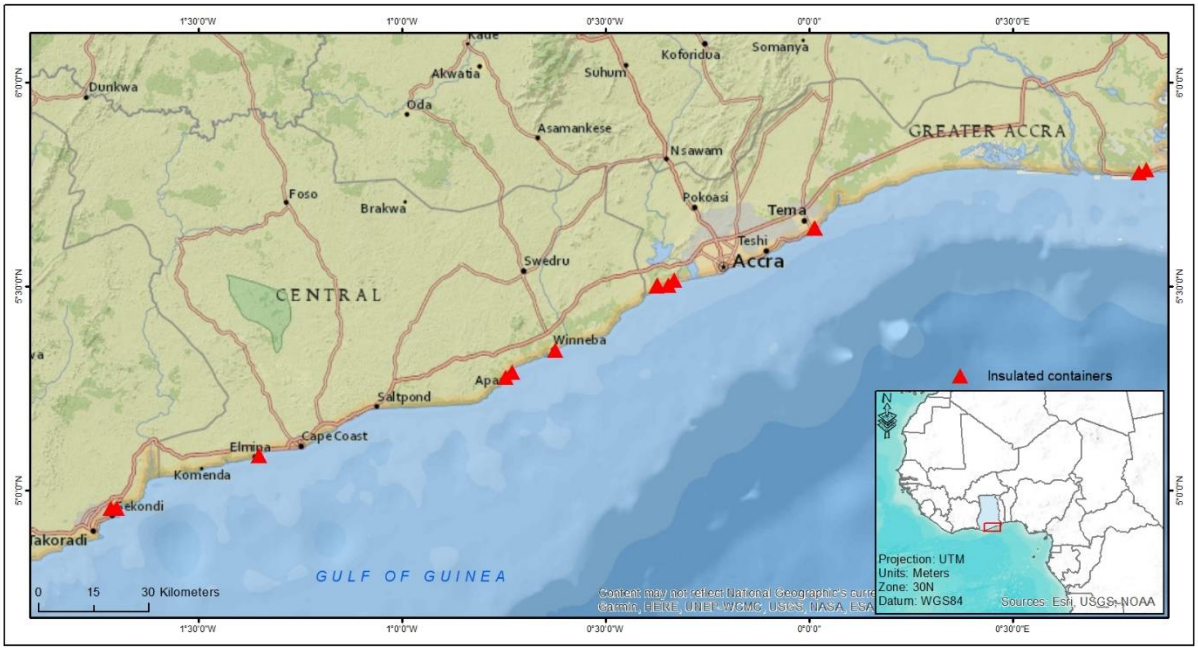

Figure 1. Location of insulated containers in Ghana

The assessment was conducted during the period of November 12-21, 2018. This period is considered the low season for small pelagic species and many demersal species, such as cassava landed in Ghana.

2.2 Sampling

One key informant, or group leader from each association that received a container was interviewed. The key informant was selected based on availability and interviewed separately from other group members. Focus groups were formed by group members from each group

that received a container. Focus groups were comprised of a minimum of two persons and maximum of 17 persons based on members' availability and proximity to the location of the insulated container.

2.3 Analysis

Where applicable, data were analyzed using Excel. Any significant differences in responses among or between various groups (i.e. fresh fish traders versus smoked fish processors) are found in the results and discussion section.

3. RESULTS

The insulated containers were made in Ghana by Team Work Powerboats Ltd. in 2017. The container came in one size. Its dimensions are 37 inches (height) x 47 inches (length) x 35 inches (width), and is made from 3-inch thick fiberglass. The containers are heavy to lift and/or move so wheels are attached for ease of mobility. See Figure 2 for different angles and features of the insulated container. The cost per container was GHS (Ghana Cedis) 3,900.

Figure 2. Three-dimensional view of the insulated containers

3.1 Perceptions and practices

In general, the size of the container is inconsistent with the needs of its users. According to respondents, a smaller size is more useful for those selling fresh fish near a roadside, or to store fish at home. A smaller container also requires less ice, hence, reducing the cost of ice. Smoked fish processors buy fish from a cold storage or at the landing site, however, due to the decline of small pelagic fish landings there is not as much fish to buy that justifies long-term storage. Therefore, many processors buy frozen blocks of fish in small increments from a cold store to process almost immediately.

Some respondents said the container should be bigger if the container is group-owned. Other suggestions with respect to its design include a bigger drain to allow excess liquid from fish and ice to drain more easily, and the container should be lower in height so members don't have to use a step or stool to reach fish at the bottom of the container or clean it. The

containers do not come with a padlock. At the fish landing site in Tema, processors built a gate around the container and secured it with a padlock. All members stated that a padlock is necessary to prevent theft. Except for Tema, all the other containers are located at the house of the group leaders or at a training center. Locating the container at the group leaders' house is seen as a deterrent to use by other group members because other members must seek consent and permission to enter before they can use the insulated containers.

Most of the associations that received containers represent smoked fish processors, especially in the Volta, Central and Western Region. Only four of the 20 associations that received containers sell primarily fresh fish. Fresh fish traders demonstrate the greatest need and incentive to use containers with ice. During the study period, only one container was seen actively in use in Winneba (Figure 3). The reason the containers are not in use by smoked fish processors is because there is not enough fish to buy and store in the container. The reason why more containers were not seen in use by fresh fish traders is said to be because it is not the season for certain types of fish they buy in volume, such as cassava fish. The cassava fish season usually begins in December and ends in April.

Figure 3. Iced fish in an insulated container in Winneba

As stated earlier, fresh fish traders demonstrate the most need for insulated containers because they sell high-value species to higher-end markets and restaurants in Accra. The fresh fish trade is time-sensitive given the perishable nature of fish. Fresh fish can be stored for up to 7 days with sufficient ice, however, most sell the fish within 3-4 days if not immediately. Fresh fish traders generally sell demersal species, or "bigger fish," such as yellowfin tuna, cassava, redfish, grouper, and barracuda. One respondent noted that buyers are willing to pay more for iced fresh fish than previously frozen fish from a cold storage. Other traders commented that they can keep fish fresh with hopes of getting a better price at a later date, yet no evidence of that was seen.

Processors that smoke fish mainly buy small pelagic species such as anchovies, herring, and sardines from the fish landing site, or mackerel from cold storage. According to respondents that specifically process these types of species, there is not a pressing demand for insulated containers to preserve fish. The containers are mainly used to store fish without ice until it has been processed. Some respondents said there was not enough fish to buy to even store in the containers. There is also a perception among respondents that some types of fish such as herring and anchovies should not be iced because they "don't last," claiming it is better to process them fresh right away.

The insulated container in Moree is used by fishermen who have taken it to sea, therefore, it was not available for inspection. A key informant in Moree commented that "the containers

would've been more beneficial to fishermen (than fish processors) because it enables them to bring fresh fish to smoke instead of spoiled fish."

Even though insulated containers are not widely in use as evidenced in this study, perceived benefits and challenges of using insulated containers were captured during the interviews and summarized in Table 1.

Table 1. Benefits and challenges of using insulated containers

Benefits of using containers	Challenges of using containers
The containers protect fish from theft and predation by animals	Members must seek permission to use the containers
The containers maintain and prolong freshness of fish	The containers are not located near its members
The containers provide storage for fish for future processing	The container is too small for the number of members it is intended to serve

3.2 Economic viability and incentive of insulated containers

Straw or woven baskets are mostly used to ice fish in Ghana by artisanal fish traders and processors. The basket is lined with rice sacks, a tarp-style plastic fabric to hold fish and ice. Baskets are then placed in a metal pan to absorb water from melting ice. Fish is transported by hired vehicle or public transportation and sold to markets along the coast and inland in baskets. This method of storing fresh fish requires a daily replacement of ice if not immediately sold. A "shoe-box" sized block of ice costs ~5 Cedis. Ice is available at fish landing sites surveyed in this study except in Mumford which gets ice from neighboring Apam at a higher cost.

Fish traders and processors who are located at or near larger landing sites use cold storages to preserve their fish. The cost of storage ranges between 5-20 Cedis/day per basket or pan depending on the amount of fish being stored. Those who smoke, salt or dry fish typically don't use ice stating their "fish would simply get processed or spoil sooner."

The containers are intended to improve the status quo while establishing a cold chain process; however, the manufacturer's cost (3,900 Cedis) and current design is prohibitive for most of the members surveyed and therefore not economically viable. The focus group members' willingness to pay for an insulated container is shown in Figure 4. Respondents were unaware of its cost when asked about their willingness to pay for individual containers.

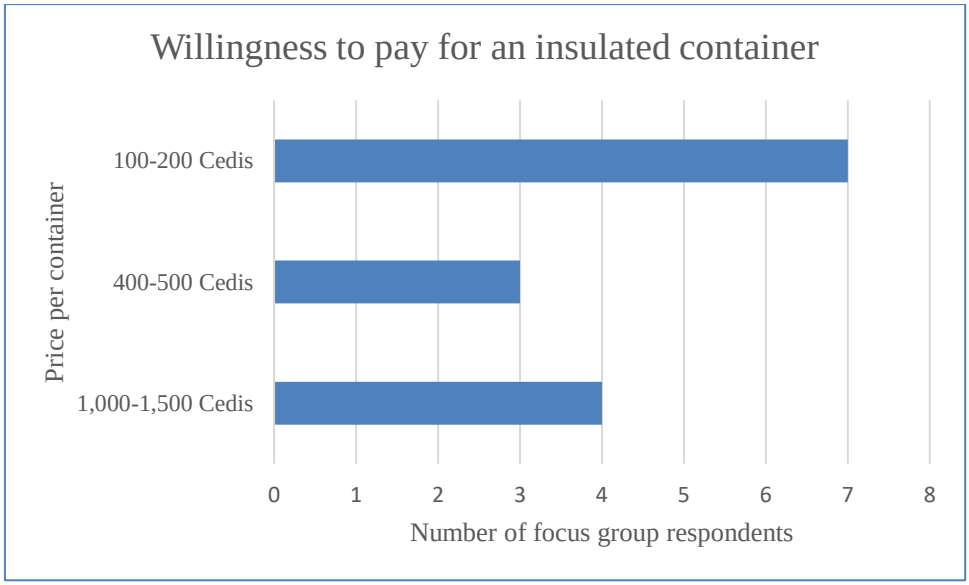

Figure 4. Focus group members' willingness to pay for an insulated container

The majority of respondents (72%) stated they would rent their group-owned containers to others at a cost. The cost of renting a container ranges between 2-20 Cedis/day or 2-10 Cedis per basket or pan of fish. Respondents were willing to rent the containers to "outsiders" or non-group members to store fish and also for events such as funerals (i.e. to store beverages). Other respondents said they were not willing to rent the containers as to encourage others to purchase one of their own. Respondents also said that since the containers were "given" to them, they did not feel as though they could charge others to use it.

3.2.1 Economic incentive of insulated containers

There is limited, anecdotal evidence insulated containers offer economic benefits to its current users. There is an incentive for fresh fish traders to use insulated containers to preserve high-value fish species[2] because ice melts faster in straw baskets than in the insulated containers which compromises quality and affects price. In Mumford, a fish trader is able to accumulate more fish using an insulated container (versus a straw basket) and uses WhatsApp on her mobile phone to communicate with interested buyers as far as Accra. Fresh fish traders in Tema said they can avoid paying the cost to store fish overnight by using their own container. Fresh fish traders in Tema were also willing to pay the most for an insulated container (1,500 Cedis).

For processors,[3] the incentive to use insulated containers is based on availability of fish and convenience, more than economics or maintaining a cold chain process. With respect to availability, there is a limited amount of small pelagic species available to process due to a decline in landings caused by overfishing, therefore, fish is processed (i.e. smoked, salted or dried) almost immediately and sold to markets. After fish has been processed, there is no need to ice fish because it is not critical to the cold chain process. Some processors did state that the containers are useful to store fish after its been landed in the event they cannot

[2] Higher-value fish species include cassava, yellowfin tuna, barracuda, and redfish. These species are typically caught by fishermen using the hook and line method of catch.

[3] Processors smoke, salt or dry small pelagic species such as herring, sardines and mackerel.

process it all in one day, or simply want to rest. Furthermore, respondents stated herring and anchovies shouldn't be iced because they become "mushy" and "don't last." The weight of the ice on top of the smaller-sized fish can damage the fish according to respondents.

3.3 Structure of ownership

All twenty of the insulated containers are owned by groups, or regional fish processing and trading associations. Some associations were formed based on tradition, meaning their mothers or other family members belonged previously belonged to it. In other cases, associations were formed as an extension of Village, Savings and Loan Associations (VSLAs) or encouraged to self-organize by the National Fish Processors and Traders Association (NAFPTA). Associations are also based the type of post-harvest commercial activity. For example, a trader of fresh fish will typically buy and sell fresh fish, but not engage in further processing activities such as smoking, salting or drying fish. A fish processor will buy either fresh or frozen fish, process and sell it.

Association members are primarily women, but men also engage in these activities. Membership varies in size. The number of members per association range between seven and 150, with average membership being 50. The majority of the containers, except four based around the Tema Fishing Harbor, are located at the house of the association's group leader. In Tema, the insulated containers are located at the beach, market and processing site locations. In Kokorbite, the group leader allowed another member to take the insulated container, that was transported on a tricycle, to her house for three weeks.

Focus groups and key informants were asked questions about the effectiveness of the implementation strategy behind group-ownership of these containers. All key informants stated that members have access and permission (upon request) to use the insulated container, except for one who was unaware of members' accessibility to it. During focus group discussions, members stated they have access to the containers but must seek permission to use them from the group leader. In Elmina, even non-members were granted access to use the container by the Market Queen at the Elmina Fish Market.

All but three associations established rules regarding use of insulated containers.[4] Rules were collectively decided upon by association members, except for two cases whereby the group leaders unilaterally decided the rules of use. Rules relate to cleaning, use, and purchase of ice or a contribution to their association for its use. For example, in Apam and Kokorbite members have to pay their association between 5-10 Cedis[5] to use the container. Members unanimously stated that those using the container are responsible for purchasing their own ice and cleaning the container after its use. In Tema, processors rotate use of the container among members, whereas elsewhere, it is on a first-come, first-serve basis or requires permission from the group leader.

Group-ownership of insulated containers has resulted in conflicts between its members. Conflicts are primarily due to availability of space (within the container) and its location. Regarding space, for example, fish processors need to "tag" or label their fish first so that it does not get mixed up and taken by another processor. Also, if more than one person is using

[4] Three associations have not established rules because the container is not in use and there has been no group meeting to determine use.

[5] 1.00-2.00 USD.

the container, it is common to ask a witness to be present if any fish is removed from the container.[6]

"No one is using the container because it causes conflict. It brings a lot of trouble"
– Association member in Tema

Group members and associations were asked if they prefer group or individual-ownership of insulated containers. All but two key informants stated that containers should be individually-owned by group members. The rationale behind individual-ownership according to key informants is related to security, convenience, and avoiding conflict. Key informants believed that individuals are more apt to use containers if they are within closer proximity to it so that they can store and process fish at their own pace, or use it for other purposes such as storing and selling chilled drinks without fear of theft or conflict. One informant argued for group-ownership because some members do not have enough capital to buy fish and ice, therefore individually, they will not use the container as it is intended. Another informant simply stated that other associations within proximity should also have access to a container of their own. A key informant in Moree that visited The Gambia as part of a peer-to-peer study trip funded by USAID/Ghana SFMP observed that in The Gambia, "the ice chests are always at the landing site and processors work as a group, while in Ghana, processors work individually."

Members that participated in focus group discussions strongly advocated for individual-ownership of containers. Currently, the containers are too small to accommodate the size of their groups. Security and convenience were also cited as main reasons for individual-ownership given that members have had fish stolen in the past, especially in the evenings, and if the containers were closer, it would be safer and more convenient to use them. Group members prefer to own individual containers built and offered in various sizes (small, medium and large) with a latch that locks.

"Why the container is group-owned, we don't know"
– Association member in Keta

3.4 Target beneficiaries for insulated containers

An interview was conducted with a fresh fish trader in the Volta Region to better understand who might be a target beneficiary for insulated containers in the future. See Figure 5 for results of that interview.

[6] Protocol states that when two people are using it, both need to be present when removing any fish.

Rebecca Zormelo is one of the largest fresh fish traders in the Volta Region. She sells high-value demersal fish species like cassava to wholesale markets in Accra. Rebecca personally owns nine freezers yet only one of them runs on electricity. Rebecca uses it to make ice. The other eight freezers are used to store fish with ice. Rebecca paid 1,500 Cedis for the freezer and 100 Cedis each for the other eight containers she uses to store fish. Rebecca is aware of the insulted containers from other associations that own them in this region; however, she did not receive one. Rebecca's business is an example of the potential target beneficiary for use of improved insulated containers.

Figure 5. Containers used to store fresh fish in the Volta Region

4. DISCUSSION

The pilot could have produced different results if the containers had been individually-owned by beneficiaries that have an economic incentive to use them. Areas for discussion center on the selection of beneficiaries, structure of ownership, size and economic viability of insulated containers used in the value chain.

4.1 Selection of beneficiaries

The majority of beneficiaries represent smoked fish processors who have little to no need for insulated containers or ice because they either buy frozen blocks of fish from a cold storage or there is simply not enough fish being landed that would require it to be stored for any significant length of time. Fresh fish traders appear to demonstrate the most need for insulated containers, however, only four associations based in Greater Accra received them. The goal behind the pilot's design was to improve the cold chain process beginning at-sea, however, during implementation a different set of beneficiaries were targeted. The selection of beneficiaries was largely driven by the SFMP project staff and the method of distribution created a source of frustration among Development Action Association (DAA), National Fish Processors and Traders Association (NAFPTA), and the Central and Western Fishmongers Improvement Association (CEWEFIA), the implementing partners. The Post-Harvest Unit at the Fisheries Commission select two of the twenty beneficiaries. Perhaps better coordination between implementing partners or introducing containers among a different entry point along

the value chain for select species based on a needs assessment would've resulted in a more suitable set of beneficiaries.

4.2 Group ownership

The model behind group-ownership is not effective because of group size, access to and location of the container, and the potential for conflict. The average group size was 50 members for one container. Access to the container is restricted because of its location and rules surrounding its use. Members must ask the group leader for permission to use the container and permission is granted on a first-come, first serve basis. If the group size were limited to 4-5 individuals and members had unrestricted access to the container, then perhaps they would be more inclined to use it according to focus group discussions. These self-imposed rules lead to conflict among members. These findings are consistent with the literature regarding collective ownership of assets in fisheries and aquaculture. Bailey and Jentoft (1990) caution of equity issues and conflict of interest among beneficiaries of fisheries development projects.

4.3 Economic viability and incentive

Among smoked fish processors, there is little economic incentive to use the containers. The containers are economically viable for fresh fish traders; however, economic benefits are difficult to quantify based on the evidence provided which was primarily anecdotal. Fresh fish traders use the containers to preserve fish for up to seven days which gives them the option to sell their fish when prices are higher (i.e. on weekends, or certain market days) and be more selective about the fish they buy knowing they have a place to keep it. Traders also avoid paying 10-20 Cedis/day for cold storage if they use the container, however, they still have to pay for the cost of ice (~5 Cedis/block). Ice does not melt as fast in insulated containers as it does in woven baskets which is an immediate, and potential economic benefit. If the containers were given exclusively to traders and sales of high-value species were tracked over time then the potential economic benefits could be better quantified.

This assessment validated that fishermen and fresh fish traders currently use local, low-cost containers to ice fish such as wooden crates and straw baskets. This pilot aimed to improve the status quo by introducing insulated containers, however, the current size and cost (3,900 Cedis) of this model may prevent future adoption of this particular design. If the container were to come in more sizes (i.e. small, medium and larger) and price points, then perhaps it would be more affordable for individuals to buy and use and customized more to needs. The threshold price point given by respondents was 1,500 Cedis which is similar to the cost of a freezer owned by the largest fresh fish trader in the Volta Region.

5. CONCLUSIONS AND RECOMMENDATIONS

The insulated containers generally failed to meet the needs of its beneficiaries, despite for the few that are in use. The failure is due to elements of poor design of the intervention as well as poor implementation. However, this pilot generated some key lessons learned that result in the recommendations provided below. These recommendations are applicable to future post-harvest investments especially with respect to improved fish preservation techniques. While the initial pilot was a failure, the concept of introducing insulated fish containers in Ghana's local fish supply chain to improve quality and potential income of fish traders should not be abandoned. Rather, a better designed and executed program could achieve the intended benefits for select fish traders taking into account the recommendations and lessons learned below.

Needs Assessment

A needs assessment should be conducted to identify specific gaps between the current type of container used in the cold chain process, and what it seeks to improve upon or replace, if needed at all. For example, traders are currently using woven baskets or old freezers to store fish with ice, both of which are smaller in size and cost less than fiberglass insulated containers.

A needs assessment can also identify beneficiaries that demonstrate the most need or demand for an insulated container. It is important to involve key stakeholders from the beginning to help with the design of the containers which might generate more "buy-in" and facilitate implementation. With respect to implementation, it is also important to maintain engagement of key stakeholders, for example in this case, the Fisheries Commission Regional and Zonal Officers to ensure distribution leads to adoption or trouble-shoot if it does not. This type of engagement might also contribute to sustainability of the intervention.

Value chain analysis

A value chain analysis should be conducted to determine which actors and fish species along the chain are most likely to economically benefit from using insulated containers. A value chain analysis can quantify the volume and value of fish to determine which species are best suited for storage using ice. The results of a value chain analysis can help advise, adjust or scale efforts to diffuse this intervention. For example, in this case, a value chain analysis should've been conducted for higher-value species such as cassava fish that is sold to higher-end markets by fresh fish traders.

Future interventions intended to improve the cold chain process should begin at the fishermen-level and continue along the value chain to determine if there are system-wide benefits from using ice and insulated containers for select species identified by a value chain analysis. If one of the objectives is better quality of fish sold in the value chain, then quality freshness and icing must occur once the fish are taken out of the water and stored on-board fishing vessels.

Build on existing technology

This survey did not ask questions about the advantages of the SFMP model of an insulated container over existing models and equipment being used to ice and store fish by fishermen and fish traders, such as wooden crates, straw baskets, and old freezers. Future interventions may benefit from evaluating and building on these existing technologies before designing and implementing new technology.

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APPENDIX A

Interview Guide for Key Informants and Group Members

Date: _____ Interviewer: _____

Study site/community where ice chest is located: _____

Beach landing site/market where fish is purchased: _____

Location of the Ice chest: _____

Occupation/role in the study of the key informant: _____

Implementation strategy

Group name if any: _____

Group ownership of ice box _____, or individual ownership of ice box _____?

Total Number of members in a group: _____ #/Male _____, #/Female _____?

How was the group formed and members selected? _____

_____

Does every group member have access to use the ice box? _____

Location and maintenance of ice and ice chest

Where is the ice box located in relation to other groups members? _____

Who maintains the ice box (cleans it)? _____

Who pays for the ice? _____

What type of fish is kept in the ice chest? (list species & mark which is most frequent or most important) and why?

_____

Are you aware of any types of fish that should not be iced? Yes ____, No _____

If yes, list the types of fish that should **NOT** be iced:

_____

Why shouldn't they be iced?

_____

How long do you keep the fish in the ice chest? _____

How many days does your fish stay fresh using the ice chest? _____

How did you store your ice before the ice chest? _____

Benefits of use of ice and ice chests

List benefits (free listing) and ask group about them

_____

Challenges of use of ice and ice chests

List challenges (free listing) and ask group about these

_____

Economic viability

Markets

What type of transport do you use to take fish to the market? _____

List your most important market for sale of iced fish _____

Why is this your most important market? _____

Has the ice chest helped you access other (new) markets? Y__ N__

_____

If yes, what new markets are you selling your fish at? _____

List the advantages of selling to a new market/customer? _____

_____

Since you started using ice chest, how can you compare the difference between the quality of fish compared to how you used to store fish before? _____

_____

Do other people notice a difference between use of ice and non-use of ice? Y__ N__ (explain)

_____

Perceptions and practices regarding use of ice and ice chests

Cost

Would you buy an ice chest if it cost (TBD) ? Yes ____ No _____ Don't know _____

If no, why?

_____

What would you be willing to pay for an ice chest?

_____

Would you charge someone else money to store fish in the ice chest (i.e. rent it)? Y___ N___

If so, how much would you rent it for?

_____

If yes, why do you think others would want to rent it from you?

_____

Attributes of the Ice Chest

What do you think about the ice chest itself – size, type of materials, weight, cover/top opening and if you could design your own, how would you build it differently?

_____

If the following do not come up in the discussions, ask respondents questions directly about the ice chests such as:

Is there a latch to lock it? _____

What is the shape and depth? _____

What is the thickness and weight? _____

What were the materials used? _____

Conflict management

Is the ice chest in a secure location? (from theft) _____

Have you ever had fish stolen from the ice chest? _____

If yes, how do you prevent theft from the ice chest? _____

Have there been conflicts or arguments over use between members with the ice chests:

Other fish processors sharing the ice chest _____

Fishermen _____

Another person (identify) _____

Did you decide on group norms or rules for usage of the ice chest? If yes, how did you do that?

_____

Did FC, SFMP or the association (NAFPTA, CEWEFIA, DAA, etc.) facilitate discussions and agreements on rules of use? Y__ N__

Do you think the ice chests should be group owned or individually owned and why?

_____

Ask if you can attribute quotes to the individual or person who made the remarks, or whether they would prefer to remain anonymous. Note response here: _____

Interview Questions for Facilitating organizations

Describe in as much detail how groups for each ice chest were formed:

How often do you visit the ice chests at in your project site?

What feedback have your received about the ice chest?

Positive feedback:

_____

Negative feedback:

_____

General (neutral) comments:

_____

APPENDIX B

An in-depth interview was conducted with the Director of the Post-Harvest Unit at the Fisheries Commission in the Ministry of Fisheries and Aquaculture to reflect on the lessons learned and account for the changes that occurred from "design to implementation" of the pilot.

Samuel Manu is Director of the Post-Harvest Unit with the Fisheries Commission at the Ministry of Fisheries and Aquaculture Development (FC/MOFAD). As Director, he oversees efforts to improve post-harvest quality and reduce economic-related loss of fish in Ghana. According to Mr. Manu, these efforts are becoming increasingly more important in order to compensate for declining stocks of small pelagic fish species landed by the artisanal fleet in Ghana. Declining stocks not only result in foregone revenue, but severely limits the availability of fish for consumption.

The Post-Harvest Unit works in partnership with the Ghana Sustainable Fisheries Management Project (Ghana/SFMP) to design activities that strengthen the post-harvest fish sector with support from the United States Agency for International Development (USAID). One way of strengthening this sector is to curb economic and quality-related losses after fish is caught. Mr. Manu proposed the construction of a two-chamber insulated container to ice fish onboard artisanal fishing canoes and a single chamber insulated container to be piloted at two fish processing (smoking) sites in Tema to improve the cold chain process. A container with one chamber better suits fish processors who use it to store fish while fishermen need two compartments to separate ice while using the second container to store fish layered with ice. The process for this particular pilot would begin at-sea and end once fish is smoked on land.

According to Mr. Manu, the design of the insulated container, its method of distribution and ultimately those who benefitted from its use changed from "design to implementation." The implementation was led by Ghana/SFMP project staff. The change in design of the container, was ultimately accepted by the Post-Harvest Unit at the Fisheries Commission. However, beneficiaries were largely selected by Ghana/SFMP project staff, not the Post-harvest Unit at the Fisheries Commission. These changes combined with logistical hurdles caused by poor communication between implementing partners resulted in frustration among beneficiaries in Tema and among Ghana/SFMP project staff and the Fisheries Commission. Therefore, the pilot was seen and experienced differently by partners seeking to achieve the same goal.