

Article

Oil Spill in Brazil—Analysis of Vulnerabilities and Socio-Environmental Conflicts

Mariana Olívia Santana dos Santos ^{1,2,*}, Mariana Maciel Nepomuceno ^{1,3}, José Erivaldo Gonçalves ¹, Ana Catarina Leite Vêras Medeiros ¹, Rafaella Miranda Machado ¹, Caroline Pontes da Silva Santos ², Maria José Cremilda Ferreira Alves ¹, Aline do Monte Gurgel ¹ and Idê Gomes Dantas Gurgel ¹

¹ Oswaldo Cruz Foundation, Aggeu Magalhães Institute, Recife 50670-420, Pernambuco, Brazil

² Federal University of Pernambuco (UFPE) Life Sciences Center, Caruaru 55014-900, Pernambuco, Brazil

³ Pernambuco School of Health (FPS), Recife 51150-000, Pernambuco, Brazil

* Correspondence: mariana.santos@fiocruz.br

Abstract: The 2019 oil spill was considered the largest environmental disaster in the Brazilian Northeastern coast. It was associated with mostly ineffective government actions, thus intensifying historical vulnerabilities faced by local populations. We aimed to analyze the environmental conflicts and injustices and the socio-environmental, economic, and health vulnerabilities arising from the oil spill, considering the COVID-19 pandemic, impacting artisanal fishing communities of the Northeastern coast. A document-based, qualitative, cross-sectional research was carried out between September 2019 and October 2022, in open access secondary databases, and using field diaries from research of the Environmental Health and Work Laboratory (LASAT) of the Aggeu Magalhães Institute of the Oswaldo Cruz Foundation. The disaster caused situations of injustice and environmental conflicts that had negative repercussions in the territories with socioeconomic impacts, on the environment, and on the health of the population. The entire marine environment was affected, resulting in physical and chemical alterations. The health vulnerabilities faced by local people were intensified, influencing the social determination of the health–disease process. The local economy was extremely affected, generating job insecurity and several socio-cultural problems. It is essential to build environmental and health diagnoses for remedial measures in disasters such as the oil spill.

Keywords: oil spill; social and environmental conflicts; health and environment; disaster vulnerability; environmental impacts; chemical contamination



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1. Introduction

During the last days of August 2019 happened one of the largest events of environmental contamination with crude oil on the Brazilian coast. Until January 2020, more than 5300 tons of crude oil were collected in 11 Brazilian states: nine states in the Northeast, Rio de Janeiro, and Espírito Santo. A total of 130 coastal municipalities and more than 1000 localities were affected along 3400 km of the Brazilian coastline. Probably several more communities affected were not accounted for [1–5]. In subsequent years, there was a systematic record of oil debris collection in several Brazilian cities/states [6].

The large spill affected the entire marine ecosystem due to the contamination of ocean waters and the continental coast by oil that dispersed on beaches and estuarine regions, making it impossible to fish for crustaceans and other vertebrates used for the subsistence of communities in these territories. Among the various groups affected by the disaster, there were artisanal fishermen, who suffered the most direct consequences, because besides depending almost exclusively on the sea for survival, they experienced previous processes of social injustice and vulnerability in their territory [7–9].

The Brazilian Navy, following an investigation by the federal police, concluded that a Greek-flagged ship carrying the oil was to blame for the spill. Despite that conclusion, it can be said that the outcome is controversial and requires further reflection. It is important to consider other scientific hypotheses regarding the origin of the oil, as well as further investigation and due punishment of those responsible. This will allow reimbursement of public expenses, reparation

actions, to keep constant monitoring for the damage and risks caused to health, the environment, and socioeconomics, as there may be an unknown amount of oil submerged in marine and estuarine waters. These hidden amounts of oil may emerge, becoming a continuous threat to ecosystems and human life [10–13]. This is an active problem in the coastline of Brazil due to its location, long coastline, constant ship traffic on the route to Africa and Europe, and incentive for oil exploration and production. For those reasons, Brazil is one of the countries most susceptible to the environmental and socioeconomic impacts of pollution by this energy matrix [4].

In this disaster, we observed inertia and absence of the state in mitigating the damage caused by the oil spill, whose actions took 30 days to be initiated by the federal government, amplifying the socioeconomic impacts, and diminishing the possibility of creating strategies to confront the spill [4,8,12,13]. The context of production of necropolitics [14] installed in the Bolsonaro (non)government, through the dismantling of public policies that create mechanisms for environmental protection and health. The lack of those policies has promoted injustices and environmental racism against those affected by the disaster, mainly, by the artisanal fishing population that is formed by the majority of blacks and northeasters [8,15].

These territories have experienced processes of environmental injustices and conflicts, with the intensification of exploitative processes. The flexibilization of protective regulatory measures for vulnerable groups are added to an underprovided socio-health state infrastructure and a lack of political and organizational strength to react to the social metabolism of the globalized economy [16,17]. These multifactorial conditions of de-structuring make it difficult for these communities to get back on their feet by themselves in the face of these territorial reconfigurations, disasters, and environmental crimes resulting in more vulnerability and conflicts. These conflicts, in turn, are characterized when social groups have differing points of view regarding the use of territory and common goods that are motivated by a complex network of causes of social and technical nature. These causes emerge from the divergence of use of a given region and/or territory to the processes of social exclusion and use of common goods, such as water, and ecosystems (coast, mangrove, countryside), often in an asymmetric way [18].

Thus, it is necessary to investigate the particularities and the ways in which the intersections between individuals and the environment interact, and how they contribute to their livelihoods, especially in communities whose relationship is intrinsic to nature. This research may help to expand the understanding of reality and the impacts and damages suffered arising from economic and political models that do not respect life and nature [19,20]. Moreover, it is key to understand that these populations are exposed to other processes that occur synergistically in the territory and that affect the health and quality of life of these populations, such as the COVID-19 pandemic that amplifies and deepens this reality in their needs and vulnerabilities [21].

This article analyzes the environmental conflicts and injustices and the socio-environmental, economic, and health vulnerabilities arising from the oil spill, considering the context of the COVID-19 pandemic, in the artisanal fishing communities of the northeastern coast of Brazil.

2. Method

We conducted documentary research, using a cross-sectional qualitative approach to identify conflicts and environmental injustices and socio-environmental, economic and health vulnerabilities arising from the 2019 oil spill on the coast of the Brazilian Northeast. Added to this, we included the process of subsumption to the COVID-19 syndemic, intensifying and amplifying the process of vulnerability in the territories of artisanal fishing.

The Northeast Brazilian states (Alagoas, Bahia, Ceará, Maranhão, Paraíba, Pernambuco, Piauí, Rio Grande do Norte, and Sergipe) were considered as the study territory because they received the largest amounts of oil in their beaches, estuaries, and mangroves [9,22,23].

The documentary survey was conducted from September 2019 to October 2022 considering open access secondary data made available on line: Epidemiological bulletins, reports, reports, notes and institutional letters from the Ministry of Health, State Health Secretariats, Pernambuco State Environment Agency (CPRH in the Portuguese acronym); Pernambuco State Environment Secretariat (SEMAS in the Portuguese acronym); Brazilian Institute of Environment and Renewable Natural Resources (IBAMA in the Portuguese acronym); Brazilian

Navy; Joaquim Nabuco Foundation (FUNDAJ); Observatory of Coronavirus Impacts on Fishing Communities Group; Coletivo Intervozes—Brazilian Social Communication Collective and Fishermen's Pastoral Council (CPP in the Portuguese acronym); Articles from the largest state and national newspapers; Participatory mapping by the Virtual Institute for Sustainable Development—IVIDES.org and data from the Environmental Justice Atlas (EJAtlas) [9].

In addition, field diaries of research developed by the Laboratory for Health, Environment and Labor (LASAT in the Portuguese acronym) of the Aggeu Magalhães Institute/Oswaldo Cruz Foundation (IAM/FIOCRUZ).

The identified documents were collated in an electronic spread sheet database, and the data were categorized according to environmental conflicts and injustices and socio-environmental, economic and health vulnerabilities arising from the oil spill in artisanal fishing communities and the COVID-19 syndrome as a process of vulnerability in fishing territories.

The reading of all the material was carried out by two reviewers, both with experience in conflicts and environmental injustice. For the selection and application of the results, the methodology of the Global Environmental Justice Map (EJAtlas) and its categories were considered (Socio-Environmental, Economic, and Health Vulnerabilities). EJAtlas is a database on an international scale that includes information from the mapping of environmental conflicts around the world. These conflicts may involve several units in their analysis, such as the economic one, represented by mining projects, oil extraction and hydroelectric dams, which cause or may cause direct and/or indirect socio-environmental damage. The construction of this platform is based on the mapping prepared by students, researchers, activists, and local people who were directly affected [9,24].

3. Results and Discussions

3.1. Oil Spill in Artisanal Fishing Communities: Environmental Conflicts and Injustices and Socio-Environmental, Economic, and Health Vulnerabilities

The 2019 oil spill in Brazil is understood as a broad socio-environmental conflict, and was published in EJAtlas, classified as a medium intensity conflict that reverberated on the conditions of access to fisheries and visibility of damages by government authorities. The EJAtlas, is an international database that documents and catalogues social conflicts around environmental issues, coordinated by researchers from the Institute of Environmental Science and Technology at the Autonomous University of Barcelona (ICTA-UAB). This database gathers the collected data that is collaboratively entered into the online platform, allowing for comparative studies on the actors of these conflicts and their forms of mobilization, the companies involved, the intensity of the conflicts, as well as the factors that lead to failure or success in achieving environmental justice [16,24,25].

Thus, considering that the EJAtlas is a global map of socio-environmental conflicts that addresses the effects according to environmental, socioeconomic, and health impacts, the systematization of conflicts and injustices gives visibility to the spill and the population groups affected by the disaster. In turn, this will enable greater democratization of access to information and allowing articulation between institutions in order to improve the quality of life of those involved [9,25].

Another participatory monitoring tool created with the intention of increasing the visibility of the disaster and its impacts on the affected communities was the Participatory Map of Oil Pollution on the Coast of Brazil by the Virtual Institute for Sustainable Development [26], the information was provided by the inhabitants of the affected places and the points were mapped in a participatory manner. IVIDES works as a focal point for scientists, entrepreneurs, public managers, academics, among others interested in the exchange of information and support for sustainability projects.

This issue of greater democratization of access to information and visibility of the spill is very important. By analyzing the information in articles from major newspapers, we noticed new records of oil spills along the Brazilian coast. In June 2020, Pernambuco and Alagoas had already registered fragments on beaches. In August 2021, oil spills appeared in Fernando de Noronha. In January 2022, six beaches in Ceara registered oily trace marks. In August 2022, when the disaster completed three years since its beginning, new traces were found on beaches in the states of Pernambuco, Paraíba, Alagoas, Bahia, and Sergipe. In the month of August 2022, eight tons of solid blocks of oil were collected in Pernambuco. In

September 2022, in Aracaju (Sergipe), more than a ton had been removed from its beaches, and in Bahia, new spots appeared between September and October 2022. [27–32].

Despite these large effects, the publication “Silenced Voices: the coverage of the oil spill off the Brazilian coast” [33], which analyzed the approach of the main media outlets in Brazil about the oil spill, it was noted what they pointed out as important issues: the delay in disclosure and abrupt interruption of media coverage of the subject, and the invisibility of traditional peoples and communities, whether in vehicles of national or regional scope. This denial of the right to a voice on an issue that directly affects the lives of these people denies them the role of subjects of history and excludes them from participation in the public sphere.

Another process of socio-environmental injustice and vulnerabilities of this population concerns the fact that they live in the Northeast region, historically marked by processes of vulnerability and social inequities. Specifically, in the affected territories there are communities that depend socio-economically on the artisanal fishing activity. In the study conducted in 2020 by Joaquim Nabuco Foundation (FUNDAJ) with artisanal fishing workers exposed to the oil spill in the Northeast region, most of the interviewees were black and brown, with low education, and had fishing as a family and the main source of income generation and food security. These findings demonstrated the intense bond with the territory, the traditionality of fishing, and the dependence on the local ecosystem [3,4,12].

Regarding environmental issues, socio-ecosystemic changes were observed in the territories after the oil spill off the Brazilian coast in 2019, as a result of the contamination of aquatic environments, related to the production and reproduction of life in these communities. Turtles, shellfish, fish, algae, among other organisms were found with remnants of the oil and many fishermen/women reported the decrease of shellfish and fish in the affected regions. Environmental exposure to oil can trigger physiological changes that depend on the duration and geographic scale of exposure, the habitat diversity of the affected site, and increased sublethal effects [1,7,34–36]. Thus, these effects may be even more intense with the new traces of oil on the Brazilian coast, demonstrating that the problem is still active in these territories.

Studies warn about the possibility of environmental imbalance in locus, and also in regions relatively distant from the main point of contamination, which increases the attention in areas more sensitive to changes, such as mangrove regions. Benthic and mangrove regions are environments that are more susceptible to impacts, through the sedimentation of this material in coastal micro and macrofauna, amplifying along the chain the toxicity, genetic alterations, and other damages of the contamination [36,37]. Although toxicological tests conducted in the Baixo Jaguaribe region in the state of Ceará indicated non-significant damage to the genetic material of shellfish due to the influence of oil pollutants [38], a recent study pointed out the relationship between exposure from the 2019 oil spill and decreased growth rate of a type of microalgae of the zooxanthella species *Symbiodinium glynii*, mutualistically influencing the maintenance of corals, which may undergo bleaching processes [39].

Owing to its insertion in this construct, human health is directly affected by oil exposure and its repercussions on the environment which, observed in a complex and systemic way, infers a deep relationship between these dimensions. Focusing on the physiological aspects, studies conducted mainly after the 2010 Gulf of Mexico oil spill indicate that individuals exposed to oil can present severe, moderate, or mild physical and mental, genotoxic, and endocrine symptoms, whether acute or chronic. Among the clinical signs and symptoms are respiratory disorders, skin lesions, eye irritation, neurological effects, risk of cardiac events, body pain, genotoxicity, hormonal changes, psychological and neurovegetative symptoms, immune and endocrine system manifestations [37,40].

Acute intoxication related to the time of response to exposure is associated with symptoms such as nausea, vomiting, vision disorders, headache, mental confusion, dyspnea, pneumonia, coma and in severe cases, death. Regarding chronic intoxication, individuals can develop leukemia, lymphoma, bone marrow aplasia, anemia, lung cancer, skin cancer, among other negative consequences to human health [15,41–43]. Mental health becomes vulnerable from the destruction of the territory, which subsidizes the mechanisms and strategies for survival of the population affected by the spill. Besides the socioeconomic burden as a foundational factor in

this process, these communities live a symbiotic relationship with nature, which involves their culture and spirituality; therefore, resonating in all dimensions of life [37,44–46].

The information about the health repercussions of oil exposure in the disaster was, at the time, less significant than the proportion of the oil spill and the reports of people involved in the removal of the material who were unwell after contact with it. The vagueness in the arguments for compulsory notification, the delay in taking action and systematic organization for surveillance and monitoring actions with the state and municipal spheres of the most affected regions, the non-activation of the National Contingency Plan for Oil Pollution Incidents (PNC in the Portuguese acronym) may explain failures in the notification of poisoning cases of people exposed to oil, especially regarding people who were involved in the activities of cleaning or containment of oil from beaches, as well as helplessness to traditional communities exposed to risks and threats to their health [47,48]. This information indicates unpreparedness of the health system to act in the emergency context that the oil spill entailed [22], and this data is worrisome given that oil has continued to appear on the beaches of northeastern Brazil.

During an epidemiological survey conducted by Fiocruz-Pernambuco with artisanal fishing workers between September 2021 and August 2022, some acute effects of oil exposure were mentioned as a partial result in the interviews and recorded in the interviewers' field diaries, mainly by the people who worked as volunteers in the removal of this oil from the beaches. Among the symptoms mentioned by some were skin problems, burning eyes, nose, and throat, strong headaches, insomnia, and psychological and social problems, such as deep sadness, anxiety, fear and anguish, reflected in the perspectives regarding the future of fishing and shell fishing, especially regarding food insecurity and reduction in family income [35].

The local economy, deeply rooted in the products coming from this set of ecosystems [49], was extremely affected in the face of changes in the environment and the repercussions of the contamination of fish and shellfish. The populations of these territories were made materially and symbolically vulnerable, projecting losses in the impossibility of selling products and in the temporary impediment of the fishing work process, including for family consumption. Faced with the context of the worsening living conditions of this population, the State did not guarantee effective measures for the social protection of these people, since a very small portion of the population received some kind of financial assistance or basic support to face the losses. As a form of dissatisfaction, protests, public hearings, lawsuits, and collective demonstrations were held [8,15].

The oil spill and the welfare starvation reinforced a historical cycle of invisibilization, injustice, and environmental racism of vulnerable traditional peoples, whether by the State, the media, and/or other social sectors, characterized as a disregard for nature and an unbridled quest for the feedback coming from an oil-dependent system [8,33] (Intervozes 2020a, 2020b). The situations of poverty, precarious working conditions, and limited access to health and education are aggravating factors and part of the process of socio-environmental injustice, making it difficult to fight for compensatory mechanisms in the face of the storms of the world and of life. It is essential that reparatory measures be formulated for a long history of damage in various dimensions, as well as the political strengthening of socio-ecosystem protection for these peoples and their territories.

3.2. *The COVID-19 Syndemic as a Process of Vulnerabilization in Fishing Territories*

COVID-19 was considered a "syndemic" [50] to the extent that it was built upon pre-existing epidemiological conditions and social vulnerabilities, which acted synergistically, leading to different impacts among groups. Syndemias are understood to result from the synergistic interaction between two or more diseases or other health conditions in a given population, a situation that is amplified by social, environmental, or economic inequities [51,52].

With this understanding Bispo Júnior and Santos [21] expand the theoretical-methodological discussion and reinforce the understanding of SARS-COV as a syndemic strengthening the need to understand the influence of social inequalities on the pandemic, in the face of a global picture of fragilities of social systems, environmental and climate challenges and a global economic crisis. They underline the social origins and the need to understand the influence of

social inequalities on the pandemic that is evidenced in the high rates of infection and death among the most vulnerable social groups and worsening living conditions of this population.

SARS-COV 2 (COVID-19) impacts were overlapped by the oil spill, worsening the situation of traditional communities of artisanal fishermen due to social isolation, decreased income, food insecurity, illnesses, and deaths in the territories. It also potentiated the monetary burden caused by the oil spill, as a result of the sanitary recommendations for isolation, in some communities the fishermen were instructed not to fish in the first months of the pandemic as a biosecurity measure, and the beaches, their main point of sale, were part of the prohibited places for circulation or social agglomeration, resulting in the closure of trade, downsizing the living conditions in these communities [2,53,54].

The Fishermen's Pastoral Council (CPP), monitored the impacts of COVID-19 on fishing communities identifying that many water workers did not get emergency assistance during the period when the sale of fish and shellfish was reduced and still hampered by the oil disaster (The Brazilian government issued Provisional Measure 911/2019 for extraordinary credit of about U \$375, paid in two installments, for about 66,000 professional artisanal fishermen registered in the General Register of Fishing Activity and residing in the area affected by the environmental disaster. The amount will be available until May 2020. During the period of social isolation resulting from the COVID-19 pandemic, an Emergency Aid was decreed, instituting financial support for informal workers, individual micro-entrepreneurs, the self-employed, and the unemployed).

The "Observatory Group of the Impacts of the Coronavirus in Fishing Communities" was created in 2020, bringing together artisanal fishermen and fisherwomen, researchers, and activists from several regions in Brazil, with the objective of monitoring and collecting data on the pandemic's progress and impact on fishing communities. The information was built in a participative way by the workers from more than 115 fishing communities, from 17 states in the four regions of the country, through message sharing applications or online forms. In the group's last epidemiological bulletin, between March 2020 and February 2021, 1267 cases of COVID were reported, 683 (53.9%) of which were suspected, 360 (28.4%) confirmed but with no record of evolution, 37 (2.9%) deaths, and 187 (14.8%) cured [55].

These data show the need for an expanded look at the care for this population and for health surveillance, in order to consider the complexity of this reality. It is known that the health-illness process is imbricated in the historical and social processes experienced by individuals and their groups, considering the relationships built and the various dimensions that make up life and that happen simultaneously. Consequently, these relationships and their intersections shape the subjects, creating expectations and projections about themselves in the world, producing and reproducing the social determination of health, being necessary to analyze the uniqueness and the ways in which these communities interact with the environment, and how it contributes to their livelihood, knowing the territories, the context, their historical process and the communities, in order to understand the reality of impacts suffered by the oil spill, considering the process of subsumption into the COVID-19 syndrome [19,20].

4. Final Considerations

The lingering consequences produced by the lack of intervention by government agents and companies involved in the event denounces the invisibility given to environmental crimes that affect vulnerable territories occupied by traditional populations (indigenous, quilombolas (Quilombolas are traditional communities originated in the fugitive slaves, keeping African roots and traditions), artisanal fishermen, among others). The unfinished outcomes from the problems created by the spills are aggravating factors indicated by the resurgence of oil on the coast of Northeastern Brazil even after three years. It is further aggravated by reports from fishery workers about the consequences for the environment. The 2019 event is not isolated from previous spills that have happened on the Brazilian coast, although it stands out by the breadth of the geographic area affected and also by the amount of material. The damage is historicized by the recurrence of the government's lack of planning strategies to minimize the losses experienced by populations and the environment in the face of the risks of economic exploitation of the oil energy matrix.

Since the effects of the 2019 oil spill on the health of the affected individuals and communities go beyond acute symptoms resulting from exposure, an articulated and inter-sectoral response is fundamental in fostering public policies to minimize the repercussions of environmental disasters. Even though the social isolation imposed by the COVID-19 syndrome has hindered investigations during the times of the spill, it is evident that health and environmental diagnoses are necessary for the development of mitigating and restorative measures for the spill. There is a need to put in place management strategies to act more effectively and quickly in response to future spills. Moreover, it is urgent to prepare a health care network allied to a popular participatory surveillance in the communities, as well as social protection instruments that can be accessed in the face of the corrosion of the socioeconomic situation of the territories affected by events such as this.

The complex interrelation between environment, productive processes, health, and the dispute over common goods is deepening social and health inequities. The global scenario of scarcity of energy sources to meet the growing demand of economic development processes is followed by the consequent massive exploitation of the natural resources still available in the territories, which are also home to vulnerable peoples and communities. In order to safeguard them, as well as the territory itself and its biodiversity, it is necessary to have emergency and coordinated action among public institutions and competent agencies to establish protective and mitigating mechanisms against future accidents, crimes, disasters and other environmental problems that may worsen the problems already impacting these populations.

The publication of conflicts and injustices on platforms such as EJAAtlas can be understood not only as an isolated event, but as processes that bring together different conflicts and their interrelationships, enabling a worldwide articulation between institutions interested in social well-being. As well as giving light to the invisibilities resulting from environmental racism experienced by different populations, effectively expanding access to information on the international level of these conflicts.

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