DAFTAR PUSTAKA

Adyasari D, Pratama MA, Teguh NA, Sabdaningsih A, Kusumaningtyas MA, Dimova N (2021) Anthropogenic Impact on Indonesian Coastal Water and Ecosystems: Current Status and Future Opportunities. Mar Pollut Bull 171:112689.

Ahmad-Kamil EI, Ramli R, Jaaman SA, Bali J, Al-Obaidi JR (2013) The Effects of Water Parameters on Monthly Seagrass Percentage Cover in Lawas, East Malaysia. Sci World J 2013:1–8.

Al-Asif A, Kamal AHM, Hamli H, Idris MH, Gerusu GJ, Ismail J, Bhuiyan MKA, Abualreesh MH, Musa N, Wahid MEA, Mishra M (2022) Status, Biodiversity, and Ecosystem Services of Seagrass Habitats Within the Coral Triangle in the Western Pacific Ocean. Ocean Sci J 57:147–173.

Allen J, Gosden C, White JP (1989) Human Pleistocene Adaptations in the Tropical Island Pacific: Recent Evidence from New Ireland, a Greater Australian Outlier. Antiquity 63:548–561.

Ambo-Rappe R (2014) Developing a Methodology of Bioindication of Human-Induced Effects Using Seagrass Morphological Variation in Spermonde Archipelago, South Sulawesi, Indonesia. Mar Pollut Bull 86:298–303.

Ambo-Rappe R (2020) Eagrass Meadows for Fisheries in Indonesia: a Preliminary Study. IOP Conf Ser Earth Environ Sci 564:012017.

Ambo-Rappe R, Moore AM (2019) Sulawesi Seas, Indonesia. In: *World Seas: an Environmental Evaluation*, 2nd ed. Sheppard C (ed) Elsevier, London, United Kingdom, p 559–581

Amesbury JR, Hunter-Anderson RL (2003) Review of Archaeological and Historical Data Concerning Reef Fishing in the U.S. Flag Islands of Micronesia: Guam and the Northern Mariana islands. Micronesia Archaeological Research Services, Guam.

Amin C, Mulyati H, Anggraini E, Kusumastanto T (2021) Impact of Maritime Logistics on Archipelagic Economic Development in Eastern Indonesia. Asian J Shipp Logist 37:157–164.

Amy RL (1983) Gamete Sizes and Developmental Time Tables of Five Tropical Sea Urchins. Bull Mar Sci 33:173–176.

Anderson SC, Flemming JM, Watson R, Lotze HK (2011) Serial Exploitation of Global Sea Cucumber Fisheries. Fish Fish 12:317–339.

Andrew NL, Agatsuma Y, Ballesteros E, Barnes D, Bazhin A, Botsford L, Bradbury A, Campbell A, Creaser E, Dixon J, Einarsson S, Gerring P, Hebert K, Hunter M, Hur S, Johnson C, Juinio-Me√±ez M, Kalvass P, Miller R, Moreno C, Palleiro J, Rivas D, Robinson S, Schroeter S, Steneck R, Vadas R, Woodby D, Xiaoqi Z (2002) Status and Management of World Sea Urchin Fisheries. In: *Oceanography and Marine Biology, An Annual Review*, 1st ed. Gibson RN, Barnes M, Atkinson RJA (eds) CRC Press, Boca Raton, p 343–425

Arachchige GM, Jayakody S, Mooi R, Kroh A (2019) An Annotated Spesies List of Regular Echinoids from Sri Lanka with Notes on Some Rarely Seen Temnopleurids. Zootaxa 4571:35–57.

Arbi UY, Sihaloho HF (2017) Panduan Pemantauan Megabentos, 2nd ed. Vimono IB, Wirawati I (eds) COREMAP-CTI Lembaga Ilmu Pengetahuan Indonesia, Bogor.

Archana A, Babu KR (2016) Nutrient Composition and Antioxidant Activity of Gonads of Sea Urchin *Stomopneustes Variolaris*. Food Chem 197:597–602.

Arnold SN, Steneck RS (2011) Settling into an Increasingly Hostile World: The Rapidly Closing “Recruitment Window” for Corals. PLoS One 6:e28681.

Asmus H, Kneer D, Pogoreutz C, Blankenhorn S, Jompa J, Nurdin N, Priosambodo D (2022) Ecology of Seagrass Beds in Sulawesi—Multifunctional Key Habitats at the Risk of Destruction. In: *Science for the Protection of Indonesian Coastal Ecosystems (SPICE)*. Elsevier, p 201–250

Asriani N, Ambo-Rappe R, Lanuru M, Williams SL (2018) Spesies Richness Effects on the Vegetative Expansion of Transplanted Seagrass in Indonesia. Bot Mar 61:205–211.

Aswani S, Albert S, Love M (2017) One Size Does Not Fit All: Critical Insights for Effective Community-Based Resource Management in Melanesia. Mar Policy 81:381–391.

Aswani S, Ferse SCA, Stäbler M, Chong-Montenegro C (2020) Detecting Change in Local Ecological Knowledge: An Application of An Index Of Taxonomic Distinctness to An Ethnoichthyological Classification in the Solomon Islands. Ecol Indic 119:106865.

Baião LF, Rocha F, Sá T, Oliveira A, Pintado M, Lima RC, Cunha LM, Valente LMP (2022) Sensory Profiling, Liking and Gonad Composition of Sea Urchin Gonads Fed Synthetic or Natural Sources of β-Carotene Enriched Diets. Aquaculture 549:737778.

Bakti NS, Nane L (2021) Spesies Composition, Density, Gonad Maturity Stage and Size of Sea Urchin at Wakatobi Archipelago, Southeast Sulawesi, Indonesia. Fish Soc 1:11–16.

Banks ER (2014) Sea Urchins: Habitat, Embryonic Development and Importance in the Environment. Banks ER (ed) Nova Publishers, New York.

Becking LE, Cleary DFR, de Voogd NJ, Renema W, de Beer M, van Soest RWM, Hoeksema BW (2006) Beta Diversity of Tropical Marine Benthic Assemblages in the Spermonde Archipelago, Indonesia. Mar Ecol 27:76–88.

de Beer M (1990) Distribution Patterns of Regular Sea Urchins (Echinodermata: Echinoidea) Across the Spermonde Shelf, SW Sulawesi (Indonesia). In: *Echinoderm Research*. Ridder D, Dubois, Lahaye, Jangoux (eds) Balkerna, Rotterdam, p 165–169

Berkes F, Hughes TP, Steneck RS, Wilson JA, Bellwood DR, Cron B, Folke C, Gunderson LH, Leslie HM, Norberg J, Nystrom M, Olsson P, Osterblom H, Scheffer M, Worm B (2006) Globalization, Roving Bandits, and Marine Resources. Science (80-) 311:1557–1558.

Black DW (2002) Out of the Blue and into the Black: The Middle-Late Maritime Woodland Transition in the Quoddy Region, New Brunswick, Canada. Hart JP, Rieth CB (eds) New York State Museum, Albany.

Bodmer MD V., Wheeler PM, Anand P, Cameron SE, Hintikka S, Cai W, Borcsok AO, Exton DA (2021) The Ecological Importance of Habitat Complexity to the Caribbean Coral Reef Herbivore *Diadema antillarum*: Three Lines of Evidence. Sci Rep 11:9382.

Boolootian RA, Moore AR (1956) Hermaphroditism in Echinoids. Biol Bull 111:328–335.

BPSPL Makassar (2012) Status Populasi dan Pemanfaatan *Isis hippuris* di Pulau Sulawesi: Review Survei. Ministry of Marine Affairs and Fisheries, Republic of Indonesia, Makassar.

Branch TA, Lobo AS, Purcell SW (2013) Opportunistic Exploitation: An Overlooked Pathway to Extinction. Trends Ecol Evol 28:409–413.

Bray JR, Curtis JT (1957) An Ordination of the Upland Forest Communities of Southern Wisconsin. Ecol Monogr 27:325–349.

Brennand HS, Soars N, Dworjanyn SA, Davis AR, Byrne M (2010) Impact of Ocean Warming and Ocean Acidification on Larval Development and Calcification in the Sea Urchin *Tripneustes gratilla*. PLoS One 5:e11372.

Bronstein O, Kroh A, Haring E (2016) Do genes lie? Mitochondrial capture masks the Red Sea collector urchin's true identity (*Echinodermata: Echinoidea: Tripneustes*). Mol Phylogenet Evol 104:1–13.

Bronstein O, Kroh A, Tautscher B, Liggins L, Haring E (2017) Cryptic Speciation in Pan-Tropical Sea Urchins: A Case Study of An Edge-of-Range Population of *Tripneustes* from the Kermadec Islands. Sci Rep 7:5948.

Bronstein O, Loya Y (2014) Echinoid Community Structure and Rates of Herbivory and Bioerosion on Exposed and Sheltered Reefs. J Exp Mar Bio Ecol 456:8–17.

Brown NP, Eddy SD (eds) (2015) Echinoderm aquaculture. Wiley Blackwell, Hoboken, New Jersey.

Buckland ST, Anderson D, Burnham KP, Laake JL, Borchers DL, Thomas L (2001) Distance Sampling: Estimating Abundance of Biological Populations. Oxford University Press, Oxford, UK.

Bulleri F, Pozas-Schacre C, Bischoff H, Bramanti L, D'agata S, Gasc J, Nugues M (2022) Compounded Effects of Sea Urchin Grazing and Physical Disturbance on Macroalgal Canopies in the Lagoon of Moorea, French Polynesia. Mar Ecol Prog Ser 697:45–56.

Byrne M, Lamare M, Winter D, Dworjanyn SA, Uthicke S (2013) The stunting Effect of a High CO2 Ocean on Calcification and Development in Sea Urchin Larvae, A Synthesis from the Tropics to the Poles. Philos Trans R Soc B 368:1–13.

Byrnes JEK, Johnson LE, Connell SD, Shears NT, McMillan S, Irving A, Buschmann AH, Graham MH, Kinlan BP (2013) The Sea Urchin–The Ultimate Herbivore and Biogeographic Variability in Its Ability to Deforest Kelp Ecosystems. PeerJ Prepr 2013:174.

Campbell CR, Schmidt L (2001) Molluscs and Echinoderms from the Emily Bay Settlement Site, Norfolk Island. Rec Aust Museum, Suppl 27:109–114.

Casilagan ILN, Juinio-Meñez MA, Crandall ED (2013) Genetic Diversity, Population Structure, and Demographic History of Exploited Sea Urchin Populations (*Tripneustes gratilla*) in the Philippines. J Exp Mar Bio Ecol 449:284–293.

Ceccherelli G, Addis P, Atzori F, Cadoni N, Casu M, Coppa S, De Luca M, de Lucia GA, Farina S, Fois N, Frau F, Gazale V, Grech D, Guala I, Mariani M, Marras MS, Navone A, Pansini A, Panzalis P, Pinna F, Ruiu A, Scarpa F, Piazzi L (2022) Sea Urchin Harvest Inside Marine Protected Areas: An Opportunity to Investigate the Effects of Exploitation Where Trophic Upgrading is Achieved. PeerJ 10:e12971.

Chuenpagdee R, Rocklin D, Bishop D, Hynes M, Greene R, Lorenzi MR, Devillers R (2019) The Global Information System on Small-Scale Fisheries (ISSF): A Crowdsourced Knowledge Platform. Mar Policy 101:158–166.

Clarke KR, Gorley RN (2015) PRIMER v7: User Manual/Tutorial. PRIMER-e Limited, Albany, New Zealand.

Cleary DFR, Becking LE, de Voogd NJ, Renema W, de Beer M, van Soest RWM, Hoeksema BW (2005) Variation in the Diversity and Composition of Benthic Taxa As A Function of Distance Offshore, Depth and Exposure in the Spermonde Archipelago, Indonesia. Estuar Coast Shelf Sci 65:557–570.

Clifton J (2013) Refocusing Conservation Through A Cultural Lens: Improving Governance in the Wakatobi National Park, Indonesia. Mar Policy 41:80–86.

Clifton J, Unsworth R, Smith DJ (eds) (2010) Marine Research and Conservation in the Coral Triangle: The Wakatobi National Park. Nova Science Publishers, Inc.,

Hauppauge.

Cohen PJ, Foale SJ (2013) Sustaining Small-Scale Fisheries With Periodically Harvested Marine Reserves. Mar Policy 37:278–287.

Contreras C, Niklitschek E, Molinet C, Díaz P, Díaz M (2019) Fishery-Induced Reductions in Density and Size Truncation of Sea Urchin *Loxechinus albus* Affects Diversity and Spesies Composition in Benthic Communities. Estuar Coast Shelf Sci 219:409–419.

Coppard SE, Campbell AC (2005) Distribution and Abundance of Regular Sea Urchins on Two Coral Reefs in Fiji. Micronesica 37:249–269.

Coppard SE, Campbell AC (2006) Taxonomic Significance of Test Morphology in the Echinoid Genera *Diadema* Gray, 1825 and *Echinothrix* Peters, 1853 (Echinodermata). Zoosystema 28:93–112.

Coppard SE, Jessop H, Lessios HA (2021) Phylogeography, Colouration, and Cryptic Speciation Across the Indo-Pacific in the Sea Urchin Genus *Echinothrix*. Sci Rep 11:16568.

Cornils A, Schulz J, Schmitt P, Lanuru M, Richter C, Schnack-Schiel SB (2010) Mesozooplankton Distribution in the Spermonde Archipelago (Indonesia, Sulawesi) with Special Reference to the Calanoida (Copepoda). Deep Sea Res Part II Top Stud Oceanogr 57:2076–2088.

Cruz-Trinidad A, Geronimo RC, Aliño PM (2009) Development Trajectories and Impacts on Coral Reef Use in Lingayen Gulf, Philippines. Ocean Coast Manag 52:173–180.

Cullen-Unsworth LC, Nordlund LM, Paddock J, Baker S, McKenzie LJ, Unsworth RKF (2014) Seagrass Meadows Globally as a Coupled Social–Ecological System: Implications for Human Wellbeing. Mar Pollut Bull 83:387–397.

Darius HT, Roué M, Sibat M, Viallon J, Gatti CM iti, Vandersea MW, Tester PA, Litaker RW, Amzil Z, Hess P, Chinain M (2018) Toxicological Investigations on the Sea Urchin *Tripneustes gratilla* (Toxopneustidae, Echinoid) from Anaho Bay (Nuku Hiva, French Polynesia): Evidence for the Presence of Pacific Ciguatoxins. Mar Drugs 16:122.

Darsono P (1986) Gonad Bulu Babi. Oseana 11:151–162.

Davis TR, Harasti D, Smith SDA, Kelaher BP (2016) Using Modelling to Predict Impacts of Sea Level Rise and Increased Turbidity on Seagrass Distributions in Estuarine Embayments. Estuar Coast Shelf Sci 181:294–301.

DeAmicis S, Foggo A (2015) Long-Term Field Study Reveals Subtle Effects of the Invasive Alga *Sargassum muticum* upon the Epibiota of Zostera marina. PLoS One 10:e0137861.

Denniston GB (1974) The Diet of the Ancient Inhabitants of Ashishik Point , an Aleut Community. Arctic Anthropol 11:143–152.

Dupont ST, Thorndyke MC (2013) Direct Impacts of Near-Future Ocean Acidification on Sea Urchins. In: *Climate change perspectives from the Atlantic: past, present and future*. Fernández-Palacios JM, de Nascimento L, Hernández JC, Clemente S, González A, Díaz-González JP (eds) Servicio de Publicaciones, Universidad de La Laguna, San Cristóbal de La Laguna, p 461–485

Ebert TA. (1982) Longevity , Life History , and Relatif Body Wall Size in Sea Urchins. Ecol Soc Am 52:353–394.

EC-PREP (2005) The Indonesian Ornamental Fish Trade: Case Studies and Options for Improving Livelihoods while Promoting Sustainability in Banggai and Banyuwangi. Network of Aquaculture Centres in Asia, Bangkok.

Edinger EN, Limmon G V., Jompa J, Widjatmoko W, Heikoop JM, Risk MJ (2000) Normal

Coral Growth Rates on Dying Reefs: Are Coral Growth Rates Good Indicators of Reef Health? Mar Pollut Bull 40:404–425.

Edrus IN, Suman A (2013) Kebijakan Perlindungan dan Konservasi Hewan Oktokoralian/Bambu Laut v Policy Synthesis on Protection and Conservation for octocoralian fauna (*Isis hippuris* Linnaeus 1758). J Kebijak Perikan Indones 5:107–112.

Eklöf JS, de la Torre-Castro M, Gullström M, Uku J, Muthiga N, Lyimo T, Bandeira SO (2008) Sea Urchin Overgrazing of Seagrasses: A Review of Current Knowledge on Causes, Consequences, and Management. Estuar Coast Shelf Sci 79:569–580.

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

Espinel-Velasco N, Agüera A, Lamare M (2020) Sea Urchin Larvae Show Resilience to Ocean Acidification at the Time of Settlement and Metamorphosis. Mar Environ Res 159:104977.

Faizal A (2023) Zonasi Perairan Kepulauan Spermonde Berdasarkan Konsentrasi Nutrient dan Dampaknya Terhadap Ekosistem Terumbu Karang Zonation of the Waters of Spermonde Archipelago Base on Nutrient Concentration and its Impact to Coral Reef Ecosystem. 6:126–137.

Faizal A, Amri K, Rani C, Nessa MN, Jompa J (2020) Dynamic model; the Effects of Eutrophication and Sedimentation on the Degradation of Coral Reefs in Spermonde Archipelago, Indonesia. IOP Conf Ser Earth Environ Sci 564:012084.

Fell FJ (1974) The Echinoids of Easter Island (Rapa Nui). Pacific Sci 28:147–158.

Ferguson CE (2021) Learning from Communities in Oceania to Build Equitable, Just and Resilient Fisheries. Stanford University

Ferse SCA, Glaser M, Neil M, Schwerdtner Máñez K (2014) To Cope or to Sustain? Eroding Long-Term Sustainability in an Indonesian Coral Reef Fishery. Reg Environ Chang 14:2053–2065.

Ferse SCA, Knittweis L, Krause G, Maddusila A, Glaser M (2012) Livelihoods of Ornamental Coral Fishermen in South Sulawesi/Indonesia: Implications for Management. Coast Manag 40:525–555.

Foster SJ, Vincent ACJ (2005) Enhancing Sustainability of the International Trade in Seahorses with a Single Minimum Size Limit. Conserv Biol 19:1044–1050.

Francis FT, Filbee-Dexter K, Yan HF, Côté IM (2019) Invertebrate Herbivores: Overlooked Allies in the Recovery of Degraded Coral Reefs? Glob Ecol Conserv 17:e00593.

Fuji A (1960) Studies on the Biology of the Sea Urchin. 北海道大學水産學部研究彙報 11:1–14.

Fujiwara A, Taguchi K, Yasumasu I (1990) Fertilization Membrane Formation in Sea Urchin Eggs Induced by Drugs Known to Cause Ca2+Release from Isolated Sarcoplasmic Reticulum. Dev Growth Differ 32:303–314.

Furkon, Nessa MN, Ambo-Rappe R (2019) Invertebrate Gleaning: Forgotten Fisheries. IOP Conf Ser Earth Environ Sci 253:012029.

Furkon, Nessa N, Ambo-Rappe R, Cullen-Unsworth LC, Unsworth RKF (2020) Social-Ecological Drivers and Dynamics of Seagrass Gleaning Fisheries. Ambio 49:1271–1281.

Gage JD, Tyler PA (1985) Growth and Recruitment of the Deep-Sea Urchin *Echinus affinis*. Mar Biol 90:41–53.

Ghofar A, Redjeki S, Madduppa H, Abbey M, Tasunar N (2018) Inclusive Blue Swimming Crab Fishery Management Initiative in Betahwalang Demak, Indonesia. IOP Conf

Ser Earth Environ Sci 116.

Girard D, Clemente S, Toledo-Guedes K, Brito A, Hernández JC (2012) A Mass Mortality of Subtropical Intertidal Populations of the Sea Urchin *Paracentrotus lividus*: Analysis of Potential Links with Environmental Conditions. Mar Ecol 33:377–385.

Giyanto, Abrar M, Hadi TA, Budiyanto A, Hafizt M, Salatalohy A, Iswari MY (2017) Status Terumbu Karang Indonesia 2017. Suharsono (ed) COREMAP-CTI, Lembaga Ilmu Pengetahuan Indonesia, Jakarta.

Glaser M, Breckwoldt A, Deswandi R, Radjawali I, Baitoningsih W, Ferse SCA (2015) A Holistic View on Participatory Coastal and Marine Management in an Indonesian Archipelago. Ocean Coast Manag 116:193–213.

Guenther CM, Lenihan HS, Grant LE, Lopez-Carr D, Reed DC (2012) Trophic Cascades Induced by Lobster Fishing Are Not Ubiquitous in Southern California Kelp Forests. PLoS One 7:e49396.

Gunawan BI, Visser LE (2012) Permeable Boundaries: Outsiders and Access to Fishing Grounds in the Berau Marine Protected Area. Anthropol Forum A J Soc Anthropol Comp Sociol 22:187–207.

Hadi T., Giyanto, Prayudha B, Hafizt M, Budiyanto A, Suharsono (2019) Indonesia Coral Reef Status 2018. 26.

Haerul A, Yasir I, Supriadi (2012) Grazing Activity and Food Preference of Sea Urchins to Seagrass Spesies Found in Coastal Area of Barrang Lompo Island, Makassar. In: *Prosiding Pertemuan Ilmiah Nasional Tahunan VIII ISOI, Makassar 25-27 September 2011*. Nababan B (ed) Ikatan Sarjana Oseanologi Indonesia (ISOI), Makassar, p 26–36

Hagström BE, Lönning S (1973) The Sea Urchin Egg As A Testing Object in Toxicology. Acta Pharmacol Toxicol (Copenh) 32:1–49.

Hammer Ø, Harper DAT, Ryan PD (2001) PAST: Paleontological Statistics Software Package for Education and Data Analysis. Palaeontol Electron 4:1–9.

Han X (2016) Persistent Alternate Abundance States in the Coral Reef Sea Urchin *Diadema savignyi* : Evidence of Alternate Attractors. Mar Ecol 37:1179–1189.

Harper S, Zeller D, Hauzer M, Pauly D, Sumaila UR (2013) Women and Fisheries: Contribution to Food Security and Local Economies. Mar Policy 39:56–63.

Harris M, Weisler M (2018) Prehistoric Human Impacts to Marine Mollusks and Intertidal Ecosystems in the Pacific Islands. J Isl Coast Archaeol 13:235–255.

Hasan MH (2019) Distribution Patterns and Ecological Aspects of the Sea Urchin *Diadema stosum* in the Red Sea, Egypt. Egypt J Aquat Biol Fish 23:93–106.

Hayes FE, Eastman ME, Duncan JC (2023) Fishes Associating with the Echinoids *Diadema setosum* and *Echinothrix calamaris* (Diadematoida: Diadematidae) in the Phi Phi Islands of southwestern Thailand. J Asia-Pacific Biodivers 16.

Heery EC, Hoeksema BW, Browne NK, Reimer JD, Ang PO, Huang D, Friess DA, Chou LM, Loke LHL, Saksena-Taylor P, Alsagoff N, Yeemin T, Sutthacheep M, Vo ST, Bos AR, Gumanao GS, Syed Hussein MA, Waheed Z, Lane DJW, Johan O, Kunzmann A, Jompa J, Suharsono, Taira D, Bauman AG, Todd PA (2018) Urban Coral Reefs: Degradation and Resilience of Hard Coral Assemblages in Coastal Cities of East and Southeast Asia. Mar Pollut Bull 135:654–681.

von Heland F, Clifton J (2015) Whose Threat Counts? Conservation Narratives in the Wakatobi National Park, Indonesia. Conserv Soc 13:154–165.

Hennicke A, Macrina L, Malcolm-Mckay A, Miliou A (2021) Assessment of Microplastic Accumulation in Wild Paracentrotus lividus, A Commercially Important Sea Urchin Spesies, in the Eastern Aegean Sea, Greece. Reg Stud Mar Sci 45:101855.

Hereu B, Linares C, Sala E, Garrabou J, Garcia-Rubies A, Diaz D, Zabala M (2012) Multiple Processes Regulate Long-Term Population Dynamics of Sea Urchins on Mediterranean Rocky Reefs. PLoS One 7:e36901.

Hernández JC, Clemente S, García E, McAlister JS (2020a) Planktonic Stages of the Ecologically Important Sea Urchin, *Diadema africanum*: Larval Performance Under Near Future Ocean Conditions. J Plankton Res 42:286–304.

Hernández JC, Sangil C, Lorenzo-Morales J (2020b) Uncommon Southwest Swells Trigger Sea Urchin Disease Outbreaks in Eastern Atlantic Archipelagos. Ecol Evol 10:7963–7970.

Hesdianti E (2011) Interaksi Landak Laut dan Lamun di Pulau Barrang Lompo, Kepulauan Spremonde, Sulawesi Selatan. Insitut Pertanian Bogor

von der Heyden S, Beger M, Toonen RJ, van Herwerden L, Juinio-Meñez MA, Ravago-Gotanco R, Fauvelot C, Bernardi G (2014) The Application of Genetics to Marine Management and Conservation: Examples from the Indo-Pacific. Bull Mar Sci 90:123–158.

Hodge S, Vink CJ (2017) Evidence of Absence is Not Proof of Absence: the Case of the New Brighton Katipō. New Zeal J Zool 44:14–24.

Hoegh-Guldberg O, Hoegh-Guldberg H, Veron JEN, Green A, Gomez E., Lough J, King M, Ambariyanto, Hansen L, Cinner J, Dews G, Russ G, Schuttenberg HZ, Peñaflor EL, Eakin CM, Christensen TRL, Abbey M, Areki F, Kosaka RA, Tewflik A, Oliver J (2009) The Coral Triangle and Climate Change: Ecosystems, People and Societies at Risk. WWF Australia, Brisbane.

Hoeksema BW (2012) Evolutionary Trends in Onshore-Offshore Distribution Patterns of Mushroom Coral Spesies (Scleractinia: Fungiidae). Contrib to Zool 81:199–221.

Hoeksema BW, Giyanto, Suharsono (2019) The Role of Maximum Shelf Depth versus Distance from Shore in Explaining a Diversity Gradient of Mushroom Corals (Fungiidae) off Jakarta. Diversity 11:16–19.

Hughes TP, Reed DC, Boyle M-J (1987) Herbivory on Coral Reefs: Community Structure Followong Mass Mortalities of Sea Urchins. J Exp Mar Bio Ecol 113:39–59.

Hurley M, Manel C (2015) Coordination, Development and Governance of Senegal Small-Scale Fisheries. Jentoft S, Chuenpagdee R (eds).

Iwasaki M, Harada R (1985) Proximate and Amino Acid Composition of the Roe and Muscle of Selected Marine Spesies. J Food Sci 50:1585–1587.

Jentoft S, Chuenpagdee R, Barragán-Paladines MJ, Franz N (2017) The Small-Scale Fisheries Guidelines. Jentoft S, Chuenpagdee R, Barragán-Paladines MJ, Franz N (eds) Springer International Publishing, Cham.

Johnson TR, Wilson JA, Cleaver C, Morehead G, Vadas R (2013) Modeling Fine Scale Urchin and Kelp Dynamics: Implications for Management of the Maine Sea Urchin Fishery. Fish Res 141:107–117.

Jompa J (1996) Monitoring and Assessment of Coral Reef in Spermonde Archipelago, South Sulawesi, Indonesia. McMaster University, Hamilton

Jompa J, McCook LJ (2002) Effects of Competition and Herbivory on Interactions Between A Hard Coral and A Brown Alga. J Exp Mar Bio Ecol 271:25–39.

Juinio-Meñez MA, Bangi HG, Malay MC, Pastor D (2008) Enhancing the Recovery of Depleted *Tripneustes gratilla* Stocks Through Grow-Out Culture and Restocking. Rev Fish Sci 16:35–43.

Kadir NN, La Nafie YA, Priosambodo D (2022) Seagrass Density Correlates with Burrow Abundance and Size in the Zebra Mantis Shrimp (Stomatopoda: Lysiosquillidae). Rev Biol Trop 70:688–701.

Kaharudin HAF (2020) Prehistoric Fast Food: Sea Urchin Exploitation on Alor Island in the Pleistocene and Holocene. The Australian National University

Kealy S, O'Connor S, Mahirta, Sari DM, Shipton C, Langley MC, Boulanger C, Kaharudin HAF, Patridina EPBGG, Algifary MA, Irfan A, Beaumont P, Jankowski N, Hawkins S, Louys J (2020) Forty-Thousand Years of Maritime Subsistence Near A Changing Shoreline on Alor Island (Indonesia). Quat Sci Rev 249:106599.

Khasanah M, Nurdin N, Sadovy de Mitcheson Y, Jompa J (2020) Management of the Grouper Export Trade in Indonesia. Rev Fish Sci Aquac 28:1–15.

King S, Saint-Amand A, Walker BK, Hanert E, Figueiredo J (2023) Larval Dispersal Patterns and Connectivity of Acropora on Florida's Coral Reef and Its Implications for Restoration. Front Mar Sci 9:1038463.

Knittweis L, Kraemer WE, Timm J, Kochzius M (2009) Genetic Structure of Heliofungia actiniformis (Scleractinia: Fungiidae) Populations in the Indo-Malay Archipelago: Implications for Live Coral Trade Management Efforts. Conserv Genet 10:241–249.

Kriegisch N, Reeves SE, Flukes EB, Johnson CR, Ling SD (2019a) Drift-Kelp Suppresses Foraging Movement of Overgrazing Sea Urchins. Oecologia 190:665–677.

Kriegisch N, Reeves SE, Johnson CR, Ling SD (2019b) Top-Down Sea Urchin Overgrazing Overwhelms Bottom-Up Stimulation of Kelp Beds Despite Sediment Enhancement. J Exp Mar Bio Ecol 514–515:48–58.

Krimou S, Gairin E, Gautrand L, Sowinski J, Trotier M, Minier L, Bischoff H, Sturny V, Maueau T, Waqalevu V, Bulleri F, Raick X, Bertucci F, Lecchini D (2023) Herbivory Effects of Sea Urchin Spesies on A Coral Reef (Bora-Bora, French Polynesia). J Exp Mar Bio Ecol 564:151900.

Kroh A (2020) Phylogeny and Classification of Echinoids. In: *Developments in Aquaculture and Fisheries Science*, 4th ed. Elsevier B.V., p 1–17

Kroh A, Mooi R (2023) World Echinoidea Database.

Kuo J (2007) New Monoecious Seagrass of *Halophila sulawesii* (Hydrocharitaceae) from Indonesia. Aquat Bot 87:171–175.

Lane DJW, Limbong D (2015) Catastrophic Depletion of Reef-Associated Sea Cucumbers: Resource Management/Reef Resilience Issues for An Indonesian Marine Park and the Wider Indo-Pacific. Aquat Conserv Mar Freshw Ecosyst 25:505–517.

Lanyon J (1986) Guide to the Identification of Seagrasses in the Great Barrier Reef Region. Gt Barrier Reef Mar Park Auth - Spec Publ Ser 3:61.

Láruson ÁJ, Coppard SE, Pespeni MH, Reed FA (2018) Gene Expression Across Tissues, Sex, and Life Stages in The Sea Urchin *Tripneustes gratilla* [Toxopneustidae, Odontophora, Camarodonta]. Mar Genomics 41:12–18.

Lawrence JM (ed) (2007) Edible Sea Urchins: Biology and Ecology, second. Elsevier, Amsterdam.

Lawrence JM (ed) (2013) Sea Urchins: Biology and Ecology, Third edit. Academic Press, London.

Lawrence JM, Agatsuma Y (2007) Chapter 24 Ecology of Tripneustes. In: *Edible sea urchins: biology and ecology*, 2nd ed. Lawrence JM (ed) Elsevier, Amsterdam, p 499–520

Legendre P, Legendre L (2012) Numerical Ecology, 3rd ed. Legendre P, Legendre L (eds) Elsevier, Amsterdam.

Lessios HA, Kane J, Robertson DR (2003) Phylogeography of the Pantropical Sea Urchin Tripneustes: Contrasting Patterns of Population Structure between Oceans. Evolution (N Y) 57:2026–2036.

Lessios HA, Kessing BD, Pearse JS (2001) Population Structure and Speciation in Tropical Seas: Global Phylogeography of the Sea Urchin Diadema. Evolution (N Y) 55:955–975.

Lestari HA, Samawi MF, Faizal A, Moore AM, Jompa J (2021a) Diversity and Abundance of Phytoplankton in the Coastal Waters of South Sulawesi. HAYATI J Biosci 28:199.

Lestari HA, Samawi MF, Faizal A, Moore AM, Jompa J (2021b) Physical and Chemical Parameters of Estuarine Waters Around South Sulawesi. Indones J Geogr 53:67831.

Levitan DR, Best RM, Edmunds PJ (2023) Sea Urchin Mass Mortalities 40 Y Apart Further Threaten Caribbean Coral Reefs. Proc Natl Acad Sci 120:e2218901120.

Li C, Haug T, Styrvold OB, Jørgensen TØ, Stensvåg K (2008) Strongylocins, Novel Antimicrobial Peptides from the Green Sea Urchin, *Strongylocentrotus droebachiensis*. Dev Comp Immunol 32:1430–1440.

Lindkvist E, Wijermans N, Daw TM, Gonzalez-Mon B, Giron-Nava A, Johnson AF, van Putten I, Basurto X, Schlüter M (2020) Navigating Complexities: Agent-Based Modeling to Support Research, Governance, and Management in Small-Scale Fisheries. Front Mar Sci 6:00733.

Liu J, Han G (2021) Controlling Factors of Riverine CO2 Partial Pressure and CO2 Outgassing in A Large Karst River Under Base Flow Condition. J Hydrol 593:125638.

De Loma TL, Conand C, Harmelin-Vivien M, Ballesteros E (2002) Food Selectivity of *Tripneustes gratilla* (L.) (Echinodermata: Echinoidea) in Oligotrophic and Nutrient-Enriched Coral Reefs at La Réunion (Indian Ocean). Bull Mar Sci 70:927–938.

Lubis SB, Suraji, Mudatstsir, Sari RP, Miasto Y, Prabowo, Monintja M, Terry N, Annisa S, Sofiullah A, Nelly E, Beginer S (2016) Pedoman Rehabilitasi Bambu Laut (*Isis hippuris*) dengan Metode Transplantasi. Rudansi A, Edrus IN, Candri DA, Kudus UA (eds) Ministry of Marine Affairs and Fisheries, Republic of Indonesia, Jakarta.

Luparello C, Ragona D, Asaro DML, Lazzara V, Affranchi F, Arizza V, Vazzana M (2020) Cell-Free Coelomic Fluid Extracts of the Sea Urchin Arbacia lixula Impair Mitochondrial Potential and Cell Cycle Distribution and Stimulate Reactive Oxygen Spesies Production and Autophagic Activity in Triple-Negative MDA-MB231 Breast Cancer Cells. J Mar Sci Eng 8:261.

Ma KCK, Redelinghuys S, Gusha MNC, Dyantyi SB, McQuaid CD, Porri F (2021) Intertidal Estimates of Sea Urchin Abundance Reveal Congruence in Spatial Structure for A Guild of Consumers. Ecol Evol:ece3.7958.

Madduppa HH, von Juterzenka K, Syakir M, Kochzius M (2014) Socio-Economy of Marine Ornamental Fishery and Its Impact on The Population Structure of the Clown Anemonefish *Amphiprion ocellaris* and its Hmost Anemones in Spermonde Archipelago, Indonesia. Ocean Coast Manag 100:41–50.

Mahon R, Almerigi S, McConney P, Parker C, Brewster L (2003) Participatory Methodology Used for Sea Urchin Co-Management in Barbados. Ocean Coast Manag 46:1–25.

Malm T (2009) Women of the Coral Gardens: The Sigificance of Marine Gathering in Tonga. SPC Tradit Mar Resour Manag Knowl Inf Bull 25:2–15.

Mangi SC, Roberts CM (2006) Quantifying the Environmental Impacts of Artisanal Fishing Gear on Kenya's Coral Reef Ecosystems. Mar Pollut Bull 52:1646–1660.

McClanahan TR (1988) Coexistence in a Sea Urchin Guild and Its Implications to Coral Reef Diversity and Degradation. Oecologia 77:210–218.

McClanahan TR (1995) Fish Predators and Scavengers of the Sea Urchin *Echinometra Mathaei* in Kenyan Coral-Reef Marine Parks. Environ Biol Fishes 43:187–193.

McClanahan TR (1998) Predation and the Distribution and Abundance of Tropical Sea Urchin Populations. J Exp Mar Bio Ecol 221:231–255.

McClanahan TR (1992) Resource Utilization, Competition, and Predation: A Model and Example From Coral Reef Grazers. Ecol Modell 61:195–215.

McClanahan TR, Shafir SH (1990) Causes and Consequences of Sea Urchin Abundance and Diversity in Kenyan Coral Reef Lagoons. Oecologia 83:362–370.

McCook L (2001) Competition Between Corals and Algal Turfs Along A Gradient of Terrestrial Influence in the Nearshore Central Great Barrier Reef. Coral Reefs 19:419–425.

McKenzie LJ (2003) Guidelines for The Rapid Assessment and Mapping of Tropical Seagrass Habitats in the Western Pacific. Department of Primary Industries, Queensland, Cairns.

McSkimming C, Tanner JE, Russell BD, Connell SD (2015) Compensation of Nutrient Pollution by Herbivores in Seagrass Meadows. J Exp Mar Bio Ecol 471:112–118.

Melis R, Ceccherelli G, Piazzi L, Rustici M (2019) Macroalgal Forests and Sea Urchin Barrens: Structural Complexity Loss, Fisheries Exploitation and Catastrophic Regime Shifts. Ecol Complex 37:32–37.

Miñarro S, Navarrete Forero G, Reuter H, van Putten IE (2016) The Role of Patron-Client Relations on the Fishing Behaviour of Artisanal Fishermen in the Spermonde Archipelago (Indonesia). Mar Policy 69:73–83.

Mok MY, Affendi YA, Ooi JLS (2023) Sea urchins of Peninsular Malaysia: Spatial Distribution and Spesies-Habitat Association. Reg Stud Mar Sci 61:102919.

Moka W, Inaku DF, Rais M, Moka W (2021) Sea urchin identification in Kodingareng Lompo waters, Spermonde Archipelago. IOP Conf Ser Earth Environ Sci 777.

Moll H (1983) Zonation and Diversity of Scleractinia on Reefs Off S.W. Sulawesi, Indonesia. dissertation, Moll, Leiden

Molla MHR, Aljahdali MO (2023) Marine-Derived Sea Urchin Compounds as Potential Anti-Cancer Drug Candidate Against Colorectal Cancer: in Silico and in Vitro Studies. Saudi J Biol Sci 30:103748.

Mooi R, Munguia A (2014) Sea urchins of the Philippines. In: *The Coral Triangle: The 2011 Hearst Philippine Biodiversity Expedition.* Williams GC, Gosliner TM (eds) California Academy of Sciences, San Francisco, p 213–235

Moore A, Ndobe S, Zamrud M (2011) Monitoring the Banggai Cardinalfish, an Endangered Restricted Range Endemic Spesies. J Indones Coral Reefs 1:99–113.

Moore AM, Ndobe S, Jompa J (2017) Fingerprints of the Anthropocene: the 2016 Coral Bleaching Event in an Equatorial Archipelago. In: *Proceedings of the 4th International Marine and Fisheries Symposium 2017*. Universitas Hasanuddin, Makassar, p 66–86

Moore AM, Ndobe S, Yasir I, Ambo-Rappe R, Jompa J (2019a) Banggai Cardinalfish and Its Microhabitats in A Warming World: A Preliminary Study. IOP Conf Ser Earth Environ Sci 253:012021.

Moore AM, Ndobe S, Yasir I, Jompa J (2019b) Disasters and Biodiversity: Case Study on the Endangered Endemic Marine Ornamental Banggai Cardinalfish. IOP Conf Ser Earth Environ Sci 253:012036.

Moore AM, Tassakka ACM, Ambo-Rappe R, Yasir I, Smith DJ, Jompa J (2019c) Unexpected Discovery of *Diadema clarkii* in the Coral Triangle. Mar Biodivers 49:2381–2399.

Moreira-Saporiti A, Hoeijmakers D, Reuter H, Msuya FE, Gese K, Teichberg M (2023)

Bottom-Up and Top-Down Control of Seagrass Overgrazing by the Sea Urchin *Tripneustes gratilla*. Mar Ecol 44:e12734.

Moreno-García DM, Salas-Rojas M, Fernández-Martínez E, López-Cuellar M del R, Sosa-Gutierrez CG, Peláez-Acero A, Rivero-Perez N, Zaragoza-Bastida A, Ojeda-Ramírez D (2022) Sea Urchins: An Update on Their Pharmacological Properties. PeerJ 10:e13606.

Mos B, Dworjanyn SA, Mamo LT, Kelaher BP (2019) Building Global Change Resilience: Concrete has the Potential to Ameliorate the Negative Effects of Climate-Driven Ocean Change on A Newly-Settled Calcifying Invertebrate. Sci Total Environ 646:1349–1358.

Muawanah U, Yusuf G, Adrianto L, Kalther J, Pomeroy R, Abdullah H, Ruchimat T (2018) Review of National Laws and Regulation in Indonesia in Relation to An Ecosystem Approach to Fisheries Management. Mar Policy 91:150–160.

Mumby PJ, Dahlgren CP, Harborne AR, Kappel C V., Micheli F, Brumbaugh DR, Holmes KE, Mendes JM, Broad K, Sanchirico JN, Buch K, Box S, Stoffle RW, Gill AB (2006a) Fishing, Trophic Cascades, and the Process of Grazing on Coral Reefs. Science (80-) 311:98–101.

Mumby PJ, Hedley JD, Zychaluk K, Harborne AR, Blackwell PG (2006b) Revisiting the Catastrophic Die-Off of the Urchin Diadema antillarum on Caribbean Coral Reefs: Fresh Insights on Resilience from A Simulation Model. Ecol Modell 196:131–148.

Murzina SA, Dgebuadze PY, Pekkoeva SN, Voronin VP, Mekhova ES, Thanh NTH (2021) Lipids and Fatty Acids of the Gonads of Sea Urchin *Diadema setosum* (Echinodermata) From the Coastal Area of the Nha Trang Bay, Central Vietnam. Eur J Lipid Sci Technol 2021:202000321.

Musfirah NH (2018) Struktur Komunitas Bulu Babi (Echinoidea) yang Berasosiasi dengan Ekosistem Lamun di Pulau Barrang Lompo, Provinsi Sulawesi Selatan. Universitas Hasanuddin

Muthiga NA, McClanahan TR (2013) Diadema. In: *Edible Sea Urchins: Biology and Ecology*. Lawrence JM (ed) Elsevier, London, p 257–274

Muthiga NA, Mcclanahan TR, Diadema S (2007) Ecology of Diadema. In: *Edible Sea Urchins: Biology and Ecology*. p 205–225

Nadiarti N, La Nafie YA, Priosambodo D, Umar MT, Rahim SW, Inaku DF, Musfirah NH, Paberu DA, Moore AM (2021) Restored Seagrass Beds Support Macroalgae and Sea Urchin Communities. IOP Conf Ser Earth Environ Sci 860:012014.

Nane L (2013) Studi Keberlanjutan Perikanan Landak Laut Berdasarkan Dimensi Biologi, Ekologi Dan Teknologi Di Sekitar Pulau Tolandono Dan Pulau Sawa Kawasan Konservasi Wakatobi. Universitas Hasanuddin, Makassar

Nane L, Baruadi ASR, Mardin H (2020) Density of the Blue-Black Urchin *Echinotrix diadema* (Linnaeus, 1758) in Tomini Bay, Indonesia. Tomini J Aquat Sci 1:16–21.

Nane L, Paramata AR (2020) Impact of Overfishing on Density and Test-Diameter Size of the Sea Urchin *Tripneustes gratilla* at Wakatobi Archipelago, South-Eastern Sulawesi, Indonesia. Ilmu Kelaut Indones J Mar Sci 25:53–56.

Ndobe S, Handoko K, Wahyudi D, Yasir M, Irawati Y, Tanod WA, Moore AM (2020) Monitoring the Endemic Ornamental Fish *Pterapogon kauderni* in Bokan Kepulauan, Banggai Marine Protected Area, Indonesia. Depik 9:18–31.

Ndobe S, Jompa J, Moore A (2018) A Tale of Two Urchins - Implications for In-Situ Breeding of the Endangered Banggai Cardinalfish (*Pterapogon kauderni*). Aquac Indones 19:65.

Ndobe S, Moore A, Salanggon AIM, Muslihuddin, Setyohadi D, Herawati EY, Soemarno (2013) Pengelolaan Banggai Cardinalfish (*Pterapogon kauderni*) Melalui Konsep

Ecosystem-Based Approach [Banggai Cardinalfish (*Pterapogon kauderni*) Management: an Ecosystem-Based Approach]. Mar Fish 4:115–126.

Ndobe S, Moore A, Yasir I, Jompa J (2019) Banggai Cardinalfish Conservation: Priorities, Opportunities, and Risks. IOP Conf Ser Earth Environ Sci 253:012033.

Ndobe S, Moore AM, Jompa J (2017) Status of and Threats to Microhabitats of the Endangered Endemic Banggai Cardinalfish (*Pterapogon kauderni*). Coast Ocean J 1:73–82.

Ndobe S, Serdiati N, Gani A, Walalangi JY, Moore AM (2023) Banggai Cardinalfish (*Pterapogon kauderni*) Monitoring in Bokan Kepulauan (2017-2021) Highlights the Need for the "BCF Garden" Approach. IOP Conf Ser Earth Environ Sci 1137:012059.

Nievales MFJ, Juinio-Meñez MA, Bangi HG (2006) Status and Prospects of Aquaculture of Threatened Echinoderms in the Philippines for Stock Enhancement and Restocking. In: *Proceedings of the Regional Technical Consultation on Stock Enhancement for Threatened Spesies of International Concern*. J. H. Primavera, Quinitio ET, Eguia MRR (eds) Southeast Asian Fisheries Development Center, Tigbauan, p 61–69

Nurdin N, Komatsu T, Rani C, Supriadi, Fakhriyyah S, Agus (2016) Coral reef destruction of Small island in 44 Years and Destructive Fishing in Spermonde Archipelago, Indonesia. IOP Conf Ser Earth Environ Sci 47:012011.

Nurdin N, Nafie Y La, Umar MT, Jamal M, Moore A (2019) Preliminary study: human trampling effects on seagrass density. IOP Conf Ser Earth Environ Sci 370:012050.

Nurhasan R, Rahim SAK (2011) Sea Urchin Fishery Practices in Sabah. In: *Proceedings of the International Fisheries Symposium 2011*. The WorldFish Center, Malaysia, Penang, p 5–9

Okada YK (1952) Some Observations on the Maturation of the Sea-Urchin, *Diadema setosum*. Annot Zool Jpn 25:265–271.

Ono R, Soegondho S, Yoneda M (2009) Changing Marine Exploitation During Late Pleistocene in Northern Wallacea: Shell Remains from Leang Sarru Rockshelter in Talaud Islands. Asian Perspect 48:318–341.

Orensanz JM, Seijo JC (2013) Rights-Based Management in Latin American Fisheries. Food and Agriculture Organization of the United Nations, Rome.

Ouréns R, Naya I, Freire J (2015) Mismatch Between Biological, Exploitation, and Governance Scales and Ineffective Management of Sea Urchin (*Paracentrotus lividus*) Fisheries in Galicia. Mar Policy 51:13–20.

Palumbi SR, Grabowsky G, Duda T, Geyer L, Tachino N (1997) Speciation and Population Genetic Structure in Tropical Pacific Sea Urchins. Evolution (N Y) 51:1506–1517.

Paredes E, Adams SL, Vignier J (2019) Cryopreservation of Sea Urchin Sperm and Early Life Stages, 1st ed. Elsevier Inc.

Parenden D, Jompa J, Rani C (2021) Condition of Hard Corals and Quality of The Turbid Waters in Spermonde Islands (Case Studies in Kayangan Island, Samalona Island and Kodingareng Keke Island). IOP Conf Ser Earth Environ Sci 921:012060.

Parvez MS, Rahman MA, Yusoff FM (2016a) Sea Urchin Fisheries in Malaysia: Status, Potentials and Benefits. Int J Chem Environ Biol Sci 4:64–66.

Parvez MS, Rahman MA, Yusoff FM (2016b) Status, Prospects and Potentials of Echinoid Sea Urchins in Malaysia. Int J Chem Environ Biol Sci 4:93–97.

Passarelli MC, Cesar A, Riba I, DelValls TA (2017) Comparative Evaluation of Sea-Urchin Larval Stage Sensitivity to Ocean Acidification. Chemosphere 184:224–234.

Pauly D (1995) Anecdotes and the Shifting Baseline Syndrome of Fisheries. Trends Ecol

Evol 10:430.

Pearse JS (1998) Distribution of *Diadema savignyi* and *D. setosum* in the Tropical Pacific. In: *Echinoderms: San Francisco*. Mooi R, Tellford M (eds) Balkema, Rottercam, p 777–782

Pearse JS, Arch SW (1969) The Aggregation Behavior of Diadema (Echinodermata, Echinoidea). Micronesica 5:165–171.

Pearse PH (1981) Fishing Rights, Regulations and Revenues. Mar Policy 5:135–146.

Pedreschi D, Vigier A, Höffle H, Kraak SBM, Reid DG (2021) Innovation Through Consultation: Stakeholder Perceptions of A Novel Fisheries Management System Reveal Flexible Approach to Solving Fisheries Challenges. Mar Policy 124.

Piazzi L, Ceccherelli G (2019) Effect of Sea Urchin Human Harvest in Promoting Canopy Forming Algae Restoration. Estuar Coast Shelf Sci 219:273–277.

Pilnick AR, Henry JA, Hesley D, Akins JL, Patterson JT, Lirman D (2023) Long-Term Retention and Density-Dependent Herbivory from *Diadema antillarum* Following Translocation Onto A Reef Restoration Site. Coral Reefs 42.

Plass-Johnson JG, Bednarz VN, Hill JM, Jompa J, Ferse SCA, Teichberg M (2018a) Contrasting Responses in the Niches of Two Coral Reef Herbivores Along a Gradient of Habitat Disturbance in the Spermonde Archipelago, Indonesia. Front Mar Sci 5:00032.

Plass-Johnson JG, Taylor MH, Husain AAA, Teichberg MC, Ferse SCA (2016) Non-Random Variability in Functional Composition of Coral Reef Fish Communities along an Environmental Gradient. PLoS One 11:e0154014.

Plass-Johnson JG, Teichberg M, Bednarz VN, Gärdes A, Heiden JP, Lukman M, Miñarro S, Kegler H, Weiand L, Wild C, Reuter H, Ferse SCA (2018b) Spatio-Temporal Patterns in the Coral Reef Communities of the Spermonde Archipelago, 2012–2014, II: Fish Assemblages Display Structured Variation Related to Benthic Condition. Front Mar Sci 5:1–15.

Pogoreutz CI (2011) Fish Diversity Patterns and Trophic Relationships in Different Types of Tropical Seagrass Meadows in the Spermonde Archipelago, South Sulawesi, Indonesia. University of Vienna

Pontheaux F, Roch F, Morales J, Cormier P (2021) Echinoderms: Focus on the Sea Urchin Model in Cellular and Developmental Biology. In: *Handbook of Marine Model Organisms in Experimental Biology*, 1st ed. Boutet A, Schierwater B (eds) CRC Press, Boca Raton, p 307–333

Prasada D (2020) Pengaruh Gaya Kepemimpinan dan Budaya Organisasi Terhadap Kinerja Karyawan Pada PT. Mandiri Konstruksi di Tangerang Selatan. J Educ Hum Soc Sci 3:629–636.

Purcell SW, Fraser NJ, Tagica S, Lalavanua W, Ceccarelli DM (2018) Discriminating Catch Composition and Fishing Modes in an Artisanal Multispesies Fishery. Front Mar Sci 5:00243.

Purcell SW, Lovatelli A, Vasconcellos M, Ye Y (2010) Managing Sea Cucumber Fisheries with An Ecosystem Approach.

Purcell SW, Pomeroy RS (2015) Driving Small-Scale Fisheries in Developing Countries. Front Mar Sci 2:1–7.

Purcell SW, Tagliafico A, Cullis BR, Gogel BJ (2020) Understanding Gender and Factors Affecting Fishing in an Artisanal Shellfish Fishery. Front Mar Sci 7:1–15.

Qiu J-W, Lau DCC, Cheang C, Chow W (2014) Community-level destruction of hard corals by the sea urchin Diadema setosum. Mar Pollut Bull 85:783–788.

R Core Team (2019) R: A Language and Environment for Statistical Computing Version

3.6.0.

Rachmawan EW, Suryono CA, Riniatsih I (2021) Perbandingan Tutupan Antar Lamun, Makroalga dan Epifit Di Perairan Paciran Lamongan. J Mar Res 10:508–514.

Rahim SAKA, Nurhasan R (2016) Status of Sea Urchin Resources in the East Coast of Borneo. J Mar Biol 2016:6393902.

Rahman MA, Amin SMN, Yusoff FM, Arshad A, Kuppan P, Nor Shamsudin M (2012) Length Weight Relationships and Fecundity Estimates of Long-Spined Sea Urchin, *Diadema setosum*, from the Pulau Pangkor, Peninsular Malaysia. Aquat Ecosyst Health Manag 15:311–315.

Rahman MA, Ismail M, Parvez MS, Asadujjaman M, Ashik A-A, Molla MHR (2022) Echinoderm Fisheries: Their Culture, Conservation, Bioactive Compounds and Therapeutic Applications. J Biol Stud 5:413–443.

Rahmawati S, Irawan A, Supriyadi IH, Azkab MH (2017) Panduan Pemantauan Padang Lamun, 2nd Editio. COREMAP-CTI Lembaga Ilmu Pengetahuan Indonesia, Jakarta.

Razak TB, Ramadhani BA, Corni S, Roelfsema C, Markey K, Bambic B, De Brauwer M, Masdar H, Purnama R, Dumbrell AJ, Jompa J, Limmon G V., Beger M, Fox HE (2021) Large Scale Study of Benthic Communities in Eastern Indonesia's Reef Systems. Reg Stud Mar Sci 44:101731.

Renema W, Hoeksema BW, Hinte JE Van (2001) Larger Benthic Foraminifera and Their Distribution Patterns on the Spermonde Shelf, South Sulawesi. Zool Verh 334:115–149.

Richardson LE, Graham NAJ, Hoey AS (2020) Coral Spesies Composition Drives Key Ecosystem Function on Coral Reefs. Proc R Soc B Biol Sci 287:20192214.

Ristanto A, Yanti AH, Setyawati TR (2018) Sea Urchin (Echinoidea) Distribution and Abundance in the Intertidal Zone of Bengkayang Regency. Biosaintifika J Biol Biol Educ 10:32–40.

Routledge RD (1979) Diversity Indices: Which Ones are Admissible? J Theor Biol 76:503–515.

RStudio Team (2016) RStudio: Integrated Development for R.

Rubilar T, Cardozo D (2021) Blue Growth: Sea Urchin Sustainable Aquaculture, Innovative Approaches. Rev Biol Trop 69:474–486.

Rustici M, Ceccherelli G, Piazzi L (2017) Predator Exploitation and Sea Urchin Bistability: Consequence on Benthic Alternative States. Ecol Modell 344:1–5.

Sadili D, Subhan B, Madduppa HH, Sarmintohadi, Ramli I (2015) Pedoman Umum Monitoring Bambu Laut. Dermawan A (ed) Ministry of Marine Affairs and Fisheries, Republic of Indonesia, Jakarta.

Sahara H, Ishikawa M, Takahashi N, Ohtani S, Sato N, Gasa S, Akino T, Kikuchi K (1997) In Vivo Anti-Tumour Effect of 3'-Sulphonoquinovosyl 1'-Monoacylglyceride Isolated from Sea Urchin (*Strongylocentrotus intermedius*) Intestine. Br J Cancer 75:324–332.

Samuel PD, Wiadnya DGR, Yanuwiadi B (2017) Spesies and Abundance of Sea Urchins (*Diadematidae*) on Different Environmental Pressure Conditions. J Trop Life Sci 7:146–150.

Sand C, Bole J, Ouetcho A (2002) Site LPO023 of Kurin: Characteristics of a Lapita Settlement in the Loyalty Islands (New Caledonia). Asian Perspect 41:129–147.

Sawall Y, Jompa J, Litaay M, Maddusila A, Richter C (2013) Coral Recruitment and Potential Recovery of Eutrophied and Blast Fishing Impacted Reefs in Spermonde Archipelago, Indonesia. Mar Pollut Bull 74:374–382.

Sawall Y, Richter C, Ramette A (2012) Effects of Eutrophication, Seasonality and Macrofouling on the Diversity of Bacterial Biofilms in Equatorial Coral Reefs. PLoS One 7:e39951.

Sawalman R, Werorilangi S, Ukkas M, Mashoreng S, Yasir I, Tahir A (2021) Microplastic Abundance in Sea Urchins (*Diadema setosum*) from Seagrass Beds of Barranglompo Island, Makassar, Indonesia. IOP Conf Ser Earth Environ Sci 763:012057.

Scheibling RE, Lauzon-Guay J-S (2010) Killer storms: North Atlantic Hurricanes and Disease Outbreaks in Sea Urchins. Limnol Oceanogr 55:2331–2338.

Schultz H (2006) Sea Urchins Volume 1: A Guide to Worldwide Shallow Water Spesies. Heinke & Peter Schultz Partner, Hemdingen.

Sheppard-Brennand H, Dworjanyn SA, Poore AGB (2017) Global Patterns in the Effects of Predator Declines on Sea Urchins. Ecography (Cop) 40:1029–1039.

Sibiya A, Jeyavani J, Sivakamavalli J, Ravi C, Divya M, Vaseeharan B (2021) Bioactive Compounds From Various Types of Sea Urchin and Their Therapeutic Effects — A Review. Reg Stud Mar Sci 44:101760.

Siddon C, Witman J (2003) Influence of Chronic, Low-Level Hydrodynamic Forces on Subtidal Community Structure. Mar Ecol Prog Ser 261:99–110.

Sjafrie NDM, Rahmadi P, Kurniawan F, Triyono, Supriyadi IH (2021) Socio-Ecological System Perspective of Seagrass Ecosystem in Wakatobi. IOP Conf Ser Earth Environ Sci 744:012078.

Sloan N (1984) Echinoderm Fisheries of the World: A Review. In: *Echinodermata: Proceedings of the Fifth International Echinoderm conference*. Keegan BF, O'Connor BDS (eds) AA Balkema, Rotterdam, p 109–124

Snelgrove PVR, Thrush SF, Wall DH, Norkko A (2014) Real World Biodiversity–Ecosystem Functioning: A Seafloor Perspective. Trends Ecol Evol 29:398–405.

Stefánsson G, Kristinsson H, Ziemer N, Hannon C, James P (2017) Markets for Sea Urchins: A Review of Global Supply and Markets. Skýrsla Matís 45:1–45.

Steneck RS (2013) Sea Urchins as Drivers of Shallow Benthic Marine Community Structure. In: *Sea Urchins: Biology and Ecology*, 3rd Editio. Lawrence JM (ed) Elsevier, London, p 195–212

Stevenson A, Kroh A (2020) Deep-sea sea urchins. In: *Sea Urchins: Biology and Ecology*, 4th ed. Lawrence JM (ed) Elsevier B.V., p 237–254

Suharsono (1996) Jenis-jenis Karang yang Umum di Jumpai di Perairan Indonesia. Jakarta : Lembaga Ilmu Pengetahuan Indonesia Pusat Penelitian dan Pengembangan Oseanologi Proyek Penelitian dan Pengembangan Daerah Pantai, 1996.

Sun J, Zhao Z, Zhao C, Yu Y, Ding P, Ding J, Yang M, Chi X, Hu F, Chang Y (2021) Interaction Among Sea Urchins in Response to Food Cues. Sci Rep 11:9985.

Suryanti S, Ain C, Latifah N (2018) Relationships Between of Sea Urchins Abundance , Macroalgae and Coral Closure on the Cemara Kecil island. IOP Conf Ser Earth Environ Sci 1025:012038.

Suwarni, Tresnati J, Tuwo A, Omar SBA (2020) Morphometric Characteristics of Rabbit Fish (*Siganus canaliculatus* park, 1797) in Makassar Strait, Flores Sea, and Bone Gulf. AACL Bioflux 13:2343–2354.

Talaue-McManus L, Kesner KPN (1993) Valuation of a Philippine Municipal Sea Urchin Fishery and Implications of Its Collapse. In: *Philippine Coastal Resources Under Stress: Selected papers from the Fourth Annual Common Property Conference, Manilla, 16-19 June 1993*. Juinio-Menez MA, Newkirk GF (eds) Coastal Resources

Research Network, Dalhousie University, Halifax, p 229–239

Tamti H, Rappe RA, Omar SBA, Budimawan (2021) Preliminary Assessment of *Tripneustes gratilla* Populations in Seagrass Beds of the Spermonde Archipelago, South Sulawesi, Indonesia. IOP Conf Ser Earth Environ Sci 763:012008.

Tis'in M, Ambo-Rappe R, Mashoreng S, Faizal A (2023) Impact of Coastal Reclamation on Seagrass Habitat in Palu Bay, Central Sulawesi, Indonesia. IOP Conf Ser Earth Environ Sci 1253:012106.

Toha AHA, Binur R, Suhaemi, Lutfi, Hakim L, Widodo N, Sumitro SB (2014) Genetic Aspects of the Commercially Used Sea Urchin *Tripneustes gratilla.* J Biol Res 20:12–17.

Toha AHA, Sumitro SB, Hakim L, Widodo N, Binur R, Suhaemi S, Anggoro AW (2017) Review: Biology of the Commercially Used Sea Urchin *Tripneustes gratilla* (Linnaeus, 1758) (Echinoidea: Echinodermata). Ocean Life 1:1–10.

Toha AHA, Sumitro SB, Hakim L, Widodo W (2012) Kondisi Habitat Bulu Babi *Tripneustes gratilla* linnaeus 1758 di Teluk Cenderawasih. J Biol Res 17:139–145.

Tresnati J, Yasir I, Aprianto R, Yanti A, Rahmani PY, Tuwo A (2019) Long-Term Monitoring of Parrotfish Spesies Composition in the Catch of Fishermen from the Spermonde Islands, South Sulawesi, Indonesia. IOP Conf Ser Earth Environ Sci 370:012015.

Tuapattinaja MA, Pattikawa JA, Natan Y (2014) Community Structure of Echinoderms at Tanjung Tiram, Inner Ambon bay, Indonesia. AACL Bioflux 7:351–356.

Unsworth RKF, Ambo-Rappe R, Jones BL, La Nafie YA, Irawan A, Hernawan UE, Moore AM, Cullen-Unsworth LC (2018) Indonesia's Globally Significant Seagrass Meadows are Under Widespread Threat. Sci Total Environ 634:279–286.

Uthicke S, Patel F, Petrik C, Watson SA, Karelitz SE, Lamare MD (2021) Cross-Generational Response of A Tropical Sea Urchin to Global Change and A Selection Event in A 43-Month Mesocosm Study. Glob Chang Biol:3448–3462.

Uthicke S, Schaffelke B, Byrne M (2009) A Boom–Bust Phylum? Ecological and Evolutionary Consequences of Density Variations in Echinoderms. Ecol Monogr 79:3–24.

Uthicke S, Soars N, Foo S, Byrne M (2013) Effects of Elevated pCO2 and the Effect of Parent Acclimation on Development in the Tropical Pacific Sea Urchin *Echinometra mathaei*. Mar Biol 160:1913–1926.

Vafidis D, Antoniadou C, Voulgaris K, Varkoulis A, Apostologamvrou C (2021) Abundance and Population Characteristics of the Invasive Sea Urchin *Diadema setosum* (Leske, 1778) in the South Aegean Sea (Eastern Mediterranean). J Biol Res 28:11.

Valentine JF, Heck KL (1991) The role of Sea Urchin Grazing in Regulating Subtropical Seagrass Meadows: Evidence from Field Manipulations in the Northern Gulf of Mexico. J Exp Mar Bio Ecol 154:215–230.

Verheij E, Erftemeijer PLA (1993) Distribution of Seagrasses and Associated Macroalgae in South Sulawesi, Indonesia. Blumea J Plant Taxon Plant Geogr 38:45–64.

Vermaat JE, Agawin NSR, Fortes MD, Uri JS (1997) The Capacity of Seagrasses to Survive Increased Turbidity and Siltation: The Significance of Growth Form and Light Use. Ambio 26:499–504.

Vonk JA, Christianen MJA, Stapel J (2010) Abundance, Edge Effect, and Seasonality of Fauna in Mixed-Spesies Seagrass Meadows in Southwest Sulawesi, Indonesia. Mar Biol Res 6:282–291.

Vonk JA, Christianen MJA, Stapel J (2008) Redefining the Trophic Importance of Seagrasses for Fauna in Tropical Indo-Pacific Meadows. Estuar Coast Shelf Sci 79:653–660.

Wagey BT, Bucol AA (2016) Indigenous Ecological Knowledge (IEK) on the Utilization and Conservation of Coastal Resources in Siquijor Island, Central Philippines. Ecol Environ Conserv 22:1137–1144.

Wahyudi AJ, Mirah Sjafrie N dhewani, Sutisna D (2022) Kupas Tuntas Legasi COREMAP Hasil, Dampak, serta Proyeksi Program Pemantauan dan Riset Ekosistem Laut Indonesia.

Wainwright BJ, Arlyza IS, Karl SA (2018) Population Genetics of the Collector Urchin, *Tripneustes gratilla*, in the Indonesian Archipelago. Mar Ecol 39:e12530.

Wallner-Hahn S, de la Torre-Castro M, Eklöf JS, Gullström M, Muthiga NA, Uku J (2015) Cascade Effects and Sea-Urchin Overgrazing: An Analysis of Drivers Behind the Exploitation of Sea Urchin Predators for Management Improvement. Ocean Coast Manag 107:16–27.

Wang T, Wang Y (2020) Behavioral Responses to Ocean Acidification in Marine Invertebrates: New Insights and Future Directions. J Oceanol Limnol 38:759–772.

Waycott M, Duarte CM, Carruthers TJBB, Orth RJ, Dennison WC, Olyarnik S, Calladine A, Fourqurean JW, Heck KL, Hughes AR, Kendrick GA, Kenworthy WJ, Short FT, Williams SL (2009) Accelerating Loss of Seagrasses Across the Globe Threatens Coastal Ecosystems. Proc Natl Acad Sci U S A 106:12377–12381.

Waycott M, Mckenzie LJ, Mellors JE, Ellison JC, Sheaves MT, Collier C, Schwarz A, Webb A, Johnson JE, Payri CE (2011) Chapter 6 Vulnerability of Mangroves, Seagrasses and Intertidal Lats in the Tropical Pacific to Climate Change. In: *Vulnerability of Tropical Paciic Fisheries and Aquaculture to Climate Change*. Bell J, Johnson J, AJ H (eds) Secretariat of the Paciic Community, Noumea, New Caledonia, p 297–368

Westbrook CE, Ringang RR, Cantero SMA, Toonen RJ (2015) Survivorship and Feeding Preferences Among Size Classes of Outplanted Sea Urchins, *Tripneustes gratilla* , and Possible Use As Biocontrol for Invasive Alien Algae. PeerJ 3:e1235.

White C, Costello C (2011) Matching Spatial Property Rights Fisheries with Scales of Fish Dispersal. Ecol Appl 21:350–362.

Wiadnyana NN, Suharti SR, Ndobe S, Triharyuni S, Lilley GR, Risuana S, Wahyudi D, Moore AM (2020) Population Trends of Banggai Cardinalfish in the Banggai Islands, Central Sulawesi, Indonesia. IOP Conf Ser Earth Environ Sci 420:012033.

Williams SL, Ambo-Rappe R, Sur C, Abbott JM, Limbong SR (2017) Spesies Richness Accelerates Marine Ecosystem Restoration in the Coral Triangle. Proc Natl Acad Sci 114:11986–11991.

Williams SL, Sur C, Janetski N, Hollarsmith JA, Rapi S, Barron L, Heatwole SJ, Yusuf AM, Yusuf S, Jompa J, Mars F (2019) Large-Scale Coral Reef Rehabilitation After Blast Fishing in Indonesia. Restor Ecol 27:447–456.

Wilson JR, Bradley D, Phipps K, Gleason MG (2020) Beyond Protection: Fisheries Co-Benefits of No-Take Marine Reserves. Mar Policy 122:104224.

Wulandewi NLE, Subagio JN, Wiryatno J (2015) Jenis dan Densitas Bulu Babi (Echinoidea) di Kawasan Pantai Sanur dan Serangan Denpasar- Bali. J Simbiosis III:269–280.

Young DAL, Bellwood DR (2012) Fish Predation on Sea Urchins on the Great Barrier Reef. Coral Reefs 31:731–738.

Yustiana D, Fadli M, Kusumaningrum A, Solimun (2021) Significant Factors Impact of Reclamation on Environmental, Economic, and Social Cultural Aspects in Makassar City. Glob J Eng Technol Adv 7:213–223.

Yusuf S, Beger M, Citra A, Tassakka MAR, Brauwer MDE, Pricella A, Umar W, Limmon G V, Moore AM, Jompa J (2021) Cross Shelf Gradients of Scleractinian Corals in the Spermonde Islands, South Sulawesi, Indonesia. Biodiversitas 22:1415–1423.

Yusuf S, Moore AM (2020) Hunting in the Seas: Population Status and Community Perspectives on Giant Clams (Tridacnidae) and Napoleon wrasse (*Cheilinus undulatus*), Endangered Marine Taxa of the Wallacea Region, Indonesia. IOP Conf Ser Earth Environ Sci 473:012061.

Yusuf S, Suharto, Amri K, Burhanuddin I, Rape RA, Supriadi (2017) Monitoring Kondisi Terumbu Karang dan Ekosistem Terkait di Liukang Tuppabiring Kabupaten Pangkep. Jompa J, Suharsono (eds) Makassar, Jakarta. UNHAS COREMAP CTI LIPI.

LAMPIRAN

Lampiran 1. Klasifikasi landak laut

Klasifikasi landak laut yang diamati selama studi menurut sistem klasifikasi dalam (Kroh 2020) dan World Echinoidea Database (Kroh & Mooi 2023).

Kerajaan Animalia Linnaeus, 1758
Filum Echinodermata Bruguière, 1791 [ex Klein, 1734]
Subfilum Echinozoa Haeckel, 1895
Kelas Echinoidea Leske, 1778
Sub Kelas Euechinoidea Bronn, 1860
Infrakelas Aulodonta Jackson, 1912
Ordo Diadematoida Duncan, 1889
Famili Diadematidae Gray, 1855
Genus *Diadema* Gray, 1825
Diadema savignyi (Audouin, 1809)
Diadema setosum (Leske, 1778)
Diadema spp
Genus *Echinothrix* Peters, 1853
Echinothrix calamaris (Pallas, 1774)
Echinothrix diadema (Linnaeus, 1758)
Infrakelas Carinacea Kroh & Smith, 2010
Superordo Echinacea Claus, 1876
Ordo Camarodonta Jackson, 1912
Infraordo Echinidae Kroh & Smith, 2010
Superfamili Odontophora Kroh & Smith, 2010
Famili Echinometridae Gray, 1855
Genus *Echinometra* Gray, 1825
Echinometra mathaei (Blainville, 1825)
Famili Toxopneustidae Troschel, 1872
Genus *Toxopneustes*, L. Agassiz, 1841
Toxopneustes pileolus (Lamarck, 1816)
Genus *Tripneustes* Troschel, 1872
Tripneustes gratilla (L. Agassiz, 1841)

Lampiran 2. Kuesioner

Survei Pemanfaatan landak laut di Indonesia

Identitas Responden

1. Nama Responden :
2. Jenis Kelamin :
3. Usia (Tahun) :
4. Pendidikan :
5. Pekerjaan Utama :
6. Pekerjaan Istri/ Suami :
7. Jumlah Tanggungan :
8. Estimasi pendapatan keluarga/ bulan (Rp) :
9. Alamat
10. No. HP

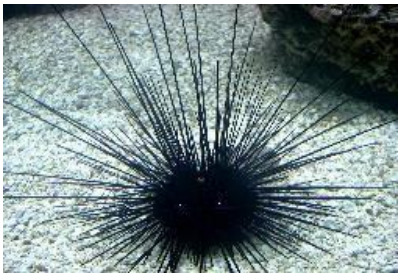
Pemanfaatan landak laut

1. Jenis landak laut yang sering dikoleksi (centang jenis landak laut)

A. *Tripneustes gratilla* (duri pendek)

B. *Echinothrix calamaris* (duri sedang/ belang-belang)

C. *Diadema* setosum. (duri panjang)



D. *Echinometra* spp. (duri besar)

2. Nama lokal untuk setiap jenis landak laut yang disebutkan pada pertanyaan 1 (jika ada):

A. ……
B. ……
C. ……
D. ……

3. Jenis alat tangkap yang digunakan (daftarkan alat yang digunakan)
    A. ……
    B. ……
    C. ……
    D. ……
4. Sejak tahun kapan melakukan penangkapan?
5. Cara/ metode penangkapan?
6. Habitat tempat penangkapan (lingkari yang pilihan relevan)?
    VI. Padang lamun
    VII. Pasir
    VIII. Karang
    IX. Tubir
    X. Dll (sebutkan)……
7. Kondisi pasang surut saat penangkapan (pasang/surut/ keduanya)?
8. Kedalaman tempat penangkapan (meter)?
9. Waktu penangkapan (pagi/siang/sore/malam)?
10. Rata-rata durasi penangkapan (jam) dalam sehari?
11. Rata-rata jumlah hari penangkapan dalam sebulan?
12. Musim penangkapan dalam setahun (jika musiman), pada bulan apa saja?
13. Saat ini, rata-rata tangkapan (berapa ekor) landak laut per trip untuk jenis *Tripneustes*?
14. Saat ini, rata-rata tangkapan (berapa ekor) landak laut per trip untuk jenis *Diadema*?
15. Saat ini, rata-rata tangkapan (berapa ekor) landak laut per trip untuk jenis *Echinotrhix*?
16. Saat ini, rata-rata tangkapan (berapa ekor) landak laut per trip untuk jenis *Echinometra*?
17. Jika dibandingkan 5 – 10 tahun lalu, bagaimana jumlah tangkapan *Tripneustes* saat ini?
    A. Tetap
    B. Meningkat
    C. Menurun
18. Jika dibandingkan 5 – 10 tahun lalu, bagaimana jumlah tangkapan *Diadema* saat ini?
    A. Tetap
    B. Meningkat
    C. Menurun
19. Jika dibandingkan 5 – 10 tahun lalu, bagaimana jumlah tangkapan *Echinotrhix* saat ini?
    1. Tetap
    2. Meningkat
    3. Menurun
20. Jika dibandingkan 5 – 10 tahun lalu, bagaimana jumlah tangkapan *Echinometra* saat ini?
        a) Tetap
        b) Meningkat
        c) Menurun

21. Jika terjadi tren perubahan jumlah tangkapan, apa yang menyebabkan perubahan tersebut? (daftarkan kemungkinan faktor-faktor penyebabnya)

a) …..
b) …..
c) …..

22. Tujuan utama penangkapan landak laut untuk (lingkari pilihan yang relevan):

a) Konsumsi
b) Dijual
c) Keduanya

23. Proporsi hasil tangkapan (%) untuk:

a) Konsumsi
b) Dijual

24. Jika mengkonsumsi landak laut, berapa jumlah yang umumnya dikonsumsi per orang (ekor/orang/hari)?

25. Cara mengkonsumsi landak laut dengan cara apa (daftarkan semua cara yang dilakukan)?

a) ……
b) ……
c) ……

26. Jika dijual, kemana/ siapa yang membeli landak laut?

27. Jika dijual, dalam bentuk apa (landak laut segar atau hanya gonad)?

28. Jika dijual, siapa yang menentukan harga? Apakah ada negosiasi harga?

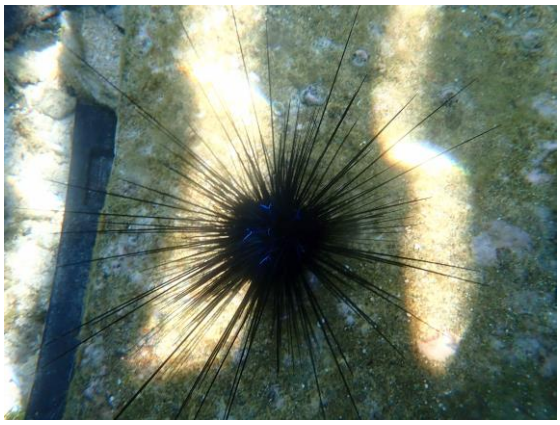
29. Harga rata-rata per ekor (Rp/ekor)?

30. Apakah terjadi fluktuasi harga penjualan?

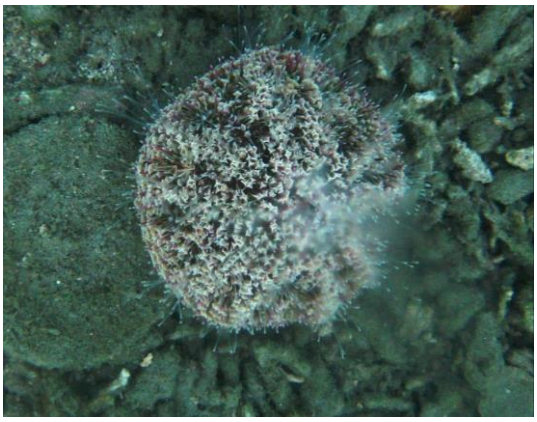
31. Untuk memastikan keberlanjutan populasi landak laut di laut, maka menurut anda, hal-hal mana saja yang perlu dilakukan? (lingkari pilihan yang relevan) (jawaban bisa lebih dari satu)

a) Tidak perlu melakukan apa-apa
b) Melakukan pembatasan ukuran yang boleh ditangkap
c) Melakukan pembatasan jumlah yang boleh ditangkap
d) Memberlakukan sistem perizinan yang ketat
e) Lainnya (silahkan ditambahkan)…….

Lampiran 3. Foto Spesimen Landak Laut

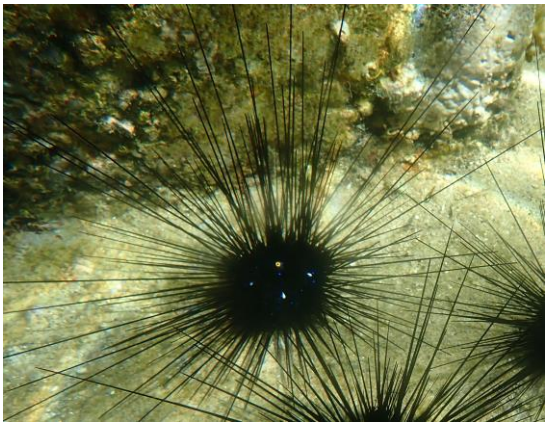


Diadema savignyi

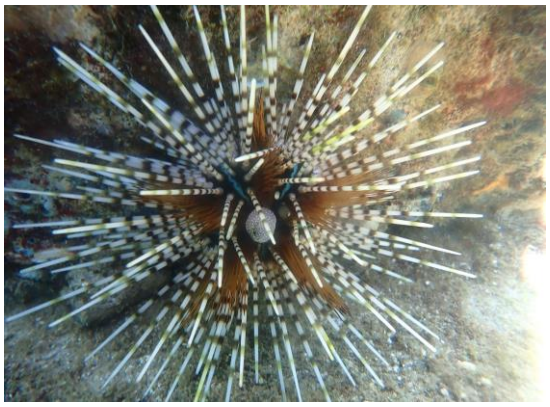


Toxopneustes pileolus

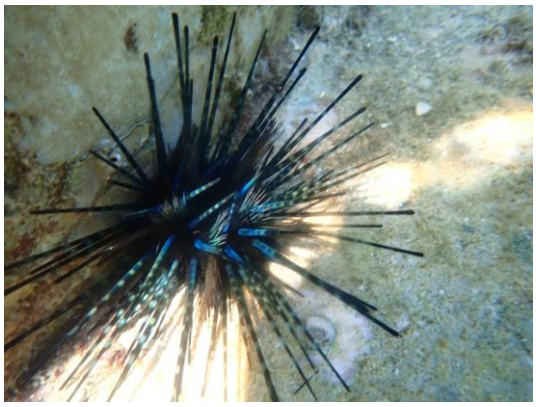
Tripneustes gratilla



Diadema setosum



Echinothrix calamares



Echinothrix diadema

Echinometra mathaei

Diadema spp

Lampiran 4. General Linear Model, SIMPER dan Diameter Landak Laut BAB II

A. General Linear Model BAB II

Fungsi glm dalam RStudio.

Kode signifikansi: p < 0.001 = ***; p < 0.01 = **; p < 0.05 = * 0.05; p < 0.1 = .

1. Jumlah Spesies Landak Laut

glm(formula = Spesies ~ Zone + Ecosystem, data = Dat)

	Estimate	Std. Error	t_value	Pr(>|t|)	Signifikansi
(Intercept)	0.2444	0.2812	0.869	0.38713	
Zonemidshelf	0.7333	0.3444	2.129	0.0361	*
Zoneouter	1.3333	0.3444	3.871	0.00021	***
EcosystemSG	0.6444	0.2812	2.292	0.02437	*

2. Kelimpahan Total Landak Laut

glm(formula = Urchins ~ Zone + Ecosystem, data = Dat)

	Estimate	Std. Error	t_value	Pr(>|t|)	Signifikansi
(Intercept)	6.235	19.98	0.312	0.7557	
Zonemidshelf	32.834	24.47	1.342	0.1832	
Zoneouter	43.224	24.47	1.766	0.0809	.
EcosystemSG	32.235	19.98	1.613	0.1103	

3. Kelimpahan Masing-Masing Jenis Landak Laut

Diadema setosum

glm(formula = D.set ~ Zone + Ecosystem, data = Dat)

	Estimate	Std. Error	t_value	Pr(>|t|)	Signifikansi
(Intercept)	9.389	18.625	0.504	0.615	
Zonemidshelf	30.767	22.811	1.349	0.181	
Zoneouter	26.876	22.811	1.178	0.242	
EcosystemSG	23.842	18.625	1.28	0.204	

Diadema savignyi

glm(formula = D.sav ~ Ecosystem + Zone, data = Dat)

	Estimate	Std. Error	t_value	Pr(>|t|)	Signifikansi
(Intercept)	-2.032	3.094	-0.657	0.5131	
EcosystemSG	6.149	3.094	1.987	0.0501	.
Zonemidshelf	0.724	3.79	0.191	0.8489	
Zoneouter	6.324	3.79	1.669	0.0988	

Diadema spp.

glm(formula = D.spp ~ Ecosystem + Zone, data = Dat)

	Estimate	Std. Error	t_value	Pr(>|t|)	Signifikansi
(Intercept)	-0.1381	0.366	-0.377	0.707	
EcosystemSG	0.2762	0.366	0.755	0.452	
Zonemidshelf	0.2857	0.4482	0.637	0.526	
Zoneouter	0.7	0.4482	1.562	0.122	

Tripneustes gratilla

glm(formula = T.gra ~ Ecosystem + Zone, data = Dat)

	Estimate	Std. Error	t_value	Pr(>|t|)	Signifikansi
(Intercept)	-0.3682	1.2059	-0.305	0.760828	

EcosystemSG	0.7364	1.2059	0.611	0.542993	
Zonemidshelf	0.643	1.4769	0.435	0.664376	
Zoneouter	5.319	1.4769	3.602	0.000529	***

Echinothrix calamares

glm(formula = E.cal ~ Ecosystem + Zone, data = Dat)

	Estimate	Std. Error	t_value	Pr(>|t|)	Signifikansi
(Intercept)	-0.522	0.5181	-1.008	0.316481	
EcosystemSG	1.044	0.5181	2.015	0.04701	*
Zonemidshelf	0.4147	0.6345	0.654	0.515159	
Zoneouter	2.486	0.6345	3.918	0.000179	***

Echinothrix diadema

glm(formula = E.dia ~ Ecosystem + Zone, data = Dat)

	Estimate	Std. Error	t_value	Pr(>|t|)	Signifikansi
(Intercept)	1.37E-01	2.41E-01	0.568	0.5716	
EcosystemSG	-2.73E-01	2.41E-01	-1.136	0.2592	
Zonemidshelf	-1.99E-16	2.95E-01	0	1	
Zoneouter	5.43E-01	2.95E-01	1.844	0.0687	.

Echinometra mathaei

glm(formula = E.mat ~ Ecosystem + Zone, data = Dat)

	Estimate	Std. Error	t_value	Pr(>|t|)	Signifikansi
(Intercept)	-2.62E-01	2.98E-01	-0.879	0.3816	
EcosystemSG	5.24E-01	2.98E-01	1.759	0.0821	.
Zonemidshelf	-6.95E-16	3.65E-01	0	1	
Zoneouter	8.81E-01	3.65E-01	2.416	0.0178	*

Toxopneustes pileolus

glm(formula = T.pil ~ Ecosystem + Zone, data = Dat)

	Estimate	Std. Error	t_value	Pr(>|t|)	Signifikansi
(Intercept)	3.18E-02	4.39E-02	0.724	0.4709	
EcosystemSG	-6.36E-02	4.39E-02	-1.448	0.1512	
Zonemidshelf	-6.21E-17	5.38E-02	0	1	
Zoneouter	9.53E-02	5.38E-02	1.774	0.0796	.

Tabulasi data untuk analisis *general linear model* (glm) dalam RStudio

Lokasi	Kode	Ecosystem	Transect	Zona	D.set	D.sav	D.spp	T.gra	E.mat	E.cal	E.dia	T.pil	Urchins	Spesies
Gusung Tallang	GT	CR	T1	inner	145.71	7.14	0	0	0	0	0	0	152.86	2
Gusung Tallang	GT	CR	T2	inner	22.86	0	0	0	0	0	0	0	22.86	1
Gusung Tallang	GT	CR	T3	inner	0	7.14	0	0	0	0	0	0	7.14	1
Kayangan	KA	CR	T1	inner	0	0	0	0	0	0	0	0	0	0
Kayangan	KA	CR	T2	inner	0	0	0	0	0	0	0	0	0	0
Kayangan	KA	CR	T3	inner	0	0	0	0	0	0	0	0	0	0
Langkadea	LG	CR	T1	inner	7.14	0	0	0	0	0	0	0	7.14	1
Langkadea	LG	CR	T2	inner	0	0	0	0	0	0	0	0	0	0
Langkadea	LG	CR	T3	inner	0	0	0	0	0	0	0	0	0	0
Salemo	SL	CR	T1	inner	31.43	0	0	0	0	0	0	0	31.43	1
Salemo	SL	CR	T2	inner	0	0	0	0	0	0	0	0	0	0
Salemo	SL	CR	T3	inner	0	0	0	0	0	0	0	0	0	0
Saugi	SU	CR	T1	inner	61.43	0	0	0	0	0	0	0	61.43	1
Saugi	SU	CR	T2	inner	78.57	0	0	0	0	0	0	0	78.57	1
Saugi	SU	CR	T3	inner	17.14	0	0	0	0	0	0	0	17.14	1
Badi	BA	CR	T1	midshelf	0	0	0	0	0	0	0	0	0	0
Badi	BA	CR	T2	midshelf	0	0	0	0	0	0	0	0	0	0
Badi	BA	CR	T3	midshelf	0	0	0	0	0	0	0	0	0	0
Barrang Lompo	BL	CR	T1	midshelf	4.29	0	0	0	0	0	0	0	4.29	1
Barrang Lompo	BL	CR	T2	midshelf	2.86	0	0	0	0	0	0	0	2.86	1
Barrang Lompo	BL	CR	T3	midshelf	1.43	0	1.43	0	0	0	0	0	2.86	2
Kodingareng Keke	KK	CR	T1	midshelf	15.71	0	7.14	1.43	0	0	0	0	24.29	3
Kodingareng Keke	KK	CR	T2	midshelf	17.14	0	0	2.86	0	1.43	0	0	21.43	2

Lokasi	Kode	Ecosystem	Transect	Zona	D.set	D.sav	D.spp	T.gra	E.mat	E.cal	E.dia	T.pil	Urchins	Spesies
Kodingareng Keke	KK	CR	T3	midshelf	18.57	0	0	0	0	2.86	0	0	21.43	3
Lumu-lumu	LL	CR	T1	midshelf	62.86	0	0	0	0	2.86	0	0	65.71	2
Lumu-lumu	LL	CR	T2	midshelf	37.14	0	0	0	0	0	0	0	37.14	1
Lumu-lumu	LL	CR	T3	midshelf	44.29	0	0	0	0	4.29	0	0	48.57	2
Samalona	SA	CR	T1	midshelf	0	0	0	0	0	0	0	0	0	0
Samalona	SA	CR	T2	midshelf	0	0	0	0	0	0	0	0	0	0
Samalona	SA	CR	T3	midshelf	0	0	0	0	0	0	0	0	0	0
Gondong Bali	GB	CR	T1	outer	7.14	0	0	0	0	0	0	0	7.14	1
Gondong Bali	GB	CR	T2	outer	0	0	0	0	0	0	0	0	0	0
Gondong Bali	GB	CR	T3	outer	0	0	0	0	0	0	0	0	0	0
Kapoposang	KP	CR	T1	outer	0	0	0	0	0	0	0	0	0	0
Kapoposang	KP	CR	T2	outer	0	0	0	0	0	0	0	0	0	0
Kapoposang	KP	CR	T3	outer	0	0	0	0	0	0	0	0	0	0
Langkai	LA	CR	T1	outer	7.14	0	0	0	1.43	1.43	0	0	10	3
Langkai	LA	CR	T2	outer	0	0	0	0	0	0	0	0	0	0
Langkai	LA	CR	T3	outer	0	0	0	0	0	0	0	0	0	0
Lanjukang	LJ	CR	T1	outer	0	0	0	0	0	0	0	0	0	0
Lanjukang	LJ	CR	T2	outer	0	0	0	0	0	0	0	0	0	0
Lanjukang	LJ	CR	T3	outer	0	0	0	0	0	0	0	0	0	0
Papandangan	PA	CR	T1	outer	410	0	0	25.71	0	2.86	10	1.43	450	5
Papandangan	PA	CR	T2	outer	195.71	0	0	10	0	0	4.29	0	210	3
Papandangan	PA	CR	T3	outer	98.57	0	0	32.86	0	4.29	0	1.43	137.14	4
Gusung Tallang	GT	SG	T1	inner	0	0	0	0	0	0	0	0	0	0
Gusung Tallang	GT	SG	T2	inner	0	0	0	0	0	0	0	0	0	0
Gusung Tallang	GT	SG	T3	inner	0	0	0	0	0	0	0	0	0	0
Kayangan	KA	SG	T1	inner	1	0	0	0	0	0	0	0	1	1
Kayangan	KA	SG	T2	inner	23	0	0	0	0	0	0	0	23	1
Kayangan	KA	SG	T3	inner	191	0	0	0	0	0	0	0	191	1

Lokasi	Kode	Ecosystem	Transect	Zona	D.set	D.sav	D.spp	T.gra	E.mat	E.cal	E.dia	T.pil	Urchins	Spesies
Langkadea	LG	SG	T1	inner	23	0	0	0	0	0	0	0	23	1
Langkadea	LG	SG	T2	inner	17	0	0	0	0	0	0	0	17	1
Langkadea	LG	SG	T3	inner	0	0	0	0	0	0	0	0	0	0
Salemo	SL	SG	T1	inner	0	0	0	0	0	0	0	0	0	0
Salemo	SL	SG	T2	inner	0	0	0	0	0	0	0	0	0	0
Salemo	SL	SG	T3	inner	0	0	0	0	0	0	0	0	0	0
Saugi	SU	SG	T1	inner	0	0	0	0	0	0	0	0	0	0
Saugi	SU	SG	T2	inner	0	9	0	0	0	0	0	0	9	1
Saugi	SU	SG	T3	inner	20	8	0	0	0	0	0	0	28	2
Badi	BA	SG	T1	midshelf	0	0	0	0	0	0	0	0	0	0
Badi	BA	SG	T2	midshelf	0	0	0	0	0	0	0	0	0	0
Badi	BA	SG	T3	midshelf	0	0	0	0	0	0	0	0	0	0
Barrang Lompo	BL	SG	T1	midshelf	371	22	0	0	0	0	0	0	393	2
Barrang Lompo	BL	SG	T2	midshelf	39	1	0	0	0	0	0	0	40	2
Barrang Lompo	BL	SG	T3	midshelf	540	4	0	1	0	0	0	0	545	3
Kodingareng Keke	KK	SG	T1	midshelf	11	11	0	0	0	0	0	0	22	2
Kodingareng Keke	KK	SG	T2	midshelf	10	0	0	2	0	0	0	0	12	2
Kodingareng Keke	KK	SG	T3	midshelf	14	0	0	0	0	1	0	0	15	2
Lumu-lumu	LL	SG	T1	midshelf	78	0	0	0	0	0	0	0	78	1
Lumu-lumu	LL	SG	T2	midshelf	22	0	0	0	0	0	0	0	22	1
Lumu-lumu	LL	SG	T3	midshelf	185	1	0	12	0	0	0	0	198	3
Samalona	SA	SG	T1	midshelf	56	11	0	0	0	0	0	0	67	2
Samalona	SA	SG	T2	midshelf	0	0	0	0	0	0	0	0	0	0
Samalona	SA	SG	T3	midshelf	32	3	0	0	0	0	0	0	35	2
Gondong Bali	GB	SG	T1	outer	120	0	0	0	0	0	0	0	120	1
Gondong Bali	GB	SG	T2	outer	9	0	0	0	0	10	0	0	19	2
Gondong Bali	GB	SG	T3	outer	1	0	0	0	1	11	0	0	13	3

Lokasi	Kode	Ecosystem	Transect	Zona	D.set	D.sav	D.spp	T.gra	E.mat	E.cal	E.dia	T.pil	Urchins	Spesies
Kapoposang	KP	SG	T1	outer	78	0	0	0	0	0	0	0	78	1
Kapoposang	KP	SG	T2	outer	22	0	0	0	0	0	0	0	22	1
Kapoposang	KP	SG	T3	outer	185	1	0	12	0	0	0	0	198	3
Langkai	LA	SG	T1	outer	105	96	9	3	6	3	0	0	222	6
Langkai	LA	SG	T2	outer	73	103	12	18	12	7	0	0	225	6
Langkai	LA	SG	T3	outer	28	17	0	21	3	1	0	0	70	5
Lanjukang	LJ	SG	T1	outer	3	0	0	0	0	0	0	0	3	1
Lanjukang	LJ	SG	T2	outer	0	0	0	0	0	4	0	0	4	1
Lanjukang	LJ	SG	T3	outer	0	0	0	0	0	0	0	0	0	0
Papandangan	PA	SG	T1	outer	49	0	0	12	0	10	2	0	73	4
Papandangan	PA	SG	T2	outer	10	4	0	25	0	4	0	0	43	4
Papandangan	PA	SG	T3	outer	44	0	0	0	3	16	0	0	63	3

B. Analisa SIMPER dan ANOSIM BAB II

1. Hasil analisa SIMPER Padang Lamun

A. Zona Dalam dan Tengah: Rata-rata *Dissimilarity* = 65.00%

Jenis	Rata-rata *Dissimilarity*	SD *Dissimilarity*	% Kontribusi	% Kumlulatif
Diadema setosum	24,17	0,76	37,18	37,18
Diadema savignyi	21	1,21	32,31	69,49
Tripneustes gratilla	15,5	1,12	23,85	93,33
Echinothrix calamares	4,33	0,48	6,67	100

B. Zona Dalam dan Luar: Rata-rata *Dissimilarity* = 74.71%

Jenis	Rata-rata *Dissimilarity*	SD *Dissimilarity*	% Kontribusi	% Kumlulatif
Echinothrix calamares	20,05	1,36	26,84	26,84
Diadema setosum	15,33	0,86	20,52	47,36
Tripneustes gratilla	12,14	1,06	16,24	63,61
Echinometra mathaei	12,14	1,06	16,24	79,85
Diadema savignyi	12,05	0,99	16,12	95,98
Diadema spp.	3,01	0,48	4,02	100

C. Zona Tengah dan Luar: Rata-rata *Dissimilarity* = 39.43%

Jenis	Rata-rata *Dissimilarity*	SD *Dissimilarity*	% Kontribusi	% Kumlulatif
Echinothrix calamares	11,84	1,23	30,02	30,02
Echinometra mathaei	8,75	1,11	22,18	52,2
Tripneustes gratilla	8,28	0,91	21	73,2
Diadema savignyi	8,21	0,84	20,82	94,01
Diadema spp.	2,36	0,49	5,99	100

D. Antar Lokasi di Zona Dalam: Rata-rata *Dissimilarity* = 13.33%

Jenis	Rata-rata *Dissimilarity*	SD *Dissimilarity*	% Kontribusi	% Kumlulatif
Diadema setosum	13,33	0,45	100	100

E. Antar Lokasi di Zona Tengah: Rata-rata *Dissimilarity* = 70.48%

Jenis	Rata-rata *Dissimilarity*	SD *Dissimilarity*	% Kontribusi	% Kumlulatif
Diadema setosum	41,05	3,48	58,24	58,24
Diadema savignyi	20,38	1,14	28,92	87,16
Tripneustes gratilla	9,05	0,62	12,84	100

F. Antar Lokasi di Zona Luar: Rata-rata *Dissimilarity* = 63.47%

Jenis	Rata-rata *Dissimilarity*	SD *Dissimilarity*	% Kontribusi	% Kumlulatif
Diadema setosum	27,95	3,72	44,04	44,04
Echinothrix calamares	15,9	1,08	25,05	69,09
Diadema savignyi	6,54	0,61	10,3	79,39
Tripneustes gratilla	6,54	0,61	10,3	89,7
Echinometra mathaei	6,54	0,61	10,3	100

2. Hasil analisa SIMPER Rataan Karang

A. Zona Dalam dan Tengah: Rata-rata *Dissimilarity* = 60.70%

Jenis	Rata-rata *Dissimilarity*	SD *Dissimilarity*	% Kontribusi	% Kumlulatif
D. setosum	25.00	0.65	41.18	41.18
Diadema sp.	11.75	0.75	19.36	60.55
Echinothrix calamares	11.75	0.75	19.36	79.91
Diadema savignyi	7.89	0.53	13.01	92.92
Tripneustes gratilla	4.30	0.50	7.08	100.00

B. Zona Dalam dan Luar: Rata-rata *Dissimilarity* = 72.12%

Jenis	Rata-rata *Dissimilarity*	SD *Dissimilarity*	% Kontribusi	% Kumlulatif
D. setosum	36.30	0.83	50.33	50.33
Echinothrix calamares	9.50	0.82	13.17	63.50
Diadema savignyi	9.31	0.53	12.91	76.41
Echinometra mathaei	5.74	0.51	7.96	84.37
Tripneustes gratilla	3.76	0.51	5.21	89.58
E. diadema	3.76	0.51	5.21	94.79
Toxopneustes pileolus	3.76	0.51	5.21	100.00

C. Zona Tengah dan Luar: Rata-rata *Dissimilarity* = 70.12%

Jenis	Rata-rata *Dissimilarity*	SD *Dissimilarity*	% Kontribusi	% Kumlulatif
D. setosum	26.23	0.75	37.39	37.39
Echinothrix calamares	14.46	0.88	20.61	58.00
Diadema sp.	11.44	0.71	16.30	74.29
Tripneustes gratilla	6.50	0.69	9.27	83.56
Echinometra mathaei	4.90	0.49	6.98	90.54
E. diadema	3.32	0.50	4.73	95.27
Toxopneustes pileolus	3.32	0.50	4.73	100.00

D. Antar Lokasi di Zona Dalam: Rata-rata *Dissimilarity* = xx%

Jenis	Rata-rata *Dissimilarity*	SD *Dissimilarity*	% Kontribusi	% Kumlulatif
Diadema setosum	38.89	0.88	100	100

E. Antar Lokasi di Zona Tengah: Rata-rata *Dissimilarity* = xx%

Jenis	Rata-rata *Dissimilarity*	SD *Dissimilarity*	% Kontribusi	% Kumlulatif
D. setosum	29	1.05	81.31	81.31
Diadema sp.	3.33	0.32	9.35	90.65
Echinothrix calamares	3.33	0.32	9.35	100

F. Antar Lokasi di Zona Luar: Rata-rata *Dissimilarity* = xx%

Jenis	Rata-rata *Dissimilarity*	SD *Dissimilarity*	% Kontribusi	% Kumlulatif
Diadema setosum	12.04	0.63	81.25	81.25
Echinothrix calamares	2.78	0.33	18.75	100

C. Diameter Landak Laut BAB II

Genus *Diadema*

1. Tabulasi data diameter landak laut (mm)

No	Zona	Lokasi	Transek	Habitat	Spesies	Jumlah	Diameter (mm)
1	Dalam	Gusung Tallang	3	Rataan Karang	*Diadema savignyi*	2	28
2	Dalam	Gusung Tallang	3	Rataan Karang	*Diadema savignyi*	2	35
3	Dalam	Gusung Tallang	3	Rataan Karang	*Diadema savignyi*	1	56
4	Dalam	Gusung Tallang	1	Rataan Karang	*Diadema setosum*	11	27
5	Dalam	Gusung Tallang	1	Rataan Karang	*Diadema setosum*	13	35
6	Dalam	Gusung Tallang	1	Rataan Karang	*Diadema setosum*	16	41
7	Dalam	Gusung Tallang	1	Rataan Karang	*Diadema setosum*	60	51
8	Dalam	Gusung Tallang	1	Rataan Karang	*Diadema setosum*	2	62
9	Dalam	Gusung Tallang	2	Rataan Karang	*Diadema setosum*	10	52
10	Dalam	Gusung Tallang	2	Rataan Karang	*Diadema setosum*	6	44
11	Dalam	Salemo	1	Rataan Karang	*Diadema setosum*	5	33
12	Dalam	Salemo	1	Rataan Karang	*Diadema setosum*	5	44
13	Dalam	Salemo	1	Rataan Karang	*Diadema setosum*	2	54
14	Dalam	Saugi	1	Rataan Karang	*Diadema setosum*	3	46
15	Dalam	Saugi	1	Rataan Karang	*Diadema setosum*	19	54
16	Dalam	Saugi	1	Rataan Karang	*Diadema setosum*	21	61
17	Dalam	Saugi	2	Rataan Karang	*Diadema setosum*	5	33
18	Dalam	Saugi	2	Rataan Karang	*Diadema setosum*	21	47
19	Dalam	Saugi	2	Rataan Karang	*Diadema setosum*	17	52
20	Dalam	Saugi	2	Rataan Karang	*Diadema setosum*	12	63
21	Dalam	Saugi	3	Rataan Karang	*Diadema setosum*	12	55
22	Luar	Gondong Bali	1	Rataan Karang	*Diadema setosum*	4	44
23	Luar	Gondong Bali	1	Rataan Karang	*Diadema setosum*	1	62
24	Luar	Langkai	1	Rataan Karang	*Diadema setosum*	5	44
25	Luar	Langkai	1	Rataan Karang	*Echinometra mathaei*	1	31
26	Luar	Langkai	1	Rataan Karang	*Echinothrix calamaris*	1	41
27	Luar	Papandangan	1	Rataan Karang	*Diadema setosum*	79	41
28	Luar	Papandangan	1	Rataan Karang	*Diadema setosum*	95	62
29	Luar	Papandangan	1	Rataan Karang	*Diadema setosum*	113	81
30	Luar	Papandangan	1	Rataan Karang	*Diadema setosum*	5	66
31	Luar	Papandangan	2	Rataan Karang	*Diadema setosum*	60	43
32	Luar	Papandangan	2	Rataan Karang	*Diadema setosum*	30	51
33	Luar	Papandangan	2	Rataan Karang	*Diadema setosum*	47	65
34	Luar	Papandangan	3	Rataan Karang	*Diadema setosum*	20	41
35	Luar	Papandangan	3	Rataan Karang	*Diadema setosum*	21	52
36	Luar	Papandangan	3	Rataan Karang	*Diadema setosum*	28	64
37	Luar	Papandangan	1	Rataan Karang	*Echinothrix calamaris*	2	62
38	Luar	Papandangan	2	Rataan Karang	*Echinothrix calamaris*	2	41
39	Luar	Papandangan	3	Rataan Karang	*Echinothrix calamaris*	2	42
40	Luar	Papandangan	3	Rataan Karang	*Echinothrix calamaris*	1	31
41	Luar	Papandangan	1	Rataan Karang	*Echinothrix diadema*	2	44
42	Luar	Papandangan	2	Rataan Karang	*Echinothrix diadema*	4	43
43	Luar	Papandangan	2	Rataan Karang	*Echinothrix diadema*	3	35
44	Luar	Papandangan	1	Rataan Karang	*Toxopneustes pileolus*	1	82
45	Luar	Papandangan	3	Rataan Karang	*Toxopneustes pileolus*	1	46
46	Luar	Papandangan	1	Rataan Karang	*Tripneustes gratilla*	12	61
47	Luar	Papandangan	1	Rataan Karang	*Tripneustes gratilla*	6	87
48	Luar	Papandangan	2	Rataan Karang	*Tripneustes gratilla*	6	67
49	Luar	Papandangan	2	Rataan Karang	*Tripneustes gratilla*	6	71
50	Luar	Papandangan	2	Rataan Karang	*Tripneustes gratilla*	2	83
51	Luar	Papandangan	3	Rataan Karang	*Tripneustes gratilla*	10	52
52	Luar	Papandangan	3	Rataan Karang	*Tripneustes gratilla*	10	63
53	Luar	Papandangan	3	Rataan Karang	*Tripneustes gratilla*	3	81

No	Zona	Lokasi	Transek	Habitat	Spesies	Jumlah	Diameter (mm)
54	Tengah	Barrang Lompo	1	Rataan Karang	*Diadema setosum*	3	45
55	Tengah	Barrang Lompo	2	Rataan Karang	*Diadema setosum*	2	52
56	Tengah	Barrang Lompo	3	Rataan Karang	*Diadema setosum*	1	61
57	Tengah	Barrang Lompo	3	Rataan Karang	*Diadema spp*	1	43
58	Tengah	Kodingareng Keke	1	Rataan Karang	*Diadema setosum*	7	33
59	Tengah	Kodingareng Keke	1	Rataan Karang	*Diadema setosum*	4	57
60	Tengah	Kodingareng Keke	2	Rataan Karang	*Diadema setosum*	7	32
61	Tengah	Kodingareng Keke	2	Rataan Karang	*Diadema setosum*	4	51
62	Tengah	Kodingareng Keke	3	Rataan Karang	*Diadema setosum*	13	44
63	Tengah	Kodingareng Keke	1	Rataan Karang	*Diadema spp*	3	41
64	Tengah	Kodingareng Keke	1	Rataan Karang	*Diadema spp*	2	52
65	Tengah	Kodingareng Keke	2	Rataan Karang	*Echinothrix calamaris*	1	42
66	Tengah	Kodingareng Keke	3	Rataan Karang	*Echinothrix calamaris*	2	42
67	Tengah	Kodingareng Keke	1	Rataan Karang	*Tripneustes gratilla*	1	51
68	Tengah	Lumu-Lumu	3	Rataan Karang	*Diadema savignyi*	3	41
69	Tengah	Lumu-Lumu	1	Rataan Karang	*Diadema setosum*	23	45
70	Tengah	Lumu-Lumu	1	Rataan Karang	*Diadema setosum*	13	62
71	Tengah	Lumu-Lumu	1	Rataan Karang	*Diadema setosum*	8	81
72	Tengah	Lumu-Lumu	2	Rataan Karang	*Diadema Setosum*	6	33
73	Tengah	Lumu-Lumu	2	Rataan Karang	*Diadema Setosum*	6	53
74	Tengah	Lumu-Lumu	2	Rataan Karang	*Diadema Setosum*	4	72
75	Tengah	Lumu-Lumu	2	Rataan Karang	*Diadema Setosum*	8	44
76	Tengah	Lumu-Lumu	3	Rataan Karang	*Diadema Setosum*	10	31
77	Tengah	Lumu-Lumu	3	Rataan Karang	*Diadema Setosum*	10	53
78	Tengah	Lumu-Lumu	3	Rataan Karang	*Diadema Setosum*	8	72
79	Tengah	Lumu-Lumu	1	Rataan Karang	*Echinothrix calamaris*	1	42
80	Tengah	Lumu-Lumu	1	Rataan Karang	*Echinothrix calamaris*	1	61
81	Dalam	Kayangan	1	seagrass	*Diadema setosum*	1	85
82	Dalam	Kayangan	2	seagrass	*Diadema setosum*	13	43
74	Dalam	Kayangan	2	seagrass	*Diadema setosum*	4	62
75	Dalam	Kayangan	2	seagrass	*Diadema setosum*	6	81
76	Dalam	Kayangan	3	seagrass	*Diadema setosum*	52	44
77	Dalam	Kayangan	3	seagrass	*Diadema setosum*	68	63
78	Dalam	Kayangan	3	seagrass	*Diadema setosum*	71	83
79	Dalam	Saugi	2	seagrass	*Diadema savignyi*	4	44
80	Dalam	Saugi	2	seagrass	*Diadema savignyi*	5	51
81	Dalam	Saugi	3	seagrass	*Diadema savignyi*	8	55
82	Dalam	Saugi	3	seagrass	*Diadema setosum*	10	44
83	Dalam	Saugi	3	seagrass	*Diadema setosum*	10	37
84	Luar	Gondong Bali	1	seagrass	*Diadema setosum*	74	42
85	Luar	Gondong Bali	1	seagrass	*Diadema setosum*	31	63
86	Luar	Gondong Bali	1	seagrass	*Diadema setosum*	15	81
87	Luar	Gondong Bali	2	seagrass	*Diadema setosum*	1	41
88	Luar	Gondong Bali	2	seagrass	*Diadema setosum*	8	62
89	Luar	Gondong Bali	3	seagrass	*Diadema setosum*	1	81
90	Luar	Gondong Bali	3	seagrass	*Echinometra mathaei*	1	61
91	Luar	Gondong Bali	2	seagrass	*Echinothrix calamaris*	10	45
92	Luar	Gondong Bali	3	seagrass	*Echinothrix calamaris*	8	41
93	Luar	Gondong Bali	3	seagrass	*Echinothrix calamaris*	3	67
94	Luar	Kapoposang	3	seagrass	*Diadema savignyi*	1	46
95	Luar	Kapoposang	1	seagrass	*Diadema setosum*	72	43
96	Luar	Kapoposang	1	seagrass	*Diadema setosum*	6	61
97	Luar	Kapoposang	2	seagrass	*Diadema setosum*	22	44
98	Luar	Kapoposang	3	seagrass	*Diadema setosum*	175	47
99	Luar	Kapoposang	3	seagrass	*Diadema setosum*	10	81
100	Luar	Kapoposang	3	seagrass	*Tripneustes gratilla*	1	45
101	Luar	Kapoposang	3	seagrass	*Tripneustes gratilla*	11	82
102	Luar	Langkai	1	seagrass	*Diadema savignyi*	23	47
103	Luar	Langkai	1	seagrass	*Diadema savignyi*	55	51

No	Zona	Lokasi	Transek	Habitat	Spesies	Jumlah	Diameter (mm)
104	Luar	Langkai	1	seagrass	*Diadema savignyi*	18	60
105	Luar	Langkai	2	seagrass	*Diadema savignyi*	16	40
106	Luar	Langkai	2	seagrass	*Diadema savignyi*	67	52
107	Luar	Langkai	2	seagrass	*Diadema savignyi*	20	66
108	Luar	Langkai	3	seagrass	*Diadema savignyi*	3	40
109	Luar	Langkai	3	seagrass	*Diadema savignyi*	6	52
110	Luar	Langkai	3	seagrass	*Diadema savignyi*	8	68
111	Luar	Langkai	1	seagrass	*Diadema setosum*	20	46
112	Luar	Langkai	1	seagrass	*Diadema setosum*	57	52
113	Luar	Langkai	1	seagrass	*Diadema setosum*	28	67
114	Luar	Langkai	2	seagrass	*Diadema setosum*	13	48
115	Luar	Langkai	2	seagrass	*Diadema setosum*	48	51
116	Luar	Langkai	2	seagrass	*Diadema setosum*	12	69
117	Luar	Langkai	3	seagrass	*Diadema setosum*	6	41
118	Luar	Langkai	3	seagrass	*Diadema setosum*	10	53
119	Luar	Langkai	3	seagrass	*Diadema setosum*	12	62
120	Luar	Langkai	1	seagrass	*Diadema spp*	8	51
121	Luar	Langkai	1	seagrass	*Diadema spp*	1	63
122	Luar	Langkai	2	seagrass	*Diadema spp*	11	50
123	Luar	Langkai	2	seagrass	*Diadema spp*	1	63
124	Luar	Langkai	1	seagrass	*Echinometra mathaei*	5	51
125	Luar	Langkai	1	seagrass	*Echinometra mathaei*	1	67
126	Luar	Langkai	2	seagrass	*Echinometra mathaei*	1	50
127	Luar	Langkai	2	seagrass	*Echinometra mathaei*	11	62
128	Luar	Langkai	1	seagrass	*Echinothrix calamaris*	1	44
129	Luar	Langkai	1	seagrass	*Echinothrix calamaris*	2	55
130	Luar	Langkai	2	seagrass	*Echinothrix calamaris*	3	55
131	Luar	Langkai	2	seagrass	*Echinothrix calamaris*	4	60
132	Luar	Langkai	3	seagrass	*Echinothrix calamaris*	1	45
133	Luar	Langkai	1	seagrass	*Tripneustes gratilla*	3	52
134	Luar	Langkai	2	seagrass	*Tripneustes gratilla*	5	40
135	Luar	Langkai	2	seagrass	*Tripneustes gratilla*	13	61
136	Luar	Langkai	3	seagrass	*Tripneustes gratilla*	5	41
137	Luar	Langkai	3	seagrass	*Tripneustes gratilla*	7	59
138	Luar	Langkai	3	seagrass	*Tripneustes gratilla*	9	66
139	Luar	Lanjukang	1	seagrass	*Diadema setosum*	3	44
140	Luar	Lanjukang	2	seagrass	*Echinothrix calamaris*	4	62
141	Luar	Papandangan	2	seagrass	*Diadema savignyi*	4	63
142	Luar	Papandangan	1	seagrass	*Diadema setosum*	13	44
143	Luar	Papandangan	1	seagrass	*Diadema setosum*	28	61
144	Luar	Papandangan	1	seagrass	*Diadema setosum*	8	85
145	Luar	Papandangan	2	seagrass	*Diadema setosum*	10	82
146	Luar	Papandangan	3	seagrass	*Diadema setosum*	44	63
147	Luar	Papandangan	3	seagrass	*Echinometra mathaei*	3	61
148	Luar	Papandangan	1	seagrass	*Echinothrix calamaris*	10	63
149	Luar	Papandangan	2	seagrass	*Echinothrix calamaris*	4	65
150	Luar	Papandangan	3	seagrass	*Echinothrix calamaris*	8	63
151	Luar	Papandangan	3	seagrass	*Echinothrix calamaris*	8	65
152	Luar	Papandangan	1	seagrass	*Echinothrix diadema*	2	62
153	Luar	Papandangan	1	seagrass	*Tripneustes gratilla*	12	65
154	Luar	Papandangan	2	seagrass	*Tripneustes gratilla*	25	64
155	Tengah	Barrang Lompo	1	seagrass	*Diadema savignyi*	10	43
156	Tengah	Barrang Lompo	1	seagrass	*Diadema savignyi*	12	55
157	Tengah	Barrang Lompo	2	seagrass	*Diadema savignyi*	1	51
158	Tengah	Barrang Lompo	3	seagrass	*Diadema savignyi*	2	36
159	Tengah	Barrang Lompo	3	seagrass	*Diadema savignyi*	2	42
160	Tengah	Barrang Lompo	1	seagrass	*Diadema setosum*	90	42
161	Tengah	Barrang Lompo	1	seagrass	*Diadema setosum*	60	45
162	Tengah	Barrang Lompo	1	seagrass	*Diadema setosum*	80	55

No	Zona	Lokasi	Transek	Habitat	Spesies	Jumlah	Diameter (mm)
163	Tengah	Barrang Lompo	1	seagrass	*Diadema setosum*	100	61
164	Tengah	Barrang Lompo	1	seagrass	*Diadema setosum*	41	73
165	Tengah	Barrang Lompo	2	seagrass	*Diadema setosum*	10	46
166	Tengah	Barrang Lompo	2	seagrass	*Diadema setosum*	29	53
167	Tengah	Barrang Lompo	3	seagrass	*Diadema setosum*	64	33
168	Tengah	Barrang Lompo	3	seagrass	*Diadema setosum*	72	43
169	Tengah	Barrang Lompo	3	seagrass	*Diadema setosum*	80	44
170	Tengah	Barrang Lompo	3	seagrass	*Diadema setosum*	90	45
171	Tengah	Barrang Lompo	3	seagrass	*Diadema setosum*	60	55
172	Tengah	Barrang Lompo	3	seagrass	*Diadema setosum*	78	42
173	Tengah	Barrang Lompo	3	seagrass	*Diadema setosum*	96	63
174	Tengah	Barrang Lompo	3	seagrass	*Tripneustes gratilla*	1	44
175	Tengah	Kodingareng Keke	1	seagrass	*Diadema savignyi*	11	32
176	Tengah	Kodingareng Keke	1	seagrass	*Diadema setosum*	4	24
177	Tengah	Kodingareng Keke	1	seagrass	*Diadema setosum*	3	35
178	Tengah	Kodingareng Keke	1	seagrass	*Diadema setosum*	3	42
179	Tengah	Kodingareng Keke	1	seagrass	*Diadema setosum*	1	56
180	Tengah	Kodingareng Keke	2	seagrass	*Diadema setosum*	5	33
181	Tengah	Kodingareng Keke	2	seagrass	*Diadema setosum*	5	51
182	Tengah	Kodingareng Keke	3	seagrass	*Echinothrix calamaris*	1	55
183	Tengah	Kodingareng Keke	2	seagrass	*Tripneustes gratilla*	2	43
184	Tengah	Lumu-Lumu	3	seagrass	*Diadema savignyi*	1	42
185	Tengah	Lumu-Lumu	1	seagrass	*Diadema setosum*	72	41
186	Tengah	Lumu-Lumu	1	seagrass	*Diadema setosum*	6	63
187	Tengah	Lumu-Lumu	2	seagrass	*Diadema setosum*	22	43
188	Tengah	Lumu-Lumu	3	seagrass	*Diadema setosum*	175	47
189	Tengah	Lumu-Lumu	3	seagrass	*Diadema setosum*	10	81
190	Tengah	Lumu-Lumu	3	seagrass	*Diadema setosum*	11	84
191	Tengah	Lumu-Lumu	3	seagrass	*Tripneustes gratilla*	1	47
192	Tengah	Samalona	1	seagrass	*Diadema savignyi*	11	41
193	Tengah	Samalona	1	seagrass	*Diadema setosum*	7	32
194	Tengah	Samalona	1	seagrass	*Diadema setosum*	16	41
195	Tengah	Samalona	1	seagrass	*Diadema setosum*	18	56
196	Tengah	Samalona	1	seagrass	*Diadema setosum*	15	63

3. Ringkasan data ukuran diameter landak laut dari genus *Diadema* (dalam mm)

	Zona dalam				Zona Tengah				Zona Luar				
Parameter	Kayangan	Gusung Tallang	Saugi	Salemo	Lumu-Lumu	Samalona	Kodingareng Keke	Barrang Lompo	Papandangan	Kapoposang	Gondong Bali	Langkai	Total
rata-rata	62,0	44,7	51,6	41,1	49,1	49,0	39,5	49,1	60,0	47,2	52,8	53,3	52,1
median	63	51	52	44	47	41	35	45	62	47	42	52	47
mode	44	51	61	33	47	41	32	42	81	47	42	52	47
max	85	62	63	54	84	63	57	73	85	81	81	69	85
min	43	27	33	33	31	32	24	33	41	43	41	40	24

4. ANOVA diameter landak laut dari genus *Diadema* antar zona

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Zona dalam	418	22358	53,488	195,056
Zona tengah	1519	74598	49,110	111,344
Zona luar	1474	80798	54,815	149,018

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	25254,33	2	12627,17	91,587	0	2,998
Within Groups	469862,9	3408	137,871			
Total	495117,2	3410				

5. Hasil Uji-f (variansi)

	Zona dalam	*Zona tengah*	*Zona luar*	*Zona dalam*	*Zona luar*	*Zona tengah*
Mean	53,49	49,11	54,82	53,49	54,82	49,11
Variance	195,06	111,34	149,02	195,06	149,02	111,34
Observations	418	1519	1474	418	1474	1519
df	417	1518	1473	417	1473	1518
F	1,752		0,764		1,338	
P(F<=f) one-tail	$2{,}23\ 10^{-14}$		0,00021		$9{,}11\ 10^{-9}$	
F Critical one-tail	1,134		0,881		1,089	

6. Hasil Uji-t (perbedaan antar zona) dengan variansi berbeda (2-*tailed*)

	Zona luar	*Zona tengah*	*Zona dalam*	*Zona luar*	*Zona luar*	*Zona tengah*
Mean	53.49	49.11	53.49	54.82	54.82	49.11
Variance	195.06	111.34	195.06	149.02	149.02	111.34
Observations	418	1519	418	1474	1474	1519
Hypothesized Mean Difference	0		0		0	
df	555		609		2903	
t Stat	5.958		-1.762		13.662	
P(T<=t) one-tail	$2.27\ 10^{-09}$		0.039		$1.56\ 10^{-41}$	
t Critical one-tail	1.648		1.647		1.645	
P(T<=t) two-tail	**$4.53\ 10^{-09}$**		**0.079**		**$3.13\ 10^{-41}$**	
t Critical two-tail	1.964		1.964		1.961	

Lampiran 5. General Linear Model BAB III

Data Kelimpahan Landak Laut dan Tutupan Lamun

Zona	Pulau	Kelimpahan Landak Laut	Persentase tutupan lamun (coverage)
dalam	Saugi	0	29.82
	Saugi	9	6.61
	Saugi	28	6.36
	Salemo	0	14.20
	Salemo	0	13.07
	Salemo	0	25.00
tengah	Barrang Lompo	393	46.59
	Barrang Lompo	40	43.18
	Barrang Lompo	545	43.18
	Langkadea	23	4.84
	Langkadea	17	4.46
	Langkadea	0	2.66
	Lumu-Lumu	78	25.00
	Lumu-Lumu	22	20.45
	Lumu-Lumu	198	19.90
Luar	Lanjukang	3	14.20
	Lanjukang	4	15.34
	Lanjukang	0	19.05
	Langkai	222	62.16
	Langkai	225	33.52
	Langkai	70	37.74
	Gondong Bali	120	19.60
	Gondong Bali	19	44.03
	Gondong Bali	13	40.35
	Papandangan	71	34.66
	Papandangan	43	24.72
	Papandangan	63	15.35
	Kapoposang	78	29.55
	Kapoposang	22	22.73
	Kapoposang	198	23.59

Lampiran 6. Hasil Analisa Regresi BAB III

1. Hasil Analisa regresi linear tutupan padang lamun dengan kelimpahan landak laut

SUMMARY OUTPUT					
Regression Statistics					
Multiple R	0.524442				
R Square	0.275039				
Adjusted R Square	0.249148				
Standard Error	110.0692				
Observations	30				
ANOVA					
	df	SS	MS	F	Significance F
Regression	1	128697.2	128697.2	10.62277	0.00293
Residual	28	339226.2	12115.22		
Total	29	467923.5			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	-29.4877	40.06134	-0.73606	0.467814	-111.55	52.57423	-111.55	52.57423
Coverage	4.567294	1.401329	3.259259	0.00293	1.696802	7.437786	1.696802	7.437786

2. Data Kelimpahan Jenis Landak Laut dengan Persentase Tutupan Lamun

Pulau	Jumlah Jenis Landak laut	Persentase tutupan lamun (SG Cov)
Barrang Lompo	2	46.59
Barrang Lompo	2	43.18
Barrang Lompo	3	43.18
Gondong Bali	1	19.60
Gondong Bali	2	44.03
Gondong Bali	3	40.35
Kapoposang	1	29.55
Kapoposang	1	22.73
Kapoposang	3	23.59
Langkadea	1	4.84
Langkadea	1	4.46
Langkadea	0	2.66
Langkai	6	62.16
Langkai	6	33.52
Langkai	5	37.74
Lanjukang	1	14.20
Lanjukang	1	15.34
Lanjukang	0	19.05
Lumu-lumu	1	25.00
Lumu-lumu	1	20.45
Lumu-lumu	3	19.90
Papandangan	3	34.66
Papandangan	4	24.72
Papandangan	3	15.35
Salemo	0	14.20
Salemo	0	13.07
Salemo	0	25.00
Saugi	0	29.82
Saugi	1	6.61
Saugi	2	6.36

3. Hasil Analisa Regresi Linear Tutupan Lamun dengan Kelimpahan Jenis Landak Laut

SUMMARY OUTPUT					
Regression Statistics					
Multiple R	0.589629				
R Square	0.347662				
Adjusted R Square	0.324364				
Standard Error	1.40475				
Observations	30				
ANOVA					
	df	SS	MS	F	Significance F
Regression	1	29.44698	29.44698	14.92254	0.000606
Residual	28	55.25302	1.973322		
Total	29	84.7			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	0.191406	0.51128	0.374367	0.710952	-0.8559	1.238716	-0.8559	1.238716
SG Cov	0.069087	0.017884	3.862971	0.000606	0.032452	0.105721	0.032452	0.105721

4. Data Kelimpahan Landak Laut dan Tutupan Karang Hidup

Pulau	Kelimpahan Landak Laut	Tutupan Karang Hidup (C_cover)
Saugi	43	16.68
Saugi	55	18.46
Saugi	12	19.97
Salemo	22	3.28
Salemo	0	3.05
Salemo	0	5.49
Kayangan	0	0.14
Kayangan	0	0.73
Kayangan	0	0.89
Gusung Tallang	107	0.61
Gusung Tallang	16	0.07
Gusung Tallang	5	0.68
Barrang Lompo	3	14.22
Barrang Lompo	2	13.08
Barrang Lompo	2	15.81
Samalona	0	3.68
Samalona	0	8.71
Samalona	0	2.72
Kodingareng Keke	17	6.33
Kodingareng Keke	15	33.75
Kodingareng Keke	15	24.42
Langkadea	5	4.03
Langkadea	0	6.32
Langkadea	0	30.61
Lumu-Lumu	46	2.93
Lumu-Lumu	26	6.20
Lumu-Lumu	34	15.16
Lanjukang	0	11.92
Lanjukang	0	27.33
Lanjukang	0	21.00
Langkai	7	6.44
Langkai	0	4.80
Langkai	0	2.53
Papandangan	315	17.09
Papandangan	147	45.31
Papandangan	96	69.30
Kapoposang	0	53.13
Kapoposang	0	46.24
Kapoposang	0	19.16

5. Analisa Regresi Linear Tutupan Terumbu Karang dengan Kelimpahan Landak Laut

Regression Statistics					
Multiple R	0.223952				
R Square	0.050155				
Adjusted R Square	0.024483				
Standard Error	57.08295				
Observations	39				
ANOVA					
	df	SS	MS	F	Significance F
Regression	1	6366.097	6366.097	1.953712	0.170512
Residual	37	120563.1	3258.463		
Total	38	126929.2			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	13.48353	12.49184	1.079386	0.287402	-11.8274	38.79441	-11.8274	38.79441
C_cover	0.797122	0.570289	1.397752	0.170512	-0.35839	1.952637	-0.35839	1.952637

6. Data Jumlah Spesies Landak Laut dan Tutupan Karang Hidup

Pulau	Transek	Jenis Landak Laut	Tutupan Karang Hidup (c cover)
Barrang Lompo	T1	1	14.22
Barrang Lompo	T2	1	13.08
Barrang Lompo	T3	2	15.81
Gusung Tallang	T1	2	0.61
Gusung Tallang	T2	1	0.07
Gusung Tallang	T3	1	0.68
Kapoposang	T1	0	53.13
Kapoposang	T2	0	46.24
Kapoposang	T3	0	19.16
Kayangan	T1	0	0.14
Kayangan	T2	0	0.73
Kayangan	T3	0	0.89
Kodingareng Keke	T1	3	6.33
Kodingareng Keke	T2	3	33.75
Kodingareng Keke	T3	2	24.42
Langkadea	T1	1	4.03
Langkadea	T2	0	6.32
Langkadea	T3	0	30.61
Langkai	T1	3	6.44
Langkai	T2	0	4.80
Langkai	T3	0	2.53
Lanjukang	T1	0	11.92
Lanjukang	T2	0	27.33
Lanjukang	T3	0	21.00
Lumu-lumu	T1	2	2.93
Lumu-lumu	T2	1	6.20
Lumu-lumu	T3	2	15.16
Papandangan	T1	5	17.09
Papandangan	T2	3	45.31
Papandangan	T3	4	69.30
Salemo	T1	1	3.28
Salemo	T2	0	3.05
Salemo	T3	0	5.49
Samalona	T1	0	3.68
Samalona	T2	0	8.71
Samalona	T3	0	2.72
Saugi	T1	1	16.68
Saugi	T2	1	18.46
Saugi	T3	1	19.97

7. Analisa Regresi Linear Tutupan Rataan Terumbu Karang dengan Kelimpahan Jenis Landak Laut

Regression Statistics					
Multiple R	0.300625				
R Square	0.090375				
Adjusted R Square	0.065791				
Standard Error	1.253349				
Observations	39				
ANOVA					
	df	SS	MS	F	Significance F
Regression	1	5.774757	5.774757	3.676121	0.062943
Residual	37	58.12268	1.570883		
Total	38	63.89744			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	0.692842	0.274279	2.52605	0.015946	0.1371	1.248583	0.1371	1.248583
c cover	0.024008	0.012522	1.917321	0.062943	-0.00136	0.049379	-0.00136	0.049379

8. Komposisi Spesies Tutupan Lamun pada 10 Lokasi di Tiga Zona Kepulauan Spermonde

Zona	Pulau	Enhalus acoroides	Thalassia hemprichii	Cymodocea rotundata	Syringodium isoetifolium	Halophila ovalis
dalam	Saugi	47.76%	38.19%	14.04%	0.00%	0.00%
	Salemo	15.96%	63.90%	9.02%	11.12%	0.00%
tengah	Barrang Lompo	29.16%	46.58%	22.42%	1.79%	0.05%
	Langkadea	6.97%	37.62%	40.67%	9.12%	5.63%
	Lumu-Lumu	32.49%	29.56%	37.95%	0.00%	0.00%
Luar	Lanjukang	0.00%	9.76%	90.22%	0.00%	0.00%
	Langkai	15.34%	37.80%	24.48%	22.37%	0.00%
	Gondong Bali	18.27%	77.99%	3.73%	0.00%	0.00%
	Papandangan	0.00%	35.09%	64.88%	0.00%	0.00%
	Kapoposang	3.21%	77.61%	19.16%	0.00%	0.00%

9. Persentase Tutupan Lamun dengan Standard Deviasi

Zona	Pulau	Persentase tutupan lamun	SD
dalam	Saugi	14.26	13.47
	Salemo	17.42	6.59
tengah	Barrang Lompo	44.32	1.97
	Langkadea	3.99	1.17
	Lumu-Lumu	21.78	2.80
luar	Lanjukang	16.19	2.53
	Langkai	44.47	15.47
	Gondong Bali	34.66	13.17
	Papandangan	24.91	9.66
	Kapoposang	25.28	3.71

10. Hasil Analisa Anova Karang Hidup

Anova: Single Factor

SUMMARY

Groups	Count	Sum	Average	Variance
Dalam	12	70.0422	5.83685	60.1116
Tengah	15	187.9734	12.5316	100.727
Luar	15	328.067	21.8711	479.102

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	1761.223	2	880.612	3.91212	0.02829	3.2381
Within Groups	8778.837	39	225.098			
Total	10540.06	41				

t-Test: Two-Sample Assuming Equal Variances

	Luar	Tengah
Mean	21.8711	12.53156
Variance	479.102	100.7268
Observations	15	15
Pooled Variance	289.915	
Hypothesized Mean Difference	0	
df	28	
t Stat	1.50218	
P(T<=t) one-tail	0.07212	
t Critical one-tail	1.70113	
P(T<=t) two-tail	0.14424	
t Critical two-tail	2.04841	

t-Test: Two-Sample Assuming Equal Variances

	Luar	Dalam
Mean	21.87114	5.83685
Variance	479.1025	60.11161
Observations	15	12
Pooled Variance	294.7465	
Hypothesized Mean Difference	0	
df	25	
t Stat	2.411458	
P(T<=t) one-tail	0.011781	
t Critical one-tail	1.708141	
P(T<=t) two-tail	0.023562	
t Critical two-tail	2.059539	

t-Test: Two-Sample Assuming Equal Variances

	Tengah	Dalam
Mean	12.53156	5.83685
Variance	100.7268	60.11161
Observations	15	12
Pooled Variance	82.8561	
Hypothesized Mean Difference	0	
df	25	
t Stat	1.898995	
P(T<=t) one-tail	0.034582	
t Critical one-tail	1.708141	
P(T<=t) two-tail	0.069164	
t Critical two-tail	2.059539	

11. Hasil Analisa Anova Karang Mati

Anova: Single Factor

SUMMARY

Groups	Count	Sum	Average	Variance
Dalam	12	402.8405	33.57	404.847
Tengah	15	1063.79	70.9193	680.158
Luar	15	1071.975	71.465	391.955

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	12134.43	2	6067.21	12.1576	7.9E-05	3.2381
Within Groups	19462.9	39	499.049			
Total	31597.32	41				

F-Test Two-Sample for Variances

	Luar	Tengah
Mean	71.465	70.9193
Variance	391.955	680.157
Observations	15	15
df	14	14
F	0.57627	
P(F<=f) one-tail	0.15703	
F Critical one-tail	0.40262	

F-Test Two-Sample for Variances

	Luar	Dalam
Mean	71.46499	33.57004
Variance	391.9552	404.8468
Observations	15	12
df	14	11
F	0.968157	
P(F<=f) one-tail	0.468621	
F Critical one-tail	0.389788	

F-Test Two-Sample for Variances

	Tengah	Dalam
Mean	70.91931	33.57004
Variance	680.1577	404.8468
Observations	15	12
df	14	11
F	1.680037	
P(F<=f) one-tail	0.19608	
F Critical one-tail	2.738648	

t-Test: Two-Sample Assuming Equal Variances

	Luar	Tengah
Mean	71.465	70.25446
Variance	391.955	725.3373
Observations	15	14
Pooled Variance	552.472	
Hypothesized Mean Difference	0	
df	27	
t Stat	0.13859	
P(T<=t) one-tail	0.4454	
t Critical one-tail	1.70329	
P(T<=t) two-tail	0.8908	
t Critical two-tail	2.05183	

t-Test: Two-Sample Assuming Equal Variances

	Luar	Dalam

Mean	71.46499	33.57004
Variance	391.9552	404.8468
Observations	15	12
Pooled Variance	397.6275	
Hypothesized Mean Difference	0	
df	25	
t Stat	4.906789	
P(T<=t) one-tail	2.37E-05	
t Critical one-tail	1.708141	
P(T<=t) two-tail	4.74E-05	
t Critical two-tail	2.059539	

t-Test: Two-Sample Assuming Equal Variances

	Tengah	Dalam
Mean	70.91931	33.57004
Variance	680.1577	404.8468
Observations	15	12
Pooled Variance	559.0209	
Hypothesized Mean Difference	0	
df	25	
t Stat	4.078706	
P(T<=t) one-tail	0.000202	
t Critical one-tail	1.708141	
P(T<=t) two-tail	0.000405	
t Critical two-tail	2.059539	

12. Hasil Analisa Anova Bukan Karang

Anova: Single Factor

SUMMARY

Groups	Count	Sum	Average	Variance
Dalam	12	332.7983	27.7332	174.6
Tengah	15	875.8163	58.3878	666.187
Luar	15	743.9078	49.5939	277.842

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	6489.668	2	3244.83	8.3602	0.00095	3.2381
Within Groups	15137.01	39	388.129			
Total	21626.68	41				

t-Test: Two-Sample Assuming Equal Variances

	Luar	Tengah
Mean	49.5939	58.38775
Variance	277.842	666.1872
Observations	15	15
Pooled Variance	472.015	
Hypothesized Mean Difference	0	
df	28	
t Stat	-1.1085	
P(T<=t) one-tail	0.13854	
t Critical one-tail	1.70113	
P(T<=t) two-tail	0.27708	
t Critical two-tail	2.04841	

t-Test: Two-Sample Assuming Equal Variances

	Luar	Dalam
Mean	49.59385	27.7332
Variance	277.8423	174.6002
Observations	15	12
Pooled Variance	232.4158	
Hypothesized Mean Difference	0	
df	25	
t Stat	3.702412	
P(T<=t) one-tail	0.00053	
t Critical one-tail	1.708141	
P(T<=t) two-tail	0.001059	
t Critical two-tail	2.059539	

t-Test: Two-Sample Assuming Equal Variances

	Tengah	Dalam
Mean	58.38775	27.7332
Variance	666.1872	174.6002
Observations	15	12
Pooled Variance	449.8889	
Hypothesized Mean Difference	0	
df	25	
t Stat	3.731614	
P(T<=t) one-tail	0.000492	
t Critical one-tail	1.708141	
P(T<=t) two-tail	0.000984	
t Critical two-tail	2.059539	

13. Hasil Analisa Anova Makroalga

Anova: Single Factor

SUMMARY

Groups	Count	Sum	Average	Variance
Dalam	12	490.6925	40.89104	651.5946
Tengah	15	249.432	16.6288	631.0703
Luar	15	74.69028	4.979352	75.95023

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	8776.899	2	4388.45	10.02879	0.000306	3.238096
Within Groups	17065.83	39	437.5853			
Total	25842.73	41				

t-Test: Two-Sample Assuming Unequal Variances

	Tengah	Luar
Mean	16.6288	4.979352
Variance	631.07	75.95023
Observations	15	15
Hypothesized Mean Difference	0	
df	17	
t Stat	1.69682	
P(T<=t) one-tail	0.05398	
t Critical one-tail	1.73961	
P(T<=t) two-tail	0.10796	
t Critical two-tail	2.10982	

t-Test: Two-Sample Assuming Unequal Variances

	Dalam	Luar
Mean	40.89104	4.979352
Variance	651.5946	75.95023
Observations	12	15
Hypothesized Mean Difference	0	
df	13	
t Stat	4.660992	
P(T<=t) one-tail	0.000223	
t Critical one-tail	1.770933	

P(T<=t) two-tail	0.000446
t Critical two-tail	2.160369

14. Hasil Analisis Anova Biotik Lain

Anova: Single Factor

SUMMARY

Groups	Count	Sum	Average	Variance
Dalam	12	102.674	8.55617	72.2674
Tengah	15	207.7783	13.8519	102.215
Luar	15	493.4668	32.8978	511.599

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	4602.822	2	2301.41	9.56026	0.00042	3.2381
Within Groups	9388.345	39	240.727			
Total	13991.17	41				

t-Test: Two-Sample Assuming Equal Variances

biotik non FA

	Tengah	Luar
Mean	13.8519	32.89779
Variance	102.215	511.5992
Observations	15	15
Pooled Variance	306.907	
Hypothesized Mean Difference	0	
df	28	
t Stat	-2.9773	
P(T<=t) one-tail	0.00297	
t Critical one-tail	1.70113	
P(T<=t) two-tail	0.00594	
t Critical two-tail	2.04841	

t-Test: Two-Sample Assuming Equal Variances

	Tengah	Dalam

Mean	13.85189	8.556168
Variance	102.2154	72.26738
Observations	15	12
Pooled Variance	89.03826	
Hypothesized Mean Difference	0	
df	25	
t Stat	1.449076	
P(T<=t) one-tail	0.079873	
t Critical one-tail	1.708141	
P(T<=t) two-tail	0.159745	
t Critical two-tail	2.059539	

t-Test: Two-Sample Assuming Equal Variances

	Luar	Dalam
Mean	32.89779	8.556168
Variance	511.5992	72.26738
Observations	15	12
Pooled Variance	318.2932	
Hypothesized Mean Difference	0	
df	25	
t Stat	3.522817	
P(T<=t) one-tail	0.000834	
t Critical one-tail	1.708141	
P(T<=t) two-tail	0.001667	
t Critical two-tail	2.059539	

Abiotik

Anova: Single Factor

SUMMARY

Groups	Count	Sum	Average	Variance
Dalam	12	606.6334	50.5528	301.691
Tengah	15	1042.79	69.5193	570.313
Luar	15	931.8429	62.1229	366.824

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit

Between Groups	2408.485	2	1204.24	2.85704	0.06952	3.2381
Within Groups	16438.52	39	421.501			
Total	18847.01	41				

t-Test: Two-Sample Assuming Equal Variances

	Tengah	Luar
Mean	16.6288	4.979352
Variance	631.07	75.95023
Observations	15	15
Pooled Variance	353.51	
Hypothesized Mean Difference	0	
df	28	
t Stat	1.69682	
P(T<=t) one-tail	0.05041	
t Critical one-tail	1.70113	
P(T<=t) two-tail	0.10082	
t Critical two-tail	2.04841	

t-Test: Two-Sample Assuming Equal Variances

	Tengah	Dalam
Mean	16.6288	40.89104
Variance	631.0703	651.5946
Observations	15	12
Pooled Variance	640.101	
Hypothesized Mean Difference	0	
df	25	
t Stat	-2.47606	
P(T<=t) one-tail	0.010205	
t Critical one-tail	1.708141	
P(T<=t) two-tail	0.020409	
t Critical two-tail	2.059539	

t-Test: Two-Sample Assuming Equal Variances

	Luar	Dalam
Mean	4.979352	40.89104
Variance	75.95023	651.5946
Observations	15	12
Pooled Variance	329.2337	
Hypothesized Mean Difference	0	
df	25	
t Stat	-5.1102	

P(T<=t) one-tail	1.4E-05
t Critical one-tail	1.708141
P(T<=t) two-tail	2.8E-05
t Critical two-tail	2.059539

15. Analisa General linear Model Spesies landak laut dengan Variabel Lingkungan

glm(formula = D.set ~ pH + DO + Cond + Turb + Temp + Sal + TDS +
Ecosystem + Zone, data = Dat)

Deviance Residuals:

Min	1Q	Median	3Q	Max
-143.16	-38.71	-17.84	28.67	357.84

Coefficients:	Estimate	Std.	Error	t	value	Pr(>|t|)
(Intercept)	-868.871	1392.805	-0.624	0.5345		
pH	-74.61	168.848	-0.442	0.6598		
DO	14.003	11.045	1.268	0.2086		
Cond	-421.661	170.972	-2.466	0.0158	*	
Turb	-34.941	16.782	-2.082	0.0406	*	
Temp	35.762	16.294	2.195	0.0311	*	
Sal	44.08	52.086	0.846	0.3999		
TDS	18.592	23.921	0.777	0.4393		
EcosystemSG	37.154	18.406	2.019	0.0469	*	
Zonemidshelf	-4.707	26.577	-0.177	0.8599		
Zoneouter	-19.209	28.468	-0.675	0.5018		

glm(formula = D.sav ~ pH + DO + Cond + Turb + Temp + Sal + TDS +
Ecosystem + Zone, data = Dat)

Deviance Residuals:

Min	1Q	Median	3Q	Max
-15.909	-6.199	-0.417	2.021	70.091

Coefficients:	Estimate	Std.	Error	t	value	Pr(>|t|)
(Intercept)	-243.469	229.902	-1.059	0.29282		
pH	45.99	27.871	1.65	0.10289		

DO	3.604	1.823	1.977	0.05151	.
Cond	-23.492	28.221	-0.832	0.40768	
Turb	-1.473	2.77	-0.532	0.59637	
Temp	-6.356	2.69	-2.363	0.02057	*
Sal	-1.108	8.597	-0.129	0.89781	
TDS	3.434	3.949	0.87	0.38716	
EcosystemSG	9.843	3.038	3.24	0.00175	**
Zonemidshelf	-2.846	4.387	-0.649	0.51842	
Zoneouter	7.257	4.699	1.544	0.12647	

glm(formula = T.gra ~ pH + DO + Cond + Turb + Temp + Sal + TDS +
Ecosystem + Zone, data = Dat)

Deviance Residuals:

Min	1Q	Median	3Q	Max
-11.254	-2.460	-1.319	1.799	20.853

Coefficients:	Estimate	Std.	Error	t	value	Pr(>|t|)
(Intercept)	344.462	90.5031	3.806	0.000277	***	
pH	-40.5402	10.9716	-3.695	0.000404	***	
DO	2.8833	0.7177	4.018	0.000133	***	
Cond	-29.5541	11.1096	-2.66	0.009453	**	
Turb	0.2788	1.0905	0.256	0.798849		
Temp	-0.6634	1.0588	-0.627	0.532786		
Sal	-4.0839	3.3845	-1.207	0.231167		
TDS	4.9089	1.5544	3.158	0.00225	**	
EcosystemSG	2.2692	1.196	1.897	0.061438	.	
Zonemidshelf	-2.4239	1.727	-1.404	0.164371		
Zoneouter	1.7901	1.8498	0.968	0.33614		
---						

glm(formula = E.cal ~ pH + DO + Cond + Turb + Temp + Sal + TDS +
Ecosystem + Zone, data = Dat)

Deviance Residuals:

Min	1Q	Median	3Q	Max
-4.3511	-1.2054	-0.3582	0.5948	10.9985

Coefficients:	Estimate	Std.	Error	t	value	Pr(>|t|)
(Intercept)	86.64866	42.47517	2.04	0.0447	*	
pH	-9.91463	5.14922	-1.925	0.0578	.	
DO	0.09029	0.33682	0.268	0.7894		
Cond	-3.56336	5.21398	-0.683	0.4963		
Turb	-0.38314	0.51179	-0.749	0.4563		
Temp	0.33118	0.49692	0.666	0.5071		
Sal	-2.71388	1.58842	-1.709	0.0915	.	
TDS	1.65493	0.7295	2.269	0.026	*	
EcosystemSG	1.47796	0.56131	2.633	0.0102	*	
Zonemidshelf	-0.27294	0.81051	-0.337	0.7372		
Zoneouter	1.63655	0.86815	1.885	0.0631	.	

glm(formula = E.dia ~ pH + DO + Cond + Turb + Temp + Sal + TDS +
Ecosystem + Zone, data = Dat)

Deviance Residuals:

Min	1Q	Median	3Q	Max
-1.9377	-0.2771	-0.1007	0.1448	8.0623

Coefficients:	Estimate	Std.	Error	t	value	Pr(>|t|)
(Intercept)	58.85032	19.23486	3.06	0.00303	**	
pH	-6.88594	2.33182	-2.953	0.00414	**	
DO	0.37547	0.15253	2.462	0.01601	*	
Cond	-5.61225	2.36115	-2.377	0.01988	*	
Turb	0.06187	0.23176	0.267	0.7902		
Temp	-0.08446	0.22503	-0.375	0.70841		
Sal	0.04656	0.71931	0.065	0.94855		
TDS	0.43279	0.33035	1.31	0.19397		
EcosystemSG	-0.11053	0.25419	-0.435	0.66487		
Zonemidshelf	-0.39798	0.36704	-1.084	0.28154		
Zoneouter	-0.09544	0.39314	-0.243	0.80882		

glm(formula = E.mat ~ pH + DO + Cond + Turb + Temp + Sal + TDS +
Ecosystem + Zone, data = Dat)

Deviance Residuals:

Min	1Q	Median	3Q	Max

-1.6352 -0.6354 -0.0770 0.1761 8.8803

Coefficients:	Estimate	Std.	Error	t	value	Pr(>|t|)
(Intercept)	-6.95271	22.87363	-0.304	0.76196		
pH	2.59775	2.77295	0.937	0.35171		
DO	0.38375	0.18138	2.116	0.03752	*	
Cond	-1.0971	2.80782	-0.391	0.69705		
Turb	0.04114	0.27561	0.149	0.88171		
Temp	-0.6443	0.2676	-2.408	0.01839	*	
Sal	-0.68033	0.85539	-0.795	0.42879		
TDS	0.55493	0.39285	1.413	0.16171		
EcosystemSG	0.85221	0.30228	2.819	0.00608	**	
Zonemidshelf	-0.34098	0.43647	-0.781	0.43701		
Zoneouter	0.98959	0.46752	2.117	0.03743	*	

glm(formula = T.pil ~ pH + DO + Cond + Turb + Temp + Sal + TDS +
Ecosystem + Zone, data = Dat)

Deviance Residuals:

Min 1Q Median 3Q Max
-0.35991 -0.04876 -0.02297 0.02464 1.07009

Coefficients:	Estimate	Std.	Error	t	value	Pr(>|t|)
(Intercept)	10.17886	3.50369	2.905	0.00476	**	
pH	-1.17541	0.42475	-2.767	0.00704	**	
DO	0.0669	0.02778	2.408	0.01837	*	
Cond	-1.11575	0.43009	-2.594	0.0113	*	
Turb	0.01433	0.04222	0.339	0.73514		
Temp	-0.02202	0.04099	-0.537	0.59269		
Sal	0.05897	0.13103	0.45	0.6539		
TDS	0.05884	0.06018	0.978	0.33111		
Ecosystem SG	-0.0353	0.0463	-0.762	0.44815		
Zonemidshelf	-0.07022	0.06686	-1.05	0.29679		
Zoneouter	-0.02213	0.07161	-0.309	0.75812		

glm(formula = D.spp ~ pH + DO + Cond + Turb + Temp + Sal + TDS +
Ecosystem + Zone, data = Dat)

Deviance Residuals:

Min	1Q	Median	3Q	Max
-2.8412	-0.6381	-0.1557	0.0507	9.1588

Coefficients:						
	Estimate	Std.	Error	t	value	Pr(>|t|)
(Intercept)	-12.7427	29.49162	-0.432	0.6669		
pH	3.5926	3.57524	1.005	0.318		
DO	0.36537	0.23386	1.562	0.1222		
Cond	-0.86752	3.6202	-0.24	0.8112		
Turb	0.1451	0.35535	0.408	0.6841		
Temp	-0.78187	0.34502	-2.266	0.0262	*	
Sal	-0.13507	1.10288	-0.122	0.9028		
TDS	0.24102	0.50651	0.476	0.6355		
Ecosystem SG	0.53299	0.38973	1.368	0.1753		
Zone midshelf	0.03218	0.56276	0.057	0.9545		
Zone outer	0.87729	0.60278	1.455	0.1495		

glm(formula = Spesies ~ pH + DO + Cond + Turb + Temp + Sal +
TDS + Ecosystem + Zone, data = Dat)

Deviance Residuals:

Min	1Q	Median	3Q	Max
-2.13247	-0.92225	-0.03355	0.62158	2.77040

Coefficients:						
	Estimate	Std.	Error	t	value	Pr(>|t|)
(Intercept)	20.6325	22.0587	0.935	0.352459		
pH	-2.093	2.6742	-0.783	0.436166		
DO	0.3693	0.1749	2.111	0.037939	*	
Cond	-7.2138	2.7078	-2.664	0.009354	**	
Turb	-0.4614	0.2658	-1.736	0.086448	.	
Temp	-0.126	0.2581	-0.488	0.626795		
Sal	-0.1676	0.8249	-0.203	0.839573		
TDS	0.7264	0.3789	1.917	0.058796	.	
EcosystemSG	1.1128	0.2915	3.817	0.000267	***	
Zonemidshelf	-0.0203	0.4209	-0.048	0.961652		
Zoneouter	0.6018	0.4509	1.335	0.185747		

glm(formula = Urchins ~ pH + DO + Cond + Turb + Temp + Sal +

TDS + Ecosystem + Zone, data = Dat)

Deviance Residuals:

Min	1Q	Median	3Q	Max
-162.92	-45.34	-20.40	31.01	342.08

Coefficients:						
	Estimate	Std.	Error	t	value	Pr(>|t|)
(Intercept)	-631.902	1473.324	-0.429	0.66917		
pH	-80.944	178.61	-0.453	0.65166		
DO	21.773	11.683	1.864	0.06609	.	
Cond	-486.961	180.856	-2.693	0.00865	**	
Turb	-36.256	17.752	-2.042	0.04445	*	
Temp	27.541	17.236	1.598	0.11407		
Sal	35.464	55.097	0.644	0.52165		
TDS	29.877	25.304	1.181	0.24125		
EcosystemSG	51.984	19.47	2.67	0.00921	**	
Zonemidshelf	-11.027	28.114	-0.392	0.69594		
Zoneouter	-6.776	30.113	-0.225	0.82255		

Lampiran 7. Data Kualitas Air

1. Data Kualitas Air di Padang Lamun

no	sites	Padang Lamun								
		Ph	Do	Cond	Turb	Temp	Salt	TDS	Time	Date
1	Lanjukang	7.44	8.01	.86	-	30.00	30.30	17.30	11.20	22/6/2021
2	Gondong Bali	7.98	3.88	4.58	-	29.80	30.50	49.90	0.34	23/6/2021
3	Papandangan	7.99	7.00	4.51	-	30.00	30.20	49.50	0.44	23/6/2021
4	Kapoposang	8.19	8.91	4.58	0.40	31.90	30.70	50.00	0.63	23/6/2021
5	Lumu-lumu	8.02	5.42	4.57	0.90	30.20	30.70	50.10	0.40	24/6/2021
6	Gusung Tallang	8.24	8.44	4.56	1.30	30.60	30.50	49.80	0.57	24/6/2021
7	Salemo	8.39	13.02	3.93	1.70	32.60	25.97	41.37	14.46	24/6/2021
8	Barrang lompo	8.12	5.97	4.46	-	30.23	29.70	48.33	8.07	27/6/2021
9	Saugi	8.24	8.14	4.07	0.33	30.27	26.80	43.13	10.16	25/6/2021
10	Kodingareng keke	8.13	7.63	4.51	-	29.10	29.90	48.90	8.07	27/04/2021
11	Langkai	8.30	10.38	4.56	-	29.90	30.40	49.80	10.21	29/04/2021
12	Langkadea	8.12	8.10	4.70	-	29.80	29.50	47.50	9.49	26/04/2021
13	Kayangan	8.10	7.79	4.42	0.50	30.00	29.70	48.30	15.52	26/04/2021
14	Samalona	8.22	7.45	4.51	-	29.20	29.40	49.00	14:03	27/042021

2. Data Kualitas Air di Terumbu Karang

no	sites	Rataan Terumbu Karang								
		Ph	Do	Cond	Turb	Temp	Salt	TDS	Time	Date
1	Lanjukang	8.15	7.04	4.54	-	30.00	30.30	49.50	11.36	22/6/2021
2	Gondong Bali	8.03	7.19	4.56	-	29.80	30.50	49.90	0.35	23/6/2021
3	papandangan	8.03	8.11	4.43	0.10	30.20	30.40	49.50	0.45	23/6/2021
4	Kapoposang	8.20	8.32	4.58	-	30.10	30.60	50.00	0.61	23/6/2021
5	Lumu-lumu	8.19	7.90	4.59	-	30.00	30.60	50.00	0.42	24/6/2021
6	Gusung Tallang	8.24	8.44	4.56	1.30	30.60	30.50	49.80	0.57	24/6/2021
7	Salemo	8.32	9.80	4.00	3.43	31.90	26.40	42.30	14.49	24/6/2021
8	Barrang lompo	8.15	7.18	4.66	0.63	30.73	31.27	51.07	8.25	27/6/2021
9	Saugi	8.25	9.79	4.08	0.03	31.23	27.00	43.33	12.31	25/6/2021
10	Kodingareng keke	8.16	8.44	4.50	-	29.70	29.80	48.70	8.25	27/04/2021
11	Langkai	8.19	7.50	4.49	-	28.70	29.80	48.90	11 37	29/04/2021
12	Langkadea	8.14	7.48	4.40	-	29.50	29.40	48.00	10.30	26/04/2021
13	Kayangan	8.23	8.35	4.45	-	30.40	29.70	48.30	0.61	26/04/2021
14	Samalona	8.20	8.84	4.51	-	29.60	30.00	49.00	14:01	27/04/2021

Lampiran 8. Koordinat Lokasi Penelitian

1. Koordinat lokasi penelitian di padang lamun

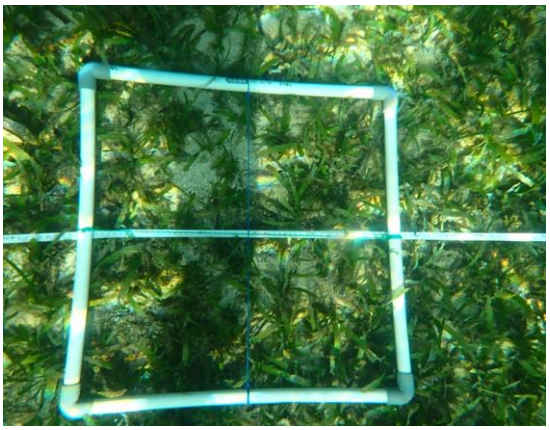
Zona	Lamun	S	E
dalam	Salemo	04 41 03.11	119 28 06.4
	Saugi	04 46 03.51	119 27 43.67
Tengah	Barrang Lompo	05 19 46.3	119 19 46.32
	Lumu-lumu	04 43 04.61	119 12 56.12
	Langkadea	04 55 28.86	119 23 54.8
Luar	Gondong Bali	04 43 04.61	119 03 51.41
	Kapoposang	04 42 09.76	118 57 58.47
	Langkai	05 01 59.2	119 05 28.42
	Lanjukang	04 58 45.41	119 04 26.91
	Papandangan	04 43 16.53	118 58 57.6

2. Koordinat lokasi penelitian di rataan terumbu

Zona	Reef Flat	S	E
Dalam	Saugi	04 46 09.1	119 27 30.2
	Salemo	04 41 19.95	119 27 46.63
	Gusung Tallang	05 07 09.56	119 23 41.39
	Kayangan	05 06 57.8	119 23 49.8
Tengah	Samalona	05 07 23.95	119 20 32.33
	Lumu-lumu	04 58 28.36	119 13 02.11
	Kodingareng Keke	05 06 12.13	119 17 14.6
	Langkadea	04 55 38.60	119 23 41 00
	Barrang Lompo	05 02 29.71	119 19 34.09
Luar	Langkai	05 01 38.61	119 05 25.38
	Lanjukang	04 58 28.13	119 04 27.67
	Papandangan	04 43 13.21	118 59 02.16
	Kapoposang	04 42 08.30	118 57 59.30
	Gondong Bali	04 43 05.52	119 03 51.08

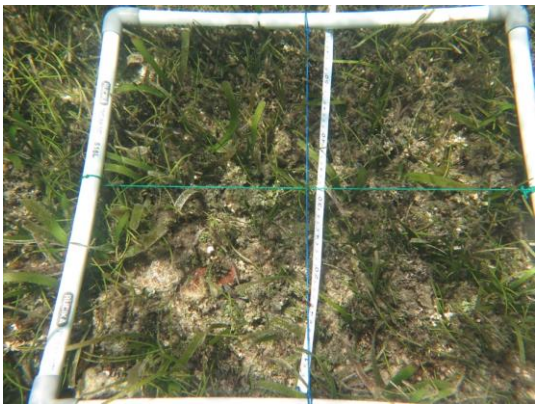
Lampiran 9. Gambar Jenis-jenis Lamun yang Ditemukan

Enhalus acoroides



Thalassia hemprichii

Cymodocea rotundata



Syringodium isoetifolium

Halophila ovalis