

The education of fishing workers about accidents caused by marine animals: a study in the Região dos Lagos of Rio de Janeiro

A educação dos trabalhadores da pesca sobre acidentes causados por animais marinhos: um estudo na Região dos Lagos do Rio de Janeiro

La educación de los trabajadores pesqueros sobre accidentes causados por animales marinos: un estudio en la Región dos Lagos de Rio de Janeiro

DOI: 10.55905/ijstvt10n3-053

Originals received: 05/03/2024

Acceptance for publication: 05/31/2024

Rodrigo Siqueira-Batista

Doctor of Sciences

Institutions: Universidade Federal de Viçosa, Faculdade Dinâmica do Vale do Piranga

Address: Av. Peter Henry Rolfs, s/n. Campus Universitário, Viçosa - MG,

CEP: 36570-900

E-mail: rsbatista@ufv.br

Orcid: <https://orcid.org/0000-0002-3661-1570>

Andreia Patrícia Gomes

Doctor of Sciences (Public Health)

Institutions: Universidade Federal de Viçosa and Fundação Oswaldo Cruz

Address: Av. Peter Henry Rolfs, s/n. Campus Universitário, Viçosa - MG,

CEP: 36570-900

E-mail: andreiapgomes@gmail.com

Orcid: <https://orcid.org/0000-0002-5046-6883>

Carolina Henrique da Silva

Medical Student

Institution: Universidade Federal de Viçosa

Address: Av. Peter Henry Rolfs, s/n. Campus Universitário, Viçosa - MG,

CEP: 36570-900

E-mail: carolhenriquesil@gmail.com

Orcid: <https://orcid.org/0000-0003-4698-2719>

Matheus de Moura Novelli

Medical Student

Institution: Universidade Federal de Viçosa

Address: Av. Peter Henry Rolfs, s/n. Campus Universitário, Viçosa - MG,

CEP: 36570-900

E-mail: matheusnovelli.nv@gmail.com

Orcid: <https://orcid.org/0000-0002-8270-0339>

João Pedro Cruz Colombari

Medical Student

Institution: Universidade Federal de Viçosa

Address: Av. Peter Henry Rolfs, s/n. Campus Universitário, Viçosa - MG,
CEP: 36570-900

E-mail: joao.colombari@ufv.br

Orcid: <https://orcid.org/0000-0002-5334-8751>

David Barreto de Aguiar

Doctor in Environmental Engineering (Environmental Sanitation)

Institution: Instituto Federal de Educação, Ciência e Tecnologia do Rio de Janeiro

Address: R. José Pinto de Macedo, S/Nº, Prainha, Arraial do Cabo – RJ,
CEP: 28930-000

E-mail: david.aguiar@ifrj.edu.br

Orcid: <https://orcid.org/0000-0003-1233-0253>

Margarete Pereira Friedrich

Doctor in Sciences (Education, Dissemination and Management in Biosciences)

Institution: Instituto Federal de Educação, Ciência e Tecnologia do Rio de Janeiro

Address: R. José Pinto de Macedo, S/Nº, Prainha, Arraial do Cabo – RJ,
CEP: 28930-000

E-mail: margarete.friedrich@ifrj.edu.br

Orcid: <https://orcid.org/0009-0002-2513-0736>

Tiago Ricardo Moreira

Doctor in Public Health

Institution: Universidade Federal de Viçosa

Address: Av. Peter Henry Rolfs, s/n. Campus Universitário, Viçosa - MG,
CEP: 36570-900

E-mail: tiago.ricardo@ufv.br

Orcid: <https://orcid.org/0000-0002-6606-4942>

Renato Neves Feio

Doctor in Zoology

Institution: Universidade Federal de Viçosa

Address: Vila Gianetti, 32, Campus da Universidade Federal de Viçosa, Centro,
Viçosa - MG, CEP: 36570-000

E-mail: rfeio@ufv.br

Orcid: <https://orcid.org/0000-0002-3607-2896>

Salvatore Siciliano

Doctor in Biological Sciences (Zoology)

Institution: Fundação Oswaldo Cruz

Address: Rua Leopoldo Bulhões, 1.480, Manguinhos, Rio de Janeiro – RJ,

CEP: 21040-900

E-mail: gemmlagos@gmail.com

Orcid: <https://orcid.org/0000-0002-0124-8070>

ABSTRACT

Fishing exposes workers to various occupational risks, including accidents caused by poisonous, venomous and traumatizing marine animals. With this in mind, the aim of this study is to present educational activities for people working in the fishing activities in the Região dos Lagos (Lakes Region) of Rio de Janeiro, southeastern Brazil, with a focus on accidents caused by marine animals (ACMA). The protocol was approved by the Human Research Ethics Committee of the Universidade Federal de Viçosa (CAAE: 53959421.8.0000.5153). The activities were carried out in the municipalities of Armação dos Búzios, Arraial do Cabo and Cabo Frio and included a workshop on the subject, lasting an average of four hours, preceded (pre-test) and followed (post-test) by an assessment consisting of objective questions on the ACMA. A total of 47 workers (with an average working time of 15.2 ± 12.8 years) took part in the activity. Each professional suffered an average of three ACMA. A comparison of the pre-test and post-test results showed a higher percentage of correct answers to almost all the questions. Further studies are needed to estimate the risks of ACMA among fishing workers and to improve educational actions to minimize the impact of these injuries on this population.

Keywords: accidents, marine fauna, health education, hunting (fishing).

RESUMO

A pesca expõe os trabalhadores a vários riscos ocupacionais, incluindo acidentes causados por animais marinhos venenosos, peçonhentos e traumatizantes. Com isso em mente, o objetivo deste estudo é apresentar atividades educativas para pessoas que trabalham na atividade pesqueira na Região dos Lagos do Rio de Janeiro, sudeste do Brasil, com foco nos acidentes causados por animais marinhos (ACMA). O protocolo foi aprovado pelo Comitê de Ética em Pesquisa em Seres Humanos da Universidade Federal de Viçosa (CAAE: 53959421.8.0000.5153). As atividades foram realizadas nos municípios de Armação dos Búzios, Arraial do Cabo e Cabo Frio e incluíram uma oficina sobre o tema, com duração média de quatro horas, precedida (pré-teste) e seguida (pós-teste) de uma avaliação composta por questões objetivas sobre a ACMA. Um total de 47 trabalhadores (com tempo médio de trabalho de $15,2 \pm 12,8$ anos) participou da atividade. Cada profissional sofreu uma média de três ACMA. Uma comparação entre os resultados do pré-teste e do pós-teste mostrou uma porcentagem maior de respostas corretas para quase todas as perguntas. São necessários mais estudos para estimar os riscos de ACMA entre os trabalhadores da pesca e melhorar as ações educativas para minimizar o impacto dessas lesões nessa população.

Palavras-chave: accidents, educação em saúde, fauna marinha, pesca.

RESUMEN

La pesca expone a los trabajadores a diversos riesgos ocupacionales, incluyendo accidentes causados por animales marinos venenosos, ponzoñosos y traumatizantes. Teniendo esto en cuenta, el objetivo de este estudio es presentar actividades educativas para las personas que trabajan en las actividades pesqueras en la Região dos Lagos (Región de los Lagos) de Río de Janeiro, sureste de Brasil, con un enfoque en los accidentes causados por animales marinos (ACMA). El protocolo fue aprobado por el Comité de Ética en Investigación Humana de la Universidad Federal de Viçosa (CAAE: 53959421.8.0000.5153). Las actividades se llevaron a cabo en los municipios de Armação dos Búzios, Arraial do Cabo y Cabo Frio e incluyeron un taller sobre el tema, con una duración media de cuatro horas, precedido (pretest) y seguido (postest) de una evaluación consistente en preguntas objetivas sobre el ACMA. Participaron en la actividad 47 trabajadores (con un tiempo medio de trabajo de $15,2 \pm 12,8$ años). Cada profesional sufrió una media de tres ACMA. La comparación de los resultados de la preprueba y la posprueba mostró un mayor porcentaje de respuestas correctas a casi todas las preguntas. Son necesarios más estudios para estimar los riesgos de ACMA entre los trabajadores de la pesca y mejorar las acciones educativas para minimizar el impacto de estas lesiones en esta población.

Palabras clave: accidentes, educación en salud, fauna marina, pesca.

1 INTRODUCTION

Accidents caused by marine animals (ACMA) represent an important clinical and public health issue in Brazil, due to the country's vast coastline and the work and recreational activities linked to these environments. These events can involve venomous, poisonous or traumatizing animals, resulting in significant consequences for different groups of people, especially fishing workers (Conceição, 2021). Understanding the nature of these accidents and identifying the main animals involved are fundamental to assessing their true impact on different populations and to implementing effective prevention measures (Brasil, 2001; Haddad Jr., 2016; Siqueira-Batista *et al.*, 2020).

In the marine environment, several animals are known to cause accidents to fishing workers. Among the most common are jellyfish, sea urchins, stingrays and a wide variety of fish (Siqueira-Batista *et al.*, 2007; Reckziegel, 2015; Lopes *et al.*, 2023). Each animal has different mechanisms for causing injury to humans, ranging from the inoculation of venoms to bites and stings that can cause serious injuries. Because of this,

accidents involving marine animals are divided into three types: (I) venomous, (II) poisonous and (III) traumatic (Jared *et al.*, 2021). Accidents considered venomous are those in which the animal injects the venom into the victim through an inoculating device, such as spines or stings, as in the case of stingrays, sea catfish and sea urchins. Poisonous animals, on the other hand, are those that, once ingested, cause the accident because they have toxins present in their skin, viscera or gonads, as is the case with pufferfish or ciguatera accidents. Lastly, traumatic accidents are caused by teeth, claws or aculei, unrelated to venom glands or venom, such as “piranha” or shark bites (Brasil, 2001; Jared *et al.*, 2021).

With an extensive coastline and great marine biodiversity, Brazil has a range of aquatic species that have been coming into closer contact with humans every day. As more of the ocean environment is explored and transformed, there is an increased risk of accidents, mainly related to those individuals with recurring practices in the environment. Cases of accidents with aquatic animals are largely unreported and publications on this issue are scanty (e.g., Cavalcante *et al.*, 2020). Artisanal fishermen, in particular, are active throughout most of the country and account for a large part of the country's fish supply (Abreu *et al.*, 2022). These workers are more susceptible to accidents when handling animals (Conceição, *et al.*, 2021; Garrone Neto; Haddad Jr., 2010). Although a large percentage of specimens are not aggressive, lack of knowledge regarding handling causes them to use their stingers, spikes or teeth as a means of defense, causing injuries of considerable morbidity (Haddad Jr., 2000; Garrone Neto *et al.*, 2005; Haddad Jr.; Barreiros, 2015).

The implementation of educational actions aimed at preventing ACMAs goes beyond the mere dissemination of information, requiring the training of professionals in order to guide them on how to act in everyday situations, in which proper management is of paramount importance in order to avoid the persistence of late morbid events such as pain and infection. Participatory teaching-learning activities – with talks and workshops – combined with the provision of information material and participation in the media, are measures that can be a starting point for minimizing the risks routinely experienced by this group, contributing to a reduction in morbidity (Haddad Jr. *et al.*, 2013).

In view of the above, the aim of this manuscript is to present the results of an investigation into the knowledge of fishermen working in the Região dos Lagos of Rio de Janeiro, southeastern Brazil, in the municipalities of Armação dos Búzios, Arraial do Cabo and Cabo Frio, about ACMA. The description of these workers' knowledge of the risks and preventive measures related to accidents caused by marine animals is highlighted. This paper also reports on the implementation of specific educational measures, using the frameworks of popular health education and environmental education, aimed at workers dedicated to activities linked to the sea, especially fishermen.

2 METHODS

2.1 ETHICAL ASPECTS

The research project that gave rise to this article involves human beings and, therefore, was prepared in accordance with Resolution 466/2012 of the National Health Council, which promulgates guidelines and standards regulating research involving human beings. Thus, the protocol was validated and approved by the Human Research Ethics Committee of the Universidade Federal de Viçosa (CAAE: 53959421.8.0000.5153). To carry out the investigation, the study participants were asked to sign the Free and Informed Consent Form, which highlights the risks and benefits of the research, in addition to guaranteeing the secrecy, confidentiality and privacy of the data collected and the dissemination of results only in scientifically recognized publications.

2.2 TYPE OF STUDY

This is an uncontrolled intervention study, known as a “*before and after*” study, as described by Medronho (2006). In this type of investigation, all research participants are subjected to the same intervention, and their conditions are assessed before the start and at different times after the treatment. This approach has been widely used in medical

research to evaluate the effectiveness and effects of therapeutic interventions, but it also has its effect on the evaluation of educational interventions.

It is important to note that, in this type of study, there is no control group with which to compare the results. Instead, the participants act as their own controls, since their condition is assessed before and after the intervention. This type of study can be especially useful when there are ethical or practical limitations to applying a randomized controlled trial.

2.3 LOCATION

The Região dos Lagos is located on the coast of the state of Rio de Janeiro and is made up of nine municipalities, which together total more than 658,000 inhabitants, with a population density of 193 inhabitants/km². In the region, the sector with the largest share of Gross Value Added (GVA) is industry, accounting for 52.4% of revenue (Sebrae, 2016). However, fishing and summer tourism contribute substantially to economic growth, since the presence of beautiful beaches, hypersaline lagoons and a favorable climate, practically every day of the year, favor these activities (Toledo, 2003; Motta, 2011).

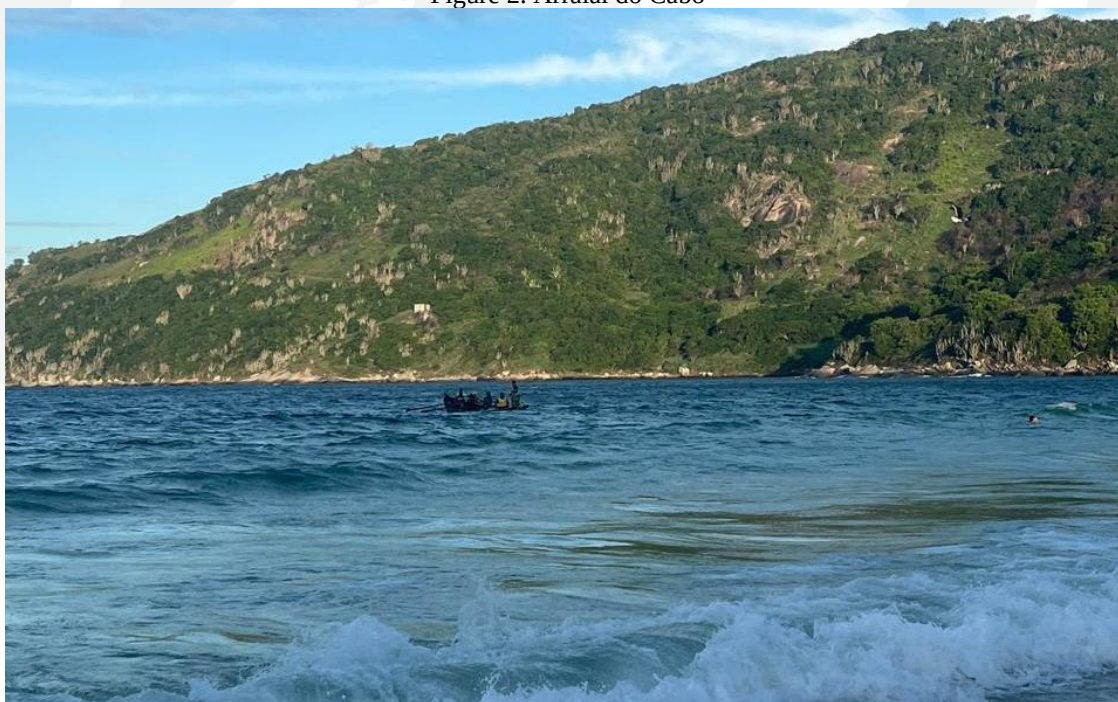
Due to the tourist aspect, the region offers many activities in the midst of nature, such as hiking, beach trails and water sports, which increases exposure and the risk of ACMAs. Therefore, in order to focus on the most representative cities, three municipalities in the region were selected, based on their size and tourism potential (Toledo, 2003; Cheung, 2017): Armação dos Búzios, Arraial do Cabo and Cabo Frio (Figures 1, 2 and 3).

Figure 1. Armação dos Búzios.



Source: Beatriz Gomes Batista.

Figure 2. Arraial do Cabo



Source: Beatriz Gomes Batista.

Figure 3. Cabo Frio.



Source: Andréia Patrícia Gomes.

Armação dos Búzios is one of the most popular destinations for tourists from all over the world and is considered the most sophisticated city in the region. The municipality has the highest GDP (Gross Domestic Product) per capita and the 6th highest in the state ranking (Sebrae, 2016). In terms of health, it has eight Family Health Programs (PSF) and two municipal hospitals, with only the Rodolpho Perissé Municipal Hospital responsible for emergency care (Armação dos Búzios, 2021).

Arraial do Cabo has natural resources with a strong visual appeal and cultural attractions, and is a popular destination for scuba diving. In terms of health, in 2016 it had

nine accredited Family Health Teams (CSMSRJ, 2016) and the Arraial do Cabo General Hospital, which is responsible for emergency care (Arraial do Cabo, 2021).

Cabo Frio is the most populous municipality in the region, with more than 200,000 inhabitants and the highest population density (508 inhabitants/km²). It has the highest GDP in this area of the state, accounting for more than half (54%) of the GDP of the Região dos Lagos (Sebrae, 2016). According to the Cabo Frio City Hall website, the city has 32 Family Health Strategy (ESF) units and, focusing on the ACMA, it has an Emergency Hospital and two Emergency Care Units (UPA), likely places that meet the demand for these incidents (Cabo Frio, 2021).

2.4 STUDY WITH FISHING PROFESSIONALS

The professionals taking part in the workshop included seafaring workers involved in fishing activities. The process of continuing education for professionals in the fishing – the *educational workshop for workers involved in activities related to the sea* (Table 1) – was taught in three stages, offered to up to 20 people at a time, in a face-to-face format.

Before the workshop, an anonymous questionnaire, *Pre-test II*, with objective questions, was used as a collection tool to characterize the fishermen's prior knowledge of the external characteristics of the main marine animals involved in accidents – usually fish, which cause injuries to this population – and how to behave after accidents.

After analyzing the quiz and defining the content that should be covered in the continuing education process, the *workshop* was scheduled. During the first 60 minutes, a talk was given, in which the most important content was briefly presented in order to characterize the marine animals that cause accidents in the Lake District. In the second 90 minute session, a space was established for sharing experiences – aimed at conversations, discussions and resolving doubts in small groups, with didactic material made available in the logic of continuing education – regarding the experiences of the workers, the ways to proceed in cases of ACMA, with regard to proper instruction in dealing with each type of injury. In this educational workshop, meaningful learning was considered, which aims to integrate new content, aiming to expand and improve what is

known (Vidal *et al*, 2014), allowing professionals to establish a correlation between the strategies presented and everyday situations. In the third and final moment, a questionnaire, *Post-test II*, and a *workshop* evaluation tool were made available at the end for participants to fill in.

Table 1. Educational workshop for maritime workers

Duration	Contents	Methodology
20 minutes	Characterization of fishermen's prior knowledge	<i>Pre-test</i> , with objective questions
1st training session		
60 minutes	General characteristics of the main marine animals that cause accidents in the Lake District	Dialogued presentation
15 minutes	Coffee break	
2nd training session		
90 minutes	Injury patterns and first aid for ACMA victims	Conversation round
15 minutes	Coffee break	
3rd training session		
15 minutes	Evaluation of knowledge construction	<i>Post-test</i> , with open and closed questions
15 minutes	Workshop evaluation	Questionnaire with objective questions
10 minutes	Closing	

Source: Research data.

In order to perpetuate the knowledge acquired in this workshop, thus contributing to continuing education on the subject, an educational material (booklet) was prepared for fishermen, aimed at preventing ACMA, which was given to all those present after the workshop.

2.5 DATA ANALYSIS

A database was created in the EpiInfo program version 7.2, while the statistical analysis was processed in the SPSS program version 23.0 for Windows (Version 23.0; SPSS Inc, Chicago, III). The initial descriptive analysis used mean, median, standard deviation and interquartile range for numerical variables and absolute and relative frequency for categorical variables. McNemar's test was used to compare the answers to the questionnaire before and after the test, with a significance level of 5%.

The assessment of the qualitative data was based on the method of content analysis, understood as “*a set of techniques for analyzing communications in order to obtain, through systematic and objective procedures for describing the content of*

messages, indicators (quantitative or not) that allow the inference of knowledge regarding the conditions of production/reception (inferred variables) of these messages” (Bardin, 2011, p. 47). The answers given in the questionnaires by the research subjects were categorized based on the initial “floating Reading” (pre-analysis), exploration of the material, treatment of the results obtained and interpretation (Gomes, 2003). Categories refer to the grouping of “*elements, ideas or expressions around a concept capable of encompassing it all*” (Gomes, 2003, p.70).

3 RESULTS

A total of 47 professionals took part in the activity, including fishermen, shellfish gatherers and marine guards. Of the participants, 11 were present in the municipality of Armação dos Búzios for the workshop, 28 tests in the municipality of Arraial do Cabo and 08 in Cabo Frio. Of the total number of participants, 10 were female and 37 were male.

With regard to the numerical variables analyzed in the study, the average age of the workshop members was 39.4 ± 13.3 years. In terms of time in the profession and total time in their current job, the average was 15.2 ± 12.8 years and 12.4 ± 12.8 years, respectively. In addition, an average of 03 (three) ACMA (wounds or injuries caused by a marine animal) per professional participating in the workshops was reported, highlighting the importance of the activity carried out and the potential positive impact of the workshops on the participants' work (Table 2).

Among the sociodemographic characteristics and those related to accidents with marine animals, there was evidence of a level of education more concentrated in complete secondary education, with no participants with a level of education higher than specialization (Table 2). Among those who had completed higher education or specialization courses, Physical Education, Tourism, Accounting and Psychology were reported, as well as technical courses in the Environment and Radiology. As a source of income, most of the interviewees said that they practiced other paid activities alongside fishing in order to increase their family income.

As well as general data on the interviewees, qualitative information was collected on their experiences involving ACMA. Regarding their experience of being injured by an animal, 29 of the 47 interviewees said they had been victims. Of these, only 4 had to seek medical help to treat the injury. At the same time, only 17 interviewees reported using PPE (personal protective equipment) while fishing, with only gloves (11.1%), boots (7%) and goggles (2.2%) listed as protection. None of the interviewees reported using helmets as PPE in their work activities, and 02 interviewees reported using sun protection clothing. Only 5 respondents had to stop working after being victims of accidents (Table 2).

The most frequently reported type of injury was burns from “live water”, with 15 interviewers reporting this type of accident, which involved redness and local pain. The second most frequently reported type of accident was punctures by sea urchin spines, 11 times, followed by stingray stings and non-specific cuts – 3 episodes each – and accidents involving fish (catfish), snails and oysters – 2 episodes each.

In addition, in the management of the injury, 6 participants who reported jellyfish accidents (burns) used vinegar as a treatment measure, while the rest reported that they waited for the pain to pass without therapeutic aid (3 participants). Others reported using running water (2 participants), saline (1 participant), painkillers (1 participant) and hydrogen peroxide (1 participant) as support measures. In addition, for the other types of accidents, 6 participants reported removing the spicule/thorn on their own in the case of piercing accidents. Another 7 interviewees reported using non-specific home treatments. One participant used running water to improve the pain and another reported using lemon and alcohol to remove sea urchin spines. Five workers interviewed did not use any therapeutic procedures.

With regard to participation in the workshop – particularly the pre- and post-tests – of the 47 participants, 42 answered the pre-test questions and 44 answered the post-test questions on ACMA. Table 3 shows the results for the three municipalities where the training workshops were held.

Table 2. General data on the categorical variables of the population participating in the workshops in the selected municipalities in the state of Rio de Janeiro, from March to December 2022.

Variables	N	%
Municipality		
Armação dos Búzios	11	23,4
Arraial do Cabo	28	59,6
Cabo Frio	8	17
Sex		
Male	37	78,7%
Female	10	21,3%
Non-binary	0	0
Age - mean (SD)	39,4 (13,3)	
Time in the profession (in years) - mean (SD)	15,2 (12,8)	
Total time in current job (in years) - mean (SD)	12,4(12,8)	
How many accidents - mean (SD)	3,1(2,0)	
Level of education		
Elementary school incomplete	11	23,4%
Completed elementary school	2	4,3%
High school incomplete	7	14,9%
High school completed	18	38,3%
Higher education incomplete	5	10,6%
Complete university degree	2	4,3%
Specialization	2	4,3%
Source of income		
Artisanal fishing is the only source of income	7	14,9%
Practice other paid activities	24	51,1%
No answer	16	33,6%
Have you ever been the victim of an accident involving marine animals?		
Yes	29	61,7%

No	16	34%
No answer	2	4,3%
The accident required medical attention		
Yes	4	8,5%
No	16	34%
No answer	27	57,5%
Uses PPE in work activities		
Yes	17	36,1%
No	20	42,6%
No answer	10	21,3%
He had to stop working because of the accidentes		
Yes	5	10,6%
No	31	66%
No answer	11	23,4%

Source: research data.

The percentage of correct answers in the pre-test and post-test on general knowledge about ACMA can be seen, as well as the p-value. There was a significant increase in the percentage of correct answers to questions 1, 2, 4 and 5. With regard to question 3, there was a significant drop in the percentage of correct answers.

At the end, participants were asked to evaluate the workshop. The fishermen expressed a positive assessment of the workshop. With regard to the organization of the event, the majority of participants considered it to be well planned and efficient, providing an environment conducive to learning. As for the subjects covered during the workshop, the fishermen praised the variety and relevance of the information shared, highlighting the importance of first aid techniques and understanding the behavior of marine animals.

Table 3. Percentage of correct answers in the pre- and post-test on Accidents Caused by Marine Animals according to the question applied.

Questions	Percentage of correct answers in the pre-test	Percentage of correct answers in the post-test	p-value (*)
One working day, while using your fishing net, you feel a sharp pain in your arm. When you look, you see that there is a wound caused by a catfish sting. What do you do?	7,9%	92,1%	<0,001
On the same day, his coworker begins to feel intense pain in his leg after coming into contact with a jellyfish. The area starts to turn red and some blisters begin to appear. What should you do to help him?	40%	85%	<0,001
Happy with your help, your friend tells of a time when he had a cut that bled a lot, caused by a stingray accident, and when he arrived at the hospital for treatment, the doctors congratulated him on taking good care of the wound. How do you think your friend took care of this wound before arriving at the hospital?	78,6%	40%	0,001
Another accident! At the end of the working day, as you were leaving the sea, you unfortunately stepped on a hedgehog. The thorn got stuck in your foot. What should you NOT do in this case?	26,2%	98,4%	0,001
Even after a day with several accidents, you return home satisfied, full of fish. When you get home, you turn on the television to rest and hear the following sentence from a journalist: "Soaking a fish wound in hot water is a useful measure for any accident and should be the first attempt at pain control". Do you agree with this sentence? If so, what other measures should be taken? If not, what's wrong with it?	22,7%	70,7%	<0,001

Source: Research Data.

Furthermore, among the activities carried out, the talk show was the most appreciated, followed by the round table discussion, which allowed participants to exchange experiences. Regarding the questions on the pre- and post-test, there was a mixed response, indicating that some questions could have been clearer. In addition, the fishermen expressed optimism about the relevance of the workshop to their work, believing that the skills acquired would be valuable in their daily activities. Finally, with regard to suggestions for improvement, some participants suggested greater interactivity during the activities, such as practical simulations of emergency situations.

4 DISCUSSION

Artisanal fishing involves traditional populations in situations of vulnerability, both in Brazil and around the world. In Brazil, there are around one million artisanal fishermen, representing approximately one in every 200 Brazilians (Rêgo, 2018). Globally, it is estimated that there are around 56 million people working in small-scale fisheries, with women accounting for almost half. Artisanal fishing plays a crucial role in coastal communities, sustaining livelihoods and promoting the preservation of natural marine resources (Brasil, 2017).

ACMA among seafarers is a significant concern due to frequent exposure to potentially dangerous marine species. These accidents can occur in a variety of ways, including stings, bites, cuts and wounds caused by the thorns, fins or stings of marine animals. In particular, for the municipalities selected in the study, burns by jellyfish, accidents by sea urchins and contact with venomous fish stand out in the context of this type of accident.

In a study carried out in 2015, Freitas and Rodrigues (2015) highlighted the working conditions faced by fishermen in the Sepetiba-RJ Bay region. A total of 109 questionnaires were collected, in which 85.0% of the interviewees reported having already suffered some kind of accident, and in this group, the highest occurrences were linked to ACMA (74.0%), showing results similar to those found by Garrone Neto and Haddad Jr. (2005), regarding the causal factor.

The proper use of Personal Protective Equipment (PPE) by fishermen plays a key role in preventing ACMA. PPE – such as gloves, boots and goggles – is designed to minimize the risk of injury and provide a layer of safety during fishing activities. The use of this equipment can significantly reduce the occurrence of injuries caused by marine animals and minimize the negative consequences for fishermen's health. The study in question confirms that only 17 of the 47 participants in the training course use this equipment in their work activities, highlighting the need to expand the educational processes aimed at these professionals, with a view to preventing ACMA.

The lack of quality information is currently one of the main predisposing factors for the occurrence of injuries involving marine animals. In a study with a community of

140 fishermen, Edilson *et al.* (2015) found that 90% of the sample had no knowledge of preventive measures that could be adopted to avoid accidents. Adequate access to information and the conscientious use of PPE are effective methods for preventing further injuries. With regard to PPE in particular, these authors have shown that even among the workers who use it, none have been trained with guidance, and use it intuitively (Edilson *et al.*, 2015).

Continuing education for fishermen plays a crucial role in promoting safety and improving practices related to ACMAs. In addition to providing training and capacity building, it is essential to encourage the sharing of experiences between workers. By sharing their experiences and learning, fishermen can benefit from each other's experiences, acquiring practical knowledge and effective strategies for preventing accidents and dealing with risky situations.

It is common to come across popular beliefs relating to the treatment of ACMA. These traditional beliefs may involve the use of homemade methods to relieve symptoms and treat injuries. Some fishermen in this study reported using substances such as lemon, alcohol and even serum as support measures to treat burns from jellyfish, injuries from sea urchin spines and other accidents. It should be noted that a large contingent of fishing workers, when they have an accident, do not go to the health service, using "home techniques" as treatment, being at high risk of infectious progression and eventually the emergence of tetanus (Edilson *et al.*, 2015; Garrone Neto *et al.*, 2005; Reckziegel *et al.*, 2015).

Even against this backdrop, it was revealed that some fishermen routinely take proper care of specific injuries. One example is the use of vinegar by many of the workshop participants for skin rashes caused by jellyfish, caravels, corals and anemones, which is well described in the literature, recommending washing the area and applying compresses with cold seawater and vinegar. In the case of puncture wounds caused by catfish, scorpionfish, frogfish and sea urchins, it was noted that the interviewees treat most of the wounds at home, removing the spicule, which sometimes penetrates the skin. In this case, the literature recommends immersing the area in hot water for 30 to 90 minutes and seeking medical help to assess the lesions.

Tetanus vaccination plays a key role in the prevention and treatment of ACMA. These accidents can involve injuries that pose a significant risk of infection by anaerobic bacteria, such as *Clostridium tetani*, responsible for tetanus. Regular vaccination for tetanus ensures adequate immune protection, avoiding serious complications from this infection (Brasil, 2023; Novelli, 2022). Therefore, it is essential that fishermen are properly immunized, reinforcing the importance of raising awareness about vaccination and its periodic updating, a role played by the team of researchers during the workshop.

In this same context, we need to reflect on the significant challenges that holding workshops with fishermen can present, due to the low level of education found in this group. Many fishermen have limited access to formal education, which can result in difficulties in understanding complex concepts and assimilating new information during the workshops. The high drop-out rate from the workshops was an additional challenge to be faced. Often, even when fishermen attended initially, it was common for some of them to abandon the process before it was over, failing to fill in the questionnaires proposed. This could be attributed to a lack of motivation, logistical difficulties or disbelief in the relevance of the workshops to their daily activities.

However, it is possible to overcome these challenges with the right strategies. It was possible to see the importance of establishing clear and effective communication, involving community leaders and local representatives to work out the importance and objectives of the workshops. A positive example can be seen in the municipality of Arraial do Cabo, where direct contact with the representative of the fishermen's colony was fundamental in mobilizing a large number of participants, representing 59.6% of the public attending the workshops. This successful partnership demonstrates the importance of establishing links and understanding the specific needs of fishermen, contributing to greater awareness and engagement in participating in the workshops.

Finally, the analysis of the results found in the questionnaires reveals the percentages of correct answers in the pre-test and post-test. This data provides a measure of how the participants' knowledge evolved after taking part in the workshop. In addition, the p-value associated with the results is presented, indicating the statistical significance of the differences found between the tests. The p-value calculated was less than 0.001,

which is well below our established significance level of 0.05. This indicates that the probability of obtaining a result equal to or more extreme than that observed – assuming the null hypothesis is true – is extremely low.

The fishermen praised the workshop on marine animal accidents, highlighting the efficient organization and the relevance of the topics covered. The dialogued presentation was particularly valued, providing an in-depth understanding of first aid procedures and the behavior of marine animals. In summary, the workshop was considered a valuable educational experience, making a significant impact on fishermen's safety and knowledge of accidents involving marine animals.

Based on these results, we can reject the null hypothesis and conclude that there is a statistically significant relationship between the variables under study. It therefore indicates a positive effect of the training workshop, since it was possible to prove that the participants got a higher percentage of questions right in relation to their knowledge of ACMAs, at least as long as it remains in their working memory. The challenge remains to consolidate the information and move from theory to practice in everyday life.

5 LIMITATIONS OF THE STUDY

As this was an uncontrolled intervention study, there was no control work, which, according to Medronho (2006), means that there is the possibility of the final result being improved *“for purely statistical reasons, of regression of the values to the mean, without necessarily representing a true effect of the intervention on that individual. In other words, in an uncontrolled study it can be difficult to implicate the observed effects in the treatment”* (Medronho, 2006, p. 79).

In fact, the lack of a control group makes it difficult to distinguish between the effects of the intervention itself and the effects of other factors that may be influencing the results. In addition, the lack of randomization can lead to selection bias and confounding, which can affect the validity of the results.

6 FINAL CONSIDERATIONS

Based on the results obtained, it is important to discuss the effectiveness of the workshop in improving the participants' knowledge of ACMA. The significant increase in the percentage of correct answers in the post-test compared to the pre-test showed that the workshop was effective in building relevant knowledge and improving participants' understanding of the risks and prevention measures related to ACMA.

However, it is important to bear in mind that statistical analysis and interpretation of the results cannot be based on the p-value alone. Other factors, such as the size of the sample, the characteristics of the participants and the quality of the tests used, must also be taken into account.

In view of this, the study met its central objective, which was to update relevant information on ACMA, with a view to preventing these incidents and promoting safe and conscientious action by maritime workers. However, it is important to mention that the construction of knowledge is a complex and continuous process and that multiple visits to certain knowledge can strengthen learning, helping it to materialize into cognitive, psychomotor and attitudinal skills, enabling the resolution of increasingly complex and new situations that arise in the daily lives of those who work at/with the sea.

ACKNOWLEDGEMENTS

The authors are grateful to Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq), Faculdade Dinâmica do Vale do Piranga (FADIP) and Universidade Federal de Viçosa (UFV) for their financial support for the project, and to the municipality of Armação dos Búzios, Arraial do Cabo and Cabo Frio for operational support to the workshops.

REFERENCES

- ABREU, J. S. *et al.* Marine artificial reef (MAR) interference in artisanal fisheries in Brazil: use of traditional knowledge. **Boletim do Instituto da Pesca**, v. 48, p. 661, 2022. Available at: <<https://doi.org/10.20950/1678-2305/bip.2022.48.e661>>. Accessed on: Sep 15, 2023.
- ARMAÇÃO DE BÚZIOS. SECRETARIA DE SAÚDE (SS). Prefeitura Municipal de Armação de Búzios – RJ. **Saúde Pública**. Available at: <https://old.buzios.rj.gov.br/informacoes_gerais_unidades_saude>. Accessed on: March 28, 2021.
- ARRAIAL DO CABO. Conselho de Secretarias Municipais de Saúde do Rio de Janeiro (COSEMS RJ). **Caderno de apoio à gestão municipal da saúde Arraial do Cabo - Região: Baixada Litorânea**. Rio de Janeiro, dezembro, 2016. Available at: <<http://www.cosemsrj.org.br/notas-tecnicas/>>. Accessed on: March 31, 2021.
- BARDIN, L. **Análise de conteúdo**. São Paulo: Edições 70, 2011.
- BRASIL. Ministério da Saúde. **Manual de diagnóstico e tratamento de acidentes por animais peçonhentos**. Brasília: Funasa; 2001.
- BRASIL. Ministério da Saúde. **A saúde das pescadoras artesanais: atividades pesqueiras: rios, lagos e lagoas. Secretaria de Gestão Estratégica e Participativa**. Departamento de Apoio à Gestão Participativa e Controle Social (DAGEP/SGEP/MS). Editora MS/Coordenação-Geral de Documentação e Informação, 2017. Available at: <https://bvsms.saude.gov.br/bvs/publicacoes/saude_pescadoras_artesanais.pdf>. Accessed on: April 30, 2022.
- BRASIL. Ministério da Saúde. Secretaria de Vigilância em Saúde. Departamento de Articulação Estratégica de Vigilância em Saúde. **Guia de Vigilância em Saúde [recurso eletrônico]** / Ministério da Saúde, Secretaria de Vigilância em Saúde. Departamento de Articulação Estratégica de Vigilância em Saúde. – 6. ed. rev. e atual. – Brasília: Ministério da Saúde, 2023. Available at: <<https://www.gov.br/saude/pt-br/centrais-de-conteudo/publicacoes/svsa/vigilancia/guia-de-vigilancia-em-saude-volume-3-6a-edicao/view>>. Accessed on: January 31, 2024.
- CABO FRIO. SECRETARIA DE SAÚDE (SS). PREFEITURA MUNICIPAL DE CABO FRIO – RJ. **Unidades de Saúde**. Available at: <<https://saude.cabofrio.rj.gov.br/unidadesaude.php>>. Accessed on: March 31, 2021.
- CAVALCANTE, M. M. S. *et al.* Health-risk assessment of Portuguese man-of-war (*Physalia physalis*) envenomations on urban beaches in São Luís city, in the state of Maranhão, Brazil. **Revista da Sociedade Brasileira de Medicina Tropical**, v. 53, p. 20200216, 2020. Available at: <https://www.researchgate.net/publication/344399536_Revista_da_Sociedade_Brasileir>.

a_de_Medicina_Tropical_Health-risk_assessment_of_Portuguese_man-of-war_Physalia_physalis_envenomations_on_urban_beaches_in_Sao_Luis_city_in_the_state_of_Maranhao_Brazil>. Accessed on: July 31, 2022.

CHEUNG, R. *et al.* Accidents by venomous animals in the lakes region, Rio de Janeiro, Brazil. **Journal Health NPEPS**, v. 2, n. 1, p. 73-87, 2017. Available at: <<https://docs.bvsalud.org/biblioref/2020/03/1052502/1775-6186-3-pb.pdf>>. Accessed on: April 30, 2022.

CONCEIÇÃO, L. C. A. *et al.* Artisanal fishing and fishermen's health problems in the municipality of Curuçá, state of Pará, Brazil. **Revista SUSTINERE**, v. 9, n. 1, p. 103-117, 2021. Available at: <https://www.researchgate.net/publication/350405234_A_pesca_artesanal_e_os_agravs_a_saude_do_pescador_no_municipio_de_Curuca_estado_do_Para_Brasil>. Accessed on: September 30, 2023.

EDILSON, A. D. *et al.* Evaluation on access to information on the prevention of accidents by aquatic animals collected by fishermen of Bacia do Alto Paraguai, Mato Grosso do Sul. **Unopar Científica Ciências Humanas e da Educação**. v. 16, n. 5, p. 460-465, 2015. Available at: <https://www.researchgate.net/publication/303531459_Avaliacao_do_Acesso_a_Informacoes_sobre_a_Prevencao_de_Acidentes_por_Animais_Aquaticos_Coletados_por_Pescadores_da_Bacia_do_Alto_Paraguai_Mato_Grosso_do_Sul>. Accessed on: March 31, 2021.

FREITAS, M. B. *et al.* Social determinants of health in the work process of artisanal fishing in Sepetiba Bay, state of Rio de Janeiro. **Saúde e Sociedade**, v. 24, n. 3, p. 753-764, 2015. Available at: <<https://www.revistas.usp.br/sausoc/article/view/104873>>. Accessed on: August 31, 2021.

GARRONE-NETO, D. *et al.* Occupational accidents among artisanal fishermen in the Middle Araguaia River region, Tocantins, Brazil. **Cadernos de Saúde Pública**, v. 21, p. 795-803, 2005. Available at: <<https://pubmed.ncbi.nlm.nih.gov/15868037/>>. Accessed on: February 15, 2021.

GARRONE-NETO, D. *et al.* Stingrays in rivers of the Southeast region of Brazil: places of occurrence and impacts on the population. **Revista da Sociedade Brasileira de Medicina Tropical**, v. 43, n. 1, p. 82-88, 2010. Available at: <<https://pubmed.ncbi.nlm.nih.gov/20305975/>>. Accessed on: March 31, 2021.

GOMES, R. **A análise de dados em pesquisa qualitativa. Pesquisa social: teoria, método e criatividade**. Vozes, v. 22, p. 67-80, 2003 Available at: <<https://acervo.enap.gov.br/cgi-bin/koha/opac-detail.pl?biblionumber=15533>>. Accessed on: October 31, 2022.

HADDAD JR, V. *et al.* Injuries by marine and freshwater stingrays: history, clinical aspects of the envenomations and current status of a neglected problem in Brazil. **Journal of Venomous Animals and Toxins including Tropical Diseases**, v. 19, p. 1-11, 2013. Available at: <https://www.scielo.br/j/jvatitd/a/KRTGvmrq8xzm8q8M56fyfLm/?lang=en>. Accessed on: March 31, 2021.

HADDAD JR, V. **Medical emergencies caused by aquatic animals**. Springer Nature. Switzerland: Springer International Publishing, 2016.

HADDAD JR, V.; BARREIROS, J. P. Animais aquáticos venenosos e perigosos da Europa com ênfase em Portugal Continental e Ilhas. **Atlântida. Revista de Cultura**, v. 60, p. 1-10, 2015. Available at: <https://repositorio.uac.pt/handle/10400.3/4139>. Accessed on: June 30, 2022.

JARED, C. *et al.* Differences between poison and venom: An attempt at an integrative biological approach. **Acta Zoologica**, v. 102, n. 1, p. 337-350, 2021. Available at: <https://repositorio.butantan.gov.br/bitstream/butantan/3597/2/10.1111azo.12375.pdf>. Accessed on: March 31, 2021.

LOPES, A. *et al.* A ancestral biologia dos cnidários. **Revista Biologia Marinha de Divulgação Científica**, v. 6, p. 37-45, 2023. Available at: <https://www.bioicos.org.br/revistabiologiamarinha>. Accessed on: November 30, 2023.

MEDRONHO, R.A. *et al.* **Epidemiologia**. Editora Atheneu. São Paulo, 2006.

MOTTA, A. *et al.* **Esporte, lazer e políticas públicas na Região dos Lagos**. iVentura, Rio de Janeiro, 2011.

NOVELLI, M. M. *et al.* **Profilaxia do tétano nos acidentes por animais marinhos: revisão da literatura**. In: Simpósio de Integração Acadêmica (SIA), 2022, Viçosa. Anais do SIA-UFV, 2022. Available at: <https://www3.dti.ufv.br/sia/vicosa/2022/trabalhos/16226>. Accessed on: October 31, 2023.

RECKZIEGEL, G. C. *et al.* Injuries caused by aquatic animals in Brazil: An analysis of the data present in the information system for notifiable diseases. **Revista da Sociedade Brasileira de Medicina Tropical**, v. 48, n. 4, p. 460-467, 2015. Available at: <https://pubmed.ncbi.nlm.nih.gov/26312938/>. Accessed on: March 31, 2021.

RÊGO, R. F. *et al.* Health surveillance of artisanal fishing workers in Todos os Santos Bay: from invisibility to proposing public policies for the Unified Health System (SUS). **Revista Brasileira de Saúde Ocupacional**, v. 43, Suppl. 1, 2018. Available at: https://www.researchgate.net/publication/329411556_Vigilancia_em_saude_do_trabalhador_da_pesca_artesanal_na_Baia_de_Todos_os_Santos_da_invisibilidade_a_proposi

cao_de_politicas_publicas_para_o_Sistema_Unico_de_Saude_SUS>. Accessed on: July 31, 2022.

SIQUEIRA-BATISTA, R. *et al.* **Acidentes por animais peçonhentos e venenosos.** In: GALVÃO-ALVES, J. *Emergências clínicas.* Rio de Janeiro: Rubio, 2007, p. 843-868.

SIQUEIRA-BATISTA, R. *et al.* **Acidentes por animais de importância médica: Répteis, anfíbios, peixes e invertebrados.** In: SIQUEIRA-BATISTA, R.; GOMES, A. P.; SILVA-SANTOS, S.; SANTANA, L. A. *Parasitologia: fundamentos e prática clínica.* Rio de Janeiro: Guanabara Koogan, 2020, p. 612-620.

TOLEDO, G. *et al.* **Competitive and cooperative strategies in tourism clusters - a diagnosis of the Lakes Region.** VII SEMEAD. 2003, Anais. São Paulo: USP/FEA/PPGA, 2004. Available at: <https://sistema.semead.com.br/7semead/paginas/artigos%20recebidos/marketing/MKT32_-_Estrat%E9gias_Competitivas_e_Cooperativa.PDF>. Accessed on: March 31, 2021.

VIDAL, S. V. *et al.* Bioethical problems in the Family Health Strategy: necessary reflections. **Revista Bioetica**, v. 22, n. 2, p. 347-357, 2014. Available at: <https://revistabioetica.cfm.org.br/revista_bioetica/article/download/865/1071/2982>. Accessed on: March 31, 2021.