Food and Agriculture Organization of the United Nations

ASFA

IDENTIFYING RESEARCH AND DATA RELATED TO SUSTAINABLE DEVELOPMENT GOAL (SDG) INDICATOR 14.4.1

CASE STUDIES FROM CAMBODIA, INDONESIA, THE PHILIPPINES AND VIET NAM

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CASE STUDIES FROM CAMBODIA, INDONESIA, THE PHILIPPINES AND VIET NAM

by

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Food and Agriculture Organization of the United Nations
Rome, 2023

Required citation:

Superio, D., Pattarapongpan, S., Binti Ali, M., Kalentsits, M. & Vicary, T. 2023. *Identifying research and data related to Sustainable Development Goal (SDG) Indicator 14.4.1: case studies from Cambodia, Indonesia, the Philippines and Viet Nam*. Rome, FAO. https://doi.org/10.4060/cc9096en

ISBN 978-92-5-138468-8

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ABBREVIATIONS

AQD	Aquaculture Department
ASFA	Aquatic Science and Fisheries Abstracts
BFAR	Bureau of Fisheries and Aquatic Resources
BRIN	National Research and Innovation Agency
CAPSU	Capiz State University
CECAF	Fishery Committee for the Eastern Central Atlantic
CECAF-PESCAO	CECAF-PESCAO Project – "Improved regional governance of marine resources in the CECAF area"
CPUE	catch per unit effort
EEZ	exclusive economic zone
FAO	Food and Agriculture Organization of the United Nations
MaFReDI	Marine Fisheries Research and Development Institute
MFRDMD	Marine Fishery Resources Development and Management Department
MMAF	Ministry of Marine Affairs and Fisheries
OECD	Organisation for Economic Cooperation and Development
RES&POA2030	Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2030
RUA	Royal University of Agriculture
SDG	Sustainable Development Goals
SEAFDEC	Southeast Asian Fisheries Development Center
WoRMS	World Registry of Marine Species

EXECUTIVE SUMMARY

During 2022, the Food and Agriculture Organization of the United Nations (FAO) and the Southeast Asian Fisheries Development Center (SEAFDEC) jointly undertook a project to identify and assess research and data from four Southeast Asian countries related to the Sustainable Development Goal (SDG) Indicator 14.4.1 – the proportion of fish stocks within biologically sustainable levels. The goals of this project were: (1) to increase the visibility of research and datasets by making them searchable on OpenASFA, a system for creating, storing and publishing abstracts and bibliographic references; and (2) to analyse knowledge strengths and gaps in the region and make recommendations for improving the accessibility of research and data. This document presents the final report of the project, including the methodology, results and recommendations for future work.

Prior to identifying any research or data, a search strategy was formulated in order to identify relevant materials and exclude any materials outside the subject scope, e.g. tuna fisheries and transboundary stocks were excluded as not related to country SDG Indicator 14.4.1 (see Annex 1 for the full search strategy). The search strategy included a list of 53 taxonomic terms of commercial interest in the region and was used to assess the volume of research and data on species of under the scope of country SDG Indicator 14.4.1. The search strategy was tested using three online sources, namely the ASFA database, SCOPUS and Web of Science, with 350 results from the ASFA database exported to Excel and used during the analysis stage of the project. Fifteen participants from the following four countries in Southeast Asia were recruited: Cambodia, Indonesia, the Philippines and Viet Nam. Each participant worked at an institute that undertook fisheries research and each had a background in either fisheries science or knowledge management, making them suitable to undertake the work. Weekly training sessions were delivered by the ASFA Secretariat and SEAFDEC staff on identifying resources relevant to country SDG Indicator 14.4.1 and how to use OpenASFA to record their results. Participants recorded a total of 1 047 resources which are now freely searchable on the FAO Fisheries and Aquaculture website. Participants' results were combined with the 350 records that had been exported from the full ASFA database hosted by ProQuest, to give a total of 1 397 records, which comprised 447 books, 702 journal articles, 109 chapters and 139 datasets. The results were then exported to an Excel sheet where a bibliometric analysis was undertaken, with each record assigned to a subcategory. Analysis revealed that over a quarter (28.4 percent) of resources recorded by participants were unavailable online, confirming that efforts are needed to make stock information accessible.

Stock information was the most recorded subcategory (29.5 percent of all records) followed by stock assessment (26.4 percent). *Portunus pelagicus* and *Rastrelliger kanagurta* were the most recorded species for the stock assessment subcategory. *Rastrelliger kanagurta* was the most recorded species overall. Based on the list of 53 taxonomic terms of commercial interest, ten terms were identified that aggregated 64 percent of all records identified as belonging

to the subcategory “stock assessment”. There was only one species from the list of 53 species of commercial interest that was not recorded as part of this project – *Sardinops sargax*. The project also revealed that the research and publication on stock assessment is still lacking in the region with 22 percent of records from the subcategory coming from dissertations and theses. Collaboration with universities in the region should be enhanced with efforts to record dissertations and theses on OpenASFA. The analysis and results can therefore be used to plan future research with collaboration of researchers across different sectors a way to ensure a broader range of species of commercial interest are studied in the region.

The majority of research and data recorded by participants was not found on the ASFA database hosted by ProQuest and, as many of the results are grey literature and hard to locate using internet search engines, work is needed to improve the online availability of research and data under the scope of country SDG Indicator 14.4.1. Barriers to sharing data were raised by participants and it is recommended best practices for data sharing be compiled to highlight the importance of sharing data and encourage institutions to implement open data policies, for example by ensuring credit is given to the collecting institute or researcher. The ASFA Secretariat will seek to produce these best practice guidelines, as well as implement other recommendations contained in this report, including: working with participants of the project to ensure the collection of records on OpenASFA is updated; providing further training to librarians and information managers in the region on how to contribute to this collection; and digitizing print only materials so that they are accessible online. To meet the SDG Target 14.4 on sustainable fishing, the capacity to store, share and access research and data on fish stocks is required. This project has resulted in 1 047 records being made available online, as well as providing training and access to an online platform to continue to share this research and data and analysis of results. ASFA Secretariat looks forward to implementing the recommendations set out in the report to ensure policy makers, governments and researchers in all countries can access research and data to facilitate the reporting and sustainable management of fish stocks.

BACKGROUND

The project, conducted from 1 January 2022 to 30 November 2022, was comprised of three stages:

1. agreement of project scope and development of search methodology;
2. recruitment and training of 15 participants to identify research and datasets from the institutional or national collections and record on OpenASFA; and
3. quality control of records identified (removing irrelevant records or any duplicates) and analysis.

The project team comprised three SEAFDEC staff members in addition to the ASFA Secretariat:

Table 1. Project team members

Name	Organization	Role
Daryl Superio	Southeast Asian Fisheries Development Center/ Aquaculture Department. (SEAFDEC/AQD). Philippines; Northern Iloilo State University (NISU), Philippines.	Provide input throughout all project stages with focus on training, quality control of records and analysis of results.
Supapong Pattarapongpan	Southeast Asian Fisheries Development Center / Training Department. (SEAFDEC/TD), Thailand.	Ensured the project collected results relevant to SDG 14.4.1. Expert input on the search strategy, training and analysis.
Mazalina Binti Ali	Southeast Asian Fisheries Development Center / Marine Fishery Resources Development and Management Department (SEAFDEC/MFRDMD), Malaysia.	Ensured the project collected results relevant to SDG 14.4.1. Expert input on the search strategy, training and analysis.
Maria Kalentsits	ASFA Secretariat, Food and Agriculture Organization of the United Nations, Italy.	Assisted with the training, quality control, and analysis.
Tamsin Vicary	ASFA Secretariat, Food and Agriculture Organization of the United Nations, Italy.	Focal point for coordinating the project.

Source: Authors' own elaboration.

For the identification and recording of materials held in local and national collections, 15 participants were recruited from Cambodia, Indonesia, Philippines and Viet Nam.

Table 2. Project participant details

Name	Institution	Country
Suy Serywath	Marine Fisheries Research and Development Institute (MaFReDI)	Cambodia
Tan Sokhom	Faculty of Fisheries Royal University of Agriculture (RUA)	Cambodia
Madiareni Sulaiman	BRIN - National Research and Innovation Agency	Indonesia
Ria Ariani	BRIN - National Research and Innovation Agency	Indonesia
Pamela Damayanti	Ministry of Marine Affairs and Fisheries	Indonesia
Duranta Kembaren	Research Institute of Marine Fisheries	Indonesia
Tirtadanu	Research Institute of Marine Fisheries	Indonesia
Ledhyane Ika Harlyan	University of Brawijawa	Indonesia
Martin F Floro	Capiz State University	Philippines
Ethelyn Magdaong Abaday	Mindanao State University – Naawan Campus	Philippines
Joy Geromiano	SEAFDEC/AQD	Philippines
Mary Grace Oliveros	SEAFDEC/AQD	Philippines
Sean Hoang	Fisheries Protection and Development Department Viet Nam Directorate of Fisheries	Viet Nam
To Van Phuong	Nha Trang University	Viet Nam
Hai Yen	Viet Nam Institute of Oceanography	Viet Nam

Source: Authors' own elaboration.

INTRODUCTION

Fish and seafood products are the primary source of animal protein for most of the population in the Southeast Asia region (FAO and OECD, 2017) and Southeast Asia is known for having one of the world's most diverse marine environments and fisheries resources (Tittensor *et al.*, 2010; Miller *et al.*, 2018). According to World Health Organization (WHO, 2022), over a quarter of the world's population lives in Southeast Asia, where fisheries and aquaculture significantly contribute to food security and nutrition. However, illegal and destructive fishing practices pose challenges to the sustainability of these resources (DeRidder and Nindang, 2018). Hence, sound and science-based management are imperative to ensure the protection and conservation of these resources for future generations.

Sustainable management of fish stocks will therefore contribute to food and nutrition security; however, the status of many stocks is unknown due to insufficient data (Sharma, 2021). Furthermore, a great deal of fisheries research remains unpublished or published only as grey literature of limited distribution (Parker *et al.*, 2010), thereby adding to the obscurity of fish stock information. This has been the case among Southeast Asian countries where, besides the volume of unpublished and poorly documented resources, even published resources can be hard to locate due to language and other barriers (Simpson, 1982; Dudley and Ghofar, 2006; Mangahas and Rodriguez-Roldan, 2019).

To address food security, the Sustainable Development Goal (SDG) Indicator 14.4.1 – the proportion of fish stocks within biologically sustainable levels – is one of four indicators coordinated by the FAO Fisheries and Aquaculture Division under SDG14 – Life below water (the other three being: 14.6.1 Combat illegal, unreported and unregulated fishing; 14.7.1 Income from sustainable fisheries; and 14.b.1 Support small-scale fishers) (FAO, 2022). According to the report *Tracking progress on food and agriculture-related SDG indicators*, the status of SDG Indicator 14.4.1 is assessed as very far from target and the trend assessed as: deterioration or move away from the target (FAO, 2023). Whilst previously reported at global and regional levels, in 2019–2020, FAO issued its first call for country reports on SDG Indicator 14.4.1 (FAO, 2021). Overall, responses came mostly from developed countries, demonstrating the need to support countries to manage their research and data in order to facilitate reporting and knowledge of fish stocks. This project was therefore formulated with two goals: (1) identifying and analysing the research and data being produced in Southeast Asia of relevance to SDG 14.4.1; and (2) identifying strengths and gaps in knowledge, as well as making recommendations for enhancing the availability of research and data.

The Southeast Asian Fisheries Development Center (SEAFDEC), the autonomous inter-governmental body in the regional fishery field has a long history of working closely with the fishery sections of its member countries. As the SEAFDEC works to promote sustainable fisheries in the region through the meetings, training courses, workshops, etc., SEAFDEC was the best supporting organization for establishing the connection between FAO and member countries of the

region to collect all the research and data, particularly grey literature which requires local knowledge to locate and catalogue. According to the envision of SEAFDEC to promote the "Sustainable management and development of fisheries and aquaculture to contribute to food security, poverty alleviation and livelihood of people in the Southeast Asian Region", the project's aim, to collect fisheries documents and research, is shared with SEAFDEC. This is also in line with the Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2030 (RES&POA2030) to strengthen the collection, sharing, and exchange of data and information among countries in the region.

For many years, Aquatic Science and Fisheries Abstracts (ASFA) has worked with its international network of fisheries and aquaculture institutions to promote and disseminate their research. ASFA has undergone a period of rapid change in recent years as it improves its services to meet aquatic science stakeholder needs (Castillo *et al.*, 2023). The launch of OpenASFA, a system to create, store and publish bibliographic references and abstracts, and ASFA's support to the CECAF-PESCO project to build and analyse an inventory of marine fisheries research, mean ASFA was well placed to assess the research capacities of countries in Southeast Asia and determine what research and data related to stock assessments existed in the countries and make recommendations on improving is visibility and accessibility. Thus, to cover this information gap on fish stock information, this project – Collection of research and datasets from data-poor countries in Southeast Asia related to country SDG Indicator 14.4.1 – was conducted. The project aimed to assess the volume and availability of research and data for stocks in four countries in Southeast Asia, namely Cambodia, Indonesia, the Philippines, and Viet Nam. Furthermore, the project aimed at making these resources available on the OpenASFA platform. Whilst the research and data identified and recorded as part of this project may not be either a formal stock assessment, or sufficient to conduct an assessment, all materials relate to the status and/or sustainability of national or shared stocks in either Cambodia, Indonesia, the Philippines or Viet Nam. Creating a catalogue of these resources helps to assess research capacity, strengths and gaps in available knowledge and to make recommendations for future work.

METHODOLOGY

Stage one: development of project scope and search strategies

To enable to identification of materials relevant to SDG 14.4.1, a search strategy was developed which comprised three sections. The first section covered how to assess holdings and collections of potential relevance to the project. As the project's focus was on hard-to-reach research and data, it was essential that participants understood the importance of looking beyond standard collections and holdings, such as databases or Google Scholar, and assessed collections at their institute or country that may hold research and datasets in non-standard ways. This could include webpages with project reports, research stored on internal folders or shared network, or even reports and datasets held by researchers at their institute with no digital record. The focus of the search strategy was not to identify the highest possible volume of results but rather to look for hard-to-reach research and datasets of potential use to performing stock assessments in the country. The second section of the search strategy looked at the specific subject, geographic, and taxonomic keywords of relevance to SDG 14.4.1 in Southeast Asia. These keywords would be recorded by the participants and form part of the analysis when understanding the availability of research and datasets on specific topics, locations, and stocks. The third and final section of the search strategy provided examples of search strings used to identify relevant records on the ASFA database. This had the dual purpose of testing the search methodology and also creating a set of records that were available online to contrast against those records that participants would identify by searching local and national collections. Searching the ASFA database identified 350 results that matched the search criteria. The search strategy can be viewed in Annex 1.

Stage two: identifying and recording research and datasets held in local and national collections

A total of 15 participants were recruited who received training in the search strategy and how to record results on OpenASFA (a virtual research environment for the creation, storage, and export of bibliographic references). Participants identified collections of relevance to the project (e.g. library holdings, institutional collections) and created a record on OpenASFA for each research and dataset they found that met the search criteria of country SDG Indicator 14.4.1. Each OpenASFA record created by a participant was then reviewed by the project team who ensured accurate completion of metadata fields and that the resource was relevant to SDG 14.4.1. When approved, the record was published and added to the Support to SDG 14.4.1 (Southeast Asia) collection, which is freely searchable on the FAO Fisheries and Aquaculture Division website: Aquatic Sciences and Fisheries Abstracts (ASFA) (www.fao.org/fishery/en/openasfa?page=1&f=collections%3D%22Support%20to%20SDG%2014.4.1%20(Southeast%20Asia)%22#search). Training sessions were used to highlight common mistakes, such as inclusion of tuna fisheries or straddling stocks, and also share hints and tips on using OpenASFA. Particular focus on the training sessions was given

to the recording of datasets that many participants struggled to identify or record. Issues around access and sharing data were a barrier to recording datasets, even with the option to share only the metadata of the dataset and not the data. Working more closely with institutions to promote the benefits of data sharing and development of best practice guidelines for open data are recommended to help overcome these barriers.

Each participant spent ten working days on the training, identification, and recording of relevant results. When the ten days had been completed, each participant submitted a report summarizing their activities and highlighting any difficulties they had encountered, as well as recommendations for future work.

Stage three: quality control and analysis of results

Participants created a total of 1 047 OpenASFA records which were exported to Excel and combined with the 350 results from the ASFA database to produce a total number of 1 397 records. Each record was assigned a single country which the resource related to and also assigned a subcategory to assist with the analysis. The different subcategories are as follows:

- Stock assessment: including assessment reference points; exploitation rate/ utilisation status (if defined in terms of output and stock status, and different from "catch rates" below);
- Biological parameters: including fish reproduction/reproductive biology; length-weight relationship, size, length, sex ratio, etc.; population parameters; population dynamics;
- Stock information: including abundance indices, catch rates; stock structure; stock density; stock dynamics; identification of stocks based on morphometric characters; population genetics; species distribution/Species diversity/biodiversity/dominant species; fish genetics; species identifications/ taxonomy, trade and market price;
- Catch history: including explanatory events, impacts of regulations; landing statistics;
- Environmental impacts: including climate change impacts, water temperature, etc.; marine protected areas;
- Fishing gear: including species composition, catch/effort statistics, catch per unit of effort (CPUE); selectivity parameters, fishery regulations; and
- Fishing vessels: including fishery fleet statistics, vessel registration, regulations.

The spreadsheet was reviewed by all members of the project team before being accepted as final and then used for the analysis.

Limitations

A significant limitation of this project was the ten working days allotted to each participant to both receive training in the search methodology and use of OpenASFA, and to identify and record materials. Many participants gave more than ten working days to the project however still reported that there were many materials they could not record due to lack of time. Collections that were not recorded due to lack of time were reported by all participants and could form the basis for future work. Some materials require more time to record than others, for example Tô Văn, Phương (Nha Trang University, Viet Nam) reported that many of the materials in his institution's library were only available in print format and therefore required each metadata field to be completed manually.

Whilst this is more time consuming, it means that the project has recorded the first digital record of these materials that is searchable online, so demonstrates the value of this project in making hard to reach materials accessible to a wider audience. However, it remains that due to time limitations this project cannot be said to have recorded all materials of relevance to SDG Indicator 14.4.1.

In addition to time, access to collections and permission to share research and data were barriers to recording materials, particularly so for data. Closed access data was hard to identify and, in some cases, even when identified permission was not given by the data owners for even the metadata to be shared. Tirtadanu (Research Institute of Marine Fisheries, MMAF, Indonesia) reported this difficulty and was only able to record data which had already been made available via published journal articles. Further limitations in recording data were highlighted by other participants who struggled in the allotted time to go through the many steps needed to identify and receive permission from the data owner to record on OpenASFA. Identifying where data are stored, who the owner is and what the access and sharing permissions are, is a time consuming endeavour and would have required more than the ten allotted days to complete. Due to these issues, several recommendations are made below for improving data access and management.

Ethelyn A. Maglangit, (Mindanao State University – Naawan, Philippines) reported that stock assessment studies were less prevalent in her institution than other areas. Discussions with researchers at her institution gave lack of funding and technology required for stock assessment studies (vessels and gear) as reasons for this. Previous research by Ethelyn has shown that "growth and survival", "feeding", and "juveniles" are topics most frequently used for research funding and she reported that: "only a few agencies focus on stock assessment studies and researchers should also engage more in fisheries rather than on aquaculture". These findings were echoed by Tan Sokhom (Faculty of Fisheries Royal University of Agriculture – RUA, Cambodia) whose review of materials found that Cambodia has limited research on marine resources, especially marine fish stocks assessment. Support for further research on marine fish stocks assessment, biodiversity, and marine fish physiology in Cambodia would be welcomed and willingness to contribute to such future work was made by both participants from Cambodia.

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RESULTS AND ANALYSIS

The results are presented in two sections. The first section presents a general analysis of all 1 397 resources identified as part of this project. These results give an overall impression of the type, volume, and subject area of resources available in the region. The second section of the results looks specifically at the taxonomic species names covered by these resources, detailing for which species research publications and datasets exist and the most studied species of commercial interest by country and subcategory. Persons interested in the research and datasets identified can perform their own searches, either by using searching the collection on OpenASFA (using either the search box or filtering using the options on the left hand menu, such as publication year; document type; language; keyword; publisher); or by downloading the Excel sheet used to compile the analysis may do so using this link: https://data.d4science.net/bGPt

Section one: overall results

Overall, a total of 1 397 references to research publications or datasets were identified as part of this project, of which 1 047 references were recorded by participants and 350 references from the ASFA database hosted by ProQuest (see Table 3). This shows that almost three quarters of records were identified by participants (74.9 percent) compared to just over a quarter using ASFA database (25.1 percent) indicating that much relevant research is missing from the ASFA database. This may be due to the high percentage of materials unavailable online that were recorded by participants (28.4 percent, see Table 8); the fact that datasets, which comprised 9.9 percent of total results, are not included on the ProQuest database; or that there has been no active participation in ASFA from institutions in Cambodia in recent years.

Table 3. Publications and datasets: distribution by source

Source	Frequency	Percentage
Participants	1 047	74.9
ProQuest	350	25.1
Total	**1 397**	**100**

Source: Authors' own elaboration.

As for the type of document recorded, the most numerous was journal article (702 references or 50.3 percent). This was followed by books, which included reports and monographs (447 references – 32 ercent); then datasets (139 references – 9.9 percent), and lastly book chapters (109 references – 7.8 percent) (see Table 4). Datasets were recorded only by participants and not covered on the ASFA database on ProQuest. Despite special attention given to the importance of datasets in this project, many participants struggled to identify and record datasets.

Table 4. Publications and datasets: distribution by type

Type	Frequency	Percentage
Journal articles	702	50.3
Books	447	32
Book chapters	109	7.8
Datasets	139	9.9
Total	**1 397**	**100**

Source: Authors' own elaboration.

The country with the most references was Indonesia (713 references – 51 percent) and Cambodia was the least (44 references – 3.1 percent). Five participants were recruited from Indonesia, more than any other country. In addition, the two participants from Cambodia struggled to find resources related to marine fisheries.

Table 5. Publications and datasets: distribution by country

Country	Frequency	Percentage
Cambodia	44	3.1
Indonesia	713	51
Philippines	384	27.5
Viet Nam	228	16.3
Multi-country or other SE countries	28	2
Total	**1 397**	**100**

Source: Authors' own elaboration.

From 2011 onwards, year of publication shows a slight increase in number of references. However, 2018 is the year that has the highest number of identified resources (142). No chronological limits were set up, however the participants were asked to focus their efforts on research and data published from 2010 onwards as these materials are most likely to be of use to anyone performing a stock assessment in 2023. Of the 266 resources recorded before 2010, almost two thirds came from the ASFA database on ProQuest (174 records or 65 percent) whereas only 35 percent (92 resources) were recorded by participants. Given that 50 percent (174 of the 350 resources) from the ASFA database were published prior to 2010, this indicates a decrease of coverage on the ASFA database in recent years.

Table 6. Publications and datasets: distribution by publication year

Year of publication	Frequency	Percentage
2022	105	7.5
2021	126	9
2020	96	6.9
2019	138	9.9
2018	142	10.2
2017	114	8.2
2016	128	9.2
2015	109	7.8
2014	67	4.8
2013	59	4.2
2012	22	1.6
2011	25	1.8
2010 or earlier	266	19
Total	**1 397**	**100**

Source: Authors' own elaboration.

Table 7. **Publications and datasets: distribution by subcategory**

Subcategory	Frequency	Percentage
Fishing vessels	31	2.2
Environmental impacts	33	2.4
Catch history	73	5.2
Biological parameters	227	16.2
Fishing gear	252	18
Stock assessment	369	26.4
Stock information	412	29.5
Total	**1 397**	**100**

Source: Authors' own elaboration.

Table 8. **Publications and datasets: distribution by format**

Source	Frequency	Percentage
Available online	1000	71.6
Unavailable online	397	28.4
Total	**1397**	**100**

Source: Authors' own elaboration.

Table 9. **Publications and datasets: combined source and type distribution**

Source	Type of publication			
	Journal articles	Books	Book chapters	Datasets
Participants	462 (65.8%)	337 (75.4%)	109 (100%)	139 (100%)
ProQuest	240 (34.2%)	110 (24.6%)	0	0
Total	**702 (100%)**	**447 (100%)**	**109 (100%)**	**139 (100%)**

Source: Authors' own elaboration.

Table 10. **Publications and datasets: combined source and format distribution**

Source	Format	
	Online	Print
Participants	873 (87.3%)	174 (43.8%)
ProQuest	127 (12.7%)	223 (56.2%)
Total	**1 000 (100%)**	**397 (100%)**

Source: Authors' own elaboration.

Table 11. **Publications and datasets: combined subcategory and country distribution**

Subcategory	Country				
	Cambodia	Indonesia	Philippines	Viet Nam	Multi-country/ other SE countries
Stock assessment	1 (2.3%)	271 (38.0%)	56 (14.6%)	34 (14.9%)	7 (25.0%)
Biological parameters	1 (2.3%)	158 (22.2%)	34 (8.9%)	31 (13.6%)	3 (10.7%)
Stock information	14 (31.8%)	145 (20.3%)	162 (42.2%)	80 (35.1%)	11 (39.3%)
Catch history	15 (34.1%)	20 (2.8%)	30 (7.8%)	7 (3.1%)	1 (3.6%)
Environmental impacts	6 (13.6%)	16 (2.2%)	5 (1.3%)	2 (0.9%)	4 (14.3%)
Fishing gear	5 (11.4%)	98 (13.7%)	97 (25.3%)	50 (21.9%)	2 (7.1%)
Fishing vessels	2 (4.5%)	5 (0.7%)	0 (0.0%)	24 (10.5%)	0 (0.0%)
Total	**44 (100%)**	**713 (100%)**	**384 (100.0%)**	**228 (100.0%)**	**28 (100.0%)**

Source: Authors' own elaboration.

Table 12. **Publications and datasets: combined country and year distribution**

Country	Year of publication												
	2010 earlier	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Cambodia	15 (5.6%)	2 (8%)	1 (4.5%)	2 (3.4%)	1 (1.5%)	3 (2.8%)	1 (0.8%)	4 (3.5%)	3 (2.1%)	3 (2.2%)	5 (5.2%)	2 (1.6%)	2 (1.9%)
Indonesia	87 (32.7%)	12 (48%)	9 (40.9%)	34 (57.6%)	30 (44.8%)	75 (68.8%)	79 (61.7%)	69 (60.5%)	87 (61.3%)	89 (64.5%)	53 (55.2%)	68 (54%)	21 (20%)
Philippines	101 (38%)	4 (16%)	4 (18.2%)	9 (15.3%)	22 (32.8%)	17 (15.6%)	32 (25%)	25 (21.9%)	35 (24.6%)	34 (24.6%)	9 (9.4%)	20 (15.9%)	72 (68.6%)
Viet Nam	45 (16.9%)	4 (16%)	7 (31.8%)	14 (23.7%)	14 (20.9%)	13 (11.9%)	16 (12.5%)	16 (14%)	16 (11.3%)	12 (8.7%)	28 (29.2%)	34 (27%)	9 (8.6%)
Multi-country/ Other SE countries	18 (6.8%)	3 (12%)	1 (4.5%)	0 (0%)	0 (0%)	1 (0.9%)	0 (0%)	0 (0%)	1 (0.7%)	0 (0%)	1 (1%)	2 (1.6%)	1 (1%)
Total	**266 (100%)**	**25 (100%)**	**22 (100%)**	**59 (100%)**	**67 (100%)**	**109 (100%)**	**128 (100%)**	**114 (100%)**	**142 (100%)**	**138 (100%)**	**96 (100%)**	**126 (100%)**	**105 (100%)**

Source: Authors' own elaboration.

Section two: taxonomic species

This section reports specifically on the taxonomic names recorded as keywords in the references collected as part of this project. The full spreadsheet is available to download here: https://data.d4science.net/CW4s

The subject, geographic and taxonomic keywords, agreed in the search strategy and assigned by participants to records allowing for precise retrieval and detailed analysis. Participants assigned taxonomic keywords to OpenASFA records using World Registry of Marine Species (WoRMS), ensuring accuracy of the keyword recorded. The 1 397 records identified during this project had a combined total of 6 720 taxonomic keywords, giving an average of 4.8 taxonomic keywords per record. Of the 6 720 taxonomic keywords, 1 556 were for unique names. These high numbers are testament to the care participants took to create detailed metadata to describe the resources.

The top ten most frequently recorded species names are presented in table 13, which also shows which subcategory they were assigned to. For the top ten most recorded species, the subcategory with the most references recorded was stock information (2 982 taxonomic keywords), with the second highest subcategory being fishing fear (2 326 taxonomic keywords).

Table 13. Top ten species: subcategory references

Species name	Biological parameter	Catch history	Environmental impact	Fishing gear	Fishing vessel	Stock assessment	Stock information	Grand total
Rastrelliger kanagurta	15	1	–	29	–	29	27	101
Portunus pelagicus	10	4	1	28	–	25	27	95
Selar crumenophthal-mus	9	1	–	36	1	12	31	90
Sardinella lemuru	5	2	1	26	–	15	24	73
Katsuwonus pelamis	–	5	–	31	–	4	30	70
Decapterus macrosoma	13	3	–	19	–	14	19	68
Thunnus albacares	–	4	1	30	–	–	28	63
Euthynnus affinis	2	–	–	30	–	5	25	62
Decapterus macarellus	3	–	–	25	–	7	24	59
Rastrelliger brachysoma	6	2	–	21	–	9	17	–
Total (top ten species)	**63**	**22**	**3**	**276**	**1**	**120**	**252**	**736**
Grand total (all taxonomic names)	**580**	**120**	**63**	**2 326**	**13**	**636**	**2 982**	**6 720**

Source: Authors' own elaboration.

The list of taxonomic terms recorded as part of this project was also compared with the initial list 53 species of commercial interest in the region, compiled during the search strategy (see Annex 2 for list). Table 14 presents the number of references to each taxonomic name of commercial interest, where the genus was recorded on the list, species of this genus are also included in its results, e.g. Acetes includes results for *Acetes japonicus* and *Acetes sibogae*. This revealed broad, overall coverage of this list with only one species, *Sardinops sagax*, not being recorded, Decapterus the most recorded genus and *Rastrelliger kanagurta* the most recorded species. However, the top ten most recorded taxonomic terms aggregated 63 percent of all references, and 64 percent of references belonging to the subcategory stock assessment. Of the 53 taxonomic terms of commercial interest, eleven had no records assigned to the subcategory stock assessment. This indicates research efforts are concentrated on a relative small number of species or genera of commercial interest, however comes with the caveats that the list of taxonomic terms includes both species and genera, making comparisons difficult, and that each participant reported inadequate time to record all materials of relevance to SDG Indicator 14.4.1. meaning research and data may exist, but was unable to recorded as part of this project.

Table 14. Commercial interest species: taxonomic records count

Taxonomic term	Number of times used as a keyword – all subcategories	Number of times used as a keyword for subcategory stock assessment
Decapterus	304	55
Epinephelus	131	18
Leioganthus	119	16
Portunus	106	27
Rastrelliger kanagurta	101	29
Portunus pelagicus	95	25
Selar crumenophthalmus	90	12
Sardinella lemuru	73	15
Penaeus	72	17
Decapterus macrosoma	68	14

Taxonomic term	Number of times used as a keyword – all subcategories	Number of times used as a keyword for subcategory stock assessment
Euthynnus affinis	62	5
Rastrelliger brachysoma	55	9
Sardinella fimbriata	54	13
Selaroides leptolepis	49	8
Loligo	49	6
Panulirus	42	14
Upeneus sulphureus	38	9
Scylla serrata	35	15
Lutjanus malabaricus	28	7
Clupeidae	27	5
Saurida tumbil	27	4
Decapterus maruadsi	21	2
Carangidae	20	3
Scombridae	19	3
Aphareus rutilans	14	2
Priacanthus macracanthus	14	2
Saurida undosquamis	14	1
Acetes	11	1
Nemipterus japonicus	10	2

Taxonomic term	Number of times used as a keyword – all subcategories	Number of times used as a keyword for subcategory stock assessment
Pristipomoides multidens	10	2
Charybdis feriatus	9	2
Etelis radiosus	8	3
Tenualosa macrura	8	2
Uroteuthis duvaucelii	8	0
Scolopsis taenioptera	7	1
Pristipomoides typus	6	1
Anchoviella	4	0
Cypselurus	4	1
Lates calcarifer	4	1
Scomber japonicus	4	0
Tenualosa ilisha	3	1
Uroteuthis chinensis	3	0
Engraulis	2	1
Metapenaeus brevicornis	2	2
Scomber australasicus	2	0
Tegillarca granosa	2	0
Tenualosa toli	2	0
Trachurus japonicus	2	1

Taxonomic term	Number of times used as a keyword – all subcategories	Number of times used as a keyword for subcategory stock assessment
Cnidaria	1	0
Parapenaeopsis hardwickii	1	0
Scoliodon laticaudus	1	0
Todarodes pacificus	1	0
Sardinops sagax	0	0

Source: Authors' own elaboration.

Source: Mud Crab, colour. Scylla serrate (Forskal). Grant's "Guide to Fishes" (1965) p.244 and p.224

Although no date limit had been set, records published after 2013 were considered most relevant to performing stock assessments in 2022. The number of times a taxonomic term of commercial interest was assigned as a keyword to a resource published after 2013 is presented in Table 15, showing its distribution by country and subcategory. Philippines recorded the most results by this criteria (958 taxonomic keywords), whilst stock information was the most recorded subcategory (568 taxonomic keywords). The number of keywords for species of commercial interest assigned to the subcategory Stock Assessment in Cambodia was zero, which could be due to several factors including difficulties sharing research and data related to stock assessments or lack of research and data on marine fisheries or stock assessments of marine species.

Table 15. Keyword assignment: commercial species by subcategory and country

Subcategory	Cambodia	Indonesia	Philippines	Viet Nam	Country unassigned	Total
Biological parameters	0	80	16	7	–	103
Catch history	5	8	27	2	–	42
Environmental impacts	1	2	2	0	–	5
Fishing gear	0	61	427	16	–	504
Fishing vessels	0	0	0	1	–	1
Stock assessment	0	168	41	8	4	221
Stock information	5	90	445	28	–	568
Grand Total	**11**	**409**	**958**	**62**	**–**	**1 444**

Source: Authors' own elaboration.

When looking only at the 221 records assigned to stock assessment subcategory for species of commercial interest, we see that Journal Article is the most numerous document type (139 records or percent) however Dissertation is the second most numerous document type with 48 records (22 percent), indicating that universities may be underutilized resource for stock assessments and/ or the research and data required to perform stock assessments. Dissertations and theses are hard to locate through internet search engines and are also missing from many databases, despite the rigorous peer review and time spent to produce them. Working with universities in the region to ensure their dissertations and theses are included on OpenASFA is therefore recommended.

Table 16. Post-2013 records: taxonomic names by document type

Document type	Count
Journal article	139
Dissertation	48
Book	15
Dataset	11
Conference	5
Report	3
Total	**221**

Source: Authors' own elaboration.

CONCLUSION

This project has successfully increased the availability of research and datasets related to SDG Indicator 14.4.1 produced in Southeast Asia, at the same time as identifying risks and barriers to open data and information sharing. Participants created a total of 1 047 records for research and datasets under the scope of this project, which they achieved in only ten working days. This compares to 350 records that were identified on the ASFA database, which has been collecting records continuously since 1971. The high percentage of records identified by participants, combined with the fact that 65 percent resources recorded before 2010 came from the ASFA database, means there is a large volume of research related to Southeast Asia which is not being recorded on ASFA or easily accessible online. The project categorized 28.4 percent of records as unavailable online, meaning efforts are needed to work with the authors, producers and publishers of research and data to ensure it is findable and accessible online.

Steps should be taken to secure engagement from libraries and information centres in the region in the ongoing contribution to the OpenASFA collection on SDG Indicator 14.4.1 that will ensure it is kept up to date and of use to researchers in the region. The ASFA Secretariat will seek to achieve this by working closely with participants of this project and recruiting more institutions to the partnership. Harvesting and importing on to OpenASFA will also allow for reduced effort from information managers in adding their records to OpenASFA, however manual entry will still be required for much grey literature and datasets which are not always catalogued in standard formats or on stable repositories.

Journal articles make up 50.3 percent of the total documents recorded with datasets the least recorded (9.9 percent). Journal articles can be easier to locate and record on OpenASFA than datasets which could explain the difference, and the difficulties outlined by participants in sharing datasets produced by their institution require further attention.

Stock information was the most recorded subcategory (29.5 percent), followed by stock assessment (26.4 percent), indicating a high level of compliance with the search strategy. Participants are to be commended for their understanding of the subject scope of SDG Indicator 14.4.1 and ability to accurately record resources on OpenASFA. The high number of relevant results recorded in a relatively short time indicates that the volume of available research and data goes beyond the 1 047 records collected in this project and that further efforts are needed to fully understand the research strengths and gaps in the region.

Based on the list of taxonomic names of commercial interest in the region, Rastrelliger kanagurta is the most recorded species and no reference for *Sardinops*

sagax was recorded during this project. This project also revealed that the research and publication on stock assessment for commercial species is still lacking in the region with 22 percent of the records were from dissertations or theses. Collaboration with universities in the region should be enhanced to increase the number of dissertations and theses recorded in the OpenASFA.

Further recommendations

Understand and overcome barriers to sharing data

Several participants were unable to share even the metadata for data concerning the status of fish stocks collected by their institution. In addition, recording data was time consuming as it involved discussions with researchers on what data they held and whether and to what extent it could be shared. Providing incentives to share data (such as assigning a DOI to make sure the institution/ owner will be credited) and making the case for open data is recommended. This could be achieved by producing best practice guidelines on data sharing and management. Such guidelines could be developed alongside the needs of the institutions highlighted below, to help overcome barriers to data sharing. There is an indication that some institutions are beginning to understand the importance of data sharing, for example it was reported that BRIN is beginning to make all biology materials collected by its researchers available online, due to this work being funded by the government that states the data should be made publicly available in the system.

Further training on data visualisations, which could provide an important incentive to share data was also requested by Tirtadanu (Research Institute of Marine Fisheries, MMAF, Indonesia). This could form of best practice guidelines for data management and sharing. Further training on how to improve systems and databases that it can accommodate full descriptions and precisions for our collections was requested by Ria Ariani (BRIN – National Research and Innovation Agency, Indonesia) and again this could be incorporated into best practice guidelines and future trainings.

Of the participants involved in the project, the below reported on difficulties in recording data:

- Some datasets or raw data in my ministry are still scattered, so for collecting them, it took times since I have to contact the PIC, person by person. (Pamela Damayanti, Ministry of Marine Affairs and Fisheries, Indonesia).
- I think for articles that have been published and stored in the archives, if there are full-text articles, we are willing to share them. With reports and raw data, we are not allowed to share without the permission of the authorities. Within the framework of the project I am only allowed to share the published articles of our Institute. (Dang Thi Hai Yen, Viet Nam Institute of Oceanography, Viet Nam).
- Some datasets could not be accessible to public for certain periods. Also, for our student theses, there is an embargo policy for publishing those documents that published in the last two years. Therefore, in this project, I could not access the link of full articles that published in the 2020–2022. (Ledhyane Ika Harlyan, Faculty of Fisheries and Marine Science, Brawijaya University, Indonesia).

- The more datasets recorded in this system, the more beneficial this system will be. However, some datasets format is not applicable to be published. It is important to conduct the training for dealing with this problem. (Ledhyane Ika Harlyan, Faculty of Fisheries and Marine Science, Brawijaya University, Indonesia).
- It is hard to record dataset since there are some issues regarding the utilization of those dataset. (Duranta Diandria Kembaren, Research Institute of Marine Fisheries, MMAF, Indonesia).
- Some were difficult record because of the nature of the data which is old and on printed materials. It takes time to record the data manually on OpenASFA. (Ethelyn A. Maglangit, Mindanao State University, Naawan, Philippines).
- It is difficult to find sources of information and fisheries data collection due to limited data/documents and not yet widely disseminated for Cambodia. In particular, data on the assessment of marine fish stocks in Cambodia has not been extensively researched. Most of data obtained is not very specific about the marine fish stocks in Cambodia, that's why I have to spend more time directly contact or phone call to request marine fish stock assessment data from institutions which working on marine or coastal areas. The data on websites of the ministries and government agencies in charge of marine fisheries have not yet been posted or published and shared, and most of the data obtained is from reverent organizations, institutions and private sectors. There are a few websites, PDF file is not allowed to be downloaded, and some files required purchase or login within complicated process and time consuming. (Tan Sokhom, Faculty of Fisheries Royal University of Agriculture, RUA, Cambodia).

Further training on datasets may be needed to better understand the types of data that could be relevant to SDG Indicator 14.4.1. For example, this could include extracting the data from some of the published materials or dissertations and theses, recorded as part of this project and creating a separate dataset record. Given participants had only ten working days to complete their tasks, this was not achievable in the time but it can be safely assumed that much data is recorded in the research materials collected and follow up work to extract the data and upload to OpenASFA could yield useful results.

Digitize print-only materials

As an abstracting and indexing service, OpenASFA does not include the option to upload the full text for research (though it does for datasets). A number of participants requested access to a full text repository to deposit print only materials, which would involve digitisation work:

- Digitising our collection, especially unpublished materials, is of great advantage to us not only for preservation but also to serve the needs of the clientele at all times. It is our Library mission to provide a wide range of relevant library services and resources to support our institution as well as the whole community. (Martin F. Floro, Capiz State University, CAPSU, Philippines).
- Due to we work in research institution, we need the applications that can be used to manage and digitalize our data and research findings. After digitising the materials, some guidance on summarizing the results is important, so we can

formulate some fisheries management recommendations to reach SDG 14.4.1. goals. (Tirtadanu, Research Institute of Marine Fisheries, MMAF, Indonesia).

- Future work could include digitising materials, creating full text repository, further collections. (Duranta Diandria Kembaren, Research Institute of Marine Fisheries, MMAF, Indonesia).
- Grey literatures digitization could help global user get collections remotely. (Madiareni Sulaiman, BRIN – National Research and Innovation Agency, Indonesia).
- For the future recommendations, I would like to put digitising the biology materials about Marine Fisheries. (Ria Ariani, BRIN – National Research and Innovation Agency, Indonesia).
- It will be of great privileged if our papers and records would be digitized and would be available online but some of the problems are manpower that will focus on the said activity, finances/ salary for the person who will do the job, human resource, space and technology. (Ethelyn A. Maglangit, Mindanao State University, Naawan, Philippines).

Improve the visibility of doctoral and master theses

A significant number of masters and doctoral theses were recorded as part of this project. Tô Văn, Phương, (Nha Trang University, Viet Nam) reported that many doctoral theses particularly on the fishing status; on specific fishing gear, specific fish species, specific fishing grounds in Vietnam; and on maximum sustainable yield in some main specific sea waters were identified as part of his contribution to the project. Working with universities that offer fisheries courses in the region could help to identify and record information on fish stocks that was previously unavailable to ministries.

Further collections and analyses of stock assessments in the region

The majority of the participants expressed willingness to continue to maintain this collection of resources related to stock assessments and to build further collections in order to highlight specific subtopics. As OpenASFA has begun to harvest from repositories this represents an opportunity to further increase the volume of research and data recorded. Identifying relevant repositories and harvesting from them will ensure the collection on OpenASFA continues to be updated and was suggested by Madiareni Sulaiman (BRIN – National Research and Innovation Agency, Indonesia). Other comments were received from participants in Indonesia and Cambodia:

- In future, I think it is still necessary to continue recording collections with the focus on the hard-to-reach sources (not available online). Furthermore, we need to analyse how is the distribution of assessed stock in the world, particularly in Southeast Asia so that we will get a picture of stock assessment and fisheries management which was conducted in these areas. (Duranta Diandria Kembaren, Research Institute of Marine Fisheries, MMAF, Indonesia).
- FAO-SEAFDEC should continue this project for further data collection or other research project and maintain this existing group as future networking. (Tan Sokhom, Faculty of Fisheries Royal University of Agriculture, RUA, Cambodia).
- For future work, focusing on stock assessment of shellfish or brackish and freshwater species is a good subject.

(Marttin F Floro, Capiz State University, CAPSU, Philippines).

Benefits of participating in the project

Participants were asked to report any ways in which they benefitted from participating in the project, with the following responses recorded:

- Since I work in library, participating in this project helps to increase the promotion of local contents or collections that published by our ministry. So, the information can be accessed widely. Ministry of Marine Affairs and Fisheries are implementing blue economy, through several programs. One of them is catching fishes based quota for maintaining the sustainability of fisheries resources. By participating in this project, it can help disseminate the programs for a healthier ocean. (Pamela Damayanti, Ministry of Marine Affairs and Fisheries, Indonesia).
- Joining the project enables SEAFDEC's scientific articles, book chapters, and other datasets of other organizations in the Philippines, tend to widen the reach and accessibility of the publications. Moreover, this project will enable our institution, particularly our researchers and scientists, to access more related references. (Joy Geromiano, SEAFDEC) .
- As a developing country, Vietnam's fisheries science and management take time to catch up with developed countries. In recent years, Vietnam has developed expertise to improve its fisheries management system. Yet, large gaps in knowledge of Vietnam's marine fisheries will continue to hinder management efforts unless the underlying issues are resolved. Providing research papers to ASFA may give a brief overview of what we are doing and may suggest potential regional, continental, and international cooperation to solve the persistent problems of exemplifying data-poor fisheries. (Son Hoang Ngoc – Vietnamese: Hoàng Ngọc Sơn – Fisheries Protection and Development Department, Viet nam Directorate of Fisheries).
- Through this project our institution will be recognized as part of or contributor of this endeavor. The works of our student, faculty and professor will be accessed online and cited by other researchers locally and internationally. Being a contributor in this project will help our institution to establish international partnership and linkages. This will also give credit to our institution (CAPSU) and the individual authors during the evaluation, monitoring and promotions. (Marttin F. Floro, Capiz State University, CAPSU, Philippines).
- For me this project will help develop my skills and knowledge in information technology. It is our duties and responsibilities as librarian to provide the needs of our clients in the right time and right place with the right information. Our institution also wishes that we can avail a free subscription on ASFA Database, hence the flagship of our institution is Fisheries and we are sure that ASFA is a great help to our student research needs. Due to constrained budgets and high prices of printed materials (books, journals, magazines) our collection related to fisheries is very limited and obsolete (the cost of a 1 year subscription of a journal in Fisheries range from 80,000 up) and our budget cannot afford the subscription. We are dependent on the publication from SEAFDEC, Bureau of Fisheries and Aquatic Resources (BFAR) and other government agencies. (Marttin F. Floro, Capiz State University, CAPSU, Philippines).

- We are thankful to FAO and SEAFDEC for this project. We get much information when collecting some records and filling the details on the system. We get more understanding on some issues of fisheries and on the gaps of fisheries research in Indonesia. This project helps us to find the important materials and planning on the fisheries future research related on SDG 14.4.1. (Tirtadanu, Research Institute of Marine Fisheries, MMAF, Indonesia).
- Our grey literatures, purely written in Indonesian language can be put into OpenASFA to increase its discoverability globally. I could dive into and get to know more about marine fisheries and the project of FAO-SEAFDEC (SDGs), which help me to communicate with our researchers about our rich collections. (Madiareni Sulaiman, BRIN - National Research and Innovation Agency, Indonesia)
- Our institution will be recognized as contributor of this project and our research studies will be cited not just locally but also internationally. This will have merits as we, Mindanao State University at Naawan vision aims to become an internationally recognized institution in research and education in the Philippines. (Ethelyn A. Maglangit, Mindanao State University – Naawan, Philippines).
- This project made me improved experiences in researching data and documents of marine fish stock assessment in Cambodia through a digital system and also using different ways to collect the data. Communication and connection with relevant institutions and organizations is more improved. I have learned and gained more knowledge and experiences on how to use a new system (OpenASFA), especially completing in each fields of entry forms need to be much pay attention. In addition, I understand more about marine sector, particularly fish stocks assessment, marine biology and marine and costal management concept that can be initiative ideas for further research for Cambodia marine sector. Collected materials /documents and data of marine fish stocks will be kept and used for further research and study by faculty or relevant institutions. (Tan Sokhom, Faculty of Fisheries Royal University of Agriculture, RUA, Cambodia).
- I am glad to be involved in this project. It could widen my networks, not only Indonesian fellows like Indonesian librarians and Indonesian researchers in Marine and Fisheries, but also Asian and International fellows from FAO team and other Asian participants in SEAFDEC project. I loved that we worked really hard together to achieve our same goals and we were very enthusiastic about the project. We put 10 days for working in the project and not realized that it finally comes to an end. Also, from this project, I learned that I found some aspects that we need to improve in our databases or systems especially about the discovery of our collections. So many benefits that myself and my institution learned from this project. (Ria Ariani, BRIN – National Research and Innovation Agency, Indonesia).

REFERENCES

Castillo, D.J., Vicary, T., Kalentsits, M., Soomai, S.S. & MacDonald, B.H. 2023. Ensuring equitable access to ocean and coastal information to advance knowledge and inform decision-making: The global Aquatic Sciences and Fisheries Abstracts. *Ocean and Coastal Management*, 231:106399. https://doi.org/10.1016/j.ocecoaman.2022.106399

DeRidder, K.J. & Nindang, S. 2018. *Southeast Asia's Fisheries Near Collapse from Overfishing*. The Asia Foundation. https://asiafoundation.org/2018/03/28/southeast-asias-fisheries-near-collapse-overfishing/

Dudley, R.G. & Ghofar, A. 2006. Marine and fisheries sector strategy study sub sector strategy review marine and coastal resources management. *MFSSS Technical Report No. 2.* Uniconsult International Limited (UCIL). https://earth01.net/RGDudley/PDF/MASECSTU.pdf

FAO. 2021. *Tracking progress on food and agriculture-related SDG indicators 2021: A report on the indicators under FAO custodianship*. Rome. https://doi.org/10.4060/cb6872en

FAO. 2022. *The State of World Fisheries and Aquaculture 2022. Towards Blue Transformation*. Rome, FAO. https://doi.org/10.4060/cc0461en

FAO. 2023. *Tracking progress on food and agriculture-related SDG indicators*. 2023. Rome. https://doi.org/10.4060/cc7088en

FAO & OECD. 2017. *OECD-FAO Agricultural Outlook 2017-2026*. OECD Publishing, Paris. http://dx.doi.org/10.1787/agr_outlook-2017-en

Mangahas, M.F. & Rodriguez-Roldan, S. 2019. Recovering Filipino production of a maritime anthropology, in E.C. Thompson & V. Sinha (eds.). *Southeast Asian Anthropologies: national traditions and transnational practices*. NUS Press. Singapore. pp. 111–140.

Miller, E.C., Hayashi, K.T., Song, D. & Wiend, J.J. 2018. Explaining the ocean's richest biodiversity hotspot and global patterns of fish diversity. *Proceedings of the Royal Society: Biological Science.* 285:20181314. https://doi.org/10.1098/rspb.2018.1314

Parker, J., Doulman, D. & Collins, J. 2010. Citation analysis for the 1995 FAO Code of Conduct for Responsible Fisheries. *Marine Policy,* 34(1):139–144.

Simpson, A.C. 1982. A review of the database on tropical multispecies stocks in the Southeast Asian region. In: D. Pauly and G.I. Murphy, eds. *Theory and management of tropical fisheries*. ICLARM Conference Proceedings 9. Cronulla, International Center for Living Aquatic Resources Management.

Sharma, R., Winker, H., Levontin, P., Kell, L., Ovando, D., Palomares, M.L.D., Pinto, C. & Ye, Y. 2021. Assessing the Potential of Catch-Only Models to Inform on the State of Global Fisheries and the UN's SDGs. *Sustainability,* 13:6101. https://doi.org/10.3390/su13116101

Tittensor, D.P., Mora, C., Jetz, W., Lotze, H.K., Ricard, D., Berghe, E.V. & Worm, B. 2010. Global patterns and predictors of marine biodiversity across taxa. *Nature*. 466(7310), pp. 1098-1101. https://doi.org/10.1038/nature09329

WHO (World Health Organization). South-East Asia. In: *WHO*. Geneva. [Cited 30 September 2022]. https://www.who.int/southeastasia

ANNEX 1. SEARCH STRATEGY

Overview

This document, jointly prepared by the FAO ASFA Secretariat, Fisheries and Resources Monitoring System (FIRMS) Secretariat, SEAFDEC/AQD and SEAFDEC/TD, presents the search strategy used to identify relevant research and data as part of the project: "Collection of research and datasets from data-poor countries in southeast Asia related to SDG 14.4.1."

The purpose of the search strategy is to define the search parameters (subject, geographic and taxonomic keywords) and scope of the project. The search methodology was tested on online sources (ASFA, Scopus, Web of Science and Google Scholar) with the results from the ASFA database exported to Excel and used throughout the project, both to assist with training participants and in the analysis of results.

The search strategy consists of three sections:

1. **Identifying collections and holdings:** instructions for identifying library catalogues, institutional repositories, publications or other holdings of potential relevance to SDG Indicator 14.4.1.
2. **Search methodology:** instructs on the search criteria for evaluating a resource's relevance to the project, including which subject, geographic and taxonomic keywords are to be used, as well as other search parameters (date, document types, etc.).
3. **Example searches:** based on the above methodology, example searches from four online sources (ASFA, Scopus, Web of Science and Google Scholar) are included.

Section one: identifying collections and informal holdings relevant to SDG 14.4.1

Participants were presented with the below steps to identify collections and informal holdings at their institution, country or region of potential relevance to the project. The term "collection", refers to any organized or formal collection of resources, such as institutional repository, library catalogue or database, whereas "informal holdings" refers to the various non-standardized ways in which research and data can be stored, which could be Excel files stored in local networks, or print only material stored by scientists and researchers in their office/institution. Participants were recruited from institutions whose work focused on fisheries so were ideally placed to know of collections held at institutional or national level that may not be easily accessible online.

Participants recorded relevant collections or holdings on the below table:

Table 17. **Table for recording potential collections**

Collection name	Online/ physical	Address (in case of online collection, insert URL)	Brief description	Estimated size (number of documents, shelf space, etc.)	Access rights

Source: Authors' own elaboration.

Step One: identifying collections of relevance to the project

To complete the above table, participants were asked to identify as many of the below collections or holdings as possible:

- **Library catalogues:** participants should identify their own institution's library catalogue as well as any library catalogues of other institutions in their country.
- **Institutional repositories:** repositories include both openly available systems, (e.g. http://tvhdh.vnio.org.vn:8080/dspace/ (VNIO electronic library, Viet Nam) and internal repositories that may be open only to staff of an institution. Both types of repositories should be recorded by participants.
- **National databases for research output:** this could include subject specific databases or wider resources that hold some marine fisheries research output. e.g. Basic Research Information System (BRIS), Philippines: https://basicresearch.nrcp.dost.gov.ph/.
- **Serial publications:** journals of national importance should be recorded by participants, examples of relevant journals include the Fisheries Statistics of the Philippines (https://psa.gov.ph/content/fisheries-statistics-philippines) and Indonesian Fisheries Research Journal (http://ejournal-balitbang.kkp.go.id/index.php/ifrj/index).
- **Archives:** historic material related to fish stocks could be included in online or physical archives, for example archives of government statistics, fisheries institutions or archives of individual scientists.
- **Personal collections:** staff at individual institutions may hold collections of relevance to this project. This could include data from stock assessments or expeditions, or personal publications lists. Project participants will be asked to assess whether staff hold material that is not included on their institution's repository or library catalogue and record any relevant collections in the table provided.

In addition to the above sources, project participants will be asked to pay particular attention to the below sources where datasets of relevance to the project might be held:

- institutional data bank;
- institutional ftp server;
- local hard disks / CD-ROMs – these could be sources of historic data not yet made available online;
- print only data collections held by the institution or individual staff members; and
- national or regional data repositories: these could be specific to marine fisheries of wider subject scope (e.g. SEANOE, Pangea, Global Biodiversity Information Facility – GBIF, Marine Data Archive, etc.).

Step two: assessing access and availability of holdings

For all relevant collections, the access and availability of its holdings should be ascertained. This is particularly important for personal collections, internal institutional collections or other print only collections. Relevant results need to be recorded on OpenASFA so if there are any copyright or access issues which would prevent this, then that should be recorded on the spreadsheet.

Whilst for publications only the metadata was recorded, in the case of datasets there

was the option to upload a Zip file of the data to each record. Participants were therefore asked to record whether the dataset has any copyright restrictions to its access.

Step three: describing the collection and its contents

Participants were asked to provide a brief description of the collection and its contents. Where known or easily ascertainable, the document types included of the collection were recorded (project reports, grey literature, data, cruise reports etc.) as well as the date range of the collection and estimated number or percentage of relevant research documents or data which cover fish stocks and their exploited fisheries.

Participants also gave an estimate of the size of collections, in terms of number of resources, file size or shelf space.

Once the above steps were completed, the participants sent the completed table to the FAO ASFA Secretariat and SEAFDEC experts for review and to ensure duplicate collections or serial titles were not covered..

Section two: Search methodology

This section presents the methodology and search parameters to be used by participants. The below table presents general search parameters used to identify research and data which fall within the scope of the project.

Table 18. Search parameters for identifying relevant research and data

Criteria	Details	Notes
Topics	The publication or dataset must fall under one (or more) of the topics (keywords) related to fish stocks and their exploiting fisheries, particularly to the sustainable management of fish stocks, as listed in Table 3.	Consult the title, abstract, introduction, table of contents, etc., if necessary. Exclude resources related to aquaculture.
Environment	Publications and datasets must be related to marine fishery (fishery resources/stocks/catches/landings)	Do not record inland fishery related publications or datasets.
Types of publications	All types of nationally published and unpublished documents (journal articles, conference proceedings, reports, books, dissertations/thesis, etc.) as well as datasets can be recorded	
Language	No limits, but preference to be on local language materials not easily findable online.	Participants may also wish to provide translations of subject keywords to enhance ASFA thesaurus.
Date of publication	No chronological limits, though priority should be given to materials produced from 2013 onwards as these years are most relevant for current stock status information.	Old historical publications and datasets can also be recorded.

Source: Authors' own elaboration.

Subject keywords

The subject keywords of a resource are to be used to determine whether a resource falls within the project's scope or not and to be recorded on the OpenASFA record created by the participant. The below table presents a summary of subject keywords which are relevant to the project, all of which can be found on the ASFA Thesaurus: https://agrovoc.fao.org/skosmosAsfa/asfa/en/

The keywords agreed below have been used to search online sources, including ASFA database and Scopus (see Section three). However, it is recognized that collections may use different subject vocabularies to describe resources, or not use a vocabulary at all as will be the case with informal holdings. The keywords here are therefore illustrative of the concepts which are relevant to the project and will not necessarily be used to describe resources in any catalogue or repository record – however participants used the below keywords to describe resources they recorded on OpenASFA.

Table 19. **Keywords for research and data identification**

Subject area	Note	Keywords
Types of marine stocks terminology	To be considered relevant to this project, a resource must relate to marine stocks. Inland stocks and aquaculture are excluded from the scope of the project.	fish stocks> breeding stocks; depleted stocks; shared stocks; straddling stocks; unit stocks; biological stocks; sustainable stocks; stock assessment units; [fishery] management unit; parental stocks; national stocks
Stock assessment terminology	The type and method of the stock assessment a resource refers to should be recorded by the participant. This includes the stock assessment methods and per recruit analysis.	stock assessment< reference points< maximum sustainable yield; catch per unit effort; catch per unit effort standardization; allowable biological catch per recruit analysis > yield per recruit; spawning per recruit; spawning potential; per recruit analysis

Subject area	Note	Keywords
Marine fisheries terminology	This project is interested in resources related to marine fisheries. Resources related to inland fisheries or aquaculture are outside the scope of the project and should not be included. To be considered relevant for this project, a resource MUST meet one of keywords related to fisheries. Participants can consider using the broad keyword 'fisheries' to search collections, in order not to exclude potentially relevant results.	fisheries>marine fisheries > deep-sea fisheries; high sea fisheries; pelagic fisheries; reef fisheries multispecies fisheries; carangid fisheries; industrial fisheries; commercial fisheries; small-scale fisheries; artisanal fisheries; subsistence fisheries; responsible fisheries; sustainable fisheries fisheries > coastal fisheries; gadoid fisheries; mackerel fisheries; mullet fisheries; percoid fisheries; redfish fisheries; shark fisheries;
Marine stock status terminology	This project is interested in resources related to the status of stocks. A resource related to any of the below keywords is relevant to the project and should be recorded.	stock status >overfished stocks; maximally sustainably fished stocks; underfished stocks; not overfished stocks; biologically sustainable stocks
Fishing gear	Where a resource records the fishing gear used, we ask that participants record this and include on the OpenASFA record. This includes the fishing line, net or other equipment used.	fishing gear > bycatch excluder devices; electrified gear; fish aggregating devices; fishing dredges; fishing lines; fishing pots; grappling gear; harvesting machines; wounding gear fishing gear > fishing lines > hooks fishing gear > fishing nets > cast nets; codends; gillnets; lift nets; seine nets; surrounding nets; trap nets; trawlnets

Subject area	Note	Keywords
Fishing methods	The following fishing methods are all relevant to the project and where a resource mentions a specific method, this should be included in the OpenASFA record.	fishing methods > electric fishing; explosive fishing; fishing by diving; fish poisoning; light fishing; line fishing; net fishing; pot fishing; pump fishing; spear fishing; trap fishing; wounding fishing methods > line fishing > handlining; jigging; long-line fishing; pole-line fishing; trolling methods > fishing methods > net fishing > seining; trawling
Fishery data and statistics	All types of marine fisheries data and statistics are relevant to this project and should be recorded on the OpenASFA record.	fishery data fishery statistics > catch statistics > fish catch statistics; shellfish catch statistics; fishing vessel statistics; landing statistics
Fishing fleets and vessels	Where a resource specifies the type of fishing vessel or refers to fishing fleets, this should be recorded in the OpenASFA record.	fishing fleets ships > fishing vessels > gillnetters; liners; seiners; trawlers
Measures analyses and methods related to stock assessment.	This project is interested in methods and measures related to the measuring and analysing of marine stocks. A resource related to any of the below keywords is relevant to the project and should be recorded.	total allowable catch; fish stock productivity; catch effort; abundance bycatch, virtual population analysis, l-infinity, ratios, length-weight relationships, length frequency

Source: Authors' own elaboration.

Geographic keywords

Relevant resources must cover (or be sub-part of) one or more of the geographic areas listed below:

- West and Central Pacific (FAO Fishing area 71), or minor bodies within the area;
- Eastern Indian Ocean (FAO Fishing area 57), or minor bodies within the area;
- Philippines (exclusive economic zone – EEZ, estuaries, coastal and adjacent marine environments);
- Indonesia (EEZ, estuaries, coastal and adjacent marine environments);
- Viet Nam (EEZ, estuaries coastal and adjacent marine environments);
- Cambodia (EEZ, estuaries, coastal and adjacent marine environments);
- [Timor-Leste] (EEZ, estuaries coastal and adjacent marine environments); and
- [Brunei Darussalam] (EEZ, estuaries, coastal and adjacent marine environments).

Participants were asked to consult the title, abstract, introduction, table of contents, etc. to identify the marine area covered in the document. This area could also be a sub-division of the EEZ. Any national subdivisions applied by countries to collect statistics or assess stocks or manage fisheries should also be identified. When such classification systems exist, these should be recorded and used for the search.

Taxonomic keywords

Listed in Annex 2 are the taxonomic names of national stocks in Southeast Asia that have been identified so far by FAO Fisheries colleagues. Participants should consider searching for these species however should not limit their search to the species on this list as there may be other stocks in the region that are not listed but still relevant to SDG 14.4.1.

Section three: searches using online sources

During the first phase of the project (February – March 2022), a number of online sources (ASFA, Web of Science, and Scopus) were searched to identify relevant documents. Results were exported in Excel format where they were de-duplicated and irrelevant results removed. The results of online searches were shared with project participants, however only those results from the ASFA database were used during the analysis stage of the project.

1. ASFA database

Detailed search strings were prepared on the ASFA database, which allows search by taxonomic name, geographic region and subject keywords. The below search string was used to identify all relevant results and is composed of three main sections: (1) scientific and common names of all species of commercial interest (Acetes to sulphur goatfish); (2) subject keywords of relevance to SDG Indicator 14.4.1. (stock* to linfinity); and geographic areas covering southeast Asia (Philippine* to “Area 51”).

To improve the accuracy of the search string, Boolean and other operators were used, which can be described as:

- NOFT: anywhere in the full text of a resource
- OR: used to look for synonyms, e.g. searching: “Apareus rutlians” OR “rusty jobfish” will return results that include either of these terms.
- Truncation character * is used to return variations of spellings or words, for

example Anchov* will return results for anchovies, anchovy and anchoviella.

- N/2 will return terms with only two words inbetween them, for example "sustainab* N/2 stock*" will return results for sustainable stocks, sustainability of stocks and sustainability of fish stocks.

(NOFT(Acetes OR Anchov* OR "Aphareus rutilans" OR "rusty jobfish" OR Carangidae OR "Charybdis feriatus" OR "crucifix crab" OR "Chionoecetes opilio" OR "snow crab" OR Clupeid* OR Cnidaria OR "Cypsilurus spp" OR "Decapterus macrosoma" OR "shortfin scad" OR "Decapterus maruadsi" OR "Japanese scad" OR "Decapterus spp" OR "Engraulis spp" OR Epinephelus OR "Etelis radiosus" OR "pale snapper" OR "Lates calcarifer" OR "barramundi" OR "Leiognathus spp" OR "Loligo chinensis" OR "Uroteuthis chinensis" OR "Loligo duvaucelii" OR "Uroteuthis duvaucelii" OR "Loligo spp" OR "Lutjanus malabaricus" OR "Malabar blood snapper" OR "Metapenaeus brevicornis" OR "Yellow shrimp" OR "Nemipterus japonicus" OR "Japanese threadfin bream" OR "Panulirus spp" OR "Parapenaeopsis hardwickii" OR "Mierspenaeopsis hardwickii" OR "spear shrimp" OR "Penaeus spp" OR "metapenaeus spp" OR "Portunus pelagicus" OR "flower crab" OR "blue crab" OR "blue swimmer crab" OR "blue manna crab" OR "sand crab" OR rajungan OR alimasag OR "Portunus spp" OR "Portunus trituberculatus" OR "Priacanthus macracanthus" OR "red bigeye" OR "Pristipomoides multidens" OR "goldbanded jobfish" OR "Pristipomoides typus" OR "sharptooth jobfish" OR "Rastrelliger kanagurta" OR "Indian mackerel" OR "Rastrilleger brachysoma" OR "short mackerel" OR "Sardinella fimbriata" OR "fringescale sardinella" OR "Sardinella lemuru" OR "Bali sardinella" OR "Sardinops melanostictus" OR "Sardinops sagax" OR "Saurida tumbil" OR "greater lizardfish" OR "Saurida undosquamis" OR "brushtooth lizardfish" OR "Scoliodon laticaudus" OR "spadenose shark" OR "Scolopsis tayenioptera" OR "Lattice monocle bream" OR "Scomber australasicus" OR "Blue mackerel" OR "Scomber japonicus" OR "Chub mackerel" OR Scombrid* OR "Scylla serrata" OR "mud crab" OR "mangrove crab" OR "Selar crumenophthalmus" OR "Bigeye scad" OR "Selaroides leptolepis" OR "Yellowstripe scad" OR "Tegillarca granosa" OR "Granular ark" OR "Tenualosa ilisha" OR "Hilsa shad" OR "Tenualosa macrura" OR "Longtail shad" OR "Tenualosa toli" OR "Toli shad" OR "Todarodes pacificus" OR "Japanese flying squid" OR "Trachurus japonicus" OR "Japanese jack mackerel" OR "Upeneus sulphureus" OR "Sulphur goatfish") AND NOFT((stock* N/2 assess*) OR "maximum sustainable yield" OR MSY OR (sustainab* N/2 stock) OR "capture fisheries" OR (fisher* NEAR statistic*) OR "biological parameter*" OR "sex ratio*" OR "length-weight relationship*" OR "size-weight relationship*" OR "weight-length relationship*" OR growth OR mortality OR recruitment OR fecundity OR reproducti* OR fertility OR lifespan OR longevity OR Linfinity)) AND NOFT(Philippine* OR Cambodia OR Indonesia OR Viet?Nam OR Brunei OR Timor?Leste OR (West* N/2 "Central Pacific") OR "East* Indian Ocean" OR ("southeast asia" OR "southeast asian" OR "southeast asians") OR "Area 71" OR "Area 57")

Whilst the search strategy given above can be used to identify all records on the ASFA database of relevance to this project, the decision was taken to search for each species individually as this allowed great precision of search, i.e. able to filter to precise geographic location, and easier manual review of results. The search strings used for three species are provided below

with the table showing the number of results for each taxonomic name.

Decapterus macrosoma - shortfin scad (71 FAO area):

NOFT("Decapterus macrosoma" OR "shortfin scad") AND NOFT(Philippine* OR Cambodia OR Indonesia OR Viet?Nam OR Brunei OR Timor?Leste OR (West* N/2 "Central Pacific") OR "East* Indian Ocean" OR ("southeast asia" OR "southeast asian" OR "southeast asians") OR "Area 71" OR "Area 57") AND NOFT((stock* N/2 assess*) OR "maximum sustainable yield" OR MSY OR (sustainab* N/2 stock) OR "capture fisheries" OR (fisher* NEAR statistic*)) – 18 results.

Loligo spp. - a genus of squid (57 FAO area); (71 FAO area):

NOFT("Loligo spp") AND NOFT(Philippine* OR Cambodia OR Indonesia OR Viet?Nam OR Brunei OR Timor?Leste OR (West* N/2 "Central Pacific") OR "East* Indian Ocean" OR ("southeast asia" OR "southeast asian" OR "southeast asians") OR "Area 71" OR "Area 57") AND NOFT((stock* N/2 assess*) OR "maximum sustainable yield" OR MSY OR (sustainab* N/2 stock) OR "capture fisheries" OR (fisher* NEAR statistic*)) – 3 results.

Portunus pelagicus - flower crab, blue crab, blue swimmer crab, blue manna crab or sand crab, rajungan in Indonesian, and alimasag in Tagalog, Kapampangan, and Pangasinan (57 FAO area) :

NOFT("Portunus pelagicus" OR "flower crab" OR "blue crab" OR "blue swimmer crab" OR "blue manna crab" OR "sand crab" OR rajungan OR alimasag) AND NOFT(Philippine* OR Cambodia OR Indonesia OR Viet?Nam OR Brunei OR Timor?Leste OR (West* N/2 "Central Pacific") OR "East* Indian Ocean" OR ("southeast asia" OR "southeast asian" OR "southeast asians") OR "Area 71" OR "Area 57") AND NOFT((stock* N/2 assess*) OR "maximum sustainable yield" OR MSY OR (sustainab* N/2 stock) OR "capture fisheries" OR (fisher* NEAR statistic*)) – 39 results.

2. Web of Science

The below search string was used on Web of Science. Due to the low number of results returned (six records) it was decided not to use Web of Science in the analysis section of the project.

ALL=(("Portunus pelagicus") AND (Philippine* OR Cambodia OR Indonesia OR Viet?Nam OR Brunei OR Timor?Leste OR "West* Central Pacific" OR "East* Indian Ocean" OR "southeast asia*" OR "Area 71" OR "Area 57") AND ("stock* assessment" OR "maximum sustainable yield" OR MSY OR "sustainable stock*" OR "capture fisher*" OR "fisher* statistic*" OR "biological parameter*")) – 3 results.

3. Scopus

Two sets of search strings were developed (3.1 and 3.2) and searched for each target country. The first search string, 3.1., was the combination of broader subject keywords of relevance to SDG Indicator 14.4.1. On the other hand, the second search string, 3.2., combined every taxonomic term of commercial interest listed in annex two. All terms in each string were truncated to retrieve all possible variations.

Listed below are the search results for Cambodia using the two sets of search strings, which were combined, deduplicated, and the non-relevant documents were removed. The title of the document was the primary basis used to identify its relevance; if the title was unclear, the article was retrieved

for further analysis. Based on the data gathered from Scopus, the majority of the published fisheries research in Cambodia was focused on freshwater fisheries, while there is a dearth of publications about marine fisheries, particularly on fish stocks. Due to the difficulty in filtering for marine stocks, the decision was taken not to include Scopus in the analysis section of this project.

3.1. Subject keywords + country name.

TITLE-ABS-KEY ((((fish* AND (stock* OR popula* OR catch* OR recruit* OR spawn* OR econom* OR industr* OR capture* OR manage* OR gear* OR data* OR stat* OR fleet* OR vessel* OR trawl* OR product*)) AND cambodia*))) – 440 results.

3.2. Taxonomic terms + country name.

(Acete* OR Anchov* OR "Aphareus rutilans" OR "A. rutilans" OR "Auxis rochei" OR "A. rochei" OR "Auxis thazard" OR "A. thazard" OR Carangid* OR "Charybdis feriatus" OR "C. feriatus" OR "Chionoecetes opilio" OR "C. opilio" OR Clupeid* OR Cypsilur* OR "Decapterus macrosoma" OR "D. macrosoma" OR "Decapterus maruadsi" OR "D. maruadsi" OR Decapter* OR Engraul* OR Epinephel* OR "Etelis radiosus" OR "E. radiosus" OR "Euthynnus affinis" OR "E. affinis" OR "Gadus chalcogrammus" OR "G. chalcogrammus" OR Jellyfish* OR "Katsuwonus pelamis" OR "K. pelamis" OR "Lates calcarifer" OR "L. calcarifer" OR "Leiognath*" OR "Loligo chinensis" OR "L. chinensis" OR Uroteuthis OR Lolig* OR "Lutjanus malabaricus" OR "L. malabaricus" OR "Metapenaeus brevicornis" OR "M. brevicornis" OR "Nemipterus japonicus" OR "N. japonicus" OR Panulirus OR Panulir* OR "Parapenaeopsis hardwickii" OR "P. hardwickii" OR "Mierspenaeopsis hardwickii" OR "M. hardwickii" OR Penaeus OR Penae* OR "Portunus pelagicus" OR "P. pelagicus" OR Portun* OR "Priacanthus macracanthus" OR "P. macracanthus" OR "Pristipomoides multidens" OR "P. multidens" OR "Pristipomoides typus" OR "P. typus" OR "Rastrelliger kanagurta" OR "R. kanagurta" OR "Rastrilleger brachysoma" OR "R. brachysoma" OR "Sardinella fimbriata" OR "S. fimbriata" OR "Sardinella lemuru" OR "S. lemuru" OR "Sardinops melanostictus" OR "S. melanostictus" OR "Saurida tumbil" OR "S. tumbil" OR "Saurida undosquamis" OR "S. undosquamis" OR "Scoliodon laticaudus" OR "S. laticaudus" OR "Scolopsis tayenioptera" OR "S. tayenioptera" OR "Scomber australasicus" OR "S. australasicus" OR Scombrid* OR "Scylla serrata" OR "S. serrata" OR "Selar crumenophthalmus" OR "S. crumenophthalmus" OR "Selaroides leptolepis" OR "S. leptolepis" OR "Tegillarca granosa" OR "T. granosa" OR "Tenualosa ilisha" OR "T. ilisha" OR "Tenualosa macrura" OR "T. macrura" OR "Tenualosa toli" OR "T. toli" OR "Thunnus tonggol" OR "T. tonggol" OR "Todarodes pacificus" OR "T. pacificus" OR "Trachurus japonicus" OR "T. japonicus" OR "Upeneus sulphureus" OR "U. sulphureus") AND cambodia* – 22 results.

4. Example search string: Google Scholar

The below search string was developed for Google Scholar to retrieve results for fish stocks in Cambodia. Due the high number of results and difficulty in exporting them, Google Scholar was not selected as a tool for the analysis section of this project.

4.1 Keywords ((*fish*) AND ((stock* OR catch* OR landing* OR manage* OR zone OR yield*) AND Cambodia))) AND (2021) – over 9 000 results.

ANNEX 2. TAXONOMIC NAMES OF COMMERCIAL INTEREST

A list of species of commercial interest in the region was compiled as part of this project and presented below. The list was compiled with the help of FAO Fisheries and Aquaculture colleagues working on SDG 14.4.1. in the region.

- Acetes (57 and 71 FAO areas);
- Anchovies (57 and 71 FAO areas);
- *Aphareus rutilans* – rusty jobfish (57 and 71 FAO areas);
- Carangidae (57 FAO area);
- *Charybdis feriatus* – crucifix crab (71 FAO area);
- Clupeidae – herrings, sardines, pilchards, shads, menhadens, and allies (57 FAO area);
- Cypselurus spp. – a genus of flying fish (71 FAO area);
- *Decapterus macrosoma* – shortfin scad (71 FAO area);
- *Decapterus maruadsi* – Japanese scad (71 FAO area);
- Decapterus spp. – mackerel scads, round scads, or horse mackerel (71 FAO area);
- Engraulis spp. – a genus of anchovies (71 FAO area);
- Epinephelus spp. – a genus of marine ray-finned fish, groupers (71 FAO area);
- *Etelis radiosus* – Pale snapper (57 and 71 FAO areas);
- *Euthynnus affinis* – Kawakawa (57 and 71 FAO areas);
- Jellyfishes (Cnidaria) (71 FAO area);
- *Lates calcarifer* – Barramundi (57 FAO area);
- Leiognathus spp. – a genus of marine ray-finned fishes, ponyfishes (71 FAO area);
- *Uroteuthis* (*Photololigo*) *chinensis* (accepted name), *Loligo chinensis* (unaccepted name) (71 FAO area);
- *Loligo duvaucelii* (unaccepted name) *Uroteuthis* (*Photololigo*) *duvaucelii* (accepted name) (57 FAO area);
- Loligo spp. – a genus of squid (57 and 71 FAO areas);
- *Lutjanus malabaricus* – Malabar blood snapper (57 and 71 FAO areas);
- *Metapenaeus brevicornis* – Yellow shrimp (71 FAO area);
- *Nemipterus japonicus* – Japanese threadfin bream (57 FAO area);
- Panulirus spp. – a genus of spiny lobsters (57 and 71 FAO areas);
- *Parapenaeopsis hardwickii* (unaccepted name); *Mierspenaeopsis hardwickii* (accepted name) – Spear shrimp (57 FAO area);
- Penaeus spp., Metapenaeus spp. – a genus of prawns (57 and 71 FAO areas);
- *Portunus pelagicus* – flower crab, blue crab, blue swimmer crab, blue manna crab or sand crab, rajungan in Indonesian, and alimasag in Tagalog, Kapampangan, and Pangasinan (57 FAO area);

- Portunus spp. – genus of crab which includes several important species for fisheries, such as the blue swimming crab, *Portunus pelagicus* and the Gazami crab, *P. trituberculatus*. (57 and 71 FAO areas);
- *Priacanthus macracanthus* – red bigeye, (71 FAO area);
- *Pristipomoides multidens* – goldbanded jobfish (57 and 71 FAO areas);
- *Pristipomoides typus* – sharptooth jobfish (57 and 71 FAO areas);
- *Rastrelliger kanagurta* – Indian mackerel (57 and 71 FAO areas);
- *Rastrilleger brachysoma* – short mackerel (71 FAO area);
- *Sardinella fimbriata* – fringescale sardinella (71 FAO area);
- *Sardinella lemuru* – Bali sardinella (71 FAO area);
- *Sardinops sagax* (accepted name) (61 FAO area), *Sardinops melanostictus* (unaccepted);
- *Saurida tumbil* – greater lizardfish (71 FAO area);
- *Saurida undosquamis* – brushtooth lizardfish (71 FAO area);
- *Scoliodon laticaudus* – spadenose shark (Main /Andaman Sea, BOBLME);
- *Scolopsis taenioptera* – Lattice monocle bream (71 FAO area);
- *Scomber australasicus* – Blue mackerel (61 FAO area);
- *Scomber japonicus* – Chub mackerel (61 FAO area);
- Scombridae – Mackerels, tunas, bonitos (57 FAO area);
- *Scylla serrata* – mud crab or mangrove crab (57 FAO area; 71 FAO area; BOBLME Area);
- *Selar crumenophthalmus* – Bigeye scad (71 FAO area);
- *Selaroides leptolepis* – Yellowstripe scad (71 FAO area);
- *Tegillarca granosa* – Granular ark (57 FAO area);
- *Tenualosa ilisha* – Hilsa shad (BOBLME Area);
- *Tenualosa macrura* – Longtail shad (71 FAO area);
- *Tenualosa toli* – Toli shad (71 FAO area);
- *Todarodes pacificus* – Japanese flying squid (61 FAO area);
- *Trachurus japonicus* – Japanese jack mackerel (61 FAO area); and
- *Upeneus sulphureus* – Sulphur goatfish (71 FAO area).

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ISBN 978-92-5-138468-8
9 789251 384688
CC9096EN/1/12.23