

Maritime Safety in the Strait of Gibraltar. Taxonomy and Evolution of Emergencies Rate in 2000-2004 Period

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ABSTRACT: Both SAR'79 and UNCLOS'82 Conventions are specific tools that establish the juridical and technical foundations for the development of reactive aspects related to maritime safety response. These conventions set up the search and rescue regions in which coastal states should assume the responsibility to dedicate resources, to cover the needs of the SAR responsibilities. 2006 amendments to IAMSAR manual volume I, in force since 2007, June the 1st, established the identification and assessment of risks related to maritime safety as one of the practical principles in maritime risk management. The Strait of Gibraltar is a narrow navigational channel connecting the Atlantic Ocean and the Mediterranean Sea between Spain and Morocco. The Strait supports a huge volume of maritime traffic increasing steadily every year. This paper presents the preliminary results obtained in relation with the taxonomy and temporal distribution of maritime emergencies reported and documented by the Spanish Maritime Administration throughout 2000-2004 period.

1 BACKGROUND

The active involvement of the coastal states in safeguarding and promoting the safety of human life, environment and property related to maritime navigation in the waters in which they exercise jurisdiction, sovereignty or sovereign rights, is shown in a number of international legal texts.

The International Convention on Maritime Search and Rescue, Hamburg, 1979 (Convention SAR'79) and the United Nations Convention for the Law of the Sea, Montego Bay, Jamaica, 1982 are included among those juridical tools.

These two fundamental legal instruments lay down both regulatory and technical aspects of the development of reactive response to maritime emergencies.

Both texts establish the principle of division of the entire maritime waters, defining areas of responsibility for maritime search and rescue associated with every coastal nation. These nations should assign specific resources - human, technical and legal - to meet the requirements that arise as a result of the liabilities undertaken by the parties.

Although both conventions regulate the commitments related to maritime search and rescue matters undertaken by the parties, the International Convention on Maritime Search and Rescue, Hamburg 1979, known as SAR'79 Convention, which Spain joined in 1993, lays down the basic guidelines to be followed by the Authorities of the coastal states in the process of design and implementation of maritime search and rescue services.

Over the years, this agreement has been amended a number of times. Among the amendments which are due to be highlighted, we find those adopted in 1998. According to these, it is essential to provide the centers responsible for carrying out maritime search and rescue operation with detailed operational plans appropriate and adapted to the particularities of each specific search and rescue region. These plans will allow carry out these actions effectively.

These plans should also establish not only the procedures to be followed during mobilization of rescue units, but also provide the methodology to be used in developing search and rescue operations. The plans require the establishment of coordination instruments between adjacent rescue centers and

procedures and criteria to be used not only during the gathering and evaluation of relevant information related to the emergency but also alerting ships and aircraft transiting the area of the incident and requesting their cooperation in operations.

A rigorous approach to the formulation and development of plans and protocols to cope with maritime emergency situations requires the application of specific methodological tools that would make possible the identification, classification and categorization of those risks that must be controlled or the mitigation of their consequences.

On the other hand, at the request of the interested countries, and with the aim of facilitating the adoption of the necessary measures for the adaptation of the standard and promoting harmonization in a global environment, the International Maritime Organization (IMO) and International Civil Aviation Organization (ICAO) published in 1999, the International Aeronautical and Maritime Search and Rescue Manual (IAMSAR), a dynamic document that over the years has undergone several modifications which enabled it to improve and adapt to changing reality.

Among these changes we can find the 2006 amendments, in force since June 1, 2007, which set out the practical principles to be followed in the implementation of aeronautical and maritime search and rescue services and addresses the need to identify and assess the risks related to maritime safety. In such a way that these amendments state that the effectiveness of the response to maritime emergencies depends, among others, upon the knowledge of type and frequency of those marine incidents that may result in a risk for human life at sea, safety of navigation and protection of marine and coastal environment.

This paper presents the preliminary results of the study carried out over the emergency rates in the Strait of Gibraltar, approaching the taxonomy and distribution of incidents and accidents documented by the Spanish Maritime Administration from 2000 to 2004 in the geographical area of the Strait of Gibraltar.

2 ENVIRONMENT

2.1 Geographical environment

The Strait of Gibraltar (Figure 1) is the natural passage which links the Mediterranean Sea with the Atlantic Ocean. Although its boundaries have never been formally established, for the present research study the western boundary has been defined by the line connecting Cape Trafalgar with Cape Spartel

while the eastern one has been considered by the opposition Europe Point - Punta Almina.

The European coast, limited by Cape Trafalgar and Europe Point, is 55 nautical miles long, whereas the African coast from Cape Spartel to Punta Almina is 42 nautical miles long.

Its longitudinal axis is divided into two sections. The Western section, some 18 nautical miles in length and oriented approximately east - west, runs from the line connecting the Island of Tarifa, located on the Spanish coast, with Cala Grande, on the African coast, towards the Atlantic Ocean. The Eastern section runs from west by southwest to east by northeast, along some 15 nautical miles to reach the eastern Strait boundary.

The channel presents its maximum width, 24.2 nautical miles, on its western limit, between Cape Trafalgar and Cape Spartel, while the narrowest section is defined by the line connecting median point between Tarifa and Punta Guadalme River, on the northern coast, and Punta Cires, on the southern coast. At this point, the channel is 7.45 nautical miles wide. The eastern embouchure has a maximum width of 12.5 nautical miles.

On the northern coast there are significant shoals and reef areas alternating with broad bays and sandy beaches. On this coast are located the ports of Algeciras- La Línea, Tarifa and Gibraltar.

The southern coast, geologically very similar to the northern one, has, however, a much more rugged and inaccessible coastline. On this coast we find the ports of Tangier, located east of Punta Malabata, Tangiers - Mediterranean, close to Punta Cires, and Ceuta, located by Punta Almina, on the eastern end of the African coast.

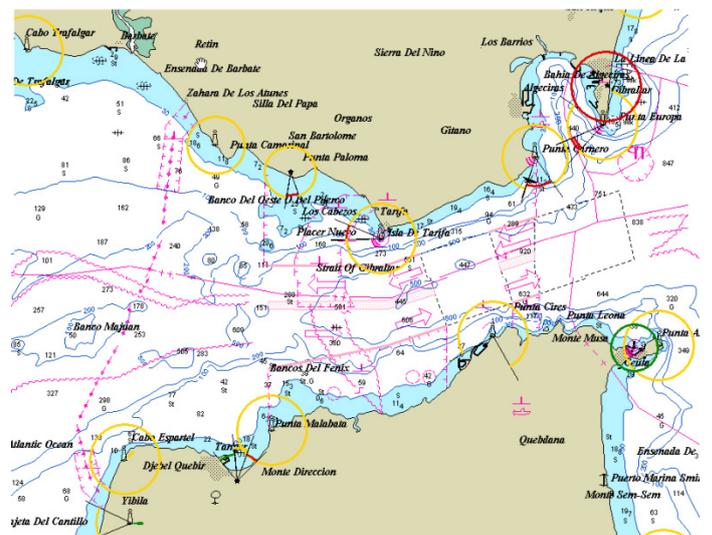


Figure 1. General overview of the Strait of Gibraltar

2.2 Traffic patterns

The maritime traffic through the Strait of Gibraltar follows a clearly defined pattern which is conditioned by four basic parameters: the last port of call of the ship, destination port, the routing measures established and prevailing weather conditions.

In general the flow of maritime traffic follows two fundamental axes (Figure 2). The most important in terms of traffic density, is the longitudinal axis defined by the tracks of the ships passing from the Mediterranean Sea towards the Atlantic Ocean and vice versa.

The second axis is defined by the tracks of the vessels, mainly ferry ships and High Speed Crafts, connecting the ports located on both sides of the Strait.

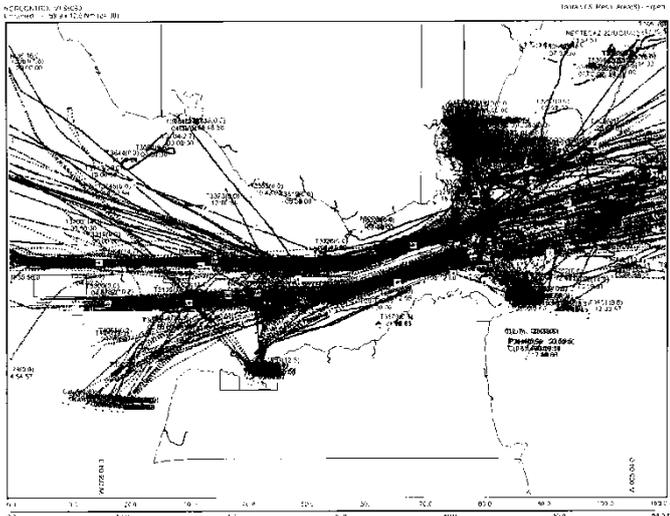


Figure 2. Cumulative maritime traffic radar surveillance picture
Source: Tarifa VTS

The combination of a very high traffic density area (94,157 transits identified through year 2005) (Figure 3), the existence of high concentration of crossing tracks and occasionally very unfavorable weather conditions within a narrow channel, have forced the Spanish and Moroccan governments to promote, through the International Maritime Organization, the establishment of several marine traffic organization and monitoring measures (Figure 4) – traffic separation scheme, mandatory reporting system, precautionary areas, vessel traffic services – all of them complemented by an extensive network of maritime signals covering both, northern and southern coasts.

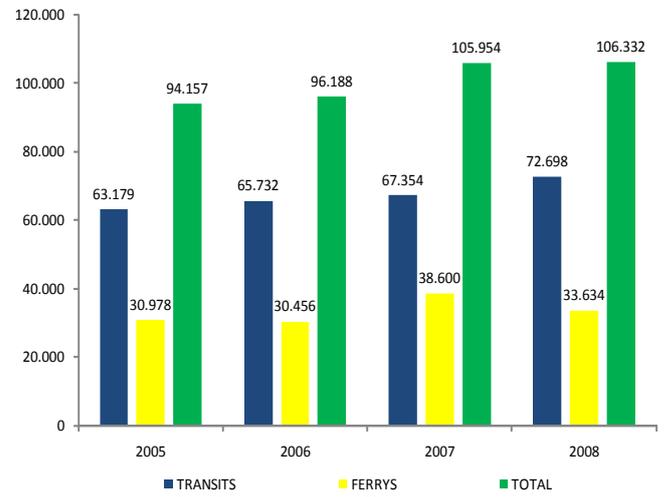


Figure 3. Traffic evolution. Years 2005-2008
Source: Tarifa VTS.

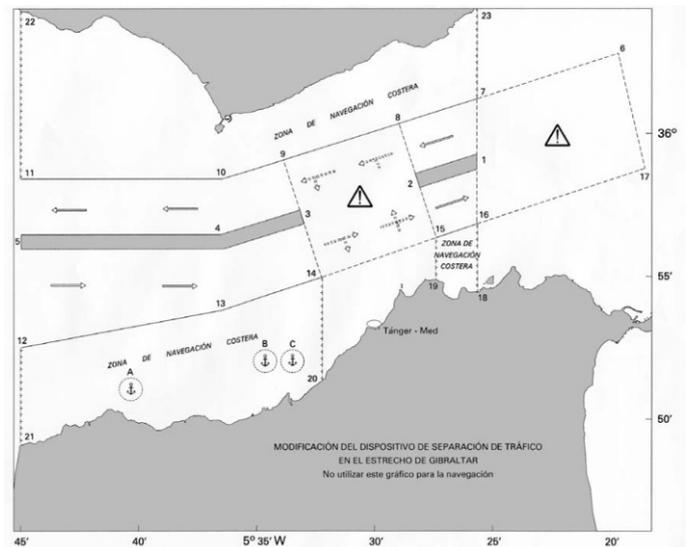


Figure 4. Traffic separation scheme and precautionary areas in the Strait of Gibraltar
Source: IMO.

3 HISTORICAL ANALYSIS OF MARITIME EMERGENCIES IN THE STRAIT OF GIBRALTAR

3.1 Documentary sources and research structure

The historical analysis of emergencies in the Straits has been developed on the basis of the information provided by three historical data sets:

- 1 The database of the General Directorate of Merchant Marine.
- 2 Annual reports of the Maritime Rescue Coordination Centre of Tarifa, and
- 3 Annual reports of the Maritime Rescue Coordination Centre of Algeciras.

The analysis of the three data sets reveals a lack of harmonization that, although the big similarities in their basic structure, leads to significant differences in the criteria followed while classifying the information related to each event. It should be

highlighted the lack of information concerning the initiating events or causes of accidents and the extent of damage to property.

Nevertheless, despite the lack of some important information, the geographical location of each event and a detailed description of the units deployed during the response operations are always available.

Due to the high level of dispersion of information regarding maritime emergencies occurred in the Strait of Gibraltar and the lack of clearly defined relationships among the historical records, it becomes necessary a previous compilation of the information, and the unification of criteria for the classification and its subsequent analysis. This all led to the creation of a special data base called GIBSAR, which is the basic tool for the development of this historical analysis of maritime accidents in the Strait of Gibraltar.

This database does not only compile information provided by the marine rescue coordination centers of Algeciras and Tarifa and the statistical series of data produce by the General Directorate of Merchant Marine, but it also establishes a scale for the assessment of effect, both for individuals an vessels, caused by the consequences of these events.

3.2 Analysis of maritime emergencies. Global data

The analysis of the data (Table 1) shows that the total maritime emergencies documented by the Spanish Maritime Administration in the period 2000-2004 within the Strait of Gibraltar area comes to a total amount of 1,216 cases. Only 23.5% of this these figures, 284 cases, are due to false alarms while the remaining 76.5%, 922 cases, are due to real alerts. Notice that the annual distribution of the data presents a great homogeneity.

Table 1. Distribution of real and false alerts related to maritime emergencies in the Strait of Gibraltar. Years 2000-2004

| Emergencies | Year | | | | | |
|-------------|------|------|------|------|------|-------|
| | 2000 | 2001 | 2002 | 2003 | 2004 | Total |
| Real | 181 | 187 | 181 | 189 | 184 | 922 |
| False | 61 | 66 | 51 | 58 | 48 | 284 |
| Total | 242 | 253 | 232 | 247 | 232 | 1206 |

Table 2 shows that 90.8% of total number of real cases are related to incidents, that means there is neither major structural damages to ships nor losses of human lives nor missing persons nor pollution episodes involved in the event.

On other hand, only 9.2% of the real emergencies are related to marine accidents, considering such events as those involving total loss of the ship or

major structural damages, or losses human lives or missing persons or a pollution episode.

In this case, the distribution is also very homogeneous, with values ranging from a minimum of 181 emergencies documented in 2000 and 2002 to a maximum of 189 emergencies in 2003.

Table 2. Distribution of accidents and incidents related to real maritime emergencies in the Strait of Gibraltar. Years 2000-2004

| Emergencies | Year | | | | | Total |
|-------------|------|------|------|------|------|-------|
| | 2000 | 2001 | 2002 | 2003 | 2004 | |
| Accidents | 20 | 19 | 14 | 12 | 20 | 85 |
| Incidents | 161 | 168 | 167 | 177 | 164 | 837 |
| Total | 181 | 187 | 181 | 189 | 184 | 922 |

Table 3 shows the distribution of all real emergencies attended in the period 2000 to 2004 according to subtype.

There is a clear predominance with 24.1% of the total amount of performed search and rescue operations due to mechanical failure of ships systems and/or services. Pollution episodes amounts 15.6% of the total number of cases.

We should also focus the attention on the number of search and rescue operations related to illegal immigration, whether in the preventive stage, escorting the crafts used in the passage through the Strait as well as in the phase of assistance to the occupants or, where appropriate, during search, location and recovery of corpses. These cases come to represent 12.8% of search and rescue operations.

Operations related to drifting objects varies from 5% to 10%, assistance to users of recreational crafts and devices amount 8.4% and 7.2% respectively, rescue operations on coast and cliffs 5.6%, and drifting boats, which comes to be 5% of the total.

We should also consider the medical transfers between Spanish hospitals located on both sides of the Strait (Ceuta to Seville or Cadiz), which means 4.6% of total operations, nearly twice the rate of medical evacuations from ships which rates 2.6% of the total.

Table 3. Distribution of real emergencies according to sub-type. Strait of Gibraltar. Years 2000-2004

| Subtype | Year | | | | | Total |
|--------------------------|------|------|------|------|------|-------|
| | 2000 | 2001 | 2002 | 2003 | 2004 | |
| Leisure crafts | 12 | 11 | 8 | 22 | 13 | 66 |
| Assistance to navigation | 2 | 5 | 3 | 3 | 6 | 19 |
| Overdue | 0 | 3 | 0 | 1 | 1 | 5 |
| Allision / Collision | 2 | 3 | 3 | 0 | 2 | 10 |
| Pollution | 29 | 35 | 35 | 23 | 22 | 144 |
| Drifting crafts | 12 | 7 | 7 | 11 | 9 | 46 |
| List / Stability | 0 | 0 | 1 | 0 | 0 | 1 |
| Medical Evacuation | 5 | 9 | 5 | 4 | 1 | 24 |
| Medical Transfer | 4 | 3 | 11 | 7 | 17 | 42 |
| Mechanical Failure | 37 | 38 | 40 | 50 | 57 | 222 |
| Man Overboard | 5 | 4 | 3 | 3 | 4 | 19 |
| Sinking | 2 | 3 | 4 | 3 | 4 | 16 |
| Fire/ Explosion | 2 | 4 | 2 | | 2 | 10 |
| Illegal Immigration | 23 | 23 | 19 | 38 | 15 | 118 |
| Drifting Objects | 18 | 18 | 24 | 8 | 9 | 77 |
| SOS Message | 1 | 0 | 0 | 2 | 0 | 3 |
| Castaway Rescue | 0 | 0 | 0 | 1 | 1 | 2 |
| Coastal Rescue | 17 | 13 | 8 | 4 | 10 | 52 |
| Grounding | 3 | 3 | 3 | 4 | 6 | 19 |
| Leaking | 4 | 2 | | 2 | 2 | 10 |
| Other | 3 | 3 | 5 | 3 | 3 | 17 |
| Total | 181 | 187 | 181 | 189 | 184 | 922 |

Regarding the severity of the consequences on persons, crafts or vessels and on the environment, it should be notice that minor and negligible severity cases range nearly 30%, while moderate severity cases range 30.4% and major severity 28.5%. Severe cases involving total losses of ships, losses of human lives, missing persons or severe pollution events range 6.5% (Table 4).

Table 4. Distribution of real emergencies according to severity rate. Strait of Gibraltar. Years 2000-2004

| Severity | Year | | | | | Total |
|------------|------|------|------|------|------|-------|
| | 2000 | 2001 | 2002 | 2003 | 2004 | |
| Severe | 15 | 13 | 12 | 9 | 11 | 60 |
| Major | 50 | 61 | 54 | 58 | 40 | 263 |
| Moderate | 57 | 49 | 47 | 77 | 84 | 314 |
| Minor | 14 | 17 | 8 | 8 | 9 | 56 |
| Negligible | 45 | 47 | 60 | 37 | 40 | 229 |
| Total | 181 | 187 | 181 | 189 | 184 | 922 |

According to table 5 and regarding casualty condition, almost 90% of the persons involved were assisted or rescued, while 6% of the total amount of persons involved in emergencies got safe by their own means and the number of persons who lost their lives or were missing rates 2.2%.

Table 5. Distribution of real emergencies according to casualty condition. Strait of Gibraltar. Years 2000-2004

| Casualty Condition | Year | | | | | Total |
|---------------------|------|------|------|------|------|-------|
| | 2000 | 2001 | 2002 | 2003 | 2004 | |
| “Shelf rescued” | 328 | 34 | 6 | 12 | 2 | 382 |
| Rescued | 431 | 825 | 474 | 2156 | 542 | 4428 |
| Assisted | 9 | 398 | 373 | 303 | 198 | 1281 |
| Evacuated | 65 | 11 | 16 | 12 | 17 | 121 |
| Died before arrival | 10 | 27 | 17 | 2 | 1 | 57 |
| Died after arrival | 22 | 4 | 12 | 12 | 9 | 59 |
| Missing | 5 | 3 | 7 | 9 | 1 | 25 |

4 CONCLUSION

Annual distribution of emergencies, considering the whole period, presents a very stable trend, ranging from a minimum value of 181 to a maximum of 189 cases.

In terms of geographical distribution, two main areas support the highest rate of emergencies both quantitatively and qualitatively. Those areas are the central zone of the Strait of Gibraltar and Algeciras Bay (Figures 5 and 6).

The results of the study highlighted the large number events, such as medical transfers, pollution incidents in port service waters, operations related to the use of recreational crafts and devices, swimmers, diving and other natures related events which, although not considered as maritime emergencies, required the deployment of specific marine search and rescue resources.

It should be noticed the low rate of emergencies directly related to any maritime search and rescue service responsibilities such as leakage, collision or allision, fire or explosion, heel or stranding, which all together rate 7.2% of the SAR operations performed. This rate would increase up to 9.8% if medical evacuations conducted from ships or boats are included.

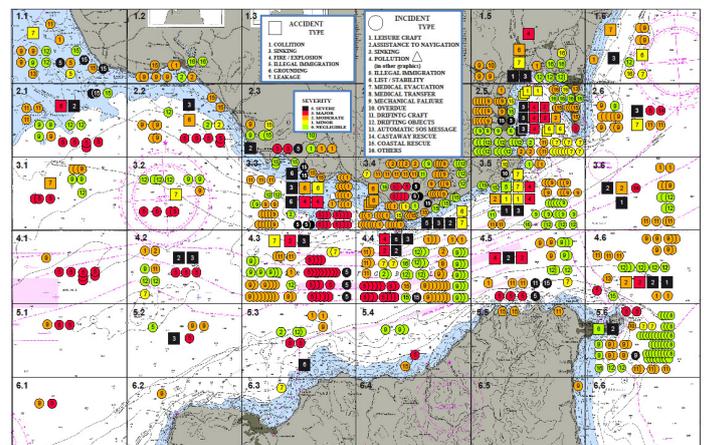


Figure 5. Geographical distribution real emergencies according to subtype. Strait of Gibraltar. Years 2000-2004

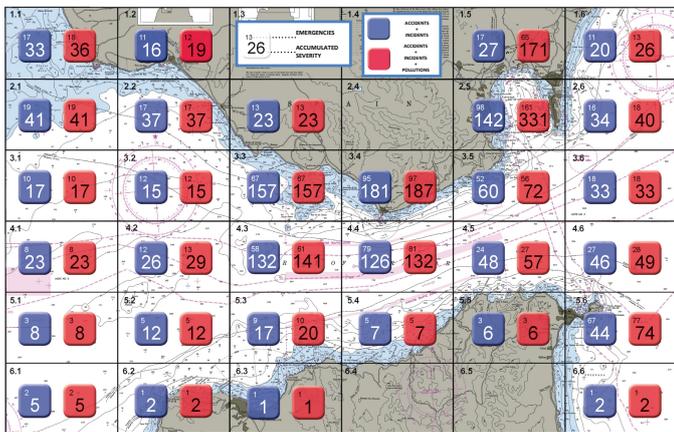


Figure 6. Geographical distribution real emergencies according to severity. Strait of Gibraltar. Years 2000-2004

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