Global research trends and innovation pathways in trap fisheries from 2000 to 2025: a bibliometric analysis

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Abstract. This study examined global research trends and innovation pathways in trap fisheries using bibliometric indicators from Scopus-indexed publications between 2000 and 2025. A PRISMA-style selection workflow was applied through Scopus TITLE-ABS-KEY searching, duplicate removal, and Python-assisted screening of titles, abstracts, and keywords. From 1,798 initial records, 605 strongly relevant journal articles were retained for bibliometric analysis using Biblioshiny and VOSviewer. The results show that trap fisheries research has expanded steadily, with an annual growth rate of 4.93%, involving 2,090 authors across 205 publication sources. The field was predominantly collaborative, with an average of 4.2 co-authors per document and international co-authorship representing 21.98% of the corpus. Thematic analysis indicated that trap fisheries research was mainly concentrated on species composition and biodiversity, trap design and fishing technology, habitat and ecosystem impacts, monitoring and data analytics, and fisheries management. In contrast, more specific themes such as bycatch mitigation, gear selectivity, ghost fishing, and fyke-net or set-net fisheries were less represented, although they are increasingly relevant in recent studies. Overall, this study provides a structured overview of the intellectual development of trap fisheries research and highlights the need for stronger integration between passive fishing gear technology, ecological sustainability, and data-driven fisheries management.
Keywords: bibliometric analysis, Biblioshiny, passive fishing gear, Scopus, trap fisheries, VOSviewer.

Introduction. Small-scale coastal fisheries play a crucial role in food production, employment, and local market systems in numerous coastal regions (Chuenpagdee et al., 2006). In Indonesia, research conducted in Bone Regency indicates that traditional sero fisheries are intricately connected to food security, coastal livelihoods, cultural identity, and local fisheries governance within the framework of the blue economy (Patangngari et al., 2026). Trap fisheries encompass a diverse array of passive gears, including set nets, fyke nets, fish traps, crab traps, and traditional staked traps. These gears are typically fixed or semi-fixed in aquatic environments and capture organisms by guiding or retaining them through fish movement, tidal flow, habitat use, and other environmental cues. In Bone Gulf, the sero represents a stationary trap system that utilizes tidal currents and fish movement to guide organisms into a trap chamber, exemplifying the operational principle of passive trap fisheries (Patangngari et al., 2026). Trap fisheries are often regarded as relatively low-impact fishing systems due to their generally lower fuel requirements and reduced active searching compared to mobile gears (Loebmann & Vieira, 2006). However, their ecological performance is not uniform. Trap fisheries may still result in bycatch, ghost fishing, and habitat interactions, contingent upon gear design, mesh size, soak time, habitat type, and target species (Hall et al., 2000; Davies et al., 2009; Shester & Micheli, 2011; Pardalou et al., 2022; Silveira et al., 2024). Indonesian sero fisheries demonstrate that passive traps can retain diverse assemblages and raise concerns regarding gear selectivity, juvenile retention, and habitat-associated catch variation, particularly when small mesh sizes are employed in coastal and estuarine areas (Patangngari et al., 2025a, b).

Research on trap fisheries has expanded to encompass several interconnected themes. Previous studies have examined catch composition, gear selectivity, bycatch reduction devices, ghost fishing, habitat-associated catch patterns, and technological advancements in passive fishing systems (Mahon & Hunte, 2001; Al-Masroori et al., 2004; Johnson, 2010; Harvey et al., 2012; Naimullah et al., 2022; Yoshida et al., 2024). Recent studies from Bone Gulf have also shown that trap-based fisheries research has begun to integrate fish diversity, catch composition, physicochemical conditions, conservation status, and habitat-specific environmental gradients, including seaweed farming areas and rocky headland ecosystems (Patangngari et al., 2025a, b). Although not focused on trap fisheries, regional evidence from Indonesian capture fisheries also shows that oceanographic conditions can influence catch performance. Putri et al. (2019) showed that skipjack tuna catches in the Makassar Strait differed between fish aggregating device (FAD) and free-swimming school fishing in relation to sea surface temperature and chlorophyll-a concentration. More broadly, recent studies have also focused on remote monitoring, acoustic observation, machine learning, and environmental predictors of catch performance in set-net and fyke-net fisheries (Tong et al., 2014; Lee et al., 2017; Liu et al., 2021; Yoshida et al., 2024). These developments indicate that research on trap fisheries has transcended traditional gear descriptions, advancing towards integrated studies of fishing efficiency, ecological sustainability, habitat-based catch dynamics, and technology-assisted management.

Despite the expansion of research in this area, the global landscape of trap fishery studies remains limited. Research efforts have been distributed across various gear types, ecosystems, regions, target taxa, and methodological approaches. Although local and regional studies have documented sero catch composition, fish diversity, habitat-associated environmental drivers, and governance-related issues in Bone Gulf and other small-scale fisheries contexts (Patangngari et al 2025a, b; 2026), the broader intellectual structure of trap fisheries research remains insufficiently synthesized on a global scale. Consequently, discerning the countries, institutions, journals, authors, and research themes that have historically influenced this field is challenging. Therefore, a bibliometric analysis is of significant value, as it provides a quantitative overview of publication growth, citation patterns, source impact, collaboration networks, and keyword structures in a specific research domain. In the context of trap fisheries, this approach can illuminate the field's development, identify topics that have attracted substantial attention, and highlight emerging themes that may inform future research directions.

This study employed a bibliometric methodology to examine Scopus-indexed publications on trap fisheries from 2000 to 2025. The analysis focused on publication trends, contributions from countries and institutions, influential journals, prolific authors, highly cited articles, keyword co-occurrence, and thematic evolution of the literature. Furthermore, this study synthesizes innovation pathways in trap fisheries, particularly the shift from traditional passive gears to more selective, habitat-sensitive, and technologically advanced systems that reduce bycatch. By mapping comprehensive bibliometric indicators, this study offers a clearer foundation for understanding the intellectual structure, research gaps, collaboration patterns, and innovation pathways of global trap fisheries research, while supporting future investigations into sustainable passive fishing technologies.

Material and Method

Study design and database selection. The present study employed a bibliometric review methodology to delineate the evolution, research trends, and thematic framework of global trap fisheries research from 2000 to 2025. Bibliometric techniques are frequently utilized to analyze publication trends, identify influential authors, leading institutions, source journals, geographic distribution, citation patterns, and conceptual relationships within a specific research domain (Zupic & Cater, 2015; Aria & Cuccurullo, 2017; Donthu et al., 2021). The Scopus database was selected as the primary source of bibliographic data due to its provision of structured metadata, including titles, abstracts, keywords, authorship, affiliations, source titles, citation counts, and publication years,

which facilitate bibliometric and science-mapping analyses (Harzing & Alakangas, 2016; Baas et al., 2020). The process of article identification, screening, eligibility assessment, and final inclusion adhered to a PRISMA-style selection pathway, as depicted in Figure 1. This workflow was employed to ensure that the final corpus comprised publications directly pertinent to trap fisheries and associated passive fishing gears.

Methodology and data statistics. The bibliometric review followed several steps, as shown in (Figure 1).

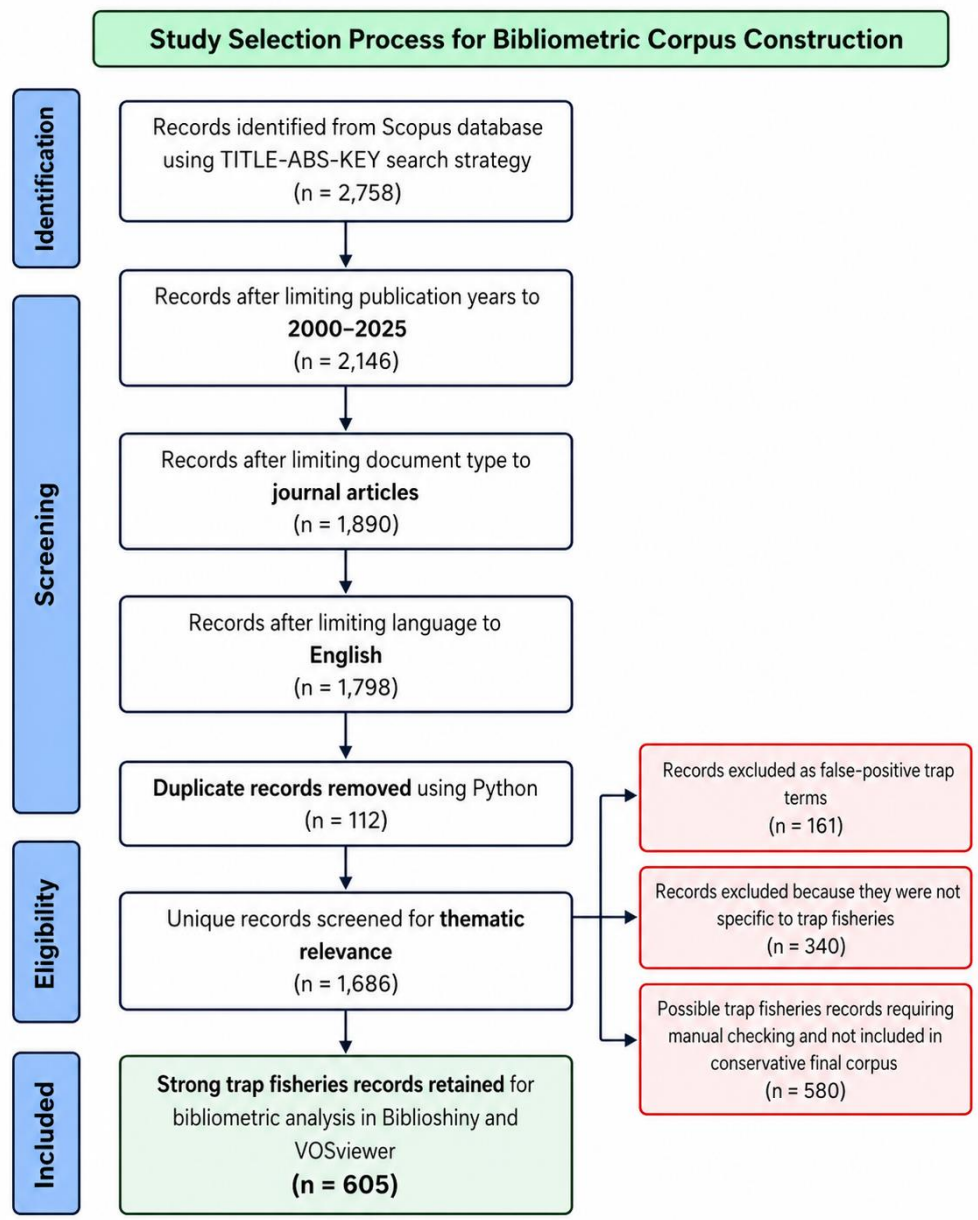


Figure 1. PRISMA-style selection workflow of Scopus-indexed trap fishery publications from 2000 to 2025. From 1,798 initial records, 112 duplicates were removed, and 1,686 records were screened using Python-assisted title, abstract, and keyword filtering. A final corpus of 605 strong trap fisheries records was retained for bibliometric analysis in Biblioshiny and VOSviewer.

First, search terms related to trap fisheries and passive fishing gear were identified in the literature. The Scopus database was used for the literature search because it offers structured data for analysis, such as titles, abstracts, keywords, authors, affiliations, source titles, citation counts, and publication years. The search was conducted using the Scopus TITLE-ABS-KEY function with the following query: TITLE-ABS-KEY (("trap fishery" OR "trap fisheries" OR "trap fishing" OR "fish trap" OR "fish traps" OR "fishing trap" OR

"fishing traps" OR "set net" OR "set-net" OR "setnet" OR "fyke net" OR "fyke-net" OR "leader net" OR "leader trap" OR "pound net" OR "pound-net" OR "fish pot" OR "fish pots" OR "baited trap" OR "baited traps" OR "stationary trap" OR "stationary traps" OR "trap gear" OR "trap gears" OR "trap net" OR "trap nets" OR "fish weir" OR "fish weirs" OR "fishing weir" OR "fishing weirs" OR "bubu trap" OR "togo net") AND (fisheries OR fishery OR fishing OR fisher* OR catch OR catches OR bycatch OR CPUE OR gear OR "fishing gear") AND PUBYEAR > 1999 AND PUBYEAR < 2026 AND (LIMIT-TO (DOCTYPE, "ar")) AND (LIMIT-TO (LANGUAGE, "English")). The search identified 1,798 English-language journal articles published between 2000 and 2025. These records were downloaded in CSV format and processed using Python to remove duplicates, standardize the data, and check relevance based on titles, abstracts, and keywords. After removing 112 duplicates, 1,686 unique records were screened for eligibility. The screening excluded 161 records with false-positive trap terms and 340 records not specific to trap fisheries. Another 580 records required manual checking and were not included in the final group. Finally, 605 strong trap fishery records were retained for analysis using Biblioshiny and VOSviewer.

Thematic research areas were classified using a keyword-based coding framework developed from titles, abstracts, author keywords, and Keywords Plus. Each publication could be assigned to more than one thematic category when multiple topics were present; therefore, percentages were calculated relative to the final validated corpus of 605 articles and were not mutually exclusive. Country, affiliation, journal, and author productivity were calculated using full counting based on Scopus metadata. Keyword co-occurrence and overlay visualization were generated in VOSviewer using author keywords, with co-occurrence links normalized using the association strength method. Citation counts were retrieved from Scopus on 30 April 2026 and therefore represent citation status at the time of data extraction.

Identification of highly cited and recent publications. After the final bibliometric corpus was established, an additional Python-based screening was conducted to identify publications specifically related to set-net and fyke-net fisheries. This step was performed to provide a more focused interpretation of recent and influential studies within the broader trap fisheries literature. Set-net and fyke-net studies were selected because both gears represent passive and stationary fishing systems that are conceptually aligned with trap fisheries. These gears operate by intercepting, guiding, or retaining fish and other aquatic organisms through their natural movement, which is comparable to the operational principles of traditional stationary trap systems used in small-scale coastal fisheries. Therefore, this focused sub-analysis was considered relevant for understanding research developments related to passive stationary trap fisheries.

The Python script searched the title, abstract, and keyword fields for terms related to set net, set-net, bottom-set net, fyke net, and fyke-net. Records that matched these terms were then extracted and ranked according to Scopus citation count and publication year. For the highly cited analysis, publications from 2000 to 2025 were ranked in descending order based on the Scopus "Cited by" count, and the top 15 records were selected after checking their relevance to set-net or fyke-net fisheries. For the recent publication analysis, records published in 2024 to 2025 were filtered using the same Python-based screening procedure. Only six publications within the validated corpus directly matched the set-net and fyke-net criteria during this period; therefore, all six were retained and reported as recent relevant studies rather than forcing the table to include 15 records. For each selected article, information on reference, title, fishing gear or trap type, target species or taxon, main research focus, and citation count was extracted. Citation count was used as a descriptive indicator of scholarly influence, while recent publications were used to identify emerging research directions.

Results

Descriptive characteristics of the bibliometric corpus. The final validated corpus comprised 605 Scopus-indexed journal articles published between 2000 and 2025. These articles were distributed across 205 sources and involved 2,090 authors, indicating that

trap fishery research has developed as a broad and multidisciplinary field. The annual growth rate of publications was 4.93%, suggesting a gradual but consistent expansion of scholarly interest during the study period. The corpus contained 53,711 cited references, with an average of 19.18 citations per document and an average document age of 10.9 years old. In terms of collaboration, the dataset showed an average of 4.2 co-authors per document, while international co-authorship accounted for 21.98% of records. Only 41 documents were single-authored, indicating that trap fishery research is predominantly collaborative. The dataset also contained 1,920 author keywords and 2,709 Keywords Plus terms, providing a sufficient basis for keyword co-occurrence and thematic mapping analyses.

Publication trend. Annual publications increased consistently from 2000 to 2025 (Figure 2). In the early years, the number of publications was relatively low and fluctuated, generally remaining below 15 articles per year. However, a more stable upward trend became evident after 2012, with a significant surge beginning in 2017. The peak in annual publication output occurred in 2021, with 41 articles, closely followed by 2025 with 40 articles. This trend indicates a growing scholarly interest in trap fisheries, particularly over the past decade. In contrast, citation patterns followed a different temporal trajectory compared to publication output. The highest annual citation count was recorded in 2013, with 915 citations, followed by several years of high citations from 2012 to 2017. In recent years, citation counts have been lower despite the high number of publications, likely because recent articles have had less time to accumulate citations. This decline in citations does not necessarily reflect a decrease in research quality but is likely attributed to citation lag, as newly published articles have had less time to gather citations.

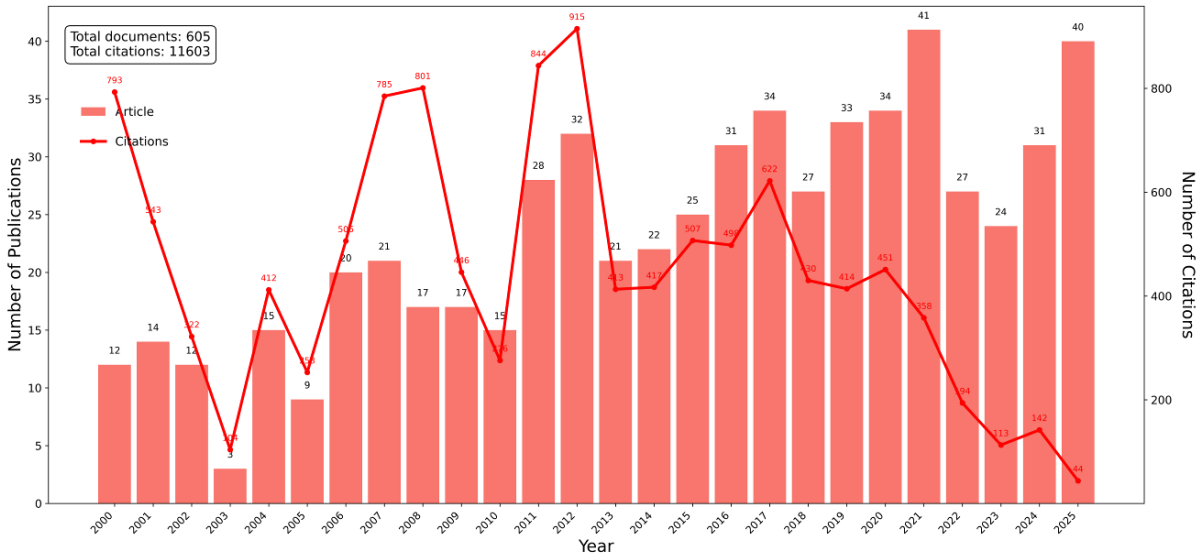


Figure 2. Annual publication and citation trends in trap fisheries research. Bars indicate the number of Scopus-indexed articles published each year, while the red line represents the annual citation count. The dataset consists of 605 articles with a total of 11,603 citations.

Top-ranked research areas, affiliations, countries, journals, and authors. The validated corpus comprised 605 Scopus-indexed articles on trap fishery. The predominant research area was Species Composition & Biodiversity, accounting for 456 publications (75.4%), followed by Trap Design & Fishing Technology with 374 publications (61.8%), and Habitat & Ecosystem Impacts with 356 publications (58.8%). This pattern indicates that trap fishery research has primarily concentrated on catch composition, biodiversity documentation, fishing gear performance, and ecological effects. Research in Monitoring, Modelling, and Data Analytics was also prominent, with 343 publications (56.7%), while Fisheries Management and Policy contributed 322 publications (53.2%). More specific themes, such as Gear Selectivity & Catch Efficiency (31.2%), Crab, Lobster & Crustacean

Trap Fisheries (30.1%), and Bycatch & Discard Management (22.0%), were moderately represented. In contrast, Eel, Fyke Net, and Set Net Fisheries (10.1%) and Ghost Fishing and Abandoned Gear (6.1%) were less frequent, highlighting potential research gaps. At the institutional level, the leading affiliations were NOAA/National Marine Fisheries Service, Fisheries and Oceans Canada, and the Institute of Marine Research, Norway. The United States emerged as the most productive country, with 161 publications (26.6%), followed by Australia, the United Kingdom, and Canada. The most prolific journal was *Fisheries Research*, with 92 publications (15.2%), underscoring its central role in disseminating trap fishery studies. Overall, trap fisheries research was heavily oriented toward biodiversity, gear technology, habitat impacts, and fisheries management, whereas topics such as set-net, fyke-net, ghost fishing, and abandoned gear remained comparatively underrepresented (Table 1).

Table 1

Top-ranked research areas, affiliations, countries, journals, and authors in the validated corpus of trap fisheries research from 2000 to 2025

Rank	*Research area*	*Number of publications*	*Percentage (%)*
1st	Species Composition & Biodiversity	456	75.4
2nd	Trap Design & Fishing Technology	374	61.8
3rd	Habitat & Ecosystem Impacts	356	58.8
4th	Monitoring, Modelling & Data Analytics	343	56.7
5th	Fisheries Management & Policy	322	53.2
6th	Gear Selectivity & Catch Efficiency	189	31.2
7th	Crab, Lobster & Crustacean Trap Fisheries	182	30.1
8th	Bycatch & Discard Management	133	22.0
9th	Eel, Fyke Net & Set Net Fisheries	61	10.1
10th	Ghost Fishing & Abandoned Gear	37	6.1
Rank	*Affiliation*	*Number of publications*	*Percentage (%)*
1st	NOAA / National Marine Fisheries Service	24	4.0
2nd	Fisheries and Oceans Canada	16	2.6
3rd	Institute of Marine Research, Norway	14	2.3
4th	University of California	12	2.0
5th	U.S. Geological Survey	11	1.8
6th	Western Australian Fisheries and Marine Research Laboratories	9	1.5
7th	NSW Department of Primary Industries	9	1.5
8th	University of Tasmania	8	1.3
9th	Carleton University	8	1.3
10th	University of Cagliari	8	1.3
Rank	*Country*	*Number of publications*	*Percentage (%)*
1st	United States	161	26.6
2nd	Australia	77	12.7
3rd	United Kingdom	55	9.1
4th	Canada	47	7.8
5th	Spain	33	5.5
6th	Norway	29	4.8
7th	Italy	26	4.3
8th	Brazil	24	4.0
9th	Sweden	21	3.5
10th	Japan	19	3.1
Rank	*Journal*	*Number of publications*	*Percentage (%)*
1st	Fisheries Research	92	15.2
2nd	North American Journal of Fisheries Management	27	4.5
3rd	ICES Journal of Marine Science	26	4.3
4th	Fisheries Management and Ecology	18	3.0
5th	Aquatic Conservation: Marine and Freshwater Ecosystems	14	2.3
6th	PLoS ONE	13	2.1
7th	Frontiers in Marine Science	13	2.1
8th	Canadian Journal of Fisheries and Aquatic Sciences	11	1.8
9th	Marine Ecology Progress Series	11	1.8
10th	Marine Pollution Bulletin	10	1.7
Rank	*Author*	*Number of publications*	*Percentage (%)*
1st	Newman S.J.	9	1.5
2nd	Kalogirou S.	8	1.3
3rd	Addis P.	8	1.3
4th	Broadhurst M.K.	7	1.2

5th	Suuronen P.	7	1.2
6th	Cooke S.J.	7	1.2
7th	Harvey E.S.	6	1.0
8th	Wakefield C.B.	6	1.0
9th	Winger P.D.	6	1.0
10th	Nguyen K.Q.	5	0.8

The geographical distribution of publications further confirms the dominance of developed fisheries research regions in the validated corpus (Figure 3). The United States contributed the highest number of publications, followed by Australia, the United Kingdom, Canada, Spain, Norway, Italy, Brazil, Sweden, and Japan. Spatially, trap fisheries research was concentrated in North America, Europe, and Australia, while contributions from tropical and developing regions remained comparatively limited. This pattern suggests that although trap fisheries are widely practiced in coastal and small-scale fisheries, bibliometric visibility is still largely driven by countries with stronger research infrastructure and publication capacity.

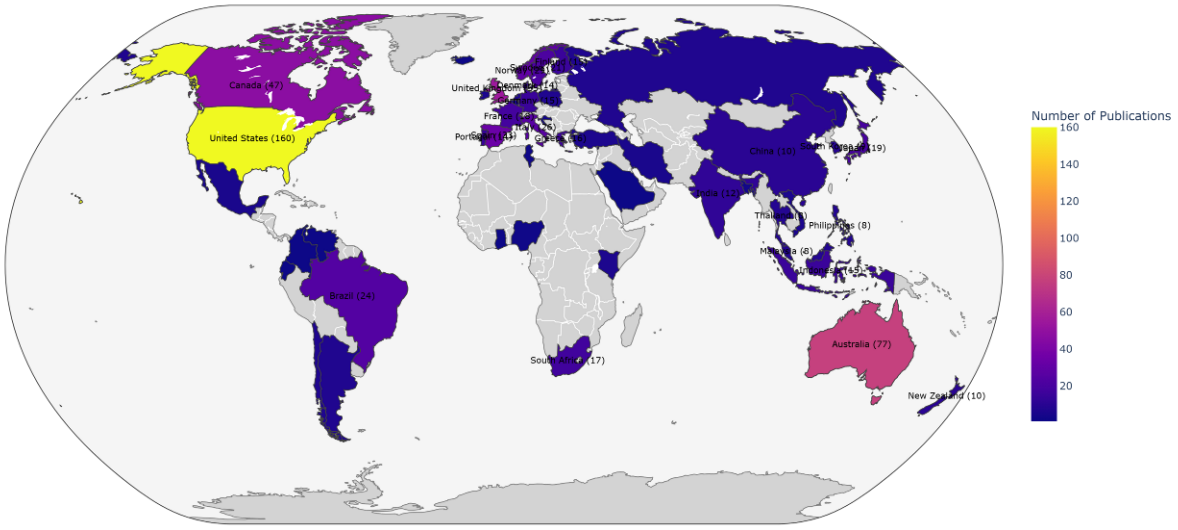


Figure 3. Global distribution of trap fisheries research publications based on the validated Scopus corpus from 2000 to 2025. Country colours indicate the number of publications, with darker to brighter colours representing increasing publication output.

Highly cited publications on set-net and fyke-net fisheries. The 15 most highly cited publications related to set-net and fyke-net fisheries from 2000 to 2025 are summarized in Table 2. The most cited study was Feunteun et al. (2000) on European eel spawner escapement using fyke/eel traps, with 91 citations, followed by Virgili et al. (2018), which focused on reducing sea turtle bycatch in Mediterranean set-net fisheries using ultraviolet illumination, with 58 citations. Overall, the highly cited studies were dominated by four main themes: population assessment and migration, bycatch mitigation involving sea turtles, seabirds, and marine megafauna, gear selectivity and catch efficiency, and habitat and nursery function. Fyke-net studies were commonly associated with eels, estuarine fishes, invasive crabs, and freshwater/coastal monitoring, whereas set-net studies were more frequently linked to bycatch, gear loss, and conservation management. This indicates that influential research on set-net and fyke-net fisheries has mainly focused on ecological assessment, conservation issues, and improving the sustainability of passive fishing gears.

Table 2

Top 15 highly cited publications on set net and fyke net fisheries during 2000-2025 based on Scopus-indexed records

Rank	*Reference*	*Title*	*Fishing gear/ trap type*	*Target species/taxon*	*Main focus*	*Citation*
1	Feunteun et al. (2000)	European eel (*Anguilla anguilla*): prediction of spawner escapement from continental population parameters	Fyke net / eel trap	European eel (*Anguilla anguilla*)	Spawner escapement, migration, population assessment	91
2	Virgili et al. (2018)	Can ultraviolet illumination reduce sea turtle bycatch in Mediterranean set net fisheries?	Set net / fixed net	Loggerhead turtle; sea turtles	Bycatch mitigation using UV illumination	58
3	Breen & Ruetz (2006)	Gear bias in fyke netting: evaluating soak time, fish density, and predators	Fyke net	Round goby, bluntnose minnow, banded killifish, bowfin	Gear bias, soak time, catch efficiency	53
4	Wasserman & Strydom (2011)	The importance of estuary head waters as nursery areas for young estuary- and marine-spawned fishes in temperate South Africa	Fyke net	Juvenile estuarine and marine-spawned fishes	Nursery habitat, estuarine fish assemblages	44
5	Sonntag et al. (2012)	Seabirds, set-nets, and conservation management: assessment of conflict potential and vulnerability of birds to bycatch in gillnets	Set net / gillnet	Diving seabirds / marine birds	Bird bycatch risk and conservation management	39
6	Glamuzina et al. (2021)	A comparison of traditional and locally novel fishing gear for the exploitation of the invasive Atlantic blue crab in the eastern Adriatic Sea	Fyke net / crab trap	Atlantic blue crab (*Callinectes sapidus*)	Gear comparison, selectivity, invasive crab fishery	33
7	Lucchetti et al. (2017)	Sea turtles bycatch in the Adriatic Sea set net fisheries and possible hot-spot identification	Set net	Loggerhead turtle; sea turtles	Bycatch hotspots and mitigation strategy	28

8	Yildiz & Karakulak (2016)	Types and extent of fishing gear losses and their causes in the artisanal fisheries of Istanbul, Turkey	Set net	Turbot, bonito, red mullet; artisanal fishery species	Gear loss, ghost fishing, fisheries management	27
9	Palma et al. (2002)	An assessment of fishery resources of Laguna de Bay	Fyke net / fish trap / fish pot	Multispecies lake fishery	Fishery resource assessment, gear inventory	27
10	Alexandre et al. (2022)	Interactions between air-breathing marine megafauna and artisanal fisheries in Southern Iberian Atlantic waters	Bottom set net	Common dolphin, bottlenose dolphin, marine turtles, seabirds	Megafauna bycatch and depredation	23
11	Støttrup et al. (2018)	Harvesting geo-spatial data on coastal fish assemblages through coordinated citizen science	Fyke net / fixed gear	European flounder (*Platichthys flesus*)	Citizen science, coastal fish monitoring	21
12	Petetta et al. (2020)	Pots vs trammel nets: a catch comparison study in a Mediterranean small-scale fishery	Bottom set net / trammel net / pot	Common cuttlefish (*Sepia officinalis*), annular sea bream (*Diplodus annularis*)	Gear comparison, discard reduction, SSF	20
13	Selman et al. (2014)	Distribution and abundance of diamondback terrapins (*Malaclemys terrapin*) in southwestern Louisiana	Fyke net	Diamondback terrapin (*Malaclemys terrapin*)	Distribution, abundance, conservation concern	17
14	St-Hilaire et al. (2016)	Break-even analysis for a green crab fishery in PEI, Canada	Fyke net	European green crab (*Carcinus maenas*)	Invasive crab fishery, economic feasibility	17
15	Formicki et al. (2004)	Effects of magnetic fields on fyke net performance	Fyke net	Perch, pike, roach, rudd, bleak, bream, ruffe, eel	Gear modification, magnetic field, catch performance	16

Recent relevant publications on set-net and fyke-net fisheries. Six recent publications from 2024 to 2025 were identified as directly relevant to set-net and fyke-net fisheries based on title–abstract screening (Table 3). These recent studies were mainly concentrated on bycatch and discard management, particularly involving seabirds, sea turtles, cormorants, and grey seals. In addition, recent research has begun to emphasize data-driven approaches, such as machine learning for classifying set-net catch volumes and statistical standardization of long-term fyke-net eel survey data. This indicates that current set-net and fyke-net research is moving

toward two major directions: reducing ecological interactions with non-target species and improving monitoring or assessment methods for passive fishing gears.

Table 3

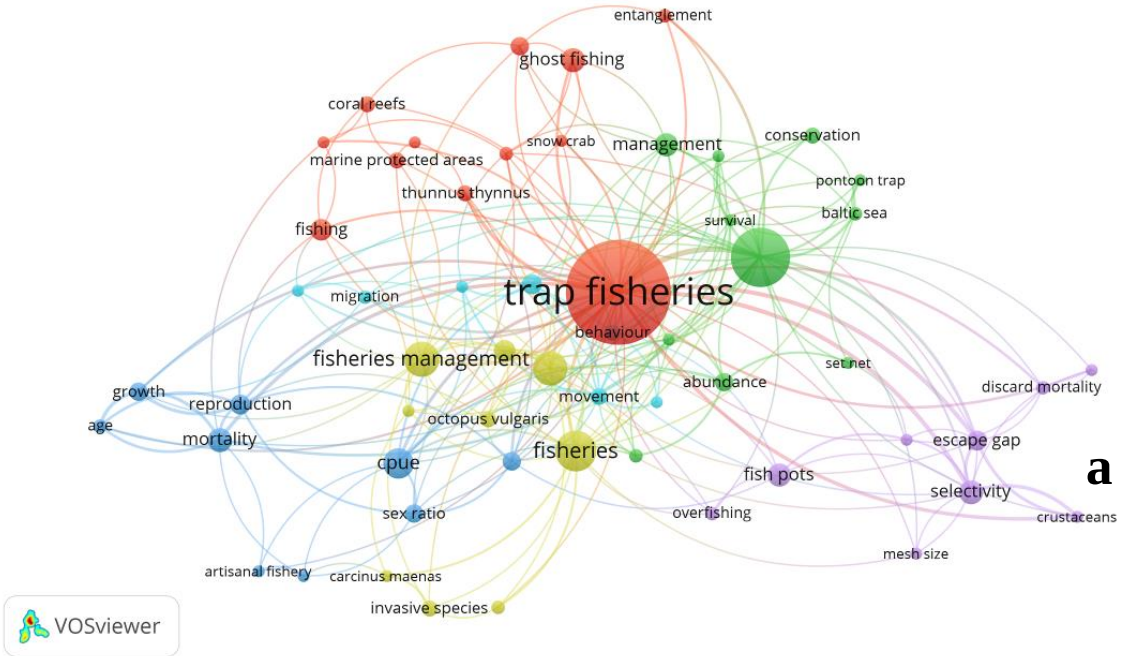
Recent relevant publications on set-net and fyke-net fisheries during 2024-2025 based on title–abstract screening

Rank	*Reference*	*Title*	*Fishing gear / trap type*	*Target species / taxon*	*Main focus*	*Citation*
1	Pereira et al. (2025)	Seasonal variation in seabird abundance and bycatch at artisanal bottom-set net fisheries in the southern Iberian Atlantic coast	Set net	Seabirds; *Larus fuscus*; *Larus michahellis*; *Ichthyaetus audouinii*	Bycatch and discard management; Fisheries management and policy; Monitoring, modelling and data analytics; Fishing gear and trap technology	3
2	Jančič et al. (2025)	Is net illumination a silver bullet for mitigating sea turtle bycatch in set net fisheries?	Set net	Sea turtle; *Caretta caretta*	Bycatch and discard management; Fisheries management and policy; Habitat and ecosystem impacts; Fishing gear and trap technology	3
3	Westerbom et al. (2025)	Cormorant predation in fyke net fishing: the direct effects of a protected bird on coastal commercial fishing	Fyke net	Great cormorant; *Phalacrocorax carbo*	Bycatch and discard management; Fisheries management and policy; Monitoring, modelling and data analytics; Fishing gear and trap technology	2
4	Westphal et al. (2025)	By-catch of grey seals in fish traps in the German Baltic Sea - from incidents to mitigation and fisheries regulation	Fyke net	Grey seal; *Halichoerus grypus*	Bycatch and discard management; Fisheries management and policy; Habitat and ecosystem impacts; Monitoring, modelling and data analytics; Fishing gear and trap technology	1
5	Yoshida et al. (2024)	Classification of set-net fish catch volumes in Iwate Prefecture, Japan using machine learning with water temperature and current distribution images at migration depth	Set net	Fish catch volume; salmon-related catch information	Fisheries management and policy; Monitoring, modelling and data analytics; Fishing gear and trap technology	5

6	Poole et al. (2024)	Standardising long-term eel (*Anguilla anguilla*) fyke net survey data reveals covariate effects and improves estimates of declining relative abundance	Fyke net	European eel; *Anguilla anguilla*	Fisheries management and policy; Monitoring, modelling and data analytics; Fishing gear and trap technology	1

Keyword co-occurrence network and thematic evolution of trap fisheries research. As shown in Figure 4a, the keyword co-occurrence analysis indicates that "trap fisheries" is the most dominant keyword and occupies the central position in the network. This position suggests that "trap fisheries" functions as the main connecting term linking different research themes. Several important keywords are closely connected to this central theme, including fisheries management, survival, CPUE, selectivity, fish pots, set net, ghost fishing, and entanglement. These patterns indicate that trap fisheries research is not limited to fishing gear description, but also covers fisheries management, catch efficiency, conservation issues, bycatch mitigation, and ecological impacts.

The overlay visualization in Figure 4b shows a temporal shift in research focus. Earlier studies were more strongly associated with biological and population-related topics, such as growth, age, reproduction, mortality, and CPUE. More recent studies have increasingly focused on set net, escape gap, selectivity, ghost fishing, entanglement, conservation, and discard mortality. This indicates that trap fisheries research has gradually moved from descriptive biological and catch-based studies toward sustainability-oriented topics, particularly gear selectivity, bycatch reduction, abandoned gear impacts, and ecosystem-based fisheries management.



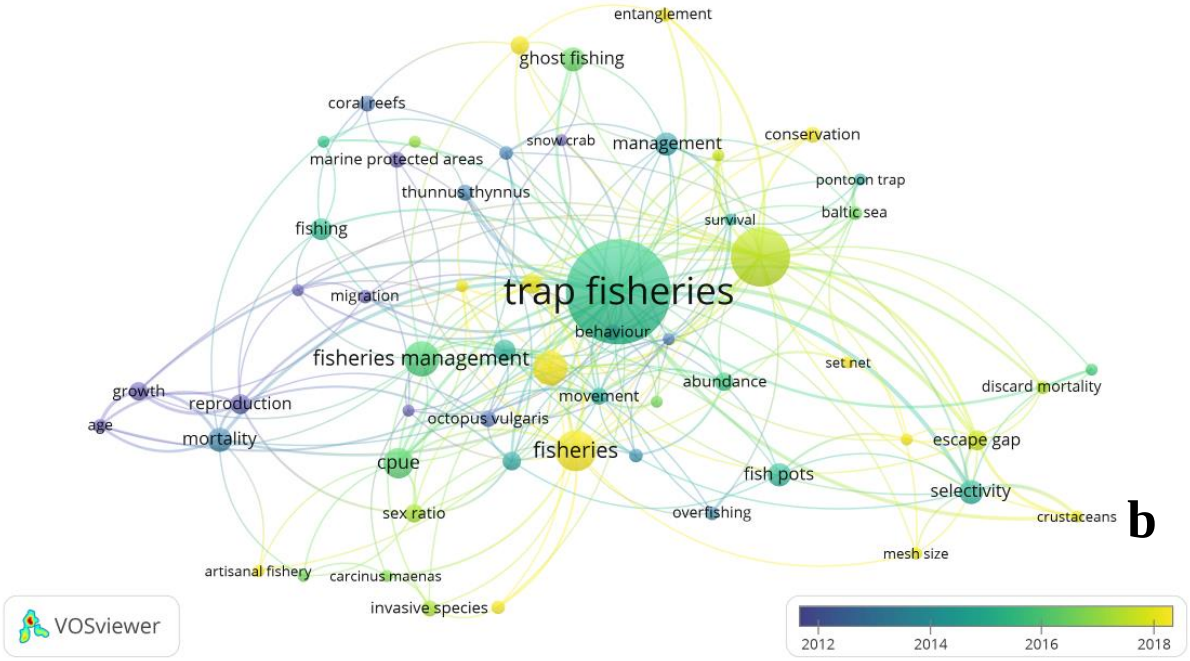


Figure 4. Keyword co-occurrence map of global trap fisheries research. (a) The network visualization illustrates thematic clusters of author keywords, with node size reflecting keyword frequency, link thickness indicating co-occurrence strength, and colors representing different clusters. (b) The overlay visualization depicts temporal keyword trends, where darker colors signify earlier topics and lighter/yellow colors highlight more recent or emerging research themes.

Discussion

Global development and thematic evolution of trap fisheries research. Trap fishery research has developed from descriptive studies of catch composition and gear use to broader ecological, technological, and management-oriented themes. The dominance of species composition and biodiversity, trap design and fishing technology, habitat and ecosystem impacts, monitoring and data analytics, and fisheries management indicates that trap fisheries are increasingly being studied not only as fishing systems but also as tools for ecological assessment and fisheries governance. This pattern suggests that trap-based fisheries are relevant for evaluating catch productivity, species-habitat relationships, gear selectivity, bycatch risk, and sustainability of small-scale fisheries.

The geographical distribution of publications shows that trap fisheries research remains concentrated in countries with strong fisheries science capacity, particularly the United States, Australia, the United Kingdom, Canada and several European countries. This pattern may reflect differences in research funding, monitoring infrastructure and access to long-term fisheries datasets. However, the presence of studies from tropical and developing regions also confirms the global relevance of trap fisheries, especially in coastal small-scale fisheries, where passive gears remain widely used.

Keyword co-occurrence and overlay visualization further indicate a thematic shift in the field. Earlier studies were more strongly associated with population dynamics, reproduction, mortality, CPUE, and fisheries assessment, whereas more recent studies increasingly emphasized management, conservation, selectivity, ghost fishing, bycatch, escape gaps, and gear modification. This transition suggests that trap fisheries research is moving toward sustainability-oriented questions, particularly regarding how passive gears can be improved to reduce ecological impacts while maintaining fishing efficiency.

Influential themes in set-net and fyke-net fisheries. The synthesis of highly cited publications shows that set-net and fyke-net fisheries have been discussed not only as fishing technologies, but also as ecological monitoring tools and management-relevant passive gears. The most influential studies focused on stock assessment, gear efficiency, bycatch mitigation, habitat use, conservation concerns, and fisheries management. For example, fyke-nets have been widely used in studies of migratory and estuarine species, particularly European eel, where the gear supports the assessment of escapement, downstream migration, and population dynamics (Feunteun et al., 2000). Other studies also highlight the importance of standardising passive gear operation, including soak time, catch efficiency, gear bias, and gear modification, before fyke nets can be reliably used for ecological or fisheries assessment (Breen & Ruetz, 2006; Formicki et al., 2004).

Bycatch and conservation also emerged as important themes in influential set-net and fyke-net studies. Several studies examined interactions between passive gears and vulnerable taxa, including sea turtles, seabirds, marine mammals, and terrapins. Research on Mediterranean set nets highlighted the potential of ultraviolet illumination and hotspot identification to reduce sea turtle bycatch (Lucchetti et al., 2017; Virgili et al., 2018), while studies on seabirds and marine megafauna showed that passive gears can create conservation conflicts when fishing grounds overlap with sensitive species habitats (Sonntag et al., 2012; Alexandre et al., 2022). These findings indicate that set-net and fyke-net fisheries should not be evaluated only through catch productivity, but also through their ecological risks and mitigation potential.

The reviewed studies also show that passive trap-related gears are useful for habitat-based fisheries research. Fyke-nets have been applied to assess nursery habitats, estuarine fish assemblages, coastal fish monitoring, and species distribution patterns (Wasserman & Strydom, 2011; Selman et al., 2014; Støttrup et al., 2018). Gear-comparison studies further indicate that trap-based gears can offer selective or lower-impact alternatives in small-scale fisheries, although their performance depends on target species, habitat conditions, and local fishing practices (Petetta et al 2020; Glamuzina et al 2021). Therefore, the highly cited literature supports the view that set-nets and fyke-nets are important passive gears that connect gear design, species ecology, habitat use, and management decision-making.

Recent research directions. Recent publications from 2024 to 2025 indicate a shift in trap fisheries research, moving beyond traditional analyses of gear performance, catch composition, and fishing efficiency. Recent studies have highlighted three emerging areas of focus: bycatch mitigation, wildlife-fishery interactions, and data-driven monitoring. This trend aligns with the broader bibliometric findings of this study, suggesting that trap fisheries are increasingly associated with conservation, selectivity, ecological impact, and management-oriented monitoring.

A major recent direction is the increasing attention to protected species interactions with passive fishing gears. Pereira et al. (2025) showed that seabird abundance and bycatch in artisanal bottom-set net fisheries varied seasonally along the southern Iberian Atlantic coast, indicating that bycatch risk is influenced by temporal ecological dynamics and fishing operations. Similarly, Jančič et al. (2025) evaluated net illumination as a mitigation tool for sea turtle bycatch in set-net fisheries but found that this approach did not significantly reduce turtle bycatch and could reduce the catch of European hake. This finding is important because it shows that technical mitigation measures cannot be treated as universal solutions; their effectiveness depends on local ecological conditions, target species, gear design, and the fishing operations.

Recent studies have shown that wildlife–fishery conflicts have become an important component of trap fisheries research. Westphal et al. (2025) examined grey seal bycatch in fish traps in the German Baltic Sea and emphasized the need for long-term datasets, gear-design information, pathological indicators, and practical technical modifications to reduce marine mammal bycatch. Westerbom et al. (2025)

used surveillance cameras to examine cormorant predation in fyke-net fishing and demonstrated how interactions with protected birds can directly affect coastal commercial fisheries. These studies indicate that trap fisheries are increasingly being studied as socio-ecological systems in which conservation objectives, fishing livelihoods, and gear performance are closely interconnected.

Recent advancements in this field have emphasized the significance of quantitative modeling and standardization of long-term data. Yoshida et al. (2024) introduced a machine learning methodology to classify set-net fish catch volumes using water temperature and current distribution images in Japan. This development underscores the increasing interest in predictive fisheries monitoring, where environmental variability is leveraged to forecast catch fluctuations and enhance the fishing efficiency. Concurrently, Poole et al. (2024) highlighted the importance of standardizing long-term fyke-net survey data for the European eel, demonstrating that historical trap-based datasets can yield more robust ecological inferences when covariate effects are appropriately considered. Collectively, these recent studies reinforce the notion that trap fisheries research is transitioning to a more management-oriented phase. Earlier research has predominantly focused on catch efficiency, trap selectivity, and gear comparison. In contrast, contemporary studies have increasingly investigated the interactions between trap and set-net fisheries with protected species, environmental variability, fisher behavior, and monitoring systems. This shift is crucial, as passive gears are often perceived as relatively selective or low-impact; however, recent evidence indicates that their ecological consequences can be substantial, contingent upon the species group, habitat, season, and gear configuration.

Limitations and future research. Firstly, the analysis was confined to Scopus-indexed, English-language journal articles, potentially excluding pertinent studies indexed in alternative databases, non-English publications, book chapters, technical reports, and local fisheries documents. Secondly, citation-based indicators are subject to citation lag, which may result in the underrepresentation of recent studies published from 2024 to 2025 despite their emerging significance. Thirdly, the reliability of keyword co-occurrence and thematic classification is contingent upon the quality and consistency of bibliographic metadata, including titles, abstracts, author keywords, and Keywords Plus. Fourthly, the findings indicate that research on trap fisheries is predominantly concentrated in temperate regions, notably Europe, North America, Australia, and Japan, while tropical small-scale trap fisheries are underrepresented. This gap is particularly pertinent to Southeast Asian fisheries, including traditional stationary trap systems such as sero in Indonesia, whose ecological performance, bycatch composition, habitat associations, and gear efficiency are less visible in global bibliometric records. Future research should integrate bibliometric evidence with field-based data on catch composition, CPUE, bycatch categories, habitat characteristics, oceanographic variables, gear configuration, and fisher knowledge to support more sustainable and context-specific trap fisheries management.

Conclusions. This study provides a bibliometric overview of 605 Scopus-indexed English-language journal articles on trap fisheries published between 2000 and 2025. The findings show that trap fisheries research has developed into a multidisciplinary field, with major attention to species composition, biodiversity, trap design, fishing technology, habitat impacts, monitoring, fisheries management, gear selectivity, bycatch, and ghost fishing. Publication output increased gradually over the study period, indicating sustained scholarly interest in passive fishing gears and their ecological and management implications.

Trap fisheries research was geographically concentrated in countries with strong fisheries science capacity, particularly the United States, Australia, the United Kingdom, Canada, and several European countries. Keyword and thematic analyses indicate a shift from conventional catch and gear studies toward sustainability-

oriented topics, including bycatch mitigation, conservation, gear modification, monitoring, and data-driven fisheries assessment. Focused synthesis of set-net and fyke-net studies further highlights their relevance to population assessment, gear efficiency, protected species interactions, and long-term monitoring. Overall, future studies should give greater attention to tropical small-scale trap fisheries and integrate bibliometric evidence with field-based ecological, technological, and socio-economic research.

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