



Fish larvae and juveniles checklist (Pisces) from the northern Yucatán Peninsula, Mexico, with 39 new records for the region

Listado de larvas y juveniles de peces del norte de la península de Yucatán, México, con 39 nuevos registros para la región

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Abstract. A taxonomic checklist for fish larvae and juveniles occurring at Yalahau (June 2001-May 2002), Celestún (July 1994-June 1995), Chelem (July 1999-June 2000) and Río Lagartos (November 1996- October 1997) lagoons located in the northern part of the Yucatán Peninsula is presented. Sampling was carried out for 5 minutes using a zooplankton net for larvae, while a Renfro net was hauled for 50 m² to capture juveniles. This work aims to provide the current state of the taxonomic composition and general distribution for 34 377 fish larvae and juveniles. Our samples represent 2 classes, 17 orders, 45 families, 83 genera and 117 species were caught, including 39 new records, where 24 have been found only in the Gulf of Mexico, 3 in the Caribbean Sea, and 90 are common to both regions. This study updates and increases the number of species in larval and juvenile stages previously reported. It was found that early reef larval stages were more abundant towards the East of the Yucatán Peninsula and less to the West. The high number of shared species (90) suggests that the northern region of the Yucatán Peninsula is a transition zone for fish larvae and juveniles between the Gulf of Mexico and the Caribbean Sea.

Key words: fish larvae and juvenile checklist, Yucatán Peninsula, Mexico.

Resumen. Se presenta un listado taxonómico de larvas y juveniles de peces de las lagunas de Yalahau (junio 2001-mayo 2002), Celestún (julio 1994-junio 1995), Chelem (julio 1999-junio 2000) y Río Lagartos (noviembre 1996- octubre 1997) del norte de la península de Yucatán. Se actualiza e incrementa el registro en el número de especies del lugar reportado en estudios previos y se hacen observaciones sobre la distribución general de las larvas y juveniles de peces del área. Los muestreos se realizaron durante 5 minutos con una red de zooplancton para las larvas de peces y una red Renfro para los juveniles cubriendo un área de 50 m². Se registraron 2 clases, 17 órdenes, 45 familias, 83 géneros y 117 especies, incluyendo a 39 nuevos registros, y de las cuales 24 han sido reportadas exclusivamente para el golfo de México, 3 para el Caribe y 90 son comunes para ambas regiones. Se encontró que los estadios larvales de peces de sistemas arrecifales fueron más abundantes hacia el este de la península, disminuyendo hacia el oeste. El gran número de especies compartidas (90) sugiere que el norte de la península de Yucatán es un área de transición para larvas y peces juveniles entre el golfo de México y el mar Caribe.

Palabras clave: listado de larvas y juveniles de peces, península de Yucatán, México.

Introduction

Taxonomic and ecological studies on early life stages of fish are very scarce for the Yucatán Peninsula, as most studies have focused their attention on economically important species and very few on species richness and general composition and distribution of the ichthyofauna.

Flores-Coto and Álvarez-Cadena (1980), Flores-Coto (1988), and more recently, Vega-Cendejas and Hernández de Santillana (2004), carried out studies on several lagoon systems, but no previous reports exist in Celestún, Yalahau, Chelem and Río Lagartos lagoons for fish larvae and juveniles.

The study area is located within the Mesoamerican Biological Corridor (Fig. 1), designated by Mexican laws as a National Shelter for Wildlife (Arriaga-Cabrera et al.,

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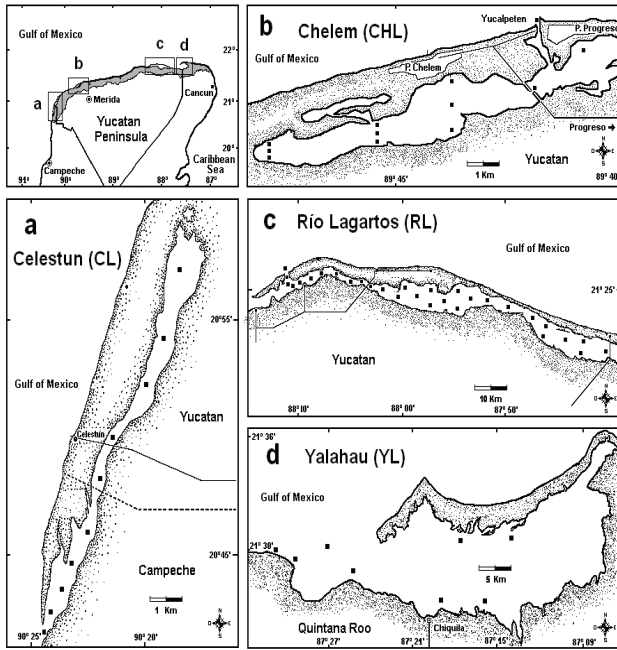


Figure 1. Localities of collection. a. Celestún lagoon; b. Chelem lagoon; c. Río Lagartos lagoon; d. Yalahau lagoon from the northern Yucatán Peninsula, Mexico.

1998). The climate is warm, semi-dry, with the main rainy season from June to October and an average rainfall of 760 mm per year (García, 1988).

The present checklist aims to summarize the current state of the composition of fish larvae and juveniles and gives a view of the general distribution for the northern Yucatán Peninsula. This study also updates and increases the number of species reported by Flores-Coto and Álvarez-Cadena (1980) and Sánchez-Velasco et al. (1996). In this work, the results of Ordóñez-López (1995; 1998), Hernández-Vázquez (2002) and García-Hernández (2004), are compiled.

Material and methods

Sampling for fish larvae was carried out using a

zooplankton net (mesh 0.5mm) and following a circular path for 5 minutes near the surface. For juveniles, trawling was employed until an area of 50 m² had been covered with a Renfro net.

All fish larvae and juveniles were sorted out from the samples and identified to the lowest taxonomic level, usually to species. In some cases, when identification was difficult to attain, fish larvae (120 organisms) were cleared and stained (Potthoff, 1984), enabling the counting of characteristics such as the number of vertebrae, rays or spines on the fins, or some other structure of taxonomic value.

Sampling was performed monthly at 4 lagoons in the northern Yucatán Peninsula: Celestún (July 1994- June, 1995), Chelem (July 1999- June 2000), Río Lagartos (November 1996-October, 1997) and Yalahau (June 2001- May 2002), (Fig. 1, Table 1). Further details of the sampling methodology can be found in Ordóñez-López (1995; 1998) Hernández-Vázquez (2002) and García-Hernández (2004).

The list of species found in this study (Appendix 1) has been added to the Ichthyological Collection of the Laboratorio de Taxonomía y Ecología de Peces, Centro de Investigación y Estudios Avanzados, Unidad Mérida, Instituto Politécnico Nacional, with registration number YUC.PEC.084 0999. The collection is validated by the Instituto Mexicano de Ecología.

Systematics on the species followed Nelson (1994) and orthography, authorship and year of description are reported as suggested by Eschmeyer (1998 and 2006). The checklist is organized by genus and in accordance with valid phylogenetic reviews. The collecting sites were identified as: Celestún Lagoon, Chelem Lagoon, Yalahau Lagoon and Río Lagartos Lagoon. Ecological habitat of adults was characterized according to Castro-Aguirre et al., (1999) as follows: (1A) recurrent inhabitants of estuarine-lagoon environments, (1B) permanent residents of estuarine-lagoon systems, (2A) marine euryhaline species, and (2B) marine stenohaline species. The species classification was performed according to Espinoza-Pérez et al., (1998) and Schmitter-Soto et al., (2000) where: GM stands for the Gulf of Mexico species, CA for those from the Caribbean Sea and NR are new records (this study) for

Table 1. Collection localities, sampling dates, number of stations occupied, type of nets, trawling time and sampling area covered for ichthyoplankton and juveniles from the northern Yucatán Peninsula

Site	Date	Stns. Occupied	Net	Trawling time	Area covered
Celestún	July 1994- June 1995	10	Conical	5 min	
Chelem	July 1999- June 2000	11	Renfro		50 m ²
Río Lagartos	November 1996- October 1997	30	Conical	5 min	
Yalahau	June 2001- May 2002	8	Renfro		50 m ²

this part of the Yucatán Peninsula. The data of each lagoon were analyzed to obtain abundance, richness, diversity (Shannon-Wiener Index) and evenness for the larval and juvenile community by using ANACOM software (De la Cruz, 1994).

Results

A total of 34 377 fish larvae and juveniles were caught during the surveys; corresponding to 2 classes, 17 orders, 45 families, 83 genera and 117 species (Appendix 1). From those, 90 species were recorded at both, the Gulf of Mexico and the Caribbean Sea, 24 were found only in the Gulf of Mexico and 3 were caught only in the Caribbean Sea. Thirty nine species are new records for this zone of the Yucatán Peninsula. The families with the greatest numbers of species were: Sciaenidae (13), Sygnathidae (9), Gobiidae (7) and Atherinopsidae (5).

A comparative analysis between lagoons indicated that Río Lagartos had the highest fish abundance (16,116) but the lowest evenness (0.508), Yalahau had the highest species richness (90) and diversity (2.300), and Chelem lagoon had low richness (35) and abundance (1576) but had the highest evenness (0.569). The lowest diversity (1.921) was found for Celestún (Table 2).

The species accumulation curve (Fig. 2) showed a good fitting of explained variance by the Clench model to the observed data (R^2 close to 1.) This fitting function applied to our collected data allowed a visual evaluation of the regional ichthyofauna and indicates that the fish inventory in Río Lagartos, Yalahau and Celestún is near completion. This is not the case at Chelem where more work is still needed.

Discussion

In this study, an increment of 64% in the number of taxa was recorded as compared to those previously reported by Flores-Coto and Álvarez-Cadena (1980) or Sánchez-

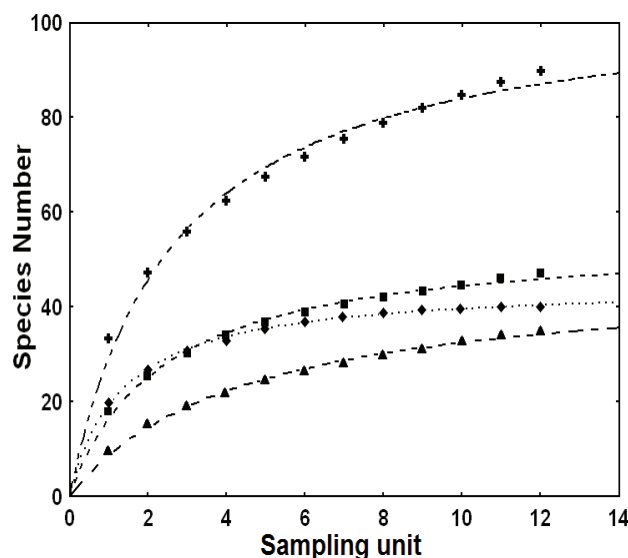


Figure 2. Plot for fish species accumulation in the collection localities from the Yucatán Peninsula. Yalahau (+): $S_{obs}=90$, $R^2=0.98$, $a/b=119$, $slope=0.04$, $quality=85\%$; Río Lagartos (■): $S_{obs}=47$, $R^2=0.99$, $a/b=60$, $slope=0.05$, $quality=86\%$; Celestún (◆): $S_{obs}=40$; $R^2=0.99$, $a/b=61$, $slope=0.04$, $quality=89\%$; Chelem (▲): $S_{obs}=35$, $R^2=0.99$, $a/b=57$, $slope=0.13$, $quality=75\%$.

Velasco et al. (1996), where 24 families and 42 species were collected. Some species such as *Diapterus auratus* Ranzani 1842, *D. rhombeus* Cuvier 1829, *Eugerres plumieri* (Cuvier, 1830), *Fundulus majalis* (Walbaum, 1792) *F. confluentus* Goode and Bean, 1879, *F. grandissimus* Hubbs, 1936, *Chriodorus atherinoides* Goode and Bean 1882, *Pogonias cromis* Linnaeus 1766, *Monacanthus ciliatus* (Mitchill, 1818) and *Halichoeres radiatus* (Linnaeus, 1758) were not included in the checklist because, although they have been reported as adults (Vega-Cendejas and Hernández de Santillana, 2004), they have not been recorded as larvae or as juveniles.

Reséndez-Medina and Kobelkowsky-Díaz (1991) and Espinosa-Pérez et al. (1998), reported 555 species of adult coastal fish in the southern Gulf of Mexico, while

Table 2. Sites of collection, abundance (\pm std), species richness, diversity and evenness for fish larvae and juveniles from the Northern Yucatán Peninsula

Site (Lagoon)	Area (Km ²)	Abundance (No. org.)	Richness (No. spp.)	Diversity (bits/ind.)	Evenness
Celestún	28.1	7208 \pm 774.5	40	1.921	0.521
Chelem	15.0	1576 \pm 139.4	35	2.022	0.569
Río Lagartos	91.0	16116 \pm 1203.6	47	1.957	0.508
Yalahau	275.0	9477 \pm 563.5	90	2.300	0.511

Schmitter-Soto et al. (2000) found 577 species for the Caribbean Sea. These results and our present findings suggest that the species composition of fish larvae and juveniles from this zone of the Yucatán Peninsula has an affinity of almost 20 % with those from the Gulf of Mexico and 16 % for the Caribbean Sea. It was also observed in this report that a high number of larvae and juvenile reef fishes were caught in the northeastern zone of the Yucatán Peninsula but decreased to the northwest. An inverse trend was found for the species of the Gulf of Mexico, i.e. they were more abundant to the west, but less to the east. The high number of shared species (90) suggested that the northeast region of the Yucatán Peninsula, specifically at Yalahau lagoon, is a transition zone where larvae and juveniles originating from both the Gulf of Mexico and the Caribbean Sea meet (García-Hernández, 2004).

Knowledge of fish larvae and juveniles and ecology of the area is starting to be obtained but a great deal of work is still needed. New sampling tools such as light traps and skate nets, among others, will substantially help to increase captures of cryptic of seagrass beds, or for those species inhabiting the reef formations. The use of these new tools will most probably increase the knowledge of the richness of fish species for Families like Labrisomidae, Haemulidae, Gerreidae, Carangidae, Lutjanidae and Gobiidae, and will also help in capturing families such as Cyprinodontidae, Fundulidae, Poecilidae and Cichlidae mainly related to brackish-freshwater environments.

The Renfro net design is particularly important because it allows the capture of fish and larvae in the water column originating from several habitats where conventional nets (zooplankton net, for example) are not efficient. Animals caught with these nets are usually found in good condition permitting species level identification.

Based on to the larvae and juvenile species captured in Río Lagartos, Yalahau and Celestún, it is possible to suggest that the faunistic inventory is nearly completed. However, this is not the case for Chelem where many more studies are needed as is shown by the pronounced slope at the end of the curve. According to Jiménez-Valverde and Hortal (2003) a total inventory is unattainable because it is not possible to register the total number of species. Also, it would be necessary to specify what kind of analysis would permit us to infer a fish catalogue from a given sampling program, as to facilitate comparison. Therefore, increasing the sampling effort or using different capture techniques will require adjustments in the calculation of each inventory.

Differences in the species richness occurring at each locality revealed the effects of the a spatial and temporal resolution of the sampling used. Diversity variation suggested a possible relationship between the species

number and the available area. Yalahau is larger than Chelem and therefore has a greater complexity and number of available habitats, which increase the richness and diversity of fish in this lagoon. Likewise, geomorphology, productivity of the systems, and the hydrological heterogeneity of the environments are important factors to take into account (García-Hernández, 2004; Vega-Cendejas and Hernández de Santillana, 2004). The presence and ethology of rare local species or occasional individuals in a dispersion phase could also influence the fish richness and diversity in the coastal systems of the region. These lagoons are good shelters, in which feeding, nursery and reproduction for a large number of marine and estuarine fishes take place (Hernández-Vázquez, 2002; García-Hernández, 2004; Ordóñez-López and García-Hernández, 2005).

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Appendix 1. Checklist of fish larvae and juveniles from the northern Yucatán Peninsula, Mexico

Superclass Gnathostomata

Class Chondrichthyes

Order Rajiformes

Family Urolophidae

Urobatis jamaicensis (Cuvier, 1816). YL. 2A.

2, 3, 4, 24, 27, 29, 39, 40, 45, 55, 56

Class Actinopterygii

Order Elopiformes

Family Elopidae

Elops saurus Linnaeus 1766. CL, RL, 2A.

3, 4, 14, 15, 24, 27, 30, 34, 39, 42, 44, 45, 50

Order Anguilliformes

Family Ophichthidae

Ahlia egmontis (Jordan, 1884). YL. 2A. NR.

2, 4, 12, 24, 25, 27

Myrophis punctatus Lütken, 1852. YL. 2A.

2, 3, 4, 8, 12, 14, 15, 22, 24, 25, 27, 34, 40, 42, 45, 51, 53, 54, 55

Order Clupeiformes

Family Engraulidae

Anchoa hepsetus (Linnaeus, 1758). CL, CHL, RL, YL. 2A. GM.

1, 2, 3, 4, 8, 14, 24, 27, 30, 34, 36, 40, 42, 44, 49, 51, 52, 54, 55, 56

Anchoa mitchilli (Valenciennes, 1848). CL, CHL, RL. 1B. GM.

1, 3, 8, 14, 15, 28, 30, 34, 36, 40, 42, 44, 49, 51, 52, 54, 55, 56

Engraulis eurystole (Swain and Meek, 1885). RL. 2B. NR.

4, 8, 30, 45

Family Clupeidae

Harengula jaguana Poey, 1865. CL, RL, YL. 2A.

1, 2, 3, 4, 8, 14, 22, 24, 27, 28, 34, 40, 42, 43, 44, 45, 47, 49, 51, 52, 54, 55

Jenkinsia lamprotaenia (Gosse, 1851). YL. 2A.

2, 4, 24, 27, 39, 40, 44, 45, 50, 51, 52, 53, 55

Opisthonema oglinum (Lesueur, 1818). CL, RL. 2B.

1, 2, 3, 4, 14, 20, 22, 24, 27, 28, 30, 34, 39, 40, 42, 43, 45, 47, 50, 52, 54, 55

Sardinella aurita (Valenciennes, 1847). CL, CHL, RL, YL. 2A.

2, 4, 8, 11, 24, 27, 30, 34, 43, 45, 47, 53, 54

Order Siluriformes

Family Ariidae

Ariopsis felis (Linnaeus, 1766). YL. 2A. GM.

1, 3, 27, 30, 34, 55, 56

Order Aulopiformes

Family Synodontidae

Synodus foetens (Linnaeus, 1766). CL, CHL, YL. 2A.

1, 2, 3, 4, 24, 27, 30, 34, 39, 40, 45, 46, 49, 52, 53, 54, 55, 56

Order Ophidiiformes

Family Ophidiidae

Lepophidium brevibarbe (Cuvier, 1829). YL. 2B. GM. NR.

27

Order Batrachoidiformes

Family Batrachoididae

Opsanus beta (Goode and Bean, 1880). CHL, YL. 2A.
1, 2, 3, 24, 27, 34, 44, 45, 49, 54, 55, 56

Opsanus phobeton Walters and Robins, 1961. YL. 2B.
2, 3, 24, 55

Order Mugiliformes

Family Mugilidae

Mugil cephalus Linnaeus, 1758. CL, RL. 1A.
3, 5, 8, 14, 27, 34, 35, 42, 44, 45, 54, 55, 56

Mugil curema Valenciennes, 1836. CL, CHL, RL. 1A.
1, 2, 3, 4, 5, 8, 22, 24, 27, 34, 35, 39, 40, 43, 44, 45, 54, 55, 56

Order Atheriniformes

Family Atherinidae

Atherinomorus stipes (Müller and Troschel, 1848). CHL, YL.
2B. NR.

1, 2, 3, 4, 7, 24, 39, 44, 45, 51, 52, 53

Hypoatherina harringtonensis (Goode, 1877). YL. 2B. CA.
NR.

2, 4, 7, 14, 24, 39, 45, 52, 53

Family Atherinopsidae

Membras martinica (Valenciennes, 1835). CHL, RL. 2B.
GM.

3, 8, 27, 34, 35, 40, 45, 52, 53

Menidia beryllina (Cope, 1867). CL, CHL. 2A.
3, 27, 34, 35, 45, 49, 55

Menidia colei Hubbs, 1936. CL, CHL, RL, YL. 1B. GM.
3, 55, 56

Menidia menidia (Linnaeus, 1766). CL. 1B. NR.
35, 45

Order Beloniformes

Family Belonidae

Strongylura marina (Walbaum, 1792). CHL, RL. 2A.
3, 4, 14, 15, 25, 27, 34, 44, 45, 52, 54, 55, 56

Strongylura notata (Poey, 1860). CL, CHL, RL, YL. 2A.
2, 3, 14, 22, 24, 34, 39, 44, 45, 55, 56

Strongylura timucu (Walbaum, 1792). CL, RL. 2A.
2, 3, 4, 22, 24, 34, 39, 44, 45, 54, 55, 56

Family Hemiramphidae

Hemiramphus brasiliensis (Linnaeus, 1758). CL. 2B.
2, 3, 4, 24, 25, 34, 39, 45, 52

Hyporhamphus unifasciatus (Ranzani, 1842). CL, RL. 2A.
2, 3, 4, 8, 14, 15, 22, 24, 25, 34, 45, 52, 53, 55, 56

Order Cyprinodontiformes

Family Fundulidae

Fundulus persimilis Miller, 1955. CL, RL. 1B.
3, 55, 56

Lucania parva (Baird and Girard, 1855). CL, CHL, RL, YL. 1B.
3, 25, 27, 44, 49, 55, 56

Family Cyprinodontidae

Cyprinodon artifrons Hubbs, 1936. CL, RL. 1B.
3, 22, 25, 44, 45, 55

Garmanella pulchra Hubbs, 1936. CL, RL, YL. 1B.
3, 22, 44, 55, 56

Floridichthys polyommus Hubbs, 1936. CL, CHL, YL. 1B.
3, 22, 44, 45, 54, 55, 56

Order Syngnathiformes

Family Syngnathidae

Anarchopterus criniger (Bean and Dresel, 1884). CHL, YL.
2B. GM. NR

2, 6, 27

Cosmocampus albirostris (Kaup, 1856). YL. 2B. NR.
2, 3, 6, 45, 52, 53

Cosmocampus elucens (Poey, 1868). RL, YL. 2B. NR.
2, 3, 4, 6, 24, 29, 45

Hippocampus erectus Perry, 1810. CHL, RL, YL. 2B. NR.
2, 3, 4, 6, 14, 24, 25, 27, 29, 40, 42, 45, 49, 52

Hippocampus zosterae Jordan and Gilbert, 1882. CHL, YL. 2B.
1, 2, 3, 6, 24, 27, 34, 45, 49, 55

Syngnathus floridae Jordan and Gilbert, 1882. CL, CHL, RL,
YL. 2A.

2, 3, 6, 25, 27, 34, 45, 49, 50, 52, 53, 55

Syngnathus louisianae Günther, 1870. YL. 2A. GM.
1, 3, 6, 14, 25, 27, 34, 40, 42, 50

Syngnathus pelagicus Linnaeus, 1758. CHL, YL. 2B.
2, 6, 24, 25, 27, 45, 52, 54, 55, 56

Syngnathus scovelli (Evermann and Kendall, 1896). CL,
CHL, RL, YL. 2A.

1, 3, 4, 6, 14, 15, 22, 27, 34, 40, 45, 49, 50, 52, 54, 55, 56

Order Scorpaeniformes

Family Scorpaenidae

Scorpaena brasiliensis Cuvier, 1829. YL. 2B.
4, 27, 39, 45, 46, 49

Scorpaena grandicornis Cuvier, 1829. YL. 2B. NR.
2, 3, 7, 24, 29, 39, 45

Scorpaena plumieri Bloch, 1789. YL. 2A.
2, 3, 4, 24, 27, 29, 34, 39, 45,

Family Triglidae

Prionotus punctatus (Bloch, 1793). CHL. 2B.
3, 4, 34, 55

Prionotus scitulus Jordan and Gilbert, 1882. YL. 2B.
1, 3, 13, 14, 27, 45, 46, 49, 50, 55

Prionotus tribulus Cuvier, 1829. YL. 2A.
3, 27, 34, 40, 49, 55

Order Perciformes

Family Serranidae

Diplectrum bivittatum (Valenciennes, 1828). YL. 2B. NR.
3, 4, 27, 34, 39

Mycteroperca microlepis (Goode and Bean, 1879). YL. 2B.
GM. NR.

26, 27, 32, 46, 49, 50

Family Carangidae

Oligoplites saurus (Bloch & Schneider, 1801). CL, RL. 2A.
1, 3, 4, 8, 14, 22, 27, 28, 31, 34, 39, 40, 42, 45, 49, 50, 52, 55

Family Lutjanidae

Lutjanus apodus (Walbaum, 1792). YL. 2A.

2, 3, 4, 7, 22, 24, 26, 27, 29, 34, 39, 44, 45

Lutjanus griseus (Linnaeus, 1758). YL. 2A.

1, 2, 3, 4, 22, 24, 26, 27, 29, 34, 39, 44, 45, 49, 52, 54, 55, 56

Family Gerreidae

Eucinostomus argenteus Baird and Girard, 1855. CL, CHL, RL, YL. 2A.

1, 2, 3, 4, 7, 24, 27, 31, 34, 39, 44, 45, 49, 51, 52, 54, 55, 56

Eucinostomus gula (Quoy and Gaimard, 1824). CL, CHL, RL, YL. 2A.

1, 2, 3, 4, 22, 24, 27, 31, 34, 44, 45, 49, 54, 55, 56

Eucinostomus melanopterus (Bleeker, 1863). RL. 1B.

1, 3, 4, 7, 14, 15, 22, 27, 28, 33, 34, 44, 45, 54, 55, 56

Family Haemulidae

Haemulon aurolineatum Cuvier, 1830. CHL, RL. 2A.

2, 3, 4, 7, 24, 27, 29, 31, 33, 34, 39, 45, 46, 49, 55, 56

Haemulon flavolineatum (Desmarest, 1823). CHL, RL, YL. 2B.

2, 3, 4, 7, 24, 29, 33, 34, 39, 44, 45, 55

Haemulon plumierii Lacepède, 1801. YL. 2B.

2, 3, 4, 7, 24, 27, 29, 31, 39, 45, 49, 52, 55, 56

Orthopristis chrysoptera (Linnaeus, 1766). YL. 2A. GM.

1, 3, 8, 27, 31, 40, 45, 46, 49, 54, 55, 56

Family Sparidae

Archosargus probatocephalus (Walbaum, 1792). CHL, RL. 2B.

1, 3, 8, 22, 27, 31, 34, 40, 42, 45, 46, 49, 55

Archosargus rhomboidalis (Linnaeus, 1758). CL, RL. 2B.

1, 3, 4, 14, 28, 34, 39, 40, 42, 45, 49, 52, 54, 55

Lagodon rhomboides (Linnaeus, 1766). CL, CHL, RL, YL. 2A. GM.

3, 8, 14, 28, 31, 34, 38, 42, 46, 49, 54, 55

Family Sciaenidae

Bairdiella chrysoura (Lacepède, 1802). CL, RL, YL. 2A. GM.

1, 3, 8, 10, 14, 15, 17, 27, 28, 31, 34, 37, 40, 41, 42, 43, 49, 54, 55

Bairdiella sanctaeluciae (Jordan, 1890). YL. 2A. GM.

4, 10, 55

Cynoscion arenarius Ginsburg, 1930. CL, RL. 2A. GM.

1, 3, 8, 10, 17, 20, 27, 34, 40, 42, 43, 49, 55

Cynoscion nebulosus (Cuvier, 1830). CL, RL, YL. 2A.

1, 3, 8, 10, 14, 17, 27, 28, 31, 37, 40, 42, 43, 45, 49, 52, 54, 55, 56

Cynoscion regalis (Bloch and Schneider, 1801). RL, YL. 2A. GM. NR.

10, 31

Equetus punctatus (Bloch and Schneider, 1801). YL. 2B. NR.

2, 4, 10, 24, 27, 29, 39, 45

Equetus iwamotoi (Miller and Woods, 1988). YL. 2B. GM. NR.

10

Larimus fasciatus Holbrook, 1855. CHL, YL. 2B. GM. NR.

3, 8, 10, 27, 31, 40, 42

Leiostomus xanthurus Lacepède, 1802. RL, YL. 2A. GM.

NR.

3, 8, 10, 19, 23, 27, 28, 31, 34, 37, 38, 40, 49

Menticirrhus littoralis (Holbrook, 1855). YL. 2B. GM.

3, 4, 10, 27, 31, 34, 55

Menticirrhus saxatilis (Bloch and Schneider, 1801). YL. 2A. GM. NR.

1, 3, 10, 17, 27, 31, 34, 42, 43

Micropogonias undulatus (Linnaeus, 1766). CL, RL. 2A. GM.

1, 3, 8, 10, 14, 17, 20, 27, 31, 34, 37, 38, 40, 42, 43, 54, 55

Pareques acuminatus (Bloch and Schneider, 1801). YL. 2B. NR.

2,3,4,7,10,24,29,39,45

Family Pomacentridae

Abudefduf saxatilis (Linnaeus, 1758). YL. 2B. NR.

2, 3, 4, 7, 13, 24, 27, 29, 34, 39, 45, 51

Stegastes leucostictus (Müller and Troschel, 1848). CHL. 2B. NR.

2, 3, 4, 7, 24, 29, 34, 39, 45

Family Labridae

Halichoeres bivittatus (Bloch, 1791). YL. 2B.

2, 4, 24, 27, 29, 34, 39, 45, 46, 55

Lachnolaimus maximus (Walbaum, 1792). YL. 2B. NR.

2, 4, 24, 27, 29, 34, 39, 45, 49, 51

Thalassoma bifasciatum (Bloch, 1791). YL. 2B. NR.

2, 4, 7, 24, 27, 29, 34, 39, 45, 48, 50

Xyrichtys martinicensis Valenciennes, 1840. YL. 2B. NR.

2, 3, 4, 24, 29, 34, 39, 45

Family Scaridae

Nicholsina usta (Valenciennes, 1840). YL. 2B.

3, 4, 27, 45, 49, 55

Sparisoma rubripinne (Valenciennes, 1840). YL. 2B. NR.

2, 4, 24, 29, 34, 39, 45

Family Dactyloscopidae

Gillellus uranidea Böhlke 1968. YL. 2B. CA. NR.

2, 24, 45, 52

Family Labrisomidae

Labrisomus nuchipinnis (Quoy and Gaimard, 1824). YL. 2B.

NR.

2, 3, 4, 21, 24, 27, 34, 39, 45

Paraclinus fasciatus (Steindachner, 1876). YL. 2B. NR.

2, 4, 21, 24, 39, 45

Paraclinus marmoratus (Steindachner, 1876). YL. 2B. NR.

2, 4, 24, 49

Family Blennidae

Hypsoblennius hentzi (Lesueur, 1825). CL, RL. 2B. NR.

13, 14, 27, 42, 45, 46, 52

Family Gobiosocidae

Gobiesox strumosus Cope, 1870. YL. 2A. NR.

3, 8, 14, 15, 27, 28, 34, 40, 45

Family Callionymidae

Diplogrammus pauciradiatus (Gill, 1865). CL, CHL, RL,

YL. 2B. NR.

2, 8, 14, 24, 45, 49, 51

Paradiplogrammus bairdi (Jordan, 1888). RL. 2B. NR.

2, 4, 24, 29, 39, 45, 51

Family Gobiidae

- Ctenogobius boleosoma* (Jordan and Gilbert, 1882). CL, RL, YL. 2A.
2, 3, 4, 13, 14, 15, 24, 27, 40, 42, 45, 46, 52, 55
- Gobionellus oceanicus* (Pallas, 1770). CL, YL. 2A. GM.
1, 3, 4, 8, 27, 34, 40, 54, 55
- Gobiosoma bosci* (Lacepède, 1800). RL. 2A.
1, 3, 13, 14, 15, 27, 34, 40, 42, 45, 46, 52, 56
- Gobiosoma robustum* Ginsburg, 1933. CL, CHL, RL, YL. 2A. GM.
3, 13, 27, 34, 42, 46, 49, 55
- Lythrypnus heterochroma* Ginsburg, 1939. YL. 2B. NR.
2, 24
- Microgobius microlepis* Longley and Hildebrand, 1940. YL. 2A. CA. NR.
2, 24
- Microgobius thalassinus* (Jordan and Gilbert, 1883). CHL, YL. 2A. GM. **50**
13, 14, 27, 42, 46, 49,
- Family Ephippidae**
- Chaetodipterus faber* (Broussonet, 1782). YL. 2A.
1, 2, 3, 4, 8, 9, 14, 24, 29, 31, 34, 39, 40, 42, 45, 46, 49, 52, 55
- Family Acanthuridae**
- Acanthurus chirurgus* (Bloch, 1787). YL. 2B. NR.
2, 4, 24, 27, 29, 34, 39, 45
- Family Sphyraenidae**
- Sphyraena barracuda* (Walbaum, 1792). YL. 2B.
2, 3, 4, 24, 27, 29, 34, 35, 39, 44, 45, 49, 50, 51, 52, 53, 54, 55, 56
- Order Pleuronectiformes**
- Family Paralichthyidae**
- Paralichthys albigutta* Jordan and Gilbert, 1882. YL. 2B.
2, 3, 18, 24, 27, 29, 38, 49, 55
- Family Achiridae**
- Achirus lineatus* (Linnaeus, 1758). CL, CHL, RL, YL. 2A.
1, 3, 4, 8, 14, 15, 16, 22, 27, 28, 34, 42, 43, 45, 46, 49, 50, 52, 54, 55, 56
- Family Cynoglossidae**
- Symphurus plagiatus* (Linnaeus, 1766). YL. 2A.
2, 3, 14, 16, 20, 22, 24, 27, 34, 35, 42, 45, 46, 49, 55
- Order Tetraodontiformes**
- Family Monacanthidae**
- Aluterus schoepfii* (Walbaum, 1792). YL. 2B.
2, 3, 4, 24, 29, 34, 35, 39, 45, 49, 55
- Monacanthus tuckeri* Bean, 1906. YL. 2B. NR.
2, 4, 24, 29, 39, 45
- Stephanolepis hispidus* (Linnaeus, 1766). CHL, RL, YL. 2B.
3, 4, 14, 27, 34, 35, 39, 40, 45, 49, 52, 55
- Family Ostracidae**
- Acanthostracion quadricornis* (Linnaeus, 1758). YL. 2A.
2, 3, 4, 7, 24, 27, 29, 34, 35, 39, 45, 49, 55, 56
- Lactophrys trigonus* (Linnaeus, 1758). YL. 2B. NR.
2, 4, 24, 35, 39, 45
- Family Tetraodontidae**
- Sphoeroides maculatus* (Bloch and Schneider, 1801). CL, CHL. 2A.
35, 42, 45, 46, 55
- Sphoeroides nephelus* (Goode and Bean, 1882). YL. 2A.
1, 2, 3, 7, 24, 27, 49, 55, 56
- Sphoeroides spengleri* (Bloch, 1785). YL. 2B.
2, 3, 4, 24, 27, 29, 34, 35, 39, 45, 46, 49, 52, 55, 56
- Sphoeroides testudineus* (Linnaeus, 1758). CL, RL, YL. 2A.
1, 2, 3, 4, 14, 22, 24, 27, 34, 35, 45, 52, 54, 55, 56
- Familia Diodontidae**
- Chilomycterus schoepfii* (Walbaum, 1792). YL. 2A.
2, 3, 14, 24, 27, 35, 40, 42, 46, 55, 56
- Diodon holocanthus* Linnaeus, 1758. YL. 2B. NR.
2, 4, 24, 27, 29, 35, 30, 39, 45

Key for numerical references:

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