THE DETERMINATION OF THE BIVALVAE *Mactra* sp.
POPULATION COHORT AT REMBANG WATERS, CENTRAL JAVA
USING THE BHATTACHARYA METHOD

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**ABSTRACT**

The determination of bivalvae *Mactra* sp. year class cohort were applied for the samples from Randu Gunting Estuaria, Rembang Waters, Central Java, using the Bhattacharya method (different logarithmic).

The abundance and shell length data of bivalvae *Mactra* sp collected on March to June, 1996 were used to improve the method.

The Bhattacharya method allowed the determination of three year class cohorts for the samples. This is discussed in regard to advantage of the method giving the input data for the construction of the growth model.

**Keywords**: Bhattacharya Method (different logarithmic), bivalvae *Mactra* sp, year class cohort.

**I. INTRODUCTION**

*Mactra* sp. is a commercially important species, but its biology is poorly known. The species inhabits the Randu Gunting Estuaria, Rembang Waters, Central Java with other species of the genus Pholas and Solen (Zainuri and Rustam, 1996; Zainuri, 1998). Groups of adults frequently consist of a few dozens to several hundreds of individuals distributed over a few square metres. The densities observed in spat ultimately do not vary abundantly. Therefore, high mortality occurs before or early after settlement. However, the period of reproduction and recruitment were not clearly known, but it is likely to consists of individuals all the same age.

The present study is an application of the Bhattacharya method to determine the possibility of different populations of the bivalvae *Mactra* sp. consecutive cohorts at Randu Gunting Estuaria, Rembang Waters, Central Java.
Figure 1. Location of Study Site (112° 4' E, 7° 13' S).
II. MATERIAL AND METHODS

The Randu Gunting Estuaria (112° 4' E, 7° 13' S) at Rembang Waters, Central Java, covers an area of about 185 ha (Fig. 1). The study sites were located on intertidal mudflats, exposed during tides of 0.6 height or less. Seagrass, benthic algae and several coral reef are present in small colony. An abundant and diverse macroinvertebrate fauna is also present.

Sampling was conducted during ebttides off a set of mudflat 0.6 height or less, as long as 20 - 50 meter of water line. Some 441 individuals of *Macra* sp. were collected and their length were measured. The observations were carried out from March to June, 1996.

Abundance and length - frequency data were based on the number of each bivalve taken from the natural population.

Abundance and length - frequency data were collected and analysed, using the Bhattacharya method, based on the number of each bivalve taken from the study site. The Bhattacharya method or different logarithmic suggested by Bhattacharya (1967), Do Chi (1978), Bebars (1981), Lam Hoai (1991) and Zainuri (1997). This method is based on the hypothesis that the size frequency of the year cohort population were distributed following the Gaussian function. The hypothesis considers that the median point of size frequency class were \( x - h / 2 < x < x + h / 2 \), in which \( h \) were the interval size. If \( n \) individuals of the class were distributed as a function of Gaussian, the average \( m \) and the square \( s \), so:

\[ g (x) = \frac{1}{(2\pi s^{2})} \exp \left( -\frac{(x-m)^{2}}{2s^{2}} \right) \]

in which:

\[ \log (g(x)) = \log \left( \frac{1}{(2\pi s^{2})} \right) - \frac{(x-m)^{2}}{2s^{2}} \]

The different logarithmic between class \( x \) and \( x + h \) is described as follows:

\[ \frac{( \log (g(x+h)) - \log (g(x)) )}{h} = \frac{(m - x - h/2)}{s^{2}} \]

which results in the linear correlation:

\[ y = a + b \left( \frac{x + h}{2} \right) \]

or \( a = m/s^{2} \) and \( b = -1/s^{2} \)

when:

\[ y = 0, x + h/2 = \]

\[ = - a/b = \left( \frac{- m}{s^{2}} \right) \left( \frac{-1}{s^{2}} \right) = m, \]

the average of class size were found at the other right side of intersection from the \( x \)-axis.

III. RESULT

Abundance (441 individuals) and size classes of bivalve *Macra* sp. collected on March, 22, 1996 at Randu Gunting Estuaria, Rembang Waters, Central Java were presented in table 1. Based on the data of shell length distribution and their abundance, several cohorts occur and successive recruitment in the sampling period. The data analysis of the Bhattacharya method is presented in figure 2. Based on the shell length frequency, the method were individualised using three linear curves consisting of three presumed cohorts.
Table 1. Abundance and shell lengths (mm) distribution of the bivalve *Mactra* sp.

<table>
<thead>
<tr>
<th>Length (mm)</th>
<th>Abundance (N)</th>
<th>Log N</th>
<th>DL / h</th>
</tr>
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<tbody>
<tr>
<td>24</td>
<td>6</td>
<td>1.7917595</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>39</td>
<td>3.6635616</td>
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</tr>
<tr>
<td>28</td>
<td>38</td>
<td>3.6375862</td>
<td>-0.012988</td>
</tr>
<tr>
<td>30</td>
<td>36</td>
<td>3.5835189</td>
<td>-0.027034</td>
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<tr>
<td>32</td>
<td>79</td>
<td>4.3694479</td>
<td>0.3929845</td>
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<tr>
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<td>83</td>
<td>4.4188406</td>
<td>0.0246964</td>
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</tr>
<tr>
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</tr>
<tr>
<td>44</td>
<td>3</td>
<td>1.0986123</td>
<td>-0.346574</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>441</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 2. Year classes (presumed cohorts) observed within samples *Mactra* sp., determined by the method of Bhatnacharya (1967).
IV. DISCUSSION

The distribution of shell lengths of bivalve Macra sp collected at the study site was unimodal, indicating that the individuals came from at least three spawns. The samples collected consisted of spat settles in summer and autumn 1995, also in early summer 1996. Therefore, the sample constituted 0+ (1996) newly settled individuals and 1+ (1995) individuals.

The differentiation of the poly-model distribution based on the Gaussian distribution data, as shown in the abundance and shell length frequency of bivalve Macra sp population in the sample of Randu Gunting Estuaia, admitted to solve the problem of recruitment and year class cohorts. In this study, the Bhattacharya method was applied to determine the cohorts of bivalve Randu Gunting Estuaia population, which was collected at the same time, but at different study sites. The advantage of the Bhattacharya method was less subjective and simple compared to other methods, e.g. the Hasselblad and the Petersen methods. Remark by Bebars (1981) that the Bhattacharya method results in the efficacy of individualism separation of the model on the distribution poly-model of the population. Lam Hoai (1991) and Zainuri (1997) state that the construction of growth model, especially the Von Bertalanffy Growth Curve, depend on the input data from the distribution poly-model analysis. Moreover, Lam Hoai (1991) presented the advantage of the application of the Bhattacharya method to determine the growth parameters, especially when there was an absence class in the distribution poly-model. Even the advantage of the model were clearly determined, Tanaka (1962) and Bebars (1981) remarked, that the application of the Bhattacharya method (or Different logarithmic) will raise the bias of the size class determination error.

V. CONCLUSION

The Bhattacharya method allowed the determination of three-year class cohorts, 0+ (early summer 1996); 1+ (summer and autumn 1995).

The Bhattacharya method allowed the input data for the construction of the Von Bertalanffy Growth Curve Model.

REFERENCES


