Turkish J. Marine Sciences 9(3) : 241-265 (2003)

The Strait of Istanbul (Bosphorus) : The seaway separating the continents with its dense shipping traffic

Necmettin Akten

Istanbul University, Institute of Marine Sciences and Management,
34116 Vefa, Istanbul-Turkey.

Abstract

The Strait of Istanbul connecting the Black Sea to the Aegean Sea, is one of the major trade artery in the World with an average of 132 transits a day, second to the Straits of Malacca.

The Montreux Convention of 1936 relating to the regime of the Turkish Straits establishes freedom of passage and navigation with certain formalities for merchant vessels of any flag and with any kind of cargo,by day and by night,and the Strait is kept open for shipping traffic. Hence the Bosphorus serves as an international seaway of economic and strategic importance.

Due to angular windings transit shopping either way, requires at least 12 major course alterations as much as 80°, with severely limited vision around these bends.

Geographical and oceanographic conditions as well as navigational constraints are the main parametres making the navigation through difficult and risky.Additionally, since passage through the Strait entails a run by about 17 nautical miles all the way and takes almost two hours, utmost vigilance is necessary in order to maintain safe standards of navigation and to conduct vessels.

Turkey introduced the traffic separation schemes, in full compliance with the Rule 10 of the ColRegs 72, in the Turkish Straits Region, the Strait of Istanbul inclusive, to enhance safety of navigation. The new schemes have been in use since 01 July 1994.

One of the contemporary safety measures that Turkish Republic has taken recently is to install the use of the VTMIS, Vessel Traffic Management and Information System. The system based on 7 radar stations is fully operational as from 01 July 2003. A

The Strait faces dense shipping transits. Mean figure to cover 1994-2002 period indicates that 132 vessels a day navigate the Bosphorus. Taking 1936 figure as the basis, shipping traffic has increased by almost ten times.

The Strait faced 461 marine casualties of different types - i.e 209 collisions, 138 groundings, 77 strandings, 28 fires / explosions and 9 others (such as rudder blockade, vessel's list, or engine breakdown) - in 1953-2002 period.

Safe navigation in the Bosphorus is a matter of vital importance to Turkey as well as to all nations using the Strait. Therefore, the dangers posed by ever increasing shipping traffic to the surrounding inhabited areas and to the environment have compelled Turkey to take immediate action and to reinforce existing regulations of maritime traffic in the Strait.

Key words: The Strait of Istanbul, Montreux Convention, seaway, Vessel Traffic System (VTS), casualty, shipping traffic, current, Traffic Separation Scheme (TSS),grounding, stranding.

Introduction

Bosphorus: Narrow and confined seaway open for international shiping

The Strait of Istanbul, the Bosphorus, or sometimes spelled as Bosporus and called as Bogazici in Turkish, is one of the two narrrow Turkish Straits connecting the Sea of Marmara with open seas, the Black Sea and the Aegean. It separates the two Continents, Asiatic and European Turkey, and is also the integral part of the Turkish Straits which comprise the Dardanelles, Sea of Marmara and Bosphorus, the whole area being known as the Turkish Straits Region (TSR). It also serves as an international waterway of economic and strategic importance.

The Strait of Istanbul is a Turkish waterway open for international shipping whose navigation regime is regulated by the Montreux Convention in force since 1936.

Prior to Montreux Convention, the Treaty of Lausanne dealt with certain issues of the Turkish Straits like principle of freedom of transit by sea which was subject to international sanitary provisions, and charges to be levied for services (such as lights, pilotage, and towage) directly rendered.

Montreux Convention regarding the regime of the Turkish Straits however, set forth the principle of the freedom of transit (passage) and navigation for merchant vessels under any flag and with any kind of cargo *(Article 2 of the Convention)*. The principle applicable by day and by night is subject to implementation of certain formalities by merchant ships. The Convention also lays down admissible and compulsory charges and dues to be effected by merchant vessels in the Annex.

The Seaway constitutes one of the major and busiest trade artery in the World, with its dense shipping traffic, local as well as international, and is second to the Malacca Straits. The Straits of Malacca are the busiest seaway in the World with approximately 300 vessels passage a day (100.000 per year).The Turkish Straits, the Bosphorus in particular, follows with an average of 132 vessels transit (passage) a day, local traffic exclusive, and the Dover Strait with approximately 125 vessels passing north-south and 100 crossings a day is the very close third (Oral,2001).

Similarly, shipping traffic compared with the main canals of the World shows clearly the high density of the traffic through the Strait : (1999-2000)

Table 1. The Bosphorus and the main Canals(*Institute of Shipping Economics and Logistics, Bremen, Yearly statistics.*)

Canal	Annual shipping traffic
Panama Canal	12755
Suez Canal	13552
Kiel Canal	23945
Bosphorus	48000

There are 265 straits in the World; the Turkish Straits, and the Bosphorus in particular, are the most unique amongst those due to their physical, hydrological and oceanographic characteristics as well as the complicated navigational conditions (İstikbal 2001).

Structurally the Strait of Istanbul is an inundated valley following an irregular northeast-southwest course with a full length of 17 nautical miles (31 km) and as it looks resembles a river with abrupt and angular windings, bordered on both sides partly by steep and mountainous coasts.

There are sixteen headlands which affect the navigation in the Strait – nine of which are on the European side and the remaining seven are on the Asian. The trends and width of the Strait permit a significant range of visibility at many parts of the navigable channel (Akten,1968) Several sharp turns within the Strait exist in areas such as Umuryeri, Yeniköy, Kanlıca,Kandilli and Kızkulesi (45° at Kandilli, 80° at Yeniköy,70° at Umur Bankı or Umuryeri) (Chapman and Akten,1998).

The narrowest reach of the Strait is the Bebek - Kandilli area, almost lying at midway along the Strait, where the width is merely 0.4 nautical mile (700 m) and a strong current usually known as "Şeytan akıntısı – devil's current", the average rate being 4 knots but can reach about 8 knots, sets.

Studies with regard to evolution models on the densely populated and busy seaway, proposed by very many authors covering the end of the 19th and the early 20th Centuries period, are still controversial. As to many of them, the Bosphorus was developed from a palaeostream; for some others, the Strait was opened as a graben. Lately however, a composite evolutionary model was suggested involving both stream and graben hypotheses. The present form of the Bosphorus was established in Holocene time by the connection of the basin in the south with the stream in the north. The barrier and the stream valley in the north have been deepened by erosion and faulting to form a strait connecting the Black Sea and the Mediterranean (Gökaşan et al. 1997)

The Strait is a singularly tricky strip of water. Due to angular windings, transits, up or down, require at least 12 major alterations

of course as much as 80°, with severely limited vision around these bends. Shape of the Strait limits to have an extended sight for a proper look-out particularly beyond several headlands, except a few, as those close the view behind, while proceeding through the current traffic lane allocated for the vessel (Akten, 2002).

Unique characteristics of the Strait of Istanbul can be summed up as follows (İstikbal;2001).

- It has a winding and quite narrow geographical structure,
- It is 17 nautical miles in length,
- Among the straits of the World it is the narrowest, constricting to a mere 0.4 nautical mile (700 metre) between Kandilli and Bebek, leaving only a vessel's length of free-way on either side in an area densely populated,
- It has numerous bends requiring 12 course alterations for; some of these alterations are very sharp, more than 80 degrees,
- At the bends (Kandilli and Yeniköy) where major course alterations have to be made, rear and forward visibility is totally obstructed prior to and during manoeuvring.

There exists 24 coastal lights in total, equally twelve on each side, and 8 navigation buoys to mark the Strait for a safe navigation.

Coastal lights are deployed on both sides to indicate clearly the lateral ends of the navigable channel. The Anatolian coast is considered the port-side and the lights accordingly exhibit red lights; the European coast similarly is considered the starboard side and the lights thus exhibit green lights (Admiralty ; 1955,1990,2000).Therefore, lateral system as such is used in the Bosphorus in conjunction with a conventional direction for marking the channel.

Two types of water current are dominant in the Bosphorus – the main surface (or kanal) current and the undercurrent. The main surface current is a slope current – the primary cause being that the level of the Black Sea is higher than that of the Sea of Marmara by about 0.4 metre - due to excessive flow of water into the Black Sea,

discharged by the rivers. The undercurrent however is of density type.

Main surface current, almost invariably setting southward, may reach upto 8 knots when northerly wind are severe and the rivers discharge the greatest volume of water into the Black Sea.

Under the influence of strong southerly winds of prolonged duration, the water level in the Bosphorus rises as much as almost 0.6 metre and thus gives rise to the rate of surface current be reduced , or reversed in direction, i.e flowing towards the Black Sea. Such current is locally named as Orkoz. The stronger is the wind the greater is the rise in sea level, ultimately Orkoz being stronger (Akten, 2002).

Navigation in the strait

"Straits that play a key-role in international communications are prime example of situations in which the interests of flag and coastal states collide. Unimpeded navigation through such important straits has for flag states great economic and strategic significance, while coastal states are confronted with a range of risks brought by heavy traffic, not at least of which concerns the marine environment. Accidents are more likely to happen in straits than in open spaces, and harmful substances will usually have relatively grave effects, due again to the proximity of the coastline and the frequently shallow waters" (Molenaar:1998).

Geographical and oceanographic conditions as well as navigational constraints of the Strait, i.e narrowness, deep and steep structure which grants poor visibility at nights for ships passing through, numerous course alterations as much as 80°, day-to-day changing currents and bad weather conditions are the main parameters making the navigation through difficult and risky. In addition, since passage through the Seaway entails a run by about 17 nautical miles all the way and takes almost two hours, utmost vigilance is necessary in order to maintain safe standards of navigation and to conduct vessels.

Several world-wide known tanker companies operating large vessels, inter alia BP, having taken the complicated factors that make navigation through difficult into consideration, conducted

studies on reasons why of the past shipping accidents in order to obtain sound measures and hence to develop a company policy for their vessels to use the Strait for future passages. BP accordingly has adopted the Turkish transit guidelines as the minimum Company requirements to follow for all tankers on BP business, as these are practical, realistic and effective.

The Company policy being complied with by all tankers carrying BP cargoes on all their transits through the Turkish Straits has been in force since 1999 and includes inter alia the following measures (Bilbo, 2001).

- Recommended pilotage for transits of the Bosphorus and Dardanelles,
- Controlled traffic flow when visibility is less than one mile,
- Maximum speed limit of 10 knots over the ground,
- Daylight only transits for larger and deep draught vessels,
- Closure of the Straits to hazardous shipping when visibility is less than one mile.

The Company insists on pilots for all their transits and wholeheartedly encourages others to do so. (Bilbo, 2001).

Measures – past and present

A "left-side up" navigation scheme was applicable in the Bosphorus within the period 1934-1982.Vessels proceeding from the Sea of Marmara had to keep the port (European) side of the channel and as close inshore as possible to avoid collisions, according to Article 25 of the Collision Regulations in force in that time. From 01 May 1982 however, the Collisions Regulations 1972 became fully applicable, and hence a "right-side up" scheme now applies in the Strait (Chapman and Akten, 1998).

Turkey introduced the traffic separation schemes, in full compliance with the Rule 10 of the ColRegs 72, in the Turkish Straits Region, the Strait of Istanbul inclusive, to enhance safety of navigation. The new schemes have been in use since 01 July 1994.

Implementation allows two-way traffic to ensure the "innocent passage" of any vessel. However, when a large vessel is enjoying the freedom of passage afforded by the Strait, an authoritative intervention of some sort is needed to avoid a potential collision.

As an international seaway, the Turkish Straits , accordingly the Bosphorus, is kept open for two-way traffic and all merchant ships enjoy freedom of navigation through it. For large vessels which cannot comply with the requirements of the schemes , the temporary suspension of two-way traffic, when needed, is envisaged by the Rules to ensure a "no-collision" situation – in order to protect the interests of vessels passing through, as well as the safety of local inhabitants and the environment. Because, keeping to the lane and coming over the centre of the channel when rounding a narrow bend with a following current, particularly in the narrowest part of the Bosphorus, namely Rumelihisarı-Anadoluhisarı area, is quite impossible for vessels of such size (Chapman and Akten, 1998) .

Traffic Separation Schemes (TSS) are implemented to ease and regulate traffic flow, and prevent ships approaching head-on to each other in the busy seaways where the shipping traffic is dense and the sea-room is rather restricted or relatively insufficient. It also helps to greatly enhance the pilot's ability.

New traffic separation schemes have been approved by IMO and were formally adopted on 25th November 1995. According to the schemes, a transit route divided into north and south bound traffic lanes, has been established all the way through the Strait and vessels, during transit of the Strait, shall not overtake, nor attempt to overtake, other vessels unless forced to do so and not to cross the median line of the transit route.

A notable feature of the Turkish TSSs in the winding and narrow Strait is that vessels larger than 200 metres in length are often unable to remain completely within the appropriate traffic lane, so that the relevant Turkish Administration temporarily suspends the two-way traffic and regulate one-way traffic to maintain a safe distance between vessels.

The current application of the Turkish Regulations with regard to larger vessels is as follows :

- Tankers of 200 metre and above in length can effect their passage through the Strait during daytime only,

- Tankers of 250 to 300 metre range in length can only pass through after temporarily suspension of the two-way traffic and hence one-way traffic is regulated,
- Vessels of 300 metre and above in length are subject to specific terms and conditions based on the safety measures of the Turkish Administration. The same would apply for vessels under towage.

One of the contemporary safety measures that Turkish Republic has taken recently is to install the VTMIS, Vessel Traffic Management and Information System. The system based on 7 radar stations is fully operational as from 01 July 2003. A Tender in this regard was announced on December 15,1998 and Lockheed Martin was granted the tender in late 1999. The full system is said to cost around 40 millions USD.

Maritime traffic

The Strait of Istanbul, or the Bosphorus, faces dense shipping transits. Mean of yearly figures covering the traffic separation schemes period, 1994–2002 in particular, indicates that on a daily basis 132 vessels (or nearly 6 vessels an hour) navigate the Strait. When local but "intra-Strait" traffic is taken into account, almost another 2000 crossings a day (or roughly 85 crossings an hour) must be added to the figure above. Therefore, it would not be wrong to say that any time in any day nearly 100 "floating bodies" use the Strait – either crossing or proceeding up or down.

Maritime traffic for number of transits was 4125 in the year 1841 and almost tripled in 1856 during the Crimenian War, being yearly 14170 , and is around 24000 in each direction today, including inter alia, large tankers, chemicals, product tankers, LNG and LPG carriers and local transits.

In the year 1936 in which the Montreux Convention was signed and brought into effect, the number of vessels passed through the Bosphorus was 4700 – aggregate tonnage and the average vessel size being 9.71 millions nrt and 2066 nrt respectively. Similar figure for the year 2002 however was 47253 vessels having aggregate tonnage of 389.4 million GT – average size per vessel being approx. 8300 GT.

The following table shows the development of shipping traffic in the Bosphorus, taking the traffic figure for the year 1936 within which the Montreux Convention was brought into effect as the basis (1936=100):

Table.2. Development of shipping traffic in the Bosphorus

Year	*Number of vessels Passed*	*Yearly increase (1936 =100)*
1841	*4125*	*88*
1856	*14170*	*301*
1910	*35256*	*750*
1936	*4700*	*100*
1982	*12983*	*276*
1994	*18720*	*398*
2000	*48079*	*1023*
2002	*47283*	*1005*
1994-2002	***47264***	***950***

N.B : 1994 and onwards, figures also include the local shipping traffic using the Strait

The Turkish Straits, for the last 10 years at least, have turned into one of the key shipping foci of the world seaborne oil trade, such as the Suez Canal,the Straits of Malacca and the Straits of Dover. It was previously the same in 1892.In that year, oil cargoes loaded in the Black Sea port Batumi were delivered by tankers to their customers in the Far East destination, passing through the Turkish Straits.

Nearly 123 millon tons of oil passed through the Turkish Straits last year, [1] representing 5 per cent of the oil traded by sea. Number of tankers passed through the Strait of Istanbul, up or down, was 6022 last year. In other words, 16 tankers a day, large or small, sailed through the Bosphorus, laden or in ballast. Similarly, 1405 tankers carrying LPG and chemicals further used the Bosphorus, which means additional 4 tankers a day - but smaller in size.

[1] Relevant figures for previous years are as follows : 63 million tons,in 1997 69 million tons in 1998, 82 million tons in 1999, 91 million tons in 2000 and 101 million tons in 2001 respectively.

Tanker traffic that the Bosphorus witnessed by vessel type in 2000-2003 period is shown in Table-3 :
Figure for 1995 indicates a sharp increase by 150 percent as compared with 1994. This is mainly because all vessels 500 GT and upward, local shipping traffic inclusive, are included in the maritime traffic schemes and are required to submit sailing plan I and II as is done by international shipping traffic as per the By-law in force.

Large vessels use the Strait although there exists navigational constrains for such vessels - figurewise constituting nearly 5 percent of the total traffic. Large vessel is specified in the Turkish Bye-law as " a vessel 200 metre or more in length". Development of large vessel traffic in the Bosphorus is shown in Table - 5 :

Table .3 . Tanker traffic by vessel type (2000 – 2003) (Turkish Chamber of Shipping (1997 through 2003) Shipping Sector Reports, Table- 48, p.82

Tanker type	*1997*	*1998*	*1999*	*2000*	*2001*	*2002*
petroleum / product	4303	4100	4452	4937	5188	6022
LPG	438	445	475	474	548	545
Chemical	628	597	577	682	782	860
LNG	-	-	-	-	-	-
Total	*5369*	*5142*	*5504*	*6093*	*6518*	*74*

Compilation of statistics produced by the Turkish Maritime Undersecretariat reveals that within the current Traffic Separation Schemes period, around 47000 vessels yearly pass the Strait - average ship size being 6024 GT :

Table .4 .Shipping traffic and marine casualties in the Bosphorus

Year	*Number of vessel passed*	*Ship tonnage : (GT)*	
		Total (million)	*Average*
1994	*18720*		
1995	*46954*		
1996	*49952*	*156.1*	*3125*
1997	*50942*	*281.1*	*5518*
1998	*49304*	*276.8*	*5614*
1999	*47906*	*293.3*	*6122*
2000	*48079*	*309.4*	*6435*
2001	*42637*	*318.2*	*7463*
2002	*47283*	*389.4*	*8241*
Yearly average	***47264***	**289.2**	***6024***

Table . 5 .Large vessels traffic in the Bosphorus

Year	Bosphorus traffic total	Large vessels total	Daily average
1994	18720	-	-
1995	46954	-	-
1996	49952	3720	10
1997	50942	6487	18
1998	49304	1943	5
1999	47906	2168	6
2000	48079	2203	6
2001	42637	2453	7
2002	47253	3013	8

The largest vessels have used the Strait so far were two tankers and a bulker of very large size (TUMPA) :

- Kanchen Junga, Indian tanker, 139820 gt, length 333 m, breadth 52 m (01 Jan 1990),
- Agip Lazio, Italian tanker, 127070 gt, 349 m in length, 52 m in breadth (25 May1990),
- S.G Enterprise, Bahamanian bulker, length 312 m, breadth 50 m (05 Aug 2000).

Break-bulk ships are the leading ship type using the Strait of Istanbul, followed by petroleum tankers. Last year 28162 break-bulkers passed through the Strait. Number of petroleum tankers for the year 2002 was 6022. Similarly, Turkey, Malta, Russian Federation and Ukraine are the top-four flag states using the Strait. Breakdown of the shipping traffic by main ship types and the first ten-flag states using the Bosphorus are shown in Table-6 and Table-7 respectively :

Table.6 . Shipping traffic by vessel type 1997-2003) (Turkish Chamber of Shipping (1997 through 2003): Shipping Sector Reports, Table- 38,48,49, p.82,99

Ship type / year	*1997*	*1998*	*1999*	*2001*	*2002*
Break-bulk	24302	24931	26429	24254	28162
Petroleum tanker	4303	4100	4452	5188	6022
Dry bulker	2794	3148	3052	3437	4029
Coaster	10824	10161	7914	3832	2643
Container	1928	1587	1273	1448	1654
Passenger	3054	2456	1862	1503	1591
Chemical tanker	628	597	577	782	860
LPG tanker	438	445	475	548	545
Reefer ship	342	349	338	384	420
Ro/ro ship	882	513	283	265	294
Tug boat	258	224	352	247	270
Livestock carrier	418	205	442	225	201
LNG tanker	-	-	-	-	-
Others	771	588	457	526	595
T o t a l	*50942*	*49304*	*47906*	*42637*	*47283*

Table .7 . Main users of the Strait

Flag / *Year*	*2000*	*2001*	*2002*
Turkey	*15311*	*12174*	*12643*
Malta	*5374*	*5065*	*5647*
Russian Federation	*5419*	*4670*	*4942*
Ukraine	*5195*	*4355*	*4591*
Syria	*2167*	*1798*	*1671*
Panama	*1090*	*1042*	*1421*
Southern Cyprus	*1054*	*970*	*1191*
Greece	*1033*	*1144*	*1188*
Bulgaria	*920*	*833*	*761*
Liberia	*358*	*404*	*732*
Total	*48079*	*42637*	*47283*

The Turkish Straits Passage Regime :

A strait is known to connect two parts of the open sea and the waters are used for international traffic. The two basic principles with regard to straits - even though territorial in character - recognized by the international law is that a foreign vessel can not be excluded from and must be allowed inoffensive passage through in time of peace. This approach is based on the understanding that a strait forms part of the highways for international traffic. Internationally accepted rules also recognize that inoffensive passage through a strait to be without any dues and tolls whatever. No taxes or dues are to be levied except those representing expenses incurred by the riparian state *for buoying and dredging, for maintaining lighthouses, and for supervising pilotage through the straits in the interest of general navigation.*

With recognition of the principle of free navigation on the sea, all dues connected with straits became no longer admissible. The inconsistency between the collection of tolls or dues and the freedom of navigation was reconciled once for all by the Treaty of Copenhagen of March 14,1857, which decided in favour of the doctrine of freedom of navigation. (Singh ,1973).

The Turkish Straits passage regime is regulated under the Montreux Convention of 1936. The Montreux Convention reckons the *freedom of passage and navigation* and provides a detailed regime for passage for vessels of any type (merchant ships and warships), flag and size.

The Montreux Convention is made of 29 articles, 4 annexes and one protocol. Its contracting parties are Bulgaria, France, Great Britain, Greece, Japan, Romania, Turkey, USSR and Yugoslavia.

The aim of the passage regime was set out in the Chapeau of the Convention as, *"desiring to regulate transit and navigation in the Straits of the Dardanelles, the Sea of Marmara and the Bosphorus comprised under the general term "Straits" in such manner as to safeguard, within the framework of Turkish security and of the security in the Black Sea, of the riparian States, the principle enshrined in Article 23 of the Treaty of Peace signed at Lausanne on July 24, 1923 ".*

Section I which is comprised of 7 articles handles merchant vessels. Article 2 states that merchant vessels shall enjoy freedom of passage and navigation in the Straits, by day and by night, under any flag and with any kind of cargo, without any formalities, except sanitary control . Pilotage and towage remain optional.

Turkey is authorised to levy taxes and charges set out in Annex I to the Convention; namely sanitary fee, light dues and life-saving dues. Amount of tax or charge to be levied to be on each ton of net register tonnage (nrt) shall not be greater than is necessary to cover the cost of maintaining the services concerned and of allowing for the creation of a reasonable reserve fund or working balance.

Amount of charges or dues to be levied for services rendered is as follows:

Nature of service rendered	*Amount of tax or charge (Francs gold)*
Sanitary control	0.075
Lighthouses, channel buoys :	
▪ Up to 800 tons	0.42
▪ Above 800 tons	0.21
Life saving services	0.10

Article 3 however, grants Turkey the sanitary control for all ships within the framework of international sanitary regulations entering the Straits by the Aegean Sea or by the Black Sea. This control, in the case of ships possessing a clean bill of health shall be carried out by day and by night with all possible speed, and the vessels in question shall not be required to make any other stop during their passage through the Straits.

The Montreux Convention has so far remained the effective instrument governing the use of the Turkish Straits.

Shipping casualties

The Strait faced 461 marine casualties of different types in 1953-2002 period, accounting 24 percent for the "left-side up scheme",58 percent for the "right-side up scheme" and the remaining 18 percent for the "traffic separation schemes" respectively.

Figurewise, 209 collisions, 138 groundings, 77 strandings, 28 fires / explosions and 9 others (such as rudder blockade, vessel's list, or engine breakdown), totalling 461 accidents and casualties occurred in the Bosphorus.

Table - 8 indicates the breakdown of the casualties occurred in the area for this period in terms of main casualty groups: i.e collision, stranding, grounding, foundering, and fire / explosion.

Table 8. Marine casualties in the Bosphorus (1953-2002) Turkish Maritime Undersecretariat, casualty records, Istanbul area, 1994 to 2002, Ankara

Navigation scheme	Period	collision	grounding	stranding	Fire/ explosion	others	Total
"left-side up"	1953-1982	79	17	14	none	-	110
"right-side up"	1982-1994	105	89	50	25	-	269
Traffic Separation Schemes	1994-2002	25	32	130	3	9 **a**	82
Total	**1953-2002**	**209**	**138**	77	**28**	**9**	**461**

a includes rudder blockade, vessel's list and engine breakdown

Ships spend quite long time from one port to others, are exposed to various external hazards like darkness, different visibility conditions which one way or another contribute to marine casualties.
The numbers of casualties known to have occurred in parts of the day, i.e in darkness and daylight, are shown in Table – 9 according to main casualty groups:

Table 9 . The Bosphorus : marine casualties in darkness and daylight

Type of casualty	Darkness	Daylight	Darkness / daylight ratio
Collision	17	8	2.1
Grounding	24	8	3.0
Stranding	8	5	1.6
Fire/explosion	-	3	0.0
Others	4	5	0.8
Total	**53**	**29**	**1.8**

Historical data show that per million transit miles it occured :

- *6 accidents in the Bosphorus, versus*
- *3 accidents in the Suez Canal, and*
- *0.2 accidents in the Mississippi River*

These are quite startling statistics – they show us how relatively more dangerous the Bosphorus is and they show us what is possible if certain safety measures are adopted (Bilbo . 2001).

There are even certain collision accidents and claims which taken in the past to the International Court of Justice for final resolution. The first such marine collision dispute is the Bozkurt v. Lotus case.

On the night of August 02, 1926 the Turkish cargo ship, Bozkurt, with 1000 tonnes of coal onboard was involved in a collision in the Aegean Sea, off Sigri Lighthouse, west of Lesvos (Mityleni) Island, with the French passenger ship, Lotus. The Bozkurt sank just after the incident and only 10 seafarers out of the full complement were rescued.

The case was brought to the attention of the Turkish criminal court and on appeal the Court found that both parties contributed to the collision and accordingly both vessels were held liable. The decision that each vessel should have proportionate share in the blame plus criminal penalties was upheld.The French side raised objections against the Court decision that the Turkish jurisdiction on the case was inconsistent. The Court decision was jointly appealed through the International Court of Justice, in Hague, and the Court finally upheld the Turkish Court decision.

Grounding and stranding are the major casualty types occurred in the Bosphorus and constitutes 56 percent of all casualties – the main risk factors being currents, sharp turns and darkness.

Yeniköy and Umuryeri are the two main crucial areas in the Bosphorus where most of the stranding and grounding casualties take place, mainly due to complex and day-to-day changing character of the prevalent currents as well as large course alterations that vessels have to make with or against the main current. Most of such casualties occur when vessels with current taking sharp turns lose their manoeuvrability. More than half of the grounding and stranding casualties in the Bosphorus in TSSs period occurred at these two critical points. Figurewise, 26 such casualties took place in Yeniköy and Umuryeri areas (13 in Yeniköy, 13 in Umuryeri) out of the total 45.

The tanker *Torrey Canyon* which grounded off the Scilly Isles just 36 years ago was the first major incident of its kind resulting in extensive oil pollution. The Norwegian tanker *Orange Star* went aground in December 1997 in the same spot as the bulk carrier *Friendly* a year previously in the Bosphorus (Chapman and Akten : 1998).Similarly, the Greek tanker *Sea Salvia* with 81000 tonnes of Russian crude onboard, and en route for the Aegean Sea ran aground in July 1998 in the same point as the other Greek tanker *Crude Gulf*, loaded with 140800 tonnes of crude of the same origin, almost a month after, on August 25, when both in the wrong shipping lane at the southern exit of the Bosphorus, even blocking the shipping movement for quite some time to and from the Haydarpaşa container terminal.

Accidents ended up with pollution have occurred in the Bosphorus and its approaches, and almost 200.000 tons of oil spilled into the sea. Major collision accidents took place in the Bosphorus region is as follows :

Ship accidents have a distinct effect on the marine ecosystem. After the collision accident occurred in 1979 between the Romanian tanker Independenta and the Greek cargo ship Evriali, 64.000 metric tons of crude oil out of the total 94.000 metric tons spilled into the sea. As a consequence of the rapid evaporation of the light components , the spilled crude oil sank rapidly to the sea bottom and the bottom area of approx. 5.5 km in diameter was fully covered with a thick tar coat of mean concentration of 46 g / m2. On the m.t Nassia case occurred in 1994, 20.000 metric tons of oil was discharged into the sea. The marine environment was greatly affected. Most bays and beaches in the Bosphorus were covered with oil and pitch. At least 1500 sea birds coated with oil - although this figure is probably underestimated.

On the m.v Rabunion-18 case, 20.000 live sheep sank with the ship after the collision accident in the Bosphorus. The sunken sheep decomposed at the bottom and caused hypoxia. Due to the hypoxia, the populations of some organisms showed mass mortality.Dissolved oxygen level was measured at 2 mg/l and water transparency value as 0.5 m. (Öztürk, et al:, 2001).

Table 10. Major collision accidents in the Bosphorus (Akten,Ustaoğlu, Rodopman ,1995). Marine casualties in the Turkish Straits and their implications for the environment, ITU Maritime *Faculty, Istanbul.)*

Date	*Vessels' name and flag*	*Accident area*	*Accident type and if oil spilt*
			collision and fire : 18000 tons oil spilled
15.09.1964	Norborn (Norwegian) v. wreck of Peter Zoranic	Kanlıca	contact: fire and oil spill
01.03.1966	Lutsk (USSR) v. Kransky Oktiabr (USSR)	Kızkulesi	collision and fire: 1850 tons oil spilled
15.11.1979	Independenta (Romania) v. Evriali (Greek)	Haydarpaşa	collision and fire : 94600 tons oil spilled
09.11.1980	Nordic Faith (British) v. Stavanda (Greek)		collision and fire
29.10.1988	Blue Star (Malta) v. Gaziantep (Turkish)	Ahırkapı	contacted m.t Gaziantep:1000tons ammonia spilled
25.03.1990	Jambur (Iraqi) v. Da Tung Shan (Chinese)	Sarıyer	collision : 2600 tons oil spilled
14.11.1991	Madonna Lilly (Philippines) v. Rabunion 18 (Lebanese)	Kanlıca	collision : 20000 live animals drowned
13.03.1994	Nassia (Philippines) v. Shipbroker (Philippines)	Sarıyer	collision and fire: 9000 tons oil spilled,20000 tons oil fired
30.12.1999	Volganeft v.	Ahırkapı	collision : 1200 tons oil spilled
07.10.2002	Gotia	Bebek	collision and stranding: 22 tons oil spilled

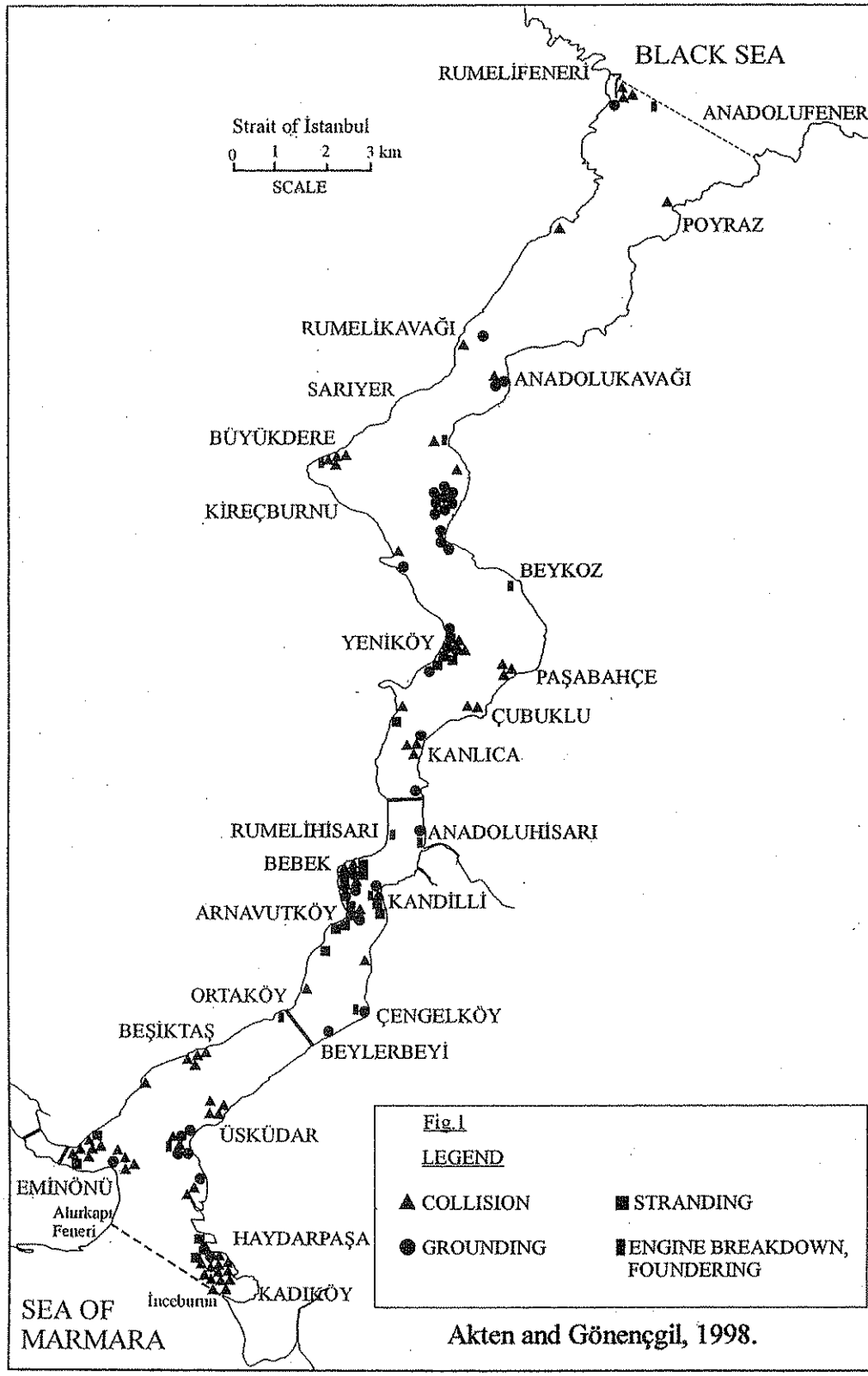

Fig. 1. Strait of Istanbul casualty chart

Conclusion

The Bosphorus is the most critical passage in the World for vessels passing through - mainly due to :

- its narrowness,
- *of vessels* its shape with several sharp turns and headlands which limits to have an extended sight for a proper look-out and close the view behind,
- complex as well as day-to-day changing nature of its currents.

"The increase in traffic density through narrow channels and also an increase in the size plying through straits have imposed heavy responsibilities on strait States for ensuring safe navigation and the protection of marine environment ... and that ... the potential for disastrous accidents in the narrow waters of straits have serious economic and social consequences for coastal communities" (Nandan,1999).

Turkey has genuine safety and environmental protection interests in the Bosphorus. As the Strait separates the metropolitan area into two almost equal parts, and due to the over-crowded character of the area (comprising one quarter of the total city population), the consequence of any casualty is likely to be catastrophic. It is simply divine luck that the city, with its 15 million inhabitants, has so far escaped relatively undamaged. (Chapman and Akten, 1998)

The Strait is something like a risk generator from the point of view of maintaining a safe passage. Not only the state of currents, eddies, fog and strong winds (even sometimes gales) within the Strait, but also its shape which limits, or closes rather, the view behind headlands, to a great extent reduce the safety of navigation and hence build up potential risks and perils for vessels to pass through. Ships of increased size and thus with reduced manoeuvrability bring further implications on the safety issue.

The Straits have significant importance as the only maritime route to and from the Black Sea markets of Bulgaria, Georgia, Romania, Russian Federation and then to the Caspian Sea and the central Asian markets of Armenia, Azerbaijan, Kazakhstan, Turkmenistan and Uzbekistan

The Black Sea is surrounded by Turkey, Bulgaria, Romania, Russian Federation, Ukraine, Moldavia and Georgia. All those Black Sea rim States except Russia and Turkey are dependent on the Turkish Straits for their seaborne commerce (İstikbal,2001). *Safe navigation in the Bosphorus is a matter of vital importance to Turkey as well as to all nations using the Strait. Therefore, the dangers posed by ever increasing shipping traffic to the surrounding inhabited areas and to the environment have compelled Turkey to take immediate action and to reinforce existing regulations of maritime traffic in the Strait.* [2]

The Montreux Convention with regard to the regime of the Turkish Straits establishes the principle of freedom of navigation for all merchant vessels, regardless their sizes, flags and cargoes, in peace time, with Turkey the sole authority with legal power to interpret the Convention.This freedom for vessels does not however give free reign to uncontrolled or undisciplined passage in accordance with the provisions of of the relevant internationally accepted rules and regulations currently in use (Akten, 2002).

The localities with high risk for grounding or stranding in the Bosphorus are Umur Banki, Yenikoy,Bebek and Kandilli; for collisions the evidence suggests that critical areas are Besiktas, Bebek, Kandilli, Kanlica, Yenikoy,Beykoz and Sariyer.

Marine casualties occurring in the Bosphorus involve local factors and are mostly of international interest. Therefore, having studied the casualty cases in-depth one may deduce either one or some of the following reasons are the major factors:

- Ships proceeding without a pilot
- Bad weather conditions
- Dense marine traffic
- Technical inadequacy of ship
- Complex and day-to-day changing nature of currents
- Lack of adequate knowledge about region
- Loss of alertness and caution impeding the safe passage
- Existence of areas with sharp turns
- Darkness and background shore lightings
- Improper conduct of vessels within the TSS

[4] The Montreux Convention and maritime traffic regulations in the Turkish Straits, http:// www.byegm.gov.tr/YAYINLARIMIZ/newspot/2002/july-aug/n7.htm

Özet
İstanbul Boğazı,halk arasındaki adıyla Boğaziçi, Türk Boğazlar Bölgesi içinde yer alan ve Karadeniz'i Marmara' ya bağlayan deniz geçişidir. 17 Deniz mili (31 km) uzunluğu olan bu dar ve kıvrımlı geçit, günden-güne değişebilen akıntıları yüzünden de gemiler için kaza rizikosu yüksek bir su yolu olma özelliğine sahiptir.
İstanbul Boğazı uluslar arası deniz trafiğine açıktır. Montrö Sözleşmesiyle, bayrağı ve yükü ne olursa olsun, ticaret gemilerine barış zamanında transit (geçiş) ve seyir serbestisi tanınmıştır. Ancak bu serbesti, hem belli formalitelerin yerine getirilmesine (fener parası, sağlık resmi, tahlisiye ücretinin ödenmesi gibi), hem de "zararsız geçiş" koşullarına bağlıdır.
İstanbul Boğazı uluslar arası deniz trafiğinin sıklığı yönünden - Malacca Boğazı'nın ardından- dünyada 2. sıradadır. Istanbul Boğazından günde ortalama 132 gemi geçiş yapmaktadır. Montrö Sözleşmesinin yürürlüğe girdiği 1936 yılı deniz trafiği rakamı baz olarak alındıkta, günümüzdeki trafik, o dönemin 10 katı mertebesindedir. Hem de gemi boyları ve tonajlar artmıştır.
İstanbul Boğazında 1953-2002 döneminde 461 deniz kazası olmuştur. Bu kazaların 110 tanesi "sol seyir döneminde"(1953-1982), 269 tanesi sağ seyir düzeninde (1982-1994), 82 tanesi de trafik ayrım düzeni (TAD) uygulamasının başladığı günden bu yana olan dönemde (1994-2002) meydana gelmiştir.
İstanbul Boğazındaki deniz kazaları içinde "karaya oturma" ve "kıyıya çarpma" önde gelmektedir (%56). Yeniköy ve Umuryeri de, gemilerin oturma kazası yönünden Boğaziçi'nin en kritik iki yeridir.
İstanbul Boğazında kazaların asgariye indirilmesi, dolayısıyla seyir güvenliğinin artırılması sadece İstanbulluların can güvenliği ve tarihi çevre için değil, dünya ticaretinin aksaksız yürümesi bakımından da çok önemlidir. Türkiye özellikle VTMIS sistemini 01Temmuz 2003'de devreye almakla bu bağlamda önemli sayılacak bir adım atmıştır.

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