Introduction

Earth, distinguished as the third planet in proximity to the Sun and the most massive of the solar system's terrestrial quartet, is uniquely characterized by its vast reserves of liquid water, covering over 71% of its surface (Carroll, 2017). This aqueous bounty has earned it the epithet "the Blue Planet," a testament to the oceans' visual dominance from space. The hydrosphere, comprising 96.54% oceanic water, serves not only as the lifeblood of our planet's biosphere but also as a pivotal regulator of atmospheric gases, including oxygen and carbon dioxide (~~Ribas~~ Fargas, 2017). It's within this regulatory matrix that the oceans contribute fundamentally to the modulation of Earth's climate, tempering weather patterns, cycling essential nutrients, and underpinning the hydrological processes that are vital to terrestrial life (Cooley et al., 2022). Oceans are the cradle from which life is theorized to have emerged, and they continue to sustain an astounding diversity of organisms, ranging from the unicellular phytoplankton that form the base of the marine food web to the colossal blue whale, the largest animal to have ever existed (Kathiresan, 2015). The scientific discipline of marine biology, broad in scope, delves into the study of these organisms, bifurcating into functional biology; the study of life processes such as mobility, sustenance, reproduction and marine ecology, which scrutinizes the complex interactions between marine life forms and their environment. These two streams, while conceptually distinct, are interwoven in practice; the functional biology of an organism often dictates its ecological role, and vice versa (Rouse, 2023).

Tracing the historical pursuit of marine biological knowledge, one encounters figures such as Aristotle, whose observations in the fourth century B.C. bestowed upon him the legacy of being marine biology's patriarch (Taylor, 1955). His holistic approach to documenting marine life provided the scaffolding for future scientific inquiry. The taxonomic classification system, refined in the 18th century by Carl Linnaeus, represents a pivotal juncture in biological sciences, offering a universal language for describing the biodiversity of the seas (Levine, 2002). The 19th-century hypothesis by Edward Forbes, which postulated a depth limit to marine life, while refuted by subsequent discoveries, reflects the nascent stage of ocean exploration (Molinos & Alabia, 2021). In the same era, Charles Darwin's extensive collection and analysis of marine specimens from the voyage of the H.M.S. Beagle laid the groundwork for evolutionary theory and a sophisticated understanding of marine adaptations (Darwin, 2005). The historical Challenger expedition, led by C. Wyville Thomson and John Murray, epitomized the era of grand voyages of discovery (Harré, 2014). It furnished the first comprehensive survey of global marine diversity, culminating in an extensive series of volumes that detailed an unprecedented array of marine life (Harré, 2014). This expedition and others like it paved the way for our contemporary understanding of marine species diversity, which includes an estimated 250,000 to 274,000 species, and illuminated the intricate relationships within marine ecosystems (Appeltans et al., 2012).

Modern marine biology builds upon these foundations, utilizing cutting-edge technologies such as genomics, remote sensing, and advanced diving apparatus to explore the furthest reaches of the marine world (Schwing, 2023). Contemporary research continues to unravel the complex ecological interactions and adaptative mechanisms of marine life, revealing not only the intrinsic elegance of marine ecosystems but also their susceptibility to anthropogenic pressures (Trevisan & Mello, 2023). This evolving body of knowledge underscores the importance of the oceans in global ecological balance and reinforces the imperative to steward the unique and precious resource that is our "Blue Planet (Lubchenco & Haugan, 2023).

The diversity and distribution of marine organisms are a testament to the adaptability and resilience of life forms in a variety of aquatic environments, ranging from the abyssal depths of the oceanic trenches to the fluctuating margins of the world's coastlines (El-Regal & Satheesh, 2023). Marine biodiversity is vast, with recent estimates suggesting that 50-80% of all life on earth is found under the ocean surface (Costello & Chaudhary, 2017). This biodiversity is not evenly distributed, however; it is profoundly influenced by a multitude of factors, including water temperature, salinity, the availability of light and nutrients, and the presence of suitable habitats. In the context of marine biodiversity, Molluscs constitute one of the most diverse and widespread phyla. They are highly adaptive organisms that have conquered nearly every marine habitat, from tidal pools to the deep sea (Dong et al., 2022). In India, the diversity and distribution of Molluscs have been the focus of scientific inquiry due to their ecological significance and economic value (Tripathy & Mukhopadhayay, 2015). The Indian coastline, which stretches for more than 7,500 kilometers, harbors a rich variety of molluscan species, reflecting the diverse habitats ranging from the tropical waters of the Indian Ocean to the temperate zones of the Bay of Bengal and the Arabian Sea (Joshi, 2010). Particularly, the state of Gujarat, with its extensive coastline, features a unique assemblage of marine Molluscs. The geographical location of Gujarat, with the vast intertidal zones of the Gulf of Kachchh and the Gulf of Khambhat, provides a range of habitats, including mudflats, sandy beaches, rocky shores, and mangroves (Sukumaran et al., 2021). These habitats support a myriad of Molluscan species, each adapted to its niche environment. The coastal diversity is mirrored in the estuarine and nearshore ecosystems, where the influx of freshwater meets the saline sea, creating dynamic environments that challenge the physiological tolerance of resident Molluscs (Mitra & Zaman, 2016).

Zooming into the Saurashtra coast, a part of Gujarat's intricate coastline, one encounters an even more specialized community of Molluscs (Vaghela, 2010). The Saurashtra region is characterized by its rugged topography, which includes cliffs, rocky shores, and sandy beaches interspersed with patches of coral reefs and seagrass beds. (Valentine et al., 2009). The intertidal zones of the Saurashtra coast, with their periodic exposure to air and their nutrient-rich waters, are particularly conducive to molluscan abundance and diversity (Sen & Naskar, 2003). Species such as gastropods and bivalves exhibit a range of adaptations here, from the burrowing behaviors of clams to the rock-grazing habits of limpets and snails. The habitats of Molluscs are as varied as the organisms themselves. While some bivalves filter feed within the soft sediments of estuaries and coastal wetlands, others, like certain species of gastropods, may be found in the challenging conditions of tidal pools, where they must contend with fluctuating temperatures and salinity levels (Little, 2000). Molluscs serve crucial ecological roles, from being integral components of the food web to influencing the geochemical structure of their environments through their calcareous shells. The study of their distribution and diversity not only enriches our understanding of marine biology but also offers insights into the health and stability of marine ecosystems (Council et al., 1995).

This thesis explores the diversity and distribution of Molluscs along the Saurashtra coast, examining their habitats and the adaptations that have enabled their survival in such a heterogeneous environment. Through this investigation, patterns of Molluscan biodiversity in relation to the distinct habitats of the Saurashtra coast will be elucidated, contributing to the broader narrative of marine biological wealth of India. Studying these organisms in their natural settings will enhance our understanding of their ecological roles, biogeographical patterns, and the conservation challenges faced in an era of global environmental change. Furthermore, a bibliometric analysis of global Molluscan diversity was conducted to review existing literature, providing a comprehensive overview of research trends, influential studies, and geographical focus areas in the field. By integrating these insights, the findings from the Saurashtra coast will be positioned within the wider context of global Molluscan research, highlighting both unique regional patterns and broader ecological implications.

Bibliometric Analysis of Molluscan research

A. Overview of Molluscs

Molluscs, a diverse phylum spanning terrestrial, freshwater, and marine habitats, comprise over 100,000 species, showcasing intricate evolutionary history (Lindberg et al., 2004). Their adaptable soft-bodied anatomy, often with shells, fuels diverse forms and lifestyles. Molluscs, ranging from the simple gastropods to the more complex cephalopods with sophisticated nervous systems, are fascinating due to their diverse adaptations. Molluscs exhibit distinct anatomical features and ecological roles (Cuvier, 1795). Gastropoda hosts diverse snails and slugs across habitats, while Bivalvia, including clams and mussels, thrives in aquatic environments, influencing ecological processes (Okafor, 2009). Cephalopoda, featuring octopuses and squids, showcase intelligence and marine predatory behaviors (Amodio et al., 2020). These organisms play crucial roles in nutrient cycling, biodiversity maintenance, and as bioindicators of environmental health. Economically, they drive fisheries, shell-based industries, and crafts. Research in multiple disciplines explores their evolutionary history, genetics, ecology, and responses to environmental stressors, providing insights into these captivating organisms (Feder et al., 2000). Advancements in molecular techniques, such as DNA sequencing and omics technologies, have revolutionized the understanding of Molluscan biology, unraveling intricate genetic networks and evolutionary relationships among taxa (Matos et al., 2020). These molecular tools, coupled with traditional morphological and ecological approaches, provide a comprehensive framework for unraveling the complexities underlying Molluscan diversity and evolution (Kocot et al., 2011). This comprehensive investigation, facilitated by the application of innovative methodologies and interdisciplinary collaborations, offers invaluable insights into the dynamics of these captivating organisms, paving the way for informed conservation strategies and a deeper appreciation of the natural world.

B. The Significance of Molluscs Research

The significance of Mollusc research in the context of environmental monitoring is multifaceted and increasingly relevant due to the diverse roles these organisms play in aquatic ecosystems and their sensitivity to environmental changes. Molluscs, including bivalves and gastropods, inhabit a wide range of habitats from terrestrial to marine environments, making them excellent indicators of environmental health and changes (SRIVASTAVA & SINGH, 2020).

Molluscs are vital to the carbonate cycle due to their calcareous shells, which have implications for understanding past and present ocean chemistry and biogeochemical cycles (Vashist et al., 2023). Their sensitivity to environmental changes, such as ocean acidification and heavy metal pollution, allows scientists to use them as bioindicators for monitoring ecosystem health (Reguera et al., 2018). The "Mussel Watch Program" is one such successful biomonitoring initiative that leverages the bioindicator capabilities of Molluscs to assess the health of aquatic environments (Fortunato, 2015). Further, Molluscs are integral to benthic ecosystems, providing habitat and influencing the colonization and settlement processes of various marine organisms. Their role as ecosystem engineers in coastal, estuarine, and riverbed habitats underscores the need to understand and monitor their responses to environmental stressors, such as habitat destruction, climate change, and anthropogenic impacts (Fortunato, 2015).

Research on bivalve Molluscs has highlighted their utility in monitoring metal pollution levels in aquatic environments. Bivalves, due to their filter-feeding habits and sedentary nature, accumulate metals in their tissues, reflecting the local metal concentrations and thus serving as effective biomonitors for assessing pollution levels (Boening, 1999). This capacity for bioaccumulation, coupled with their ecological significance, positions bivalves as key species in environmental monitoring programs aimed at detecting and assessing the impact of metal pollution on aquatic ecosystems and human health (Yap et al., 2021). Moreover, studies have demonstrated the potential of marine Molluscs to monitor organic pollutants in sediments and their tissues, revealing pollution trends and providing insights into the bioavailability and transfer of pollutants within marine ecosystems. It is crucial to understand the persistence and impact of organic pollutants, such as polycyclic aromatic hydrocarbons (PAHs), on marine life and the broader environment (Gan et al., 2021; Moore et al., 1987). The findings underscore the need for ongoing monitoring and research to protect marine ecosystems and ensure the sustainability of Molluscan populations and the services they provide (Bresler et al., 2003).

The Molluscan research is indispensable for environmental monitoring, offering insights into the health of aquatic ecosystems, the impacts of pollution, and the broader implications for biodiversity and human health (Gupta & Singh, 2011). The continued study of these organisms will play a crucial role in conservation efforts and in shaping policies aimed at preserving the integrity of our natural environments.

C. Significance of Bibliometric Analysis in Molluscan Research

Bibliometric analysis stands as a pivotal tool in the contemporary scientific landscape, enabling a systematic and quantitative exploration of the vast corpus of scholarly literature within the realm of Molluscan research. Its significance is underscored by its capacity to unveil intricate patterns, trends (Cao et al., 2023), and dynamics entrenched (Mabele et al., 2023) within the scientific discourse. Through the meticulous parsing of publication data, citation networks, and authorship trends, bibliometric analysis furnishes invaluable insights into the evolution of ideas, emergence of seminal contributions, and the interplay of knowledge dissemination within the Molluscan domain. This methodological approach acts as a compass, guiding researchers through the labyrinth of information, facilitating the identification of seminal works, uncovering research gaps, and delineating the trajectory of scientific inquiry.

Moreover, the application of bibliometric analysis within Molluscan research transcends mere scrutiny of scholarly output; it serves as a compass guiding the course of future investigations. By unveiling the intellectual lineage of ideas and highlighting seminal contributions, this analytical approach facilitates informed decision-making regarding research directions and resource allocation. Additionally, it delineates pivotal research themes and illuminates the interwoven collaborative networks and interdisciplinary junctures driving scientific progress in the realm of Molluscans through this methodical evaluation, bibliometric analysis augments the strategic planning and policy-making processes, fostering an environment conducive to sustained scientific progress and innovation.

Methodology

The entire methodology consisted of two distinct components as depicted in Fig (1) Data retrieval and data analysis.

A. Data retrieval

The primary data source employed for this study was the Science Citation Index (SCI) database within the Scopus core collection, renowned for its expansive academic repository. A query formula was applied to extract research articles on phylum Mollusca from 1969 to 2024. The search was refined using keywords related to marine Molluscs, encompassing names of specific species, their ecological roles, evolutionary research, and their impacts on society and economics. A meticulous process of retrieval and screening resulted in the identification of a total of 2,276 articles out of 32,714 articles. These articles were subjected to subsequent quantitative analyses encompassing various publishing metrics, including publication year, affiliating institution, authorship, journal, country of origin, and employed keywords, as outlined by Williams and team (Williams et al., 2015). The specific query formula utilized for this extraction encompassed a comprehensive set of exact keywords related to Mollusca and its various facets, restricted to specific document types and languages while emphasizing articles from reputable sources at their final publication stage.

The query formula utilized for this extraction was: (TITLE-ABS-KEY(Mollusca) AND PUBYEAR > 1969 AND PUBYEAR < 2024 AND (LIMIT-TO (EXACTKEYWORD,"Mollusca") OR LIMIT-TO (EXACTKEYWORD,"Mollusc") OR LIMIT-TO (EXACTKEYWORD,"Gastropoda") OR LIMIT-TO (EXACTKEYWORD,"Bivalvia") OR LIMIT-TO (EXACTKEYWORD,"Bivalve") OR LIMIT-TO (EXACTKEYWORD,"Physiology") OR LIMIT-TO (EXACTKEYWORD,"Controlled Study") OR LIMIT-TO (

EXACTKEYWORD,"Metabolism") OR LIMIT-TO (EXACTKEYWORD,"Gastropod") OR LIMIT-TO (EXACTKEYWORD,"Snail") OR LIMIT-TO (EXACTKEYWORD,"Molluscs") OR LIMIT-TO (EXACTKEYWORD,"Animal Tissue") OR LIMIT-TO (EXACTKEYWORD,"Taxonomy") OR LIMIT-TO (EXACTKEYWORD,"Phylogeny") OR LIMIT-TO (EXACTKEYWORD,"Biodiversity") OR LIMIT-TO (EXACTKEYWORD,"Genetics") OR LIMIT-TO (EXACTKEYWORD,"Female") OR LIMIT-TO (EXACTKEYWORD,"Male") OR LIMIT-TO (EXACTKEYWORD,"Comparative Study") OR LIMIT-TO (EXACTKEYWORD,"Morphology") OR LIMIT-TO (EXACTKEYWORD,"Algae") OR LIMIT-TO (EXACTKEYWORD,"Histology") OR LIMIT-TO (EXACTKEYWORD,"Evolution") OR LIMIT-TO (EXACTKEYWORD,"Shell") OR LIMIT-TO (EXACTKEYWORD,"Classification") OR LIMIT-TO (EXACTKEYWORD,"Shellfish") OR LIMIT-TO (EXACTKEYWORD,"Nucleotide Sequence") OR LIMIT-TO (EXACTKEYWORD,"Cytology") OR LIMIT-TO (EXACTKEYWORD,"Cephalopoda") OR LIMIT-TO (EXACTKEYWORD,"Environmental Monitoring") OR LIMIT-TO (EXACTKEYWORD,"Species Specificity") OR LIMIT-TO (EXACTKEYWORD,"Marine Environment") OR LIMIT-TO (EXACTKEYWORD,"Seawater") OR LIMIT-TO (EXACTKEYWORD,"Species Diversity") OR LIMIT-TO (EXACTKEYWORD,"New Species") OR LIMIT-TO (EXACTKEYWORD,"Snails") OR LIMIT-TO (EXACTKEYWORD,"Electron Microscopy") OR LIMIT-TO (EXACTKEYWORD,"Calcium") OR LIMIT-TO (EXACTKEYWORD,"Isolation And Purification") OR LIMIT-TO (EXACTKEYWORD,"Species Difference") OR LIMIT-TO (EXACTKEYWORD,"Growth, Development And Aging") OR LIMIT-TO (EXACTKEYWORD,"Benthos") OR LIMIT-TO (EXACTKEYWORD,"MOLLUSCA") OR LIMIT-TO (EXACTKEYWORD,"Mussel") OR LIMIT-TO (EXACTKEYWORD,"Ecology") OR LIMIT-TO (EXACTKEYWORD,"Abundance") OR LIMIT-TO (EXACTKEYWORD,"Temperature") OR LIMIT-TO (EXACTKEYWORD,"Gene Expression") OR LIMIT-TO (EXACTKEYWORD,"Muscle") OR LIMIT-TO (EXACTKEYWORD,"Oyster") OR LIMIT-TO (EXACTKEYWORD,"Marine Biology") OR LIMIT-TO (EXACTKEYWORD,"Enzyme Activity") OR LIMIT-TO (EXACTKEYWORD,"Protein") OR LIMIT-TO (EXACTKEYWORD,"Muscles") OR LIMIT-TO (EXACTKEYWORD,"Species Richness") OR LIMIT-TO (EXACTKEYWORD,"Water Pollution") OR LIMIT-TO (EXACTKEYWORD,"Cephalopod") OR LIMIT-TO (EXACTKEYWORD,"Sea Water") OR LIMIT-TO (EXACTKEYWORD,"Sediment") OR LIMIT-TO (EXACTKEYWORD,"Toxicity") OR LIMIT-TO (EXACTKEYWORD,"PH") OR

LIMIT-TO (EXACTKEYWORD,"Mytilus Edulis") OR LIMIT-TO (EXACTKEYWORD,"Molluscs") OR LIMIT-TO (EXACTKEYWORD,"Fresh Water") OR LIMIT-TO (EXACTKEYWORD,"Molecular Weight") OR LIMIT-TO (EXACTKEYWORD,"DNA") OR LIMIT-TO (EXACTKEYWORD,"Ganglion") OR LIMIT-TO (EXACTKEYWORD,"Action Potentials") OR LIMIT-TO (EXACTKEYWORD,"Zinc") OR LIMIT-TO (EXACTKEYWORD,"Seasonal Variation") OR LIMIT-TO (EXACTKEYWORD,"Mytilus") OR LIMIT-TO (EXACTKEYWORD,"Biomass") OR LIMIT-TO (EXACTKEYWORD,"Mytilus Galloprovincialis")) AND (LIMIT-TO (SRCTYPE,"j") OR LIMIT-TO (SRCTYPE,"k") OR LIMIT-TO (SRCTYPE,"b")) AND (LIMIT-TO (LANGUAGE,"English")) AND (LIMIT-TO (PUBSTAGE,"final")) AND (LIMIT-TO (DOCTYPE,"ar"))).

B. Data analysis

The analysis of the extracted pertinent data from a Scopus dataset of 2,276 manuscripts employed two distinct programs: R studio (1.4.5) and VOSviewer (1.6.20) (Olisah & Adams, 2021). Bibliometrix, embedded in the R studio programming environment, has been developed to offer advanced functionalities for bibliometric analysis, enabling intricate examination of citation networks and facilitating their visualization (Borrett et al., 2018). Conversely, VOSviewer has emerged as a specialized software solution meticulously designed for creating and depicting bibliometric networks (Cesarano et al., 2021), extensively adopted across the bibliometric research spectrum.

The Bibliometrix package in R studio was utilized to conduct a comprehensive cluster analysis, emphasizing authorial contributions, affiliated national entities, and the intricate web of collaborative endeavors (Hughes, 2012). A comprehensive bibliometric analysis was conducted on Mollusc research, focusing on the frequency and interplay of key terms within the field. This in-depth investigation, inspired by the approach of Roemer and Borchardt (2015), revealed subtle yet significant trends and core subjects that characterize Mollusc studies. Furthermore, utilizing the capabilities of ArcGIS v10.8 (ESRI, Inc., Redlands, CA), an intricate geospatial visualization was crafted. This map effectively displays the worldwide distribution of Mollusc research publications, categorized by their originating countries, offering a clear visual representation of the global reach and geographical diversity of this scientific domain.

Within bibliometric assessment, the Impact Factor and the H-index played pivotal roles as cornerstone metrics (Hossain et al., 2020). The Impact Factor, encapsulating the overarching influence and academic rigor of manuscripts associated with a journal, guides scholars in journal selection and serves as a barometer for academic prominence.

The H-index serves as a metric to gauge the cumulative impact of an individual's or nation's research contributions, highlighting the depth of scholarly activity within specific fields, as described by (Grech & Rizk, 2018). This indicator's higher values denote a significant academic presence. In conducting this study, the impact factors were carefully selected from the 2023 Journal Citation Report provided by Clarivate Analytics, following the methodology outlined by (Kelly & Jennions, 2006). This approach ensures a reliable assessment of journal prestige and influence, guiding the evaluation of scholarly work. The H-index values were calculated using the analytical capabilities of the Bibliometrics package, as illustrated in Prisma flow diagram (Figure 1).

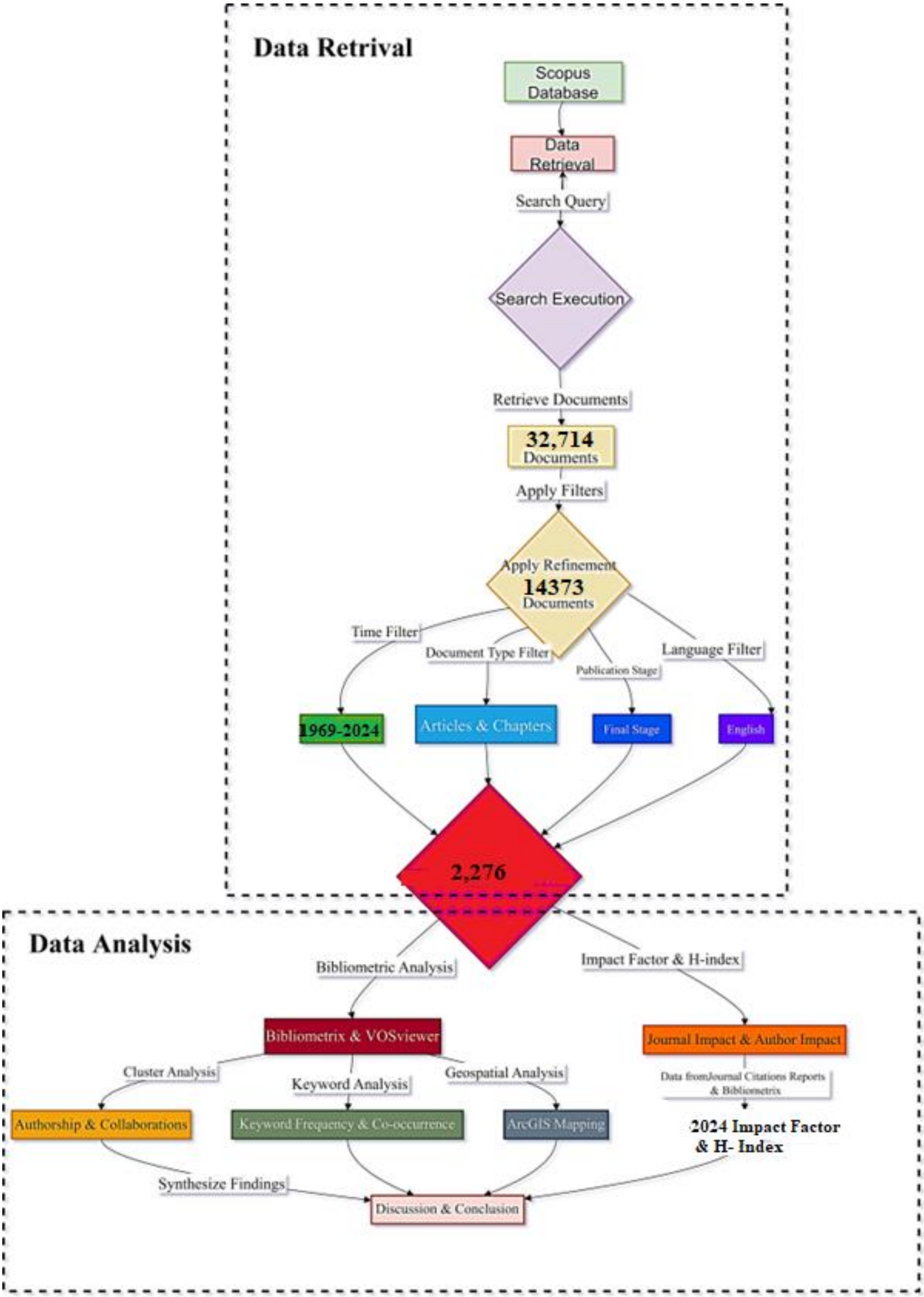

Figure 1: Workflow Diagram of Data Retrieval and Analysis in Molluscan Research (1969-2024)

Results

The production of articles for bibliometric analysis underwent dynamic fluctuations over the years. Commencing from 1969 with a minimal count of 2 articles, subsequent years witnessed sporadic variations in publication output. Between 1973 and 1979, a gradual increase occurred, with intermittent contributions observed in some years. The year 1980 witnessed a slight dip before a resurgence in 1981 and subsequent years, signifying a growing interest in marine Mollusc research. From 1990 onwards, a discernible upward trend in publication output emerged, showcasing an escalating interest in this research domain. Notably, from 2001, a significant surge in articles occurred, reflecting a substantial intensification in scholarly activities related to marine Molluscs. This trend continued notably until 2021, witnessing a consistent increase in research output, peaking at 132 articles. However, in 2022 and 2023, a decline in article production is evident, possibly suggesting a temporary deviation or a shift in focus within the scholarly community studying marine Molluscs. This fluctuation in output may indicate various factors such as evolving research priorities, funding alterations, or transitional phases within the field, warranting further investigation for a comprehensive understanding of the observed trend.

A. Publication Growth Over Time

The article production in "A Bibliometric Analysis of Research on Marine Mollusca" shows dynamic fluctuations. From 1969 to 1989, output was subdued with sporadic peaks in 1978, 1979, and 1990. Post-1990, there was a significant surge in research, with consistent growth from 1991 to 2003. A peak occurred in 2004 with 68 articles, culminating in 2011 with 124 articles, indicating heightened academic interest. From 2011 to 2023, article production remained high but fluctuated, with a slight decline in 2022 and 2023.

The "Annual Total Citation per Year" metric reveals the citation impact dynamics. Starting with a mean of 20.5 citations per article in 1969, the citation impact varied over time. The peak in 1992 showed 89.17 mean citations per article. After 2000, a declining trend emerged, with mean citations dropping from 52.56 in 2000 to 7.56 in 2021. In 2022 and 2023, mean citations per article fell to 3.4 and 0.71, respectively, indicating reduced scholarly attention. These trends reflect evolving recognition and shifts in research focus within marine Mollusc studies.

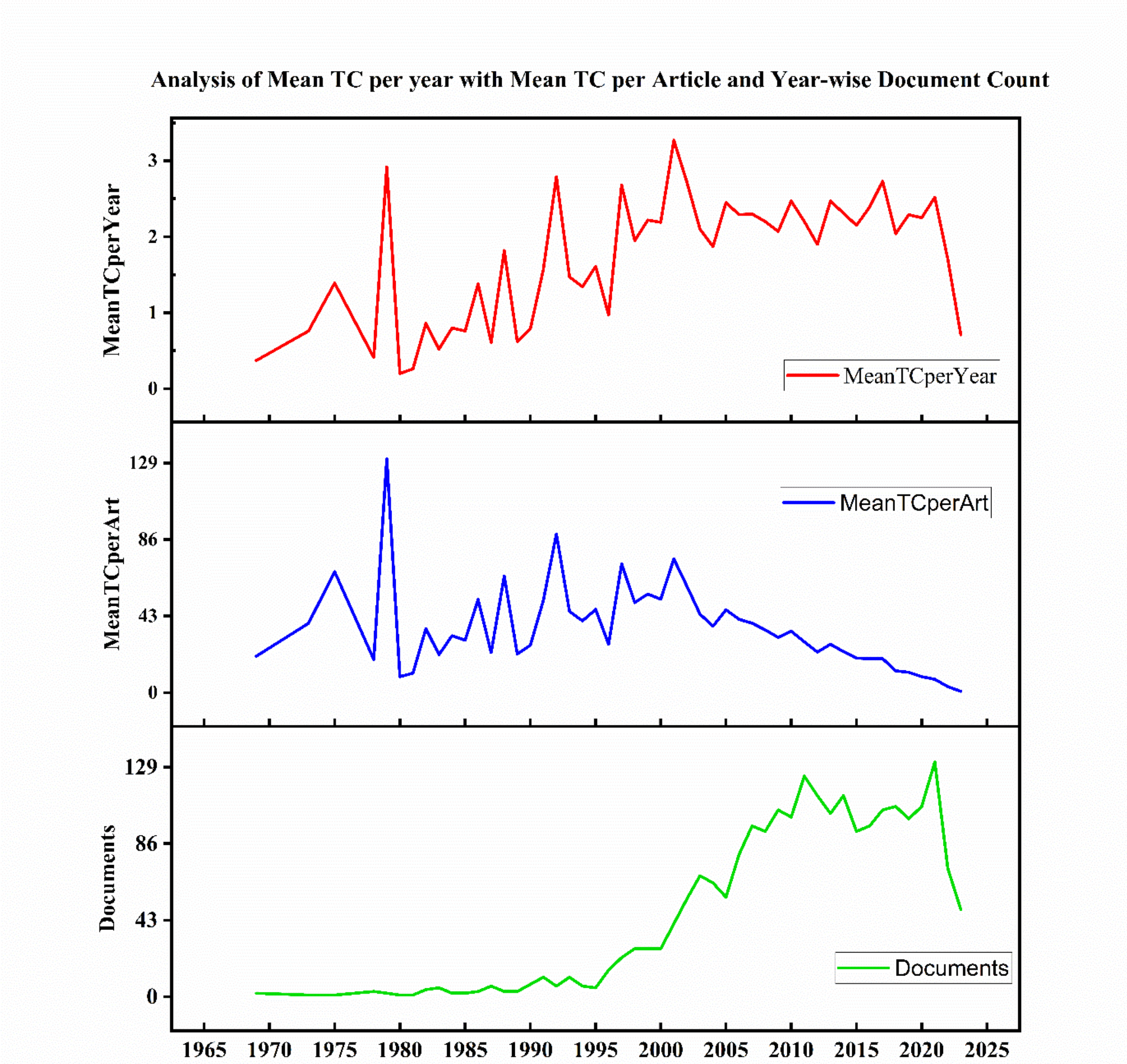

Figure 2: The figure depicting the Documents, Mean Total Count per articles, Mean Total Count per Year for the Year (1969-2024)

B. Authorship Patterns and Collaboration Networks

The analysis of authorship patterns and collaboration networks in marine Mollusc research reveals key global contributions. The United States leads with 259 articles, showing a high independent research output (192 SCP) and notable international collaborations (MCP Ratio 0.259). China follows with 122 articles and a higher MCP Ratio (0.287), indicating active collaboration despite fewer individual publications.

Germany and France contribute significantly with 110 and 101 articles, respectively, both displaying high MCP Ratios (0.464 for Germany and 0.406 for France), emphasizing strong collaborative efforts. The UK, Italy, and Spain have similar article counts (95-99), with Italy showing a dominance in independent publications (62 SCP). Brazil shows a high SCP count (73) but a low MCP Ratio (0.180), indicating limited international collaboration. Japan, Argentina, and India present balanced SCP and MCP distributions but with lower MCP Ratios (0.171 for Argentina and 0.103 for India), reflecting less collaboration. Austria and Portugal, despite lower article counts, exhibit high MCP Ratios (0.571 and 0.552), indicating active collaboration. This analysis highlights the balance between independent contributions and international collaborations in marine Mollusc research across different countries.

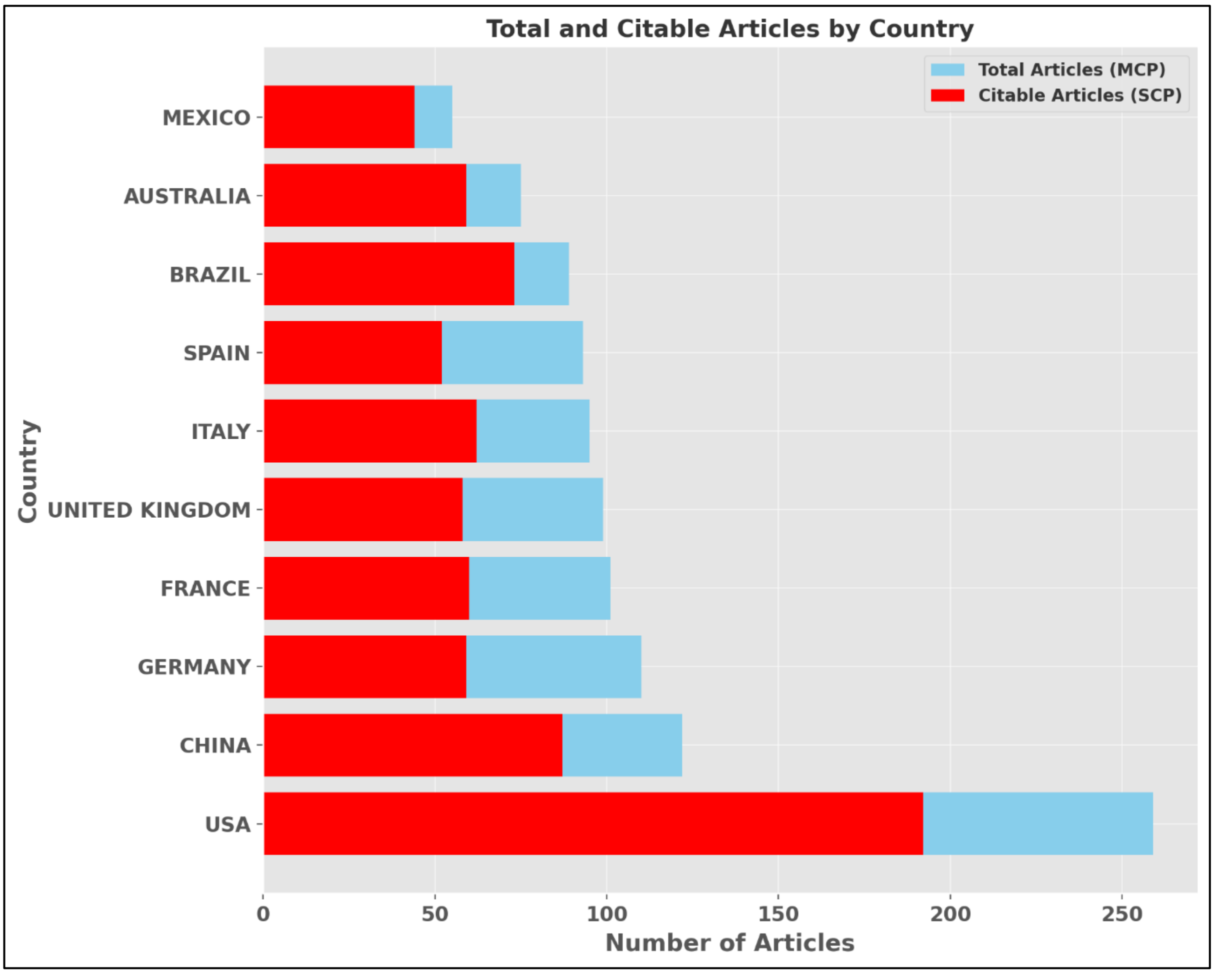

Figure 3: Comparative analysis of MCP and SCP

C. Geographic Distribution of Research

The geographic distribution of marine Mollusc research highlights significant contributions from various regions. The United States leads with 1245 publications, followed by China with 718 and Italy with 556. Germany (525), France (493), and the UK (468) also show strong engagement. Brazil and Spain each contribute over 400 publications (446 and 412, respectively), while Australia has 345 and Japan 245. These figures reflect active and growing interest in marine Mollusc studies across these regions. (Fig)

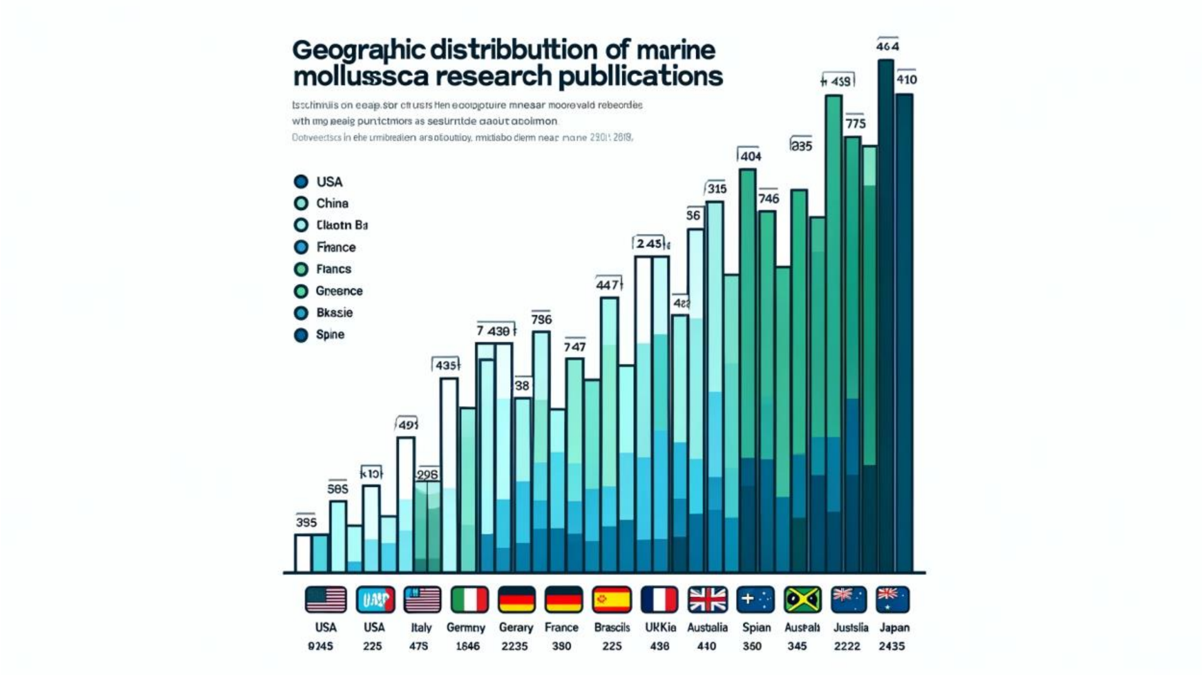

Figure 4: Comparative Chart of Total and Single Country Publications in Molluscan Research by Country

D. Interdisciplinary Trends in Molluscan Research

The bibliometric analysis reveals the diverse scope of Molluscan research across scientific disciplines. Agricultural and Biological Sciences lead with 12,316 articles (34.79%), highlighting the ecological significance of Molluscs. Biochemistry, Genetics, and Molecular Biology follow with 6,801 articles (19.21%), exploring their molecular and genetic adaptations. Environmental Science contributes 5,412 articles (15.29%), emphasizing Molluscs as bioindicators. Earth and Planetary Sciences, with 4,841 articles (13.67%), focus on their fossil records for paleontological studies. Medicine accounts for 2,433 articles (6.87%), utilizing Molluscs in pharmaceutical research. Immunology and Microbiology (1,481 articles, 4.18%) and Pharmacology, Toxicology, and Pharmaceutics (1,170 articles, 3.30%) investigate their immune mechanisms and natural toxins. The Multidisciplinary sector, with 947 articles (2.68%), underscores the cross-disciplinary impact of Molluscan studies (Figure 5).

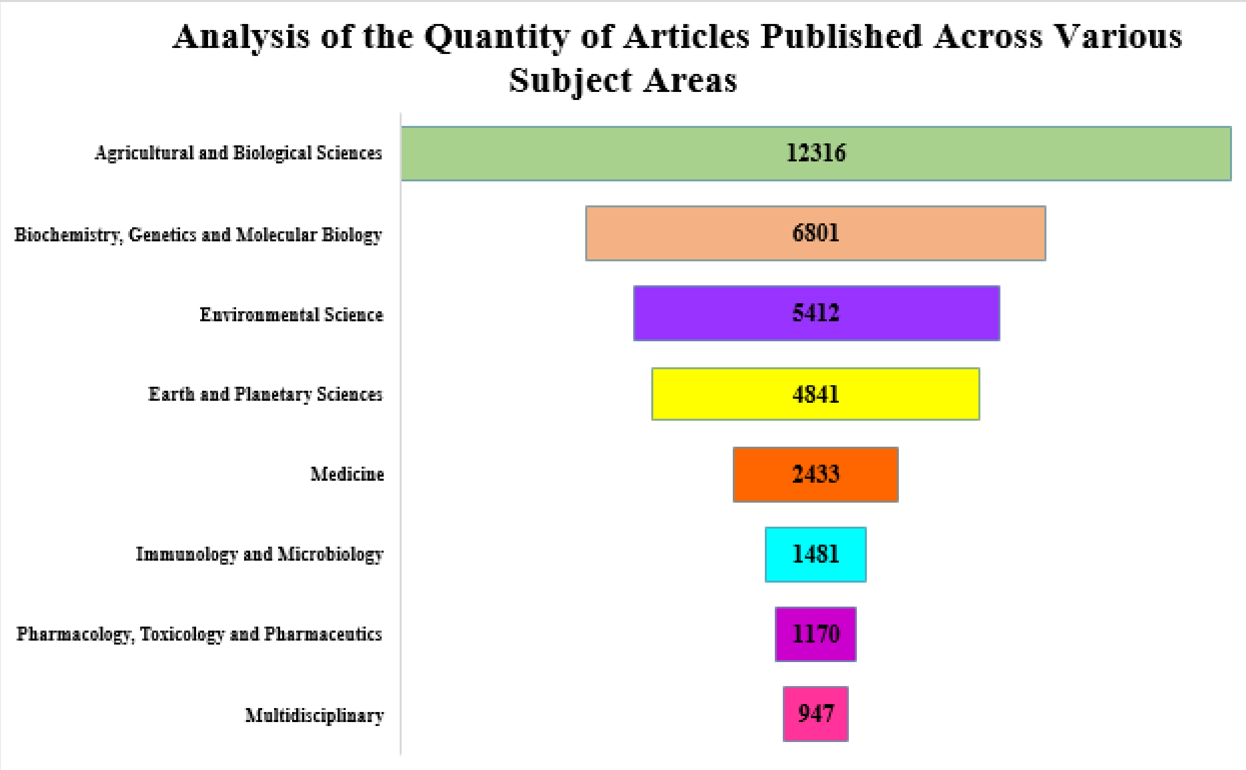

Figure 5: Distribution of Molluscan Research Articles by Scientific Discipline

E. Most Globally Cited Papers and Influential Authors

The table presents a compilation of significant works exploring diverse aspects of Molluscs, encompassing their biology, ecology, culture, evolution, diseases, and environmental contributions. The seminal textbook by Gosling (2008) extensively covers bivalve Molluscs, delving into their biology, ecology, and culture, amassing 1656 citations, reflecting its comprehensive insights. Bayne and Newell's work (1983) focuses on the physiological energetics of marine Molluscs, acquiring 1428 citations and delving into energy budgets across various species. Dillon's ecological exploration of freshwater Molluscs (2000) garnered 896 citations, offering valuable insights into the ecological dynamics of these aquatic organisms. Furthermore, reviews on specific topics stand out: Villalba, Reece, Ordás, Casas, and Figueras (2004) examine perkinsosis in Molluscs, emphasizing the disease caused by

Perkinsus marinus, amassing 407 citations. Gibson, Barnes, and Atkinson (2001) discuss Molluscs as archives of environmental change, highlighting their potential in reconstructing environmental conditions, garnering 360 citations. Berthe, Le Roux, Adlard, and Figueras (2004) investigate marteiliosis, a disease triggered by Marteilia refringens, amassing 160 citations. The evolutionary aspects are covered by Wanninger and Wollesen (2019), exploring the evolution of Molluscs, accumulating 138 citations. Haszprunar and Wanninger (2012) contribute a chapter within Current Biology, garnering 137 citations and discussing the biology, ecology, and evolution of Molluscs. Vinther's work (2015) on the origins of Molluscs, published in Palaeontology, obtained 94 citations, delving into the evolutionary beginnings of these organisms. These works collectively represent an expansive and impactful body of literature exploring the multifaceted dimensions of Molluscs, from their fundamental biology to their ecological roles, diseases, and evolutionary trajectories (Table 1).

Table 1: Most Globally cited papers for the Molluscan Research.

CITATION GLOBALLY		
Paper	DOI	Total citations
Gosling, E. (2008). Bivalve Molluscs: biology, ecology and culture. John Wiley & Sons	https://books.google.co.in/books?hl=en&lr=&id=mnQtr7GAjy0C&oi=fnd&pg=PR5&dq=Molluscs+&ots=kZAn1WFKMt&sig=Rsc0IgJAEFFGSUH mg03tFPQzgLM&redir_esc=y#v=onepage&q=Molluscs&f=false	1656

(Gosling, 2008).		
Bayne, B. L., & Newell, R. C. (1983). Physiological energetics of marine Molluscs. In *The Mollusca* (pp. 407-515). Academic press (Bayne & Newell, 1983)	https://doi.org/10.1016/B978-0-12-751404-8.50017-7	1428
(Dillon, 2000) The ecology of	https://books.google.co.in/books?hl=en&lr=&id=j452fQtp8koC&oi=fnd&pg=PP1&dq=Molluscs+&ots=JWwZzE8F62&sig=9hQ7Ojdm-83Wpu2ZsRwfLsynDpg&redir_esc=y#v=onepage&q=Molluscs&f=false	896

freshwater Molluscs.		
(Villalba et al., 2004) Perkinsosis in Molluscs: a review. *Aquatic living resources*, *17*(4), 411-432.	https://doi.org/10.1051/alr:2004050	407
(Gibson et al., 2001) Molluscs as archives of environmental change. Oceanogr. Mar. Biol. Annu. Rev, 39, 103-164.	https://books.google.co.in/books?hl=en&lr=&id=fPUdxCqI6m4C&oi=fnd&pg=PA103&dq=Molluscs+&ots=Qssrk5Ib7K&sig=hLpt1pqLxcdTrntSS3vX1BAwNpQ&redir_esc=y#v=onepage&q=Molluscs&f=false	360

(Barker, 2001) *The biology of terrestrial Molluscs*. CABI publishing.	https://www.cabidigitallibrary.org/doi/abs/10.1079/9780851993188.0000	332
(Berthe et al., 2004) Marteiliosis in Molluscs: a review. Aquatic Living Resources, 17(4), 433-448.	https://doi.org/10.1051/alr:2004051	160
(Wanninger & Wollesen, 2019) The evolution of Molluscs. *Biological*	https://doi.org/10.1111/brv.12439	138

Reviews, *94*(1), 102-115.		
(Haszprunar & Wanninger, 2012) Molluscs. Current Biology, 22(13), R510-R514.	chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.cell.com/current-biology/pdf/S0960-9822(12)00592-1.pdf	137
(Vinther, 2015) The origins of Molluscs. *Palaeontology*, *58* (1), 19-34.	https://doi.org/10.1111/pala.12140	94

F. Locally top cited papers

The data provided enumerates seminal research on Molluscs within the Indian context, reflecting diverse facets of their ecology, environmental contributions, and disease dynamics. The highest citation count is attributed to Mitra and Choudhury's study in 1993, exploring trace metals in macrobenthic Molluscs of the Hooghly estuary, accumulating 95 citations. Sarkar, Cabral, Chatterjee, and colleagues' research in 2008 scrutinized heavy metal biomonitoring in bivalve Molluscs in the Sunderban mangrove wetland, amassing 81 citations. Following suit, Kesavan, Murugan, Venkatesan, and Kumar's investigation in 2013 focused on heavy metal accumulation in Molluscs from the

Uppanar estuary, collecting 67 citations. Other studies, like Mitra and Dey (2010), Khade and Mane (2012), and Boominathan, Ravikumar, Chandran, and Ramachandra (2012), delve into annotated checklists, diversity, and mangrove-associated Molluscs, garnering 49, 23, and 23 citations, respectively. Additionally, Mavinkurve, Shanbhag, and Madhyastha (2004) highlight non-marine Molluscs of the Western Ghats, accumulating 22 citations, while Tripathy and Mukhopadhayay (2015) provide insights into the diversity, distribution, and conservation of freshwater Molluscs, amassing 15 citations. Moreover, Paul, Panigrahi, and Tripathy's study in 2014 examined marine Mollusc diversity on the northeast coast, securing 11 citations, similar to studies by Biju Kumar and Ravinesh (2015) on taxonomy and challenges in marine Mollusc classification. This collection of studies illustrates the breadth of research conducted on Molluscs in India, emphasizing varied aspects such as heavy metal analysis, ecological monitoring, taxonomy, and conservation strategies (Table 2).

Table 2: Locally top cited papers

Maximum Citation in India		
Paper	DOI	Total citations
(Mitra & Choudhury, 1993) Trace metals in macrobenthic Molluscs of the Hooghly estuary, India. Marine pollution bulletin, 26(9), 521-522.	chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.researchgate.net/profile/Abhijit-Mitra-4/publication/327390219_Molluscan_Baseline_on_Heavy_Metals/links/5f401c1f299bf13404dddfb1/Molluscan-Baseline-on-Heavy-Metals.pdf	95
(Sarkar et al., 2008) Biomonitoring of heavy metals using the bivalve Molluscs in Sunderban mangrove wetland, northeast coast of Bay of Bengal (India): possible risks to human health.	https://doi.org/10.1002/clen.200700027	81

CLEAN–Soil, Air, Water, 36(2), 187-194.		
(Kesavan et al., 2013) Heavy metal accumulation in Molluscs and sediment from Uppanar estuary, southeast coast of India. Thalassas, 29(2), 15-21.	http://eprints.cmfri.org.in/9742/	67
(Mitra & Dey, 2010) Annotated checklist of Indian land Molluscs. *Occasional Paper-Records of the Zoological Survey of India*, (306).	https://www.cabdirect.org/cabdirect/abstract/20113115401	49
(Khade & Mane, 2012) Diversity of Bivalve and Gastropod, Molluscs of some localities from Raigad district, Maharashtra, west coast of India. Recent Research in Science and Technology, 4(10).	chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://core.ac.uk/download/pdf/236010499.pdf	23
(Khade & Mane, 2012) Mangrove associated Molluscs of India. In National Conference on Conservation and Management of Wetland Ecosystems (Vol. 7, pp. 1-11).	chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://wgbis.ces.iisc.ac.in/energy/lake2012/fullpaper/boomi_fullpaper.pdf	23

(Mavinkurve et al., 2004) Non-marine Molluscs of Western Ghats: A status review. Zoos' Print Journal, 19(12), 1708-1711.	chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.researchgate.net/profile/Rajendra-Mavinkurve/publication/215630200_Non-marine_Molluscs_of_Western_Ghats_A_status_review/links/5dc6904d299bf1a47b244226/Non-marine-Molluscs-of-Western-Ghats-A-status-review.pdf	22
(Tripathy & Mukhopadhayay, 2015) Freshwater Molluscs of India: An insight of into their diversity, distribution and conservation. *Aquatic Ecosystem: Biodiversity, Ecology and Conservation*, 163-195.	https://link.springer.com/chapter/10.1007/978-81-322-2178-4_11	15
(Tripathy & Mukhopadhayay, 2015) A study of marine Molluscs with respect to their diversity, relative abundance and species richness in northeast coast of India. Indian Journal of Applied Research, 40(12), 40-43.	chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.researchgate.net/profile/Basudev-Tripathy/publication/339815269_A_Study_of_Marine_Molluscs_With_Respect_to_Their_Diversity_Relative_Abundance_and_Species_Richness_in_North-East_Coast_of_India/links/5e6727674585153fb3d1d329/A-Study-of-Marine-Molluscs-With-Respect-to-Their-Diversity-Relative-Abundance-and-Species-Richness-in-North-East-Coast-of-India.pdf	11
(Tripathy & Mukhopadhayay, 2015) Taxonomy of marine Molluscs of India: status and challenges ahead. In	chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.researchgate.net/profile/Ravinesh-R/publication/303333869_Taxonomy_of_Marine_Molluscs_of_India_Status_and_Challenges_Ahead/li	11

Training manual-1st international training workshop on taxonomy of bivalve Molluscs. CUSAT, Kochi (pp. 67-87).	nks/573d6c6f08ae9ace840ff601/Taxonomy-of-Marine-Molluscs-of-India-Status-and-Challenges-Ahead.pdf	

G. Most Affiliated Institutions

The data highlights prolific marine science research from various global academic institutions. Leading the field, the Ocean University of China has published 92 articles. The University of Vienna and Ege University follow with 65 and 39 articles, respectively. Universidad de Málaga and the Institute of Oceanology of Goa also contribute 39 articles each. Masaryk University and the University of California have published 38 and 37 articles, respectively. Hokkaido University and Universidad Nacional de Colombia show notable contributions with 32 and 31 articles each. The University of Bologna also produced 31 articles. These institutions demonstrate a strong global commitment to advancing marine science research.

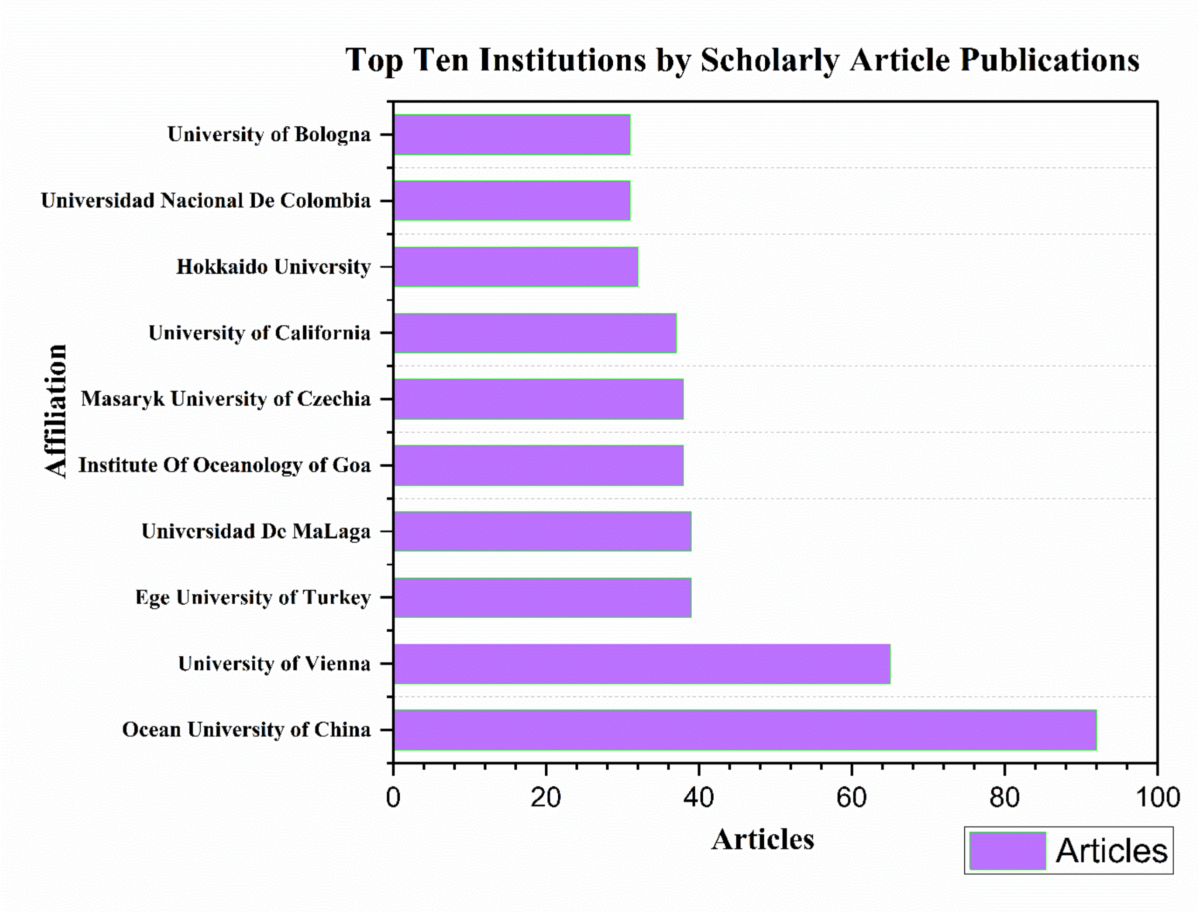

Figure 6: Top 10 institutes according to the number of publications

H. Citation - Country Analysis

The visualization in Figure 7 illustrates global research collaborations through variously colored clusters representing thematic, geographic, or cultural groupings. Red Cluster: Centered on the United States, indicating high-impact research and extensive international collaborations. Orange Cluster: Likely represents the Asia-Pacific region, showing dynamic regional cooperation and increasing investments in science and technology. Green Cluster: Composed of European nations, reflecting strong academic ties and enhanced by EU funding mechanisms like Horizon Europe. Blue Cluster: Potentially includes Latin American and African nations, indicating developing research infrastructures and growing global integration. Purple Cluster: Smaller, possibly representing specialized research domains or developing research communities like Egypt. Figure 7 offers a vivid snapshot of global research collaborations, highlighting patterns of intellectual synergy and strategic partnerships essential for advancing international scientific efforts.

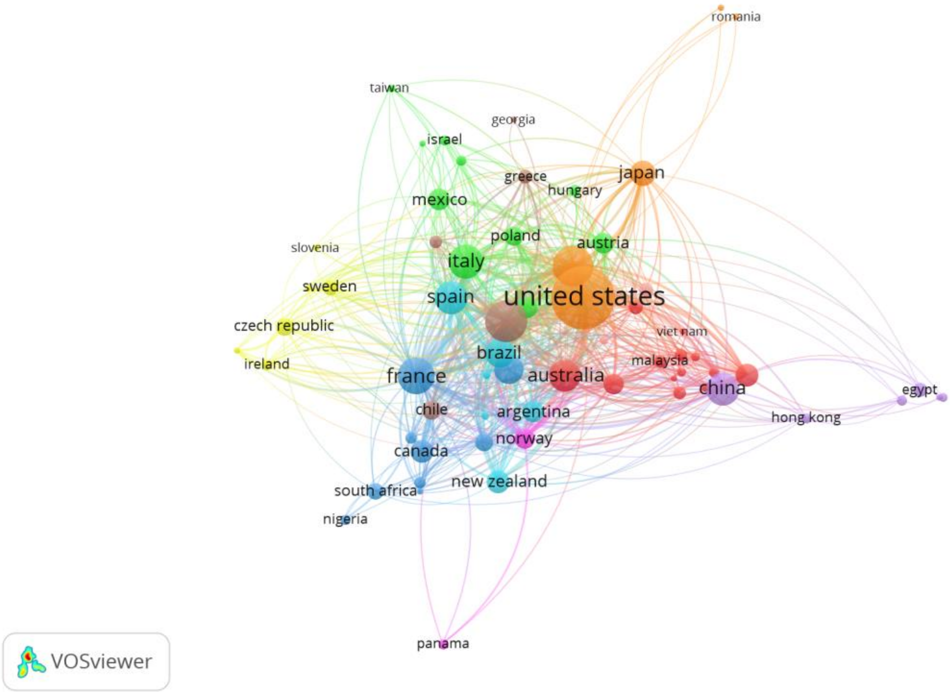

Figure 7: Citation- Country analysis

I. Keywords Analysis

The network visualization map (fig 8) detailing the interconnected nature of marine biodiversity research, with specific emphasis on molluscs. The red cluster at the heart of the network encapsulates key terms like "biodiversity," "diversity," and "community structure," suggesting a primary focus on the variation and distribution of marine life, particularly macroinvertebrates and the ecosystems they inhabit, such as seagrass beds and intertidal zones. Adjacent to this is the green cluster, where "mollusc," "gastropoda," and "bivalvia" are prominent, indicating research into the taxonomy and evolutionary history of these classes of molluscs. Here, "phylogeny" and "species delimitation" imply genetic analysis, which is likely central to understanding evolutionary relationships. The yellow cluster introduces an element of time, with "paleoecology" and "taphonomy" pointing to investigations into the ancient marine environments and the processes affecting the preservation of biological remains, potentially offering historical context to current biodiversity patterns. Finally, the blue cluster addresses environmental concerns, highlighting "pollution," "invasive species," and "genetic diversity," aspects that are crucial for the conservation of marine species and the study of their resilience in the face of anthropogenic impacts. Each cluster, though distinctive in scope, intersects with the others, illustrating the complex and multi-faceted nature of marine biodiversity studies, where the lineage of molluscs, the integrity of their habitats, and the pressures of environmental change are deeply entwined.

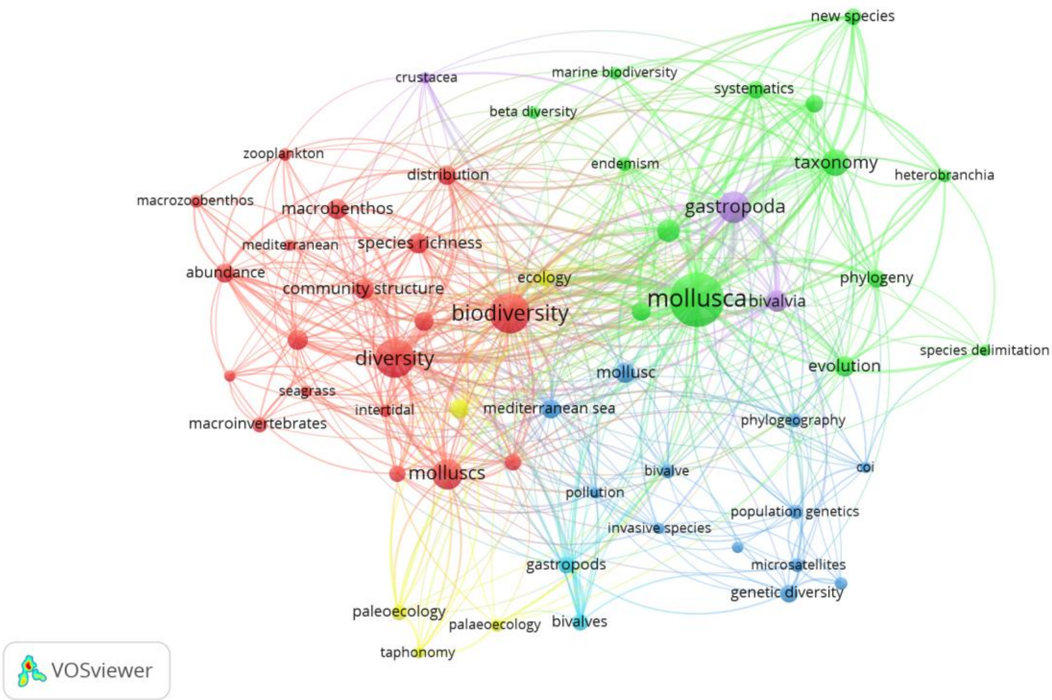

Figure 8: Network Visualization of keywords used in Molluscan Research Studies

J. Trend topics

The surge in the term "community structure" within scientific literature, with 44 instances peaking in 2015, underscores a growing recognition of the intricate web of biotic interactions that sustain ecosystems, a trend that likely reflects the escalating urgency to understand and conserve biodiversity in the face of climate change (Figure 9). This is paralleled by the attention to "benthos," accounting for 39 mentions, as these organisms are pivotal in aquatic ecosystems, their health being an indicator of the overall vitality of our oceans and lakes, especially as they face unprecedented threats from pollution and warming waters. The focus on "microsatellites," appearing 21 times, signifies the shift towards molecular methods in biodiversity research, offering granular insights into population genetics that are essential for species conservation, a field that has itself garnered increased interest as evidenced by the term's frequency from 2001 to 2013. The resurgence of "palaeoecology" in 19 papers, with its longest quartile reaching to 2015, reflects a retrospective approach to biodiversity, using the past as a lens to predict and mitigate future ecological crises, while the mention of "beta diversity" in 17 instances since 2002 indicates a growing need to comprehend how species composition differences between habitats can inform conservation priorities and ecological health assessments. "Species diversity," with 42 occurrences and a peak in 2017, remains a central tenet of ecological research, essential for the assessment of ecosystem health and resilience. Meanwhile, studies on "macrofauna," found in 28 instances, emphasize the role of these organisms in maintaining soil and sediment health, which are crucial to broader ecosystem functions and services. The concept of "diversity" stands out with a striking 160 mentions, highlighting it as a key concern across various biological scales and emphasizing the importance of preserving the myriad forms of life. Finally, the focus on "Molluscs," observed in 100 instances, not only showcases their use as a barometer for environmental health but also their broad application in evolutionary biology, serving as a testament to the interconnectedness of life and the imperative to protect our planet's vast biological tapestry.

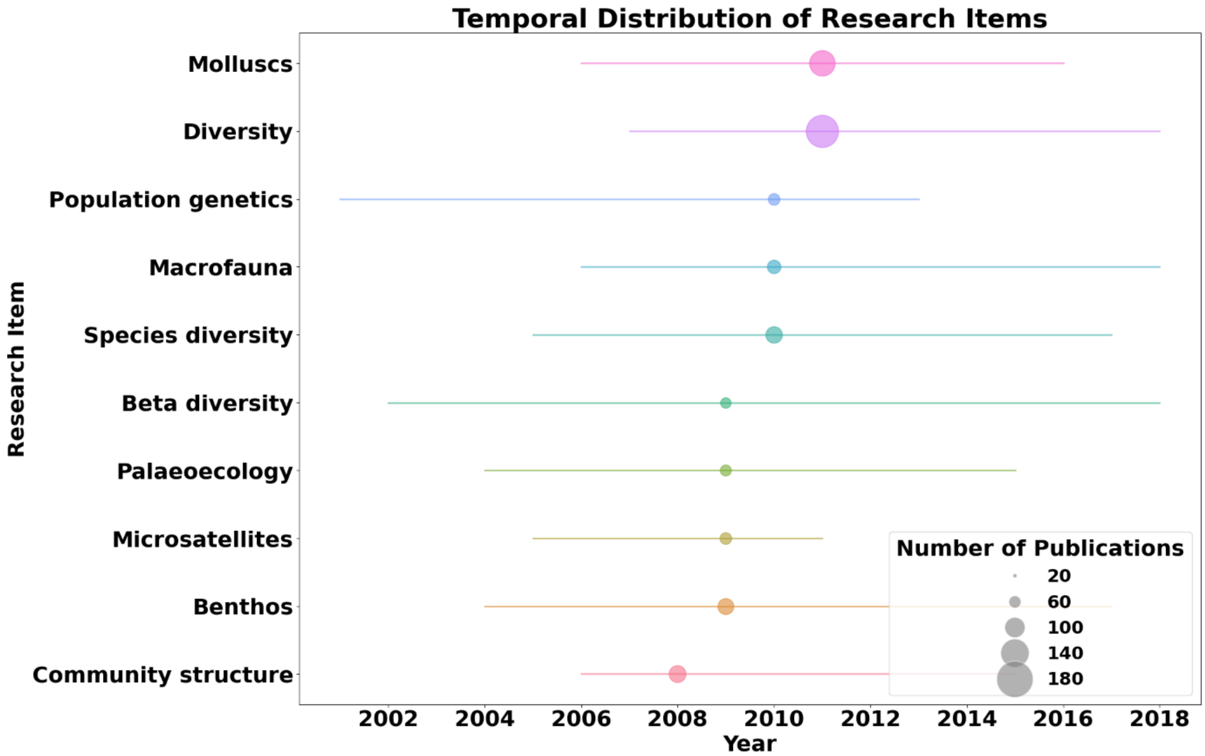

Figure 9: Trends in Molluscan Research Publications (2002-2018)

K. Journal metrics

The bibliometric analysis of Molluscan studies reveals a robust publication landscape across various esteemed journals. Within this sphere, the "Marine Ecology Progress Series" stands out as the most prolific journal, publishing 50 articles in the domain. This journal's extensive contribution signifies its pivotal role in advancing scholarly discourse and shaping the trajectory of Molluscan research (Figure 10). Following closely is "Paleogeography, Palaeoclimatology, Paleoecology," which has published 45 articles. The high publication count in this journal underscores its significance in facilitating discussions on the historical contexts, climate, and ecological evolution pertaining to Molluscan studies. Additionally, "Hydrobiologia" and "Estuarine, Coastal and Shelf Science" have contributed significantly with 33 and 32 articles, respectively. These journals serve as crucial platforms for disseminating research focusing on the aquatic habitats and ecosystems housing Molluscan species, playing integral roles in the dissemination of pertinent findings. "PLOS ONE," with 29 articles, signifies the multidisciplinary nature of Molluscan research, offering a diverse range of studies addressing various aspects of this field, while "Zootaxa" (28 articles) serves as a platform for taxonomic studies, emphasizing the classification and taxonomy of Molluscan species.

Moreover, "Journal of the Marine Biological Association of the United Kingdom" and "Marine Biodiversity" have both published 27 articles, highlighting their roles in facilitating comprehensive explorations into the biodiversity, ecology, and biological associations within marine environments concerning Molluscs. Simultaneously, "Marine Pollution Bulletin" and "Molluscan Research" have contributed significantly with 26 articles each, shedding light on the ecological impacts of pollutants and the diverse array of research encompassing various aspects of Molluscan biology, respectively. The diverse array of journals underscores the multidimensional nature of Molluscan studies, encompassing ecology, taxonomy, biodiversity, and environmental impact. Each journal serves as a vital conduit for the dissemination of groundbreaking research, collectively contributing to the holistic understanding and advancement of the field of malacology.

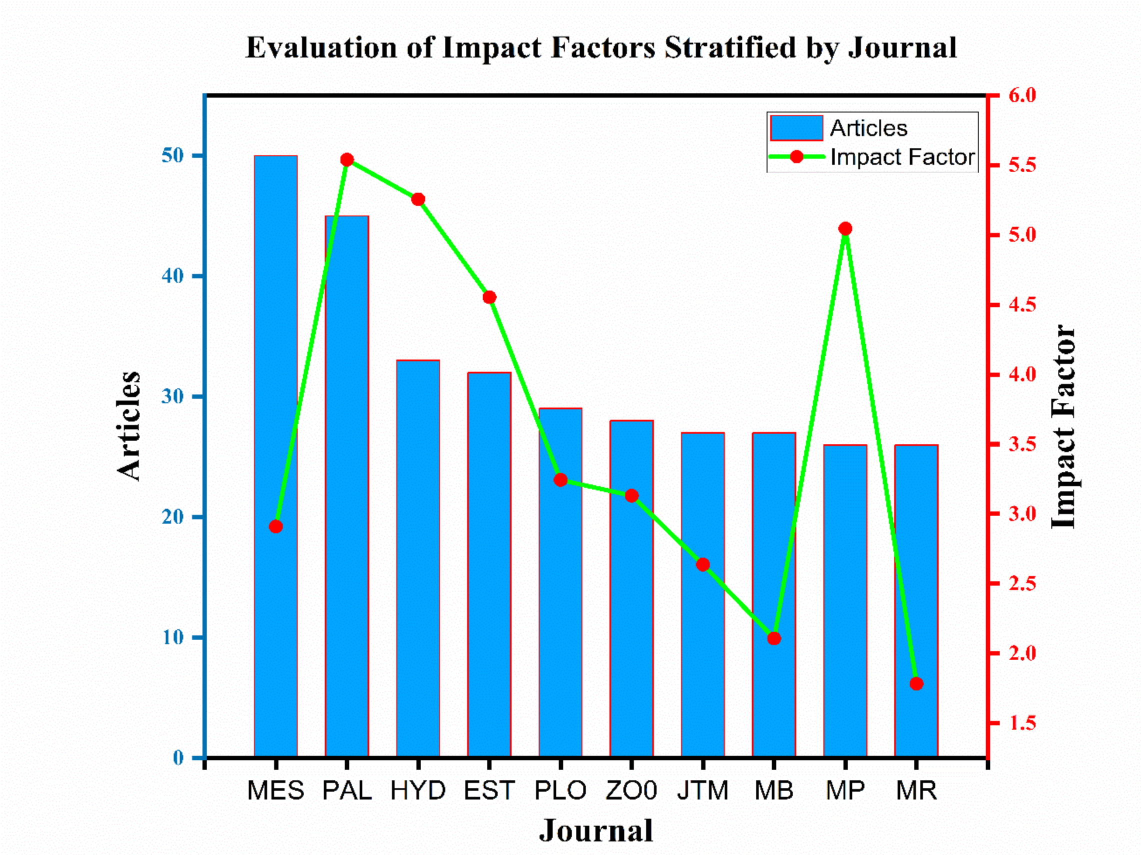

Figure 10: Comparative Analysis of Article Counts and Impact Factors Across Key Journals in Molluscan Research

Discussion

The data presented provides a comprehensive overview of my research output and collaborative efforts over a significant period from 1969 to 2023. Over these years, I have utilized 676 sources, including journals and books, to publish 2,276 documents. This breadth of sources reflects my commitment to disseminating knowledge across a variety of platforms, ensuring accessibility and diversity in the reach of my research. The documents show a robust annual growth rate of 6.1%, indicating my continuous and expanding contribution to my field. The average document age stands at 11.9 years, demonstrating the enduring relevance of my work. Furthermore, each document garners an average of 27.82 citations, underlining the impact of my research within the academic community, which is further evidenced by the substantial number of references totaling 127,061.

In the domain of research themes and focus, the data speaks to the depth and variety of interests, with 11,362 Keywords Plus (ID) and 5,794 Author's Keywords in German (DE). This indicates not only the extensive scope of my research but also my ability to engage with a wide array of topics, possibly pointing to a multidisciplinary approach in my work. The collaboration data is particularly telling of my research practices. While I have a significant number of authors (7,208) contributing to my documents, there are 213 instances of single-authored documents, reflecting moments where I have independently pursued and presented my research. However, the trend leans towards collaboration, as seen in the 254 single-authored docs and an average of 4.13 co-authors per document. The high percentage of international co-authorships, at 30.54%, is indicative of my strong global network and the value I place on international perspectives to enrich the research. All the documents are classified as articles, which aligns with the academic convention of sharing research findings. This consistency shows a focused approach in my dissemination strategy, catering to the scholarly audience through the traditional and widely recognized format of articles. In summary, this data encapsulates the dynamic and collaborative nature of my academic career, highlighting a sustained influence through a variety of research topics and a strong international collaboration network, all of which contribute to the global body of knowledge in this field.

Molluscan Research across India and Gujarat

The molluscan fauna, especially benthic Molluscs, has been less studied regarding various ecological aspects such as distribution patterns and population ecology. However, detailed studies on the distribution patterns of benthic molluscan fauna have been conducted in different mangrove and estuarine regions of India. For instance, Ansari et al. (1986) examined the spatio-temporal variation of benthic macrofauna in the Zuari estuary of Goa, highlighting that seasonal changes in water quality parameters significantly influence the distribution patterns of macrofauna in estuarine regions. Similarly, Chakraborthy et al. (1992) studied the zonation patterns of various macrofauna in the mangrove habitats of Sagar Island in the Sundarbans. Kashinathan and Sanmugham (1986) investigated the distribution patterns of macrofauna across different zones in the Pichavaram mangroves. Additionally, Sukumaran and Krishnaswamy (1962) correlated sea water salinity changes with the density of *Cellana radiata* along the Madras coast in Tamil Nadu.

Investigations by Rao and Ganapati (1971) on *C. radiata* from Visakhapatnam waters on the east coast of India revealed aspects of hermaphroditism, radula fraction, shell length, distribution, population density, and resistance to temperature, salinity, and desiccation. Although the intertidal zones of Gujarat state have been less explored, some studies on diversity and distribution have been conducted by ecologists and researchers. Apte (1998) recorded 188 molluscan species along the Gujarat coastline, while various researchers have explored different areas of the Saurashtra coast (Pandya, 2015; Gohel, 2016; Desai, 1987; Joshi, 2010; Prasad, 1984; Malli, 1983; Patel, 1984; Misra, 2004; Bhadja, 2010; Vaghela, 2010). Bhadja (2010) and Vaghela (2010) documented seven diverse phyla of macrofauna, including Annelida, Arthropoda, Coelenterata, Echinodermata, Mollusca, Platyhelminthes, and Porifera along the Saurashtra coastline, with Arthropoda, Coelenterata, and Mollusca being the most prominent groups.

Vaghela (2010) recorded a total of 120 intertidal macrofaunal species, including 65 species of Mollusca, 17 species of Coelenterata, 15 species of Arthropoda, eight species of Annelida, six species of Porifera, six species of Echinodermata, and three species of Platyhelminthes. Earlier studies by Vadher et al. (2014) on the Chorwad coast identified 69 molluscan species, while Pandya et al. (2013, 2014) and Dave et al. (2016) documented the diversity and distribution of the Anthozoan class from selected sites of the Saurashtra coast.

The Saurashtra coastline, characterized by its rocky, sandy, and muddy intertidal zones, harbors a rich and varied diversity of flora and fauna (Nayar and Appukuttan, 1983). The substratum, mainly formed of miliolite and laterite stone, provides a unique habitat for intertidal populations (Sarvaiya, 1977). Rapid industrialization and consequent pollution have led to the deterioration of the community along the Saurashtra coast. Despite some ecological studies on certain limpets (Prasad, 1984), turbinids (Malli, 1983), and cerithids (Patel, 1984), there is limited reporting on the macrofaunal resources of this region (Misra, 2004). Samantaray (1979) observed the reproduction and population of C. radiata along the Veraval coast, while Prasad and Mansuri (1982) reported the density of Cellana radiata in the polluted area at Porbandar, on the west coast of India. Sarvaiya (1977) described the distribution of two turbinids, *T. intercostalis* and *T. coronatus*, at Okha and nearby islands.

The collective studies on molluscan diversity and community structures across various habitats in India highlight the crucial ecological roles these species play, from freshwater ponds to marine intertidal zones. Parikh and Mankodi (2008) emphasized the diversity of freshwater molluscs in Vadodara, India, and their significant role in transmitting diseases. The study identified 11 species of molluscs in urban ponds, with gastropods being more prevalent than bivalves. Key species such as *Lymnae andersonia*, *Thiara pyramis*, and *Planorbis planorbis* serve as intermediate hosts for trematode parasites, which cause diseases like fascioliasis, paragonimiasis, and schistosomiasis. This underscores the public health importance of studying molluscan diversity and the need for updated systematic and faunal checklists.

In the marine context, Kardani et al. (2011) explored the community structure of bivalve molluscs in the intertidal region of the Northern Gulf of Kachchh, Gujarat. The study recorded 16 species from 10 families across three stations: Sanghi, Mundra, and Mandvi. Significant variations in bivalve density were observed, with the highest density recorded at Mandvi during the monsoon season. The Shannon diversity index ranged from 0.84 to 1.92, with the highest diversity also observed during the monsoon. This study underscores the ecological importance of bivalves in the intertidal zone and highlights how seasonal variations and habitat characteristics influence their distribution and diversity.

Gohel et al. (2016) conducted a population study of the gastropod family Cerithiidae at Mangrol Coast, Gujarat. This research focused on the population dynamics and distribution of Cerithiidae over two years. The rocky intertidal zone with diverse microhabitats supported a stable population of Cerithiidae. Significant seasonal variations were noted, with the highest population densities observed in November and May. The study concluded that physical conditions, such as wave action and substratum characteristics, significantly influence the distribution patterns of Cerithiidae. Due to its sensitivity to habitat changes, this family is considered an indicator of environmental health.

In another marine study, Devanshi M. Joshi and Pradeep C. Mankodi (2016) examined the density and substrate preferences of vermetid gastropods in the Gulf of Kachchh. Vermetids, which form dense aggregates in high-energy environments, were studied across various substrates, including live corals and abiotic materials. The study recorded three genera: Ceraesignum, Thylacodes, and Petaloconchus. Ceraesignum showed the highest density, primarily associated with silt-covered rocks, while Thylacodes was mostly found on live coral Porites. The study emphasizes the ecological role of vermetids and their impact on coral growth and survival.

The reviewed literature collectively highlights the ecological significance of molluscs across different habitats. Freshwater molluscs play a crucial role in disease transmission, necessitating updated taxonomic studies and public health interventions. In marine environments, bivalves and gastropods exhibit diverse community structures and population dynamics influenced by seasonal and habitat-specific factors. Studies on bivalves in the Gulf of Kachchh reveal high species diversity and density variations driven by environmental conditions. Similarly, the stable populations of Cerithiidae at Mangrol Coast and the substrate preferences of vermetids in the Gulf of Kachchh underscore the importance of habitat characteristics in shaping molluscan communities.

Further studies by Kundu and Mishra (2005) on the intertidal distribution of key gastropod species along the Saurashtra coast indicated that the distribution pattern is highly influenced by the area's geomorphology, intertidal zone structure, and seasonal variations in water quality parameters. Trivedi et al. (2013) examined the shell preference behavior of the hermit crab *Clibanarius zebra*, noting that the behavior is significantly influenced by the availability of various gastropod species in the intertidal area.

Venkatraman and Wafar (2005) listed the occurrence of 218 coral species under 60 genera and 15 families, with the maximum diversity reported from the Andaman Nicobar Islands and the minimum from the Gulf of Kachchh. The zoanthid fauna, integral to the coral reef environment, remains poorly studied in Indian waters. Hornell (1916) documented the presence of a few zoanthid species along the coastal region of Okha, including *Palythoa tuberculosa*. Bhattji et al. (2010) later reported Palythoa sp. from the coastal areas of Dwarka. Pandya and Mankodi (2012) identified four zoanthid species, noting that *Palythoa mutuki* occurs in high densities in the lower intertidal zone.

While significant research has been conducted on the ecological studies and benthic diversity in regions like Veraval, Sutrapada, and Mangrol of Saurashtra, areas such as Navapara, Aadri, Vadodra Dodiya, and Chorwad have been less studied. Systematic reporting and scrutiny of these lesser-studied areas are essential to understanding habitat characteristics, creating a comprehensive database of macro benthos assemblages, and estimating various attributes of key species, which will be invaluable for future references.

Based on the comprehensive review of the literature and the identified research gaps, the following objectives were defined to guide this study,

(01) To study Diversity of marine Molluscs from selected sites of South Saurashtra Coast, Gujarat, India.

(02) To study distribution status/pattern of Molluscs on the basis of its substratum structure along South Saurashtra Coast on selected sites.

(03) To analyse Population ecology of Dominant species of marine Mollusca along South Saurashtra coast.

These objectives seek to catalog the various species present in the region, thereby providing an understanding of local biodiversity. By examining how different substratum types influence Molluscan distribution, one can gain insights into their habitat preferences and ecological niches. Furthermore, investigating the population dynamics of key species will elucidate their roles within the ecosystem and inform effective conservation strategies. These interconnected objectives collectively aim to enhance the knowledge of Molluscan biodiversity, distribution, and ecological interactions in this coastal region.