Research Report

Open Access

Identification and assess anthropogenic impacts on species richness of coral reef fishes in Larak Island, Persian GulfSh.Khatami¹, T.Valinassab², P.Tavakoli-Kolour³

1. Department of Marine Biology, Islamic Azad University, Bandar Abbas Branch, PO Box 79159-1311, Bandar Abbas, Iran

2. Iranian Fisheries Research Organization, P.O. Box: 14155-6116, Tehran, Iran

3. Young Researchers and Elite Club, Bandar Abbass Branch, Islamic Azad University, PO Box 79159-1311, Bandar Abbass, Iran

✉ Corresponding author email: Shadi.khatami1@gmail.com

International Journal of Marine Science, 2014, Vol.4, No.53 doi: 10.5376/ijms.2014.04.0053

Received: 19 Jun., 2014

Accepted: 23 Jul., 2014

Published: 01 Sep., 2014

Copyright © 2014 Khatami et al., This is an open access article published under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Preferred citation for this article:

Khatami et al., 2014, Identification and assess anthropogenic impacts on species richness of coral reef fishes in Larak Island, Persian Gulf, International Journal of Marine Science, Vol.4, No.53 1-5 (doi: 10.5376/ijms.2014.04.0053)

Abstract Coral reefs are amongst the most important and rich ecosystems in the world and are provide habitat for a diverse range of species groups of fishes and invertebrates. Larak Island is one of fourteen islands found in the Persian Gulf which was selected for this study. The reef fish distribution around this island was identified and then for sampling, six stations were randomly selected by Manta Tow method. The identification was conducted using visual census technique in all stations. A total of 54 species belonging to 42 genera and 23 families were identified and amongst them the abundant species group belonged to family Pomacentridae with 11 species. The results indicated that further the stations were from an urban area higher species richness was.

Keywords Coral reef fishes; Species richness; Larak Island; Persian Gulf

Introduction

Coral reefs rival that other well-known tropical community, the rain forest, in their beauty, richness, and complexity. Coral reefs are such massive structures, in fact, that they must be considered not only biological communities but geographical features, the largest geological features built by organisms (Castro and Huber, 1991). Major coral reef ecosystems occur in the tropical Indo-Pacific region, the tropical western Atlantic mostly in the Caribbean Sea, the Red Sea, and the Persian Gulf (Liske and Myers, 2001).

The highest diversity of fishes is found in coral reef ecosystems and it has been reported that 25% of marine fish species (about 6000 to 8000) inhabit in coral reefs (Feary et al., 2009). Destruction of coral reefs can lead to decrease of coral-dependent fishes due to direct effects of habitat loss on feeding, recruitment, or mortality (Feary et al., 2009).

In the Iranian waters of the Persian Gulf, the coral reefs are found around 14 islands. Coral reefs around the islands are fringing reefs and in some shallow water areas there are patch reefs (Shokri et al., 2005). Factors affecting the coral reef communities in this

area include salinity, change of temperature and low tides. During the last two decades coral reef bleaching events due to high temperatures had occurred in this area as reported in other areas in all around the world, including the Persian Gulf (Valavi et al., 2009).

There are a few publications on identification of reef fish in coral regions of the Persian Gulf (Rezai and Savari, 2004) and a total of 168 species have been reported previously in this area (Asadi and Dehghani, 2003). Some Iranian islands, including Larak Island that has been incompletely studied (Hosseinzadeh and Kamali, 2003). Therefore, the main objective of this research was to make species identification and diversity determination of coral reef fishes around Larak Island and to assess anthropogenic impacts on species richness.

1 Materials and Methods

In this study, six stations around Larak Island were selected by Manta Tow method (Valavi et al., 2009) from July to December 2010. The coral reef regions have been identified previously in Larak Island (Rezai et al., 2010). The visual census technique was used for reef fish identification (Randall, 1963).

Stations	Latitude (N)	Longitude (E)
A	26° 53' 13.1"	56° 24' 12"
B	26° 53' 19.6"	56° 23' 20.2"
C	26° 52' 46.1"	56° 20' 19.1"
D	26° 51' 54.8"	56° 19' 13.6"
E	26° 49' 27.2"	56° 19' 22.6"
F	26° 49' 16.7"	56° 19' 30"

Stations were selected to provide a contrast in the degree of anthropogenic impact expected (Figure 1). Stations A and B were selected in urban areas (near a break-water) which were likely to be affected by human activities, including a desalination plant and transportation. Stations C and D were selected at an intermediate distance from urban regions in areas with mostly patch reef corals (distance from urban areas 5 and 8 km, respectively). Stations E and F were selected in areas remote from human activity and likely to have experienced limited anthropogenic stress (distance from urban areas 11 km). In these areas the coral reefs were both fringing and patch reefs. The Margaloff test was applied for comparing species richness of six stations.

Figure 1 Sampling sites in the Larak Island in Persian Gulf (St = Stations)

2 Results

A total of 54 species belong to 42 genera and 23 families were identified over all sites during the sampling period. Family Pomacentridae dominated this assemblage with 11 species (Table 1, Figure 2).

Twelve of the 54 identified species were observed in all six stations, belonging to the families Pomacentridae, Pomacanthidae, Carangidae, Labridae, Mullidae, Chaetodontidae, Nemipteridae and Lutjanidae.

Figure 2 Species richness of reef fish around the Larak Island, Persian Gulf

According to the results of the present study, species richness from the sampling sites in Larak Island were differed. The results indicated that however the stations were far from urban area; the species richness has been higher (Table 2). The lowest species richness have been reported from B station near urban areas.

3 Discussion

The few previous studies on identification of coral reef fish in Persian Gulf reported lower species counts from this area. Hosseinzadeh and Kamali (2003) and Asadi and Dehghani (2003) respectively reported only 24 and 43 species around Larak Island, while this study identifies 54 fish species.

Changes in species composition and condition of coral habitats have significant effects on diversity and abundance of associated species (Pratchett et al., 2004; Munday, 2004; Wilson et al., 2006; Coker et al., 2009). In addition to anthropogenic impacts, the coral reefs of the Persian Gulf experienced bleaching events due to El Niño phenomenon in 1997-98 and the live coral coverage decreased from 90% to 22-26% (Pratchett et al., 2011). Such events have had impacts on fish diversity as well as affecting the survival of fishes such as coral-feeding butterflyfishes, (Chaetodontidae) (Pratchett et al., 2011). Five species of Chaetodontidae (of 116 species worldwide) have been reported from the Persian Gulf, four species of *Chaetodon* and one species of *Heniochus* (Shokri et al., 2005). Three

Table 1 Checklist of coral reef fish species from 6 sampling sites around Larak Island, Persian Gulf

No	Family	Species	Sites					
			A	B	C	D	E	F
1	Torpedinidae	<i>Torpedo panthera</i>						×
2	Scorpaenidae	<i>Scorpaenopsis</i> sp.		×				
3	Serranidae	<i>Cephalopholis hemistiktos</i>	×		×		×	×
4	"	<i>Epinephelus coioides</i>	×			×	×	×
5	Pseudochromidae	<i>Pseudochromis aldabraensis</i>						×
6	Apogonidae	<i>Apogon fleurieu</i>					×	×
7	"	<i>Cheilodipterus novemstriatus</i>	×		×	×	×	×
8	Carangidae	<i>Alepis jedaba</i>			×			
9	"	<i>Carangoides bajad</i>	×	×	×	×	×	×
10	"	<i>Gnathanodon speciosus</i>					×	
11	Lutjanidae	<i>Lutjanus ehrenbergii</i>	×	×	×	×	×	×
12	"	<i>Lutjanus argentimaculatus</i>						×
13	"	<i>Lutjanus johnei</i>					×	
14	Caesionidae	<i>Caesio varilineata</i>	×				×	×
15	Nemipteridae	<i>Scolopsis ghanam</i>	×	×	×	×	×	×
16	Mullidae	<i>Parupeneus margaritatus</i>	×	×	×	×	×	×
17	Pempheridae	<i>Pempheris vanicolensis</i>			×			×
18	Chaetodontidae	<i>Chaetodon nigropunctatus</i>	×	×	×	×	×	×
19	"	<i>Chaetodon melapterus</i>						×
20	"	<i>Heniochus acuminatus</i>			×			×
21	Pomacanthidae	<i>Pomacanthus maculosus</i>	×	×	×	×	×	×
22	Pomacentridae	<i>Abudefduf vaigiensis</i>	×	×	×	×	×	×
23	"	<i>Abudefduf</i> sp.			×			
24	"	<i>Pomacentrus leptus</i>	×	×	×	×	×	×
25	"	<i>Pomacentrus trilineatus</i>						×
26	"	<i>Pomacentrus aquilus</i>			×			
27	"	<i>Chromis fluvaxilla</i>	×			×		
28	"	<i>Chromis xanthopterygia</i>	×	×	×		×	×
29	"	<i>Neopomacentrus cyanomos</i>	×		×	×	×	×
30	"	<i>Neopomacentrus sindensis</i>				×		
31	"	<i>Dascyllus trimaculatus</i>	×	×	×	×	×	×
32	"	<i>Dascyllus</i> sp.	×	×	×	×	×	×
33	Labridae	<i>Thalasso malunare</i>	×	×	×	×	×	×
34	"	<i>Labroides dimidiatus</i>	×	×	×	×	×	×
35	"	<i>Cheilinus lunulatus</i>	×				×	×
36	"	<i>Halichoeres marginatus</i>			×		×	×
37	Scaridae	<i>Chlorurus sordidus</i>	×			×		
38	"	<i>Scarus persicus</i>	×		×		×	×
39	"	<i>Scarus ferrugineus</i>			×			
40	Blenniidae	<i>Ecseniuspulcher</i>				×		
41	Gobiidae	<i>Amblygobius albimaculatus</i>		×				
42	"	<i>Cryptocentrus lutheri</i>	×			×	×	×
43	"	<i>Gnatholepis enjerensis</i>	×		×	×	×	×
44	"	<i>Istigbius decoratus</i>				×		
45	"	<i>Valenciennea sexguttata</i>	×		×	×	×	×
46	"	<i>Gobiodon citrinus</i>	×					
47	Siganidae	<i>Siganus javus</i>					×	×
48	"	<i>Siganus canaliculatus</i>					×	×
49	Acanthuridae	<i>Acanthurus sohal</i>	×		×		×	×
50	"	<i>Zebrasoma xanthurum</i>	×		×		×	×
51	Balistidae	<i>Rhinecanthus assasi</i>				×		
52	Ostraciidae	<i>Ostracion cubicus</i>			×			
53	"	<i>Ostracion cyanurus</i>				×	×	×
54	Tetraodontidae	<i>Arothorn stellatus</i>					×	×
Number of species			29	15	29	25	34	39

Table 2 Species counts by study sites and expected degree of anthropogenic impacts

Anthropogenic Impact	Sampling sites	Observed species counts	Mean	SD
Impacted	A	29	22	9.899
	B	15		
Intermediate	C	29	27.0	2.828
	D	25		
Remote from impact	E	34	36.5	3.535
	F	39		

species (*Chaetodon melapterus*, *C. nigropunctatus* and *Heniochus acuminatus*) were observed at Larak Island, but only *C. nigropunctatus* was found in all stations.

The Chaetodontidae have been considered as a useful fishing mortality index (English et al., 1997). *Chaetodon melapterus* is a rare and obligate corallivore ornamental fish (Cole et al., 2008) which was observed only in station F although this species was previously reported from other islands of Kish, Bu-Musa and Farour in the Persian Gulf (Hosseinzadeh and Kamali, 2003). The limited distribution and low abundance of this precious species may be an indicator of illegal overfishing of ornamental fishes in the study area.

Red tides are another factor causing damage to coral reefs and fishing mortality. A major red tide event occurred in the Persian Gulf in 2008 and 2009 (Richlen et al., 2010) and caused considerable damage to the coral reefs including at Larak Island (Rezai Marnani et al., 2010). Coral loss due to the red tide phenomenon led to decreased fish species diversity based on obtained results of this study. According to the field observation in year 2007 (unpublished data), there was a high frequency of *Rhinecanthus assasi* (Balistidae) in stations C and D meanwhile during this survey only one times was observed in station D in which can be effect of overfishing and red tide.

Amongst of coral reef fish in Persian Gulf the Pomacentridae is the most diverse family with 20 species reported by Hosseinzadeh and Kamali (2003). This is also true in this study with 11 species belonging to this family identified at Larak Island. Amongst them, three species (*Abudefduf vaigiensis*, *Pomacentrus leptus* and *Dascyllus trimaculatus*) were found in all stations. While the occurrence of Pomacentrids on live and un-damaged corals was high, these species are omnivorous or herbivorous and do not feed on corals. Symbiotic effects of some species

with corals may even lead to increased growth of corals (Cole and Pratchett, 2011).

The highest abundance of fishes have been reported from the family Lutjanidae in coral regions in the Persian Gulf (Rezai and Savari, 2004); and the same results were obtained in this study. Amongst reef fish the species *Pomacanthus maculosus* (Pomacanthidae) and *Acanthurus sohal* (Acanthuridae) have the greatest reported distribution in the Persian Gulf (Rezai and Savari, 2004) and at Larak Island *P. maculosus* was observed in all stations and *A. sohal* was observed in four of the six stations.

The pattern of results is consistent with anthropogenic impacts reducing species richness (Table 2). However, there was no significant differences between species richness per site ($p>0.05$). The species richness were highest at the stations that are far from urban areas and the lowest count (Station B, 15 species) was from a site adjacent to urban area and desalination plant. Waste water from the desalination plant near Station B (elevated temperature and salinity water) may cause damage to the coral reefs (Hawkins and Roberts, 1994) with consequent decrease in frequency and diversity of reef-dependent species (Coles and McCain, 1990). Ten identified species were found only in stations E and F (i.e. areas remote from impacts) suggesting some or all of these may be useful indicators of relatively pristine conditions. By comparison, the site of near urban area had $5.69 \pm 0.54\%$ coral cover, whereas the station E and F had $21.74 \pm 1.92\%$ (Mohammadizadeh et al., 2013; Kavousi et al., 2014).

References

- Asadi H., and Dehghani R., 2003, The fishes of Persian Gulf and Oman Sea, Iranian Fisheries Research Organization, pp.226
- Castro P., and Huber M.E., 1991, Marine Biology, Edward Morphy Publisher, New York, pp.592
- Coker D.J., Pratchett M.S., Munday P.L., 2009, Coral bleaching and habitat degradation increase susceptibility to predation for coral-dwelling fishes, Behavioral Ecology 20:1204-1210
<http://dx.doi.org/10.1093/beheco/arp113>

- Cole A., Pratchett M., and Jones G., 2008, Diversity and functional importance of Coral-feeding fishes on tropical coral reefs, *Fish and Fisheries* 9: 286-307
<http://dx.doi.org/10.1111/j.1467-2979.2008.00290.x>
- Cole A.J., Pratchett M.S., 2011, Effects of juvenile coral-feeding butterflyfishes on host corals, *Coral Reefs*, 30: 623-630
<http://dx.doi.org/10.1007/s00338-011-0746-2>
- Coles S.L., and McCain J.C., 1990, Environmental factors affecting benthic infaunal communities of the western Persian Gulf, *Marine Environmental Research*, 29: 289-315
[http://dx.doi.org/10.1016/0141-1136\(90\)90024-I](http://dx.doi.org/10.1016/0141-1136(90)90024-I)
- English S., Wilkinso, C., and Baker V., 1997, Survey Manual for Tropical Marine Resources, Australian Institute of Marine Science, Townsville, Australia: pp.378
- Feary D.A., McCormick M.I., and Jones G.P., 2009, Growth of reef fishes in response to live coral cover. *Journal of Experimental Marine Biology and Ecology*, 373: 5-49
<http://dx.doi.org/10.1016/j.jembe.2009.03.002>
- Hawkins J.P., and Roberts C.M., 1994, The growth of coastal tourism in the Red Sea: Present and future effects on corals, *Ambio* 23: 503-508
- Hosseinizadeh H., and Kamali E., 2003, Ornamental fishes of Persian Gulf. Iranian Fisheries Research Organization, pp.116
- Kavousi J., Tavakoli-kolour P., Mohammadizadeh M., Bahrami A., and Barkhordari A., 2014, Mass coral bleaching in the northern Persian Gulf, 2012. *Scientia Marina*, 78 (3): 1-8
<http://dx.doi.org/10.3989/scimar.03914.16A>
- Liske E., and Myers R., 2001, *Coral Reef Fishes: Indo-Pacific and Caribbean*, Princeton University Press. ISBN 0691989957
- Mohammadizadeh M., Tavakoli-Kolour P., Rezai H., 2013, Coral reefs and community around larak island (Persian Gulf). *Caspian Journal of Applied Sciences Research*, 2 (11): 52-60
- Munday P.L., 2004, Habitat loss, resource specialization, and extinction on coral reefs, *Glob Change Biology*. 10:1642-1647
<http://dx.doi.org/10.1111/j.1365-2486.2004.00839.x>
- Pratchett M.S., Wilson S.K., Berumen M.L., and McCormick M.I., 2004, Sublethal effects of coral bleaching on an obligate coral feeding butterflyfish, *Coral Reefs*. 23:352-356
<http://dx.doi.org/10.1007/s00338-004-0394-x>
- Pratchett M.S., Hoey A.S., Wilson S.K., Messmer V., and Graham N.A.J., 2011, Changes in Biodiversity and Functioning of Reef Fish Assemblages following Coral Bleaching and Coral Loss, *Journal of Diversity*, 3:424-452
<http://dx.doi.org/10.3390/d3030424>
- Randall J.E., 1963, An analysis of the fish populations of artificial and natural reefs in the Virgin Islands, *Caribbean Journal of Science*, 3(1): 1-16
- Rezai H., and Savari, A., 2004, Observation on reef fishes in the coastal waters off some Iranian Islands in the Persian Gulf. *Zoology in the Middle East* 31:67-75
<http://dx.doi.org/10.1080/09397140.2004.10638024>
- Rezai Marnani H., Kamrani E., Samimi K., Kabiri K., and Ghavasi M., 2010, Coral degradation, distribution and abundance around Larak, Hengam and Kish Islands, Persian Gulf, Iranian National Centre for Oceanography, Tehran, pp. 150
- Richlen M.L., Morton S.L., Jamali E.A., Rajan A., and Anderson D.M., 2010, The Catastrophic 2008-2009 red tide in the Arabian Gulf region, with observations on the identification and phylogeny of the fish-killing dinoflagellate *Cochlodinium polykrikoides*, *Harmful Algae* 9, pp.163-172
<http://dx.doi.org/10.1016/j.hal.2009.08.013>
- Shokri M., Fatemi M., and Crosby M., 2005, The status of butterflyfishes in the northern Persian Gulf, IR.Iran, *Aquatic Conservation: Marine and Freshwater Ecosystems*.15:91-99
<http://dx.doi.org/10.1002/aqc.714>
- Valavi H., Savari A., Yavari V., Kochanian P., Safahieh A., and Sedighi Savadkuhi O., 2009, Coral reef Anthropogenic impact Bio-Indicators in the Northern part of the Persian Gulf, *Ecology and Environmental Research* 7(3): 215-227
http://dx.doi.org/10.15666/aeer/0703_215227
- Wilson S.K., Graham N.A.J., Pratchett M.S., Jones G.P., Polunin N.V.C., 2006, Multiple disturbances and the global degradation of coral reefs: are reef fishes at risk or resilient? *Global Change Biology*. 12:2220-2234
<http://dx.doi.org/10.1111/j.1365-2486.2006.01252.x>