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TÁLIS PEREIRA MATIAS

POLÍTICAS AMBIENTAIS MARINHAS E COSTEIRAS, EDUCAÇÃO AMBIENTAL E AVALIAÇÃO DE IMPACTOS AMBIENTAIS COMO PROCESSOS INTEGRADOS PARA A GESTÃO AMBIENTAL E SUSTENTABILIDADE

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Tese apresentada como parte dos requisitos para a obtenção do título de Doutor em Ciências Ambientais da Universidade Federal de Alfenas. Área de concentração: Ciências Ambientais.

Orientadora: Dra. Adriana Maria Imperador.

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TÁLIS PEREIRA MATIAS

" Políticas Ambientais Marinhas e Costeiras, Educação Ambiental e Avaliação de Impactos Ambientais como instrumentos integrados para a Gestão Ambiental e Sustentabilidade "

A Banca examinadora abaixo-assinada aprova a Tese apresentada como parte dos requisitos para a obtenção do título de Doutor em Ciências Ambientais pela Universidade Federal de Alfenas. Área de concentração: Ciências Ambientais.

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RESUMO

O desenvolvimento humano vem causando diversos impactos ambientais, dentre eles a poluição marinha, a degradação ambiental e a perda de serviços ecossistêmicos. Este processo ressalta a importância de políticas públicas eficazes voltadas para a conservação dos recursos naturais, além do uso de ferramentas integradas da Gestão Ambiental, como a Educação Ambiental (EA) e a Avaliação de Impactos Ambientais (AIA). Desta forma, o presente trabalho busca investigar as relações entre o oceano e a sociedade, a relevância de Políticas Ambientais Marinhas e Costeiras (PAMC) no Brasil, as funções da Educação Ambiental (EA) para a eficácia destas políticas e os principais impactos antrópicos que incidem sobre ecossistemas insulares e costeiros, haja vista a sua vulnerabilidade acentuada perante os impactos do turismo costeiro. Para isso, foi realizada uma análise exploratória da legislação voltada à conservação dos recursos marinhos no Brasil, pesquisa bibliográfica qualitativa, desenvolvimento e aplicação de metodologia de Levantamento de Aspectos e Impactos Ambientais (LAIA) com base ecossistêmica em duas ilhas com forte relevância turística no estado de Santa Catarina, Brasil, e uma Avaliação de Impactos Ambientais (AIA) pelo método de rede de interações, também com base ecossistêmica, na praia dos Ingleses, localizada no norte da ilha de Florianópolis – SC. Os resultados mostraram que, com a pandemia da Covid-19, iniciada no ano de 2020, muitos impactos foram acentuados, como a problemática do plástico no ambiente marinho, demandando ações conjuntas e responsabilidade compartilhada. Além disso, pode-se estabelecer relações entre políticas de conservação do mar e ações de Educação Ambiental que podem contribuir para a redução de impactos antrópicos no mar. Também se ressaltou a importância da abordagem ecossistêmica, com foco na realidade local e nos processos de Avaliação de Impactos Ambientais (AIA). Conclui-se que existe um grande distanciamento entre teorias e práticas abordadas por Políticas Ambientais Marinhas e Costeiras (PAMC) no Brasil, que a participação social e a responsabilidade compartilhada ainda são lentas no país, que a Avaliação de Impactos Ambientais (AIA) com base ecossistêmica é um instrumento fundamental para a coordenação de medidas voltadas para a conservação dos recursos naturais e desenvolvimento sustentável em ecossistemas insulares e costeiros, e que a Educação Ambiental deve integrada neste processo e estimulada pelo Poder Público.

Palavras-chave: serviços ecossistêmicos; conservação; ilhas; gestão costeira; participação social.

ABSTRACT

Human development has caused several environmental impacts, including marine pollution, environmental degradation and the loss of ecosystem services. This process highlights the importance of effective public policies aimed at conserving natural resources, in addition to the use of integrated Environmental Management tools, such as Environmental Education (EE) and Environmental Impact Assessment (EIA). Therefore, this research seeks to investigate the relationship between the ocean and society, the relevance of Marine and Coastal Environmental Policies (MCEP) in Brazil, the functions of Environmental Education (EE) for the effectiveness of these policies and the main anthropic impacts that affect island ecosystems and coastal areas, given their heightened vulnerability to the impacts of tourism. Thus, an exploratory analysis of the legislation aimed at the conservation of marine resources in Brazil was carried out, besides qualitative bibliographic research, development and application of an ecosystem-based Environmental Impact Assessment (EIA) methodology on two islands with strong tourist relevance in the state of Santa Catarina, Brazil, in addition to an Environmental Impact Assessment (EIA) using interaction networks, also based on ecosystems, at Praia dos Ingleses, located in the north of Florianópolis – SC. The results showed that, with the Covid-19 pandemic, many impacts were accentuated, such as the problem of plastic in the marine environment, demanding joint actions and shared responsibility. In addition, relationships can be established between sea conservation policies and Environmental Education actions that can contribute to the reduction in anthropic impacts at sea. The importance of an ecosystem approach focused on the local reality in the Environmental Impact Assessment (EIA) processes was also highlighted. It is concluded that there is a great gap between some theoretical and practical actions addressed by Marine and Coastal Environmental Policies (MCEP) in Brazil, that social participation and shared responsibility are still slow in the country and the ecosystem-based Environmental Impact Assessment (EIA) is a fundamental instrument for the coordination of measures aimed at the conservation of natural resources and sustainable development in island and coastal ecosystems, and Environmental Education must be integrated in this process and stimulated by the Government.

Keywords: ecosystem services; conservation; islands; coastal management; social participation.

SUMÁRIO

PARTE 1

APRESENTAÇÃO

O formato de apresentação desta tese de doutorado em Ciências Ambientais pelo Programa de Pós-Graduação em Ciências Ambientais da Universidade Federal de Alfenas (PPGCA/UNIFAL-MG) segue o formato de artigo científico, conforme o Art. 56, parágrafo II, das Normas Acadêmicas (RESOLUÇÃO Nº 9 DE 12 DE JUNHO DE 2019), adequado segundo as normas da revista em que cada artigo foi submetido ou publicado.

Esta tese parte da hipótese de que Políticas Ambientais Marinhas e Costeiras (PAMC), Educação Ambiental e Avaliação de Impactos Ambientais são importantes instrumentos da Gestão Ambiental que podem ser integrados para a promoção da sustentabilidade em ecossistemas insulares e costeiros. Desta forma, a estrutura adotada para a defesa desta tese consiste na apresentação de 5 capítulos, sendo cada capítulo composto um artigo científico completo que busca abordar partes dos assuntos necessários para a conclusão da tese.

O primeiro capítulo corresponde ao artigo intitulado: "Oceano e Sociedade: perspectivas da Educação Ambiental para a problemática do plástico no ambiente marinho" que teve como objetivo introduzir parte da temática geral que impulsionou o desenvolvimento das demais pesquisas, expressas na forma dos artigos subsequentes. Este trabalho discorre sobre a problemática de um dos principais poluentes marinhos, o plástico, e reflete sobre importância da Educação Ambiental nas relações entre oceano e sociedade, frisando, como principais conclusões a urgência da implementação de políticas públicas eficazes que contemplem ações de Educação Ambiental. Este trabalho foi aceito no VII Congresso Brasileiro de Educação Ambiental Aplicada e Gestão Territorial em formato virtual.

Na sequência, no capítulo 2, o segundo artigo, "*Overview of sea conservation policies in Brazil and social and environmental impacts in the context of the Covid-19 pandemic*", publicado na *Research, Society and Development* (MATIAS; IMPERADOR, 2021), foi construído com o intuito de compreender a dinâmica das políticas voltadas para a conservação do mar no Brasil, considerando o cenário internacional e os problemas potencializados com a pandemia da Covid-19, como o aumento da poluição por plástico, desigualdade social, impactos socioambientais e perda de serviços ecossistêmicos.

Ademais, este trabalho revela a importância de estudos de impactos ambientais sobre os sistemas marinhos mais vulneráveis e as suas relações com as comunidades, inclusão e responsabilidade compartilhada.

No terceiro capítulo, o artigo, "As funções da Educação Ambiental na efetividade de Políticas Ambientais Costeiras e Marinhas no Brasil", publicado na Revista Brasileira de Educação Ambiental (MATIAS; IMPERADOR, 2022), é uma versão complementar do segundo, com um foco nas funções da Educação Ambiental no contexto de impactos antrópicos no mar. Neste trabalho, foi possível estabelecer intersecções mais próximas entre as Políticas Ambientais Costeiras e Marinhas (PAMC) e a Educação Ambiental.

O quarto capítulo corresponde ao artigo: "*Systemic Environmental Impact Assessment on Tourism in Island and Coastal Ecosystems*" em que foi desenvolvida e aplicada uma metodologia de Levantamento de Aspectos e Impactos Ambientais (LAIA) com base ecossistêmica em ecossistemas insulares e costeiros. Este artigo liga-se aos demais mostrando os impactos da pressão antrópica e ressaltando a importância da efetividade de leis e políticas conservacionistas além de processos de Educação Ambiental em ecossistemas insulares e costeiros. Este artigo foi submetido no periódico "*Environmental Development*" e já retornou com as considerações dos revisores. Após a realização dos ajustes sugeridos pelos revisores, o artigo encontra-se aguardando a decisão final.

No capítulo 5, o artigo intitulado "*Assessment of Environmental Impacts of tourism in coastal environments: a case study on an island beach in Southern Brazil*" é o resultado de uma Avaliação de Impactos Ambientais (AIA) com metodologia de redes de interação e base ecossistêmica, em que muitos impactos ambientais negativos foram encontrados e similares aos levantados no estudo anterior, realizado em outras localidades. Devido a maior complexidade da área de estudo e das variáveis que influenciam a dinâmica local, este trabalho concentrou-se apenas nos impactos negativos, diferentemente do capítulo 4 que contempla impactos positivos e negativos. O artigo foi submetido no periódico "*Regional Studies in Marine Science*".

INTRODUÇÃO

O oceano, ambientes insulares e costeiros comportam uma grande gama de serviços ecossistêmicos que se ligam de diversas formas, trazendo muitos benefícios para os seres humanos, como alimento, trabalho, lazer, qualidade de vida, medicamentos e muitos outros benefícios decorrentes de serviços de provisão, cultura, regulação e suporte. São também, ambientes que vêm sendo fortemente impactados por diversas ações antrópicas, como poluição por resíduos sólidos, efluentes domésticos, mudanças climáticas e muitos outros que vão em desencontro com os objetivos do desenvolvimento sustentável e dos princípios básicos do direito ambiental, que embasam diversas políticas voltadas para conservação do mar e uso sustentável dos recursos naturais (BROCKERHOFF et al., 2017; HALL-SPENCER; HARVEY, 2019; MULAZZANI; MALORGIO, 2017; WOODHEAD et al., 2019).

Neste sentido, a carência e urgência de medidas e processos ligados à Gestão Ambiental, como a Educação Ambiental e a Avaliação de Impactos Ambientais, ganham destaque. A Educação Ambiental emerge como um importante processo para a eficácia de políticas públicas de conservação dos recursos naturais, principalmente no que tange a organização e participação social, valorizando e reconhecendo a interdependência entre meio ambiente, sociedade e desenvolvimento, buscando propiciar aos cidadãos, condições de engajamento, reconhecimento e pertencimento do ecossistema ao qual ele está inserido (TORO; SORRENTINO, 2021; VARELA-CANDAMIO; NOVO-CORTI; GARCÍA-ÁLVAREZ, 2018).

Já a Avaliação de Impactos Ambientais, permite a identificação, quantificação e qualificação de aspectos e impactos ambientais de atividades antrópicas como turismo, empreendimentos e outros serviços, que interagem ou podem interagir com os ecossistemas e as comunidades, trazer benefícios ou malefícios, ganho ou perda de serviços ecossistêmicos e apresentar amplitudes variadas, podendo implicar na geração de impactos secundários que se estendem para além dos limites territoriais de origem (FUKUSHIMA, 2018; GLASSON; THERIVEL, 2019; LONGO; RODRIGUES, 2017), como é o caso do plástico no mar, que viaja com ajuda das correntes marítimas para regiões distantes potencializando o passivo ambiental (JAÉN; ESTEVE; BANOS-GONZÁLEZ, 2019; KOELMANS et al., 2017).

Desta forma, a presente pesquisa busca compreender como estas ferramentas da Gestão Ambiental podem contribuir para a conservação dos recursos do mar no Brasil, especialmente em ambientes mais vulneráveis como ecossistemas insulares e costeiros sobre forte pressão turística, considerando a abordagem com base ecossistêmica, as relações entre oceano e sociedade e os efeitos da pandemia da Covid-19 associados.

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PARTE 2

CAPÍTULO 1

Oceano e Sociedade: perspectivas da Educação Ambiental para a problemáticado plástico no ambiente marinho

Ocean and Society: perspectives of Environmental Education for the problem ofplastic in the marine environment

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Resumo

As relações existentes entre a sociedade e o oceano compõe um campo que transcende barreiras territoriais. A problemática do plástico no ambiente marinho tem origens enraizadas no modo de vida do Antropoceno e não se limita apenas a uma região, pois possuem externalidades que afetam o ambiente e a sociedade em escala global. Compreender a interdependência entre estas relações e o papel da Educação Ambiental neste contexto pode auxiliar no enfrentamento do problema, que deve ser multifocal e multidisciplinar. Por meio de pesquisa bibliográfica este estudo visou avaliar a importância da Educação Ambiental no combate à poluição marinha por plástico, e como principal resultado enfatiza-se a demanda crescente de ações nesta área vinculada a outras práticas para o combate de um problema emergente que envolve ciência, política, meio ambiente, economia, educação e sociedade. Conclui-se que a dinâmica ambiental do plástico no ambiente marinho pode e deve ser trabalhada com urgência por educadores ambientais com apoio do Poder Público em escalas locais, regionais e globais, a curto, médio e longo prazo.

Palavras-Chave: Sustentabilidade; Resíduos Sólidos; Poluição; Conservação.

Abstract

The existing relations between society and the ocean make up a field that transcends territorial barriers. The problem of plastic in the marine environment has its roots rooted in the Anthropocene way of life and is not limited to just one region, as it has externalities that affect the environment and society on a global scale. Understanding the interdependence between these relationships and the role of Environmental Education in

this context can help to tackle the problem, which must be multifocal and multidisciplinary. Through bibliographic research, this study aimed to evaluate the importance of Environmental Education in combating marine pollution by plastic, and as a main result emphasizes the growing demand for actions in this area linked to other practices to combat an emerging problem involving science, politics, environment, economy, education and society. It is concluded that the environmental dynamics of plastic in the marine environment can and should be worked with urgently by environmental educators with the support of the public authorities at local, regional and global scales, in the short, medium and long term.

Key words: Sustainability; Solid Waste; Pollution; Conservation.

1. Introdução

O oceano suporta diversos processos fundamentais à manutenção da vida, além de ser uma fonte importante de recursos naturais. Este ambiente abriga ampla biodiversidade, comporta processos físicos, químicos e biológicos de forte impacto, como ciclos biogeoquímicos, e também é fonte de alimentos, energia, recreação, transporte, e tem importância na saúde e regulação das condições climáticas. Portanto, ele é um recurso indispensável à vida como um todo, demandando atenção e cuidado de todos que dele usufruem, direta ou indiretamente (COSTANZA, 1999; JACOBS et al., 2020).

Todavia, este ambiente vem sofrendo em decorrência da insustentabilidade do modo de vida vigente, baseado no consumo desenfreado de produtos perigosos aos ambientes marinhos e costeiros. Dentre os poluentes oceânicos a problemática associada ao plástico vem despertando o interesse e preocupação de autores na área (BISPO et al., 2020; HARTMANN et al., 2019), além de ser um tema popular por apresentar impactos ambientais mais percetíveis pela sociedade (AVERY GOMM et al., 2019; LAW, 2017).

Embora seja um problema mais evidente, ele ainda representa um grande obstáculo a ser superado, o que reforça a implantação de ações coletivas no âmbito da Educação Ambiental para a busca por soluções participativas contribuindo para o engajamento das comunidades (IMENIS, 2020).

Desta forma, frisa-se a importância pela busca e aplicação de práticas, metodologias e processos voltados à conscientização, sensibilização, e ampliação da percepção ambiental sobre os impactos das atividades humanas no oceano e como estes impactos retornam para a sociedade trazendo prejuízos significativos a sua qualidade de vida. Este artigo fundamenta-se por meio de revisão bibliográfica qualitativa

(MARCONI; LAKATOS, 2003; PEREIRA et al., 2018) para destacar a importância de práticas de Educação Ambiental neste contexto, tendo em vista a amplitude dos impactos ambientais e sociais decorrentes do modo de vida dominante, com foco na situação socioambiental do Brasil.

2. Metodologia

O presente trabalho é o resultado de pesquisa bibliográfica qualitativa (MARCONI; LAKATOS, 2003) e abordagem dialética (PEREIRA et al., 2018), considerando artigos científicos com conteúdo interdisciplinar entre impactos do plástico no oceano, suas relações com a sociedade, economia e o papel da Educação Ambiental. Além destes artigos científicos, dados oficiais do governo federal foram utilizados na pesquisa, assim como a observância da legislação pertinente ao tema.

Inicialmente foram discutidos os impactos de práticas insustentáveis no oceano enfatizando a importância de ações conjuntas e colaborativas. Em seguida foi realizada uma contextualização considerando os processos históricos e emergentes, realizando um balanço conceitual sobre perspectivas presentes e futuras. Por fim, destaca-se a importância e o papel da Educação Ambiental neste contexto.

3. Os impactos da insustentabilidade no oceano

O modelo de consumo vigente gera uma grande quantidade de resíduos dos mais diversos tipos, com uma gama de impactos ambientais muito ampla. Embora muitos destes efeitos ambientais, econômicos e sociais sejam percebidos por muitas pessoas, ainda há muito o que ser feito para melhorar a gestão dos resíduos sólidos no Brasil, tendo em vista os resultados alarmantes da situação dos lixões e aterros sanitários (FAGUNDES; MISSIO, 2019). Ademais, as metodologias utilizadas para o levantamento da situação dos resíduos sólidos no Brasil carecem de consistência, assim como falhas normativas e de política no setor precisam ser superadas (FRANCESCHI et al., 2017; SILVA; CHAVES; GHISOLFI, 2016).

O consumo de embalagens no Brasil representa um grande potencial poluidor do oceano, considerando que no Brasil entre 2010 e 2019, a geração de Resíduos Sólidos Urbanos (RSU) registrou considerável incremento, passando de 67 milhões para 79 milhões de toneladas por ano. Enquanto isso, a cobertura de coleta passou de 88% para

92%, o que é bom, mas verifica-se que ainda existem desafios a serem superados, uma vez que a quantidade de resíduos que segue para unidades inadequadas (lixões e aterros controlados) também cresceu, passando de 25 milhões de toneladas para pouco mais de 29 milhões de toneladas por ano (BRASIL, 2020). Além disso, ainda deve-se considerar a importação de resíduos referente às embalagens pelo Brasil. A Figura 1 mostra os principais RSU importados em embalagens no país, que corresponde a cerca de 53% da importação plástico (ABRE, 2021).

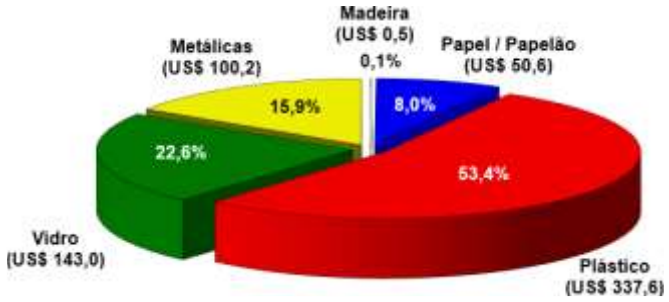

Figura 1. Consumo aparente de embalagens no Brasil.
Fonte: (ABRE, 2021).

Dentre os resíduos destacados os plásticos se sobressaem nos impactos no mar, onde podem contribuir para a propagação de espécies exóticas que utilizam os plásticos como transporte, causando danos gastrointestinais em diversos organismos, emaranhamento, entupimento de vasos, perda de biodiversidade, também podem adsorver e propagar poluentes, comprometer a harmonia paisagística além de outros impactos indiretos que afetam a economia e a sociedade (BAIA et al., 2020; FAGUNDES; MISSIO, 2019; SOBRAL; FRIAS; MARTINS, 2011; VILLARRUBIA-GÓMEZ; CORNELL; FABRES, 2018).

Além da produção de embalagens, que é responsável pelo maior percentual de plástico no Brasil, outros usos também são notáveis (Figura 2). Só no Brasil, são mais de 11 milhões de toneladas de plástico, o que coloca o país como quarto maior produtor deste resíduo no mundo, o que mostra que os desafios associados plástico devem ser trabalhados em diversas áreas, considerando que estes polímeros são poluidores ativos em todos os seus estágios de ciclo de vida, desde a extração de petróleo e gás até o seu processo produtivo e descarte inadequado (ZAMORA et al., 2020).

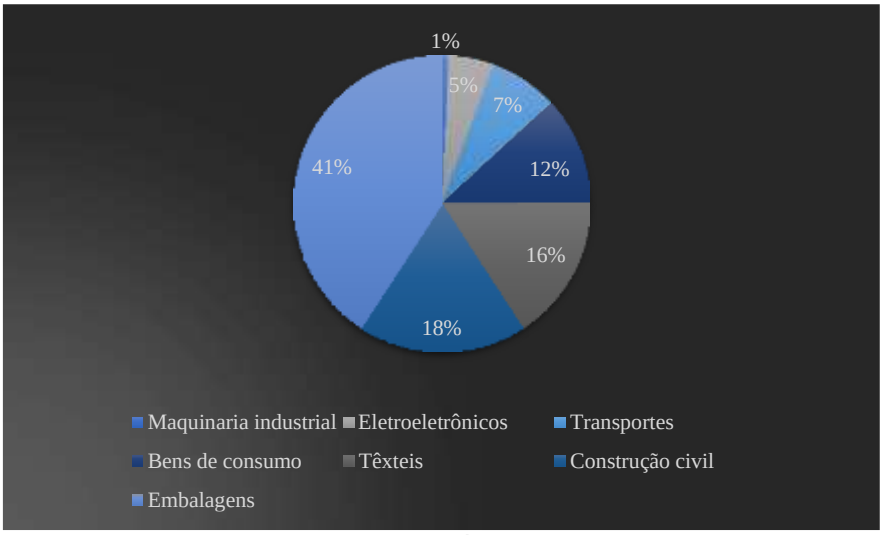

Figura 2. Uso de plástico no Brasil.
Fonte: Dos autores, adaptado de (ZAMORA et al., 2020).

Ainda é importante destacar que estes impactos não se restringem ao ambiente oceânico, a interdependência entre os ecossistemas e o desenvolvimento das sociedades ocorrem por diferentes formas. Os efeitos deletérios de poluentes como o plástico no oceano podem causar problemas como falta de alimentação (associado à pesca), redução do turismo, e prejuízos à saúde humana, além de aspectos difíceis de prever, tendo em vista a complexidade biogeoquímica dos oceanos e as suas implicações na sociedade e vice-versa (HATJE; DA CUNHA; DA COSTA, 2013; JACOBS et al., 2020).

> As empresas de plásticos e petroquímicas estão cada vez mais atentas à crescente "guerra" contra os plásticos. E embora algumas empresas estejam começando a pelo menos reconhecer sua responsabilidade por essa poluição, elas ainda afirmam, agressiva e publicamente, que o consumidor é o verdadeiro culpado pela poluição do plástico. Isso está em desacordo com a realidade. O fato é que as marcas de consumo estão abrindo mercados em profusão em novas regiões – Ásia, África, América do Sul – plenamente conscientes de que na maioria das regiões a infraestrutura de resíduos e os sistemas de reciclagem estão muito atrás da maioria dos países do norte global (ZAMORA et al., 2020. p.9).

Desta forma, é importante que o poder público, as instituições, empresas e a sociedade trabalhem em conjunto, reconhecendo a importância da manutenção, equilíbrio e desenvolvimento sustentável num mundo em que todos habitam, interagem e coexistem.

4. De onde partimos, onde estamos e para onde vamos?

Tendo em vista a problemática abordada no tópico anterior, parte-se do pressuposto de que para a solução de problemas complexos, como os que foram discutidos, deve-se buscar soluções sistêmicas. Parte-se de um contexto em que as

desigualdades sociais e os resultados do modelo de consumo neoliberal agregam impactos sem precedentes na história humana e repercutem ao redor do mundo sinalizando a necessidade de mudanças por modelos mais sustentáveis.

> O capitalismo predatório e seu intenso ritmo de produção e exploração da indústria sobre fauna, flora e todos os recursos naturais sem um limite respeitado, os reflexos no aumento do consumo e, consequentemente, na produção de resíduos sólidos, a degradação de rios, oceanos e outras fontes hídricas com efluentes industriais, domésticos e também resíduos, a poluição atmosférica, desmatamento e queimadas, o aquecimento global e as alterações climáticas já se mostravam como sinais da necessidade de uma mudança na relação sociedade x meio ambiente x economia. A pandemia do novo coronavírus se apresentou à sociedade como um "freio" do modo de vida o qual se era acostumado, provocando uma desorganização global e oferecendo uma oportunidade de se criar uma nova organização (SOUZA, 2020. p.7).

Em 2020, os resultados da pandemia provocada pelo novo coronavírus repercutiram também no oceano, uma vez que o fenômeno global interrompeu gravemente as políticas de redução de plástico, aumentado a geração destes resíduos, o que ressalta a importância da abordagem cidadã para a redução da poluição por plástico e ligações diretas entre política, indústria e pesquisa para o desenvolvimento sustentável (SILVA et al., 2020a).

A Covid-19 afetou diretamente o sistema de globalização e mobilização de serviços e pessoas. No Brasil, a produção de resíduos hospitalares aumentou, e muitos destes resíduos que deveriam ser incinerados acabam se perdendo e sendo encontrados em ambientes inadequados, como lixões, aterros, praias e ambientes costeiros e marinhos (RAMBO; DUTRA; CUBAS, 2020; REZENDE; SILVA; MARQUES, 2020). Além disso, devido à dependência de plástico para fins de segurança e higiene, a pandemia pode alterar o comportamento do consumidor frisando a importância da responsabilidade social, ação corporativa, política e governamental (VANAPALLI et al., 2020).

As questões sobre oceano e sociedade ligam-se ao processo de globalização e demandam um conjunto de regulação territorial, considerando que o ambiente marinho também é um espaço de circulação material de produtos, indivíduos e de informação, pautadas por disputas por vantagens competitivas de empresas, cidades e regiões (RIO, 2018).

O momento atual ainda carece de atenção à interdependência entre oceano e sociedade, o que faz da Educação Ambiental uma ferramenta poderosa e urgente para a transformação social e para a melhoria e sustentabilidade das relações diretas e indiretas entre oceano e sociedade, buscando promover uma cultura oceânica (*ocean literacy*) de forma colaborativa entre cientistas e educadores, trabalhando o despertar e ampliação da percepção ambiental (IMENIS BARRADAS, 2020).

No futuro, a transição para materiais ecológicos e novas tecnologias sustentáveis será crucial para o combate a futuras pandemias. Embora as reversões e o relaxamento da proibição de plástico de uso único possam ser temporários, suas implicações prováveis na percepção do consumidor podem atrapalhar os objetivos traçados para o longo prazo de transição para uma economia circular (KAHLERT; BENING, 2020; VANAPALLI et al., 2020).

Além disso, os problemas indiretos associados aos impactos do plástico no ambiente marinho no contexto pós-pandemia também serão desafios que demandarão investimentos e gerarão impactos potenciais na sociedade, especialmente quando reconhece-se que a saúde humana está conectada e dependente da saúde dos ecossistemas, o que destaca a situação emergencial em investimentos na gestão de resíduos, educação e ciência para o desenvolvimento de tecnologias sustentáveis que possam reduzir os impactos ambientais do plástico (SILVA et al., 2020b).

O problema discutido é multifocal e deve ser atacado em diferentes frentes, visando substituir a competição e atritos entre as partes interessadas nos oceanos, pelo estímulo às alternativas econômicas mais sustentáveis, como a economia circular, medidas políticas de proteção ambiental e processos educativos que visem a mudança e quebra de paradigmas obsoletos danosos aos ecossistemas, à manutenção da vida e ao equilíbrio dinâmico entre o ambiente marinho e o desenvolvimento urbano.

5. Como e por quê a Educação Ambiental?

A Educação Ambiental é um componente essencial e permanente da educação nacional que consiste em processos pelos quais os indivíduos e a sociedade constroem valores sociais, conhecimentos, habilidades, atitudes e competências voltadas para a qualidade ambiental e sustentabilidade (BRASIL, 1999).

Considerando a problemática sistêmica dos assuntos levantados anteriormente, a Educação Ambiental possui o arcabouço necessário para contribuir para a resolução dos problemas destacados, por intermédio de metodologias específicas construídas para realidades locais, regionais e globais (SAMPAIO; SANTOS, 2020).

Para que projetos de Educação Ambiental sejam mais eficazes, é importante que cada vez mais tenham-se novas pesquisas na área, para que os educadores usufruam de fundamento atualizado representando pautas significativas de preocupação social (ANHÊ et al., 2020), como descreve um estudo feito na praia de Navegantes/SC, em que os pesquisadores construíram uma coleção didático-científica para a promoção de ações de Educação Ambiental quanto ao "lixo" marinho a partir de problemas relevantes da sociedade (ROSA; WIDMER, 2019).

Outros autores também destacam que, embora a prevenção ainda seja melhor do que a remediação, algumas alternativas criativas podem ser tomadas para a conscientização e sensibilização, como um trabalho realizado por alunos do ensino fundamental na construção de um protótipo para a retirada de resíduos do oceano (SOUZA et al., 2019). Esse tipo de trabalho promove o senso crítico e fortalece o envolvimento dos jovens para lidar com problemas reais.

A problemática do plástico no oceano pode e deve ser trabalhada, por meio de ferramentas da Educação Ambiental como a problematização e trabalhos lúdicos desde a infância (BRUCK; FERREIRA; MACHADO, 2020). Este tipo de trabalho vincula-se à ciência cidadã que pode desempenhar um papel suplementar grande e cada vez mais importante no futuro fornecimento de evidências, ciência e monitoramento dos oceanos, deixando claro a interdependência entre política oceânica e cidadania, embora a situação ainda demande outras soluções técnicas e especializadas (HYDER et al., 2015).

Ainda é preciso que as pessoas compreendam a magnitude dos impactos do plástico no oceano, assim como de outros poluentes. Os efeitos aos ecossistemas, às comunidades tradicionais, à economia e também à sociedade como um todo, devem ser objeto de atenção pela Educação Ambiental, que por sua vez deve ser estimulada pelo Poder Público, frisando que o problema cresce em relevância no Antropoceno (OLIVATTO et al., 2018).

Por fim, vale ressaltar que a poluição marinha por plástico é uma realidade que se impõe à sociedade nacional e internacional, causando muitos tipos de danos de caráter ambiental, social e econômico, demandando ações conjuntas e multidisciplinaridade para lidar com o problema.

6. Considerações Finais

A Educação Ambiental como processo transformador de valores sociais e promotora do conhecimento sobre aspectos relativos ao meio ambiente e sustentabilidade é fundamental para a melhoria da qualidade dos oceanos e mitigação/redução da poluição ambiental por plástico e outros resíduos.

Deve-se sempre ser lembrado o caráter multidisciplinar do problema abordado e da necessidade de estudos, pesquisas e decisões conjuntas, entre as diferentes partes interessadas no recurso marinho, visando o uso sustentável, conservação dos ecossistemas marinhos e ambientes costeiros.

A sociedade deve reconhecer e aceitar a interdependência entre as suas ações e os danos causados aos ecossistemas marinhos derivados de práticas insustentáveis, buscando um modo de vida mais equilibrado que minimize os impactos ambientais nos oceanos e também à própria sociedade.

A implantação de projetos de Educação Ambiental no Brasil se faz urgente, pois ela é um forte processo que aliada a outras práticas também urgentes, como o desenvolvimento de novas tecnologias, redução, reciclagem e reaproveitamento de resíduos, pode trazer significativas mudanças na qualidade ambiental em curto, médio e longo prazo, também em escalas local, regional e global.

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CAPÍTULO 2

Overview of sea conservation policies in Brazil and social and environmental impacts in the context of the Covid-19 pandemic

Visão geral das políticas de conservação do mar no Brasil e impactos socioambientais no contextoda pandemia da Covid-19

Panorama general de las políticas de conservación del mar en Brasil y los impactos sociales yambientales en el contexto de la pandemia Covid-19

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Abstract

The ocean and its areas of influence are fundamental environments for life on the planet, harbor ample biodiversity and are the basis of support for many vulnerable families and communities, which justifies the implementation and effectiveness of laws and policies for the conservation of marine resources throughout the world. With the pandemic caused by the new coronavirus, many impacts have intensified in these environments, which emphasizes the importance of research that considers these effects and the political scenario in which the pandemic erupted. The objective of this discussion was to evaluate the social and environmental impacts associated with the resources of the sea, verifying the effectiveness of public policies and highlighting the importance of social inclusion, environmental education and shared responsibility. The study area was the Brazilian coast and the research methodology was based on the analysis of secondary data, analysis of official reports and documents, as well as a qualitative bibliographic review of scientific articles, presenting comparisons and interdisciplinary discussions between Brazil and other countries, in order to build a narrative review on the subject, presenting hypotheses for improvements in the post- pandemic scenario. The study reveals that there is a large gap between theory and practice with regard to sea conservation policies, which is enhanced by the political crisis in Brazil and its social, economic and environmental effects, generating impacts and externalities that affect national interests and international. It is concluded that, in the post-pandemic scenario, there will be a great need for joint actions to mitigate the intensified impacts of the pandemic, and it is up to

the government to support the most affected and seek to ensure the practical effectiveness of the sea conservation policies and effective environmental education actions.

Keywords: Sustainability; Environmental Education; Covid-19; Environmental Impacts.

Resumo

O oceano e suas áreas de influência são ambientes fundamentais para a vida no planeta, abrigam ampla biodiversidade e são a base de apoio para muitas famílias e comunidades vulneráveis, o que justifica a implementação e eficácia de leis e políticas de conservação dos recursos marinhos em todo o mundo. Com a pandemia provocada pelo novo coronavírus, muitos impactos se intensificaram nesses ambientes, o que enfatiza a importância de pesquisas que considerem esses efeitos e o cenário político em que a pandemia eclodiu. O objetivo desta discussão foi avaliar os impactos socioambientais associados aos recursos do mar, verificando a eficácia das políticas públicas e destacando a importância da inclusão social, da educação ambiental e da responsabilidade compartilhada. A área de estudo foi o litoral brasileiro e a metodologia da pesquisa baseou-se na análise de dados secundários, análise de relatórios e documentos oficiais, bem como revisão bibliográfica qualitativa de artigos científicos, apresentando comparações e discussões interdisciplinares entre o Brasil e outros países a fim de construir uma revisão narrativa sobre o assunto, apresentando hipóteses de melhorias no cenário pós-pandemia. O estudo revela que existe um grande fosso entre teoria e prática no que diz respeito às políticas de conservação do mar, que é potencializado pela crise política no Brasil e seus efeitos sociais, econômicos e ambientais, gerando impactos e externalidades que afetam os interesses nacionais e internacionais. Conclui-se que no cenário pós-pandêmico haverá grande necessidade de ações conjuntas para mitigar os impactos intensificados da pandemia, cabendo ao Poder Público apoiar os mais afetados e buscar garantir a eficácia prática de políticas de conservação do mar e ações eficazes de educação ambiental.

Palavras-chave: Sustentabilidade; Educação Ambiental; Covid-19; Impactos Ambientais.

Resumen

El océano y sus áreas de influencia son entornos fundamentales para la vida en el planeta, ya que albergan una amplia biodiversidad y son la base de sustento de muchas familias y comunidades vulnerables, lo que justifica la aplicación y eficacia de leyes y políticas de conservación de los recursos marinos en todo el mundo. Con la pandemia causada por el nuevo coronavirus, muchos impactos se han intensificado en estos entornos, lo que subraya la importancia de una investigación que tenga en cuenta estos efectos y el panorama político en el que estalló la pandemia. El objetivo de este debate fue evaluar los impactos socioambientales asociados a los recursos del mar, verificando la eficacia de las políticas públicas y destacando la importancia de la inclusión social, la educación ambiental y la responsabilidad compartida. El área de estudio fue el litoral brasileño y la metodología de la investigación se basó en el análisis de datos secundarios, análisis de informes y documentos oficiales, así como en la revisión bibliográfica cualitativa de artículos científicos, presentando comparaciones y discusiones interdisciplinarias entre Brasil y otros países con el fin de construir una revisión narrativa sobre el tema, presentando hipótesis de mejoras en el escenario post-pandémico. El estudio revela que existe una gran brecha entre la teoría y la práctica en cuanto a las políticas de conservación

del mar, que se ve potenciada por la crisis política en Brasil y sus efectos sociales, económicos y ambientales, generando impactos y externalidades que afectan a los intereses nacionales e internacionales. Concluimos que, en el escenario post-pandémico, habrá una gran necesidad de acciones conjuntas para mitigar los impactos intensificados de la pandemia. Corresponde a los poderes públicos apoyar a los más afectados y tratar de asegurar la eficacia práctica de las políticas de conservación del mar y de las acciones eficaces de educación ambiental.

Palabras clave: Sustentabilidad; Educación Ambiental; Covid-19; Impactos Ambientales.

1. Introduction

Throughout history, the ocean has been the scene of disputes, clashes and conflicts of interest that in many cases exclude minorities from the decision-making process that end up losing their representativeness and having their needs suppressed by the predominant model of unsustainable capitalism (Korpinen et al., 2021; Marques, 2020).

Urban expansion processes, linked to the lack of sustainable development and conservationist practices, have been putting increasing pressure on coastal and marine ecosystems, causing several environmental, social and economic losses that affect mainly the most vulnerable communities (Grip & Blomqvist, 2021; MacNeill & Wozniak, 2018).

These environments are essential for maintaining the life and survival of different social groups. They provide ecosystem services, harbor wide biodiversity, contribute to climate regulation and several other important functions for the Earth's dynamic balance, which emphasizes the relevance of maintaining actions that seek its sustainable use (Di Ciommo, 2007; Marceniuk et al., 2013).

These ecosystems have been suffering several impacts associated with anthropogenic intervention, such as marine pollution, with losses for the polluting agents themselves, also causing negative externalities to sectors, social groups and environments in a geographic location very distant from the main polluting sources (Aslan et al., 2017).

Thus, the role of the State is decisive, since it is it that, with its duty to preserve and protect the environment, must regulate, in a sustainable way, the use of natural resources, integrating and strengthening environmental policies based on the precautionary principle, preventive action, polluter-pays, seeking to guarantee constitutional rights for all (Moreira, 2020).

In the context of the pandemic for the new coronavirus, marked by weaknesses in the Brazilian political and economic system, by a democracy that has been heavily attacked, a society in crisis and a vulnerable environment (Ferraz, 2020; Matias et al., 2020), it is urgent to find alternatives, innovation and integration to build a competent and inclusive management system.

To overcome, therefore, the presented obstacles, it is necessary to understand how the legislation of protection and conservation of the sea contributes, in practice, to the sustainability and which are the main impacts of the pandemic on the marine and coastal ecosystems, besides identifying how the traditional communities and other vulnerable minorities.

Therefore, the objective of this research is to assess the socio-environmental impacts on the sea, on communities dependent on this natural system and on its ecosystem services, considering the context of worsening social, environmental and economic damage caused by the Covid-19 pandemic and the political situation Brazilian before other nations. The objective of this work is also to carry out an assessment of the post-pandemic scenario, as well as to carry out proposals, management and environmental education measures to solve the real and potential impacts raised in this research.

2. Methodology

This research analyzes the relevant legislation, official documents and also results from the qualitative bibliographic review, dialectical and functional (Pereira et al., 2018) of scientific articles published in Brazil and in other countries, with relevance for the treatment of the aspects addressed throughout the text. It is a bibliographical review to support the hypotheses raised throughout the text and emphasized in the last chapter.

In Brazil, the documents studied were: the National Environmental Policy (Brazil, 1981), the National Coastal Management Plan (1988), the National Policy for Sea Resources (Brazil, 2005) and the National Solid Waste Policy (Brasil, 2010) due to their relevance for the discussion and for presenting important interdisciplinary aspects.

The main databases used in this research were Scopus, Web of Science and SciELO, using descriptors such as "marine policies", "marine policies and environmental

education". Articles that addressed the relationship between sea conservation policies, society and sustainable development in a multidisciplinary way were used. While, very specific articles with little interdisciplinary approach were discarded. Some works considered relevant cited by the articles used in the research were also evaluated.

The research focus surrounds theoretical variants between legal purposes and their practical results, with an emphasis on the approach to ecosystem services that are fundamental to life and most significant for the communities that directly depend on them. For this process, the systemic socio-environmental study, with its national and international economic influences, is considered, looking for multidisciplinary elements to solve complex problems associated or intensified by the Covid-19 pandemic.

This research does not consist in the evaluation of the positive effects of the pandemic on the environment, considering the change in habits such as isolation, vacations of natural areas, noise reduction, air pollution and among others (Zambrano-Monserrate et al., 2020). The research focuses on the search for interdisciplinary solutions to combat the harmful effects of the pandemic and its implications for the current Brazilian political scenario, which remains a constant challenge for the scientific community.

3. Results and Discussion

3.1 Marine and coastal ecosystems: a shared responsibility

Investigations on the role of the State, the effectiveness of proposed measures and the actions that are implemented, within the scope of environmental sciences, must be studied, evaluated and supervised by academia, civil society and all who coexist with the impacts of human actions (Brasil, 1988). These impacts vary according to the undertakings, services and human actions in the environment. In the ocean, there is a wide range of effects caused by industrial, agricultural, commercial and residential activities that damage biota, affect the dynamic balance of marine ecosystems and cause national and international political tensions between different stakeholders in these natural resources (Matias et al., 2018).

With the increase in the use of disposables due to the growth of the delivery system for ready-to-eat foods during the pandemic of the new coronavirus and hygiene measures

(Kahlert & Bening, 2020), the risks to marine and coastal ecosystems are heightened, and impacts of this process are already being perceived, such as the increase in plastic and hospital supplies in the ocean and in the organism of marine fauna species (Silva, Prata, Walker, Campos, et al., 2020; A. L. P. Silva, Prata, Walker, Duarte, et al., 2020). This problem, associated with poor management and public planning, incorporating pre-existing serious issues such as inadequate disposal and the lack of solid waste treatment in several countries, shows the alarming situation that these ecosystems face and those that depend on them, directly or indirectly (Baia et al., 2020; Franceschi et al., 2017).

In addition, the neoconservative negationist intensified in Brazil and in some other countries in 2019 and 2020, and even propagated by managers and public servants, bring setbacks whose impacts can be very serious on the environment, in addition to being an unfavorable to the practices of education environmental that value social awareness before the worrying scenarios of conservation units, areas of permanent preservation and all the environmental, biotic and abiotic complexity in which human beings are inserted as protagonists in the generation of environmental impacts (Azevedo & Lima, 2020; Guenther, 2020).

With an emphasis on marine environments, it is necessary to investigate the historical evolution and effectiveness of conservation and coastal planning policies, seeking studies, experiences and comparing legal aspects between countries that are references in marine management with the situation in countries whose management model is still needs improvement (Vianna et al., 2012).

It is important to note that the verification of the effectiveness of management models and public policies is not a simple process. In addition to the detailed analysis of the specific legislation, it is necessary to seek quantitative and qualitative data and information that provide greater robustness for the assessment, which is not always the case in a transparent and accessible to all. This process also requires interdisciplinary attention on all aspects involved in marine management, considering the political, social and economic divergences between the countries and regions that surround a defined object of study.

In Brazil, integrating the National Policy for the Resources of the Sea - PNRM and National Environment Policy - PNM (Brasil, 1981), the National Coastal

Management Plan - PNGC is fundamental to raise the quality of life of the population and protect their natural, historical, ethnic and cultural heritage (Brasil, 1988). This instrument makes clear the role of sectoral and local bodies of the National Environment System (SISNAMA), as well as universities and other cultural, scientific and technological institutions in forwarding data to the subsystem, relating to natural, historical, ethnic and cultural heritage, the quality of the environment and environmental impact studies of the coastal zone.

The update of the National Policy for the Resources of the Sea (decree nº 5.377 of February 23, 2005), carried out in 2005, was another important milestone in the search for improvements in marine management, which aims at the effective use, exploration and use of marine resources, in line with national interests, in a rational and sustainable manner aiming at the country's socioeconomic development, generating employment and income and contributing to social inclusion (Brasil, 2005).

However, would legislation alone be sufficient to protect vulnerable ecosystems and populations? In a country full of unconstitutional acts by the executive branch (Calil, 2021; Piaia & Alves, 2020), the answer is clear, which emphasizes the urgency of social and institutional mobilization in the search for the guarantee of constitutional rights, such as health, environment and work, which are directly and indirectly interconnected in the great terrestrial biome.

Abroad, the International Maritime Organization (IMO) and the United Nations Convention on Law at Sea, in addition to other Conventions and international agreements aimed at environmental conservation and sustainable development, were and are important for the improvement of global marine management and meeting of promising paths to be followed.

However, in 2021 Brazil faces serious health, economic, human rights and natural systems problems. The neglect of environmental issues, such as loss of biodiversity and pollution, highlights the urgency of sustainability and the guarantee of fundamental rights to life, as a healthy biosphere for the present and for future generations, which not only promotes the propagation of life, but also the quality and well-being of the way of life among the species that coexist on the planet and that also has this ecological and moral right.

Therefore, the role of science is of great relevance for facing emerging problems, combating fake news (Viscardi, 2020), promotion of environmental education, and influence in the search for sustainable planning in the post-pandemic context, looking for interdisciplinary solutions in the short, medium and long term, contemplating local, regional and global scales, unifying forces between different institutions so that sustainability goes from utopia to reality (Matias et al., 2020).

Thus, the moment is one of effort to guarantee rights and the fulfillment of collective duties by all. For this, it is important that society, as well as public and private authorities, recognize itself as an integral and fundamental part of the environment and become aware of the importance of shared responsibility in facing the socio-environmental problems aggravated by the coronavirus pandemic.

3.2 The Brazilian coast and the impacts of national unsustainability

Brazilian environmental legislation, its respective policies and instruments aimed at the preservation, conservation, monitoring and proper management of natural resources and defense of national interests, represent important legacies towards sustainability (Brasil, 1981). However, in reality, outside of the legal attributes, many challenges still remain and express concerns that have not yet been controlled with the creation of laws alone (Acacio & Passos, 2020).

Considering the dynamics of solid waste propagation to the sea, there is a need for consonance between the National Solid Waste Policy (PNRS), which brings together the set of principles, objectives, instruments, guidelines, goals and actions adopted by the federal government, in isolation or in cooperation with states, the Federal District, municipalities or individuals, with a view to integrated management and the environmentally sound management of solid waste (Brasil, 2010) and other coastal management policies.

Although it is estimated that 80% of the waste at sea originates on the continent, along 8500 km of coastline, of the 274 Brazilian coastal cities, only 153 (55.8%) prepared the Municipal Plan for Integrated Solid Waste Management by 2017, while in relation to selective collection, only 61 (22.3%) municipalities declared to have these services. In these conditions, Brazil contributes up to 190 tons of the total volume of waste at sea (Brasil, 2019).

In 2018, among the materials found on the Brazilian coast, the most abundant items were: bottle caps and caps in general; bottles; food packaging; plastic bags; cigarettes, filters or butts; derivatives of ropes and cables; ropes and cables (less than 1 meter); flexible rods; unidentified fragments; sponges, foams, satin vinyl foams - EVAs; Styrofoam cups and packaging; buoys and pieces of Styrofoam. These residues are a serious threat to marine fauna and pose problems for navigation, tourism and fishing and bathing activities (Brasil, 2019).

A recent study by Magris et al. (2021) in Brazil revealed priority areas for marine conservation (Figure 1). The authors reveal that industrial fishing, climate change and terrestrial activities, linked to the production of waste, were the greatest threats to biodiversity, and stress the importance of a comprehensive ecological approach when identifying strategic conservation priorities.

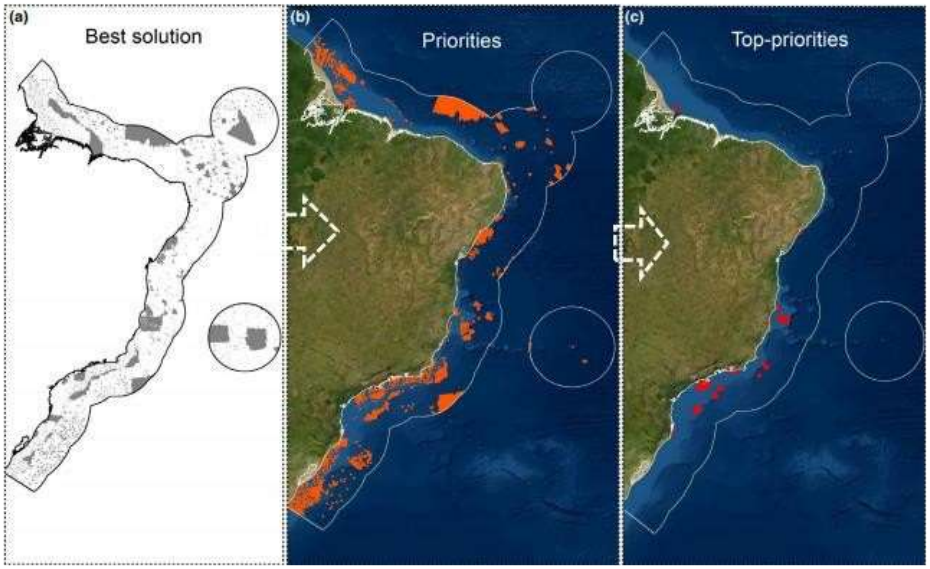

Fig. 1. Identification of priority areas for conservation. (a) information on irreplaceable values and cumulative impact scores (gray colored planning units). In (b), the planning units colored in orange represent the priorities. In (c), the planning units in red represent the main priorities.
Extracted from: (Magris et al., 2021).

Data also show that, in 2018, 79 million tons of solid urban waste were generated in Brazil, of which only 92% was collected. Of what was collected, landfills received around 59.5%, leaving 40.5% of waste that was disposed of in inappropriate places by 3001 municipalities (ABRELPE, 2019).

Also, according to the Brazilian Association of Public Cleaning and Special Waste Companies (ABRELPE) (2019), the consumption and generation of waste per capita of

the population has been increasing. In 2020, with the pandemic caused by Covid-19 this consumption increased even more, in even more serious circumstances, because in addition to the country's health crisis, the increase in consumption and generation of waste is associated with the incorrect disposal of these materials impacting laws and bringing more serious environmental risks (ABRELPE, 2021).

Another information worth mentioning for this discussion is that 26.6% of the Brazilian population lives in areas close to the coast, which is equivalent to about 50.7 million people, which justifies the organization of socioeconomic information in these regions, and evaluation environmental impacts on marine and coastal ecosystems (CNT, 2021).

The ecosystem resources and services provided by marine ecosystems, mangroves, restingas, and other environments suffer from impacts resulting from the lack of human sustainability, resulting in losses for society itself, especially the most vulnerable (Angelelli & Saffache, 2013).

Seagrass grasslands and submerged aquatic vegetation (VAS) are among the most threatened ecosystems on the planet. In Brazil, unsustainable exploitation and occupation of the coastal zone during the last 100 years has led to the rapid degradation and loss of many of the marine and coastal benthic habitats, which highlights the country's critical situation in these areas (Copertino et al., 2016).

Thus, considering the situation of solid waste generated in Brazil and its impacts on the marine environment, also in view of the worsening of this case resulting from the pandemic, it is urgent to build multidisciplinary plans and projects with scientific dissemination and the use of environmental education practices to reduce impacts in the future and promote sustainable development.

3.3 Conjecture and political influence on marine resources

At the international level, the concept of marine security encompasses a matrix of relationships with other concepts, such as maritime energy, blue economy and resilience.

The term was the subject of discussion in the North Atlantic Treaty Organization (NATO) and of divergent political interests and ideologies, which demands a great diplomatic framework on the conservation of sea resources in international relations (Bueger, 2015). Most nations in the world have adopted conservation goals including the protection of at least 10% of their coastal and marine areas by 2020. However, reconciling biodiversity conservation goals with socioeconomic demands remains a challenge for the implementation of conservation policies (Vilar et al., 2020).

Marine plastic pollution is an example of a global challenge, since these wastes affect biodiversity, compromise tourist and economic activities and can also harm vulnerable populations (Prata et al., 2020). Public policy instruments such as payment for ecosystem services are alternatives that attract entrepreneurs and can contribute to reducing environmental impacts and improving quality of life (Mäntymaa et al., 2019).

The effects of neoliberalism, the lack of investment and the effectiveness of legal structures in guaranteeing human rights around the world, as well as the neglect of the situation of fishing and traditional communities, has been a problem that needs attention. This situation should not be restricted to legislation only, it is necessary to be effective in promoting human dignity and international cooperation (Song, 2015).

With the entry into force of the United Nations Convention on the Law of the Sea, concluded in Montego Bay, Jamaica, on December 10, 1982, by Decree No. 1,530, of June 22, 1995, Brazil adheres to a series of terms and articles aimed at cooperation on all matters relating to the law of the sea and awareness of the historic significance of the Convention as an important contribution to the maintenance of peace, justice and progress for all the peoples of the world (Brasil, 1995).

The general considerations of the Convention are in line with the National Environment Policy (Brasil, 1981) emphasize the importance of ecosystem services provided by marine ecosystems and the participation of different stakeholders in these services, which emphasizes the relevance of systemic assessment of environmental impacts in these environments.

Although social participation is of paramount importance in matters related to marine and coastal management, the law No. 7,661, of May 16, 1988, which institutes the

National Coastal Management Plan and provides other measures, does not mention, at any time, in isolation, the socio-environmental participation of vulnerable communities.

The same can be said for Decree No. 5,377 of February 23, 2005, which approves the National Policy for the Resources of the Sea (PNRM). Nothing is said or indicated about traditional and vulnerable communities that depend on the resources of the sea, which can be understood as:

> (...)todos os recursos vivos e não-vivos existentes nas águas sobrejacentes ao leito do mar, no leito do mar e seu subsolo, bem como nas áreas costeiras adjacentes, cujo aproveitamento sustentável é relevante sob os pontos de vista econômico, social e ecológico (Brasil, 2005).

Decree No. 1,265, of October 11, 1994, which approves the National Maritime Policy (PMN) also does not bring this approach in an effective way, although it brings significant contributions to marine conservation and incentives for research in these environments.

As with the other decrees already mentioned, PMN faces difficulties in practical implementation, since the lack of resources has proved to be a contemporary obstacle to compliance with environmental laws (Koeller, 2020).

Investment in science and technology in Brazil has been reduced since 2013. In 2013, R$ 15.401 billion were allocated, while in 2019 the settled values did not exceed R$ 6.721 billion, which shows a reduction of 56.36%. The National Council for Scientific and Technological Development (CNPq) is one of the agencies that suffered the most dismantling in six years, from 2013 to 2019, there was a 52.39% reduction in the budget (Macário & Reis, 2020).

The aforementioned context shows a practical impossibility to comply with the legislation due to the lack of resources. Furthermore, the appearance of the pandemic in a country whose president and his followers who promote denialism, neoliberal reason and still show contempt for vulnerable communities, science and all those who question government decisions, does not favor a promising scenario in any way for the preservation of natural resources and sustainable development (Caponi, 2020).

3.4 What is expected of the future?

Encouraging the protection of forests and sustainable management of river basins (Bremer et al., 2021), as well as the development of circular economy (Awasthi et al., 2019), urban, economic planning, seafront reconstruction (Chen, 2020), transdisciplinary practices of environmental education and the strengthening of ecological policies (Meek & Lloro-Bidart, 2017) are urgent alternatives to be adopted to promote sustainable development.

In different regions around the Earth, the participation of indigenous communities in the decisions of public authorities and also of other traditional communities signals a promising path to be followed by the rest of the world for the adoption of conservationist, participatory and inclusive measures (Welch & Coimbra Jr., 2019).

The fight against dictator, centralizing and denialist powers must also be done by everyone who is affected by measures coming from these governments, especially in the context of the Covid-19 pandemic (Morel, 2021). The control of militarization, the valorization of science, the dissemination of knowledge in a safe and accessible way, reforms in public policies, inspection and respect for human rights will also be fundamental ways in improving the near future (Acacio & Passos, 2020).

Although they face difficulties due to the lack of resources and public support, actions such as those carried out by Fundação Projeto Tamar, which fight for the preservation and conservation of environmental reserves in coastal and marine environments (Brasil, 2021), must be strengthened, as are other institutions and civil society groups.

In addition, legal support (Galdamez Zelada, 2020) and the development of active methodologies and environmental education linked to an ecopolitical thinking aimed at the formation of a citizen consciousness (Layrargues, 2020), focusing on the problem of the ocean and its socioeconomic implications, as well as integrated environmental management measures (Layrargues, 2020), must be on the rise to mitigate the economic, social and environmental impacts of the pandemic.

It is also expected that there will be greater effectiveness in the application of laws and respect for the constitution. Although Brazil faces an unstable political context that

threatens the economy, health and the environment (Lima et al., 2020), it is up to the people, civil society and institutions to defend by guaranteeing fundamental rights and fulfilling elementary duties for the recovery of the nation in the post-pandemic scenario.

Taking into account that the political performance of young people contributes to the constitution of critical and participative subjects in the process of social transformation, with the exercise of citizenship, commitment to the collective (Silva et al., 2018) the participation of youth in synergy with science and leadership of the State will be fundamental.

A state that is out of alignment with science means that the population does not respect security measures and socio- environmental balance (Duarte & César, 2020). The negationism associated with the climate and spread on Twitter is a factor that threatens marine ecosystems (Andrade et al., 2020) and it must be worked through environmental education practices and alignment between State and universities, aiming to combat misinformation, denial and skepticism (Abellán López, 2021).

In this way, it is expected to find results that support new decisions and serve as an auxiliary instrument in the decision-making process by public managers and also paths to be followed by educators and scientists in contributing to a better, more just and coherent society in the future, noting that the need for change, the construction of knowledge and participatory actions must begin in the present, with historical facts and phenomena as lessons to be overcome and learned.

4. Conclusions

It appears that interests in ecosystem services provided by the ocean generate global interest and diplomatic negotiation is necessary to conserve natural resources and resolve conflicts of interest around the world. International measures, such as Conventions, Forums and other types of events, have had an impact on Brazilian decisions, bringing contributions to the country's legal and political scenario.

With the conclusion of this research, it is verified that there are still many challenges to be overcome for the effectiveness of marine conservation policies in Brazil, that the role of the State is fundamental and that the omission of actions on the part of it

can potentiate the social and environmental impacts, especially for the most vulnerable communities.

With the pandemic caused by the new coronavirus, on the management of an authoritarian far-right government, Brazil faces severe impacts on health, environment, economy and society, which invariably has repercussions on damage to marine ecosystems and coastal environments, such as the increase of solid waste at sea due to the pandemic, linked to the lack of effective solid waste management.

Considering the distance between theory and practice observed in compliance with legislation, it appears that, against the grain of sustainability, human actions have repercussions on environmental damage that, in many cases, return to the agents themselves, in addition to causing externalities of global impact, as the increase in ocean pollution.

In the post-pandemic context, it is expected that learning from the mistakes of the present will not be repeated, that there will be collective engagement and participation in decision-making, including fishermen, traditional communities and vulnerable and marginalized groups in society, that the valorization of the resources of the the State and the conservation of ecosystems are highlighted by the State, that environmental education projects are strengthened by public policies, with investment and incentives in teaching, research and technology for sustainable development.

It also emphasizes the importance of multi and interdisciplinarity for the sustainable planning of the future, which will have the consequences of a neglected present by the Brazilian State and the results of a worn out and abandoned people by the government itself. This scenario shows the importance of the performance of teaching and research institutions in Brazil and the world, for the promotion of scientific dissemination.

Finally, we suggest that researches identifying the transforming potential of social values, such as environmental education, be carried out within the scope of marine sciences, seeking interdisciplinary solutions for anthropogenic impacts on the sea and protection of ecosystem services. In addition, we also highlight the importance of studies and research to assess environmental and socio-environmental impacts on coastal ecosystems and vulnerable environments such as islands at a local scale, seeking to

support public policies for decision-making and conservation of natural environments, seeking to promote development sustainable. Furthermore, we emphasize the importance of scientific communication and dissemination about the results obtained with these surveys, aiming at inclusion and social participation.

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CAPÍTULO 3

AS FUNÇÕES DA EDUCAÇÃO AMBIENTAL NA EFETIVIDADE DE POLÍTICAS AMBIENTAIS MARINHAS E COSTEIRAS NO BRASIL

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Resumo: Ecossistemas marinhos e ambientes costeiros são amparados por leis específicas que demandam ações complementares como fiscalização e Educação Ambiental para a efetividade de muitos aspectos abordados por estas bases jurídicas. Desta forma, este trabalho objetiva a avaliação das funções e proposições de alternativas de Educação Ambiental para a eficácia de Políticas Ambientais Marinhas e Costeiras (PAMC). A metodologia utilizada foi qualitativa, buscando informações em decretos, leis e artigos científicos. Dentre os principais resultados destaca-se o potencial e funções da Educação Ambiental para a conquista de objetivos conservacionistas e sustentáveis associados às PAMC no Brasil.

Palavras-chave: Meio Ambiente; Sustentabilidade; Conservação; Direito Ambiental; Impactos Ambientais.

Abstract: Marine ecosystems and coastal environments are supported by specific laws that demand complementary actions such as inspection and Environmental Education for the effectiveness of many aspects addressed by these legal bases. Thus, this research aims to evaluate the functions and propositions of alternatives in Environmental Education for the effectiveness of Marine and Coastal Environmental Policies (MCEP). The methodology used was qualitative, seeking information in decrees, laws and scientific articles. Among the main results, the potential and functions of Environmental Education for achieving conservation and sustainable goals associated with MCEP in Brazil stand out.

Keywords: Environment; Sustainability; Conservation; Environmental Law; Environmental impacts.

Introdução

O oceano é assunto de interesse global, é um ambiente heterogêneo, fundamental para a manutenção da vida na Terra e presta serviços ecossistêmicos fundamentais, além de abrigar ampla biodiversidade (HATJE; DA CUNHA; DA COSTA, 2013). Todavia, em função de atividades antrópicas, estes ambientes vêm sendo altamente impactados, trazendo prejuízos ambientais, sociais e econômicos, o que frisa a importância de ações participativas e inclusivas de Educação Ambiental (IMENIS BARRADAS, 2020).

Neste cenário, o conhecimento sobre a legislação vigente, ações do poder público e contribuição social são essenciais, assim como a avaliação de medidas adotadas para a mitigação de impactos ambientais negativos nestes ambientes. Para isso, a legislação específica de conservação do mar e outras políticas ambientais são fundamentais.

Muitas ações podem minimizar os impactos ambientais negativos no oceano, como a redução de poluição continental, hídrica, atmosférica, marinha e costeira, assim como a redução, reciclagem e reutilização de resíduos sólidos, como os de origem comercial, residencial, agrícolas e industriais. Entretanto, não basta a existência de leis, normas e políticas públicas, é preciso mais, é necessário fiscalização, gestão integrada, conscientização e sensibilização (COSTANZA, 1999; FRANCESCHI et al., 2017; SILVA; CHAVES; GHISOLFI, 2016).

Nestes quesitos, a Educação Ambiental possui um arcabouço forte de metodologias e atividades para a promoção de ações mais conscientes e sustentáveis (FIALHO; CUNHA, 2018). Como a própria Política Nacional de Educação Ambiental (lei nº 9.795, de 27 de abril de 1999) dispõe, é por meio dela que o indivíduo e a coletividade constroem valores sociais voltados para a conservação do meio ambiente (BRASIL, 1999).

Considerando estes aspectos, o presente trabalho tem como objetivo a avaliação das principais funções da Educação Ambiental para a efetivação de Políticas Ambientais Marinhas e Costeiras (PAMC) e a indicação de propostas de ações participativas e interdisciplinares para a promoção da sustentabilidade e Educação Ambiental sobre os ecossistemas marinhos e costeiros.

Metodologia

A metodologia de pesquisa adotada neste trabalho provém de revisão bibliográfica qualitativa com foco sobre o método funcionalista e dialético. O método funcionalista visa o estudo social de um ponto de vista da função de suas unidades, considerando um sistema organizado de atividades, enquanto o dialético penetra o mundo dos fenômenos e considera que os fatos não podem ser considerados fora de um contexto social (PEREIRA et al., 2018).

A ferramenta principal de busca, para a construção da narrativa, foi o *Scientific Electronic Library Online* (SciELO) e complementada por Web of Science. Utilizou-se, também, pesquisa exploratória nas referências dos artigos encontrados com resultados relevantes para o tema da pesquisa, visando melhorar a compreensão geral sobre a problemática aqui proposta e as suas implicações. Desta forma, com destaque para as Políticas Ambientais Marinhas e Costeiras (PAMC) e Educação Ambiental, os métodos descritos se aplicaram ao contexto socioambiental que circunda estes dois assuntos.

Para este estudo, considerou-se como Políticas Ambientais Marinhas e Costeiras (PAMC), leis em que se podem extrair princípios de proteção dos recursos ambientais marinhos e costeiros. Foram adotadas perspectivas similares ao contexto de políticas de conservação do mar (MATIAS; IMPERADOR, 2021), seus recursos e principais áreas de influência.

Por meio da análise destas leis, decretos (BRASIL, 1981; BRASIL, 1988; BRASIL, 1994; BRASIL, 1995; BRASIL, 1999; BRASIL, 2005) e artigos ligados ao tema, foi possível elaborar uma discussão pautada na interdisciplinaridade e importância da Educação Ambiental para a efetivação de Políticas Ambientais Marinhas e Costeiras (PAMC), conservação ambiental e promoção da sustentabilidade.

O direcionamento dos métodos adotados iniciou-se com a leitura e interpretação da legislação marinha brasileira pertinente e de artigos científicos em revistas especializadas na temática proposta, visando destacar a importância de práticas de Educação Ambiental para a promoção de hábitos mais sustentáveis associados ao ambiente marinho e costeiro. Com isso pode-se elaborar um mapa conceitual, uma nuvem interdisciplinar e um quadro com atividades de Educação Ambiental aplicadas à problemática do oceano e às PAMC, incluindo uma discussão reflexiva sobre o assunto.

Contextualização e Aspectos Históricos

Ao longo do tempo, problemas sociais, ambientais e econômicos marcaram a história do desenvolvimento humano. A Revolução Industrial foi um dos grandes marcos, que acentuou desigualdades e impulsionou a crise ambiental, associada ao crescimento populacional, exploração descontrolada dos recursos naturais e geração de poluição (VALERO; SANTIAGO; FRANÇA, 2019).

Segundo Barbosa e Aguiar (2018, p. 251),

> (...) tratar de conservação em cenários onde a problemática ambiental se entrelaça a questões econômicas, sociais, culturais e políticas, a exemplo do que acontece em países em desenvolvimento como o Brasil, exige uma abordagem diferenciada e abrangente que considere ao máximo essa multiplicidade de fatores.

Ademais, os mesmos autores (2018, p. 251) ainda destacam que:

> (...) essa relação humano/natureza é instituída desde os primórdios da civilização, sua análise exige um recorte temporal mais amplo, uma vez que atuais circunstâncias socioambientais podem ter origem em eventos do passado.

A evolução brasileira conta com amplo histórico de degradação ambiental e perdas de serviços ecossistêmicos. O Brasil, com aproximadamente 8500 km de costa, com uma zona costeira que se estende desde águas rasas até o oceano profundo, apresenta grande diversidade de ecossistemas e formações geomorfológicas suscetíveis à interferência antrópica (RIBEIRO et al., 2018), o que frisa a importância de Políticas Ambientais Marinhas e Costeiras (PAMC) eficazes.

Segundo Aslan, Pinto e Oliveira (2017, p. 183),

> O crescimento populacional, associado ao desenvolvimento, a exploração dos recursos do mar e a crença na infinitude destes recursos pelo homem, tem alterado significativamente os níveis de poluição nos mares. A partir desta percepção, e ao reconhecer que o mar, por ser um recurso de uso comum, foram realizadas convenções e tratados internacionais ao longo dos últimos 50 anos na tentativa de criar mecanismos de controle e prevenção da poluição marinha. Neste contexto, o Brasil tem ampliado seu arcabouço jurídico, com leis e políticas públicas associadas a setores regulamentados.

Os desequilíbrios ecológicos, impactos ambientais e outros fenômenos decorrentes da falta de um desenvolvimento sustentável ao longo da história, além de impactos na saúde pública, foram fortes propulsores para debates e discussões que resultaram em grandes congressos, seminários e conferências internacionais, como Estocolmo (1972), Belgrado (1975), Tbilisi (1977), Moscou (1987), Eco 92 (1992) e Rio+20 (2012), em que o papel da Educação Ambiental ganha destaque para a contribuição das medidas de gestão e políticas adotadas por diversos países (BEZERRA, 2021).

Educação Ambiental e Políticas Ambientais Marinhas e Costeiras (PAMC): conexões e funções

As políticas nacionais de conservação do mar, assim como planos, documentos e outras formas de iniciativas públicas são medidas importantes para o alinhamento brasileiro ao contexto internacional, uma vez que traçam estratégias e normas específicas para a gestão marinha, conservação dos recursos do mar, segurança marítima e relações internacionais (BEIRÃO, 2019; BRASIL, 1988, 1994, 2005; BUEGER, 2015; MOREIRA, 2020; TRAJANO, 2010).

No Brasil, para que ocorra a efetivação de aspectos conservacionistas destacados pela Política Nacional de Meio Ambiente (BRASIL, 1981) e pela Política Nacional para os Recursos do Mar (BRASIL, 2005), é necessário que haja participação e engajamento comunitário, visando o manejo adequado direto e indireto dos recursos marinhos e o desenvolvimento sustentável, o que frisa a função da Educação Ambiental neste aspecto (LAYRARGUES, 2020; SONG, 2015).

A Política Nacional para os Recursos do Mar (decreto nº 5.377 de 23 de fevereiro de 2005) estabelece princípios e objetivos para a elaboração de planos, programas e ações de governo em formação de recursos humanos, desenvolvimento de pesquisa, ciência e tecnologia marinha, exploração e aproveitamento sustentável dos recursos do mar.

Dentre os princípios da política, destacam-se: a harmonização com as demais políticas, definições de prioridades voltadas à sustentabilidade, execução descentralizada e participativa, princípio da precaução, proteção da biodiversidade e do patrimônio

genético de áreas sob a jurisdição nacional, além da observância dos compromissos internacionais assumidos pelo Brasil.

Para a garantia de certos atributos das PAMC estudadas, no que tange à sociedade e à responsabilidade coletiva, se faz necessário que a Educação Ambiental atue na promoção de uma nova cultura, na construção de valores sociais conservacionistas e na percepção do papel de cada indivíduo e da sua responsabilidade coletiva.

Desta forma, a Figura 1 mostra um mapa conceitual que ilustra as conexões principais entre a Educação Ambiental e as PAMC. Percebe-se que os processos de Educação Ambiental implicam em aspectos fundamentais para a prática das PAMC, e que em função disso, a interdisciplinaridade entre as duas partes deve ser fortalecida.

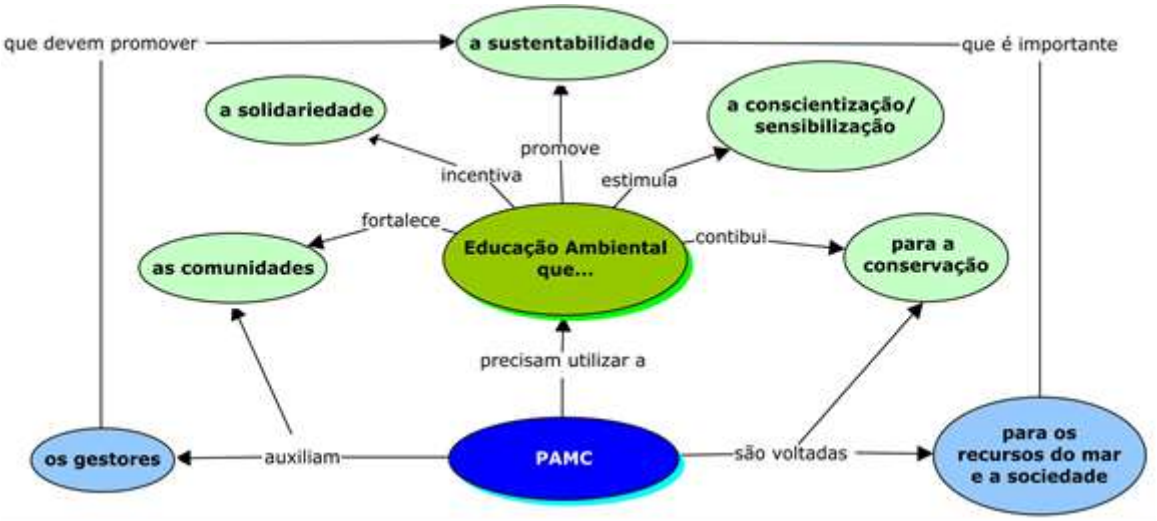

Figura 1: Mapa conceitual sobre as Políticas Ambientais Marinhas e Costeiras (PAMC) e a Educação Ambiental
Fonte: dos autores.

A análise da Figura 1 resulta do estudo sistemático da legislação específica sobre recursos do mar e da zona costeira (BRASIL, 1988, 1994, 1995, 2005) e Educação Ambiental (BRASIL, 1999). Tais aspetos evidenciam a importância e a função da Educação Ambiental como ferramenta transformadora de práticas lesivas aos ecossistemas marinhos e costeiros.

Destaca-se ainda que, praticar a Educação Ambiental no Brasil é um grande desafio, em diversos aspectos. Avanços e retrocessos na Política Nacional de Educação Ambiental são fatores que evidenciam esta realidade e mostram a importância de apoio público e processos independentes de Educação Ambiental, uma vez que diversas questões, como falta de investimentos públicos na área, afetam diretamente a implementação de políticas públicas no Brasil (GARCIA et al., 2020).

A prática da Educação Ambiental como alternativa integradora para a efetividade de Políticas Ambientais Marinhas e Costeiras (PAMC)

Diversos processos como a urbanização, modelos de produção, fluxo de produtos e serviços, além de outros fatores políticos, econômicos e culturais configuram um quadro complexo de ações que afetam os ambientes marinhos e costeiros (HATJE; DA CUNHA; DA COSTA, 2018; RIO, 2018; SILVA; CHAVES; GHISOLFI, 2016). Observa-se, neste sentido, que soluções interdisciplinares englobando, principalmente política e ciência, devem ser alavancas urgentes para a sustentabilidade (TELLES, 2018).

A percepção ambiental é um dos elementos relevantes para subsidiar decisões importantes e estratégias em Gestão Marinha e Costeira, uma vez que a percepção ambiental representa o modo pelo qual os indivíduos expressam o meio ao qual interagem, ficando notável a existência de relações benéficas ou nocivas ao meio ambiente e até mesmo para a própria comunidade (DE OLIVEIRA; DOS SANTOS; TURRA, 2018).

Desta forma, considerando os atributos da Educação Ambiental, percebe-se que este instrumento da Gestão Ambiental pode e deve ser utilizado como alternativa fundamental para lidar com os impactos antrópicos no mar e na efetivação de Políticas Ambientais Marinhas e Costeiras (PAMC).

Ações de abordagem sistêmica em escolas envolvendo a problemática do lixo no oceano já foram trabalhadas por educadores ambientais mostrando a importância do tema e a resposta de crianças do ensino fundamental, que de forma conjunta, buscaram soluções para o problema (BRUCK; FERREIRA; MACHADO, 2020).

O trabalho de Educação Ambiental em escolas, comunidades tradicionais, de pescadores, incluindo também eixos do comércio e as demais partes interessadas nos recursos do mar, são caminhos que devem ser estimulados pelo poder público por meio do fornecimento de recursos e condições para as práticas educativas (IMENIS BARRADAS, 2020; SAMPAIO; SANTOS, 2020).

Estas questões, no contexto atual, em que o mundo todo enfrenta dificuldades graves em diversos setores em função da pandemia da Covid-19, repercutem gravemente nos ecossistemas marinhos e costeiros, como o aumento significativo de resíduos, especialmente o plástico, nestes ambientes (SILVA et al., 2020).

Estes materiais são uma ameaça à fauna marinha, podem comprometer atividades turísticas e de pesca, trazendo prejuízos para as comunidades locais que dependem dos recursos do mar. Além disso, podem provocar desequilíbrio ecossistêmico, o que destaca a importância de uma consciência ambiental e sensibilização para a problemática, buscando ações unificadas e solidárias (COSTA; DUARTE; ROCHA-SANTOS, 2019; SANTOS et al., 2020; SILVA et al., 2020).

Para mitigar estes impactos e colaborar para a eficácia das PAMC, sugere-se a aplicação de jogos, discussões, oficinas, debates, eventos e outros projetos à curto, médio e longo prazo, em diversos locais e distribuídos para diferentes públicos-alvo, considerando as especificidades de cada grupo social, suas fragilidades e disponibilidade para as atividades.

Frisa-se também, a relevância da interdisciplinaridade no desenvolvimento de quaisquer atividades de Educação Ambiental aplicadas aos ecossistemas marinhos e costeiros, respeitando e valorizando as diferentes formas do saber e incluindo diversidade cultural, religiosa e local. A Figura 2 representa um mapa com os principais assuntos, temas e disciplinas relevantes para trabalhar a Educação Ambiental na problemática oceânica.

Figura 2: Nuvem da interdisciplinaridade entre alguns aspectos da Educação Ambiental e das Políticas Ambientais Marinhas e Costeiras (PAMC).
Fonte: dos autores.

Além disso, é importante que estudos e pesquisas de acompanhamento sejam feitos, visando compreender a percepção ambiental popular sobre a problemática dos oceanos, incluindo as mudanças climáticas e aspectos correlacionados (PEDRINI et al., 2016).

Outro elemento fundamental é a compreensão dos impactos antrópicos no mar, suas causas e o papel social nesta dimensão. O desenvolvimento deste conhecimento pode ser um instrumento fundamental para a Gestão Marinha e Costeira, visando a redução de impactos ambientais e a preservação dos recursos marinhos e costeiros, dos ecossistemas e da biodiversidade.

O Quadro 1 sugere opções de atividades de Educação Ambiental que podem ser utilizadas para a reflexão e o estímulo à adoção de práticas sustentáveis e quebra de paradigmas. Os questionamentos citados podem ser desdobrados gerando uma série de novas questões, enriquecendo o processo de aprendizado.

Frisa-se ainda que, a abordagem dos aspectos descritos no Quadro 1 devem ser trabalhados em harmonia com os principais princípios do Direito Ambiental, que se encontram hierarquicamente superiores a qualquer regra ou política (SILVA; FELÍCIO, 2017), de forma que o cidadão tenha consciência de seus direitos e deveres sobre os recursos ambientais que usufrui, direta ou indiretamente.

Dentre estes princípios destacam-se: a) do Desenvolvimento Sustentável; b) da Participação Comunitária ou Cidadã; c) da Precaução; d) da Prevenção; e) do Poluidor-Pagador; f) da Proibição do Retrocesso Ambiental; g) democrático; h) da responsabilidade (SILVA; FELÍCIO, 2017).

Quadro 1. Opções de atividades de Educação Ambiental.

Práticas de Educação Ambiental aplicadas à problemática dos impactos antrópicos nos ambientes marinhos e costeiros		
Prática/ Atividade	**Objetivos/ Observações**	**Questionamentos/ Problemas-chave**
Jogos interativos ou individuais, virtuais ou coletivos.	Despertar, por meio lúdico, o interesse pelo tema, aplicado principalmente para o público jovem e infantil.	"Quais são os impactos das atividades humanas que são mais evidentes no mar?"; "Qual é a nossa responsabilidade para a conservação do mar?"; "Você sabe a importância do oceano na sua vida?"; "Quem são os responsáveis pelo lixo no mar?"; "Como podemos contribuir para a melhoria do ambiente marinho?"; "Que práticas do seu dia-a-dia que poderiam ser modificadas para a sustentabilidade no oceano?"; "O que são ecossistemas costeiros e marinhos?"; "O que dizem as Políticas Ambientais Marinhas e Costeiras?"
Cartilhas, livros, Gibis, Apostilas, impressas ou virtuais.	Despertar o interesse pelo tema. Abordagem mais aprofundada. Para todos os tipos de público. Buscar garantir fácil acesso.	
Reuniões, Debates, Congressos, Seminários, Conferências, Palestras e afins.	Atingir um público formador de opinião, professores, gestores, empresários e outros. Caráter mais formal.	
Aulas, e processos pedagógicos a médio e longo prazo, contendo monitoramento.	Garantir o aprendizado contínuo e duradouro. Acompanhar os resultados do processo. Pode contemplar as práticas anteriores.	

Fonte: Dos autores.

Conclusões

As Políticas Ambientais Marinhas e Costeiras (PAMC) são importantes para a preservação dos recursos do mar. Todavia, precisam de ferramentas da Educação

Ambiental para a sua efetividade, especialmente na construção de uma nova cultura e de valores sociais comprometidos com a conservação dos recursos naturais e sustentabilidade.

Neste sentido, as práticas de Educação Ambiental, como as expressas no Quadro 1, são alternativas que podem contribuir para a efetividade das PAMC, uma vez que as ferramentas utilizadas podem ser adaptadas para diferentes realidades e tipos de público.

A importância de atividades de Educação Ambiental em escalas locais, regionais e globais é urgente e deve ser feita em todos os níveis de ensino, buscando atingir primeiramente os indivíduos com relações mais diretas com o oceano, seguido daquelas cujas ações implicam em impactos indiretos nestes ambientes.

Em um contexto global de crise emplacada pela pandemia provocada pelo novo coronavírus (SARS-CoV-2), a vulnerabilidade dos ecossistemas marinhos e costeiros é acentuada perante o aumento de resíduos, o que frisa um obstáculo presente e futuro a ser resolvido, ao qual a participação coletiva será essencial, o que demandará processos intensos de Educação Ambiental e incentivo do Estado.

A atenção comunitária pode resultar em conservação dos recursos naturais, assim como o seu abandono em impactos negativos e degradação ambiental. Desta forma, conclui-se que, no cenário atual, com a problemática da poluição marinha e costeira intensificada pela pandemia da Covid-19, devido ao aumento de resíduos, vinculada também ao negacionismo científico e propagação de informações falsas, o futuro representará um cenário em que o papel da Educação Ambiental será ainda mais importante.

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CAPÍTULO 4

A Systemic Environmental Impact Assessment on Tourism in Island and Coastal Ecosystems

Abstract

Intense tourism is a common occurrence in environments with very attractive natural traits and that host important ecosystem services, such as islands and coastal environments. However, these activities can cause impacts and loss of ecosystem services, thus requiring assessments about tourism activities and how to manage their complexity. Thus, the objective of the present study was to carry out an environmental impact assessment based on ecosystems in two islands with strong tourist pressure in the state of Santa Catarina, Brazil. The islands analyzed were Anhatomirim and Campeche, and the methodology used was the ecosystem-based Survey of Environmental Aspects and Impacts (SEAI), carried out by means of structured technical visits following a bibliographic analysis of the study area. Results indicated that the analysis model constructed can contribute to decision-making in environmental management, as it enabled a clear and objective identification of the main aspects, environmental impacts, and ecosystem services that are somehow connected. Among the negative impacts observed, the most relevant were water pollution, impaired health of wild animals, loss of biodiversity, and the spread of Covid-19. In turn, the most prominent positive impact was the generation of employment and income. The demand for environmental education projects in the tourist system that involves the two islands is also highlighted. Thus, this investigation was shown to be useful for the identification of the main anthropic elements derived from tourism that affect these ecosystems.

Keywords: ecosystem services, conservation, sustainability, environmental education, environmental management.

1. Introduction

Marine and coastal ecosystems have consistently been suffering several impacts from human actions (Grip & Blomqvist, 2021; Russell et al., 2017). Even in remote regions, such as Antarctica, anthropogenic impacts are perceived, directly or indirectly, including negative effects to endemic fauna that are affected by the introduction of exotic

species and ocean acidification due to exacerbated burning of fossil fuels (Aronson et al. al., 2011). In addition, the disposal of untreated effluents in the sea, as well as solid waste, can cause loss of biodiversity and changes in food webs (Sanches et al., 2020; Woodhead et al., 2019; Ziegler et al., 2016). In Europe alone, the combined effects of multiple human actions affect an estimated 96% of the continent's marine area and 86% of its coastal area, which puts these ecosystems, and the communities that rely on their ecosystem services, at risk (Korpinen et al., 2021).

The pace at which humanity has explored the ocean goes against the consensus of international forums on the subject, which can generate tensions and social, environmental, and economic strains (Marques, 2020). Plastic islands and extreme levels of coastal pollution draw attention to the urgency for environmental and coastal management and planning measures to mitigate and reduce negative environmental impacts (Leah Filho et al., 2019).

Island ecosystems and coastal zones are characterized by having specific and peculiar biodiversity conditions, with important interactions with the abiotic environment, and by being more sensitive to ecosystem disturbances, whether of natural or artificial origin, which places these locations at a more vulnerable position than other more resilient environments (Kort et al., 2021; Li et al., 2020; R, 1975; Reaser et al., 2007). In addition to ecosystem vulnerability, traditional communities living on islands and coastal environments depend on local natural resources for their survival, but do not always enjoy the benefits promised by the implementation of tourist activities, which may incur in the deterioration of the local population in meeting their needs (MacNeill & Wozniak, 2018; Seixas et al., 2014).

Unsustainable tourism, characterized by massive, polluting activities, and unbalanced with economic, social, and environmental development, is responsible for major environmental impacts on the ocean, such as those that derive from the inadequate disposal of solid waste, which ends up reaching the ocean and generating drastic consequences for marine ecosystems, such as loss of biodiversity, loss of habitat, ecological changes, in addition to socio-environmental problems (Cong & Chi, 2020; Grechinski & Goveia, 2021; Mury et al., 2021). Furthermore, although many tourists call for sustainable tourism, it is not always possible for tourists to clearly understand whether

tourism is really sustainable (Goffi et al., 2019). Thus, unsustainable tourism can compromise environmental or social aspects to the detriment of primarily economic interests, which can lead to environmental degradation and the unfeasibility of ecosystems for various purposes, also impacting economic problems (Gössling et al., 2018; Mendoza-González et al., 2018).

In Brazil, several impacts on island and coastal ecosystems have been observed with consequent losses to ecosystem services, highlighting the importance of environmental management measures (Araujo et al., 2018; Araújo et al., 2018; Asmus, Nicolodi, Scherer, Gianuca, Costa, Goersch, Hallal, Victor, Ferreira, Ribeiro, Pereira, et al., 2018; Cristiano et al., 2020; Woodhead et al., 2019; Ziegler et al., 2016). Mass tourism, predatory fishing, increased pollution, and disordered development represent strong impacts to these environments, which lack urgent sustainable actions to recover affected areas (Loiola et al., 2014).

Thus, it is essential that we find interdisciplinary solutions encompassing public policies, community engagement, science, and technology, together, in order to preserve the health, collective well-being, and conservation of biodiversity for the promotion of sustainable development, seeking to reframe habits that are harmful to the environment, bringing more environmental justice and education to society (Meek & Lloro-Bidart, 2017; Walsh et al., 2021). To achieve this, there are different environmental management instruments that can be used. These include environmental impact assessments (EIA) and strategic environmental assessments (SEA), keeping in mind that research shows the importance of a systemic approach, considering ecosystem services to improve EIA processes and SEA (Honrado et al., 2013; Kumar et al., 2013; Partidario & Gomes, 2013; Pürrer et al., 2021).

Different methodologies are used for the assessment of environmental impacts such as control lists, ad hoc method, interaction matrices, interaction networks, simulation models, cost-benefit analysis, map overlay, multi-objective analysis, and others. However, most of them are intended for specific assessment of projects in the environment, and the ecosystem approach is not always considered in the studies. In addition, the subjectivity of many of these methodologies is still a challenge to be overcome, which creates a gap and opportunity for new research, especially for works

interested in the systemic assessment of environmental impacts, and not just linked to specific projects that need environmental licensing (Cremonez et al., 2014; Karjalainen et al., 2013; Martins & Junior, 2018; Nita et al., 2022; Silva et al., 2022; Sousa et al., 2020).

So, is it possible to develop an ecosystem-based environmental impact assessment methodology that can be adapted to the problem of tourism in insular and coastal ecosystems? Furthermore, how can the results of this methodology contribute to local socio-environmental management and development? Our hypothesis is that it is possible to create a methodology based on an adaptation of the ISO standardization: 14001 regarding the Survey of Environmental Aspects and Impacts (SEAI), and aggregate ecosystem services through systemic analysis of areas affected by tourism. Furthermore, we believe that the results of this research can provide relevant information for an interdisciplinary discussion and a better understanding of the local tourist dynamics and its impacts.

Therefore, the objective of the present study was to survey and evaluate the main environmental aspects and impacts associated with tourism that affect the ecosystems of two subtropical islands regarding their ecosystem services. This allows a discussion about which measures can be used to mitigate or reduce negative impacts and enhance positive impacts, aiming at environmental conservation and sustainable use of natural resources by stakeholders.

2. Methodology

2.1 Characterization of the study area

The locations chosen for this study were the islands of Anhatomirim and Campeche (Figure 1), state of Santa Catarina, Brazil, due to their environmental, cultural, and touristic importance to the region. Both islands have remnants of Atlantic Forest vegetation and rocky outcrops. The climate is subtropical, with an average annual temperature of 21.8 °C, total annual precipitation of 1,400 mm, and relative humidity between 80 and 85% (UFSC, 2021; Filho, et al., 2015).

Figure 1. Images of the study areas. (a) and (c) correspond to Anhatomirim Island; (b) and (d) correspond to Campeche Island. Source: (UFSC, 2021; Google Earth Pro, 2021).

Anhatomirim Island is an Environmental Protection Area (EPA) since 1992 (Brasil, 1992). It belongs to the municipality of Governador Celso Ramos, state of Santa Catarina. Located between the continent and the northern bay of Santa Catarina Island, it covers approximately 45,000 m². The island is home to the Santa Cruz Fortress, which was built in 1739 with Renaissance influence and with buildings spread across the island. In 1938, the fortress was encompassed by the Institute of National Historical and Artistic Heritage (IPHAN) of Brazil, being deactivated as a military unit after World War II. In 1979, the Federal University of Santa Catarina (UFSC) signed an agreement with the Ministry of the Navy and IPHAN assuming the custody and guardianship of the fortress and streamlining the process of restoring its historic ruins. In 1984, the Santa Cruz Fortress was reopened for public visitation (UFSC, 2021).

Campeche Island, on the other hand, is defined by the Florianópolis Municipal Master Plan as a Permanent Preservation Area (PPA), through Complementary Law No. 482, 2014 (Florianópolis, 2014). It covers a total area of 486,399.5 m² and holds a rich collection of archaeological sites. The island is accessed by vessels licensed by the Port Authority. Since 2000, the area has been protected as a National Archaeological and

Landscape Heritage by IPHAN. There are buildings in the western portion of the island, built before it was classified as a PPA. These constructions are used as restaurants to meet tourist demand during the high tourist season. Marine resources are explored in the region through recreational as well as traditional and industrial fishing (Filho et al., 2015).

2.2 Data collection and analysis

Data were collected through a technical visit to the islands of Anhatomirim and Campeche, in June and September 2021, respecting health safety recommendations during the Covid-19 pandemic. On Anhatomirim Island, due to health risks associated with the spread of the new coronavirus (Sars-CoV-2), it was not possible to leave the boat; thus, the visit was made circling the region still onboard the vessel. On the Campeche Island, visitation was allowed.

An evaluation of the landscape and of current and potential human interferences, mainly those linked to tourism activities, was carried out in both islands. Whenever possible, photographic records were used to identify and discuss the main environmental aspects and impacts reported. Information was also collected through informal conversations with island managers and those responsible for tourist visitations and access to the islands. In these informal conversations, carried out during the visits, it was asked what would be the main benefits of the islands for tourists and the local community. Based on this information and the technical observations made by the researchers, based on research by Asmus et al. (2018), Lau et al. (2019), Lima et al. (2018), it was possible to outline and group the main ecosystem services provided by the two islands studied in a table.

This enabled the creation of a specific protocol for the Survey of Environmental Aspects and Impacts (SEAI) and their relationship with the most notable ecosystem services on the two islands. Scores for each of the variables applied in the procedure were stipulated after the first technical visit to the islands, in order to identify which criteria would have the potential to better represent the local environmental systems and their relationships with human activities, seeking to illustrate, as objectively as possible, the environmental aspects and impacts identified. After this process, the SEAI procedure was applied, and its results were discussed (Figure 2).

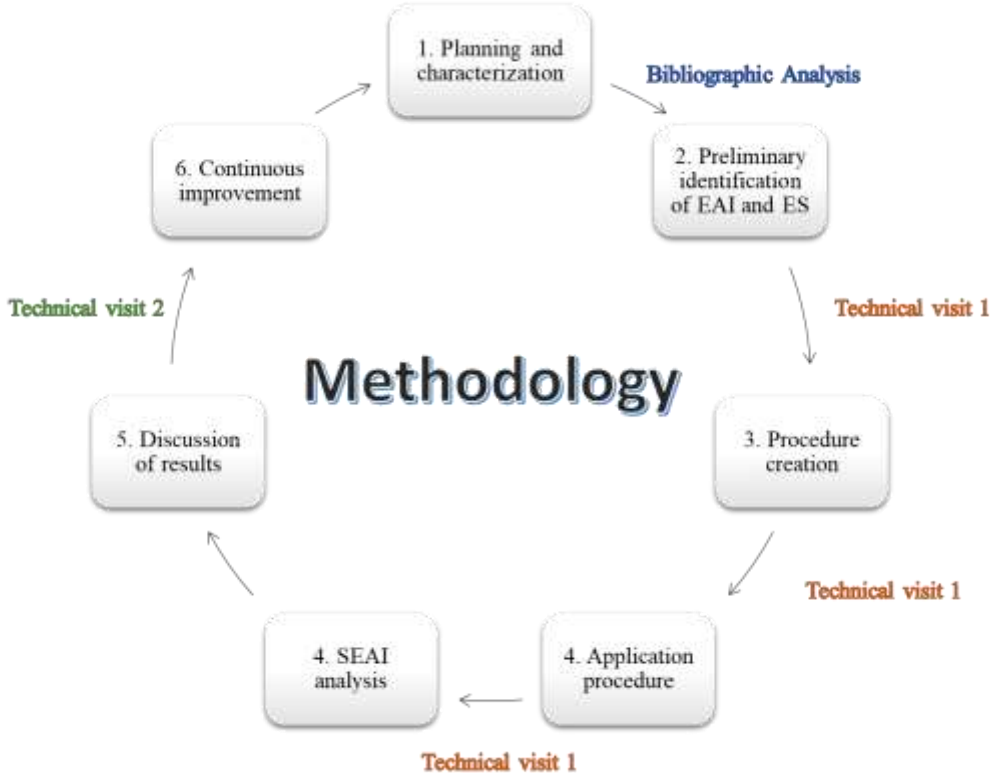

Figure 2. Methodological proposal applied for the systemic assessment of environmental impacts.

Source: From the authors.

2.3. Procedure for Surveying Environmental Aspects and Impacts (SEAI)

The Survey of Environmental Aspects and Impacts (SEAI) is an environmental management tool widely applied in business organizations, according to ABNT NBR ISO 14001, to obtain environmental certification. However, this tool can be applied to other environments, such as island ecosystems and coastal environments to assist in environmental management and planning (Matias et al., 2018; Llantada and Matias, 2021).

In the research carried out by Matias et al. (2018) it was possible to observe that the authors were able to use this method and identify the most relevant environmental aspects and impacts in the study area, through field analysis. In the search of Llantada and Matias (2021), the SEAI was generated from the process of assessing environmental impacts by overlaying maps, using geoprocessing tools. This methodology is mainly indicated for situations in which field visits or validations are not possible (Braga et al.,

2021; Sànchez, 2020). However, none of the studies used the ecosystemic basis highlighted by authors such as Asmus et al. (2018), Backer et al. (2013), Karjalainen et al. (2013), Lau et al. (2019), Lima et al. (2018), who emphasize the importance of including the ecosystem approach in management processes and assessment of environmental impacts. It is also important to note that no studies were found published in scientific journals that used the SEAI method for insular and coastal ecosystems, in addition to the article by Matias et al. (2018), which highlights a gap in knowledge.

According to ABNT NBR ISO 14001 (2015), an environmental aspect can be understood as: “an element of an organization’s activities, products or services (3.1.4), which interacts or can interact with the environment (3.2.1)”. However, in the present study, the concept was adapted as an element regarding activities, products or actions associated with local tourism, which interacts or can interact with the environment. The same standard defines environmental impact as a “modification in the environment (3.2.1), both adverse and beneficial, totally or partially resulting from the environmental aspects (3.2.2) of an organization (3.1.4)”. However, this concept was addressed here as a modification in the environment, both adverse and beneficial, totally or partially resulting from the environmental aspects of tourism activities that affect a particular location, which in this study are island and coastal ecosystems. In addition, the socio-environmental effects observed on the islands that affect or may affect health, well-being, work, culture and local ecosystem services were integrated into this concept of environmental impact.

The concepts adopted in this research also coincide with Braga, et al. (2005) and Sánchez (2013), as well as a resolution of the National Council for the Environment (CONAMA – No. 001/86). These references, in general, define environmental impact as a change in environmental quality resulting from human action. Furthermore, the benefits provided by the functions that ecosystems perform, both directly and indirectly, which can be enjoyed by society and subject to economic valuation, were considered as ecosystem services (Asmus et al., 2018; Brasil, 2021; Lau et al., 2019; Mehvar et al., 2018). Thus, for the construction of a local SEAI, the following variables were considered after the technical visit: type of environmental impact (positive or negative), impact on the affected ecosystem service (low, medium, or high), environmental impact factor (real

or potential impact), and amplitude (local, regional, or global). With this, the degree of environmental aspect and impact could be calculated (Equation 1).

$$G_{aia} = t2S_e + R + Am \quad (1)$$

Where:

G_{aia}: Degree of the corresponding environmental aspect and impact. This indicator was created to identify which situations are more or less significant, whether positive or negative, and which situations should receive more attention from environmental managers.

t: Used to indicate the type of environmental impact. If the impact is positive, t will have a value of +1.0, if the impact is negative, t will have a value of -1.0.

S_e: Relationship between environmental impacts and affected ecosystem services. This variable can be low, medium, or high, with a score of 1.0, 2.0, or 3.0, respectively, or zero when there is no relationship. The score was assigned based on the potential for reversibility of environmental impacts that affect or may affect ecosystem services, with 1.0 point being assigned for impacts considered easily reversible, 2.0 points for impacts with more complex reversibility and 3.0 points for short-term irreversible impacts. The value used in the equation is the average of the values of ecosystem services affected by a given environmental impact. The type and quantity of these services was elaborated after the technical visits and applied to the characteristics of each location, being, therefore, the first step made in the visitation.

R: Environmental impact factor. For real impacts, that is, those that already occur or for which future occurrence is evident, 2.0 points are scored. For potential impacts, which are those that may come to happen, a score of 1.0 point is attributed.

Am: Amplitude of impact. Local impacts score 1.0 point, while regional and global impacts score 2.0 and 3.0 points, respectively. Local impacts were defined as those restricted to the two islands studied, regional to those that reach or may reach other municipalities without leaving the southern region of Brazil, and global impacts were

considered as those that exceed or may exceed the territorial limits of the southern region of Brazil and may include other national regions as well as other countries.

2.4. Main Ecosystem Services Surveyed on the Two Islands and the Assigned Division

After visiting each island, a structured analysis was applied to the two ecosystems to divide the main ecosystem services observed. This division is the result of one of the methodological steps, which consists of evaluating the ecosystem services (ES) of the site studied without generalizations, that is, evaluating local specificities regardless of comparisons with other islands or ecosystems with different structures and dynamics. This step was based on research by Asmus et al. (2018), Becker et al. (2013), and Honrado et al. (2013). Thus, it was possible to build Table 1 with the main ecosystem services observed and their definition applied to the local context, so that they could be considered in the SEAI generated, according to procedure described in item 2.3.

Table 1. Main Ecosystem Services Considered for the Survey of Environmental Aspects and Impacts (SEAI).

Ecosystem Service (ES)	**Definition adopted for the local reality**
Cultural and psychological	Regards the relevance of the ecosystems, as a whole, for the tradition, knowledge, and habits of local residents and workers, as well as for other individuals who frequently use these natural environments, making them means to obtain psychological well-being and for the continuous practices of cultural processes. It includes religious, family, educational and spiritual practices.
Recreation and leisure	When the importance of the ecosystems is directly related to activities linked to local tourism. These are activities that visitors enjoy for leisure and personal satisfaction. It includes hiking, landscape contemplation, sea bathing, games and similar activities.
Employment and income	These are the working conditions for the local community, directly (on the islands) or indirectly (outside the islands), including a wide range of activities such as transport, sale of supplies and food products, package tours, and entertainment.
Navigation	Regards the potential of the marine and coastal environment near the islands to provide navigation conditions for different activities such as fishing, tourism, and transportation.
Ecological	This category comprises all services, known or not, that derive from the dynamic balance of the local ecosystem, which includes the balance between biotic and abiotic elements and their interactions with the generation or potential to generate direct and indirect benefits to human well-being. This includes regulation and provisioning services. It includes carbon sequestration, climate regulation, biodiversity, wildlife habitat, biogeochemical cycles, biomass, and food generation.
Environmental health	Encompasses the physical, chemical, biological, social, and psychological factors of the environments that cause or may cause changes in human health, including quality of life. It includes water, soil and air quality, and zoonoses control.

Source: from the authors.

It is important to highlight that the methods of surveying ecosystem services vary a lot and there is no consolidated standard on this in the literature, however, case studies, comparative listings with the literature, and structured interviews are among the most common. In addition, the purpose of the survey can be more or less specific, varying according to the objective of the research, which can be focused on the valuation of ecosystem services, which requires greater systematization, or on the alert of vulnerability in the face of anthropic pressure, in which the relationship with environmental impacts is emphasized (Silva et al., 2022; Silva & Scherer, 2021; Jardeweski et al., 2021; Kieslich & Salles, 2021; Pisani et al., 2021) which is the case of this research.

2.5. Discussion of results

The results are discussed based on the SEAI, which was constructed in an interdisciplinary way and focusing on a functionalist and dialectical method. The functionalist method is developed through the social study from a perspective of the function of its units, considering an organized system of activities and their implications, which in this study are the environmental aspects and impacts surveyed in the ecosystem evaluated. The dialectical method penetrates the world of phenomena and considers that facts cannot be considered outside a social context (Pereira et al., 2018), which is fundamental for an interdisciplinary discussion and approach regarding the vulnerability of islands and coastal environments, such as intended for the present study.

3. Results

3.1. Survey of Environmental Aspects and Impacts (SEAI) on Anhatomirim Island

The SEAI carried out for Anhatomirim Island is represented in Table 2. Percentages between environmental impact factors (R) and amplitude (Am) for positive and negative impacts are shown in Table 3.

Table 2. Survey of Environmental Aspects and Impacts (SEAI) on Anhatomirim Island.

Environmental Aspect	Code	Environmental Impact	t	R	*Am*	Scores				
						t	R	*Am*	*Se*	Gaia
Non-use or inappropriate use of a mask during the Covid-19 pandemic	I1	Virus and disease spread	-	P	G	-1	1	3	2.50	-9.00
Generation and inadequate disposal of solid waste	I2	Water pollution	-	R	G	-1	2	3	2.17	-9.34
	I3	Soil pollution	-	R	G	-1	2	3	1.50	-8.00
	I4	Damage to the health of organisms and loss of biodiversity	-	P	G	-1	1	3	1.50	-7.00
	I5	Landscape degradation	-	R	G	-1	2	3	1.50	-8.00
	I6	Navigation interference	-	P	G	-1	1	3	1.00	-6.00
Feeding wild animals	I7	Damage to the health of organisms and loss of biodiversity	-	P	L	-1	1	1	1.67	-5.34
Transportation of passengers	I8	Employment and income	+	R	L	1	2	1	2.00	7.00
Fuel leakage	I9	Water pollution	-	P	Re	-1	1	2	1.50	-6.00
Fossil fuel burning	I10	Atmospheric pollution	-	R	Re	-1	2	2	1.50	-7.00
Pollution control and monitoring of the island and human activities	I11	Ecological balance	+	P	Re	1	1	2	3.00	9.00
	I12	Water quality preservation	+	P	G	1	1	3	2.83	9.66
	I13	Soil quality	+	P	L	1	1	1	1.00	4.00
	I14	Air quality	+	P	G	1	1	3	2.83	9.66
	I15	Employment and income	+	R	L	1	2	1	2.33	7.66
	I16	Preservation of biodiversity	+	R	G	1	2	3	1.67	8.34
	I17	Conservation of historical heritage	+	R	G	1	2	3	2.33	9.66
Energy use and electrical installations	I18	Fire and environmental degradation	-	P	L	-1	1	1	2.33	-6.66
	I19	Electric light	+	R	L	1	2	1	0.50	4.00
	I20	Cleaning	+	R	L	1	2	1	1.17	5.34
	I21	Electric shocks (accidents)	-	P	L	-1	1	1	2.00	-6.00
Generation of domestic effluents	I22	Spread of diseases	-	P	L	-1	1	1	1.67	-5.34
	I23	Soil pollution	-	P	L	-1	1	1	0.83	-3.66
	I24	Water pollution	-	P	L	-1	1	1	1.17	-4.34
Sound and noise generation	I25	Noise pollution	-	P	L	-1	1	1	1.50	-5.00

Legend:	Negative impacts (-); Positive impacts (+); Real (R) and Potential (P) impacts; Local (L), Regional (Re) and Global (G) impacts.

Source: from the authors.

Table 3. Percentage of impact factors (R) and amplitude (Am) for positive and negative impacts.

	R **(%)**		***Am (%)***		
	Potential	**Real**	**Location**	**Regional**	**Global**
Negative impacts 60.00%	73.33	26.67	46.67	13.33	40.00
Positive impacts 40.00%	40.00	60.00	50.00	10.00	40.00

Source: from the authors.

Potential negative environmental impacts (73.33%) were found to mostly have a local reach (63.64%), with regional and global amplitude representing 9.09% and 27.27% of impacts, respectively. As for the real negative impacts (26.67%), values were 25% and 75% for regional and global reach, respectively. Considering the scenario for potential positive impacts (40%), local and regional reach represented 25% each, while a global reach was considered for 50% of impacts. As for the real positive impacts (60%), 66.67% corresponded to the local scale and 33.33% to the global one.

Considering these impacts, Tables 4 and 5 show the specific score for each ecosystem service surveyed in the field and its respective code for the linked environmental impact, which can be seen in Table 1. Figures 3 and 4 show the percentage distribution of ecosystem services associated with negative and positive impacts.

Table 4. Score of ecosystem services affected by negative environmental impacts on Anhatomirim Island.

Ecosystem Service	I1	I2	I3	I4	I5	I6	I7	I9	I10	I18	I21	I22	I23	I24	I25	Total
Cultural and psychological	2	2	2	1	3	1	2	1	1	3	3	1	0	1	2	25
Recreation and leisure	3	3	3	1	3	1	1	1	1	3	2	1	0	1	2	26
Employment and income	3	2	1	1	1	1	1	1	2	2	2	1	1	1	1	21

Navigation	3	1	0	1	0	3	1	1	2	1	0	1	0	0	0	14
Ecological	1	3	2	3	1	0	3	3	1	3	2	3	2	2	3	32
Environmental health	3	2	1	2	1	0	2	2	2	2	3	3	2	2	1	28
Mean	2.50	2.17	1.50	1.50	1.50	1.00	1.67	1.50	1.50	2.33	2.00	1.67	0.83	1.17	1.50	

Source: from the authors.

Table 5. Score of ecosystem services affected by positive environmental impacts on Anhatomirim Island.

Ecosystem Service	I8	I11	I12	I13	I14	I15	I16	I17	I19	I20	Total
Cultural and psychological	3	3	3	1	3	2	3	2	1	1	22
Recreation and leisure	3	3	3	1	3	2	3	2	0	1	21
Employment and income	3	3	3	0	3	3	3	2	1	2	23
Navigation	3	3	2	0	2	2	1	2	0	0	15
Ecological	0	3	3	2	3	3	0	3	0	0	17
Environmental health	0	3	3	2	3	2	0	3	1	3	20
Mean	2.00	3.00	2.83	1.00	2.83	2.33	1.67	2.33	0.50	1.17	

Source: from the authors.

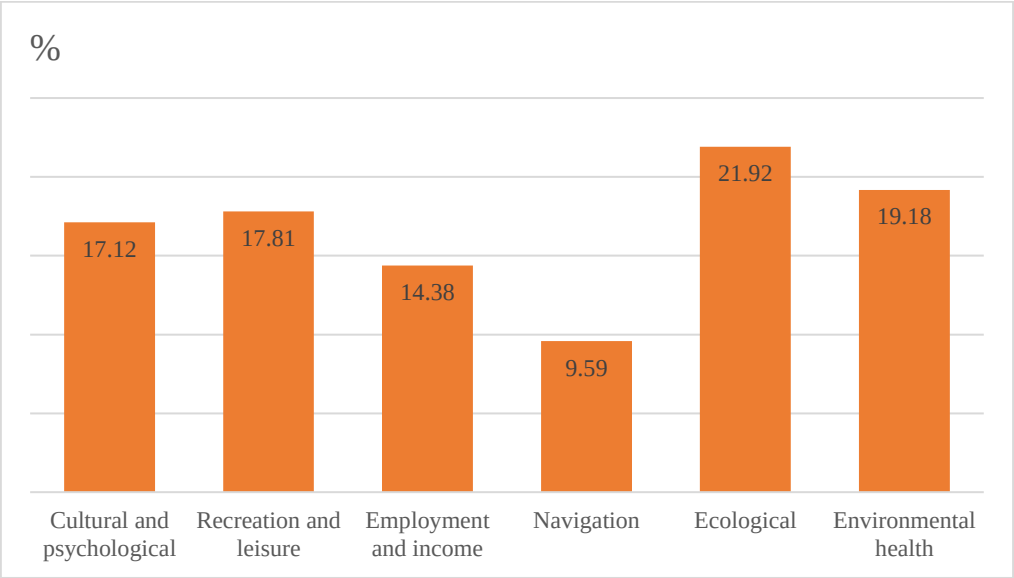

Figure 3. Distribution of ecosystem services affected by negative environmental impacts on Anhatomirim Island.

Source: from the authors.

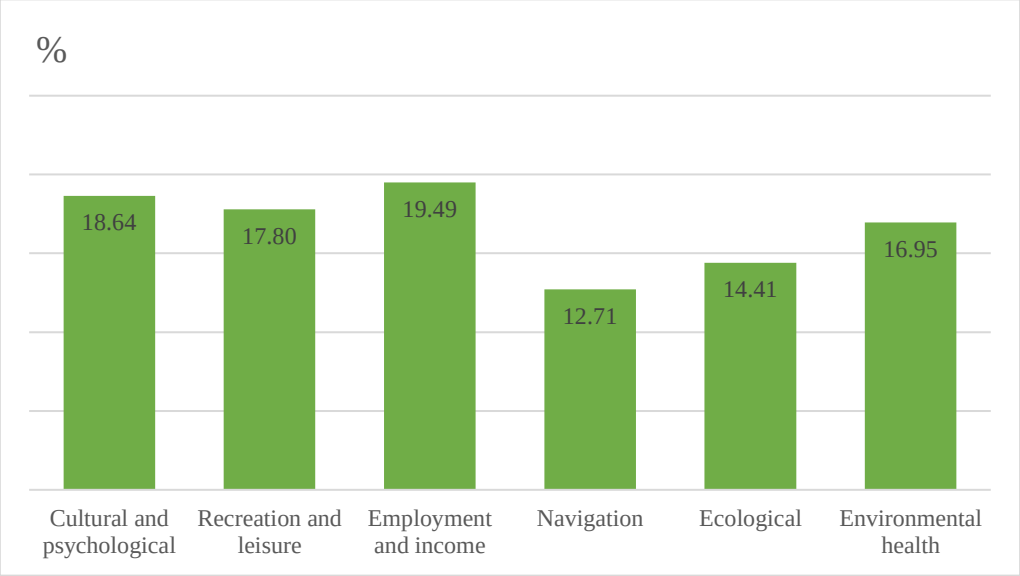

Figure 4. Distribution of ecosystem services affected by positive environmental impacts on Anhatomirim Island.

Source: from the authors.

Comparing the two graphs represented in Figures 3 and 4, the relationship between ecosystem services is shown to be affected by both negative and positive impacts, following a similar pattern. Though this can contribute to a dynamic balance of the system, it does not mean that positive and negative impacts can neutralize each other. In this relationship, the highest discrepancy (7.51%) between the two graphs refers to ecological ecosystem services, which are more affected by negative impacts than positive ones.

Considering all the variables analyzed, it was possible to build a graph (Figure 5) that indicates the degree (G_{aia}) of each aspect and accumulated environmental impact. The highest negative environmental impacts were water pollution; damages to the health of organisms and loss of biodiversity; and soil pollution, due to the fact that they are linked to different environmental aspects. In turn, the most significant positive environmental impacts were water and air quality and the conservation of historical heritage, all associated with the same environmental aspect: pollution control and monitoring of the island and human activities. Although it seems antagonistic that there is a high negative impact associated with water pollution and a high positive impact on water quality, it is important to remember that these results occur due to the different environmental aspects that generate these impacts. This difference can be seen in Table 2.

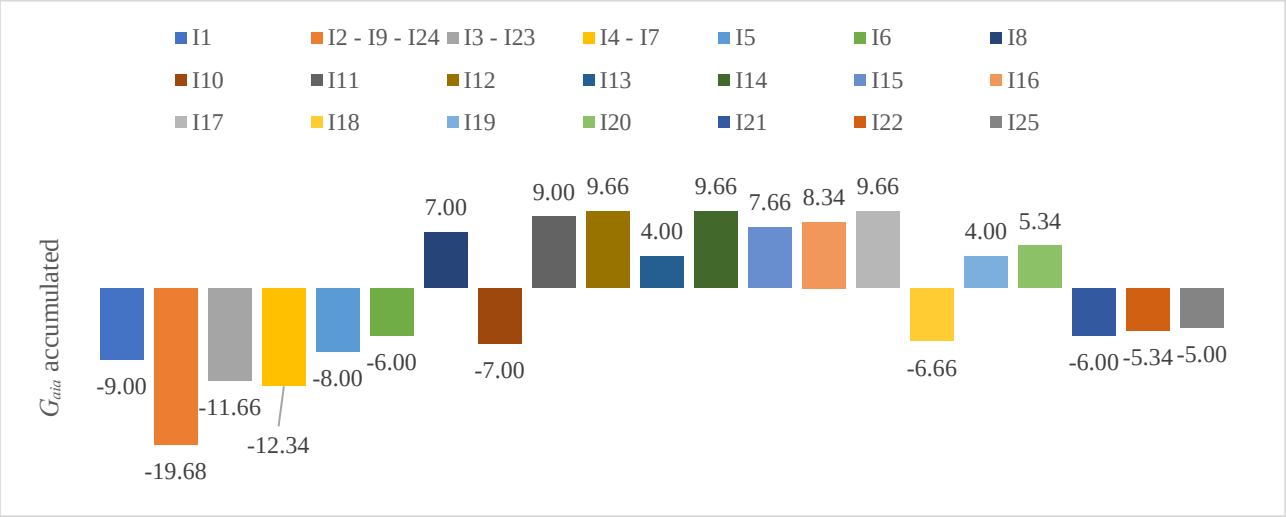

Figure 5. Degree of appearance and environmental impact accumulated on Anhatomirim Island.

Source: from the authors.

3.2 Survey of Environmental Aspects and Impacts (SEAI) on Campeche Island

Table 5 represents the SEAI applied to Campeche Island, while Table 6 shows the percentage division between environmental impact (R) and amplitude (Am) factors for positive and negative impacts.

Table 5. Survey of Environmental Aspects and Impacts (SEAI) on Campeche Island.

Environmental Aspect	**Code**	**Environmental Impact**	**t**	**R**	***Am***	**Scores**				
						t	**R**	***Am***	***Se***	**G_{aia}**
Non-use or inappropriate use of a mask during the Covid-19 pandemic	i1	Virus and disease spread	-	P	G	-1	1	3	2,50	-9,00
Generation and inadequate disposal of solid waste	i2	Water pollution	-	R	G	-1	2	3	2,17	-9,34
	i3	Soil pollution	-	R	G	-1	2	3	1,50	-8,00
	i4	Damage to the health of organisms and loss of biodiversity	-	P	G	-1	1	3	1,50	-7,00
	i5	Landscape degradation	-	R	G	-1	2	3	1,50	-8,00
	i6	Navigation interference	-	P	G	-1	1	3	1,00	-6,00
Feed wild animals	i7	Damage to the health of organisms and loss of biodiversity	-	P	L	-1	1	1	1,67	-5,34
Transport passengers	i8	Employment and income	+	R	L	1	2	1	2,00	7,00
Fuel leakage	i9	Water pollution	-	P	Re	-1	1	2	1,50	-6,00
Fossil fuel burning	i10	Atmospheric pollution	-	R	Re	-1	2	2	1,50	-7,00
	i11	Ecological balance	+	P	Re	1	1	2	3,00	9,00

Pollution control and monitoring of the island and human activities	i12	Water quality preservation	+	P	G	1	1	3	2,83	9,66
	i13	Soil quality	+	P	L	1	1	1	1,00	4,00
	i14	Air quality	+	P	G	1	1	3	2,83	9,66
	i15	Employment and income	+	R	L	1	2	1	2,33	7,66
	i16	Security of archaeological heritage	+	R	G	1	2	3	1,67	8,34
	i17	Preservation of biodiversity	+	R	G	1	2	3	2,33	9,66
Energy use and electrical installations	i18	Fire and environmental degradation	-	P	L	-1	1	1	2,33	-6,66
	i19	Food for employees and visitors	+	R	L	1	2	1	1,00	5,00
	i20	Lighting	+	R	L	1	2	1	0,50	4,00
	i21	Cleaning	+	R	L	1	2	1	1,17	5,34
	i22	Electric shocks (accidents)	-	P	L	-1	1	1	2,00	-6,00
Generation of domestic effluents	i23	Disease spread	-	P	L	-1	1	1	1,67	-5,34
	i24	Soil pollution	-	P	L	-1	1	1	0,83	-3,66
	i25	Water pollution	-	P	L	-1	1	1	1,17	-4,34
Sound and noise Generation	i26	Noise pollution	-	P	L	-1	1	1	1,50	-5,00
Legend:	Negative impacts (-); Positive impacts (+); Real (R) and Potential (P) impacts; Local (L), Regional (Re) and Global (G) impacts.									

Source: from the authors.

Table 6. Impact factor (R) and amplitude (Am) percentages for positive and negative impacts.

	R (%)		*Am (%)*		
	Potential	**Real**	**Local**	**Regional**	**Global**
Negative impacts 57.69 %	73.33	26.67	46.67	13.33	40.00
Positive impacts 42.31%	36.36	63.64	54.55	09.09	36.36

Source: from the authors.

The results presented in Table 5 demonstrate that, out of the potential negative environmental impacts (73.33%), 63.64% have a local reach, 09.09% regional, and 27.27% a global one. In turn, considering the environmental impacts' real negative impact (26.67%), the values are 25.00% for a regional scope and 75.00% globally. As for potential positive impacts (36.36%), these were distributed as 25.00% local, 25.00% regional and 50.00% global. Finally, for the actual positive impacts (63.63%) the

distribution was divided into 71.43% local and 28.57% global. The score of ecosystem services associated with these impacts is represented by Tables 7 and 8, while Figures 6 and 7 show the percentage of each category of ecosystem service affected by environmental aspects and impacts.

Table 7. Score of ecosystem services affected by negative environmental impacts on Campeche Island.

Ecosystem Service	i1	i2	i3	i4	i5	i6	i7	i9	i10	i18	i22	i23	i24	i25	i26	Total
Cultural and psychological	2	2	2	1	3	1	2	1	1	3	3	1	0	1	2	25
Recreation and leisure	3	3	3	1	3	1	1	1	1	3	2	1	0	1	2	26
Employment and income	3	2	1	1	1	1	1	1	2	2	2	1	1	1	1	21
Navigation	3	1	0	1	0	3	1	1	2	1	0	1	0	0	0	14
Ecological	1	3	2	3	1	0	3	3	1	3	2	3	2	2	3	32
Environmental health	3	2	1	2	1	0	2	2	2	2	3	3	2	2	1	28
Mean	2.50	2.17	1.50	1.50	1.50	1.00	1.67	1.50	1.50	2.33	2.00	1.67	0.83	1.17	1.50	

Source: from the authors.

Table 8. Score of ecosystem services affected by positive environmental impacts on Campeche Island.

Ecosystem Service	i8	i11	i12	i13	i14	i15	i16	i17	i19	i20	i21	Total
Cultural and psychological	3	3	3	1	3	2	3	2	2	1	1	24
Recreation and leisure	3	3	3	1	3	2	3	2	2	0	1	23
Employment and income	3	3	3	0	3	3	3	2	1	1	2	24
Navigation	3	3	2	0	2	2	1	2	0	0	0	15
Ecological	0	3	3	2	3	3	0	3	0	0	0	17
Environmental health	0	3	3	2	3	2	0	3	1	1	3	21
Mean	2.00	3.00	2.83	1.00	2.83	2.33	1.67	2.33	1.00	0.50	1.17	

Source: from the authors.

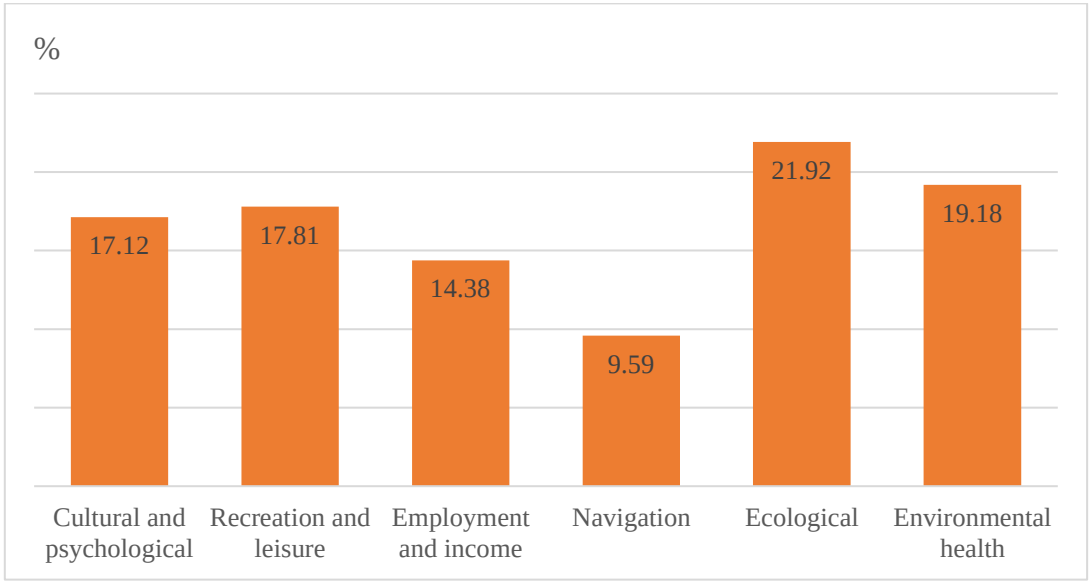

Figure 6. Distribution of ecosystem services affected by negative environmental impacts on Campeche Island.

Source: from the authors.

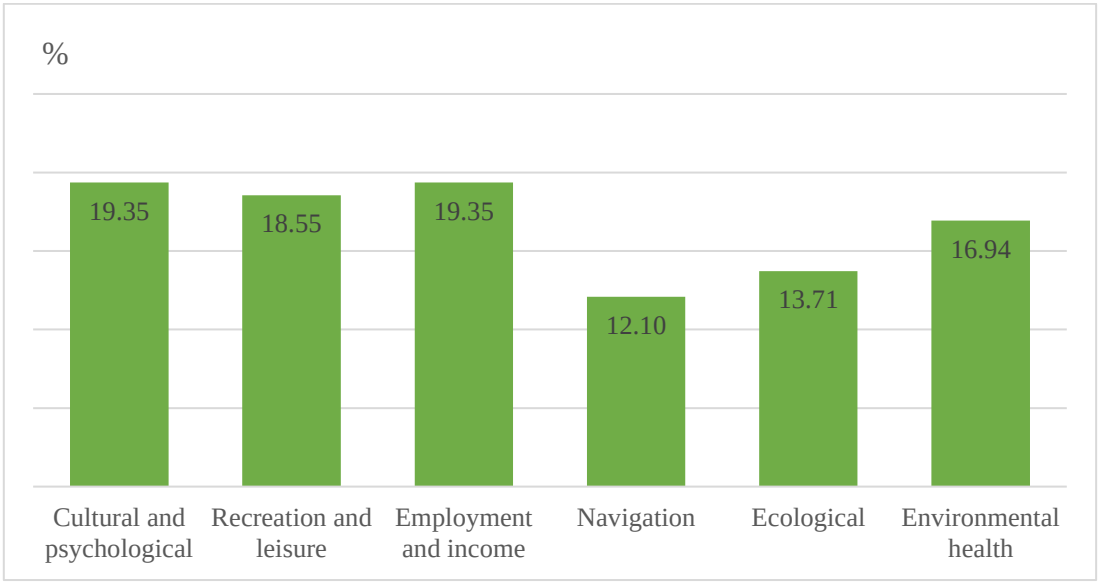

Figure 7. Distribution of ecosystem services affected by positive environmental impacts on Campeche Island.

Source: from the authors.

Considering the results shown in Figures 6 and 7, the greatest variation observed between ecosystem services affected by negative and positive impacts were among those in the ecological category (8.21%). This indicates the importance of prevention and

precaution measures applied to local ecological balance, as well as strengthening environmental aspects that can contribute to the improvement of this ecosystem service, such as the environmental aspect of pollution control actions and monitoring the island and human activities. Figure 8 shows the accumulated Degree of Environmental Aspect and Impact (G_{aia}) calculated from the results expressed in Table 5. The three environmental impacts that scored the highest, considering both positive and negative impacts, were similar to what was found for Anhatomirim Island.

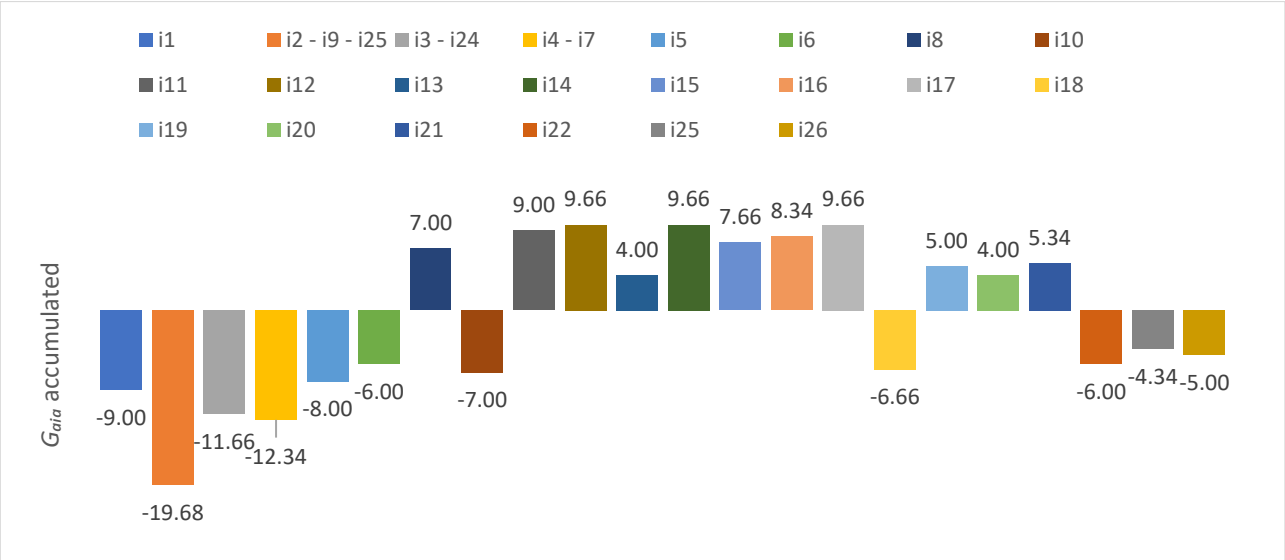

Figure 8. Degree of appearance and environmental impact accumulated on Campeche Island.

Source: from the authors.

4. Discussion

4.1. Negative environmental impacts and necessary measures for continuous improvement

The results show that, for the two islands, the most relevant G_{aia} at the time the research was developed refers to the risk of spreading Covid-19 due to sanitary problems and lack of basic care. This result highlights the importance of environmental education and collective health projects for local professionals and the community involved, since education is an effective measure for the transformation of limiting social values and beliefs (Imperador et al., 2020).

Other negative impacts with high G_{aia} were those associated with solid waste, which can have different effects on ecosystems and compromise local environmental dynamics. Among the materials that compose this solid waste, plastics stand out and can be transported by sea currents and cause damage to marine organisms even in locations different from their sources. In addition, they can also transport exotic species and pollutants adsorbed on their surface. All these aspects result in environmental, social, and economic impacts due to the loss of ecosystem services (Beaumont et al., 2019; Wilcox et al., 2019).

Considering the two islands studied, inadequate disposal of solid waste was an environmental aspect capable of causing five different types of environmental impacts on each of the island ecosystems: water and soil pollution, damage to the health of organisms and loss of biodiversity, landscape degradation, and interference with navigation. This evidence makes clear the importance of strengthening reverse logistics actions (Prajapati et al., 2019) and improvements in the implementation of solid waste policies and environmental education actions (Pereira & Fernandino, 2019). In addition, studies and investigations that encompass the treatment and integrated management of ecosystem services, based on data generated in this research, are essential for promoting sustainability and conservation of natural resources.

In this context, ecosystem-based environmental impact assessments, used by several authors (Asmus, Nicolodi, Scherer, Gianuca, Costa, Goersch, Hallal, Victor, Ferreira, Ribeiro, Da Rosa Pereira, et al., 2018; Baker et al., 2013; Kumar et al., 2013; Lima et al., 2018; Partidario & Gomes, 2013; Turra et al., 2017), which is an assessment that encompasses the characterization of local ecosystem services, brings good results. This is because ecosystem services from a given area can vary greatly, being framed in different categories such as support, regulation, provision and culture. In addition, there are different methodologies that have been developed by researchers and economists for the attribution of economic valuation on ecosystem services, which can contribute to the recovery of impacted areas and the preservation of natural resources (Mehvar et al., 2018).

Depending on the results obtained on the two islands evaluated, the ecosystem services that suffer the most, or with the greater potential to be the most negatively affected, are ecological services, environmental health, and recreation and leisure. These and other services can be affected by several environmental impacts, many of which were

identified in this study and that corroborate other authors (MacNeill & Wozniak, 2018; Monteiro et al., 2020). These authors emphasize that the effects of mass tourism in the high seas and coastal areas, as well as the problem of solid waste in these regions, draw attention to the loss of valuable ecosystem services, such as ecological, cultural, psychological, and other services, which emphasizes the importance of a planned and sustainable tourism.

On Campeche Island, several items of solid waste were found improperly disposed, generating marine litter (Figure 9), and becoming susceptible to ingestion and entanglement by aquatic and terrestrial organisms. This litter can either be generated locally or brought from more distant regions by ocean currents, which justifies the emergence of local and global environmental management initiatives (Louro & Widmer, 2017).

Figure 9: Marine litter found on Campeche Island, (a) fishing nets, pieces of rope and plastic; (b) tile and plastic pieces; (c) plastic bottle; (e) plastic packaging.

Source: From the authors.

These and other litter items, if ingested, can harm local fauna, especially for opportunistic species such as the *Nasua nasua* (Figure 10), which can feed on anthropogenic waste such as plastics and food waste (Rodrigues, 2017). Plastics can also affect marine species, through either direct or indirect ingestion (due to bioaccumulation processes), in addition to complications due to entanglement, suffocation, and loss of habitat. Here, it is clear that evaluating and managing the life cycle of these polymers is important, which, once in the environment, can fragment and generate microplastic, which is even more difficult to remove from beaches and the ocean (Guzzetti et al., 2018; Woods et al., 2019).

Figure 10: (a) *Nasua nasua* in an establishment on Campeche Island; (b) *Nasua nasua* on the beach of Campeche Island.

Source: From the authors.

This scenario emphasizes the importance of constant environmental education and management measures, in addition to monitoring and controlling the environmental aspects and impacts identified in the present study. While visiting both islands if we were to take on the perspective of a tourist, there was no approach to environmental education, in addition to the fact that many people ignore basic recommendations such as wearing a mask, especially during the trip to Anhatomirim Island.

In this sense, it is important to highlight the role of environmental education, which should not be just symbolic or doomed to a simple protocol, but rather arouse critical thinking, sensitization, awareness in a way that rejects the pedagogical conservatism that makes it subservient to the interest of capital and instrumental to the market, in addition to false information that induce people to neglect basic health care (Layrargues, 2020).

Some actions that can contribute to the reduction of environmental impacts through environmental education for tourists are: highlighting the environmental importance of the ecosystems visited, both for the conservation of biodiversity and for the maintenance of life as a whole; emphasizing that human beings are a fundamental and integral part of the environment; and that the responsibility to reach a balanced environment is shared among everyone. To this end, the ecosystem services observed in this research can serve as a starting point for this discussion. It is important to highlight that, for this, tourist guides must undergo a process of theoretical training on environmental education, which, according to the National Environmental Education Policy (Art. 1, I, Law n. 9,795 of 1999) is defined as "processes through which the individual and the community build social values, knowledge, skills, attitudes and competences aimed at the conservation of the environment, a common good for the people, essential for a healthy quality of life and its sustainability." (Brazil, 1999).

Other fundamental measures associated with environmental education are technical activities carried out by specialized professionals aimed at controlling environmental impacts and scientific research in the study area. In this context, an ecosystem-based environmental management system should be developed and maintained (Asmus et al., 2018; Lima et al., 2018) and guided by planning, execution, verification, and corrective and enhancing actions, thus aiming at continuous improvement of the environmental system (Sinhor et al., 2018).

Knowledge about the status of ecosystem services and the impacts that affect them are also important tools for the search for measures to restore these services. The process of restoring ecosystem services can occur through the adoption of several measures, such as the restoration of native vegetation, cleaning and adequate disposal of waste, protection and generation of conditions conducive to the recovery of native biodiversity, water purification, soil management, protection and dune restoration, integrative and participatory approaches with communities, among other interdisciplinary alternatives (Blythe et al., 2020; Orth et al., 2020; Yang et al., 2019; You et al., 2018). All this makes clear the importance of coordinated and harmonious work between different areas of knowledge, such as biology, tourism, environmental management, oceanography, environmental engineering, forestry engineering, chemistry, geology, and other fields, especially when the evaluation process is included of environmental impacts, which must

be a multidisciplinary work (Karjalainen et al., 2013; Raimundo et al., 2022; Sousa et al., 2020).

4.2 Positive environmental impacts and enhancing measures aimed at continuous improvement

Among the positive environmental impacts, the three that stood out the most on the islands were: water quality, air quality, and preservation of biodiversity. These impacts are the result of ecosystem services that occur in the two conservation units and the management activities of UFSC on Anhatomirim Island and IPHAN on Campeche Island. These and other positive impacts are directly and indirectly associated with the Sustainable Development Goals (SDGs) proposed by the United Nations (UN) since they include social, environmental, and economic aspects. The generation of employment and income, resulting from local tourism combined with the development of local communities, is a positive impact with strong social and economic repercussions that contribute to three SDGs: decent work and economic growth (SDG 8), reduction of poverty (SDG 1), and reduction of hunger (SDG 2) (Naidoo & Fisher, 2020; Sachs et al., 2019).

The most relevant ecosystem services on the islands studied were cultural and psychological services, recreation and leisure, as well as employment and income, which is also a positive environmental impact linked to the environmental management measures that encompass the two island environments. In contrast to the negative environmental impacts that affect these ecosystems, it is necessary to focus on measures that enhance environmental aspects that generate positive impacts, such as passenger transport and tourist services provided by the local community in a supervised, controlled, and assisted manner by managers, seeking the development of sustainable tourism.

The development of sustainable tourism allows carrying out tourist activities supported by a governance system that leads to the exploitation of natural resources, respecting the ability of ecosystems to ensure ecosystem services for present and future generations, promoting economic development, strengthening social inclusion, and bringing direct and indirect benefits for different stakeholders (Rasoolimanesh et al., 2020). Thus, it is necessary to think in a systemic way about the environments suffering from human impacts, whether derived from tourism or other activities, seeking to

understand the structures of the systems and the mechanisms of action and reaction that influence the process of tourism operation over time (Roxas et al., 2018).

Conservation measures combined with environmental education processes and training of local professionals to work in the environment in which they live, obtaining a source of income and expanding their knowledge about the potential of their surroundings, is an alternative that contributes to sustainable development and should be strengthened by managers involved in tourist activities. In addition, professional qualification and the hiring of qualified personnel to deal with sustainable tourism management is essential, to either reduce or eliminate the negative impacts of these activities and to identify opportunities and enhance possibilities for growth, ensuring environmental preservation and conservation and improving the quality of life of local communities (Hales & Jennings, 2017; Zimmermann, 2018).

The approach and questioning of ecosystem services in protected areas is also a process that can be incorporated into sustainable tourism, including conducting research aimed at assessing tourists' perception of the different ecosystem services provided by these protected areas and their relevance. This process can enhance the development of environmental ethics and tourists' feeling of integration and belonging with nature, in addition to contributing to local sustainability (Enriquez-Acevedo et al., 2018; Ghermandi et al., 2020; Lamim-Guedes, 2022); Urbis et al., 2019).

Research such as those by Mehvar et al. (2018) and by Ghermandi et al. (2020) show that ecosystem services linked to culture, such as leisure and scenic beauty, are the most valued by tourists in coastal areas. Thus, relating aesthetic and landscape enhancement to the conservation of natural resources and socio-environmental responsibility can be a good start for environmental management and education projects applied to sustainable tourism in insular and coastal ecosystems.

4.3 General considerations after the technical visit and proposals for continuous improvement

The methodology used proved to be satisfactory in understanding and organizing the main environmental aspects and impacts on the two islands, as well as providing an ecosystem-based approach. However, there is a need for studies aimed also at the practice of commercial and recreational fishing in both regions, since these practices can cause

numerous environmental impacts that are very relevant to marine and coastal ecosystems, such as loss of biodiversity, ecological changes, and socioeconomic effects (Lewin et al., 2019; Wolanski et al., 2020).

The lack of guiding legislation in Brazil for recreational fishing in protected areas is also a problem that requires solutions such as the creation of more detailed and specific laws, norms at a local scale with effective dissemination programs for communities and investment in research, and monitoring and control of affected areas (Oliveira et al., 2020). In this sense, considering the two studied islands and their surroundings, there were opportunities for research and development of sustainable alternatives for fisheries management in the localities, as well as the implementation of environmental education projects aimed at sensitizing and making fishers aware of the conservation of natural resources, encouraging actions such as the proper disposal of waste, such as nets and accessories common to fishing.

According to the National Environmental Education Policy, environmental education processes must be permanent and continuous, and can be conducted formally or informally (Brasil, 1999), and in the case observed in this research, oriented to everyone who has direct relations with the two islands, including tourists, fishermen, workers and other actors involved. This is a process that must be carried out by the government and also by the whole community, companies, class entities, public and private institutions, educational institutions and the agencies of the National Environment System (SISNAMA) (Brasil, 1999), since that, according to article 225 of the Constitution of the Federative Republic of Brazil of 1988, “Everyone has the right to an ecologically balanced environment, a good for common use by the people and essential to a healthy quality of life, imposing itself on the government and the community duty to defend and preserve it for present and future generations.” (Brazil, 1988).

Future research should also aim at continuous improvement in the environmental management process of protected areas, carrying out systematic studies on ecosystem services in these environments, and possibilities of environmental services that can be provided to contribute to the socioeconomic benefits that the two islands provide directly or indirectly. One option is payment for environmental services, which can be a useful and motivating tool for the use and preservation of natural resources (Coelho et al., 2021; Paiva et al., 2019). Payment for environmental services consists of the financial transfer of beneficiaries of environmental services to those who provide these services through

the preservation of natural resources or recovery of degraded areas, which may be voluntarily or guaranteed by the government (Jardim & Bursztyn, 2015). Therefore, detailed studies are suggested to investigate the possibility of this application in the context of the two islands.

In Brazil, Law No. 14,119 of January 13, 2021 defines concepts, objectives, guidelines, actions and criteria for implementing the National Policy for Payment for Environmental Services (NPPES), establishing the National Register of Payment for Environmental Services (NRPES) and the Federal Payment for Environmental Services Program (FPPES), which deals with payment contracts for environmental services and differentiates ecosystem services from environmental services. Thus, under this federal law, ecosystem services are the relevant benefits to society generated by ecosystems, in terms of maintenance, recovery or improvement of environmental conditions, and environmental services are individual or collective activities that favor the maintenance, recovery or the improvement of ecosystem services (Brazil, 2021). Thus, the state of Santa Catarina must pay attention to this law, developing state laws applied to the context of the state that are not contradictory or less restrictive than the federal law. Thus, with regard to conflicting legal elements, state law n. 15,133, of January 19, 2010 (Santa Catarina, 2010) may be suspended, because in Brazil, a state law cannot be less restrictive or in conflict with a federal law (Brasil, 1988). With this, it is expected that there will be effort and political interest in the federal, state and municipal alignment so that there is regulation and legal effectiveness for the appreciation of ecosystem services.

5. Conclusions

The methodology used in this study allowed a broad understanding of the main environmental aspects and impacts that affect the ecosystems evaluated due to tourist activities carried out on the islands, in addition to the most affected ecosystem services. Through the analyses carried out, it is also possible to identify a great demand for effective actions in environmental education, as well as research opportunities and possibilities for improvements in local management, including fishing.

The environmental aspect that generated the most negative environmental impacts was the "inappropriate generation and disposal of solid waste", in which all environmental impacts resulting from this aspect were negative, namely: water pollution, soil pollution,

damage to the health of organisms and loss of biodiversity, landscape degradation and interference with navigation.

The environmental aspect that presented the greatest positive environmental impacts was "pollution control and monitoring of the island and human activities", with only positive impacts, namely: ecological balance, water quality, soil quality, air quality, employment and income, safety of archaeological heritage, and biodiversity conservation.

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CAPÍTULO 5

Assessment of Environmental Impacts of tourism in coastal environments: a case study on an island beach in Southern Brazil

Abstract

Anthropic pressure in coastal and island environments has been causing a series of impacts and reducing many ecosystem services that are provided by these environments. Among the numerous human activities that affect these ecosystems, unsustainable coastal tourism is one of the practices that causes great damage. In this context, the objective of this research was to carry out an assessment of the environmental impacts of coastal tourism, based on ecosystems, on Praia dos Ingleses, in the state of Santa Catarina, located in the Southern region of Brazil, highly impacted by tourism activities. This research was developed through an exploratory and descriptive case study using, for the assessment of environmental impacts, interaction networks, with a qualitative approach. The results showed environmental pollution as the main primary impact, including different types of pollution: marine, atmospheric, soil, sound and visual, as well as other second-order impacts. Different types of ecosystem services were also detected, including regulatory, provision, culture and support services, the main benefits arising from these services, the main actors involved and the influence of environmental impacts detected in the field on these services. It is concluded that the study area still has potential for many other studies, such as the identification of the effects of climate change on local traditional communities, environmental impacts of property development and studies on urban and coastal planning; this research provides information that can help in other studies, besides coastal management.

Keywords: coastal management; environmental pollution; ecosystem services, environmental management, island ecosystems.

1. Introduction

Unsustainable human development has been causing great damage to ecosystems (Hammar et al., 2020), such as changes in biogeochemical cycles, loss of biodiversity, changes in the quality of environmental resources, loss of habitat and ecosystem services, fundamental to life maintenance in the terrestrial biosphere (Braga et al., 2021; Matias; Maesteghin; Imperador, 2020). Among the various impacts of anthropic pressure, unbridled tourism on vulnerable ecosystems, linked to the lack of infrastructure and public and private planning to receive tourists in a sustainable way, causes environmental damage that can be irreversible (Koçak et al., 2020; Kongbuamai et al., 2020; Santana & Senna, 2019).

Among the numerous environmental impacts on the ocean, pollution caused by various anthropic actions is one of the most relevant elements for marine environmental management, since there is a very wide range of pollutants that end up having the ocean as their final destination. Solid waste, pharmaceuticals, industrial waste, domestic sewage, sediments and nutrients are some of the various pollutants that cause severe damage to the ocean, in addition to social, economic and health problems (Alves et al., 2021; Clayton et al., 2021; Riechers et al., 2021; Willis et al., 2022). Tourism is one of the human activities that has been growing around the world and contributing to the increase in marine pollution and degradation of various ecosystems, which commonly becomes a concern of public management, demanding a series of actions aimed at identifying impacts and measures to promote socio-environmental responsibility, mitigation of environmental damage and elimination of polluting sources (Lloret et al., 2021; Panwanitdumrong & Chen, 2021; Santana & Senna, 2019; Yoon et al., 2021).

Coastal and island regions are areas that commonly receive many visitors around the world. They are also zones that provide important ecosystem services, such as regulation, provision, support and culture, both for local, regional and even global communities, considering the ubiquitous characteristic of the environmental good (Canteiro et al., 2018; Dagola et al., 2022; Jardeweski et al., 2021; Villanthenkodath et al., 2021). In this context, environmental management, monitoring and control measures are fundamental to guarantee the balance and sustainable use of these natural resources. Furthermore, the importance of public policies aimed at sea conservation are important tools to assist in this process (Matias & Imperador, 2021, 2022). Thus, there are alternatives that can contribute to decision-making and coastal and environmental management. Among these alternatives, environmental impact assessment (EIA) is an important tool capable of bringing relevant information about services, property development or actions that imply actual or potential damage to the environment, thus enabling the construction of risk plans, adoption of mitigating or compensatory measures, in addition to other options that can be listed by local management (Martins & Junior, 2018; Sánchez, 2020; Silva & Filho, 2019).

Therefore, considering the increasing pressure on coastal and island regions, which imply far-reaching damage to marine ecosystems (Kuleli & Bayazıt, 2022; Mehvar et al., 2018; Newton et al., 2018; Silva & Filho, 2019; VanderWilde & Newell, 2021),

such as plastic pollution and other types of waste that cause loss of biodiversity and valuable ecosystem services (MacLeod et al., 2021; R. C. P. Monteiro et al., 2018; Tessnow-von Wysocki & Le Billon, 2019; Thushari & Senevirathna, 2020; Yang et al., 2019), this research aimed to carry out an exploratory and descriptive study, using ecosystem-based environmental impact assessment methods, to identify the main negative environmental impacts derived from tourism at Praia dos Ingleses (Florianópolis/SC) and their implications at the local level, since this environment is a coastal island ecosystem whose anthropic pressure is accentuated (Sadowski & Rossetto, 2018).

2. Methodology

2.1 Characterization of the study area

Praia dos Ingleses is located in the neighborhood of Ingleses, on the island of Florianópolis, capital of the State of Santa Catarina, Brazil. The length of the beach is 4,830 meters, considered extensive for the region. It is an oceanic beach, oriented to the north and characterized by very fine and white sand, with crystal clear waters and long waves, considered strong for the standards of the island. The region is a major tourist center in the south of the country and has a large flow and anthropic pressure (Florianópolis, 2022; Turcato, 2019). It is a beach that is generally in good condition for bathing, although the increase in tourists in the high season is one of the factors that causes environmental problems and adverse effects on public health, due to the lack of a comprehensive and effective sanitation system (Turcato, 2019). In addition, the region has great homogeneity of rainfall, mainly due to synoptic conditions and relief (Pereira & Júnior, 2022) and has intense marine erosion processes that put many buildings and residences at risk (Furtado, 2018). The location of Praia dos Ingleses is shown in Figure 1, with the study area indicated by the red line on the edge of the beach.

Figure 1 – (a) Florianópolis Island / SC. (b) Praia dos Ingleses: study area.
Source: *Google Earth*, September 2021.

Historically, in the Ingleses dunes, most of the sand was removed and the land was subdivided by land grabbers, who used the real estate appreciation in the place to profit from the urban land, without significant interventions by the public power to inhibit the practice. During this period, many local residents were attracted by the demand for employment in the region, built their houses on the mobile and fixed dunes, and began to coexist in the environment in a precarious way once, unlike the local occupation by the Middle Class, they did not have infrastructure and fought for their permanence in the place and for better living conditions (Schons, 2019).

2.2 Data collection

Data collection occurred through technical visits to Praia dos Ingleses, in Florianópolis, in the state of Santa Catarina (Brazil), as well as analysis of the environment under anthropic pressure. The sampling period was divided into high and low season, with collections in both periods, only on weekends and on sunny days and with free movement of people and services. The visits occurred in December, January and February 2021 and April, May and June 2022, on interspersed weekends. The difference between the high and low season analyses is important as a function of the variation in the flow of visitors. Summer has a greater number of tourists than the other seasons, mainly due to the natural attractions of the beaches in Florianópolis (Florianópolis, 2022), which justifies the importance of studies in different periods, since

the environmental impacts can be different, more or less intense or have other specific seasonal characteristics (Matias et al., 2018).

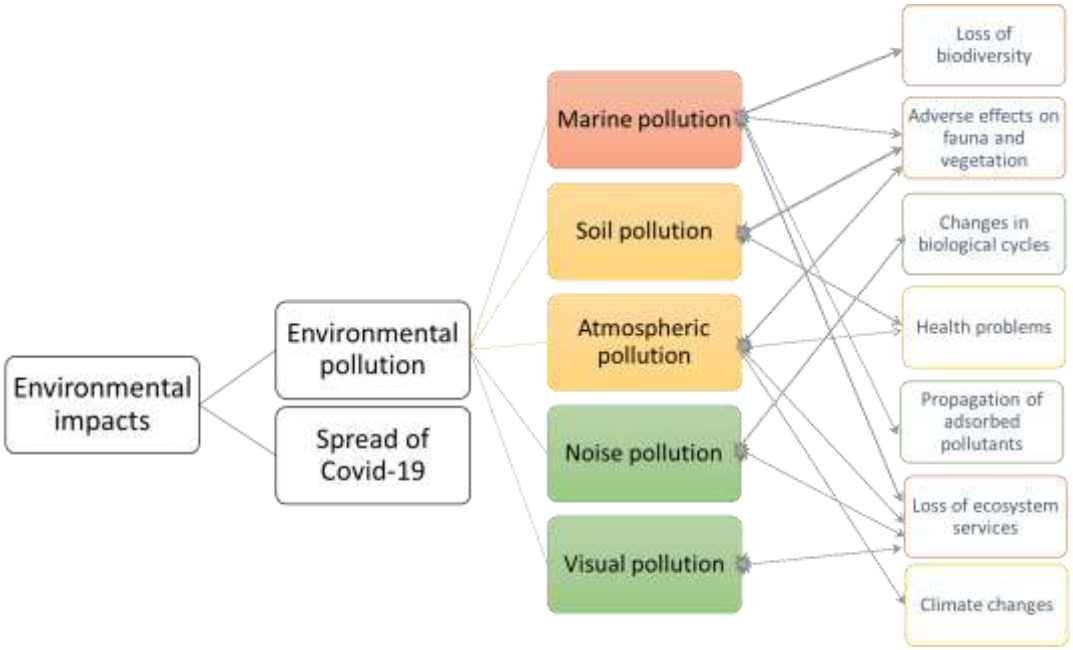
2.3 Analysis of results

This study has exploratory and descriptive objectives and a qualitative approach carried out in a field study (Cesário et al., 2020). As a procedure for the assessment of negative environmental impacts, the method of interaction networks was used, aiming at the identification of indirect, secondary or lower-order impacts, to understand the cause-condition-effect relationships (Braga et al., 2021; Sánchez, 2020). This methodology consists of a network comprising a system that allows the identification of the main negative environmental impacts and their consequences (Martins & Junior, 2018; Sánchez, 2020). In addition, an analysis was carried out on the main types of ecosystem services (Asmus et al., 2018; Heckwolf et al., 2021) that are or may be affected by the negative environmental impacts surveyed in the study area. Thus, provision, support, regulation and cultural ecosystem services were considered, including the subdivisions identified in the field, considering the concepts listed by Asmus et al. (2018), Braga et al. (2021) and Sanchez (2020). Both the environmental impacts and their effects on ecosystem services were ranked according to the intensity observed and marked as follows: red (severe: they demand greater attention from the manager and immediate actions), yellow (moderate: they demand quick and planned actions) and green (mild: can be resolved with less urgency or after more severe impacts have been resolved).

3. Results and Discussion

3.1 Environmental impacts detected and their implications

The results observed for the different seasons (high and low) did not differ in qualitative aspects, only quantitative since, in high seasons, the pressure on Praia dos Ingleses by tourists was greater, thus enhancing the negative impacts detected. The main environmental aspects detected in the field were: inadequate disposal of solid waste and the dumping of domestic effluents into the sea. Figure 2 shows the interaction network generated for the study area.



b

Spread of Covid-19	Marine pollution	Soil pollution	Atmospheric pollution	Noise pollution	Visual pollution
• Agglomerations; • Not wearing a mask; • Lack of hygiene.	• Inadequate disposal of solid waste; • Transshipment of domestic effluents;	• Inadequate disposal of solid waste; • Transshipment of domestic effluents;	• Increase in car-derived emissions; • Increase in emissions in general caused by the increase in visitors	• Undesirable sounds and noises emitted on site; • Musical overlay by speakers.	• Night lighting; • Inadequate disposal of solid waste.

Figure 2. (a) Interaction network for the main environmental impacts of tourism detected in the field. (b) Main environmental aspects for each type of environmental impact detected.
Source: the authors.

Environmental pollution was the main primary impact detected associated with local tourist activities, presenting different types of pollution linked to second-order or secondary impacts, which are those that derive or may derive from primary or direct impacts of a particular activity or enterprise (Braga et al., 2021; Sánchez, 2020). There were no other types of negative environmental impacts linked to tourist activities in the study area, such as degradation or other types of environmental damage, except the ones that have other causes, such as those linked to the lack of urban planning in coastal areas, for example, irregular constructions, lack of planned and sustainable infrastructure,

occupations in risk areas and socio-environmental problems (Rojas et al., 2019; Xu et al., 2021).

Thus, considering that pollution was the main environmental impact detected in this research, it is important to clarify that, in Brazil, the concept of pollution, according to law No. 6,938, of August 31, 1981, which establishes the National Environmental Policy (PNMA), is:

> the degradation of environmental quality resulting from activities that directly or indirectly: a) harm the health, safety and well-being of the population; b) create adverse conditions for social and economic activities; c) adversely affect the biota; d) affect the aesthetic or sanitary conditions of the environment; e) release materials or energy that do not comply with established environmental standards (Brasil, 1981).

In this context, it can be observed that pollution is a type of environmental impact that can include a wide range of second-order impacts, such as loss of biodiversity, ecosystem services, health problems and many others (Hasan et al., 2020; Koçak et al., 2020; Rojas et al., 2019; Thushari & Senevirathna, 2020; Xu et al., 2021). Considering tourist activities in coastal environments, it is essential to have pollution control and planning, seeking to develop practices aimed at sustainable tourism (Canteiro et al., 2018; Kongbuamai et al., 2020; Rasoolimanesh et al., 2020) and implementation of environmental education projects to raise awareness of tourists regarding their responsibility towards the visited environment (Ghazvini et al., 2020; Reis & Santos, 2020).

Another problem observed was the lack of care to prevent the spread of Covid-19, especially in the summer, when many agglomerations were formed, without safety measures such as isolation or the use of masks. With the restrictions and conditions of social isolation adopted by many governments around the world to contain the advance of the pandemic, studies (Akinsorotan et al., 2021; Cooper & Alderman, 2020; Loh et al., 2021; A. Monteiro et al., 2021) showed that, although temporarily, many environmental benefits were observed, such as the reduction in atmospheric, water and noise pollution, mainly resulting from the reduction in anthropic pressure on ecosystems. However, other factors such as the increase in the consumption of plastic, which is an element associated

with the pandemic that will need innovative solutions, have become an even greater threat to marine ecosystems (Costa, 2021; Patrício Silva et al., 2021; Shams et al., 2021).

A relevant aspect that can be observed, although not directly linked to local tourism, was the sea level which, when the tide is high, can reach the bars and cover the entire area of available sand, invading the main entrances to the beach and approaching the first roads just after the shore. Sea level rise is a global phenomenon linked to human influence that can cause many socio-environmental impacts and loss of various ecosystem services (Storlazzi et al., 2018; Zemp et al., 2019), especially for traditional communities that directly depend on marine and coastal resources, such as artisanal fishermen, and can also generate political and social conflicts (Jandrey & Aumond, 2020; Lam et al., 2020; Mendenhall et al., 2020). In addition, it can bring a series of economic losses that affect local activities such as tourism and commerce (Arabadzhyan et al., 2020; Bernstein et al., 2019).

In the study area, it was also possible to observe that high tide favors the entry of solid waste into the sea, as many residues that are found in dumps and further away are easily carried away by strong waves. Among these residues, the following stand out: small pieces of plastic, cigarette butts, various types of plastics, wooden sticks, paper napkins, straws, masks, cans and caps for soft drinks and beverages, fishing materials, in addition to various similar materials and others that could not be classified by visual observation alone.

In addition, it was also observed that most of the waste found on the beach is taken by tourists and restaurants. It is common to notice napkins and plastics, especially those used to wrap cutlery, being carried by the wind, leaving the tables and going to land directly on the sand or in the sea, in addition to other residues such as cans, caps, straws, organic residues such as foods and the like, which represents a great risk for many marine species that can ingest these residues, trigger ecotoxicological problems or become entangled in some of these materials, phenomena that are reported in several studies (Andrades et al., 2018; Barboza et al., 2019; Galgani et al., 2019; Wang et al., 2019).

Therefore, it is clear that the absence of these residues on the beach would be an important alternative for the mitigation of environmental impacts caused by this type of pollution. Thus, in addition to effective coastal management and environmental planning,

it is important that there is a permanent and continuous environmental education, supported by public policies, public-private partnerships, inspection, availability of resources for coastal management, professional training, pollution monitoring and control, as well as measures to promote local community engagement and organization for the development of tourism that does not cause damage to marine and coastal ecosystems, nor to the population that directly or indirectly enjoys the ecosystem services provided by these environments (Andrade & Scherer, 2014; De Lima et al., 2018).

In addition, some stretches of Praia dos Ingleses were detected, which are in a project to revitalize the Permanent Dune Preservation Area, with the recovery of sandbanks and protection of dunes, helping protect the ecosystem, the urban environment and acting to contain erosion, although they have been increasingly less privileged due to flexibilities in Brazilian environmental protection legislation (Nascimento et al., 2021). Even so, establishments parallel to the sandbanks continue to exist and are threatened by the rise in sea level. Figure 3 shows some visual aspects of the landscape, in which it is possible to notice the existence of establishments flooded by the high tide, residues and some sandbanks.

Figure 3. High tide recorded at praia dos Ingleses, Florianópolis (SC), Brazil.
Source: the authors.

This whole scenario, including tourism, environmental impacts and local socio-environmental characteristics, bring important reflections on the sustainable use of natural resources, on the preservation of ecosystem services provided by these environments and the threats to ecological balance. Thus, the next chapter discusses the main ecosystem services detected in the study area and the influence of the environmental impacts of local coastal tourism on these services.

3.2 Ecosystem services and their vulnerabilities to the impacts of local coastal tourism

Ecosystems are sources of resources necessary for life maintenance on Earth, and provide fundamental services for the balance of natural dynamics on the planet, as well as for the satisfaction of human needs. In this context, ecosystem services are linked to a concept that aims to connect natural capital and human well-being, and represent the benefits provided by the functions that ecosystems perform, both directly and indirectly, which are enjoyed by society (Heckwolf et al., 2021; Newton et al., 2018; VanderWilde & Newell, 2021).

However, many human activities can cause different types of changes in these services, causing environmental, social and economic damage and, in most cases, affecting more traditional communities and less privileged peoples (Lau et al., 2019). Thus, considering the aspects discussed so far, Table 1 shows the main ecosystem services detected in the study area, divided by categories, and also the perception of the effects of environmental impacts raised in the region on local ecosystem services.

Table 1. Ecosystem services detected and their susceptibility to environmental impacts.

Ecosystem Services (ES) detected in the field				
Classification	**Ecosystem Services (ES)**	**Benefits**	**Actors (Beneficiaries)**	**Influence of negative environmental impacts on ES**
Regulation	Absorption of carbon dioxide by the sandbanks;	Safety for human occupation in regulated areas, water and air quality, environmental and collective health.	Regional population, especially local residents and artisanal fishermen; tourists, educational institutions, Non-Governmental Organizations (NGOs), companies and workers.	Low influence
	Filtering of rainwater as a function of sandy deposits;			Low influence
	Erosion containment due to sandbanks;			Low influence
	Climate regulation;			Low influence

	Protection from marine weather due to sandbanks and dunes;			Low influence
	Sediment retention;			Low influence
	Natural pest and disease control;			High influence
Provision	Genetic resources associated with biodiversity;	Food (artisanal fishing), energy, crafts and multiple uses.	Local community and tourists.	Medium influence
	Biomass production;			Low influence
	Energy potential;			Low influence
Cultural	Landscape and natural biotic and abiotic resources;	Leisure and recreation; Sports practices; Religiosity; Formal and informal trade; General services provided to tourists; Landscape contemplation and spirituality; Beach trips and boats.	Local community, tourists and researchers.	High influence
Support	Nutrient cycling;	Basic conditions for the existence of other ES, survival and life quality in the biosphere.	Global population.	Low influence
	Primary production;			Low influence
	Refuge for fauna;			Medium influence
	Ecological balance;			High influence

Source: The authors.

Each ecosystem service can be more or less vulnerable to certain environmental impacts (Armoškaitė et al., 2020; Heckwolf et al., 2021; P. Pereira, 2020). Cultural services linked to landscape harmony can be easily compromised by visual pollution, which includes solid waste found in the sea. Furthermore, the notable risk of injury from sharp residues found in the sand and sea, in addition to point pollution from sewage sources or other types of effluents, are also aspects that can reduce the benefits of ecosystem services that are provided by coastal and marine animals, as well as altering the ecological balance of the ecosystem and providing more favorable conditions for the spread of diseases (Beaumont et al., 2019; Drius et al., 2019; Hall-Spencer & Harvey, 2019).

Considering pollution as the main environmental impact linked to tourist activities on Praia dos Ingleses, it is known that this undesirable change in environmental quality can alter the natural dynamics of coastal and marine ecosystems, causing losses of ecosystem services and environmental degradation (Strehse & Maser, 2020; Turner et al.,

2021). These adverse effects on the environment also have social and economic impacts, and may vary according to local characteristics, such as plant cover, presence of dunes, sociocultural characteristics, urban planning, coastal management and other local peculiarities (De Lima et al., 2018; Lau et al., 2019; Schons, 2019).

In Southern Brazil, there are many beaches with environmental and tourist dynamics similar to Praia dos Ingleses (Antunes, 2020; Nunes, 2021; Tagliani, 2018; Teixeira, 2019), highlighting the importance of this study as a general basic parameter for conducting similar studies and research in other locations, since the generation of information on environmental impacts and ecosystem services in coastal regions is an important mechanism for coastal management, which needs updated and continuous data and information about their management units (Asmus et al., 2018; Tagliani, 2018).

Therefore, it can be observed that Praia dos Ingleses has important areas of permanent preservation of dunes and sandbanks and, although it has a history of degradation (Schons, 2019) and is now heading towards a restoration process, this process collides with the local anthropic pressure, both from tourism and real estate, causing the loss or reduction in ecosystem services as a function of environmental impacts linked to tourism. These impacts, primarily linked to environmental pollution, can also have second or third order impacts, which are even more difficult to detect, prove or validate in the field, generating new threats to ecosystems and ecological balance, causing damage and direct or indirect effects on society and local communities, as shown by other studies in different locations (Baptista & Bernardes, 2021; Corbau et al., 2019; Vale et al., 2020).

4. Conclusions

With this research, it was possible to identify the main environmental impacts derived from tourist activities at Praia dos Ingleses, which include environmental pollution and its different classifications, marine, atmospheric, soil, visual and noise pollution, as well as second-order environmental impacts. generated from the primary impacts, and the spread of Covid-19. It was also possible to identify ecosystem services of regulation, provision, culture and support, their main benefits for the region, groups that are favored or benefit directly or indirectly from these services, besides the influence of negative environmental impacts detected in the field on these services.

Considering the seasonal variations in which the research was carried out, it was also possible to conclude that, during summer periods in the high season, the number of tourists on the beach is significantly higher, with a high density of visitors and an increase in the number of environmental impacts, such as the generation of solid waste and other organic and inorganic pollutants.

It was also observed that, during high tides, many residues are carried to the sea, increasing environmental impacts. In this context, for future research, a study on the effects of climate change in the locality and its interfaces with the traditional communities of artisanal fishermen is suggested, in addition to other studies focused on the evaluation of environmental impacts linked to local enterprises and the urban planning of Bairro dos Ingleses, as well as in other neighborhoods and beaches in Florianópolis, since this island is very visited and impacted by tourism.

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PARTE 3

CONSIDERAÇÕES FINAIS

Com a realização desta pesquisa, pode-se observar que o oceano e os ecossistemas insulares e costeiros apresentam muitas vulnerabilidades ambientais, e que o modelo de desenvolvimento antropocêntrico gerou e ainda gera impactos ambientais de alcance global, afetando diversos ecossistemas e trazendo prejuízos econômicos, sociais e ambientais, como aqueles que estão associados à poluição por plástico em ambientes marinhos.

Verificou-se que o contexto político, social, ambiental e econômico é muito relevante para a conservação ambiental e para a execução de medidas de Gestão Ambiental abordadas por diferentes políticas públicas. Neste sentido, destaca-se que apenas existência de Políticas Ambientais Marinhas e Costeiras (PAMC), não é suficiente para a garantia do uso sustentável dos recursos naturais, e que ações de Educação Ambiental são essenciais para a eficácia destas políticas.

Além da harmonia entre as PAMC e a Educação Ambiental, a Avaliação de Impactos Ambientais (AIA) é um importante processo ligado à Gestão Ambiental que pode contribuir para a tomada de decisão local, regional e global rumo à sustentabilidade. Neste trabalho, pode-se detectar, por meio de metodologias de AIA, a existência de muitos aspectos e impactos ambientais nocivos aos ecossistemas marinhos e costeiros derivados do turismo insustentável, e a sua relação com outros fatores como crescimento urbano desordenado e mudanças climáticas, o que frisa a urgência de uma mudança de paradigmas e construção de uma ética ambiental.

Frisa-se ainda que, existem muitos desafios associados ao desenvolvimento de metodologias de AIA no mundo, como as dificuldades em reduzir a subjetividade que envolve grande parte dos diferentes métodos de AIA, a construção de métodos globais que não excluam as peculiaridades locais e a valorização dos serviços ecossistêmicos. Além disso, a importância de avaliações e diagnósticos participativos, englobando comunidades tradicionais e populações menos privilegiadas, são elementos fundamentais a serem incorporados nos processos de tomada de decisão e Gestão Ambiental.

Desta forma, conclui-se que a problemática ambiental que envolve o oceano, demanda ações coordenadas entre sociedade, o Poder Público, a iniciativa privada e toda a coletividade para o desenvolvimento de sistemas sustentáveis, e que os desafios impostos pelo modelo de crescimento insustentável e predatório em que a humanidade se desenvolveu, precisam de soluções integradas como o desenvolvimento de PAMC, promoção de programas e projetos contínuos de Educação Ambiental, considerando os diferentes níveis de ensino, a interdisciplinaridade e as especificidades locais e culturais, conforme determina a Política Nacional de Educação Ambiental, voltados para a conservação dos recursos marinhos, a identificação e valorização dos seus serviços ecossistêmicos e metodologias sistêmicas de AIA, que sejam capazes de apresentar resultados que expressem a situação real dos ecossistemas e forneçam informações sólidas para a tomada de decisão por gestores ambientais.

APÊNDICES A - Principais atividades desenvolvidas no Doutorado em Ciências Ambientais

Tabela 1. Principais atividades desenvolvidas durante o doutorado.

Atividades realizadas entre 2020 e 2022	Quantidade	Observações
Artigos científicos publicados	17	*
Artigos científicos publicados referentes à tese	3	*
Artigos científicos submetidos referentes à tese	2	*
Resumos publicados em congressos	1	*
Resumos expandidos publicados em congressos	7	*
Trabalhos completos publicados em congressos	3	Sendo um deles referente à tese
Capítulo de livro publicado	2	*
Livro publicado	1	Organizador
Apresentação de trabalho	5	Em congressos e eventos
Participação de banca de TCC e comissão julgadora	3	Online
Coorientação de TCC	3	Duas em andamento
Participação em eventos	10	Online
Disciplinas cursadas em outras instituições	3	Uma na UNIFEI e três na UFSC
Cursos realizados	7	Curta duração
Cursos ministrados	1	No Instituto Esperança
Estágio Docente (Educação Ambiental)	3 semestres	Online
Revisor de periódicos	11	Revistas diferentes

Fonte: do autor.

ANEXO A - Autorização IPHAN

MINISTÉRIO DO TURISMO
INSTITUTO DO PATRIMÔNIO HISTÓRICO E ARTÍSTICO NACIONAL
Superintendência do IPHAN no Estado de Santa Catarina

Ofício Nº 418/2021/IPHAN-SC-IPHAN

Ao Senhor
Tális Pereira Matias
talis.matias@sou.unifal-mg.edu.br

Assunto: **Autorização de Pesquisa na Ilha do Campeche para tese de Doutorado.**
Referência: Caso responda este, indicar expressamente o Processo nº 01510.000373/2021-26.

Prezado Senhor,

Cumprimentando-o cordialmente, vimos **autorizar** a realização da pesquisa proposta na Ilha do Campeche, Florianópolis/SC.

Por oportuno informamos que para as visitas a campo devem ser contatado o Instituto Ilha do Campeche para agendamento prévio, que deve necessariamente ser acompanhado por monitores do referido Instituto.

Quanto as pesquisas na Ilha de Anhatomirim, deverá ser contatada a Universidade Federal de Santa Catarina, a quem compete tal autorização de acesso e pesquisa.

Após a finalização da pesquisa, devem ser enviados os resultados a esta Superintendência.

Atenciosamente,

(assinatura digital)
Liliane Janine Nizzola
Superintendente do IPHAN em Santa Catarina

Documento assinado eletronicamente por **Liliane Janine Nizzola, Superintendente do IPHAN-SC**, em 26/05/2021, às 12:03, conforme horário oficial de Brasília, com fundamento no art. 6º, § 1º, do Decreto nº 8.539, de 8 de outubro de 2015.

A autenticidade deste documento pode ser conferida no site http://sei.iphan.gov.br/autenticidade, informando o código verificador **2699641** e o código CRC **3F702249**.

Praça Getúlio Vargas, nº 268 , Florianópolis. CEP 88020-030
Telefone: (48) 3223-0883 | *Website*: www.iphan.gov.br

ANEXO B - Comprovante de realização do exame de qualificação.

Ministério da Educação
Universidade Federal de Alfenas
Docentes do PPGCA
Rua Gabriel Monteiro da Silva, 700 - Bairro centro, Alfenas/MG - CEP 37130-001
Telefone: (35) 3701-9000

PROGRAMA DE PÓS-GRADUAÇÃO EM CIÊNCIAS AMBIENTAIS

Conforme consta nas Normas Acadêmicas do Programa de Pós-graduação em Ciências Ambientais, o exame de qualificação foi realizado pela submissão do manuscrito para parecer e avaliação circunstanciados por banca examinadora.

O exame do discente Tális Pereira Matias foi realizado com base no manuscrito intitulado *" Políticas Martonhas, Educação Ambiental e Avaliação de Impactos Ambientais como Instrumentos Urgentes para a Gestão Ambiental e Sustentabilidade"* que foi submetido a banca examinadora designada para proceder o exame de qualificação de Doutorado no dia 10 de novembro de 2021.

De acordo com os requisitos legais e transcorridos 06 dias de envio do manuscrito a banca examinadora, na data de 16 de novembro de 2021, Profa. Dra. Luciana Botezelli(UNIFAL-MG) enviou seu parecer APROVADO e transcorrido 27 dias de envio do manuscrito, na data 07 de dezembro de 2021, Profa. Dra. Daniela Rocha Teixeira Riondet-Costa (UNIFEI) enviou seu parecer APROVADO. Baseado na avaliação dos membros, o presidente da Banca Examinadora, Prof. Dra. Adriana Maria Imperador deliberou considerar o candidato **APROVADO.**

Sugestões de correção da banca:

A banca considerou o candidato aprovado e as sugestões foram encaminhadas ao discente.

Documento assinado eletronicamente por **Adriana Maria Imperador, Professor do Magistério Superior**, em 08/02/2022, às 15:08, conforme horário oficial de Brasília, com fundamento no art. 6º, § 1º, do Decreto nº 8.539, de 8 de outubro de 2015.

Documento assinado eletronicamente por **Luciana Botezelli, Professor do Magistério Superior**, em 08/02/2022, às 16:26, conforme horário oficial de Brasília, com fundamento no art. 6º, § 1º, do Decreto nº 8.539, de 8 de outubro de 2015.

Documento assinado eletronicamente por **Daniela Rocha Teixeira Riondet-Costa, Usuário Externo**, em 15/02/2022, às 11:52, conforme horário oficial de Brasília, com fundamento no art. 6º, § 1º, do Decreto nº 8.539, de 8 de outubro de 2015.

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Referência: Processo nº 23087.014751/2021-81 SEI nº 0602293