RESEARCH ARTICLE

Bibliometric Investigation of Climate Change Literature in Fisheries using Dimensions.AI Database

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ABSTRACT

Background: Climate change is the most critical and contentious issue confronting the globe today. Changes in rainfall patterns and temperature have already influenced the fisheries sector unfavourably. This bibliometric analysis examined the publications on climate change's effects on fisheries from 2008 to 2022, using Dimension-listed journals with DOIs. Keywords, authors, co-citations and journal trends are studied.

Methods: A total of 180 research articles were analysed using Dimension (https://dimension.ai) with search terms' climate change,' 'fishery', 'fisheries' and 'aquaculture'. The dataset was updated on May 20, 2022. A bibliometric map was created using the R Biblioshiny package.

Result: The number of articles discussing climate change and its influence on fisheries has risen dramatically. Several journals cover this topic, the most prominent of which is Fisheries Oceanography. Animals, fisheries, climate change, ecosystems and fishes are among the most often used keywords. Cheung WWL is the most prolific author and has published the most publications over the 15-year study period. Among countries, Canada has the most popular articles and China has the most authors. This research summarises the most popular authors, publications and keywords used in papers on climate change subjects. Furthermore, their impact on fisheries gives information to researchers interested in climate change research and its impact on fisheries. Finally, ample scope exists for developing adaptation strategies through insightful research and funding.

Key words: Bibliometric analysis, Climate change, Dimension database, Fisheries, R Biblioshiny package.

INTRODUCTION

Climate variability has significantly impacted the global ecosystem and skewed human socioeconomic structure over the last two decades. Countries all over the world implement policies to reduce environmental hazards, limit global temperature rise and eliminate greenhouse gas emissions (Wang *et al.,* 2018; Belete *et al.,* 2021). The Intergovernmental Panel on Climate Change (IPCC) states that many climate change effects will persist for centuries, even if greenhouse gas emissions stop, making short-term mitigation challenging (Pachauri *et al.,* 2014; Sharma *et al.,* 2024; Suryawanshi *et al.,* 2024). Continued emissions of greenhouse gases and rising global average temperatures significantly impact the rise in sea levels, changes in oceanic temperature and acidifying the oceans (Velumani *et al.,* 2019). Climate change affects the abundance, migration and mortality of wild fish stocks, determining species' culture. It also indirectly impacts communities reliant on aquaculture and fisheries for their livelihoods (Sumaila, 2011; Lindegren and Brander, 2018; OECD, 2011). The Kyoto Protocol, ratified in 1997, spurred climate change research. SDG 13 (Climate Action) emphasizes urgent action to ensure sustainable fishery resources, regardless of emission reductions and efforts to manage climate risks.

Recent studies show climate change is impacting fish populations, aquaculture productivity and coral reefs, leading to coral bleaching and shifts in species composition and diversity (Munday *et al.,* 2008; Pratchett *et al.,* 2008; Daw *et al.,* 2009; Ateweberhan *et al.,* 2013; Belhabib *et al.,*

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2018; FAO, 2020). Climate change also affects species distributions, community structures, diversity patterns and the habitat suitability of sensitive benthic species (Poloczanska *et al.,* 2016; Weinert *et al.,* 2016). Climate change significantly impacts inland water bodies like lakes, reservoirs, wetlands and ponds by altering physio-chemical parameters, species composition and diversity (Goldman *et al.,* 2013). In the current situation, understanding extreme

climatic events like rising temperatures, sea level rise, floods, droughts and cyclones is crucial to predict fish stock dynamics and their impact on future food systems. These events are already causing fishery stock declines and significantly affecting commercial fisheries. (O'Reilly et al., 2003; Vollmer et al., 2005; Badjeck et al., 2010; Rezaee et al., 2016; Blanchard et al., 2017; Troell et al., 2017; Townhill et al., 2023). Despite growing attention to climate change, most studies focus on specific issues like adaptation and resilience, with few addressing overall research trends and development. Research increasingly addresses climate change minimisation through integrated resilience, adaptation strategies and models. Scientists are focusing more on its impact on fisheries and aquaculture due to climate-related disasters like tsunamis, floods, irregular rainfall and droughts. Notably, global research on climate change in fisheries has grown rapidly.

The application of bibliometric analysis in numerous topics has made it a crucial tool for quantitative analysis since it efficiently conveys the general trajectory of a subject's or field's growth (De Bakker et al., 2016; Hirsch, 2005). The bibliometric technique has gained popularity among climate change researchers. Li et al. (2011) used it to analyse trends and approaches in climate change literature from 1992 to 2009, while Wang et al. (2014) focused on vulnerability assessment in water management, health and agriculture. Wei et al. (2014) evaluated climate change policy models and Janssen et al. (2006) examined global resilience, vulnerability and adaptability. Velumani et al. (2019) analysed climate change's impact on fisheries, suggesting adaptation strategies. Wang et al. (2018) explored climate adaptation research and Rana (2020) compared disaster and climate change research using bibliometric methods.

Reviewing and compiling literature to provide a comprehensive overview of current research, key issues and future directions in climate change and fisheries is essential. Understanding the progress of bibliometric studies in this field and identifying areas for adaptation and mitigation strategies is crucial. This study aims to highlight the primary challenges and propose strategies for addressing climate change in fisheries and aquaculture through bibliometric mapping of trends in keywords, authors and journals.

MATERIALS AND METHODS

The Dimension-ai database is a partially open-access platform for global research and innovation (Thelwall, 2018). This study used data from dimensions.ai on climate change's effects on fisheries for descriptive bibliometric analysis, focusing on articles with unique DOIs. Bibliometric mapping is found to be a compelling research subject in the area of bibliometric analysis (Börner et al., 2003). Creating bibliometric maps and their graphical depiction are key features in bibliometric studies.

Researchers have focused on mapping software like VOSviewer, Pajek and CiteSpace for this purpose (Boyack et al., 2005; Van Eck and Waltman, 2007a) and the impact of variations in similarity metrics (White, 2003; Ahlgren et al., 2003; Klavans and Boyack, 2006a; Van Eck and Waltman, 2007b). Because of the low consideration of bibliometric maps, some researchers have seriously studied the problems related to graphical representations (Chen and Chen, 2003; Chen, 2006; Skupin, 2004). Most bibliometric research relies on simple graphical representations from programs like SPSS and Pajek, which work well for small datasets. However, there's a growing trend toward using more prominent and complex maps (Boyack et al., 2005; Klavans and Boyack, 2006b; Van Eck et al., 2006) and such maps do not lend themselves well to straightforward graphical representations. Zoom, labelling algorithms and density metaphors can improve large bibliometric maps, but common software lacks these features. R Biblioshiny is used to address these graphic representation issues in bibliometric studies.

Descriptive data, including numbers, percentages and rankings, were used to analyse articles on climate change in fisheries from 2008-2022. A total of 4,928 records were found in the Dimension-ai database, with 744 related to fisheries science. Of these, 485 focused on SDGs related to Climate Action and Life Below Water (SDG 14) and 180 papers were selected for bibliometric analysis (Table 1). The search keywords are "climate change" or "global warming" or "sea level rise" and in combination with "fisheries" or "fishing" or "aquaculture" or "fish" or "mariculture" or "coastal aquaculture" or "ocean acidification or thermal stress" were considered to obtain data, which are available in the title and abstract only. R Biblioshiny software was used to analyse authors, journals and keywords, which is free and accessible at https://bibliometrix.org.

RESULTS AND DISCUSSION

The present study investigates the impacts of climate change on fisheries by analyzing patterns and trends across existing literature. The key areas of focus include thematic evolution, trends in word usage over time, temporal trends in author productivity, geographic distribution of corresponding authors, growth of publication sources, and insights derived from three-field plots. The findings are systematically presented in subsequent sections to provide a comprehensive understanding of the observed patterns and trends.

Thematic evolution

Research themes constantly evolve, with newer papers showing different focuses than older ones. Fig 1 illustrates this evolution, with "Climate change in fisheries" as the central theme. From 2008 to 2013, six major themes emerged, with "climate" being the most prominent, followed by "information" and "future."

From 2014 to 2019, many research themes evolved as extensions of earlier ones. Themes like "fishing" emerged from previous themes such as "climate," "information," "future," "impacts," "management," and "global." During this period, "fishing" became the most frequently used theme, followed by "climate." While from 2020 to 2022, six key themes emerged, all extensions of earlier themes. Notably, "approach" and "temperature" evolved from prior themes, indicated by vibrant connections to earlier topics.

Word growth

The study tracks the yearly evolution of frequently used terms in climate change and fisheries research. Since 2008, these terms have grown steadily. As shown in Fig 2, "Animals" saw the highest increase, with its occurrence

Table 1: Exclusion and inclusion of publications using the preferred reporting items for systematic reviews and meta-analyses (PRISMA) flow model.

| Components	Articles extraction	Reasons for exclusion/inclusion
Identification	Extract data from free scientific citations and indexing databases (n=4928)	The source of data collection is from Dimension. ai only.
Screening	Article screened as per the requirement of the study (n=485)	The search was focused on the article-type resources available under fisheries science and sustainable development goals, where life below water and climate action are only included.
Eligibility	Articles published with abstracts are eligible (n=330)	Those articles that are non-accessible and non-English language publications abstracts were excluded from the datasets.
Induced	Publications included in qualitative and quantitative synthesis (n=180)	
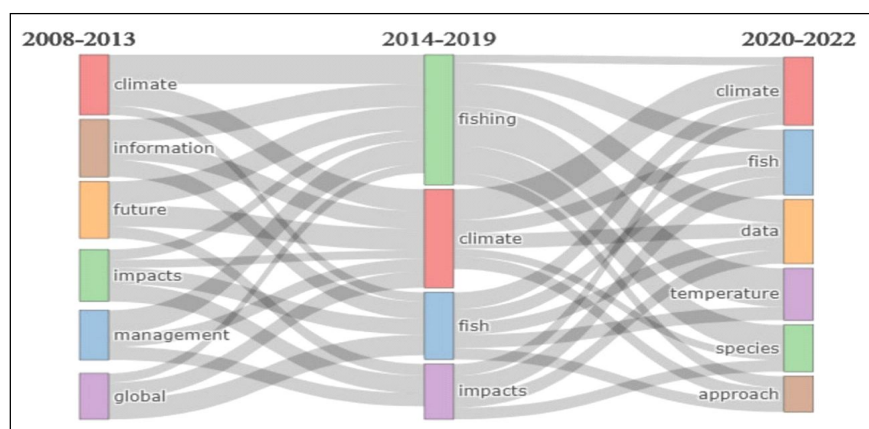
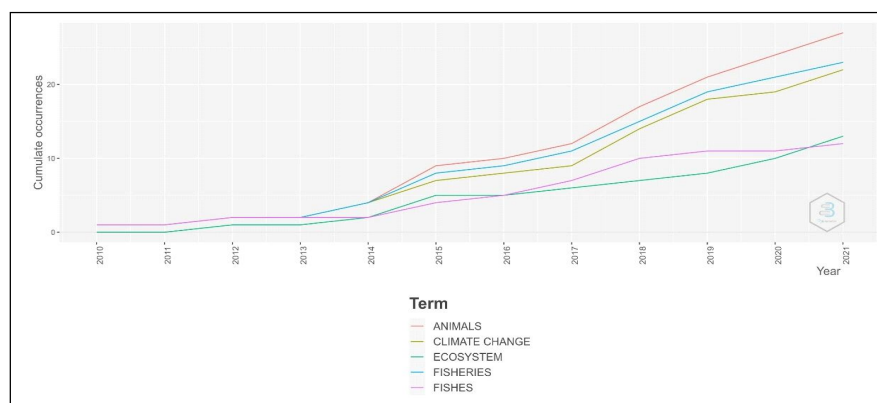**Fig 1:** Thematic evolution of climate change articles in relation to fisheries topics.

Fig 2: Word growth of climate change articles with fisheries topics.

exceeding 25 in 2021. "Fisheries" followed, exceeding 20 by 2020, while "Climate change" ranked third, nearing 20 but growing more slowly.

Top author's production over time

Fig 3 illustrates author productivity from 2008 to 2022. A red line connects the first and last years an author published, with circles along the line representing the number of publications each year.
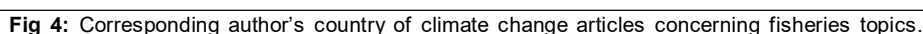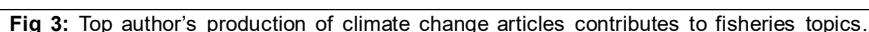
The study shows that some authors, like Cheung WWL (since 2012) and Barange M (2010–2018), have been writing on climate change in fisheries for years. Others, like Fernandes JA, began more recently in 2020. Notable contributors include Hobday AJ, Pecl GT, Sumaila UR and Lam VWY, all publishing from 2013 to 2021.

Corresponding author's country

Fig 4 shows the author's correspondence by country and the level of collaboration, highlighting SCP (single country collaboration) versus MCP (multiple country collaboration) in each article.

The top 7 countries for author correspondence on climate change in fisheries show China as leading, with at least three publications annually. Canada and Norway each have two papers, while others publish at least one. There is a need for more publications from African and Southeast Asian countries.

Source growth

The study examines the growth of journals publishing on climate change in fisheries. Fig 5 shows the cumulative increase or decline in journal occurrences from 2008 to 2022, highlighting trends in publishing papers on this theme.

Several journals focused more on climate change in fisheries after 2010, with notable growth. The ICES Journal of Marine Science saw significant increases since 2008, surpassing an occurrence value of 10. Fisheries Oceanography

Fig 3: Top author's production of climate change articles contributes to fisheries topics.

Fig 4: Corresponding author's country of climate change articles concerning fisheries topics.

peaked at 12 by 2022, overtaking ICES Journal. Fish and Fisheries, Fisheries Research, Reviews in Fish Biology and Fisheries and Scientific Reports also showed steady growth, exceeding seven by 2021.

Three fields plot

The three fields plot (Fig 6) shows the relationships between journals, authors and themes in climate change and fisheries research. It lists 13 journals, with "Reviews in Fish Biology and Fisheries" being the top publisher, linked to authors like Cheung WWL, Hobday AJ and Pecl GT. The middle section lists the top 20 authors, with Cheung WWL having the most publications. Authors also rely upon frequently used themes in their papers. The size of each rectangle reflects the number of documents associated with each journal, author and theme.

The third component of the Three Fields Plot highlights the most frequent keyword topics in the research, with 20 listed. "Temperature" is the most common, shown by a large green rectangle, followed by "climate" and "change." Nearly all authors use these keywords. Other frequently used terms include "fisheries," "marine," "fish," "adaptation," and "impacts," reflecting the study's focus on climate change's impact on fisheries.

The study's findings highlight the increasing volume of research on climate change in fisheries, analysed using R Biblioshiny on journal articles with DOIs. Since the late 21st century, this topic has gained momentum, with fisheries institutions contributing to its growth. Thematic evolution reveals key terms like "climate," "impacts," and "management" have been prevalent from 2008 to 2022, showing the development of research on this theme.
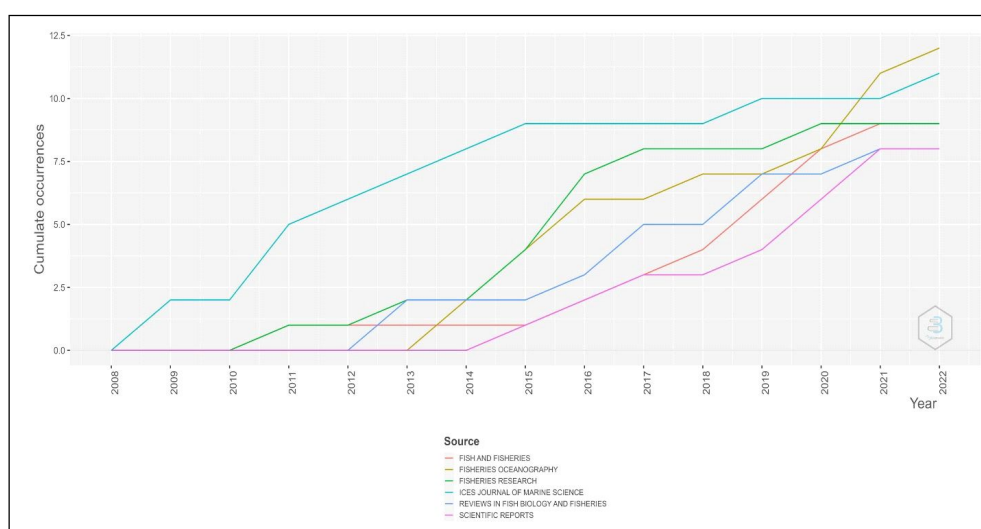

Fig 5: Source growth of climate change articles with fisheries topics.
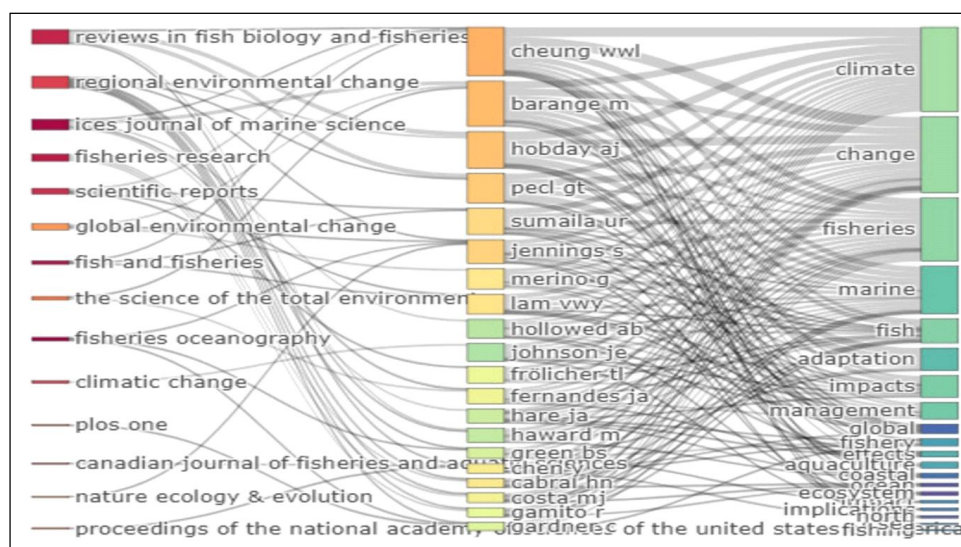

Fig 6: Three field plots of climate change articles related to fisheries topics.

The recent emergence of the term "approach" reflects growing awareness of climate change impacts in fisheries sectors. However, research primarily concentrates on marine and coastal realms, indicating a need for broader studies in areas like inland fisheries, society and economy.

Author productivity has increased recently, with China leading in climate change in fisheries research, followed by Canada. Collaboration among authors from productive countries drives this trend. Journals such as the ICES Journal of Marine Science and Fisheries Oceanography are the most productive in publishing climate change and fisheries-related papers. However, there is no dedicated journal on this intersection, presenting an opportunity for fisheries-focused journals to explore more climate-related topics.

The "Dimension.ai" database offers limited data access, so this study systematically analyses available literature on climate change in fisheries. Many articles are available in subscription databases like Web of Science and Scopus and developed nations often receive more support for open-access publications, leading to potential bias. Publish or Perish provides open-source access via Google Scholar. Despite data limitations regarding co-authors and affiliations, the Dimension database helps address these issues. Most scientometric studies on climate change focus on popular keywords such as adaptation, resilience, disaster, vulnerability and risk assessment (Wang *et al.,* 2014; Wei *et al.,* 2014; Wang *et al.,* 2018). The main focus of climate change research in fisheries is on its impacts on species growth, production, marine biodiversity and socioeconomic issues related to adaptation and resilience (Velumani *et al.,* 2019; Huang *et al.,* 2021; Azra *et al.,* 2022a, 2022b). Developing nations face higher adaptation costs than developed ones to minimise climate change impacts on fisheries (Sumaila and Cheung, 2010), attracting more research on the topic. Climate change risks to global food production and aquaculture vary by region, economy and species (Maulu *et al.,* 2021). Studies focus not only on impacts but also on resilience and management, helping to understand and mitigate climate change effects (Sharma *et al.,* 2024; Suryawanshi *et al.,* 2024). The bibliometric study gathered extensive data to provide targeted management approaches for addressing these challenges.

Future research should focus on specialised topics like the effects of global warming on forestry, agriculture, fisheries and viniculture (Haunschild *et al.,* 2016). Adaptation to climate change requires building strong political, legal, financial and social infrastructures, not just raising awareness (Lindegren and Brander, 2018). Integrated strategies that include social, institutional and infrastructural dimensions are crucial to resilience (Rawlani and Sovacool, 2011; Xu and Marinova, 2013). A shift to strategic environmental assessment (SEA) will enhance climate change research (Li and Zhao, 2015). Understanding how climate change affects fisheries' economic factors, such as revenues and employment, is crucial (Sumaila *et al.,* 2011). This study, unlike others, highlights the value of open-source platforms for comprehensive research.

CONCLUSION

The study concludes that many research articles on climate change with DOIs are published, likely increasing as fisheries-related institutions expand. Key research areas include climate change adaptation, ecosystem management and impacts on aquaculture and fisheries. The study tracks trends in keywords, authors and journals, highlighting thematic evolution, word growth, author productivity and journal publication counts. Future research should focus on more in-depth software-based bibliometric studies and the effects of climate change on fisheries and livelihoods.

Author contribution

Avisweta Nandy: Manuscript formatting, Manuscript correction and review
Pritam Tripathy: Conceptualisation; Investigation; Data curation; Formal analysis; Visualisation; Writing -original draft.
Subal Kumar Ghosh: Data curation; Manuscript correction and reviewing.
Dwity Sundar Rout: Manuscript correction and reviewing.

Disclaimers

The views and conclusions expressed in this article are solely those of the authors and do not necessarily represent the views of their affiliated institutions. The authors are responsible for the accuracy and completeness of the information provided, but do not accept any liability for any direct or indirect losses resulting from the use of this content.

Informed consent

All open source data had been used and this research contains no information from any sources which require consent.

Conflict of Interest

The authors have no conflict of interest.

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