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Review Article

Scientometric analysis of climate change in artisanal fisheries over 2004–2024: trends, networks and knowledge gaps

Adriano Prysthon da Silva[1]*

[1]Embrapa Alimentos e Territórios – Maceió (AL), Brazil.
*Corresponding author: adriano.prysthon@embrapa.br

ABSTRACT

Climate change in artisanal fisheries has amassed increasing attention in the scientific community due to the potential damage to fishermen's livelihoods. This study presents a scientometric analysis of English-language articles from the Scopus database examining the relationship between climate change and artisanal fishing over the last 20 years. We analyzed trends in publication output, research areas, contributing countries, authors, affiliations, journals, funding networks, and keywords. Data was processed using Bibliometrix and VOSviewer. Our findings indicated an exponential increase in publications since 2014. The United States of America is the leading producer of articles, yet European countries receive more citations, highlighting their global influence. Additionally, most countries engage in international research collaborations. In Latin America, Brazil stands out as the leading country in terms of production, citations, and funding. While European and North American researchers dominate in publication output and co-authorship, Malaysia and South Korea also play significant roles. Notably, assessing the impacts of climate change on artisanal fishery requires a multidisciplinary approach and international cooperation rather than relying on a single thematic perspective. Furthermore, our analysis highlighted critical knowledge gaps and underscores the need for increased investment in research and publications, particularly in developing countries of the Global South.

Keywords: Bibliometrics; Fisheries sciences; World wide web; Knowledge management.

Análise cienciométrica das mudanças climáticas na pesca artesanal entre 2004–2024: tendências, redes e lacunas de conhecimento

RESUMO

As mudanças climáticas na pesca artesanal têm ganhado crescente atenção na comunidade científica devido aos potencias danos no modo de vida dos pescadores. Apresentamos uma análise cienciométrica de artigos em inglês (base Scopus) sobre a relação entre mudanças climáticas e a pesca artesanal nos últimos 20 anos. Analisou-se a tendência de produção, áreas, países, autores, filiações, periódicos, redes de financiamento e palavras-chave. Os dados foram minerados no Bibliometrix e VOSviewer. Houve um aumento exponencial de publicações a partir de 2014. Os Estados Unidos são o maior produtor de artigos, porém os países europeus são mais citados, demonstrando maior influência global e a maioria dos países publica em parceria internacional. O Brasil é protagonista na América latina, tanto em produção, citação e financiamento. Os autores europeus e norte-americanos se destacam na produção e em co-autoria. Porém, Malásia e Coreia do Sul também são relevantes. Destaca-se ainda que avaliar os impactos das mudanças climáticas na pesca artesanal não depende da visão de uma única área temática, e sim, de pesquisas multidisciplinares e cooperação internacional. Conclui-se também que as principais lacunas de conhecimento e necessidade de maiores investimentos em pesquisa e publicações nesta temática estão nos países em desenvimento do sul global.

Palavras-chave: Bibliometria; Ciências pesqueiras; Rede mundial; Gestão do conhecimento.

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INTRODUCTION

The impacts of climate change on artisanal fisheries have drawn significant scientific attention due to their potential to cause irreversible damage to communities' livelihoods and cultural heritage. Artisanal fisheries sustain the food systems and economies of millions in rural and coastal communities worldwide, while also playing a vital role in shaping cultural identity (Jentoft, 2023). Approximately 60 million people engage in small-scale fishing, either part-time or full-time, accounting for 90% of all capture fisheries jobs along the value chain. Notably, women make up four out of every ten individuals involved in artisanal fishing (FAO, 2022).

Recent climate change has significantly impacted artisanal fisheries, with sharp and chronic consequences (Coulthard, 2008). These communities are particularly vulnerable to disasters due to their geographic location, livelihood characteristics, and exposure to natural hazards and shocks, as direct (Béné et al., 2015) and indirect impacts. Additionally, their governance structures and ways of life further influence their susceptibility (Kalikoski et al., 2010). Besides, climate change-driven shifts in geomorphological dynamics, flooding, and sudden erosion pose significant threats to ecosystems such as mangroves and rivers. These environments are crucial habitats, providing food and protecting marine and freshwater biodiversity (Blankespoor et al., 2017).

In continental environments, events like El Niño have triggered severe droughts in the Amazon region, disrupting flood pulses and reducing fishing productivity (Furtado et al., 2024; Marengo, 2006). In marine environments, unexpected temperature fluctuations directly impact the aquatic species' physiology, reproduction, and survival. These changes also affect food production, alter ecosystems, and contribute to the emergence of pathogens (Brander, 2010).

Evidence of climate change impacts on aquatic ecosystems and artisanal fisheries is growing. However, few studies have explored the direct relationship between climate change and artisanal fishing (Muhammad et al., 2018). The lack of visibility on this issue remains a key challenge. Therefore, it is crucial to expand research and publications on the interactions between climate change and artisanal fishing, including their patterns and future trends.

Scientometrics, which involves the quantitative analysis of scientific publications, citations, and collaborations, offers a systematic approach to understanding the structure and evolution of scientific knowledge (Martínez-López et al., 2020). This method enables the identification of key themes, influential authors, leading journals, emerging research areas, and collaborative networks across various fields. As a powerful tool, scientometrics provides quantitative and statistical insights into research trends and the defining characteristics of a given topic (Barisaux, 2017; Leal et al., 2019; Liu et al., 2019; Martinho, 2018).

A quick search on the Scopus platform using the keywords *scientometrics* or *bibliometrics* reveals that social sciences dominate the field, accounting for 23% of publications, while agricultural and biological sciences make up only 2.5% (San-Juan-Heras et al., 2024). This indicates a significant gap in studies on these fields, particularly regarding the impacts of climate change on artisanal fishing. For instance, Alves and Minte-Vera (2013) conducted a bibliometric study on artisanal fishing in Brazil and found that the number of publications had declined since 2008. They also emphasized the importance of multidisciplinary approaches in training human resources. However, their study focused on Brazil's inland fisheries only. To address this gap, a more comprehensive analysis is needed, linking climate change and artisanal fishing–both marine and inland–on a global scale.

This study aimed to conduct a scientometric analysis of the relationship between climate change and artisanal fishing (marine and inland) over the past 20 years on a global scale. It sought to identify key aspects such as subject areas, annual publication trends, author group distribution, geographical patterns, leading journals, institutional affiliations, and major funding agencies. Additionally, this research aimed to provide valuable insights for researchers, policymakers, and professionals working on the impacts of climate change on artisanal fisheries by systematically analyzing scientific publications, citation patterns, and existing knowledge gaps in the field.

METHOD

The data was collected and processed in February 2025 using the Scopus database, a highly recognized bibliographic resource known for its extensive collection of scientific documents (Baas et al., 2020). This study focused solely on a scientometric analysis, considering only scientific journal articles.

Although this study relied on the Scopus database for scientometric analysis, using a single source may result in the omission of some records available in other databases, such as Web of Science, PubMed, or Google Scholar. However, due to the significant overlap among major bibliographic databases, this limitation is unlikely to have a major impact. The key trends and insights identified in this analysis are expected to remain robust.

The Scopus search query used to identify publications on climate change in artisanal fishing was: TITLE-ABS-KEY [("artisanal*" OR "small-scale*") AND ("fisheries*" OR "fishery*") AND "climate change*" NOT "COVID-19*" NOT "aquaculture*" NOT "small farmers*" NOT "industrial"]. The "TITLE-ABS-KEY" field

searches for the specified terms in document titles, abstracts, and keywords, ensuring that relevant publications are included in the analysis. The exclusion of the term *small farmers* is due to the nature of the activity (agriculture rather than fishing). Also, the exclusion of *industrial* relates to the scale of fish production, as the study focused exclusively on artisanal, that is, small-scale fisheries. A manual review of the results was conducted to exclude unrelated publications. The search was restricted to the period from 2004 to 2024, as records on this topic before 2004 are scarce or nonexistent.

The search included publications from the earliest available records up to January 2025. An initial analysis covered the total number of publications, which was then refined to include only articles in English. The dataset, containing complete records and cited references, was exported from the Scopus database in CSV format. Scientometric data were visualized and analyzed using VOSviewer (Van Eck & Waltman, 2014) and Bibliometrix (Aria & Cuccurullo, 2017) in the RStudio interface. These tools facilitated comprehensive exploration and visualization of various networks. The analysis focused on annual scientific production, production and citations by country, co-authorship by country, thematic areas, collaboration maps between countries, and contributions from funding agencies. Additionally, the study examined production by affiliation, key publication sources, author collaboration networks, the most productive authors over time, keyword clouds, and seasonal trends in keyword linkages.

RESULTS

Over the past 20 years, 168 articles have been published, with an annual growth rate of 23,4%. The average number of citations per article was 19,9, and the total number of references exceeded 11,000 (Table 1). Notably, among the 168 publications, nine were authored by a single individual, while the average number of co-authors per article was 5,67. Lastly, the international co-authorship rate stood at 58,9%, indicating strong collaboration between countries on this topic.

Table 1. Key findings from the Scopus search on climate change in artisanal fisheries.

Description	Results
Timespan	2004–2024
Documents	168
Annual growth rate (%)	23,42
Document average age	4,68
Average citations per document	19,96
References	11,664
Authors	819
Authors of single-authored docs	9
Co-Authors per document	5,67
International co-autorships (%)	58,93

Figure 1 illustrates the evolution of these studies over time. The annual publication trend can be divided into three distinct periods. The first period (2004–2008) saw almost no publications worldwide, except for a single article in 2008 (Coulthard, 2008), reflecting limited scientific interest in the topic. During the second period (2008–2013), the number of publications remained low, with only one or two articles per year. In the third period (2014–2024), research output grew exponentially, reaching 29 articles in 2024.

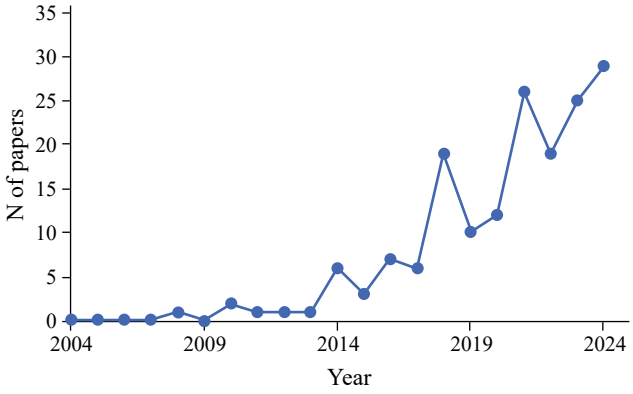


Figure 1. Global trend in annual publications on climate change in artisanal fisheries (2004–2024).

Regarding the number of articles published per country, the United States of America leads the ranking, with 42 publications, followed by the United Kingdom (29), Australia (27), Spain (21), and Canada (19). Together, these countries account for 80% of the total publications in this field, with most research concentrated in developed nations (Fig. 2). Brazil ranks in sixth position, with 13 publications, and, along with Mexico (10), is the only Latin

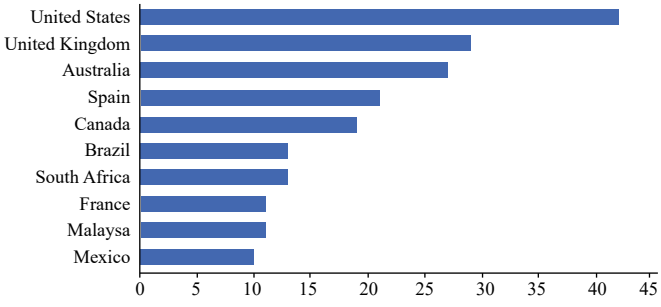


Figure 2. Top countries producing climate change research in artisanal fishing.

American representative. South Africa, with 13 publications, is the sole representative from Africa, while Malaysia (10) is the only Asian country in the ranking.

According to Table 2, the United Kingdom has the most cited articles, with 475 citations, followed by Canada (288), Australia (237), Sweden (230), and Italy (190). Although the United States of America leads in the number of published articles, it ranks sixth in citations, with 186. Brazil, the only Latin American country in the top 10, has 170 citations. This indicates that research from these countries has a significant impact, even with fewer publications.

Table 2. Ranking of countries by article citations on climate change in artisanal fisheries.

Country	Article citations
United Kingdom	475
Canada	288
Australia	237
Sweden	230
Italy	190
United States of America	186
Netherlands	180
Brazil	170
South Africa	159
Spain	153

Regarding article co-authorship, the United Kingdom (18) and Brazil (11) have 72,2% of their publications written in collaboration with other countries (Fig. 3). Spain (13) stands out, with all its articles co-authored internationally (Fig. 3a). In contrast, all authors in India (6) are domestic. Malaysia and Mexico prioritize national authorship over international collaborations.

Most articles fall within environmental sciences (119), followed by agricultural and biological sciences (84), social sciences (64), and earth and planetary sciences (52). Together, these four fields account for over 85% of published articles (Fig. 4), highlighting the fundamental role of multidisciplinary research in assessing and mitigating the impacts of climate change on artisanal fisheries.

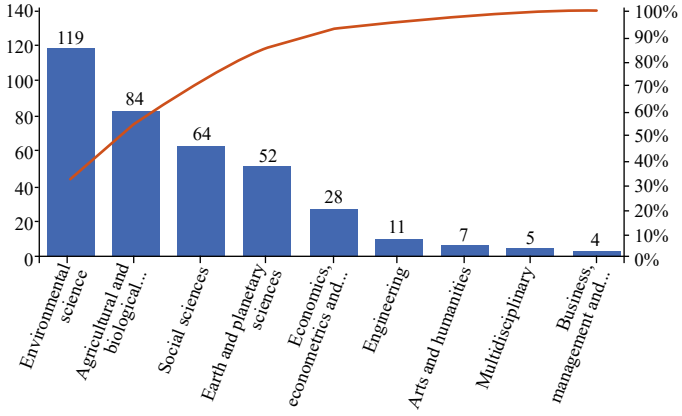
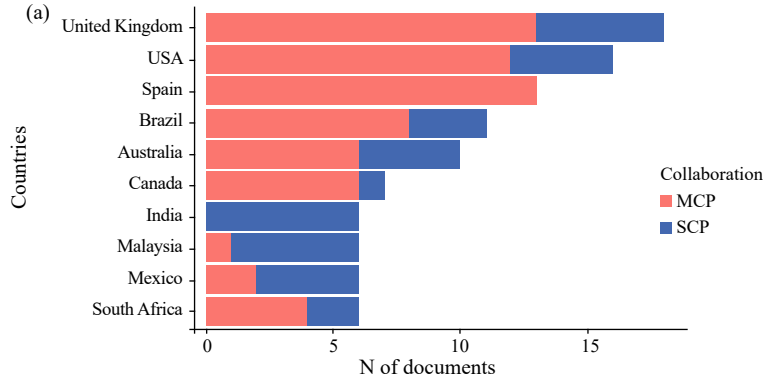


Figure 4. Distribution of the most productive articles on climate change in artisanal fishing.

Regarding international collaboration, the United States, the United Kingdom, Spain, and Australia lead the main research networks, represented by the thicker lines in Fig. 5, making them the most influential research hubs. Brazil appears on the map with partnerships primarily in North America and Europe. Among the top 10 funding agencies supporting research on



(b)

Country	Articles	Articles %	SCP	MCP	MCP%
United Kingdom	18	10,7	5	13	72,2
USA	16	9,5	4	12	75
Spain	13	7,7	0	13	100
Brazil	11	6,5	3	8	72,7
Australia	10	6	4	6	60
Canada	7	4,2	1	6	85,7
India	6	3,6	6	0	0
Malaysia	6	3,6	5	1	16,7
Mexico	6	3,6	4	2	33,3
South Africa	6	3,6	2	4	66,7

SCP: single country publications; MCP: multiple country publications.

Figure 3. Top 10 most relevant countries in co-authorships on climate change in artisanal fisheries.

climate change impacts in artisanal fisheries, nine are based in developed countries, reflecting their significant investment in this field. The European Commission's Horizon 2020 Framework and the European Research Council lead the funding rankings, supporting 19, 16, and 12 articles, respectively (Fig. 6). Brazil also plays a notable role, with two major funding institutions–the National Council for Scientific and Technological Development and the Coordination for the Improvement of Higher Education Personnel–, funding eight and four articles, respectively.

Regarding the most relevant affiliations, Fig. 7 highlights the University of Vigo (Spain) as the leading institution, with 21 publications, followed by the University of Queensland (Australia) and Stanford University (United States of America), each with nine. Once again, institutions from developed countries dominate. However, notable contributions also come from Africa and Asia, with the University of Putra (Malaysia) and the Central Marine Fisheries Research Institute (India) producing six and five publications, respectively, and Rhodes University (South Africa) contributing with six.

For the most relevant sources, Fig. 8 shows that *Marine Policy* leads with 19 publications, followed by *Frontiers in Marine Science* (11), *Regional Environmental Change* (8), and *Ocean & Coastal Management* (7). All the top 10 journals are based in developed countries, possess a high impact factor, and together account for approximately 40% of all published articles on this topic. A common feature among them is their multidisciplinary scope and focus on marine and coastal environments. Two journals with a specialized focus on climate change rank among the top 10: *Regional Environmental Change*, in third place, and *Climate and Development*, in seventh. Together, they represent 20% of the top 10 sources.

Regarding co-authorship among authors, VOSviewer processed 98 items, organizing them into nine clusters, each with

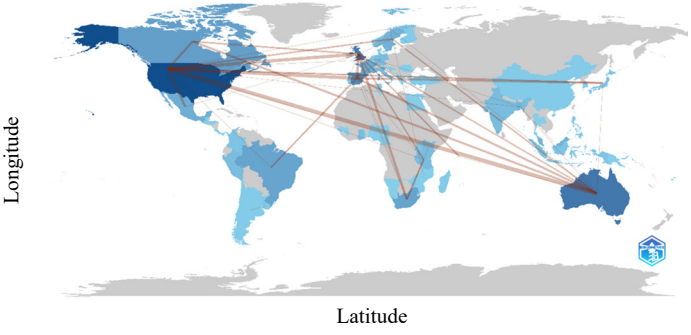
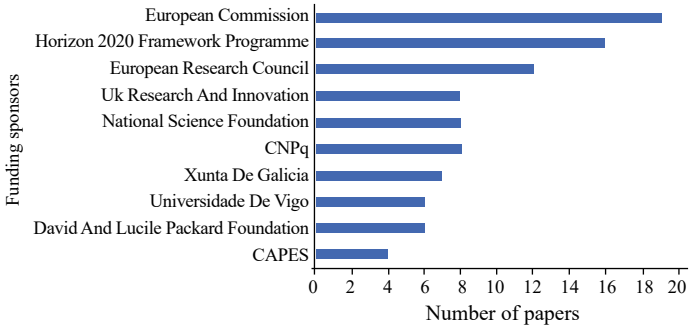
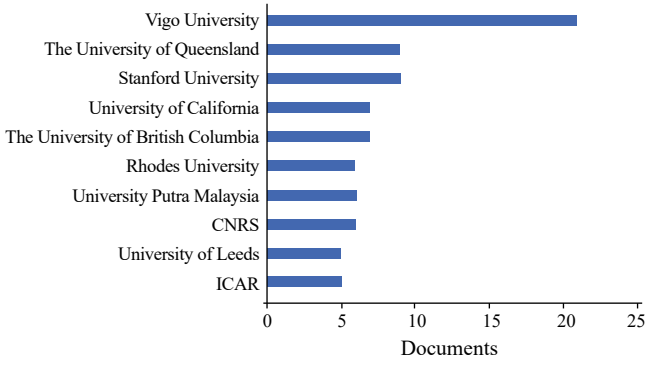


Figure 5. Collaboration map of leading countries in climate change research on artisanal fisheries. Line thickness represents collaboration intensity between the countries.



CNPq: National Council for Scientific and Technological Development; CAPES: Coordination for the Improvement of Higher Education Personnel.

Figure 6. Top 10 funding agencies for articles on climate change in artisanal fishing.



CNRS: Centre National de la Recherche Scientifique; ICAR: Central Marine Fisheries Research Institute.

Figure 7. Number of most relevant articles by affiliation on climate change in artisanal fishing.

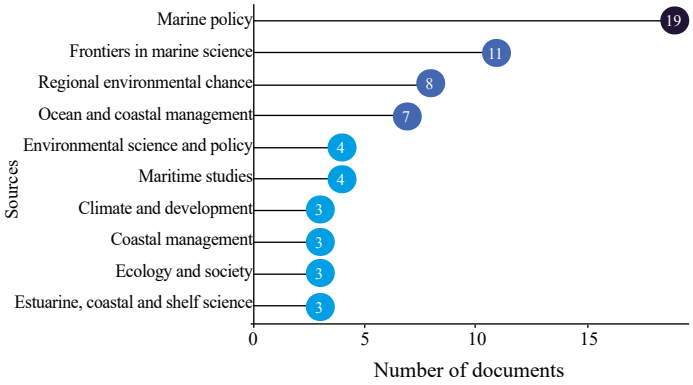


Figure 8. List of most relevant sources for articles on climate change in artisanal fishing.

at least one publication (Fig. 9). A cluster represents a group of closely collaborating researchers, while the colors indicate the authors' active periods. 'Yellow' signifies researchers who have published more recent studies on climate change in artisanal fisheries, 'green' indicates that most publications date to around 2020, and 'blue' represents works published before 2018. In the bottom left corner (yellow), there is a large group of collaborators with balanced production, as indicated

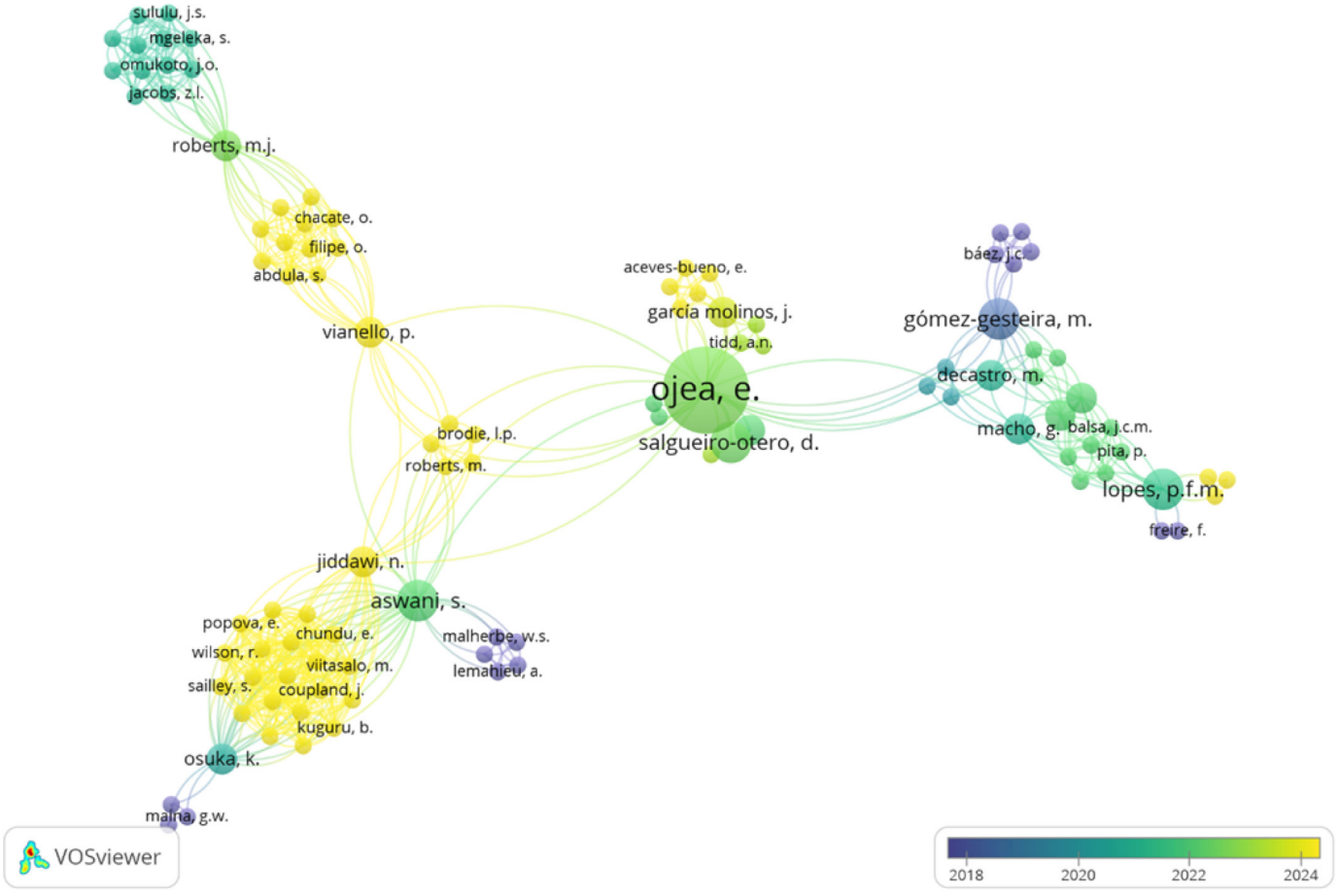
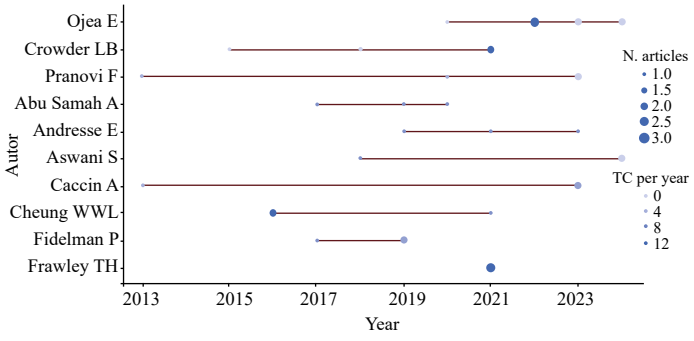


Figure 9. Temporal visualization of collaboration and co-authorship networks in climate change research on artisanal fisheries (2004–2024).

by the node sizes. A similar pattern is observed in the top left corner (green).

Another analysis that helps identify the most influential authors considers publication frequency over the years (Barbosa & Galembeck, 2022), as shown in Fig. 10. Notably, the most prolific authors were also the most cited, including Dr. Elena Ojea (University of Vigo, Spain), Dr. Larry B. Crowder (Stanford University, United States of America), Fábio Pranovi (Ca' Foscari University of Venice, Italy), Dr. Asnarulkhadi Abu Samah (Putra University, Malaysia), and Dr. Edo Andriesse (Seoul National University, South Korea). These scholars have been the most productive and highly cited in the past decade.



TC: total citations.

Figure 10. Top 10 most productive authors over time in climate change research on artisanal fisheries (2004–2024).

DISCUSSION

Regarding the most productive and most cited countries, it is ironic that the United States of America, the leader in scientific output, is also the world's second-largest emitter of greenhouse gases (GHGs) (IPCC, 2023). Meanwhile, China, the largest GHG emitter, has contributed only two publications in this field (Kindong et al., 2024; N'Souvi et al., 2024). Carbon emissions from China's marine fisheries increased between 2006 and 2019, suggesting that the country's rapid economic development has significantly driven this rise (Chen et al., 2022), with potentially harmful effects on other regions.

Scientometric studies on climate change regarding adaptation, mitigation, risks, and vulnerability remain relatively scarce. However, their presence in scientific literature has increased exponentially since 2005 (Haunschild et al., 2016). As a natural consequence, research specifically focused on artisanal fisheries began to grow later, with a noticeable increase from 2014 onwards (Fig. 1). This expansion is driven by the growing number of official records documenting climate change and its impacts across various regions of the planet, which has fueled a rising scientific effort toward mitigation, ultimately leading to a greater number of published articles. For instance, abnormal temperature increases cause irreversible damage to the metabolism of fish larvae, reducing species size and negatively affecting the productivity of artisanal fisheries (Schroeder & Castello, 2010). Therefore, investing in science and technology is essential to mitigating the negative impacts of climate change on biodiversity and fisheries (IPCC, 2023).

Multidisciplinarity is a key characteristic of publications on climate change in artisanal fisheries. In a scientometric study on inland fisheries, Alves and Minte-Vera (2013) emphasized the importance of multidisciplinary research in Brazil, despite the low number of specialists in the field. The country's main research institutions for fisheries include the National Institute for Amazonian Research, the Center for Advanced Amazonian Studies, and the Emilio Goeldi Museum of Pará. Additionally, public universities play a significant role, as they house most fisheries science researchers (Leite et al., 2011).

In the context of co-authorship, VosViewer's temporal network analysis proved to be a valuable tool, as it clarified which research groups are most closely connected and their publication frequency over time. This method is widely applied across various fields, including education (Li et al., 2022; Mishra et al., 2021), nursing (Damar et al., 2018), engineering (Darko et al., 2019; Martinez et al., 2019), technology (De Sousa, 2021), teaching (Gomis et al., 2023), exact sciences (Zhong et al., 2019), geology (Laksono et al., 2024), chemistry (Oliveira et al., 2024), health (Elisha & Viljoen, 2021), veterinary sciences (Alvitez-Temoche et al., 2024), among others.

Among the 1,203 keywords found in the articles, a minimum occurrence threshold of seven was applied (VosViewer default), resulting in 45 processed keywords with frequencies ranging from seven to 117 (Fig. 11). The keyword cloud highlighted research trends on this topic, with *climate change* at the center, appearing 117 times, followed by *fishing* (47) and *artisanal fishing* (44) (Fig. 11). Additionally, *climate change* exhibited the strongest overall connection to other keywords (Fig. 12). Terms such as *sustainability*, *fisheries production*, *food security*, *overfishing*, *coastal communities*, and *resilience*, highlighted in yellow, were more prevalent in recent publications, particularly around 2022. These keywords, in the context of artisanal fisheries, are essential for management, public policy development, socioeconomic analysis (Almeida et al., 2009; Begossi, 2008), and the social and cultural inclusion of artisanal fishers (Chuenpagdee & Jentoft, 2018; Cohen et al., 2019).

Figure 11. Word cloud illustrating the co-occurrence and significance of keywords related to climate change in artisanal fisheries.

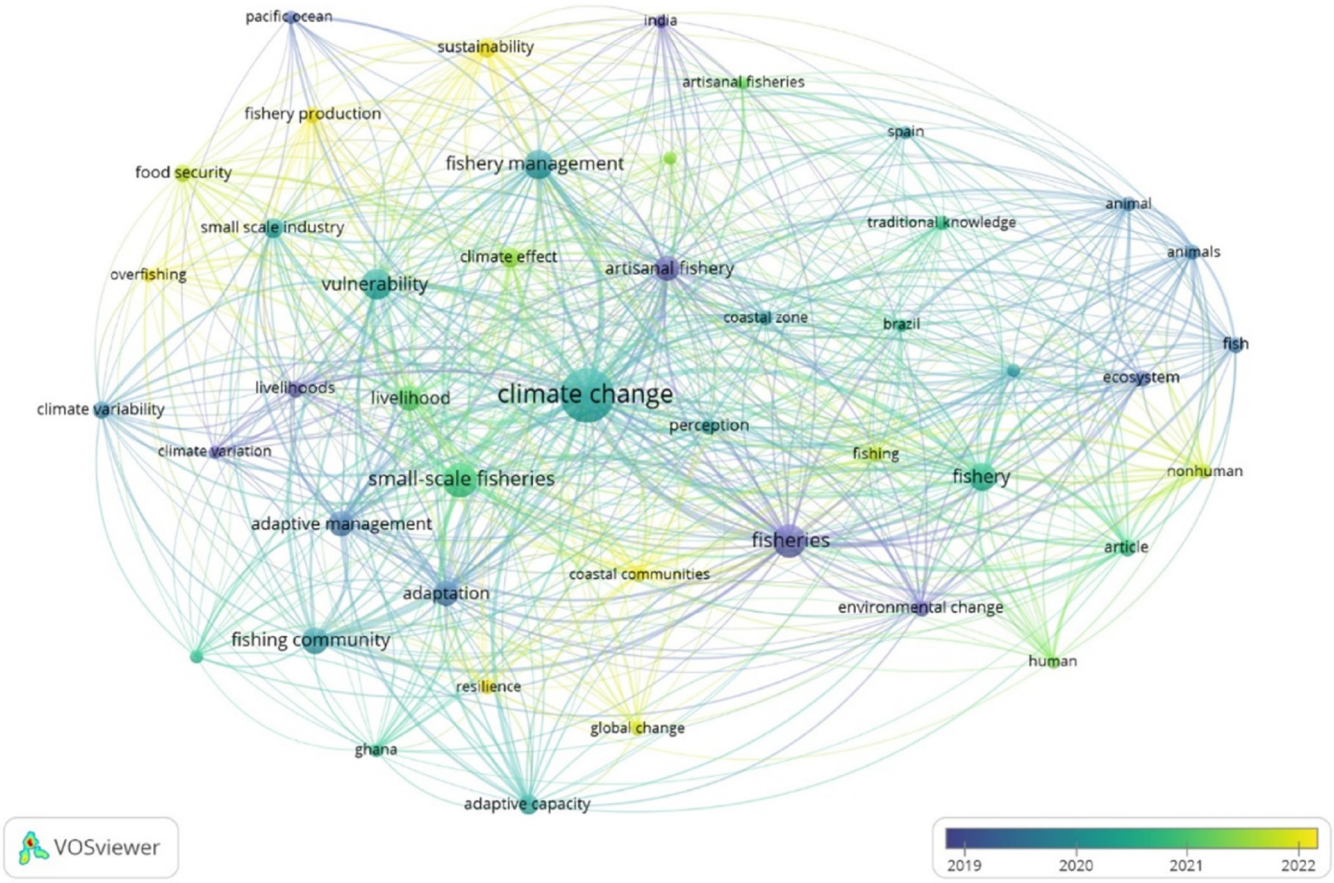


Figure 12. Temporal visualization of keyword link strength related to climate change in artisanal fisheries (2004–2024).

CONCLUSION

Over the past 20 years, the number of articles has grown significantly only since 2014, indicating that global concern about the effects of climate change on artisanal fisheries has intensified over the last decade. Developed countries–including the United States of America, Spain, Australia, the United Kingdom, Canada, and Sweden–lead in both publications and citations on this topic.

The United States of America is the largest producer of articles, but European countries receive more citations, demonstrating greater global influence. In Latin America, Brazil leads in both publication volume and citations. Most of the top-producing countries collaborate internationally, with European and North American authors standing out in terms of article production and co-authorship. However, Asian researchers, particularly those from Malaysia and South Korea, also play a significant role.

Assessing the impacts of climate change on artisanal fisheries requires a multidisciplinary approach and international cooperation, rather than a single thematic perspective. This is evident as over 85% of the articles fall under multidisciplinary sciences. Finally, developed countries are the largest investors in research and publications, but Brazil and Mexico stand out in Latin America. However, the greatest knowledge gaps and the need for increased research funding remain in developing countries of the Global South.

CONFLICT OF INTEREST

Nothing to declare.

DATA AVAILABILITY STATEMENT

All data sets were generated or analyzed in the current study

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