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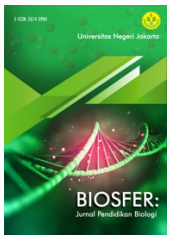

Tarakan city's marine potential as a teaching material for marine biology: A systematic literature review

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ARTICLE INFO

Article history
Received: 02 February 2024
Revised: 29 September 2024
Accepted: 04 October 2024

Keywords:
Biology
Marine Potential
Systematic Literature Review
Tarakan
Teaching

ABSTRACT

This is a Systematic Literature Review (SLR) research that aims to identify the marine potential of Tarakan City which can be used as teaching material in Marine Biology courses. Search using the Publish or Perish 8 application by analyzing articles indexed by Google Scholar and Crossref. After carrying out the process of identification, screening, eligibility, and inclusion, a total of 9 articles were obtained, consisting of 6 Google Scholar articles and 3 Crossref articles. The entire article was analyzed for its suitability with the material content in the marine biology semester learning plan (RPS). Findings of this study show that the marine biota of Tarakan City that can be used as teaching materials for marine biology are seaweed, *Signus Jjavus* fish, *Harpadon nehereus*, *Ilisha elongate*, Protista, and Mangroves Research locations at Amal Beach, Binalatung Beach, Mamburungan, Juata waters, Juata Laut waters, KKMB Tarakan City, and Sadau Island, Indonesia. These articles can be used as teaching material for marine biology regarding the geographical conditions of Indonesian seas, marine animals, marine plants, marine biogeochemical cycles, marine primary productivity, coastal biota, mangrove biota, and research methods for plankton, benthos, and nekton. This research contributes to the planning and preparing of marine biology learning resources based on local potential.

INTRODUCTION

The learning process can be developed by utilizing the uniqueness or potential abundance of an area (Ramdiah et al., 2020). The local potential is the potential possessed by an area that is specific or unique. This local potential can be utilized in the education sector to decentralize education (Alimah et al., 2018). A local potential that can be utilized as a means of education is Natural Resources (SDA), Human Resources (SDM), services, arts, culture, technology, history, geographical location, perspective, productivity, creativity, values, and norms (Nurhidayati & Khaeruman, 2021; Hayati et al., 2019; Ramdiah et al., 2020; Tisngati, 2015).

Local resources can support the success of community-based education programs. This is because the ongoing educational program is based on the abilities of the community by the community and for the community so that it will create a sense of belonging in the community. The learning outcomes will be even greater meaning felt by society (Bahri, 2016). Apart from that, learning based on local potential can make it easier for students to understand learning concepts because learning is more contextual and close to students' lives (Nurhidayati & Khaeruman, 2021), the learning process can also be more conducive (I. A. Hayati et al., 2019), and can improve relationships. students with the surrounding community and can connect local knowledge with modern knowledge (Ismiati, 2020).

Based on the results of the evaluation of the field practicum program for marine biology courses based on local potential which was carried out in 2022, information was obtained that the planning stages of the practical program were in the poor category, therefore the Marine Biology lecturer team is expected to be able to prepare and plan field practicum activities based on marine biology local potential well. One indicator that can be improved is providing practice guidelines based on local potential (Sam et al., 2023)

In addition to local potential-based practical guides, it turns out that other marine biology teaching materials such as modules, student worksheets, handouts, books, and learning videos do not yet exist or are not yet available. So far, the teaching team has used more power points when teaching. This was also a finding of the AMI (Internal Quality Audit) audit team in the Biology Education Department in 2022. Therefore, it is recommended that lecturers create Research and Community Service Guidelines for 2023 teaching materials for their courses. The availability of teaching materials is an important domain that must be provided in learning, because if teaching materials are limited or even non-existent, it can hinder the achievement of learning objectives (Adip, 2022)

From these problems, it can be concluded that creating teaching materials for marine biology courses is necessary to support the classroom and field learning process. Teaching materials are an important part of the implementation of education because they can help teachers deliver material, make learning easier and students will be more assisted and easier to learn (Magdalena et al., 2020). Marine biology teaching materials that are created or developed will later be integrated with local potential. This refers to Law Number 20 of 2003 Article 37, which emphasizes that the Education curriculum must include local content components.

The contextual marine biology learning process by utilizing local potential is certainly very feasible because it is supported by the geographical conditions of Tarakan City, which is an archipelagic country with abundant marine resources. So that later students will be able to directly observe/observe various flora and fauna in several biota in Tarakan City, Indonesia. Tarakan Borneo University is located in Tarakan City. This city is an archipelago in North Kalimantan Province, Indonesia. These geographical conditions make Tarakan City have abundant marine potential, so it is suitable if marine biology courses are taught more contextually.

However, before teaching materials for this course, it is necessary to carry out preliminary research regarding identifying various local potentials of Tarakan City. This is supported by the opinion Bahri (2016), that the first step that can be taken in planning the use of local potential in learning is to identify various local potential areas that are expected to be used in learning activities.

The results of the discovery of local potential in the region can then be integrated into learning both as media and learning resources (Nurhidayati & Khaeruman, 2021). Utilizing local potential in developing media or teaching materials will be easier (Suryanda et al., 2020) because learning objects are available in the surrounding environment. Activities to explore local potential. A direct connection to the course will provide a clear and relevant picture of the learning material (Sarah & Maryono, 2014).

Based on the statement above, the use of local potential-based teaching materials is important, and no researcher has studied this, especially using the Systematic Literature Review (SLR) approach.

Therefore, this study aims to identify various local potentials owned by Tarakan City that can be used as teaching materials. Through this study, it is expected to be a reference material and consideration in developing teaching materials for marine biology courses.

METHODS

Research Design

The design of this research is a Systematic Literature Review (SLR) (Purssell & McCrae, 2020). Systematic Literature Review is a research method for answering research questions systematically, explicitly, and comprehensively through the activities of identifying, evaluating, and synthesizing a collection of published articles (Fink, 2005; Kitchenham, 2007).

Population and Samples

The population and sample referred to in this research are all articles searched using the Publish or Perish 8 application. The population is 1000 articles consisting of 500 articles indexed by Google Scholar and 500 articles indexed by Crossref. After going through the article filtering stage, a sample of 9 articles was obtained, consisting of 6 articles indexed by Google Scholar and 3 articles indexed by Crossref.

Procedure

The first step is to create research questions. The research questions are 1) what marine biota in Tarakan City can be used as teaching materials?; 2) Where are the research locations that can be used as practicum locations?; and 3) What research results can be used as material for marine biology teaching materials? In this study, the protocol used refers to scientific procedures and reasons for systematic literature reviews (SPAR-4-SLR) (Paul et al., 2021). Search using the Publish or Perish 8 application by analyzing articles indexed by Google Scholar and Crossref. The keywords used are marine potential, Tarakan, and learning resources. There is no limitation on the year of publication. All articles obtained were then selected. Duplicate books, monographs, and articles are eliminated. Then screened again by reading the abstract. Articles with research locations outside Tarakan, inappropriate titles, and not pure research and repository publications are eliminated. Next, look at the suitability of the article by reading the contents of the results and discussion. Research results that are inadequate/not by the RPS (Semester Learning Plan) are eliminated. The final result was 9 articles.

Data Analysis Techniques

The remaining 9 articles were then summarized narratively and analyzed for their sustainability to the content of the material in the marine biology semester learning plan (RPS). Then presented through visualization and published

In detail the research process or stages can be seen in the following flowchart:

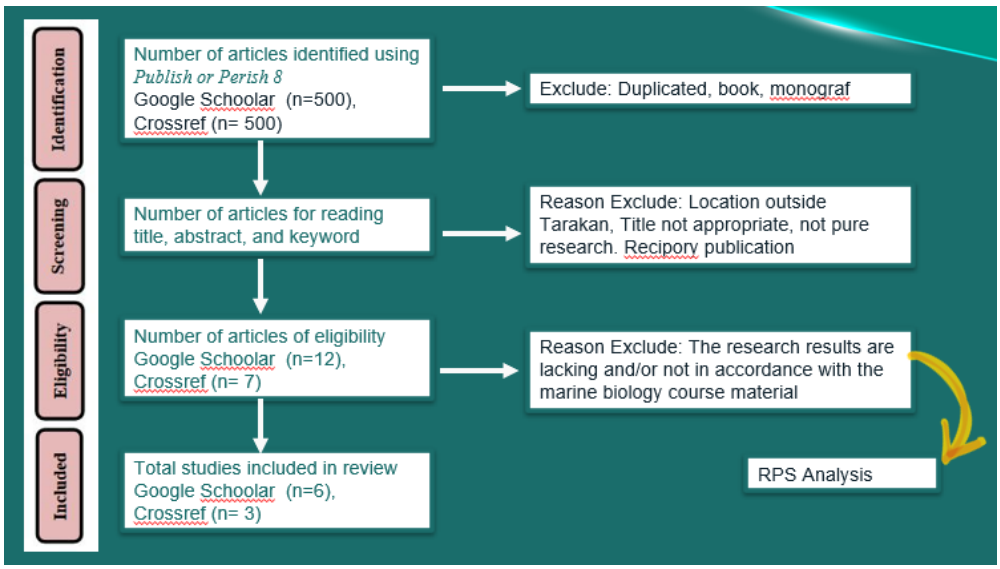

Figure 1. SLR Protocol uses SPAR-4-SLR

RESULTS AND DISCUSSION

1. What marine biota in Tarakan City can be used as teaching materials?

The results of the article review are presented in the following Table 1.

Table 1.
SLR Search Results

Article Code	Research Purposes	Writer	Publication year	Publisher	Marine Biota Studied
P1	Analyzing externalities arising from seaweed cultivation activities in the aspect of sustainable development in the Amal Coastal Area, Tarakan City	Hatta and Julisna	2021	Ekonomika journal	Seaweed
P2	Analyze biotechnical of conditionÂ index of Siganus javus	Salim	2013	Harpodon Borneo journal	*Siganus Javus* Fish
P3	To know the growth aspects and age structure of nomei fish (Harpodon nehereus) from the catch of fishermen in the waters of the city of Tarakan	Firdaus, et.al	2013	Akuatika journal	Nomei Fish (*Harpodon nehereus)*
P4	Analyze biotechnical of Model Growth absolute, allometri growth of Siganus javus	Achyani, et al	2012	Harpodon Borneo journal	*Siganus Javus* Fish
P5	To determine the types and impacts of aromatic hydrocarbons on the mangrove ecosystem	Rachmawani, et.al	2016	Manusia dan Lingkungan journal	Mangrove
P6	Studying the population of puput fish (Ilisha elongata) namely sex ratio, growth rate and mortality rate based on the catch of fishermen around the waters of Tarakan Island	Firdaus and Gazali	2011	Harpodon Borneo journal	Puput fish (*Ilisha elongata*)

P7	Knowing the diversity of Protista in mangrove forests	Wijarini, et al	2020	BJBE journal	Protista in Mangrove forest
P8	To predict the distribution and spawning time of Nomei Fish	Nugroho, et al	2017	Biogenesis: Jurnal Ilmiah Biologi	Nomei Fish (*Harpodon nehereus)*
P9	Analyzing the Suitability Level of Eucheuma Cottonii Seaweed Cultivation Land in Tarakan Waters with Limiting Factors of ENSO and Seasonal Variability	Avianti, et al	2015	Segara journal	Seaweed

Furthermore, from this article information was obtained that the marine biota that had been used as research samples can be seen in the following diagram:

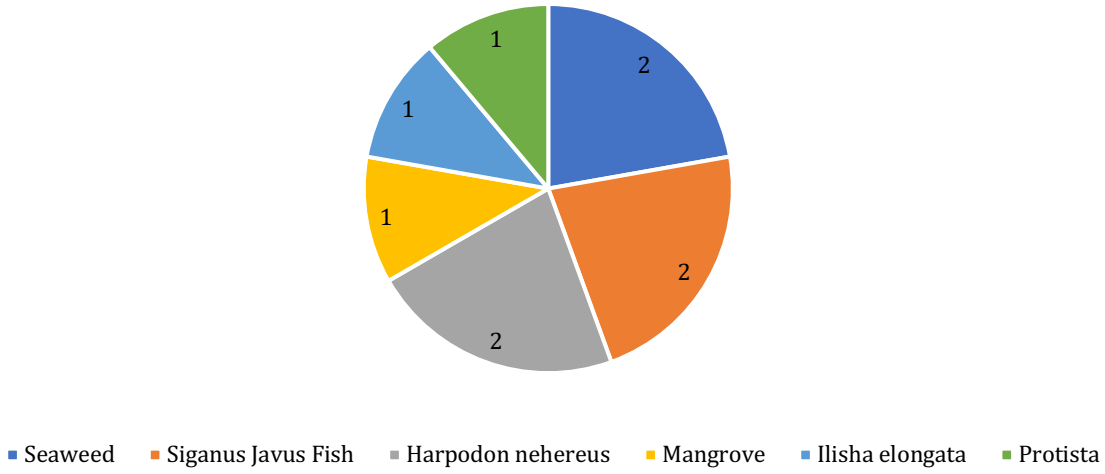

Figure 2. Biota Studied

From and Figure 2, it can be seen that the marine biota used as research samples based on the SLR results are Seaweed, *Siganus javus*, *Harpodon nehereus*, Mangrove, Protista, and *Ilisha elongate*. The samples most often used as research objects are *Harpodon nehereus, Siganus javus*, and Seaweed.

Tarakan City has marine potential in the form of several types of fish, including *Siganus javus, Harpodon nehereus,* and *Ilisha elongate*. These fish are one of the marine products commodities found in the waters of Tarakan City (Nugroho, et al., 2017; Firdaus & Salim, 2011; Achyani et al., 2012). Nomei fish (Harpodon nehereus) is even one of the typical souvenirs of Tarakan City, which is usually processed into thin dried fish (Nugroho, et al., 2017). The people of Tarakan City usually call it pepija thin fish. Siganus javus fish is endemic, has high potential in terms of market demand, and has a high protein content of 69.2% (wet weight) and 18.5% (dry weight) (Firdaus & Salim, 2011).

Tarakan City's next marine potential is seaweed. Many people cultivate seaweed in the Amal Beach Village, precisely along the sea coast of Amal Beach, there is also a small part in the Tanjung Pasir area. The type of seaweed produced in this area is *Euchema cottoni* (Djuanda & Julisna, 2021)

The coast of Tarakan Island is also covered with mangroves. Specifically, in Tarakan City, there is a mangrove ecotourism area called the Kawasan Konservasi Mangrove dan Bekantan (KKMB). In this area, there are 3 types of mangroves, namely *Avicennia marina, Rhizophora mucronata, and Rhizophora stylosa.* The total area of Tarakan City's mangrove forests is 47 ha (Sulaiman & Situmorang, 2023).

2. Where are the research locations that can be used as practicum locations?

From Figure 3, And then from the article, the data collection location is in the Tarakan area with the following specific locations (Table 2).

Table 2.
Research Specific Location

Article code	Research Location
P1	Amal beach
P2	Tarakan (Not Spesific)
P3	Juata
P4	Tarakan (Not Spesific)
P5	Binalatung
P6	Juata Laut
P7	KKMB Tarakan
P8	Juata
P9	Amal beach, mamburungan, and Sadau island

From the Table 2 above it can be concluded that the research location is along the coast of Tarakan Island with the most favorite locations being the Juata area and Amal Beach. The Juata area, especially Juata Laut, is in West Tarakan District, an area where almost the entire population works as fishermen, and is dominated by the Bugis tribe. In Juata Laut there is a production center for thin pepija fish and a shrimp company. Amal Beach is in East Tarakan District, an area where the majority of the population works as fishermen and seaweed farmers with a land area of 2,036 ha. This area is capable of producing large quantities of dry and wet seaweed (Djuanda & Julisna, 2021)

3. What research results can be used as material for marine biology teaching materials?

Table 3.
Sustainability of the content of the article with the Marine Biology course material

Article Code	Findings	Suitability to the Material
P1	The biggest positive externality is caused by the activities of seaweed farmers in the economic sector, namely, increased distribution of goods from coastal areas to out-of-coastal areas, increased distribution of goods from outside coastal areas into coastal areas, and increased production of food or goods in coastal areas. Meanwhile, the largest positive externality is caused by seaweed cultivation activities related to social and environmental problems, namely, the increasing damage to the mangrove ecosystem on the coast, health problems related to skin allergies, and environmental problems related to the increase in the volume of waste on land. A comparison of the ratio of positive and negative externalities shows that seaweed cultivation activities still cause greater negative externalities. Enhancement of Community income from seaweed cultivation activities has not demonstrated sustainable economic development with social and environmental dimensions not yet resolved. Sustainable development can be realized if community economic activities continue to run along with increasing social impacts and environmental conservation. (Djuanda & Julisna, 2021)	Marine plants and coastal biota (Study topic: Advantages and disadvantages of seaweed cultivation in the economic, social, and environmental fields, and description of coastal and marine ecosystems where seaweed cultivation is located)
P2	The percentage of condition index model values for male Siganus javus showed a flat body shape of 47.46%, a proportional body shape of 5.08%, and a fat body shape of 47.46%, while the condition index of females obtained a percentage of flat body shape. obese by 31.71% and very obese body shape by 4.88% (Salim, 2013)	Marine animals (exploratory study of marine animals in Tarakan City) and Nekton research methods
P3	The growth of male nomei fish has a maximum length growth of 33,847 cm and reaches an age of 206 days. Von Bertalanffy's growth model is Lt = 33.847 (1–2.71828 - 0.0176 (t +1.7928)) (males) (r = 0.9 and n = 481). The growth of female nomei fish has a maximum length growth of 35,743 cm at an age of 603 days, but female nomei fish at the age of 290 days have reached a length growth of around 35,068 cm. Von Bertalanffy's growth	Marine animals (exploratory study of marine animals in Tarakan City) and Nekton research methods

	model is Lt = 35.743 (1 – 2.71828 -0.0136 (t + 1.9025)) (females) (r = 0.99 and n = 239) (Firdaus et al., 2013)	
P4	1. The model obtained using the von approach Bertalanffy is: For male sex, the model obtained is Lt = 32.495 (1–2.71828-0.0091 (t+2.091)) (r = 0.627 and n = 59). The growth speed of male Siganus javus is 0.0091 cm/day, where the initial growth rate is 0.614 cm. The female sex model obtained was Lt = 38.128 (1–2.71828-0.0172 (t + 1.7889)) (r = 0.648 and n = 41). The growth speed of female Siganus javus is 0.0172 cm/day, where the initial growth is 1.155 cm. 2. The allometric growth model for male Siganus javus obtained a value of b < 2.608 which is negative allometry with a correlation value of 0.951 which has a very strong relationship and for the female sex obtained a value of b < 2.644 which has negative allometry with a correlation value of 0.937 which has very strong relationship (Achyani et al., 2012)	Marine animals (exploratory study of marine animals in Tarakan City) and Nekton research methods
P5	The content of aromatic hydrocarbon compounds in mangroves consists of; styrene 2,4,6-trimethyl, xylene, styrene, phenanthrene, and naphthalene 2-benzyl with quite high concentration values and is indicated as the cause of mass death of mangroves in the Binalatung area. An alternative treatment for aromatic hydrocarbon content is the phytoremediation method (Rachmawani et al., 2017)	Marine plants, mangrove biota, marine biogeochemical cycles, and primary productivity
P6	Comparison of the sex ratio values of the catches of puput fish (Ilisha elongata), namely 33 male fish and 102 female fish with a ratio of 1: 3.1. The growth rate of female fish is faster than the growth rate of male fish, where the growth rate of female fish is 2.3% per three months and the growth rate of male fish is 1.3% per three months. However, the maximum length of male puput fish is higher than the maximum length of female puput fish, where the maximum length of male puput fish is 41.615 cm while the minimum length of female puput fish is 38.565 cm. The mortality rate from fishermen's catches is estimated for female fish to be higher. faster compared to female fish where for female fish the value is 2.5% per three months, while for male fish the value is 2.2% per three months The mortality rate from fishermen's catches is estimated for female fish to be faster than for female fish, where for female fish the value is 2.5% per three months, while for male fish the value is 2.2% per three months (Firdaus & Salim, 2011)	Marine animals (exploratory study of marine animals in Tarakan City) and Nekton research methods
P7	Most of the Protista found are animal-like protista or protozoa. For algae-like protists, only chlorophyta algae were found, while fungus-like algae were not found. The diversity of protozoa found comes from the ciliate class. The diversity of Protists resulting from research in mangrove forests can be used as a learning resource for students taking Protista courses. Utilizing Protista diversity as a learning resource provides real experiences for students (Wijarini et al., 2020)	Marine animals, marine plants, mangrove biota, biogeochemical cycles and primary productivity, research methods for plankton, benthos and nekton
P8	Sampling locations spread across stations 1-3 are spawning habitats. Nomei fish spawn twice a year, namely June-August and December-February. If they spawn in June-August they will not spawn again in June-December (Nugroho et al., 2017)	Marine animals (exploratory study of marine animals in Tarakan City) and Nekton research methods
P9	In seaweed cultivation, environmental factors are greatly influenced by ENSO and seasonal variability. The waters east of Tarakan have a higher level of suitability than the west. The Indonesian Cross Current influences the transfer of water masses from the West Pacific hot pool into Tarakan waters. During the El Nino period and the East Season, the waters of	Geographical conditions of Indonesian seas, especially in Tarakan

	eastern Tarakan have a high level of suitability, and during La Nina and the West Season the high level of suitability moves to the north of the Tarakan waters. Analysis of the suitability of cultivated land using the scoring and weighting method shows that the waters around the Amal coast to the south have the highest suitability and the Mamburun and Sadau beaches have moderate suitability. Analysis of the level of suitability in Tarakan waters using sensing satellite data provides information on the El Nino period at Amal and Tanjung Simaya beaches, the La Nina period at Tanjung Simaya and Juata, the Normal period at Tanjung Binalatung and Simaya, the West Monsoon at Tanjung Simaya and Juata, and East Monsoon at Amal and Tanjung Selayang beaches (Avianti et al., 2015)

From the Table 3, in the first paper, the content and results of the research are by the material: 1) marine plants (algae) and 2) coastal biota. The first paper can be used as a reference in the case study learning model with the topic of studying the advantages and disadvantages of seaweed cultivation in the economic, social, and environmental fields, and a description of coastal and marine ecosystems where seaweed cultivation is located. Case study is a learning process where students are directed to study real cases or designed cases. The determining factor of the case study is the students' activeness in bringing real conditions into real life (Yusnidar & Syahri, 2022), learning becomes more contextual (Pernantah et al., 2022).

Papers 2, 3, 4, 6, 7, and 8 contain research results by the material: 1) marine animals with the topic of marine animal exploration studies, and 2) benthos and nekton research methods. The research results of paper 5 are following the material 1) marine plants, 2) mangrove biota, 3) marine biogeochemical cycles, and 4) primary productivity. Paper 9 is the material on the geographical conditions of the Indonesian sea, especially in the Tarakan City area.

The research findings in Papers 2,3,4,5,6,7,8 and 9 can be included in lecture materials which can then be developed into teaching materials, be it books, teaching modules, practical guides, and so on. Local potential studies for packaging teaching materials can be used as a reference for developing teaching materials based on local potential through adjustments to the curriculum, characteristics and needs of students and the abilities of lecturers (Situmorang, 2016)

Utilization of learning resources based on local potential can help improve learning outcomes (Destiara, 2020; Mardotilah et al., 2018), improve critical thinking and environmental awareness (Rahmi et al., 2023). In addition, the research location can be used as a location for practicum/field studies. Learning in the open air allows students to explore environmental problems, namely marine environmental problems (Doering & Valetsianos, 2008).

Research findings in Papers 2,3,4,5,6,7,8 and 9 can be included in lecture materials The collection of papers above can help us learn marine biology more contextually. Utilizing the potential that exists in the surrounding environment makes students not only understand the teaching material theoretically but also more applicable and care about the surrounding environment (Nurhidayati & Khaeruman, 2017). Biology lessons need to utilize local potential because biology studies must be relevant to students' lives and needs. Courses that are integrated with local wisdom are expected to develop regional potential and increase student creativity and character. Utilizing local potential in learning can save local wisdom, help students learn in real life, closer to everyday life, improve student relationships with the surrounding community, and connect local knowledge with modern knowledge (Ismiati, 2020). Local potential can be used as a biology learning resource, including marine biology because students can learn about the preservation of natural resources and their conservation (Nurmalasari et al., 2020). In addition, the use of local potential in maritime education can improve students' maritime literacy (Hayati & Ma'rifah, 2024).

CONCLUSION

The results of the research show that the marine biota of Tarakan City that can be used as teaching materials for marine biology are seaweed, *Siganus javus* fish, *Harpadon nehereus*, *Ilisha elongate*, Protista, and Mangroves with research locations at Amal Beach, Binalatung Beach, Mamburungan, Juata waters, Juata Laut waters, KKMB Tarakan City, and Sadau Island. So these locations

can be used as locations for field lectures or field practicums. The research results from these articles can be used as teaching material for marine biology regarding the geographical conditions of Indonesian seas, marine animals, marine plants, marine biogeochemical cycles, marine primary productivity, coastal biota, mangrove biota, and research methods for plankton, benthos, and nekton.

ACKNOWLEDGMENT

Thanks are given to the LPPM of the University of Borneo Tarakan who has agreed to fund this research through DIPA funds for the 2023 fiscal year (Decree 001/UN51.9/ST-PENELITIAN/2023). Then to the research team, as well as all colleagues in the Biology Education Department who have provided support.

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