



Marble Goby (*Oxyeleotris marmorata* Bleeker, 1852) Habitat Mapping on Cirata Reservoir in West Java Province, Indonesia

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Abstract: This research was conducted to know the pattern of distribution of Marble Goby based on reproductive performance. It was carried out at five research stations namely Jangari, Ciputri, *Inlet* Citarum River, *Inlet* Cibalagung River and Tegal Datar from January to March, 2016. Identification activities were performed at Aquaculture Laboratory in Faculty of Fisheries and Marine Sciences, Universitas Padjadjaran. Different reproductive parameters including Relative Abundance, Sex Ratio, Gonad Level Maturity (GLM), Gonad Maturity Index, Hepatosomatic Index (HSI) and Fecundity were observed. The data were analyzed in a descriptive exploratory. The fish reproductive performance at each research station was almost the same. Gonad Index Maturity of male Marble Goby was between 0.03 % to 0.78 % while in female between 0.25 % to 17.59 %. HSI in female fish was found to vary from 0.92 % to 9.37 %. Fecundity ranged between 1 586 grains to 63 942 grains. Regarding characteristic reproductive performance, this study revealed that Marble Goby were doing spawning on Jangari, Ciputri, inlet Citarum, Cibalagung, and Tegal Datar waters, in January during the rainy season, and in Jangari waters spawning was observed until February.

Keywords: Cirata reservoir, habitat mappings, Marble Gobby, reproductive performance

1. INTRODUCTION

One of the Citarum River native fish that can adapt on inundated waters in Cirata Reservoir is Marble Goby. Marble Goby was known as sleeper fish. This fish was common in freshwater and estuaries in Java, Sumatra and Borneo. Astuty et al. [1] reported that this fish lives in shallow and muddy waters like river mouth, a reservoir that has quiet current and used to take refuge under the aquatic plants.

Marble Goby is also famous for name like marble goby or sand goby. This fish have excellent economic value because it is not only supplied to restaurants of major cities but also exported to Malaysia, Singapore and Hong Kong [2]. The price of Marble Goby in normal days for

250 g is IDR 70 000 kg⁻¹ while on the feast day of Chinese New Year and the New Year, it may be elevated to IDR 300 000 kg⁻¹. The price for fish weighed above 250 g may reached up to IDR 500 000 kg⁻¹.

In Cirata Reservoir, Marble Goby exploitation occurs continuously without any regulatory capture, this can have a negative impact on the Marble Goby population, and the number of the catch was going to reduce from year to year. Marine and Fisheries Agency, West Java Province report the Marble Goby production in Cirata Reservoir from 2011 to 2014. The catch in Purwakarta was decreased from 0.9 t (2011) to 0.89 t (2013), and then increased to 1.03 t (2014). Caught result in Cianjur was 6.4 t in 2013 while 4.95 t in 2014.

Keeping in view the above studies, the pattern of the distribution for Marble Goby based on reproductive performance was mapped for the management purpose on Cirata Reservoir. The fish that used in this research were already aquacultured in laboratory of Fisheries and Marine Science, Universitas Padjadjaran. The fish are now able to mate although as they have minimum reproduction ability [3].

2. MATERIALS AND METHODS

The different tools including mesh net sized 0.5 inch and 1 inch, surgical tool, microscope, hand counter, analytical scales and a measuring cup were used to study reproductive parameters of Marble Goby. This study was conducted on Cirata Reservoir, West Java Province from January to March, 2016 at different stations. Details given below:

Station I: Jangari waters are located at 6°44'40" South Latitude and 107°17'10" East Latitude.

Station II: Ciputri waters are located at 6°44'36" South Latitude and 107°19'22" East Latitude.

Station III: Inlet Citarum river is located at 6°46'48" South Latitude and 107°17'26" East Latitude.

Station IV : Inlet Cibalagung river is located at 6°44'39" South Latitude and 107°16'14" East Latitude

Station V: Tegal Datar waters are located at 6°43'11" South Latitude and 107°18'49" East Latitude.

Identification of reproductive performance was done at Aquaculture Laboratory in Faculty of Fisheries and Marine Sciences, Universitas Padjadjaran.

Survey method was adopted to conduct this research work. Sampling was done by using purposive and census methods on monthly basis from January to March. Parameters measured were the sex ratio, Gonad Level Maturity (GLM), Gonad Maturity Index, Hepatosomatic Index and

Fecundity using the method of Fisheries Biology [4].

3. DATA ANALYSIS

3.1 Sex Ratio

Sex ratio was calculated by comparing a number of males and females fish, using the following formula:

$$\text{Sex ratio} = J : B \quad (1)$$

Description:

J = The number of male fish,

B = The number of female fish

3.2 Gonad Level Maturity

Determination of the gonad level maturity was carried out by observations on the primary and secondary sexual characteristics including morphometrics and meristic studies of Marble Goby set identification criteria.

3.3 Gonad Maturity Index/Gonado Somatic Index (GSI)

Gonad maturity index was calculated by using the following formula:

$$\text{GSI} = \frac{B_g}{B_i} \times 100 \% \quad (2)$$

Description:

GSI = Gonado Somatic Index/Gonad Maturity Index/Index Maturity

B_g = Weight of gonads (g)

B_i = Weight of fish (g)

3.4 Hepatosomatic Index (HSI)

Hepatosomatic index was calculated by using the following formula:

$$\text{HSI} = \frac{B_H}{B_T} \times 100 \% \quad (3)$$

Description:

HIS = Hepatosomatic Index (%)

B_H = Weight of Liver (g)

B_T = Weight of fish (g)

3.5 Fecundity

Individual fecundity was calculated by gravimetry methods by using the following formula:

$$F = \left(\frac{G}{g} \right) \times n \quad (4)$$

Description:

F = the total number of eggs in the gonads (fecundity).

G = the weight of each fish gonads

g = the weight of some gonads (sample) from one fish

n = the number of eggs from samples of gonads

3.6 Population Abundance KR

Calculation of the relative population abundance was made by following Krebs [5].

$$KR = \frac{ni}{N} \times 100 \% \quad (5)$$

Description:

KR = The Relative Abundance

Ni = The number of individuals caught in the station-i

N = The total number of individuals caught in the entire station

The data were analyzed using descriptive exploratory methods and presented in the form of maps, pictures, graphics and tables. Determination of habitat was based on the level of maturity and sex ratio of the gonads. Nasution [6] reported that the sex ratio is alleged to have linkages with

habitat, the ideal fish habitats can do the spawning which will be successful balance of the male and female fish in particular habitat.

4. RESULTS AND DISCUSSION

Marble Goby caught during the research period varied in total length between 11.5 cm to 36.5 cm and in weight from 16 g to 682 g. The biggest male Marble Goby weighed as much as 682 g and its total length was 36.5 cm. The calculation according to the *Battacharya* formula categorized the entire fish catch of the study period into seven group sizes, i.e., between 11.5 cm to 14.5 cm, 15.5 cm to 18.5 cm, 19.5 cm to 22.5 cm, 23.5 cm to 26.5 cm, 27.5 cm to 30.5 cm, 31.5 cm to 34.5 cm, and 35.5 cm to 38.5 cm (Table 1). The most catches were in Jangari waters with the relative abundance of 28.2 % (Tabel 2).

Table 1. Group size and frequency of Marble Goby during the study.

Length (cm)	Frequency
11.5 to 14.5	5
15.5 to 18.5	18
19.5 to 22.5	27
23.5 to 26.5	21
27.5 to 30.5	3
31.5 to 34.5	0
35.5 to 38.5	1

Table 2. Relative abundance (%) of Marble Goby at different research stations from January to March 2016.

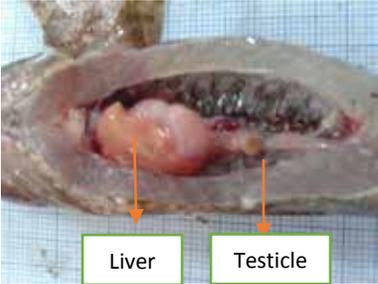
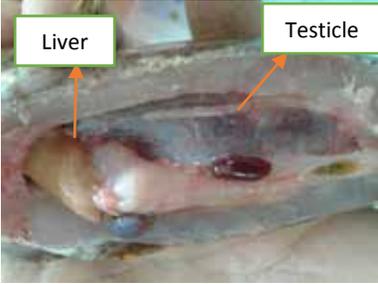
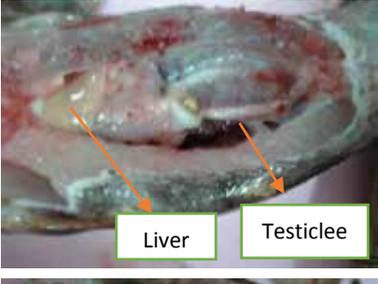
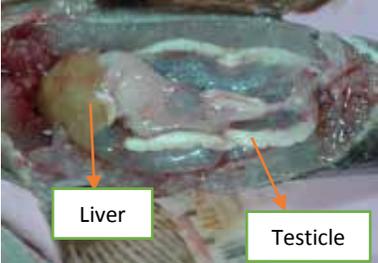
Station	January		February		March		Total	KR Average (%)
	Total (Fish)	KR (%)	Total (Fish)	KR (%)	Total (Fish)	KR (%)		
Jangari water	5	29.4	5	27.8	11	27.5	21	28.2
Ciputri water	4	23.6	3	16.7	3	7.5	10	15.9
Inlet Citarum river	2	11.8	2	11.0	9	22.5	13	15.1
Inlet Cibalagung river	3	17.6	3	16.7	13	32.5	19	22.3
Tegal Datar water	3	17.6	5	27.8	4	10	12	18.5

4.1. Gonad Level Maturity

Reproduction is very important feature of an organism's life cycle, by knowing the reproductive biology of fish we can find out about the level of maturity of the gonads, fecundity and spawning season, frequency, and size of the fish [7]. The process of maturation of the gonads is closely associated with environmental signals such as supplementary feeding for fry. -Further, the presence of the *petrichor* substance when the surface waters are rising and moisten the dry plains after the dry season is the trigger to spawning process [8].

Gonads as fish are one of the three components involved in fish reproduction, in addition to environmental signals and the hormonal system. In the process of maturation of the gonads fish, environmental signals are received by the central nervous system and then forwarded to the hypothalamus. The hypothalamus release hormones GnRH (*Gonadotropin releasing hormone*) to stimulate hipofisa gland to release Gonadotropin-I working on the gonads. Due to the hormone's work, gonads can synthesize testosterone and estradiol- β . Estradiol- β further stimulates the liver to secrete vitellogenin which is

Table 3. Identification of the levels of maturity in gonads of male Marble Goby.

GLM	Documentation	Description
I (Underdeveloped testicles)		Testicle like threads, short and visible ends in body cavities. Clear coloured.
II (The period of testicle development 1)		The size of the testicles is thicker. The color is white as milk. A clearer form of gonads of maturity level I.
III (The period of testicle development 2)		The surface of the testes appears jagged. The color is whiter. Testes is more thick and easy to break.
IV (Mature testes)		Morphology as in level III however looks larger and clearly visible. The testes are increasingly solid.

ultimately the primer of eggs [9].

By observing the difference in morphometrics and meristic characteristics, gonads level maturity was identified as shown in Table 3 and Table 4.

4.2. Habitat Characteristics and Reproductive Performance of Marble Goby at Different Research Stations

4.2.1 Jangari Waters (6°44'40" SL, 107°17'10" EL).

Jangari is included in the area of Cianjur, West Java and is at the entrance to Cirata Reservoir where most of the visitors to do fish farming. There is a harbour for loading and unloading of fish and fish feed. There is also a large number of floating net cages at the distance of about 5 m, used for boat traffic lanes. On the surface of the waters, there are many water hyacinth (*Eichornia crassives*) and land plants *Mimosa pigra* on the edge of the Lake and many are found on the surface of reservoir

Water temperature was relatively stable each year between 26.2 °C to 28.9 °C, light penetration ranged from 55 cm to 135 cm, pH ranged between 5.93 to 6.83, dissolved oxygen can be said to be low each year (as it ranged from 2.6 mg L⁻¹ to 3.2 mg L⁻¹), while ammonia concentration was normal, i.e., from 0.001 mg L⁻¹ to 0.006 mg L⁻¹ [10]. Some water quality parameters does not support to Marble Goby growth in Cirata Reservoir like pH and dissolved oxygen. This refers to the studies from Kordi [2] that optimum water quality criteria for living Marble Goby are, temperature 28 °C to 32 °C, light penetration more than 45 cm, pH 7.0 to 7.5, dissolved oxygen over than 3 mg L⁻¹.

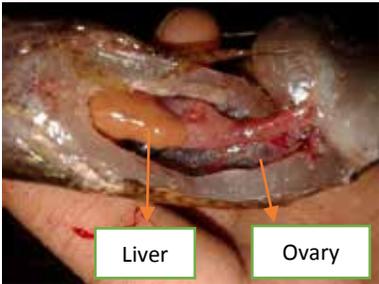
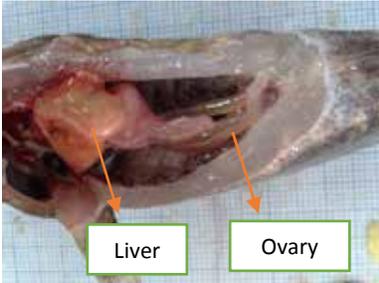
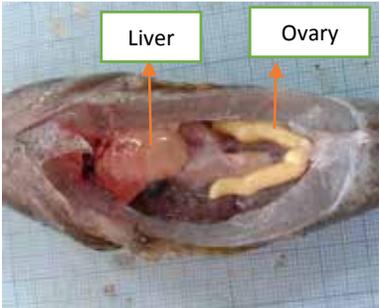
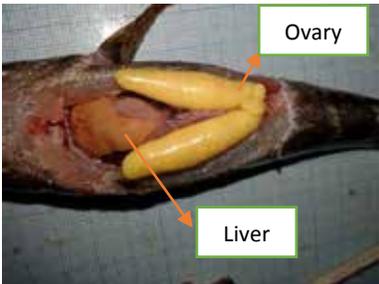
Marble Goby caught in Jangari (21 fish) were the most number of catches, with an abundance of relatively in January 29.4 %, February 27.8 % and March 27.5 %. The high relative abundance of Marble Goby in Jangari allegedly because there are many aquatic plants in the form of water hyacinth and land plants *Mimosa pigra* on the outskirts of reservoir used as shelter at the same time the substrate attach eggs when the mature fish

spawning. In addition the outskirts of reservoirs have sloping ground contours so when the tide there is a wide shallow water area, the place is very well liked by smaller Marble Goby. Mulyono [11] stated that Marble Goby that already have ripe gonads together migrate to areas of overgrown vegetation water leaf or that has a smooth stem in preparation for laying their eggs while the smaller fish are more likely in the shallow waters. In Jangari also most numerous Floating Net Cage farming system that generates a lot of wasted feed to the rest of the waters so that invite such organisms as Crustacean and small fish to congregate in search of food. Both are the preferred food for Marble Goby.

The sex ratio of male fish and female fish fluctuated in Jangari waters and male fish was more dominant than female fish; the ratio was 2:3 in January, 3:2 in February and 9:2 in March. The level of gonads maturity of the male fish in January was calculated to be 50 % of the fish examined. The testes were in development stage GLM 3 (Tabel 3), the surface of the testes appeared jagged, their color was whiter and testes were more thick and easy to break. In the female fish, 20 % of the fish examined had their ovaries at a developmental stage GLM II (Tabel 4). Ovarian size was larger than ¼ part of the abdominal cavity, the surface was darker brass and eggs are not yet clearly visible; 40 % of ovaries were in mature at stage GLM IV and 40 % of the ovaries were post spawning GLM V. This indicated that January is a prime spawning time. In February, GLM male fish 100 % of the fish examined the testes was in development GLM II, female 100 % ovaries are in mature. In March, 80 % of the GLM male fish examined had underdeveloped testes and 20 % had mature testes; in females, 50 % of the examined fish were at a developmental GLM II and in 50 % the ovaries were mature.

The female fish had GSI value relatively larger compared with the male GSI [12]. In Male fish, the GSI value was found 0.78 % in January while the female fish 10 %, in February, male fish GSI 0.3 % and female 5.48 %, in March, male fish GSI 0.17 % and female 2.03 %.

Table 4 . Identification of the levels of maturity in gonads of female Marble Goby.

GLM	Documentation	Description
I (The underdeveloped ovary)		Ovaries look like threads long, until the fore body cavities. Clear colored.
II (The period of ovary development 1)		Ovarian size larger fills ¼ part of the abdominal cavity. The surface darker brass. Eggs are not yet clearly visible.
III (The period of ovary development 2)		The ovary is larger. Yellow colored, number on Toca Color TC 0312. The eggs start to look details. ¼ to ½ of the ovary filling part of the abdominal cavity. Yellow colored, color numbers on Toca Color TC 0411. The egg granules hard to be separated. Egg diameter ranged between 14 µm to 25 µm.
IV (Mature ovary)		The ovary filling up to 2/3 part of the abdominal cavity. Yellow, color numbers on Toca Color TC 0314. Eggs granule are more easily separated. Egg diameter ranged between 26 µm to 30 µm.
V (Post-spawning ovary)		The ovary is filling up to ½ part of the abdominal cavity. Orange, color numbers on Toca Color TC 0315. Eggs granule are more easily separated. Egg diameter about 26 µm to 30 µm.

The HSI of female fish in January was high from 6.72 % to 9.31 %, in February from 1.90 % to 1.97 % and the lowest in March from 1.02 % to 1.20 %. Fecundity of Marble Goby in Jangari waters in January 15 711 to 35 125 grains, in February 49 770 to 53 682 grains and on March 3 402 to 10 692 grains. Based on reproductive performance, in January and February Jangari waters was observed to be the spawning ground, in March it was nursery ground and feeding ground (Table 5).

4.2.2 Ciputri (6°44'36" SL, 107°19'22" E.L.)

This site is included into the realm of Cianjur, West Java. The region is rarely visited by tourists and the activity of ship loading and unloading; however, quite often visited by fishermen from outside the city. Floating Net Cages are crowded in the middle section of reservoir. The quantity of these net cages is denser than other sites. .

Water quality is relatively stable every year, water temperatures fluctuated between 26.1 °C to 29.2 °C. light penetration ranged from 55 cm to 105 cm, pH approaching neutral in the range between 5.94 to 6.86. Dissolved oxygen belongs to low ranges between 1.9 mg L⁻¹ to 3.3 mg L⁻¹, ammonia is normal range between 0.001 mg L⁻¹ to 0.006 mg L⁻¹.

Marble Goby catches in Ciputri waters were 10 fish with relative abundance in January 23.6 %, in February 16.7 % and in March 7.5 %. The sex ratio of male and female fish in Ciputri was the same as in January (i.e., 2:2), in February 1:2 and in March 2:1. In January all male fish gonad maturity level was in GLM IV (Table 3) Testis morphology as in GLM III however looks larger and clearly visible. The testes were more solid, while all in female fish ovary was mature. In February all male fish testes were in GLM I, while the female fish 50 % ovary were in GLM II and 50 % ovary were mature. In March all male fish testes in the developing and all ovary female fish is developing.

The GSI in January male fish was calculated 0.28 % while in female 4.7 %, in February, male GSI 0.26 % and female IM 3.12 % and in March, male GSI 0.04 %, female IM 0.53 %. The HSI of

female fish in January was very high from 3.80 to 5.02, in February from 0.93 to 1.10 and in March 2.79. Fecundity of Marble Goby in Ciputri waters in January are 24 594 grains to 63 942 grains, on February 4 982 grains to 15 285 grains, and March 2 863 grains, based on index data maturity and fecundity indicate that in January is spawning season. Based on the reproductive performance Ciputri waters in January is a spawning ground, February is a feeding ground, and in March is nursery ground and feeding ground.

4.2.3 Inlet Citarum River (6°46'48" SL, 107°17'26" EL).

It directly related to Citarum River basin included in Purwakarta Regency, West Java. Many plants, especially water hyacinths are living at the edge and in the middle of the reservoir. Fishing at this station is the most compared to other stations allegedly because there are much fish. Organic matter that is carried by the flow of the river contains many nutrients that nourish the waters and the plankton needed by the fish as a food source. Plankton are the natural food of fish or shrimp, small shrimp feed naturally favored by fish predators including Marble Goby. Water temperature was relatively stable between 26.9 °C to 29.1 °C, light penetration ranged from 55 cm to 105 cm, pH was close to neutral (i.e., between 6.61 to 7.42), dissolved oxygen was found low every year ranging from 3.3 mg L⁻¹ to 4.0 mg L⁻¹, and ammonia was in normal range between 0.001 mg L⁻¹ to 0.028 mg L⁻¹. Marble Goby caught at the inlet Citarum river during research were 13 fish with relative abundance in January 11.8 %, in February 11 % and in March 22.5 %.

Sex ratio between male and female fish in Citarum are fluctuated, male fish is more dominant than female, in January 1:1, on February 1:1 and on March 7:2. The level of gonads maturity of the male fish in January 100 % of the fish examined are in mature, female fish 100 % of the fish examined the ovaries are at a developmental GLM II. In February GLM male fish 100 % of the fish examined the testes is in development GLM I, female fish 100 % of the fish examined the ovaries are at a developmental GLM II. In March, The

Tabel 5. Marble Goby habitat mapping on Jangari waters from January to March 2016.

Station	Parameter		January	February	March	
Jangari Waters	Relatif abundance (%)		29.4	27.8	27.5	
	Sex Rasio (male:female)		2:3	3:2	9:2	
	Gonado level maturity	Male		III, IV	III	I, II
		Female		III, IV, V	IV	III, IV
	Gonado Somatic Index (%)	Male		0.78	0.3	0.17
		Female		10,04	5,48	2,03
	Fecundity (grain)			15 711 to 35 125	49 770 to 53 682	3 402 to 10 692
	HSI			6.72 to 9.31	1.90 to 1.97	1.02 to 1.20
<i>Oxyeleotris marmorata</i> habitat			Spawning ground	Spawning ground	Nursery and Feeding ground	

Tabel 6. Marble Goby habitat mapping on Ciputri waters from January to March 2016.

Station	Parameter		January	February	March	
Ciputiriri Waters	Relatif abundance (%)		23.6	16.7	7.5	
	Sex Rasio (male:female)		1:1	1:2	2:1	
	Gonado level maturity	Male		III	II	I
		Female		IV	III, IV	III
	Gonado Somatic Index (%)	Male		0.28	0.26	0.04
		Female		4.7	3.12	0.53
	Fecundity (grain)			24 594 to 63 942	4 982 to 15 285	2 863
	HSI			3.80 to 5.02	0.93 to 1.10	2.79
<i>Oxyeleotris marmorata</i> habitat			Spawning ground	Feeding ground	Nursery and Feeding ground	

Tabel 7. Marble Goby habitat mapping on Inlet Citarum river from January to March 2016.

Station	Parameter		January	February	March	
Inlet Citarum River	Relatif abundance (%)		11.8	11.0	22.5	
	Sex Rasio (male:female)		1:1	1:1	3:1	
	Gonado level maturity	Male		IV	II	I, II, III, IV
		Female		III	III	II, IV
	Gonado Somatic Index (%)	Male		1.34	0.2	0.15
		Female		4.23	0.98	2.18
	Fecundity (grain)			5 706	4 784	17 597
	HSI			9.37	0.95	1.29 to 2.81
<i>Oxyeleotris marmorata</i> habitat			Spawning ground	Feeding ground	Nursery and Feeding ground	

GLM in male fish 28 % of the fish examined the testes is in underdeveloped, 28 % mature testes GLM I, 28 % mature testes GLM II, 12 % mature testes, female 50 % of the fish examined the ovaries are at a developmental GLM I and 50 % mature ovaries.

Male fish GSI in January is 1.34 %, while female fish 4.23 %, in February GSI male fish 0.2, female 0.98, in March GSI male fish 2.18, female 17.59. Hepatosomatic Index of female fish in January is very high among 9.37, in February 0.95 and in March between 1.29 to 2.81. Fecundity of Marble Goby in inlet Citarum river on January 5

706 grains, on February 4 784 grains, and on March 17 597 grains, the low level of fecundity in January and February is according to that the caught fish is already breed. Based on the reproductive performance, *inlet* Citarum river on January until February is feeding ground, and on March are nursery ground and feeding ground.

4.2.4 Inlet Cibalagung River (6°44'39" SL, 107°16'14" EL)

The water flow directly related to Cibalagung river and included into the realm of Cianjur, West Java. There are fish farming activities with around 20

Tabel 8. Marble Goby habitat mapping on inlet Cibalagung river from January to March 2016.

Station	Parameter		January	February	March	
Inlet Cibalagung River	Relatif abundance (%)		17.6	16.7	32.5	
	Sex Rasio (male:female)		3:0	2:1	2:1	
	Gonado level maturity	Male		III, IV	III	I, II, III, IV
		Female		III	III	II, IV
	Gonado Somatic Index (%)	Male		0.28	0.32	0.17
		Female		4.70	0.5	2.37
	Fecundity (grain)			- -	1 511	2 343 to 18 250
HSI			-	1.29	1.16 to 3.10	
	<i>Oxyeleotris marmorata</i> habitat		Spawning ground	Feeding ground	Nursery and Feeding ground	

Tabel 9. Marble Goby habitat mapping on Tegal Datar waters from January to March 2016.

Station	Parameter		January	February	March	
Tegal Datar Waters	Relatif abundance (%)		17.6	27.8	10.0	
	Sex Rasio (male:female)		2:1	2:3	1:1	
	Gonado level maturity	Male		III	II, III	I
		Female		IV	III, IV	I, III
	Gonado Somatic Index (%)	Male		0.24	0.26	0.03
		Female		5.02	3..55	0.25
	Fecundity (grain)			20 536	7 745 to 20 346	1 586
HSI			2.09	0.92 to 1.2	1.55	
	<i>Oxyeleotris marmorata</i> habitat		Spawning ground	Feeding ground	Nursery and Feeding ground	

units. The surface of the water, there is a lot of garbage and water hyacinth plants around the floating net cage and land plants *Mimosa pigra* on the edge of reservoir. The number of fishermen are fewer than the at the *Inlet* of Citarum River (Station III). Water temperature was relatively stable between 26.7 °C to 29.1 °C, light penetration ranges from 35 cm to 80 cm, pH was close to neutral between 6.74 to 7.07, dissolved oxygen was low ranged between 3.3 mg L⁻¹ to 4.3 mg L⁻¹, the ammonia was in normal range from 0.001 mg L⁻¹ to 0.012 mg L⁻¹. Marble Goby catches in *inlet* Cibalagung river during research were 16 fish with relative abundance in January 17.6 %, in February 16.7 % and in March 32.5 %.

Sex ratio between male and female fish in Cibalagung were fluctuated, in January male fish was dominant than female, namely in Januari 3:0, in February 2:1 and in March 8:5. The level of gonads maturity in male fish in January was 68 % of the fish examined were at a developmental GLM II, 32 % mature testes, GLM female fish is undetected because female fish are unable to catch. In February, GLM male fish 100 % of the fish examined were at a developmental GLM II, female fish 100 % of the fish examined the ovaries were at a developmental GLM I. In March, GLM male fish 12 % of the fish examined the testes was in underdeveloped GLM I, 62 % mature testes GLM II, 12 % mature testes. As for the female fish, 20 % of the fish examined the ovaries were at a developmental GLM I, 60 % of the fish examined were at a developmental GLM II, and 20 % mature ovaries.

The GSI in Male fish was 0.28 % and in females 4.7 % in January. in February, GSI male fish 0.32, female 0.50, in March GSI male fish 0.17, female 2.37. The HSI in female fish in January undetected because female fish were unable to catch, in February 1.29 and in March between 1.16 to 3.1. Fecundity of Marble Goby in *inlet* Citarum rivers in January was also undetected but discovered post spawning ovary, on February 1 511 grains, and on March 2 343 grains to 18 250 grains. Based on the reproductive performance, *inlet* Cibalagung in January was

spawning ground, in February was feeding ground, and in March as nursery and feeding ground.

4.2.5 Tegal Datar Station (6°43'11" SL, 107° 18'49" EL)

It is located in Purwakarta Regency, near the dam of Cirata Reservoir,. The harbour is busy with the activity of loading and unloading fish and fish feed but not like the Jangari waters. Also rarely seen tourists and anglers while fish farming activities are many and extensive until the middle of reservoir. At this station, there are a lot of shrimp and small fish, the water surface is covered by water hyacinth plants and plastic waste. Among water quality parameters, temperature each year relatively remained stable between 26.0 °C to 29.2 °C, light penetration ranged from 30 cm to 85 cm, pH was close to neutral between 6.40 to 6.78, dissolved oxygen was low ranged between 2.4 mg L⁻¹ to 3.3 mg L⁻¹, ammonia was in normal range between 0.002 mg L⁻¹ to 0.006 mg L⁻¹. Low content of dissolved oxygen allegedly was influenced by the abundance of aquatic plants, especially water hyacinth that covered most of the waters so blocking the penetration of light from the sun plays an important role in photosynthesis in phytoplankton to produce oxygen in the water. It also alleged the oxygen used to process organic and inorganic materials reshuffle in the waters. Marble Goby catches in Tegal Datar waters during research were 12 fish with relative abundance in January 17.6 %, February 27.8 % and March 10%.

Sex ratio between male and female fish in Tegal Datar waters was fluctuated, female fish and male fish was same, namely in January 2:1, in February 2:3 and in March 2:2. The level of gonads maturity of the male fish in January 100 % of the fish examined are at a developmental GLM II, female fish 100 % of the fish examined the ovaries are at a developmental GLM II. In February GLM male fish 50 % of the fish examined testes are at a developmental GLM I, and 50 % in developmental GLM II, female fish 45 % of the fish examined the ovaries are at a developmental GLM II, 55 % mature ovaries. In March, GLM male fish 100 % of the fish

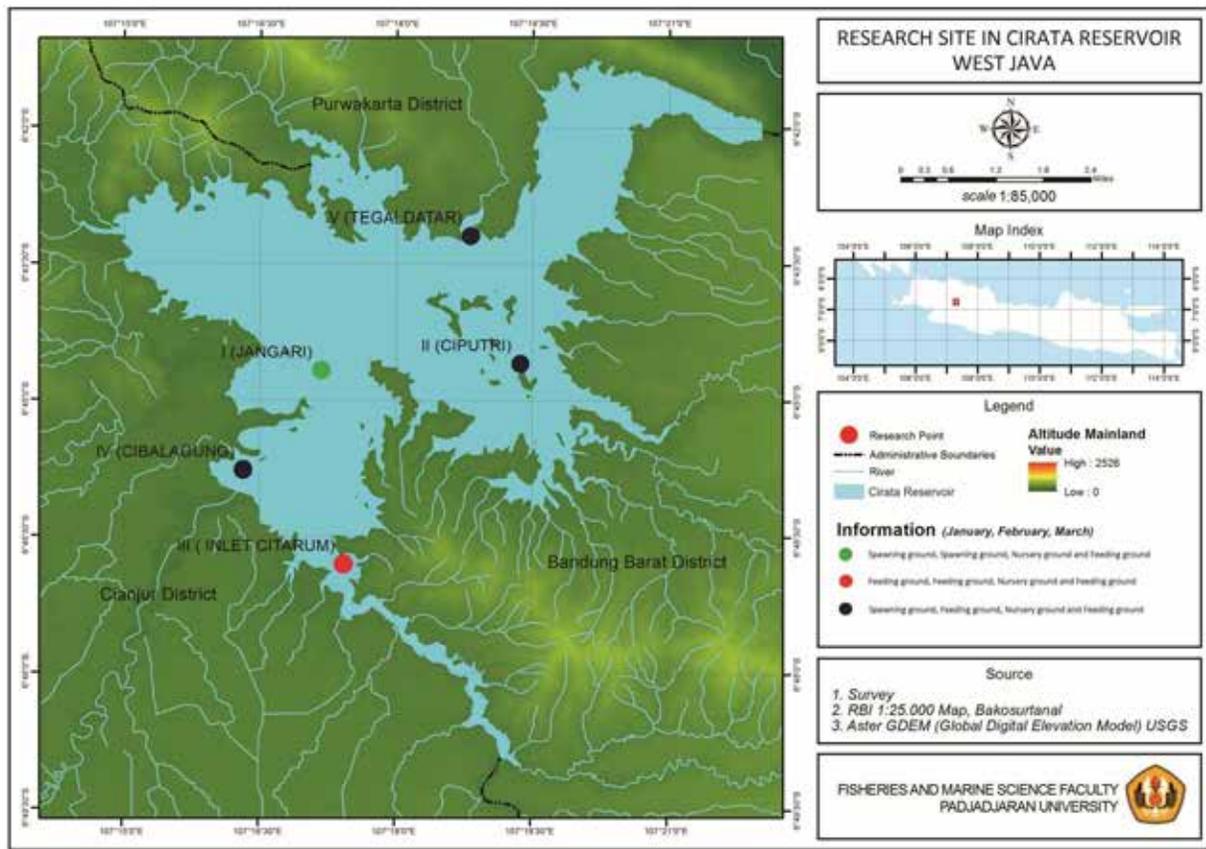


Fig. 1. Marble Goby habitat map for the study from January to March 2016.

examined the testes is in underdeveloped, female fish 50 % of the fish examined the testes are in underdeveloped, 50 % ovaries are in development GLM II.

In January, GSI in male fish was 0.24 % and in female fish was 5.02 %; in February, GSI in male fish was 0.26 and in female fish were 3.54; in March GSI in male fish was 0.03 and in female fish was 0.25. Hepatosomatic index female fish in January 2.09, in February 0.92 to 1.2 and in March 1.55. Fecundity of Marble Goby in Tegal Datar waters on January 20 536 grains, on February 7 745 grains to 20 346 grains, and on March 1 586 grains. Based on the reproductive performance, Tegal Datar waters in January is spawning ground, in February is feeding ground, and in March is nursery ground and feeding ground. Based on observations on aspects of Marble Goby reproduction including sexes ratio, Gonad Level Maturity (GLM), Gonad Maturity Index (GMI), Hepatosomatic Index (HSI) and fecundity in

Cirata Reservoir in January to March 2016 that reproductive performance of Marble Goby in Cirata Reservoir is the same at each station and reproductive performance was heavily influenced by the time or season.

5. CONCLUSION

Based on the results of this study it can be concluded that reproductive performance of Marble Goby at each station was very similar. In Cirata reservoir Marble Goby was doing spawning in January during the rainy season and in Jangari waters spawning was observed until February.

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