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# First record on the distribution and abundance of three sponge species from Hormoz island, Persian Gulf-Iran

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**ABSTRACT: Persian Gulf is one of the largest covert of aquatic animals. Different types of sponge species are existing in Persian Gulf which have important ecological role in marine ecosystem. In this study three species of sponges including *Cliona celata, Cliona vastifica* and *Niphates furcated* were identified for the first time by using spicules (Silica deposition in sponges). The samples were collected by scuba diving from tidal and sub tidal habitats in five stations at 0, 5, 10, 15 and 20m depths sites from Hormuz island in July 2011 and February 2012. The identification of sample was done based on scanning optical microscope on skeletal slides, dissociated calcareous and siliceous spicule mounts by the keys of Sponguide, John N. A. Hooper. The main scope of this investigation was to examine distribution of these spongs by depth on thier abundance in this area.**

**Key words:** Sponge identification, Spicule, Demospongiae, Depth, Season.

## INTRODUCTION

Sponges (phylum Porifera) are multicellular animals (Barnes 1987) although they are withstand being completely pulled apart until all of the cells are separate, which can re-form a sponge. Unlike true colonials, the cells can not live indefinitely on their own, but this re-formation ability is still just a small step above colonialism (Campbell and Dawes 2005). At least 15000 species are classified into the phylum Porifera (Manconi and Pronzato 2002), which are divided into three classes, the Demospongiae, containing the majority of extant species, the Hexactinellida, and the Calcarea, sponges inhabit a wide variety of marine and freshwater (Barnes 1987).

Classification and identification of sponges are inherently difficult, because colour, shape and size often variable within single species (Bell and Barnes 2000), but internal skeletal structures in sponges, mineral spicules and the architecture of the skeleton, have been as useful as macroscopic morphological characters. The taxonomy of sponges is so essential as they play an important role in marine ecosystem and marine biotechnology.

In spite of being sessile, they play a consequential role in marine ecosystem (Bell and Barnes 2000). Sponges are among the most abundant and diverse sessile animals in many hard substratum marine habitats, including coral reefs, rock walls and caves (Hooperand van Soest 2002). Sponges appear to be predated by selected groups of marine animals, such as several fishes, turtles, sea urchins and sea stars, some kinds of gastropoda and flat worms (Van Soest 1994). They are forming complex structures on the sea floor, which provide habitat for many fish and invertebrate species (Hooper and Kennedy 2002). Sponges are also great interest for the natural products as they contain a large variety of unique bioactive compounds (Faulkner 2002 and Joseph and Sujatha 2011).

Sponges have an important energy coupling between the benthic and pelagiccommunities, (Duckworth *et al* 2006). The abundance and distribution patterns of sponges can be influenced by water flow and depth (Wilkinson and Evans 1989; Robertsand 1996), larval dispersal and recruitment patterns (Maldonado and Young 1996), predation (Dunlap and Pawlik 1996), light intensity (Wilkinson and Trott 1985) as well as substrate and habitat type (Reiswig 1973; Adjeroud 1997). The influence or impact of each factor varies between sponge species, often restricting species to a specific area or depth and exacerbating heterogeneity in community structure between and within reefs orislands (Duckworth *et al* 2007).

One of the best habitat for sponges in the world is Indian ocean (Barnes and Bell 2002), The Persian Gulf, in Southwest Asia, is an extension of the Indian ocean. The Persian Gulf is considered to have the highest concentration of marine biodiversity because of extensive coral reefs. Persian Gulf is home to many islands, one of them is Hormuz island. It is located in the Strait of Hormuz, but distribution and taxonomy of sponges in Persian Gulf and the islands not received widespread attention. Although some notable works have done in Hengam and Faror islands but just 8 different species were reported (Sadeghi *et al* 2008; Nazemi *et al* 2010). This study is the first report of identification and distribution of sponges in Hormuz island, Persian Gulf, Iran, which is to examine distribution of them by depth on sponge's abundance in this area.

## MATERIALS AND METHODS

*A. Sponges sampling*

Sponge species were photographed and sampled by Omid Ahmadzadeh and Melika Nazemi by scuba diving from tidal and sub tidal habitatsin on July 2011 and February 2012 by 5m belt transects which they were located at 0, 5, 10, 15 and 20m depth sites at five locations of Hormuz island, at 27° 4? 0? N, 56° 28? 0? E. It has an area of 42 km2 in the Strait of Hormuz (Fig 1). Number of sponges specimens of each species were recorded in each depth in locations, then the sponges was frozen as soon as possible and transferred to the laboratory to identify the sponge species.


**Fig. 1.** Geographical location of sampling area in Hormuz island.

*B. Spicule preparation*

Calcareous spicules for Light and Scanning Electron Microscopy. Small fragments of 'tissue', including fragment from both the surface and deeper parts of the sponge, were placed in small ehrlenmeyer flask. A small quantity of active bleach (sodium hypochlorite) was added to the fragment, and after a short period of time the organic components dissolve leaving only the mineral skeleton. The bleach has been carefully diluted and eventually washed out tissues several times. Finally, clean spicule suspensions were aspirated and pipetted onto a glass slide, ethanol allowed to evaporate and mounted (Hooper 2000).

Siliceous spicules for light and scanning electron microscopy (SEM). Fragments of sponges were placed in flasks, directly on glass slides. Several drops of acid nitric were placed on the fragment, gently heated over a flame until bubbling, and repeated until all organic matter was digested. Siliceous spicules were bonded directly onto the substrate by this technique, which they were made useful for both light and scanning electron microscopy (Hooper 2000).

After preparing microscopic slides of spicule from both holotype and paratype were obtained by dissolving sponge fragments in boiling nitric acid, we captured images by using an Olympus CX21 light microscope and a Coolpix 5200 digital camera attached to the microscope. For SEM analysis, cleaned spicules were spread onto glass cover slides mounted on SEM aluminum sample stubs and subsequently sputtered with gold using an EMITECH K500 sputter coaterscanning electron micrographs were taken using a Leo 440i SEM.

Analysis sponges abundance data. Sponge abundance (percentage cover and number of sponges) was compared between site and depth in different season, summer and winter. At first statistical data were controlled by Kolomogrove- Smirnov after that General Linear Model (GLM) by One- Way ANOVA and Duncan test were used to examine different in sponges abundance data among depth and season.

## RESULTS

Class: Demospongiae
Order: Hadromerida
Family: Clionidae Orbigny, 1852
Genus: Cliona Grant, 1826
Type species: Cliona celata Grant, 1826

**Description:**

**Shape (Fig. 2):** An excavating species which produces a massive or 'raphyrus' or 'gamma' stage. These sponges are consistency firm with tough outer layer, compact. The whole sponge shows a noticeable decrease in size when removed from the water. The oscules become a lesser extent. They contract to such an extent that they become almost invisible out of the water.

**Colour:** Yellow, becomes darker out of water, and in alcohol goes brown discolouring both the alcohol and the specimen labels.

**Oscula:** Largeoscules with raised rims are found along the tops of ridges. Delicate, thin walled, retractable inhalentpapillae, Theoscula are not noticeable when out of the water as they close and retract below the surface.

Spicules (Fig. 2a): Megascleres are tylostyles; densely and irregularly arranged. The heads have swellings in most spiculesmicroscleres are absent.

**Distribution (Fig. 3):** Common in deep water, under 10 meter depth, and analysis variance shows signification relation to depth and season.

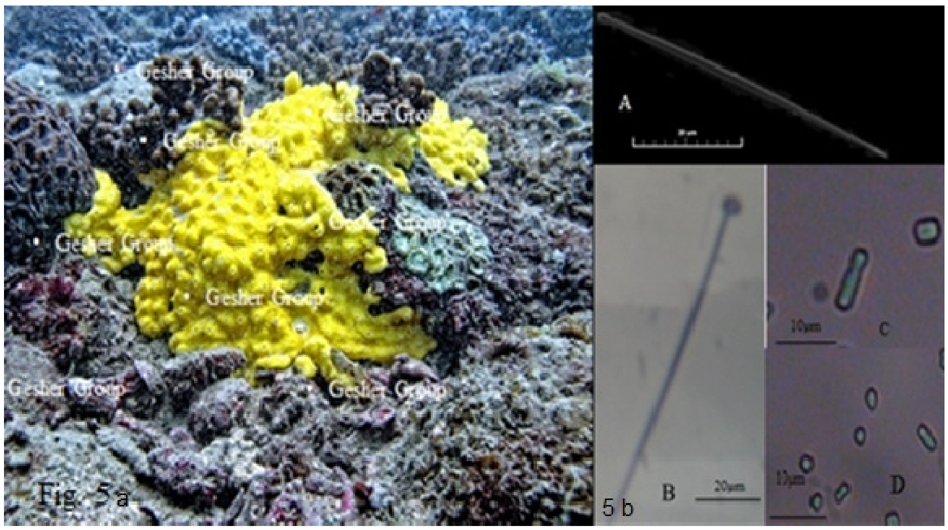


**Fig. 2.** *Cliona celata* (Photo by Omid Ahmadzadeh, Hormuz island, 2012)(a), spicules in SEM (A), Light microscope (B, C and D) of Cliona celata (b).

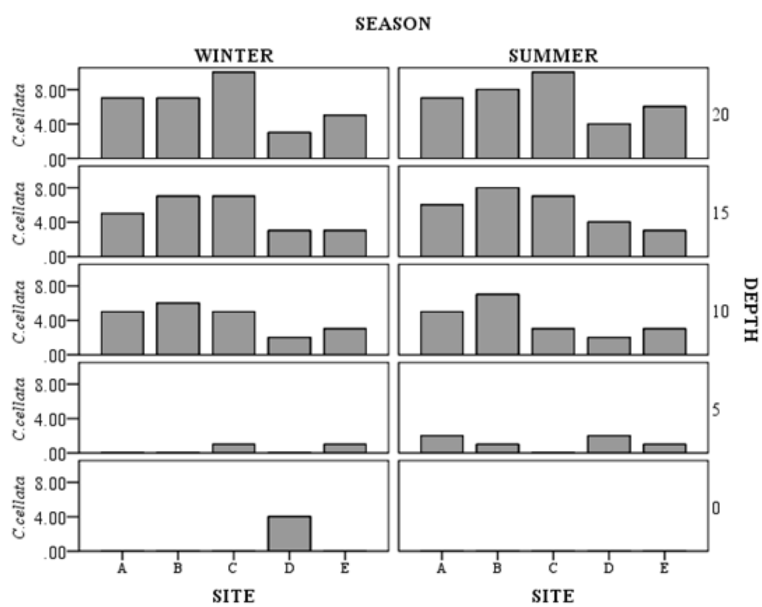


**Fig. 3.** Abundance of Cliona celata located at 0, 5, 10, 15 and 20m depth sites in five locations of Hormuz island in two seasons.

Class: Demospongiae
Order: Hadromerida
Family: Clionidae Orbigny, 1852
Genus: Cliona Grant, 1826
Type species: Cliona vastifica Hancock, 1849
Description:
Shape (Figs 4): The boring sponges which they are attached to calcium carbonate substrates. These sponges are similar to C. celata; they decrease in size when removed from the water.
Colour: Orange-red, becomes lighter out of water, and in alcohol goes red brown.
Oscula: These openings may be arranged irregularly on the surface or distributed in a linear and reticulates pattern. The oscula are not noticeable when out of the water as they close and retract below the surface.


**Fig. 4.** *Cliona vastifica* (Photo by Omid Ahmadzadeh, Hormuz island, 2012).

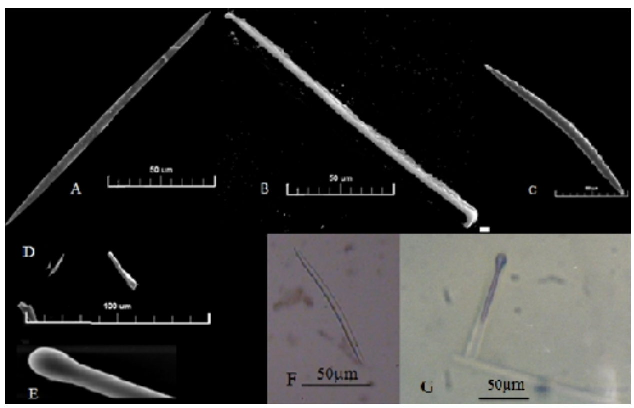


**Fig. 5.** Spicules in SEM (A -E), Light microscope (FandG) of Cliona vastifica.

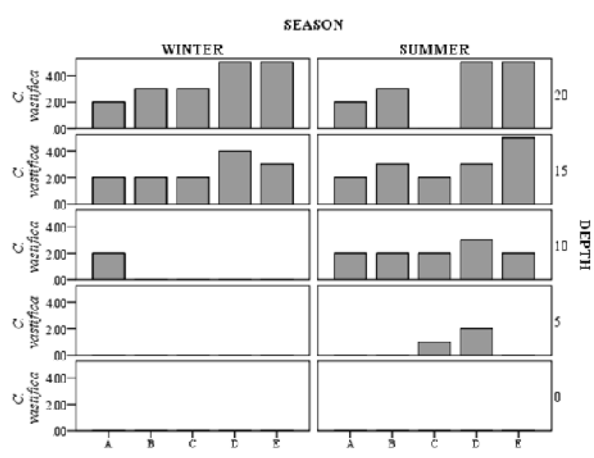


**Fig. 6.** Abundance ofCliona vastifica located at 0, 5, 10, 15 and 20m depth sites in five locations of Hormuz island in two seasons.

**Spicules (Fig. 5):** The spicules are tylostyles, straight and sharply pointed. Heads well developed and sphericaled. Oxeas and microspined are in varying degrees or even smooth.

Distribution(Fig 6): Common in deep water, under 10 meter depth, and analysis variance shows signification relation to depthand season.

Class Demospongiae

Order: Haplosclerida

Family: NiphatidaeVan Soest, 1980

Genus: Niphate Duchassaing & Michelotti, 1864

Type species: Niphatesfurcate Keller, 1889

Description:

**Shape (Fig. 7):** Branching growth formswith an optically smooth surface

Colour: Light brown, becomes darker out of water, and in alcohol goes light brown.

Oscula: These members are distributed irregularly on the surface.

**Spicules (Fig. 8):** The calcareous spicules are not identified, but the siliceous spicules are identified. The siloceus spicules are so gigantic and high, the spicules are monoaxon with length of 15-125 µm.

**Fig. 7.** Niphates furcate(Photo by Melika Nazemi, Hormuz island, 2012).

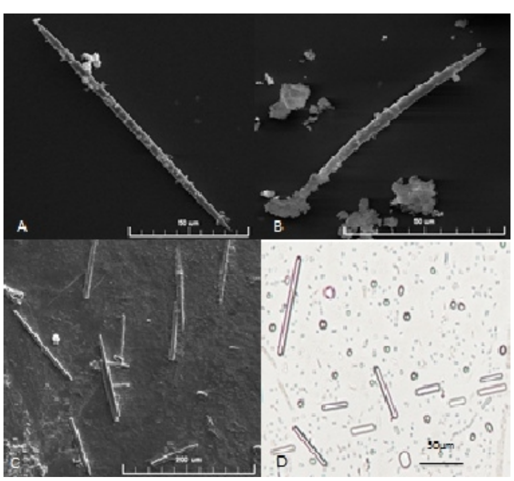


**Fig. 8.** Spicules in SEM (A-C), Light microscope (D) of Niphates furcate.

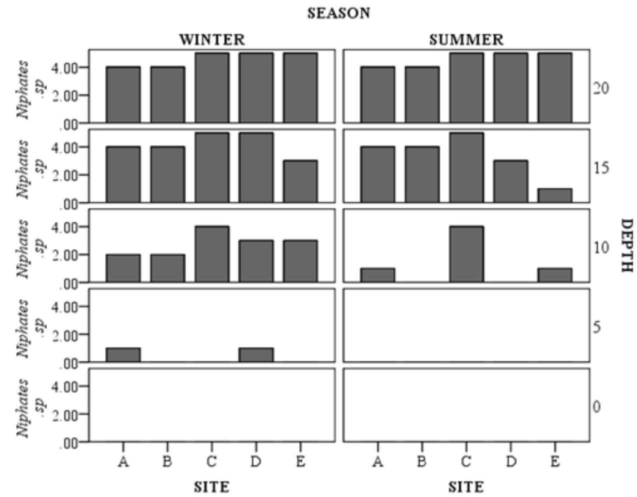


**Fig. 9.** Abundance of *Niphates furcate* located at 0, 5, 10, 15 and 20m depth sites in five locations of Hormuz island in two seasons.

**Distribution (Fig. 9):** Common in deep water, under 5 meter depth, and analysis variance shows signification relation to depth and season.

## DISCUSSION

This study is the first investigation on distribution and abundances of the sponge species in the Hormoz island ( Persian Gulf, Iran). Based on confirmed identification keies , three species of sponge fauna were detected from Hormoz island offshores- including *Cliona celata, Cliona vastifica* and *Niphates furcated* species. Traditionally, the sponges has been identificated based on their morphological characters. The skeletal architecture and spicule composition have been the particular importance characters for this purpose (Hooper 2000). This study showed that abundance of sponge species in our research (five locations of Hormuz island) would be increased from 15 to 20m depths. Also analysis variance showed significant differences for distribution of *C. cellata* and *N. furcated* changed based on various depths during winter and summer (P< 0.05) on the other hand we did not-record any significant differences for *Cliona vastifica* (P> 0.05). The abundance of studied species are shown based on region and depth during summer and winter in figures 3, 6 and 9. Distribution of *N. furcated* were significantly different during summer and winter in five studied regions (P< 0.05). These records confirmed that the seasons influence on their abundance, but this was not significant for *C. cellata* and *C. vastifica* species. (P> 0.05). Bell and Barnes (2000) confirmed that the two major factors for distribution and living the spongs are depth and location area. It is cleared that sponges are the important component for benthic populations in terms of biomass and diversity ( Reiswig 1973; Dayton *et al* 1974; Schmahl 1990).

They can interact with other community in several important ways for providing of food (Ayling 1981; Wulff 1994) or shelter (Costello and Myers 1987; Duffy 1992) for other organisms. They are filter feeders (Bergquist 1978; Rützler 1990) and also can filter and extract the phytoplanktons to the possible detriment for the other suspension feeding organisms (Reiswig 1971; Pile *et al* 1996, 1997; Duckworth *et al* 2006).

The biological and physical factors such as degree of physical turbulence, light transmittance, predators and sedimentation can affect on variation in sponges abundance . The first two factors have negative relationship with the depth (Wilkinson and Cheshire 1989). This is confirmed that water turbulence such as wave action can be considered as a negative factor for sponge growth in shallow water habitats (Palumbi 1984; Wilkinson and Evans 1989) . Also sunlight radiation may also affect sponges distribution. The other nessassaries like food and oxygen are prepared by water circulation and removes wastes and additional sediments (Harrison 1974). In addition, few sponges can withstand strong turbulence and sponge populations increase markedly below 10 m where effects of turbulence are attenuated (Wilkinson and Evans 1989). Also, Some species exhibit broad tolerance ranges for water chemistry parameters and thus would be expected to be widely distribution. Others, however, are more limited in distribution due to their narrow ecological tolerances (Harrison 1974; Frost 1991; Okland and Okland 1996).

It is clear that spongivorous fishes can limit the distribution and abundance of some sponge species. In shallower waters, fish and turtles feed on sponges while these predators are not apparent at greater depths. Hawksbills turtles are important components of healthy coral reef ecosystems and are primarily spongivorous in the Caribbea (Meylan 1988). *Eretmochelys imbricata* are major predators of sponges in the Persian Gulf (Sadeghi *et al* 2008) that this species exists in shallow water habitats of some Islands of Persian Gulf, such as Shidvar, Qeshm, Hendourabi, Lavan and Hormoz (Devin *et al* 2008; Mobaraki 2006; Nabavi *et al* 2012). This can be a reason for high abundance of sponges at 15-20 m depths on Hormoz island. The highest sponge population in variable depth is in deeper water where levels of water turbulence and radiation are lower (Wilkinson and Evans 1989; Diaz *et al* 1990; Schmahl 1990; Roberts and Davis 1996; Duckworth *et al* 2007). Ultraviolet (UV) radiation is apotentially known as damaging factor (Jokiel 1980) showed that UV light could inhibit the growth of some sponges within the first 10 m depth, but, growth did occur where the sponges were protected from UV light.

Seasonal variation in ambient water temperature can influence the distribution and survival of sponges. For example, temperature has been considered to explain medium and large scale distribution patterns in sponges. Also, temperature can affect physiological processes during all their life stages (Reid 1968; Vacelet 1973, 1979); Moore 1908; Battershill and Page 1996). Food abundance in various-seasons and periodic investment of metabolic resources in reproduction may affect the abundance of sponges in different seasons.

According to results of present study, maximum distribution in stations B, C; D, E; D and C, D, A are the suitable stations for *C. cellata, C. vastifica* and *N. furcated*, respectively. Additionally, this study showed that two depth including 15 and 20 m are the best regions for sponge habitat and the other sampled species. Also the maximum sponges abundance observed in the mentioned depths are agree with some other records which reported by researchers regarding to the sponges abundance in 15 and 20 m depths (Sadeghi *et al* 2008; Wilkinson and Evans 1989).

This study suggest that season, water flow and depth can be considered as the main environmental factors which could influence on sponge farming and distribution.

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