



Reef fishes of the Mazunte-Bahías de Huatulco reef track, Oaxaca, Mexican Pacific

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Abstract

Although fish are one of the most abundant, conspicuous and structurally important inhabitants of reef systems, the group has remained largely ignored from biodiversity accounts on the Oaxaca reef track. Reef ichthyofauna composition at 10 sites between Mazunte and Isla Montosa was gathered through stationary visual census techniques during 1998–2008. A total of 112 species belonging to 81 genera, 40 families and 11 orders were recorded. Species richness of the study area is higher than similar reef communities in the Mexican Pacific. Thirty species represent new records for the study area, and some discrepancies were found between local (this study) and regional accounts. Our data suggest that species composition in the area is still incomplete.

Key words: reef ichthyofauna, checklist, faunal completeness, Oaxaca, Mexican Pacific

Introduction

During the last decade, studies on the Oaxaca reef system have greatly improved our understanding on biodiversity and community level dynamics on several taxa. In particular, meaningful additions to the biodiversity knowledge of the area have been published on stony corals (Leyte-Morales 1995; 1997; Glynn and Leyte-Morales 1997; Reyes-Bonilla and Leyte-Morales 1998; Cruz-Pinon and Reyes-Bonilla 1999; Reyes-Bonilla *et al.* 2005), echinoderms (Benítez-Villalobos 2001; Benítez-Villalobos 2008), macroalgae (Ramírez-González 2008a), mollusk (Zamorano *et al.* 2006; Ramírez-González 2008b), crustaceans (Carvacho and Haasmann 1984; Ramírez-Luna *et al.* 2002) and polychaetes (Gómez *et al.* 1997; Bastida-Zavala 2008) but many taxonomic groups, both invertebrate and vertebrate, are poorly known or have been largely ignored.

Although reef and reef-related ichthyofauna are one of the most abundant and conspicuous inhabitants of the Oaxaca reef system, except for the recent works on reef fish biodiversity and dynamics at Bahía San Agustín (Ramírez-Gutiérrez *et al.* 2007) and Isla Cacaluta (López-Pérez *et al.* 2008), the group is absent from biodiversity accounts. This situation is particularly serious in the area since urbanization and environmental degradation (López-Pérez *et al.* 2002; López-Pérez and Hernández-Ballesteros 2004) is proceeding at a faster rate than data acquisition and analysis (Conanp 2003). The lack of information on coastal and near-shore shallow-water marine biodiversity, particularly on one of the most conspicuous and ecologically relevant groups in coral reefs (Christensen and Pauly 1993; Mumby *et al.* 2004), exert potential negative impacts not only on management and conservation of coral reefs itself, but also on small-scale fisheries and fishing

communities. On this regard, the aim of the present contribution is to add on the biodiversity knowledge of the Mazunte-Bahías de Huatulco area. Further analysis of fish assemblages, structure and dynamics will be discussed elsewhere.

Material and methods

The Bahías de Huatulco coral reef area represents the southernmost reef system in the Mexican Pacific. The area is composed of 17 fringing reefs (Leyte-Morales 1997; Glynn and Leyte-Morales 1997) and because its high richness and biogeographic value, a portion of the system along the adjacent continental area was declared as a Natural Protected Area by the Mexican government in 1998 (Conanp 2003). Most of the year, the area is influenced by tropical shallow waters (high temperature, low salinity), except in severe winter conditions when the California Current (low temperature, low salinity) reach the Gulf of Tehuantepec (Fiedler 1992). Most of the reefs exhibit high (30–50%) to very high (60–90%) live coral cover (Glynn and Leyte-Morales 1997; Reyes-Bonilla and Leyte-Morales 1998). Although it is probably one of the best-developed coral reef systems in the western México (Reyes-Bonilla 2003), its species richness and composition and coral coverage is frequently altered by environmental perturbations (Lirman *et al.* 2001; López-Pérez *et al.* 2002; Reyes-Bonilla *et al.* 2002).

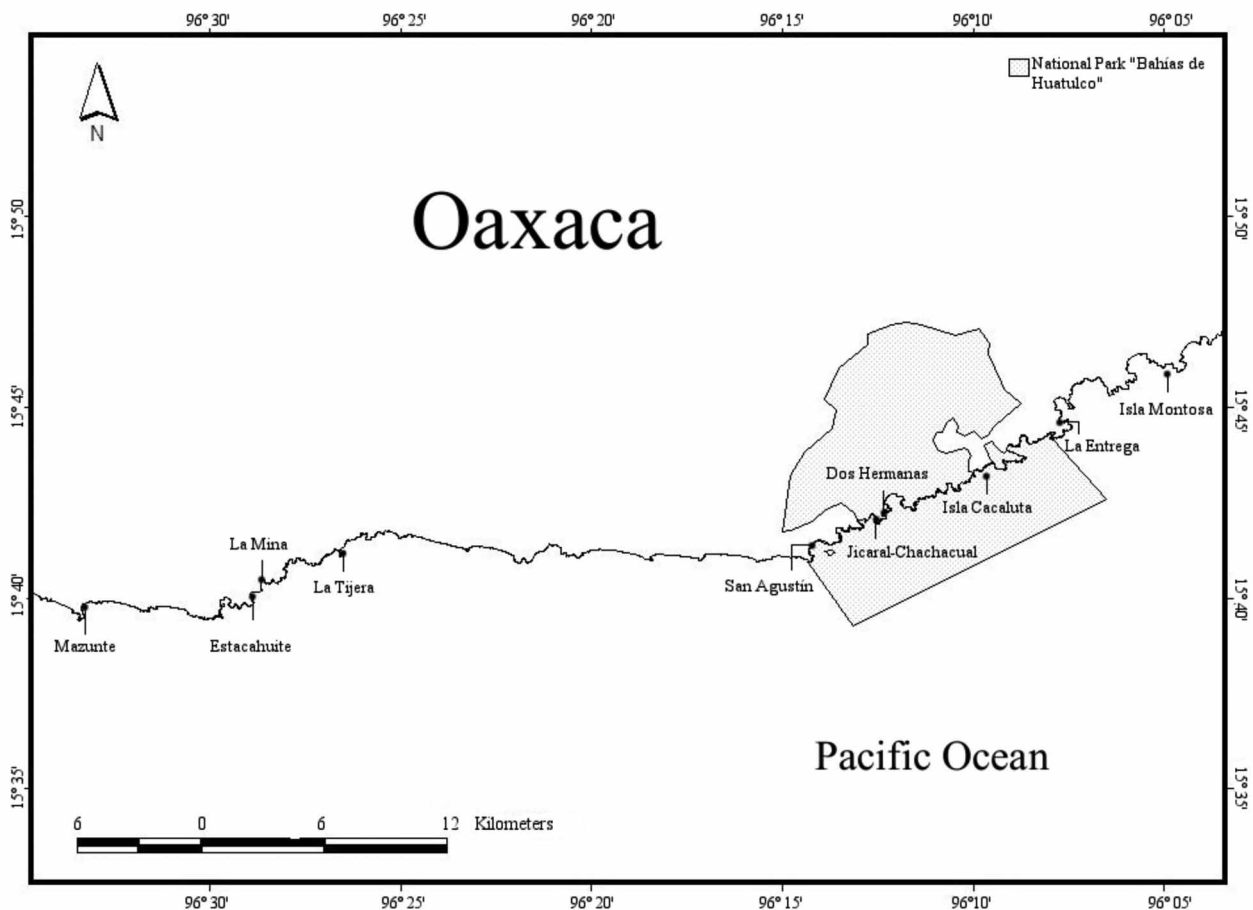


FIGURE 1. Geographic location of the study area, with the 10 census sites named.

The list presented here includes all reef fish species recorded during 1998–2008 at 10 sites along the coast of the Mazunte-Isla Montosa corridor on the Oaxaca reef track, western México (Fig. 1). Fish assemblages were sampled through stationary visual census techniques using the method of Bohnsack and Bannerot

(1986), modified by Villareal-Cavazos *et al.* (2000). Basically, the method consisted of counting all fish that moved across observation cylinders of 5-m radius (79 m²), in a time period of 5 min. In addition, during the 1998 and 2002-2003 seasons, 5 min additional time periods after each census were devoted to search for territorial and cryptic species. Between March 1998 and May 1998, three monthly stationary censuses were conducted at Isla Montosa (15°45'N, 95°05'W), La Entrega (15°44'N, 96°07'W), Jicaral-Chachacual (15°42'N, 96°12'W) and San Agustín (15°41'N, 96°14'W); between October 2002 and August 2003, ten bimonthly stationary censuses were conducted at La Entrega; between February 2006 and January 2007 (except April, July and August), ten monthly stationary censuses were conducted in San Agustín, Jicaral-Chachacual, Dos Hermanas (15°42'N, 96°12'W), Isla Cacaluta (15°43'N, 96°09'W), La Entrega and Isla Montosa; finally, ten stationary censuses were conducted at Mazunte (15°39'N, 96°33'W), La Mina (15°39'N, 96°29'W), Estacahuite (15°40'N, 96°28'W) and La Tijera (15°41'N, 96°26'W) during March 2008 (Fig. 1). All sampling units were randomly placed in the reefs at any depth, but inside the bathymetric interval where reefs occur (2-13 m, Glynn and Leyte-Morales 1997). Finally, once the species list was assembled, previous occurrence in the area was determined following Robertson and Allen (2008) whereas widespread distribution (Indo West Pacific, Eastern Pacific and Atlantic) was gathered from Fishbase (www.fishbase.org). Species list was ordered according to Eschmeyer (1998).

Results and discussion

A total of 112 fish species included in 11 orders, 40 families and 81 genera were recorded in the Bahías de Huatulco area. Of those, five species occurred in the genera *Haemulon*, *Lutjanus*, and *Halichoeres* and three in the genera *Epinephelus*, *Scarus* and *Stegastes*. Thirteen genera possess up to two species, the rest (62 genera) are represented by just one species in the area (Table I). To date, except for the works of Ramírez-Gutiérrez *et al.* (2007) in which 64 fish species were recorded at San Agustín Bay, and López-Pérez *et al.* (2008) in which 58 fish species were seen at Isla Cacaluta, no further accounts of the species composition at the Bahías de Huatulco area have been published. In this sense, the 112 reef fish species recorded here represent a meaningful addition to the knowledge of the near-shore shallow-water marine biodiversity of the Oaxaca reef track.

Fish biodiversity in the Bahías de Huatulco reef track is higher than the reported for Zihuatanejo (75 species, López-Ortiz 2007), Acapulco (99 species, Palacios-Salgado *et al.* 2004) and the Bahía de La Paz area (74-89 species, Pérez-España *et al.* 1996; Jiménez-Gutiérrez 1999; Calapiz-Segura 2004; Villegas-Sanchez 2004). Nonetheless, species richness at family level in the Huatulco area (Labridae, 10 species; Serranidae, 9; Pomacentridae, 8 species) is comparable to that displayed in rocky and coral reef habitats in the Mexican Pacific (Gulf of California, Pérez-España *et al.* 1996; Villareal-Cavazos *et al.* 2000; Aburto-Oropeza and Balart 2001; Acapulco, Palacios-Salgado *et al.* 2004), along with reef areas in the Indo West Pacific and Atlantic (Sale 1991). In addition, of the 112 listed species, 85 are restricted to the eastern Pacific, 12 also occur in the Indo West Pacific, 5 in the Atlantic/Caribbean, and 9 displayed a circumtropical distribution (<http://www.fishbase.org>).

Thirty species represent new records to the previously known reef and reef related fish fauna of the Bahías de Huatulco area (Ramírez-Gutiérrez *et al.* 2007; López-Pérez *et al.* 2008), in addition some of them represent new additions to the reef-related fish fauna of southwestern México (Robertson and Allen 2008). Discrepancies between local (this study) and regional accounts (Robertson and Allen 2008) on species occurrences, along with doubtful determinations deserve scrutiny and more research on this respect is needed (Table 1). For example, the Pacific night-sergeant *Abudefduf concolor* (Gill) and the cortez damselfish *Stegastes rectifraenum* (Gill) were reported at San Agustín by Ramírez-Gutiérrez *et al.* (2007). *Abudefduf concolor* is confirmed to occur from El Salvador to Peru, including the Galapagos, Cocos and Malpelo, but not in the Mexican Pacific; it is more likely, however, that *A. concolor* recorded by Ramírez-Gutiérrez *et al.* (2007) is *Abudefduf declivifrons* (Gill) (Mexican night-sergeant) (López-Pérez *et al.* 2008) that inhabit lower Baja and the central Gulf of California to Costa Rica, including the Revillagigedos (Robertson and Allen

2008). Regarding *Stegastes rectifraenum* the species was also reported by López-Pérez *et al.* (2008), however according to regional accounts (Robertson and Allen 2008) the species inhabit Northern Baja California and the entire Gulf of California south to Acapulco on the Mexican mainland, and the Revillagigedos. The gungo highhat *Pareques viola* (Gilbert in Jordan and Evermann) was reported at Isla Cacaluta by López-Pérez *et al.* (2008) but regional accounts (Robertson and Allen 2008) indicates that the species is distributed from Panama to Peru, including Malpelo; it is more likely, however, that the species correspond to the Pacific highhat *Pareques* sp. A (Robertson & Allen 2008), nonetheless further collection of specimens should eliminate any doubt on this regard. Lastly, the cortez pikeblenny *Chaenopsis coheni* (Böhlke), the whiptail stingray *Dasyatis dipterura* (Jordan & Gilbert) and the grouper *Mycteroperca* cf. *M. rosacea* were recorded at La Entrega during the 2002-2003. Currently, *Chaenopsis coheni* is confirm to occur in the western Gulf of California and near Puerto Vallarta on the mainland (Robertson and Allen 2008); *Dasyatis brevis* is not considered as part of the eastern Pacific shore-fish assemblages by Robertson and Allen (2008), but it is currently found near reefs on sand and mud bottoms from Hawaii and California to Peru (<http://www.fishbase.org>); *Mycteroperca rosacea* is confirm to occur in southern Baja and the Gulf of California to central México (Jalisco and Colima), but absent from Oaxaca, concurrently, *Mycteroperca xenarcha* has been recorded to range from Northern California to the central Gulf of California to Peru (Robertson and Allen 2008) and therefore it is not out of any doubt that organism belonging to *M. xenarcha* were misidentified as *M. rosacea*, further collection *Mycteroperca* spp. in the area should clarify doubts on this regard.

TABLE 1. Systematic list and biogeographical affinity of fishes of the Mazunte-Bahías de Huatulco reef track. Systematic order according to Eschmeyer (1998). Mz = Mazunte, Es = Estacahuite, Mi = La Mina, T = Tijera, S = San Agustín, J = Jicaral-Chachacual, H = Dos Hermanas, C = Cacaluta, E = La Entrega, M = Montosa, IWP = Indo West Pacific & Eastern Pacific, EP = Eastern Pacific only, A = Atlantic and Eastern Pacific, R&A = distribution in the area according to Robertson and Allen (2008). * Specimens needed for reliable determination.

	Mz	Es	Mi	T	S	J	H	C	E	M	IWP	EP	A	R&A
Class ELASMOBRANCHII														
Order Orectolobiformes														
Family Ginglymostomatidae														
<i>Ginglymostoma cirratum</i>							X					X	X	X
Order: Rajiformes														
Family Dasyatidae														
<i>Dasyatis dipterura</i>									X			X		X
Family Myliobatidae														
<i>Aetobatus narinari</i>					X		X		X	X	X	X	X	X
Family Urolophidae														
<i>Urobatis concentricus</i>					X					X		X		X
<i>Urobatis halleri</i>									X	X		X		X
<i>Urotrygon aspidura</i>										X		X		X
Class ACTINOPTERYGII (OSTEICHTHYES)														
Order Anguilliformes														
Family Muraenidae														
<i>Echidna nebulosa</i>							X	X		X	X	X		X
<i>Gymnomuraena zebra</i>			X		X		X	X			X	X		X
<i>Gymnothorax castaneus</i>					X			X				X		X
<i>Muraena lentiginosa</i>			X	X	X	X	X	X	X	X		X		X
Family Ophichthidae														

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TABLE 1 (continued)

	Mz	Es	Mi	T	S	J	H	C	E	M	IWP	EP	A	R&A
<i>Myrichthys tigrinus</i>		X	X		X							X		X
Order Clupeiformes														
Family Clupeidae														
<i>Harengula thrissina</i>									X			X		X
<i>Sardinops sagax</i>					X						X	X		
Order Aulopiformes														
Family Synodontidae														
<i>Synodus lacertinus</i>					X	X	X	X	X	X		X		X
<i>Synodus sechurae</i>					X							X		X
Order Cyprinodontiformes														
Family Belontiidae														
<i>Platybelone argalus pterura</i>					X							X		X
<i>Tylosurus pacificus</i>					X		X	X	X			X		X
Family Hemiramphidae														
<i>Hemiramphus saltator</i>					X							X		X
* <i>Hyporhamphus</i> cf. <i>H. rosae</i>									X			X		X
Order Beryciformes														
Family Holocentridae														
<i>Myripristis leiognathus</i>	X	X		X	X			X	X	X		X		X
<i>Sargocentron suborbitalis</i>	X		X	X	X	X	X	X	X	X		X		X
Order Syngnathiformes														
Family Fistulariidae														
<i>Fistularia commersonii</i>	X	X	X		X	X		X	X	X	X	X	X	X
Family Syngnathidae														
<i>Hippocampus ingens</i>					X							X		X
Order Scorpaeniformes														
Family Scorpaenidae														
<i>Scorpaena mystes</i>			X						X	X		X		X
Order Perciformes														
Family Serranidae														
<i>Alphestes immaculatus</i>									X	X		X		X
<i>Cephalopholis panamensis</i>	X	X	X	X	X	X	X	X	X	X		X		X
<i>Dermatolepis dermatolepis</i>					X							X		X
<i>Epinephelus analogus</i>									X			X		X
<i>Epinephelus itajara</i>										X		X	X	X
<i>Epinephelus labriformis</i>	X	X	X	X	X	X	X	X	X	X		X		X
* <i>Mycteroperca</i> cf. <i>M. rosacea</i>									X			X		
<i>Rypticus bicolor</i>					X			X	X			X		X
<i>Serranus psittacinus</i>		X			X	X	X	X	X	X		X		X
Family Apogonidae														
<i>Apogon pacificus</i>					X	X	X	X	X	X		X		X
<i>Apogon retrosella</i>		X			X	X			X	X		X		X

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TABLE 1 (continued)

	Mz	Es	Mi	T	S	J	H	C	E	M	IWP	EP	A	R&A
Family Carangidae														
<i>Caranx caballus</i>				X	X	X	X	X	X	X		X		X
<i>Caranx caninus</i>					X							X		X
<i>Elagatis bipinnulata</i>					X						X	X	X	X
<i>Naucrates ductor</i>									X			X		X
<i>Selar crumenophthalmus</i>				X	X				X		X	X	X	X
<i>Seriola rivoliana</i>					X						X	X	X	X
<i>Trachinotus rhodopus</i>					X				X			X		X
Family Lutjanidae														
<i>Hoplopagrus guentherii</i>									X			X		X
<i>Lutjanus argentiventris</i>	X		X		X	X	X	X	X	X		X		X
<i>Lutjanus guttatus</i>									X	X		X		X
<i>Lutjanus inermis</i>									X			X		X
<i>Lutjanus novemfasciatus</i>									X			X		X
<i>Lutjanus viridis</i>									X			X		X
Family Gerreidae														
<i>Eucinostomus currani</i>					X							X		X
<i>Gerres cinereus</i>					X							X	X	X
Family Haemulidae														
<i>Haemulon flaviguttatum</i>							X		X	X		X		X
<i>Haemulon maculicauda</i>					X	X	X	X	X	X		X		X
<i>Haemulon scudderii</i>						X		X	X	X		X		X
<i>Haemulon sexfasciatum</i>			X		X	X	X	X	X	X		X		X
<i>Haemulon steindachneri</i>		X		X	X	X	X	X	X	X		X	X	X
Family Sciaenidae														
* <i>Pareques</i> sp. A			X		X	X	X	X	X	X		X		X
Family Mullidae														
<i>Mulloidichthys dentatus</i>					X	X	X	X	X	X		X		X
Family Kyphosidae														
<i>Kyphosus analogus</i>	X				X	X			X	X		X		X
<i>Kyphosus elegans</i>	X				X	X	X	X	X	X		X		X
<i>Sectator ocyurus</i>			X											X
Family Chaetodontidae														
<i>Chaetodon humeralis</i>			X	X	X	X	X	X	X	X		X		X
<i>Johnrandallia nigrirostris</i>	X	X	X	X	X	X	X	X	X	X		X		X
Family Pomacanthidae														
<i>Holacanthus passer</i>		X	X		X	X	X	X	X	X		X		X
<i>Pomacanthus zonipectus</i>					X				X			X		X
Family Cirrhitidae														
<i>Cirrhitichthys oxycephalus</i>	X	X		X	X	X	X	X	X	X	X	X		X
<i>Cirrhitus rivulatus</i>	X	X		X	X	X	X	X	X	X		X		X

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TABLE 1 (continued)

	Mz	Es	Mi	T	S	J	H	C	E	M	IWP	EP	A	R&A
<i>Oxycirrhites typus</i>								X				X		X
Family Mugilidae														
<i>Mugil curema</i>					X	X				X		X	X	X
Family Pomacentridae														
<i>Abudefduf declivifrons</i>					X	X		X	X			X		X
<i>Abudefduf troschelii</i>			X		X	X	X	X	X	X		X		X
<i>Chromis atrilobata</i>	X	X	X	X	X	X	X	X	X	X		X		X
<i>Microspathodon bairdii</i>		X			X	X	X	X	X	X		X		X
<i>Microspathodon dorsalis</i>	X	X	X	X	X	X	X	X	X	X		X		X
<i>Stegastes acapulcoensis</i>	X	X	X	X	X	X	X	X	X	X		X		X
<i>Stegastes flavilatus</i>	X	X	X	X	X	X	X	X	X	X		X		X
<i>Stegastes rectifraenum</i>					X	X		X	X	X		X		
Family Labridae														
<i>Bodianus diplotaenia</i>	X	X	X	X	X	X	X	X	X	X		X		X
<i>Halichoeres chierchiai</i>	X	X	X	X	X	X	X	X	X	X		X		X
<i>Halichoeres dispilus</i>	X	X	X	X	X	X	X	X	X	X		X		X
<i>Halichoeres melanotis</i>						X		X	X	X		X		X
<i>Halichoeres nicholsi</i>		X	X	X	X	X	X	X	X	X		X		X
<i>Halichoeres notospilus</i>	X	X	X	X	X	X	X	X	X	X		X		X
<i>Iniistius pavo</i>					X							X		X
<i>Novaculichthys taeniourus</i>					X		X		X		X	X		X
<i>Thalassoma grammaticum</i>	X	X	X	X	X				X			X		X
<i>Thalassoma lucasanum</i>	X	X	X	X	X	X	X	X	X	X		X		X
Family Scaridae														
<i>Scarus compressus</i>					X		X		X			X		X
<i>Scarus ghobban</i>					X	X	X		X		X	X		X
<i>Scarus rubroviolaceus</i>		X		X	X	X	X	X	X	X	X	X		X
Family Chaenopsidae														
<i>Chaenopsis coheni</i>									X			X		
Family Blenniidae														
<i>Ophioblennius steindachneri</i>	X	X	X	X	X	X	X	X	X	X		X		X
<i>Plagiotremus azaleus</i>	X	X	X	X	X	X	X	X	X	X		X		X
Family Gobiidae														
<i>Elacatinus punctulatus</i>										X		X		X
Family Zaclidae														
<i>Zanclus cornutus</i>						X						X		X
Family Acanthuridae														
<i>Acanthurus nigricans</i>								X	X		X	X		X
<i>Acanthurus xanthopterus</i>					X	X			X		X	X		X
<i>Prionurus laticlavus</i>					X							X		X
<i>Prionurus punctatus</i>	X		X		X	X	X	X	X	X		X		X

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TABLE 1 (continued)

	Mz	Es	Mi	T	S	J	H	C	E	M	IWP	EP	A	R&A
Order Tetraodontiformes														
Family Balistidae														
<i>Balistes polylepis</i>					X	X	X		X	X		X		X
<i>Melichthys niger</i>								X			X	X	X	X
<i>Pseudobalistes naufragium</i>								X	X	X		X		X
<i>Sufflamen verres</i>		X		X	X	X	X	X	X	X		X		X
Family Monacanthidae														
<i>Aluterus scriptus</i>					X				X	X	X	X	X	X
<i>Cantherhines dumerilii</i>					X			X				X		X
Family Ostraciidae														
<i>Ostracion meleagris</i>	X								X	X	X	X		X
Family Tetraodontidae														
<i>Arothron hispidus</i>					X	X		X	X	X	X	X		X
<i>Arothron meleagris</i>	X				X	X	X	X	X	X	X	X		X
<i>Canthigaster punctatissima</i>					X	X		X	X	X		X		X
<i>Sphoeroides annulatus</i>					X		X		X			X		X
<i>Sphoeroides lobatus</i>					X							X		X
Family Diodontidae														
<i>Diodon holocanthus</i>				X	X	X	X	X	X	X	X	X	X	X
<i>Diodon hystrix</i>	X				X	X	X	X	X	X	X	X	X	X
Total	27	30	29	28	82	54	51	58	83	65	12	85	5	106

The highest species richness occurs at La Entrega (83) and San Agustín (82), intermediate at Isla Montosa, Isla Cacaluta, Jicaral-Chachacual and Dos Hermanas (65-51) and lowest at Estacahuite, La Tijera, La Mina and Mazunte (30-27) (Table I). We do not have strong arguments to support any meaningful species richness trend in the area since richness was drawn from seasons with different sampling techniques and intensities (stationary 10 minutes cylinders: 1998, 2002-2003; stationary 5 minutes cylinders 2006-2008, López-Pérez *et al.* 2008). In addition a raw comparison between sampling intensity (indirectly considered here as number of field parties per locality) versus species richness, reveals that species richness apparently reflects changes in sampling intensity (Spearman Rank Correlation = 0.828, $p < 0.05$) but not true richness differences. This data suggest that the record is still incomplete and in the near future the odds that additional fish species will be added to the present contribution are high; in particular, cryptic crevice, bottom and burrow dwellers (e.g., blennies, gobies) species, to date poorly represented, are likely to be added to the list.

Finally, although there has been an improvement on reef biodiversity knowledge in southwestern México, spatio-temporal intensive sampling focusing mainly in poorly known taxa is mandatory, particularly since urbanization and environmental degradation is proceeding at a fastest rate than data acquisition and sustainable management and conservation.

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