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Remaking the Future Studies of Global Small-Scale Fisheries; Bibliometric Analysis Findings Between 1965 and 2020

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Abstract

Small-scale fisheries (SSF) have long been recognized as critical to many facets of human life. SSF-related bibliometric studies have focused on specific topics, including marine protected areas and sustainable utilization. Since SSF is associated with numerous dimensions of life, a comprehensive bibliometric study is required. This study aims to analyze and visualize state of the art in SSF research using bibliometric analysis on articles published between 1965 and 2020 obtained from the Scopus database in August 2021. Harzing's Publish or Perish, VOSviewer, and Microsoft Excel software were used to fulfill the objectives. The findings indicate that SSF research, more prevalent in the areas of Agricultural and Biological Sciences, grew slowly from 1965 to 1997 before increasing. Initially, the publication themes were bio-ecological before associated with management concerns and evolving into a more socio-economic tone. With an average of 35.75 citations per year, Allison and Ellis's 2001's article was the most cited paper. In terms of total publication, Brazil and The University of British Columbia were the most productive countries and affiliations (210 and 42 articles, respectively). SSF's future research should prioritize local fisheries ecology and resources assessment, as well as addressing cross-disciplinary issues such as socio-ecological system resilience. Collaborations between authors from different countries and institutions are also more expected.

Keywords: Global Small-Scale Fisheries Research, Bibliometric Analysis, Scopus Database, Harzing's Publish or Perish, VOSviewer

Introduction

Small-scale fisheries (SSF), often confused with artisanal fisheries, have been recognized for their critical role in human and economic development. Oceans have sustained 47 million people in developing countries involved in SSF and fish trading (World Bank, 2012). Over three billion people rely on fish for more than 20% of their animal protein requirements, and rural populations, who frequently have less diverse diets and higher rates of food insecurity, rely even more on fish (FAO 2018). SSF's contributions have also long been recognized in developed countries. Coastal communities on Canada's Pacific Coast have historically relied on the ocean, and some still do so today (Bennett et al., 2021). In 2016, Japan had 160,000 fishermen, and their activities remain a significant source of revenue for rural coastal towns (Teh et al., 2020). It is critical for national food security because most of Japan's SSF catch is marketed and consumed locally (Bulian and Makano, 2018; MAFF, 2018).

Moreover, SSF plays a crucial role in fostering the growth of new businesses and increasing remittances around the globe (Bravo-Olivas and Chávez-Dagostino 2020) and have the potential to provide the government with secure revenues when adequately managed (FAO and OECD, 2014). However, the future of SSF has long been questioned due to the persistence of its issues and challenges. In today's SSF world, global issues such as population pressure, unfair trade policy, and climate change are viewed as wicked situations. To address such issues, sustained efforts from multi-actors including studies by researchers are critical for providing society with science-based policy and appropriate actions.

Despite widespread interest in SSF research, trends in the literature using a bibliometric approach have been limited. A few studies have been conducted in this area (Table 1). While these studies can shed critical light on the future development of SSF, they frequently focus on narrow issues and cover only a subset of bibliometric analysis. Thus, this current bibliometric study attempts to analyze and visualize all SSF topics that have emerged between 1965 and 2020. By examining the evolution of issues over time and incorporating standard bibliometric study features, related stakeholders will gain a broader perspective necessary to inform the future of global SSF studies.

Table 1

Comparison of other studies related to small-scale fisheries using bibliometric analysis.

Compared Elements	Authors			
	Oliveira Júnior et al. (2016)	Picone et al. (2020)	Xu et al. (2021)	Martínez-Vázquez et al. (2021)
Data Source & Time Period Analysis	Web of Science (WoS), from 1973 to 2014	Scopus, from 1983 to 2020 and WoS, from 1990 to 2020	WoS, from 1990 to 2020	WoS and Scopus, from 1979 to 2020
Research Focus	Global production of scientific knowledge in coastal & marine artisanal fisheries	Marine Protected Areas (MPA)	Fishery Resource Assessment and Sustainable Utilization (FRASU)	Blue Economy (BE)
Search Strings	("artisanal fisheries" OR "artisanal fishing") OR ("Small-scale fisheries").	"marine protected area*"	'TS = (Fishery resources* AND (Assessment* OR Sustainable use*))'	"blue economy" or "ocean economy" or "blue growth" or "maritime economy" or "marine economy"
Search Date	05 November 2014	15 January 2020	20 July 2020	Not mentioned
Total Documents Examined (TDE)	1127	5908	1631	499
Bibliometric Indicators Used	Geographic structure of research networks and centers of knowledge production and geographical patterns and shortfalls in research effort	Co-occurrence of network of keywords, citation burst analysis of keywords, temporal trend of research	Trend of publication, co-citation analysis, authorship analysis, institutions analysis, countries or territories analysis, analysis of reference citations, and analysis of keywords	Analysis of scientific production (publication and citation), analysis of keywords, and analysis of authors

Mapping Tools and other supported software	Bibexel v.24-03-25, Pajek v.4, Inkscape v.0.47, and software R	VOSviewer (version 1.6.13), CiteSpace (version 5.6.R2)	CiteSpace (version R11)	VOSviewer 5.3. Biblioshiny (R-Studio)	and (R-
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This article will elaborate on the findings from the previous article. Following that, the following research questions (RQs) were proposed:

1. What is the current state of research in the field of SSF?
2. What are the most popular topics in SSF among scholars?
3. Which authors were the most active and influential in SSF research, and how did they collaborate with other authors?
4. Which country and institution are the most influential in terms of SSF research and how have they collaborated with others?

The present study will examine:

- The characteristics of research trends, subject areas, most active source titles, and document languages (RQ1);
- Title analysis (RQ2); citation, authorship, and co-authorship analyses (RQ3); and
- Geographical distribution of publications and most active institutions (RQ4).

Materials and Methods

Several processes were carried out to accomplish the research objective. First, SSF research data was gathered using the Scopus database. Burnham (2006) claims Scopus is easy to use even for novices. He adds that being able to search both forward and backward from a citation would be very useful. It also covers more journals than Web of Science (WoS) or PubMed, and its citation analysis is faster and includes more articles than WoS (Falagas et al., 2008).

Second, the authors used the research title to narrow the search to relevant literature. As a result, the search process used the query shown in figure 1. 1965 was chosen as the starting year because that year saw the first SSF article in Scopus, *the role of fish in the Indonesian child's diet and methods for improving traditional fish processing*. The data was analyzed using Microsoft Excel, VOSviewer, and Harzing's Publish and Perish. Van Eck and Waltman (2009) claim that unlike CiteSpace II and VantagePoint, VOSviewer emphasizes the graphical representation of bibliographic maps.

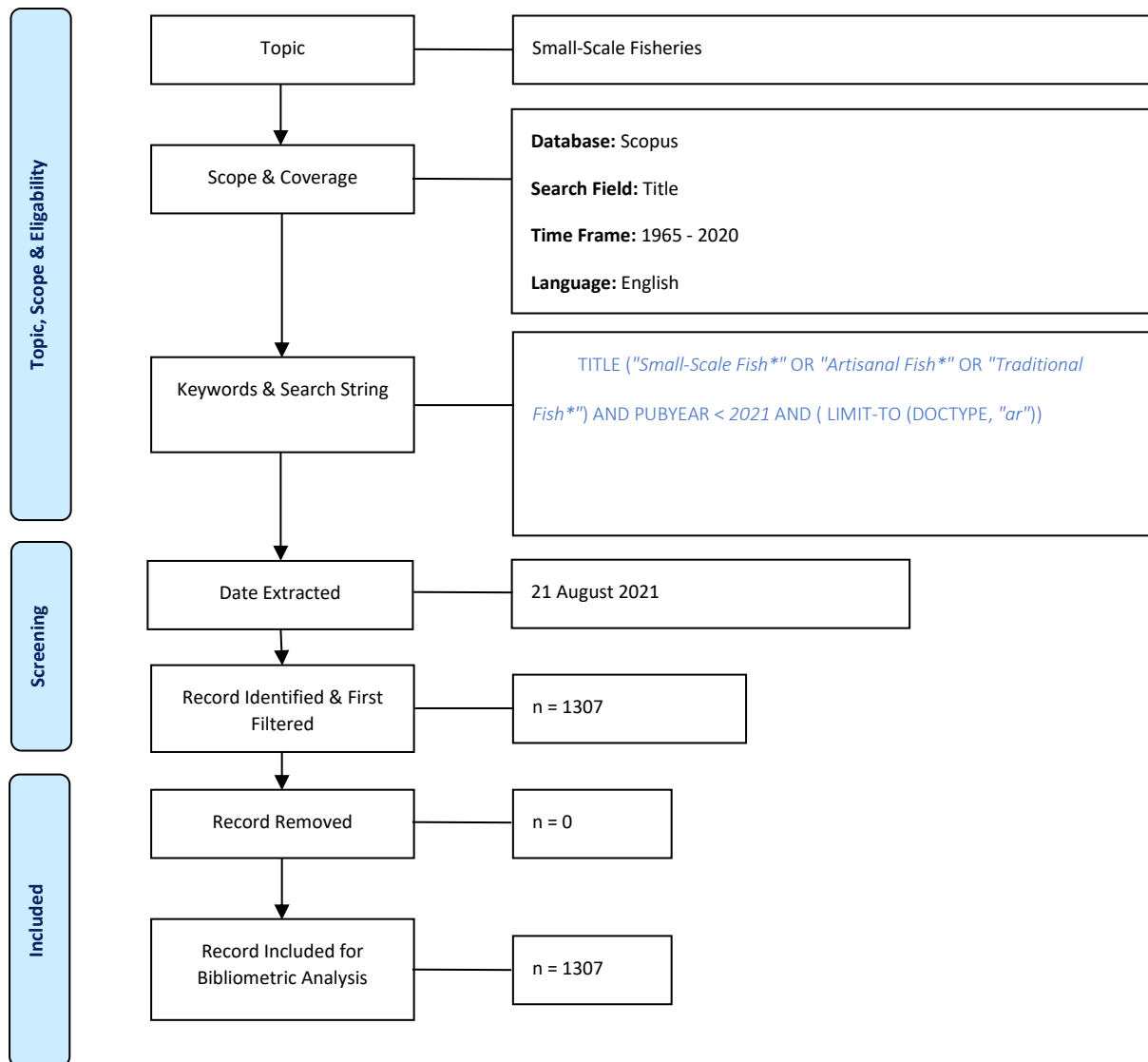


Figure 1. Flow diagram of the search strategy (Source: Moher et al. 2009; Zakaria et al. 2020)

Results and Discussion

1. What is the research trend in the field of SSF?

Research trend in the field of SSF was not only about the trend itself, but also consisted of the subject area, the most active source title, and languages of the articles.

Research Trend

The research trend was determined by the number of total publications (TP) and citations (TC) per year. According to Ahmi and Mohamad (2019), analysing articles according to their publication year enables researchers to observe and monitor the topic's popularity and pattern.

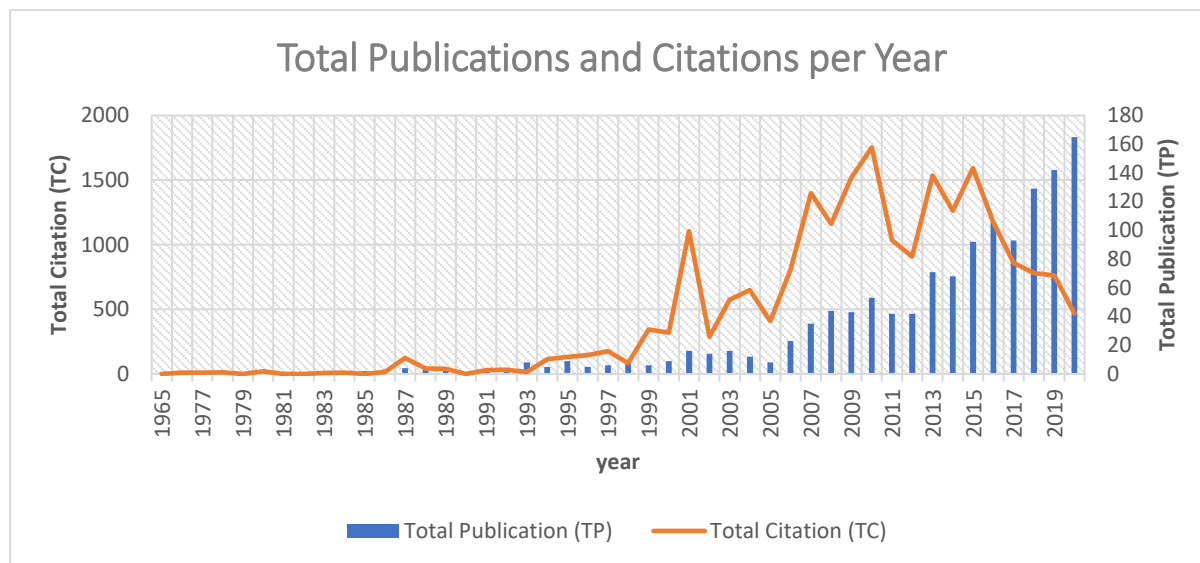


Figure 2. Total publications and citations by year

During the study period, there were 1,307 SSF research articles. The number of articles started to grow gradually after 2000 and increased more after 2015, especially after the adoption of the Sustainable Development Goals (SDGs) 2030 and the FAO's voluntary guidelines for securing sustainable SSF. These two international platforms may be responsible for the rise in the number of publications as both have created momentum for researchers to assess SSF's impact on human and global ecosystems from a broader perspective.

On the other hand, the total number of TC did not track the TP. From 1965 to 2015, it increased gradually, matching the TP trend, but from 2016 to 2020, the trend shifted. As TP increased, the TC decreased significantly. The reason could be related to the age of publication. If published at a younger age, research topics may be less accessible and more challenging to find. Authors whose publications were published in 2019, for example, would not cite more publications from the same year. This is because the number of publications related to their studies was likely limited compared to those that appeared approximately ten years ago.

Subject Area

Data analysis revealed that most of the studies were classified in clump of life and social sciences as shown in the following table.

Table 2

Total publication of small-scale fisheries based on subject area.

Subject Area	Total Publication (TP)	Percentage (%)
Agricultural and Biological Sciences	873	66.79%
Environmental Science	672	51.42%
Social Sciences	429	32.82%
Earth and Planetary Sciences	269	20.58%
Economics, Econometrics and Finance	193	14.77%
Medicine	57	4.36%
Engineering	50	3.83%
Arts and Humanities	45	3.44%
Biochemistry, Genetics and Molecular Biology	42	3.21%
Multidisciplinary	37	2.83%
Business, Management and Accounting	24	1.84%
Energy	21	1.61%
Health Professions	16	1.22%
Computer Science	9	0.69%
Immunology and Microbiology	9	0.69%
Neuroscience	8	0.61%
Veterinary	8	0.61%
Chemistry	6	0.46%
Mathematics	6	0.46%
Pharmacology, Toxicology and Pharmaceutics	6	0.46%
Decision Sciences	4	0.31%
Nursing	4	0.31%
Chemical Engineering	3	0.23%
Materials Science	2	0.15%
Physics and Astronomy	2	0.15%
Psychology	1	0.08%

The table indicates that most SSF research was focused on agricultural and biological sciences, which is not surprising as bio-ecological aspects had dominated the studies for years before the human socio-ecological aspect stepped in. Research in the latter area has become increasingly appealing to researchers worldwide after human population growth has become another issue and challenge to the SSF management.

Most Active Source Title

Ten journals were identified as the most active ones based on total publication (TP) and total citation (TC). Even though these two metrics were examined to determine the productivity or quantity of the source title, other metrics were also included in the following table to demonstrate the impact or quality of the source, including Schimago Journal Rank (SJR), Source-Normalized Impact per Paper (SNIP), NCP = number of cited papers, C/P = number of citations per paper, C/CP = average number of citations per cited publication, h (h index) and g (g index).

Table 3

Most active source title.

Source Title	TP	%	Publisher	Cite Score 2020	SJR 2020	SNIP 2020	NCP	TC	C/P	C/CP	h	g
Marine Policy	149	11.40	Elsevier	5.8	1.355	1.556	145	3,560	23.89	24.55	30	53
Fisheries Research	88	6.73	Elsevier	4.1	0.925	1.169	86	2,504	28.45	29.12	31	47
Ocean And Coastal Management	81	6.20	Elsevier	5.2	0.916	1.43	76	1,020	12.59	13.42	17	27
Boletim Do Instituto De Pesca	31	2.37	Springer Nature	1.1	0.262	0.499	29	196	6.32	6.76	8	11
Maritime Studies	29	2.22	Public Library of Science	2.7	0.487	0.758	28	301	10.38	10.75	10	16
PloS One	23	1.76	Wiley-Blackwell	5.3	0.99	1.349	23	642	27.91	27.91	14	23
Fisheries Management and Ecology	22	1.68	Frontiers Media S.A.	3.0	0.693	0.918	22	558	25.36	25.36	13	22
Frontiers In Marine Science	22	1.68	Oxford University Press	5.0	1.558	1.437	21	277	12.59	13.19	9	16
ICES Journal of Marine Science	21	1.61	The Resilience Alliance	5.8	1.348	1.309	21	447	21.29	21.29	11	21
Ecology And Society	17	1.30	Wiley-Blackwell	7.2	1.528	1.501	17	465	27.35	27.35	11	17

The ten most active journals account for approximately two-thirds of the total. This dispersion of research across numerous journals suggests that authors may be unsure of the most appropriate venue for their work. Xu et al (2021) claim that authors could identify major journals with high publication and citation rates to better understand significant SSF studies. As a result, the current study may provide helpful guidance. According to the analysis, the three most attractive journals were 'Marine Policy,' 'Fisheries Research,' and 'Ocean and Coastal Management,' and Elsevier was the market leader in this field. Moreover, among the most active journals, only Ecology and Society has a CiteScore greater than 5.0, indicating a more valuable journal in 2020. Its low total publication also implies that the journal is the most difficult to publish. The remaining journals have a CiteScore of more than 1.0 but less than 4.0, indicating that the level and quality of research published in the journals need to be improved, necessitating global author contacts and collaborations.

Meanwhile, increased publication in Marine Policy may be linked to the journal's broader readership and reputation. The journal currently has a Citescore of 5.8 (2020), which places it in Quartile 1. Additionally, manuscripts are peer-reviewed and receive an initial decision within 62 or 63 days of submission. Most articles are likely to be published in two formats, one of which is open access. While some authors may seek financial gain from their publication's readers, others value increased accessibility to benefit science and communities.

Warlick and Vaughan (2007) argue that the selection of open access journals appears to be motivated by both the quality of the publications and their open access and visibility.

Languages of the Documents

English was the language of most publications in this field of study. Three documents, on the other hand, were presented in a vague language.

Table 4

Used Languages

Language	Total Publications (TP)*	Percentage (%)
English	1,195	89.58
Spanish	58	4.35
Portuguese	56	4.20
French	10	0.75
Chinese	4	0.30
Croatian	2	0.15
Russian	2	0.15
Thai	2	0.15
Japanese	1	0.07
Norwegian	1	0.07
Undefined	3	0.22
Total	1,334	100.00

Note: *27 documents have been prepared in dual languages (The total articles being studied were 1307, but since 27 papers have been published in dual languages, the number of articles appeared here became 1334 in total)

The reason many publications use English as the language of presentation is evident. As the world's lingua franca, many authors want their articles read by diverse group targets who use English as their second language. Di Bitetti and Ferreras (2016) claim that articles published in languages other than English are less likely to be cited. It is a widely spoken language with a global reach that enables people to communicate across cultures and access a range of information (McKay, 2018).

2. What are the most popular topics in SSF among scholars?

The most popular topics in the field of SSF could be known by analysing the titles of articles based on their number of co-occurrences. The co-occurrence network analysis depicted in Figure 3 was based on the title containing a minimum of 30 co-occurrences of a term. Themes in the title were color-coded according to the average year of publication in which they appear.

The map shows that until 2012, SSF research focused on bio-ecological issues before expanding to management and more integrated sciences. Like marine protected areas and development, these themes have been linked to other facets of bio-ecology and socioeconomics. That is, such issues require a higher level of understanding and approach and additional resources in comparison to other single issues. Moreover, while socio-economic aspects have dominated recent publications, future studies of SSF will likely be more interdisciplinary because of the complicated issues of climate change and resource depletion for example.

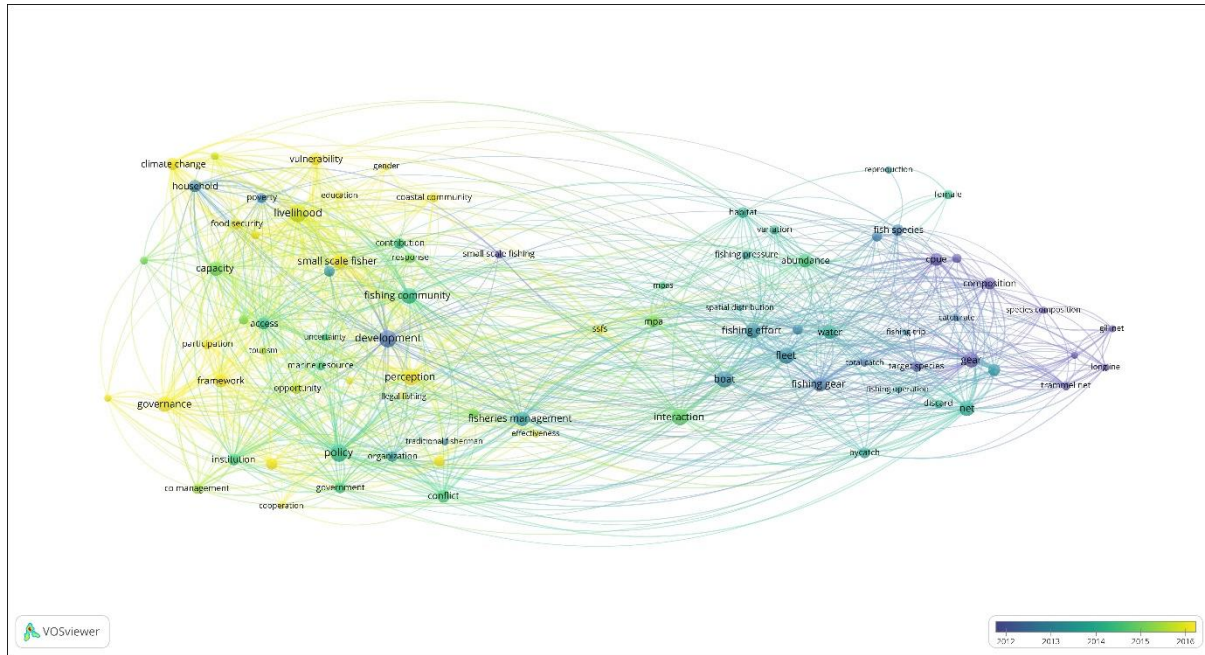


Figure 3. Visualization of a term co-occurrence network based on title fields (Full Counting)

3. Which authors were the most active and influential in SSF research, and how did they collaborate with other authors?

By analysing citation metrics and authorship and co-authorship, the most active and influential authors in SSF research and their collaborative works with scientists from around the world were identified.

Citation Analysis

There were 21,725 citations to SSF publications over 56 years. The average number of citations per year was 387.95, based on 1307 publications.

Table 5

Citations metrics.

Metrics	Data
Number of Articles	1,307
Number of Citations	21,725
Citation Years	56 (1965-2020)
Citation per Year	387.95
Citation per Paper	16.62
Citation per Author	8,357.38
Papers per Author	517.20
Authors per Paper	3.62
h_index	67
g_index	99

Simultaneously, Table 6 below summarizes the top twenty highly cited publications on SSF based on the number of mentioned times. These articles can be the most significant in the field.

Table 6

Top 10 highly cited articles on small-scale fisheries.

No.	Authors	Title	Cites	Cites per Year
1	Allison & Ellis (2001)	The livelihoods approach and management of small-scale fisheries	715	35.75
2	Salas et al (2007)	Challenges in the assessment and management of small-scale fisheries in Latin America and the Caribbean	244	17.43
3	Hastings & Botsford, (1999)	Equivalence in yield from marine reserves and traditional fisheries management	241	10.95
4	<u>Béné</u> et al (2010)	Not by rent alone: Analysing the pro-poor functions of small-scale fisheries in developing countries	237	21.55
5	Andrew et al (2007)	Diagnosis and management of small-scale fisheries in developing countries	226	16.14
6	Cinner et al (2009)	Socioeconomic factors that affect artisanal fishers' readiness to exit a declining fishery	208	17.33
7	Pechham et al (2007)	Small-scale fisheries bycatch jeopardizes endangered pacific loggerhead turtles	170	12.14
8	Hawkins & Roberts (2004)	Effects of Artisanal Fishing on Caribbean Coral Reefs	167	9.82
9	Mc Clanahan & Mangi (2004)	Gear-based management of a tropical artisanal fishery based on species selectivity and capture size	164	9.65
10	Basurto et al (2013)	The social-ecological system framework as a knowledge classificatory system for benthic small-scale fisheries	157	19.63

The livelihoods approach and management of small-scale fisheries authored by Edward Hugh Allison and Frank Ellis in 2001 received the most citations in the history of SSF studies. Its authors were influential in SSF research after 2001. The livelihoods approach and management of small-scale fisheries, the two themes in the article, have long been topics of academic and other stakeholder interest. However, comparing the article's total citations is unfair because older papers were cited more frequently than recent ones.

The article of "The social-ecological system framework as a classification system for benthic small-scale fisheries" authored by Basurto et al (2013), for instance, has been cited 19.63 times per year. Other articles have higher total citation per article, such as Salas et al (2007), Hastings and Botsford (1999); Andrew et al (2007), yet have lower citations per year than the

article by (Basurto et al., 2013). From this statistical record, it can be assumed that the article of Basurto et al (2013) was the most appealing to the other authors, as it received the most citations per year. Unlike the other articles, which focused exclusively on the management of SSF, this one included a social component in the bio-ecological assessment of fisheries. As a result, the likelihood of being cited by both social and bio-ecological scholars increases.

Authorship & Co-Authorship Analysis

The analysis was conducted based on the total published articles (TP) written by each author. In doing the analysis, the authors set at least ten publications on SSF as the threshold. Based on the TP, ten authors were identified as the most productive in writing and publishing scientific articles.

Table 7

Top 10 productive authors.

Author Name	TP	Affiliation	Country	NCP	TC	C/P	C/CP	h	g
Gelcich	13	Pontificia Universidad Católica de Chile	Chile	13	622	47.85	47.85	8	13
Godley	13	University of Exeter, College of Life and Environmental Sciences	United Kingdom	13	485	37.31	37.31	10	13
Béné	12	Centro Internacional de Agricultura Tropical	Colombia	12	1,082	90.17	90.17	10	12
Alfaro-Shigueto	11	University of Exeter; Universidad Científica del Sur, Facultad de Biología Marina	United Kingdom; Peru	11	380	34.55	34.55	7	11
Begossi	11	Universidade Estadual de Campinas; Universidade Santa Cecília, Graduate Program; Fisheries and Food Institute – FIFO	Brazil	11	135	12.27	12.27	7	11

Mangel	11	University of Exeter; Pro Delphinus	United Kingdom; Peru	11	380	34.55	34.55	7	11
Basurto	10	Duke University	United States	10	396	39.60	39.60	8	10
Pomeroy	10	University of Connecticut Avery Point Campus	United States	9	158	15.80	17.56	7	10
Sumaila	10	The University of British Columbia, Fisheries Economics Research Unit	Canada	10	277	27.70	27.70	8	10
Zappes	10	Universidade Federal Fluminense	Brazil	10	94	9.40	9.40	6	9

Based on the analysis, Stefan Gelcich, a Universidad Católica de Chile researcher, was the most prolific SSF author. This number matched Brendan J. Godley's publications from the University of Exeter's College of Life and Environmental Sciences in the United Kingdom, but the former received more total and average citations.

Table 8

Number of author(s) per document.

Author Count	Total Publications (TP)	Percentage (%)
1	175	13.31
2	268	20.50
3	278	21.27
4	242	18.52
5	134	10.25
6	80	6.12
7	53	4.06
8	24	1.84
9	13	0.99
10	11	0.84
11	9	0.69
12	3	0.23
13	4	0.31
14	1	0.08
15	2	0.15
16	1	0.08
17	2	0.15
18	1	0.08
20	2	0.15
25	3	0.23
0*	2	0.15
Total	1307	100.00

Note: *Cannot be recognized because there is no author name (Appropriate Technology, 2006) and written by the institution (World Bank Technical Paper, 1991)

In terms of the number of authors per document, the result revealed that 13,31% of document were written by one author, while the rest were written by two to 25 people. Two documents for which their authors' names were unknown because they cannot be found in the Scopus database. In the table, it was also noted that research on SSF had been linked to different affiliations. It was also a sign of cooperation among the authors' organizations and countries of origin. Therefore, further analysis of co-authorship as well as the geographical distribution of publications was performed.

Authors with at least five citations and three co-published documents were used in the co-authorship analysis with fractional counting. According to Perianes-Rodriguez et al. (2016), the fractional counting approach is often better than the whole counting method because each operation is given equal weight. Depending on the colour, size of the circle, text size, and thickness of the lines, these attributes indicated the writers' relationship. Authors who shared a colour were frequently grouped.

Based on the collaboration network, a total of 23 clusters of researchers often conducted collaborative research and co-published together. The purple color, for instance, represented the work of Hanazaki, Bender, Daura-Jorge, and others who had closely cooperated and usually conducted research jointly (Figure 4). Additionally, some authors in a particular group had worked together with other researchers from other clusters (Figure 4). For example, apart from collaborating with Salas, Seijo, Chin, and other scholars in the green set, Sumaila had teamed up with Allison (red cluster), Chuenpagdee (pink group), Pita (black and white groups), and with Lopes and Carvalho (light blue collection). It could mean that researchers' collaboration is fluid rather than exclusive. While a research institution may not have a formal agreement with another research office, its researchers can collaborate on projects based on mutual needs.

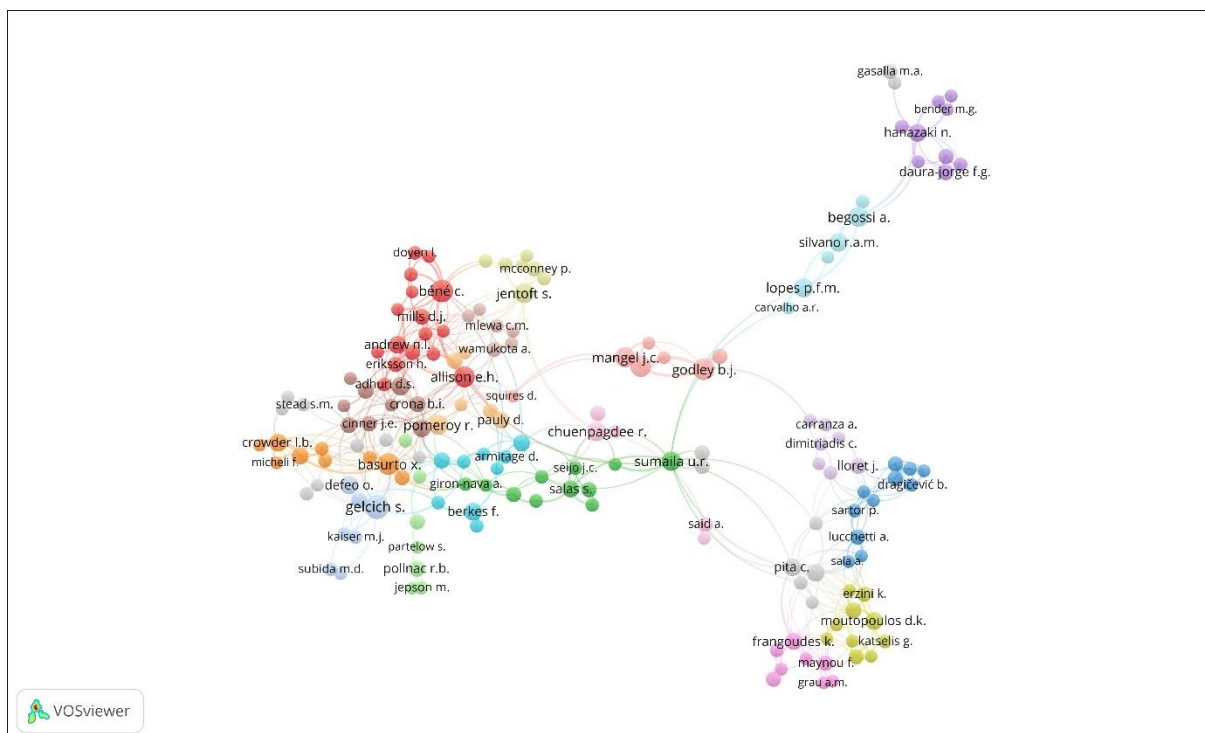


Figure 4. Network visualization map of the co-authorship among the authors

Which country and institution are the most influential in terms of SSF research and how have they collaborated with others?

This study also revealed that certain nations and institutions were more engaged in SSF research than others. The fact has been confirmed by an analysis of the geographical distribution of published articles and active organizations.

Geographical Distribution of Publications

According to the result analysis, 41 countries had contributed to SSF articles in total. The 20 highly active ones can be seen in the following table.

Table 9

Top 20 highly active countries & continents contributed to the publications.

Country	Continent	TP	%	NCP	TC	C/P	C/CP	h	g
Brazil	South America	210	16.07	185	2,822	13.44	15.25	27	42
USA	North America	202	15.46	191	5,318	26.33	27.84	39	66
UK	Europe	117	8.95	114	4,256	36.38	37.33	32	63
Canada	North America	108	8.26	107	3,117	28.86	29.13	32	52
Spain	Europe	103	7.88	95	2,030	19.71	21.37	24	41
Australia	Oceania	86	6.58	84	1,861	21.64	22.15	24	40
Mexico	North America	80	6.12	69	1,318	16.48	19.10	19	34
Chile	South America	64	4.90	54	1,128	17.63	20.89	16	32
France	Europe	60	4.59	56	1,319	21.98	23.55	20	35
Italy	Europe	55	4.21	53	1,018	18.51	19.21	17	29
Sweden	Europe	48	3.67	48	974	20.29	20.29	18	29
Indonesia	Asia	47	3.60	30	294	6.28	9.83	9	16
Malaysia	Asia	43	3.29	38	1,436	33.40	37.79	16	37
Germany	Europe	40	3.06	38	583	14.58	15.34	11	23
India	Asia	39	2.98	34	152	3.90	4.47	7	9
South Africa	Africa	31	2.37	31	608	19.61	19.61	11	24
Norway	Europe	30	2.30	28	666	22.20	23.79	12	25
Greece	Europe	29	2.22	29	753	25.97	23.79	14	27
Nigeria	Africa	28	2.14	21	328	11.71	15.62	8	18
Portugal	Europe	28	2.14	28	567	20.25	20.25	13	23

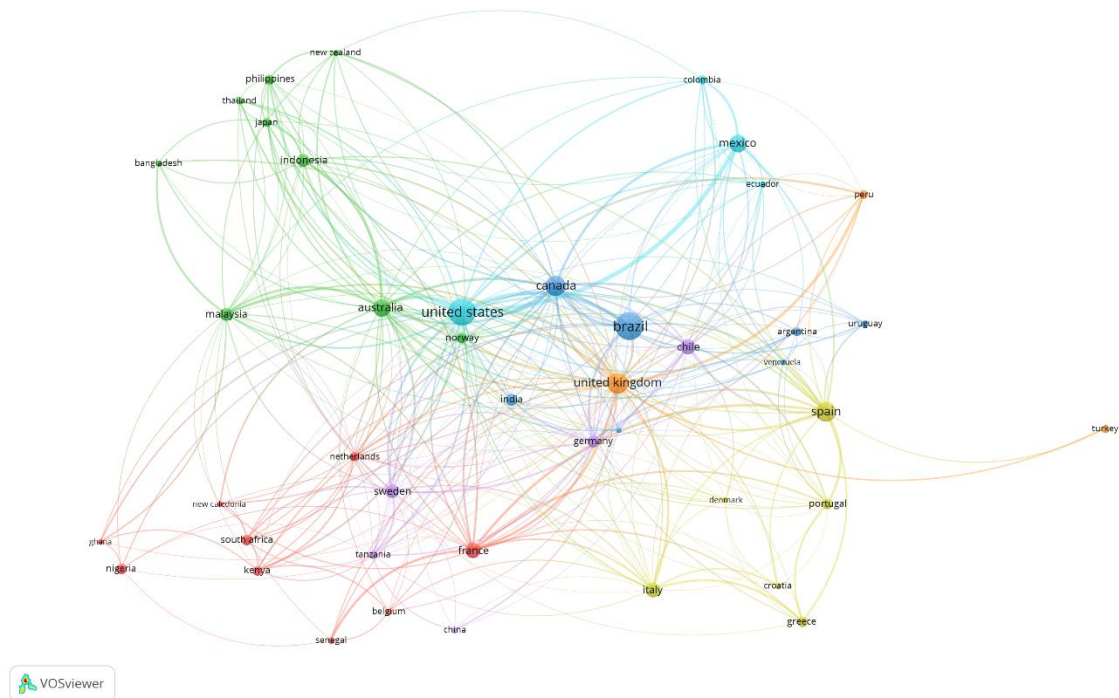


Figure 5. Network visualization map of co-authorship by countries
 The study also looked at author networks (co-authorship) by country. On the co-authorship map, 43 countries were grouped into seven clusters based on their number of co-authorships (Figure 5, Table 10).

Table 10
 Clusters of co-authorship by countries.

Color	Cluster	Countries	Total Link Strength
Red	1	Belgium	6.00
		France	43.00
		Ghana	7.00
		Kenya	14.00
		Netherlands	14.00
		New Caledonia	7.00
		Nigeria	4.00
		Senegal	9.00
		South Africa	11.00
Green	2	Australia	63.00
		Bangladesh	9.00
		Indonesia	21.00
		Japan	11.00
		Malaysia	29.00
		New Zealand	12.00
		Norway	18.00
		The Philippines	15.00
		Thailand	10.00
		Blue	3
Brazil	52.00		

Color	Cluster	Countries	Total Link Strength
Purple	4	Canada	62.00
		Costa Rica	7.00
		India	4.00
		Uruguay	7.00
		Venezuela	6.00
		Croatia	6.00
		Denmark	6.00
	5	Greece	15.00
		Italy	26.00
		Portugal	21.00
		Spain	54.00
		Chile	27.00
		China	4.00
		Germany	28.00
Sky Blue	6	Sweden	30.00
		Tanzania	15.00
		Colombia	14.00
	7	Ecuador	11.00
		Mexico	40.00
		USA	121.00
		Peru	18.00
		Turkey	3.00
		United Kingdom	81.00

The tables 9 and 10 and figure 5 above suggest that authors from America and Europe had dominated SSF research. Brazil came out on top in terms of productivity. Meanwhile, authors from Indonesia, Malaysia, and India made up only 4% of the total publication output. However, their countries and people rely on SSF products for employment, family nutrition, and income to help alleviate poverty. It, therefore, indicates a divide in research quantity and quality between the northern and southern hemispheres.

In terms of collaboration, Indonesian authors frequently work with colleagues from Malaysia and Bangladesh, whereas American authors prefer to work with colleagues from Mexico and Colombia. Aside from these countries, authors from the US also work with counterparts from Indonesia and France. This reality is linked to the United States' concerns and interests in SSF globally, as shown by the thickest line on the map (Figure 5). Moreover, while Brazil produced eight more articles than the USA, Brazilian researchers collaborated with foreign authors less than their American counterparts. Another intriguing fact concerns Indonesia-Malaysia relations. Indonesia produced more articles than Malaysia but received fewer citations. This shows that Malaysia is a far more reliable SSF reference than Indonesia or India, especially in Asia.

Most Active Institutions

In this paper, the most active institutions also were analyzed based on research related to SSF with a minimum of 18 publications.

Table 11

Most active institutions with a minimum of 18 publications.

Institution	Country	TP	NCP	TC	C/P	C/CP	h	g
The University of British Columbia	Canada	42	42	1,345	32.02	32.02	21	36
WorldFish	Malaysia	32	31	1,407	43.97	45.39	17	32
James Cook University	Australia	29	29	940	32.41	32.41	16	29
Stockholm Universiteit	Sweden	25	25	669	26.76	26.76	13	25
ARC Centre of Excellence for Coral Reef Studies	Australia	24	24	819	34.13	34.13	14	24
Stockholm Resilience Centre	Sweden	24	24	660	27.50	34.13	13	24
<i>Instituto Politécnico Nacional</i>	Mexico	22	18	175	7.95	9.72	8	12
University of Exeter	United Kingdom	21	21	604	28.76	28.76	12	21
<i>Pontificia Universidad Católica de Chile</i>	Chile	20	19	721	36.05	37.95	11	20
Universidade Federal do Rio Grande	Brazil	19	17	260	13.68	15.29	8	16
Duke University	USA	18	18	866	48.11	48.11	13	18
CNRS Centre National de la Recherche Scientifique	Paris	18	17	299	16.61	17.59	9	17
<i>Universidade Federal Rural de Pernambuco</i>	Brazil	18	15	113	6.28	7.53	6	10

The findings indicated that The University of British Columbia had more publications than the others. Regarding the authors' affiliations, a reverse pattern emerged. While Brazilian and American authors have published more articles than other countries, their institutions have published fewer empirical SSF findings. Moreover, the existence of Malaysia-based WorldFish revealed another interesting pattern. It was ranked as the second most active organization in SSF publications as an institution. However, such a prestigious position has yet to increase the number of Asian researchers' publications.

Conclusion

Based on the analysis conducted, it can be concluded that SSF studies have been more prevalent in the agricultural and biological sciences. This is because they grew slowly until 1997 before gradually increasing after that. The publication themes were initially about bio-ecological aspects before addressing management concerns and taking on a socio-ecological and economic tone, which means that such issues involve complex understanding and approaches and require more resources than other single issues. The most prolific authors of SSF studies were Edward Hugh Allison, Frank Ellis, Stefan Gelcich, and Brendan J. Godley. Although many authors from America and Europe had published articles, institutions from the continents, on the other hand, published less. In addition to involve more than one author,

research on SSF included different affiliations. It was a sign of cooperation between the organizations as well as a connection among the authors' various countries of origin.

This bibliometric study is crucial in examining and quantifying facets of scientific literature, including citation patterns, publication trends, and research collaborations, contributing both theoretically and contextually to the small-scale fisheries (SSF) knowledge base. Theoretically, the study aids in research evaluation and discipline mapping. It offers valuable insights into research impact and quality for researchers, institutions, and funding agencies. By examining citation patterns, it identifies influential publications, authors, and fields, providing insights into scientific discipline structures, collaboration patterns, emerging areas, and interdisciplinary trends in SSF.

Contextually, this study informs policy-making, institutional assessment, collaboration, networking, and research-agenda setting. It guides policy-makers in allocating funding, evaluating programs, and establishing priorities by highlighting influential areas and assessing SSF research performance. Universities and research institutions can use this analysis to gauge their performance, compare with others, and identify improvement areas. Additionally, the research reveals collaboration patterns, encouraging new collaborations and strengthening existing research networks.

Finally, it helps researchers recognize literature gaps, emerging trends, and potential future research directions. While this article contains insightful information, it also includes several constraints that should be addressed to improve future research. Although Scopus is one of the largest online databases indexing all scientific publications, it does not include all available sources, and the search engine is not always stable. As a result, some exclusions from this study are highly probable. Additionally, no search query can capture all academic activities in this field. Additional databases such as the Web of Science, Google Scholar, and CABI may be used in future research. SSF-related critical strings by type, region, and gender should be included in future bibliometric studies.

Future research should focus on integrating fisheries ecology and resources into a local management perspective, the 2030 Agenda's goals and targets, and cross-disciplinary topics like climate change and social resilience. More international collaborations between authors and institutions are expected in the future. WorldFish should actively connect Asian researchers with SSF in its research and publication activities.

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