

Oil Pollution of the Black Sea, Turkish Straits System [Istanbul Strait (Bosphorus), Sea of Marmara, Çanakkale Strait, (Dardanelles)] and Golden Horn, in 1997 – 2003

Karadeniz, Türk Boğazları Sisteminde [Istanbul Boğazı, Marmara Denizi, Çanakkale Boğazı] ve Haliç'te 1997–2003 arasında Petrol Kirliliği

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Abstract

The Turkish Straits has been a tanker route for the Russian and Caspian oils from the Black Sea to the Mediterranean Sea.

In this work, the monitoring surveys were conducted on sea water during the years 1997-2003 in the Turkish Straits System (Istanbul Strait, northern part sea of Marmara and Dardanelles), Golden Horn, and vicinity of the Bosphorus entrance to the Black Sea, and additionally west part of the Black Sea in 2003. The oil pollution was determined monthly/seasonally. The highest oil amount in surface water of examined regions between 1997-2003 were ranked as:

for vicinity of Bosphorus entrance to the Black Sea:

2002>1999>2001>2003>1997>2000>1998,

for the Istanbul Strait:

2002>2001>2003>1999>1997>1998>2000,

for the Golden Horn:

2002>2003>2001>2000,

for the Sea of Marmara:

2003>2002>2000>1997>2001>1998>1999,

for the Dardanelles:

2002>2003>2001>1999>1998>1997>2000.

This investigation showed that the oil pollution had varied during the years. It is clear that Turkish Straits system is under the risk of oil pollution. This problem can be solved by the diminish of tanker traffic in the Turkish Straits system.

This monitoring plan was coordinated by İSKİ (The Istanbul Water and Sewerage Administration) and carried out by our Institute.

Keywords: Oil pollution 1997–2004, The Black Sea, Istanbul Strait, Marmara Sea, Dardanelles, Golden Horn.

Introduction

The Turkish Straits System is composed of the Istanbul Strait (Bosphorus), Sea of Marmara and Çanakkale Strait (Dardanelles), Golden Horn inclusive. It connects the Black Sea to the Mediterranean by way of the Aegean Sea.

A comprehensive accounts on oceanography of the Turkish Straits System are given in Memorandum (1941) as follows:

The Istanbul Strait lies between the latitudes of $41^{\circ} 01' N$ and $41^{\circ} 13' N$ and is about 31 km (17 nautical miles) in length, with an average width 1.4 km (8 cables). The narrowest part of the Strait is the İstinye-Kandilli area, lying almost at midway along the Strait, is merely 720 m. (0.4 nautical mile) wide.

The Marmara Sea is 11.500 km² with a volume of 3.378 km³. Its maximum length (Gelibolu- Izmit) is 276 km and the maximum width is 76 km. The whole coastline extends 927 km-264 km of which lies in the European and 663 km in the Asian sides, the deepest point being 1.335 m.

The Golden Horn is an integral part of the Marmara Sea and separates the historical part of the city of Istanbul almost into two equal parts. Golden Horn is 7 km long and 150-900 m wide, having depths ranging from 1m to 42m.

The Dardanelles (Çanakkale Strait) on the other hand, connects the Marmara Sea to the Aegean Sea and then to the Mediterranean Sea. It is 60 km long, 1.2 km at the narrowest and 6.5 km at the widest part, with depths varying between 60 and 100 m. Two layer-current exists in both straits. Water exchange between the Marmara Sea (the Black Sea water, upper layer) and the Aegean Sea (the Mediterranean water, lower layer) produces characteristic layered water structure within the Straits. Speed of the upper-

layer current in southward direction is 0.5-4.8 knots in the Istanbul Strait and 1.6 knots in the Dardanelles; and whereas the rate of bottom current, towards the Black Sea, is 1.6 knots in the Istanbul Strait and 0.4 knot in the Dardanelles.

Number of vessels in dense shipping traffic reaches approximately 65.000 vessels in the Istanbul Strait and 35.000 in the Dardanelles almost every year. Number of tankers passes through the Istanbul Strait, up and down is 16 per day. Tanker traffic that the Strait witnessed by tanker types in 2002 was: petroleum 6022, LPG 545, chemical 860 (Akten, 2003; 2004).

Petroleum hydrocarbons are the important contaminants in seawater. There are several sources of petroleum hydrocarbons introduced to marine environment as spills - tanker accidents, tanker washings (gas-freeing operations), water ballasting, shipping transport, ship operations, storage, etc. All these processes in one way or other increase the oil pollution at sea water.

As indicated above the major problem in the Turkish Straits is especially the tanker traffic. Numerous tanker accidents have occurred in the Turkish Straits. The ship accidents in the Istanbul Strait amounted to 205 in total; 28 of which involved tankers in the period of 1982-1994 (Akten, 2003; 2004).

Many of the following incidents ended up with high or serious rate of oil spill:

- The major disaster was the collision accident between m.t Independenta (laden with 93.000 tons crude oil) with the dry cargo ship Evrialy, happened on 15 Nov. 1979, almost at the southern entrance to the Istanbul Strait, resulting in oil 70.000 tons crude spill and 20.000 tons oil burnt.
- The second major disaster was the Nassia case. It was again a collision accident between the m.t Nassia (with a dangerous cargo of 100.000 tons onboard) and MV Shipbroker occurred at the northern entrance to the Istanbul Strait in March 1994. Outcome of the accident was 2000 tons of crude oil spilled and more than 20.000 tons of oil burnt. Its pollution was investigated by Güven *et al.* (1995, 1996, 1998) and Okuş *et al.* (1996).
- Another serious casualty was the TPAO tanker fire occurred in Tuzla Bay on February 13, 1997 where 41.35 tons oil spilled (Ünlü *et al.*, 2000). The tanker had been taken to the yard for repair before

the fire broke out.

- The river tanker Volganefit 248 accident occurred in Dec. 29, 1999 at Florya, İstanbul, coast of Sea of Marmara. It was broken in two and sank with an oil cargo of 4365 tons, 3086 tons of which was spilled and leaked into the Sea of Marmara (Güven *et al.*, unpublished data).
- M.V Gotia sank at 7 October 2002 in the İstanbul Strait, off the Emirgan quay, with 1082 tons of urea. After the incident 25 tons oil spilled and affected the İstanbul Strait (Güven *et al.*, 2004).

Primary factors responsible for oil pollution in the İstanbul Strait are not only the tanker traffic but also industrial pollution from the countries entouring the Black Sea, plus the city sewage.

The present problem of the Turkish Straits is the transportation of the the Russian and Caspian oils by tankers via the Turkish Straits. Sharp increase in tanker transportation in the Turkish Straits is a major problems for this area. Turkish authorities are committed to reduce the risk of serious oil spill in the high sensitive Turkish Straits (Anon. 1996a). According to papers published so far, oil discharge into the Black Sea is estimated as 410.000 t/a (Polikarpov *et al.*, 1991), however, other estimate an average of 80.000 t (Fashchuk, 1998). Shipping caused the input of 12.000 t/a oil into the Black Sea. Only 28% of the total amount of oil entered into the Black Sea is with river flow, 32–40% from shipping, and 5–10% as a result of oil spills caused by ships, accident and pipeline damage (Fashchuk and Shaporenko, 1995). In the most stable regions of oil film accumulation in the Black Sea in 1981–1990 in Novorossiisk to Tuapse and from Sochi to Batumi (Fashchuk *et al.*, 1996). In a recent paper on oil pollution with regard to Russian and Caspian coastal waters, stands out receives 86% of petroleum hydrocarbons (Shaporenko, 1997). Oil pollution in the region of İstanbul, Odessa and Sochi causes alarming, though 48% of approx. 110 thousand tons of petroleum is transported annually to the Black sea by the inflow of Danube waters (Anon. 1996 b).

In the Sea of Marmara the oil pollution is mostly caused by the inflow from the Black Sea, as well as heavy shipping/tanker traffic and the İzmit refinery. The Dardanelles was also affected by the pollution carried from the Sea of Marmara and shipping/tanker traffic (Güven *et al.*, 2002).

The determination of oil pollution has some problems. These are extraction solvents and reference materials used for quantification. The determination of oil pollution in marine environment was made by various extraction of

