



Benthic communities in three Mediterranean touristic ports: MAPMED project

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Abstract

Background

Mediterranean ports are sources of significant economic activity and at the same time they act as recipients of considerable anthropogenic disturbance and pollution. Polluted and low-in-oxygen sediments can negatively impact benthic biodiversity and favour recruitment of opportunistic or invasive species. Macro-benthic communities are an important component of the port biota and can be used as environmental quality indicators. However, a baseline database for benthic biodiversity in Mediterranean ports has not yet been widely established.

New information

Macrobenthic assemblages were recorded in three Mediterranean touristic ports under the framework of the ENPI CBC MED project MAPMED (MANagement of Port Areas in the MEDiterranean Sea Basin). Samples were collected from Cagliari (Sardinia, Italy), Heraklion (Crete, Greece) and El Kantaoui (Tunisia) ports during February, May and September 2012. The sampling stations were selected according to the different sectors within each port (i.e. leisure, fishing, passenger/cargo vessels and shipyard). A total of 277 taxa belonging to 12 phyla were found, of which the 96 taxa were present in all three ports. El Kantaoui port hosted the highest number of macrobenthic taxa. Mollusca were the most abundant group (34%) in all ports. The highest percentage of opportunistic taxa per station was found before the touristic period in the shipyard of Heraklion port (89.3%).

Keywords

macrobenthos, ports, harbours, Mediterranean, Greece, Italy, Tunisia

Introduction

Mediterranean ports are sources of significant economic activity and they strongly support local, regional and national economic development. The Mediterranean Sea hosts about 480 ports and terminals and is one of the busiest maritime areas of the world (REMPEC 2008). Shipping of goods between the main EU ports and ports located in the Mediterranean reached 598 million tonnes in 2015 (Eurostat 2015), while crude oil transported through the Mediterranean Sea was 421 million tonnes in 2006 (REMPEC 2008). Ports act as recipients of considerable anthropogenic disturbance and pollution due to the activities they are hosting, such as emission of air pollutants, noise, sediment dredging and transport, industrial installations, wastewater discharges, oil spill accidents, storage and spillage of hazardous materials and introduction of invasive species (Darbra et al. 2005). Polluted marine sediments, commonly low oxygen levels and low hydrodynamism can have a negative impact on benthic biota and marine biodiversity, which may favour recruitment by opportunistic or more resistant taxa, including invasive species. Macrobenthic communities are an important component of the port biota and have been commonly used as environmental quality indicators in biomonitoring studies (Gray and Elliot 2010). Therefore, the establishment of a baseline database for benthic biodiversity in Mediterranean ports can offer valuable background information for port management activities, including the identification of biological risks, such as pollution events or invasion by alien species (Mandal and Harkantra 2013).

General description

Purpose: This dataset includes macrobenthic taxa identified in three touristic ports in the Mediterranean, located at Cagliari (Sardinia, Italy), Heraklion (Crete, Greece) and El

Kantaoui (Tunisia) (Chatzinikolaou and Arvanitidis 2017). Sampling was undertaken seasonally during the ENPI CBC MED project MAPMED in 2012 in different sectors within each port, which were defined according to their distinct usage activities (i.e. leisure, fishing, passenger/cargo vessels and shipyard). Samples were collected during winter (February), before the touristic period (May) and after the touristic period (September) in order to identify the impact of seasonal touristic activities on benthic communities. A detailed comparison of macrobenthic biodiversity amongst different locations - sectors - seasons was performed in order to offer information about the environmental quality at these understudied artificial port environments. A total of 277 taxa belonging to 12 phyla were found, of which 96 taxa were common in all ports. Differences in benthic biodiversity were found between ports and between sectors in each port, while seasonal differences were not apparent (Chatzinikolaou et al. 2018). The El Kantaoui port hosted the highest number of macrobenthic taxa, while the shipyard sector in Heraklion port had the lowest number of taxa. The highest abundance of opportunistic taxa was found in Heraklion port at the passenger ships and shipyard stations.

Project description

Title: MAPMED: MAnagement of Port areas in the MEDiterranean sea basin

Personnel: Dr Eva Chatzinikolaou (project management, design and implementation of sampling, taxonomic identification), Dr Panagiotis Damianidis (taxonomic identification), Dr Christina Pavludi (taxonomic identification), Dr Katerina Vasileiadou (taxonomic identification), Dr Sarah Faulwetter (taxonomic identification), Kleoniki Keklikoglou (taxonomic identification), Wanda Plaiti (taxonomic identification), Dimitra Mavraki (data management), Stamatina Nikolopoulou (data management) and Dr Christos Arvanitidis (principal investigator).

Study area description: Mediterranean touristic ports: Cagliari (Sardinia, Italy), Heraklion (Crete, Greece) and El Kantaoui (Tunisia).

Design description: During this study, differences in macrobenthic assemblages were examined across three levels: a) geographical differences (three countries), b) use-sectoral differences (3-5 stations within ports) and c) temporal differences (three seasons in relation to the touristic period).

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Sampling methods

Sampling description: Five replicates of sediment samples were collected from each station using a box corer (13.5 cm × 13.5 cm × 16 cm) manually operated from a small boat. A Garmin 60 CS portable GPS and a depth meter were available on board to record the exact position and depth of each station respectively. The sediment samples were sieved through a 0.5 mm sieve and then fixed and preserved in 5% formaldehyde buffered with seawater and stained with Rose Bengal. The benthic organisms were sorted out of the sediment under a stereoscope, counted and identified down to the lowest possible taxonomic level.

Quality control: All scientific names were standardised against the World Register of Marine Species using the Taxon Match tool (<http://www.marinespecies.org/aphia.php?p=match>) on 10-03-2021.

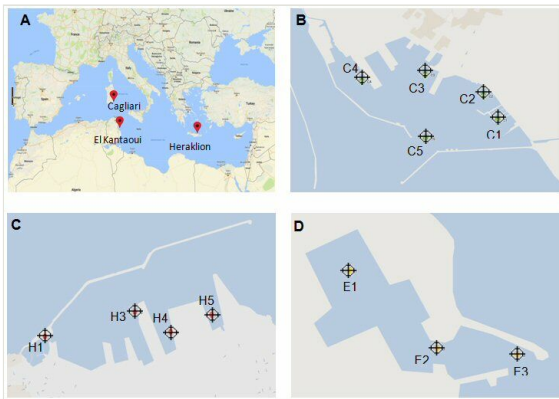


Figure 1. [doi](#)

The three Mediterranean touristic ports (A) and location of the sampling stations in Cagliari (B), Heraklion (C) and El Kantaoui (D)

Geographic coverage

Description: Three Mediterranean touristic ports were selected as study sites and they are presented in Fig. 1. The port of Cagliari (Fig. 1B) is a large port (2.07 km²) located on the southern coast of Sardinia (Italy). The port of Heraklion (Fig. 1C) is medium-sized (0.87 km²) and it is located on the northern coast of Crete (Greece). The port of El Kantaoui (Fig. 1D) is a small touristic *marina* (0.04 km²) on the eastern Tunisian coast. Both the ports of Heraklion and Cagliari host a leisure *marina*, large passenger, cruise and cargo vessels, while El Kantaoui port offers moorings only for smaller fishing boats, luxury yachts and boats for sporting activities. Heraklion port has also a shipyard section.

Sampling stations were selected in order to achieve good spatial coverage in each port and also to represent sectors with different uses according to the Water Management Units

in MAPMED Action Plans (MAPMED 2015). Four stations were selected in the port of Heraklion, five stations in the port of Cagliari and three stations in the port of El Kantaoui (Table 1).

Table 1.

Maximum depth (m), use sectors and coordinates of all sampling stations in the Mediterranean ports of Cagliari, Heraklion and El Kantaoui.

Port	Station	Depth (m)	Port sector	Coordinates
Cagliari	C1	7.8	Leisure/fishing	39°12'12.2"N; 09°07'25.1"E
	C2	4.5	Leisure/fishing	39°12'23.0"N; 09°07'16.7"E
	C3	8.3	Leisure/fishing	39°12'34.0"N; 09°06'45.9"E
	C4	13.5	Passenger/cargo ships	39°12'29.7"N; 09°06'14.8"E
	C5	11.4	Intense maritime traffic	39°12'01.7"N; 09°06'45.2"E
Heraklion	H1	3.7	Leisure/fishing	35°20'38.7"N; 25°08'12.4"E
	H3	19.5	Passenger ships	35°20'45.6"N; 25°08'43.3"E
	H4	10.5	Cargo ships	35°20'39.5"N; 25°08'55.5"E
	H5	19.0	Shipyard	35°20'42.9"N; 25°09'08.6"E
El Kantaoui	E1	2.5	Leisure/fishing	35°53'39.9"N; 10°35'52.1"E
	E2	4.0	Leisure/fishing	35°53'34.6"N; 10°35'58.9"E
	E3	3.2	Leisure/fishing	35°53'34.1"N; 10°36'05.2"E

Coordinates: 33.724 and 41.311 Latitude; 7.954 and 27.598 Longitude.

Taxonomic coverage

Description: The dataset includes information on macrobenthic assemblages found in the three Mediterranean touristic ports belonging to the following 12 phyla: Annelida, Mollusca, Arthropoda, Echinodermata, Sipuncula, Nemertea, Cnidaria, Phoronida, Chordata, Foraminifera, Platyhelminthes and Priapulida (Table 2).

Table 2.

List of taxa (phylum, class, family and species name) found in the three Mediterranean touristic ports.

Phylum	Class	Family	Species	Cagliari	Heraklion	El Kantaoui
Annelida	Polychaeta	Ampharetidae	<i>Amage adspersa</i>	x		
Annelida	Polychaeta	Amphinomidae	<i>Chloeia viridis</i>		x	

Phylum	Class	Family	Species	Cagliari	Heraklion	EI Kantaoui
Annelida	Polychaeta	Amphinomidae	<i>Eurythoe complanata</i>	x		
Annelida	Polychaeta	Capitellidae	<i>Capitella capitata</i>	x	x	x
Annelida	Polychaeta	Capitellidae	<i>Capitella giardi</i>		x	x
Annelida	Polychaeta	Capitellidae	<i>Heteromastus filiformis</i>	x	x	x
Annelida	Polychaeta	Capitellidae	<i>Notomastus latericeus</i>	x	x	x
Annelida	Polychaeta	Chaetopteridae	<i>Spiochaetopterus costarum</i>	x		x
Annelida	Polychaeta	Cirratulidae	<i>Aphelochaeta filiformis</i>	x	x	x
Annelida	Polychaeta	Cirratulidae	<i>Aphelochaeta marioni</i>	x	x	x
Annelida	Polychaeta	Cirratulidae	<i>Cirriformia tentaculata</i>	x	x	x
Annelida	Polychaeta	Cirratulidae	<i>Tharyx killariensis</i>	x	x	x
Annelida	Polychaeta	Cossuridae	<i>Cossura soyeri</i>	x	x	
Annelida	Polychaeta	Dorvilleidae	<i>Dorvillea atlantica</i>			x
Annelida	Polychaeta	Dorvilleidae	<i>Dorvillea rubrovittata</i>	x	x	
Annelida	Polychaeta	Dorvilleidae	<i>Protodorvillea kefersteini</i>		x	x
Annelida	Polychaeta	Dorvilleidae	<i>Schistomeringos rudolphi</i>	x	x	x
Annelida	Polychaeta	Eunicidae	<i>Eunice vittata</i>	x	x	x
Annelida	Polychaeta	Eunicidae	<i>Lysidice unicornis</i>		x	
Annelida	Polychaeta	Flabelligeridae	<i>Piromis eruca</i>		x	x
Annelida	Polychaeta	Glyceridae	<i>Glycera lapidum</i>	x	x	x
Annelida	Polychaeta	Glyceridae	<i>Glycera tessellata</i>	x		
Annelida	Polychaeta	Glyceridae	<i>Glycera tridactyla</i>	x	x	x
Annelida	Polychaeta	Goniadidae	<i>Goniada emerita</i>		x	
Annelida	Polychaeta	Hesionidae	<i>Psamathe fusca</i>	x	x	x

Phylum	Class	Family	Species	Cagliari	Heraklion	El Kantaoui
Annelida	Polychaeta	Lumbrineridae	<i>Hilbigneris gracilis</i>	x	x	x
Annelida	Polychaeta	Lumbrineridae	<i>Lumbrineris latreilli</i>	x	x	x
Annelida	Polychaeta	Lumbrineridae	<i>Scoletoma funchalensis</i>		x	
Annelida	Polychaeta	Magelonidae	<i>Magelona minuta</i>			x
Annelida	Polychaeta	Maldanidae	<i>Euclymene palermitana</i>	x		x
Annelida	Polychaeta	Maldanidae	<i>Praxillella affinis</i>	x	x	
Annelida	Polychaeta	Maldanidae	<i>Praxillella gracilis</i>	x	x	
Annelida	Polychaeta	Melinnidae	<i>Melinna palmata</i>	x	x	x
Annelida	Polychaeta	Nephtyidae	<i>Nephtys caeca</i>		x	x
Annelida	Polychaeta	Nephtyidae	<i>Nephtys hystricis</i>	x	x	x
Annelida	Polychaeta	Nephtyidae	<i>Nephtys incisa</i>	x		
Annelida	Polychaeta	Nereididae	<i>Neanthes acuminata</i>	x	x	x
Annelida	Polychaeta	Nereididae	<i>Nereis rava</i>			x
Annelida	Polychaeta	Nereididae	<i>Nereis zonata</i>		x	
Annelida	Polychaeta	Onuphidae	<i>Aponuphis bilineata</i>	x		x
Annelida	Polychaeta	Onuphidae	<i>Aponuphis brementi</i>		x	x
Annelida	Polychaeta	Onuphidae	<i>Diopatra neapolitana</i>	x	x	x
Annelida	Polychaeta	Opheliidae	<i>Polyopthalmus pictus</i>	x	x	x
Annelida	Polychaeta	Orbiniidae	<i>Phylo foetida</i>	x	x	x
Annelida	Polychaeta	Orbiniidae	<i>Scoloplos (Scoloplos) armiger</i>	x	x	x
Annelida	Polychaeta	Oweniidae	<i>Owenia fusiformis</i>	x	x	x
Annelida	Polychaeta	Paraonidae	<i>Aricidea (Aricidea) fragilis</i>	x	x	x
Annelida	Polychaeta	Paraonidae	<i>Levinsenia gracilis</i>	x	x	
Annelida	Polychaeta	Paraonidae	<i>Paradoneis lyra</i>	x	x	x
Annelida	Polychaeta	Pectinariidae	<i>Lagis koreni</i>	x	x	x

Phylum	Class	Family	Species	Cagliari	Heraklion	El Kantaoui
Annelida	Polychaeta	Phyllodocidae	<i>Eteone longa</i>			x
Annelida	Polychaeta	Phyllodocidae	<i>Mysta picta</i>		x	
Annelida	Polychaeta	Phyllodocidae	<i>Phyllodoce</i> sp.	x		
Annelida	Polychaeta	Pilargidae	<i>Ancistrosyllis groenlandica</i>	x		
Annelida	Polychaeta	Poecilochaetidae	<i>Poecilochaetus serpens</i>		x	x
Annelida	Polychaeta	Polynoidea	<i>Harmothoe impar</i>	x	x	
Annelida	Polychaeta	Polynoidea	<i>Harmothoe spinifera</i>		x	x
Annelida	Polychaeta	Sabellidae	<i>Amphiglana mediterranea</i>	x		
Annelida	Polychaeta	Sabellidae	<i>Dialychone dunerificta</i>			x
Annelida	Polychaeta	Sabellidae	<i>Pseudopotamilla reniformis</i>	x	x	x
Annelida	Polychaeta	Scalibregmatidae	<i>Polyphysia crassa</i>			x
Annelida	Polychaeta	Serpulidae	<i>Serpula vermicularis</i>	x	x	x
Annelida	Polychaeta	Spionidae	<i>Polydora ciliata</i>			x
Annelida	Polychaeta	Spionidae	<i>Prionospio cirrifera</i>	x		x
Annelida	Polychaeta	Spionidae	<i>Prionospio malmgreni</i>	x	x	x
Annelida	Polychaeta	Spionidae	<i>Spio filicornis</i>	x	x	x
Annelida	Polychaeta	Sternaspidae	<i>Sternaspis scutata</i>	x	x	x
Annelida	Polychaeta	Syllidae	<i>Exogone</i> sp.	x		
Annelida	Polychaeta	Syllidae	<i>Sphaerosyllis hystrix</i>	x	x	x
Annelida	Polychaeta	Syllidae	<i>Syllis armillaris</i>	x	x	x
Annelida	Polychaeta	Syllidae	<i>Syllis garciai</i>			x
Annelida	Polychaeta	Syllidae	<i>Syllis hyalina</i>	x	x	x
Annelida	Polychaeta	Syllidae	<i>Syllis prolifera</i>	x	x	x

Phylum	Class	Family	Species	Cagliari	Heraklion	El Kantaoui
Annelida	Polychaeta	Terebellidae	<i>Lanice conchilega</i>	x		x
Annelida	Polychaeta	Terebellidae	<i>Pista cristata</i>	x	x	x
Annelida	Polychaeta	Trichobranchidae	<i>Terebellides stroemii</i>	x		
Annelida	Polychaeta		Echiura ind.	x	x	x
Annelida	Clitellata		Oligochaeta ind.	x	x	x
Arthropoda	Arachnida	Pontarachnidae	<i>Pontarachna punctulum</i>	x		
Arthropoda	Insecta		Insecta ind.	x	x	x
Arthropoda	Malacostraca	Ampeliscidae	<i>Ampelisca diadema</i>	x		
Arthropoda	Malacostraca	Ampeliscidae	<i>Ampelisca ledoyeri</i>	x		
Arthropoda	Malacostraca	Amphilochidae	<i>Apolochus neapolitanus</i>			x
Arthropoda	Malacostraca	Anthuridae	Anthuridae ind.	x	x	x
Arthropoda	Malacostraca	Anthuridae	<i>Cyathura carinata</i>			x
Arthropoda	Malacostraca	Aoridae	<i>Aora</i> sp.	x		
Arthropoda	Malacostraca	Aoridae	<i>Aora gracilis</i>	x	x	
Arthropoda	Malacostraca	Aoridae	<i>Aora spinicornis</i>		x	x
Arthropoda	Malacostraca	Aoridae	Aoridae ind.	x	x	x
Arthropoda	Malacostraca	Aoridae	<i>Autonoe spiniventris</i>	x		x
Arthropoda	Malacostraca	Aoridae	<i>Lembos websteri</i>	x	x	
Arthropoda	Malacostraca	Aoridae	<i>Microdeutopus</i> sp.	x		x
Arthropoda	Malacostraca	Aoridae	<i>Microdeutopus anomalus</i>		x	x
Arthropoda	Malacostraca	Aoridae	<i>Microdeutopus stationis</i>		x	
Arthropoda	Malacostraca	Aoridae	<i>Microdeutopus versiculatus</i>	x		
Arthropoda	Malacostraca	Apseudidae	<i>Apseudopsis mediterraneus</i>	x	x	x
Arthropoda	Malacostraca	Atylidae	<i>Nototropis guttatus</i>		x	

Phylum	Class	Family	Species	Cagliari	Heraklion	El Kantaoui
Arthropoda	Malacostraca	Bodotriidae	<i>Bodotria scorioides</i>	x		x
Arthropoda	Malacostraca	Bodotriidae	<i>Iphinoe serrata</i>	x	x	x
Arthropoda	Malacostraca	Bodotriidae	<i>Iphinoe tenella</i>	x		x
Arthropoda	Malacostraca	Bodotriidae	<i>Iphinoe trispinosa</i>	x	x	x
Arthropoda	Malacostraca	Bodotriidae	<i>Vaunthompsonia cristata</i>		x	x
Arthropoda	Malacostraca	Calliopiidae	<i>Apherusa mediterranea</i>		x	
Arthropoda	Malacostraca	Caprellidae	<i>Liropus elongatus</i>		x	
Arthropoda	Malacostraca	Caprellidae	<i>Phtisica marina</i>	x	x	x
Arthropoda	Malacostraca	Caprellidae	<i>Pseudolirius kroyeri</i>	x	x	x
Arthropoda	Malacostraca	Corophiidae	<i>Apocorophium acutum</i>	x	x	x
Arthropoda	Malacostraca	Corophiidae	<i>Leptocheirus</i> sp.		x	
Arthropoda	Malacostraca	Corophiidae	<i>Medicorophium minimum</i>	x		
Arthropoda	Malacostraca	Corophiidae	<i>Medicorophium runcicome</i>	x	x	x
Arthropoda	Malacostraca	Dexaminidae	<i>Dexamine spinosa</i>		x	x
Arthropoda	Malacostraca	Diastylidae	<i>Diastylis rugosa</i>		x	
Arthropoda	Malacostraca	Gammaridae	Gammaridae ind.	x	x	x
Arthropoda	Malacostraca	Gnathiidae	<i>Gnathia</i> sp.	x	x	x
Arthropoda	Malacostraca	Holognathidae	<i>Cleantis prismatica</i>		x	x
Arthropoda	Malacostraca	Hyalidae	<i>Apohyale perieri</i>	x		
Arthropoda	Malacostraca	Hyalidae	<i>Parhyale aquilina</i>	x		
Arthropoda	Malacostraca	Idoteidae	<i>Idotea</i> sp.		x	x
Arthropoda	Malacostraca	Ischyroceridae	<i>Ericthonius punctatus</i>		x	x
Arthropoda	Malacostraca	Ischyroceridae	<i>Jassa marmorata</i>	x	x	
Arthropoda	Malacostraca	Leptocheliidae	<i>Chondrochelia savignyi</i>	x	x	x

Phylum	Class	Family	Species	Cagliari	Heraklion	El Kantaoui
Arthropoda	Malacostraca	Leucothoidae	<i>Leucothoe incisa</i>	x	x	x
Arthropoda	Malacostraca	Maeridae	<i>Elasmopus rapax</i>	x	x	x
Arthropoda	Malacostraca	Maeridae	<i>Maera grossimana</i>	x	x	x
Arthropoda	Malacostraca	Melitidae	<i>Melita hergensis</i>	x	x	x
Arthropoda	Malacostraca	Microtopodidae	<i>Microtopodus maculatus</i>			x
Arthropoda	Malacostraca	Nannastacidae	<i>Cumella (Cumella) pygmaea</i>	x	x	x
Arthropoda	Malacostraca	Nannastacidae	<i>Nannastacus</i> sp.			x
Arthropoda	Malacostraca	Nuuanuidae	<i>Gammarella fucicola</i>		x	x
Arthropoda	Malacostraca	Oedicerotidae	<i>Kroyera carinata</i>	x		
Arthropoda	Malacostraca	Oedicerotidae	<i>Pericolodes longimanus</i>	x	x	x
Arthropoda	Malacostraca	Oedicerotidae	<i>Pontocrates arenarius</i>		x	
Arthropoda	Malacostraca	Oedicerotidae	<i>Synchelidium haplocheles</i>	x		x
Arthropoda	Malacostraca	Oedicerotidae	<i>Synchelidium maculatum</i>	x	x	
Arthropoda	Malacostraca	Paranthuridae	<i>Paranthura japonica</i>			x
Arthropoda	Malacostraca	Photidae	<i>Cerapopsis longipes</i>	x		
Arthropoda	Malacostraca	Sphaeromatidae	<i>Dynamene bidentata</i>		x	x
Arthropoda	Malacostraca	Sphaeromatidae	<i>Sphaeroma</i> sp.	x		
Arthropoda	Malacostraca	Stenothoidae	<i>Stenothoe elachista</i>			x
Arthropoda	Malacostraca	Tanaididae	<i>Tanais dulongii</i>	x	x	x
Arthropoda	Malacostraca		Amphipoda ind.	x	x	x
Arthropoda	Malacostraca		Isopoda ind.	x	x	x
Arthropoda	Malacostraca		Tanaidacea ind.		x	
Arthropoda	Pycnogonida		Pycnogonida ind. 1		x	

Phylum	Class	Family	Species	Cagliari	Heraklion	EI Kantaoui
Arthropoda	Pycnogonida		Pycnogonida ind.2		x	
Chordata	Asciacea		Asciacea ind.			x
Chordata	Asciacea	Styelidae	<i>Botryllus</i> sp.			x
Chordata			Pisces ind.	x		
Cnidaria	Anthozoa		Anthozoa ind.	x	x	x
Cnidaria	Hydrozoa		Hydrozoa ind.		x	x
Echinodermata	Asteroidea		Asteroidea ind.	x		x
Echinodermata	Holothuroidea	Cucumariidae	<i>Trachythyone</i> sp.	x		
Echinodermata	Holothuroidea		Holothuroidea ind.1	x	x	
Echinodermata	Holothuroidea		Holothuroidea ind.2			x
Echinodermata	Ophiuroidea	Amphiuridae	<i>Amphiura chiajei</i>	x	x	x
Echinodermata	Ophiuroidea	Ophiodermatidae	<i>Ophioderma longicaudum</i>	x	x	x
Echinodermata	Ophiuroidea		Ophiuroidea ind.1	x	x	x
Echinodermata	Ophiuroidea		Ophiuroidea ind.2	x	x	x
Echinodermata	Ophiuroidea		Ophiuroidea ind.3	x		
Foraminifera			Foraminifera ind.	x		x
Mollusca	Bivalvia	Arcidae	<i>Arca tetragona</i>	x		x
Mollusca	Bivalvia	Cardiidae	<i>Cerastoderma glaucum</i>		x	x
Mollusca	Bivalvia	Cardiidae	<i>Papillicardium minimum</i>	x	x	x
Mollusca	Bivalvia	Cardiidae	<i>Papillicardium papillosum</i>	x		x
Mollusca	Bivalvia	Cardiidae	<i>Parvicardium exiguum</i>	x	x	x
Mollusca	Bivalvia	Corbulidae	<i>Varicorbula gibba</i>	x	x	
Mollusca	Bivalvia	Lasaeidae	<i>Kurtiella bidentata</i>	x	x	x
Mollusca	Bivalvia	Lasaeidae	<i>Litigiella glabra</i>	x	x	x
Mollusca	Bivalvia	Lucinidae	<i>Ctena decussata</i>	x	x	x
Mollusca	Bivalvia	Lucinidae	<i>Loripes orbiculatus</i>	x	x	x

Phylum	Class	Family	Species	Cagliari	Heraklion	El Kantaoui
Mollusca	Bivalvia	Lucinidae	<i>Loripinus fragilis</i>		x	
Mollusca	Bivalvia	Lucinidae	<i>Lucinella divaricata</i>	x	x	x
Mollusca	Bivalvia	Lucinidae	<i>Myrtea spinifera</i>	x	x	x
Mollusca	Bivalvia	Mytilidae	<i>Modiolus adriaticus</i>	x	x	x
Mollusca	Bivalvia	Mytilidae	<i>Modiolus barbatus</i>	x		x
Mollusca	Bivalvia	Mytilidae	<i>Musculus subpictus</i>	x	x	x
Mollusca	Bivalvia	Mytilidae	<i>Mytilus edulis</i>	x		
Mollusca	Bivalvia	Nuculanidae	<i>Lembulus pella</i>	x	x	x
Mollusca	Bivalvia	Nuculidae	<i>Nucula nitidosa</i>	x	x	
Mollusca	Bivalvia	Pharidae	<i>Pharus legumen</i>			x
Mollusca	Bivalvia	Semelidae	<i>Abra alba</i>	x	x	x
Mollusca	Bivalvia	Semelidae	<i>Abra prismatica</i>	x		
Mollusca	Bivalvia	Solemyidae	<i>Solemya togata</i>			x
Mollusca	Bivalvia	Tellinidae	<i>Asbjornsenia pygmaea</i>			x
Mollusca	Bivalvia	Tellinidae	<i>Gastrana fragilis</i>			x
Mollusca	Bivalvia	Tellinidae	<i>Macomopsis cumana</i>			x
Mollusca	Bivalvia	Tellinidae	<i>Moerella donacina</i>	x	x	x
Mollusca	Bivalvia	Tellinidae	<i>Peronidia albicans</i>	x	x	x
Mollusca	Bivalvia	Thraciidae	<i>Thracia phaseolina</i>	x		
Mollusca	Bivalvia	Veneridae	<i>Chamelea gallina</i>		x	x
Mollusca	Bivalvia	Veneridae	<i>Dosinia lupinus</i>	x	x	x
Mollusca	Bivalvia	Veneridae	<i>Gouldia minima</i>	x	x	x
Mollusca	Bivalvia	Veneridae	<i>Pitar rudis</i>	x		
Mollusca	Bivalvia	Veneridae	<i>Ruditapes decussatus</i>	x		x
Mollusca	Bivalvia	Veneridae	<i>Venerupis lucens</i>	x	x	x
Mollusca	Gastropoda	Bullidae	<i>Bulla striata</i>	x		x
Mollusca	Gastropoda	Caecidae	<i>Caecum subannulatum</i>		x	x

Phylum	Class	Family	Species	Cagliari	Heraklion	El Kantaoui
Mollusca	Gastropoda	Cerithiidae	<i>Bittium latreillii</i>	x	x	x
Mollusca	Gastropoda	Cerithiidae	<i>Bittium reticulatum</i>		x	x
Mollusca	Gastropoda	Cerithiidae	<i>Cerithium protractum</i>			x
Mollusca	Gastropoda	Cerithiidae	<i>Cerithium scabridum</i>			x
Mollusca	Gastropoda	Cerithiidae	<i>Cerithium vulgatum</i>			x
Mollusca	Gastropoda	Cerithiopsidae	<i>Cerithiopsis minima</i>			x
Mollusca	Gastropoda	Conidae	<i>Conus ventricosus</i>	x		
Mollusca	Gastropoda	Epitoniidae	<i>Epitonium clathrus</i>			x
Mollusca	Gastropoda	Eulimidae	<i>Eulima bilineata</i>	x		
Mollusca	Gastropoda	Eulimidae	<i>Parvioris ibizenca</i>			x
Mollusca	Gastropoda	Granulinidae	<i>Granulina marginata</i>	x		x
Mollusca	Gastropoda	Mangeliidae	<i>Mangelia paciniana</i>			x
Mollusca	Gastropoda	Mangeliidae	<i>Sorgenfreispira brachystoma</i>		x	x
Mollusca	Gastropoda	Muricidae	<i>Hexaplex trunculus</i>	x	x	x
Mollusca	Gastropoda	Muricidae	<i>Nucella lapillus</i>			x
Mollusca	Gastropoda	Nassariidae	<i>Tritia corniculum</i>	x		x
Mollusca	Gastropoda	Nassariidae	<i>Tritia reticulata</i>	x	x	x
Mollusca	Gastropoda	Nassariidae	<i>Tritia varicosa</i>	x	x	x
Mollusca	Gastropoda	Naticidae	<i>Neverita josephinia</i>		x	x
Mollusca	Gastropoda	Neritidae	<i>Smaragdia viridis</i>			x
Mollusca	Gastropoda	Omalogyridae	<i>Ammonicera rota</i>	x		x
Mollusca	Gastropoda	Phasianellidae	<i>Tricolia pullus</i>			x
Mollusca	Gastropoda	Phasianellidae	<i>Tricolia speciosa</i>	x		x
Mollusca	Gastropoda	Phasianellidae	<i>Tricolia tenuis</i>	x		x
Mollusca	Gastropoda	Pyramidellidae	<i>Chrysallida indistincta</i>		x	x
Mollusca	Gastropoda	Pyramidellidae	<i>Eulimella acicula</i>		x	

Phylum	Class	Family	Species	Cagliari	Heraklion	EI Kantaoui
Mollusca	Gastropoda	Pyramidellidae	<i>Megastomia conoidea</i>	x	x	x
Mollusca	Gastropoda	Pyramidellidae	<i>Odostomia unidentata</i>		x	
Mollusca	Gastropoda	Pyramidellidae	<i>Ondina diaphana</i>	x	x	x
Mollusca	Gastropoda	Pyramidellidae	<i>Parthenina terebellum</i>		x	x
Mollusca	Gastropoda	Pyramidellidae	<i>Pyrgiscus rufus</i>			x
Mollusca	Gastropoda	Pyramidellidae	<i>Turbonilla gradata</i>		x	x
Mollusca	Gastropoda	Pyramidellidae	<i>Turbonilla micans</i>			x
Mollusca	Gastropoda	Pyramidellidae	<i>Turbonilla multilirata</i>			x
Mollusca	Gastropoda	Pyramidellidae	<i>Turbonilla pumila</i>			x
Mollusca	Gastropoda	Raphitomidae	<i>Raphitoma philberti</i>		x	x
Mollusca	Gastropoda	Retusidae	<i>Retusa truncatula</i>		x	x
Mollusca	Gastropoda	Retusidae	<i>Retusa umbilicata</i>			x
Mollusca	Gastropoda	Rissoidae	<i>Alvania algeriana</i>			x
Mollusca	Gastropoda	Rissoidae	<i>Alvania cimex</i>	x	x	x
Mollusca	Gastropoda	Rissoidae	<i>Alvania discors</i>			x
Mollusca	Gastropoda	Rissoidae	<i>Alvania mamillata</i>	x	x	x
Mollusca	Gastropoda	Rissoidae	<i>Manzonina crassa</i>		x	
Mollusca	Gastropoda	Rissoidae	<i>Pusillina marginata</i>	x		x
Mollusca	Gastropoda	Rissoidae	<i>Pusillina radiata</i>	x	x	x
Mollusca	Gastropoda	Rissoidae	<i>Rissoa aartseni</i>			x
Mollusca	Gastropoda	Rissoidae	<i>Rissoa splendida</i>		x	x
Mollusca	Gastropoda	Skeneidae	<i>Skenea serpuloides</i>			x
Mollusca	Gastropoda	Trochidae	<i>Gibbula ardens</i>	x		x
Mollusca	Gastropoda	Trochidae	<i>Gibbula magus</i>	x		
Mollusca	Gastropoda	Trochidae	<i>Jujubinus gravinae</i>	x		
Mollusca	Gastropoda	Trochidae	<i>Jujubinus karpathoensis</i>		x	
Mollusca	Gastropoda	Trochidae	<i>Jujubinus montagui</i>	x		

Phylum	Class	Family	Species	Cagliari	Heraklion	El Kantaoui
Mollusca	Gastropoda	Trochidae	<i>Jujubinus striatus</i>	x		x
Mollusca	Gastropoda	Trochidae	<i>Jujubinus unidentatus</i>			x
Mollusca	Gastropoda	Trochidae	<i>Steromphala adansonii</i>			x
Mollusca	Gastropoda	Trochidae	<i>Steromphala varia</i>		x	x
Mollusca	Scaphopoda	Dentaliidae	<i>Antalis dentalis</i>	x	x	
Mollusca	Scaphopoda	Fustiariidae	<i>Fustiaria rubescens</i>			x
Nemertea	Hoplonemertea	Amphiporidae	<i>Amphiporus</i> sp.		x	x
Nemertea	Hoplonemertea	Carcinonemertidae	<i>Carcinonemertes carcinophila</i>			x
Nemertea	Hoplonemertea	Drepanophoridae	<i>Drepanophorus</i> sp.			x
Nemertea	Hoplonemertea	Oerstediidae	<i>Oerstedia dorsalis</i>			x
Nemertea	Hoplonemertea	Ototyphlonemertidae	<i>Ototyphlonemertes duplex</i>			x
Nemertea	Hoplonemertea	Prosorhochmidae	<i>Prosorhochmus</i> sp.	x	x	
Nemertea	Hoplonemertea	Tetrastemmatidae	<i>Tetrastemma</i> sp.			x
Nemertea	Palaeonemertea	Cephalotrichidae	<i>Cephalotrix</i> sp.		x	
Nemertea	Pilidiophora	Lineidae	<i>Micrura</i> sp.	x	x	
Nemertea			Nemertea ind.1	x	x	
Nemertea			Nemertea ind.2	x	x	x
Nemertea			Nemertea ind.3			x
Nemertea			Nemertea ind.4	x	x	x
Phoronida			Phoronida ind.	x		x
Platyhelminthes	Turbellaria		Turbellaria ind.			x
Priapulida			Priapulida ind.	x		
Sipuncula	Phascolosomatidea	Phascolosomatidae	<i>Phascolosoma</i> sp.	x	x	x
Sipuncula	Sipunculidea	Sipunculidae	<i>Sipunculus</i> (<i>Sipunculus</i>) <i>nudus</i>			x
Sipuncula			Sipuncula ind.1	x	x	x
Sipuncula			Sipuncula ind.2			x

Phylum	Class	Family	Species	Cagliari	Heraklion	El Kantaoui
Sipuncula			Sipuncula ind.3	x	x	x

A total of 46,187 individuals were identified down to the lowest possible taxonomic level, from which 15,535 were found in Cagliari port, 11,571 in Heraklion port and 19,081 in El Kantaoui port. A total of 277 macrofaunal taxa were identified in the three ports, from which 32 were present exclusively in Cagliari port, 22 were found only in Heraklion port and 53 were found only in El Kantaoui port. A total of 96 taxa were common between all three Mediterranean ports (Fig. 2). The highest number of taxa in total was found in El Kantaoui port (206), while Cagliari and Heraklion ports had 170 and 165 taxa in total, respectively.

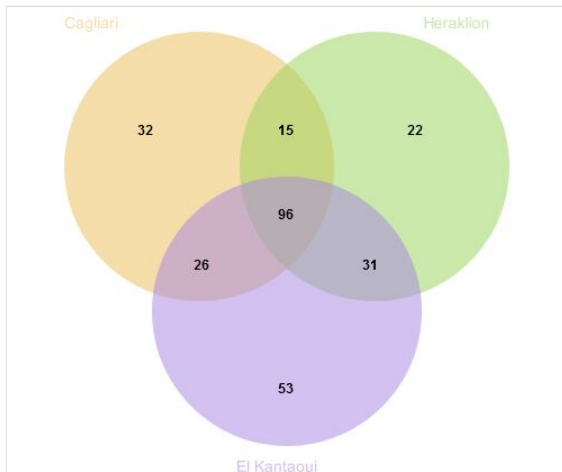


Figure 2. [doi](#)

Chart showing number of common and unique taxa in the three Mediterranean ports (Cagliari, Heraklion and El Kantaoui).

Mollusca were the most abundant group (34.7%), Annelida (28.2%) and Arthropoda (24.2%) were also highly represented, while each of the remaining groups contributed less than 5% in the benthic assemblages studied (Fig. 3).

The percentage of opportunistic taxa abundances (i.e. short-lived taxa often characterising disturbed or stressed habitats) was calculated for each station as the percentage of abundances for Capitellidae, Cirratulidae, Spionidae and Oligochaeta taxa (Pearson and Rosenberg 1978, Munari et al. 2005) in the total sample (Fig. 4). The highest percentages (> 50%) of opportunistic taxa abundances were found in Heraklion port at stations H3 (passenger ships) during all seasons and at H5 (shipyard station) in winter and especially before summer. Additionally, in El Kantaoui station E1 (leisure boats), the percentage of opportunistic taxa abundance increased before summer. The percentage of opportunists in Cagliari was generally lower than in the other ports.

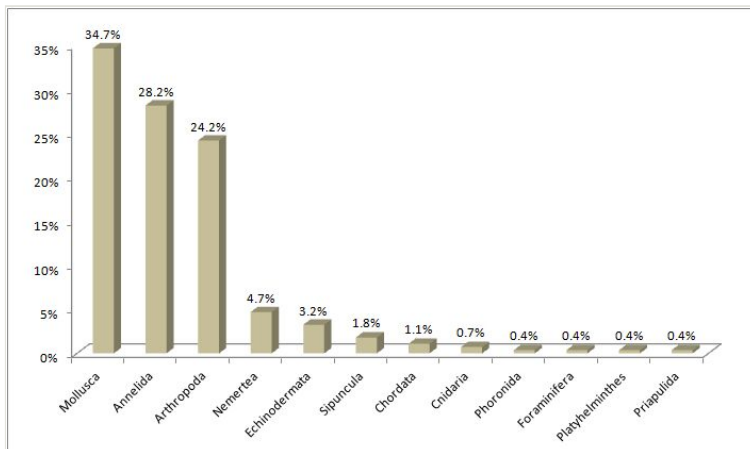


Figure 3. [doi](#)

Distribution of the different phyla found in the three Mediterranean ports (Cagliari, Heraklion and El Kantaoui).

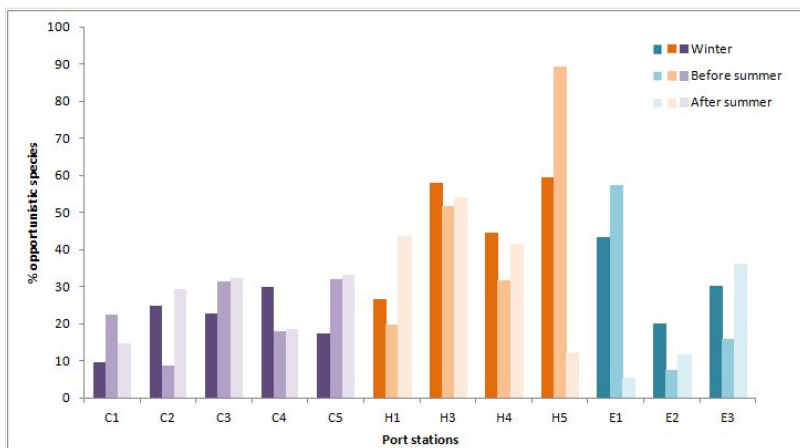


Figure 4. [doi](#)

Percentage (%) of opportunistic taxa abundances in the different stations of Cagliari port (purple: C1, C2, C3, C4 and C5), Heraklion port (orange: H1, H3, H4 and H5) and El Kantaoui (blue: E1, E2 and E3) during the three different sampling seasons (dark colours: winter, medium colours: before summer, light colours: after summer).

Additional statistical analysis has been applied to the species composition matrices of the specific dataset by Chatzinikolaou et al. (2018) and Dimitriou et al. (2020) in order to explore the multivariate patterns of benthic assemblages and to calculate benthic diversity and biotic indices for the assessment of the ecological status of the habitats. A detailed comparison of macrobenthic biodiversity amongst the different locations - sectors - seasons indicated significant differences between ports and between sectors in each port, while seasonal differences were not apparent (Chatzinikolaou et al. 2018).

Temporal coverage

Data range: 2012-2-13 - 2012-9-25.

Notes: Three seasonal sampling campaigns were carried out during 2012: one in winter (February), one in spring before the beginning of the touristic season (May) and one in late summer after the touristic season (September).

Collection data

Collection name: Benthic communities and environmental parameters in three Mediterranean ports (Sardinia, Crete and Tunisia).

Specimen preservation method: 5% formaldehyde buffered with seawater.

Curatorial unit: Hellenic Centre for Marine Research (HCMR), Institute of Marine Biology, Biotechnology and Aquaculture (IMBBC), Heraklion, Crete, Greece.

Usage licence

Usage licence: Open Data Commons Attribution License

IP rights notes: This work is licensed under a [Creative Commons Attribution \(CC-BY\) 4.0 License](https://creativecommons.org/licenses/by/4.0/). All data in the database can be freely used provided it is fully cited even if only partially used.

Data resources

Data package title: Benthic communities and environmental parameters in three Mediterranean ports (Sardinia, Crete and Tunisia).

Resource link: <https://www.gbif.org/dataset/9b11f305-fb7a-4a65-826e-7fb97af06e5f>

Alternative identifiers: http://ipt.medobis.eu/resource?r=mapmed_ports

Number of data sets: 1

Data set name: Benthic communities and environmental parameters in three Mediterranean ports (Sardinia, Crete and Tunisia).

Character set: UTF-8

Download URL: http://ipt.medobis.eu/resource?r=mapmed_ports

Data format: Darwin Core Archive.

Description: The dataset is available via the [MedOBIS \(Mediterranean node of Ocean Biodiversity Information System\)](https://www.medobis.eu/), [Integrated Publishing Toolkit \(IPT\)](https://ipt.seis.uoi.gr/) which has been

established through the [LifeWatchGreece](#) Research Infrastructure and is hosted in the Institute of Marine Biology, Biotechnology and Aquaculture (IMBBC) of the Hellenic Centre for Marine Research (HCMR). The data are also harvested by and made available through the Ocean Biodiversity Information System ([OBIS](#)). The dataset is available as a DarwinCoreArchive and all fields are mapped to [DarwinCore terms](#).

This publication refers to the most recent version of the dataset available through the IPT server or MedOBIS. Future changes to the dataset due to quality control activities might change its content or structure.

The current publication refers to the "occurrence" source file (txt file) that is associated with the particular dataset. Additional details about the sampling events can be found in the "event" source file (txt file) associated with the same dataset.

Column label	Column description
id	A unique identifier for the record within the dataset or collection, auto-incrementing number automatically added by the system (same with eventID).
eventID	An identifier for the set of information associated with an Event (something that occurs at a place and time).
samplingProtocol	The description of the method or protocol used for sample collection.
eventDate	The date-time or interval during which an Event occurred.
year	The four-digit year in which the Event occurred, according to the Common Era Calendar.
month	The integer month in which the Event occurred.
day	The integer day of the month on which the Event occurred.
eventRemarks	Comments or notes about the Event.
locationID	An identifier for the set of location information (station name).
locality	The specific description of the place.
minimumDepthInMetres	The lesser depth of a range of depth below the local surface, in metres.
maximumDepthInMetres	The greater depth of a range of depth below the local surface, in metres.
decimalLatitude	The geographic latitude (in decimal degrees, using the spatial reference system given in geodeticDatum) of the geographic centre of a Location. Positive values are north of the Equator, negative values are south of it. Legal values lie between -90 and 90, inclusive.
decimalLongitude	The geographic longitude (in decimal degrees, using the spatial reference system given in geodeticDatum) of the geographic centre of a Location. Positive values are east of the Greenwich Meridian, negative values are west of it. Legal values lie between -180 and 180, inclusive.

geodeticDatum	The ellipsoid, geodetic datum or spatial reference system (SRS) upon which the geographic coordinates given in decimalLatitude and decimalLongitude are based.
coordinateUncertaintyInMetres	The horizontal distance (in metres) from the given decimalLatitude and decimalLongitude describing the smallest circle containing the whole of the Location.
georeferenceProtocol	A description or reference to the methods used to determine the spatial footprint, coordinates and uncertainties.
institutionCode	The name (or acronym) in use by the institution having custody of the object (s) or information referred to in the record.
collectionCode	An identifier for the collection or dataset from which the record was derived.
basisOfRecord	The specific nature of the data record.
occurrenceID	An identifier for the Occurrence (as opposed to a particular digital record of the occurrence).
catalogNumber	An identifier (preferably unique) for the record within the dataset or collection.
individualCount	The number of individuals represented present at the time of the Occurrence.
occurrenceStatus	A statement about the presence or absence of a Taxon at a Location.
scientificNameID	An identifier for the nomenclatural (not taxonomic) details of a scientific name (Isid of WORMS).
scientificName	The full scientific name, not including authorship.
kingdom	The full scientific name of the kingdom in which the taxon is classified.
phylum	The full scientific name of the phylum in which the taxon is classified.
class	The full scientific name of the class in which the taxon is classified.
order	The full scientific name of the order in which the taxon is classified.
family	The full scientific name of the family in which the taxon is classified.
genus	The full scientific name of the genus in which the taxon is classified.
specificEpithet	The species epithet of the scientificName.
scientificNameAuthorship	The authorship information for the scientificName formatted according to the conventions of the applicable nomenclaturalCode.
nomenclaturalCode	The nomenclatural code (or codes in the case of an ambiregnal name) under which the scientificName is constructed.
taxonRemarks	Comments or notes about the taxon or name in the original dataset file.

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Author contributions

Dr Eva Chatzinikolaou (writing of manuscript, project management, design and implementation of sampling, taxonomic identification), Dr Panagiotis Damianidis (taxonomic identification), Dr Christina Pavlodi (taxonomic identification), Dr Katerina Vasileiadou (taxonomic identification), Dr Sarah Faulwetter (taxonomic identification), Kleoniki Keklikoglou (taxonomic identification), Wanda Plaiti (taxonomic identification), Dimitra Mavraki (data management), Stamatina Nikolopoulou (data management) and Dr Christos Arvanitidis (principal investigator).

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