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Text mining policy documents to support transboundary integrated ecosystem assessment: the case of the South Mid-Atlantic Ridge

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TEXT-MINING POLICY DOCUMENTS TO SUPORT TRANSBOUNDARY INTEGRATED ECOSYSTEM ASSESSMENT:

The case of the South Mid-Atlantic Ridge

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Declaration

I certify that all the material in this dissertation that is not my own work has been identified, and that no material is included for which a degree has previously been conferred on me.

The contents of this dissertation reflect my own personal views, and are not necessarily endorsed by the University.

(Signature):
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(Date):
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Supervised by:
.....

Supervisor's affiliation**.....**

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Abstract

Title of Dissertation: **Text-mining policy documents to support transboundary integrated ecosystem assessment: The case of the South Mid-Atlantic Ridge**

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Successful management and Governance of human activities is an important challenge in EBM. It requires a sound understanding of the links between sectors, human activities, pressures, and ecosystem components. It also requires an understanding of whether or not policies address those pressures and ecosystem components. This is particularly complex in transboundary cases where ecosystems straddle different countries and international waters, which each have different policies. The South mid-Atlantic ridge (SOMAR) is a transboundary marine region that is found off the coast of Brazil in the Atlantic. It straddles International, Brazilian, and UK waters. This study takes inventory of the policies that address the main pressures and ecosystem components in SOMAR's, Brazilian, UK, and international waters to identify where important gaps in ecosystem protection might exist. To accomplish this, I used a combination of an existing conceptual model with a text-mining approach to analyzing policy documents from Brazil, UK, and International waters. The existing conceptual model related sectors and pressures from human activities on ecosystem components using the "Options for Delivering Ecosystem-Based Management " (ODEMM) approach. I used the ODEMM to help to identify key words relating to human pressures and ecosystem components. I then used a text mining approach on policy documents from Brazil, the UK, and international conventions to take inventory of the occurrence of the key words in the documents. I then compared the frequency of keywords across Brazil, UK, and international documents. The coverage and gaps of policies approach to identify the inclusion of pressures and ecosystem components affected by shipping and fishing in the SOMAR. The results showed that the regulatory framework for fishing, shipping, and biodiversity conservation in SOMAR differ in different jurisdictions. The UK emerged as the jurisdiction that covered the widest range of pressures and ecosystem components. In contrast, Brazil covered the least amount of pressure and ecosystem components. Moreover, the international conventions that applied to international waters showed to cite more keywords per document compared to the other jurisdictions. Lack of coverage of pressures and ecosystems components were identified in all jurisdictions, and no document addresses all these components together. The findings indicate that the policy approach in these documents are predominantly sectoral fragmented and integrative management approach that could fill the gaps and help to support EBM in SOMAR.

KEYWORDS: Text mining, South-Mid Atlantic Ridge, Fisheries, Shipping, Ecosystem components, Pressures

Table of Contents

Declaration i

Acknowledgements ii

Abstract iii

List of Figures v

List of Abbreviations vi

1. Introduction 1

1.1. Sectors, pressures, and ecosystem components affected in the South-Mid Atlantic Ridge. 3

2. Materials and Methods 8

2.1. The SOMAR study case 8

2.2 Step 1: Identifying the main sectors based on the SOMAR ODEMM 9

2.3. Step 2: Selection of documents 11

2.4. Step 3: Text mining 12

2.4.1. Analysis of the documents using text mining approach and keyword selection. 14

2.5. Step 4: Comparison of International, Brazilian and UK keyword results 14

3. Results 15

3.1. Anthropogenic Impacts on SOMAR 15

3.2. The International agreements and the national policies for integrating marine biodiversity, fishing and shipping. 15

3.3. Keyword frequency 1

4. Discussion 6

4.1. The documents 6

4.2 The keywords 9

4.3 Limitations of this study and opportunities 12

4.3 Challenges of Not Including Climate Change - ODEMM 13

5. Conclusions and recommendations 15

References 17

Appendice I: Document database used in this study 24

Appendice II: Text mining R code used in this study 26

List of Figures

Figure 1: The cycle of the Integrated Ecosystem Assessment.....5
Figure 2: Methodological sequence composed by three steps for the analysis.....8
Figure 3: South Mid-Atlantic Ridge Case Study area (green polygon). 9
Figure 4: ODEMM results for the fishing sector on SOMAR. 10
Figure 5: ODEMM results for the shipping sector on SOMAR. 11
Figure 6: List of keywords for pressures and ecosystem components. 13
Figure 7: Key documents associated with International agreements in Brazil and UK. 17
Figure 8: Number of documents including the keywords per jurisdiction.....2
Figure 9: Average of keywords categories included in the documents.....3
Figure 10: Percentage of documents containing the pressure keywords 4
Figure 11: Percentage of documents containing ecosystem components keywords. 5

List of Abbreviations

ABNJ - Areas Beyond National Jurisdiction
BBNJ - Intergovernmental Conference on Marine Biodiversity of Areas Beyond CBD - Convention on Biological Diversity
CITES - Convention on International Trade in Endangered Species of Wild Fauna and Flora
MARPOL - International Convention for the Prevention of Pollution from Ships
IOC - Intergovernmental Oceanographic Commission
SDGs – Sustainable Developed Goals
SPSP - Saint Peter and Saint Paul
UK – United Kingdom
UNCLOS - United Nations Convention on the Law of the Sea
National Jurisdiction
UN – United Nations
SOMAR – South Mid-Atlantic Ridge
ODEMM - Options for Delivering Ecosystem-Based Management
MPA – Marine Protected Area
UNFCC - United Nations Framework Convention on Climate Change
ICCAT - International Commission for the Conservation of Atlantic Tunas
ICRW - International Convention for the Regulation of Whaling
CMS - Convention on the Conservation of Migratory Species of Wild Animals
CBD - Convention on Biological Diversity
IUCN - International Union for Conservation of Nature
EEZ - Exclusive Economic Zone
IOC - Intergovernmental Oceanographic Commission
UNESCO - The United Nations Educational, Scientific and Cultural Organization
FAO - Food and Agriculture Organization
IMO - International Maritime Organization
NGOs - Non-Governmental Organisation
EBM - Ecosystem Based Management
IEA – Integrated Ecosystem Assessment

1. Introduction

The global ocean is the largest Earth's ecosystem (Angel, 1993). Covering more than 90% of the habitable areas on the planet's surface and with 1.3 billion Km^3 of water (Rogers et al., 2016), the oceans are vital for providing goods and services for society, and they are the cornerstone to maintaining the environmental balance and regulating life conditions in the atmosphere. Living and non-living resources have been exploited, providing food, energy, and commercial benefits for communities.

Ocean fisheries and aquaculture yields food security and maintenance of livelihoods for millions of people (Rogers et al., 2016, Bennette, 2019, Blasiak, 2019, FAO, 2020). Shipping is crucial for trade and employment, contributing to the global gross domestic product. Oils and gas, minerals, sand, and gravel are essential in the current business as usual scenario. The advances in clean energy make it possible to use tides, waves and currents to produce energy, and investments in science and technology supported findings showing the ocean as a strategic component to mitigate the climate crisis (Rogers et al., 2016, Bennette et al, 2019).

Coastal ecosystems such as mangroves and coral reefs are natural barriers for protecting the continent from climate events, erosion, and sea level rise. Mangroves and high seas are a centerpiece in the carbon storage The oceans are also a source of migration and leisure, being tourism an increasing sector (Rogers et al., 2016). However, the health of oceans and the benefits generated are threatened by anthropogenic activities, impacts, and overexploitation of marine resources (Roger et al., 2016). The First Global Integrated World Ocean Assessment (2016) showed extensive ocean degradation, changing structure and function of marine ecosystems (Nash et al., 2022). Furthermore, marine productivity and biodiversity are undermined by the cumulative effects of human intervention in the environment along with the uncertainties raised by climate change (Rogers et al., 2016, Halpern et al., 2019, IPCC, 2022).

Governing the oceans for a sustainable future is a major challenge owing to environmental issues such as pollution, loss of biodiversity, resource scarcity, and management and jurisdictional matters (Singh et al., 2018). Haas et al. (2022) define the ocean as a “global common-pool resource”, in which the management systems occur fragmented under national jurisdictions and by diverse sectoral and regional organizations. Numerous actors, institutions (formal and informal), and governmental bodies take part in the governance of services and uses of oceans (Haas et al., 2022). The success of ocean governance has been hampered by fragmented approaches by sectors, interest conflicts between actors and jurisdictions, and poor communication across the organizations in the governance system (Balgos et al. 2015; Stephenson et al. 2019, Hass et al., 2022). Therefore, achieving ocean sustainability faces different obstacles from a human and environmental perspective (Jansen, 2003; Singh et al., 2018). These challenges are critical to the effectiveness of the governance and sustainability of marine ecosystems and demand great global effort, collaboration between nations, and robust scientific evidence (Singh et al., 2018; Alexander & Haward, 2019; Duarte et al., 2020; Polejack et al., 2021).

The international conventions are instruments designed to guide the management of human activities, and they play an important role for conservation and sustainable use of natural resources (Rogers et al., 2016). The United Nations Convention on the Law of the Sea (UNCLOS, 1982), The Convention on Biological Diversity (CBD) and International Convention for the Prevention of Pollution from Ships (MARPOL) are some important examples of legally binding instruments established in order to regulate and mitigate impacts of society impacts on the environment. These international treaties, together with national policies and regional agreements, address specific objectives for governing human activities that could affect e.g. climate, biodiversity, or pollution. (Haas et al., 2022).

In 2015, the Sustainable Development Goals (SDGs) emerged with targets to achieve sustainability established by The United Nations (Singh et al., 2018), followed by the initiative (started in 2018) to establish an international treaty for protection of marine life in the high seas (Tiller et al., 2019). Moreover, in addition, Intergovernmental Oceanographic Commission (IOC) in response to the Agenda 2030 drove the UN to declare the international "Decade of Ocean Science for

Sustainable Development" during 2021-2030 and together came new opportunities for cross-disciplinary approaches (Ryabinin et al., 2019, Wisz et al., 2021). Polejeck et al. (2021) discuss the alliances established between Atlantic countries, and the challenges involved in this process. One of the initiatives, the EU's Horizon 2020, funded the international project "Mission Atlantic", a collaborative action between 14 countries across the Atlantic Ocean to access the Atlantic ecosystems' status implementing Integrated Ecosystems Assessments (IEAs), with a focus in focused on five study cases (Mission Atlantic, 2021).

The Atlantic Ocean is the world's second-largest ocean, covering three continents: America, Africa, and Europe. Political and geographic characteristics are used to divide the Atlantic Ocean. The South Mid-Atlantic Ridge (SOMAR) is a large area in the South Atlantic Ocean's tropical and equatorial bands that includes three oceanic islands within Marine Protected Areas (MPAs): Saint Peter and Saint Paul Archipelago (SPSP), Saint Helen, and Ascension Islands (Mission Atlantic, 2021). These islands' economic exclusive zones (EEZ) fall under the Brazilian EEZ (SPSPA) and, United Kingdom EEZ (Saint Helen, and Ascension Islands). Furthermore, the high seas areas between the islands include Areas Beyond National Jurisdiction (ABNJs). Each of these jurisdictions, and international waters, have different policies in place for regulating human activities. Moreover, because of the high connectivity of the ocean, oceanographic processes, living and non-living ecosystem components, and human pressures are not limited to administrative boundaries (Bishop, et al. 2017). Therefore, the SOMAR is an interesting case of governance across and beyond national jurisdictions.

1.1. Sectors, pressures, and ecosystem components affected in the South-Mid Atlantic Ridge.

Due to the complex and dynamic nature of environmental uncertainties and cumulative effects of human activities on ecosystem components, integrated approaches are needed to inform decision-making. Integrated approaches view human activities as part of the natural systems, and take into account the cumulative interactions within ecosystems (Leslie & McLoad, 2007; Levin et al., 2009, Hapern et al., 2019). Integrated Ecosystem Assessment (IEA) is a well-established, cyclical

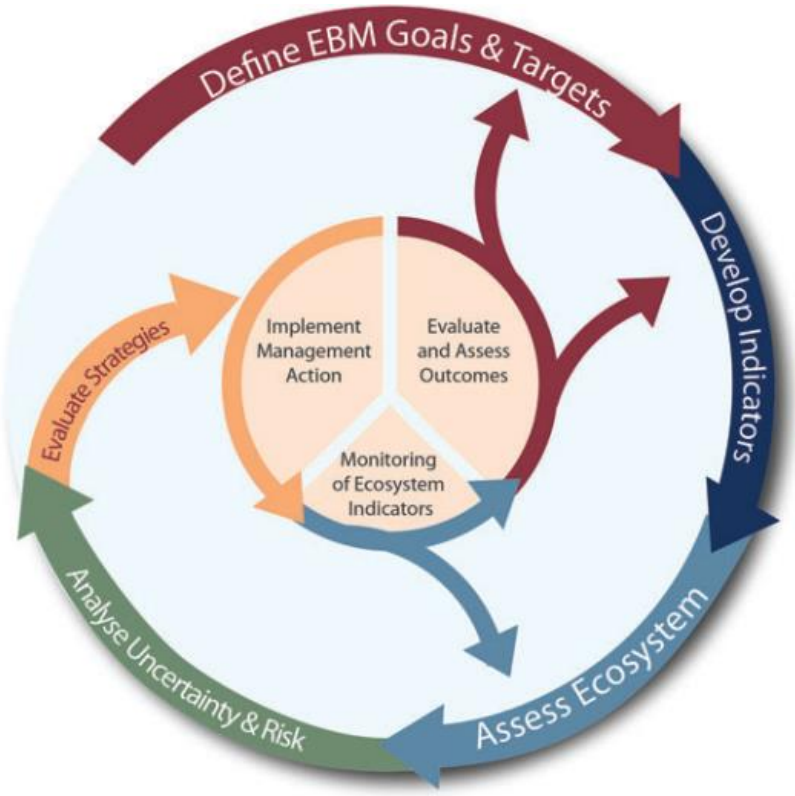
framework for scoping societally relevant questions and relevant stakeholders, understanding ecosystems, developing indicators to track and monitor environmental change, and informing decision-makers (Levin et al., 2009).

IEA is a tool to collect a set of scientific information in order to guide the management of natural resources and the policymaking process in an ecosystem approach. The development of IEA assists the evaluation of cumulative impacts of human activities and steer the efforts on the priority ecosystems objectives to be achieved. Thus, the IEA outcomes is an important tool to support the governance process and facilitate the implementation of ecosystem-based management (EBM) measures (DeFreitas & Nagendra, 2017). This framework has been applied by the UN Environment Program (UNEP, 2022), and the US National Oceanic and Atmospheric Administration (Harvey et al., 2017) and the International Council for the Exploration of the Seas (Walther & Möllmann, 2014).

An important part of the IEA process is the scoping phase (Figure 1). In the scoping phase societally relevant questions, stakeholders, and links between human activities in ecosystems, pressures, and ecosystem components are established (Samhouri et al., 2014). In order to conceptualize links between human activities, pressures and ecosystem components, diverse frameworks have been developed in the past decades, aimed to facilitate the environmental assessment (Patrício et al., 2016).

Figure 1:

The cycle of the Integrated Ecosystem Assessment



Note: Extracted from *"Lessons learned from developing integrated ecosystem assessments to inform marine ecosystem-based management in the USA" by Samhouri, (2014). Journal of Marine Science, 71(5), 1205-1215. https://doi.org/10.1093/icesjms/fst141.* Copyright 2014 by Samhouri.

The "Options for Delivering Ecosystem-Based Management" (ODEMM) is a conceptual model which allows visualizing the links between human activities, the pressures, and the ecosystem components, developed for IEA in Irish Waters (Pedreschi et al., 2019). This framework "focuses on the structure, tools, and resources required to choose and evaluate management options that are based on the principles of Ecosystem-Based Management" (ODEMM. n.a.). The Mission Atlantic project delivered an ODEMM conceptual model to represent linkages between human activities, human pressures and ecosystem components in the SOMAR region. The SOMAR ODEMM conceptual model drew upon information

collected at a 2020 workshop that integrated and analyzed input from scientists, NGOs, industry experts, and other stakeholders. Therefore, the outcomes present an important overview and unprecedented opportunity to help identify the human activities (such as shipping and fishing) and pressures (such as noise, abrasion, over-extraction or bycatch) that should be regulated by policies to protect the marine environment in SOMAR. This study case also presents a pathway to identify the ecosystem components that may benefit from policies with objectives to protect and, or conserve ecosystem components such as relevant species or habitats.

Thus, the main aim of this study is to ascertain the extent to which international, Brazilian and UK ocean-related agreements, biodiversity conventions, and legally binding instruments address the impacts on ecological components impacted by pressures from key maritime and ocean sectors in Brazil (finishing and shipping). The present dissertation uses an existing ODEMM carried out in the SOMAR case study to identify links between sectors, human pressures and ecosystem components. It was used to inform an analysis of policies for the SOMAR region. The goal was to identify which of the human pressures and ecosystem components are addressed in the policy documents for Brazil, UK, and international waters so that obvious potential gaps in ecosystem protection could be identified. Shipping and fishing are the two sectors considered to have the greatest impact in the SOMAR region (Mission Atlantic, 2021). Consequently, this study has a special focus on these sectors.

National policies do not necessarily align with international agreements that countries are signatures, and this can be a challenge for the implementation of policies that support EBM within the EEZ of particular countries. Consequently, I attempted to create a window into how Brazil and the United Kingdom national policies support the international agreements within their EEZ and the oceanic MPAs in SOMAR. The specific questions posed in this study include: (a) which policies exist for international waters, Brazil, and the UK that can be used to regulate the fishing and shipping sector, and ecosystem pressures from those sectors? (b)Which policies exist that can be used to protect and, or conserve ecosystem components in the SOMAR region? (c) Which pressures are currently not regulated in international, Brazilian and, or UK waters? (d) which ecosystem components are not protected by

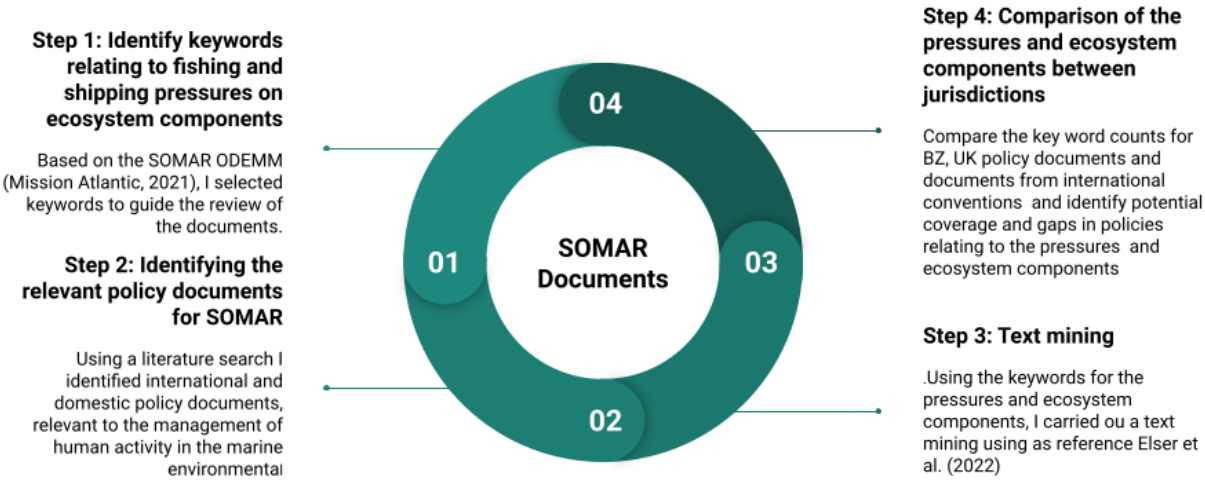
policies to conserve or protect them in SOMAR's international, Brazilian and, or UK waters? (e) How do the international, Brazilian and UK policies compare in their capacity to support IEA through the regulation of human activities and the protection of ecosystem components? (f) to the degree that it is possible, which of the non-binding international agreements (e.g. Convention on Biological Diversity, Convention on the Conservation of Migratory Species of Wild Animals) are supported by domestic policies in BR and UK, and which policies these are.

2. Materials and Methods

This research has a quantitative approach and was organized in four steps: (1) analysis of the ODEMM results, (2) literature review on legal documents and selection of the policies, (3) text mining, and finally (4) the comparison of the pressures and ecosystems covered between the jurisdictions. The details sequence of methods is described as follows (Figure 2):

Figure 2:

Methodological sequence composed by three steps for the analysis



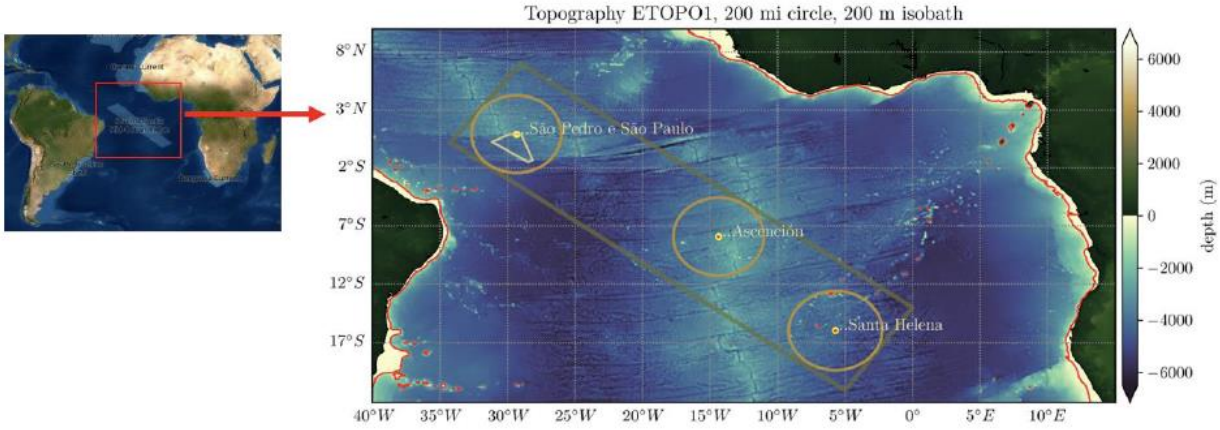
2.1. The SOMAR study case

The South Mid-Atlantic Ridge (SOMAR) study case encompasses three different islands surrounded by international and high seas areas (Figure 3). The three islands located in this region have many similarities, including the isolation from the continent and the small size (Edwards & Lubbock, 1983). The ecological resemblance adds a unique feature to this group of islands. Among the characteristics related, high fish richness and endemic indices are highlighted. There are many common endemic species found around the three islands. Ascension and St. Helena share a variety of unique species and biogeographical similarities (Floeter et al., 2008, Kulbicki et al., 2013). Otherwise, in the SPSP, the major resemblances are found in the oceanic

islands on Brazil's coastline, such as Fernando de Noronha (Pinheiro et al., 2020). Additionally, the waters between the islands are used by megafauna species as a migratory route, for instance, species of tuna, whale shark, and manta ray (Vaske Jr. et al., 2005, Hazin et al., 2008; Mendonça et al., 2012, Pinheiro et al., 2020,). Both biogeography and evolutionary connectivity make this area a significant ecological site, therefore, the combination of all aspects increases the importance of biodiversity conservation strategies in this region (Edwards & Lubbock, 1983; Wirtz et al., 2014, Brown et al., 2019). Regarding the human population living in the islands, St. Helena has a large community established in the territory, reaching 4,439 (St. Helena Government, 2021), while Ascension with 500 people (Ascension Island government, 2022), and SPSP, with 4 people have a few habitants (Viana et al., 2015).

Figure 3:

South Mid-Atlantic Ridge Case Study area (green polygon).



Note: Extracted form "Deliverable 1.1: Regional and Pan-Atlantic management objectives", by Mission Atlantic (2021). Available in https://cdn.sanity.io/files/s2g49i7w/production/b980ec5106adfe7684ab5655dd2a27e6ebf8a4c3.pdf. Copyright 2021 by Mission Atlantic

2.2 Step 1: Identifying the main sectors based on the SOMAR ODEMM

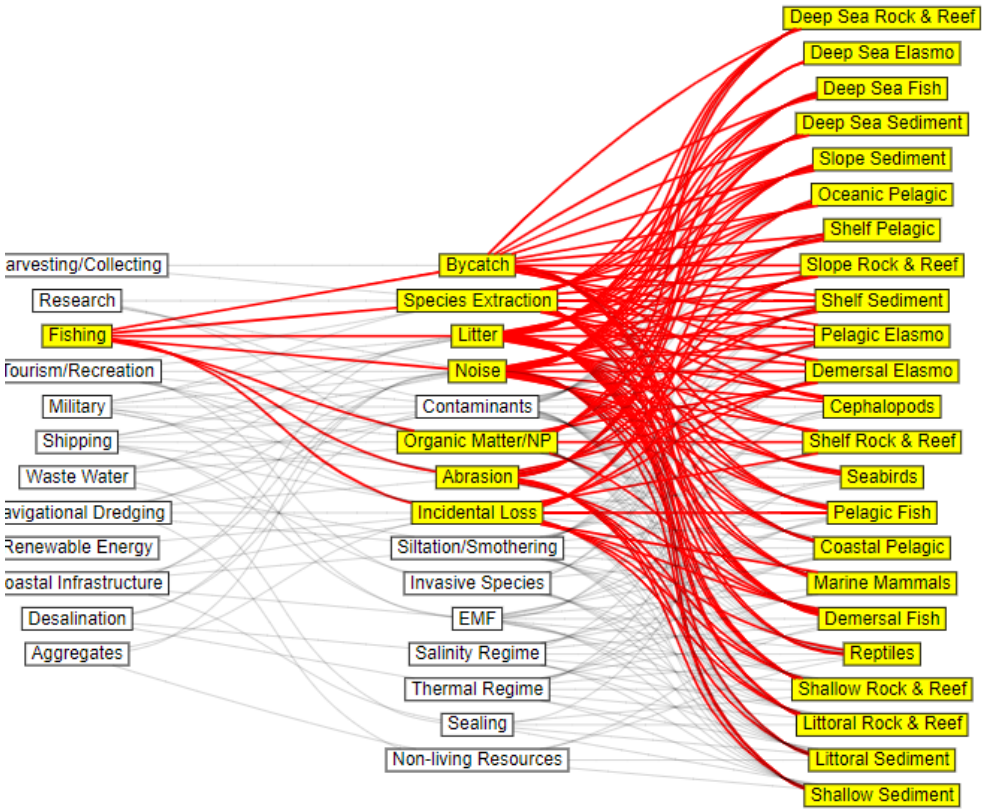
The SOMAR ODEMM was obtained from the deliberative report (Mission Atlantic, 2021), which is currently in review. The ODEMM methodology used to assess the SOMAR study case is described in detail in this document and was composed of two steps: (1) linkage frameworks, which build upon a matrix connecting

which pressures affect which ecosystem components; and, (2) risk assessment, based on semi-quantitative scores distribute for the elements according to spatial extension, frequency, and degree of impact, that were multiplied giving a final score of Impact Risk (Mission Atlantic, 2021). Also, the source of knowledge was considered based on gray and scientific literature, observations or expert opinions

The outcomes of the SOMAR ODEMM (which was developed prior to this study, guided the design of this dissertation policy analysis) are presented in Figure 4 and 5 for reference.

Figure 4:

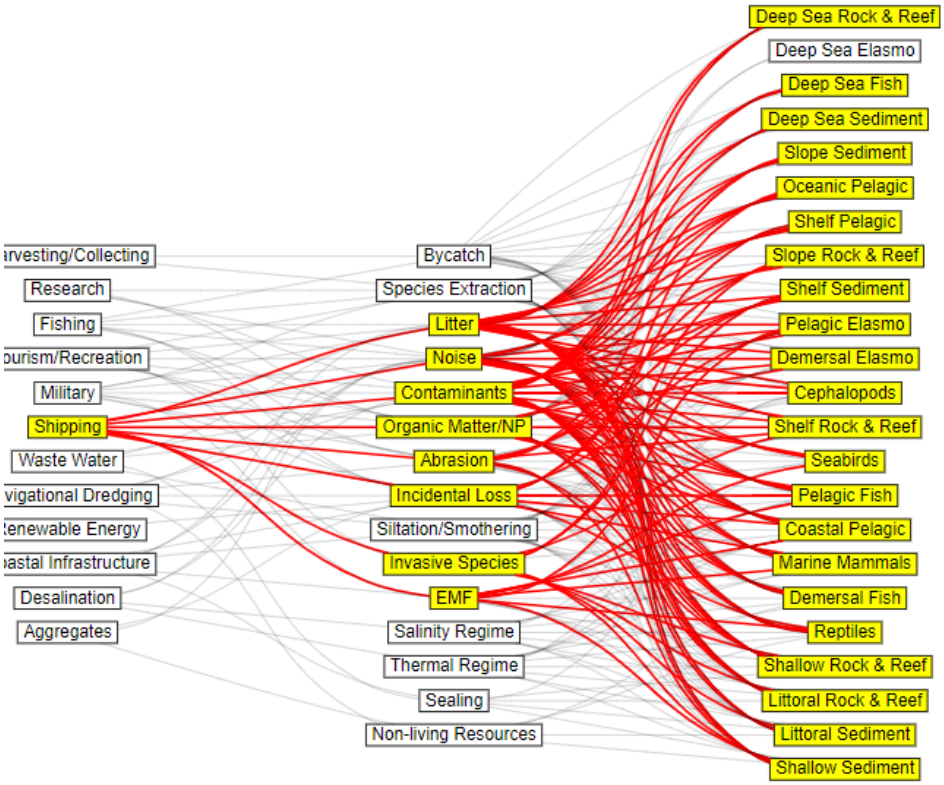
ODEMM results for the fishing sector on SOMAR.



Note: Extracted form "Deliverable 1.1: Regional and Pan-Atlantic management objectives", by Mission Atlantic (2021). Available in https://cdn.sanity.io/files/s2g49i7w/production/b980ec5106adfe7684ab5655dd2a27e6ebf8a4c3.pdf. Copyright 2021 by Mission Atlantic. First column represents the sector, second column represents the pressures on the environment and the third column represents the ecosystem components affected.

Figure 5:

ODEMM results for the shipping sector on SOMAR.



Note: Extracted from “Deliverable 1.1: Regional and Pan-Atlantic management objectives”, by Mission Atlantic (2021). Available in https://cdn.sanity.io/files/s2g49i7w/production/b980ec5106adfe7684ab5655dd2a27e6ebf8a4c3.pdf. Copyright 2021 by Mission Atlantic. First column represents the sector, second column represents the pressures on the environment and the third column represents the ecosystem components affected.

2.3. Step 2: Selection of documents

I identified those international agreements and policy documents with the potential for contributing to the protection of marine biodiversity and to mitigate or regulate the pressures from human activities focusing on fishing and shipping activities. Also, I identify national policies from Brazil and United Kingdom, some of which were developed to support the international agreements or address the management of human interaction and biodiversity conservation in the SOMAR study case region.

The criteria used to select the documents were as follows and were inspired by Elser et al. (2022): i) address human activities in the ocean; ii) address marine biodiversity; iii) have global or near-global coverage - for international agreements (in this case, the definition of global coverage is either by the geographic extension or the geographic coverage of States parties); iv) have a local or regional coverage in the SOMAR islands, and the two states EEZ (Brazil and UK).

Accordingly, I selected the main convention and international instruments with the mandate to govern human ocean activities, marine biodiversity, and fisheries. I only included documents in which one or both States (Brazil and UK) are parties. Unlike Elsler et al. (2022), I also included regional agreements considered important for biodiversity conservation and two documents addressing High Seas areas (included in the international set of documents). The key international conventions selected are summarized in Appendix I. The selection of documents was guided by previous research on Atlantic Ocean policies (Mission Atlantic, 2021) and Elsler et al. (2022).

In total, I selected 66 documents covering the global ocean and high seas (n=25 documents), Brazil's EEZ (n= 14), and the United Kingdom (n=27). I included policy documents from official governments' websites, respective websites of formal organizations (e.g. UN, IMO and FAO websites) and other policy documents available online. I downloaded and used the documents in PDF format which were organized according to the jurisdiction (Brazil, UK, and International) and the conventions or policy name. Nine documents were in Portuguese (addressing the EEZ of Brazil) and the rest were in English.

2.4. Step 3: Text mining

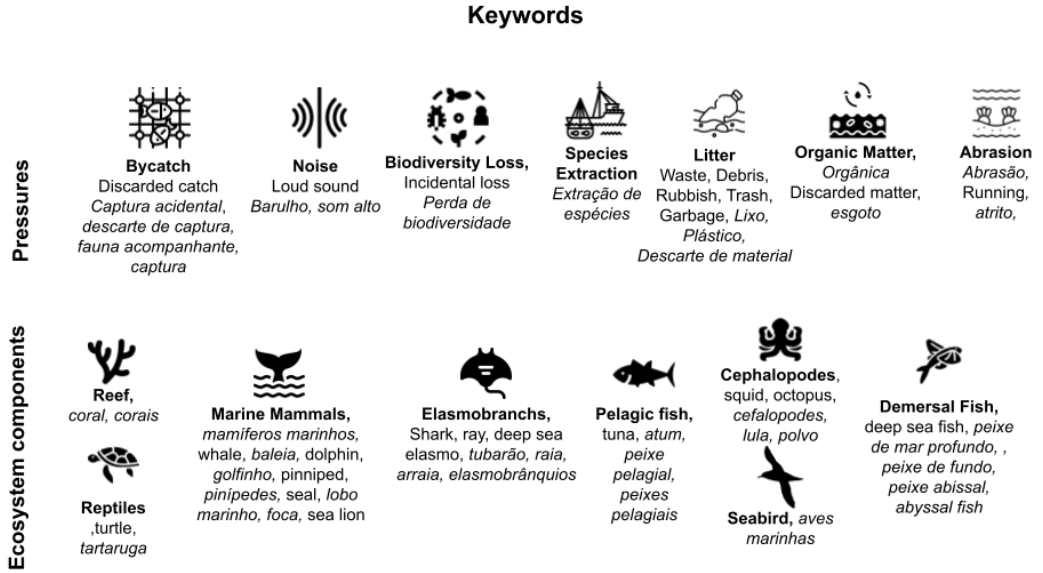
After I compiled the collection of documents, I carried out the text mining analysis. An important step in the text mining process is to develop a comprehensive list of keywords (i.e., "bycatch", and "litter") for the text mining algorithm to search for within the documents. I developed a comprehensive list of keywords based on the results of the SOMAR ODEMM conceptual model (Mission Atlantic, 2021). As mentioned above and noted in the Mission Atlantic report (Mission Atlantic, 2021),

fishing and shipping are the sectors with a major impact in this region. According to the ODEMM outcomes, the fishing sector yields seven pressures affecting 23 ecological components, while shipping yields eight pressures affecting 22 ecological components. The keywords list includes some of the words explicitly encompassed in the SOMAR ODEMM conceptual model and some synonyms for those words. The choice of the keywords was based on the main impacts, the broader ecosystem components, and in my expertise. Thus, a few words were not included (such as contaminants, EMF and shallow sediment). However, the further inclusion of these words is important for more accreted conclusions, mainly because they have a great impact on SOMAR.

I divided the keywords into two groups, one related to the pressures and a second one focused on the ecosystem components, as follows in Figure 6. The keywords in italic are in Portuguese due to the fact that ten official documents of the government of Brazil are written in the country's language. I the total, I selected 81 keywords among 7 pressures and 8 ecosystems components.

Figure 6:

List of keywords for pressures and ecosystem components.



Note: Adapted from Deliverable 1.1: Regional and Pan-Atlantic management objectives", by Mission Atlantic (2021). Available in

https://cdn.sanity.io/files/s2g49i7w/production/b980ec5106adfe7684ab5655dd2a27e6ebf8a4c3.pdf. Copyright 2022 by Ramalho

2.4.1. Analysis of the documents using text mining approach and keyword selection.

The text mining approach I used followed the method developed in Elsler et al. (2022). The code used the *pdftools* package (Ooms, 2021) in R (R Core Team, 2020) to find the keywords in the policy documents I selected. These data were organized in CSV format with the following information: PDF name (jurisdiction/convention), detected keyword, part of the text where the keyword is contained, line, and page numbers in which the keyword were mentioned. The code utilized was adapted from Elsler et al. (2022) and it is described in Appendice II.

2.5. Step 4: Comparison of International, Brazilian and UK keyword results

After running the analysis, I produced plots of the percentage of documents citing the pressures and ecological components set of keywords. The percentage was selected to allow comparisons across jurisdictions, and across pressures and ecosystem components, since the number of documents of international, Brazil and UK mandates were not similar.

3. Results

3.1. Anthropogenic Impacts on SOMAR

According to the ODEMM of the South-Mid Atlantic Ridge (SOMAR ODEMM), the fishing and shipping sectors were the most impactful sectors based on spatial and temporal effects of human activities, the frequency of the impacts, and the risk and degree of impact derived from these activities in the SOMAR region study case (Mission Atlantic, 2021). For fishing, the main pressures are species extraction, bycatch, contaminants and abrasion. For the shipping sector, contaminants, abrasion, noise and invasive species are the main pressures that SOMAR affects the ecosystem components. Climate change is not addressed in the ODEMM conceptual model approach because of the complex and cumulative way it interacts with all pressures and ecosystem components (Pedreschi et al. 2019).

According to the SOMAR ODEMM, the ecological components mostly frequently impacted by pressures from fishing and shipping are deep-sea fish, pelagic fish, demersal fish, and elasmobranchs in general. Marine Mammals were also impacted by pressures from noise and contaminants. Seabirds and cephalopods were impacted by abrasion, littoral sediments and organic matter. Species extractions pressure driven by fishing are acute for cephalopods, demersal and pelagic fish, also pelagic elasmobranchs and oceanic pelagic. Contaminants and noise can come from shipping or fishing sectors. These two pressures affect the greatest number of ecological components. However, contaminants were not assessed in this present study.

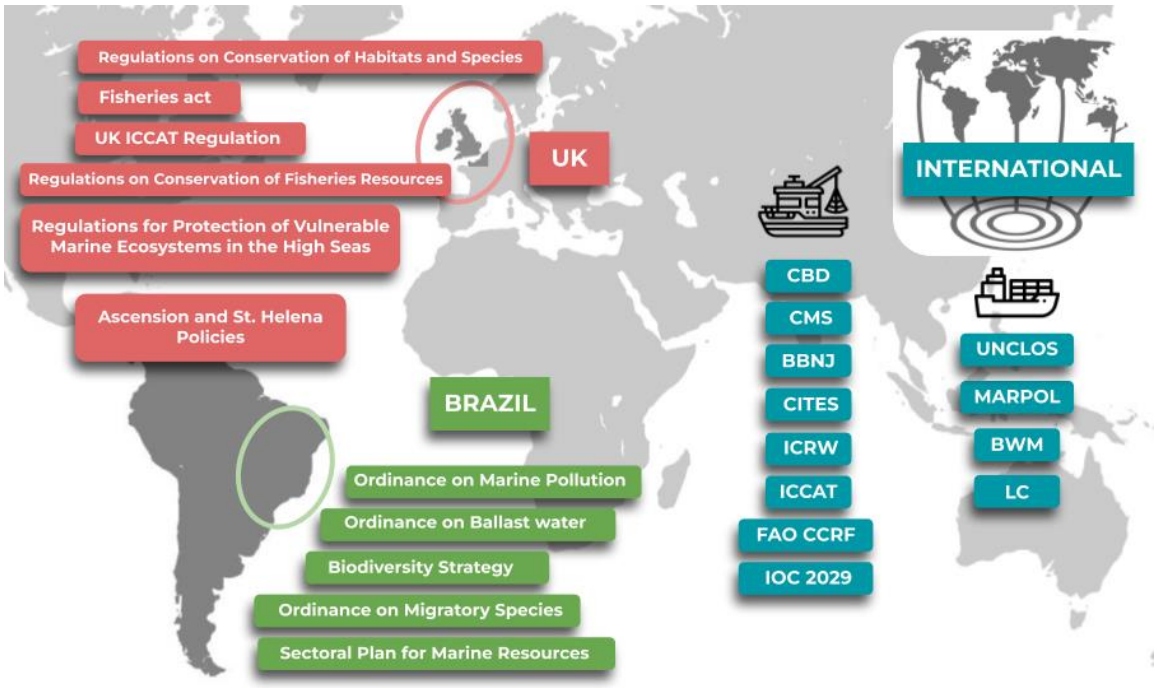
3.2. The International agreements and the national policies for integrating marine biodiversity, fishing and shipping.

The international agreements, treaties, and frameworks developed to govern human activities in the ocean and manage marine biodiversity are crucial to guide states to elaborate their own legislation to approach environmental targets and regulations (Grip, 2017). There were 25 international documents, 27 UK documents

and 14 Brazilian documents, and the total number of documents was 66. Thus, most of the documents were for UK policies, which included the management instruments for both islands (St. Helena and Ascension).

The key international documents I identified included, for instance, UNCLOS, MARPOL, CBD, London Convention, ICRW, BWM, CMS and its appendices, the IOC-UNESCO strategy plan and the BBNJ agreement draft. These were key instruments including one or some of the keywords (Table 1). The documents regulating the EEZ in Brazil included, for instance, the National Biodiversity Strategy and Action Plan, the Sectoral Plan for Marine Resources, which are two major policies for marine resources and biodiversity in the country. The management plan of San Peter and St. Paul (SPSP) MPA was not yet published, and most of the documents analyzed (n=8 documents) were ordinances to enforce international guidelines in the national policy (Figure 7). Finally, the UK documents were the most numerous in the database I analyzed, and in addition to others included documents related specifically to Ascension and St. Helena MPAs (such as the MPA Management Plan). I also identify policies established in the UK EZZ to implement international agreements (Figure 7).

Figure 7:*Key documents associated with International agreements in Brazil and UK.*



Note: The figure shows the main national policy documents derived from the international agreements (in blue). The documents in red are applied in the UK EEZ, and the documents in green are applied in Brazil EEZ.

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Summarizing the main finding regarding the policies, the international policies that cover the most pressures in SOMAR included the CMS Executive Summary of Guidance on Implementing the Plan Targets and the ICCAT resolution which was also the document with higher frequency of keywords, and the document covering more ecosystem components (Table 1). The Brazilian policy that covers the most pressures include the National Sectoral Plan for Marine Resources, and the policy covering more ecosystem components is the National Biodiversity Strategy plan. Regarding UK policies, that cover most pressures were the UK Marine Policy Statement and the Biodiversity 2020, while the document including most of the ecosystem components was the Ascension Island Marine Protected Area Management Plan 2021-2026. Considering the policies which cited at least one keyword (total n= 45 documents), in Brazil, the national ordinance of creation of St. Peter and St. Paul MPA does not address any pressures, and the national ordinances to enforce the International Convention for the Control and Management of Ballast Water and Sediments from

Ships (BWM), Convention on the Prevention of Marine Pollution from Dumping of Waste and Other Matter (London Convention) and Convention on the Conservation of Migratory Species of Wild Animals (CMS) does not address any ecosystem components. In the UK, the Ascension Wildlife protection ordinance, Conservation of Seals-Act 1970, Regulation of Foreign Fishing Boats, Regulation to implement the Convention are of the International Commission for the Conservation of Atlantic Tunas (ICCAT), Control Measures applicable to fishing for certain stocks of highly migratory fish and the Regulation for protection of vulnerable marine ecosystems in the high seas from the adverse impacts of bottom fishing gears does not address any pressure. The UK Regulation for the management of the introduction and spread of invasive alien species does not address any ecosystem components. Finally, in the international waters, the International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM), the Convention on International trade in Endangered Species (CITES), Appendices I and II, the Convention on Migratory Species: Strategic Plan 2015-2023 (CMS), the Convention on Migratory Species - Conservation of Critical, Intertidal and Other Coastal Habitats for Migratory Species, the Regulation to implement the Convention are of the International Commission for the Conservation of Atlantic Tunas (ICCAT), and the International Convention for the Regulation of Whaling (ICRW) do not address pressures. Besides, the draft of the Conservation and Sustainable use of Marine Biological Diversity of areas Beyond National Jurisdiction (BBNJ), the Intergovernmental Oceanographic Commission of UNESCO Medium-Term Strategy, 2022–2029 (IOC strategy 2029), the Convention on the Prevention of Marine Pollution by Dumping of wastes and other matter (London Convention), and the Agreement for Relating to the Conservation and Management of Straddling Fish Stock and Highly Migratory Fish Stocks do not address any ecosystem component.

Table 1:

Pressures and ecosystems components found in the documents

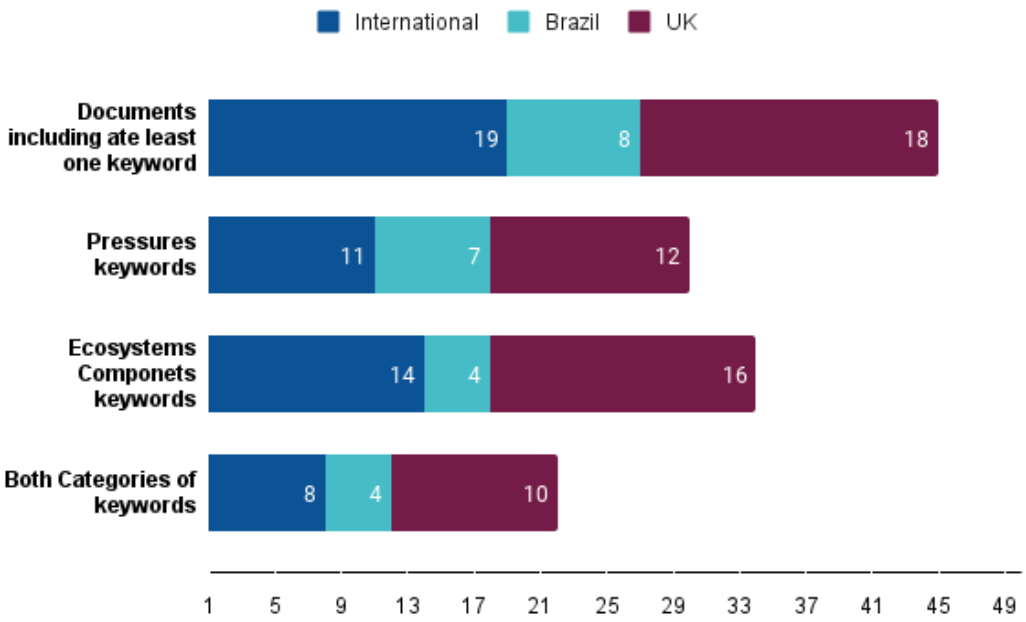
JURISDICTION	Pressures/Ecosystem components	Bycatch	Species extraction	Litter	Noise	Organic Matter	Abrasion	Biodiversity loss	Pressures p/ doc	Number pressure keywords p/document	Reef	Marine Mammals	Reptile	Elasmobranchs	Seabirds	Cephalopods	Pelagic Fish	Ecosystem components p/doc	Number EC keywords p/document	Sum Pressures/EC per document	total of keywords mentioned p/doc
BRAZIL	BR_Biodiversity_Strategy.pdf	0	0	21	0	0	0	7	2	28	13	5	6	1	0	1	0	5	26	7	54
	BR_Conservation_Albatrosses_Petrels.pdf	0	0	1	0	0	0	0	1	1	0	0	0	0	2	0	0	1	2	2	3
	BR_Conservation_Turtles.pdf	0	0	2	0	0	0	0	1	2	2	0	47	0	0	0	0	2	49	3	51
	PT_decrete_ballast_water.pdf	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	1	1
	PT_decrete_marine_pollution.pdf	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	1	1
	PT_decrete_migratory_species.pdf	7	0	0	0	0	0	0	1	7	0	0	0	0	0	0	0	0	0	1	7
	PT_decrete_MPA_SPSP.pdf	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
	PT_PSRM.pdf	5	0	3	0	0	0	0	2	8	2	2	0	5	0	0	1	4	10	6	18
	Total pressures/ecossystem components Brazil	**12**	**0**	**27**	**0**	**2**	**0**	**7**		48	**17**	**7**	53	**6**	2	1	**2**		88	2.75	136
INTERNATIONAL	HS_BBNJ_draft_2022.pdf	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	1	1
	IN_BWM.pdf	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	1	1
	IN_CITES_Appendices_2020.pdf	0	0	0	0	0	0	0	0	0	0	9	6	6	0	0	0	3	21	3	21
	IN_CITES_convention_text.pdf	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	1	2	1	2
	IN_CMS _strategic_plan.pdf	0	0	0	0	0	0	0	0	0	0	5	4	0	0	0	0	2	9	2	9
	IN_CMS_bycatch.pdf	17	0	0	1	0	0	0	2	18	0	0	7	5	5	0	0	3	17	5	35
	IN_CMS_habitat_conservation.pdf	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	2	2	2	2
	IN_CMS_noise_cetaceans.pdf	0	0	1	72	0	0	0	2	73	0	6	2	7	0	2	0	4	17	6	90
	IN_CMS_strategic_plan_implementation.pdf	1	0	3	2	0	0	0	3	6	1	0	1	0	0	0	0	2	2	5	8
	IN_FAO_Responsible_Fisheries.pdf	1	0	13	0	0	1	0	3	15	0	6	0	0	0	0	0	1	6	4	21
	IN_ICCAT_convention.pdf	0	0	0	0	0	0	0	0	0	0	1	0	3	0	19	0	3	23	3	23
	IN_ICCAT_resolution.pdf	19	0	3	0	0	2	0	3	24	0	17	25	148	12	0	526	5	**728**	8	752
	IN_ICRW.pdf	0	0	0	0	0	0	0	0	0	0	19	0	0	0	0	0	1	19	1	19
	IN_IOC_strategy_2029.pdf	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	1	1
	IN_London_Convention.pdf	0	0	2	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	1	2

	Pressures/Ecosystem components	Bycatch	Species extraction	Litter	Noise	Organic Matter	Abrasion	Biodiversity loss	Pressures p/ doc	Number pressure keywords	Reef	Marine Mammals	Reptile	Elasmobranchs	Seabirds	Cephalopods	Pelagic Fish	Ecosystem components p/doc	Number EC keywords p/document	Sum Pressures/EC per document	total of keywords mentioned p/doc
	IN_Marpol_convention.pdf	0	0	51	0	0	4	0	2	55	0	2	0	1	0	0	0	2	3	4	58
	IN_Migratory species_GA_UN.pdf	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	1	1
	IN_Protocol_London Convention.pdf	0	0	38	0	0	0	0	1	38	0	0	0	0	0	0	0	0	0	1	38
	IN_UNCLOS.pdf	0	0	6	0	0	0	0	1	6	3	0	0	3	0	0	8	3	14	4	20
	Total pressures/ecossystem components International	**38**	**0**	**118**	**75**	**0**	**7**	**2**		**240**	**4**	**69**	**46**	**173**	**17**	**21**	**534**		**864**	**2.84**	1104
UK	UK_Ascension_Fisheries_ordinance.pdf	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	1	1
UK	UK_Ascension_Fisheries_Strategy.pdf	1	0	0	0	0	0	0	1	1	0	0	0	2	0	0	2	2	4	3	5
UK	UK_Ascension_Management_Plan.pdf	0	0	10	1	0	0	0	2	11	1	2	13	8	8	1	13	7	46	9	57
UK	UK_Ascension_Wildlife_Protection_Ordinance.pdf	0	0	0	0	0	0	0	0	0	0	2	1	5	0	0	0	3	8	3	8
UK	UK_Conservation_Fisheries_Resources.pdf	2	0	0	0	0	1	0	2	3	1	0	6	21	6	2	9	6	45	8	48
UK	UK_Conservation_Habitats_and_Species.pdf	0	0	5	0	0	0	0	1	5	0	1	0	1	0	0	0	2	2	3	7
UK	UK_Conservation_Migratory_Species.pdf	1	0	2	0	0	0	0	2	3	0	5	10	7	0	0	22	4	44	6	47
UK	UK_Conservation_Seals.pdf	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	1	1
UK	UK_Fisheries_Act_2020.pdf	7	0	0	0	0	2	0	2	9	0	17	0	2	0	0	2	3	21	5	30
UK	UK_Foregin_fishing_boats.pdf	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	1	2	1	2
UK	UK_ICCAT.pdf	0	0	0	0	0	0	0	0	0	0	0	16	20	5	0	29	4	70	4	70
UK	UK_Invasive_Species.pdf	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	1	1
UK	UK_Marine_Policy_Statement.pdf	0	0	17	14	0	0	2	3	33	1	0	0	0	0	0	0	1	1	4	34
UK	UK_Migratory_Fishes.pdf	0	0	0	0	0	0	0	0	0	0	2	0	1	0	0	24	3	27	3	27
UK	UK_National_Protected_Areas_Ordinance.pdf	0	0	3	0	0	0	0	1	3	0	0	3	0	0	0	0	1	3	2	6
UK	UK_Protection_Fishing_Bottom_Impacts.pdf	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	1	3	1	3
UK	UK_StHelena_Management_Plan.pdf	6	0	15	0	0	0	0	2	21	0	59	13	65	23	1	33	6	**194**	8	215
UK	UK_Strategy_Ecosystems_Services.pdf	2	0	4	0	0	0	15	3	21	1	2	0	7	1	0	3	5	14	8	35
UK	**Total pressures/ecosystem components UK**	**19**	**0**	**58**	**15**	**0**	**3**	**17**		112	**7**	**91**	**62**	**141**	**43**	**4**	**137**		**485**	3.94	**597**
	Total pressures/ecosystem components Total	**69**	**0**	**203**	**90**	**2**	**10**	**26**			**28**	**167**	**161**	**320**	**62**	**26**	**673**				

3.3. Keyword frequency

The results of my analysis show that 45 of the 66 documents (68,1%) mention pressures or ecosystem components. In the total, 22 documents of the 66 (33,3%) cite both pressures and ecosystem components (Figure 8). For international documents, 19 of 25 documents mention at least one pressure or one ecosystem component, 11 documents mention pressures and 14 mention ecosystem components. However, only 8 documents mention pressures and ecosystem components. Regarding the Brazilian documents, 8 of the 14 documents mention at least one pressure or one ecosystem component, 7 documents mention pressures and 4 mention ecosystem components, but these 4 documents also mention pressures, being the number of documents mentioning pressures and ecosystems components equal (4). Finally, of the UK documents, 18 of 27 documents mention at least one pressure or one ecosystem component, 12 documents mention pressures and 16 mention ecosystem components. Although, only 10 documents mention pressures and ecosystem components. I found that ecosystem components were mentioned more commonly in the UK and international waters documents, while in Brazil, the pressures were mentioned in more documents. (Figure 8).

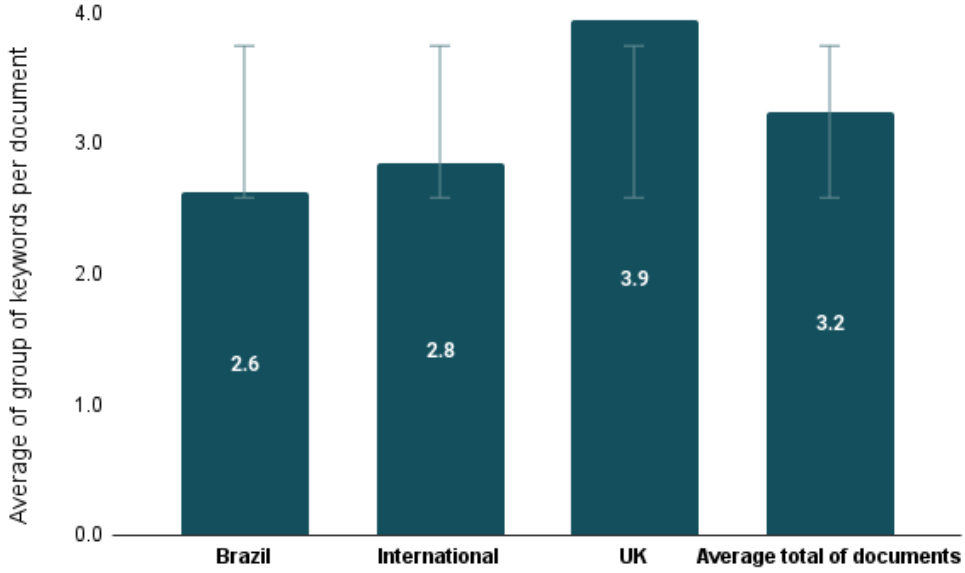
Figure 8:*Number of documents including the keywords per jurisdiction.*



Note: Chart providing the number of documents including any of the keywords, the keywords related to the pressures, the ecosystem components and the documents containing both groups of keywords in each jurisdiction (International, Brazil and UK = United Kingdom.

Figure 9 illustrates the joint average of pressures and ecosystem components (categories) addressed in each jurisdiction and in the total of documents citing keywords (45 of 66 documents). The average was joint because I aimed to identify the jurisdiction by integrating more comprehensively pressures and ecosystem components together in their respective documents. The UK has the higher average (n= 3.9 categories of keywords), surpassing the average number of international documents (n= 2.8 categories of keywords), while the Brazilian average was the lowest (n=2.6 categories of keywords). The average considering the total of documents containing keywords was 3.2 components of the group of keywords.

Figure 9: *Average of keywords categories included in the documents*



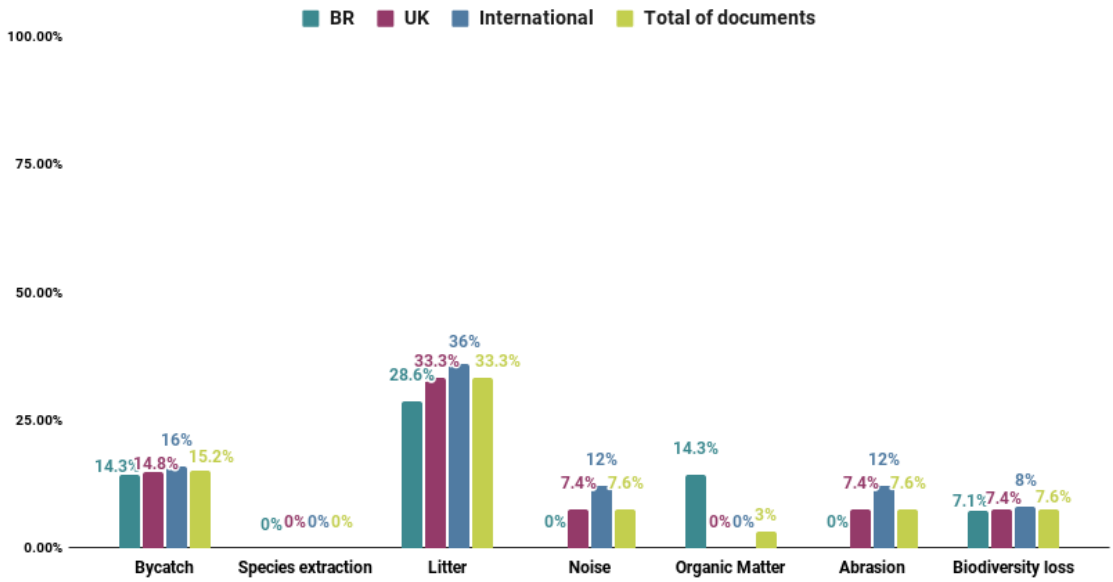
Note: The average was calculated using the sum of keywords categories cited per document ("bycatch", "litter", "marine mammals" are examples of keywords categories) and divided by total amount of keywords categories cited in that jurisdiction (error bars show standard errors).

The key findings regarding the coverage of the documents on pressures and ecosystem components affected by fishing and shipping in the jurisdictions are summarized in Table 1. Considering the total frequency of keywords, the international documents cited more keywords (n=1104 keywords), followed by the UK (n=597 keywords) and Brazil (n=136 keywords). The international documents also had a higher frequency of pressure and ecosystem components keywords (n=240 pressures keywords and n = 864 ecosystem component keywords), followed by UK documents frequency (n=112 pressure keywords and n=485 ecosystem components keywords), and lastly, Brazilian documents frequency that is the lowest (n=48 pressure keywords and n=88 ecosystem components keywords). For each jurisdiction, the policies that cited more keywords were in the international documents, MARPOL convention for pressures (n= 55 keywords) and ICCAT resolution for ecosystem components (n= 728 keywords) and in the total (n=728). From the UK set of documents, the policies that cited more keywords were Marine Policy Statement for pressures (n=33 keywords) and St. Helena Marine Management Plan for

ecosystem components (n=194 keywords) and the total (n=215). Finally, regarding Brazil's set of documents, the policy that cited more keywords was the National Biodiversity Strategy and Action Plan, which cited 28 pressure keywords, and 26 ecosystem components, totaling 54 keywords.

From the pressures resulting from fishing and shipping activities, "species extraction" was the only one not found in any document. "Litter" and "bycatch" were the most common pressures found among the documents from all jurisdictions (Figure 10). The pressure "noise" was not covered in any Brazilian documents, only in those under international and UK jurisdiction, while "organic matter" was found exclusively in two policies from Brazil (Ordinance on the Convention on the Prevention of Marine Pollution from Dumping of Waste and Other Matter and the Ordinance on International Convention for the Control and Management of Ballast Water and Sediments from Ships). Figure 10 presents the percentage of documents in each jurisdiction and in the total of documents that mention the keyword related to the pressures.

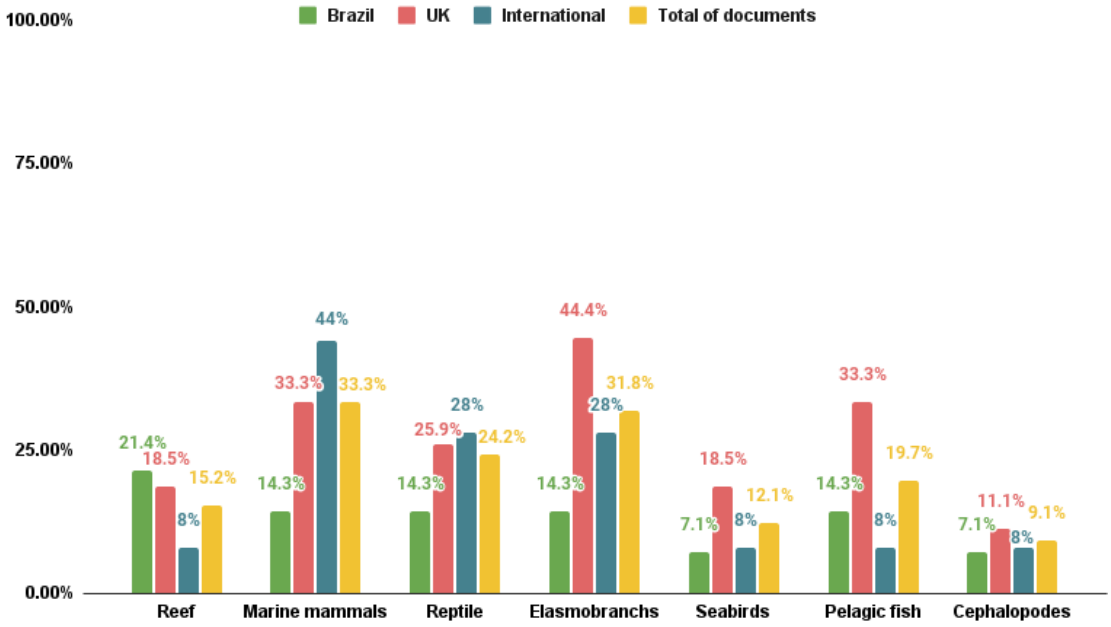
***Figure 10**:Percentage of documents containing the pressure keywords*



Note: This figure shows the percentage of documents, including each pressure out of the total of documents per jurisdiction and in the total (Total per jurisdiction: International n = 25 documents, Brazil n = 14 documents, UK n = 27 documents, and total n = 66 documents). The X-axis represents the categories of pressure keywords ("bycatch", "species extraction", "litter", "noise", "organic matter", "abrasion" and "biodiversity loss") and, Y-axis represents the percentage of documents per jurisdiction.

The ecological component cited most in the documents varied among the jurisdictions. In the international database of documents, “marine mammals” were cited per more documents (n= 11 of 25 documents, which represents around 44% of the international documents), while in the UK dataset of documents, “elasmobranchs” were cited per more documents (n=12 of 27 documents, that represents 44% of international documents), and Brazil had “reef” cited in more documents (n=3 of 14 documents, what represents around 21% of Brazilian documents). Considering the total number of documents (n= 66 documents), “marine mammals” was the ecological component cited per more documents (n= 22 of 66 documents, representing around 33% of the total) and cephalopods were the less cited ecological component (n=6 of 66 documents, representing around 9% of the total). Figure 11 illustrates the percentage of documents citing each ecosystem component.

Figure 11*: Percentage of documents containing ecosystem components keywords.*



Note: This figure shows the percentage of documents including each ecosystem component out of the total of documents per jurisdiction and in the total (Total per jurisdiction: International n = 25 documents, Brazil n = 14 documents, UK n = 27 documents, and total n = 66 documents). The X-axis represents the ecosystem components keywords (“reef”, “marine mammals”, “reptile”, “elasmobranchs”, “seabird”, “pelagic fish”, “cephalopods”), and, Y-axis represents the percentage of documents per jurisdiction.

4. Discussion

Ecosystem-based management requires an understanding of the links between sectors, human activities, pressures on the environment and the ecosystem components affected (Curtin & Prellezo, 2010, Samhouri et al., 2014). It also requires policies that address these impacts, promotes the protection of the ecosystems and leads to sustainable solutions. These policies need to operate in international and also national waters to effectively protect ecosystem components from the pressures of human activities (Grip, 2017). Identifying the pressures and ecosystem components that are addressed in the policies already taken in place helps to understand where the gaps exist in these policies, and where there are possibilities to use these actual policies to improve the protection of the ecosystem components from the pressures. Besides, marine fisheries represent the largest maritime sector in the number of people involved, while shipping has the majoritarian contribution to international trade (over 90 percent), thus being the most relevant maritime sectors for society (United Nations, 2021).

This study provided a qualitative analysis of international agreements and national policies from Brazil and UK that address various kinds of integration of fishing and shipping pressures and marine and the ecosystem components affected. Through a combination of ODEMM results on the study case of South Mid-Atlantic Ridge (SOMAR) and a text mining approach, it was possible to identify and compare the inclusion of the pressures and ecosystem components by the jurisdiction's policies.

4.1. The documents

The decline of marine biodiversity and habitats affects the functioning of ecosystems, and it remains to be worrisome worldwide (Biswas, 2017, United Nations, 2021, Barirani, 2022). As a consequence, several treaties have been signed to embed marine ecosystem protection (e.g. Convention on Biological Diversity, Convention on Migratory Species and UNCLOS). Increasingly, regional conventions and national legislation are also incorporating environmental concerns (United

Nations, 2021). However, numerous frameworks for management and protection of marine ecosystems have a sector-focused approach and thus may have different objectives and purposes for marine environmental protection across sectors (Mission Atlantic, 2021).The sectoral approach is often used because of the management facilities compared with ecosystemic approaches, but the synergies between environment components and the cumulative impacts of human activities with a changing environment are affecting different sectors in a different degree concurrently (Bodansky, 2007, Alexandre & Howard, 2019). Thus, integrated approaches, such as ecosystem-based solutions are more inclusive and preferable to promote environmental protection (McLeod & Leslie, 2009, Harvey et al, 2017). Previous research indicates that the Atlantic legal framework is sectoral based (Mission Atlantic, 2021, Elsler et al., 2022), a fact that also resembles the findings of the present study. No policy covered all the pressures or ecosystem components analyzed. On the national level, the majority of the documents were not overly thorough in their inclusion of pressures and ecosystem components, once the keywords were cited a few times. And on an international level, despite the policies do not cover as many pressures and ecosystem components as the UK, it was the jurisdiction with higher frequency of keywords. It suggests these policies are not broadly inclusive regarding the coverage of various pressure and ecosystem components, but mentioned these items more times. This fact indicates that the international policies might have an in-depth coverage of the pressures and ecosystem components rather than an all-inclusive approach.

The UK database was the one including more documents, compared with Brazil and international waters. The UK documents also cited more pressures and ecosystem components per document. This evidence suggests that the impacts of fishing and shipping in the UK waters are better covered by national policies than in Brazil. The Brazilian database has the fewest documents, which were majority government ordinances decreeing or validating that specific international agreements were endorsed in Brazil. These documents enforce the whole of Brazil as part of those conventions, however, the implementation at a national level demands better regulatory measures (Grip, 2017, United Nations, 2021). Therefore, those documents were shown to have less integrative coverage, both due to the low inclusion of

pressures and ecosystem components and for the lowest frequency of keywords (Table 1). This indicates that Brazil has a set of policies that do not comprehensively address the impacts of fishing and shipping on the environment. The two Brazilian documents including more keywords were the Biodiversity Strategy policy and the Sectoral Plan for Marine Resources, standing out as the most relevant documents for marine biodiversity in the country.

Furthermore, the SOMAR islands (St. Peter and St. Paul in Brazil, and St. Helena and Ascension in the UK), are located in three different MPAs. This study evidenced that the UK has a robust set of management documents for regulating activities in St. Helena and Ascension islands, unlike Brazil that is still developing the management plan for St. Peter and St. Paul (SPSP). The SPSP MPA was established in 2018 and was an important mark for the country to achieve the Aichi target, having more than 25% of marine areas under environmental protection until 2022 (Gonçalves & De Santos, 2022). Nonetheless, the management is still being negotiated among the stakeholders affected, what might be a challenging process considering the diverse interests and conflicts involved**.** The issues of collaboration and involvement of stakeholders in the process of management of MPAs seem to be present in more other cases in Brazil (e.g. de Freitas, et al. 2022), and might negatively affect the efficiency of the protection of the species and habitats (Solomonsz et al., 2021). For instance, the UK MPAs documents presented a high number of items (pressures and ecosystems components) being covered, which demonstrates these documents are more comprehensive and promising for promoting pressures mitigation and ecosystem components protection at a local level. Although, the specialized agreements (such as the ICCAT resolution and CMS appendices on bycatch) along with these UK MPAs management plans emerged with more exhaustive considerations, whereas the documents with broad approaches covered fewer pressures and ecosystem components.

Despite Brazil and the UK being both parties to the international agreements analyzed in this study, the outcomes of this research suggest that the database of Brazilian documents addressing marine biodiversity, shipping and fisheries are less comprehensive compared to the UK. Moreover, the evidence indicates that the SOMAR region seems to lack an integrative approach on the documents, which are

not comprehensively covering pressures and ecosystem components affected by fishing and shipping. Thus, overall it was identified as a predominant sectoral feature rather than a holistic approach to the database of documents analyzed.

4.2 The keywords frequency

Considering the frequency of keywords, the average of items cited per document was low in all jurisdictions (international waters, Brazil and UK) and the ecosystem's components keywords were cited more compared to the pressure keywords. This could be indicative of the results of the effort that has been made regarding the conservation of biodiversity (Grip, 2018). The establishment of the CBD, CMS, CITES and the IUCN red list steered countries' initiatives towards species protection (Kuunal, et al., 2020) especially after the public awareness of emblematic species such as turtles and marine mammals. However, Biermann et al. (2022) discuss that this global targets (such as SDGs) have showing some results in driving global governance and countries policies, although it remains still limited and in a discursive aspect rather than active.

Regarding the pressures, “species extraction” was not identified in the text mining in any of the documents. However, this result might be due to terminology discrepancies, being the keyword not adequately selected. The exploitation of fish stock is a huge impact caused by the fishing sector, and the management of living resources is challenging for states. The mobility of species across the ocean requires sharing information between countries and management measures that cross boundaries (Kraus & Diekmann, 2017). Even though this pressure might be addressed on some documents, the keywords “species extraction” were not found.

“Organic matter” was the pressure less addressed, and was found only in Brazilian documents, missing in UK and international waters documents. However,, the keyword was mentioned only in two documents including the national ordinance implementing the BWM Convention (2004) and the London Convention (1972). Nonetheless, the keyword was not found in the conventions per se. Most probably it is also due to different terminologies used in the documents, once this is an important problem affecting the productivity of the open ocean and consequently the marine

biodiversity and fish stocks (Robinson and others, 2010, United Nations, 2021). Due to its importance, the inclusion of the pressure “organic matter” should be improved, especially in international waters and UK documents.

In contrast, “noise” and “abrasion” were not addressed in Brazilian documents. Anthropogenic noise is a pressure that may be caused by diverse sources, including shipping and fishing. Unlike the other pressures, noise is not have a permanent impact, however is very frequent and affects diverse ecosystem components (Bittencourt et al, 2014, United Nations, 2021). Therefore, the not inclusion of “noise” in the policies is a huge gap that is affecting the ecosystem components and should be addressed in the policymaking process. The fact that “noise” and “abrasion” were not mentioned in Brazilian documents might be an evidence that the shipping and fishing policies lack an environmental approach, a fact that treats the protections of species for several reasons (Forte et al., 2021)

On the other hand, “litter” was the pressure mentioned most in the documents. Marine litter is a very important concern for countries, especially by the impact in other sectors (such as tourism) and its polluting potential. Although, the quantification of litter inputs in the ocean remains uncertain, making this pressure a challenge for management (United Nations, 2021). The impact of litter on megafauna is also an increasing concern in the last decades (Kühn et el., 2015, Roman et al., 2020) and have touching the civil society, promoting, at some level, awareness about this topic.

Regarding the ecosystem components, “demersal fish” was not found in any document. However, this ecosystem component is highly affected by fishing activities, especially trawlers and, considering the biodiversity importance and specificity of islands in SOMAR, these species should be covered by policies, in order to promote a holistic approach. Local studies should be carried out and followed up in order to indicate to policymakers the sensitivity species and habitats to be covered. The inclusion of ecological components such as deep sea fish and particular species, which is lacking in all documents, should be considered for improving the ecosystem based management outcomes.

The most cited ecosystem components overall were “marine mammals” and “elasmobranchs”. In the international documents, marine mammals were cited by 11 documents and elasmobranchs by 7 documents. The inverse happened with the UK documents, which cited marine mammals in 9 documents, while elasmobranchs were cited in 12 documents. However, unlike both jurisdictions, Brazil had the “marine mammals” and “elasmobranchs” cited by only 2 documents while “reef” was the ecosystem component most mentioned, found in 3 documents (Table 1). Marine mammals and elasmobranch species are highly vulnerable to environmental impacts. Human activities such as illegal, unreported and unregulated fishing (IUU fishing) are major threats to the conservation of these animals (United Nations, 2021). Many species of marine mammals and elasmobranchs are registered on the IUCN red list of endangered species (IUCN, 2022). Although, management measures have been applied in the last decades and the statistics on the threatening of these species have improved (United Nations, 2021). The international treaties on biodiversity (CBD), migratory species (CMS), endangered species (CITES) and management of fisheries (ICRW and ICCAT conventions, for instance) played an important role in promoting biodiversity conservation on these ecosystems components (Kuunal et al, 2020) However, internationally, the document that emerged citing “marine mammals” (following the ICRW) and “elasmobranchs”, were the ICCAT resolution, while the other conventions did not have an expressive number of citations of these ecosystems components (Table 1).

Both Brazil and the UK are signatory parties to those conventions and have enforced them in their national legislation. Brazil has policies addressed specifically to ecosystem components, such as the Agreement on the conservation of Albatrosses and Petrels and the Inter-American agreement for conservation of sea turtles. Likewise, the UK has an Agreement on conservation of seals. However, unlike Brazil, the UK also has a variety of legislation on management of marine resources and the environment (e.g. Regulation on the Conservation of Fisheries Resources and protection of marine ecosystems, the Conservation of Habitats and Species Regulations). The existence of these policies are promising to promote broad protection of species and habitats. Besides, the keywords reveal that UK policies

cover more ecosystem components and address more pressures, indicating a stronger ecosystem based approach to governance.

Lastly, “cephalopods” were the keyword covered by fewer documents among all jurisdictions (Figure 11). The low coverage of this component might be due to the fact that invertebrate animals lack the regulation and do not be considered “charismatics” (Mather, 2022). However, they hold an important role in the fishing industry and also for the economy (Ospina-Alvarez et al, 2022). This fact emerged as a significant gap to be addressed in the policymaking process.

4.3 Limitations of this study and opportunities

The text mining approach proved to be promising in identifying whether a document includes or not a defined component. However, some pressures and ecosystem components had surprisingly low results, but probably are covered in the policies. For example, “species extraction” was not found in any document, and “organic matter”, identified only in two Brazilian documents. In addition, according to the results, “demersal fish” does not emerge in the findings, but most probably is integrated into the fishing policies (e.g. Fisheries Act in the UK, and the draft of the BBNJ negotiations). Therefore, the choice of keywords may have to be more complete, a fact that could have affected the results of this study. The inclusion of all pressures and ecosystems component (for example contaminants that was not assessed in this research) and any terminology or derivations is essential for ensure accuracy in the analysis. Further studies should elaborate a keyword list more exhaustively, including as much synonymous as possible, and specific terms (the scientific name of species, for example). A reanalyzing with the improved list of keywords might be necessary. The findings of this study should therefore be considered as a window into obvious gaps addressed to certain pressures and ecosystem components in the policies.

Furthermore, the use of keywords is promising to identify the gaps in documents regarding the inclusion of the impacts of sectors in the ecosystem components. However, it should be noted that the reference to the keywords does not mean that those pressures and ecosystem components are effectively managed or

governed through these policies. Effective policy implementation requires incentives, penalties, and enforcement measures to be effective (Gripe, 2017). Future research to ascertain the efficiency and success of policies integrating the ecosystems pressures and components are essential to providing recommendations for strengthening that effectiveness.

Therefore, the present study is the first approach to mapping the spatial overlap and co-occurrence of each of the policies in a transboundary management zone. It helps to inform how policies address the occurrence of human activities and the ecosystem components in a transboundary region shared by two countries and international waters would give an explicit spatial assessment of policy gaps and synergies. Additionally, following up on the evolution of national policies and international agreements would lead to a stronger perspective about the performance of the environmental protection political framework, as Elsler et al. (2022) suggest.

4.3 Challenges of Not Including Climate Change - ODEMM

Climate change was not identified as a pressure in the ODEMM from the SOMAR study case. Pedreschi et al. (2019) recommend excluding climate change due to the complexity and the requirement of global-scale management strategies. Although, this is one of the major stressors affecting oceans and the cryosphere (Tittensor et al, 2019, IPCC, 2022) and the SOMAR region. The latest Intergovernmental Panel on Climate Change (IPCC) has been warning about the multi-stressor nature of climate change and the complexity of its impacts on the whole earth system (IPCC, 2022). The uncertainties on the cumulative effects of climate change on the environmental components potentially affect human activities and likewise (Halpern et al., 2019). International agreements (such as the UNFCCC) and common goals were established, and the countries are leading to adapt their national regulations to include this component in the management of ecosystems (Biermann et al, 2022). The scope of this study does not consider climate change in the analysis, although further studies following up on the developments on climate change integration on the legal framework could provide to state policymakers with a comprehensive idea where the gaps are and what to prioritize in order to achieve the targets for sustainable development.

The highly connective nature of the ocean is a challenge for the management of marine biodiversity and environmental changes, and highlights the challenges of transboundary governance. The quantification and mitigation of actions for human activities demand an effort beyond national boundaries. The complex task of improving the management strategies for sustainable use require collaboration and coordination between jurisdictions, investments in science and new technologies, support for capacity building especially in regions where it is lagging and effort in integrated management and marine spatial planning, with a holistic and multidisciplinary approach (Tittensor et al, 2019, United Nations, 2021,). The consideration of both science and traditional knowledge, the inclusion of all stakeholders and the facilitation of the decision-making process are pathways to strengthen the environmental and marine legal framework and advance the common goals for a sustainable future.

5. Conclusions and recommendations

This study discusses the cover of pressures from fishing and shipping sectors in the South-Mid Atlantic Ridge and the ecosystem components affected by the main international agreements and local policies from Brazil and UK considering the regulation of human activities and biodiversity conservation. The analysis has revealed that in the UK more policies were identified then in international and Brazilian waters. Besides, the UK has a higher average of keywords citations per document, meaning that its approach is more comprehensive compared with the other two jurisdictions. On the other hand, in the international document the keywords were cited more time throughout the documents. This evidence might suggest that even though the pressures and ecosystem components may be found addressed together in the same document, it does not ensure that these documents are promoting the protection of marine environment, once its approach might be shallow.

The evidence found in this study suggests that the legal framework encompassing the region of SOMAR is predominantly sectoral fragmented, especially for Brazil and International jurisdictions, meeting other studies' results. The pressure “species extraction” and the ecosystem component “demersal fish” were not found in any document. Besides, the UK addressed most of the pressures (except “organic matter”) and all ecosystem components (not considering “demersal fish”). The same coverage was found in the international documents. Unlike UK and international waters, Brazil does not address “noise” and “abrasion” in any of the documents and has the poorest coverage for ecosystem components compared with the other two jurisdictions. Considering this fact, future policies should address the apparent gaps in coverage of these missing pressures and ecosystem components to strengthen ecosystem based management.

In addition, strengthening the reference to key pressures and ecosystem components in policies is important, however it is crucial to have effective implementation of these policies. Conventions enforcement, incentives and other approaches are needed to ensure this. Besides, the results also show that the MPA

management plans, found in the UK, are a promising tool for promoting an integrative management approach to human use of the ocean. A similar integrative management plan for Brazil might help to support EBM in the country and thus in SOMAR.

Finally, this study showed that the combination of ODEMM with a text mining method could be useful to overview and identify obvious gaps in policies for regulating human activities and the protection of ecosystem components. Further work should address additional pressures and ecosystem components, and the synonyms. Closer inspection of the content of the policies where keywords were identified is also recommended. Moreover, future work should examine the degree to which policies that contain these keywords are effectively implemented in SOMAR.

References

Alexander K. A, Howard M (2019) The human side of marine ecosystem-based management (EBM): 'Sectoral interplay' as a challenge to implementing EBM. *Marine Policy* 101:33–38. https://doi.org/10.1016/j.marpol.2018.12.019

Angel, M. (1993). Biodiversity in the pelagic ocean. *Conservation Biology* 7: 760–772. https://doi.org/10.1046/j.1523-1739.1993.740760.x

Ascension Island Government. (2021, May 23). Living on Ascension Island. Retrieved August 9, 2022, from https://www.ascension.gov.ac/lifestyle-and-employment/living-here-2

Balgos M, Cicin-Sain B, VanderZwaag D (2015) A comparative analysis of ocean policies in fifteen nations and four regions. In: Cicn-Sain B, VanderZwaag D, Balgos M (eds) Routledge handbook of national and regional ocean policies. Routledge, USA

Barirani, D. (2022). A UN Treaty for Marine Biodiversity: Establishing Environmental Policy Integration in Global Governance.*Global Policy*. https://doi.org/10.1111/1758-5899.13088

Bennette, N. J. (2019). Marine social science for the peopled seas. *Coastal Management*,*47*(2), 244-252. https://doi.org/10.1080/08920753.2019.1564958

Biermann, F., Hickmann, T., Sénit, C. A., Beisheim, M., Bernstein, S., Chasek, P., Grob, L., Kim, R. E., Kotzé, L. J., Nilsson, M., Llanos, A. O., Okereke, C., Pradhan, P., Raven, R., Sun, Y., Vijge, M., van Vuuren, D., & Wicke, B. (2022). Scientific evidence on the political impact of the Sustainable Development Goals. *Nature Sustainability*, 1-6. https://doi.org/10.1038/s41893-022-00909-5

Bishop, M. J., Mayer-Pinto M., Airoldi, L., Firth, L. B., Morris, R. L., Loke, L. H. L., Hawkins, S. J., Naylor, L. A., Coleman, R. A., Chee. S. & Dafforn, K. A. "Effects of ocean sprawl on ecological connectivity: impacts and solutions." *Journal of Experimental Marine Biology and Ecology* 492 (2017): 7-30. https://doi.org/10.1016/j.jembe.2017.01.021

Biswas, H. Global marine biodiversity: loss and conservation in the Anthropocene.*COHERENCE*, 12. https://www.thebges.edu.in/wp-content/uploads/2022/04/Coherence-Vol-2-Dec-2017.pdf#page=14

Bittencourt, L., Carvalho, R. R., Lailson-Brito, J., & Azevedo, A. F. (2014). Underwater noise pollution in a coastal tropical environment. *Marine Pollution Bulletin*,*83*(1), 331-336. doi.org/10.1016/j.marpolbul.2020.111648

Blasiak R (2020) Climate change vulnerability and ocean governance. In: Cisneros-Montemayor AM, Cheung WWL, Ota Y (eds) Predicting future ocean.

sustainability of ocean and human systems amidst global environmental change. *Elsevier,* Netherlands, pp 357–364

Bodansky, D. (2007). International sectoral agreements in a post-2012 climate framework. *Pew Center on Global Climate Change Working Paper*. Bodansky, Daniel, International Sectoral Agreements in a Post-2012 Climate Framework (May 2007). Pew Center on Global Climate Change Working Paper, Available at SSRN: https://ssrn.com/abstract=1028187 or http://dx.doi.org/10.2139/ssrn.1028187

Brown, J., Beard, A., Clingham, E., Fricke, R., Henry, L. and Wirtz, P. (2019) The fishes of St Helena Island, central Atlantic Ocean - new records and an annotated check-list. *Zootaxa,* https://doi.org/10.11646/zootaxa.4543.2.1.

Curtin, R., & Prellezo, R. (2010). Understanding marine ecosystem based management: a literature review. *Marine policy*, *34*(5), 821-830. https://doi.org/10.1016/j.marpol.2010.01.003

de Freitas, R. R., Costa, R. C., Alvite, C. M. D. C., Balensiefer, D. C., & Prado, J. H. (2022). Challenges for fishers' engagement in Marine Protected Areas: Lessons from Right Whale Environmental Protection Area, Southern Brazil. *Marine Policy*, *43*, 105135. https://doi.org/10.1016/j.marpol.2022.105135

Duarte, C. M., Agusti, S., Barbier, E., Britten, G. L., Castilla, J. C., Gattuso, J. P., Fulweler, R. W., Hughes, T. P., Knowlton, N., Loveloclk, C. E, Lotze, H. K., Predragovic, M., Poloczanska, E., Roberts, C. & Worm, B. (2020). Rebuilding marine life. Nature, 580(7801), 39-51. Doi.org/10.1038/s41586-020-2146-7

Edwards, A. J. and Lubbock, H. R. (1983) The ecology of Saint Paul's Rocks (Equatorial Atlantic). *Journal of Zoology* 200: 51-69. https://doi.org/10.1111/j.1469-7998.1983.tb06108.x

Elsler, L. G., Oostdijk, M., Levin, L. A., Satterthwaite, E, V., Pinsky, M. L., Crespo, G. O., Wisz, M. S. (2022) Protecting ocean carbon through biodiversity and climate governance. *Frontiers in Marine Science*

FAO (2020) The State of the World Fisheries and Aquaculture 2020. Sustainability in action. http://www.fao.org/3/ ca9229en/CA9229EN.pdf.

Floeter S.R., Rocha, L. A., Robertson, D. R., Joyeux, J. C., Smith-Vaniz, W. F., Wirtz, P. , Edwards, A. J. , Barreiros, J. P., Ferreira, C. E. L., Gasparini, J. L., Brito, A. , Falcón, J. M. , Bowen, B. W. , Bernardi, G.(2008) Atlantic reef fish biogeography and evolution. *Journal of Biogeography,* https://doi.org/10.1111/j.1365-2699.2007.01790.x.

Gonçalves, L., & De Santo, E. M. (2022). Unpacking the process: how agenda-setting theory explains the case of creating large scale marine protected areas in Brazil.*Environmental Politics*,*31*(2), 205-225. https://doi.org/10.1080/09644016.2021.1915037

Grip, K. (2017). International marine environmental governance: A review. *Ambio*,. *46*(4), 413-427. 10.1007/s13280-016-0847-9

Haas, B., Mackay, M., Novaglio, C., Fullbrook, L., Murunga, M., Sbrocchi, C., McDonald, J., McCormack, P. C., Alexander, K. Fudge, M., Goldsworthy, L., Boschetti, F., Dutton, I., Dutra, L., McGee, J., Rousseau, Y., Spain, E., Stephenson, R., Vince, J., Wilcox, C., & Haward, M. (2022). The future of ocean governance. *Reviews in fish biology and fisheries*, 32(1), 253-270. https://doi.org/10.1007/s11160-020-09631-x

Halpern, B. S., Frazier, M., Afflerbach, J., Lowndes, J. S., Micheli, F., O'Hara, C., Scarborough, C., & Selkoe, K. A. (2019). Recent pace of change in human impact on the world's ocean. *Scientific reports*, *9*(1), 1-8. doi.org/10.1038/s41598-019-47201-9

Harvey, C. J., Kelble, C. R., & Schwing, F. B. (2017). Implementing "the IEA": Using integrated ecosystem assessment frameworks, programs, and applications in support of operationalizing ecosystem-based management. ICES Journal of Marine Science, 74(1), 398–405. https://doi.org/10.1093/icesjms/fsw201

Hazin, F. H. V., Vaske Júnior, T., Oliveira, P. G., Macena, B. C. L., & Carvalho, F. (2008). Occurrences of whale sharks (Rhincodon typus Smith, 1828) in the Saint Peter and Saint Paul archipelago, Brazil. Brazilian Journal of Biology, 68(2), 385-389. https://doi.org/10.1590/S1519-69842008000200021

IUCN. 2022. The IUCN Red List of Threatened Species. Version 2022-1. https://www.iucnredlist.org. Accessed on [18.09.2022]

Jansen, L. (2003). The challenge of sustainable development. *Journal of cleaner production*, 11(3), 231-245. https://doi.org/10.1016/S0959-6526(02)00073-2

Kraus, G., & Diekmann, R. (2018). Impact of fishing activities on marine life. In *Handbook on Marine Environment Protection* (pp. 79-96). Springer, Cham. https://doi.org/10.1007/978-3-319-60156-4_4

Kühn, Susanne, and others (2015). Deleterious effects of litter on marine life. In Marine Anthropogenic Litter. Cham, Switzerland: Springer, pp. 75–116

Kulbicki M., Parravicini V., Bellwood D.R., Arias-Gonzàlez E., Chabanet P., Floeter S.R., Friedlander A., McPherson J., Myers R.E., Vigliola L. and Mouillot D. (2013) Global biogeography of reef fishes: a hierarchical quantitative delineation of regions. *PloS one*, 8, e81847. https://doi.org/10.1371/journal.pone.0081847 Kuunal, S., Mair, L., Pattison, Z., & McGowan, P. J. (2020). Identifying opportunities for improving the coherence of global agreements for species conservation. *Conservation Science and Practice*, *2*(12), e294. /doi/epdf/10.1111/csp2.294

Kuunal, S., Mair, L., Pattison, Z., & McGowan, P. J. (2020). Identifying opportunities for improving the coherence of global agreements for species conservation. *Conservation Science and Practice*, 2(12), e294. DOI: 10.1111/csp2.294This

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Leslie, H. M., & McLeod, K. L. (2007). Confronting the challenges of implementing marine ecosystem-based management. *Frontiers in Ecology and the Environment*, 5(10), 540-548. https://doi.org/10.1890/060093

Mather, J. (2022). Why Are Octopuses Going to Be the 'Poster Child'for Invertebrate Welfare?. *Journal of Applied Animal Welfare Science*, *25*(1), 31-40. https://doi.org/10.1080/10888705.2020.1829488

Mendonça, S. A., Macena, B. C. L., Creio, E., Viana, D. L., Viana, D. F., & Hazin, F. H. V. (2012). Record of a pregnant Mobula thurstoni and occurrence of Manta birostris (Myliobatiformes: Mobulidae) in the vicinity of Saint Peter and Saint Paul Archipelago (Equatorial Atlantic). Pan-Am J Aqua Sci, 7(1), 21-26. https://doi.org/10.1371/journal.pone.0164440

Mission Atlantic (2021). Deliverable 1.1: Regional and Pan-Atlantic management objectives. Avaiable in: https://cdn.sanity.io/files/s2g49i7w/production/b980ec5106adfe7684ab5655dd2a27e6ebf8a4c3.pdf

Nash, K. L., Alexander, K., Melbourne-Thomas, J., Novaglio, C., Sbrocchi, C., Villanueva, C., & Pecl, G. T. (2022). Developing achievable alternate futures for key challenges during the UN decade of ocean science for sustainable development. *Reviews in Fish Biology and Fisheries*, 32(1), 19-36. https://doi.org/10.1007/s11160-020-09629-5)

ODEMM (n.a.). ODEMM Approach. https://odemm.com/content/odemm-approach-0

Ooms, J., 2021. pdftools.

Ospina-Alvarez, A., de Juan, S., Pita, P., Ainsworth, G. B., Matos, F. L., Pita, C., & Villasante, S. (2022). A network analysis of global cephalopod trade. *Scientific reports*, *12*(1), 1-14. https://doi.org/10.1038/s41598-021-03777-9

Patrício, J., Elliott, M., Mazik, K., Papadopoulou, K. N., & Smith, C. J. (2016). DPSIR—two decades of trying to develop a unifying framework for marine environmental management?. *Frontiers in Marine Science*, 3, 177. https://doi.org/10.3389/fmars.2016.00177

PCC, 2022: *Climate Change 2022: Impacts, Adaptation, and Vulnerability.* Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S.

Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama (eds.)]. Cambridge University Press. In Press.

Pedreschi, D., Bouch, P., Moriarty, M., Nixon, E., Knights, A. M., & Reid, D. G. (2019). Integrated ecosystem analysis in Irish waters; providing the context for ecosystem-based fisheries management. Fisheries Research, 209, 218-229. https://doi.org/10.1016/j.fishres.2018.09.023

Pinheiro, H.T., Macena, B.C.L., Francini-Filho, R.B., Ferreira, C.E.L., Albuquerque, F.V., Bezerra, N.P.A., Carvalho-Filho, A., Ferreira, R.C.P., Luiz, O.J., Mello, T.M., Mendonça, S.A., Nunes, D.M., Pimentel, C.R., Pires, A.M.A., Soares-Gomes, A., Viana,D.L., Hazin, F.H.V and Rocha, L.A. (2020) Fish biodiversity of Saint Peter and Saint Paul's Archipelago, Mid-Atlantic Ridge, Brazil: new records and a species database. *Journal of Fish Biology*, https://doi.org/10.1111/jfb.14484.

Polejack, A., Gruber, S., & Wisz, M. S. (2021). Atlantic Ocean science diplomacy in action: the pole-to-pole All Atlantic Ocean Research Alliance. *Humanities and Social Sciences Communications*, 8(1), 1-11. https://doi.org/10.1057/s41599-021-00729-6

R Core Team, 2020. R: A language and environment for statistical computing.

Rogers AD, Sumaila R, Hussain SS, Baulcomb C (2016) The High Seas and Us—Understanding the Value of High-Seas Ecosystems. http://www.oceanunite.org/wp-content/ uploads/2016/03/High-Seas-and-Us.FINAL_.FINAL_. high_.spreads.pdf. Accessed 21 Mar 2018

Roman, L., Schuyler, Q., Wilcox, C., & Hardesty, B. D. (2021). Plastic pollution is killing marine megafauna, but how do we prioritize policies to reduce mortality?. *Conservation Letters*, *14*(2), e12781. https://doi.org/10.1111/conl.12781

Ryabinin, V., Barbière, J., Haugan, P., Kullenberg, G., Smith, N., McLean, C., Troisi, A., Fischer, A., Aricó, S., Aaryp, T., Pissierssens, P., Visbeck, M., Enevoldsen, H. O. & Rigaud, J. (2019). The UN decade of ocean science for sustainable development. *Frontiers in Marine Science*, 6, 470. https://doi.org/10.3389/fmars.2019.0047

St Helena Government (2021) Population & Housing Census, Main Report, St Helena Government, July 2021'.sainthelena.gov.sh/wp-content/uploads/2021/08/Census-2021-Main-Report.pdf

Samhouri, J. F., Haupt, A. J., Levin, P. S., Link, J. S., & Shuford, R. (2014). Lessons learned from developing integrated ecosystem assessments to inform marine ecosystem-based management in the USA. *ICES Journal of Marine Science*, 71(5), 1205-1215. https://doi.org/10.1093/icesjms/fst141

Singh, G. G., Cisneros-Montemayor, A. M., Swartz, W., Cheung, W., Guy, J. A., Kenny, T. A., McOwen, C. J., Asch, R., Geffert, J. L., Wabnitz, C. C. C.,

Sumalia, R., Hanich, Q.& Ota, Y. (2018). A rapid assessment of co-benefits and trade-offs among Sustainable Development Goals. *Marine Policy,* 93, 223-231. https://doi.org/10.1016/j.marpol.2017.05.030

Solomonsz, J., Melbourne-Thomas, J., Constable, A., Trebilco, R., van Putten, I., Goldsworthy, L., (2021). Stakeholder Engagement in Decision Making and Pathways of Influence for Southern Ocean Ecosystem Services*. Frontiers in Marine Science* 8, 541. https://doi.org/10.3389/fmars.2021.623733

Stephenson RL, Hobday AJ, Cvitanovic C, Alexander KA, Begg GA, Bustamante R, Dunstant PK, Frusher S, Fudge M, Fulton EA, Haward M, Macleod C, McDonald J, Nash KL, Ogier E, Pecl G, Plaga´nyi E´E, van Putten I, Smith ADM, Ward TM (2019) A practical framework for implementing and evaluation integrated management of marine activities. *Ocean Coast Manage* 177:127–138. https://doi.org/10. 1016/j.ocecoaman.2019.04.008

Tiller, R., De Santo, E., Mendenhall, E., & Nyman, E. (2019) "The once and future treaty: towards a new regime for biodiversity in areas beyond national jurisdiction. *Marine Policy.* 99 239-242. https://doi.org/10.1016/j.marpol.2018.10.046

Tittensor, D. P., Beger, M., Boerder, K., Boyce, D. G., Cavanagh, R. D., Cosandey-Godin, A., Crespo, G. O., Dunn, D. C., Ghiffary, & Worm, B. (2019). Integrating climate adaptation and biodiversity conservation in the global ocean. *Science Advances*,*5*(11), eaay9969. DOI: 10.1126/sciadv.aay9969

UNEP. (2022). Integrated Ecosystem Assessment. Retrieved February 24, 2022, from https://www.unep.org/global-environment-outlook/integrated-environmentalassessment

United Nations (2021). The Second World Ocean Assessment. https://www.un.org/regularprocess/sites/www.un.org.regularprocess/files/2011859-e-woa-ii-vol-i.pdf

United Nations [UNCLOS]. (1982). Law of the Sea Convention.

United Nations Sustainable Developing Goals [SDGs]. (2015).

Vaske-Jr., T., Lessa, Rp., Nóbrega, Mf., Montealegre-Quijano, S., Santana, Fm., And Bezerra-Jr., (2005). A checklist of fishes from Saint Peter and Saint Paul Archipelago, Brazil. J. *Applied Ichthyology*, vol. 21, no. 1, p. 75-79. 0175–8659/2005/2101–0075$15.00/0

Viana, D. L., Hazin, F. H. V., Oliveira, J. E. L., Souza, M. A. C. (2015). Arquipélago São Pedro e São Paulo: o Brasil no meio do Atlântico / Marinha do Brasil – Recife : Vedas Edições, 2015. 200p.

Walther, Y. M., & Möllmann, C. (2014). Bringing integrated ecosystem assessments to real life: a scientific framework for ICES. ICES *Journal of Marine Science*, 71(5),1183–1186. https://doi.org/10.1093/icesjms/fst161

Wirtz, P., Bingeman, J.J., Bingeman, J.J., Fricke, R., Hook, T.J., & Young, J. (2014) The fishes of Ascension Island, central Atlantic Ocean – new records and an annotated checklist. *Journal of the Marine Biological*. Association of the United Kingdom, DOI: https://doi.org/10.1017/S0025315414001301.

Wisz, M. S., Satterthwaite, E. V., Fudge, M., Fischer, M., Polejack, A., St John, M., Fletcher, S. & Rudd, M. A. (2020). 100 opportunities for more inclusive ocean research: cross-disciplinary research questions for sustainable ocean governance and management. *Frontiers in Marine Science*, 576. https://doi.org/10.3389/fmars.2020.0057

Appendice I: Document database used in this study

	Policy Name	Year	Language
Brazil	National Biodiversity Strategy and Action Plan	2017	English
	Agreement on the Conservation of Albatrosses and Petrels	2018	English
	Inter-American Conservation for the Protection and Conservation of Sea Turtles	2001	English
	National Legislation on Marine Resources	2017	English
	Convenção Internacional para Controle e Gerenciamento da Água de Lastro e sedimentos de Navios, 2004	2010	Portuguese
	Convenção sobre Comércio Internacional das Espécies da Flora e Fauna Comércio Internacional das Espécies da Flora e Fauna	2000	Portuguese
	Convenção sobre Alto Mar	1958	Portuguese
	Convenção sobre Prevenção da Poluição Marinha por Alijamento de resíduos e Outras Matérias	1982	Portuguese
	Convenção sobre a Conservação das Espécies Migratórias de Animais Silvestres (de 23 de junho de 1979)	2017	Portuguese
	Criação da Área de Proteção Ambiental de São Pedro São Paulo e o Monumento do Arquipélago de São Pedro São Paulo	2018	Portuguese
	Convenção Internacional sobre Preparo, Resposta e cooperação em Caso de Poluição por Óleo	1998	Portuguese
	Convenção Internacional para a Prevenção da Poluição Causada por Navios	1998	Portuguese
	Portaria Interministerial MMA/MAPA para ações de conservação e uso sustentável para espécies pertencentes à Lista Nacional das Espécies da Fauna Brasileira Ameaçada de Extinção - Peixes e Invertebrado Aquáticos	2021	Portuguese
	Plano Setorial para Recursos do Mar	2020	Portuguese
International	International Agreement on Whaling	1975	English
	Fisheries Ordinance	2017	English
	Ascension Island Fisheries Compliance & Enforcement Strategy	2020	English
	The Ascension Island Marine Protected Area Management Plan 2021-2026	2021	English
	Ascension Wildlife protection ordinance	2017	English
	Regulation on the conservation of fisheries resources and protection of marine ecosystems	2019	English
	Wildlife countryside	2017	English
	The Conservation of Habitats and Species Regulations 2019	2019	English
	Technical measures for the conservation of certain stocks of highly migratory species and repealing Regulation	2007	English
	Conservation of Seals Act 1970	1970	English
	Fisheries Act	2020	English
	Fisheries Convention	1966	English
	Regulation of Foregin Fishing Boats	2020	English
	Regulation to implement the Convention are of the International Commission for the Conservation of Atlantic Tunas (ICCAT)	2007	English
	Regulation for the management of the introduction and spread of invasive alien species	2014	English
	UK Marine Policy Statement	2011	English
	Marine Pollution - The Environment Protection (Overseas Territories) Order	1988	English
	Control Measures applicable to fishing for certain stocks of highly migratory fish	2001	English
	National Protected Areas Ordinance	2003	English

	Policy Name	Year	Language
UK	Council Regulation for protection of vulnerable marine ecosystems in the high seas from the adverse impacts of bottom fishing gears	2008	English
	Sea Fisheries	2018	English
	Sea Fisheries, England and Wales Sea Fisheries, Northern Ireland	2015	English
	Sea Fisheries - Conservation of Sea Fish	2020	English
	Sea Fisheries Enforcement Regulations	2018	English
	Sea Fisheries, England	2003	English
	St. Helena Marine Management Plan	2016	English
	Biodiversity 2020: A strategy for England's wildlife and ecosystem services	2011	English
	Agreement to Promote Compliance with the International Conservation and Management Measures by Fishing Vessels on the High Seas	1995	English
	Further revised draft text of an agreement under the United Nations Convention on the Law of the Sea on the Conservation and Sustainable use of Marine Biological Diversity of areas Beyond National Jurisdiction	2022	English
	Convention on Fishing and Conservation of the Living Resources of the High Seas	2005	English
	International Convention for the Control and Management of Ships' Ballast Water and Sediments	2004	English
	Convention on Biological Diversity	1992	English
	Convention on International trade in Endangered Species - Appendices I and II	2020	English
	Convention on International trade in Endangered Species	1973	English
	Convention on Migratory Species - Strategic Plan 2015-2023	2011	English
	Convention on Migratory Species - Bycatch	2017	English
	Convention on Migratory Species - Conservation of Critical, Intertidal and Other Coastal Habitats for Migratory Species	2017	English
	Convention on Migratory Species - Adverse Impacts of Anthropogenic Noise on Cetaceans and Other Migratory Species	2017	English
	Convention on Migratory Species - Executive Summary of Guidance on Implementing the Plan Targets	2017	English
	Code of Conduct for Responsible Fisheries	1995	English
	International Commission for the Conservation of Atlantic Tunas	2019	English
	Management Recommendations and Resolutions Adopted by ICCAT for the Conservation of Atlantic Tunas and Tuna-like Species	2020	English
	International Convention for the Regulation of Whaling	1946	English
	International Plan of Action for Reducing Incidental Catch of Seabirds in Longline Fisheries	1999	English
	Intergovernmental Oceanographic Commission of UNESCO Medium-Term Strategy, 2022–2029.	2022	English
	International Plan of Action to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing	2001	English
	Convention on the Prevention of Marine Pollution by Dumping of wastes and other matter	1972	English
	International Convention for the Prevention of Pollution from Ships	1973	English
	Agreement for the Implementation of the Provision of the UN Convention on the Law of the Sea Relating to the Conservation and Management of Straddling Fish Stock and Highly Migratory Fish Stocks.	1995	English
	Protocol to the convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter	1972	English
	Stockholm Declaration	1972	English
	United Nations Conventions on the Law of the Sea	1982	English

Appendice II: Text mining R code used in this study

```
#This file finds the keywords in the policy documents of SOMAR region#Debora
Ramalho, adapted from Laura Elsler, WMU, 2022.
#Master dissertation

# packages
library(textreadr)
library(pdftools)
library(pdfsearch)
library(tidyverse)
library(ggplot2)
library(plotly)
library(RColorBrewer)

# directory
dirct  <-  "C:/Users/debor/Documents/WMU/Dissertation/Documents  for  analysis"# HERE
PUT YOUR FOLDER PATH

# functions
readCleanCount<-function(pdf){      # uses pdftools to convert pdfs to plain-text,
replaces line breaks with spaces and then counts the words, ignoring non-word
symbols
  txt<-pdf_text(pdf)
  txt<-paste(gsub(txt,pattern="\r\n",replace="   "),collapse="   ")
  count<-sapply(gregexpr("[[:alpha:]]+", txt), function(x) sum(x > 0))
  return(count)
}

completeFun <- function(data, desiredCols) {
  completeVec <- complete.cases(data[, desiredCols])
  return(data[completeVec, ])
}

######################  kw_pressures ANALYSIS        ######
################################################################################
######################  KW ANALYSIS
########################################
################################################################################

######################## PRESSURES#################################################

###################################      UK
#####################################

## keywords for the pressures
kw <- c('bycatch','discarted catch','species extraction', 'litter','waste',
'debris', "rubbish", "trash",'garbage','discated matter','noise','loud sound',
'organic matter', 'abrasion','running','incidental loss', 'biodiversity loss')

dirct_uk <- "C:/Users/debor/Documents/WMU/Dissertation/Documents for
analysis/UK_doc" # UK
#setwd("~/Dropbox/current_projects/ocean_carbon/analysis/data/original/UK")

## keywords
uk  <-  keyword_directory(dirct_uk,
                          keyword = kw,
                          surround_lines = 0, full_names = TRUE)
```

```
uk$token_text <- NULL
uk$line_text <- (unlist(uk$line_text, use.names = FALSE)) # change classfrom list
to vector

# leftjoin count to result (dataframe with extracted keywords andsentences)
uk <- uk %>% mutate(country='UK')


###################################      INTERNATIONAL
#####################################################

## keywords
kw <- c('bycatch','discated catch','species extraction', 'litter','waste','debris',
"rubbish", "trash",'garbage','discated matter','noise','loud sound', 'organic
matter', 'abrasion','running','incidental loss', 'biodiversity loss')

dirct_international <-  "C:/Users/debor/Documents/WMU/Dissertation/Documents for
analysis/International_doc" # UK
#setwd("~/Dropbox/current_projects/ocean_carbon/analysis/data/original/UK")

## keywords
international  <-  keyword_directory(dirct_international,
                                     keyword = kw,
                                     surround_lines = 0, full_names = TRUE)

international$token_text <- NULL
international$line_text  <-  (unlist(international$line_text,  use.names  =
FALSE)) # change class from list to vector

# leftjoin count to result (dataframe with extracted keywords andsentences)
international  <-  international  %>%  mutate(country='International')


###################################      BRAZIL
#####################################################
## keywords
kw <- c('abrasÃ£o', 'extraÃ§Ã£o de espÃ©cies', 'orgÃ¢nica','bycatch','discated
catch','species extraction', 'litter','waste', 'debris', "rubbish",
"trash",'garbage','discated matter','noise','loud sound', 'organic matter',
'abrasion','running','incidental  loss',  'biodiversity  loss',  'capturaacidenta',
'perda de biodiversidade', 'lixo', 'barulho', 'esgoto', 'plastico', 'descarte de
material', 'som alto', 'organica', 'atrito','descarte de captura', 'fauna
acompanhante', 'captura', 'perda de biodiversidade')
str_replace(kw, 'matÃ©ria orgÂ¢nica', 'organica') str_replace(kw,
'extraÃ§Ã£o de espÃ©cie', 'extracao de especie')str_replace(kw,
'abrasÃ£o', 'abrasao')

dirct_br <- "C:/Users/debor/Documents/WMU/Dissertation/Documents for
analysis/Brazil_doc" # UK
#setwd("~/Dropbox/current_projects/ocean_carbon/analysis/data/original/UK")

## keywords
```

```
br  <-  keyword_directory(dirct_br,
                            keyword = kw,
                            surround_lines = 0, full_names = TRUE)

br$token_text <- NULL
br$line_text <- (unlist(br$line_text, use.names = FALSE)) # change classfrom list
to vector

# leftjoin count to result (dataframe with extracted keywords andsentences)
br <- br %>% mutate(country='BR')


##############################################################################################
################################################          CLEAN DATA
################################################
##############################################################################################

result <- uk %>% full_join(br) %>% full_join(international)#
merge data
result  = read.csv(("~/Desktop/Results.csv"), as.is=T)

##############################################################################################
################################################          PLOTTING
################################################
##############################################################################################

################################################          PREP PLOT DATA
################################################
# create dataset for policy, number of PDF documents
pdf <- data.frame (country  = c('UK','BR','International'),
                       pdfs = c(27,14,25))

# counts the number of all keyword occurrence per PDFik =
result %>%
   group_by(pdf_name, keyword)
   %>%tally() %>%
   rename(individual_count_keywords = n) # individual keywordsik <-
as.data.frame(ik)

# pull in data, match pdf and keyword sets file result1 =
result %>% left_join(ik)  %>% left_join(pdf)
write.csv(result1,  "result1.csv")
# kw counted per set and policy
me_sums = result1 %>%
   group_by(country, pdfs) %>%
   summarise(total_keywords  =  sum(individual_count_keywords))

me_sums = me_sums %>%
   mutate(kw_per_pdf=total_keywords/pdfs)


me_sums = result1 %>%
```

```
  group_by(country, pdfs) %>%
  summarise(total_keywords = sum(individual_count_keywords)) %>%
  mutate(kw_per_pdf=total_keywords/pdfs)


######################  kw_ecosystem_components   ANALYSIS          ######
######################  UK  ###################################
## keywords for the pressures
kw_ec <- c("tuna", "deep sea fish", "abyssal fish", "deep sea elasmo", "shark",
"ray", "pelagic fish", "cephalopod", "squid", "octopus","reef",
"seabird", "whale", "dolphin", "pinniped", "seal", "sea lion","elasmobranchs",
"reptile", "turtle")

dirct_uk_ec <- "C:/Users/debor/Documents/WMU/Dissertation/Documents for
analysis/uk_ec_doc" # uk_ec
#setwd("~/Dropbox/current_projects/ocean_carbon/analysis/data/original/ uk_ec")

## keywords
uk_ec <- keyword_directory(dirct_uk_ec,
                                keyword = kw_ec,
                                surround_lines = 0, full_names = TRUE)

uk_ec$token_text <- NULL
uk_ec$line_text <- (unlist(uk_ec$line_text, use.names = FALSE)) # changeclass from
list to vector

# leftjoin count to result_ec (dataframe with extracted keywords andsentences)
uk_ec <- uk_ec %>% mutate(country='uk_ec')


####################  INTERNATIONAL  ##############################

## keywords
kw_ec <- c("tuna","deep sea fish", "abyssal fish", "deep sea elasmo", "shark",
"ray", "pelagic fish", "cephalopod", "squid", "octopus","reef",
"seabird", "whale", "dolphin", "pinniped", "seal", "sea lion","elasmobranchs",
"reptile", "turtle")

dirct_international_ec <- "C:/Users/debor/Documents/WMU/Dissertation/
Documents for analysis/international_ec_doc" # uk_ec
#setwd("~/Dropbox/current_projects/ocean_carbon/analysis/data/original/ uk_ec")

## keywords
international_ec  <-  keyword_directory(dirct_international_ec,
                                        keyword = kw_ec,
                                        surround_lines = 0, full_names =
TRUE)

international_ec$token_text  <-  NULL
international_ec$line_text  <-  (unlist(international_ec$line_text,  use.names
= FALSE)) # change class from list to vector
```

```
# leftjoin count to result_ec_ec (dataframe with extracted
keywords andsentences)
international_ec  <-  international_ec  %>%  mutate(country='International')


################### BRAZIL     ##################################
## keywords
kw_ec <- c("tuna", "atum", "peixe de mar profundo", "peixe
de fundo", "deepsea fish", "deep sea elasmo", "shark",
"ray", "tubarÃ£o", "raia", "arraia","pelagic fish", "peixes
pelÃ¡gicos", "peixes pelagiais", "cephalopod", "squid",
"octopus", "cefalÃ³podes", "lula", "polvo", "reef",
"coral", "corais", "seabird", "aves marinhas", "marine
mammals", "mamÃfero marinho","mamÃferos marinhos", "whale",
"baleia", "dolphin", "golfinho", "pinniped","pinÃpedes",
"seal", "lobo marinho", "lobos marinhos", "foca", "sea
lion", "peixe abissal", "peixes abissais",
"elasmobrÃ¢nqios", "elasmobranchs", "reptile", "turtle",
"tartarugas","abyssal fish")
str_replace(kw_ec_ec, 'tubarÃ£o', 'tubarao')
str_replace(kw_ec, 'peixes pelÃ¡gicos',
'peixe pelagico') str_replace(kw_ec,
'cefalÃ³podes', 'cefalopodes')
str_replace(kw_ec,'mamÃfero marinho',
'mamifero marinho') str_replace(kw_ec,
'mamÃferos marinhos', 'mamiferos marinhos')
str_replace(kw_ec, 'pinÃpedes', 'pinipedes')
str_replace(kw_ec, 'elasmobrÃ¢nquios',
'elasmobranquios')


dirct_br_ec <-
"C:/Users/debor/Documents/WMU/Dissertation/Documents
foranalysis/Brazil_doc" # uk_ec
#setwd("~/Dropbox/current_projects/ocean_carbon/analys
is/data/original/ uk_ec")

## keywords
br_ec <- keyword_directory(dirct_br_ec,
                                keyword = kw_ec,
                                surround_lines = 0, full_names = TRUE)

br_ec$token_text <- NULL
br_ec$line_text <- (unlist(br$line_text, use.names =
FALSE)) # change classfrom list to vector

# leftjoin count to result_ec (dataframe with extracted
keywords andsentences)
br_ec <- br_ec %>% mutate(country='BR')



########################### Results
##############################################################################
#########

result_ec <- uk_ec %>% full_join(br) %>%
full_join(international_ec)# merge data
result_ec  = read.csv(("~/Desktop/result_ecs.csv"), as.is=T)
```