PRODUCT DESCRIPTION FOR STAKEHOLDERS
CERF Marine Biodiversity Hub

MARINE BIODIVERSITY RESEARCH
Prediction and Management of Australia's Marine Biodiversity

Product title: Predicted seabed assemblage patterns of marine fauna in the Northwest Marine Region (NWMR).

Relevance of product to marine planning and management

This product provides planners and managers with the most recent and complete information about the predicted seabed assemblage patterns of marine fauna, at a range of scales, in the NWMR, based on extensive analyses of species responses to the physical environment. It can be used as follows:

1. To produce maps of predicted patterns of seabed assemblage of marine fauna (i.e. benthic invertebrates and demersal fish combined) in the NWMR;
2. To provide the results of scientific analysis of extensive biological data to planners and managers with the responsibility to conserve and manage seabed biodiversity in the NWMR (e.g. MPA planning and management);
3. As a biologically informed data input to models of the marine environment in the NWMR, where appropriate (e.g. Marxan); and
4. To identify areas of highest priority for future seabed biodiversity surveys, the findings of which can be compared with these predictions of seabed assemblage patterns of marine fauna in the NWMR.

Product description

This product (i.e. an Access database) contains data (longitude, latitude and attribute variables) that describe the predicted spatial patterns of the seabed assemblages of demersal fish and benthic invertebrates in the NWMR. The predicted patterns are represented as point data on a 0.01 degree grid (~1.2 km^2) covering most of the NWMR (approximately 940,000 km^2). Four separate meso-scale (10's-100's km) predictions have been provided that subdivide the NWMR into 20, 40, 60, 80 sub-units (i.e. the 20 prediction divides the region into 20 sub-units called clusters, collectively they form a cluster set).

Interpretation of product

The product represents the predicted spatial patterns of seabed assemblages of marine fauna (i.e. demersal fish and benthic invertebrates) in the NWMR. Each predicted assemblage is represented as a cluster in the data-product that should be interpreted as areas of seabed where the mixture of demersal fish and benthic invertebrate species and their abundances are characteristic of a particular physical environment, reasonably homogeneous and to varying extents distinct from other assemblages in the cluster set. Some clusters will be more distinct compared to others, and the boundaries between them will have varying levels of fuzziness; some are gradual, some are steep — the accompanying continuous colour maps provide insight into this (this information to be provided soon).

The different scales of clusters (i.e. cluster sets of 20, 40, 60 and 80) provide progressively finer scale information. The individual clusters of finer-scale cluster sets are expected to represent more homogeneous assemblages, compared to those in coarser scale cluster sets, but at finer scales the differences between individual clusters are smaller and less certain. In coarser scale cluster sets, individual clusters may not be as homogenous, but are expected to have greater and more certain differences compared to their neighbouring clusters. For more information on certainty please phone or email the contact.

Brief description of methods/data used develop output

The following provides a basic description of methods/data used to develop this product:

1. All suitable available biological data (i.e. demersal fish and benthic invertebrate species) for the NWMR were collated from four different sources: the Northwest Shelf seabed biodiversity survey, the Russian fishing fleet, the Voyage of Discovery survey, and the Data Trawler archive data set of older broad-scale voyages in the region.
2. All suitable available physical data, comprising 29 physical variables (e.g. bathymetry, mud content of sediment, dissolved oxygen, temperature, light availability, etc.) were collated to provide full coverages of the region.
3. Analyses were conducted on about 1000 seabed fish and invertebrate species to identify thresholds along each of the 29 physical gradients (e.g. percentage of mud content in sediment) that correspond to observed changes in the spatial patterns of benthic species;
4. Thresholds of each of physical gradient (i.e. within a single physical variable such as percentage of mud content in sediment) were then used to transform that physical variable to a biologically-informed variable. Thresholds that corresponded to relatively large changes in benthic assemblages were more influential in transforming the variable than those corresponding to small changes;
5. Each of the 29 biologically informed variables was weighted based on the importance of that variable in determining seabed assemblages. Physical variables that corresponded to relatively large changes in benthic assemblages were considered more important than those corresponding to small changes; and
6. The 29 biologically informed variables were then used to populate each 0.01° × 0.01° grid cell in the NWMR. The data were used to produce maps to display predicted spatial patterns in seabed assemblages (see attachments).

It should be note that this method identifies the physical attributes that are associated with the predicted seabed assemblages of marine fauna; it does not identify the suite of species that typify the assemblages. The method has been developed in collaboration with and reviewed by an international team of 10 scientists from Australia, Canada, USA (Maine and Texas) and is being applied in these regions also.

Advantages/improvements over existing products

The product is based on a novel technique that uses biological information to transform physical data and predict spatial patterns of seabed assemblages of marine fauna at a range of scales in the NWMR. This product uses the most recently available and broadest collation of data on the physical environment and of biology (surveys of demersal fish and benthic invertebrates) in the NWMR. The data sources have been newly collated to provide input to this product, and include additional data for some variables (e.g. bathymetry and sediments), as well as many new variables (eg. bottom water attributes) and new biological surveys that have not been used previously for this purpose.

Conditions of use

This product does not contain any confidential information. It is a preliminary product subject to further development by the CERF Marine Biodiversity Hub. Final product is due around May 2010 .The data may be copied for distribution within DEWHA for their internal business operations, but may not be provided to third parties. Enquiries from third parties should be directed to the CERF Hub.

Contact for further information

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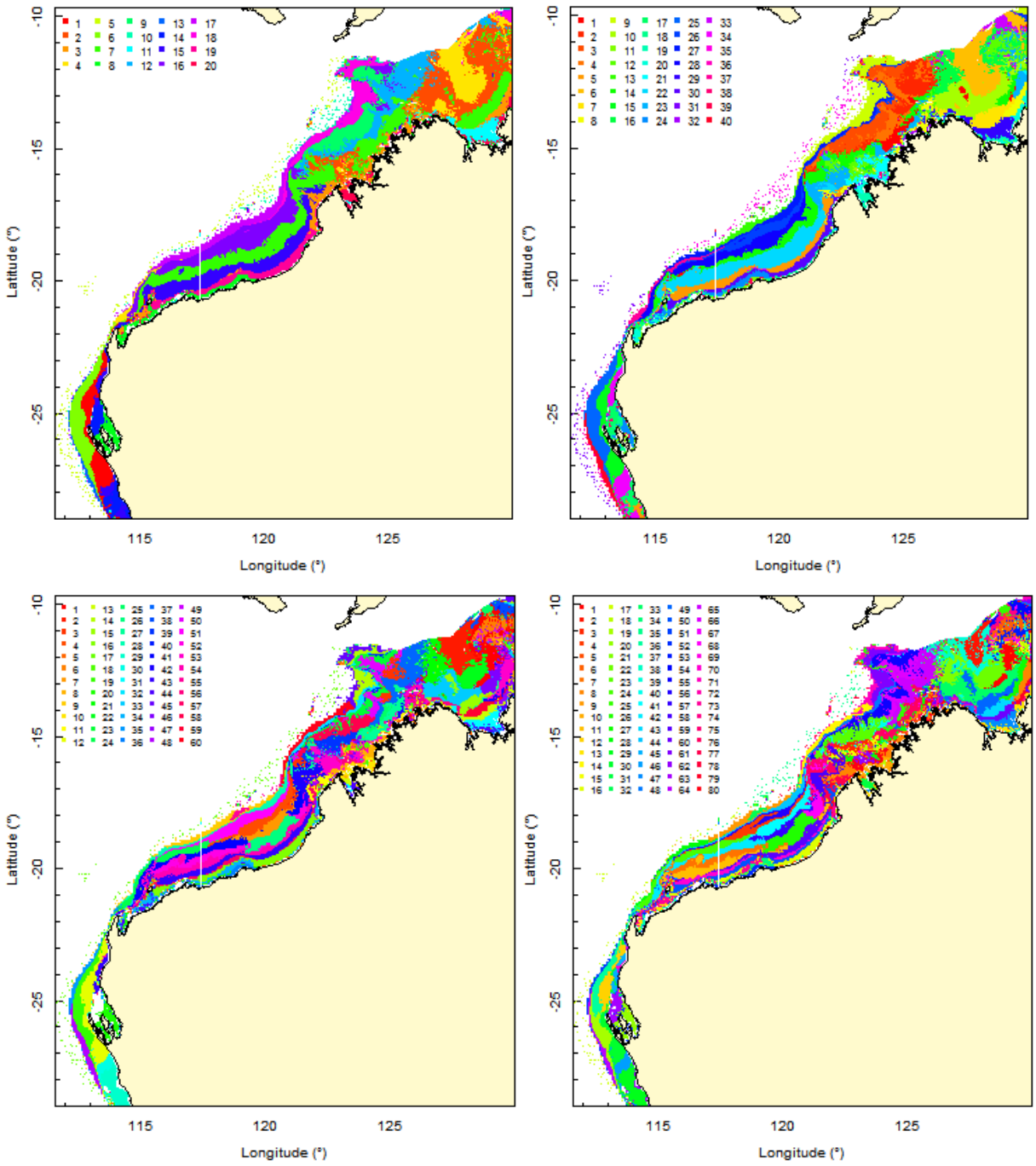
Attachments

1. Four maps for a quick view of the each of the cluster sets (i.e. 20, 40, 60 and 80 clusters) predicting seabed assemblage patterns of marine fauna in the Northwest Marine Region.
2. A map of the 20-cluster set identifying the physical variables having most influence on the predicted seabed assemblages pattern of marine fauna in the Northwest Marine Region.
3. Maps identifying the spatial limits of each individual cluster in the 20 cluster set predicting seabed assemblage patterns of marine fauna in the Northwest Marine Region.
4. Description of physical attributes for each individual cluster in the 20 cluster set predicting seabed assemblage patterns of marine fauna in the Northwest Marine Region
5. Metadata record for database of seabed assemblage patterns of marine fauna in the Northwest Marine Region.

Attachment 1: Four maps for a quick view of the each of the cluster sets (i.e. 20, 40, 60 and 80 clusters) predicting seabed assemblage patterns of marine fauna in the Northwest Marine Region.

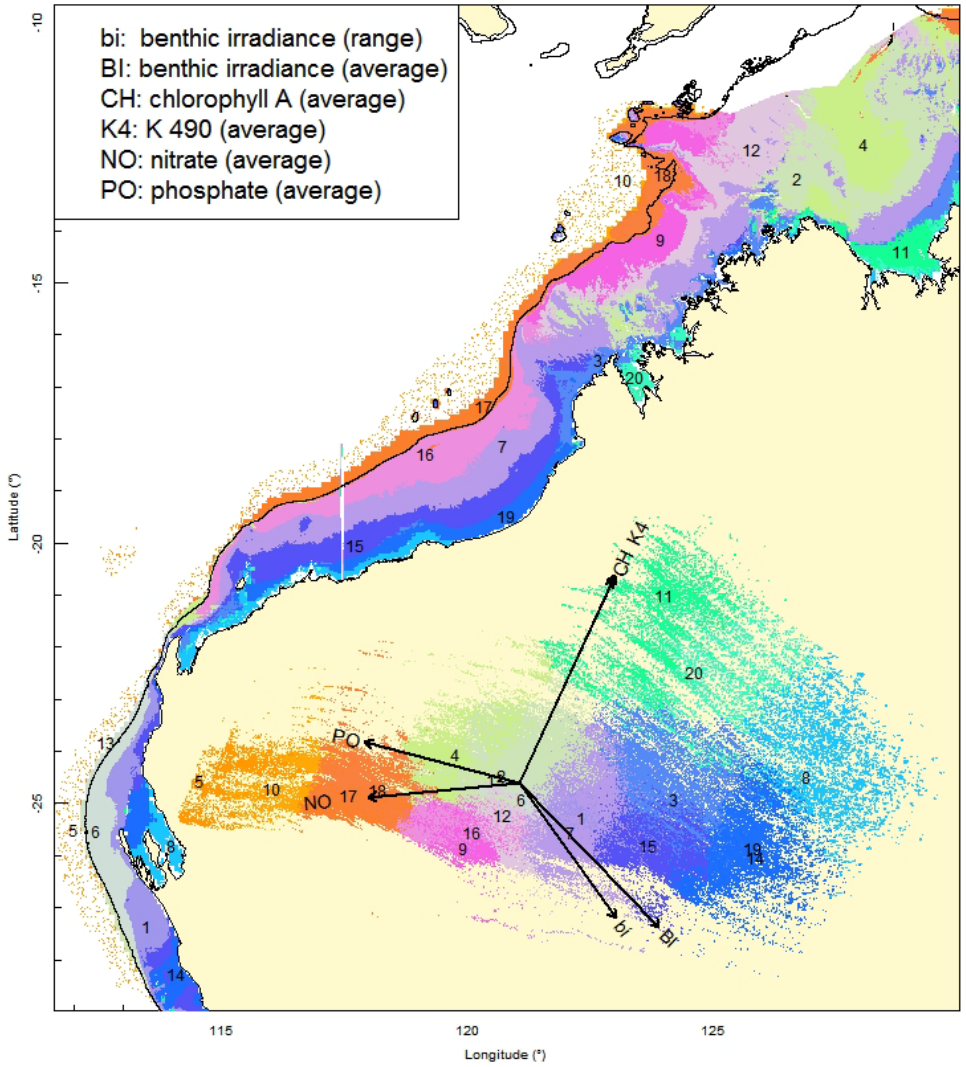


Attachment 2: A map of the 20-cluster set identifying the physical variables having most influence on the predicted seabed assemblages pattern of marine fauna in the Northwest Marine Region. The black line offshore is the 200m depth contour.

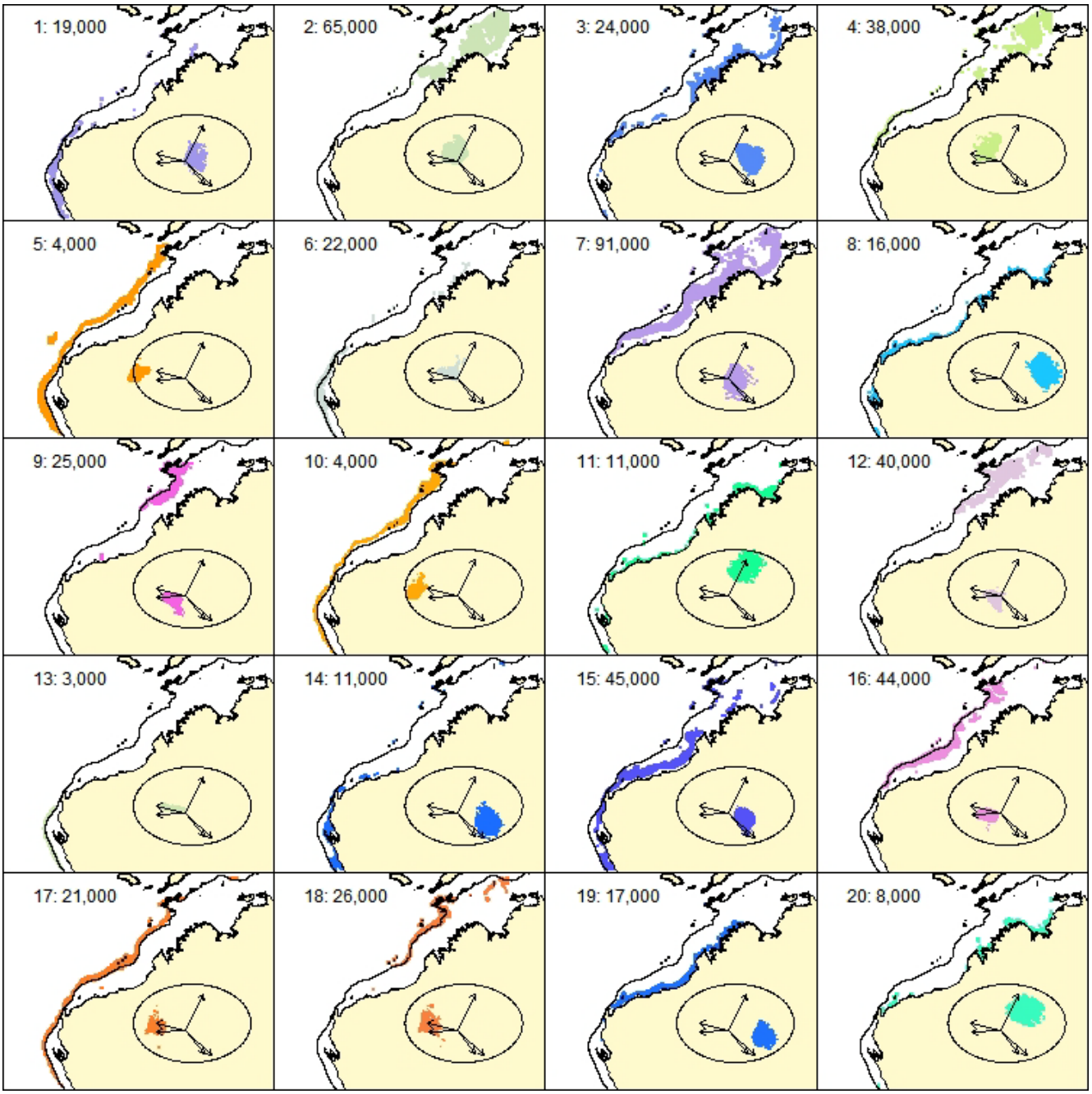
The interpretive colour key (bottom right) can be used to identify the physical variables having most influence on predicted patterns. For example, the colour green is associated with high chlorophyll A average, orange with high nitrate average, blue with high benthic irradiance predictors. The grayer area near the origin of the arrows corresponds to medium values of the physical variables.

Also shown in the colour key are the centres (medoids) of each cluster in the 20-cluster set. Many clusters are disjointed (see Attachment 3 to identify their spatial limits). A brief description of the physical variables having most influence on predicted seabed assemblage patterns is provided in Attachment 4.

Note - The map and interpretive colour key account for 71% of the total variation; the remaining 29% is not shown as it cannot be displayed in 2 dimensions (if more information is required please phone the provided contact person)



Attachment 3: Maps identifying the spatial limits of each individual cluster in the 20 cluster set predicting seabed assemblage patterns of marine fauna in the Northwest Marine Region. The number of 0.01° × 0.01° grids in the cluster is shown to the nearest thousand.



Attachment 4: Description of physical attributes for each individual cluster in the 20 cluster set prediction for seabed assemblage patterns of marine fauna in the Northwest Marine Region

The physical attributes of each predicted assemblage of the 20 cluster output are distinguished by multiple variables used to characterise the region. Many clusters are distinguished on multi-variable combinations rather than individual variables. The following descriptions identify the most influential physical variables for each of the predicted seabed assemblages of marine fauna in the cluster set, clusters particularly distinctive on one variable are indicated by * (typical range shown in parentheses).

1. Carnarvon offshore [~56K km^2]: depth (Depth: 66–89 m), very high sediment sand content (Sand: 83–95 %)
2. Kimberley/Timor mid-shelf [~40K km^2]: depth (Depth: 63–83 m), low sediment carbonate (CRBNT: 53–80 %), high variation in seabed oxygen (O2 SR: 0.80–1.29 mg l^{-1}), high variation in salinity (S SR: 0.5–0.6 ‰), high variation in silicate (Si SR: 6.45–8.82 µM)
3. Kimberley inner-shelf [~58K km^2]: moderately low depth (Depth: 17–28 m), high average water temperature at the seabed (CRS T: 27.1–28.2 °C)
4. Timor mid-shelf [~41K km^2]: depth (Depth: 97–125 m), very low sediment sand content (Sand: 33–59 %), very high average sea surface temperature (SST: 28.6–28.9 °C)
5. NW Deep slope [~4K km^2]: very high depth (Depth: 569–821 m)*, very high nitrate (NO3: 30.7–36.0 µM), very high phosphate average (PO4: 1.95–2.46 µM), very low average water temperature at the seabed (CRS T: 5.6–7.6 °C)*, very high silicate average (Si: 39.47–72.40 µM), low chlorophyll A (Chl A: 0.129–0.168 mg m^{-3}), low turbidity (K490: 0.033–0.039 m^{-1}), very low benthic irradiance (BI: 0–0)*, very low variation in benthic irradiance (BI SR: 0–0)*
6. Carnarvon outer shelf [~20K km^2]: depth (Depth: 121–168 m), very low variation in chlorophyll A (Chl A SR: 0.110–0.129 mg m^{-3}), very low variation in turbidity (K490 SR: 0.014–0.016 m^{-1})
7. NW mid-shelf [~51K km^2]: depth (Depth: 50–71 m), high bottom stress (BS: 0.1–0.4 Nm^{-2}), high variation in bottom stress (BS IQR: 0.2–1.1 Nm^{-2})
8. NW shallow coastal strip [~64K km^2]: very low depth (Depth: 2–8 m), very low nitrate (NO3: 0.2–0.2 µM), very low phosphate average (PO4: 0.09–0.14 µM), very high variation in chlorophyll A (Chl A SR: 1.548–2.493 mg m^{-3}), high turbidity (K490: 0.157–0.224 m^{-1}), high variation in sea surface temperature (SST SR: 7.2–8.6 °C), very high benthic irradiance (BI: 0.204–0.614), high variation in benthic irradiance (BI SR: 0.127–0.241)
9. Kimberley outer-shelf [~20K km^2]: depth (Depth: 98–113 m), very high variation in nitrate (NO3 SR: 7.7–10.2 µM), very high variation in phosphate (PO4 SR: 0.65–0.70 µM)*, high variation in water temperature at the seabed (CRS T SR: 4.5–5.3 °C), very high variation in silicate (Si SR: 10.44–11.50 µM), very low variation in sea surface temperature (SST SR: 3.5–3.7 °C)
10. NW upper slope [~6K km^2]: high depth (Depth: 306–415 m)*, high nitrate (NO3: 28.7–31.6 µM), high phosphate average (PO4: 1.95–2.15 µM), very low average seabed oxygen (O2: 2.22–2.38 mg l^{-1}), very low variation in salinity (S SR: 0–0 ‰), low average water temperature at the seabed (CRS T: 9.2–11.1 °C)*, low variation in water temperature at the seabed (CRS T SR: 0.5–0.8 °C), high silicate average (Si: 44.52–50.84 µM), very low chlorophyll A (Chl A: 0.136–0.182 mg m^{-3}), very low turbidity (K490: 0.034–0.041 m^{-1}), low benthic irradiance (BI: 0–0), low variation in benthic irradiance (BI SR: 0–0)
11. NW inshore [~54K km^2]: depth (Depth: 19–34 m), very high bottom stress (BS: 0.1–0.7 Nm^{-2}), very high variation in bottom stress (BS IQR: 0.1–1.8 Nm^{-2}), very low sediment carbonate (CRBNT: 45–57 %), very high sediment gravel content (Gravel: 16–38 %), low nitrate (NO3: 0.2–0.4 µM), very high average water temperature at the seabed (CRS T: 27.6–28.2 °C), very high chlorophyll A (Chl A: 2.313–5.444 mg m^{-3}), very high turbidity (K490: 0.164–0.277 m^{-1})

12. Timor outer-shelf [~24K km^2]: depth (Depth: 76–90 m), high variation in phosphate (PO4 SR: 0.53–0.63 µM)*, very high variation in seabed oxygen (O2 SR: 0.86–1.18 mg l^{-1}), very low salinity average (S: 34.5–34.6 ‰), low variation in sea surface temperature (SST SR: 3.5–3.9 °C)
13. Western upper slope [~23K km^2]: moderately high depth (Depth: 204–296 m), very high slope (Slope: 0.38–1.37), very high average seabed oxygen (O2: 4.91–5.11 mg l^{-1}), very high salinity average (S: 35.6–35.8 ‰), very low silicate average (Si: 2.21–2.45 µM), very low variation in silicate (Si SR: 0.23–0.90 µM), low benthic irradiance (BI: 0–0), low variation in benthic irradiance (BI SR: 0–0)
14. Western shelf [~38K km^2]: moderately low depth (Depth: 12–37 m), low nitrate (NO3: 0.2–0.2 µM), very low variation in nitrate (NO3 SR: 0.2–0.2 µM), low phosphate average (PO4: 0.11–0.15 µM), high average seabed oxygen (O2: 4.88–4.96 mg l^{-1}), low silicate average (Si: 2.42–2.88 µM), very low average sea surface temperature (SST: 21.6–22.5 °C), high benthic irradiance (BI: 0.113–0.290), very high variation in benthic irradiance (BI SR: 0.158–0.239)
15. West-NW inner shelf [~48K km^2]: depth (Depth: 34–50 m), low slope (Slope: 0.04–0.14), high sediment carbonate (CRBNT: 88–93 %), high sediment sand content (Sand: 79–94 %), low sediment mud content (Mud: 1–6 %)
16. NW outer shelf [~45K km^2]: depth (Depth: 107–139 m), very high sediment carbonate (CRBNT: 89–94 %)
17. NW shelf break [~6K km^2]: high depth (Depth: 232–287 m), very high aspect (Aspect: 270–333 degrees), high nitrate (NO3: 20.3–25.7 µM), high phosphate average (PO4: 1.36–1.78 µM), low average water temperature at the seabed (CRS T: 12.2–14.3 °C), low variation in water temperature at the seabed (CRS T SR: 1–2 °C), low chlorophyll A (Chl A: 0.144–0.156 mg m^{-3}), low turbidity (K490: 0.035–0.036 m^{-1})
18. Kimberley shelf break [~3K km^2]: moderately high depth (Depth: 180–236 m), low average seabed oxygen (O2: 2.37–2.59 mg l^{-1}), very low variation in seabed oxygen (O2 SR: 0.05–0.10 mg l^{-1}), high silicate average (Si: 27.84–34.91 µM), low variation in sea surface temperature (SST SR: 3.6–3.8 °C)
19. NW coast [~27K km^2]: low depth (Depth: 9–18 m), very low sediment mud content (Mud: 1–2 %), low phosphate average (PO4: 0.13–0.16 µM), very high variation in water temperature at the seabed (CRS T SR: 5.9–6.4 °C), very high variation in turbidity (K490 SR: 0.063–0.091 m^{-1}), very high variation in sea surface temperature (SST SR: 7.2–8.9 °C), high benthic irradiance (BI: 0.158–0.352), high variation in benthic irradiance (BI SR: 0.173–0.223)
20. Kimberley coast [~15K km^2]: low depth (Depth: 7–19 m), very low variation in phosphate (PO4 SR: 0.07–0.09 µM), very high variation in salinity (S SR: 0.3–0.9 ‰), high average water temperature at the seabed (CRS T: 27.6–28.4 °C), high chlorophyll A (Chl A: 2.174–5.293 mg m^{-3}), high turbidity (K490: 0.164–0.280 m^{-1}), high variation in sea surface temperature (SST SR: 5.8–7.6 °C)

Attachment 5: Metadata record for benthic habitat database for the Northwest Marine Region

Database for benthic habitat prediction in the Northwest Marine Region (NWMR). Version 1.0

Short title :
MarLIN record number : 8593
Anzlic Identifier : ANZCW0306008593
ISO Topic Category/s
Oceans
Data Type
Aggregated/Derived Data
Area of Interest
Northern Bioreg Data
Custodian Organisation :
CSIRO Division of Marine and Atmospheric Research - Cleveland
PO Box 120
Cleveland
QLD Australia
4163
http://www.cmar.csiro.au/
Jurisdiction : Australia

Contributors : Nick Ellis
Acknowledgements : Geoscience Australia for sediment, bathymetry and benthic stress CSIRO Marine and Atmospheric Research for CARS data SeaWifs for turbidity data Funding: CERF Marine Biodiversity Hub
References :

Abstract : This product (i.e. an Access database and csv files) contains data (longitude, latitude and physical data) that explains the predicted spatial patterns of benthic habitats for demersal fish and benthic invertebrates in the NWMR. Predicted patterns for habitats represent point data on a 0.01 decimal degree grid covering most of the NWMR (approximately 600,000 square km).
Attributes Overview :
CERF_ID: a primary key
LON: longitude
LAT: latitude
component01-10: the 10-dimensional principal component data that was clustered
probweight: cell weighting used in two-stage CLARA/PAM clustering
cluster20: the 20-cluster clustering
cluster40: the 40-cluster clustering
cluster60: the 60-cluster clustering
cluster80: the 80-cluster clustering
Location Keywords

Australia > Western Australia Coast North > Australian North West Shelf

ANZLIC Geographic Extent Names (Category, [Jurisdiction], Name)

Ocean and Sea Regions, [Australia], Australian NW Shelf

Geographic Extent

9.68 S

111.61 E  129.99 E

28.99 S

Dataset contains GIS spatial data in format Geocentric Australia (New Standard GDA).

Subject Categories and Search Word(s)

MarLIN Subject Categories

1383. Biogeography and biogeographic regions

Habitat Keywords

EARTH SCIENCE > Biosphere > Aquatic Habitat > Benthic Habitat

GCMD Keywords

EARTH SCIENCE > Land Surface > Landscape > Landscape Ecology
EARTH SCIENCE > Oceans > Marine Biology > Marine Habitat

ANZLIC Search Words

ECOLOGY
ECOLOGY Habitat
ECOLOGY Landscape
MARINE Biology

Northern Bioreg Data
Oceans

Originating Research Project

Not Entered

Beginning date : Not Known
Ending date : Not Known
Progress : Complete
Maintenance and Update Frequency : As required

Stored Data Format(s)

DIGITAL - Database Files - MS Access

Stored Data Volume

93 MB of digital data

Specific Software Requirements

Requires Microsoft Access

Stored Data Documentation

Stored Data Location

Available Format Type(s)

Same As Stored

Access constraint

The data may be copied for distribution within DEWHA for their internal business operations, but may not be provided to third parties. Enquiries from third parties should be directed to the CERF Hub.

Lineage

This is an original derivation.

Positional accuracy

Data are based on interpolated values from a variety of sources. E.g. see CARS (Anzlic Identifier : ANZCW0306005960)

Parameter accuracy

Logical consistency report

Completeness

There are many cells missing in the deeper waters beyond the 200m depth contour. The data have a glitch running cross-shelf near longitude 117.5E.

Contact

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Metadata Access

Public

Metadata Entry Created

26-Nov-2009 by Nick Ellis

Metadata Export

Show ANZLIC core metadata in ANZLIC XML format
Show full metadata in MarLIN (extended ANZLIC) XML format

Metadata Updateable By

Nick Ellis

Edit this MarLIN record (authorisation required)
