# MARINE GARBAGE: AN ANALYSIS OF TECHNICAL DOCUMENTS FROM THE SCIENCE, TECHNOLOGY AND SOCIETY PERSPECTIVE

*MARINE LITTER: AN ANALYSIS OF TECHNICAL DOCUMENTS UNDER THE SCIENCE, TECHNOLOGY AND SOCIETY PERSPECTIVE*

Ellen Joana Nunes Santos Cunha[[1]](#footnote-1)

Allan Paul Krelling[[2]](#footnote-2)

**Summary:**This study aims to understand whether in the technical documents related to the theme of Garbage in the Sea, there is a presence of Traditions in CTS studies - European, North American and Latin American Thought. The theoretical contribution was based on the technical documents on litter at sea and on the theoreticians of the CTS studies. The method used was Content Analysis, using the Atlas.ti software, Version 7.5. The analysis took place in nine technical documents that were observed in chronological order, for the historical sequencing of the proposed activities. The results showed that the triad science, technology and society and their traditions are identified, through conceptual discussions about scientific theories and social consequences of technological innovations. Presenting influence on the way of life of citizens and institutions. In addition to the dialogue for the construction of actions to combat garbage at sea, establishing exchanges between developed and developing countries. It is concluded that the CTS approach, represented by its traditions, is present in the context and in the writing of the analyzed documents and that the traditions can appear in an isolated or associated way, indicating that the discussions about Garbage in the Sea are broad, diversified and that deals with a global problem.

**Key words**: Garbage in the sea. CTS Studies. Oceans and Seas.

**Abstract:**Thisstudy aims to understand if in the technical documents related to the theme of Garbage at Sea, there is the presence of Traditions in studies STS - European, North American and Latin American Thought. The theoretical basis was based on the technical documents about trash at sea and on the STS studies theorists. The method used was Content Analysis using Atlas.ti software, Version 7.5. The analysis took place in nine technical documents that were observed in chronological order, for the historical sequencing of the proposed activities. The results showed that Garbage at Sea is a cross-border issue of global concern. In this context the triad science, technology and society and their traditions are identified, through conceptual discussions on scientific theories, social consequences of technological innovations, influence on the way of life of citizens and institutions, and dialogue for the construction of actions. combat waste at sea by establishing trade between developed and developing countries. It is concluded that the STS approach, represented by its traditions, is present in the context and in the writing of the analyzed, that the traditions may appear in isolation or in association, indicating that the discussions about Garbage at Sea are wide, diverse and it is a worldwide problem. In summary, it is believed that discussions about Waste at Sea tend to advance much more globally and nationally, and the STS perspective has much to contribute to the academic solutions and discussions of the topic. combat waste at sea by establishing trade between developed and developing countries. It is concluded that the STS approach, represented by its traditions, is present in the context and in the writing of the analyzed, that the traditions may appear in isolation or in association, indicating that the discussions about Garbage at Sea are wide, diverse and it is a worldwide problem. In summary, it is believed that discussions about Waste at Sea tend to advance much more globally and nationally, and the STS perspective has much to contribute to the academic solutions and discussions of the topic. combat waste at sea by establishing trade between developed and developing countries. It is concluded that the STS approach, represented by its traditions, is present in the context and in the writing of the analyzed, that the traditions may appear in isolation or in association, indicating that the discussions about Garbage at Sea are wide, diverse and it is a worldwide problem. In summary, it is believed that discussions about Waste at Sea tend to advance much more globally and nationally, and the STS perspective has much to contribute to the academic solutions and discussions of the topic. indicating that the discussions about Garbage at Sea are wide, diverse and it is a worldwide problem. In summary, it is believed that discussions about Waste at Sea tend to advance much more globally and nationally, and the STS perspective has much to contribute to the academic solutions and discussions of the topic. indicating that the discussions about Garbage at Sea are wide, diverse and it is a worldwide problem. In summary, it is believed that discussions about Waste at Sea tend to advance much more globally and nationally, and the STS perspective has much to contribute to the academic solutions and discussions of the topic.

**Keywords:**Marine debris. STS Studies. Oceans and Seas.

1. INTRODUCTION

Garbage at sea is considered one of the main forms of ocean pollution. Garbage, more precisely called solid waste, corresponds to all material from the daily activities of society (MOTA et al, 2006). Unfortunately, many people maintain the false idea that the oceans have unlimited capacity to assimilate, without risk, the immense and continuous contribution of this garbage and other pollutants (ARAÚJO, COSTA, 2010).

The European Environment Agency (2014) highlights litter at sea as a worldwide problemand cross-border reach, since when it reaches the sea, it belongs to no one (VINCE, HARDESTY, 2018). When at sea, its management becomes difficult and very dependent on the existence of good regional and international collaboration.(HONOLULU STRATEGY, 2011). However, solid waste management on land and at sea often depends on agreements between nations, on the transfer of technological knowledge and even on financial support between the entities involved.

From the environmental point of view, especially related to the issue of garbage at sea, solutions are commonly based on various reports and/or international agreements signed at congresses, technical meetings and symposia. These products arise from social and cultural-historical demands, which highlights the importance of the influence of social aspects on science and technology.

It is understood, therefore, that these documents serve as guidelines for the generation of scientific and technological products to face the problem of marine litter. On the other hand, the scientific-technological development related to the topic has consequences for society and the environment (SILVA et al., 2014) and also ends up influencing the creation of new documents..

This relationship presents an adherence between Science Technology and Society, demonstrating a guiding thread (KAHLAU, et al, 2019), which exerts a reciprocal influence between them. And for this understanding, it is necessary to adopt an integrative approach, as proposed by studies in Science, Technology and Society - CTS (CHRISPINO, 2017). This field of study also aims to contribute to the development and consolidation of egalitarian attitudes and practices on issues of social importance related to technological innovation or environmental intervention (PINHEIRO, SILVEIRA, BAZZO, 2007), promoting a diversity of perspectives on the problem in question.

Bazzo et al (2003) highlights the existence of three typologies of STS thought, two of which are known as Traditions: European and North American, and finally Latin American thought. The European tradition is a way of analyzing how the diversity of social factors influences scientific-technological change. This tradition investigates, in an academic way, the influence of social factors on the development of S&T in society, totally based on the investigation of the creation of technological artifacts through social processes, making criticisms related to technological determinism (a type of reductionism,(CANDÉO, 2013). Once this tradition is presented as a social process, emphasizing a variety of non-epistemic values ​​(political, economic, ideological – “social context”) in explaining the origin, variation and legitimacy of scientific theories (PALACIOS et al, 2003).

The North American Tradition, on the other hand, defends citizen participation in decisions that permeate S&T and highlights the consequences that scientific and technological development causes to society and the environment. Cerezo et al (2002) indicate three arguments for public participation in the scientific and technological context: the instrumental argument, which defends public participation as the best guarantee to avoid mistrust and resistance; the normative argument, in which citizens are the best judges and defenders of their own interests; and the substantive argument, which considers laymen's positions as valid as those of experts. In this tradition, it is believed that technology is a product capable of influencing society..

Thus, the North American Tradition led by academics, critics and writers emerged during a period of social upheaval in the United States as a response to the sociocultural inactivity of the 1950s. These actors began to question the beneficial properties of science and technology, the which was considered a consensus after the Second World War (LÜCKEMEYER, CASAGRANDE, 2010).

In the following decades, the 1960s and 1970s, the Latin American Thought in Science, Technology and Society - PLACTS emerged, representing an autonomous current of thought that originated in Latin America. It was written by scientists, engineers and mathematicians who were looking for other ways and tools to develop scientific and technological knowledge in the region of the Latin American continent (LINSINGEN, 2007). Different from the European and North American traditions, according to Chrispino (2017), some authors such as Vaccarezza (2002), Dagnino, Thomas & Davyt (2003) and Kreimer & Thomas (2004) the Latin American Thought in STS (PLACTS), with roots in the sociopolitical scenario of the period, part of a reflexive approach, with a strong influence of the peculiar local aspects that do not allow the homogenization of cultures,(LÜCKEMEYER and CASAGRANDE, 2010).

Research carried out in different parts of the world, including Brazil, shows that the dominant composition of Garbage in the Sea is plastic (SANTANA, 2009; SANTOS, 2009; ARAÚJO, 2003). The origins of these residues are the most diverse, such as tourism activities, drainage networks, fishing activities and disposal by boats, which are directly linked to the pollution of seas and oceans (TOURINHO, 2007; IVAR DO SUL, 2005; PIANOWSKI, 1997). Demonstrating that society's consumption behavior interferes in these environments, and this consumption pattern has a strong association between Science, Technology and Society.

Therefore, it is possible that the different traditions of CTS studies are intrinsically present in the content of these documents that serve as a guideline for actions and solutions to combat garbage at sea. Therefore, it is necessary that the investigation of the presence of the CTS types of thinking be carried out. With this, the general objective of this research is to understand if in the technical documents related to the theme of garbage at sea there is the presence of Traditions in European, North American and Latin American Thought studies.

**2. METHODOLOGY**

Nine technical documents were chosen in the area of ​​environmental impact, with specificity in the theme Garbage in the Sea (Table 2), in the temporal space between the 1970s and 2010s, documents that presented developments on how to deal with the problem in question, in the sphere government agencies in different regions of the world. These documents were evaluated forverification of the existence of Traditions in CTS Studies (European, North American) and Latin American Thought on CTS (PLACTS) in its contents.

OIn chronological order, the technical documents were analyzed using the Content Analysis (CA) technique, which is a research method used for the analysis and interpretation of texts, with emphasis on the contextual meaning or content of the text. Silva and Fossá (2015) summarize the content analysis method in the following phases:

1. General reading of the material collected (9 documents);
2. Coding to formulate analysis categories, using the theoretical framework and the indications provided by the general reading (Table 1);
3. Clipping of the material, in comparable recording units (words, sentences, paragraphs) and with the same semantic content (Table 2), for this study, the recording unit was the purposes of each document;
4. Establishment of categories that differ, thematically, in the registration units (transfer from raw data to organized data), in this case the categories were Traditions in CTS Studies;
5. Grouping of registration units into common categories (Table 2);
6. Inference and interpretation, supported by the theoretical framework.

The Content Analysis technique was used to identify traditions in European, North American and/or Latin American thought STS studies in the texts of these documents.

For the occurrence of words, in each analyzed document, Atlas.ti software, Version 7.5 was used. Words with the highest occurrence were considered those that had more than twenty times their presence in the document, this amount served as a limiting factor for the result parameter. These highlights made it possible to verify the existence or not of STS approaches in the technical documents.

For a summary analysis, Table 1 presents the Typology of European, North American and Latin American CTS Traditions. The typologies of Traditions in CTS Studies are alternatives for understanding the triad science, technology and society and their biases. For the European Tradition in CTS Studies the term used for the analysis was the “social dimension antecedent to scientific and technological developments”, for the North American Tradition in CTS Studies the term used was the “social consequences of technological innovations” and for the Latin American in CTS the term was “interdisciplinary, dialogic studies constructed through the different expositions”.

Table1- Analysis Category - Typology of Traditions in CTS Studies

|  |  |
| --- | --- |
| **TRADITION** | **DESCRIPTION** |
| **EUROPEAN** | Emphasis on the social dimension antecedent to scientific and technological developments, highlighting the diversity of economic, political and cultural factors that participate in the genesis and acceptance of scientific theories. |
| **NORTH-AMERICAN** | Emphasis on addressing the social consequences of technological innovations and the influences on the way of life of citizens and institutions. |
| **LATIN-AMERICAN** | The main features are interdisciplinary, dialogic studies built through different exposures and points of view on Latin American underdevelopment. |

Source: Adapted from CHRISPINO (2017), SILVA (2015) and CACHAPUZ et al (2008).

**3. RESULTS AND DISCUSSION**

This study allowed the perception of considerable time gaps in relation to the discussion and production of technical documents on Garbage at Sea, such as, for example, the more than twenty years between MARPOL in 1973 and GPA in 2001. it took seven years for the topic of Garbage in the Sea to be discussed again in the European Environment Directive of 2008. Then comes the Honolulu Strategy in 2011 and from that point on, discussions and technical productions began to be less interspersed.

The nine technical documents analyzed covered laws, treaties, action plans, strategies, commitments, as well as the involvement of different actors and nations in the registered initiatives. THETable 2 presents the Registration Units, corresponding to the smallest segment of content to be categorized, of each document evaluated.

Table 2 – Registration Units of the technical documents evaluated in this work.

|  |  |  |  |
| --- | --- | --- | --- |
| No. | DOCUMENT | YEAR | REGISTRATION UNIT |
| 1 | Marpol 73/78 - Annex 5 | 1973 | International environmental regulation of dumping at sea. |
| two | GPA – Global Action Program for the Protection of the Marine Environment against Land-Based Activities | 2001 | Global action to protect and preserve the marine environment. |
| 3 | European Directive for the Environment | 2008 | Public policy action on the European continent. |
| 4 | Honolulu Strategy | 2011 | Basic strategy for the deployment of Action Plans to combat litter at sea. |
| 5 | Declaration of Manilla | 2012 | Global action to encourage other nations to commit to the theme. |
| 6 | GPML – Global Partnership on Marine Litter | 2012 | Global action to reduce and manage marine litter, protect human health and the global environment. |
| 7 | Oceans Conference | 2017 | Moment in which the UN member states made a real commitment to solutions to pollution in the oceans and seas. |
| 8 | Report of the European Union Meeting | 2017 | Record of existing Action Plans to combat litter at sea. |
| 9 | PAF ZC 2017/2019 - Federal Action Plan for the Coastal Zone (Brazil) | 2017 | Document that internalizes in the Brazilian government the voluntary commitment to develop the PNCLM. |

Source: The authors

In Table 3, the documents are ordered in chronological sequence, with the five most frequent words in their writing. This result was reached after processing the data in the Atlas.ti software, Version 7.5, where a pattern of words was found among the analyzed documents. These are: sea (ocean, marine or marine water), garbage, action, management and implementation. These words are recurrent in most documents, it is worth mentioning that in addition to having full adherence to the issue of Garbage at Sea, they also represent “actions” that connote a connection with the Tradition in North American CTS studies that emphasizes the approach of social consequences. technological innovations and influences on the way of life of citizens and institutions.

Table 3 - Most frequent words in technical documents

|  |  |  |
| --- | --- | --- |
| DOCUMENT | YEAR | WORDS OF MOST OCCURRENCE |
| Marpol (Annex 5) | 1973 | **trash**,**sea**, ship, area, rule |
| GPA | 2001 | **Implementation**, pollution, action,**marine**, residual waters |
| European Directive for the Environment | 2008 | member states, measures,**aquamarine**, region, environmental |
| Honolulu Strategy | 2011 | waste,**sea**, to develop,**management**, trash |
| Declaration of Manilla | 2012 | **marine**, global, environment, program,**action** |
| GPML | 2012 | partners, regional,**marine**, global,**trash** |
| Oceans Conference | 2017 | development,**ocean**, sustainable,**Implementation**, countries |
| Report of the European Union Meeting | 2017 | **marine**,**trash**, environment, waste |
| PAF ZC 2017/2019 | 2017 | **action**, indicator,**Implementation**, plan,**management** |

Source: The authors

Based on the CA method, the presence of the CTS perspective represented by its traditions was identified in the technical documents related to Garbage at Sea (see Table 4), highlighting a field of study that seeks to understand the relationship between CTS and the Environment . The documents analyzed come from different parts of the world with the participation of several representatives. These documents serve as a theoretical basis for the construction of action plans to combat litter at sea and for scientific research around the world.

It is noticed that the Tradition in North American CTS studies is predominant in most of the documents analyzed, with only the exception of the Report of the Meeting of the European Union (2017), which is a document recording the Action Plans to combat waste existing sea.

Table 4 - Traditions in CTS Studies

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| DOCUMENT | YEAR | YOU | TNA | PLA |
| Marpol (Annex 5) | 1973 |  | X |  |
| GPA | 2001 | X | X |  |
| European Directive for the Environment | 2008 |  | X |  |
| Honolulu Strategy | 2011 | X | X | X |
| Declaration of Manilla | 2012 |  | X |  |
| GPML | 2012 | X | X |  |
| Oceans Conference | 2017 |  | X | X |
| Report of the European Union Meeting | 2017 | X |  |  |
| PAF ZC 2017/2019 - | 2017 |  | X |  |

Subtitle:TE-European Tradition, TNA-North American Tradition and PLA-Latin American Thought

Source: The authors

Another pattern observed is that only the Honolulu Strategy (2011) presents its adherent bias with the Traditions in European, North American STS studies and with the Latin American Thought in STS. Since this document is anbasic strategy for the deployment of Action Plans to combat garbage at sea, where perceiving the antecedent context, the consequences, impacts on people's lives and the specificities of each region, were necessary for the construction of this document, thus transiting in the approach of CTS studies.

It is noticed that of the nine documents analyzed, eight of them highlight the North American Tradition, showing that the content of these documents recommend actions that interfere in the way of life of people and institutions, and as one of the solutions highlighted for these documents, are the construction of public policies in favor of the fight against Garbage at Sea.

The European Tradition stands out in four documents, which emphasize the emphasis on scientific evaluations, valuing the scientific depth of the theme.

On the other hand, Latin American Thought stands out in only two documents, which recognize the specificities of developing countries and the need for dialogue and financial and technological assistance for future solutions on the subject. It is noteworthy in this study that the Honolulu Strategy (2011) presents the three types of discussions in CTS studies, since this document has a strong bias in actions (TNA) to combat Garbage at Sea, it does not fail to highlight the need for scientific studies (TE) and the need for technology transfer and financial resources to developing countries (PLACTS). These findings lead us to understand that this document includes the CTS discussions, when given with localized emphases.

The European Union Report presents the European Tradition in isolation, this document was concerned to highlight the scientific studies that nation-states have been developing over the years on Garbage at Sea, as it is a report, this may have favored the European Tradition to have stood out.

Latin American Thought stands out in only two documents, the Honolulu Strategy and the Oceans Conference, not in isolation, but in conjunction with European and North American traditions. It is worth noting that all documents recognize and indicate the increase in litter at sea as a global problem.

And for each technical document, a brief history of its emergence was carried out, the analysis of adherence to Traditions and Thought in CTS studies and the occurrence of words.

**3..1 Marpol 73/78 - Annex 5**

The 1960s and 1970s were the scene of the biggest oil spills of the century. There have been several ecological disasters that have instigated different nations to discuss and build international regulations regarding the marine environment. One of the major disasters of this period was the grounding of the oil tanker Torrey Canyon on May 13, 1967 in the English Channel, projecting one hundred thousand tons of crude oil into the sea, polluting the French, Belgian and British coasts, in the extension of tens of kilometers (MARTINS, 2008).

Over time, some international groups began to think about regulations for the disposal of waste in the oceans. In 1973, the first international document of an environmental nature appeared, the International Convention for the Prevention of Pollution from Ships, currently called MARPOL 73/78 (short for “Marine Pollution”). 1978. It has six annexes and, among them, Annex 5 deals specifically with the Regulation for Disposal of Garbage from Ships, being considered the main environmental regulation document to emerge, until that moment, internationally related to Garbage at Sea.

According to the Brazilian CCA-IMO (Coordinating Committee on Affairs of the International Maritime Organization) the purpose of MARPOL 73/78 is “to establish rules for the complete elimination of intentional pollution of the environment by oil and other harmful substances from ships, as well as as the minimization of accidental discharge of those substances into the air and the marine environment.”

This document is in line with the North American Tradition, as it has a strong influence on the way the institutions responsible for vessels act, establishing rules for the disposal of generated waste, for example, as in the section of Marpol 73/78 in its Annex 5, in Rule 8, where it provides for port State control over operational requirements.

Annex 5, in word occurrence analysis, as part of the AC of this document, presents 5 highlighted words, namely: Garbage, Sea, Ship, Area, Rule, respectively in that order of occurrence. These words refer us to the idea of ​​a regulatory document that interferes in the way of acting of institutions that use vessels as a means of transport, validating the idea of ​​Tradition in North American CTS studies.

**3.2. GPA – Global Action Program for the Protection of the Marine Environment against Land-Based Activities**

In 1995, the UN (United Nations), due to the accelerated degradation of the oceans and coastal areas, creates the GPA - Global Action Program for the Protection of the Marine Environment against Land-based Activities, with the objective of protecting and preserving the environment. marine environment, as well as helping nations to fulfill the obligations necessary for these actions. The GPA is considered the first global initiative that addresses the relationship between terrestrial, coastal and marine environments. The objectives of the GPA are: 1) to identify the origin and impacts of marine pollution sources from the terrestrial surface; 2) identify priority problems to carry out actions; 3) establish managerial objectives for priority problems; 4) Identify, evaluate and select strategies and measures to achieve the objectives;

The GPA is aligned with the Sustainable Development Goals: Goal 12 – Sustainable Consumption and Production, Goal 13 – Climate Action and Goal 14 – Life under water (UN, 1995).

This document promotes space for actions, strategies and evaluation of scientific results of impact of terrestrial activities in the marine environment, demonstrating a convergence for two traditions in CTS studies: the North American Tradition, since these actions interfere on the way of life of the citizens and institutions and for European Tradition, when emphasis is placed on scientific assessments of the impact of terrestrial activities on the marine environment, recognizing the diversity of factors that the topic requires.

The GPA in word occurrence analysis, as part of the AC of this document, presents 5 highlighted words, namely: Implementation, Pollution, Action, Marine, Wastewater, respectively in that order of occurrence, ratifying the presence of Traditions in CTS Studies : European and North American. The words Implementation and Action refer to the way and place of strategy, expressing the North American Tradition, while the words Pollution, Marine and Wastewater, demonstrate the diversity of factors that participate in the genesis, indicating the European Tradition.

**3. 3. European Directive for the Environment**

In the economic bloc of the European Union (EU), in 2008, the European Directive for the Environment appears, specifically Directive 2008/56/EC of the European Parliament and of the Council of June 17, 2008, which establishes a framework for community action in the domain of marine policy.

The European continent has always established a strong and continuous relationship with seas and oceans. Based on the local geography, many EU member-nations have borders with seas and oceans, which leads to the reason for discussions and actions on policies on the seas and oceans in this specific block. The directive has in its structure the protection of the marine environment as its object, its application will be in all marine waters considering the transboundary effects that the marine environment presents. It is a technical document with enough breadth and scope, making it feasible, and proposing the presence of garbage in the sea as an indicator of environmental quality.

This document presents convergence to the Tradition in North American CTS studies, when it brings in its context a policy for the marine environment, recognizing the need for action on the part of those involved.

The European Directive for the Environment, in word occurrence analysis, as part of the CA of this document, presents 5 highlighted words, namely: Member States, Measures, Marine Water, Region and Environmental, respectively in that order of occurrence. These words represent actions and impacts on the way of life of citizens, institutions and the marine environment, they are actions through policies and the involvement of the most diverse nation-states confirming the presence of the Tradition in North American CTS Studies.

**3.4 Honolulu Strategy**

In 2011, the 5th International Conference on Marine Litter took place in the municipality of Honolulu, Hawaii, from which the Honolulu Strategy emerged. This document brings in its wording the term “marine litter” with greater specificity, it is the first technical document to focus exclusively on litter at sea.

The Honolulu Strategy also designates the importance of other technical documents necessary to combat marine litter efficiently and effectively, such as MARPOL 73/78, Regional Marine Conventions, Action Plans and other mechanisms to combat this type of pollution. It is the first technical document that presents in its essence the harmonization between the most diverse technical documents generated by several nations, in which it is understood that the seas and oceans are transboundary and their conservation and management are the responsibility of all Nations and human beings.

This document presents the three types of thinking in STS studies: the European and North American traditions; and Latin American Thought. The European tradition stands out in the section where it indicates that there is a need for scientific research to understand the origins, destinations and impacts that litter at sea causes on the marine environment and thus promote the search for feasible solutions for the issue in question.

The North American Tradition stands out in the passage where it brings, the needs for actions at a global level and a support model for the execution of possible solutions to the problem.

Latin American Thought in CTS studies stands out in the section where the special needs that developing countries need to make actions to combat litter at sea are recognized.

The Honolulu Strategy in word occurrence analysis, as part of the CA of this document, presents 5 highlighted words, namely: Waste, Sea, Develop, Management and Garbage, respectively in that order of occurrence. The word “develop” symbolizes the Tradition in European CTS studies, as it implies the act of investigation to build something, this stands out when the Honolulu Strategy recommends the need for scientific investigation to deal with the genesis in question. However, this word can also symbolize Latin American Thought on STS due to the interpretation of developing S&T according to local specificities. The words waste, sea,

**3.5 Manila Declaration**

In January 2012, in Manila, Philippines, the third session of the Intergovernmental Meeting to Review the Implementation of the Global Action Program for the Protection of the Marine Environment from Terrestrial Activities takes place, when the Manila Declaration appears. It highlights the speed in the degradation of the oceans and coastal zones on the planet, this scenario is inextricable, indicating that conventions and regional action plans take place in the most diverse countries with specific actions on land-based sources, through the integrated management of systems coastal and oceanic. The declaration aimed to recognize global actions for the protection of the marine environment, highlighting that “marine litter is a problem, which is global in scale and underestimated in impact and which directly threatens coastal and marine habitats and species, economic growth, human health and security, and social values ​​[...]”. The document also highlights that a significant portion of marine litter originates from land-based activities. The Manila Declaration is a document of recognition, emphases, observations on the protection of the marine environment, the term “garbage in the sea” or “marine litter” begins the process of conceptual dissemination at a global level, starting to be cited in several documents. which has as its plot the protection of the marine environment.

This document presents the North American Tradition, in all its writing, but in the section that highlights the decision to commit to the implementation of the Global Action Program in relation to the Marine Environment, as an effective action for the sustainable development of the oceans and how it affects society's way of life.

The Manila Declaration in word occurrence analysis, as part of the AC of this document, presents 5 highlighted words, namely: Marine, Global, Environment, Program and Action, respectively in that order of occurrence, these words indicate the presence of the North American tradition, as it represents the social consequences of technological innovations and the influence generated in society.

**3.6 Global Partnership on Marine Litter – GPML**

In June 2012, Rio+20 (United Nations Conference on Sustainable Development) takes place in Rio de Janeiro, Brazil. In this event, the Global Partnership on Marine Litter – GPML is launched, with the main objective of reducing and managing marine litter, in addition to to protect human health and the global environment.

In this document, in addition to its emphasis on combating marine litter, the “need for urgent action and encouragement from governments and the private sector to ensure a more efficient use of resources and good management of plastics and microplastics” is also highlighted. This document mentions the importance of scientific studies. The main sources and categories of plastic / microplastic are discussed, with the need for technologies to evaluate this material, considered the one with the highest incidence as garbage at sea.

GPML presents the two types of Tradition, European and North American. The European Tradition presents itself when scientific studies are recognized. The North American Tradition is manifested at the time of the text that highlights the partnership of several actors who work with marine litter and sharing knowledge and experience for actions to combat litter at sea.

GPML has 5 highlighted words, namely: Partnerships, Regionals, Marine, Global and Garbage, respectively in that order of occurrence. The word partnership demonstrates the need mentioned in the text of the scientific field for the social construction of dialogue on the subject in question, revealing the European Tradition in this document. The words regional, marine, global and garbage, demonstrate in the text the necessary actions to combat the problem, highlighting the North American Tradition, as it reveals the social consequences of technological innovations in the way of life of society.

**3. 7 Ocean Conference**

In New York in the United States in June 2017 the Ocean Conference takes place. The final document of this conference had the collaboration of 193 UN member states for its writing. The entire base was based on Sustainable Development Goal 14 (Life on water), the title of the document is “Our Ocean, Our Future: Call to Action”. The title already brings the inseparable relationship that the planet and living beings have with water, it is observed the collaborative content that actions in favor of the oceans and seas can promote among nations, it is a cry for awareness and mobilization of all for conservation and management of this environment in a sustainable way.

In this document, the conceptual issue of “garbage in the sea” is overcome and the discussion goes further, recognizing key actors for conservation and sustainable management, such as women and young people, for example. The need for actions in low-developed countries is highlighted. An appeal is made for the globalized market to find solutions to reduce waste generation. The issue of plastic and microplastic raw materials appears more consolidated in the newsroom and presents itself as a major concern, due to the amount that is found in the oceans and seas. The document makes it clear that “garbage at sea” is a cross-border issue, it is clear that the concern is with the management of this waste and not with the exact origin, in the sense of accountability, indicating the urgency in this demand, as solutions to which the member states must do.

The Ocean Conference presents two types of thinking in CTS studies, the North American tradition and the Latin American thought. The North American Tradition stands out at the beginning of the document when the Heads of States recognize the need for a commitment to the theme.

And Latin American Thought stands out when the text recognizes that there are countries that have, in the problem of combating Garbage at Sea, difficulties in solving this fact, making it a challenge to be achieved.

The Ocean Conference has 5 highlighted words, namely: Development, Ocean, Sustainable, Implementation and Countries, respectively in that order of occurrence. The word development indicates the need for progress in S&T in several countries, which PLACTS defends as development. The words ocean, sustainable, implementation and countries demonstrate the North American Tradition, indicating necessary actions in the environment and the commitment of the most diverse social actors in favor of the cause in question.

**3.8 European Union Technical Report**

In 2017, the European Union held a meeting that resulted in a report entitled “Combating plastic and microplastic marine litter: An assessment of the effectiveness of international, regional and strategic initiatives, sub-regional governance approaches”. This report recorded what already existed at a global level on combating litter at sea.

The report highlights the perception that plastic and microplastic are threatening sources of pollution of the oceans and seas. There is a record that synthetic microfibers are present in the atmosphere, making it a possible contamination by microplastics through atmospheric precipitation.

There are records of incentives/actions in the field of a circular and more sustainable economy, stipulating production and consumption patterns, as a long-term action, in various parts of the planet. Global discussions from this record begin to take on a proportion in the sense that plastic is a long-lasting compound, becoming a source of pollution that is not addressed within the scope of a single legally binding international instrument (Report of the European Union , 2017).

This document shows the global need to deepen the discussion on “plastic raw material”, since in the records of classification of garbage at sea, plastic is the leader in terms of quantities.

The report records the existence of several global actions/strategies involving biodiversity and pollution of the marine environment from oceanic sources and, to a lesser extent, from terrestrial sources, which are also sources of pollution to oceans and seas.

This document presents convergence to the European Tradition, emphasizing the social dimension of the theme and highlighting the diversity of scientific, economic, political and cultural factors that participate in this genesis.

The European Union Technical Report presents 5 highlighted words, namely: Marine, Garbage, Plastic, Environment and Waste, respectively in that order of occurrence. These words, according to European Tradition, demonstrate the social dimension that precedes the development of actions around the theme.

**3. 9 IV Federal Action Plan for the Coastal Zone (PAF-ZC 2017/2019) - Brazil**

At the Ocean Conference in 2017, Brazil, in addition to participating in the event, signed a voluntary participation with the UN for the development of the National Plan to Combat Garbage at Sea - PNCLM. This action plan is internalized in the administrative structure of the Brazilian government in the IV Federal Action Plan for the Coastal Zone (PAF-ZC 2017/2019). According to this document, “the PAF-ZC is an instrument of the National Coastal Management Plan-PNGC, established by Law No. 7,661/88, created and regulated by Decree No. 5,300/04, which aims to plan strategic actions for the of public policies incident in the coastal zone, seeking shared responsibilities for action.”

This document was prepared throughout 2017 during the sessions of the Coastal Management Integration Group (GI-Gerco). It is composed of 18 actions, in which solutions to problems affecting the Coastal Zone are considered. The PAF-ZC are prepared for three years, so the proposed actions have a maximum period of execution of three years. Those responsible for carrying out the actions depend on the object of each plan, to which they are assigned to the PAF-ZC 2017/2019: Scientific Community, Ministry of the Environment, Secretary of Federal Heritage, Civil Society, National Association of Municipal Environmental Bodies Environment, Transport, Ports and Civil Aviation, Subgroup of Integration of Coastal States and Federal Public Ministry.

The content of the text presents the North American Tradition, as it demonstrates a set of actions that will influence the way of life of citizens and institutions.

The PAF-ZC 2017/2019 has 5 highlighted words, namely: Action, Indicator, Implementation, Plan and Management, respectively in that order of occurrence. These words, according to the North American Tradition, reinforce the idea of ​​the participation of several actors in the decisions that permeate public policies in favor of the Brazilian Coastal Zone, confirming that these actions have an influence on the way of life of citizens and institutions.

Garbage in the sea has become a major problem, as it is a considerable pressure for the most diverse nations of the world to intervene to prevent and clean up to mitigate the effects of garbage in the ocean. Avoiding negative impacts and taking preventive measures on the environment and the economy become a critical priority while being a key political issue (DIAS, CUNHA, WATKINS, TRIANTAPHYLLIDIS, 2022), for all member states involved. in the most diverse world agreements on environmental problems.

It is worth mentioning that this problem is complex due to the variety of actors involved around the cause, as each group has interests and often of conflicting order, such as environmentalists, governments, the marine industry in general, financial institutions, consumers, formulators. of public policies, among others. Therefore, the initiatives presented in this study can often present difficulties in their implementation due to the lack of legal structure and consolidated policies, for the proper implementation of these solutions (FRANZTI et al, 2021).

It is understood that public policies must be formulated and internalized within the scope of strategic decision-making in member states (KEENEY, 2004). Demanding levels of interdisciplinary and multidisciplinary understanding of those involved with the problem, which in this case would be the garbage in the sea. The CTS approach is a possible way to understand how to deal with such complexity that environmental problems present.

Environmental problems through the CTS approach, according to Luckemeyer, Casagrande (2010), need to reach the “public sphere” and this is done through the construction of public policies, in past times the discussions revolved only around the “social influences” at the same time. “purely internal development” favoring the formation of scientific bias only.

However, one cannot fail to highlight that the problem of litter at sea is a “macro problem” and, in addition to being transboundary, it involves many actors and as a possible mitigation strategy for the problem, action plans, strategies and large-scale commitments between nations are developed. highlighted in the writing of these documents. And one of the points that makes the tradition in North American CTS studies stand out in this study is precisely because it has “public policy” in its bias, and at the same time does not despise the large-scale economic interest of interest groups.

It is also worth mentioning that in the writing of these documents in specific parts, strategies and actions arise that take into account the local, creative and critical focus of developing countries, demonstrating total adherence to the Latin American Thought on STS (KREIMER & THOMAS, 2004).

Identifying the presence of the CTS triad in the proposed documents, in this study, presents as a positive point the holistic and systemic articulation that the fight against Garbage at sea demands. This articulation highlights that the Garbage at sea problem involves many more variables than just the action of improper disposal, demonstrating the interdisciplinarity necessary to address the issue. On the other hand, as a negative point, the possibility of observing only one of the points of the triad stands out, which can lead to the development of solutions based only on the consequences (and not on the cause) of the problem, on common sense and on the lack of vision of the complexity of a dynamic problem, as is the case of Garbage at sea.

**4 FINAL CONSIDERATIONS**

Based on what was analyzed in this article, we can understand that the STS approach, represented by its European, North American and Latin American Thought traditions, are present in the context and in the writing of the documents analyzed.

Ohe documents analyzed show some patterns, such as the predominance of tradition in North American CTS studies. The tradition in European CTS studies was present in less than half of the documents. And Latin American Thought on STS was presented only in association with the other two traditions, in only two documents. With this analysis, it was possible to perceive that the theme Garbage at Sea, being observed by the CTS lens, also promotes discussions at an academic level, accepting scientific theories, the social consequences of technological innovations and the influences on the way of life of citizens and institutions, as well as as the dialogue for the construction of actions through the different expositions and points of view of the developed and developing countries.

The analysis of this study also allowed us to understand that traditions in CTS studies can appear in isolation or in association.the approach to a problem. Through this triad, the relationships and interactions between them are demonstrated, such as, for example, society defines new technologies and, in turn, scientific recommendations can be defined by new social relationships and living conditions. However, CTS relationships and interactions for discussions about Garbage at Sea are broad and diverse, making it relevant, since it is a global issue, traditions in CTS studies can and should be predominant for understanding the situation.

For an analysis of this cause, scientometric studies would be suggestive to delineate the possible tendencies of the discussions and technical productions on Garbage in the Sea.. And for a national perspective, the analysis of the National Plan to Combat Garbage at Sea is suggestive.and the focus on the STS approach to public policy.

**REFERÊNCIAS**

AGÊNCIA EUROPEIA DO AMBIENTE. Disponível em: < <https://www.eea.europa.eu/pt> >. Acesso em: 08 jan. 2019.

AIBAR, E.; QUINTANILLA, M.A. (edit.). **Ciencia, Tecnologia y Sociedad Madrid**: Editorial Trotta; Consejo superior de Investigaciones Cientificas, 2012.

ÁLVAREZ, F. M. **Hacia una visión social integral de la ciencia y la tecnologia.** Disponível em: < <https://www.oei.es/historico/salactsi/vision.htm>> Acesso em: 25 de out. 2018.

ARAÚJO, Maria Christina B.; COSTA, Mônica Ferreira. Lixo no ambiente marinho. **Ciência Hoje** - vol. 32, nº 191, março de 2003. Disponível em: <https://cienciahoje.org.br>. Acesso em: 20 set. 2019.

BARDIN, L. **Análise de conteúdo.** Edições 70: Portugal, 2008.

BAZZO, W.A. et al. **Introdução aos estudos CTS:** O que é Ciência, Tecnologia e Sociedade? Cadernos de Ibero-América, Editora OEI, 2003.

BRAGA, B. et al. **Introdução à engenharia ambiental:** o desafio do desenvolvimento sustentável. São Paulo: Pearson Prentice Hall, 2005.

BRASIL. **IV Plano de Ação Federal para a Zona Costeira – PAF-ZC 2017/2019.** Brasília, 2017. Disponível em: <https://antigo.mma.gov.br/informma/item/8962-plano-de-a%C3%A7%C3%A3o-federal-para-a-zona-costeira-paf_zc.html#:~:text=Assim%2C%20o%20IV%20PAF%2DZC,o%20descrito%20no%20item%20Documento>. Acesso em27 jul. 2019.

CACHAPUZ, A.; PAIXÃO, F.; LOPES, B. E GUERRA, C. Pesquisa em Educação em Ciências e o Caso CTS. **Alexandria Revista de Educação em Ciência e Tecnologia**, v.1, n.1, p. 27-49, mar.2008.

CAMPOS, F. R. G. **Ciência, tecnologia e sociedade.** Florianópolis: Publicações do IF-SC, 2010.

CANDÉO, M. **Alfabetização Científica e Tecnológica (ACT) por meio do enfoque Ciência, Tecnologia e Sociedade (CTS) a partir de filmes de cinema.** 2014. 123 f. Dissertação (Mestrado em Ensino de Ciência e Tecnologia) -Universidade Tecnológica Federal do Paraná. Ponta Grossa, 2014.

CARVALHO, I. C. de M. **Educação Ambiental:** a formação do Sujeito ecológico. 6.ed. São Paulo: Cortez, 2012.

CEREZO J. A. Ciência, Tecnologia e Sociedade: o estado da arte na Europa e nos Estados Unidos. In: SANTOS, Lucy W. Dos; ICHIKAWA, Elisa Y.; SENDIN Paulo V.; CARGANO, Doralice de F (orgs). **Ciência, Tecnologia e Sociedade:** o desafio da interação. Londrina: IAPAR, 2002, pp. 03-39.

CHRISPINO, A. **Introdução aos Enfoques CTS – Ciência, Tecnologia e Sociedade – na Educação e no Ensino.** Documentos de Trabajo de Iberciencia, nº 4, 2017.

Conferência das Nações Unidas sobre Desenvolvimento Sustentável. Rio+20. 2012, Rio de Janeiro-Brasil. Disponível em: <http://www.rio20.gov.br/sobre_a_rio_mais_20.html>. Acesso em: 10 abr. 2019.

Conferência Internacional de Detritos Marinhos, 5. 2011, Honolulu-Havaí. Disponível em: <https://marinedebris.noaa.gov/sites/default/files/publications-files/Honolulu_Strategy.pdf>. Acess em: 09 ago 2019.

Conferência sobre os Oceanos: Nosso Oceano, Nosso Futuro: Chamada para Ação. 2017, Nova Iorque-Estados Unidos. Dusponível em: <https://brasil.un.org/>. Acesso em 09 ago. 2019.

CUNHA, E. J. N. S. **A percepção ambiental e mapas interativos no ensino básico.** 2018. 111 f. Dissertação (Mestrado Profissional em Ensino de Ciências Ambientai–) - Setor Litoral, Universidade Federal do Paraná, Matinhos, 2018.

CUTICLIFFE, S. **Ciencia tecnologia y sociedade:** un campo interdisciplinar. Universidad la educación y en la Gestión publica, Barcelona: Anthoropos, 1990.

**Declaração de Manila.** Filipinas: jan. 2012. Relatório técnico. Disponível em: <https://wedocs.unep.org/bitstream/handle/20.500.11822/12347/ManillaDeclarationREV.pdf?sequence=1&isAllowed=y> Acesso em: 09 ago. 2019.

DIAS, L. C.; CUNHA, M.C.; WATKINS, E.; TRIANTAPHYLLIDIS, G, 2022. A multi-criteria assessment of policies to achieve the objectives of the EU marine litter strategy **Marine Pollution Bulletin.** Disponível em: [www.elsevier.com/locate/marpolbul](http://www.elsevier.com/locate/marpolbul) <https://doi.org/10.1016/j.marpolbul.2022.113803>. Acesso em: 26 jul. 2022.

FRANTZI, S., BROUWER, R., WATKINS, E., van BEUKERING, P., CUNHA, M.C., DIJKSTRA, H., DUIJNDAM, S., JAZIRI, H., OKOLI, I.C., PANTZAR, M., RADA COTERA, I., REHDANZ, K.,SEIDEL, K., TRIANTAPHYLLIDIS, G., 2021. Adoption and diffusion of marine litter cleanup technologies across european seas: legal, institutional and financial drivers and barriers. **Marine Pollution Bulletin**. 170. Disponível em: <https://doi.org/10.1016/j.marpolbul.2021.112611>. Acesso em: 26 jul. 2022.

JACOB, P. R.; BESEN, G. R. Gestão de resíduos sólidos em São Paulo: desafios da sustentabilidade. **Estudos Avançados 25**, São Paulo, p.135-158, 23 fev. 2011.

KAHLAU, C.; SCHNEIDER, A. H.; SOUZA-LIMA, J. E. de; A tecnologia social como alternativa ao desenvolvimento: indagações sobre ciência, tecnologia e sociedade. **Revista Tecnologia e Sociedade.** V. 15, n. 36, p. 190-213, abr./jun. 2019. Disponível em: <https://periodicos.utfpr.edu.br/rts/article/view/8128/6045>. Acesso em: 04 jul. 2022

KEENEY, R.L., 2004. Framing public policy decisions. Int. J. Technol. **Policy Management**. 4 (2), 95–115. Disponível em: <https://doi.org/10.1504/IJTPM.2004.004815>. Acesso em 26 jul. 2022.

KRELLING, A. P. **Abordagem Transfronteiriça do Lixo Marinho:** A exportação de resíduos flutuantes ao longo de um gradiente estuarino e seus impactos socioeconômicos. 2017. 185 f. Tese (Doutorado em Sistemas Costeiros e Oceânicos) – Setor de Ciências da Terra, Centro de Estudos do Mar, Universidade Federal do Paraná, Pontal do Paraná, 2017.

KREIMER, P., THOMAS, H. Un poco de reflexividad .o? de donde venimos? Estúdios sociales de la ciencia y la tecnologia en America Latina. In Production y Uso Social de Conocimientos. Estudios de Sociologia de la Ciencia y la Tecnologia en America Latina. Bernal, Buenos Aires: Universidad Nacional de Quilmas Editorial, 2004.

LINSINGEN, I. V. Perspectiva educacional CTS: aspectos de um campo em consolidação na América Latina. **Ciência & Ensino**, v. 1, p. 1-19, 2007. Disponível em: <https://wiki.sj.ifsc.edu.br/images/2/23/Irlan.pdf>. Acesso em: 18 jul. 2022.

LÜCKEMEYER, A. C. A. B.; CASAGRANDE, E. F. Jr. Uma introdução aos estudos CTS na américa latina com enfoque em tecnologia e ambiente. **Revista Educação & Tecnologia.** Ano 1, nº 10, abril de 2010. Disponível em: <http://revistas.utfpr.edu.br/pb/index.php/revedutec-ct/index>. Acesso em: 05 mai. 2019

MARPOL. **International Convention for the Prevention of Pollution from Ships.** 1978. Disponível em: <https://www.ccaimo.mar.mil.br/ccaimo/sites/default/files/marpol_anexo1-11ago_0.pdf>. Acesso em: 09 ago. 2019.

MILLER JR., G. Tyler. **Ciência ambiental**. São Paulo: Cengage Learning, 2008.

MOTA, A.E. *et al.* (Orgs.). **Serviço social e saúde:** formação e trabalho profissional. São Paulo: OPAS: OMS: Ministério da Saúde, 2006.

ONU. **GPA – Programa de Ação Global para a proteção do Ambiente Marinho frente às Atividade baseadas em Terra.** 1995. Disponível em: <http://www.gpa.unep.org/document_lib/es/pdf/whole_gpa_sp.pdf>. Acesso em 09 ago. 2019.

PALÁCIOS, E. M. G.; LINSINGEN I. von; GALBARTE, J. C. G.; CEREZO, J. A. L.; LUJÁN, J. L.; PEREIRA, L. T. V.; GORDILLO, M. M; OSÓRIO, C.; VALDÉS, C.; BAZZO, W. A. **Introdução aos estudos CTS**: Ciência, Tecnologia e Sociedade. Cadernos de Ibero-América. UFRN, 2003. Disponível em: <http://arquivos.info.ufrn.br/arquivos/2017081016a4ce38376218dc8a5149b27/1__Introduo_aos_estudos_CTS_Bazzo_et_al.pdf>. Acesso em: 18 jul. 2022.

PINHEIRO, N. A. M; SILVEIRA, R. M. C. F.; BAZZO, W. A. Ciência, Tecnologia e Sociedade: a relevância do enfoque CTS para o contexto do Ensino Médio. https://doi.org/10.1590/S1516-73132007000100005. **Ciência & Educação (Bauru)**. Ano 1, nº 13, abril de 2007. Disponível em: <https://www.scielo.br/j/ciedu/a/S97k6qQ6QxbyfyGZ5KysNqs/>. Acesso em: 18 jul. 2022.

SAES, S. G. **Aplicação de métodos bibliométricos e da *“Co-Word Analysis”* na avaliação da literatura científica brasileira em ciências da saúde de 1990 a 2002.** 2005. 183 f. Tese (Doutorado em Saúde Pública) – Faculdade de Saúde Pública, Universidade de São Paulo, São Paulo, 2005.

SILVA, P. B. C. DA**. Ciência, Tecnologia e Sociedade na América Latina nas décadas de 60 e 70:** Análise de obras do período. Dissertação (Mestrado em Ciência, Tecnologia e Educação) Centro Federal de Educação Tecnológica Celso Suckow da Fonseca, 2015.

SILVA, M. C. da; OGATA, M. N; PEDRO, W. J. A. A Política de Saúde do Idoso sob o espectro CTS: considerações preliminares. **Revista Tecnologia e Sociedade.** Ano 1, nº 1, 2014. Disponível em: <https://periodicos.utfpr.edu.br/rts>. Acesso em: 09 jul. 2019

UNIÃO EUROPÉIA. **Diretriz Europeia para Meio Ambiente.** Diretiva 2008/56/CE. Parlamento Europeu. Conselho de 17 de jun.2008. Disponível em: <https://europa.eu/european-union/topics/environment_pt>. Acesso em: 09 ago. 2019.

UNIÃO EUROPÉIA. **Relatório** **Combate ao Lixo marinho plástico e microplástico: Uma avaliação da eficácia das iniciativas internacionais, regionais e estratégicas, abordagens de governança sub-regional.** Nairobi: dez.2017. Relatório técnico.Disponível em: <https://europa.eu/european-union/topics/environment_pt>. Acesso em: 09 ago. 2019.

ZANI, L. B.; PAIVA, C. L.; DUARTE, I. D.; JONIS-SILVA, M. DO A. A técnica da controvérsia controlada sob a perspectiva do enfoque CTS: uma contribuição para o ensino de biologia**. Revista Brasileira de Ensino de Ciência e Tecnologia**, v. 6, n. 2, 2013. Disponível em: <https://periodicos.utfpr.edu.br/rbect>. Acesso em: 09 ago. 2019.

1. PhD student in Oceanography, UFPE, e-mail[ellen.joana@ufpe.br](mailto:ellen.joana@ufpe.br). [↑](#footnote-ref-1)
2. Doctor in Coastal and Oceanic Systems, Professor at the Federal Institute of Paraná – Campus Paranaguá – e-mail[allan.krelling@ifpr.edu.br](mailto:allan.krelling@ifpr.edu.br). [↑](#footnote-ref-2)