THE COLLECTION PHARELLA ACUTIDENS (BRODERIP & SOWERBY, 1828) SMALLER THAN 20 MM AS AN INDICATION FOR THE TIME OF SPAT SETTLEMENT IN THE MANGROVE FOREST OF THE RIAU UNIVERSITY, DUMAI

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Abstract

Five years field observation, Januari 2006 – December 2010, were carried out to document the presence of Pharella acutidens (Broderip & Sowerby 1828) smaller than 20 mm in the mangrove forest of the Riau University Marine Station, Dumai. It was done in order to describe the seasonally of spat settlement. The purposive sampling technik was used in this work. The psycochemical parameters of its habitat were also monitored every month. Not every month of the year the bivalve smaller than 20 mm was presence, but only from Agustus until November at the year. It was found at special substrate at the habitat where the waters was contained more than 4,2 mgl^{-1} disolve oxygen, pH arround 7, salinity 8,5- 20,5 ppt. It is supposed that the spat settle on substrate from Februari until Mei every year.

key words: spat, settle, presence, substrate.

1. INTRODUCTION

Pharella acutidens is one of Mangrove bivalve, live in mud and sand flat, shallow waters to a depth of 10 m at the mangrove area, often in mixed populations with *Pharella javanica*. Its distribution was restricted to the tropical Western Pacific, in South China Sea, Indonesia, and Philippines (Carpenter & Niem, 1998); more detail Tanjung e*t al.* (2000[2]) explained that it can be found at the special muddy sand and sandy mud flats of mangrove areas, where flooded area and under the shelter of mangrove tree, and lived withoud *P. Javanica*; known locally name as 'Sipetang'.

P. acutidens is active exploited in Philippines (Carpenter & Niem, 1998), and it is also active exploited in Riau Coast of Indonesia; Even their habitat was disturbed by domestic activities (Tanjung 2005). If the speeding up of organism exploitation is higher than the speeding up of its population growth rate, it will cause that organism will destroy in not so long time; therefor, the aquaculture should be done as an effort to avoid its extinction.

Amini & Pralampita (1987) said that marine aquaculture was the one way to keep sustainable of marine life resources. Nganro and Syarmidi (2000) said that the habitat engineering was needed to get successful industrial aquaculture. Even Tanjung (2005) had tried ex-situ aquaculture, and said that habitat manipulation could be done in order to get the nice population growth rate. Eventhought ex-situ aquacultured had been done, but smaller juvenile of *P. Acutidens* survival from laboratorium is still low, whereas bigger juvenile has lower

survival than the smaller one. That means, the supply of smaller juvenile from the nature is still needed, and so the time of veliger settlement should be known.

To know veliger settlement time directly is didifficult, because it can not be seen when the veliger settle to surface of bottom. This study attemps to document the presence of *P. Acutidens* (smaller than 20 mm) in mangrove forest of the Riau University Marine Station, Dumai. Base on the presence of them, it can be predicted the veliger settlement time.

2. MATERIALS AND METHODS

Sampling was carried out monthly at the mangrove forest of the Riau University Marine Station Dumai (**Figure 1**) from January 2006 to December 2010. The purposive sampling technik was used in this work, where the location of this research was divided into 7 sampling points. This work done refers to Tanjung (2005).

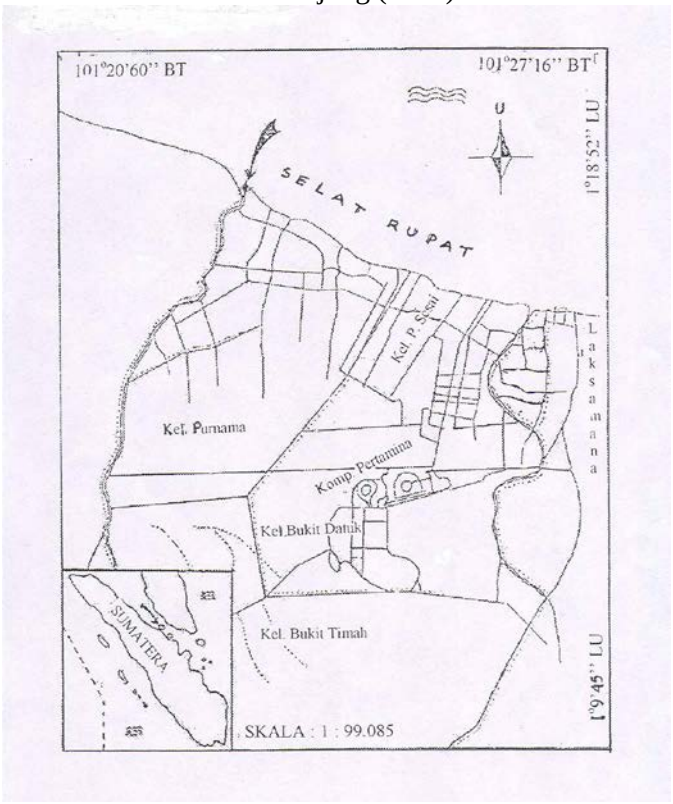

Figure 1. The map of sampling location (Source: Tanjung, 2005)

The psycochemical parameters of its habitat were also monitored. The sampling for water quality (DO2, Salinity, and pH) did monthly and sampling for sediment did only in the initial sampling.

To estimate the time of veliger settlement, it could be estimated from the growth rate in the field which counted by Tanjung (2005), where the minimal growth rate was 1,21 mm per month, the maximal growth rate was 3,41 mm per month, and the average growth rate was 2,29 mm per month. The intersection of all the time above could be as prediction time for the veliger settlement.

The found juvenile of *P. Acutidens* was divided into 5 size groups: 'a' is the juvenile less than 10 mm, 'b' (10, 0 – < 12,5 mm), 'c' (12,5 – < 15,0 mm), 'd' (15,0 - < 17,5 mm), and 'e' (17,5 - , 20 mm). Presence time of these groups was also compared with the result of Tanjung field observation in 2002.

P. Acutidens smaller than 10 mm in size needs the time arround 2,93 – 8,26 months to reach the size 20 mm. This growth rate is an assumption in this work. The way to predict the veliger settlement time could be used if the assumption worked on it.

3. RESULTS

Juvenile (smaller than 20 mm) was only found in four months every year, those are August, September, October, and November. Their distribution in the research area variated among sampling points, but the amount increased from August to November. The Average of juvenile (smaller than 20 mm) found at sampling point 1, 4 and 5 was more than the other sampling points for all observed time (Table 1).

Table 1. Presence of *P acutidens* juvenile (smaller than 20 mm) at the Sampling Point from 2006 to 2010

Sampling Time	Sampling Point (individu)						
	1	2	3	4	5	6	7
August	22 – 42	12 – 24	8 – 15	24 – 48	28 – 44	5 – 16	6 – 12
Average	35,2	18	11	37,6	35,6	9,8	7,4
September	24 – 41	8 – 22	6 – 14	22 – 46	22 – 41	6 – 20	22 – 46
Average	34,6	15	9,2	33,6	33,8	11,6	8,4
October	18 – 31	7 – 18	6 – 10	16 – 41	16 – 42	4 – 12	4 – 10
Average	22,2	13,4	7,8	29,2	28,4	7,6	6,4
November	10 – 20	8 – 16	4 – 10	6 – 25	12 – 22	3 – 8	4 – 8
Average	14,8	9,4	6,4	18	16,4	5	6,4

The smallest size group (a size group) was only found in August and September, ‘b’ size group was found in September and October, ‘c’ size group was only found in October, ‘d’ and ‘e’ size group were only found in earlier November (Table 2).

Table 2. Size Group Distribution at the Sampling Point from 2006-2010

Sampling Time	Sampling Point						
	1	2	3	4	5	6	7
August	a	a	a	a	a	a	a
September	b	b	b	a	b	a	a
October	c	c	c	b	c	b	b
November	e	d	e	e	d	d	d

Note : a = < 10,0 mm, b = 10,0 - < 12,5 mm, c = 12,5 – < 15,0 mm, d = 15,0 mm - < 17,5 mm, and e = 17,5 - < 20,0 mm.

Distribution of DO_2 variated from time to time and from sampling point to sampling point. The lowest (4,3 mgl^{-1}) found at sampling point two in for fourt month, at sampling point three in Mart, and at sampling point seven in Mart and May; while the highest (5,6 mgl^{-1}) found at sampling point one in May, at sampling point four in Mart, at sampling point 5 in February, and at sampling point 6 in April and May (Tabel 3).

Table 3. Dissolved Oxygen Distribution in observed Month from 2006 -2010

Sampling Time	Sampling Point (mgl^{-1})						
	1	2	3	4	5	6	7
February	4,8 – 5,4	4,3 -5,1	4,4-5,2	4,4-5,5	4,8- 5,6	4,4-5,0	4,4-5,3
Mart	4,4 -5,2	4,3-5,2	4,3-5,3	4,8-5,6	4,4-5,5	4,4-5,5	4,3-5,4
April	4,5-5,5	4,3-5,2	4,5-5,4	4,4 -5,1	4,6-5,2	4,5-5,6	4,4-5,5
May	4,4-5,6	4,3-5,2	4,4-5,5	4,6-5,2	4,3-5,4	4,4-5,6	4,3-5,4

Distribution of salinity variated from time to time and from sampling point to sampling point. The lowest salinity found at sampling point 1 and 2 (8,5 ppt) in May, while the highest salinity (20,5 ppt) found at sampling point 6 and 7 in Februari and Mart (Tabel 4). Distribution of pH was almost not so different, the range of pH in the sampling area arround 6,8 – 7,2 (Tabel 5).

Tabel 4. Salinity distribution in observed Month from 2006 -2010

Sampling Time	Sampling Point (ppt)						
	1	2	3	4	5	6	7
February	16,5-18,2	14,3-17,1	15,4-20,2	14,4-19,5	12,8-20,2	12,4-20,5	11,4-20,5
Mart	12,5-18,2	12,4-15,2	14,3-19,3	13,2-18,7	10,3-15,5	11,3-15,8	10,8-20,0
April	9,5-15,4	14,4-15,2	9,5-15,4	14,4-19,6	8,9-12,2	8,6-11,2	8,6-14,3
May	8,5-16,5	8,5-15,2	9,4-17,5	8,9-12,8	8,8-11,6	8,9-11,4	8,9-13,8

Tabel 5. pH Distribution in observed Month from 2006 -2010

Sampling Time	Sampling Point						
	1	2	3	4	5	6	7
February	7,0-7,2	6,8-7,2	6,7-7,3	7,0-7,2	7,1-7,2	6,9-7,1	7,0-7,2
Mart	7,0-7,3	6,9-7,2	6,8-7,2	7,0-7,2	7,0-7,2	7,0-7,1	7,0-7,1
April	7,1-7,2	7,0-7,1	7,0-7,3	6,9-7,2	6,9-7,2	7,0-7,1	6,9-7,1
May	6,8 -7,2	7,0-7,2	7,0-7,1	6,8-7,2	7,1-7,2	7,1-7,2	2,1-7,2

4. DISCUSSION

The presence time of the *P. acutidens* juvenile (smaller than 20 mm) was in August to November at the year. It is different with the result of Tanjung field observation which be done in 2002, where they be found from February to May (Tanjung, 2005). Many factors could cause this difference, like the sea condition, gonad maturity index, growth rate of the new juvenile, and the settlement time of the veliger.

The average of juvenile (smaller than 20 mm) presence was higher at sampling point 1, 4, and 5 than the others. It was agree with Tanjung (2005). It could be occured as existence of the sampling point quality. The sampling point 1, 4, and 5 consist of the substrate muddy sand mix with fibrous root of mangrove tree; 3,8 – 5,4 mgl^{-1} in DO_2 ; 12,4 -21,5 ppt in salinity, and 6,9 – 7,1 in pH. These psycal conditions were suitable to grow and life.

If it be counted from the minimal growth rate, that means the last time of veliger settlement is supposed at the late February, because they need 8,26 months to reach the size group 'b' - 'd' from the size group 'a'. While the earlier time veliger settlement could not been estimated from the way above, because it will give the unreasonable time (November), whereas the sea condition is not save for the veliger to settle. The sea wave and current is start to be strong. According Tanjung (2005), the late January was the earlier time for the larva veliger to settle, because the sea wave and current start to be calmly; **See Table 6**.

DO_2 4,2 – 5, 8 mgl^{-1} (Tabel 3), salinity 8,5 – 20,5 ppt (Tabel 4), and pH 6,8 – 7,2 (Tabel 5) were suitable for veliger of *P. acutidens* to settle. It is agree with Tanjung (2005) said that DO2 and salinity were the limiting factors in the settlement process of the veliger.

If it be counted from the maximal growth rate, that means the last time for veliger settlement is supposed at the late July. While the first time of veliger settlement was supposed in April. It migh be caused they need 2,93 months in order to reach the size group 20 mm. Both estimated settle time, July and April might be reasonable time to settle. From April to July is also the save time for the larva veliger to settle, where in this time the sea condition is the best, the sea wave and current is most calmly; **See Table 6**.

When the veliger settlement time is counted from averate growth rate, June and July were doubt, because it is not enought time to reach the size 20 mm. To reach the size arround 20 mm neeeded the growth time arround 4,37 month; that means the new juvenile will be disturbed by the sea wave and current in that time. The sea wave and current begin more strongger than the sea wave and curren before the season in October (**See Table 6**). According to Tanjung (2005), the juvenile with size 20 mm is more survive and has good adaptation on the fluctuated condition of substrate and waters; therefore, this size has to be reached before the storm coming. The storm occured from the last October to earlier Januari in Dumai waters, it is called as 'Musim Barat' or West Season.

Settlement process is not only affected by the psycal condition of the sea, moreover, bivalve larva settlement is also affected by the DO_2 (Baker & Mann, 1992), salinity (Lau *et al*.,1994), The sea wave and current should be convenient for settlement (Ma, 2001); while Tanjung (2005) had explained the factors affected the larva of *P. acutidens* in detail, where veliger settlement depends on Gonad Maturity index**,** the psycal condition of the sea, DO_2, and salinity; Therefore the different time of veliger settlement between Tanjung (2005) and the result of this estimation is supposed as a consequence of gonad maturity difference.

To predict the veliger settlement time, it could be decided from the intersection of all counted time, that is from February to May every year, **See Table 6**.

Table 6. The estimation time of veliger settlement

	Veliger Settlement Time								
	Nov	Dec	Jan	Feb	Mart	April	May	June	July
2002				*	*				
MaxGR						*	*	*	*
MinGR	*	*	*	*					
AveGR								*	*
Predicted Time				*	*	*	*		

5. CONCLUSION

The presence of the juvenile *P. acutiden* (smaller than 20 mm) at the mangrove forest of the Riau University Marine Station Dumai, occured in August to November at the year. It

was found at the fibrous substrat, mixed mangrove root and muddy sediment, and the waters contained more than 4,2 mgl^{-1} disolve oxygen, pH arround 7, and salinity 8,5- 20,5 ppt. The settlement of the veliger is predicted from February to May every year.

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