

Injuries caused by aquatic animals in Brazil: an analysis of the data present in the information system for notifiable diseases

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ABSTRACT

Introduction: We present a review of injuries in humans caused by aquatic animals in Brazil using the Information System for Notifiable Diseases [*Sistema de Informação de Agravos de Notificação (SINAN)*] database. **Methods:** A descriptive and retrospective epidemiological study was conducted from 2007 to 2013. **Results:** A total of 4,118 accidents were recorded. Of these accidents, 88.7% (3,651) were caused by venomous species, and 11.3% (467) were caused by poisonous, traumatic or unidentified aquatic animals. Most of the events were injuries by stingrays (69%) and jellyfish (13.1%). The North region was responsible for the majority of reports (66.2%), with a significant emphasis on accidents caused by freshwater stingrays (92.2% or 2,317 cases). In the South region, the region with the second highest number of records (15.7%), jellyfish caused the majority of accidents (83.7% or 452 cases). The Northeastern region, with 12.5% of the records, was notable because almost all accidents were caused by toadfish (95.6% or 174 cases). **Conclusions:** Although a comparison of different databases has not been performed, the data presented in this study, compared to local and regional surveys, raises the hypothesis of underreporting of accidents. As the SINAN is the official system for the notification of accidents by venomous animals in Brazil, it is imperative that its operation be reviewed and improved, given that effective measures to prevent accidents by venomous animals depend on a reliable database and the ability to accurately report the true conditions.

Keywords: Neglected tropical diseases. Epidemiologic surveillance. Public health. Underreporting. Venomous animals. Bites and stings.

INTRODUCTION

Brazil is a country with more than 8,500km of coastline and the largest freshwater system in the world, with a diverse aquatic fauna capable of causing lesions and/or intoxications in humans^{(1) (2) (3)}. Risk activities for accidents caused by these animals typically include recreational and professional fishing, bathing in rivers and seas, and scuba diving or snorkeling⁽⁴⁾. In Brazil, several local and regional studies report injuries for aquatic animals^{(5) (6) (7) (8) (9) (10) (11) (12)}, but few papers that address and discuss the epidemiology of these injuries in the country are available^{(4) (13)}.

The most common injuries by aquatic animals in Brazil are caused by sea urchins⁽¹⁴⁾, freshwater and marine fish, and cnidarians^{(4) (13)}. Wounds by fish are typically caused by retro-opercular or dorsal spines, dorsal or caudal stingers and rays of fins, which are sharp and can be covered with a toxin-producing glandular tissue^{(4) (13) (15)}. Envenoming by cnidarians (e.g., jellyfish, Portuguese man-of-war, anemones and corals) is caused by contact with the tentacles and even with the body of the animals, which have defensive cells bearing nematocysts. These organelles fire on contact with the human skin in a manner that is likened to a microscopic switchblade, injecting toxins with neurotoxic and cardiotoxic actions^{(4) (13) (15)}. Traumatic wounds by sea urchins are very common, and the permanence of spines in the points of penetration favors secondary infections and the formation of foreign body granulomas⁽¹⁴⁾. Laboratory assays confirmed the presence of toxins in some parts of the black sea urchin (*Echinometra lucunter*)⁽¹⁶⁾. However, clinical studies conducted in coastal zones of Southeastern Brazil have only found the existence of traumatic injuries and local manifestations in these occurrences⁽¹⁴⁾.

Deaths involving accidents by aquatic animals are rare, but they can occur in case of damage to vital organs⁽¹⁷⁾ or in severe cases of envenoming⁽¹⁸⁾. In Brazil, one death caused by myocardial perforation by the stinger of a marine catfish

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(Ariidae)⁽¹⁷⁾ and fatal cases of poisoning through ingestion of the pufferfish (Tetraodontidae) have been reported⁽¹⁹⁾. Notwithstanding, the injuries by aquatic animals can reach important clinical proportions. Envenomings by jellyfish and Portuguese man-of-war are characterized by typical linear lesions on the skin with variable extensions and can lead to severe cardiac and respiratory failure⁽²⁰⁾.

The lesions caused by venomous fish are characterized by intense pain that is disproportional to the injury and possible local necrosis⁽²¹⁾. This profile is observed in many envenomings caused by venomous Brazilian fish, such as freshwater stingrays (Potamotrygonidae family), catfish (especially Ariidae and Pimelodidae families)⁽²²⁾, toadfish (Batrachoididae family)⁽⁶⁾ and scorpionfish (Scorpaenidae family)⁽¹³⁾⁽²³⁾.

Although accident by venomous animals has been reported in Brazil for many years, the notification became compulsory only from 2010⁽²⁴⁾⁽²⁵⁾. To standardize these notifications and support epidemiological surveillance programs, the Brazilian Ministry of Health adopted the Information System for Notifiable Diseases [*Sistema de Informação de Agravos de Notificação* (SINAN)] as the official system for the notification of diseases and disorders of compulsory notification⁽²⁵⁾. In the SINAN, envenomings/injuries by venomous animals are recorded in an electronic database called SINAN-Net. Since the version SINAN-Net was implemented in 2007, the field *type of animal - fish* was removed from the existing form, and accidents caused by aquatic animals were reported as *accident type - other*.

This change in reporting is a matter of concern given that the treatment of accidents with high morbidity, such as those caused by stingrays and other aquatic animals, without any specificity can lead to the perpetuation of neglected health problems with important socio-economic and epidemiological impacts⁽⁸⁾⁽²⁶⁾. This fact highlights the importance of evaluating injuries by aquatic animals in reporting systems, such as SINAN, to identify information gaps and suggest improvements. Thus, in the present study, we analyzed the accidents by aquatic animals registered in the SINAN database, described the epidemiological profile of these accidents in Brazil, and discussed possible inconsistencies in the analyzed records.

METHODS

We conducted a descriptive and retrospective epidemiological study on the injuries by aquatic animals recorded in the SINAN database between 2007 and 2013, emphasizing the envenomings by venomous species. For this analysis, the following variables presented in the *Fields Notification/Investigation Sheet* (FNI) of the SINAN form were used: age, sex, date, Federated Unit/State of occurrence, occurrence area of the wound, elapsed time between the injury and the treatment, site and type of the wound, case classification, work-related accident and outcome.

The records were filtered from the *accident type - other* and divided into six groups of aquatic animals contained in the SINAN: jellyfish/Portuguese man-of-war, stingray, catfish, toadfish, sea urchin and other. Envenomings by stingrays were

classified as occurring in a freshwater or marine environment according to the proximity or not of the municipality with the sea using the FNI *location of occurrence of the accident*. Accidents by stingrays that could not be classified as freshwater or marine were titled in a simplified form using names such as *accident by stingray*. The group *other* in the SINAN was composed of all accidents by aquatic animals that could not be classified in the six existing groups, such as: accident by fish, fish sting, marine fish, *ictismo* (i.e., an imprecise Brazilian term for accident by fish), *Tilapia* sp., piranha, trahira and moray eel. All records that could lead to errors in classification of the cases were excluded.

The data were organized using the softwares TabWin32 3.6b [*Departamento de Informática do Sistema Único de Saúde* (DATASUS), Brazil], EpiInfo 7.1.3.3 [Centers for Disease Control (CDC), USA] and Excel 2010 (Microsoft, USA). For the spatialization of the accidents, we used the TerraView 3.2.0 [*Instituto Nacional de Pesquisas Espaciais* (INPE), Brazil] software. For description and data analysis, we used raw data, simple frequency measures and arithmetic means.

Ethical considerations

The study complied with the ethical and legal requirements according to the Resolution 196/96 of the Brazilian National Health Council. However, as the study was based on secondary data and we did not have access to nominal information or any other information to promote identification, approval by an ethics committee was not necessary.

RESULTS

From 2007 to 2013, 4,118 injuries by aquatic animals in Brazil were registered in the SINAN (**Table 1**). Among these injuries, 88.7% (3,651) were caused by venomous aquatic animals, and 11.3% (467) were caused by poisonous and traumatic aquatic animals or unidentified taxa (**Figure 1**). Most accidents involved stingrays (69%) and jellyfish/Portuguese man-of-war (13.1%). Among the envenomings by stingrays, 91.6% (2,603) were caused by freshwater stingrays (Potamotrygonidae).

The male gender was the most (76.4%) affected, with the exception of injuries caused by jellyfish/Portuguese man-of-war, which exhibited equal frequency between men and women. The most frequently affected individuals were 20 to 34 years old (32.2%). Regarding jellyfish/Portuguese man-of-war accidents, most cases occurred in victims up to 19 years of age (68.8%). This observation differs from accidents caused by stingrays (34.7%), catfish (29.6%) and sea urchins (47.1%), which occurred more frequently in individuals 20 to 34 years old. Envenoming by toadfish more frequently occurred in individuals who were 35 to 49 years old (32.4%) (**Table 2**).

Table 2 also shows that the location of the lesion was characteristic of the animal that caused the accident. Injuries caused by jellyfish/Portuguese man-of-war were distributed throughout the body, especially in extended areas, such as the thorax (21.5%) and legs (20.2%). Stingrays (83.6%) and sea urchins (52.9%) caused the most frequent injuries in the lower

TABLE 1 - Accidents by aquatic animals registered in the SINAN. Brazil, 2007-2013.

Aquatic animals	2007		2008		2009		2010		2011		2012		2013		Brazil 2007-2013	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Stingrays	193	42.9	331	58.5	387	67.5	405	76.6	429	77.7	624	82.5	473	68.4	2,842	69.0
Jellyfish/PMW	114	25.3	127	22.4	75	13.1	26	4.9	43	7.8	47	6.2	108	15.6	540	13.1
Toadfishes	18	4.0	14	2.5	26	4.5	33	6.2	29	5.3	25	3.3	36	5.2	181	4.4
Catfishes	9	2.0	6	1.1	6	1.0	9	1.7	4	0.7	14	1.9	23	3.3	71	1.7
Sea urchins	3	0.7	2	0.4	3	0.5	2	0.4	2	0.4	1	0.1	4	0.6	17	0.4
Other	113	25.1	86	15.2	76	13.3	54	10.2	45	8.2	45	6.0	48	6.9	467	11.3
Brazil	450	-	566	-	573	-	529	-	552	-	756	-	692	-	4,118	-

PMW: Portuguese man-of-war; SINAN: Sistema de Informação de Agravos de Notificação; SVS: Secretaria de Vigilância em Saúde; MS: Ministério de Saúde. Source: SINAN/SVS/MS.

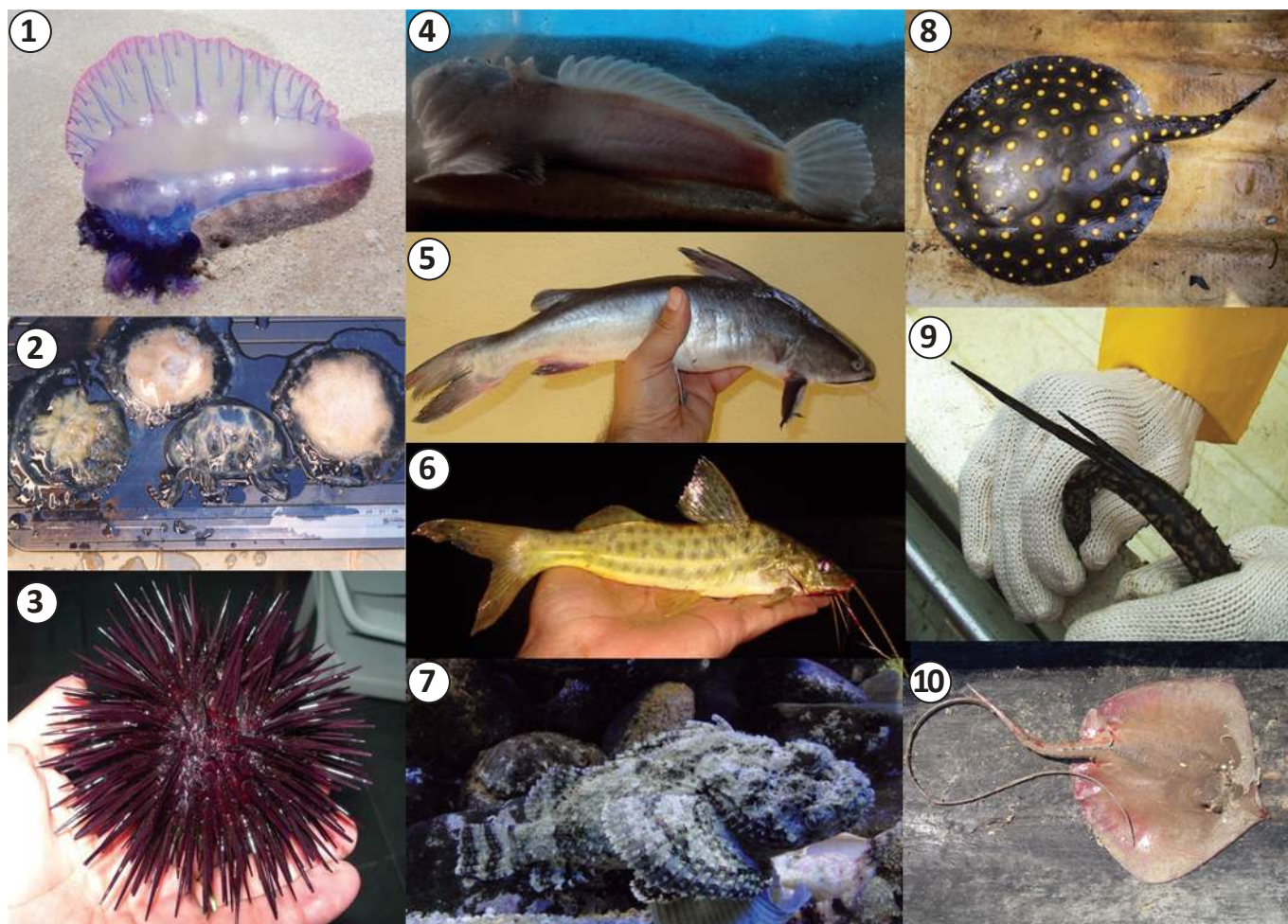


FIGURE 1 - Aquatic animals associated with injuries recorded by the SINAN from 2007 to 2013: 1) Portuguese man-of-war, *Physalia physalis*. 2) Jellyfish, *Chrysaora lactea* and *Chiropsalmus quadrumanus*. 3) Black sea urchin, *Echinometra lucunter*. 4) Toadfish, *Thalassophryne nattereri*. 5) Marine catfish, *Genidens genidens*. 6) Freshwater catfish, *Pimelodus maculatus*. 7) Scorpionfish, *Scorpaena plumieri*. 8) Freshwater stingray, *Potamotrygon henlei*. 9) Stingers of freshwater stingray. 10) Marine stingray, *Dasyatis americana*. (Images 1, 6 and 8 – Guilherme Carneiro Reckziegel; images 2 to 5, 7 and 10 – Vidal Haddad Junior; image 9 – Domingos Garrone Neto). SINAN: Sistema de Informação de Agravos de Notificação.

TABLE 2 - Epidemiological characteristics of the accidents by aquatic animals registered in the SINAN. Brazil, 2007-2013.

Aquatic animals	Jellyfishes/PMW N=540		Stingrays N=2,842		Catfishes N=71		Toadfishes N=181		Sea Urchins N=17		Other N=467		Total N=4,118	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Gender														
male	270	50.0	2,308	81.2	58	81.7	140	76.9	12	70.6	358	76.8	3,146	76.4
female	270	50.0	534	18.8	13	18.3	41	22.5	5	29.4	109	23.4	972	23.6
ignored/not answered	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Age (years)														
≤ 9	193	35.7	158	5.6	1	1.4	5	2.7	2	11.8	32	6.9	391	9.5
10 to 19	179	33.1	649	22.8	18	25.4	28	15.4	5	29.4	120	25.8	999	24.3
20 to 34	108	20.0	986	34.7	21	29.6	55	30.2	8	47.1	149	32.0	1,327	32.2
35 to 49	43	8.0	693	24.4	17	23.9	59	32.4	1	5.9	96	20.6	909	22.1
50 to 64	14	2.6	291	10.2	13	18.3	22	12.1	1	5.9	60	12.9	401	9.7
≥ 65	3	0.6	65	2.3	1	1.4	11	6.0	0	0.0	10	2.1	90	2.2
Ignored/not answered	0	0.0	0	0.0	0	0.0	1	0.5	0	0.0	0	0.0	1	0.0
Injury site														
forearm	30	5.6	14	0.5	2	2.8	1	0.5	1	5.9	5	1.1	53	1.3
hand/finger	70	13.0	82	2.9	28	39.4	82	45.1	2	11.8	143	30.7	407	9.9
chest/abdomen	116	21.5	6	0.2	0	0.0	1	0.5	1	5.9	6	1.3	130	3.2
leg	109	20.2	231	8.1	2	2.8	3	1.6	0	0.0	23	4.9	368	8.9
foot/toe	37	6.9	2,375	83.6	29	40.8	72	39.6	9	52.9	263	56.4	2,785	67.6
other*	153	28.3	55	1.9	5	7.0	3	1.6	2	11.8	13	2.8	231	5.6
ignored/not answered	25	4.6	79	2.8	5	7.0	19	10.4	2	11.8	14	3.0	144	3.5
Elapsed time accident/treatment (hours)														
< 1	367	68.0	1,056	37.2	25	35.2	29	15.9	3	17.6	154	33.0	1,634	39.7
1 to 3	56	10.4	697	24.5	7	9.9	29	15.9	1	5.9	97	20.8	887	21.5
3 to 6	9	1.7	281	9.9	5	7.0	14	7.7	3	17.6	39	8.4	351	8.5
6 to 12	4	0.7	81	2.9	2	2.8	17	9.3	1	5.9	20	4.3	125	3.0
12 to 24	12	2.2	110	3.9	4	5.6	20	11.0	2	11.8	42	9.0	190	4.6
> 24	23	4.3	265	9.3	18	25.4	27	14.8	4	23.5	61	13.1	398	9.7
ignored/not answered	69	12.8	352	12.4	10	14.1	45	24.7	3	17.6	54	11.6	533	12.9

SINAN: Sistema de Informação de Agravos de Notificação; PMW: Portuguese man-of-war. *head, thigh and arm. Source: SINAN.

limbs (especially in the feet), and catfish and toadfish caused injuries mostly on the feet (40.8% and 39.6%) and hands (39.4% and 45.1%). The time between the accident and clinical treatment varied. Victims of accidents by jellyfish/Portuguese man-of-war, stingray and catfish sought medical care mostly within three hours post-accident (78.4%, 61.7% and 45.3%, respectively). However, records of treatment after 24 hours were observed in accidents by catfish (25.4%), sea urchins (23.5%) and toadfish (13.1%).

The North region was responsible for the most accidents registered in the SINAN (66.2%), with important emphasis on accidents by stingrays (88.4%). Among these, 92.2% (2,317) of accidents were caused by freshwater stingrays. The South

region recorded the second highest number of accidents (15.7%), which were primarily caused by jellyfish/Portuguese man-of-war (83.7%). With 12.5% of the records, the Northeast region was notable with almost all accidents caused by toadfish (95.6%) (Table 3).

Figure 2 shows that among the Brazilian states, Pará reported most of the accidents (897; 21.8%) with 86.4% (775) of injuries caused by stingrays, followed by Tocantins (837; 20.3%) with 95.1% (796) of accidents caused by freshwater stingrays, Paraná (513; 12.5%); with 72.4% (372) of accidents caused by jellyfish/Portuguese man-of-war, and Amazonas (428; 10.4%) with 96.3% (412) of accidents caused by freshwater stingrays. Records of accidents caused by toadfish were more frequent

TABLE 3 - Distribution of accidents caused by aquatic animals according to the type of animal and macro-region. Brazil, 2007-2013.

Macro-Regions	Jellyfishes/PMW*		Stingrays		Catfishes		Toadfishes		Sea urchins		Other		Brazil	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
North	0	0.0	2,511	88.4	6	8.5	6	3.3	1	5.9	204	43.5	2,728	66.2
Northeastern	83	15.4	85	3.0	27	38.0	174	95.6	6	35.3	141	30.1	516	12.5
Southeastern	5	0.9	27	1.0	1	1.4	2	1.1	3	17.6	33	7.0	71	1.7
South	452	83.7	93	3.3	34	47.9	0	0.0	7	41.2	60	12.8	646	15.7
Central West	0	0.0	124	4.4	3	4.2	0	0.0	0	0.0	31	6.6	158	3.8
Brazil	540	-	2,842	-	71	-	181	-	17	-	467	-	4,118	-

PMW: Portuguese man-of-war; SINAN: *Sistema de Informação de Agravos de Notificação*. Source: SINAN.

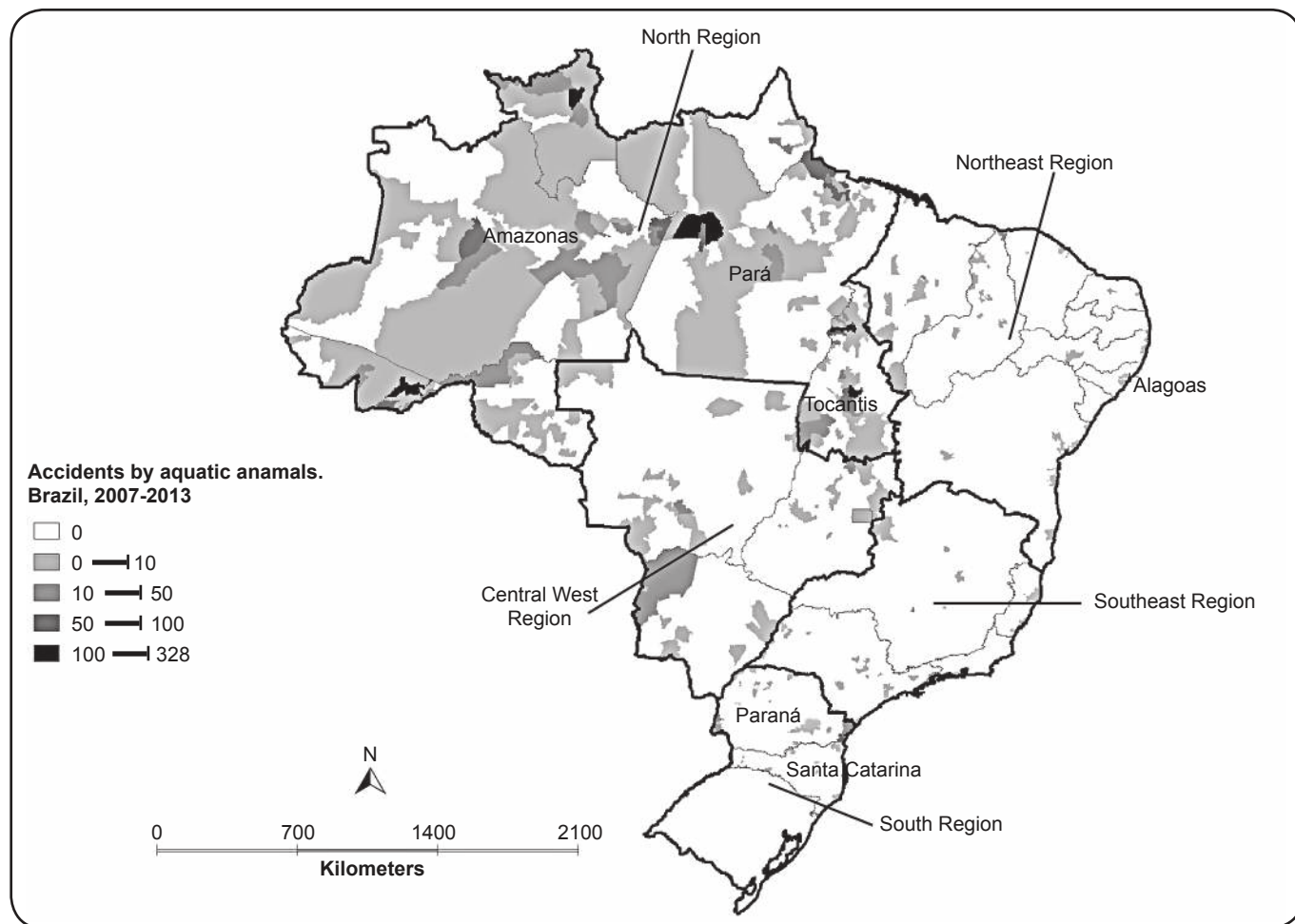


FIGURE 2 - Distribution of accidents by aquatic animals in Brazil. 2007-2013. SINAN: *Sistema de Informação de Agravos de Notificação*; Source: SINAN.

in the State of Alagoas (113; 62.4%). Accidents caused by catfish were most common in the State of Paraná (28; 39.4%), and accidents by sea urchins were most common in the State of Santa Catarina (7; 41.2%). In addition, other less frequent cases were observed over the Brazilian states: envenoming by lionfish (one record in São Paulo City); accidents by scorpionfish (one record in Santa Catarina, one in Pernambuco, three in Bahia, and one in Paraná); and intoxications by pufferfish (one record in Santa Catarina, one in Paraná, and one in the Rio Grande do Norte).

On a microscale, the municipalities in Brazil with the highest number of records were: I) Santarém/Pará (329) with 99.7% (328) of accidents caused by freshwater stingrays; II) Palmas/Tocantins (322) with 96.9% (312) of accidents caused by freshwater stingrays; III) Pontal do Paraná/Paraná (258) with 99.6% (257) of accidents caused by jellyfish/Portuguese man-of-war; IV) Boa Vista/Roraima (148) with 95.3% (141) of accidents caused by freshwater stingrays; V) Maceió/Alagoas (132) with 65.9% (87) of accidents caused by toadfish; VI) Araguaína/Tocantins (127) with 96.9% (123) of accidents caused by freshwater stingrays, and VII) Rio Branco/Acre (108) with 98.1% (106) of accidents caused by freshwater stingrays.

DISCUSSION

The accidents by aquatic animals registered in the SINAN/Brazil increased to greater than 50% from 2007 to 2013, particularly the cases of accidents by stingrays and jellyfish/Portuguese man-of-war, which accounted for 82% of cases.

Envenomings caused by marine and freshwater stingrays are relatively common in Brazilian fishing communities⁽²⁷⁾. However, accidents caused by stingrays are typically unreported due to their occurrence in remote areas where access to health services is limited⁽⁸⁾. Thus, despite an apparent concern by the health services in reporting cases, the data presented here possibly represent just a small fraction of all occurrences. Local and regional surveys demonstrated that accidents involving stingrays still occur silently and are closely related to beach seasons, school vacations and traditional fishing activities^{(21) (26) (27) (28)}. Accidents caused by stingrays are also commonly accompanied by popular treatments and delays in the search for medical attention, which favors the occurrence of disabling injuries and promotes the lack of reporting by the SINAN^{(8) (26)}.

Garrone Neto et al.⁽²⁶⁾ and Garrone Neto & Haddad Jr⁽⁸⁾ confirm this fact in studies of victims of stingray injuries who did not seek medical care and cases where even under medical care the accidents were not recorded in the SINAN. Additionally, Rosseto et al.⁽²⁹⁾ reports 38 cases of seabather's eruption, a dermatitis caused by the planulae larvae of the scyphomedusae *Linuche unguiculata*. This study reports that the number of victims was likely underestimated because many of them did not go to hospitals or clinics for medical treatment, and proper notification was consequently not made. Other studies also presented an important difference between the number of notifications in the SINAN and other reporting systems, raising the possibility of underreporting. Here, underreporting is noted

as the existence of victims who did not seek clinical care and as the positive difference between the frequencies of accidents recorded in other sources and accidents recorded in the SINAN in the same location and year⁽³⁰⁾.

For accidents by jellyfish/Portuguese man-of-war, the occurrence of underreporting in the SINAN is also recognized. However, in this case, the increase in the number of records in the SINAN appears to be more related to the large outbreaks that occurred in the South and Southeastern regions in recent years, rather than with a permanent action for monitoring and notification of accidents by cnidarians. Marques et al.⁽³¹⁾ reported approximately 20,000 accidents by jellyfish in the State of Paraná in the summer of 2011 to 2012 and presented several non-exclusive hypotheses to explain the occurrence of such a number of cases. One of these ideas involved an efficient method of data collected by firemen (lifeguards) and the health department during this season, which may indicate that the real number of accidents may not have been accurately reported in previous years with a high possibility of underreporting in the SINAN⁽³¹⁾.

Regarding accidents by sea urchins, Haddad Jr^{(13) (32)} states that injuries by these animals are very common and represent over 50% of the occurrences with aquatic animals observed in the emergency services of the Southeastern coast of Brazil. This finding is in contrast to our findings. Perhaps the low severity of the injuries, which are typically treated with the simple extraction of spines, discourages the search for medical care and justifies such a difference between the records.

In relation to other types of accidents, such as those caused by toadfish and catfish, we expect a similar situation regarding underreporting. Accidents with toadfish are recognized as frequent and an important public health issue in the Northeastern and North shores of Brazil⁽⁶⁾. Injuries and envenomings by catfish are also important in different Brazilian regions, both in freshwater and marine environments. However, as with the majority of the accidents investigated in this study, an important delay in the search for clinical care was noted by some victims, particularly regarding accidents caused by catfish and toadfish. The mild severity of these envenoming prompts the victims to use popular home treatments for the injuries, which delays or limits the demand for medical care^{(10) (26)}.

The severity of the accident, which is often evaluated by the victim based on the lesion appearance and/or intensity of pain, causes an increased demand for clinical care. Thus, this characteristic can justify the low frequency of accidents by toadfish and catfish as well as the high (69%) frequency of accidents by stingrays observed in this study. Injuries by others fishes, such as the scorpionfish and lionfish, and intoxications by pufferfish were considered uncommon in the SINAN database. However, due to the potential of severe cases of pain and intoxication (including fatal cases), occurrences involving these fish should be further investigated given that several species belonging to the families Scorpaenidae and Tetraodontidae are found in Brazil.

In addition to the problem of underreporting, the identification of accidents by aquatic animals in the SINAN as *accident type – other* reduced the quality of the data analyzed. The professionals responsible for filling this FNI in the SINAN form address

this process of identification via a variety of diverse methods, thus resulting in several cases being not reported or exclusively classified as *accident by aquatic animal*. This fact undermines the actual determination of the problem in the country and complicates the planning of preventive actions given that the accident characteristics are particular to each group of animals. Furthermore, the FNI field *local of occurrence of the accident* was insufficient for the classification of the total accidents by stingrays as occurred in rivers or coastal areas. This limitation is another important failure of the SINAN due to the high morbidity and marked seasonality of accidents by stingrays in the Central West and North regions, where these accidents could be easily avoided through information programs and collective protection measures in areas and with high-risk groups (e.g., bathers, riverside communities and marine/freshwater fishermen).

The envenomings/injuries caused by aquatic animals were reported in the SINAN for all regions of Brazil. Accidents by stingrays, especially those occurring in the North region, were the most frequent occurrence registered in the SINAN possibly due to the increased morbidity of these events. Injuries by cnidarians were important in the South region, following jellyfish and Portuguese man-of-war outbreaks during the austral summer. Accidents with sea urchins in the analyzed data proved to be underestimated, since they represent over 50% of all accidents recorded by the health services in Southeast coast during the austral summer. Although a comparison of different databases has not been performed, the data presented in this study indicate an important underreporting of accidents compared with local and regional surveys.

In contrast to the reporting systems designed for snakebites and spiders and scorpions stings, the study of injuries caused by aquatic animals in Brazil has always been relegated to a second plan and neglected by the agencies responsible for the knowledge, control and prevention of diseases involving venomous animals. Due to a gap in the epidemiology of accidents caused by aquatic animals in Brazil, the limited information available in the literature is the result of cross-sectional studies or active searches of cases or research in medical files, with the appropriate restrictions inherent to the collection of secondary data. Thus, given that the SINAN is the official system for the notification of accidents caused by venomous animals in Brazil, it is imperative that the system is improved and that its use be encouraged, given that effective measures to prevent and control accidents by venomous animals depend on reliable data and the ability to accurately report the problem.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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