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BMIS - RELEVANCE TO WCPFC DECISION-MAKING AND EFFECT OF AI

WCPFC-SC22-2026-EB-WP05

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Executive Summary

The Bycatch Management Information System (BMIS) is an established resource with an active editorial process, global coverage and an existing user base across fisheries managers, national agencies, WCPFC CCMs (Members, Participating Territories and Cooperating Non-Members), NGOs, industry, other RFMOs (Regional Fisheries Management Organisations) and research scientists. It provides:

1. equitable access to bycatch science information for WCPFC CCMs and other stakeholders with limited science capacity. It ensures small island developing state CCMs and participating territories with limited dedicated bycatch mitigation, management or stock assessment science capacity can access the same curated evidence base as well-resourced delegations, supporting more substantive engagement in all WCPFC Commission processes.
2. global coverage that facilitates rapid and coherent comparison of bycatch CMMs across the tuna RFMOs. This coverage benefits WCPFC by enabling it to:
 - a. identify gaps in current WCPFC bycatch CMMs that are addressed by measures adopted in other tuna RFMOs
 - b. connect with the research and management decisions of other tuna RFMOs
 - c. provide a single, consistently maintained information system that reduces the risk of conflicting technical advice to industry
 - d. support the development of harmonised bycatch management and mitigation guidance across tuna RFMOs, where practical
3. supports the development, implementation and ongoing review of CMMs.
4. for 'generative' or 'answer' engine optimisation (GEO/AEO), allowing content to be parsed, summarised, and referenced by AI systems. The extent to which the BMIS should support these large language models, however, requires direction from WCPFC members. The crawlers these models use to access BMIS content also distort the usage statistics that have previously been used to report BMIS impact.

Financing for the BMIS from donors outside of the WCPFC has now terminated. Resources to redevelop and to maintain consistency with the annual curation, maintenance and administration of the BMIS are required if the BMIS is to be continued.

Recommendations

WCPFC - SC22 is requested to consider the value WCPFC derives from the BMIS as outlined in this document. If SC22 considers the BMIS a required WCPFC resource, then:

1. endorse an annual WCPFC budget of USD42,000 to support curation, maintenance and administration of the BMIS.
2. request SPC and the WCPFC-Secretariat to develop an appropriate policy on crawler/bot activity on WCPFC web resources.

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1 Background

The Bycatch Management Information System (BMIS; bmis-bycatch.org) was launched online in 2011, fifteen years ago. It was developed by the Western and Central Pacific Fisheries Commission (WCPFC) to support its responsibilities under international agreements¹ to sustainably manage bycatch in western and central Pacific Ocean (WCPO) fisheries targeting tuna and billfish. Bycatch here refers to highly migratory species (HMS) of special interest, including seabirds, sharks and rays, marine turtles and marine mammals (principally cetaceans). Funding from the FAO Common Oceans Project - Areas Beyond National Jurisdiction (ABNJ) - enabled a major expansion and redevelopment of the website and database with a global focus, culminating in a site relaunch in 2017. The BMIS now covers all five tuna RFMOs.

This document outlines how BMIS assists WCPFC and its members with the development, implementation and ongoing review of evidence-based conservation and management measures (CMMs). It demonstrates its capacity to support WCPFC in internationally coordinated efforts to manage HMS bycatch.

It also describes the challenges and opportunities presented by AI and briefly addresses website usage and proposed changes.

2 Application of BMIS to WCPFC decision-making

2.1 Equitable access to science among CCMs

BMIS supports equitable access to bycatch science information for WCPFC CCMs (Members, Participating Territories and Cooperating Non-Members) and other stakeholders with limited science capacity. Small island developing state CCMs and participating territories with limited dedicated bycatch mitigation, management or stock assessment science capacity can access the same curated evidence base as well-resourced delegations, supporting more substantive engagement in Scientific Committee (SC), Technical and Compliance Committee (TCC), and Commission processes.

WCPFC provides links to BMIS from these pages on its website:

- Key Documents <https://www.wcpfc.int/about/key-documents-library-policies-procedures-and-regulations>
- Sustainability/ Bycatch <https://www.wcpfc.int/sustainability/bycatch>

¹ Relevant convention text & guiding international agreements outlined in Section 1.2 Fitzsimmons et al (2017)

2.2 Cross-RFMO coherence

The global coverage of the BMIS facilitates rapid and coherent comparison of bycatch CMMs across the tuna RFMOs. This coverage benefits WCPO fisheries managers, researchers and policy workers by making it easier to:

- a. identify gaps in current WCPFC bycatch CMMs that are identified and addressed by the CMMs in other tuna RFMOs (see 2.3).
- b. connect with the research and management decisions of other tuna RFMOs.
- c. provide a single, consistently maintained information system that reduces the risk of conflicting technical advice to industry.
- d. supports the development of harmonised management and mitigation guidance across tuna RFMOs where practical.

2.3 Development, Implementation and Review of WCPFC Conservation & Management Measures

The BMIS supports the development, implementation and ongoing review of CMMs. It concentrates bycatch mitigation and management literature in one place and is easy to use. Its features include:

- **Global** – covers all ocean basins and all five tuna RFMOs
- **Structured** – a knowledge base organised by practical categories (references, mitigation techniques, regulations, management)
- **Comprehensive** – spans the four highly migratory bycatch species groups of interest to the WCPFC²
- **Reference coverage** – captures both peer-reviewed and grey literature, with an emphasis on tuna RFMO ecosystem and bycatch meetings, working groups and similar. Much of the operationally relevant evidence on bycatch mitigation and management sits in RFMO working and information papers - material that is poorly indexed in conventional bibliographic databases
- **Mitigation-focused** – emphasises mitigation techniques and their efficacy, providing summaries of recent research alongside access to original documents. Promotes best practice advice
- **Analytical** – provides access to meta-analyses, which are particularly useful for understanding the complexity around techniques such as circle hooks and bait type
- **Multi-disciplinary** – collates research across diverse fields such as sensory biology, population modelling, risk assessment, dynamic spatio-temporal management, gear construction and testing, economic and social analysis
- **Cross-referenced** – linked to by other organisations

² By contrast, many websites focus on one taxonomic group, e.g., ACAP, Birdlife International, International Whaling Commission, IUCN Sea Turtle group, Manta Trust

- **Concise** – as a curated database, it is much less noisy than tools such as Google Scholar and, at this stage, more reliable than AI-generated reference lists
- **Current** – ongoing updates keep it current, including emerging technologies such as [traplines](#) (meka rings/ lazos) and eDNA, and growing concerns such as climate change and marine pollution
- **Efficient** – (i) reduces time spent trawling scattered and fast-moving literature and (ii), lets researchers and managers scan abstracts from adjacent fields and encounter novel ideas that may enhance their work

The BMIS keeps track of what bycatch-mitigation approaches exist and what evidence supports them, what's been tried, where, and how well it worked. It consolidates both existing (active, partially active, agreed – not yet active) and superseded regulations from all tuna RFMOs, making it easier to access rules from elsewhere. This allows WCPFC managers to learn from what has worked elsewhere and evaluate how well WCPFC is doing in comparison with other RFMOs.

2.3.1 Implementation and ongoing review of WCPFC Conservation Measures

Once a CMM is in place, BMIS supports its implementation and ongoing review. The regulations section allows users to access and download the PDF of the CMM and its supplementary documents. From the CMM webpage, managers, observers and fishers can link through to information about the mitigation techniques referred to in the CMM (Figure 1). For example, BMIS provides links to species identification guides (important in data quality) and safe handling and release guides. These include gear specifications (such as appropriate equipment to keep on deck) and illustrated instructions for handling different species groups.

SC and its themes (EB - Ecosystem and Bycatch, SA - Stock Assessment, MI - Management Issues) regularly assess the technical basis for bycatch CMMs. The BMIS simplifies the process of compiling literature by providing a stable reference point with all information available in one place. It provides ongoing updates of the evidence used to formulate CMMs, as well as identifying new, pertinent research and advice. New advice added to the database may be used to prompt review.

Figure 1 BMIS webpage for WCPFC CMM-2025-06 Conservation and Management Measure for Sharks

CMM 2025-06

Regulation Type

Conservation & Mgt Measure

Agency

Western and Central Pacific Fisheries
Commission

Mitigation Techniques

Monofilament / Wire Leaders
Safe handling & release
Spatial & temporal measures

Species Groups

Sharks and Rays

Fishing Gear

Longline
Purse Seine

Replaces Regulation

CMM 2024-05

Status

Active

Date Adopted: 05/12/2025

Date into Force: 03/02/2026

PDF of the Regulation

CMM 2025-06 SHARKS

Regulation Title

Conservation and Management Measure for Sharks

Description

- FAO International Plan of Action - Sharks
- Full utilization of shark and prohibition of finning
- Minimizing bycatch and practicing safe release (Reference to Shark Safe Release Guidelines)
- Species specific requirements - Oceanic whitetip and silky sharks (non-retention), whale sharks (avoid setting on whale sharks; safe release)
- Reporting requirements
- Research
- Capacity Building
- Review

Supplements:

- [Guidelines for the safe release of encircled whale sharks](#)
- [WCPFC Best Handling Practices for the Safe Release of Sharks \(other than Whale Sharks and Mantas/Mobulids\)](#)

Comment

To be reviewed in 2027

3 Compatibility and Integration with Artificial Intelligence

3.1 Overview

3.1.1 Search Engines vs AI summaries

The BMIS website employs traditional Search Engine Optimisation (SEO) strategies such as keywords and site mapping to improve its rankings in search engine results (i.e. to increase its visibility in standard web-search practices by web-users). However, it is well set up for 'generative' or 'answer' engine optimisation (GEO/AEO). The latter emphasises structuring content so that it can be parsed, summarised, and referenced by AI systems.

Standalone AI-powered assistants (Large language models (LLM) such as ChatGPT, claude.ai, Gemini and Copilot) are increasingly being used for information seeking. These tools however are only as reliable as the information they are accessing. The attributes outlined in Section 2.3 which make the BMIS useful for developing, implementing and reviewing management measures also accommodate LLM methods. The BMIS is one of few comprehensive, structured knowledge bases focused on bycatch mitigation in tuna

fisheries. Resources of this kind - curated, well-organised, and rich in scientific content - are potentially valuable as material for training large language models and for aggregation into other databases. The BMIS is routinely crawled by automated agents, and the BMIS has experienced substantial bot traffic.

Google's own documentation suggests that site visitors coming from AI overviews are 'higher quality' (meaning visitors are more likely to spend time on a site) than traditional search users³. In the case of the BMIS, this is expected to translate as fewer visitors but a higher proportion of those directly accessing the information they are seeking from the database.

3.1.2 Crawler/ Bot traffic – BMIS data harvesting

The BMIS experienced a dramatic increase in direct traffic at the start of October 2025, with most originating in China and, to a lesser degree, Singapore and Vietnam. The traffic pattern indicated automated crawler, bot, or scraper activity: 'users' systematically crawling all reference pages (4,300) and following links to discover further content but extracting text and metadata within seconds per page.

In March 2026, the Pacific Community (SPC) deployed Cloudflare to block most of these bots to maintain integrity of its site analytics. This presents a conundrum. While the bots wreaked havoc with site analytics, they caused no downtime for the BMIS website and had no impact on real users. At the same time, the harvesting of BMIS content allows the material to be used for training LLM and supports its wider dissemination.⁴

LLMs draw on content by two distinct routes: inclusion in the data used to train a model, and live retrieval of indexed web pages at the time a query is answered. The relative importance of each varies by platform. Broad accessibility of BMIS content increases the likelihood of it informing responses from AI tools. In effect, the BMIS is a potential source of quality data for these systems, one which can add value to AI query responses and support a wider dissemination of bycatch reduction information.

3.2 AI and decision making

Good decision-making still requires human skills: judgement, context, negotiation, and accountability. At this stage, AI must be used carefully, as errors are not uncommon. But used in conjunction with material collected in the BMIS, it can boost productivity, assisting with a range of analytical tasks.

When reviewing a management measure (for example, in a workshop), using the BMIS and AI together can support evaluation and discussion. From the 'Regulations' search page, measures can be filtered (e.g., active shark measures from all tuna RFMOs) and the PDFs downloaded. Once uploaded into an LLM, these documents can support a wide range of requests - among them, tabulating provisions by RFMO, such as wire leader restrictions,

³ There is a growing body of research on AI conversion rates, e.g., [Marketix](#).

⁴ Based on advice obtained from [Eighty Options](#)

retention policies, or safe handling and release requirements. This makes it quicker to examine the approaches used; identify global differences, gaps, and inconsistencies; and avoid duplication of research effort or pinpoint areas for collaboration.

3.3 BMIS Analytics

Google analytics shows that the BMIS website is receiving a steady flow of referrals from LLM. However, there's no public, reliable way to measure how often the BMIS, or any specific website appears in LLM query responses. The major LLM providers (OpenAI, Anthropic, Google, etc.) don't publish data on which sources their models cite or surface in responses. There's no equivalent of Google Search Console for LLM outputs.

Initial assessment of BMIS organic search visitation suggests a small decline when comparing the six months to 31 March 2026 against the prior period. Active users fell 6.5%, though with considerable variation between countries. Average engagement time per active user and event counts both dropped by around 20%, again varying widely by country. Overall visitor engagement rate (views, clicks, downloads, scrolls) was down just 2%. Average search position - where BMIS links appear in Google results - improved, likely driving a large rise in search impressions (up 121%), though without a corresponding increase in clicks.

3.3.1 Citations

Citations help clarify how the system is being used. An initial review confirmed 86 Google Scholar-sourced citations for “bmis-bycatch.org”⁵ since 2022. These indicate that the BMIS user base is broad, encompassing scientists, academics, doctoral and master's students, fisheries managers and others from industrialised and developing nations worldwide, including the WCPO.

Citations of the website address are only a partial indication of usage, for two reasons. Traditional citation indexes are built to capture references to indexed publications (DOIs /papers) rather than to a URL, so they often miss bare website citations in reference lists. In addition, visitors may discover references within the BMIS but then cite the source material itself.

To encourage more authors to cite the BMIS as a source if they accessed and used content, a request to do so has been placed on the References 'Read More' page.

⁵ Citations for variations such as 'Bycatch Mitigation Information System' not included here. The 86 citations do not capture most tuna RFMO papers that have cited the BMIS.

4 Redevelopment plans

4.1 Website Currency and Redesign

The BMIS website is hosted by the WCPFC. The underlying site architecture (Drupal/PHP/MySQL) is current and compatible with the WCPFC environment. This also facilitates future data sharing with the WCPFC website, should the need arise.

In WCPFC-SC15-2019/EB-IP-01 a workplan for the BMIS identified that “in approximately 2025, a complete revisit of the layout and currency of BMIS with a view to substantive redevelopment” should occur. A recent, limited review of the site has led to plans for a minor update (valued at USD10,000).

The site needs a visual refresh, particularly the Home page. The visible design patterns are dated but functional and other pages will not significantly alter. Work is also needed to fix errors and improve administrative tools. In summary:

- Add icons/ links for BlueSky and LinkedIn; remove references to Twitter/X
- New content section – add a ‘dynamic’ section highlighting new reference material, updated mitigation techniques and regulations; this promotes new content and keeps the site looking active.
- Statistics – in brief to highlight site content.
- Remove the “Contact Us” form, replacing it with short text to direct visitors to reach out via email or social media.
- References – add options to select more than one mitigation or management technique.
- Regulations – add ‘description’ to CSV export file.
- Update Site map to reflect changes.
- Fix the ‘backend’ – administrative modules - of the BMIS.

Future redevelopment should consider improving **search functionality**, particularly for references and regulations, and modernizing the visual design.

4.2 Social Media

Until recently, ‘X’ has been the sole social media option used to promote BMIS content. However, ‘X’ is no longer an effective means of promotion⁶ and Bluesky @bmis-bycatch.bsky.social is under trial as an alternative. To date there has been limited engagement with the BMIS Bluesky account. While posts have been made to a science stream, those who have responded are mainly from a general audience, rather than a fisheries orientated one.

With the upcoming redevelopment of the BMIS, an ability for users to share content via **LinkedIn** will be added. LinkedIn has a significant, active fisheries science community, with major organisations such as NOAA, the Australian Fisheries Management Authority,

⁶ See Shiffman and Wester (2025) for trends in use of social media by scientists

fisheries science journals and universities with fisheries programs posting. Also present are government scientists, consultants, academics, and NGO staff. Fisheries scientists share professional resources, including new research, tools, and guidelines they've found. Having LinkedIn would enable organisations and individuals to share BMIS content among colleagues and their wider professional networks (including people not actively searching for bycatch info). While the BMIS coordinator can post to LinkedIn, resources are very limited and relying on organic sharing is efficient.

Note that ACAP has recently engaged a communications consultancy to advise them “on strategic communications options designed to support the uptake and implementation of seabird bycatch mitigation measures” (ACAP 2026). As part of this the consultants have suggested using LinkedIn.

4.3 BMIS Resourcing

Resources for curation and maintenance of the BMIS expired in June 2026. Initial financing was provided by WCPFC and the ISSF before a more substantive investment under the GEF-FAO Common Ocean I project. Since 2019 resourcing has been provided by SPC through small contributions from various SPC donors. Resourcing has typically been in the range of USD15,000 to USD50,000 in any year. The current yearly budget to curate, maintain and administer the BMIS is USD42,000.

5 Recommendations

BMIS is an established resource with an active editorial process, global coverage and an existing user base across WCPFC fisheries managers, national agencies, WCPFC CCMs, NGOs, industry, other RFMOs and research scientists. The sections above describe proven benefits to WCPFC bycatch management objectives.

1. Financial Support is required to keep the BMIS active. WCPFC engagement through funding will keep the resource available for WCPFC activity and accessible to all members.
2. Policy direction is required to manage crawler/bot traffic. These agents can slow web-based information systems and in some cases create IT security risks, although there is no evidence that crawler/bot activity is currently affecting BMIS performance. Blocking them, however, prevents harvesting by AI models and would likely compromise information dissemination through AI-powered search tools. In the absence of a policy on crawler/bot access, SPC has implemented blocks as a precaution. WCPFC guidance on the appropriate balance is required.

6 Declaration of Generative AI and AI-assisted Technologies in the SC paper Preparation Process

During the preparation of this work the authors used claude.ai to draft and edit text. All conclusions are those of the authors, who reviewed and verified all AI-assisted output.

7 Acknowledgements

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