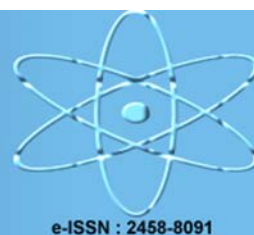




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Effects of Mucilage on Turkish Strait Sea Area-TSSA and Marine Environment

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Abstract

As of May 2021, the mucilage threat affecting the marine environment of the Sea of Marmara and the Turkish Straits has affected the environment and marine life. Significant in Mucilage formation is a slippery and gel-like mass of microorganisms composed of proteins, carbohydrates, and released fatty acids, often aggregated and covering large areas. It is also a structure expressed by single-celled organisms in polluted, polluted, and stressful marine environmental conditions. In particular, Mucilage can be seen in the Turkish Straits, although it is the waterway that connects the Caspian Sea and the Mediterranean Sea, both sea creatures and ships passing by sea creatures. One of the effects of Mucilage is the clogging effect in the filtration of the seawater taken to provide operation in the machine cooling water circuits of the passing ships. The study tries to define the effects of Mucilage on ships and the importance of sea pollution during cruising in the Turkish Straits.

Key words

Mucilage, Turkish Straits Sea Area-(TSSA), BWMS, MARPOL, Marine Environment. Strategy of Maritime Management.

1. INTRODUCTION

Due to the geopolitical and geographic position, the Turkish Straits have a significant role in global Maritime Transportation. The Republic of Turkey has essential geopolitical and strategic work. The strait of Istanbul-SoI, the Strait of Çanakkale-SoC, and the sea of Marmara-SoM are three significant participants which created the Turkish Strait Sea Area. Also, Asia and Europe connect with TSSA as a natural valley like a gate [1,2].

Recent years show with increasing energy transportation, The Turkish Straits are the safest and most eligible waterway between the Black Sea and the Mediterranean and the Black Sea. The Turkish Straits and sea area components have been begun to govern by the Montreux Convention since 1936 [3].

As of May 2021, mucilage effects in the Strait of Istanbul-SoI and the Sea of Marmara-SoM negatively affect the marine environment and navigation safety [4]. It is located in middle latitudes such as the Republic of Turkey, and due to atmospheric effects, its four seasons and meteorological effects are felt. It has exceptional conditions, such as marine plant and animal diversity, which is located in a geographically special place and includes oceanographic and atmospheric conditions to a great extent.

The Turkish Straits are also a migration route used by marine species while connecting two different seas. Therefore, there is the visibility and presence of many kinds of marine life. For this reason, it acts as a biological corridor and also a natural barrier for sea creatures [5]. The study aims to research the evaluation of the effects of the mucilage structure observed in the Turkish Straits marine area on the marine environment.

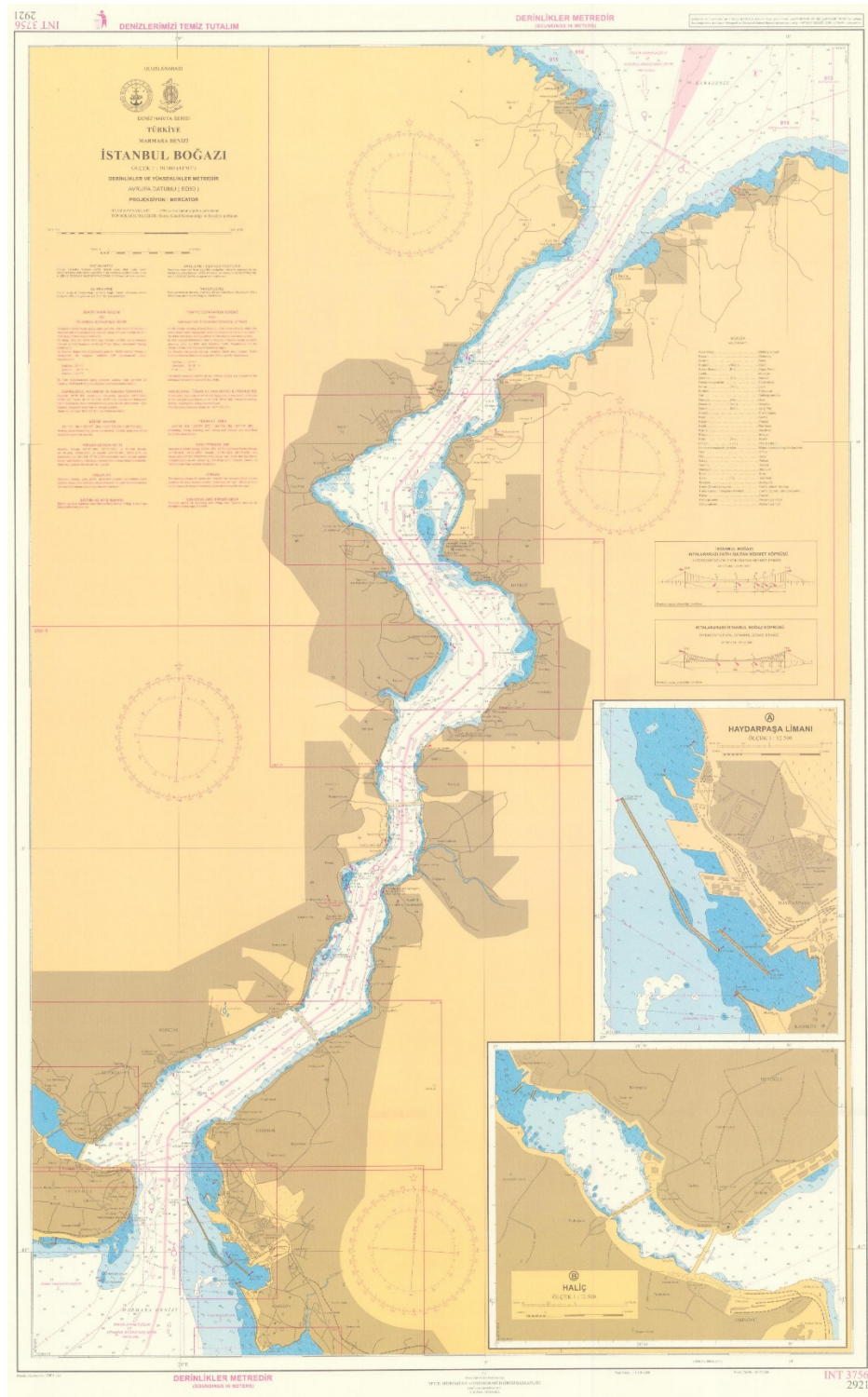


Figure 1. The Strait of Istanbul from paper chart number TR2921.

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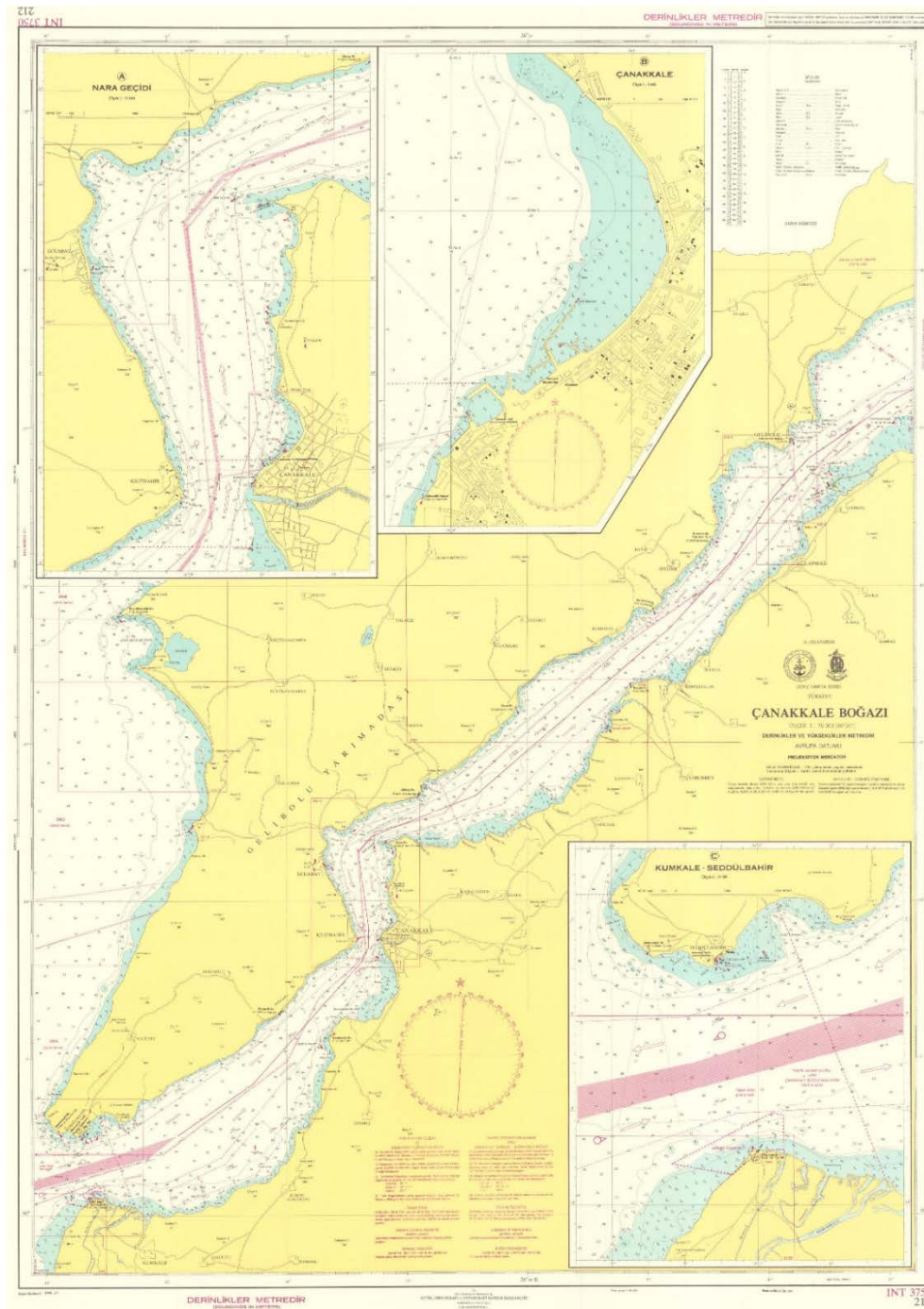


Figure 2. The Strait of Canakkale from paper chart TR 212.

2. MUCILAGE DEFINITION

The mucilage structure contains other forms, which have different names, such as sea saliva, sea snow, or sea snot. In the explanation of the observed part, visible lumps are structures such as living organisms, organic and inorganic substances, dead cells, or passive cell remnants. These structures are common in the open seas or oceans far from the coast but form an essential component of the carbon cycle in the areas mentioned [6]. Mucilage, saliva, or similar structures develop due to certain events in the marine environment. These are events such as the warming of the sea surface and stratification in different water columns in the coastal area. While the salivary structure is first in small lumps, it combines to form large pieces, and the spreading areas find kilometers. The mucilage structure, generally observed in coastal regions, stays on the water surface as a layer. Still, after a while, they age and settle to the bottom as extended filamentous networks and structures due to the deterioration of the natural balance [7]. Primarily phytoplanktons are observed in dynamic seas. The phytoplankton structure, which is thought

Both straits have two different current regimes, surface and subsurface current going through controversial. In the Turkish Straits, the surface current comes from the Black Sea to the Aegean Sea using the Sea of Marmara. Contrary to the surface current, the subsurface current is in the form that the water from the Mediterranean passes into the Black Sea using the Sea of Marmara [2]. As seen in Fig. 3, layers covering the sea surface along the shoreline, long filamentous and network structures, aging and sinking tangles, and formations that form thick layers covering the seabed and the creatures living there were influential in the Sea of Marmara. It affects both the vitality of the sea and the safe navigation of sea vehicles.

4. MARINE ENVIRONMENT, POLLUTIONS REACTIONS STRATEGY PLANNING IMPORTANCE

According to the General Directorate of Coastal Security official statistics, 43.759 vessels in 2019 and 42.036 vessels in 2020, 43.342 vessels in 2021 passed at the Strait of Canakkale. The same statistics show that 41.112 vessels in 2019, 38.404 vessels in 2020, and 38.551 vessels in 2021 sailed at the strait of İstanbul. While such a high traffic volume caused marine pollution in TSSA, the pollution rate increased with the mucilage observed as of May 2021 and raised in coastal areas.



Figure 5. Seawater Inlet filters after mucilage effects [27].

This pollution also affects the filtering systems of the ships during the cruise and causes negative results. Remarkably, the mucilage effect in clogged filters, rudder, and propulsion systems affects the safety of navigation at a high level and causes accidents.



Figure 6. Mucilage in the Sea of Marmara from research ship [28].

5. CONCLUSION AND RESULTS

According to the study, for TSSA, The Marmara Basin, which includes the Sea of Marmara, the Straits, and sea connections, should be considered and evaluated as a whole. Contingency plans should be determined to detect

and reduce land and sea-borne pollutant loads that increase mucilage formation processes in TSSA. For this reason, a science-based approach should be adopted, focusing on the sea and covering all disciplines, protecting marine nature. The use of the water obtained as a result of the Advanced Biological decontamination study in industrial studies for the cleaning of urban green areas and recreation areas and the precise determination and reduction of the amount of wastewater with TSSA should be ensured through inspections and legally penal sanctions. The necessity of prioritizing recycling in terrestrial wastewater treatment plants should be explained with the legal support and control of the government. In places with no facility, coastal areas should be established immediately with management organizations. The formation of marine ecology conditions, which were lost in the TSSA, especially in the upper part of the Marmara Sea, which forms the surface layer, should be regained. Keeping in mind that the sea creatures in TSSA do not belong only to the region, it should be reminded that there are fish refuge/spawning areas with fish migration between the Black Sea, Marmara, and Aegean Seas. Thus, the marine environment protection of TSSA and related marine areas is ensured, and the sustainability of marine life is guaranteed. In particular, studies for monitoring mucilage and pollution should be continued, not only when the problem first started, and satellite images with different spatial and temporal resolutions should be provided. Active satellite detection systems should be examined, comparative studies should be made, and progress processes should be reported. Training should be given on the importance of our seas in the Turkish Straits Sea Area. The importance of the concept of the state of the sea and the importance of the land state should be realized, and the images of being a maritime nation should be given to the next generations from different levels of schools.

CONFLICT OF INTEREST STATEMENT

The author declares that there is no conflict of interest.

REFERENCES

- [1]. H.B.Usluer, Environmental Management Planning and Policies of Marine Pollution at the Strait of Canakkale (Dardanelle), EJSDR European Journal of Sustainable Development Research, Pg.16-25, 2016
- [2]. H.B.Usluer, A.G.Bora, C.Gazioglu, What if the Independenta or Nassia tanker accidents had happened in the Strait of Canakkale (Dardanelle)?, Ocean Engineering, Volume 260, 2022
- [3]. H.B.Usluer, C.Gazioglu, A.G.Bora, "Simulation of Marine Pollution from a Tanker Accident at the Strait of Canakkale (Dardanelle)" 6th ICOEST, 2020
- [4]. Usluer, H., (2021). Musilage Effects on Ships at The Turkish Straits. International Journal of Environment and Geoinformatics (IJEgeo), 9(3): 084-090. doi. 10.30897/ijegeo.1057466
- [5]. H.,B.,Usluer, G.B.Alkan, "Importance of the Marine Science and Charting about Environmental Planning, Management and Policies at the Turkish Straits", EJSDR European Journal of Sustainable Development Research, Pg.16-25, 2016
- [6]. Alldredge, A.L., Silver, M.W., 1988. Characteristics, dynamics, and significance of marine snow. Prog. Oceanogr. 20, 41–82. [https://doi.org/10.1016/0079-6611\(88\)90053-5](https://doi.org/10.1016/0079-6611(88)90053-5)
- [7]. Danovaro, R., Umani, S.F., Pusceddu, A., 2009. Climate change and the potential spreading of marine mucilage and microbial pathogens in the mediterranean sea. PLoS One 4. <https://doi.org/10.1371/journal.pone.0007006>.
- [8]. Bilgili, L., Çetinkaya, A.Y., Sarı, M., Analysis of the effects of domestic waste disposal methods on mucilage with life cycle assessment, Marine Pollution Bulletin, Volume 180, 2022, 113813, ISSN 0025-326X, doi.org/10.1016/j.marpolbul.2022.113813.
- [9]. Suzuki, N., Kato, K. (1953). Studies on suspended materials. Marine snow in the sea. I. Source of marine snow. Bulletin of Faculty of Fisheries, 132- 135.
- [10]. Riley, G. (1963). Organic aggregates in seawater and the dynamics of their formation and utilization. Limnology and Oceanography, 372-381.
- [11]. Lancelot, C. (1995). The mucilage phenomenon in the continental coastal waters of the North Sea. Science in the Total Environment, 83-102
- [12]. Rinaldi, A., Vollenweider, R., Montanari, G., Ferrari, C., and Ghetti, A. (1995). Mucilages in the Italian seas: the Adriatic and Tyrrhenian seas during 1988-1991. Science in the Total Environment, 165-183.
- [13]. Piazzzi, L., Atzori, F., Cadoni, N., Cinti, M.F., Frau, F., Ceccherelli, G. (2018) Benthic mucilage blooms threaten coralligenous reefs. Marine Environmental Research 140: 145-151.
- [14]. Piazzzi, L., Atzori, F., Cadoni, N., Cinti, M.F., Frau, F., Ceccherelli, G. (2018) Benthic mucilage blooms threaten coralligenous reefs. Marine Environmental Research 140: 145-151.
- [15]. Aksu, A., Taşkın, Ö.S., Çağlar, N. (2021). Müsilajın Çevresel Şartlarda Değişen Kimyasal Karakterizasyonu. Marmara Denizi'nin Ekolojisi: Deniz Salyası Oluşumu, Etkileşimleri ve Çözüm Önerileri. Türkiye Bilimler Akademisi

- [16]. Savun-Hekimoğlu, B. , Erbay, B. , Burak, Z. S. Gazioğlu, C. (2021). A Comparative MCDM Analysis of Potential Short-Term Measures for Dealing with Mucilage Problem in the Sea of Marmara. *International Journal of Environment and Geoinformatics*, 8(4), 572-580, doi.: 10.30897/ijegeo.1026107
- [17]. Öztürk, B., Topçu, NE. (2022). The impact of the massive mucilage outbreak in the Sea of Marmara on gorgonians of Prince Islands: A qualitative assessment, *J. Black Sea/Mediterranean Environment*, 27(2), 270-278
- [18]. Karadurmuş, U., Sarı, M. (2022). Marine mucilage in the Sea of Marmara and its effects on the marine ecosystem: mass deaths, *Turk J Zool* 46: 93-102.
- [19]. Gazioğlu, C., Çelik Oİ., Çelik, S. (2022). Marmara Denizi için 2002-2021 Yılları Arasında Klorofil-A Değerlerinin Google Earth Engine Yardımı ile İzlenmesi, TÜDAV Marmara Sempozyumu 2022- İstanbul (In Turkish).Proceeding of the Sym, 25
- [20]. Usluer, H., ,(2021). Musilage Effects on Ships at The Turkish Straits. *International Journal of Environment and Geoinformatics (IJEgeo)*, 9(3): 084-090. doi. 10.30897/ijegeo.1057466
- [21]. Yıldırım O et al., Evaluation of the biogas potential of mucilage formed in the Marmara Sea, *International Journal of Hydrogen Energy*, <https://doi.org/10.1016/j.ijhydene.2021.11.153>
- [22]. Sea saliva (mucilage) in the US press. Is Marmara dying?. <https://indigodergisi.com/2021/05/deniz-salyasi-musilajabd-basininda-marmara-oluyor-mu/Data> Accessed:28.08.2022
- [23]. IHO, 1953. Limits of Oceans and Seas (3rd edition). International Hydrographic Organization, Special Publication 23, IMP Monégasque, Monte Carlo.
- [24]. Alpar,B., Usluer,H.B., Aydın,Ş., Chapter II-GEOGRAPHIC AND BATHYMETRIC RESTRICTIONS ALONG THE TURKISH STRAITS SEA AREA, pg.61-75, (2018). Oil Spill along the Turkish Straits Sea Area; Accidents, Environmental Pollution, Socio-Economic Impacts and Protection. Turkish Marine Research Foundation (TUDAV), Publication No: 47 İstanbul, Turkey
- [25]. <https://www.gemitrafik.com/gemi-trafik-hizmetleri-kullanici-rehberi-yeni-versiyonu/>
- [26]. Usluer,H.B., Environmental Management Planning and Policies of Marine Pollution at the Strait of Canakkale (Dardanelle) , *EJSDR*, Volume 5, Issue 1 (2021), pp. 55–62
- [27]. Acces Date: 10.08.2022, DTO, I. (2021). Marmara denizinde musilaj sorunu ve musilajın gemi makine operasyonlarına etkisi konulu eğitim.
- [28]. Savun-Hekimoğlu, B. and Gazioğlu, C. (2021). Mucilage Problem in the Semi-Enclosed Seas: Recent outburst in the Sea of Marmara. *International Journal of Environment and Geoinformatics (IJEgeo)*, 8(4):402-413. DOI: 10.30897/ijegeo.955739
- [29]. Usluer,H.B.,Bora,A.G.,Gazioğlu,C. (2022). What if the Independenta or Nassia tanker accidents had happened in the Strait of Canakkale (Dardanelle)?, *Ocean Engineering*, Volume 260, doi.org/10.1016/j.oceaneng.2022.111712, pg 1-12