Journal of Fish Health Vol. 3 (1) - June 2023
https://doi.org/10.29303/jfh.v3i1.2117

THE EFFECT OF THE INTERVAL TIME IMMERSION IN THE NATURAL FEED TANK OF *Chaetoceros simplex* ON GROWTH AND SURVIVAL RATE OF PEARL OYSTER (*Pinctada Maxima*)

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Received : 2023-05-28
Accepted : 2023-06-28

Keywords :
Chaetoceros simplex, Immersion, Interval Time, *Pinctada maxima*

ABSTRACT

Pearl oysters are a fishery commodity with a high economic value because all parts of its body have a sale value. However, many problems of pearl oyster hatcheries are low survival rates and pearl oyster growth is not uniform. The research objective is to determine the effect of the interval time immersion in the natural feed tank in the feed concentrate of *Chaetoceros simplex* and to determiinterval time best immersion is duced the grey growth and survival rate of (*Pinctada maxima*). The method in this research is the experimental method and with a completely randomised design (CRD), with five treatments andthree3 replications. The A treatment) : control/without immersion, B (Interval time 24 hours immersion every one day, C (Interval time 48 hours immersion every two days, D (Interval time 72 hours): Immersion every three days and E treatment (Interval time 92 hours): immersion-furry for four days. The research result is interval time immersion spat of pearl oysters in the natural feed tank significantly affects the shell growth of the dorso ventral of pearl oyster *Pinctada maxima* ($p<0,05$). The highest growth was achieved in treatment B with an absolute growth value of 1.68 mm, a relative growth of 122,06% from the initial size, and a daily specific growth rate of 0,59% per day.

INTRODUCTION

Pearl oysters are a fishery commodity with high economic value because all parts of its body are of the sale value. Shells as handicrafts, shell meat as food and pearl grains as jewellery. The cultivation of pearl mussels is increasingly interesting to develop as the South Sea Pearl type of *Pinctada maxima* is increasingly popular, originating from Indonesian waters (Fathurrahman & Aunurohim, 2013).

There are many problems found in pearl oyster hatcheries, one of which is the low survival of pearl oyster larvae (Anwar et al., 2004). Mussels have a critical period of 10-20 days with a fairly low survival rate (SR) ranging from 1%-5% (Wardana et al., 2013). Another critical

phase occurs when the larva attaches to the collector. External factors include watty, place of maintenance, water temperature and inappropriate feeding (Anwar et al., 2004).

Incorrect feeding affects the amount and availability of feed in the rearing tanks. Lack of feed causes the development of shells to be disrupted because space for growth is limited, and the shells are tightly packed together (Winanto et al., 2016). In one period of spat maintenance of pearl oysters, only 20% showed fast growth (Wardana et al., 2014).

Chaetoceros sp. natural feed that has a size of less than 10 microns. This size corresponds to the filtration of pearl oysters (Astriwana et al., 2008). The nutritional content of *Chaetoceros* sp. namely 30% protein, 7% fat, and 6.5% carbohydrates (Yulianto, 2016). *Chaetoceros* sp. added silicate (SiO_4) could help shell growth (Taufiq et al., 2010).

Many studies have been conducted to increase the production of quality seeds. Soaking in a *Chaetoceros simplex* tub is thought to improve the quality of the seeds to be produced. One way that can be done is to give the shallow seeds out the maximum amount of natural feed particles by adjusting the density of the feed with high concentrations. Soaking pearl mussels in natural feed, tanks has been shown to speed up spawning (Kotta, 2015).

The adequacy of nutrition and the amount of feed are important in increasing pearl oysters growth and survival rate. Therefore, applying immersion in Chaetoceros simplex feed concentrate is considered to oin quality seeds. Research on the periodic soaking of pearl oyster seeds in feed concentrates has yet to be reported before, r; research immersion time intervals in feed concentrates is necessary.

METHODOLOGY

Time and Place

The research was conducted for 20 days, from 21 October 2020 to 9 November 2020. The research was conducted at the Coastal Aquaculture Development Center (BPBPP), Gili Genting village, Sekotong sub-district, West Lombok district.

Materials

The tools used are fibreglass tubs, plastic jars, thermometers, DO meters, pH meters, refractometers, wood supports, microscopes, haemocytometers, glass preparations, tweezers, pipettes, multilevel filters, measuring cups, containers, blowers, aerator hoses, collector, ballast, rope rapid, hand counter, cover glass and the materials used were pearl shell spatter, seawater, *Chaetoceros simplex*, ffertilizersilicate, sodium hypochlorite, sodium thiosulfate.

Research Design

The study used an experimental method with a completely randomised design (CRD): five treatments and three replications. The treatment tested was the spat soaking time interval in the *Chaetoceros simplex* feed tank, namely treatment A (control/no immersion), treatment B (24-hour time interval): soaking once a day, C (48-hour time interval): soaking once every two days, treatment D (72 hour time interval): soaking once every three days and E treatment (92 hour time interval). The layout of the experimental unit is determined by drawing or lottery method.

Research activities began with the preparation of natural feed and seed preparation. The natural feed culture of *Chaetoceros* simplex is the preparation of tools and materials. Culture equipment is washed and rinsed with hot water. The seawater was sterilised with 10

mL chlorine in 30 L water, and 5 mL sodium thiosulfate was added. The chlorinated water was put into an 8 L plastic jar, and 10 mL of fertiliser and 5 mL of silicate were added using a dropper pipette. The jar is aerated for 5-10 minutes until thoroughly mixed, and 1 L of *Chaetoceros simplex* stock is put into the culture jar and aerated and tightly closed while the seeds used are seeds that have stuck to the collector at the age of 50 days and have entered the spat phase with an actual size -average + S.D is 1.38 + 0.22 mm (Dorso-Ventral). Spat pearl shells attached to the collector measuring 20 x 30 cm2 (density 0.33 spat per cm2 collector). Spat was obtained from seeding the Sekotong Coastal Aquaculture Development Center (BPBPP). Pearl mussel spars were reared in fibreglass tubs with 1 m3 of water volume by feeding *Chaetoceros simplex* as much as 14,500 cells/mL/day.

Initial immersion was carried out by immersing all collectors in one natural feed tub except treatment A. Subsequent soaking was carried out according to the research treatment. Feed immersion density of 4,000,000 cells/mL with a 1 L Chaetoceros simplex volume. It is necessary to dilute natural feed to obtain the desired feed density. The dilution in the immersion medium can be determined using the formula according to Sopian et al. (2019), namely:

$$\mathbf{V1 \times N1 = V2 \times N2}$$

Note:
V1 = Required volume of *Chaetoceros simplex* stock (mL),
N1 = *Chaetoceros simplex* stock density (cells/mL)
V2 = Final culture volume (mL)
N2 = Desired population density of *Chaetoceros simplex* (cells/mL)

Spat size observations were carried out at the study's beginning and end. Initial size observations were made before immersion, while follow-up measurements were made every four days. Spat took randomthreey three tails using tweezers on each collector. The total sample is nine observations/treatments or 45 spat samples. Shell measurements (dorsoventral) are based on instrument calibration using a haemocytometer.

Observation of spat density on the collector was carried out at the beginning and the end. Initial density observations were made by randomly counting five collector samples from all treatments, while final density observations were made by observing the density of each collector for each treatment. Density observations were carried out manually with flashlights and hand counters.

Water quality parameters measured were temperature using a thermometer, salinity using a refractor meter, DO use a DO meter and pH using a pH meter. Water quality is observed every two days in the rearing tank.

The main parameters tested were absolute growth (mm), relative growth (%) and specific growth (% per day). The absolute growth can be calculated using the formula according to Kotta (2017):

$$\mathbf{P = Pt - Po}$$

Note:
P = Length growth (mm)
Pt = Final length (mm)
Po = Initial length (mm)

Relative growth and specific growth of pearl oysters can be calculated using the formula according to Mukhlis et al. (2017), namely:

$$\mathbf{RGR} = \frac{Lt-L0}{Lo} \mathbf{\times 100\%}$$

Note:

RGR = Relative growth rate (%)
L0 = initial length (mm)
Lt = Final length (mm)

$$\mathbf{SGR} = \frac{(\mathbf{Lt/L0})\text{^}\mathbf{1}}{\mathbf{t-1}} \mathbf{x\ 100\ \%}$$

Note:
SGR = Specific growth rate (% per day)
L0 = Initial length (mm)
Lt = Final length (mm)
t = Length of the observation period (days)

In addition to growth, the parameter tested is the survival rate which is calculated using the formula proposed by Kotta (2017), namely:

$$\mathbf{SR} = \frac{Nt}{No} \times 10$$

Note:
SR = Survival Rate (%)
Nt = Number of the population at the end of rearing (individuals)
No = Total population at the start of rearing (individuals)

RESULTS AND DISCUSSION

Spat Shell Length of Pearl Clam (*Pinctada maxima*)

The average spat size of pearl mussels was 1.38 + 0.22 mm (Dorso-Ventral) (Figure 1. a), and the results of observations of shell length during the experiment showed that the Dorso-Ventral length in all treatments relatively increased. The highest shell length at the end of the experiment was shown by treatment B, which was 3.06 mm (Figure 1. b).

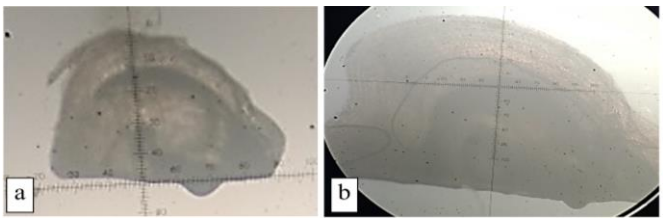

Figure 1. Spat of pearl oysters on day 0 (a) and day 17 (b)

The next highest sequence was shown for treatment C: 2.64 mm, treatment D: 2.59 mm, treatment A (control): 2.32 mm and treatment E: 2.31 mm (Figure 2). The results showed that different soaking time intervals gave various responses. Treatment B responded highest to increasing the size of pearl mussel spat shells. However, longer immersion time intervals seem to give a negative response. The soaking interval every four days (Treatment E) looks relatively the same as the control treatment (Treatment A).

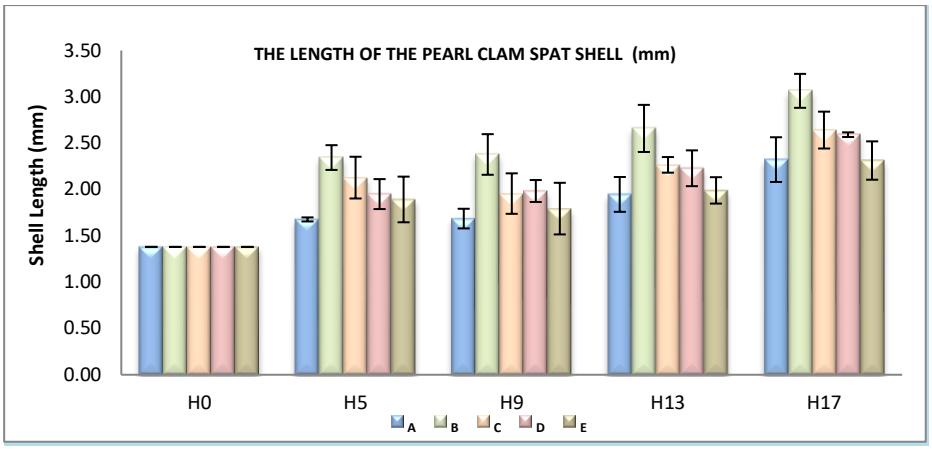

Figure 2. Graph of shell length (dorsoventral) of pearl oysters

Absolute Growth

The results of fundamental growth analysis showed that the highest absolute growth was obtained during 17 days of maintenance shown by treatment B (24-hour time interval), namely soaking once a day with an average value of 1.68 mm (Table 1).

Table 1. Absolute Growth Data

Treatment	Repetition			Average (mm)
	1	2	3	
A (Control)	1,12	0,67	1,04	0,94
B (Soaking once a day)	1,55	1,61	1,89	1,68
C (Soaking once every two days)	1,48	1,1	1,2	1,26
D (Soaking once every three days)	1,24	1,19	1,2	1,21
E (Soaking once every four days)	0,69	1,06	1,04	0,93

The results of the analysis of diversity (ANOVA) absolute (dorsoventral) growth of pearl oysters *Pinctada maxima* at an error rate of 5% showed that the F value > F table (Table 2) showed that the treatments tested had a significantly different (significant) effect on the absolute growth of mussel seeds pearl. The results of the Least Significant Difference (LSD) test showed that the growth of pearl oyster seed shells in treatment B was significantly different from all treatments, including the control treatment (Figure 3).

Table 2. Absolute Growth Diversity Analysis

Diversity standards	Db	JK	KT	F value	F table
Treatment	4	1,1278	0,28196	8,13	3.48
Error	10	0,35	0,035		
Total	14	1,47			

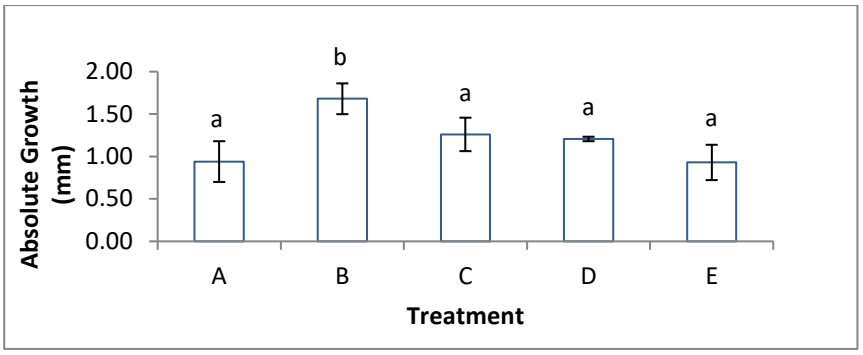

Figure 3. Graph of absolute (Dorso-Ventral) growth of pearl oysters

Relative Growth

The analysis of relative growth during the 17 days of rearing showed that the highest relative growth was shown by Treatment B (24-hour time interval), namely immersion once a day with an average growth value of 122.06% from the initial size of the experiment.

Table 3. Relative Growth

Treatment	Repetition			Average (%)
	1	2	3	
A (Control)	80,92	48,31	75,6	68,28
B (Soaking once a day)	112,32	116,67	137,2	122,06
C (Soaking once every two days)	107,49	79,71	86,96	91,39
D (Soaking once every three days)	89,86	86,47	86,96	87,76
E (Soaking once every four days)	50,24	76,81	75,6	67,55

The results of the analysis of variance (ANOVA) at an error rate of 5% showed the F count > F table (Table 4), which means that the treatments tested had a significantly different (significant) effect on the relative growth of pearl oyster seeds. From the results of further tests using the Least Significant Difference Test (LSD), it can be seen that the relative growth of pearl oyster spat in Treatment B was significantly (significantly) different from all treatments, including the control treatment (Figure 4).

Table 4. Analysis of Relative Growth Diversity

Diversity standards	Db	JK	KT	F value	F table
Treatment	4	5931,89	1482,97	8,071	3.48
Error	10	1837,45	183,74		
Total	14	7769,34			

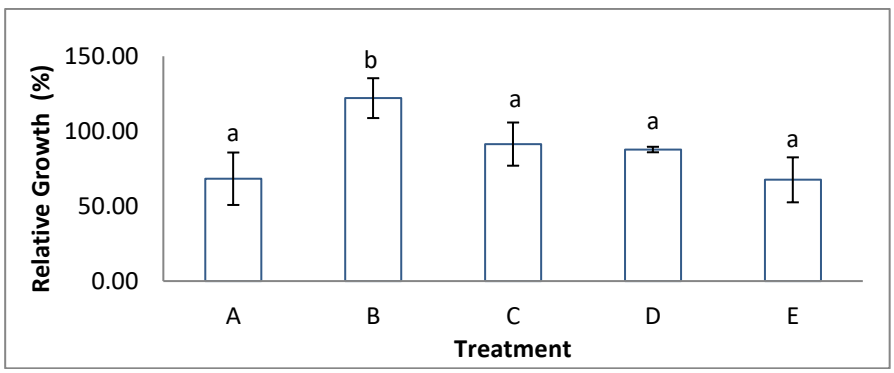

Figure 4. Graph of relative (Dorso-Ventral) growth of pearl oysters

Specific Growth Rate

The analysis of the specific growth rate showed that the highest specific growth rate was obtained during the 17 days of maintenance shown by Treatment B (24-hour interval), namely immersion once a day with an average value of 5.11% per day (Table 5).

Table 5. Specific Growth Rate

Treatment	Repetition			Average (% per day)
	1	2	3	
A (Control)	3,77	2,49	3,58	3,28
B (Soaking once a day)	4,82	4,95	5,55	5,11
C (Soaking once every two days)	4,67	3,73	3,99	4,13
D (Soaking once every three days)	4,09	3,97	3,99	4,02
E (Soaking once every four days)	2,58	3,63	3,58	3,26

Based on the results of the analysis of variance (ANOVA) at an error rate of 5%, the calculated F value > F table (Table 6) indicates that the treatments tested had a significantly different (significant) effect on the specific growth rate of pearl oyster spat. The results of the Least Significant Difference (LSD) test showed that the specific growth rate of pearl oyster spat in Treatment B was significantly (significantly) different from all treatments, including the control treatment (Figure 5).

Table 6. Analysis of Specific Growth Rate Variations

Diversity standards	Db	JK	KT	F value	F table
Treatment	4	6,884	1,721	7,057	3.48
Error	10	2,439	0,244		
Total	14	9,323			

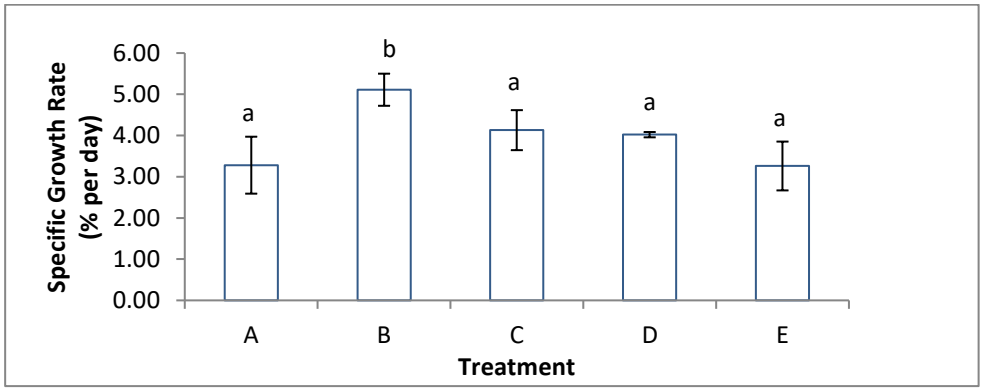

Figure 5. Graph of specific growth rate (Dorsal-Ventral) of pearl oysters

Survival Rate (SR)

The results of the survival rate analysis (SR) showed that the highest survival rate obtained during 17 days of maintenance was shown by treatment B, with an average value of 93.77% (Table 7).

Table 7. Survival Rate (SR)

Treatment	Repetition			Average (%)
	1	2	3	
A (Control)	87,45	92,10	83,81	87,79
B (Soaking once a day)	93,85	97,99	89,46	93,77
C (Soaking once every two days)	91,34	84,69	83,06	86,36
D (Soaking once every three days)	92,35	84,32	86,45	87,71
E (Soaking once every four days)	87,45	90,72	82,56	86,91

Based on the results of the analysis of variance (ANOVA) at an error rate of 5%, the calculated F value <F table (Table 8). This indicates that the treatment tested did not have a significantly different (not significant) effect on the survival rate of pearl oysters. This study showed that soaking in natural feed tanks did not affect changes in pearl oyster spat death rates compared to controls (without soaking) (Figure 6).

Table 8. Analysis of variability in survival rates

Diversity standards	Db	JK	KT	F value	F table
Treatment	4	107,9	26,97	1,51	3.48
Error	10	177,74	17,77		
Total	14	285,65			

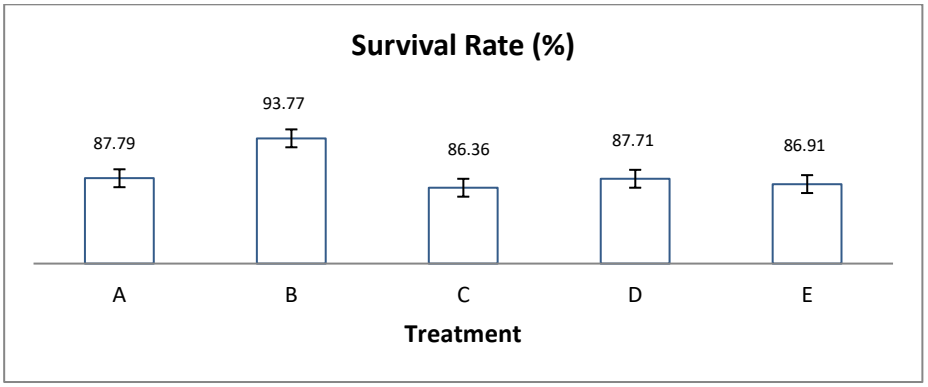

Figure 6. Graph of pearl oyster survival rate

Water Quality

Data on the results of water quality measurements of temperature 26.8-27.6, salinity 34-35, dissolved oxygen 5.1-5.7 and pH 7.1-7.8 (Table 9) show that the water quality values (Temperature, Salinity, DO, pH) of each treatment were in the normal or proper range for the growth and survival rate of pearl oyster (*Pinctada maxima*) seeds.

Table 9. Results of Water Quality Measurements

Parameters	Range	References
Temperature (°C)	26,8-27,6	26 – 28^{0}C (Hamzah, 2016)
Salinity (ppt)	34-35	30-35 ppt (Hamijaya, 2018)
Dissolved Oxygen (mg/L)	5,1-5,7	4,3-6,3 mg/L (Fathurrahman, 2013)
pH	7,1-7,8	7-8 (Kota, 2016)

CONCLUSION

From this study, it can be concluded that the time interval of soaking *Pinctada maxima* pearl oyster seeds in *Chaetoceros simplex* natural food concentrate gave significant results (P<0.05) on shell growth (Dorsal-Ventral) both from absolute growth, relative growth and specific growth. The best immersion in treatment B (24-hour time interval) or immersion once daily in the *Chaetoceros simplex* tub. The lower the soaking time interval, the more pearl oyster growth increases. The highest absolute growth was 1.68 mm, the highest relative growth was 122.06%, and the highest specific growth was 5.09% daily. Significantly different in treatments A (control) C, D, and E, and the soaking time interval did not significantly affect the survival rate of *Pinctada maxima* pearl oyster seeds.

ACKNOWLEDGMENT

Thank you to Mr Joni and Mr Wan as technicians who have helped provide research facilities and guided during the research; thanks also to Mr Sadikin and Mr Alis as supervising lecturers for their suggestions and input while preparing the thesis.

REFERENCES

Anwar, K., M. Toelihere, R. Affandi, N.R. Azwar dan E. Riani. 2004. Kebiasaan Makan Tiram Mutiara *Pintada maxima* di Perairan Teluk Sekotong, Lombok. *Jurnal Ilmu-ilmu Perairan dan Perikanan Indonesia*. Vol 11 (2): 73-79.

Astriwana, B. P. Wibowo dan G. M. Novia. 2008. *Pembenihan Tiram Mutiara* (*Pinctada maxima*) Metode *Donor Sperma dan Thermal Shock* di Balai Pengembangan Budidaya Laut Lombok, Nusa Tenggara Barat. Institut Pertanian Bogor : Bogor.

Fathurrahman dan Aunurohim. 2013. Kajian Komposisi Fitoplankton dan Hubungannya Dengan Lokasi Budidaya Kerang Mutiara (*Pinctada maxima*) di Perairan Sekotong, Nusa Tenggara Barat. *Jurnal Teknik Pomits.* Vol 2 (1): 1-6.

Hamijaya, R. 2018. *Analisis Kesesuaian Perairan Berdasarkan Parameter Fisika dan Kimia Untuk Budidaya Tiram Mutiara, Pinctada maxima (Jameson, 1901) di Perairan Pulau Lelangga Lunik Kabupaten Pesawaran Provinsi Lampung*. Skripsi. Universitas Lampung Bandar Lampung. Bandar Lampung. 54.

Hamzah, A. S., M. Hamzah dan M. S. Hamzah. 2016. Perkembangan dan Kelangsungan Hidup Larva Kerang Mutiara (*Pinctada maxima*) pada Kondisi Suhu yang Berbeda. *Media Akuatika*. Vol 1 (3): 152-160.

Kotta, R. 2015. Teknik Pembenihan Tiram Mutiara (*Pinctada maxima*). *Prosiding Seminar Nasional KSP2K II*. Vol 1 (2): 228-244.

Kotta, R. 2017. Pertumbuhan dan Perkembangan Spat Tiram Mutiara (*Pinctada maxima*) di Perairan Ternate Selatan Pulau Ternate. *Jurnal Prosiding Seminar Nasional KSP2K II.* Vol 1 (2): 158-166.

Kota, R. 2016. Pengaruh Kedalaman Terhadap Kelangsungan Hidup (Survival Rate) Benih Tiram Mutiara (*Pinctada maxima*) Stadia Spat. *Jurnal Ilmiah agribisnis dan Perikanan (agrikan UMMU-Ternate)*. Vol 9 (1): 1-9.

Mukhlis, A., Abidin, Z., & Rahman, I. (2017). Pengaruh Konsentrasi Pupuk Amonium Sulfat Terhadap Pertumbuhan Populasi Sel Nannochloropsis sp. Biowallacea. *Jurnal Perikanan*. Vol 3 (3): 149-155.

Sopian, T., M. Junaidi dan F. Azhar. 2019. Laju Pertumbuhan *Chaetoceros* sp. Pada Pemeliharaan Dengan Pengaruh Warna Cahaya Lampu yang Berbeda. *Jurnal Kelautan*. Vol 12 (1): 36-44.

Taufiq, N., D. Rachmawati, J. Cullen dan Yuwono. 2010. Aplikasi *Isochrysis galbana* dan *Chaetoceros amami* Serta Kombinasinya Terhadap Pertumbuhan dan Kelulushidupan Veliger-Spat Tiram Mutiara (*Pinctada maxima*). *Ilmu Kelautan.* Vol 15 (3): 119-125.

Wardana, I. K., S. B. M. Sembiring dan K. Mahardika. 2013. Aplikasi Perbaikan Manajemen Dalam Perbenihan Tiram Mutiara (*Pinctada maxima*). *Media Akuakultur.* Vol 8 (2): 120-126.

Wardana, I. K., Sudewi, A. Muzaki dan S. B. Moria. 2014. Profil Benih Tiram Mutiara *(Pinctada maxima)* dari Hasil Pemijahan yang Terkontrol. *Jurnal Oseanologi Indonesia.* Vol 1 (1): 6-11.