Classification of Gomishan Lagoon (Caspian Sea, Iran) by Using the Coastal and Marine Ecological Classification Standard (CMECS)

Yasaman Gandomi, Ahmad Shadi and Ahmad Savari

Khoramshahr Marine Science and Technology University, Iran

Abstract: There is an increasing need for classification of coastal and marine systems due to resource management and habitat conservation goals. This study was performed to apply CMECS (Coastal Marine Ecological Classification Standard) for ecologically classification of Gomishan wetland located in the south east of Caspian Sea. Using existing data sources, coastal survey, PAN image from HRVIR sensor of SPOT satellite, surface sediment sampling and GIS approach, habitats of the study area was identified and classified according to CMECS classifiers and modifiers. The habitat maps of the study area was procured for three components of CMECS (surface geology component (SGC), biotic cover component (BCC) and geoform component (GFC)). Appropriate codes for each unit were allocated according to CMECS III. Due to simple format of CMECS and compatibility with a variety of sampling methods and observational tools in addition to standardized, yet flexible classification lexicon it is appropriate to be used for identification of marine protected areas, essential fish habitat and areas of special concern for biodiversity throughout the Caspian Sea.

Key words: Coastal Classification · CMECS · Habitat mapping · Gomishan · Caspian Sea

INTRODUCTION

Coastal wetlands are among the most complex environments in the transitional zone located between terrestrial ecosystems and adjacent seas. In recent years coastal lagoons attracted more attention in recent years due to their biodiversity, fisheries, tourism and need to protection of this valuable environments. There is an increasing need for classification of coastal and marine system due to resource management and habitat conservation goals. Many classification systems have been developed for regional or local applications [1-3]. The Coastal Marine Ecological Classification Standard (CMECS) was developed with the input of over 40 coastal and 20 marine habitat experts to meet this need and provide a universally accepted standard classification for coastal and marine habitats [4].

The goal of CMECS is to classify ecological and habitat units within a simple standard format that uses a common terminology. CMECS provides a uniform protocol for identification and characterizing ecological units which is intended to allow monitoring, protection and restoration of unique biotic assemblages, protected species, critical habitats and important ecosystem components [5]. The domain of CMECS includes tidal splash zone in the coast to the deepest part of the oceans encompassing all continental and oceanic waters. CMECS uses a uniform code structure to incorporate any type of CMECS information into one code sentence that can be consistently applied. Code labels uniquely describe classification concepts and so the code sentence is searchable. The code allows easy updating, so that new types of spatial data can be added to existing code sentences for older data at locations [5].

Gomishan wetland which met the criteria of Ramsar Convention on wetlands is one of the most important ecosystems of south Caspian Sea. This study was performed to apply CMECS for ecologically classification of Gomishan wetland to adapt this system for use in the Caspian Sea which possesses unique characteristics and to create a standard database for management purposes.

MATERIALS AND METHODS

Study Area: Gomishan International lagoon is located in south eastern corner of Caspian Sea and stretching in north- south direction (Fig. 1). Gomishan Lagoon with 20000ha of area is limited to Gorgan River (Iran)

Corresponding Author: Yasaman Gandomi, Khoramshahr Marine Science and Technology University, Iran.
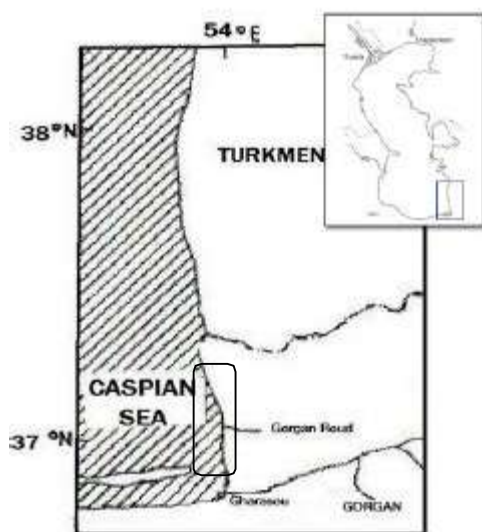
Fig. 1: The study area

from south and to northern branch of Atrak River (Turkmenistan) in north. In west a narrow ribbon like sand bar is separating Gomishan lagoon from Caspian Sea. Sea- wetland connection is through a number of inlets. The eastern border of this lagoon is still subjected to change due to fluctuations in Caspian Sea water level [6].

Gomishan lagoon is consisted of lowlands with fine silty to highly adhesive carbonated clay sand sediments. The depth of water is variable and depends on fluctuations in Caspian Sea water level. In spite of this variation, Gomishan lagoon is about 1m depth in most locations except of north west region which may reach to 2.5 m in depth [6].

Study Method: During an information-gathering phase for this project, we scoured existing data sources, consulted marine experts and made primary field visits to identify overall descriptions of coastal habitats then performed a detailed coastal survey to more precise habitat mapping and incorporated these units into CMECS structure.

Sampling was carried out in summer and winter, in 2009 for BCC and SFG components. The geomorphologic units which needed for geoform component GFC coding, are definable areas, so can be extracted from the satellite image. Physico-chemical variables (e.g. temperature, conductivity and pH) were measured in situ using a TDS tool. Surface

sediment samples (10 cm thick) were collected from each sampling site using a 5 cm diameter manually operated corer.

For habitat mapping a Geographic Information Systems (GIS) approach was used (ESRI, 2004, ArcGIS Version9.3). Data layers include surface geology component (SGC), biotic cover component (BCC) and geoform component (GFC). In order to making GIS maps for these three components of CMECS georeferencing of satellite image using Ground Control Points (GCP) was done.

PAN image from HRVIR sensor of SPOT satellite was used in order to procure source data and shape files of GIS and to draw more detailed habitat maps.

RESULTS

Different habitats with different SGC, BCC and GFC were coded after investigation of satellite images and probing the in-field collected data.

The maps of different habitats were prepared using these cods (Figs. 2, 4 and 5). From the view point of surface geology Gomishan lagoon comprises unconsolidated bottom (Code:UB) and its sediments divided into two groups: mud or silty and organic sediments with ES.0_s:UB.3 and ES.0_s:UB.4 codes, respectively (Fig. 2).

Coastal vegetation cover of the study area was classified according to CMECS and the results showed that the [Dens] percent coverage category is the most frequent category of the study area (Fig. 3).

On this basis of BCC classifiers three different environmental zones (emergent wetland, aquatic bed and faunal bed) were recognized and coded as [ES.0_b:EM.1], [ES.0_b:AB.3] and [ES.0_b: fb.2] (Fig. 4).

CMECS has divided geoformal components into natural and anthropogenic (man-made) categories. The Caspian sea belongs to natural geoform which has the characteristics of an enclosed sea, so that it receives the code: g:11.n.SInf. Gomishan lagoon inlets and sand bar have coded as g:11.g and g:11.m/f respectively. Dredged channel as an anthropogenic geoform has code as a-dg. Fig. 5 shows the coded station in respect to their geoform codes.
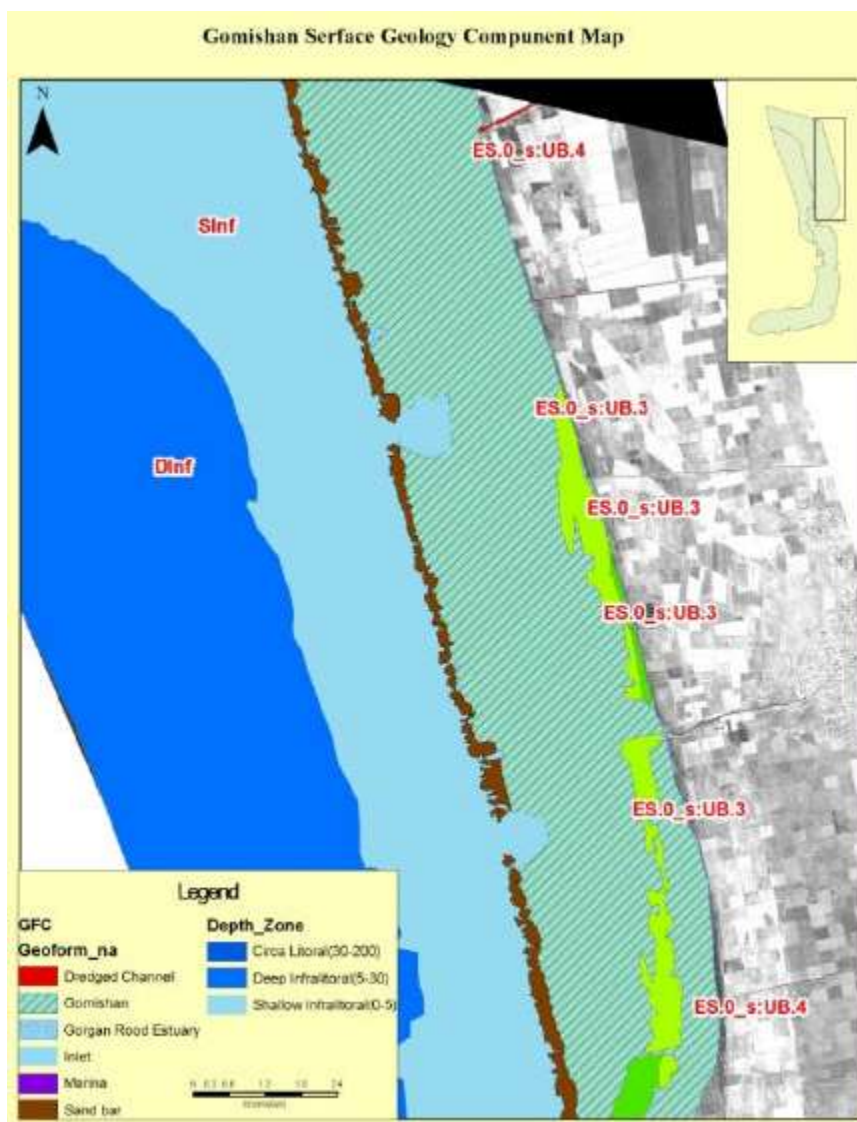
Fig. 2: Classified Map of Gomishan wetland Applying CMECS Surface Geology Component
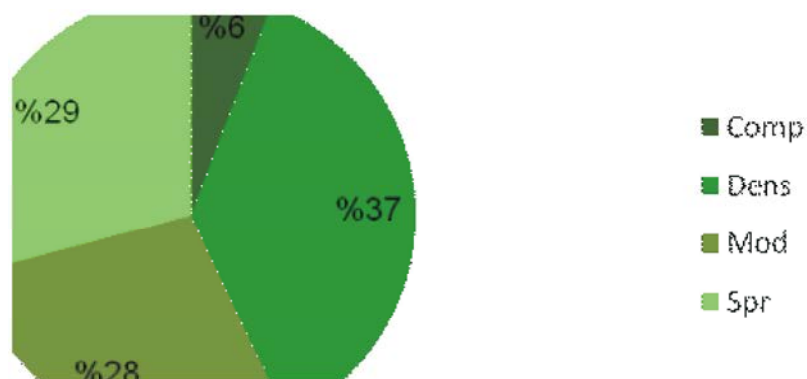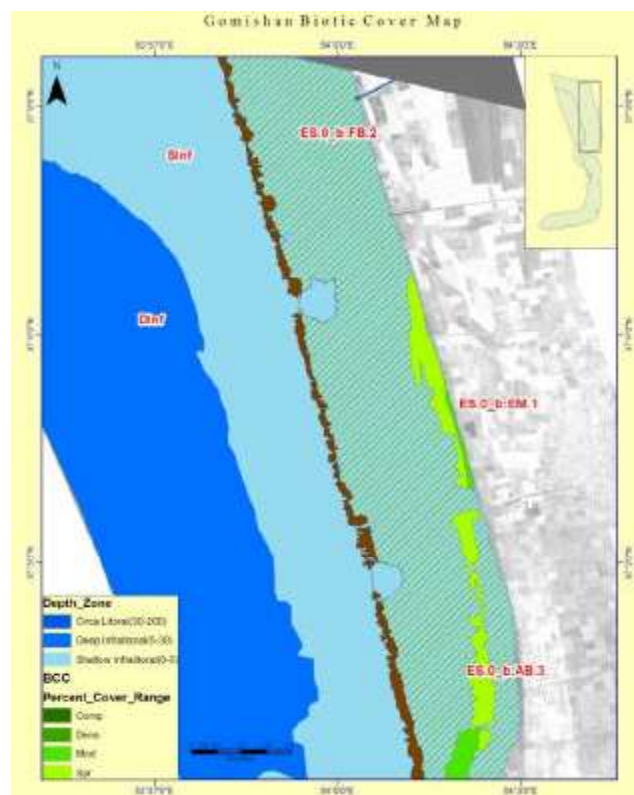

Fig. 3: Gomishan Percent cover Range

Fig. 4: Gomishan BCC Map

Fig. 5: Gomishan GFC Map

DISCUSSION

The urgency of the need for an ecological classification standard for coastal and marine systems increases as marine habitat hazards grow [7, 8] and as effectiveness of traditional classification and management ystems progressively disprove. CMECS is prepared to meet this challenge [9]. CMECS uses a simple format and is compatible with a variety of sampling methods and observational tools. In addition standardized, yet flexible classification lexicon makes it appropriate to be used for identification of marine protected areas, essential fish habitat and areas of special concern for biodiversity [10].

The components of CMECS represent a way of organizing information to describe different aspects of the coastal and marine environment. The units within each component are the various elements that make up the seascape and these units can be re-arranged in a variety of ways to categorize different types of aquatic habitat. This structure also allows the CMECS framework to be compatible with a variety of sampling methods and observational tools [5].

Coastal human population growth and the Caspian Sea level fluctuations are the main threads which Gomishan lagoon faces. In addition different sources of pollution inter the lagoon through river and Caspian Sea. Previous investigations have confirmed high ecological values of Gomishan wetland [11].

So this study supports ongoing resource conservation efforts and also enables researchers and managers to continue classification and mapping of the vulnerable environment of the Caspian Sea. The flexibility of this classification will support a variety of local and regional applications.

ACKNOWLEDGMENT

REFERENCES

1. Allee, R.J., M. Dethier, D. Brown, L. Deegan, G.R. Ford, T.R. Hourigan, J. Maragos, C. Schoch, K. Sealey, R. Twilley, M.P. Weinstein and M. Yoklavich, Mary, 2000. Marine and Estuarine Ecosystem and Habitat Classification. NOAA Technical Memorandum. NMFS-F/SPO-43.

2. Connor, D.W., J. Allen, N. Golding, K. Howell, L. Lieberknecht, K. Northen and J. Reker, 2004. The national marine habitat classification for Britain and Ireland, version 04.05. Joint Nature Conservation Committee. Available at: http://www.jncc.gov.uk/pdf/04_05_introduction.pdf.

3. Cowardin, L.M., V. Carter, F.C. Golet and E.T. LaRoe, 1979. Classification of wetlands and deepwater habitats of the United States. U.S. Fish and Wildlife Service. FWS/OBS-79/31 GPO 024-010-00524-6 Washington DC., pp: 103.

4. Madden, Christopher J., Dennis H. Grossman and Kathleen L. Goodin, 2005. Coastal and Marine Systems of North America: Framework for an Ecological Classification Standard: Version II. NatureServe, Arlington, Virginia.

5. Madden, C.J., K. Goodin, R.J. Allee, G. Cicchetti, C. Moses, M. Finkbeiner and D. Bamford, 2009. Coastal and Marine Ecological Classification Standard. NOAA and NatureServe, pp: 109.

6. Abdoli, A., B. Kiabi and R. Ghaemi, 1999. Wetland and river in ecosystem s of Golestan province. Iran ian Department of Environment.

7. Snelder, T.H., J.R. Leathwick, K.L. Dey, A.A. Rowden, M.A. Weatherhead, G.D. Fenwick, M.P. Francis, R.M. Gorman, J.M. Grieve, M.G. Hadfield, J.E. Hewitt, K.M. Richardson, M.J. Uddstrom and J.R. Zeldis, 2007. Development of an ecologic marine classification in the New Zealand Region. Environmental Management, 39: 12-29.

8. Valesini, F.J., M. Hourston, M.D. Wildsmith, N.J. Coen and I.C. Potter, 2010. New quantitative approaches for classifying and predicting local-scale habitats in estuaries. Estuarine,Coastal and Shelf Sci., 86: 645-664.

9. Keefer, M.L., C.A. Peery, N. Wright, W.R. Daigle, C. Caudill and S. Clabough, 2008. Evaluating the NOAA Coastal and Marine Ecological Classification Standard in estuarine systems: A Columbia River Estuary case study. Estuarine, Coastal and Shelf Sci., 78: 89-106.

10. Madden, Christopher J. and Kathleen L. Goodin, 2007. Ecological Classification of Florida Bay Using the Coastal Marine Ecological Classification Standard (CMECS). NatureServe, Arlington, Virginia.