

Safety and health of shrimp fishermen in Bertioga-São Paulo/Brazil: A study focused on atmospheric risk factors

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Abstract

The risk of accidents during oceanic fishing is often high and it can cause several harms, from small injuries to death by drowning. The risks to fishermen's safety and health are potentiated by atmospheric factors such as storms, wind, solar radiation, humidity, heat and cold waves, among others. Fishing is one of the most dangerous labour activities; therefore, it demands constant adjustments in its standards, procedures and public policies. The aim of the present study is to assess the work conditions of a group of fishermen based on atmospheric risk factors in order to contribute to measures taken towards these issues in Brazil. A questionnaire was answered by 20 shrimp fishermen from Bertioga-SP; it was the tool adopted to identify control measures taken by them in order to prevent accidents and diseases. Based on the results, these fishermen work under precarious work conditions and face high vulnerability, as well as the risk of accidents and of catching diseases. Moreover, results have shown that atmospheric factors have significantly contributed to increase such risks. In addition, these precarious work conditions have been worsened by the absence of safety adequate methods, as well as of preventive and emergency measures.

Keywords: Safety and health. Atmosphere. Artisanal fishing.

Introduction

According to the International Labour Organization (ILO, 2016), there are more than 58 million workers in the primary sector - catch fishing and agriculture - worldwide. More than 15 million among them work in fishing vessels (boats or ships used to catch fish at the sea). Professional fishing in Brazil is regulated by law number 11.959, according to which, commercial fishing is composed of both industrial and artisanal fishing. Industrial fishing counts on approximately 1,600 fishing vessels and 9,000

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workers, who account for 55% of the fish production in the country. More than one million artisanal fishermen produce 45% of the fish commercialized on a yearly basis, and this number turns this fishing type into one of the activities having the greatest social and economic impact on Brazil. According to Instituto de Pesca (IP), the mean annual production from 2009 to 2013, in Bertioga, São Paulo (SP) was 213.6 tons, and it represents a revenue of ~ R\$ 1.25 million a year (IP, 2016). Recently, also for Bertioga, data presented mean annual production of 148.9 tons from 2013 to 2017; this amount corresponds to production drop by approximately 30.3% in comparison to the 2009-2013 period (IP, 2019).

Despite the expressive production, fishing is historically known as an extremely dangerous labour activity. Many papers have documented different and concerning issues about the safety and health of fishermen worldwide. Dzugan (2010) and Levin et al (2016) carried out a study in the United States of America (USA) about the need of using safety equipment and fishermen's training to have positive influence on the mitigation of these risk factors. Rodrigues and Kiran (2013) verified that Indian fishermen need to improve security through positive acts such as using safety equipment. Frantzeskou et al (2012) identified that 28% of these workers in Greece had already suffered at least one lesion, whereas 14% of them had experienced situations where they almost drowned. Eklof and Torner (2005) observed that Swedish fishermen who had suffered some kind of accident rarely started to adopt preventive measures after it; therefore, it would be necessary to make longer or more intensive interventions in their workspaces. Murray et al (1997) verified that fishermen in Canada who have anxiety symptoms are more vulnerable to lesions. Fishermen in Norway deal with risks due to beliefs and practices they share, which lead to the wrong idea of not needing formal regulations to improve safety (Thorvaldsen, 2013). Although most studies just address big fishing vessels, many scientific publications have documented diseases and accidents due to

fishing in Brazil, mainly artisanal fishing (PENA and GOMEZ, 2014; ALBIZU, 2014; FREITAS and RODRIGUES, 2014; DOIMO et al., 2012; RIOS et al., 2011; ROSA and MATTOS, 2010; PENA et al., 2009; BARBOSA, 2004) and in other countries (KUM and SAHIM, 2014; QUINTINO, 2013; JANOCHA, 2012; FRANTZESKOU et al., 2012; ALVES, 2012; PERCIM et al., 2011; LAURSEN et al., 2008; MARSHAL et al., 2004). Bad weather conditions are mentioned as the main cause of diseases and accidents in many of these studies, mainly when it comes to seagoing fisherman, who are more vulnerable to atmospheric phenomena and sea conditions. Based on the recent study by Madhanagopal and Pattanaik (2019), Indian fishermen have been changing due to climatic patterns observed in the last decade, which contrasts to conventional fishermen's knowledge. They also realized that their own knowledge about local weather conditions was no longer enough to deal with future climate changes.

The bad weather and sea conditions in the Brazilian coast emerged as important causes of accidents that often lead to shipwreck. Fuentes et al. (2013) have investigated the atmospheric and oceanic conditions that have caused 69 shipwrecks between Sergipe and Rio Grande do Sul states. Most of these shipwrecks (94%) happened with small vessels, similar to the ones used by fishermen in Bertioga. According to Fuentes et al. (2013), wind (54%) and sea swell (46%) were more intense than the normal conditions during the accidents. Weather and sea conditions can also cause from minor to severe injuries due to accidents, since fishing vessels often have wet floors and constantly move due to the swell. Sea conditions also pose other risks to fishermen such as physical agents (noise, radiation, among others), chemical agents (fuel, engine smoke, among others) and labour accidents like slip, fall or fish bite - all these factors have negative impact on Safety and Health at Work (SHW). Ultraviolet radiation can cause skin diseases, including cancer, since fishermen are daily exposed to the sun. In addition, extreme

temperatures during cold and heat waves can cause respiratory and circulatory system issues.

Accordingly, the aim of the present study was to investigate whether work conditions faced by artisanal shrimp fishermen in Bertioga are appropriate to prevent accidents and atmospheric-related diseases. Data were collected from 20 fishermen through the application of a semi-structured qualitative-quantitative questionnaire.

Materials and Methods

The methodological reference by Gray (2012), who considers the case study as a valuable method, was used in the current study since it adds understanding, experience and conviction about a particular issue or phenomenon, and its relationship with real contexts. Data were collected through a semi-structured questionnaire, adapted from Albizu (2014) and validated through eight tests carried out in fishing communities. Researchers went along in a shrimp fishing trip to observe this activity during a whole day.

Of the 347 fishermen registered in the fisherman's colony of Bertioga (CPZ23), just 30 were identified as shrimp fishermen – they fished varieties 'seven beards' and 'white'. In total, 20 of them agreed on participating in the interviews. They were selected because shrimp fishing is the most significant economic activity in Bertioga-SP and because fishing vessels and fishing tackles are similar to each other. Interviews were carried out during the shrimp closed-cycle, from April to May 2016 - the gathered information was registered in the field journal. Data were systematized in worksheets and visualized through graphics and through some illustrative figures. The qualitative-quantitative questionnaire allowed a broader participation of fishermen who exposed their main experiences and difficulties at work. The questionnaire encompassed open (free answers) and close (alternative

answers) questions, as well as aimed at identifying risks and preventive actions based on fishermen's perspective and focused on atmospheric risk factors. This instrument also traced risk and prevention-related aspects, including fishermen's profile, general work conditions and the control of measures taken by fishermen. The questionnaire also helped verifying whether there was safety equipment in the vessels.

Meetings were held in Bertioga City Hall between representatives and members of CPZ23 and the fire department to help better understanding the organization of the local fishing. Field observation was carried out in places where fishing vessels are moored for maintenance. The research project was submitted to the Research Ethics Committee of "Maternidade Carmela Dutra de Santa Catarina" and registered under "Certificado de Apresentação para Apreciação Ética" (CAAE) number 45593215.6.0000.0114, at "Plataforma Brasil" website <http://plataformabrasil.saude.gov.br/login.jsf>.

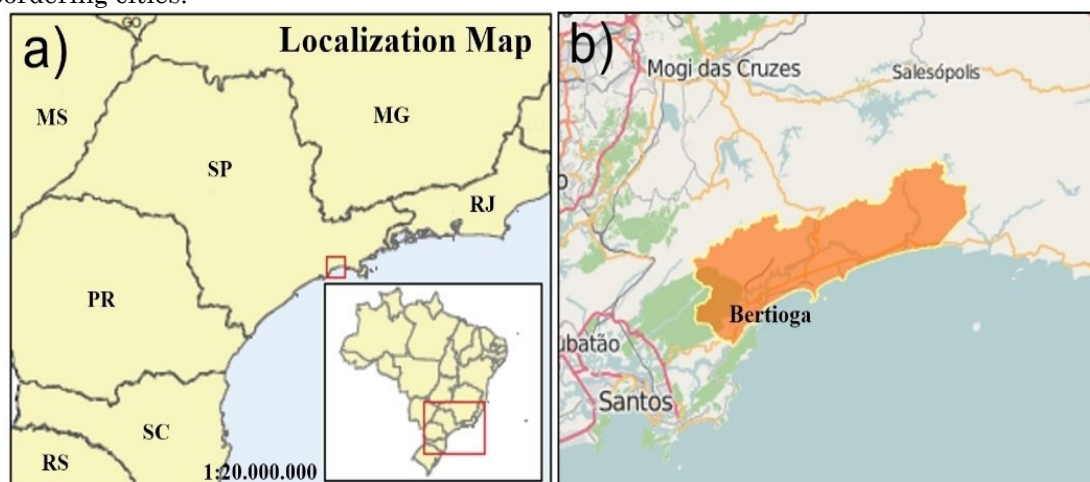
The analysis took into account the graphics of the quantitative results and the fishermen's qualitative answers. The analysis of qualitative results obtained during the shrimp fishing trip was emphasized to complete the collected information and the answers given by other actors involved in Bertioga shrimp fishing.

Bertioga is a coastal town located in the metropolitan region of "Baixada Santista" (Figure 1a); its territory covers 490,148 km (IBGE, 2015) and its population counts on 56,555 inhabitants. Bertioga beach is on the border of Salesópolis, Biritiba Mirim, Mogi das Cruzes, Guarujá, São Sebastião and Santos (Figure 1b).

If one just takes into consideration the local forcing, it can be said that weather conditions in Bertioga microregion are influenced by the sea. The coast is drawn Southwest - Northeast wards – South/East wards in the Atlantic Ocean and North/West wards (~ 5 km) in Restinga da Bertioga Park. There are elevations from 600 to 800 m in this zone, which favour

mesoscale meteorological system conditions, such as mountains and sea breezes (VIANELO and ALVES, 2000). On the other hand, synoptic scale systems such as cold fronts, cold air masses and extratropical cyclones have impact on broader areas. Climate behaviour regarding rainfall and temperature in the Brazilian Southeastern region, where one finds the Bertioga microregion, is characterized by a dry season in the cold months and by a rainy season during the hot months. The South Atlantic Convergence Zone (SACZ) stands out; it is formed by cloud bands that act in spring and summer and that often cause extreme rainfall events.

Figure 1 – (a) Geographic location of Bertioga-SP and (b) a detailed map of it, including its bordering cities.



Source: IBGE, 2011.

Results and Discussions

Most of the 20 interviewed Bertioga shrimp fishermen was in the age group 41 to 50 years. The youngest fisherman in the sample was 20 years old and the oldest one was 68 years old. In total, 80% of them started fishing before they turned 18, 25% (5) of them started doing so before they turned 11 and 10% (2) of them confirmed to have started fishing at the age of 7. Four (4) fishermen confessed that in their opinion starting to learn how to fish between 12 and 14 years old is 'normal'. The most experienced fishermen own their vessels, since fisherman only have financial conditions

to buy a vessel after many years in this profession. Vessel owners who do not work with fishing rather select more experienced fishermen to use their vessels, since they are more concerned with safety and more skilled to handle fishing tackles.

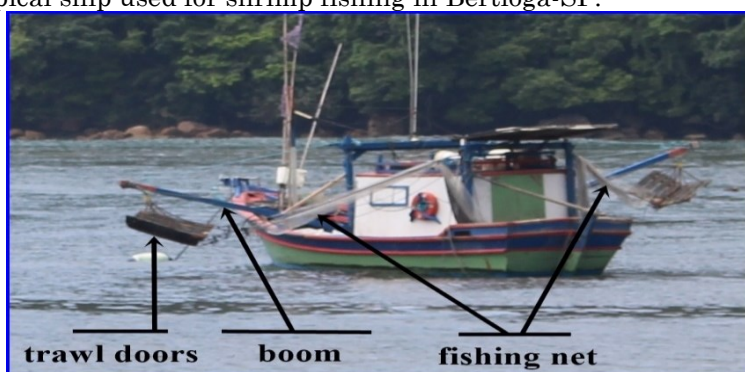
Based on the results, 65% of fishermen has only attended elementary school; most of them did not even finish it. Younger fishermen have attended high school, but none of them has gone to college. According to their testimonies, there is low availability of higher education institutions in Bertioga. In total, 60% of fishermen in the county attended navigation or fishing courses; however, most of them has attended these courses many years ago and does not remember their content. Just few of them attended recycling courses, but most of them did not remember the name of the courses – they referred to them as "captaincy course" (basic navigation, safety and rescue knowledge). Some fishermen attended Navy courses, they mentioned that they used to work in industrial fishing, which requires this course to the working license. Most fishermen (65%) confirmed to have learned how to fish from their fathers when they answered the question "How did you learn to fish?" and 25% of them said to have learnt from older workmates, the remaining fishermen said that they had learnt from uncles or brothers. These numbers confirm one of the cultural aspects of fishing, according to which, "fishing is taught from father to son" and it shows the degree of family dependence to engage in this profession. Beginner fishermen who do not have such family bonds have a hard time with practical lessons; therefore, they become more vulnerable to risks posed by fishing trips.

Most fishermen are married and their family members: wife, children, and others, help cleaning and painting the vessels, as well as help repairing fishing tackles, among other activities. More than half (60%) of fishermen said to earn from 2 to 3 minimum wages a month and 20% of them declared to earn from 4 to 5 minimum wages in the same period. Fishing was the

only activity performed by 9 of the 20 interviewees, but they said to work with tourism on the weekends, they transport amateur fishermen who want to fish in open sea. The others have declared to have additional incomes, such as retirement pensions, house rent, vessel and tackle repairs, fish selling, among others. In total, 20% of the interviewees did not know their total monthly income, they said that it depends on the season or on the weather conditions.

Boats or whalers are the typical ships used for shrimp fishing in Bertioga, which use double drags or similar fishing tackles. There are differences between fishing vessels, mainly when it comes to length (from 8 to 12.6 meter) and engine type (from 18 to 310 HP) and between fishing tackles such as fishing net and trawl doors (Figure 2).

Figure 2 - A typical ship used for shrimp fishing in Bertioga-SP.



Org.: by the author, 2016

Overall, there is no accurate information or documents about vessel manufacture year, but fishermen estimate that they can be used from 4 to 40 years. All fishing vessels are made of wood and most of them sail in water depth from 5 to 20 meters. The trawl door is managed with a strong structure called boom (Figure 2), which is used to support the cables during drag and to broaden fishing net opening.

A checklist was applied and its results showed that almost 50% of all fishing vessels do not fulfil even one of the required safety items (Table 1). Although many fishing vessels fulfil these items, some of them are not used by fishermen on board. Hearing protectors and life jackets, for example, are

rarely used, only 6 among the 20 interviewed fishermen did not know how to swim or confessed to be poorly able to swim. In addition, some of the fishermen who have stated to know how to swim said that they do not practice it so often. All these factors add to the fact that most fishermen work alone, increase their risk falling off the vessel. This risk becomes greater given the constant moving of fishing vessels, with the wet surface on the boat and the several fishing tackles spread across the deck. The shrimp fishing monitoring showed that fishermen stay in a risky position when they handle the fishing net or other fishing tackles on deck.

Table 1 - Safety items: “yes” or “no” answers in the fishing vessel safety checklist.

| Item | Yes | No | Item | Yes | No |
|-----------------------------------|-----|----|----------------------------|-----|----|
| Rádio “Very High Frequency” (VHF) | 18 | 2 | Flare and distress signals | 11 | 9 |
| Compass | 18 | 2 | Fire extinguisher | 16 | 4 |
| Life jackets | 20 | 0 | Internal lighting | 20 | 0 |
| Electronic nautical chart | 13 | 7 | External lighting | 18 | 2 |
| Probe / sonar | 13 | 7 | Spotlight | 10 | 10 |
| “Global Positioning System” (GPS) | 14 | 6 | | | |

Org.: by the author, 2016

In total, 40% of fishermen stated to do fishing vessel maintenance themselves once a year, often at the shrimp closed-cycle. Approximately 55% of them have confirmed to do vessel maintenance from 2 to 4 times a year. Just one of the interviewed fishermen declared to only do some maintenance when the fishing vessel presents some perceptible problem. The applied questionnaire did not allow specifying or detailing the kind of maintenance.

Most fishermen (65%) reported to work daily based on the “go and back” system, they go to the sea in the morning and return at late afternoon or early evening. The remaining 35% work at the sea for more than 24 hours and sleep in the fishing vessel. The working day can vary in the “go and back” system, and it often begins between 04:00 and 06:00 a.m. and finishes between 02:00 to 06:00 p.m. Overall, these fishermen have a departure and arrival target, but their plan can change due to weather and sea conditions or depending on fish catching. The working day can vary so much that some

fishermen do not adopt schedules, they just informed that the working shift "depends on the day". Anyhow, it is clear that the working day is long, from 8 to 16 straight hours. Most fishermen stated to work on a daily basis throughout the week, including weekends. Fishermen who also work with tourism (transportation) are an exception, since they stop fishing on weekends to work as "tour guides" in amateur fishing trips. The working day is also often long in these trips since they assist many groups. They use to work in 2 or 3 shifts (12-hour long) when they are transporting amateur fishermen - two fishermen take turns in the fishing vessel in these cases. Besides transportation, they also clean fish to get extra income. Fishermen who stay at the sea for more than 24 hours do not return home before they reach the pre-defined targets, so they can pay the costs of the fishing trip. However, these trips vary depending on fishing vessel size, on fishing type and on profit distribution system. Some fishermen stay in the sea for one entire month in bigger fishing vessels and some others for 5 days or as long as the ice stocks last. The working day starts at 03:00 a.m., when they are at the sea, and finishes at 08:00 p.m. Fishermen look for a safe place to be at night, but it will depend on fishing vessel location and on environmental conditions: wind direction, tide and ocean currents. In the case of shrimp fishermen from Bertioga, they usually stay in Indaiá (beach), Monte de Trigo (island) or in the islands close to Barra do Sahy, in São Sebastião-SP. One of the interviewed fishermen stays in the sea for two days, at most, and, even though, only if the fishing conditions are favourable.

Fishermen who do not own a fishing vessel are the most vulnerable ones, since they need to prolong their working days, regardless of the weather and sea conditions, to ensure some profit. Longer working days imply greater exposure to risks, including diseases, due to the exposure to physical agents. Fisherman can suffer with physical and mental fatigue due to their long stay in the sea, and it can impair their concentration at work and increase risk levels. The structural precariousness of fishing vessels

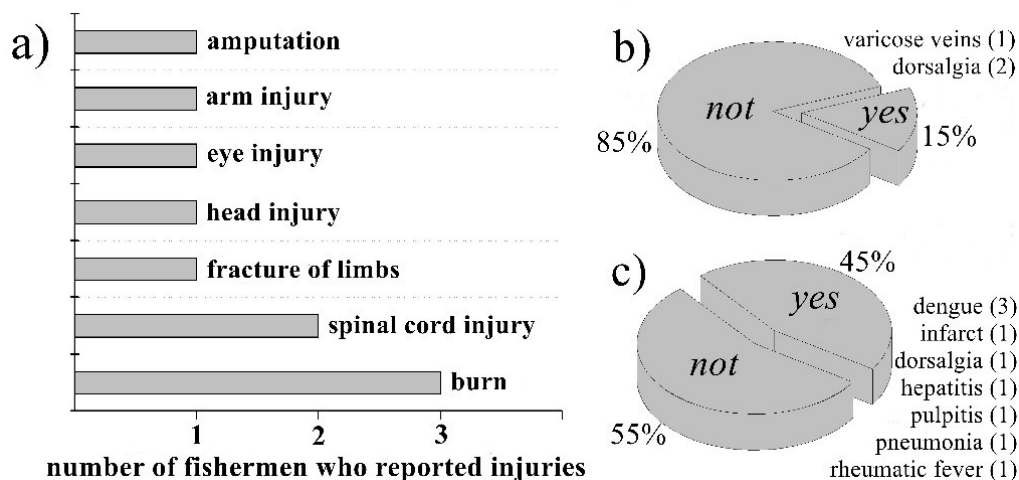
must be emphasized, 45% of them does not have a bathroom and/or a kitchen, and 15% not even has beds. Improvised stoves also increase the risk of fire in the ship.

In total, 50% of fishermen have already experienced at least one accident and acquired lesions during labour shifts (Figure 3a). Assumingly, fishermen who said never to have suffered an accident, actually do not see such events as accidents at work. They only reported a lesion (Figure 3a) when fishing had to stop so they could have assistance in an intensive care unit. In other words, only extremely severe accidents are seen as work accident by most fishermen. Burns are the most common accidents, which are caused by the use of stoves in the ship or by engine exhaustion. There is contrast between the statement of 50% of fishermen who said "never to have suffered lesions" and the testimonies following the answers in the questionnaire. There was the example of two fishermen who were involved in a shipwreck but who have reported no lesions because of it. They said that the accident happened because they were alone and due to bad weather and sea conditions - these comments meet the findings by Fuentes et al. (2013). Bad weather and sea conditions were pointed out as the causes of head (beat on the boom) and eye (work with trawler) lesions, as well as of broken arms (fall on the deck).

Most fishermen (85%) said they do not get sick at work (Figure 3b). When they were questioned about whether they had already acquired some disease that was not related to work, almost half of them answered "yes" (Figure 3c). However, they also reported some diseases likely related to fishing. In their opinion, cold, influenza, heat stroke and other diseases are "normal in the profession", they are considered occupational diseases only when the work has to stop because of them.

Figure 3 – (a) Lesions specified by 50% of fishermen who stated to have suffered a work accident and the percentage (%) of interviewees who answered yes/no to the questions (b) "Did you already get any disease which, in your opinion, was caused by the work? If yes, what was the disease?" and (c) "Did you get any disease which was not caused by the work?"

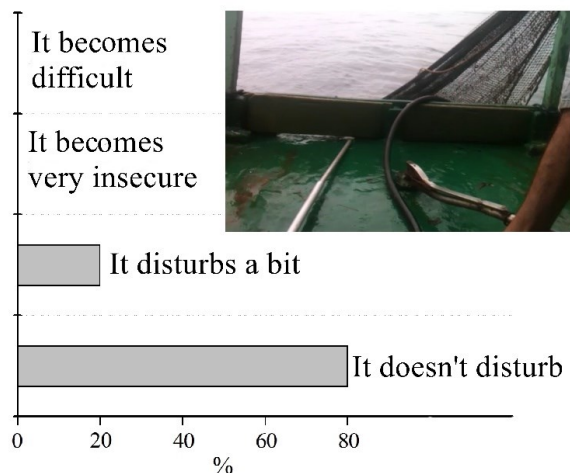
If yes, what was the disease?". Disease specification and the number of cases (into parenthesis) are shown in graphics (b) and (c).



Org.: by the author, 2016.

Most fishermen (80%) stated that rain "does not cause any disturbance" at work and 20% of them have said that it just "disturbs a little" (Figure 4). No fisherman agreed that rainfall "disturbs to much" or mentioned some association between rainfall and safety, despite the evidence about the risk of falling on the deck, as shown in Figure 4. The probability to fall increases significantly when the deck is wet and slick due to rain, agitated sea, constant fishing vessel move and bad swimming by some fishermen, which is worsened by the non-use of lifejackets.

Figure 4 – Percentage of answers (%) to the alternatives of question "When it is raining, how is the work condition?". The image in the upper/right corner depicts the deck's situation under the rain.



Org.: by the author, 2016.

The question "What, in your opinion, is more harmful to SHW?" had the following answering alternatives: "sun", "cold", "heat", "rain", "wind", "agitated sea" or "lightning". Fishermen were told to point out all seven atmospheric factors and to classify them by importance order, from the most to the least harmful. Most fishermen did not understand the difference between "sun" and "heat", and it evidences their lack of awareness about differences between two important physical agents: ultraviolet radiation and heat (thermal comfort). Assumably, the ignorance about ultraviolet radiation is worrisome, fishermen do not worry about this physical agent. However, it is dangerous in Bertioga regions because the air temperature can be "nice" in some seasons (without heat or thermal discomfort), but the ultraviolet radiation index can remain high. The difference between "wind" and "agitated sea" was also not perfectly understood. In this case, one can observe a strong link between these atmospheric factors, since stronger winds lead to agitated sea. However, it is possible having strong wind without immediate changes in the sea; in this case, the "wind" factor can become an important cause of accidents (from fishermen falling on deck to shipwreck). Accordingly, fishermen just interpreted five atmospheric factors: "sun - heat", "cold", "rain", "wind - agitated sea" and "lightning". Based on the results, the most harmful to SHW is clearly the "wind - agitated sea", which was pointed out by 95% of the fishermen. Fuentes et al. (2013) identified that strong wind and/or agitated sea are important causes of shipwrecks on the Brazilian coast, from Sergipe to Rio Grande do Sul states. According to the interviewed fishermen, "cold" is the least harmful atmospheric factor to SHW (Table 2).

Table 2 – Percentage (%) of answers pointing out atmospheric factors concerning the question "What, in your opinion, is more harmful to SHW?"

| Atmospheric factor <u>most</u> | answer alternatives | | | | |
|--------------------------------|---------------------|------|------|---------------------|-----------|
| | sun - heat | cold | rain | wind – agitated sea | lightning |
| | 0 % | 0 % | 0 % | 95 % | 5 % |

| | | | | | |
|---|-----|------|-----|-----|-----|
| harmful to SHW (the most remembered) | | | | | |
| Atmospheric factor <u>least</u> harmful to SHW (the least remembered) | 0 % | 90 % | 5 % | 0 % | 5 % |

Org.: by the author, 2016.

Although it is not common sense among fishermen, ultraviolet radiation is an extreme risk factor for skin diseases. We did not find any prevention standard probably due to complete unfamiliarity with current damages caused by this physical agent (Table 3). Some fishermen do not even protect their face, neck and shoulders with a hat or a cap, which are the parts of the body most often exposed to the sun. Most fishermen (55%) informed not to use sun block, whereas 10% of them have informed to use it eventually. In total, 35% of them uses sun block and, among them, just one fisherman renew the sun block application every 3 hours. Half of fishermen has reported to wear sunglasses and 75% of them have reported to work in the shade, because fishing vessels have a roof or an awning. The remaining fishermen said that the vessels' roofs do not protect them from the sun, because the protection depends on the vessel position in relation to the sun.

Table 3 – Measures to prevent ultraviolet (UV) radiation taken by Bertioga-SP shrimp fishermen.

| prevention | yes | no | sometimes | prevention | yes | no | sometimes |
|--------------------|-----|----|-----------|----------------------------------|-----|----|-----------|
| hat | 5 | 15 | | sunglasses with UV filter | 6 | 4 | |
| wide brim hat | 3 | 2 | | usually wets the body | 8 | 12 | |
| cap | 6 | 7 | 2 | wet or rinse with drinking water | 3 | 5 | |
| shirt | 17 | 3 | | work in the shade | 15 | 5 | |
| long sleeves shirt | 6 | 11 | | sun block | 7 | 11 | 2 |
| sunglasses | 10 | 10 | | | | | |

Org.: by the author, 2016.

The answer to the question "What is the major risk in fishing?" did not induce interviewees to think about the risk of catching a disease or the risk to their safety. This question did not make fisherman take into consideration some specific causes, such as atmospheric factors. However,

40% of fishermen believed that the major risk of it is the "bad weather". This belief is synthesized by answers such as "agitated sea", "strong wind", "thunderstorm", among others. According to 30% of the fishermen, the major risks in fishing work are the shipwrecks caused by bad weather and sea conditions, fall from the deck or lesions acquired when they handle fishing tackles. The remaining 30% consider aspects such as "having no credit", "not being afraid", "old fishing vessel", "criminals" and "accidents" as the most critical issues. Except for "accident", these references are distant from atmospheric risk factors.

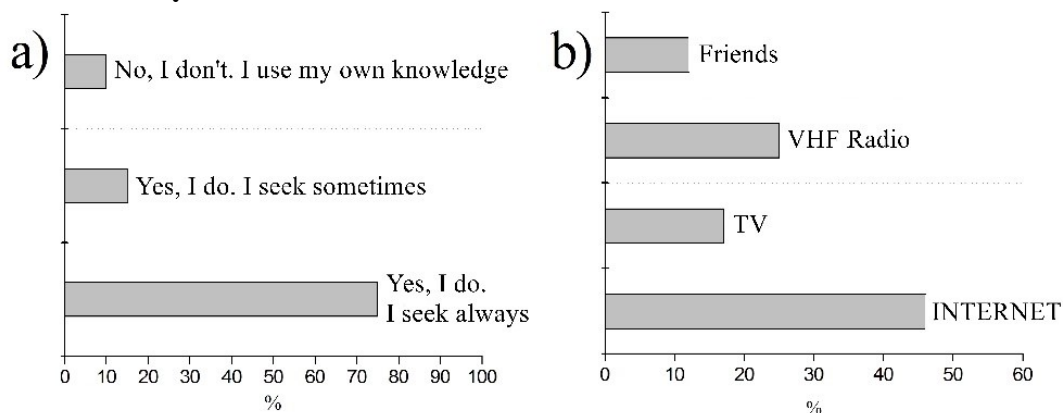
Answers to the question "What is the most dangerous wind?" showed that half of the fishermen answered that the Southwest wind is the most dangerous one – the Northwest and South winds were also mentioned. Many fishermen said that the "wind of thunderstorm" is the most dangerous one, as one of the fishermen has stated: "The Southwest has its warns, but the wind of thunderstorm does not have them. They come suddenly and catch you before you can get out"; in fact, the thunderstorm develops suddenly at the sea and generates wind gust, which is local, has no defined direction and is usually very strong and dangerous.

When it came to the question "What do you do to protect yourself when you go to sea?", fishermen exposed different actions, some were not effective at all or had limited effect on their health and safety. For example, one fisherman said "I am always concentrated", three fishermen said "I do not need to be afraid", and other three said "I pray before going to the sea". One of the fishermen stated "I do not work in the dark because the fishing vessel has no external light". Another fisherman said that "the engine must be in good shape; we need to be healthy and to have a cell phone". Finally, eight fishermen (40%) related the answer to a checklist, mainly for engine spare parts, radio, cell phone, fishing tackles, tools, life jackets, water, drainage pump, backup battery, flashlight, mirror, flag, signal buoy, anchor, fuel, ice and additional food. The complete list of items was not mentioned

by all eight fishermen, they just remembered parts of it, but some items were remembered by more than one fisherman. According to evidences, these fishermen do not follow any pre-defined prevention standards, they were greatly concerned with emergencies rather than with preventive actions.

Similar to prevention actions, weather forecasting is essential for a safe fishing, mainly for fishermen who stay in the sea for more than 24 hours. Most fishermen said to have access to this information before going to the sea. According to Figure 5a, 75% of fishermen seek weather forecasting services and 15% of them have stated to seek it just sometimes. Two fishermen (10%) said to seek this service because they use their own knowledge, which was acquired through practice and observation. In total, 90% of those who use weather forecasting services usually access them at the internet (Figure 5b).

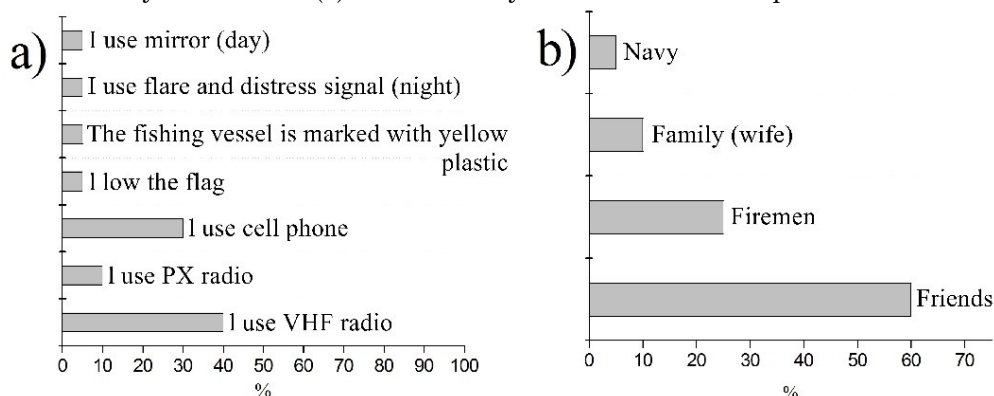
Figure 5 – Percentage of answers (%) to alternatives of questions (a) "Do you seek weather forecasting before you start your activity?" and (b) "If yes, how do you seek this information?". Question "b" could have more than one alternative.



Org.: by the author, 2016.

Half of the fishermen has stated that they would use the Very High Frequency (VHF) radio or the called PX radio in case of an emergency and 30% of them have said that they would use a cell phone to ask for help (Figure 6a). However, 75% said that the fishing vessel "sometimes" has no cell phone signal and 20% said that the cell phone works normally in it. Just 5% of fishermen said they "never" have cell phone signal in the vessel. According to Figure 6a, just some fishermen (5%) would use other communication alternatives to seek help and 70% of them would call friends or relatives and 30% of interviewees would call official organizations (navy or firemen) in case of emergency (Figure 6b).

Figure 6 – Percentage of answers (%) to the questions (a) "In case of an accident at the sea, how would you act?" and (b) "Who would you call to ask for help?".



Org.: by the author, 2016.

Fishermen who would call firemen in emergency situations said that they would do that through numbers 193 or 013 33175101. However, the right number to ask for help is 013 33171516, which is the number of the Marine Fire Brigade Group (GBMAR). In addition, fishermen do not know that GBMAR just attend cases involving victims and that it does not rescue fishing vessel, although Bertioga's GBMAR has inflatable boats and jet skis. According to information provided by the firemen, the boat marina is in charge of rescuing ships at the sea. However, as CPZ23 fishing vessels are allocated in Bertioga's channel buoys and as they do not belong to the marina, fishermen depend on friends to help them in case of emergencies.

Most questions aimed at making fishermen reflect about atmospheric risk factors. However, the answers to the question "What do you think should be done to improve fishing or any other factor impairing your work?" showed that atmospheric risk factors are not a priority to them. Fishermen reported many difficulties about fishery structures such as lack of a pier, water distribution locations, fuel supply locations, ice factory and access ramp for boat maintenance.

Final Considerations

Bertioga shrimp fishermen have low schooling level and most of them has never attended training or further training courses. Many aspects are responsible for the bad work conditions, such as long work shifts, which can lead to emotional distress. In extreme cases, such distress can cause depression or mental disorders, even under good atmospheric conditions. The probability of having diseases and accidents is greater under bad weather and sea conditions. The high vulnerability of fishermen is mainly caused by their habit of prioritizing work to the expense of safety and health.

Fishermen do not have adequate work conditions to avoid diseases and accidents, risks at the sea are always real and they increase under bad weather and sea conditions. Although fishermen are aware of this hazard, in most cases prevention measures are incipient and emergency measures are not enough. Knowledge about the hazardous potential of some atmospheric factors for disease development remains scarce. This is the case of ultraviolet solar radiation which, after long exposure periods, can cause severe health damages.

Some actions must be taken at different scales by different sectors such as the fishing community itself, the public power and the scientific community. The fishing community should better organize its working class,

mainly through CPZ23. The public power should be responsible for improving or developing public policies to protect the artisanal fishing sector. The municipal government should create, enlarge or improve Bertioga's fishing structure, mainly when it comes to safety at the sea. This target could be reached by agreements set among CPZ23, the city hall, the fire department and the marinas in order to implement a rescue system, which would demand many procedures, namely: fishing vessel registration, equipment checklist, fishing training (including rescue simulations) and the access to meteorological information through community radio. Scientific studies must develop technologies focused on collective and individual protection in order to improve all processes involved in fishing safety and in fishermen's health.

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