Biodiversity and distribution patterns of coral reef ecosystems in ROPME Sea Area (Inner part: Persian Gulf -Iranian waters)

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Abstract

The Persian Gulf is northern part of the ROPME Sea Area (RSA), and is semi-enclosed shallow sea which located in subtropical climate. Measuring is 1000km in length, varying in width 60-340km, and average depth is about 35m and maximum depth is 105m. This research was carried out during 2005-2010 for reviewing the corals status and determination of coral reef habitats distribution in the Persian Gulf. Coral reef sites and patches were determined by field surveys and direct observations. Also, the violet-blue bands of Land Sat satellite images were used for seaward extent of coral reefs. Sampling sites covered by SCUBA, Manta Tow technique and Transect survey base on Reef Check and GCRMN standard method. Coral reefs habitats in Iranian coastal areas are found in two types and structures which observed around seventeen islands fringing coral reefs and two limited patches of coral reefs around Nayband Bay. Widest coral reef cover observed around Khark, Kharko and Larak Islands. Due to extremes of water temperature and salinity that are close to the physiological tolerance limits ,coral reefs diversity and coral species composition in this area is similar and close to Indo-Pacific eco-region coral communities. In comparison, species richness of hard corals in the Gulf of Oman; with about 70 species is more than the entire Persian Gulf. Totally, 36 species belonging to 9 family and 20 genera of hard coral has been reported and documented. Among identified coral species, Porites and Acropora were the dominant and Faviidae family was the most diverse.

Keywords: Coral reefs, Biodiversity, Distribution patterns, Persian Gulf

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Introduction

The coral reefs ecosystems of the Persian Gulf - Iranian waters are not very diverse compared to other tropical areas such as Red Sea, due to fluctuation of ecological condition and environmental stress (ROPME, 1999). Corals habitats of the Persian Gulf can withstand temperatures much higher than coral reef ecosystems from many other similar zones (Harrington, 1986). Due to sensitivity of semi enclosed marginal sea of the Persian Gulf, from ecological and environmental point of view, it is important to study the global warming impact and increased sea surface temperatures on coral ecosystems. (Owfi *et al*., 2004).This area is a very shallow sea with an average depth of about 35 meters which located in continental shelf (ROPME, 1999). At present, our knowledge and information about some of coral reef sites in the Iranian waters is not complete, thus some of them are protected area or marine national park such as: Shidvar, Khark, Khargo, and Faorur Islands, and Nayband Bay (Rabbaniha & Owfi, 2007).

The Persian Gulf coral reefs structure including two different types. Dominant type is fringing corals which located in surround all the Iranian islands of the Persian Gulf from 1-20 meter depth (Rezaei, 1996).This zone mostly covered by Acroporidae species, whereas the dominant species in deeper depths are mainly Poritidae and Faviidae (Shokri *et al*., 1999). This is occurs at nearly and around all islands.But in some Hormuz strait islands including Qeshm and Hormuz we cannot find any dominant fringing corals. Second type of corals structure is patchy corals which present in shallow waters and along the shoreline, such as Bandar Taheri Port and Nayband Bay in Bushehr province (Owfi *et al*., 2010).

Materials and Methods

According to the main aims and goals of present research and study, activity focus on results of field investigations in all of the fringing and patch corals habitats in northern Persian Gulf (Iranian waters), from Khark & Khargo Islands in Bushehr province to Hormuzgan province - Hormuz Strait Islands of Hormuz. Data and information collection and determination of distribution patterns were based on the field observations and surveys at coral sites (Fatemi *et al*., 1989) .Available references were used for identification of coral species. Species were photographed for showing the description of specimen and also the corallite structures (Harington, 1986; Sheppard & Sheppard, 1991; Wilkinson, 2010). Also, Manta Tow Technique and Transect survey with refer to Reef Check standard methods and Global Coral Reef Monitoring Network (GCRMN) was the field method (Reef Check, 1998; Wilkinson, 2010).

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Figure 1: Distribution of fringing and patch coral habitats of the Iranian Persian Gulf (*Source: Shokri et al., 1999*)

Results

The result of identification of corals species determined that 27 species belonging to 9 families and 20 genera were found in both type of fringing and patch corals habitats of the Persian Gulf. According to the check list, Faviidae with 6 genera and 8 species was the abundant family, then Acroporidae with 5 and Poritidae with 4 species were the second and third dominant coral familys . Among identified species, Anacropora forbesi is reported for the first time for the Persian Gulf, and other 26 speies have been reported from the studied area.

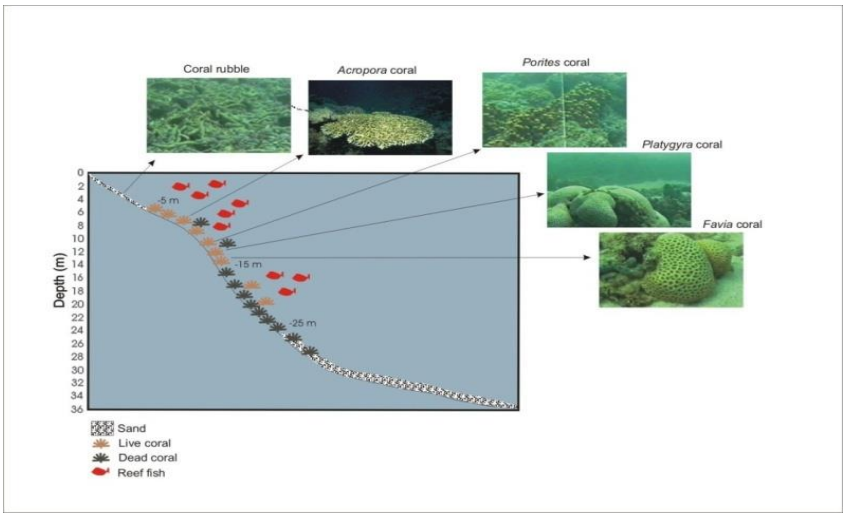

Figure 2: Structure and zonation of corals community in fringing coral reefs (*Source: Shokri et al., 1999*)

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Table 2: Check list of corals species of the Persian Gulf Iranian waters

Family	Species	
Acroporidae	*Acropora*	*clathrata*
	Acropora	*downingi*
	Acropora	*arabensis*
	Anacropora	*forbesi*
	Anacropora	*aequituberculata*
	Montipora	*M. sp.*
Agaricidae	*Pavona*	*decussata*
Dendrophyllidae	*Turbinaria*	*reniformis*
	Turbinaria	*peltata*
Faviidae	*Favia*	*pallida*
	Favia	*speciosa*
	Favites	*chinensis*
	Favites	*pentagona*
	Platygyra	*daedalea*
	Leptastrea	*transversa*
	Cyphastrea	*microphthalma*
	Plesiastrea	*versipora*
Pectinidae	*Echinophyllia*	*aspera*
Pocilloporidae	*Stylophora*	*pistillata*
Poritidae	*Porites*	*Lutea*
	Porites	*compressa*
	Porites	*harrisoni*
Mussidae	*Goniopora*	*lobata*
	Acanthastrea	*echinata*
Siderastreidae	*Siderastrea*	*savignyana*
	Anomastraea	*irregularis*
	Psammocora	*contigua*
	Coscinaraea	*columna*
Total of taxon	**9 Family, 20 Genus, 28 species**	

(*Source: After* Owfi *et al*., 2004)

Discussion

Field studies and researches on species diversity of fishes that executed in 6 seasonally marine cruises in the Iranian side of the Persian Gulf & Strait of Hormoz, and also review of all ichthyology and identification references of the this region from 20 years ago, showed that level of coraline species diversity had decrease. Unfortunately, this phenomenon was not to take a long time, so that to happen since 20 years ago (Owfi *et al*., 2004) .Before 1990-91 with slowly speed, 2 species in each 5 years averagely, and after 1990-91 with semi fast speed, 3 species in each 3 years averagely (Rabbaniha & Owfi, 2007).About 139 species are found on the coral reef and rocky-coral ecosystems of the Persian Gulf and Hormoz Strait (Owfi *et al*., 2010).

Environmental extremes in the Persian Gulf and Hormoz Strait have limited the distribution of many species (Fatemi *et al*., 1989). Peak of fish species diversity and population densities of the dominant species attained on the well-developed offshore coral reefs. In addition, the richest reef fish fauna will be found on the Iranian

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reefs, especially in the Bushehr and Hormozgan (near Hormoz Strait) provinces waters to Kuwait and Saudi Arabia diverse reef ecosystems. Among those, some of them are Protected Area, Wildlife Refuge, Biosphere Reserve, and Marine National Park and also are sites in the Ramsar international wetlands list convention. (Rezaei, 1996; Owfi *et al*., 2004 & 2010).

Table 1: Behavioral characteristics of the Persian Gulf endemic coralline fish species

Species	Family	EcologicalGroup	Habitat	Feeding Behavior
Blennis persicus	Blenniidae	Coralline	Rocky Beds - Coral Reef	Piscivores
Cheilodipterus bipunctitus	Apogonidae	Coralline- Neritic	Rocky Beds - Coral Reef	Benthivores
Petrus belayewi	Sparidae	Rocky - Neritic	Rocky Beds - Coral Reef	Benthivores
Pseudochromis persicus	Pseudochromidae	Coralline	Coral Reef	Piscivores

(*Source: After* Owfi *et al*., 2004)

Most of coral reefs located on around waters of the Iranian islands and some limited coastal area, which information and data about their status not completed. Here there are sandy flats and mixed communities of live and dead corals, with the best live coral on north and northeastern margins. In shallower depths (5-8 m) there is higher biodiversity of reef fishes, invertebrates and hard corals, compared to the deeper reef slope (10 m). There was considerable destruction of bleaching corals, anchor damage is higher in deeper water (10-15m), and many corals in shallower waters are damaged by uncontrolled recreational activities (ROPME, 1999). The best hard coral growth observed in upper slope at less than 10m depth (Peak of diversity in 8m) with 22% of live coral coverage, 21% dead coral coverage (Shokri *et al*., 1999), 44% of sand and 13% of invertebrates groups (Shokri *et al*., 1999; Wilkinson, 2010).

Also, dead coral coverage was estimated 28% which observed in deeper water (more than 10m) and 48% in shallow water (less than 10m) (Owfi *et al*., 2010). Reef Check surveys showed the highest diversity of fish in shallow water. The Iranian waters of the Persian Gulf has a lower coral species richness and diversity than the southern part which belonging on Arabian countries including Kuwait, KSA, Qatar, Bahrain, UAE and Oman (Madden et al., 2009), where Kuwait 34 species, KSA 55 species, UAE 34 species and Oman 53 species (ROPME, 1999 & Wilkinson, 2010). Ichthyoplankton studies of the Iranian waters of the Persian Gulf determined that average of density for fish larvae in rocky andcoral reef habitats in the studied area including Nayband Bay, Khark and Khargo Islands. Sparidae, Lutjanidae, Sciaenidae and Scorpanidae were respectively, found to be the most abundant. Total fish larval abundance in

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Nayband Bay as well as southeast Bushehr waters was 45% higher than Khark and Khargo Islands (Rabbaniha & Owfi, 2007). More detailed research and study via field survey in Iranian side of the Persian Gulf, especially around the islands and fringing corals habitats will show result of more species.

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