

Trend ocean literacy research in Indonesia: A bibliometric analysis

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Abstract. Ocean literacy (OL) is crucial in sustainably maintaining and protecting the oceans. The main objective of this research is to present bibliometric data on articles related to OL in Indonesia published in journals indexed in the SINTA database between 2014 and October 2023. Articles collected from 26 articles published within the scope of this research were bibliometrically analyzed based on five categories: 1) number of articles published each year, 2) most frequently used keywords, 3) type of research used, 4) universities or institutions that conduct OL research, and 5) journals that publish OL articles. Bibliometric analysis shows that most articles regarding OL studies were published in 2021 (8 articles). The keywords most frequently used are ocean literacy, literacy, and environmental education. The types of research often used are quantitative research (10 articles) and qualitative research (9 articles). The university with the most OL articles published is Universitas Maritim Raja Ali Haji (UMRAH) (8 articles). This study presents a perspective on OL research in Indonesia that can be used as a reference for researchers, educators, and parties involved in sustainably preserving the ocean in the future.

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1 Introduction

Ocean literacy (OL) refers to a comprehensive comprehension of the reciprocal relationship between the ocean and humanity, encompassing the impact of the ocean on human beings and the effect exerted by humans on the ocean. Individuals with marine literacy possess a comprehensive understanding of marine science, can effectively speak about the ocean, and can make well-informed decisions about marine policy [1–3]. Ocean literacy was defined in 2005 by a collective agreement among over 100 marine educators and scientists, which included members of the National Marine Educators Association (NMEA) and the Centers for Ocean Sciences Education and Excellence (COSEE) [3]. Seven important principles are used as a reference in guiding the scope of ocean literacy (Figure 1).

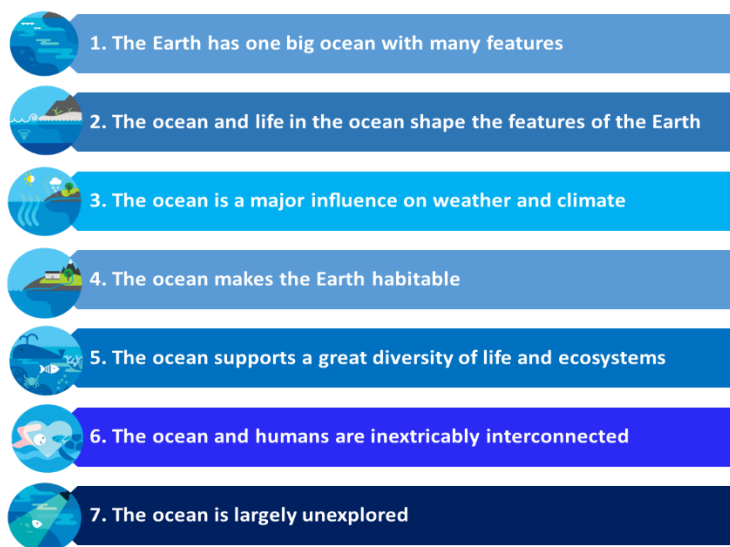


Fig. 1. The seven essential principles of ocean literacy

Everyone should possess ocean literacy since it enables a profound comprehension of the seas and oceans, vital resources in human existence, and the planet's environment [5–7]. There is a pressing need to address environmental concerns of great significance, such as climate change, coral reef degradation, marine pollution, and dwindling fish populations. Comprehending the ocean fosters consciousness and initiatives to save marine ecosystems and plentiful marine resources. An individual with a profound comprehension of the marine environment can play a vital role in preserving the ecosystem's equilibrium, mitigating adverse effects on the ocean, and promoting sustainable policies and initiatives. Furthermore, ocean literacy research aids in the identification of novel solutions and efficient educational methods to effectively convey the significance of ocean conservation to future generations [8–10].

This paper aims to present a comprehensive review of academic literature on ocean literacy in Indonesia. The data for this review was gathered from several sources indexed in SINTA and analyzed using bibliometric methods. By undertaking this approach, it is possible to understand better the areas where information is lacking, enabling further in-depth exploration of ocean literacy in Indonesia. The SINTA database search using the terms "ocean literacy and marine literacy" yielded 43 publications from 2014 to October 2023. An in-depth analysis of these publications is necessary to ascertain the trends throughout that period. This analysis should consider factors such as the year of distribution, keywords used, the type of research, the universities or institutes conducting

research on ocean literacy, and the journals publishing papers on this topic. Bibliometric methods are highly suggested for research and analysis.

We have yet to find a bibliometric analysis targeting Ocean Literacy research in Indonesia using the SINTA database. Hence, we aim to perform a bibliometric study by examining and contrasting different review papers published in journals about OL research. This bibliometric analysis can provide valuable insights for academics and readers interested in the issues we are reviewing, specifically concerning ocean literacy in Indonesia. It can serve as a reliable reference for further research on this topic.

2 Method

This study uses bibliometric methods. The decision to rely on bibliometric methods is based on several factors. Generally, bibliometric methods are concerned with studying scientific documents, authors, and places of publication. Bibliometrics has expanded beyond frequency analysis and citation counting to encompass a wide range of methods and techniques that combine, for example, network analysis, learning media, advanced visualization, and text mining [11,12]. Additionally, bibliometrics can help map multiple authors and their impact, countries, or institutions [13,14].

2.1 Bibliometric analysis

Bibliometric analysis refers to the methodical examination of literature to quantify and assess patterns in publication, collaboration, and citation [13,15]. This evaluation methodology utilizes the extensive data pool in published research articles, patents, conference proceedings, and other sources to comprehend a certain scientific or technical topic's development, organization, and impact. Bibliometric analysis is extensively employed across diverse fields such as science, technology, medicine, and social sciences. Its purpose is to examine patterns in research and development, identify prominent authors and institutions, assess the influence of research initiatives, and monitor the advancement of scientific disciplines [13,14,16].

Bornmann and Mutz (2015) [14] define bibliometric analysis as a quantitative literature analysis method that evaluates the effect and influence of a specific research topic by considering variables such as the number of publications, citations, and authors. The Sinta database is an Indonesian scientific database. The Sinta database can be accessed at <https://sinta.kemdikbud.go.id/>. This article analysis uses VOS viewer software to identify relevant articles and create a research landscape map [17]. The search used the keywords "ocean literacy" and "marine literacy" in the GS document sources menu in the Sinta database. These keywords are used to search for articles in the Sinta database search menu from 2014 to October 2023.

In this research, bibliometric analysis reviews articles related to OL in the SINTA database by investigating the number of articles by year, the most frequently used keywords, the type of research most widely used in OL-themed research, the universities/institutions that publish the most articles, and Journal that publishes articles on OL topics that are included in the SINTA category. OL, according to the Sinta database in Indonesia.

2.2 Mechanism for article selection

The Sinta database was searched using pertinent keywords related to "ocean literacy." The designated terms are "ocean literacy" or "marine literacy". A total of 43 publications were

identified in the initial scan. For the subsequent phase, we chose published publications from 2014 to 2023. Consequently, our study incorporated a bibliometric analysis of 26 papers in the Sinta database. Figure 2 illustrates the comprehensive process of selecting articles outlined by the recommended reporting elements for systematic reviews and meta-analyses (PRISMA) guidelines [18].

This research aims to find OL research patterns published in journals indexed by the Sinta database. Identify the distribution of articles per year, keywords used, research methods used, universities/institutions that frequently publish articles, and journals with the most publications. Bibliometric techniques analyze publications with the theme OL in Indonesia in the Sinta database. In this bibliometric study, we used the keyword "ocean literacy" to find 13 articles. We also used the keyword "marine literacy" and obtained 13 articles. So, the total number of articles we analyzed in bibliometric studies was 26.

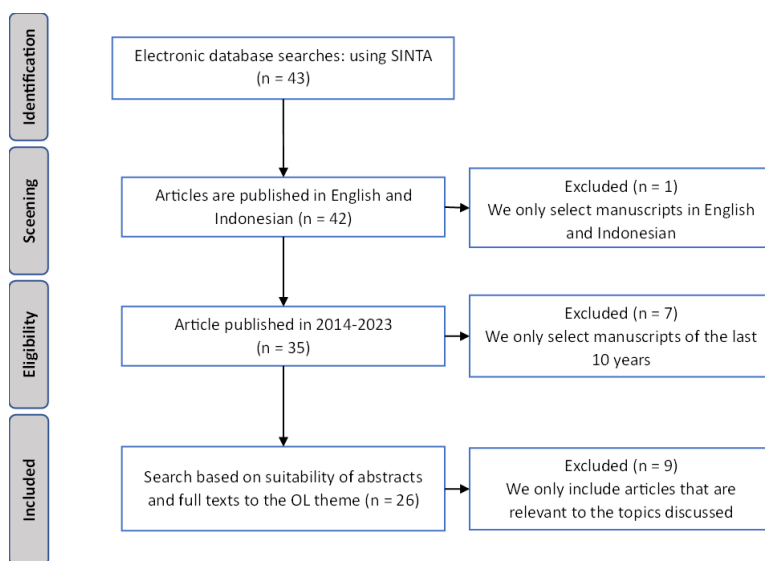


Fig. 2. Process for selecting articles

2.3 Research Questions

This bibliometric analysis covers OL-related research articles between 2014 and October 2023 and focuses on the following research questions.

- RQ1: What is the distribution of OL-related articles by year?
- RQ2: What keywords are most often used in articles about OL?
- RQ3: What method/type of research is used in research with the OL theme?
- RQ4: What universities or institutions are the main researchers contributing to OL research?
- RQ5: What journals publish articles on OL topics classified in the SINTA category?

2.4 Finding

2.4.1 Distribution year

An examination of publication trends might be initiated by examining the yearly distribution of article publications. The article distribution offers insight into the temporal

trends of publications centered around the OL theme, indicating whether their prevalence has risen or fallen. From 2014 to 2017, no study was conducted on the OL theme. During the academic year of 2018-2019, there was a rise in research focused on OL, resulting in the publication of four articles. In 2021, there was a significant rise in publication activity, reaching its highest point with 10 articles published, surpassing the previous year's count. In 2022, the number of articles published will reduce to three. In 2023, there are two articles. There may be an upsurge in article releases due to ongoing article searches until October 2023. Figure 3 displays the annual count of published articles.

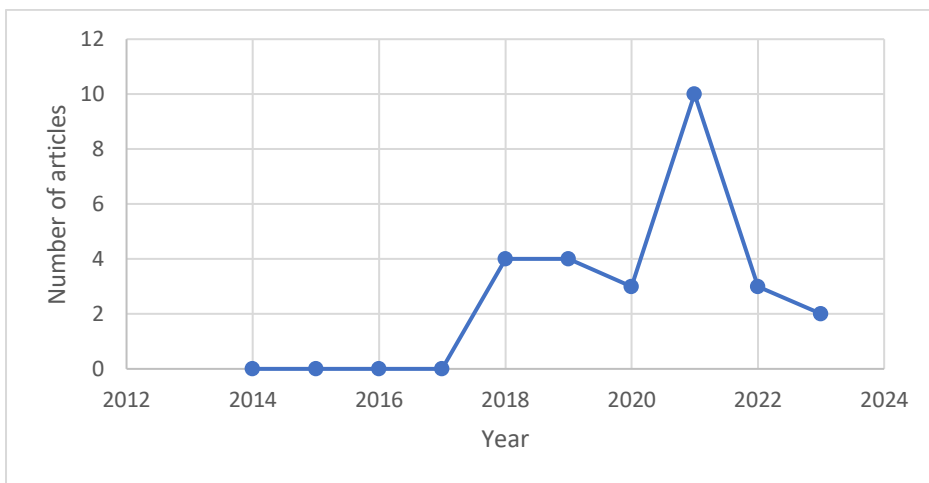


Fig. 3. Distribution year of article

2.4.2 The Most Used Keywords in Articles

The analysis based on keyword research on Ocean Literacy indicates that "ocean literacy, environmental education, and literacy" are the most dominant keywords. The keyword "ocean literacy" indicates that this topic is the main focus. Figure 4 illustrates the output of VOSviewer regarding the keyword trends in OL research.

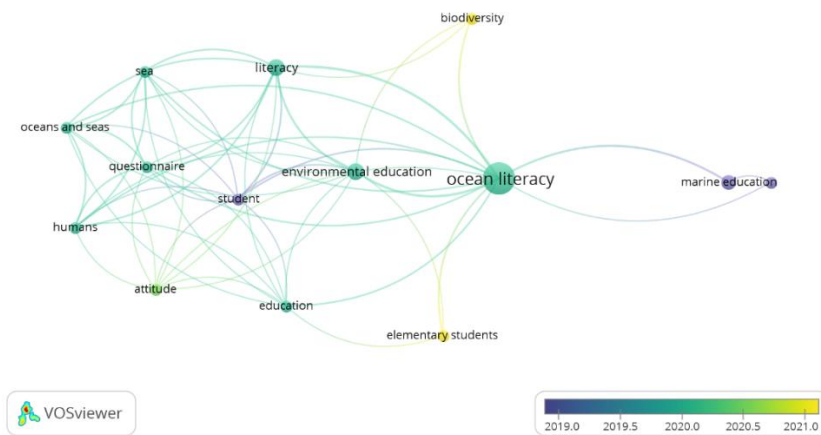


Fig. 4. Distribution of the most frequently used keywords in articles related to OL

2.4.3 Type/method of research used

Most research studies on "ocean literacy" employ a quantitative methodology, as evidenced by 10 papers. The qualitative research is likewise quite comprehensive, comprising 8 papers. This illustrates that ocean literacy in science education can be addressed from a quantitative and qualitative perspective. A research and development (R&D) technique is employed, consisting of 7 papers. Furthermore, a singular publication utilizes the action research methodology in a study about OL. Using these numerous methodologies, researchers can effectively address research inquiries with greater depth, integrate a wide range of perspectives, and attain a more holistic comprehension of OL. Table 1 presents the various types of research employed in studies on OL.

Table 1. Types of research on OL themes in Indonesia

No	Types of research	Amount	Percentage	References
1	Quantitative	10	38.46	[19–28]
2	Qualitative	8	23.08	[29–36]
3	R&D	7	34.62	[37–43]
4	Action Research	1	3.85	[44]

2.4.4 University or Institution

Based on the SINTA database, 14 universities or institutes have provided contributions to 26 publications related to OL. Based on the SINTA database, the top four universities are actively producing significant contributions to OL. The institutions that produced the most significant contributions were Universitas Maritim Raja Ali Haji, which published eight papers; Universitas Pendidikan Indonesia, which published four articles; and Universitas Mataram and Universitas Sulawesi Barat, each with two articles. The universities and institutions that publish articles about the OL theme are listed in Table 2.

Table 2. Universities or institutions in Indonesia that contribute articles on OL themes

No	Author's University or Institution	Amount	Percentage
1	Universitas Maritim Raja Ali Haji	8	30.77
2	Universitas Pendidikan Indonesia	4	15.38
3	Universitas Mataram	2	7.69
4	Universitas Sulawesi Barat	2	7.69
5	Universitas Negeri Yogyakarta	1	3.85
6	Universitas Negeri Surabaya	1	3.85
7	Universitas Negeri Jakarta	1	3.85
8	Universitas Negeri Semarang	1	3.85
9	Universitas Negeri Sebelas Maret	1	3.85
10	Institut Teknologi Sepuluh Nopember	1	3.85
11	Universitas Halu Oleo	1	3.85
12	Universitas Negeri lampung	1	3.85
13	UIN Sultan Maulana Hasanuddin	1	3.85
14	UIN Sunan Gunung Djati Bandung	1	3.85

2.4.5 The journals that publish articles

Our analysis of journal articles found that 26 publications were scattered throughout various journals with varying SINTA categories, spanning from S1 to Non-SINTA. There are a combined total of 6 journals, with 3 in the S2 category and 3 in the S3 category. Moreover, there are 6 journals classified under the S4 category, 2 journals classified under

the S2 category, and 10 journals classified under the Non-S category. Non-S category, consisting of journals and international conference proceedings. The data clearly shows that no publication in the S1 category has published articles related to the OL theme. This allows scholars to publish OL-related articles in journals categorized as S1. Table 3 presents the distribution of SINTA-indexed articles that exclusively publish papers related to the OL theme.

Table 3. Distribution of articles published in journals

No	Journal	SINTA Category*	Amount
1	Jurnal Penelitian Pendidikan IPA (JPPIPA)	S2	3
2	Jurnal Pendidikan Usia Dini	S2	
3	Jurnal Kependidikan: Jurnal Hasil Penelitian dan Kajian Kepustakaan di Bidang Pendidikan, Pengajaran dan Pembelajaran	S2	
4	Jurnal Pedagogi Hayati	S3	3
5	JUPI (Jurnal IPA dan Pembelajaran IPA)	S3	
6	Journal of Primary Education	S3	
7	Assimilation: Indonesian Journal of Biology Education	S4	6
8	Jurnal Ilmiah Profesi Pendidikan	S4	
9	Sewagati : Jurnal Pengabdian Kepada Masyarakat	S4	
10	Bioedukasi: Jurnal Pendidikan Biologi	S4	
11	Jurnal Pijar MIPA	S4	
12	Jurnal Penelitian Pendidikan IPA	S4	
13	Jurnal Kiprah	S5	2
14	Omega: Jurnal Fisika dan Pendidikan Fisika	S5	
15	Journal of Physics: Conference Series	Non-S	10
16	Proceedings of the 7th International Conference on Research, Implementation, and Education of Mathematics and Sciences (ICRIEMS 2020)	Non-S	
17	Jurnal Pendidikan Perikanan Kelautan	Non-S	
18	Student Online Journal (SOJ) UMRAH	Non-S	
19	JSGA: Jurnal Studi Gender dan Anak	Non-S	
20	Talenta Conference Series: Science and Technology	Non-S	
21	Journal of Gifted Education and Creativity	Non-S	
22	Journal of Hunan University	Non-S	
23	Proceedings of The Symposium on Advance of Sustainable Engineering 2021 (SIMASE 2021)	Non-S	

*SINTA category (database indexing scientific articles in Indonesia):

- S1: SINTA 1
- S2: SINTA 2
- S3: SINTA 3
- S4: SINTA 4
- S5: SINTA 5
- S6: SINTA 6
- Non-S: Non-SINTA

3 Discussion

Analysis of publication trends can provide an overview of research developments on a topic. In this case, publication trend analysis was carried out on the Ocean Literacy (OL) theme from within the last decade (2014-2023). In 2014-2017, research related to the OL theme remained the same. However, in 2018-2019, there was an increase in OL research, with 4 articles published. 2021 saw an increase and was the peak of publication with the highest number of articles published compared to the previous year, namely 10 articles. In 2022, there will be a decrease in the number of articles, with 3 articles published. 2023, there are 2 articles; an increase in article publications could occur because article searches were carried out until October 2023. From these data, it can be concluded that OL research has increased in 2018-2021 but has decreased in 2022-2023. Analysis of publication trends can provide important information for researchers and policymakers to discover the development of research on ocean literacy, especially in Indonesia. In addition, research areas that still need to be developed can be identified by analyzing publication trends.

The results of analysis based on keywords show that the theme of this research focuses on OL, with the keywords "ocean literacy," "environmental education," and "literacy" being the most dominant. From these keywords, it can be concluded that this research focuses on understanding and knowledge about the sea, with "ocean literacy" as the main focus. "ocean literacy" includes understanding marine ecology, marine resources, and marine conservation efforts. In addition, OL as a concept can include aspects such as sustainability of marine resources, protection of marine ecosystems, and awareness of the impact of human activities on the balance of marine ecosystems [1,3,17,45]. Currently, every individual is expected to have ocean literacy skills, which must be embedded in thoughts, attitudes, and behavior in maintaining the sustainability of marine ecosystems in a sustainable manner [3,46-48].

The keyword "environmental education" shows the relevance of research to environmental education, emphasizing the importance of understanding the ocean in an educational context. OL refers to understanding and knowledge about the sea; it can be seen as an integral part of marine education [10,49,50]. In a broader context, marine education is an inseparable part of environmental education [3,10,45]. By including ocean literacy in the framework of marine education, we can expand the scope of environmental education to cover specific aspects related to marine ecosystems, marine resources, and human impacts on the ocean. Therefore, ocean literacy not only includes understanding the complexity of marine life but also involves awareness of the ocean's important role in maintaining the balance of the global ecosystem. In a broader context, by including marine education as part of environmental education, this approach recognizes the close relationship between marine sustainability and the overall sustainability of the environment [10,45]. Thus, ocean literacy and marine education are important components in forming a holistic and responsible understanding of the marine environment and its ecosystem in environmental education [10,51].

The analysis results based on research types show that ocean literacy research predominantly uses quantitative research. Research trends focusing on the "ocean literacy" theme show a dominant tendency to use quantitative approaches. Along with this, qualitative research has also received significant attention. The fact that ocean literacy in the context of science education can be explored quantitatively and qualitatively illustrates the diversity of approaches that can be applied to understand and improve society's understanding of the ocean. Interestingly, there is also a prevalence of Research and Development (R&D) research methods in the context of ocean literacy. The R&D method is used to design, develop, and evaluate programs or learning strategies that can increase ocean literacy. Meanwhile, there is one article that chooses an action research approach,

showing the diversity in research strategies applied to overcome the issue of ocean literacy. In the action research method, researchers can be directly involved in changing educational practices or policies by involving active participation from stakeholders. Given the various research methods used, including quantitative, qualitative, R&D, and action research approaches, it can be concluded that ocean literacy research reflects this issue's complexity and relevance in science education. OL can be improved and integrated into the educational curriculum.

In the OL research contributions documented in the SINTA database based on universities or institutions, 14 universities or institutions can be identified as the main contributors to 26 publications on the OL theme. Raja Ali Haji Maritime University topped the rankings with a contribution of eight articles, indicating their central role in developing understanding of OL. Raja Ali Haji Maritime University has a very important role in OL research. This is because every research and publication focuses more on the maritime theme as a characteristic of the University. This achievement reflects the institution's commitment to supporting the development of ocean literacy through research and publications and providing an overview of the distribution and diversity of the university's contributions in advancing understanding of marine issues in Indonesia.

Based on the analysis of journal articles, 26 articles related to OL spread across various SINTA categories, showing the diversity and distribution of publications in various journal levels. Interestingly, it was found that the Non-S category also had a significant share, including journals and international conference proceedings. This shows that the issue of ocean literacy is recognized and expressed in national journals and international forums, which can expand the impact of this research globally. However, it should be noted that in the Undergraduate category, no journals publish articles related to OL, indicating the potential for increased research and publications at this level. In conclusion, the distribution of articles in various SINTA categories shows the variety and diversity of research to increase understanding and awareness of OL.

This bibliometric analysis reveals that OL research in Indonesia is still small and needs to be increased yearly in publications in various national journals (SINTA indexed) and international journals (Scopus indexed). Interestingly, Indonesia, as a maritime country with an ocean area wider than the plains [35,52], should have a more dominant number and focus of research related to marine and OL. The limited number of publications may only partially reflect the potential and richness of Indonesia's marine resources. Emphasis on increasing the number and quality of publications in national and international journals is becoming increasingly important, considering Indonesia's strategic role as a country with great maritime potential. The Indonesian scientific community can contribute significantly to understanding and supporting marine resource conservation and sustainable use by increasing research and publications related to OL. Therefore, there needs to be awareness and joint efforts to increase exploration and discussion regarding OL to maximize understanding of the complexity of marine ecosystems and their potential. Thus, this analysis provides an opportunity for further research and increased publication related to OL in Indonesia. This growth will strengthen public understanding and awareness of the importance of marine sustainability.

4 Conclusion

The bibliometric findings of this article represent research trends regarding ocean literacy in Indonesia. The main objective of this research is to provide bibliometric information on OL-related journal articles published in Indonesian journals indexed by SINTA between 2014 and October 2023. Bibliometric analysis was carried out on 26 articles published within the scope of this research. Based on bibliometric analysis, the highest number of

articles related to OL studies was eight articles published in 2021. Ocean literacy, literacy, and environmental education were the most frequently used keywords. Quantitative research (10 articles) and qualitative research (9 articles) are frequently used research categories. Eight articles have been published by Raja Ali Haji Maritime University (UMRAH), the university with the most OL articles. This study offers insights into ocean literacy research in Indonesia that can become a valuable resource for future stakeholders, including researchers, educators, and parties involved in sustainable marine conservation.

Limitations

There are certain limitations to this investigation. Initially, this study's scope is restricted to scholarly literature published within the past decade, with a particular emphasis on sources derived from the SINTA academic database in Indonesia. Furthermore, the publications that have been chosen are solely about the subject matter of ocean literacy in Indonesia. The publications included in the evaluation and analysis were strictly restricted to articles published in scientific journals.

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