The Role of Fishers' Group in the Establishment and Management of a Refugia System: Experience of Cambodia

Ing Try, Seiichi Etoh and Jariya Sornkliang

As part of the commitment of the FiA of Cambodia in the UNEP/GEF Project on the establishment of a system of fisheries *refugia* in the South China Sea and the Gulf of Thailand, a *refugia* for blood cockles was established by the local fishers group. The establishment of the blood cockle *refugia* was also made part of the activities of the SEAFDEC-supported project on ICRM-SV. The Blood Cockle Fishers Group of Sihanoukville which was organized under the ICRM-SV project has successfully managed the said blood cockle *refugia*.

The Fisheries Administration (FiA) of Cambodia collaborated with the Southeast Asian Fisheries Development Center (SEAFDEC) for the implementation of the project on Integrated Coastal Resources Management in Sihanoukville, Cambodia (ICRM-SV) starting in 2005, with funding support from the Trust Fund Program of the Government of Japan. Technical assistance to the ICRM-SV project was also provided by the Grassroots Funds of the Embassy of Japan in Phnom Penh and the Japan International Cooperation Agency (JICA) in Cambodia (SEAFDEC, 2010).

The establishment and management of fisheries *refugia* had been carried out as one of the activities of the ICRM-SV in conjunction with the UNEP/GEF project on Reversing Environmental Degradation Trends in the South China Sea and the Gulf of Thailand. While the FiA collaborated with the said UNEP/GEF project since 2006, and since SEAFDEC also participated the UNEP/GEF project's Regional Working Group on Fisheries (RWG-F) for the establishment of a system of fisheries *refugia* focusing on the critical links between fish stock and their habitats, the establishment and management of a fish *refugia* in Sihanoukville, Cambodia was made part of the ICRM-SV project activities (Etoh, 2010). Therefore, the establishment and management of fish *refugia* in Sihanoukville as one of the ICRM-SV activities also complied with the commitment of FiA to the implementation of the UNEP/GEF project on the establishment and management of fish *refugia* along the coast of Cambodia.

Members of the BCFG refugia Committee

Locating the *refugia* sites

As early as 2006, the FiA started to identify the locations along the coast of Sihanoukville where fish *refugia* could be established. A research group was organized comprising representatives from the Community Fisheries (CF) and village administrations, to carry out an extensive study in identifying the appropriate fish *refugia* sites. After a series of consultations with all stakeholders of the fisheries community, villagers and local authorities, two sites in the ICRM-SV project area were identified: one for sea grass and the other for blood cockles. Blood cockle is one of the major marine commodities in the community but the resource has been facing the risk of stocks degradation because of the destruction of the fisheries habitats from rampant illegal fishing by dredgers and over-exploitation. Recognizing its importance as a critical issue, the CF was tasked to take imminent measures on the blood cockle resources for food security of the fishers in the community.

In the meantime, the issue on sea grass beds was not considered urgent since sea grasses are neither directly utilized for human consumption nor used for any commercial purposes. In fact, the issue could be outside the criteria of fish *refugia* as defined by the RWG-F, viz: "*Fish refugia is spatially and geographically defined marine or coastal areas in which specific management measures are applied to sustain important species (fisheries resources) during critical stages of their life cycle for their sustainable use*" (Pernetta *et. al*, 2010).

Thus, only the *refugia* for blood cockles had been initiated. Moreover, the selection of the proposed specific site for the *refugia* was conducted by the fishers with sufficient

experience at sea, and using their local knowledge, the *refugia* site was found in an area where there was dense aggregation of blood cockles and where abundant juvenile cockles have been observed.

Organization of Blood Cockle Fishers Group

As soon as the site and the target species for the *refugia* were determined, the beneficiary group was organized to be directly involved with the establishment and management of the *refugia* on blood cockles. The Blood Cockle Fishers Group (BCFG) was then established under the Community Fisheries of Prey Nup II, a district of Sihanoukville. With its initial 25 members in 2006, the number increased to 208 towards the end of 2009. During the series of consultations, the BCFG initially recommended that the *refugia* should cover only a 20-ha area to take into consideration their practical managerial capacity. However, since a 20-ha could be too small to meet the requirements of a fish *refugia* dimension, a 200-ha area which include the 20-ha blood cockle *refugia*, was declared as a demarcated zone which could be used for the further expansion of the *refugia* (**Fig. 1**).

Management of the blood cockle *refugia*

Along with the enforcement of the demarcated zone, a simultaneous effort was made by the BCFG to formulate the fisheries management plan within the concept of community-based fishery resources management which has been promoted under the ICRM-SV project. Such effort led to the development of the Self-regulatory Measures for Blood Cockles Fishing in conjunction with the establishment of the *refugia*. Among the provisions was the required minimum size of harvestable blood cockles which should be limited to less than 100 pc/kg or over 10 g in weight or over 32x22 mm (LxH) in size. Consistent with the size restriction, the mesh size of the filter sieve to be used for controlling the harvest of blood cockles was also fixed with the dimension of the mesh at 19x19 mm. At the start of the implementation of the said regulatory measures, four units of sieves were distributed to four blood cockles middlemen who were responsible in regulating the size of blood cockles purchased from the fishers.

The introduction of the size regulatory measures was made possible through the collective efforts of the BCFG with assistance from the CF and the fishery officers in the Cantonment of FiA. The CF was mainly responsible for monitoring the compliance of the regulatory measures shown in **Box 1**.

Moreover, in order to conserve the gravid blood cockles during the spawning season, harvesting of mature blood cockles with sizes exceeding 20 g per piece in weight or over 40x28 mm (LxH) in size was prohibited. In order to determine the period of the spawning season, a research on the biological aspects of the blood cockles was also carried out as part of the activities of the ICRM-SV project with the cooperation of the members of the BCFG. Meanwhile, the application of the abovementioned provisions was enforced

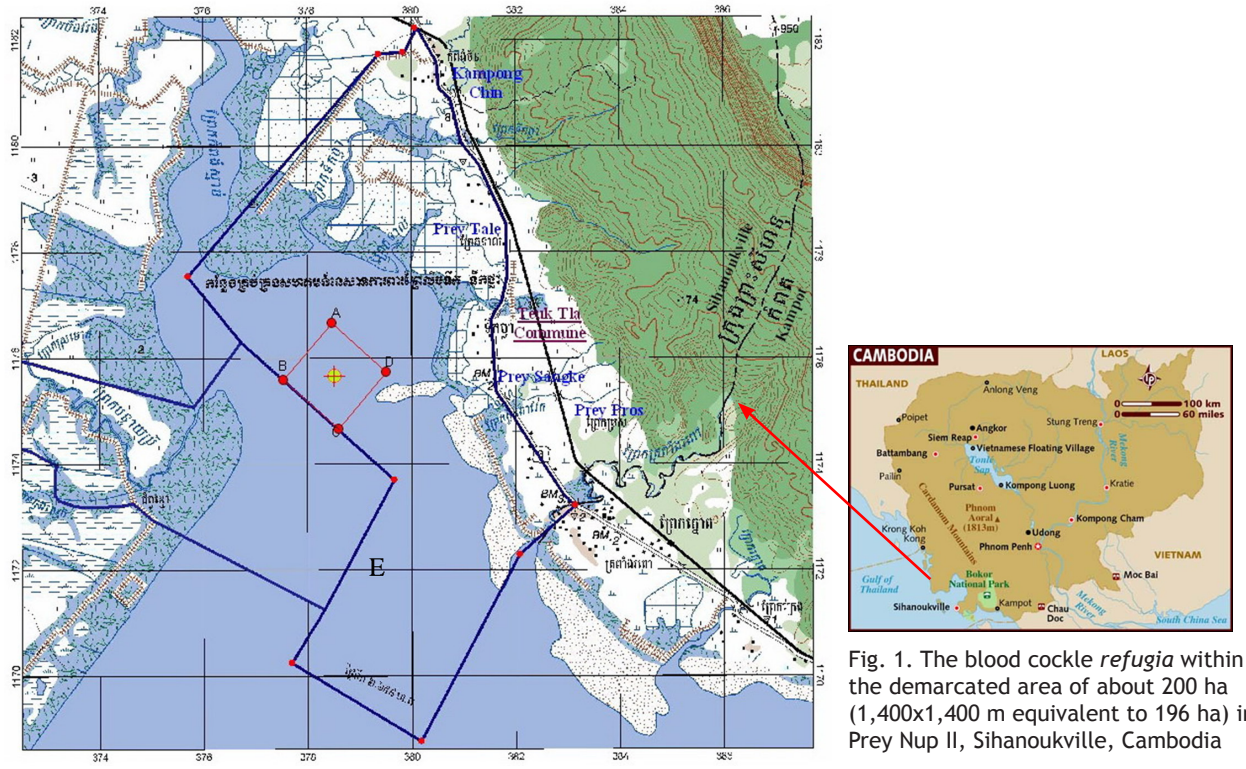


Fig. 1. The blood cockle *refugia* within the demarcated area of about 200 ha (1,400x1,400 m equivalent to 196 ha) in Prey Nup II, Sihanoukville, Cambodia

Box 1. Self-regulatory measures for blood cockles fishing (Community Fisheries of Prey Nup II)

1. **Demarcated fishing area (Khos Angkok)**
   Spatial description:
   (A). Long. 103°53.328 E, Lat. 10°38.544 N
   (B). Long. 103°52.824 E, Lat. 10°37.968 N
   (C). Long. 103°53.400 E, Lat. 10°37.470 N
   (D). Long. 103°53.904 E, Lat. 10°38.046 N
   (E). Long. 103°53.364 E, Lat. 10°38.007 N
   Area of coverage: 1,400 x 1,400 m = 1.96 km^2 = 196 ha or about 200 ha
2. **Fishing rights and entry**
   The fishing rights in the demarcated blood-cockle resource management zone are awarded not only to the members of the BCFG, but also to any outsider who strictly abides by the provisions spelled out in the self-regulatory measures.
3. **Fishing methods**
   The fishing method permitted in the demarcated zone is limited to manual fishing or only the use of hand collection without using any mechanically-driven cockle collectors like dredgers.
4. **Fishing seasons**
   All year round
5. **Limitation of fishing hours**
   None
6. **Restriction of harvestable size**
   - Juvenile blood cockle, over 100 pc/kg or less than 10g/pc in weight or less than 32 x 22 mm (L x H) in size are not allowed to be collected the whole year
   - Broodstock of cockles, less than 50 pc/kg or over 20 g/pc in weight or over 40 x 28 mm (LxH) in size should not be collected during the whole month of August (spawning season)
7. **Tool for size selection**
   - Filtering of harvested cockles using a sieve with mesh size 19 x 19 mm (blood cockles sifted through this sieve should not be harvested)
   - During the month of August, in addition to the above tool, another sieve with mesh size 26 x 26 mm is used to filter gravid blood cockles (blood cockles not sifted through this sieve should not be harvested)

Source: *SEAFDEC (2010)*

requiring that all blood cockles harvested should be filtered by the members of the BCFG committee who are responsible for the implementation of the regulatory measures, using the prescribed sieve (**Fig. 2**), before selling the harvested cockles to the middlemen.

Biological research on blood cockles

The *refugia* system established under the ICRM-SV project was specifically meant for the fisheries management and conservation of blood cockles. In order to confirm the self regulatory measures for blood cockles in the *refugia* area in Prey Nup II, it was deemed necessary to conduct a research to obtain data that would include the gonad development of blood cockles as well as the abundance and distribution of the blood cockles. Thus, the one-year research study on the gonad development of blood cockles was conducted from April 2008 to February 2009 with the blood cockle samples analyzed using the histological and condition index

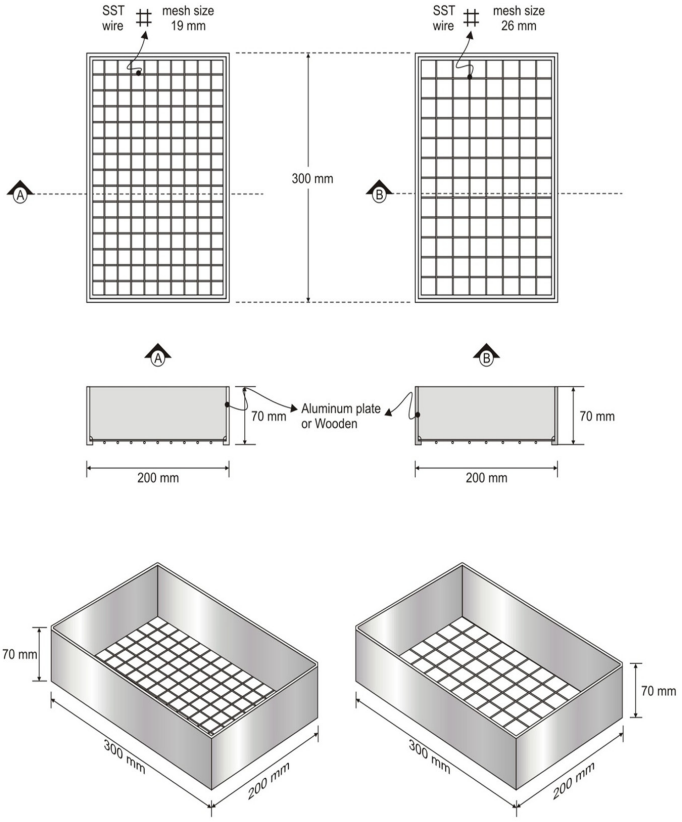


Fig 2: Designs of the two sieves prescribed for sifting the blood cockles

methods. The results indicated that 85% of the samples collected in April 2008 had mature gonads while 15% had developing gonads. In June, 60% of the cockles had already spawned showing spent gonads, 35% were mature and 5% were still developing gonads. In August, 60% of the samples were mature, 35% had spawned and 5% with developing gonads. In November, 95% had developing gonads while 5% were mature. In December, 60% were mature and 40% had developing gonads. Finally, in February 2009, 55% of the blood cockles had mature gonads, 40% had spawned and 5% had developing gonads (**Fig. 3** and **Fig. 4**).

Filtering of blood cockles by members of BCFG using the sieve prescribed in the self-regulatory measures

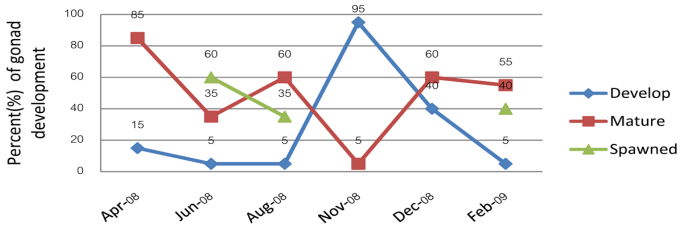
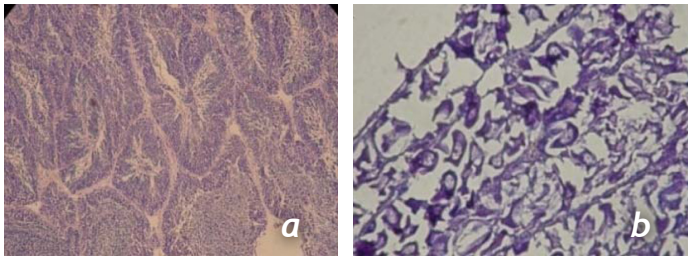
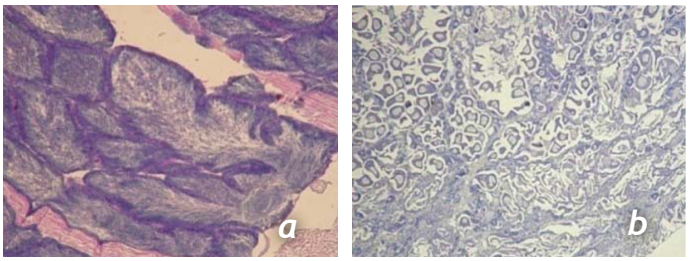


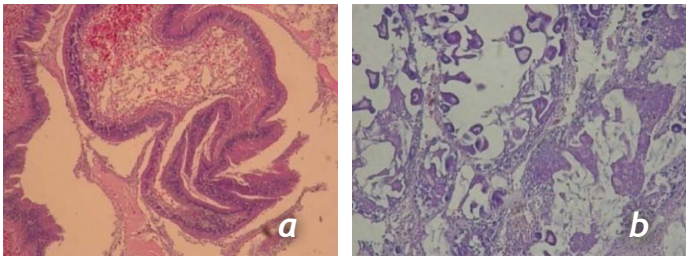
Fig. 3. Gonad development of blood cockles collected in the refugia area



Gonad development in blood cockles: male (a) and female (b)



Mature development in blood cockles gonads: male (a) and female (b)



Spawned stages of gonads in male (a) and female (b) blood cockle

Fig.4. Gonad development of blood cockles (using microscope)

Moreover, an analysis using the condition index was conducted to support the histological method. The rapid declining of the stage of the gonads indicated the spawning period. **Fig. 5** shows the low condition indices which averaged in June, August and February. This concurred with the results of the histological collection, indicating that there could be two spawning periods for blood cockles in one year in Prey Nup II, which are June to August and February. Based on such findings, it was recommended that harvesting of blood cockles could be allowed only during March to May and September to January.

Abundance and distribution of blood cockles in the *refugia* area

Sampling of the blood cockles by the BCFG was done every two months for one year. The analysis of the results showed that the biggest size of blood cockles was found in February while the smallest was in August. Furthermore, the data on CPUE obtained in Prey Nup II showed that the trend of the CPUE of blood cockles in the *refugia* did not show any difference in each month (Sornkliang, 2010). The maximum CPUE was at 0.7 kg/hr/person and the minimum at 0.2 kg/hr/person, indicating that the CPUE of blood cockles in the area is 0.2-0.7 kg/hr/person. Moreover, considering that blood cockles have long spawning periods, therefore it can be harvested during the whole year. However, during the spawning season the restrictions for harvesting blood cockles should be enforced.

Installation of marking posts and obstacle devices

In conjunction with establishment of the *refugia* for blood cockles, the next concern of the BCFG was to protect the *refugia* area from illegal fishing boats especially those using the mechanical cockle dredgers. As means of addressing the concern, marking posts and obstacle objects were installed by the BCFG in the demarcated zone with the main objective of protecting the illegal fishing boats from entering the demarcated zone, bearing in mind that such objects should be eco-friendly and could be used in conserving the fish resources and in enhancing the habitats. Furthermore, considering that the bottom strata of the area have soft mud layer covering, the design of the obstacle objects should consider such conditions. Following such requirements, 30 units were appropriately designed, constructed by SEAFDEC and installed in the *refugia* area by the FiA in November 2009. Similarly, the BCFG put up marking poles in every 200 m distance around the *refugia* area in order to define the area and for the effective management of the *refugia* area.

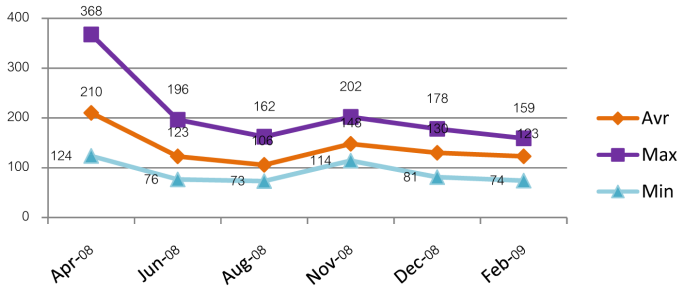


Fig. 5: Condition index of the gonads of blood cockles

Construction (above) and
installation of the obstacle objects (below)

Dissemination of the concept of refugia

After the establishment of the fish *refugia*, the BCFG considered it crucial to disseminate its existence and its function to the neighboring villages where some fishers share in harvesting of the blood cockles in the same area. Since the Self-regulatory Measures indicated that outsiders are allowed to harvest the blood cockles provided that "they abide by all the provisions spelled out in the self-regulatory measures", the BCFG initiated the dissemination of the information to the neighboring villages.

Disseminating the concept of the *refugia* was made possible through the cooperation of the ICRM-SV project staff, FiA officers and representatives from CF of Prey Nup II especially the members of the BCFG. In each village, the implications of the establishment of a *refugia* and its expected function in line with the self-regulatory measures were thoroughly explained by the BCFG committee members. After learning the concepts of the *refugia*, the fishers from neighboring communities while appreciating the new approach, expressed their willingness to cooperate with the management of the *refugia* especially in complying with the self-regulatory measures. To re-emphasize the *refugia* concepts, the BCFG also put up posters explaining the Self-regulatory Measures on every community house in each village.

Way Forward

Although the involvement of SEAFDEC in the ICRM-SV Project was completed in December 2009, implementation of the project activities including the management of the *refugia* by the BCFG has been pursued by the CF with the assistance of the FiA. The continued support of the Grassroots Funds of the Embassy of Japan to the project had also been sought by the FiA in order that the project would attain its goals.

References

Etoh, Seiichi. 2010. Establishment and Management of Fish *Refugia*. *In:* Proceedings of the Regional Seminar on Integrated Coastal Resources Management Approach in Southeast Asia: Review of the ICRM-SV Project. Southeast Asian Fisheries Development Center, Bangkok, Thailand; and Fisheries Administration, Phnom Penh, Kingdom of Cambodia; February 2010; pp 95-100

Pernetta, J.C., Paterson, C.J.,Somboon Siriraksophon. 2010. Fisheries *Refugia* and Marine Protected Areas: Can They Help Sustain the Contribution of Fisheries Towards Food Security? *In:* Fish for the People, Vol. 8 No. 2. Southeast Asian Fisheries Development Center, Bangkok, Thailand, 2010; pp 15-23

SEAFDEC. 2010. Proceedings of the Regional Seminar on Integrated Coastal Resources Management Approach in Southeast Asia: Review of the ICRM-SV Project. Southeast Asian Fisheries Development Center, Bangkok, Thailand; and Fisheries Administration, Phnom Penh, Kingdom of Cambodia; February 2010; 164 p

Sornkliang, Jariya. 2010. Marine Biological Research in Blood Cockle. *In:* Proceedings of the Regional Seminar on Integrated Coastal Resources Management Approach in Southeast Asia: Review of the ICRM-SV Project. Southeast Asian Fisheries Development Center, Bangkok, Thailand; and Fisheries Administration, Phnom Penh, Kingdom of Cambodia; February 2010; pp 81-85

About the Authors

Mr. Ing Try is the Deputy Director-General of the Fisheries Administration of Cambodia and is the SEAFDEC National Coordinator for Cambodia.

Mr. Seiichi Etoh worked with the Training Department of the Southeast Asian Fisheries Development Center (SEAFDEC/TD) as Project Leader of ICRM-SV Project until 2009. He is now working as Fisheries Development Advisor of the Government of Japan for the African and Asian countries.

Ms. Jariya Sornkliang is with the SEAFDEC Training Department in Samut Prakarn, Thailand. She conducted the biological study on the blood cockles in Prey Nup II, Sihanoukville, Cambodia.