

An updated checklist of YOY fish occurrence in the shallow perimetral areas of the Mar Menor (Western Mediterranean Sea)

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Received: 04/05/20

Accepted: 12/03/21

ABSTRACT

An updated checklist of YOY fish in shallow areas of the Mar Menor (Western Mediterranean)

The Mar Menor is one of the largest coastal lagoons in the Mediterranean basin. This study provides an updated checklist of the fish species inhabiting its shallow areas as young of the year in the period 2018-2019. A total of 43 taxa in 19 families were detected. This information should be useful to establish environmental monitoring programmes, as well as the implementation of management actions.

Key words: Mediterranean lagoon, Iberian Peninsula, shallow habitats, recruitment, settlement, fish assemblages

RESUMEN

Listado actualizado de peces jóvenes del año en áreas someras del Mar Menor (Mediterráneo occidental)

El Mar Menor es una de las lagunas costeras más grandes del área mediterránea. Este estudio proporciona un listado actualizado de las especies de peces cuyos juveniles del año ocuparon las zonas someras de la laguna en el periodo 2018-2019. Un total de 43 taxones pertenecientes a 19 familias fueron detectados. Esta información puede ser útil para realizar seguimientos ambientales y para la implementación de medidas de gestión.

Palabras clave: laguna mediterránea, península ibérica, hábitats someros, reclutamiento, asentamiento, comunidad de peces

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INTRODUCTION

Coastal lagoons are important habitats for fish in different phases of their life-cycles, such as nursery, breeding, feeding and migration (Franco *et al.*, 2008; Pérez-Ruzafa *et al.*, 2019). Shallow areas within these systems are critical for supporting young of the year (YOY; fish produced from the current year's spawning) and juveniles, as well as several threatened fish species (Franco *et al.*, 2010; Moreno-Valcárcel *et al.*, 2013).

The Mar Menor (SE Spain) is one of the largest coastal lagoons in the Mediterranean Sea and hosts a high biodiversity (Pérez-Ruzafa *et al.*, 2018). However, it has suffered strong environmental alterations in the last decades, including a decrease in salinity due to enhanced connectivity with the sea (the lagoon was originally hypersaline). Increasing nutrient-rich urban and agricultural effluents have driven a change from an originally oligotrophic state to the current eutrophic

state (Pérez-Ruzafa *et al.*, 2018), which in 2016 caused the disappearance of seagrass meadows at depths larger from 2 m (Pérez-Ruzafa *et al.*, 2018). In October 2019 an anoxia process derived from eutrophy (Ruiz-Fernández *et al.*, 2019) caused a massive fish mortality event.

Shallow perimetral areas of the Mar Menor coastal lagoon are important settlement areas and juvenile refuges for several fish species (Oliva-Paterna *et al.*, 2006; Verdiell-Cubedo *et al.*, 2013a, 2013b). These habitats have apparently been less impacted by eutrophication in comparison with other environments within of the Mar Menor, thus becoming critical habitats for natural regeneration processes. However, the available information on fish community composition in these shallow habitats has not been updated since 2002-2004. Here, we report YOY fish communities inhabiting the shallow areas of Mar Menor in 2018-2019 and compare the results with those obtained in 2002-2004 (Oliva-Paterna *et al.*, 2006).

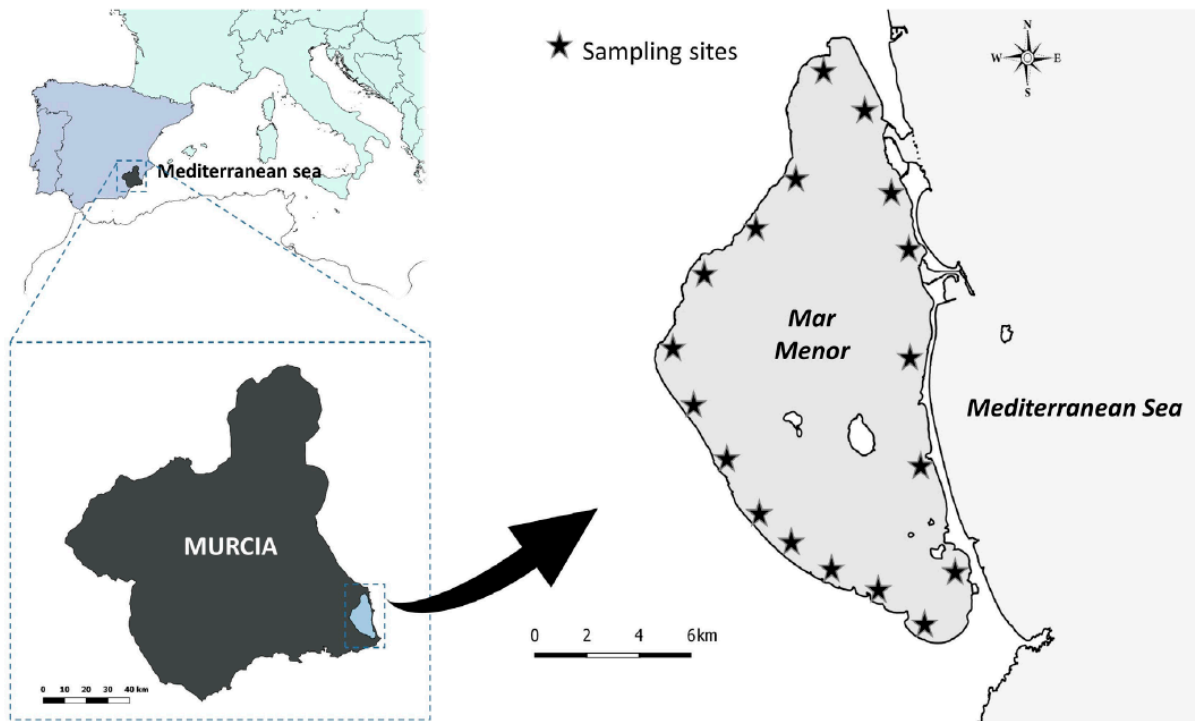


Figure 1. Mar Menor location and shallow areas sampling sites distribution. *Localización del Mar Menor y distribución de las unidades de muestreo de las áreas someras.*

MATERIALS AND METHODS

YOY fish sampling was conducted eight times (in January, April, July and October 2018 and 2019) in 18 shallow-water (< 1 m) sites distributed along the perimeter of the coastal lagoon (Fig. 1), reproducing the sampling design of Oliva-Paterna et al. (2006). Sampled sites had patches of *Cymodocea nodosa* monospecific meadows or *Caulerpa prolifera* and *C. nodosa* mixed meadows, and had sandy or muddy substrates. Fish were collected using a 10 m-long bag seine net with 0.5 mm mesh size, which bottom-hauled an approximate surface of 500-600 m². This methodology is considered to be highly effective to detect small fish species (Franco et al., 2012).

Fish that were not identifiable in the field were carried to the laboratory for identification and later deposited in the ichthyological collection of the Department of Zoology and Physical Anthropology of the University of Murcia.

RESULTS AND DISCUSSION

A total of 43 fish species belonging to 19 families

and 32 genera were collected (Table 1). Four families (Sparidae, Mugilidae, Gobiidae and Syngnathidae) accounted for more than half of the species identified. Four species were new records to the Mar Menor coastal lagoon: *Tylosurus acus* (Lacepède, 1803), *Alosa fallax* (Lacepède, 1803), *Gobius geniporus* Valenciennes, 1837 and *Mycteroperca rubra* (Bloch, 1793). *Tylosurus acus* was detected in different seasons, sites and years, suggesting a nursery role of the Mar Menor. One *A. fallax* individual was detected. Since the Mar Menor system lacks appropriate habitats for the reproduction of *A. fallax*, this record suggests long-distance movements of YOY of this species (Nachón et al., 2019; David Nachón., Per. Com.). A single individual of *G. geniporus* was caught, although this species has recently become a common by-catch of the Mar Menor fisheries (Antonio Zamora-López, Per. Com.). Finally, three individuals of *M. rubra* were detected in October 2019 in two different sampling sites. Despite the fishing interest of this species, the occurrence of YOY individuals in Mediterranean coastal lagoons has poorly been documented, having being cited only in the Marchica lagoon (Morocco) (Selfati et al., 2018).

Table 1. Frequency of occurrence (% of 144 samples per period) of taxa collected from shallow perimetral areas of Mar Menor coastal lagoon in two different periods (2002-2004; 2018-2019); (*) new record for the lagoon. The conservation status of each species is included, following the IUCN red list (<https://www.iucnredlist.org>; accessed July 2020): (DD) Deficient data; (LC) Least concern; (VU) Vulnerable; (EN) Endangered; (CR) Critically endangered. *Frecuencia de aparición (% sobre 144 muestreos por periodo) de los taxones capturados en las áreas someras perimetrales del Mar Menor en dos periodos diferentes (2002-2004; 2018-2019); (*) nueva cita para la laguna. IUCN: Estatus de conservación de cada especie, según la lista roja de la IUCN (<https://www.iucnredlist.org>; visitada en Julio de 2020): (DD) Datos Deficientes; (LC) Preocupación Menor; (VU) Vulnerable; (EN) En Peligro de Extinción; (CR) En Peligro Crítico de Extinción.*

Taxonomic list		IUCN	2002-04	2018-19
Anguillidae	<i>Anguilla anguilla</i> (L., 1758)	CR	4	5
Atherinidae	<i>Atherina boyeri</i> Risso, 1810	LC	95	99
Belonidae	<i>Belone belone</i> (L., 1760)	LC	3	16
	<i>Tylosurus acus</i> * (Lacepède, 1803)	LC	0	4
Blennidae	<i>Microlipophrys dalmatinus</i> (Steindachner & Kolombatovic, 1883)	LC	19	6
	<i>Parablennius sanguinolentus</i> (Pallas, 1840)	LC	<1	0
	<i>Salaria pavo</i> (Risso, 1810)	LC	65	61
Callionymidae	<i>Callionymus pusillus</i> Delaroche, 1809	LC	6	0
Carangidae	<i>Lichia amia</i> (L., 1758)	LC	0	<1
	<i>Trachinotus ovatus</i> (L., 1758)	LC	3	3

Cont.

Table 1. (cont.)

Taxonomic list		IUCN	2002-04	2018-19
Clupeidae	<i>Alosa fallax</i> * (Lacepède, 1803)	LC	0	<1
	<i>Sardina pilchardus</i> (Walbaum, 1792)	LC	3	<1
	<i>Sardinella aurita</i> Valenciennes, 1847	LC	1	0
Cyprinodontidae	<i>Aphanius iberus</i> (Valenciennes, 1846)	EN	65	40
Engraulidae	<i>Engraulis encrasicolus</i> (L., 1758)	LC	1	18
Gobiidae	<i>Gobius bucchichi</i> Steindachner, 1870	LC	<1	0
	<i>Gobius cobitis</i> Pallas, 1814	LC	31	26
	<i>Gobius geniporus</i> * Valenciennes, 1837	LC	0	<1
	<i>Gobius niger</i> L., 1758	LC	50	22
	<i>Gobius paganellus</i> L., 1758	LC	3	1
	<i>Pomatoschistus marmoratus</i> (Risso, 1810)	LC	96	91
Labridae	<i>Symphodus cinereus</i> (Bonnaterre, 1788)	LC	25	15
	<i>Symphodus ocellatus</i> (L., 1758)	LC	<1	0
Moronidae	<i>Dicentrarchus labrax</i> (L., 1758)	LC	16	11
	<i>Dicentrarchus punctatus</i> (Bloch, 1792)	LC	4	0
Mugilidae	<i>Chelon auratus</i> (Risso, 1810)	LC	86	69
	<i>Chelon labrosus</i> (Risso, 1827)	LC	3	9
	<i>Chelon ramada</i> (Risso, 1827)	LC	35	51
	<i>Chelon saliens</i> (Risso, 1810)	LC	89	96
	<i>Mugil cephalus</i> L., 1758	LC	35	29
	<i>Oedalechilus labeo</i> (Cuvier, 1829)	LC	0	1
Mullidae	<i>Mullus barbatus</i> L., 1758	LC	2	1
Poeciliidae	<i>Gambusia holbrooki</i> Girard, 1859	LC	2	0
Pomatomidae	<i>Pomatomus saltatrix</i> (L., 1766)	VU	3	4
Serranidae	<i>Mycteroperca rubra</i> * (Bloch, 1793)	LC	0	1
Soleidae	<i>Pegusa impar</i> (Bennett, 1831)	LC	2	0
	<i>Solea senegalensis</i> Kaup, 1858	DD	2	0
	<i>Solea solea</i> (L., 1758)	DD	6	1
Sparidae	<i>Boops boops</i> (L., 1758)	LC	<1	0
	<i>Diplodus annularis</i> (L., 1758)	LC	<1	1
	<i>Diplodus cervinus</i> (Lowe, 1838)	LC	<1	0
	<i>Diplodus puntazzo</i> (Walbaum, 1792)	LC	39	17
	<i>Diplodus sargus</i> (L., 1758)	LC	17	14
	<i>Diplodus vulgaris</i> (Geoffro & Saint-Hilaire, 1817)	LC	<1	6
	<i>Lithognathus mormyrus</i> (L., 1758)	LC	0	2
	<i>Oblada melanura</i> (L., 1758)	LC	0	1
	<i>Sarpa salpa</i> (L., 1758)	LC	12	8
	<i>Sparus aurata</i> L., 1758	LC	40	38
	Syngnathidae	<i>Nerophis ophidion</i> (L., 1758)	LC	1
<i>Syngnathus abaster</i> Risso, 1827		LC	90	100
<i>Syngnathus acus</i> L., 1758		LC	2	3
<i>Syngnathus typhle</i> L., 1758		LC	14	32
<i>Hippocampus guttulatus</i> Cuvier, 1829		DD	11	20

Threatened species (i.e. *Syngnathus abaster* Risso 1827; *Pomatoschistus marmoratus* (Risso 1810) and *Aphanius iberus* (Valenciennes, 1846)) and species of commercial interest (i.e. Mugilidae taxa; *Atherina boyeri* Risso, 1810 and *Sparus aurata* L., 1758) were the most frequent taxa in shallow areas of the Mar Menor, a situation that seems to have remained stable since 2002-2004 (Table 1). These results highlight the critical ecological, conservation and economic role of shallow areas in the Mar Menor system (Verdiell-Cubedo et al., 2013b; Oliva-Paterna et al., 2016).

Ten fish species recorded previously in the shallow areas of the Mar Menor coastal lagoon (2002-2004 surveys) were not detected in the present study, while we report eight new taxa inhabiting these shallow areas, most of them being occasional species (Table 1). In any case, both non-detections and newly detected species involve rare taxa in terms of frequency of occurrence.

This study updates the checklist of fish species present in the Mar Menor as YOY. However, the October 2019 massive fish mortality episode, the dynamic nature of the Mar Menor and its environmental degradation calls for a long-term monitoring of its fish assemblages, including YOY. This monitoring would inform appropriate lagoon management plans and decision-making involving biodiversity conservation and fisheries management.

ACKNOWLEDGMENTS

The authors are grateful to other members of the Department of Zoology and Physical Anthropology of the University of Murcia for their help in field sampling and laboratory processing, as well as to Víctor Orenes for their support with fish identification. Part of this research was supported by the Environmental Service and Mar Menor Service of the Government of the Autonomous Community of Murcia (Spain) and the contract “Estudio del estado de la ictiofauna indicadora de zonas someras, mejora de la información y aplicación en la redacción de proyectos en zona sumergida del Mar Menor” (TRAGSATEC). We thank two anonymous reviewers as well as Miguel Clavero for improving the original version of this manuscript.

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