GONAD DEVELOPMENT OF BLOOD COCKLE : STUDY CONDUCTED IN PREY NOP II SIHANOUKVILLE CAMBODIA

Integrated Coastal Resources Management in Sihanoukville Project (ICRM-SV)

Southeast Asian Fisheries Development Center(SEAFDEC)

Fisheries Administration, Cambodia

Gonad Development of Blood Cockle: A study conducted in Prey Nop II, Sihanoukville, Cambodia

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Abstract

A study of the development of blood cockle gonad was conducted from April 2008 to February 2009 at Prey Nop II, Sihanoukville, Cambodia. Every two months during the one-year study period, 20 and 60 samples of blood cockle were collected and analyzed by histological and condition index methods, respectively. Using the microscope for checking and analysis, results indicated that in April 2008 on the average, the gonads of 85% of blood cockle samples were mature while 15% had developed gonads. In June 2008, some have already spawned (60%) while 35% were mature and 5% developed. In August 2008, 60% had mature gonads, 35% spawned and 5% developed. In November of the same year, 95% had developed gonads while only 5% were mature. In December, 60% were mature and 40% developed. Finally in February 2009, 55% were mature, 40% spawned and 5% developed. Consequently, the analysis of the condition indices showed low average in three months, i.e., in June, August and February. It should also be noted that data was not collected in October 2008 because of traveling problems, therefore samples collection was postponed to November 2008.

Based on the results of this study, two spawning periods in one year could be established for the blood cockles in Prey Nop II: June to August and February. Therefore, harvesting for blood cockles from this area should be allowed only during April to May and September to January of each year.

Key words: Blood cockle, developed, mature, spawned

I. Background

The Integrated Coastal Resources Management in Sihanoukville (ICRM-SV) project is being implemented in Sihanoukville, Cambodia starting in 2005, by the Southeast Asian Fisheries Development Center (SEAFDEC) in collaboration with the Fisheries Administration (FiA) of Cambodia. One of the main objectives of the project is to raise the awareness of the fishermen and villagers on the status of their fisheries resources. Results from the socio-economic survey conducted in March of 2005 showed that shell fishing by hand could yield 2.0 – 6.0 kg/day of which 1.6 – 6.0 kg/day are sold per day. Blood cockles are the dominant species of shells in the project area where the market is also available. Therefore, the ICRM-SV project has established a refugia for blood cockles in the project operational area in 2008 with the aim of sustainably exploiting the said resource. Henceforth, shell fishing by hand is now being controlled by the Blood Cockle Fishers Group, which was organized in the project area with their self-regulatory measures formulated by the group members themselves. As part of their regulatory measures, fishing for gravid cockles is prohibited during the spawning seasons. Prior to the promulgation of this regulation, it was deemed necessary to scientifically determine the exact spawning seasons for blood cockles in the project area. Thus, this research study was initiated by the SEAFDEC project team starting in April 2008.

Blood cockles are benthic bivalves of the genus Anadara, Family Arcida, and source of protein in the tropical, subtropical and warm temperature countries (Thanomkiat 1994). A hermaphrodite species, the suitable areas for growing blood cockle are the fine muddy floor of the coastline with salinity of not lower than 25 ppt (Thukwinaat 1983). The bivalve likes to burrow in the 1-12 inches thick mud (Thanomkiat 1994). Blood cockles consume phytoplankton, zooplankton and organic matters through filter feeding (Thukwinaat 1985).

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II. Study Methodology

The one year study of the gonad development of the blood cockle was conducted from April 2008 to February 2009 at Prey Nop II, Sihanoukville. Every two months 20 samples of the blood cockles were collected and analyzed by histological methods while another 60 samples were collected for condition index analysis at the laboratories of the Department of Fisheries of Thailand and SEAFDEC/TD.

Histological Collection

Histological method was used to check the conditions of the gonads development following the steps indicated below:

1. The weight and length of the 20 samples were measured and recorded. Only blood cockles weighing more than 10 g were used in the study. The samples selected were then measured for their width and depth, after which the gonads tissues were cut and put in cassettes. The sampled gonads were then kept in 10% formalin solution.
2. The samples were fixed by paraffin embedding in the laboratory and the cross sections obtained by an automatic microtome knife sharpener. After sectioning, the slides were stained by Haematoxylin and Eosin following the Humson method.
3. The slides were finally checked for gonads development using a microscope.

Condition Index

Walne (1974) cited that the relationship between the shell and the meat content of bivalves is important since it is the simplest way of judging the condition of the animal. A fat bivalve contains a larger proportion of meat than a thin one, and this becomes obvious when the samples are opened. A really fat bivalve fills a large proportion of the space between the two shells, whereas a thin one still has plenty of space. In this study, condition index was used to estimate the development stage of the blood cockle. The rapid declining of the condition index indicates the spawning season of the blood cockle.

The formula used to express the condition index is (Walne 1974):

$$\text{Condition index} = \frac{\text{Average dry weight of meat (g)}}{\text{Average volume between shell (ml)}} \times 1000$$

For this study, the following steps were undertaken to determine the condition index:

1. The weight, length, width and depth of the 60 samples were measured and recorded.
2. Then the volume of each blood cockle was estimated, after which the meat was taken out to determine the shell volume and the volume between shells.
3. The meat taken out in the second step were dried by oven at 70°C in 72 hours and weighed.

III. Results

3.1 Histological Collection

tThe development of the gonads of blood cockle is shown in Fig.1

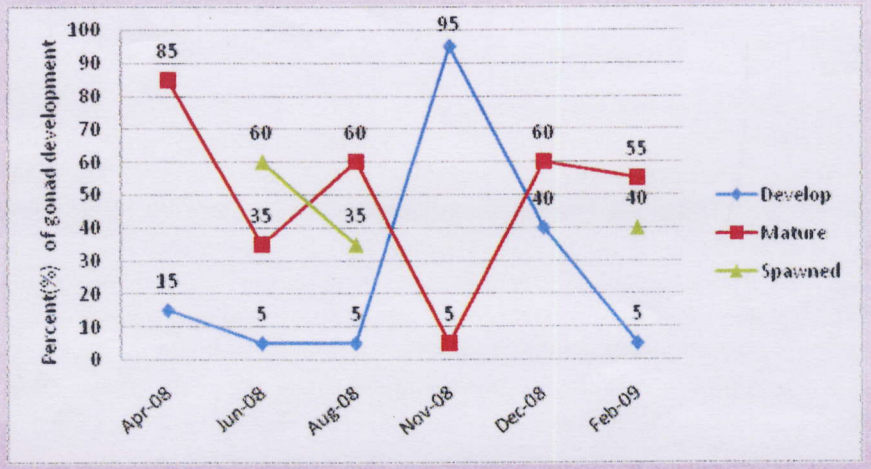


Fig. 1: Development of blood cockle gonads

Based on the graph above, the three stages of blood cockle gonad development are the developed, mature and spawned stages. In April 2008, there were only two stages, namely: developed and mature, with the conditions indicating that 15% and 85% were developed and mature, respectively. In June 2008, the spawned stage appeared, and the percentage of each stage were developed 5%, mature 35% and spawned 60%. In August 2008, the results showed 5% developed, 60% mature and 35% spawned. Sample collection was again resumed in November 2008 as there were traveling problems in October. The results showed that 95% were developed and 5% mature. In December 2008, the conditions indicated 40% developed and 60% mature. The last data obtained in February 2009 showed that 5% were developed, 55% mature and 40% spawned. In summary, the results showed that twice in one year, the gonads development of blood cockles could be determined. Moreover, the average sizes of the blood cockles collected for this study are shown in Table 1.

Table 1. Average size of the blood cockles collected for the study

Month-year	Average width (mm)	Average length (mm)	Average depth (mm)	Average weight (g)
April-08	23.65	31.25	20.80	10.40
June-08	28.85	37.35	25.65	20.50
Augast-08	24.65	32.55	21.40	14.10
November-08	28.40	41.35	31.30	21.95
December-08	25.20	32.90	21.80	10.85
February-09	24.45	31.75	21.60	10.80

3.2 Condition Index

The condition index was also determined to support the histological method .The rapid declining condition index indicates the spawning period. As shown in Fig. 2, the average low condition indices were observed in June, August and February.

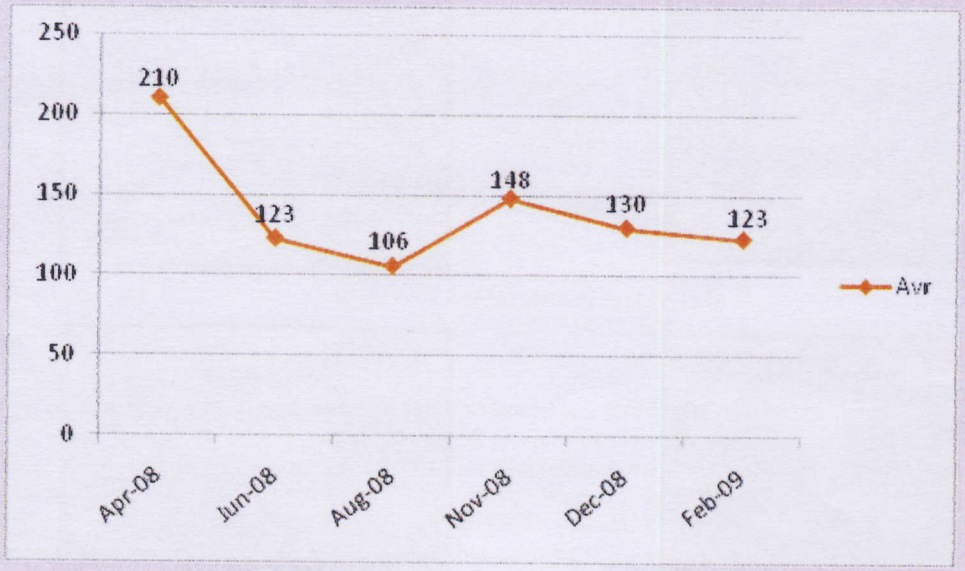


Fig. 2: Condition index of the blood cockle gonads

IV. Discussion

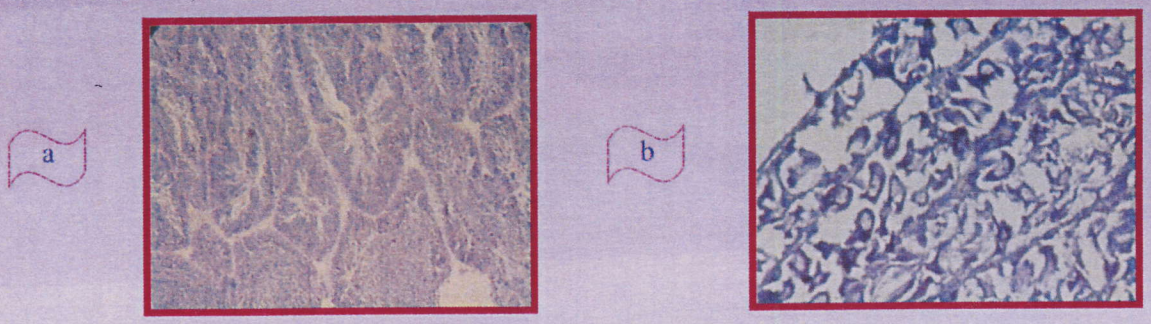
The ICRM-SV project assisted the fishermen to set their self-regulatory measures by establishing refugia in the project area for blood cockles in order to attain sustainable yield. The project therefore informed the fishermen to stop shell fishing during the spawning season following the refugia measures developed by the concerned group. This study was therefore conducted to examine the period of gonad development and confirm the spawning season of blood cockles in Prey Nop II.

The gonad study for blood cockles in Prey Nop II adopted two methods for data analysis, namely: histological and condition index methods. The condition index was also used in order to increase the confidence about the spawning season of blood cockles. As shown in Fig. 1, two seasons were found to indicate the maturation in blood cockles, i.e. June to August and February. Consequently, the result of the condition index analysis (Fig. 2) showed that there are three months of low average condition indices as follows: June, August and February. Thus, blood cockles have two spawning season periods in one year: a long period during June to August and short period in February. However, the short period in February could not be confirmed whether the spawning season starts from January to February or February to March, because samples were not collected every month and the small number of samples collected within the one year data collection period. Moreover, since there was no replication made, the clarity of the seasonal trend must have also been affected. Considering that the results using the two methods were harmonious, these could be used as reference for the setting of the self regulations on fish refugia for fishermen in Prey Nop II.

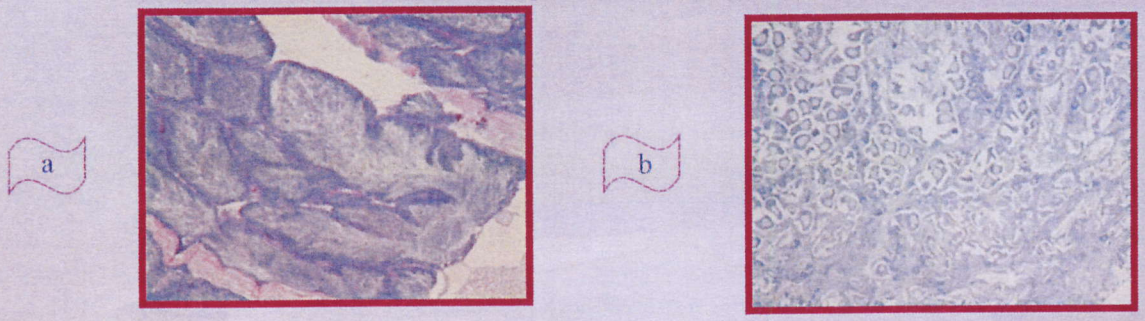
V. Conclusion

Considering that fish refugia is important for blood cockle conservation, the ICRM-SV project tried to establish it in the project operational area. Based on the above outcomes of one year research data analysis, it can be concluded that the spawning seasons for blood cockles are from June to August and February. Thus, the fishermen in Prey Nop II can design their self-regulatory measures specifying the time to stop blood cockle fishing by themselves. However, it is also recommended that the prohibition of harvesting matured size of blood cockles could be confined for two months in July and February. Moreover, a replication of the study should be conducted in June/August and January/March in order to confirm the findings from this study. The pictures of gonad development in three stages obtained from microscopic analysis are shown in Fig. 3.

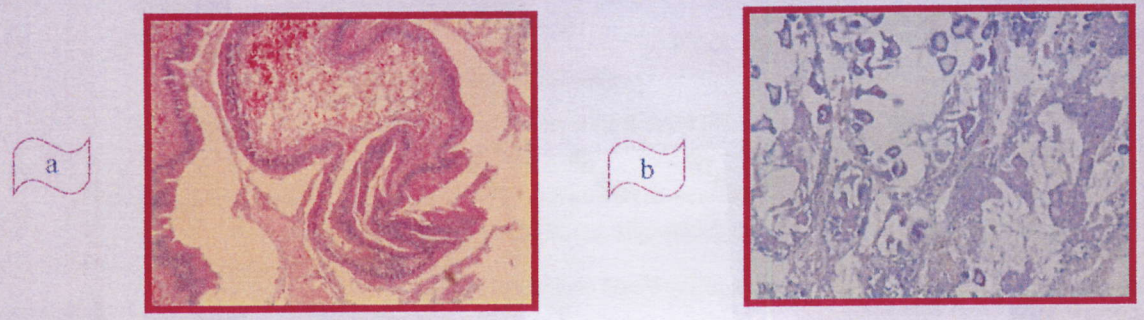
Fig 3. Pictures of the development of blood cockle gonad using the micro scope



1.Developed stage in Male (a) and Female (b)



2. Mature stage in Male (a) and Female (b)



3. Spawned stage in Male (a) and Female (b)

VI. References

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Table 1:The water quality at demarcated zone of blood cockle refugia (by Va Longdy, FiA Staff and Tatsuya HATORI, JICA Expert at FiA)

Area	Date	Time	Measure Depth(m)	Temperature (°C)	Salinity ‰	D.O ppm	%
Centre	26-Nov-08	14:00	Surface	30.19	26.53	6.33	97.5
			1.4	30.03	24.52	6.38	98.9
A(Right Upper)	26-Nov-08	14:33	Surface	30.34	25.03	6.59	101.3
			1.5	28.4	27.25	5.82	89.6
B(Left Upper)	26-Nov-08	14:30	Surface	30.35	26.89	6.53	100.7
			1.4	30.26	26.5	6.38	98.7
C(Left Lower)	26-Nov-08	14:45	Surface	30.62	26.92	6.9	106.9
			0.5	31.39	26.95	11.29	175.2
D(Right Lower)	26-Nov-08	15:00	Surface	29.86	23.5	5.65	84.9
			0.6	29.67	24.8	8.44	127.7

Annex

Table 2: Results of water quality measurement by pack test kits by Kyoritsu Rikagaku laboratory (by Va Longdy, FiA Staff and Tatsuya HATORI, JICA Expert at FiA)

NO_2-N	NO_3-N	NH_4-N	COD
<0.005ppm	<0.2ppm	<0.2ppm	5ppm