DAFTAR PUSTAKA

Adrim, M. 2011. Struktur komunitas ikan karang di Perairan Kendari. Pusat Penelitian Oseanografi – LIPI. UNPAD. Jatinangor.

Afeworki, Y., Videler, J.J., & Bruggemann, J.H. 2013. Seasonally changing habitat use patterns among roving herbivorous fishes in the southern Red Sea: the role of temperature and algal community structure. Coral Reefs, 32(2): 475–485. doi:10.1007/s00338-012-1000-2.

Allen, G. 1997. Marine fishes of tropical Australia and South East Asia. A Field Guide for Angler and Diver. Western Australia Museum, Perth.

Allen, G., Steene, R., Hulmann, P., & Deloach, N. 2018. Reef Fish Identification Tropical Pacific (Second Edition). New World Publication Inc. Jacksonville, Florida, USA.

Aswani, S., Albert, S., Sabetian, A., & Furusawa, T. 2007. Customary management as precautionary and adaptive principles for protecting coral reefs in Oceania. Coral Reefs, 26: 1009–1021.

Bellwood, D., & Wainwright, P. 2001. Locomotion in labrid fishes: implications for habitat use and cross-shelf biogeography on the Great Barrier Reef. Coral Reefs, 20(2): 139–150. doi:10.1007/s003380100156.

Bellwood, D.R., & Wainwright, P.C. 2002. The History and Biogeography of Fishes on Coral Reefs. Coral Reef Fishes, 5–32. doi:10.1016/b978-012615185-5/50003-7.

Bellwood, D.R., Hughes, T.P., Folke, C., & Nystrom, M. 2004. Confronting the coral reef crisis. Nature, 429: 827-833.

Bellwood, D.R., Hughes, T.P., & Hoey, A.S. 2006. Sleeping functional group drives coral reef recovery. Current Biology, 16: 2434–2439.

Bellwood, D.R., Pratchett, M.S., Morrison, T.H., Gurney, G.G., Hughes, T.P., Álvarez-Romero, J.G., & Cumming, G.S. 2019. Coral reef conservation in the Anthropocene: Confronting spatial mismatches and prioritizing functions. Biological Conservation. doi:10.1016/j.biocon.2019.05.056.

Bonaldo, R.M., Hoeyand, A.S., & Bellwood, D.R. 2014. The Ecosystem Roles of Parrotfishes on Tropical Reefs. Oceanography and Marine Biology, 52: 81–132. doi:10.1201/b17143-3.

Burke, L., Reytar, K., Spalding, M., & Perry, A. 2009. Reefs at Risk Revisited in the Coral Triangle. World Resources Institute, Washington DC. USA.

Burkepile, D.E., & Hay, M.E. 2008. Herbivore species richness and feeding complementarity affect community structure and function on a coral reef. Proceedings of the National Academy of Sciences, 105(42): 16201–16206. doi:10.1073/pnas.0801946105.

Ceccarelli, D.M., Jones, G.P., & McCook, L.J. 2011. Interactions between herbivorous fish guilds and their influence on algal succession on a coastal coral reef. Journal of Experimental Marine Biology and Ecology, 399(1): 60–67. doi:10.1016/j.jembe.2011.01.019.

Clements, K.D., German, D.P., Piché, J., Tribollet, A., & Choat, J.H. 2016. Integrating ecological roles and trophic diversification on coral reefs: multiple lines of evidence identify parrotfishes as microphages. Biological Journal of the Linnean Society. doi:10.1111/bij.12914.

Clifton, K.E. 1995. Asynchronous food availability on neighboring Caribbean coral reefs determines seasonal patterns of growth and reproduction for the herbivorous parrotfish Scarus iserti. Mar. Ecol. Prog. Ser, 116: 39-46.

Cole, A.J., Pratchett, M.S., & Jones, G.P. 2008. Diversity and functional importance of coral-feeding fishes on tropical coral reefs. Fish and Fisheries, 9(3): 286–307. doi:10.1111/j.1467-2979.2008.00290.x.

English, S., Wilkinson, C., & Baker, V. 1997. Survey Manual for Tropical Marine Resources. Australian Institute of Marine Science, Townsville. 368 pp.

Estradivari., Setiawan, E., & Yusri, S. 2009. Pengamatan jangka panjang terumbu karang Kepulauan Seribu (2003-2007). Yayasan Terumbu Karang Indonesia, Jakarta.

Faizal, A., Jompa, J., Nessa, N., & Rani, C. 2012. Pemetaan spasio-temporal ikan-ikan herbivora di Kepulauan Spermonde, Sulawesi Selatan. Jurnal Ikhtiologi Indonesia, 12(2): 121-133.

Farghal, T.K., Mohames, M.A.Z., & Mostafa, M.F. 2021. Abundance diversity and distribution of coral reef fish families in the Egyptian Red Sea at Hurghada Egypt. Egyptian Journal of Aquatic Biology and Fisheries, 25: 541-554.

Fazillah, M.R., Afrian, T., Razi, N.M., Ulfah, M., & Bahri, S. 2020. Kelimpahan, keanekaragaman dan biomassa ikan karang pada pesisir ujung panko, Kabupaten Aceh Besar. *J* Perikanan Tropis, 7(2): ISSN: 2355-5564.

Feary, D.A., Almany, G.R., McCormick, M.I., & Jones, G.P. 2007. Habitat choice, recruitment and the response of coral reef fishes to coral degradation. Oecologia, 153(3), 727–737. doi:10.1007/s00442-007-0773-4.

Fong, C., Gaynus, C., & Carpenter, R. 2020. Extreme rainfall events pulse substantial nutrients and sediments from terrestrial to nearshore coastal communities: a case study from French Polynesia. Scientific Reports, Los Angeles, USA. 10.1038/s41598-020-59807-5.

Froese, R., & Pauly, D. 2000. FishBase 2000, Concepts, Design and Data Sources. ICLARM Contrib. No.1594. International Center for Living Aquatic Resources Management (ICLARM). Los Banos, Laguna, Philippines. 344 p.

Giffin, A.L., Rueger, T., & Jones, G.P. 2019. Ontogenetic shifts in microhabitat use and coral selectivity in three coral reef fishes. Environmental Biology of Fishes, 102: 55–67. doi:10.1007/s10641-019-0842-7.

Glynn, P.W., & Manzello, D.P. 2015. Bioerosion and Coral Reef Growth: A Dynamic Balance. Coral Reefs in the Anthropocene, 67–97. doi:10.1007/978-94-017-7249-5_4.

Goatley, C.H.R., & Bellwood, D.R. 2012. Sediment suppresses herbivory across a coral reef depth gradient. Biology Letters, 8(6): 1016–1018. doi:10.1098/rsbl.2012.0770.

Graham, N.A.J., & Nash, K.L. 2013. The importance of structural complexity in coral reef ecosystems. Coral Reefs, 32(2): 315–326.

Green, A., & Bellwood, D.R. 2009. Monitoring Functional Groups of Herbivorous Reef Fishes Coral Reef Resilience - A practical Guide for Coral Reef Managers in the Asia Pacific Region. IUCN Working Group on Climate Change and Coral Reefs. IUCN, Gland, Switzerland.

Grutter, A.S., Bejarano, S., Cheney, K.L., Goldizen, A.W., Sinclair-Taylorand, T., Waldie, P.A. 2020. Effects of the cleaner fish *Labroides dimidiatus* on grazing fishes and coral reef benthos. Marine Ecology Progress Series, 643: 99–114.

Hadi, T.A., Abrar, M., Giyanto, Prayudha, B., Johan, O., Budiyanto, A., Dzumalek, A.R., Alifatri, L.A., Sulha, S., & Suharsono. 2020. The Status of Indonesian Coral Reefs 2019. Puslit Oseanografi-LIPI, Jakarta.

Hatcher, B.G. 1984. A maritime accident provides evidence for alternate stable states in benthic communities on coral reefs. Coral Reefs, 3: 199-204.

Hernández-Landa, R.C., & Aguilar-Perera, A. 2018. Structure and composition of surgeonfish (Acanthuridae) and parrotfish (Labridae: Scarinae) assemblages in the south of the Parque Nacional Arrecife Alacranes, southern Gulf of Mexico. Marine Biodiversity, 49(2).doi:10.1007/s12526-017-0841-x.

Hill, J., & Wilkinson, C.R. 2004. Methods for Ecological Monitoring of Coral Reefs. Australian Instititue of Marine Science, Townsville, Australia.

Hughes, T.P., Rodriguez, M.J., Bellwood, D.R., Ceccarelli, D., Hoegh-Guldberg, O., McCook, L., Moltschaniwskyj, N., Pratchett, M.S., Steneck, R.S., & Willis, B. 2007. Phase shifts, herbivory, and the resilience of coral reefs to climate change. Current Biology, 17: 1–6.

Husain, A. A. A. 2012. Bio-Ekologi Ikan Karang Herbivor dan Hubungannya dengan Kelompok Alga Bentik di Paparan Terumbu Karang Kepulauan Spermonde, Disertasi Sekolah Pasca Sarjana Universitas Hasanuddin, Makassar.

Johnson, M.D., Comeau, S., Lantz, C.A., & Smith, J.E., 2017. Complex and interactive effects of ocean acidifcation and temperature on epilithic and endolithic coral-reef turf algal assemblages.Coral Reefs, 36: 1059–1070. https://doi.org/10.1007/s00338-017-1597-2

Kegler, H.F., Lukman, M., Teichberg, M., Plass-Johnson, J., Hassenruck, C., Wild, C., & Gardes, A. 2017. Bacterial community composition and potential driving factors in different reef habitats of the Spermonde Archipelago, Indonesia. Frontiers in. Microbiology, 8: 662. doi:10.3389/fmicb.2017.00662.

Klumpp, D.W., & McKinnon, A.D. 1989. Temporal and spatial patterns in primary production of a coral-reef epilithic algal community. J. Exp. Mar. Biol. Ecol, 131(1): 1-22.

Kuiter, R.H., & Tonozuka, T. 2001. Photo Guide: Indonesian Reef Fishes. Zoonetics. Seaford VIC 3198, Australia.

Lamb, J.B., Van de Water, J.A.J.M., Bourne, D., & Altier, C. 2017. Seagrass ecosystems reduce exposure to bacterial pathogens of humans, fishes, and invertebrates. Science, 355(6326): 731-733.

Latuconsina, H.M., Nessa, M.N., & Rappe, R.A. 2012. Komposisi spesies dan struktur komunitas ikan padang lamun di Perairan Tanjung Tiram – Teluk Ambon Dalam. J. Ilmu dan Teknologi Tropis, 4(1): 35-46.

Lewis, S.M., & Wainwright, P.C. 1985. Herbivore abundance and grazing intensity on a Caribbean coral reef. Journal of Experimental Marine Biology and Ecology, 87(3): 215–228. doi:10.1016/0022-0981(85)90206-0.

Lin, X., Hu, S., Liu, Y., Zhang, L., Huang, H., & Liu, S. 2021. Disturbance-mediated changes in coral reef habitat provoke a positive feeding response in a major coral reef detritivore, *Ctenochaetus striatus*. Frontiers in Marine Science, 8: 682-697. 10.3389/fmars.2021.682697.

Marine Stewardship Council. 2020. Sebuah Panduan Praktis Perbaikan Perikanan Menuju Keberlanjutan. Go Agency Press, Jakarta.

McClanahan, R.T., & Jadot, C. 2017. Managing coral reef fish community biomass is a priority for biodiversity conservation in Madagascar. Mar. Ecol. Prog. Ser, 580: 169- 190.

McClanahan, T.R., Maina, J.M., Graham, N.A.J., & Jones, K.R. 2016. Modeling Reef Fish Biomass, Recovery Potential, and Management Priorities in the Western Indian Ocean. PLOS ONE, 11(5): e0154585.

McManus, J.W., & Polsenberg, J.F. 2004. Coral–algal phase shifts on coral reefs: Ecological and environmental aspects. Progress in Oceanography, 60(2-4): 263–279. doi:10.1016/j.pocean.2004.02.014.

Meyer, J.L., Schultz, E.T., & Hefman, G.S. 1983. Fish school: an asset to corals. Science, 220: 1047-1049.

Mujiyanto., & Satria, F. 2015. Diversitas Ikan Karang Herbivora di Kepulauan Karimunjawa, Jawa Tengah. COREMAP-CTI, Jakarta, Indonesia.

Müller, M., Staab, C.F.K., Puk, L.D., Schoenig, E.M., Ferse, S.C.A., & Wild, C. 2021. The Rabbitfish Siganus virgatus as Key Macroalgae Browser in Coral Reefs of the Gulf of Thailand. Diversity, 13(3): 123. doi:10.3390/d13030123.

Mumby, P.J., Hastings, A., & Edwards, H.J. 2007. Thresholds and the resilience of Caribbean coral reefs. Nature, 450: 98–101.

Myers, R.F. 1991. Micronesian reef fishes. Second Edition. Coral Graphics, Barrigada, Guam. 298 p. (Ref. 1602).

Nelson, J.S. 2006. Fishes of the World. Fourth Edition. John Wiley & Sons, Inc., New York.

Nybakken, J.W. 1992. Biologi Laut, Suatu Pendekatan Ekologis. PT. Gramedia, Jakarta.

Obura, D.O., & Grimsdith, G. 2009. Resilience Assessment of Coral Reefs – Assessment Protocol for Coral Reefs, Focusing on Coral Bleaching and Thermal Stress. IUCN Working Group on Climate Change and Coral Reefs. IUCN, Gland, Switzerland. 70 p.

Odum, E.P. 1971. Fundamental of ecology. W.B. Saunders Co, Philadelphia. 574p.

Odum, E.P. 1998. Dasar-dasar Ekologi. Edisi Ketiga, Terjemahan: Tjahyono Samingan. Gadjah Mada University Press, Yogyakarta.

Pedoman E-KKP3K. 2014. Panduan monitoring biofisik (sumberdaya kawasan), kawasan konservasi perairan, pesisir dan pulau-pulau kecil. Jakarta.

Peraturan Menteri Kelautan dan Perikanan Republik Indonesia Nomor 31/PERMEN-KP/2020 Tentang Pengelolaan Kawasan Konservasi.

Plass-Johnson, J.G., Ferse, S.C.A., Jompa, J., Wild, C., & Teichberg, M. 2015. Fish herbivory as key ecological function in a heavily degraded coral reef system. Limnology and Oceanography, 60(4): 1382–1391. doi:10.1002/lno.10105.

Plass-Johnson, J G., Teichberg, M., Bednarz, V., Gardes, A., Heiden, J.P., Lukman, M., Minarro, S., & Kegler, H. 2018b. Spatio-Temporal Patterns in the Coral Reef Comunities of the Spermonde Archipelago, 2012-2014, II: Fish Assemblages Display Structured Variation Related to Benthic Condition. Front. Mar. Sci, 5: 36. doi:10.3389/fmars.2018.00036.

Plass-Johnson, J., Bednarz, V., Hill, J., Jompa, J., Ferse, S., & Teichberg, M. 2018a. Contrasting Responses in the Niches of Two Coral Reef Herbivores Along a Gradient of Habitat Disturbance in the Spermonde Archipelago, Indonesia. Frontiers in Marine Science, 5. 10.3389/fmars.2018.00032.

Pombo-Ayora, L., Coker, D.J., Carvalho, S., Short, G., & Berumen, M.L. 2020. Morphological and ecological trait diversity reveal sensitivity of herbivorous fish assemblages to coral reef benthic conditions. Marine Environmental Research, 105102. doi:10.1016/j.marenvres.2020.105102.

Putra, R.D., Suryanti, A., Kurniawan, D., Pratomo, A., Irawan, H., Said Raja'I, T., & Jumsurizal. 2018. Responses of Herbivorous Fishes on Coral Reef Cover in Outer Island Indonesia (Study Case: Natuna Island). E3S Web of Conferences, 47: 04009. doi:10.1051/e3sconf/20184704009.

Rahimi, S.A.E., Hendra, E., Isdianto, A., & Luthfi, O.M. 2021. Feeding preference of herbivorous fish: Family Scaridae. IOP Conf. Ser. Earth Environ. Sci, 869:012004. doi: 10.1088/1755-1315/869/1/012004.

Randall, J.E., Allen, G.R., & Steene, R.C., 1990. Fishes of the Great Barrier Reef and Coral Sea. University of Hawai'i Press, Honolulu.

Rasyid, A., & Ibrahim. 2013. Spermonde kondisi oseanografi versus ikan pelagis. Masagena Press, Makassar – Sulawesi Selatan.

Robertson, D.R. 1982. Fish feses as fish food on a pacific coral reef. Mar. Ecol.Prog Ser, 7: 253-265.

Rudi, E. & Fadli, N. 2012. Komunitas ikan karang Herbivora di Perairan Aceh bagian utara. Depik. 1: 37-44.

Russ, G. 2003. Grazer biomass correlates more strongly with production than with biomass of algal turfs on a coral reef. Coral Reefs, 22: 63-67. 10.1007/s00338-003-0286-5.

Setiawan, F., Razak, T.B., Idris., & Estradivari. 2013.Komposisi spesies dan perubahan komunitas ikan karang di wilayah rehabilitasi *ecoreef* Pulau Manado Tua, Taman Nasional Bunaken. J. Ilmu dan Teknologi Kelautan Tropis, 5(2).

Siqueira, A.C., Bellwood, D.R., & Cowman, P.F. 2019. The evolution of traits and functions in herbivorous coral reef fishes through space and time. Proceedings of the Royal Society B: Biological Sciences, 286(1897): 20182672. doi:10.1098/rspb.2018.2672.

Sorenson, L., Santini, F., Carnevale, G., & Alfaro, M.E. 2013. A multi-locus timetree of surgeonfishes (Acanthuridae, Percomorpha), with revised family taxonomy. Molecular Phylogenetics and Evolution, 68(1): 150–160. doi:10.1016/j.ympev.2013.03.014.

Suharti, S.R., & Edrus, I.N. 2018. Kondisi ikan karang di perairan Tapanuli Tengah. Oseanologi dan Limnologi di Indonesia, 3(2): 105-121. 10.14203/oldi.2018.v3i2.112.

Tambunan, F.C., & Trianto, M.A., 2020. Kelimpahan dan biomassa ikan karang famili Scaridae pada ekosistem terumbu karang di perairan Pulau Kembar, Karimunjawa, Jepara. Journal of Marine Research, 9(2): 159-166.

Tebbett, S., & Bellwood, D. 2019. Algal turf sediments on coral reefs: what's known and what's next. Marpolcul*,* 149: 110542. doi: 10.1016/j.marpolbul.2019.110542.

Tebbett, S.B., Goatley, C.H.R., & Bellwood, D.R. 2017. The effects of algal turf sediments and organic loads on feeding by coral reef surgeonfshes. PLoS One, 12: e0169479. https://doi.org/10.1371/journal.pone.0169479.

Thresher, R. 1984. Reproduction in reef fishes. Publications, Neptune City, NJ.

Utomo, S.P.R., Ain, C., & Supriharyono. 2013. Keanekaragaman jenis ikan karang di daerah rataan dan tubir pada ekosistem terumbu karang di Legon Boyo, Taman Nasional Karimunjawa, Jepara. Diponegoro Journal of Maquares, Management of Aquatic Resources.

Veron, J.E.N., Devantier, L.M., Turak, E., Green, A.L., Kininmonth, S., Stafford-Smith, M., & Peterson, N. 2009. Delineating the Coral Triangle. Galaxea, J. of Coral Reef Studies, 11: 91-100.

Wibowo, K., Abrar, M., & Siringoringo, R.M. 2016. Status trofik ikan karang dan hubungan ikan herbivora dengan rekrutmen karang di perairan Pulau Pari, Teluk Jakarta. Oseanologi dan Limnologi di Indonesia, 1(2): 73-89. doi: 10.14203/oldi.2016.v1i2.85.

Wismer, S & Hoey, A. 2009. Cross-shelf benthic community structure on the Great Barrier Reef: Relationships between macroalgal cover and herbivore biomass. Marine Ecology-progress Series - MAR ECOL-PROGR SER, 376: 45-54. 10.3354/meps07790.

Yulianda, F., Fahrudin, A., Hutabarat, A. A., Harteti, S., Kusharjani, & Kang, H.S. 2010. Ekologi Ekosistem Perairan Laut Tropis. School of Environmental Conservation and Ecotourism Management, Bogor.

LAMPIRAN

Lampiran 1. Konstanta biomassa a dan b untuk setiap jenis/spesies ikan karang herbivora yang ditemukan pada penelitian ini (sumber: datamermaid.org)

Family	Name	Biomass Constant A	Biomass Constant B	Average Length
Acanthuridae	*Acanthurus auranticavus*	0.02291	2.96	10 - 30 cm
	Acanthurus nigricans	0.0263	2.93	12 cm
	Acanthurus pyroferus	0.02344	2.96	10 - 20 cm
	Acanthurus thompsoni	0.01698	2.99	10 - 20 cm
	Ctenochaetus striatus	0.01569	3.058599	5 - 15 cm
	Ctenochaetus tominiensis	0.02344	2.97	12 cm
	Naso annulatus	0.05103	2.71537	12 - 20 cm
	Naso lituratus	0.0324	2.94	15 - 25 cm
	Naso unicornis	0.029529	2.923551	30 - 35 cm
	Naso vlamingii	0.03104	2.843	10 - 25 cm
	Zebrasoma scopas	0.034129	2.939876	10 - 15 cm
	Zebrasoma veliferum	0.034107	2.861415	15 - 35 cm
Scaridae	*Cetoscarus bicolor*	0.0276	2.92	20 - 25 cm
	Chlorurus bleekeri	0.0415	2.946	8 - 35 cm
	Chlorurus microrhinos	0.021734	3.012728	35 cm
	Chlorurus spilurus	0.020118	3.059482	10 - 35 cm
	Hipposcarus longiceps	0.0161	3.05	25 - 30 cm
	Scarus chameleon	0.01445	3.04	15 - 20 cm
	Scarus dimidiatus	0.0278	3.049	8 - 25 cm
	Scarus flavipectoralis	0.01995	3.01	6 - 35 cm
	Scarus forsteni	0.0142	3.13	15 cm
	Scarus frenatus	0.01889	3.06	20 - 30 cm
	Scarus ghobban	0.015696	3.016738	12 - 15 cm
	Scarus hypselopterus	0.00794	3.11	15 - 30 cm
	Scarus niger	0.024136	3.147753	10 - 30 cm
	Scarus oviceps	0.0144	3.14	12 - 35 cm
	Scarus quoyi	0.0565	2.818	10 - 35 cm
	Scarus rivulatus	0.0184	3.058	12 - 35 cm
	Scarus scaber	0.0278	2.857	6 - 25 cm
	Scarus schlegeli	0.020801	3.00244	12 cm
	Scarus spinus	0.00794	3.11	15 cm
	Scarus tricolor	0.0229	3.106	15 - 30 cm
Siganidae	*Siganus canaliculatus*	0.0232	2.8	20 cm
	Siganus corallinus	0.00234	3.82079	10 - 35 cm
	Siganus guttatus	0.054842	2.662305	30 cm
	Siganus puellus	0.01761	3.02839	12 - 35 cm
	Siganus punctatissimus	0.01585	3.07	10 - 25 cm
	Siganus punctatus	0.019708	3.075761	12 - 20 cm
	Siganus virgatus	0.0204	3.236	5 - 25 cm
	Siganus vulpinus	0.01585	3.07	10 - 25 cm

Lampiran 2. Hasil transformasi data

```
> with(species.comp, shapiro.test(sum.sp[Year == "2021"]))

        Shapiro-Wilk normality test

data:  sum.sp[Year == "2021"]
W = 0.55842, p-value = 2.353e-08

> with(species.comp, shapiro.test(sum.sp[Year == "2022"]))

        Shapiro-Wilk normality test

data:  sum.sp[Year == "2022"]
W = 0.62454, p-value = 2.229e-08
```

a

```
        F test to compare two variances

data:  sum.sp by Year
F = 0.23147, num df = 29, denom df = 35, p-value = 0.000124
alternative hypothesis: true ratio of variances is not equal to 1
95 percent confidence interval:
 0.1153013 0.4758351
sample estimates:
ratio of variances
         0.2314682
```

b

1. Untuk melakukan uji-t, dilakukan uji *Shapiro-test* dan *F-test* untuk memenuhi asumsi uji *t-test.*

(a) *Shapiro-test* menunjukkan data komposisi jenis ikan karang herbivora p<0,05, sehingga data tidak memenuhi asumsi normalitas uji-t.

(b) *F-test* menunjukkan data komposisi jenis ikan karang herbivora p>0,05, sehingga data memenuhi asumsi homogenitas uji-t.

```
> with(species.comp, shapiro.test(sp.logg2[Year == "2021"]))    #p>0.05

        Shapiro-Wilk normality test

data:  sp.logg2[Year == "2021"]
W = 0.96229, p-value = 0.354

> with(species.comp, shapiro.test(sp.logg2[Year == "2022"]))    #p>0.05

        Shapiro-Wilk normality test

data:  sp.logg2[Year == "2022"]
W = 0.96666, p-value = 0.3414
```

a

```
        F test to compare two variances

data:  sp.logg2 by Year
F = 0.63518, num df = 29, denom df = 35, p-value = 0.2139
alternative hypothesis: true ratio of variances is not equal to 1
95 percent confidence interval:
 0.3164028 1.3057577
sample estimates:
ratio of variances
          0.635181
```

b

2. Data komposisi jenis ikan karang herbivora tidak memenuhi asumsi normalitas dan homogenitas untuk uji-t, sehingga dilakukan *treatment* data dengan mentransformasi data menjadi log2.

(a) *Shapiro-test* menunjukkan data komposisi jenis ikan karang herbivora p>0,05, sehingga data memenuhi asumsi normalitas uji-t.

(b) *F-test* menunjukkan data komposisi jenis ikan karang herbivora p>0,05, sehingga data memenuhi asumsi homogenitas uji-t. Sehingga uji-t dilanjutkan dengan menggunakan data transformasi log2.

```
> with(species.comp, shapiro.test(sp.logg10[Year == "2021"]))

        Shapiro-Wilk normality test

data:  sp.logg10[Year == "2021"]
W = 0.96229, p-value = 0.354

> with(species.comp, shapiro.test(sp.logg10[Year == "2022"]))

        Shapiro-Wilk normality test

data:  sp.logg10[Year == "2022"]
W = 0.96666, p-value = 0.3414
```

a

```
        F test to compare two variances

data:  sp.logg10 by Year
F = 0.63518, num df = 29, denom df = 35, p-value = 0.2139
alternative hypothesis: true ratio of variances is not equal to 1
95 percent confidence interval:
 0.3164028 1.3057577
sample estimates:
ratio of variances
          0.635181
```

b

3. Data komposisi jenis ikan karang herbivora tidak memenuhi asumsi normalitas dan homogenitas untuk uji-t, sehingga dilakukan *treatment* data dengan mentransformasi data menjadi log10.

(a) *Shapiro-test* menunjukkan data komposisi jenis ikan karang herbivora p>0,05, sehingga data memenuhi asumsi normalitas uji-t.

(b) *F-test* menunjukkan data komposisi jenis ikan karang herbivora p>0,05, sehingga data memenuhi asumsi homogenitas uji-t.

```
> with(species.comp, shapiro.test(sp.sqrtt[Year == "2021"]))

        Shapiro-Wilk normality test

data:  sp.sqrtt[Year == "2021"]
W = 0.81216, p-value = 0.0001101

> with(species.comp, shapiro.test(sp.sqrtt[Year == "2022"]))

        Shapiro-Wilk normality test

data:  sp.sqrtt[Year == "2022"]
W = 0.82498, p-value = 5.316e-05
```

a

```
        F test to compare two variances

data:  sp.sqrtt by Year
F = 0.39359, num df = 29, denom df = 35, p-value = 0.01191
alternative hypothesis: true ratio of variances is not equal to 1
95 percent confidence interval:
 0.1960570 0.8091047
sample estimates:
ratio of variances
          0.393586
```

b

4. Data komposisi jenis ikan karang herbivora tidak memenuhi asumsi normalitas dan homogenitas untuk uji-t, sehingga dilakukan *treatment* data dengan mentransformasi data menjadi *square root*.

(a) *Shapiro-test* menunjukkan data komposisi jenis ikan karang herbivora p<0,05, sehingga data tidak memenuhi asumsi normalitas uji-t.

(b) *F-test* menunjukkan data komposisi jenis ikan karang herbivora p<0,05, sehingga data tidak memenuhi asumsi homogenitas uji-t.

```
> with(species.comp, shapiro.test(sp.fourth[Year == "2021"]))

        Shapiro-Wilk normality test

data:  sp.fourth[Year == "2021"]
W = 0.91702, p-value = 0.02246

> with(species.comp, shapiro.test(sp.fourth[Year == "2022"]))

        Shapiro-Wilk normality test

data:  sp.fourth[Year == "2022"]
W = 0.91665, p-value = 0.01005
```

a

```
        F test to compare two variances

data:  sp.fourth by Year
F = 0.50855, num df = 29, denom df = 35, p-value = 0.0655
alternative hypothesis: true ratio of variances is not equal to 1
95 percent confidence interval:
 0.2533251 1.0454435
sample estimates:
ratio of variances
         0.5085521
```

b

5. Data komposisi jenis ikan karang herbivora tidak memenuhi asumsi normalitas dan homogenitas untuk uji-t, sehingga dilakukan *treatment* data dengan mentransformasi data menjadi *fourth root*.

(a) *Shapiro-test* menunjukkan data komposisi jenis ikan karang herbivora p<0,05, sehingga data tidak memenuhi asumsi normalitas uji-t.

(b) *F-test* menunjukkan data komposisi jenis ikan karang herbivora p>0,05, sehingga data memenuhi asumsi homogenitas uji-t. Namun uji-t tidak dapat dilanjutkan karena data tidak memenuhi asumsi normalitas.

```
> with(fish.trans, shapiro.test(Abundance[Year == "2021"]))

        Shapiro-Wilk normality test

data:  Abundance[Year == "2021"]
W = 0.87782, p-value = 0.01098

> with(fish.trans, shapiro.test(Abundance[Year == "2022"]))

        Shapiro-Wilk normality test

data:  Abundance[Year == "2022"]
W = 0.72516, p-value = 3.022e-05
```

a

```
        F test to compare two variances

data:  Abundance by Year
F = 0.13376, num df = 21, denom df = 22, p-value = 2.018e-05
alternative hypothesis: true ratio of variances is not equal to 1
95 percent confidence interval:
 0.0563725 0.3201883
sample estimates:
ratio of variances
         0.1337587
```

b

6. Untuk melakukan uji-t, dilakukan uji *Shapiro-test* dan *F-test* untuk memenuhi asumsi uji-t.

(a) *Shapiro-test* menunjukkan data kelimpahan ikan karang herbivora p<0,05, sehingga data tidak memenuhi asumsi normalitas uji-t.

(b) *F-test* menunjukkan data kelimpahan ikan karang herbivora p>0,05, sehingga data memenuhi asumsi homogenitas uji-t. Namun uji-t tidak dapat dilanjutkan karena data tidak memenuhi asumsi normalitas.

```
> with(fish.trans, shapiro.test(log.2[Year == "2021"]))

        Shapiro-Wilk normality test

data:  log.2[Year == "2021"]
W = 0.91031, p-value = 0.04803

> with(fish.trans, shapiro.test(log.2[Year == "2022"]))

        Shapiro-Wilk normality test

data:  log.2[Year == "2022"]
W = 0.85799, p-value = 0.003811
```

a

```
        F test to compare two variances

data:  log.2 by Year
F = 1.1402, num df = 21, denom df = 22, p-value = 0.7611
alternative hypothesis: true ratio of variances is not equal to 1
95 percent confidence interval:
 0.4805472 2.7294440
sample estimates:
ratio of variances
          1.140226
```

b

7. Data kelimpahan ikan karang herbivora tidak memenuhi asumsi normalitas dan homogenitas untuk uji-t, sehingga dilakukan *treatment* data dengan mentransformasi data menjadi log2.

(a) *Shapiro-test* menunjukkan data kelimpahan ikan karang herbivora p>0,05, sehingga data tidak memenuhi asumsi normalitas uji-t.

(b) *F-test* menunjukkan data kelimpahan ikan karang herbivora p>0,05, sehingga data memenuhi asumsi homogenitas uji-t. Namun uji-t tidak dapat dilanjutkan karena data tidak memenuhi asumsi normalitas.

```
> with(fish.trans, shapiro.test(log.10[Year == "2021"]))

        Shapiro-Wilk normality test

data:  log.10[Year == "2021"]
W = 0.91031, p-value = 0.04803

> with(fish.trans, shapiro.test(log.10[Year == "2022"]))

        Shapiro-Wilk normality test

data:  log.10[Year == "2022"]
W = 0.85799, p-value = 0.003811
```
a

```
        F test to compare two variances

data:  log.10 by Year
F = 1.1402, num df = 21, denom df = 22, p-value = 0.7611
alternative hypothesis: true ratio of variances is not equal to 1
95 percent confidence interval:
 0.4805472 2.7294440
sample estimates:
ratio of variances
          1.140226
```
b

8. Data kelimpahan ikan karang herbivora tidak memenuhi asumsi normalitas dan homogenitas untuk uji-t, sehingga dilakukan *treatment* data dengan mentransformasi data menjadi log10.

(a) *Shapiro-test* menunjukkan data kelimpahan ikan karang herbivora p<0,05, sehingga data tidak memenuhi asumsi normalitas uji-t.

(b) *F-test* menunjukkan data kelimpahan ikan karang herbivora p>0,05, sehingga data memenuhi asumsi homogenitas uji-t. Namun uji-t tidak dapat dilanjutkan karena data tidak memenuhi asumsi normalitas.

```
> with(fish.trans, shapiro.test(square.root[Year == "2021"]))

        Shapiro-Wilk normality test

data:  square.root[Year == "2021"]
W = 0.96938, p-value = 0.6968

> with(fish.trans, shapiro.test(square.root[Year == "2022"]))

        Shapiro-Wilk normality test

data:  square.root[Year == "2022"]
W = 0.90601, p-value = 0.03369
```
a

```
        F test to compare two variances

data:  square.root by Year
F = 0.43175, num df = 21, denom df = 22, p-value = 0.05901
alternative hypothesis: true ratio of variances is not equal to 1
95 percent confidence interval:
 0.181961 1.033514
sample estimates:
ratio of variances
         0.4317506
```
b

9. Data kelimpahan ikan karang herbivora tidak memenuhi asumsi normalitas dan homogenitas untuk uji-t, sehingga dilakukan *treatment* data dengan mentransformasi data menjadi *square root*.

(a) *Shapiro-test* menunjukkan data kelimpahan ikan karang herbivora p<0,05, sehingga data tidak memenuhi asumsi normalitas uji-t.

(b) *F-test* menunjukkan data kelimpahan ikan karang herbivora p>0,05, sehingga data memenuhi asumsi homogenitas uji-t. Namun uji-t tidak dapat dilanjutkan karena data tidak memenuhi asumsi normalitas.

```
> with(fish.trans, shapiro.test(fourth.abundance[Year == "2021"]))

        Shapiro-Wilk normality test

data:  fourth.abundance[Year == "2021"]
W = 0.97329, p-value = 0.7858

> with(fish.trans, shapiro.test(fourth.abundance[Year == "2022"]))

        Shapiro-Wilk normality test

data:  fourth.abundance[Year == "2022"]
W = 0.93749, p-value = 0.1587
```
a

```
        F test to compare two variances

data:  fourth.abundance by Year
F = 0.73024, num df = 21, denom df = 22, p-value = 0.4749
alternative hypothesis: true ratio of variances is not equal to 1
95 percent confidence interval:
 0.3077579 1.7480238
sample estimates:
ratio of variances
         0.7302372
```
b

10. Data kelimpahan ikan karang herbivora tidak memenuhi asumsi normalitas dan homogenitas untuk uji-t, sehingga dilakukan *treatment* data dengan mentransformasi data menjadi *fourth root*.

(a) *Shapiro-test* menunjukkan data kelimpahan ikan karang herbivora p>0,05, sehingga data memenuhi asumsi normalitas uji-t.

(b) *F-test* menunjukkan data kelimpahan ikan karang herbivora p>0,05, sehingga data memenuhi asumsi homogenitas uji-t. Selanjutnya uji-t kelimpahan ikan karang herbivora akan dilakukan menggunakan transformasi data *fourth root.*

```
> with(fish.trans, shapiro.test(Biomass[Year == "2021"]))

        Shapiro-Wilk normality test

data:  Biomass[Year == "2021"]
W = 0.91309, p-value = 0.05475

> with(fish.trans, shapiro.test(Biomass[Year == "2022"]))

        Shapiro-Wilk normality test

data:  Biomass[Year == "2022"]
W = 0.91718, p-value = 0.05799
```
a

```
        F test to compare two variances

data:  Biomass by Year
F = 0.10639, num df = 21, denom df = 22, p-value = 2.878e-06
alternative hypothesis: true ratio of variances is not equal to 1
95 percent confidence interval:
 0.04483863 0.25467745
sample estimates:
ratio of variances
         0.1063915
```
b

11. Untuk melakukan uji-t, dilakukan uji *Shapiro-test* dan *F-test* untuk memenuhi asumsi uji-t.

(a) *Shapiro-test* menunjukkan data biomassa ikan karang herbivora p>0,05, sehingga data memenuhi asumsi normalitas uji-t.

(b) *F-test* menunjukkan data biomassa ikan karang herbivora p<0,05, sehingga data tidak memenuhi asumsi homogenitas uji-t.

```
> with(fish.trans, shapiro.test(log.2bio[Year == "2021"]))

        Shapiro-Wilk normality test

data:  log.2bio[Year == "2021"]
W = 0.8881, p-value = 0.01731

> with(fish.trans, shapiro.test(log.2bio[Year == "2022"]))

        Shapiro-Wilk normality test

data:  log.2bio[Year == "2022"]
W = 0.91226, p-value = 0.04559
```
a

```
        F test to compare two variances

data:  log.2bio by Year
F = 1.2488, num df = 21, denom df = 22, p-value = 0.6085
alternative hypothesis: true ratio of variances is not equal to 1
95 percent confidence interval:
 0.5262889 2.9892505
sample estimates:
ratio of variances
          1.24876
```
b

12. Data biomassa ikan karang herbivora tidak memenuhi asumsi homogenitas untuk uji-t, sehingga dilakukan *treatment* data dengan mentransformasi data menjadi log2.

(a) *Shapiro-test* menunjukkan data biomassa ikan karang herbivora p<0,05, sehingga data tidak memenuhi asumsi normalitas uji-t.

(b) *F-test* menunjukkan data biomassa ikan karang herbivora p>0,05, sehingga data memenuhi asumsi homogenitas uji-t*.* Namun uji-t tidak dapat dilanjutkan karena data tidak memenuhi asumsi normalitas.

```
> with(fish.trans, shapiro.test(log.10.bio[Year == "2021"]))

        Shapiro-Wilk normality test

data:  log.10.bio[Year == "2021"]
W = 0.8881, p-value = 0.01731

> with(fish.trans, shapiro.test(log.10.bio[Year == "2022"]))

        Shapiro-Wilk normality test

data:  log.10.bio[Year == "2022"]
W = 0.91226, p-value = 0.04559
```

a

```
        F test to compare two variances

data:  log.10.bio by Year
F = 1.2488, num df = 21, denom df = 22, p-value = 0.6085
alternative hypothesis: true ratio of variances is not equal to 1
95 percent confidence interval:
 0.5262889 2.9892505
sample estimates:
ratio of variances
          1.24876
```

b

13. Data biomassa ikan karang herbivora tidak memenuhi asumsi homogenitas untuk uji-t, sehingga dilakukan *treatment* data dengan mentransformasi data menjadi log10.

(a) *Shapiro-test* menunjukkan data biomassa ikan karang herbivora p<0,05, sehingga data tidak memenuhi asumsi normalitas uji-t*.*

(b) *F-test* menunjukkan data biomassa ikan karang herbivora p>0,05, sehingga data memenuhi asumsi homogenitas uji-t*.* Namun uji-t tidak dapat dilanjutkan karena data tidak memenuhi asumsi normalitas.

```
> with(fish.trans, shapiro.test(square.root.bio[Year == "2021"]))

        Shapiro-Wilk normality test

data:  square.root.bio[Year == "2021"]
W = 0.98997, p-value = 0.9973

> with(fish.trans, shapiro.test(square.root.bio[Year == "2022"]))

        Shapiro-Wilk normality test

data:  square.root.bio[Year == "2022"]
W = 0.98263, p-value = 0.9457
```

a

```
        F test to compare two variances

data:  square.root.bio by Year
F = 0.34156, num df = 21, denom df = 22, p-value = 0.01669
alternative hypothesis: true ratio of variances is not equal to 1
95 percent confidence interval:
 0.1439491 0.8176117
sample estimates:
ratio of variances
        0.3415574
```

b

14. Data biomassa ikan karang herbivora tidak memenuhi asumsi homogenitas untuk uji-t, sehingga dilakukan *treatment* data dengan mentransformasi data menjadi *square root*.

(a) *Shapiro-test* menunjukkan data biomassa ikan karang herbivora p>0,05, sehingga data memenuhi asumsi normalitas uji-t*.*

(b) *F-test* menunjukkan data biomassa ikan karang herbivora p<0,05, sehingga data tidak memenuhi asumsi homogenitas uji-t*.*

Lampiran 2. Lanjutan

```
> with(fish.trans, shapiro.test(fourth.bio[Year == "2021"]))

        Shapiro-Wilk normality test

data:  fourth.bio[Year == "2021"]
W = 0.97222, p-value = 0.7619

> with(fish.trans, shapiro.test(fourth.bio[Year == "2022"]))

        Shapiro-Wilk normality test

data:  fourth.bio[Year == "2022"]
W = 0.97362, p-value = 0.7747
```

a

```
        F test to compare two variances

data:  fourth.bio by Year
F = 0.63831, num df = 21, denom df = 22, p-value = 0.3081
alternative hypothesis: true ratio of variances is not equal to 1
95 percent confidence interval:
 0.2690171 1.5279812
sample estimates:
ratio of variances
         0.6383144
```

b

15. Data biomassa ikan karang herbivora tidak memenuhi asumsi homogenitas untuk uji-t, sehingga dilakukan treatment data dengan mentransformasi data menjadi *fourth root*.

(a) *Shapiro-test* menunjukkan data biomassa ikan karang herbivora p>0,05, sehingga data memenuhi asumsi normalitas uji-t.

(b) *F-test* menunjukkan data biomassa ikan karang herbivora p>0,05, sehingga data memenuhi asumsi homogenitas uji-t. Selanjutnya uji-t dilakukan dengan menggunakan transformasi data *fourth root*.

Lampiran 3. Hasil uji-t komposisi jenis, kelimpahan, dan biomassa ikan karang herbivora

1. Hasil uji-t komposisi jenis ikan karang herbivora.

```
> species.comp %>%
+   group_by(Year) %>%
+   get_summary_stats(sum.sp, type = "mean_sd")
# A tibble: 2 x 5
  Year  variable     n  mean    sd
  <fct> <fct>    <dbl> <dbl> <dbl>
1 2021  sum.sp      30  29.6  49.7
2 2022  sum.sp      36  61.8 103.
```

```
        Two Sample t-test

data:  sp.logg2 by Year
t = -1.0646, df = 64, p-value = 0.291
alternative hypothesis: true difference in means between group 2021 and group 20
22 is not equal to 0
95 percent confidence interval:
 -1.6246647  0.4950306
sample estimates:
mean in group 2021 mean in group 2022
          3.676143           4.240960
```

2. Hasil uji-t kelimpahan ikan karang herbivora.

```
> fish.trans %>%
+   group_by(Year) %>%
+   get_summary_stats(fourth.abundance, type = "mean_sd")
# A tibble: 2 x 5
  Year  variable             n  mean    sd
  <fct> <fct>            <dbl> <dbl> <dbl>
1 2021  fourth.abundance    22 0.59  0.144
2 2022  fourth.abundance    23 0.737 0.169
```

```
        Two Sample t-test

data:  fourth.abundance by Year
t = -3.1562, df = 43, p-value = 0.002918
alternative hypothesis: true difference in means between group 2021 and group 20
22 is not equal to 0
95 percent confidence interval:
 -0.24223531 -0.05336194
sample estimates:
mean in group 2021 mean in group 2022
         0.5895138          0.7373124
```

3. Hasil uji-t biomassa ikan karang herbivora.

```
> fish.trans %>%
+   group_by(Year) %>%
+   get_summary_stats(fourth.bio, type = "mean_sd")
# A tibble: 2 x 5
  Year  variable       n  mean    sd
  <fct> <fct>      <dbl> <dbl> <dbl>
1 2021  fourth.bio    22  3.21 0.738
2 2022  fourth.bio    23  4.34 0.924
```

Lampiran 3. Lanjutan

```
        Two Sample t-test

data:  fourth.bio by Year
t = -4.4863, df = 43, p-value = 5.335e-05
alternative hypothesis: true difference in means between group 2021 and group 20
22 is not equal to 0
95 percent confidence interval:
 -1.6259854 -0.6174984
sample estimates:
mean in group 2021 mean in group 2022
          3.213002           4.334744
```

Lampiran 4. Kelimpahan ikan karang herbivora berdasarkan site pengamatan

Famili	Spesies	LL		SA		BL		BO		BA		LU		KS		KP		Kelimpahan individu
		Tahun		Tahun		Tahun		Tahun		Tahun		Tahun		Tahun		Tahun		
		2021	2022	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022	
Acanthuridae	*Acanthurus auranticavus*	1				5	7	4	3		4			3	7		2	36
	Acanthurus nigricans							2							2			4
	Acanthurus pyroferus												2			14	129	145
	Acanthurus thompsoni													2		3		5
	Ctenochaetus striatus			14	55	22	14	24	67	7	22	17	37	26	27	140	242	714
	Ctenochaetus tominiensis																3	3
	Naso annulatus				2			1	5		4	2	5	2	1			22
	Naso lituratus						2		2	12			16			8	7	47
	Naso unicornis										6							6
	Naso vlamingii				3												23	26
	Zebrasoma scopas						5	4	7		7	2	3		2	60	311	401
	Zebrasoma velifer							1				1		4		2		8
	Zebrasoma veliferum						2						1		62		3	68
Scaridae	*Cetoscarus bicolor*						1				3			1		2		7
	Chlorurus bleekeri			15	30	23	78	18	32	4	23	27	15	33	16	10	75	399
	Chlorurus microrhinos										6							6
	Chlorurus spilurus			3	1	3	46	5	20			1	18	14	3	21	12	147
	Hipposcarus longiceps													3				3
	Scarus chameleon								1		3				2			6
	Scarus dimidiatus			1		5	6	1	3	1	8	1	6	2	8		29	71
	Scarus flavipectoralis			4	37	4	36	13	62		22	3	24	11	17	12	6	251
	Scarus forsteni			2					1						2			5
	Scarus frenatus				3												2	5
	Scarus ghobban					2	25	1						5				33
	Scarus hypselopterus									2					2		2	6
	Scarus niger			2	13	14	3	2	13		6	4	21	4	37	8	10	137
	Scarus oviceps							3						1		2		6
	Scarus quoyi				4	8	32	6	15	1	12			3		2	3	86
	Scarus rivulatus				2	34	2	30		3	6							77
	Scarus scaber					1		1				1		4		9		16
	Scarus schlegeli								2									2
	Scarus spinus											2			3			5
	Scarus tricolor			1	2					1	1		2	1				8
Siganidae	*Siganus canaliculatus*		12										2					14
	Siganus corallinus			2				2				3	12	9	17		2	47
	Siganus guttatus						1											1
	Siganus puellus											6	3	11	3	3	3	29
	Siganus punctatissimus			2	4		13	4			8	1	6	4	7		3	52
	Siganus punctatus						6		2									8
	Siganus virgatus		5	10	8	2	70	7	10		2	7	10	2	5	1	2	141
	Siganus vulpinus			2	2			3	2		2	14	13	6	8	2	5	59
	Jumlah jenis	1	2	12	14	12	18	20	17	8	18	17	20	22	20	17	21	3112

Lampiran 5. Komposisi jenis ikan karang herbivora

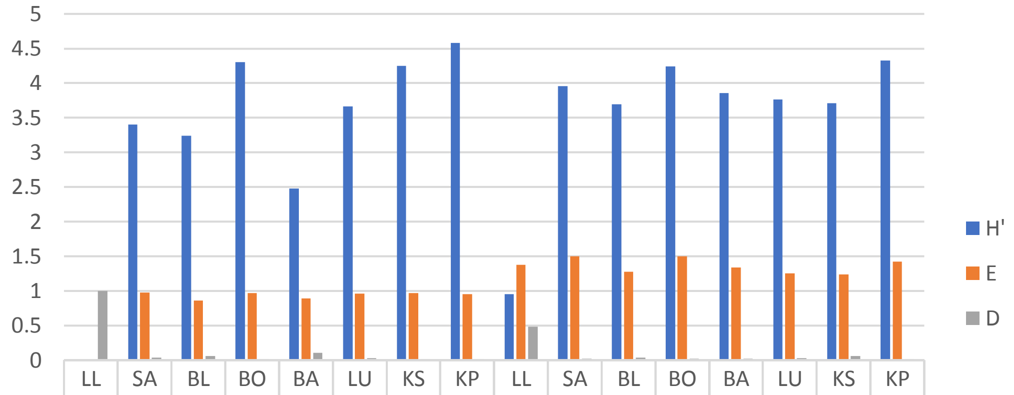
Famili	Jumlah jenis		Total jenis
	2021	2022	
Acanthuridae	9	11	12
Scaridae	16	17	20
Siganidae	5	8	8
Total	**30**	**36**	**40**

Lampiran 6. Nilai standar error (SE) kelimpahan dan biomassa per famili dan tahun ikan karang herbivora

	Year	Fish_family	Av.Biomass	Av.BiomassSE	Av.Abundance	Av.AbundanceSE
1	2021	Acanthuridae	36.82834	18.791013	0.06575000	0.05594439
2	2021	Scaridae	86.40641	32.909238	0.07638095	0.02392050
3	2021	Siganidae	21.61637	7.439914	0.02444444	0.00841398
4	2022	Acanthuridae	146.30069	111.522367	0.20990476	0.19183731
5	2022	Scaridae	274.86492	84.073727	0.16666667	0.04054931
6	2022	Siganidae	68.51517	21.687877	0.05241667	0.03108407

	Year	Biomass	BiomassSE	Abundance	AbundanceSE
1	2021	48.28371	19.56064	0.05552513	0.01584047
2	2022	163.22692	60.16624	0.14299603	0.04697818

Lampiran 7. Indeks ekologi per site



	LL 2021	SA 2021	BL 2021	BO 2021	BA 2021	LU 2021	KS 2021	KP 2021	LL 2022	SA 2022	BL 2022	BO 2022	BA 2022	LU 2022	KS 2022	KP 2022
H'	0	3.40	3.23	4.30	2.47	3.66	4.24	4.58	0.95	3.95	3.69	4.24	3.86	3.76	3.70	4.33
E	0	0.97	0.86	0.96	0.89	0.95	0.96	0.95	1.37	1.49	1.28	1.49	1.33	1.25	1.23	1.42
D	1	0.03	0.06	0.01	0.10	0.03	0.01	0.01	0.48	0.02	0.03	0.01	0.02	0.03	0.06	0.01

Lampiran 8. Dokumentasi kegiatan di lapangan: a. persiapan menuju lokasi penelitian; b. persiapan peralatan pengambilan data; c;d. pengambilan data ikan karang herbivora; d. pengambilan peralatan bawah air setelah pendataan; e. tim pengambilan data tahun 2021; f;g. tim pengambilan data tahun 2022