5.2 Socially sustainable economy in culture-based fisheries in reservoirs of Sri Lanka and implications for sustainable livelihoods of rural communities

Mohottala G Kularatne
Department of Economics, University of Kelaniya, Sri Lanka

Gayani P Paranamana
Faculty of Graduate Studies, University of Kelaniya, Sri Lanka

Dinusha NB Ekanayake
Faculty of Graduate Studies, University of Kelaniya, Sri Lanka

RAC Kanchana
Department of Geography, University of Kelaniya, Sri Lanka

Elizabeth H Petersen
Principal Applied Economist, Advanced Choice Economics Pty Ltd, Australia

Abstract

CBF can be used to achieve social and economic goals for reservoir-associated rural farming communities in Sri Lanka. The policy must be formulated for the integration of GFP production into Sri Lanka's reservoir CBF through scientific investigation. This paper examines social science aspects for the improvement of productivity, efficiency and sustainability of GFP and finfish, based on evidence from 48 minor, medium-sized and large irrigations in 10 administrative districts of Sri Lanka. The information was collected from fishers and non-fisher communities through the randomly selected sample surveys and case studies, using pretested questionnaires for face-to-face interviews to examine socioeconomic, cultural and local governance opportunities and constraints to maximise social equity and livelihood benefits, and inclusive, complete market-chain analysis from harvest to plate, to ensure both male and female actors in the supply chain gain maximum benefit for achieving equitable livelihood benefits for women and men. The 3 main analyses performed for each objective are sustainable livelihood framework, value chain analysis and the thematic analysis.

The research reveals that the socioeconomic conditions and the value-chain mechanism are more favourable for medium-sized reservoirs to develop CBF to achieve both social and economic goals of reservoir fisheries. CBF integration should focus on equity and resilience within fishing communities to ensure sustainable and effective CBF production. CBF has the potential to benefit both men and women. However, the economic benefits currently accrued to men are greater than those received by women, due to the predominance of men in most nodes of CBF value chains. The CBF sector can maximise the productive potential of both male and female members and their wellbeing by fostering an inclusive atmosphere, which will increase sustainability, economic development and food security.

However, challenges such as fingerling availability, water management, market fluctuations and the proper harvesting method must be addressed to ensure long-term sustainability. Therefore, we claim that the fisheries policy must be focused on the social equity of CBF to a more efficient, equitable and sustainable reservoir fishery system together with biological productivity.

***Keywords**: social economic aspects, value chain, gender equity*

Introduction

ACIAR initiated a 5-year research project titled 'Improved productivity, efficiency and sustainability of the CBF for finfish and GFP in Sri Lankan reservoirs'. This project aimed to establish a robust, science-based and inclusive management regime for the CBF of GFP and finfish species in Sri Lankan reservoirs.

This initiative builds upon previous research, such as the project 'Assessing production of giant freshwater prawns in reservoirs in Sri Lanka', which aimed to improve yields and fisher community incomes through better stock and recapture strategies. By enhancing fish and prawn production, the current project seeks to contribute to the health and economic well-being of rural communities in Sri Lanka.

The project's objectives included:

- Investigating stocking, monitoring and harvesting practices to maximise fish and GFP production and product quality.
- Analysing the market chain to determine supply and post-harvest practices that meet market requirements and deliver maximum benefit for male and female fishers.
- Generating bioeconomic models as inputs to effective fisheries management.
- Determining opportunities and constraints to achieving gender-equitable livelihood benefits from CBF.

The productivity and efficient sustainable condition of GFP production is a collaborative effort of the natural science and social science component of the project. The latter is investigated mainly under the following 3 areas:

1. Socioeconomic, cultural and local governance opportunities and constraints to maximise social equity and livelihood benefits.
2. An inclusive, complete market-chain analysis from harvest to plate, to ensure both male and female actors in the supply chain gain maximum benefit.
3. Opportunities and constraints for achieving equitable livelihood benefits for women and men.

Economic importance of GFP production

The GFP (*Macrobrachium rosenbergii*) is a highly economically valued species in aquaculture due to its fast growth, high market demand and adaptability to freshwater environments. In countries like Sri Lanka, it plays a crucial role in CBF, where prawns are stocked in reservoirs and harvested to improve rural livelihoods. The economic impact of GFP is twofold. GFP production is an extension of ongoing CBF production. Therefore, its direct beneficiaries are rural farmer communities. Many rural fishers rely on CBF and GFP production as an alternative or supplementary income source to reduce economic vulnerability. This sector can be further improved to generate supplementary employment in hatcheries,

grow-out farms, processing and marketing. On the other hand, increased availability of GFP contributes to protein intake in local diets. However, now fishers' priority is to increase their income by selling GFP rather than increase their consumption as an alternative source of nutrition intake. Women's participation in post-harvest processing, value addition and marketing are ongoing normal fisheries activities around the world for enhancing household incomes. However, GFP has a vast future potential as a less time-consuming profitable fisheries activity for women that can be developed to maintain their household activities.

The national importance of GFP production is as a source of export revenue. GFP has a strong international market, boosting foreign exchange earnings. GFP has more international demand than the tilapia and carp species. The expansion of GFP farming reduces dependence on marine capture fisheries as well. Overall, the aquaculture sector, including GFP, strengthens the agriculture and fisheries sector of the economy. Evidence-based scientific management of culture-based prawn fisheries can enhance food security and economic resilience without over-exploiting natural resources.

Materials and methods

The research project covers 10 administrative districts in different ecological zones, and 48 reservoirs are investigated. Reservoirs are categorised based on their capacity and operational conditions, namely: large, medium and minor. CBF activities in large- and medium-sized reservoirs operate more than one fishery cooperative society, while small-scale reservoirs operate with one fishery cooperative society under respective farmer organisations. However, 3 different aspects of social sciences were investigated in a selected number of reservoirs, depending on their focus (Table 5.2.1).

The social science research was conducted in a subset of the 48 reservoirs as specified in Table 5.2.1. Data collection was performed using Participatory Rural Appraisal (PRA) and Rapid Rural Appraisal (RRA) tools for each objective. Mainly fisher households and fish vendors were interviewed using pre-test questionnaires individually. Also, researchers conducted focus group discussions where necessary. In particular, the case study research method was used for the value-chain study.

Table 5.2.1: Selected sample size for each objective of the social sciences studies

Social sciences research objectives	Number of reservoirs			Sample size
	Large	Medium	Minor	
1. Socioeconomic, cultural and local governance opportunities and constraints to maximise social equity and livelihood benefits.	01	04	08	272 households
2. An inclusive, complete market-chain analysis from harvest to plate, to ensure both male and female actors in the supply chain gain maximum benefit.	01	03	01	06 supply chain
3. Opportunities and constraints for achieving equitable livelihood benefits for women and men.	02	04	04	Fisher household 237 Non-fisher household 59

Data analysis

The primary objective of this activity was to identify opportunities and constraints in achieving socially equitable livelihood benefits from CBF. Data on Objective 1 of the social sciences study integrated into a sustainable livelihood framework SWOT analysis.

The value-chain analysis focuses on 3 main areas of the GFP market channel. One is market destination. Three major market destinations were identified: local/village, national/urban, and foreign/export markets. Sub-themes were identified for analysis under the main theme of assessing existing supply chains in the CBF sector: the number of value chains, chain nodes and their relationship, market proportion, nature of the price determination, operating cost, profit and market merger into the industry. The social relations of the fisheries community and the subsequent benefits and implications they can derive from the fisheries industry were analysed under division of labour: men may work in formal jobs, commercial farming or other income-generating endeavours, while women may handle childcare, home duties and subsistence farming. However, foreign/export markets analysis was not performed due to unavailability of reliable data and information. The second is access to resources. It is obvious that usually men have greater control over land, credit and technology, while women may have limited decision-making power in household and community matters. And the third analysis focuses on income generation. In most South Asian societies, men dominate formal employment and entrepreneurial activities, while women engage in informal or unpaid labour. Finally, decision-making power. Men often engage in household and community decision-making, while women's voices may be marginalised.

Thematic analysis was used to analyse qualitative data in Objective 3, the gender analysis of CBF. Descriptive statistics and analysis were used to calculate patterns and trends from the quantitative data generated by the study within the 3 dimensions: gender roles and relations, constraints and opportunities, and fisheries governance.

Although both gender groups participate, this inclusive perspective recognises that their roles, relations, opportunities, constraints and contribution to decision-making may differ within the 3 dimensions.

Results and discussion

Socioeconomic, cultural and local governance opportunities and constraints to maximise social equity and livelihood benefits

The general social perception of CBF in Sri Lankan reservoir fisheries is twofold. On one hand, CBF in reservoirs is considered a source of income, and on the other, it is a source of nutritional supply to the rural farming community. The income distribution among fishing communities varies across major, medium and minor reservoirs, reflecting different economic conditions. The community in the major- and medium-sized reservoirs belong to high average income groups (80% and 60%, respectively). However, the community of minor reservoirs had a relatively higher percentage (54%) of low-income households. These variations highlight the economic disparities among fishers, with minor reservoir communities experiencing higher levels of poverty compared to those in major and medium reservoirs. This implies that the community occupied in CBF in medium and minor reservoirs are involved in CBF to ensure their food security (Figure 5.2.1).

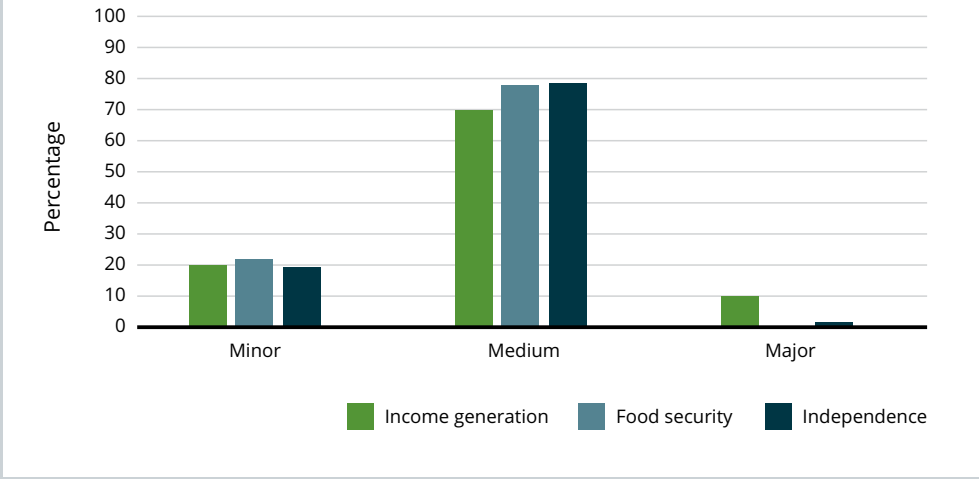

Figure 5.2.1: Perceptions of social equity and livelihood benefits in CBF

The medium-sized reservoirs are highlighted as types of reservoirs for the perceived benefits of reservoirs in a threefold consideration in the study. They considered CBF as a source of income generation, ensuring food security and independent economic activity. Farmer communities in the medium-sized reservoirs organise their agricultural practices under more than one farmer organisation, depending on the surface water distribution of the reservoirs. Furthermore, CBF in reservoirs was investigated under a sustainable livelihood framework.

The analysis of human capital in reservoir fishing communities was based on education, main occupation and training received for their main occupations. The results reveal significant differences in these 3 criteria across the 3 types of reservoirs. However, medium-sized reservoirs have the highest scores for the following 3 main factors: trained fishers in medium reservoirs (73%), followed by minor reservoirs (20%), and lowest in major reservoirs (7%). These findings indicated that the medium reservoir fishers had the most access to training opportunities, while major and minor reservoir fishers had limited exposure to capacity-building programs.

The financial capital analysis shows that the highlight credit usage is reported from medium-sized reservoirs (65%). The minor reservoirs and major reservoirs credit usage is 23% and 12%, respectively. Similarly, the savings behaviour of the fishers of medium-sized reservoirs is comparatively higher (69%) than the other 2 types of reservoirs. Therefore, the medium-sized reservoirs reported the highest financial capital among the other reservoirs.

The communities of medium-sized reservoirs are on the frontier of natural capital assets. Access to drinking water and land ownership are the 2 major determinants included as natural capital assets in the study. The drinking water

access is 72%, and the land ownership of the fisher communities associated with the medium-sized reservoirs is 91%. However, land ownership is more evenly distributed based on the size of the plots (i.e. with 27% owning small plots, 30% medium-sized (41–100 perches) and 34% large plots (101–400 perches). The unequal distribution of land and water resources affects livelihoods and resilience of fishing communities.

Physical capital, including household assets and fishing equipment, has a direct impact on their productivity and the quality of life. Mobile phone ownership is widespread, with 100% of major reservoir fishers owning one, followed by 98% in medium and 94% in minor reservoirs. Electricity access is nearly 100% in major and minor reservoirs, and 99% in medium reservoirs. Ownership of fishing equipment availability also varies, with fibre boats being more common in major reservoirs (96%) compared to medium (83%) and minor (85%) reservoirs. Traditional rafts (Theppan) are used only in minor (17%) and medium (12%) reservoirs.

CBF is a group activity that is very much dependent on collective action and collective decision-making. Social capital plays a crucial role in shaping trust, cooperation and social relations within reservoir fishing communities, enhancing social cohesion. Trust in fisheries community leaders and fisheries society members is relatively high, indicating strong confidence in leadership and collective decision-making within fisheries societies. Trust in people within the fishing community is slightly lower but still significant, suggesting a sense of unity among fishers. Having a strong social capital is a prerequisite for the sustainable CBF activities as far as equity is concerned. Among the 3 types of reservoirs, medium-sized reservoirs are reported to be rather well equipped with social capital.

As depicted in Figure 5.2.2, medium-sized reservoirs have significant livelihood opportunities in the development of CBF, except for their low representation of physical capital (fishing gear and fibreglass boats), and mobile phone usage is comparatively low compared with the other reservoirs.

Contributing factors to social equity and livelihood benefits

Poor financial management is no exception in reservoir fisheries as a common issue in all sectors of fisheries. Wasteful or unproductive expenditure behaviours could be observed in the major reservoir communities more than the medium-sized and minor reservoir communities where the latter have notably poor financial management practices. One determinant for the quality of life is the expenditure on food. All 3 reservoir communities are spending a similar amount for their daily food necessities. Knowledge of the CBF process among communities associated with minor reservoirs is comparatively lower than that of communities associated with major reservoirs. Water allocation and benefit sharing issues related to conflict were very common in minor reservoirs rather than the other 2 types of reservoirs. The survey results show that these factors are considerable contributing factors for the inefficient socially equitable and livelihood benefit sharing among the CBF farming communities.

In addition, several constraints hinder the maximisation of social equity and livelihood benefits in reservoir fishing communities, particularly environmental, governance and economic challenges. Unauthorised fishing is a significant issue across all reservoirs, reported by 100% of major, 90% of medium and 67% of minor reservoir communities. Elephant threats are a major concern

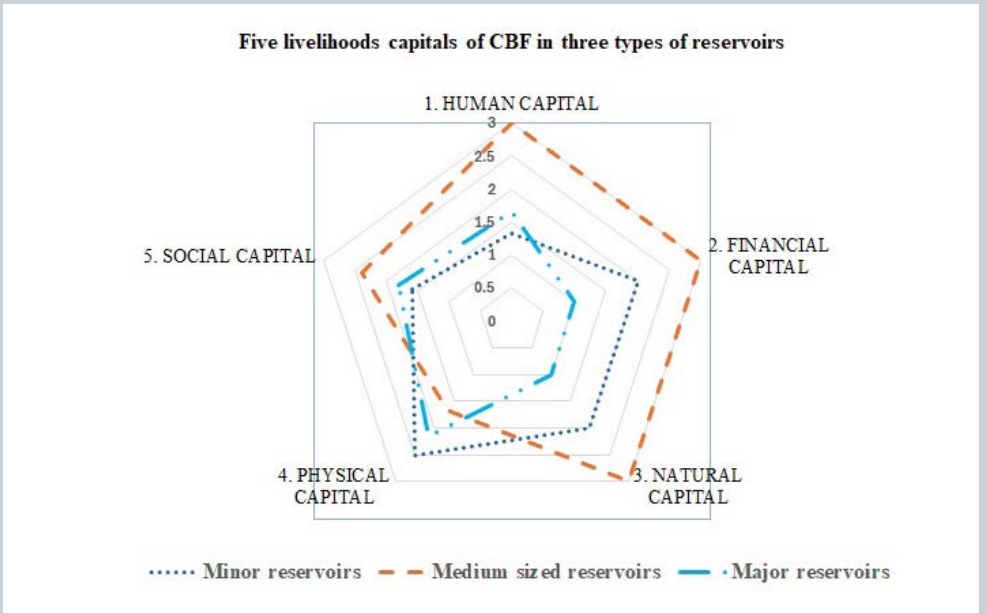

Figure 5.2.2: Estimated values of sustainable livelihoods assets of 3 reservoirs

in all reservoir types, affecting 100% of major and 59% of both medium and minor reservoirs. Furthermore, fishing activities being disrupted by governance issues, such as compliance with rules and regulations, are relatively low, with 4% in major, 11% in medium and 7% in minor reservoirs. Such threats can be minimised by introducing risk management mechanisms for medium reservoirs and introducing an insurance system. Furthermore, enhanced CBF activities in minor reservoirs need to be provided with subsidiary schemes. To ensure equitable fish consumption, establishing rural fish stalls is suggested.

An inclusive, complete market-chain analysis from harvest to plate, to ensure both male and female actors in the supply chain gain maximum benefit

Successful value chains should focus on 2 goals of CBF in reservoirs. The social goal of CBF activities is to ensure food security and the economic goal is maximising profit (Figure 5.2.3). The main sources of the rural nutrition requirement are provided by the finfish supply in the rural market with excess demand. Therefore, the finfish supply in the reservoir fisheries has to be continued irrespective of the market price and the economic profit to maintain the social conflicts for sustainable CBF.

GFP in CBF is the main target for the export market due to the lucrative financial benefits. Local demand for GFP is still considerably low due to the market price. The local demand for GFP depends on the quantity of rejection from the export quality. Local market demanded 26% of GFP while export percentage is about 74%. Therefore, increased production of both finfish and GFP in reservoir fisheries can achieve both social and economic goals.

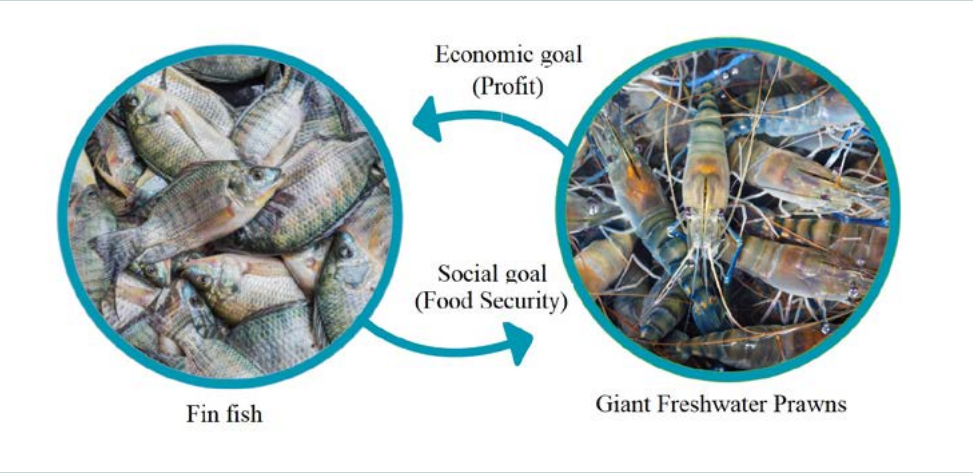

Figure 5.2.3: Social and economic goals of CBF in reservoir fisheries

Five channels were identified within the GFP value chain in the survey (Figure 5.2.4), and 6 channels were identified for the finfish market based on the product movement from fishers through different intermediaries before reaching the end market. The end users for the finfish market are dominated by the local consumers, and the foreign and local market are the end users of the GFP production. However, the noticeable factor is the large proportion of GFP sales exported to the foreign market as mentioned.

A large proportion of the market margin of the GPF market is received from the secondary collectors (in the local market), and the wholesaler receives it from the finfish market. The secondary collector of the GFP market receives such a big proportion for several reasons. There is an uncertainty of GFP production because fishers have no proper techniques (fishing gears) to harvest GFP. Ongoing harvesting methods damage the GFP and, therefore, considerably damage the GFP catch. The damage to GFP is not of the accepted quality for the export market. When the final output is not predictable, the market price is not stable. This situation is aggravated with the scarcity of buyers that exist in the GFP market chain. There is no competitive market for GFP, therefore, fishers are price takers. Hence, the income of the fishers is unpredictable. Also, there is no proper grading or pricing method. In addition, poor fingerling supply is another drawback for sustainable GFP production.

Fishing, fish farming, wholesaling, retailing and processing are the main nodes in GFP and finfish value chains. Several marketing nodes are evident, along with unequal benefit sharing among the value-chain actors, which were investigated by Sinh et al. 2014. The gendered value chain in the fishing industry reveals that fishing, primary handling, wholesaling and retail selling are predominantly male-dominated activities. In contrast, the production of dried fish is primarily a female-dominated task. Although women participate in retail selling,

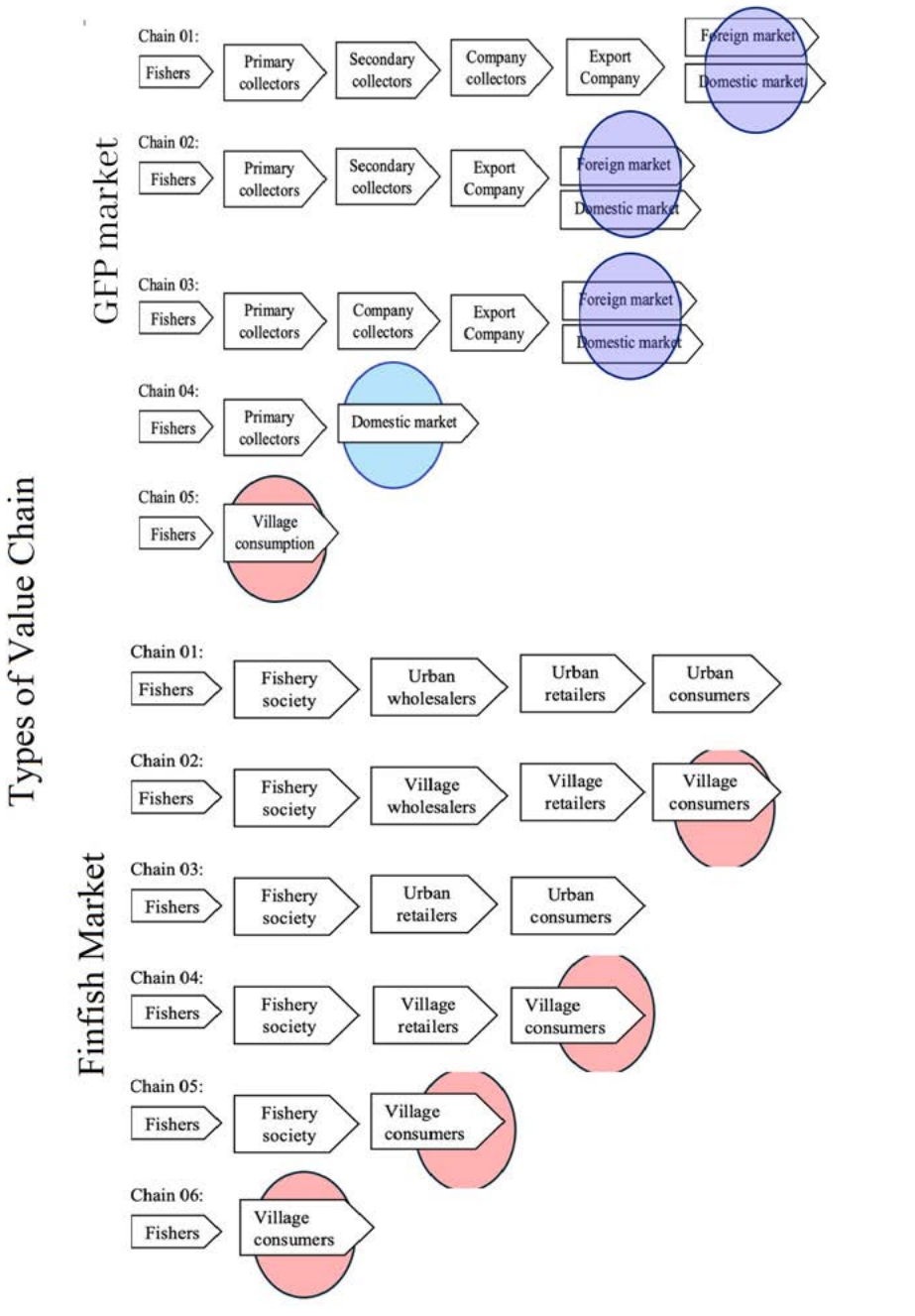

Figure 5.2.4: Value chain for finfish and GFP market of reservoir fisheries

they do not typically engage in wholesale selling. In the aquaculture sector, women represent a significant portion of the labour supply (FAO 2011). Their contributions are particularly notable in fish processing, marketing, fry collection, fish feeding and net mending, as evidenced by cases in other developing countries (Bueno 1997; Locicero 1997; Virulhakul 1997; Murray et al. 1998; Kusakabe 2003; Paranamana et al. 2024).

Opportunities and constraints for achieving equitable livelihood benefits for women and men

Gender roles and relations within the livelihood system of CBF communities reveal how men and women share responsibilities, access resources and engage in economic activities within households, which constitute the community. These roles and relations can differ across communities and societies due to cultural, social, economic and environmental factors. Gender roles define the expectations for men and women in economic, social and domestic spheres. These roles often dictate:

- Division of labour: Men often work in formal jobs, commercial farming and fishing, or other income-generating endeavours, while women handle childcare, housework and subsistence farming or fishing-related activities.
- Access to resources: Generally, men tend to have greater control over land, credit and technology, while women may have limited decision-making power in household and community matters.
- Income generation: In most societies, men dominate formal employment and entrepreneurial activities, while women engage in informal or unpaid labour.
- Decision-making power: Men often engage in household and community decision-making, while women's voices may be marginalised.

There are several opportunities and constraints for achieving equitable livelihood benefits for women and men. Naturally, CBF have excess supplies of labour in the reservoir fisheries. Therefore, the women's involvement in fisheries is yet to be debated. However, female fishers play a big role in support services in fishing. On the other hand, households' income in the rural farming community culture is inseparable (cannot be separated between female and male). However, the opportunity cost of female fishers' roles in households is not estimated. There is an opportunity for female involvement in north and east Sri Lanka due to the unemployed women-headed fisher households due to the past civil unrest. Therefore, as fisheries offer a less time-consuming livelihood, women can be more involved in CBF activities (especially GFP) without disturbing their day-to-day household commitments. In some cases, women are excluded from the fisheries activities because women's membership in fisheries cooperative societies is restricted.

Conclusion and recommendation

The socioeconomic conditions and the value-chain mechanism are more favourable for medium-sized reservoirs to develop CBF to achieve both social and economic goals. Due to water availability and the ongoing agreement in the farmer organisations, minor reservoirs are more suitable for finfish production in order to ensure rural fish consumption and enhance rural nutrition levels. CBF integration should focus on equity and resilience within fishing communities to ensure sustainable and effective CBF production. Policy must be focused on the social equity of CBF to a more equitable and sustainable reservoir fishery system. Both GFP and finfish are important for CBF communities and the

rural economy. While finfish is essential for food security, GFP offers a high earning potential for households engaged in CBF. Therefore, the value chains for both products need to be improved. To maximise benefit sharing among value-chain actors, the information asymmetry regarding price determination must be minimised. CBF has the potential to benefit both men and women. However, the economic benefits currently accrued to men are greater than those received by women, due to the predominance of men in most nodes of CBF value chains. The CBF sector can maximise the productive potential of both male and female members and their wellbeing by fostering an inclusive atmosphere, which will increase sustainability, economic development and food security.

GFP production can significantly uplift rural communities and contribute to Sri Lanka's national economy by investing in science-based management, efficient stocking practices and value-chain improvements. However, challenges such as fingering availability, water management, market fluctuations and proper harvesting methods must be addressed to ensure long-term sustainability. The integration of GFP production into Sri Lanka's CBF has positively impacted the sustainable livelihoods of rural fishing communities. While challenges remain, particularly concerning market stability and resource management, the overall benefits underscore the potential of GFP cultivation as a viable livelihood strategy.

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