The National Database for Deep Sea Corals and Sponges: A key resource for biogeographic investigation of deep sea communities

NOAA Deep Sea Coral Research and Technology Program

Speaker:

Robert McGuinn,
Conservation Biologist / Ecologist / Data Scientist, with JHT, Inc.
Data System Manager for DSCRTP
Robert.McGuinn@noaa.gov
843-762-8640
Outline

- Introduction to key data products of DSCRTP
- Insight into workflows and tools used for data management, quality assurance, archive, and distribution
- Brief introduction to the National Database for Deep Sea Corals and Sponges
- Initial Case Study: Deep sea coral community analysis using National Database and Marine Eco-Regions of the World
- We want to encourage you to use the data!
People - Thank you!

NOAA/NMFS/OHC/DSC-RTP (Silver Spring)
- Tom Hourigan (program lead)
- Heather Coleman

NOAA/NCCOS/CCMA/Biogeography Team/Deep Coral Ecology Lab (Charleston, SC)
- Peter Etnoyer (federal lead)
- Robert McGuinn (data systems mngr.)
- Janessy Frometta
- Ren Salgado
- Andrew Shuler
- Daniel Wagner

NOAA/National Centers for Environmental Information (Stennis, MS)
- Scott Cross (federal lead)
- Matt Dornback (data systems specialist)
- David Sallis
- David Moffitt
- Many others

NOAA, Office of Exploration and Research

NOAA/NCCOS/CCMA/BioGeography Team
- John Christensen (lead)
- Brian Kinlan
- Matt Poti
- Dan Dorfman

NOAA - NWFSC
- Curt Whitmire

USGS
- Kathy Scanlon et al. 2010 (Cold Water Coral Geographic Database - CoWCoG)

USGS/OBIS-USA
- Abigail Benson

* Current DSC Data Working Group members listed in black
Key Products:
DSCRTP Data Working Group

- National Database of DSC and Sponge occurrences
- Habitat Suitability Models
- Site Characterization Reports
- Archiving services for all cruise data and DSCRTP reports

Delivery Mechanism: DeepSeaCoralData.NOAA.gov
  - Web Portal
  - Mapping Portal
  - ERDDAP Data Service and Web Mapping Service
Clients / Partners

- *Fisheries Management Councils*
- Managers for MPAs (Sanctuaries and National Monuments)
- Marine Spatial Planning Processes
- Government, Academic, and NGO Researchers
- Other Stakeholders
Welcome to the NOAA Deep Sea Coral Data Portal

This Portal provides access to deep sea coral and sponge data, images, and technical reports from research funded by NOAA's Deep Sea Coral Research and Technology Program (DSCRTP) and its partners.
Digital Map & Database

Data Search, Discovery & Download
The DSCRTF map allows for search, discovery, and download of the National Deep Sea Corals and Sponges Database. All points are categorized and colored by common vernacular categories. Users can search by taxon, region, time, and depth. Data downloads can be initiated using the search parameters on the map and the on-screen geographic extent. Go to the digital map.

Information Access
Users can also view site characterization reports for DSCRTF funded research. These reports give habitat summaries of specific undersea areas and summarize the dives on the area. Go to the digital map.

Deep Sea Coral Database Documentation
DSCRTF’s Technical Memo on the National Database. Go to the publication.

Metadata for the Deep Sea Coral Database. Go to the metadata.

---

2016 Report to Congress
Read the 2016 Deep Sea Coral Research and Technology Program Report to Congress.

State of DSC Report
Preview the 2015 report on the state of deep sea corals and sponges in the U.S.

Research Sites
Read reports characterizing deep sea coral and sponge sites.

Okeanos Explorer
Follow the Pacific Islands explorations.

Report Archive
Visit NOAA’s Coral Reef Information System (CoRIS).
Work Flow – Data to Action

Priority Setting

Conservation Actions

Decision Analysis

Research Exploration

Data Streams

Standards Quality Assurance

Archive Discovery Distribution

Synthesis and Reporting

Photos
Video
Navigation
CTD and other sensors
Samples
Multi-beam mapping
Cruise reports
Site characterizations
Database records
National Database
(Operating principles)

- Comprehensive nationally
- Contributing internationally
- Darwin Core compliant schema, better interoperation with international standards for biological occurrence data
- Committed to a high degree of quality
- Networked with other aggregation and portal services (ERDDAP data service and WMS) Marine Multipurpose Cadastre and OBIS-USA
- Connection points to other databases (WoRMS, GenBank)
- Future Integrations: IOOS Marine Biodiversity Observation Network Data Portal, and habitat compliance with Coastal and Marine Ecological Classification Scheme (CMECS)
For all records:

- Metadata regarding provenance (how did I get here?)
- Taxonomy (who am I?), with assessment of ID quality
- Position (where am I?) horizontal (lat,long) and depth, with accuracy assessment

For many records:

- Still Image of actual occurrence
- Habitat
- Size
- Condition
- Associated Environmental Variables (in-situ observations)
  - Temperature, pH, Total Alkalinity, Salinity, Dissolved Oxygen, Partial Pressure of CO2, Dissolved Inorganic Carbon

For all the details see Hourigan et al. 2015 (NOS NCCOS 191) [LINK](#)
The Numbers (404,368 Records)

- Caribbean: 1,359
- Gulf of Mexico: 23,924
- Mid-Atlantic: 1,380
- New England: 961
- North Pacific: 76,194
- Pacific: 232,871
- South Atlantic: 7,008
- Western Pacific: 43,026
- Outside of US EEZ: 17,645
Habitat Suitability Models
Questions:
- Are there distinctly identifiable coral community types that are apparent within and between marine ecoregions?
- Which ecoregions have similar communities and where are the breaks between community types?

Site designations: Marine Ecoregions of the World - MEOW (Spalding et al., 2007)
- Biogeographic classification of the world's coasts and shelves.
- MEOW represents broad-scale patterns of species and communities in the ocean.
- Led by WWF and The Nature Conservancy.
Regions with > 100 coral observations (where taxon rank = species).

Dissimilarity matrix was constructed using the “Chao” method (robust against sampling differences between sites).

Software used: R “vegan” package (Okansen et al. 2016), specifically “hclust” and “metaNMDS” functions.

Diversity metrics were calculated for each eco-region (Figure 3).

The number of coral observations at the species level within each eco-region is captured in Figure 4.
<table>
<thead>
<tr>
<th>Marine Eco-Region's with &gt;100 Observations</th>
<th>Number of Species</th>
<th>Shannon-Weaver Diversity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Floridian</td>
<td>132</td>
<td>3.97</td>
</tr>
<tr>
<td>Greater Antilles</td>
<td>166</td>
<td>3.91</td>
</tr>
<tr>
<td>Eastern Caribbean</td>
<td>130</td>
<td>3.65</td>
</tr>
<tr>
<td>Bahamian</td>
<td>184</td>
<td>3.57</td>
</tr>
<tr>
<td>Western Caribbean</td>
<td>84</td>
<td>3.57</td>
</tr>
<tr>
<td>Hawaii</td>
<td>183</td>
<td>3.41</td>
</tr>
<tr>
<td>Southern Caribbean</td>
<td>75</td>
<td>3.25</td>
</tr>
<tr>
<td>New Caledonia</td>
<td>35</td>
<td>3.14</td>
</tr>
<tr>
<td>Carolinian</td>
<td>126</td>
<td>3.04</td>
</tr>
<tr>
<td>Southwestern Caribbean</td>
<td>79</td>
<td>3.02</td>
</tr>
<tr>
<td>Northern Gulf of Mexico</td>
<td>169</td>
<td>2.90</td>
</tr>
<tr>
<td>Southern Gulf of Mexico</td>
<td>31</td>
<td>2.90</td>
</tr>
<tr>
<td>Eastern Galapagos Islands</td>
<td>26</td>
<td>2.68</td>
</tr>
<tr>
<td>Guianan</td>
<td>54</td>
<td>2.63</td>
</tr>
<tr>
<td>Gulf of Maine/Bay of Fundy</td>
<td>49</td>
<td>2.56</td>
</tr>
<tr>
<td>Southern California Bight</td>
<td>47</td>
<td>2.50</td>
</tr>
<tr>
<td>Scotian Shelf</td>
<td>18</td>
<td>2.20</td>
</tr>
<tr>
<td>Malvinas/Falklands</td>
<td>14</td>
<td>2.08</td>
</tr>
<tr>
<td>South Georgia</td>
<td>18</td>
<td>2.04</td>
</tr>
<tr>
<td>Channels and Fjords of Southern Chile</td>
<td>16</td>
<td>1.89</td>
</tr>
<tr>
<td>South Shetland Islands</td>
<td>9</td>
<td>1.77</td>
</tr>
<tr>
<td>Amazonia</td>
<td>25</td>
<td>1.51</td>
</tr>
<tr>
<td>Palawan/North Borneo</td>
<td>12</td>
<td>1.34</td>
</tr>
<tr>
<td>Oregon, Washington, Vancouver Coast and Shelf</td>
<td>38</td>
<td>1.33</td>
</tr>
<tr>
<td>Aleutian Islands</td>
<td>60</td>
<td>1.30</td>
</tr>
<tr>
<td>Virginian</td>
<td>44</td>
<td>1.27</td>
</tr>
<tr>
<td>Eastern Bering Sea</td>
<td>10</td>
<td>1.27</td>
</tr>
</tbody>
</table>
Eco-regional community and diversity differences are readily apparent from the cluster and NMDS ordinations.

Six major community types emerged (with subgroupings that need further exploration).

Differences in sampling effort between eco-regions is a major confounding factor in the analysis.

This initial look at community differences reveals the convenience and advantage of having a global database that is regularly updated and conforms to a standard schema (Darwin Core).
Next analysis will use *ESRI’s Ecological Marine Units* as the site boundaries. (3D biogeographic groupings with environmental envelopes.)

Sampling bias between eco-regions will be further quantified and explored.

Sharing of R code. (get in touch!)

This is just a start. We would love to get additional collaborators involved!
Overall Conclusions

- High utility is realized from the creation of a one stop (value added) database for deep sea corals and sponges.
- Easy to contribute data: Simplified template-based approach for data contributors! We need your data.
- Standardization leads to greater scientific insight and synthesis!
- Look for:
  - *Quarterly updates of data – this thing is ALIVE!*
  - New integrations with new distribution platforms
  - New synthesis and visualization products
  - New science and management application examples
Questions? Comments?

Deep Sea Coral Research and Technology Program

Robert McGuinn, Data Systems Manager
Robert.McGuinn@noaa.gov
843-762-8640

We Need Your Data and Feedback to Improve!
References


