JOABE

JOURNAL OF ARTHA BIOLOGICAL ENGINEERING

Journal Homepage : https://jos.joabe.id

Morphological Character and Percentage of Hotate Clams (*Patinopecten Yessoensis*) Meat Weight in the Growing Phase, in Funka Bay, Hokkaido, Japan

Faza Amalia Khoerunnisa[1*], Petrus Hary Tjahja Soedibya[2], Emyliana Listiowati[2], Iriyama Gyogyo[3]

[1]Student of Aquaculture Study Program, Faculty of Fisheries and Marine Sciences, Jenderal Soedirman University, St. Dr. Soeparno, Karangwangkal, Purwokerto 53122, Indonesia.
[2]Lecture of Aquaculture Study Program, Faculty of Fisheries and Marine Sciences, Jenderal Soedirman University, St. Dr. Soeparno, Karangwangkal, Purwokerto 53122, Indonesia.
[3]Kunnui Research Company, Oshamambe-cho, Yamakoshi-gun, Hokkaido, Japan 049-3462.

Article Information

Article history :
Received: April 25, 2023
Accepted: October 05, 2023
Available online: October 15, 2023

Keywords :
Hotate scallop, Length - weight relationship, Meat percentage

Correspondence :
fazaamaliakh2@gmail.com

Abstract

This study focuses on the growth and meat weight percentage of Hotate clams (*Patinopecten yessoensis*) during the rearing phase in Funka Bay, Hokkaido, Japan. Japan, as a major producer of seafood, including Hotate clams, plays a significant role in global seafood consumption. The objective of this study was to analyze the length- weight relationship of Hotate scallops and assess their meat weight percentage during the rearing phase. The research method involved observations using a random sampling technique during the period from August to October 2022. Samples were taken in Funka Bay, with coordinates between 42°20'-42°40' North and 140°00'-141°00' East at a depth of 43 meters. Results showed that the length-weight relationship of Hotate clams during August to October exhibited a negative allometric growth pattern, with the highest constant reaching 2.640. This means that length growth is faster than body weight. The percentage of Hotate clam (*P. yessoensis*) meat weight during the rearing phase ranged from 31.03% to 35.70%. This study provides important insights into the growth and meat composition of Hotate clams during critical phases in their culture in Funka Bay, Hokkaido, Japan. It can serve as a valuable information foundation for the management and maintenance of sustainable and productive Hotate clam aquaculture in the future.

DOI : https://doi.org/10.62521/7njrz078

Introduction

Japan is one of the largest seafood producing island countries in the world with the majority of its population consuming seafood such as fish, shrimp and shellfish, one of which is Hotate clams (*Patinopecten yessoensis*) (Aya *et al*., 2014). According to Guo dan Luo (2016), Hotate clams are a successful cultivated shellfish species with production increasing from less than 50,000 tons to 500,000–600,000 tons every year and accounting for 90% of Hotate shellfish production in Japan (Sakurai and Seto, 2000). Hotate clams cultivation is carried out through several stages.

Hotate clams are bred in pearl nets or lantern nets from summer to spring during the hon-bunsan and kari-bunsan breeding stages. The most efficient method of obtaining good and fast growth is to place 20-30 clams per sheet in pearl and lantern nets and cultivate them for approximately one to two years (Dvoretsky, 2022). The growing phase begins after the clams are 1 year old in spring from the growth of juvenile clams measuring 5-7 cm to a marketable size of 10-13 cm using the "Mimi-zuri" (hanging) method by drilling the left valve ear (Kosaka, 2016). Hotate clams during the enlargement phase experience changes in length and weight.

The length-weight relationship is the process of increasing clams growth over a certain period of time. Negative allometric and positive allometric values from the relationship between length and weight describe morphological characters as growth patterns for the clams (Aisyah, 2021). Negative allometric values indicate that the increase in length of the clams is more dominant than the increase in weight, and vice versa, this value also describes the environmental, physiological and productivity conditions of the clams (Kovitvadhi *et al*., 2009). Previous research indicates that the relationship between length and weight of Knife Clams is negative allometric. According to Prasadi *et al*., (2016) the length-weight relationship of blood clams (*Anadara granosa*) in Karangantu and Labuan shows negative allometric values. Apart from the length-weight relationship, shellfish growth can also be seen from the percentage of meat weight.

The percentage of meat weight in various types of clams is a form of growth pattern. Changes in size and increase in body weight of each clams are a measure that the organism is experiencing growth (Zabarun *et al*., 2016). Additionally, the meat weight percentage describes how much meat consumers can consume. Research on the weight percentage of clams meat was carried out by Zabarun *et al*., (2016) who informed that the weight percentage of clams meat was influenced by the time of sampling; Setiawan *et al*., (2016) reported the percentage of wet meat weight of male A. antiquata clams; Haryatik *et al*., (2013) reported the percentage of wet meat weight of S. grandis clams. There is still not much information regarding the growth of Hotate clams from the aspect of the relationship between length and weight and percentage of meat weight, so research needs to be done.

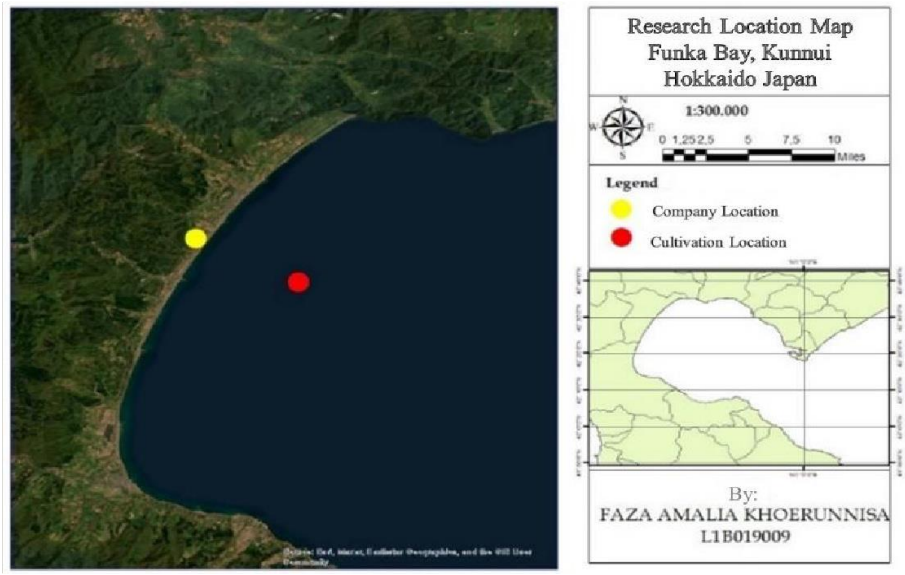

Figure 1. Funka Kunnui Bay Hokkaido, Japan

Materials and Methods

This research was carried out from August–October 2022 in Funka Bay, Hokkaido, Japan. Astronomically, the latitude and longitude points of Funka Bay are located at 41°50'–42°40' North and 140°00'–141°00' East. Funka Bay is a location for cultivating Hotate clams in the Kunnui area of Hokkaido, Japan (Figure 1). The research location was carried out on the border of the beach located at the Hotate shellfish cultivation location. Hotate clams were collected with a tool called a creane in Funka Bay, Hokkaido, Japan. The depth of collection for the research samples was 42 – 45 m. The location for collecting Hotate clams from the processing location is approximately 20km.

Research Methods

The method used in this research is observation. The observation method is a method used to obtain data directly by observing and examining objects. The research data collection technique uses random sampling technique. According to Harahap *et al*., (2018) random sampling is a technique for determining locations and samples randomly by determining the number of samples to be studied. The main variables in this study include measuring owth characteristics which include length (Figure 2), weight and weight of clams (Figure 3).

Claim Weight Total Calculation

The total weight of the clams was calculated using a Tanita Fit Scan digital

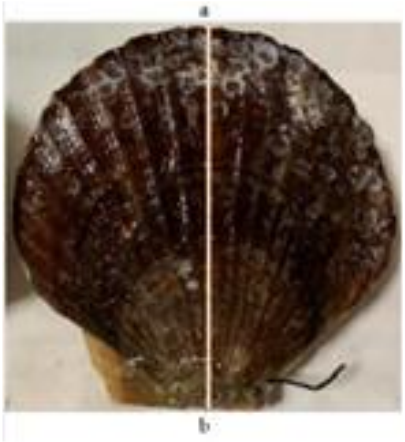

Figure 2. Hotate Clams Length Measurement (a) Ventral; (b) dorsal

scale with an accuracy of 1 g. Total weight is measured by weighing the total weight of the shellfish as a whole by first cleaning the shells of attached parasites and pests.

Meat Weight Calculation

The weight of the meat was calculated using a Tanita Fit Scan digital scale with an accuracy of 1 gram. Weighing wet meat is done by weighing the meat filling which includes meat, heart, liver, tantacles, stomach, gills, intestines and tentacles without using feces.

Data Processing

Sample data processing was carried out using Microsoft Excel software. Then the data is tabulated to get the desired data. The total lengths and weight of the clams will be used to calculate the length-weight relationship to calculate the growth of shellfish. Then divided the wet meat weight by the total meat clams weight, then multiply by 100 to get the percentage of clams weight (Zabarun *et al*., 2016).

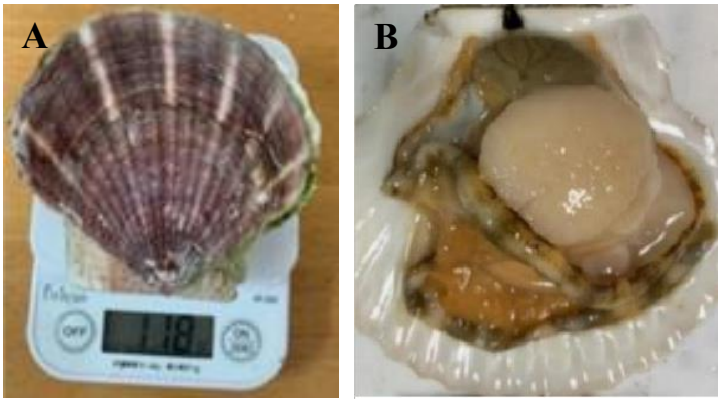

Figure 3. Total Weight Calculation (A); Meat Weight Calculation (B)

Results and Discussion

Relationship between Length and Weight of Hotate Clams

The length-weight relationship is a relationship that describes two forms of growth, namely allometric and isometric. A value of b<3 means growth in length is faster than growth in weight (negative allometric), while a value of b>3 means growth in fish weight is faster than fish length (positive allometric) (Monice *et al*., 2021). The length- weight relationship also shows the growth value using length-weight parameter calculations (a and b) (Rahardjo dan Simanjuntak, 2008). Data on the total length and weight of Hotate clams (*Patinopecten yessoensis*) with an observation period of three months were used to calculate the relationship between length and weight. The results of calculating the relationship between length and total weight of Hotate clams in August, September and October can

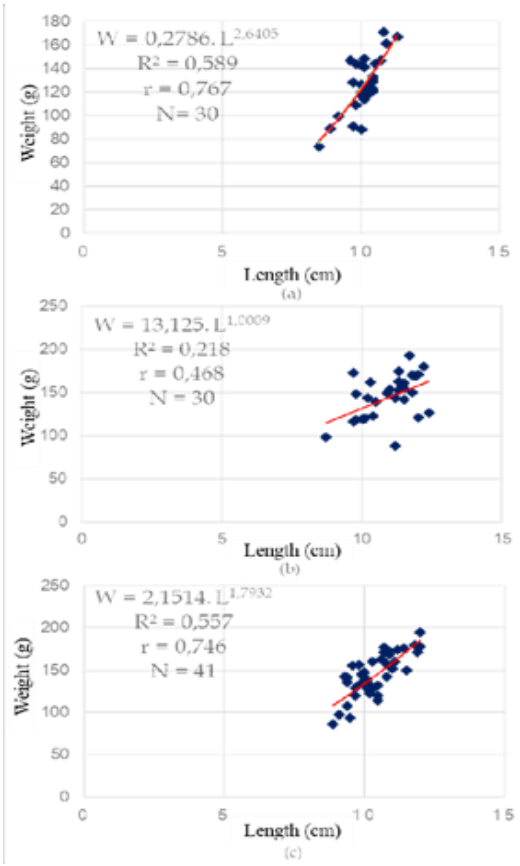

Figure 4. Graph of the Relationship between Length and Weight of Hotate Clams for the Months (a) August, (b) September and (c) October

be seen in Figure 4.

The relationship between the length and weight of Hotate clams in August, September and October showed b values of 2.640, 1.001 and 1.793 respectively so that the growth of Hotate clams was negative allometric (b < 3). Accordingly, shell length growth dominates shell weight growth. The results of this study are the same with Maharani *et al.*, (2019) which stated that shellfish (Anodonta woodiana) from July to September showed a constant value of b<3, which was negative allometric. Research by Haryatik *et al*., (2013) explains that the relationship between length and weight of knife clams (Solen grandis) shows a negative allometric value with a constant b value of 2.152 in November, resulting in a flat shape due to the increase in shell length being faster than the increase in weight. According to Hasan *et al*., (2014) the b value for the length- weight relationship of *G. erosa* clams in the Belawan mangrove ecosystem is 2.302. Notonegoro and Pratiwi, (2022) also explained that shellfish (Anadara granosa) produced a b value of 2.132.

The calculation results in Figure 4 for August, September and October produce coefficient of determination (R2) values of 58.9%, 21.9% and 55.7%. According to Komala *et al*., (2011), the coefficient of determination (R2) for *A. antiquata* clams was 0.94, indicating that the length of the shells influenced the total weight of the shells by 94.5%. Each point has a constant b value and a different coefficient of determination (R2) value with a different correlation coefficient (r) value, namely in August and October it was 0.767 and 0.746, meaning the correlation is strong, while in September the r value is 0.468, which means weakcorrelation. The correlation coefficient (r) is used to determine the direction and strength of the relationship between two or more variables. According to Rochmady, (2012) if the correlation coefficient value is close to 1 then there is a strong relationship between total weight and shell length. This is in accordance with (Monice *et al.*, 2021; Windarti, 2020) which states that if the r value is close to 1, it means there is a strong relationship between length and weight and if the r value is not close to 1, it means the relationship between length and weight is weak. This strong or close relationship is thought to be due to the availability of sufficient food and also environmental conditions that support growth. This is in accordance with (Jamabo *et al*., 2009) the value of the b constant in *Tympanotonus fuscatus var* clams from

August to October decreased, thought to be caused by three factors that influence the growth rate of clams, namely water temperature, food and reproductive activity.

Hotate Clams Meat Weight Percentage

Hotate clams (*Patinopecten yessoensis*) have internal organs such as mantle, tentacles, eyes (ocelli), flesh, anus and nervous system (adductor muscles). Calculation of wet meat weight per total weight aims to determine the percentage of wet meat weight contained in the shell (Zabarun *et al*., 2016). The calculation of the percentage of meat weight from August to October is shown in Figure 5.

Based on the research results, it shows that the weight percentage of Hotate clams meat in August was 35.70%, in September was 34.46% and in October was 31.03%. The results of the ANOVA analysis showed that the time (month) of sampling had a significant effect on the percentage of meat weight ($P<0.05$). Tukey's further test results showed that the percentage of Hotate clam meat in August (35.70 ± 5.41%) b was significantly different from October (31.03 ± 4.70%) a, while the percentage of Hotate clams in August was (35.70 ±5.41%)b is not significantly different from September (34.46±5.28%)b (Figure 5). This is thought to be due to the high suspended food and organic matter values in August and September compared to other months. According to Bahtiar (2012), food availability is one of the factors that influences growth. Food provides energy for

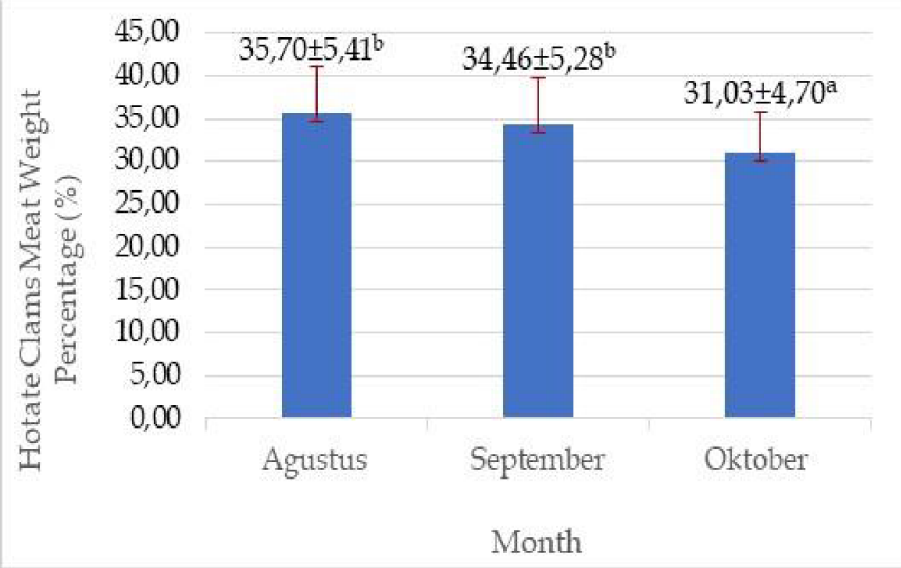

Figure 5. Weight Percentage of Hotate Clams Meat in August, September and October

organisms that allows them to grow, survive, and develop. If food is available abundantly enough, it will allow for increased reproduction in clams.

The results of the percentage weight of Hotate clams meat ranged from 31.03 ± 4.70 to 35.70 ± 5.41. The results of this study are similar with Fuji and Hashizume, (1974) who stated that the percentage of meat from *Patinopecten yessoensis* clams kept for 3 years was 29%-50%. The results of this study differ from those of Parsons and Dadswell, (1991) who also stated that the percentage of cultured mussels (*Patinopecten magellanicus*) in Passamaquoddy Bay, New Brunswick was 17.08% and wild mussels was 12.23%. Hennen and Hart, (2012) said that clams (*Patinopecten magelllanicus*) in Georges Bank had a meat weight percentage of 8.55% to 7.94%.

Conclusion

Based on the results and discussions it was concluded that Hotate Clams (*Patinopecten yessoensis*) in the enlargement phase produced negative allometrics, which means that growth in length was more dominant than weight. The weight percentage of Hotate clam meat (*P. yessoensis*) in the growing phase in August, September and October produced a percentage of (31.03 ± 4.70 %) to (35.70 ± 5.41 %).

Acknowledgement

The author would like to thank IRO (International Relations Office) Jenderal Soedirman University, PT Yonata Dewi Sejahtera (YDS), and Iriyama Gyogyo Co., Ltd as the parties who have facilitated this research activity in the Independent Campus Learning Program.

References

Aisyah, S. D. (2021). Pola pertumbuhan dan faktor kondisi ikan lemeduk (*Barbodes schwanenfeldii*) di Sungai Belumai Deli Serdang Provinsi Sumatera Utara. *Acta Aquatica*, 8(8): 98–102.

Aya, F. A., Hidaka, Y., & Kudo, I. (2014). Clearance rates and ingestion efficiency of the Japanese scallop *Patinopecten yessoensis. Plankton and Benthos Research*, 8(3): 134–140.

Bahtiar. (2012). Studi Bioekologi dan Dinamika Populasi Kerang Pokea (*Batissa violacea celebensis Martens*, 1897) yang Tereksploitasi sebagai Dasar Pengelolaan di Sungai Pohara Sulawesi Tenggara. [PhD thesis, Bogor Agricultural Institute]. Bogor.

Dvoretsky, A. G., & Dvoretsky, V. G. (2022). Biological Aspects, Fisheries,

and Aquaculture of Yesso Scallops in Russian Waters of the Sea of Japan. *Diversity*. 14(5).

Fuji., Akira., Hashizume., Masao. (1974). Energy Budget for a Japanese Common Scallop, *Patinopecten yessoensis* (Jay), in Mutsu Bay. *Bull Faculty Fish Hokkaido University.* 25(1): 1-7.

Guo, X., & Luo, Y. (2016). Scallops and Scallop Aquaculture in China. Elsevier

Harahap, M., Bambang, S., & Djoko, S. (2018). Analisis Tingkat Kematangan Gonad Teripang Keling (*Holothuria atra*) Di Perairan Menjangan Kecil, Karimunjawa. *Journal Of Maquares,* 7(3): 263-269.

Haryatik, R. D., Hafiluddin, & Farid, A. (2013). Hubungan Panjang Berat Dan Morfometrik Kerang Pisau (*Solen grandis*) di Perairan Prenduan Kabupaten Sumenep Madura. *Jurnal Rekayasa*, 6(1): 28–36.

Hasan, U., Hesti, W., & Erni, J. (2014). Kepadatan Dan Pola Pertumbuhan Kerang Lokan (*Geloina erosa, Solander* 1786) Di Ekosistem Mangrove Belawan. *Jurnal Perikananan dan Kelautan.* 19(2): 42.

Hennen, D. R., & Hart, D. R. (2012). Shell Height-To-Weight Relationships for Atlantic Sea Scallops (*Placopecten magellanicus*) in Offshore Waters. *Journal of Shellfish Research,* 31(4): 1133–1144.

Jamabo, N. A., Chindah, A. C., & Alfred J. F. O. (2009). Length-weight relationship of a mangrove *prosobranch tympanotonus fuscatus var fuscatus* (Linnaeus 1758) from the Bonny Estuary, Niger Delta. Nigeria. *World Journal of Agricultural Sciences,* 5(4): 384-388.

Komala, R., Yulianda, F., Lumbanbatu, D. T. F., & Setyobudiandi, I. (2011). Morfometrik Kerang Anadara ganosa dan Anadara antiquata pada Wilayah yang Tereksploitasi di Teluk Lada Perairan Selat Sunda. *UMMI,* 1(1): 1-7.

Kosaka, Y. (2016). Scallop Fisheries and Aquaculture in Japan. Elsevier B.V. 40.

Kovitvadhi, S., Kovitvadhi, U., Sawangwong, P., Trisaranuwatana, P., & Machado, J. (2009). Morphometric relationship of weight and size of cultured freshwater pearl mussel, Hyriopsis (*Limnoscapha*) myersiana, under laboratory conditions and earthen pond phases. *Aquaculture International,* 17(1): 57–67.

Maharani, M., Bahtiar., & Haslianti. (2019). Pola Pertumbuhan, Faktor Kondisi Dan Rasio Berat Daging Kerang Kijing (*Anodonta woodiana*) Di Perairan Nanga-Nanga Kota Kendari. *Jurnal Manajemen Sumber Daya Perairan.* 4(3): 208–213.

Monice, S., Eddiwan., Putra, R. M. (2021). Hubungan panjang berat dan faktor kondisi ikan gabus (*Channa striata*) di Danau Teluk Petai Provinsi Riau. *Jurnal Sumberdaya dan Lingkungan Akuatik,* 2(1): 2722–6026.

Notonegoro, H., & Pratiwi, F. D. (2022). Morfometri Kerang Anadara granosa Di Perairan Sukal Bangka Barat. *Jurnal Ilmu Perairan,* 4(1): 18–22.

Parsonsa, G. J. & Dadswell, M. J. (1991). Effect of stocking Density on Growth, Production and Survival of the Giant Scallop (*Placopecten mugellanicus*), Held in Intermediate Suspension Culture in Passamaquoddy Bay, New Brunswick. *Journal Aquaculture,* 103: 291–309.

Prasadi, O., Setyobudiandi, I., Butet, N. A., & Nuryati, S. (2016). Karakteristik Morfologi Famili Arcidae di Perairan yang Berbeda (Karangantu dan Labuan, Banten). *Jurnal Teknologi Lingkungan,* 17(1): 29.

Prasetya, J. D., Sprijanto, J., & Hutabarat, J. (2010). Potensi Kerang Simping di Kabupaten Brebes Jawa Tengah. *Seminar Nasional Tahunan Hasil Penelitian Perikanan dan Kelautan.* (VII): 1–14.

Rahardjo, M. F., & Simanjuntak, C. P. H. (2008). Hubungan panjang bobot dan faktor kondisi ikan tetet (*Johnius belangerii*) cuvier (pisces: sciaenidae) di perairan pantai Mayangan, Jawa Barat. *Jurnal Ilmu-ilmu Perairan dan Perikanan Indonesia,* 15(2): 135–140.

Rochmady, R. (2012). Hubungan panjang bobot dan faktor kondisi kerang lumpur Anodontia edentula, Linnaeus 1758 di pulau Tobea Kecamatan Napabalano, Kabupaten Muna. *Agrikan: Jurnal Agribisnis Perikanan,* 5(1): 1–8.

Sakurai, I., & Seto, M. (2000). Movement and orientation of the Japanese scallop *Patinopecten yessoensis* (Jay) in response to water flow. *Aquaculture.* 181(3-4): 269–279.

Setiawan, A., Nurgayah, W., & Bahtiar. (2016). Pola Pertumbuhan dan Rasio Bobot Daging Kerang Bulu (*Anadara antiquata*) di Perairan Bungkutoko Kota Kendari. *Jurnal Manajemen*

Sumber Daya Perairan, 1(2): 115–129.

Zabarun, A., Bahtiar, & Haslianti. (2016). Hubungan panjang berat, faktor kondisi dan rasio berat daging Kerang Pasir (*Modiolus modulaides*) di perairan Bungkutoko Kota Kendari. *Jurnal Manajemen Sumberdaya Perairan,* 2(1): 21–32.