Meeting Information Needs in Marine and Aquatic Sciences: A Case Study of the Use of the International Aquatic Sciences and Fisheries Abstracts Database

By

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Esta tesis es dedicada a Sra. Pinkerton, quien me enseñó la mágica de las bibliotecas/This thesis is dedicated to Sra. Pinkerton, who showed me the magic of libraries

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Abstract

Since 1971, the Aquatic Sciences and Fisheries Abstracts (ASFA) database has been an important international information resource, particularly for grey literature, on the science, technology, and management of marine and freshwater environments. Recent changes in the information landscape, however, have led to changes in information-seeking behaviour and affected use of databases.

To gain an understanding of current perceptions and use of ASFA, a mixed-methods approach was implemented to study longitudinal usage data, Google Analytics tracking data, a global survey of ASFA subscribers, and interviews with marine science librarians around the world. While many information professionals value ASFA, the emergence of Google Scholar and other search engines, and adoption of integrated discovery layers, such as Summon and Primo, in library systems are influencing database subscription decisions and information searching behaviour. Closure of ASFA would negatively affect information access globally, particularly in low-income food deficit countries or at smaller institutions.

List of Abbreviations Used

A&I – Abstracting and Indexing

ASFA – Aquatic Sciences and Fisheries Abstracts

DFO – Canadian Department of Fisheries and Oceans

ECR – Early Career Researchers

ENSO – El Niño Southern Oscillation

FAO – Food and Agriculture Organization of the United Nations

FFABW – Fish, Fisheries, and Aquatic Biodiversity Worldwide

GDP – Gross Domestic Product

IAMSLIC – International Association of Aquatic and Marine Science Libraries and Information Centers

ILL – Interlibrary Loans

IOC – Intergovernmental Oceanographic Commission

LIFDC – Low Income Food Deficit Country(ies)

NABS – North American Benthological Society

REB – Social Sciences & Humanities Research Ethics Board Dalhousie University

RPA – Retrievals per Account

TAMU – Texas A&M University

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Chapter 1: Introduction

Oceans cover 71% of the globe and play a large role in the international economy, ranging from shipping to medical research to mineral extraction to many other interests. Fisheries and aquaculture comprise a sizable portion of the "blue economy," with an estimated 10-12% of the world's population involved in this economic sector (World Bank Group, 2018). The 2016 *State of the World Fisheries and Aquaculture* report estimates that fisheries and aquaculture are one of the largest drivers of international food commodities trade, and that related activities are vital to the economic well-being of a variety of states (Food and Agriculture Organization of the United Nations [FAO], 2016). Because of their importance to a sizeable segment of the global community, ensuring that the oceans and other aquatic environments remain healthy is vital. In order to achieve and maintain healthy oceans, researchers, managers, and decision-makers need access to current, accurate, and reliable information to craft evidence-based policies to promote sustainable practices for fisheries and aquaculture.

Providing access to information can be a difficult task, however, as there is a very large quantity of scientific information about the oceans available to researchers and decision-makers in a wide diversity of formats. Even though the information may be available, these sources can still be difficult to locate by both information professionals and key stakeholders (Lenkart & Trei, 2017). Challenges in discoverability can limit the information's reach and the impact it may have on current and future research and practice (Lawlor, 2003). How information is described and disseminated is a recurring concern, which has been affected by the changing information landscape of recent decades. Part of that change has been the substantial move from traditional print journals and books to digital formats by publishers (Newman & Sack, 2013). In addition, users have changed how they search for information, thanks to the invention of Google and other web search engines (Hawkins, 2013). Combined, these changes are significantly affecting how people search for, access, and use information.

The rapid growth of science and hence scientific information includes not only more primary publications but also an increase in the volume of grey literature. Broadly

defined, grey literature is any publication that does not originate from a commercial publisher. Grey literature can include government reports, especially technical reports, publications from non-governmental organizations, conference proceedings, open data sets, and newsletters (Farace & Schöpfel, 2010). Grey literature often contains a wealth of scientific information that could be invaluable to researchers and decision makers, which may not be reproduced in other locations, in addition to being difficult to locate. As with other forms of scientific information, the value of grey literature to researchers and decision makers increases with the ability to locate and access it.

One of the oldest methods to assist with the discovery of information is the abstracting and indexing (A&I) services that focus on metadata production. This method uses consistent standardized descriptive language and brief summaries of the text and data to aid researchers in the discovery process. Abstracting and indexing services became formalized in the 1800s, at a time when the volume of scientific information was increasing rapidly (Lawlor, 2003). As early adopters of computer technology in the closing decades of the twentieth century, A&I services transitioned from paper products sold directly to institutions to digital databases sold through subscription licenses by vendors to allow users access for set periods of time (Lawlor, 2003). Despite the changes in format and distribution, specialized A&I databases continue to offer detailed metadata records for various types of information sources; such databases can be invaluable for researchers wishing to locate difficult-to-find materials (Dehmlow, 2015). Modern A&I databases are designed to allow users to search for relevant information via curated metadata, filter the results based on material type, limit the results by language and year, and also create complex search strategies to find materials.

In addition to A&I services, researchers use other sources to find information. Web search engines, such as Google, Yahoo, and Bing, all serve as free discovery platforms pulling together results from a wide range of sources. One of the most frequently used is Google Scholar. In a systematic review of articles comparing web-based search engines to A&I databases, researchers found that Google Scholar was used in all the studies comparing a free web search engine to specialized A&I databases (Bates, Best, McQuilkin, & Taylor, 2017). Using web crawlers, Google Scholar indexes abstracts,

titles, and full article text to provide users with an overview of the information available on particular subjects (Van Noorden, 2014). Due to its reach, full-text access, familiarity of use, and availability at no cost compared to traditional A&I databases, Google Scholar has become a preferred discovery platform for researchers (Nicholas et al., 2017). Google Scholar has also influenced the development of web-based discovery layers, which are centralized locations for users to conduct searches over an organization's entire collection, including various electronic resources that organizations license, such as Summon, Primo, EBSCO Discovery System, and WorldCat (Dahlen & Hanson, 2017; Foster, 2018).

A prominent example of a specialized A&I service focused on marine sciences, fisheries management, and aquaculture, the Aquatic Sciences and Fisheries Abstracts (ASFA) database was founded in 1971 as a physical printed product (Varley, 1995). The project was initiated as part of the FAO directive to facilitate the flow of information and it replaced existing bibliographic projects overseen by the FAO (Varley, 1995). ASFA has since become an electronic A&I database made accessible by subscription by the vendor, ProQuest, as well as distributed by the ASFA Partnership through CD/DVD to Low-Income Food Deficit Countries (FAO, 2009a; M. Vojar, personal communication, January 29, 2018).

Since its founding, ASFA has been a major resource on marine science, technology, and management and related economic, social, and legal subjects. Operating as an international partnership of over 50 national contributing partners, 11 international organizations, and four UN agencies, ASFA compiles and disseminates relevant information produced around the world (FAO, 2018a). ASFA currently contains more than two million records, with its main aim to facilitate the global sharing of information. To fulfill its mandate, ASFA monitors over 3200 serial titles for inclusion of records of relevant publications in the database, with ASFA partners also abstracting and indexing other materials that may be of interest, including grey literature (FAO, 2009b). The ASFA Partnership specifically mentions grey literature as an important source of information and prioritizes its inclusion in the database so users can find or request a version of the material (FAO, 2009b). In a 2005 study, ASFA was found to contain a

higher percentage of grey literature compared to other databases used by marine scientists at the time (Parker, 2005). Its focus on creating metadata records for grey literature allows researchers around the world to find technical reports and government documents that they might otherwise be unaware of or unable to access. About a decade ago, the ASFA Secretariat set a goal to extend the Partnership in order to expand global coverage of information, with a particular focus on partnering with developing countries (FAO, 2009b).

Despite the near half-century history of ASFA and the lengthy history of A&I services in general, their place in a rapidly changing information landscape is being re-evaluated. In a workshop write-up, Donald T. Hawkins noted that due to funding constraints, the change in discovery platforms, and shifts in information-seeking behaviour, many people question what role A&I services will have in the future (Hawkins 2013). Academic and governmental libraries in many developing as well as developed countries, and key subscribers for A&I databases such as ASFA, face budget constraints that limit their subscription choices. Although A&I databases have a rich history, the move towards free web-based search engines like Google Scholar and the desire of users for immediate full-text results can be seen as a threat to their long-term viability (Hawkins, 2013). Understanding how libraries currently evaluate database usage and relevance and understanding how information professionals now view these services is essential for conceptualizing the future of A&I databases and how they can remain relevant for researchers.

Sharing research information, particularly information available in grey literature, and making it accessible can assist managers and decision makers in developing policies and strategies to manage and protect the oceans for the future (MacDonald, Soomai, De Santo, & Wells, 2016). Changing how that information is shared could have an impact on policy development and future collaborations. Modifications to discovery platforms such as ASFA, which specialize in disseminating otherwise hard to find information, could have measurable impacts on the information-seeking behaviour of users. While attempts have been undertaken to create localized digital depositories and information portals for marine science information, ASFA is currently the only product that has both global

coverage and international backing (Lenkart & Trei, 2017). Due to recent dramatic shifts in the global production and use of information, the ASFA Secretariat convened the ASFA Impact Evaluation Group to examine the potential impacts of changes to the ASFA database, including whether it was to continue operation.

This research was carried out as part of the larger impact evaluation, specifically focusing on how information professionals use and perceive the ASFA database. The research focused on the perspectives of marine and aquatic science information professionals. These professionals, such as librarians, direct users to relevant resources, assist with locating information, and help their organizations make decisions about subscriptions to serials or databases. They provide a unique and informed perspective about ASFA and its use. The insights obtained from interviews and a survey of information professionals in countries on all continents, combined with longitudinal usage data and data available via Google Analytics, both provided by ProQuest, can inform the next steps in the larger impact evaluation project to determine ASFA's future.

To answer the question of how ASFA is used now and to determine the perceptions of marine science information professionals about the current relevance and importance of ASFA, the following questions directed the research:

1. Does an abstracting and indexing service, such as ASFA, have a place in present day aquatic and marine research and fisheries management?
    a. Are there trends in the usage and number of subscription accounts in the data between 2012 – 2017 provided by ProQuest that explain usage activities?
    b. What types of organizations are the primary subscribers to ASFA?
    c. Do the types of ASFA subscribers vary by country and region?
    d. What influence might country-level GDP, fisheries production, and population have on the number of accounts?
2. Does ASFA meet the information needs and requests of its potential users or are there alternatives available that work better?

a. How do librarians/information professionals observe users interacting with information sources?
b. How are users interacting with ASFA based on the Google Analytics data?
c. How has information-seeking behaviour for aquatic and marine and fisheries information changed over time?
d. What resources other than ASFA exist to help users find information related to marine and aquatic sciences?
e. What would the impact be of ASFA changing its coverage or operation or potentially closing?

These research questions guided the design and data analysis for this study. Chapter Two provides an overview of the literature related to A&I databases, the use of Google Scholar, grey literature use, and previous research about ASFA. Chapter Three outlines the mixed methods research design applied in this study. Chapter Four details the results of both the qualitative and quantitative data, discussion of the results from all of the data sources is laid out in Chapter Five, and Chapter Six presents the conclusions and recommendations.

Chapter 2: Literature Review

2.1. Introduction

The information landscape has dramatically changed over recent years, particularly in regard to how scientific information is distributed to and accessed by users.

For academic and research institutions, rising licensing costs and changes in information-seeking behaviour have led to discussions about the value of traditional abstracting and indexing databases compared to services like Google Scholar (Hawkins, 2013). In order to maximize their collections budgets, libraries have intensified their evaluation into the value of abstracting and indexing (A&I) databases and whether less expensive options are available to them. Because Google Scholar is one of the most prominent free alternatives, multiple studies have examined its efficacy as a comparable discovery service to both general and specialized A&I databases for particular fields (Chen, 2010; Ştirbu, Thirion, Schmitz, Haesbroeck, & Greco, 2015). For institutions with a small marine or aquatic sciences department, or for institutions with a limited budget, Google Scholar may be seen as a viable alternative to the Aquatic Sciences and Fisheries Abstracts (ASFA) database.

The four issues—the current state of A&I databases, the role of Google and Google Scholar, access to grey literature, and the status of ASFA—are all important components of this research study. Understanding how the issues intearct and influence each other puts the case study into context and provides important background information on the current state of the field of information management.

2.2 Abstracting and Indexing Databases

With the increased volume of new information currently being produced, locating relevant information to help answer questions and inform policy can be difficult. To counter this challenge, abstracting and indexing—also referred to as bibliographic—databases are designed to help users find information through the use of consistent standardized metadata and brief summaries of the materials.

As a discovery tool, A&I databases do not always provide full-text access, being more concerned with the creation of metadata for description and discovery (Duong, Perruso, & Ramachandran, 2013). Bibliographic databases can range from being very broad—such as Scopus, Web of Science, or EBSCO Academic Search Premiere—or be subject specific, such as ASFA or Library Literature & Information Science Full Text. The line between databases and e-journals has become blurred, however, with the discovery systems that publishers have put in place to search across the various journals which a publisher produces (Duong et al., 2013). In their discussion about the database subscription decision-making process implemented at California State University, Long Beach, Duong, Perruso, and Ramachandran (2013) note that Elsevier's Science Direct service allows users to build searches in Elsevier's catalog in a similar fashion to searching databases. Other publishers, such as Springer and Taylor & Francis, have incorporated searching capabilities across all their respective titles as well. The difference here, however, is that A&I databases allow users to search across the products of multiple publishers and document types, and give users access to a set of controlled metadata, rather than relying on author-generated keywords and a publisher's catalogue.

Within the last two decades, there have been ongoing discussions about the place of specialized A&I databases and whether they still serve different user populations well (Rabe, 2002). With discovery services like Google Scholar, Scopus, and Web of Science, librarians and information management professionals have been examining the utility and value of specialized A&I databases for their user communities (Chen, 2010). Rising subscription costs for both databases and journals, limited budgets, and the impact of changing exchange rates for universities based outside of the United States have put pressure on libraries to cut costs by eliminating databases that users are not accessing regularly (Salisbury, 2010; Scott & Eva, 2016). These factors, among others, are influencing decisions regarding collections development and how particular resources are evaluated.

In the event of a budget shortfall or changing priorities for a university, an academic library may begin the process of evaluating database licenses for potential cancellation. Stephen Shapiro (2012) wrote a short guide for librarians focusing on database

cancellations and how to navigate the process. He noted that the process can be complicated for a number of reasons, including the number of individuals involved in the process, different methods of calculating usage by vendors, and whether a database's coverage significantly overlaps with others (Shapiro, 2012). An additional layer of complexity can emerge if the database in question is subject-specific. Usage statistics of such databases compared to multi-disciplinary databases in these cases may not accurately reflect their importance to particular users, especially if a database focuses on a field deemed essential by the institution (Shapiro, 2012). Cost, usage, and necessity to users are all factors that libraries typically consider when reviewing database subscriptions and determining cancellation strategies (Shapiro, 2012).

Two papers emerged from a database licensing experiment conducted by Texas A&M University (TAMU) and ProQuest (Pickett, 2011; Tabacaru et al., 2016). In order to reduce staff time and university resources devoted to renewing database licenses, in 2011 TAMU decided to experiment with a Big Deal approach with ProQuest (Pickett, 2011). Big Deal, in this context, refers to the practice of subscribing to a large bundle of e-journals from major vendors, such as Elsevier, Wiley, and Springer (Lemley & Li, 2015). Several benefits of a Big Deal include the increased access to journals that a library might otherwise not subscribe to, a reduction in administrative costs, and limiting the amount of time spent negotiating with vendors (Lemley & Li, 2015; Pickett, 2011). As part of the Big Deal approach to database subscriptions, TAMU gained access to all of databases solely owned and operated by ProQuest for five years at a set cost (Pickett, 2011). Databases with third-party content that ProQuest administers, such as ASFA, were not covered under this licensing agreement (Pickett, 2011).

A follow-up study in 2016 reported the results of TAMU's experiment (Tabacaru et al., 2016). One complication the study noted was that ProQuest's business practices can make it difficult to evaluate databases using the statistics provided by the vendor (Tabacaru et al., 2016). The rebundling and renaming of databases potentially impacted usage statistics, making it difficult to track trends over the five years of the Big Deal at TAMU (Tabacaru et al., 2016). Another downside to the ProQuest comprehensive experiment was the loss in flexibility and the inability to diversify offerings with

databases either from other vendors or from third parties administered by ProQuest (Tabacaru et al., 2016). This situation mirrored problems that other libraries can have with Big Deal journal subscription packages. TAMU's experiment with bundling ProQuest databases ended after the initial subscription expired, with the librarians deciding to diversify the database licenses for their university (Tabacaru et al., 2016). This decision also gave TAMU the freedom to potentially cancel low usage databases if need be.

While A&I databases have traditionally played an important role in information-seeking and help to describe information via curated metadata, Google Scholar has grown into a popular resource for users and many rely Google Scholar on for information.

2.3 The Role of Google Scholar

Since 2004, Google Scholar has been designed to allow users to quickly search a wide range of scholarly materials using a simple search option. In addition to its searching capabilities, Google Scholar also provides information on article citations and impact measurements. For the purposes of this study, the literature reviewed focused solely on the searching and indexing capabilities of Google Scholar and the research about that component of the service. This review was undertaken to reflect the fact that Google Scholar is the web search engine used most frequently in studies comparing search engines with bibliographic databases (Bates et al., 2017; Halevi, Moed, & Bar-Ilan, 2017; Ştirbu, Thirion, Schmitz, Haesbroeck, & Greco, 2015).

For some institutions, free services like Google Scholar may be considered a viable alternative to paying vendors for database licenses. One study compared Google Scholar with several different database platforms in an attempt to determine if Google Scholar could be a suitable replacement for specialized databases (Chen, 2010). The impetus for the research was the rising costs for specialized databases, despite advancing technology making it easier for developers to build the databases in the first place (Chen, 2010). For this study, Chen specifically focused on academic journals that may place their tables of contents online to be discoverable by search engines and on whether Google Scholar could be a reasonable alternative to specialized databases (Chen, 2010). Based on the

information publishers provided and Google Scholar's indexing capabilities, the study concluded that if libraries need to cut subscriptions or reallocate funds, free services such as Google Scholar could be an alternative (Chen, 2010).

A study published five years later specifically focused on the subject of geography found a high level of coverage overlap between Google Scholar and Web of Science, and less overlap between Google Scholar and more specialized databases (Ştirbu et al., 2015). In addition to the high level of overlap, compared to other databases, Google Scholar returned more articles and documents in languages other than English (Halevi et al., 2017).

Google and Google Scholar have also influenced the development of web-based discovery platforms. Discovery layers—such as Summon, Primo, and EBSCO Discovery Service—serve as a centralized location for users to conduct searches over an organization's entire collection, including various electronic resources that organizations license (Dahlen & Hanson, 2017). These discovery layers are designed to be easy to use and encourage patrons to use the library's system as a starting point for research rather than Google Scholar or other search engines (Dahlen & Hanson, 2017; Foster, 2018). While these systems are popular with users, librarians have expressed concerns about how the discovery services order search results and how some bibliographic databases an organization subscribes to cannot be incorporated into the service (Foster, 2018). A study comparing Summon with the Social Sciences Abstracts database found that while students preferred using a library's default version of the discovery layer, it did not always return the articles with the most authority (Dahlen & Hanson, 2017).

There are several limitations to Google Scholar, however, including the inability to filter search results by document type, making it difficult to find specific types of materials (Halevi et al., 2017; Ştirbu et al., 2015). Because Google Scholar relies on an algorithm to sort and rank articles returned, methods are available to manipulate the results and inflate citation metrics to give more attention to some publications rather than others (Halevi et al., 2017). Another limitation of Google Scholar compared to traditional databases is related to the single search box and the lack of an advanced search function

(Boeker, Vach, & Motschall, 2013). Character limits to search strings, the inability to use symbols to indicate truncations or uncertain spelling, and restrictions on using logical operators can hamper researchers or librarians attempting to use Google Scholar as their main discovery tool (Boeker et al., 2013).

Furthermore, in a survey of studies comparing Google Scholar to more traditional databases, researchers found that these studies focused on journal coverage and did not necessarily include grey literature, despite Google Scholar's ability to return grey literature results and measure impact through citation analysis (Halevi et al., 2017; Hutton, 2009; Ştirbu et al., 2015). This oversight makes it difficult to compare the effectiveness in locating grey literature between Google Scholar and more traditional databases. For researchers dependent on grey literature for complete information, a library's decision to switch from specialized databases to relying on Google Scholar could prove problematic and make it more difficult to discover all relevant information in a timely manner.

Despite these limitations, Google Scholar has become a popular discovery platform for many researchers. In the first part of a longitudinal study examining how early career researchers (ECRs) find information, the study authors found that Google Scholar was ECRs' preferred platform (Nicholas et al., 2017). This preference for Google Scholar over general databases, such as Web of Science, or specialized databases was consistent across the different countries and disciplines sampled for this study (Nicholas, et al., 2017). One of the potential reasons for the researchers' preferences could be an overall familiarity with the structure of a Google search versus searching in a bibliographic database that offers multiple ways to conduct searches depending on the database. The study also found that ECRs are interested in reaching the full text of an information source as quickly as possible, which may also lead to a preference for Google Scholar over bibliographic databases (Nicholas et al., 2017). While some bibliographic databases offer full text, many require linking to the relevant websites or journal articles, necessitating extra steps for users. For researchers looking to save time, Google Scholar offers a reasonable alternative, particularly as it can pull information from a wide range of resources, including grey literature.

2.4 Grey Literature Dissemination and the Decision-making Process

Studies analyzing the types of information that policy makers rely on have found that grey literature may outweigh primary literature in some contexts (Cvitanovic et al., 2014; Soomai, 2017). Cvitanovic et al. (2014) found that information stemming from academic journals made up less than 15% of the total number of references cited in marine protected area plans. The information used also tended to be locally relevant to the area under discussion, rather than about different geographic regions (Cvitanovic et al., 2014). When explaining the lack of citations to academic literature, the researchers identified barriers, including accessibility, language, and timeliness as reasons grey literature may be preferred (Cvitanovic et al., 2014). Another study that focused on increasing access to grey literature surveyed decision-makers in Australia and found that grey literature, including reports, briefings, and conference papers, were heavily used and considered to be important resources (Lawrence, Thomas, Houghton, & Weldon, 2015). This study also found that grey literature comprised a majority of the information sources used by the decision makers surveyed (Lawrence et al., 2015).

The observation regarding the reliance on localized grey literature is supported by other research on the role of information in marine decision-making at national and international levels. For example, in a case study examining the flow of scientific information in fisheries management, Soomai (2017) documented the grey literature production process within the Canadian Department of Fisheries and Oceans (DFO). In this examination of the science-policy interface, she noted that many of the reports used by DFO were commissioned to address specific areas of concern (Soomai, 2017). Policy makers within DFO trusted these reports to be relevant to current problems and to contain information that could help inform their decisions. Another study found that grey literature comprised a majority of the sources cited in research conducted on the El Niño Southern Oscillation (ENSO) along the South American coast, with over 70% of the studies about how the ENSO impacted fishery and ecosystem management coming from grey literature (Thatje, Laudien, Heilmayer, & Nauen, 2007).

Relying on grey literature about specific locations, however, means that decision-makers may be unaware of grey literature concerning similar environments in different parts of

the world (Cvitanovic et al., 2014). While information within grey literature may be unique or of value to multiple audiences, if it is difficult to find, undocumented, or unorganized, then it is of very little use to decision makers and researchers (Davis, Tenopir, Allard, & Frame, 2014; Lawrence et al., 2015). In a survey assessing the information needs of biodiversity researchers, Davis et al. (2014) found that a lack of quality metadata describing information sources created barriers to finding grey literature. Researchers in Australia also found that poor metadata, costs, and a lack of accessibility were also barriers to grey literature use by decision makers (Lawrence et al., 2015). Metadata, either generated by the user or by a third party, describes the publication and can assist users in locating relevant information. Lack of consistent metadata can prevent grey literature from being fully accessible. A related barrier to grey literature use identified by researchers is that it may be in formats that limit easy discovery, such as printed reports that have yet to be made digitally accessible or in older data storage formats (Lawrence et al., 2015; Thatje et al., 2007). This lack of accessibility can pose specific problems for longitudinal studies, potentially leading to the impression that the data for earlier periods of time are absent rather than difficult to locate (Thatje et al., 2007).

Language may also serve as a barrier to grey literature discovery and dissemination (Thatje et al., 2007). While English is the dominant language for science globally, grey literature tends to be written in the language most useful to the producers and users, potentially limiting its reach (Thatje et al., 2007). When conducting their study on grey literature relating to the Humboldt Current and ENSO, researchers found that papers published in commercial journals regarding ENSO contained very few references to grey literature published in Spanish (Thatje et. al, 2007). The researchers also noted a stigma may also be associated with citing grey literature, after observing that Latin American researchers were not citing grey literature in their commercial publications (Thatje et al., 2007). Possible reasons for this theorized stigma could include confusion over proper citation or fear of online grey literature disappearing from the internet (Smart, 2015). One of the main goals of the ASFA Partnership is to address some of these barriers to grey literature access, such as indexing grey literature from developing countries and allowing for greater access and exposure (FAO, 2018a).

Aside from ASFA, other international initiatives aim to disseminate information about marine and fisheries focused grey literature. The International Association of Aquatic and Marine Science Libraries and Information Centers (IAMSLIC) oversees the Aquatic Commons, which is a free digital repository aimed at collecting and sharing information from around the world (Aquatic Commons, n.d.). The Aquatic Commons is linked to OceanDocs, another international digital repository overseen by the Intergovernmental Oceanographic Commission (IOC) of UNESCO (Aquatic Commons, n.d.). While not a bibliographic database like ASFA, both the Aquatic Commons and OceanDocs focus on the digitization and preservation of grey literature from developing countries that may not have repositories of their own, as a way to facilitate sharing information and preserving the documents in the event of a natural disaster or other form of destruction (Kalentsits & Gribling, 2013). In addition to serving as a digital repository, the Aquatic Commons has also partnered with ASFA to ensure the metadata for the grey literature is included in the ASFA database, widening the depository's reach (Kalentsits & Gribling, 2013). Kalentsits and Gribling (2013) found that the focus of the Aquatic Commons on digitizing and disseminating grey literature from developing countries increased awareness and distribution of information, particularly older grey literature that may have been difficult to previously locate or access.

2.5 Previous Research about ASFA

ASFA serves as valuable source of otherwise difficult to locate information for researchers, particularly grey literature (Papathanasopoulou, Queiros, Beaumont, Hooper, & Nunes, 2016; Pedersen et al., 2016; Schwindt & Bortolus, 2017). Similar to the studies comparing Google Scholar with other bibliographic databases, some research has compared ASFA to similar bibliographic databases used in aquatic sciences. A study, conducted in 2005 by Joan Parker, compared ASFA with Biosis Previews, Web of Science, and Zoological Record (Parker, 2005). Using a series of search terms, she aimed to determine if content overlap occurred, which databases contained unique materials, and what specialized types of materials the databases held (Parker, 2005). Parker found that ASFA contained on average more records for grey literature than the other three databases used, but ASFA did not index as many academic journals as the other

databases (Parker, 2005). This result may be due to ASFA's explicit prioritization of grey literature inclusion within the database to facilitate discovery and dissemination of information (FAO, 2009b).

A more recent study comparing ASFA with other discovery services for the marine sciences has not been conducted, but Parker's research highlights some key points regarding ASFA. The first is that, in alignment with the ASFA Partnership's goals of disseminating information about grey literature, ASFA contains more grey literature records than similar services. Grey literature can be dispersed among many locations and in a diversity of formats. By ensuring that ASFA abstracts and indexes grey literature, the database facilitates its discoverability by researchers who may need it. The second point is that some researchers may undervalue ASFA due to it not indexing some academic journals (Parker, 2005). Parker notes that while the number of indexed academic journals may not be a surprise to information professionals, researchers may be unaware of ASFA's goals and devalue the database as a research tool (Parker, 2005).

In addition to the marine sciences, ASFA also covers literature related to freshwater research. In a similar study to Parker's, University of Montana librarian Barry N. Brown analyzed select databases for information on freshwater biology. Prior to conducting the comparison searches, he surveyed members of IAMSLIC about their preferred freshwater biology databases. ASFA was listed as the most popular, followed by Biological Abstracts, Web of Science, Scopus, and Google Scholar (Brown, 2007). Brown then looked at databases to determine whether they indexed the 12 most influential journals identified by the North American Benthological Society (NABS) and if there was a significant delay from a journal's publication to its inclusion in records in the database (Brown, 2007). In addition, he also conducted searches within the databases and ranked them based on the number of results returned and their relevance (Brown, 2007).

Brown found that ASFA was the only database in the top five listed by IAMSLIC members that did not index all 12 journals tested in his study, and that of the journals it did index, there was a lag between the initial publication date and records included in ASFA (Brown, 2007). Based on his criteria, Brown's study ranked ASFA 7th out of 14,

the only preferred database identified by IAMSLIC members to not make the top five based on his criteria (Brown, 2007). Brown specifically focused on academic journals and made no note of grey literature related to freshwater biology. His research indicates, though, that scientists looking for primary literature on freshwater biology may not find what they are looking for by using ASFA.

Both the Parker and Brown studies were conducted over ten years ago with no recent follow up research to determine whether any factors may have changed. These studies also analyzed how ASFA compared to other databases using a set of search terms and other criteria, rather than determine how users value these services. Parker and Brown provide insight into how ASFA compared with similar databases and where ASFA's strengths and weaknesses may lie, but they did not explore how users may have valued the database and the features it offers.

2.6 Summary

Rising licensing prices for A&I databases like ASFA, limited library collections budgets, and increased use of Google Scholar are all factors that could contribute to declining use of ASFA and the subsequent loss of royalties. For institutions outside the United States that do not qualify for free copies of ASFA, fluctuating currency exchange rates may further influence their decision to cancel a license (Scott & Eva, 2016). Understanding the decision-making process behind choosing and evaluating databases for subscription, cancellation, or renewal helps provide context to usage trends, as well as how users are interacting with the ASFA database. While previous research examined ASFA's content, no investigation has been conducted about how the database is used, how information professionals view the database, or has analyzed the global usage patterns. This study was designed to provide context to the subscription and usage data ProQuest and the ASFA Secretariat were seeing, as well as to gain new insight into what ASFA's strengths and weaknesses might be to a user from the perspective of information professionals around the world.

Chapter 3: Methodology

Because the research questions in this project are focused on both usage and subscription trends and the reasons behind the trends, a mixed methods research design was chosen as the best way to collect and analyze data. Reviews of research designs have indicated that mixed method approaches may be preferred for a variety of reasons, including initiatives to gain a more complete view of a research problem or using the different methods to confirm findings (Bryman, 2006). Analysis of the longitudinal usage data provided by ProQuest can help to identify trends over time, including growth or decline in subscriptions, the main types of users, and whether usage in countries in the same geographic regions display similar patterns. The Google Analytics data can be analyzed to determine how users are engaging with the database and the results can possibly provide insights about redesigning the user interface. What the quantitative data do not do, however, is explain the decision-making process(es) behind the choice to subscribe to the Aquatic Sciences and Fisheries Abstracts (ASFA) database or explain why particular usage and subscription trends may be occurring. Using mixed methods helped provide context for the usage data and a more comprehensive analysis and set of conclusions.

Qualitative data were collected through the following two methods: a survey of ASFA subscribers and interviews with marine science librarians around the world. Both the survey and the interviews were designed to provide context to the usage data through questions about changes in information-seeking behaviour, information about the database selection process, and a list of sources of marine and aquatic information other than ASFA. The questions in the survey and interviews also explored what subscribers and information professionals think the future of abstracting and indexing services is and what can be done to improve ASFA. The results based on all the data sets can be used to help direct future studies conducted by the ASFA Impact Evaluation Working Group.

3.1 Pilot Interview Process

Prior to embarking on the larger research study, the interview protocol was tested and refined through pilot interviews with an academic librarian and a government librarian, completed in August 2017 (see Appendix A: Pilot Interview Protocol). In addition to

testing the interview protocol, these interviews were designed to gather preliminary data that would direct the thesis proposal and influence other aspects the research design. The two librarians were chosen due to their specialization in marine science, as well as the expectation of providing different perspectives based on the differences in user populations and areas of their institutions' focus.

To conduct the pilot interviews, ethics approval was obtained through the Dalhousie University Faculty of Management ethics review process. (see Appendix B: Faculty of Management Ethics Approval Letter). The interviews, with consent from the participants, were recorded and transcribed for analysis. The preliminary findings were used to revise the interview protocol and to develop the questions for the survey. These preliminary findings were also presented at two conferences in 2017 (the Dalhousie Marine Affairs Program Sustainable Oceans Conference in Halifax, Nova Scotia in September 2017 and the International Association of Aquatic and Marine Science Libraries and Information Centers (IAMSLIC) Annual Conference in Honolulu, Hawaii in October 2017).

3.2 Ethics Approval

Prior to embarking on the larger research study, ethics approval was sought and received from the Dalhousie University Social Sciences & Humanities Research Ethics Board (REB) for the survey and interviews (see Appendix C: Dalhousie Social Sciences & Humanities Research Ethics Board Letter of Approval). Ethics approval was not required for the analysis of the longitudinal usage data and Google Analytics data, as personal information was not included in the data provided by ProQuest.

3.3. Quantitative Data

Two forms of quantitative data, both provided by ProQuest, were used in this research project: longitudinal ASFA usage data for the period 2012 to 2017 and Google Analytics data for 2016-2017.

3.3.1 ASFA Usage Data

The usage data contained the number of accounts, total retrievals, average retrievals per account, and the number of billing accounts for all ASFA subscribers. The data was categorized by country and then Ringgold tier. Ringgold tier refers to a part of a proprietary classification system developed by Ringgold Inc. to help publishers and database vendors organize and maintain records about their clients (Ringgold, 2018a). Ringgold tiers group institutions by type, with academic institutions aside from medical schools grouped further by school level and size. The number of billing accounts differs from the total accounts due to the fact that a billing account might support multiple accounts.

Although data beginning in 2004 was requested from ProQuest in order to determine whether the introduction of Google Scholar, which was launched in 2004, might have impacted ASFA, it was not feasible to obtain data for the period from 2004 to 2012. ProQuest bought rights to ASFA from the previous database administrator, and the companies used different methods to track usage. Data prior to 2012 were recorded in a different format and contained different variables than data collected by ProQuest, making it impossible to complete an analysis that included pre-2012 data. The 2012-2017 longitudinal usage data do not reflect the full reach of ASFA, as the Food and Agriculture Organization of the United Nations (FAO) provides Low Income Food Deficit Countries (LIFDC) with copies of the database on CD-ROM or DVD for free.

The business intelligence software SAP Lumira was chosen to assist with the analysis of the ASFA longitudinal usage data. SAP Lumira offers a variety of visualization options, including creation of charts documenting changes over time, as well visualizations displaying geographic distribution of data (SAP SE, 2018). For most of the analysis of this data, the number of accounts was chosen as the main variable, with retrievals per account (RPA) selected as a secondary variable. This decision was due to the fact that the number of retrievals was not a consistently reliable metric. Three large spikes in retrievals were noted which ProQuest identified as possibly due to illegitimate use. Due to the way ProQuest formatted the data, the RPAs for different accounts were added together to achieve the total average RPAs used when examining usage over time.

To augment understanding of the usage data by providing additional dimensions, data retrieved from the World Bank Data Catalog were included in the analysis. The variables selected included per country total fisheries production in metric tons, gross domestic product (GDP) in current US dollars, and population. These data variables were licensed under Creative Commons Attribution 4.0, for use with credit (World Bank Group, 2017). In addition to identifying general trends in the usage data over time, including these variables was designed to help explain usage patterns based on economic status and education levels of the countries. Some difficulties were encountered, however, in integrating this data. Data for the selected variables were not available for every country for all years of the study. Data about fisheries production were only available for 2012 to 2015, and GDP and population only up to 2016. Population and GDP data were the most consistently available, with only data for Venezuela missing. Data for Taiwan, which is listed as a separate territory in the ASFA database, are included with mainland China in the World Bank data catalog. Thus, in an analysis of the ASFA usage data in relation to World Bank data, it was not possible to present Taiwan separate from China. For country specific analysis, Taiwanese accounts were combined with Chinese accounts and new RPAs calculated.

3.3.2 Google Analytics Data

Google Analytics is a service designed to provide insights into how users interact with web pages. Basic Google Analytics data provide information on new and returning users, the length of an average session, and the pages in a website that users visit. ProQuest, which began using Google Analytics in 2016 to track user interactions with its various databases, provided the data for 2016 and 2017. This data covers a short period in contrast to the longitudinal usage data. The Google Analytics data does, however, show how users interacted with the ASFA database product during two recent years, which can complement the longitudinal data for the same period.

3.4 Survey of ASFA Subscribers

To augment the analysis of the longitudinal usage data, an online survey of current ASFA subscribers throughout the world was conducted. A representative of each subscribing

institution was invited to complete the survey, which asked how databases are evaluated for initial subscription or renewal, whether and how database usage is tracked, the number of database subscriptions, and other information sources used in addition to ASFA (see Appendix D: Survey Protocol). The survey also asked participants for their opinions about the key features of ASFA and whether the database meets the needs of their user community. The survey was designed to determine why institutions subscribe to ASFA and to gain insight into the decision-making processes about database subscriptions. The survey contained a mix of "yes/no," multiple choice, and open-ended questions, with branching of questions to capture variations in the subscriber population. In developing the survey questions, the advice of the ASFA Secretariat was sought which was incorporated in the design of questions. The survey was created in Opinio and hosted on a server in Canada in accordance with Nova Scotian privacy laws. The opening screen of the survey contained the consent form and only participants who gave consent were able to proceed with the survey.

Descriptive statistics were used to gain an understanding of the quantitative data (Leedy & Ormand, 2016). The open-ended responses were analyzed using inductive qualitative analysis, which involves coding responses and grouping them into categories (Elo & Kyngäs, 2008).

3.4.1 Survey Data Collection

To protect the proprietary nature of their subscription list, ProQuest agreed to distribute the survey invitation message, which included a link to the online survey. Two mass email batches were sent to ASFA subscribers, one to those based in the United States and the second for those outside the US. Due to Canadian anti-spam law, invitation messages were sent individually to the Canadians subscribers. The initial invitation was sent to 216 ASFA subscribers on February 5, 2018, with the survey scheduled to close on February 28, 2018. A reminder email was sent on February 19, 2018.

The low number of initial responses to the survey uncovered a technical glitch affecting the messages sent to subscribing institutions other than those located in Canada. The technical issue occurred with the mass email messages, leading to a large number of the

invitations being supressed (messages bounced back). Because of the technical problem, the closing date of the survey was extended to April 2, 2018 and ProQuest re-sent the invitation message to ASFA subscribers on March 20, 2018 using a method to prevent bounce back. Out of the 265 subscriber email addresses, 45 failed to deliver due to invalid email addresses.

To promote completion of the survey, the ASFA Secretariat sent a message about the survey to the IAMSLIC email list. Blog entries promoting the survey were also posted on the Open Channels Sustainable Ocean Management & Conservation website (https://www.openchannels.org/blog/emdesanto/afsa-survey-invitation) and the website of the Environmental Information: Use and Influence research program (https://eiui.ca/eiui-researcher-conducts-study-about-the-international-aquatic-sciences-and-fisheries-abstracts/).

3.5 Interviews with Marine Science Librarians

The fourth data collection method used in this research project was semi-structured interviews with members of IAMSLIC. The interviews were designed to complement the survey data by obtaining more detailed views from information professionals working in the marine science field that ASFA serves. These professionals could provide insight into features of ASFA that are or are not working for users, as well as provide additional information about the key features of ASFA. IAMSLIC is the leading professional organization for marine science librarians, with members located around the world. Interviewing IAMSLIC members provided additional perspectives about ASFA as recruitment for the interviews was not limited to ASFA subscribers.

The initial recruitment for interviewees occurred in conjunction with the IAMSLIC annual conference held in Honolulu in October 2016. Prior to the conference, an interview invitation was sent to the 36 attendees. The invitation was verbally repeated during a presentation at the conference. Five attendees agreed to face-to-face interviews and three expressed interest in participating through other means. The face-to-face interviews were conducted over Skype and Google Hangouts (see Appendix E: Interview

Protocol). With the participants' consent, the interviews were recorded and transcribed into Microsoft Word.

Feedback received from non-native English-speaking attendees at the IAMSLIC conference led to a modification of the interview protocol and recruitment process. Due to language proficiency and time differences, the interview questions were converted into a Word form that participants could complete and return by email (see Appendix F: Revised Interview Protocol).

Recruitment for the email version of the interview took place in several stages. Invitations were sent by email to IAMSLIC regional groups for distribution in November. In late 2017, the ASFA Secretariat helped to identify IAMSLIC members in regions not represented in the interviews conducted at that point. Recruitment email messages were sent to these members, with the most interest in completing the interview via the Word form coming from Latin America and Africa. A final recruitment email message was sent in late January 2018. In total, including the pilot interviews, 18 interviews were completed with participants; seven were conducted orally and 11 were completed using the Word form.

3.5.1 Analysis

The audio files of interviews conducted orally were transcribed into Word files and along with the interviews completed via the Word form, were thematically coded using qualitative content analysis in the qualitative data software NVivo 11 for Mac. The codes were reviewed and grouped into themes. The coding was then independently checked, and a second round of thematic grouping occurred. The codes were then counted and analyzed independently before being compared to the coded open-ended responses from the surveys to identify possible similarities and differences.

The results from each of the data sets are presented in Chapter 4, along with the analysis of the data.

Chapter 4: Results

As outlined in Chapter 3, four different datasets were collected to conduct this research. This chapter focuses on the analysis of the longitudinal usage data and Google Analytics provided by ProQuest, as well as the survey and interview data.

4.1 Longitudinal Usage Data

The longitudinal data provided by ProQuest covered the years from 2012 to 2017. The data were grouped by country and then by Ringgold tiers. Ringgold tiers refer to a classification method used by ProQuest to identify and group database subscribers (see Table 1). The academic tiers, aside from medical schools, were assigned the codes A1 through A6 to differentiate them.

Table 1. Ringgold Tier Definitions for Tiers A1 Through A6 (Ringgold, 2018b).

Ringgold Tier	Description
A1	Education establishments teaching to the end of K12, including preschools, kindergarten, nursery school, elementary, primary, middle and high schools, and sixth-form colleges, and school districts and local authorities running education at this level including special schools for the disadvantaged
A2	Community colleges, technical colleges, and colleges of further education (CFEs). Includes vocational subjects and covers both K12 and older age groups. Institutions in this tier do not grant degrees
A3	Smaller non-PhD universities, and their faculties and departments, which grant degrees and masters degrees, but not doctorates. These institutions carry out very little research
A4	Universities which grant doctorates, and carry out significant amounts of research, and their faculties and departments. They may have a large number of students, but are in this tier because of their research activities
A5	Large non-PHD universities with 20,000+ students, and their associated faculties and departments, and distance learning universities
A6	An administrative grouping of teaching institutions, universities or colleges, usually covering a large region or state

4.1.1 Global Patterns

For the purposes of analysis, the Aquatic Sciences and Fisheries Abstracts (ASFA) accounts were grouped into two categories: academic and non-academic accounts. Academic accounts include Ringgold tiers A1-A6 plus medical schools. Non-academic accounts include the Ringgold tiers for consortia, corporate, government, hospitals, museums, non-profits, and public libraries. The two groups were created to place similar subscribing institutions together and to determine whether trends exist in the number of accounts and the total average retrievals per account (RPAs) for the different account types.

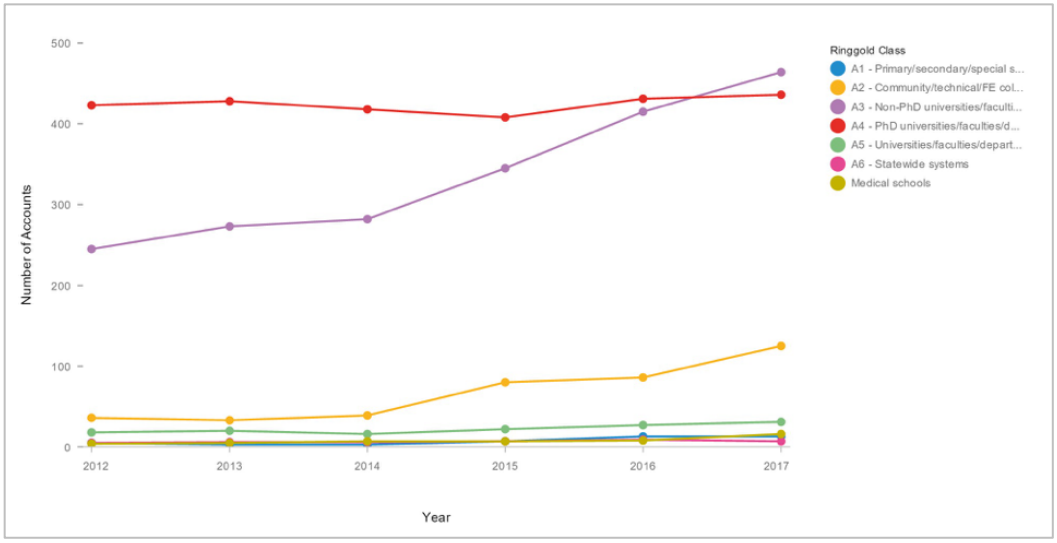

Figure 1. Number of Academic ASFA Accounts by Year and Ringgold Class 2012-2017.

On a global level, the number of ASFA accounts steadily increased from 2014 to 2017, growing from 960 to 1321 (an increase of 37.6% or an average of 12.5% per year) (see Figure 1). The growth in this period was much more rapid compared to 2012 to 2014, when the number of accounts increased slowly from 928 to 960 (3.4% or 1.7% a year). A large increase in A3 Ringgold tier accounts contributed to the rise in subscriptions, which grew from 282 in 2014 to 464 in 2017 (64.5% or an average of 21.5% a year). In 2017, A3 tier accounts overtook A4 as the most numerous type. During the period from 2014 to 2017 A2 tier accounts grew from 39 to 125 accounts (220.5% or an average of 73.50% per year). From 2012 to 2017, A4 accounts experienced minimal growth, from 423 in 2012 to 436 in 2017 (3.1% or an average of 0.6% per year). During that same period, A4

tier accounts reached a low point of 408 in 2015. Overall, all academic tier accounts experienced some growth from 2012 to 2017, although A6 declined from eight accounts in 2016 to seven in 2017 (12.5% decline).

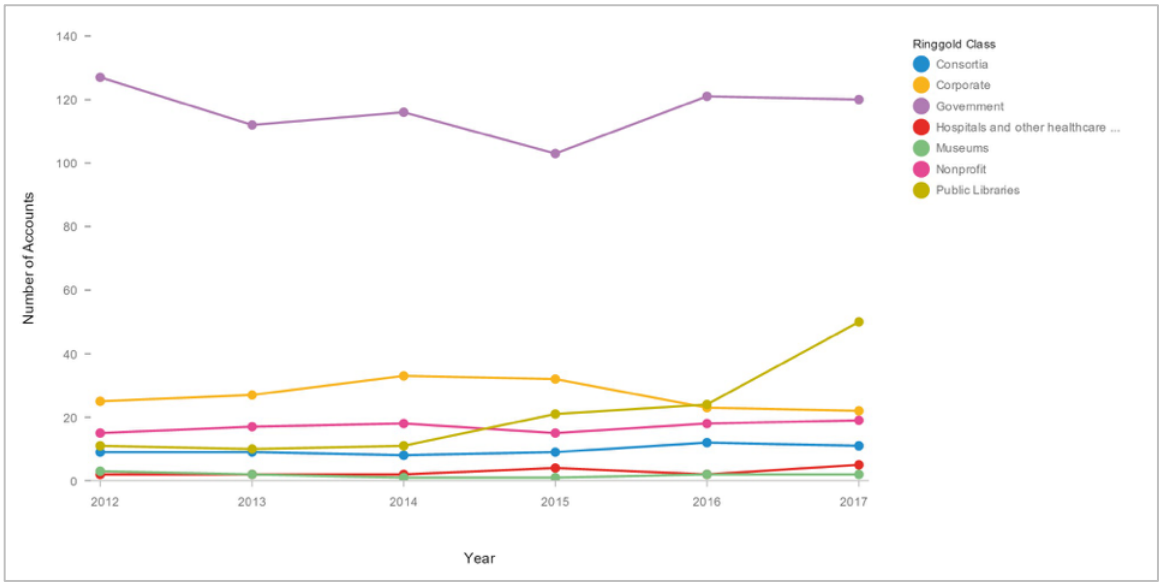

Figure 2. Number of Non-Academic ASFA Accounts by Year and Ringgold Class 2012-2017.

Among the non-academic accounts, government subscriptions comprised the largest group (see Figure 2). The number of government accounts fluctuated with an overall decline from 2012 to 2017. They started with 127 in 2012, declining to a low of 103 in 2015 (18.9% decline or an average of 6.3% a year), and then rising to 120 in 2017 (16.5% growth or an average of 8.25% a year). In the non-academic group, public library accounts demonstrated the most growth, rising from 11 in 2012 to 50 in 2017 (355% growth or an average of 71% a year). Corporate accounts initially grew from 2012 to 2014 before declining starting in 2015. Among the remaining non-academic accounts, non-profits, consortia, and hospitals experienced a small rate of growth from 2012 to 2017, while museums declined from three accounts in 2012 to two in 2017.

The global total average retrievals per account (RPAs) fluctuated between 2012 through 2017. The lowest point occurred at the beginning of the period in 2012, with 64,251 total average RPAs, corresponding to the lowest number of total accounts. The data shows a spike in average retrievals per account in 2013, due to a substantial increase in retrievals

in China and Brazil, which may have been the result of attempts to circumvent ASFA paywalls or large-scale efforts to download records from database (R. Newman, personal communication, October 19, 2017). Aside from 2012, the lowest average retrievals per account was 81,294 in 2016.

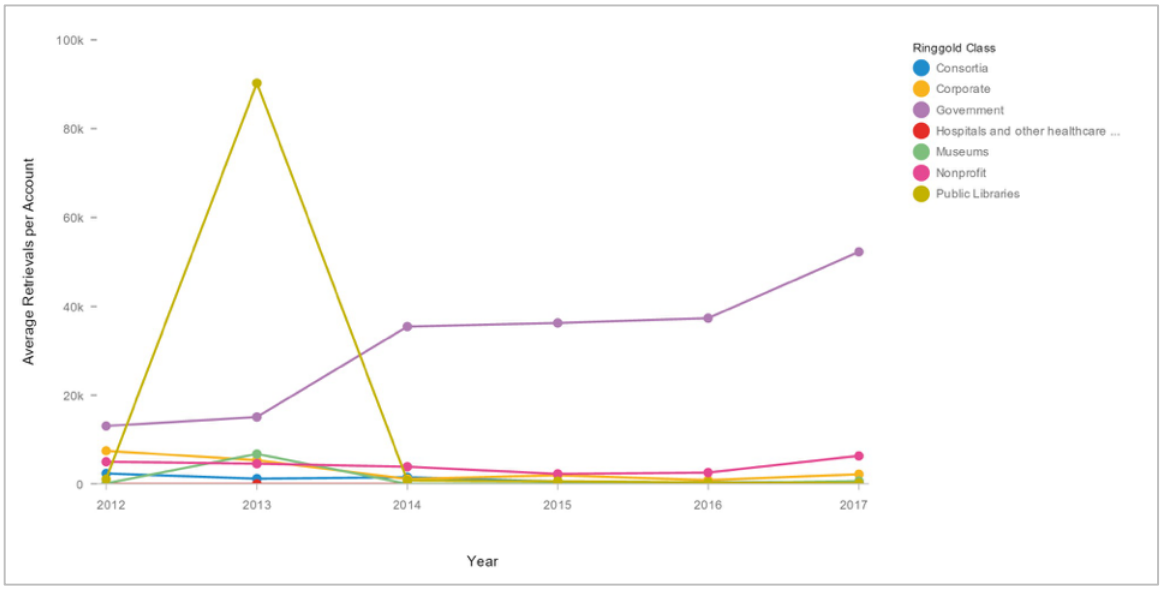

Figure 3. Non-Academic Average Retrievals per Account by Year and Ringgold Class 2012-2017.

When retrievals are considered by Ringgold tier, only the government category showed a continuing increase in total average RPAs (see Figure 3). In 2014, this category overtook A4 accounts with the largest share and continued to grow through 2017 to 52,256 RPAs in that year. The A4 accounts fluctuated in the average retrievals per account, peaking in 2015 with around 33,586 RPAs before decreasing to a low of 16,536 RPAs in 2017 (see Figure 4). The average retrievals per A3 account increased between 2012 and 2016 before declining in 2017. Despite the number of A2 accounts increasing from 2012 to 2017, the total average retrievals remained low, peaking in 2016 at 102, but otherwise never reaching higher than 87 RPAs.

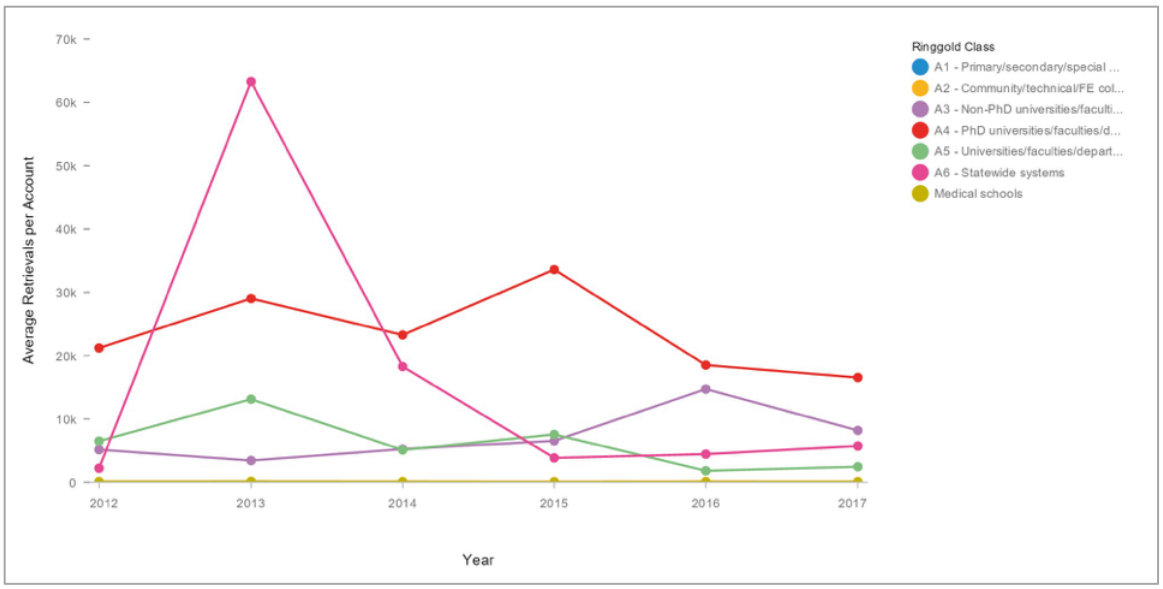

Figure 4. Academic Average Retrievals per Account by Year and Ringgold Class 2012-2017.

Globally, while there appears to be substantive growth in the academic sector for new ASFA accounts, that growth has not led to a corresponding increase in RPAs. This was particularly noticeable for A2 accounts, which grew substantially in number but had very little use. Government accounts, on the other hand, showed continued use by users who maintained access to ASFA. The increase in academic accounts may be due to how ProQuest packages the ASFA database, with more academic institutions choosing to subscribe to a database bundle that includes ASFA, despite not having a specialized aquatic science or aquaculture program.

4.1.2 Regional Patterns

To analyze the longitudinal data further, countries with ASFA accounts were grouped into seven geographic regions: Africa, Asia, Australia and the Pacific, Europe, the Middle East, North America and the Caribbean, and South America. This grouping was done to see if there were regional variations in subscriptions to ASFA, as well as how the database was being accessed.

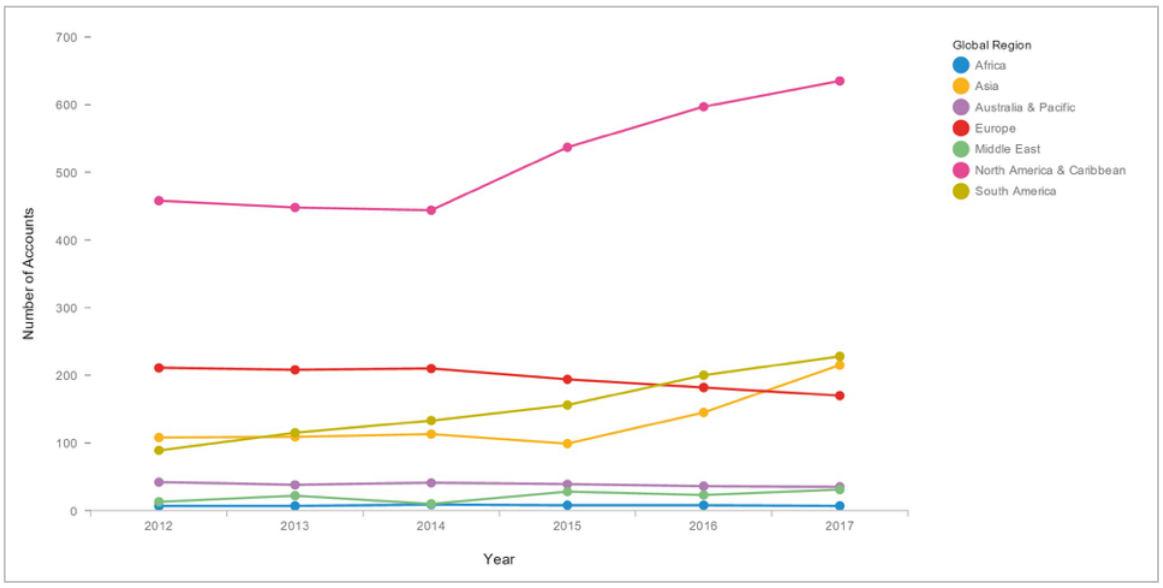

Figure 5. Number of Accounts by Year and Global Region 2012-2017.

Among these regions, institutions in North America and the Caribbean subscribe to the largest portion of accounts (see Figure 5). While accounts declined slightly from 458 in 2012 to 444 in 2014 (3.1% decline or 1.5% a year), after 2014 the number of accounts grew to 635 in 2017 (43.0% growth or 14.4% a year). The region with the next largest share is South America, followed by Asia and Europe. Out of the four regions with the higher number of subscriptions, only Europe showed a decline in accounts during the period from 2012 to 2017. European subscriptions dropped from second to fourth position by 2017, with South America overtaking Europe in 2016 and Asia overtaking Europe in 2017. From 2012 to 2017 South American accounts grew from 89 to 228 (156.2% growth or 31.2% a year). Asian accounts also experienced growth; except for a low of 99 in 2015, accounts grew to 215 in 2017 (an increase of 117.2% from 2015 to 2017 or 58.6% a year). Among the remaining three regions, Africa had the lowest number of accounts, fluctuating from 7 in 2012 to 9 in 2014 then back to 7 in 2017. The Australia and the Pacific region experienced a small decline from 42 accounts in 2012 to 35 accounts in 2017 (16.7% decline or an average of 3.3% a year). The Middle East overall experienced growth in the number of accounts, from 13 in 2012 to 31 in 2017 (138.5% or an average of 27.7% a year) with a dip in in 2014 to 10 accounts.

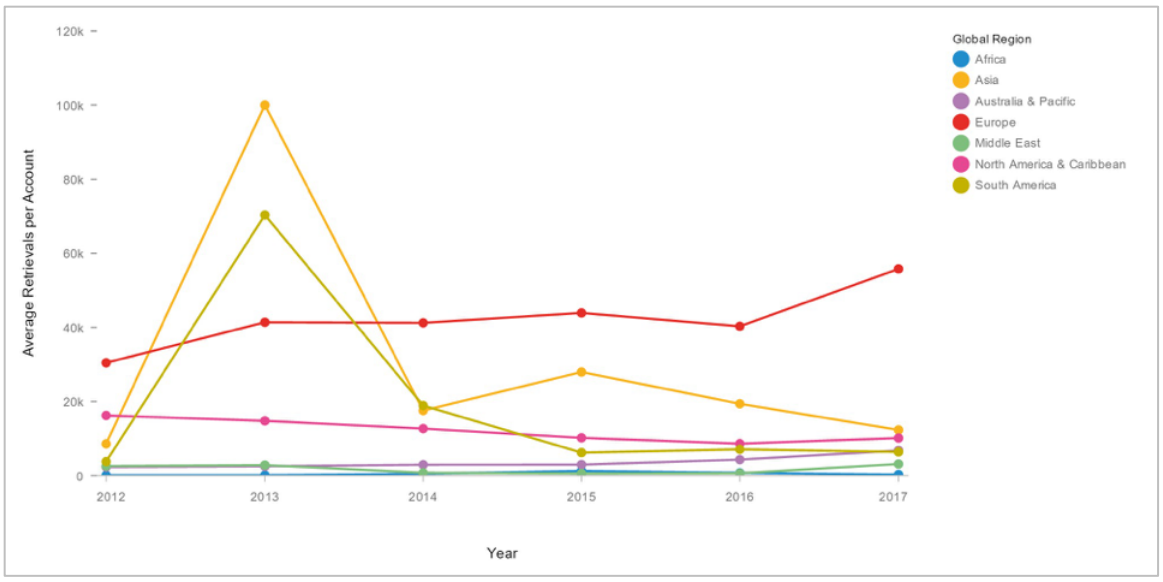

Figure 6. Average Retrievals per Account by Year and Global Region 2012-2017.

Several trends stand out in the regional data of average retrievals (see Figure 6). The European retrievals grew from 30,467 RPAs 2012 to 55,805 in 2017 (83.2% growth or an average of 16.6% a year). North American and the Caribbean RPAs, on the other hand, declined from 16,252 RPAs in 2012 to 8,645 in 2016 (46.8% decline or an average 11.7% a year) before increasing in 2017 to 10,174 retrievals per account (17.7% increase). Asian RPAs experienced two spikes in 2013 to 99,991 RPAs and 2015 to 27,982 RPAs, associated with usage in China. Overall, the average retrievals per account in Asia increased from about 8,598 RPAs in 2012 to 12,350 in 2017 (43.64% growth overall). South American accounts, aside from the peak in 2013, showed average retrievals per account of under 10,000, with 6,430 average RPAs in 2017. While the average RPAs in 2017 are higher than in 2012, retrievals per account in South America are currently fewer than in four other regions (Europe, Asia, North America and the Caribbean, and Australia and the Pacific). In the Australia and the Pacific region, the average retrievals per account grew from 2,353 in 2012 to 6,809 in 2017 (189.4% increase or an average of 37.9% a year). The average retrievals per account in the Middle East region also exhibited growth over that period of time, although showing more variability, reaching a low of 797 RPAs in 2014. In Africa, the average retrievals per account peaked in 2015 with 1,298 RPAs before declining to 318 in 2017 (75.5% decrease).

Despite seeing a decrease in the number of accounts, European subscribers continued to access ASFA at higher levels than other regions. North American and Caribbean accounts, on the other hand, had an overall decline in RPAs compared to the region's overall growth with accounts. As with the global comparison for types of accounts and the RPAs, this usage pattern may be due to how ASFA is bundled and licensed with other databases. Another point of interest is that the year to year decline in Asian RPAs begins in 2015, the same year that the number of accounts in the region began to increase. This outcome may be due to more organizations that do not focus on aquatic sciences or aquaculture gaining access to the database.

Africa

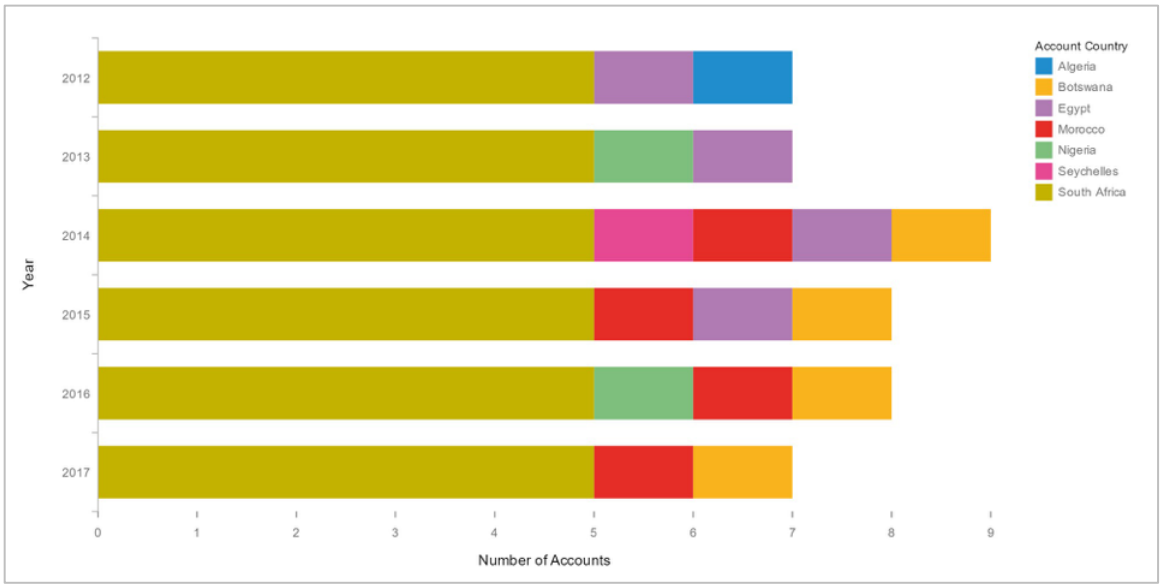

Figure 7. African Accounts by Year and Country 2012-2017.

Within Africa, South Africa was the only country whose institutions maintained ASFA accounts every year between 2012 and 2017 (see Figure 7). Institutions in both Algeria and the Seychelles had ASFA accounts for one year, 2012 and 2014 respectively, but otherwise did not subscribe. There was one account in Nigeria in 2013 and 2016. Egypt had a single account from 2012 to 2015, and institutions in Botswana and Morocco began subscribing in 2014 with a single account each.

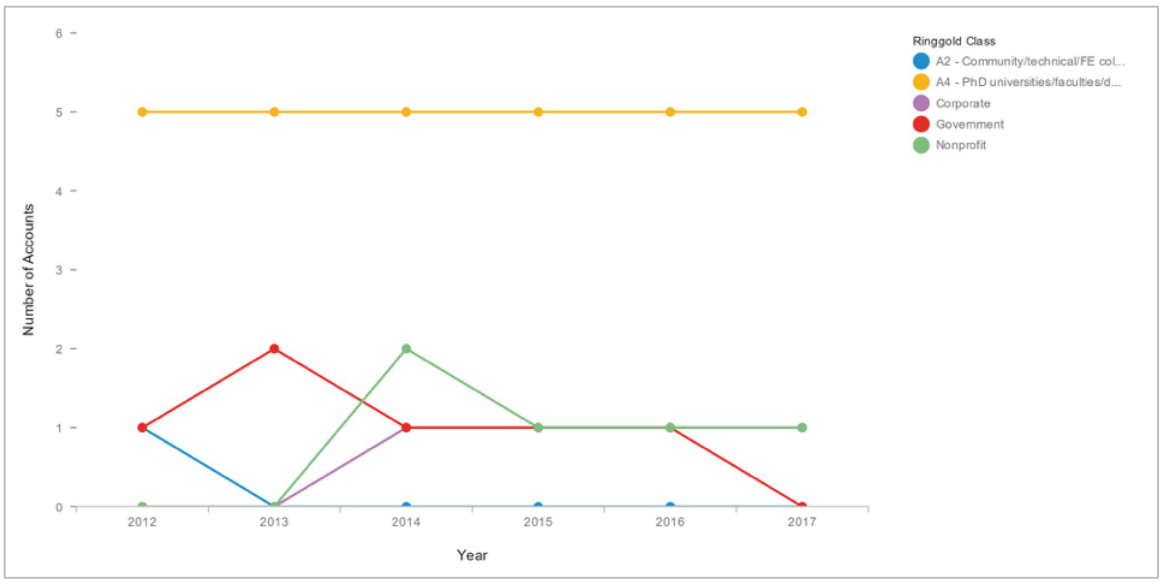

Figure 8. African Accounts by Year and Ringgold Class 2012-2017.

By Ringgold tiers, A4 accounts were the most numerous, with five accounts each year (see Figure 8). Government accounts went from one in 2012 to two in 2013 before returning to one in 2014 and none in 2017. Two non-profit accounts were set up in 2014 before falling to one from 2015 through 2017. Beginning in 2014, a single corporate institution opened an account in the region. A subscription by a community college (A2 tier) was established in 2012 but none after that year.

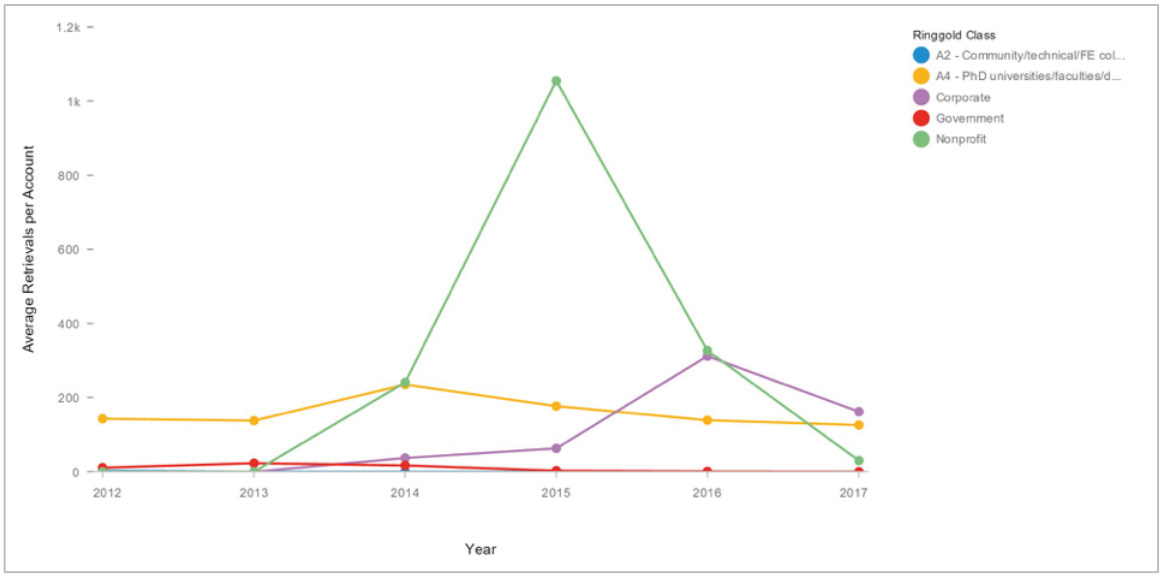

Figure 9. African Average Retrievals per Account by Year and Ringgold Class 2012-2017.

In regard to the total average RPAs by account type in the region, only two Ringgold tiers achieved above 300 (see Figure 9). A non-profit organization accounted for 1,055 RPAs in 2015, and 327 in 2016. In 2016 a corporate account showed 312 RPAs. A4 accounts peaked at 235 RPAs in 2014 before declining to 126 in 2017. After a peak in 2015, the RPAs for the non-profit account declined to 327 in 2016 and only 30 in 2017.

While the number of accounts in Africa showed little variation, the RPAs were more variable. The RPAs peaked at different times, indicating that user groups were accessing the database at different points in time. The much higher usage by the non-profit organization in 2015 compared to the other accounts is notable as no other account type came close to the same level of retrievals.

Asia

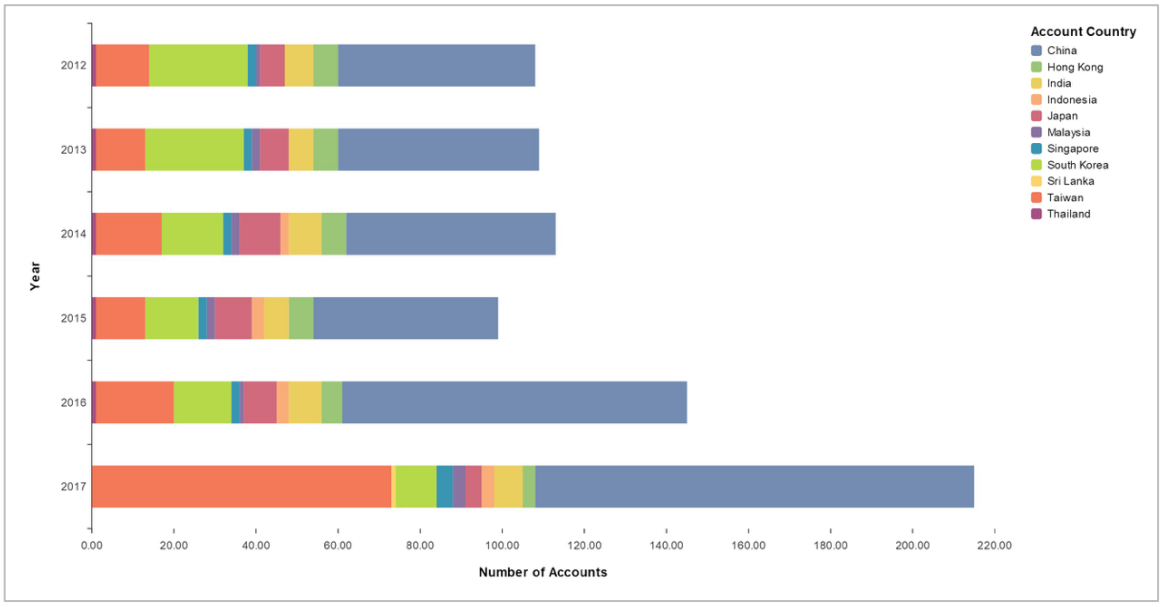

Figure 10. Asian Accounts by Year and Country 2012-2017.

As mentioned above, the number of Asian accounts grew from 2012 to 2014 before declining in 2015 and increasing again in the subsequent two years (see Figure 10). While at least one institution in most of the Asian countries subscribed to ASFA between 2012 through 2017, there were a few exceptions. An Indonesian organization began subscribing in 2014 and continued through 2017. In Thailand, one institution maintained

a subscription from 2012 through 2016 before dropping the subscription in 2017. One Sri Lankan account was opened in 2017.

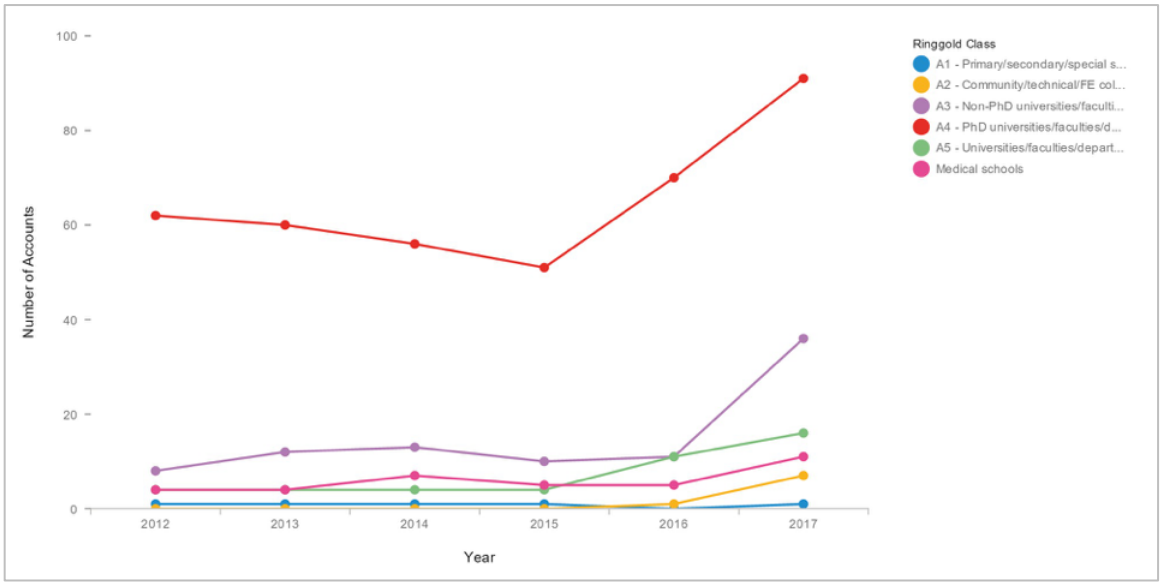

Figure 11. Asian Academic Accounts by Year and Ringgold Class 2012-2017.

In terms of Ringgold tiers, A4 accounts were the most numerous, followed by government and A3 accounts. A4 accounts declined from 62 in 2012 to 51 in 2015 then rose to 91 in 2017 (a 46.8% increase from 2012 to 2017) (see Figure 11). Government accounts rose and fell several times between 2012 and 2015 (see Figure 12). From 2015 to 2017, government subscriptions grew from 22 to 41 (86.4% increase). A3 accounts grew slowly between 2012 and 2014, from eight to 13 before dropping to 10 in 2015 and then rising to 36 between 2015 and 2017. Overall, between 2012 and 2017 all academic accounts experienced growth. A5 accounts remained steady at four between 2012 and 2015 before increasing to 16 in 2017. Between 2016 and 2017 A2 accounts grew from one account to seven. Accounts for medical schools increased from four in 2012 and 2013 to seven in 2014 before dropping to five in 2015 and 2016, and then rising to 11 in 2017. A single A1 account existed from 2012 through 2015, there were none in 2016, followed by one in 2017.

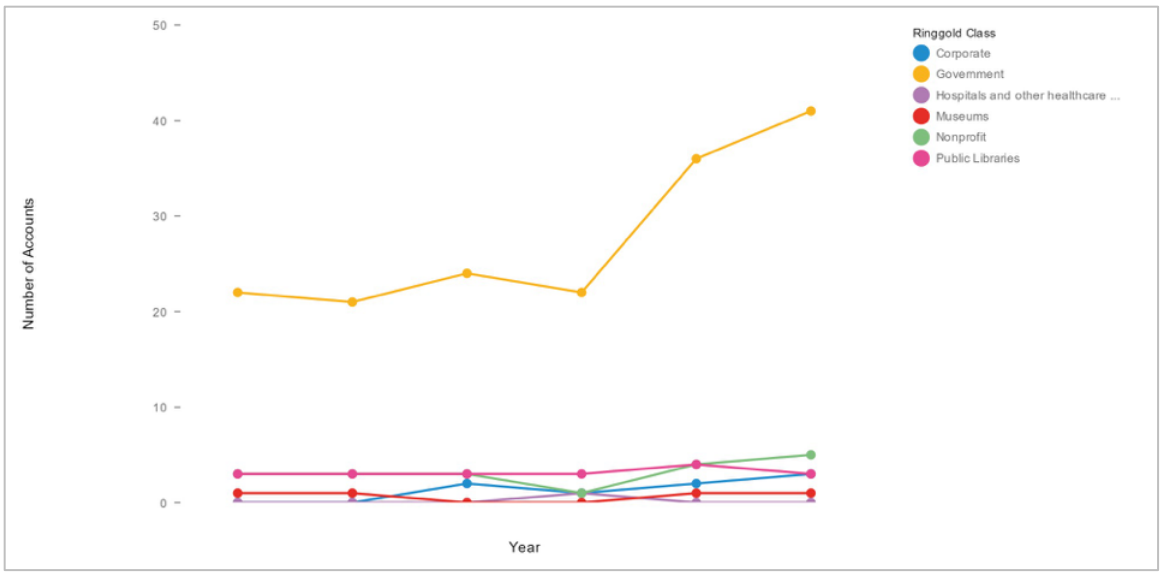

Figure 12. Asian Non-Academic Accounts by Year and Ringgold Class 2012-2017.

Among the non-academic accounts, non-profit subscriptions were the second largest group after government organizations. Between 2012 and 2014, there were three non-profit accounts, which dropped to one in 2015 before rising to five in 2017. Public libraries maintained three accounts from 2012 to 2015, which rose to four in 2016, returning to three in 2017. Corporate accounts began with two in 2014, declining to one in 2015 and rising to three in 2017. A museum maintained an account in 2012 and 2013, none from 2014 to 2015, before resubscribing in 2016. In 2015, there was one hospital subscription but none before or after.

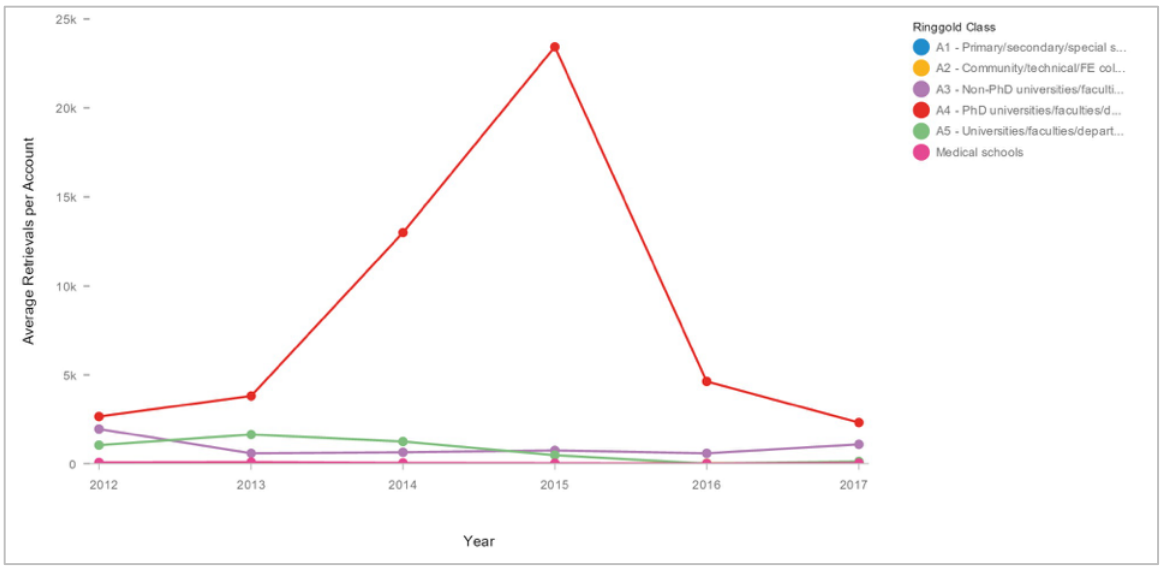

Figure 13. Asian Academic Average Retrievals per Account by Year and Ringgold Class 2012-2017.

Aside from the 2013 spike in RPAs by public libraries, A4 and government subscribers accounted for the highest total averages in Asia (see Figures 13 and 14). Government subscriptions overtook A4 in 2016. A4 accounts peaked in 2015 with 23,434 RPAs before declining to 2,314 in 2017 (90.1% drop or an average of 45.1% a year). Retrievals through government accounts declined from 2,319 RPAs in 2012 to 1,527 in 2014, peaked at 13,666 RPAs in 2016 (795.7% growth between 2014 and 2016), then dropped to 7,440 RPAs in 2017 (45.6% decline). Among the other academic institutions, A3 accounts showed considerable variation (1,952 RPAs in 2012, 586 in 2013, 748 in 2015, 585 in 2016, and rising to 1,089 in 2017). The retrievals by A2 subscribers, which began in 2016, were low: 35 in 2016 and only two in 2017. Retrievals by the sole A1 institution were also very low: six in 2012 and one in 2015. No A1 institutions subscribed to ASFA in 2016 and the single A1 account in 2017 completed four retrievals. A5 institutions began with 1,044 RPAs in 2012, peaked at 1,642 in 2013 before declining substantially to 14 in 2016, then rising modestly to 88 in 2017. Medical schools showed modest use of ASFA with 48 RPAs in 2013 and only eight in 2016.

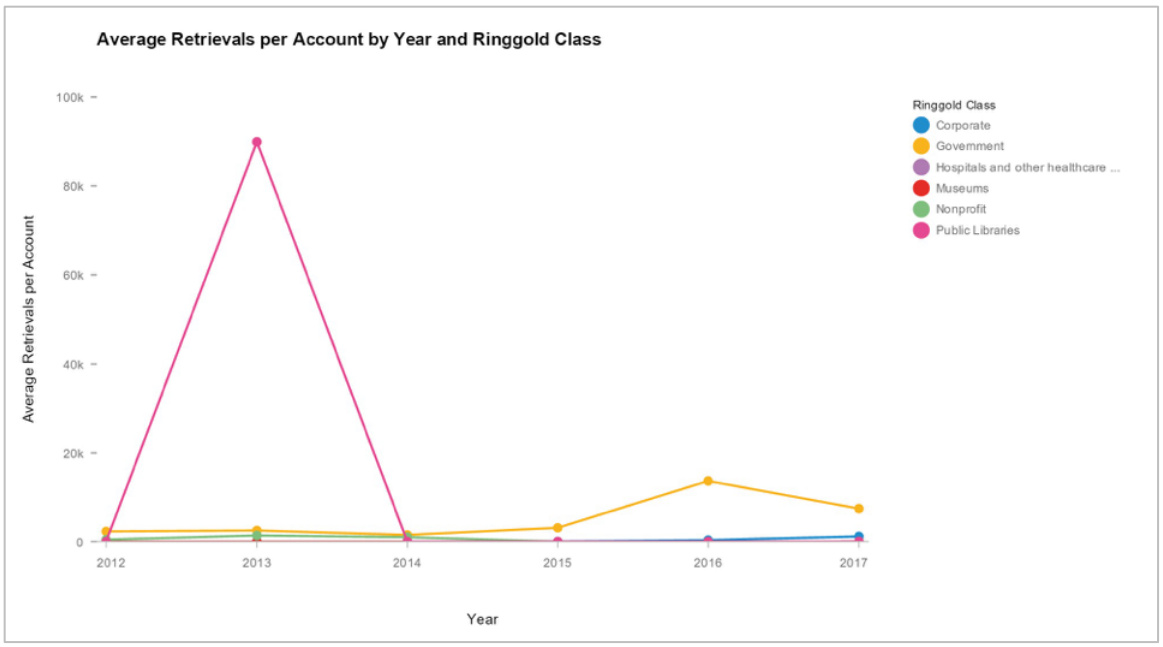

Figure 14. Asian Non-Academic Average Retrievals per Account by Year and Ringgold Class 2012-2017.

For non-academic subscribers, corporate accounts, which began in 2014, showed 16 RPAs, increasing to 383 in 2016 before declining to 74 in 2017. Public libraries experienced a very large spike in RPAs in 2013, going from 28 in 2012 to 89,889 in 2013 before dropping to 38 in 2014. The retrievals dropped even further to 26 in 2015 before rising modestly to 85 in 2017. Retrievals by museums never exceeded the two RPAs reported in 2012. There was one RPA in 2013, none in 2014 and 2015 before returning to two in both 2016 and 2017. Retrievals by non-profit accounts grew from 497 RPAs in 2012 to 1,408 in 2013, then dropped off to 18 in 2017. There was a single retrieval for hospitals in 2015.

In Asia, the overall growth in the number of accounts coincided with increased subscriptions by government, A4, and A3 institutions. The academic account types also experienced an increased number of subscriptions from 2016 to 2017, primarily from growth in Taiwan. However, this growth did not lead to an increase in RPAs. A downward trend in retrievals occurred. Despite the growing number of institutions gaining access to the database, a corresponding increase in usage did not follow in both academic and non-academic subscriptions.

Australia and the Pacific

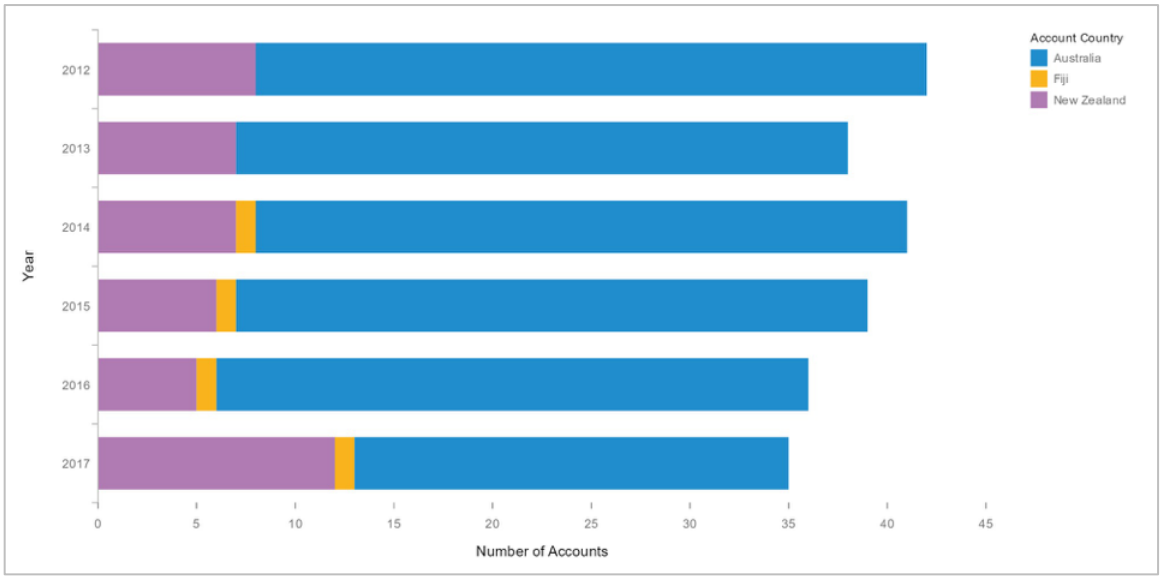

Figure 15. Australia and the Pacific Accounts by Year and Country 2012-2017.

In the Australia and the Pacific region, the number of accounts declined year-to-year from 2014 to 2017, which had the lowest number of accounts (see Figure 15). Institutions in Australia and New Zealand maintained subscriptions for the entire period of time, and Fiji began subscribing in 2014. While the number of accounts based in New Zealand declined from 2012 to 2016, they then grew in 2017, while the number of Australian subscriptions shrank.

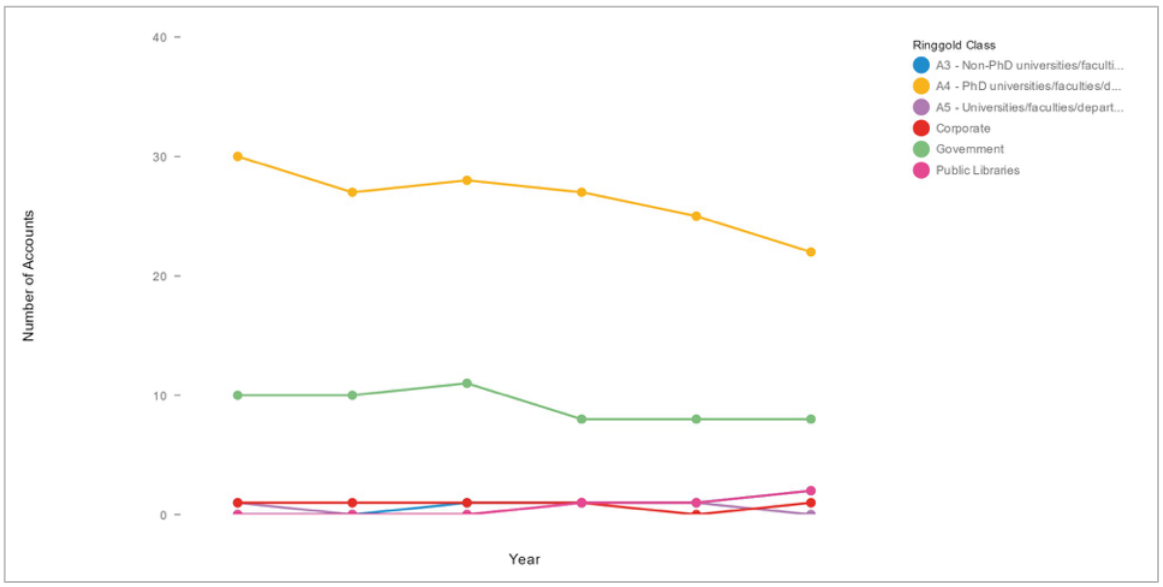

Figure 16. Australia and the Pacific Accounts by Year and Ringgold Class 2012-2017.

Among the account types, A4 institutions were most numerous in the Australia and the Pacific region (see Figure 16). Thirty A4 accounts existed in 2012, but over the next five years the number dropped to 22 (27 in 2013, 28 in 2015, and 22 in 2017 – a 26.7% decrease). Government institutions were the next largest group with 11 accounts in 2014 dropping to eight in 2015 through 2017. The first public library subscriptions began in 2015 and increased to two in 2017. A single A5 account existed in 2012, none in 2013 and 2014, one in 2015 and 2016, and none again in 2017. A single corporate institution maintained a subscription from 2012 to 2015, none in 2016, and another single account was opened in 2017. One A3 account existed between 2014 and 2016, which increased to two in 2017.

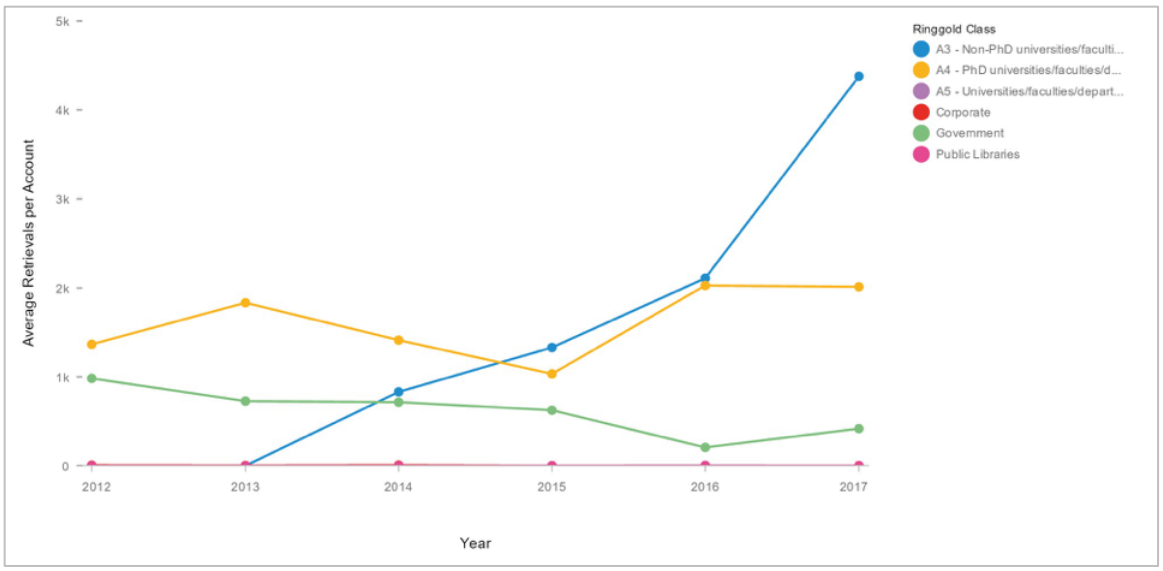

Figure 17. Australia and the Pacific Average Retrievals per Account by Year and Ringgold Class 2012-2017.

Initially A4 institutions accounted for the highest RPAs before A3s overtook them in 2015 (see Figure 17). Retrievals by A3 institutions grew from 830 RPAs in 2012 to 4,378 in 2017 (427.5% increase or an average of 85.5% a year). In contrast, retrievals by A4 accounts fluctuated between 2012 and 2017 (1,365 RPAs in 2012, 1,832 in 2013, decreasing to 1,033 in 2015, then rising to 2,026 in 2016, followed by a decline in 2017 to 2,012). Retrievals by government institutions showed an overall decline from 982 RPAs in 2012 to 206 in 2016, before increasing to 417 in 2017. Retrievals by A5 institutions, corporate accounts and public libraries were all very low (one retrieval by an A5 account in 2015 and four in 2017; six retrievals by corporate accounts in 2012, three in 2013 and seven in 2014, and none in 2017 and one retrieval by public library accounts in 2015 and two in both 2016 and 2017).

In the Australia and the Pacific region, the overall decline in subscriptions included a decline in A4 account types. Despite the decrease in accounts, by 2017 many account types showed an increase in RPAs, indicating the remaining subscribers were still accessing the database.

Europe

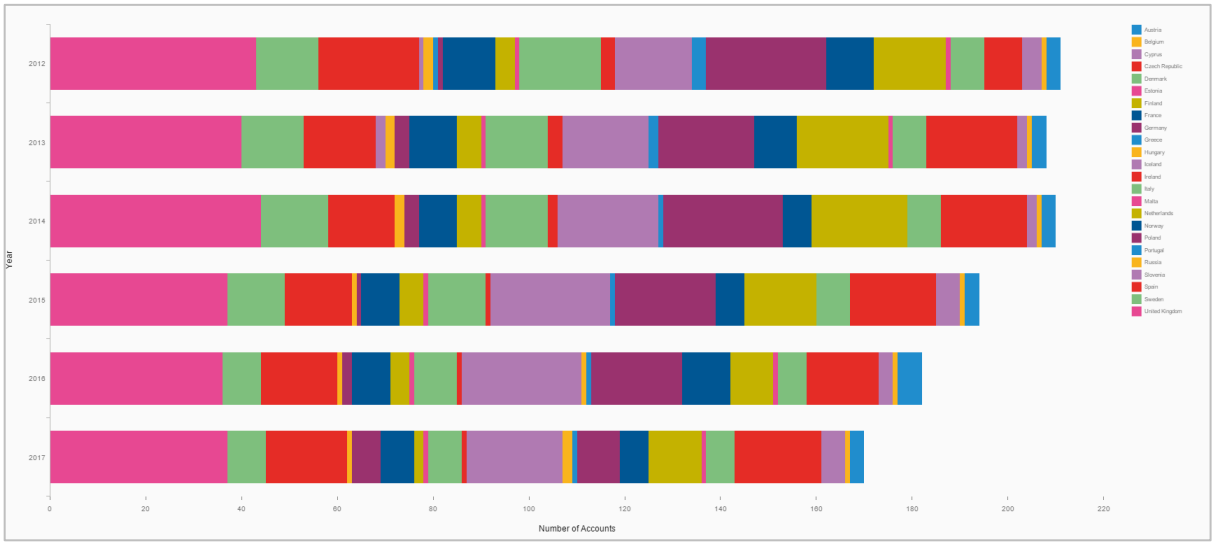

Figure 18. European Accounts by Year and Country 2012-2017.

As mentioned above, the number of European accounts declined during the period from 2012 to 2017. The number fluctuated moderately between 2012 and 2014 (211 in 2012; 208 in 2013, and 210 in 2014) and then declined year over year to 170 in 2017 (overall a 19.4% decrease) (see Figure 18).

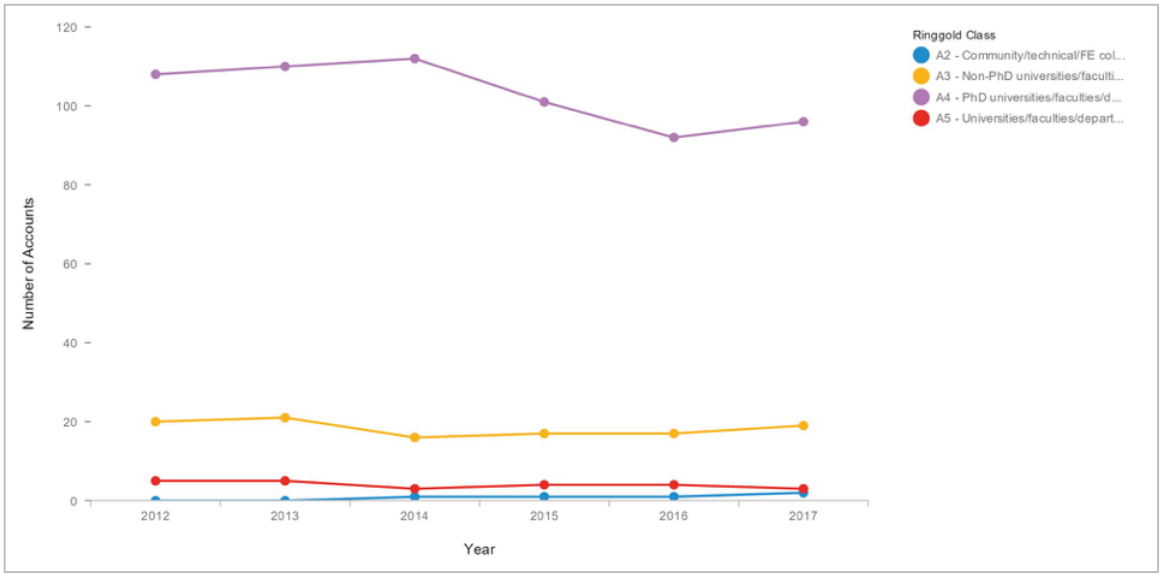

Figure 19. European Academic Accounts by Year and Ringgold Class 2012-2017.

In this region, the most numerous accounts for all years between 2012 and 2017 were held by A4 institutions, followed by government organizations. A4 accounts grew from

108 in 2012 to 112 in 2014 followed by a drop to 92 in 2016 before increasing slightly to 96 in 2017 (11.1% decline over the five years) (see Figure 19). In the same period, subscriptions by government organizations decreased by 52.2%, dropping from 46 accounts in 2012 to 22 in 2017 with some variation in between (37 in 2013, 40 in 2014, 32 in 2015 and 34 in 2016) (see Figure 20).

In terms of number of accounts, Ringgold tiers A3, A5, and A2 followed A4 (in that order). Accounts held by A3 institutions experienced a small decline between 2012 and 2017 (varying between 21 in 2013, 16 in 2014, and 19 in 2017). Subscriptions by A5 institutions also declined, from five in 2012 and 2013, to three in 2014, followed by four in 2015 and 2016 and then three in 2017. A2 accounts grew modestly from none in 2012 to two in 2017.

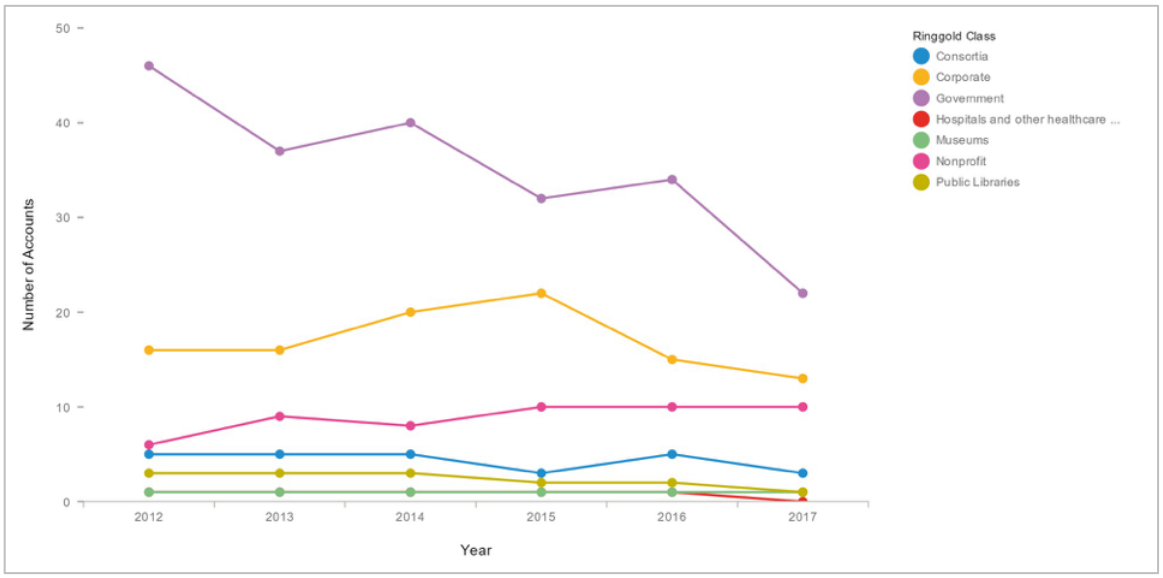

Figure 20. European Non-Academic Accounts by Year and Ringgold Class 2012-2017.

Aside from government accounts, corporate and non-profit organizations had the next highest proportion of subscriptions by non-academic institutions. Corporate subscriptions grew from 16 in 2012 to 22 in 2015 but dropped to 13 in 2017. Between 2012 and 2017, non-profit accounts grew 66.7%, from six in 2012 to nine in 2013, dropping to eight in 2014 before reaching 10 for 2015 through 2017. Consortia subscriptions declined from five accounts in 2012 to three in 2017 (with modest variation in between). Public library accounts also experienced a decline from three between 2012 to 2014 to one in 2017.

There was one subscription by a museum subscription through the five-year period and one hospital account from 2012 to 2016.

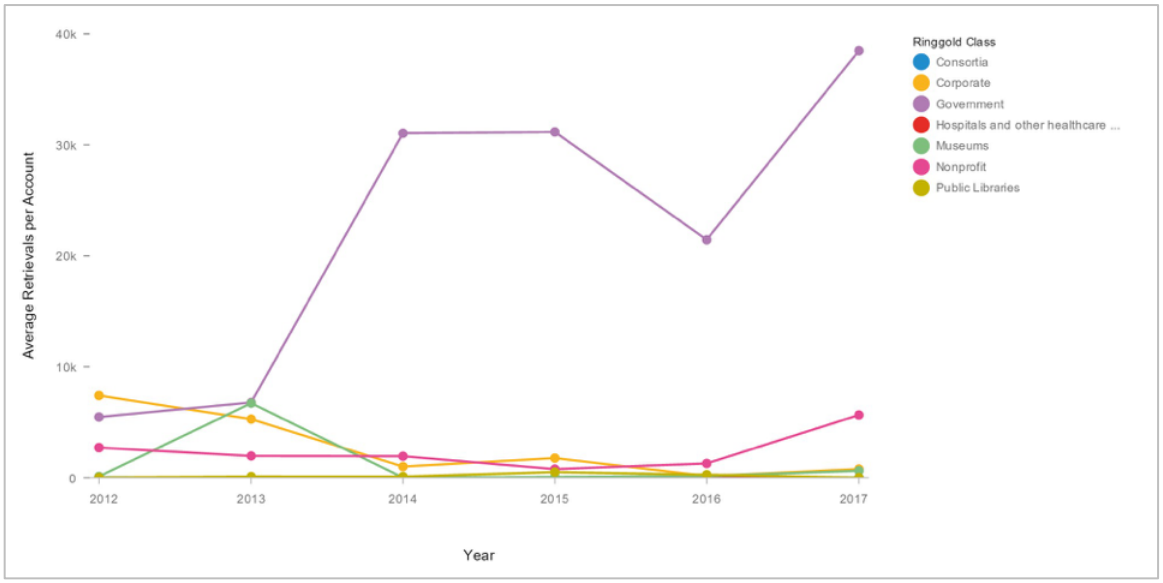

Figure 21. European Non-Academic Average Retrievals per Account by Year and Ringgold Class 2012-2017.

Government institutions accounted for the highest total average retrievals per account, followed by A4 and then A3 institutions (see Figures 21 and 22). Government RPAs grew from 5,482 s in 2012 to 31,166 in 2015, followed by a decline to 21,457 in 2016 before rising to 38,485 in 2017 (a 602% overall growth). The RPAs for A4 accounts declined 38.17% from 2012 to 2017 (varying from 11,887 in 2012 to 19,028 in 2013 followed by a drop to 5,211 in 2010 before increasing to 7,959 in 2016 and shrinking to 7,350 in 2017).

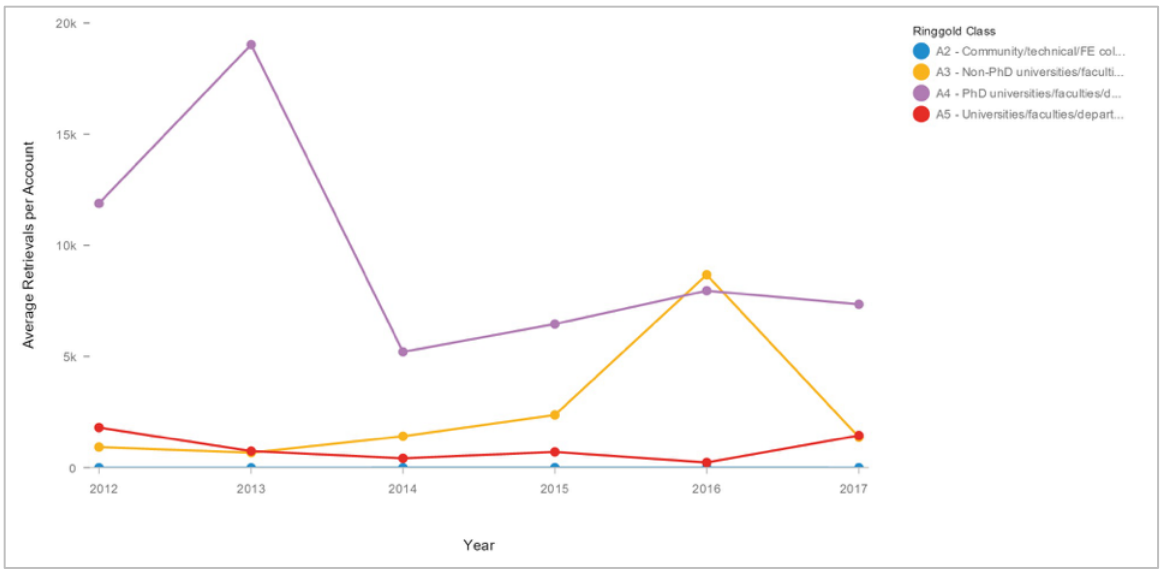

Figure 22. European Academic Average Retrievals per Account by Year and Ringgold Class 2012-2017.

Among the remaining academic Ringgold tiers, A3 accounts ranked the next highest in RPAs after the A4 institutions. Retrievals for the A3 group increased by 47.8% between 2012 and 2017 (from 929 RPAs in 2012 to 1,373 in 2017 (with some variation in between: 676 in 2013 and rising to 8,676 in 2016). Retrievals by A5 account holders experienced a small drop in RPAs from 1,805 in 2012 to 1,448 in 2017 (also varying in the intervening years: 424 in 2014, 711 in 2015, and 237 in 2016). Retrievals by A2 accounts were very low throughout the period (varying from four in 2014, to seven in 2015 and three in 2017).

Among the non-academic categories, non-profit accounts contributed the second highest RPAs after government subscriptions. Retrievals declined from 2,727 RPAs in 2012 to 789 in 2015 before growing to 5,666 in 2017. Retrievals by corporate accounts decreased by 89.3% from 2012 to 2017, dropping from 7,421 RPAs in 2012 to 795 in 2017 (1,017 in 2014, 1,785 in 2015, and 168 in 2016). Retrievals by consortia accounts dropped from 50 RPAs in 2012 to 26 in 2017. Retrievals by the public library subscribers varied between 39 RPAs in 2012 to 521 in 2015 before dropping to 26 in 2017. Retrievals by museum accounts also varied considerably from 127 RPAs in 2012 to 6,729 in 2013, to only 29 in 2014 before growing to 635 in 2017.

Despite the decreasing number of government subscriptions to ASFA between 2012 and 2017, the total average RPAs for these accounts increased, and these accounts accessed the database more frequently than all other groups by a large margin. The decrease in the number of European accounts is due largely to a drop in both government and corporate accounts, which the small increases by A4 and A3 institutions did little to offset.

The Middle East

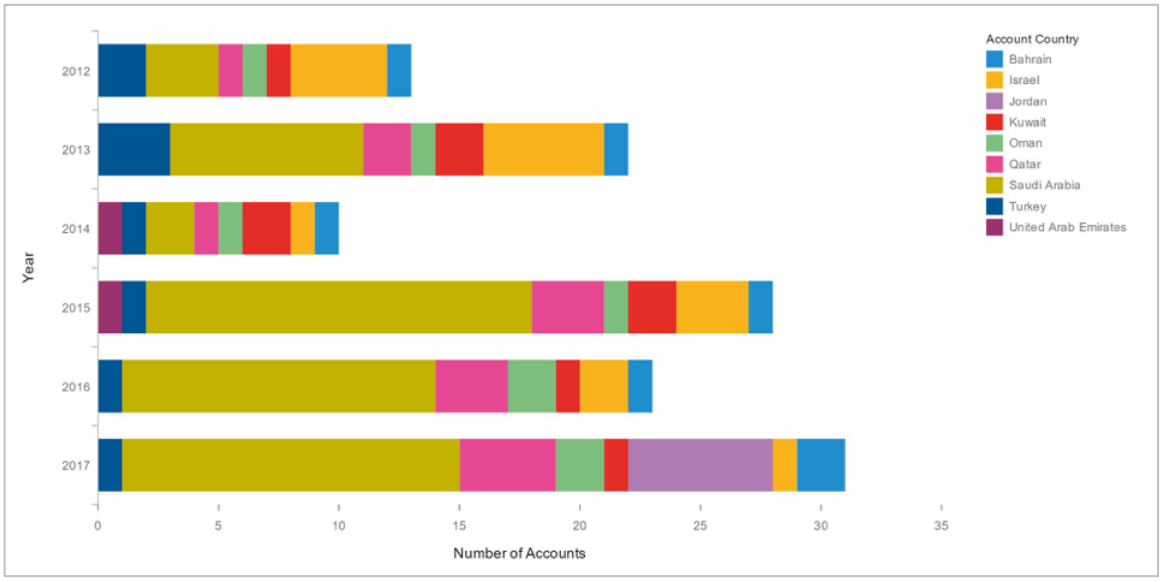

Figure 23. Middle Eastern Accounts by Year and Country 2012-2017.

In the Middle East, the number of accounts increased from 2012 to 2017. During that time, all subscribing countries, minus the United Arab Emirates and Jordan, maintained at least one account. Saudi Arabia consistently had the most subscriptions, followed by Israel and Qatar. The jump in number of accounts in 2017 corresponds to Jordan beginning to subscribe to ASFA for the first time in the data provided by ProQuest.

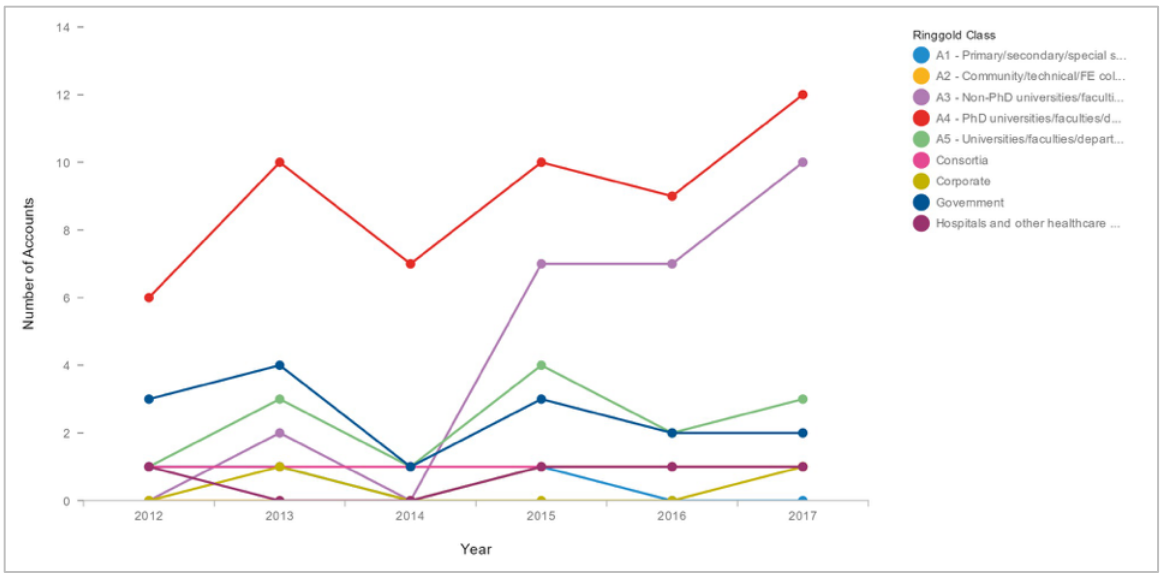

Figure 24. Middle Eastern Accounts by Year and Ringgold Class 2012-2017.

In the Middle East region, A4 institutions, followed by A3, had the largest number of accounts (see Figure 24). Subscriptions by A4 institutions doubled from six in 2012 to 12 in 2017 (with variation in the intervening years: 10 in 2013, seven in 2014, 10 in 2015, and nine in 2016). The number of A3 institutional accounts also increased in the same period (none in 2012, two in 2013, none in 2014, 10 in 2017). Among the other academic Ringgold tiers, A5 institutions, which ranked next in proportion of subscriptions, fluctuated between one and four accounts (one in 2012, three in 2012, one in 2014, four in 2015, two accounts in 2016, and three in 2017). One A1 institution maintained a subscription from 2012 to 2013; another in 2015, with no accounts in 2016 and 2017. Starting in 2014, there was a single A2 account.

Subscriptions by government organizations were the most numerous in the non-academic group, although a low number in total: three in 2012, four in 2013, one in 2014, three in 2015, and two in 2016. The other non-academic accounts were also low: one consortia account for all the years between 2012 and 2017; a single corporate account in both 2013 and 2017, but none in the other years; and a single hospital account in 2012, followed by none in 2013 and 2014, and one subscription in 2015 through 2017.

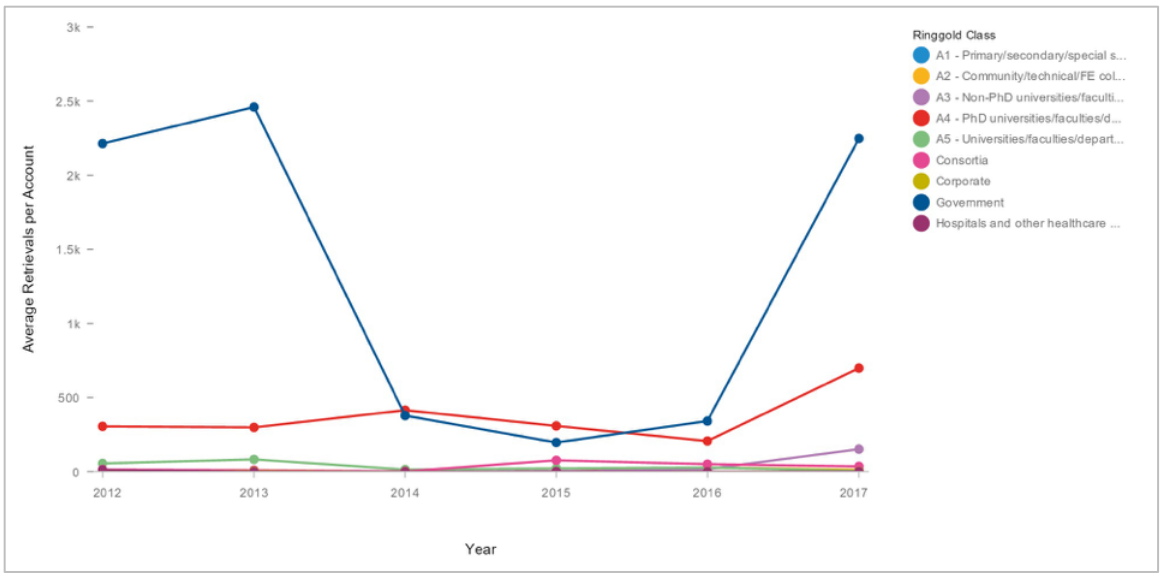

Figure 25. Middle Eastern Average Retrievals per Account by Year and Ringgold Class 2012-2017.

Between 2012 and 2017, retrievals by government accounts periodically exceeded A4 institutions, which had the next highest share (see Figure 25). Retrievals in government subscriptions fluctuated from 2,214 RPAs in 2012 to 2,460 in 2013, plummeting to 197 in 2015 and rebounding to 2,248 in 2017. Retrievals among the A4 accounts, grew by 128.4% from 2012 to 2017 (increasing from 306 to 699 in 2017).

Among the other academic accounts, A3 institutions experienced a growth in retrievals of 152%, going from one total average RPA in 2013 to 152 RPAs in 2017. Overall, retrievals by A5 institutions declined from 56 total average RPAs in 2012 to seven RPAs in 2017. Retrievals by A1 and A2 institutions were low throughout the period. A1 institutions averaged less than one RPA per year and A2 accounts averaged 8.6 RPAs, with some years showing no retrievals at all.

Among the non-academic institutional accounts, retrievals were also low between 2012 and 2017. Search activity in consortia accounts fluctuated from as low as three RPAs in 2014 to 77 in 2015. In the corporate accounts, there were only four RPAs in 2013 and three in 2017, and in the hospital accounts, there were 12 RPAs in 2012 and two in 2014, with no retrievals in other years.

In the Middle East region, the increase in RPAs coincided with the growth in the number of subscriptions between 2012 and 2017. The growth in retrievals was largely due to activity at government institutions followed by A4 accounts.

North America and the Caribbean

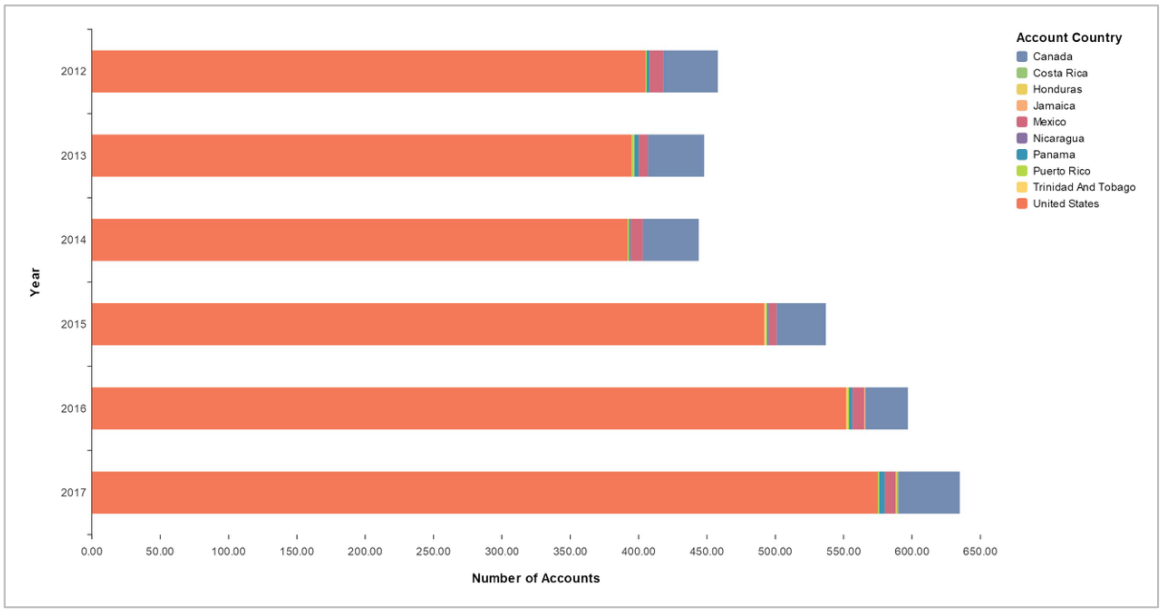

Figure 26. North American and the Caribbean Accounts by Year and Account Country 2012-2017.

Accounts based in the United States comprised a vast majority of ASFA subscriptions in North America and the Caribbean (see Figure 26). The changes in numbers of accounts from 2012 to 2017, particularly the increases, is tied in with the changes in subscriptions within that country. Canada had the next largest subscriber base, followed by Mexico. Other countries in the region had fewer accounts and several of them did not maintain accounts for all the years documented.

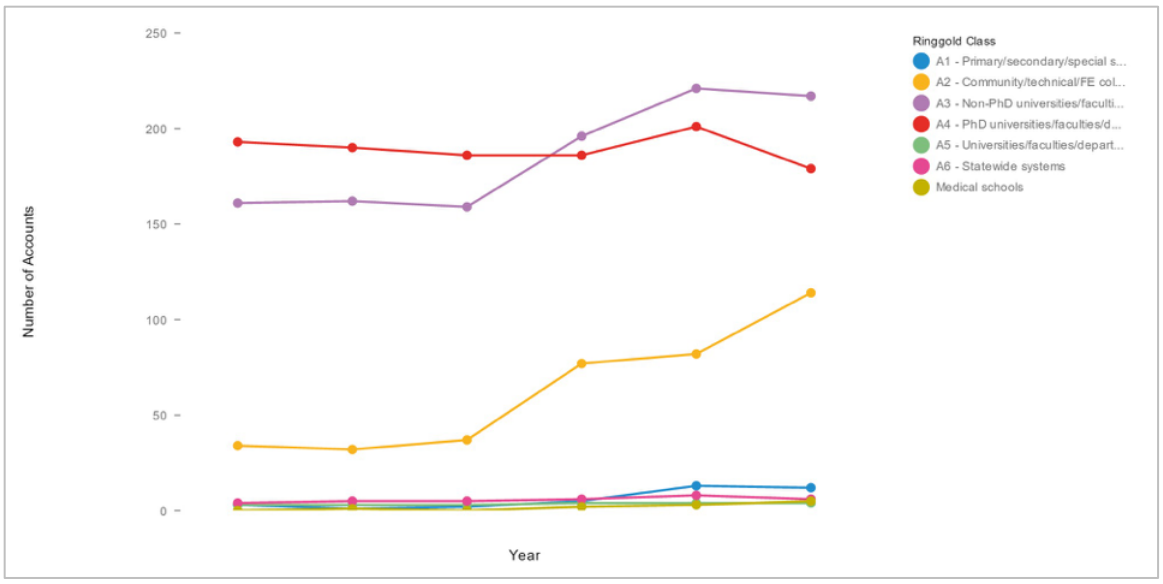

Figure 27. North American and the Caribbean Academic Accounts by Year and Ringgold Class 2012-2017.

In the North America and the Caribbean region, A3 and A4 accounts were the most numerous, followed by A2 (see Figure 27). A4 accounts declined 7.2% overall from 2012 to 2017. There were 193 subscriptions in 2012 which dropped to 186 in 2014 before rising to a high of 201 in 2016 and then fell to a low of 179 in 2017. A3 accounts grew 34.8% overall, from 161 in 2012 to 162 in 2013 before declining to 159 in 2014. After 2014, they grew to a high of 221 in 2016 before dropping slightly to 217 in 2017. A2 accounts initially decreased from 34 in 2012 to 32 in 2013 before growing to 114 in 2017 (235.3% growth). Out of the other academic account types, A5 increased from three in 2012 to four in 2015 through 2017. A6 accounts grew from four in 2012 to a high of eight in 2016 before declining to six in 2017. A1 subscriptions dropped from three in 2012 to one in 2013, then rose to 13 in 2016 before declining to 12 in 2017. There was a single medical school account in 2013, with none in 2014. The number then rose from two in 2015 to five in 2017.

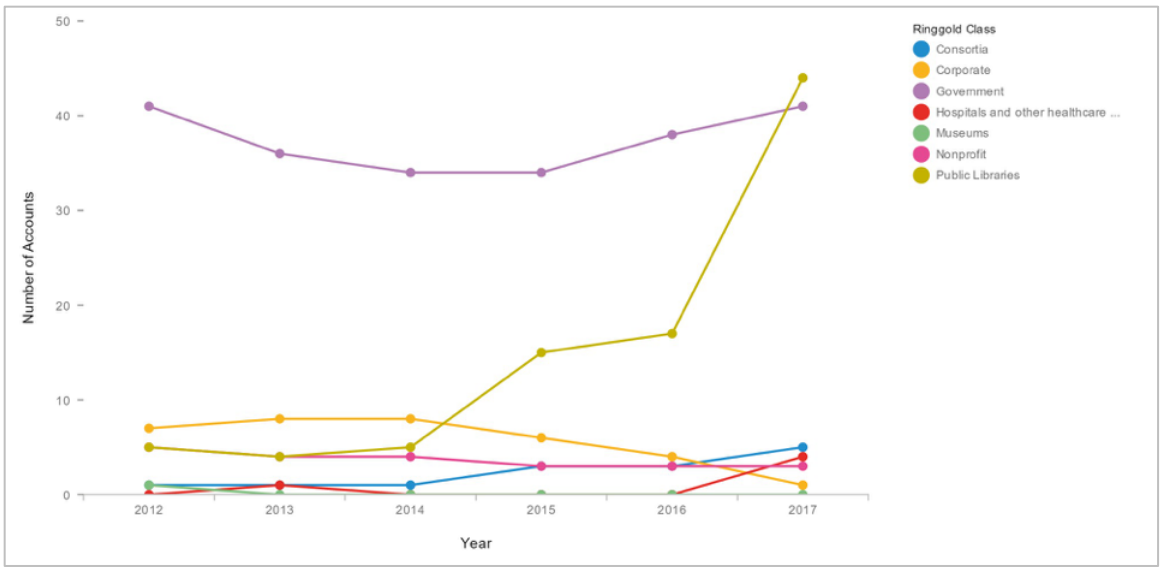

Figure 28. North American and the Caribbean Non-Academic Accounts by Year and Ringgold Class 2012-2017.

For the non-academic accounts, government accounts were the most numerous, followed by public libraries (see Figure 28). Government accounts initially dropped from 41 accounts in 2012 to 34 in both 2014 and 2015 before returning to 41 in 2017. Public library subscriptions initially decreased from five accounts in 2012 to four in 2013, then increased to 44 in 2017 (780% overall growth). Consortia accounts also grew, from one in 2012 through 2014 to five in 2017. Non-profit accounts declined from five in 2012 to three in 2017. Corporate accounts initially grew from seven in 2012 to eight in 2013 and 2014, then declined to one in 2017. There was a single hospital account in 2013, and then none from 2014 to 2016. There were then four hospital subscriptions in 2017 and one by a museum in 2012 with none in subsequent years.

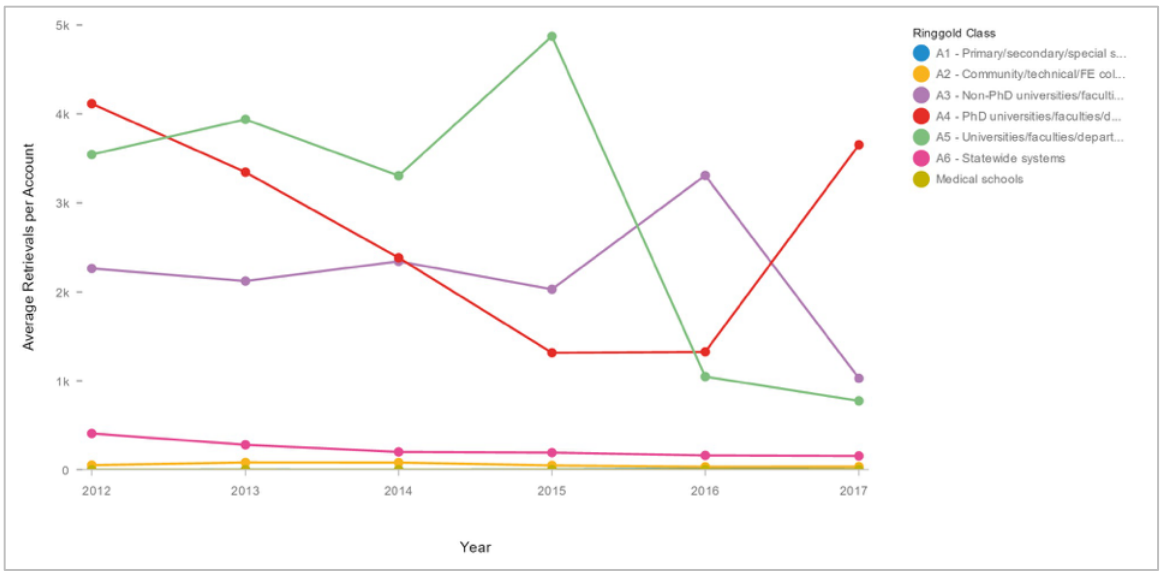

Figure 29. North American and the Caribbean Academic Average Retrievals per Account by Year and Ringgold Class 2012-2017.

For the total average RPAs, both A4 and government accounts had the highest shares as of 2017 (see Figures 29 and 30). A4 accounts initially dropped from 2,263 RPAs in 2012 to 2029 in 2015 before growing to 3,653 RPAs in 2017 (a 61.42% total increase). Government accounts saw their total average RPAs grow from 1,946 in 2012 to 2,530 in 2013, then decline to 1,113 RPAs in 2015. After 2015 the RPAs increased to 3,649 in 2017, with an overall growth of 87.51% over five years.

For the other academic accounts, A3 and A5 institutions had the next highest total average RPAs. The numbers for A3 accounts fluctuated year to year, going from 2,263 RPAs in 2012, declining to 2,121 in 2013 before growing again to 2,343 in 2014. The RPAs dropped once more in 2015 to 2,029, grew to 3,309 in 2016 before decreasing once again in 2017 to 1,028. A5 retrievals had a 78.16% decline from 2012 to 2017. They initially grew from 3,544 total average RPAs in 2012 to 3,939 in 2013. They decreased to 3,306 in 2014, increased to a high of 4,873 in 2015 and then declined to a low of 774 RPAs in 2017. Retrievals for A2 accounts started at 52 RPAs in 2012 before peaking at 28 in 2013. Afterwards, they declined to a low of 24 in 2016 before rising slightly to 36 in 2017. A1 accounts had one RPA in 2012, three in 2013, one in 2014, and then a high of 12 in 2016. The A1 accounts ended 2017 with five total average RPAs. A6 accounts declined from 408 total average RPAs in 2012 to 155 RPAs in 2017 (62% decrease

overall). Medical schools had one RPA in 2013, none in 2014, and then grew to three in 2017.

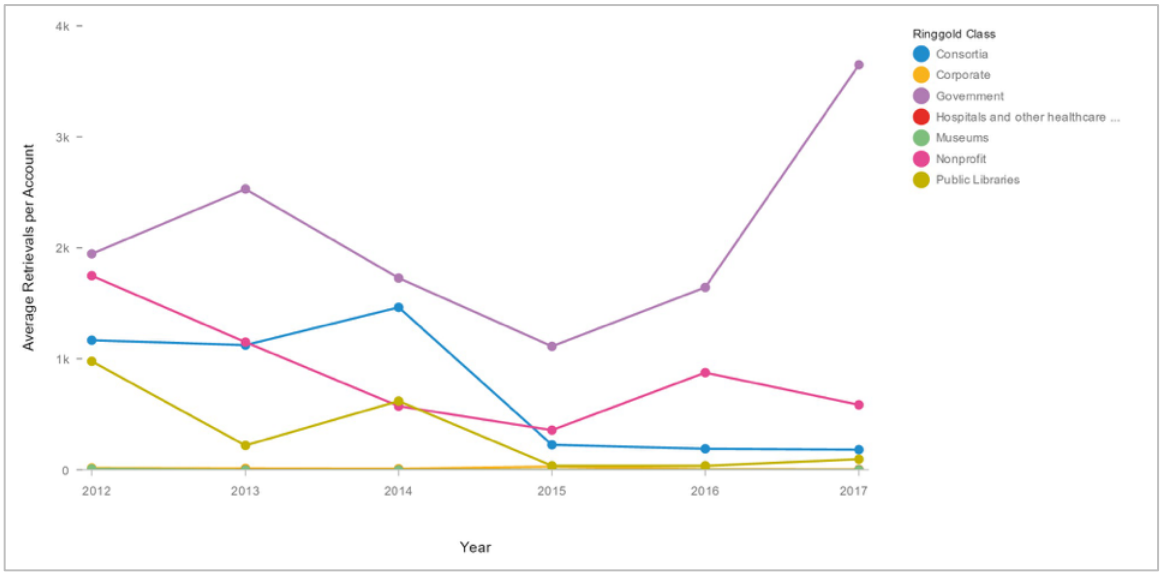

Figure 30. North American and the Caribbean Non-Academic Retrievals per Account by Year and Ringgold Class 2012-2017.

Of the non-academic accounts, non-profits had the next highest total average RPAs after government. Overall, the RPAs declined 66.50% from 2012 to 2017, going from 1,749 RPAs in 2012 to 358 in 2015. There was a small rise in 2016 to 876 but then a decrease to 586 in 2017. Consortia subscriptions declined 84.44% over the five-year period, from 1,168 RPAs in 2012 to 1,124 in 2013, before increasing to 1,464 in 2014. After 2014, the RPAs declined to 182 in 2017. RPAs in public library accounts dropped from 978 in 2012 to 220 in 2013. The access rose to 620 RPAs in 2014 before decreasing to 37 in both 2015 and 2016, with a small uptick to 96 in 2017 (90.2% total drop). Corporate accounts initially grew from 13 RPAs in 2012 to 14 in 2013, declined to 11 in 2014, and then increased to 30 in 2015. The RPAs then dropped further to five in 2017. There was one RPA for hospitals in 2013 and another two in 2017, with none in the intervening years. There were 10 RPAs in museum accounts in 2012 and none in the following years.

The increase in North American subscriptions by the end of 2017 appears to have been driven in part by the increased number of A2 institutions and public libraries subscripting to the database. Out of the other major subscriber types, both A3 and A4 organizations showed a decline in number of accounts, while government subscriptions increased

slightly. Despite the growth in A2 and public library account types, however, the average RPAs was lower than several other account types, including government, A3, and A4 institutions. The increase in government and A4 RPAs from 2016 to 2017 is also worth noting, as they were the only account types that saw that growth. The data from 2016 to 2017 appears to indicate, at least for North America and the Caribbean, that the primary growth market for accounts does not match the primary user base.

South America

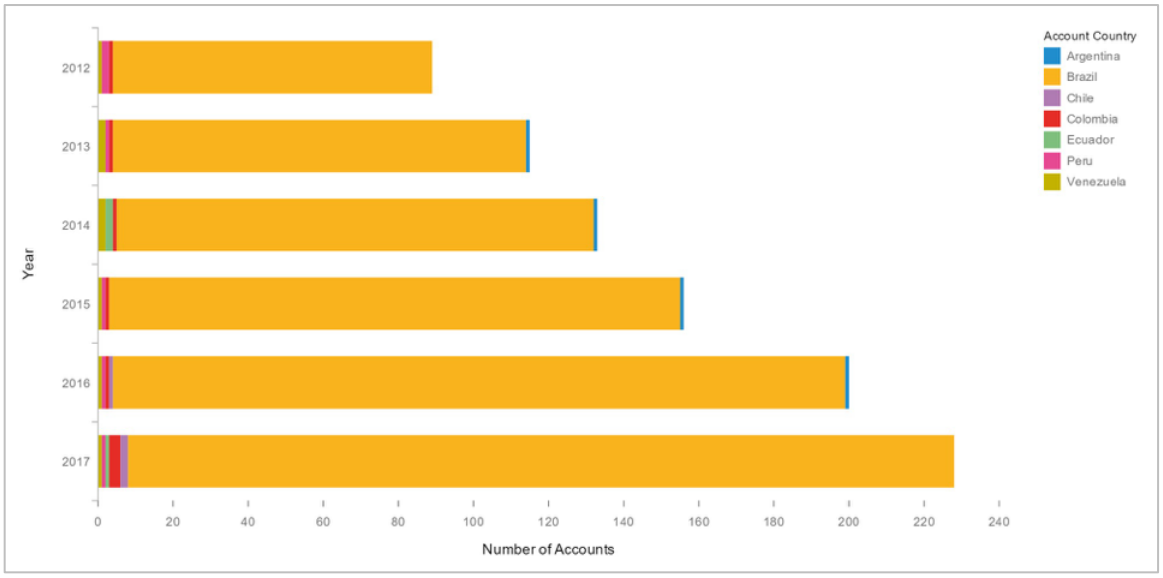

Figure 31. South American Accounts by Year and Account Country 2012-2017.

Within South America, the growth in ASFA subscriptions was driven by the increased number of accounts in Brazil. Aside from Brazil, Colombia and Venezuela had at least one subscriber for all the years between 2012 and 2017. In all the other countries subscriptions were inconsistent and none with an equivalent number of accounts as in Brazil.

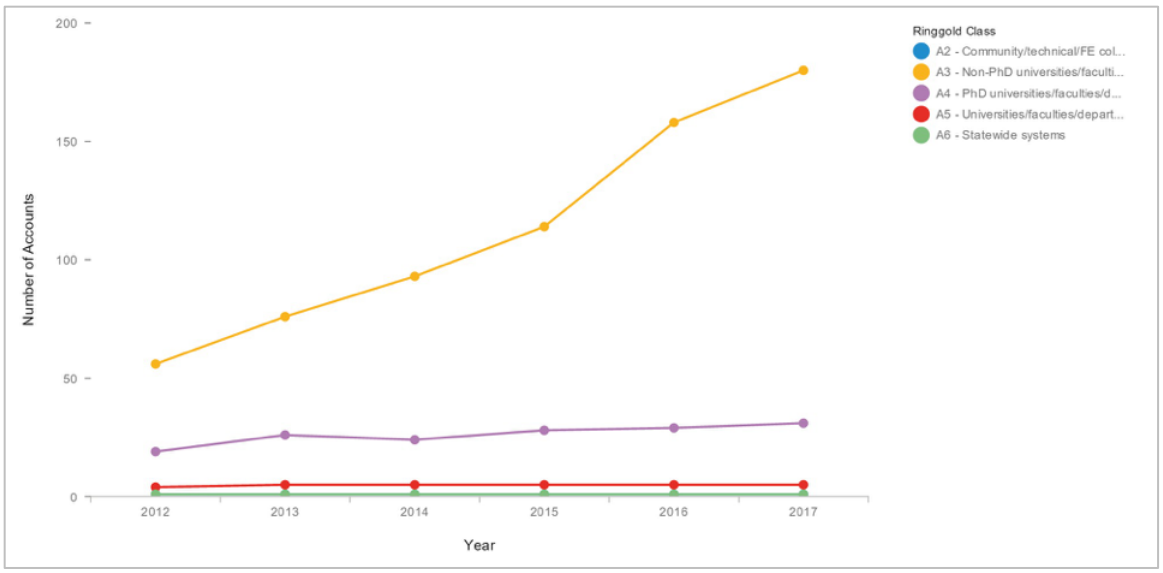

Figure 32. South American Academic Accounts by Year and Ringgold Class 2012-2017.

In South America, A3 accounts, followed by A4 were the most numerous (see Figure 32). A3 accounts grew year to year, beginning in 2012 with 56 and ending 2017 with 180 accounts (221.4% overall growth). A4 accounts grew from 19 in 2012 to 26 in 2013 before declining to 24 in 2014. Following 2014, the number increased to 31 in 2017. A5 accounts grew from four in 2012 to five in 2013, which remained consistent through 2017. Each A2 and A6 Ringgold tier had one subscription from 2012 through 2017.

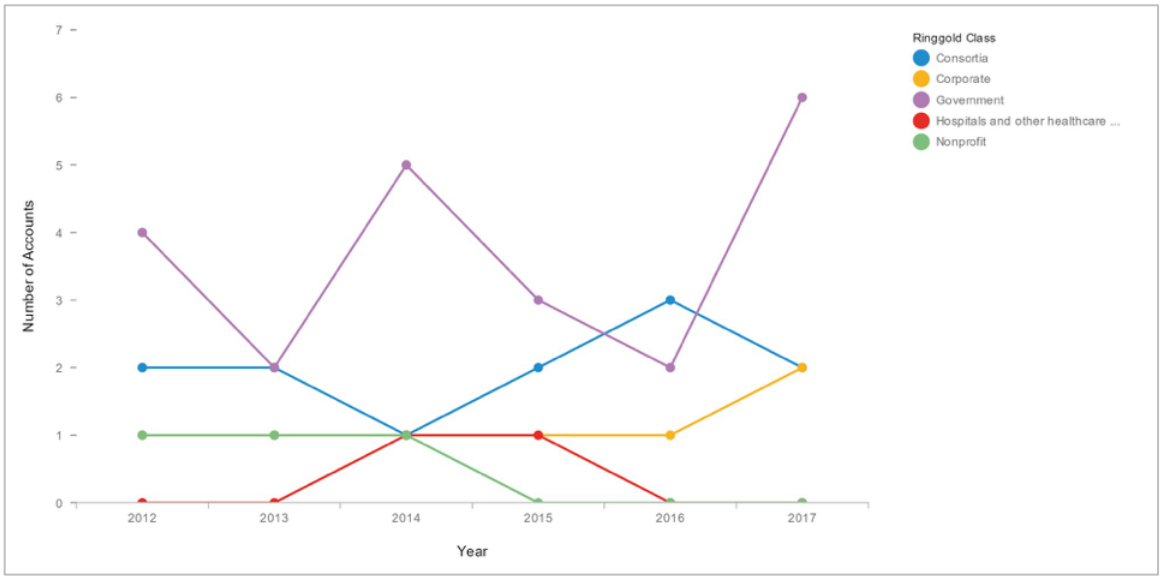

Figure 33. South American Non-Academic Accounts by Year and Ringgold Class 2012-2017.

Government accounts were the most numerous non-academic subscriptions (see Figure 33). Overall, government accounts increased 50% but showed variability year to year. There were four accounts in 2012, a drop to two in 2013 and then an increase to five in 2014. The accounts then returned to two in 2016 before growing to six in 2017. Consortia accounts varied from two in 2012 to 2013, to one in 2014, to three in 2016 before returned to two in 2017. One corporate subscription was maintained from 2012 to 2016 which increased to two in 2017. One hospital account existed in 2014 and 2015, and one non-profit subscription from 2012 to 2014.

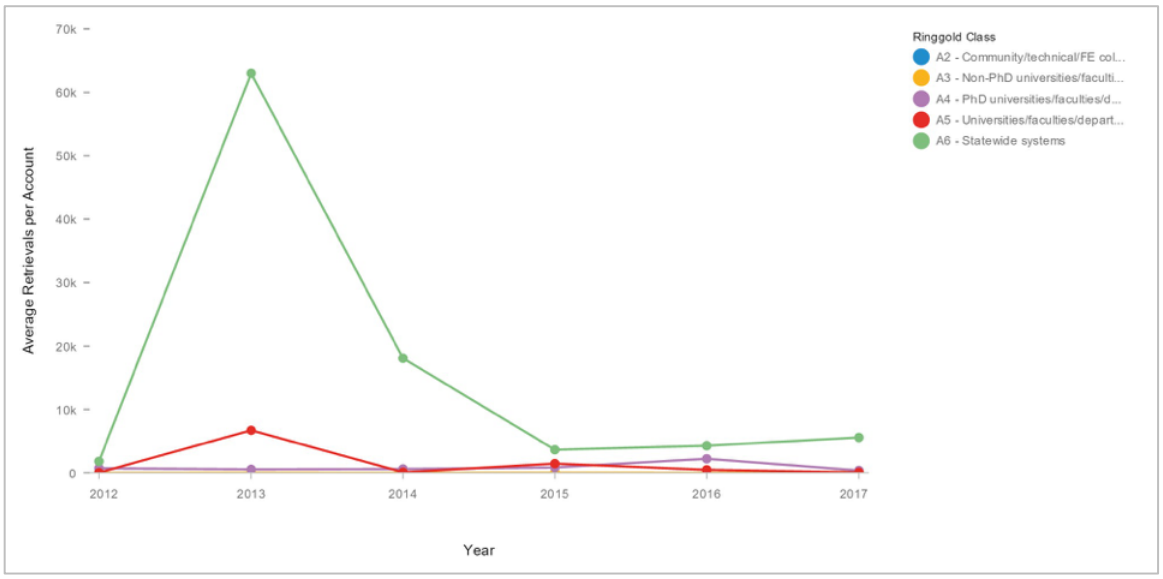

Figure 34. South American Academic Retrievals Per Account by Year and Ringgold Class 2012-2017.

A6 and A4 accounts experienced the highest total average RPAs. A6 accounts began 2012 with 1,818, spiking 3,365% to 62,993 in 2013, and then declining to 3,656 in 2015. The average then grew to 5,570 in 2017. Activity in A4 accounts declined from 735 RPAs in 2012 to 563 in 2013 followed by 2,227 in 2016 before dropping to 382 in 2017. Searches in A5 subscriptions grew from 40 RPAs in 2012 to a high of 6,705 in 2013 before declining to 109 in 2014, growing again to 1,458 in 2015, and then dropping to 91 in 2017. Retrievals by A3 accounts were low throughout the period from 2012 to 2017 (11 RPAs in 2012, 50 in 2013, 14 in 2014, 58 in 2015, 21 in 2016, before rising to 164 in 2017). Retrievals in A2 accounts began with 15 RPAs in 2012, none in both 2015 and 2016 and only two in 2017.

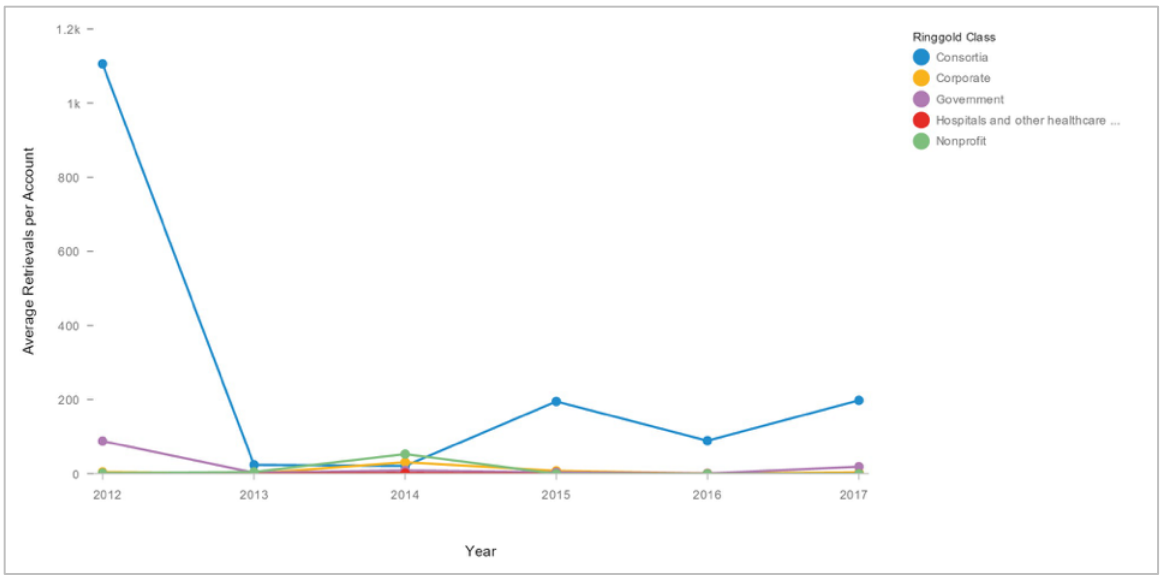

Figure 35. South American Non-Academic Retrievals per Account by Year and Ringgold Class 2012-2017.

Consortia subscriptions had the highest total average RPAs of the non-academic accounts (see Figure 35). These accounts began with 1,106 RPAs in 2012 before dropping to only 21 in 2014. Activity then increased to 195 RPAs in 2015, declined to 89 in 2016 before closing out 2017 with 198 (an 82.1% overall decline). Search activity in government accounts were very low throughout the study period. The highest activity occurred in 2017 with 19 RPAs; in all other years, retrievals were less than 10 (eight in 2012, three in 2013, nine in 2014 and only one in 2016). Searches were also very low among the corporate, hospital, and non-profit accounts. In the corporate account retrievals reached 31 in 2014, but in all other years the number was less than five. In the hospital accounts, only two retrievals occurred throughout the full period (accounts were only held in 2014 and 2015). Non-profit accounts only existed from 2012 to 2014 and showed two retrievals in 2012 and 53 in 2014.

While an increase in A3 and A4 accounts drove the growth in number of subscriptions within South America, usage in these accounts was consistently substantially less than the single A6 account in the region. As in other regions, the primary growth market for accounts does not appear to match the primary group of users of ASFA.

4.1.3 Country Patterns

Additional analysis of the longitudinal usage data was undertaken at the country level (see Tables 2, 3, and 4), incorporating data retrieved from the World Bank Open Data Bank. For 2012-2015, the later data included gross domestic product (GDP) (current US $), population, and total fisheries production (metric tons). For 2016, due to the lack of data regarding fisheries production, only GDP and population were used. Data was not available for 2017 for all three variables.

Two countries from each geographic region were chosen for comparison, one with higher and one with lower GDP. Additionally, for inclusion in this analysis the countries selected had at least one institution subscribing to ASFA for multiple years. Based on these criteria, the following countries were selected: Botswana and South Africa (Africa); China and Malaysia (Asia); Australia and Fifi (Australia and the Pacific); Germany and Iceland (Europe); Bahrain and Turkey (the Middle East); Panama and the United States (North America and the Caribbean); and Brazil and Peru (South America).

Table 2. Selected Countries GDP 2012 to 2016 in Current US $ (million) (World Bank Group, 2017b).

Country	2012	2013	2014	2015	2016
Africa					
Botswana	14.7	14.9	16.3	14.4	15.6
South Africa	396	367	351	318	295
Asia					
China	8,560.5	9,607.2	10,482.4	11,064.7	11,199.1
Malaysia	314	323	338	296	297
Australia and the Pacific					
Australia	1,538.2	1,567.2	1,459.6	1,345.3	1,204.6
Fiji	4.0	4.2	4.5	4.4	4.7
Europe					
Germany	3,544.0	3,752.5	3,890.6	3,375.6	3,477.8
Iceland	14.3	15.5	17.3	16.9	20.3
The Middle East					
Bahrain	30.7	32.5	33.4	31.1	32.2
Turkey	874	951	934	860	864
North America and the Caribbean					
Panama	39.9	44.8	49.2	52.1	55.2
United States	16,200	16,700	17,400	18,100	18,600
South America					
Peru	193	201	201	189	192
Brazil	2,465.2	2,472.8	2,456.0	1,803.7	1,796.2

Table 3. Selected Country Population 2012 to 2016 (million) (World Bank Group, 2017b).

Country	2012	2013	2014	2015	2016
Africa					
Botswana	2.1	2.1	2.2	2.2	2.2
South Africa	53.0	53.8	54.5	55.3	56.0
Asia					
China	1,351.0	1,357.4	1,364.3	1,371.2	1,378.7
Malaysia	29.2	29.7	30.2	30.7	31.2
Australia and the Pacific					
Australia	22.7	23.1	23.5	23.8	24.2
Fiji	.874	.880	.886	.892	.899
Europe					
Germany	80.4	80.6	81.1	81.7	82.5
Iceland	.321	.324	.327	.331	.335
The Middle East					
Bahrain	1.3	1.3	1.3	1.4	1.4
Turkey	74.6	75.8	77.0	78.3	79.5
North America and the Caribbean					
Panama	3.8	3.8	3.9	4.0	4.0
United States	314.0	316.2	318.6	320.9	323.1
South America					
Brazil	200.6	202.4	204.2	206.0	207.7
Peru	30.1	30.6	31.0	31.4	31.8

Table 4. Selected Country Fisheries Production 2012 to 2015 in Metric Tons (World Bank Group, 2017b).

Country	2012	2013	2014	2015
Africa				
Botswana	378.0	431.0	1,168.0	201.0
South Africa	725,234.5	436,857.0	615,411	578,450
Asia				
China	70,368,028.4	73,671,123.4	76,149,368.4	79,389,44.7
Malaysia	2,116,236.9	2,023,321.8	1,989,740.5	2,003,019.2
Australia and the Pacific				
Australia	242,906.7	238,768.0	229,257.7	246,121.8
Fiji	45,090.0	42,500.0	44,707.0	43,607
Europe				
Germany	240,768.0	260,396.0	268,775.0	291,653.0
Iceland	1,384,106.3	1,390,896.0	1,103,629.5	1,342,608.6
The Middle East				
Bahrain	27,092.7	14,976.0	15,859.7	15,006.0
Turkey	645,249	607,991.6	536,516.0	670,873.0
North America and the Caribbean				
Panama	185,501.6	208,612.2	171,545.0	151,465.3
United States	5,521,244.1	5,582,389.5	5,405,669.5	5,471,416.2
South America				
Brazil	1,300,992.0	1,243,038.0	1,331,208.0	1,275,260.0
Peru	4,925,088.8	6,002,128.9	3,714,469.4	4,929,850.46

Botswana and South Africa

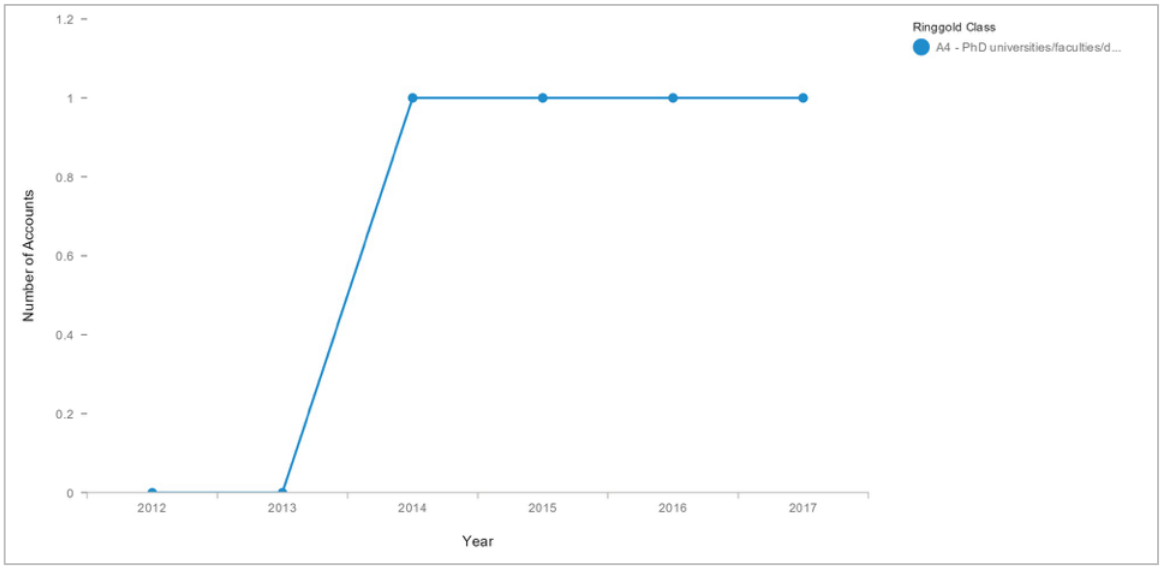

Figure 36. Botswanan Accounts by Year and Ringgold Class 2012-2017.

In Botswana, a single A4 subscription began in 2014 (see Figure 36). The retrievals from this subscription rose 1,633.3%, from three in 2014 to 52 in 2017 (see Figure 37). This data on retrieval activity does not represent Botswana's total usage, as it is one of the Low-Income Food Deficit Countries (LIFDC) countries receiving a free version of the database referred to earlier.

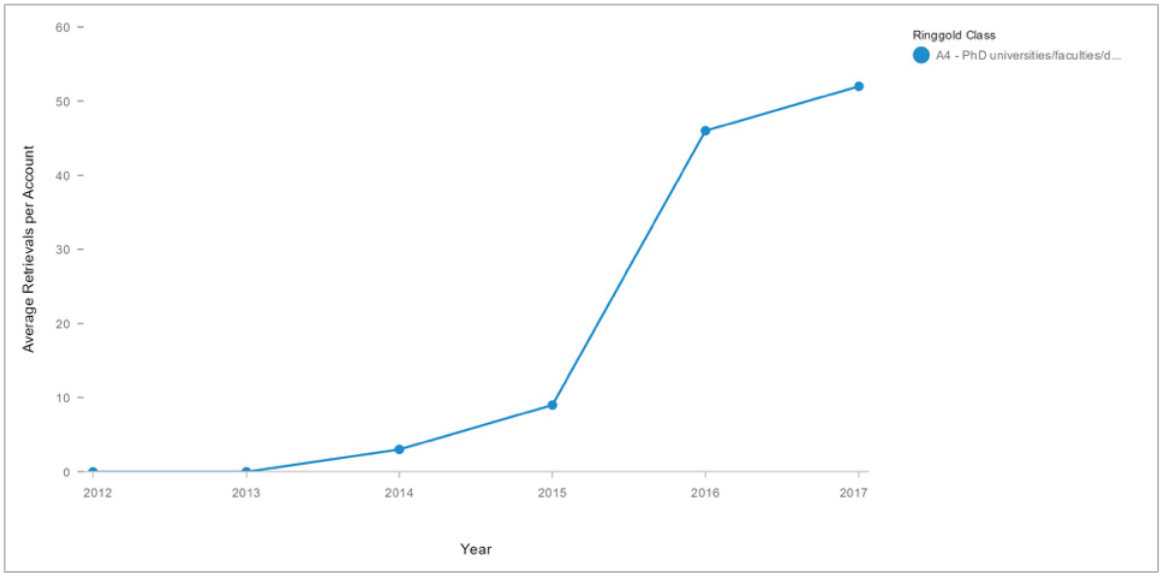

Figure 37. Botswanan Retrievals per Account by Year and Ringgold Class 2012-2017.

Botswana's GDP fluctuated between 2012 and 2016, but overall saw a total growth of 6.1% (see Table 2). During the same period, Botswana's population grew 7.7% from 2,089,315 in 2012 to 2,250,260 in 2016 (averaged 1.9% growth a year) (see Table 3). Starting in 2012, fisheries production initially grew until 2014, but then dropped the following year (see Table 4).

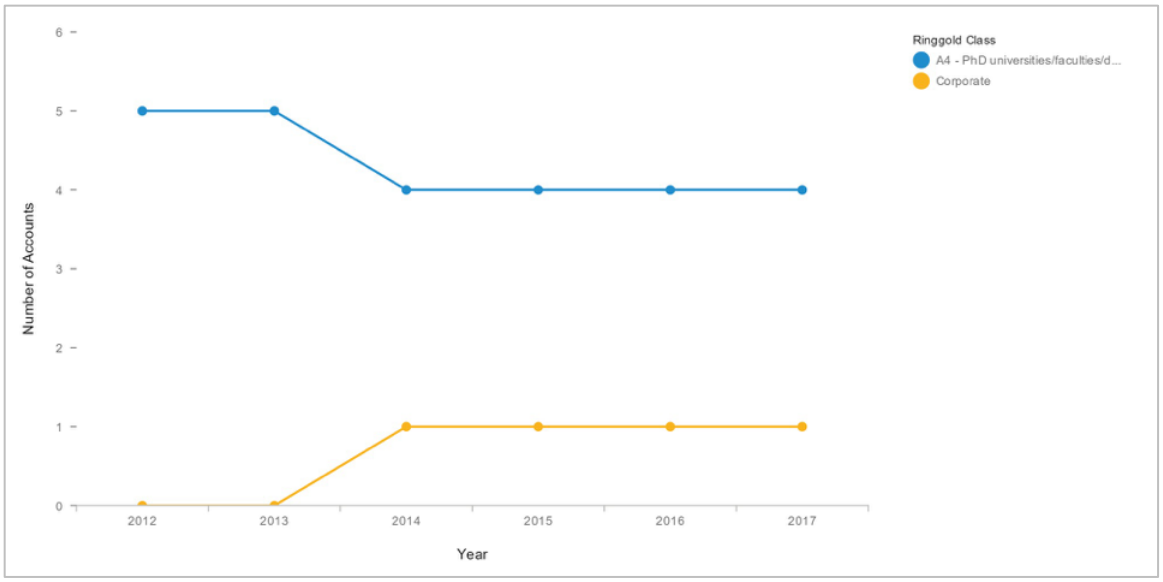

Figure 38. South African Accounts by Year and Ringgold Class 2012-2017.

In the 2012 to 2017 period, five ASFA subscriptions existed in South Africa (see Figure 38). The makeup of the subscriptions changed, however, with A4 accounts dropping from five in 2012 and 2013 to four in 2014 and a single corporate subscription began that year. There was no consistency in the total average RPAs (see Figure 39). Retrievals fluctuated for the A4 and corporate accounts, with A4 accounts experiencing an overall decline after peaking in 2012.

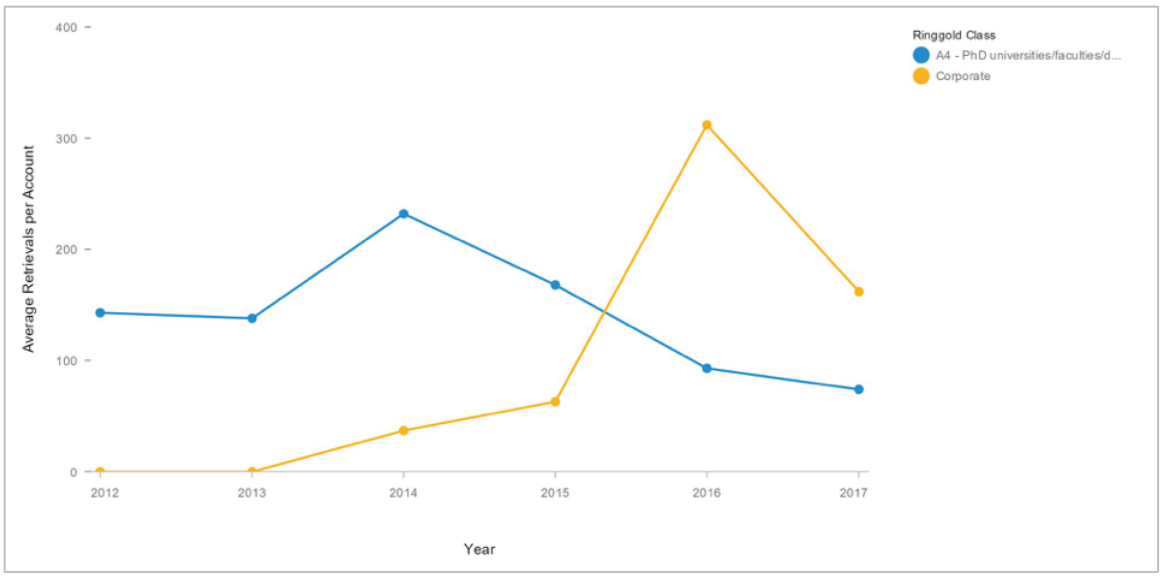

Figure 39. South African Retrievals per Account by Year and Ringgold Class.

From 2012 to 2016, South Africa's GDP declined by 25.5%. During this same time, the population grew by 5.7% (averaged 1.4% a year). Like Botswana, no consistent trends were evident in fisheries production. Production in 2012 amounted to 725,234.53 metric tons but declined the following year to 436,857 tons. Production then rose to 615,411 in 2014 and dropped to 578,450 in 2015.

An obvious connection between changes in GDP, population, or fisheries production and ASFA subscriptions or usage is not evident for Botswana. In South Africa, however, the changes in combined retrievals in ASFA do appear to be related to changes in fisheries production for the years with available data.

China and Malaysia

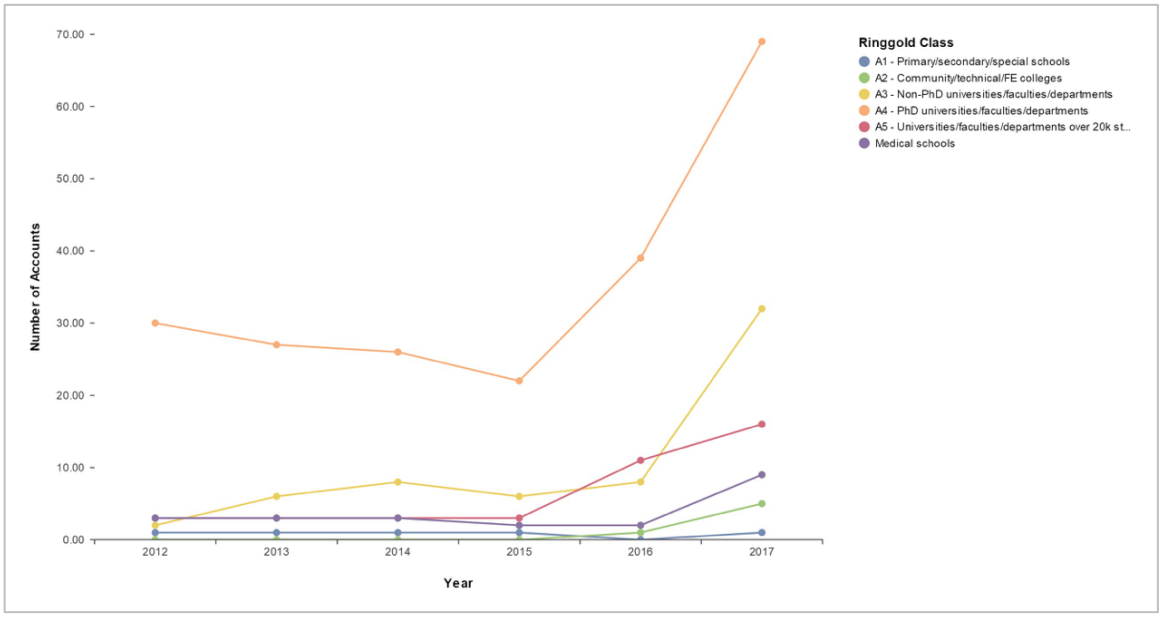

Figure 40. Chinese Academic Accounts by Year and Ringgold Class.

Because the World Bank data groups Taiwan with mainland China, the number of ASFA accounts for the two countries were combined and new retrievals per accounts were calculated based on the combined data. In this section the ASFA accounts and retrievals are labeled as Chinese.

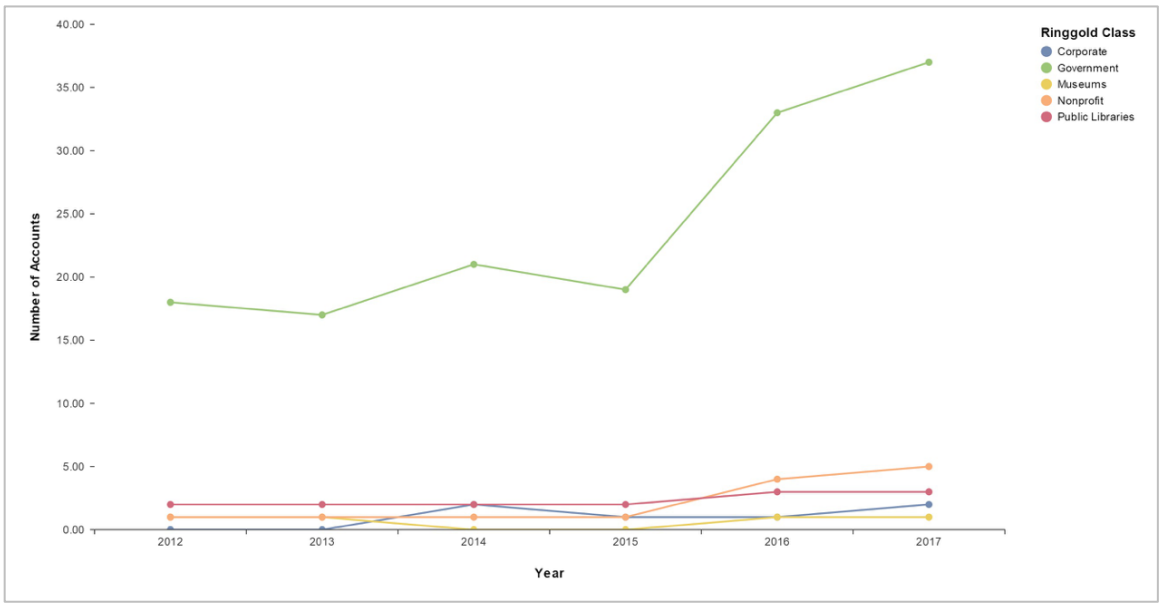

Figure 41. Chinese Non-Academic Accounts by Year and Ringgold Class.

Chinese subscriptions to ASFA rose from 61 in 2012 and 2013 to 67 in 2014, dropped to 57 in 2014, and then increased to 180 in 2017 for a total growth of 195.1% from 2012 to 2017. During this time, government, A3, and A4 accounts comprised the largest type of subscriptions which all experienced growth. A3 subscriptions rose from two in 2012 to 32 in 2017 (a growth of 1500%). The number of A4 accounts shrunk from 30 in 2012 to 22 in 2015, but then grew to 69 by 2017 (130% growth from 2012). The number of government subscriptions fluctuated between 17 and 21 during 2012 to 2015 and then grew to 37 in 2017 (or 105.5% from 2012).

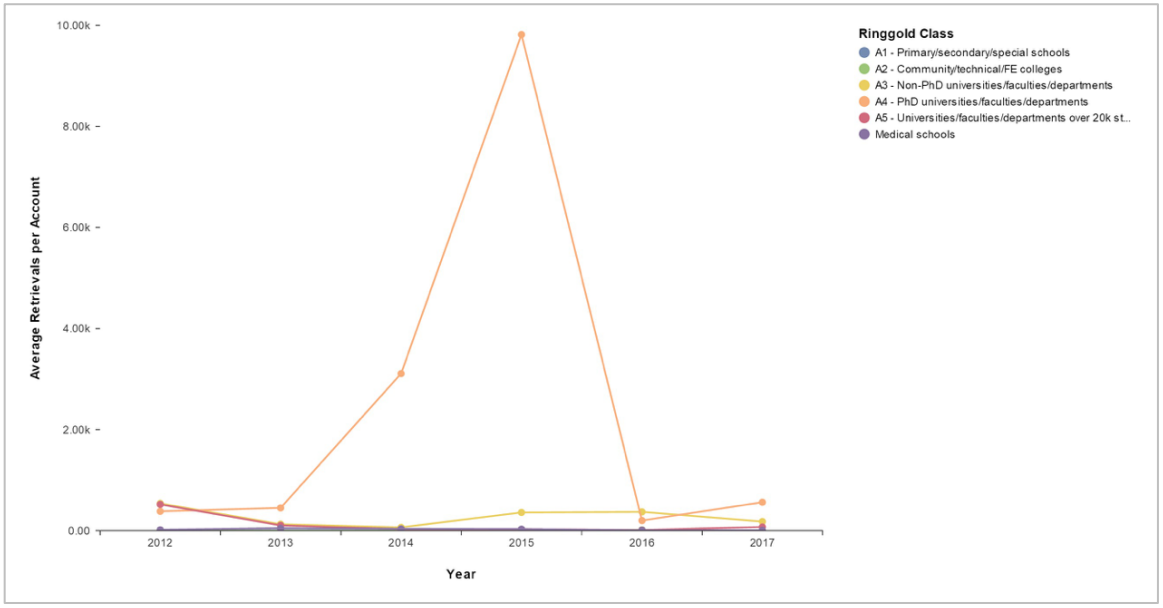

Figure 42. Chinese Academic Retrievals per Account by Year and Ringgold Class.

The total average RPAs for Chinese accounts rose rapidly from 1,798 in 2012 to 92,227 in 2013, due to a spike from public library accounts. The RPAs then plummeted in 2014 to 4,926, rose to 11,213 in 2015 and declined to 996 in 2017. Aside from the large number of public library retrievals in 2013, A4 accounts contributed the largest portion of RPAs, which rose from 385 in 2012 to 9,816 in 2015 (2449.6% increase) and then dropped to 202 in 2016 before rising slightly to end 2017 with 564. The RPAs from government accounts peaked at 1,481 in 2013 from 84 in 2012 and then dropped year over year to 22 RPAs in 2017. Retrievals in A3 accounts fluctuated from 541 in 2012 to 68 in 2014, rising to 374 in 2016 and then declining to 182 in 2017.

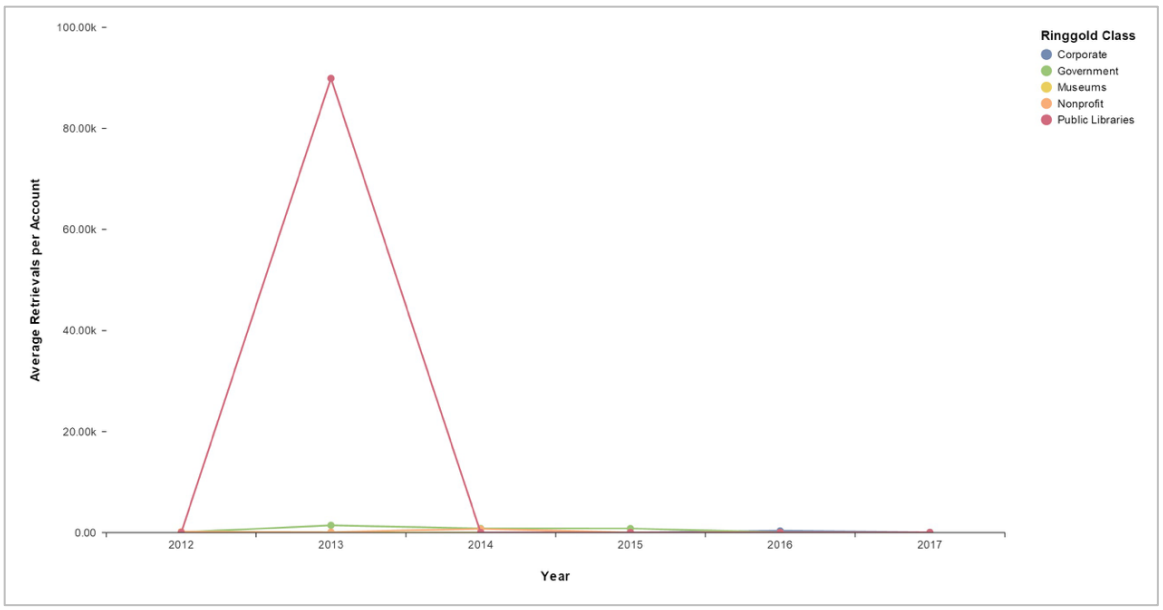

Figure 43. Chinese Non-Academic Retrievals per Account by Year and Ringgold Class.

From 2012 to 2016, both the Chinese GDP and population increased annually (see Tables 2 and 3). The GDP rose 30.8% during this time (an average of 7.7% a year) and the population grew 2.1% over the same period. From 2012 to 2015, fisheries production increased from 70,368,028.40 metric tons to 79,389,444.75 (12.8% overall or an average of 4.3% per year) (see Table 4).

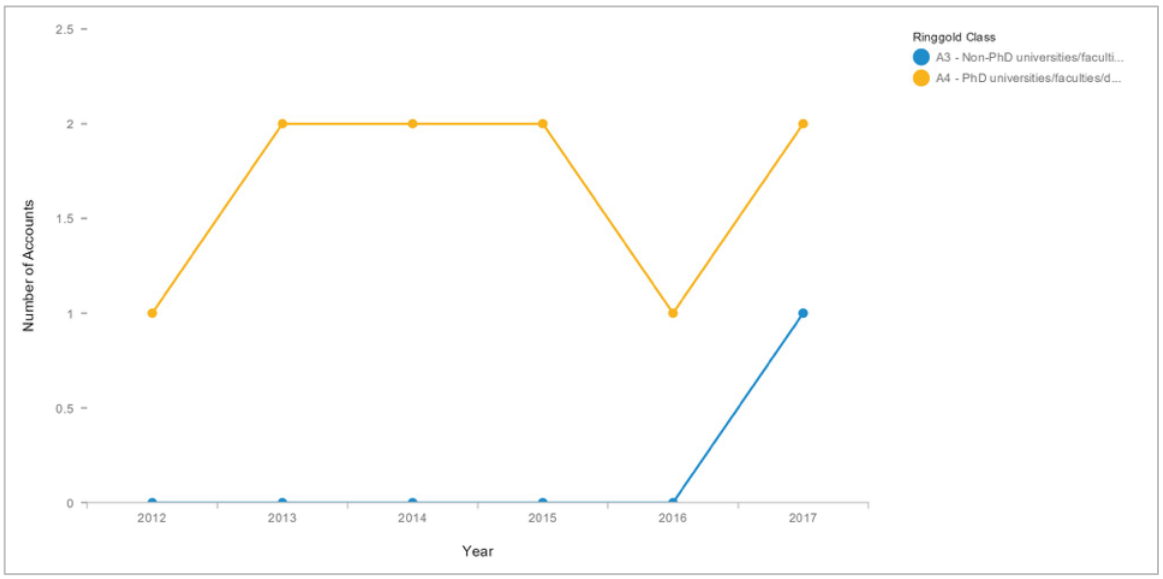

Figure 44, Malaysian Accounts by Year and Ringgold Class.

Subscriptions to ASFA in Malaysia consisted of A4 and A3 accounts, which grew from one in 2012 to two in 2013 to 2015 then one in 2016 and three in 2017. During this time, the retrieval activity for the A4 account was low, varying between 56 in 2012 to 25 in 2015 before rising to 58 in 2017. The A3 account had 27 retrievals for 2017.

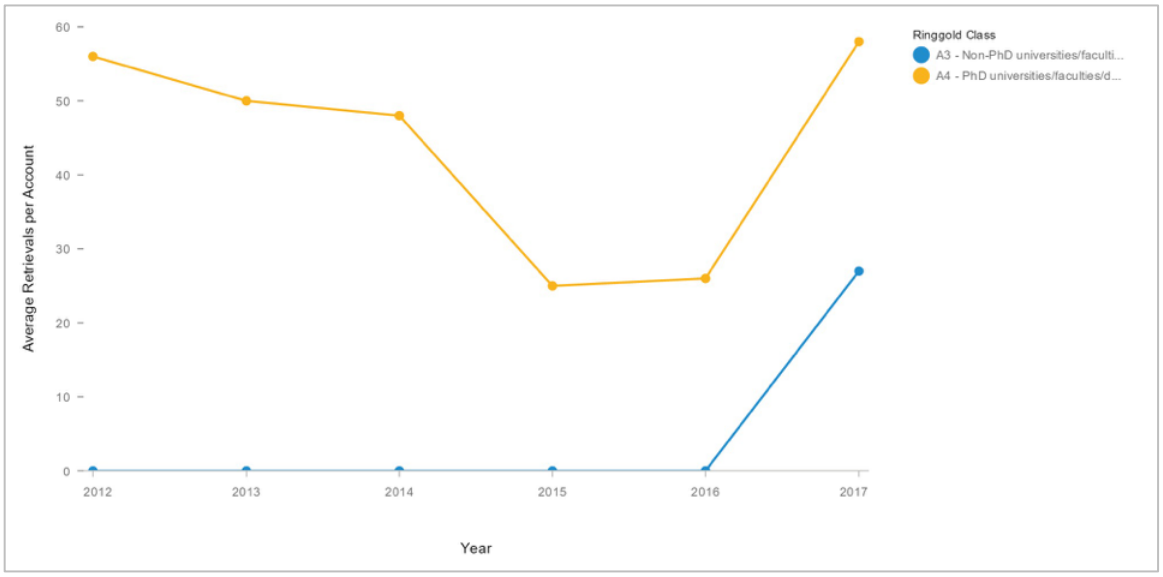

Figure 45. Malaysian Retrievals per Account by Year and Ringgold Class.

The Malaysian GDP fluctuated between 2012 and 2016 but saw an overall decrease of 5.41% during that period of time (see Table 2), while the Malaysian population grew 6.91% (see Table 3). Fisheries production declined from 2,116,236.9 metric tons in 2012 to 1,989,740.465 in 2014 followed by a small increase in 2015 to 2,003,019.2 (for an overall decrease of 5.35%)

For the Chinese accounts, a relationship between the changes in the number of ASFA accounts and retrievals and the selected development indicators is not evident. With Malaysia, however, there did appear to be a decrease in the number of ASFA subscriptions and retrievals following years with either a drop in fisheries production or in GDP.

Australia and Fiji

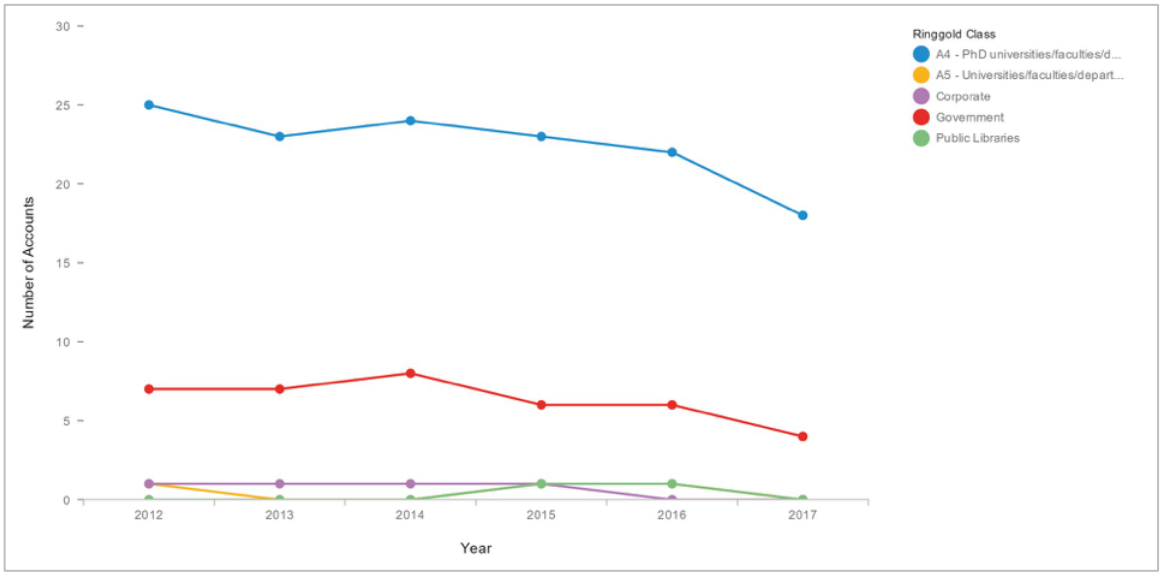

Figure 46. Australian Accounts by Year and Ringgold Class.

Overall, Australia experienced a decline in the number of ASFA subscriptions, from 34 in 2012 to 22 in 2017 (a 35% decrease). A small increase between 2013 and 2014, from 31 to 33, was short-lived. The reduction occurred in both A4 and government accounts, along with a cessation of corporate and A5 subscriptions (see Figure 46). There was only one public library account between 2015 and 2016. The total average RPAs during that same period decreased from 1700 in 2012 to 1053 in 2015 (38% decline), before increasing again to 1815 in 2017 (see Figure 47). In Australia, the primary subscribers corresponded with the primary users according to the retrieval data. The declining number of A4 accounts, coupled with the rising RPAs, appears to indicate that the users at those institutions still subscribing were continuing to access the database at similar or increased rates as before.

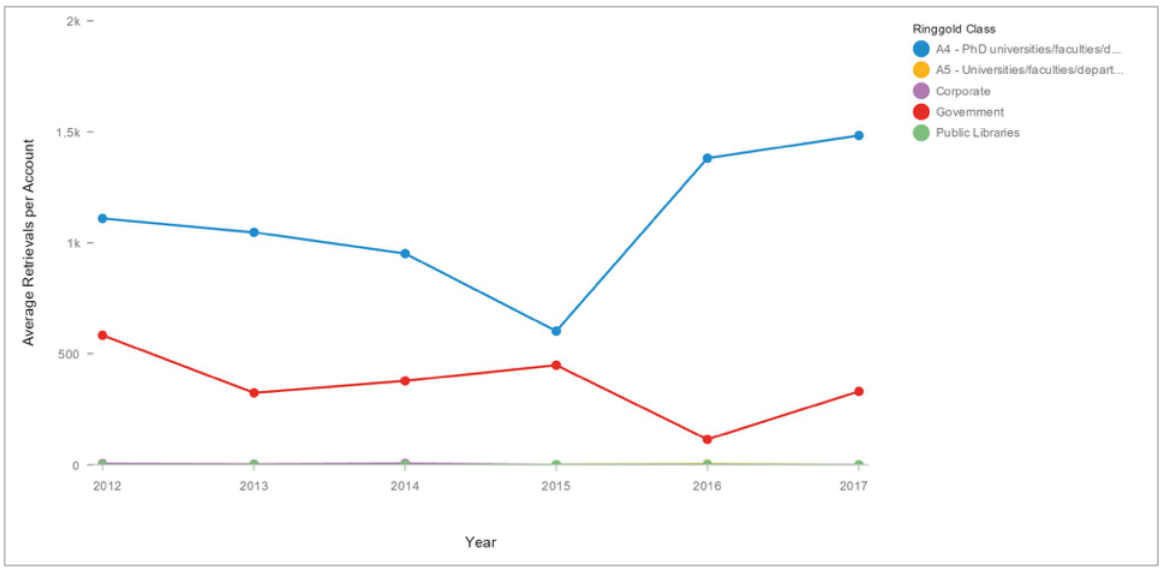

Figure 47. Australian Average Retrievals per Account by Year and Ringgold Class.

From 2012 to 2016, Australia saw a 21.7% (averaged 5.4% a year) decline in its total GDP (see Table 2). During this same period, the country's population grew 6.4% (see Table 3). Fisheries production slowed from 2012 to 2014 by 5.6% and then grew in 2015 (see Table 4).

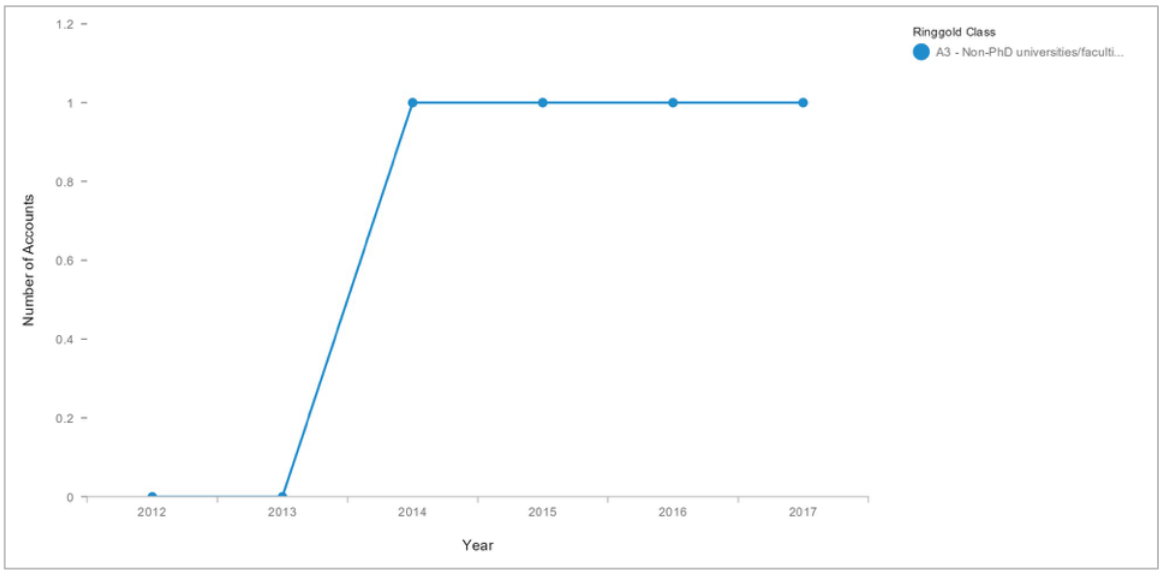

Figure 48. Fijian Accounts by Year and Ringgold Class.

In Fiji, there is a single ASFA subscription, an A3 account, which began in 2014. The retrievals for this account initially declined from 1830 RPAs in 2014 to 1329 in 2015 but then increased to 4354 in 2017, or a 227.1% increase.

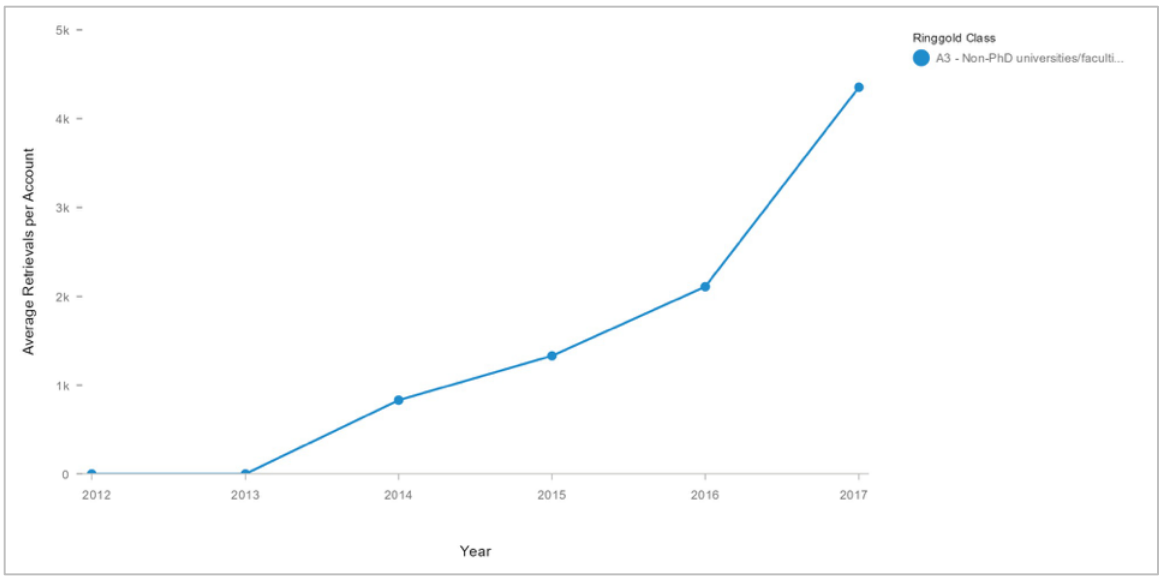

Figure 49. Fijian Retrievals per Account by Year and Ringgold Class.

Both the GDP and population of Fiji grew from 2012 to 2016. The GDP initially increased from 2012 to 2014, followed by a small drop in 2015 before rising in 2016, for an overall 18.4% increase from 2012 (see Table 2). The population of Fiji increased by 2.9% during that period of time (see Table 3). The fisheries production in the years between 2012 and 2015 had an overall decline by 3.3% (see Table 4), with an initial drop from 2012 to 2013. Production then rebounded slightly in 2014 but fell again in 2015.

In Australia and the Pacific region, there is no correlation between GDP, population, or fisheries production and ASFA subscriptions or retrievals in Australia and Fiji. While the decline in ASFA accounts within Australia does coincide with the shrinking GDP, the lower GDP does not account for the changes in retrievals between 2012 and 2016. The change in number of ASFA retrievals in Fiji does coincide with the changes in fisheries production in 2014 and 2015, although insufficient data are available to confirm either a coincidence or a longer-term trend.

Germany and Iceland

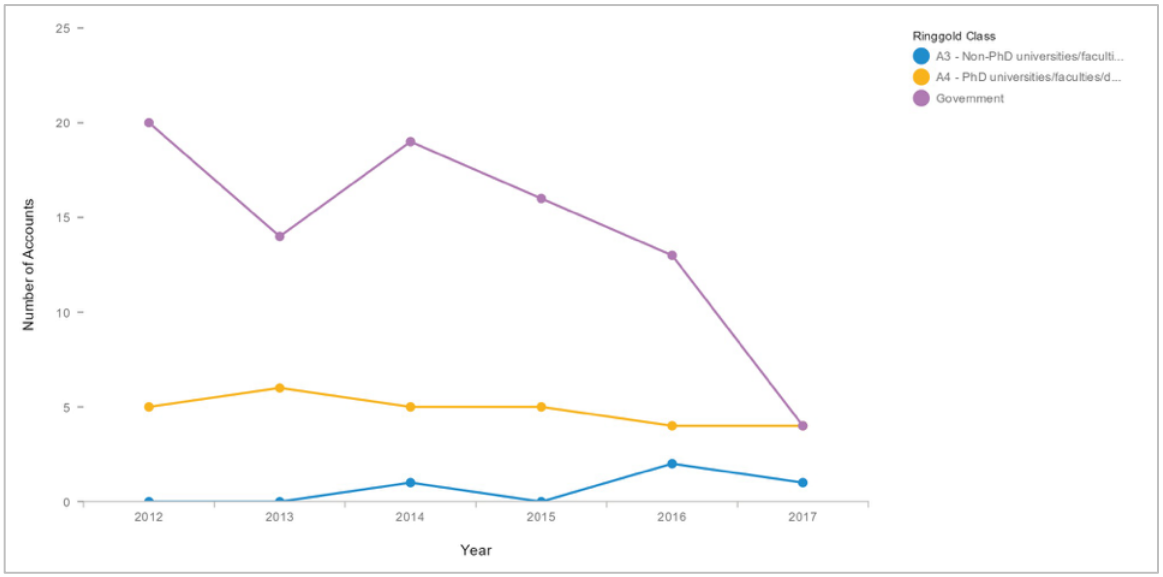

Figure 50. German Accounts by Year and Ringgold Class.

The number of German accounts decreased by 64% between 2012 and 2017. From 2012 to 2014, subscriptions fluctuated between 20 and 25 and then declined to nine in 2017. This decrease coincided with the changing number of government accounts from 20 in 2012 to four in 2017 (see Figure 50). While more stable, A4 subscriptions still experienced an overall decline over the same period. The total average RPAs varied, initially declining from 719 in 2012 to 558 in 2013 but rising to 1285 in 2016 before dropping considerably to 214 in 2017 (an overall decline of 70.2% from 2012). A4 accounts followed by government accounts contributed the larger portion of retrievals among the German subscribers (see Figure 51).

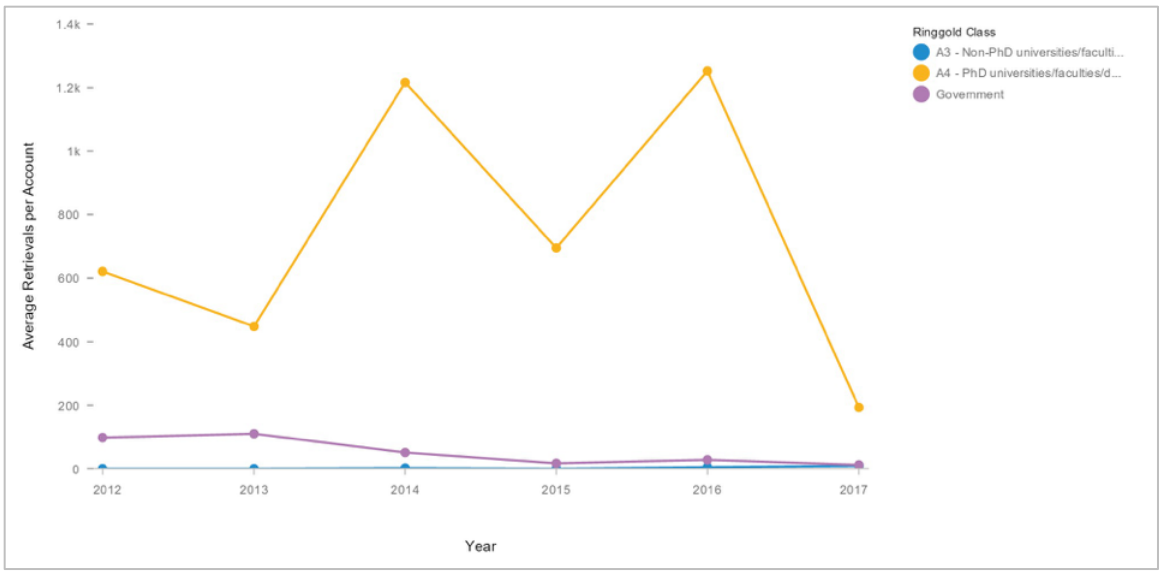

Figure 51. German Retrievals per Account by Year and Ringgold Class.

From 2012 to 2014, the German GDP grew year over year, followed by a decline in 2015 and then growing slightly to end 2016 (see Table 2). During this same period, the population increased 2.6% (see Table 3). Fisheries production also grew 21.1% from 2012 to 2015 (see Table 4).

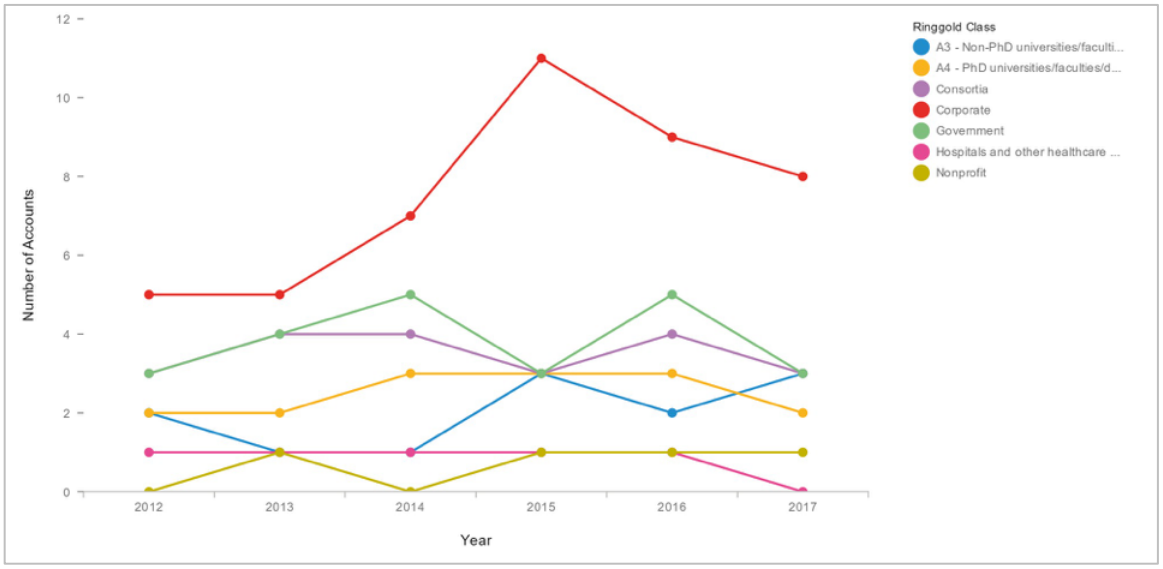

Figure 52. Icelandic Accounts by Year and Ringgold Class.

A more diverse selection of ASFA accounts exists in Iceland compared to Germany. In addition to the A3, A4, and government subscriptions, corporate, consortia, hospital, and non-profit accounts are present in Iceland. The total number of accounts grew from 16 in

2012 to 25 in 2015 and 2016, before dropping to 20 in 2017. Corporate subscriptions formed the largest share, followed by consortia and government. The consortia and government subscriptions also accounted for the largest portion of RPAs, with corporate retrievals finishing 2017 in third position. Overall, the number of RPAs was low, varying between 63 in 2012 to 116 in 2013, 83 in 2015, 97 in 2016, and 61 in 2017.

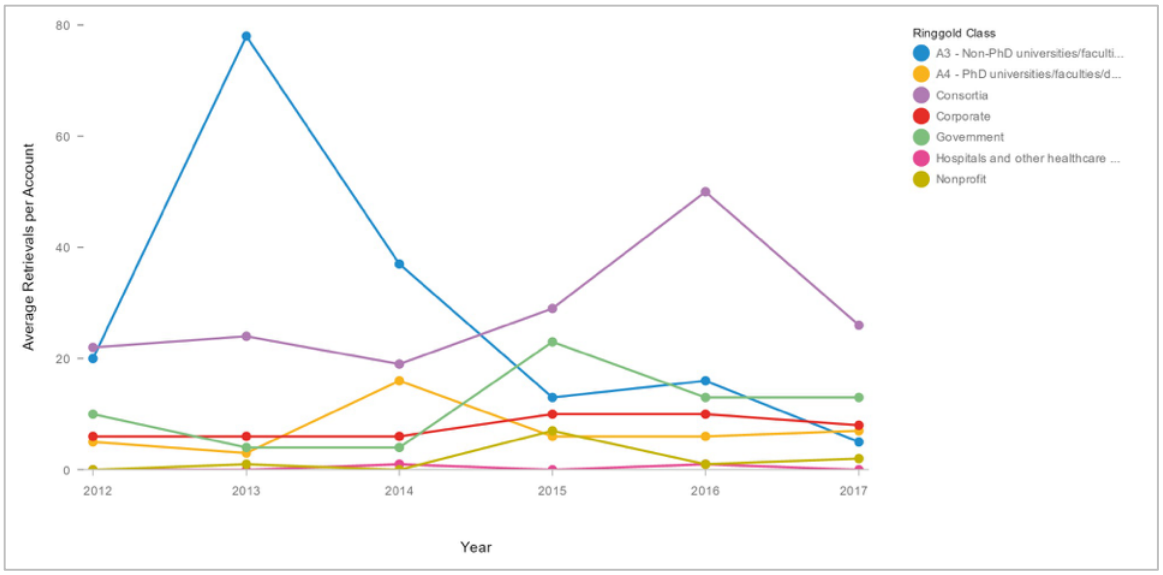

Figure 53. Icelandic Retrievals per Account by Year and Ringgold Class.

Iceland's GDP grew 42.1% between 2012 and 2016 (see Table 2). During this period of time, the country's population also rose 4.6% (see Table 3). Fisheries production experienced an overall decrease of 3%, initially rising from 2012 to 2013, dropping in 2014, and then growing again in 2015 (see Table 4).

As noted earlier, the makeup of organizations subscribing to ASFA differs between Germany and Iceland, with Iceland ending 2017 with more ASFA subscriptions than Germany. There does not appear to be a relationship between changes in GDP, population, or fisheries production and changes in number of ASFA accounts or usage in either country. Non-academic accounts, particularly corporate, are more numerous in Iceland than in Germany or in other regions of the world. This discrepancy may be due to Iceland's status as an island nation with an emphasis on fisheries production. Heavy involvement in the fishing sector may influence the decision of fishing companies to subscribe to the database, although the relatively low use per account is puzzling.

Bahrain and Turkey

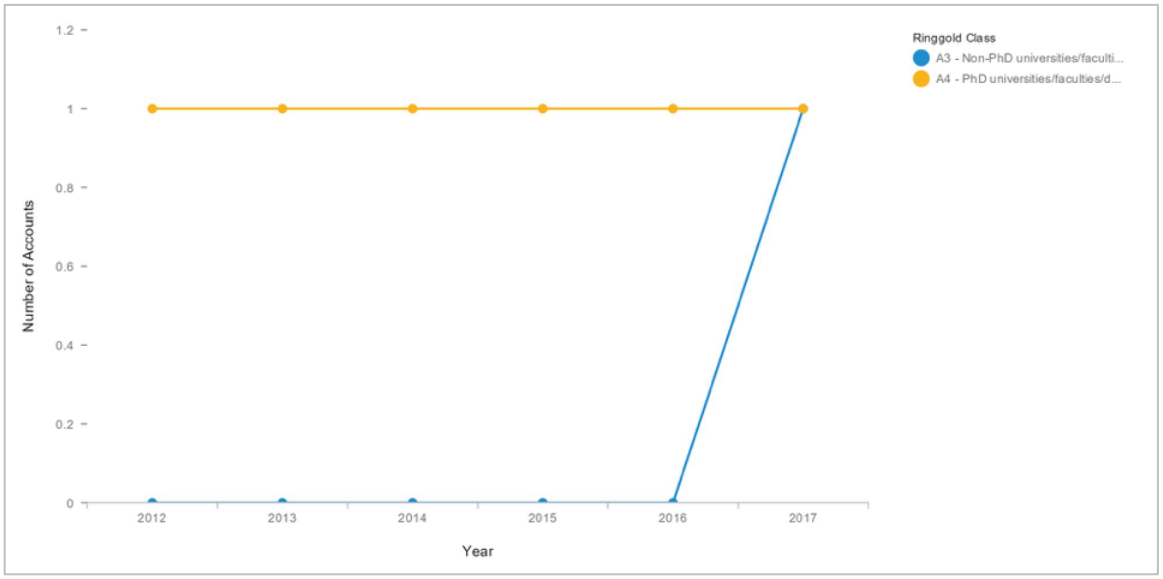

Figure 54. Bahraini Accounts by Year and Ringgold Class.

From 2012 to 2017, there was a single A4 ASFA subscription in Bahrain. An A3 subscription began in 2017, bringing the number of accounts in the country to two. The total average RPAs grew 358.4% between 2012 and 2017 but varied from 32 in 2012 to 9 in 2015 and ending the period with 147 in 2017.

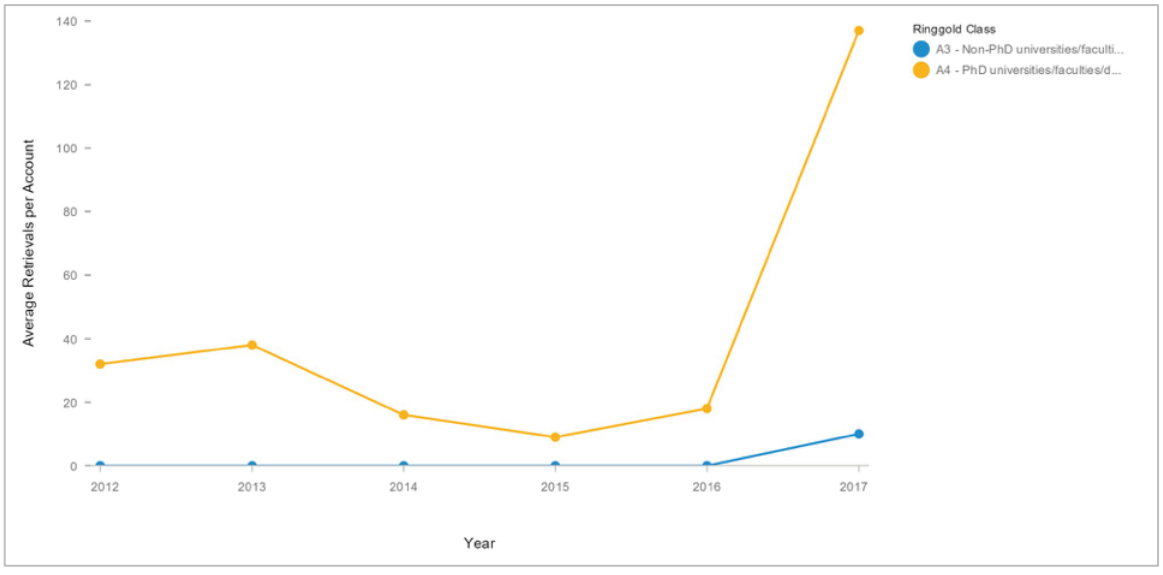

Figure 55. Bahraini Retrievals per Account by Year and Ringgold Class.

Bahrain's GDP experienced an overall growth of 4.6% but saw variations between 2012 and 2016 (see Table 2). In the same period the population grew 9.6% (an average of 2.4% a year) (see Table 3). Fisheries production, however, dropped 44.2% between 2012 and 2015 (see Table 4).

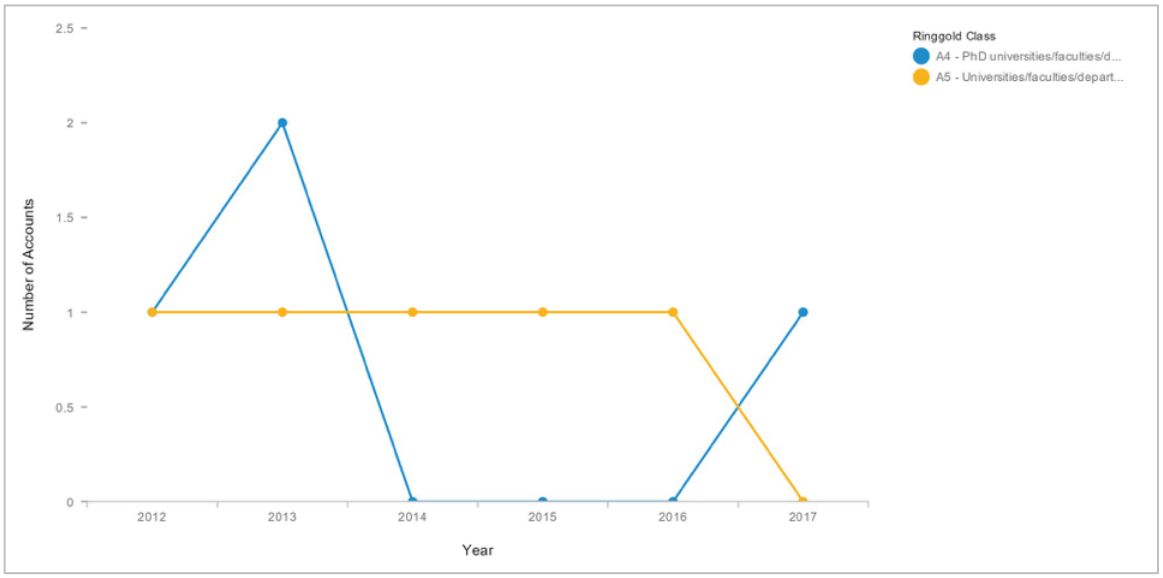

Figure 56. Turkish Accounts by Year and Ringgold Class.

In Turkey, the small number of ASFA subscriptions went from two in 2012 to three in 2013 and only one account between 2014 and 2017 (see Figure 56). The activities in these accounts was also very low, varying from 125 RPAs in 2012 to only two in 2017 (see Figure 57).

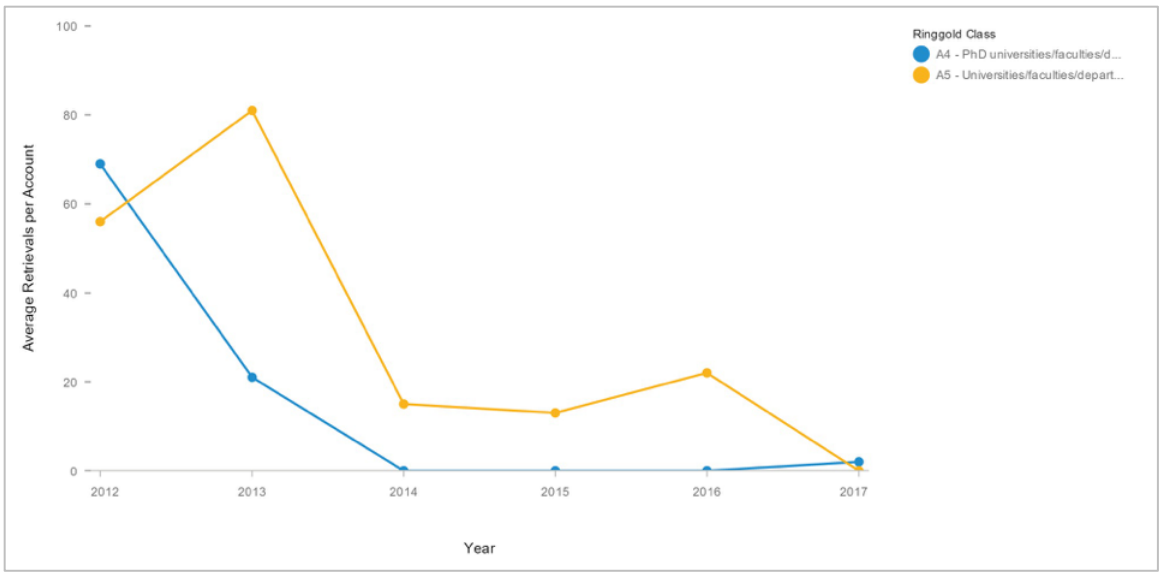

Figure 57. Turkish Retrievals per Account by Year and Ringgold Class.

Turkey's GDP decreased modestly by 1.1% between 2012 and 2016, although it varied during that time (see Table 2). Turkey's population increased 6.6% during that same period (see Table 3). Between 2012 and 2015, fisheries production increased 4.0%, although it initially declined from 2012 to 2014 (see Table 4).

For both Bahrain and Turkey, a relationship is not apparent between the economic indicators and the number of ASFA subscriptions and retrievals. Of all the countries selected for this section, Turkey has the lowest number of accounts for its GDP. Turkey is an ASFA Partner, however, and the full range of use of the database might not be reflected in the data provided by ProQuest.

Panama and the United States

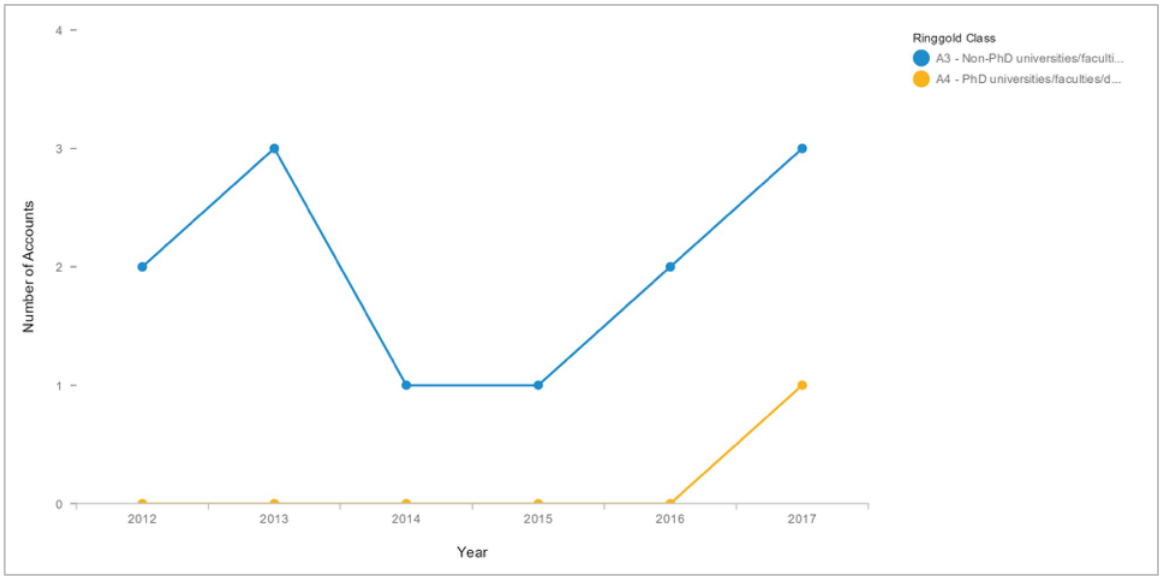

Figure 58. Panamanian Accounts by Year and Ringgold Class.

In Panama, while an overall growth in the ASFA subscriptions occurred in the five-year period of the data, the number of accounts varied between one to three between 2012 and 2015 and increased to four in 2017, when an A4 institution began an account to complement the A3 subscriptions. At the beginning of the period, the RPAs were very low (three in 2012 and 2015, and 21 in 2014) but rose to 36 in 2017.

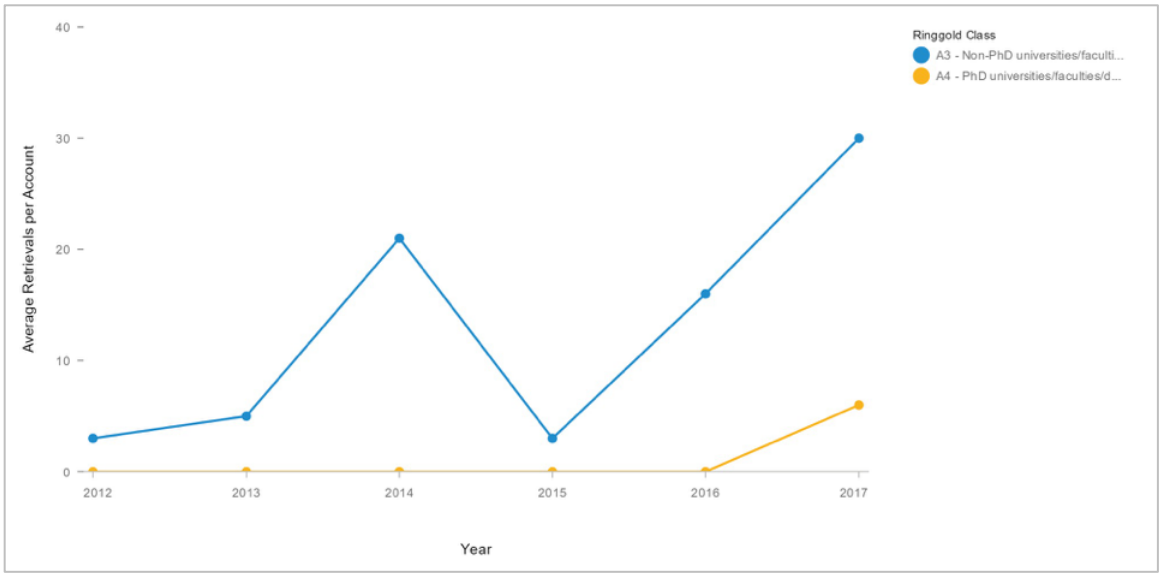

Figure 59. Panamanian Retrievals per Account by Year and Ringgold Class.

Both the Panamanian GDP and population grew between 2012 to 2016 (see Tables 2 and 3). The GDP increased 13.8% (averaged 3.4% a year) and the population grew 6.9%. Fisheries production initially increased from 2012 to 2013 but then shrank in 2015 for an overall decline of 23.7% (see Table 4).

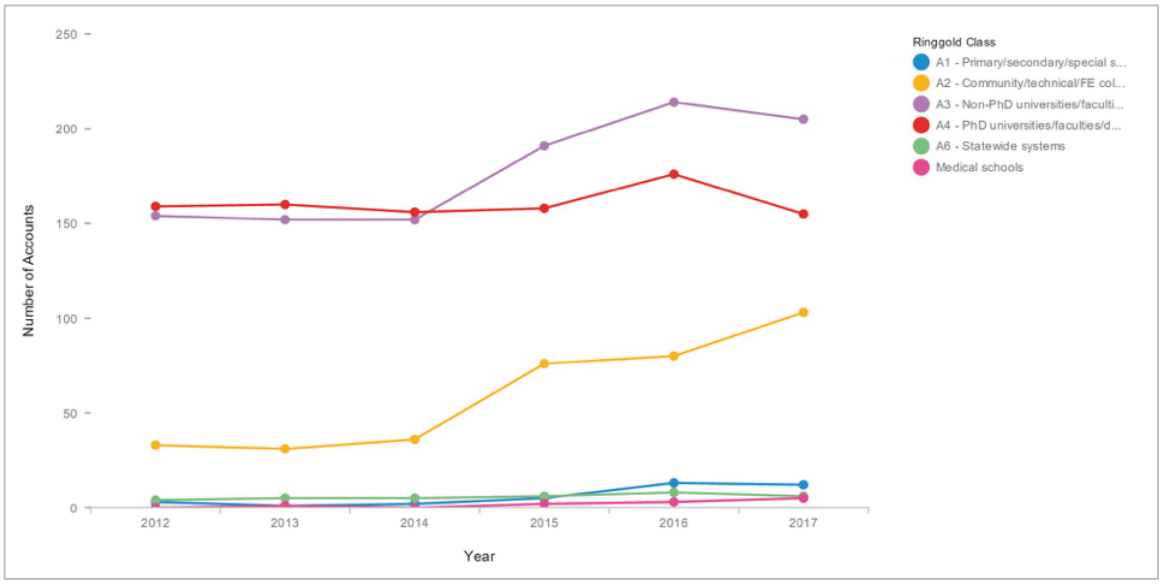

Figure 60. American Academic Accounts by Year and Ringgold Class.

In the United States, the number of subscriptions initially declined from 405 in 2012 to 392 to 2014, but then grew to 575 in 2017 (a 42% growth over the five years). During this period, the A3 tier accounts overtook A4 as the largest subscription type, with A2 as the third largest group. A3 accounts increased from 154 in 2012 to 205 in 2017. Over the five-year period, A4 institutional accounts were the only account type that decreased in number from 2012 to 2017. A marked increase in A2 subscriptions occurred during that period of time, rising from 33 in 2012 to 103 accounts in 2017 (a 212.1% overall growth). All other academic accounts—A1, A6, and medical schools—showed growth from 2012 to 2017. From 2016 to 2017, only the increased number of A2 accounts prevented a decline in academic accounts, possibly signalling subscriptions in the academic market segment are contracting.

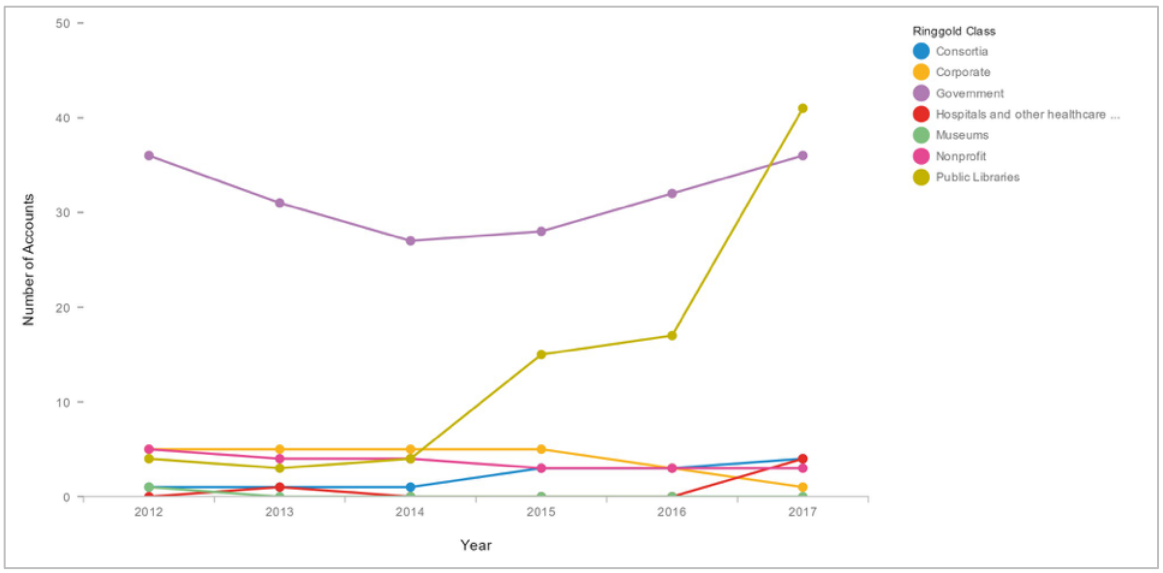

Figure 61. American Non-Academic Accounts by Year and Ringgold Class.

For most of the period between 2012 and 2017, government accounts were the most numerous non-academic accounts before they were overtaken by public libraries in 2017. While there was no overall change in the number of government subscriptions, they dropped in 2013 before rising again. A substantial change in public library subscriptions occurred between the four in 2012 to 41 in 2017. Consortia subscriptions grew from one in 2012 to four in 2017. Corporate accounts shrunk from five in 2012 to one in 2017. The small number of non-profit accounts declined from five in 2012 to three in 2015 through 2017. A single hospital account existed in 2013, and four in 2017, with none in 2012 or 2014 through 2016. One museum held a subscription in 2012, but none in the following years.

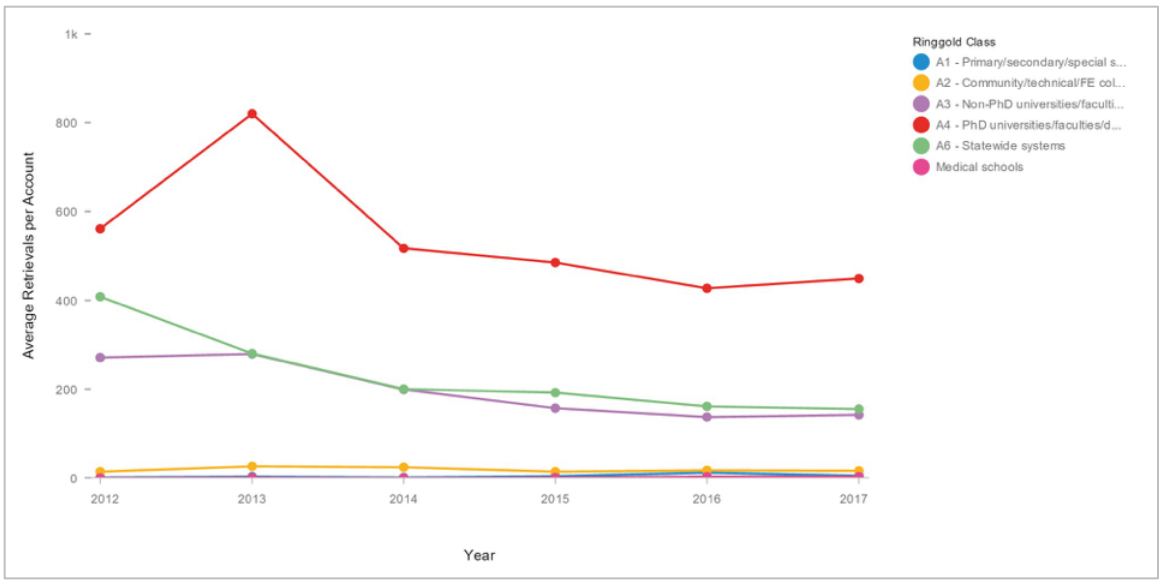

Figure 62. American Academic Retrievals per Account by Year and Ringgold Class.

Overall, the average retrievals in all of the America accounts declined by 67% from 2012 to 2017. Among the accounts, A4 and non-profit accounts contributed the largest portion of the retrievals. In both types the retrievals decreased over the five years. The RPAs for A4 accounts fell from 561 in 2012 to 449 in 2017. In the same period, retrievals in non-profit accounts dropped from 1,749 in 2012 to 586 in 2017 (an overall 66.5% drop).

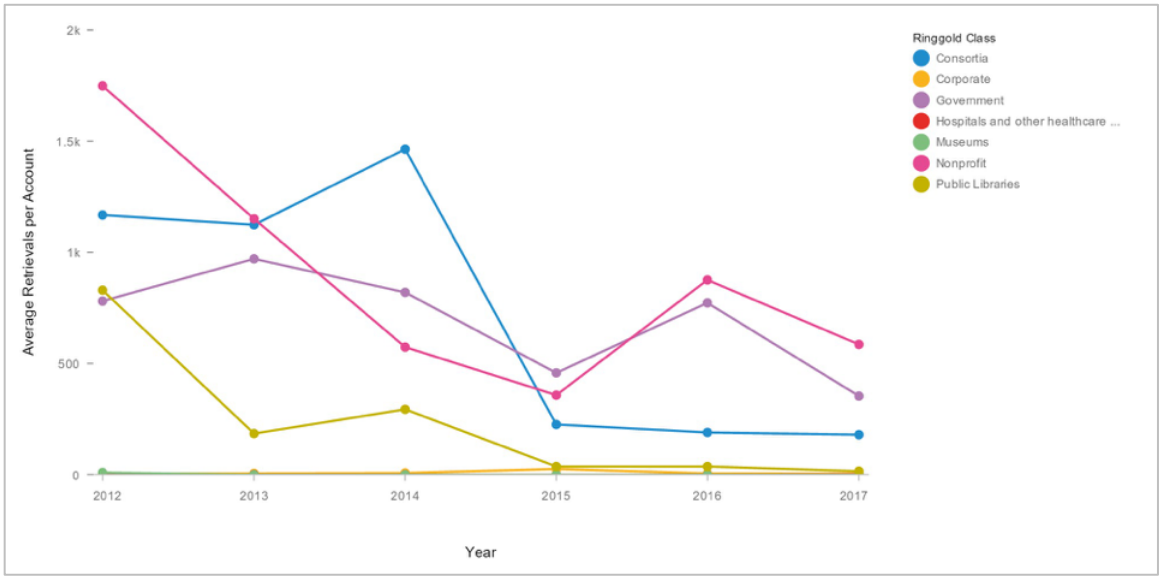

Figure 63. American Non-Academic Retrievals per Account by Year and Ringgold Class.

Fluctuations in retrievals occurred in all other account types over the five-year period, but generally the number of retrievals declined overall, in some cases substantially. Notably, despite the increased number of A2 accounts, the RPAs for this subscription type were never higher than 16 (see Figure 62). Public library RPAs also decreased significantly from 830 in 2012 to 16 in 2017, indicating that the increased number of accounts is not maintaining or increasing overall usage (see Figure 63). The data also shows that the growth areas in the market—namely public libraries, A3 and A2 institutions—are not the primary users of ASFA. A3 accounts were also consistently below A6 accounts in usage per account, despite A6 accounts comprising a small share of the subscriber base.

The American GDP and population both grew from 2012 to 2016 (see Tables 2 and 3). The GDP increased 14.8% (an average of 3.7% a year) and the population 2.9%. Fisheries production varied but dropped overall by 1% from 2012 to 2015 (see Table 4).

For Panama, there does not appear to be a relationship between the changes in GDP, population, or fisheries production with the changes in ASFA subscriptions or usage. In the United States, the changes in fisheries production appear to mirror the changes in number of ASFA accounts from 2012 to 2015, but more data may be needed to verify this impression. As noted earlier, despite the number of accounts increasing in the United States, the usage per account has gone down for a majority of the account types. This is particularly noticeable in A2 and public library accounts, as mentioned above.

Brazil and Peru

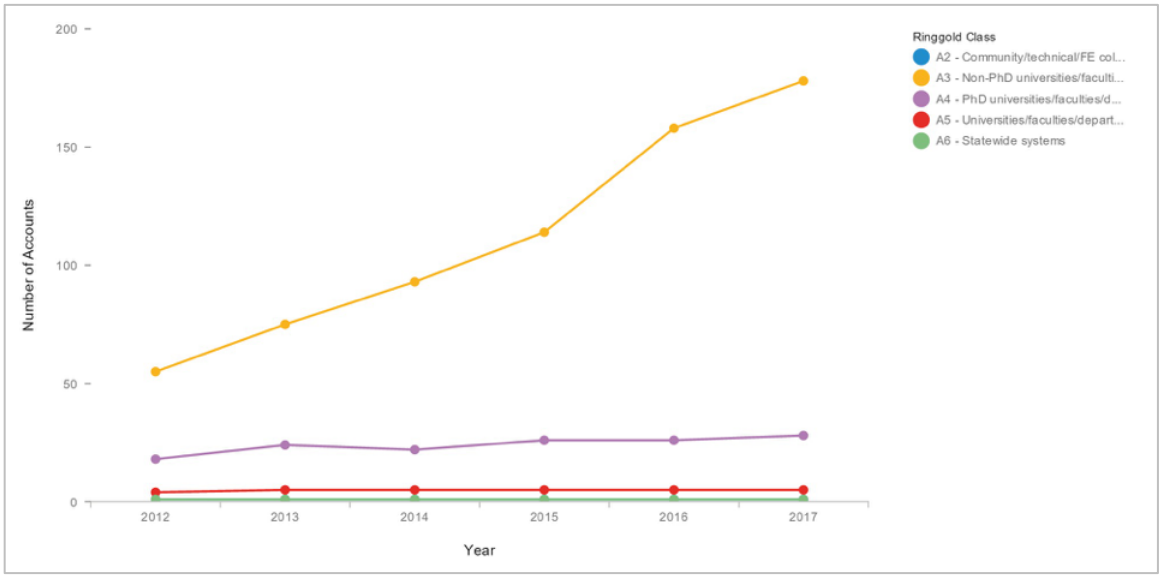

Figure 64. Brazilian Academic Accounts by Year and Ringgold Class.

In Brazil, the total number of ASFA subscriptions rose continuously from 85 in 2012 to 220 in 2017 (a 158.8% increase or 31.8% per year). The biggest driver of this growth was in A3 accounts (rising 223.6% from 55 in 2012 to 178 in 2017) (see Figure 64). A4 and A5 accounts also experienced a small increase during this period of time. A2 and A6 institutions each had single accounts from 2012 to 2017.

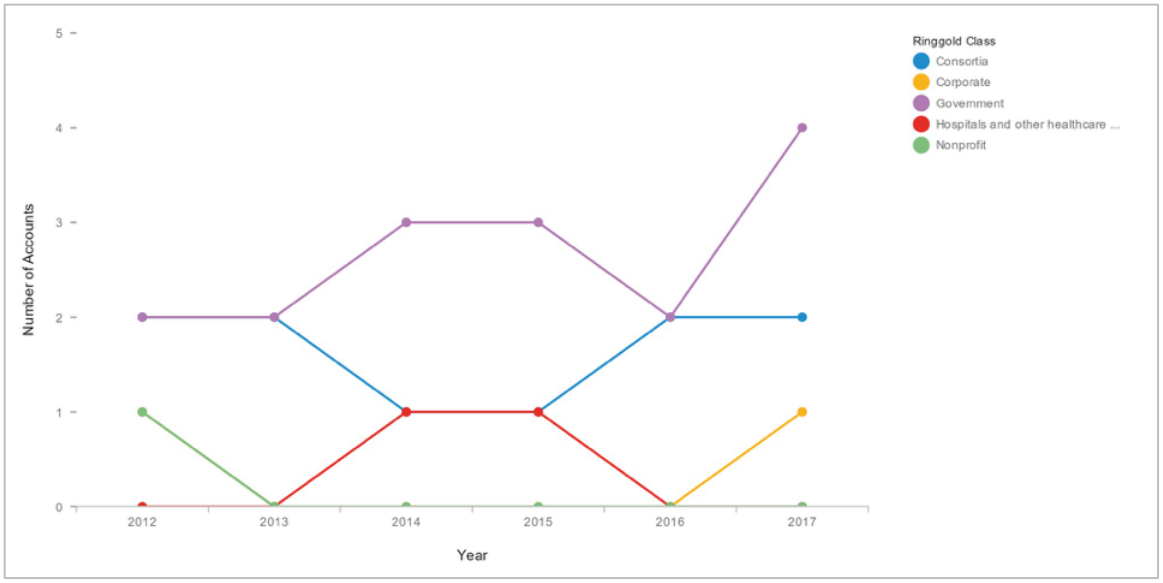

Figure 65. Brazilian Non-Academic Accounts by Year and Ringgold Class.

Non-academic accounts are less numerous than academic accounts in Brazil. Consortia subscriptions remained the same (namely two in 2012 and two in 2016 through 2017) (see Figure 65). Government accounts increased from two in 2012 to four in 2017. There was a single corporate account in both 2012 and 2017, with none in the intervening years. One non-profit organization subscribed to ASFA in 2012, and one hospital account existed in 2014 and 2015.

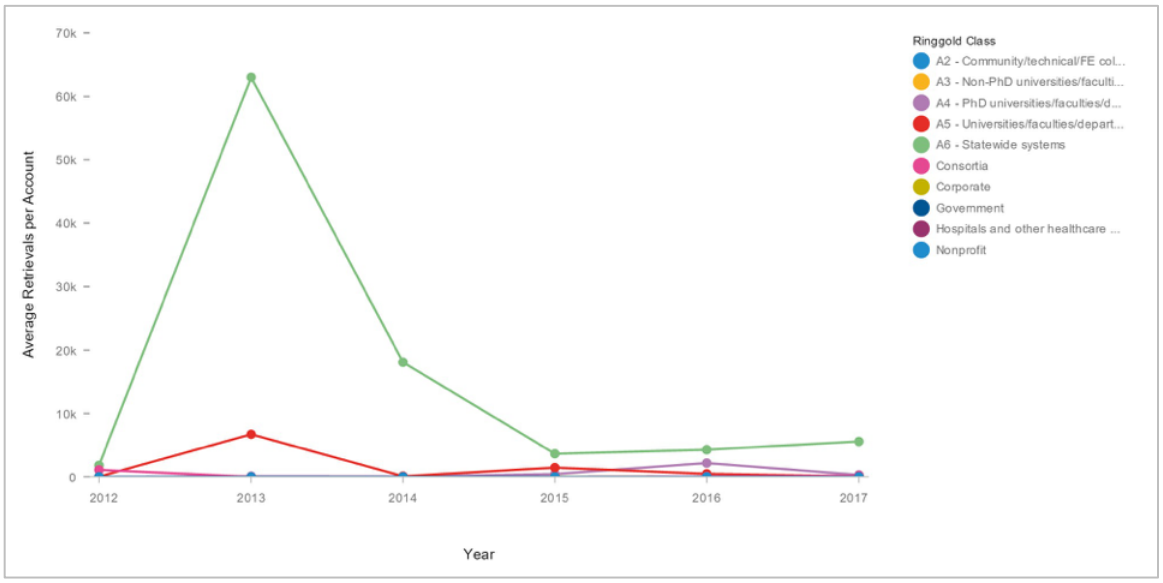

Figure 66. Brazilian Retrievals per Account by Year and Ringgold Class.

Retrievals in the Brazilian accounts experienced overall growth from 2012 to 2017, with several rises and falls. Retrievals peaked dramatically in 2013, rising from 3,028 RPAs in 2012 to 69,895 in 2013. The retrievals then dropped to 5,646 in 2015, rising to 7,056 in 2016 and decreasing to 6,244 in 2017. Outside of the unusual spike in 2013, retrieval activity in the Brazilian accounts increased from 3,028 RPAs in 2012 to 6,244 in 2017, a change of 106.2%. The sole A6 account contributed the largest share of retrievals, followed by the A5 and the A4 accounts.

Brazil's GDP initially grew from 2012 to 2013 (see Table 2). Afterwards, however, the GDP shrunk year over year, ending 2016 at a total decline of 27.1% from 2012. During this same period, the Brazilian population grew by 3.5% (see Table 3). Brazilian fisheries production varied from 2012 to 2015 but experienced an overall decline of 2% (see Table 4).

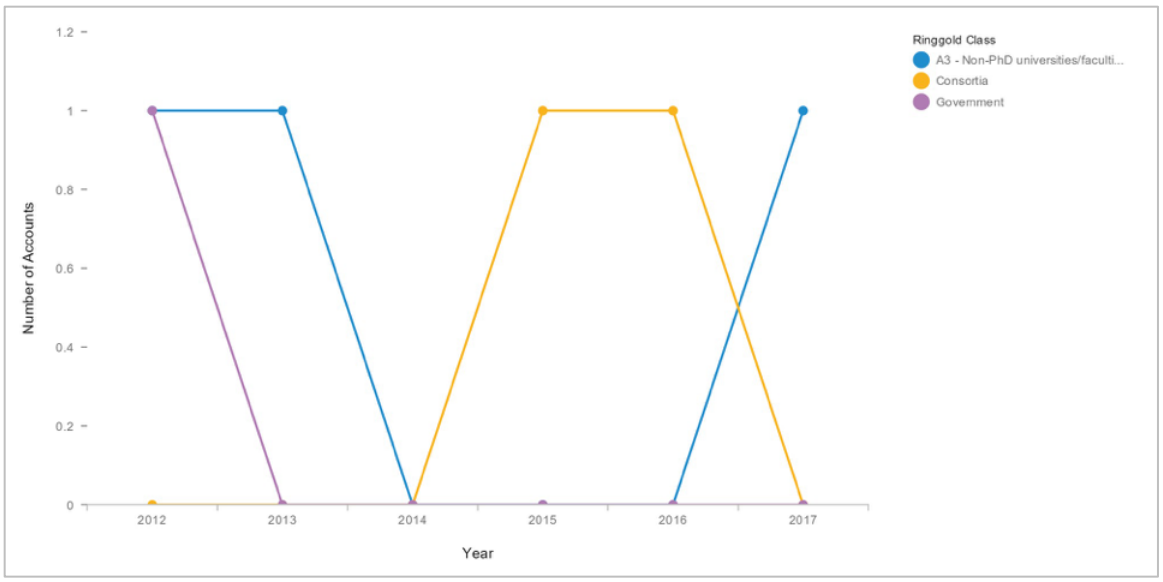

Figure 67. Peruvian Accounts by Year and Ringgold Class.

Only two institutions subscribed to ASFA in Peru between 2012 and 2017. The period began with two accounts in 2012, which dropped to none in 2014, and then one account between 2015 and 2017. One of the two accounts in 2012 was held by a government institution. A consortia account established in 2015-206 was cancelled and an A3 institution subscribed in 2017. The small number of subscriptions was reflected in the retrievals: 29 in 2012, none in 2013-2014, 174 in 2015, nine in 2016, and 26 in 2017.

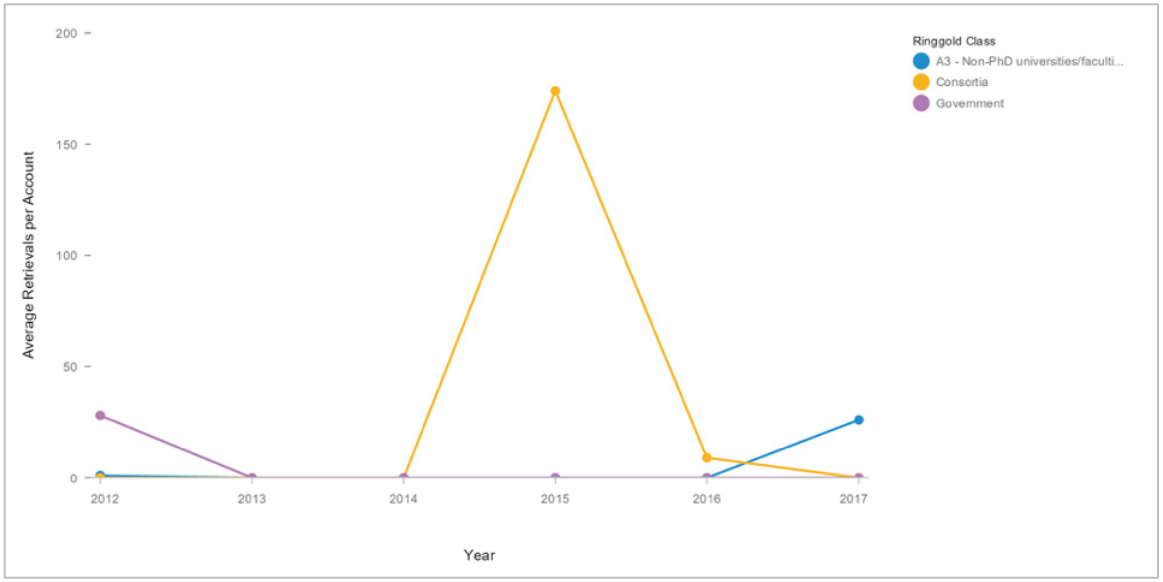

Figure 68. Peruvian Retrievals per Account by Year and Ringgold Class.

The Peruvian GDP fluctuated between 2012 and 2016 but experienced an overall decline of 0.5% (see Table 2), while Peru's population grew substantially during that time (see Table 3). Fisheries production also fluctuated considerably from 2012 to 2015, although overall production remained relatively level (see Table 4).

The changes in the economic indicators within these two countries, do not appear to be a related to changes in ASFA subscriptions and usage. For Brazil in particular, despite the decline in GDP, ASFA subscriptions continued to rise throughout this period of time. The very small number of subscriptions in Peru demonstrates that ASFA's modest presence is unlikely to be affected by fluctuations in economic conditions of the country.

4.2 Google Analytics

As discussed in Chapter 3, Google Analytics is a program designed to give insights into how users are interacting with websites. ProQuest began using Google Analytics to track user interactions with its databases in mid-2016. As a result, there are incomplete data for that year, making a direct comparison of the number of sessions and document views between 2016 and 2017 difficult. Instead, the breakdown of event type, bounce back and exit rates, session duration, and document view conversion rate were compared. The session data were classified by total user behaviour, new visitors, and returning visitors. This arrangement allows developing a general picture of changes in user behaviour from 2016 and 2017, as well as determining whether noticeable differences are evident in how new and returning visitors interacted with ASFA tagged pages.

For this data, document view or docview refers to viewing of the extended bibliographic entry in ASFA. Docview conversion rate is the percentage of sessions that ended at docviews. Bounce rate means the percentage of users who left the database website without performing an action and exit rate refers to the number of people who left. The data collected came only from sessions with an ASFA tagged page and does not include any data from database bundles of which ASFA is a part. This data also does not include ASFA records that were retrieved through an integrated discovery service like Primo or Summon. Because Google Analytics uses cookies to track new users, the number of new

visitors may be over counted if these users cleared cookies from their computers or used virtual private network (VPN) services.

Table 5. Google Analytics Session Data 2016-2017.

	2016	**2017**
Total Docview Conversion Rate	53.9%	51.0%
Docview New Visitors	48.9%	57.0%
Docview Returning Visitors	56.4%	49.1%
Total Average Session Time (seconds)	844.2	964
Average Session Time New Visitors (seconds)	669.8	866.7
Average Session Time Returning Visitors (seconds)	931.4	997.6
Total Average Time Spent on Page (seconds)	92.1	96.5
Average Time Spent on Page New Visitors (seconds)	87.1	88.0
Average Time Spent on Page Returning Visitors (seconds)	94.0	99.3
Total Bounce Rate	13.0%	14.1%
Bounce Rate New Visitors	16.0%	17.2%
Bounce Rate Returning Visitors	11.4%	13.0%
Total Exit Rate	9.8%	9.0%
Exit Rate New Visitors	11.5%	9.2%
Exit Rate Returning Visitors	9.1%	9.0%

Overall, the total docview conversion rate fell from 2016 to 2017 (see Table 5). Between the two years, however, the docview conversion rate for new visitors rose while the rate for returning users dropped. During this time, the average session time in seconds rose by nearly two minutes. Unlike the docview conversion rate, this increase was consistent for both new and returning visitors (see Table 5). The average time spent on a page rose during this time as well, for both new and returning visitors. Notably, returning visitors spent more time on ASFA tagged pages than new visitors. Although it is difficult to tell

why that difference might be the case, returning visitors could be spending more time refining their searches. The bounce rate grew overall, for both new and returning visitors. The exit rate, on the other hand, showed an overall decrease. Both the bounce rates and the exit rates were lower for returning visitors than new visitors for both years, suggesting that more familiarity with ASFA influences how users interact with the database.

Table 6. Google Analytics Events Categories 2016-2017.

Event	2016	2017
Results	29%	35%
Basic Search	23%	17%
Advanced Search	17%	11%
Docview	15%	14%

Table 6 refers to the different ways that users interact with the ASFA database, referred to as "events categories." For both 2016 and 2017, the four largest events categories were results, basic search, advanced search, and docview. The other event categories in the Google Analytics data had much smaller shares and provided less insight into how users were interacting with the database. While the results category increased, the other three experienced declines (see Table 6). Both search events declined by 6% each, indicating that visitors were spending much less time interacting with the search pages themselves.

From 2016 to 2017, visitors spent more time on ASFA tagged web pages and having longer sessions. This change corresponds with the larger percentage of results events in 2017 compared to 2016. The percentage of visitors reaching an ASFA record, however, decreased during that year. In 2017 the percentage of advanced searches, basic searches, and docviews dropped compared to the previous year. The drop in docviews for returning visitors may be due to returning users being more familiar with the ProQuest interface and using the preview feature to find relevant records. Newer users may be unaware of that feature, leading them to go to the full record to determine whether a document is of interest. The drop in percentages for the searching events, combined with the rise in

results, might indicate users are spending less time constructing search strings or modifying their searches. Instead, they may be choosing to enter in a word or phrase and use the results page to filter what is returned or scrolling through the results page to find the materials they want. This behaviour, if correct, would reflect how users interact with a web-based search engine like Google or Google Scholar, which has more limited search capabilities than ASFA.

4.3 Survey Data

Out of the 220 survey invitations delivered, 55 individuals entered into the survey through the consent form. Answers from four participants were removed once the survey closed due to the fact that these respondents indicated at various points that their organizations did not subscribe to ASFA. The final dataset included 51 participants and a response rate of 23.2%.

4.3.1 Community Profiles, Information-Seeking Behaviour, and Challenges

Table 7. Types of Organizations for Survey Respondents (n=47).

Option	Total Responses	Relative Frequency by Choice	Relative Frequency
University/College/Institute of Higher Education	18	34.0%	38.3%
Research Centre	20	37.7%	42.6%
Government Office	10	18.9%	21.3%
Private Sector	1	1.9%	2.1%
Other	4	7.5%	8.5%
Sum	53	100%	112.8%

Respondents were asked to describe their institutions using the provided options or to write in a response if none of the options fit their organization. Five respondents selected multiple options, indicating that their organizations serve a variety of functions. Research centres and institutes of higher education were the most frequently selected, followed by government (see Table 7). The “other” responses included: international organization; non-profit research; museum; and navy. The high number of respondents who selected

"university/college/institute of higher education" was unsurprising, given the large number of academic subscribers to ASFA. Research centre was not defined or limited to a particular type of centre, which may explain why so many respondents selected that option.

When asked to describe their user communities, 19 respondents (41.3%) said only one of the categories provided described their user communities; nine (19.6%) selected two categories; 13 (28.2%) chose three categories; four (8.7%) selected four categories; and one respondent (2.2%) used all five categories (see Table 8).

Table 8. User Community Description for Survey Respondents (n=46).

Option	Total Responses	Relative Frequency by Choice	Relative Frequency
Students	22	22.7%	46.8%
Professors	20	20.6%	43.5%
Researchers (Non-Faculty)	34	35.1%	73.9%
Government Staff	16	16.5%	34.8%
Other	5	5.1%	10.9%
Sum	97	100%	209.9%

By far, the most common members of the respondents' user communities were non-faculty researchers, followed by students, and then professors. Of the "other" responses, three were either labelled "public" or "general public," and the remaining two listed "school children" and "professional and non-professional staff." The high number of respondents who identified non-faculty researchers as a primary part of their user community is not surprising, given the answers to the previous question. The second and third most selected options are interesting, however, given how much lower they are than non-faculty researchers. They were also slightly more frequently selected than the number of respondents who selected "institute of higher education." Finally, the fact that more respondents selected students than professors is worth noting, perhaps indicating that students access library services more frequently than faculty on a regular basis.

Table 9. User Community Size (n=45).

User Community Size	Responses	Percentage
0-100	10	22.2%
101-500	14	31.1%
501-1000	3	6.7%
1001-5000	7	15.6%
5001+	11	24.4%

User community sizes varied among respondents (see Table 9). The majority of respondents indicated that their communities were comprised of 500 or fewer people. This proportion could possibly align with the number of respondents who indicated that they work at research centres. The respondents might also only have counted the users who they directly interact with for aquatic sciences, fisheries management, or aquaculture related information requests.

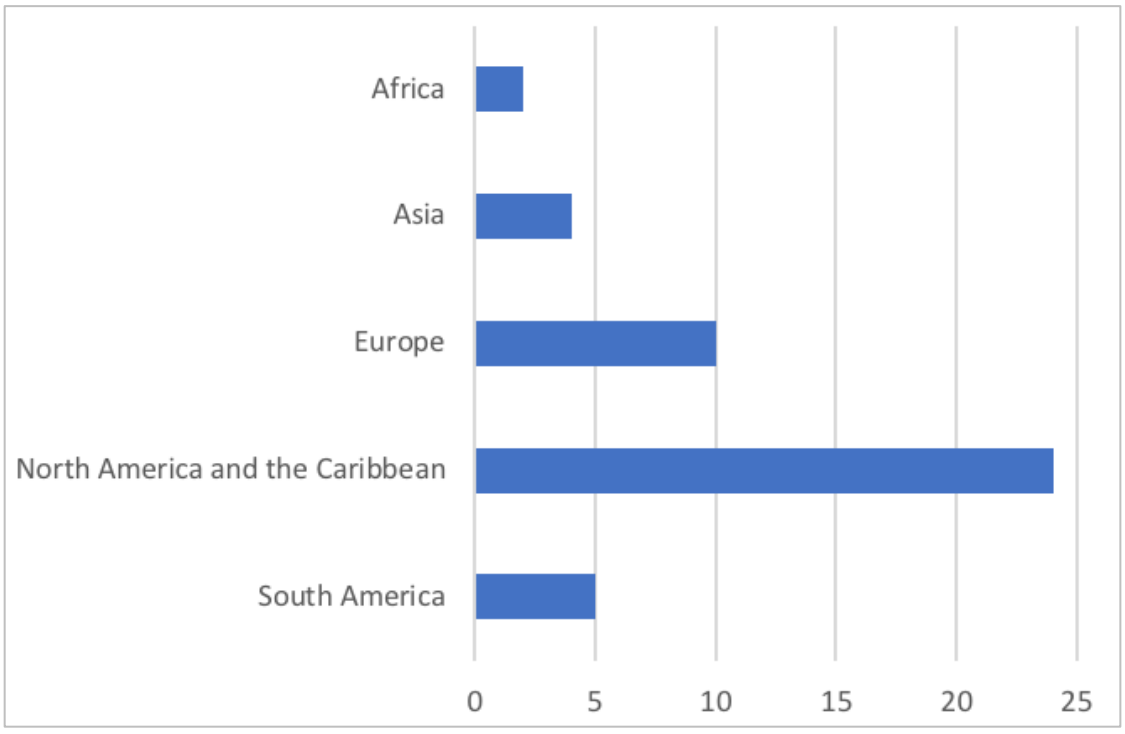

Figure 69. Regional Distribution of Survey Respondents (n=45).

When asked to identify their country of origin, 12 (26.7%) respondents said they were from the United States and 11 (24.4%) were from Canada. Of the remaining responses, Brazil, the United Kingdom, the Philippines, and Russia each had two responses (4.4%). Countries represented by one respondent were Argentina, Cayman Islands, Chile, Colombia, Croatia, France, India, Ireland, Latvia, Mauritania, Malaysia, Poland, Portugal, and Uganda. While a large number of respondents are located in North America and the Caribbean, that number does reflect the proportion of accounts in that region compared to others. The lack of respondents from either the Middle East or Australia and the Pacific is regrettable, but otherwise there is representation from a wide range of countries in the responses.

When asked if they worked in a library or information centre, 42 respondents indicated that they did, while two said they did not. Those who said that they worked in libraries or information centres then were asked their organization's approximate staff size (see Table 10). In addition, a vast majority of respondents reported that they worked for organizations that specialized in or studied aquatic sciences, fisheries management, or aquaculture (see Figure 70).

Table 10. Library or Information Centre Approximate Staff Size (n=41).

Staff Size	Responses	Percentage
1-10	27	65.8%
11-20	8	19.5%
21-30	2	4.9%
31+	4	9.8%

Nearly two thirds of respondents who answered this question worked in organizations with staff sizes of ten people or less. Fewer than 15% of respondents reported staff sizes over 20 people. The question did not ask respondents to differentiate between librarians, library technicians, or other staff members, so it is possible that the number of trained librarians serving these communities is lower. Overall, these answers, combined with the user community size, means a small number of librarians are tasked with serving a large number of users.

The high number of respondents who indicated that their organization specializes in or studies aquatic sciences, fisheries management, or aquaculture also appears to indicate that those who subscribe to ASFA do so because it is relevant to their organizations' needs. It is possible, however, that additional potential respondents from organizations that do not specialize in or study aquatic sciences, fisheries management, or aquaculture, self-selected out of the survey because they did not see their insights as valuable to this study or that it was no interest to them.

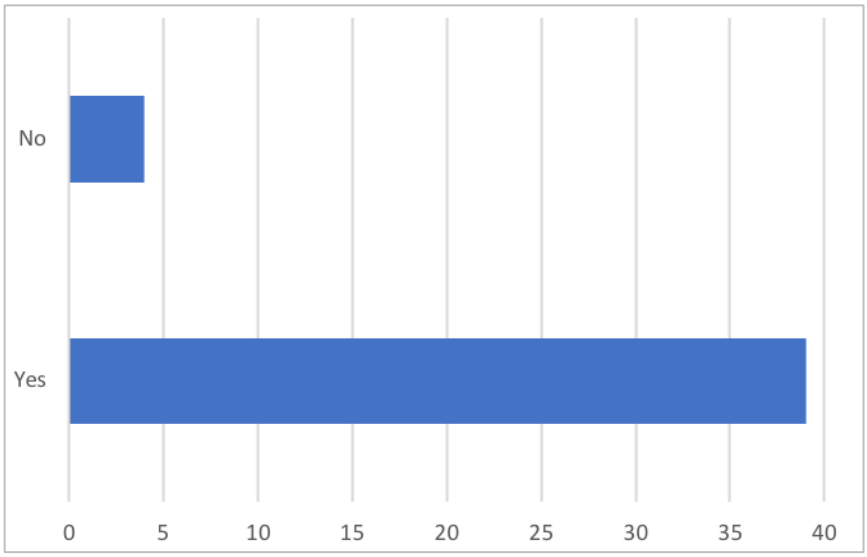

Figure 70. Organizational Focus in Aquatic Sciences, Fisheries Management, or Aquaculture (n=43).

4.3.2 Database Subscriptions and Evaluations

For most of the respondents, their organizations subscribed to between one and 50 bibliographic/abstracting & indexing (A&I) databases (see Table 11). The number of organizations subscribing to 50 or fewer databases could be explained several ways. Because database subscriptions can be expensive, as discussed in Chapter 2, organizations may choose to prioritize serials subscriptions over databases. Organizations may also have a limited subject scope and only choose to subscribe to databases that are directly relevant to their areas of focus.

Table 11. Number of Bibliographic/A&I Database Subscriptions (n=42).

Number of Database Subscriptions	Responses	Percentage
Zero	2	4.8%
1-50	26	61.9%
51-100	3	7.1%
101-200	1	2.4%
201+	7	16.7%
Unknown	3	7.1%

Database subscription lengths tended to skew towards year-to-year rather than multi-year (see Table 12). Year-to-year subscriptions give organizations the flexibility to reassess subscription choices, negotiate new deals, or cancel databases if needed. The number of respondents who said their organization subscribes to databases year-to-year roughly corresponds to the number of respondents who later said that their organization evaluates databases roughly every year (see Table 13). While the database evaluation process might take time, evaluating a database every year can also be beneficial for generating longitudinal data that can be consulted when making subscription choices. If a database consistently shows declining use, it may be worth cancelling, while a sudden drop might warrant investigation to determine what might be causing the change. In general, respondents indicated that their database evaluation cycles are strongly linked to the subscription length. Database evaluation could also be completed as needed or undertaken due to factors outside the institutions, like a substantial price increase (labelled as "other" in Table 13).

Table 12. Database Subscription Length (n=41).

Subscription Length	Responses	Percentage
Year-to-Year	25	61.0%
Multi-Year	4	9.8%

Both Year-to-Year and Multi-Year	4	9.7%
Other	6	14.6%
No Subscriptions	2	4.9%

Table 13. Database Evaluation Frequency (n=40).

Evaluation Frequency	**Responses**	**Percentage**
Every Year	23	57.5%
Every Few Years	6	15.0%
No Evaluation	2	5.0%
Other	8	20.0%
Not Involved	1	2.5%

The database evaluation processes and the factors respondents identified as being important were varied. According to the answers received, examination of usage statistics is the most common method of evaluating databases, followed by looking at total cost, and then cost per use (see Table 14). The importance of usage might be due to a library wanting to allocate funds to resources that are relevant or of interest to users, and if a database has low usage it could be a sign that the funds might be better spent elsewhere. Obtaining user input is also a part of the database evaluation process, either receiving feedback on the databases the organization is already subscribing to or asking for recommendations for new databases. With regard to database usage, a specialized database might have low use compared to a more general one but is considered to be essential in the field of study. User input can help identify those databases and help prevent a cancellation.

Table 14. Database Evaluation Process Factors (n=39).

Identified Factors in the Evaluation Process (number of respondents)
• Examination of user statistics (20) • Total cost and budget (11) • Cost per use (5) • Importance of topic to organization (5) • Database coverage (5) • User feedback (4) • Availability of alternate resources (4) • Faculty input or recommendations (3) • Database content (2) • Number of users (2) • No evaluation process (2) • Database used in instruction (1) • Number of connections (1) • Supports programs at organizations (1) • Community interest (1) • Input from librarians (1) • Data management plan requirements (1) • Seek expert advice from marine and coastal research community (1) • Government policies (1) • Database relevancy (1) • Unsure of process (1)

Respondents also commented about how the process itself plays out in their specific organization, with one person mentioning that the local campus makes decisions for specialized databases. While this point will be discussed more in the next section, it can be noted that this respondent might work on a campus that is part of a larger system (e.g. a statewide system in the United States), where individual campuses select databases relevant to the programs they support, while the central system negotiates contracts for more general databases like JSTOR or Academic Search Premier.

While cost and budget related factors were the second and third most mentioned in the database evaluation process, cost does play an important role in the decision-making process about database subscriptions (see Table 15). One respondent said that while cost was an important factor in subscription decisions, so were the research needs of users. Another respondent said that even though cost is an important factor, most of the

institution's databases are bundled which makes cancellation more difficult if the price increases. In general, several librarians expressed concern about price increases and how that affects their libraries' limited budgets.

Table 15. The Importance of Cost on Database Subscription Decisions (n=39).

The Role Cost Plays (Number of Responses)

• Cost is a factor (36)
  ○ Significant, large, major, or big factor (27)
  ○ Weighted at 50% or more in decision-making process (4)
  ○ Cost a factor in general (3)
  ○ Cost per use the major factor (1)
  ○ Cost somewhat of a factor (1)
• Organization receives databases for free (1)
• Difficult to answer (1)
• None (1)

Given that financing is a limited resource and cost is a factor in decision-making for nearly all respondents, incorporating usage and user feedback in evaluating databases helps to add informative data layers to the evaluation process. A database might be expensive but if users deem it to be essential to their field or it has substantial use, a library might be able to justify its continued subscription.

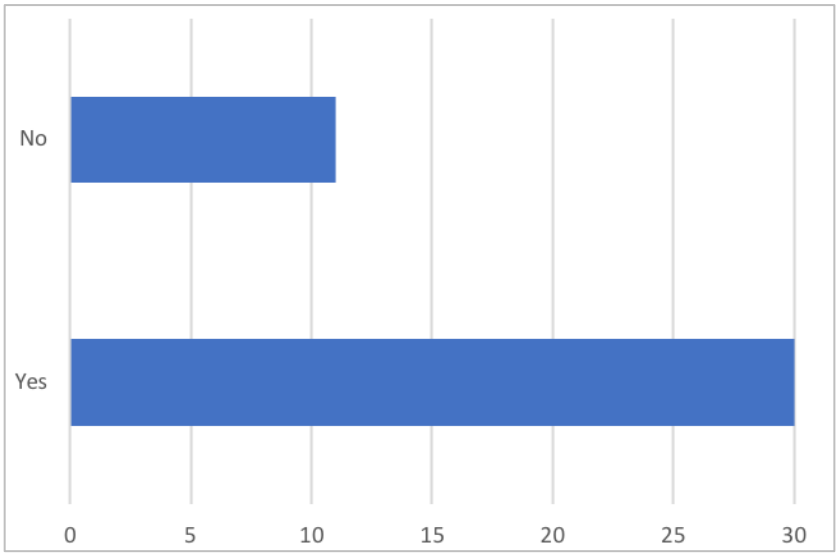

Figure 71. Number of Organizations that Track Database Usage (n=41).

Reflecting the number of respondents who said that reviewing usage statistics is an important part of the evaluation process, many respondents said that their organization tracks database usage (see Figure 71). Most of the data collected is provided by vendors, while some respondents indicated that they use specialized software to track usage or utilize other methods (see Table 16). Several respondents indicated that their organizations use multiple methods to track usage.

Table 16. Database Usage Tracking Methods (n=25).

Usage Tracking Method (Number of Responses)
• Vendor-supplied statistics (12) • COUNTER (software program) (4) • Google Analytics (2) • Usage reports from database (2) • Administrative site (1) • Manual collection (1) • SUSHI statistics (1) • Online software (1) • Integrated statistics tool (1) • Handled centrally (1) • Main campus tracks (1)

The data collected is then used for several purposes (see Table 17). The primary purpose of the data appears to be tracking how many users access the database, along with being used to determine whether a database should be cancelled or renewed during the evaluation process. In general, according to the respondents, usage data play an important role in various forms of decision-making. Usage data and cost appear to be intertwined, with the cost of a database compared to how often the database is being used or how important users deem it to their field of research. The responses collected here give the impression that respondents are currently balancing the needs of their users in terms of managing subscriptions, while also being aware of budgets and how much leeway there is before difficult discussions need to be made about cancelling resources.

Table 17. Collected Usage Data Purpose (n=24).

Purpose (Number of Responses)
• Tracking usage (7) • Renewal/cancellation decisions (7) • Calculate cost per use (3) • General decision-making (3) • Outreach/spending decisions (2) • Subscription decisions (2) • Evaluation (1) • Monitoring (1) • Reporting (1) • Identifying priority databases (1)

4.3.3 ASFA Related Questions

After discussing databases and the database evaluation process more generally, the focus of the survey switched to questions about ASFA. Because ProQuest bundles ASFA in several different packages as well as offering it individually, respondents were asked not only how they subscribe to ASFA (see Figure 72) but also to which of the packages their organizations subscribed (see Table 18). There appeared to be come confusion about how the organization subscribed to ASFA, with multiple respondents selecting one of the packages but saying they subscribed to ASFA individually. Six respondents also, in answering the question about which packages they subscribed to, selected "other" and wrote in ASFA. Respondents may also not fully know what databases their organization subscribes to, as one respondent wrote that the institution simply receives access to databases from a central authority, rather than choosing their own subscriptions. Other responses listed under "other" included Major Dailies, Oceanic Abstracts, ProQuest Central, the Agricultural and Environmental Science Database, and ProQuest Dissertations and Theses Global.

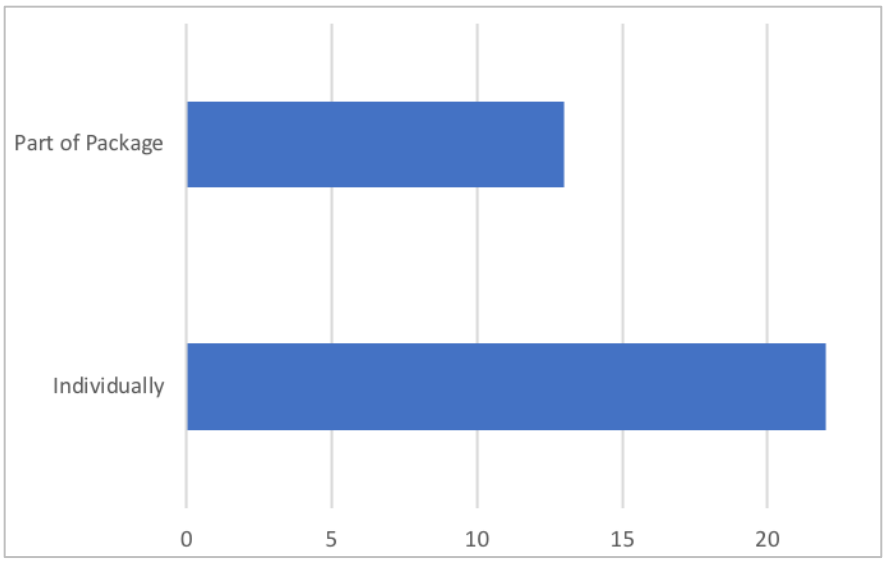

Figure 72. Method of ASFA Subscription (n=35).

Table 18. Subscriptions to ProQuest Bundles Containing ASFA (n=37).

Subscription Option	Total Responses	Relative Frequency by Choice	Relative Frequency
Earth, Atmospheric and Aquatic Science Database	15	30.6%	40.5%
Natural Science Collection	7	14.3%	18.9%
SciTech Premium	5	10.2%	13.5%
None	8	16.3%	21.6%
Other	14	28.6%	37.8%
Sum	49	100%	132.3%

Because of the confusion mentioned in the previous paragraph, it is difficult to draw definitive conclusions from the data. The responses suggest, however, that database bundles might comprise a sizeable share of ASFA subscriptions. While data to corroborate this theory was not included in this study, the distribution among bundles and single subscriptions might explain the increases in low-use subscriptions noted in Section 4.1. The data also may not fully capture the range of subscribers, as discussed earlier, because potential respondents who might not be familiar with ASFA or subscribe via a bundle may not have opted to take the survey. Given that all respondents said that they were at least somewhat familiar with the ASFA database and that their organizations

either conducts research or offers programs in marine sciences, fisheries management, and/or aquaculture (see Tables 19 and 20), this very well might be the case. Despite being an option in the survey, no participant selected the reason that their organization subscribed to ASFA was because it was included in a bundle. Three respondents who selected "other" indicated their organizations were members of the ASFA Partnership.

Table 19. Level of Familiarity with the ASFA Database (n=39).

Level of Familiarity	Responses	Rate
Very Familiar	26	66.7%
Familiar	7	17.9%
Somewhat Familiar	6	15.4%

Table 20. Reasons for Subscribing to ASFA (n=37).

Reason	Responses	Rate
Research Focuses on Marine Science, Fisheries Management, and/or Aquaculture	21	56.8%
Offers a Program on Marine Science, Fisheries Management, and/or Aquaculture	9	24.3%
Other	7	18.9%

In addition to ASFA, respondents also listed other databases focused on aquatic science, fisheries management, and/or aquaculture their organizations subscribe to (see Table 21). This list included more general databases like Web of Science, but also more specialized databases that have a similar focus to ASFA, namely Oceanic Abstracts (sold by ProQuest) and Fish, Fisheries, and Aquatic Biodiversity Worldwide (FFABW) (sold by EBSCO). Oceanic Abstracts, which is one of the databases bundled with ASFA by ProQuest, solely focuses on ocean and marine related topics, unlike ASFA which also includes freshwater topics. One of the respondents who selected other in Table 20 wrote that their organization chose to subscribe to ASFA because it does include materials concerning freshwater. While the product page for FFABW does not specifically mention whether it includes freshwater topics, it has existed since the 1970s like ASFA and states

that it collects information from around the world (EBSCO, 2018). Based on that description, FFABW appears to be the direct competitor to the ASFA database. Institutions may choose to subscribe to either ASFA or FFABW, but, as seen in the responses listed in Table 20, rarely both. If an organization has a limited budget for database subscriptions, purchasing licenses for two databases with very similar coverage could be considered unnecessary and costly duplication.

Table 21. Aquatic Science, Fisheries Management, and/or Aquaculture Database Subscriptions (n=34).

Database (Number of Responses)
• ASFA (25) • Web of Science (3) • Oceanic Abstracts (3) • Earth, Atmospheric and Aquatic Sciences (3) • Fish, Fisheries, and Aquatic Biodiversity Worldwide (3) • Zoological Records (2) • Biosis (2) • Agricola (2) • Agris (1) • Agricultural and Environmental Science (1) • Arctic Science and Technology Information System (1) • FAOLEZ (1) • Invasive Species Compendium (1) • Ocean Docs (1) • OARE (1) • FishBase (1) • Management of the Northern Cod Fishery (1) • National Citation Index (1) • SeaGrant Publications (1) One person wrote “none” and another person listed Google Scholar when answering this question.

That assumption does not mean that organizations never subscribe to different databases with similar features or resources. Nearly two-thirds of respondents to the survey indicated that they use databases and information sources with similar features and resources as ASFA (see Figure 73).

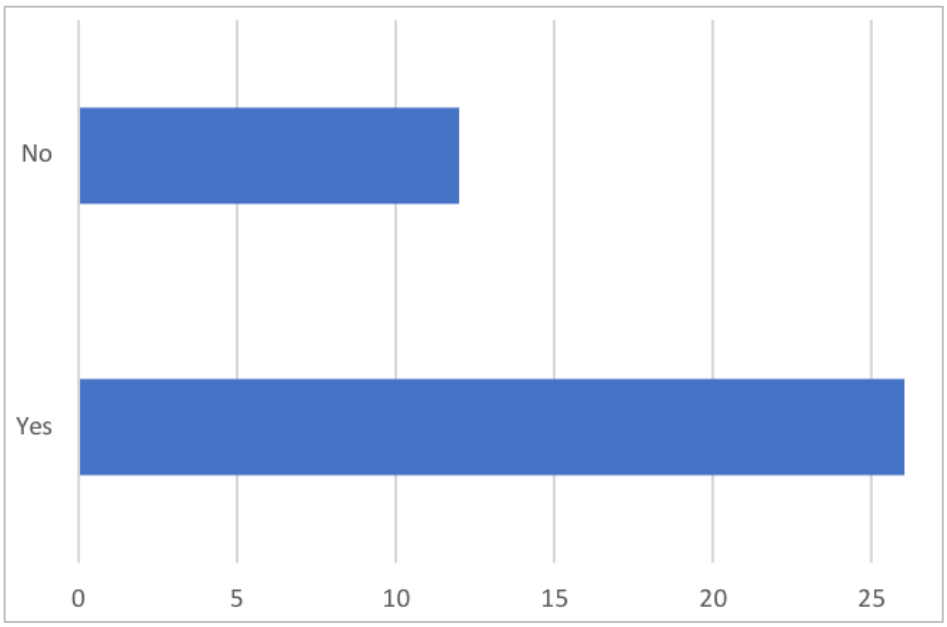

Figure 73. Institutions Use Databases or Information Sources with Similar Features or Resources as ASFA (n=38).

The most commonly used database listed by respondents who said they use sources with similar features or resources as ASFA was Web of Science (see Table 22). Because Web of Science is a general database, however, that does not specialize in the same area as ASFA, it lends credence to the idea that organizations might only choose to subscribe to one highly specialized database in a particular topic. Only one respondent listed FFABW as a resource used, and nobody listed Oceanic Abstracts. Ocean Docs and Aquatic Commons, which are online repositories, were listed more frequently than specialized databases. If an organization has limited resources, then choosing to subscribe to both a general science database that could serve a wide range of users and one more specialized database would be the best use of resources. This scenario would also explain why so many respondents listed open access sources and general databases over more specialized ones (see Table 22).

Table 22. Databases or Information Sources Used with Similar Features or Resources as ASFA (n=23).

Database or Information Sources (Number of Responses)
• Web of Science (9) • Ocean Docs (4) • Aquatic Commons (3) • Zoological Record (3) • Agricola (2) • Scopus (2) • Fish, Fisheries, and Aquatic Biodiversity Worldwide (1) • Academic Search Complete (1) • Waters and Oceans Worldwide (1) • Arctic and Antarctic Regions Database (1) • IAMSLIC Joint Catalog (1) • National Citation Index (1) • JSTOR (1) • Google Scholar (1) • Agris (1) • Agricultural and Environmental Science (1) • Arctic Science and Technology Information System (1) • FAOLEX (1) • CAB (1) • Biological Sciences (1) • Wildlife and Ecology Studies Worldwide (1) One user listed general science databases with no further details. Other users listed journal publishers and the discovery systems they use, like Science Direct.

For the respondents who indicated that they did not use other sources or databases with similar functions or resources as ASFA, budget was the most frequently selected reason (see Table 23). While some respondents indicated that a lack of demand from users and ASFA was sufficient for their needs, the limited room in the organizational budget was chosen by a majority of respondents to this question. If an organization is highly specialized in aquatic sciences, fisheries management, or aquaculture, then it may only have the financing to subscribe to one specialized database to satisfy user needs.

Table 23. Reasons for Only Using or Subscribing to ASFA (n=12).

Reasons	Responses	Relative Frequency by Choice	Relative Frequency
Budget Constraints	7	43.7%	58.3%
ASFA is Enough	4	25.0%	33.3%
No Other Demand from Users	2	12.5%	16.7%
Similar Databases Are Not Included in Packages	1	6.3%	8.3%
Other	2	12.5%	16.7%
Sum	16	100%	133.3%

In general, the respondents indicated their organizations had subscribed to ASFA for over a decade (see Table 24). This period, combined with the low number of new subscribers, could also explain why all respondents were at least somewhat familiar with ASFA (see Table 19).

Table 24. Number of Years Subscribed to ASFA (n=36).

Years Subscribed	Responses	Rate
1-5 Years	2	5.6%
6-10 Years	4	11.1%
11 + Years	25	69.4%
Unknown	5	13.9%

A slight majority of respondents to the survey indicated that their organization participated in the ASFA Partnership (see Figure 74).

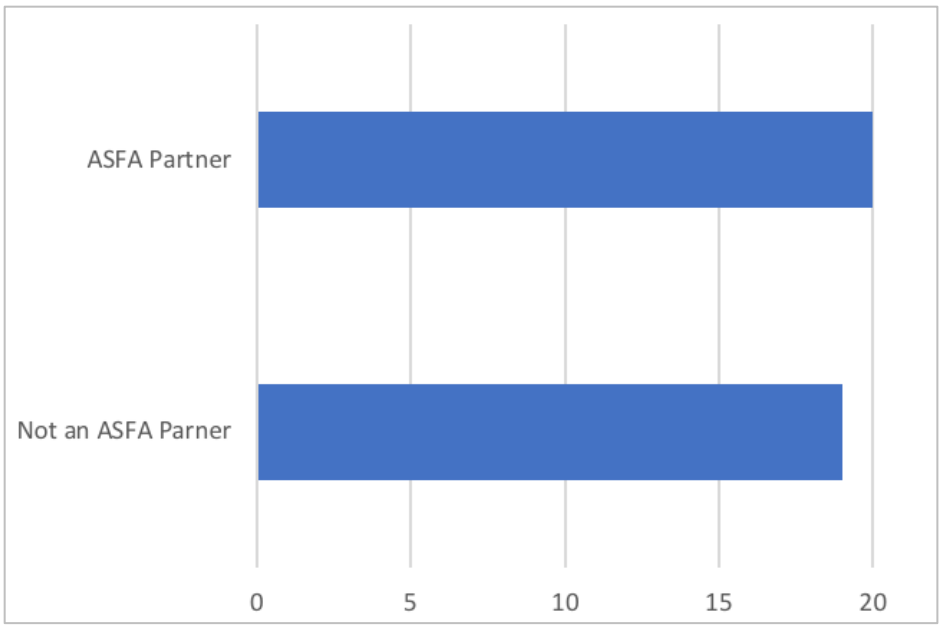

Figure 74. Participation in the ASFA Partnership (n=39).

The respondents who said they were not members of the ASFA Partnership gave a variety of explanations (see Table 25). More than half said they were unsure or not familiar with the Partnership. One person in this group did say that their organization deposits materials into Ocean Docs, which is one of the larger online repositories for marine-related grey literature.

Table 25. Reasons for Not Participating in the ASFA Partnership (n=14).

Reason (Number of Responses)
• Unsure or unfamiliar with ASFA Partnership (9) • Size of organization influenced decision (2) • Affiliation is a work in progress (1) • Country already has a national ASFA Partner (1) • Main campus handles these types of decisions (1)

How information-seeking behaviour may or may not have changed over time could explain some of the usage patterns discussed in Sections 4.1 and 4.2. According to a majority of respondents, the information-seeking behaviour of their users has changed in the last five years (see Figure 75).

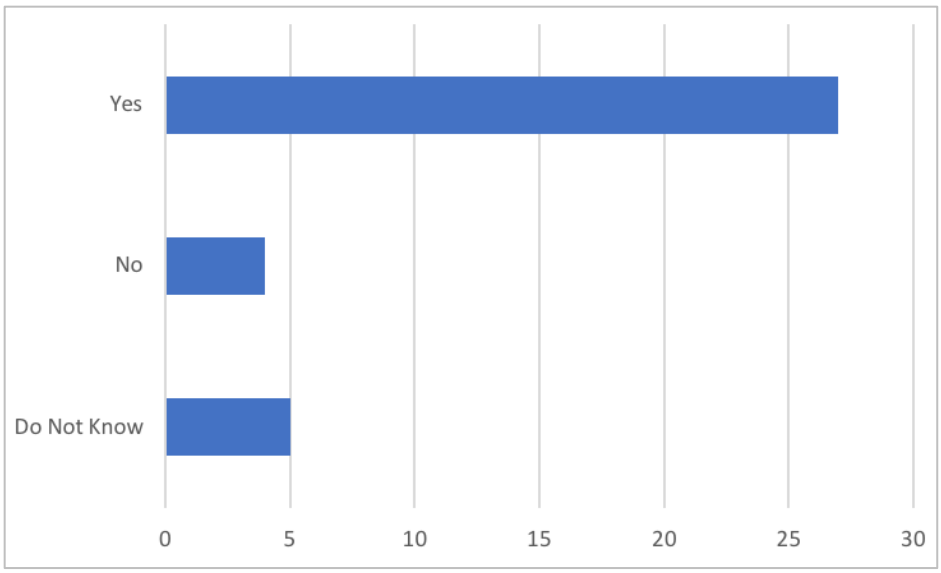

Figure 75. Change in Information-Seeking Behaviour in the Last Five Years (n=36).

When asked to provide more detail about how information-seeking behaviour had changed, the use of Google and Google Scholar over traditional databases was the most frequently mentioned explanation (see Table 26). While the respondents did not offer specifics about how Google Scholar and Google have changed how users search for information, the change does align with the previous research discussed in Chapter 2 detailing the impact of Google Scholar. Although other discovery methods were mentioned when discussing changes in information-seeking behaviours, none appeared to have the same impact as Google and Google Scholar. User reliance on Google and Google Scholar might also explain the other changes noted by the respondents, namely users being less reliant on librarians to help search for information and being more reluctant to ask for help finding information.

Table 26. Changes in Information-Seeking Behaviour in the Last Five Years.

Changes in Information-Seeking Behaviour (Number of Responses)

• Increased use of Google and Google Scholar over traditional A&I databases (17)
• Increased use of other discovery methods (8)
  o ResearchGate (4)
  o Social media (2)
  o EBSCO discovery layer (1)
  o Ability to access more information online through increased open access publishing and new technologies (1)
• Less reliance on library/librarian when starting research process (4)
• More reluctance to ask for help (1)
• Preference for electronic resources over physical resources (1)
• More full-text options available to users (1)

Of those who said that information-seeking behaviour had not changed, one stated that while their community relied on Google Scholar, this trend extended far longer than five years. A second said that users ask the library staff for information, and a third said that ASFA is still relevant even though users depend on other online sites for information.

The comment listed in Table 26 about increased open access publishing leading to greater access to information was reflected in the number of respondents who said that open access information was changing expectations of their user communities (see Figure 76).

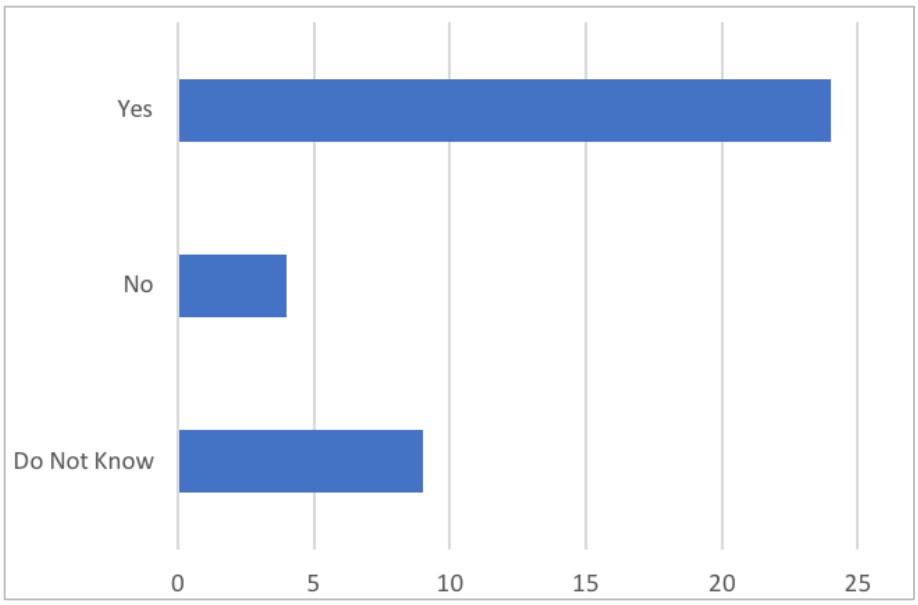

Figure 76. Increased Availability of Open Access Information Changed User Expectations (n=37).

According to respondents who said that the growth in open access information was changing user expectations, there is now a dual expectation of free information and faster access (see Table 27). Patrons also, according to the respondents, want fuller access to information when they search and might believe an error has occurred if they encounter a paywall. This outcome might further influence information-seeking behaviour, if the users are using Google Scholar to search for information. They may choose not to access sources of information that require payment or will only use discovery methods that guarantee a full-text result.

Table 27. User Expectations Change with Regard to Open Access Information.

User Expectations (Number of Responses)
• Free information (6) • Faster access to information (6) • Full-text access (2) • Total access to information without paywall (1) • Open access to electronic copies of theses (1) One respondent commented that a benefit of open access information is making science more visible, while another noted open access increases access and the potential for citations. A third respondent said there is an overreliance on open access compared to traditional sources.

Of those who said the increased availability of open access information was not changing user expectations, one respondent mentioned that the user community still needs items held behind paywalls, which can be obtained through inter-library loan. The respondent then added that users do not understand open access. Another respondent wrote that users have difficulty differentiating sources and choose to publish in journals based on impact factor. A third expressed uncertainty about whether students are aware of open access. For those who selected "do not know," one respondent wrote that open access may have changed user expectations, but users had not been surveyed to determine how and to what extent. A second said that researchers at their organization publish frequently and have discussed page charges for open access publishing.

Given the changes in information-seeking behaviour and the possible impact that open access information has on user expectations, determining how a traditional A&I database like ASFA meets user information requests is important. The respondents were divided in their views: either they believed that it did meet the information requests (18 out of 37) or they were unsure (14 out of 37) (see Figure 77). A small number (five responents) said that ASFA did not satisfy the information requests of users.

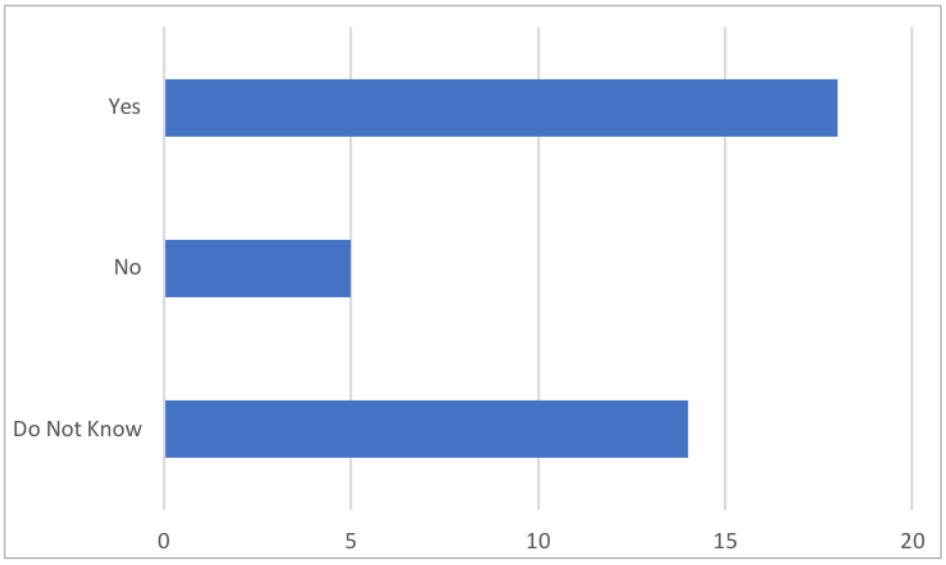

Figure 77. Does ASFA Meet the Information Requests of Your User Community? (n=37).

Many of the features that allows ASFA to respond to the information requests of respondents' user communities are due to its highly specialized characteristics (see Table 28). For researchers, faculty, and other users who want information on aquatic sciences, fisheries management, and/or aquaculture, access to a database specifically designed to meet their needs can be incredibly beneficial. For users who have experience in the field, familiarity with the database was also an asset. The grey literature coverage and the high proportion of publications from developing countries are unique to ASFA, however, as a result of its mission and how information is collected from partners. One respondent did say that while ASFA generally met user requests, there is room for improvement for the database.

Table 28. How ASFA Meets Requests of User Communities.

ASFA Features (Number of Responses)
• Content, coverage, and scope of database (8) • Citation coverage (1) • Familiarity of database (1) • Metadata (1) • Scale of grey literature coverage (1) • High share of documents from developing countries (1) One respondent noted that while ASFA generally fulfills requests, there are gaps and hopes that new initiatives are launched to address them.

For those who said that ASFA in its current form does not meet the requests of their user communities, the most common complaint was the lack of full-text access within the database itself (three respondents). While ASFA does offer some full-text access to the grey literature, access is not consistent. ASFA also does not offer full-text access to journal articles, which may be what users expect based on previous experiences with web-based search engines like Google and Google Scholar (recognizing that neither Google or Google Scholar provide direct access to publications behind a paywall). One respondent stated that ASFA only has partial relevance for users because the organization focuses on the polar regions. Another respondent said that while ASFA meets some requests, users focused on inter-disciplinary projects need a wider-ranging database and the expense cannot be justified by the organization.

Respondents who selected “do not know” provided a variety of reasons. Two said that while their users are accessing ASFA, they do not know if it is meeting all their requirements or whether the database is critical for the research being pursued. Related to research activities, one respondent who selected “don’t know” stated that very little aquatic research is actually conducted at their organization. Finally, one respondent said that ASFA is not used. Of note, one respondent, who did not know what resources their community consulted, mentioned that the Summon discovery layer has been implemented, which could take the place of more specialized searching.

While only one respondent specifically mentioned grey literature as a feature of ASFA to fulfill user requests, over two-thirds of respondents said the inclusion of grey literature is helpful (see Figure 78) and the responses to the survey suggest that none of the respondents found the feature to be unhelpful.

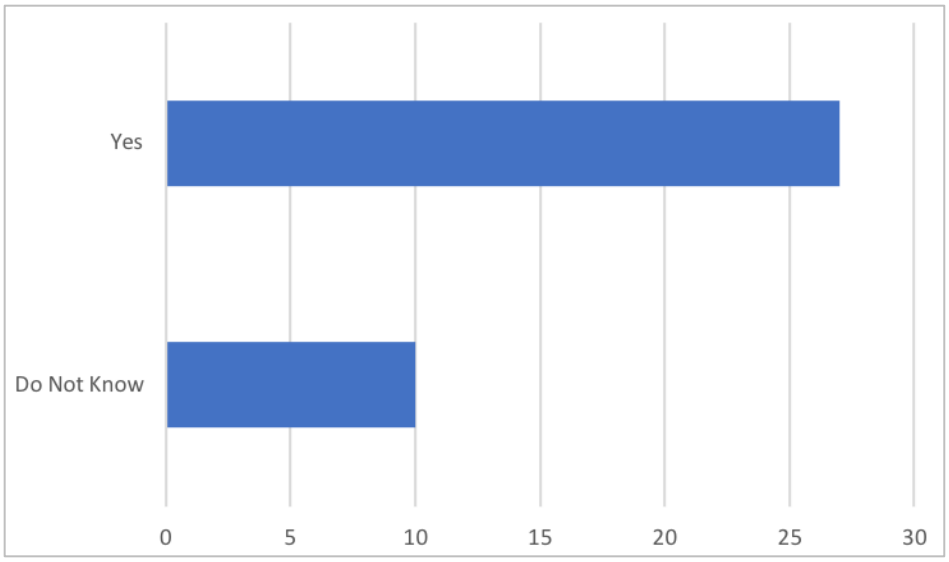

Figure 78. Inclusion of Grey Literature in ASFA as a Helpful Feature (n=37).

The most common advantage about the inclusion of grey literature provided was access to information not findable elsewhere (see Table 29). In general, many of the responses noted the unique information found in grey literature and ASFA made locating it easier. While grey literature can be found in some online repositories like Aquatic Commons or Ocean Docs, inclusion of grey literature in search results in ASFA helps to increase awareness and use of that information. The comment about grey literature potentially

incentivizing further research relevant to developing countries shows how ASFA can be a benefit to people searching for information as well as the producers of the literature. By increasing access, the number of people citing technical reports or other forms of grey literature can grow and show the value of the research reported in these publications.

Table 29. Benefits of Grey Literature Inclusion in ASFA.

Benefits (Number of Responses)
• Provides access to information not found elsewhere (12) • Allows discovery of grey literature not found in other databases or search engines (4) • Widens reach of grey literature from developing countries and incentivizes further research (1) • Collects grey literature otherwise only found in Aquatic Commons (1) Two respondents commented that the grey literature is not always accessible, and one asked for more full-text inclusion or linking within ASFA.

The most common suggestion about how to improve ASFA is to increase full-text access (see Table 30 and also a comment noted in Table 29). As mentioned above, ASFA does include full-text for some of the grey literature but such access is not consistently offered for all materials. The respondents may not be aware about full text access via ASFA, however, and perhaps this feature could be included in promotion of the database among librarians and other users. The suggestion to expand the ASFA Partnership could achieve several other recommendations, namely expanding the grey literature selection and increasing the number of journals being monitored. Because the ASFA Partnership relies on its members to collect materials, create the metadata, and submit records to add to the database, enlarging the Partnership would be the primary way to expand ASFA's coverage. One of the respondents who suggested expanding the grey literature coverage specified more state level items. If the ASFA Partnership included organizations on a more localized level coverage could be increased and further distinguish ASFA from similar databases.

Table 30. Recommended Enhancements to the ASFA Database (n=27).

Ways to Enhance ASFA (Number of Responses)
• Link or include full-text (8) • Expand grey literature selection (3) • Update the search page (2) • Link to published data (1) • Include serial title and number on brief ASFA record (1) • Fill in database records (1) • Increase number of journals monitored (1) • Expand the ASFA Partnership (1) • Incorporate more bibliometric tools (1) • Index items relating to policy development like Sustainable Development Goals (1) • Consolidate ASFA into one database for subscription purposes (1) • Enhance the transfer to discovery layers like Summon (1) Five respondents were unsure or had no suggestions at the time of completing the survey.

While one respondent indicated that the ASFA Partnership should restructure the subscription model, the respondents were mostly satisfied with it (see Table 31). Two who noted that the current model does not meet community needs said that cost is a factor.

Table 31. Current Subscription Model Meets User Community Needs (n=35).

Response	**Number of Responses**	**Rate**
Yes	27	77.1%
Believe So	2	5.7%
No	4	11.4%
Do Not Know	1	2.9%
Receive ASFA for Free	1	2.9%

When asked what the implications would be if ASFA were no longer available, the majority of respondents said that some form of negative impact would affect their organization or user communities (see Table 32). The most common impacts included reliance on other discovery sources that lack the same level of coverage, as well as an overall loss of access to information. Effects on organizational budgets were also mentioned, with one respondent saying that most commercial databases are too expensive

for their organization, and another saying that if an in-house version of the database were built, it would not fully replicate ASFA. ASFA's closure would also impact research, both at the organizations where the respondents work and potentially also in developing countries. As mentioned earlier, one of the perceived benefits of ASFA is that it can incentivize continued research through dissemination of grey literature and increase the likelihood of publications being discovered by researchers around the world. Closing ASFA could limit that discoverability and negatively impact research.

Table 32. Implications if ASFA Is No Longer Available (n=32).

Potential Outcome (Number of Responses)
• Forced to rely on other sources of information that lack same level of coverage (7) • Loss of information held within the database (7) • Loss of access to grey literature from around the world (6) • Negative impact on research conducted at organization (3) • Users would be upset (2) • Difficulty in finding other source of information due to budget restrictions (1) • ASFA's closure would be a general loss (1) • Organization would have to build in-house database that would lack range and functionality of ASFA (1) Two respondents said they were unsure what the implications would be for their organization. A third believed users would not notice, and a fourth said ASFA's potential closure would not have a large impact.

When asked for any additional remarks about the database, respondents indicated that ASFA is a useful resource, but it needed to adapt to remain relevant (see Table 33). Some respondents provided suggestions for improving the database, such as updating the thesaurus. Overall, respondents who commented reiterated their views that ASFA is a valuable resource that should continue in some form.

Table 33. Additional Remarks on ASFA (n=25).

Remark (Number of Responses)
• ASFA is a useful resource for finding information (2) • ASFA needs to remain relevant to the competition (1) • More full-text access is needed (1) • Make ASFA more widely available (1) • Help information professionals quantify benefits to justify cost (1) • ASFA should continue because users rely on it (1) • ASFA is a valuable resource for users who might not have access to other databases (1) • ASFA needs to remain accessible and affordable (1) • ASFA should expand abstracts and update the thesaurus (1) • ASFA has database overlap in terms of coverage (1) Twelve respondents indicated in this section that they had no additional remarks at this time.

The data gathered in this survey shows a diversity of subscribers who view ASFA as a valuable resource for themselves and their user communities. While there is room for improvement, the respondents indicated that ASFA helps to collect and disseminate information to those who need it, and that inclusion of grey literature is widely appreciated. As noted in the preceding section, however, there is a possibility that the respondents to the survey do not represent the full spectrum of ASFA subscribers, given the relatively low number of participants whose institutions recently opened subscriptions. Nonetheless, the responses do provide informative insights about how subscribers view the database and initiatives that could be pursued to keep it continuously relevant.

4.4 Interview Data

While the survey discussed in the previous section focused on current ASFA subscribers and was designed to determine their views about the database, the interviews conducted in this research project focused more generally on the perspectives of marine science librarians. As well as interviews with librarians familiar with ASFA, the interviews included librarians whose organizations do not subscribe to ASFA to gain an understanding of why that might be the case and learn about the discovery sources they

are using. The interviews provided an opportunity for all participants to provide perspectives on database selection, user communities and habits, and how information-seeking behaviour might be changing. In total, 18 librarians were interviewed for this study (see Table 34 for descriptions of participants).

Table 34. Interview Participant List (n=18).

Code	Description
Interviewee A	Academic librarian based in North America
Interviewee B	Governmental librarian based in North America
Interviewee C	Academic librarian based in North America, university linked to separate marine research institute
Interviewee D	Governmental librarian based in Asia
Interviewee E	Academic librarian based in North America
Interviewee F	Governmental librarian based in North America
Interviewee G	Academic librarian based in North America, university linked to separate marine research institute
Interviewee H	Governmental librarian based in Asia
Interviewee I	Academic librarian based in North America
Interviewee J	Academic librarian based in South America
Interviewee K	Academic librarian based in Africa
Interviewee L	Governmental librarian based in Africa
Interviewee M	Governmental librarian based in Australia and the Pacific
Interviewee N	Governmental librarian based in Europe
Interviewee O	Academic librarian based in Europe
Interviewee P	Non-governmental organization (NGO) librarian based in Europe
Interviewee Q	Governmental librarian based in South America
Interviewee R	Governmental librarian based in Australia and the Pacific

4.4.1 Community Profiles, Information-Seeking Behaviour, and Challenges

Who interviewees identified as their primary users is related to the organizations where they worked. Among the government affiliated librarians, eight listed researchers and scientists as their main users, with some itemizing their specialities: biologists, fisheries and aquaculture scientists, and veterinarians (42.1%). Three interviewees mentioned staff members more generally as another main user group, and two said that policy makers or

managers also comprise part of their user base (16.7% and 11.1% respectively). Members of the public, students, and the fishing community were all included once by different librarians. All of the academic librarians listed students among their primary users (42.1%). Only seven who worked in academic libraries, however, included faculty as part of their main user communities, perhaps indicating that faculty access library services less frequently than students (38.9%). Staff and researchers were also listed separately three times each (16.7%). Interviewee E's campus shares space with national and state agencies, and the governmental staff members also access the university's library. Interviewee K said that the families of staff members are included in the university's user community. Interviewee P, the sole librarian based at an NGO, said that members of the marine research community, the educational field, and the general public made up the user population.

In addition to identifying their user bases, four librarians—three governmental and one academic—also listed outside users who access their libraries' services (22.2%). All of the librarians identified the general public and outside researchers as a segment of this external user base. Two of the governmental librarians, Interviewees H and R, also said students access their collections, and the academic librarian, Interviewee A, noted that students from other universities as well as local high schools use the university's library for research projects. Interviewee A also said that calls are received from provincial librarians regarding resources in the university collection. Only this librarian—other than Interviewee E, whose campus houses the federal and state agencies—mentioned governmental departments accessing the campus services. This arrangement is similar to a governmental librarian at a small branch who accesses a nearby university's catalogue to locate resources or search for information. University libraries typically provide access to a wider range of resources in contrast to specialized governmental libraries. In addition, staff of local governments, like the state-level employees Interviewee E mentioned, simply may not have a library they can use for research purposes.

For all of the librarians, the type of institution where they worked heavily influenced how they defined their core user communities. The absence of policy or decision makers in the user population of governmental librarians is worth noting, possibly indicating different

pathways than libraries for how policy and decision makers obtain information. Interestingly, only one academic librarian specifically mentioned outside users, why they might come to the university library, and described how they interact with the library's marine science collection. Possibly, Interviewee A was the only librarian in this study who was contacted by external users on a frequent enough basis to merit mentioning.

Finding materials for users, either in the library or locating an electronic version, was the most frequently mentioned information request the interviewees received, with eight librarians listing this activity (44.4%). One of the government librarians, Interviewee B, said that many requests users present related to locating documents published by the agency for which they all work. Interviewee I was more specific, saying that a majority of requests are to find miscellaneous pieces of grey literature that have been cited but the researchers are unable to locate. Interviewee I added that responding to these inquiries is time intensive. Interviewee A said that graduate students and honours students often ask for help finding information after they have completed an initial search and then feel they need additional help locating materials for a project.

Reference searches and interlibrary loans (ILL)/document delivery were the second most frequently listed information requests, with six librarians mentioning both respectively (33.3%). Four librarians included questions about articles or books as some of their more frequent information requests (22.2%). Two government librarians stated that they receive data requests, with Interviewee D mentioning that policy makers want data related to marine economic activities. Interviewee L spoke about inquiries for fisheries and aquaculture data, as well as socioeconomic factors surrounding the fisheries.

Other information requests listed by the librarians included questions about publishing, h-index scores, bibliometrics, publication loans, acquiring materials, instructional sessions, issues with copyright, and processing publications edited by their organization.

Five librarians, two governmental and three academic, also provided details about common requests from faculty and researchers and their information-seeking habits (27.8%). In Interviewee F's experience, researchers tended to know what publications

they want when making requests. Interviewee D, a governmental librarian based in Asia, said that local researchers typically seek access to papers in national and international journals, while researchers outside the country were more interested in the local marine research output. Among the academic librarians, both of the librarians who also work with marine research institutes described the types of requests they receive. Interviewee C said that the requests varied from marine science to climate change to ecology. Interviewee G stated that researchers are mostly interested in new tools for citation management and data management. The third academic librarian, Interviewee I, said that faculty tend to seek assistance only when the databases or websites change but not when they are searching for information.

Five librarians—one governmental and four academic—also described the type of requests they receive from students (27.8%). Interviewee D said that students request books and journals from their country in the local language. Interviewee I, an academic librarian, mentioned the differences in requests from undergraduate versus graduate students. Undergraduates typically search for information to support their work in labs, while graduate students usually have received some research training already and seek assistance on data management, grant writing, and more advanced research training. Interviewee C rarely dealt with the general student population, and only interacted with that group on referral about subject-specific questions. Two other academic librarians said that students ask for help identifying information, as well as building more complex search strategies.

The differences between researcher and faculty requests compared to students' questions are interesting. The student requests tend to be general inquiries, aligned with finding information or receiving training on how to find and manage information. Researchers and faculty, on the other hand, are more varied in their requests, and less focused on searching for information alone. They ask more specific questions compared to the broader topics students need help with. Researchers and faculty members have greater experience in their particular fields and are more aware of existing resources, reducing the need to rely on librarians for assistance in finding information in most cases.

Notably, the most frequent types of information requests received related to a library's traditional focus of helping users find and organize information. While issues relating to publishing, such as how to publish in an open access venue or which journals to publish in, were mentioned, only one reference was made to data management. While the frequency of the latter subject may be due to how the question was posed in the interviews, the few references to publishing practices and data management may also reflect user perceptions of the services that libraries offer and why users approach librarians.

When asked how they respond to information requests, eight librarians said they provide reference services for their user communities (44.4%). Interviewee C noted that most requests are received through email rather than in-person. Interviewee H said that in addition to reference searches, "library pathfinders" were created for common topics to help users find information or resources. Six librarians—two governmental and four academic—said that they provide instruction and training for users (33.3%), which included one-on-one sessions, participation in classes, and training on the use of databases and library catalogues. Four interviewees said they create guides or FAQs for their users, listing various resources together in one-page guides as well as including frequently asked questions. Interviewee I said while LibGuides were prepared on numerous subjects, their usefulness was limited, due largely to the incorporation of a simple search box on the home page of library websites that potentially encourages users to bypass searching databases individually. Providing outreach to their community and ILL services were each mentioned by two librarians as additional ways they respond to user requests.

One interesting theme that emerged from responses to the question about information requests was the habits of users when they contact librarians for assistance described by four librarians. Interviewee E, a librarian at a North American university, said that because students commute between a satellite campus and the main campus, they address questions to the most conveniently accessible librarian. Interviewee P, based in an NGO, said that users consult publications in the library itself rather than borrowing them for further review. Two librarians, one governmental and one academic (Interviewees F and

A respectively), both said that in their experience users are generally self-servicing in searching for information. Interviewee A mentioned that students who frequent the library rarely consult the staff stationed at the reference desk. Interviewee F said that researchers are comfortable with their own ways of looking for information and usually do not require assistance.

How the librarians said they respond to questions appear to be related to the most frequent types of requests they receive. The interviewees spoke about providing reference services and instruction to help users find information, in addition to providing users with the tools to access library services on their own. The interviewees described themselves as being available to assist, but also to provide users with the resources they need to become self-sufficient after an initial instruction or consultation.

The interviewees gave a variety of responses when asked how their respective organizations allocate resources to meet information requests. The majority (11 or 61.1%) mentioned the budgets organizations established for the operation of the libraries. Many of these librarians provided an explanation of how the funds were allocated. For example, Interviewee F, who works on contract to a national government, noted that while the institutional budget is handled centrally, funds are designated to purchase access to journals relevant to the community served by the branch library. Interviewee G noted that about 80% of funds are assigned to purchase serials. That interviewee also stated that funds are not available for specialized tools or resources, aside from support for an institutional repository. Interviewee C said that the main university campus covers the costs of electronic subscriptions, with a small budget for specialized marine print resources. In contrast, at the institution where Interviewee E works, collection costs are borne by the main library and the budget of the branch focuses on staffing, supplies, and events. In the case of the institution where Interviewee P is employed, the library's budget includes a specified allocation for collections, including scanning of publications and document delivery. While most librarians who mentioned budgetary matters said that their organization provides the funding, two academic librarians pointed out that external sources, such as grants, are used to purchase access to databases and serials.

How the organizations staff their libraries was frequently mentioned by the interviewees. Five librarians (27.8%) referred to their organizations' allocation of financial resources to hire professional staff. Two participants in this group specifically mentioned the presence of professional staff as a measure of their organization's commitment to the library and marine sciences. A university employing multiple librarians was highlighted by two academic librarians. In addition to the professional staff, two academic librarians noted that students are hired to staff reference and circulation desks. While employment of students is common on university campuses, their presence in staff positions could indicate insufficient funds to hire professional personnel. Students can, however, be trained on the job to handle routine matters while the professional librarians focus on more complex information inquiries.

In addition to staffing matters, the interviewees commented on other activities or services that required budgetary allocation, such as instruction and training sessions about tools and resources (three interviewees; 16.7%) and databases offered to patrons, e.g., ASFA and the IAMSLIC joint catalog (four interviewees; 22.2%). Some institutions provided unique services. For example, the organization where Interviewee D, a governmental librarian in Asia, works publishes documents in the local language and participates in a national and international document exchange program to help distribute those materials. A government librarian in Africa, Interviewee L, said that resources are assigned for the collection of local information, the creation of documents, and dissemination of those materials.

Half of the librarians (nine; 50%) said they had observed changes in information-seeking behaviours in their user communities over the last five years. Five others were less certain of changes, one of whom recently obtained a master's degree in the field and was, therefore, unable to comment. Others in this latter group included Interviewee K, an academic librarian in Africa, who noted the reason that fewer seek assistance of professional staff may be due to the information literacy training that has been provided. Interviewee N, a governmental librarian based in Europe, also expressed uncertainty about changes in information seeking behavior and noted that users are increasingly accessing open access sources like ResearchGate. Another in this group, Interviewee M,

a governmental librarian in Australia and the Pacific, stated that while some users have begun to adopt the digital tools developed to facilitate information access, information literacy has not progressed, and awareness of information located outside of the internet is still limited. Similarly to survey participants, Interviewee M, along with three others, noted that users rely heavily on Google and Google Scholar to find information (see Section 4.3.3). A North American academic librarian, Interviewee G, said that users conduct most searches in Google and go to a library for assistance when questions require more complicated search strategies than basic Google searches. In comments about Google, Interviewee E, stated: "People might technically know how to go through the motions of finding stuff, but I don't think they necessarily know the best places to look." This librarian and two other academic librarians noted that students, in particular, believe themselves to be self-sufficient in searching for information when that might not be the case. Interviewee I attributed this belief to how students learned to search through Google and seeing information as a large mass rather than different subjects in distinct areas.

How users request information has also changed according to four participants. Interviewee D stated that fewer users are accessing traditional library services, while an academic librarian, Interviewee K, noted that, possibly due to information literacy training and increased provision of computer terminals in libraries, fewer users seek assistance from library staff. Users are more likely to contact library staff via email than in person, according to Interviewee C, and very few information requests are received by phone. Email may be more convenient and also give users more flexibility to explain the information they wish to locate or problems they encountered in searching. Interviewee C pointed out that a branch library closure, which removed a contact point for users, could have contributed to a change in how users interacted with librarians.

In the experience of the interviewees, reliance on Google or other web-based search engines and searching practices appear to be the largest driver in changes in information-seeking behaviour. Interviewee P claimed that today's users are more comfortable with searching due to increased standardization of metadata in catalogs and databases, which enhances searchability. Multiple librarians noted, however, that while users appear to be more comfortable searching, they may not be skilled in understanding the information

they have accessed and how to interpret it. The interviewees stated that information literacy skills have not advanced to complement searching behavior. Users are often unaware of the cost of information, according to Interviewee M. They appear surprised to discover that information is not always free. Encounters with paywalls, in contrast to freely available information obtained through Google searches, could result in frustration and directly seeking information elsewhere.

The interviewees also commented on users' expectations regarding open access to information. Five librarians (27.8%) noted that users seem to be confused about open access. Interviewee M, for example, pointed about that users need to be taught that availability of an image online does not obviate negotiating a copyright arrangement in order to use the image. Interviewee G noted that users are not fully familiar with the current state of scholarly communication and often accept with minimal questioning the information found using Google. Interviewee I said that students begin searches in Google or Google Scholar and want information to be quickly available. Four other librarians (22.2%) made the same point. For example, Interviewee E stated that users "don't really care how much [the information] costs or if it's open access or not, they just want it because they need it for their research."

Web-based search engines like Google and Google Scholar clearly are influencing how users look for information and also how they value it, according to interviewees. As stated earlier, because users are accustomed to accessing information quickly and without cost, their choice of information sources is based on this experience. Users may select information based on convenience rather than on the quality.

Open access publishing models may be making government funded research more accessible than previously. Interviewee F, for example, discussed how national directives regarding public access to research has influenced publishing practices of researchers as well as requiring that publications be accessible to people with visual disabilities.

When asked if there were challenges in meeting the information needs of users, the librarians presented a variety of observations. The most common, mentioned by eight

(44.4%), were issues related to staffing, particularly having insufficient staff to fully meet community needs. One member of this group, Interviewee G, said that serving as the sole professional librarian required being knowledgeable in a variety of different areas of the job because other information professionals with different experience and knowledge are not available at the site. This scenario relates to the discussion above regarding the presence of student staff, workload, and resources allocated for staffing. Budgets constraints were the second most cited challenge that librarians face, mentioned by six (33.3%). Two interviewees noted that limited budgets negatively affect serials subscriptions. Interviewee E, for example, pointed out that budget increases do not match the cost of subscription licenses, which rise about 8% a year. Interviewee A, based in North America, drew attention to changes in currency exchange rates which pose a problem. Interviewee D, located in Asia, noted that the government stopped providing funding for collections development, leaving the library in the difficult position of attempting to provide information via other resources. In this case, the government's decision was due to the belief that the information researchers needed could be obtained through open access publications.

A lack of time to fulfil information requests was mentioned by five librarians (27.8%). Two in this group specifically mentioned that increases in workload depended on the time of year. Three said that changes in their field caused difficulties resulting from a need to learn and adapt to new tools or to find ways to encourage users to access the full range of available resources instead of simply relying on Google searches. While many of the interviewees in this study commented on challenges in pursuing their work, two stated that they have not encountered any major difficulties in meeting the information requests of their communities.

The two most frequently mentioned challenges—staffing and budget limitations—appear to be linked. From the interviewees' perspective, budget constraints affect whether libraries can adequately serve their communities. The rising subscription costs for serials in the face of limited budgets means maintaining access to serials is unsustainable, as Interviewee E emphasized. Rising costs result in cuts to subscriptions or other decisions as to what resources to prioritize. For institutions outside the United States or the

Eurozone, unfavourable changes in exchange rates may pose a significant problem regarding serial subscriptions. A database that may be affordable one year might need to be eliminated in another year due to the combined pressure of a price increase and an unfavorable exchange rate. Increasing costs of serials and databases may also impact staffing arrangements. Being able to offer ongoing access to materials may be seen as more important than maintaining or increasing staff. Decisions about staffing may exacerbate the current challenge interviewees identified relating to workload and make it more difficult to effectively meet the information expectations of their communities.

4.4.2 Database Subscriptions

As in the survey, the interviewees were asked to identify the database vendors with which their organization had licensing agreements (see Table 35). EBSCO and ProQuest, two large global companies, were the most frequently mentioned. The search interfaces that journal publishers have implemented were also noted, perhaps indicating that the interviewees view those search interfaces as similar to the databases or that access to journals is handled in a similar manner to database subscriptions. Despite a high number of interviewees stating that their institutions subscribe to EBSCO databases in response to a question later in the interview, only three mentioned subscribing specifically to A&I databases offered by EBSCO (see the bottom of Table 36). A similar discrepancy happened with JSTOR. This inconsistency may be due to interviewees choosing to only list the vendor and not the specific database. While ASFA was the most frequently mentioned of the individual databases subscribed to, less than half of the total interviewees did so and no other aquatic science specific database was mentioned in this section.

Table 35. Database Vendors Subscriptions Mentioned by Interviewees (n=18).

Vendor (Number of Responses)
• EBSCO (7) • ProQuest (6) • Web of Science (5) • JSTOR (4) • Wiley (4) • IEEE (3) • Scopus (3) • Elsevier (3) • BioOne (2) • Agora (2) • GeoRef (2) • Science Direct (2) • Emerald (1) • Informit (1) • Lexis Nexis (1) • Research 4 Life (1) Aquatic Commons was listed twice and Ocean Docs once by interviewees, but not included in the list above as they are online repositories. The Summon discovery system was also mentioned by one interviewee.

Table 36. Individual Database Subscriptions Mentioned by Interviewees (n=18).

Databases (Number of Responses)
• ASFA (7) • Web of Science (5) • Lexis Nexis Australia (1) • Biosis (1) • Zoological Records (1) • Scopus (1) • JSTOR (1) Both EBSCO and ProQuest were mentioned by interviewees three and two times respectively.

The number of databases the interviewees' organizations subscribed to varied (see Table 37). In addition to the interviewees who provided specific ranges, one interviewee was unaware of the number and another said their library currently obtains database access for free. While the range was not quite as extensive as the survey respondents listed, many

interviewees reported low numbers of subscriptions. The low number could be attributed to several factors, such as institutions focused on specialized subjects that do not require access to many databases, limited budgets, or an organizational reliance on inexpensive or free databases or tools to find information.

Table 37. Number of Database Subscriptions (n=18).

Range of Database Subscriptions	Responses	Percentage
0-10	5	38.9%
11-20	2	11.1%
21+	2	11.1%

According to many of interviewees, the budgets of their organizations and the scope of a database are important factors in subscription decisions. Seven participants (38.9%) said that the subscription price and the limits of their current budget influenced their choices. These responses corroborate the discussion above about how budget challenges influence decisions organizations make regarding subscriptions and staffing. Interviewee A, for example, commented on how currency exchange rate changes can result in higher subscription prices and result in a cancellation. Librarians also compare prices of similar databases to determine the most cost-efficient choice or whether switching to a database with similar coverage at a lower cost will be a better option for the organization. Six librarians (33.3%) said that the subject and scope of a database are other significant selection factors. These factors mean aligning the database and journal subscriptions with the teaching or research interests of the user community. A decision may be made to not subscribe to competing databases with a wide overlap in coverage. Two librarians said that they review usage patterns for databases to determine if the subscription should continue or not, and one said that subject librarians provide recommendations for databases.

Who decides on the subscriptions was also mentioned by seven librarians (38.9%). The responses varied, from one governmental librarian saying that only the electronic resources librarian made the decisions, to an academic librarian noting that subscriptions were negotiated with collections management staff. The size of the organization, and

whether it was a part of a larger institution, appeared to influence who made decisions about database subscriptions and the level of involvement of interviewees.

Interviewee M said that the ability to integrate a database into the organization's discovery system was a major factor in selecting databases. According to this interviewee, users wanted a single search option rather than use different platforms or systems during search processes. This observation matches earlier comments by the interviewees about how users are searching for information and illustrates how Google and similar services are influencing the development of searching technologies. Because the government department where Interviewee M works uses the EBSCO Discovery Service, this platform excludes databases, e.g., ASFA, offered by ProQuest. This government unit does subscribe to LexisNexis because no other comparable service is available for legal researchers. Interviewee M pointed out that if a switch is made to Summon, the ProQuest discovery system, a subscription to ASFA might be considered. Discovery layers and their impact on subscription choices are discussed further in Chapter 5.

Database subscriptions can either be year-to-year or multiple year contracts, depending on negotiations with the vendors and organizational preferences. Interviewee A, who drew attention to the effect of fluctuating currency exchange rates, said that year-to-year subscriptions give the flexibility to cancel a subscription at the conclusion of the contract if the economy changes, but multi-year subscriptions provide the organization with the certainty of a stable price. A governmental librarian, Interviewee M, also commented on the benefits of flexibility with year-to-year subscriptions, which also supports frequent evaluation of the databases and decisions about renewal. Interviewee I, whose university is part of a statewide academic system, said that the central office negotiates subscriptions for the larger databases, such as Web of Science, which usually are multi-year contracts. The database subscriptions overseen by the local campus, on the other hand, tend to be year-to-year. This scenario also fits with the financial flexibility a year-to-year package offers. Because the single campus is responsible for selected database subscriptions, an annual subscription gives more flexibility in cancellations and reallocation of funds to other resources, should user needs change. Some libraries work

within consortia or larger systems in subscribing to databases and serials. In these arrangements, cost savings can occur due to better subscription prices for individual institutions and lower administrative costs achieved through collective negotiation. Four academic librarians reported being part of different consortia that obtain journal or database subscriptions together. The consortia are different than the United States state university systems noted by three interviewees, in which the central offices purchase subscriptions to some commonly preferred packages and leave more specialized subscriptions to the campus level. Three interviewees, two with governmental units and one with an NGO, said their libraries are part of larger national organizations that assist with subscription negotiations. Two of the government librarians said that the national system oversees acquisition of most electronic resources for branch libraries.

Eight interviewees (44.4%) said that participation in consortia or larger systems did influence subscription choices. For example, Interviewee K, a librarian in Africa, said the database choices depend on the funds the consortium raises from its members. Interviewee H said that participation in the IAMSLIC email list and shared catalogue led to a reduction in database subscriptions, as publications not available locally can be obtained through the email list and shared catalogue. Two academic librarians based in North America commented that while the consortia negotiate Big Deal subscriptions on behalf of all members, individual libraries have the ability to choose not to participate for a variety of reasons. Similar to the experience of Interviewee I, who described a division of subscriptions between a central office and branch units, Interviewee G stated that smaller, more specialized subscriptions were handled by individual libraries while the state system negotiates access to larger databases sought by all units. As noted above, participation in consortia subscriptions reduces the administrative burden on individual libraries negotiation access to larger, more general databases. Responses by the interviewees imply that specialized databases like ASFA, however, do not appear to be covered under this collaborative arrangement.

Much like the responses to the survey discussed in section 4.3, the interviewees discussed how usage data is collected in evaluating database subscriptions. Ten interviewees (61.1%) said that their organizations use statistics supplied by the database vendors.

Interviewee I, for example said that a staff member standardized the statistics received from the different vendors and provided an analysis on cost per use that librarians can then reference. While only Interviewee I mentioned a staff member dedicated to this function, other organizations may also assign a staff member to prepare data for use by other staff. Five librarians (27.8%) said that their organizations use internal usage tracking methods, e.g., surveying users and documenting statistics about information inquiries, to include in internal reports. For example, Interviewee A, whose organization uses both methods, stated that the university primarily relies on tracking software supplemented by vendor-supplied data, if needed. Data supplied by vendors may be cost-efficient, but libraries with the resources to implement tracking systems might choose that method to collect usage data to avoid relying on the vendors.

In terms of how the statistics are used, four interviewees (22.2%) mentioned that statistics help to determine cancellation or renewal, implying that the data was included in database evaluation processes. When asked whether evaluation processes exist in their organizations, 12 librarians (66.7%) responded affirmatively, including the four previously mentioned in the previous sentence. Eight commented on the frequency of the evaluations, with five saying that it occurs annually. Among the remaining three, Interviewee I said that a sharp increase in cost can trigger an evaluation, while Interviewee K said that databases are evaluated at the end of their term of subscription. The third, Interviewee A, said that the frequency depends on how essential the assessment is to the library, with some databases being evaluated less frequently than others. A matter of resources may explain the evaluation schedule. Five librarians voiced difficulties in evaluating databases, from a lack of institutional experience to budgetary constraints to difficulties in obtaining feedback from faculty on how they use or value the databases. Of the librarians who responded to this question, only Interviewee C specified a set process to evaluate the databases at a system-wide level:

> And for [my areas of specialization], annually in summer … they [central administration] have a whole survey where they ask for performance, were there problems, were complaints [received] from users, what is the platform like, and then are there improvements, are there plans from the vendor or publisher what to do. And I answer that series of questions for everyone I'm resource liaison for.

> And that happens for all ten campuses. So there are hundreds of resources where there's a librarian that has one or two or three resources they report on every summer. And that's very organized at [a system-wide level] because when they negotiate licenses, they look at the notes we put, how we evaluate them, like if there were faculty complains or the platform was lousy, or it's really good or good response from their customer support, all of these areas.

This interviewee pointed out that on the campus level, the process becomes "mushier" and discretion about the factors to evaluate databases is left to individual librarians. Interviewee C's observations emphasize the benefit of negotiating licenses within a larger system or consortium. These collaborative groups can draw upon data collected from a number of member institutions, identify common problems (if any), gather user feedback, and use that combined information to make decisions and negotiate the best deal for members. An established system can ease the process for individual members, as well as ensure availability of consistent longitudinal data that the larger organization can consult to identify potential trends, which can then be used in the collective decision-making process. However, this approach may only apply to larger, more general databases rather than specialized ones like ASFA.

Only six librarians (33.3%) said that they participated in the database evaluation processes in some way and two (11.1%) reported they were not involved in the process at all. Of those who said they were engaged in the process, four said they make decisions along with other staff members, while the remaining two said the evaluation process is solely their responsibility.

The respondents were then asked to elaborate on what evaluation factors they consider. Of the nine who described their evaluation factors, four said usage statistics play a role in how they assess databases. Cost and cost per use was mentioned by five librarians. Interviewee I, for instance, said that price increases could lead to evaluations, commenting that subscriptions had been cancelled for that reason previously. When asked to what extent cost is a factor in their evaluation process, ten librarians (55.6%) said that it played a substantial role. One librarian said it was the main factor, while two more said it between 95% and 100% of their decision-making was based on cost. Interviewee C said that, "[cost] does [play a factor] when it's a low-use item that's very

expensive. So, for example, we had to give up a few databases last year where they say, it's like only used, you know, maybe ten times a month and costs us thousands." This interviewee is consulted on possible cancellations as a subject specialist when cost per use is very high and justification for a continued subscription is needed. Although not all of the librarians answered this question, the responses to the question taken in conjunction with how many identified budget as a challenge to meeting users' requests, point to cost as one of the most influential factors in whether a database is cancelled or not.

In addition to cost, the interviewees identified other factors used in the database evaluation process. Three said that matching subscriptions to the needs of their users or organization was a factor. The subject and content of a database, as well as overlapping content among different databases were each mentioned by two librarians. The most cited evaluation factors, cost and usage, can be easily quantified, and thus are possibly the easiest to use to justify subscription or cancellation decisions. In addition, the interviewees also identified collecting user feedback on particular resources as a challenge. Relying more heavily on usage statistics and cost might be a way to mitigate that difficulty and ensure that some factors are applied consistently in the evaluation process. Nonetheless, user feedback is sometimes considered, as Interviewee G detailed in a description of an evaluation process.

Having recently completed a database evaluation, Interviewee G was able to provide details about the process used and the factors considered. As a solo librarian, all collections management decisions fell within this librarian's responsibilities. To evaluate a specialized database, usage statistics and cost were reviewed before contacting users in the subject field of the database covered. Interviewee G wanted to determine users' thoughts about the database and whether it was essential to their work, given its high level of specialization. Despite the database experiencing low usage, Interviewee G decided to continue the subscription for at least another year based on conversations with the relevant users, who claimed that the database is essential to their field. The librarian plans to increase usage through further outreach, but ultimately the subscription decision was based on listening to the community and meeting its needs with subscription choices.

Notably, Interviewee G did not cite cost or use as the deciding factors in the decision-making process. Rather, the main factors were users' needs and how important they considered the database to their area of study.

The frequency that interviewees accessed A&I databases in the month prior to the interviews varied. Three librarians said they use A&I databases daily and that that frequency was typical. Seven said they regularly used A&I databases of which six indicated that level of use was common. One person, who reported a low level of use was atypical, said it was due to the time of year for the interview. Five librarians said they used A&I databases infrequently in the previous 30 days, with three saying that use level was not typical. Two of those three said that the time of year affected their levels of use. Two librarians said that in the previous month, they had not accessed A&I databases at all which was typical.

Those who answered that they had consulted A&I databases during the previous month outlined their reasons for doing so. Four librarians said that they use A&I databases to help with literature searches on specific subjects for patrons or for themselves. Three librarians said that using such databases helps in locating specific publications a patron might be looking for, and two said that using the databases saves time when looking for information compared to conducting searches via a general web search engine like Google. For these interviewees, the ability to conduct targeted searching in a specialized tool was a major factor in their decisions to use these databases. The time saving factor is notable, given the number of interviewees who identified workload as one of their main challenges. Being able to quickly search for information could be seen as especially beneficial and a way to offer timely help to many patrons.

Whether A&I databases provide full-text access was mentioned by several interviewees. Interviewee A, for instance, said that software can be applied to place links to full-text in a database if the database itself does not offer full-text as part of its services. This librarian was the only one to mention initiatives to supply full-text access in databases searched by users. The interviewees also discussed full-text in response to a question on the benefits of A&I databases. Two librarians noted that users expect full-text to

publications to be available at the conclusion of a search. This expectation might be a reason users do not consult databases frequently, particularly when their expectations in searching a database were not met.

Despite the lack of full-text as a deterrent for users, 16 librarians did outline benefits of A&I databases. The benefits echoed the reasons the interviewees used such databases described above. Five mentioned that the databases help them to refine searches, with two saying they prefer searching databases for information compared to Google Scholar. These librarians explained that Google Scholar is too unfocused to be used reliably for finding a specific publication or locating information on a particular topic. Somewhat related, four librarians said that they like the specificity that A&I databases allow which aids in simplifying their searching process. Three interviewees talked about how useful they find the controlled vocabulary and metadata A&I databases offer and how these features make it easier to find information. Two said that A&I databases increases awareness of information, one of whom commented that the databases are useful for researchers to find information published in languages other than English. Similarly, two other librarians said that the different publication types included in A&I databases is helpful, with one specifically mentioning grey literature. For the most part, the benefits mentioned by the interviewees specifically centred on A&I databases helping them to find information in a focused, reliable manner.

4.4.3 ASFA Related Questions

In addition to questions about databases in general, the interviewees were asked about ASFA specifically, particularly whether or not their organizations maintained a subscription and their reasons for either option. Eleven interviewees confirmed that their organizations subscribed to ASFA or participated in the ASFA Partnership, with the remaining seven saying their organizations did not subscribe to the database.

The number of years that the eleven organizations subscribed to ASFA was more or less evenly distributed. Two organizations had subscribed for under ten years, two for between ten and 20 years, and three more than 20 years. Two librarians were unsure how long their organization had been subscribing to ASFA but believed it was for a long

period. Interviewee O, whose organization had subscribed for over 20 years pointed out that organization was a member of the ASFA Partnership which resulted in free access to the database. Interviewee C, whose organization had recently subscribed to ASFA, commented that a license to a different database that ceased to exist necessitated a switch to ASFA.

The inclusion of grey literature in ASFA was mentioned as a key feature by five interviewees. Librarians in three geographic regions commented on this feature. For example, Interviewee L, based in Africa, said that the grey literature in ASFA is unavailable in other databases, and Interviewee H in Asia mentioned that grey literature from around the world can be located by using the database. Interviewee E, located in North America, emphasized that the grey literature included in ASFA makes it possible to find not easily found information. ASFA's controlled vocabulary was the next most frequently mentioned key feature, with four interviewees referring to it. Related to the controlled vocabulary, three interviewees also talked about how ASFA helps with the searching process. In this theme, Interviewee A liked that ASFA allowed filtering by environmental regime, thereby supporting specificity in the searching process. Interviewee E appreciated ASFA's international reach, saying the coverage provided access to a wide range of information that is useful for researchers. These responses, excluding the discussion about inclusion of grey literature in ASFA, mirrored what interviewees generally found to be valuable about A&I databases.

In addition to ASFA, seven librarians said that they use other information sources to meet information requests from their aquatic science communities. Three said that they use other databases—such as Oceanic Abstracts, Web of Science, Agora, Scopus, or national databases—to help meet requests. In this group, Oceanic Abstracts is the only specialized database focusing on marine sciences mentioned. Oceanic Abstracts is also offered by ProQuest and is frequently bundled with ASFA. Organizations that subscribe to ASFA via a database bundle would, therefore, also gain access to Oceanic Abstracts. Three other librarians said they use Google Scholar in addition to ASFA to find information for patrons and one librarian also uses general web searching to locate information. Interviewee F frequently accesses a nearby university's catalog to locate materials.

Because the library has a specific regional focus that the university shares, Interviewee F is able to locate items not in the federal library system. The same librarian also mentioned that when searching for grey literature for users, the author or the organization that published the piece is frequently contacted directly rather than try to locate it through a database.

When asked if ASFA met the information needs of their user communities, the responses varied. Four said it did meet the needs of their communities, although Interviewee E said users are encouraged to search a variety of databases. Interviewee C specifically said it met the needs of the marine biology users. One person said that ASFA does not meet all users' needs, and three respondents were unsure if it met the needs of their communities. One of these three, Interviewee A said that without surveying users, it would not be possible to determine the sources users are accessing. This librarian added that professors say they do not consult databases but use other methods to stay up to date on what is being published such as word of mouth or setting up journal alerts. Two librarians said that to promote awareness and use of ASFA and other discovery systems they provide instruction to their communities. Interviewee C promotes ASFA among students who are researching a specialized topic and need to review grey literature.

Two themes—users saying they do not search databases and librarians promoting awareness and use of particular services—emerged when the interviewees were asked to what extent their user communities are aware of ASFA and whether the interviewees recommend the database. Four librarians said that their users are aware of ASFA and make use of it. Interviewee H stressed that ASFA was primarily used by older researchers rather than younger members at the organization. In the experience of Interviewee G, ASFA is the database with which researchers were most familiar. Two librarians said their users were somewhat aware of ASFA and one academic librarian was unsure of the extent users knew of the database. Interviewee N did not believe users were overly aware of the database and noted that researchers prefer tools that provide full-text. Two librarians said that they introduce users to ASFA, either in one-on-one instruction sessions or in larger classes. One these two, Interviewee C, hopes people continue to use ASFA after being shown its features and benefits but is unsure if they do.

In addition to the two librarians who instruct users on how to use ASFA, four other librarians promote awareness of ASFA. For example, Interviewee H, based in Asia, frequently refers users to ASFA, while a North American librarian, Interviewee B, promotes the database on an institutional website. Seven librarians—including the two who incorporate ASFA into their database instruction—said that they recommend ASFA among other databases, although Interviewee N does not particularly focus on ASFA, and Interviewee C, as mentioned earlier, recommends ASFA based on a researcher's area of study. Interviewee F said that while ASFA is included in recommended databases, the user community appears self-reliant and only seeks assistance in locating particular articles or pieces of grey literature. This librarian also mentioned that users often learn about publications based on peer word of mouth. Because this librarian was newly appointed and has not conducted a user survey, awareness of searching habits is limited to instances when users sought help in locating information and publications.

Librarians whose organizations do not subscribe to ASFA were asked what information sources they use to meet user requests. There responses demonstrate that a variety of strategies are used to fulfill the requests. For example, three librarians said they rely on the IAMSLIC shared catalogue for resources they need. This catalogue allows IAMSLIC members to determine whether particular resources are available at member institutions and can be accessed electronically. Interviewee J, an academic librarian based in South America, stated that their organization used to subscribe to ASFA but it was cancelled due to budgetary constraints. Three librarians rely on their own catalogues and collections to meet information needs. One of these librarians, Interviewee I, collects local grey literature that researchers frequently use, in addition to providing access to subject specific databases and Web of Science. Interviewee Q's organization subscribes to international printed paper sources to meet information requests. Interviewee M said that Google Scholar alerts combined with EBSCO databases are used to respond to user requests. This librarian also mentioned that database subscriptions are limited to those that can be integrated with a discovery platform. As mentioned earlier, this decision was based on feedback from users for an integrated search platform to avoid searching multiple resources. While only Interviewee M spoke about the influence of discovery

layers on subscription choices, other institutions may make similar subscription decisions if libraries choose to implement particular discovery layers.

When asked if ASFA meets their users' expectations, the interviewees offered a variety of perspectives. Five believed ASFA met the expectations of their user communities, two said they were unsure, and one said that the database does not fully address user expectations. In the course of answering this question, four librarians commented on their users' searching habits. Interviewee H said that while ASFA is a useful resource, users are more likely to search the internet first, followed by specialized databases if the users cannot find the information they want. Interviewee A commented that experienced faculty members tend to keep track of developments in their field by following relevant journals or setting up news alerts. This librarian also mentioned web search engines like Google Scholar that make it easier for users to discover information without using an A&I database. Interviewee E said that databases like ASFA may be confusing for undergraduate students because different types of publications are included. This librarian also said that the database may be overwhelming for students who have not received instruction in how to use the databases with controlled vocabulary.

The interviewees' recommendations on how to improve the ASFA database were also varied. Six respondents offered no suggestions, with three in this group saying they were satisfied with the current ProQuest interface. Interviewees H and L asked for more full-text access in ASFA. One librarian commented on the lag between a journal's publication and its inclusion in the ASFA database and how Google alerts were more reliable in terms of being notified of new information. Interviewee E found the basic ProQuest search page inadequate, saying that "people would get there and probably not realize all the other things that you could do with it." Interviewee H suggested the number of partnership members be increased in order to expand grey literature holdings to strengthen the global coverage. Interviewee M proposed including research datasets within the database. This same librarian expressed disappointment that their country is no longer a member of the ASFA partnership, meaning that local publications are not being included in the database. This librarian and Interviewee H both commented that inclusion of grey literature from around the world is ASFA's strength. A country leaving the

partnership, then, limits the database's effectiveness in promoting its core mission of disseminating world-wide information. Increasing the partnership and finding ways to incorporate more grey literature, such as the local collection Interviewee I mentioned, could help promote ASFA and enhance its reach.

Towards the end of the interviews, the participants were asked for their opinion about the possible impact if ASFA were discontinued. While consensus did not emerge in the responses, substantial loss of access to information was noted. Three librarians, two of whom said that their organizations did not subscribe to the database, said the impact would be limited or minimal. Four other librarians said that they were unable to predict the impact for their users. One in this group, Interviewee D, added that ASFA is an important mechanism to support low-income countries and help to disseminate the research they undertake to a global audience. Related to this view, five librarians said that the discontinuance of ASFA would lead to a loss of access to information, particularly making grey literature more difficult to find. Three North American librarians said that if ASFA ceased to exist, they would be more reliant on other databases and Google Scholar to find similar information. One of these librarians, Interviewee C, suggested that it would take far longer to find a small portion of the information they can locate in ASFA. Four librarians offered additional insights on how the shuttering of ASFA might impact users. Of the four, Interviewee F said that complaints would undoubtedly come from researchers, while Interviewee C said closure of the database would affect student instruction. This group included Interviewee I whose university does not subscribe to the database. Nonetheless, this librarian felt that discontinuing ASFA would have a negative impact on users around the world. For organizations with access to a wide range of resources, discontinuing ASFA could make locating information more difficult, but based on the interviewees' comments, the effect would be disproportionately felt in low-income countries or organizations with a smaller pool of resources. The three librarians who said they could rely on other systems were all based in North America. For subscribers and ASFA partnership members in low-income countries, however, the closure of ASFA could cut them off from a valuable source of information in addition to preventing the dissemination of their countries' research beyond their borders.

At the conclusion of the interviews, the participants were provided with an opportunity to offer any additional comments. Four librarians said that rising costs and limited budgets are affecting their institution, with one of the governmental librarians specifically stating ProQuest subscription prices are no longer affordable. Interviewee H suggested that ProQuest offer a lower-cost ASFA database to organizations in developing countries. Interviewee G said that with Google and Google Scholar popular among users, librarians may choose to commit more of their budgets to serial subscriptions rather than database licenses. Three other librarians mentioned the impact that Google and Google Scholar have had on the research process. For example, Interviewee E commented on "The Googlization of everything and even the Primo searching that everybody is adding […] I just think that people waste a ton of time going through gazillions of results that don't really match what they're looking for and they don't understand how to do a better search."

Overall, the interviewees touched on several key themes. One is the changing searching habits of users and how they interact with information. Google Scholar was specifically mentioned throughout the interviews by nearly every participant, as a tool librarians frequently use and a powerful search platform that contributed to changing search habits and expectations. Google was also mentioned but to a lesser extent. The rising costs of database licenses coupled with limited budgets present a real and persistent challenge to librarians and is a large influence on their decisions about database subscriptions. Finally, there appears to be an agreement among many of the interviewees that ASFA provides a valuable service, both in terms of collecting and disseminating information from around the world, and also facilitating ease of searching. If ASFA were to cease to exist, it would be a loss to the global marine science community.

Individually, each form of data collected and analysed in this chapter provides insights about ASFA's value to users, as well as how users are interacting with the database. When the data sets are considered together, several patterns emerge about the main users of ASFA, as well as how changes in information technologies and information-seeking behaviour are affecting usage, and how ASFA could adapt to remain a viable and

informative resource in the future. These insights and patterns arising from the four types of data will be discussed in the next chapter.

Chapter 5: Discussion

One of the benefits of a mixed methods research approach as used in this study is the ability to consider different types of data related to the research questions and identify areas of corroboration or divergence. The Google Analytics data, surveys, and interviews are informative about changes in how users are searching for information and how that searching behaviour might be impacting usage of the Aquatic Sciences and Fisheries Abstracts (ASFA) database. This chapter focuses on several themes that occurred repeatedly in Chapter 4 about usage of the ASFA database, specifically focusing the issue of main subscribers versus main users, how changes in information technologies might be affecting searching behaviour, and the impact of cost in the subscription decision making processes in many institutions. This chapter will also discuss ASFA's areas of strength as identified by the interviewees and survey participants and their views about what could be improved about the service. Finally, this chapter will discuss the impact that ASFA's closure might have on various user communities and subscribers.

5.1 Determining ASFA's Primary Users

Analysis of the longitudinal usage data provided by ProQuest highlighted several insights about the main users of ASFA, as well as how users are interacting with the database. As noted previously, while the data considered in this study did not include organizations that receive the database on CD or DVD, it does show the types of subscribing organizations and subscribers who are using the database.

The longitudinal usage data (see Section 4.1) focused on the number of accounts and average retrievals per account (RPAs) in subscriptions around the world. Starting in 2014, the number of accounts grew rapidly, particularly in North America and the Caribbean, South America, and Asia. Despite more institutions licensing the database and granting access to users, usage decreased slightly from 2012 to 2017. Many of the academic accounts, where most of the growth occurred, experienced declines in RPAs, suggesting that despite being available to more people, the database was not accessed at a rate to maintain the same level of RPAs (see Figure 4 in Chapter 4). The data did not indicate which accounts were from individual ASFA subscriptions or from database

bundles that included ASFA. More academic institutions, particularly in North America and the Caribbean, may subscribe to one of the bundles that includes ASFA but do not specifically focus on aquatic sciences, fisheries management, or aquaculture. This subscription arrangement could explain the growth in number of academic accounts without a corresponding growth in usage. The increased usage per account seen in 2017 appears to be a result of a rise in retrievals among the subscriptions at governmental institutions (see Figure 3 in Chapter 4). While there was an overall decrease in government accounts in the period from 2012 to 2017, the number did not change from 2016 to 2017, when a rise in RPAs occurred. This growth in RPAs in government accounts is evident in each of the global regions, even among government accounts where retrievals were low. The increase in retrievals among the government institutions suggests that despite fewer governmental organizations or departments with access to ASFA, these subscribers view the database as a valuable resource which they consult.

Although several interviewees noted that without surveying users they are unsure which resources are being used, it appears that government-based researchers and staff are familiar with ASFA and use it more frequently than users in other sectors. This may be due to government institutions providing more limited access to other specialized databases compared to what is typically available at academic institutions. It may also be due to the relevancy of the information contained within ASFA to the work of the government researchers and staff members. If ASFA's operational revenue model is partially based on usage, then initiatives to expand the number of government accounts could prove financially beneficial. The relevancy of publications documented in ASFA and access to other databases at academic institutions might also explain why on a global level, academic accounts generated fewer RPAs than governmental accounts.

If academic institutions subscribe to ASFA at higher rates over time because of how it is bundled with other databases, the decrease in RPAs might mean that the materials described in the database are not considered relevant to the institution's mission or that users are consulting other databases or resources to meet their information needs. This scenario can include both faculty and non-faculty researchers working at academic institutions that focus on aquatic sciences and aquaculture. For example, Interviewee A,

who works at a university in North America with a large marine science program, commented that researchers keep up to date by directly consulting journals or by setting up web alerts for new publications. In Interview A's experience, faculty researchers might use databases if they are preparing systematic literature searches on a new topic. This selected searching combined with the lag in the time between a journal's publication to its inclusion in ASFA, identified by both Brown (2007) and Interviewee M, might explain the lower RPAs at academic institutions compared to government accounts. Further research about searching preferences, focusing on both government and academic users, could prove whether these theories are correct, or if other reasons can account for the difference in usage between academic and government ASFA account holders.

5.1.1 How Users Interact with ASFA

How users interact with ASFA is important to consider when discussing usage trends. As noted in Section 4.2, which focused on the Google Analytics data, there are observable changes in user interactions with ASFA. The most notable change is the increased length of time users spent in the database combined with an increase in the events occurring in the results page. Conversely, comparatively fewer users are using the basic and advanced search features, in addition to there being a lower docview conversion rate (see Table 6 in Chapter 4). Because the Google Analytics data do not capture when users are accessing the preview feature on the website (see Figure 79), the full spectrum of interactions with the results page may not be documented.

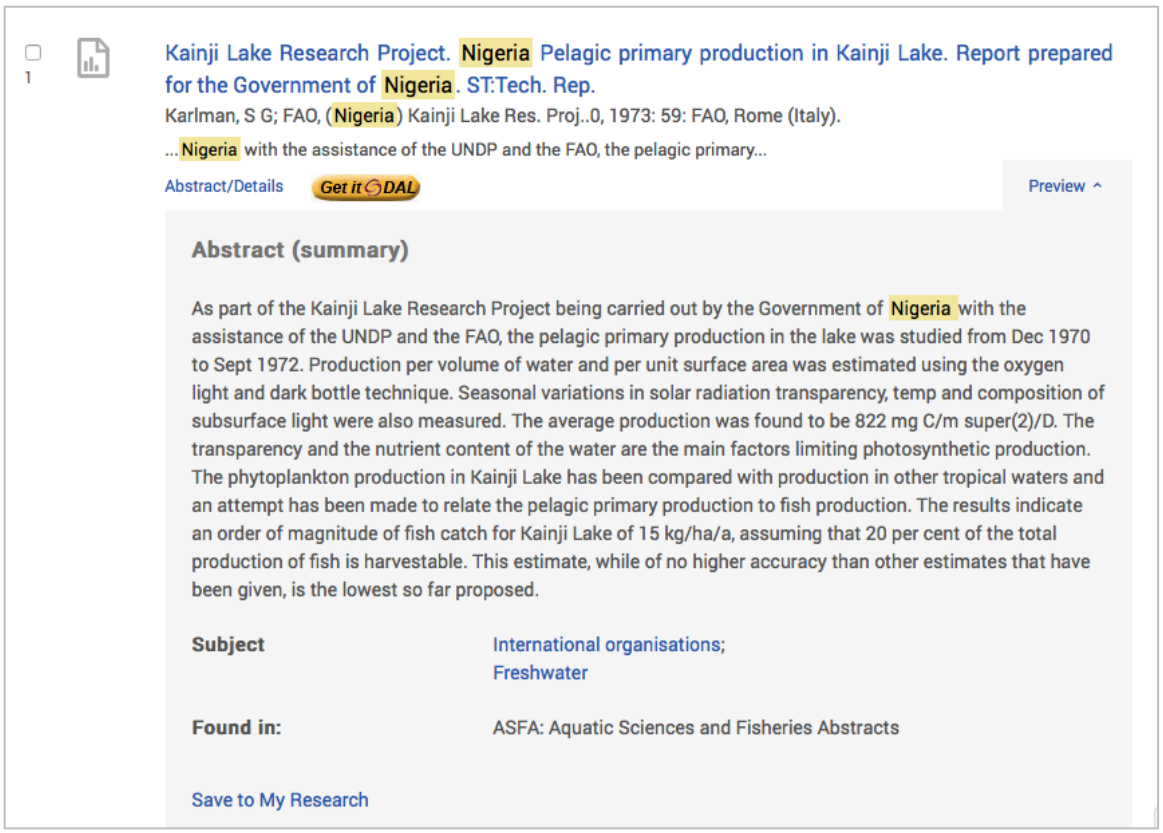

Figure 79. Preview of an ASFA Record on the Results Page (accessed at Dalhousie University). (ASFA, n.d.a).

The available data, particularly the change in numbers between 2016 and 2017, suggests users may be using ASFA in a similar manner to searches conducted in Google. As discussed in Section 4.2, users appear to enter a single term into the search box and peruse the results page to find the information they want. Users who may be unfamiliar with different database operators or Boolean search strategies, may be using the same strategies that they use in Google searches or in a discovery layer. Even researchers trained on how to search databases, may rely on similar methods. Previous research using eye-tracking software, for example, indicated that in library catalog settings, users spend more time examining the results page and not as much time interacting with the search box or search facets (Kules & Capra, 2011). While the researchers noted that user behaviour did change after watching training videos, there was no follow-up to confirm whether a lasting change had occurred or whether the training videos only affected user behaviour in that particular session (Kules & Capra, 2011).

If an organization chooses to set the default ASFA page as the basic search page, it may result in users with limited or no experience with abstracting and indexing (A&I) databases searching as they would in Google or another web-based search engine. Even users with previous experience or training in searching databases may demonstrate an overreliance on accepting the results page as presented, rather than refining their searches using facets or more specific search strings. While data about how organizations configure their ASFA landing page was not available for this study, the Google Analytics data do imply that some searchers may be using the basic search option instead of the advanced search page (see Figures 80 and 81). For both 2016 and 2017, the basic search event rate was higher than the advanced search rate (see Table 6 in Chapter 4).

Figure 80. Basic Search Page for ASFA. (ASFA, n.d.b).

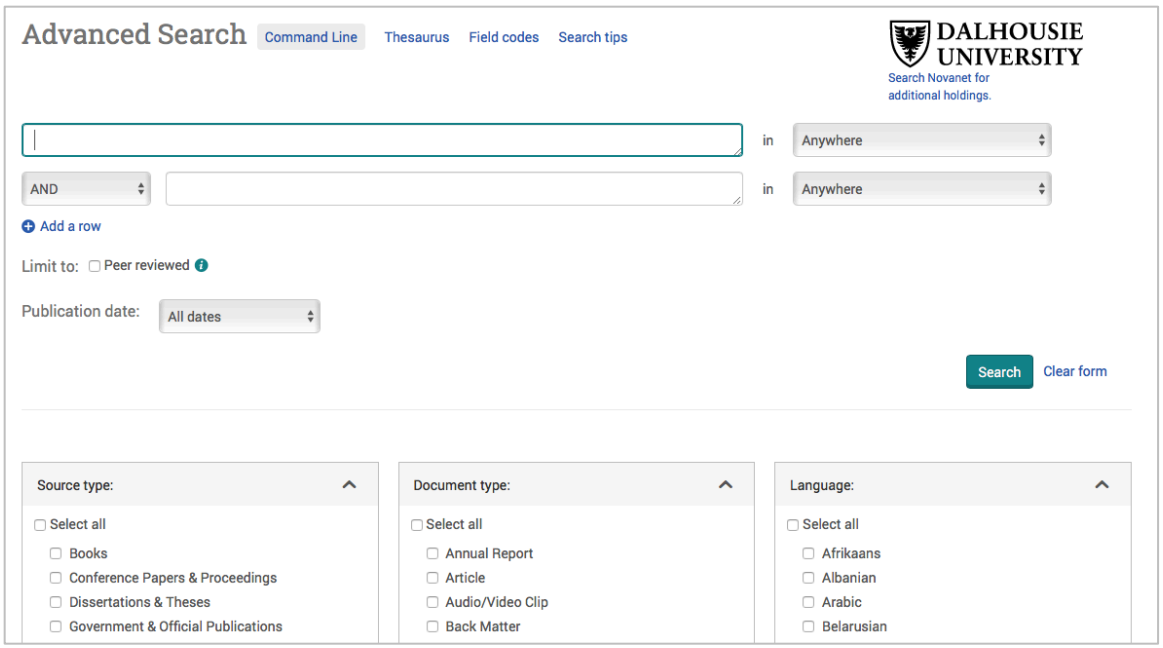

Figure 81. Advanced Search Page for ASFA (accessed at Dalhousie University). (ASFA, n.d.c).

Should this theory be correct, it supports a comment by Interviewee I, who spoke about the information seeking behaviour of students. This librarian commented that undergraduate students are familiar with seeing information as a large mass, rather than something with discrete parts. Part of a librarian's job, Interviewee I pointed out, was teaching users how to sort the information they encounter into different groupings. One of the key differences between ASFA's basic and advanced search pages is that the advanced search page provides the opportunity to limit and sort the information while executing a search through filters present on the page itself, which are not available with the single search box. As a consequence, users must resort to interacting with record after record in the results page after a basic search to determine which publications may be relevant. This reliance on the basic search option is an example of a larger trend observed in this research, namely, changes in information technologies, e.g., the prevalence of "Google-like" search features, influencing users' information-seeking behaviour.

5.2 The Impact of Google and Google Scholar on Information-Seeking

The introduction and increased prominence of Google and Google Scholar appear to have led to numerous changes in information-seeking behaviour. The literature reviewed in

Chapter 2 and the data from the survey and interviews suggest that users now expect information to be accessed as quickly as possible and they have become accustomed to a single search box with minimal filters to separate or exclude potential results. As mentioned above, the way users are interacting with ASFA, as determined from the Google Analytics data, implies they are using the database in a similar fashion to web-based search engines. Much of the discussion in Section 2.3 focused on research about the role Google, Google Scholar, and other web-based search engines play in the information-seeking behaviours of researchers, particularly younger researchers (Nicholas et al., 2017). The conclusions of that research were corroborated by the data analyzed in this project. Numerous librarians mentioned their observations about the impact of web-based search engines at various points in the searching process.

As one example, users believe that they can find information without the assistance of a librarian. Many participants in both the survey and interviews noted that users use the tools available and only seek the assistance of librarians when they are unable to locate the information that they expect to find. Several librarians said that while users believe they can find information on their own, in reality many have very little understanding of search strategies or how best to evaluate search results. There is the perception among multiple participants that users are primarily interested in obtaining information as quickly as possible. For example, one survey respondent stated that "finding something fast is enough" satisfied users. Google Scholar facilitates this outcome through its use of a search and ranking of results based on a relevancy algorithm. Previously published research and observations of participants in this study suggests that reliance on Google Scholar or a similar search service may contribute to the preference for fast, reliable search results.

Because Google Scholar relies on a proprietary algorithm focusing on keywords, the results can be subject to search engine optimization efforts which can skew results. For example, researchers based at the University of California discussed methods researchers could use to boost an article's discoverability in Google Scholar and increase its prominence (Beel, Gipp, & Wilde, 2010). While optimization is not unique to Google Scholar—an Elsevier blog post lists IEEE, PubMed, and Elsevier's proprietary system as

other examples—the ability of publishers and authors to influence search engine results could have an effect on how researchers search for and evaluate information (Elsevier, 2012). Previous research into how users interpret search engine results pages indicates that users believe results that appear higher on the page have more credibility and are selected more often than results on the bottom of or on subsequent pages (Novin & Meyers, 2017; Unkel & Haas, 2017). Academic search engine optimization efforts, then, can lead users to believe certain articles have more credibility than they may deserve and push more relevant or credible materials down a list of publications selected for consideration.

In addition to users assuming that using Google Scholar and other web-based search engines makes them proficient searchers, those tools may also be driving the desire for full-text access as a result of the searching process. Increasing full-text access was one of the most frequent suggestions on how to improve ASFA. Several librarians mentioned that users want immediate full-text results when searching for information. If users are accustomed to instant gratification, their perceptions on database capabilities may be skewed, making them less inclined to use databases that do not match their expectations.

Libraries have implemented discovery layers as one method of encouraging users to consult library resources and not rely so heavily on Google Scholar. As noted in Chapter 2, Dahlen and Hanson (2017) and Foster (2018) discussed the increased use of integrated discovery layers by academic libraries, what impacts they might have on searching, and how the layers are perceived by students and librarians. Integrated discovery layers allow users to search for a range of materials through a single interface rather than conducting numerous individual searches in multiple databases and discovery services (Cowell, Quinton, Pigza, Gravier, & Hinz, 2018). Use of discovery layers has led to more users accessing information resources available through some libraries than previously (Cowell et al., 2018). The interviewees in this study noted that implementation of discovery layers is occurring at both academic and governmental libraries. While discovery layers are designed to allow users to locate information found in library collections and resources available through license arrangements, unintended side-effects may result through reinforcement of search behaviours learned in use of Google and Google Scholar. The

single box search feature offered in Primo or EBSCO Discovery, which mimics a Google search experience, for example, could reinforce Google-like searching behavior (see Figure 82).

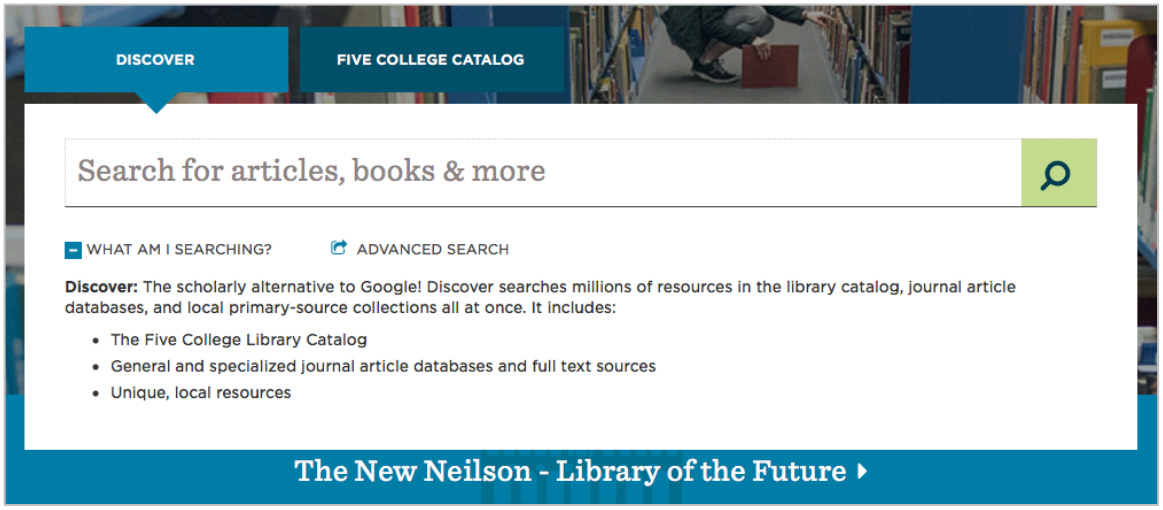

Figure 82. Smith College Library Discovery Layer Search Box (Smith College Libraries, n.d.).

Increased deployment of integrated discovery layers may also give users the impression that they can search all of a library's electronic resources, when only selected databases are included in discovery layer coverage. Interviewee M mentioned that because ASFA is not compatible with the EBSCO discovery layer, the database is not included in that librarian's institutional subscriptions. Some libraries, such as the University of California, Santa Cruz, advise users to search some databases separately, particularly EBSCO databases, as they are not integrated with Primo system (see Figure 83). While ProQuest, the vendor for the ASFA database, owns two discovery layers, Primo and Summon, libraries that select the EBSCO platform may decide, like Interviewee M's institution, to not subscribe to ASFA.

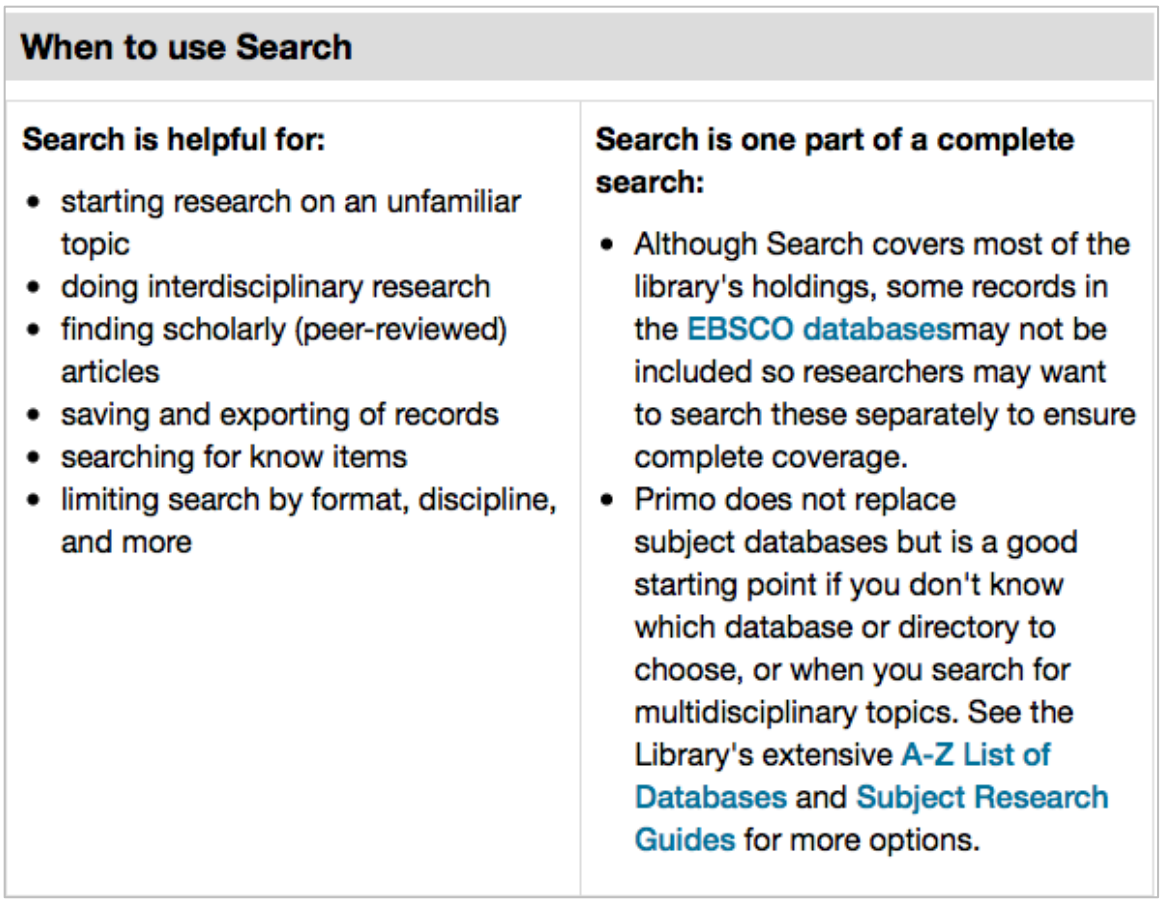

Figure 83. University of California, Santa Cruz Library's Guide on When and When Not to Use their Primo Layer (UC Santa Cruz Library, n.d.).

Searches completed through a discovery layer versus a direct search in ASFA can retrieve different results. For example, a comparative search conducted through the Primo layer available at Dalhousie University Libraries and directly in ASFA generated different results. The search conducted via Primo omitted some records obtained via the direct search in ASFA. In addition, some of the publication descriptions were different. A publication described as a government report in the ASFA record, for example, was listed as a book in the search output conducted through the Primo layer.

Overall, the data obtained in this study suggests that Google's search features appear to have influenced the information-seeking behaviour of users, and also the development of search interfaces of other systems. Both the interviewees and survey respondents noted that while users might be comfortable searching for information, typically they are not as knowledgeable about effective search strategies as they believe they are.

To accommodate widespread search behaviour, the interface to the ASFA database has incorporated Google features, such as the single search box in the basic search option. Whether the implementation of discovery layers contributes to increased retrieval of records from the ASFA database will not be known until evidence, other than obtained in this study, is considered.

5.3 The Impact of the Cost of ASFA and Financial Factors on Subscriptions

In addition to the role of information seeking behaviour and evolving search technologies, cost and financial factors are critical to ASFA's use and number of subscriptions. This study was conducted in part due to a concern by the ASFA Secretariat about declining royalties generated by use of the database. In light of this concern, survey and interview participants were asked to what extent cost is a factor in their database subscription choices. Interview and survey questions were designed to determine the subscription cancellation threshold of participants, as well as to explore whether a country's gross domestic product (GDP) related to usage of the database and subscription patterns.

Both the survey and interview participants stated that cost was a major factor in subscription decision-making processes regarding cancellations and renewals. For example, one interviewee said that subscriptions had previously been cancelled due to steep price increases, and another stated that a sudden price increase can cause an immediate evaluation of whether a subscription should be maintained. Many librarians noted that limited budgets can present challenges in meeting the needs of users. Several pointed out that a substantial portion of collections budgets are allocated to journal subscriptions. For example, Interviewee G stated that journals account for about 80% of their library's collection budget. Rapidly escalating costs of journal subscriptions recently have prompted institutions in many countries to carefully evaluate subscription arrangements and in some instances take collective action. For example, libraries in Germany and Sweden have refused the subscription offers from the publishing giant Elsevier, leading to an impasse that resulted in Elsevier cutting access to journals in both countries in July 2018 (Else, 2018). Outside of these countries, the costs for journal

subscriptions to meet the needs of user communities is also a major issue. As noted in Chapter 2 and the prominence of Google and Google Scholar discussed in Section 5.2, some institutions are finding it necessary to cut database licenses and set priorities for journal subscriptions. One survey participant said that a method needed to be developed to "quantify the benefits" of ASFA in order to justify a continued subscription to those making spending decisions.

Given the number of librarians who stated that cost was a major factor in decisions by their organizations about database subscriptions and recent declining royalties generated by ASFA, a decrease in either usage of the database or the number of subscriptions could be expected. However, the data assembled in this study shows that this outcome has not occurred. As documented in Section 4.1, the number of accounts at academic institutions, particularly in North America, South America, and Asia, rose year by year. While government accounts dropped, the retrievals per account at governmental institutions were higher in 2017 than in 2012. Aside from peaks in 2013 and 2015, usage has not substantially changed since 2012.

Notably, the GDP of the countries selected for analysis does not appear to be a reliable indicator of the cause of subscription or usage changes. The GDP in Brazil, for example, declined from 2012 to 2016, yet the number of ASFA subscriptions within the country continued to rise. In some countries, subscription and usage patterns may have been related to GDP or fisheries production, but consistency was not evident in either across or within regions. Perhaps, if more countries were examined or subscription and usage data were available prior to 2012, a consistent pattern might emerge. However, a consistent relationship between the economic indicators selected in this study and a decrease in subscriptions or usage is not evident.

Factors that might explain the decline in revenue for ASFA (fluctuating currency exchange rates, for example), the data obtained in the interviews and surveys or received from ProQuest do not explain the decreasing royalties. The budget model and the agreement between the ASFA Secretariat and ProQuest were not examined in this study. As mentioned in Chapter 3, the longitudinal data provided by ProQuest, which began in

2012, limits determining long-term trends that included major financial developments such as the 2007-2008 global financial crisis. Longer term trends might explain declining royalties, but in the absence of data an explanation needs to be sought elsewhere. A review of the budget model for ASFA, so as to compare with other databases, is warranted.

5.4 User Perceptions of ASFA

A primary goal of this study was to determine the awareness and understanding of information professionals around the world of the use and value of ASFA. They were asked to describe ASFA usage at their institutions, as well as their views about its key benefits and shortcomings. Their responses provided insights into what distinguishes ASFA from other services, its weaknesses, and potential areas of improvement to help keep the database relevant for users. These insights can assist the ASFA Secretariat in ensuring that ASFA is competitive and a valuable resource for subscribers globally.

One of ASFA's primary strengths, identified by both the research participants and the literature, is its capacity to support finding literature primary and grey within many aquatic sciences and fisheries subjects published around the world. A barrier to grey literature use in public policy is the lack of bibliographic information, in addition to grey literature producers not collaborating or being included in discovery services like A&I databases (Lawrence, 2018). ASFA, through its collaboration with members of the ASFA Partnership, helps alleviate those problems and helps researchers find information. A search in Google Scholar shows that on average in the five-year period from 2013 to 2017, ASFA was cited 179 times per year in studies that used the database to identify relevant literature globally. The search in Google Scholar identified 43 publications that cited ASFA in 2018 (as of 1 October 2018) that included non-English language reports. In a 2018 paper published in *Marine and Freshwater Research*, the authors specifically mentioned searching ASFA for grey literature as the database "provide[d] flexible advanced search options, allow[ed] complex Boolean operators and export search results" (Miller et al., 2018, p. 1213). These options allowed the researchers to be efficient in the searching portion of their project and to focus their attention on the data analysis (Miller

et al., 2018). When asked to describe particularly valuable features of ASFA, Interviewee C also mentioned the advanced search options, such as combining search strings within the database. The ability to construct complex searches and account for different spellings or stemmed words is particularly valuable for researchers seeking information on specific subjects. Exporting the search results helps researchers to track what they have previously reviewed, prevent accidental repetition of search steps, or allow identification of new publications returned in the searching process. With regard to facilitating searching, numerous interviewees mentioned the controlled vocabulary as a key benefit of the database. In contrast to Google Scholar's reliance on words either in the abstract of an article or in the body of the work itself, ASFA uses standardized metadata. This practice supports searching through English and non-English records, retrieve relevant results, and also find related terms or topics. ASFA's thesaurus also contains the taxonomic names of species, which is particularly helpful for researchers (ASFA, n.d.d).

The controlled vocabulary is particularly useful due to the inclusion of grey literature in the database. As mentioned in earlier chapters in this thesis, one of ASFA's primary goals is to facilitate awareness and dissemination of information contained within grey literature. Grey literature can be particularly important in marine policy development, as governments frequently commission studies and reports regarding specific areas of concern. In addition, government departments and agencies publish reports as grey literature in the creation of new guidelines, regulations, or policies (Nikitine, Wilson, & Dawson, 2018; Soomai, 2017). Grey literature can also be valuable to academic researchers. One survey respondent stated that students and faculty rely on locally produced grey literature which ASFA helps to identify. Interviewee E mentioned that researchers with an international focus in their work want a broad range of materials. In addition, as Interviewee D pointed out, grey literature can also help disseminate the research output of low-income food deficit countries (LIFDC), especially if the research is written in the local language. One survey participant echoed this sentiment, saying:

> The impact of grey literature by developing countries is growing in ASFA, unlike in commercial databases. The possibility to follow the research from many

> countries using the materials, which were not widely distributed earlier, gives a push for further research in both comparative studies and retrospective analysis.

As these comments show, ASFA's inclusion of grey literature promotes the work of developing or LIFDCs to reach wider audiences beyond local readers. As the survey participant mentioned, the grey literature records in ASFA can spur further research when there is interest in the grey literature available in the database.

While ASFA focuses on creating metadata and disseminating grey literature, gaps do exist in the database. Because ASFA relies on national partners to contribute to the database, grey literature created by organizations like the World Wildlife Fund or other local, environmental non-governmental organizations (NGO) is often not collected and therefore not included in records submitted to ASFA. If a country leaves the ASFA Partnership, as Australia did in 2015, records of relevant publications may not be prepared and submitted. Several participants suggested expanding the Partnership to capture more of the information being produced globally. Overall, the participants appeared to value ASFA's inclusion of grey literature and identified grey literature as a reason that their organization subscribes to the database.

While ASFA's inclusion of grey literature is considered a strength, the participants also identified areas where ASFA is not meeting user expectations. The most frequently mentioned feature by both survey and interview participants concerned the lack of full-text access to publications, especially the grey literature. The participants stated that users are accustomed to rapid access to information, which explains the appeal of Google and Google Scholar. According to many librarians, users do not want to take extra steps to locate materials. While ASFA does include full text access to some publications, such access is not consistent for all materials and broken links may occur in some records. The lack of full text is particularly noticeable for papers in academic journals. Subscribing organizations can invest in link resolvers that direct users to the full-text copies of publications, but resolver software is expensive. For example, at a major Canadian research university, the annual cost for the link resolver is between $15,000 and $20,000, in addition to the implementation costs and the salary of the staff member who maintains it (H. MacFayden, personal communication, September 4, 2018). The link resolvers also

are primarily focused on providing connections to commercially published literature, which means users need to take additional steps to locate other types of publications. The suggestion of participants to find a way to increase full text access when possible could encourage users to use and continue to use the database.

Overall, a majority of survey and interview participants see ASFA as a valuable resource for themselves and their user communities. They identified ASFA as containing unique sources of information not findable elsewhere. Participants who worked at organizations producing information acknowledged ASFA's role in disseminating difficult-to-find information to wider audiences, as well as serving as a resource to locate documents. For many librarians, ASFA serves a vital purpose in the global information landscape, one that other resources would not be able to replicate if ASFA were to cease operation.

5.5 Potential Impact If ASFA Ceased to Exist

To determine the outcome should ASFA cease to exist, both the survey and interview participants were asked to comment on the potential impacts of that scenario. Many of the respondents said that ASFA's closure would negatively affect both them and their users for a variety of reasons. The participants particularly emphasized that the closure of ASFA would result in a loss of information available to researchers. As stated in the previous section, inclusion of grey literature not findable elsewhere was a commonly cited benefit of ASFA. Other databases may monitor and include records from a similar list of journal titles, but they do not have access to ASFA's partners and the grey literature they monitor and include in ASFA. This point was highlighted by Interviewee A who stated that ASFA's closure could create a problem for users trying to find different types of grey literature. While international repositories are available, such as Aquatic Commons or Ocean Docs, they lack the coverage of ASFA and are more focused on serving to store materials rather than provide a systemic description of the information. Those repositories are also mostly dedicated to technical reports or historical literature and do not include more recent publications that are hosted elsewhere. Without the support of the ASFA Partnership, former members will likely lack the resources to

disseminate information about the research their countries and institutes conduct to a wider audience.

Awareness about publications produced around the world is likely to drop in concert with the loss of information if ASFA were to close. As noted above, ASFA is unique in collecting and disseminating information produced globally. Without the database, students, researchers, and managers would lose easy access to documents or would no longer become aware of research conducted in many other parts of the world. For example, Interviewee L said that their "organization would miss out on grey literature from other parts of the world in fisheries, aquaculture, socio-economics of fish, water environment and many more." According to one survey respondent, a local affect could also occur: "Researchers would be much less aware of the existence of locally produced publications." Several survey and interview participants said that losing ASFA would lead to their users relying more heavily on Google or Google Scholar or non-subject specific databases. This outcome could lead to less effective searching that might result in missing relevant documents or resources. Searching would also become less efficient, as a larger investment of time would be needed to locate materials through conducting searches in several databases to achieve the same coverage as ASFA.

Finally, the data also suggests that ASFA's closure would disproportionally affect smaller institutions and developing or LIFDCs that access the database. Interviewees from Asia and Africa stated that closing ASFA could have negative consequences for their organizations and their users. Interviewee D said that losing ASFA would hurt developing countries that rely on the database to help distribute their research output. Interviewee J stated that losing ASFA would cause significant problems for organizations outside the United States that rely heavily on the database. One survey participant indicated that most commercial databases are priced outside what the organization can afford, meaning that institution heavily relies on ASFA to meet the research needs of users. Another said that when other databases were cut due to costs, ASFA was retained because it was essential to the work of the institution. Organizations that can afford multiple databases in one subject might not feel the loss of ASFA quite so keenly, aside from an increased inconvenience in searching, but the demise of the database could lead

to substantial difficulties for others. Additional research on the impact of ASFA closing on organizations outside of North America and Europe may be required to substantiate this theory, but it appears that ASFA being discontinued would particularly harm areas of the world the Partnership was designed to help.

Overall, from the standpoint of information professionals, ASFA is a valuable resource whose closure would have multiple negative impacts on the marine science community. The subscription data appears to suggest a continuing market for the database and usage has not substantially changed since 2012. While the Google Analytics data implies that users might not be interacting with the database to its fullest potential, they spent more time on ASFA tagged pages in 2017 compared to 2016. Although it is too early to fully evaluate the impact discovery layers may have on usage of the database, the implementation of these search technologies may draw increased attention to the more than two million records in the ASFA database and, therefore, the search technologies should be included in future research.

Chapter 6: Conclusions

This chapter summarizes the key findings from this research project based on the data analysis in Chapter 4 and the discussion in Chapter 5, as well as revisits the research questions first posed at the end of Chapter 1. The chapter then presents recommendations for the Aquatic Sciences and Fisheries Abstracts (ASFA) Secretariat arising from the research objectives, namely, to conduct a user study from the perspective of users, undertake an updated content comparison study between ASFA and other databases, increase efforts to promote the database, and revisit the licensing agreement with ProQuest.

6.1 Key Findings and Conclusions

6.1.1 ASFA's Place in Current Aquatic Research and Management

One of the primary goals of this project was to assess ASFA's place in present day aquatic research and management. Part of this process involved identifying ASFA's main subscribers and if variations exist based on geographic region of the world. The analysis of usage data provided by ProQuest, presented in Section 4.1, shows that academic institutions, particularly universities, are the primary organizations subscribing to ASFA. The three top account types in 2017 were all academic, with both community colleges and non-PhD granting universities in particular showing substantial growth over the 2012 to 2017 period. While this subscription pattern may be due to the global number of universities relative to the number of government institutions with aquatic and/or marine science libraries, universities and community colleges appear to be the main growth sector for the ASFA database. Because the data combined subscribers for both ASFA as a single resource with institutions that subscribed to a bundle of databases including ASFA, it is difficult to determine the reason for growth. On a country level, the United States, Brazil, Taiwan, and China have the most subscribers, with the United States the overall leader. A marked increase in the number of accounts is seen in Taiwan in 2017 compared to 2016. Regionally, North America and the Caribbean had the most accounts, primarily held by institutions in the United States. Australia and the Pacific and Europe were the only regions to see a decrease in the number of accounts from 2012 to 2017.

While academic institutions may be the primary subscribers to ASFA, the data showed that they were not the primary users. When analyzed according to the Ringgold tier, users in governmental organizations accessed the database at a higher rate than users at other types of organizations. Despite the number of government accounts decreasing from 2012 to 2017, the total average retrievals per account (RPAs) grew. As mentioned in Chapter 5, this usage activity was not an isolated trend in one region. Furthermore, while A2 (community colleges and technical colleges) accounts in the United States were a growing share of the types of subscribers, the total average RPAs for the A2 account type was among the lowest in the academic groups. This discrepancy leads to question why are these institutions subscribing to ASFA? More detailed data, not available in this study, is needed to determine how many of the A2 accounts are based in organizations subscribing to ASFA due to licensing a bundle versus organizations that acquire a license to the database due to the interests of faculty and students for access to information about marine science subjects.

While the number of subscribers has increased substantially since 2012, usage of the database has not. Despite more people receiving access to the database, they are not taking advantage of it. As noted in the previous paragraph, the rise in accounts may be due to more organizations subscribing to a bundle that includes ASFA rather than because organizations offer educational programs or pursue research where ASFA would be a benefit. The rise in public library accounts in the United States also lends credence to this theory, but data not available in this study are needed to investigate why public libraries are subscribing.

No consistent trends were found in the attempt to determine a relationship between economic indicators (gross domestic product (GDP), fisheries production, and population) and subscriptions to or usage of ASFA. While this relationship test merited consideration, the data suggests that changes in usage and the number of subscribers are independent from changes in GDP, fisheries production, or population. GDP in particular is not a reliable indicator, as the situation with Brazil—where GDP decreased and ASFA subscriptions increased for the period of time studied—showed. Although a better indicator to explain changes in ASFA subscriptions and use may be a country's

investment in research or post-secondary education, these data were not consistently available from the World Bank Open Data Bank for each year of the available longitudinal data. Future research could consider these variables, if the data become available.

Several librarians stated in responses to questions in the survey and interviews that members of their communities are aware of ASFA and find the information it contains valuable. Interviewee G at a North American university, for example, said that ASFA is one of the databases researchers at that institution are most aware. While policy makers were only identified by two interviewees among their core user communities, the higher number retrievals at government institutions compared to academic accounts may mean that individuals involved in management and policy development as well as researchers in government units are accessing the database. Overall, the longitudinal usage data provided by ProQuest and the responses to survey and interview questions indicates that ASFA continues to fulfil an important role in aquatic science research and management globally.

6.1.2 Does ASFA Meet Information Needs?

The second main goal of this research was to assess if ASFA met the information needs of users or whether other resources are better products. Because this study focused on the views of information professionals, they were asked in both the surveys and interviews to describe their observations of users interacting with resources like ASFA or other abstracting and indexing databases. They were also asked if they have observed any recent changes in information-seeking behaviour related to searching activity. According to responses obtained in both the interviews and the survey, users appear to operate under the belief that they are fully capable of finding information on their own and they rely heavily on Google and Google Scholar. Interviewee G, for example, said that fewer questions are currently received from users but questions that are directed to librarians are more complex than before and take longer to address. The librarians also noted that today's users appear to be more impatient when searching for information, wanting results as quickly as possible. One survey participant commented that users "expect

access to content immediately." According to various participants, ease of use, wide availability, and the desire for full text access are key reasons that users rely on Google and Google Scholar. Neither Google or Google Scholar provide access to publications behind paywalls, however.

The widespread availability of Google and Google Scholar and its impact on the searching practices were mentioned frequently. Interviewee E, based in North America, lamented that libraries' move to employing a single box discovery layer to emulate Google would have a negative impact on searching behaviour. For this librarian, the single box searching experience taught users to rely on habits formed from searching Google rather than more systematic searching that takes advantage of a database's built-in advanced features to locate information. As discussed in Section 5.1.1, the Google Analytics data suggests that users may not be using ASFA in a way that maximizes its capabilities. This conclusion, combined with the librarians' observations reported in both the survey and interviews about how users interact with information, could reflect overall changes in information-seeking behaviour independent of usage of ASFA. The rise of web-based search engines like Google and Google Scholar has influenced the development and implementation of discovery layers, further affecting how individuals seek information.

In terms of other resources that exist to help users find information, Google Scholar and ResearchGate, a social network site designed to connect researchers and share information and publications, were the most frequently mentioned by survey and interview participants as sites that users commonly consult (ResearchGate, 2018). The attraction of both sites is the immediate and free access to information, although as noted above, publications behind paywalls are not accessible via either resource. With regard to sharing information about new publications or researchers, librarians mentioned that researchers communicate amongst themselves via social media in addition to more traditional forms of communication, such as word of mouth. The participants in this study did not directly mention websites like SciHub that allow users to download a wide variety of scholarly literature, including paywalled articles (Himmelstein et al., 2018), but one interviewee noted that users want information and do not necessarily care if they obtain it

legally. Other equivalent databases mentioned by participants included Oceanic Abstracts and Fish, Fisheries, and Aquatic Biodiversity Worldwide (FFABW), in addition to more general databases like Scopus and Web of Science. While numerous librarians said that they encourage their users to search a wide range of databases for information, many of acknowledged that ASFA serves as an important resource that contains unique information not found elsewhere. Both Interviewee H and Interviewee L, from Asia and Africa respectively, specifically mentioned that the inclusion of grey literature not found elsewhere is what helps set ASFA apart from other databases.

With unique features of ASFA in mind, the potential loss of ASFA was viewed by many to have negative consequences on the aquatic sciences research and management community. Even librarians like Interviewee I, based in North America, whose library does not subscribe to ASFA, said that closure of the database would harm many institutions around the globe. As discussed in Chapter 5, this loss would disproportionately impact organizations with limited access to other resources. ASFA ceasing to exist would also negatively impact researchers publishing in non-English languages, as their output is discoverable through the ASFA database and can be used to promote their country's research programs. The librarians themselves recognized that ASFA closing would make their jobs more difficult. Instead of being able to consult one database that contains records to a large volume of grey literature from around the world, they would have to consult multiple other resources. This outcome would occupy time that could be spent on other tasks such as assisting more patrons with their requests. Overall, the consensus from both survey and interview participants was that while ASFA needs to continue to adapt and remain relevant, its closure should be avoided if at all possible.

6.2 Recommendations

This research project was conducted in collaboration with the ASFA Secretariat as one component of a larger impact evaluation. The following recommendations are based on the data collected and analyzed, as well as consideration of several limitations faced in this study.

6.2.1 Conduct Additional User Studies

This research project focused primarily on usage data and the perspectives of information professionals located throughout the world about ASFA. Based on the responses received from the librarians, particularly in the interview portion of the study, there appears to be a difference between how the librarians use the database and how their user communities interact with ASFA. While these observations, combined with the Google Analytics data, provide some general insights, a more comprehensive study about user behaviour should be conducted by the ASFA Secretariat. The follow-up study would provide additional data for the ASFA Secretariat to consider in the wider impact evaluation, such as whether there are differences in how individuals in different types of organizations use the database, or how ASFA's potential closure might impact them. While the data collected from survey and interview participants are informative, the data provide indirect observations about searching activities by users of the database. A direct study of user interactions with the database would complement the current research and give the ASFA Secretariat a fuller understanding of use perceptions of the database.

Any follow-up research should involve users from diverse backgrounds and geographic regions. Because ASFA is a global resource with subscribers in a variety of places and institutions, ensuring that users represent that spectrum is important. Additional studies should also address one of the limitations of this study, which would be to include individuals in organizations that receive ASFA on CD/DVD. Because the survey was distributed through ProQuest to the company's list of subscribers, institutions receiving the CD/DVD version of ASFA were not included in the study. Surveying or interviewing these users might offer additional unique perspectives on the value of ASFA, as well as provide information on how users from low income food deficit countries (LIFDC) search for information that could shape the ASFA Secretariat's decisions. The study might focus on the resources the users regularly access and how frequently, tracking searching behaviour over a period of time, as well as determining the subjects of interest to users. A future study, which could be conducted separately from the impact evaluation, could take the 2011 study by Kules and Capra a step further and determine if any long-

term changes to information seeking behaviour resulted from training on how to use databases like ASFA (Kules & Capra, 2011).

Another related study that the ASFA Secretariat might consider would determine why the types of organizations that are subscribing to ASFA in increasing numbers are not accessing the resource to any significant degree. As noted in Chapters 4 and 5, public libraries and community/technical colleges are subscribing to ASFA in larger numbers, but usage remains low. None of the librarians interviewed or surveyed in the current study worked in either of these types of organizations, leaving the question unanswered as to why subscriptions by these organizations are increasing. Understanding why there is growth in these particular market segments could aid the ASFA Secretariat in future outreach and promotional efforts, potentially increasing both awareness and use.

To assist in identifying potential users to conducting the additional studies, the ASFA Secretariat could partner with International Association of Aquatic and Marine Science Libraries and Information Centers (IAMSLIC). IAMSLIC represents librarians serving the aquatic sciences community around the world and in a variety of institutions. Currently, IAMSLIC coordinates with the ASFA Secretariat in sharing the metadata from entries in the Aquatic Commons (Kalentsits & Gribling, 2013). Through these efforts and working to serve the aquatic sciences community, IAMSLIC is already familiar with the content and value offered by ASFA and may have an interest in improving the database and ensuring its continuation.

6.3.2 Conduct a Content Comparison Study

In addition to a more comprehensive user study, the ASFA Secretariat could conduct a content comparison analysis between ASFA and comparable databases such as Oceanic Abstracts or FFABW. Two studies by Parker (2005) and Brown (2007) were mentioned in Chapter 2 in conjunction with the overview of previous research about ASFA. While Parker's study was a straightforward content comparison, measuring the overlap in results between ASFA and several non-aquatic sciences specific databases, both studies examined the content included or not included in the ASFA database. More recent comparative studies have not been conducted, however, meaning there is no current

assessment on how ASFA compares to other databases to reflect developments over the past decade since the Parker and Brown studies.

For a new content comparison, both specific aquatic sciences and more general databases should be included. One study could examine how ASFA compares with a potentially competing product, like FFABW which is administered by EBSCO, or Oceanic Abstracts, which is another ProQuest product. Organizations with a focus on aquatic sciences on a limited budget may choose to only subscribe to one of those databases and understanding how ASFA compares to them regarding both commercially-published and grey literature could help with future promotional efforts of ASFA. Comparing ASFA with more general databases like Web of Science, Scopus, or Zoological Records could provide additional insights about what content distinguishes ASFA as a database. A list of what is or is not included in ASFA or related databases could also be used as a marketing or promotional tool. Because ASFA monitors and includes records for publications produced around the world, this feature could be used to attract users with an international focus like the academic researchers in the academic community identified by Interviewee E. An analysis of how ASFA compares with other databases could show how it is unique and help to draw potential users' attention to it.

The content comparison could also be used to identify, should ASFA cease to exist, what publications or types of publications might be missed by remaining databases. If the ASFA Secretariat relies on external funding, other than royalties based on usage, this comparative analysis could be used to highlight what might be lost if the ASFA database ends operation. Given that ASFA closing or ceasing to operate in its current form might occur, being prepared takes on extra importance. While ASFA closing is not the desired endpoint to the larger impact evaluation, and the data in this study do not support closing the database, being able to identify the possible consequences in advance could lead to efforts to minimize the possible harms or identify alternatives to closing.

6.2.3 Consider New Promotion and Outreach Options

Related to the suggestion in Section 6.2.1 of determining why organization types with rising subscription rates show low use, the ASFA Secretariat should consider new

promotion and outreach efforts. Given that the number of accounts has been increasing since 2014 in various parts of the world but use has remained static, information about ASFA seems not to be reaching potential users. In the survey and interview responses, most of the participants identified what makes ASFA a unique resource from their perspective. They also discussed their own efforts to connect users to the database and encourage them to take advantage of it. There is room, however, for a change of promotion on the part of ProQuest and the ASFA Secretariat to encourage new users and to highlight the variety of materials and topics ASFA covers.

This recommendation is based in part on the frequent comments made by both survey and interview participants regarding the lack of full text. As discussed in Section 5.4, ASFA does contain the full text of some of the grey literature documents. While it is not consistent for all documents—some of the older materials do not appear to be included, and there were some broken links—ASFA does provide users with full text access in certain cases. Increasing the visibility and awareness of the full text that is already included in the database might encourage users to access ASFA when searching for information about marine science subjects. Combining this effort with initiatives to increase awareness of ASFA by newer subscribers might lead to an increase in use among academic accounts and should be worth considering.

In addition to focusing promotion and outreach efforts on the full text options within the database, the ASFA Secretariat and ProQuest could also promote the breath of materials included. When commenting on the situations in which ASFA is recommended, Interviewee C, an academic librarian in North America, stated that ASFA is used "mostly for my biological oceanography and marine biology people. … If they're off in other fields like climate or geoscience, I'm not gonna mention ASFA." While ASFA's "About" page on the ProQuest website lists climate change, along with policy and legislation, sanitation, and public health, Interviewee C's comment might reflect a more wide-spread misunderstanding of when the database should be consulted (ProQuest, 2018). A search of the ASFA database on September 20, 2018 by the author shows over 170,000 records with some reference to climate change in either the title, abstract, or controlled

vocabulary. Potential promotional and outreach efforts to librarians should include the diversity of topics that ASFA covers.

Other promotional efforts should find new ways to appeal to users. In the interviews, multiple librarians said that they promote ASFA among their user communities in training sessions, in email messages, and on their websites. Interviewee C suggested that in addition to these strategies, ProQuest might consider creating brochures or handouts that subscribers can give to searchers. This librarian said that the resources to create materials to distribute to users are not available locally, and that while LibGuides, commonly available in many libraries to provide readily accessible guidance about searching for information in many domains, are helpful, brochures or similar printed guides to give to users might be more useful. These products could be part of a larger promotional effort by ProQuest to encourage database use. Creating and providing materials to librarians could be an immediate course of action while the ASFA Secretariat considers the next steps in the larger impact evaluation.

6.2.4 Review the Budget Model and the Agreement with ProQuest

The final recommendation to come from this study encourages the ASFA Secretariat to review the budget model for the database including its agreement with ProQuest. As was stated earlier, while the larger ASFA evaluation project was initiated due to declining royalties, the current study did not include consideration of the financial operation of ASFA. The data assembled in this study shows that while the number of accounts has been increasing, usage has remained mostly stable from 2012 to 2017. If ASFA is to continue as a commercial database, reviewing the budget model in light of the conclusions of this study should be the next step in the larger evaluation of ASFA. The ASFA Secretariat should keep several factors in mind in implementing this recommendation. The first is to examine how bundling of ASFA with other databases in ProQuest's subscriptions might impact royalties. When asked if their organizations subscribed to ASFA via a bundle, a majority of respondents to the survey said that they subscribed to at least one of the bundles that includes ASFA. Database bundle arrangements that include ASFA may be an important method for increasing the number

of subscriptions to the database. Thus, reviewing the revenue model in relation to bundling or single database subscriptions may be needed.

Another factor the ASFA Secretariat should consider is how the implementation of discovery layers might impact revenue. As discussed in Chapter 5, libraries are increasingly implementing discovery layers to aid users in their searches by drawing attention to locally available items in the library's holdings. Interviewee B, who works at a governmental institution in North America, stated that the Summon discovery layer has been implemented in national science departments. According to this librarian, the ASFA database is integrated with the larger information system and the output of searches through Summon should include ASFA records when relevant. Because discovery layers are playing a larger role in how libraries enable searching processes and present information to users, the impact of the discovery tools on the royalty arrangements should be considered. The ASFA Secretariat should also keep in mind that the increasing deployment of discovery layers may limit subscriptions to ASFA by some institutions. Interviewee M, a librarian based in the Australia and Pacific region, noted, for example, that institutions may not subscribe to ASFA if it is not compatible with a discovery layer. The current options for accessing ASFA include a subscription, being an ASFA Partner, or receiving the database on CD/DVD. A lower cost or free version of the database could potentially increase use by organizations hampered by limited resources. Interviewee H, based in southeast Asia, suggested that ASFA and ProQuest consider offering a smaller version of ASFA targeted at fisheries schools which are not be able to afford a subscription to the full database. The current pricing structure for ASFA may prohibit subscriptions by organizations in the developing world and limit their exposure to information that could be beneficial to them. A revised budget model for the database could include a low-cost option as well as distribution of the database on CD/DVD.

6.3 Concluding Remarks

The ASFA database is a unique resource for aquatic sciences and aquaculture, containing information on a diverse range of publications generated around the world. For information professionals, even those whose organizations do not subscribe to ASFA, it

represents a valuable source of information and one that would be missed should it close. There is room for improvement and growth, however, if the ASFA Secretariat chooses to continue offering the database. In the event that closure is implemented, users globally would experience a significant loss of information access and awareness that unavailable by other sources.

The research approach adopted in this study could be applied more widely in the information management field. The suite of data sets obtained through the mixed methods methodology provided detailed insights about database usage at regional and global levels. The results show the effects that Google, integrated discovery layers in library systems, and other search engines can have on information seeking behaviour in usage of specialized databases like ASFA. Such findings for other databases could be particularly informative for information professionals conducting evaluations of subject specific databases. Determining usage patterns and users' understanding of specialized information sources would provide evidence for decision-making processes for database subscriptions. This study amply demonstrates the value of a mixed methods research methodology for such evaluation work.

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Appendix A: Pilot Interview Protocol

Organizational background – To get started, I'd like to discuss your organization and the community you serve.

- What are the main communities that make up your organization's user base?
- What are the most frequent types of information requests of the community? (for example, reference searches, finding materials, etc.)
    - If you serve multiple communities, please identify the most frequent types of information requests for each one.
- How do your organization allocate resources to meet these types of information requests?
- How does your organization respond to these types of requests from patrons? For example, this could include conducting reference searches, creating LibGuides, etc.
- Are there challenges in responding to the information requests of your organization's community? (In relation to staffing? Budgeting? Time?)
    - What are these challenges?
- Is your organization part of a consortium?
    - If yes, how does it function?

Database Subscriptions – I'd like to move on to discuss the databases your organization subscribes to and the decision making process around selecting them.

- Can you tell me about the database vendors that your organization uses?
- How does your organization choose which databases to subscribe to?
- Approximately how many database services does your organization subscribe to?
    - How does the subscription process generally work?
    - What is the typical length of the term of a subscription?
    - Can databases be subscribed to individually?
    - Is there a negotiation process between your organization and the vendor?
- (If they answered that their organization is part of a consortium) Does being a part of a library consortium influence database subscription choices?
- Does your organization track usage of databases?
    - (if yes) What methods does your organization use?
    - How does it collect this data?
    - What is the data collected used for?

Database Evaluation – I'd like to move on to discuss how your organization evaluates databases it subscribes to or is considering subscribing to.

- Is there a process used to evaluate databases offered by a) different vendors and b) services offered by the same vendors?
    - What factors are used in evaluating databases?
    - How often are databases evaluated?
- How are you involved in the process of evaluating databases for subscription or renewal?

Abstracting & Indexing– We've now concluded the section on evaluation. I'd like to turn to a discussion on abstracting and indexing.

- Does your organization subscribe to A&I services? Tell me more.
- Over the last month, how frequently did you access A&I services in the course of your job?
    - Is that typical?
    - Why are you using A&I services in these cases?
- What are the benefits to using an abstracting and indexing service?

I'd like to turn our attention now to a specific database, the Aquatic Sciences and Fisheries Abstracts (ASFA). This database is compiled by the Food and Agriculture Organization of the United Nations and made accessible worldwide by ProQuest.

- Does your organization subscribe to ASFA?
    - If yes,
        - How long has your organization subscribed to ASFA?
        - What are the key features that ASFA offers?
        - Do you use other information sources aside from ASFA to meet marine science information requests?
        - If your organization subscribes to ASFA, does it meet the information requests of your community?
            - If yes, how?
            - If no, what could be implemented to meet those needs?
        - Do you recommend ASFA to users as a resource when providing information about services the organization offers?
            - To what extent do you think your user community is aware of ASFA and takes advantage of it?
    - If no, what information sources do you use to meet the marine/fisheries information requests of your community?
- In the event that ASFA were discontinued, what impact would that have on your organization and your users?
- In light of the questions I have asked, do you have anything further that you would like to add with regard to abstracting and indexing services or ASFA in particular?

Thank you for your participation in this interview.

Appendix B: Faculty of Management Ethics Approval Letter

DALHOUSIE UNIVERSITY
Inspiring Minds
Faculty of Management

Faculty of Management Graduate Student Ethics Approval for a Course-based Project

August 11, 2017

Diana Castillo,

I am pleased to inform you that I have reviewed your project **"Abstracting and Indexing, Grey Literature Discovery, and Database Evaluation" (file no. 080817),** for the course INFO6700 (Reading Course) under the supervision of Dr. Bertrum MacDonald, and have found the proposed research involving human participants to be in accordance with the *Faculty of Management Ethics Review Policy for Course-based Projects* and the *Tri- Council Policy Statement on Ethical Conduct for Research Involving Humans (TCPS2).* This project has received ethics approval.

This approval will be in effect until and not exceeding December 25, 2017 (fourteen days from the final date of classes for the 2017 Dalhousie Fall Semester). It is your responsibility to immediately report any adverse events involving participants to both your instructor and to the Research Ethics Officer. Please note that any significant changes to the research methodology, consent form or recruitment materials must be resubmitted to Research Ethics Officer for review and approval prior to their use.

Congratulations on your successful Faculty of Management Graduate Student Ethics Approval for your Course-based Project. I wish you all the best as you begin this next phase of your research. Should you have any questions regarding ethical issues at any point during your project, please do not hesitate to contact me.

Sincerely,

Ashley Cummiskey (Doyle)
Faculty of Management Research Ethics Officer
Rowe 2029
Dalhousie University
PO Box 15000, Halifax, NS B3H 4R2
a.doyle@dal.ca

Appendix C: Dalhousie Social Sciences & Humanities Research Ethics Board Letter of Approval

Social Sciences & Humanities Research Ethics Board
Letter of Approval

September 21, 2017

Diana Castillo
Management\Information Management

Dear Diana,

REB #: 2017-4305
Project Title: Meeting Information Needs in Marine and Aquatic Sciences: A Case Study of the Use of the International Aquatic Sciences and Fisheries Abstracts Database

Effective Date: September 21, 2017
Expiry Date: September 21, 2018

The Social Sciences & Humanities Research Ethics Board has reviewed your application for research involving humans and found the proposed research to be in accordance with the Tri-Council Policy Statement on *Ethical Conduct for Research Involving Humans.* This approval will be in effect for 12 months as indicated above. This approval is subject to the conditions listed below which constitute your on-going responsibilities with respect to the ethical conduct of this research.

Sincerely,

Dr. Karen Beazley, Chair

Appendix D: Survey Protocol

The following version of the survey was submitted with the application for ethics approval.

Note: The online survey in Opinio will begin with the consent form. Participants will only be able to complete the survey if they give consent. In the Opinio survey some questions will be set to branch, depending on the response options that a participant selects.

1. It is your decision whether you want to take part in this research project. Even if you do, you can leave the study at any time for any reason without any negative consequences. Since no personal information will be collected, the survey responses will not be identifiable and cannot be withdrawn after they have been submitted. All information given in this survey will be kept private. When this data is used in the thesis, all quotations will be attributed anonymously. This means that it will not be possible for you to be identified. Thank you for assisting with this research. Please read and confirm the following in order to start the survey. I understand what I am being asked to do and my questions about the study have been answered. I agree to take part in this study. I know that participating is my choice and that I can leave the study at any time.

   Yes
   No

2. Which of the following options best describes your organization? (Please check all that apply)
   University/college/institute of higher education
   Research centre
   Government office
   Private sector
   Other (Please describe) _____

3. Which of the following options best describes the user community you serve? (Please check all that apply)
   Students
   Professors
   Researchers (non-faculty)
   Government staff
   Others

4. Which country is your organization located in?

   _____

5. What is the approximate size of your user community? (Number of students, non-faculty researchers, faculty, government staff, etc.)

   _____

6. Do you work in a library or information centre?
   Yes
   No

7. (If yes to question 6) What is the approximate number of staff at the library or information centre? _____

8. Does your organization either specialize in or study marine sciences, fisheries management, or aquaculture?
   Yes
   No

9. Approximately how many bibliographic databases does your organization subscribe to or have access to?

   _____

10. What is the typical period of database subscription used by your organization? (Year to year vs multiple year subscriptions?)

11. How often does your organization evaluate databases or database packages considered for subscription or renewal purposes?

12. What process does your organization apply in evaluating databases that are being considered for subscription or renewal? (open-ended response)

13. In decisions about database subscriptions, to what extent is cost a factor? (open-ended response)

14. Does your organization record database usage?
   Yes
   No

15. (If yes to 14) What methods do you use to collect database usage statistics? (open-ended response)

16. (If yes to 14) What do you use the data collected for?

17. Which of the following ProQuest Packages does your organization subscribe to? (check all that apply)
   Earth, Atmospheric & Aquatic Science Database
   Natural Science Collection

SciTech Premium Collection
None
Other _____

18. Does your organization subscribe to ASFA as an individual database or as part of a database package?
    Individually
    Part of a package

19. Are you familiar with the Aquatic Sciences and Fisheries Abstracts (ASFA) database?
    Not at all
    Somewhat familiar
    Familiar
    Very Familiar

20. What marine sciences, fisheries management, and/or aquaculture databases does your organization subscribe to or have access to? (open-ended response)

(The following questions apply if "somewhat", "familiar", or "very" were selected for question 19)

21. Why does your organization subscribe to ASFA? (Please select the most appropriate)
    It was included in a database bundle
    The organization's research focuses on marine science, fisheries management, and/or aquaculture
    The organization offers a program on marine science, fisheries management, and/or aquaculture
    Other (please explain)

22. How long has your organization subscribed to ASFA?
    Less than a year
    1-5 years
    6-10 years
    11+ years
    Do not know

23. Is your organization a member of the ASFA Partnership?
    Yes
    No

24. (If no to 23) If you answered no to the previous question, please explain why your organization is not part of the ASFA Partnership. (open-ended response)

25. Do you use databases or other information sources that offer similar features or resources as ASFA?
    Yes
    No

26. (If no to 25) Why do you only subscribe to ASFA? (Please check all that apply)
    ASFA is enough
    Budget constraints
    No other demand from users
    Similar databases aren't included in packages
    Other (please specify)

27. (If yes to 25) If you answered "yes" to the previous question, please list the information sources you use. (open-ended response)

28. In your experience, have your users' information seeking behaviours changed in the last five years? (For example, using Google more, how often they ask you for information, etc.)
    Yes (please explain below)
    No (please explain below)
    Do not know

29. Is the increasing availability of open access information changing the expectations of your user community?
    Yes (please explain below)
    No (please explain below)
    Do not know

30. Does ASFA in its current form meet the information requests of the community you serve?
    Yes (please explain below)
    No (please explain below)
    Do not know

31. From the beginning, the ASFA database has included records for grey literature (i.e. information that is not produced by a commercial publisher) due to the difficulty of locating this form of literature worldwide. Have you found this feature of ASFA to be helpful?
    Yes (please explain below)
    No (please explain below)
    Do not know

32. The ASFA Board is interested in enhancing the ASFA database. Based on your experience what improvements would you recommend? (open-ended response)

33. ASFA is currently available via subscription from ProQuest. Does this arrangement meet the needs of your user community? (open-ended response)

34. If ASFA were not available, what would the implications be for your organization? (open-ended response)

35. In light of the questions I have asked, do you have anything further that you would like to add with regard to abstracting and indexing services or ASFA in particular? (open-ended response)

[The following text will be presented at the end of the survey]

Thank you for completing this survey. If you would like to read a summary report of the final project, please watch the Environmental Information: Use and Influence website (www. eiui.ca) starting in April 2018.

Appendix E: Interview Protocol

[Note: Prior to beginning the interview, participants will review the consent form and given time to ask questions about the project and the interview process. Only once participants have asked all their questions and signed the consent form will the interview begin.]

Organizational background – To get started, I'd like to discuss your organization and the community you serve.

- What are the main communities that make up your organization's user base?
- What are the most frequent types of information requests of the community? (for example, reference searches, finding materials, etc.)
    - If you serve multiple communities, please identify the most frequent types of information requests for each one.
- How do your organization allocate resources to meet these types of information requests?
- How does your organization respond to these types of requests from patrons? For example, this could include conducting reference searches, creating LibGuides, etc.
- In your experience, have information seeking behaviours changed in the last five years? If so, please explain.
- Is the increasing availability of open access information changing the expectations of your user community?
- Are there challenges in responding to the information requests of your organization's community? (In relation to staffing? Budgeting? Time?)
    - What are these challenges?
- Is your organization part of a consortium?
    - If yes, how does it function?

Database Subscriptions – I'd like to move on to discuss the databases your organization subscribes to and the decision making process around selecting them.

- Can you tell me about the database vendors that your organization uses?
- How does your organization choose which databases to subscribe to?
- Approximately how many database services does your organization subscribe to?
    - How does the subscription process generally work?
    - What is the typical length of the term of a subscription?
    - Can databases be subscribed to individually?
    - Is there a negotiation process between your organization and the vendor?
- (If they answered that their organization is part of a consortium) Does being a part of a library consortium influence database subscription choices?
- Does your organization track usage of databases?
    - (if yes) What methods does your organization use?
    - How does it collect this data?
    - What is the data collected used for?

Database Evaluation – I'd like to move on to discuss how your organization evaluates databases it subscribes to or is considering subscribing to.

- Is there a process used to evaluate databases offered by a) different vendors and b) services offered by the same vendors?
    - What factors are used in evaluating databases?
    - How often are databases evaluated?
- How are you involved in the process of evaluating databases for subscription or renewal?
- To what extent does cost influence decisions about subscriptions?

Abstracting & Indexing– We've now concluded the section on evaluation. I'd like to turn to a discussion on abstracting and indexing.

- Does your organization subscribe to databases specifically focused on abstracting and indexing? Tell me more.
- Over the last month, how frequently did you access A&I services in the course of your job?
    - Is that typical?
    - Why are you using A&I services in these cases?
- What are the benefits to using an abstracting and indexing service?

I'd like to turn our attention now to a specific database, the Aquatic Sciences and Fisheries Abstracts (ASFA). This database is compiled by the Food and Agriculture Organization of the United Nations and made accessible worldwide by ProQuest.

- Does your organization subscribe to ASFA?
    - If yes,
        - How long has your organization subscribed to ASFA?
        - What are the key features that ASFA offers?
        - Do you use other information sources aside from ASFA to meet marine science information requests?
        - If your organization subscribes to ASFA, does it meet the information requests of your community?
            - If yes, how?
            - If no, what could be implemented to meet those needs?
        - Do you recommend ASFA to users as a resource when providing information about services the organization offers?
            - To what extent do you think your user community is aware of ASFA and takes advantage of it?
    - If no, what information sources do you use to meet the marine/fisheries information requests of your community?
- Based on your response to the question about changes in information seeking behaviour, does ASFA meet the expectations of current users?
    - (Depending on the answer) What improvements could be made to the database to meet the needs of users?
- In the event that ASFA were discontinued, what impact would that have on your organization and your users?

- In light of the questions I have asked, do you have anything further that you would like to add with regard to abstracting and indexing services or ASFA in particular?

Thank you for your participation in this interview.

Appendix F: Revised Interview Protocol

Interview Form

Thank you for agreeing to complete this interview via email. Please respond to the following questions to the best of your ability. If at any time you feel you can't answer a particular question, or if a question makes you uncomfortable, you may skip the question. If you have questions or want clarification at any time, please email me at Diana.Castillo@dal.ca. The text boxes will expand, as necessary, to accommodate your responses.

Please return this form to me by February 15, 2018 by email.

Organizational background – To get begin, this first section will focus on your organization.

1. What are the main communities that make up your organization's user base?

2. What are the most frequent types of information requests of the community (for example, reference searches, finding materials, etc.)? If you serve many communities, please identify the most frequent types of information requests for each one.

3. How do your organization allocate resources to meet these types of information requests?

4. How does your organization respond to these types of requests from patrons? For example, this could include conducting reference searches, creating LibGuides, etc.

5. In your experience, have information seeking behaviours changed in the last five years? If yes, please explain.

6. Is the increasing availability of open access information changing the expectations of your user community?

7. Are there challenges in responding to the information requests of your organization's community? (In relation to staffing? Budgeting? Time?) What are these challenges?

8. Is your organization part of a consortium?
   ☐ Yes (go to question 8a) ☐ No (go to question 9)

   a. If yes, how does it function?

Database Subscriptions –The next section of the interview guide will focus on the databases your organization subscribes to and the decision making process regarding the choice of database.

9. Can you tell me about the database vendors that your organization uses?

10. How does your organization choose which databases to subscribe to?

11. Approximately how many database services does your organization subscribe to?

12. How does the subscription process generally work? What is the typical length of the term of a subscription? Can databases be subscribed to individually? Is there a negotiation process between your organization and the vendor?

13. **If you answered yes to question 8,** does being a part of a library consortium influence database subscription choices?

14. Does your organization track usage of databases?
    ☐ Yes (go to question 14a) ☐ No (go to question 15)

    a. **If yes,** what methods does your organization use? How does it collect this data? What is the data collected used for?

Database Evaluation – The next section of the interview guide will focus on how your organization evaluates the databases it subscribes to or is considering.

15. Is there a process used to evaluate databases offered by different vendors? What about databases offered by the same vendors?

16. What factors are used in evaluating databases? How often are databases evaluated?

17. How are you involved in the process of evaluating databases for subscription or renewal?

18. To what extent does cost influence decisions about subscriptions?

Abstracting & Indexing– This next section will specifically focus on abstracting and indexing databases.

19. Does your organization subscribe to databases specifically focused on abstracting and indexing? If you do, what databases are they?

20. Over the last month, how frequently did you access abstracting and indexing databases in the course of your job?

    a. Is that typical? Why were you using abstracting and indexing databases in these cases?

21. What are the benefits to using an abstracting and indexing database?

This section will cover a specific database, the Aquatic Sciences and Fisheries Abstracts (ASFA). This database is compiled by the Food and Agriculture Organization of the United Nations and made accessible worldwide by ProQuest.

22. Does your organization subscribe to ASFA?

☐ Yes (go to question 22a) ☐ No (go to question 22b)

a. If yes,

i. How long has your organization subscribed to ASFA?

ii. What in your opinion are the key features that ASFA offers?

iii. Do you use other information sources aside from ASFA to meet marine science information requests?

iv. If your organization subscribes to ASFA, does it meet the information requests of your community? If yes, how? If no, what could be implemented to meet those needs?

v. Do you recommend ASFA to users as a resource when providing information about services the organization offers?

vi. To what extent do you think your user community is aware of ASFA and takes advantage of it?

b. **If no,** what information sources do you use to meet the marine/fisheries information requests of your community?

23. Does ASFA currently meet the expectations of the users you serve?

    a. Could improvements could be made to the database to meet the needs of users?

24. In the event that ASFA were discontinued, what impact would that have on your organization and your users?

25. In light of the questions I have asked, do you have anything further that you would like to add with regard to abstracting and indexing services or ASFA in particular?

Thank you again for completing this interview via email. If you have any questions or comments, please contact me at "Diana.Castillo@dal.ca." **Please return this file to me by December 1, 2017.**