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 Southwest Marine Region (SWMR).

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 SWMR, 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 SWMR;
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 SWMR (e.g. MPA planning and management);
3. As a biologically informed data input to models of the marine environment in the SWMR, 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 SWMR.

Product description

This product (i.e. an Access database and csv files) 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 SWMR. The predicted patterns are represented as point data on a 0.01 degree grid (~1.2 km^2) covering most of the SWMR (approximately 400,000 km^2). Four separate meso-scale (10's-100's km) predictions have been provided that subdivide the SWMR 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 SWMR. 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. primarily demersal fish and some benthic invertebrate surveys) for the SWMR were collated from four different sources: the Russian fishing fleet, the Voyage of Discovery survey, the WA slope fish survey, and the Data Trawler archive data set of older broad-scale voyages in the region.
2. All suitable available physical data, comprising 28 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 200 seabed fish and invertebrate species to identify thresholds along each of the 28 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 28 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 28 biologically informed variables were then used to populate each 0.01° × 0.01° grid cell in the SWMR. The data were used to produce maps to display predicted spatial patterns in seabed assemblages.

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 SWMR. 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 SWMR. 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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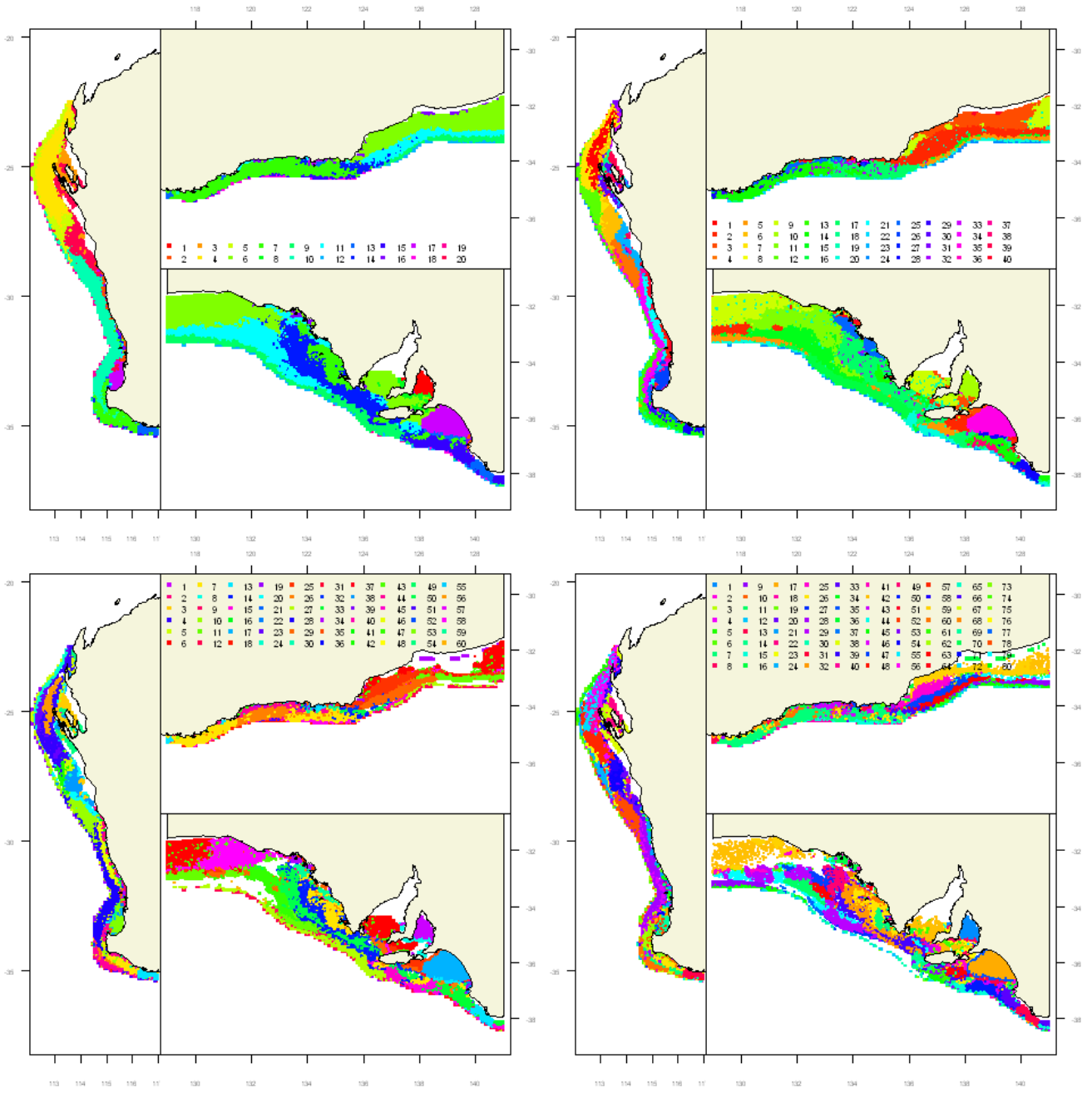
Attachments

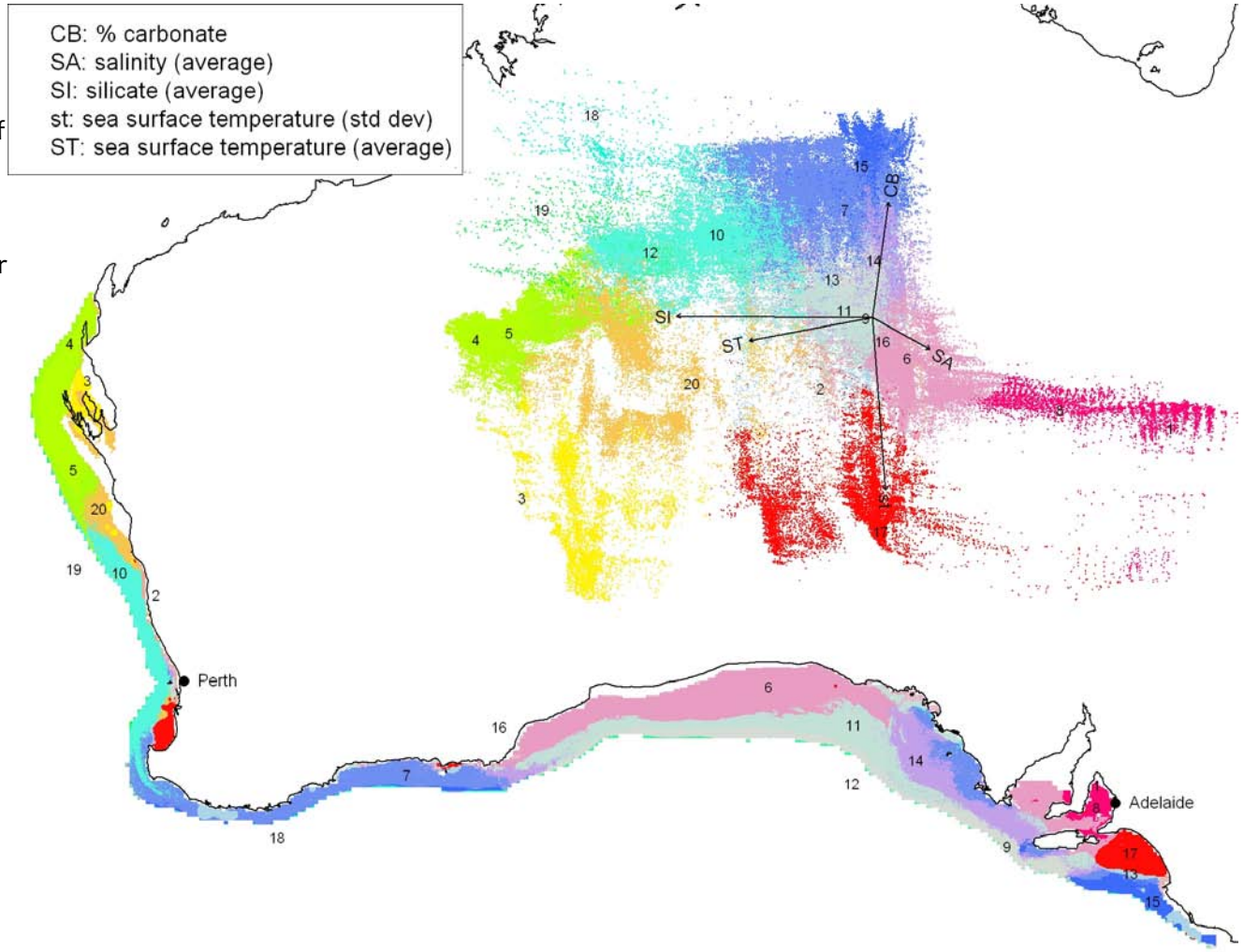
1. Four maps for a quick view of the each of the clusters (i.e. 20, 40, 60 and 80 clusters).
2. A map of the 20-cluster set identifying the physical variables having most influence on the predicted seabed assemblages pattern of marine fauna in the SWMR.
3. Maps identifying the spatial limits of each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

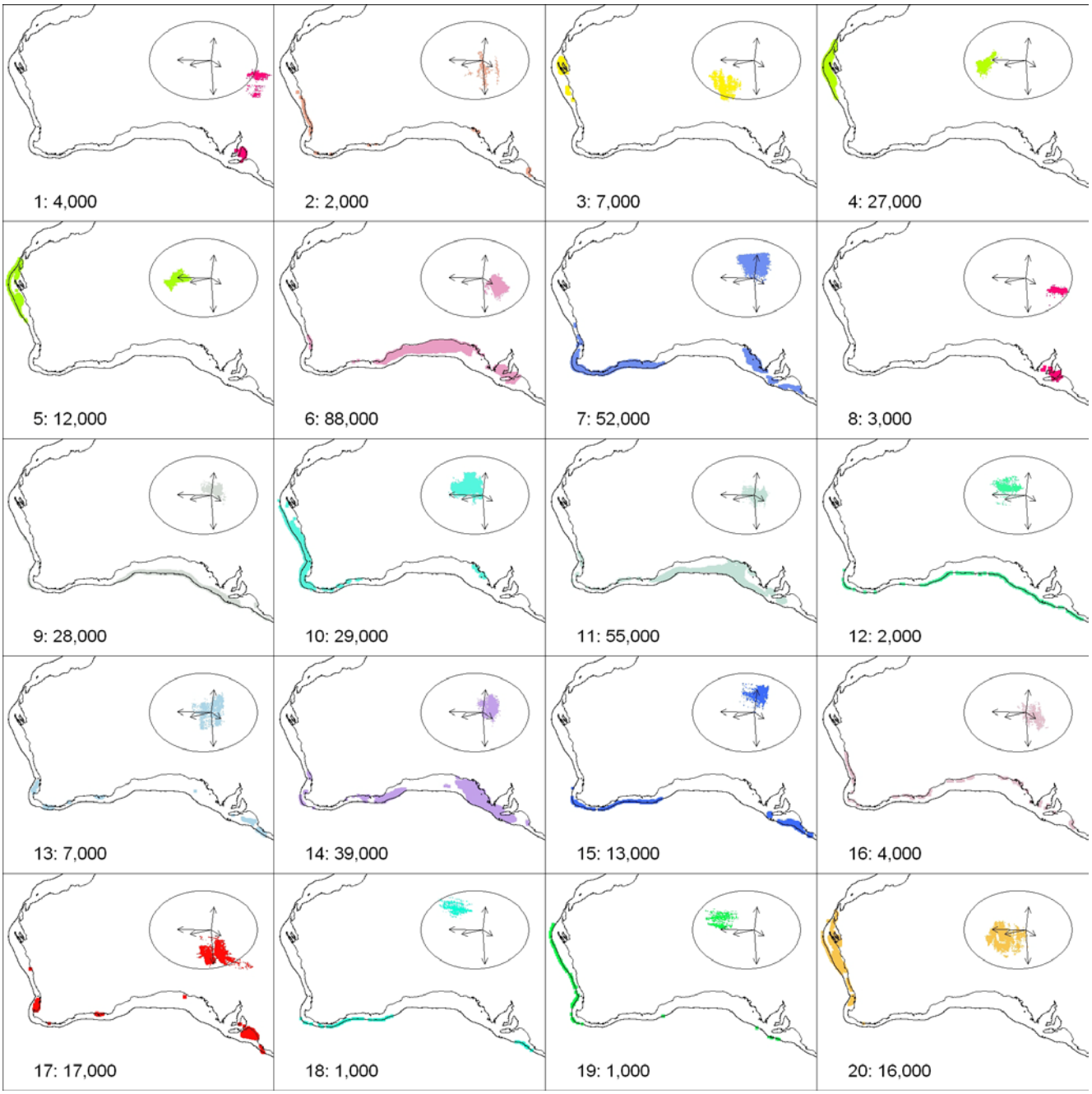


Attachment 2: A map of the 20-cluster set identifying the physical variables having most influence on the predicted seabed assemblages pattern of marine fauna in the SWMR. The interpretive colour key can be used to identify the physical variables having most influence on predicted patterns. For example, the colour green is associated with high silicate average, red with high sea surface temperature variation, blue with high sediment carbonate average. The gray 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 60% of the total variation; the remaining 40% 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 Southwest 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 Southwest 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. upper Gulf St Vincent SA [~4K km²]: very high salinity average (S: 36.6–36.8 ‰)*, very large variation in sea surface temperature (SST SD: 3.1–3.5°C)*, very low silicate average (Si: 0.45–0.48 µM)*, relatively high turbidity (K490: 0.083–0.154 m^{-1}), moderately high average water temperature at the seabed (CRS T: 17.6–17.9°C), moderately shallow depth (14.5–31 m),
2. Cervantes coast WA [~2K km²]: shallow depth (8–22 m), moderately high average water temperature at the seabed (CRS T: 19.5–20.2) and surface (SST: 19.7–20.7), moderately high turbidity (K490: 0.074–0.11),
3. Shark Bay/Coral Coast WA [~7K km²]: very high average water temperature at the seabed (CRS T: 22.7–23.1)* and relatively high sea surface temperature (SST: 22.3–22.8), very shallow depth (8–26 m), relatively high turbidity (K490: 0.081–0.13), relatively low sediment carbonate (CRBNT: 49–62 %), moderately low oxygen average at the seabed (O2: 4.84–4.92 mg/l),
4. Carnarvon offshore WA [~27K km²]: very low oxygen average at the seabed (O2: 4.56–4.67)*, very high sea surface temperature (SST: 23.1–24), high average water temperature at the seabed (CRS T: 20.7–22.5), high silicate average (Si: 3.73–4.47), moderate outer-shelf depth range (84–136 m),
5. Carnarvon outer shelf WA [~12K km²]: low oxygen average at the seabed (O2: 4.68–4.82)*, very high surface temperature (SST: 22.5–24.1), high silicate average (Si: 2.81–3.63), shelf-break depth range (86–204 m), moderately high average water temperature at the seabed (CRS T: 18.6–21.2), relatively high sediment carbonate (CRBNT: 86–91),
6. Great Australian Bight & SA gulf entrances [~88K km²]: high sediment carbonate (CRBNT: 89–94), moderately large variation in sea surface temperature (SST SD: 1.73–2.11), moderately high salinity average (S: 36–36.2)*, intermediate average water temperature at the seabed (CRS T: 16.6–17.6), inner-shelf depth range (43–60 m),
7. SW and SA mid-shelf [~52K km²]: moderately small variation in sea surface temperature (SST SD: 1.13–1.21), relatively high sediment carbonate (CRBNT: 84–93), moderate salinity average (S: 35.7–35.8), mid-shelf depth range (58–82 m),
8. Lower SA gulfs [~3K km²]: high salinity average (S: 36.2–36.6)*, large variation in sea surface temperature (SST SD: 2.39–2.94)*, low silicate average (Si: 0.57–0.66)*, moderately low average water temperature at the surface (SST: 16.9–17.3), moderately high turbidity (K490: 0.078–0.1), moderately shallow depth (11–31 m),
9. Great Australian Bight shelf-break [~28K km²]: low turbidity (K490: 0.043–0.049), high sediment carbonate (CRBNT: 89–93), moderately low silicate average (Si: 1.2–1.46), high oxygen average at the seabed (O2: 5.37–5.45), shelf-break depth range (122–148 m), low moderate average water temperature at the seabed (CRS T: 14.4–15.8),
10. South Western shelf [~29K km²]: shelf depth range (44–117 m), moderately high average water temperature at the seabed (CRS T: 19–20.6) and surface (SST: 20.6–21.4), moderate low variation in sea surface temperature (SST SD: 1.21–1.27), intermediate low oxygen average at the seabed (O2: 4.96–5.14), moderately high sediment carbonate (CRBNT: 87–92),
11. Great Australian Bight outer shelf [~55K km²]: high sediment carbonate (CRBNT: 91–95), high intermediate salinity average (S: 35.8–35.9), outer-shelf depth range (71–102 m),

12. Southern upper slope [~2K km²]: upper slope depth range (307–381 m), low salinity average (S: 34.9–35.1), low average water temperature at the seabed (CRS T: 10.6–11.9), low turbidity (K490: 0.043–0.047), high nutrients (NO_3: 9.42–13.15 µM), high oxygen average at the seabed (O2: 5.39–5.46), high sediment carbonate (CRBNT: 89–92), steep slope (1.22–3.19),
13. Mid-shelf patches [~7K km²]: relatively low sediment carbonate (CRBNT: 57–63), mid-shelf depth range (49–78 m), some areas of high sediment mud content (typical range: 3–47 %),
14. East & west GAB fringes [~39K km²]: very high sediment carbonate (CRBNT: 94–96), moderately high salinity average (S: 35.7–35.9), shelf depth range (72–97 m), moderate average water temperature at the seabed (CRS T: 15.3–15.9),
15. SW and SE outer shelf and break [~13K km²]: very low surface water temperature average (SST: 15.8–16.7) and variation (SST SD: 0.9–1.2), moderately low average seabed water temperature (CRS T: 14.2–15.1), high average seabed oxygen (O2: 5.35–5.5), relatively low silicate average (Si: 1.11–1.35) and variation (Si SD: 0.44–0.56), outer shelf/break depth range (61–118 m),
16. Coastal patches [~4K km²]: shallow coastal depth range (8–27 m), moderate high turbidity (K490: 0.071–0.107), high sediment carbonate (CRBNT: 82–94), moderate high salinity average (S: 35.8–36),
17. large coastal embayment's [~17K km²]: low carbonate (CRBNT: 30–51)*, low surface water temperature average (SST: 14.8–18.3) and variation (SST SD: 0.9–1.2), inner shelf depth range (33–52 m),
18. SW & SE upper slope [~1K km²]: very low salinity average (S: 34.6–35), very low average seabed water temperature (CRS T: 9–11.4), very high nutrients (NO_3: 10.4–18.3), high average seabed oxygen (O2: 5.36–5.47), high silicate average (Si: 2.93–5.83), upper slope depth range (320–523 m),
19. Western upper slope [~1K km²]: very high average seabed oxygen (O2: 5.4–5.5), upper slope depth range (386–498 m), very low salinity average (S: 34.7–35), very low average seabed water temperature (CRS T: 9.2–11.2), very high nutrients (NO_3: 9.6–16.9), high silicate average (Si: 2.7–5.3), moderately high average surface water temperature (SST: 20.7–23),
20. Western shelf [~16K km²]: very high average seabed water temperature (CRS T: 21.2–22.3), moderately high sea surface temperature (SST: 21.5–22.3), moderately low oxygen average at the seabed (O2: 4.89–4.95 mg/l), shelf depth range (14–52 m).

Attachment 5: Metadata record for benthic habitat database for SWMR.

Database for benthic habitat prediction in the Southwest Marine Region (SWMR). Version 1.0

Short title :
MarLIN record number : 8526
Anzlic Identifier : ANZCW0306008526
ISO Topic

Category/s Oceans

Data Type Aggregated/Derived Data

Area of Interest Southwestern Bioreg Data

Custodian Organisation :
CSIRO Division of Marine and Atmospheric Research - Cleveland
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http://www.cmar.csiro.au/

Jurisdiction : Australia

Contributors : Nick Ellis

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References :

Abstract : This product (i.e. an Access database and csv files) contains data (longitude, latitude and attribute variables) that describe the predicted spatial patterns of seabed biodiversity composition for demersal fish and benthic invertebrates in the SWMR. The predicted patterns are represented as point data on a 0.01 degree grid (~1.2 km2) covering most of the SWMR (approximately 400,000 km^2). Four separate meso-scale (10's-100's km) predictions have been provided that subdivide the SWMR into 20, 40, 60, 80 sub-units (i.e. cluster sets).

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
r:	red value for rendering on a map (scale 0-1)
g:	green value for rendering on a map (scale 0-1)
b:	blue value for rendering on a map (scale 0-1)

Geographic Extent

22.51 S

112.15 E  140.99 E

38.44 S

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

Maximum Depth

1341

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
Southwestern 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 71 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
About 175,000 cells have been omitted from the outer shelf and slope owing to missing values for benthic stress. About 32,000 cells have been omitted from inshore areas owing to missing values for SeaWifs and CARS data.
Contact
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Metadata Access Public
Metadata Entry Created 22-Jul-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)
