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Ichthyological survey on the Yucatan Coastal Corridor (Southern Gulf of Mexico)

Evaluación ictiológica en el Corredor Costero de Yucatán (Sureste del Golfo de México)

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Abstract

It is provided a systematic checklist of the ichthyofauna inhabiting the Yucatan coastal corridor, as part of the Mesoamerican Corridor which connects two of the most important reserves in Yucatan Peninsula Mexico: Celestun and Ria Lagartos. Fish specimens were collected bimonthly, from January 2002 to March 2004, in 24 localities along the coast (140 km). The systematic list includes 94 species belonging to 44 families and 19 orders. The best represented families by species number were Sciaenidae (10), Carangidae (9) and Engraulidae (5). Information about size range, number of specimen per species and zoogeographic affinities are included. The species with the highest occurrence (100%) were *Harengula jaguana* and *Trachinotus falcatus*. It is confirmed the presence of *Rypticus maculatus* (Serranidae) in the southern Gulf of Mexico and of three brackish species into the marine environment.

Keywords: Biodiversity, Coastal fishes, Gulf of Mexico, Ichthyofauna, Yucatan.

Resumen

Se presenta un listado sistemático de la ictiofauna que habita el corredor costero de Yucatán, el cual forma parte del Corredor Mesoamericano que conecta dos de las reservas más importantes en la Península de Yucatán (México): Celestún y Ría Lagartos. Los especímenes se colectaron bimensualmente entre enero 2002 a marzo 2004 en 24 sitios a lo largo de los 300 km de costa. El listado sistemático contiene 94 especies incluidas en 44 familias y 19 órdenes. Las familias mejor representadas por número de especies fueron Sciaenidae (10), Carangidae (9) y Engraulidae (5). Para cada especie se incluye el número de ejemplares, intervalo de tallas y afinidades zoogeográficas. Las especies con la mayor ocurrencia (100%) fueron *Harengula jaguana* y *Trachinotus falcatus*. Se confirma la presencia de *Rypticus maculatus* (Serranidae) en el sureste del Golfo de México y de tres especies salobres en el ambiente marino.

Palabras clave: Biodiversidad, Golfo de México, Ictiofauna, Peces costeros, Yucatán.

Introduction

Taxonomic inventories (or species censuses) are the most elementary data in biogeography, macroecology and conservation biology. They play fundamental roles in the construction of species richness patterns, delineation of species ranges, quantification of extinction risk and prioritization of conservation efforts in hot spot areas (Gaston and Blackburn 2000). It is recognized that this knowledge is the starting point for subsequent studies and analysis for fisheries research, fish management, environmental assessments, as well biogeographic and phylogenetic studies, among others (Karr 1981, Moncayo-Estrada *et al.* 2006). The basic knowledge of diversity alpha through species discovery and description is mostly complete for some areas of the world and for many families of fishes, but important gaps remain (Eschmeyer *et al.* 2010). Remarkably, tropical areas that are well known for their diversity have among the lowest completeness of all taxonomic inventories. These data gaps occurred regardless of habitat (Mora *et al.* 2008).

In Yucatan Peninsula (YP) because of karst con-

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ditions, soils are porous with rapid infiltration of rainwater and absence of surface drainage (Southworth 1984). The water flow is mostly underground, where drainage is discharged into the direction of the coast. The absence of rivers and freshwater discharges develop in coastal and, heterogeneous habitats (mangroves, petenes, seagrass) for fishes (Toledo-Ocampo 2005, Yáñez-Arancibia *et al.* 2009), where marine fish species migrate to and from coastal lagoons and wetlands for feeding, reproduction and protection (Arceo-Carranza *et al.* 2013). In these environments fish species are represent by freshwater, estuarine, euryhaline and estenohaline marine components, some of them of endemic nature.

Coastal fishes of the northwest coast of YP, are of particular interest because they share fauna elements with the Caribbean Province and Western Tropical Atlantic region; about 6.4% of fish species recorded in the Gulf of Mexico (GM), are restricted to the southeast subregion (i.e. Cape Rojo, Veracruz; Cape Catoche, Quintana Roo), and although most of them occur in the Caribbean, some are endemic to the YP, like the giant killifish *Fundulus grandissimus* (Miller 2005).

The YP separates the Caribbean Sea from the GM, with 1,100 km of coastline. It is the exposed portion of the larger Yucatan Platform, which is composed of carbonate and soluble rock with a shallow depth and an unconfined flat lying karst landscape. The northwestern coast comprises the not protected area with 140 km^2 of coastline from El Palmar (21° 0.3' - 90° 16.0') to Chabihau (21° 21.0'- 89° 7.0'). In this biological corridor diverse economic activities are realized, as fishing, aquaculture, tourism and port trade. The predominant climate of this region is the driest of the subhumid type with summer rains and a low proportion of winter precipitation (Batllori *et al.* 2000).

In general, fish research in the southern GM has been concentrated in the coastal lagoons from Veracruz to Yucatan (Reséndez-Medina 1983, Salvadores-Baledón and Reséndez 1990, Yáñez-Arancibia *et al.* 1993, Obregón-Barboza *et al.*1994, Pérez-Hernández and Torres-Orozco 2000, Ayala-Pérez *et al.* 2003, Vega-Cendejas 2004, García-Hernández *et al.* 2009, Arceo-Carranza *et al.* 2010, Palacios-Sánchez y Vega-Cendejas, 2010, Peralta-Meixuero and Vega-Cendejas 2011, Vega-Cendejas *et al.* 2012, Caballero-Vázquez and Vega-Cendejas 2012), while littoral species have been little studied. In the particular case of the northwestern coast of the YP, there is a lack of systematic information. The present research provides the first checklist of the coastal biological corridor of the Yucatan (CBCY), whose function is to maintain the physical and biological connection between two of the most important biosphere and ecological reserves of Mexico: Celestun and Ria Lagartos (Smardon 2009).

Materials and methods

Fish collections were conducted monthly during a biannual period (January 2002-March 2004) in twenty four sites along the coast (Figure 1, Table 1). Temperature and salinity were recorded using a multiparametric probe (Yellow Springs Instrument, model 85). Fish specimens were caught with a beach seine (15 m long, 2 m high, 2.5 cm mesh size), approximately at 30 m from the coastline (Figure 2). A total of forty meters were trawled, covering an estimated area of 264 m^2 with two replicas per station. Specimens were preserved in 15% formalin solution and subsequently transferred to ethyl alcohol.

Each individual was identified to species, measured (standard length to the nearest 0.1 cm), and weighed (to the nearest 0.1g). Species identification was based on several taxonomic sources (Fischer 1978,

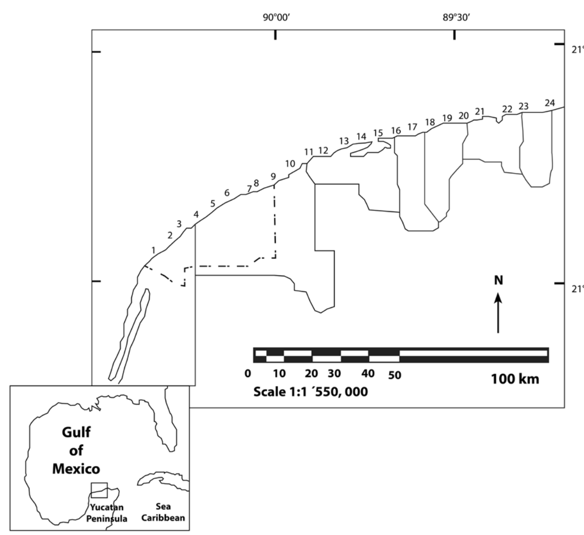

Figure 1. Study area indicating the sampling sites in the northwestern coast of Yucatan Peninsula (Southern Gulf of Mexico).

Table 1. List of sampling sites in the northwest coast of Yucatan Peninsula with their code number

	Station	Position	% N	S
El Palmar	(1) Faro M	21º3.49’, 90º15.93’	4.4	27
Reserve	(2) Faro I-M	21º3.05’, 90º16.46’	21.8	38
Western zone	(3) Cahuich	21º4.46’, 90º15.02’	2.0	21
	(4) Punta Pantera	21º5.36’, 90º12.71	13.5	33
	(5) La tabla	21º6.80’, 90º10.81	5.3	35
El Palmar Reserve	(6) Punta Elefante	21º8.04’, 90º9.55’	10.3	36
Eastern zone (EPR)	(7) Punta Piedra	21º9.46’, 90º5.74’	1.1	33
	(8) Yaxantún	21º 9.69’, 90º 4.31’	1.6	36
	(9) Pecis-M	21º10.65’, 89º59.91’	1.2	31
	(10) Bocana-M	21º13.73’, 89º54.35’	7.8	37
	(11) Chuburná	21º15.40’, 89º49.34’	2.5	27
Progreso (PG)	(12) Chelem	21º16.02’, 89º46.78’	0.8	16
	(13) Progreso	21º17.25’, 89º40.10’	4.4	37
	(14) Chicxulub	21º14.55’, 89º37.73’	1.6	25
	(15) Uaymitun	21º17.99’, 89º35.13’	0.8	33
	(16) San Bruno II	21º18.72’, 89º32.33’	2.4	40
Ixil (IX)	(17) San Benito	21º19.41’, 89º29.04’	1.2	36
	(18) San Bruno	21º19.56’, 89º26.55’	1.0	30
	(19) Telchac I	21º20.61’, 89º18.33’	1.3	24
Telchac (TC)	(20) Telchac II	21º20.61’, 89º16.70’	3.2	33
	(21) San Crisanto I	21º20.92’, 89º13.64’	2.6	37
Sinanche (SC)	(22) San Crisanto II	21º21.27’, 89º10.56’	1.3	36
	(23) Chabihau I	21º21.44’, 89º7.62’	5.9	34
Yobaín (YB)	(24) Chabihau II	21º21.47’, 89º7.13’	2.1	32

Geographic coordinates (Latitude N, Longitude W), relative numerical abundance (% N) and species richness (S) are specified.

Whitehead 1985, Hoese and Moore 1998, McEachran and Fechhelm 1998, 2005, Schmitter-Soto 1998, Castro-Aguirre *et al.* 1999, Carpenter 2002a, 2002b), and systematic classification according to Nelson (2006). The name, author and description year were checked against Eschmeyer (2015). A representative sample of each species was deposited and catalogued in the ichthyological collection of CINVESTAV-IPN, Merida (YUC.PEC.084.0999 key).

The list includes information about the number of individuals collected by species, size ranges of the specimens expressed in cm of standard length and their occurrence frequency in the region. The ichthyo-geographic classification was assigned according to Briggs (1974) and considering the information published on the geographic distribution of the species: West Atlantic (WA), Circumtropical (CT), Gulf of Mexico (GM), Amphiamerican (AA) Amphiatlantic (AT) and Yucatan Peninsula (YP). The comparisons of maximum sizes recorded in previous studies were performed considering the Fishbase website (Froese and Pauly 2015).

Results

As a tropical region, the study area showed little variations in temperature and salinity, with average values of 27.02 (±2.31) ºC and 35.84 (±1.71), respectively. A total of 94 species included in 81 genera, 44 families and 19 orders were sampled during the study. From this total, the Eslasmobranchs (Chondrichthyes) were represented by three orders, six families, six genera and six species, while Teleosts (Actinopterigii) by 16 orders, 38 families, 75 genera, and 88 species (Table 2). The best represented families were Sciaenidae (10 species), Carangidae (9) and Engraulidae (5). The highest relative numerical abundance (21%) and species richness (38 species) were recorded in localities from the Palmar Reserve, located near a Biosphere Reserve (Celestun), while the lowest values of these ecological parameters were found in localities from Progreso (Table 1). Twenty species (80% equivalent to the total catch recorded), were found in more than 80% from all localities (>75% occurrence frequency); within these, we have the en-

Figure 2. Collecting fish with a beach seine in northwestern coast of Yucatan Peninsula.

Table 2. Total numbers of the Orders, Families, Genera and Species recorded in the northwestern coast of Yucatan Peninsula

Classes	Orders	Families	Genera	Species
Chondrichthyes	Torpediniformes	1	1	1
	Rajiformes	1	1	1
	Myliobatiformes	4	4	4
Total	3	6	6	6
Actinopterygii	Elopiformes	1	1	1
	Albuliformes	1	17	1
	Clupeiformes	2	3	8
	Siluriformes	1	2	2
	Aulopiformes	1	1	1
	Ophidiiformes	1	1	1
	Batrachoidiformes	1	1	1
	Lophiiformes	2	2	2
	Mugiliformes	1	1	2
	Beloniformes	2	4	7
	Cyprinodontiformes	2	2	3
	Gasterosteifomes	1	1	3
	Scorpaeniformes	1	1	3
	Perciformes	14	29	41
	Pleuronectiformes	3	4	4
	Tetraodontiformes	4	5	8
Total	16	38	75	88
Totales	19	44	81	94

graulids (*Anchoa mitchilli, Anchoa hepsetus*), gerrids *Eucinostomus argenteus, Eucinostomus gula*), catfish (*Sciades felis*) and checkered puffer (*Sphoeroides testudineus*). The species with the highest occurrence (100%) were *Harengula jaguana* and *Trachinotus falcatus*. By contrast 35 species showed an occasional occurrence (<2%) (Table 3).

The fish fauna of the northwest coast of YP was characterized by a mixture of tropical, subtropical and temperate-warm species with 73 exclusive from west Atlantic, five Circumtropical, eight Amphiatlantic, two Amphiamerican, one Amphiatlantic/Amphiamerican, two endemic from the GM (McEachran and Fechhelm 2005), and three from YP (Miller 2005) (Figure 3).The curatorial information obtained in this research is part of the National Information System on Biodiversity (SNIB-CONABIO), which website (www.conabio.gob.mx) is available for consultation.

Discussion

Biological corridors are fundamental strategies for biodiversity conservation in fragmented landscapes. However, little evidence exists about their functionality or the population viability of its species on long term especially for the tropics (González-Maya *et al.* 2013). The CBCY, is spatially located among two biosphere reserves, which maintain the biological diversity in the unprotected area.

The report of fish species at specific sites is probably the most basic data in ecology (Gaston and Blackburn 2000). Such records are often used to calculate the number of species occurring at each site or as a source of information with which to extrapolate the extent of species occurrence and their area of occupancy. There is a general agreement that without species-level data, basic processes such as energy fluxes, biological interactions, evolutionary history, habitat specificity, and biogeographic distributions cannot be studied. Identification of exotic species and the establishment of reserves are not possible without reliable information on species distributions (Grassle and Stocks 1999). Our incomplete knowledge about the current fish distribution in tropical areas also raises concern upon the effectiveness of conservation efforts (Mora *et al.* 2008).

One of the species recorded in the northwest coast of YP, is within the category of critically endangered (*Narcine bancroftii*), two of them near threatened (*Rhinobatos lentiginosus, Aetobatus narinari*) (IUCN 2015), and three are reported with a size range greater than previously recorded by Froese and Pauly (2015)

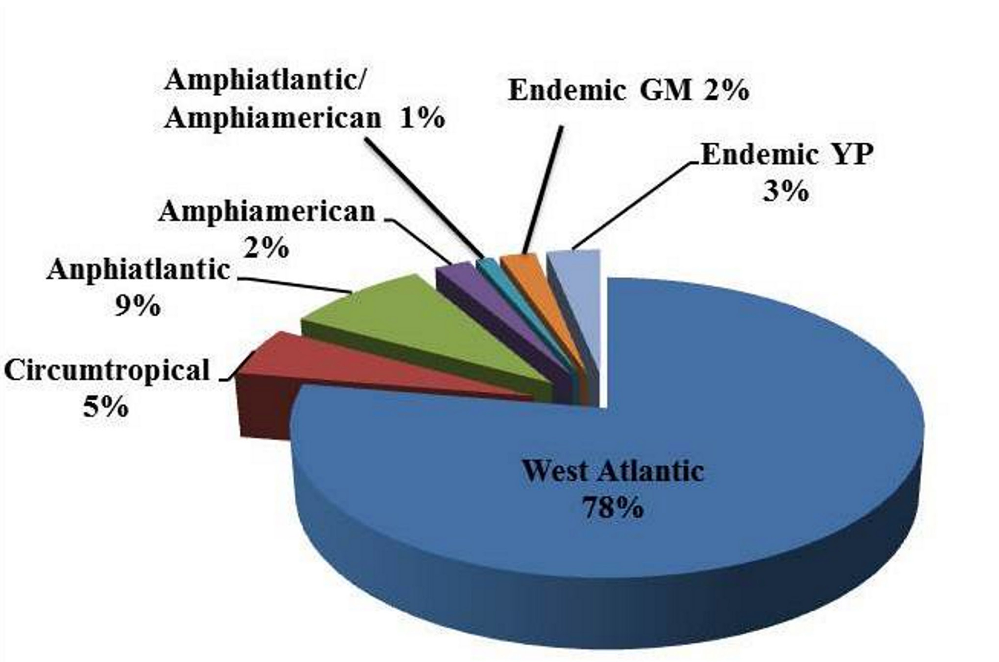

Figure 3. Relative contribution of ichthyogeographic categories recorded in the northwestern coast of Yucatan Peninsula, based on Briggs (1974).

Table 3. Fish checklist of the northwestern coast of Yucatan Peninsula (Southern Gulf of Mexico)

Taxa	Sampling sites	SL	n >1, [OF]	D
Chondrichthyes				
I. Torpediniformes				
Narcinidae				
1.*Narcine bancroftii* (Griffith & Smith 1834)[CE]	8	25.0	[4.2]	WA
II. Rajiformes				
Rhinobatidae				
2. *Rhinobatos lentiginosus* Garman 1880[NT]	23, 24	28.5-34.9	8 [8.3]	WA
III. Myliobatiformes				
Urotrygonidae				
3. *Urobatis jamaicensis* (Cuvier 1816)	6-9, 14-16, 21, 23	12.5-29.9	11 [37.5]	WA
Dasyatidae				
4. *Dasyatis americana* Hildebrand & Schroeder 1928	23, 24	44.2-56.7	2 [8.3]	WA
Gymnuridae				
5. *Gymnura micrura* (Bloch & Schneider 1801)	1-11, 13, 16-18, 21-24	13.0-21.7	68 [79.2]	WA
Myliobatidae				
6. *Aetobatus narinari* (Euphrasen 1790)[NT]	24	128.0	[4.2]	CT
Actinopterygii				
IV. Elopiformes				
Elopidae				
7. *Elops saurus* Linnaeus 1766	2, 6-10, 15-16, 19, 21	19.5-31.5	27 [41.7]	WA
V. Albuliformes				
Albulidae				
8. *Albula vulpes* (Linnaeus 1758)[J]	7, 8, 10-11, 16, 19, 21-22	3.2-14.8	23 [33.3]	CT
VI. Clupeiformes				
Engraulidae				
9. *Anchoa cubana* (Poey 1868)	1-2, 6-7, 9	2.0-5.9	493 [20.8]	WA
10. *Anchoa hepsetus* (Linnaeus 1758)	1-2, 5-11, 13-14, 16-21	2.7-10.5	3972 [70.8]	WA
11. *Anchoa lamprotaenia* Hildebrand 1943*	1-2, 4-24	2.6-12.8	883 [95.8]	WA
12. *Anchoa lyolepis* (Evermann & Marsh 1900)	1-2, 4, 6-7, 13, 19	3.5-6.3	263 [29.2]	WA
13. *Anchoa mitchilli* (Valenciennes 1848)	1-2, 4-22, 24	2.3-10.1	1914 [91.7]	WA
Clupeidae				
14. *Harengula humeralis* (Cuvier 1829)[J]	14-16, 18	2.3-3.1	22 [16.7]	WA
15. *Harengula jaguana* Poey 1865*	1-24	1.87-25.0	5470 [100.0]	WA
16. *Opisthonema oglinum* (Lesueur 1818)	4-8, 10-11, 13-14, 23, 19-20			
VII. Siluriformes				
Ariidae				
17. *Sciades felis* (Linnaeus 1766)	1, 3-5, 6-11, 13-24	4.0-26.3	1458 [91.7]	WA
18. *Bagre marinus* (Mitchill 1815)[J]	1, 3-4, 9-10, 13-14, 18, 20	7.2-15.3	26 [37.5]	WA
VIII. Aulopiformes				
Synodontidae				
19. *Synodus foetens* (Linnaeus 1766)	1-10, 13, 15, 18, 20-24	3.9-24.5	45 [75.0]	WA
IX. Ophidiformes				
Bythitidae				
20. *Gunterichthys longipenis* Dawson 1966	16	6.2	[4.2]	GM
X. Batrachoidiformes				
Batrachoididae				
21. *Opsanus beta* (Goode & Bean 1880)	7, 16, 17, 21	4.5-10.4	23 [16.7]	WA
XI. Lophiiformes				
Antennariidae				
22. *Histrio histrio* (Linnaeus 1758)[J]	15	5.5	[4.2]	CT
Ogcocephalidae				
23. *Ogcocephalus cubifrons* (Richardson 1836)	23	21.2	[4.2]	WA
XII. Mugiliformes				
Mugilidae				

Table 3. Fish checklist of the northwestern coast of Yucatan Peninsula (Southern Gulf of Mexico) (continuation)

Taxa	Sampling sites	SL	n >1, [OF]	D
24. *Mugil curema* Valenciennes 1836	2, 4, 7-8, 10-11, 13, 24	2.0-23.9	14 [33.3]	AA/AT
25. *Mugil trichodon* Poey 1875[J]	9, 13, 16, 20, 21-22, 24	2.1-15.3	50 [29.2]	WA
XIII. Beloniformes				
Hemiramphidae				
26. *Chriodorus atherinoides* Goode & Bean 1882	1, 4, 7, 10, 12, 17-18, 22-24	4.2-18.5	42 [41.7]	WA
27. *Hyporhamphus meeki* Banford & Collette 1993*	21	19.3	[4.2]	WA
28.*Hyporhamphus unifasciatus* (Ranzani 1841)	1-2, 4-8, 11-13, 15-18, 20-24	6.2-25.5	162 [79.2]	AA
Belonidae				
29. *Strongylura marina* (Walbaum 1792)	12, 17	9.0-28.0	2 [8.3]	WA
30. *Strongylura notata* (Poey 1860)	1-7, 12-18, 21-22, 24	4.7-46.0	118 [70.8]	WA
31. *Strongylura timucu* (Walbaum 1792)	5, 8, 16, 21-22, 24	7.2-39.3	11 [25.0]	WA
32. *Tylosurus crocodilus* (Péron & Lesueur 1821)	2, 3	4.5-75.0	3 [4.2]	CT
XIV. Cyprinodontiformes				
Fundulidae				
33. *Fundulus grandissimus* Hubbs 1936[E]	10	8.7	[4.2]	YP
34. *Fundulus persimilis* Miller 1955E,*	4-5, 9-10, 17, 21	2.6-18.5	14 [25]	YP
Cyprinodontidae				
35. *Floridichthys polyommus* Hubbs 1936	3, 5, 20	1.7-8.0	3 [8.3]	YP
XV. Gasterosteiformes				
Syngnathidae				
36. *Syngnathus floridae* (Jordan & Gilbert 1882)	17	11.9	[4.2]	WA
37. *Syngnathus louisianae* Günther 1870	15	11.0	[4.2]	WA
38. *Syngnathus pelagicus* Linnaeus 1758	4	7.5	[4.2]	WA
XVI. Scorpaeniformes				
Triglidae				
39. *Prionotus scitulus* Jordan & Gilbert 1882	9, 22-24	3.3-11.1	7 [16.7]	WA
40. *Prionotus tribulus* Cuvier 1829	5, 16,18, 23-24	7.1-14.3	35 [20.8]	WA
XVII. Perciformes				
Centropomidae				
41. *Centropomus undecimalis* (Bloch 1792)[J]	19	27.1-32.2	2 [4.2]	
CINV-NEC 2436; ()				WA
Serranidae				
42. *Diplectrum bivittatum* (Valenciennes 1828)[J]	20	13.9	[4.2]	WA
43. *Rypticus maculatus* Holbrook 1855[J]	5-18, 20	6.4-8.9	10 [20.8]	WA
Carangidae				
44. *Caranx bartholomaei* Cuvier 1833	22	6.8	[4.2]	WA
45. *Caranx crysos* (Mitchill 1815)	2, 15-16, 22-23	9.7-13.0	5 [20.8]	AT
46. *Caranx hippos* (Linnaeus 1766)	6, 13	3.6-17.3	3 [8.3]	AT
47. *Caranx latus* Agassiz 1831	4-6, 16-17, 20-21, 24	7.0-14.9	16 [33.3]	AT
48. *Oligoplites saurus* (Bloch & Schneider 1801)	2, 4-6, 8-11, 13, 17, 21-22, 24	4.2-23.8	22 [50.0]	AA
49. *Selene vomer* (Linnaeus 1758)	4-8, 10-11, 13, 16-17, 20	1.8-12.5	26 [45.8]	WA
50. *Trachinotus carolinus* (Linnaeus 1766)	1-2, 4-14, 16-20,22-24	1.8-11.4	114 [87.5]	WA
51. *Trachinotus falcatus* (Linnaeus 1758)	1-24	1.4-14.5	561 [100.0]	WA
52. *Trachinotus goodei* Jordan & Evermann 1896	1-2, 5, 10-11, 13-15, 17, 20, 22	2.9-15.3	25 [45.8]	WA
Lutjanidae				
53. *Lutjanus analis* (Cuvier 1828)	21	6.6	[4.2]	WA
54. *Lutjanus griseus* (Linnaeus 1758)	2-5,10, 13, 15, 17-19, 22-24	4.8-16.3	37 [54.2]	WA
Lobotidae				
55. *Lobotes surinamensis* (Bloch 1790)	18, 13	5.2-19.1	2 [8.3]	CT
Gerreidae				
56. *Eucinostomus argenteus* Baird & Girard 1855	2-11, 13-24	1.6-19.0	401 [91.7]	WA
57. *Eucinostomus gula* (Quoy & Gaimard 1824)	2-17, 19-24	2.6-9.1	26 [91.7]	WA
58. *Eucinostomus harengulus* Goode & Bean, 1879	2, 6,10, 18, 22	1.6-10.2	25 [20.8]	WA
59. *Eugerres plumieri* (Cuvier 1830)	5, 15	15.3-19.0	4 [8.3]	WA

Table 3. Fish checklist of the northwestern coast of Yucatan Peninsula (Southern Gulf of Mexico) (continuation)

Taxa	Sampling sites	SL	n >1, [OF]	D
Haemulidae				
60. *Anisotremus virginicus* (Linnaeus 1758)	14	8.0	[4.2]	WA
61. *Haemulon flavolineatum* (Desmarest 1823)	2	7.5-15.7	2 [4.2]	WA
62. *Haemulon plumierii* (Lacepède 1801)	11	2.5	[4.2]	WA
63. *Orthopristis chrysoptera* (Linnaeus 1766)	2, 9-10, 13, 15, 20-21, 23-24	4.2-20.5	19 [37.5]	WA
Sparidae				
64. *Archosargus probatocephalus* (Walbaum 1792)	16-17	12.0-13.6	3 [8.3]	WA
65. *Archosargus rhomboidalis* (Linnaeus 1758)	1-18, 20-23	2.7-20.2	151, [91.7]	WA
66. *Lagodon rhomboides* (Linnaeus 1766)	1-13, 15, 17-24	4.7-13.0	259 [91.7]	WA
Polynemidae				
67. *Polydactylus virginicus* (Linnaeus 1758)	1, 10, 13, 19-21	4.4-10.0	8 [25.0]	WA
Sciaenidae				
68. *Bairdiella chrysoura* (Lacepède 1802)	1-3, 5, 7-9, 11-15, 17-21, 23-24	3.3-17.0	140 [79.2]	WA
69. *Bairdiella ronchus* (Cuvier 1830)	8, 7	13.6-15.6	2 [8.3]	WA
70. *Corvula sanctaeluciae* Jordan 1890	8, 17-18, 21	4.9-17.5	8 [16.7]	WA
71. *Cynoscion arenarius* Ginsburg 1930	1-11, 13-15, 17-21	2.6-20.9	105 [79.2]	GM
72. *Cynoscion nebulosus* (Cuvier 1830)	1-3, 5, 7, 13, 15, 17	3.5-18.5	17 [33.3]	WA
73. *Menticirrhus americanus* (Linnaeus 1758)	1-23	2.1-16.2	129 [95.8]	WA
74. *Menticirrhus littoralis* (Holbrook 1847)	1, 4-22, 24	1.7-15.7	90 [87.5]	WA
75. *Menticirrhus saxatilis* (Bloch & Schneider 1801)	1, 2, 4-17, 19-23	2.1-19.0	90 [87.5]	WA
76. *Micropogonias undulatus* (Linnaeus 1766)	8, 13, 15	3.0-9.3	3 [12.5]	WA
77. *Umbrina coroides* Cuvier 1830	20	11.6	[4.2]	WA
Kyphosidae				
78. *Kyphosus sectatrix* (Linnaeus 1758)	23	12.3	[4.2]	AT
Scaridae				
79. *Cryptotomus roseus* Cope 1871	5	4.7	4, [4.2]	WA
80. *Nicholsina usta* (Valenciennes 1840)	16	7.5	[4.2]	WA
Ephippidae				
81. *Chaetodipterus faber* (Broussonet 1782)	6, 8, 13-14,16,21-22	2.8-13.8	21 [29.2]	WA
Sphyraenidae				
82. *Sphyraena barracuda* (Edwards 1771)	23	25.8	[4.2]	AT
XVIII. Pleuronectiformes				
Paralichthyidae				
83. *Citharichthys macrops* Dresel 1885	8, 10, 13, 15-16,18, 22, 24	3.6-10.4	8 [33.3]	WA
84. *Paralichthys albigutta* Jordan & Gilbert 1882	6, 10	8.5-28.0	2 [8.3]	WA
Achiridae				
85. *Achirus lineatus* (Linnaeus 1758)	11, 19, 21, 23, 24	7.5-16.9	11 [20.8]	WA
Cynoglossidae				
86. *Symphurus plagiusa* (Linnaeus 1766)	2, 9, 19-24	6.0-14.4	16 [33.3]	WA
XIX. Tetraodontiformes				
Monacanthidae				
87. *Stephanolepis hispidus* (Linnaeus 1766)	16	3.3-3.8	4 [4.2]	AT
88. *Stephanolepis setifer* (Bennett 1831)	2, 4, 9	3.6-6.5	6 [12.5]	WA
Ostraciidae				
89. *Acanthostracion quadricornis* (Linnaeus 1758)	3, 4, 6, 10, 14, 16, 22	12.9-21.5	17 [29.2]	AT
90. *Lagocephalus laevigatus* (Linnaeus 1766)	8	9.6	[4.2]	AT
91. *Sphoeroides nephelus* (Goode & Bean 1882)	1, 3, 5, 7, 9-10 16-17, 20-22	2.3-9.6	15 [45.8]	WA
92. *Sphoeroides spengleri* (Bloch 1785)	6, 8, 16-17, 22-23	3.8-12.7	24 [25.0]	WA
93. *Sphoeroides testudineus* (Linnaeus 1758)	1-11, 13-17, 19-24	3.5-28.0	132 [91.7]	WA
Diodontidae				
94. *Chilomycterus schoepfii* (Walbaum 1792)	15, 24	3.3-7.5	22 [8.3]	WA

*Species with a maximum length greater than previously recorded (Froese and Pauly 2013). J: juveniles CE: Species critically endangered NT: Species near threatened E: Species endemic. Sampling sites, size range (cm) as standard length (SL), number of individuals (n), occurrence frequency [OF] and distribution (D), are indicated for each species: west Atlantic (WA), circumtropical (CT), Gulf of Mexico (GM), amphiamerican (AA) amphiatlantic (AT) and Yucatan Peninsula (YP). Sampling site code numbers are from Table1.

Figure 4. *Rypticus maculatus* (Serranidae) recorded in the northwestern coast of Yucatan Peninsula.

(Table 3). From this set of species, is confirmed the presence of *Rypticus maculatus* (Serranidae) (Figure 4), as in the southern GM has only been reported in the Campeche Bank (Carpenter 2002a, McEachran and Fechhelm 1998, McEachran and Fechhelm 2005).

According to the proposed ecological classification by Castro-Aguirre *et al.* (1999), 46.8% of the recorded species belong to the stenohaline marine component, and 44.7% to marine eurihaline, so most of these species (82%) have been reported in coastal lagoons of the northeast and northwest YP coast (Vega-Cendejas 2004, Arceo-Carranza *et al.* 2010, Peralta-Meixuero and Vega-Cendejas 2011, Caballero-Vázquez and Vega-Cendejas 2012). The occurrence in the marine environment of typical freshwater and brackish species of the northwest coast of Yucatan like *Fundulus grandissimus*, *Fundulus persimilis* and *Floridichthys polyommus* indicate a clear relation to the hydrological conditions prevailing on the YP coast: 1) direct access of seawater with the marsh through breaks of the land barrier between them, and 2) underwater springs which discharge fresh water from the aquifers to sea water, mainly during the rainy season (Herrera-Silveira *et al.* 2004, Aranda-Cirerol *et al.* 2006). Both processes coupled with the high salinity tolerance of these species, may explain their occasional occurrence in the coastal marine area, and stretch the high proportion of the marine fish composition recorded in the area (>90%).

Though most of the recorded species have a wide distribution in the Mexican Caribbean (62), Netherlands Antilles (45), Bahamas (43), Bermudas (39) and in northwest of the Gulf of Mexico (48) (Guitart 1974, Smith *et al.* 1975, Robins and Ray 1986; Böhlke and Chaplin 1993, Darovec 1995, Hoese and Moore 1998, Smith-Vaniz *et al.* 1999, Schmitter-Soto *et al.* 2000), their diversity and distribution patterns are related to nearshore habitat heterogeneity and the bioecological dependence of many marine species to coastal lagoons and wetlands. The present checklist is a taxonomic inventory of an area that is important for its biodiversity and highlights the value of the coastal systems within the biological strategies of marine fish species. The lack of taxonomic inventories can introduce substantial mistakes in assessing diversity patterns, and raise concerns over the effectiveness of conservation strategies. While specific data are lacking, fishing activities, both artisanal and commercial in nature are generally intense and most often unregulated in shallow inshore waters. Changes in community structure and abundance of even the most common, well-known species add a sense of urgency to measurement of the present composition and limits of marine life to evaluate human impacts and making management decisions.

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