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Participatory Evaluation and Demonstration of Improved Fishery Technologies in Gambella Zuria District, Gambella Region, Ethiopia

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Abstract *— This study was conducted in Gambella Zuria District, Opagna kebele, along the Baro River in Gambella Region, Ethiopia, with the objective of evaluating and demonstrating improved fishery technologies through participatory approaches. The study specifically aimed to demonstrate improved fishery technologies, enhance the knowledge and skills of fishermen and extension workers, and collect feedback for further technology improvement and dissemination. The research employed a participatory extension approach using one Farmers Research and Extension Group (FREG) consisting of 15 fishermen. Improved fishery technologies including fish processing tables, improved fishing nets (Beach seine with 8 cm mesh size), and retaining cages were demonstrated at the selected site. Data were collected through field observation, focus group discussions, interviews, and training evaluations, and analyzed using descriptive statistics using SPSS version 21. The findings revealed that the majority of participants were male (80%) and within the productive age group of 36–50 years. Training and demonstration activities significantly improved awareness and practical knowledge of fishermen, development agents, and experts regarding improved fish handling, processing, and sustainable fishing practices. The introduced technologies showed positive impacts on fish production, fish quality, and household income. Improved fishing nets resulted in the highest income increase, raising average monthly income from 2,800 ETB to 5,600 ETB (100% increase), while fish processing tables and retaining cages increased income by 75% and 53.6%, respectively. Farmers positively evaluated the technologies based on ease of use, efficiency, durability, and market acceptability, with improved fishing nets ranking first among the demonstrated technologies due to their high catch efficiency and quick economic returns. The study concluded that participatory demonstration of improved fishery technologies has significant potential to improve fish handling practices, reduce post-harvest losses, increase fishermen's income, and promote sustainable fishery resource management in Gambella Region.*

Keywords *— **Baro River, beach seine, demonstration, fishery technology, processing table, retaining cage.***

I. INTRODUCTION

Fish is an aquatic animal that serves as a source of food, nutrition, income, and livelihood for millions of people worldwide (FAO, 2018). The fishery sector is one of the fastest-growing food production sectors and contributes significantly to employment opportunities,

food security, and economic development. Inland fisheries are especially important in developing countries where alternative livelihood options are limited.

In Africa, fisheries contribute substantially to nutritional security and household income. According to NEPAD (2014), Africa's total fishery production stands at about 10.4 million tons annually. Ethiopia is endowed with abundant inland water bodies including lakes, rivers, reservoirs, and wetlands that support fisheries production. However, illegal fishing practices, lack of awareness on sustainable fishery management, and inadequate post-harvest handling technologies remain major challenges affecting the sector (Temesgen and Getahun, 2016).

Gambella Region possesses extensive water resources and diverse fish species compared with many parts of Ethiopia. Despite this potential, fish production and productivity remain below expectation due to poor fish handling systems, inadequate fishing gears, poor preservation methods, and limited access to improved fishery technologies. Traditional fish processing methods expose fish products to contamination, spoilage, and post-harvest losses.

Participatory technology demonstration is important for enhancing adoption of improved fishery technologies and strengthening the capacity of fishermen, extension workers, and local stakeholders. Therefore, this study was initiated to evaluate and demonstrate improved fishery technologies in Gambella Zuria District.

Objectives of the Study

- To evaluate and demonstrate improved fishery technologies at selected sites.
- To enhance fishermen, development agents, and agricultural experts' knowledge on improved fishery technologies.
- To collect feedback information for further technology improvement and dissemination.

II. MATERIALS AND METHODS

Description of the Study Area

The study was conducted in Gambella Zuria District, Opagna kebele, along the Baro River in Gambella Region, Ethiopia. Gambella Region is located about 763 km southwest of Addis Ababa between 7°N to 8.17°N latitude and 33°E to 35.02°E longitude. The area is characterized by lowland tropical climate with altitudes ranging from 300 to 2300 meters above sea level.

The average annual rainfall ranges from 800 to 1200 mm, while the average temperature ranges from 30.7°C to 37°C. The region experiences two major seasons: wet season (May–October) and dry season (November–April). Fishing activities are commonly practiced along rivers and wetlands of the region.

Research Design and Target Area

The study employed a participatory extension approach using Farmers Research and Extension Groups (FREGs). Gambella Zuria District was selected purposively because of its high fish production potential and inclusion under the FSRP-GARI intervention areas.

Site and Fishermen Selection

The demonstration site was selected based on:

- Fish production potential
- Active fishing practices
- Accessibility to roads and markets
- Demand for improved fishery technologies
- Suitability for technology demonstration

One FREG consisting of 15 fishermen was established at Opagna kebele along the Baro River.

Technology Demonstration Techniques

Participatory approaches such as:

- FREG establishment
- Training
- Field demonstrations
- Joint monitoring and evaluation
- Mini field days

were employed to facilitate technology dissemination and information exchange.

The following technologies were demonstrated:

- Fish processing tables
- Beach seine fishing net (8 cm mesh size)
- Retaining cages

Data Collection Methods

Both qualitative and quantitative data were collected using:

- Field observations
- Focus group discussions
- Participant interviews
- Training evaluation formats

The collected data included:

- Number of participants
- Type of technologies demonstrated
- Stakeholder participation
- Farmers' feedback
- Household income changes

Roles and Responsibilities of Participants

Table 1. Roles and Responsibilities of Stakeholders

Actors	Roles and Responsibilities
Fishermen	Land provision, participation in installation, monitoring, evaluation, and feedback provision
Research Team	Training provision, material preparation, facilitation, technical support, data collection, and analysis
Extension Workers	Facilitation, technical support, mobilization, monitoring, and information dissemination

Data Analysis

Quantitative data were analyzed using SPSS version 21 software. Descriptive statistics such as frequencies, percentages, and means were employed to summarize and interpret the data.

III. RESULTS AND DISCUSSION

Socio-Economic Characteristics of Participants

Table 2. Socio-Economic Characteristics of Participants (n = 15)

Variable	Category	Frequency	Percentage (%)
Sex	Male	12	80
	Female	3	20
Age	20–35	5	33.3
	36–50	7	46.7
	>50	3	20
Education	Illiterate	6	40
	Primary	7	46.7
	Secondary	2	13.3

The majority of participants were male (80%), indicating male dominance in fishing activities. Most respondents had primary education, which supports the adoption of improved technologies through training and extension services.

Training of Fishermen and Other Stakeholders

Training was the first major activity conducted during the demonstration process. Awareness creation was provided on fish collection, handling, processing methods, and sustainable fishery resource management.

Table 3. Training Participants

Participants	Male	Female	Total
Fishermen (FREGs)	15	–	15 (75%)
Development Agents	2	–	2 (10%)
Experts	1	–	1 (5%)
Leaders	1	1	2 (10%)
Total	19	1	20 (100%)

The training significantly improved awareness regarding hygienic fish handling and post-harvest loss reduction.

Demonstration and Technology Transfer

The technologies demonstrated included:

- Fish processing tables
- Beach seine fishing nets
- Retaining cages

A processing shade measuring 24 m² (8 m × 3 m) was constructed using locally available materials. Six fish processing tables were installed at the landing site.

Table 4. Participants During Technology Demonstration

Participants	Male	Female	Total
Fishermen (FREGs)	15	–	15 (46%)
Development Agents	2	–	2 (6%)
Experts	2	–	2 (6%)
Researchers	3	1	4 (12%)
Non-FREG Members	5	4	9 (28%)
Total	27	5	32

Fishermen Feedback and Reaction

The majority of fishermen positively evaluated the demonstrated technologies based on:

- Ease of use
- Improvement in fish hygiene
- Income contribution
- Reduction of fish spoilage
- Sustainability

Table 5. Fishermen Feedback Toward Demonstrated Technologies

Technology	Criteria	Yes (%)
Processing Table	Simple to prepare and install	100
	Improve hygienic status	66.6
	Increase household income	86.6
	Minimize processing time	80
Fishing Net	Improve income	80
	Catch table-size fish	100
	Ensure sustainability	100
Retaining Cage	Minimize fish loss	66.6
	Improve income	86.6

The improved fishing net was highly appreciated because it increased fish catch efficiency and promoted sustainable fishing practices.

Monthly Income Before and After Technology Introduction

Table 6. Monthly Income Comparison

Technology Use	Average Monthly Income Before (ETB)	Average Monthly Income After (ETB)	Income Increase (%)
Traditional Fishing Methods	2,800	–	–
Improved Fishing Net	2,800	5,600	100
Fish Processing Table	2,800	4,900	75
Retaining Cage	2,800	4,300	53.6

The improved fishing net generated the highest income increase due to improved fish catch and better market access.

Farmer Evaluation of Fishery Technologies

Table 7. Mean Score Evaluation (1–5 Scale)

Technology	Ease of Use	Efficiency	Durability	Market Acceptability	Mean Score
Fish Processing Table	4.6	4.7	4.5	4.8	4.65
Improved Fishing Net	4.8	4.9	4.3	4.6	4.65
Retaining Cage	4.4	4.5	4.6	4.7	4.55

Participatory Ranking Results

Table 8. Participatory Ranking of Technologies

Rank	Technology	Reason for Preference
1st	Improved Fishing Net	High catch efficiency and quick returns
2nd	Fish Processing Table	Improves hygiene and market price
3rd	Retaining Cage	Useful for reducing spoilage

Challenges Encountered

The major challenges encountered during the study included:

- Poor coordination among fishery cooperative members
- Weak linkage between fishermen and district agricultural offices
- Lack of boats and fishing equipment

IV. CONCLUSION

Participatory demonstration of improved fishery technologies was successfully conducted in Gambella Zuria District along the Baro River. The demonstrated technologies, namely fish processing tables, improved fishing nets, and retaining cages, showed positive impacts on fish handling, income generation, and sustainable fishery management.

The technologies improved fish quality, reduced post-harvest losses, and enhanced fishermen's household income. The improved fishing net was ranked first by participants because of its high efficiency and quick economic return.

Therefore, the demonstrated technologies should be promoted and pre-scaled up in other fish production potential areas of Gambella Region.

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