



Review on microplastic studies in Brazilian aquatic ecosystems

Rebeca Oliveira Castro^a, Melanie Lopes da Silva^{a,*}, Fábio Vieira de Araújo^b

^a Universidade Federal Fluminense, Niterói, Brazil

^b Faculdade de Formação de Professores – Universidade do Estado do Rio de Janeiro, Brazil



ARTICLE INFO

Keywords:

Brazil
Marine ecosystems
Marine pollution
Pellets
Rivers

ABSTRACT

The microplastic studies in the world is increasing, reflecting concern about its effects on the ecosystem. The same happened in Brazil, especially in the last six years, but few places were monitored. Thus, a literature review was conducted to collect data on microplastic pollution in Brazilian aquatic ecosystems, analyzing this pollutant in samples of sandy sediments, plankton and other invertebrates and vertebrates. As results, we highlight the following points: 56% of the studies were published in the Journal Marine Pollution Bulletin; collaborative and independent studies presented the same number; the Brazilian Northeast and Southeast were the most studied areas; the investigation of microplastics associated with biota was highlighted (46% of studies); only one study was conducted in a freshwater environment. Based on this review, we identified the subjects that would be more studied in researches in the Brazilian environment about microplastics. The monitoring of microplastics must be continuous to verify the impacts of this material and extend the understanding of this problem.

1. Introduction

The presence of plastic waste in coastal and marine environments reflects the increasing in consumption of this material and the inability to properly manage these residues (Mason et al., 2016; Au et al., 2017). Resistance to degradation by microorganisms makes plastic waste persist in the environment (Yoshida, 2016). In addition, consumption and disposal rates suggest that the amount of these pollutants in the aquatic environment will continue to increase in the coming years (Au et al., 2017). Although plastic pollution in marine environment has been a scientific and social concern for 60 years, recently this concern has increased (Costa and Barletta, 2015) due to the great amount of plastic particles with small size found in the environment. Plastic waste is not biodegradable but rather “photodegradable”, breaking down into smaller sizes due to the action of solar radiation (Watson, 2001). These small particles, called microplastics, are particles smaller than 5 mm. The definition of potential sources are already well defined by the scientific community that classifies them as primary and secondary sources (Andrady, 2011; Cole et al., 2011; Hidalgo-Ruz et al., 2012; Duis and Coors, 2016). Sources primary is when are purposefully manufactured in these dimensions for industrial application as granules pellets and abrasive microspheres used in cleaning and hygiene products; and secondary, when are formed through the rupture of synthetic clothing and other larger plastic parts (IMO, 2015). These plastics particles are ubiquitous, being described in several places of the world

(Thompson et al., 2004; Van Cauwenberghe et al., 2015), as for example in the water column (Wang et al., 2017a), in marine sediments and beaches (Alomar et al., 2016; Ballent et al., 2016; Retama et al., 2016) in waste water effluents (Gallagher et al., 2016; Napper and Thompson, 2016) and Artic polar ice (Obbard et al., 2014) and water (Lusher et al., 2015a). Due to their small size, they become available to several representatives of the marine biota, and can be ingested by planktonic organisms and even whales (Cole et al., 2013; Lusher et al., 2015a; b; Ferreira et al., 2016; Auta et al., 2017). This ingestion can cause pathological stresses such as false satiety, block enzyme production, reproductive complications, reduction in growth rate and oxidative stress (Sutton et al., 2016; Fossi et al., 2016). Beside this, microplastics can serve as substrate for biofilm formation on their surface; that may include pathogens such as *Arcobacter* spp. and *Vibrio* spp. (Harrison et al., 2014), besides adsorbing toxic substances present in water, which can be accumulated and transferred in the food chain (Reisser et al., 2014).

These problems have caused a rapid and exponential increase in the number of scientific publications that study microplastics in the oceans in the last decades (Barboza and Gimenez, 2015; GESAMP, 2015), and several critical reviews have been made around the world (Wright et al., 2013; Ivar do Sul and Costa, 2014; Barboza and Gimenez, 2015; Li et al., 2016). Recently, the literature has focused on specific environments (Costa and Barletta, 2015; Anderson et al., 2016) as sediments (Besley et al., 2017), freshwater environments (Eerkes-Medrano

* Corresponding author.

E-mail address: melaniels_1@hotmail.com (M.L.d. Silva).

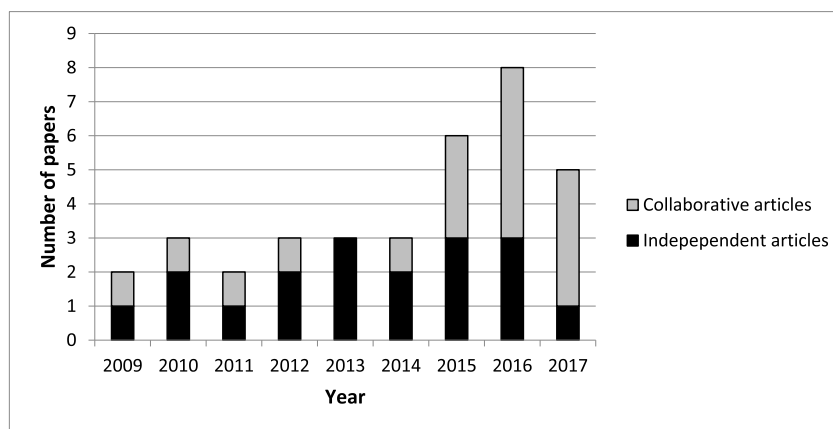


Fig. 1. Number of papers on microplastics published in Brazilian ecosystems in an independent and collaborative way (n = 35).

et al., 2015; Horton et al., 2017), and in methodologies and analysis challenges (Wesch et al., 2016). The present review aimed to gather and analyze the scientific articles that investigated microplastics in Brazilian ecosystems, in order to have an overview of the state of the art of studies on microplastics in Brazil, identifying possible gaps in this knowledge, in order to direct future research on the subject in the country.

2. Methodology

The review was conducted in October 2017 through a bibliographical research in several databases such as PubMed, ISI Web of Science and Capes scientific works platform. Keywords like “microplastic”, “pellets”, “Brazil”, “marine pollution”, “rivers” were used to retrieve valid data records in the database. In this review, technical reports, course monographs, dissertations, academic theses, abstracts of symposia and congresses that deal with this topic were not considered. All the articles about microplastic in Brazil available until October 2017 were selected based on the relevance of the information for the construction of this review. Studies that presented results about microplastics despite the main focus be macroplastics were also selected. The research allowed the construction of a database with the references on the researches carried out in Brazil since 2009, when the first scientific publications related to the subject studied appeared. Based on Barboza and Gimenez (2015), we sought to answer the following questions: (I) how has the scientific research on microplastics evolved in Brazil in recent years?; (II) In which journals were these studies published?; (III) what were the main axes of microplastic surveys? (IV) which points in Brazil were studied? (V) of which part of the country are researchers working in this area?; (VI) which are the educational and research institutes involved; (VII) are there collaborative networks among research institutions?; and (VIII) what are the main knowledge gaps to inform and guide future work? (Barboza and Gimenez, 2015).

3. Results and discussion

Brazil, which has an extensive coastal area, also suffers this problem. The first study on microplastics in Brazil was reported in the 1970s (Gomes, 1973) dealing with the presence of pellets on the coast of Rio Grande do Sul, related to offshore cleaning by ships. Pianowski (1997), Pianowski et al. (1997) and Ivar do Sul et al. (2014a) reported the presence of pellets on beaches analyzed throughout the year. However, although we mention these studies and consider them extremely important, as well as others focusing on microplastics in the Brazilian ecosystem, they were not counted as data in the present review because they are completion papers or annals of symposia and congresses.

3.1. Number of researches on microplastics in Brazil

Due to the increase in the number of publications in high-impact scientific journals, it is a common mistake to assume that microplastics in the marine environment is a recent issue. The research began in the 1970s with marine pollution from pellets, primary plastics (Carpenter et al., 1972; Gregory, 1977, 1978), evolving several other reports about various types of microplastics that came from degradation of different plastic objects, that is secondary sources (Costa and Barletta, 2015). In Brazil the scientific articles dealing with the plastic fragments with dimensions ≤ 5 mm were published since 2009 (Colabuono et al., 2009; Ivar do Sul et al., 2009). Ivar do Sul and Costa (2014) reviewed 101 articles and observed that more than 80% of them were published in the last sixteen years, with more than 60% of these articles published in the last six years (Ivar do Sul and Costa, 2014).

In Brazil, we retrieved 35 articles about microplastics. This represent 8.4% of the total published in the world in the same period. An increase in publications in Brazil occurred in 2015, and may be a reflection of the progress of publications on microplastics in 2013 in the global scenario (Barboza and Gimenez, 2015). However, there was also an increase in the number of publications in 2016. Although there was an expectation of the growth of studies that investigate microplastics in Brazilian ecosystems, until the end of the third quarter of 2017, the increase in publications on the subject did not follow previous growth patterns (Fig. 1).

The decrease in the number of publications observed in 2017 probably is a reflection of the Brazilian political crisis of 2013 that triggered an economic crisis, intensified after 2015, and a social crisis that was exposed in manifestations that occurred between 2013 and 2016 (Martins Junior et al., 2016). In the area of science and technological innovation, the crisis reverberated internationally, since many researches were interrupted due to a budget cut that was already insufficient before it occurred (Carneiro, 2017). According to Luiz Davidovich, president of the Brazilian Academy of Sciences (ABC) in a BBC Brazil interview in July 2017, “in 2013 there was a peak in the budget, but since then there have been successive cuts”. The 44% cut in the budget for 2017 was from R\$ 5.8 billion to R\$ 3.2 billion. This crisis is bringing Brazilians scientific production to a “terminal state” and “will penalize Brazil for decades,” says the president of ABC (Carneiro, 2017).

3.2. Distribution of educational institutes and collaborative research network

Twenty-nine institutions were cited in the analysis of the 35 papers published on microplastic studies in Brazil, with researchers from different Brazilian states. The main flagship institutions of microplastic research in Brazil are the University of São Paulo, present in 14 articles

Download English Version:

<https://daneshyari.com/en/article/11007293>

Download Persian Version:

<https://daneshyari.com/article/11007293>

[Daneshyari.com](https://daneshyari.com)