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# Analysis of the specific risks in the different artisanal fishing methods in Andalusia, Spain

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**Abstract**

Andalusia, Spain, has an important tradition in the fishing industry that makes it one of the areas of the European Union where fisheries policies have a great significance for the population. In order to analyse the sector, a total number of boats to be surveyed was set at 10% of the total population: 202 boats of the total of 2027 in the census. The sample was distributed among the four fishing techniques and gear. This paper deals comprehensively with the so-called ''artisanal fleet'', with the aim of presenting a new approach in the policies for reducing the risk in this important fisheries sector. We discuss relevant issues related to fishing vessel safety according to the typology of the vessel. The specific risks are summarized. In each type of fishing various specific tasks have to be performed that entail characteristic kinds of risk. The paper concludes that specific risks presented in this study could contribute to maritime safety. Policy implications: policies that reduce specific risks will be effective in reducing fisherman injuries. The present study is part of the presentation of results of the research project financed by the Regional Government on the state of Safety of the artisanal or craft fishing fleet, analyzing, in this case, the typical occupational risks entailed in the fishing activity. Policymakers should find the results of this study useful in developing regulation and enforcement mechanisms for reducing fishing vessel injuries and total losses.


*Keywords:* Artisanal fishing; Occupational injuries; Andalusia, Spain

## 1. Introduction

In the past fifteen years, annual landings of fresh fish catches in Andalusia, Spain, have amounted to between 100,000 and 150,000 tonnes, for every port in the region, with an approximate value of 250 million euros per year. Commercial fishing is one of the least safe occupations (Jin et al., 2001). Some examples: Chauvin and Le Bouar (2007) study the occupational injuries in the French sea fishing industry; Murray and Tilley

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(2006) in the communities of fishermen in Newfoundland, Canada; Brooks (2005) in Australia; and Jin and Thunberg (2005) in fishing areas off the northeastern United States. A specific case of the Danish demersal fisheries has been studied by Christensen and Raakjær (2006). FAO has played an important role in the safety at sea for fishermen (Turner and Petursdottir, 2002). Lack of a safety culture is one of the more important factors contributing to high rate of accidents in the fishing industry (Kaplan and Kite-Powell, 2000; Acheson, 2000; Hopper and Dean, 2002; Jensen et al., 2006).

For our study the andalusian fishing vessels are classified as

– *the Deepwater and Ocean-going Fleets*, working outside fishing grounds, with a tonnage exceeding 100 GRT and 250 GRT, respectively, that undertake industrial activity with appropriate mechanisation of fishing tasks and product preparation.

– *the coastal or Shallow-water Fleet,* working waters under Spanish jurisdiction or closed fishing grounds, with a tonnage between 20 and 100 GRT, that carry out a primary industrial activity.

– *and the Artisanal or craft fishing Fleet,* comprising small vessels, with a tonnage of <20 GRT, and that get underway daily to fish.

The Coastal and Artisanal fleets have similar characteristics: the ship owner usually works on board as one more crew member, since the company is usually family-owned and managed. The number of crew per vessel does not usually exceed 10. The fisherman is an artisan or craftsman who has a thorough understanding of all aspects of fishing; there is no clear hierarchy among the crew, and the remuneration system is by shares of the net proceeds, known as "a la parte".[1] The time spent at sea varies from one to seven days per voyage, working from 60 to 80 h a week, and the technology and productivity are low, in contrast to the situation in the industrial fleet comprising the Deepwater and Ocean-going Fleets (Montero Llerandi, 1989).

There exists a classification of the typology based on the Census of the Fishing Fleet, with a total of 12 basic types: stern trawler, side trawler, seine net with catharpin, seine net without catharpin, hand lines, longline, other hook gear (rods and lines, tuna longline, and currican/trolling), traps/pound nets, gill nets, dragnets, multi-purpose gear and multi-purpose vessels (Diputación Provincial, 2001). The Andalusian fishing fleet is made up of some 2612 boats, with a total tonnage of 63,655.3 GRT; the low tonnage artisanal boats are the most numerous. At present, a clear division exists between the more modernised fleets and the fleets that continue undertaking artisanal fishing (Jin et al., 2001). Despite this, the Andalusian fishing fleet is second in importance of all the Spanish regions: it accounts for 15% of total vessels, and the catches represent more than 20% of the total value of fishing in our country.

The present study is only a part of a wider study of the Artisanal Fishing Fleet conducted throughout the year 2002,[2] a cross-sectional study with proportional sampling by conglomerates and financed by the Regional Government of Andalusia (Piniella et al., 2007, 2003; Piniella and Soriguer 2002). This paper study deals comprehensively with the so-called "artisanal fleet", especially in respect of specific risks and on the type of the fishing gear used, with the aim of presenting a new approach in the policies for reducing the level of fisherman injuries.

## 2. Method

### 2.1. Design of the sampling

The geographic area of application covers the entire shoreline of the Autonomous Region of Andalusia, which consists of two well differentiated regions: the South Atlantic and the South Mediterranean. In vessels of the Andalusian artisanal and coastal fishing fleets (ships of up to 20 GRT, and of 20–100 GRT, respectively). As the first step in the design of the sampling, the census chosen as the survey base is that produced by the Andalusian Federation of Fishermen's Guilds, since this was the most up-to-date. The number of boats by port was quantified for each segment of the fleet; sampling ports were selected for each sector in function of

[1] The "salary" of the workers takes the form of a proportional share, in function of the job position held, and the profits obtained from the catch. This system permits all the crew to obtain a benefit from their work, but can be a risk factor that encourages fishermen to accept unsafe working conditions and prolonged working days.

[2] Complete report is available in spanish:http://www2.uca.es/grup-invest/trans-maritimo/segumar/segumar2.htm.

Table 1
Sampling ports and participants including types of fishing vessels

| Ports | Bottom trawling | Small-scale gears | Seine nets | Longlines | Total |
|---|---|---|---|---|---|
| Isla Cristina | 13 | 11 | 2 | | 26 |
| Lepe | | 9 | 2 | | 11 |
| Punta Umbría | 1 | 16 | 3 | | 20 |
| Sanlúcar | 8 | | | | 8 |
| Puerto de Santa María | 5 | | | | 5 |
| Barbate | | | 8 | | 8 |
| Conil | | 36 | | | 36 |
| Tarifa | | 19 | | | 19 |
| Algeciras | | 2 | 7 | 3 | 12 |
| La Línea | | 25 | | | 25 |
| Estepona | 1 | 19 | | | 20 |
| Fuengirola | 5 | 1 | | | 6 |
| Vélez-Málaga | 2 | 13 | 6 | | 21 |
| Motril | 11 | | | | 11 |
| Adra | 1 | 10 | 8 | | 19 |
| Almería | 8 | 1 | 4 | | 13 |
| Roquetas | | 15 | | | 15 |
| Carboneras | 1 | | | 12 | 13 |
| Garrucha | 8 | 1 | | 1 | 10 |
| Total | 64 | 178 | 40 | 16 | 298 |

the ports in which each particular segment was best represented in each of the provinces. In addition it was taken into account that, in certain provinces, significant differences could exist between ports within the same segment; advice was therefore sought from the Fishermen's Guilds of the zone and the list of ports to study was completed. Subsequently it was necessary to determine the absolute size required for a reliable sample, and the distribution of this sample, so that it should be representative of the population. The total number of boats to be surveyed was set at 10% of the total population: 202 boats of the total 2027 in the census (the number finally surveyed was higher than this, with 298 ships, 14.7%).

A cross-sectional study was performed using a questionnaire. A non-random selection was made with a view to ensuring an adequate representation of the whole sector according with to census of each fishing modality (longlines, seine net, bottom trawling and small-scale gears) (Table 1).

Once the ports to be visited and the modalities to be studied in each port were known, the number of ships in the sample size was distributed corresponding to the percentages present in the population. The sample was distributed among the four fishing techniques and gear (metiers) that would be studied, respecting the proportion existing in the population; then the number corresponding to each port was determined. To finish with the calculation of the sample size, an adjustment was made with the intention of making it possible to compare fleets using the same fishing gear from different ports. The last step was to randomly select the specific boats of each port and of each fishing technique, using the port census, and assigning a reserve alternative for each boat thus selected.

### 2.2. Conduct of the surveys

To achieve more reliability, the interviewer always attempted first to get the ship's master to respond to the survey, and whenever this was possible to arrange for the interview to take place if not on board ship then in close physical proximity to her: the purpose of this was to be able to check and amplify the information provided by the master with that obtained visually by the interviewer. The survey interviews were conducted anonymously.[3] One crew member per vessel was interviewed (Table 2); in 86% of cases, this was the master

[3] *Margin of error:* Taking a level of confidence for the results of 95% ($Z = 1.96$) and considering the maximum dispersion of the results ($p$ and $q = 0.5$ in dichotomous variables), the resulting margin of error is 5.24%. *Field work:* This present work was carried out intermittently from 16 April to 29 June, by means of personal interviews to the fishermen of the ships.

Table 2
Age of fishermen by type of gear employed

| Type of gear | *N* | Percent | Age | | Age | |
|---|---|---|---|---|---|---|
| | | | mean | SD | IC95% | |
| 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 |
| Small scales | 44 | 17.8 | 40.70 | 13.57 | 36.5 | 44.8 |
| Multipurpose | 94 | 38.1 | 38.23 | 10.41 | 33.7 | 43.4 |
| Longline | 18 | 7.3 | 38.55 | 9.75 | 36.1 | 40.3 |
| Total | 247 | 1000 | 40.29 | 11.56 | 38.8 | 41.7. |

of the vessel (skipper), in 9% of cases, the shipowner, and in the remaining 5%, the Engineer or another sailor. In our point of view the skippers were the persons, in the boat, with more experience about the safety equipment and the different fishing techniques.

The questionnaire used consists of two parts, one on health and working conditions (50 items), and the other on the technical and safety characteristics of the vessels, taking into account the national legislation on the prevention of occupational and health risks and respecting the protection of personal data. Some of the variables studied are profile of the worker, health status, life styles, working conditions and accidents on board. More details about the surveys were presented in a previous paper (Piniella et al., 2007), especially in respect of data on the typology of vessels (construction particulars), number of crew on each type, and on the extractive effort made (distances and depths where they fish, duration of fishing voyages, the fishing gear used and target species) (Kleinbaum et al., 1988).

## 3. Results

### *3.1. Utilisation of personal protective gear (ppg)*

The essential requirements of health and safety applicable to the design and manufacture of protective equipment follow the European legislation with its corresponding implementation in the national regulations. By attaching or printing the CE marking on the product, the manufacturer declares that it complies with these requirements. Table 1 shows the participants including types of fishing vessels.

#### *3.1.1. Safety belt*

The safety belt is the fundamental element for avoiding falls at different levels and should be utilised in work that requires the displacement of the fisherman where free falls are possible: only 2% of the fishermen interviewed have safety belts available on their vessel, but even these few never utilise the belt.

#### *3.1.2. Gloves*

The risks derived from fishing tasks that can affect hands are incurred by the handling of both the fishing equipment and the catches; this makes essential to wear gloves that are selected correctly in respect of size, material of manufacture and properties. Gloves made of wool and synthetic material are not commonly used, although 43% of those surveyed did not wear safety gloves. Among the 57% of fishermen who do possess them 15% never used them, 6% only used them during the fishing tasks, 13% sometimes used them, 13% normally used them and only 11% always used them. Of those who wear gloves only 10% possessed gloves of various types (rubber, wool, leather, neoprene, etc.). In the classification of the catch, an activity that is performed in most types of fishing, only 26% utilised gloves always, and 3% sometimes. It is in this activity of classification where the greatest risks exist (i.e., pricks, bites, cuts, etc., from the species fished).

#### *3.1.3. Safety footwear*

For the protection of the lower limbs in the fishing sector, waterproof boots are utilised. Their soles should present a high degree of adherence to prevent slipping. Their utilisation should be obligatory and only boots of

Table 3
Summary of the specific risks in the different artisanal fishing methods

| Risk | Bottom trawling | Small-scale gears | Seine nets | Longlines |
|---|---|---|---|---|
| Stability | **XXX** | **X** | **XX** | **X** |
| Winches and hauling equipment | **XXX** | **X** | **XX** | **X** |
| Trapped by mesh nets or by the slacking of ropes or cables... | **XX** | **X** | **X** | |
| Detachment of the cables–cable breaking | **X** | | **XXX** | |
| Fall to sea | **XX** | | **X** | |
| Handling of fish species and hooks | | **XXX** | | **XXX** |

Some percentages on the specific items:
*Botton trawling*
98% do not fit the overpound net
14% have been trapped by mesh nets or by slacking of ropes
*Small-scale gears*
28% accidents due to fish species
8% accidents with gear hooks
*Seine nets*
13% (only) of the boats carry special quick-release opening for throwing the load onto deck
11% accident due to a cable breaking
*Longlines*
32% (only) utilise gloves
34% accidents due to fish species
25% accidents with gear hooks

approved type should be utilised. There are "normal" boots whose exclusive function is to protect against water, and others with protection of reinforced toe caps, with consequent resistance to perforation and corrosion. Therefore, the safety footwear employed during fishing are waterproof boots: 78% always wear them, 6% never, and 2% do not have any.

### 3.1.4. Safety clothing

The use of waterproof clothing as personal protection is important because the work is physically hard and life on board means constant exposure to water; the purpose is both to maintain body temperature and to protect against knocks, abrasions and injuries caused by projections: 73% always wear it, and 12% only when actually fishing. Out of the sample all those surveyed (100%) have waterproof clothing and most always wear it; no one was found who never utilises it. The colours of the clothing worn are orange (38%), green (27%) and yellow (25%), with only small percentages red or grey.

### 3.1.5. Goggles

Regarding the use of protective goggles in the selection of fish caught, only 1% of those surveyed utilise them. The use of goggles would help prevent eye infections and injuries that can be caused by the projection of scales and liquid (Table 3).

## 3.2. Winches and hauling equipment

There are no specific regulations for the machinery used on fishing vessels, in respect of the correct handling of fishing gear. All that exists are a European regulation on machinery in general (Directive 1998/37/EC and the revised 2006/42/EC) that is implemented at the national level. Most winches are of the hydraulic type. A valuable added advantage that affects safety is the possibility of fitting remote controls, with the mounting of valves in parallel with the principal valve. Of the total boats 92% have sufficient visibility from the machinery working zone to the rest of the deck[4]; 42% have controls with the following commands marked on them: haul in or crank stop and slacken or pay out; 60% do not have a system that prevents overloading by the catch

[4] The problems of visibility come up when the control over the hydraulics are from the bridge to the aft part of the fishing boat.

when the net is hauled in with the risk of causing an important list in the boat; 69% do not possess double controls, local and remote; the remaining 31% do possess double controls. Only 17% have the double controls configured in such a way that simultaneous handling is blocked. In the event of a power failure, only 12% possess safety devices to prevent over-hoisting or the accidental dropping of the load. Winch breakdowns have occurred in 35% of the sample. The boats fitted with winching machinery are mostly trawlers and seine netters: 23% of trawlers utilise automatic guiding devices and 8% utilise a dynamometer on the suspension hook. As a general rule, boats switching gears throughout the year are fitted with different hoisting devices, and depending on the gear to be employed, they utilise one or another type of hoist. The seine netters employ cranes for hoisting the net. Out of the small boats 79% utilise the hydraulic hauler; they may also have pulleys, jibs and turning engines. In a small percentage (3%), hauling in the gear and raising the anchor are operations carried out by hand.

### 3.3. Stability

It is important to take into account where the heavy tackle is stowed, because the closer it is to the keel of the boat, the more stable the vessel will be. The fishing tackle is usually carried on deck (84%) or in hold (13%). In 39% of cases the hold is divided into sections by a bulkhead that separates the fish from the ice. In 6% of the boats there is no hold; thus only the deck of the boat is available. When not fishing, 71% of those surveyed always close the hatch cover to prevent water from entering the hold while underway and 7% never close it, while in some boats of smaller dimensions, the hatch cover is kept open to let the engine "breathe".

Next we will analyse risks as classified by the type of gear (Table 3).

### 3.4. Specific risks of bottom trawling (Fig. 1)

There is enormous variety in the length of the bands and of the poundnet that comprise the fishing gear: Most of the fishermen (98%) do not fit the overpound net. The number of pay-outs and haul-ins that are done can range from 1 up to a maximum of 50 depending on the duration of the working day or trip, which can be from approximately 6 h to 5 days, as it occurs in some places of Andalusia. Some 14% have been trapped by mesh nets or by the slacking of ropes or cables and/or have been dragged into the sea when the tackle is paid out. In 72% of cases the guide blocks or pulleys are fitted with safety catches, which are the ones used for preventing the detachment of the cables.


Fig. 1. Bottom trawling.

### 3.5. Specific risks of seine netting (Fig. 2)

The net that is utilised in seine fishing net can reach a length of 4500 m and a height of 110 m. In the boats that use oil and gas lamps, the number of lamps and their power rating will depend on the size of the fishing boat. As a general rule, the lamps employed to attract the fish are located in the small lamp boat (71%), but they can also be situated in the fishing boat (3%) or in both. Only 13% of the boats surveyed carry the auxiliary boat on board and 66% utilised the leading boat or the lamp boat as lifeboat. Guide blocks with safety catch


Fig. 2. Seine netting.


Fig. 3. Boulter fishing.

are carried by 58% of boats; only 32% carry special quick-release openings for throwing the load onto deck The accidents caused by burns or fires due to the oil or gas lamps of the boat are characteristic of seine net fishing; however, accidents of this type have not been described in the survey conducted, and only 11% recall having had some accident due to a cable breaking. Lifejackets are worn in the small auxiliary boats by 53% of the crew members; and only 8% recall any operation in which the stability of the boat was endangered by fish overloaded in the net.

### 3.6. Specific risks of longline or boulter fishing (Fig. 3)

The hooks used in fishing with longline are mainly curved (70%), although they can be straight; their size varies depending on the catch species, usually of size 6; their number can range from 30 up to 4000 in a single set; the number of sets deployed varies from 1 up to 20 according to the duration of the working day. In bottom hooked lines it is customary to utilise stones as ballast (65%), followed by concrete blocks (27%), and on the largest longliner fishing boats a maximum of 3000 kg in ballast could be carried on board. The type of bait used is very varied. In 68% of the boats surveyed, the baskets, buckets, and line reels are fastened so as not to tip over in bad weather. In the largest longliners there is an area on deck used exclusively for placing the longline. Only 32% utilise gloves when priming the hooks with bait or when handling the longlines, and 34% recall some accident involving the teeth of fish species. The cases of bites that occur most frequently are those produced by the cutlass fish (50%) and the moray eel (16.67%). Of those surveyed 25% recall some accident caused by gear hooks resulting in serious wounds. In 23% of cases workers have suffered pricks due to the handling of hooks, presumably without wearing ppg.

### 3.7. Specific risks of small-scale fishing (Fig. 4)

In small-scale fishing a large number of fishermen switch between different types of gear throughout the year. Twenty-eight percent of the interviewed fishermen who utilise small-scale gear recall some accident from

Fig. 4. Small-scale fishing.

the teeth or spines of a species caught, mostly pricks produced by the poisonous spines of the weeverfish, and 8% recall some accident by being hooked in the gear. The trammel nets utilised have an average length of 3000 m and a height of 1.5 m, and aprons with a maximum mesh size of 60 cm. Various types of traps are used, mainly employed in the fishing of soldier shrimp, octopus and shrimp, for which sardine, bogue and sardinella are used as bait. The traps are fabricated from several different materials such as cloth, rattan and plastic. The mean length of time for setting them is 27 h approximately. The alcatruces, which consist of clay pots employed to catch octopus, can number as many as 2500 in each set. The boats dedicated to drag netting have a mean dragging distance of 221 m and most of them carry on deck 3–4 drag nets, positioned on both sides, carrying out a maximum of 50 sets in each working day. According to the target species fished, their mesh size ranges from 1 cm to 16 cm. Only a minority utilise the hydraulic dredge for fishing; this is employed for the extraction of molluscs by means of powerful submarine blasts; the molluscs are brought on board by suction or conveyor belts. The pressure of the jet employed is 2 kg (47%) or 3 (20%), and the mean dimensions of the bottom plate or grid are 2.42 m long and 2.30 m wide. Among the other types of nets utilised, the zorta is employed in 21% of cases; nets are also utilised for red and common pandora, red mullet, hake, caramote prawn, etc. These have a mean mesh size of 5 cm, a height of 4 m and a maximum length of 2195 m. In the fishing conducted with types of hook different from those employed on longlines, the main types of bait utilised are mackerel (50%), seabream (33%) and sardine (17%).

## 4. Discussion and conclusions

### *4.1. Ppg, winches and stability*

This study has shown the overall and specific risks in the different artisanal fishing methods in Andalusia. Many former papers have studied fishing safety, mainly focused in the loss of the vessels (as recently Wang et al., 2005) than in the occupational injuries to fisheries workers. Even in this case, there are not references about the different artisanal fishing methods; but a study among fisheries workers in Norway (Bull et al., 2001) showed the types of injuries event associated to the same risks shown in our paper: fall, machinery, and so on.

For preventing these risks, in general terms, it is very important to select the correct personal protective gear in function of the particular nature of the risks incurred, as previously reported, including risks from the activities carried out prior to embarking, such as getting the boat and fishing tackle ready for use, the loading of tackle, equipment and supplies, the activities during the fishing work, and the subsequent unloading (see Table 4). The use of safety belts in bad weather on deck to avoid falls from upper levels is not considered fundamental, as is clear from its reported lack of use on board. In the protection of hands, gloves should be utilised, because they are scarcely used (only 6%); particularly during the selection of the catches, fishermen suffer from pricks caused by various species that may lead to skin rashes or even be poisonous. Therefore, it is recommended to use gloves with sufficient length to cover the complete forearm. In longline fishing 34% of all accidents are caused by bites from various species, and in small-scale fishing, bites and pricks account for 28% of all accidents among fishermen. The mechanics and those charged with operating hoists and similar machinery on the vessel should also wear safety gloves to avoid accidents. The protection of lower limbs that appears to be quantitatively acceptable should also be so qualitatively, by wearing boots with protection not only against water but also against the mechanical risks that could be incurred on deck. The study shows the existence of a significant percentage of accidents due to slipping (54%). All the fishermen possess waterproof clothing, but perhaps there should be more attention to the colour of the waterproof material, so that bright

Table 4
Personal protective gear (ppg)

| | |
|---|---|
| Safety belt | 2% |
| Gloves | 57% |
| Safety footwear | 78% |
| Safety clothing | 100% |
| Goggles | 1% |

and reflective colours are always worn; these colours would obviously be better for the detection or location of anyone unlucky enough to fall into the sea. It is significant that 20% of the fishermen recall some incident of falling into the sea. Almost all the boats surveyed have sufficient room and visibility at the winch or hoist working area but despite this, 10% of accidents are produced by becoming trapped in tackle, cables, ropes, etc., or by impacts from these. It is also important that the machinery should be fitted with correct markings or devices (indicators, signals, etc.) that state what is necessary for it to be operated safely: only 44% of winches have the commands of "haul in, stop, and pay out" marked I on the controls. Equally important are the systems that prevent catch overload when hauling in the net; these only exist on a small percentage of boats. They should also be fitted with double controls, local and remote, to be able to operate them from the bridge.

### *4.2. Specific risks in the different artisanal fishing methods*

In each type of fishing various specific tasks have to be performed that entail characteristic kinds of risk; we conclude this study by considering these.

#### *4.2.1. Bottom trawling*

In the trawler fleet, the main tasks or operations performed in trawling are paying out, towing and dragging the gear, hauling in the gear with the catch, and handling the fish. The trawlers with greater length of service usually have wooden stern gates, and those of more recent construction and greater length have steel gates. During the visits to the various ports, it could be observed that both the winches and the stern gates, in some boats, were very rusty; this represents a risk of infections if workers suffer injuries like abrasions, cuts and pricks. The use of safety catches on the guide blocks prevents the detachment of the cables, which can produce serious injuries, even amputations, due to the whiplash effect when safety devices fail, are released incorrectly, or when cables and ropes break under tension. The employment of automatic guides would prevent the occurrence of the load dropping or moving accidentally, with the consequent risk to the crew of being hit, trapped, or crushed, and the risk of loss of stability of the vessel.

#### *4.2.2. Seine netting*

In the Purse-Seine fleet, the tasks and operations that are undertaken in this type of fishing, from the time of leaving port until the vessel's return, and the preparations for when the vessel next gets underway, include the following: hoisting the auxiliary boat on board; mooring and towing the lamp boat; and putting out to the open sea; gathering the fish; paying out the gear or setting the seine net, recovering the gear, and unloading the fish.

During the hoisting of the auxiliary boat on board, neither of THE interviewers stated any accidents (such as strains or the boat falling into the water); this is probably because only a small percentage of vessels (14%) carry this type of boat on board. As a general rule the auxiliary boat is towed behind the fishing vessel. During the location of the fish, the Master of the vessel can get his eyes damaged by the echosounder screen; all vessels should have the echosounder well illuminated, so that no damage is caused to the vision of the fishermen for this reason. Purse seine fishing with lamps at night time is the purse seine system par excellence, and is typical of the Mediterranean area.

In addition to the risks incurred from purse seine fishing in itself, the extra risks derived from the use of the lamp boat should be considered. As a general rule, when the lamp boats are being towed, there is a risk of becoming trapped between the rails, as well as risks of burns, explosion of lamps, and falls into the sea. The survey conducted did not detect any accident due to the use of lamp boats, and more than half of the fishermen reported wearing life jackets while in the auxiliary boats, in case of possible falls into the sea. These kinds of risks can be avoided by placing the lamps on the bridge of the vessel, as it occurs with the more recently constructed fishing vessels.

During the paying out of the gear, the risks that can be incurred are mainly falls, strains and impacts from getting entangled in the ropes. Of the total surveyed, 10% of fishermen had suffered some accident or other from getting trapped; therefore it is essential that the winching machinery and reel should be operated by experienced personnel, in both trawling and purse seine fishing. The same occurs when the net is hauled in: it is

important to operate the winch correctly to avoid entanglement of the catharpin. It was found that 11% of the fishermen had suffered some accident because of the rupture of a cable or catharpin.

With reference to this type of gear, the survey also asked about the material employed in the fish containers used. In the majority of the ports wooden crates or boxes are used to load the fish; this produces risks of scratches and pricks for the fishermen and reduces the quality of the fish. In the survey conducted, 8% of those surveyed employed plastic containers (not including boxes of expanded polystyrene). This is the plastic material recommended in the Plan for the Modernisation of the fisheries sector in Andalusia, for the more valuable species, together with other plastic materials for the remaining species.

#### *4.2.3. Longline*

In the Longline or boulter fleet, the tasks and operations characteristic of this type of fishing gear are different from those discussed previously, basically due to the use of hooks. The operations undertaken are the following: handling and baiting the fish hooks, extending the gear, pulling in the gear, and handling the lines. When baiting the fish hooks or handling the boulters, injuries can be suffered from the hooks, like pricks and cuts to the hands (24%); for this reason the fishermen must wear safety gloves and avoid snagging their clothes on the hooks. The risk of snags and pricks from hooks can also be incurred if the baskets, buckets and line reels are not fastened against tipping over in bad weather, as it was reported on 32% of the boats. The lines must also be well coiled and the hooks positioned with caution after use, and the crew members who are not participating directly in the paying out or pulling in of the lines must stay well clear. When mechanical haulers are being employed, special care must be taken not to get hands caught in the main line or branch lines carrying the hooks. Within the Plan for the Modernisation of the fisheries sector of Andalusia, aid is provided towards installing machinery for baiting the hooks and unhooking the fish automatically, which would reduce accidents produced by getting caught in this kind of tackle.

With reference to the stability of the fishing vessel, the boats fishing by bottom boulters carry on board the heavy weight caused by the ballast employed (stones, blocks of concrete, and others) which represents an additional risk, mainly when the longlines are paid out or hauled in. During the recovery of the gear accidents can occur from fish bites; half of the bites recorded were from the cutlass fish species. The reduced feeling resulting from wearing gloves is uncomfortable for the fishermen; however, they do not need so much feeling when hauling in the gear as when baiting the boulters. Also, to avoid this type of risk, the fishes that are likely to bite or are dangerous can be killed or left to die before hoisting them onto the deck and removing the hook.

#### *4.2.4. Small-scale fishing*

Lastly, in respect of the small-scale fishing, the risks of accidents inherent in the fisheries sector are increased in the boats engaged in small-scale fishing, mainly due to their smaller dimensions. There is not enough room for stowing the gear and lifesaving devices, which in turn makes the fishing tasks more difficult. Since the crew are fishing fairly close to the coast, they are not so aware of the risks to which they are exposed, and tend not to take care of their safety equipment.

Among the boats engaged in small-scale fishing, the hydraulic dredge is an unusual type of vessel that requires special consideration, since it introduces new risk factors in the modalities of fishing. In compliance with the particular regulations governing the fishing of striped venus clams in the Gulf of Cádiz, the hydraulic dredge is understood to be "the system of shellfish extraction constituted by a metal frame installed on the bow of the vessel. This frame or dredge is in turn towed by the vessel, from its bow, and the vessel proceeds in reverse, in a backwards direction, through the action of a winch that winds in a cable joined to an anchoring device previously paid out from the stern, which constitutes the fixed point for the fishing manoeuvres". These vessels are longer and of greater tonnage, and may thus entail greater problems in respect of the stability of the vessel. In the standard there are stability criteria that these boats must comply with, depending on their GRT. The work involved in fitting the hydraulic dredge to the vessel must be undertaken, inspected and authorized according to the conditions laid down in the regulation. The metallic frame suspended from the bow of the boat may become detached at any moment, causing serious injuries or even death by crushing. This type of fishing boat has a greater degree of mechanisation, basically through the employment of the dredge, conveyor belts or suction equipment for raising the molluscs on board from the seabed; therefore, personnel must be

specially trained or experienced in this type of machinery. Likewise, special attention must be paid to the maintenance of this machinery.

Policymakers should find the results of this study useful in developing regulation and enforcement mechanisms for reducing fishing vessel injuries and total losses.

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