

# 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

ulteriorly 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.

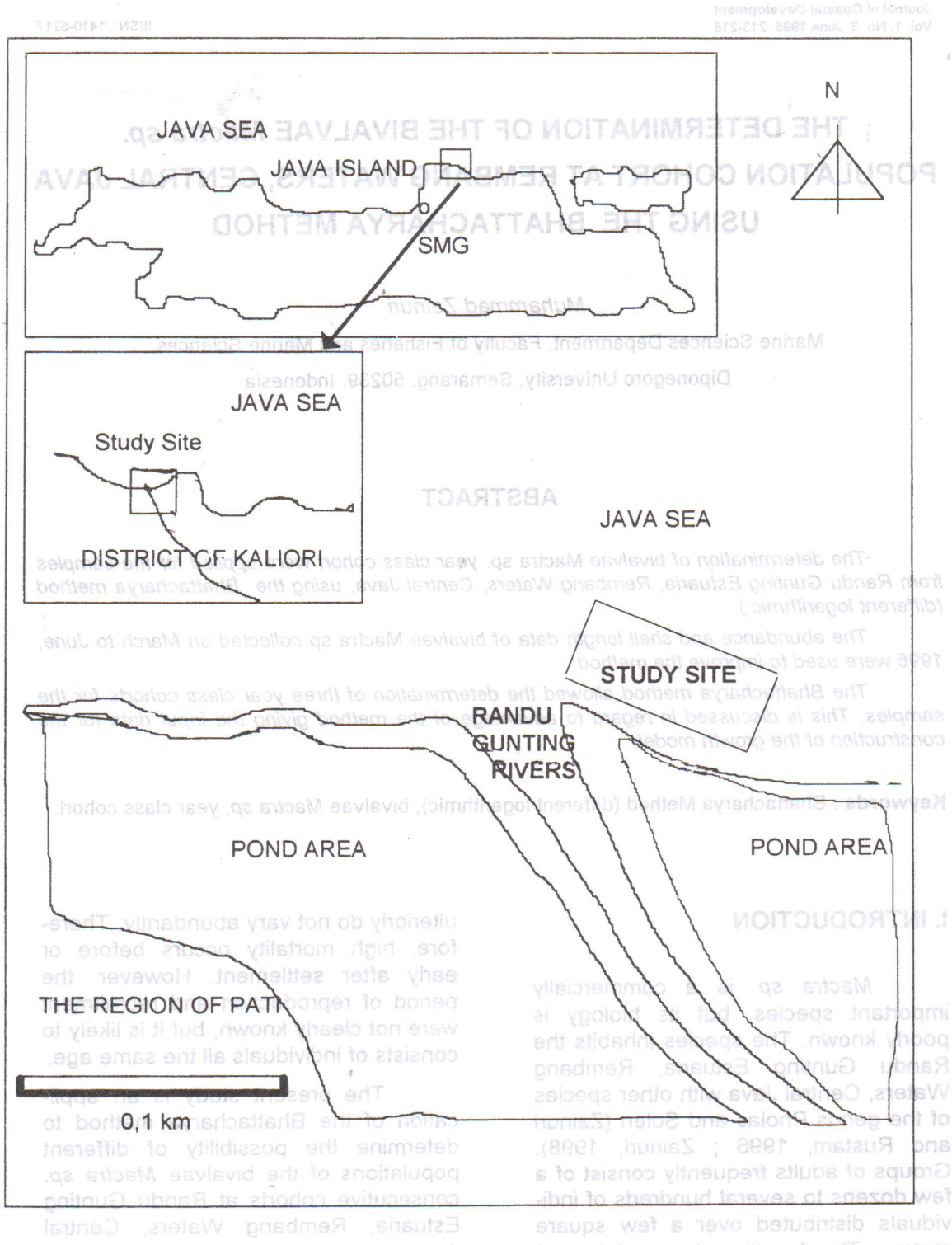


Figure 1. Location of Study Site ( 112° 4' E, 7° 13' S ).



## 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 ebbs tides off a set of mudflat 0.6 height or less, as long as 20 - 50 meter of water line. Some 441 individuals of *Mactra* 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 bivalvae taken from the natural population.

Abundance and length - frequency data were collected and analysed, using the Bhattacharya method, based on the number of each bivalvae 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 :

$$g(x) = (1/(s\sqrt{2\pi})) \exp(-(x-m)^2 / (2s^2))$$

in which :

$$\log(g(x)) = \log(1/(s\sqrt{2\pi})) - (x-m)^2 / (2s^2)$$

The different logarithmic between class  $x$  and  $x + H$  is described as follows :

$$(\text{Log}(g(x+h)) - \text{Log}(g(x))) / h =$$

$$(m - x - h / 2) / s^2$$

which results in the linear correlation :

$$y = a + b(x + h / 2),$$

$$\text{or } a = m/s^2 \text{ and } b = -1/s^2$$

when :

$$y = 0, x + h / 2 =$$

$$= -a/b = (-m/s^2) / (-1/s^2) = m,$$

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 bivalvae *Mactra* 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.

Length ( mm )	Abundance ( N )	Log N	DL / h
24	6	1.7917595	
26	39	3.6635616	0.9359011
28	38	3.6375862	-0.012988
30	36	3.5835189	-0.027034
32	79	4.3694479	0.3929645
34	83	4.4188406	0.0246964
36	61	4.1108739	-0.153983
38	45	3.8066625	-0.152106
40	45	3.8066625	0
42	6	1.7917595	-1.007452
44	3	1.0986123	-0.346574
TOTAL	441		

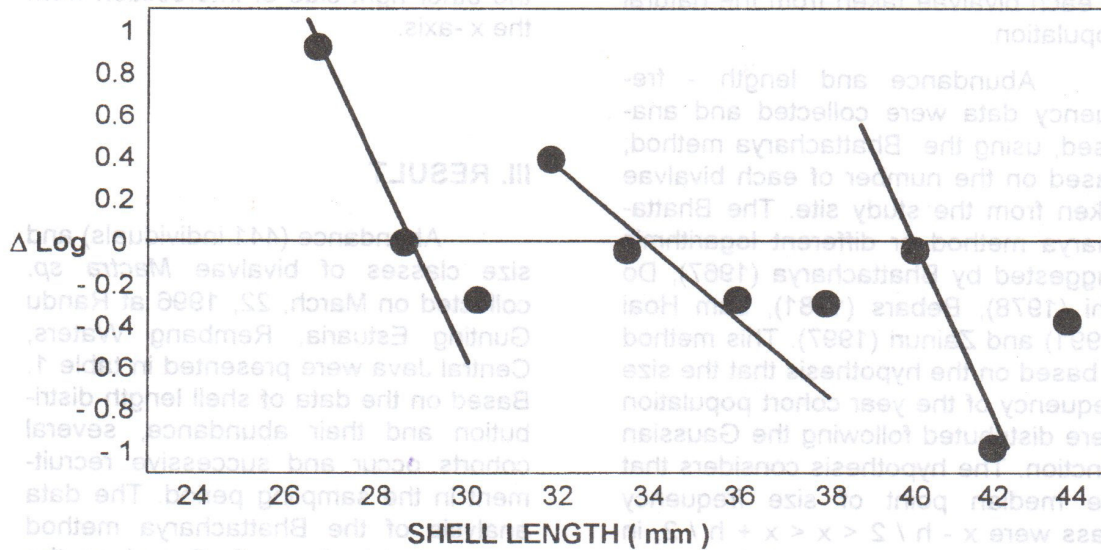


Figure 2. Year classes ( presumed cohorts ) observed within samples *Mactra* sp. determined by the method of Bhattacharya ( 1967 ).



#### IV. DISCUSSION

The distribution of shell lengths bivalvae *Mactra sp* collected at the study site was plurimodel, 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 polymodel distribution based on the Gaussian distribution data, as shown in the abundance and shell length frequency of bivalvae *Mactra sp* population in the sample of Randu Gunting Estuaria, admitted to solve the problem of recruitment and year class cohorts. In this study, the Bhattacharya method was applied to determine the cohorts of bivalvae Randu Gunting Estuaria 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 polymodel 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 polymodel 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 polymodel. 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

- Bebars, M.I., 1981. Exploitation Rationnelle des Pecheries Egyptiennes: Application aux Pecheries des Sardinelles (*Sardinella aurita*, Valenciennes, 1847) de la Baie du Salloum, Egypte. These de Doct. Etat, Univ. Sci. Tech. Languedoc, Montpellier, 354p
- Bhattacharya., C.G., 1967. A Simple Method of Resolution of a Distribution Into Gaussian Components. *Biometrics*, 23:115-135
- Do Chi, T., 1978. Modeles Cinetiques et Structuraux en Dynamiques des Populations Exploitees. Application au squilles, *Squilla mantis* L (crustaces stomatopode) du Golfe du Lion. These de Doct. Etat, Univ. Sci. Tech. Languedoc, Montpellier, 272p.

Lam Hoai, Thong., 1991. Expression Numerique De la Croissance Chez les Poissons. *Trav. Praq. Dir. d'Hydro-biologie. Univ. Montpellier II.* 27p.

Tanaka, S., 1962. A Method of Analysig a Polymodal Frequency Distribution and its Application to the Length Distribution of the Porgy, *Taius Tumifrons* (T et S). *J. Fish. Res. Board. Can.*, 19(6):1143-1159.

Zainuri, M., 1997. The Application of the Method Bhattacharya for Determination of the Bivalvae *Ruditapes decussatus* Cohort. *Perikanan Ilmu Kelautan*, 1(2):54-62.

Zainuri, M., 1998. The Application of Von Bertalanffy Growth Curve on the Demographic Structure of Bivalvae Populations at Rembang Waters, Central Java. *Jour. Coast. Dev.* 1(2):151-163.

Zainuri, M. and A. Rustam, 1996. Demographic Structure of Bivalve Population at Rembang Waters, Central Java. in Hylleberg, J., T. Cedhagen, A. Nateewathana and P. Middlefart. 1996. Proceeding of the Seventh Workshop of the Tropical Marine Mollusc Programme. 58-65.

REFERENCES

Bedars, M.I., 1981. Exploitation Ratio- nelle des Pecheres Egyptiennes: Application aux Pecheres des Sardinelles (*Sardinella aurita*, Valenciennes, 1847) de la Baie du Salloum, Egypte. These de Doct. Etat. Univ. Sci. Tech. Languebec, Montpelier, 384p.

Bhattacharya, C.G., 1967. A Simple Method of Resolution of a Distribution into Gaussian Components. *Biometrics*, 23:145-155.

De Cuir, T., 1978. Modelles Cinetiques et Structures en Dynamiques des Populations Explorees. Application au squalle, *Squalus mantis* L. (crustacees, stomatopode) du Golfe du Lion. These de Doct. Etat. Univ. Sci. Tech. Languebec, Montpelier, 272p.

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