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Quality Status of Coastal Waters of Special Economic Zone of Mandalika Central Lombok Based on the Community of Microalgae as Bioindicator

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Abstract: Coastal waters well known to provided large number of natural resources, but it recives some negative effects due to numerous ectivities take place on it, so it's quality status tend to decrease. The coastal waters of Mandalika SEZ Central Lombok is no in exception. Microalgae as maind primery producent, have been much reported as bioindicator for controlling the waters quality. Study for community of microalgae as bioindicator in the coastal waters of Mandalika SEZ Central Lombok never been done. This study was conducted to observed and analyze the potency of microalgae community in the coastal waters of the Mandalika SEZ for determining the quality status that waters. Five bottles of 150 ml volume sea waters samples were collected using a free fall nylon plankton net of 20 rm mesh sized. Samples were preserved using formalin in final consentration of 4%. Samples were observed in both laboratories of Biology Education Faculty of Teacher Training and Education and Biology Science Faculty of Math and Science, University of Mataram. Data were analyzed for counting of density, percentage dominancy, and species diversity indexs. Total 72 species of microalgae were fully indentified and *Chaetoceros didymum* was a dominant species with percentage dominacy and density of 16.243% and 143.949 ind/L, respectively. The highest dencity was recorded in sample taken in the Seger Beach (1567.941 ind./L), then followed by the beaches of Gerupuk, Serinting, Mandalika, dan Kuta with density velue of 1469.214 ind./L, 1038.217 ind./L, 759.023 ind./L, and 622.081 ind./L, respectively. Based on the data of microalgae density, species diversity indexs, and number of taxa, the five sampling sites have high percentage similarity (83.336%). Species diversity index of microalgae in the coastal waters of the Mandalika SEZ was in intermediate category (H'=3.415). Based on the rerults of this study, mainly based on the velue of microalgae species diversity indexs, it can be concluded, that the quality status of coastal waters of Mandalika SEZ Central Lombok was in non polluted category.

Keywords: Quality; Coastal Waters; Mandalika; Microalgae; Bioindicator

Introduction

Indonesia as an island country has the coastal line long more than 81.000 km (Resosoedarmo *et al.*, 1992, Dahuri, 2000), with the area of sea waters reaced 67% of the total areas (Noor, 2000). In that long coastal line, wide area of intertidal ecosystems lay down. The coastal line of the southern part of Lombok Island where the special economic zone (SEZ) of Mandalika Central Lombok lay down is an example. The coastal waters of the Mandalika SEZ is also mush be in much higher attentioned as it being a central of touristms activities in Lombok Island, including such as the international motor GP sircuit. Two previous researchs conducted by Bachtiar *et al.* (2019) and Karrnan *et al.* 2020 were as the mined inpiration for doing the research of the waters quality of the Mandalika SEZ Central Lombok based on microalgae as bioindicator.

This vest sea area is a priceless natural resource potential, as well as huge challange for its managment. One thing that it certain is that area aroudn the coast is wheree the activities and activities of the majority of the population re concentrated, including ports and residential areas, as well as targets for liquid and solid waste disposal. Various forms of activities carries out in coastal areas can be fatal to the condition of the coastal environment in general, for example pollution and the decrease in the quality of the ecosystem. Therefore, if it

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is not managed properly, it is possible that the balance of marine ecosystems will be disrupted. One of the biological indicatos that can be monitored early is the plankton community, especiallya phytoplankton. In this regars, coastal waters of the Mandalika special economic zone, Central Lombok, can also be monitore using phytoplankton as a biological indicator.

Changes in the quality of the aquatic environment are closely related to the potential of the waters, especially the organisms that live in them such as phytoplankton. Phytoplankton are microscopic organisms that play an important role in productivity of waters because at the tropic level they act as producers in the process of tranferring energy through the food chain (Sulistiowati et al., 2016). The exitence of phytoplankton, especially seen from the diversity and abundance of species, describes the characteristics of a waters whether the waters area polluted or not fertile or not. Therefore phytoplankton can be used as a bioindicator in evaluating the level of pollution of a water area (Nurbaeti and Octorina, 2012). Munch research has been done on phytoplankknton as bioindicator of seawater pollution including: Yuliana et al. (2012), Imran (2016), Faturohman et al. (2016) and Nasution et al. (2019).

Phytoplankton density in a waters describes the primary productivity of the aquatic ecosystem. Phytoplankton as aquatic unicellular organism are very sensitive to changes in aquatic ecosytems, which can also reflect the quality of the water. In this regard, phytoplankton is the most widely reported gropu of the aquatic organisms as a benchmark in controlling the quality of a waters. Loss of up to 5% of phytoplankton can cause a decrease in fish production by up to 70.000 tons per year (Harder et al., 1995). In this regards, water quality management is an important policy in enviromental and natural recource aspects (Hall and Smol, 1999), which requires special attention in order to adopt optimal management policies for welfare while still referring to sustainable and enviromentally friendly principles.

There has been no report on the potencial of microalgae (phytoplankton) communities in the waters of the SEZ Mandalika Central Lombok. Therefore, this research need to be done to : (1). Inventory and identify species of phytoplankton in the SEZ Mandalika, Central Lombok. (2). Calculating and analyzing the abundance, dominance and diversity of phytoplankton species in the SEZ Mandalika, Central Lombok. (3). Determining the status of Central Lombok Mandalika SEZ waters, based on micoalgae bioindicators.

Method

Location

Samplings of sea waters were conducted at five points along the coast of Kuta to Gerupuk in the coastal area the Mandalika SEZ Central Lombok (Figure 1) and geographic position of each sampling point is given in Table 1.

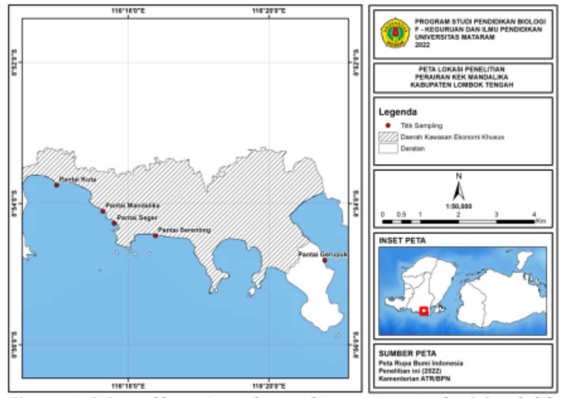


Figure 1. Map of location of sampling points in the Mandalika SEZ, Central Lombok

Table 1. Sampling points geografic position

Lokasi	Longitude	Latitude
Kuta (KUT)	116,2830576	-8,89563693
Mandalika (MAN)	116,2940278	-8,901887942
Seger (SGR)	116,2967789	-8,904413494
Serenting (SRT)	116,3057723	-8,907509062
Gerupuk (GRP)	116,3464858	-8,913803032

Samplings and Laboratory Obervation

Samples of five 150 ml volume bottles were taken using a 30 cm in diametre of free fall plankton net of 20 µm mesh sized. Plankton net was sunk and pull out as par as 20 m. All samples were preserved using formalin in 4% of final consentration preservation. Samples observation dan cell counting were conducted in the laboratory of Biology Education, Faculty of Teacher Training and Education. Photographs for some species were done in the Biology Science, Faculty of Math and Science University of Mataram. Microalgae species identification was done based morfological similarity (Hall dan Smol, 1999) using some books identication writen by: Labour (1930), Allen dan Cupp (1935), Davis (1955); Simonsen, (1974); Belcher and Swale, (1976); Taylor, (1976); Vinyard, (1979); Navarro, (1982); Yamji (1984); and Hernandez-Becerril, (1996).

Data Analyses

Data of microalga were analyzed for calculation of density (D), number of individual cell per littre, using formula of Romimuhtarto dan Juwana, (2001); Species important value (species percentage dominancy), using formula of Surasana dan Taufikurahman (1993); and species diversity index (H') based on the Shannon-Wienner Index, using formula of Cox (1976); Romimuhtarto dan Juwana, (2001); and Dahuri et al.

(1993). Water quality status was then determined based on the species diversity index (Wardana, 2006).

Result and Discussion

A total of 72 species of microalgae were celarly fully indentified in the coastal wates of the Mandalika SEZ, whith species diversity index was intermediate category (H'=3.415), and total density was 1095.754 ind/L. List of microalgae species including their distribution in sampling sites, density, perentage dominance are given in Appendix 1. The proportion of density, number of taxa, and value of species diversity index among sampling sites can be seen in Figure 2. The highest density of micoalgae was recorded in sampling site Seger beach (1567,941 ind/L), the followed by beaches of Grupuk, Serinting, Mandalika, and Kuta with density values were 1469, 214 ind/L, respectively. The number of taxa comparison among sampling sites was not so different. The highest number of taxa (44 taxa) was recorded in Serinting beach sampling site, and the lowest (37 taxa) was in sampling site of Kuta beach.

The microalgae species with the highest abudance and dominance was Cheatoceros didymum which had a density of 143.949 ind/L and a domination percentage of 16.243%. The cheatoceros genus comes with 19 species (the highest number of species) compared to the number of species from othe genera. Diatoms of the genus Chaetoceros are reported as an abundant componet of marine phytoplankton, but because of the large number of species and idenfitication it is difficul (Hernandez Becerill, 1996). The Chaetoceros genus, was also reported to have a higher number of species than the number of species of ohter genera in the coastal wates of Lombok Island, for example : the waters of the West Lombok Sheer harbor (Japa, 2000), the coastal waters of Sambelia, East Lombok (Japa and Suripto, 2003), the coastal waters The city of Mataram (Japa and Karnan, 2004), and the waters of the Gili Ranggo fishing reserve Serewe Bay, East Lombok (Japa et al., 2004), the waters of the fish auciton port (PPI) of Tanjung Luar (Audah et al., 2022), Padang et al.. (2020) in Broccoli Island Waters. The dominance of the presence of diatoms from genus Chaetoceros could be related to the form of colonies that form chains with a spiny morphology (having cheata) which allows a low cell sinking rate, and is less favored by herbivorous predatos (Wulandari et al. (2014).

Five species with the highest abundance and dominance values in the coastal waters area of SEZ Mandalika are: Chaetoceros didymum, (D=143,949 ind/L and NP=16,243%) Rhizosolenia stoltelphorthii (D=85,775 ind/L and NP=10,939%), Rhizosolenia fragilia (D=67,728 in/L and NP=9,287%), Psudeo-nitzshia sp. (D=62,420 ind/L and NP=8.802%), and Cheatoceros cinctum (D=60,085 ind/L and NP=7,357%). Furthermore, at each sampling point, the species with the highest abudance and dominance were not the same from one sampling point to another, including those in the area. Chaetoceros didymum was always present with the highest abudance and dominance at the four sampling points, expcept at the Grupuk Beach sampling point where it was recoreded with the second highest abudance and dominance, after Chaetoceros cinctum. In general, it can be concluded that Chaetoceros didymum is amicroalgae species that dominates the coastal waters of the Mandalika SEZ. Pictures of several are presented in Figure 4.

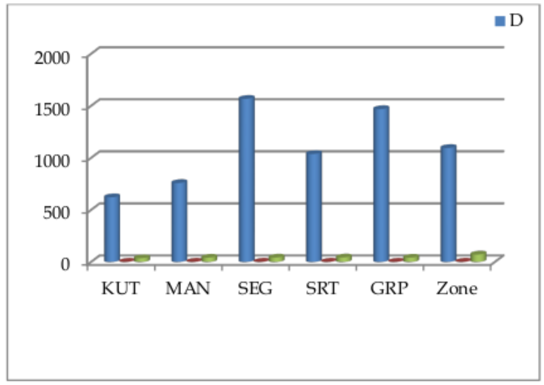


Figure 2. Proportion of microalgae density, species diversity index, and number of taxa in each sampling points and zone

Species of microalgae recorded with highest density and percentage dominacy was *Chaetoceros didymium*, where it's density was 143.949 ind/L and percentage dominancy was 16,243%. Genus *Chaetoceros* also presents with highest number species (19 species) compared to the others genera identified in the coastal waters of Mandalika SEZ. Diatom genus *Chaetoceros* reported to be abundonce componen of marine phytoplankton which has large number of species and very difficult to identify (Hernandez-Becerril, 1996). Genus *Chaetoceros,* was also reported to has more species than others genera in some coastal waters of Lombok Island, such as: in the waters of Lembar Harbour West Lombok (Japa, 2000), in the coastal waters of Sambelia East Lombok (Japa dan Suripto, 2003), coastal waters of Mataram City (Japa dan Karnan, 2004), and in the waters of fish santuary Gili Ranggo Serewe Bay East Lombok (Japa et al., 2004), and in the waters of fish landing based Tanjung Luar East Lombok (Audah et al., 2020). Padang et al. (2020) also reported that the community of mikroalgae in the coastal waters of Brokoli Island was dominated by diatom genus *Chaetoceros*. The dominance occurance of diatom genus Chaetoceros in some coastal waters can be highly related to colony formation and morphological much chaetae, so their sinking opportunity is low and they tend to be rejected by herbivore predators (Wulandari et al., 2014).

Five species of microalgae recorded in highest density and percentage dominacy in the coastal waters of Mandlika SEZ were: *Chaetoceros didymun*, (D=143,949 ind./L dan IV=16,243%) *Rhizosolenia stoltelphorthii* (D=85,775 ind./Ldan IV=10,934%), *Rhizosolenia fragilima* (D=67,728 ind./L dan NP=9,287%), *Pseudo-nitzschia* sp. (D=62,420 ind./L dan IV=8,802%), dan *Chaetoceros cinctum* (D=60,085 ind.L dan IV=7,347%). Furthermore, in each sampling site, species presented in highest density and percentage dominacy was not similar betewen one to the others sampling sites, including to all areas. However, *Chaetoceros didymum* always presents with highest density and percentage domiancy in the fist four sampling sites, exept in the sampling site of Gerupuk coastal water, it was recorded in the second place, after *Chaetoceros cinctum*. In general, it can be concluded that *Chaetoceros didymun* was the dominant species in the waters of Mandalika SEA. Photographes for some species were provided in Figure 4.

The percentage of similarity between sampling points was analyzed according to the Bray Curtis Cluster Analysis using Probiodiversity Program based on data of abundance, diversity index, and number of microalgae taxa and the results were as shown in **Figure 3.** The five sampling points were diveded into three groups, namely Kuta Beach being one with Mandalika Beach, Seger Beach being one group with Gerupuk Beach, and Serinting Beach in one group. The Seger and Gerupuk Beach side points had the highest similarity percentage (96.806%), and in general the five sampling points had a hight similarity (83.336%).

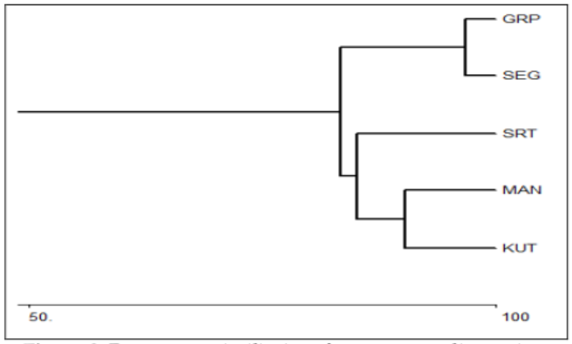
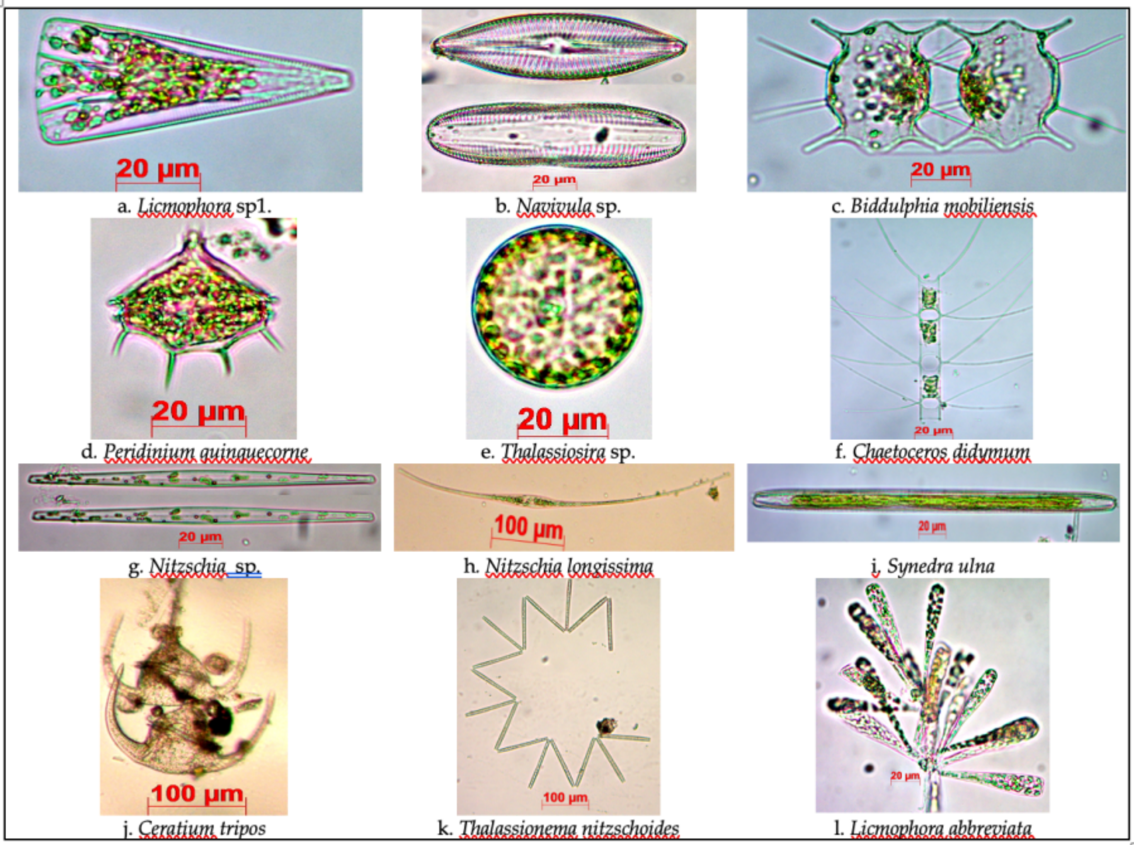


Figure 3. Percentage similiarity of among sampling points



a. *Licmophora* sp1. b. *Navivula* sp. c. *Biddulphia mobiliensis*
d. *Peridinium quinquecorne* e. *Thalassiosira* sp. f. *Chaetoceros didymum*
g. *Nitzschia* sp. h. *Nitzschia longissima* i. *Synedra ulna*
j. *Ceratium tripos* k. *Thalassionema nitzschoides* l. *Licmophora abbreviata*

Figure 4. Photographes of some species of microalgae in the Mandalika SEZ coastal waters

The index value of microalgae species diversity in the waters of Mandalika SEZ Kuta Central Lombok is 3.415 (medium category). Thus it can be said that the status of the quality of the waters of Mandalika SEZ, Kuta, Centeral Lombok, based on the diversity index of microalgae species as a bioindicator, is in the category of not being polluted. These results are in accordance with what was stated by Barus (2020), that a waters that have a microalgae species diversity index of greater than 2 indicates the waters are not polluted. The water quality of Central Lombok's Mandalika SEZ is still better than the Tanjung Luar Fish Auction Port (FAP) waters which are classified as moderately polluted (Audah et al., 2020). The index value of microalgae species diversity in the waters of the Mandalika SEZ was also higher than the species diversity index of the class Bacillariophyceae in the waters of Klui Beach, West Lombok, which was 2.37, as reported by Hadi et al. (2022).

Conclusion

From the results of this study it can be concluded: (1). Seventy-two species of microalgae were identified in the coastal waters of Mandalika SEZ with a medium species diversity index (H'+3.415), and a population density for the entire area of 1095.754 ind/L. (2). The highest abudance was recorded at the sampling point located at Seger Beach (1567.941 ind/L). (3). The microalgae species with the highest abundance and dominance was Cheatoceros didymum which had a density of 143.949 ind/L and a domination percentage of 16.243%. (4). The Cheatoceros genus comes with 19 species (the highest number of species) compared to the number of species from other genera. (5). The Water quality status of SEZ Mandalika Kuta, Centeral Lombok is not in polluted condition. (6). The similarity between sampling points is high, reaching 83.336%.

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References

Allen, W.E., & Cupp, E.E. (1935). Plankton Diatoms of the Java Sea. *Annales du Jardin Botanique de Buitenzorg*, 44.101-174. Retrieved from https://www.semanticscholar.org/paper/Plankton-d5a723295569d2a88281e555409302a1e14c52f4

Audah, N., L. Japa., & Yamin, M. (2020). Abundance and Diversity of Diatom Class Bacillariophyceae as Bioindictaor of Pollution in the Waters of Tanjung Luar Fish Landing Based. *Jurnal Biologi Tropis*, 20(3). 525-531. https://doi.org/10.29303/jbt.v20i3.2343

Bachtiar, I., Bahri, S., & Japa, L. (2019) *Keanekargaman Genetik cacing Nyale Di Pesisir Selatan Pulau Lombok.* Laporan Penelitian. LPPM Universitas Mataram.

Barus, I.T.A. (2020). *Limnologi*. Makassar: CV. Nas Media Pustaka.

Belcher, J.H., & Swale, E.M.F. (1976) *A Beginner's Guide to Freshwater Algae*, Institude of Terrestrial Ecology Natural Environmental Research Council, Cambridge, London,

Dahuri, R. (2000) Kebijaksanaan Pengelolaan Sumberdaya Kelautan (Pesisir, Laut dan Pulau-Pulau Kecil), *Makalah Konggres dan Seminar Kelautan Nasional KTI III*, Lombok.

Dahuri, R., Putra, I.N.S., Zairion., & Sulistiono. (1993) *Metode dan Teknik Analisis Biota Perairan, Pusat Penelitian Lingkungan Hidup*, Lembaga Penelitian, IPB, Bogor.

Davis, C.C. (1955). *The Marine and Freshwater Plankton*, Michigan State University Press, Chicago.

Cox, G.W. (1976). *Laboratory Manual of General Ecology*, W.M.C. Brown Co. Publisher, Iowa.

Faturohman, I., Sunarto, dan Nurruhwati, I. (2016). Korelasi Kelimpahan Plankton dengan Suhu Perairan Laut Di Sekitar PLTU Cirebon. *Jurnal Perikanan Kelautan*, 7(1).115–122.

Hadi, Y.S., Japa, L., & Zulkifli, L. (2022). Community Structure of Bacillariophyceae in the Water of Klui Beach, North Lombok. *Jurnal Biologi Tropis*, 22(2). 557-564. https://doi.org/10.29303/jbt.v22i2.3398

Hall, R.I., & Smol, J.P. (1999). Diatoms as Indicators of Lake Eutrophication, di dalam E,F, Stoermer dan J,P, Smol (Editor). *The Diatoms: Applications for the Environmental and Earth Sciences*. Cambride University Press, United Kingdom.

Harder, D.P., Worrest, R.C., Kumar, H.D., & Smith, R.C. (1995). Effects of Increased Solar Ultraviolet Radiation on Aquatic Ecosystems, *Ambio*, 24(3): 174-180.

Hernandez-Becerril, D.U. (1996). A Morphological Study of *Chaetoceros* Species (Bacillariophyta) from the Plankton of the Pacific Ocean of Mexico. *Bull, Nat, Hist, Mus, Lond, (Bot,)*, 26(1). 1-73.

Imran, A. (2016). Struktur Komunitas Plankton sebagai Bioindikator Pencemaran di Perairan Pantai Jeranjang Lombok Barat. *JIME*, 2(1): 1-8. http://dx.doi.org/10.58258/jime.v2i1.17

Japa, L. (2000). Seasonal Succession of Phytoplankton Communities in Lombok Indonesian Coastal Waters, with Emphasis on Species of the Diatom

Genera Pseudo-nitzshia and Thalassiosira. *Thesis*. Program Master, Universitas Tasmania.

Japa, L., & Suripto. (2003). Inventarisasi Spesies Fitoplankton Di Kawasan Perairan Budidaya Kerang Mutiara Dadap Sambelia Lombok Timur, *Laporan Penelitian*, Lembaga Penelitian Universitas Mataram.

Japa, L. & Karnan. (2004). Studi Komunitas Fitoplankton Di Perairan Pantai Kota Mataram, *Laporan Penelitian*, Universitas Mataram.

Japa, L., Karnan, & Santoso, D. (2004). Survei Kuantitatif Komunitas Fitoplankton dan Zooplankton Perairan Suaka Perikanan Gili Ranggo, Teluk Serewe, Lombok Timur, *Laporan Penelitian*, Prog. Pend. Biologi, FKIP Universitas Mataram.

Karnan, D, Santoso, L. Japa, B.S. & Handayani, (2020). Literasi Kebaharian Siswa Sekolah Dasar dan Menengah Di Kawasan Ekonomi Khusus (KEK) Mandalika Lombok Tengah, *Laporan Penelitian PNBP*, LPPM Universitas Mataram.

Lebour, M.V. (1930). *The Planktonic Diatoms of Northern Seas*, Adlard and Son, Limited, London.

Linus, Y., Salwiyah, & Irawati, N. (2016). Status Kesuburan Perairan Berdasarkan Kandungan Klorofil- a di Perairan Bungkutoko Kota Kendari. *Jurnal Manajemen Sumber Daya Perairan*, 2(1):101–111. Retrieved from http://ojs.uho.ac.id/index.php/JMSP/article/view/2498

Nasution, A., Widyorini, N., & Purwanti, F. (2019). Analysis of Phytoplankton Abundance to Nitrate and Phosphate in the Morosari Waters, Demak. *Management of Aquatic Resources Journal (MAQUARES), 8*(2), 78-86. https://doi.org/10.14710/marj.v8i2.24230.

Navarro, J,N. (1982). A Survey of the Marine Diatoms of Puerto Rico III, Suborder Biddulphiineae: Family Chaetoceraceae. *Botanica Marina*, 25.305-319. https://doi.org/10.1515/botm.1982.25.7.305

Noor, A. (2000). Program Buginesia (Upaya Mengisi Matriks Pengetahuan Kelautan Indonesia) Dan Gagasan Pengembangan Riset Kelautan KTI, *Makalah Konggres dan Seminar Kelautan Nasional KTI III*, Lombok.

Nurbaeti, N., & Octorina, P. (2012). Hubungan Keanekaragaman Fitoplankton dengan Kualitas Air di Situ Minera Bekas Galian Pasir Gekbong, Cianjur-Jawa Barat. *Jurnal Pertanian-UMMI*, 1(2):1–10.

Padang, R.W.A.L., Nurgayah, W., & Irawati, N. (2020). Keanekaragaman Jenis dan Distribusi Fitoplankton Secara Vertikal di Perairan Pulau Brokoli. *Sapa Laut*, 5(1). 1–8.

Resosoedarmo, R.S., Kartawinata, K., & Soegiarto, A. (1992). *Pengantar Ekologi*, Remaja Rosdakarya, Bandung.

Romimuhtarto, K., & Juwana, S. (2001). *Biologi Laut Ilmu Pengetahuan tentang Biota Laut*, Djambatan, Jakarta.

Round, F.E., Crawford, R.M., & Simola, H. (1990). *The Diatom: Biology and Morphology of the Genera*, Cambriage University Press, Cambridge, UK.

Simonsen, R. (1974). The Diatom Plankton of the Indian Ocean Expedition of R/V 'Meteor" 1964-1965, *"Meteor" Forsch,-Ergebnisse, Berlin Stuttgart*, 19(D).1-107,

Sulistiowati, D., Tanjung, R.H.R., & Lantang, D. (2016). Keragaman dan Kelimpahan Plankton sebagai Bioindikator Kualitas Lingkungan di Perairan Pantai Jayapura. *Jurnal Biologi Papua*, 8(2). 79–96. https://doi.org/10.31957/jbp.56

Surasana, E., & Taufikurahman. (1993). *Penuntun Praktikum Ekologi Tumbuhan*, Jurusan Biologi, FMIPA, ITB, Bandung

Taylor, F.J.R. (1976). *Dinoflagellates from the International Indian Ocean Expedition: A Report on Material Collected by the R,V, "Anton Bruun" 1963-1964*, Stuttgart, E, Schweizerbart'sche Verlagsbuchhandlung (Nagele u, Obermiller),

Vinyard, W.C. (1979). *Diatoms of North America*, Mad River Press, Inc. California,

Wardhana. (2006). *Pelatihan Penyusun Analisis Mengenai Dampak Lingkungan: MetodaPrakiraan Dampak dan Pengelolaannya pada Komponen Biota Akuatik*. Jakarta: Universitas Indonesia.

Wulandari. D.Y., Pratiwi. N.T.M., & Adiwilaga. E.M. (2015). Distribusi Spasial Fitoplankton di Perairan Pesisir Tangerang. *Jurnal Ilmu Pertanian Indonesia, 19*(3), 156-162. Retrieved from https://journal.ipb.ac.id/index.php/JIPI/article/view/9150.

Yamaji, I. (1984). *Illustrations of The Marine Plankton of Japan* 3rd. Eddition. Hoikusha Publishing Co., Ltd., Japan.

Yuliana, Adiwilaga, E. M., Harris, E., dan Pratiwi, N. T. M. (2012). Hubungan Antara Kelimpahan Fitoplankton dengan Parameter Fisik-Kimiawi Perairan di Teluk Jakarta. *Jurnal Akuatika*. 3(2):169–179.
http://jurnal.unpad.ac.id/akuatika/article/view/1617

Appendix 1. List of microalgae species, distribution, density, and percentage dominace

No.	Nama Spesies	KUT	MAN	SEG	SRT	GRP	D (ind./L)	NP (%)
1.	*Bacteriatrum comasum*					+	4,034	0,965
2.	*B. delicatulum*			+	+		19,745	2,990
3.	*B. hyalinum*					+	4,459	1,004
4.	*B. varian*			+	+	+	11,677	2,557
5.	*Biddulphia mobiliensis*				+		0,212	0,319
6.	*B. obtusa*	+					0,849	0,377
7.	*B. puchella*	+					0,425	0,338
8.	*Cerataulina* sp.	+	+	+	+		26,327	4,187
9.	*Ceratium tripos*				+		0,212	0,319
10.	*Chaetoceros affine*			+	+	+	14,225	2,788
11.	*C. atlanticum*	+					1,274	0,415
12.	*C. cinctum*	+	+			+	60,085	7,251
13.	*C. compressum*	+	+				8,493	1,669
14.	*C. costatum*		+			+	6,582	1,795
15.	*C. curvisetum*			+	+	+	57,962	7,059
16.	*C. didymum*	+	+	+	+	+	143,949	16,063
17.	*C. distan*				+	+	1,486	0,734
18.	*C. heurchii*					+	1,486	0,434
19.	*C. holsaticum*		+				1,062	0,396
20.	*C. laciniosum*			+			10,191	1,524
21.	*C. lorenzianum*	+	+			+	4,883	1,641
22.	*C. membranaceus*				+		8,705	1,389
23.	*C. messanense*		+		+	+	3,397	1,207
24.	*C. mitra*			+	+		20,594	2,768
25.	*C. paradoxum*		+		+		3,397	0,907
26.	*C. peruvianum*		+			+	0,425	0,637
27.	*C. pseudodechaeta*		+				8,068	1,331
28.	*C. tortissimum*		+	+			19,533	2,971
29.	*Climacodium frauenfeldianum*					+	0,849	0,377
30.	*Climacosphenia* sp.	+	+				8,917	1,708
31.	*Coconeis* sp.	+		+	+	+	1,699	1,651
32.	*Coscinodiscus* sp.	+	+	+	+		2,335	1,709
33.	*Cyclotella* sp.	+		+	+		2,335	1,110
34.	*Cymbella* sp.				+		0,212	0,319
35.	*Diatomae* sp.	+	+	+	+	+	15,074	3,165
36.	*Eucampia zoodiacus*	+	+	+	+	+	44,161	5,506
37.	*Fragilaria* sp.	+	+	+	+		11,465	2,538
38.	*Gyrosigma* sp.	+		+	+	+	2,123	2,289
39.	*Hemiaulus cornuta*		+				0,425	0,338
40.	*H. Haukii*				+		0,425	0,338
41.	*H. membranaceus*		+	+		+	54,989	6,789
42.	*H. sinensis*		+	+	+	+	33,121	5,402
43.	*Navicula* sp.	+	+	+	+	+	4,883	3,138
44.	*Nitzschia longissima*	+	+	+	+	+	8,280	3,147
45.	*N. sigma*	+					0,425	0,338
46.	*Nitzschia* spp.	+	+	+	+	+	17,622	4,594
47.	*Leptocylendricus danicus*	+	+	+	+	+	36,943	6,348
48.	*Licmophora abbreviata*	+	+	+	+	+	4,034	2,163
49.	*Oscillatoria* sp.		+	+		+	1,486	1,033
50.	*Peridinium quinquecorne*			+		+	1,062	0,695
51.	*Peridinium* sp.			+	+	+	2,548	1,130
52.	*Prorocentrum gracille*	+					0,212	0,319
53.	*Pseudo-nitzschia* sp.	+	+	+	+	+	62,420	8,661
54.	*Rhizosolenia alata*	+	+	+	+	+	18,259	4,652
55.	*R. calcar*	+	+		+		0,849	0,975
56.	*R. delicatula*		+	+	+	+	33,758	5,460
57.	*R. fragillima*	+	+	+	+	+	67,728	9,143
58.	*R. hebetata*	+	+	+	+	+	2,760	1,748
59.	*R. imbricata*	+	+	+	+	+	47,771	7,331
60.	*R. setigera*		+	+	+	+	6,582	2,993

61.	*R. Stoltelphorthii*	+	+	+	+	+	85,775	10,781
62.	*R. styliformis*		+	+			0,637	0,956
63.	*Stauroneis membranacea*	+	+	+	+	+	7,643	3,089
64.	*S. thamensis*	+		+	+	+	18,471	3,773
65.	*Suriella* sp.	+		+		+	1,062	1,294
66.	*Synedra ulna*		+	+		+	1,699	1,651
67.	*Tabellaria* sp.	+	+	+			19,533	3,570
68.	*Thalassionema nitzschicoides*				+	+	13,163	2,093
69.	*Thalassiosira* sp.	+	+	+	+		3,397	2,404
70.	*Thalassiotrix frauenfeldii*			+	+		2,335	0,811
71.	*Triseratium favus*	+	+	+		+	1,486	1,333
72.	*T. reticulum*		+		+		1,062	0,995
	Jumlah	37	42	43	44	42	1095,754	200.000

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