Original article

Karakteristik lingkungan dan keragaman fenotipe populasi ikan belut Monopterusalbus (Zuiew 1793) asal Kepulauan Bangka Belitung sebagai dasar pengembangan budidaya

The environmental characteristics and phenotypic diversity of Asian swamp eel Monopterusalbus *(Zuiew, 1793) from Bangka Belitung islands as basic for aquaculture developments*

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Abstract

The research aimed to analized the environmental characteristics and toevaluate the phenotypes diversity of asian swamp eel from Bangka Belitung islands for basic aquaculture developments.Samples of Asian swamp eel catches were collected from three locations Rias, Bencah and Balunijuk. All of catches was measured by truss morphometrics and sexual distributions.Water quality measurements was conducted in situ at each sample location. The results showed that there is close relationship betweenasian swamp eel population of Bencah and Balunijuk based on similarities of their phenotypic diversity, but not with population from Rias. It showed that Asian swamp eel from Bencah and Balunijuk is potential to be cultured, but it must be adjusted with the conditions of physical-chemical variabel of each locations for the best adapted to culture.

Keywords: *asian swamp eel, environment, phenotypes, truss morphometric, aquaculture*

Introduction

Eel *Monopterus albus* (Zuiew, 1793) is the one prospectscommodity that has market and high export value. Eel fish exports from Jakarta to Hong Kong has been going on since 1979. The potential of the local eel fish market today are considerable, for example, in Jakarta needs 20 tons per day, while in Yogyakarta require as much as 30 tons per day for 150domestic industry, while another areas demand reaches hundreds of kg per day. The production data in 2010 showed that the Indonesian exports of eel fish were directed to several major consumer countries of eels in the world such as China, Hong Kong, Japan, Singapore, Taiwan, Korea, and Thailand. According to the datastatistics on fisheries and marine in 2015, eel fish production currently reached 893 496 tonnes with a very significant increase since 2011.

Those data, still not represent the eel production, due to the production was not from eel culturing but it depend on fishing,especially in(Sarwono, 1999). Thus, the potential development of eels in Indonesia need to be explored through the cultivation techniques, among others hatchery practices that form the core of cultivation in controlled containers, domestication (adaptation of natural conditions to the controlled conditions), laboratory-seed scale production that has been domesticated by spawning naturally or artificially. In addition, the commercial development scale of seed production with a success rate through transfer of aquaculture technologies into large productionscale for economically profitable are needed (Maskur, 2002).

Furthermore, optimizing the quality and quantity of feed and environmental approach to successful production of the other factors are needed to consider in the cultivation. It will increase the probability rate by superior qualityandquantity of seeds. Improvements to the quality of seeds can be made by parent selection through understanding the characteristics of the genetic commodity to measure the genetic and phenotypic diversity. The genetic diversity of population is the information that needed in the improvement of seed quality, management of biodiversity and management of genetic diversity in the gene pools of species (Wijana, 1999).

The genetic diversity of phenotypeshave important value in increasing production program of eel on a large scale. Genetic diversity study could analyze based on thequality and quantity improving, so that it can be more easily (Fehr, 1987 in Martono, 2009). It can be used to know the related of fish or eels in the germ plasm collections to determine the furtherpotential development. The diversity linkage of phenotypes measured by*truss morphometric* and environmental studies to know the variations between intrapopulation and interpopulation of eels for further development.

Material and Method

Material Collection

This research was conducted in July 2016 to August 2016. Eel sample was comes from Rias, Bencah, and Balunijuk (Table 1). The ell that obtained was live in paddy fields, marshes and rivers, caught using fishing (bubu). The catching eels were characterized through *truss morphometric* measurement and distribution of sex status analysis.

The in situ measurements include temperature, pH, conductivity, turbidity, total dissolved solids (TDS), and salinity was measured using a multichecker (Table 2)

Tabel 1.Sample collection and habitat characterization of *M. albus*

Name of population	Population's origin	Coordinate	Habitate
Rias	Kec. Toboali, Kab. Bangka Selatan	02,1685^{o}S 106,0900^{o}E	Paddy fields
Bencah	Kec. Air Gegas Kab. Bangka Selatan	02,9652^{o}S 106,4362^{o}E	Swamps
Balunijuk	Kec. Merawang, Kab. Bangka	02,7333^{o}S 106,4054^{o}E	Rivers

Keterangan: Kec. (district), Kab. (regency)

Tabel 2. Physical-chemical parameter of water sampling

Parameter of water quality	Location		
	Rias	Bencah	Balunijuk
Temp. (^{o}C)	28,00-29,00	27,40-28,10	28,50-30,30
Conductivity(mS.cm^{-1})	26,64-134,40	15,60-18,60	71,20-120,20
TDS (mg.L^{-1})	18,90-94,50	11,10-13,00	51,10-86,60
pH	6,36-6,71	6,70-6,90	5,71-5,79
Salinity (g.L^{-1})	0,00-0,00	0,00-0,00	0,00-0,00

Measurements of truss morphometrics

Firstly, the eel was stunned by using commercial drug Stabilizer Arowana®with 4 ml

doseper one liter of water. Morphometric characters measured includes 8 truss phenotype (Figure 1). Numbers 1-4 were measured with a ruler and numbers 5-8 with calipers.

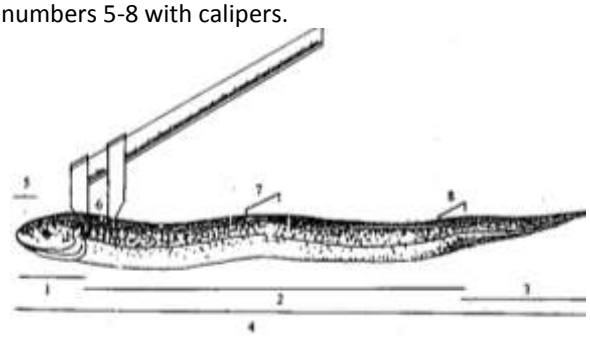

Figure 1 Morphometric character of *M. albus* (Wijana 1999)

Description: 1) Long Section Head (PK), ie the distance from the anterior end of the mouth up to the edges of the gill cover; 2) Long Section Board (PB), ie the distance from the caudal edge of the gill cover to the anus; 3) Long Tail Section (PE), which is the distance from the anus to the posterior end; 4) Total Length (PT), which is the distance from the anterior end to the posterior end; 5) Long Nose (PH), ie the distance from the anterior end until the edges of the eyes; 6) Wide-Body I (LB-I), which is the distance between the left and right side of the body right at the edge of the gill cover (dorsoventral specimen position); 7) Wide-Body II (LB-II), which is the distance between the left and right sides of the body in the midst of LB-I and LB-III (dorsoventral specimen position); 8) Wide-Body III (LB-III), which is the distance between the left and right sides of the body right in front of the anus (dorsoventral specimen position).

Data Analysis

Morphometric measurements performed using the ratio to avoid sample that taken was not uniformly. The eight characters phenotypes that have been measuredjust used seven relevantratios, which are PK / PT, PB / PT, PE / PT, PH / PK, LB-PK / LB-II, PB / LB-II and PE / I. Then descriptiveanalyzed using Microsoft Excel 2013.It also used for the distribution and sex ratio status of truss morphometric variables to determine the potential of superior eels from several locations.

Result

Analysis of truss morphometric diversity coefficient ratio for three populations of eel (Figure 2) shows that one of eel characters was different compare to others. The different character was (PT: PB) body length and total length.

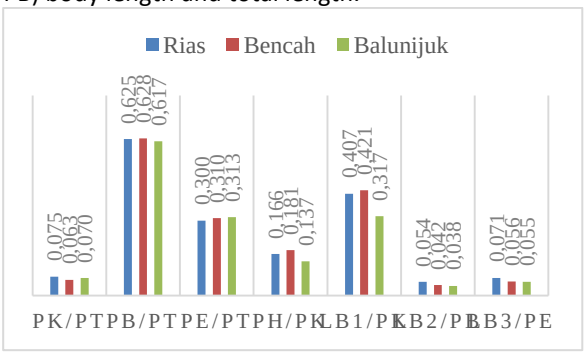

Figure2 T*russ* morphometric diversity coefficient of *M. albus*from Rias, Bencah dan Balunijuk

Description: PK (Long Head), PB (Long Body), PT (Total Length), PE (Long Tail), PH (Long Nose), LBI (Wide Body-1), LBII (Wide Body-2), LBIII (Body width-3)

Based on observations of eels gonads from three sampling sites found 4 categories sex status, which are female, intersex, male and unknown (Figure 3). At one eel populations, the percentage of females was 50%. However, the population of eels from Bancah found the male percentage is greater than other populations.

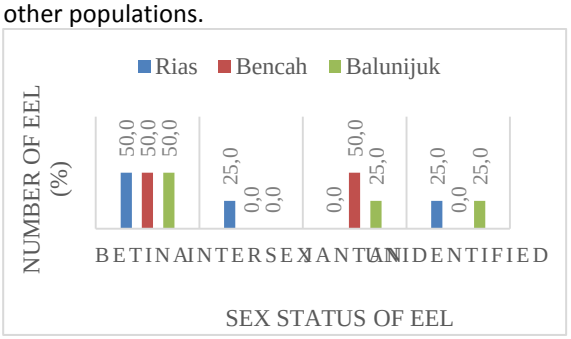

Figure 3 Sex status distribution of *M. albus* from Rias, Bencah and Balunijuk

Based on morphometric characters distribution of eel phenotype illustration from three sampling sites showed that eel from Rias shows was lower than the eel population from Bencah and Balunijuk (Figure 4).

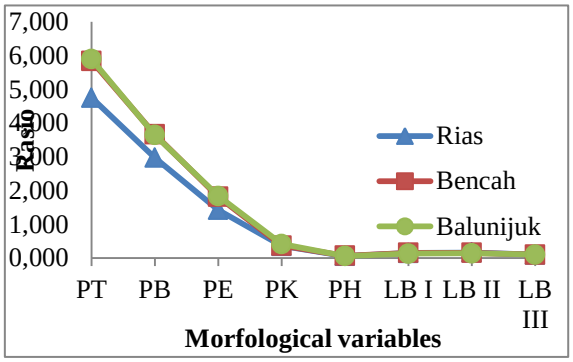

Figure4 T*russ* morphometric variable ratio of *M. albus*from Rias, Bencah and Balunijuk

Description: PK (Long Head), PB (Long Body), PT (Total Length), PE (Long Tail), PH (Long Nose), LBI (Wide Body-1), LBII (Wide Body-2), LBIII (Body width-3

Discussion

Genotype variations and environment interaction will arise because of the contributions some alleles are responsible for a phenotype expressed periodically in different environments (Westra, 1994). Analysis of the diversity seven truss morphometric coefficient ratios of the three eel population (Figure 2) shows the difference interpopulasi based on one character which is body length ratio to the total length (PB: PT). According Sudarto & Rizal (2007), the different morphometric characters shows the difference population areas, it also occurs in Botia fish (*Botia macracanthus*). In addition, different morphometric characters can be used as an identifier of a group to distinguish populations with other populations (Kris & Kusrini 2007).

Naturally,male sex transition can occur on the reaching size 30-45 cm (Chan & Phillips 1969; Affandi et al. 2003). Based on observations of the eelsgonads were caught from three sampling sites, we found 4 categories of female, intersex, male and unidentified (Figure 3). At one eel populations, the percentage of females was 50%. However, the population of eels from Bancah found the male percentage is greater than other populations. Eels are protoginihermaphrodite that change naturally to male from female through intersex phase at a certain age after the larval stages reaching size 34-45 cm (Liem, 1963; Chan & Phillips, 1989). Inhibition of the aromataseenzyme can occur due to physical induction such as temperature (Athauda et al. 2012). The activity of the aromataseenzyme which acts to stimulate the process of biosynthesis of testosterone to estradiol in ovarian development so that the concentration of testosterone increases and change directly to male sex (masculinization). According Popma and Masser (1999) temperature range that suitable for the survival of fish physiological processes are 29.4 to 31.1 ° C at pH 6-9 and dissolved oxygen levels above 2 mg / L.

According Gjederm (2005), the difference that occurs between population genetic, reproductive isolation, and genetic differentiation will increase due to the geographical isolation (Table 2). Indirectly, this condition can be observed by observing to aspects of morphology, behavior, origin, physiological characteristics and isozyme electrophoresis analysis. Variations that occur among populations is important for better adapt to the environmental changes (Wijana 1999).

The pattern of morphometric ratios of the three populations (Figure 4) shows that the eels from Balunijuk and Bencah have higher values than Riaseels. The pattern of morphometric ratios used roughly to estimate the genetic diversity of a population because there is relationship between morphometric ratios with genetic variations (Wijana 1999). Generally, the fish showed sub-division presenceof each species as a result of a variety of insulation. At the same environment or continuous migration,gene flow will continue and reveal many similarities both phenotype and genotype. However, in different environment/contrast, the changes may occur to the structure of the population. These factors, will affect genetic variation and population size and allows influence heterzigositas within an original species (Carvalho 1993).

Conclusion

The diversity of phenotypes from three populations of eel based morphometric variable ratio indicates a similarpatternforBencah and Balunijuk, whereas the Riaspopulation was seem different. Our findings revealed that the eel fromBencah and Balunijuk of Bangka Belitung Province was potential for development. Furthermore, it alsoneed to be adjusted to the physical-chemical parameters of water of each habitat in order to respond good cultivation.

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