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RESEARCH ARTICLE

Micro- and mesoplastics in the surface waters of the Finike (Anaximander) Seamounts in the eastern Mediterranean

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Abstract

Micro- (< 5mm) and mesoplastic (5- 25mm) pollution is reported for the surface waters of the Finike (Anaximander) Seamounts, which is a high sea marine protected area in the eastern Mediterranean Sea. Samples were collected from surface waters with plankton nets during two research cruises in May and September 2021. Plastics were physically and chemically characterized using optical microscopy and FT-IR. Microplastics were the most common size range, comprising 79% and 68% of the total plastic particles collected in May and September, respectively. Microplastic concentrations varied from $0.78x10^4$ to $73.9x10^4$ par.km^{-2} (mean $19.2x10^4 \pm 26.7x10^4$ par.km^{-2}) and $0.13x10^4$ to $60.9x10^4$ par.km^{-2} (mean $13.0x10^4 \pm 26.7x10^4$ par.km^{-2}) in May and September, respectively. In both cruises, microplastics were mostly fragments in shape, transparent in colour and 2-5mm in size. Regarding mesoplastics, their concentrations ranged from $0.13x10^4$ to $16.7x10^4$ par.km^{-2} (mean $5.19x10^4 \pm 6.38x10^4$ par.km^{-2}) and $0.13x10^4$ to $28.7x10^4$ par.km^{-2} (mean $6.09x10^4 \pm 12.6x10^4$ par.km^{-2}) in May and September, respectively. Mesoplastics were mainly films in shape and transparent in colour. FT-IR analysis revealed that the most abundant polymers were low-density polymers polyethylene (69%), followed by polypropylene (18%). Results show that plastics are ubiquitous in the Finike Seamounts area. This is a cause for concern regarding the health of the ecosystem in this marine protected area and highlights the urgent need to develop solutions for the problem of plastic pollution in the Mediterranean Sea. Data provided by the present study serve as a baseline for future environmental assessments in the region and supports the implementation of directives and strategies for long-term conservation and reduction of plastic pollution in the marine environment.

Keywords: Microplastic, mesoplastic, pollution, MSFD, Mediterranean Sea, Finike Seamounts (Anaximander)

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Introduction

Plastics are recognized as one of the fastest growing threats to our oceans, with serious ecological and socio-economic effects (UNEP 2021). Plastic particles can enter the marine environment in a variety of forms, sizes, colours and chemical content. Large plastic items that reach the ocean fragment over time into meso- (5-25mm) and microplastics (<5mm). These smaller particles float at the surface and water column reaching vast distances from their original sources and eventually sink and deposit on the sea floor. Plastics in these small size ranges can also enter the marine environment directly, such as small fibres released during the laundering of synthetic textiles, microbeads (e.g., used in cosmetics and cleaning agents), industrial pellets, and atmospheric deposition of the small particles released from tyre abrasion (Boucher and Friot 2017). Plastics in the marine environment have an effect from the surface to the seafloor. Plastics can alter the optical and physiochemical properties of sea water (VishnuRadhan *et al.* 2019), and physically and chemically affect marine biota in multiple ways, such as by entanglement or ingestion (Wright *et al.* 2013).

The smaller plastics are of concern, not only because they are more difficult to remove from the marine environment by clean-up efforts, but also because they are easily ingested by marine life (Wright *et al.* 2013) and subsequently enter the marine food chain (Costa *et al.* 2020). Ingestion of small plastics by a variety of organisms from lower to higher trophic levels, such as plankton (Bottorell *et al.* 2020; Aytan *et al.* 2022), invertebrates and fish (Wright *et al.* 2013) and mammals (Zantis *et al.* 2021) have been reported. Plastics also contain toxic chemical additives such as antioxidants, pigments and colorants, and adsorb hydrophobic contaminants from the surroundings including polychlorinated biphenyls (PCBs) and heavy metals (Koelmans 2015). Plastic ingestion by biota can cause bioaccumulation of these chemicals throughout the food chain and eventually transfer into human diets (Zarfl and Matthies 2010). Due to the increasing trend in plastic production and significant impacts of marine plastics on biota, human health, climate and economy, there is an urgent call to understand plastics flux and fate in the marine environment.

The Mediterranean Sea is considered one of the most affected environments by plastic pollution in the world (Cózar *et al.* 2015). This is because of several factors, in particular, due to its semi-enclosed configuration, which makes it prone to plastic accumulation, and the high population densities ranging from 100 million near the coast to nearly half a billion when including hydrological basins (Cózar *et al.* 2015; Boucher and Bilard 2020). Poor waste management practices, intense marine traffic, heavy fishing and coastal regions dedicated to tourism also highly contribute to the problem of plastic pollution in the region. In addition, large rivers (e.g., Nile, Ebro, and Po) draining into the basin are major plastic pathways. Estimations of total plastic accumulated in the basin are in the order of magnitude of 1,178,000 tonnes, whereas the plastic leakage has been estimated at 229,000 tonnes per year (Boucher and Bilard 2020).

The contamination of the Mediterranean environment by plastics has been the subject of an increasing number of studies and surveys in the last two decades (Boucher and Bilard 2020). However, there is still limited information on plastic pollution around seamounts in the basin, and specifically within marine protected areas. In the Northern Levantine Basin of the Eastern Mediterranean Sea, the Finike (Anaximander) Seamounts accommodate enhanced densities of organisms including large migratory fishes and cetaceans (Öztürk *et al.* 2010, 2013). Due to the ecological and biological importance of the region, it was declared a "Special Environmental Protection Area" on 16th August 2013 by the Turkish government.

To assess the environmental status of the Finike (Anaximander) Seamounts region, a programme for biogeochemical monitoring, including plastic pollution, was carried out . Based on data collected through this programme, the present study reports, for the first time, the concentrations and distribution of micro- and mesoplastics at the surface waters of the Finike Seamounts region. This is important to better understand the status of plastic pollution in this special and protected ecosystem and to provide baseline data for future studies and comparisons with other regions of the Mediterranean Sea. In addition, it provides key information to support the implementation of the European Union's Marine Strategy Framework Directive (MSFD) (EC 2008) and the UNEP/MAP Barcelona Convention's Regional Plan on Marine Litter Management in the Mediterranean (UNEP/MAP 2013).

Materials and Methods

Sampling area

The Finike Seamounts are 54 nautical miles off the southern coast of Türkiye in the eastern Mediterranean Sea (Figure 1). The Finike Seamounts consist of three main elevations, which rise to more than 1000m. The regional circulation is characterized by a persistent anticyclonic feature, known as the Anaximander eddy, located between the southern Turkish coast and the Rhodes gyre (Özsoy *et al.* 1993).

The Turkish coastline is heavily populated and a well-known tourist destination with many tourists visiting the region every year during the warmer months (April–October). In addition, the intense agricultural activities along the coast, marine traffic and fisheries are the important anthropogenic pressures in the region.

Sampling

The presence and distribution of micro- and mesoplastic in the surface waters of the Finike Seamounts region were evaluated during two research cruises in May and September 2021. Samples were collected from surface waters at the sampling stations shown in Figure 1 and Table 1, using a cylindro-conical plankton net with 133cm mouth diameter, 280cm long and 300mm mesh. The net was towed horizontally for 10 min at a ship speed of approximately 2 knots, in the upper 20cm of the water column. To collect all plastics stocked, the net was washed with sea water. The samples were then transferred into glass bottles and preserved in 4% borax-buffered formaldehyde.

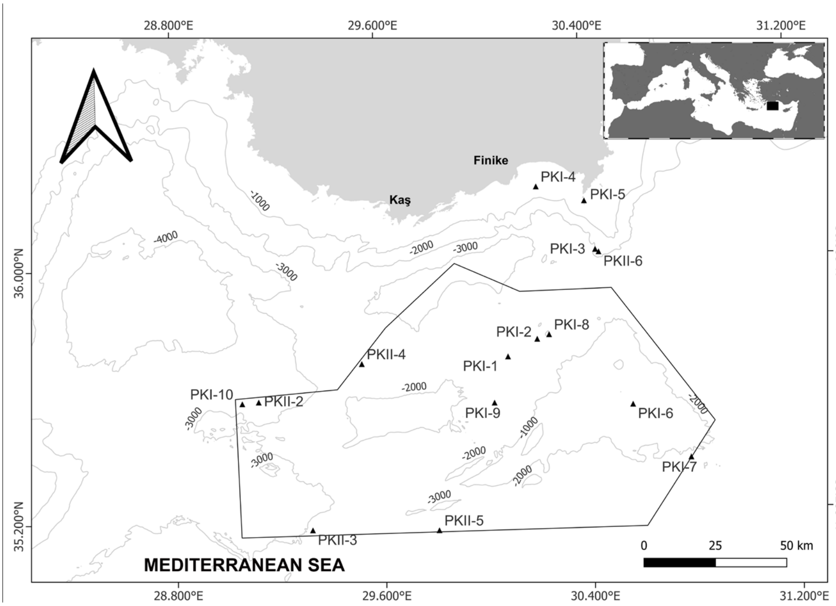

Figure 1. The Finike Seamounts Special Environmental Protection Area and sampling stations

Table 1. Sampling dates and coordinates of the sampling stations

Stations	Date	Latitude (N)	Longitude (E)
PKI-1	14.05.2021	35°42'17.34"	30°05'30.36"
PKI-2	14.05.2021	35°45'27.06"	30°12'24.96"
PKI-3	14.05.2021	36°2'6.90"	30°26'35.04"
PKI-4	15.05.2021	36°14'18.84"	30°13'14.46"
PKI-5	16.05.2021	36°11'22.14"	30°24'23.04"
PKI-6	19.05.2021	35°32'32.40"	30°34'8.40"
PKI-7	19.05.2021	35°22'8.40"	30°47'9.72"
PKI-8	20.05.2021	35°46'14.40"	30°15'12.60"
PKI-9	24.05.2021	35°33'37.08"	30°2'3.42"
PKI-10	25.05.2021	35°34'32.04"	29°3'33.39"
PKII-2	18.09.2021	35°34'47.39"	29°7'22.43"
PKII-3	25.09.2021	35°10'19.98"	29°19'15.60"
PKII-4	25.09.2021	35°41'37.40"	29°31'30.21"
PKII-5	26.09.2021	35°9'45.06"	29°48'27.12"
PKII-6	27.09.2021	35°1'37.08"	30°27'21.78"

Laboratory analysis

To assess the presence of plastics, samples were sieved through a 5mm mesh, rinsed with ultrapure water to remove the salt. Due to very low organic content within samples, oxidative reagent addition step was not applied. Samples were directly filtered through a 10µm filter and left to dry in a petri dish in the oven. Samples were then visually inspected using a ZEISS Stemi 508 stereo microscope and classified according to morphological characteristics and physical response features (Desforges *et al.* 2014). Plastics were visually classified according to type (film, fibre, fragments, foam, pellet, bead, paint) and colour. The largest cross-section of plastics was measured manually using the KameraM software in the images taken with an integrated digital camera and plastics were classified into three size-classes for microplastics (0.3-1mm, 1-2 mm, 2-5mm) and mesoplastics (5-25mm).

Fourier transform infrared spectroscopy (FT-IR) was used to confirm the synthetic polymer origin of the most common types of plastics. FT-IR analysis was carried out on a Perkin Elmer Spectrum 100 FT-IR spectrophotometer. The spectrum range was 4000-650cm^{-1} and a resolution of 1.0cm^{-1} with 32 scans for each measurement. The polymer type identification was done by comparing absorbance spectra to a reference library by using Perkin Elmer SEARCH Plus® software. Spectra for each sample was compared with reference FT-IR data and samples showing more than 70% spectral similarity were accepted.

Contamination control

Cotton lab coats and nitrile gloves were always worn. All laboratory analysis was done in laminar flow cabin. To account for a potential air borne contamination, dampened PCTE filters in a petri dish were placed for every stage of the sampling and laboratory work. In case contamination was noted, particles were excluded from the data.

Results

Micro- and mesoplastics were widely distributed in the surface waters of the Finike Seamounts region during the two cruises in May and September of 2021 (Table 2, 3). A total of 1880 and 735 plastic particles were analysed in May and in September 2021, respectively. Analysis revealed that most of the items were in the size range of microplastics (0.3-5mm), representing 79% and 68% of the total items in May and September, respectively (Figure 2). Examples of the different shapes of microplastics are shown in Figure 3.

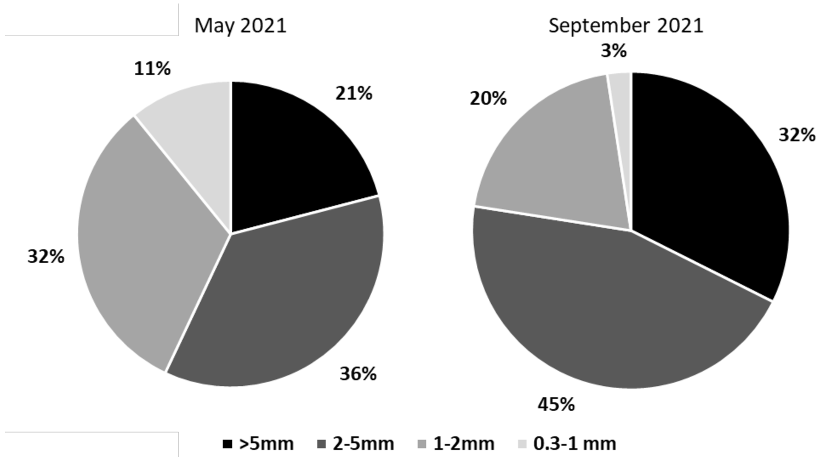

Figure 2. Size distribution of micro- and mesoplastics in surface waters collected during the surveys in May and September 2021

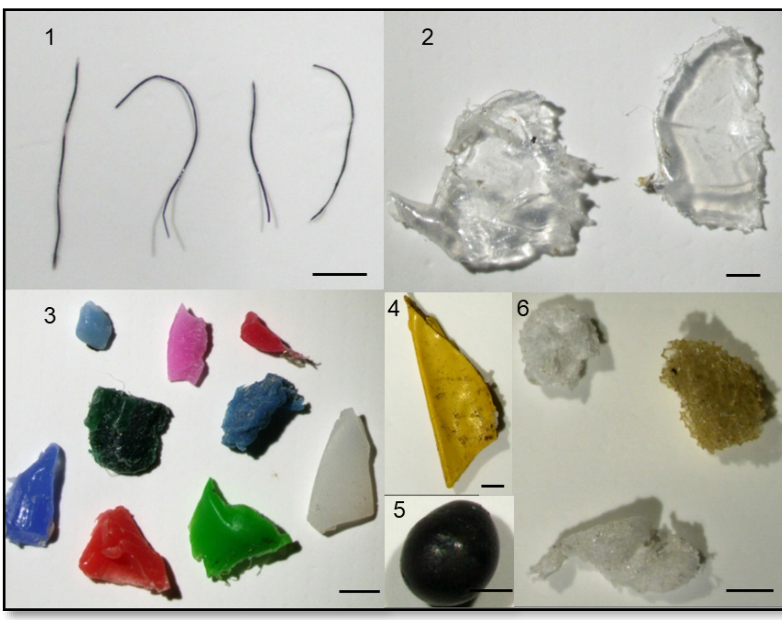

Figure 3. Examples of microplastics collected from surface waters of the Finike Seamounts region
(**1:** fibres, **2:** films, **3:** fragments, **4:** paint, **5:** bead, **6:** foams, scale=0.5mm)

Concerning the microplastics collected in May 2021, fragments were the primary shapes (average ~ 88.4%), followed by films (average ~ 8.6%), fibres (average ~ 2.6%), paints (average ~ 0.6%), foams (average ~ 0.1%) and beads (average ~ 0.1%) with no pellet were found. Microplastics concentration in surface waters varied from 0.78×10^4 to 73.9×10^4 par.km^{-2} with a mean concentration (± standard deviation) of $19.2 \times 10^4 \pm 26.7 \times 10^4$ par.km^{-2} (Table 2). Thirteen different colours of microplastics were found with transparent (average ~ 38%) being the most common colour followed by white (average ~ 29%) and black (average ~ 12%) (Figure 4). The size of microplastics were mainly 2-5mm (45.6%), followed by 1-2mm (40.7%) and 0.3-1mm (13.7%).

Table 2. Concentration of microplastics (par.km^{-2}) during May and September 2021

			May 2021				
	Film	**Fibre**	**Fragment**	**Foam**	**Bead**	**Paint**	**TOTAL**
PKI-1	-	-	22135	-	-	-	**26042**
PKI-2	7813	-	29948	-	-	-	**37760**
PKI-3	32552		705729	-	1302	-	**739583**
PKI-4	55990	11719	500000	1302	-	-	**569010**
PKI-5	5208	-	18229	-	-	-	**23438**
PKI-6	42969	31250	283854	-	-	5208	**363281**
PKI-7	13021	6510	75521	-	-	1302	**96354**
PKI-8	1302	-	6510	-	-	-	**7813**
PKI-9	1302	-	35156	-	-	-	**36458**
PKI10	1302	-	27344	-	-	-	**28646**
mean	**16146**	**4948**	**170443**	**130**	**130**	**651**	**192839**
SD	20267	10063	246660	412	412	1653	267709
			September 2021				
	Film	**Fibre**	**Fragment**	**Foam**	**Bead**	**Paint**	**TOTAL**
PKII-2	-	1302	-	-	-	-	**1302**
PKII-3	1302	-	14323	-	-	-	**15625**
PKII-4	-	1302	13021	-	-	-	**14323**
PKII-5	-	-	11719	-	-	-	**11719**
PKII-6	70313	2604	516927	19531	-	-	**609375**
mean	**11936**	**868**	**92665**	**3255**	-	-	**130469**
SD	28603	1063	207945	7974	-	-	267776

As for the microplastics analysed in September 2021, fragments were also the primary shapes (average ~ 85.2%), followed by films (average ~ 11%), foams (average ~ 3%) and fibres (average ~ 0.8%) while no pellet, bead and paint were found. Microplastic concentration in surface waters varied from 0.13×10^4 to 60.9×10^4par.km^{-2} with a mean concentration of $13.0 \times 10^4 \pm 26.7 \times 10^4$ par.km^{-2} (Table 2). A total of twelve different colours of microplastics were found with transparent (average ~ 33%) being again the most common colour followed by white (average ~ 25%), blue (average ~ 14%) and black (average ~ 12%) (Figure 4). The sizes of microplastics were mainly 2-5mm (59.2%), followed by 1-2mm (26.4%) and 0.3-1mm (3.2%).

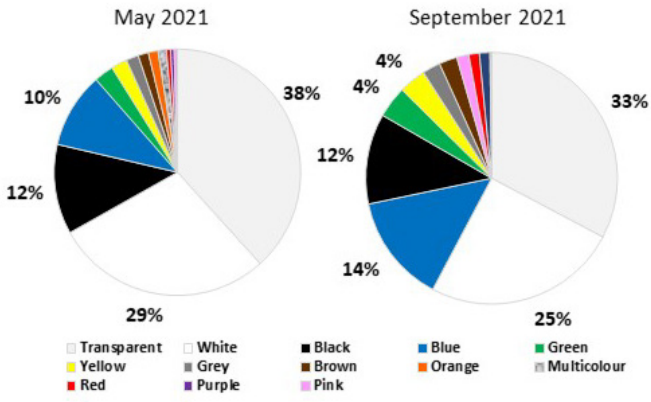

Figure 4. Colours of microplastics in surface waters collected during the surveys in May and September 2021

Regarding the mesoplastics sampled in May 2021, the primary shapes of mesoplastics were films (79%), followed by fragments (24.1%), fibres (5.6%) and foams (0.3%). Surface mesoplastic concentration varied from $0.13x10^4$ to $16.7x10^4$ par.km^{-2} (mean $5.19x10^4 \pm 6.38x10^4$ par.km^{-2}) (Table 3). Eleven different colours of mesoplastics were found in the surface waters with transparent being the most common colour (72.1%) (Figure 5).

Table 3. Concentration of mesoplastics (par.km^{-2}) collected during the surveys in May and September of 2021

			May 2021		
	Film	**Fibre**	**Fragment**	**Foam**	**TOTAL**
PKI-1	-	-	3906	-	**3906**
PKI-2	20833	-	1302	-	**22135**
PKI-3	80729	-	26042	-	**106771**
PKI-4	138021	3906	24740	1302	**167969**
PKI-5	13021	1302	3906	-	**18229**
PKI-6	91146	9115	48177	-	**148438**
PKI-7	7813	14323	10417	-	**32552**
PKI-8	1302	5208	5208	-	**11719**
PKI-9	2604	-	3906	-	**6510**
PKI-10	1302	-	-	-	**1302**
mean	**35677**	**3385**	**12760**	**130**	**51953**
SD	49239	4918	15514	412	**63888**
			September 2021		
	Film	**Fibre**	**Fragment**	**Foam**	**TOTAL**
PKII-2	-	-	1302	-	**1302**
PKII-3	3906	1302	-	-	**5208**
PKII-4	1302	-	3906	-	**5208**
PKII-5	3906	-	1302	-	**5208**
PKII-6	199219	6510	82031	-	**287760**
mean	**34722**	**1302**	**14757**	-	**60938**
SD	88091	2823	35986	-	**126809**

For the mesoplastics found in September 2021, films (68.4%) were also the most common shape of mesoplastics followed by fragments (29.1%) and fibres (2.6%). Surface mesoplastic concentrations varied from $0.13x10^4$ to $28.7x10^4$ par.km^{-2} (mean $6.09x10^4 \pm 12.6x10^4$ par.km^{-2}) (Table 3). A total of ten different colours of mesoplastics were found in the surface waters with transparent being again the most common colour (73.9%) (Figure 5).

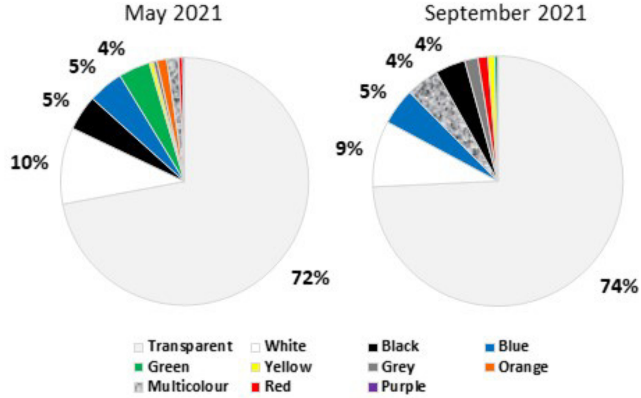

Figure 5. Colours of mesoplastics in surface waters collected during the surveys in May and September 2021

According to the FT-IR results for micro- and mesoplastics, polyethylene (PE) (69%) was the most prevalent polymer in surface waters during both cruises, followed by polypropylene (18%), while others (PET, PVC, PA, PS, PETG, PVA, paraffin) constituted only a small fraction (13%) of the total (Figure 6).

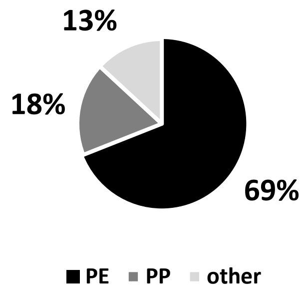

Figure 6. Distribution of polymers (PE: polyethylene, PP: polypropylene and others) in surface waters collected during the surveys in May and September 2021

Discussion

In this study, micro- and mesoplastic pollution at the surface waters of the Finike Seamounts in the eastern Mediterranean Sea is reported for the first time. Micro-and mesoplastics were found in all sampling stations, showing that plastics are ubiquitous in the region. Microplastic pollution of the Mediterranean Sea has been widely reported. However, reports of both micro- and mesoplastics are scarce. Table 4 presents the mean concentrations of microplastics from 21 studies in the Mediterranean Sea, of which seven studies also reported mesoplastics concentrations. In both cruises of May and September 2021, we found higher concentrations of microplastics than mesoplastics, which tends to agree with most of the previous concurrent reports of micro- and mesoplastics (Table 4). This is expected since one mesoplastic can fragment over time into many microplastics.

Fragments were clearly the most dominant shape of microplastics (88.4% in May and 85.2% in September), followed by films (8.6% in May and 11% in September). This agrees with previous reports from the Mediterranean, which also report fragments as the primary shape (Table 4). By contrast, the main shapes of mesoplastics were films (79% in May and 68.4% in September), followed by fragments (24.1% in May and 29.1% in September). This is also in line with previous reports from the Mediterranean (Table 4). As for colours, in both micro- and mesoplastics, transparent and white were the most common colours, comprising together always more than half of the total items.

Fragments and films, of white and transparent colours, clearly represented most of the micro- and mesoplastic pollution in the Finike Seamounts region. While the source of fragments is less clear, white and transparent films are mainly the result of the fragmentation of single-used plastic (SUP) items, such as plastic bags and food packaging. This agrees with SUP items being commonly reported as floating macro litter from the Mediterranean Sea (e.g. Zeri *et al.* 2018). The prevalence of fragments and films in the surface waters of the Finike Seamounts region shows the need for urgent measures to reduce the amount of plastic entering the sea, including better waste management.

Low density polymers polyethylene (PE) and polypropylene (PP) were prevalent in the surface waters of the study area in parallel with previous reports from the Mediterranean Sea (e.g. Suaria *et al.* 2016; Zeri *et al.* 2018; Palatinus *et al.* 2019; de Haan *et al.* 2019; Camins *et al.* 2020; Adamopoulou *et al.* 2021; Güven 2022) and with their global production (62% of the global plastic demand). These polymers are widely used in the disposable packaging industry and the most common polymers found in surface waters worldwide. The prevalence of these polymers again supports that most of the white and transparent films are likely from SUP items. Because of their high buoyancy, low density polymers can travel long distances from their sources by winds and currents and constitute a transboundary problem difficult to tackle.

Regarding spatial differences in plastic concentrations, during the May cruise, the highest micro- and mesoplastic concentrations were found in stations PKI-3 and PKI-4, respectively. As for the September cruise, the highest concentrations for both micro- and mesoplastics were at station PKII-6. Clearly, these three stations (PKI-3, PK-4, ad PKII-6) were nearer the Turkish southern coast, outside the Special Environmental Protection Area (Figure 1). The fact that higher plastic concentrations were found at these coastal stations is explained by their proximity to the densely populated coastline and land-based inputs such as poor waste management, tourism and agriculture (Güven 2022).

Despite this, it is noted that in the May cruise, the PKI-6 station just above the summit of the seamount showed also relatively high micro- and mesoplastic concentrations (Tables 2 and 3), similar to the concentrations in the previously referred coastal stations. This demonstrates that the range of coastal concentrations, can also be found near the seamount and that open waters can have similar levels of plastic pollution as coastal waters. Heterogeneous distribution of micro- and mesoplastics in the study area, and the higher values in some open-ocean stations, may be explained by the complex effects of seamounts on ocean circulation (e.g. upwelling and convergent regions) and on the regional circulation features such as the Anaximander eddy (Özsoy *et al* 1993; Denda and Christiansen 2011).

To compare with other studies, the mean concentration of micro- and mesoplastics is computed for all stations but excluding the four coastal stations (PKI-3, PKI-4, PKI-5, PKII-6) for a better representation of the open-ocean protected area of the seamounts. The resulting mean concentration of microplastics (58120±104404 par.km^{-2}) is in the same order of magnitude of previously reported values (Table 4) and higher than in several other regions, such as NW Mediterranean (Collignon *et al.* 2014), Mediterranean-wide (Eriksen *et al.* 2014), and Ligurian and Tyrrhenian Seas (Caldwell and Petri-Fink 2019; Caldwell *et al*. 2020). As for the mean mesoplastic concentration (22135±42981 par.km^{-2}) similar to studies reported from Balearic Sea (Ruiz-Orejon *et al.* 2018), Ligurian and Tyrrhenian Sea (Caldwell *et al.* 2020) (Table 4). However, it is higher than in all other previous reports (Table 4), except for the study from the NW Mediterranean Sea (Collignon *et al.* 2014).

Enclosed and semi-enclosed seas are characterised with high densities of plastic litter (Barnes *et al.* 2009) and the Mediterranean Sea is considered one of the great accumulation zones of floating plastic litter at a global scale (Cózar *et al.* 2015). Annual plastic leakage from the Mediterranean riparian countries was estimated to vary between 150,000 and 610,000 tonnes, with macroplastics resulting from mismanaged waste making up 94% of total leakage. Türkiye is one of the top three countries contributing to plastic leakage according to Boucher and Bilard (2020). Recent studies also show that rivers along the southern coast of Türkiye carry a considerable amount of land-based microplastics into the Levantine Basin (Güven 2022; Özgüler *et al.* 2022). This may explain the relatively high values of micro- and mesoplastic concentrations in the Finike Seamounts region.

Table 4. Comparison with some previous studies on microplastics and mesoplastics in the Mediterranean Sea

Location	Microplastics		Mesoplastics		References
	Mean conc. (par.km^{-2})	**Dominant Type**	**Mean conc. (par.km^{-2})**	**Dominant Type**	
NW Mediterranean	116000				Collignon *et al.* 2012
Ligurian & Sardinian Sea	620000				Fossi *et al.* 2012
NW Mediterranean	51000		132000 ±228000		Collignon *et al.* 2014
Mediterranean-wide	48789				Eriksen *et al.* 2014
NW Mediterranean	130000	Fragment	5700	Film	Faure *et al.* 2015
Central-W Mediterranean	130481± 609426		16000 ±28000		Suaria *et al.* 2016
Northern Adriatic Sea	406000				Gajst *et al.* 2016
NE Mediterranean	140418				Guven *et al.* 2017
Israel Mediterranean	1518340				van der Hal *et al.* 2017
Levantine Sea	376000 (micro+meso)	Fragment			Gündoğdu and Cevik 2017
Balearic Sea	875466	Fragment	23298		Ruiz-Orejon *et al.* 2018
NW Mediterranean	112000	Fragment			Schmidt *et al.* 2018
Ligurian Sea	69161±83244	Fragment			Baini *et al.* 2018
Adriatic Sea	315009 ± 568578	Fragment			Zeri *et al.* 2018
Ligurian and Tyrrhenian Sea	19220	Fragment	9156	Fragment	Caldwell and Petri-Fink 2019
Central Adriatic Sea	127135± 294847	Filament-fragment			Palatinus *et al.* 2019
Western Mediterranean	102000± 90000		6000±7000		de Haan *et al.* 2019
Balearic sea	224294				Ruiz-Orejon *et al.* 2019
Ligurian and Tyrrhenian Sea	23327± 81057	Fragment	21938 ±35045	Fragment	Caldwell *et al.* 2020
Western Mediterranean	94500	Fragment			Camins *et al.* 2020
Ionian,Aegean, Levantine Seas	260000± 360000	Fragment			Adamopoulou *et al.* 2021
Eastern Mediterranean	172049± 259779 58120± 104404*	Fragments	54948 ±85074 22135 ±42981*	Film	This Study

(*mean concentration of micro- and mesoplastics in Finike Seamounts excluding the coastal stations)

Plastics have been reported from many ecologically and economically important fish, invertebrate species, turtles and mammals of the Mediterranean Sea (Fossi *et al.* 2017; Tonay *et al.* 2021). The Finike Seamounts is an important spawning and feeding ground of pelagic and benthic fish species (Tserpes *et al.* 2008). It is also an important site for deep diving marine mammals including Cuvier's beaked whales (*Ziphius carvirostris*) and sperm whales (*Physeter macrocephalus*) (Woodside *et al.* 2006; Öztürk *et al.* 2013). Results suggest a high potential for micro- and mesoplastics to enter the pelagic and benthic food webs of this high sea marine protected area by direct ingestion or indirectly by contaminated prey. As a part of the present research expedition, plastic was also found in the sediment samples taken from a depth of 2200m in the Finike Seamounts region confirming that this ecosystem is vulnerable to plastic pollution in several environmental matrices. There is an urgency to fully understand how plastics behave in this region and take the necessary measures to reduce the risks of plastics posed to Finike Seamounts wildlife within the framework of the UNEP/MAP Barcelona Convention Regional Plan for Marine Litter Management in the Mediterranean and the EU Marine Strategy Framework Directive (Descriptor 10).

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Finike (Anaximander) Denizaltı Dağları (Kuzeydoğu Akdeniz) yüzey sularında mikro- ve mesoplastikler

Öz

Doğu Akdeniz'de açık deniz özel çevre koruma alanı olan Finike (Anaximander) Denizaltı Dağları yüzey sularında mikro (<5mm) ve mezoplastik (5-25mm) kirliliği ilk kez rapor edilmektedir. Örnekler Mayıs ve Eylül 2021 dönemlerinde gerçekleştirilen araştırmalar esnasında yüzey sularından plankton ağı ile toplanmıştır. Plastikler, stereomikroskop ve FT-IR kullanılarak fiziksel ve kimyasal olarak karakterize edilmiştir. Mikroplastikler, Mayıs ve Eylül aylarında yüzey sularından toplanan plastiklerin sırasıyla %79 ve %68'ini oluşturmuştur. Mikroplastik konsantrasyonu Mayıs 2021'de 0.78×10^4 ile 73.9×10^4 par. km^{-2} (ortalama $19.2 \times 10^4 \pm 26.7 \times 10^4$ par. km^{-2}) ve Eylül 2021'de 0.13×10^4 ile 60.9×10^4 par. km^{-2} (ortalama $13 \times 10^4 \pm 26.7 \times 10^4$ par. km^{-2}) arasında değişmiştir. Mikroplastiklerde en sık rastlanılan form parça, en baskın renk şeffaf ve en yaygın boyut 2-5mm boy aralığı olarak tespit edilmiştir. Mezoplastik konsantrasyonu Mayıs ve Eylül 2021'de sırasıyla 0.13×10^4 ile 16.7×10^4 par.km^{-2} (ortalama $5.19 \times 10^4 \pm 6.38 \times 10^4$ par. km^{-2}) ve 0.13×10^4 ila 28.7×10^4 par.km^{-2} (ortalama $6.09 \times 10^4 \pm 12.6 \times 10^4$ par. km^{-2}) arasında değişmiştir Mezoplastikler en sık rastlanılan form film ve en baskın renk şeffaf olarak tespit edilmiştir. FT-IR analizi sonuçları, yüzey sularında düşük yoğunluklu polimerden polietilen (%69) ve ardından polipropilenin (%18) baskın olduğunu doğrulamıştır. Sonuçlar, Finike Denizaltı Dağları bölgesinde plastiklerin yaygın olarak bulunduğunu göstermektedir. Bu durum açık deniz özel çevre koruma alanındaki ekosistemin sağlığına ilişkin bir endişe nedenidir ve Akdeniz plastik krizi için acil çözümler geliştirme ihtiyacının altını çizmektedir. Mevcut çalışma tarafından sağlanan veriler, bölgede gelecekteki çevresel değerlendirmeler için temel teşkil ederek deniz ortamının plastik kirliliğinden uzun vadeli korunması ve plastik kirliliğinin azaltılmasına yönelik direktiflerin ve stratejilerin uygulanmasını desteklemektedir.

Anahtar kelimeler: Mikroplastik, mesoplastik, kirlilik, DSÇD, Akdeniz, Finike (Anaximander) Denizaltı Dağları

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