Enhancing the value of ROV Deep Discoverer video data through application of the Coastal and Marine Ecological Classification Standard (CMECS)

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Wiling to Attend Workshop? Yes

Target Names

All Seafloor Habitats (particularly seeps, sandy, and hard-bottom habitats with deep corals and sponges)

Geographic Areas of Interest within the North Atlantic Ocean

Southwest (Southeast United States and Caribbean Sea)

Relevant Subject Areas

Geology, Biology, Habitat Mapping

Description of Topic

Video imagery collected with remotely operated vehicles (ROV) is a hard-to-obtain and highly valuable source of oceanographic data that supports a wide array of scientific, archaeological, and management objectives. High-definition video collected and live-streamed from the ROV Deep Discoverer is a hallmark data product of the NOAA Okeanos Explorer Program, which has continually increased its value through proactive video data management policies focused on accessibility, improved scientific annotation, and development of species identification guides. Recent investigations have indicated that Coastal and Marine Ecological Classification Standard (CMECS) can be applied to ROV video data to further enhance its value to the ocean research and management communities by temporally indexing and geospatially referencing observed environmental features and organisms (Ruby, 2017; Etnoyer et al, 2018). This would allow investigators to rapidly identify features of interest within the very large video data sets and cartographically represent the spatial relationships between identified features, a key factor in understanding fundamental biological, chemical, physical, and geological processes in the ocean. Here, we suggest further enhancement of ROV video data through the systematic application of the Coastal and Marine Ecological Classification Standard (CMECS) to Deep Discoverer video data collected during the ASPIRE Campaign, particularly the ongoing efforts in the Southeastern US and Caribbean Sea. Specifically, we encourage NOAA OER to support and enable telepresence-based integration of CMECS classification into the existing Deep Discoverer video data annotation and processing workflow, including the SeaScribe and SeaTube annotation systems.

CMECS is a comprehensive framework of common terminology developed for the classification of biological species, water column properties, and seafloor morphology as well as composition in all lacustrine and marine environments including the deep sea (Bassett et al, 2017). It is organized in a hierarchal structure that allows users to select a set of common terms to fully describe a marine environment observed in video data. CMECS was endorsed as a national data standard by the Federal Geographic Data Commission in 2012 (USGS, 2012) with the goal of standardizing marine environmental feature classification across a wide range of geographic locations, and spatiotemporal scales. It has subsequently been adopted by a number of governmental agencies, organizations, and partnerships, notably the Renewable Energy and Marine Minerals Program with the Bureau of Ocean Energy Management. Because CMECS has seen wide adoption, annotating Deep Discoverer video data with CMECS compliant terminology would improve its accessibility and compatibility with other marine data

sets. The effort serves as an example for the unification of the wide variety of habitat and substrate classification approaches currently employed by the deep-sea research community (Etnoyer, 2018).

Notable benefits of the application of CMECS to Deep Discoverer video data, beyond compatibility and standardization include enhanced video indexing and geospatial representation as demonstrated by Ruby (2017). Video indexing is an important aspect of data accessibility that allows investigators to query the location of particular CMECS defined environmental characteristics (e.g. seafloor composition, substrate) or biological attributes (e.g. squat lobsters, corals) of interest within voluminous video data sets. This reduces the need for individual investigators to scan through many hours of video data to potentially find observations relevant to their work, saving substantial amounts of time and removing a barrier to wider ROV video data use. A related data access tool enabled by CMECS is the geospatial representation of ROV Video observations. Ruby (2017) developed an automated geographical information system tool that produces maps of CMECS classified environmental features based upon the navigational and environmental sensor data recorded during ROV dives as well as the view angle geometry of the ROV camera system (Fig 1). The resulting visualizations of ROV video data enable researchers to rapidly understand the spatial distribution and relationships of classified features, which will promote discovery and accelerate ROV video data use among the ocean research and management communities.

Substantial efforts have been made to consider how to best implement CMECS with the existing Deep Discover video data workflow. Ruby (2017) presented a detailed analysis of the feasibility of CMECS application to ROV Deep Discover video data and guidelines for implementation. Additionally, the use remote application of CMECS to video data via telepresence and the existing SeaScribe annotation system was successfully demonstrated by the Etnoyer Lab during Okeanos Explorer ROV expeditions in 2017 and 2018. As OER seeks geographic locations of broad community interest for exploration during the ASPIRE campaign, we would suggest that it is equally important to consider exploring new data processes and products of value to a broad cross section of the ocean research and management community as well. Accordingly, we suggest the ASPIRE campaign as an ideal opportunity to test, optimize, and operationalize CMECS as a classification standard for Deep Discoverer video data.

Bassett, RD, M Finkbeiner, and PJ Etnoyer. 2017. Application of the Coastal and Marine Ecological Classification Standard (CMECS) to Deep-Sea Benthic Surveys in the Northeast Pacific: Lessons from Field Tests in 2015. NOAATechnical Memorandum NOS NCCOS 228,NOAA National Ocean Service, Charleston, SC 29412. 49 pp.

Etnoyer, PJ et al. (2018), Working with Video to Improve Deep-Sea Habitat Characterization, *Oceanography*, *31*:*1*, *Supp*, 64–67.

Ruby, C. (2017), Application of Coastal and Marine Ecological Classification Standard (CMECS) to remotely operated vehicle video data for enhanced geospatial analysis of deep sea environments. M.S. thesis, 266 pp., Mississippi State University.

U.S. Geological Survey (2012), Coastal and Marine Ecological Classification Standard, Fed. Regist., 77(170), 53224–53225.

Relevant Partnerships

NOAA National Centers for Environmental Information, Deep Sea Coral Research and Technology Program, NOAA National Centers for Coastal Ocean Science, Bureau of Ocean and Energy Management

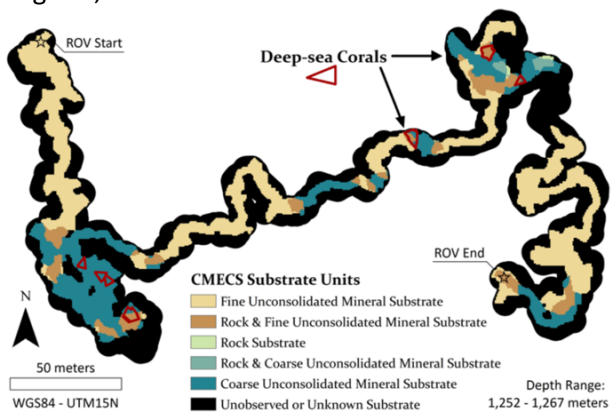

Figure 1: A map of CMECS classified seafloor substrate and deep-sea corals, observed during a dive of the ROV Deep Discoverer. The map visually indicates the spatial relationship between deep-sea corals and rock as well as coarse unconsolidated mineral substrate. Image created by Caitlin Ruby (NOAA) and adapted from Etnoyer et al. (2018).