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**Bycatch Management Information System (BMIS) Update and Introducing the New
Bycatch Data Explorer**

WCPFC-SC20-2024/EB-IP-04

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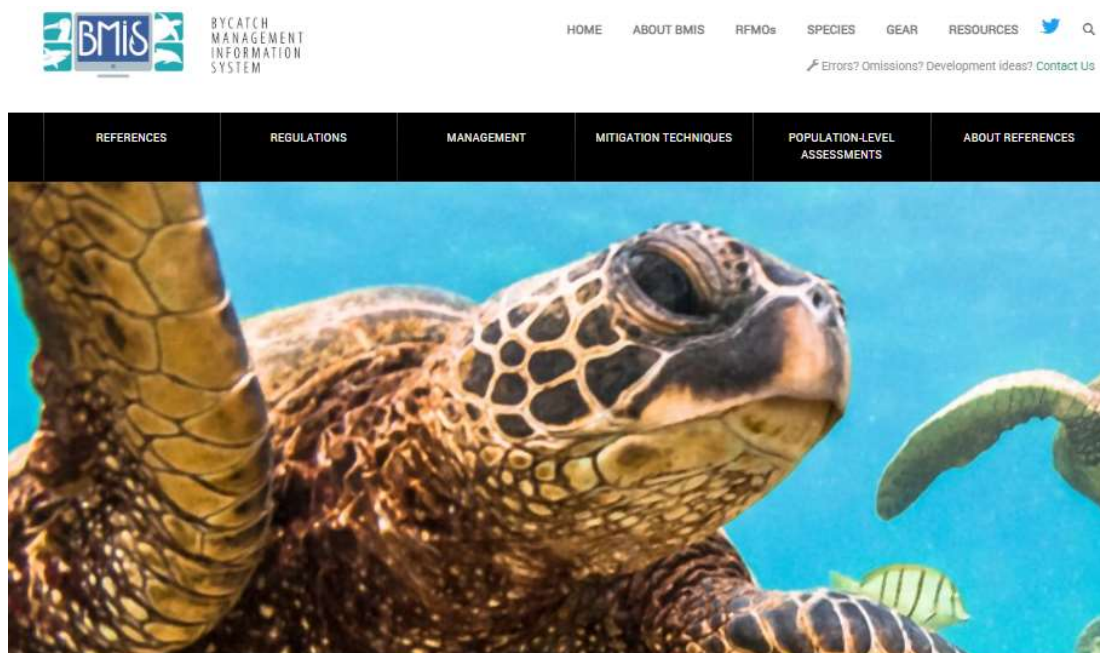
Bycatch Management Information System (BMIS) Update and Introducing the New Bycatch Data Explorer

1. Introduction

The WCPFC **Bycatch Management Information System (BMIS)** is an online resource centralising scientific and technical information on the mitigation and management of bycatch in global pelagic tuna and billfish fisheries (Figure 1). Bycatch here refers to highly migratory species of special interest, including seabirds, sharks and rays, marine turtles and marine mammals (principally cetaceans). The BMIS is aimed at fisheries managers and scientists, fishers, educators and the general public. Website visitors have access to over **3600 references, 52 mitigation technique descriptions, tuna RFMO conservation measures, species identification tools and safe handling and release guides**, among other resources. Comprehensive search filters help BMIS visitors find information specific to their interests.

This paper provides an update on BMIS curation, usage and collaboration. In addition, it introduces the new **Bycatch Data Explorer**, a tool developed to explore and visualise Western and Central Pacific Ocean public domain bycatch data.

Figure 1 The BMIS landing page, accessed at <https://www.bmis-bycatch.org>. Subscribe to the BMIS 'X' feed @BMIS_bycatch. Questions? info@bmis-bycatch.org



Bycatch Management Information System

The Bycatch Management Information System (BMIS) focuses on bycatch mitigation and management in oceanic tuna and billfish fisheries*. It is an open resource useful for fishery managers, fishers, scientists, observers, educators and anyone with an interest in fisheries management. As a reference and educational tool, the BMIS aims to support the adoption and implementation of science-based management measures so that bycatch is managed comprehensively and sustainably. The BMIS is concerned with highly migratory species with low reproductive rates, including seabirds, sharks and rays, sea turtles and marine mammals.

BYCATCH SPECIES DATA LINK *Beta Version*

[MORE ON THE BMIS »](#)



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The following sections describe:

- Curation
- Website usage (visitor numbers, what they looked at, where they are from)
- Collaboration
- Bycatch Data Explorer
- Summary and future BMIS support.

2. Curation

BMIS content is continuously updated. [References](#) and [mitigation technique](#) descriptions are the most frequently accessed resources within the BMIS (see website usage in Section 3 below) and where most curation effort is expended. Currently there are more than **3600 references** and 52 mitigation technique descriptions in the database. BMIS content is explained below.

References (mitigation and management literature) are collected from many sources. Among these are tuna RFMO scientific meetings (or equivalents, e.g., ICCAT's Collected Volumes of Scientific Papers) and bycatch related workshops, ACAP and Birdlife International factsheets and ACAP scientific meetings. Other sources include ISSF publications and blogs, Table of Content alerts (a selected list of scientific journals), google scholar alerts, ResearchGate and X (formerly known as Twitter).

Mitigation Techniques (MT) are revised to reflect new research. Some MT are a sub-set or variation of other MT, e.g. 'purse seine deck release devices' is a sub-category of 'safe handling and release techniques'. Experimental MT, such as 'Auto-release technology' are carefully labelled as such.

Species Group pages summarise, for each group, the nature of bycatch interactions in longline, purse seine and gillnet tuna and billfish fisheries. Proven and promising MT are outlined. Links to further information on biological and distribution data, species identification and bycatch reduction are included.

Gear pages provide descriptions of longline (LL), purse seine (PS) and gillnet (GN) fishing gear used in tuna fisheries. There are also links to other websites with good descriptions of gear.

Management information (MC) in the BMIS provides context and rationale for the development of bycatch conservation and management measures, which are called **Regulations** in the BMIS. The BMIS [Regulations database](#) includes measures from all five tuna RFMOs. **Population-Level Assessments (PLA)** highlight ecological risk assessment frameworks for estimating the vulnerability and stock status of (data poor) bycatch populations and evaluating potential consequences of fisheries management actions. To alert users to the breadth of this material, twenty-two 'Management' and 'Population-Level Assessment' categories have been devised, e.g., the new category 'PLA – **stock status**'.

Categorising references helps BMIS users to filter (narrow) database searches, particularly when used in conjunction with 'Keywords'. **Figure 2** below illustrates how references collated in **Zotero**³ are categorised by using 'tags'.

³ BMIS literature is captured and stored in [Zotero](#), a standalone, open source, online reference manager. Individual references, with their associated bibliographic data, can be assigned various keywords or "tags". Groups of tags, along with pre-defined logic, are used to connect items from the BMIS website to their associated items from Zotero, enabling them to be cross-referenced, searched and filtered.

Figure 2 – Screenshot of a tagged reference in Zotero, the reference manager underpinning BMIS.

Title	Creator	Info	Notes	Tags	Related
Updated ACAP Advice on Reducing the Bycatch of Albatrosses and Petrels in WCP...	ACAP			11 tags: <input type="button" value="Add"/>	
ISSF workshop on different approaches to limit the number of FADs in the oceans	Anonymous				
Update on Antipodean albatross tracking and overlap with pelagic longline fishing...	Bose et al.			LL	
Characterisation of the fisheries catching Silky sharks (<i>Carcharhinus falciformis</i>) in t...	Brouwer et al.			MC	
Modelling drifting Fish Aggregating Devices (FADs) trajectories arriving at essentia...	Escalle et al.			Open Access	
Update on flesh-footed shearwater tracking and potential areas of bycatch risk	Fisher et al.			PLA	
Bycatch Management Information System (BMIS) Update	Fitzsimmons			PLA - abundance indices	
Using electronic monitoring to verify best practices for safe handling and release...	Heberer			post-release mortality	
Population genomics of blue shark <i>Prionace glauca</i> in the Pacific Ocean based on ...	Ibe et al.			PS	
Global prevalence of setting longlines at dawn highlights bycatch risk for threaten...	Kroodtsma et al.			sharks and rays	
Tori line experiments on Taiwanese tuna longline fishing vessels in the North Pacifi...	Kuo et al.			silky shark - <i>Carcharhinus falciformis</i> FAL	
A novel FAD tracking device tested in the Pacific Ocean (WCPFC SC19 version)	Moreno et al.			WCPFC SC	
Progress in addressing key research to inform Mobulid ray conservation in the Paci...	Moreno et al.			western and central Pacific Ocean	

X (formerly Twitter) [@BMIS_bycatch](#) is used to promote the BMIS website, to keep the website looking active, and as a source of reference material, news and events in the wider world of bycatch management. Posts highlight new BMIS content and events, including tuna RFMO meetings and papers (see Figures 3 and 4, which illustrate how X generates website visitation).

International concern regarding 'X' as a social media platform is significant. The BMIS may need to move to another platform. There are several 'X' competitors (e.g., Blue Sky, Threads), however, as the dominant social media site may take some time to emerge, an established intermediary platform such as Instagram should be adopted.

Figure 3 - (a) Griffiths et al (2024) and (b) Bortoluzzi et al (2024) X posts.

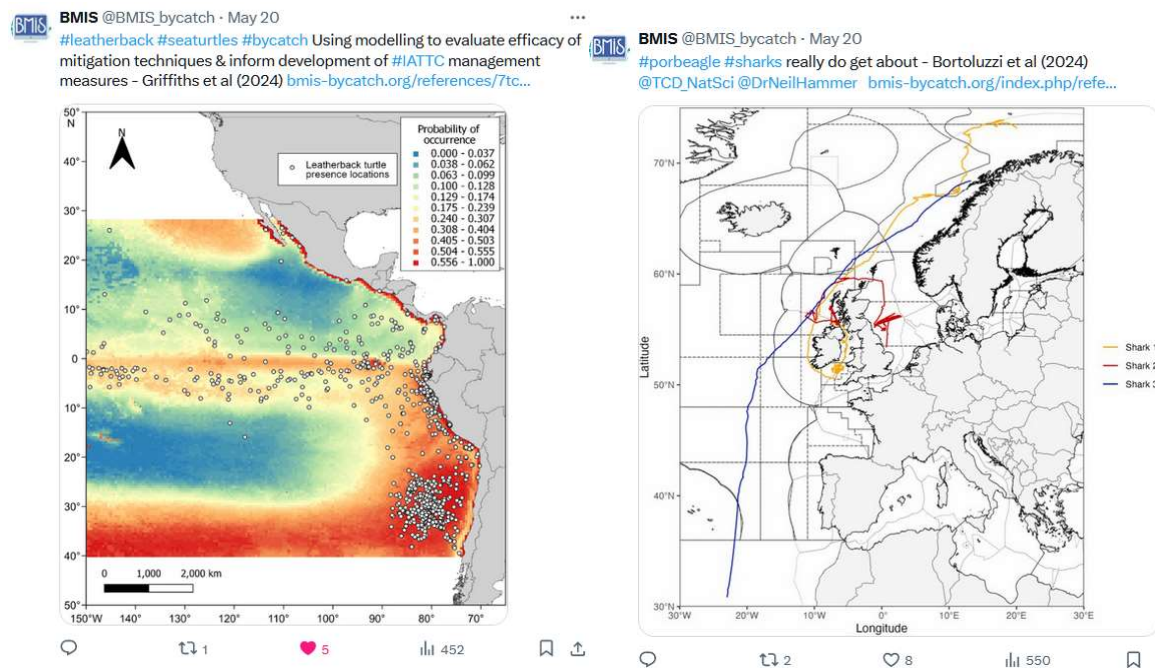
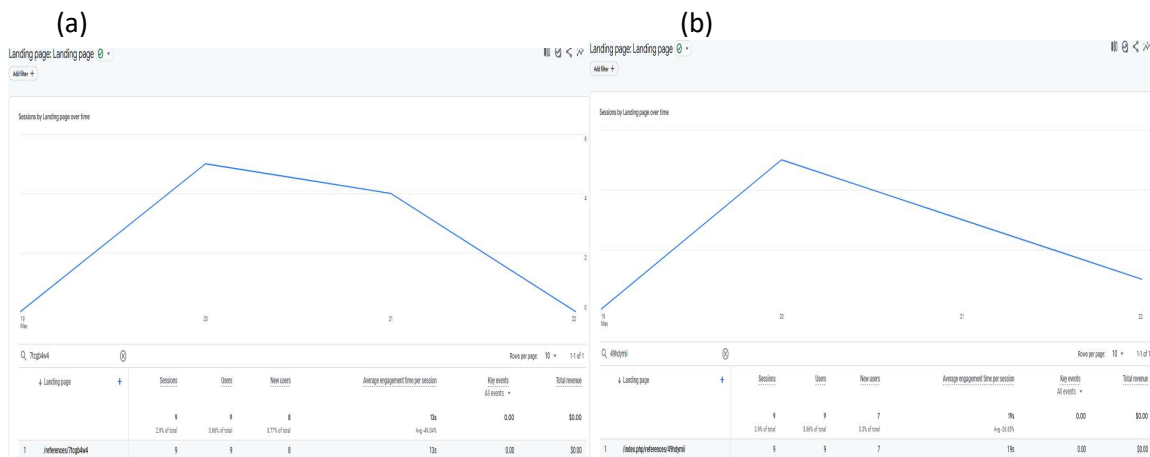


Figure 4 (a) & (b) – graphs illustrating direct clicks to the references promoted in the posts in Figure 3. The date range is 18-22 May 2024, with the X posts made on May 20th.



3. Website Usage

Google Analytics – GA4

BMIS uses Google analytics (GA) to understand website usage. Google recently implemented GA4 (replacing ‘Universal Analytics’ UA), a new method of analysing and reporting website data. GA4 tracks each user interaction as an individual event, rather than grouping them together by session. This shift provides a more detailed view of user behavior, from specific clicks to scrolling behavior. GA4 was applied to the BMIS website in October 2021. In the past year, significant improvements to GA4 functionality have been made, notably an increase in the number of ‘pre-defined’ reports. These cover, for example:

- user acquisition (e.g., number of users, whether searches were organic, direct, referral or organic social);
- engagement (events such as clicks, scrolls, downloads; page views; demographic details – country);
- user retention.

Teething problems

‘Referral spam’ has proved difficult to block. For the period 15 May 2023 to 16 May 2024, used in the analyses in this report, spam represented 5% of ‘new users’ and has been deleted from counts of visitor numbers. ‘Hits’ were restricted to the home page; these spam page views were also removed (except for Figure 5).

Visitor numbers, retention & how they arrived

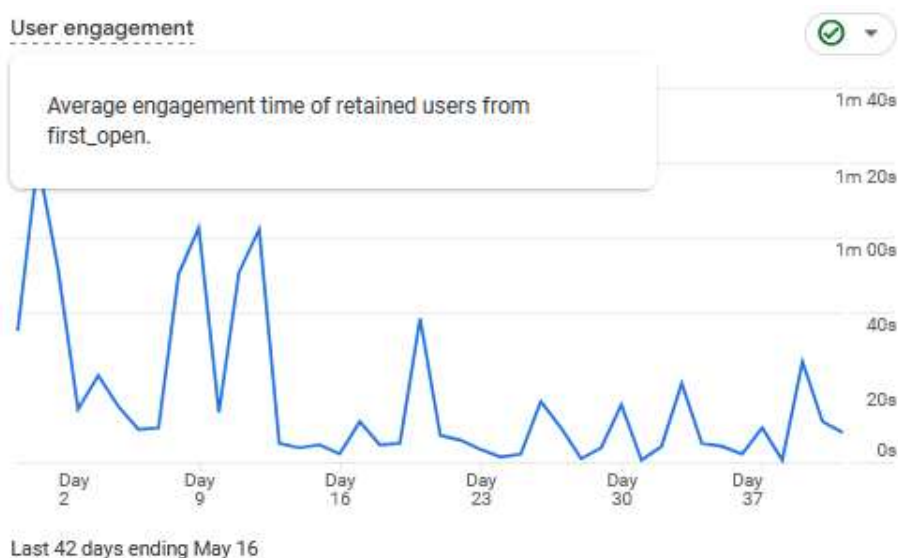
BMIS patronage has increased substantially since the website relaunch in May 2017. In the first six months following relaunch, unique visitor numbers averaged 300 per month, compared with recent figures of around 1200 per month. Considering the year 15 May 2023 to 16 May 2024, 18,128 unique users (reported as ‘new’ users to the website) visited the BMIS website, an increase of 19% on the previous year. Similarly, the number of users who visited more than once increased 7.6% (Figure 5). Most users arrived at the site via ‘organic Google search’ (71%). **Direct searches** (e.g., users typed a BMIS url into their browser) accounted for 26% of arrivals (versus 20% the previous year). Usage is reasonably consistent throughout the year, except for a dip around the December-January holiday period.

Figure 5 Comparison between the period 15 May 2023 to 16 May 2024 and the previous year for new and returning site visitors. Note that spam visits have not been removed from this figure; the corrected number of new users is 18,000 and increase in visitors is 19%.



The behaviour of 'return users' is illustrated in Figure 6. This suggests that those who visit the site spend more time on their first visits, then are more targeted in later usage. 'Engagement' is any event, including clicks, scrolls, downloads, page or screen views, and demographic details.

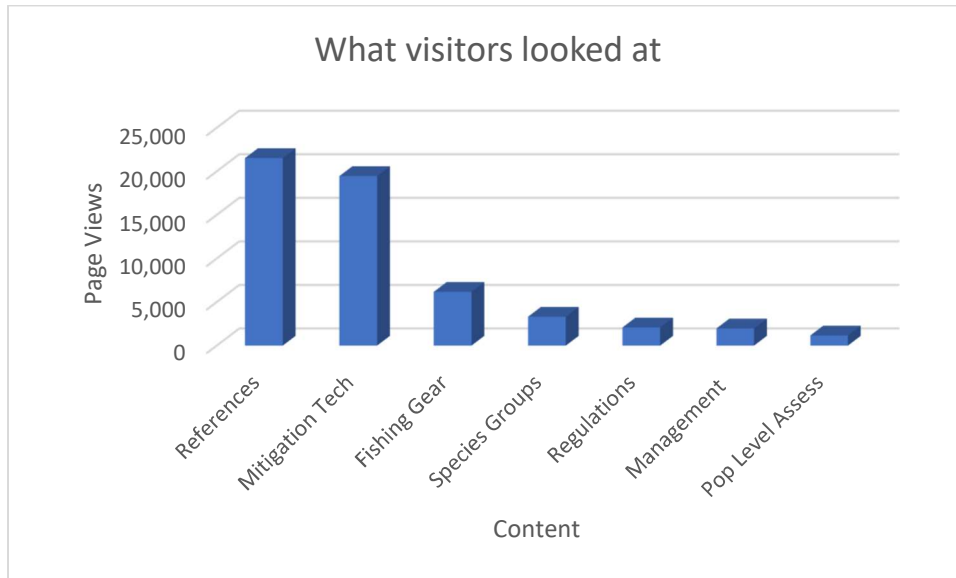
Figure 6 User engagement for the period 15 May 2023 to 16 May 2024.



What visitors looked at

For the year 15 May 2023 to 16 May 2024 total page views exceeded 75,000 pages. Figure 7 shows that the most heavily used sections of the BMIS were references and mitigation techniques, followed by fishing gear (purse seine gear descriptions were more popular than LL, GN). Regulations had fewer visitors but more page views than management category information.

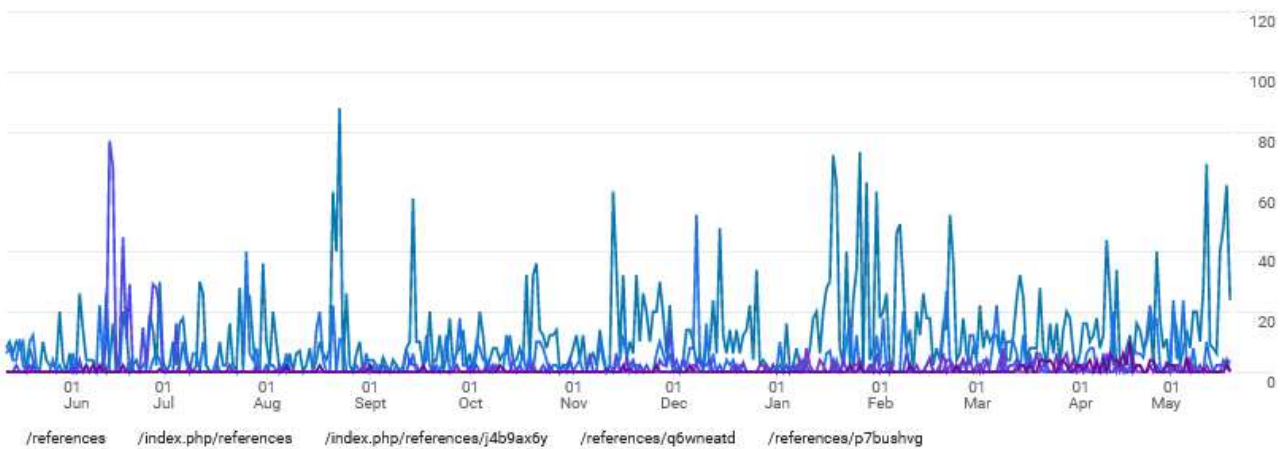
Figure 7 Content that BMIS visitors accessed 15 May 2023 to 16 May 2024.



Drilling down on references

The most visited section of the BMIS was References, with more than 21,500 page views (plus 5,700 views of the References main search page). Around **60%** of the 3600+ references in the database were viewed at least once. Figure 8 below looks at use across the year. Engagement during this period included 1837 PDF downloads, 2680 clicks away to URLs (e.g., journal DOIs included on the reference page), and 3772 clicks to other pages within the BMIS.

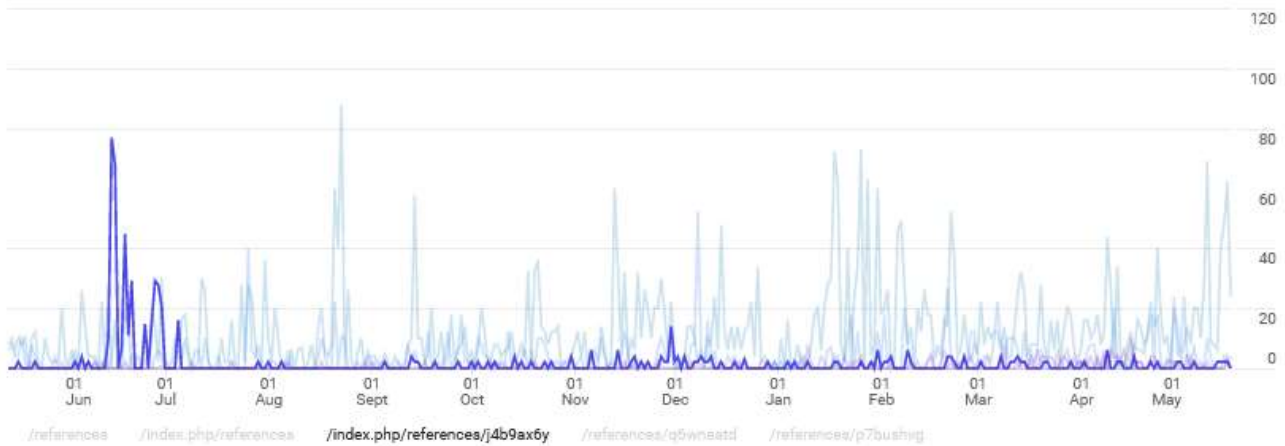
Figure 8 Use of the Reference section for the period 15/5/2023 to 16/5/2024.



Most references were only accessed once across the year, but others had significant use. For example, the reference [Crespo & Crawford \(2019\)](#), Figure 9, was viewed 614 times by 279 unique users, with a spike in

usage (145) on 15-16th June 2023. Spikes may indicate usage of the BMIS for e.g., a workshop. The PDF was downloaded 44 times, there were 28 clicks away from BMIS using the URL provided and 45 clicks on links to other pages within the BMIS.

Figure 9 Page views for the reference Crespo JP, Crawford R (2019) Bycatch and the Marine Stewardship Council (MSC): A review of the efficacy of the MSC certification scheme in tackling the bycatch of non-target species. Birdlife International for the period 15/5/2023 to 16/5/2024



There is potential to look at the types of references accessed, to see what sections of the literature are of most interest to BMIS users. For example, Table 1 below lists the ‘top 10’ references by number of views.

Table 1 ‘Top 10’ references by number of page views

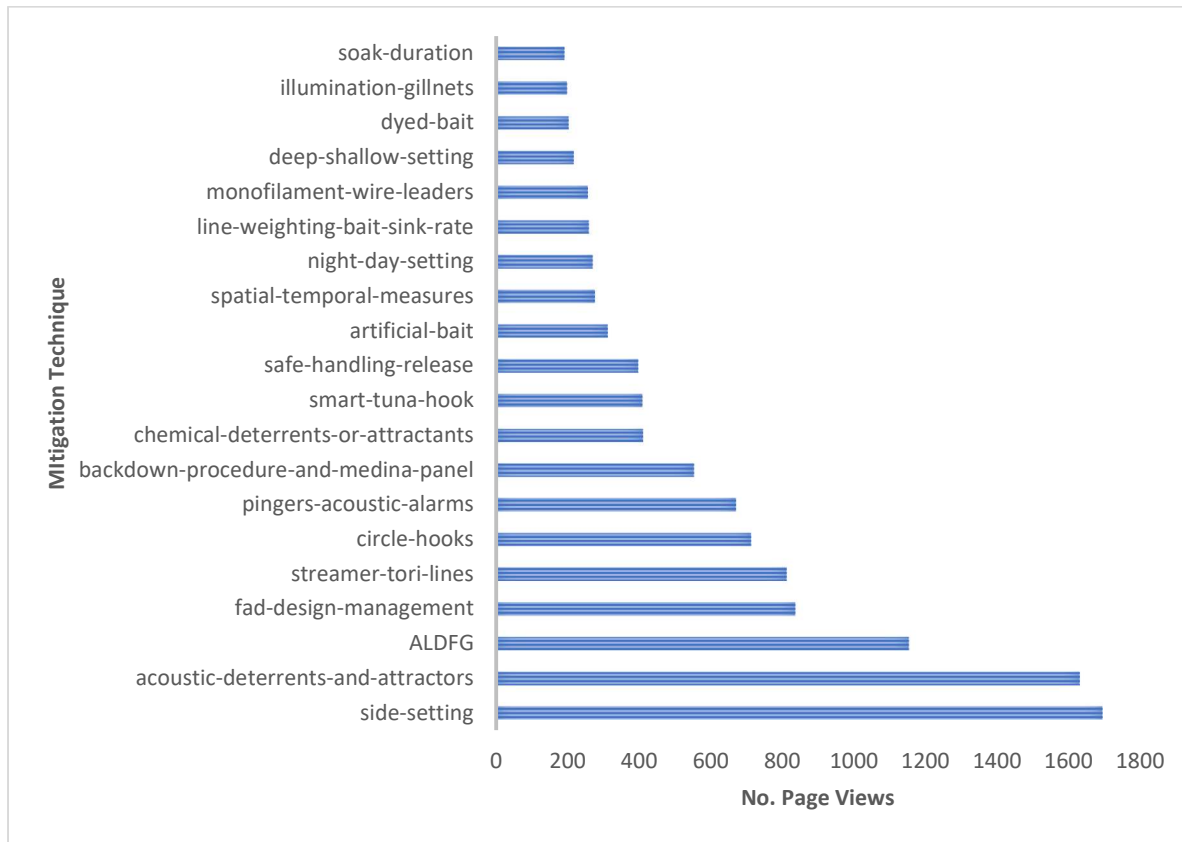
Reference	No. Views	No. users
Crespo JP, Crawford R (2019) Bycatch and the Marine Stewardship Council (MSC): A review of the efficacy of the MSC certification scheme in tackling the bycatch of non-target species	614	279
Jayathilaka RAM, Haputhanthri SSK, Perera H (2016) Identification of thirteen pelagic shark species of the Indian ocean occurring around Sri Lanka; using morphological characters of their fins. In: IOTC - 12th Working Party on Ecosystems and Bycatch. IOTC-2016-WPEB12-23_Rev_1	195	91
Baird RW, Mahaffy SD, Gorgone AM, et al (2015) False killer whales and fisheries interactions in Hawaiian waters: Evidence for sex bias and variation among populations and social groups. Mar Mam Sci 31:579–590. https://doi.org/10.1111/mms.12177	146	71
Kizhakudan S Joe, Zacharia PU, Thomas S, et al (2015) Guidance on National Plan of Action for Sharks in India. IOTC, Olhao, Portugal	144	5
Birdlife International (2023) Seabird Tracking Database: A platform for seabird researchers to share their tracking data with the research and conservation communities	130	59
Swimmer Y, Zollett E, Gutierrez A (2020) Bycatch mitigation of protected and threatened species in tuna purse seine and longline fisheries. Endang Species Res 43:517–542.	119	41
Rice J (2021) Stock assessment of Blue Shark in the Indian Ocean. In: IOTC- 17th Working Party on Ecosystems & Bycatch (Assessment). IOTC-2021-WPEB17(AS)-15_rev1, Online	116	37
Birdlife International (2016) Birdlife Data Zone. In: BI Data Zone. http://www.birdlife.org/datazone/home . Accessed 12 Jun 2012	112	49
Moreno G, Salvador J, Zudaire I, et al (2023) The Jelly-FAD: A paradigm shift in the design of biodegradable Fish Aggregating Devices. Marine Policy 147:105352.	108	33
Mancusi C, Bairo R, Fortuna C, et al (2020) MEDLEM database, a data collection on large Elasmobranchs in the Mediterranean and Black seas. Mediterranean Marine Science 21:276–288.	106	45

Mitigation Techniques

After references, mitigation technique (MT) descriptions are the most visited section of the BMIS. In Figure 10, below, which shows the ‘top 20’ visited MT for the period 15/5/2023 to 16/5/2024, there are a few points to note. Firstly, the visits to the MT ‘home page’, which lists and briefly explains each of the 52 MT, is not included in the figure (an additional 4,300 views). Secondly, there are more longline MT described in the BMIS than purse-seine and gillnet MT and cumulatively, interest in longline MT was higher than for the other

two gears. Thirdly, adding counts for both ‘acoustic deterrents’ and ‘pingers’ together shows the significant interest in this MT category.

Figure 10 Interest in mitigation techniques for the period 15 May 2023 to 16 May 2024 (top 20 of 52).



Where users are located

In the past year the BMIS has been accessed by people from across the globe (Figure 11). A sample of country data is presented in Table 2 . Maps are generated in GA4 using ‘path exploration’ (a deep ‘data dive’) but this capability is still under development; map generation is limited to a period of one month. GA4 also reports on live usage of the BMIS (Figure 12).

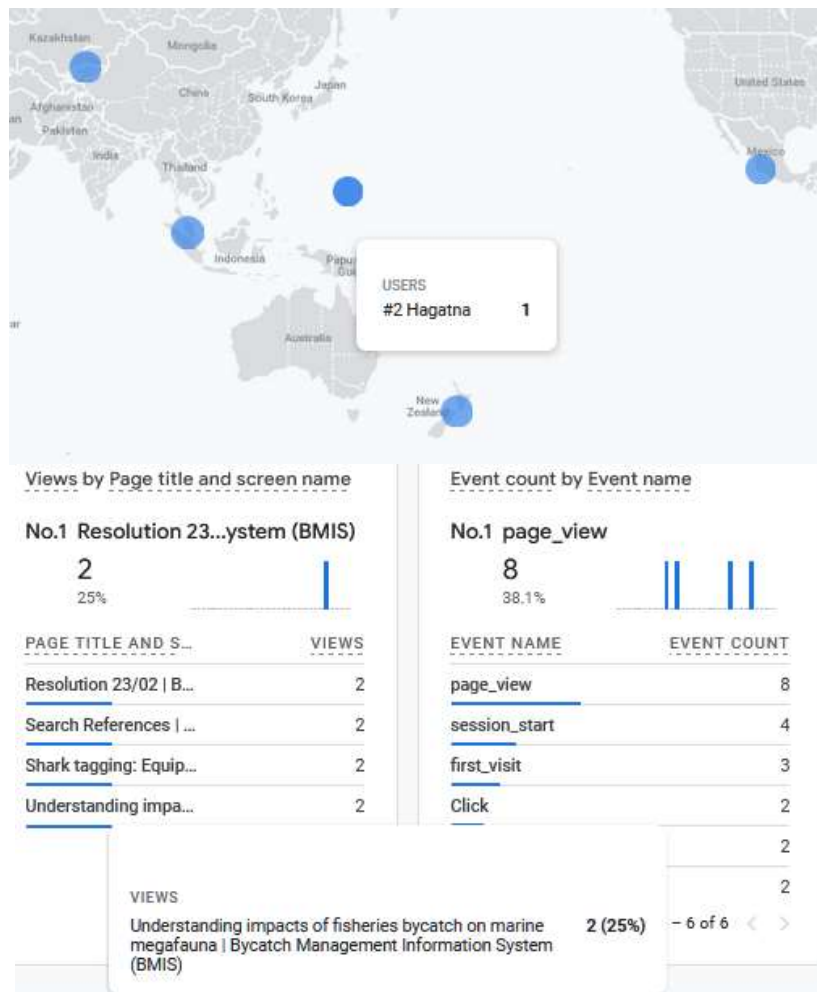
Table 2 ‘Top 20’ countries by visitor numbers for the period 15 May 2023 to 16 May 2024.

Country	No. Users	%	Country	No. Users	%
United States	4429	24	New Zealand	348	2
Australia	2608	14	Japan	318	2
United Kingdom	1347	7	Brazil	299	2
India	933	5	Germany	241	1
Philippines	563	3	Italy	240	1
Canada	524	3	Taiwan	226	1
Indonesia	470	3	Sri Lanka	222	1
Spain	453	2	Bangladesh	206	1
China	438	2	Netherlands	200	1
France	358	2	South Korea	179	1

Figure 11 BMIS usage by country for the month 15/04 to 16/05 2024



Figure 12 Live usage of BMIS website at approximately 2:50pm on 4 June 2024. Countries - Putrajaya (Indonesia), Wellington (NZ), Hagatna (Guam), Villa de Alvarez (Mexico), Bishkek (Kazakhstan) – and what users were looking at.



4. Collaboration

The BMIS includes links to other databases and organisations concerned with bycatch management in tuna fisheries. Re the latter, we are happy to publish relevant work on the website. New tools that we anticipate adding in the coming year include:

- **Seabird-Smart Fishing Toolkit** - Southern Seabirds Trust, in conjunction with the New Zealand Department of Conservation, is developing this interactive decision-support tool.
- **Seabird identification photographs database** – being developed by **CCSBT**.

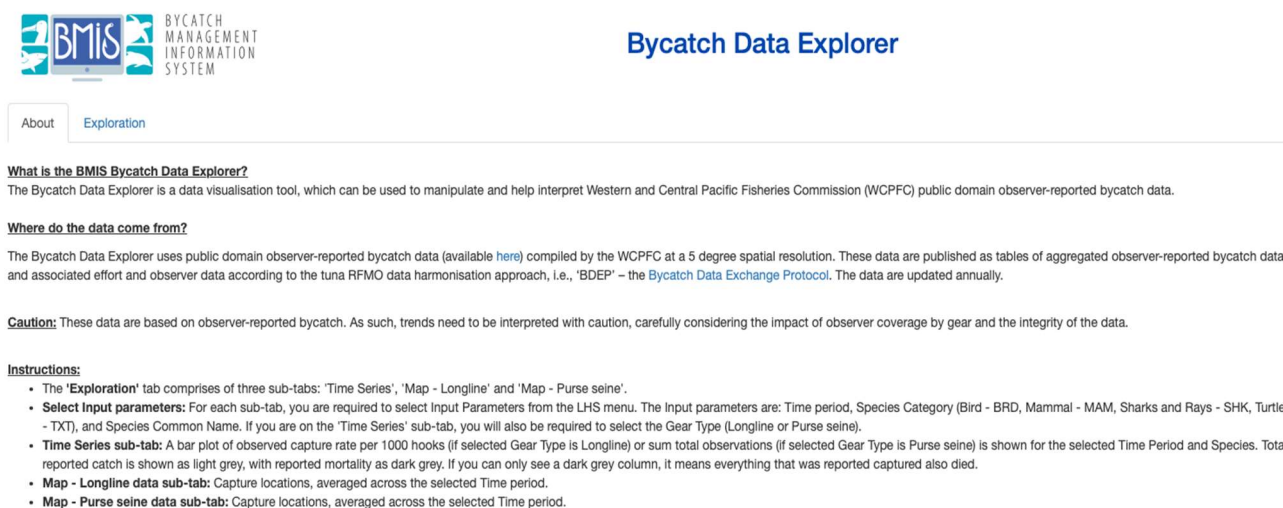
5. New Bycatch Data Explorer

The new Bycatch Data Explorer (BDE) is a tool developed to explore and visualise Western and Central Pacific Ocean (WCPO) public domain observer-reported bycatch data. It updates an earlier project to create an accessible, central source for public domain bycatch-related data (Fitzsimmons, 2023; Fitzsimmons et al, 2017; Fitzsimmons et al, 2019; and Williams, 2017). The new BDE uses open-source R Shiny scripts; version controlled code is stored on GitHub. The BDE is available here: <https://ofp-sam.shinyapps.io/bmis/> and a summary of its features follows below. A link to the new BDE will be placed on the Home Page of the BMIS website, prominent in the black ribbon at the top of the page, replacing the 'About References' tab. It will also be placed in other locations on the website and SPC and WCPFC logos added. We invite users to engage with the new BDE. Please provide feedback and feature requests to info@bmis-bycatch.org.

Home page

The home page includes a brief introduction to the Bycatch Data Explorer and its data sources. While the BDE is user-friendly, a concise set of instructions is available on the Home Page to help users select input parameters and navigate between subtabs in the Exploration main tab (Figure 13).

Figure 13 Home page of the BMIS Bycatch Data Explorer.



BMIS BYCATCH MANAGEMENT INFORMATION SYSTEM

Bycatch Data Explorer

About Exploration

What is the BMIS Bycatch Data Explorer?
The Bycatch Data Explorer is a data visualisation tool, which can be used to manipulate and help interpret Western and Central Pacific Fisheries Commission (WCPFC) public domain observer-reported bycatch data.

Where do the data come from?
The Bycatch Data Explorer uses public domain observer-reported bycatch data (available [here](#)) compiled by the WCPFC at a 5 degree spatial resolution. These data are published as tables of aggregated observer-reported bycatch data and associated effort and observer data according to the tuna RFMO data harmonisation approach, i.e., 'BDEP' – the [Bycatch Data Exchange Protocol](#). The data are updated annually.

Caution: These data are based on observer-reported bycatch. As such, trends need to be interpreted with caution, carefully considering the impact of observer coverage by gear and the integrity of the data.

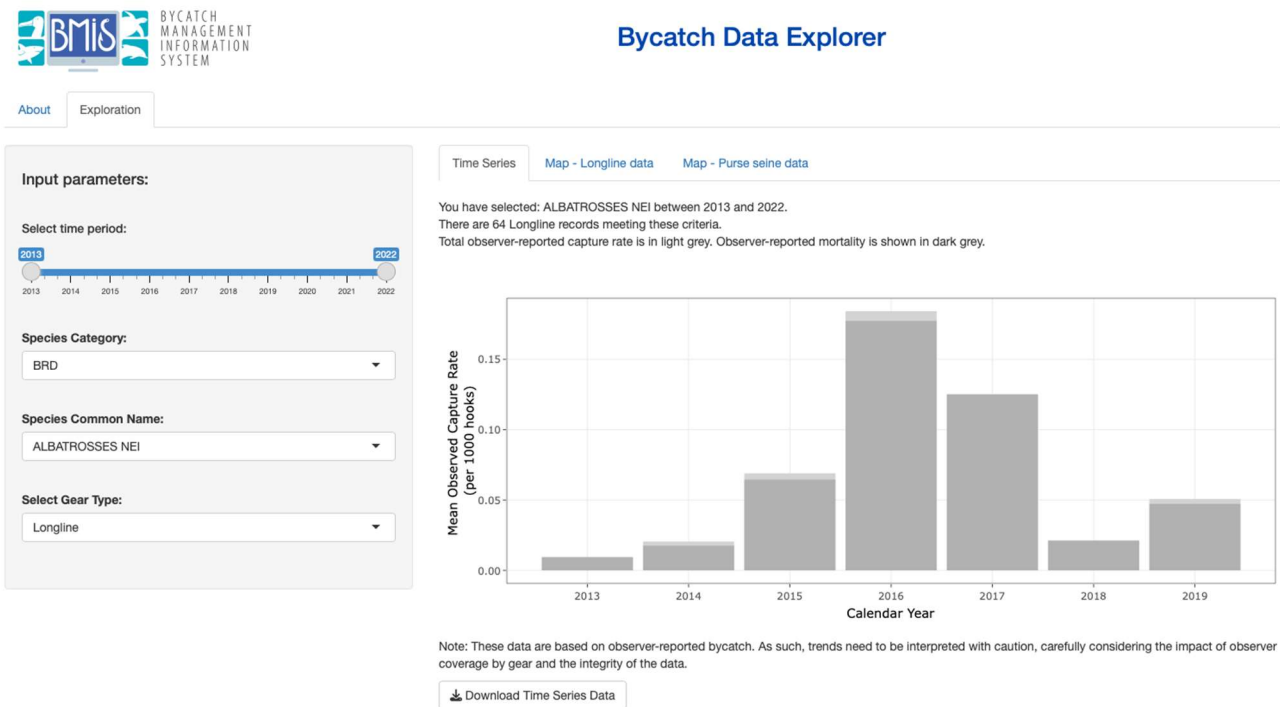
Instructions:

- The 'Exploration' tab comprises of three sub-tabs: 'Time Series', 'Map - Longline' and 'Map - Purse seine'.
- **Select Input parameters:** For each sub-tab, you are required to select Input Parameters from the LHS menu. The Input parameters are: Time period, Species Category (Bird - BRD, Mammal - MAM, Sharks and Rays - SHK, Turtles - TXT), and Species Common Name. If you are on the 'Time Series' sub-tab, you will also be required to select the Gear Type (Longline or Purse seine).
- **Time Series sub-tab:** A bar plot of observed capture rate per 1000 hooks (if selected Gear Type is Longline) or sum total observations (if selected Gear Type is Purse seine) is shown for the selected Time Period and Species. Total reported catch is shown as light grey, with reported mortality as dark grey. If you can only see a dark grey column, it means everything that was reported captured also died.
- **Map - Longline data sub-tab:** Capture locations, averaged across the selected Time period.
- **Map - Purse seine data sub-tab:** Capture locations, averaged across the selected Time period.

Exploration tab

The Exploration tab consists of a left-hand sidebar for the Input Parameters, and a main panel on the right-hand side with three subtabs. The first subtab is the Time Series (Figure 14). Once the user has selected the Time period, Species Category (Bird - BRD, Mammal - MAM, Sharks and Rays - SHK, Turtles - TTX), Species Common Name and Gear Type, the bar plot in the main panel will update. Output text will inform the user how many records met conditions specified by the input parameters, and the bar plot is the observer-reported Mean Observed Capture Rate (light grey bars) and Mean Observed Mortality Rate (dark grey bars, Figure 14). A download button is provided, which outputs data as a .csv file.

Figure 14 Map - Longline data panel. Requisite input parameters are the Time Period, Species Category (Bird - BRD, Mammal - MAM, Sharks and Rays - SHK, Turtles - TTX) and Species Common Name. The main panel is a map of the observer-reported Capture Rate per 1,000 hooks, averaged over the selected time period.



The Map – Longline data tab provides a map of the average observer-reported capture rate (per 1,000 hooks) for longline gear over the selected time period, for the selected species (Figure 15). The Map – Purse seine data tab provides the same, but for purse seine data (Figure 16). Both maps are downloadable as a .png file, as shown in Figure 16.

Figure 15 Map – Purse seine data panel. Requisite input parameters are the Time Period, Species Category (Bird - BRD, Mammal - MAM, Sharks and Rays - SHK, Turtles - TTX) and Species Common Name. The main panel is a map of the observer-reported interaction rate per set, averaged over the selected time period.

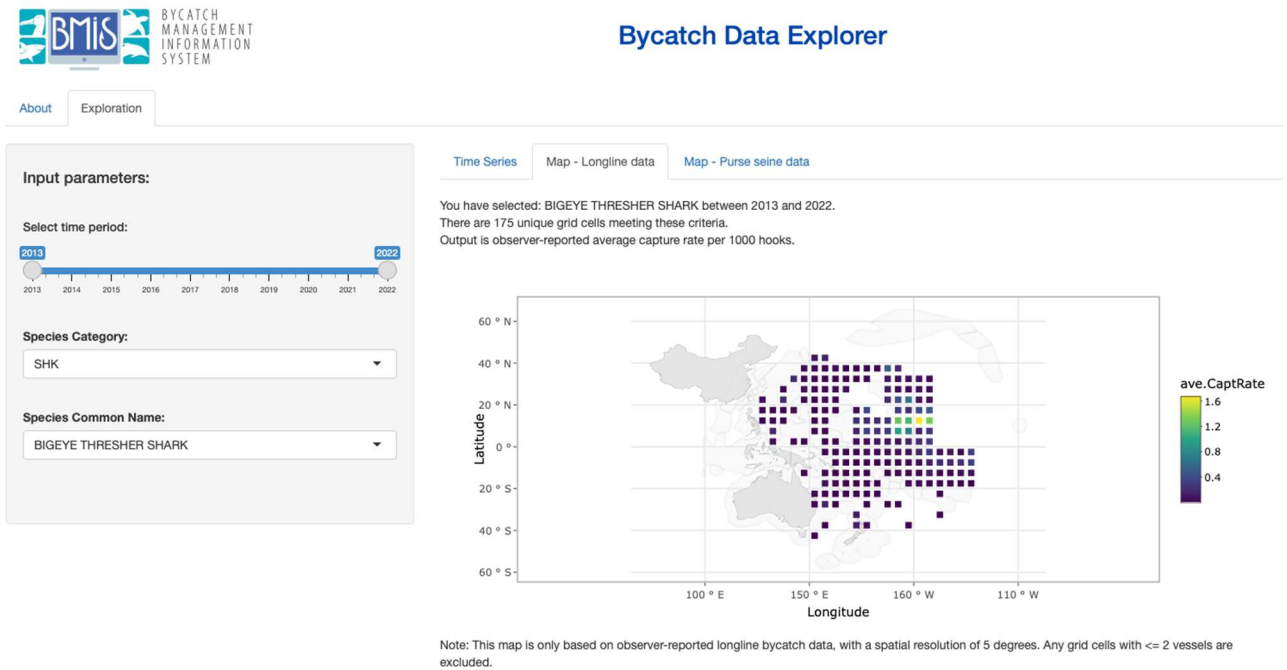
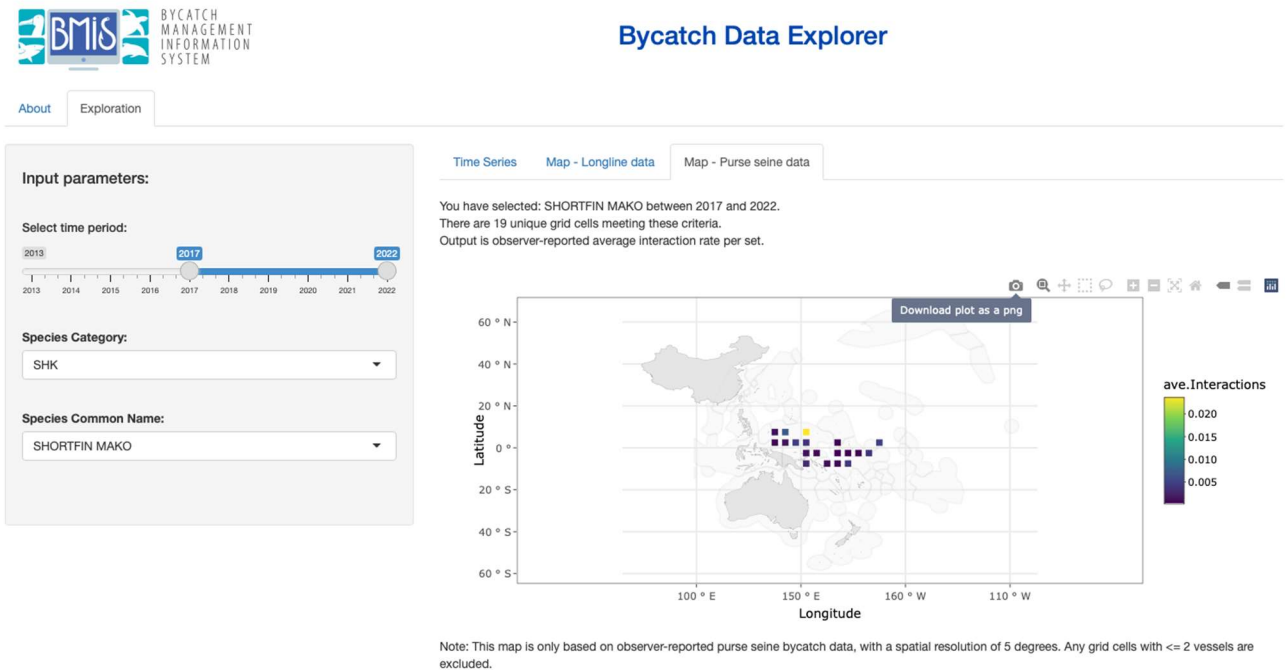


Figure 16 Map – Purse seine data panel. Requisite input parameters are the Time Period, Species Category (Bird - BRD, Mammal - MAM, Sharks and Rays - SHK, Turtles - TTX) and Species Common Name. The main panel is a map of the observer-reported interaction rate per set, averaged over the selected time period.



6. Summary and future BMIS support

The WCPFC BMIS is a comprehensive resource that consolidates information on the mitigation and management of bycatch species of special interest in tuna and billfish fisheries. Analysis of recent use demonstrates a strong interest in BMIS content with increases in visitor numbers and page views over the past few years. Additionally, BMIS provides a platform for the new Bycatch Data Explorer, a tool to explore WCPO public domain bycatch data. Resources are required for the following:

- Ongoing maintenance - which allows the site to remain online, accessible and safe to visit (*website security updates, site administrator changes to web pages; domain hosting; software updates; and Zotero cloud storage capacity fees*)
- Ongoing curation, communications and analysis - to keep the site current and fresh (*Update of literature collection and mitigation technique descriptions, social media; annual data update for the Bycatch Data Explorer; Google analytics to assess website usage*)
- Ongoing development to ensure the site remains a relevant and flexible platform (*Resolving spam; Fixing errors; Minor development to improve user experience, e.g., broadening the range of regulations included, improving the species identification pages; reviewing and implementing feedback on the Bycatch Data Explorer*).

7. References

Fitzsimmons L (2023) Bycatch Management Information System (BMIS) Update. In: WCPFC Scientific Committee 19th Regular Session. [WCPFC-SC19-2023/EB-IP-05](#), Koror, Palau.

Fitzsimmons L, Abraham E, Caillot S, Smith N (2019) An update on the Bycatch Management Information System (BMIS): developments in 2018-19 including the integration of data visualisation and mapping for bycatch data. In: WCPFC Scientific Committee 15th Regular Session. [WCPFC-SC15-2019/EB-IP-01](#), Pohnpei, Federated States of Micronesia.

Fitzsimmons L, Caillot, S., Clarke, S. and Smith, N. (2017). Redevelopment of the Bycatch Management Information System (BMIS): status and future work plan including integrating regional bycatch data summaries. 13th Meeting of the Scientific Committee of the Western and Central Pacific Fisheries Commission, [WCPFC-SC13-2017/EB-WP-09](#), Rarotonga, Cook Islands.

Williams P, Smith N, Tuiloma I, Panizza A (2017). Bycatch data exchange protocol. In: WCPFC Scientific Committee 13th Regular Session. [WCPFC-SC13-2017/EB-IP-15](#), Rarotonga, Cook Islands.