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BALLAST WATER AND THE NEED FOR EFFECTIVENESS OF PROTECTION RULES FOR THE MARINE BIODIVERSITY IN THE AMAZONIAN SITUATION

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ABSTRACT

Precedents have shown that ballast water can influence the biological balance of native species, spread diseases and produce economic, sanitary and social impacts. In view of the projections for growth of port traffic in the Amazon region, the risk of environmental damage is aggravated, also with the possibility of affecting local traditional populations, who are at the mercy of the inefficiency in the control of ballast water in Brazilian ports. By using the deductive method, this article aims to analyze the rules that control ballast water management, pointing out some flaws in domestic legislation and the worsening of risks to biodiversity and local populations. All this based on accident precedents and on forecasts of growth in cargo handling at Vila do Conde Port, which is directly related to the growth in ship traffic and the worsening of environmental pollution risks. We conclude, therefore, that inefficient regulation and ineffective control of ship ballast water aggravate the vulnerability of the Amazon Region and its inhabitants.

Keywords: ballast water; bioinvasion; Vila do Conde Port; Amazon region; local populations.

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A ÁGUA DE LASTRO E A NECESSIDADE DE EFETIVIDADE DAS NORMAS DE PROTEÇÃO DA BIODIVERSIDADE MARINHA NO CONTEXTO AMAZÔNICO

RESUMO

Precedentes demonstram que a água de lastro pode influenciar no equilíbrio biológico de espécies nativas, proliferar doenças e gerar impactos econômicos, sanitários e sociais. Em face das projeções de crescimento da movimentação portuária na Região Amazônica, agrava-se o risco de danos ambientais, com possível afetação de populações tradicionais locais, que estão à mercê da ineficiência do controle da água de lastro nos portos brasileiros. O presente artigo, por meio do método dedutivo, visa analisar as normas que regulam o gerenciamento da água de lastro, sinalizando alguns pontos falhos da legislação nacional, e o agravamento dos riscos à biodiversidade e populações locais. Isso foi feito com base em precedentes de acidentes e projeções de crescimento da movimentação de carga no Porto de Vila do Conde, o que está diretamente relacionado ao aumento do tráfego de navios e agravamento de riscos de poluição ambiental. Conclui-se, portanto, que a ineficiência da regulação e a ineficácia da fiscalização da água de lastro de navios agravam a vulnerabilidade da Região Amazônica e de seus habitantes.

Palavras-chave: *água de lastro; bioinvasão; populações locais; Porto de Vila do Conde; Região Amazônica.*

FOREWORD

With the phenomenon of globalization, the formation of complex economic chains is increasingly noted, in which countries form trade agreements, economic blocs, and adopt other instruments that directly or indirectly link the world economy.

Foreign trade relationships is a worldwide reality for all sovereignties, in varying degrees. One of the means of consolidating this economic interconnection is the international trade in goods by means of importation and exportation.

It is the maritime modal, represented by various types of vessels, that moves most cargo in the world. Cargo ships are responsible for 90% of the international movement of that cargo. In Brazil, the maritime modal is responsible for 95% of cargo handling (MARTINS, 2013). That is why thousands of exotic species are transported in their tanks and, after being moved from one location to another and are inserted into *habitats* foreign to them, thus impacting the environment, the economy of countries and human and animal health.

The regulation of ballast water management in Brazil by means of international, constitutional and infraconstitutional norms imposes a series of measures that must be complied with at the time when ballast intake and discharge by the ship's crew, federated entities and companies that directly exploit ports, in order to mitigate the risks of pollution and allow the Government to exercise efficient control.

The development of regulations is a move forward in the prevention of environmental impacts caused by vessels, but control is flawed and has been inefficient with regard to the proposal of the International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM).

The Amazon Region shelters a vast biological and cultural diversity, and is under special legal protection, both at the domestic and international level. The inherent risk of ballast water in this spatial context is aggravated by various factors, given the vulnerability of the environment and the traditional local communities that live along the riverbanks. The scenario tends to worsen in view of the projected growth of port movement in the so-called northern arch[3].

3 "The Northern Arc Project is the transportation system, in its various modes, responsible for the flow of cargo and goods using ports in Northern Brazil, from the town of Porto Velho, state of Rondônia, through the states of Amazonas, Amapá and Pará, down to the São Luís port system in Maranhão" (BRASIL, 2016, p. 11).

This article aims to analyze the danger of ballast water in the Amazon Region, assessing whether the (domestic and international) legislation can ensure the balance and ecological diversity of the Amazon, as well as meet the Prevention Principle. To this end, examples of ballast water pollution occurring in Brazil will be used, including in the region that is the object of this analysis, comparing them with the projected growth of ship movement in the Vila do Conde Port, as disclosed by official agencies.

To that end, we will use the deductive method, together with documentary and bibliographic survey techniques.

1 BALLAST WATER AND ITS REGULATION

Ballast is the weight placed on board a vessel to produce balance and stability. It is not considered cargo, nor does it have any other commercial function. Its operationalization is related to navigation safety.

For safe operation, the vessel must operate within a weight range (minimum safety weight and maximum safety weight), which directly impacts its draft and center of gravity, and therefore its stability. When the boat is light and the minimum weight limit is not reached, it is necessary to temporarily incorporate external weight.

Thanks to the development of pumps, the ballast used today is predominantly water due to its easy handling. Water placed aboard a vessel is called ballast water and is stored in specific and specialized compartments called ballast tanks, for the purpose of controlling the vessel stability[4], structural strengths, trim[5], list[6] and draft[7].

The ship is designed to collect water and store it in ballast tanks to supplement the weight until it reaches the minimum draft limit for safe navigation. Ballast is of fundamental importance for maintaining safe navigation, especially when the ship is "light", i.e. unloaded or underloaded.

When unloading goods, the ship fills its ballast tanks with water at the place it is, in order to maintain stability (operate within its weight safety interval). When traveling for loading in another port, the ship is full of ballast water and unloaded. Arriving at the cargo loading location, the ballast water from the place of origin is discharged, so that the goods

4 Ability of the vessel to return to its equilibrium position after action by an external force.

5 Difference between bow draft and stern draft.

6 Difference between port draft and starboard draft.

7 Corresponds to the distance from the waterline to the keel of the vessel. In short, it is the depth that the vessel is at any given time.

can be loaded, so the ship can continue to operate within its weight safety interval.

With the intensification of world trade and the modernization of merchant ships, along with the goods shipped by vessels, water from a particular ecosystem migrates in ballast tanks to a foreign niche, bringing with it exotic species, thus causing the phenomenon of bioinvasion[8], which is especially severe in the Amazon region.

1.1 Normative framework

Environmental damage derived from ballast water can, as a rule, take place immediately, is difficult to reverse, and can influence several countries.

In view of the great international relevance of the matter, several rules, both domestically and internationally, have been regulating the issue, aiming to prevent environmental damage and control the management of ballast water in ships.

In February 2004, the International Maritime Organization (IMO)[9], by means of the Marine Environment Protection Committee (MPEC), proposed the International Convention for the Control and Management of Ships' Ballast Water and Sediments, aimed at preventing and eliminating pollution risks from ballast water due to the introduction of harmful aquatic organisms and pathogens into different ecological niches.

Ballast water is legally defined by BWM as "*water with its suspended particles carried aboard a ship for control of ship trim, band, list, stability or stress*". This Convention recognizes the transfer and introduction of Harmful Aquatic Organisms and Pathogens through ships' Ballast Water as a threat to the conservation and sustainable use of biological diversity.

In the same vein, the Convention on Biological Diversity also ensures the protection and conservation of marine biodiversity, specifically postulates the need for the adoption of mechanisms for impact assessment and minimization of negative impacts on biodiversity, providing for the duty of Countries to adopt measures that provide information from

8 "Bioinvasion or biological invasion is the act or effect of one or more organisms invading and settling in environments where there were no previous records of that species. However, there are two types of invasions: expansions and introductions. Expansions consist of the scattering of organisms by natural mechanism and introductions occur when species are transported intentionally or unintentionally by human activities to an area where they did not occur before" (LUZ DE SOUZA, 2010, p. 01).

9 Entity specialized in maritime affairs of international interest, linked to the United Nations (UN). It has powers for drafting, organizing and bringing together Public International Maritime Law Conventions.

countries impacted by damages or risks due to activities under their jurisdiction that may be felt in the territory of other Countries. As with ballast water, Countries are thus obliged to:

> d) Immediately notify those Countries that may be affected by imminent or severe hazard or damage to biological diversity in an area under the jurisdiction of those Countries or in areas beyond domestic jurisdiction boundaries, as well as adopt measures to prevent or minimize said hazard or damage (UN, 1992, p. 14).

At the national level, we point out to the Federal Constitution, which attributes to a balanced environment the status of essential asset for a healthy quality of life of the people, specifically protecting the genetic heritage of biodiversity in the face of activities that pose risks to its integrity.

Infraconstitutionally, we highlight Law no. 9537/97, which deals with the safety of water traffic, Law no. 9605/1998 and Decree no. 6514/08 on environmental crimes and administrative violations. In the case of non-statutory norms, there is Maritime Authority Standard (NORMAM) 20, which regulates the management of ballast water in ships, and the Resolution of the Collegiate Board (RDC) 72/2008, of the National Health Surveillance Agency (ANVISA) that controls vessel ballast water.

BWM, which entered into force in September 2017, requires signatory countries to undertake to supervise vessels located in their maritime areas or under their authority, providing conditions for vessels to discharge their ballast at specialized catching facilities, thus allowing for cleanup and the repair of ballast tanks in their territory. In addition to the obligations of signatory countries, the Convention sets out minimum procedures that ships must follow to minimize the risks of ballast water pollution and a series of documents that will require vessels to be BWM-compliant[10].

Ships subject to the Convention shall have an International Ballast Water Management Certificate[11], a ballast water operations logbook[12] and

10 Brazil has internalized the International Convention for the Control and Management of Ships' Ballast Water and Sediments by means of Legislative Decree 148/2010 from March 15, 2010. On April 14, 2010, the ratification instrument was deposited with IMO. BWM applies only to ships that are authorized to fly the flag of a signatory state, or that operate under its authority, make international trips, or operate exclusively in a country other than that of its flag, unless expressly authorized by that country. The Convention does not apply to immune ships or those designed to operate without ballast or with fixed ballast.

11 The International Ballast Water Management Certificate is granted by the ship's flag country, or the one having immediate sovereignty over it, and is valid for up to five years. It has international validity, giving the ship a guarantee of presumption of adequacy to the Convention. The Certificate does not prevent the coastal country from carrying out inspections and checking the authenticity of the document. Its issuance is subject to a survey by the country with jurisdiction, or agents representing it, where they will review the ship's Ballast Water Management Plan (PGAL), and keeping the certificate is subject to a series of periodic surveys.

12 The ballast water logbook is the vessel's official document. Every ship that is subject to BWM is

an individualized ballast water management plan[13]. The Convention also provides procedures for ballast water replacement by ocean water[14] and other forms of treatment approved by the IMO[15].

The Principles of Navigation Safety, Safeguarding Human Life, and Protection of the Marine Environment are set out in the BWM and override ballast collection and discharge procedures[16].

1.2 Regulation on Ballast Water in Brazil

Internal rules should not diverge from the Convention, as they will create serious legal uncertainty and have a negative impact on the Principles of Safe Navigation, Standardization and Freedom of Navigation. As a

required to have such a document on board, which shall contain information on ballast operation. Its model is detailed in Appendix 2 of the Convention. The rules for filling the logbook out are similar to those for the Navigation Journal, where the officer in charge must sign at the end of the record and the commander in charge of the vessel and crew must validate all records made by his subordinates by signing at the bottom of the page. Erasures are forbidden, and the phrase "meaning" between commas must be used for any corrections. If the registration has already been closed, its rectification must be done using the expression "By the way", followed by the correct text. The record shall, as a rule, contain the date, time and place of the ballast collection and discharge, an estimate of the collected and/or discharged volume, whether any abnormalities that prevented discharging as per the BWM procedure took place, whether the ballast water management plan was complied with and, the signature of the officer who performed the registration at the end. After its last entry, the book shall be kept on board for a period of two years, after which time it shall be held by the shipping company responsible for the ship for a further three years.

13 The Ballast Water Management Plan is the set of operational and preventive measures, including the emergency plan in case of leakage, which each ship must have individually, and that must contain: 1- detailed safety procedures for the ship and crew associated with ballast water management; 2- a detailed description for the BWM implementation; 3- procedures for the disposal of sediments at sea and on land; 4- Ballast water discharge procedures; 5- appointment of the officer responsible for compliance with the BWM; 6- reporting regulations provided for in the BWM; 7- translation of the Plan into one of the official IMO languages (English, French, or Spanish).

14 The Convention also provides for procedures for the operation of ballast water sheeding and collection. Ballast water should normally be replaced in oceanic waters. When approaching the maritime territory of a country, vessels beyond two hundred nautical miles from the coast and in areas with a depth of at least 200 meters, have to perform ballast water replacement. In cases where the minimum distance for ballast discharging is not complied with, the reasons for non-compliance with the norm have to be explained in the ballast water logbook, and the vessel should discharge its ballast as far as possible from the shore to a depth of no less than 200 meters, and at no less than 50 miles off the coast.

15 Today, most vessels use ballast water replacement as a treatment method. Only in late 2017, the first Brazilian flagged ships of the new Transpetro fleet were launched at sea; they have a double treatment system, which does not require replacement for oceanic waters.

16 The vessel's captain may discharge the ballast in violation of the requirements of the Convention if, justifiably and reasonably, he/she decides that ballast replacement would threaten the stability of the ship, and/or the safety its crew and passengers. The basis of such permissiveness is the valuation of life, risk weighting and reasonableness. The BWM aims at preserving the environment. A shipwreck has a higher pollution potential than ballast water, so it would not be reasonable to require a commander to act in a way that would pose a higher pollution risk. In addition, the lives of people on board are an express and sovereign principle in most Public Maritime Conventions, thus making preset procedures relative.

result, all countries with a long maritime tradition develop standards in line with the precepts of the International Standard, and may complement them with new requirements that make measures more efficient in the local situation, in order to achieve their purpose.

In Brazil, in the constitutional context, we can highlight article 170, which defines the protection of the environment as one of the principles of the economic order, and article 225, which lays down that an "ecologically balanced environment, an asset for the common use of the people and essential to a healthy quality of life" is everyone's right.

There is also Law no. 9605/1998 and the respective Regulatory Decree no. 6514/08 (Law on Environmental Crimes and Administrative Infringements), which provide for criminal, civil and administrative responsibilities arising from conduct and activities harmful to the environment, including pollution caused by ballast water.

The highlights are the punishments of a criminal nature, with an unconditional public action, ranging from six months to eight years, depending on conduct and aggravating factors. At the administrative level, fines are also expected as a result of environmental violations.

The above-mentioned Law provides for the Principle of International Cooperation for the Preservation of the Environment, stipulating that Brazil should provide, with regard to the environment, the necessary cooperation to other countries, free of charge, but safeguarding national sovereignty, public order, human rights, and good morals, considering the Brazilian Navy as Environmental Authority, as far as ship-related pollution is concerned.

ANVISA Collegiate Board Resolution 72/2008 deals with "the promotion of health in sanitary control ports deployed in the Brazilian territory and vessels passing through them". RDC 72/08 ensures the prerogative of the National Health Surveillance Agency to make visits to vessels located in Brazilian territory in order to collect water from the ballast tanks and submit it to testing. It imposes upon the crew of the vessel, when requesting free pratique, the obligation to inform about the ballast water that is on board and to submit a form according to the model attached to the ANVISA standard itself.

In its Article 4, item VII, Law no. 9537/97, known as Waterway Traffic Safety Act (LESTA) determines that it is the Maritime Authority's task "*to establish the requirements regarding safety and habitability conditions and for the prevention of pollution by vessels, platforms or their support facilities*".

The Navy Command (Maritime Authority), through the Directorate of Ports and Coasts, drafted two Maritime Authority Norms (NORMAM) with Resolution power that regulate the process of ballast water control in vessels.

NORMAM 08, which deals with the rules for the traffic and permanence of vessels in Brazilian jurisdictional waters, determines that vessels entering Brazilian waters from other countries must send the Maritime Authority a form containing information about the ship's ballast. NORMAM 20 regulates ballast water management on ships. It is the most specific Brazilian standard on the subject.

Among the highlights of the standard, we point out the most specific guidelines for the ballast water exchange procedure. NORMAM requires the ship, as determined by BWM, to replace ballast water in ocean waters at an estimated volume of three times the capacity of its ballast tanks, except in cases of impaired navigation safety, where the vessel must change ballast water as soon as possible in the deepest and most remote location off the coast, without compromising navigability.

Application of NORMAM 20 is broader, covering all vessels equipped with ballast water tanks using Brazilian ports and terminals. As it is a domestic standard, it covers more situations, including vessels that only travel in Brazilian jurisdictional water.

Regarding the ballast water replacement procedure, NORMAM adopts the same procedures as the Convention (in addition to 200 miles, with a minimum depth of 200 meters, or, to preserve the safety of the vessel, before getting to 200 miles, the furthest possible from the nearest landmass, and at least 50 miles off the coast, at a minimum depth of 200 meters), allowing also for the replacement at less than 50 miles off the coast at a place with a greater depth; it does not determine distance or depth limits when vessel route does not exceed that distance. In cases of risk to navigation safety, the captain may decide, by written justification, not to replace ballast water, based on the Principles of Navigation Safety and the Safeguarding Human Life.

Ballast discharging in ecologically sensitive areas is forbidden[17]. As a form of control, NORMAM 20 provides that, in addition to the items set forth in the Convention (Ballast Water Logbook, the ship's Ballast Water Management Plan and the International Certificate), Brazil may verify whether the ballast water form was correctly filled out, collect

17 The ecologically sensitive areas are highlighted in the nautical chart.

water to check its physiochemical conditions[18], verify the accuracy of the information contained in the documents, cross-check information described in the Ballast Water Logbook, and also other official books on board[19].

Said regulation also establishes the competence of the agent of the Maritime Authority to draw up the environmental violation notice and to file the administrative process. In addition to the already-mentioned aspects, it also establishes that infractions arising from non-compliance with the precepts contained therein will be followed by the procedures and punishments provided for in Law no. 9605/98 and Decree no. 6514/08, which determine the offender must pay a fine ranging from R$ 5,000 to R$ 50,000,000, or R$ 150,000,000.00, in case of repeated offense.

The previous version of NORMAM 20, with its respective amendments[20], established specific procedures for river navigation. It took into account the variety of ecosystems in the various river basins. In the past, a ship originating from one river basin could only discharge in another if it replaced ballast twice in a transition zone.

The revision of the Maritime Authority Standard that regulates operation with ballast water fails to take into account a restricted number of aquatic ecosystems, which is not in line with reality, especially the Amazon situation. Simply changing the ecosystem of a species carried in ballast water can lead to imbalance.

Therefore, the Maritime Authority has to consider the complexity and variety of the various national aquatic ecosystems. We point out to the study on Brazilian ecosystems conducted by the Secretariat of Biodiversity and Forests, which is linked to the Ministry of Environment:

> The extent and diversity of the Brazilian Coastal Zone and Marine Zone in terms of ecosystems and species constitute a unique situation, where local biodiversity and the numerous endemic species overlap migratory routes and conditioning and spawning sites for migratory species distributed worldwide. Thus, the preservation or degradation of certain ecosystems no longer has a purely local effect. The loss of endemic species implies the depletion of global biodiversity, and the devastation or fragmentation of habitats can have extended effects on diverse populations and their migratory routes, interfering with the dynamics of ecosystems that are often far from the affected areas (BRASIL, 2002b, p. 272).

18 The Maritime Authority agent may examine the ballast water using a refractometer, in order to check the salinity of the water. As a result, it can be ascertained whether the water contained in the ballast tanks is from the same region where, according to the Ballast Water Logbook and the ballast water form, the water was replaced.

19 On board a ship there are several books with documentary value. We highlight the Navigation Journal, Machinery Journal, and Oil Logbook, among others.

20 NORMAM 20 was created by Ordinance 52/DPC/2005. The current standard was amended by Ordinances 80/DPC/2005, 95/DPC/2005, 01/DPC/2006, 66/DPC/2006 and 125/DPC/2008.

The current NORMAM 20 does not touch on a point of great importance for achieving the purpose of the Convention (to eliminate ballast water pollution). In Chapter 3, item 3.2, it states that "[...] vessels traveling between river ports/terminals of different river basins, when their route goes by sea, shall replace Ballast Water" if they do not have a ballast water treatment system; but the norm mentions nothing regarding vessels navigating exclusively along river waterways. Vessels traveling between two river basins do not need to replace ballast.

Brazil is a continental-sized country. In the same river basin, we can find several distinct ecosystems[21]. In the Amazon Basin, the environment is heterogeneous, with a vast diversity of landscapes, species and human settlements (BRASIL, 2002b). We verified three types of rivers, with distinct environmental peculiarities (whitewater rivers, blackwater rivers and clearwater rivers)[22]. Considering there is no need for ballast renewal in internal navigation[23] is synonymous with taking on a risk of environmental pollution by ballast water, validated by the procedures described in the Maritime Authority Standard 20.

In order to mitigate the risks of ballast water pollution, it is necessary for NORMAM 20 to include a map of BRASIL's marine ecosystems, particularly for internal navigation, where ballast renewal is waived, establishing transitional zones where the vessel going along the internal waterway can thus replace its ballast with less potential for harming the environment.

Another point to note is in coasting navigation[24]. NORMAM provides that vessels do not have to divert from their route to comply with the ballast replacement procedure. If the vessel is going on a coasting voyage along a route less than fifty nautical miles offshore, it shall replace its ballast at the deepest section, with no minimum distance limit.

Such permissiveness poses a great risk to the environment. The most appropriate measure for article 225 of the Federal Constitution of Brazil and the BWM would be the requirement for ships with their own treatment system, that do not need the ballast water replacement (economically

21 "The Amazon discharge amounts to almost five times the discharge of the Zaire River, the world's second largest discharge, and 20% of all freshwater that is discharged into the planet's oceans by all rivers" (BRASIL, 2002b, p. 29)

22 Whitewater rivers (Solimões and Purus) carry high fertility sediments. Blackwater rivers (Negro and Urubu) have high acidity and contain few minerals. Finally, the clearwater rivers (Tapajós and Xingú) have medium quality waters regarding nutrient (JUNK, 1979).

23 Navigation performed behind the baseline of the coast.

24 Navigation between domestic ports

unfeasible), or the creation of a map of ecosystems and transition zones, and/or – where maritime traffic is outside internal waters – the obligation to establish a route beyond 50 nautical miles, so that the vessel could replace the ballast without changing the route.

To enhance the economic and environmental efficiency of maritime transportation, the two measures should be adopted together. A ship would only need to follow a route beyond 50 nautical miles if it moved to another marine ecosystem that did not have a transition zone, when the ship did not have an internal ballast water treatment system.

1.3 Difficulties in controlling ballast water pollution in Brazil

The regulation on ballast water in Brazil is relatively developed, providing efficient procedures for the prevention of environmental impacts, adopting the guidelines provided by the BWM, with some caveats that can be corrected by the Brazilian maritime authority. Moreover, the effectiveness of these standards is quite questionable.

The rules that impose obligations on the crew to send documents to the Brazilian Maritime and Sanitary Authorities, such as RDC 72/09 and NORMAM 08, with their respective information on water stored in the ship's ballast tanks, are formally efficient. Mooring is permitted only after submission of these forms.

The requirements that are the responsibility of the Government: supervising on board vessels, such as documents, certificates and, especially, the authenticity of the information provided, are partially efficient. Scientific surveys have already shown that it is common for ships to discharge ballast in violation of Brazilian standards. Verification was carried out by crosschecking the data contained in the official forms and the ballast water logbook, with salinity examinations performed on the water from ship ballast tanks. Such data show a flaw in the effectiveness of the standard.

Studies carried out by researchers from Centro de Instrução Almirante Braz de Aguiar (CIABA), in partnership with Universidade Federal do Pará (UFPA), showed, by means of an analysis of the salinity of the water contained in the ballast tanks of three ships operating in the Port of Miramar, in Belém do Pará, that two of them had not replaced ballast in oceanic waters. The records contained in the ballast water logbook and the forms showed that the ballast renewal operation had been carried out

in accordance with internal regulations. It was evident that the records of a vessel were not consistent with the ballast water samples collected (SIQUEIRA et al., 2012).

In 2002, ANVISA carried out 99 ballast water collections at 09 Brazilian ports. The salinity of the water showed that 62% of the vessels that claimed to have performed ballast water replacement according to IMO guidelines of the time did not do so (BRASIL, 2002a).

This scenario is believed to be slowly changing. A survey published in 2009 by Eliane Boldrini and Leticia Procopiak, carried out at the Ponta do Felix Port Terminal in Paraná, found that most of the ships tested performed ocean ballast water replacement, but there are still reports that show a possible alteration in the information in the control documents, in order to circumvent the inspection.

Another problem was the difficulty of gaining access to some of the ballast tanks of several vessels, making the examination impossible in all tanks. The architecture of several ships, especially the older ones, does not take into account facilitation of ballast water collection (BOLDRINI; PROCOPIAK, 2005).

In her doctoral dissertation, Leticia Procopiak (2009) surveyed ship captains' knowledge of ballast water bioinvasion in the ports of Paraná, and found that Brazilian officials know that there is a risk of bioinvasion, but do not know the reason, the importance and the actual impact that such a phenomenon may have on the environment and human health. The knowledge of merchant navy officers focuses on pragmatic procedural issues, and is generally limited to what is described in standards.

The surveyor concluded that an environmental campaign that could make the crew of ships, dockers and ship-owners awareness of the dangers of ballast water is important. The officers interviewed unanimously suggested putting together an awareness-raising documentary that they could watch aboard the ship when navigating, since when the boat is moored it is difficult to pay due attention to educational campaigns, as they are short on time (PROCOPIAK, 2009).

Another important point is environmental awareness-raising to be included in the training of merchant marine officers. There are only two institutions in Brazil that have the Bachelor Course in Nautical Sciences, which certify students to become ship officers, with qualification in machinery or nautical: Centro de Instrução Almirante Braz de Aguiar, located in Belém, and Centro de Instrução Almirante Graça Aranha, located in Rio de Janeiro.

Until 2012, BWM was not part of the syllabus of those courses. In 2013, DPC updated the summary of subjects, adding BWM and NORMAM 20 as a complementary subject as part of the Maritime and Environmental Legislation discipline, due to their relevance. From the end of 2015, when the first class graduated in the new syllabus, the new merchant officers now have a more consolidated base on the dangers of ballast water to the marine environment.

Research programs in ballast water monitoring are being created by several Brazilian universities, with the one from Universidade de São Paulo (USP), which has been developing ballast control equipment, standing out. Using this equipment, the Maritime Authority would have information about the ballast location and physiochemical properties of water, such as pH, oxygenation, turbidity, salinity, temperature and dissolved oxygen. The proposed system automatically sends the information to the authorities with jurisdiction in the matter, without the crew having to do so. Laboratory testing was successful and ship testing is ongoing (USP, 2013).

Another important highlight in the development of effective ballast water management systems at the international level is the Global *Ballast Water Management Program* (GloBallast). GloBallast was created via a partnership between the United Nations Development Program, the Global Environment Fund and IMO, in order to promote international cooperation to mitigate the impacts of ballast water by helping developing countries to reduce the inherent risks of this operation.

This system has been improved by a public-private partnership, through the Global Industry Alliance (GIA) and the GIA Fund, established with partners of major shipping companies and the European Bank for Reconstruction and Development, which produced the so-called *IMO-EBRD Marine. Biosafety Initiative* (MBI).

As the major ballast water governance guidelines, we highlight the expansion of government and port management capacities, the encouragement of legal, political and institutional reforms at the national level, the development of sustainability mechanisms, a stimulus to regional coordination and cooperation, risk assessment, ballast water risk assessment, survey of port biota, ballast water management measures, and funding and self-financing (SERAFIN; HENKES, 2013).

At all events, it should be noted that there is no national ballast water management plan or strategies for implementing ballast water governance guidelines in Brazil, although the National Work Plan for Ballast Water Risk Assessment has been approved.

2 THE INCREASING IN BIOINVASION RISKS IN THE FACE OF VILA DO CONDE PORT GROWTH FORECASTS

2.1 Bioinvasion from ballast water Brazil

Between 3 and 5 billion tons of ballast water are moved about every year worldwide (BRASIL, 2012).

The main negative consequences of the introduction of exotic and harmful species include the ecological imbalance of invaded areas, with the possible loss of biodiversity, and damage to economic activities that use the affected natural resources, resulting in the social destabilization of communities that depend directly on water as a source of labor and subsistence; there is also the spreading of diseases to coastal populations, caused by the introduction of pathogenic organisms.

The first case of bioinvasion caused by ballast water that had international repercussion, with direct impact on Brazil, was that of the golden mussel (*Limnoperna fortunei*). Originally from Asian waters, the invasive species was first sighted on the American continent in 1991, in Río de la Plata, Argentina (COLLYER, 2007).

Among the damage caused by the mussel, we can highlight the destruction of aquatic vegetation, occupation of space and dispute over food with native mollusks, damage to fishery, clogging of pipes, ducts, water filters, and other equipment installed in a waterway environment, clogging of hydroelectric systems, impaired navigation safety, and interfering with the structure of signaling equipment and hulls of vessels.

In Brazil, the invasive mollusk was first sighted in 1999, in Rio Grande do Sul, and can be found today in the South, Southeast and Midwest states.

Nationally, the case that gained repercussion was that of the *Charybdis hellerii* crab, brought by ballast water probably collected in the Caribbean, which was first sighted in 1996. The invading agent can be found in the states of Rio de Janeiro, Sao Paulo, Alagoas and Bahia. The arthropod, which has no commercial value, has been replacing native crab species, harming local fishermen, and hosting the white spot syndrome virus (WSSV), which causes white spot syndrome, which affects other species, often resulting in the death of contaminated animals (SÃO PAULO, 2010).

In 2002, ANVISA pointed to the presence of marine bacteria in 71% of the ballast water samples analyzed. From this total, the following were identified:

> [...] the transport of vibrios (31%), fecal coliforms (13%), Escherichia coli (5%), fecal enterococci (22%), Closdridium perfringens (15%), coliphages (29%), Vibrio cholerae O1 (7%), and non-O1 Cholerae (23%) in ballast water samples and (21%) in plankton samples; 12 strains in seven samples were identified as V.C. O1-EL TOR, two of them, toxigenic (SERAFIN; HENKES, 2013, p. 94-95).

In Pará, the exotic Asian *corbicula fluminea* species has already been found in the municipality of Alenquer and near Santarém, in the Amazon Basin. To date, no research has been carried out to assess the existence of impacts on human health and negative influences on traditional communities living near islands, but this region has great environmental sensitivity, and the river directly influences the life of fishermen, quilombola communities, indigenous peoples and local communities of nearby municipalities. Indeed, extra caution is required when operating ballast in river basins (HAGER, 2008).

2.2 Forecasts for the growth of Vila do Conde Port and increased pollution risks

The organized port of Vila do Conde is located in the interior of Pará, in the town of Barcarena, on the right bank of Pará River, in a place called Ponta Grossa, where the Amazon, Tocantins, Guamá and Capim rivers converge. It can be accessed by road via BR-316 highway, following the Road Grid down to the point it meets highway PA-151 and, later, PA-483 and PA-481, a total of 120 km from the capital of Belém.

Its location was decided considering the proximity of Belém Tucuruí Hydroelectric Power Plant (supporting metropolis), the central geographic position of the municipality in relation to the Trombetas and Paragominas bauxite deposits, the availability of maritime access (through the Quiriri Channel), as well as large areas for port and industrial facilities. It is worth mentioning the port's geoeconomic area of influence towards the sea, thanks to the proximity to the European and Asian continents (through the Panama Canal), when compared to other Brazilian ports.

The organized port of Vila do Conde has the largest traffic in the Northern Region.

In 2013, the Vila do Conde Port Master Plan was released, highlighting the main characteristics of the port, and its growth and expansion forecasts up to the year 2030. It was estimated that the amount of cargo shipped between 2011 and 2030 would more than triple from approximately 16,000 (t) to 53,000 (t) (BRASIL, 2013).

Over the past few years, Brazil has suffered a severe economic crisis stemming from several factors, notably a political crisis and the various corruption scandals, which had a negative influence on the economy in 2016. However, in 2017 and 2018, Vila do Conde Port grew beyond what was forecast. Data from the yearbook of the National Agency of Waterway Transportation for the year 2016 indicate that Vila do Conde Port moved about 14,796,941 (t), well below forecasts in the master plan, which provided for a movement of 25,000 (t). In 2017 and 2018, however, cargo movements exceed projections, reaching 35,436,372 (t) and 33,071,712 (t), while forecasts were around 26,000 (t) and 28,000 (t), respectively (ANTAQ, 2018).

The increase in cargo movement at Vila do Conde Port is directly related to the increase in merchant ship traffic and, consequently, a significant increase in the volume of ballast water discharged in the region, which represents an increased risk of bioinvasion via introduction. However, there is no actual prospect of increasing the efficiency of ballast water control, or requiring ships to incorporate equipment that will enable it to be treated on board.

In this context, the aggravation of the risk of pollution is directly related, cumulatively, to the increased traffic of ships. Problems in the legislation affect the matter and the precariousness of enforcement.

In the case of the Amazon Region, inspection difficulties are aggravated by the extension of navigable areas and the large number of vessels that travel in the area, whether in internal or open sea navigation.

Another point worth mentioning is the great diversity of traditional communities that inhabit the region. The identity of various traditional Amazonian communities implies a plurality of relationships and valuations of aquatic fauna (ROMAGNOLI, 2016).

The river, for these communities, constitutes a space for reproduction of their daily lives; it is closely linked to their culture, subsistence, leisure, transportation, domestic activities, commerce, and other things. It is from it that they get fish for sale and for food (FERREIRA, 2013) and it is through it that they move about, go to neighboring schools, hospitals and places to exchange or sell goods taken from nature: "The dynamics imposed by the water cycle, which at one time kills and at another gives life, makes these men, women and children believe that what ultimately prevails is

life – that is why they remain there" (WITKOSKI, 2007, p. 20). Given this high capacity for dynamic river adaptation, Harris (2006) points out that flexibility and resilience are essential characteristics of these communities.

Paz (2007) estimated that, if environmental change occurs in the areas adjacent to Vila do Conte Port – which include Capim Island – the economic losses for the surrounding river dwellers and artisanal fishers would amount to at least R$ 724,431.00 (seven hundred and twenty four thousand, four hundred and thirty one reais), compounded by social losses.

There is no research on the sanitary impact caused by navigation or industrial accidents and resulting in water pollution in the region; however, there are reports of skin and gastrointestinal problems suffered by residents of the island during periods compatible with the occurrence of the narrated accidents.

The close relationship with the river, as part of their territoriality, culture, and way of life aggravates the vulnerabilities of these traditional communities in the face of a risk of ballast water pollution, which results in a high possibility their territory, lives, economy, health and the very existence of some communities being affected.

Bacterial transport can result in various pathologies for people who are in direct contact with this water. The imbalance caused by an invasive species, as observed in the case of the *Charybdis hellerii* crab, can lead to a decrease and/or extinction of native species related to trading and diet of these communities.

CONCLUSION

Ballast water poses a real risk to all who inhabit the Amazon Region. The precedents of pollution in Brazilian territory have already caused several damages to human health (cholera), the economy of local populations (*Charybdis hellerii* crab) and industry (golden mussel).

Inspection of ballast water treatment is materially flawed, as it only requires information by documentary evidence, and there are reports of data being altered by some ship crews themselves. In spite of the little used possibility of examinations to verify the veracity of the information, it is formally failed, due to the excessive flexibility of treatment requirements, which always prioritize commercial interest over the prevention of environmental impacts.

NORMAM 20, quite mistakenly, considers internal waters as a single ecosystem, dispensing with the replacement of ballast water for vessels engaged in such navigation, thus aggravating the risks of environmental pollution.

Vila do Conde Port has been displaying a constant annual growth, getting closer and closer to the Master Plan forecasts, which foresees an increase in cargo movement three times higher than the one observed in 2011, which means a larger number of vessels in the region, and therefore an increased volume of ballast water discharged in and around the port area.

The risk of ballast water pollution in the Amazon Region is aggravated by the inefficiency of regulation, ineffectiveness of enforcement, and an increased volume of discharged ballast.

In spite of the impossibility of establishing in advance the repercussions of eventual actual damage, the vulnerability of traditional Amazonian communities, especially those that inhabit the surroundings of Vila do Conde Port, is enhanced due to their direct interaction with the river, causing the territoriality of these communities to be trespassed upon.

A redrafting of NORMAM 20 promoting efficient regulation, prioritizing the prevention of environmental impacts caused by ballast water, with requirements for verification of the veracity of information provided in ballast water forms and logbooks is required. This must be accompanied by implementation policies to provide the conditions necessary for promote for proper oversight by the maritime authority (human resources, training and equipment). These are essential conditions to mitigate and, as provided in BWM, eliminate the risks of ballast water pollution, while respecting the territoriality and dignity of traditional Amazonian communities.

The establishment of general national standards for the environmental management of ballast water, without prejudice (and with compliance of) the guidelines of good governance, is necessary.

As essential measures, we highlight the need for biodiversity surveys in sensitive regions, the mapping of socioenvironmentally sensitive regions, proper equipping of inspection agents, integrated action by the maritime authority, port authority, port administration, municipality, state, and local communities, ship crew and local community awareness-raising campaigns on the risks posed by ballast water, effective surveillance procedures capable of reducing and/or removing the possibility of fraudulent information being provided.

These technical measures would certainly greatly help the coexistence of navigation from Vila do Conde Port with the traditionally established communities that depend on the river.

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