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Investigation of Transit Maritime Traffic in the Strait of Çanakkale (Dardanelles)

Rü0tü Ilgar

Department of Geography Education, Campus of Anafartalar, Çanakkale Onsekiz Mart University, Turkiye

Abstract: Dardanelles is a 61 km (28 mile) long and from 1.2 to 6.4 km (3/4 to 4 miles) vital transportation bridge between the Black Sea and Mediterranean Sea. It separates Asian Turkiye from European Turkiye (Trace), thus it also separates the two continents. This strategically important strait is the Dardanelles. It leads from the Aegean Sea to the Sea of Marmara and to the Black Sea. Marmara is a small harbor sea in Turkiye, connected to the Black Sea by the Istanbul Strait (Bosporus) and to the Aegean Sea by the Çanakkale Strait (Dardanelles). Thus the Dardanelles is the outer gateway to a great productive area. It deals with increasing ecological problems for the last 50 years that concentrations of the organic and inorganic toxic substances in the sea water and sediment are high due to municipal and industrial wastes because of Marmara Coastline city (mainly ¤zmit, ¤stanbul, Tekirdað, Band2rma and Black Sea Country City and South and Central Europe via Dune. The fish and natural life exposed to these compounds are negatively affected. The world's ships must pass through here to reach the grain ports oil ports of Black Sea Country's and the Caucasus region. A total of 49 thousand 453 ships passed the Straits of the Dardanelles in 2009. Increase in the volume of maritime traffic on the Çanakkale Strait and the Sea of Marmara have increased the risk of the maritime accidents over the years. 152.725.704 tone /year using petroleum tanker floating by Çanakkale Strait.

Key words: Marine traffic % Maritime % Vessel % Dardanelles % Turkiye

INTRODUCTION

Turkiye is divided by a complex waterway that connects the Black Sea to the Sea of Marmara and the Aegean Sea. The channel passing between the Black Sea and the Sea of Marmara is named the Istanbul Strait more commonly called the Bosporus. Istanbul is positioned at the south end of the Bosporus. The Sea of Marmara is connected to the Aegean Sea by a channel called the Çanakkale Strait also known as the Dardanelles. The Turkish Straits are very narrow and wind more like a river than the sea. These straits are some of the most dangerous waterways in the world for maritime travelers [1]. The Dardanelles originated as a river valley that became inundated by the sea as a result of the land's subsidence. Length, 120.5 km; width, 1.3 - 18.5 km; depth. 53–106 m. The banks of the Dardanelles are composed of sandstones and limestone, covered with sparse vegetation. The water exchange through the Dardanelles is determined by the difference in the water densities of the two adjoining seas. The surface current, flowing from the Sea of Marmara in the northeast toward the southwest, carries fresher, less dense waters (with a salinity of between 25.5 and 29.0 parts per thousand and a density of 1.018). The velocity of current ranges from 2 to 6 km/h. A deep current flows from the southwest to the northeast and carries from the Aegean Sea saline (up to 38.5 parts per thousand) and dense (1.028–1.029) water. Dardanelles is a 61 km (28 mile) long and from 1.2 to 6.4 km (3/4 to 4 miles) vital transportation bridge between the Black Sea and Mediterranean Sea.

Turkiye, as the third largest importer of Russian gas after Germany and Italy, depends on Russia for almost two-thirds of its gas imports [2]. As a result, some Caspian Basin states are now considering exporting their hydrocarbons via Russia even if that gives Moscow leverage over them [4] while some Western countries that want to punish Russia are discussing allowing exports via Iran [5], causal factors of oil cargo spills and tanker barge vessel accidents, while Anderson and Talley [6] investigates the main factors of the risk and the severity of container cargo accidents. Similarly Psaraftis *et al*. [7], these straits are some of the most dangerous waterways in the world for maritime travelers. Resulting from this massive transportation, the annual global anthropogenic marine oil discharge has been estimated to be around 4.15 million tons [8]. This waterway with its sharp turns (12 within the Strait of TSS, some up to 80º and six within the Strait of Çanakkale. 8 times mucher then Panama Canal, 50 000 ships passed through this narrow canal

Corresponding Author: Rü0tü Ilgar, Department of Geography Education, Campus of Anafartalar, Çanakkale Onsekiz Mart University, Turkiye

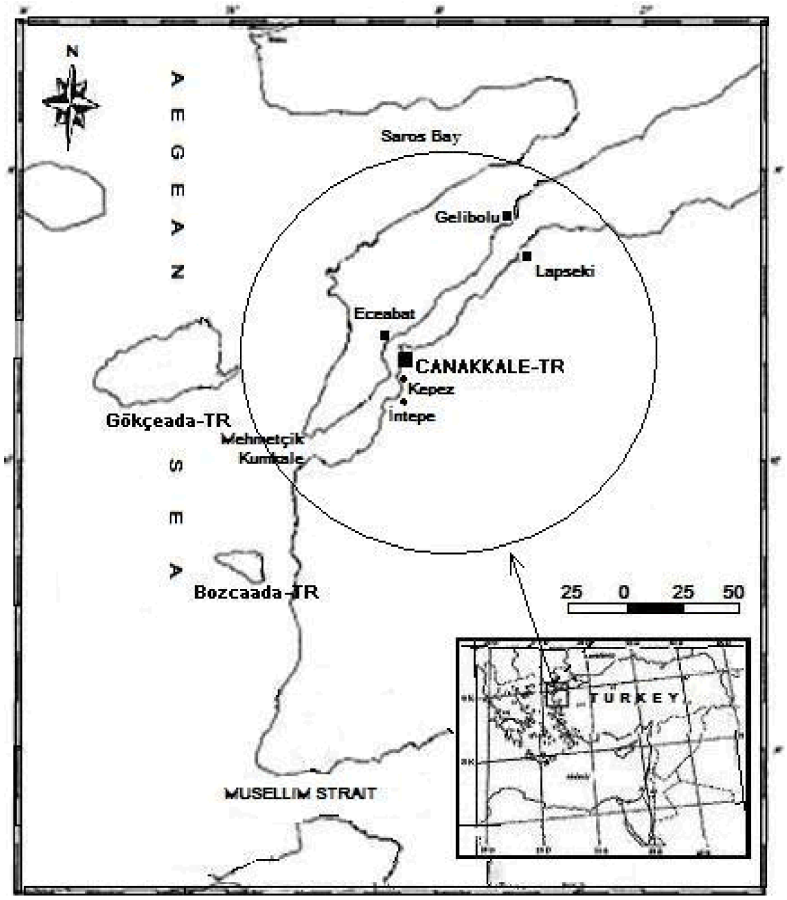


Fig. 1: The Location of Study Area

between the Mediterranean and Black Sea. At the other end of the Mediterranean, the Straits of Gibraltar are traversed by over 80,000 vessels; Çanakkale take a place main city and Gelibolu in coastline. Whilst natural oil seepages into the sea are around 600,000 tons [9] a risk for species invasions, as these vessels were found to carry an average of 60 tons of residual, unpumpable water and sediments [10]. Çanakkale Strait is possible effecting habitats as passing 49 thousand 453 vessel.

Background and Legal Status: The Dardanelles has been a strategic water route-and an object of conquest-throughout history. It is famous for Troy and Fist War marine conflict. That takes progress and alters as a continuous from past (BC, Anatolian Principalities and Ottoman period) to today had came important and increase from every time. Dardanelles called the Hellespont in ancient times; the strait is associated with the legend of Hero and Leander. The modern name comes from Dardanus, mythical ancestor of nearby Troy. The richness of the ancient Troy owed to the wind because ships refuge coast by channel. Çanakkale Strait (Dardanelles) which is located near the Çanakkale city center. Long controlled (1402-1918) by the Ottoman Empire, it was a primary factor in the Eastern Question of the 19th century and the scene of an intensive Allied campaign in World War I. Britain's War Council discussed the possibility of attacking Turkiye in order to re-open the Dardanelles Straits. it was decided to send British troops and units of the Australian and New Zealand Corps (ANZAC) to arrive Russia. But Turkish hero created biggest marine war in The Strait. The fleet included Queen Elizabeth, Lord Nelson, Agamemmon, Inflexible, Ocean, Irresistible, Prince George and Majestic from Britain and the Gaulois, Bouvet and Suffren from France. At first they made good progress until the Bouvet struck a mine, heeled over, capsized and disappeared in a cloud of smoke. Soon afterwards two more ships, Irresistible and Ocean hit mines.

The United Nations Convention on Law of the Sea (UNCLOS) (art. 35/c, 311/5). This article also recognizes the established regimes for the Gibraltar, Danish and Magellan Straits. In legal terms, this means the exclusion, in principle, of the provisions of Part III (art. 34-45) of

UNCLOS to those straits [11]. The Montreux Convention regulates the legal regime of the Turkish Straits and this is recognized by European Country. The Montreux Convention implicitly gives Turkey the power to adopt such a regulatory scheme [12]. The International Convention for the Prevention of Marine Pollution from Ships, (MARPOL), International Regulations for Preventing Collisions at Sea, 1972 (COLREG) [13], 1978) was accepted by Turkish government [14] are related strait rules. The International Maritime Organization (IMO), as a consequence of this UN document, started to refer to the Straits as the Strait of Istanbul, Strait of Çanakkale and the Marmara Sea. Turkey, due to these facts and as the sovereign state of the Straits, started to officially use the term 'Turkish Straits' in its domestic legislation, Turkish Government is set The Traffic Separation Scheme (TSS) which maritime traffic regulations have been implemented for indicates that the yearly casualty rate has sharply been reduced especially after 1998 rules.

RESULTS AND DISCUSSION

The Çanakkale Strait is the most dangerous waterway in the world and serious maritime accidents occurred in the past causing severe environmental destructions besides the loss of life and property and also strategic and economic importance. The Çanakkale Straits both geographically and metaphorically connect Europe to Asia. The TSS are the most unique amongst others due to others physical, hydrological and oceanographic characteristics, as well as the complicated navigational conditions. Turkish Government has taken several constructive steps forward to enhance the navigation through the Strait, inter alia, maritime traffic rules and the VTMIS.

Traffic Scheme: Çanakkale Strait is divided 3 strategically regional transport and naval ship telecommunication.

Çanakkale Straits not only have geopolitical and strategic significance, but also rapidly increasing importance for international transportation, both for the Black Sea states and for the whole world. This waterway with its sharp turns (12 within the Strait of Istanbul, some up to 80º and six within the Strait of Çanakkale also in certain places reaching 80º) and narrowness (in some places to less than a nautical mile) creates real dangers for safety of passage and navigation. Those physical restrictions also create dangers for the environment, including the human and marine environment. There for strait is divided 3 local areas.

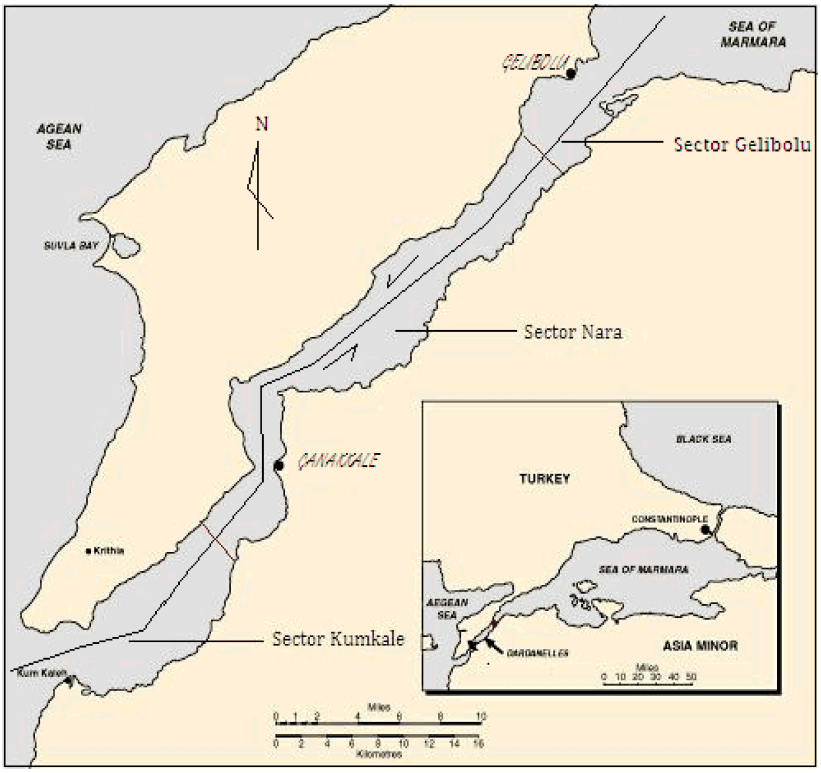


Fig. 2: Çanakkale Strait Sectoral Area Which Establish Risk Scenario

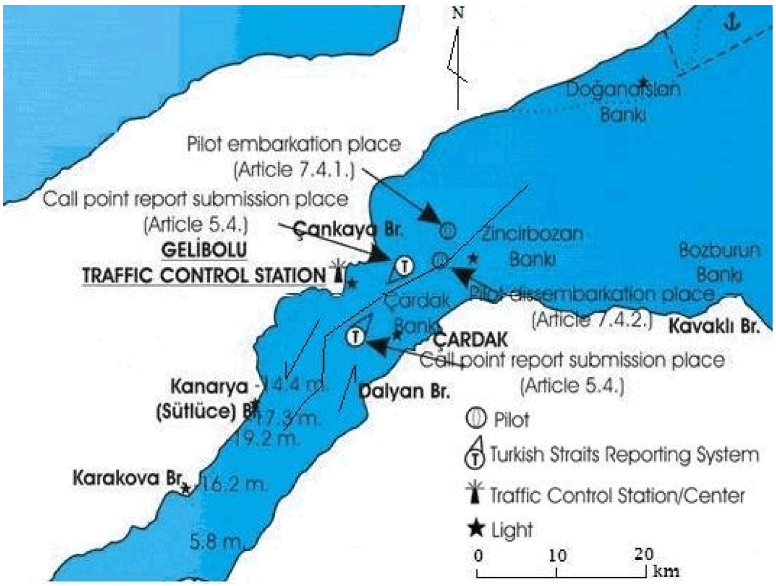


Fig. 3: Sector Gelibolu, Enterence from Marmara in Çanakkale Strait

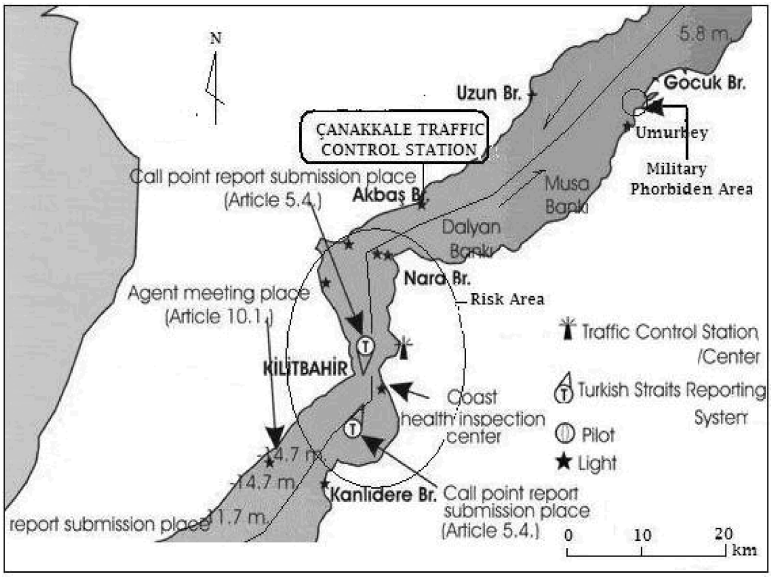


Fig. 4: Dangerous Areas Sector Nara Middle of Çanakkale Strait

Gelibolu Control Station put in order by VHF Channel 11, prior 30 nm to Gelibolu Light House and asking for permission to enter Dardanelles Strait. When you get green light from the Control Station, calling also Gelibolu Pilot by VHF Channel 71 advising position and stand by on VHF Channel 11/71 till entering the Dardanelles and then switch to VHF Channel 13 till leaving the Dardanelles Strait.

The Dardanelles, vessels should, in accordance with rules of Regulations for Prevention Collisions at Sea, keep to that side of mid-channel which lies on their starboard side, taking care to make sound signals in accordance with the rule when approaching the narrows of Çanakkale and the bend of Nara. Vessels should also take every precaution to avoid meeting other vessels in the areas between Kilitbahir and Çanakkale, between Nara and Kilia, between Gelibolu and Cardak; and, when the current or weather is in their favor should give way to oncoming vessels by stopping or reducing speed.

Çanakkale Strait approximately 90 degrees turning make ship maneuvering difficult at Nara Turning point. Current speed is 4 knots at Nara turning point is obvious which would also negatively affect navigation. Nara is the shortest sector and has a sharp turning point both of side. There is environmental potential risk on to Çanakkale city on a account of Nara corner.

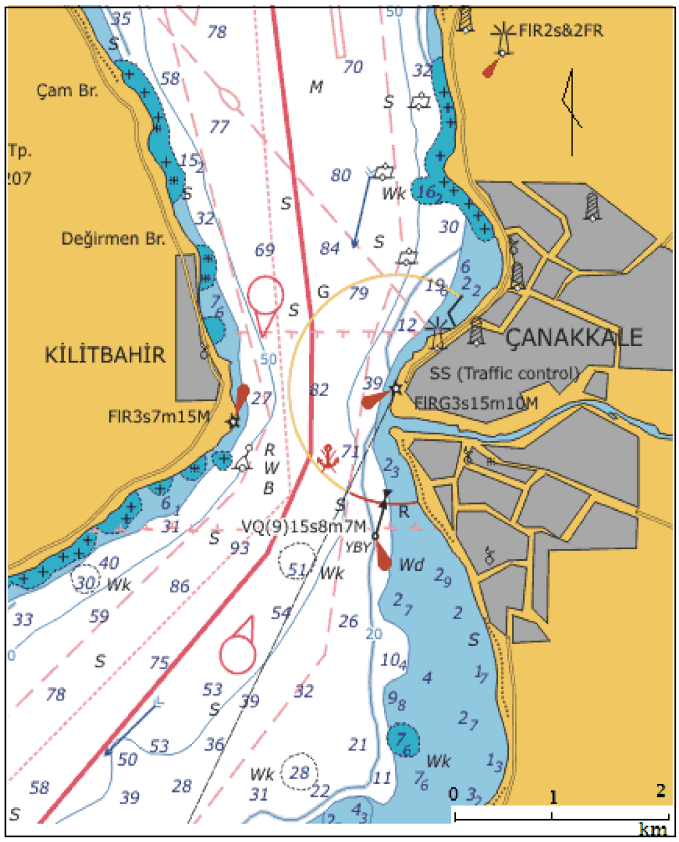


Fig. 5: Properties of Marine Traffic Condition in Front of Nara and Çanakkale City

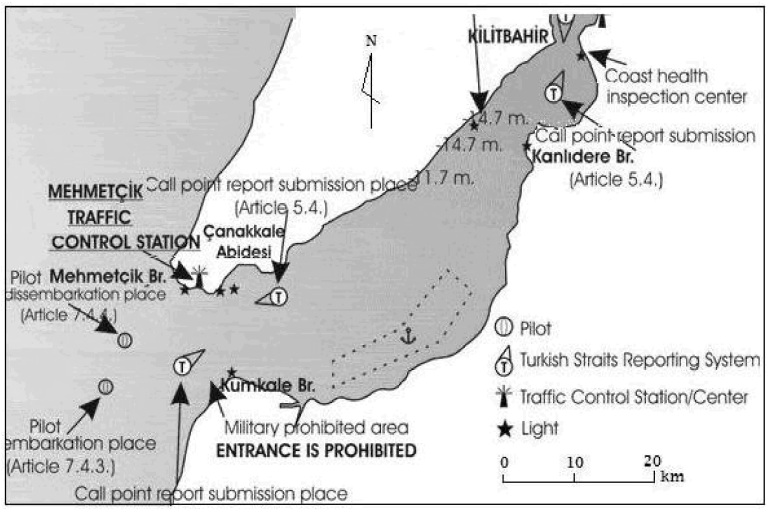


Fig. 6: Sector Kumkale, Exite from Çanakkale Strait to Aegean and Mediterranean Sea

Mehmetcik Control Station by VHF Channel 11, Prior 30 nm to Mehmetcik Light House and ask for permission to enter Dardanelles Strait. When vessel get green light from the Control Station, call also Mehmetcik Pilot by VHF Channel 71 advising position and stand by on VHF Channel 11/71 till entering the Dardanelles.

The Amount of Transit Vessel Traffic: Maritime traffic in the Turkish Straits is exceptionally dense due to merchant traffic, coasters, fishing vessels and local traffic crossing the strait and causing difficulties in the navigation of the transit passage. Approximately 1.5 million people cross the waterway daily on intercity ferries and shuttle boats, accounting for about 1,000 east-west crossings [15] in

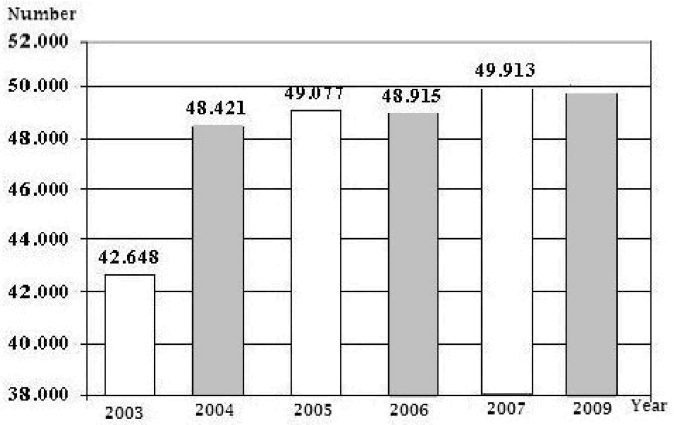


Fig. 7: Vessel Traffic Statistics in the Çanakkale Straits [16]

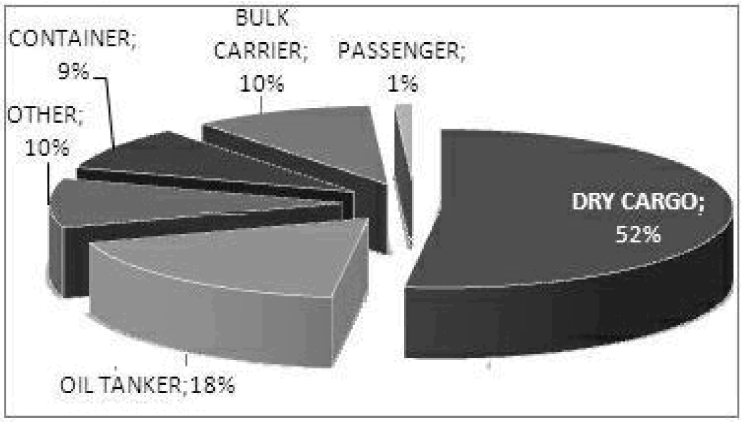


Fig. 8: According to the Distribution of Ship Transition by Type

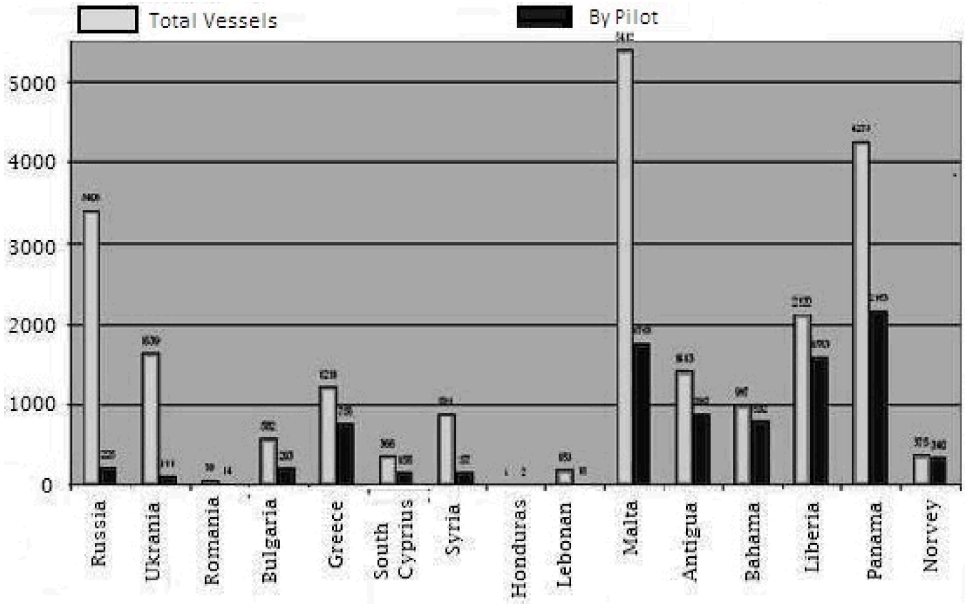


Fig. 9: According to the Type of Ship Transition by flag [16]

Table 1: Amount of Transit Vessel Traffic Statistics in the Çanakkale Straits

Year	Total Vessel	with Pilot	%	Sp1 Giving	%	non Stop	%	>150M	%	<150M	%	>500GT	%	<500GT	%
1995	35459	8292	23	12382	35	23249	66	27295	77	8164	23	3797	11	31662	89
1996	36198	10307	28	13550	37	24072	67	27894	77	8304	23	1409	4	34789	96
1997	36543	11047	30	13570	37	24668	68	28032	77	8511	23	1117	3	35426	97
1998	38777	11448	30	17692	46	25136	65	36383	94	2394	6	1482	4	37295	96
1999	40582	10002	24	24553	61	26900	66	38014	94	2568	6	1492	4	39090	96
2000	41561	11130	26	33861	82	27033	65	38864	93	2697	7	1398	3	40163	97
2001	39249	10704	27	37525	96	26452	67	36289	92	2960	8	936	2	38313	98
2002	42669	12164	28	42077	99	29900	70	39004	91	3665	9	689	2	41980	98
2003	42648	13020	30	42648	100	29114	68	38925	91	3723	9	677	2	41971	98
2004	48421	14404	30	48421	100	36310	75	44504	92	3917	8	1327	3	47094	97
2005	49077	15661	32	48979	100	34784	70	44585	91	4492	9	1211	2	47866	98
2006	48915	16871	35	48264	99	32061	66	44070	90	4845	10	1404	3	47511	97
2007	49913	16885	33	48802	97	31981	64	44968	91	4945	9	1873	4	48040	96
2008	48978	18334	37	48565	99	31981	65	43755	89	5223	9	844	2	48134	98
2009	49453	18588	38	49210	99	32559	66	44277	90	5176	10	615	1	48838	99

Table 2: Usage Pilot and Vessel Traffic Condition in the Çanakkale Straits

Year	Total	Use Pilot	SP I Report	Ship of >200m	Ship of >500	Transit Pass	Tanker
1995	35.450	8.292	12.382	8.164	31.662	23.554	5658
1996	35.387	10.307	13.473	8.304	34.789	24.668	5658
1997	36.543	10.307	13.473	8.304	34.789	24.061	6043
1998	38.777	11.448	17.692	2.394	37.295	25.137	6546
1999	40.582	10.002	24.533	2.568	44.354	26.900	7266
2000	41.561	11.130	33.861	2.697	40.163	26.849	7529
2001	39.249	10.703	-	2.960	38.313	26.443	7064
2002	42.669	12.164	42.477	3.665	41.980	29.600	7637
2003	42.648	13.020	42.648	3.892	42.530	29.120	8114
2004	48.421	14.404	31.469	2.496	30.602	36.123	9016
2005	49.077	15.661	-	4.492	47.866	34.387	8813
2006	48.915	16.871	-	4.845	47.511	32.061	9567
2007	49.913	16.885	48.802	4.945	48.040	31.892	9271
2008	48.978	18.334	48.565	5.223	48.134	31.981	8358

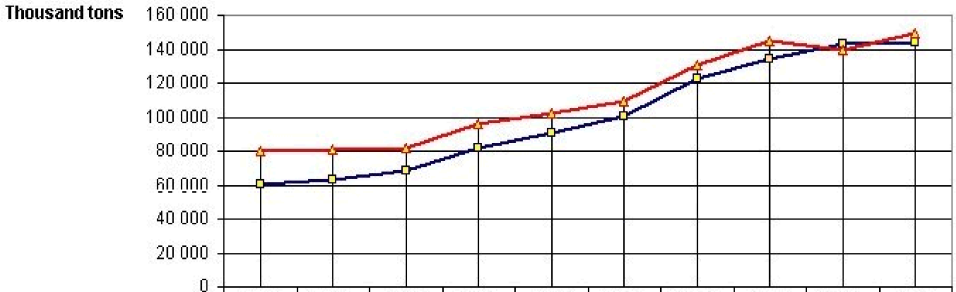
Istanbul strait. No other city in the world is exposed to the transit of such volatile cargo every day.

A total of 49 thousand 453 vessel are transit passed from Çanakkale Strait in 2009 [16] It is mean 135 ships per day pass. A total 5 176 ships big a 200 m in a total 49 453 ship and 9 576 is a oil tanker. A a result vessels are increasing year by year.

While there are no strict length or draft limits on vessels using the Dardanelles Strait, vessels between 150 and 200 meters long and/or with a draft between 10 and 15 meters must report to the Traffic Control Center no less than 24 hours before entering the Dardanelles Strait. Larger vessels must report no less than 48 hours before entering the Turkish straits.

Annual tonnage of dangerous cargo passing through the Çanakkale Straits as bellow:

Dangerous Cargo and Accidents of Maritime Traffic: The nature of Çanakkale Strait and the existing grave situation created dense traffic congestion. In this case, the strait cannot bear additional oil shipments without putting into danger the safety of Çanakkale, the lives of its population and its unique historical and precarious environment. The increase in the maritime traffic becomes more dramatically, reviewing the number of ships passing through the Straits carrying dangerous cargo. Presents and analysis on the factors that are important determinants of maritime transportation risk [17]. Turkish Strait Systems is under ever increasing tanker traffic. The increase in the number of tankers carrying dangerous cargo through the Strait between years 1996-2009 The transit traffic consists of the goods imported and exported by the Black Sea countries and also, at an alarmingly increasing rate, of the oil LNG and LPG. In the past decade



	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Istanbul strait	60 119	63 017	68 574	81 515	91 045	100 769	122 953	134 604	143 448	143 567
Canakkale strait	79 810	80 486	81 975	95 932	102 570	109 626	130 867	145 155	139 204	148 951

Fig. 10: The Amount of Ships per-Year Pass in Çanakkale Strait [2]

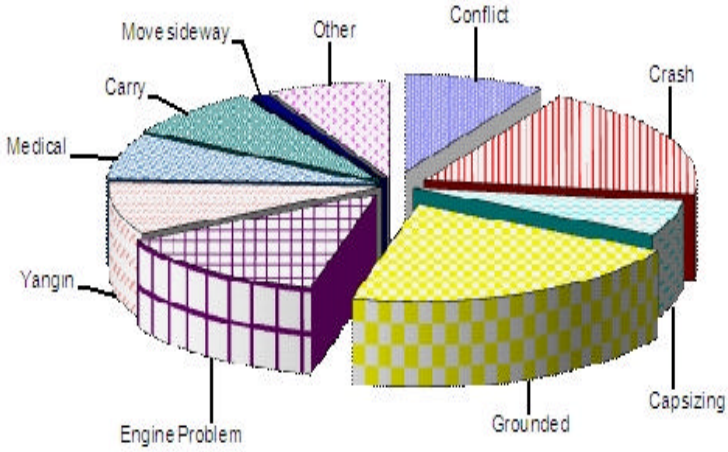


Fig. 11: The cause of the accident in Çanakkale Strait

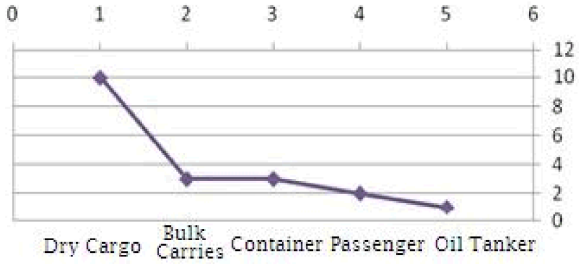


Fig. 12: Types of ships involved in the accident in Çanakkale Strait

the system consisting of the Istanbul and Çanakkale Straits with the inner Sea of Marmara among is a major oil hub the other world energy transportation systems.

The number has reached to 8358. The amount of dangerous cargo being carried through the Straits has increased 138%, being 60.1 million tons in 1996 and 143.5 million tons in 2005 (Figure 10).

The amount of oil transported by sea worldwide increased from 1.3 billion tons in 1988 to over 2 billion tons in 2004 [3]. Marine transportation is the primary means of oil transportation and oil makes up over 35% of the annual tonnage of all sea cargoes [2]. Tankers transport almost 60% of the oil consumed in the world [18].

Ship accidents in the TSS are examined mainly under four categories; collision, grounding, fire and stranding. Each has a distinct effect on the marine ecosystem. Collision is the dominant type of accident in the area. It is caused by poor visibility and strong currents. Mainly ships are breakdown and dry cargo types. It is presented Figure 12.

Prevent of accident must be use pilot system. Because The Dardanelles Strait is almost 38 nautical miles with a width of from 0.7 to 1.1 nautical miles and it contains a very sharp turn at the narrowest point near Çanakkale. Turkish vessels over 150 meters long must use a pilot, but other vessels are recommended to use a pilot, even though it is not required for transit vessels. Vessels not using a pilot in the Dardanelles Strait may expect longer waits than those with pilots. Masters, owners or agents of the vessels carrying dangerous cargo and which are 500 gross tons and more, 24 hours before entering the entrance of the Strait of Istanbul and the Strait of Çanakkale, shall give Sailing Plan I (SP I) as determined by the administration.

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