

# Report to FGDC Coordination Group: *Coastal and Marine Ecological Classification Standard (CMECS)*

## CMECS Implementation Group

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# Agenda

- *Background*
- *Public review*
- *Next steps*

# Objectives

*No national standard exists for classifying coastal and marine habitats*

- Assure **consistent names** and descriptions for ecological features
- Accommodate biological, geological, chemical, and physical **data in single structure**
- Articulate with **FGDC standards**
- Be **gear-independent**
- Apply to **multiple scales**
- Facilitate **data sharing** and **integration**



# What is CMECS?



CMECS *is* a **catalog of terms**

- Provides **means** for classifying ecological units in simple, standard format using common terminology
- **Tool** for organizing observational information

CMECS *is not:*

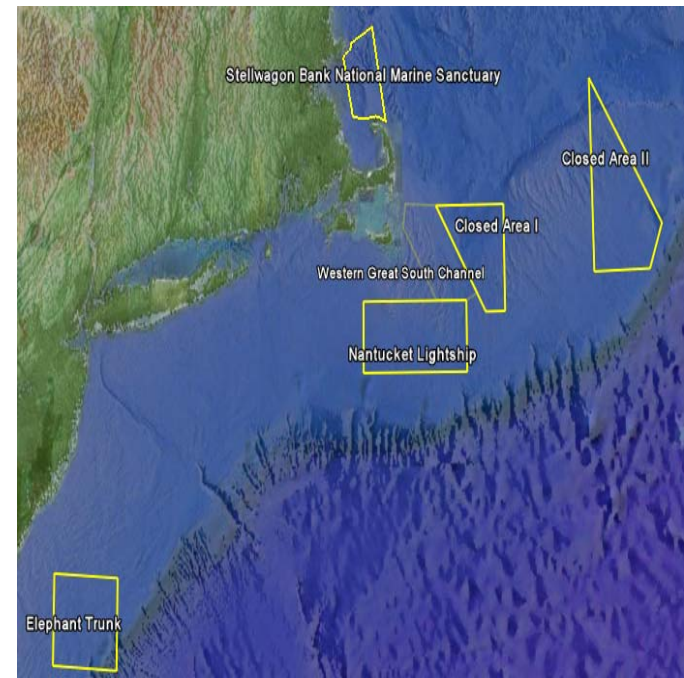
- **Mapping guidance**
- **Analytical approach** for comparing ecosystem units

Ecological units classified using CMECS can be mapped, compared, or otherwise analyzed with **existing, available methods**

# Scope

All waters, substrates, and organisms

- **On land** from tidal splash zones, intertidal and brackish wetlands, and waters of Great Lakes
- **Down-river/estuary** from head of tide
- **Seaward** to deep ocean



# Settings and Components

**Biogeographic Setting**

**Water Column Component (WC)**

**Biotic Component (BC)**

**Substrate Component (SC)**

**Geoform Component (GC)**

**Aquatic Setting**

# Development Approach

- Reach out widely to user communities and potential stakeholders
- Involve *the* experts
- Include not impose
- Pilot and demonstrate
- Revise in response
- Publicize results



# Cooperators

- **Federal agencies:** NOAA, EPA, USGS, FWS, NPS, BOEM, COE, USDA/NRCS, NASA
- **State agencies:** MA Division of Marine Fisheries, OR Coastal Management Program, SC Department of Natural Resources, TX Parks and Wildlife, CA State Coastal Conservancy
- **Academia:** URI, WHOI, VIMS, U. Miami, U. Michigan, FIU, U. San Francisco, U. So. Mississippi, U. Aukland
- **NGOs:** NatureServe, TNC
- **International:** Australia, Canada, Germany, OAS





# Relationship to Other Standards

## Articulates with relevant FGDC standards

- FGDC 1996 -- *Classification of Wetlands and Deepwater Habitats of the United States*
- FGDC 2001 -- *Metadata Profile for Shoreline Data*
- FGDC 2008 -- *National Vegetation Classification Standard*
- FGDC 1997 -- *Soil Geographic Data Standard*

## Articulates with other approaches

- Wherever possible, built on accepted approaches
  - Crosswalks and comparisons
  - Applications completed, underway and in planning



# Public Comments and Peer Reviews



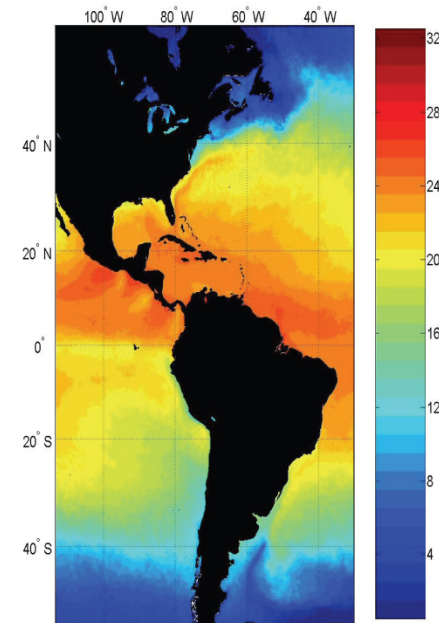
- August 16 - December 13, 2010
- Vigorous response: **~800 comments** from **>31 organizations/individuals**
- Sources: on-line form, hard-copy, email, separate write-ups, and edited digital documents

# Response Generation

For technical issues--**did not** just return to desks to develop replies

- **Reached out** to non-CMECS experts
- **Vetted responses** with CMECS developers and other professional colleagues
- **Conferred with commenters** for complex or unclear issues
- **Convened ad hoc expert teams** when needed

**Discrete quality control** of text, figures, tables, and appendices



# CMECS 4.0--Measuring Up

## *Significantly improved*

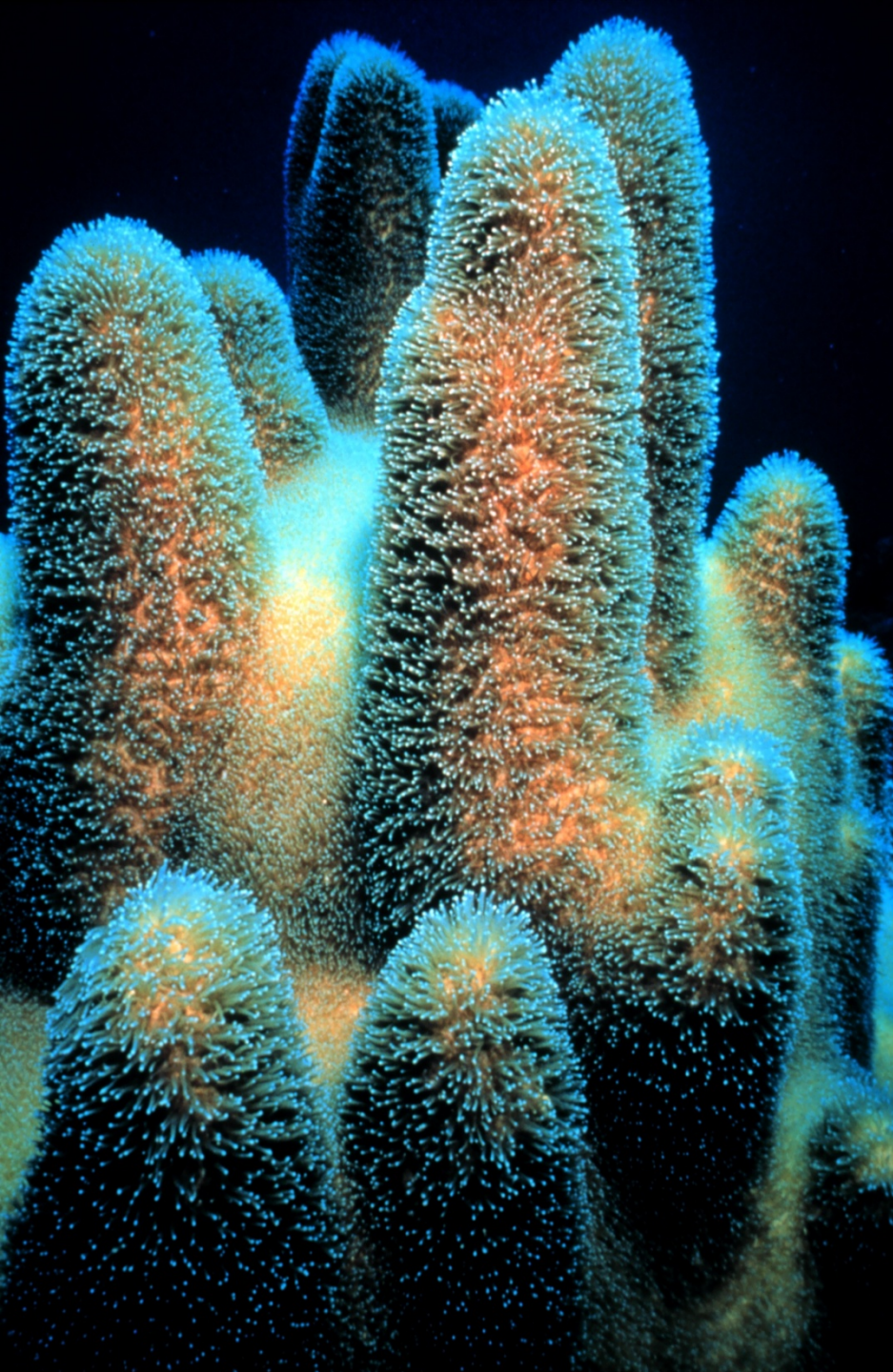
- Responsive to reviews and comments
- More straightforward
- Easier to understand and apply
- More comprehensive
  - Geographically
  - Ecologically
- Enhanced guidance and explanations



# Next Steps

- Assemble **infrastructure** to maintain and enhance CMECS over time--**multiagency**
- Engage North American constituents to **widen awareness** about CMECS
- Develop **implementation guidance**
- Establish **dynamic standard** provisions
- Reach out **internationally**





**Thank you!**  
*Questions?*  
*Comments?*



# Leadership and Expertise

## Implementation Group

### Core group of 8 scientists and managers

- Dealt with operations and day-to-day issues

## Working Group

### Standing panel of 35-40 users and technical experts

- Responsible for technical content
- Chosen for discipline expertise, geographic diversity, and stakeholder affiliation

## Issue Teams

### Ad hoc groups of selected discipline experts (4-20 people)

- Resolved specific issues
- WG members + invited outside experts



# Response Process

Comments:

- Characterized as *general, editorial, or technical*
- Organized by section, topic area, keyword, and origin
- Parsed out to experts/chapter leads for response
- **Master spreadsheet tracked and compiled responses**
- **Original comment documents preserved for context**

Follow-up briefings arranged for agencies providing important input

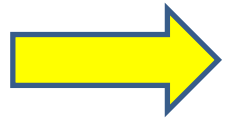


# CMECS Is a Vital Tool for Marine and Coastal Science and Management

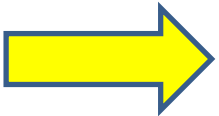
- Continuity from “uplands to sea floor”
- Built on existing classification approaches
- Common terminology for data from different sources
  - Across methods
  - Across scales
  - Across geographic regions
- Easily customizable
- Responsive but stable



# Major Revisions



- Significantly refined settings and components
- Expanded modifiers section



- Added biotopes chapter
- Augmented review of spatio-temporal framework
- Upgraded discussion of data collection and mapping
- Improved crosswalking guidance

# Settings

*Version 3.1*

Aquatic setting →

*Version 4.0*

Aquatic setting  
*Primarily unchanged*

***New*** → Biogeographic setting  
**Hierarchical**

- **Realms**
- **Provinces**
- **Ecoregions**

# Components

Version 3.1

Version 4.0

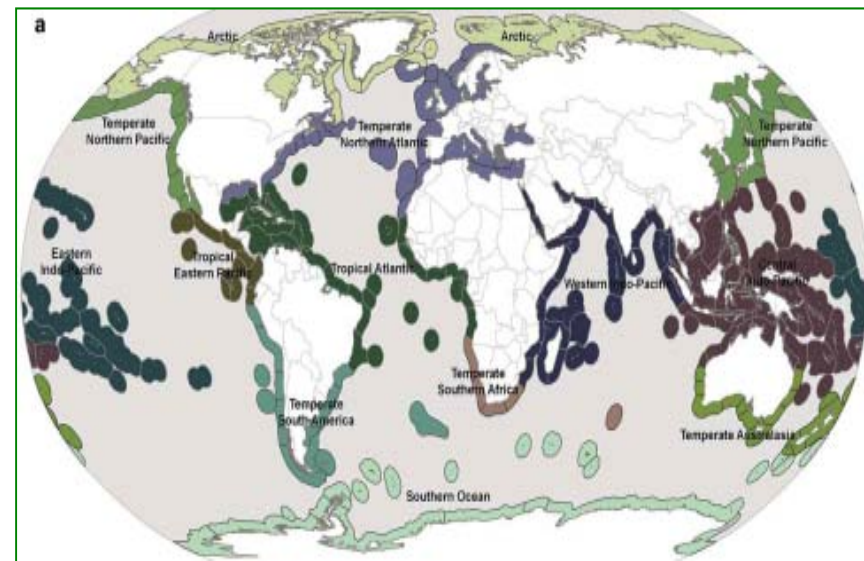
Water Column	→	<b>Water Column</b>	<i>Reorganized</i>
Benthic Biotic	→	<b>Biotic</b>	<i>Renamed and expanded</i>
Surface Geology	→	<b>Substrate</b>	<i>Renamed and expanded</i>
Sub-Benthic	----->	<i>Removed</i>	
GeoForm	→	<b>Geoform</b>	<i>Reorganized</i>

# Settings and Components

Biogeographic Setting (BS)	Aquatic Setting (AS)	Water Column Component (WC)	Geoform Component (GC)	Substrate Component (SC)	Biotic Component (BC)
Realm Province Ecoregion	System Subsystem Tidal Zone	<b>Layer Subcomponent</b>	<b>Tectonic Setting Subcomponent</b>	Substrate Origin Substrate Class Substrate Subclass Substrate Group Substrate Subgroup	Biotic Setting Biotic Class Biotic Subclass Biotic Group Biotic Community
		<b>Salinity Subcomponent</b>	<b>Physiographic Setting Subcomponent</b>		
		<b>Temperature Subcomponent</b>	<b>Level 1 Geoform Subcomponent</b> Geoform Origin Level 1 Geoform Level 1 Geoform Type		
		<b>Hydroform Subcomponent</b> Hydroform Class Hydroform Hydroform Type	<b>Level 2 Geoform Subcomponent</b> Geoform Origin Level 2 Geoform Level 2 Geoform Type		
		<b>Biogeochemical Feature Subcomponent</b>			

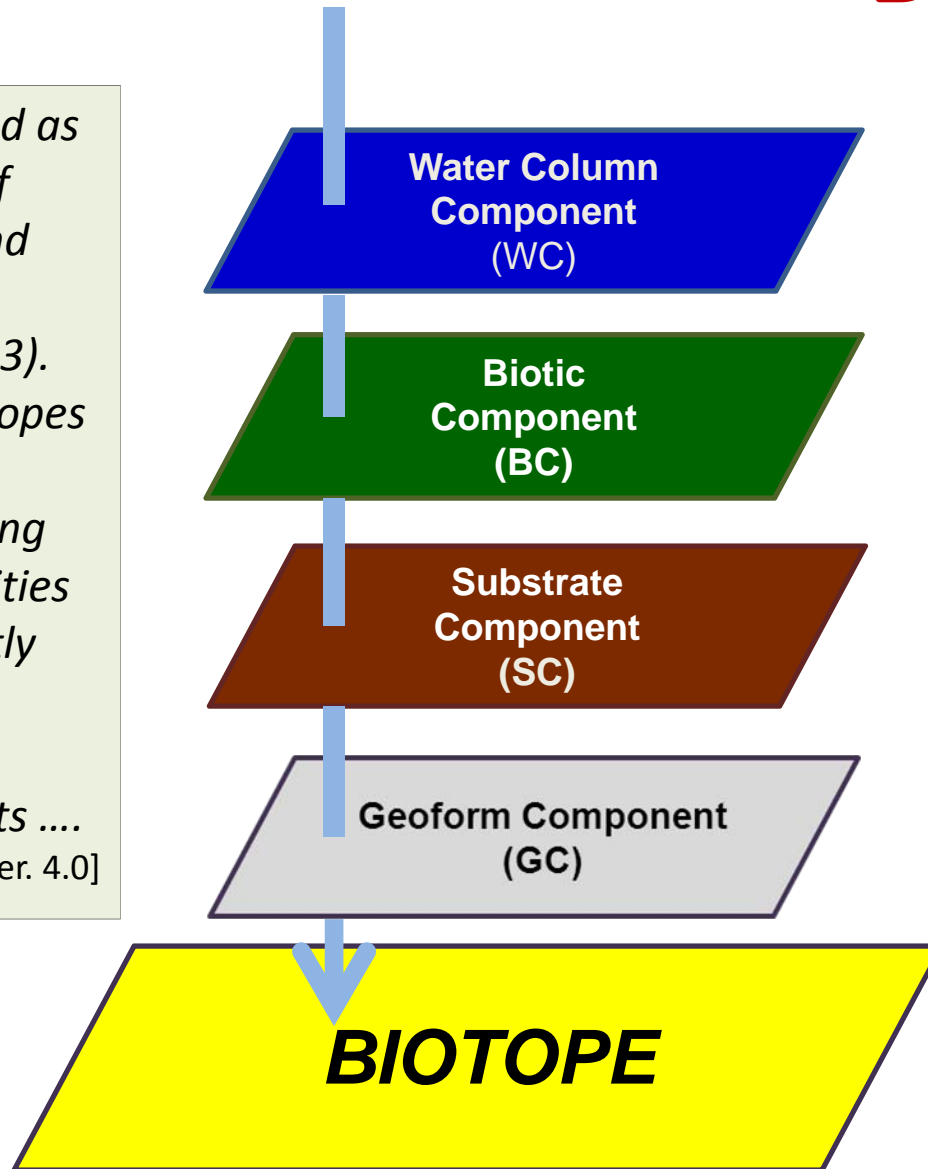
# Biogeographic Setting

- Reflects composition and characteristics of biological communities
- Estuarine and marine coastal and shelf environments  
*Marine Ecoregions of the World, Spalding et al. (2007)*
- Marine oceanic  
*Global Open Oceans and Deep Seabed Biogeographic Classification, UNESCO (2009)*
- Both hierarchical
  - Realms
  - Provinces
  - Ecoregions



# Biotope

*A biotope is defined as the combination of abiotic features and associated species (Connor et al., 2003). Using CMECS, biotope can be derived by identifying repeating BC biotic communities that are consistently associated with combinations of environmental units ....*  
[CMECS ver. 4.0]



# Water Column Component

- Water column structure and
  - features
- Four elements; non-hierarchical
  - Vertical layers
  - Temperature and salinity
  - Hydroforms--*e.g.*, gyres, named water masses
  - Biogeochemical features--*e.g.*, oxygen minimum, chlorophyll maximum layers





# Biotic Component

- Describes composition of biota
  - **Benthos**
  - **Water column**
- Hierarchical
- Classes and subclasses emulate FGDC Wetland Standard
- Vegetated assemblage names from FGDC National Vegetation Classification Standard



# Substrate Component



- Characteristics of substrate
  - Particle size and composition
  - To extent of penetration by multicellular biota
- Substrates: Geologic, biogenic, anthropogenic
- Particle sizes: Wentworth (1922), mixes: Folk (1954)
- Hierarchical

**Substrate origin:** Geologic

**Substrate Class:** Unconsolidated Substrate

**Substrate Subclass:** Fine Unconsolidated Substrate

**Substrate Group :** Sandy Mud

**Substrate Subgroup:** Sandy Clay

# Geoform Component

- Major geomorphic or structural characteristics
- From Greene et al. (2007) with modifications
- Geologic, biogenic, anthropogenic features
- Spatially hierarchical, three subcomponents
  - **Tectonic Setting:** Global tectonic features, scale:  $>1000 \text{ km}^2$  (e.g., abyssal plain)
  - **Physiographic Setting:** Landscape level geomorphological features, scale:  $\sim 100\text{'s km}^2$  (e.g., fjord, submarine canyon)
  - **Geoform:** Coastal and seafloor structures, scale:  $<100 \text{ km}^2$  (e.g., terminal moraine)

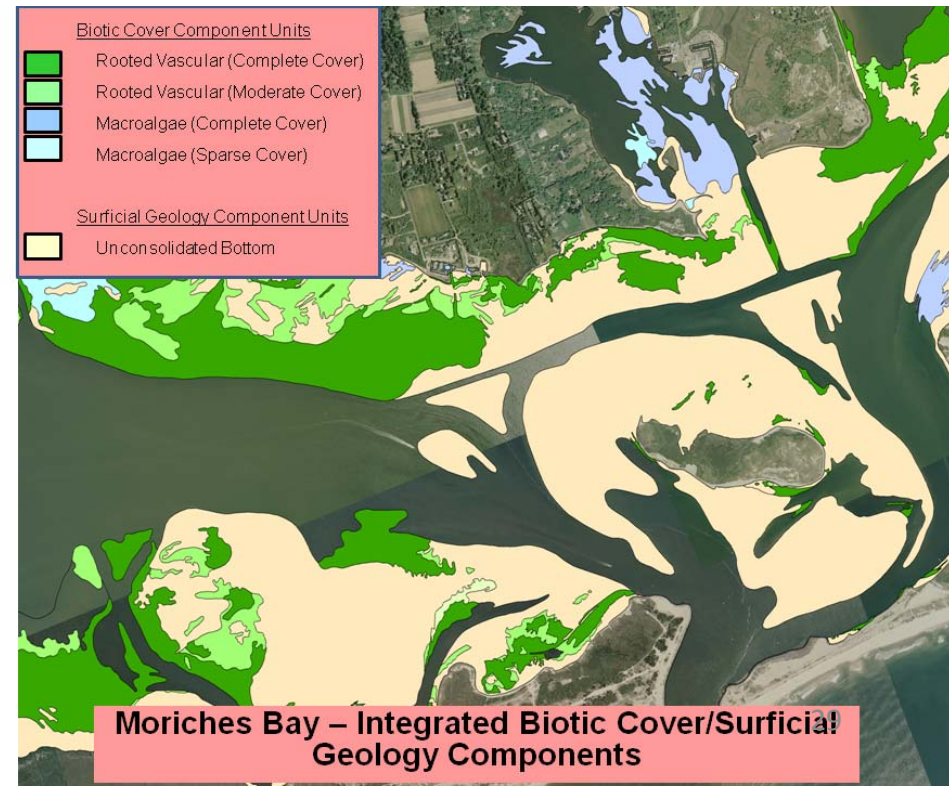


# Modifiers

- Consistent set of variables to further describe standard units
- Allows users to customize applications

*Examples:*

- Energy level
- Percent cover
- Bottom slope
- Turbidity



# Seagrass Bed Classification

## System, Subsystem, Tidal Zone

Marine Nearshore Subtidal

## Biotic Component (BC)

Class: Aquatic Vegetation Bed

Subclass: Saltwater Aquatic Rooted Vegetation

Biotic Group: Seagrass Bed

Biotope: *Thalassia testudinum* Herbaceous  
Vegetation

Modifier: Dense

## Substrate Component (SC)

Class: Unconsolidated Substrate

Subclass: Fine Unconsolidated Substrate

Group: Sand

## Geoform Component (GC)

Physiographic Setting: Coast

Geoform: Lagoon

**Water Column Component (WC):** Not used

**Ecoregional Component (EC):** Not used



Image: C. Moses

# Sediments and Soils

- FGDC *Soil Geographic Data Standard* originally included as part of CMECS 3.1
- Significant consternation voiced by public
- Switched to more commonly used marine sediment classifications--particle sizes:  
Wentworth (1922); mixes: Folk (1954)
- Text referencing soil standard developed by soils scientists working in coastal settings

