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Artisanal fishing in Andalusia (II): Safety and working conditions policy

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Abstract

In an earlier paper, we presented a statistical study dealing comprehensively with the so-called "artisanal fleet", with data on the typology of vessels and on the extractive effort. In this paper, we focus our research on safety and working conditions.

Although numerous factors are known that can directly influence the health of the sailor or fisherman, and that are present one way or another in both the fishing and merchant fleets, it is necessary to address in particular the problem of coastal fishermens' health in order to identify areas of health and safety that need to be improved. The results of this analysis, among other aspects, identify the injuries associated with machinery, tools, nets and protection devices, the health status, the life styles and the working conditions.

Keywords: Fishing safety; Seafarer; Andalusia; Spain

1. Introduction

The study forms part of a research project undertaken in the University of Cádiz, with funding by the European Union, on the "General state of the fishing fleet of Andalusia from the perspectives of Maritime Safety and the Prevention of occupational risks". In a first paper published in this Journal [1], we presented a statistical study dealing comprehensively with the so-called "artisanal fleet", with data on the typology of vessels (construction particulars) and on the extractive effort.

In this paper, we focused our research on safety and working conditions. Sea fishing is one of the most dangerous and hardest occupations. Occupational injuries are more frequent than in any other profession [2–4]. In the context of all industrial activities, fishing is among those presenting the highest rates of occupational accidents [5]. A recent paper has studied the state of the art in fishing safety policy [6]. On top of this, the working conditions are very aggressive for employees' health, not only because the work tasks on board ship are physically demanding but also these employees have greater difficulty in obtaining the correct health care and attention since access to the health system is almost impossible while they are at sea; another factor is that this population is characterised by lower educational and socioeconomic levels. All these factors are known to contribute to high morbidity and mortality in this occupational subsector, as well as to the high prevalence of unhealthy life styles.

There are some classic studies of mortality and morbidity of this population, with a focus on accidents in the Northeast fisheries [7,8] and other studies made of the shore-bound part of the population; these studies frequently reflect conditions of life on board that are considerably different from those in the boats of our community, which are mostly dedicated to intensive fishing relatively close to port in both time and distance. Although numerous factors are known that can directly influence the health of the sailor or fisherman, and that are present one way or another in both the fishing [9] and merchant fleets [10], it is necessary to address in particular the problem of coastal fishermens' health in order to identify areas of health and safety that need to be improved.

2. Method

In our previous paper in this journal [1], we presented the design of the sampling and other methodological aspects.

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In this study, we are centred on surveying and evaluating the health, safety and working conditions of employees of the artisanal or craft fishing fleet of Andalusia (Spain), an occupational sector that, according to the fishermen's guilds (Spanish institutions of "cofradías"), employs a total of 9419 workers. The sampling procedure took into consideration the four fishing techniques and gear to be studied, bottom trawling, small-scale gears, seine net and longliners, respecting the proportions existing in the population; then the number of sampling units corresponding to each port was determined. The surveys were performed on the arrival in port of the boat; the questionnaire used consists of two parts, one on health and working conditions, and the other on the technical and safety characteristics of the vessels,[1] taking into account the national legislation on the prevention of occupational and health risks [11] and respecting the protection of personal data [12]. The injury rate will be studied based on the self-reported questionnaire, to analyse the injuries associated with machinery, tools, nets and protection devices. The prevalence of accidents is evaluated over the working lifetime and on the last voyage or trip.

3. Results

3.1. Profile of the worker

The mean age of the population studied is 40.3 years (S.D. 11.5) and the age range is from 17 to 71 years (five subjects exceed retirement age) (Table 1). The different fishing modalities are also characterised by different numbers of crew, with purse seiners and trawlers carrying a larger crew; as well as for the duration of the period spent on board which is longer in longliners, with a mean trip of 27 days, while in trawlers the mean trip is 4 days, and in multipurpose and smaller artisanal boats the mean trip is 1 day. Regarding educational level, 3.6% of workers are illiterate, 61% only reached primary level (completed or not), and 10% have secondary level education. Their family structure conforms to traditional patterns, with 72% being married. Family responsibilities tend to be heavy due to the presence in the immediate family of several dependents: each worker has an average of three to four dependents, reflecting a typically complex family nucleus in which three generations co-exist. In family antecedents the most frequent pathologies found are carcinoma of the lung, hepatic cirrhosis and coronary ischemic disease, stomach cancer, cerebrovascular disease, and a high percentage of diabetes and arterial hypertension.

Table 1
Age of fishermen by type of gear employed

Type of gear	*N* (%)	Age	
		Mean (S.D.)	(CI 95%)
Trawlers	58 (23.5)	42.68 (11.66)	39.6 (45.7)
Purse seiners	33 (13.4)	42.39 (11.91)	38.1 (46.6)
Artisanal fishing techniques			
Small scales	44 (17.8)		36.5 (44.8)
Multipurpose	94 (38.1)	40.70 (10.41)	33.7 (43.4)
Longline	18 (7.3)	38.55 (9.75)	36.1 (40.3)
Total	247 (100.0)	40.29 (11.56)	38.8 (41.7)

Table 2
Prevalence of medical conditions

Medical conditions	Fishermen
	N (%)
Muscle–skeletal problems	72 (29.1)
High respiratory pathways problems	35 (14.1)
Low respiratory pathways problems	42 (17.0)
Digestive conditions	25 (10.1)
High blood pressure	25 (10.1)
Diabetes mellitus and/or hyperglycemia	16 (6.4)
ORL diseases	14 (5.6)
Kidney and urinary system	14 (5.6)
Heart and coronary disease	6 (2.4)
Mental or nervous problems	6 (2.4)
Transient ischemic attack	1 (0.4)
Sexual transmitted diseases	2 (0.8)
Infectious diseases (other)	2 (0.8)
Ophthalmologic and ocular problems	94 (38.0)
Others	27 (10.9)

3.2. Health status

A previous short report has been presented with our preliminary results [13]. The prevalence of medical conditions was homogeneous by fishing modalities and age-group (Table 2); however, the frequency of muscle–skeletal and respiratory pathologies was similar in all age-groups. The skin phototype and presence of dermal lesions on exposed skin have also been studied. A sensitive skin (phototypes I and II) was found in 25% of the workers, and 54% presented dermal lesions, frequently multifocal, in skin exposed to the sun. Hearing problems are present in 5.6% of the population, significantly associated with

[1] Some of the variables studied are:

- *Profile of the worker*: Age, job or responsibility on board, educational level, occupational experience, level of remuneration, family and economic situation, and other social variables.
- *Health status*: Previous personal and family pathologies, any current pathology and consumption of medication (on shore and on board).
- *Life styles*: Consumption of alcohol, tobacco and drugs (psychoactive substances); physical activity; hours of sleep; eating habits (survey of consumption recorded over 24 h period).
- *Working conditions and characteristics of life on board*: Organisation of work in shifts; hours of work, hours of sleep; accommodation: ventilation and noise, and accidents on board.
- Mechanical risks.

engineers. Problems of carbohydrate intolerance (hyperglycemia) or diabetes are present in 6.4% of those surveyed; pathologies incompatible with working conditions at sea, like diabetes insulin-dependence, angina and depression, have been detected in 2% of fishermen.

3.3. Life styles

Most workers have an excess of calories in their daily diet on shore, with notably high levels of ingestion of animal fats, and a moderate-high ingestion of alcohol. However, while at sea, when the daily work requires an estimated 2850–3000 kcal (physical constitution of the worker), the calorie content provided by their diets is usually not more than 1800 kcal. This deficit is greater on the smaller boats (small-scale fishing and polyvalents) where it is frequent that the ingestion of food, during a working period of 5–12 h, is limited to coffee, sandwiches and, in the better cases, some fruit. The lack of a galley on the vessel means that pre-cooked food from home is taken on board; this food contains an excess of carbohydrates and proteins, and is frequently deficient in calories and vitamins, with a deficit of calcium, liposoluble vitamins and dietary fibre; dairy foods and fruit are also scarce. In boats of larger draft, the availability of cooking facilities facilitates the ingestion of more energy-rich food [13].

On the use of tobacco, smokers account for 60% of the population, with a pattern of high consumption (average of 34 cigarettes/day). The great majority of the population (77%) either smokes currently or has smoked in the past an average of 28 cigarettes/day (S.D. 17), for an average period of 18 years. Regarding alcohol consumption, the "on shore" data differ significantly from the "at sea": when on shore, fishermen consume an average of 19 g/day, and when at sea, the average is 8.5 g/day. While at sea, only 30% of workers have any alcohol consumption, and this is mainly associated with meals (35–40 g of ethanol max per day). In respect of consumption of drugs, taking into account the confidentiality of the question (5.7% refused to answer), 8.5% of those fishermen responding admitted consuming drugs; overall 6.1% presented regular consumption (on 5–7 days of the week), mostly in the younger population (<35 years); in respect of the type of drugs (revealed spontaneously), these were cannabis and derivatives. During the last trip, eight workers (3.4%) admitted to drug consumption on board. The drugs use was associated with the youngest workers and deckhands of multipurpose ships (Table 3).

Table 3
Use of illicit drugs (days in last week)

Days of use	*N* (%)	Valid (%)	Cumulative (%)
1	2 (0.8)	0.9	0.9
2	3 (1.2)	1.3	2.2
5	1 (0.4)	0.4	2.6
7	15 (6.1)	6.4	9.0
None	212 (85.8)	91.0	100.0
Total	233 (94.3)	100.0	

Fourteen of respondents (5.7%) chose not to answer this question.

3.4. Working conditions

In all types of vessel apart from the longliners, the working day exceeds 8 h, and the average duration of the trip is 15 h: in small-scale fishing and polyvalent boats, the average trip lasts around 9 h (8.6 and 9.2, respectively); in seine netters 10 h (S.D. 2.6); and in trawlers 32 h. The rest time on shore is around 6 h (5.98 ± 2.07) at night-time and between 1.5 and 2 h of afternoon "siesta". With respect to the quality of this rest, 85% consider it restorative. Concerning nocturnal work: most of those surveyed commence their work very early, at around 3–4 a.m.; the end of the work does not coincide with the completion of the fishing tasks: once in port, the catch must be unloaded and put on sale in the Fish Wharf, nets must be cleaned, and the boat must be prepared for the next trip.

Some accident on board during their working life was reported by 76% of the workers, and 43% of them had taken sick leave or 'down time' for injuries on board. The most frequent injuries are connected with the fishing apparel worn (35% of injuries are due to punctures and cuts), impacts from objects (14.8%), being trapped by moving equipment (12.1%) and falls from higher levels (8.9%). By job or workstation, the injury rate and the length of sick leave was very similar in the various duties on board. When the sick leave was due to an accident, the means duration was 67 days. By fishing modalities, there are more accidents with sick leave in trawlers and multipurpose vessels, and the longest average duration of sick leave was found in trawler crew. Analysed as a whole, the effect of age, job experience, duration of service, fishing modality and duties on board on the duration of sick leave was only found to be significant in respect of the first three variables. Only 58% of the boats have cabins available for the crew (individual cabins in 15%, in the rest cabins shared by an average of 4.3 persons); however, 90.5% of the workers consider that the boat possesses adequate ventilation, and 88% describe their boat as "comfortable"; 79.3% consider the noise level on board to be excessive, but despite this it is not experienced as especially annoying and is assumed to be "normal". It must be taken into account that 10% of the response is not applicable since there is no period of rest during the fishing activities. In respect of the installations, more than half of the boats (63%) have no sanitary facilities (washbasin, toilet or shower); only 14% have hot water available.

As another parameter for assessing the safety conditions, we have included in our study the need to have on board

reliable information on the stability characteristics of the vessel; this requirement is met in only 3% of the boats surveyed, which refer to the hydrostatic stability curves to calculate the stability of the boat. In the majority, 67%, concern for the stability of the vessel is limited to certain working practices such as stowing the fishing gear with the weight spread equally between both sides, to keep the boat righted, not listing to one side that could endanger its transversal stability. Regrettably in the fishing fleet of Andalusia, 31% of boats do not use any criterion to calculate stability, and do not take this parameter into account. Despite this, only 2% of those surveyed report any incidents due to problems of stability.

Only 22% of the boats carry hinged watertight doors that close on both sides. It was confirmed that all such boats with this type of door have a length of more than 15 m, and were constructed since the year 1980 (Fig. 1). Only in 13% of the boats are there warnings on both sides of these doors that they should be kept closed while sailing, and in almost all of these the watertight gasket or sealing joint were found to be in good condition.

3.5. Mechanical risks

In the section on mechanical risks we deal with the risks of falls, blows, trappings, interior spaces, and warning signs on these aspects for purposes of prevention.

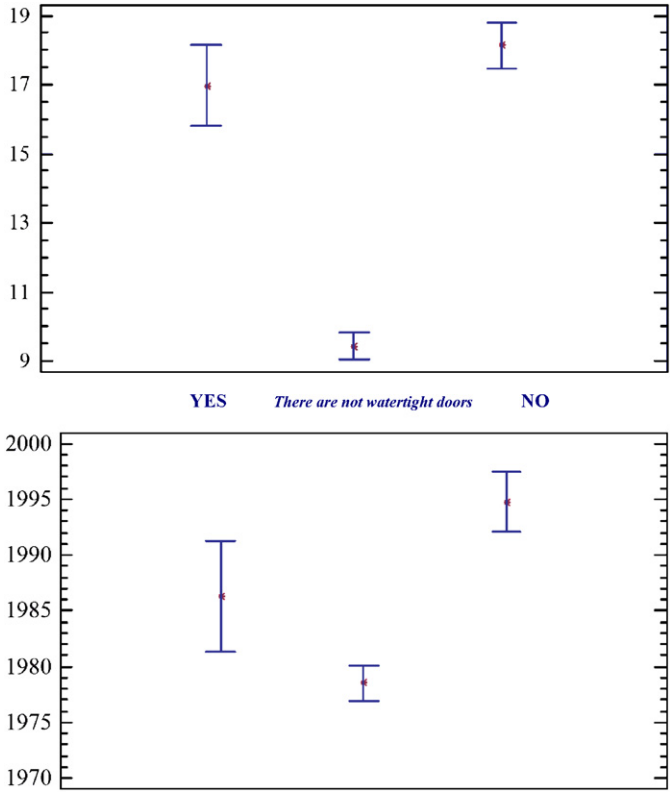

Fig. 1. Use of watertight doors/length/year.

Thus, we detected that in a majority of the fleet, 97% of boats, it is permitted to jump over the side on joining or leaving the boat, which leads us to think of the implications of this for estimating the accidents on board. Included in this percentage are those boats that, when anchored, make use of a dingy to get to shore, since in these cases also, no special measures are utilised for getting on board or leaving. The percentage of boats reporting falls into the sea is 20%. This is worrying since 4% admit directly that they do not know how to swim, and the response for 16% was "Do not know/no reply". With reference to accidents produced by trappings or blows from various items of gear, cables, ropes, doors, etc., only a small percentage, 10%, reported having such accidents. However, 147 of the 271 crew members surveyed declared that they had suffered blows from falls on deck due to slipping, losing their balance, etc., although only 24% of these accidents caused them to be off work. Interior spaces or cabins are possessed by 68% of the boats, and 89% of those surveyed consider that these spaces have fresh air available. Although only 30% are fitted with some type of mechanical ventilation and only 6% have air conditioning on the boat. Those that possess mechanical ventilation and air conditioning are the most modern boats of the fishing fleet (Fig. 2). With respect to blows to the head due to the low height of interior spaces or doorways, 33% responded affirmatively. It is important to utilise a non-slip material on the deck of the boat and in the interior spaces, to avoid falls and impacts from slipping. In fact, in the majority of the cases, what is usually done is to employ paint mixed with sand. Finally, there are 27% that do not utilise any non-slip material or product. There are some boats that have decks covered with a ribbed or embossed surface to prevent slipping; this, however, can sometimes be counterproductive by causing personnel to trip and fall, possibly giving rise to more serious accidents. Only 29% of the boats are fitted with guardrails, and these correspond to the boats of greater length (Fig. 3).

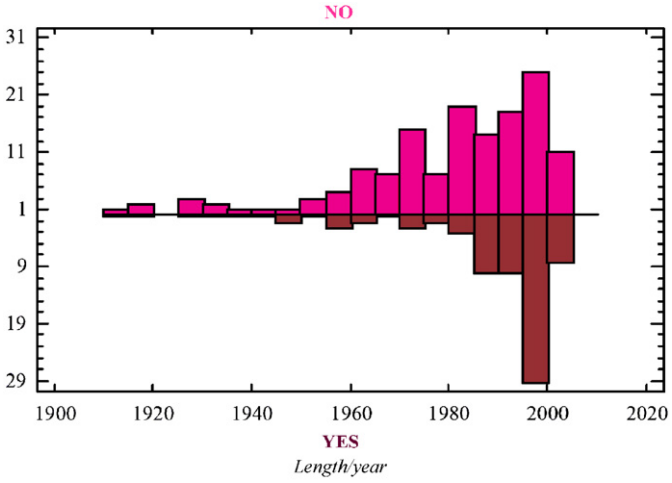

Fig. 2. Mechanical ventilation—inner spaces.

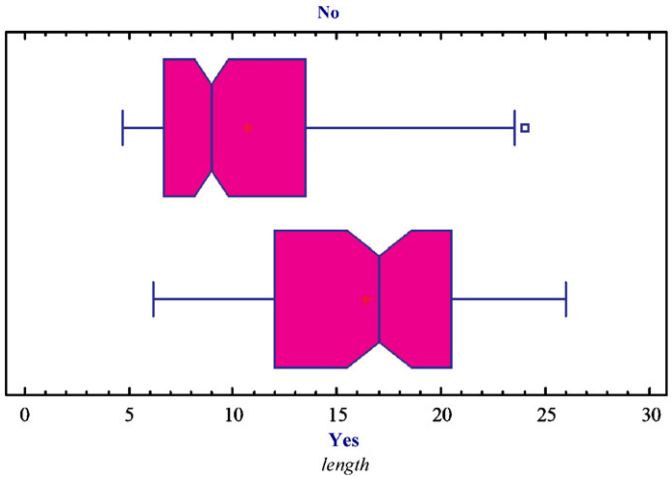

Fig. 3. Boats fitted with guardrails.

4. Discussion and conclusions

The working population studied is mature (mean age of 40.3 years), and the majority (64.4%) have no more than primary level education. The boat masters, however, have a good practical occupational training but a moderate or low cultural level; this must be because, up to mid-1970s in Spain, these qualifications were obtained as part of adult training courses. In recent years, following reforms in the teaching of the corresponding subjects, the training in safety and academic educational content in general is higher. From reviewing previous studies [14], the academic level can be considered to have increased significantly in the last 10 years, together with education in health and safety matters [15].

On the state of health of workers as measured by a survey of morbidity felt subjectively, no major differences in quantitative terms are found from the data provided by studies conducted on other sectors of the fishing industry, such as deep-sea fishing: the respiratory, digestive and skeletal–muscle pathologies [7,16]. Numerous studies made of fishermen show the preponderance of subjective skeletal–muscle symptoms; however, the correlation between these subjective symptoms and physical signs of lesion is usually low [17] and such symptoms are associated with the performance of movements and efforts of isometric elevation. This correlation between subjective symptoms in respect of soft tissues and the presence of organic pathology has been shown to be low in the case of symptoms referring to the back, hips and ankles, but, in contrast, is usually higher in the case of the shoulders [18].

It is notable that there exist pathologies or treatments incompatible with the arduous conditions of work at sea, particularly insulin-dependent diabetes, angina of the chest, and depression), probably because the pre-employment health programs and periodic medical examinations are administered principally to crew members of the merchant marine or industrial fishing sectors.

Auditory and ophthalmologic problems and multifocal dermal lesions in exposed skin are also frequent; these problems can be especially relevant considering that the affected persons will probably continue with this occupational activity and attribute little importance to these adverse medical conditions; this would in part explain the greater frequency of squamous carcinomas of skin and lips described in fishermen.

The diets on board observed in our study are poorly balanced; the calorie supply is clearly insufficient for the energy effort required by the type of work [19]. These risks are aggravated by the use of tobacco and excessive fats content of the diet. For this reason, in populations like this, where the working conditions do not allow application of the recommendations of the health promotion and cardiovascular risk prevention programs, these recommendations need to be adapted in function of the opportunities allowed by the occupational environment. On the other hand, many studies have been conducted [20] demonstrating that mere knowledge of these recommendations is not sufficient to change attitudes, dietary habits and tobacco use in the population.

The intensity in tobacco consumption seems to be associated with the duration of the trip [14,21] or with the performance of work tasks while at sea [22]. Diverse studies seem to coincide in detecting a reduction of the cardiovascular risk profile in fishermen during the last 10–15 years; however, the time-lag found with respect to the general population demonstrates the need for specific preventive strategies [23], especially when similar studies (populations of Italian fishermen) [21] associate this with an increase in the risk of lung cancer, with the consequent increase in mortality from this cause; but it has not been possible to demonstrate the same for other diseases like cardiac disease or tumours of the mouth, pharynx, oesophagus and bladder. An identical situation has been demonstrated with alcohol and hepatic cancer.

If our results with respect to the use of tobacco, alcohol and other drugs are compared with earlier studies, a significant drop in these harmful habits can be appreciated [15]. If our figures for the consumption of drugs are accepted, 8.5% of workers being consumers, and 6.5% having a pattern of "regular" consumption, excessive differences are not found with respect to the rates recorded by other studies conducted on the Spanish adult population. According to studies of the prevalence of drug consumption in our country [24,25], in the adult population (older than 18 years), between 2.8% and 4.5% are "regular" consumers of cannabis or derivatives, and 10% had consumed during the month prior to the survey. The implications of this are not only increased health problems but also increased risk of accidents on board, which are even greater when consumed simultaneously with alcohol [26] and considering the long shifts that workers associate with occupational fatigue [27]. However, the employment of drugs taken parenterally was no detected. In studies conducted on fishermen, it is observed that intravenous

drug injection is being increasingly abandoned [28], and this means that, both in our environment and in the north of Europe [29], the principal risk for the acquisition of infection by HIV is derived from heterosexual practice among populations with high rates of prevalence of the infection.

There is a high frequency of hearing problems: the effect of exposure for several hours to the continuous noise of the boat's engine [30,31]; some studies refer to greater risk of hearing loss when a carbon monoxide exposure, high consumption of tobacco, arterial hypertension or Raynaud's phenomenon are combined in the same worker [32,33]. In addition, it should not be forgotten that prolonged or continuous exposure to noises of invariable/monotonous character has other physical and psychosocial effects on workers [34,35].

We find no explanation for the high rates of ocular refraction defects reported by the population studied. Studies conducted in populations of fishermen associate the presence of myopia and other ocular disorders [36,37] with the frequent performance during infancy and adolescence of tasks that require a high degree of attention, a possible cause that could not be checked in this study. Among the other factors possibly associated with ocular defects are the intense solar radiation and atmospheric contamination [38].

Lastly, with respect to psychiatric pathology, it is a known fact that populations of seamen present a greater risk [39], either due to the conditions inherent in their work and working environment (isolation, disrupted social and family life, …); hence it is important to study social conditioners to identify any harmful habits. The association between a greater prevalence of psychiatric diagnosis and sea-going employment is maintained for diagnoses related to the consumption of alcohol and to diagnoses not so related; however, this association is not found in the population studied here.

As regards the physical conditions under which this study has been undertaken, in the majority of the fleet (89%) [1], the boats fish during the daytime and therefore the crew members spend most of their time working on deck at the various fishing activities, and only need a place to rest for short periods between shifts. This possibly explains the relative lack of attention paid to the habitability of the interior spaces, since it can be said that in 11% of boats, these cabins cannot be opened to the fresh air and generally the temperature in the cabins depends mainly on the ambient external temperature. A similar reflection may explain the lack of emergency provisions and the low percentage of vessels that have watertight doors, and the little attention paid to the maintenance of these facilities; only 22% of boats have deckhouses that can be closed on both sides as recommended by the legislation. The same may apply to the measures in the legislation referring to routes for personnel movement on board, danger zones, stairs and passageways on the boat. It should be taken into account that it is only practical to use gangways and guardrails for boarding on the larger vessels. In most cases, although the boat may have the gangway stowed on board, the personnel are not disposed to use it; most fishermen of the fleet normally board or leave the boat by jumping over the side, whether in port or when a dingy is used between the boat and the shore. In addition to the risk of falls, there are also risks of collisions between the boats themselves, and the risk of propagation in the event of a fire occurring on board any of the boats moored in port is increased considerably. With respect to the state of the various decks on board, it is worrying that there are still around 30% of boats that do not utilise any method for the prevention of falls inherent in the slippery condition of the working environment [40–42].

In relation to the risks related to sources of energy, and associated with exposure to electrical contacts, the accidents not resulting in lost working days in the fishing and aquaculture sector are very low in comparison with other activity sectors in Spain.[2] By regions in Spain, Andalusia accounts for 211 of a total of 1786 accidents, and there is no clear relationship between the number of accidents and the provinces that are coastal.[3]

Concerning the mechanical installations, comparisons are made still more complicated, since among the different sections into which the national statistics are broken down (Ministry of Work[4]), it is difficult to find any that, from the characteristics given, correspond to the definition of sectors studied in this project, and on this point in particular. Thus, if "impacts by objects and tools" are taken as a reference, these are the accidents that correspond most closely to those suffered in the mechanical installations of this type of fleet; it can be observed that in fishing and aquaculture these accidents reach an annual total of 991; in relation to the numbers of employees of the Andalusian coastal community (13,394), this total represents approximately 7% of the national total, and is generally in line with those reported for other Autonomous Regions with similar fleets.

From these data it could be concluded that the accident rate in respect of this type of installation is around the national average when analysed at the regional level, and even below this average if we analyse by sectoral activities. But it has been observed that these data are not representative of what really takes place in this sector: due to the fatalism, previously commented on, and to the particular circumstances of these accidents, usually of less severe character, taking place while at sea, there are many more cases that are not recorded or reported, and that are

[2]Statistics of accidents from the Ministry of Work.

[3]With respect to other Autonomous Regions, and taking into account those with littoral, Andalusia can be compared with Galicia (with 71 accidents), Valencia (202), Murcia (54) and Asturias (48); these may be smaller in area, but they are relevant because they also have sizeable fishing populations, although the statistics do not refer specifically to this sector.

[4]http://www.mtas.es/Estadisticas

therefore not included when estimations of this type are made.

Finally, we can say that safety policies in the fishing sector, with special attention to the case studied, need to be taken much more seriously and conscientiously by the sector; this calls for a break from the fatalism that is traditional in past and present generations of fishermen. As we stated, the cases of injury found in our study are similar to those of other studies [43] with no significant differences found by occupation on board, although injuries could be related to the type of vessel or work processes [44,45]. The analysis of accident differences in the Spanish fishing fleet in the period 1994–2002 shows a need to develop safety policies particularly in Andalusia, which is a region where accident rates have tended to increase, mainly in the trawling and long-line fishing modes [46].

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