Jurnal Pengelolaan Perikanan Tropis (*Journal of Tropical Fisheries Management*)

Website: http://journal.ipb.ac.id/index.php/jurnalppt
e-ISSN: 2721-1525
Vol. 08 No. 01: 1–8 (2024) DOI: https://doi.org/10.29244/jppt.v8i1.48555

Density, Water Quality Suitability and Size Distribution of Pokea Clams (*Batissa violacea* var. celebensis, von Martens 1897) at Lasolo River Southeast Sulawesi

Bahtiar [1,*], Latifa Fekri[1], Muhammad Nur Findra[2]

Received: 23 07 2023 / Accepted: 02 06 2024

ABSTRACT

The pokea density and its size distribution are different in every place and time which influenced by water quality. This study aimed to determine the density and suitability of water quality, and size distribution of pokea at Lasolo River, Southeast Sulawesi. Pokea samples were collected randomly in all water segment every month for 1 year in the area of Lasolo River, North Konawe. Some samples of pokea were collected using the wide range of tangge fishing gear (traditional tool/ traditional fishing gear) as much as 6 pull times. In the process of collecting the sample of water quality, it was done simultaneously with the samples of shell. The shell density in every place and time was analyzed using the Mann-Whitney test. The preferences of pokea in water quality were analyzed using Principal Component Analysis (PCA) and Group Analysis (CA) in the package of multivariate statistical program (XLSTAT). The results of this analysis showed that the density of the middle of estuary was significantly different (higher) than its density in the initial and final regions which found upstream (lowest density) and in the estuary area, while the density of pokea clams was not significantly different in each month of observation. The pokea clams were dominantly found in small size (1.62-2.10-3.09-3.57 cm). The size of the pokea were distributed in all water segment, which were so many in May and June. The preferences habitat of pokea clams were the slow-flowing, high-brightness, and deep water.

Keywords: *Batissa violacea, clams, density, size, water quality*

INTRODUCTION

Pokea clam or commonly known as violet batissa clam (*Batissa violacea* var. *celebensis*, von Martens 1897) is one type of economic clams in Southeast Sulawesi (Bahtiar, 2005). These clams have been consumed by local people and used as raw materials in various dishes for daily consumption. Clams of the same type (*Batissa* sp.) in several countries such as the Philippines (Mayor *et al.* 2016; Mayor and Ancog, 2016) and the Fiji Islands (Ledua *et al.* 1996) have been exploited on a large scale and are listed as one of the the country's incomes from the inland fisheries sector (Major *et al.* 2016). This clam has a fairly wide distribution and can be found in several places in Indonesia such as: Sumatera (Puteri, 2005), Sulawesi (Bahtiar, 2005; Bahtiar *et al.* 2008, 2023; Alkadri *et al.* 2018) and even in Papua (Djajasasmita, 1977; Kusnoto, 1953; Sastrapradja, 1977).

Pokea clams distributed in several different river estuaries tend to have different environmental qualities. River estuaries that receive input from land have different dynamics. Pokea clams that live in river estuaries with different environmental pressures (high and low ecological pressure) have different responses and elasticity as indicated by the tendency of habitat preferences for pokea clam populations to be different (Bahtiar *et al.* 2012). Thus, pokea clams have preferences for certain environmental qualities. This is the case in several water quality conditions such as: current and TDS (Total Dissolve Solid). Pokea clams that live in different currents in each part of the water also influence the size distribution of pokea clams. This is the case with these clams which inhabit fresh waters in a narrow zone between the furthest tidal runoff and estuary areas approaching the meeting of fresh water and sea. Even though these bivalves live in the estuary zone, they relatively do not like water quality conditions with TDS which tends to

*Corresponding author
✉ Bahtiar
bahtiar@uho.ac.id

[1]Program Studi Manajemen Sumberdaya Perairan, Fakultas Perikanan dan Ilmu Kelautan, Universitas Halu Oleo, Indonesia.
[2]Program Studi Manajemen Sumberdaya Perairan, Fakultas Perikanan dan Ilmu Kelautan, Universitas Khairun, Indonesia.

increase due to the influence of high tides (Bahtiar, 2012).

So far, research on the density and suitability of habitat and size distribution of pokea clams has only been carried out in several places, including: Pohara River (Bahtiar, 2007; Bahtiar *et al.* 2012, Bahtiar dan Purnama, 2020), Langkumbe River (Bahtiar, 2005; Bahtiar *et al.* 2012; Bahtiar dan Purnama, 2020) dan Sungai Laeya (Bahtiar *et al.* 2023) and the Laeya River (Bahtiar *et al.* 2023), while research on pokea clams in the Lasolo River is still focusing on reproduction (Bahtiar, 2017) and population dynamics (Bahtiar *et al.* 2018). In fact, management of aquatic resources requires various information from the aspects of density, suitability of water quality and size distribution (Afara *et al.* 2023; Findra, 2010, 2016; Findra *et al.* 2016, 2020, 2023; Pratama *et al.* 2023; Taula *et al.* 2022), including pokea clams in the Lasolo River so that they can be used as a basis for future development and management efforts. Therefore, this research aims to determine the density, appropriate water quality, and size distribution of pokea clams in the Lasolo River, Southeast Sulawesi.

MATERIAL AND METHOD

Pokea clam samples were collected periodically every month for 1 year from January to December 2014 in the Lasolo River, North Konawe Regency (S = 03°30'20,3" E = 122°09'05,9" dan S = 03°31'55,1" E = 122°13'14,6") (Figure 1). Clam samples were collected randomly at five stations throughout the waters based on the ecological characteristics and presence of pokea clams. Stations I and II are the initial areas where pokea clams were found towards the upstream, then stations III and IV are in the middle of the waters, and station V is at the end where pokea clams were found towards the estuary (where the first mangroves were found). Pokea clams are collected using an iron basket (*tangge*, a traditional tool) which is operated by 2 people by pulling a 70 cm long fishing gear. This tool has a mouth opening of 24 cm. The number of tool pulls at each station is 10 pulls. Pokea clam sampling is carried out every month. The number of clam samples taken on the *tangge* tool was counted. Taking and measuring water quality samples is carried out in the field and laboratory which includes: current speed, brightness, depth, substrate pH, water organic matter, sediment, temperature, chlorophyll-a, alkalinity, and TSS. The length of the pokea shell was measured using a caliper to an accuracy of 0.05 mm. Observing the sex ratio is by counting the number of males and females in each month.

Pokea clam density, based on place and time of observation, was calculated from the number of samples per area swept by the *tangge* tool (ind/m2) based on the following equation (Brower *et al.* 1998):

$$D = \frac{ni}{A}$$

Details:
D = density of pokea (ind/m2)
ni = number of individuals
A = area (m2)

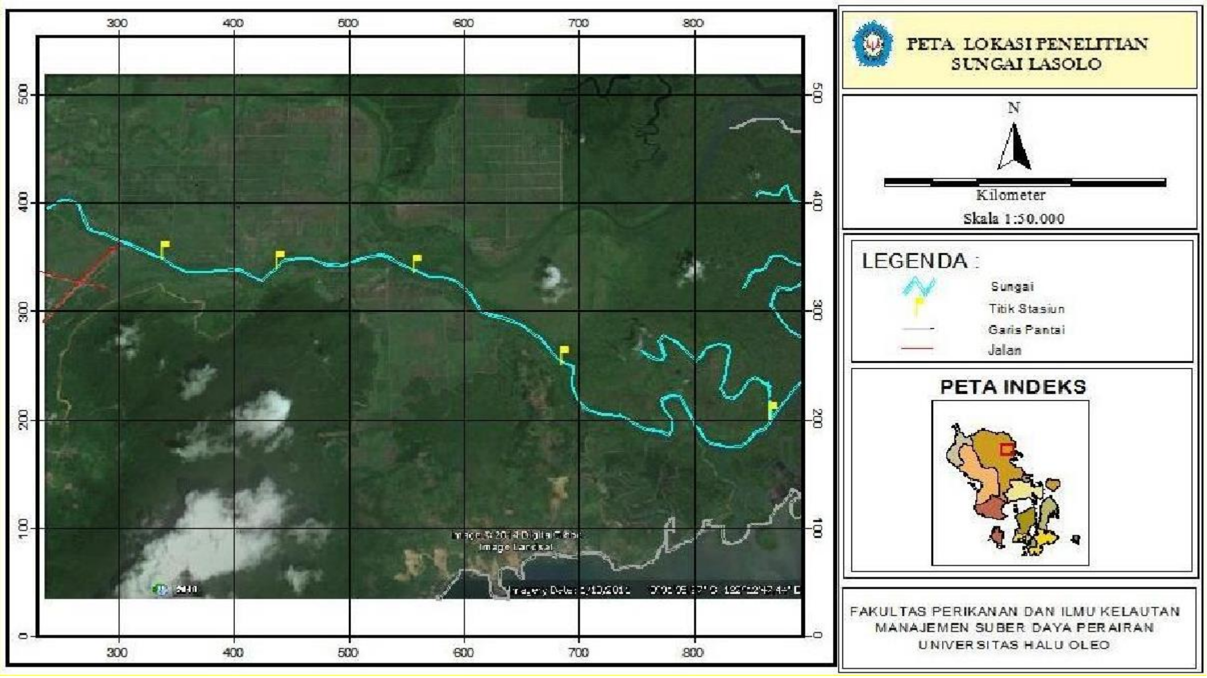


Figure 1. Map of research locations in the Lasolo River, Southeast Sulawesi.

The average density between research stations and observation time was analyzed using the Mann-Whitney test (Ocaña, 2015). The spatial and temporal distribution of size classes (class intervals) is divided based on Sturges separation (Bahtiar, 2012). Pokea preferences for water quality and substrate texture were analyzed using Principal Component Analysis (PCA) dan Cohort Analysis (CA) in the Excel STAT multivariate statistical program package (Bahtiar, 2007).

RESULT AND DISCUSSION

Results

Density Based on Place and Time of Observation

The highest density of pokea is at station III, while the lowest density is at station I, with the respective ranges being: 198-1446 ind/m2 and 59-126 ind/m2. The results of the Mann Whitney analysis show that stations III and IV have the same density and are relatively higher than the other stations, while station I has the lowest density (Figure 2A). Based on the results of temporal observations, it shows that pokea density at all stations tends to fluctuate, but the tendency for higher density occurs in June and low density occurs in February and August.

The highest density of pokea clams was found in May, June, and September, while the lowest density was found in February, April, August, and October (Figure 2B), although the Man Whitney test showed that the density of clams was not significantly different in each month of the study.

Water Quality Suitability

The eigenvalue is 93.45 which is contributed by the F1 axis of 85.75 and F2 of 7.69. The stations contribute greatly to the F1 axis, namely: stations 1a (0.34), IIa (0.36), IIIa (0.36), IVa (0.45), Va (0.48), Ic (0.12) , IIc (0.15), and IVc (0.21), while on the F2 axis they are: 1a (0.20), IIa (0.19), IIIa (0.13), IVa (0.20), Va (0.27), IV (0.36), Vb (0.26), IIIc (0.10), IVc (0.28), Id (0.30), IId (0.33), IIId (0.16), IVd (0.22), Vd (0.28), and Ie (0.18). Water environmental quality parameters that contribute to the F1 axis are: TDS (0.26), current (0.35), depth (0.60), brightness (0.63), while on axis 2, namely: TDS (0.41) , temperature (0.15), current (0.11), depth (0.36), brightness (0.56), TSS (0.55), and alkalinity (0.11) (Figure 3).

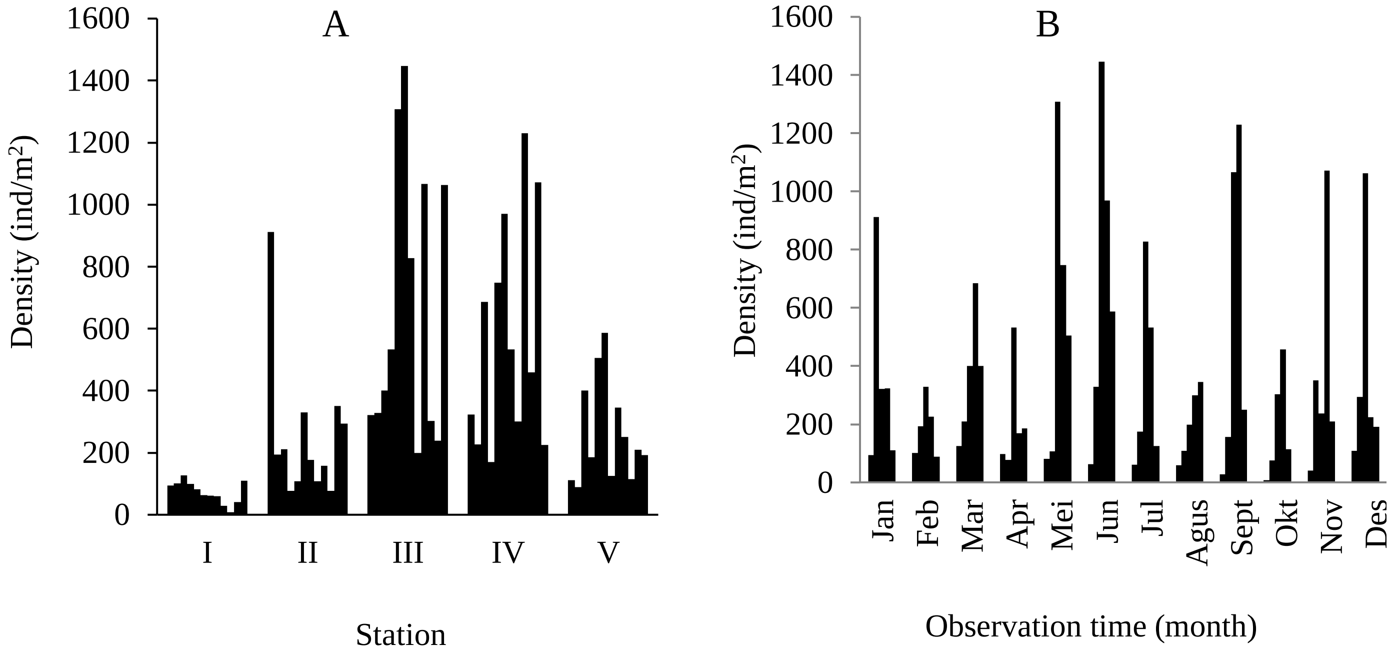


Figure 2. Density of pokea clams based on place (A) and time (B) of observation.

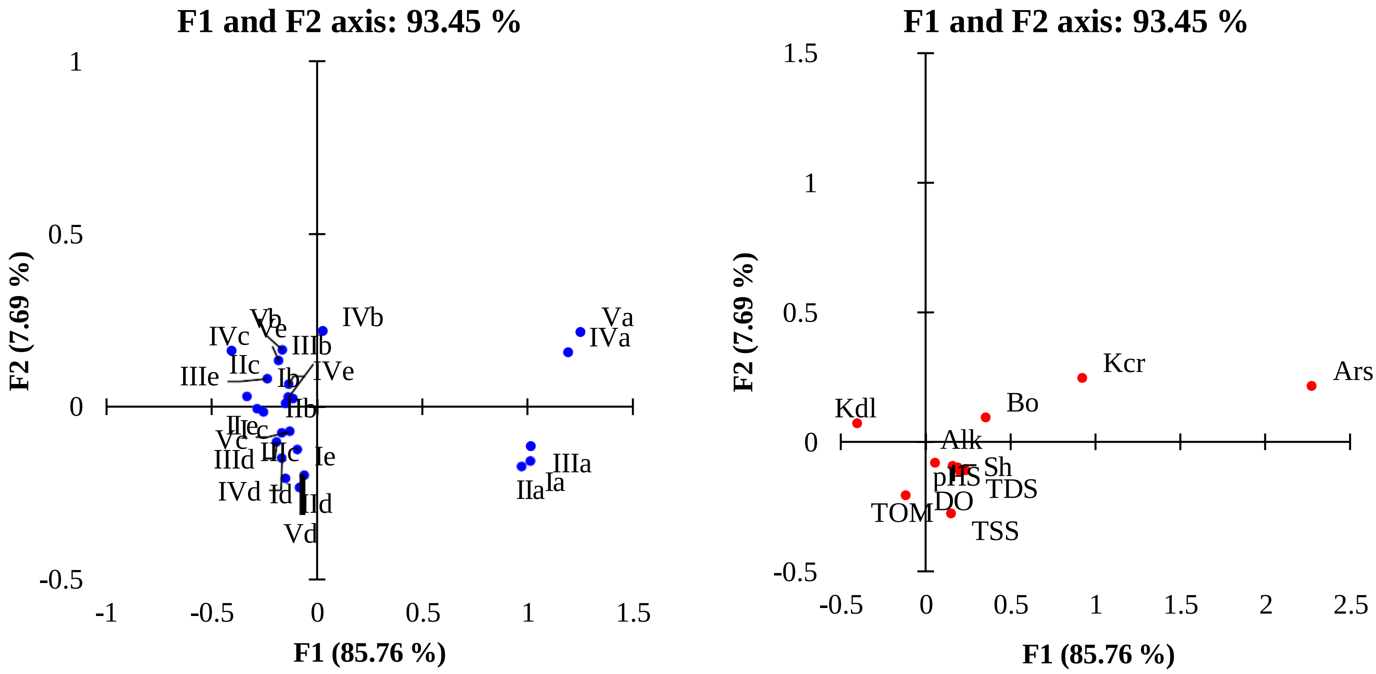


Figure 3. Water quality suitability for pokea clams in the Lasolo River, Southeast Sulawesi

Size Distribution Based on Place and Time of Observation

Pokea clams are distributed in the range of 0.15-0.67 to 7.57-8.09 cm, and are dominant in sizes from 1.74-2.26 to 3.33-3.85 cm. Pokea clams are dominant at sizes 2.80-3.32 cm at stations I and II, then these clams are dominant at sizes 2.27-2.79 cm at stations III and IV. Pokea clams were dominant at a size of 1.74-2.26 cm at station V. In general, the size of pokea shells was distributed at all research stations (Figure 4). Pokea shells in various size classes are found in every month which are found in abundance in May and June. Pokea shells at a size of 0.15-2.26 cm and a size range of 2.27–3.32 are dominantly found in May. Pokea clams with a size range of 3.33-3.85, 3.86-5.97 and a size range of 5.98-8.09 were abundant in June (Figure 5).

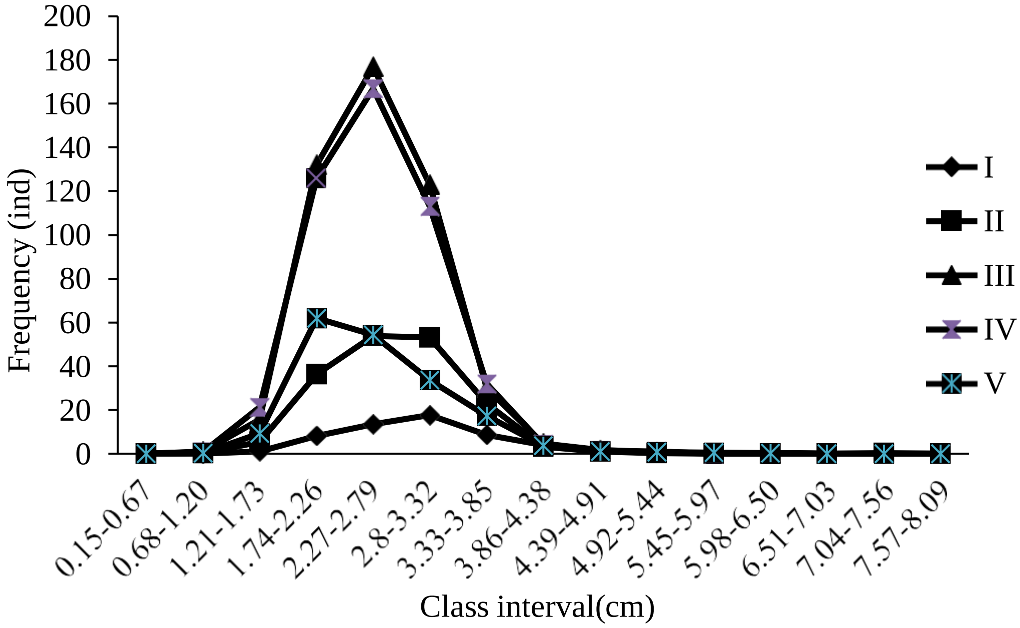
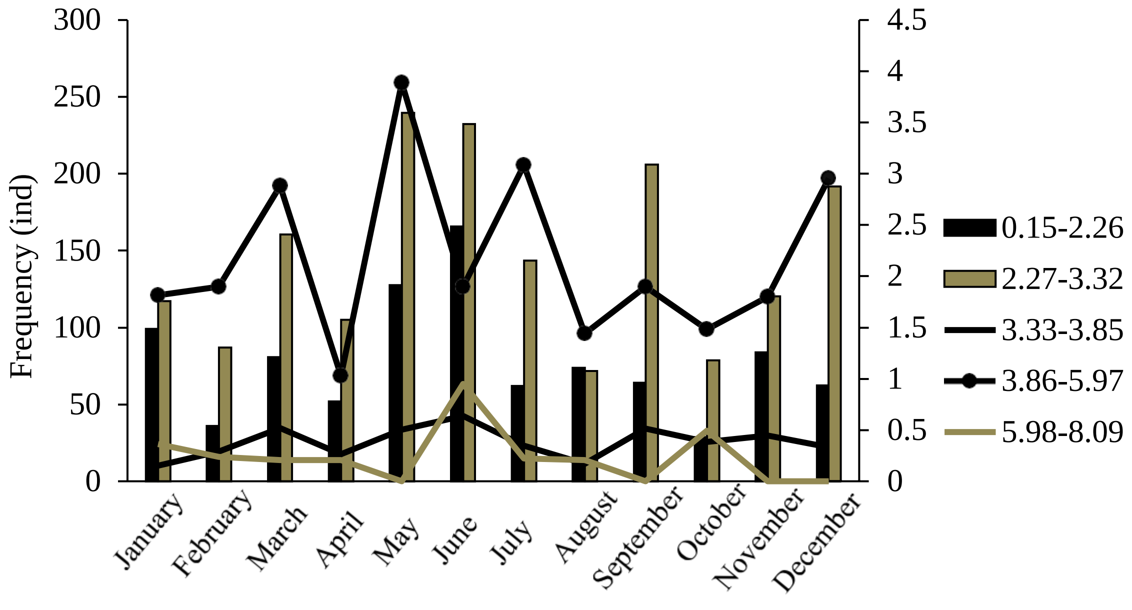


Figure 4. Size distribution of pokea shells based on place of observation



Observation time (month)

Figure 5. Size distribution of pokea shells based on time of observation

Discussion

Pokea clams have the highest density in the middle water area. In this area, it is part of the waters at high tide, the water is calm/not moving. This condition provides the opportunity for young clams /spat to fall and inhabit the bottom substrate of the waters. This is in line with the lowest pokea density in the initial area found towards the upstream. This is thought to be related to: 1) strong currents carrying spawning spat to waters further towards the middle of the river towards the middle of the river, 2) the rock bottom substrate without fine sand and clay sediment is a type of substrate that is less favored by clams because clams are more difficult to bury themselves/stability of attachment in the bottom substrate of unstable waters and is not good at binding/retaining organic material (nutrients) as a food source for pokea clams (detritus) (Bahtiar *et al.* 2014; Box dan Mossa, 1999). In this area, shellfish bury themselves behind chunks of gravel and rocks. Low density is also found in river estuary areas that have been influenced by sea water. Pokea clams, which are purely freshwater animals, relatively do not like water with high TDS (Bahtiar *et al.* 2012). Several cases show that pokea clams have low densities in areas directly adjacent to sea water. The density of clams decreases as the TDS value of the water increases. In extreme conditions, sea water intrusion in the dry season causes mass deaths in the Pohara River (Bahtiar, 2012). This is characterized by piles of dead clams at the bottom of the water. Apart from current speed, TDS and water substrate, pokea clams in the Lasolo River also prefer habitats with water quality conditions such as: depth, brightness and TSS of the water. Pokea shells are found in high densities and varying sizes (small-large sizes) in deeper waters. In general, deep water has calmer currents, giving nutrients/food the opportunity to fall to the bottom of the water (Bahtiar, 2012). Apart from that, water currents are related to the water substrate in this area which provides good stability for the attachment of pokea clams because it is composed of a combination of clay, mud and sand, and gravel. High water TSS which is negatively correlated will cause low brightness. Pokea clams do not like very murky waters. High turbidity can cause the respiratory mechanism of mussels to become disturbed. Even though Pokea clams can adapt to turbidity, high turbidity can cause the clams to suffocate/run out of oxygen during respiration (Bahtiar *et al.* 2012).

In general, the density of pokea clams in the Lasolo River is higher than the density of similar clams in other places, including: the density of pokea clams in the Pohara River ranges from 8.71 to 225 ind/m^2 (Bahtiar, 2007), 34-792 ind/m^2 (Bahtiar, 2012), The Langkumbe River ranges 49,9-167 ind/m^2 (Alkadri *et al.* 2018), Ba River at 270 ind/m^2 (Ledua *et al.* 1996), and Batang Anai River ranges 6-31 ind/m^2 (Puteri, 2005). The density of this clam in the Lasolo River is relatively the same as several other freshwater invasive clams such as: *Corbicula fluminea* ranges 80-4185 ind/m^2 (Sousa *et al.* 2008), 160-630 ind/m^2 (Paschoal *et al.* 2013), *Darina solenoides* by 779 ind/m^2 (Lizarralde *et al.* 2018), and bivalve *Pisidium amnicum* ranges 24-1144 ind/m^2 (Sousa *et al.* 2008), *Cerastoderma edule* ranges 32-704 ind/m^2

(Callaway *et al.* 2013), but lower than *Dreissena polymorpha* which ranges from 9000-16000 (Kobak, 2005) and *Limnoperna fortunei* at 2765 ind/m^2 (Musin *et al.* 2015). Pokea clams in the Lasolo River have a much higher density than clams that live in estuaries, including: *Anodonta anatina* (8-15 ind/m^2) (Ercan *et al.* 2013) and *Polymesoda erosa* (7-12 ind/m^2) (Clemente dan Ingole, 2011). Differences in the density of each type of clams can be caused by: food availability (Bahtiar *et al.* 2022, 2023) and the growth characteristics (age) and length of life of each type of clams population, such as the short-lived Corbicula clam, which have faster growth (Sousa *et al.* 2008) than *Polymesoda* sp (Ransangan *et al.* 2019).

Pokea clams in the Lasolo River are found in varying sizes in nature, representing all size groups, from the smallest (juvenile) to the largest (old) in all parts of the water. This illustrates that the regeneration of pokea clam populations occurs normally in nature (Bahtiar *et al.* 2018). The dominant clam size is 1.74-2.26 to 3.33-3.85 cm. This shows that the clam population is at the productive age of early gonad maturity as indicated by pokea clam starting to mature gonads at a size of 2 cm (Bahtiar, 2017). However, the relative size of dominant clams differs based on location. The size of clams in the upstream section tends to be relatively large, namely >2.80-3.32 cm, and smaller clams are found more frequently as the water moves towards the estuary. In areas with stronger currents upstream, small shellfish will be transported towards the estuary (Bahtiar, 2005). Pokea shells found in the middle area of the estuary are in the middle size ranging from 2.27 to 2.79 cm and the size of pokea shells gets smaller as they approach the area where fresh water and sea meet, ranging from 1.74 to 2.26 cm. The size distribution of pokea mussels in each part of the water (upstream, middle and near the estuary) is relatively the same as in the Pohara River (Bahtiar *et al.* 2015) and Laeya River (Bahtiar *et al.* 2022, 2023).

The highest abundance of pokea clams in various size classes was found during 2 months, namely May and June. This illustrates the life/reproduction cycle of pokea clams after experiencing the maturity phase and spawning which occurs in April and early May and spat which float in the waters in the same month, followed by the fall of morphologically perfect clams to the bottom of the waters which occurs every month and reaches its peak in May and June (Bahtiar, 2017). This is characterized by the dominance of pokea clams in small sizes, namely 0.15-2.26 cm and 2.27-3.32 cm. Furthermore, clams continued to experience rapid changes in size with the discovery of larger shell sizes measuring 3.33-3.85, 3.86-5.97 cm and 5.98-8.09 cm.

CONCLUSION

The density of pokea clams in the Lasolo River tends to be higher in the middle area of the estuary with water quality conditions of slow flow, deep water and high clarity. Pokea clam size is distributed along river mouths and peak recruitment into the population occurs in May and June.

REFERENCES

Afara MY, Sara L, Halili, Findra MN. 2023. Pola pertumbuhan dan faktor kondisi udang merah (*Parhippolyte uveae*) di perairan rawa kawasan Pantai Koguna Kabupaten Buton, Sulawesi Tenggara. *Juvenil: Jurnal Ilmiah Kelautan Dan Perikanan*, *4*(1), 43–50. https://doi.org/10.21107/juvenil.v4i1.18815

Alkadri MA, Bahtiar, Yasidi F. (2018). Preferensi habitat kerang pokea (*Batissa violacea* var. celebensis von Martens, 1897) di Sungai Langkumbe Kecamatan Kulisusu Barat Kabupaten Buton Utara. *Jurnal Manajemen Sumber Daya Perairan*, *3*(2), 105–115.

Bahtiar. 2005. Kajian Populasi Pokea *(Batissa violacea* var. *celebensis*, von Martens, 1897*)*, 1897 di Sungai Pohara Kendari Sulawesi Tenggara. [Tesis]. Bogor: Institut Pertanian Bogor.

Bahtiar. 2007. Preferensi habitat dan lingkungan perairan pokea (*Batissa violacea* var. *celebensis*, von Martens 1897) di Sungai Pohara Sulawesi Tenggara. *Jurnal Aqua Hayati*, *5*, 81–87.

Bahtiar. 2012. Studi Bioekologi dan Dinamika Populasi Pokea (*Batissa violacea* var. *celebensis* von Martens, 1897) yang Tereksploitasi Sebagai Dasar Pengelolaan di Sungai Pohara Sulawesi Tenggara [Disertasi]. Bogor: Institut Pertanian Bogor.

Bahtiar. 2017. Biologi reproduksi kerang pokea *Batissa violacea* var. celebensis, von Martens 1897 di Muara Lasolo, Sulawesi Tenggara. *Jurnal Ilmu Dan Teknologi Kelautan Tropis*, *9*(1), 9–18.

Bahtiar, Anadi L, Nurgayah W, Emiyarti. 2018. Dinamika populasi kerang pokea (*Batissa violacea* var. celebensis, von Martens 1897) di muara Sungai Lasolo Sulawesi Tenggara.

Jurnal Ilmu Dan Teknologi Kelautan Tropis, *10*(2), 301–315. https://doi.org/10.29244/jitkt.v10i2.24046

Bahtiar B, Findra MN, Ishak E. 2023. Length-weight relationships and condition index of Pokea clams (*Batissa violacea* var. celebensis, von Martens 1897) in the Laeya River, Southeast Sulawesi, Indonesia. *Aceh Journal of Animal Science*, *8*(2), 45–52. https://doi.org/https://doi.org/10.13170/ajas.8.2.30994

Bahtiar, Hamzah M, Hari H. 2015. Studi struktur dan pertumbuhan populasi kerang pokea (*Batissa violacea* var. celebensis, von Martens 1897) di Sungai Pohara Sulawesi Tenggara. *Jurnal Biologi Tropis*, *15*(2), 112–124. https://doi.org/10.29303/jbt.v15i2.200

Bahtiar, Nurgayah W, Irawati N. 2014. Studi kebiasaan makanan kerang pokea (*Batissa violacea* var celebensis, von Martens 1897) saat penambangan pasir di Sungai Pohara Sulawesi Tenggara. *Jurnal Biologi Tropis*, *14*(2), 75–82. https://doi.org/10.29303/jbt.v14i2.135

Bahtiar, Purnama MF. 2020. Preferensi habitat kerang pokea (*Batissa violacea* var. celebensis von Martens, 1897) berdasarkan karakteristik substrat di Sungai Pohara Sulawesi Tenggara. *Jurnal Moluska Indonesia*, *4*(2), 74–82. https://doi.org/10.54115/jmi.v4i2.9

Bahtiar, Purnama, MF, Muis, Ishak E, Kasim M. 2022. The size structure, growth, mortality, and exploitation rate of freshwater clam (*Batissa violacea* var. celebensis) from Southeast Sulawesi, Indonesia. *Journal of Shellfish Research*, *41*(1), 145–152. https://doi.org/10.2983/035.041.0112

Bahtiar, Riani E, Setyobudiandi I, Muchsin I. 2012. Kepadatan dan distribusi pokea (*Batissa violacea* var. celebensis, von Martens 1897) pada substrat berbeda di Sungai Pohara Kendari Sulawesi Tenggara. *Aqua Hayati*, *8*(2), 115–123.

Bahtiar, Yulianda F, Setyobudiandi I. 2008. Kajian aspek pertumbuhan populasi pokea (*Batissa violacea* var. celebensis, von Martens 1897) di Sungai Pohara Kendari Sulawesi Tenggara. *Jurnal Ilmu-Ilmu Perairan Dan Perikanan Indonesia*, *15*(1), 1–5.

Box JB, Mossa J. 1999. Sediment, land use, and freshwater mussels: prospects and problems. *Journal of the North American Benthological Society*, *18*(1), 99–117. https://doi.org/10.2307/1468011

Brower J, Zar J, von Ende CN. 1998. *Field and Laboratory Methods for General Ecology* (4th ed.). McGraw-Hill Education.

Callaway R, Burdon D, Deasey A, Mazik K, Elliott M. 2013. The riddle of the sands: how population dynamics explains causes of high bivalve mortality. *Journal of Applied Ecology*, *50*(4), 1050–1059. https://doi.org/10.1111/1365-2664.12114

Clemente S, Ingole B. 2011. Recruitment of mud clam *Polymesoda erosa* (Solander, 1876) in a mangrove habitat of Chorao island, Goa. *Brazilian Journal of Oceanography*, *59*(2), 153–162. https://doi.org/10.1590/S1679-87592011000200004

Djajasasmita M. 1977. An annotated list of the species of the genus Corbicula from Indonesia (Mollusca: Corbiculidae). *Bulletin Zoologisch Museum*, *6*(1), 1–9.

Ercan E, Gaygusuz Ö, Tarkan AS, Reichard M, Smith C. 2013. The ecology of freshwater bivalves in the Lake Sapanca basin, Turkey. *Turkish Journal of Zoology*, *37*, 730–738. https://doi.org/10.3906/zoo-1212-23

Findra MN. 2010. Komposisi Jenis, Kelimpahan dan Ukuran Kima di Perairan Pulau Tolandono dan Pulau Sawa, Kawasan Taman Nasional Wakatobi [Skripsi]. Makassar: Universitas Hasanuddin.

Findra MN. 2016. Studi populasi dan profil genetik kima (Bivalvia, Cardiidae, Tridacninae) di perairan Taman Nasional Wakatobi [Tesis]. Bogor: Institut Pertanian Bogor.

Findra MN, Hasrun LO, Adharani N, Herdiana L. 2016. Perpindahan ontogenetik habitat ikan di perairan ekosistem hutan mangrove. *Media Konservasi*, *22*(3), 304–309. https://doi.org/DOI: 10.29244/medkon.21.3.304-309

Findra MN, Lawelle SA, Arsal LOM, Mokodongan DF, Permatahati YI, Risfandi, Ikbal M, Sapri. 2023. Sebaran ukuran, hubungan panjang-berat, dan faktor kondisi ikan julung-julung (*Nomorhamphus* sp.) di air terjun Nanga-nanga Kota Kendari, Sulawesi Tenggara. *Juvenil: Jurnal Ilmiah Kelautan Dan Perikanan*, *4*(2), 117–126. https://doi.org/10.21107/juvenil.v4i2.19213

Findra MN., Setyobudiandi I, Butet NA, Solihin DD. 2020. Status populasi sumber daya kima (Tridacnidae) di perairan Taman Nasional Wakatobi. *Prosiding Seminar Nasional Perikanan Dan Kelautan Berkelanjutan III*, 126–132.

Kobak J. 2005 Recruitment and distribution of *Dreissena polymorpha* (Bivalvia) on substrates of different shape and orientation. *International Review of Hydrobiology*, *90*(2), 159–170. https://doi.org/10.1002/iroh.200410756

Kusnoto. 1953. Kebun Raya Indonesia (Botanic Gardens of Indonesia). *Treubia A Journal of Zoology, Hydrobiology and Oceanography of the Indo-Australian Archipelago*, *22*, 53–57.

Ledua E, Matoto SV, Sesewa A, Korovulavula J. 1996. *Freshwater Clam Resources Assesment of the Ba River*.

Lizarralde Z, Pittaluga S, Albarracin T, Perroni M. 2018. Population dynamics and secondary production of *Darina solenoides* (Bivalvia: Mactridae) in the Río Gallegos Estuary, Southern Patagonia. *Latin American Journal of Aquatic Research*, *46*(2), 411–415. https://doi.org/10.3856/vol46-issue2-fulltext-16

Mayor AD, Ancog R. 2016. Fishery status of freshwater clam (*Batissa violacea*, Corbiculidae) (Bivalvia) (Lamarck, 1818) in Cagayan River, Northern Philippines. *International Journal of Fisheries and Aquatic Studies*, *4*(3), 500–506.

Mayor AD, Ancog RC, Guerrero RD, Camach MVC. 2016. Environmental factors influencing population density of freshwater clam *Batissa violacea* (Bivalvia) (Lamarck, 1818) in Cagayan River, Northern Philippines. *International Journal of Aquatic Science*, *7*(2), 69–72.

Musin GE, Rojas MF, Giri F, Williner V. 2015. Structure and density population of the invasive mollusc *Limnoperna fortunei* associated with *Eichhornia crassipes* in lakes of the Middle Paraná floodplain. *Journal of Limnology*, *74*(3), 537–548. https://doi.org/10.4081/jlimnol.2015.1107

Ocaña FA. 2015. Growth and production of *Donax striatus* (bivalvia: donacidae) from Las Balsas Beach, Gibara, Cuba. *Revista de Biología Tropical*, *63*(3), 639. https://doi.org/10.15517/rbt.v63i3.16242

Paschoal LRP, Andrade DP, Darrigran G. 2013. Size comparison of quadrats in sample of non-native bivalve *Corbicula fluminea* (Muller, 1774) (Bivalvia: Corbiculidae). *Pan-American Journal of Aquatic Sciences*, *8*(4), 369–374.

Pratama MF, Sara L, Halili, Findra MN. 2023. Karakteristik habitat udang merah (*Parhippolyte uveae*) di perairan rawa sekitar kawasan Pantai Koguna Kabupaten Buton, Sulawesi Tenggara. *Habitus Aquatica*, *4*(1), 8–16. https://doi.org/10.29244/HAJ.4.1.8

Puteri RE. 2005. Analisis Populasi dan Habitat : Sebaran Ukuran dan Kematangan Gonad Kerang Lokan *Batissa violacea* Lamarck (1818) di Muara Sungai Batang Anai Padang Sumatera Barat [Tesis]. Bogor: Institut Pertanian Bogor.

Ransangan J, Soon TK, Duisan L. 2019. Population dynamics of marsh clam, *Polymesoda* spp. (Bivalvia: Corbiculidae) in Marudu Bay, Malaysia. *AACL Bioflux*, *12*(2), 395–403.

Sastrapradja S. 1977. Sumber protein hewani. Lembaga Biologi Nasional-LIPI.

Sousa R, Antunes C, Guilhermino L. 2008. Ecology of the invasive Asian clam *Corbicula fluminea* (Müller, 1774) in aquatic ecosystems: an overview. *Annales de Limnologie - International Journal of Limnology*, *44*(2), 85–94. https://doi.org/10.1051/limn:2008017

Taula K, Bahtiar, Purnama MF, Findra MN. 2022. Preferensi habitat kerang lentera (*Lingula unguis*) di Perairan Nambo, Kota Kendari, Sulawesi Tenggara. *Habitus Aquatica*, *3*(2), 51–67. https://doi.org/10.29244/HAJ.3.2.51