Spatial and temporal distribution dataset of benthic macroalgae during the 2015-2016 tropical monsoonal cycle in Malaysia

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Abstract

Background

The effects of small-scale disturbances, such as monsoon, are understudied in tropical regions. The storms associated with monsoon events not only modify the local macroalgal community structure, but also reveal the continuation of short-term recolonisation. Thus, this study aims to determine the variation in species, assemblage and cover of macroalgae during the monsoonal cycle from 2015 to 2016. This paper presents data on the spatial and temporal distribution of benthic macroalgae along the coastline of Johor, Malaysia. The information is presented as raw and partially-processed data, which summarises the cover and frequency of macroalgae at the respective study sites. This paper describes an important set of data that can be used further for in-situ experiments on the effects of environmental disturbances towards pioneer and climax species in tropical areas.

New information

This study provides a description of the east coast shore of Peninsular Malaysia, specifically in Johor coast in 2015-2016. The spatial and temporal distribution and abundance of a total of 41 taxa were assessed at four monsoon-exposed locations. These data provide a comprehensive baseline against disturbance and recolonisation of macroalgal community can be effectively and objectively evaluated.

Keywords

abundance, occurrence, seaweed, specimen

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Introduction

Environmental stress, such as disturbance, occurs over a short period of time and results in significant changes in the ecosystem. Many ecosystems and species evolve in response to particular environmental disturbances that create patches of disturbed habitat and play a significant role in controlling such things as life cycles, food, nutrient supply and habitat availability (Kroeker et al. 2020). Community structure in the disturbed area creates variability at spatial and temporal scales, including in terrestrial, freshwater and marine ecosystems (Turner 2010). In Malaysia, monsoonal storms are the primary annual storms associated with local changes in rainfall, wave, current and wind speed intensities (Satari et al. 2015). Monsoonal storm activities, such as wave impact, heavy winds and strong currents affect the eastern coast of Peninsular Malaysia, specifically Johor which is located in the southern region of Peninsular Malaysia. The coastline features vary from being very exposed to very sheltered and, therefore, impact the delicate marine macrophytes that reside along the coastline, such as macroalgae (Lindenmayer and Fischer 2007).

The existence of macroalgae is usually species-specific as most species require specific conditions for colonising their respective habitats (Zainee et al. 2019b). Dominant macroalgal species can be found attached to any available substrate including in water puddles on the surface of artificial substrate, such as sea wall rocks (Zainee et al. 2019a). However, the effect of monsoon reduces the macroalgal productivity through modification and destruction of their habitat (Kim et al. 2017). These events will not only pull away the early coloniser, fleshy and delicate macroalgal (such as *Chaetomorpa* spp.), but also affect the climax macroalgal community that have strongly-attached holdfasts, such as *Sargassum* (Zainee and Rozaimi 2020). Once the actual disturbance event is finished, the succession process begins and favours those that are opportunistic in nature (e.g. Suding et al. 2004), which may eventually produce a similar ecosystem to the one that existed prior to the monsoon disturbance. Some of the disturbances events relating to macroalgal community are those related to small scale environmental events in general (e.g. Kendrick et al. 2004, Kim et al. 2017, Prathep et al. 2008), whereas others are specific to large scale disturbances such as hurricane and tsunami (Prathep et al. 2008, Wilson et al. 2020). Therefore, more comprehensive studies are needed to obtain data on the impacts of monsoons on the macroalgal community.

Thus, this data paper presents the dataset on the immediate impact of monsoon on the eastern coast of Johor. The temporal and spatial data include the changes in cover and frequency of benthic macroalgae in the area, demonstrating variation in macroalgae diversity over the 14-months study period. Such data allow further in-situ experiments on the effect of environmental disturbances towards pioneer and climax species. Besides, substratum- and habitat-specificity of the macroalgae species is presented, which allows insights into assessing macroalgal abundances. In conclusion, the data serve as part of a larger assessment effort and the dataset synthesises the results of macroalgal diversity work done in the eastern coastal waters of Johor (Malaysia).

Project description

Title: Spatial and temporal distribution dataset of benthic macroalgae during the 2015-2016 tropical monsoonal cycle in Malaysia

Sampling methods

Description: Sampling activity was conducted in four locations in the eastern Johor coastline: Pantai Pasir Lanun, Pulau Mawar, Telok Gorek and Tanjung Lompat (Fig. 1). Pantai Pasir Lanun is located at the tip of a foreland with a relatively straight coastline, predominantly featuring hard substrates composed of large areas of coral rubble and boulders. Pulau Mawar is characterised by a shallow-elevated sandy terrain with small patches of mangrove trees and coral rubble. Telok Gorek is located within an indented bay, covered with mangrove trees and sheltered from the foreland. Tanjung Lompat consists of a foreland and an extensive bay, characterised by boulder-pebbles on the foreland and a shallow sandy bay.

Sampling description: Sampling was undertaken from January 2015 until February 2016 during the lowest tide of the month (Table 1). Transects were placed randomly, taken to represent the macroalgae cover and frequency at each site. The quadrats were placed alternately at every 1 metre of the 25-metre transect line. Initially, the macroalgae that were found inside the quadrat were recorded, identified and inventoried according to the type of species, percentage of cover and percentage of frequency (Suppl. material 1). The types of substratum attached by macroalgae were noted as representing the habitat specificity of the macroalgae (Table 2). The raw data of cover and frequency were calculated by multiplying the vertical count of every species to the five levels of multiplier and the total number of sub-quadrat from the nine transect lines with a total of 234 quadrats (Suppl. materials 2, 3, 4, 5). The cover of every species of macroalgae was then analysed by summing the percentage cover value of prostrate and erect parts of the macroalgae in each sub-quadrat (10 cm × 10 cm) after Saito and Atobe (1970) (Suppl. material 6). The percentage frequency of macroalgae was obtained by calculating the total number of squares (q_n) in which the species occurred, divided by the total number of small squares in the quadrat (= 25) and multiplied by 100 (Suppl. materials 2, 3, 4, 5). A pre-analytical view of the percentage cover and frequency data of macroalgae is visualised in Fig. 2.

Quality control: All scientific names are morphologically identified according to Ismail (1995), Trono and Ganzon-Fortes (1988), Zainee et al. (2018) and Zainee et al. (2019a) and are standardised according to Guiry and Guiry (2021) and WoRMS Editorial Board (2021).

Step description:

1. In-situ identification of species and destructive collection for first-time observed samples and preservation in formaldehyde,

2. Non-destructive sampling (except for filamentous algae that need microscopic observation in the laboratory) at four study sites,
3. Photography, sorting, cleaning and preparation of herbarium specimens,
4. Conversion of paper-based records from the field and laboratory into an electronic data format (Excel spreadsheets),
5. Organising the datasets into a standardised format,
6. Standardisation of taxonomy using the World Register of Marine Species and AlgaeBase,
7. Export of data as a DarwinCore Archive and
8. Generation of dataset-level metadata.

Geographic coverage

Description: Sampling was undertaken along four major shore stretches of the entire coast of east Johor, covering approximately 180 km from Desaru to Mersing. The eastern coast of Johor extends approximately 175 km from Teluk Lipat (i.e. Lipat Bay) to the north and Teluk Ramunia to the south.

Coordinates: Pantai Pasir Lanun (02°38'52"N, 103°45'29"E), Pulau Mawar (02°37'08"N, 103°47'01"E), Telok Gorek (02º18'37"N, 103°57'31"E), Tanjung Lompat (01°36'10"N, 104°15'17"E).

Coordinates: 1.197 and 2.757 Latitude; 102.48 and 104.546 Longitude.

Taxonomic coverage

Description: We report the identification of marine algae species from rhodophytes, chlorophytes and phaeophytes.

Taxa included:

Rank	Scientific Name
class	Ulvophyceae
class	Phaeophyceae
class	Florideophyceae
order	Bryopsidales
order	Cladophorales
order	Dasycladales
order	Ulvales
order	Dictyotales
order	Fucales

order	Ceramiales
order	Corallinales
order	Gelidiales
order	Gigartinales
order	Gracilariales
order	Nemaliales
order	Rhodymeniales
family	Rhodomelaceae
family	Lithophyllaceae
family	Corallinaceae
family	Pterocladiaceae
family	Gigartinaceae
family	Galaxauraceae
family	Gracilariaceae
family	Cystocloniaceae
family	Lomentariaceae
family	Dictyotaceae
family	Sargassaceae
family	Polyphysaceae
family	Caulerpaceae
family	Cladophoraceae
family	Boodleaceae
family	Ulvaceae
family	Valoniaceae
species	*Caulerpa racemosa*
species	*Cladophoropsis membranacea*
species	*Chaetomorpha aerea*
species	*Chaetomorpha crassa*
species	*Chaetomorpha ligustica*
species	*Chaetomorpha linum*
species	*Chaetomorpha minima*

species	*Cladophora stimpsonii*
species	*Cladophora vagabunda*
species	*Valonia aegagropila*
species	*Acetabularia acetabulum*
species	*Ulva clathrata*
species	*Ulva intestinalis*
species	*Dictyopteris delicatula*
species	*Canistrocarpus cervicornis*
species	*Dictyota mertensii*
species	*Dictyota dichotoma*
species	*Padina australis*
species	*Padina boergesenii*
species	*Padina minor*
species	*Sargassum oligocystum*
species	*Sargassum paniculatum*
species	*Sargassum polycystum*
species	*Sargassum microcystum*
species	*Sargassum tenerrimum*
species	*Acanthophora muscoides*
species	*Acanthophora spicifera*
species	*Polysiphonia coacta*
species	*Amphiroa fragilissima*
species	*Jania adhaerens*
species	*Pterocladiella caloglossoides*
species	*Chondrus crispus*
species	*Hypnea cervicornis*
species	*Hypnea spinella*
species	*Gracilaria arcuata*
species	*Gracilaria bursa-pastoris*
species	*Crassiphycus changii*
species	*Gracilaria coronopifolia*

species	*Gracilaria salicornia*
species	*Galaxaura rugosa*
species	*Ceratodictyon intricatum*

Traits coverage

Data coverage of traits

PLEASE FILL IN TRAIT INFORMATION HERE

Temporal coverage

Notes: 2015-01-10 through 2016-02-26

Collection data

Collection name: Plantae

Specimen preservation method: dried and pressed, microscopic preparation

Usage licence

Usage licence: Open Data Commons Attribution License

IP rights notes: To the extent possible under law, the publisher has waived all rights to these data and has dedicated them to the Open Data Commons Attribution License, which permits unrestricted use, distribution and reproduction in any medium, provided the original author and sources are credited.

Data resources

Data package title: Spatial and temporal distribution dataset of benthic macroalgae during the 2015-2016 tropical monsoonal cycle in Malaysia

Resource link: https://cloud.gbif.org/asia/resource?r=dataset_macroalgae_johor&v=1.5

Alternative identifiers: https://cloud.gbif.org/asia/resource?r=dataset_macroalgae_johor

Number of data sets: 1

Data set name: Spatial and temporal distribution dataset of benthic macroalgae during the 2015-2016 tropical monsoonal cycle in Malaysia

Data format: Darwin Core Archive (DwC-A)

Data format version: 1.5

Description: This data paper presents the dataset on the inventory of macroalgae during the monsoonal storm cycle of 2015-2016 at the selected sites along the eastern coast of Johor, Malaysia. In particular, we focused on recording the occurrence of every species at the selected sites over the 14-months study period. Besides, substratum- and habitat-specificity of the macroalgae species is presented, which allows insights into assessing macroalgal abundances. In conclusion, the data serve as part of a larger assessment effort and the dataset synthesises the results of macroalgal diversity work done in the eastern coastal waters of Johor (Malaysia).

Column label	Column description
id	Same as OccurrenceID.
type	The nature or genre of the resource.
language	A language of the resource.
datasetName	The name identifying the dataset from which the record was derived.
basisofRecord	The specific nature of the data record.
occurenceID	An identifier for the Occurrence (as opposed to a particular digital record of the occurrence).
recordedBy	A list of names of peoples responsible for recording the original Occurrence.
individualCount	The number of individuals present at the time of the Occurrence.
organismQuantity	A number or enumeration value for the quantity of organisms.
organismQuantityType	The type of quantification system used for the quantity of organisms.
behaviour	The behaviour shown by the subject at the time the Occurrence was recorded.
occurenceStatus	A statement about the presence or absence of a Taxon at a Location.
preparations	A list (concatenated and separated) of preparations and preservation methods for a specimen.
disposition	The current state of a specimen with respect to the collection identified in collectionCode or collectionID.
occurenceRemarks	Comments or notes about the Occurrence.
eventDate	The date-time or interval during which an Event occurred.
habitat	A category or description of the habitat in which the Event occurred.
sampling protocol	The names of, references to, or descriptions of the methods or protocols used during an Event.
sampleSizeValue	A numeric value for a measurement of the size (time duration, length, area or volume) of a sample in a sampling event.

sampleSizeUnit	The unit of measurement of the size (time duration, length, area or volume) of a sample in a sampling event.
samplingEffort	The amount of effort expended during an Event.
eventRemarks	Comments or notes about the Event.
waterBody	The name of the water body in which the Location occurs.
country	The name of the country or major administrative unit in which the Location occurs.
stateProvince	The name of the next smaller administrative region than country (state, province, canton, department, region etc.) in which the Location occurs.
locality	The specific description of the place.
locationRemarks	Comments or notes about the Location.
decimalLatitude	The geographic latitude (in decimal degrees, using the spatial reference system given in geodeticDatum) of the geographic centre of a Location.
decimalLongitude	The geographic longitude (in decimal degrees, using the spatial reference system given in geodeticDatum) of the geographic centre of a Location.
geodeticDatum	The ellipsoid, geodetic datum or spatial reference system (SRS) upon which the geographic coordinates given in decimalLatitude and decimalLongitude are based.
coordinateUncertainty in metres	The horizontal distance (in metres) from the given decimalLatitude and decimalLongitude describing the smallest circle containing the whole of the Location.
identifiedBy	A list (concatenated and separated) of names of people, groups or organisations who assigned the Taxon to the subject.
dateIdentified	The date on which the subject was determined as representing the Taxon.
identificationReferences	A list of references (publication, global unique identifier, URI) used in the Identification.
identificationRemarks	Comments or notes about the Identification.
acceptedNameUsageID	An identifier for the name usage (documented meaning of the name according to a source) of the currently valid (zoological) or accepted (botanical) taxon.
scientificName	The full scientific name, with authorship and date information, if known.
parentNameUsage	The full name, with authorship and date information, if known, of the direct, most proximate higher-rank parent taxon (in a classification) of the most specific element of the scientificName.
kingdom	The full scientific name of the kingdom in which the taxon is classified.
phylum	The full scientific name of the phylum or division in which the taxon is classified.
class	The full scientific name of the class in which the taxon is classified.
order	The full scientific name of the order in which the taxon is classified.
family	The full scientific name of the family in which the taxon is classified.

taxonRank	The taxonomic rank of the most specific name in the scientificName.
scientificNameAuthorship	The authorship information for the scientificName formatted according to the conventions of the applicable nomenclaturalCode.
taxonomicStatus	The status of the use of the scientificName as a label for a taxon.
lifeStage	The age class or life stage of the Organisms at the time the Occurrence was recorded.
reproductiveCondition	The reproductive condition of the biological individuals is represented in Occurrence.

Additional information

A total of 41 taxa were identified: three Groups (Rhodophyceae, Phaeophyceae and Clorophyceae), 17 Family (Rhodomelaceae, Lithophyllaceae, Corallinaceae, Pterocladiaceae, Gigartinaceae, Galaxauraceae, Gracilariaceae, Cystocloniaceae, Lomentariaceae, Dictyotaceae, Sargassaceae, Polyphysaceae, Caulerpaceae, Cladophoraceae, Boodleaceae, Ulvaceae and Valoniaceae) (Zainee and Rozaimi 2020). A description of number of taxa of each Order is presented in Suppl. material 7. Overall, our study sites in Tanjung Lompat had a higher number of species (31 species) per sites, followed by Telok Gorek (nine species) and Pantai Pasir Lanun (eight species). Pulau Mawar had the lowest number of species, five species (Zainee and Rozaimi 2020). Our findings presented significant changes in species composition due to the effects of the monsoon event.

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Author contributions

Nur Farah Ain Zainee: Conceptualisation; Data curation; Formal analysis; Funding acquisition; Investigation; Methodology; Project administration; Resources; Validation; Writing - original draft & editing.

Mohammad Rozaimi: Data curation; Formal analysis; Funding acquisition; Project administration; Supervision; Validation; Roles/Writing - original draft, review & editing.

References

- Guiry MD, Guiry GM (2021) AlgaeBase. World-wide electronic publication, National University of Ireland, Galway. https://www.algaebase.org/search/species/detail/?species . Accessed on: 2021-11-29.
- Ismail A (1995) Rumpai Laut Malaysia. [Seaweed of Malaysia]. Dewan Bahasa dan Pustaka, Kuala Lumpur, 277 pp. [In Malay]. [ISBN 9836244158 9789836244154]
- Kendrick GA, Harvey ES, Wernberg T, Harman N, Goldberg N (2004) The role of disturbance in maintaining diversity of benthic macroalgal assemblages in southwestern Australia. The Japanese Journal of Phycology 52: 5-9.
- Kim HH, Ko YW, Yang KM, Sung G, Kim JH (2017) Effects of disturbance timing on community recovery in an intertidal habitat of a Korean rocky shore. Algae 32 (4): 325-336. https://doi.org/10.4490/algae.2017.32.12.7.
- Kroeker KJ, Bell BE, Donham EM, Hoshijima U, Lummis S, Toy JA, Willis-Norton E (2020) Ecological change in dynamic environments: Accounting for temporal environmental variability in studies of ocean change biology. Global Change Biology 26 (1): 54-67. https://doi.org/10.1111/gcb.14868.
- Lindenmayer DB, Fischer J (2007) Tackling the habitat fragmentation panchreston. Trends in Ecology and Evolution 22 (3): 127-132. https://doi.org/10.1016/j.tree.2006.11.006.
- Prathep A, Mayakun J, Tantipras P, Darakrai A (2008) Can macroalgae recover 13 months after the 2004 Tsunami?: A case study at Talibong Island, Trang Province, Thailand. Journal of Applied Phycology 20: 907-914. https://doi.org/10.1007/978-1-4020-9619-8_55.
- Saito Y, Atobe S (1970) Phytosociological study of intertidal marine algae:I. Usujiri Benten-Jima, Hokkaido. Bulletin of the Faculty of Fisheries Hokkaido University 21 (2): 37-69.
- Satari SZ, Zubairi YZ, Hussin AG, Hassan SF (2015) Some statistical characteristic of Malaysian wind direction recorded at maximum wind speed: 1999-2008. Sains Malaysiana 44 (10): 1521-1530. https://doi.org/10.17576/jsm-2015-4410-18.
- Suding KN, Gross KL, Houseman GR (2004) Alternative states and positive feedbacks in restoration ecology. Trends in Ecology and Evolution 18: 46-53. https://doi.org/10.1016/j.tree.2003.10.005.
- Trono GC, Ganzon-Fortes E (1988) Philippine Seaweeds. National Book Store Inc, Manila.
- Turner MG (2010) Disturbance and landscape dynamics in a changing world. Ecology 91 (10): 2833-2849. https://doi.org/10.1890/10-0097.1.
- Wilson SS, Furman BT, Hall MO, Fourqurean JW (2020) Assessment of Hurricane Irma impacts on South Florida seagrass communities using long-term monitoring programs. Estuarine and Coasts 43 (5): 1119-1132. https://doi.org/10.1007/s12237-019-00623-0
- WoRMS Editorial Board (2021) World Register of Marine Species. https://www.marinespecies.org. Accessed on: 2021-11-29.
- Zainee NF, Ismail A, Taip ME, Ibrahim N, Ismail A (2018) Diversity, distribution and taxonomy of Malaysian marine algae, *Halimeda* (Halimedaceae, Chlorophyta). Malayan Nature Journal 70 (2): 211-219.

- Zainee NF, Ibrahim N, Ismail A (2019a) Rumpai Laut Johor. [Seaweeds of Johor]. Penerbit UKM, Bandar Baru Bangi, 160 pp. [In Malay]. [ISBN 9789674129460]
- Zainee NF, Ismail A, Taip ME, Ibrahim N, Ismail A (2019b) Habitat preference of seaweeds at a tropical island of southern Malaysia. Songklanakarin Journal of Science and Technology 41 (5): 1171-1177.
- Zainee NF, Rozaimi M (2020) Influence of monsoonal storm disturbance on the diversity of intertidal macroalgae along the eastern coast of Johor (Malaysia). Regional Studies in Marine Science 40 (101481). https://doi.org/10.1016/j.rsma.2020.101481.

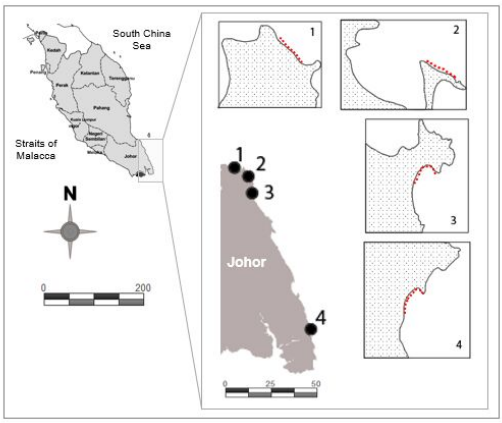


Figure 1.

Locations of collected macroalgae along the Johor coast: (1) Pantai Pasir Lanun; (2) Pulau Mawar; (3) Telok Gorek; and (4) Tanjung Lompat.

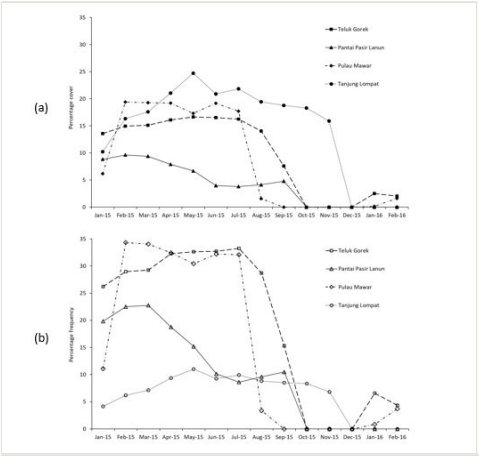


Figure 2.

Pre-analytical view of percentage (a) cover and (b) frequency of macroalgae observed at the eastern coast of Johor during 2015-2016 observations.

Table 1.

Coordinate, types of shore, coastline feature, types of vegetation and date of sampling of every study site.

Descriptions	Tanjung Lompat	Telok Gorek	Pulau Mawar	Pantai Pasir Lanun
Latitude	1°36'10"N	2°18' 37"N	2°37'08"N	2°38'52"N
Longitude	104°15'17"E	103°57'31"E	103°47'01"E	103°45'29"E
Types of shore	sandy, rocky	sandy	sandy	sandy, rocky
Coastline feature	bay	foreland	foreland	foreland
Vegetation	-	mangrove	mangrove	-
Date of sampling	10-Jan-15	21-Jan-15	22-Jan-15	23-Jan-15
	8-Feb-15	19-Feb-15	20-Feb-15	21-Feb-15
	10-Mar-15	20-Mar-15	21-Mar-15	22-Mar-15
	8-Apr-15	19-Apr-15	20-Apr-15	21-Apr-15
	8-May-15	19-May-15	20-May-15	21-May-15
	8-Jun-15	17-Jun-15	18-Jun-15	19-Jun-15
	6-Jul-15	31-Jul-15	31-Jul-15	31-Jul-15
	29-Aug-15	30-Aug-15	30-Aug-15	31-Aug-15
	1-Aug-15	14-Sep-15	14-Sep-15	15-Sep-15
	26-Oct-15	27-Oct-15	28-Oct-15	29-Oct-15
	14-Nov-15	25-Nov-15	26-Nov-15	27-Nov-15
	15-Dec-15	26-Dec-15	27-Dec-15	28-Dec-15
	14-Jan-16	26-Jan-16	27-Jan-16	28-Jan-16
	13-Feb-16	24-Feb-16	25-Feb-16	26-Feb-16

Table 2.

Life form of macroalgae and mode of substrate attachment (1 indicates the life-form of each species; N = natural substratum; A = artificial substratum; a = epilithic; b = epipsamonic; c = epizoic; d = epipelic; e = epiphytic; f = ropes; g = gunny fibres; h = fishing net).

Species list	N_a	N_b	N_c	N_d	N_e	A_f	A_g	A_h
Green algae								
Caulerpa racemosa	1	1						
Cladophoropsis membranacea	1	1		1	1			
Chaetomorpha aerea	1	1	1	1	1	1	1	
C. crassa	1							
C. ligustica	1	1	1	1	1	1	1	
C. linum	1	1	1	1	1	1	1	
C. minima	1	1	1	1	1	1	1	
Cladophora stimpsonii	1							
C. vagabunda	1							
Valonia aegagropila	1							
Acetabularia acetabulum	1							
Ulva clathrata	1		1	1				
U. intestinalis	1	1						
Brown algae								
Dictyopteris delicatula	1							
Canistrocarpus cervicornis	1				1			
Dictyota mertensii	1							
D. dichotoma	1							
Padina australis	1	1						
P. boergesenii								
P. minor	1	1						
Sargassum oligocystum	1							1
S. paniculatum	1							1
S. polycystum	1							
S. microcystum	1							
S. tenerrimum		1						

Red algae								
Acanthophora muscoides		1						
A. spicifera	1							
Polysiphonia coacta		1						
Amphiroa fragilissima	1	1						
Jania adhaerens	1							
Pterocladiella caloglossoides	1	1						
Chondrus crispus	1							
Hypnea cervicornis		1			1			
H. spinella		1						
Gracilaria arcuata	1	1				1		
G. blodgetti	1	1						
G. bursa-pastoris	1	1						
Crassiphycus changii		1						
G. coronopifolia	1	1				1		
G. salicornia	1	1						
Galaxaura rugosa	1							
Ceratodictyon intricatum	1	1			1			

Supplementary materials

Suppl. material 1: Percent cover and frequency of macroalgae along the eastern coast of Johor

Authors: Zainee, N.F.A. and Rozaimi, M.
Data type: abundance
Brief description: Percent cover and frequency of macroalgae along the eastern coast of Johor were recorded from January 2015 to February 2016. The sub-ranges from 1-25 m refer to the points along the transect line (%C: percentage of cover; %F : percentage of frequency; NF: species not found along the replicate lines). This Table presents the spatial and temporal abundance of macroalgae from four different localities in the east coast of Johor, Malaysia. Percentage of cover and frequency of every species were recorded along the 25 m line transect which is grouped into 5 m intervals.
Download file (18.82 kb)

Suppl. material 2: Raw data of cover and frequency of macroalgae recorded at Pantai Pasir Lanun

Authors: Zainee, N.F.A. and Rozaimi, M.
Data type: raw data - abundance
Brief description: Raw data of cover and frequency of macroalgae recorded at Pantai Pasir Lanun from January 2015 to February 2016 (TL1-TL9: transect numbers 1 to 9; NF: species not found along the replicate lines). This Table presents raw data of recorded species using five categories of multiplier, along the 25 m line transect and nine replications of transect line.
Download file (24.67 kb)

Suppl. material 3: Raw data of cover and frequency of macroalgae recorded at Pulau Mawar

Authors: Zainee, N.F.A. and Rozaimi, M.
Data type: raw data - abundance
Brief description: Raw data of cover and frequency of macroalgae recorded at Pulau Mawar from January 2015 to February 2016 (TL1-TL9: transect number 1 to 9; NF: species not found along the replicate lines). This Table presents raw data of every species using five categories of multiplier, along the 25 m line transect and nine replications of transect line.
Download file (24.93 kb)

Suppl. material 4: Raw data of cover and frequency of macroalgae recorded at Telok Gorek

Authors: Zainee, N.F.A. and Rozaimi, M.
Data type: raw data - abundance
Brief description: Raw data of cover and frequency of macroalgae recorded at Telok Gorek from January 2015 to February 2016 (TL1-TL9: transect number 1 to 9; NF: species not found along the replicate lines). This Table presents raw data of every species using five categories of multiplier, along the 25 m line transect and nine replications of transect line.
Download file (35.58 kb)

Suppl. material 5: Raw data of cover and frequency of macroalgae recorded at Tanjung Lompat

Authors: Zainee, N.F.A. and Rozaimi, M.
Data type: raw data - abundance
Brief description: Raw data of cover and frequency of macroalgae recorded at Tanjung Lompat from January 2015 to February 2016 (TL1-TL9: transect number 1 to 9; NF: species not found along the replicate lines). This Table presents raw data of every species using five categories of multiplier, along the 25 m line transect and nine replications of transect line.
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Suppl. material 6: The 5 categories of multiplier used by Saito and Atobe (1970)

Authors: Zainee, N.F.A. and Rozaimi, M.
Data type: calculation for percent cover and frequency
Brief description: The 5 categories of multiplier used by Saito and Atobe (1970) to represent surface area covered by macroalgal species on a small sub-quadrat. This Table illustrates the calculation of the percentage of cover and frequency of macroalgae.
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Suppl. material 7: Taxonomic literature of marine macroalgae found in the eastern coast of Johor, Malaysia

Authors: Zainee, N.F.A. and Rozaimi, M.
Data type: taxonomic literature
Brief description: This Table presents the taxonomy hierarchy of every macroalgae species found in the east coast of Johor, Malaysia.
Download file (6.71 kb)