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An update on the Bycatch Management Information System (BMIS): developments in 2018-19 including the integration of data visualisation and mapping for bycatch data

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1 Introduction

The WCPFC Bycatch Management Information System (BMIS) is an online resource for fisheries managers, scientists, fishers, educators and the public (see Figure 1). 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).

The Bycatch Data Exchange Protocol (BDEP) is a format standardised public domain regional bycatch data summary. The WCPFC BDEP tables now are updated annually and available at www.wcpfc.int/node/29966. This work has improved the quality of, and access to WCPFC bycatch data.

BMIS has been significantly expanded and redeveloped with funding from the FAO Common Oceans (Areas Beyond National Jurisdiction - ABNJ) Tuna Project over the period 2015-2019 (Clarke and Smith, 2019). This project has also funded development and improvements of the WCPFC BDEP tables. This paper provides an update on project tasks related to BMIS and BDEP in the final year of funding (to 31 August 2019). Further detail about the previous developments can be found in Fitzsimmons et al. (2015, 2017, and 2018), Williams et al. (2016 and 2017), and Williams (2018).
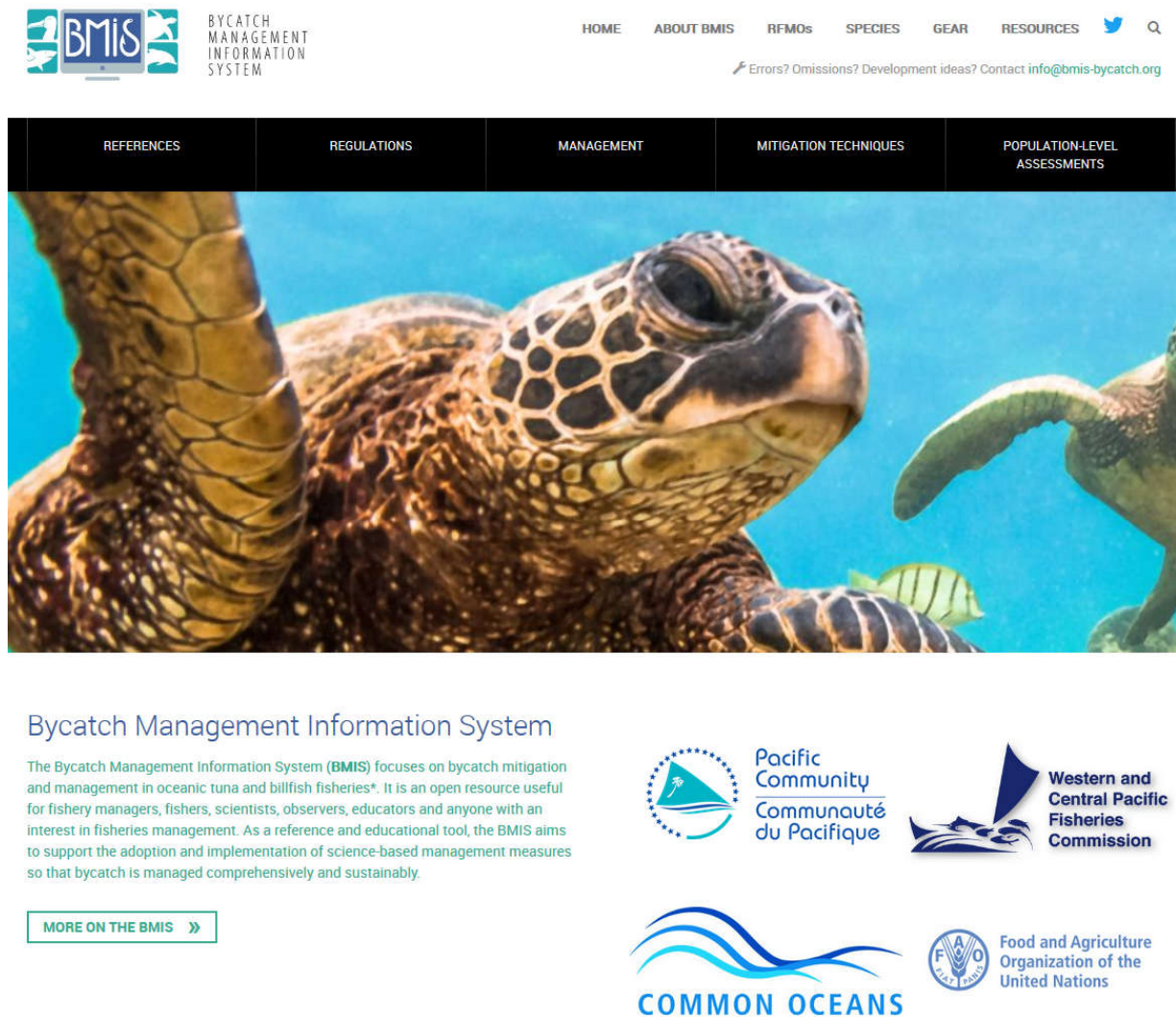

Figure 1: The BMIS landing page - the BMIS can be accessed at www.bmis-bycatch.org. Subscribe to the BMIS Twitter feed @BMIS_bycatch.

2   Update on BMIS and BDEP

2.1   Use of the BMIS website

Since the relaunch, the BMIS website has been widely used, with more than 13,800 unique visitors and more than 50,200 page views. Visitation[1] has risen steadily since the new website was launched in May 2017. Over the first 6 months post relaunch there were an average of 281 unique visitors (1138 page views) per month, compared with the most recent 6 month period averaging 893 visitors and 2627 page views per month (the most popular pages were those for references, mitigation techniques and species groups). Return visitors accounted for about 13% of total visits over the past 6 months. Over the same period, 22% of visits to the site were from direct hits (people had typed the address in), 73% resulted from organic searches (search terms not known), 3% were referrals (mostly from the WCPFC website) and 1% were from social media (majority Twitter). Deeper analysis of Twitter impact (see Section 2.2) suggests that this latter figure is an incomplete representation of the influence of Twitter activity on site visitation.

Among the reasons for the upward trend in site visitation is exposure via Google search engine results. A Google search using the terms 'bycatch mitigation' or 'bycatch management' returns BMIS at the top of the results list (see Figure 2).
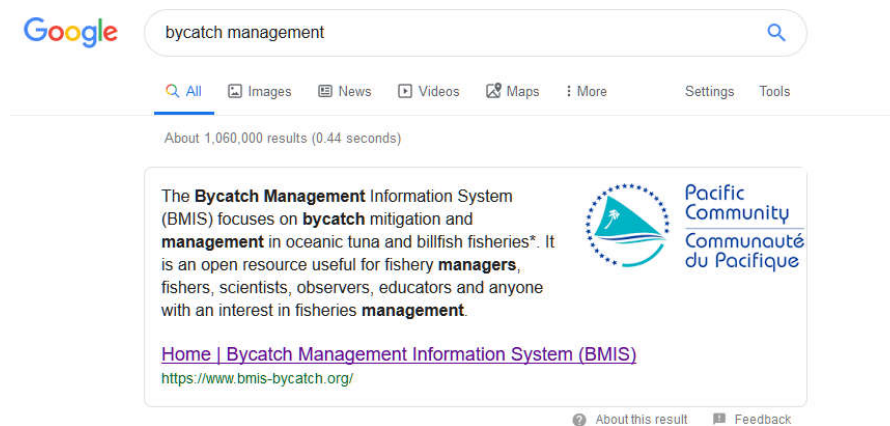

Figure 2: Results of Google search of the phrase bycatch management.

The charts below demonstrate the continuing steady increase in BMIS usage since the WCPFC bycatch problem-solving workshop in late May 2018. Note that the low point on the 'Weekly trend of users' chart corresponds to the 2018-19 Christmas-New year period (Figure 3).
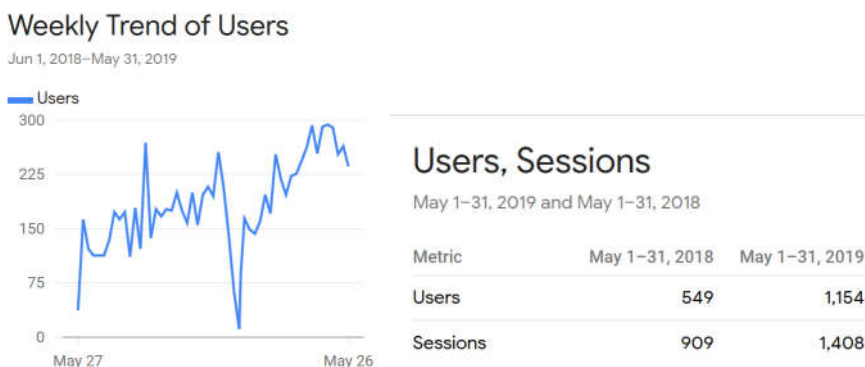

Figure 3: Website use analytics for the period 31/05/18 through 31/05/19.

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[1] Source - Google Analytics. Visitation is a measure of the number of visitors to the site, whether the person uses only the landing page or several pages, they count as one visitor.

2.2 BMIS social media and site promotion

2.2.1 Improving and evaluating Twitter presence

One of the features of the new website has been the use of social media to promote BMIS and its contents. Over this period, Twitter has proved an efficient, inexpensive means of BMIS site promotion. Regular, sustained posting has improved the BMIS Twitter presence, with a positive impact on visits to the Twitter profile (@BMIS_bycatch) and BMIS website and has helped to retain and increase followers. Efforts have been made to increase the appeal of BMIS posts by incorporating images, using #hashtags, embedded links and favouring topics of interest (by reviewing success of past posts). There is a lot of 'noise' on Twitter, and to retain a point of difference (and hopefully attractiveness), BMIS posts focus on its niche area of expertise.

In Twitter, website visitors can be garnered either via direct links within a Tweet (a twitter post) or via the BMIS profile, which includes an embedded website link (see Figure 4).

Figure 4: Examples of promoting BMIS through Twitter: at top in a Tweet, at bottom embedded in profile.

An analysis of the BMIS Home Page (using 'Hotjar' 'thermal imaging' of visitor habits) showed that many visitors landing on the page did not scroll down far enough to see the embedded Twitter feed. In March this year a Twitter icon (which links to the BMIS Twitter profile) was added to the top right of the Home Page, to increase visibility. The Twitter feed remains visible further down the Home page. Reanalysis of Home Page usage will help to determine the impact of this change. Adding the icon to the top of all BMIS pages may be warranted.

The overall contribution of Twitter to BMIS site visitation is difficult to quantify. It is not simply the sum of 'clicks' gained from Tweets. Twitter analytics offer insight, but not a full understanding. Impressions are important, as are the number of followers. An impression is the number of times someone is served a Tweet in their timeline or search results, i.e., the number of times the Tweet is seen. BMIS Twitter impressions have increased since the first BMIS Tweet in May 2017 (e.g., 1,500 for June 2017 vs 10,200 for June 2019), though with significant variance along the way. Figure 5 below illustrates this growth. In addition, the ratio of impressions to Tweets has improved (attributed in part to improved Tweet content and an increase in the number of site followers). Impressions that do not result in immediate site visitation may spur a later visit to the site. Precise site details do not need to be remembered. As described above, a Google search using general bycatch search terms is likely to turn up on the BMIS website. Similarly, a Twitter search would also turn up BMIS information.
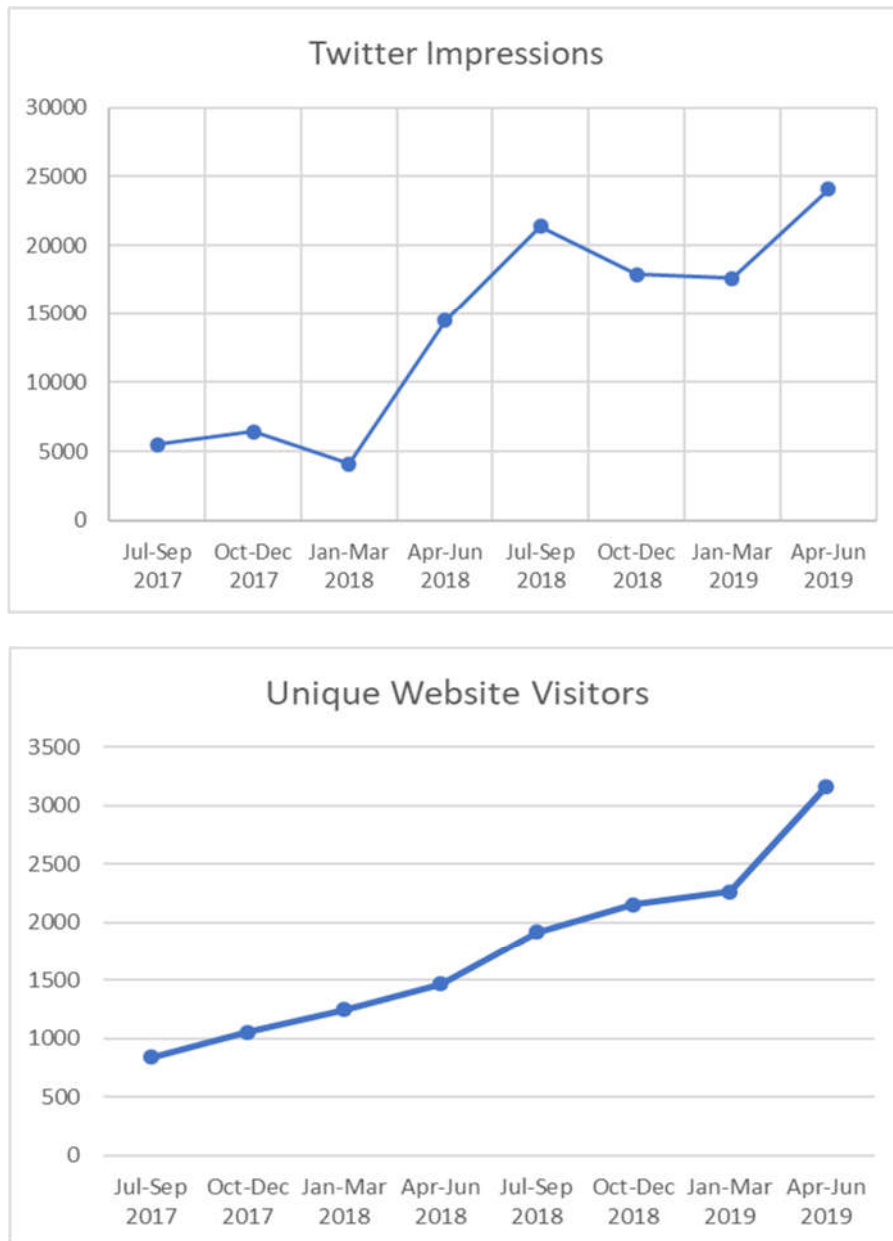
Figure 5: BMIS Twitter account analytics for the period July 2017 through June 2019. At top, the number of Twitter impressions per three month period, at bottom, the unique number of website visitors per three month period.

Another Twitter metric is 'Potential Reach', defined as the total number of people who may have seen a Tweet, which is influenced by the number of BMIS Twitter followers. For example, of the 115 (at 30/6/19) BMIS followers, if one of these (who has, say, 200 followers) retweets a BMIS Tweet, then the potential reach is 115 + 200 = 315. With every account that retweets a BMIS Tweet, the followers get added on. Considering impressions and potential reach together can give a clearer view of a Tweet's impact. While a Tweet is unlikely to reach all BMIS followers, the Tweet's actual reach is likely a function of the number of impressions and the 'Potential Reach' metric.

Understanding Twitter better, and thus using it to greater advantage is an ongoing challenge. Efforts continue in this regard. However, to date Twitter has proved an efficient, inexpensive means of BMIS site promotion with a positive impact on visits to the BMIS website.

2.2.2   Other benefits of using Twitter

Twitter has benefits beyond site promotion. It keeps the website looking 'fresh' or active. It is a source of new material for the BMIS reference database, and ideas for Bycatch Bytes. It provides updates on research, news and events in the wider world of bycatch management. Furthermore, Twitter is used to promote RFMO meetings, literature and regulations. See recent examples in Figure 6 below.

Figure 6: Examples of the use of Twitter to promote RFMO meetings, literature and regulations.

2.2.3   ResearchGate

The BMIS team recently created a ResearchGate profile, which lists the BMIS project and website, to make it easier to request full texts for 'Not open access' journal articles and to 'follow' researchers in the marine megafauna bycatch field. It is also a good way to discover new material for the BMIS. However, there is the added benefit of site promotion. Requests for PDFs serve to raise the profile of the BMIS among bycatch researchers. Some researchers have sent PDFs and subsequently followed the BMIS on Twitter. Furthermore, to 30/6/19, there have been 174 'reads' (68 full-text, the remainder abstract & authors) of the BMIS scientific committee meeting papers posted to ResearchGate.

2.2.4   Bycatch Bytes

The value of Bycatch Bytes remains to be fully utilised in the sense that more regular stories and guest stories can be used to keep the site more fresh, and to continue to promote the site. As with Twitter, regular postings may improve its value to website visitation. As the Bycatch Bytes material allows more in depth consideration of the topic than a Tweet, it provides a useful complementary tool. Each Bycatch Bytes story also provides an opportunity for associated Tweets, amplifying the effect of such material. For these reasons Bycatch Bytes is considered an important part of the overall approach for BMIS.

2.3   Continued development of BMIS including ongoing maintenance tasks

2.3.1   General literature

As of 30 June 2019, there were 1,915 references in the BMIS, compared with 1,500 at the same time in 2018. There has been a focus on increasing holdings of RFMO literature (see 2.3.2) and expanding the scope of the BMIS to include gillnet literature, as there are major gill net fisheries for tuna in the Indian

Ocean with bycatch challenges. Marine mammal references have also increased substantially in number, partly because of the recent focus on gillnets, but also because they were the species group most recently added to the BMIS.

2.3.2   Tuna RFMO grey literature holdings

2.3.2.1 Current holdings

The BMIS holds a substantial tranche of t-RMFO 'grey literature' related to bycatch mitigation and management (more than 600 references, predominantly meeting papers and reports). These can be easily accessed using the 'Collections' filter on the References page (see Figure 7 below).

Figure 7: Use of the Collections filter to retrieve tuna RFMO grey literature from BMIS.

Literature can be filtered by year. There is comprehensive coverage of RFMO bycatch literature from the past three years (five years for some), though there are many RFMO references from earlier years. To note, the exception is CCSBT which has only recently made Commission meeting papers publicly available.

2.3.2.2 Assistance for RFMOs to publish bycatch literature in the BMIS

RFMO literature appears more rapidly on the BMIS website if PDFs, e.g. for meeting papers, have embedded metadata. When imported into Zotero (reference management software used by BMIS), embedded metadata automatically translates as bibliographic details, reducing data entry time.

Private membership Zotero group libraries have been created to provide an option for RFMOs to contribute references, both peer-reviewed and grey literature, directly to the BMIS. They are an avenue for RFMOs to promote meeting papers and reports, publishing them more rapidly (or at a time that suits) in the BMIS. CCSBT adopted this initiative early in 2019, and provided valuable feedback to improve the instruction manual *"BMIS 'RFMO Portal' Libraries in Zotero – how to join and use them".* The manual can be accessed on BMIS here.

2.3.3   Accessing videos in the BMIS

In response to feedback from the 2018 Workshop on WCPFC Bycatch Mitigation Problem Solving (Common Oceans (ABNJ) Tuna Project, 2018), training and information videos have been added to the BMIS and made more easily accessible by using the 'Collections' filter on the References page. The videos cover safe handling and release techniques, such as removing hooks from sea turtles, and the implementation of mitigation techniques, such as 'how to reduce seabird bycatch'.

2.3.4   Species background information

Feedback from the 2018 Workshop on WCPFC Bycatch Mitigation Problem Solving (Common Oceans (ABNJ) Tuna Project, 2018) led to improvements in species' background information. Explanatory text pointing to sources of biological and distribution data for individual species has been added for each species group. For seabirds, links have been added to ACAP and Birdlife International data portal pages. For sharks, links to FishBase and the FAO guide to shark/batoid/chimeras of the North Atlantic have been added. For sea turtles, links to SeaLifeBase and the 'Marine Turtles of the Maldives' were added and for marine mammals, links to SeaLifeBase and to FAO's guide to the Marine Mammals of the World were made available.

In addition, for each species group, text and links to a pre-filtered search on BMIS Species ID Guides have been added. For sharks, sea turtles and marine mammals, there are also links to NOAA's 'Find a Species' databases (which includes facts about species biology, population status, distribution, threats, and conservation & research). Explanatory text for marine mammals and sharks was revised.

2.3.5   Search Prioritisation

2.3.5.1   Species groups and mitigation techniques

In response to feedback from the 2018 Workshop on WCPFC Bycatch Mitigation Problem Solving (Common Oceans (ABNJ) Tuna Project, 2018), changes have been made to improve the user experience when searching on mitigation techniques (MT) and species groups. Explanatory text has been improved. Links have been added, enabling users to connect from the Mitigation Techniques page to species groups' descriptions and a summary of which MT work for each (Figure 8).

Figure 8: Links in BMIS to link species groups to mitigation techniques.

Efforts to improve the order in which MT are returned when users search by Species Group ± Fishing Gear - so that proven or recommended MT are at the top of the list - were moderately successful (based on an assessment of search results compared with expert opinion on ranked order).

An alternative prioritisation method is being further investigated. This new approach relies upon pre-determining the order in which MT will show in search results. Proven MT should be at the top of the list, with, e.g., a line separating them from those that are under testing or not shown to be effective. The success of this will be an area for ongoing investigation, and should a pre-determined order approach be selected, it will need ongoing peer review.

2.3.5.2   References

At the 2018 Workshop on WCPFC Bycatch Mitigation Problem Solving (Common Oceans (ABNJ) Tuna Project, 2018), the question 'when a long list of results is returned, how does a user determine which references are most relevant?' was asked. Among the suggestions were: using a star rating; prioritise references rather than allow filtering; identify key references used when RFMOs adopt a conservation measure; and, show the number of 'downloads' or 'reads'. Finding a useful and cost efficient way to prioritise lists, however, remains challenging.

Among the issues considered have been audience (i.e., the interest of the user – what is their project or purpose in seeking information) and the subjective nature of applying any rating system to references. While the criteria for selecting references could be clearly stated, these will represent one point of view about the subject matter. Furthermore, the criteria may be applied differently by BMIS administrators, depending on their knowledge and experience. Proceeding this way is labour and cost intensive and risks becoming rapidly superseded.

Regarding downloads or 'reads', such counts could be automated based on existing tools, e.g., Google Scholar citations or ResearchGate's '[Research Interest](#)' (RG RI) index. These are imperfect methods, but the flaws are generally well understood by researchers, if not the layperson. There is an existing Application Programming Interface (API) for linking Zotero and Google Scholar citations. However, this does not work well as it stands, due to the Google Scholar site perceiving that the request for batches of citation counts is a robot, and hence blocking such requests. There would be costs for developing independent APIs and the scale and complexity of this approach is not currently clear. There would be minor development costs associated with altering the BMIS web interface to implement this approach (e.g., provide a 'button' for Google Scholar citation counts or RG RI score).

2.3.6   Developing country access to copyright protected papers

At the 2018 Workshop on WCPFC Bycatch Mitigation Problem Solving (Common Oceans (ABNJ) Tuna Project, 2018), the concept of SPC as a development agency facilitating access for members to discounted / free pay-per-view journal (copyrighted) articles was discussed. SPC has explored this further during 2018. Several publishers are able to offer discounted access to articles for developing states (although not territories). Such access needs to be channelled through a national government institution and includes specific constraints around any further distribution. Although there is a role for SPC to work on this directly with individual members on a case-by-case basis, there are no perceivable benefits for BMIS in pursing this further.

2.3.7   STAGIS – Shark Tagging Database

The STAGIS - Shark Tagging Database – was compiled in 2011 and hosted initially by SPC. With the redevelopment of BMIS it was decided to integrate STAGIS into the new website. However, the structure of STAGIS is logically quite different from that of the BMIS and problems inherent in the design of STAGIS (the most limiting being the lack of a unique identifier for individual field studies) prevented simple direct connection of the two databases. As redesign of STAGIS was not feasible at the time, STAGIS data was imported 'as is' and an interface developed to allow data entry in the existing format (Fitzsimmons et al., 2018).

Redevelopment of the STAGIS database will ensure linkage with other BMIS databases and more efficient updates. As an interim step, literature updates can be undertaken using Zotero to capture recent tagging studies in the Pacific Ocean region. Data extracted from new field studies/references are entered in an MS Excel spreadsheet (i.e., compatible with BMIS database platforms). New literature can be made immediately available via the 'Collections' filter in 'References' (and explanatory text on the STAGIS landing page). Generic literature search approaches are being used and the references from the 2019 Workshop on Joint Analysis of Shark Post-Release Mortality Tagging Results (Common Oceans (ABNJ) Tuna Project, 2019) provide a few important updates. Work in this area will continue until the end of this project.

2.3.8   Peer review

As identified in Fitzsimons et al. (2018), peer review of BMIS is an ongoing workstream. Several of the review and feedback items from the 2018 Workshop on WCPFC Bycatch Mitigation Problem Solving (Common Oceans (ABNJ) Tuna Project, 2018) have been reported on earlier in this paper (Sections 2.3.3, 2.3.4, and 2.3.5.)

In 2018-19, three additional components of BMIS peer review were undertaken: shark expert peer review; CCSBT peer review; and, ongoing development of the processes for external peer review of content. The shark expert peer review has been completed and the recommendations are gradually being addressed and implemented. The CCSBT review was completed and resulted in several minor fixes. Following the review of the website, CCSBT requested creation of a reference 'Collection' (search filter) for commission documents and this has been completed. Additionally, CCSBT staff provided considerable

feedback on development of the instruction manual "BMIS 'RFMO Portal' Libraries in Zotero – how to join and use them" as described in Section 2.3.2.2. Work in this area will continue until the end of this project.

2.3.9   Ongoing maintenance tasks

In addition to the general curation reported in Section 2.3.1, a range of basic ongoing maintenance tasks continue. These have included ensuring website security updates, refreshing broken links, responding to user emails and suggestions for change, maintaining the domain, managing the underpinning Zotero database and monitoring analytics (see Section 2.1).

One area of focus in 2018-19 has been to update the background database within BMIS to use the most recent lookup tables for FAO species codes and common names. This has resulted in instances of duplicate species where records exist for both the old and new code versions, and several orphan codes (where a species is associated with an invalid higher order taxa code). Resolving such details is time consuming and challenging, but critical to keeping BMIS up to date.

3   BDEP ongoing tasks and new developments

The Bycatch Data Exchange Protocol (BDEP) is a public domain regional bycatch data summary in a standardised format. WCPFC adopted BDEP on a trial basis in 2016 (Anon., 2016a and 2016b) which continued in 2017 (Williams et al., 2017), and has implemented BDEP as regular business since 2018 (Anon., 2018a and 2018b). Subsequent to discussions at SC13, some BDEP work has been integrated into the BMIS project (Fitzsimmons et al., 2018), including reporting on progress with BDEP related tasks.

3.1   The BDEP tables

The annual WCPFC BDEP tables have been prepared for 2018 and include updated data for 2013-2017 as noted in Williams (2019). They are available on the WCPFC BDEP page at: www.wcpfc.int/node/29966. Work undertaken this year and recent developments with respect to enhancements and availability of BDEP data include:

- reporting seabird and marine mammal catch to species level where possible;
- updating database species code/name tables to latest versions from FAO (see also Section 2.3.7);
- tables of observer effort by 5°x5° completed for purse seine;
- continuing efforts to expand loading of ROP observer data not previously available; and
- the notes describing the tables continue to be expanded.

A direct consequence of all of this work is continued improvements in the amount of available longline observer data in the BDEP tables across several years (see Table 1), and as seen in 2018, a doubling in the coverage from the previous year (Fitzsimmons et al., 2018; Table 2). For the purse seine fishery there are improvements in most years, with a significant improvement in the volume of latest year data at time of reporting (e.g. 19.1% in 2018 for 2017 data, c.f. 45.5% in 2019 for 2018 data).

3.1.1   The BDEP work plan

Williams et al. (2016) identified nine tasks for further work on BDEP. Of the five remaining tasks reported in 2018 (Fitzsimmons et al., 2018), three have been completed this year:

- Task 4 - Providing tables of observer effort by 5°x5° for purse seine;
- Task 6 - Report seabirds to the species level; and
- Task 7 - Expand the BDEP protocol to marine mammals at the species level.

Table 1: BDEP data in 2017 and 2018, with additions in 2019 (Source: Williams et al., 2017; Williams, 2018 and 2019; and WCPFC BDEP at www.wcpfc.int/node/29966).

2017 BDEP Data					2018 BDEP Data					2019 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	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%	2013	L	1,012,765,893	23,672,473	2.3%
2014	L	1,041,829,254	10,837,161	1.00%	2014	L	1,045,076,076	20,682,112	2.0%	2014	L	1,049,691,355	21,277,512	2.0%
2015	L	1,108,528,037	15,790,034	1.40%	2015	L	1,102,994,869	21,254,860	1.9%	2015	L	1,103,165,120	23,681,879	2.1%
2016	L	1,056,020,829	15,019,975	1.40%	2016	L	1,044,268,441	18,107,763	1.7%	2016	L	1,043,744,314	24,027,045	2.3%
					2017	L	897,143,360	13,867,560	1.5%	2017	L	905,068,740	28,581,806	3.2%
										2018	L	936,076,185	25,197,661	2.7%
2013	S	64,338	36,770	57.20%	2013	S	64,338	38,679	60.1%	2013	S	64,338	38,263	59.5%
2014	S	65,075	32,985	50.70%	2014	S	65,630	37,503	57.1%	2014	S	65,630	37,755	57.5%
2015	S	56,051	27,865	49.70%	2015	S	55,649	31,997	57.5%	2015	S	55,640	34,962	62.8%
2016	S	53,931	17,622	32.70%	2016	S	52,799	26,828	50.8%	2016	S	52,811	30,438	57.6%
					2017	S	56,680	10,802	19.1%	2017	S	57,422	21,961	38.2%
										2018	S	57,570	26,218	45.5%

Of the remaining two tasks, Task 8 - Review length-length and length-weight relationships for SSIs has been incorporated into the work of Project 90 and progress is reported in SPC-OFP (2019). The remaining task, Task 9 - *Undertake a trial regional BDEP compilation for purse seine at the scale of the Pacific Ocean,* is work in progress, with progress on the API aspects reported in Section 2.4.3.

In summary, eight of the nine BDEP tasks identified at SC12 have been completed, and there has been substantive progress on the remaining task. This BDEP work continues as a positive step toward improving the quality of, and access to WCPFC bycatch data.

3.2 Bycatch summary data visualisation and mapping

The BMIS website is being extended to allow for public domain bycatch data to be explored, visualised, and made accessible. The goal is for the BMIS data explorer to become a central source for public domain bycatch related data, including:

- fisheries effort data;
- observer effort data;
- reported bycatch;
- estimated bycatch;
- species distributions;
- population data;
- risk assessments; and
- related management measures.

The datasets will ultimately be drawn from a range of sources, including RFMOs and scientific and technical publications. The data included in BMIS will only be publicly available data. Initially, the emphasis is on data from the WCPFC (e.g. BDEP), and information sourced from research papers and technical reports. Over time, the scope will be expanded to include data from any RFMO. The initial focus is on data related to shark bycatch, including information on shark risk assessment, and on summarising the applicable management measures. However, the system is being built so as to accommodate all species of special interest in future.

3.2.1 Data visualisation and mapping

As part of the development of the BMIS data explorer, all data will be processed to align with consistent dimensions (species taxonomy, RFMO, ocean, fishing gear, fleet, year, and 5-degree grid), with a consistent set of values applied within each dimension. A screenshot of a page from the proposed design is shown below (Figure 9), showing how the use of the dimensions allows for selection of data of interest.
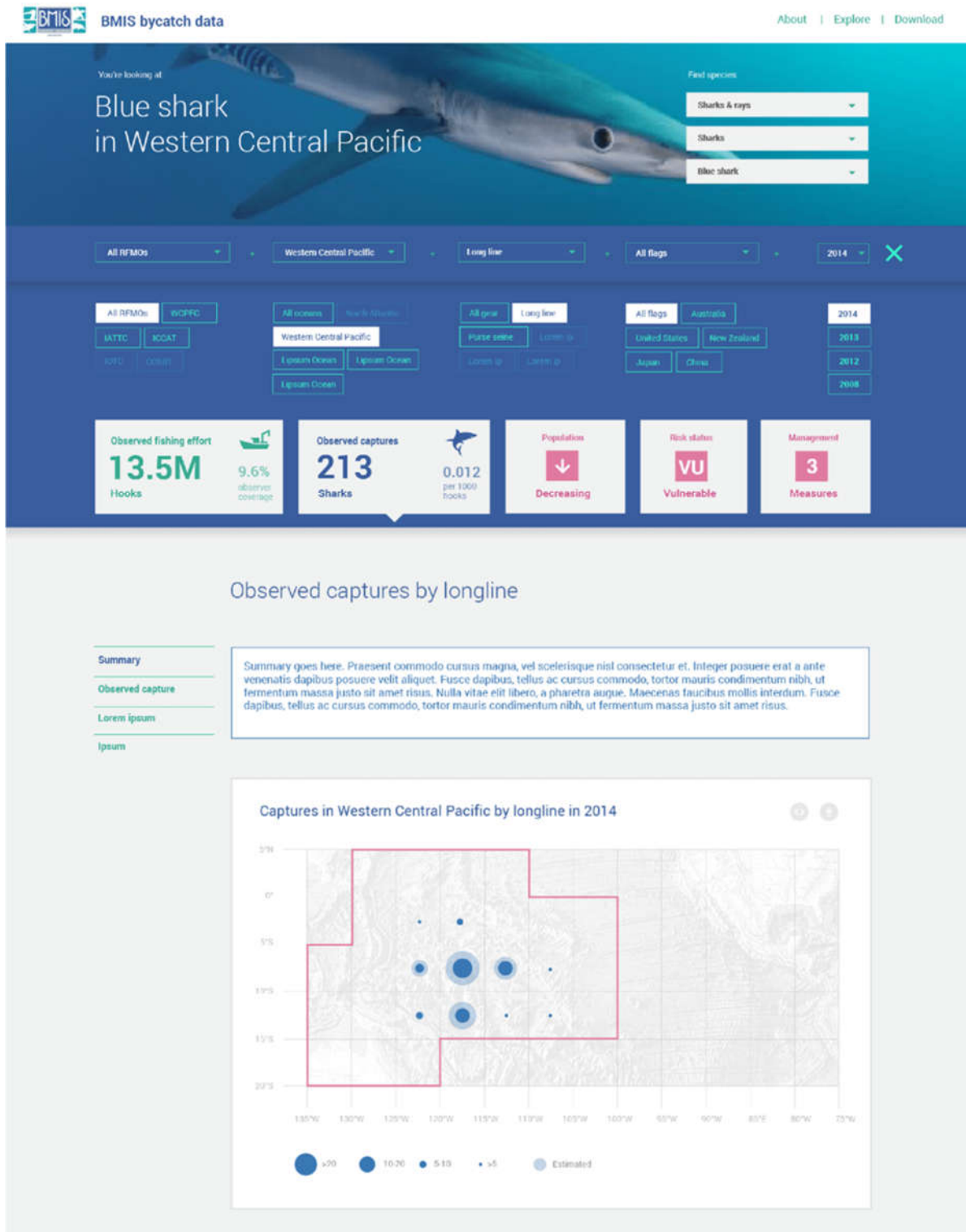

Figure 9: Screenshot of a page from the proposed design of the BMIS data visualisation and mapping tool: summary data and mapping.

In this view, information related to the bycatch of blue shark in the Western Central Pacific is selected. When a selection is made, a high level summary of the information related to five key indicators is presented, allowing for someone browsing the site to rapidly gauge the extent of the available data (note that the numbers shown in Figure 9 are placeholders only).

For each selection, the available data will be visualised (shown as maps, as time series, or as a table, as appropriate). The data associated with each chart will be able to be downloaded, and each chart will have a unique URL, meaning that it can be embedded in other websites. In addition to the visualisations, the website will also include qualitative information, such as qualitative risk assessments, as tabular data (see Figure 10, noting that the numbers shown in the figure are placeholders only).
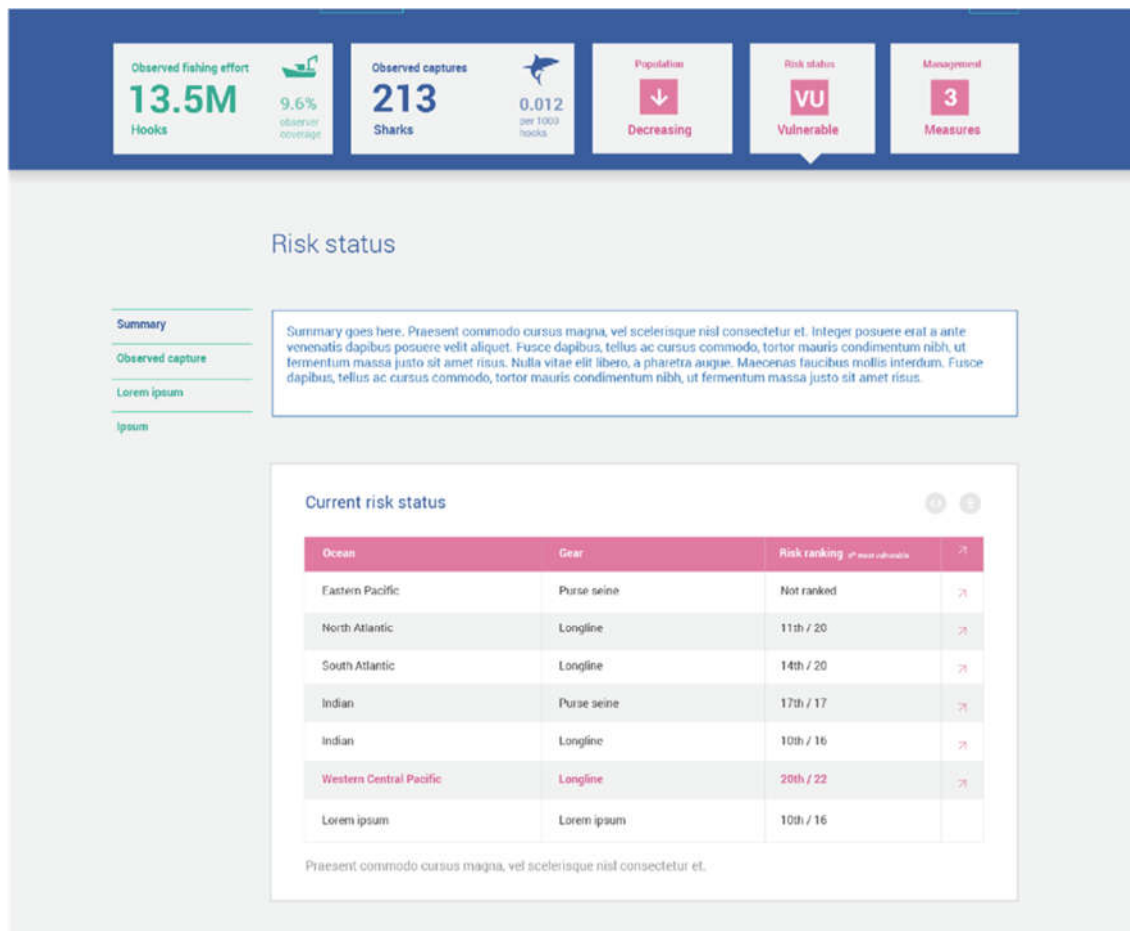

Figure 10: Screenshot of a page from the proposed design of the BMIS data visualisation and mapping tool: qualitative information included as tabular data.

3.2.2   Information and system architecture

The architecture of the BMIS data explorer is described in Figure 11. The website code and the collated input data will be brought together in a build process that will generate the Hyper-Text Markup Language (HTML) and JavaScript files needed to display the interactive visualisations. Once the website build has been completed, it will be reviewed via a staging site, and once approved for release, the files will be shared through a Content Distribution Network (CDN). With this architecture, there will be no need for ongoing server maintenance, and so no security issues. It will also mean that the files will be able to be downloaded and viewed offline. An Application Programmable Interface (API) will be defined that allows for the data to be downloaded as JavaScript Object Notation (JSON) files, suitable for use by other websites or applications.

To date, initial designs and an initial schema for the data (defining the dimensions, and the values of each dimension) have been developed. The website is being built, with initial loading of the data underway. By the end of the project an initial release of the data explorer website will be available, which will include publicly available fishing effort data from RFMOs; BDEP data on observed shark, seabird, and turtle bycatch; and information on shark risk assessment and management measures, which will be derived from publications and reports.
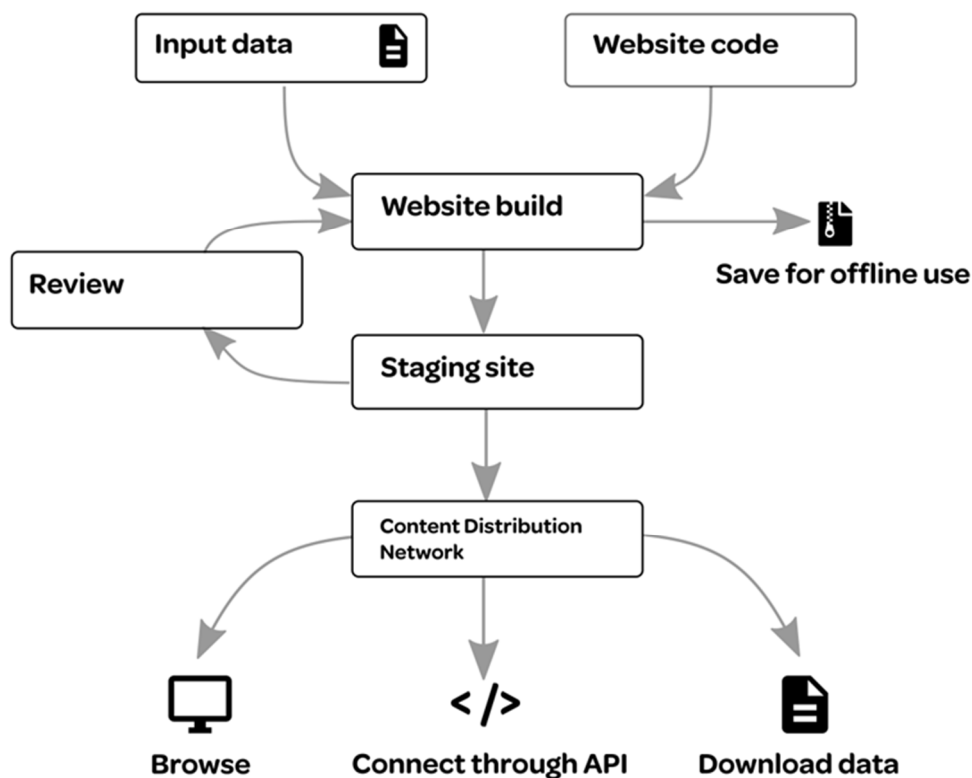

Figure 11: The technical architecture of the BMIS data explorer.

3.2.3 *Future updating*

In future, the BMIS website will be updated when the BDEP data are released, and the BMIS team will work to incorporate data from other RFMOs that can also be updated in an automated way as the data are released. When a new analysis is conducted, such as the oceanic whitetip shark stock assessment (Tremblay-Boyer et al. 2019), then the authors will be contacted, and key information from the reporting (such as estimated biomass by year of the oceanic whitetip shark stock) will be made available through BMIS. The maintenance of the BMIS data explorer will be through a combination of relatively automated procedures, and manual processes (e.g., relevant information from SC15 will be included to the extent possible in the initial release). Over time, we expect that the acquisition of new data will become more standardised, with templates available to researchers for making their data available.

4   Summary, work plan and future BMIS

The WCPFC Bycatch Management Information System (BMIS) has proven a valuable online resource to consolidate information on the mitigation and management of species of special interest incidentally caught in fisheries as reflected in its use. BMIS was redeveloped with a global focus and re-launched in May 2017. There has been an over 300% increase in average monthly unique users since the re-launch, noting that the rate of increase has been generally steady through that period.

As of 30 June 2019, there were 1,915 references in the BMIS, and 2018-19 has seen a focus on increasing holdings of RFMO literature and expanding the scope of the BMIS to include gillnet literature and marine mammal references. The development of the data visualisation and mapping tools provides significant integration of public domain bycatch data and the associated bycatch management information in one 'go to' platform.

The current FAO Common Oceans (Areas Beyond National Jurisdiction - ABNJ) Tuna Project support for the WCPFC BMIS finishes 31 August 2019. There is a range of ongoing work between now and the end of the project to complete. A longer term workplan has been identified and will continue to evolve beyond the end of the FAO Common Oceans (Areas Beyond National Jurisdiction - ABNJ) Tuna Project. Several arrangements for the future of WCPFC BMIS beyond the end of this project are already in place, and those address the critical elements of future work and web hosting. Given the global need, additional arrangements are required to ensure that the global vision for BMIS can be realised and the development of the platform can continued and refreshed to meet coming needs.

4.1   Pre-project completion work

The key remaining tasks before the end of the current project are all underway and are expected to be completed by the close of project. Specific work includes:

- finalisation of the data visualisation and mapping tool as described in Section 3.2 with an emphasis on having public domain shark information for WCPFC and at least one other tRFMO available online;
- implementing actions arising from peer review;
- ongoing maintenance and curation tasks;
- add additional RFMO grey literature where available (Section 2.3.2);
- update of the STAGIS references as described in Section 2.3.7; and
- finalise arrangements for ongoing web hosting.

4.2   BMIS work plan

The workplan for BMIS includes four key elements. Ongoing maintenance which simply allows the site to remain online, accessible and safe to visit. Ongoing curation and communications including annual BDEP data updates, to keep the site current and fresh. Ongoing development to ensure the site remains a relevant and flexible platform. There are also a range of medium-term developments which can be identified for future work to ensure the value obtained from this platform meets the global vision.

4.2.1   Ongoing maintenance

Keeping the BMIS online requires ongoing attention and incurs some minor costs. These include:

- IT – website security updates, site administrator changes to web pages;
- domain hosting; and
- Zotero cloud storage capacity fees.

4.2.2 Ongoing curation

Maintaining BMIS and keeping content current and relevant requires ongoing curation and communications work which includes:

- update of literature collection, including RFMO grey literature and curation;
- update of mitigation technique descriptions (e.g. circle hooks and FADs) and cross-taxa effects;
- social and science media updates - Twitter, Bycatch Bytes, ResearchGate;
- seek peer-review and implement findings;
- annual update of BDEP data and associated underpinning references (Section 3.2.33);
- periodic analysis of use statistics, communication tools and social media analytics including tools such as Hotjar to continue to improve the layout of the web page; and
- minor changes to layout and structure of the website.

4.2.3 Ongoing developments

Ongoing developments which are needed to ensure the site remains relevant and flexible include:

- expand the data mapping and data visualisation tool to cover seabirds, turtles and marine mammals, other tRFMOS and to automate annual data updates;
- redesign and update the underlying STAGIS database;
- optimisation of the search prioritisation and associated site architecture changes to appropriately priority-rank references; and
- expand ResearchGate use (Section 2.2.2).

4.2.4 Medium-term developments

Some medium-term developments can be identified now, although others will evolve with BMIS. Those already identified include:

- develop a multi-RFMO steering group (or similar) and associated processes to own and co-ordinate BMIS in the long-term;
- developing and or integrating online interactive species identification tools which can be downloaded to tablet or similar for use at-sea; and
- in approximately 2025, a complete revisit of the layout and currency of BMIS with a view to substantive redevelopment.

4.3 Current and future hosting of BMIS

The following arrangements are in place for the current and future hosting of WCPFC BMIS by the Scientific Services Provider:

- support for ongoing maintenance as identified in Section 4.2.1 and for the ongoing curation as identified in Section 4.2.2 has been secured through until at least the end of 2022;
- support for some of the ongoing developments identified in Section 4.2.3 has been secured and ongoing discussions are underway to secure funding for the others.

With these arrangements in place, SPC intends to continue to host the BMIS project and contribute towards securing support for and implementing the required medium-term developments. As a result, the WCPFC BMIS should remain a valuable online resource, consolidating information on the mitigation and management of species of special interest incidentally caught in fisheries for the foreseeable future.

5 Acknowledgements

6 References

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