Socioeconomics and Gender Roles in the Blood Cockle Fishery *Refugia* in Prek Sangke Village, Prey Nop 2, Sihanoukville Province, Cambodia

JTF 6-2 Pillar II.
Promotion of sustainable aquaculture and resources enhancement in Southeast Asia

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Blood cockle is a vital food source and income for coastal communities, but its populations are declining due to pollution, habitat loss, and overharvesting. The SEAFDEC Training Department conducted a survey in December 2023 in Prek Sangke Village, Prey Nop 2, Sihanoukville Province, Cambodia to assess the socioeconomic condition and gender roles of fishers, along with their views on the benefits and challenges of the fishery *refugia* for blood cockle. The data were collected through interviews and focus group discussions with 28 female respondents and key informants. The results showed that all respondents were engaged in blood cockle collection, with 48 % relying on it as their main source of income, earning around KHR 308,806 (USD 76) per month. The fishery *refugia* for blood cockle preserved jobs and boosted fisheries, but illegal fishing and unclear boundaries remained a challenge. Gender roles are distinct, with women handling household chores and net repairs. The survey emphasizes the need for community involvement, especially women, in fisheries management. Strengthening surveillance, educating outsiders, and promoting co-management could improve sustainability. Clear guidelines and inclusive decision-making are essential for effective blood cockle resource conservation.

Blood cockles, particularly *Tegillarca granosa*, are a valuable resource across Southeast Asia, supporting regional economies, traditional diets, and biodiversity (FAO, 2021; Nguyen *et al*., 2019). They provide a rich source of protein, minerals, and vitamins (Rahman *et al*., 2020), making them a staple in local dishes and essential for nutritional security in coastal communities (WorldFish, 2018). However, blood cockle populations have been facing significant declines due to environmental degradation, pollution, and overharvesting, threatening their sustainable production (Nguyen *et al*., 2020; FAO, 2021). Environmental issues, especially poor water quality from pollutants such as ammonia, have resulted in high mortality rates and habitat deterioration (Tan *et al*., 2019; World Bank, 2020). The status of the blood cockle population in Southeast Asia is declining, with significant reductions in production reported in Thailand and Malaysia. In Thailand, the production in Samut Songkhram Province decreased by 81 % from 2006 to 2016 (Department of Fisheries of Thailand, 2018). Similarly, Malaysia saw a dramatic decline in blood cockle yield from around 57,544 t in 2011 to around 16,866 t in 2015 (Saffian *et al*., 2020). Additionally, the overharvesting and illegal trading of blood cockle spat have reduced breeding stock and impacted reproduction rates, as blood cockle is often harvested before reaching sustainable size, typically from 2.5 cm to 3.0 cm in shell length (Tanaka *et al*., 2018). This pressure on blood cockle populations has led to calls for stricter management and conservation strategies, such as using biological indices to monitor growth and habitat health, which can guide more sustainable practices. Overall, ensuring sustainable management of blood cockle habitats and enforcing size regulations are crucial for maintaining their role in coastal economies and ecosystems in Southeast Asia. These measures can help balance local livelihoods with conservation needs, protecting this valuable species for future generations.

Fishery resource enhancement is crucial for sustaining fish stocks and supporting fishing communities, which are essential for global food security. This process involves various activities such as installing artificial reefs, mangrove reforestation, coral planting, and establishing marine protected areas. Since 2001, SEAFDEC has been actively promoting fisheries resource enhancement, particularly through the Integrated Coastal Resources Management (ICRM) Project in Southeast Asia with support from the Japanese Trust Fund. This initiative addressed the decline in coastal livelihoods due to overexploitation and habitat degradation. A survey on fishery *refugia* for blood cockle in Prey Nub 2, Sihanoukville, Cambodia, conducted by SEAFDEC Training Department (TD) in 2014, indicated that the fishery *refugia* effectively enhanced blood cockle stocks and their habitats, such as mangroves and seagrass beds. However, the management approaches required updates to reflect local socioeconomic and environmental conditions and incorporate new scientific research (Chanthana, 2016).

Therefore, SEAFDEC/TD conducted a survey of the fishery *refugia* for blood cockle in Prey Nop 2, Sihanoukville, Cambodia, to evaluate the success of the fishery *refugia* as a model for resource enhancement initiatives and the importance of community involvement in sustaining fisheries in December 2023. The survey was under the project “Sustainable Utilization of Fisheries Resources and Resources Enhancement in Southeast Asia” supported by the Japanese Trust Fund (JTF) 6-2. This endeavor supports the implementation of the FAO Voluntary Guidelines for Securing Sustainable Small-scale Fisheries in the Context of Food Security and Poverty Eradication (SSF Guidelines) as well as the Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2020 (RES&POA-2030), particularly *RES No. 6 Implement effective management of fisheries that integrates habitat with fishery resources management, and aims to improve the social and economic benefits of all stakeholders, especially by delegating selected management functions to the local level and promoting co-management as a partnership between government and relevant stakeholders and POA No. 35 Promote resource enhancement approaches with appropriate monitoring and evaluation programs, e.g. deployment of appropriate resource enhancement structures, restocking of commercially-important aquatic species, and restoration of degraded habitats, taking into consideration possible socio-ecological impacts*.

Socioeconomic and gender analysis are ways to understand how differences in income, education, and gender roles impact people's access to resources, opportunities, and decision-making power. It helps us see the unique needs, strengths, and challenges faced by different groups in a community, especially women, men, and marginalized populations. This approach is crucial for creating fair and inclusive policies that promote equality and sustainable development. By considering gender perspectives, it ensures that both women and men can equally benefit from and contribute to social and economic progress. The SEAFDEC Training Department conducted a survey in December 2023 in Prek Sangke Village, Prey Nop 2, Sihanoukville Province, Cambodia to obtain information on socioeconomic and gender roles in blood cockle collecting and to understand the perspectives of women and men on fishery *refugia* for blood cockle.

Fishery *refugia* for blood cockle

The Integrated Coastal Resources Management in Sihanoukville (ICRM-SV) project in Cambodia, which was focused on community-based fishery resource management from 2005 to 2009, incorporated fishery *refugia* management, including efforts to protect blood cockle, a vital marine resource at risk due to habitat destruction from illegal fishing and overexploitation (Etoh, 2010). One major issue in Sihanoukville Province was the decline of blood cockle populations due to habitat destruction and illegal dredging activities. Recognizing the urgent need to protect this resource, the local Community Fisheries (CFi) took action to safeguard the blood cockle population, which is vital for the livelihoods of people in Prek Sangke Village, Prey Nop 2, Sihanoukville Province in Cambodia. The establishment of the fishery *refugia* for blood cockle has been one of the significant achievements of the ICRM-SV project, with local authorities and community members continuing the initiative since its inception in 2007 (SEAFDEC, 2010), alongside efforts to encourage community-based fisheries management and self-regulatory measures (**Box**).

Box. Self-regulatory measures for fishery *refugia* for blood cockle (Try *et al.*, 2010)

Location: Khos Angkok

Area: 1,400 m × 1,400 m (approximately 1.96 km^2 or 200 ha)

Collection method: by hand only

Fishing season: year-round without any limitation on fishing hours

Size restriction: Juvenile measuring over 100 pieces per kilogram (or less than 10 g per piece) or smaller than 32 mm × 22 mm in size, are prohibited from being collected throughout the year; broodstock fewer than 50 pieces per kilogram (or over 20 g per piece) or larger than 40 × 28 mm, should not be collected during the spawning season In August

Size selection: Harvested cockles must be filtered using a sieve with a mesh size of 19 mm × 19 mm; in August, an additional sieve with a mesh size of 26 mm × 26 mm should be used to filter gravid cockles, those that do not pass through these sieves should not to be harvested

The CFi in Prek Sangke Village, Prey Nop 2, Sihanoukville Province, Cambodia (**Figure 1**) has 75 members (28 females and 47 males). All females collect blood cockle by hand while males are engaged in catching fish and crabs using gillnets. The interview was conducted with 28 female fishers on 17–23 December 2023 by using a semi-structured questionnaire with questions about fishing activities and perspectives about the fishery *refugia* for blood cockle (**Figure 2**). Moreover, the focus group discussion was done on 19 December 2023 for one group of women (n = 7) and one group of men (n = 7) to understand women’s and men’s roles in fishing activities, earning income, maintaining households, fishery *refugia* activities as well as their perspective in fishery *refugia* for blood cockle (**Figure 3**). The data were analyzed using descriptive statistics.

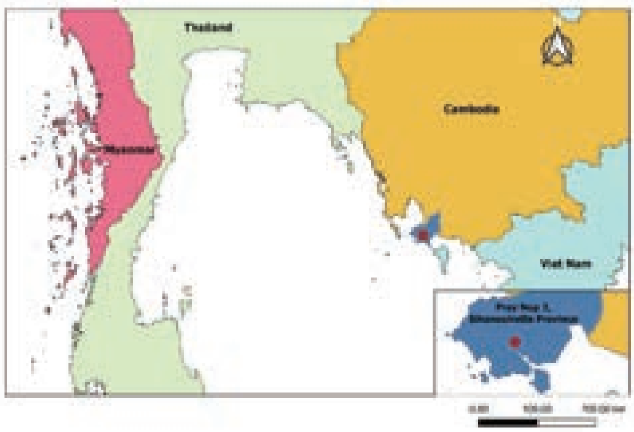

Figure 1. Location of the survey site in Prek Sangke Village, Prey Nop 2, Sihanoukville Province, Cambodia

Figure 2. Fisheries officers from the FiA interviewing the respondents in Prek Sangke Village, Prey Nop 2, Sihanoukville Province, Cambodia

Figure 3. Focus group discussion with women (top) and men (bottom) in Prek Sangke Village, Prey Nop 2, Sihanoukville Province, Cambodia

Fishing activities

The average age of the respondents was 44 years, ranging from 20 years to 63 years (n = 28). The respondents had an average of 23 years of fishing experience, suggesting that many started collecting blood cockles at a young age of 17 years. Their household consisted of an average of about four members, with two men and two women, indicating the presence of nuclear families. The average daily expenditure of their families was KHR 31,200 (USD 7.5), with a maximum of KHR 70,000 (USD 17.0) and a minimum of KHR 5,000 (USD 1.2). Blood cockle collecting (**Figure 4**) is the primary occupation of about half of the respondents (48 %), and it also serves as a part-time job for the rest of the respondents (52 %), with an average monthly income of approximately KHR 306,806 (USD 76) from blood cockle collecting. Among the respondents, 86 % sold blood cockle to retailers, while only one respondent sold directly to consumers at the Trapang Ropov market. Notably, 86 % of the respondents were engaged in at least two jobs, indicating a significant reliance on multiple sources of income (**Table**), which underscores the importance of blood cockle collecting as both the main and diverse supplementary sources of income of the respondents. On the other hand, men operate gillnets to catch mullet and other fish species, which typically takes place during fishing season from July to September.

Table. Other sources of income of the respondents in Prek Sangke Village, Prey Nop 2, Preah Sihanoukville Province, Cambodia, aside from collecting blood cockle (n = 28)

Other occupations	% of respondents (n = 28)	Income (KHR)	Income (USD)
Mending nets	33	86,429/day	21/day
Gillnet fishing	50	837,083/ month	209/month
Chicken raising	4	45,000/day	11/day
Hand push net fishing	4	350,000/ month	87/month
Grocery stores	4	200,000/day	50/day
Buy blood cockle	4	250,000/day	62/day

Figure 4. Women collecting blood cockle in Prek Sangke Village, Prey Nop 2, Preah Sihanoukville Province, Cambodia

Roles of women and men

- **Fishing activities**

Women and men have distinct responsibilities in fishing activities. All men are primarily responsible for preparing fishing gear (**Figure 5**), typically starting at 4:00 a.m. All women, on the other hand, are responsible for preparing food when men go fishing, especially when trips extend beyond 20 km, which requires them to wake up at 4:00 a.m. as well. Then, all men handle the installation of nets at sea and return home at around 8:00 a.m. Men (70 %) dominate in catching crabs at sea, while women (30 %) accompany the men on windy days. Both men and women return from crab collection at 4:00–5:00 p.m. Upon returning home, men clean the fishing gear. Women (80 %) play a significant role in mending nets to maintain the fishing gear, which they perform at 6:00–10:00 a.m., 1:30–3:30 p.m., and 4:30–7:00 p.m.

- **Earning income from other occupations**

Blood cockle collecting is performed exclusively by women (100 %) (**Figure 6**) during low tide, either at 6:00–10:00 a.m. or 4:30–7:00 p.m., depending on tidal level and when they are not mending nets. Additionally, women handle the family business, *i.e.* grocery shop, which takes place throughout the day when they are not occupied with other tasks. These roles highlight women's essential contributions to both earning income and household management.

- **Managing households**

All women take on the full responsibility for various household tasks, including cooking, cleaning, and caregiving (**Figure 7**). Women prepare meals typically at 5:00–6:00 AM, 10:00 a.m.–12:00 p.m., and 3:30–4:30 p.m. They also manage the cleaning of the house, which takes place throughout the day as needed. Additionally, women are solely responsible for caring for children and providing support to elderly or sick family members, attending to these duties during the day. These gender roles emphasize the central role women play in maintaining household well-being and caregiving.

- **Fishery *refugia* activities**

While women held positions such as vice chief, secretary, cashier, and member in the fishery *refugia* for blood cockle, there was a shift from having women as leaders. This change occurred because group members believed that women were unable to participate in night patrols like men, as women often have significant household responsibilities and are not permitted by their husbands to go out at night. This perception

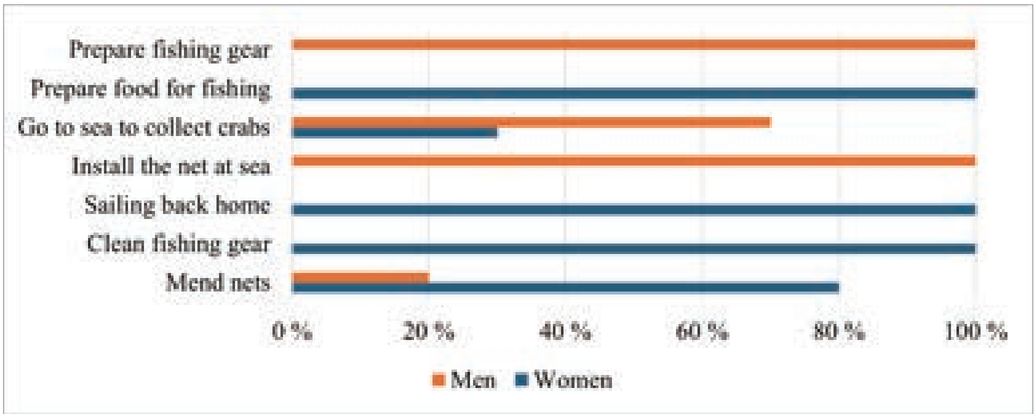

Figure 5. Roles of women and men in fishing activities in Prek Sankae Village, Prey Nop 2, Preah Sihanoukville Province, Cambodia (n = 7 women and 7 men)

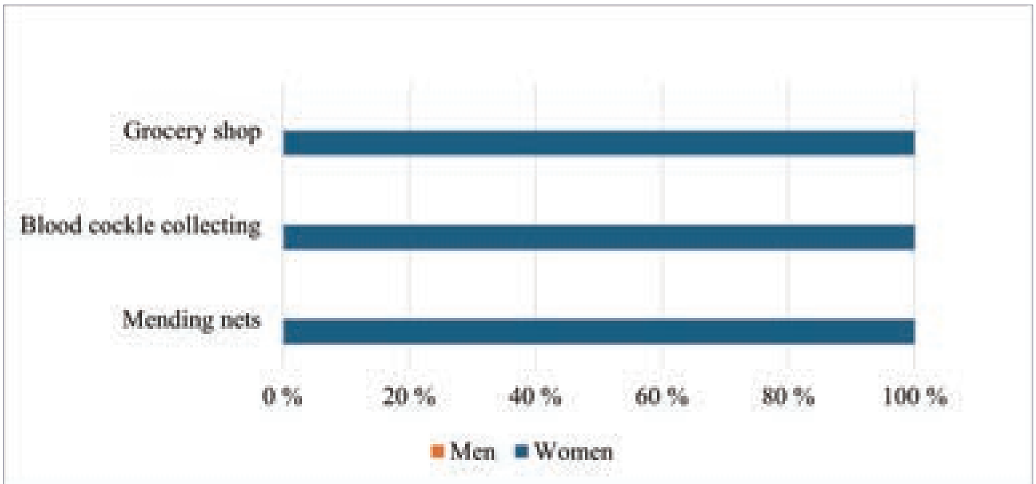

Figure 6. Roles of women and men in other earning income in Prek Sankae Village, Prey Nop 2, Preah Sihanoukville Province, Cambodia (n = 7 women and 7 men)

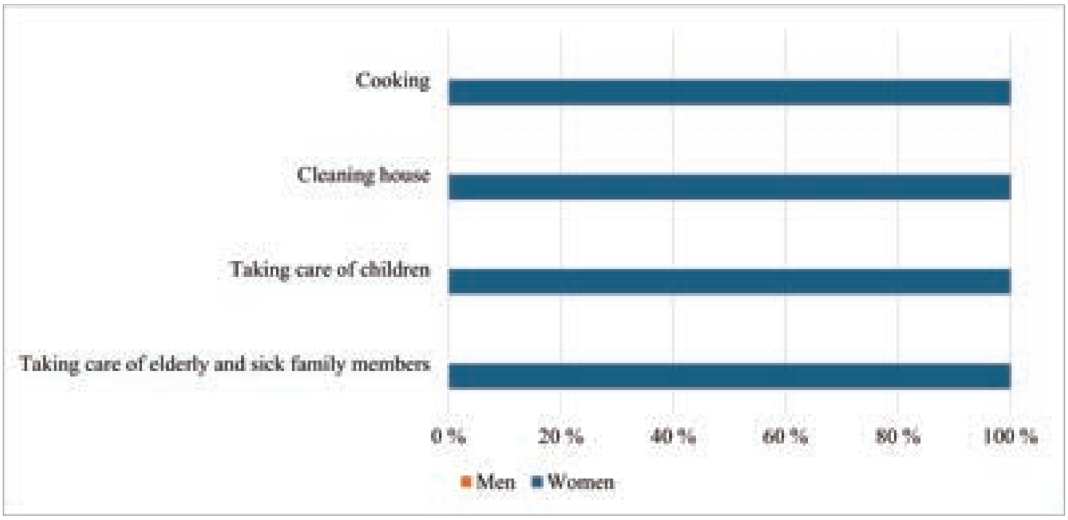

Figure 7. Roles of women and men in households in Prek Sankae Village, Prey Nop 2, Preah Sihanoukville Province, Cambodia (n = 7 women and 7 men)

is influenced by cultural and religious beliefs that discourage women from taking on leadership roles.

Perspective in fishery *refugia* for blood cockle

The respondents indicated the key benefits of the fishery *refugia* for blood cockle, which include maintaining women's jobs (29 %), increase the fishery resources such as blue swimming crab, shrimp, fish, and blood cockle (46 %), and providing nutrition to families (11 %). On the other hand, they expressed that the negative impact of fishery *refugia* is obstruction to navigation because the poles that mark the boundaries are difficult to see during high tide (18 %). The major issue of the fishery *refugia* is the use of dredges to catch blood cockle along the edge of the fishery *refugia* (79 %).

During the FGDs, the key informants were aware of the self-imposed rule in the fishery *refugia* for blood cockle established in 2010, which is the prohibition of the collection of blood cockle more than 100 pieces/kg. However, many were not aware of the exact boundaries of the fishery *refugia* for blood cockles.

The men's group discussion revealed that illegal fishing continues despite the demarcation of the fishery *refugia*, as some individuals who were involved in its installation know how to bypass the blocks and fish within the protected area. The men expressed the need for more frequent surveillance by authorities to monitor the area and address ongoing illegal fishing activities.

Meanwhile, the women suggested that the government should consult with fishers before installing the block to protect the fishery *refugia* area and take stronger measures to combat illegal fishing. They also requested permission from the government for fishers to conduct the fishing around the block and advocated for allowing hand collection of blood cockle throughout the year. Additionally, they emphasized that when illegal fishers are arrested, any blood cockle seeds found should be left in the fishery *refugia*.

Conclusion and Way Forward

Both female and male key informants have distinct roles in supporting their families financially in Prek Sankae Village, Prey Nop 2, Preah Sihanoukville Province, Cambodia. Women primarily engage in blood cockle collecting, while men focus on gillnet fishing, and they often assist each other in fishing activities. Despite the cooperation of women and men in fishing activities, women are still predominantly responsible for housework. Both genders benefit from the fishery *refugia* for blood cockle, which supports their family livelihoods due to the enhanced blood cockle stock. However, there is a shared concern among the respondents on the need to protect the fishery *refugia* from dredgers as these practices contribute to the decline in blood cockle stocks, undermining the effectiveness of the fishery *refugia*.

To promote sustainable fishery resource utilization, there is a need for better education and awareness among individuals from outside the community who engage in illegal fishing in the fishery *refugia* for blood cockle. Additionally, the new laws and regulations related to fisheries should be more widely promoted. Establishing a co-management system for regular patrolling in the fishery *refugia* for blood cockle is essential to ensure consistent monitoring. Before installing any physical barriers or blocks, it is important to involve local fishers in the process to address both long-term and short-term needs and ensure the blocks are marked effectively, particularly for high tide levels. Furthermore, the participation of both women and men in fisheries management decision-making is crucial, as it helps incorporate diverse perspectives from the local community to improve fishery resources and enhance livelihoods.

The handbook that will be developed by SEAFDEC/TD is useful for data collection to identify the impact of blood cockle resource enhancement on ecological and socioeconomic aspects. The key findings will be crucial for the improvement and implementation of management practices.

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