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Bycatch Management Information System (BMIS): redevelopment update

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1 Introduction

A comprehensive overview of the redevelopment of the Western and Central Pacific Fisheries Commission (WCPFC) Bycatch Management Information System (BMIS)¹ was tabled at the 2017 Scientific Committee meeting (Fitzsimmons et al., 2017). The work under the final year of funding from the FAO Common Oceans (Areas Beyond National Jurisdiction - ABNJ) Tuna Project is now underway. This paper provides an update on project tasks, integration of regional bycatch data summaries (BDEP tasks), performance of the new website/database platform, and future directions, including funding. Feedback from the recent workshop on WCPFC bycatch mitigation problem-solving (see Common Oceans (ABNJ) Tuna Project, 2018) is also addressed.

1.1 BMIS

The WCPFC Bycatch Management Information System (BMIS) is an online resource for fisheries managers, scientists, fishers, educators and the public. The database consolidates information on the mitigation and management of species of special interest, including seabirds, sharks and rays, marine turtles and marine mammals, incidentally caught in the pelagic tuna and billfish fisheries of the Western and Central Pacific Ocean (WCPO). It is currently funded from the FAO Common Oceans (Areas Beyond National Jurisdiction -ABNJ) Tuna Project. BMIS was redeveloped with a global focus (www.bmis-bycatch.org) and re-launched in May 2017.

The new BMIS offers a broader range of curated material, retaining an emphasis on mitigation techniques and their efficacy, while expanding management topics to issues including data harmonisation, bycatch threats and interaction rates, population-level assessments and fisheries management performance. It highlights information on species identification, given its role in data quality and compliance, and on safe handling and release, which affects post-release survival rates. A logo, social media (Twitter) and a 'Bycatch Bytes' blog have been added. The new database platform has significantly improved data entry and real-time update and provides flexibility for future development. As of 30 June 2018, there were over 1500 references in the BMIS.

1.2 Public Domain Bycatch Data

The Bycatch Data Exchange Protocol (BDEP) is essentially a public domain regional bycatch data summary in a standardised format. Subsequent to discussions at SC13, some BDEP work has been integrated into the BMIS project, including reporting on progress with BDEP related tasks.

The concept of a BDEP amongst the t-RFMOs was raised at WCPFC Scientific Committee (SC) 11, and SC11 agreed to proceed with the WCPFC component of a BDEP (subject to resourcing from the Common Oceans (ABNJ) Tuna project, and subject to WCPFC data confidentiality rules) (paras. 654-657, Anon., 2016). In response to the WCPFC SC11 recommendation, The Pacific Community (SPC), with resourcing from the Common Oceans (ABNJ) Tuna project, prepared and formatted the bycatch data it holds into the BDEP template as described by "Proposal for a Bycatch Data Exchange Protocol (BDEP) amongst the t-RFMOs" (Clarke et al. 2015). Williams et al. (2016) reported on the methods for compiling the template, issues identified in compiling the data, and recommended future work. WCPFC SC12 recommended that the trial of BDEP be continued in 2017 and 2018 (Anon., 2017a) and this was endorsed by the WCPFC (Anon., 2017b.). However, due to a combination of no new WCPFC funding and competing priorities, and despite additional funding being available from ABNJ, 2017 work was largely limited to the no cost option of publishing BDEP as public domain information on the WCPFC web site, and issues arising in compiling the data were identified in the generic data gaps paper (Williams, 2017)).

¹ The BMIS can be accessed at www.bmis-bycatch.org. Subscribe to the BMIS Twitter feed [@BMIS_bycatch](https://twitter.com/BMIS_bycatch).

Fitzsimmons et al. (2015) noted that the BMIS would be a useful, central location to present RFMO summary bycatch data, should this become available. The development of the BDEP tables within several RFMOs also supports this. The feature depends on first being able to source the relevant data from the various RFMOs. The second is being able to manipulate the data into a common format so that tables and graphs for exploring the combined datasets can be automatically generated. At SC13 it was recommended that the WCPFC BDEP tables (Williams et al., 2016; Williams et al. 2017)) also be made available via BMIS.

2 Update on BMIS website & database platforms, social media (2017-2018)

Since the relaunch, the BMIS website has been widely used, with more than 5,100 unique visitors and more than 23,700 page views. Visitation² has improved since the relaunch. Over the first 6 months there were an average of 281 unique visitors (1138 page views) per month, compared with the most recent 6 month period averaging 465 visitors/ 2445 page views per month (in part influenced by the WCPFC bycatch problem-solving workshop). Return visitors accounted for about 13% of total visits over the past 6 months. Over the same period, 21% of visits to the site were from direct hits (people had typed the address in), 65% resulted from organic searches (search terms not known), nearly 12% were referrals (mostly from the WCPFC website) and 2% were from social media (majority Twitter). With regard to Twitter (see Section 2.1.2), it is possible that someone who sees a BMIS tweet but doesn't engage (counts as an impression³), may - at some future time - use the knowledge in a direct or organic google search to find the site. This would be useful to measure through online analytic tools.

The most popular pages were those for references (about 4 minutes per page) and mitigation techniques (more than 2 minutes per page). Of most interest among mitigation techniques were the descriptions for circle hooks (perhaps due to the WCPFC bycatch problem-solving workshop) and ALDFG (abandoned, discarded and lost fishing gear; these visits were spread evenly over the 6 months).

A Google search on the term 'bycatch mitigation' returns BMIS at the top of the list. However, using 'bycatch reduction' or 'bycatch' does not result in BMIS at the top of the results. Addressing this issue would serve to improve site visitation and investigating how to do so is part of the future workplan.

2.1.1 Social media and site promotion

The BMIS Twitter account [@BMIS bycatch](#) was created in mid-2017. The account is used to promote the website, drawing attention to new and existing material on the website and linking the website to other activities (individuals and organisations) in the larger sphere of bycatch management in tuna fisheries. Importantly, it serves to keep the website looking 'fresh' and active, rather than stale. Bycatch Bytes provides an avenue for more in-depth bycatch features. Both Twitter and Bycatch Bytes provide opportunities to promote t-RFMO bycatch management (see Section 5).

Over a three month period from mid-April to mid-June 2018 @BMIS_bycatch earned a total of 15,500 impressions³ and averaged one link click per day. Tweets and re-tweets are varied, covering new research added to the BMIS, meetings (such as ACAP or RFMO scientific meetings) bycatch news from blogs or news reports, and frequently, relevant tweets from people/organisations that BMIS follows. Re-tweets are most valuable when they can be used to promote the BMIS by including a caption that links the retweet to material in the BMIS, thus inviting engagement with the website. This is particularly effective when retweeting an item from someone with many followers.

Regular, sustained posting has a positive impact on visits to websites and also helps to retain followers. Regular monitoring of Twitter analytics helps to improve the quality/impact of tweets as they reveal

² Visitation is a measure of the number of visitors to the site, whether the person uses just the landing page or several pages, they count as one visitor.

³ Impression means the number of times a user is served a Tweet in timeline or search results.

which posts are most interesting to people (e.g. eco-FAD stories are very popular, as is shark bycatch). Over the next five months, we aim to increase the number of followers, impressions and engagement with the website. Our strategy includes consistently following the techniques outlined above, ‘following’ more accounts and researching/adopting other helpful techniques, such as [Twitter cards](#).

Bycatch Bytes is intended to showcase recent developments in bycatch management, e.g., new or improved mitigation technologies, or notable research projects underway. To date, it has not been possible (using Google Analytics) to gauge the number of ‘hits’ for Bycatch Bytes. Over the next five months, the BMIS team will devote more effort into posting stories and evaluating user interest in order to assess the impact of the Bycatch Bytes feature.

2.1.2 Zotero

Zotero (<https://www.zotero.org>) is the open source reference management software behind the BMIS library. In late 2017, the Zotero 5.0 ‘standalone’ upgrade was introduced. Zotero no longer appears as a tab in Firefox. Instead, a Zotero icon appears in the browser pane (Firefox, Chrome or Safari) after the appropriate connector, i.e., add-on, has been downloaded and installed. The transition did not cause any problems for the BMIS as the web API remained the same. Cloud based, systematic Zotero backups have been instituted using ‘Syncback’ software to allow a mirror copy of the main Zotero files to be backed up and shared via Google Drive.

Zotero was used at the recent WCPFC bycatch problem-solving workshop to share copyrighted references among workshop participants, an example of how the redevelopment BMIS can be of considerable benefit to users. Zotero will continue to be the reference management software for BMIS and the BMIS team will put effort into ensuring all Zotero features are understood and utilised in the future work on BMIS.

3 WCPFC bycatch problem-solving workshop

The WCPFC bycatch problem-solving workshop (hereafter referred to as ‘the workshop’) was held at SPC in Noumea, New Caledonia, from 28-30 May 2018 (Common Oceans (ABNJ) Tuna Project, 2018). The workshop provided peer-review of the new BMIS. Feedback on the BMIS from the workshop, BMIS team initial responses as derived from discussions during and post-workshop, and subsequent actions, if any, are summarised in Table 1. Some feedback items were already under consideration by the BMIS project team and those are discussed in more detail in the following sections.

Table 1. Feedback and questions from the WCPFC bycatch problem-solving workshop, with corresponding responses and subsequent follow up.

| Feedback/ query | Initial responses/Subsequent actions |
|---|---|
| a. Are there plans to make the BMIS available in different languages | <ul style="list-style-type: none"> • Technically possible (Drupal platform would support necessary changes to user interface) • No change in short term primarily because core scientific references in BMIS will continue to be published in English |
| b. What are the criteria for inclusion of species in the species lists? Can background information on each species be included (including how they are affected by bycatch)? For example: www.bmis-bycatch.org/bycatch-species-groups/seabirds | <ul style="list-style-type: none"> • Species lists included in the BMIS on the species pages are derived from other databases • Explicit criteria for inclusion will be developed (with a default to relevant international organisations where they exist, e.g. ACAP) • For each species group, explanatory text pointing to sources of biological and distribution data has been added (e.g., for seabirds, links to ACAP and BirdLife International species data portals) • Links to Species ID guides will be added • Bycatch data for individual species will be addressed as part of the BMIS bycatch summary data mapping project, and integration of BDEP tables |

| | |
|---|--|
| <p>c. Provide forum for management practitioner insight (e.g. management experiences, case studies, lessons learnt, 'tips & tricks') for exchange between fisheries managers in different countries</p> | <ul style="list-style-type: none"> • This is able to be done with the existing platform and would make BMIS more interactive • Such forums require moderation and there is currently insufficient resourcing to support moderation • As part of the engagement strategy with t-RFMOs and other organizations, options for resourcing this will be explored |
| <p>d. Criteria for inclusion of references in the BMIS?</p> | <ul style="list-style-type: none"> • The current scope is material relevant to tuna bycatch issues • Currently seek to provide comprehensive coverage of peer-reviewed and grey literature (including from RFMO scientific/ecosystem etc. meetings) • Scope to be expanded to cover gill net as there are major gill net fisheries for tuna in the Indian Ocean with bycatch challenges |
| <p>e. Search results – when a long list of results is returned, how does a user determine which references are most relevant?</p> <ul style="list-style-type: none"> - Prioritise references rather than filter - Use star rating system - Identify refs used as key supporting refs when t-RFMO adopts a CMM - Show number of 'downloads' or 'reads' | <ul style="list-style-type: none"> • Work is underway to prioritise search results (most relevant returned at the top of the list) for both the mitigation technique and references search databases • This involves deciding what the basis is for prioritization, and then determining how to achieve this technically • Trials with the mitigation technique database have improved the order of search results but further refinement is required • Google web Application Programming Interface may be able to help with the number of reads for a document, though generally this will work better for peer-reviewed documents • A star system and showing reads/downloads will be investigated |
| <p>f. Improve site navigation and guidance and provide training (in use of BMIS)</p> | <ul style="list-style-type: none"> • BMIS team will endeavour to provide more on-screen guidance (e.g. hover text, meta-ribbon) • Ensure target groups are aware of the BMIS and know how to use it • Explore options for BMIS training sessions utilizing the scenario approach to be built into future Stock Assessment Workshops |
| <p>g. Provide guidance on safe handling & release techniques, including video content</p> | <ul style="list-style-type: none"> • BMIS team will explore hosting (including the option of simply linking to YouTube) and curation of video within the existing technology, and if necessary identify development needs and costs associated with incorporating videos into BMIS • Subject to development and costs issues being addressed, training videos will be added as they become available |
| <p>h. Explore potential for SPC's library to support access to copyright protected papers for developing countries</p> | <ul style="list-style-type: none"> • SPC's library will be approached to explore BMIS obtaining developing countries access to special subscription rates (low cost or free) for currently-pay-for-view references • The United Nations (UN) programme "Online access to research in the environment" (OARE) will also be approached |
| <p>i. Promote the website at national and regional levels</p> | <ul style="list-style-type: none"> • Promotion is a key focus of the workplan in 2018-19, in particular a t-RFMO engagement strategy will be developed and implemented • Part of the strategy will be to identify champions for wider promotion across t-RFMOs and this has already commenced |
| <p>j. Position as tool to share information across tuna RFMOs (& possibly other regional organisations)</p> | <ul style="list-style-type: none"> • Requires improved RFMO engagement and potentially, additional features (already technically possible for external contributors to be given administration rights to update and upload information such as mitigation technique descriptions) • Administration rights are already multi-layered, so functionality in place • How, where and when will be addressed through the t-RFMO engagement strategy • As a first, informal step, a new 'Public, Closed Membership', Zotero group called 'Tuna RFMOs BMIS portal' has been created to enable RFMO contact points⁴ (by invitation only) to contribute references, both peer-reviewed and grey literature, to the BMIS (this still needs approval from the respective RFMOs, but, the functionality now exists) • In an initial trial period contributions will be moderated by the BMIS team until such time as quality is assured |
| <p>k. Support the planned inclusion of a tool for global queries based on RFMO data available in the public domain such as BDEP</p> | <ul style="list-style-type: none"> • BMIS team note support for the planned inclusion of a tool for global queries based on RFMO data available in the public domain such as BDEP • Terms of reference for this work will be developed in August 2018 |

⁴ This may be Secretariat staff, working group convenors, scientific service providers or nominated experts, dependent on the particular tRFMO. Such decisions may have resourcing implications.

| | |
|--|--|
| k. Support the planned inclusion of a tool for global queries based on RFMO data available in the public domain such as BDEP | <ul style="list-style-type: none"> The BMIS team note that synergies with ongoing initiatives in other tuna t-RFMOs should be explored with a view to avoiding duplication, and this will be informed through the t-RFMO engagement strategy |
| l. Develop strategy for long term resourcing of BMIS | <ul style="list-style-type: none"> The BMIS team will develop a strategy for long-term resourcing of BMIS during the remaining work period (until August 2019) At a minimum, hosting of BMIS will continue through SPC in the medium-term. |

4 Update on project tasks

4.1 Bycatch summary data and mapping, including BDEP data visualisation

Fitzsimmons et al. (2015) noted that the BMIS would be a useful, central location to present RFMO summary bycatch data, should these become available. The development of Bycatch Data Exchange Protocol (BDEP) tables (Williams et al. 2016, 2017) within IOTC (Clarke and Smith, 2018) and CCSBT suggest positive movement in this direction. One objective might be to manipulate the data into a common format so that tables, graphs and maps for exploring the combined datasets can be automatically generated. Given the spatial and temporal scale of bycatch information, visual representations (maps) of the data can be particularly useful when attempting to understand management implications.

For an example of the presentation of summaries of fishing effort, observer coverage, bycatch events and estimated total bycatch, readers are referred to the website of the New Zealand research provider [Dragonfly](#). The interactive website allows users to examine bycatch species, fisheries, areas and years of interest, highlighting where further research, observer coverage and management may be appropriate. Taking a similar approach will improve access to species-specific information for users, a recommendation from the WCPFC bycatch problem-solving workshop (Section 3). This work will also integrate the shark data inventory browser and provide a platform for ongoing incorporation of shark data visualisations.

SPC has progressed the development of a Request for Proposals which includes the work required to be completed in developing mapping and incorporating BDEP tables into BMIS (see also Section 4.2). Proposals received have been evaluated, and the final recommendation is awaiting formal approval by SPC administration. The SPC BMIS team has commenced writing technical specifications for the work; a contract to complete the work should be in place by the end of August 2018.

4.2 BDEP work in 2017-18

4.2.1 *The BDEP tables*

The annual WCPFC BDEP tables have been prepared and are noted in Williams (2018), and are available on the WCPFC BDEP page at: www.wcpfc.int/node/29966. The additional work undertaken and recent developments with respect to enhancements and availability of BDEP data include:

- ROP observer data from several national programmes not previously available have been loaded recently (e.g. Japan, Korea, and USA for recent years);
- a backlog of observer data entry has been advanced (SPC resolving); and
- reconciliation of data recorded on species of special interest form (GEN-2) and normal catch monitoring forms highlighted gaps in SSIs not recorded on normal catch monitoring form and these gaps have now been resolved⁵.

⁵ The SPC/FFA Gen-II form was introduced in 2003. Observers were instructed to record catch events of species of special interest (SSIs) on both the LL-4 form and the Gen-II form, with the GEN-II form intended to provide additional information on the event. A comparison of LL-4 and Gen-II data indicates that some observers did not record all SSI catch events on the LL-4 form. Review of available data indicated that there were a small number of additional GEN-II catch records (representing ~ 60 individuals) from 2003 to 2010 that had not been successfully

A direct consequence of all of this work is a doubling of available longline observer data in the BDEP tables for 2013 and 2014, and notable improvements for longline in 2015 and 2016 (Table 2). For the purse seine fishery there are improvements in all years, with the improvement in 2016 particularly notable (Table 2).

| 2017 BDEP Data | | | | | 2018 BDEP Data | | | | |
|----------------|---------|--|-----------------------|-------------------|----------------|---------|--|-----------------------|-------------------|
| Calendar Year | Fishery | Total Effort (LONGLINE: Hooks PURSE SEINE: Sets) | Total observed effort | Observer Coverage | Calendar Year | Fishery | Total Effort (LONGLINE: Hooks PURSE SEINE: Sets) | Total observed effort | Observer Coverage |
| 2013 | L | 1,007,843,511 | 10,972,601 | 1.10% | 2013 | L | 1,012,735,732 | 22,324,430 | 2.2% |
| 2014 | L | 1,041,829,254 | 10,837,161 | 1.00% | 2014 | L | 1,045,076,076 | 20,682,112 | 2.0% |
| 2015 | L | 1,108,528,037 | 15,790,034 | 1.40% | 2015 | L | 1,102,994,869 | 21,254,860 | 1.9% |
| 2016 | L | 1,056,020,829 | 15,019,975 | 1.40% | 2016 | L | 1,044,268,441 | 18,107,763 | 1.7% |
| | | | | | 2017 | L | 897,143,360 | 13,867,560 | 1.5% |
| 2013 | S | 64,338 | 36,770 | 57.20% | 2013 | S | 64,338 | 38,679 | 60.1% |
| 2014 | S | 65,075 | 32,985 | 50.70% | 2014 | S | 65,630 | 37,503 | 57.1% |
| 2015 | S | 56,051 | 27,865 | 49.70% | 2015 | S | 55,649 | 31,997 | 57.5% |
| 2016 | S | 53,931 | 17,622 | 32.70% | 2016 | S | 52,799 | 26,828 | 50.8% |
| | | | | | 2017 | S | 56,680 | 10,802 | 19.1% |

Table 2: BDEP data in 2017 and additions in 2018 (Source: Williams et al., 2017; Williams, 2018; WCPFC BDEP at www.wcpfc.int/node/29966).

Indirectly, considerable additional work has been completed by SPC that identifies issues in the bycatch data (see Peatman et al., 2017; Peatman et al., 2018a; and Peatman et al., 2018b). The recommendations in those papers feed into progressing the BDEP workplan.

4.2.2 The BDEP Workplan

Williams et al. (2016) identified nine tasks for further work on BDEP. SC12 recommended proceeding with a no-cost option which included Task 1 – *Continue BDEP Trial*, and Task 2 – *Publish BDEP on the WCPFC website* (Anon., 2016, paragraphs 838-841). Williams et al. (2017) reported that Tasks 1 and 2 had been completed and recommended this work be normalized into the ongoing work of the WCPFC (which was endorsed by SC and has occurred as reported in Section 4.2.1). They also reported the resolution of Task 5 - *Request vessel identities in observer data where missing*. Subsequent to SC13, Task 3 - *Estimating mortality rates for purse seine* has been resolved as reported above (and through the Peatman et al. (2017) analysis and the Peatman (2018a) update).

Williams et al. (2017) also reported progress on remaining tasks and since SC13 further progress has been made as follows:

- Task 4 - *Providing tables of observer effort by 5°x5°* has been completed for longline (see WCPFC BDEP at www.wcpfc.int/node/29966), with the work on purse seine to be completed in 2018;
- Task 6 - *Report seabirds to the species level, where possible* has been progressed with the exploratory analyses for work to date under Project 68 (Peatman and Smith, 2018) and will be completed in the 2019 BDEP update (see also footnote 5);
- Task 8 - *Review and update length-length and length-weight relationships for SSIs* has been progressed considerably with the review work on L:L and W:W data holdings and a future workplan identified in Williams and Smith (2018), and subject to resourcing will be completed in the 2019 BDEP update;

migrated to SPC’s existing master observer data. This has been resolved as of 10 July 2018. The 2016 revision of the GEN-II form will prevent these issues from occurring in the future.

- Task 7 - *Expand the BDEP protocol to marine mammals to the species level, where possible, has made limited progress with an approach identified and this work will be completed in the 2019 BDEP update; and*
- Task 9 - *Undertake a trial regional BDEP compilation for purse seine at the scale of the Pacific Ocean, in co-operation with the IATTC and CCSBT Secretariats, has progressed slightly with the IATTC public domain data accessed, and consideration of those informing the inclusion of an Application Programming Interface (API) into the development of a technical terms of reference for the work in Section 4.1, and, preliminary discussions with the CCSBT Secretariat underway.*

In summary, four of the nine BDEP tasks identified at SC12 have been completed, and there has been substantive (three) or some (two) progress on the remaining five tasks. With the goodwill of other t-RFMOs, it is planned to complete all tasks by the end of this project. This BDEP work continues as a positive step toward improving the quality of and access to WCPFC bycatch data.

4.3 Peer review

Peer review of BMIS is an ongoing work stream. In 2017-18, four components of peer review were undertaken: pre-workshop review; FAO review; workshop peer review (see Section 3); and, further development of the processes for external peer review of content.

4.3.1 Pre-workshop review

Prior to the workshop, the convenors provided considerable input on BMIS functionality, especially with respect to the workshop topics. This peer review focused on ensuring all elements of the website functioned as envisaged. This identified additional further improvements to species identification and safe handling (Section 4.3.1.1), search prioritisation (Section 4.3.1.2), and, content definition (Section 4.3.1.3).

4.3.1.1 Species identification and safe handling and release

One of the aims of the BMIS redevelopment was to give greater prominence to species identification (ID) and safe handling and release (SHR). This has been achieved through (i) text and links on the BMIS Home/ landing page, (ii) a page dedicated to [Species ID and SHR](#), (iii) the creation of 'Collections' for '[Species ID Guides](#)' and '[Safe handling & Release Guides](#)' in the References database and (iv) multiple cross-links, from different pages within the BMIS, to these guides and related reference material.

In preparation for the May 2018 WCPFC bycatch problem solving workshop (see Section 3), all reference items in Zotero tagged as 'SHR guidelines' and 'Species ID guides' were reviewed and the corresponding tags removed from items that weren't clearly guides. New guides for both species ID and SHR were added. Furthermore, access to guides was improved through the revision of website explanatory text & the inclusion of links to pre-filtered search results, e.g., (iii) above.

4.3.1.2 Search prioritisation

As part of the peer review provided by both workshop convenors and participants, the BMIS team has commenced a project with the website platform technical service provider (Eighty Options) to prioritise search results for both the mitigation technique and references search databases. Because some reference searches return very long result lists, it is not easy to immediately assess which are most useful and thus the aim is to return the most relevant results at the top of the list.

Improving results is not a straightforward task as firstly, the basis for prioritising references or mitigation techniques must be decided and then a technical fix found. Trials with the mitigation technique database have improved the order of search results but further refinement is required. Additional text on the

mitigation techniques landing page has helped to explain to users which mitigation techniques are effective in reducing bycatch for each species group.

The references database is more complex as a reference may be tagged to multiple mitigation techniques or management categories. A consistent method of assigning priority is required. Feedback from the workshop (Table 1) on how to do this included: using a star rating system; identification of references used by RFMOs to support adoption of conservation measures; showing number of downloads or reads for each reference.

4.3.1.3 Content definition

In response to peer review provided by both workshop convenors and participants, efforts are underway to better define information in the BMIS. For example, changes have been made to the BMIS Home page so that the reference and regulation databases are grouped together in the black ribbon banner. More on-screen guidance will be provided (e.g. hover text). Name changes for sections will be considered (for Regulations and Management). Management categories will be reviewed and input sought for the Population Level Assessments (PLA) categories. For example, it may be useful to add categories which would better describe literature on biological parameters and when updates have occurred, e.g. size and fecundity data.

4.3.2 FAO review

Prior to the workshop FAO resourced a technical review of the current BMIS content. The BMIS team will shortly commence work to address that useful review, noting that some of the material overlaps with the workshop feedback on species lists and species identification.

4.3.3 External peer review

On the external peer review of content, there are two components, subject matter expertise and cross tuna RFMO (t-RFMO) input (Fitzsimmons et al., 2017). Subject matter experts across taxa have been identified (a shark expert, a seabird expert, a turtle expert and very recently a cetacean expert) and discussions on the form of review and timing are at various stages of development. These reviewers will undertake an initial review as well as ongoing periodic review. It is intended that all initial reviews will be completed in 2018. One t-RFMO reviewer has been identified and agreed to conduct a review in 2018 and assist with ongoing review. Part of the future RFMO engagement strategy will be to arrange the external peer review by other RFMOs (and the Zotero t-RFMOs BMIS portal group may be useful in this regard (see Table 1, Row j).

5 Update on t-RFMO opportunities & future engagement

A considerable volume of t-RFMO material is already in the BMIS:

- t-RFMO [pages](#)
- t-RFMO [Regulations database](#)
- t-RFMO grey literature reference 'Collections', e.g., for [IOTC](#)
- t-RFMO [public domain data](#), and
- Twitter posts.

5.1 BMIS as a tool for cross RFMO engagement

BMIS has the potential to better facilitate cross t-RFMO engagement. External contributors can be given administration rights to update and upload information to the BMIS website, noting that the Zotero Tuna RFMOs BMIS portal group may be useful in this regard (see Table 1, Row j), although there are challenges

to address and, inevitably differing views on the best ways to present, maintain and access relevant information as discussed in Fitzsimmons et al. (2017)). Initial discussions with Secretariat staff in two other RFMOs have highlighted considerable support for BMIS and willingness to engage. To identify the tasks to be completed, a strategy for greater engagement among t-RFMOs will be developed in 2018 and implemented through 2018-19.

5.2 RFMO grey literature and regulations

New 'Collections' (a filter in the References database) were created for RFMO meetings that have a bycatch management focus, i.e., WCPFC Scientific Committee's Ecosystem and Bycatch Theme (SC), IOTC Working Party on Ecosystems and Bycatch (WPEB) and relevant IATTC and ICCAT groups. This gives RFMOs greater visibility within the site. References are tagged according to RFMO acronyms as listed above; however, in some cases these tags cover relevant papers from other meetings. For example, in the case of ICCAT, literature is garnered from the all-encompassing 'Collected Volumes of Scientific Papers' which publishes from all ICCAT meetings.

Within the BMIS Zotero library, each RFMO has a folder and under these, literature is filed by publishing year. By the end of 2018, the aim is to have reviewed and added grey literature from at least the last five years of meetings (this is well advanced). It would greatly improve the speed at which RFMO meeting documents are available in the BMIS if they are saved as Pdfs with embedded meta-data. RFMO regulations are also stored in Zotero. This helps BMIS administrators to keep track of when to check for new regulations. The engagement strategy will attempt to address such improvements.

5.3 RFMOs and BMIS social media

BMIS tweets alert users when significant new RFMO content is added, e.g., new/amended conservation measures, a particularly useful journal article, or a suite of papers from an RFMO meeting. Tweets generally include a direct link to the document(s) in the BMIS.

There is an opportunity for RFMOs to contribute articles for the BMIS Bycatch Bytes feature. An annual contribution would be very useful (subject to the intended review of Bycatch Bytes utility on an ongoing basis).

5.4 RFMO public domain bycatch data

Under the BMIS page 'Resources / [Other Bycatch Databases](#)', a separate section, 'RFMO Databases in the Public Domain', has been added at the top of the page. ICCAT's MS Access bycatch meta-database was downloaded but at the time was not functioning and could not be tested. It is proposed that the list of RFMO databases will eventually be superseded by BDEP through annually updated species bycatch data summary pages (Section 4.1 and 4.2 above).

6 Funding, work plan and future developments

The current BMIS project was scheduled to be completed in December 2018. As identified in Clarke and Smith (2018) there is now approved an opportunity for a no-cost extension through August 2019. This project plans to utilise the no cost extension to bring all tasks to completion. An end of project report will be submitted to SC15 in August 2019.

6.1 Ongoing maintenance

Keeping the BMIS current incurs ongoing costs. These include:

- Literature collection and curation;
- Update of mitigation technique descriptions and cross-taxa effects;

- Social media update - Twitter, Bycatch Bytes;
- IT – website security updates, site administrator changes to web pages; and
- Zotero cloud storage capacity fees.

6.2 2018-19 workplan

Work in 2018-19 will include the following tasks noting that the BDEP, mapping/visualisation, RFMO engagement, and peer review are considered highest priority:

- i. Ongoing maintenance tasks as above;
- ii. Improve Twitter presence and evaluate Bycatch bytes (analytics);
- iii. Undertake an update of STAGIS references ;
- iv. Increase RFMO grey literature holdings (at least last 5 years of meetings);
- v. Implement actions arising from workshop feedback;
- vi. Peer reviews completed and work to implement findings;
- vii. Search prioritization and content definition work completed;
- viii. Bycatch summary data tool developed (BDEP) with at least one other RFMO’s data incorporated;
- ix. RFMO engagement strategy completed and implemented;
- x. Mapping functionality developed and Shark Data Inventory Browser incorporated into data visualisations; and
- xi. BMIS promotional brochure completed.

A key project completion task in 2019 will be to write a summary report on BMIS, future development needs and opportunities, and an ongoing work plan.

7 Recommendations

We invite WCPFC SC14 to:

- note that the Bycatch Management Information System (BMIS) site provides a portal to >1500 curated references, species identification and safe release guides;
- note 2017-18 progress on BMIS and BDEP and the workplan through completion in August 2019;
- visit www.bmis-bycatch.org and give feedback (errors, missing or out-of-date information) or make contributions to info@bmis-bycatch.org and follow [@BMIS_bycatch](https://twitter.com/BMIS_bycatch) on Twitter now; and
- note the future developments for BMIS identified in this paper, and the future resourcing issues for of BMIS.

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9 References

- Anonymous. 2011. Report of the First Meeting of the Joint Tuna RFMO Technical working group on by-catch. La Jolla, California, USA -July 11, 2011. Accessed online at http://www.tunaorg.org/Documents/TRFMO3/RFMO%20TECH%20WG%20BY-CATCH_REP_ENG.pdf
- Anonymous. 2016. Report of the Twelfth Regular Session of the Scientific Committee of the Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean. 3-11 August 2016, Bali, Indonesia. WCPFC, Pohnpei, Federated States of Micronesia.
- Anonymous. 2017a. Report of the Thirteenth Regular Session of the Scientific Committee of the Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean. 9-17 August 2017, Rarotonga, Cook Islands. WCPFC, Pohnpei, Federated States of Micronesia.
- Anonymous. 2017b. Report of the Thirteenth Regular Session of the Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean. 5-9 December 2016, Denarau Island, Fiji. WCPFC, Pohnpei, Federated States of Micronesia.
- Clarke, S., S. Nicol and P. Williams 2015. Proposal for a Bycatch Data Exchange Protocol (BDEP) amongst the t-RFMOs. SC11 EB-WP-06. Eleventh Regular Session of the Scientific Committee of the WCPFC. Pohnpei, FSM. 5-13 August 2015.
- Clarke, S., and N. Smith. 2018. Update on the Common Oceans (ABNJ) Tuna Project's Shark and Bycatch Components, 2017-2018. 14th Meeting of the Scientific Committee of the Western and Central Pacific Fisheries Commission, WCPFC-SC14, Busan, Republic of Korea, 8-16 August 2018, WCPFC-SC14-2018/ RP-ABNJ-01.
- Fitzsimmons, L. 2010. WCPFC Bycatch Mitigation Information System (BMIS). WCPFC-SC6-EB-IP-06. Accessed online at <http://www.wcpfc.int/node/2461>
- Fitzsimmons, L. 2011. Bycatch Mitigation Information System. WCPFC-SC7-EB-IP-03. Accessed online at <http://www.wcpfc.int/doc/eb-ip-03/bycatch-mitigation-information-system>
- Fitzsimmons, L. 2012. Bycatch Mitigation Information System. WCPFC-SC8-EB-IP-01. Accessed online at <http://www.wcpfc.int/doc/EB-IP-01/Bycatch-Mitigation-Information-System>
- Fitzsimmons, L. and Bunce, S. 2013. Bycatch Mitigation Information System. WCPFC-SC9-2013-EB-IP-03. Accessed online at <http://www.wcpfc.int/node/3691>
- Fitzsimmons, L., Clarke, S., Caillot, S. and Nicol, S. 2015. Redevelopment of the Bycatch Management Information System. WCPFC-SC11-EB-IP-07.
- 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. Accessed online at <https://www.wcpfc.int/node/29567>
- Peatman T., Allain V., Caillot S., Williams P., and Smith N. 2017. Summary of purse seine fishery bycatch at a regional scale, 2003-2016. 13th Meeting of the Scientific Committee of the Western and Central Pacific Fisheries Commission, WCPFC-SC13, Rarotonga, Cook Islands, 9-17 August 2017, WCPFC-SC13-2017/ST-WP-05.
- Peatman T., Allain V., Caillot S., Park, T., Williams P., Tuiloma, I., Panizza, A., Fukofuka, S., and Smith, N. 2018a. Summary of purse seine fishery bycatch at a regional scale, 2003-2017. 14th Meeting of the Scientific Committee of the Western and Central Pacific Fisheries Commission, WCPFC-SC14, Busan, Republic of Korea, 8-16 August 2018, WCPFC-SC14-2018/ST-IP-04.
- Peatman T., Bell L., Allain V., Caillot S., Williams P., Tuiloma, I., Panizza, A., Trembley-Boyer L., Fukofuka, S., and Smith N. 2018b. Summary of longline fishery bycatch at a regional scale, 2003-2017. 14th Meeting of the Scientific Committee of the Western and Central Pacific Fisheries Commission, WCPFC-SC14, Busan, Republic of Korea, 8-16 August 2018, WCPFC-SC14-2018/ST-WP-03.
- Peatman, T., and Smith, N. 2018. A short note on the development of WCPFC seabird bycatch estimates for Project 68. 14th Meeting of the Scientific Committee of the Western and Central Pacific Fisheries Commission, WCPFC-SC14, Busan, Republic of Korea, 8-16 August 2018, WCPFC-SC14-2018/EB-WP-03.
- Williams, P. G. 2007. Specification of a database system to manage and facilitate access of information covering (i) by-catch and (ii) by-catch mitigation on behalf of the Western and Central Pacific Fisheries Commission (WCPFC). WCPFC-SC3-2007/EB-IP-02. Accessed online at <http://www.wcpfc.int/doc/eb-ip-2/specification-a-database-system-manage-and-facilitate-access-information-covering-i-catc>
- Williams, PG, N. Smith, I. Tuiloma, C. Falasi, and S. Clarke. 2016. Bycatch Data Exchange Protocol (BDEP) – Summary tables. SC12 EB-WP-12. Twelfth Regular Session of the Scientific Committee of the WCPFC (SC12). Bali, Indonesia. 3-11 August 2016.
- Williams, PG, N. Smith, and E. Schneider. 2017. Bycatch Data Exchange Protocol (BDEP) – Summary tables. SC13 EB-IP-05. Thirteenth Regular Session of the Scientific Committee of the WCPFC (SC13). Rarotonga, Cook Islands. 9-17 August 2017.
- Williams, P. 2018. Scientific Data Available to the Western and Central Pacific Fisheries Commission. 14th Meeting of the Scientific Committee of the WCPFC, WCPFC-SC14, Busan, Republic of Korea, 8-16 August 2018, WCPFC-SC14-2018/ST-WP-01.
- Williams, P., and Smith, N. 2018. Requirements for enhancing conversion factor information. 14th Meeting of the Scientific Committee of the Western and Central Pacific Fisheries Commission, WCPFC-SC14, Busan, Republic of Korea, 8-16 August 2018, WCPFC-SC14-2018/ST-IP-05.