

Inventory of the free–living marine nematode species from el Bibane Lagoon (Tunisia)

S. Jouili, F. Semprucci, A. Nasri, I. Saidi, E. Mahmoudi, N. Essid

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Abstract

Inventory of the free–living marine nematode species from el Bibane Lagoon (Tunisia). A detailed inventory of the free–living nematodes of Tunisia has been made for the northern part of Tunisia, but the southern part of the country is unexplored. El Bibane is the second largest lagoon in Tunisia. It is thus of high importance for future conservation actions, but little is known about its biodiversity. In this study, we identified 71 nematode species, belonging to 68 genera and 22 families. Richness was lowest in the central area of the lagoon where the highest percentages of mud and organic matter were found. The number of species detected in this study is high compared to other transitional environments in the Mediterranean basin, but lower than those reported for North Europe. Most of the species are typical of transitional environments or sediments rich in the fine fraction and detritus. The richest families were Cyatholaimidae and Chromadoridae, but the most frequently found species were Xyalidae, Linhomoeidae and Cyatholaimidae. Six of the species collected are new to science, seven are new records for Tunisian waters, and four are new for the Mediterranean basin. This study adds also important information to the biogeography of the phylum because some of the species detected here were previously known only for other geographical regions. Species that currently appear endemic to the Mediterranean Sea include *Chromadorina metulata*, *Synonchiella edax*, *Paralongicyatholaimus mastigodes*, *Trichotheristus setifer* and *Metalinhomoeus numidicus*.

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Key words: Meiofauna, Nematoda, Transitional environments, Biogeography, Mediterranean Sea

Resumen

Inventario de las especies de nematodos de vida libre de la laguna de El Bibane (Túnez). Se ha realizado un inventario detallado de los nematodos de vida libre de la parte norte de Túnez, pero la parte sur del país está inexplorada. La laguna de El Bibane es la segunda más extensa de Túnez, por lo que su importancia es fundamental para el desarrollo de futuras acciones de conservación y su biodiversidad debe ser evaluada. Se encontraron 71 especies de nematodos, pertenecientes a 68 géneros y 22 familias, registrándose la menor riqueza en la zona central de la laguna, donde se concentran los porcentajes más elevados de lodo y

materia orgànica. El número de espècies halladas en este estudio es elevado si se compara con el de otros entornos de transición de la cuenca mediterránea, pero más bajo que los registrados en el norte de Europa. La mayor parte de las especies son típicas de entornos de transición o de sedimentos ricos en fracción fina y detritos. Las familias más ricas fueron Cyatholaimidae y Chromadoridae, pero las halladas con mayor frecuencia fueron Xyalidae, Linhomoeidae y Cyatholaimidae. Merece destacarse que seis especies recolectadas son nuevas para la ciencia, siete son nuevos registros en aguas tunecinas y cuatro nuevos registros en la cuenca mediterránea. Este estudio aporta asimismo información importante para la biogeografía del filo puesto que hasta ahora algunas de las especies registradas aquí eran conocidas únicamente en otras regiones geográficas. Entre las especies que en este momento aparecen como endémicas en el mar Mediterráneo se encuentran *Chromadorina metulata*, *Synonchiella edax*, *Paralongicyatholaimus mastigodes*, *Trichotheristus setifer* y *Metalinhomoeus numidicus*.

Datos publicados en GBIF [[Doi:10.15470/wuvqpg](https://doi.org/10.15470/wuvqpg)]

Palabras clave: Meiofauna, Nematodos, Entornos transicionales, Biogeografía, Mar Mediterráneo

Resum

Inventari de les espècies de nematodes de vida lliure de la llacuna del Bibane (Tunísia). S'ha fet un inventari detallat dels nematodes de vida lliure de la part nord de Tunísia, però la part sud del país està inexplorada. La llacuna del Bibane és la segona més extensa de Tunísia, per la qual cosa té una importància fonamental per al desenvolupament de futures accions de conservació i cal avaluar-ne la biodiversitat. S'hi van trobar 71 espècies de nematodes, pertanyents a 68 gèneres i 22 famílies. La riquesa més baixa es va registrar a la zona central de la llacuna, on es concentren els percentatges més elevats de llot i matèria orgànica. El nombre d'espècies trobades en aquest estudi és alt si es compara amb el d'altres entorns de transició de la conca mediterrània, però més baix que els registrats al nord d'Europa. La major part de les espècies són típiques d'entorns de transició o de sediments rics en fracció fina i detrits. Les famílies més riques van ser Cyatholaimidae i Chromadoridae, però les trobades amb més freqüència van ser Xyalidae, Linhomoeidae i Cyatholaimidae. Cal posar en relleu que sis espècies recol·lectades són noves per a la ciència, set són nous registres en aigües tunisenques i quatre nous registres a la conca mediterrània. Aquest estudi també aporta informació important per a la biogeografia del filum atès que fins ara algunes de les espècies registrades aquí només eren conegudes en altres regions geogràfiques. Entre les espècies que en aquest moment apareixen com a endèmiques al mar Mediterrani es troben *Chromadorina metulata*, *Synonchiella edax*, *Paralongicyatholaimus mastigodes*, *Trichotheristus setifer* i *Metalinhomoeus numidicus*.

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Paraules clau: Meiofauna, Nematodes, Entorns transicionals, Biogeografia, Mar Mediterrani.

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Soufiane Jouili, Ahmed Nasri, Ibtihel Saidi, Ezzeddine Mahmoudi and Naceur Essid, Laboratory of Environment Biomonitoring, Faculty of Sciences of Bizerte (FSB), University of Carthage, 7021 Zarzouna, Bizerte, Tunisia.– Federica Semprucci, Dipartimento di Scienze Biomolecolari (DiSB) dell'Università degli Studi di Urbino, 61029 Urbino, Italy.

Corresponding author: jouili.soufienejouili@gmail.com

Introduction

Biodiversity studies help to understand the functioning of the ecosystem and to protect natural resources (e.g. Cardinale et al., 2006; Chen et al., 2017). As awareness of the importance of oceanic biodiversity on a planetary scale has increased, so has scientific interest in understanding and estimating species richness of all components of the ecosystem, including the most inconspicuous species, such as free-living nematodes (Balvanera et al., 2006).

Nematodes are arguably the most successful metazoans on earth (Da Rocha et al., 2006; Appeltans et al., 2012). They are also key organisms in marine ecosystems and play a central role in trophic chains (Semprucci et al., 2016). They can enhance energy flow, rates of mineralization, and recirculation of nutrients, becoming an important and direct contributor to the functioning of coastal shallow ecosystems (Semprucci and Balsamo, 2012).

The aim of faunistic and taxonomical studies is to develop accurate baseline information on species biodiversity that can be used to determine if and how the ecosystem is changing (Appeltans et al., 2012). Researchers are also using these organisms as biological indicators to assess water quality and to monitor marine ecosystems (Semprucci et al., 2017).

Estimating the diversity of nematodes is particularly important in tropical and subtropical areas because studies in these areas are often scarce (Semprucci and Balsamo, 2014), thus limiting our knowledge about the biogeography of the Phylum (Liu, 2009). Although the African continent has a great heterogeneity of habitats, biogeographic sectors (e.g. Mediterranean Sea and Red Seas, Atlantic and Indian Oceans) and climatic conditions (i.e. North–South and East–West transects), information on the distribution of free-living marine nematodes is limited (Boufahja et al., 2015). According with these authors Tunisia (Northern African coast) is the area for which the most information on nematodes has been collected, followed by eastern Africa (data were mainly at genus level), while such information for southern and western Africa is practically nonexistent. Boufahja et al. (2014) published the first list of nematode species for Tunisia. They documented 419 species for the Northern Tunisian coasts, but only 95 species in the south of the country for which only Bou Ghrara lagoon has been studied.

Although El Bibane is the second largest lagoon in Tunisia and offers a wide variety of natural habitats for benthic populations (e.g. *Cymodocea nodosa*, *Posidonia oceanica* and *Caulerpa prolifera*, *Neogoniolithion notarsii*), data available are scarce (Jouili et al., 2017). Furthermore, the anthropogenic impact in this area (BRL Ingenierie Idea Consult, 2008) has increased. The aim of the present paper was to provide a preliminary list of nematode species in the El Bibane lagoon and to increase the information available on the distribution of the Phylum.

Material and methods

Sediment samples were collected at 15 stations in January 2012 (table 1). The station depth ranged from 0.5 (Sts. 2, 12) to 5.5 m (St. 7) (fig. 1). At each sampling station, meiofauna were collected in four replicates using plexiglas hand-cores (area 10 cm²), preserved in formaldehyde solution buffered sea-water (5% formaldehyde), and stained with Rose Bengal (0.2 g/l).

In the laboratory, the samples were washed through 1 mm and 40 µm sieves and the fractions retained by the 40 µm sieve were centrifuged with Ludox–HS40 (Mirto and Danovaro, 2004). After counting of the meiobenthic groups, we randomly picked one hundred nematodes from each sample and mounted specimens on permanent slides for taxonomical identification (Seinhorst, 1959). Genus level was identified using the pictorial keys of Platt and Warwick (1983, 1988) and Warwick et al. (1998), the NeMys online identification key, and literature therein (Guilini et al., 2017). The list of nematode species reported below is according to Hodda (2011) for the taxonomic status and NeMys website for the relative

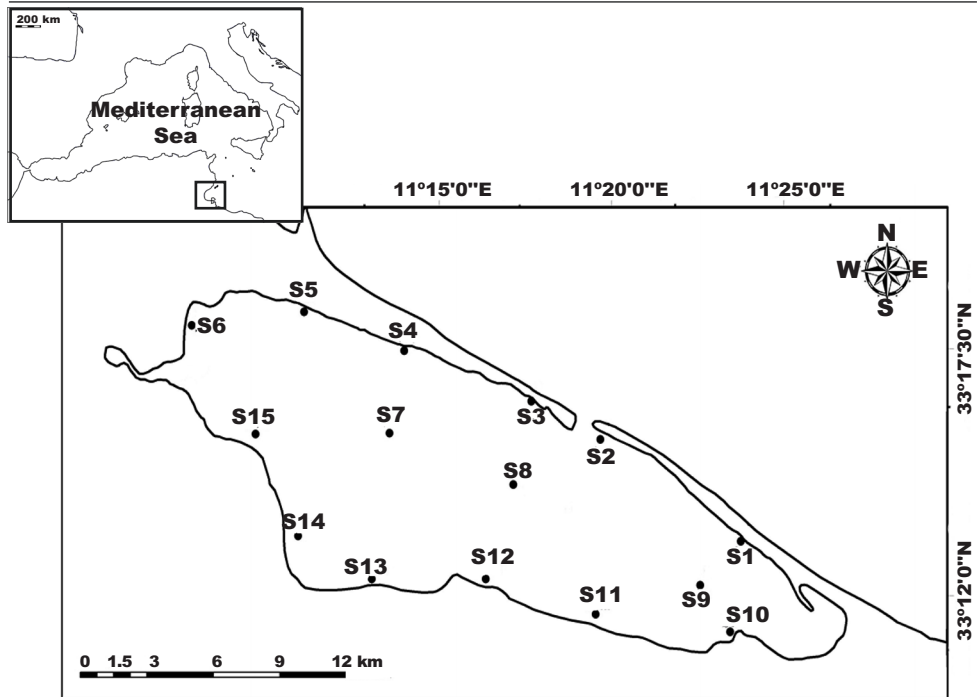


Fig. 1. Sampling locations in the El Bibane lagoon (Tunisia, Mediterranean Sea).

Fig. 1. Localización de los muestreos en la laguna El Bibane (Túnez, mar Mediterráneo).

geographical distribution. The distribution of the Tunisian nematode species is reported according to Boufahja et al. (2014). All the nematode specimens found in this study were deposited in the collection of the Laboratory of Environment Biomonitoring, University of Carthage, Faculty of Sciences of Bizerte (Tunisia).

Results

Seventy-one nematode species, belonging to 68 genera and 22 families, were found at El Bibane lagoon (table 1, GBIF: [doi:10.15470/wuvqpg](https://doi.org/10.15470/wuvqpg)). Species richness ranged from 1 (V29) to 15 (V7) species per station.

The richest families were Cyatholaimidae and Chromadoridae (9 species each), followed by Xyalidae (7), Comesomatidae (6), Desmodoridae, Linhomoeidae and Oncholaimidae (5 each). Monhysteridae and Selachinematidae were represented by three species each, while Oxystominidae, Thoracostomopsidae, Microlaimidae, Monoposthiidae and Axonolaimidae by two species each. For the other families counted, we found only one species each. It is of note that six new species (pending formal taxonomical description) were found.

The list of the species identified is given below along with their distribution in the world and in Tunisia. Some ecological information about the sampling stations is also included. The new species pending taxonomical description are not included in this list.

Table 1. List of the marine nematode specie from el Bibane Lagoon (Tunisia). Data published through GBIF (doi:10.15470/wuvqpg).

Table 1. Lista de los nematodos marinos registrados en la laguna de El Bibane (Túnez). Datos publicados en GBIF (doi:10.15470/wuvqpg).

Order/Family	Longitude	Stations															Total
		S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	
Species	Latitude	33°13'01,33"N	33°11'4,35"N	33°17'04,98"N	33°17'16,18"N	33°18'45,68"N	33°18'4,03"N	33°15'24,49"N	33°13'13,94"N	33°12'24,49"N	33°11'07,27"N	33°11'52,91"N	33°12'26,67"N	33°12'30,99"N	33°13'45,44"N	33°12'36,30"N	
		11°23'55,21"E	11°18'46,87"E	11°16'03,54"E	11°15'6,21"E	11°10'48,33"E	11°7'30,55"E	11°12'56,40"E	11°21'16,60"E	11°22'53,90"E	11°23'12,42"E	11°17'51,42"E	11°16'05,19"E	11°12'55,69"E	11°10'13,19"E	11°11'4,00"E	
O. Enopliida Filipjev, 1929																	
F. Anoplostomatidae Gerlach & Riemann, 1974																	
<i>Chaetonema vicinum</i> Gerlach, 1954					X							X	X	X	X	X	7
F. Anticomidae Filipjev, 1918																	
<i>Anticoma acuminata</i> (Eberth, 1863)		X	X	X	X	X	X				X	X	X	X		X	11
F. Thoracostomopsidae Filipjev, 1927																	
<i>Enoploides longispiculosus</i> Vitiello, 1967		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	15
<i>Enoploaimus longicaudatus</i> (Southern, 1914)		X	X	X			X			X	X	X				X	8
O. Ironida Hodda 2007																	
F. Oxystominidae Filipjev 1918																	
<i>Halalaimus capitulatus</i> Boucher, 1977							X										1
<i>Oxystomina clavicauda</i> (Filipjev, 1918)			X														1
F. Tripyloididae De Coninck & Schuurmans Stekhoven 1933																	
<i>Bathylaimus tenuicaudatus</i> (Allgén, 1933)					X						X	X	X	X	X	X	7
O. Oncholaimida Siddiqi, 1983																	
F. Enchelidiidae Filipjev, 1918																	
<i>Eurystomina ornata</i> (Eberth, 1863)												X	X				2
F. Oncholaimidae Filipjev, 1916																	
<i>Metoncholaimus demani</i> (Zur Strassen, 1894)		X	X	X	X	X		X	X	X			X	X	X	X	12
<i>Oncholaimus campylocercoides</i> De Coninck & Stekhoven, 1933		X	X	X	X												4
<i>Oncholaimellus mediterraneus</i> Stekhoven, 1942		X															2
<i>Prooncholaimus megastoma</i> (Eberth, 1863)		X															1
<i>Viscosia glabra</i> (Bastian, 1865)		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	15
O. Chromadorida Chitwood, 1933																	
F. Chromadoridae Filipjev, 1917																	
<i>Atrochromadora n. sp.</i>														X			1
<i>Chromadora brevipapillata</i> Micoletzky, 1924		X	X														2
<i>Chromadora metulata</i> Aissa & Vitiello, 1977							X									X	2
<i>Euchromadora striata</i> (Eberth, 1863)			X							X	X						3
<i>Neochromadora poecilosomoides</i> Filipjev, 1918							X										1
<i>Parachromadora stygia</i> (Gerlach, 1952)							X										1
<i>Prochromadora n. sp.</i>							X										1
<i>Prochromadorella neapolitana</i> (de Man, 1876)							X							X			2
<i>Ptycholaimellus ponticus</i> (Filipjev, 1922)												X	X				2
F. Cyatholaimidae Filipjev, 1918																	
<i>Craspodema</i> Gerlach, 1956						X											1
<i>Cyatholaimus prinzi</i> (Marion, 1870)							X									X	2
<i>Longicyatholaimus longicaudatus</i> (de Man, 1876)											X	X					2
<i>Marylynna stekhoveni</i> (Wieser, 1954)		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	15
<i>Metacyatholaimus cylindrobucca</i> (Stekhoven, 1950)						X											1
<i>Nannolaimoides effilatus</i> (Boucher, 1976)			X	X	X	X	X							X	X		7
<i>Paralongicyatholaimus mastigodes</i> Stekhoven, 1950							X										1
<i>Pomponema astrodes</i> Lorenzen, 1972						X	X				X	X	X	X	X	X	8
<i>Praeacanthonchus n. sp.</i>							X								X	X	3
O. Desmodorida De Coninck 1965																	
F. Desmodoridae Filipjev, 1922																	
<i>Chromaspirina renaudae</i> Boucher, 1975												X	X				2
<i>Croconema longiseta</i> Stekhoven, 1950													X	X			2
<i>Metachromadora macroutera</i> Filipjev, 1918							X										1
<i>Paradesmodora supplementatis</i> Inglis, 1968							X									X	2
<i>Spirinia parasitifera</i> (Bastian, 1865)		X	X	X	X	X	X				X	X	X	X			10
F. Draconematidae Steiner 1930																	
<i>Draconema claparedii</i> (Mechnikov, 1867)							X										1
F. Microlaimidae De Coninck & Stekhoven, 1933																	
<i>Aponema torosum</i> (Lorenzen, 1973)												X	X				2
<i>Microlaimus cyatholaimoides</i> de Man, 1922			X			X	X				X	X	X	X	X		8
F. Monoposthiidae De Coninck 1965																	
<i>Nudora gerlachi</i> Andrassy, 1973		X															1
<i>Monoposthia mirabilis</i> Schulz, 1932		X				X											2
O. Selachinematida Hodda, 2011																	
F. Selachinematidae De Coninck, 1965																	
<i>Halichoanaimus dolichurus</i> Ssaweljev, 1912			X														1
<i>Richtersia elongata</i> Stekhoven, 1950 <i>inquirenda</i>			X														1
<i>Synonchiella edax</i> Aissa & Vitiello, 1977		X	X	X	X	X	X				X	X	X	X	X	X	12
O. Monhysterida Filipjev, 1929																	
F. Axonolaimidae De Coninck & Stekhoven, 1933																	
<i>Odontophora villoti</i> Luc & De Coninck, 1959			X	X	X	X							X	X			6
<i>Paradontophora sp. n.</i>													X				1
F. Comesomatidae Filipjev, 1918																	
<i>Comesoma vulgare</i> Bastian, 1865							X					X	X				3
<i>Dorylaimopsis mediterranea</i> Grimaldi-De Zio, 1968		X	X	X	X	X	X										6
<i>Metacommesoma n. sp.</i>												X	X				2
<i>Minolaimus lineatus</i> Vitiello, 1970																X	1
<i>Paracommesoma dubium</i> (Filipjev, 1918)		X	X	X	X	X	X	X	X	X	X	X	X	X			13
<i>Sabatieria granifer</i> Wieser, 1954		X	X	X	X	X	X										6
F. Diplopeltidae Filipjev, 1918																	
<i>Southerniella n. sp.</i>						X	X										2
F. Linhomoeidae Filipjev, 1922																	
<i>Linhomoeus undulatus</i> Wieser, 1959						X	X										2
<i>Metalinhomoeus numidicus</i> Aissa & Vitiello, 1977		X	X	X		X	X	X	X	X	X	X	X	X	X	X	14
<i>Paralinhomoeus tenuicaudatus</i> (Bütschli, 1874)		X			X	X	X					X	X	X	X	X	9
<i>Terschellingia communis</i> de Man, 1888		X	X	X		X	X						X	X	X	X	8
<i>Terschellingia longicaudata</i> de Man, 1907		X	X	X	X	X	X		X	X							8
F. Monhysteridae de Man, 1876																	
<i>Diplolaimelloides brucei</i> Hopper, 1970		X															1
<i>Monhystera parva</i> (Bastian, 1865)						X	X										2
<i>Promonhystera faber</i> Wieser, 1956							X							X			2
F. Sphaerolaimidae Filipjev, 1918																	
<i>Sphaerolaimus macrocirculus</i> Filipjev, 1918			X														1
F. Xyalidae Chitwood, 1951																	
<i>Ammotheristus helgolandicus</i> (Riemann, 1967)		X					X										2
<i>Daptonema fallax</i> (Lorenzen, 1972)		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	15
<i>Daptonema hirsutum</i> (Vitiello, 1967)		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	12
<i>Theristus flevensis</i> Stekhoven, 1935		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	14
<i>Trichotheristus setifer</i> (Gerlach, 1952)		X	X	X	X	X	X				X	X	X	X	X	X	12
<i>Scaptrella cincta</i> Cobb, 1917		X									X	X					4
<i>Steineria pilosa</i> Cobb, 1914											X	X	X	X	X	X	6
O. Leptolaimida Hodda 2007																	
F. Paramicrolaimidae Lorenzen 1981																	
<i>Paramicrolaimus spirulifer</i> Wieser, 1959			X														1
Species/station		28	29	21	22	28	40	9	10	11	21	28	27	25	18	22	339

Order Enoplida Filipjev, 1929

Family Anoplostomatidae Gerlach & Riemann, 1974

Chaetonema vicinum Gerlach, 1954

Documented distribution: Mediterranean Sea, North Atlantic Ocean.

Distribution in Tunisia: Bizerte Bay and Kram.

Additional ecological notes: the species was found in seven stations in the south western part of the lagoon (Sts. 4, St. 10–15). It was found in sediments with a fine fraction from 8% (St. 13) to 29% (St. 4) and a level of organic matter (TOM) that ranged from 0.58% to 2.32%.

Family Anticomidae Filipjev, 1918

Anticoma acuminata (Eberth, 1863)

Documented distribution: Mediterranean Sea, North Sea, Black Sea, New Zealand, North Atlantic Ocean.

Distribution in Tunisia: Bizerte bay and lagoon.

Additional ecological notes: the species was found in 11 stations, all in the marginal area (Sts. 1–6, 10–13, 15). It was in sediments with a mud fraction from 8% (St. 13) to 29% (St. 4) and a level of TOM that ranged from 0.55% to 2.32%.

Family Thoracostomopsidae Filipjev, 1927

Enoploides longispiculosus Vitiello, 1967

Documented distribution: Mediterranean Sea, North Atlantic Ocean, North Sea.

Distribution in Tunisia: Bizerte bay.

Additional ecological notes: this species was found in all 15 stations of the lagoon. The sediments ranged from 8% to 87% of fine fraction and a level of organic matter that ranged from 0.55% to 5.05%.

Enoplolaimus longicaudatus (Southern, 1914)

Documented distribution: North Sea, North Atlantic Ocean.

Distribution in Tunisia: Bizerte bay and lagoon, Bou Ghrara and Ghar El Melh lagoons.

Additional ecological notes: it was documented in eight stations located in both margins of El Bibane (Sts. 1–3, 6, 9–11, 15). The species was found in sediments characterized by a range of mud from 14% to 73% and a level of organic matter from 0.55% to 3.95%.

Order Ironida Hodda 2007

Family Oxystominidae Filipjev 1918

Halalaimus capitulatus Boucher, 1977

Documented distribution: North Atlantic Ocean, North Sea.

Distribution in Tunisia: Bizerte bay and lagoon.

Additional ecological notes: the species was found in only one station, which was near the Boujmel sebkhat (St. 6) and characterized by 28% of mud and 1.77% of TOM.

Oxystomina clavicauda (Filipjev, 1918)

Documented distribution: North Atlantic Ocean, Black Sea.

Distribution in Tunisia: Ghar El Melh lagoon.

Additional ecological notes: the species was found in only one station, situated close to the lagoon opening to the sea (St. 2) and characterized by 14% of mud and 0.87% of TOM.

Order Tripyloidida Hodda 2007

Family Tripyloididae De Coninck & Schuurmans Stekhoven 1933

Bathylaimus tenuicaudatus (Allgén, 1933)

Documented distribution: North Sea, North Atlantic Ocean.

Distribution in Tunisia: Bizerte bay and Bou Gharara lagoon.

Additional ecological notes: the species was reported for seven stations, mainly located in the south western part of the lagoon (Sts. 4, 10–15). The sediments ranged from 8 % to 29 % of mud and 0.58 % to 2.32 % of TOM.

Order Oncholaimida Siddiqi, 1983

Family Enchelidiidae Filipjev, 1918

Eurystomina ornata (Eberth, 1863)

Documented distribution: Mediterranean Sea, Black Sea, North Atlantic Ocean, Japan.

Distribution in Tunisia: Bizerte and Ghar El Melh lagoons.

Additional ecological notes: the species was found in only two stations in the Southern part of the lagoon (Sts. 11, 12). The sediments showed a mud fraction of 12 % and 19 % and TOM of 1.84 % to 2.32 %, respectively.

Family Oncholaimidae Filipjev, 1916

Metoncholaimus demani (Zur Strassen, 1894)

Documented distribution: Mediterranean Sea, Black Sea, North Atlantic Ocean.

Distribution in Tunisia: Bou Gharara lagoon.

Additional ecological notes: the species was found in a total of 12 stations from the area located near sea to the central area to the south western part of the lagoon (Sts. 1–5, 7–9, 12–15). The sediments were characterized by a fine fraction that ranged from 8 % to 87 % and a level of TOM from 0.55 % to 5.05 %.

Oncholaimus campylocercoides De Coninck & Stekhoven, 1933

Documented distribution: Mediterranean Sea, Black Sea, North Atlantic Ocean, North Sea.

Distribution in Tunisia: Bizerte bay and lagoon, Bou Ghrara, Ghar El Meh lagoons, Northern Lake of Tunis, Old Harbour of Bizerte, southern Lake of Tunis.

Additional ecological notes: the species was found in four stations all located in the marginal area near the sea (Sts. 1–4). The fine fraction of the sediments ranged from 14 % to 29 %, while TOM ranged from 0.55 % to 1.06 %.

Oncholaimellus mediterraneus Stekhoven, 1942

Documented distribution: Mediterranean Sea, North Atlantic Ocean, North Sea, Black Sea (Ürkmez et al., 2016).

Distribution in Tunisia: Bizerte bay and lagoon, Bou Ghrara and Ghar El Melh lagoons, Southern Lake of Tunis, Old harbour of Bizerte.

Additional ecological notes: it was detected at two stations (Sts. 1, 4) located in the marginal area near the sea, with a fine fraction of 15 % and 29 % and TOM of 0.55 % to 0.87 %, respectively.

Prioncholaimus megastoma (Eberth, 1863)

Documented distribution: Mediterranean Sea, North Atlantic Ocean.

Distribution in Tunisia: Bizerte, Bou Ghrara and Ghar El Melh lagoons, and Ichkeul lake.

Additional ecological notes: it was documented in only one station (St. 1) in the extreme southern part of the lagoon. It was characterized by 15 % of mud and 0.55 % of TOM.

Viscosia glabra (Bastian, 1865)

Documented distribution: Mediterranean Sea, North Atlantic Ocean.

Distribution in Tunisia: Bizerte bay and lagoon, Bou Ghrara, Ghar El Melh lagoons, Northern Lake of Tunis.

Additional ecological notes: the species was found in the throughout the El Bibane lagoon (15 stations). It was found in sediments characterized by a range of mud from 8% to 87% and TOM of 0.55% to 5.05%

Order Chromadorida Chitwood, 1933

Family Chromadoridae Filipjev, 1917

Chromadora brevipapillata Micoletzky, 1924

Documented distribution: Japan, Mediterranean Sea, North Atlantic Ocean.

Distribution in Tunisia: Bizerte bay.

Additional ecological notes: this species was found in only two stations (Sts. 1, 2) and located in the southern part of the margin close to the sea. It was mainly found in sediments characterized by a low level of fine fraction (14–15%) and TOM (0.55–0.87%).

Chromadorina metulata Aissa & Vitiello, 1977

Documented distribution: Mediterranean Sea.

Distribution in Tunisia: Bizerte bay and lagoon, Bou Ghrara and Ghar El Melh lagoons, northern and southern Lakes of Tunis.

Additional ecological notes: this species was found only in one station, near the Boujmel sebkhat. It was found mainly in sediments with 28% of mud and 1.77% of TOM.

Euchromadora striata (Eberth, 1863)

Documented distribution: Mediterranean Sea, Black Sea, North Atlantic Ocean.

Distribution in Tunisia: Bizerte bay and lagoon, Bou Ghrara and Ghar El Melh lagoons.

Additional ecological notes: found only in St. 2, St. 10, and St. 11. One station was in front of the lagoon opening to the sea; the two other stations were in the southern marginal area. It was found in sediments with mud from 14% to 19% and TOM from 0.58% to 1.84%.

Neochromadora poecilosomoides Filipjev, 1918

Documented distribution: Mediterranean Sea, North Atlantic Ocean, Black Sea, North Sea.

Distribution in Tunisia: Bizerte bay and lagoon, Bou Ghrara and Ghar El Melh lagoons; and Old Harbour of Bizerte.

Additional ecological notes: it was found only in one station, near the Boujmel sebkhat. It was characterized by 28% mud and 1.77% TOM.

Parachromadorita stygia (Gerlach, 1952)

Documented distribution: North Sea.

Distribution in Tunisia: a new record for Tunisia.

Additional ecological notes: this species was found only in the station near the Boujmel sebkhat. It was characterized by 28% of mud and 1.77% of TOM.

Prochromadorella neapolitana (de Man, 1876)

Documented distribution: Mediterranean Sea, North Atlantic Ocean.

Distribution in Tunisia: Bou Ghrara, Ghar El Melh, Bizerte lagoons, Northern Lake of Tunis, Old Harbour of Bizerte, Southern Lake of Tunis.

Additional ecological notes: the species was found at St. 6 (close to the Boujmel sebkhat) and at St. 13 in the western margin of the lagoon. The stations were characterized by 28% and 8% of mud and 1.77% and 1.92% of TOM.

Ptycholaimellus ponticus (Filipjev, 1922)

Documented distribution: Mediterranean Sea, Baltic Sea, North Atlantic Ocean, North Sea.

Distribution in Tunisia: Bizerte bay and lagoon, Bou Ghrara and Ghar El Melh lagoons, Ichkeul Lake and Southern Lake of Tunis.

Additional ecological notes: it was found only in two stations (Sts. 11, 12), both in the south western part of the lagoon. The station sediments were characterized by 19% and 12% of mud and 1.84% to 2.32% of TOM, respectively.

Family Cyatholaimidae Filipjev, 1918

Cyatholaimus prinzi (Marion, 1870)

Documented distribution: Mediterranean Sea, English Channel, North Atlantic Ocean, North Sea.

Distribution in Tunisia: Bizerte and Ghar El Melh lagoons, Northern Lake of Tunis.

Additional ecological notes: it was found in two stations (Sts. 6, 15) that are both the closest ones to the Boujmel sebkhat. The mud fraction was 28% and 18% and TOM was 1.77% and 1.53%.

Longicyatholaimus longicaudatus (de Man, 1876)

Documented distribution: Mediterranean Sea, Gulf of Mexico, North Atlantic Ocean, North Sea.

Distribution in Tunisia: Bizerte bay, Bou Gharara lagoon.

Additional ecological notes: it was found in two stations, both in the southern marginal area (Sts. 10, 11). The mud fraction was 17% and 19% and the organic content was 0.58% and 1.84%, respectively.

Marylynnia stekhoveni (Wieser, 1954)

Documented distribution: Mediterranean Sea, North Atlantic Ocean.

Distribution in Tunisia: Bou Ghrara and Ghar El Melh lagoons.

Additional ecological notes: it was documented throughout El Bibane lagoon (15 stations). The mud fraction was 8% to 87% and TOM was 0.55% to 5.05%.

Metacyatholaimus cylindribucca (Stekhoven, 1950)

Documented distribution: Mediterranean Sea, North Atlantic Ocean.

Distribution in Tunisia: Bizerte lagoon.

Additional ecological notes: it was found only in St. 5, in the northern part of the lagoon margin, facing to the sea. The mud fraction was 28% and TOM was 2.01%.

Nannolaimoides effilatus (Boucher, 1976)

Documented distribution: North Atlantic Ocean.

Distribution in Tunisia: the first record from Tunisia coasts.

Additional ecological notes: it was found in seven stations, mainly at sea margins (Sts. 2–6). It was documented in the opposite margin only at St. 13 and St. 14. The mud fraction was 8–29% and TOM was 0.67% to 2.01%.

Paralongicyatholaimus mastigodes Stekhoven, 1950

Documented distribution: Mediterranean Sea.

Distribution in Tunisia: it was recorded only at the Bizerte lagoon.

Additional ecological notes: it was documented only at St. 6 (Boujmel sebkhat). The mud fraction was 28% and TOM was 1.77%.

Pomponema astrodes Lorenzen, 1972

Documented distribution: North Atlantic Ocean, North Sea.

Distribution in Tunisia: Bou Ghrara and Ghar El Melh lagoons.

Additional ecological notes: it was found throughout the area between St. 5 and St. 15 for a total of eight stations. The mud sediment was 8 % to 28 % and TOM was 0.58 % to 2.32 %.

Order Desmodorida De Coninck 1965

Family Desmodoridae Filipjev, 1922

Chromaspirina renaudae Boucher, 1975

Documented distribution: North Sea.

Distribution in Tunisia: Bou Ghrara and Ghar El Melh.

Additional ecological notes: it was documented only at St. 11 and St. 12 in the south western margin. The mud fraction was 19% and 12% and TOM content was 1.84% and 2.32 %, respectively.

Croconema longiseta Stekhoven, 1950

Documented distribution: Mediterranean Sea, North Atlantic Ocean.

Distribution in Tunisia: Bizerte bay.

Additional ecological notes: it was documented only in two stations of the inner margin (Sts. 12, 13). The mud fraction was 12% and 8 %, respectively; and TOM was 2.32 % and 1.92 %, respectively.

Metachromadora macroutera Filipjev, 1918

Documented distribution: Black Sea, North Atlantic Ocean.

Distribution in Tunisia: the present species was previously reported for the Tunisian coasts in an unspecified locality.

Additional ecological notes: it was found only at St. 6 (Boujmel sebkhat) in sediments with 28% of mud and 1.77% of TOM.

Paradesmodora supplementatis Inglis, 1968

Documented distribution: New Caledonia.

Distribution in Tunisia: Bizerte bay.

Ecological notes: it was documented at St. 6 (Boujmel sebkhat) and St. 15 in sediments with 28% and 18% of mud and 1.77% and 1.53% of TOM, respectively.

Spirinia parasitifera (Bastian, 1865)

Documented distribution: Mediterranean Sea, Black Sea, North Atlantic Ocean, North Sea, Indo–Pacific area.

Distribution in Tunisia: Bizerte bay and lagoon.

Additional ecological notes: it was widely found in the study area (10 stations) and mainly in the marginal areas (Sts. 6–13). The species was in sediments characterized by a range of mud from 8% to 29%, and of TOM from 0.55% to 2.32%.

Family Microlaimidae De Coninck & Stekhoven, 1933

Aponema torosum (Lorenzen, 1973)

Documented distribution: Mediterranean Sea, North Atlantic Ocean, North Sea.

Distribution in Tunisia: Bizerte bay and lagoon.

Additional ecological notes: it was documented only at the St. 11 and St. 12 in the south western margin. The sediments in these stations showed 19% and 12% of mud and 1.84% and 2.32% of TOM, respectively.

Microlaimus cyatholaimoides de Man, 1922

Documented distribution: North Atlantic Ocean, North Sea.

Distribution in Tunisia: Bizerte, Bou Ghrara, Ghar El Melh lagoons, Northern and Southern Lakes of Tunis.

Additional ecological notes: it was found in several stations (eight stations) located in both margins (Sts. 2, 5, 6, 10–14). Sediments ranged from 8% to 28% of mud and from 0.58% to 2.32% of TOM.

Family Draconematidae Steiner 1930

Draconema claparedii (Mechnikov, 1867)

Documented distribution: North Atlantic Ocean, Mediterranean Sea.

Distribution in Tunisia: it is the first record in Tunisia.

Additional ecological notes: it was documented only at St. 6 (Boujmel sebkhat) in sediments with 28% of mud and 1.77% of TOM.

Family Monoposthiidae De Coninck 1965

Nudora gerlachi Andrassy, 1973

Documented distribution: Cuba.

Distribution in Tunisia: Bizerte bay.

Additional ecological notes: it was documented only for the St. 1 located in the southern part of the lagoon and characterized by 15% of mud and 0.55% of TOM.

Monoposthia mirabilis Schulz, 1932

Documented distribution: Mediterranean Sea, North Atlantic Ocean, North Sea, Southern Ocean.

Distribution in Tunisia: Bizerte bay and lagoon, and Bou Ghrara lagoons.

Additional ecological notes: it was found in two stations (Sts. 1, 5) characterized by 15% and 28% of mud and 0.55% and 2.01% of TOM.

Order Selachinematida Hodda, 2011

Family Selachinematidae De Coninck 1965

Halichoanolaimus dolichurus Ssaweljev, 1912

Documented distribution: Mediterranean Sea, Black Sea, North Atlantic Ocean, North Sea.

Distribution in Tunisia: Bizerte and Bou Ghrara lagoons, Northern Lake of Tunis.

Additional ecological notes: it was documented only for St. 2, close to the opening to the sea and characterized by 14% of mud and 0.87% of TOM.

Richtersia elongata (Stekhoven, 1950) (species inquirenda for incomplete description)

Documented distribution: English Channel.

Distribution in Tunisia: Northern Lake of Tunis.

Additional ecological notes: It was documented only for St. 2 close to the opening to the sea and characterized by 14% of mud and 0.87% of TOM.

Synonchiella edax Aissa & Vitiello, 1977

Documented distribution: Mediterranean Sea.

Distribution in Tunisia: Bizerte and Bou Ghrara lagoons, Northern Lake of Tunis and Old Harbour of Bizerte.

Additional ecological notes: it was documented in a wide range of 12 marginal stations (Sts. 6–15). The mud ranged from 8% to 29% and TOM from 0.55% to 2.32%.

Order Monhysterida Filipjev, 1929

Family Axonolaimidae De Coninck & Stekhoven, 1933

Odontophora villoti Luc & De Coninck, 1959

Documented distribution: North Atlantic Ocean, North Sea.

Distribution in Tunisia: Bizerte bay and lagoon, Bou Ghrara and Ghar El Mehl lagoons, Old Harbour of Bizerte.

Additional ecological notes: the species was found in six stations, all located on the margins of the lagoon (Sts. 2–5, 12, 13). Mud ranged in the sediments of the stations from 8% to 29% and TOM from 0.67% to 2.32%.

Family Comesomatidae Filipjev, 1918

Comesoma vulgare Bastian, 1865

Documented distribution: Mediterranean Sea, North Atlantic Ocean, North Sea.

Distribution in Tunisia: Bizerte lagoon.

Additional ecological notes: it was collected from three stations (Sts. 6, 11, 12). They are characterized by 28%, 19%, 12% of mud and 1.77%, 1.84%, 2.32% of TOM, respectively.

Dorylaimopsis mediterranea Grimaldi–De Zio, 1968

Documented distribution: Mediterranean Sea, North Atlantic Ocean.

Distribution in Tunisia: Bizerte lagoon and bay, Bou Ghrara and Ghar El Melh lagoons and Southern Lake of Tunis.

Additional ecological notes: it was collected in six stations from the area located near the margin facing the sea (Sts. 1–5) and at St. 6 close to the Boujmel sebkhat. It was found in sediments with a mud fraction from 14% to 29% and TOM from 0.55% to 2.01%.

Minolaimus lineatus Vitiello, 1970

Documented distribution: Mediterranean Sea, North Atlantic Ocean.

Distribution in Tunisia: the first record for Tunisia.

Additional ecological notes: it was collected only at St. 15, in 18% of mud and 1.53% of TOM.

Paracomesoma dubium (Filipjev, 1918)

Documented distribution: Mediterranean Sea, North Atlantic Ocean.

Distribution in Tunisia: Bizerte, Bou Ghrara and Ghar El Melh lagoons, Ichkeul Lake, Old harbour of Bizerte and Southern Lake of Tunis.

Additional ecological notes: it was collected from 13 stations both in the margins and in the central part of the lagoon (Sts. 1–13). It was found in sediments with a mud fraction from 8% to 87% and TOM from 0.55% to 5.05%.

Sabatieria granifer Wieser, 1954

Documented distribution: Mediterranean Sea, North Atlantic Ocean.

Distribution in Tunisia: Bizerte bay and lagoon, Bou Ghrara and Ghar El Melh lagoons and Southern Lake of Tunis.

Additional ecological notes: it was collected in six stations from the margin facing the sea and in the station close to the Boujmel sebkhat (Sts. 1–6). It was in sediments from 14% to 29% of mud and from 0.55% to 2.01% of TOM.

Family Linhomoeidae Filipjev, 1922

Linhomoeus undulatus Wieser, 1959

Documented distribution: Salish Sea (Pacific Ocean).

Distribution in Tunisia: Bizerte, Bou Ghrara, Ghar El Melh lagoons, Old Harbour of Bizerte.

Additional ecological notes: it was found only in the two stations (Sts. 5, 6) closest to the Boujmel sebkhat. It was mainly associated with sediments with 28 % of mud and 2.01 % and 1.77% of TOM, respectively.

Metalinhomoeus numidicus Aissa & Vitiello, 1977

Documented distribution: It was found only in Tunisia.

Distribution in Tunisia: Bizerte, Bou Ghrara and Ghar El Melh lagoons and Northern and Southern Lake of Tunis.

Additional ecological notes: it was found in all the stations (14 stations) except St. 4. It was detected in a mud fraction of 8 % to 87 % and TOM of 0.55 % to 5.05 %.

Paralinhomoeus tenuicaudatus (Bütschli, 1874)

Documented distribution: Mediterranean Sea, North Atlantic Ocean, North Sea.

Distribution in Tunisia: Bizerte, Bou Ghrara and Ghar El Melh lagoons.

Additional ecological notes: it was found in nine stations, all in the margins of the lagoon (Sts. 1, 4–6, 11–15). It was mainly associated with mud sediments with a range of mud from 8 % to 29 % and TOM from 0.55 % to 2.32 %.

Terschellingia communis de Man, 1888

Documented distribution: Mediterranean Sea, North Atlantic Ocean and North Sea.

Distribution in Tunisia: Bizerte, Bou Ghrara and Ghar El Melh lagoons, Old Harbour of Bizerte and Southern Lake of Tunis.

Additional ecological notes: it was found in 8 stations, all marginal in the lagoon (Sts. 1–3, 5, 6, 13–15). The species was detected in sediments with mud from 8 % to 28 % and TOM from 0.55 % to 2.01 %.

Terschellingia longicaudata de Man, 1907

Documented distribution: Mediterranean Sea, Baltic Sea, Barents Sea, Gulf of Mexico, Black Sea, North Atlantic Ocean, North Sea and New Zealand.

Distribution in Tunisia: Bizerte bay and lagoon, Bou Ghrara and Ghar El Melh lagoons, Ichkeul Lake, Old Harbour of Bizerte, Northern and Southern lakes of Tunis.

Additional ecological notes: it was present in eight stations located both in the central area and in the margin of the lagoon close to the sea (Sts. 1–6, 8, 9). The species was found in sediments with ranges of mud from 14 % to 86 % and TOM from 0.55 % to 3.95 %.

Family Monhysteridae de Man, 1876

Diplolaimelloides brucei Hopper, 1970

Documented distribution: Gulf of Mexico, North Atlantic Ocean.

Distribution in Tunisia: it is a new record for Tunisia.

Additional ecological notes: it was found only in St. 1, with a mud fraction of 15 % and TOM of 0.55 %.

Monhystera parva (Bastian, 1865)

Documented distribution: Mediterranean Sea, Red Sea, Black Sea, Gulf of Mexico, North Atlantic Ocean, North Sea.

Distribution in Tunisia: Bou Ghrara and Ghar El Melh lagoons and Southern Lake of Tunis.

Additional ecological notes: it was found only in a total of two stations (Sts. 5, 6). The species was associated with mud values of 28 % and TOM of 2.01 % and 1.77 %.

Promonhystera faber Wieser, 1956

Documented distribution: North Sea.

Distribution in Tunisia: it is a new record for Tunisia.

Additional ecological notes: it was documented in only two stations (Sts. 6, 13), that were characterized by 28% and 8% of mud and 1.77% and 1.92% of TOM, respectively.

Family Sphaerolaimidae Filipjev, 1918

Sphaerolaimus macrocirculus Filipjev, 1918

Documented distribution: Mediterranean Sea, Black Sea, North Atlantic Ocean.

Distribution in Tunisia: Bizerte lagoon.

Additional ecological notes: it was found only at St. 2 that is located close to the opening of the lagoon to the sea, in sediments with 14% of mud and 0.87% of TOM.

Family Xyalidae Chitwood, 1951

Ammotheristus helgolandicus (Riemann, 1967)

Documented distribution: North Atlantic Ocean, North Sea.

Distribution in Tunisia: Bizerte lagoon.

Additional ecological notes: it was found only in two stations (Sts. 1, 6), that were characterized by 15% and 28% of mud and 0.55% and 1.77% of TOM.

Daptonema fallax (Lorenzen, 1972)

Documented distribution: North Atlantic Ocean, North Sea.

Distribution in Tunisia: Bizerte bay and lagoon, Bou Ghrara and Ghar El Melh lagoons and Southern Lake of Tunis.

Additional ecological notes: it was found in the whole lagoon (15 stations) associated with a wide range of mud from 8% to 87% and TOM from 0.55% to 5.05%.

Daptonema hirsutum (Vitiello, 1967)

Documented distribution: North Atlantic Ocean, North Sea.

Distribution in Tunisia: Bizerte bay and lagoon, Bou Ghrara and Ghar El Melh lagoons, Old harbour of Bizerte and Southern Lake of Tunis.

Additional ecological notes: it was collected at 12 stations, mainly from the margin close to the sea and in the central area of the lagoon (Sts. 1– 11, 15). The species was associated with a mud fraction from 14% to 87% and TOM from 0.55% to 5.05%.

Theristus flevensis Stekhoven, 1935

Documented distribution: Mediterranean Sea, Baltic Sea, North Atlantic Ocean, North Sea, Red Sea.

Distribution in Tunisia: Bizerte bay and lagoon, Bou Ghrara and Ghar El Melh lagoons, Northern and Southern Lake of Tunis, Old Harbour of Bizerte.

Additional ecological notes: it was well distributed in the lagoon in all the stations with the exception of St. 15 (14 stations). It was associated with mud sediments from 8% to 87% and TOM from 0.55% to 5.05%.

Trichotheristus setifer (Gerlach, 1952)

Documented distribution: Mediterranean Sea.

Distribution in Tunisia: it is a new record for Tunisia.

Additional ecological notes: it was documented in almost the whole marginal area of the lagoon (Sts. 6–15), for a total of 12 stations that showed a range of mud from 8% to 29% and organic matter from 0.55% to 2.32%.

Scaptrella cincta Cobb, 1917

Documented distribution: North America, Brazil.

Distribution in Tunisia: it was found only in the Bizerte bay.

Additional ecological notes: it was collected in a total of four stations that are scattered in the lagoon (Sts. 1, 6, 10, 11). The species was collected in sediments with a mud range from 15% to 28% and TOM from 0.55% to 1.84%.

Steineria pilosa Cobb, 1914

Documented distribution: Chile, Öresund, Kiel Bay, Bay of Bengal, Antarctica, Arabian Sea.

Distribution in Tunisia: Bizerte bay and lagoon, Bou Ghrara and Ghar El Melh lagoons.

Additional ecological notes: it was well distributed in the inner margin of the lagoon (Sts. 10–15) for a total of six stations. It was associated with sediments with a mud fraction from 8% to 21%, while TOM from 0.58% to 2.32%.

Order Leptolaimida Hodda 2007

Family Paramicrolaimidae Lorenzen 1981

Paramicrolaimus spirulifer Wieser, 1959

Documented distribution: Pacific Ocean, Baltic Sea.

Distribution in Tunisia: Bizerte bay and lagoon; Ghar El Melh lagoon.

Additional ecological notes: it was documented only for St. 2 at the opening of the lagoon to the sea. The species was found in 14% of mud and 0.87% of TOM.

Discussion

The information currently available on the free-living nematodes of Tunisia is mainly focused on the northern part of this country, and the southern area is practically unexplored (Jouili et al., 2017). El Bibane is one of the largest lagoons in Tunisia. It has a high number of habitats that are of interest from a naturalistic point of view. However, as these habitats are under increasing exploitation, estimates of lagoon biodiversity are urgent (Guelorget et al., 1982; Pergent and Zaouali, 1992; Rabaoui et al., 2014; Jelassi et al., 2015).

The number of nematode species (71) detected in this survey is high compared to other transitional environments in the Mediterranean basin (e.g. Guerrini et al., 1998, Fabbrocini et al., 2005, Semprucci and Balsamo, 2015) and low compared to European transitional environments (Barnes et al., 2008; Ferrero et al., 2008). Moreover, six species in the Orders Chromadorida (two in Chromadoridae and one in Cyatholaimidae) and Monhysterida (one in each of the following families: Axonolaimidae, Diplopeltidae, Comesomatidae) are waiting for a formal taxonomical description and are considered new to science. Seven species are recorded for the first time in Tunisia (Boufahja et al., 2015) and four species (*P. stygia*, *N. effilatus*, *P. faber* and *D. bruciei*) are also new records for the Mediterranean basin. However, it is noteworthy that all of the species listed in this study are new records for the southern part of Tunisian waters. Among the species found in El Bibane, *A. acuminata*, *E. ornata*, *O. campylocercoides*, *C. brevipapillata*, *N. poecilosomoides*, *L. longicaudatus*, *S. parasitifera*, *M. mirabilis*, *T. longicaudata*, *M. parva*, *T. flevensis* and *S. pilosa* are cosmopolitan species with a widely documented geographic distribution. *P. stygia*, *C. renaudae*, *R. elongata*, *N. effilatus* are until now exclusively known for the Northern European sector, while *P. supplementatis*, *L. undulatus*, *P. spirulifer* for Pacific Ocean and/or Baltic Sea, *N. gertlachi* for the Atlantic Ocean and *S. cincta* for American coasts. Their discovery in Tunisian waters greatly increases the information available on the distribution and so on the biogeography of free-living nematodes. At the moment, *C. metulata*, *S. edax*, *P. mastigodes*, *T. setifer*, *M. numidicus* are confirmed as endemic to the Mediterranean Sea. However, the biogeography

graphy of meiofauna is often complicated due to the low number of studies on nematodes at species level and scarcity of reports with complete lists of species.

The nematode assemblage of El Bibane lagoon mainly comprises families of transitional environments (e.g. Villano & Warwick, 1995; Pallo et al., 1998; Barnes et al., 2008; Semprucci et al., 2014). Among the most frequent families found, Xyalidae, Linhomoeidae and Cyatholaimidae show representatives typical of muds rich in detritus and often characterized by anoxic conditions (e.g. Stekhoven, 1950; Heip et al., 1985; Semprucci, 2013; Sandulli et al., 2014). *D. fallax*, *D. hirsutum*, *T. flevensis* and *T. setifer* (Xyalidae) are among the widespread species in El Bibane together with *E. longispiculosus*, *V. glabra* and *M. stekhoveni* (Thoracostomopsidae, Oncholaimidae and Cyatholaimidae, respectively). The stations of the central part of the lagoon, which are characterized by the highest mud and organic matter percentages, show the lowest number of species according to the observations in literature (e.g. Semprucci et al., 2010; Vanaverbeke et al., 2011; Frontalini et al., 2014). In contrast, St. 6, located close to the Boujmel sebkhat, reveals the highest richness, as documented by Jouili et al. (2017) who reported that the area is characterized by a high diversity and ecological quality of the nematode assemblage.

In conclusion, this study underlines the relevance of faunistic studies in areas where such data are previously unknown and improves our knowledge on the global distribution of the nematodes and in the Mediterranean basin. The increase in such studies is particularly important for the inconspicuous metazoan taxa, collectively named 'meiofauna' because they have been neglected for a long time by marine biologists and ecologists worldwide (Semprucci, 2013).

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References

- Appeltans, W., Ahyong, S. T., Anderson, G., Angel, M. V., Artois, T., Bailly, N., Bamber, R., Barber, A., Bartsch, I., Berta, A., Błażewicz-Paszkowycz, M., Bock, P., Boxshall, G., Boyko, C. B., Nunes Brandão, S., Bray, R. A., Bruce, N. L., Cairns, S. D., Chan, T.-Y., Cheng, L., Collins, A. G., Cribb, T., Curini-Galletti, M., Dahdouh-Guebas, F., Davie, P. J. F., Dawson, M. N., De Clerck, O., Decock, W., De Grave, S., Voogd, N. J. de, Domning, D. P., Emig, C. C., Erséus, C., Eschmeyer, W., Fauchald, K., Fautin, D. G., Feist, S. W., Fransen, C. H. J. M., Furuya, H., Garcia-Alvarez, O., Gerken, S., Gibson, D., Gittenberger, A., Gofas, S., Gómez-Daglio, L., Gordon, D. P., Guiry, M. D., Hernandez, F., Hoeksema, B. W., Hopcroft, R. R., Jaume, D., Kirk, P., Koedam, N., Koenemann, S., Kolb, J. B., Kristensen, R. M., Kroh, A., Lambert, G., Lazarus, D. B., Lemaitre, R., Longshaw, M., Lowry, J., Macpherson, E., Madi, L. P., Mah, C., Mapstone, G., McLaughlin, P. A., Mees, J., Meland, K., Messing, C. G., Mills, C. E., Molodtsova, T. N., Mooi, R., Neuhaus, B., Ng, P. K. L., Nielsen, C., Norenburg, J., Opresko, D. M., Osawa, M., Paulay, G., Perrin, W., Pilger, J. F., Poore, G. C. B., Pugh, P., Read, G. B., Reimer, J. D., Rius, M., Rocha, R. M., Saiz-Salinas, J. I., Scarabino, Schierwater, B., Schmidt-Rhaesa, A., Schnabe, K. E., Schotte, M., Schuchert, P., Schwabe, E., Segers, H., Self-Sullivan, C., Shenkar, N., Siegel, V., Sterrer, W., Stöhr, S., Swalla, B., Tasker, M. L., Thuesen, E. V., Timm, T., Todaro, M. A., Turon, X., Tyler, S., Uetz, P., van der Land, J., Vanhoorne, B., van Ofwegen, L. P., van Soest, R. W. M., Vanaverbeke, J., Walker-Smith, G., Chad Walter, T., Warren, A., Williams, G. C., Wilson, S. P., Costello, M. J., 2012. The Magnitude of Global Marine Species Diversity. *Current Biology*, 22: 2189–2202.

- Balvanera, P., Pfisterer, A. B., Buchmann, N., He, J. S., Nakashizuka, T., Raffaelli, D., Schmid, B., 2006. Quantifying the evidence for biodiversity effects on ecosystem functioning and services. *Ecology Letters*, 10: 1146–1156.
- Barnes, N., Bamber, R., Moncrieff, C., Shearer, M., Ferrero, T., 2008. Meiofauna in closed coastal saline lagoons in the United Kingdom: structure and biodiversity of nematode assemblage. *Estuarine Coastal Shelf Science*, 79: 328–340.
- Boufahja, F., Semprucci, F., Beyrem, H., Bhadury, P., 2015. Molecular tools for studying free-living marine nematodes of Africa: promising prospects in systematics against scarcity of information. *Journal of Nematology*, 47: 198–206.
- Boufahja, F., Vitiello, J., Aissa, P., 2014. More than 35 years of studies on marine nematodes from Tunisia: a checklist of species and their distribution. *Zootaxa*, 3786: 269–300.
- BRL Ingenierie Idea Consult, 2008. *Preparation d'un plan de gestion de la lagune des Bibans, diagnostics et mesures d'urgence*. Groupe STUDI, Tunis, Tunisia.
- Cardinale, B. J., Srivastava, D. S., Duffy, J. E., Wright, J. P., Downing, A. L., Sankaran, M., Jouseau, C., 2006. Effects of biodiversity on the functioning of trophic groups and ecosystems. *Nature*, 443: 989–992.
- Chen, C. A., Soo, C. L., Balsamo, M., Semprucci, F., 2017. An approach based on nematode descriptors for the ecological quality (EcoQ) classification of the Malaysian coasts. *Marine Biodiversity*: 1–10. [Doi:10.1007/S12526-017-0813-1](https://doi.org/10.1007/S12526-017-0813-1)
- Da Rocha, C. M. C., Venekey, V., Bezerra, T. N. C., Souza, J. R. B., 2006. Phytal marine nematode assemblages and their relation with the macrophytes structural complexity in a Brazilian tropical rocky beach. *Hydrobiologia*, 553: 219–230.
- Fabbrocini, A., Guarino, A., Scirocco, T., Franchi, M., D'Adamo, R., 2005. Integrated bio-monitoring assessment of the Lesina Lagoon (Southern Adriatic Coast, Italy): preliminary results. *Chemistry and Ecology*, 21: 479–489.
- Ferrero, T. J., Debenham, N. J., Lamshead, P. J. D., 2008. The nematodes of the Thames estuary: Assemblage structure and biodiversity, with a test of Attrill's linear model. *Estuarine Coastal Shelf Science*, 79: 409–418.
- Frontalini, F., Semprucci, F., Armynot, du Châtelet, E., Francescangeli, F., Margaritelli, G., Rettori, R., Spagnoli, F., Balsamo, M., Coccioni, R., 2014. Biodiversity trends of the meiofauna and foraminifera assemblages of Lake Varano (southern Italy). *Proceedings of Biological Society of Washington*, 127: 7–22.
- Guelorget, O., Frisoni, G. F., Perthuisot, J. P., 1982. Contribution à l'étude biologique de la Bahiret el Biban, lagune du Sud–Est tunisien. *Mémoires de la Société Géologique de France*, 144: 173–186.
- Guerrini, A., Colangelo, M. A., Ceccherelli, V. U., 1998. Recolonization patterns of meiobenthic communities in brackish vegetated and unvegetated habitats after induced hypoxia/anoxia. *Hydrobiologia*, 375/376: 73–87.
- Guilini, K., Bezerra, T. N., Eisendle-Flöckner, U., Fonseca, G., Holovachov, O., Leduc, D., Miljutin, D., Mokievsky, V., Sharma, J., Smol, N., Tchesunov, A., Venekey, V., 2017. *NeMys: World Database of Free-Living Marine Nematodes*. <http://nemys.ugent.be> [Accessed on 22 February 2017].
- Heip, C., Vincx, M., Vranken, G., 1985. The ecology of marine nematodes. *Oceanography and Marine Biology: An Annual Review*, 23: 399–489, Doi: 10.1080/00785326.1986.10422004
- Hodda, M., 2011. Phylum Nematoda Cobb 1932. In: *Animal biodiversity: An outline of higher-level classification and survey of taxonomic richness* (Z.–Q. Zhang, Ed.). *Zootaxa*, 3148: 63–95.
- Jelassi, R., Khemaissia, H., Zimmer, M., Garbe-Schönberg, D., Nasri-Ammar, K., 2015. Biodiversity of Talitridae family (Crustacea, Amphipoda) in some Tunisian coastal lagoons. *Zoological Studies*, 54: 17. [Doi: 10.1186/s40555-014-0096-1](https://doi.org/10.1186/s40555-014-0096-1)
- Jouili, S., Essid, N., Semprucci, F., Boufahja, F., Nasri, A., Beyrem, H., Mahmoudi, E., 2017. Environmental quality assessment of El Bibane lagoon (Tunisia) using taxonomical and

- functional diversity of meiofauna and nematodes. *Journal of Marine Biological Association of the United Kingdom*, 97(8): 1593–1603. [Doi: 10.1017/s0025315416000990](https://doi.org/10.1017/s0025315416000990)
- Liu, X. S., 2009. Response of Meiofauna with Special Reference to Nematodes upon Recovery from Anthropogenic Activities in Subtropical Waters of Hong Kong. PhD thesis, City University of Hong Kong.
- Mirto, S., Danovaro, R., 2004. Meiofaunal colonisation on artificial substrates: a tool for biomonitoring the environmental quality on coastal marine systems. *Marine Pollution Bulletin*, 48: 919–926.
- Pallo, P., Widbom, B., Olafsson, E., 1998. A quantitative survey of the benthic meiofauna in the Gulf of Riga (Eastern Baltic Sea), with special reference to the structure of nematode assemblages. *Ophelia*, 49: 117–139.
- Pergent, G., Zaouali, J., 1992. Analyse phénologique et lépidochronologique de *Posidonia oceanica* dans une lagune hyperhaline du sud tunisien. In *Rapport de la Commission Internationale pour l'Exploration Scientifique de la Mer Méditerranée*, 33: 48–49. CIESM Ed., Monaco.
- Platt, H. M., Warwick, R. M., 1983. *Free-living marine nematodes. Part I. British Enoploids. Synopses of the British Fauna*. Cambridge University Press, Cambridge.
- 1988. *Free-living marine nematodes. Part II. British Chromadorids. Synopses of the British Fauna*. Cambridge University Press, Cambridge.
- Rabaoui, L., Balti, R., El Zrelli R., Tlig-Zouari, S., 2014. Assessment of heavy metal pollution in the gulf of Gabes (Tunisia) using four mollusc species. *Mediterranean Marine Science*, 15: 45–58.
- Sandulli, R., Semprucci, F., Balsamo, M., 2014. Taxonomic and functional biodiversity variations of meiobenthic and nematode assemblages across an extreme environment: a study case in a Blue Hole cave. *Italian Journal of Zoology*, 81: 508–516.
- Seinhorst, J. W., 1959. A rapid method for the transfer of nematodes from fixative to anhydrous glycerine. *Nematologica*, 4: 67–69.
- Semprucci, F., 2013. Marine nematodes from the shallow subtidal coast of the Adriatic Sea: species list and distribution. *International Journal of Biodiversity*, 1: 1–9.
- Semprucci F., Balsamo M., 2012. Free-living Marine Nematodes as Bioindicators: Past, Present and Future Perspectives. *Trends in Environmental Science*, 6: 17–36
- 2014. New records and distribution of marine free-living nematodes in the Maldivian Archipelago. *Proceedings of Biological Society of Washington*, 127: 35–46
- 2015. Checklist of free-living nematode species in the transitional environment of Lake Varano (Southern Italy). *Arxius de Miscel·lània Zoològica*, 13: 32–46.
- Semprucci, F., Balsamo, M., Appoloni, L., Sandulli, R., 2017. Assessment of ecological quality status along the Apulian coasts (Eastern Mediterranean Sea) based on meiobenthic and nematode assemblages. *Marine Biodiversity*, [Doi: 10.1007/s12526-017-0745-9](https://doi.org/10.1007/s12526-017-0745-9)
- Semprucci, F., Balsamo, M., Frontalini, F., 2014. The nematode assemblage of a coastal lagoon (Lake Varano, Southern Italy): ecology and biodiversity patterns. *Scientia Marina*, 78: 579–588.
- Semprucci, F., Balsamo, M., Sandulli, R., 2016. Assessment of the Ecological quality (EcoQ) of the Venice lagoon using the structure and biodiversity of the meiofaunal assemblages. *Ecological Indicators*, 67C: 451–457.
- Semprucci, F., Colantoni, P., Baldelli, G., Rocchi, M., Balsamo, M., 2010. The distribution of meiofauna on back-reef sandy platforms in the Maldives (Indian Ocean). *Marine Ecology: An evolutionary perspective*, 31: 592–607.
- Stekhoven, J. H., 1950. The free-living marine nemas of the Mediterranean. I. The Bay of Villafranche. *Mém. Inst. R. Sci. nat. Belg.* 2 Sér., 37: 1–220.
- Ürkmez, D., Sezgin, M., Ersoy-Karaçuha M., Öksüz, İ., 2016. Meiobenthic Assemblages from the Southwestern Coast of the Black Sea, Igneada (Turkey). *Biologia*, 71(9): 1017–1026. [Doi: 10.1515/biolog-2016-0129](https://doi.org/10.1515/biolog-2016-0129)

- Vanaverbeke, J., Merckx, B., Degraer, S., Vincx, M., 2011. Sediment-related distribution patterns of nematodes and macrofauna: two sides of the benthic coin? *Marine Environmental Research*, 71: 31–40.
- Villano, N., Warwick, R. M., 1995. Meiobenthic communities associated with the seasonal cycle of growth and decay of *Ulva rigida* Arardh in the Palude Della Rosa, Lagoon of Venice. *Estuarine Coastal Shelf Science*, 4: 181–194.
- Warwick, R. M., Platt, H. M., Somerfield, P. J., 1998. Free-living Marine Nematodes. Part III. British Monhysterids. *Synopses of the British Fauna (New Series)*, 53. Field Studies Council, Shrewsbury, UK.
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