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A review of fish-handling training activities in Malaita Province



In partnership with



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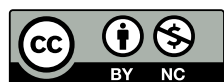
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Introduction

Fish handling refers to the practices used by fishers, vendors, processors and consumers that determine the quality of fish, including appearance, smell, taste and safety for consumption. These practices relate to catching, storing, transporting, selling, processing and preparing fish. Good fish handling is important for consumer health and confidence. It can also help minimize quality loss and waste, which can improve earnings for individuals and households reliant on fishery livelihoods (Ward and Beyens 2012).

Surprisingly, given the prevalence of fish in the Solomon Islands economy and diets, there are not many ready-to-use tools and materials to support fish-handling training activities. In 2018, WorldFish and the Pacific Community (SPC) developed a set of written briefs with messaging around hygienic and safe handling for fishers, vendors and consumers (Li et al. 2018). These were the first products on simplifying technical material and communicating for improved practices since the seminal technical work done by Chamberlain et al. (2001). Making technical tools and information accessible to rural users remains a challenge.

In Solomon Islands, many fishers, fish vendors and processors live and work in remote locations without access to electricity, roads, clean water or landing-site facilities. Some may also lack the skills, knowledge or capital to invest in new equipment or put their ideas into practice. As a result, fish is often handled in ways that cause spoilage or contamination with dirt or bacteria, which can reduce income earned and make consumers sick or hesitant to eat fish.

While there are many factors that contribute to poor fish-handling practices, provision of training to increase knowledge, develop skills and change attitudes is one step that can be taken to improve the quality of fishery products. In some provinces, including Malaita Province, several training workshops on fish handling have been held in the past for both fishers and fish vendors. However, to our knowledge, there has been no evaluation of such workshops to understand their effectiveness in bringing about change.



Trainer explaining practical activity to fish vendors participating in a fish-handling training workshop in Auki.

1. Aims and methods

In this report, we focus on fish-handling practices and training activities in Malaita Province. Specifically, we: (a) examine the need and demand for training to improve existing fish-handling practices in Malaita; and (b) document and evaluate past fish-handling training activities carried out in the province.

These aims were investigated through informal discussions with fishery actors and stakeholders in Malaita Province, including: a fish vendor (woman), a fisher (man) and a family fishing business operator (woman); Malaita provincial fishery officers (PFOs); a representative from the Indigenous women's organization West 'Are'Are Rokotanikeni Association (WARA); and an officer from the Environmental Health Division of the Malaita Provincial Government. We also conducted a desktop review of available summary reports of past trainings and training materials, and reflected on observations at Auki Fish Market and past fish-handling workshops.

The training evaluation component was guided by the Kirkpatrick Model's four-level training evaluation framework, which comprises: (1) reaction—how participants reacted to the training; (2) learning—the extent to which participants learned new knowledge, improved skills and/or changed attitudes; (3) behavior—the extent to which participants demonstrated application of learning through changes in behavior; and (4) results—the outcomes resulting from participants' attendance, learning and application of the training (Kirkpatrick and Kirkpatrick 2006). While this framework has been critiqued and expanded over the years since it was first described in 1959, it remains widely used due to its practicality and simplicity (Reio et al. 2017). In line with some expanded models (see review, Reio et al. 2017), we also assessed: (a) design of training content and materials; and (b) delivery of training. Given a paucity of information for the "behavior" and "results" components, our approach was also informed by the success case method of evaluation (Brinkerhoff 2005), which investigates a small number of participants' stories to describe how past training has been applied (or not).



Participants of past fish-handling training workshops in Malaita Province.

2. Current need and demand for training to improve fish-handling practices in Malaita Province

Discussions and observations indicate a need and demand for improving fish-handling practices in Malaita Province.

While many fishers and fish vendors in the provincial capital of Auki do currently use eskies (portable iceboxes) and/or ice to preserve their catch, some do not. Loose fish in open boats can be exposed to high temperatures, contaminated with dirt or fuel, or damaged by being dropped or stood on. These practices can lead to a loss of fish quality, a loss of income and/or potential health risks for consumers (Ward and Beyens 2012). However, customers at Auki Fish Market are not yet willing to pay more for well-handled fish. A woman fish vendor lamented that she was often compelled to lower prices for her esky-kept fish to compete with poor-quality fish sold cheaply for quick sale.

Fishers in Auki typically rinse their catch in the seawater adjacent to the market before sale. This seawater has high levels of *Escherichia coli* bacteria – a strong indicator of sewage

contamination – as shown by analysis in 2017 by Malaita Provincial Environmental Health Division at the request of WorldFish. This practice therefore potentially exposes consumers to food contaminated with *E. coli*, which can cause diarrhea, food poisoning or more serious illness. A fisher from Auki Bay Fishermen's Association (ABFA) commented that most fishers and fish vendors at Auki Fish Market were unaware of the health risks of using contaminated seawater to wash their catch.

Fishers and fish vendors in Auki currently sell fish at a temporary marketplace, on customary-owned land, while construction of a new fish market is completed. At the temporary market, fish are displayed and sold from makeshift wooden tables. The ground is unsealed and there is no drainage system, resulting in the pooling of waste seawater and the presence of mud throughout the marketplace. A family fishing business operator commented that the poor condition of the temporary market is an unresolved issue for fishers and fish vendors, despite paying a daily market



Fish market at temporary site in Auki in September 2022.

fee to the landlord. As of October 2022, the new fish market – to be located within the general Auki Market – has a concrete slab and is awaiting the construction of permanent display tables.

Fishers sometimes use the former Provincial Fishery Centre or the ABFA cold-storage facilities to store unsold fish for a fee. The Auki Langalanga Constituency Fishery Centre was also previously used, before it ceased operations due to technical issues. Customers also use the current facilities to store purchased fish at times, mainly for occasions such as Easter, weddings and church events.

However, anecdotal sources revealed that many households in inland areas had experienced food poisoning from eating fish. Households in these areas typically buy whole, ungutted fish at the coast during the daytime and transport it home in plastic bags without ice or adequate protection from flies, dirt or other contaminants. These practices likely accelerate fish spoilage and could explain some reports of food poisoning in inland consumers.

While it is acknowledged that many factors – some of which are mentioned above – contribute to existing poor practices, training for women and men involved in the fishing industry (and for customers) is likely a useful step towards improving these practices. For instance, all fishery workers with whom we held discussions

for this report commented that some fishers and fish vendors in Auki and other locations in Malaita lack knowledge and skills on good fish-handling practices. The ABFA fisher – based on his own positive experience of attending training – said that training could help raise awareness of the importance of proper fish handling and the benefits to fishery workers, such as increased income. He recommended training for fishers and fish vendors as well as boat owners, who often casually recruit relatives or other community members to assist with fishing or fish selling. The fisher also suggested that government authorities, such as the Malaita Provincial Environmental Health Division, have a role to play in increasing awareness about seawater contamination and health risks, and to set regulations to protect consumers.

The introduction of fish-preservation technologies to Malaita Province – such as solar freezers and ice-making facilities – has also led to demand for fish-handling training, including chilling and freezing fish. A member of women’s organization WARA, who was involved in piloting solar-powered freezers with WorldFish, commented that the past introduction of freezer technology without training had led to poor fish-storage practices in some locations. She recommended training on fish handling be included before introducing freezers to any new location to raise awareness on hygienic and safe freezing practices.



Photo credit: Filip Milovac/WorldFish

Tuna for sale at Auki Fish Market, Malaita Province.

3. Past fish-handling training in Malaita Province

3.1. Overview

Over the past six years (2017–2022), fish-handling training workshops in Malaita Province have been carried out by two providers using similar but distinct training materials and methods – referred to in this report as “Training A” and “Training B”. Training A was provided by a consultant with post-harvest fisheries expertise contracted by WorldFish in 2017 to conduct two workshops on fish handling, processing and hygiene in Auki and Radefasu village to improve the quality and safety of fish sold in Auki Fish Market. Training B has been provided by a PFO based in Auki. He has delivered numerous fish-handling and preservation training workshops since 2018 at the request of organizations such as World Vision and the United Nations Entity for Gender Equality and the Empowerment of Women (UN Women) (Table 1). The PFO designed his training package in 2018, after attending a two-day workshop by the Training A consultant and a two-week course provided by SPC in Honiara. Further revisions and improvements were made in 2019 after he attended a course in Japan.

We are not aware of any other organizations that have conducted fish-handling trainings with fishers or fish vendors in Malaita in the past six years. Discussions with the Environmental Health Division of the Malaita Provincial Government – which is responsible for all health services that prevent illness and safeguard the health of the general public – indicated that they use a Hazard Analysis and Critical Control Points (HACCP) tool, contextualized to Solomon Islands. The HACCP tool provides a technical management method for protecting food supply to minimize the risk of food safety hazards. However, to date, this has not involved the delivery of training to fishers or fish vendors in rural communities in Malaita.

3.2. Evaluation of past training

3.2.1. Design of training content and materials

Both training packages were designed to comprise a theory component followed by a practical component in the form of a demonstration by the trainer and/or a practical session for participants.

The theory component of both workshops included a PowerPoint presentation. Content was fairly similar and covered key topics, including why good fish handling is important, personal hygiene and using ice (Table 2). A key difference was the inclusion of more detailed background science on fish spoilage in Training A. The presentation used in Training A comprised mainly pictures¹, with the minimal text focused on key messages (Figure 1). This design was likely useful for participants with a lower level of literacy, although it was not always clear if a picture illustrated a good or poor practice. The Training B presentation (2021 materials) comprised mainly blocks of text or bullet points (Figure 1) with one or two pictures as well as a video.²

The practical component in both workshops covered application of sanitizers (such as cleaning hands and surfaces) and filleting and packaging techniques. Training A also included skills used in tuna canneries, such as calculation of fillet recovery rate, tuna loining and sashimi tasting.

3.2.2. Delivery of training

Training A was contracted and delivered as a one-day workshop, although the trainer noted in his report that each of the main topics covered could be a short course on its own, ranging from two to eight days. These longer training courses were said to include lectures, quizzes, discussions, practical exercises and demonstrations, which allowed greater engagement and in-depth learning by participants. Training B was designed as a two- or three-day workshop, but actual delivery ranged from a half day to two days, depending on the availability of participants and contract arrangements with the funding provider. In some instances, the practical session of Training B was not carried out or was delivered as a demonstration only due to lack of training equipment.

3.2.3. Reaction

According to the report from Training A, most participants found the training very useful but said the duration (one day) was too short to adequately cover the topics. In particular, participants wanted to spend more time learning

| Training site | Training package | Date | Training structure | Training content | Participants | Duration | Report | Funding provider |
|--|------------------|-----------|---|---|--|----------|--------|-----------------------------|
| Auki Fish Market | A | Dec 2017 | Theory & practical | Fish spoilage, personal hygiene, using ice | Fishers & vendors (women & men) | 1 day | Yes | WorldFish |
| Radefasu village | A | Dec 2017 | Theory & practical | Fish spoilage, personal hygiene, using ice | Representatives from OKRONUS (community org.) | 1 day | Yes | WorldFish |
| Heo (West 'Are'Are) | B | June 2018 | Theory presentation | Fish handling, preservation, fish quality assessment | 40 representatives from WARA (community org.) | Half day | Yes | WorldFish |
| WARA Fisheries (Takataka) (East 'Are'Are) | B | July 2018 | Theory & demonstration | Fish handling, preservation, fish quality assessment, personal hygiene | 18 people from 6 communities using mini-fisheries centre | 2 days | Yes | MFMR (Ministry of Commerce) |
| O'au (Small Malaita) | B | Sept 2018 | Theory & demonstration | As above | Fishing community (men & women) | 1 day | Yes | World Vision |
| Walande (Small Malaita) | B | Sept 2018 | Theory & demonstration | As above & community-based resource management | Fishing community (women & men) | 1 day | Yes | World Vision |
| Kiu (West 'Are'Are) | – | 2018 | Handout | Fish handling, preservation | WARA Zone 2 freezer group | NA | No | WorldFish |
| Auki Market | – | Sept 2019 | Handout & market billboard | Fish handling & quality assessment | Fish vendors and general public | NA | No | WorldFish |
| Auki (Auki Fish Market women fish vendors) | B | 2020 | Theory presentation | Fish handling, preservation, personal hygiene | Fish vendors (women) | 1 day | Yes | UN Women |
| Luma'alu (North Malaita) | B | May 2021 | Theory, group discussions, demonstration & market visit | Fish handling, preservation, fish spoilage, fish quality assessment, personal hygiene | Fishing community (women & men) | 2 days | Yes | World Vision |
| O'au (Small Malaita) | B | 2022 | Theory & practical | Fish handling, preservation, personal hygiene, business planning | Fishing community | 3 days | No | World Vision |

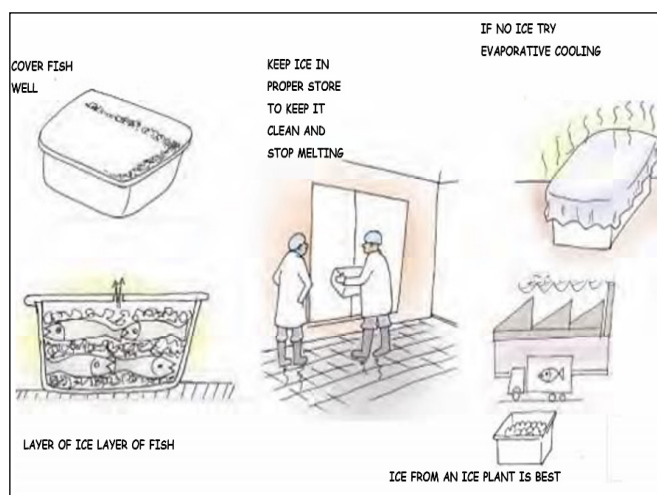
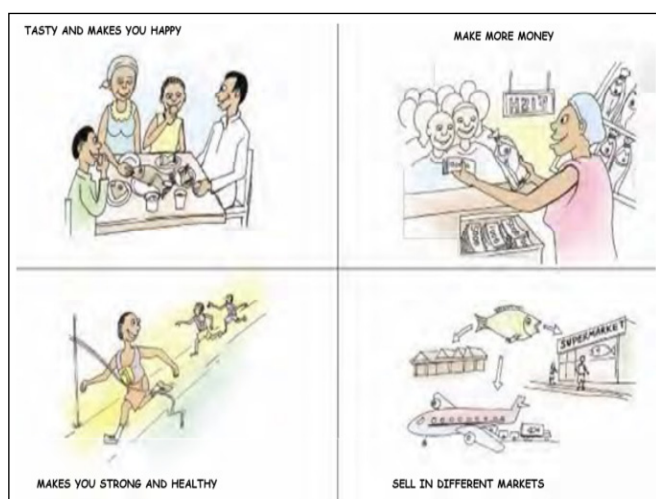
Note: Details of the training packages are given in the text of Section 3. OKRONUS is a community-based organization spearheading local sustainability and development initiatives – the acronym represents the six villages involved (Oibola, Kona, Radefasu, One'oneabu, Ura and Sita); WARA = West 'Are'Are Rokotaniken Association (WARA); MFMR = Ministry of Fisheries and Marine Resources; NA = not applicable.

Table 1. Fish-handling training and awareness campaigns in Malaita Province,'2017–2022'.

| | Topics | Training A (2017 content) | Training B (2021 content) |
|--|--|------------------------------|------------------------------|
| Theory (PowerPoint presentation) | Importance of good fish handling | 2 slides | 2 slides |
| | Fish quality assessment | 1 slide | 1 slide |
| | Fish spoilage (background science: bacteria & enzymes) | 7 slides | – |
| | Importance of gilling and gutting (including science) | – | 1 slide |
| | Personal hygiene | 4 slides | 1 slide |
| | How to use ice & fish storage practices | 3 slides | 3 slides |
| Practical (practice activity or demonstration) | Application of sanitizers | Yes | Yes |
| | Fish filleting & packaging | Yes | Yes |
| | Tuna loining | Yes | – |
| | Sashimi tuna product making & taste testing | Yes | – |

Table 2. Content of past fish-handling training workshops in Malaita Province.

Training A



Training B

FISH HANDLING

1. FISH HANDLING

- Understanding proper fish handling is vital to every people involved in small scale fisheries operations.
- Fresh fish must be protected from damage by poor handling practices and from contamination by dirt and bacteria, the rate of spoilage must be controlled

WHY PROPER FISH HANDLING IS IMPORTANT?

- Taste better
- Be healthier for you
- Be less likely to make you sick
- Fetch a better market for you

FOUR RULES OF FISH HANDLING

- Care – Keep fish undamaged
- Cool – Keep fish cool
- Clean – Keep fish & Equipments clean
- Quick – Keep delays in handling a minimum

FISH STORAGE PRACTICES

In slurry

- Put fish in slurry for not more than 6 hours
- Put some cube in the belly cavity
- Make sure to have good mix of slurry – 2 : 1 (Ice : Salt water)

In Eskies

- Make sure that first layer of fish is stack on blocks of ice
- Do not use bigger ice cubes as they will damage the fish
- Crush ice is better to use

In Freezer Storage

- Do not over fill the freezer right up to the top
- Stack the fish vertically with belly cavity down ward
- Do not store fish directly touching the bottom of the freezer, allow space for circulation of cool freezing air.
- Do not throw fish and other products into the freezer as it will damage the freezer.

Figure 1. Examples of theory presentation materials used in past fish-handling training workshops in Malaita Province.

and practicing the fish-processing component. The report also noted participants' willingness to taste the sashimi product demonstrated by the trainer. Based on observations of Training A, the content and delivery style kept participants' interest until the end of the workshop. This was demonstrated in their eagerness to complete group activities despite the practical session continuing into the evening.

Reports from Training B workshops stated that participants appreciated the training. One report noted that participants asked questions after the presentations, suggesting their interest and engagement with the content. A report from a theory-only workshop stated that participants wanted handouts of the information presented and expressed a desire for a practical component.

3.2.4. Learning

None of the training reports indicated that any form of assessment (such as a pre- and post-test comparison) was carried out to determine the extent to which participants had changed attitudes, increased knowledge or improved in skills from attending the training. While most Training B reports included a general statement that participants had acquired new

knowledge and skills, only one report included any supporting evidence in the form of a summary statement from one participant.

3.2.5. Behavior

There have been no formal follow-up observations or meetings after any of the past trainings to determine whether participants' learning from the training workshops had resulted in a transfer of new knowledge, skills and/or attitudes to their fishing or fish-selling activities. Furthermore, there is no evidence of documenting participants' fish-handling practices before attending training workshops, necessary for assessing any post-training behavioral change. Discussions with the Training B trainer highlighted that contracts for fish-handling training had not included financial support to carry out any post-training monitoring or evaluation.

Based on informal observations by WorldFish staff, there have been some changes in fish-handling practices in Auki. Since around the time of the 2017 training workshop, more fishers started using eskies to store fish during their fishing trips and at the market while selling fish to customers. Change was gradual: at first, a couple of fishers and vendors (who attended the training) started changing practices; others then followed, after observing the benefits and learning



Filleting practice during fish-handling training in Auki.

from these pioneers' experiences. Over this time, fishers and fish vendors also changed to displaying and selling fish on raised wooden tables rather than on plastic sheets directly laid on the footpath.

We also documented stories from two participants who attended Training A in 2017. The first participant – a fisher from ABFA – reported that both the 2017 training as well as a previous workshop he had attended in Honiara in 2009 had greatly helped him and his brothers improve the quality of fish they sell to customers in Auki Fish Market. He also mentioned trying to raise awareness among other fishers and fish vendors who did not attend the training. However, he noted that it took time to change attitudes and improve skills. In addition, at least this fisher, after learning about the high concentrations of *E. coli* bacteria in Auki Bay seawater at the 2017 workshop, started using seawater collected from outside the bay to wash his catch when selling at the market. The second participant – an operator of a family fishing business comprising two boats, two fishers and a fish vendor – reported already using an esky before the 2017 training to resolve issues of damaged and low-quality fish. However, the training had taught her techniques to properly brine and ice fish, which led to further quality improvements. This had enabled the business to earn more income because

they could maintain a good-quality product to sell the next day. She had also taught these new skills to their casual workers, which ensured good handling from the time of catch through to sale.

Lack of equipment and infrastructure is also likely to be a barrier for some participants to practice and implement new knowledge and skills acquired during fish-handling training. As mentioned in Section 2, the condition of the existing temporary fish market in Auki is a challenge for fishers and fish vendors. One of the Training B reports also recommended fishers be provided with assistance to obtain eskies and solar-powered freezers, to both improve fish-handling practices and to promote small value-adding fish-based businesses.

3.2.6. Results

While no formal assessments of past training impacts have been carried out to our knowledge, the two stories described in Section 3.2.5 provide some evidence that past training has improved the quality of fish sold and incomes earned for at least some participants. However, we have no information about the experiences of other participants nor on broader measures such as overall changes in the quality of fish available at Auki Fish Market or the frequency of illness resulting from consumption of spoiled or contaminated fish.



Photo credit: West Fish Sukulu/WorlFish

Filleting practice during fish-handling training at Radefasu village.

Conclusion and recommendations

This report highlights the need and demand for improving fish-handling practices in Malaita Province. Based on the review of past training activities, we make the following recommendations to be considered when developing and implementing similar training activities in the future:

1. Basic fish-handling training should focus on simple practices and techniques that fit the context of local fishers and vendors in rural areas. Training materials should be engaging for a wide audience, including those with lower literacy. Duration of training activities, such as workshops, should be guided by the time required to properly cover the content, rather than the demands and priorities of funding organizations. Developing a standardized basic fish-handling training module could help resolve these tensions. Information on longer training courses or study pathways could be made available to participants interested in gaining in-depth knowledge or specialized skills in fish handling.
2. Trainers should be encouraged to develop their confidence and skills – and have access to adequate equipment – so that they can deliver an engaging and participatory training experience. This could involve regular refresher training and/or discussions among trainers to share ideas for engaging participants. For instance, training activities could be framed around responding to questions and demonstrating innovation by confident trainers rather than delivering rehearsed technical components.
3. Reporting on training activities should aim to provide sufficient details on the training delivered and include evidence of participants' reactions and learning. Documenting pre- and post-training knowledge, skills and attitudes of participants would help to evaluate the effectiveness of training activities and identify areas for improvement. A new or revised basic fish-handling training module could usefully include a reporting template, pre- and post-training evaluation questions and a guide on how to use information collected to improve future training delivery.
4. Inclusion of post-training follow-up activities or mentoring could help remind participants of key messages, encourage application of learnings, and identify challenges and barriers faced. Information could then be shared on locally appropriate ideas for overcoming these challenges.

Finally, provision of training workshops can still be expensive and inaccessible to many, so simple and cheap alternatives to spread information or demonstrate innovation should also be considered and investigated as ways of upskilling rural fishers and vendors.

Notes

- ¹ Pictures used in the Training A presentation were sourced from Ward and Beyens (2012).
- ² Mentioned in training reports. Note: the video was not reviewed as part of this evaluation.

References

Brinkerhoff RO. 2005. The success case method: A strategic evaluation approach to increasing the value and effect of training. *Advances in Developing Human Resources* 7(1):86–101. doi: 10.1177/1523422304272172

Chamberlain T, Titili G and Lambeth L. 2001. Seafood handling. *Community Fisheries Training Pacific Series 5*. Suva, Fiji: University of the South Pacific (UPS) Marine Studies Programme; and Noumea, New Caledonia: Secretariat of the Pacific Community. https://spccfpstore1.blob.core.windows.net/digitallibrary-docs/files/5a/5a3381074c66e5ddca1f0317ca1c8f0c.pdf?sv=2015-12-11&sr=b&sig=SZgOgGYt5iYiKxHDPnHbrJWqR7vuq0xcSgo1y5Ewbmg%3D&se=2023-04-09T18%3A22%3A59Z&sp=r&rsc=public%2C%20max-age%3D864000%2C%20max-stale%3D86400&rsct=application%2Fpdf&rscd=inline%3B%20filename%3D%22Chamberlain_01_SeafoodHandling.pdf%22

Kirkpatrick DL and Kirkpatrick JF. 2006. *Evaluating training programs: The four levels* (3rd edn). San Francisco, USA: Berrett-Koehler.

Li O, Eriksson H, Bertram I, Desurmont A and Blanc M. 2018. Handling seafood in the Pacific Islands: Information sheets for fishers, vendors and consumers. Noumea, New Caledonia: Pacific Community, Coastal Fisheries Program. <https://coastfish.spc.int/en/component/content/article/485-handling-seafood-in-the-pacific-islands>

Reio TG Jr, Rocco TS, Smith DH and Change E. 2017. A critique of Kirkpatrick's evaluation model. *New Horizons in Adult Education & Human Resource Development* 29(2):35–53. doi: 10.1002/nha3.20178

Ward A and Beyens Y. 2012. Fish handling, quality and processing: Training and community trainers manual. SmartFish Working Papers No. 001. Rome, Italy: Food and Agriculture Organization of the United Nations; and Ebène, Mauritius: Indian Ocean Commission (FAO/IOC). <https://www.fao.org/3/az083e/az083e.pdf>



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