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FECUNDITY AND THE BODY LENGTH OF RAG WORM, *PERINEREIS CULTRIFERA* (GRUBE 1840) FROM WEARLILIR BEACH WATERS, SMALL KEI ISLANDS, SOUTHEAST MALUKU DISTRICT

Martha Rettob

Dosen Politeknik Perikanan Negeri Tual
Jl.Langgur-Sathean Km 06 Kab. Maluku Tenggara 97611

ABSTRACT

The knowledge of fecundity is an important aspect in the reproductive biology. Understanding the fecundity may allow the estimation of the number of rag worm individual and the determination of the number of rag worm in the questioned length class. The number of egg released represents a linking chain for one generation to next generation.

The objective of research is to understand the range of fecundity, the range of body length, and the relationship of fecundity and body length of rag worm from Wearlilir waters, Moluccas, Indonesia. Achieving this objective, the observation to 238 individuals of female rag worm which are captured at Wearlilir beach waters, Small Kei Islands, Southeast Maluku District for a year from June 2010 to May 2011. The fecundity is calculated with the mixed methods including volumetric, gravimetric, and arithmetic.

*The relationship between fecundity and body length of rag worm is following the square function, $F = 144.6533PT^{1.2911}$. It can be transformed into a form of natural logarithm to produce the regression equation: ln (WF) = 4.97434 + 1.29109 * ln (WP). Result of linear regression analysis of variance indicates that there is a positive relationship between the fecundity and body length. This relationship is not so close because only 26 % fecundities are influenced by the length, while 74 % are influenced by other factors such as environment and food.*

Keyword : Polychaeta, *Perinereis cultrifera*, Fecundity, Body Length, Reproduction
Correspondece : E-mail : martharettob@gmail.com

INTRODUCTION

Wearlilir Waters remain in the Small Kei Islands, Southeast Maluku District, and protected by Dullah Island and Kalvik Island. Wearlilir Beach is made of hard substrate with the ebb distance of ± 50 – 300 m. In the comprehensive ecosystem context, marine worm plays very important role in the food chain, which acts as decomposer of organic matters. Marine worm has also important economic value which is used as the life prey for the fishing activity in Europe countries. The considered worm species is mostly polychaeta worm species such as *Nereis sp*, *Arenicola marina* or *Sipunculus nudus* (Sipunculidae).

Marine worm, however, has limited benefit for the human being, but its existence is still very important in the nature. The direct benefit of marine worm may be as food for human. These consumed species involve palolo worm, *Eunice viridis* (Annelida phylum) and *Sipunculus sp* from Sipunculidae family. Besides, worm species *Perinereis cultrifera* from Annelida phylum can also be used as the food consumption for human.

Related to the spawning activity, the knowledge about the egg number (fecundity) and its relationship with the body length of rag worm are the important part of the study on productivity. Here, the reproductive potential will be scientifically reviewed through this research.

The reproduction mode of marine worm is varied. However, the mostly found type is asexual reproduction, which is facilitated by its soft body and its segmentation into separated body parts. Sexual reproduction is also carried

out by some Annelid marine worm. Polychaeta does not have fixed gonad. Gamete has been produced through proliferation process of cells from peritoneum. These cells are released into *coelom* with the latter acts as primary gametocyte. The establishment of gamete may be possible throughout body cavity or only in certain regions called reproductive segment. Polychaeta carries on external fertilization, when the sperm and the egg are discharged simultaneously into waters. If the fertilization is complete, a planktonic larva is emerged.

During the maturity of genital cell, rag worm (*Perinsereis cultrifera*) show metamorphosis, including the enlargement of eye, seta and parapodia in the middle part to be modified as the swimming device. Many worms live in the base of waters, but swim into surface at night during spawning to release egg and sperm. The length is changing during the development of natatory setae. Rag worm may develop into heteronereid phase, but in this phase, the development is difficult to identify (Rouabah and Scaps, 2003).

The reproduction rate is high among epitokous species. For *Nereis pelagica* (Olive et al., 1984), 75 % of total energy are allocated to the seed network, while 79% of total energy are allocated to the larvae tissue in *Perinereis cultrifera* (Cassai and Prevedelli, 1998). It seems little bit lower in atokous species (62 % for *Perinereis rullieri*; Cassai and Prevedelli, 1998). The release of gamete during spawning requires much energy for gonad contraction, gonoduct delivery, and body contraction. Egg development for Nereidae follows a regular phase, while the initial phase of egg development is very slow in the previtellogenesis and vitellogenesis phases. Egg develops fast in the corticogenesis phase. *P. cultrifera* has 3 years age of life, and reproduces exclusively by epitoky. Its reproduction season is short, while its spawning occurs from the end of April to the beginning of May when the temperature of marine water surface is getting high (Andries, 2001).

The objective of research is to understand the range of fecundity, the range of body length, and the relationship of fecundity and body length of rag worm at Wearlilir waters.

MATERIAL AND METHOD

The sampling method for *Perinereis cultrifera* is horizontal line transect which is made along the coastline. Two transects are used. The distance between coastlines is 10 m, while the distance between transects is 20 m. Transect length is 700 m with 14 sampling points. The distance between points in each transect is 100m. Rag worm was collected from June 2010 to May 2011 using the gear in the form of round-shaped filter with a volume of ± 2 dm^3. The catch is inserted into the reservoir container and weighed. Rag worms obtained in each month captured 40 individuals at random and given a alcohol 50% to study fecundity.

Rag worm which is captured is then identified through the method in the identification book titled *A Monograph on The Polychaeta of Southern Africa*, written by Day (1967). Its body length is measured by digital calipher at observation rate of 0.01 mm. The gonad is weighted to examine the weight of whole gonads. Egg is taken from some places to be weighted until the model weight is achieved. The model egg is diluted with aquadest until it is reaching the mass of 100 ml and then evenly mixed. Next, 1 ml of mixed solution is used to calculate the egg number (Effendie,1997). The egg number is calculated with hand counter tally under Nikon Microscope Type Labophot–2, at 40 times magnification. Calculating fecundity involves mixing some method such as gravimetric, volumetric, and arithmetic, thus resulting in the following formula:

$$F = \frac{G \times V \times X}{Q}$$

where, F = Fecundity
G = Gonad Weight (gr)
V = Dilution Content (cc)
X = Egg number in every cc
Q = Model egg weight (gr)

To ensure the relationship between the fecundity and the body length of rag worm, data are analyzed using the following equation model:

$$F = a L^b$$

Parameter a and b are obtained by changing the square equation into additional form through natural logarithm transformation. Therefore, a straight line equation is obtained:

$$\ln F = \ln a + b \ln L$$

where F = fecundity
L = body length

To attest the parameter b and the coefficient of determination, R^2, and also to attest the assumption of the linear relationship from both variables (after natural logarithm transformation), the analysis of variance is operated against the model imprecision (Scherrer, 1984).

RESULT AND DISCUSSION

The observation of fecundity is conducted on 238 individuals of *Perinereis cultrifera* female. The fecundity obtained is in the range between 6,383 and 30,460 eggs at the body length ranging from 18.00 to 48.25 mm. The fecundity of each individual observed is varied based on the capture timing (Figure 2). According to Rettob (2007), the fecundity of *Perinereis cultrifera* is 1,500 – 136,500 eggs. The relationship between fecundity and body length is not close. It is about 28 % variances of fecundity affected by the length. It is about 72 % variances of fecundity depending on other factors such as environmental length and food supply. The fecundity average of *Perinereis cultrifera* may be less than that obtained from the previous study because of the difference of body size. Indeed, *Perinereis cultrifera* individual obtained from one capture timing is having shorter body length than that is previously studied. Besides, according to Bagenal (1978), in Effendie, 2002), the high or low of fecundity of an organism is depending on waters where the organism lives. Organism may live in the infertile waters, thus causing lower egg production. In contrast, the egg production may high in the fertile waters. Individuals with high genetic variable have some fitness components such as growth, fecundity, viability and survivability against the environmental change and stress (Ariani, 2011).

The relationship between fecundity and body length of rag worm is following the square function $F = 144.6533PT^{1.2911}$, which is transformed into natural logarithm form through a regression equation: ln (WF) = 4.97434 + 1.29109 * ln (WP).

Based on the result of analysis over the relationship between fecundity and body length, the rate of coefficient of correlation is obtained (r = 0.510), meaning that there is a relatively strong relationship between fecundity and body length. According to Santoso (2002), the rate of coefficient of correlation above 0.5 means the existence of relatively strong correlation. However, the r rate below 0.5 signifies the weak correlation. Subsequently, the rate of coefficient of determination is achieved (R^2 = 26.0225 %), showing that the relationship between fecundity and body length of rag worm (*Perinereis cultrifera*) is less closely because only 26 % variances of fecundity are influenced by the length, while 74 % of fecundity change are influenced by other factors such as environment and food supply. The Analysis of Variance against the straight line equation produces F_{count} = 83.02 > F_{table} = 6.81 with its probability value (P = 0.0000) less than 0.05 at 95 % trust degree, meaning that there is a statistically significant relationship between fecundity and body length.

Figure 1 shows that statistically, there is a significant relationship between fecundity and length. There is also a positive relationship between length and fecundity such that the longer of the worm is related to the greater number of egg. In the model imprecision test (lack-of-fit), the probability rate (P = 0.3042) is greater than or equal to 0.05 with 95 % trust degree, indicating that the model used is suitable to the data observed.

The number of egg laid by an organism is a linkage chain for one generation to the

next generation. The young rag worm, *Perinereis cultrifera*, has heterogeneous egg composition with different maturity rate, but has homogenous or uniform egg size at the maturity stage and at about spawning (Rettob, 2009).

CONCLUSION

Considering the result of research, it may be concluded that the distribution of fecundity is ranging between 6.383 and 30.460. The body length is ranging between 18.00 to 48.25 mm. There is a positive but not close relationship between fecundity and body length of rag worm, *P. cultrifera*, at Wearlilir Waters.

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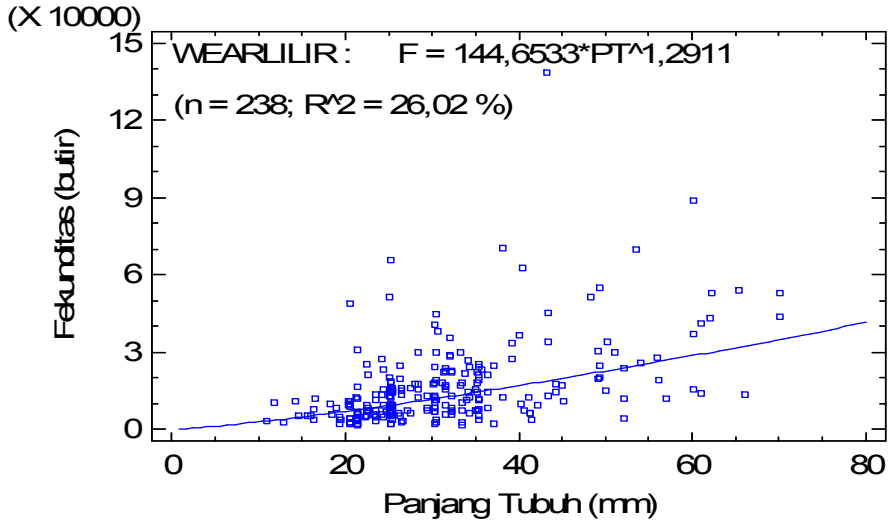

Figure 1. The Relationship between Fecundity and Body Length of Ragworm *Perinereis cultrifera*