

## Coastal and Marine Ecological Classification Standard (Cmecs - Version Iii) in Southern Part of Caspian Sea from Nowshahr to Ramsar

Hamed Manuchehri<sup>1</sup>, Fereydoun Owfi<sup>2</sup>, Arashjoghtae<sup>3</sup>

<sup>1,3</sup> Islamic Azad University of Babol, Fisheries Department

<sup>2</sup> Fisheries Research Institute of Iran

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### ABSTRACT

The purpose of this research is to improve the understanding of the biological and physical characteristics of the southern shore of the Caspian Sea from Nowshahr to Ramsar. Optimal management of the Caspian coast is hindered by the lack of environmental statistics and information in plans and projects for the area. Effective administrative and research in this area is also limited. The region of study was from Nowshahr to Ramsar beach that like other beach areas in the northern Iran has a strong tourism industry. In this study the CMECS system was used to classify 127 kilometers of the Caspian Sea coastal zone. Needed data for this study was collected over a 2-year period from summer 2010 to summer 2012 at 25 stations in the spray zone of the beach. This study is based on library studies, field research, new data collection and classification using the Coastal and Marine Ecological Classification Standard (CMECS). The results are organized into two parts of the CMECS components; the Biotic Cover Component (BCC), and the Surface Geology component (SGC). Three kinds of sediment surfaces were identified: a sand surface (29.28 km), a cobble-gravel surface (24.20km) and an anthropogenic surface (69.13km). Dominant organisms in this region are attached ephemeral macro algae and small surface-burrowing fauna such as Gamaridae Cardidae communities. At the end of the analysis four habitats with eight CMECS units were identified.

**KEYWORDS:** Biotope, Standard Classification, BCC, SGC, Caspian Sea.

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### INTRODUCTION

A coast is a region where sea meets land [1] and is one of the most sensitive ecosystems on the planet. Many plant and animal species live in this region. Despite occupying only 15% of the land, more than 60 percent of the world population lives in this region. In recent years the populations living in the coastal zone region are increased [2]. Beach environments contain a variety of habitats and form one of sensitive ecosystems along the coast. For this reason they receive great interest from biological scientists the vulnerable coastal region is exposed to pollutants originating in land and sea and faces the potential threat that processes on shore will have a direct impact on marine processes and resources[3]. Without complete maps of the marine environment and a standard for classifying of habitats, resource management and protection of productive and sensitive habitats is delayed and it is impossible to assess the relative abundance of different habitats. To ensure sustainable development of the coastal region and protect and manage soil, water resources, agriculture, and fisheries in the region, it is necessary to identify all natural features and to classify and process these data [4]. The primary goal of the classification is to create an overall vision of the extent and distribution of major ecosystem types, monitor their changes over time, and gather the most important information that currently limits manager's understanding of the ecosystems [5]. Various habitat classifications are being used by managers but none of them is accepted by the whole world [6]. An important model for classifying coast and marine is CMECS that is based on existing classification systems and is a synthesis of them [7]. In this research the southern part of Caspian Sea from Nowshahr to Ramsar is classified using the CMECSIII [8].

### MATERIAL AND METHODS

The region of study consisted of 127 km of southern part of Caspian Sea. This area was chosen based on the variety of features and characteristics present in the area and their effects on the coastal geomorphology. For convenience, the region was divided into three sub-regions with a total of 25 stations selected for sampling. Once the stations were chosen, data on each station was gathered through several sources.

Information about region's status (biological and geological) was collected through internet searches and a review of library and research projects, in order to achieve the following:

- The range of environmental parameters such as salinity and water temperature,
- The distribution, abundance, and diversity of coastal aquatic species,
- The regional climate,
- Regional and geographical information.

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\*Corresponding Author: Arashjoghtae, Islamic Azad University of Babol, fisheries department  
Email:Arash.joghtae@gmail.com

Field data was collected to supplement the information obtained through the internet and library searches.



Figure 1. Sub region 1- Nowshahr to Sang e Kileh River



Figure 2. Sang-e Kileh River to Nashtroud

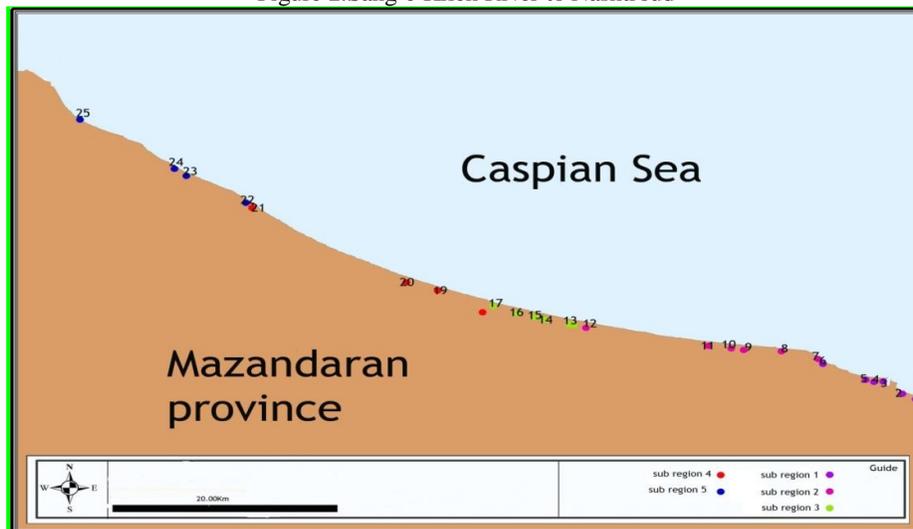


Figure 3. stations (habitats) and their position in the region

**Field operation**

With Google earth software the coast was used to analyzed and plan the field operations. Areas where the geomorphology and ecosystem appeared to have changed were marked on the map. Then sampling stations was chosen using a selective sampling approach [9]. Field observations (ground photographs) where made and the data from each station were recorded in a questionnaire. These data included the station coordinates, ecosystem

type, dominant fauna in each station, residential centers, anthropogenic structures (like port, sea wall ...) and other descriptive information.

Table 1. Dates of field operation

	Date of field operation
First operation	December 2010
Second operation	March 2011
Third operation	June 2011

**The sampling method:**

Sampling was done for each station in 3 seasons, late fall, late winter and early summer to understand effect of seasons on Dominant organisms in the region. Observations at each station included examining the gradation of sediments in the substrate and also identifying them macro-benthos using the identification key in the Atlas of Caspian Sea Invertebrates [10]. GPS was used to navigate to each intended station each station. Upon arriving at the station photos were taken looking in all directions from the site. In this way all the area was surveyed. Photos were taken for all the stations. To classify this region into BCC and SGC units the following actions were done.

The amount of sediment sampled for grain size analysis was based on the area occupied by that sediment type. That is in areas where there was 1km of fine sediment beach and 10 km of cobble gravel beach 10 kg of cobble/gravel sediment was analyzed and in the sandy shores only 1 kg of sand was analyzed. This sediment was put in a standard filtering chamber. In the top chamber there is a large hole which drains into the chamber below. The hole in that sieve is finer than the first and so the series of chambers continues with each hole allowing only finer sediments to pass to the next level. There was no hole in the final chamber so no sediment was lost. After filling the filter with sediment the filter was put on a shaker. The amount of sediment that remained in each chamber was then weighed. The percent of each sediment type in each chamber was measured. In this study chambers with numbers 200 , 100, 70, 52, 4, 3.8, 3.4 and 1.2 in the standard of ASTM was used and the sediments was aggregated by this method [11].

**RESULT**

In this stage the collected data was classified using SGC and BCC components of CMECSIII. The classification was done based on the latest version of CMECS from 2009. Both coastal and marine habitats were classified. There are a variety of species in the splash zone of Caspian Sea. The identified organisms are listed in the following table.

Table 2. Organisms observed in southern part of Caspian Sea beach (from Nowshahr to Ramsar) within the spray zone

Aquatic plants	Crustaceans	Mollusks
Attached ephemeral macroalgae – Azola- mixed drift macroalgae	Gammaridae communities	<i>Cardidae communities</i> <i>Cerastodermalamarcki</i> <i>Abraovata</i>

Through the analysis of satellite information and field data the profile of the coast was classified into 4 habitats; 69.13 km of the coast is anthropogenic substrate, 29.28 km is sandy coast, 24.20 km is cobble/gravel, and 4.2 km is mixed shore.

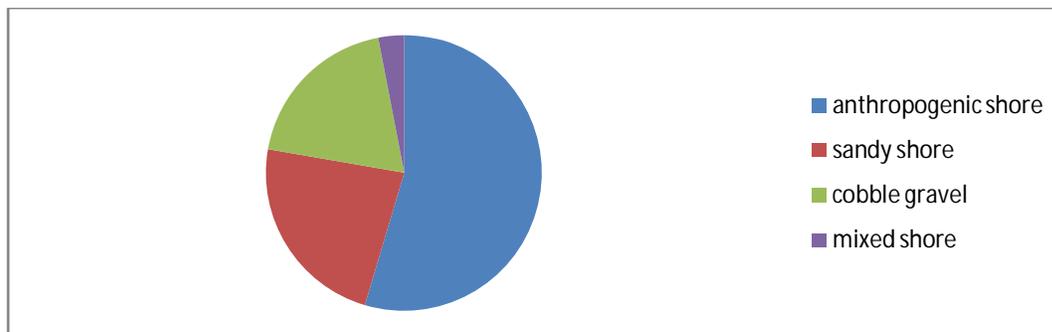


Figure 4. Areas of the four coastal SGC types for the Caspian Sea from Nowshahr to Ramsar in percent. 2011 As a final step, BCC units were added to the four substrate types resulting in eight CMECS habitats.

Table 3. The codes of CMECS and their mean in study area (Noshar to Ramsar)

1	La.2-s:US.1-b:AB.1.ae	Sandy shore with attached macroalgae
2	La.2-s:US.2-b:FB.3.sb	Sandy shore with small burrowing fauna
3	La.2-s:US.2-b:FB.3.cb	Sandy shore with clam bed
4	La.2-s:RS.2impd-b:AB.1.ae	Anthropogenic rock shore with attached macroalgae
5	La.2-s:US.1-b:FB.3.cb	Cobble gravel with clam bed
6	La.2-s:US.1impd-b:AB.1.de	Cobble gravel with drift algae
7	La.2-s:US6.impd-b.FB.3.sb	Mixed shore with small surface burrowing fauna
8	La.2-s:US6.impd-b.FB.3.cb	Anthropogenic mixed shore with clam bed

Table 4. The CMECS codes belong to the region (Nowshar to Ramsar)

Station	CMECS code	
1	First Nowshahr	LA.2-s:US1impd-b:AB.1.de
2	Mashalak Estuaries	LA.2-s:US1impd-b:AB.1.de
3	Hosseini Beach	LA.2-s:us2-b:FB.3.cb LA.2-s:us2-b:FB.3.sb
4	Kourkoursar Estuaries	LA.2-s:US2-b:FB.3.sb LA.2-s:us2-b:FB.3.cb
5	Radio Darya	LA.2-s:RS2.impd-b.FB.3.cb LA.2-s:RS2.impd-b.FB.3.sb
6	Next Radio darya	LA.2-s:US.1-b:AB.1.de.
7	SangeKileh estuaries	LA.2-s:US.1-b:AB.1.de.
8	NamakAbroud	LA.2-s:US.1-b:AB.1.de.
9	Namakabroud estuaries eastern part	LA.2-s:US.1-b:AB1.ae
10	Namakabroud estuaries Western part	LA.2-s:US.1-b:AB1.ae
11	Salman shahr beach	LA.2-s:US.6-b:FB3.cb LA.2-s:US6.impd-b.FB.3.sb
12	Klarabad Beach	LA.2-s:US.1-b:AB1.ae
13	Jamshidabad Beach	La.2-s:US2-b:FB.3.cb LA.2-s:US2.impd-b.FB.3.sb
14	Asbe chin estuaries	La.2-s:RS2impd-b:AB.1.ae
15	Amrajroud estuaries	La.2-s:US.2-b:FB.3.sb
16	Kazemroud estuaries	La.2-s:US2impd-b:FB.3.cb LA.2-s:US2.impd-b.FB.3.sb
17	Nashtroud estuaries	LA.2-s:US.1-b:AB.1.ae
18	Nashtroud beach	LA.2-s:RS.2impd-b:AB1.ae
19	7 Kilometers after Abbasabad	LA.2-s:US.2-b:AB.1.ae.impd
20	Tonekabon Government beach	LA.2-s:US.6-b:fb3.cb LA.2-s:US6.impd-b.FB.3.sb
21	Eastern part of shiroud beach	LA.2-s:US.6-b:fb3.cb LA.2-s:US6.impd-b.FB.3.sb
22	Western part of shiroud beach	LA.2-s:US.2-b:FB.3.cb LA.2-s:US2.impd-b.FB.3.sb
23	Chalakroud Estuaries	LA.2-s:US.1
24	Ramsar national park beach	LA.2-s:US.2-b:FB.3.cb LA.2-s:US2.impd-b.FB.3.sb
25	Ramsar beach	LA.2-s:US.1-b:FB.3.cb LA.2-s:US1.impd-b.FB.3.sb

Previous studies have also used the CMECS classification in some parts of southern beaches of Iran such as North Qeshm Island [12], and the southern part of Qeshm Island [13]. Additional research has been done at Mahshahr Bay and Moses Port [14] and in the Guatr Gulf and Chabahar [15]. All of these studies have been done on coasts that fall within the Marine System in CMECS and their salinities are 30 PSU or above; however the Caspian Sea actually is a lake. In addition, the Caspian coast from Nowshahr to Ramsar is highly affected by man-made structures like sea walls, port buildings, and tourism facilities. These factors have affected the natural structure of the coast from Nowshahr to Ramsar, while Qeshm Island is less affected by man-made structures. In Mahshahr Bay and Moses Port man-made structures are more abundant. The presence of fishing piers, beach structures, buildings, residential neighborhoods, an oil company, derelict ships, and docks show that these coasts are more similar to the southern part of Caspian Sea from Nowshahr to Ramsar.

Another issue that make this study differs from previous work is that the variety of species in North Qeshm Island [12] and the southern part of Qeshm Island [13] as well as Mahshahr Bay, Moses port [14], Guatr gulf, and Chabahar[15] is greater than in this paper's study zone. Rahimi (2011) reported 40 habitats for north Coast of Qeshm Island and Ansari (2011) reported 60 habitats for southern part of Qeshm Island while in this study only 8 habitats were found. In the sandy shores of south and north Qeshm Island there are four types of fauna. Surface Epifauna, Attached Epifauna, Mobile Epifauna and Infauna[12]; [13]. However, in this study only infaunal organisms like Gammaridae communities and Cardidae Communities were found. Also in some parts of North Qeshm island [12], the southern part of Qeshm Island [13], the southern coast of Systan and Baluchistan provinces, as well as on the Oman sea [15] mangrove forests and seagrasses are dominant but these habitats are not found in the southern Caspian Sea. One habitat found in both the northern and southern coasts of Iran was the tidal zone of northern part of Qeshm Island (east station of Laft) which is similar to certain places on the Caspian Sea coast (Nowshahr, Salman shahr, Asbechin river estuary Kazemroud river estuaries, and Tonekabon and Ramsar). Cardidae communities are dominant in all of these regions.

This study identified two CMECS geomorphic region sin common with the work of Ansari (2011). The first is sandy beach and the second is rock shore (boulder) but in this study rocky shore means breakwaters, walls and dams that were built by humans to prevent of rising sea water, whereas the rocky shores reported by Ansari were natural. So the Impounded suffix was added as a modifier to CMECS codes at these regions of Caspian Sea where human activity has interfered in this region. Anthropogenic regions include various structures. One of the biggest man-made structures in the region is the Nowshahr port. From coast of Chalous to the west that profile of coast changed to Beach villas in most of these villas that built near sea there is breakwater and sea walls to prevent rising water [16], From Nowshahr to Chalous there are many recreational sites used by the public and in these regions there are many structures built in and along the water.

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