V

Development and Innovation in Fisheries and Aquaculture in Brazil: A Legal Analysis

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Abstract

The Brazilian State seeks the promotion and development of fisheries and aquaculture in a sustainable manner to provide social inclusion, environmental conservation, and economic growth. To set up a feasible model of sustainable development, it is necessary to have an appreciation for and encouragement of research and innovation environments in educational and research institutions, as well as in the productive sector. Scientific knowledge of the oceans and coastal areas is a prerequisite for the proper management, protection, and sustainable use of their resources. The present work focuses on providing a comprehensive panoramic

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of the international and national legal framework concerning research, development and innovation activities in fisheries and aquaculture, as well as discusses on the importance of consolidating a research, development, and innovation structure to support the sustainable development of fisheries and aquaculture in relation to the decision-making process, enhancement of governance, and sound and effective policies in this area. Despite the progress made in promoting and implementing research, development, and innovation activities relating to fisheries and aquaculture, there are still significant challenges to be overcome.

Keywords: Governance, Policies, Scientific Research, Sustainable Development

1. Introduction

Sustainable food production has become one of the greatest challenges for nations in the 21st century. Food security, in terms of production, distribution, and the population's right of access to quality food, associated with the economic efficiency of production systems and their potential environmental impacts, urgently demands the development of integrated policies that ensure environmental conservation as a basis for production systems. The achievement of sufficient and sustainable food production for the current and future generations will need an information exchange among scientists from different disciplines and stakeholders from government and productive sectors and the broad public. Additionally, food security must be permanently included in the global research agenda.[1]

1. Jan Jansa and others, 'Future Food Production as Interplay of Natural Resources, Technology, and Human Society' (2010) 14 Journal of Industrial Ecology 6, 877.

According to the Food and Agriculture Organization (FAO) of the United Nations,[2] fisheries and aquaculture sectors have been increasingly recognised for their essential contribution to global food security and nutrition. In the past seven decades, the total fisheries and aquaculture production has significantly increased from 19 million tonnes in 1950 to 178 million tonnes in 2020. For fisheries and aquaculture, sustainable development must consider the exploitation of fisheries resources together with environmental conservation, maintenance of stocks, fisheries management, sustainable management of aquaculture, proper disposal of processing waste, use of best practice management, and appreciation of fishermen and aquaculture producers, and the need to develop research, innovation, and new technologies that support these factors.

The 2015 United Nations Sustainable Development Summit adopted the 2030 Agenda for Sustainable Development,[3] which includes a set of 17 Sustainable Development Goals (SDGs). The 2030 Agenda defines global sustainable development priorities and aspirations for 2030 and seeks to mobilise global efforts to benefit people, planet, prosperity, peace, and partnership. The SDGs include an aim to end poverty and hunger, further development of agriculture, support for economic development and employment, restoration and sustainable management of natural resources and biodiversity, a reduction in inequality and injustice, and action on climate change by 2030. It commits stakeholders to work together to promote sustained and inclusive economic growth, social development, and environmental protection.

2. Food and Agriculture Organization of the United Nations, 'The State of World Fisheries and Aquaculture (SOFIA) 2022' (2022), 5 <https://www.fao.org/publications/sofia/2022/en/> accessed 31 December 2022 (FAO).

3. The 2030 Agenda for Sustainable Development, adopted by all United Nations Member States in 2015, provides a shared blueprint for peace and prosperity for people and the planet, now and into the future. United Nations General Assembly Resolution 70/1. Transforming our world: the 2030 Agenda for Sustainable Development.

According to the FAO,[4] several SDGs are relevant for fisheries and aquaculture and for the sustainable development of the sector, but SDG 14[5] is of particular relevance. SDG 14 focuses expressly on oceans, underlining the importance of the conservation and sustainable use of oceans and seas and their resources for sustainable development, including their contributions to poverty eradication, sustained economic growth, food security, and the creation of livelihoods and decent work.

To confront this reality, the Brazilian State policies seek to organise, promote, and develop fisheries and aquaculture activities sustainably to provide income, job creation, social inclusion, environmental conservation, and economic growth, understanding that to establish this sustainable developmental model, strong support for and encouragement of research and innovation is needed in educational and research institutions as well as within the productive sector.[6]

The importance of oceans, seas, and coasts, including their resources and ecosystems as utilised by fisheries and aquaculture, is now widely recognised by the international community. This statement can be verified by noting the wide range of mandatory and voluntary instruments to regulate the use of oceans, seas, and their resources to comply with the precepts of sustainable development. Considering that scientific research and the transfer of technology are components present in all of these instruments, they should necessarily be observed when proposing public policies related to the promotion of research, development, and innovation in fisheries and aquaculture for sustainable development.

4. FAO, *The State of World Fisheries and Aquaculture 2016. Contributing to Food Security and Nutrition for All* (FAO 2016).

5. United Nations, 'SDG 14: Conserve and Sustainably Use the Oceans, Seas and Marine Resources for Sustainable Development' <https://sdgs.un.org/goals/goal14> accessed 31 December 2022.

6. Eric A B Routledge and others, 'Ações e Desafios para Consolidação das Políticas de PD&I em Pesca e Aquicultura' (Parcerias Estratégicas, 2011) vol 16, 167.

The present work focuses on providing a comprehensive panoramic of the international and national legal framework concerning research, development and innovation activities in fisheries and aquaculture, as well as discusses on the importance of consolidating a research, development, and innovation structure to support the sustainable development of fisheries and aquaculture in relation to the decision-making process, enhancement of governance, and sound and effective policies in this area.

2. International Legal Framework Related to Fisheries and Aquaculture in the Context of Scientific Research

Until the 1950s, marine scientific research was not regulated by any international treaty, so customary law provided the main source of law in this field. The increase in scientific research in the oceans and technological development after the Second World War, together with its gradual application to exploration and exploitation of resources and military purposes, led the international community to develop and codify the international legal framework in this regard.[7]

The term 'marine scientific research' can be referred to as a variety of scientific disciplines dedicated to the study of the oceans and their marine flora and fauna, including their physical, chemical, and geological characteristics, the objective of which is 'to observe, to explain, and eventually to understand sufficiently well how to predict and explain changes in the natural (marine) world.'[8] Marine scientific research thus contrib-

7. United Nations Division for Ocean Affairs and the Law of the Sea, *Marine Scientific Research: A Revised Guide to the Implementation of the Relevant Provisions of the United Nations Convention on the Law of the Sea* (UNP 2010) vol. 10 and 12.

8. Marko Pavliha and Norman Gutiérrez, 'Marine Scientific Research and the 1982 United Nations Convention on the Law of the Sea' (2010) 16 Ocean & Coastal Law Journal 4, 115-133.

utes to the rational exploitation of the sea's resources and the preservation of the marine environment. For example, the sustainable exploitation of fish stocks can be achieved after appropriate marine scientific research provides the necessary data to avoid overfishing.[9]

The scope of this work was to focus on the legal instruments framework currently in force and established by international organisations, as well as by current national legislation in Brazil. Although this review has sought to be as comprehensive as possible, it worth be noted that a new legally binding instrument for the conservation and sustainable use of marine biological diversity in areas beyond national jurisdiction (BBNJ) is being negotiated between UN member states. In this regard, BBNJ aims to preserve vulnerable marine ecosystems, use the ocean and marine species sustainably, legally regulate access to and benefit sharing of marine genetic resources in international waters, and strengthen ocean science and marine technology throughout the world.[10]

2.1 Convention on International Trade in Endangered Species of Wild Fauna and Flora (1973)

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)[11] is an international agreement aimed at ensuring that wild plant and animal species are not threatened by interna-

9. Florian Wegelein, *Marine Scientific Research: The Operation and Status of Research Vessels and Other Platforms in International Law* (vol 49, Brill – Nijhoff, 2005) 14-15.

10. Ina Wysocki and Alice Vadrot, 'The Voice of Science on Marine Biodiversity Negotiations: A Systematic Literature Review' (2020) 7 Front. Mar. Sci., 614282.

11. CITES was drafted as a result of a resolution adopted in 1963 at a meeting of the members of the World Conservation Union (IUCN). The text of the Convention was finally agreed upon at a meeting of representatives of 80 countries in Washington, D.C. on March 3, 1973. On July 1, 1975 CITES entered into force.

tional trade. It works through the regulation and control of international trade in selected species. Such determinations indicate that all import, export, re-export, and introduction from the sea of species covered by the Convention must be authorised through a licensing system. Each Party to the Convention must designate its Management Authority, responsible for administering this licensing system and its Scientific Authority, whose function is to provide advice on the effects of this trade on the status of the species.[12] The species covered by CITES are listed in three Appendices, according to the degree of protection they need.

A Secretariat is provided by the Executive Director of the United Nations Environment Programme. The functions of the Secretariat include undertaking scientific and technical studies in accordance with programs authorised by the Conference of the Parties (CoP) that will contribute to the implementation of the Convention, such as studies concerning standards for appropriate preparation and shipment of living specimens and the means of identifying specimens, and making recommendations for the implementation of the aims and provisions of the Convention, including the exchange of information of a scientific or technical nature.[13]

Many marine species that are traded internationally are highly migratory, often crossing national borders, so their conservation and sustainable exploration and exploitation can only be achieved if Member States work collaboratively. Thus, CITES provides a legal framework to regulate international trade in species, ensuring its sustainability and promoting cooperation between Parties. Therefore, the Parties to the Convention, upon prior consultation with their Scientific Authorities, submit proposals for voting on the inclusion of new species in the Appendices,

12. Convention on International Trade in Endangered Species of Wild Fauna and Flora, Article IX (CITES).

13. ibid., Article XII (CITES).

demonstrating that the CITES listing criteria are met in each case. Prior to the vote, Parties receive advice from the FAO, the International Union for Conservation of Nature, and the CITES Secretariat, among others.[14]

2.2 United Nations Convention on the Law of the Sea (1982)

Marine scientific research was first considered during the first United Nations Conference on the Law of the Sea in 1958,[15] although the term marine scientific research is not defined in the United Nations Convention on the Law of the Sea (UNCLOS),[16] despite the number of proposals that were made for a definition during the negotiations for the Convention, particularly during the Third United Nations Convention on the Law of the Sea.[17] Compared to the 1958 Geneva Conventions, the UNCLOS has increased the geographic scope of the regulation of marine scientific research by including the most important areas for its development by Member States.

The UNCLOS sets out the legal framework within which all activities in the oceans and seas must be carried out. It is the most comprehensive international legal system for the oceans and seas of the world,

14. Kim Friedman and others, 'Informing CITES Parties: Strengthening Science-Based Decision-Making When Listing Marine Species' (2019) 21 Fish & Fisheries 1, 13-31.

15. The four 1958 Conventions adopted in Geneva on April 29, 1958 are: the Geneva Conventions on the High Seas, on the Territorial Sea and Contiguous Zone, on the Continental Shelf, and on Fishing and Conservation of the Living Resources of the High Seas.

16. UNCLOS was opened for signature on December 10, 1982 in Montego Bay, Jamaica. This marked the culmination of more than 14 years of work involving participation by more than 150 countries representing all regions of the world, all legal and political systems, and the spectrum of socio/economic development. The Convention entered into force in accordance with its article 308 on November 16, 1994, 12 months after the date of deposit of the sixtieth instrument of ratification or accession.

17. The Conference, in which 160 states participated, held eleven sessions between 1973 and 1982.

establishing rules governing many of the uses of the oceans as well as the exploration and exploitation of their living and non-living resources. In addition, it provides the framework for international cooperation on delimitation of ocean space, environmental control, marine scientific research, economic and commercial activities, transfer of technology, and the settlement of disputes relating to ocean matters.

Currently, the most important legal source governing marine scientific research is Part XIII of the UNCLOS, and its provisions are closely related to Part XIV, which regulates the development and transfer of marine technology. The General Assembly of the United Nations has consistently highlighted the importance of marine science for eradicating poverty, contributing to food security, conserving the world's marine environment and resources, promoting the sustainable development of the oceans and seas, and helping to understand, predict, and respond to natural events.

The conduct of marine scientific research is a right for all States and competent international organisations, which are called on to promote and facilitate the development of research activities in accordance with the UNCLOS.[18] The general principles for the conduct of marine scientific research take into consideration that it is to be conducted exclusively for peaceful purposes and with appropriate scientific methods and means compatible with the Convention.[19] Moreover, in accordance with the principle of respect for sovereignty and jurisdiction, and on the basis of mutual benefit, States and competent international organisations are required to promote international cooperation in marine scientific research for peaceful purposes.[20]

18. United Nations Convention on the Law of the Sea (adopted 10 December 1982, entered into force 16 November 1994), 1833, 1834, 1835 UNTS 3 (UNCLOS), Articles 238 & 239.

19. ibid., Article 240.

20. ibid., Article 242.

In the exercise of their sovereignty, coastal States have the exclusive right to regulate, authorise, and conduct marine scientific research in their territorial seas and their exclusive economic zones (EEZs), as well as on their continental shelf, in accordance with the relevant provisions of this Convention.[21] Beyond their EEZs, under the principle of freedom of the high seas, the UNCLOS grants all nations the freedom to conduct scientific research. Furthermore, states are strongly encouraged to harmonise their national legislation with the provisions of the Convention and, where applicable, relevant agreements and instruments, to ensure the consistent application of those provisions.[22] Moreover, States are called on to cooperate, directly or through competent international organisations, in accordance with their capabilities to promote actively the development and transfer of marine science and marine technology on fair and reasonable terms and conditions.[23]

2.3 Convention on Biological Diversity (1992)

The Convention on Biological Diversity (CBD)[24] indicates that among its objectives 'are the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of the benefits arising out of the utilisation of genetic resources, including by appropriate access to genetic resources and by appropriate transfer of relevant

21. ibid., Articles 245 and 246.

22. United Nations General Assembly Resolution 63/111, ¶ 5 (UNGA).

23. UNCLOS, Article 266.

24. The CBD was opened for signature on June 5, 1992 at the United Nations Conference on Environment and Development (the Rio 'Earth Summit'). It remained open for signature until June 4, 1993, by which time it had received 168 signatures. The Convention entered into force on December 29, 1993, 90 days after the 30th ratification.

technologies, taking into account all rights over those resources and to technologies, and by appropriate funding.'[25]

States are required to establish and maintain programs for scientific and technical education and training in measures for the identification, conservation, and sustainable use of biological diversity and its components, and to provide support for such education and training for the specific needs of developing countries. They are also required to promote and encourage research that contributes to the conservation and sustainable use of biological diversity, inter alia, in accordance with decisions of the CoP taken in consequence of recommendations of the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA),[26] and to promote and cooperate in the use of scientific advances in biological diversity research in developing methods for conservation and sustainable use of biological resources.[27]

The increasing interrelations between science and policy for the purpose of the biodiversity governance have been gaining attention. There is a general view that the interface between science and policy must be strengthened, in particular at the international level, in support of more effective biodiversity governance. In this context, the official interface between science and policy of the CBD is the SBSTTA. Established as an open-ended intergovernmental multidisciplinary scientific advisory body for the CoP of the CBD, the SBSTTA was envisaged as an advisory mechanism with a strong scientific character.[28] One of SBSTTA's operating principles is to continuously 'improve the quality of its advice by

25. Convention on Biological Diversity (adopted 5 June 1992, entered into force 29 December 1993) 1760 UNTS 3, Article 1 (CBD).

26. ibid., Article 25.

27. ibid., Article 12.

28. Thomas Koetz and others, 'The role of the Subsidiary Body on Scientific, Technical and Technological Advice to the Convention on Biological Diversity as Science–Policy Interface' (2008) 11 J Environmental Science & Policy 6, 506-516.

improving scientific, technical and technological input into, debate at, and work of, meetings of the Subsidiary Body.'[29]

States recognising that both access to and transfer of technology are essential elements for achieving the objectives of the Convention undertaken to provide and/or facilitate access to and transfer of technologies that are relevant to the conservation and sustainable use of biological diversity or those that make use of genetic resources and do not cause significant damage to the environment.[30] Furthermore, States are required to promote international technical and scientific cooperation in the field of conservation and sustainable use of biological diversity and to promote the establishment of joint research programs and joint ventures for the development of technologies relevant to the objectives of the Convention.[31] It was envisaged that the fundamental contribution of the CBD to science would be the conservation of the resource base for life sciences, that is, biological diversity.

2.4 United Nations Fish Stocks Agreement (1995)

The Agreement for the Implementation of the Provisions of the UNCLOS Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks[32] sets out the principles

29. Conference of the Parties, Decision VIII/10, Annex III, paragraph 4 (CoP).

30. CBD, Article 16.

31. ibid., Article 18.

32. The Agreement was adopted on August 4, 1995, by the United Nations Conference on Straddling Fish Stocks and Highly Migratory Fish Stocks and was opened for signature on December 4, 1995. It remained open for signature until December 4, 1996, and was signed by 59 states and entities. The Agreement entered into force on December 11, 2001, 30 days after the date of deposit of the thirtieth instrument of ratification or accession, in accordance with Article 40 (1) of the Agreement.

for the conservation and management of those fish stocks based on a precautionary approach and the best available scientific information. It elaborates on the fundamental principle, established in the UNCLOS, which States should cooperate to ensure conservation and promote the objective of the optimum utilisation of fisheries resources both within and beyond EEZs.

Seeking the conservation and management of fish stocks, States are required, when giving effect to their duty to cooperate in accordance with the UNCLOS, to adopt measures to ensure long-term sustainability, promote the objective of their optimum utilisation, ensure that such measures are based on the best scientific evidence available, and promote and conduct scientific research and develop appropriate technologies in support of fishery conservation and management.[33]

States are also required to collect and exchange scientific, technical, and statistical data with respect to fish stocks; ensure that data are collected in sufficient detail to facilitate effective stock assessment; and take appropriate measures to verify the accuracy of such data. Consistent with Part XIII of the UNCLOS, States are required to cooperate to strengthen scientific research capacity in the field of fisheries and to promote scientific research related to the conservation and management of fish stocks for the benefit of all. Furthermore, States are called on to actively promote the publication and dissemination to any interested States of the results of the research and information relating to its objectives and methods and, to the extent practicable, to facilitate the participation of scientists from those interested States in such research.[34]

33. Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks (adopted 4 August 1995, entered into force 11 December 2001) 2167 UNTS 3, art 5 (Fish Stocks Agreement).

34. ibid., Article14.

2.5 Code of Conduct for Responsible Fisheries (1995)

The FAO Code of Conduct for Responsible Fisheries[35] is voluntary, but certain parts of it are based on relevant rules of international law, including the UNCLOS, and contain provisions that may be or have already been given binding effect by means of other obligatory legal instruments among the Parties, such as the Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas.[36]

Global in scope, the Code is directed toward FAO Members and non-Members; fishing entities; subregional, regional, and global organisations, whether governmental or non-governmental; and all persons concerned with the conservation of fisheries resources and management and development of fisheries, such as fishermen, those engaged in processing and marketing of fish and fisheries products, and other users of the aquatic environment in relation to fisheries. The Code provides principles and standards applicable to the conservation, management, and development of all fisheries. It also covers fishing operations, aquaculture, fisheries research, the integration of fisheries into coastal area management, and the capture, processing, and trade of fish and fisheries products.

35. The Code was initiated in 1991 by the FAO Committee on Fisheries and was unanimously adopted on October 31, 1995, by the over 170 member governments of the FAO Conference.

36. This Code sets out principles and international standards of behavior for responsible practices with a view to ensuring the effective conservation, management, and development of living aquatic resources, with due respect for the ecosystem and biodiversity. The Code recognises the nutritional, economic, social, environmental, and cultural importance of fisheries, and the interests of all those concerned with the fishery sector. The Code considers the biological characteristics of the resources and their environment and the interests of consumers and other users. States and all those involved in fisheries are encouraged to apply the Code and give effect to it.

Among its objectives are to facilitate and promote technical, financial, and other forms of cooperation in the conservation of fisheries resources and fisheries management and development and to promote research on fisheries and associated ecosystems and relevant environmental factors.[37] In that regard, States are required to recognise that responsible fisheries require the availability of a sound scientific basis to assist fisheries managers and other interested parties in making decisions. Therefore, States are responsible for ensuring that appropriate research is conducted into all aspects of fisheries, including biology, ecology, technology, environmental science, economics, social science, aquaculture, and nutritional science. States also have a responsibility to ensure the availability of research facilities and to provide appropriate training, staffing, and institution building to conduct the research, taking into account the special needs of developing countries.[38]

3. National Legal Framework Related to Fisheries and Aquaculture in the Context of Scientific Research

Adequate governance of fisheries and aquaculture is necessary to guarantee the sustainability of these activities and overall ocean health. The sustainable growth of fish production is a challenge, the importance of which is evident in the face of the continuous increase in demand, both domestically and worldwide. In this regard, fisheries and aquaculture legislation assumes a fundamental role in the definition of policies to encourage these activities, social outreach policies in support of fishermen

37. Code of Conduct for Responsible Fisheries (adopted 31 October 1995), Article 2.
38. ibid., Article 12.

and aquaculture farmers, and ordering, inspection, and control measures.

To ensure the contribution of fisheries and aquaculture activities to sustainable development, poverty eradication, and food security, adequate management is necessary, as well as the effective conservation of the living aquatic resources used. Social, economic, institutional, and political circumstances are responsible for conditioning the effectiveness and performance of measures for the conservation and management of fisheries resources. The sectoral governance of fisheries and aquaculture encompasses complex social, institutional, and political processes whose dimensions at international, national, and local levels require legal, social, environmental, economic, and political considerations. In addition, it necessarily involves interactions between governments and civil society, including fishermen, aquaculture farmers, industry, and the private sector in general, as well as other groups that may be related to the issues in some way.[39]

3.1 Law No. 6938 of 31 August 1981

The Law No. 6938 of the National Environmental Policy (*Política Nacional do Meio Ambiente* - PNMA)[40] aims to preserve, improve, and restore the environmental quality of Brazil in order to ensure conditions for socioeconomic development, the interests of national security, and

39. FAO, 'Management and Conservation of Aquatic Resources: Background to Division's' Activities <www.fao.org/fishery/topic/16032/en> accessed 31 December 2022.

40. *Lei* nº 6.938, *de* 31 *de agosto de* 1981. *Dispõe sobre a Política Nacional do Meio Ambiente, seus fins e mecanismos de formulação e aplicação, e dá outras providências.* <www.planalto.gov.br/ccivil_03/leis/L6938.htm> accessed 31 December 2022.

the protection of the dignity of human life, one of its principles being the encouragement of the study and research of technologies oriented toward the rational use and protection of environmental resources.[41]

The PNMA's goals include the development of research activities and technologies aimed at the rational use of environmental resources and the diffusion of environmental management technologies.[42] Under this policy, the governmental organisations, entities, and programs intended to promote scientific and technological research consider, among their priority goals, the support of projects that aim to acquire and develop applicable basic knowledge in environmental and ecological areas.[43] Thus, the search for sustainable development should be the orientation of all environmental science and scientific research practice.

The PNMA was inspired by the Stockholm Conference[44] and represents a milestone in the advancement of environmental protection. The insertion of an environmental theme into the Brazilian political agenda reveals a posture by the government in relation to environmental issues in which the reconciliation between economic growth and environmental preservation is possible and necessary, which is the central objective of the policy.[45]

41. ibid., Article 2.

42. ibid., Article 4.

43. ibid., Article 13.

44. The 1972 United Nations Conference on the Environment in Stockholm was the first world conference to make the environment a major issue. The participants adopted a series of principles for sound management of the environment including the Stockholm Declaration and Action Plan for the Human Environment as well as several resolutions. One of the major outcomes of the Stockholm conference was the creation of the United Nations Environment Program.

45. Pollyana M Santos and Maria das D S de Loreto, 'Política Nacional do Meio Ambiente Brasileira: Uma Análise à Luz do Ciclo de Políticas Públicas' (2020) 13 Perspectivas em Políticas Públicas 25, 297-335.

3.2 Decree No. 96000 of 2 August 1988

Decree No. 96.000[46] provides for the conduct of scientific research on the Continental Shelf and in waters under Brazilian jurisdiction, as well as on foreign research vessels and aircraft visiting Brazilian ports or airports during transit across Brazilian jurisdictional waters or in overlying airspace.

The activities covered by this decree, restricted to the Continental Shelf and to the waters under Brazilian jurisdiction, may not contradict the provisions of the National Maritime Policy, the National Policy for Marine Resources, or the PNMA, but the decree does not apply to research included in the monopoly of the Brazilian Government nor to those activities regulated by specific legislation.[47] The Brazilian Navy is the competent body to authorise and monitor the development of research activities and scientific investigation carried out on the Continental Shelf and in waters under Brazilian jurisdiction, and the contribution to national scientific and technological development is a fundamental condition for granting such authorisation.[48]

Scientific research, for the purposes of this decree, comprises any works carried out with a purely scientific purpose using ships, aircraft, and other means, through recording, filming, probing, and other operations.[49] Scientific research on the Continental Shelf and waters under Brazilian jurisdiction may only be carried out for exclusively peaceful

46. *Decreto* nº 96.000, *de* 2 *agosto de* 1988. *Dispõe sobre a realização de pesquisa e investigação científica na plataforma continental e em águas sob jurisdição brasileira, e sobre navios e aeronaves de pesquisa estrangeiros em visita aos portos ou aeroportos nacionais, em transito nas águas jurisdicionais brasileiras ou no espaço aéreo sobrejacente.* <www.planalto.gov.br/ccivil_03/decreto/1980-1989/D96000.htm> accessed 31 December 2022.

47. ibid., Article 1.

48. ibid., Article 2.

49. ibid., Article 3.

purposes and in accordance with the provisions of Brazilian law or the international acts to which Brazil is bound.[50]

3.3 Law No. 8617 of 4 January 1993

The Law No. 8617 (Law of the Sea)[51] adopted concepts and parameters agreed in the UNCLOS relating to the territorial sea, contiguous zone, EEZ, and continental shelf. In the exercise of its jurisdiction within the EEZ and the continental shelf, Brazil has the exclusive right to regulate marine scientific research, the protection and preservation of the marine environment, and the construction, operation, and use of all types of artificial islands and structures. Marine scientific research in the EEZ and continental shelf may only be conducted by other States with the prior consent of the Brazilian government, in accordance with the legislation in force that regulates the matter.[52]

3.4 Decree No. 1265 of 11 October 1994

The Decree No. 1265 of the National Maritime Policy (*Política Marítima Nacional* - PMN)[53] aims to guide the development of maritime activities in Brazil in an integrated and harmonious manner, aiming at the effec-

50. ibid., Article 5.

51. *Lei* nº 8.617, *de 4 de janeiro de* 1993. *Dispõe sobre o mar territorial, a zona contígua, a zona econômica exclusiva e a plataforma continental brasileiros, e dá outras providências.* <www.planalto.gov.br/ccivil_03/leis/L8617.htm> accessed 31 December 2022.

52. ibid., Articles 8 and 13.

53. *Decreto* nº 1.265, *de 11 de outubro de* 1994. *Aprova a Política Marítima Nacional* (PMN). <www.planalto.gov.br/ccivil_03/decreto/1990-1994/D1265.htm> accessed 31 December 2022 (PMN).

tive, rational, and full use of the seas and inland waterways in accordance with national interests. Its objectives include the research and development of national technology in the field of maritime activities and the research, exploration, and rational exploitation of living and non-living resources in the water column, bed, and subsoil of the seas, rivers, and navigable lakes where significant commercial activities for the maritime power[54] are carried out.

Among the actions related to research and development are the following: encouraging national companies related to maritime activities to incorporate the results of national scientific and technological research efforts; encouraging research that contributes to obtaining or developing national technology in the field of maritime activities; supporting universities, research centres, associations, congresses, and entities responsible for technical publications that contribute to the development of national technology in the field of maritime activities; encouraging the establishment or development of research institutions in the field of maritime activities; and aiming to maintain, in an integrated way, databases on the capture, production, and marketing of fish and fish products.

54. Maritime Power is understood as the component of National Power that the nation has to achieve its purposes linked to or dependent on the sea, which are of a political, economic, military and social nature and include, among many others, the maritime consciousness of the people and the political class, the Merchant Navy and the War Navy, the shipbuilding industry, ports and the structure of the maritime trade. The Naval Power is the military component of the Maritime Power.industry, ports and the structure of the maritime trade. The Naval Power is the military component of the Maritime Power.

3.5 Decree 5377 of 23 February 2005

The Decree No. 5377 of the National Policy for Marine Resources (*Política Nacional para os Recursos do Mar* - PNRM)[55] is intended to guide the development of activities aimed at the effective use, exploration, and exploitation of the living and non-living resources of the territorial sea, the EEZ, and the continental shelf in accordance with national interests in rational and sustainable development for the socioeconomic development of the Brazilian State, generating employment and income and contributing to social integration. The PNRM aims to establish principles and objectives for the elaboration of governmental plans, programs, and actions in the field of human resources training; for the development of marine research, science, and technology; and for the exploration and sustainable exploitation of marine resources.

Its strategy is formed by a set of actions to be undertaken to achieve the objectives of the PNRM. The actions are carried out under the guidance and coordination of the bodies comprising the Interministerial Commission for Marine Resources in accordance with their legally established specific competences and in line with the guidelines of this collegiate. Actions related to marine scientific research are highlighted below.

a) Human resources training actions:
   - strengthening teaching and research institutions in the field of marine science.
   - expanding internal and external technical and scientific exchange, aiming at the exchange and dissemination of data and information related to the training of human resources in marine science and technology, research, exploration, and sustainable use of marine resources.

55. *Decreto* nº 5.377, *de* 23 *de fevereiro de* 2005. *Aprova a Política Nacional para os Recursos do Mar - PNRM*. <www.planalto.gov.br/ccivil_03/_Ato2004-2006/2005/Decreto/D5377.htm> accessed 31 December 2022.

b) Marine research, science, and technology actions:
- encouraging the creation of teaching and research institutions dedicated to the study of the sea.
- promoting studies and research for knowledge, inventory, potential assessment, sustainable use, management, and ordering of the use of living and non-living resources existing in maritime areas under jurisdiction and of national interest.
- establishing, implementing, and maintaining a system for the collection, processing, and dissemination of data relating to the living resources of the sea.
- promoting the development and dissemination of technology with a view to increasing fish production and reducing waste, and promoting studies and research for knowledge, inventory, and assessment of the biotechnological potential of marine organisms existing in maritime areas under jurisdiction and of national interest.
- stimulating the exchange of scientific and technological data and information between teaching and research institutions at national and international levels regarding sea resources, exploration, and sustainable use.
- establishing the conditions for international cooperation in research, exploration, and exploitation of sea resources in maritime areas under national jurisdiction and ensuring effective Brazilian participation in all phases of these activities.
- encouraging the development of technologies and national production of materials and equipment necessary for research and exploration activities and sustainable use of sea resources.
- inducing technological projects in marine resources, aiming at the effective insertion of institutions and companies into the national efforts at research, development, and innovation in marine technology.
- fostering technological training in institutions linked to marine science necessary for the development of studies and research related to sea resources, their exploitation, and sustainable use.

c) Exploration and sustainable use of marine resources actions:
   • incorporating the principles of sustainability from a social, economic, environmental, and cultural point of view in all programs, projects, and initiatives for research, evaluation, exploration, and use of marine resources.
   • promoting the construction of vessels, platforms, attracting buoys, artificial reefs, and other floating and submerged means for teaching, research, exploration, and sustainable use of sea resources.

3.6 Law No. 11959 of 29 June 2009

The Law No. 11959 of the National Policy for the Sustainable Development of Aquaculture and Fisheries (*Política Nacional de Desenvolvimento Sustentável da Aquicultura e da Pesca* - PNAP)[56] was formulated and implemented to promote the sustainable development of fisheries and aquaculture in harmony with the preservation and conservation of the environment and biodiversity; the planning, promotion, and monitoring of fishing activities; the preservation, conservation, and recovery of fisheries resources and aquatic ecosystems; and socioeconomic, cultural, and professional development for people engaged in fisheries and aquaculture activities and their communities.[57]

Fishing activities comprise all the processes of fishing, including research into fishing resources.[58] The sustainable development of fishing

56. *Lei* nº 11.959, *de* 29 *de junho de* 2009. *Dispõe sobre a Política Nacional de Desenvolvimento Sustentável da Aquicultura e da Pesca, regula as atividades pesqueiras, revoga a Lei* nº 7.679, *de* 23 *de novembro de* 1988, *e dispositivos do Decreto-Lei* nº 221, *de* 28 *de fevereiro de* 1967, *e dá outras providências.* <www.planalto.gov.br/ccivil_03/_ato2007-2010/2009/lei/l11959.htm> accessed 31 December 2022.

57. ibid., Article 1.

58. ibid., Article 4.

activities will take place through the research of resources, techniques, and methods relevant to such activities, among other things.[59] Aquaculture activities are classified as scientific or demonstrative when practiced solely for the purpose of research, studies, or demonstrations by an entity legally qualified for these purposes.[60] Fisheries research will be conducted to obtain and provide, on a permanent basis, information and scientific data that allow the sustainable development of fishing activities.[61]

3.7 Law No. 13123 of 20 May 2015

The Law No. 13123 (Law of Biodiversity)[62] regulates Article 1, Article 8 (line j), Article 10 (line c), Article 15, and Article 16 (lines 3 and 4) of the CBD; it provides for access to genetic heritage, protection of and access to associated traditional knowledge, and the sharing of benefits for the conservation and sustainable use of biodiversity. The objective of this law is to promote the sustainable use of the genetic resources of biodiversity and to increase the interest of companies in the use and regularisation of their activities through a self-declaratory system of registration of activities that use Brazilian biodiversity.

59. ibid., Article 7.

60. ibid., Article 19.

61. ibid., Article 30.

62. *Lei* nº 13.123, *de* 20 *de maio de* 2015. *Regulamenta o inciso* II *do §* 1º *e o §* 4º *do art.* 225 *da Constituição Federal, o Artigo* 1, *a alínea j do Artigo* 8, *a alínea c do Artigo* 10, *o Artigo* 15 *e os §§* 3º *e* 4º *do Artigo* 16 *da Convenção sobre Diversidade Biológica, promulgada pelo Decreto* nº 2.519, *de* 16 *de março de* 1998; *dispõe sobre o acesso ao patrimônio genético, sobre a proteção e o acesso ao conhecimento tradicional associado e sobre a repartição de benefícios para conservação e uso sustentável da biodiversidade; revoga a Medida Provisória* nº 2.186-16, *de* 23 *de agosto de* 2001; *e dá outras providências.* <www.planalto.gov.br/ccivil_03/_Ato2015-2018/2015/Lei/L13123.htm> accessed 31 December 2022 (Law No. 13123).

According to its definitions of access to genetic heritage and research, the law covers all activities carried out using Brazilian biodiversity. To develop any of these activities, registration in the National System for the Management of Genetic Heritage and Associated Traditional Knowledge is required. Regarding the sharing of benefits, the rules are clear and prefixed, with the National Fund for Benefit Sharing, linked to the Ministry of the Environment, established for those of a financial nature.

4. Conclusion

As observed in the international legal frameworks, the importance of oceans, seas, and coasts, including their resources and ecosystems utilised by fisheries and aquaculture, is widely recognised by the international community. This statement can be verified by noting the wide range of mandatory and voluntary instruments available to regulate the use of oceans, seas, and their resources to comply with the precepts of sustainable development. Given that scientific research and the transfer of technology are components present in all of these instruments, it is necessary to bear them in mind when proposing public policies related to the promotion of research, development, and innovation (RD&I) in fisheries and aquaculture for the purpose of sustainable development, and it is possible to note a strong tendency for the promotion and strengthening of RD&I in new technologies for the productive activities of fisheries and aquaculture, mainly through international laws and soft laws.

The CITES came into effect to protect the species of wild fauna and flora against over-exploitation through international trade. The determination of which trade is harmful to the survival of these species is one of the major difficulties in the implementation of CITES by national authorities, partly due to limited knowledge and understanding of the

species' biology, management, and the impacts of harvesting. However, some of this knowledge could be acquired through targeted scientific research.[63]

The UNCLOS defines the rights and responsibilities of nations with respect to the oceans of the world, establishing guidelines for, among others, the conservation and use of the marine living resources, marine scientific research, and the development and transfer of marine technology. The importance attached to marine scientific research and to the development and transfer of marine technology is such that the UNCLOS itself devotes Parts XIII and XIV to dealing exclusively with proposing actions and measures that promote and regulate these matters.

The CBD is an international legally binding treaty with three main goals: conservation of biodiversity, sustainable use of biodiversity, and fair and equitable sharing of the benefits arising from the use of genetic resources. Likewise, it is worth noting that the CBD also dedicates some of its Articles to the promotion and development of scientific research, including Article 12 (Research and Training), Article 16 (Access and Transfer of Technology), Article 17 (Exchange of Information), and Article 18 (Technical and Scientific Cooperation).

The Fish Stocks Agreement marked a major step forward in the development of a comprehensive legal regime for the long-term conservation and sustainable use of straddling and highly migratory fish stocks. Item 3 of Article 14 states that 'Consistent with Part XIII of the Convention, States shall cooperate, either directly or through competent international organisations, to strengthen scientific research capacity in the field of fisheries and promote scientific research related to the conservation and management of straddling fish stocks and highly migratory fish stocks for the benefit of all.'

63. Matthew Smith and others, 'Assessing the impacts of international trade on CITES-listed species: Current practices and opportunities for scientific research' (2011) 144 Biological Conservation 82, 82.

In relation to the Code of Conduct for Responsible Fisheries, it is necessary to ensure that all people working in fisheries and aquaculture commit themselves to its principles and goals and take practical measures to implement them. Governments, in cooperation with their industries, fish farmers, and fishing communities, have a responsibility to implement the Code, which will be most effectively achieved if governments incorporate its principles and goals into national fisheries policies, regulations, and legislation. Furthermore, Article 12 of the Code is dedicated exclusively to fisheries research; it is worth highlighting Item 2, which indicates that 'States should establish an appropriate institutional framework to determine the applied research which is required and its proper use.'

As a Member State of the United Nations and a signatory to these international instruments, Brazil has been seeking to align its national policies to the precepts of sustainable development advocated by the international community. Observing the Brazilian national policies dedicated to the conservation and sustainable use of marine resources, as well as regarding the fisheries and aquaculture activities, it is generally noted that RD&I is a present component, as observed in the international instruments above.

The PMN and PNRM are the main Brazilian national policies that deal specifically with the marine sciences, having been elaborated simultaneously with the international discussions on the UNCLOS.[64] Since the marine sciences are an important tool in providing information on how to better approach the marine environment, these national policies take advantage of this field of knowledge to guide the exploitation of marine resources and to develop new maritime technologies.

The sustainable growth of fish production is a challenge, the importance of which is evident in the face of the continuous increase in demand, both domestic and worldwide. In this sense, fishing and aquaculture legislation assumes an essential role in defining policies to encourage these activities, in social policies to support fishermen and aquaculture, and in management, surveillance, and control measures.[65] The PNAP became

the main legal instrument to be established on fisheries and aquaculture in Brazil, aiming to ensure the sustainable use of fishery resources and optimise the resulting economic benefits, in harmony with the protection of the environment and biodiversity; to promote the development, promotion, and monitoring of fishing activity and the preservation, conservation, and recovery of fishery resources and aquatic ecosystems; and to stimulate the socioeconomic, cultural, and professional development of those who carry out fishing activities.

However, in the field of research and innovation, a challenge worth highlighting is the difficulty of combining the focus of RD&I activities on the real needs of the productive sectors, through survey research lines and the definition of priority species, with the involvement of the productive, governmental, and academic sectors.[66] On the part of the federal government, it is necessary to develop public policies that encourage the formation of an innovation environment and the approximation of the academia with the productive sector.

One governmental report of the federal government Court of Auditors[67] focused on the management of the sustainable use of fisheries resources in the country has highlighted structural problems affecting the success of the sustainable management in the country in terms of

64. Andrei Polejack, 'Enhancing the Policies in Support of the Marine Sciences in Brazil' (2010) Division for Ocean Affairs and the Law of the Sea, 18-19.

65. Câmara dos Deputados, *Legislação Sobre Pesca e Aquicultura: Dispositivos Constitucionais, Leis e Decretos Relacionados à Pesca e Aquicultura* (Série Legislação n 137, Edições Câmara 2015), 14.

66. *supra* 3, 180.

67. Brazilian Court of Audit (*Tribunal de Contas da União* - TCU). *Relatório de Levantamento de Auditoria TC* nº 034.633/2011-1. *Avaliação da internalização, nas políticas públicas nacionais, dos objetivos e compromissos assumidos pelo país em decorrência da Conferência Rio-92, análise no âmbito da Agenda 21 e das convenções sobre Mudança do Clima, Diversidade Biológica e Combate a Desertificação: estudo de caso sobre a gestão dos usos sustentável dos recursos pesqueiros, determinações e recomendações. Brasília: TCU*, 2012.

the lack of use of available technical and scientific knowledge to support decision making, the weakening of governmental research centres of fishery resources, and the absence of a government policy aimed at the continued generation of scientific data and information on the marine ecosystem and its resources.[68]

The consolidation of Brazil as an important player in the South Atlantic oceanic fisheries can only be achieved if the entire fishing development effort is adequately grounded in conducting scientific research and using technical information capable of contributing to the competitiveness and efficiency of the national fleet.[69]

Despite the progress made in the promotion and implementation of actions in RD&I in recent years, there are significant challenges related to research in fisheries and aquaculture that need to be evaluated and reworked, such as the lack of trained human resources, the need to define the focus of the research lines, the lack of integration of the academic and the productive sectors, the need for networking, and the need to define a suitable methodology for evaluating the results of RD&I projects in order to permit corrections in direction and technology transfer to the productive sector.

Therefore, the main goal of the present work was to significantly contribute to a comprehensive overview of the international and national legal framework concerning research, development and innovation activities in fisheries and aquaculture, as well as to deepen discussions on the importance of consolidating a research, development, and innovation structure to support the sustainable development of fisheries and aquaculture in relation to the decision-making process, enhancement of governance and sound and effective policies in this area.

68. João P Viana, 'Recursos Pesqueiros do Brasil: Situação dos Estoques, da Gestão e Sugestões para o Futuro' (2013) Instituto de Pesquisa Econômica Aplicada, 53.

69. Fábio H V Hazin and Paulo E Travassos, 'Aspectos Estratégicos para o Desenvolvimento da Pesca Oceânica no Brasil' (2006) 23 Parcerias Estratégicas 11, 306.

References

• Friedman K, Braccini M, Bjerregaard-Walsh M, Bonfil R, Bradshaw C, Brouwer S, Campbell I, Coelho R, Cortés E, Dimmlich W, Frisk M, Kingma I, Phillips S, O'Criodain C, Parker D, Shephard S, Tovar-Ávila J, Yokawa K, 'Informing CITES Parties: Strengthening science-based decision- making when listing marine species' (2019), Fish and Fisheries 21 (1) 13.

• Hazin F, 'O Futuro da Pesca e da Aquicultura Marinha no Brasil: A Pesca Oceânica' (2010), Ciência e Cultura 62 (3) 36.

• Jansa J, Frossard E, Stamp P, Kreuzer M, Scholz R, 'Future food production as interplay of natural resources, technology, and human society. A problem yet to solve' (2010), Journal of Industrial Ecology 14 (6) 874.

• Koetz T, Bridgewater P, van den Hove S, Siebenhüner B, 'The role of the Subsidiary Body on Scientific, Technical and Technological Advice to the Convention on Biological Diversity as science–policy interface' (2008) Environmental Science & Policy 11 (6) 505.

• Loreto M, Santos P, 'Política Nacional do Meio Ambiente Brasileira: uma análise à luz do ciclo de políticas públicas' (2020), Perspectivas em Políticas Públicas 13 (25) 297.

• Pavliha M, Gutiérrez N, 'Marine Scientific Research and the 1982 United Nations Convention on the Law of the Sea' (2010) Ocean & Coastal Law J. 16 (1) 115.

• Polejack A, Enhancing the policies in support of the marine sciences in Brazil. Thesis of the United Nations-Nippon Foundation Fellowship Programme 2010-2011 (New York, United Nations, 2010).

• Routledge E, Zanette G, Freitas L, Ferreira F, Lima E, 'Ações e Desafios para Consolidação das Políticas de PD&I em Pesca e Aquicultura' (2011) Parcerias Estratégicas. Brasília: CGEE 16 165.

• Smith M, Benítez-Díaz H, Clemente-Muñoz M, Donaldson J, Hutton J, McGough H, Medellin R, Morgan D, O'Criodain C, Oldfield T, Schippmann U, Williams R, 'Assessing the impacts of international trade on CITES-listed species: Current practices and opportunities for scientific research' (2011) Biological Conservation 144 (1) 82.

• United Nations, Office for Ocean Affairs and the Law of the Sea. Marine Scientific Research: A revised guide to the implementation of the relevant provisions of the United Nations Convention on the Law of the Sea (New York, United Nations, 2010).

• Viana J, 'Recursos pesqueiros do Brasil: situação dos estoques, da gestão e sugestões para o futuro' (2013) IPEA: Boletim Regional, Urbano e Ambiental, Brasília 7 45.

• Wegelein F, Marine scientific research: the operation and status of research vessels and other platforms in international law (Publications on Ocean Development, v. 49. Leiden/ Boston: Martinus Nijhoff Publishers, 2005).