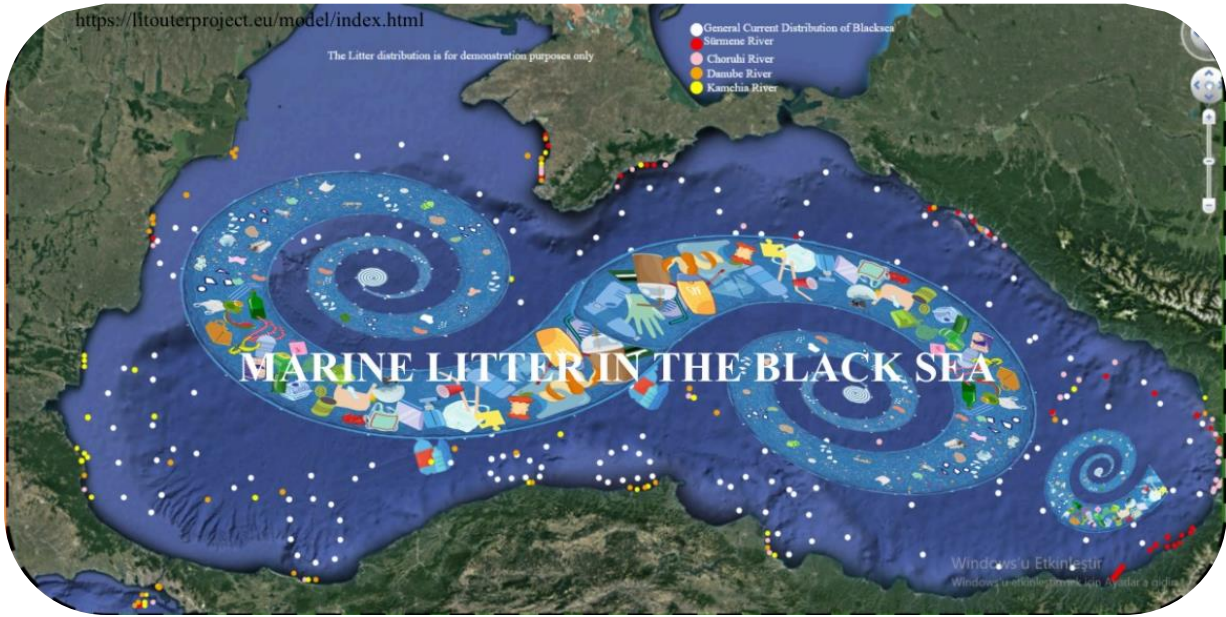


## SYMPOSIUM E-BOOK



# INTERNATIONAL SYMPOSIUM ON MARINE LITTER IN THE BLACK SEA: ECOLOGICAL AND SOCIO-ECONOMIC PROBLEMS

31 October – 2 November 2022

Trabzon, TURKIYE





Common borders. Common solutions.



## PREFACE

The international symposium, called "MARINE LITTER IN THE BLACK SEA: ECOLOGICAL AND SOCIO-ECONOMIC PROBLEMS", organized within the scope of the LitOUTer project, the problem of marine litter was discussed within the framework of the environment, economy, and social life. The international symposium was held in Osman Turan Conference Hall Trabzon/ TURKEY between 31 October-2 November 2022. The symposium was organized as an output of the LitOUTer project and was supported by the instrument ENI CBC-BSB (2014-2020) (BSB-785).

Invited speakers, oral and poster presenters were from many national and international institutions and organizations, non-governmental organizations, and regional organizations, and related ministries. Presentations were based on raising awareness about the effects of marine litter on the environment, economy and social life. At the symposium, invited speakers and participants looked at the litter problem from a broad perspective and discussed all aspects of reducing the amount of marine litter, the importance of recycling, and the effects of plastics and microplastics, together with academics, subject experts, and stakeholders.

12 invited speakers, 27 oral presentations, and 16 poster presentations were made in the symposium. More than 200 people attended the meeting. The symposium was attended by oral presentations from 6 countries (Turkey, Georgia, Bulgaria, Romania, Denmark and Ukraine). A total of 39 oral presentations were presented by experts, 19 foreign and 20 from Turkey.

We would like to thank all the participants who added value to the symposium with their contributions and participation, and all the members of the board who made great efforts in the realization of this event.

Especially, we would like to thank all public institutions, municipalities and non-governmental organizations managers, and representatives who contributed and participated in the symposium and LitOUTer project studies as stakeholders. We also thank our project partners for their contribution to the success of the project and the symposium.

Prof. Dr. Fatma TELLİ KARAKOÇ

Assoc. Prof. Dr. Coşkun ERÜZ



KARADENİZ  
TEKNİK ÜNİVERSİTESİ  
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## SYMPOSIUM PROGRAM

1<sup>st</sup> Day: Monday, 31 October 2022

Time	HALL-1		
09.00-10.00	Registration / Kayıt		
Announcer	Assoc. Prof. Dr. Sercan EROL		
10:00-11:00	Opening Speeches / Açılış Konuşmaları	LitOUTer Project Leader / Proje Lideri	Assoc. Prof. Dr. Coşkun ERÜZ
		Rector / Rektör	Prof. Dr. Hamdullah ÇUVALCI
		MFA-Directorate of EU Affairs / AB Başkanlığı Mali İş Birliği ve Proje Uygulama Genel Müdürlüğü, Gen. Md. Yrd. (invited speaker)	Serdar ÖZTÜRK
		Ministry of Environment Urbanization and Climate Change / Çevre Şehircilik ve İklim Değişikliği Bakanlığı, Çevre Yönetimi Genel Müdürü	Eyyüp KARAHAN
		Governor of Trabzon / Vali	İsmail USTAOĞLU
11:00-11:30	Coffee Break / Ara		
Chair	Prof. Dr. Ertuğ DÜZGÜNEŞ	INVITED SPEAKER PRESENTATIONS	
11:30-11:45	EEA Source to sea European Marine Litter Assessment and EEA Marine Litter Watch / AÇA Avrupa'da Kaynaktan Denize Deniz Çöpü Değerlendirmesi ve AÇA Deniz Çöpü İzleme	European Environment Agency / Avrupa Çevre Ajansı	Mustafa Aydın (online)
11:45-12:00	Role of the Black Sea Litter Pollution and Regional Actions / Karadeniz'de Deniz Çöpü ve Bölgesel Uygulamalar	Black Sea Commission (BSC) / Karadeniz Komisyonu Sekreteryası	Iryna MAKARENKO (online)
12:00-12:15	Pilot Activities on Fighting Micro Plastics and Marine Litter in the Black Sea / Mikroplastikle mücadelede Pilot Uygulamalar ve Karadeniz'de Deniz Çöpleri	BSEC Permanent Secretariat / Karadeniz Ekonomik İş birliği Örgütü	Rositsa STOEVA (online)
12:15-12:30	Waste Management Policy and Issues in Khelvachauri Municipality-Georgia /Gürcistan, Khelvachauri Belediyesinde Katı Atık Yönetim Politikası ve uygulama	Chairman of Khelvachauri Council / Halvachauri Konsey Başkanı	Tengiz IREMADZE
12:30-12:45	Fisheries, Marine Litter and Ghost Nets / Balıkçılık, Deniz Çöpleri ve Hayalet Ağlar	MoAF, DG Fisheries and Aquaculture, Directorate of Resource Management and Fisheries Infrastructures, Director/Tarım ve Orman Bak., Balıkçılık ve Su Ürünleri Gn Müd., Kaynak Yön. ve Balıkçılık Yapıları Daire Başkanı	Assoc. Prof. Dr. Mahir KANYILMAZ (online)
12:45-13:00	Marine Litter Action Plan of Türkiye / Deniz Çöpleri Eylem Planı ve Çalışmalar	Ministry of Environment Urbanization and Climate Change / Çevre, Şehircilik ve İklim Değişikliği Bakanlığı / Çevre Yönetimi Genel Müdürlüğü	Özlem KARAKURT ÖZER
13:00-14:15	LUNCH / Öğle Yemeği		
Chair	Prof. Dr. Muhammet BORAN	INVITED SPEAKER PRESENTATIONS	
14:15-14:30	The Impact of the LitOUTer Project on The Partner Countries in the Black Sea / LitOUTer Projesinin Karadeniz Ortak Ülkelerindeki Etkisi	Karadeniz Technical University - Marine Science Faculty - LitOUTer Project Coordinator	Prof. Dr. Fatma TELLİ KARAKOÇ
14:30-14:45	Turkish National Marine Monitoring Program-Marine Litter Monitoring / Ulusal Deniz İzleme Programı-Deniz Çöpü İzleme	Ministry of Environment Urbanization and Climate Change / Çevre Şehircilik ve İklim Değişikliği Bakanlığı, ÇED İzin ve Denetim Genel Müdürlüğü	Hacer SELAMOĞLU ÇAĞLAYAN
14:45-15:00	Monitoring of the Microplastic in the Turkish Seas / Türk Denizlerinde Mikroplastik Kirliliğinin İzlenmesi	Recep Tayyip Erdoğan University - Fisheries Faculty	Assoc. Prof. Dr. Ülgen AYTAN

15:00-15:15	The Results of the National Marine Litter Monitoring Studies / Ulusal Deniz Çöplü İzleme Çalışm. Sonuçları	TÜBİTAK-MAM (invited speaker)	Dr. Leyla TOLUN
15:15-15:45	Coffee break / Ara		
15:45-16:00	NGO marine litter activities / STK Deniz Çöplü Aktiviteleri	TURMEPA - Türkiye	Damla BALÇIK (online)
16:00-16:15	Marine Litter in The Black Sea: Distributions, Sources, and Ecological Interactions / Karadeniz'de deniz Çöpleri: Dağılım, Kaynaklar ve Ekolojik Etkiler	TÜDAV (invited speaker)	Assoc. Prof. Dr. Ülgen AYTAN
16:15-16:30	Evaluation of the first day of the Symposium / Sempozyum1. günün değerlendirmesi		
16:30-17:00	POSTER PRESENTATION / POSTER SERGİSİ		

2<sup>nd</sup> Day: Tuesday, 1 November 2022

Time	HALL-1	HALL-2
	<b>Ecological Impacts and Sources of Marine Litter Pollution</b>	<b>Education/Training and Awareness Activities Regarding Marine Litter</b>
<b>Chair</b>	<b>Dr. Elena STOICA</b>	<b>Prof. Dr. Violin RAYKOV</b>
10:00-10:15	Works On Cleaning the Port Waters from Marine Litters / Liman Sularının Deniz Çöplerinden Temizlenmesi Çalışmaları <b>Anna SHOTADZE, Mzia DIASAMIDZE (invited speaker)</b>	Young People in Georgia / Gürcistan'da Gençler <b>Mariam Avakova (online)</b>
10:15-10:30	An Awareness Study on Environmental Pollution Caused by Building Materials Used in Construction: The Case of Artvin, Arhavi / Çevre Kirliliğine Neden Olan İnşaatlarda Kullanılan Yapı Malzemelerinin farkındalık Çalışması: Artvin Arhavi Uygulaması <b>Güler ERÜZ, Birgül ÇAKIROĞLU, Emre BELGE, Esra Orhan YILMAZ, A. Orhun ERÜZ</b>	Stakeholders' training for Raising Public Awareness and Reducing Marine Litter in the Black Sea / Karadeniz'de Deniz Çöpünün Azaltılması ve Toplumsal Farkındalığın Arttırılması İçin Paydaş Eğitimi. <b>Anca-Maria PANAIT, Andreea Stefania IONASCU, Angelica PAIU, Coşkun ERUZ, Fatma TELLİ KARAKOÇ, Ertuğ DÜZGÜNEŞ, David TSISKARIDZE, Violin RAYKOV, Elena STOICA, Emma GILEVA</b>
10:30-10:45	Sea Coastal Zone in The Pollution Formation of The Black Sea by Marine Litter / Deniz Çöpleri ile Karadeniz Kıyılarında Kirlilik Oluşumu <b>Tamerlan SAFRANOV, Nikolai BERLINSKY, Mariia SLIZHE, Youssef EL HADRI (online)</b>	Marine litter Assessment, Awareness, and Preservation / Deniz çöplü Değerlendirilmesi, Farkındalık ve Korunma <b>Violin RAYKOV</b>
10:45-11:00	Seasonal Change of Solid Waste Composition of Trabzon (Ortahisar) Beaches / Trabzon Ortahisar Kıyılarında Katı Atık İçeriğinin Mevsimsel Değişimi <b>Koray ÖZSEKER, Yahya TERZİ, Coşkun ERÜZ, Neira Purwanti ISMAIL</b>	Education And Enhancing Raising Awareness for School Students of Adjara Region Georgia and Knowledge Attitudes of Black Sea Coastal Population in Waste Management and Marine Litter Issue / Gürcistan Acara Bölgesi Okul Öğrencilerinde ve Karadeniz Kıyı Nüfusunun (Acjara Bölgesi, Gürcistan) Atık Yönetimi ve Deniz Çöplü Konusunda eğitim ve Farkındalığını arttırma <b>Davit TSISKARIDZE, Tsitsino TURKADZE, Khatuna CHIKVILADZE</b>
11:00-11:30	Coffee Break / Ara	
11:30-11:45	Marine Litter Surveys and Citizen Science – ANEMONE Project Experience / Deniz Çöplü Araştırması ve vatandaş Bilimi-ANEMONE Proje Deneyimi <b>Laura BOICENCO (invited speaker), Elena Bişinicu, Aurelia Totoiu, George Harcota, Madalina Galatchi, Angelica PAIU, Elena Stoica, Florin Timofte, Hakan Atabay</b>	“Would You Like No Litter in Your Home” / “Evinizde Çöp Olmamasını İsternisiniz” <b>Nagihan EROL</b>
11:45-12:00	Current And Wind Effect on Marine Litter Distribution in The Black Sea / Akıntı ve Rüzgarın Karadeniz'de Deniz Çöplü Dağılımına Etkisi <b>Ercan KÖSE, Coşkun ERÜZ</b>	Have the nature for your future / Geleceğiniz İçin Doğaya Sahip Çıkn <b>Arzu Çelik KAYALAR</b>
12:00-12:15	First Effort of Using Marine Mammal Aerial Survey Platform to Collect Marine Litter Data in The Black Sea / Karadeniz'de Deniz Çöplü Verilerinin Toplanmasında Deniz Memelileri Havadan Araştırma Platformu Kullanımına Yönelik İlk Çalışma <b>Marian PAIU, Costin TIMOFTE, Angelica PAIU, Pavel GOL'DIN, Dimitar POPOV, Arda M. TONAY, Ayaka Amaha OZTÜRK, Ayhan DEDE</b>	Clean Coast Clean Sea / Temiz Kıyı Temiz Deniz <b>Safive CUBUKÇU NEZİR</b>
12:15-12:30	Litter Hotspot Mapping in the Manahoz Stream / Manahoz Çayında Çöp Yoğun Noktaların Haritalanması	Determining The Opinions of Pre- Service Science Teachers on Marine Litter Pollution: Example of Trabzon University / Deniz Çöplü Kirliliği hakkında Fen Bilgisi



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	<b>Neira Purwanty ISMAIL, Coşkun ERÜZ, Fatma TELLİ KARAKOÇ, Yahya TERZİ, Koray ÖZŞEKER, Nurettin BAŞKAN</b>	Öğretmen Adaylarının Görüşlerinin Belirlenmesi: Trabzon Üniversitesi Örneği <b>Hava İPEK AKBULUT, Ayşegül ŞEYİHOĞLU</b>
12:30-12:45	Plastic Occurrence in the Romanian Marine Biota: A Case Study of the Black Sea / Romanya Deniz Biotasında Plastik Varlığı: Karadeniz’de bir Vaka Analizi <b>Andreea M. CIUCA, Lucica BARBES, Elena PANTEA, Elena STOICA</b>	BSNN Traditions and Experience in Using Citizen Science for Beach Litter Monitoring <b>Mihaela KOZOVSKA</b>
<b>12:45-14:00</b>	<b>LUNCH / Öğle Yemeği</b>	
	<b>Ecological Impacts and Sources of Marine Litter Pollution</b>	<b>Legislation and Socio-Economic Administrative Situation and Practices on Marine Litter</b>
<b>Chair</b>	<b>Marian PAIU</b>	<b>David TSISKARIDZE</b>
4:00-14:15	Ecological Situation and Solid Waste (Litter) Pollution at the Water of Kolkheti National Park (Georgia) / Kolheti Ulusal Parkında Ekolojik Durum Su kaynaklarında Katı Atık Kirliliği <b>Khatuna TSIKLARI (invited speaker), Manana CHIKOVANI</b>	Marine Litter: Interactions with Fisheries and Tourism Industry / Deniz Çöpi: Balıkçılık ve Turizm Endüstrisi İle Etkileşimi <b>Ertuğ DÜZGÜNES, Neira Purwanty ISMAIL</b>
14:15-14:30	Pollution and Black Sea Biota: How much is Too much! / Kirlilik ve Karadeniz Biyotası: Ne Kadar Çok Fazla! <b>Nesho CHIPEV (Online)</b>	Waste Management in Trabzon Province / Trabzon İlinde Atık Yönetim Uygulamaları. <b>Funda DURMUŞ</b>
14:30-14:45	“Do You Think Plastic Pollution Affect Fish in Valleys Of Solaklı And İkizdere Being Important Water Resources Of The Eastern Black Sea Region In Terms Of Tourism?” / “Doğu Karadeniz Bölgesi’nin Turizm Yönünden Önemli Su Kaynaklarından Solaklı ve İkizdere Vadilerinde Plastik Kirliliği Sizce Balıklar Etkiler Mi?” <b>Mehmet KOCABAŞ, Filiz KUTLUYER KOCABAŞ</b>	Regulatory Framework for Reducing Plastic Pollution in The Black Sea Basin / Karadeniz Havzasında Plastik Kirliliğini Azaltmak İçin Düzenleyici Direktifler <b>Aleksandar SHIVAROV (online)</b>
14:45-15:00	Promoting Green Ports Theory and Practice to Partners in the Black Sea Basin <b>Georgi GILEV</b>	Waste Management in Trabzon Ortahisar City / Trabzon Ortahisar İlçesinde Atık Yönetim Çalışmaları <b>Ezgi KAZAN</b>
15:00-15.15	Solid Waste Pollution Threats to Marine Protection Area Management on the Southeast Black Sea Coast <b>Neira Purwanty ISMAIL, Coşkun ERÜZ, Koray ÖZŞEKER</b>	Survey Assisting the LitOUTer Project Teams in Awareness and Training Activities with Stakeholders to Abate Marine Litter and Plastic Pollution of The Black Sea <b>Emma GILEVA</b>
<b>15:15-15-30</b>	<b>POSTER PRESENTATION / POSTER SERGİSİ</b>	
<b>15:30-15:45</b>	<b>Evaluation and closing ceremony / Değerlendirme ve kapanış</b>	

### 3<sup>rd</sup> Day: 2 November 2022

**9:00-17:00 Field Trip-Litter survey – (Değirmedere River basin villages, national park) / Saha Gezisi (Değirmedere Havzası)**

<b>POSTER SESSION</b>	
<b>Code</b>	<b>Title - Author</b>
ML-1	Autumn Trend of Solid Waste Pollution in Dam Lake of Artvin / Artvin Baraj Gölünde Katı Atık Kirliliğinin Sonbahar Trendi <b>Koray ÖZŞEKER, Yahya TERZİ, Coşkun ERÜZ, Neira Purwanty ISMAIL</b>
ML-2	The Journey of Plastic Litter in The Marine Environment / Plastiklerin deniz ortamında Dolaşımı <b>Nigar ALKAN, Berrin ÖZKILIÇ, Elif Pınar İLHAN</b>
ML-3	I'm Not Throwing, Adding to Life / Atmıyorum, Hayata Katıyorum <b>Arzu MERT, Tansu ŞEN, Elif ÇAVDAR</b>
ML-4	Macro Beach Litter in The Sürmene Coasts, Southeast Black Sea / Sürmene Kıyılarında Kaba Çöpler <b>Neira Purwanty ISMAIL, Koray ÖZŞEKER, Yahya TERZİ, Nurettin BAŞKAN, Coşkun ERÜZ, Fatma TELLİ KARAKOÇ</b>
ML-5	Solid Waste Pollution in The Manahoz Stream, Southeast Black Sea / Manahoz Çayında Katı Atık Kirliliği <b>Neira Purwanty ISMAIL, Koray ÖZŞEKER, Yahya TERZİ, Nurettin BAŞKAN, Coşkun ERÜZ, Fatma TELLİ KARAKOÇ</b>
ML-6	Marine Litter Pollution in The Of Coasts, Southeast Black Sea / Of Kıyılarında Deniz Çöpi <b>Neira Purwanty ISMAIL, Koray ÖZŞEKER, Yahya TERZİ, Nurettin BAŞKAN, Coşkun ERÜZ, Fatma TELLİ KARAKOÇ</b>
ML-7	Behavioral and Informative Changes of The Trainees After Training Sessions Organized Under the LitOUTer Project / LitOUTer projesi kapsamında Organize Edilen Eğitimler sonrası Eğitim Alanlarda Davranış Değişimi <b>Ertuğ DÜZGÜNES, Fatma TELLİ KARAKOÇ, Coşkun ERÜZ, Neira Purwanty ISMAIL</b>
ML-8	The Presence of Microplastic in Pelagic and Benthic Fishes Along the Giresun Coast / Giresun Kıyıları pelajik ve bentik balıklarda da Mikroplastik Varlığı

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	<b>Murat KODAT, Handan AYDIN, Yalçın TEPE</b>
ML-9	Spatial Distribution of Cetaceans and Marine Litter in The Romanian Waters / Romanya Kıyılarında Deniz memelileri ve Deniz Çöprü Dağılımı <b>Costin TIMOFTE, Marian PAIU, Angelica PAIU, Lavinia VOICULESCU</b>
ML-10	Beach Macro Litter Assessment in Romania – LitOUTer Field Study (2021) / Makro Çöplerin Romanya Plajlarındaki Durumu: LitOUTer Çalışması (2021) <b>Angelica PAIU, Anca-Maria PANAIT, Romulus-Marian PAIU, Costin TIMOFTE, Andreea Stefania IONASCU, Patricia TOMASIAN, Lavinia VOICULESCU</b>
ML-11	Why Legal Regulations and Sanction Do Not Stop the Litter Pollution / Neden Yasal Düzenlemeler ve yaptırım Deniz Çöprü Kirliliğini Önlemiyor? <b>Fatma TELLİ KARAKOC</b>
ML-12	Fishing Materials that Cause Pollution in Trabzon Provincial River and Marine Environment / Trabzon İli Akarsu ve Deniz Çevresinde Kirliliğe Neden Olan Balıkçılık Malzemeleri <b>Bayram SANCAR, Osman ŞENTÜRK, Muhammet Ali ALTUN, Aytekin AYDIN</b>
ML-13	The impact of microplastics on aquatic organisms: A review / Mikroplastiklerin Sucul organizmalara Etkileri <b>Hacer SAĞLAM</b>
ML-14	Marine Pollution in the Eastern Black Sea: Wastewater and Solid Waste Status / Doğu Karadeniz Bölgesi'nde Karsal Kökenli Deniz Kirliliği: Atıksu ve Katı Atık İşletmesi Örneği <b>Osman ÜÇÜNCÜ, Muhammet BORAN</b>
ML-15	Waste Occurred on Ships and Methods of Disposal of Waste Under the MARPOL 73/78 Convention / MARPOL 73/78 Sözleşmesi Kapsamında Gemilerde Oluşan Atıklar ve Atıkların Bertaraf Yöntemleri <b>Alevna ULUCUTSOY, Betül SARAC</b>



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## INVITED SPEAKER PRESENTATIONS



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## PILOT ACTIVITIES ON FIGHTING MICROPLASTICS AND MARINE LITTER IN THE BLACK SEA

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### ABSTRACT

The Black Sea React! - Pilot innovative solutions for fighting marine litter in the Black Sea research project aims to contribute to the regional dialogue on mitigating and effectively tackling marine pollution and marine litter, while at the same time seeking innovative solutions to salient problems.

The project is co-funded by the European Commission under Grant Contract ENI/2020/421-957, coordinated by the Permanent International Secretariat of the Black Sea Economic Cooperation Organization (BSEC PERMIS).

The project's activities pilot an innovative circular economy solution to marine (plastic) litter by involving local fishermen and a coastal municipality from the Black Sea region. In parallel, it develops a strong and positive narrative on marine litter prevention targeting specifically young people. Provided the pilot is successful, the proposed activity will ultimately strive to promote a follow-up joint action involving various coastal municipalities from the BSEC Member States to tackle marine litter.

The target group involves municipalities from the Black Sea littoral countries, fishing communities from Sariyer Municipality of Istanbul (Türkiye), and young people and primary school students from all littoral countries.

It runs under the coordination of the Permanent International Secretariat of BSEC (BSEC PERMIS) in cooperation with the International Centre for Black Sea Studies (ICBSS), the GAMA Recycle A.S., and the Municipality of Sariyer. The USA Consulate in Istanbul is Associated Partner.



## MANAGEMENT OF MARINE LITTER IN TÜRKİYE

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### ABSTRACT

The coastline of Türkiye faces significant environmental problems due to industrial facilities established as a result of dense industrial activities in coastal regions, urbanization concentrated especially in coastal areas, tourism activities, maritime transport, and domestic and industrial pollution from inland areas via surface waters. Marine litter is considered as a global problem as it threatens the oceans, seas, and river basins. Because of these impacts, marine litter is one of the priority issues both at the national and international levels. The Turkish national legislation developed to combat marine litter covers general technical solutions as well as public awareness activities countrywide.

**Keywords:** Environmental legislation; marine litter; marine debris; zero waste; zero waste blue

### 1. INTRODUCTION

Marine litter poses threat to health, the environment, and the economy. In order to combat the marine litter problem, provincial action plans are prepared and implemented in all coastal provinces of Türkiye since 2020. Provincial action plans to combat marine litter is prepared for 5 years by commissions chaired by the respective Governors of the province, with contributions from different stakeholders such as relevant institutions and non-governmental organizations. These action plans cover; the determination of areas that pose a risk in terms of marine litter, research, monitoring and evaluation studies, development of region-specific solutions, identification of waste sources and their current situation, plans on how to prevent a generation of waste, clean-up activities and also public awareness-raising activities. Moreover, Zero Waste System is an environmental movement set out to prevent and reduce waste generation, collect waste separately at the source, recycle and save raw materials as well as energy. After the implementation of the Zero Waste System, it is observed that it is necessary to expand the applications to cover the water and marine environment. Therefore, the Zero Waste Blue initiative was implemented to support the protection of marine and water bodies, and carry out countrywide public awareness-raising and training activities.

### 2. MATERIALS AND METHODS

The national environmental legislation is reviewed and the rules related to marine litter are summarized. In addition, the studies are conducted by the “Turkish Ministry of Environment, Urbanization and Climate Change, General Directorate of Environmental Management”.

### 3. RESULTS AND DISCUSSIONS

The fact that, despite all measures and actions taken, waste reaches seas and coasts through various ways and forms of marine litter. It is therefore essential to plan new measures, such as prevention of waste at source and clean-up activities in order to reduce the damage of present marine litter. The Zero Waste System, Zero Waste Blue initiative, and provincial action plans for marine litter are the main methods applied to combat the marine litter problem in Türkiye. The solution marine litter problem requires a multi-disciplinary perspective and further studies may be developed with this view.

### REFERENCES

Circular on Preparation and Implementation of Marine Litter Provincial Action Plans (dated 10.06.2019 and numbered 2019/09)

## THE IMPACT OF THE LITOUTER PROJECT ON THE PARTNER COUNTRIES IN THE BLACK SEA

Fatma Telli KARAKOÇ<sup>1</sup>, Coşkun ERÜZ<sup>1</sup>, Ertuğ GÜZGÜNEŞ<sup>1</sup>, Hacer SAĞLAM<sup>1</sup>, Neira Purwanty ISMAIL<sup>1</sup>, Koray ÖZŞEKER<sup>1</sup>, Yahya TERZI<sup>1</sup>, Sercan EROL<sup>1</sup>, Nigar ALKAN<sup>1</sup>, Nurettin BAŞKAN<sup>1</sup>, David TSISKARIDZE<sup>2</sup>, Anca-Maria PANAIT<sup>3</sup>, Angelica PAIU<sup>3</sup>, Andreea Ştefania IONAŞCU<sup>3</sup>, Violin RAYKOV<sup>4</sup>, Dimitar DIMITROV<sup>4</sup>, Petya IVANOVA<sup>4</sup>, Ivelina ZLATEVA<sup>4</sup>, Elena STOICA<sup>5</sup>, Emma GILEVA<sup>6</sup>, Sabira STAHLBERG<sup>6</sup>, Mihaela KOZOVSKA<sup>6</sup>

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### ABSTRACT

The LitOUTer project (BSB-785) is supported by ENI CBC Black Sea Basin Programme 2014-2020 and is part of the European Union’s Cross Border Cooperation (CBC) under its European Neighborhood Instrument (ENI). The project has six partners from four Black Sea Countries. The partners are members of the universities and NGOs that are consisting of many professionals who use the best instruments to raise public awareness. Raising public awareness should feed on scientific research results. It is a bridge stretching from science to the public. The project has been built on the same activities in all partner countries. The reason for this is to analyze the cultural differences in producing a solution to the litter problems. During the project, there have been many activities with many different types of stakeholders.

**Keywords:** Black Sea, Public awareness, stakeholders, litter dispersion model

### 1. INTRODUCTION

There are many projects/studies run by the government, universities, and NGOs related to the marine litter issue. Legal baseline, environmental impacts, and economic impacts have been the main subjects to study. In addition to that, last year many institutions and NGOs have been focused on raising awareness activities on a national base. In the LitOUTer project, there are many actions have been done to raise public awareness of litter pollution and its impact on nature, health, and social life.

### 2. MATERIALS AND METHODS

In the project, there were many awareness methods used for raising public awareness. The selected methods were applied in all partners' target areas. These can be listed as;

1. Selection of the stakeholders (women, children, fishermen, decision-makers, etc.);
2. Selection of the measuring methods for their awareness level (Questionnaire);
3. Specification of the printed awareness materials according to the stakeholders;
3. A cartoon production for children special to this project /Documentary film;
5. Toys produced for the children /Play cards for the children;
7. Litter dispersion modeling /Produced dispersion model scenarios according to the wind direction;
8. Training activities / Field studies /Open-air exhibition;
9. Internal discussion platforms such as workshops and partner meetings /Symposium.

### 3. DISCUSSIONS AND CONCLUSIONS

The main outputs of the project can be mentioned as;

1. The most enthusiastic groups among the stakeholder were children, women, and clergy;



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2. The most affected target group from the marine litter is fishermen. Fishermen might be harmed by the litter which was produced by other sectors but they may also harm their environment where they earn economic gain with ghost nets;
3. The level of knowledge is quite enough. Although the awareness of the litter problem is very low, the habit of the public to produce litter is very high;
4. Decision maker is a key stakeholder to supply legal sanctions and infrastructure requirements;
5. Decision-makers should listen to the public requirements and take an action to support them;
6. Government should teach the villager how to make a composition from organic waste.

## **REFERENCES**

BSB 785 LitOUTer Project



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## MARINE LITTER MONITORING STUDIES IN TÜRKİYE

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### ABSTRACT

Marine litter is a growing environmental problem, which has global, ecological, social, and economic impacts. In Türkiye, the Ministry of Environment, Urbanization and Climate Change has implemented the National Marine Pollution Monitoring Program with the coordination of TÜBİTAK Marmara Research Center according to the requirements of the Bucharest and Barcelona Conventions and national legislation. The program supports marine and coastal management policy development and its implementation. The Program involves marine litter monitoring components since 2013. Indicators like; microplastic in sediment, surface water, water column and litter amount in seafloor, litter washed ashore and/or deposited on coastlines are monitored in pilot scales within the program.

**Keywords:** Marine litter monitoring; macro litter; microplastic monitoring; regional marine conventions

### 1. INTRODUCTION

The increased usage of plastic materials in modern life caused inevitably the spread of marine litter and this pollution now threatens marine life. Recent studies show that; any size and type of litter are found in all of the layers of the marine environment such as; on the beaches, in water column, sediment and also marine creatures. Regional and global actions have been taken against marine litter pollution. Monitoring activities have an important role to demonstrate information on the distribution, providing insight into the extent of the threat to marine ecosystems, economic and social impacts and lastly assessing the effectiveness of the measures taken by the countries as well as marine management policies.

### 2. MATERIALS AND METHODS

The national monitoring program covers various marine litter monitoring components; the indicators are in line with the Barcelona Convention framework and the EU Marine Strategy Framework Directive. Data quality and standardization are assured by using standard methods in national and international guidelines.

### 3. RESULTS AND DISCUSSIONS

Turkish marine monitoring program covers 4 seas and coasts of Türkiye; 97 stations in the Black Sea and a total network of 423 stations. Marine litter monitoring activities are done at pilot scale in most of the marine matrices. In 2016; a marine litter monitoring guideline was published to standardize sampling, analysis methods, and evaluation of analysis results to ensure data comparison and evaluation at national and international levels.

After the implementation of Zero Waste System, a charge for plastic bags is introduced in Türkiye. 2021 marine litter monitoring data shows that there is a significant decrease in the number of newly introduced shopping bags into the marine environment at the pilot monitoring stations of the Black Sea and coasts.

Another activity under marine litter monitoring is that, Türkiye has contributed to the UNEP/MAP marine litter monitoring guidelines and determination of threshold/baseline values in the Mediterranean Sea. In order to compare and evaluate data; threshold/baselines for macro and micro-litter for the Black Sea and coasts must be determined at the regional level. Besides; to reduce detailed monitoring studies which are both laborious and time-consuming; modeling of marine litter studies, to take preventive





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regional actions against marine litter pollution, decision support systems and tools providing studies should be increased.

## **REFERENCES**

National Marine Monitoring Program of Türkiye (2014-2016, 2017-2019, 2020-2022 Periods)

## MARINE LITTER MONITORING STUDIES ON BLACK SEA COAST OF TURKEY

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### ABSTRACT

Within the framework of the National Marine Pollution Monitoring and Evaluation Program of Turkey (DEN-İZ) supported by Ministry of Environment and Urbanization, the quantitative and spatial distribution of the macro litter (coastal, floating and bottom) monitored in the Black Sea coastal and transitional waters in 2018, 2019 and 2021 were presented. In addition to this, the results of the litter monitoring study carried out in 2019 in the Yeşilirmak and Sakarya river impact areas, which are among the working areas of the ANEMONE Project supported within the scope of the EU Cross-Border Cooperation Program, were emphasized. Plastics (over 90%) has been identified as dominant litter type in the river impact areas in question.

**Keywords:** Marine litter; Black Sea; National Monitoring Program of Turkey; River Influence Areas; ANEMONE project

### 1. INTRODUCTION

Considering the pollution caused by litter in the seas as an important social problem in the global context due to its environmental, economic, social, political and cultural consequences. Marine litter also raises new concerns in terms of human health and safety. This issue has been included in the 2030 Agenda for Sustainable Development and Strategic Development Goals by the UN General Assembly. “Marine Litter” is also included among 11 descriptors within the scope of the strategy to achieve “good environmental status” in European seas (MSFD 2008). In this presentation, quantitative criteria of the descriptor, such as; existence of beach litter, sea surface litter and seafloor litter will be mentioned with the implementation in Black Sea Coast of Turkey. The projects carried out within the scope of harmonization with the Marine Strategy Framework Directive and the directive's environmental management policies in our country will be mentioned and the activities on "monitoring", one of the important articles of the directive, will be explained.

### 2. MATERIALS AND METHODS

Within the framework of the National Marine Pollution Monitoring and Evaluation Program (DEN-İZ), the quantitative and spatial distribution of the macro litter (coastal, floating and bottom) monitored in the Black Sea coastal and transitional waters in 2018, 2019 and 2021. In addition, the results of the litter monitoring study carried out in 2019 in the Yeşilirmak and Sakarya river impact areas, which are among the working areas of the ANEMONE Project. Methods used in DEN-İZ program are given in the Table 1.

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### Marine Litter Monitoring Methods used in DEN-İZ Program

MSFD D-10 criteria	Methods/Assessments/References
Flotating Litter (C1-Primary)	-amount of litter >2.5 cm per km <sup>2</sup> surface layer of the water column -based on observations by experts on sailing vessels -estimation of abundance and intensity values in R, using distance package
Beach/Coastal Litter (C1-Primary)	-per 100 meters (m) on coastline, > 2,5 cm litters (number and weight per category) -Clean Coast Index (CCI)
Sea Bottom Litter (C1-Primary)	Litter on seabed obtained by trawling operation -MEDITS protocol, in 9 categories

### 3. RESULTS AND DISCUSSION

The western Black Sea coast especially Sakarya River mouth exposed to an important amount of marine litter pollution (Stoica et al. 2020). Plastics (over 90%) has been identified as dominant litter type in the river impact areas in question. Within the scope of the monitoring studies carried out within the framework of the DEN-İZ Program, it has been determined that Rize Sarayköy Beach is in a “very polluted” class in terms of beach litter and contains plastic materials both in number (96%) and weight (72%). it was also observed that the amount of floating litter increased as one went to the east, especially between Samsun-Çarşamba, Ordu and Rize and Hopa, and the amount of floating garbage increased and was predominantly plastic. It can be said that the seafloor macrolitter is mainly plastic and rubber (rubber). Higher amounts of seafloor litter were observed in western Black Sea than the Eastern part. It was calculated that 14-21 % of the stations are higher the UNEP operational targets (Yıldız et al. Eds., State of the Environment Report, Turkey-Black Sea 2021) (Fig.1). Monitoring studies are very important to identify sources and take necessary action to reduce the litter from the sources.

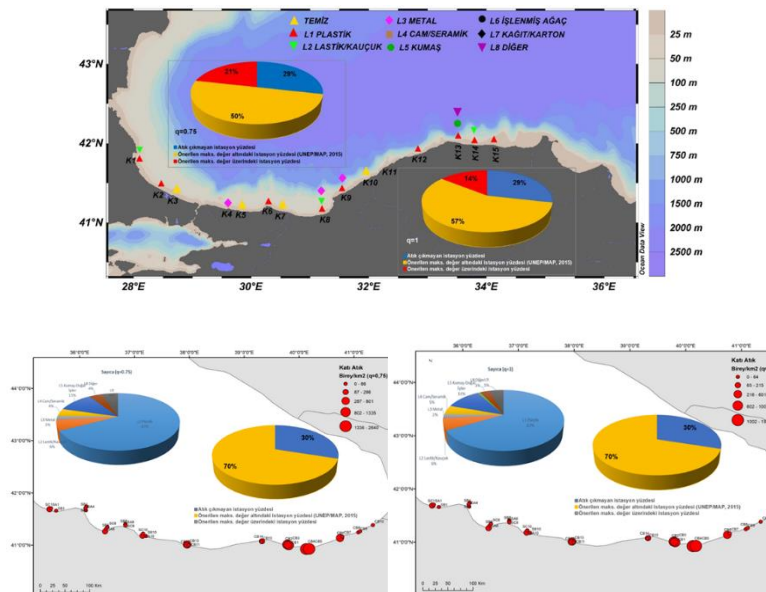


Fig.1 Seafloor solid waste distribution in Eastern BS of Turkey (2019 data of DEN-İZ Project). Red Pie diagram (red: above max value, yellow: below max value; blue: no litter)



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## REFERENCES

- Aytan, Ü. Sahin, F.B.E., Karacan, F. (2020) Beach litter on Sarayköy Beach (SE Black Sea): Density, composition, possible sources and associated organisms. *Turkish Journal of Fisheries and Aquatic Sciences* 20(2): 137-145.
- Bertrand, J., A. Souplet, L., Gil de Soula, G., Relini, C., Politou. 2007. International bottom trawl survey in the Mediterranean (Medits), Instruction manual, Version 5. pp. 62.
- Galgani, F., Hanke, G., Werner, S., De Vrees, L. Marine Litter within the European Marine Strategy Framework Directive. *ICES Journal of Marine Science*, 70: 1055–1064
- Galgani, F., Hanke, G., Werner, S., Oosterbaan, L., Nilsson, P., Fleet, D., Kinsey, S., Thompson, R., van Franeker, J., Vlachogianni, T., Scoullou, M., Mira Veiga, J., Palatinus, A., Matiddi, M., Maes, T., Korpinen, S., Budziak, A., Leslie, H., Gago, J. and Liebezeit, G. (2013). Monitoring Guidance for Marine Litter in European Seas. JRC Scientific and Policy Reports, Report EUR 26113 EN, (p. 120). <http://publications.jrc.ec.europa.eu/repository/handle/JRC83985>
- JRC - Guidance on Monitoring of Marine Litter in European Seas (EU MSFD TG10, 2013)
- Yildiz, Y. Ç., Donertaş, A.S., Demirtaş A., State of the Environment Report (in Tr) 2021. Türkiye Deniz Çevresi Stratejisinin Oluşturulması Projesi (2019-2021) 5188704. Prepared for the Ministry of Environment and Urbanization, General Directorate of Environmental Management.
- Marine Strategy Framework Directive, 2008/56/EC and Revised Community Decision (EU) 2017/845 and 848
- Marine Litter Assessment in the Mediterranean UNEP 2015 ISBN No: 978 -92 -807 -3564 2
- Ministry of Environment, Urbanization and Climate Change, TUBITAK Marmara Research Center (2022). “Integrated Marine Pollution Monitoring 2020-2022 Programme: 2021 The [Black](#) Sea Report, TÜBİTAK-MRC Press, Kocaeli.
- Stoica E., Atabay H., Bat L., Ciuca A., Creanga S., Martin D., Öztekin A., Tanase M., Tolun E., Marin litter occurrence in the river influenced Black Sea coast. In Aytan, Ü., Pogojeva, M., Simeonova, A. (Eds) 2020, Marine Litter in the Black Sea. TUDAV Publication No: 56, İstanbul Turkey
- Topçu, E.N., Tonay, A.M., Dede, A., Öztürk A.A. and Öztürk, B. (2013). Origin and abundance of marine litter along sandy beaches of the Turkish Western Black Sea coast. *Marine Environmental Research*, 85: 21–28.
- Veiga, J.M., Fleet, D., Kinsey, S., Nilsson, P., Vlachogianni, T., Werner, S., Galgani, F., Thompson, R.C., Dagevos, J., Gago, J., Sobral, P. and Cronin, R.; 2016; *Identifying Sources of Marine Litter. MSFD GES TG Marine Litter Thematic Report*; JRC Technical Report; EUR 28309; doi:10.2788/018068



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## NGO MARINE LITTER ACTIVITIES

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**Keywords:** Marine ecology education; Marine litter; sea waste collect; zero waste; plastics

### 1. INTRODUCTION

80% of marine pollution is human related. As a consequence of daily activities of people, thrown wastes are dragged on to seas by rain, underground waters and wind. Single use only products along with disposable habits constitute vast majority of the pollution. With the Covid-19 pandemic, usage of the disposable products increased correspondingly, and pollution on the seas which are considered 50% to 70% oxygen source of the world has risen at the same time.

### 2. MATERIALS AND METHODS

Simultaneous shore and bottom cleanings were carried out in different regions of Turkey. With the TURMEPA Waste Collection Boats, wastes collected from the boats during the summer months. Within the scope of the existing training protocol with the Ministry of National Education, marine ecology training suitable for all age groups was given, pre-test and post-test were made to the participants, and the results are recorded.

### 3. RESULTS AND DISCUSSIONS

Plastic is the most common type of waste we encounter in simultaneous shore and bottom cleanings in different regions of Turkey. When the pre-test and post-test results of the trainings we conducted were evaluated, it's observed that most of the participants did not know that 50-70% of the oxygen we breathe came from the sea. And also, that observed the most common type of waste they encountered in the sea was plastic.

### 4. CONCLUSIONS

With the coastal and bottom cleanings carried out by TURMEPA waste collection boats and volunteers, a total of 43.000.000 liters of liquid waste and 2.770.000 tons of solid waste were prevented from being mixed into the sea. With the TURMEPA environmental trainings, that one of the two breaths humans took came from the sea told to 8.550.000 people. Citizens were informed about the harm caused by single-use plastic to the seas with awareness activities.

### REFERENCES

- DenizTemiz Derneği/TURMEPA Faaliyet Raporu (2021)
- NOAA (Feb, 2021), How much oxygen comes from the ocean.
- UNFCCC SBSTA Dialogue on the Ocean and Climate Change to Consider How to Strengthen Mitigation and Adaptation Action, (Nov, 2020)



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## **SESSION 1: ECOLOGICAL IMPACTS AND SOURCES OF MARINE LITTER POLLUTION**

## WORKS ON IDENTIFICATION AND CLEANING THE PORT AREA FROM MARINE LITTER

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### ABSTRACT

The Black Sea, like other water bodies, suffer from marine debris. Every year, several million tons of plastic enters the world's oceans, which damages biodiversity, spreading diseases and toxins. Part of the fishing gear is lost or deliberately thrown into the sea, which is a significant part of all marine debris. From the beach into the sea, the wind carries various household waste (plastic, nylon). The purpose of the study is to bring people closer to the problem of garbage, to the environment and to try to restore the natural balance "man – nature". This is the path to significant change - much more than cleaning up the port area. We propose to apply the method of cleaning the water areas with the involvement of students and watercraft of the Batumi Port, following the scheme of actions developed by us: 1) characteristics: a) pollution of the port water area with marine litters; 2) technical means for garbage collection; 3) methods of cleaning water areas; 4) hydrometeorological conditions; 5) safety measures during the cleaning of water areas.

**Key words:** port area; marine litters; student; monitoring.

### 1. INTRODUCTION

One of the global problems of our planet is the ecological and aesthetic deal with household waste. Most of the garbage is made up of the subject items related to various human entertainment: cigarette butts, wrapping paper and caps, bags, boxes and bags, plastic and glass bottles, various utensils, cocktail straws, tin cans, etc.

The purpose of our work is to determine how serious the problem of household waste is in the water area of the port of Batumi. To do this, we gathered a group of interested students and together with them set ourselves the following tasks:

- classification of marine wastes;
- calculation of household waste;
- Methods and procedures for cleaning up water areas;
- the issue of disposal of these waste procedures

### 2. MATERIALS AND METHODS

There is a serious problem of marine pollution, but there are ways to solve it. The subject of our study is household waste entering water bodies. The following methods were used in the research process: observation, comparison, statistical processing method, analysis of information sources.

### 3. RESULTS AND DISCUSSION

**Environmental safety** – waste monitoring by using modern technologies will allow us to reduce the pollution of the Black Sea.

**Clean coast** – in addition to preventing health conditions, also creates a basis for attracting more tourists, which is prerequisite for the economic development of our region.

**Motivation and engagement** – we will use educational resources to help students make a personal contribution to cleaning up the Black Sea coast.

**Material side** – by further utilization of the waste, we will have the opportunity to produce personal safety and hygiene products, which we will use not only for marine purposes, but also for various purposes.



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**Popularization** – Raising the awareness of the public through the dissemination of information in general educational institutions about the significant improvement of the ecological condition of the Black Sea. Taking preventive measures is easier than restoring the polluted environment to its original state.

#### REFERENCES:

- Diasamidze M., Shotadze A., „Study of water treatment technologies”, IAMU AGA22, the 22nd Annual General Assembly, 19-21 October 2022;
- Diasamidze M., Shotadze A., „Renewable energy sources in maintaining environmental stability on the Black Sea coast”, E3S Web of Conferences 250, 05001 (TRESP 2021);
- Diasamidze M., Shotadze A., „Experimental study of Pollution by oil and oil products in the Batumi port area”, International Academy Journal web of Scholar, Poland, 3(33), March 2021, pp. 20-24;
- Diasamidze M., Shotadze A., „Experimental study of pollution by oil and oil products in the Batumi port area”, XVI International scientific-technical conference on „Water Transport Problems”, Proceedings of Azerbaijan State Maritime Academy, №1, Baku, 2021, pp. 176-183;
- Diasamidze M., Shotadze A., „Ballast water management and their system processing”, Fundamental and applied research in practices of leading scientific schools, Croatia, 2019, V.31, № 1, pp. 58-60.





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## AN AWARENESS STUDY ON ENVIRONMENTAL POLLUTION CAUSED BY BUILDING MATERIALS USED IN CONSTRUCTION: THE CASE OF ARTVIN, ARHAVI

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### ABSTRACT

This study focused on the amounts and types of waste which are producing environmental pollution problems, discarded during the construction phase of the buildings. In this context, the research was carried out with a multidimensional perspective covering different disciplinary fields such as ecological awareness, sustainability, architectural practice, and economy and aimed to form a basis for related fields.

**Keywords:** Building waste; sustainability; environmental awareness, recycling; architecture

### 1. INTRODUCTION

The wastes generated during the construction of buildings are among the heaviest and most bulky solid debris (Coşkun and Öztürk, 2012). These wastes pose a severe threat to both the environment and human health. Various measures have been taken, and policies have been developed to reduce the rates of construction waste and, consequently, their damages. However, due to multiple problems in implementing penalties, it may be much more effective to raise the sector's awareness of environmental protection.

After the ratification of the law "the Urban Transformation Law" by The Ministry of Environment and Urbanization-Department of Waste Management reported that the 45 million tons of structural waste generated annually in Turkey will be reduced to 10 million tons in the first three years.

According to the report prepared by the Waste Management Presidency of the Ministry of Environment and Urbanization, it is determined that the 45 million tons of structural waste generated annually in Turkey will be reduced to 10 million tons in the first three years within the scope of the Urban Transformation Law. The material to be recycled will be 6 million tons (Kılıç, 2012). As a result, structural wastes should not be seen only as a problem of the architectural discipline but also are being constituted a significant threat to the environment, wellness, and economy.

### 2. METHODOLOGY

Within the scope of this study, a group of volunteer lecturers and students of Artvin Çoruh University Faculty of Art and Design visited the new construction sites. These areas are under construction in Arhavi district. A field study is conducted for awareness of the types of solid wastes generated by the pollution caused by the materials used in construction as well as the personal materials of the employees during the construction phase. Structural solid wastes in the immediate vicinity of the construction site were categorized and processed on pre-prepared questionnaire forms. Statistical methods then analyzed these data. At the end of the study, it was determined that there is a wide variety and a significant number of waste materials.

### 3. RESULTS AND DISCUSSIONS

The study determined that there is a significant amount of construction waste around the construction sites. It has been observed that the students who carried out the investigation have become aware of construction waste by seeing the variety and amount of existing waste. Ideas were exchanged about the deficiencies of the construction site and how to prevent them. It has been determined that there is no practice to minimize waste in this construction site, organic debris and solid wastes are not regularly stored in designed areas, and wastes suitable for recycling are not recycled. It is thought that architects,



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who are decision-makers or practitioners in project construction and implementation in the construction sector, should be aware of this issue starting at the studenthood stage. They should be raised by questioning "how to reduce waste production", "how to recycle", and "how to reduce the environmental and economic damage" during construction.

### REFERENCES

- Coşkun, H. ve Öztürk, M. (2012). Katı Atık Yönetimi Konusunda İnşaat Sektörü Paydaşlarının Algılamaları: Hatay İli Örneği. *New World Science Academy Engineering Science*, 7/1
- Kılıç, N. (2012). Kentsel Dönüşümde Geri Dönüşüm Atağı. *AR-GE Bülten*, Aralık <https://www.yumpu.com/tr/document/view/23618086/kentsel-donusumde-geri-donusum-atagi-nurel-kilic>



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## THE ROLE OF PLASTIC WASTE OF THE NORTHWESTERN BLACK SEA COASTAL ZONE IN THE POLLUTION FORMATION OF THE BLACK SEA BY MARINE LITTER

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### ABSTRACT

The study presents the results of an assessment of the plastic waste area in the coastal zone of the North-Western part of the Black Sea. Using the method of system analyses defined their role of pollution formation.

**Keywords:** Municipal solid waste; plastic; marine litter; sources of pollution.

### 1. INTRODUCTION

The aim of the study is to assess the extent of plastic waste generation in the coastal zone of the Northwestern part of the Black Sea and its potential role in the formation of marine litter in the waters of the Black Sea.

### 2. MATERIALS AND METHODS

The methodological basis of the work is a critical analysis of the existing information on the scale of the generation of waste plastic materials in the coastal zone of the Northwestern part of the Black Sea in connection with the assessment of their possible contribution to the formation of marine litter in the Black Sea water area.

### 3. RESULTS AND DISCUSSIONS

The annual volume of solid waste in the North-Western Black Sea region can reach 2.5 million tons per year, and the volume of plastic litter – is up to 323 thousand tons per year. In spite of plastic litter as a resource, at present, there is no definite system for handling them, and under these conditions, they are disposed of at numerous dumps (including unauthorized ones) of solid domestic wastes. A significant part of plastic (up to 80 %) from unorganized landfills and from other coastal pollution sources is carried out by air and water flows in the water area of the Northwestern part of the Black Sea. Approximately 83 % of marine litter in the Black Sea is plastic. In turn, the presence of marine litter is associated with the non-proper solid waste management system. The dominant way of waste management is their removal and disposal in landfills. As of 2019, in the Odesa region, there were 528 landfills, in the Nikolaev region – 267, and in the Kherson region – 54. Almost 17 % of landfills in the Odesa region and 26 % in the Nikolaev region do not comply according to environmental hazard standards. A significant part of the plastic litter, first of all from unauthorized solid waste dumps, is carried by air flows into the river network, and if they are close to the beach area, directly into the Black Sea. Plastic litter is carried out from the catchment areas of the large rivers (Danube, Dniester, Southern Bug, and Dnieper), as well as water intakes of numerous medium and small rivers. Almost the whole beach area of the North-Western part of the Black Sea is actively used for recreational purposes and, therefore, is a source of beach waste. In addition, the coastal sources of garbage can be settlements, marine complexes, and agricultural lands located along the coastal line. An insignificant share of plastic litter is generated within the sea area (from shipping, fishing, etc.).

### 4. CONCLUSIONS

The main component of marine litter is plastic, as it accounts for 83 % of marine litter found in the Black Sea. Macroplastics can be subject to long-term movement by sea currents, winds, and waves and poses



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a direct threat to the marine ecosystem. Directions of movement of marine litter depend on the processes of general circulation in the surface layer (0-500 m) of the Black Sea. The processes of biodegradation of macroplastic are hindered in the marine environment, and therefore its transformation is limited by the processes of destruction and dispersion in micro- and nanoparticles. Taking into consideration the environmental hazard of microplastics, it is advisable to create a system for monitoring in the marine environment. To improve the environmental situation in the coastal zone of the North-Western part of the Black Sea, it is necessary to significantly increase the volume of recycled plastic litter, as well as to eliminate numerous landfills for solid household waste that do not accord to environmental safety requirements.

## SEASONAL CHANGE OF SOLID WASTE COMPOSITION ON TRABZON (ORTAHISAR) BEACHES

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**Keywords:** Marine Litter; Beach; COVID-19; plastic

### 1. INTRODUCTION

The effect of the recent technological developments in the world and the rapid increase in production is a major environmental problem in our region in terms of human-induced solid waste/marine litter pollution. In addition, due to the COVID-19 pandemic, disposable personal protective equipment (gloves, masks, goggles, aprons, etc.) has become mandatory and these materials are left unconsciously, increasing the pressure of marine litter pollution on the environment (Cerim et al. 2014; Vişne 2015; Terzi et al. 2020; Özşeker et al. 2022).

### 2. MATERIALS AND METHODS

Marine litter sampling was carried out on seasons in 2021 from three stations located on the beaches of the Ortahisar district of Trabzon. Physical conditions ranging from 25 m<sup>2</sup> to 100 m<sup>2</sup> such as beaches, embankments, and streams were taken into account in the selection of stations.

### 3. RESULTS AND DISCUSSIONS

The highest densities in number and weight were recorded at station O3 (autumn; 33,46 items/m<sup>2</sup>; 288,58 g/m<sup>2</sup>). Plastic was the most abundant waste material in terms of the number of parts, with a percentage contribution varying between 30% and 90% at all stations. In addition, a significant increase in medical supplies was observed during the COVID-19 pandemic. The difference between the seasons was caused by plastic and medical waste. The main sources of marine litter were river transport (32.11%), recreational and tourism activities (30.50%), improper disposal (17.85%), and others (19.54%).

### 4. CONCLUSIONS

The results of our study can be a basis for transport models, local governments, and non-governmental organizations. In addition, it is noteworthy that the COVID-19 pandemic affects the composition of marine litter and creates negative effects on the environment by increasing its abundance in the study area.

### REFERENCES

- Cerim H, Filiz H, Gülsahin A, Erdem M (2014) Marine Litter: Composition in Eastern Aegean Coasts. OALib 01:1–7. <https://doi.org/10.4236/OALIB.1100573>
- Özşeker K, Terzi Y, Erüz C (2022) Solid waste composition and COVID-19-induced changes in an inland water ecosystem in Turkey. *Environ Sci Pollut Res* 29:54596–54605.
- Terzi Y, Erüz C, Özşeker K (2020) Marine litter composition and sources on coasts of south-eastern Black Sea: A long-term case study. *Waste Manag* 105:139–147. <https://doi.org/10.1016/J.WASMAN.2020.01.032>
- Vişne A (2015) Evaluation of Marine Litter on the Marine Strategy Framework Directive and Current Status in the Black Sea. *J Aquac Eng Fish Res* 1:104–115.



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## MARINE LITTER SURVEYS AND CITIZEN SCIENCE – ANEMONE PROJECT EXPERIENCE

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### ABSTRACT

Marine litter is recognized as a worldwide rising pollution problem affecting all the oceans and coastal areas of the world and the Black Sea is not an exception. However, there is insufficient data to evaluate marine litter. Investigation of river-influenced beaches from Romanian and Turkish Black Sea coast have been done to reveal the transportation of land-based litter items through rivers. Surveys on the sea surface micro- and mesolitter distribution from the south-western part of the Black Sea were performed as part of integrated research cruises done during the project. In addition, marine litter case studies were conducted in Bulgaria, Turkey and Ukraine. The results of these studies, implemented with the help of citizens, represent the ground of the educational and awareness-raising campaigns focusing on real data collected from the field, analyzed, and transposed for public acknowledge. The direct involvement of the citizens in the marine litter monitoring process raises awareness of the current issue in a scientific way.

**Keywords:** Marine litter, citizen science, Black Sea

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## THE FIRST EFFORT OF USING A MARINE MAMMAL AERIAL SURVEY PLATFORM TO COLLECT MARINE LITTER DATA IN THE BLACK SEA

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### ABSTRACT

Marine litter/debris is one of the major threats to the water bodies (lakes, rivers, marine, and oceans) ecosystems. In the past years, it is researched and recorded within different frameworks, from Bucharest Convention to the Marine Strategy Framework Directive (MSFD) also in the Black Sea. Under MSFD, Descriptor 10 - the marine litter is used to establish the Good Environmental Status of the ecosystems (GES). During the CeNoBS project, in the aerial survey missions performed over the Black Sea collecting marine mammal data, 4608 floating macro litter items were recorded, and categorized into three material types and 3 sizes, with the objective of creating the first database of its kind.

**Keywords:** Marine litter; CeNoBS; MSFD; Black Sea; basin-wide survey

### 1. INTRODUCTION

Marine litter is a recognized problem of the environment, both on land and water (E.U. MSFD - Directive 2008/56/EU and Decision 2017/848/EU; ACCOBAMS Resolution 7.15). Little is known about the extent of the problem in the Black Sea regarding the distribution and abundance. Being for some time on the agenda of both the Black Sea Commission and the European Commission, within the project we performed a survey on this descriptor towards a quantitative assessment of debris floating on the water or near the surface and identifying the distribution along the surveyed transect strips.

### 2. MATERIALS AND METHODS

The aerial survey has been conducted following line transect distance sampling methodologies (Buckland et al., 1993), using two small planes equipped with two engines, high wings, and bubble windows, to allow the vertical view by the observers (one on each side). Flights have been conducted during the daytime, with good weather conditions, at an altitude was 183 m and a speed of 100 knots, recording data using SAMMOA software (SAMMOA 1.1.2, 2017-2018).

Observations were made through so-called bubble windows allowing a direct view of the track line below the plane and recorded on a laptop through the SAMMOA dedicated software. The plane position, speed, and altitude were continuously recorded through a GPS connected to the laptop.

### 3. RESULTS AND DISCUSSIONS

The survey was performed over 6 blocks, on 60 transects within the waters of Bulgaria, Georgia, Romania, Türkiye, and Ukraine, along 7323 km of transects were recorded: 4349 plastics, 102 wood, and 157 pieces of unidentified marine litter items.

The number of recorded marine litter items exceeded by far the number of marine mammal sightings collected. Distribution of it, at a first sight, looks uniform all over the Black Sea, and further analysis of the data by modeling is necessary to understand the real distribution and the factors responsible for it.

### REFERENCES

SAMMOA 1.1.2. Système d'Acquisition des données sur la Mégafaune Marine par Observations Aériennes, Software developed by UMS 3462 Pelagis LRUniv-CNRS and Code Lutin (2012-2019).  
Buckland, S.T., Anderson, D.R., Burham, K.P., Laake, J.L. 1993. Distance Sampling: Estimating Abundance of Biological Populations. New York-London, Chapman and Hall, 446 p.



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<https://accobams.org/conservations-action/marine-debris/>

<https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32008L0056&from=EN>





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## LITTER ‘HOTSPOT’ MAPPING IN THE MANAHOZ STREAM; A PRELIMINARY STUDY TO DETERMINE MARINE LITTER SOURCE AND IMPROVING WASTE MANAGEMENT IN THE BLACK SEA REGION

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### ABSTRACT

The present study determines litter density distribution and litter hotspot mapping along the Manahoz stream and Sürmene-Of coasts. This study proposes a solution to reducing marine litter pollution from its source and enhancing awareness regarding marine litter by community engagement using GIS technology to protect the Black Sea ecosystem.

**Keywords:** Marine litter; clean-up; citizen science; GIS; Black Sea

### 1. INTRODUCTION

A growing amount of marine litter has negatively impacted the environment and humankind (Bergmann et al., 2015). Mitigation of marine litter pollution demand high energy and costs. Therefore, litter entering the marine environment must be prevented from its source, in particular preventing litter from riverine input. In this study, geospatial analysis was engaged to determine litter hotspots to provide an effective method for clean-up and better waste management in the Black Sea region. In addition, the present study proposes simple methods for litter hotspot mapping by employing citizen science and GIS techniques to raise awareness and reduce marine litter for the protection of the Black Sea ecosystem.

### 2. MATERIALS AND METHODS

In this study, the Manahoz stream has been elected as a pilot project for litter ‘hotspot’ mapping in the Black Sea. All anthropogenic litter in the stations was collected based on the OSPAR guidelines (Wenneker et al., 2010). Collected litter from 16 stations along the Manahoz stream and Sürmene-Of coasts was recorded with latitude and longitude information. Location and litter density data were then utilized for geostatistical analysis of litter hotspots in the area. Data analysis was performed using QGIS 3.26 with EPSG: 3857- WGS84/UTM 37N as a coordinate system.

### 3. RESULTS AND DISCUSSIONS

As a result, litter density by number in the study area ranged from 0.21 to 16.48 items/m<sup>2</sup>. Higher litter density was observed at the M2 and M4 for the stream station and S2 and O3 for the beach stations. Higher density reflects litter hotspots in the region. The hotspot map shows areas with a higher density of litter situated in the center of the study area which is associated with residential and recreational areas. These data can be used by policymakers and stakeholders to identify litter sources, optimize waste infrastructure and improve clean-up efforts in the area.

GIS technology is a useful tool to solve a common problem such as marine litter pollution. However, preventing litter from entering the marine litter environment requires various parties’ involvement. Engaging citizen science in litter hotspot mapping can be one of the solutions to raise public awareness and reduce marine litter by providing optimal clean-up efforts and better waste management in the area.

### 4. CONCLUSION

Marine litter pollution must be prevented from its sources. Litter hotspot mapping supports effective cleaning efforts and better waste management. In order to solve a common problem such as marine litter



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requires a common solution. GIS techniques can be utilized to improve public participation in raising awareness of and reducing marine litter pollution.

## **REFERENCES**

- Bergmann, M., Gutow, L., & Klages, M. (2015). Marine anthropogenic litter. *Marine Anthropogenic Litter*, 1–447. <https://doi.org/10.1007/978-3-319-16510-3>
- Wenneker, B., Oosterbaan, L., & Intersessional Correspondence Group on Marine Litter (ICGML). (2010). *Guideline for Monitoring Marine Litter on the Beaches in the OSPAR Maritime Area (1.0)*. OSPAR Commission. [www.ospar.org](http://www.ospar.org)

## PLASTIC OCCURRENCE IN THE ROMANIAN MARINE BIOTA: A CASE STUDY OF THE BLACK SEA

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### ABSTRACT

Plastic pollution has become a growing threat to the environment and marine species around the world. Filter-feeding organisms are of particular interest because they are directly exposed to plastic present in the water column (Li et al., 2015). Plastic ingested by marine birds is a good indicator of the state of the ecosystem that they live in. The marine biota of the Black Sea makes no exception to this threat. Our results show the presence, type, and quantity of plastic in mussels (*Mytilus galloprovincialis*) and marine birds (*Larus* sp. and *Phalacrocorax carbo*) from the Romanian coast of the Black Sea.

**Keywords:** Marine litter, plastic; pollution, biota, Black Sea.

### 1. INTRODUCTION

Plastic is an emerging pollutant and one of the most challenging types of marine litter once it reaches the sea, accumulating not only in the environment but also in marine biota. Any organism can be affected and apart from the physical risk posed by ingesting plastic, there are also threats related to ingesting hazardous chemicals from or absorbing onto the plastic's surface. The amount of plastic in marine organisms reflects the quality of their environment and is one of the MSFD goals. However, there is a lack of data on litter in the marine biota of the Black Sea. Our study emphasizes the need for establishing a monitoring program to properly mitigate plastic pollution in the Black Sea biota.

### 2. MATERIALS AND METHODS

Mussels (*Mytilus galloprovincialis*) were collected from three port areas and from one reference area of the Romanian Black Sea coast, then were measured, opened and the soft tissue was extracted and treated with hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) for the digestion of it. Digested tissue was mixed with saturated saline solution (NaCl) and filtered on a cellulose nitrate membrane filter. Microplastics were identified according to the physical characteristics of the particles, counted, and measured. Marine birds' carcasses, seagulls (*Larus* sp.), and great cormorants (*Phalacrocorax carbo*) were collected from the Romanian coastal area of the Black Sea and were subsequently dissected for stomach sampling, examination of the contents, and separation and characterization of the observed ingested plastics.

### 3. RESULTS AND DISCUSSIONS

The number of total microplastics found in the analyzed mussels varied from 18.89 to 69.89 items/individual. The highest mean abundance of microplastics per size class was observed in mussels of 2-3 cm (172.22 items), followed by those of 6-7 cm (160.40 items) and 7-8 cm (123.5 items). Fibers were the most representative type of microplastic (70%) in all samples, with spheres, and films being the least common type of microplastic found.

The percentage of frequency of occurrence (FO%) of seabirds that ingested plastic was FO= 29.41%. Ingested plastic belonged to all size categories as described by Barnes et al. (2009): micro-, meso-, macro-, and megaplastics, with microplastics being the most abundant type of plastic found (88,6%). The most numerous items were transparent items, followed by white and brown ones.



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## REFERENCES

- Barnes, D. K. A., Galgani, F., Richard C. Thompson, R. C., Barlaz, M., (2009) Accumulation and fragmentation of plastic debris in global environments, *Philosophical Transactions of the Royal Society, B*, 1–14
- Li, J Yang, D Li, L Jabeen, K Shi, H (2015). Microplastics in commercial bivalves from China *Environmental Pollution*, vol 207, pp 190-195.

## ECOLOGICAL SITUATION AND SOLID WASTE (LITTER) POLLUTION AT THE WATER RESOURCES OF KOLKHETI NATIONAL PARK GEORGIA

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**Keywords:** Kolkheti National Park; Marine Litter; Rioni Managed Reserve; Paliastomi Lake

### 1. INTRODUCTION

Due to growing effect of economic projects and technological developments in the Black Sea basin of Georgia. As well as pour waste water treatment system in Poti and human-induced solid waste/marine litter pollution. All this effects on the Black Sea marine environment. The Black Seas marine part, which is protected by the administration of Kolkheti National Park, belongs to a Strong zone of the National Park which is under a special regime (according to the Law on Protected Areas System of Georgia). One year ago, for the protection of the Black Sea biodiversity and Sturgeons population, the new Rioni reserve (on Rioni river) was established, which is managed by the Kolkheti National Park. It should be mentioned that during last 5 years quality and quantity data of Paliastomi Lake water little bit deteriorated.

### 2. MATERIALS AND METHODS

Presenting information about the ecological situation and solid waste (litter) pollution at water resources of Kolkheti National Park (Ramsar, Emerald and Unesco sites) collected from 4 different reports of scientific researches and routine monitoring materials of NEA during 2015-2020 yy period. Monitoring data for 2021 and 2022 is not available for the time being because they are in the process of analyses. These researches covered 3 main water objects (Black see part, Paliastomi lake and Rioni River) of the National Park and consist of hydrobiological and chemical monitoring data. Marine litter sampling was carried out in 2020 from three stations located on Rioni river (S. Chaladidi, Poti southern tributary and Poti northern tributary (near Nabada) [1]. Research of Palistomi Lake implemented in 2015, 2017 and 2019 years [2,3,4,5]. During 2015, 2017 yy samples were taken in 9 points of Lake (by NGO "Flora and Fauna), in last research was done on 4 points (by NEA) [1]. Administration of Park permanently conducts Biodiversity and water monitoring of the lake. In summer period during last 5 years high mortality of fishes is registered [7].

Researches of the sturgeon population started in 2014 and now it is ongoing [2,3,4,5]. Samples of water pollution were taken near every hydropower plant as well as along Rioni river. Sturgeons' samples were taken and in parallel water chemical analyzes were made.

### 3. RESULTS AND DISCUSSIONS

Ecological situation in the Black Sea part of Kolkheti National Park and in the Rioni river is little bit changed due to construction of a new infrastructure of the harbors and operation of hydropowers on the Rioni river. All this has a negative influence on the pour population of Sturgeon. Palistomi lake need some interventions and apply some technical works for conservation a local biodiversity [6.]. In addition, main causes of changing condition of the Palistomi lake are a significant increase of municipal waste waters through small rivers which are connected to the lake and pollution also flows from coastal waters through the channel, which effects on hydrobionts and changes local biodiversity [6].

### 4. CONCLUSIONS

The results of our study describe a next picture: one of the important steps in biodiversity conservation process is to establish a new Rioni river Managed reserve by the Ministry Environment Protection and



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Agriculture and Agency of Protected Areas. Protected with strong regime in Black Sea part, as well as strong zone of Kolkheti National Park decrease a negative influence on the local biodiversity and absolute necessity develops management plan for new protected area and implement special activities for remediation and rehabilitation of Paliastomi lake – unique ecosystem of Colchic lowland of Georgia, important Ramsar, Emerald and UNESCO site.

### REFERENCES

- NEA, 2020 years Annual report of Department of Environmental pollution monitoring. Water yearbooks of surface water on the territory of Georgia, Tbilisi, 2021, pp- 5-8.
- WWF- Programm office of Caucasus, NGO” Flora and Fauna, “The research of sturgeon species in Rion estuary and Black Sea coastal aquatoria, general assessment of ichthyofauna and study of associated parameters, 2014, Batumi, pp-1- 44;
- WWF- Programm office of Caucasus, NGO” Flora and Fauna, “The research of sturgeon species in Rion estuary and Black Sea coastal aquatoria, general assessment of ichthyofauna and study of associated parameters, 2017, Batumi, pp-1-55;
- WWF- Programm office of Caucasus, NGO” Flora and Fauna, WWF project, “The research of sturgeon species in Rion estuary and Black Sea coastal aquatoria, general assessment of ichthyofauna and study of associated parameters, 2018, Batumi, pp-1-55;
- WWF- Programm office of Caucasus., “Strengthening Sturgeon Conservation in Georgia”, 3 years, from 2021 through 2023 (WWF Switzerland), pp. 1- 15;
- NGO “Ecospectr”, Environmental Impact Assessment document, St. Project for the construction and of a new deep-water multi-purpose modern harbor in Poti”, Tbilisi, 2021, I pp.485-505;
- Annual report of Kolkheti National Park administration, Poti, 2017, 2018, 2019, 2020, 2021.

## POLLUTION AND BLACK SEA BIOTA: HOW MUCH IS TOO MUCH!

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### ABSTRACT

Oxidative stress biomarkers were measured in different target species of bivalves and fish from different localities of the Bulgarian Black Sea coast. Specific Oxidative Stress (SOS) index based on the ratio of the standardized data of pro- and antioxidant biomarkers was constructed and applied to assess the ecological state of the marine environment. SOS index indicated discrepancies in the ecological state of the marine water bodies, according to the Commission on the Protection of the Black Sea Against Pollution (2019). SOS indicated even bad ecological conditions compared to the moderate and good conditions estimated by the officially accepted indicators. In conclusion, it is necessary to include also stress indicators (oxidative stress) at the biochemical level in the assessment of the ecological state of Black Sea environment.

**Keywords:** Bulgarian Black Sea; bivalves; fish; oxidative stress index; ecological state

### 1. INTRODUCTION:

Black Sea is the drainage area of multiple industrialized countries (Aytan et al. 2020). In the last four decades, the Black Sea has suffered important changes induced by human activities. Waste from towns and cities, farms and factories flow into the Black Sea; some come directly from the coast, but most flows relentlessly from the region's major rivers, River Danube, Dnieper and Dniester (Bat et al., 2018). Traditionally, risk assessment of pollution concerned human health and was based mainly on marine water physicochemical analysis or contents of pollutants in sentinel marine organisms. However, studies on characteristic reactions of bioindicator organisms towards the pressure of multiple stressors in the Bulgarian Black Sea part are scarce (Yakimov, et al., 2020; Alexandrova et al., 2021). Here, results are presented of a number of recent researches on the specific stress-response reactions to multiple environmental stressors of different key species inhabiting the Bulgarian Black Sea part.

### 2. MATERIALS AND METHODS

Different target species were studied from different localities of the northern and southern Bulgarian Black Sea coast. Bivalves were gathered by diving from typical habitats and fish species were randomly sampled from trawl catches. Different oxidative stress biomarkers were measured including lipid peroxidation, glutathione, superoxide dismutase, catalase, acetylcholinesterase, glutathione peroxidase etc. A Specific Oxidative Stress (SOS) index based on the ratio of the standardized data of pro- and antioxidant biomarkers in indicator species was constructed and applied to assess the ecological state of the marine environment.

### 3. RESULTS AND DISCUSSION

Using the SOS index, we evaluated the ecological state of the marine environment from the view point of the biotic response of the indicator species studied to the local environmental conditions. Our data showed discrepancies in the assessed ecological state of the Bulgarian marine water bodies, according to Report of the Commission on the Protection of the Black Sea Against Pollution (2019).

The SOS index indicated the presence of even bad ecological conditions compared to the moderate and good conditions of the Bulgarian coast estimated by the official administration. In conclusion, it is necessary to include stress indicators of key marine organisms in the assessment of the Black Sea environmental state.



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## REFERENCES

- Alexandrova, A., N. Chipev, Y. Raev, E. Tsvetanova, A. Georgieva, V. Raykov. 2021. Is the Marine Environment of the Black Sea Stressful for Organisms: A Pilot Assessment of Oxidative Stress in Bulgarian Coastal Fish Species. *Ecologia Balkanika*. Special Edition 4: 163-172.
- Aytan, Ü., Pogojeva, M., Simeonova, A. (Eds.,) 2020. *Marine Litter in the Black Sea*. Turkish Marine Research Foundation (TUDAV) Publication No:56, Istanbul, Turkey. 361 pp.
- Bat, L., Öztekin, A., Şahin, F., Arıcı, E., Özsandıkçı, U. 2018. An overview of the Black Sea pollution in Turkey. *MedFAR*, 1(2):67-86.
- Yakimov, L., E. Tsvetanova, A. Georgieva, G. Nenkova, N. Chipev, A. Alexandrova. 2020. Comparative Analysis of the Oxidative Stress in Bulgarian Black-Sea Bivalves and their Bioindicator Potential. *Acta Zool. Bulg.*, Supplement 15: 147-153.

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## “DO YOU THINK PLASTIC POLLUTION AFFECT FISH IN VALLEYS OF SOLAKLI AND İKIZDERE BEING IMPORTANT WATER RESOURCES OF THE EASTERN BLACK SEA REGION IN TERMS OF TOURISM?”

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**Keywords:** Waste plastic; fish; pollution; Solaklı Çayı; İkizdere Çayı.

### 1. INTRODUCTION

Plastics are used in all areas of life, including health, because they are durable and cheap as packaging raw materials. Research warns that the use of plastics will double, especially in the next 5 years. Although the plastic forms used today are classified as environmentally friendly and degradable in nature, this situation emerges as a separate problem. Decomposed plastic can pass from many small organisms to higher organisms. As a result of this, it may cause various harms to people who are end users. Through the sewage and rainwater channels of the cities, all plastic debris reaches the seas either through rivers passing nearby or directly. During this transport, it shreds all the pollution material that they collect from their living areas, especially in rivers, from their living areas along the valley, by grinding them like a mill. This fragmentation includes many pollutants that are likely to be recycled into the food diet of other organisms living in the environment.

### 2. MATERIAL AND METHODS

Plastic particles, which are not included in their natural food, enter the digestive system of fish, shellfish, seabirds, sea turtles, even mammals, and can cause adverse effects such as organ damage, slowing growth and gastrointestinal obstruction in the organism. In this review, it is aimed to present the effects of plastic pollution on fish in Solaklı and İkizdere Valleys.

### 3. RESULTS AND DISCUSSIONS

The accumulation and transport of plastics in the food chain / network is also a potential threat to human health. Although it is not possible for direct plastics to pass to humans, it is possible for the chemicals such as paint on the plastic material to dissolve into the body of the living thing and then pass to the person who consumes it. As in all parts of the world, the Eastern Black Sea Region also suffers from the pressure of pollutants along with the increasing population and highland tourism. Ecological importance is extremely high; Pollutants, especially plastic derivatives, show themselves intensely in Solaklı, which contain Uzungöl and İkizdere Valleys, Anzer Plateau. Monitoring studies should be carried out on the effects of plastics, which are among the products that have increased in use in recent years and have a high polluting potential, on the environment and fish populations, and legal arrangements should be made to minimize their negative effects, and people should be made aware of them.

### REFERENCES

Kocabas, M., Kutluy Kocabas, F., 2022. Biyo-indikatör alabalıklar mikroplastikten etkilenir mi?/ Are bio-indicator trout affected by microplastic? 6.Ulusal Alabalık Sempozyumu, Isparta, Turkey.

## SOLID WASTE POLLUTION THREATS TO MARINE PROTECTED AREA MANAGEMENT ON THE SOUTHEAST BLACK SEA COAST

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### ABSTRACT

In this study, solid waste pollution threats to the potential coastal and marine protected areas in the Southeast Black Sea coasts have been evaluated. Human activities in the Çamburnu-Sürmene coasts pose pollution threats to the coastal habitat ecosystem in the area.

**Keywords:** Conservation; sustainability; marine protected area; solid waste; Black Sea

### 1. INTRODUCTION

The Black Sea coastal ecosystem has undergone human interventions such as overfishing, pollution, and coastal landfills. Increasing human activities in coastal areas also has an impact on the increasing volume of solid waste in the environment. All these anthropogenic pressures and the absence of marine protected areas in the region cause coastal habitat degradation to become ineluctable. Marine-protected areas have been widely used for marine resource management (Bonanno, 2022). However, inappropriate solid waste management of solid waste poses threats to marine protected area management (Tsai et al., 2021). The present study aims to determine coastal and marine protected areas and evaluate solid waste pollution threats in the area. Furthermore, we provide solutions for solid waste management in the area.

### 2. MATERIALS & METHODS

In this study Çamburnu - Sürmene coasts of Trabzon, Türkiye has been selected as a pilot project for a coastal and marine protected area in the Southeast Black Sea. The ecological and socio-economic features of Çamburnu - Sürmene coasts also potential threats particularly solid waste pollution threats in the region were evaluated.

### 3. RESULTS & DISCUSSIONS

Marine protected areas are known as an effective tool for sustainable marine resource management. In this study, the Çamburnu - Sürmene coasts have been proposed as a coastal and marine protected area in the region. However, human activities in the region result in solid waste problem which steadily increases. Increasing human activities in the coastal area of the Trabzon coast increases the urgency for the conservation and protection of the coastal ecosystem. Marine-protected area status has been proven to reduce solid waste pollution in the marine protected area (Baroth et al., 2022). As a recommendation of this study, the Solid waste collection should be carried out effectively and efficiently in order to solve the solid waste problem in the Trabzon region. Garbage collection needs to be done not only limited to residential areas but also in coastal settlements, rural areas, and highlands. Moreover, the use of plastic items should be limited.

### REFERENCES

- Baroth, A., Mamgain, S., Sivakumar, K., Hatkar, P. S., & Pathan, S. (2022). Role of protected area in reducing marine and plastic litter: A case study from India's first Marine Protected Area and comparison with Non-Protected Areas. *Journal of Industrial Ecology*. <https://doi.org/10.1111/JIEC.13248>
- Bonanno, G. (2022). Marine-protected areas and plastic pollution. *Plastic Pollution and Marine Conservation: Approaches to Protect Biodiversity and Marine Life*, 249–273. <https://doi.org/10.1016/B978-0-12-822471-7.00010-9>



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Tsai, F. M., Bui, T. D., Tseng, M. L., Lim, M. K., & Tan, R. R. (2021). Sustainable solid-waste management in coastal and marine tourism cities in Vietnam: A hierarchical-level approach. *Resources, Conservation and Recycling*, 168, 105266. <https://doi.org/10.1016/J.RESCONREC.2020.105266>



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## **SESSION 2: EDUCATION/TRAINING AND AWARENESS ACTIVITIES REGARDING MARINE LITTER**

## STAKEHOLDERS' TRAINING FOR RAISING PUBLIC AWARENESS AND REDUCING MARINE LITTER IN THE BLACK SEA

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### ABSTRACT

There are many pathways for marine litter pollution; the primary sources are from land-based origins and litter from maritime activities to a lesser extent. The latter has also reached serious levels in some areas of the world. Marine litter generally comes from dispersed sources like floods, rivers (discharged solid wastes along the river basin settlements), and coastal facilities (tourism, landfilling activities, fisheries, industry, and maritime). The destination of uncontrolled solid waste is the sea.

**Keywords:** Trainings; raise awareness; marine litter; Romania

### 1. INTRODUCTION

One of the main targets of the “Raising Public Awareness and Reducing Marine Litter for Protection of the Black Sea Ecosystem” (LitOUTer, BSB-785) project is raising the awareness of the stakeholders in the partner countries at the same time. Training programs for the stakeholders in the selected area were arranged according to their understanding, level of education, and interests. This training represents the effort made by partners within LitOUTer project, in four Black Sea riparian countries, to raise awareness of stakeholders to contribute to reducing the marine litter in the Black Sea.

### 2. MATERIALS AND METHODS

Training sessions cover three pillars of the marine litter problem: technical, governance, and social. The main aim is to reduce the social impacts of marine litter on local inhabitants and coastal citizens. In the project, the training was organized based on two main stakeholder groups: training of children/students/young people about reducing marine litter pollution and second, training programs for raising awareness of adults, such as villagers’ housewives, fishermen, imams/priests, local citizens, local schoolteachers, and children in the local areas.

### 3. RESULTS AND DISCUSSIONS

From July 2020 to October 2022 were organized 120 pieces of training for children and 67 for adults) during which 4902 participants (3037 children and 1865 adults) were trained and informed about marine litter topics around the Black Sea. Training’s impact, participants’ feedback, and lessons learned are important aspects that help to evaluate the activities, contribute to better development of future activities, and consist of reactions to or opinions about the effort from those who are affected by it.



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## **EDUCATION AND ENHANCING RAISING AWARENESS FOR SCHOOL STUDENTS OF ADJARA REGION (GEORGIA) AND KNOWLEDGE AND ATTITUDES OF BLACK SEE COASTAL POPULATION (ADJARA REGION, GEORGIA) IN WASTE MANAGEMENT AND MARINE LITTER ISSUES**

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### **ABSTRACT**

The presented work discusses about education and awareness issues for school students and adults of the Black Sea coastline (Adjara region, Georgia) on Waste Management and Marine Litter. The study was conducted by IBEDC of Georgia, within the project on "Raising Public Awareness and Reducing Marine Litter for Protection of the Black Sea Ecosystem" (LitOUTer)" in the framework of Black Sea Basin Program 2014-20 with lead partner Karadeniz Technical University. In 2021 were conducted the survey of the target audience (808 respondents): school students; Project stakeholders, such as municipality governance, University Auditorium, Stakeholders of the Tourism Industry; Population of Chorokhi gorge; Fisheries Sector. The survey aimed at rating the Black Sea coastline population's knowledge and attitudes in the target region regarding waste management and marine litter.

**Keywords:** Marine litter; waste management; awareness-raising activities; the Black See coastline, stakeholders

### **1. INTRODUCTION**

The survey aimed at figuring out the basic knowledge state, attitude, and behavior of stakeholders in connection with marine litter.

In 2021 within the framework of the LitOUTer project conducted awareness-raising educational activities for students V, VI, VII, and VIII grades at more than 20 schools located on the Black Sea coastline of Adjara Region (Georgia). The educational activities accentuated the following issues: the composition of marine waste; the environmental sustainability of plastic and adverse effects/hazards caused by this feature; the relationship and importance of waste recycling and source separation; the sources of marine waste generation and the importance of correct individual actions; examination of the negative influence of marine waste on sectors such as tourism; fisheries; local self-government expenditures in respect of marine litter; biodiversity; resources, recycling.

### **2. MATERIALS AND METHODS**

In 2021 within the framework of the LitOUTer project were conducted the survey of the target audience: school students-371 respondents; Project stakeholders (municipality governance, university auditorium, stakeholders of tourism industry) -257 respondents; Population of Chorokhi gorge-149 respondents; Fisheries Sector-31 respondents. Obtained outcomes, main findings, and conclusions were compiled using of desk research, and quantitative and qualitative analysis methods.

Within the framework of the project, we conducted a first, pre-training survey of the given target audience and after that, we planned relevant training, based on which we can present the level of awareness, ongoing studies, and good examples from Georgia. The presentation, which took into account the age and developmental characteristics of the children, ensured their active participation in the education of the students and lecturers. The study materials that were used for such activities were: the electronic PowerPoint presentation about the project and the first project survey results; a Printed brochure about the project; The electronic PowerPoint presentation about Marine litter; Animation film "I don't want to be a litter" (Georgian subtitle); The electronic PowerPoint presentation about Waste



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Management and Landfills; Printed cards with the information and images; Electronic cards with the information and images.

### 3. RESULTS AND DISCUSSION

The Project stakeholders survey results: respondents have little information about the municipal action plans; a small number of respondents are involved in public activities against marine litter; 40% of respondents remarked that the protection of the sea and the coastline will complicate economic development.

The school student survey results: only 20% of the students know what percentage of marine litter is plastic; 47.2% of students don't know the duration of plastic decomposition in the environment; Students do not have a clear idea of how important it is to separate waste at the source; A significant percentage of students do not prefer the goods with less packaging.

As we mentioned through such mutual understanding and discussion of issues, the participants themselves came to conclusions and decisions. At the end of the training, it was observed that the children's and teachers' understanding levels were above our expectations. Key finding and participant feedback: A novelty for them was the discussion of the relationship between waste recycling and separation; Additionally interested in the impact of marine pollution on Black Sea animals; Liked and thought about the animation prepared within the project; Expressed great interest in participating in further project activities (cleaning promotions, etc.); Willingness to share marine waste information with others (peers and superiors); Did not know about the dangers of uncontrolled waste incineration and have relevant knowledge as a result of training; They are worried about the problem of microplastic pollution of the seas.

### REFERENCES

<https://litouterproject.eu/project/>

<http://www.ibedc.ge/>

<https://www.theoceancleanup.com/great-pacific-garbage-patch/>

<http://emblasproject.org>

## DETERMINING THE OPINIONS OF PRE- SERVICE SCIENCE TEACHERS ON MARINE LITTER POLLUTION: EXAMPLE OF TRABZON UNIVERSITY

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### ABSTRACT

The aim of this study was to determine the opinions of pre-service science teachers about the definition of marine litter, its difference from other wastes, its sources, economic, ecological, socio-cultural effects and what should be done to prevent marine litter. An open-ended questionnaire consisting of 6 questions was applied to 34 pre-service science teachers. In the descriptive analysis of the data obtained, marine litter pollution was generally defined as litter thrown into the sea and its accumulation in certain areas and plastics are given as an example. Pre-service teachers stated that marine litter differs from other litter in that it has a longer time to decompose and disappear in nature, and that the source of marine litter is human and anthropic activities. Educational activities are mostly suggested for the solution of marine litter pollution.

**Keywords:** Marine litter pollution; effects of marine litter pollution; pre-service science teacher

### 1. INTRODUCTION

Marine litter; is defined as human-generated solid wastes arising from activities on land or at sea, transported or discharged by rivers, sewage or drainage systems to coastal or marine environments by means of erosion, wind, etc. (UNEP, 2005; Galgani vd.,2010). It is known that marine litter threatens the environment, economy, culture, health and safety (Bat and Vişne, 2015). In order to prevent marine litter pollution, coasts and river mouths should be cleaned, garbage collection activities should be increased, reception facilities should be established for wastes originating from fisheries, pollution sources should be identified and eliminated, and rehabilitation studies should be carried out (Eyüboğlu & Eyüboğlu, 2022). For all these precautions to be useful, the first thing to do is awareness-raising activities. It is necessary to start awareness-raising activities with pre-service teachers who will raise future generations. Therefore, with this study, it is aimed to determine the views of pre-service science teachers about marine litter pollution, its sources, its differences from other garbage, its effects, and the precautions to be taken to prevent it.

### 2. METHOD

This research was carried out according to the phenomenographic (phenomenological) method, which is one of the qualitative research designs. In phenomenological studies, it is aimed to reveal the experiences of the participants about the investigated phenomenon, the meanings they create in their own world, and their feelings (Aydın-Günbatır, 2019, Baker, Wuest & Stern, 1992). The sample of the study consists of 34 pre-service-science teachers (29, women, 5 men) studying at Trabzon University Fatih Faculty of Education and 25 of them are living by the sea.

### 3. CONCLUSION AND DISCUSSION

It was observed that the majority of the pre-service teachers defined the concept of marine litter as litter/waste thrown into the sea, chemical waste, accumulation of those thrown into the sea and pollution. It was observed that most of the pre-service science teachers gave plastic and its derivatives/products as examples of marine litter. They stated the differences between marine litter and other litter as that marine litter does not dissolve in nature, disappears in a longer time, is in direct contact with living things and is difficult to collect. The sources that cause marine litter pollution are generally expressed as human and anthropic activities. The economic effects of marine litter pollution by pre-service teachers are reduction in fishing, clean-up costs, tourism, marine use and choices; ecological impacts are disruption





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of ecosystem balance, population and biodiversity reduction; socio-cultural effects are expressed as changes in tourism sector preferences, damage to the image of the country, weakening of the nutrition culture and negative reflection on mood. As a solution to the prevention of marine litter pollution, they suggested educating the public, raising awareness, fines and inspections where necessary.

### REFERENCES

- Aydın Günbatar, S. (2019). Olgu bilim (fenomenolojik araştırma) yöntemi. H. Özmen ve O. Karamustafaoğlu (Eds), Eğitimde araştırma yöntemleri içinde (s. 293-316). Ankara: Pegem Akademi.
- Baker, C., Wuest, J., & Stern, P. N. (1992). Method slurring: The grounded theory/phenomenology example. *Journal of Advanced Nursing*, 17(11), 1355-1360.
- Bat, L. & Vişne, A. (2015). Deniz ve sahillerdeki büyük tehlike! Küçük plastik parçacıklar. 18. Ulusal Su Ürünleri Sempozyumu, 1-4 Eylül 2015, Ege Üni. AKM, İzmir, Bildiri Özetleri Kitabı, s. 234.
- Eyüboğlu, Ö., Eyüboğlu, H. & Eyüboğlu, F. (2022). Preparation of a national action plan against land-based pollution in the seas and coasts of Turkey, which takes into account the ecosystem approach: determining the program of measures. *Biological Diversity and Conservation*, 15(1), 50-61.
- Galgani, F., Fleet, D., Van Franeker, J., Katsavenakis, S., Maes, T., Mouat, J., Oosterbaan, L., Poitou, I., Hanke, G., Thompson, R., Amato, E., Birkun, A. & Janssen, C. (2010). Marine Strategy Framework Directive Task



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## **SESSION 3: LEGISLATION AND SOCIO-ECONOMIC ADMINISTRATIVE SITUATION AND PRACTICES ON MARINE LITTER**



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## MARINE LITTER: INTERACTIONS WITH FISHERIES AND TOURISM INDUSTRY

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### ABSTRACT

**Keywords:** Marine litter; fisheries; tourisms; awareness; Black Sea

#### 1. INTRODUCTION

Marine litter is one of the major global threats on terrestrial and aquatic ecosystems, habitat destruction, biodiversity of all living organisms, all economic sectors, coastal degradation, and humankind (Bergmann et al., 2015). Under the effects of winds, floods, and riverine systems litter is transported long distances, resulting wide range of transboundary impacts in all basins and coastal cities (Dahms et al., 2019; Gall & Thompson, 2015). In spite of intensive scientific developments, surveys showing distribution patterns, determination of hot spots, recent technological developments to get rid of or reduce litter, recycling methods, very limited progress has been provided. There should be more radical measures taken at the multinational level as concerted actions. This study aims to investigate marine litter impact to fisheries and tourisms sectors.

#### 2. METHODOLOGY

Several conclusions in this presentation are based on the observations from the implementation of the LitOUTer project carried out in the Trabzon city, provinces and highlands.

#### 3. RESULTS AND DISCUSSIONS

Tourism and fisheries sectors are the major economic activities facing the risks oriented by marine litter and its different forms. The fisheries sector has two components; capture fisheries and aquaculture. Marine litters cause habitat losses for the species living on the sea bottom such as turbot, sole, and plaice. Reefs can be coated with litters having wide surface areas likely plastic sheets and fishing nets which disturbs all kinds of aquatic plants and fish living on, in, and around these micro-ecosystems by blocking lifecycles and protective facilities previously offered to plenty of organisms. Due to unpreferable conditions, some species may die due to lack of food, shelters and unfavorable conditions due to reduced light penetration and diminished nutritional cycle with detritus and other feed sources while the others are obliged to change their locations or migrate to distant areas. As a result, abundance and production of marine living organisms may decrease and biodiversity in this specific area may reduce. In case of aquaculture, overall risks are more visible than the capture fisheries. Accumulation of the litter may block the meshes of cage nets by limiting water exchange within the cages. Also, accumulated litter may provoke infectious diseases which cause massive fish deaths in the nets. Microplastics may give serious damage to fish health due to being kept in high numbers. Healthy fish need clean water. Abandoned fishing nets and cage nets used in mariculture, all kinds of fishing lines and hooks, feed bags, empty cigarette boxes, and butts, used food packs and other personal litters thrown to the sea are the major littering in the fisheries sector.

The majority of the litter is plastics, with the longest duration in marine and other aquatic environments. Microplastics are very small particles either directly discarded to the environment or decomposed into small, tiny particles under the physical effects of fractioning and degrading letting aquatic organisms easily eaten or swallowed (Galloway et al., 2017). In the meantime, all kinds of microplastics are transferred to other organisms living in the upper trophic levels of the food web, and the final destination would be the humans who used to consume these organisms. The number of deaths of sea turtles and marine mammals is increasing year by year due to litter and microplastics floating in the seas and oceans.

#### 4. CONCLUSION

Fisheries and tourism sectors are two main components of the economic drivers in the Black Sea. They may pollute or get polluted by the litters; both require clean environment. There are very diverse activities in the tourism sector such as touring in highlands, forests, historical assets, trekking, picnicking and camping, swimming, diving, yachting, and recreational fishing. Tourists demand clean environment to visiting and swim. Actually, keeping the environment clean as a behavior is closely related to their own habitats in their countries, the existence of sufficient waste bins on their route, and the effective waste collection systems of the local governments and municipalities. It is observed that native tourists are not sensitive to keeping nature clean as much as the foreign tourists.

#### Recommendations:

1. Effective waste management plans should be prepared by the local governments for all settlement and attraction areas,
2. Efficient waste collection and public run recycling systems should be applied,
3. Litter watch system is essential to determine the dimensions of the threat,
4. Polluter pays system is strongly needed even in rural areas,
5. A surveillance system needs to be established.
6. Litter fishing campaigns will be useful to collect litters in rivers and sea especially in no fishing season.
7. Landfills without barriers and wild waste storage should not be permitted

#### REFERENCES

BSB785 LitOUTer Project

- Bergmann, M., Gutow, L., & Klages, M. (2015). Marine anthropogenic litter. *Marine Anthropogenic Litter*, 1–447. <https://doi.org/10.1007/978-3-319-16510-3>
- Dahms, H. U., Galgani, L., Beiras, R., Galgani, F., Panti, C., & Borja, A. (2019). Editorial: Impacts of Marine Litter. *Frontiers in Marine Science* | *Www.Frontiersin.Org*, 1, 208. <https://doi.org/10.3389/fmars.2019.00208>
- Gall, S. C., & Thompson, R. C. (2015). The impact of debris on marine life. *Marine Pollution Bulletin*, 92(1–2), 170–179. <https://doi.org/10.1016/J.MARPOLBUL.2014.12.041>
- Galloway, T. S., Cole, M., & Lewis, C. (2017). Interactions of microplastic debris throughout the marine ecosystem. *Nature Ecology & Evolution*, 1(5). <https://doi.org/10.1038/S41559-017-0116>



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## REGULATORY FRAMEWORK FOR REDUCING PLASTIC POLLUTION IN THE BLACK SEA BASIN

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### ABSTRACT

Marine litter harms ecosystems and public health worldwide. Plastic pollution is of particular concern as it exerts environmental, social and economic impacts at various scales. The study addresses the development of the regulatory framework for tackling plastic pollution in the Black Sea Basin, resulting from the interaction of international bodies, regional organisations and national legislations. This study relies on content analysis and comparison to assess the evolution of the legislative steps in the coastal countries. The review outlines the main drivers of change in the governance framework in the Black Sea region and potential future extensions.

**Keywords:** Plastic pollution; marine litter; legislation; governance; Black Sea

### 1. INTRODUCTION

The growing volume of marine litter and plastic pollution threaten the health of the world's oceans and seas. Plastic items of all sizes are found everywhere: from the highest mountain peaks to deepest ocean trenches. Plastics and microplastics affect adversely marine life and ecosystems and influence global climate. Their pervasive presence poses risks to human health and well-being and entails substantial economic costs to coastal communities and various business sectors. This process is driven by the expanding global demand for polymers and the low level of recycling of plastic waste. The need to deal with the rising wave of plastic pollution has prompted actions at national, regional and global level.

### 2. MATERIALS AND METHODS

The study traces the development of the international legal framework tackling different aspects of plastic pollution and reviews the national regulation in the Black Sea Basin countries. It applies content analysis and comparative approach to assess the evolution of the legislative steps in the coastal states.

### 3. RESULT AND DISCUSSIONS

The regulatory framework of Bulgaria and Romania for reducing plastic pollution has been largely determined by the membership of both states in the European Union. The Association Agreements of Georgia, Moldova and Ukraine with the EU have also provided direction in the development of governance solutions for abating plastic waste. The Turkish policies and measures are affected by national priorities, regional cooperation and bilateral relations with the EU.

The international and regional solutions are moving towards prevention, the introduction of quantitative targets linked with time schedules, as well as wider application of economic and administrative instruments for reducing plastic pollution. The transboundary character of this form of pollution makes imperative international cooperation for reducing plastics in the environment.

### REFERENCES

- Black Sea Commission, 2018. Black Sea Marine Litter Regional Action Plan.  
Black Sea NGO Network, 2021. Guidebook on marine litter reduction. Varna.  
Borrelle, S. et al., 2020. Predicted growth in plastic waste exceeds efforts to mitigate plastic pollution. *Science*, 369(6510), 1515–18. doi:10.1126/science.aba3656.  
Geyer, R. et al., 2017. Production, use, and fate of all plastics ever made. *Science Advances*, 3 (7), p. e1700782. doi:10.1126/sciadv.1700782.



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- Sabadash, V. et al. 2020. A dynamic approach to the study of institutions in a green economy. *Int. J. Glob. Environ. Issues*, 19(1–3), 243–63. doi: 10.1504/IJGENVI.2020.114880
- UNEP, 2016. *Marine litter legislation: a toolkit for policymakers*. Nairobi.
- UNEP, 2021. *From pollution to solution: a global assessment of marine litter and plastic pollution*. Nairobi.



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## **SESSION 4: POSTER PRESENTATIONS**



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## CLEAN COAST CLEAN SEA

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### ABSTRACT

Reducing pollution to the seas should be one of the prime goals for global cleanup efforts since seas play crucial role on global ecosystem. As Of HMB Ulusoy Anadolu High School, we have organized series of activities to educate students about global pollution and raise the awarnes on fight against pollution. “Mavi Kapak” (Blue Cap), Atik Pil (Discarded Batteries), “Temiz Kent Temiz Deniz” (Clean City Clean Sea) and “Temiz Kiyi Temiz Deniz” (Clean Coast Clean Sea) have been our primary activities so far. We have invited various news agencies and organizations to help us promote our cause and spread the concerted effort on fight against pollution. We have seen many waste products that could have been easily recycled. We have seen that lack of knowledge on recycling results in big misconception that every used product is waste.

**Keywords:** Ecosystem; waste; recycle; activity

### 1. INTRODUCTION

The seas, which provide the opportunity for many living things to live, are an important part of nature and ecosystem that must be protected. It is seen that the level of pollution in the seas increases with the growing population, urbanization and industrialization. The wastes left in the seas and the litter thrown on the sea shores threaten the health of humans and other living things. Based on the idea that education begins in the family and continues in schools, the aim of this study is to adopt the importance of protecting the environment and keeping it clean both as a concept and a practice in teacher-student cooperation. In this context, minimizing the use of plastics and reducing waste are important suggestions.

### 2. PREVIOUS STUDIES

Various activities have been planned in order to raise individuals who are conscious of the environment and nature. These activities started with the waste battery activity, continued with the blue cap and other recycling materials, and finally ended with the Clean Coast and Clean Sea activities. By participating in the waste battery project organized by TAP, 243 kg of batteries have been collected and the school has been awarded. With the blue cap project, an agreement was made with the solid waste company and a wheelchair was given to a disabled student in exchange for 4000 plastic covers. A Turkish flag consisting of 600 plastic caps was made and sent to the Zero Waste Competition organized by the Ministry of Environment. A total of 100 students from three different schools participated in the Clean Coast, Clean Sea event, 40 of which were students from the Maritime field. 15 different public institutions such as Port Authority, Directorate General Of Coastal Safety, Coast Guard Command, Police Department, KTU Marine Sciences Faculty were also included. The walk was held with the placards, posters, t-shirts and hats organized within the scope of the event. Protocol talks and speeches about sea pollution were made in the event area. In front of the port facility belonging to the school, the Frogman Team affiliated to the Provincial Directorate of Security dived to reveal the invisible surface of the underwater. On a boat belonging to the Coast Guard Command, the banner "Young Seamen Own the Sea and the Environment" was displayed. In the litter collection activity area, 100 kg of litter was collected and delivered to the Municipality.





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### 3. RESULTS AND DISCUSSION

As a result of these studies, it has been seen that waste batteries, plastic, glass and metals exist in every environment we live in and that they are randomly stacked and thrown away. It has been concluded that a lot of waste is made and that people are overconsumers and they are not conscious about recycling. It has been seen that everything thrown is considered litter, plastics and other solid wastes can reach the sea, and many metals, plastics, and glass materials have been extracted from a small area of the sea. It was concluded that litter traps should be placed at stream mouths, people should be conscious about recycling, sanctions should be increased for people who cause environmental pollution, environmental club activities should be increased in schools, and the accessibility and size of recycling bins should be increased.

## AUTUMN TREND OF SOLID WASTE POLLUTION IN DAM LAKE OF ARTVİN

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**Keywords:** Solid waste, Pollution, COVID-19, Plastic

### 1. INTRODUCTION

The increasing population, growing urban settlements, technological developments, industrialization, and improved living standards have led to a rapid and consistent increase in solid waste production. Solid wastes are non-soluble, solid materials, discarded from industrial, municipal, and agricultural activities (Moeller 2011). Solid wastes are among the most common types of pollutants in sea and land ecosystems (Malinauskaite et al. 2017; Lestari and Trihadiningrum 2019). They cause a wide variety of impacts on the environment, economy, and human health by contaminating soil, air, and water sources.

### 2. MATERIAL AND METHOD

Solid waste was collected from seven stations comprising four on the Borçka Dam Lake (B1–B4) and three along the Murgul Stream (M1–M3) (Fig. 1). In choosing the stations, anthropogenic inputs, such as city centers, stream entrances, and aquaculture activities, were considered. The sampling was carried out during the autumn season in 2022. Physical conditions range from 25 m<sup>2</sup> to 50 m<sup>2</sup>. In choosing the stations, anthropogenic inputs, such as city centers, stream entrances, and aquaculture activities, were considered.

### 3. RESULTS AND DISCUSSION

A total of 3745 solid waste items with a combined weight of 230.67 kg were collected from the seven stations. Each type of solid waste item was found at all the stations during the 5-year survey period. The abundance of litter items varied between the stations. The highest densities in terms of number and weight were recorded at M3 in 2020 (5.72 items/m<sup>2</sup>) and M1 in 2020 (0.39 kg/m<sup>2</sup>), respectively. The composition of the solid waste items was highly variable between the stations. Plastic was the most abundant material by number at all the stations. Its percentage contribution varied between 25.47 and 88.89%. The contribution of the plastic items by weight varied between 3.41 and 63.91%. Metal and cloth items were dominant at different stations. Water ecosystems of Borçka Dam Lake and Murgul Stream varied qualitatively and quantitatively during the study period. Seasonal changes are one of the main reasons for the differences observed in solid waste density.

### 4. CONCLUSION

The findings of this study show that the most common type of solid waste in the examined region was plastic, with river transportation being the primary source. In addition, unfortunately, we still encounter hygienic solid waste types such as masks and disinfectants that we use extensively during the Covid-19 pandemic period.

### REFERENCES

- Lestari P, Trihadiningrum Y (2019) The impact of improper solid waste management to plastic pollution in the Indonesian coast and marine environment. *Mar Pollut Bull* 149:110505
- Malinauskaite J, Jouhara H, Czajczyńska D, Stanchev P, Katsou E, Rostkowski P, Thorne RJ, Colon J, Ponsá S, Al-Mansour F (2017) Municipal solid waste management and waste-to-energy in the context of a circular economy and energy recycling in Europe. *Energy* 141:2013–2044
- Moeller DW (2011) *Environmental health: Fourth edition*. Harvard University Press

## THE JOURNEY OF PLASTIC LITTER IN THE MARINE ENVIRONMENT

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### ABSTRACT

Marine litter is defined as any man-made object that enters, throws, disposes of, or exits the coastal or marine environment. Since the 1950s, the use of plastic continues to increase rapidly due to its many advantages in our daily lives, is ubiquitous in the oceans and is internationally recognized as a matter of increasing concern. It is also extremely durable, highly flexible, and inexpensive to produce. Plastic offers extraordinary properties to modern life. But these benefits also come with challenges associated with mismanaged plastic waste that turns into significant plastic pollution. There are more than 30 types of primary plastics today, and they combine with a few different additives to yield thousands of plastic materials [1,2,3].

Most plastics in the ocean break up into very small particles. These small plastic bits are called "microplastics." Microplastics (plastic particles <5 mm) come from a variety of sources. Such microplastics are called secondary microplastics that form from the breakdown of larger plastics; this typically happens when larger plastics undergo weathering, through exposure to, for example, wave action, wind abrasion, and ultraviolet radiation from sunlight. Microplastics are not biodegradable and can be ingested by aquatic organisms, including various additive chemicals due to their high potential to adsorb contaminants from other polluting sources. Consequently, they can pose a serious risk to aquatic species and human health directly or indirectly. Plastics and derivatives are a huge problem all over the world. We can help keep plastic out of the ocean. Don't forget: Reduce, Reuse, Recycle [4].

### REFERENCES

- Andrady, A. L., & Neal, M. A. (2009). Applications and societal benefits of plastics. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 364(1526), 1977-1984.
- Worm, B., Lotze, H. K., Jubinville, I., Wilcox, C., & Jambeck, J. (2017). Plastic as a persistent marine pollutant. *Annual Review of Environment and Resources*, 42(1), 1-26.
- Thushari, G. G. N., & Senevirathna, J. D. M. (2020). Plastic pollution in the marine environment. *Heliyon*, 6(8), e04709.
- Schmaltz, E., Melvin, E. C., Diana, Z., Gunady, E. F., Rittschof, D., Somarelli, J. A., ... & Dunphy-Daly, M. M. (2020). Plastic pollution solutions: emerging technologies to prevent and collect marine plastic pollution. *Environment international*, 144, 106067.

## I'M NOT THROWING, ADDING TO LIFE: GOOD PRACTICES ABOUT ZERO WASTE MANAGEMENT IN A PRIMARY SCHOOL

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### ABSTRACT

The aim of the project was to make our students comprehend the interaction between society and the environment, to develop an awareness of sustainable development about natural resources, to notice the contribution of recycling to the environment, to prevent or minimize the waste that causes the environmental pollution, to contribute to the recycling and converting waste into reusable material, to collect and recover waste at source separately. During the project, we tried to give prominence to zero waste and recycling studies. With the help of various seminars, exhibitions, presentations, excursions, and hands-on and in-class activities our students had basic information about what recycling is and why it is needed. They were able to realize the difference between waste and garbage. They learned some waste evaluation methods. They gained the ability to plan and organize while designing products, developed hand skills, and developed awareness about protecting nature and the environment.

**Keywords:** Recycling; zero waste; primary school

### 1. INTRODUCTION

At the beginning of the 2019-2020 academic year, a survey on "Environmental Sensitivity and Recycling" was conducted and 179 students and 160 parents responded to this survey. When we examine the results of the survey, we see that 77% of the respondents know what recycling means, and only 44% of them separate and throw their garbage. 64% of the participants think that the efforts to protect the environment and nature are insufficient, while almost half of them think that the practices related to recycling in our school are insufficient. There were no attempts about raising awareness of zero waste and recycling in our school before. Zero waste and recycling themes were not frequently included in the classroom activities. There was no equipment for the collection of wastes separately, there was no waste area where the collected wastes could be stored. All these situations had prevented the waste generation and the recycling of waste in our school.

### 2. METHODS

Primarily, a protocol was signed between our school and the Trabzon Provincial Directorate of Environment and Urbanization for supplying recycle bins and containers, collecting waste, and sending them to the recycling facilities. A temporary waste storage area was created for separating and placing the used materials. The amount of waste from our school and waste inventory was created and information was entered into the **integrated environmental information system** in which the management of hazardous and non-hazardous wastes originated from your company within the scope of the Zero Waste Regulation dated 12 July 2019 and numbered 30829. Our school was the first and only primary school that received zero waste certificate as a result of those initiatives. The project was awarded in the 'Collecting waste oil and waste battery' competitions organized by Ortahisar Municipality. In order to attract people's attention and participation in recycling, social media accounts were created. Monthly bulletins were prepared to promote and provide information about the project activities. The school garden was built and decorated with waste materials. The students experienced how waste materials can be used in daily life while planting vegetables and flowers in the garden with their peers. They also gained the ability to develop common products and organize in cooperation. Trabzon's first Zero Waste Library, which we created together with our students, teachers, parents, and staff using waste materials, was opened within the scope of the "No School Without Library" and "Zero Waste" projects organized by the Ministry of National Education in January 2022. The library was also



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included in the promotional video of the Zero Waste Libraries created in 250 schools in 81 provinces. During the project, we collected 1000 kg. waste batteries, 8000 kg. waste paper and 500 lt. waste oil and sent to the recycling facilities.

### **3. CONCLUSION**

With the help of the monthly activities, the students became an integral part of the process. Seminars, exhibitions, presentations, excursions and in-class activities were held throughout the academic year for our students to achieve the target goals. They had opportunities to raise awareness about separating waste and recycling, and to design products from waste materials that they can use in their daily lives. Our long-term goals are to raise awareness in sustainable development about natural resources, to continue to collect and recycle waste, and to support social responsibility projects and waste collection campaigns.

### **REFERENCES**

<http://zerowaste.gov.tr/en/zero-waste/what-is-zero-waste>

## SOLID WASTE COMPOSITION IN MANAHOZ STREAM, SE BLACK SEA

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### ABSTRACT

This study presents the solid waste composition and distribution in the Manahoz stream following the OSPAR guidelines. As a result, plastic materials dominated the solid waste on the stream with a higher density in number observed at the M2 (16.5 items/m<sup>2</sup>).

**Keywords:** Solid waste; riverine input; monitoring; Black Sea

### 1. INTRODUCTION

Most of the global population settled in the coastal areas and river banks, which made it vulnerable to human pressure such as anthropogenic waste. Most of the waste escapes management schemes and ends up in the marine environment (Ioakeimidis et al., 2014). Further investigations are required to monitor river input to the marine environment in the Black Sea (Terzi et al., 2020). The present study aims to determine the solid waste composition in the Manahoz stream, Southeast Black Sea in the Summer of 2022.

### 2. MATERIALS AND METHODS

Solid waste in the Manahoz stream, Sürmene – Köprübaşı was monitored during the Summer of 2022. Seven stations were elected to represent the stream pollution state. Stations were defined by distance to the coast and human activities along the stream. All unnatural litter was collected and categorized according to OSPAR guidelines (Wenneker et al., 2010).

### 3. RESULTS AND DISCUSSION:

A total of 1238 litter items were collected from the stream. The highest litter density was recorded at M2 (16.5 items/m<sup>2</sup>). Plastic materials are the most abundant litter in the stream. Plastic dominated 71% of the total litter in the Manahoz stream. Most plastics were single-use products. It is worth mentioning that the area observed a high amount of illegally dumped rubble and building materials waste.

### 4. CONCLUSION

A high amount of solid waste was monitored during the Summer of 2022 in the Manahoz stream, Southeast Black Sea. Plastic materials were the most abundant items in the stream. Solid waste along the stream indicates a lack of awareness and a high level of waste dumping by locals in the area. This result is expected to be taken into consideration by stakeholders to prevent illegal dumping in stream banks and protect the Black Sea ecosystem.

### REFERENCES

- Loakeimidis, C., Zeri, C., Kaberi, H., Galatchi, M., Antoniadis, K., Streftaris, N., Galgani, F., Papatheodorou, G. (2014). A comparative study of marine litter on the seafloor of coastal areas in the Eastern Mediterranean and Black Seas. *Marine Pollution Bulletin*, 89(1–2), 296–304. <https://doi.org/10.1016/J.MARPOLBUL.2014.09.044>
- Terzi, Y., Erüz, C., & Özşeker, K. (2020). Marine litter composition and sources on coasts of south-eastern Black Sea: A long-term case study. *Waste Management*, 105, 139–147. <https://doi.org/10.1016/J.WASMAN.2020.01.032>



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Wenneker, B., Oosterbaan, L., & Intersessional Correspondence Group on Marine Litter (ICGML). (2010). Guideline for Monitoring Marine Litter on the Beaches in the OSPAR Maritime Area (1.0). OSPAR Commission. [www.ospar.org](http://www.ospar.org)

## BEACH MACRO LITTER IN THE SÜRME NE COASTS, SOUTHEAST BLACK SEA

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### ABSTRACT

This study presents the beach macro litter composition and distribution in the Sürmene coasts following the OSPAR guidelines. As a result, plastic materials dominated the solid waste on the stream with a higher density in number observed at the S2 (3.2 items/m<sup>2</sup>).

**Keywords:** Beach litter; plastic pollution; monitoring; Black Sea

### 1. INTRODUCTION

Land-sea interactions in the coastal areas excuse land-based litter input in this area inevitable. Human activities in the land and coastal area result in foul litter and create an eyesore. Beach litter negatively impacts the tourism sector. People spent less time on dirty beaches (Qiang et al., 2020). Moreover, beach litter generates adverse effects on ecosystems and marine organisms (Gall & Thompson, 2015). The present study aims to determine the beach litter status on the Sürmene coast, Southeast Black Sea to support national and regional assessment of marine litter.

### 2. MATERIALS AND METHODS

This study was carried out during the Summer of 2022 along the Sürmene coasts. Five stations were elected to represent the coast's pollution state. Stations were defined by distance to the stream mouth and human activities along the coasts. All anthropogenic litter was collected and categorized following OSPAR guidelines (Wenneker et al., 2010).

### 3. RESULTS AND DISCUSSION

A total of 730 items were collected from the Sürmene beaches. The highest litter density was observed in S2 (3.2 items/m<sup>2</sup>). The beach litter was dominated by plastic materials. Plastic contributed to 73% of total beach litter on Sürmene coasts. Most plastic litters were single-use products such as cigarette butts, plastic bags, beverage containers, plastic bottles, and plastic packages associated with beachgoers' consumption. Based on the Coastal Clean Index (Alkalay et al., 2007), four beaches (S1, S2, S3, and S4) in Sürmene were categorized as extremely dirty.

### 4. CONCLUSION

Macro beach litter was observed during the Summer of 2022 in the Sürmene coasts, Southeast Black Sea. Plastic-based litter dominated the beach litter pollution in the area. Beach litter indicates a high frequency of visits and a lack of awareness among beachgoers. These results are expected to be taken into consideration by stakeholders to take action to prevent marine litter from entering the marine environment by providing better waste management.

### REFERENCES

- Alkalay, R., Pasternak, G., & Zask, A. (2007). Clean-coast index—A new approach for beach cleanliness assessment. *Ocean & Coastal Management*, 50(5–6), 352–362. <https://doi.org/10.1016/J.OCECOAMAN.2006.10.002>
- Gall, S. C., & Thompson, R. C. (2015). The impact of debris on marine life. *Marine Pollution Bulletin*, 92(1–2), 170–179. <https://doi.org/10.1016/J.MARPOLBUL.2014.12.041>





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- Qiang, M., Shen, M., & Xie, H. (2020). Loss of tourism revenue induced by coastal environmental pollution: a length-of-stay perspective. *Journal of Sustainable Tourism*, 28(4), 550–567. <https://doi.org/10.1080/09669582.2019.1684931>
- Wenneker, B., Oosterbaan, L., & Intersessional Correspondence Group on Marine Litter (ICGML). (2010). *Guideline for Monitoring Marine Litter on the Beaches in the OSPAR Maritime Area (1.0)*. OSPAR Commission. [www.ospar.org](http://www.ospar.org)



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## MARINE LITTER POLLUTION IN THE OF COASTS, SOUTHEAST BLACK SEA

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### ABSTRACT

This study presents the marine litter composition and distribution in the Of coasts following the OSPAR guidelines. As a result, plastic materials dominated the solid waste on the stream with a higher density in number observed at the O3 (5.7 items/m<sup>2</sup>).

**Keywords:** Beach litter; plastic pollution; monitoring; Black Sea

### 1. INTRODUCTION

Most marine litter pollution was associated with human activity in land and coastal area (Bergmann et al., 2015). Although waste dumping is prohibited, due to a lack of awareness and waste mismanagement this practice is still common in rural areas and eventually accumulated in the marine environment (Terzi et al., 2020). Of district is a coastal town situated 53 km east of Trabzon city known as one of the stop visits during holidays by domestic and international tourists. This study aims to determine the marine litter pollution status on the Of coasts, the Southeast Black Sea to support national and regional monitoring of marine litter.

### 2. MATERIALS AND METHODS

This study was conducted during the Summer of 2022 along the Of coasts, Southeast Black Sea. Five stations were elected to represent the coast's pollution state. Stations were determined based on the distance to the stream mouth and human activities along the coasts. All unnatural litter was collected and categorized based on OSPAR guidelines (Wenneker et al., 2010).

### 3. RESULTS AND DISCUSSION

A total of 2360 items were collected from the Of beaches. The highest litter density was monitored in O3 (5.7 items/m<sup>2</sup>). Plastic and plastic coating materials were the most commonly found on the beaches. Plastic materials constituted 75% of total beach litter on Of coasts. Plastic litter was dominated by single-use products and daily uses products. Litter found in the area was associated with beachgoers and illegal dumping and/or stream input in the area. According to the Coastal Clean Index (Alkalay et al., 2007), all beaches on Of coasts were categorized as extremely dirty.

### 4. CONCLUSION

A high amount of litter was observed during the Summer of 2022, along the Of coasts, Southeast Black Sea. Plastic materials are the most abundant litter in the area. This litter indicates a high amount of land-based litter transported or dumped in the area. These results are expected to be taken into consideration by stakeholders to provide better waste management in the region.

### REFERENCES

- Alkalay, R., Pasternak, G., & Zask, A. (2007). Clean-coast index—A new approach for beach cleanliness assessment. *Ocean & Coastal Management*, 50(5–6), 352–362. <https://doi.org/10.1016/J.OCECOAMAN.2006.10.002>
- Bergmann, M., Gutow, L., & Klages, M. (2015). Marine anthropogenic litter. *Marine Anthropogenic Litter*, 1–447. <https://doi.org/10.1007/978-3-319-16510-3>



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Terzi, Y., Erüz, C., & Özşeker, K. (2020). Marine litter composition and sources on coasts of south-eastern Black Sea: A long-term case study. *Waste Management*, 105, 139–147. <https://doi.org/10.1016/J.WASMAN.2020.01.032>

Wenneker, B., Oosterbaan, L., & Intersessional Correspondence Group on Marine Litter (ICGML). (2010). *Guideline for Monitoring Marine Litter on the Beaches in the OSPAR Maritime Area (1.0)*. OSPAR Commission. [www.ospar.org](http://www.ospar.org)



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## BEHAVIORAL AND INFORMATIVE CHANGES OF THE TRAINEES AFTER TRAINING SESSIONS ORGANIZED UNDER THE LITOUTER PROJECT

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### ABSTRACT

LitOUTer is a project aims to raise public awareness of the various group of citizens in the local society by trainings, using different awareness materials and questionnaire surveys. After measuring their level of understanding of marine litter problem, different training materials were used in the number of training sessions for the children, various student groups at different ages and education levels, adults and decision makers, fishers and maritime business members, tourism sector workers, housewives living in cities and rural areas, and representatives of religion. In this presentation, responses of different social segments of the citizens before and after trainings as behavioral and informative changes.

**Keywords:** Marine litter; behavior; awareness; education, Black Sea

### 1. MATERIALS AND METHODS

Wide range of training materials were used during the trainings of attendees. Mostly face to face sessions were organized but some were online meetings during the close up period due to Covid 19 Pandemics. While using toys, play cards, cartoons and animated films for children and young generation, power point presentations, discussion and interview programs were conducted for the adults. Number of sector representatives were invited to the kickoff meeting, workshops organized in Trabzon and partner countries; Batumi, Burgas, Constanta, Tulcea and Varna. Project brochures, press bulletins and newsletters, leaflets were widely used to promote project and inform public in widest scale. To demonstrate the way of transportation of litters and its transboundary impact, a simulation model was performed under different scenarios discarded one of major rivers to each of the partner countries. On the other hand, project web site, and social media accounts were effectively used to inform public about the activities and achievements of the project.

Two questionnaire surveys were carried out to understand the public level of information about marine litters, to analyze the effect of trainings on their perception, information and solution-based interference to mitigate litter pollution in the project implementation area.

### 2. RESULTS

According to the preliminary evaluations without completing statistical analyses, some round conclusions have been reached:

- Majority of public are aware of the level of litter pollution, measures need to be reduction,
- Children are the most sensitive group to learn, motivate to other children and elders when they notice someone throwing litters,
- Elders know the problem very well but do not want to be a part of solution, instead they prefer to assault others
- Common idea is there are deficiencies about waste collection systems under the responsibility of local governments,
- Separation of litters should start at source; houses, workshops, factories etc., for better recycling systems.
- Recycling services should be provided by public companies. Private companies prefer to separate and recycle the materials which are the most profitable. It means the rest are still remains waste and litter threat to the environment.



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- Litter collection campaigns organized in schools are very effective for the motivation of the students to keep their close and distant environment clean.
- This symposium and following openair exhibition will be the last activities to attract the attention of the society to the dimensions of marine litter pollution in the coastal ecosystem of the region.

## **REFERENCES**

LitOUTer Project

## THE PRESENCE OF MICROPLASTICS IN PELAGIC AND BENTHIC FISHES ALONG THE GİRESUN COAST

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### ABSTRACT

Microplastics (MPs) contamination in stomach contents of red mullet, whiting, horse mackerel, and anchovy total from the Giresun coastline were determined. A total of 1272 MPs were detected in 40 fish of which 20% (250 pieces) were from horse mackerel, 59% (757 pieces) from red mullet, 10% (125 pieces) from anchovy, and 11% (140 pieces). The most common color in MPs samples was black (1201 particles, 94%). This was followed by blue (45 particles, 3.53%) and red (25 particles, 1.96%). The most observed shape in MPs was a fragment (1117 particles, 87%). This was followed by fiber (105 particles, 8.25%) and pellets (50 particles, 3.93%).

**Keywords:** Microplastics, Pollution, Giresun, Horse Mackerel, Anchovy

### 1. INTRODUCTION

The world's total plastic production has increased from 1.7 million tons in 1950 to ~359 million tons in 2018. Excluding almost 1% of bioplastics, most parts of them are not biodegradable, therefore litter the environment, part of which accumulates in living organisms, especially aquatic animals.

Two demersal and two pelagic fish species, which have an important place in the diet of Giresun residents, were sampled and their MP contents were investigated in 2022.

### 2. MATERIALS AND METHODS

A total of 40 fish samples from red mullet, whiting, horse mackerel, and anchovy species caught by fishing boats along the Giresun coastline were kept in ice packs at 4 °C. The length (cm) and weight (g) of each fish were recorded. Prior to extraction, all solutions, ethanol, and HPLC-grade distilled water were filtered through a 26 µm GF/F Whatman microfiber filter paper. All glassware and metal laboratory materials were washed and rinsed twice with HPLC-grade distilled water and ethanol consecutively, and then dried in the oven. For each of the samples placed in falcon tubes, 50 ml of 10% potassium hydroxide (KOH) solution was added. Samples placed in falcon tubes were then incubated at 40 °C to speed up the digestion process. Samples were shaken daily during the digestion procedure to speed up the process. The suspension was sonicated at 50 Hz for 5 min and shaken at 200 rpm for 5 min. The suspension was centrifuged at 500xg for 5 min and the supernatant was collected and filtered through a Whatman filter membrane. The filtrate was analyzed for the presence of MP particles under light microscopy (Olympus CKX41) using 10× objectives.

### 3. RESULTS AND DISCUSSION:

MP particles were found in all fish samples. MPs' color distributions were 97% (242 pieces) black, 2% (6 pieces) red, and 1% (2 pieces) blue in horse mackerel; 95.50% (723 pieces) black, 3.69% (28 pieces) blue and 0.66% (5 pieces) red MPs in red mullet; 87% (108 pieces) black, 10% (13 pieces) blue and 3% (4 pieces) red in anchovy and 91% (128 units) of black, 8% (11 units) of blue and 1% (1 unit) of red in whiting.

### REFERENCES

Herrera A, Štindlová A, Martínez I, Rapp J, Romero-Kutzner V, Samper MD, et al. Microplastic ingestion by Atlantic chub mackerel (*Scomber colias*) in the Canary Islands coast. *Mar Pollut Bull.* 2019;



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Barnes DKA, Galgani F, Thompson RC, Barlaz M. Accumulation and fragmentation of plastic debris in global environments. *Philos Trans R Soc B Biol Sci.* 2009.

## SPATIAL DISTRIBUTION OF CETACEANS AND MARINE LITTER IN THE ROMANIAN WATERS

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### ABSTRACT

Marine debris poses a serious threat to marine habitats and wildlife and the three Black Sea species of cetaceans are not excluded from this. A clearer understanding of the existing impact on cetacean species from both macro- and micro-litter is necessary. The close link between this type of pollution and some cetaceans, as well as the specific feeding habits and vast distribution of three cetacean species, suggests that they can be considered as marine health indicators for macro- and micro-litter impacts at the basin scale. Between 2019 and 2021, 4 sea surveys were conducted collecting data on cetaceans and floating macro litter in the Romanian territorial waters to identify the interaction between them.

**Keywords:** Marine litter; interaction; Black Sea cetaceans; ANEMONE; CETMAL

### 1. INTRODUCTION

The Black Sea is home to three species of cetaceans: bottlenose dolphin (*Tursiops truncatus* ssp. *ponticus*, Barabasch-Nikiforov, 1940), common dolphin (*Delphinus delphis* ssp. *ponticus*, Barabasch-Nikiforov, 1935), and harbour porpoise (*Phocoena phocoena relicta*, Abel 1905) and according to IUCN, the range of the three species is accepted as the entire Black Sea basin. Without no exception, the Black Sea is subject to pollution, and according to United Nations Development Programme (UNDP), the amount of marine litter is almost twice as high as in the Mediterranean Sea making it the most polluted sea in Europe.

### 2. MATERIALS AND METHODS

The survey was designed in accordance with principles of distance/line transect sampling (Buckland et al., 2001) and the baseline used for mapping was the Romanian territorial waters boundaries. The design followed the equal spacing zigzag design class within the 12 nautical miles area, covering 7% of the study area (~5872 km<sup>2</sup>). A sailing yacht equipped with a single platform for observation, travelling between 6-8 kts on effort, was used. A team of two observers and one data recorder were actively searching and recording the sightings. The maximum distance for searching marine mammals was the horizon, whereas for marine litter the range was a strip of 10 meters. Data regarding cetaceans, floating macro litter, as well as environmental conditions: sea state, glare, cloud coverage and an overall assessment of conditions were recorded.

### 3. RESULTS AND DISCUSSION

Along the 4 vessel surveys performed in spring 2019 and summer 2019, 2020 and 2021 a total of 213 sightings of cetaceans and 76 sightings of floating litter were recorded. The surveys revealed an inconsistency within the distribution of animals, between expeditions, probably influenced by the availability of prey while the distribution of floating litter was influenced by the environmental conditions (waves and currents). Overall, the surveys showed no clear evidence of interaction between macro floating litter and the Black Sea cetaceans. However, given the short amount of time spent on the effort we cannot assume that this interaction could not occur on other occasions and more studies are needed.





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## REFERENCES

BUCKLAND S.T., ANDERSON D. R., BRURNHAM K. P., LAAKE J. L., BORCHERS D. L., THOMAS L. 2001. Introduction to distance sampling. Estimating abundance of biological populations. Oxford University Press. 448.



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## BEACH MACRO LITTER ASSESSMENT IN ROMANIA – LitOUTer FIELD STUDY (2021)

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### ABSTRACT

Marine litter is one of the most pervasive threats to the health of the Black Sea coastal areas and marine life. It is an issue of local, regional, national, and international concern. In 2016, Mare Nostrum NGO started the monitoring and assessment of beach marine litter, which became a key program of the organization. In 2021, there were organized 3 monitoring sessions within LitOUTer project, and 29158 marine litter items were removed from 10 beach sectors. Plastic or synthetic polymers represented the major category of marine litter by material type on the Romanian Black Sea coast (80%) in 2021.

**Keywords:** Beach marine litter; pollution; plastic; monitoring; Romania

### 1. INTRODUCTION

Marine litter is defined as “any persistent, manufactured or processed solid material discarded, disposed of, or abandoned in the marine environment” (UNEP, 2009). It is listed as descriptor ten among the eleven descriptors assessed for achieving good environmental status in all EU marine waters, one of the Marine Strategy framework’s objectives. Thus, it is required for Member States to ensure that “properties and quantities of marine litter do not cause harm to the coastal and marine environment” (MSFD, 2008).

Marine litter issues are not properly addressed, and even actual levels of pollution are not adequately evaluated and monitored in the Black Sea riparian countries.

### 2. MATERIALS AND METHODS

The study presents the recording of macro litter performed on the Romanian Black Sea coast, in 2021, covering 3 seasons: winter, spring, and autumn. Marine debris has been classified into 8 major categories: polymeric/plastic, processed wood, rubber, textile, ceramics/glass, paper, metal, and others. The 10 sampled beaches from South (Vama Veche) to North (Edighiol) were monitored applying the methodology available in the “Guidelines on Monitoring of Marine Litter in European Sea”, periodically updated by the Marine Strategy Framework Directive (MSFD) Technical Group (TG) Litter. The monitoring was done on a section of 100 m in length, and all objects, with a size of more than 2,5 cm, found on the unit were registered.

### 3. RESULTS AND DISCUSSION

The number of inventories and eliminated waste was 29158 (winter – 5799, spring- 5506, and autumn – 17853). By material, the most frequent and abundant debris was plastics, constituting 80% of the total (24813 plastic items). The most common items were cigarette butts and filters (G27) (12058), followed by plastic pieces 2.5<>50 cm (G79) (1901), and crisp packets/sweet wrappers (G30) (1835). The impacts of marine litter are diverse, interconnected and making mitigation even harder.

### REFERENCES

- European Commission, (2013): MSFD Technical Subgroup on Marine Litter, Guidance on Monitoring of Marine Litter in European Seas  
EU-MSDF (2008). Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy



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(Marine Strategy Framework Directive).

UNEP (2009). Marine Litter: A Global Challenge. Nairobi: UNEP.

## WHY LEGAL REGULATIONS AND SANCTIONS DO NOT STOP THE LITTER POLLUTION

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### ABSTRACT

Marine litter may be identified as artificially produced materials are fall into, wash out, and are carried by the wind from land to the marine system. Ineffective waste management on the land is the main reason for litter in the sea. Regional and international regulations and conventions are also ratified by many countries to act together. These regulations support the countries to work together on these serious problems that threaten the world and human life. The reason for not diminishing the litter problem although there are many national and international sanctions is unconscious humans. The conscious is directly related to knowledge and experience. This poster is to explain the statement paper litter problem is not solved without human support.

**Keywords:** National and international legislations, awareness human being

### DISCUSSION AND CONCLUSIONS

For decades, developed, developing, and underdeveloped countries are trying to solve anthropogenic macro pollution but the situation is getting worse each year. Human beings are preferring packaged food and single used materials for catching the speed of life and these requirements are supported by developing technology. This “cause and effect” relationship should be broken down by knowledge and raising awareness about the natural environment. The knowledge must be about the diminishing of natural resources and the protection of the world. The reason for not diminishing the litter problem although there are many national and international sanctions is unconscious humans. The conscious is directly related to knowledge and experience. The first notice of marine litter pollution in the sea in the 1960s, then there are many studies on the natural environment and social and economic impact of litter (Galgani et al., 2015; Newman et al., 2015). There was much advice suggested to reduce marine litter but none of them was a success. Because none of these suggestions were made of humans and raising public awareness. UN submitted a report in 2022 "The Sustainable Development Goals" on the most threatening subjects to the world and humanity (UN, 2022). The report has 17 goals and two of them are directly or indirectly related to litter pollution. Raising public awareness is a crucial step in diminishing litter pollution on earth (Figure 1). Awareness must be supported by scientific results, volunteer workers, and NGOs. The practical studies in front of the public (children) may help raise their awareness (Figure 2).

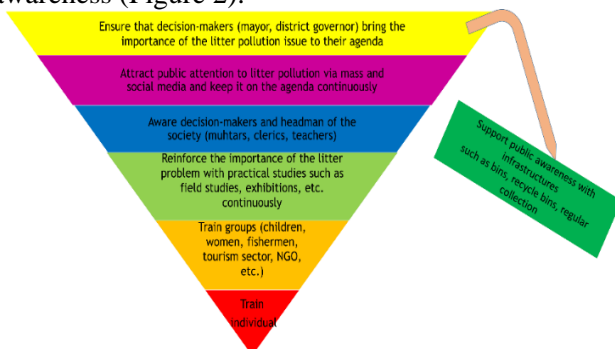


Figure 1: Diagram for creating raising public awareness in society for the litter pollution

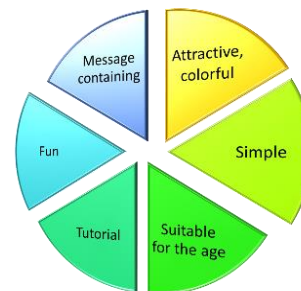


Figure 2: The specification of the awareness materials for children



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## REFERENCES

- Galgani, F., Hanke, G., Maes, T. (2015). Global Distribution, Composition and Abundance of Marine Litter. pp:29-56 In: Bergmann, M., Gutow, L., Klages, M. (eds) Marine Anthropogenic Litter. Springer, Cham. [https://doi.org/10.1007/978-3-319-16510-3\\_2](https://doi.org/10.1007/978-3-319-16510-3_2).
- Newman S., Watkins E., Farmer A., Brink P., Schweitzer J-P.,2015. The Economics of Marine Litter. pp: 367-394 In: Bergmann, M., Gutow, L., Klages, M. (eds) Marine Anthropogenic Litter. Springer, Cham. [https://doi.org/10.1007/978-3-319-16510-3\\_2](https://doi.org/10.1007/978-3-319-16510-3_2).
- UN, 2022. United nations The Sustainable Development Goals Report 2022.68p. <https://unstats.un.org/sdgs/report/2022/The-Sustainable-Development-Goals-Report-2022.pdf>

## FISHING MATERIALS THAT CAUSE POLLUTION IN TRABZON PROVINCIAL RIVER AND MARINE ENVIRONMENT

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**Keywords:** Fishing line; tırıvrı net; marine litter

### 1. INTRODUCTION

Marine litter is defined as solid materials such as plastic, metal, and glass that are left or thrown into rivers and the marine environment (Vişne and Bat, 2015). Marine litter, a global problem; it adversely affects the health of living and interacting creatures in the ocean, sea, and rivers. The fishing line (monofilament and multifilament), which does not deteriorate for a long time when it is forgotten, thrown or left in nature due to the material it is made from, harms the ecosystem. These types of hunting materials continue to be hunted by ghost hunting, especially during their stay in the water. Since natural resources are not unlimited, a balance of protection and use must be observed when using them. If it is used uncontrolled and without considering the ecosystem, it can cause irreparable destruction in the future, and the destruction of habitats and species. Sometimes it may be necessary to spend a great deal of effort and resources to compensate for these losses. Conservation and sustainable use of seas and inland water resources in line with sustainable development is directly related to fisheries management.

### 2. MATERIAL AND METHOD

The coastal cordon of Trabzon province (from the sea), the fishermen's shelters throughout the province and the rivers reaching the sea were determined as the study area. Line nets, which were left or discarded in the sea and used as fishing material, and scrambled tırıvrı nets in inland waters were collected by the control teams of our Provincial Directorate, within the framework of the regulations of our Ministry, with the Kotrol-1 ship within the body of our Provincial Directorate throughout 2021.

### 3. RESULTS AND DISCUSSION

A total of 485 kg of fishing line and tırıvrı nets used as fishing material were collected from the sea, fishing shelters and streams. Of the collected nets, 480 kilograms were fishing line nets and 5 kilograms were tırıvrı nets. Line nets from these fishing materials were taken from sea and fishermen's shelters, and tırıvrı nets were taken from stream mouths. Pollution caused by fishing in Trabzon is more common in the marine environment than in rivers

### 4. CONCLUSION

Information meetings and training activities should be conducted by using visual and written media on the damage caused by marine litter to the aquatic ecosystem of fishermen engaged in fishing activities in seas and rivers. In addition, hunting materials that are broken or become unusable during hunting should not be released into nature.

### REFERENCES

Vişne A., Bat L. (2015). Marine Strategy Framework Directive on the Evaluation of Marine Litter and Current Situation in the Black Sea. *Journal of Aquaculture Engineering and Fisheries Research*, 1(3): 104-115.

## THE IMPACT OF MICROPLASTICS ON AQUATIC ORGANISMS: A REVIEW

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### ABSTRACT

The present review is discussing about biological and physical impacts of microplastics when ingested by aquatic organisms.

**Keywords:** Microplastic; fish gut

### 1. INTRODUCTION

Plastic production has increased globally from 441 MT in 2018 to 459 MT in 2019. Global fish production was 174,6 MT in 2020 decreased to 177,8 MT in 2019. In Türkiye, fish production is 800 thousand tons in 2021. In 2019 per capita consumption of fish is 20.5 kg and 6.2 kg in world and in Turkey respectively (FAO, 2021; TUIK, 2021). While plastics make our lives easier, they are a serious threat to the marine environment. Inadequate management of plastic waste has led to increased contamination of freshwater, estuarine and marine environments. It has been estimated that between 4.8 million to 12.7 million tons of plastic waste entered the oceans.

Primary microplastics are small plastic particles that are directly released into the environment while secondary microplastics originated from bigger plastic items through the process of fragmentation. It degrades into smaller fragments due to UV light, wind and current. Due to the ocean currents, microplastics are widely dispersed in the marine environment (Lusher 2017). Microplastic ingestion can consume the plastic directly, mistaking it for food or inhaling it accidentally or when prey that has consumed plastic is taken by a predator (Wotton 2021). The epithelium of the gut wall represents an important barrier to microplastics, In contrast to microplastics, the epithelium of the gut wall does not form an impenetrable barrier to nanoparticles. Plastic ingestion may cause internal blockages and injury to the digestive tract of fish, which can lead to starvation or malnutrition (Lusher et al 2017).

### 2. RESULTS AND DISCUSSION

Microplastics (MP) will affect many aspects of the aquatic organisms and food web. MPs had negative impacts on reduced the photosynthetic activity in phytoplankton, reduced hatching success and reproduction rate in zooplankton (copepods), gut blockages, decreased feeding rate, oxidative stress in fish and reduced filtering in molluscs (mussel and oysters) (Nanthini devi et al 2022). The negative impacts of microplastics in fish are also decreased condition indexes, fecundity, growth rate, food consumption, larval survivorship and recruitment. Ingestion of microplastic could also reduce nutrient assimilation via digestive tract blockages and irritation of epithelial lining (Lusher et al 2017; Wootton et al 2021). MPs are consumed directly by suspension feeders including oysters and mussels and deposit feeders, such as sea cucumbers annelids, crabs and lobster (Wright et al 2013). Filters and deposit-eating fishes are more vulnerable to microplastics ingestion than predator fishes due to their non-selective feeding behavior (Bhuyan 2022). Fish behavior is also affected by microplastic exposure: the common goby (*Pomatoschistus microps*) displayed reduced predatory performance, abnormal swimming behavior and lethargy (de Sa et al 2015). Overall, 49% of fish contained microplastic, with an average of 3,5 pieces of microplastic per fish in worldwide. But it was 92.5% in China.

The presence of microplastics in the Turkish coast was observed in the gastrointestinal tract contents of pelagic, demersal and mussel (Güven et al 2017; Gedik&Eryasar 2020; Gundogdu et al 2020; Aytan et al 2021). Pelagic fish ingested more microplastic than demersal species (Rummel et al 2015; Phaksopa et al 2021). In contrast Wootton et al (2021) reported that demersal fish had higher amounts of plastic than pelagic fish. Large numbers of small pelagic fishes that consumed microplastics mistaken for food items are converted into fishmeal and fish oil which is used in the aquaculture industry as feed. The entry



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of plastics into the food chain means that they can become more concentrated at higher trophic levels. It should be focused on the impacts of microplastic on fish populations ensuring a sustainable fishing stock.

## REFERENCES

- Aytan et al (2021). Plastic Occurrence in Commercial Fish Species of the Black Sea, Turkish Journal of Fisheries and Aquatic Sciences, 22(7)
- Bhuyan MS (2022). Effects of Microplastics on fish and in Human Health, Frontiers in Environmental Science, 10:1-17.
- De Sa LC, Luis LG, Guilhermino L (2015). Effects of microplastics on juveniles of the common goby (*Pomatoschistus microps*): confusion with prey, reduction of the predatory performance and efficiency, and possible influence of developmental conditions, Environmental Pollution, 196:359-362
- Gundogdu S, Cevik C, Temiz Aktas N (2020). Occurrence of microplastic in the gastrointestinal tracts of some edible fish species along Turkish coast. Turkish Journal of Zoology, 44(4): 312-323
- Güven O, Gökdağ K, Kıdeys AE (2017). Microplastic litter composition of the Turkish territorial waters of the Mediterranean Sea, and its occurrence in the gastrointestinal tract of fish. Environmental Pollution, 223:286-294
- Lusher A, Hollman P, Mendoza-Hill J (2017). Microplastics in fisheries and aquaculture Status of knowledge on their occurrence and implications for aquatic organisms and food safety. FAO Fisheries and Aquaculture Technical paper 615, Rome.
- Nanthini devi K, Raju P, Santhanam P, Perumal P (2022). Impacts of microplastics on marine organisms: Present perspectives and the way forward, Egyptian Journal of Aquatic Research 48 (2022) 205–209
- Phaksopa J, Sukhsangchan R, Keawsang R, Tanapivattanakul K, Thamrongnawasawat T, Worachananant S, Sreesamran P (2021). Presence and Characterization of Microplastics in Coastal Fish around the Eastern Coast of Thailand. Sustainability, 13:13110.
- Wootton NK 2021. Occurrence of microplastic in fish: presence, knowledge and solutions. School of Biological Sciences, The University of Adelaide, Australia.





## WASTES OCCURRED ON SHIPS AND METHODS OF DISPOSAL OF WASTE UNDER THE MARPOL 73/78 CONVENTION

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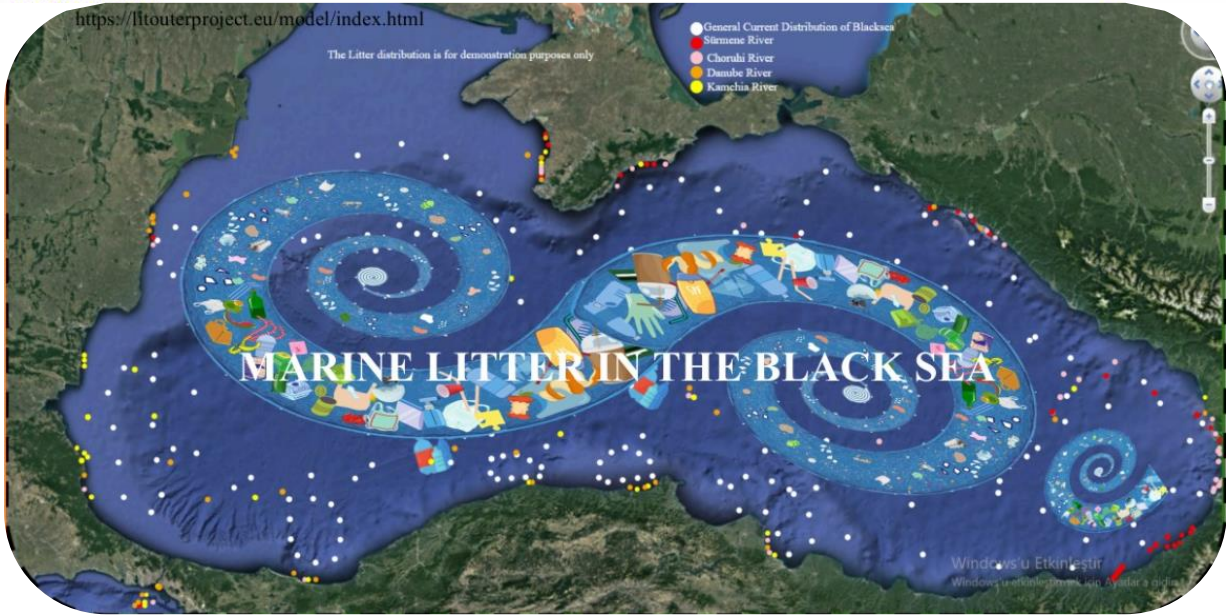
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### ABSTRACT

The wastes formed as a result of the activities and operations of the ships at sea form the basis of today's marine pollution problem. Adoption of the MARPOL 73/78 “International Convention for the Prevention of Pollution of the Seas from Ships” convention is one of the leading measures taken to prevent pollution caused by ship activities. The convention contains rules on how to prevent marine pollution and how to store and dispose of waste. States that have signed the convention must accept the rules and sanctions contained in this convention. Within the scope of this contract signed, various sanctions have been introduced on how to dispose of garbage and wastes arising from operations and crew activities on ships. These sanctions are clearly stated in MARPOL 73/78 Annex-I, Annex-IV and Annex-V, which include sanctions related to solid and garbage according to the type of waste. It is aimed to prevent the pollution of the seas by limiting the disposal of wastes with various sanctions in accordance with the contract. In this study, the processes of disposal of solid waste and garbage defined in MARPOL 73/78 Annex-I, Annex-IV and Annex-V, removal from the ship or sending to port waste facilities were examined.

**Keywords:** Ship waste; marine pollution; MARPOL convention; waste disposal

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## INTERNATIONAL SYMPOSIUM ON MARINE LITTER IN THE BLACK SEA: ECOLOGICAL AND SOCIO-ECONOMIC PROBLEMS

31 October – 2 November 2022

Trabzon, TÜRKİYE

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