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# Evolution of Maritime Accidents in Spanish Fishing

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*ABSTRACT*

During the last years, we have studied the Spain's maritime accidents that occurred in fishing and the causes that produced them from 2000 (year of starting of the CIAIM reports) to June 2016. It was decided to study this problem because there is observed a large number of accidents compared to other sectors such as building construction or metallurgy. We have been studying all of maritime accidents occurred from 2000 to 2016 including merchant vessels, fishing vessels and others. The study shows that the fishing vessels obtained the most important number of accidents and number of persons' casualties. Having said that, we have considered it appropriate to observe the evolution of maritime accidents, especially in fishing vessels, that have occurred since June 2016 to the present separately, and its causes.

In some cases, it can only be counted as a number and the causes that produced them cannot be taken into account since some recent investigations are still ongoing. This paper aims to analyze whether despite the measures that have been implemented during these years in the field of training professionals in the fisheries sector, the relatively high number of accidents persists. The results obtained are of vital importance in the evaluation of the measures applied to the problem of the large number of accidents in fishing and also in the preparation of future measures that must be proposed in the direction of reducing the effects on people, resulting from the accidents occurred in fishing.



## 1. Introduction.

Fishing was in the past and remains today one of the important productive sectors of Spain, 388.386 tons at December 31 2018. This important sector develops, and is divided into 4 main modes, Siege, Drag, Longlines, Minor Arts and a fifth that encompasses all other less important modes. From the point of view of value, according to the Spanish Ministry of Agriculture (MAPA, 2020), the products of fishing represented 1.056.643,78 (thousand Euros) in 2018 (MAPA, 2020). If we observed the circular about fisheries 966 published by the Food and Agriculture Organization of the United Nations that this Organization (FAO), this Organization estimate that 15 millions of "fishers" engaged in fisheries in the world, and approximately 98% work in vessels less than 24 meters in length.(Petursdottir G. et al., 2001).

Besides being an important industry in Spain, it is also characteristic for the large number of accidents recorded. The accident rate in the fisheries sector worldwide has been the subject of study and concern for different countries, including Spain. Levels of fishing accidents fired alarms because they are above many sectors of our society, including construction. (Moreno R. et al., 2014)(Rodríguez A. et al, 2013). The same problem is observed in United States. Time ago, in U.S. the investigators comes observing the accidents in the fishing industries, and we look the problem is important. In 1998 published an report about this problem and conclude: "*Fishing has consistently ranked as the most deadly occupation since 1992*".(Dutch Safety Board, 2020). The similar conclusions were obtained in France or Ireland.(Berciaud P. et al., 2012)(MAIB, 2008)

For years, organizations from several countries launched various actions aimed to reducing the high accident rate that was collected in inshore fisheries. These measures, even to-

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day in continuous development, address specific issues on the construction of ships, control and prevention of the values of the ship's stability, training and awareness of fishermen, among others (García N. & Carro P., 2004)(Tasende J., 1998). The different measures implemented by the different countries for analysing the accidents and the proposal of actions to reduce them, comes to the specific organizations, such as the Marine Accident Investigation Branch (MIAB) in the United Kingdom, or the Dutch Safety Board in Netherlands, and others (MAIB, 2020)(Dutch Safety Board,2020).

The different lines of action against accidents have resulted in the creation of programs that control at all times the stability of the ship, rules to avoid types of undesirable vessels from a constructive point of view, talks in brotherhoods to educate the fishermen on the risks and training in the use and operation of equipment and safety on board (Míguez M. et al., 2009). All these actions have significantly reduced accidents in fishing, however accident figures remain still high, much higher than the construction sector (Neachtain S., 2006)(Asociación Mar Seguro de Galicia, 2012). In the circular 966, the FAO explained the problem and says that: "a*bout 24.000 fatalities occur worldwide per year*". The problem exist and this is global. Specific organizations in some countries make recommendations to reduce accidents, but at the moment, they are not very effective.

In order to specify the scope of the problem, an investigation by the authors was started in 2016, with the aim of determining the causes of maritime accidents that occurred and were published from 2000 to 2016. This period of accidents, we call it "first period" . Then we wanted to look at how the accidents have behaved further on, opening a new period of published maritime accidents that runs from 2016 to 2019, called the "second period".

The first period for the analysis of accidents published by the CIAIM (*Maritime Accident and Incident Investigation Commission* of Spain) (CIAIM, 2020) that was carried out in this research, was between 2000 and July 2016. The publication of the various accidents occurs in a scattered manner and in some cases the accidents are published the following year. This fact is understandable because in some of the cases it is difficult to determine the causes with the information available. For the study of different reports about accidents in fishing industries, in Spanish we have the CIAIM. In other countries different organizations do the same work: analizy the maritime accidents, U.K (the MIAB), Netherlands (DSB), France (Ministry of ecology), Ireland (HSA), ...

On the other hand, because of the expansion of the publications on time makes it necessary to determine a deadline for the inclusion of accidents in the database, since otherwise, we would never complete it and we would not be able to go to the analysis phase. We also understand that from the deadline we set in 2016 to the present, there have been other accidents that we want to analyze as an addenda to the first analysis. We are interested in the evolution of the events that happened, regarding the first phase of the study and at the same time we are aware that the volume of accidents is not high very high in s short period of time, but it can show us if the problem persists or how it behaves over time.

That said, fishing vessel accidents that occurred and have been reported from July 2016 to November 2019 have been a total of 27, in which 31 vessels have been involved. We analyze only this part, since they are exclusively accidents that have occurred or have been involved, fishing vessels. It is also important to determine in which case the accidents occurred. Before going into detail with the analysis of the 31 crashed vessels we will observe the distribution by fisherman.

## 2. Methods.

### *2.1. Geographic Distribution.*

The first of the data analyzed is the geographical area in which the accidents occurred, to compare it with the previous data.

In the accidents that occurred (2016-2019), we observe that most of the accidents occurred in the Cantabrian-northwestern fishing grounds (maritime zone of Galicia, Cantabria, Basque country and Asturias). Specifically, they were a total of 31 affected vessels, distributed in the following fishing vessels, Cantabrian-Northwestern 22 (70.97%), Mediterranean 7 (22.58-%), Gulf of Cadiz 1 (3.23%), Canary 0 (0 %), North Atlantic 0 (0%) and International Waters 1 (3.23%).

In the first phase of the accident study in (2000-2016), the percentage of accidents that occurred in the different fishing grounds were 197 distributed as follows, Cantabrian-northwestern 103 (52.28%), Mediterranean 46 (23, 35%), Gulf of Cadiz 15 (7.61%), Canary 6 (3.05%), North Atlantic 9 (4.57%) and International Waters 18 (9.14%).

If we compare the two periods, it can be seen that the Cantabrian-northwestern fishery is still the geographical area with the highest number of accidents and has even increased in percentage of total. We think it would not be correct to claim a rise of 20% between analyzed periods, as some of the accidents that occurred in that same period have not yet been announced, but that is the area with the highest number of accidents. Next is the Mediterranean zone and then with much less accident follow other fishing grounds. Then we can say that the most recurrent place in a fishing accident is the fishing zone Cantabrian-northwestern.

### *2.2. Modalities.*

The data analyzed in this section are those concerning fishing modes. In the 2016-2019 period, the mode with the highest number of accidents or affected vessels are the minor arts, with 11 affected vessels making up 35.48% of the total, followed by the trawling mode with 8 affected vessels that suppose 25.81%. Then with lower percentages of affected vessels are the fence, and the longline.

In the analysis of fishing vessel accidents from 2000 to 2016 recorded in the northwestern Cantabrian fishing boat, the following data were collected: Of the 103 fishing boat accidents recorded, 66 occurred in the minor arts mode, with 64.08% of the total , followed by trawling with 14 vessels that account for 13.59% and finally with quantities of smaller affected vessels, longline, steering wheels and fishing auxiliaries.

The conclusion that can be drawn comparing the data in the Cantabrian-northwestern fishing shed is that the mode with the highest accident rate is still that of the minor arts.

### 2.3. The Depht.

The depth was one of the data analysed previously in an article published in (Torné et al., 2016), in which it was observed that most accidents occurred between 0 and 10 meters, in particular the largest number between 5 and 10m of depth, and followed by the strip 50+ m. It should be added that the strip of 50 m or more pools a great amount of depths, further enhancing the real importance of the number of affected vessels in shallow water.

On the other hand, if we look at the accident data published between 2016 and 2019, we can see that even the number of vessels affected at shallow depths has increased its ratio. In the worst case, we might consider some unpublished accidents from the same period, but in any case it can be said that most accidents occur in shallow water and the dynamics in the latest data analysed confirm this data.

Looking at the two periods analysed, it is confirmed that most accidents occur near the coast and we also see that the largest number of accidents followed by those occurring at shallow depths occur far from the coast or at much greater depth, being the intermediate zone the one with the lowest incidence. That said, at this point it is appreciated that the shallow waters are home to a larger number of affected vessels or the same thing, which would be that the vessels at the time of the accident were in shallow places.

### 2.4. The Time the Accidents Happened.

This was also one of the data analysed in the previous article (Torné et al., 2016), which we expected to find that accidents occurred when it was dark and the results of the analysis showed that they followed this rule if they did not occur more or less homogeneously or attending to the stripes. in which the vessels carried out their fishing. We have to recall that most of the vessels affected are of the minor arts mode.

Of the 103 accidents that took place in the Cantabrian Bay, most proportion occurred between 04:00 and 12:00. We also appreciate that the hours before or afterwards also collect quite a few accidents, observing relative homogeneity.

The statistic dates show the hour of he accident is normally aleatory, but some cases are far of the standard deviation, approximately 30% of total.

In the 2016-2019 study period, the accident data regarding the time that they occurred are quite similar and follow the same pattern very closely. We observe, as in the period 2000-2016, a great homogeneity and also a decrease between 20:00 and 24:00, perhaps due to fishing reasons most of the vessels are in port. Therefore, at this point we can conclude that the time of the accident also follows the same dynamics as in the 2000-2016 study period.

### 2.5. Casualties, Deaths and Missing Persons.

Perhaps this data is the most important of this investigation, since the object of it is in the study of accidents and the proposal of measures aimed at reducing maritime accidents and therefore of people injured, missing and deceased. One of the reasons that aroused our curiosity at the beginning of this thesis was the great accident rate shown by the fishing sector. The data (Torné et al., 2016) that showed the accidents in the Cantabrian from 2000 to 2016 were: in 103 accidents 23 people injured, 59 dead and 21 missing. It can be seen that the accident rate persists.

When studying the accidents of the 2016-2019 period we want to determine if the accident rate remains high despite the measures and recommendations taken in this sector. In this period 31 vessels were affected and 3 injured, 7 dead and 5 missing were collected as data. It is true that there seems to be a slight decrease of dead plus missing people referred to the number of accidents, but it is difficult to assess whether the trend is real or blurred by statistics, up or down from previous work [18] with so few sample accidents, but it is undeniable that in just 3 years they have lost their lives 12 people, this is absolutely negative data to be taken into account. At the same time these data encourage us to continue in the search for knowledge of the events and to the proposal of measures.

### 2.6. Ship Damages.

Damage to the ship is also a relevant fact since it shows us how accidents are, if so violent and fast, if the ship sinks slowly, if it fully refloats, etc. When analysing the data of the Cantabrian *Calador* for the 103 ships that were affected (Torné et al., 2016), we observe that the great majority resulted in the total loss of the ship or the accident ended up in the sinking of the ship that was later refloated. For a ship to declare a total loss, the event must be violent. On the other hand, if the event has been of another nature, the ship sinks and then can be refloated later with some damage.

In the 2016-2019 period, we observe that the affected vessels in the fishing sector follow the same pattern than in 2000-2016. Most of the affected vessels are declared in total loss, followed by sinking. Therefore, we can conclude that accidents remain essentially of the same characteristics as in the 2000-2016 period.

### 2.7. Meteorological Data. Wind Force and Wind Direction.

The meteorologist was one of the first hypotheses we argued at the beginning of the previous accident investigation (Torné et al., 2016). With hardly very few data of the maritime accidents, we are induced to think that the accidents were due to the fact that the ships were small and that when they moved away from the coast, with strong winds, they made them tip over and gave rise to the accidents. No further from reality, in fact were not right at all. The accidents that occurred between 2000 and 2016, mostly happened near the coast and the study of the meteorological variables on the day of the accident, show us that the wind was not high, even more, as the force of wind increases the accidents decrease. Therefore, neither the direction nor the force of the wind seems to be the cause of the accidents.

The data recorded in the accidents that occurred in the 2016-2019 period show very similar data to those collected in the 2000-2016 period. We see that the largest number of affected vessels is between 0 and 15 knots of wind force. Therefore, they follow the same norm as far as wind force is concerned, understanding that wind force is not the cause of accidents.

### *2.8. Cause of Accidents.*

Finally, a fact of interest is the cause that caused the accident. We believe that knowing the cause and studying all the variables within our reach, we can come up with proposals to reduce these accidents. The most common cause of accident on the affected vessels (103) in the Cantabrian in the 2000-2016 period was that of overturning (capsizing) above all others, followed by embarking water, operational accidents, flooding and boarding.

The data related to the 31 vessels affected in the 2016-2019 period show us that the most common cause among them remains the overturn (capsize), followed by boarding, embarking water, operational and fire. When observing the data, we can affirm that as regards the event, the overturning is still the most common. At the same time we wonder: overturn? If the wind conditions suggest that it is unlikely to tip over. So what is the overturn due to? We will investigate it in the open thesis on this subject.

## Conclusions.

Once the accidents of the periods (2000-2016) and (2016-2019) have been analysed, and then compared them to each other, in terms of geographical distribution by drawer, the one with the highest accident rate remains that of the Cantabrian - Northwest. Compared data shows that over time accidents continue to be majorities in the area of Galicia and Cantabrian.

As for the modalities, in the study of accidents of the period (2000-2016) the modality that includes more accidents was of minor arts. In the current period (2016-2019) minor arts remain the modality that includes a greater number of affected vessels.

Another of the data that we consider relevant in comparing fishing accidents is depth. The results of the comparison are clear, most of the vessels affected at the time of the accident were at low depths, between 0 and 10 m. This data is the same trend as in the study of accidents between 2000 and 2016.

As for the time slot in which the accidents occurred, in the period 2000-2016 the data were very homogeneous and coincide with the hours in which the vessels were fishing. In any case, there was a decrease in accidents between 4:00 PM and 12:00 PM the next day. In the 2016-2019 period the data is quite similar and homogeneous. There is a decrease between 12:00 and 24:00 the next day. The major accident rate is between 00:00 and 12:00.

The people killed in the accidents between 2000 and 2016 were 59, which added to the 21 missing, make a total of 80 people killed. In the current period of less than 3 years, 7 deaths have been collected, which together with the 5 missing, make a total of 12 deaths in the 31 vessels affected. There is no doubt that the sector has a high accident rate, despite the measures taken (Tasende, 1998)(Neachtain, 2006)(AMS Galicia, 2012)(FUNDAMAR, 2012) and the recommendations (CIAIM, 2016) made to reduce the number of deaths.

Regarding the damage done to the ships, we observe that in the period 2000-2016 most of the accidents resulted in the total loss of the ship and the sinking. In the 2016-2019 period, the data shows the same trend. The first result is total loss followed by sinking.

As for the meteorology, specifically the force of the wind, in the 2000-2016 period most of the accidents occurred with wind forces between 0 and 15 knots. This data is all the fee of what we estimate as hypothesis at the beginning of the investigation. In the 2016-2019 period, the data is practically the same, most accidents are recorded between calm and 15 knots of wind, and if the intensity of the wind increases, the accidents decrease.

As for the type of event, in the accidents that occurred in the 2000-2016 period, the cause that picked up the most accidents was that of overturning (capsizing), followed by other causes to a lesser extent. If we look at the 2016-2019 period, the most frequent cause is still the boat overturning, followed by other diverse causes.

The problem of fishing accidents in Spain is defined more or less in this way; The geographical area that registers the greatest number of accidents and victims in them is the North-west of the peninsula. The large number of accidents coincide in the data influencing them being nearly the same we had from the ongoing investigation (Torné et al., 2016), they are related to the depth of the water under the keel and to factors related to maritime conditions. Relatively good meteorological conditions existed in the majority of accidents.

The measures to be proposed on this problem to reduce the number of victims revolves around training of crews, revision of current safety regulations, and others aimed at avoiding the capsizing of boats. These could be automatic stabilization systems or other similar systems that avoid loss of stability.

Finally, in order to predict what the probability of accidents will be repeated, we have drawn up a graph where we have located the accidents that have occurred and we have crossed them over time. The result has been a straight, "very straight" line that suggests that the probability of accidents happening again the same way as previously is very high. Therefore the problem, despite the efforts, persists and there is no evidence that it is solved.

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