Supplementary Materials

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An interactive atlas for marine biodiversity conservation in the Coral Triangle

1. Documentation file

This documentation file of the Coral Triangle Atlas provides information on the map objectives, datasets, dataset sources, classifications, and original citations of the data sources. This file can be accessed from: *https://sites.google.com/view/coral-triangle-digital-map.*

1.1. Coral Triangle – General Information

The "*Interactive Atlas of the Coral Triangle"* consists of three sets of web-mapping applications: (1). Biodiversity Features, (2) Areas of Importance for Biodiversity Conservation, (3) Marine Protected Area (MPA) Network Expansion.

The first atlas, Biodiversity Features, provided comprehensive data on the region's marine protected areas and biodiversity features including biogenic habitat, habitat rugosity, species richness, distribution of threatened and endemic species, and areas important for sea turtles. This tool also provided datasets of threats to the marine environment (anthropogenic and climate change induced pressure), and of environmental characteristics of the region including physical and biochemical oceanography.

The second atlas, Areas of Importance for Biodiversity Conservation, comprised of two layers: (1) regional biodiversity hotspots, and (2) Sites of biodiversity importance. Each layer was developed based on the multi-criteria analysis of five ecological criteria, namely sensitive habitat, species richness, the presence of species of conservation concern, the occurrence of restricted-range species, and areas of importance for particular life history stages of species.

The third atlas, Marine Protected Area (MPA) Network Expansion, consisted of two datasets: (1) Regional priority areas, and (2) National priority areas. The map was developed using conservation prioritization tools based on seven different sets of biodiversity features (biogenic habitat, habitat rugosity, species richness, distribution of threatened and endemic species, areas important for sea turtle), two types of threat (anthropogenic and climate change induced pressure) and the coverage of the existing MPA network.

The atlas of the Coral Triangle presents representative information to support a better understanding of important areas for biodiversity conservation and the application of marine biodiversity informatics to aid conservation prioritization.

1.2. Atlas of the Biodiversity Features in the Coral Triangle

These maps provide comprehensive data on the region's marine protected areas and biodiversity features including biogenic habitat, habitat rugosity, species richness, distribution of threatened and endemic species, areas important for sea turtle. This tool also provides a dataset of threats to the marine environment (anthropogenic and climate change induced pressure), and of the environmental characteristics of the region including its physical and biochemical oceanography.

Please acknowledge and refer to the original sources and citations of each of the datasets (provided below).

This map, Biodiversity Features, comprises four types of data: (a) Distribution of existing Marine Protected Areas, (b) seven layers of biodiversity features, (d) two types of threat, and (e) 16 environmental variables.

The original citations of data sources

1. Allen, G.R.: Conservation hotspots of biodiversity and endemism for Indo-Pacific coral reef fishes, Aquat. Conserv., 18(5), 541-556, **2008**.
2. Allen, G.R., & Erdmann, M.V.: Reef fishes of the East Indies. Mobile Application Software, Version 1.1 (Rev.10.2016). https://geo.itunes.apple.com/us/app/reef-fishes-east-indies-vol./id705188551?mt=8 (9)., accessed 15/06/2016, **2013**.
3. Asaad, I., Lundquist, C.J., Erdmann, M.V., & Costello, M.J.: Delineating priority areas for marine biodiversity conservation in the Coral Triangle, Biol. Cons., 222, 198-211, doi: //dx.doi.org/10.1016/j.biocon.2018.03.037, **2018a**.
4. Asaad, I., Lundquist, C.J., Erdmann, M.V., Van Hooidonk, R., & Costello, M.J.: Designating spatial priorities for marine biodiversity conservation in the Coral Triangle, Front Mar.Sci., (Submitted), **2018b**.
5. Basher, Z., Bowden, D.A., and Costello, M.J.: Global Marine Environment Datasets (GMED)-World Wide Web electronic publication, Ver. 1.0 (Rev.01.2014), http://gmed.auckland.ac.nz., accessed 01/06/2016, **2014.**
6. Cros, A., Fatan, N.A., White, A., Teoh, S.J., Tan, S., Handayani, C., Huang, C., Peterson, N., Li, R.V., Siry, H.Y., Fitriana, R., Gove, J., Acoba, T., Knight, M., Acosta, R., Andrew, N., & Beare, D.: The Coral Triangle Atlas; An Integrated Online Spatial Database System for Improving Coral Reef Management, Plos One, 9(6), doi: 10.1371/journal.pone.0096332, http://ctatlas.reefbase.org/, **2014**.
7. Froese, R., & Pauly, D.: FishBase, World Wide Web electronic publication. Ver. (06/2016). www.fishbase.org., accessed 01/06/2016, **2016**.
8. Giri, C., Ochieng, E., Tieszen, L., Zhu, Z., Singh, A., Loveland, T., Masek, J., & Duke, N.: Status and distribution of mangrove forests of the world using earth observation satellite data, Glob. Ecol. Biogeogr., 20(1), 154-159, **2011a.**
9. Giri, C., Ochieng, E., Tieszen, L., Zhu, Z., Singh, A., Loveland, T., Masek, J., & Duke, N.: Global distribution of mangroves forests of the world using earth observation satellite data, In Supplement to: Giri et al. (2011a), UNEP World Conservation Monitoring Centre, Cambridge – UK, http://data.unep-wcmc.org/datasets/4, **2011b**.
10. Halpern, B. S., Walbridge, S., Selkoe, K. A., Kappel, C. V., Micheli, F., D'Agrosa, C., Bruno, J. F., Casey, K. S., Ebert, C., Fox, H. E., Fujita, R., Heinemann, D., Lenihan, H. S., Madin, E. M. P., Perry, M. T., Selig, E. R., Spalding, M., Steneck, R., & Watson, R.: A global map of human impact on marine ecosystems, Science, 319(5865), 948-952, doi: 10.1126/science.1149345, **2008.**
11. Halpern, B. S., Frazier, M., Potapenko, J., Casey, K. S., Koenig, K., Longo, C., Lowndes, J. S., Rockwood, R. C., Selig, E. R., & Selkoe, K. A.: Spatial and temporal changes in cumulative human impacts on the world's ocean, *Nat.* Commun., 6, **2015a**Halpern, B. Frazier, M., Potapenko, J., Casey, K.S., Koenig, K., Longo, C., Lowndes, J.S., Rockwood, R.C., Selig, E.R., & Selkoe, K.A.: Cumulative human impacts: raw stressor data (2008 and 2013), https://knb.ecoinformatics.org/, doi:10.5063/F1S180FS, accessed 01/06/2016, **2015b.**
12. IUCN, & UNEP-WCMC.: The World Database on Protected Areas (WDPA). UNEP - World Conservation Monitoring Centre, www.protectedplanet.net, Cambridge – UK, assessed 01/08/2016, **2016**.
13. Kaschner, K., Rius-Barile, J., Kesner-Reyes, K., Garilao, C., Kullander, S.O., Rees, T., &; Froese, R.: AquaMaps; Predicted range maps for aquatic species, World Wide Web electronic publication, www.aquamaps.org., Version 08/2016, accessed 01/08/2016, **2016**.

14. MoF-MoMAF.: Data of the Ecological representation gap analysis for conservation areas in Indonesia, Ministry of Forestry and Ministry of Marine Affairs and Fisheries, Jakarta-Indonesia, **2010.**
15. MoMAF.: The database of Marine Protected Areas in Indonesia, Ministry of Marine Affairs and Fisheries, Jakarta – Indonesia, **2016**.
16. OBIS.: Data from the Ocean Biogeographic Information System, Intergovernmental Oceanographic Commission of UNESCO, http://www.iobis.org/., accessed 22/01/2015, **2015**.
17. UNEP-WCMC, Short FT.: Global distribution of seagrasses (version 3.0). Third update to the data layer used in Green and Short (2003).URL: http://data.unep-wcmc.org/datasets/7. UNEP World Conservation Monitoring Centre, Cambridge – UK, **2005.**
18. UNEP-WCMC, WorldFish Centre, WRI, TNC. Global distribution of coral reefs, compiled from multiple sources including the Millennium Coral Reef Mapping Project. Version 1.3, updated by UNEP-WCMC. Includes contributions from IMaRS USF and IRD (2005), IMaRS-USF (2005) and Spalding *et al.* (2001). URL: http://data.unep-wcmc.org/datasets/1, UNEP World Conservation Monitoring Centre, Cambridge – UK, **2010.**
19. Van Hooidonk, R., Maynard, J., Tamelander, J., Gove, J., Ahmadia, G., Raymundo, L., Williams, G., Heron, S. F., & Planes, S.: Local-scale projections of coral reef futures and implications of the Paris Agreement. Sci. Rep., 6, 39666, **2016**.
20. VLIZ.: Maritime Boundaries Geodatabase, http://www.marineregions.org, Version 8, accessed 22/03/2016, **2014**.
21. Wright, D., Pendleton, M., Boulware, J., Walbridge, S., Gerlt, B., Eslinger, D., Sampson, D., & Huntley, E.: ArcGIS Benthic Terrain Modeler (BTM), V. 3.0, Environmental Systems Research Institute (ESRI), NOAA Coastal Services Centre, Massachusetts Office of Coastal Zone Management, Redlands – CA, **2012**.

1.3. Atlas of the Areas of Biodiversity Importance in the Coral Triangle

The digital map of areas of biodiversity importance in the Coral Triangle is comprised of: (1) Regional biodiversity hotspots, (2) Sites of biodiversity importance.

This dataset is comprised of two layers of areas of biodiversity importance. Each layer was developed based on a multi-criteria analysis of five ecological criteria: (1) fragile and sensitive habitat (the coverage of biogenic habitats: coral reefs, seagrass and mangrove); (2) species richness (modeled geographic distributions of 10,672 species ranges and occurrence records of 19,251 species); (3) the presence of species of conservation concern (distributions of 834 species of special conservation concern); (4) the occurrence of restricted-range species (distributions of 373 restricted-range reef fish species); and (6) areas of importance for particular life history stages (distribution of six species of sea turtle).

The datasets were clipped to the CT region using a grid approach of half-degree cells (0.5°), where each cell covered an area of ~ 55 x 55 km. All of the datasets obtained from each criterion were superimposed to produce an integrated dataset. The areas of biodiversity importance were analyzed based on the biodiversity score of each cell. The score of each criterion was calculated based on the total number of habitat, species or species index that fell within each cell.

The map comprises:

a) The regional biodiversity hotspots analyzed using ESRI's hotspots analysis tools ESRI ArcGIS (ESRI, 2016b; Getis & Ord, 1992; Ord & Getis, 1995). The statistically significant Z scores (GI* statistics) were analyzed by comparing the local sum of a cell's score and its neighbors proportionally to the sum of all cells' scores. The hotspots analysis clustered the area into three classes of hotspots (99%, 95% and, 90% confidence level), and one class of non-statistically significant clusters.

b) The sites of biodiversity importance that identified areas of biodiversity importance by analyzing the biodiversity score of each cell. The higher the score, the higher their biodiversity importance. The cells were ranked into five equal interval classes, from high to low biodiversity importance.

1.4. Atlas of the Priority Areas for MPA Network Expansion

The digital map of priority areas for marine protected area (MPA) network expansion in the Coral Triangle region is comprised of: (1) Regional priority areas, (2) National priority areas.

Spatial distributions of priority areas for marine protected area network expansion are illustrated for the Coral Triangle. These datasets were developed using the conservation prioritization tool of *Zonation*, by analyzing the proportions of the CT region's area that is within the existing CT MPA network and then prioritizing areas for MPA network expansion (*e.g.,* expansion of the MPA network from existing coverage to 10%, 20% and 30 % of the Economic Exclusive Zone (EEZ) area).

These datasets comprise two sets of maps: (1) Regional priority areas (performed for the full CT EEZ region) and (2) National priority areas (performed individually on each of the CT country national EEZs).

All analyses were performed using sets of raster grids, with a spatial resolution of 500 m. The prioritization analyses were based on seven different sets of biodiversity features: biogenic habitat, habitat rugosity, species richness, distribution of threatened and endemic species, areas important for sea turtles, two types of threat (anthropogenic and climate change induced pressure), and the coverage of the existing MPA network.

2. Metadata of the Atlas of biodiversity conservation in the Coral Triangle

Biogenic Habitat	
Description	This map presents a spatial distribution of three biogenic habitat (coral reef, seagrass and mangrove) and shows the habitat richness at each cell.
Temporal range	Follow the native sources: Coral reefs: 1954-2009 Mangrove forest: 1997-2000 Seagrass meadows: 1934-2011
Geographical range	Coral Triangle of the Indo Pacific Realm
Citations	Asaad, I., Lundquist, C. J., Erdmann, M. V., & Costello, M. J. (2018). Delineating priority areas for marine biodiversity conservation in the Coral Triangle. *Biological Conservation, 222*, 198-211. doi: dx.doi.org/10.1016/j.biocon.2018.03.037
Original datasets / citations	UNEP-WCMC, WorldFish Centre, WRI, TNC (2010). Global distribution of coral reefs, compiled from multiple sources including the Millennium Coral Reef Mapping Project. Version 1.3, updated by UNEP-WCMC. Includes contributions from IMaRS USF and IRD (2005), IMaRS-USF (2005) and Spalding *et al.* (2001). Cambridge (UK): UNEP World Conservation Monitoring Centre. URL: http://data.unep-wcmc.org/datasets/1. UNEP-WCMC, Short FT (2005). Global distribution of seagrasses (version 3.0). Third update to the data layer used in Green and Short (2003). Cambridge (UK): UNEP World Conservation Monitoring Centre. URL: http://data.unep-wcmc.org/datasets/7.

	Giri, C., Ochieng, E., Tieszen, L., Zhu, Z., Singh, A., Loveland, T., Masek, J., & Duke, N. (2011). Status and distribution of mangrove forests of the world using earth observation satellite data. *Global Ecology and Biogeography, 20*(1), 154-159. Giri, C., Ochieng, E., Tieszen, L., Zhu, Z., Singh, A., Loveland, T., Masek, J., & Duke, N. (2011). Global distribution of mangroves forests of the world using earth observation satellite data. In Supplement to: Giri et al. (2011b). from UNEP World Conservation Monitoring Centre http://data.unep-wcmc.org/datasets/4
Purpose of creation	To identify areas of biodiversity importance within the Coral Triangle based on habitat richness.
Creation methodology	All datasets were clipped to the Coral Triangle region using a grid approach of 5 km^2 cells. Using this approach, the datasets were presented and mapped into a regular shape of a grid square. Thus, those three datasets were superimposed and overlaid to generate a single dataset. Further, the dataset was classified and scored based on the total number of habitats that fell within each cell. Cell values ranged from 1 – 3. The methodology is fully described at Asaad *et al.* (2018 a).
Version	Ver. 1 (July 2018)
Keywords:	Coral Triangle, biodiversity importance, biodiversity feature, biogenic habitat.
Category	Biodiversity Features
Limitations:	The biogenic habitat distribution map was created from coral reefs, seagrass, and mangroves. It thus excludes deep-sea and other coastal habitats. However, benthic rugosity may indicate the distribution of rocky, sediment and deep-water coral. A detailed habitat maps and a defined list of habitat types are needed to develop a comprehensive biodiversity conservation programme.
Main access/use constraint:	Creative Commons Attribution 4.0 (CC BY 4.0)
Contact Organization	Institute of Marine Science, University of Auckland.
Name	Irawan Asaad
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email	i.asaad@auckland.ac.nz ; irawan.asaad@gmail.com
Data format	Geodatabase (Grid square cells; polygon)
Distribution format	GeoJSON
Dataset size	0.65 MB
Webpage	*www.marine.auckland.ac.nz/CT_Biodiversity*
Otherweb page	https://uoa.maps.arcgis.com/apps/webappviewer/index.html?id=1406b9131245493195c12a1df3d2ada6
Resolution / scale	5 km^2
Reference System	WGS 84
North bounding	22.0
South bounding	-16.0
West bounding	90.0
East bounding	175.0
Date of metadata	10th July 2018

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Species Richness Ranges	
Description	This map shows the potential species richness based on the modelled geographic species ranges extracted from 10,672 species ranges that were retrieved from AquaMaps database (www.aquampas.org). The richness was calculated based on the total number of species ranges that fell within the cell.
Temporal range	The species ranges were modelled based on publicly available location data in OBIS and FishBase largely reported over the past century.

Geographical range	Coral Triangle of the Indo Pacific Realm
Citations	Asaad, I., Lundquist, C. J., Erdmann, M. V., & Costello, M. J. (2018). Delineating priority areas for marine biodiversity conservation in the Coral Triangle. *Biological Conservation, 222*, 198-211. doi: dx.doi.org/10.1016/j.biocon.2018.03.037
Original datasets / citations	Kaschner, K., Rius-Barile, J., Kesner-Reyes, K., Garilao, C., Kullander, S.O., Rees, T., Froese, R. (2016). AquaMaps: Predicted Range Maps for Aquatic Species. Worldwide Web Electronic Publication. www.aquamaps.org (Version 08/2016).
Purpose of creation	To identify areas of biodiversity importance within the Coral Triangle based on species richness.
Creation methodology	To assess the criterion of species richness, modelled geographic species ranges were extracted from AquaMaps (Kaschner *et al*., 2016). AquaMaps generates a prediction of relative probabilities of species range at a resolution of half-degree cells. Each cell contains a probability value ranging from 0 and 1, representing the relative suitability of that cell for the specified species. Species were considered present when a cell's P > 0.5. The richness was based on the number of predicted species in each cell. Within the study area, the number of species per 0.5° cells ranged from 11 to 5509. Thus, the cells were classified into 10 equal interval classes based on the total number of species that fell within each cell, i.e., class 1 (11–550 species); class 2 (>550 – 1.100) to class 10 (>4950 – 5509 species). The methodology and list of species used are fully described at Asaad et al. (2018a).
Version	Ver. 1 (July 2018)
Keywords:	Coral Triangle, biodiversity importance, biodiversity feature, species richness.
Category	Biodiversity Features
Limitations:	The spatial resolution of the map is 50 km^2. The predicted extent is based on species occurrence record and environmental distribution modelling. As a modelling approach, the reported distribution merits confirmation from field observations. In addition, the data are limited to common species because rare species lack sufficient locations for environmental niche modelling.
Main access/use constraint:	Creative Commons Attribution 4.0 (CC BY 4.0)
Contact Organization	Institute of Marine Science, University of Auckland
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Data format	Geodatabase (Grid square cells; polygon)
Distribution format	GeoJSON
Dataset size	1.98 MB
Webpage	*www.marine.auckland.ac.nz/CT_Biodiversity*
Otherweb page	https://uoa.maps.arcgis.com/apps/webappviewer/index.html?id=1406b9131245493195c12a1df3d2ada6
Resolution / scale	50 km^2
Reference System	WGS 84
North bounding	22.0
South bounding	-16.0
West bounding	90.0
East bounding	175.0
Date of metadata	10th July 2018

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Species Richness- Occurrence	
Description	This map presents the potential species richness based on the occurrence records of 19,251 species retrieved from datasets in OBIS (www.iobis.org). The richness was analysed based on the Hulbert's index of expected species richness of ES50 (estimated species in random 50 samples).

Temporal range	The species occurrence records were based on publicly available location data in OBIS and reported over the past century.
Geographical range	Coral Triangle of the Indo Pacific Realm
Citations	Asaad, I., Lundquist, C. J., Erdmann, M. V., & Costello, M. J. (2018). Delineating priority areas for marine biodiversity conservation in the Coral Triangle. *Biological Conservation, 222*, 198-211. doi: dx.doi.org/10.1016/j.biocon.2018.03.037
Original datasets / citations	OBIS (2015). Data from the Ocean Biogeographic Information System. Intergovernmental Oceanographic Commission of UNESCO. Retrieved 02/05/2015. http://www.iobis.org
Purpose of creation	To identify areas of biodiversity importance within the Coral Triangle based on species richness.
Creation methodology	To assess species richness, the occurrence records of 19,251 species were retrieved from datasets in OBIS (www.iobis.org). The richness was analysed based on the Hulbert's index of expected species richness of ES50 (estimated species in random 50 samples) using 0.5*0.5° cells. Within the study area, the species index ranged from 0 – 50. Thus, the cells were classified into 10 equal interval classes, i.e., class 1 (ES50 1–5); class 2 (6−10); to class 10 (46–50). The methodology and list of datasets used are fully described at Asaad *et al.* (2018a).
Version	Ver. 1 (July 2018)
Keywords:	Coral Triangle, biodiversity importance, biodiversity feature, species richness.
Category	Biodiversity Features
Limitations:	The occurrence records are mostly available for a wide-ranging species, and thus prone to omission errors (false absences).
Main access/use constraint:	Creative Commons Attribution 4.0 (CC BY 4.0)
Contact Organization	Institute of Marine Science, University of Auckland
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Data format	Geodatabase (Grid square cells; polygon)
Distribution format	GeoJSON
Dataset size	0.06 MB
Webpage	*www.marine.auckland.ac.nz/CT_Biodiversity*
Otherweb page	https://uoa.maps.arcgis.com/apps/webappviewer/index.html?id=1406b9131245493195c12a1df3d2ada6
Resolution / scale	50 km^2
Reference System	WGS 1984
North bounding	22.0
South bounding	-16.0
West bounding	90.0
East bounding	175.0
Date of metadata	10th July 2018

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Species of Conservation Concern	
Description	This map shows the distribution of species of conservation concern based on the occurrence records of 834 species (bony fish, anthozoans, elasmobranchs, mammals, and molluscs) retrieved from OBIS datasets (www.iobis.org). The richness was analysed based on the Hulbert's index of expected species richness of ES35 (estimated species in random 35 samples).
Temporal range	The species occurrence records were based on publicly available location data in OBIS and Fishbase and reported over the past century.
Geographical range	Coral Triangle of the Indo Pacific Realm

Citations	Asaad, I., Lundquist, C. J., Erdmann, M. V., & Costello, M. J. (2018). Delineating priority areas for marine biodiversity conservation in the Coral Triangle. *Biological Conservation, 222*, 198-211. doi: dx.doi.org/10.1016/j.biocon.2018.03.037
Original datasets / citations	OBIS (2015). Data from the Ocean Biogeographic Information System. Intergovernmental Oceanographic Commission of UNESCO. Retrieved 02/05/2015. http://www.iobis.org Froese, R., Pauly, D. (2016). FishBase. World Wide Web Electronic Publication. Retrieved version (06/2016). www.fishbase.org.
Purpose of creation	To identify areas of biodiversity importance within the Coral Triangle based on the distribution of species of conservation concern.
Creation methodology	The distribution of species of conservation concern were evaluated based on species occurrence records of five classes on each 0.5^0 cell. The occurrence records were extracted from OBIS (www.iobis.org) and FishBase (www.fishbase.org). A species was included as species of conservation concern following the IUCN Red List categories (IUCN, 2015), CITES (UNEP-WCMC, 2015) and national directives of the Coral Triangle countries (Indonesia, Malaysia and The Philippines). A species was assigned as a species of conservation concern if it was categorized as either (1) Critically Endangered (CR), Endangered (EN) or Vulnerable (VU) according to the IUCN Red List of Threatened Species, or (2) listed in Appendix 1 or Appendix 2 of CITES as species that need a greater level of protection from over-harvesting, or (3) classified as threatened or protected based on national regulations A Hulbert index with ES35 (estimated species in random 35 samples) was used to identify cells with the highest richness of species of conservation concern. The cells were classified into 10 equal interval classes, i.e., class 1 (ES35 1–4); class 2 (>4 – 7) to class 10 (.> 28–35). The methodology and list of species are fully described at Asaad *et al* (2018a).
Version	Ver.1 (July 2018)
Keywords:	Coral Triangle, biodiversity importance, biodiversity feature, biogenic habitat, species of conservation concern
Category	Biodiversity Features
Limitations:	The dataset covers only selected taxa to represent a diversity of threatened taxa. Thus, not all of the threatened species that may exist within the region were listed in the maps.
Main access/use constraint:	Creative Commons Attribution 4.0 (CC BY 4.0)
Contact Organization	Institute of Marine Science, University of Auckland
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Data format	Geodatabase (Grid square cells; polygon)
Distribution format	GeoJSON
Dataset size	0.18 MB
Webpage	*www.marine.auckland.ac.nz/CT_Biodiversity*
Otherweb page	https://uoa.maps.arcgis.com/apps/webappviewer/index.html?id=1406b9131245493195c12a1df3d2ada6
Resolution / scale	50 km^2
Reference System	WGS 84
North bounding	22.0
South bounding	-16.0
West bounding	90.0
East bounding	175.0
Date of metadata	10th July 2018

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Species of Restricted-range (Endemic species)	
Description	This map shows the distribution of restricted range species, based on the ranges of 373 reef fishes that are known to be endemic to the Coral Triangle. The data was extracted from a dataset of nearly 4000 species of Indo-Pacific reef fishes (Allen and Erdmann, 2013).
Temporal range	Distribution data were gathered by the author (Allen and Erdmann) from a variety of sources including personal observations throughout the Indo-Pacific over the past four decades, literature, monographs, collections and collaboration of numerous colleagues and museums.
Geographical range	Coral Triangle of the Indo Pacific Realm
Citations	Asaad, I., Lundquist, C. J., Erdmann, M. V., & Costello, M. J. (2018). Delineating priority areas for marine biodiversity conservation in the Coral Triangle. *Biological Conservation, 222*, 198-211. doi: dx.doi.org/10.1016/j.biocon.2018.03.037
Original datasets / citations	Allen, G.R., Erdmann, M.V., 2013. Reef Fishes of the East Indies. Mobile Application Software. Version 1.1 (Rev.10.2016). Retrieved 15/06/2016. https://geo.itunes.apple.com/us/app/reef-fishes-east-indies-vol./id705188551?mt=8.
Purpose of creation	To identify areas of biodiversity importance within the Coral Triangle based on the distribution of restricted range reef fishes species.
Creation methodology	The distribution of restricted-range species was assessed using the distributions of 373 reef fishes (comprising 150 genera and 47 families) that are each endemic to the Coral Triangle region. The ranges of reef fishes species were assigned to 5 km grid cells. The richness was calculated based on the total number of restricted range reef fishes that fell within each cell. The value ranged from 0 to 101 species. Thus, the cells were classified based on an equal interval into 10 classes (i.e.: class 1 (1–10 species); class 2 (10–20 species) to class 10 (100 – 101 species)). The methodology and list of species are fully described at Asaad *et al.* (2018a).
Version	Ver.1 (July 2018)
Keywords:	Coral Triangle, biodiversity importance, biodiversity feature, species restricted range, endemic spcies
Category	Biodiversity Features
Limitations:	This dataset uses predefined descriptions: ▪ Restricted-range is defined as a reef fish species with a spatial distribution of<5 million km^2 and whose known range is only within the Coral Triangle. ▪ Reef fishes is defined as fish species that live on shallow water coral reefs and associated substrata (i.e., sand or rubble patches, seagrass beds, etc.) <60m deep. Other datasets and references may apply different definitions and descriptions.
Main access/use constraint:	Data agreement
Contact Organization	Institute of Marine Science, University of Auckland
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Data format	Geodatabase (Grid cells; polygon)
Distribution format	GeoJSON
Dataset size	0.54 MB
Webpage	*www.marine.auckland.ac.nz/CT_Biodiversity*
Otherweb page	https://uoa.maps.arcgis.com/apps/webappviewer/index.html?id=1406b9131245493195c12a1df3d2ada6
Resolution / scale	5 km^2
Reference System	WGS 84
North bounding	22.0
South bounding	-16.0
West bounding	90.0
East bounding	175.0

Date of metadata	10th July 2018

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Areas important for Sea Turtle	
Description	This is a map of nesting sites and migratory routes of six species of sea turtle and shows the richness at each cell. The richness was calculated based on the total number of species that fell within the cell.
Temporal range	The sea turtle occurrence records were based on publicly available location data in OBIS and MoF-MOMAF datasets and reported over the past century.
Geographical range	Coral Triangle of the Indo Pacific Realm
Citations	Asaad, I., Lundquist, C. J., Erdmann, M. V., & Costello, M. J. (2018). Delineating priority areas for marine biodiversity conservation in the Coral Triangle. *Biological Conservation, 222*, 198-211. doi: dx.doi.org/10.1016/j.biocon.2018.03.037
Original datasets / citations	OBIS (2015). Data from the Ocean Biogeographic Information System. Intergovernmental Oceanographic Commission of UNESCO. Retrieved 02/05/2015. http://www.iobis.org MoF-MoMAF, 2010. Ecological Representation Gap Analysis for Conservation Areas in Indonesia. Ministry of Forestry and Ministry of Marine Affairs and Fisheries, Jakarta- Indonesia.
Purpose of creation	To identify areas of biodiversity importance within the Coral Triangle based on the criterion of areas importance for a life history stages of species.
Creation methodology	Sea turtle nesting habitat and migratory routes were used as indicators of important areas for sea turtles. Six sea turtle species inhabit the Coral Triangle: green, leatherback, loggerhead, hawksbill, olive Ridley and flatback turtles. A total of 2055 point occurrence records of sea turtles were retrieved from OBIS (www.iobis.org) and Indonesian sea turtle datasets (MoF-MoMAF, 2010). The occurrence points were transformed into grid cells of 5 km. Thus, the richness was calculated based on the total number of species that fell within each cell. The value of each cell ranged from 0 to 3 species. No cells had more than three species of turtle present. The methodology and datasets are fully described at Asaad *et al* (2018a).
Version	Ver.1 (July 2018)
Keywords:	Coral Triangle, biodiversity importance, biodiversity feature, species restricted range, endemic species
Category	Biodiversity Features
Limitations:	This dataset uses a point location for sea turtle nesting area and migratory route. Without an exact boundary of nesting beaches or the migratory perimeter thus this dataset prone to an omission errors.
Main access/use constraint:	Creative Commons Attribution 4.0 (CC BY 4.0)
Contact Organization	Institute of Marine Science, University of Auckland
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email	i.asaad@auckland.ac.nz; irawan.asaad@gmail.com
Data format	Geodatabase (Grid square cells; polygon)
Distribution format	GeoJSON
Dataset size	0.17 MB
Webpage	*www.marine.auckland.ac.nz/CT_Biodiversity*
Otherweb page	https://uoa.maps.arcgis.com/apps/webappviewer/index.html?id=1406b9131245493195c12a1df3d2ada6
Resolution / scale	5 km^2
Reference System	WGS 84
North bounding	22.0
South bounding	-16.0
West bounding	90.0

East bounding	175.0
Date of metadata	10th July 2018

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Environmental Variables	
Description	This map shows spatial distribution of environmental variables (physical, biochemical and nutrients). This is a composite of point futures of 16 environmental variables, i.e., depth, slope, land distance, temperature, surface current, salinity, wind speed, tide, primary productivity, photosynthetically active radiation (PAR), chlorophyll-a, pH, dissolved oxygen, nitrate, silicate, and calcite. The environmental variables datasets were retrieved from Global Marine Environment Dataset (GMED) (gmed.auckland.ac.nz).
Temporal range	GMED collated environmental variables from variety publicly available datasets with different temporal range ((Depth, slope, land distance, tide, primary productivity (unknown)); Temperature (2002 – 2009); surface current (2009-2010); salinity (1961-2009); wind speed (1945-1989), , photosynthetically active radiation (PAR) (1997-2009), chlorophyll-a (2002 – 2009), pH (1910-2007), dissolved oxygen (1898 – 2009), nitrate (1922 – 1986), silicate (1930 – 1986), and calcite (2002 – 2009)).
Geographical range	Coral Triangle of the Indo Pacific Realm
Citations	Asaad, I., Lundquist, C. J., Erdmann, M. V., & Costello, M. J. (2018). Delineating priority areas for marine biodiversity conservation in the Coral Triangle. *Biological Conservation, 222*, 198-211. doi: dx.doi.org/10.1016/j.biocon.2018.03.037
Original datasets / citations	Basher, Z., Bowden, D.A., Costello, M.J., 2014. Global Marine Environment Datasets (GMED)-World Wide Web electronic publication. Version 1.0 (Rev.01.2014). Retrieved 15/01/2016. http://gmed.auckland.ac.nz.
Purpose of creation	To describe environmental characteristics of the Coral Triangle
Creation methodology	16 Environmental variables were extracted from the Global Marine Environment Datasets (GMED). Thus, the data were transformed into a point dataset. A composite point dataset was generated to with a spatial resolution of 50 km. The methodology is fully described at Asaad *et al.* (2018a)
Version	Ver. 1 (July 2018)
Keywords:	Coral Triangle, biodiversity importance, biodiversity feature, environmental variables
Category	Biodiversity Features
Main access/use constraint:	Creative Commons Attribution 4.0 (CC BY 4.0)
Contact Organization	Institute of Marine Science, University of Auckland
Name	Irawan Asaad
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Data format	Geodatabase (point)
Distribution format	GeoJSON
Dataset size	3.59 MB
Webpage	*www.marine.auckland.ac.nz/CT_Biodiversity*
Otherweb page	https://uoa.maps.arcgis.com/apps/webappviewer/index.html?id=1406b9131245493195c12a1df3d2ada6
Resolution / scale	50 km^2
Reference System	WGS 84
North bounding	22.0
South bounding	-16.0
West bounding	90.0

East bounding	175.0
Date of metadata	10th July 2018

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Habitat Rugosity	
Description	This map presents a Vector Ruggedness Measure (VRM) of benthic terrain as a proxy of benthic habitat heterogeneity. The VRM index ranged from 0.1 (areas with low terrain variations to 0.9 (areas with high terrain variations).
Temporal range	Unknown
Geographical range	Coral Triangle of the Indo Pacific Realm
Citations	Asaad, I., Lundquist, C. J., Erdmann, M. V., Van Hooidonk, R., & Costello, M. J. (2018). Designating spatial priorities for marine biodiversity conservation in the Coral Triangle. *Frontiers in Marine Science, 5*, 400. doi: 10.3389/fmars.2018.00400
Original datasets / citations	Basher, Z., Bowden, D.A., & Costello, M.J. (2014). Global Marine Environment Datasets (GMED)- World Wide Web electronic publication. Version 1.0 (Rev.01.2014). Retrieved 01 June 2016 http://gmed.auckland.ac.nz Wright, D., Pendleton, M., Boulware, J., Walbridge, S., Gerlt, B., Eslinger, D., Sampson, D., & Huntley, E. (2012). ArcGIS Benthic Terrain Modeler (BTM), v. 3.0, Environmental Systems Research Institute (ESRI), NOAA Coastal Services Center, Massachusetts Office of Coastal Zone Management. Redland - CA.
Purpose of creation	To identify areas of biodiversity importance within the Coral Triangle based on the habitat heterogeneity.
Creation methodology	The dataset of a Vector Ruggedness Measure (VRM) of benthic terrain was analyzed to measure benthic terrain rugosity and topographic ruggedness as an indicator of benthic habitat heterogeneity. To quantify this index, bathymetry data were extracted from GMED (Global Marine Environment Datasets) (Basher *et al.*, 2014) and analyzed it using the Benthic Terrain Modeller (BTM) 3.0 of ArcGIS 10.5 (Wright *et al.*, 2012). The VRM index ranged from 0.1 to 0.9, and were classified into 10 equal interval classes. The methodology is fully described at Asaad *et al.* (2018b).
Version	Ver. 1 (July 2018)
Keywords:	Coral Triangle, biodiversity importance, biodiversity feature, habitat rugosity
Category	Biodiversity Features
Limitations:	This dataset used bathymetry and slope data to generate benthic terrain rugosity and topographic ruggedness as a proxy of habitat heterogeneity. However, bathymetry and slope are not the only drivers of habitat heterogeneity in several habitats such as soft sediment habitats.
Main access/use constraint:	Creative Commons Attribution 4.0 (CC BY 4.0)
Contact Organization	Institute of Marine Science, University of Auckland
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Data format	Geodatabase (Grid square cells; polygon)
Distribution format	GeoJSON
Dataset size	2.27 MB
Webpage	*www.marine.auckland.ac.nz/CT_Biodiversity*
Otherweb page	https://uoa.maps.arcgis.com/apps/webappviewer/index.html?id=1406b9131245493195c12a1df3d2ada6
Resolution / scale	50 km^2
Reference System	WGS 84

North bounding	22.0
South bounding	-16.0
West bounding	90.0
East bounding	175.0
Date of metadata	10th July 2018

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Anthropogenic Pressure	
Description	This map presents a spatial distribution of anthropogenic pressure to marine environments. This map was generated based on the cumulative impact of 19 different types of anthropogenic stressors developed by by Halpern *et al.* (2008;2015). The anthropogenic pressure value ranged from 0 – 15.4, indicating areas from low to high human-induced pressure.
Temporal range	2008 - 2013
Geographical range	Coral Triangle of the Indo Pacific Realm
Citations	Asaad, I., Lundquist, C. J., Erdmann, M. V., Van Hooidonk, R., & Costello, M. J. (2018). Designating spatial priorities for marine biodiversity conservation in the Coral Triangle. *Frontiers in Marine Science, 5*, 400. doi: 10.3389/fmars.2018.00400
Original datasets / citations	Halpern, B.S., Walbridge, S., Selkoe, K.A., Kappel, C.V., Micheli, F., D'Agrosa, C., Bruno, J.F., Casey, K.S., Ebert, C., Fox, H. E., Fujita, R., Heinemann, D., Lenihan, H.S., Madin, E.M.P., Perry, M.T., Selig, E.R., Spalding, M., Steneck, R., & Watson, R. (2008). A global map of human impact on marine ecosystems. *Science, 319*(5865), 948-952. DOI: 10.1126/science.1149345. Halpern, B.S., Frazier, M., Potapenko, J., Casey, K.S., Koenig, K., Longo, C., Lowndes, J.S., Rockwood, R.C., Sselig, E.R., & Selkoe, K.A. (2015a). Spatial and temporal changes in cumulative human impacts on the world's ocean. *Nature communications*, 6. Halpern, B. Frazier, M., Potapenko, J., Casey, K.S., Koenig, K., Longo, C., Lowndes, J.S., Rockwood, R.C., Selig, E.R., & Selkoe, K.A. (2015b). Cumulative human impacts: raw stressor data (2008 and 2013). Accessed 01/06/2016. https://knb.ecoinformatics.org/.
Purpose of creation	To identify the spatial distribution of anthropogenic pressure within the Coral Triangle.
Creation methodology	The spatial distribution of anthropogenic pressure to marine environments was retrieved from the database of cumulative human impacts on the world's oceans developed by Halpern *et al.* (Halpern *et al.*, 2008; Halpern *et al.*, 2015a; 2015b). This dataset was based on the cumulative impact of 19 different types of anthropogenic stressors: land-based drivers (nutrient inputs, organic and inorganic pollution, and population density), ocean-based drivers (commercial fishing, artisanal fishing, benthic structures, shipping lanes, invasive species, and pollution), and climate change (sea-level rise, sea-surface temperature anomalies, ultraviolet radiation and acidification). With spatial resolution of 5 km^2, the anthropogenic pressure value of each cell was ranged from 0 – 15.4. Thus, the cells were classified into 10 equal interval classes. The methodology is fully described at Asaad *et al.* (2018b)
Version	Ver.1 (July 2018)
Keywords:	Coral Triangle, biodiversity importance, biodiversity feature, habitat rugosity
Category	Biodiversity Features
Limitations:	This dataset developed based on the cumulative human impact at global scale. The dataset captured trends and variations of pressure at local scale, but has a limitation to identify local events (e.g. impact of dynamite and poisonous fishing).
Main access/use constraint:	Creative Commons Attribution 4.0 (CC BY 4.0)
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Data format	Geodatabase (Grid square cells; polygon)
Distribution format	GeoJSON
Dataset size	0.76 MB
Webpage	*www.marine.auckland.ac.nz/CT_Biodiversity*
Otherweb page	https://uoa.maps.arcgis.com/apps/webappviewer/index.html?id=1406b9131245493195c12a1df3d2ada6
Resolution / scale	5 km^2
Reference System	WGS 84
North bounding	22.0
South bounding	-16.0
West bounding	90.0
East bounding	175.0
Date of metadata	10th July 2018

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Climate change Pressure	
Description	This map presents a spatial distribution of sea surface thermal stress level. This map was generated based on the average of Degree Heating Weeks (DHW) datasets developed by Van Hooidonk *et al* (2016). The projected thermal stress index ranged from 5.6 – 20.2, indicating areas from low to high vulnerability to climate change.
Temporal range	2006 - 2099
Geographical range	Coral Triangle of the Indo Pacific Realm
Citations	Asaad, I., Lundquist, C. J., Erdmann, M. V., Van Hooidonk, R., & Costello, M. J. (2018). Designating spatial priorities for marine biodiversity conservation in the Coral Triangle. *Frontiers in Marine Science, 5*, 400. doi: 10.3389/fmars.2018.00400
Original datasets / citations	Van Hooidonk, R., Maynard, J., Tamelander, J., Gove, J., Ahmadia, G., Raymundo, L., Williams, G., Heron, S.F., & Planes, S. (2016). Local-scale projections of coral reef futures and implications of the Paris Agreement. *Scientific reports, 6*, 39666.
Purpose of creation	To identify the spatial distribution of sea surface thermal stress level pressure as an indicator of climate -induced stressor within the Coral Triangle.
Creation methodology	The dataset of the sea-surface thermal stress level was derived from Van Hooidonk *et al.* (2016). This dataset was based on the average of projected Degree Heating Weeks (DHW) (2006 to 2099) under RCP8.5 scenario. Degree heating weeks (DHW) is a measurement to assess patterns of sea surface temperature (SST) variability by combining the intensity and duration of thermal stress in order to predict coral bleaching (Liu *et al.*, 2003). With spatial resolution of 5 km^2, the thermal stress value of each cell was ranged from 5.6 – 20.2. Thus, the cells were classified into 10 equal interval classes. The methodology is fully described at Asaad *et al.* (2018b).
Version	Ver. 1 (July 2018)
Keywords:	Coral Triangle, biodiversity importance, biodiversity feature, climate-induced pressure
Category	Biodiversity Features
Limitations:	
Main access/use constraint:	Data agreement / author contributions
Contact Organization	Institute of Marine Science, University of Auckland
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Data format	Geodatabase (Grid cells; polygon)
Distribution format	GeoJSON
Dataset size	1.02 MB
Webpage	*www.marine.auckland.ac.nz/CT_Biodiversity*
Otherweb page	http://uoa.maps.arcgis.com/apps/webappviewer/index.html?id=1406b9131245493195c12a1df3d2ada6
Resolution / scale	5 km^2
Reference System	WGS 84
North bounding	22.0
South bounding	-16.0
West bounding	90.0
East bounding	175.0
Date of metadata	10th July 2018

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Regional biodiversity hotspots	
Description	This map presents clusters of areas of biodiversity importance within the Coral Triangle. Retrieved from datasets of areas of biodiversity importance developed by Asaad *et al*., (2018a). The regional biodiversity hotspots were classified into 3 classes of biodiversity hotspots (high, medium and low) and 1 class not significant.
Temporal range	No temporal range available. The map is a result of spatial analysis developed from various datasets.
Geographical range	Coral Triangle of the Indo Pacific Realm
Citations	Asaad, I., Lundquist, C. J., Erdmann, M. V., & Costello, M. J. (2018). Delineating priority areas for marine biodiversity conservation in the Coral Triangle. *Biological Conservation, 222*, 198-211. doi: dx.doi.org/10.1016/j.biocon.2018.03.037
Original datasets / citations	Asaad, I., Lundquist, C. J., Erdmann, M. V., & Costello, M. J. (2018). Delineating priority areas for marine biodiversity conservation in the Coral Triangle. *Biological Conservation, 222*, 198-211. doi: dx.doi.org/10.1016/j.biocon.2018.03.037
Purpose of creation	To identify "clustered hotspots" (*i.e.,* groups of cells) of biodiversity significance within the Coral Triangle.
Creation methodology	To evaluate clustered areas of biodiversity importance, Asaad *et al* (2018a) used multi-criteria analysis to five ecological criteria (sensitive habitat, species richness, the presence of species of conservation concern, the occurrence of restricted-range species, areas of importance for particular life history stages). Areas of biodiversity importance were identified by superimposing each of the different criterion. Using a grid approach of half-degree cells (0.5°), the regional-level analyses were conducted by evaluating clustered areas of biodiversity importance using the hotspots analysis tool in ArcGIS 10.5. The hotspot tool identifies the spatial patterns of data based on the Getis-Ord GI* statistics, clustered the cells from hotspot (high score cells) to coldspots (low score cells). The methodology is fully described at Asaad *et al.* (2018a).
Version	Ver. 1 (July 2018)
Keywords:	Coral Triangle, biodiversity importance, biodiversity feature, biodiversity hotspots
Category	Biodiversity Features
Limitations:	To have a comprehensive assessment of the biodiversity conservation value of the region, other ecological criteria are recommended: unique and rare habitats, representativeness and ecological integrity. In addition, in the absence of deep-sea biodiversity datasets, the areas of biodiversity importance may exhibit geographical bias toward shallow-water area.
Main access/use constraint:	Creative Commons Attribution 4.0 (CC BY 4.0)

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Data format	Geodatabase (Grid cells; polygon)
Distribution format	GeoJSON
Dataset size	1.82 MB
Webpage	*www.marine.auckland.ac.nz/CT_Priority*
Otherweb page	http://uoa.maps.arcgis.com/apps/webappviewer/index.html?id=429a21089ce243eb9d683b23d7c53da2
Resolution/scale	55 km^2
Reference System	WGS 84
North bounding	22.0
South bounding	-16.0
West bounding	90.0
East bounding	175.0
Date of metadata	10th July 2018

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Sites of biodiversity importance	
Description	This map shows distribution of sites of biodiversity importance within the Coral Triangle. Retrieved from datasets of areas of biodiversity importance developed by Asaad *et al*., (2018a). The site based biodiversity importance were classified into 5 classes (high, medium-high, medium, medium-low and low).
Temporal range	No temporal range available. The map is a result of spatial analysis developed from various datasets.
Geographical range	Coral Triangle of the Indo Pacific Realm
Citations	Asaad, I., Lundquist, C. J., Erdmann, M. V., & Costello, M. J. (2018). Delineating priority areas for marine biodiversity conservation in the Coral Triangle. *Biological Conservation, 222*, 198-211. doi: dx.doi.org/10.1016/j.biocon.2018.03.037
Original datasets / citations	Asaad, I., Lundquist, C. J., Erdmann, M. V., & Costello, M. J. (2018). Delineating priority areas for marine biodiversity conservation in the Coral Triangle. *Biological Conservation, 222*, 198-211. doi: dx.doi.org/10.1016/j.biocon.2018.03.037
Purpose of creation	To identify sites of biodiversity "clustered hotspots" (*i.e.,* groups of cells) of biodiversity significance within the Coral Triangle.
Creation methodology	To identify sites of biodiversity importance, Asaad et al (2018a) used multi-criteria analysis to five ecological criteria (sensitive habitat, species richness, the presence of species of conservation concern, the occurrence of restricted-range species, areas of importance for particular life history stages). Areas of biodiversity importance were identified by superimposing each of the different criterion. Using a grid approach of half-degree cells (0.5°), the site-based analysis identifies specific sites of highest biodiversity importance by analyzing the biodiversity score of each cell. The higher the score, the higher their biodiversity importance. The methodology is fully described at Asaad *et al.* (2018a).
Version	Ver. 1 (July 2018)
Keywords:	Coral Triangle, biodiversity importance, biodiversity feature, biodiversity hotspots
Category	Biodiversity Features
Limitations:	To have a comprehensive assessment of the biodiversity conservation value of the region, other ecological criteria are recommended: unique and rare habitats, representativeness and ecological integrity. In addition, in the absence of deep-sea biodiversity datasets, the areas of biodiversity importance may exhibit geographical bias toward shallow-water area.

Main access/use constraint:	Creative Commons Attribution 4.0 (CC BY 4.0)
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Data format	Geodatabase (Grid cells; polygon)
Distribution format	GeoJSON
Dataset size	0.12 MB
Webpage	*www.marine.auckland.ac.nz/CT_Priority*
Otherweb page	http://uoa.maps.arcgis.com/apps/webappviewer/index.html?id=429a21089ce243eb9d683b23d7c53da2
Resolution / scale	55 km^2
Reference System	WGS 84
North bounding	22.0
South bounding	-16.0
West bounding	90.0
East bounding	175.0
Date of metadata	10th July 2018

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Marine Protected Area (MPA) Network Expansion: Regional priority areas	
Description	This map presents spatial distribution of regional priority areas with three expansion scenario layers (*e.g.,* expansion of the MPA network from existing coverage to 10%, 20% and 30 % of the Economic Exclusive Zone (EEZ) area). Retrieved from datasets of Coral Triangle Marine Protected Area (MPA) System Expansion developed by Asaad *et al*., (2018b).
Temporal range	No temporal range available. The map is a result of spatial analysis developed from various datasets.
Geographical range	Coral Triangle of the Indo Pacific Realm
Citations	Asaad, I., Lundquist, C. J., Erdmann, M. V., Van Hooidonk, R., & Costello, M. J. (2018). Designating spatial priorities for marine biodiversity conservation in the Coral Triangle. *Frontiers in Marine Science, 5*, 400. doi: 10.3389/fmars.2018.00400
Original datasets / citations	Asaad, I., Lundquist, C. J., Erdmann, M. V., Van Hooidonk, R., & Costello, M. J. (2018). Designating spatial priorities for marine biodiversity conservation in the Coral Triangle. *Frontiers in Marine Science, 5*, 400. doi: 10.3389/fmars.2018.00400
Purpose of creation	To develop a prioritization scenario for expansion of the MPA system in the Coral Triangle and provide a conservation strategy to expand the CT MPA system to fulfill the obligations to the CBD-Aichi Biodiversity Target 11, and to achieve Goal 14 of the UN-United Nations-Sustainable Development Goals.
Creation methodology	To guide the identification of an effective MPA system, Asaad *et al.* (2018b) conducted prioritization analyses using systematic conservation planning software of *Zonation.* The prioritization scenarios were based on seven sets of biodiversity features (biogenic habitat, habitat rugosity, species richness, distribution of threatened and endemic species, areas important for sea turtle); two types of threat (anthropogenic and climate change induced pressure); and the coverage of the existing MPA network. Analysis were conducted by compared changes in the proportion of biodiversity features protected and the spatial distribution of priority areas with increasing proportions of the CT region placed into an MPA network. That is, it projected the expansion of the MPA system in the Coral Triangle from the present 1.8% to 10%, 20% and 30% of the combined EEZ area. Using a grid approach of 0.5 km resolution, Regional analyses were performed for the full CT EEZ region The methodology is fully described at Asaad *et al.* (2018b).

Version	Ver. 1 (July 2018)
Keywords:	Coral Triangle, biodiversity importance, biodiversity feature, biodiversity hotspots
Category	Biodiversity Features
Main access/use constraint:	Creative Commons Attribution 4.0 (CC BY 4.0)
Contact Organization	Institute of Marine Science, University of Auckland
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Data format	Geodatabase (Grid cells; polygon)
Distribution format	GeoJSON
Dataset size	14.65 MB
Webpage	*www.marine.auckland.ac.nz/CT_MPA*
Otherweb page	http://uoa.maps.arcgis.com/apps/webappviewer/index.html?id=2f36a9ec18674a13a4e57fd290fc020a
Resolution / scale	0.5 km^2
Reference System	WGS 84
North bounding	22.0
South bounding	-16.0
West bounding	90.0
East bounding	175.0
Date of metadata	10th July 2018

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Marine Protected Area (MPA) Network Expansion: National Priority Areas	
Description	This map presents spatial distribution of national priority areas with six layers of scenarios representing national MPA network expansion for Indonesia, Malaysia, the Philippines, Papua New Guinea, Solomon Islands and Timor Leste. Each country has three expansion scenario layers (*e.g.,* expansion of the MPA network from existing coverage to 10%, 20% and 30 % of the Economic Exclusive Zone (EEZ) area). Retrieved from datasets of Coral Triangle Marine Protected Area (MPA) System Expansion developed by Asaad *et al*., (2018b).
Temporal range	No temporal range available. The map is a result of spatial analysis developed from various datasets
Geographical range	Coral Triangle of the Indo Pacific Realm
Citations	Asaad, I., Lundquist, C. J., Erdmann, M. V., Van Hooidonk, R., & Costello, M. J. (2018). Designating spatial priorities for marine biodiversity conservation in the Coral Triangle. *Frontiers in Marine Science, 5*, 400. doi: 10.3389/fmars.2018.00400.
Original datasets / citations	Asaad, I., Lundquist, C. J., Erdmann, M. V., Van Hooidonk, R., & Costello, M. J. (2018). Designating spatial priorities for marine biodiversity conservation in the Coral Triangle. *Frontiers in Marine Science, 5*, 400. doi: 10.3389/fmars.2018.00400
Purpose of creation	To develop a prioritization scenario of each country in the Coral Triangle to expand their MPA system and provide a conservation strategy to fulfill the obligations to the CBD-Aichi Biodiversity Target 11, and to achieve Goal 14 of the UN-United Nations-Sustainable Development Goals.
Creation methodology	To guide the identification of an effective MPA system in each CT country, Asaad *et al.* (2018b) conducted prioritization analyses using systematic conservation planning software of *Zonation.* The prioritization scenarios were based on seven sets of biodiversity features (biogenic habitat, habitat rugosity, species richness, distribution of threatened and endemic species, areas important for sea turtle); two types of threat (anthropogenic and climate change induced pressure); and the coverage of the existing MPA network. Analysis were conducted by compared changes in the proportion of biodiversity features protected and the spatial distribution of priority areas with increasing proportions of the CT region placed into

	an MPA network. That is, it projected the expansion of the MPA system in the Coral Triangle from the present 1.8% to 10%, 20% and 30% of the combined EEZ area. Using a grid approach of 0.5 km resolution, national analyses were performed individually on each CT country national EEZ. The methodology is fully described at Asaad *et al.* (2018b).
Version	Ver. 1 (July 2018)
Keywords:	Coral Triangle, biodiversity importance, biodiversity feature, biodiversity hotspots
Category	Biodiversity Features
Main access/use constraint:	Creative Commons Attribution 4.0 (CC BY 4.0)
Contact Organization	Institute of Marine Science, University of Auckland
Name	Irawan Asaad
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Data format	Geodatabase (Grid cells; polygon)
Distribution format	GeoJSON
Dataset size	4.6 MB
Webpage	*www.marine.auckland.ac.nz/CT_MPA*
Otherweb page	http://uoa.maps.arcgis.com/apps/webappviewer/index.html?id=2f36a9ec18674a13a4e57fd290fc020a
Resolution / scale	0.5 km^2
Reference System	WGS 84
North bounding	22.0
South bounding	-16.0
West bounding	90.0
East bounding	175.0
Date of metadata	10th July 2018

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Marine protected areas (MPA) coverage	
Description	This map presents spatial distribution of marine protected areas within the Coral Triangle. This dataset consisted of 678 MPA boundaries, retrieved from the World Database of Protected Areas-WDPA (www.protectedplanet.net), the Coral Triangle Atlas (ctatlas.reefbase.org) and the Indonesian database of marine protected areas.
Temporal range	The datasets were collated from different sources with different temporal range ((WDPA = 1819 – present), Indonesian MPA database (1990 – present)).
Geographical range	Coral Triangle of the Indo Pacific Realm
Citations	Asaad, I., Lundquist, C. J., Erdmann, M. V., & Costello, M. J. (2018). Delineating priority areas for marine biodiversity conservation in the Coral Triangle. *Biological Conservation, 222*, 198-211. doi: dx.doi.org/10.1016/j.biocon.2018.03.037. Asaad, I., Lundquist, C. J., Erdmann, M. V., Van Hooidonk, R., & Costello, M. J. (2018). Designating spatial priorities for marine biodiversity conservation in the Coral Triangle. *Frontiers in Marine Science, 5*, 400. doi: 10.3389/fmars.2018.00400.
Original datasets / citations	Cros, A., Fatan, N.A., White, A., Teoh, S.J., Tan, S., Handayani, C., Huang, C., Peterson, N., Li, R.V., Siry, H.Y., Fitriana, R., Gove, J., Acoba, T., Knight, M., Acosta, R., Andrew, N., & Beare, D. (2014a). The Coral Triangle Atlas: An Integrated Online Spatial Database System for Improving Coral Reef Management. *Plos One, 9*(6). DOI: 10.1371/journal.pone.0096332. http://ctatlas.reefbase.org/ IUCN & UNEP-WCMC. (2016). The World Database on Protected Areas (WDPA). Accessed 01/08/2016, from UNEP - World Conservation Monitoring Centre. www.protectedplanet.net. Cambridge-UK MoF-MoMAF. (2010). Ecological representation gap analysis for conservation areas in Indonesia (pp. 29). Ministry of Forestry and Ministry of Marine Affairs and Fisheries. Jakarta-Indonesia.

	MoMAF. (2016). Database of Marine Protected Areas in Indonesia. Ministry of Marine Affairs and Fisheries. Jakarta - Indonesia.
Purpose of creation	To identify areas of biodiversity importance and to develop a geographic prioritization of marine biodiversity conservation in the Coral Triangle region.
Creation methodology	This dataset is a combined data of 3 sources: the World Database of Protected Areas-WDPA, the Coral Triangle Atlas and the Indonesian database of marine protected areas. In total, there are more than 2000 MPA exists in the region, but this dataset contains only 678 MPA boundaries in a polygon format. We excluded MPAs which had missing boundaries or were represented only by point locations (longitude and latitude coordinates) as they may reduce the validity. The layers' attribute table provides detailed information following its native sources (WDPA, CTAtlas) (e.g., information of Name, Local Name, Designation Type, IUCN Category, coverage etc.) (IUCN & UNEP-WCMC,2016; Cros *et al.*,2014) with amendment and adjustment from local sources (Indonesian database). To allow simple indexing, a new CT MPAs ID format (MPA_ID) is introduced. The new ID consists of 10 digits: " C IC XXXX yyy " Where: C = Country; 1 = Indonesia, 2 = Malaysia, 3 = Philippines, 4 = Papua New Guinea, 5 = Solomon Islands, and 6 = Timor Leste IC = IUCN MPAs Category; Strict Nature Reserve (1a = 11, 1b = 12), National Park (20), Habitat and Species Management Areas (40), Protected Landscape/Seascape (50) and Managed Resources Protected Areas (60) XXXX = Establishment year (*e.g.,* 1980) yyy = Number; ordered based on their establishment year The methodology is fully described at Asaad *et al.* (2018b).
Version	Ver. 1 (July 2018)
Keywords:	Coral Triangle, biodiversity importance, biodiversity feature, biodiversity hotspots
Category	Biodiversity Features
Limitations:	The total coverage of MPA summed over the available polygon boundaries (240,443 km^2) is larger than the total coverage of MPA officially reported by the Coral Triangle countries (200,881 km^2) (White *et al.*, 2014). The discrepancy in MPA coverage occurs as some protected areas have both terrestrial and marine components (*e.g.,* coastline, beaches or small islands), and there were inconsistencies between the official documents and the accompanying GIS spatial boundary datasets.
Main access/use constraint:	Data agreement
Contact Organization	Institute of Marine Science, University of Auckland
Name	Irawan Asaad
City	Auckland
Country	New Zealand
email	i.asaad@auckland.ac.nz; irawan.asaad@gmail.com
Data format	Geodatabase (Polygon)
Distribution format	GeoJSON
Dataset size	4.1 MB
Webpage	*www.marine.auckland.ac.nz/CT_Biodiversity*
Otherweb page	https://uoa.maps.arcgis.com/apps/webappviewer/index.html?id=1406b9131245493195c12a1df3d2ada6
Resolution / scale	0.5 km^2
Reference System	WGS 84
North bounding	22.0
South bounding	-16.0
West bounding	90.0
East bounding	175.0
Date of metadata	10th July 2018

3. Interface of the atlases of marine biodiversity conservation in the Coral Triangle

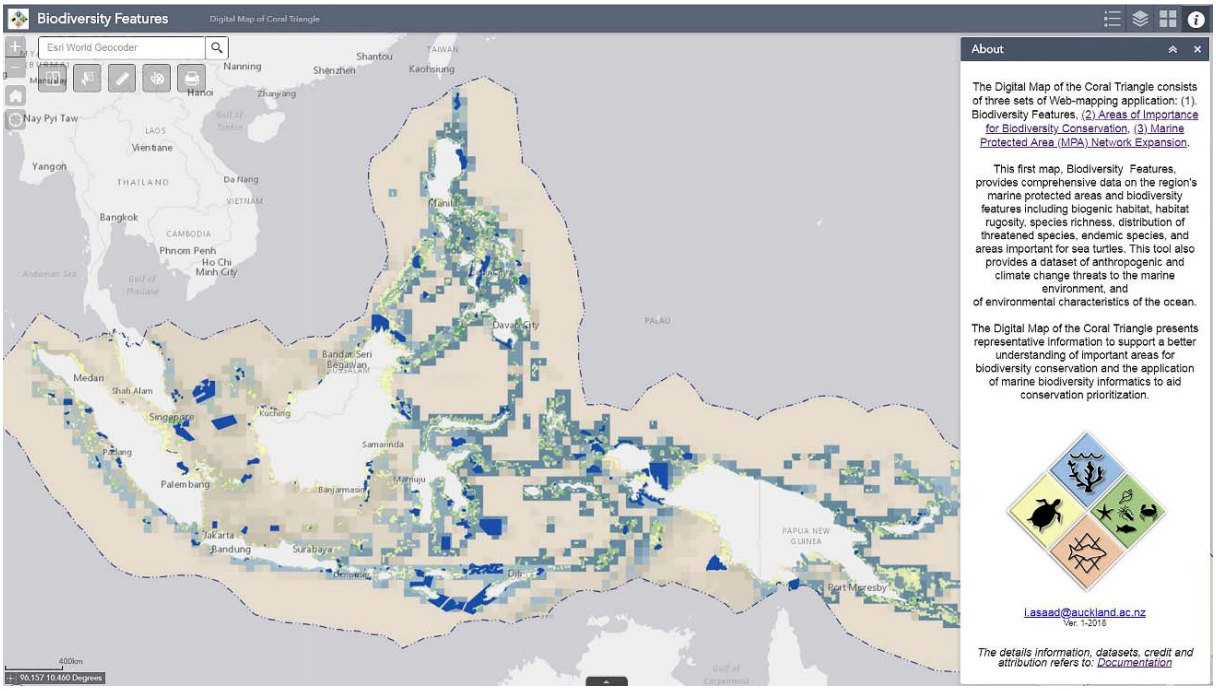

Figure S.1. The interface of the "Biodiversity Features" atlas. The right panel shows the "About" widgets that provides basic information about the map and hyperlinks to two other interrelated atlases ("Areas of Biodiversity Importance" and "Priority Areas of MPA Network Expansion") and to the documentation file.

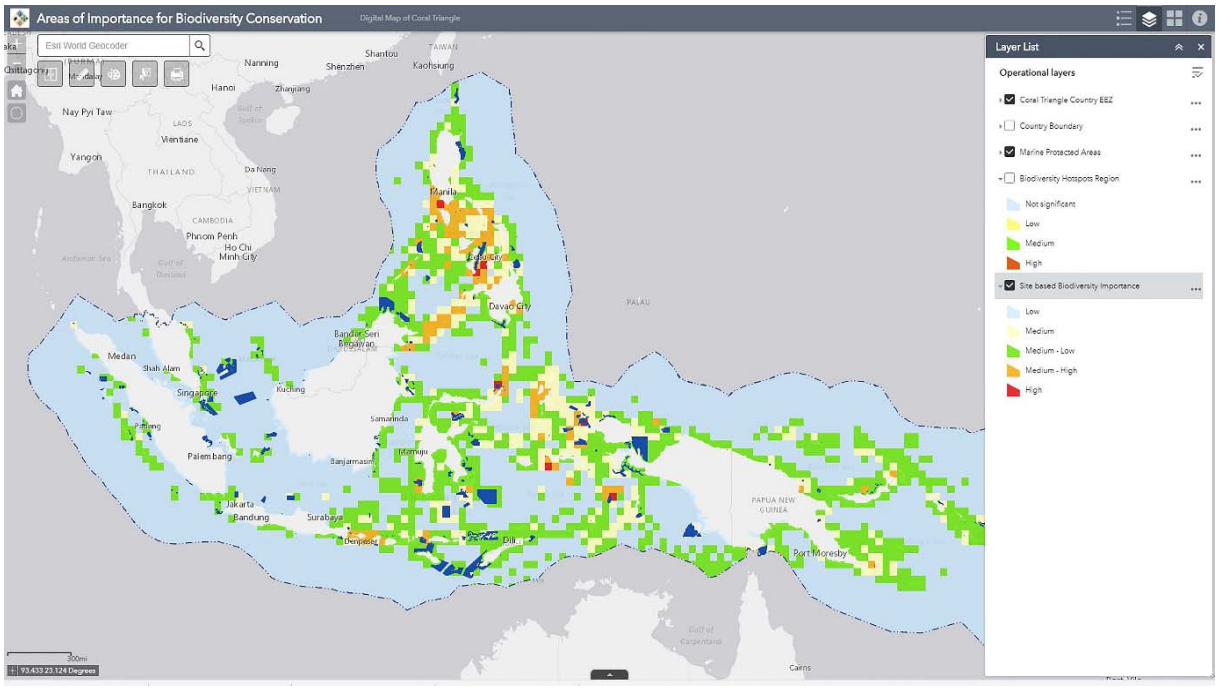

Figure S2. The interface of "Areas of Importance for Biodiversity Conservation" atlas. The right panel shows the "Layer List" widgets that provides access to interactively activated map layers and its accompanying map legends.

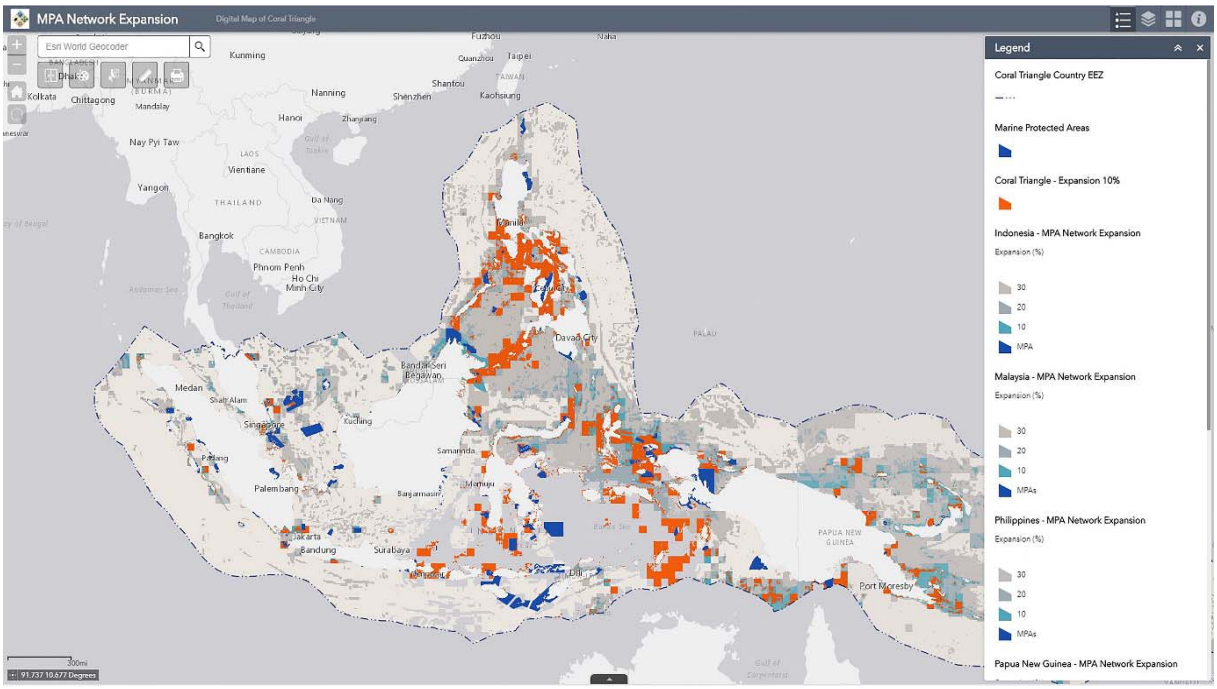

Figure S3. The interface of -"MPA Network Expansion" atlas showing priority areas for expansion of current MPAs or siting new ones, based upon analyses on chapter 4. The right panel shows the "Legend" widgets that display the map key including layer types (lines or polygon) and elements. The maps' screenshot shows 6 layers. Three layers each have one elements, and the other three are comprised of four different elements.

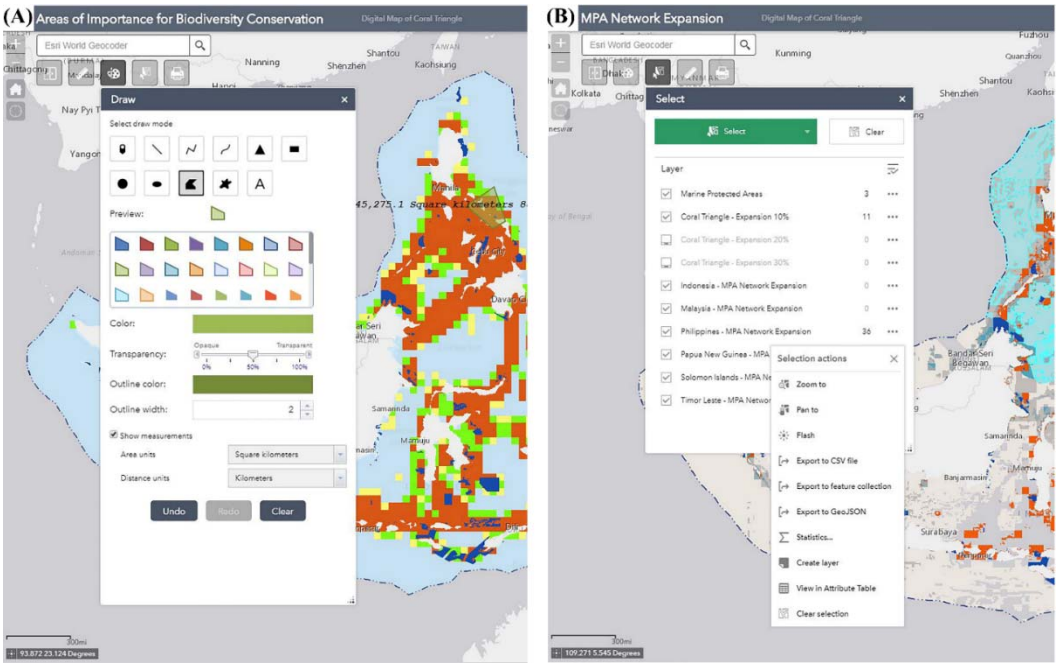

Figure S4. Interactive widgets: **(A)** "Draw" widgets, using various draw mode (e.g., point, line, polygon, freehand polygon), and colour scheme to sketch areas of interest in the map; **(B)** "Select" widgets, that allow user to select specific attributes and extract the selected spatial information in different formats.

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