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SUSTAINABLE FISHERIES MANAGEMENT IN MARINE CAPTURE FISHERIES: SYSTEMATIC LITERATURE REVIEW

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Abstract: Sustainable fisheries entails managing fishery to promote resources and economic development. Worldwide capture fisheries have fallen dramatically in recent years, and some of the fisheries have collapsed due to improper management, overfishing, overexploitation, and climate stressors. Sustainable fisheries management crucially needs to be evaluated on the behaviour of fishing fleets and management regimes in specific fisheries. The study pinpointed and highlighted fisheries management practices in global marine fisheries and findings and suggestions by previous studies for sustainable fisheries by reviewing 167 articles from the Web of Science (WoS) database. The results indicated that sustainable fisheries management has been conducted in Europe, South, and North America, followed by Africa and Asia, using mostly quantitative methods of statistical tools, spatial distribution and evaluation of catch and effort, and qualitative and mixed methods. The studies are mostly in trawl fisheries, bottom longline fisheries, and purse seine fisheries, with few studies on small-scale fisheries and tuna fisheries. The management in many fisheries was entangled with resource depletion and economic downturns in the industry, and studies suggested that sustainable fisheries could be achieved with the proper sustainable fisheries management practices in specific areas, and trawl fisheries required greater concerns.

Keywords: Fisheries management, commercial fisheries, Systematic Literature Review (SLR).

Introduction

Marine ecosystem management is complicated, especially in the context of increasing resource exploitation, rising human coastal populations, and a changeable and changing climate (Holsman *et al*., 2017). Spatial management, particularly in Marine Protected Areas (MPAs), is gaining favour as a preventive measure to ensure population sustainability and safeguard against fisheries failures (Li *et al*., 2020). The most frequently utilised fisheries management and conservation objectives are properly allocating conservation measures to reduce socioeconomic impacts on local fishing communities and encourage socioeconomic development that minimises conservation consequences (Li *et al.*, 2020). To effectively manage inshore fisheries, authorities must make choices based on precise and detailed information concerning reality among fishing communities, including fundamental concerns such as local fishing practices, regulatory compliance patterns, and fisheries resource dynamics (Schultz, 2017).

Most marine fish populations are overexploited, and fishing fleets globally have significant overcapacity. One of the causes of the mismatch between resource availability and fishing capacity is technical advancement, which constantly improves vessel efficiency, a process known as "technological creep" (Eigaard *et al.*, 2014). Many catch fisheries worldwide have fallen dramatically in recent years or have already failed due to overfishing, and significant fishing grounds are concentrated in areas

impacted by pollution, habitat loss, and coastal zone alteration (Monteiro, 2017). Identify and explain 25 ecological issues, as well as seven prominent families of management approaches for dealing with them, and capture the challenges operating in three major categories: (a) The impacts of fishing on marine habitats and future fishing possibilities, (b) the levels of external conditions on fish and fishing opportunities, and (c) the consequences of context in terms of socioeconomics and fisheries management (Bastardie *et al*., 2021).

Overexploitation of marine fisheries is still a severe problem around the world, and in fisheries that coastal nations have densely managed, multiple uncertainties have significantly hampered the effectiveness of traditional fisheries management strategies in replenishing exploited stocks (Li *et al.*, 2020). Overfishing is sometimes associated with inefficient commercial fishing methods that bring in enormous volumes of undesired fish or other animals, which are subsequently wasted. Fishing is indeed a complicated economic activity that is impacted not only by overfishing but also by pollution, technologies, financial issues, and other variables (Perissi *et al.*, 2017). Overcapacity with extreme overexploitation may lead to depletion and extinction of the fishing population under full unrestricted access with no control over access or property rights (Sin *et al.*, 2019). Presently, the fishing sector contributes more than 50% of the global marine fish capture to the nation's fishing industries. Nevertheless, they are confronted with overexploitation, increases in demand, overcapitalisation, and new issues imposed by fish markets and climate change (Pedroza-gutiérrez, 2019).

Assessing overfishing and controlling fishing limits are key worldwide concerns for the twenty-first century, both in terms of sustaining humanity and conserving marine ecosystems (Perissi *et al.*, 2017). Garrett Hardin's research (Hardin, 1968), titled "The Tragedy of the Commons," significantly impacted the wider topic of resource overexploitation. Hardin's model was only qualitative, but it identified patterns of overexploitation of any resource that is exploited at a level quicker than it can reform itself (Perissi *et al.*, 2017). Incentives to the fishing industry are prevalent worldwide, and it is widely acknowledged that such incentives lead to overcapacity in fishing fleets and overexploitation of fishery resources (Sharp & Sumaila, 2009). Overcapacity relates to a fleet's capability to fish at levels that exceed a fishery's sustainable catch (for example, due to several vessels and/or too many fishermen). The term 'overcapacity' refers to the maximum harvest rate a fleet might generate with inputs such as fuel, fishing gear, ice, hook, engine performance, and vessel size (Castro *et al*., 2019). When a problem happens, such as the occurrence and persistence of chronic inadequacies between fleet overcapacity and fishing resources, the same outcomes in stock depletion and overexploitation force the continuation of unregulated strategies such as exceeded catches and unwanted discards (Monteiro, 2017).

For the future of fisheries to be better than in the past, management authorities must create legally enforceable and tested harvest plans, as well as suitable rights-based incentives for the fishing community (Monteiro, 2017). Bycatch, which is a catch that is either underutilised or mismanaged, has already been claimed to account for 40% of worldwide marine catches. Sustainable fisheries must ensure that marine resources are exploited sustainably and efficiently. The necessity to include the economic and social components in the management process has been recognised in recent years, owing to the ecosystem-based fisheries management strategy (Garcia *et al*., 2017). Concerns regarding marine conservation have grown fast across the world, owing mostly to overfishing and the ineffectiveness of various management methods (Lauck *et al*., 1998), such as Total Allowable Catches (TAC) and fishing gear limits (Rolim *et al*., 2016).

Sustainable fishery management is effective in many factors. The author Echwikhi *et al*. (2012) suggested that to limit bycatch fishing, particularly targeting the loggerhead

turtle, further awareness campaigns should be conducted, particularly among fishermen. The study focuses on the dynamics of fishing efforts and provides a valuable tool for optimising trawl fisheries management, avoiding undesired captures, improving sustainability, and managing fishing efforts and daily fishing trips (Garcia-De-Vinuesa *et al*., 2018). The study also identified that overexploitation factors and fish landing affect fishing mortality, which appears to be particularly difficult, and technological challenges not only limit the development of drift fisheries but also impact other species due to overexploitation (Eigaard *et al.*, 2014). In this situation, the geographical allocations of effort after implementation to minimise valuable catches and increase fishing effort and landings, and it also enables MPAs to manage the act more towards sustainable management and more to safeguard the fisheries resources (Rolim & Ávila-Da-Silva, 2016).

The marine capture fisheries and fisheries management are highly relevant to the outcome of the studies. This study helps to determine the critical of sustainable fishery management needs and explains the overexploitation status in many study areas. The research focuses on the fishing fleet dynamic in marine captures with systematic reviews using the Web of Science (WoS) sources. The study aims to highlight the global fisheries issues in managing sustainable fisheries, especially in marine capture fisheries. The specific objectives are (a) to identify the study area of the studies, (b) to assess the research methods used in the articles, (c) to determine the type of fishing gear, (d) type of fisheries based on the articles, and (e) to assess the research findings with the recommendation of the articles that reviewed. Therefore, the study uses a Systematic Literature Review (SLR) to analyse the gap between marine fisheries and sustainable fisheries management. Besides, the study also focuses on the type of fishing gear that is highly used among the reviewed articles. The study shows the sustainable management fisheries policies or ways suggested by the authors.

Methodology

Systematic Literature Review (SLR)

An SLR seeks to find and summarise related studies systematically, transparently, dependably, and accurately at each stage of the process (Mohamed Shaffril *et al*., 2021). By use of extensive search tools, predefined search terms, and consistent inclusion and exclusion criteria, SLR encourages researchers to explore studies beyond their topic areas and networks (Robinson & Lowe, 2015). SLR was discussed in seven major points: (a) The development and validation of the review protocol/publication standard/reporting standard/guidelines, (b) the formulation of research questions, (c) systematic searching approaches, (d) quality assessment, (e) data extraction, (f) data synthesis, and (g) data demonstration (Mohamed Shaffril *et al*., 2021). Following the SLR process, there was a qualitative analysis and synthesis using content analysis, a research approach for generating accurate conclusions from texts in a reproducible manner (Weber *et al.*, 2019).

There are two main keywords utilised in the search of literature: (1) *'Marine Capture Fisheries'* and (2) *'Fishing Fleet Dynamic'*. These keywords have been searched in the WoS database and filtered up with publication year, types of documents, type of database, and language. The total number of articles before the filtering process was 167. After the filtering process, the number of articles was 74, and these filtered articles were used in the SLR process in this literature. Table 1 shows the screening process of the study.

There are specific steps that need to be implemented in the SLR process. The total amount of articles gained after the filtration process is 74. Consequently, the articles were evaluated according to the title and abstract relevant to the literature. A total of 60 articles are filtered from the abstract extraction. The title and abstracts were analysed to determine any potential relevant papers, and the full text of those chosen for relevant data in stage one will

be reviewed (Romulo *et al.*, 2017). There were 60 final articles that will be used in the literature.

The SLR has a few processes that need to be followed precisely. This literature uses the coding structure method to evaluate the variables. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow chart has been utilised in this literature. The review technique for this study consisted of three steps: (1) Identification, (2) screening, and (3) data extraction (Bastardie *et al*., 2021). After the process of all three steps, the data will be analysed and presented according to the variables. The study has a flow chart of PRISMA, and the flow chart consists of multiple functions.

Study Design

The SLR approach included three steps: (a) Collecting and selecting relevant literature in a systematic, reproducible manner; (b) qualitatively evaluating the selected articles using content analysis and hierarchical coding; and (c) designing graphical analysis (Weber *et al*., 2019). In the SLR, researchers defined models as any approach described as a model by the publication's authors, which includes qualitative and quantitative models, process and conceptual models, and frameworks. Figure 1 is Scientific Procedures and Rationales for Systematic Literature Review (SPAR-4-SLR). It consists of three stages with six substages that flow sequentially.

Systematic reviews of the literature gathering, classifying, and evaluating literature based on the SPAR-4-SLR methodology should be capable of providing (1) reducing insights and (2) generating agendas to progress knowledge in the review domain (Paul *et al.*, 2021). This SPAR-4-SLR has been utilised in this literature because it helps to classify the understanding of the database used in SLR.

Reviewing Process and Protocols

The process of SLR on the topic of "Marine Capture Fisheries of Fishing Fleet Dynamic in Commercial Fishing Industries" used the WoS database by Thomson Reuters with extensive search. It is divided into two different processes, which are (1) identification and (2) screening Process. In the SLR, the database included in the literature is the WoS Core Collection. The systematic review here was retrieved using limited criteria. Figure 2 explains the PRISMA flow chart for the systematic review protocols. PRISMA summarises a modification of these standards, called Preferred Reporting Items for Systematic Reviews and Meta-Analyses, which have been revised to reflect many conceptual and practical developments in systematic review research (Moher *et al*., 2009). PRISMA's primary focus is randomised trials. However, it may also serve as a guide for systematic reviews in other fields of research that involve the evaluation of interventions (Mohamed Shaffril *et al.*, 2021).

Table 1: The number of articles that were included and excluded

	Activity Description	Number of Articles Used	Notes
1st screening	Selected articles using keywords	167 articles	Source: Web of Science (WoS) Keywords: "Marine Capture Fisheries" and "Fishing Fleet Dynamics"
2nd screening	Inclusion criteria: Year, language, document type	74 articles	Eliminated articles = 93
3rd screening	Exclusion criteria: By title and abstract that is out of relevancy.	60 articles	Eliminated articles = 14

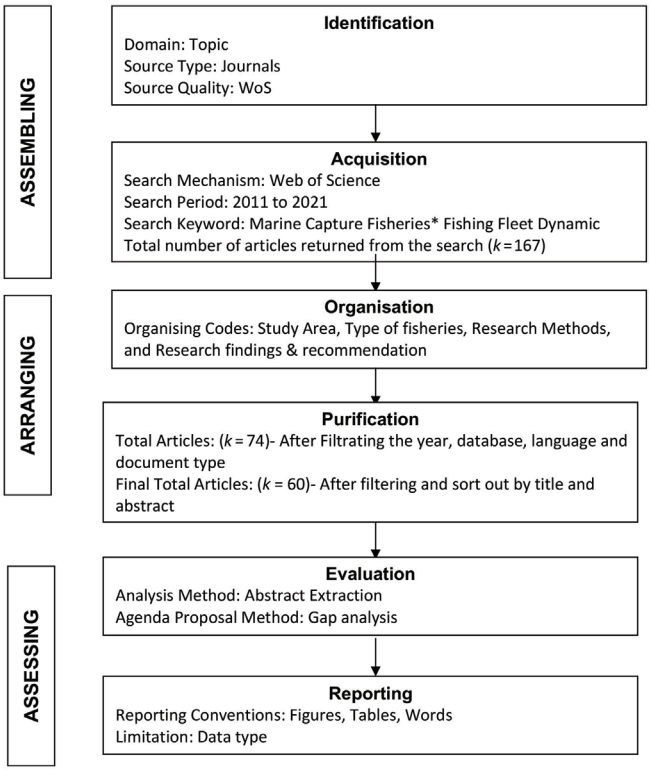

Figure 1: SPAR-4-SLR flow chart of the study. Adapted from Paul *et al.* (2021)
Note: Abbreviation: *k*, number of systematic reviews

Identification

The identification process means identifying the number of journals using the keywords. Researchers enhance fundamental keywords during identification, and when more keywords are used, the database can retrieve more possible articles (Mohamed Shaffril *et al.*, 2021). The WoS has been used to identify the journals. In the search in WoS from all databases, the main keywords used are Marine Capture Fisheries* Fishing Fleet Dynamic. The number of journals is 167 from all databases. Then, it was refined with a few criteria, such as (1) publication year, (2) document type, (3) database, and (4) language. Figure 2 shows the flow of the identification process. After the identification process, the screening process needs to filter all the criteria. The total number of articles is 167 from the keywords finding.

Table 2: Screening details of the first phase

Criteria	Screening Details
Publication year	2011 to 2021
Document type	Articles
Database	Web of Science Core Collection
Language	English

Screening

The screening process includes two phases: (1) Based on criteria such as publication year, document types, database, and language and (2) title and abstract extraction. Table 2 illustrates the first phase of screening. The table shows the exact details of screening in phase one. The total number of articles after the first phase of screening was 74.

The second phase screening here was focused on the title and abstract extraction. The total number of articles after screening in the second phase was 60, where 14 were excluded for relevant reasons such as unrelatable studies or focused more on different studies. Figure 2 wisely describes the flow of including and excluding in the PRISMA flow chart.

Coding Structure of Systematic Review

The coding structure of the systematic review consists of four steps: Screening, extracting, structuring, and synthesising findings. Step 1 explains the inclusion and exclusion, Step 2 is data coding, Step 3 is structuring the coding, and Step 4 synthesises the findings.

Step 1: Inclusion and Exclusion

The numeric coding system is set according to the inclusion criterion. After the screening, the selected articles will go through this inclusion and exclusion process according to the criterion. The following criteria were set for the reviewing process:

(1) Study Area
(2) Research Methods
(3) Type of Fisheries

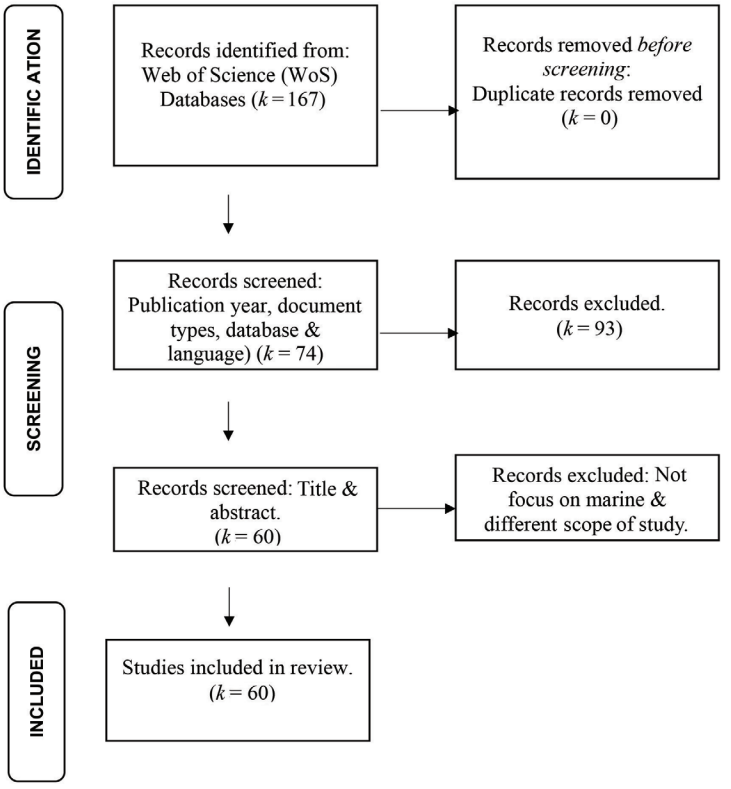

Figure 2: The PRISMA flow chart of systematic review process. Adapted from Page *et al.* (2021)
Note: Abbreviation: *k*, number of systematic reviews

(4) Type of Fishing Gears
(5) Research Findings and Policy

There are exclusion criteria factors in the articles to emphasise the objective of the study (Table 3).

Step 2: Data Coding

The screening criteria are coded numerically from one digit to five digits. The abstract of the articles is thoroughly analysed, and articles are classified with a coding system. The coding structure used for the analysis is shown in Table 4.

Step 3: Structure of Coding Data

The structure of coding data is based on the numerical coding arrangement in Table 4. In step 3, the criterion will be split according to the numerical coding in Table 5 below. Five criteria focused on this literature are (1) study area, (2) research method, (3) type of fisheries, (4) type of fishing gears, and (5) research findings and policies. The specific coding structure will help to organise the articles specifically.

Step 4: Synthesise the Findings

The final step is synthesising the result from the previous steps of coding. The findings synthesise the overall findings in numerical and graphical ways. It will bring out the research findings in all 60 articles. The results will help to identify the gap in the study in this literature.

Assessment of Risk of Bias

The remaining articles from the eligibility process must be reviewed to confirm that the approach is devoid of bias (Higgins & Green, 2008; Mohamed Shaffril *et al*., 2021). We used an approach based on Prof. Barnaby Reeves in collaboration with the Cochrane Non-Randomised Studies Methods Group to evaluate the potential for bias in effect assessments (Dietrichson *et al*., 2021). This theory is an extension of the Cochrane Collaboration's risk of bias tool, and it addresses bias risk in non-randomised trials with a specified control group (Dietrichson *et al*., 2021). The standard of proof may vary between outcomes, even within the same research, such as between a primary effectiveness outcome, which is likely to be evaluated extremely thoroughly and consistently, and the evaluation of significant risks (Moher *et al.*, 2009).

The Risk of Bias (RoB 2) tool provides a framework for assessing the risk of bias in any type of randomised trial data. The evaluation is limited to a single trial result that estimates the relative effect of two therapies or intervention methods on a given outcome (The Cochrane Collaboration, 2019). The Cochrane Risk Assessment holds five domains that need to be completed and will help identify the risk of bias. All five domain risks have been concluded as a LOW risk of bias (rating as insignificant bias

Table 3: Exclusion criteria of the articles

No.	Criterion	Exclusion Criteria
1	Type of fishing gears	The study is focused on the fishing gear of commercial fishing industries only.

Table 4: Numerical Coding System

Coding Items	Code
Area	1
Research method	01
Type of fisheries	001
Type of fishing gear	0001
Research findings and recommendations	00001

Table 5: Specific coding structure of inclusion articles

Coding Items	
Area Coding Items	**Code**
Asia	1
Africa	2
South America	3
North America	4
Europe	5
Australia	6
Others	7
Research Method Coding Items	**Code**
Qualitative Analysis with Interview	01
Quantitative Method	02
Mixed Method	03
Type of Fisheries	**Code**
Small Scale Fisheries & Artisanal Fisheries	001
Bottom Longline Fisheries	002
Tuna Fisheries	003
Trawl Fishery	004
Purse Seine Fishery	005
Type of Fishing Gears	**Code**
Trawl Nets	0001
Gill Nets	0002
Longline	0003
Hooks and Lines	0004
Purse Seine	0005
Traps	0006
Research Findings & Recommendation in Review Article	**Code**
Socioeconomic Indicators and Community livelihood	00001
Bycatch of marine fisheries	00002
Sustainability of fisheries	00003
Overexploitation and landing fish affected	00004

and validating the results of systematic review in terms of design, structure and distortion in review analysis), which shows the data used in SLR are eligible and can be used wisely in studies. The design, structure and domains used in this review were assessed with Cochrane Risk Assessment (RoB 2) tool with the proper guidelines (The Cochrane Collaboration, 2019) and it concluded that "LOW risk" and the review system has no bias with the domains which are empirically set in the PRISMA framework.

Results

Marine Capture Fisheries: Study Area

The results were divided into specific study areas: Asia, Africa, South America, North America, Europe, Australia, and others. Figure 3 below shows the specific division of the study area accordingly. The studies on marine capture fisheries, especially in commercial fishing industries, are mostly found in these study areas: (1) South America with 31.7% and (2) Europe with 31.7%, whereas the least studies in (1) Asia and (2) Australia with 1.7%. In the seas and oceans of the Mediterranean Coast, the management of bottom trawling is mainly conducted through fishing effort control systems, which may be effective in specific areas (Garcia-De-Vinuesa *et al*., 2018). The studies here indicate the areas where commercial fishing occurs. The minor studies are in Asia and Australia, from Bangladesh (Barua *et al*., 2018) and New Zealand (Pierre *et al*., 2012). The major areas found in these articles are Brazil and the United States, with 38 articles from these study areas. The studies from other areas, such as Papua New Guinea and Turkey, are referred from these studies (Ozyurt *et al*., 2017) (Cardoso *et al*., 2011).

Research Methods and Type of Fisheries

The research method criterion is divided into three sub-criteria: (1) Qualitative method, (2) quantitative method and, (3) mixed method. All the research methods of all articles showed the methods utilised in the specific study, especially the quantitative method, with 48 articles. The least utilised methods in this literature are qualitative analysis with interviews and mixed

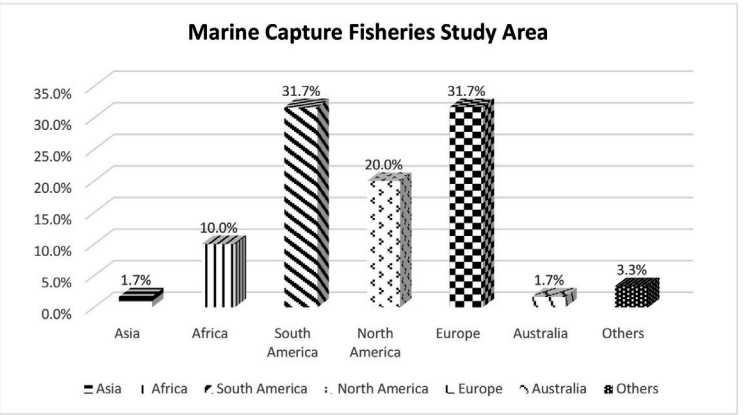

Figure 3: Marine capture fisheries study areas

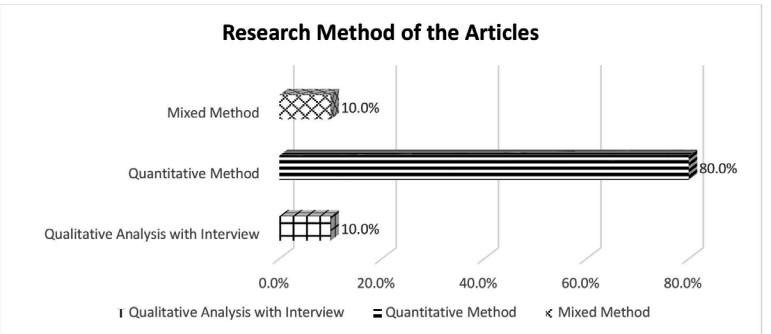

Figure 4: Research methods used in fisheries studies

methods. Type of the quantitative methods often used in the studies were (1) Simper (Garcia-De-Vinuesa *et al.*, 2018), (2) Generalised Linear Model (GLM) analysis (Coelho *et al*., 2012), (3) MiniPAT (Casale, 2011; Schaefer *et al*., 2021), (4) Kernel Density Estimation (Marceniuk *et al*., 2019), (5) POSEIDON model (Cardoso *et al.*, 2011; Madsen *et al*., 2021), (6) Random Forest analysis (Báez *et al*., 2014), and (7) WARD's method (Statistical method: Minimum Variance Clustering Method) and Maximum Sustainable Yield (MSY) approach from the studies (François Bastardie *et al*., 2017). Figure 4 shows that the use of quantitative data is huge in the research market because it is more easily available than qualitative data. The mixed method categories are two research methods used in a study with valid reasons and functions. There are few studies from these articles focused on the simulation approach (Benhardouze *et al.*, 2012) and (Forrestal *et al.,* 2019). These studies are comforting, and the findings of the research method are relevant.

Table 6 shows the type of fisheries in the studies, which are divided into five sub-criteria: (1) Small scale fisheries or artisanal fisheries, (2) bottom longline fisheries, (3) tuna fisheries, (4) trawl fisheries, and (5) purse seine fishery. The results show that most of the studies are on trawl fishery at 43%, whereas the least number of studies focused on this literature is tuna fisheries at 5%. The tuna fisheries articles support the studies a lot with a minimal number of articles (Havice *et al*., 2012; Sun *et al*., 2016; Sepulveda *et al.*, 2019). The purse seine fishery has also lately been reduced where the number of articles gained was only six, which are Monteiro (2017 and major fishing grounds are concentrated in zones threatened by pollution, habitat, and coastal zone modification. In Portugal, the European pilchard or sardine (Sardina pilchardus), Zhou *et al.* (2019), Benvenuti, Yan Li *et al*. (2016), Kane *et al.* (2020) and González *et al*. (2015). The small-scale fisheries are limited, with a few articles in these findings, which is 12%. Bottom longline fisheries have been equally categorised as the number of studies found is quite high at 30%. The studies in the bottom longline fisheries are Echwikhi *et al.* (2012), Varisco *et al*. (2015 relative abundance (RA), Rábago-Quiroz *et al*. (2015) and Sulikowski *et al*. (2020). These studies help to indicate the results of the type of fisheries are adequate.

Types of Fishing Gears Used

The type of fishing gear here are six sub-criteria which are (1) trawl nets, (2) gill nets, (3) longline, (4) hooks and lines, (5) purse seine, and (6) traps. Figure 5 shows the percentage of fishing gear usage in the commercial fishing industry. The researcher limits the type of gear specifically to commercial fishing. The fishing gear reflects on the commercial fishing industry's gear only. The (1) hooks and lines and (2) traps are automatically removed from the list because it does not suit commercial fishing industries.

The trawl nets are probably the most used gear type in the fishing industries for more catches, with 43%. Commercial fishing welcomes the trawl nets freely in the industries. The studies that support the findings are Garcia-De-Vinuesa *et al.* (2018), Rolim and Ávila-Da-Silva (2016), Cardoso *et al*. (2011), Burgos *et al*. (2013), Barua *et al.* (2018), Bastardie *et al*. (2017), Tagliolatto *et al.* (2020) and Capparelli

Table 6: The type of fisheries of the study

Type of Fisheries	Percentage (%)
Small scale fisheries and artisanal fisheries	12
Bottom longline fisheries	30
Tuna fisheries	5
Trawl fishery	43
Purse seine Fishery	10

et al. (2012). Many European countries use trawl nets, and the overexploitation status with the landing fish is high due to the usage of trawlers. Then, the trawl nets also affect the bycatch the most among the other gear types listed in Table 6 and Figure 5. Besides, the trawl gear is highly efficient towards the community livelihood and socioeconomic indicator based on the salary gained by the trawlers commonly. It explains that trawl gear is used mostly by the fishers, and it affects many factors that are reflected in the findings of the articles. The least type of gear that gain from these articles is gill net, with 14% of the studies with the support (Eigaard *et al*., 2014; Levy *et al*., 2015; Mafra Pio *et al*., 2016; Liles *et al.*, 2017; Fiedler *et al*., 2020). Most of the studies and fishermen are focusing on the trawl nets. The longlines are equally important in these findings. The types of longlines are (1) Bottom longline and (2) Tuna drift longline and supported with articles (Lucena Frédou *et al.*, 2015; Carvalho *et al.*, 2015; Forrestal *et al.*, 2019).

Research Findings and Recommendations in the Review Articles

The findings of previous studies are classified into four main themes such as (1) socioeconomic indicators and community livelihood, (2) bycatch of marine fisheries, (3) sustainability of fisheries, and (4) overexploitation and landing fish affected.

(i) Socioeconomic Indicators and Community Livelihood

Improving the fisher's lifestyle by catching more fish, the fishers are looking at the operation costs and the expected revenue from the resources. Space-based management would be the better way for the resource use strategies to accommodate new regulations (Sun *et al*., 2016), and monitoring of fisheries is the most effective strategy and will be lacking in impacting the fishery process (Sun *et al*., 2016). Moreover, implementing mitigation measures is urgent and needs to be included in fishermen, sea researchers, seabird conservationists, and policymakers' agendas to minimise the impact of fishing activity at sea (Oliveira *et al*., 2015). The promising approach for managing fisheries is to assign fishing efforts, resolved at a single trip scale with specific metiers, even giving an independent assessment of fishing activity concerning those provided by logbook and capture data (Russo *et al*., 2011). Compared to the other types of gear, the trawlers and purse seine fisheries are highly gained in the socioeconomic factor where the communities' livelihood is much better than the other types of fishing gear.

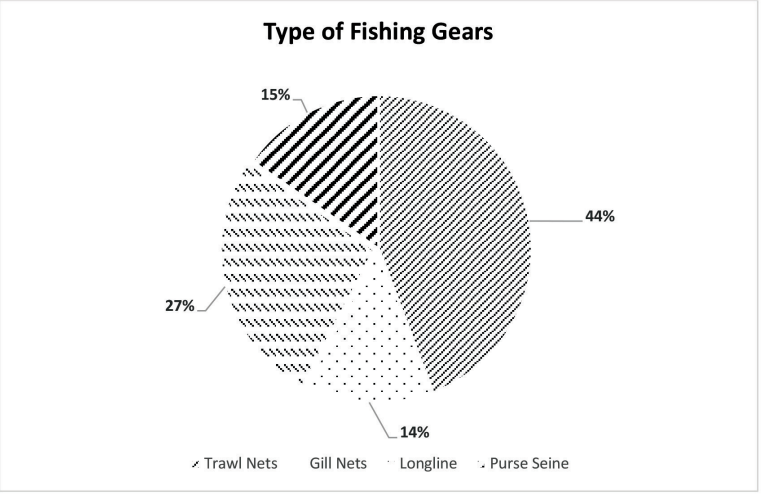

Figure 5: Type of fishing gear in fisheries research studies

(ii) Controlling Bycatch of Marine Fisheries

The bycatch activities happen naturally when the traps are set out (López-Martínez *et al.,* 2014) and need balancing preferable management to avoid overexploitation in marine fisheries and conducting more awareness campaigns, especially aimed towards the fishermen is crucial (Echwikhi *et al*., 2012). Bycatch data from small-scale fisheries globally impedes conservation interventions, particularly for hawksbills in the eastern Pacific. Community-based efforts to enhance sustainable self-governance by establishing locally crafted conservationist norms and MPAs (Liles *et al*., 2017). If the species caught as bycatch are also targeted by a fishery, bycatch management is very difficult. Effective management in the region depends on understanding the population dynamics (Rábago-Quiroz *et al*., 2015).

The trawl cables are a major threat for species that frequently forage behind the vessel with open wings. Birds are often trapped and forced underwater by the drag created by the forward motion of the fishing vessel. In contrast, mandatory measures to reduce the seabird's bycatch were only applied to longline fisheries (Tamini *et al.*, 2015). Several conservation and fisheries management options have been put forward, which include mandatory release and prohibition of vulnerable bycatch species (Coelho *et al*., 2012). The bycatch activities need to be focused on precisely and carefully for the future of the fisheries (Jordaan *et al*., 2020). In trawl fisheries, principles of waste holdings guidelines apply to any fishery discharging waste attractive to seabirds. Waste can minimise seabird captures on trawl warps worldwide while holding fisheries (Pierre *et al*., 2012).

(iii) Sustainability of Fisheries Management

Sustainable fisheries are achieved by establishing a permanent no-take zone to avoid unwanted catches and prevent habitat degradation (Garcia-De-Vinuesa *et al*., 2018) by protecting the main species and as well as conserving the marine (Fiedler *et al*., 2020). Designing protected area-based conservation strategies for a taxonomic group requires basic knowledge of spatial patterns of biodiversity, which is considered crucial (Lucena Frédou *et al.*, 2015). Moreover, this multi-gear/fishery approach can be advantageous in conservation and management and provide decision-makers with a comprehensive picture to prioritise actions in particular fisheries under limited resource and capacity scenarios (Copello *et al*., 2014). Báez *et al*. (2014) suggested that the most important factors for management applications are geographical location followed by the technical characteristics of the fishery and fisheries interaction. The important issue of mismatch between management and biological units and the potential consequences of not incorporating them in assessment and management and management strategy evaluation is instrumental in capturing the non-linear effects of different recommendations on sustainability and economic viability (Bastardie *et al.,* 2017).

Most of the articles based on the trawl gear type suggest effective fishery management policies for the better future of the marine stock. The trawlers usually take advantage of the policies, and this results in failures of implementation by the management. The articles highlight that the ders also need to use the same policies to enforce and sustain the fishery stock for the future. Therefore, sustainable fishery management is an important element needed to look forward to a better future for the fishery status.

(iv) Overexploitation and Effecting on Landing Fish

The fishing mortality appears to be particularly difficult, and the tech challenges not only restrict the development of drift fisheries but also affect the other species due to overexploitation, which is the potential management improvement by balancing harvesting capacity (Eigaard *et al.*, 2014). The spatial allocations of effort reduce the valuable catches and increase the fishing effort and landings, and it also helps the MPAs to manage towards sustainable management

and more to protect the fisheries resources. The MPAs need to ensure the environmental resources with the regulatory process and that the MPA management acted more towards territorial management (Rolim & Ávila-Da-Silva, 2016). The vessels take advantage of the overspill of fish stock from MPAs, and the fisheries management is a little less regulatory and breaking laws. The approach to managing a complex and dynamic Human-environment system should be used in fisheries management in the future (Madsen *et al.*, 2021). The overexploitation leads to scarcity of the fishery's resources, and ensuring adequate publicity and dissemination of the investments supports availability and applicability for adherence among fishing communities (Monteiro, 2017).

The depletion of fish stocks increases due to fishing overcapacity and artisanal fleets' decline in several economical alternatives in small-scale fisheries. The question is whether management policy will adapt as well or continue to overlook the fishery problems (Castro *et al*., 2019). Although not highly exploited resources in the coastal area and the commercial exploitation of the species evaluation, the exclusive operations need to be restricted in coastal water (Varisco *et al.*, 2015). Overexploitation of the two main target species suggests the need to reduce fishing capacity by removing vessels and/or reducing the extent of the fishing gears if their biological sustainability is to be achieved (Mafra Pio *et al.,* 2016). High exploitation coupled with very poorly selective gears determines a low production level for most of the examined stocks and fisheries under the current fishing regime, and predicted fishery yield remains at generally lower levels compared to those expected under the Fishing Effort at Maximum Sustainable Yield (FMSY) (Colloca *et al*., 2013). Overall, despite the diversity of distributional assumptions, model selection methods, software, and variable treatments, most models could capture the underlying population trends. Moreover, the priority of variable inclusion or exclusion should be based on a first principles knowledge of the fishery and the historical management measures that have taken place (Forrestal *et al*., 2019).

Based on the outcome, the trawlers are highly affecting the overexploitation status of the fishery stock, according to the reviewed articles. The overexploitation and landing fish affect the fishery stock highly. The trawlers are the draggers of the marine world, and they are vigorously polluting the marine seabed by overcapacity and high exploitation. The seiners and other gear types are lowly exploited compared to the trawlers. Hence, according to the reviewed articles, the trawlers are contributing highly to the overexploitation of the marine fishery stock.

Discussion

The overall finding explains the studies about marine capture fisheries and fishing fleet dynamics in South America and Europe, mostly according to the reviewed articles. The research mostly focuses on European countries due to the different types of species and the depletion of fish stocks in this area. The types of methods utilised in studies are least geared towards qualitative methods. The quantitative method has been focused on by most of the researchers so that it would be more efficient to compare the fish species mortality, bycatch, and the extinction of the species. The more years will be relevant to prove the outcome, which is that the catches are increasing rapidly every year. The trawl fishery and trawl gears are commonly used in these study areas.

Most articles define trawl fishery as the most used type in the common years. Trawl fishery is a type of fishery that focuses on using trawl nets. The number of catches is simply high, leading to bycatch cases globally. The trawl nets are severely destroying marine habitats and damaging the marine ecosystem in the catchment area. It is an advanced gear used in industry but fails to keep the marine habitat safe. According to the articles, the outcome of the literature is that overexploitation and overfishing activities are destroying marine habitats and decreasing the number of marine resources.

The research here focuses on enhancing the fishers' lifestyle by capturing more fish, and

the fishers consider the operating expenses and projected revenue from the resources (Sun *et al*., 2016). The vessels exploiting the excess fish stocks from MPAs and the fisheries management are highly regulated (Madsen *et al.*, 2021). Fish supply depletion is increasing due to overfishing (Castro *et al.,* 2019). Bycatch of sea turtles for meat and other purposes, and the entire catch rate is higher than expected. The fishing gear is not environmentally friendly and has a significant bycatch problem (Casale, 2011).

The overexploitation and landing fish effect outcomes hold 26.7% of the most outcomes referred to Forrestal *et al*. (2019), Russo *et al*. (2015), and Metri and Perez (2014). Then, the socioeconomic indicators and community livelihood here hold the second highest outcomes with 25%, together with the bycatch of marine fisheries. The articles that support the findings are Sun *et al.* (2016), Echwikhi *et al*. (2012), Cardoso *et al.* (2011), Benhardouze *et al.* (2012), Coelho *et al*. (2012), Báez *et al*. (2014), Kane *et al.* (2020), Kane *et al.* (2020) and Sant'Ana and Perez, (2016). The last outcome stands at 23.3% for sustainable fisheries. The researchers also agree with those findings, especially on the overexploitation and landing fish effects specifically. Overexploitation is a common issue that is brought up in the commercial fishing industry in marine capture fisheries. The effects of overexploitation need to be discussed further by implementing relevant policies in management.

Fisheries management has been implemented in most regions in Europe according to changes in the conditions of fisheries. According to Hoof *et al.* (2020), the Netherlands is focusing on technological challenges that are restricted and lead to overexploitation, and mixed methods are used to analyse the issue in the area. Rolim and Ávila-Da-Silva (2016) studied an area in Brazil focusing on the spatial allocations of effort following implementation to reduce valuable catches and increase fishing effort and landings. It also helps MPAs to manage the act more towards sustainable management and more to protect the fisheries resources. The research in the United States focuses on improving the fishermen's lifestyle by catching more fish, and the fishers consider the operation costs and expected revenue from the resources. To accommodate new regulations, space-based management must be improved in new ways, as well as resource utilisation strategies (Sun *et al.*, 2016).

These authors also focus on the bottom longline fishery that triggers the marine animals. The authors discussed the bycatch activities that often happen due to the type of nets used in this fishery industry. It triggers sea turtles and other marine life. Author Barua *et al.* (2018) explain the fishery condition in Bangladesh where beyond the catch and effort dataset used, there are other important sources of information about the status of the offshore shrimp fishery, such as differences in catch rates between areas and changes in the geographical distribution of the stock and fleet. Therefore, sustainable fishery management plays a huge role in the future of marine fish stocks.

Besides, according to author Pierre *et al.* (2012), fishery management can be more efficient than suggested. The principles of these guidelines apply to any fishery that discharges waste that is appealing to seabirds as the bycatches. Most countries are worried about bycatch activities that kill sea life. The trawl cables pose a significant threat to species of the order, which frequently forage behind the vessel with open wings. Seabirds are frequently trapped and forced underwater because of these strikes due to the drag created by the forward motion of the fishing vessel, and only longline fisheries were required to implement mandatory measures to reduce seabird bycatch (Tamini *et al.*, 2015). Moreover, better management policies can also be implemented, as the author Rábago-Quiroz *et al*. (2015) suggests. Some examples are avoiding bycatch hotspots through fleet communication programs and/or area and seasonal closures, enforceable legislation, effective penalties, and proper waste management.

Conclusion

To conclude, the studies have unique data that can summarise the findings about marine capture fisheries and better management policies. The overall outcome will illustrate the findings of the literature review on marine capture fisheries and fishing fleet dynamics. The study explains the need for better sustainable fishery management due to multiple issues from the commercial fishing industry. All 60 articles summarise that the commercial fishing industry is a bigger global issue that needs to be focused on by applying logical policies, especially on the trawlers. The demand for fish stocks is getting lower and faster than expected by the Food and Agriculture Organisation (FAO).

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Conflict of Interest Statement

The authors declared that they have no conflict of interest.

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APPENDICES

Findings of review with coding criteria

Doc Id	Area Code	Research Methods	Type of Fisheries	Type of Fishing Gears	Research Findings and Recommendations	Authors
1	5 (Mediterranean)	5-2 (Simper & MDS Analysis)	5-2 (Simper & MDS Analysis)-4	5-2 (Simper & MDS Analysis)-4-1 (Bottom Trawl)	5-2 (Simper & MDS Analysis)-4-1 (Bottom Trawl)- 3 (the research focuses on the fishing effort dynamics and provides useful tools for improving the management of trawl fisheries and avoiding unwanted catches. To control fishing efforts and daily fishing trips for better sustainability. Establishing a permanent no-take zone to avoid unwanted catches and prevent habitat degradation).	(Garcia-De-Vinuesa *et al.*, 2018)
2	5 (Netherlands)	5-3 (Skipper Interview & GLM Analysis)	5-3 (Skipper Interview & GLM Analysis)-4	5-3 (Skipper Interview & GLM Analysis)-4-2	5-3 (Skipper Interview & GLM Analysis)-4-2-4 (The fishing mortality appears to be particularly difficult, and the tech challenges not only restrict the development of drift fisheries but also affect the other species due to overexploitation occur the potential management improvement by balancing harvesting capacity and according to availability).	(Eigaard *et al.*, 2014)
4	4 (California)	4-1	4-1-1	4-1-1-6	4-1-1-6-2 (The different dynamic population parameters found from the different commercial captures with traps from the shrimp catches. Here, the bycatch activities happen naturally when the traps are set according to the findings. Balancing a preferable management to avoid overexploitation).	(López-Martínez *et al.*, 2014)
5	3 (Brazil)	3-2	3-2-4	3-2-4-1(Pair Trawl)	3-2-4-1 (Pair Trawl)-4 (In this case, the spatial allocations of effort after the implementation to reduce the valuable catches and to increase the fishing effort and landings, and it also helps the MPAs to manage the act more towards the sustainable management and more to protect the fisheries resources. The MPAs need to ensure the environmental resources with the regulatory process and that the MPA management acted more towards territorial management).	(Rolim & Ávila-Da-Silva, 2016)

Doc Id	Area Code	Research Methods	Type of Fisheries	Type of Fishing Gears	Research Findings and Recommendations	Authors
6	4 (United States)	4-2(Model Specification)	4-2(Model Specification)-3	4-2(Model Specification)-3-5	4-2 (Model Specification)-3-5-1 (The research here focuses on improving the fisher's lifestyle by catching more fish and the fishers are looking at the operation costs and the expected revenue from the resources. The space-based management needs to improve in better ways and resource use strategies to accommodate new regulations).	(Sun *et al*., 2016)
7	2 (Tunisia)	4-2(MiniPAT)	4-2(MiniPAT)-2(Bottom)	4-2(MiniPAT)-2(Bottom)-3	4-2 (MiniPAT)-2 (Bottom)-3-2 (To reduce the bycatch fishing especially towards the loggerhead turtle. Whereas to recommend conducting more awareness campaigns especially aimed towards the fishermen.	(Echwikhi *et al*., 2012)
8	3 (Brazil)	3-2(Cluster Analysis)	3-2(Cluster Analysis)-4	3-2(Cluster Analysis)-4-2(gill nets)	3-2 (Cluster Analysis)-4-2 (Gill nets)-3 (Sustainable fisheries by protecting the main species, conserving the marine. The study focuses on coastal fisheries where the sustainable fisheries may be interrupted.	(Fiedler *et al.,* 2020)
9	4 (Costa Rica)	4-2(MiniPAT)	4-2(MiniPAT)-2	4-2(MiniPAT)-2-3(Bottom longline)	4-2 (MiniPAT)-2-3 (Bottom longline)-3 (Captured by longline gear and landed alive aboard those vessels using a rope noose have a high probability of survival following release, which should be considered in discussions of mitigation measures to reduce their fishing mortality rates).	(Schaefer *et al*., 2021)
10	3 (Brazil)	5-2 (ABM & POSEIDON Model)	5-2 (ABM & POSEIDON Model)-4	5-2 (ABM & POSEIDON Model)-4-1	5-2 (ABM & POSEIDON Model)-4-1-2 (The bycatch activities often occur on the penguin species. It also classifies as incidental capture in fisheries. There is usage of driftnet and gill net.	(Cardoso *et al*., 2011)
11	3 (Brazil)	3-2(Cluster Analysis)	3-2(Cluster Analysis)-2	3-2(Cluster Analysis)-2-3(Bottom Longline)	3-2 (Cluster Analysis)-2-3 (Bottom Longline)-4 (A gradual increase in effort observed as from 2001 could be related to the migration of vessels arising from the collapse of shrimp and grey triggerfish (*Balistes capriscus*) fisheries on the coast of Espírito Santo. Need to overcome the overlapping of	(Distal *et al.,* 2015)

Doc Id	Area Code	Research Methods	Type of Fisheries	Type of Fishing Gears	Research Findings and Recommendations	Authors
					fishing areas, focus on the fishing strategy, and use technology to obtain good yield).	
12	3 (Brazil)	3-2(Kernel Density Estimation (KDE))	3-2(Kernel Density Estimation (KDE))-4	3-2(Kernel Density Estimation (KDE))-4-1	3-2 (Kernel Density Estimation (KDE))-4-1-1 (This encompasses the transitions zones of different fish communities. The recognition of distinct communities affected by industrial trawling operations is fundamental to the effective management of local stocks and the biota impacted by the industrial fisheries of northern Brazil. Monitoring of fisheries is the most effective strategy and will be lacking in impacting the fishery process).	(Marceniuk *et al.*, 2019)
13	5 (United Kingdom)	5-2 (ABM & POSEIDON Model)	5-2 (ABM & POSEIDON Model)-4	5-2 (ABM & POSEIDON Model)-4-1	5-2 (ABM & POSEIDON Model)-4-1-4 (The vessels taking advantage of the overspill of fish stock from MPAs, and the fisheries management are very less regulatory. The fisheries are breaking laws, and the simulated patterns are not fitting to the parameters)-1(approach to the management of complex and dynamic Human-Environmental systems should be used in fisheries management in the future).	(Madsen *et al.*, 2021)
14	7 (Papua New Guinea)	3-2(Chi-Square Test)	3-2(Chi-Square Test)-3(Tuna Fisheries)	3-2(Chi-Square Test)-3(Tuna Fisheries)-5	3-2 (Chi-Square Test)-3 (Tuna Fisheries)-5-1 (The socioeconomic factors that lead the foreign firms to work in tuna fisheries. To recommend the benefits of fisheries industries in sustainable ways.	(Havice & Reed, 2012)
15	5 (Strait of Gibraltar)	5-2(Spatial Distribution)	5-2(Spatial Distribution)-1	5-2(Spatial Distribution)-1-1	5-2 (Spatial Distribution)-1-1-1 (It explains the fishing trips and fishing operations (hauls) with the times of landings. The estimated times explain that the trips are in the smaller scale of period. It also quantifies fishing activities using VMS. Here, the expected revenue overmeets the fishers. To integrate	(Burgos *et al.*, 2013)

Doc Id	Area Code	Research Methods	Type of Fisheries	Type of Fishing Gears	Research Findings and Recommendations	Authors
					analysis of VMS and the sales information of the past years, we need to add further concerns).	
16	5 (Portugal)	5-2	5-2-5	5-2-5-5 (Sardine Purse Seine)	5-2-5-5 (Sardine Purse Seine)-4 (It decreases the resource abundance from sardines to other targeted pelagic species. The scarcity increases in sardine's pelagic species. The overexploitation leads to a scarcity of fisheries resources. To ensure adequate publicity and dissemination of the investments, support availability and applicability for adherence among fishing communities).	(Monteiro, 2017)
17	5 (Spain)	5-2	5-2-1	5-2-1-5(Tuna Purse Seine)	5-2-1-5 (Tuna Purse Seine)-4 (The depletion of fish stocks increases due to fishing overcapacity. The artisanal fleets declined in several economic alternatives, and the small-scale fisheries were no longer in good fishing and fisher categories. Recreational fishing, the question is whether management policy will adapt as well or continue to overlook the fishery problems).	(Castro *et al.*, 2019)
18	3 (Argentina)	3-2(Chi-Square Test)	3-2(Chi-Square Test)-2	3-2(Chi-Square Test)-2-6(Traps)	3-2 (Chi-Square Test)-2-6 (Traps)-4 (Not Highly exploited resources in the coastal area and the commercial exploitation of the species evaluation using traps. The exclusive operations are restricted in coastal water).	(Varisco *et al.*, 2015)
19	3 (Argentina)	3-1(Interview Survey)	3-1(Interview Survey)-2	3-1(Interview Survey)-2-1	3-1 (Interview Survey)-2-1-3 (Sustainable fisheries in summer fishing with high catches. To recommend the spatial management tool. It is efficient and reliable to have sustainable management in fishing industries).	(Varisco *et al.*, 2015)
20	2 (Morocco)	3-2	3-2-2	3-2-2-4(Trawler)	3-2-2-4 (Trawler)-2 (Bycatch of sea turtles is high in this case, where the longline fleets have been abusive to the sea turtles. The mortality rate is high and ignored by most of the fishermen. The bycatch activities often happen).	(Benhardouze *et al.*, 2012)

Doc Id	Area Code	Research Methods	Type of Fisheries	Type of Fishing Gears	Research Findings and Recommendations	Authors
22	4 (Nicaragua)	4-3 (Observation & Akaike's Information Criteria)	4-3 (Observation & Akaike's Information Criteria)-1	4-3 (Observation & Akaike's Information Criteria)-1-2(Bottom Gill Net)	4-3 (Observation & Akaike's Information Criteria)-1-2 (Bottom Gill Net)-2 (Unintentional capture of non-target species, or bycatch, and is considered a primary driver in population declines of many long-lived marine megafaunas. However, the paucity of bycatch data from small-scale fisheries globally continues to impede conservation interventions, particularly for hawksbills in the eastern Pacific. Community-based efforts to enhance sustainable self-governance via the establishment of locally crafted conservationist norms and MPAs).	(Liles *et al.*, 2017)
23	4 (California)	4-3	4-3-3	4-3-3-5(Tuna Purse Seine)	4-3-3-5 (Tuna Purse Seine)-1 (There was also one predation event that occurred seven days after release; if the predation is included as a capture-related mortality, the combined survivorship estimate is 95%. Allowing sports operations to continue to operate with reduced harvest or impact on the resource can also reduce the economic loss associated with regulatory changes).	(Sepulveda *et al.*, 2019)
24	3 (Brazil)	3-2	3-2-2	3-2-2-3(Tuna Drift Longline)	3-2-2-3 (Tuna Drift Longline)-3 (In the southern Atlantic Ocean, high fishing effort zones overlap significantly with some nursery areas, especially for the oceanic whitetip shark, indicating that these areas are at a direct risk from the industrial longline fishery. Designing protected area-based conservation strategies for a taxonomic group requires basic knowledge of spatial patterns of biodiversity).	(Lucena Frédou *et al.*, 2015)
25	5 (Mediterranean)	5-2	5-2-4	5-2-4-1(Bottom trawl)	5-2-4-1 (Bottom trawl)-2 (Bycatch the sea turtles' purpose for the meat and the needs. The total catch rates rise than the assumption. The fishing gear is not environment friendly and deals with a lot of bycatch problems).	(Casale, 2011)

Doc Id	Area Code	Research Methods	Type of Fisheries	Type of Fishing Gears	Research Findings and Recommendations	Authors
26	3 (Brazil)	3-2	3-2-4	3-2-4-2 (Gill Net)	3-2-4-2 (Gill Net)-3 (Bycatch activities towards the Hippocampus in CFI are severe and often. It has been endangered, and the study would like to suggest evaluating the policy management more precisely.	(Silveira *et al.*, 2018)
27	4 (Washington)	5-2	5-2-4	5-2-4-4	5-2-4-4-4 (Overfishing towards the wild capture fisheries. The global fish stock is down, and the hard limit of fishing mortality is high. To balance it between profitability and employment.	(Anderson *et al.,* 2019)
28	3 (Peru)	3-1(Interview Survey)	3-1(Interview Survey)-2	3-1(Interview Survey)-2-3(Bottom Longline)	3-1 (Interview Survey)-2-3 (Bottom Longline)-1 (This study adds to these approaches by incorporating detailed knowledge from fishers about the spatial distribution and fleet characteristics into the bycatch analysis, thereby adding a new angle to understand this conservation issue. In this way, including more information could improve scientific research and management).	(Ayala *et al.*, 2019)
29	3 (Brazil)	3-2	3-2-4	3-2-4-2(Bottom Trawl)	3-2-4-2 (Bottom Trawl)-4 (Overexploitation of the two main target species suggests the need to reduce fishing capacity by removing vessels and/ or reducing the extent of the fishing gears if their biological sustainability is to be achieved. The view of management is broad about the gillnetting regulations and characterised).	(Mafra Pio *et al.*, 2016)
31	4 (Mexico)	4-2(Catch-at-size analysis (CASA))	4-2(Catch-at-size analysis (CASA))-2	4-2(Catch-at-size analysis (CASA))-2-1(Bottom Trawl)	4-2 (Catch-at-size analysis (CASA))-2-1 (Bottom Trawl)-2 (However, if the species caught as bycatch are also targeted by a fishery, bycatch management is very difficult. Hence, the flatfish species in the bycatch are aided by the same management action. Effective management of flatfish in the region depends on understanding the population dynamics of target (shrimp) and flatfish species and related ecosystem processes).	(Rábago-Quiroz *et al.,* 2015)

Doc Id	Area Code	Research Methods	Type of Fisheries	Type of Fishing Gears	Research Findings and Recommendations	Authors
33	2 (Africa)	1-2 (Biomass Model)	1-2 (Biomass Model)-5	1-2 (Biomass Model)-5-3	1-2 (Biomass Model)-5-3-2 (The bycatch activities in CFI using the longline fisheries destroy the habitat to worst. This will have a major effect on the environment and the pollution on land or sea will increase).	(Zhou *et al.*, 2019)
34	5 (Mediterranean)	5-1 (Questionnaire-Based Survey)	5-1 (Questionnaire-Based Survey)-4	5-1 (Questionnaire-Based Survey)-4-1	5-1 (Questionnaire-Based Survey)-4-1-1(The reliability of fishermen's answers is a central issue when using questionnaires to assess the bycatch of legally protected species since fishermen do not typically record data on incidental catch, or they just can simply lie. Proposals to deal with this conservation problem have to be addressed through actions aiming to reduce or avoid the incidental catch of turtles to reduce the rate of post-release mortality).	(Domènech *et al.*, 2015)
35	5 (Spain)	5-2(Statistical catch-at-age model (SCAM))	5-2(Statistical catch-at-age model (SCAM))-2	5-2(Statistical catch-at-age model (SCAM))-2-3(Bottom Longline)	5-2 (Statistical catch-at-age model (SCAM))-2-3 (Bottom Longline)-1 (The ecological differences within and between members of a population suggest that this simple form of model may overlook important influences on population dynamics).	(Carvalho *et al.*, 2015)
36	5 (Portugal)	5-1(On Board Data Analysis & Interview Survey)	5-1(On Board Data Analysis & Interview Survey)-4	5-1(On Board Data Analysis & Interview Survey)-4-1	5-1 (On Board Data Analysis & Interview Survey)-4-1-1 (Despite the small number of rips, interviews also highlighted this gear as one with the most impact on the gannet population. CPUE found in this study was higher than that found in several other works. Implementation of mitigation measures is urgent and needs to be included in fishermen, sea researchers, seabird conservationists, and policymakers' agendas to minimise the impact of the fishing activity at sea on incidental bird bycatch).	(N. Oliveira *et al.*, 2015)

Doc Id	Area Code	Research Methods	Type of Fisheries	Type of Fishing Gears	Research Findings and Recommendations	Authors
37	3 (Brazil)	3-2	3-2-5	3-2-5-5(Tuna Purse Seine)	3-2-5-5 (Tuna Purse Seine)-4 (The estimated exploitation rate in the present study (E = 0.67) in addition to those estimated for the southern region in the period 2004–2009 are all higher than 0.5, suggesting that the exploitation level is above the biological recovery capacity. Suggest the expansion of studies that could clarify the patterns of displacement of individuals and eventual correlations with water mass characteristics, such as satellite monitoring and mark-recapture experiments).	(Benevenuti Soares *et al.*, 2019)
38	7 (Turkey)	4-2(Longline Simulation Model)	4-2(Longline Simulation Model)-2(Trammel Nets)	4-2(Longline Simulation Model)-2(Trammel Nets)-4	4-2 (Longline Simulation Model)-2 (Trammel Nets)-4-1 (In the region, the mortality numbers of teleosts and crustaceans caused by bottom trammel nets lost by the entire fishing fleet were identified as 1291 (100 kg) and 6102 (990 kg) individuals, respectively. This mortality rate (0.55% for fish) can be insignificant in all fisheries, but the mortality rates of threatened species, such as Chelonia mydas.	(Ozyurt *et al.*, 2017)
39	5 (Adriatic Sea)	5-2	5-2-4	5-2-4-1(Pair Trawl)	5-2-4-1 (Pair Trawl)-4 (Via strategies may determine important consequences on the resources in terms of exploited areas and the impact of fishing activity. A low fuel price when the fish price is high leads to higher values of CPUE and then to a more efficient but also impacting fishing activity concerning some environmental conditions, whereas it is extensively influenced by economic factors such as Fuel and Fish prices).	(Russo *et al.*, 2015)
40	5 (United Kingdom)	3-2(Geostatistical Model)	3-2(Geostatistical Model)-1	3-2(Geostatistical Model)-1-2	3-2 (Geostatistical Model)-1-2-2 (The mortality rate through trawling and the stranding density is the highest in the region, emphasising the urgent need to regulate the Israeli fishery. This fishery poses a major	(Levy *et al.*, 2015)

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					threat to the whole Levantine Sea turtle population, especially during the vulnerable reproduction stage)	
41	2 (Liberia)	3-2	3-2-4	3-2-4-1	3-2-4-1-3(DINEOF is based on an Empirical Orthogonal Functions decomposition performed with a Lanczos method. DINEOF was tested with different amounts of missing data, intentionally removing values from 3.4% to 95.2% of data loss and then compared with the same data set with no missing data. These validation analyses show that DINEOF is a reliable methodological approach).	(Ganzedo *et al*., 2013)
42	3 (Argentina)	3-2	3-2-4	3-2-4-3	3-2-4-3-2 (The trawl cables are a major threat for species of the order, which frequently forage behind the vessel with open wings. As a result of these strikes, birds are often trapped and forced underwater by the drag created by the forward motion of the fishing vessel. The implementation of mandatory measures to reduce the seabird's bycatch was only applied to longline fisheries).	(Tamini *et al*., 2015)
43	5 (Mediterranean)	5-2	5-2-4	5-2-4-1	5-2-4-1-4 (Currently, high exploitation coupled with very poorly selective gears determines a low production level for most of the examined stocks and fisheries. Under the current fishing regime, calculated biomass at sea and predicted fishery yield remain at generally lower levels compared to those expected under the FMSY. Management experiences also showed that they improved.	(Colloca *et al.*, 2013)
44	5 (Denmark)	5-1	5-1-4	5-1-4-4	5-1-4-4-3 (The objective method is suggested that provides an optimal set of fishing mortality within the range, minimising the risk of TAC mismatches among stocks captured within mixed fisheries, and explicitly addressing the trade-offs between the most and least productive stocks).	(Ulrich *et al.,* 2017)

Doc Id	Area Code	Research Methods	Type of Fisheries	Type of Fishing Gears	Research Findings and Recommendations	Authors
45	5 (Portugal)	5-2 (GLM & GAM Model)	5-2 (GLM & GAM Model)-2	5-2 (GLM & GAM Model)-2-4	5-2 (GLM & GAM Model)-2-4-2 (There were differences in the hooking mortality depending on the region of operation of the fleet, but those differences were also species-specific. For blue and crocodile sharks, the hooking mortality was higher. Several conservation and fisheries management options have been put forward, which include mandatory release and prohibition of vulnerable bycatch species).	(Coelho *et al*., 2012)
46	5 (Italy)	5-2	5-2-4 (Trammel nets)	5-2-4 (Trammel nets)-1	5-2-4 (Trammel nets)-1-1 (The probability of immediate survival for sea turtles caught in trammel nets seems to be directly related to the size of the specimens caught. However, this relationship is plausible only when incidental capture in the net occurs shortly before gear retrieval).	(Resources & Biology, 2011)
47	1 (Bangladesh)	1-2 (Biomass Model)	1-2 (Biomass Model)-4	1-2 (Biomass Model)-4-1	1-2 (Biomass Model)-4-1-1 (However, it should also be considered that there are other important sources of information about the status of the offshore shrimp fishery beyond the catch and effort dataset used here, such as differences in catch rates between areas, changes in the geographical distribution of the stock and fleet. Suggesting management measures, augmenting other sources of information on the offshore shrimp stock).	(Barua *et al.,* 2018)
50	3 (Argentina)	3-2	3-2-4	3-2-4-3(Bottom Longline)	3-2-4-3 (Bottom Longline)-3 (In terms of conservation and management, this multi-gear/ fishery approach can be advantageous, providing decision-makers with a comprehensive picture to be used to prioritise actions in particular fisheries under limited resource and capacity scenarios).	(Copello *et al.,* 2014)
51	2 (South Africa)	2-2	2-2-4	2-2-4-3(Bottom Longline)	2-2-4-3 (Bottom Longline)-2 (It is more to bycatch activities that need to focus on very precisely and carefully for the future of CFI).	(Jordaan *et al.,* 2020)

Doc Id	Area Code	Research Methods	Type of Fisheries	Type of Fishing Gears	Research Findings and Recommendations	Authors
54	5 (Mediterranean)	5-2(Random Forest Analysis)	5-2(Random Forest Analysis)-2	5-2(Random Forest Analysis)-2-4(Hook and Lines)	5-2 (Random Forest Analysis)-2-4 (Hook and Lines)-3 (They could be controlled is fundamental for improving the management of fisheries and so carry out better conservation of Cory's shearwater populations in the Mediterranean. Our conclusion is clear because seabirds are more likely to approach longline vessels when trawlers are not allowed to operate. Suggests that the most important factors for management applications are geographical location followed by the technical characteristics of the fishery and fisheries interaction).	(Báez *et al.*, 2014)
55	4 (United States)	4-2	4-2-5	4-2-5-3	4-2-5-3-2 (When compared with the estimates from the RYEM (145–1049 seabirds with a CV of 16.4–23.5%), the SEM produced higher estimates (155–1489 seabirds) of the total seabird bycatch for each of these areas and a larger CV (19.1–65.4%). The RYEM may be appropriate for seabird bycatch assessment when spatial variation is not a concern; the SEM could be an alternative when observed data vary greatly over space.	(Li *et al.*, 2016)
56	4 (United States)	4-3	4-3-1	4-3-1-3	4-3-1-3-3 (Although most sea turtles caught as bycatch were released alive, they often remained hooked with trailing lines. Most captains expressed their willingness to be trained in the safe-handling and release of hooked and entangled turtles to increase the probability of their survival).	(Blades *et al.*, 2019)
57	5 (Central Baltic Sea)	5-2(MSY Approach)	5-2(MSY Approach)-4	5-2(MSY Approach)-4-1(Trawl Net)	5-2 (MSY Approach)-4-1 (Trawl Net)-3 (This study addresses the important issue of mismatch between management and biological units and the potential consequences of not incorporating this bio-complexity in assessment and management.	(Bastardie *et al.*, 2017)

Doc Id	Area Code	Research Methods	Type of Fisheries	Type of Fishing Gears	Research Findings and Recommendations	Authors
					Our management strategy evaluation is instrumental in capturing the non-linear effects of different recommendations on sustainability and economic viability).	
59	2 (Mauritania)	2-3	2-3-5(Lobster net)	2-3-5(Lobster net)-5	2-3-5 (Lobster net)-5-1 (It is estimated that the Mauritanian segment creates 25% more jobs than the European segment. This assessment of the economic performance of the exploratory fishery in Mauritania lobster first step towards a deeper understanding of its cost structure and dynamics, necessary for managing TACs and fishing quotas).	(Kane *et al.*, 2020)
62	5 (Italy)	5-2	5-2-1	5-2-1-2	5-2-1-2-1 (Disaggregating fishing activity represents a challenge to the scientific community since VMS and logbook technology is still developing and no direct way exists to assign metiers with certainty.)-suggest that this is a promising approach to assign fishing effort, resolved at single trip scale, to specific metiers, even giving an independent assessment of fishing activity concerning those provided by logbook and capture data).	(Russo *et al.*, 2011)fishing ground, target species
63	4 (United States)	4-2	4-2-2	4-2-2-3	4-2-2-3-4 (Forty-three of the 50 deployed tags reported data with deployment times ranging from 1 to 28 days (11.2 ± 9.8 days). Four dusky sharks were in poor condition at release, and two individuals suffered PRM, which occurred within two hours after release. The total mortality rate (AVM + PRM) in the current study was 5.1%, far below estimates reported for bottom longline gear (˜97%), and reinforces the notion that PRM should be evaluated by species, season, and gear type).	(Sulikowski *et al.*, 2020)

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64	6 (New Zealand)	6-3	6-3-4	6-3-4-1	6-3-4-1-2 (However, holding waste is preferred, due to relative simplicity in the mechanics of dealing with waste, lower cost, and greater reductions in seabird abundance. Though developed on trawl fisheries, the principles of these guidelines apply to any fishery discharging waste attractive to seabirds. While holding fisheries waste can minimise seabird captures on trawl warps worldwide, evidence-based management measures are still required to reduce seabird mortalities in trawl nets).	(Pierre *et al*., 2012)
65	4 (United States)	4-2(Longline Simulation Model)	4-2(Longline Simulation Model)-2	4-2(Longline Simulation Model)-2-3(Bottom Longline)	4-2 (Longline Simulation Model)-2-3 (Bottom Longline)-4 (Overall, despite the diversity of distributional assumptions, model selection methods, software, and treatments of variables, most models were able to capture the underlying population trends. Priority of variable inclusion or exclusion should be based on a first principles knowledge of the fishery and the historical management measures that have taken place.) Establishing a permanent no-take zone to avoid unwanted catches and prevent habitat degradation.	(Forrestal *et al*., 2019)
66	3 (Chile)	3-2(Generalised Linear Mixed Method (GLMM)	3-2(Generalised Linear Mixed Method (GLMM)-5	3-2(Generalised Linear Mixed Method (GLMM)-5-5	3-2 (Generalised Linear Mixed Method (GLMM))-5-5-2 (This correlation can be explained in two ways; firstly, most seabirds registered during the study are coastal species (mainly seagulls, pelicans, boobies, and cormorants), whose numbers tend to decrease as the fishing activities move further from the coast).	(González *et al.,* 2015)
67	4 (California)	4-2	4-2-2	4-2-2-1	4-2-2-1-3 (Given the lack of information surrounding the predation-induced mortality, two survivorship estimates are provided, one that includes the event as mortality resultant of the	(Sepulveda *et al.*, 2019)

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					capture event (86% survivorship) And one that excludes the event from the analysis (92% survivorship).	
69	3 (Brazil)	3-2(Geostatistical Model)	3-2-2	3-2(Geostatistical Model)-4-1	3-2 (Geostatistical Model)-4-1-1 (The implication of this finding was that fishery-generated catch rate data could produce reliable biomass estimates at lower costs and regularly, supporting the demand for determining the total biomass of exploited stocks periodically available for fishing. Suggests that observed operations of 'generalist slope trawlers' could provide more informative data for biomass assessments than 'specialised' trawlers).	(Sant'Ana & Perez, 2016)
71	3 (South Brazil)	3-2	3-2-2	3-2-2-1(Bottom Trawl)	3-2-2-1 (Bottom Trawl)-4 (Although no stock-recruitment relationship has been formally established, the limitation of effort should contribute to avoiding excessive mortality in the years that follow years of high abundances and catches. This would be possible if the number of boats or the intensity of the activity seeking the resource was limited).	(Metri & Perez, 2014)
73	3 (Brazil)	3-2	3-2-4	3-2-4-1	3-2-4-1-4 (Are valuable for directing and implementing specific and local mitigation measures along the Rio de Janeiro state coast, such as avoiding bycatch hotspots through fleet communication programmes and/or area and seasonal closures, enforceable legislation, effective penalties, and proper waste management).	(Tagliolatto *et al.,* 2020)
74	3 (Uba tuba Bay)	3-2	3-2-4	3-2-4-1	3-2-4-1-3 (We found that the largest catches in the estuary were in late spring and early summer. In Uba Tuba Bay, peak catches occurred during winter and early spring, whereas in the second year, already in May, there was a high peak capture).	(Capparelli *et al.*, 2012)