The Timeliness of Scientific Information in Support of Sustainable Management of Canada's Fisheries and Oceans

Devan Archibald and Robert Rangeley, Oceana Canada
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Introduction

Successful modern fisheries management requires evidence-based decision-making, supported by strong science (Hilborn et al., 2020; Melnychuk et al., 2017). Most fisheries management agencies around the world generate and use science advice in decision-making, developed with some level of peer review (Brown et al., 2020). Commonly, this is accomplished using fish stock assessments, scientific analysis of stock health, trends, and projections of what the stock is likely to do under different management options that are then considered in fisheries management decisions, such as setting quotas.

A recent global review of stock assessment processes indicates transparency is a shared priority (Brown et al., 2020). Transparency is increasingly becoming a cornerstone principle in modern fisheries management (Davis and Hanich, 2020; Fisheries Transparency Initiative, 2021; Harrison, 2020). In Canada, the peer review of science related to the management of fisheries and oceans fall under the purview of the Canadian Science Advisory Secretariat (CSAS), within Fisheries and Oceans Canada (DFO) (CSAS, 2020a). Transparency in Canada's science advisory process is provided by the publication of meeting schedules and resultant reports online, which provide a record of requests for advice and its subsequent production (Brown et al., 2020; Soomai, 2017).

The CSAS is required to follow the principles of Canada's Science Advice for Government Effectiveness (SAGE), which includes a principle on openness and transparency that indicates the public should have access to the findings and advice of scientists as early as possible (Council of Science and Technology Advisors [Canada], 1999; DFO, 2019). To this end, in 2012 the CSAS published a policy on timelines for submission and publication of documents (CSAS, 2012). It states that documents produced from CSAS peer-review meetings need to be published in a timely manner, because failure to do so can lead to delays in management decisions and perceptions that advice is being withheld or unduly influenced by lobbyists, tainting the credibility of the process (CSAS, 2012). However, in 2018 it was found by Oceana Canada, and later confirmed in a DFO internal review of the entire CSAS process, that this policy is rarely met and only 11 per cent or less of documents are published according to its timelines each year (Archibald et al., 2020a, 2021; Archibald and Rangeley, 2018, 2019; DFO, 2019). Accordingly, in 2020 DFO removed the policy from its website (CSAS, 2021a), and it is currently under review and revision (DFO, 2019).

To inform revisions the CSAS policy on timelines, this report evaluates the timeliness of the publication of scientific information by CSAS from meetings held in 2017–2020 against the deadlines established in the 2012 CSAS timelines policy. Further, for a subset of the CSAS meetings held in the last four years (2017–2020), the timing of the publication of science advice is also compared to when associated fisheries management decisions were posted online, to evaluate the relative timing of the communication of decisions to the public and the science advice considered while making them. This analysis provides an indication of the functionality of the transparency provided by CSAS publications

relied on most during decision-making. That is, were they publicly available to be considered when it mattered most, before decisions were made and communicated?

Background on the CSAS and its publications
The CSAS coordinates scientific peer review and the generation of science advice for DFO. The CSAS process is intended to provide the best possible science advice to the Minister of DFO (who holds the ultimate decision-making authority), managers, rights-holders, stakeholders and the public through rigorous peer review that is evidence-based, objective, impartial, and respectful (CSAS, 2011). The CSAS was first formed in 1997 and originally focused on fish stock assessments, but since 2001 it has expanded its scope to provide information and advice related to species at risk, invasive species, ecology of marine and freshwater ecosystems, marine protected areas, and aquaculture, as well as its traditional focus on commercial fish, invertebrate and marine mammal populations (CSAS, 2020a).

The CSAS operates on an annual cycle. According to the CSAS, requests for advice are reviewed, assessed, and prioritized based on risks, and the schedule is finalized prior to the start of the new fiscal year so scientists and managers can develop work plans and make necessary resource allocations (CSAS, 2012). Participants for meetings are chosen for their knowledge of the topic under review (e.g., species, modelling) (CSAS, 2011), and conclusions and final scientific advice from meetings are reached by consensus (CSAS, 2010b).

The CSAS currently produces four types of publications resulting from its meetings (CSAS, 2010a):

1. Science Advisory Reports (SAR): These outline the peer-reviewed scientific advice that was developed through the consensus of meeting participants. These documents contain a synopsis of the evidence in support of the advice but usually lack specific details on the scientific analysis. The 2012 policy on timelines for publication indicated they should be submitted to the CSAS as soon as possible and at the latest within eight weeks of the end of the meeting and then posted online by the CSAS within ten working days once received (CSAS, 2012).
2. Research Documents: These outline in detail the scientific studies and analyses that were peer reviewed during the meeting and are based on working papers that are produced before the meeting. These documents contain all the detail required for other scientists to review, critique, or replicate the research. The 2012 policy on timelines for publication indicated they should be submitted to the CSAS as soon as possible and at the latest within four months of the end of the meeting and then posted online by the CSAS within three weeks once received (CSAS, 2012).
3. Proceedings: These outline the discussions that occur during a peer-review meeting and list who participated and their affiliations. These documents contain the relevant details of any concerns expressed by participants about methodology, as well as alternate interpretations of the scientific analysis or resultant advice. The 2012 policy on timelines for publication indicated they should be submitted to the CSAS as soon as possible and at the latest within four months of the end of the meeting and then posted online by the CSAS within three weeks once received (CSAS, 2012).
4. Science Responses (SR): These outline the scientific advice and proceedings from meetings convened to address urgent and unforeseen reviews undertaken under the Science Response Process (SRP). SRPs are less thorough review processes (i.e., an internal peer review that usually does not include any external reviewers) held in response to urgent and unforeseen

> issues or where a fully inclusive and thorough science peer-review meeting is not required because such a meeting has already developed a framework for the issue (CSAS, 2020b). These documents contain a synopsis of the evidence in support of the advice but lack specific details on the scientific analysis. The 2012 policy on timelines for publication indicated they should be submitted to the CSAS as soon as possible and at the latest within eight weeks of the end of the meeting, and they should be posted online by the CSAS within ten working days once received (CSAS, 2012).

Multiple publications are often expected from each meeting. There are no requirements on which types need to be published, but given their differing yet complementary content, peer review meetings often indicate the expected publication of a SAR, at least one Research Document, and Proceedings. For SRPs, which are often urgent and have less thorough review processes, the CSAS website materials usually only indicate the expectation of a SR, and it is only in rare circumstances that a report would not be required (CSAS, 2020b).

Generally, there are two steps in the publication process: 1) submission of draft reports to the CSAS by authors and 2) formatting of reports and publication by the CSAS (CSAS, 2012). Following meetings, the meeting Chair is responsible for ensuring the SAR (or SR) and Proceedings are finalized, reviewed, and approved by participants before submitting the documents to the appropriate regional CSAS office or the national CSAS office (DFO, 2019). The science lead for the meeting is responsible for ensuring that Research Documents are finalized with any updates discussed during the peer review and submitted to the appropriate regional CSAS office for publication. Once documents are received, CSAS staff ensure they are complete, formatted as required, and available for publication in both English and French (official government languages), and occasionally in Indigenous languages. Regional CSAS offices then submit all documents to the Secretariat for publication. The Secretariat publishes all submitted documents on the CSAS website, which ensures that the science advice is publicly available (DFO, 2019).

Methods

The methods used for this report are available in detail in Archibald et al. (2021) and are summarized below.

Timeliness of publications relative to policy requirements

For this report, the dates of publications ensuing from all CSAS peer review meetings (both external peer reviews and SRPs) held in 2017–2020 were evaluated against the deadlines established in the CSAS timelines policy (CSAS, 2012). Timeliness of publications relative to policy requirements was evaluated on an annual basis. The CSAS schedule website, publication search tool, and associated spreadsheet export tools (CSAS, 2021b, 2021c, 2021d) were used to determine how many meetings held each year resulted in the publishing of all expected publications within expected timelines, how many resulted in publications published late, and how many still had publications forthcoming as of July 1st of the following year. This benchmark date is more than one month past the longest deadline for publication under the CSAS timelines policy for meetings held at the end of the previous calendar year (e.g., if a meeting ended on December 31, the longest timeline would require publication by May 21). This is consistent with Oceana Canada's information inclusion cut-off date for other Fishery Audit indicators (Archibald et al., 2020a). Using this approach across years ensures a standardized window is assessed each year, enabling annual comparisons (i.e., if all years were evaluated as of the present,

meetings held in 2017 would have had substantially more time to publish expected publications than those held in 2020). In this analysis, documents published after the annual July 1 benchmark date were considered not yet published. To characterise the focus of meetings, broad taxon group (e.g., invertebrate, groundfish) and general subject area category (e.g., stock or population assessment, habitat and biodiversity, other) were assigned to each meeting.

A schedule website provided by the CSAS and a corresponding exported spreadsheet list all expected publications for each CSAS meeting (CSAS, 2021b, 2021c). These were used to assess whether all expected publications were published. When a publication becomes available, it is removed from the CSAS "expected" list and the CSAS schedule website is updated with links to publications. All published documents were assumed to have been expected; if a meeting was noted as having been postponed or cancelled, and therefore not held in the calendar year, it was excluded from the analysis.

Document publication dates, as they appear in exported spreadsheets from the results of the CSAS publication searches (CSAS, 2021d), were compared to the CSAS policy on timelines for submission and publication of documents to evaluate the timeliness of publications produced (CSAS, 2012). Because only meeting end dates and document publication dates are publicly available, timelines outlined in policy for submission of documents to the CSAS and timelines for the CSAS to publish them were merged (see *Background on CSAS and its publications* in this report). Research Documents and Proceedings were evaluated as being published on time if they were published within 145 days of the meeting end date. SARs and SRs were evaluated as being published on time if they were published within 70 days of the meeting end date. Given the differing content and differing requirements laid out in the timelines policy requirements for each document type — and the fact that not all types of documents are expected from each meeting — adherence to the CSAS timelines policy is reported at the unit of meeting and document.

Timeliness of publications relative to decisions
To evaluate relative timing in the communication of science advice considered during fisheries management decisions (e.g., total allowable catches) and the communication of the final decisions, the timing of science advice publication from CSAS meetings held in 2017–2020 was compared to when associated fisheries management decisions were posted online, up to July 1, 2021. Because science advice considered during decisions is mainly provided in the form of a SAR or SR, this analysis was restricted to comparing the timing of the publication of these report types to the posting of associated decisions on the fisheries decision website. Sometimes a single SAR or SR provided the advice for several fisheries management decisions. In some cases, these decisions were posted online at the same time. In other cases, they were published at different times. In these instances, the timing of the first decision was used in the analysis.

For this component of Oceana Canada's assessment, all SARs or SRs produced from these meetings as of July 1, 2021 were included, even if they were published much later than the annual cut-off date (July 1st of the following year) used elsewhere in this evaluation.

The evaluation of publications relative to decisions was conducted for a subset of CSAS meetings. DFO posts annual fisheries management decisions (e.g., total allowable catches) for fisheries located within Canada's Exclusive Economic Zone (EEZ) in Atlantic Canada, Quebec, and the eastern Arctic on its fisheries management decisions website (DFO, 2010), but it does not include decisions pertaining to

inland commercial freshwater fisheries or fisheries off the coast of British Columbia. Annual management decisions for the latter, administrated by the DFO Pacific region, appear in annually updated Integrated Fisheries Management Plans (IFMPs). Although annual summaries of Pacific region IFMPs are published on the DFO IFMP website (DFO, 2008), complete IFMPs that include annual decisions can only be found via a search of the federal science library (Government of Canada, 2021), limiting their ease of access and ability to provide functional transparency. Due to this lack of functional transparency, combined with unstandardized locations of annual decisions (e.g., total allowable catches) among Pacific region IFMPs, our evaluation relied exclusively on the fisheries management decisions website. Therefore, only CSAS meetings pertaining to species (marine fish, invertebrate and seals) and areas covered by the fisheries management decision website (Atlantic Canada and the eastern Arctic) were included.

Results

Meetings and timelines policy requirements
From 2017 to 2020, the number of CSAS meetings were similar each year (112, 130, 119, and 108 respectively). The types of meetings were likewise similar, with most being identified as external peer review processes in the CSAS schedule export tool spreadsheet (59%, 56%, 71%, and 55%). The rest were mainly SRPs, although in 2018 there was also one Science Special Response Process and one Advisory meeting held by the CSAS. Neither of these meeting types were held in 2017 or 2019, while in 2020, 12 Advisory meetings were held. The subject matter (e.g., stock assessments, recovery potential assessments) and report types expected (Proceedings, Research Documents, SAR) from these meetings suggest they were equivalent to external peer review processes. Therefore, Advisory meetings were classified as external peer review meetings for purpose of the analysis and results reported here. Similarly, the single Science Special Response held in 2018 was classified as a SRP for the purpose of Oceana Canada's analysis.

In all years, the subject matter of meetings was similar, with the large majority dedicated to stock or population assessments of numerous categories of commercial fish (Figure 1). In each year, the greatest number of meetings pertained to population assessments of invertebrates (> 20%), while many meetings pertained to population assessments of both groundfish (≥ 8%) and diadromous fish (≥ 9%). But in both 2019 and 2020, the catch-all "other" category for the "other" taxa, which does not focus on a specific taxa group, was the subject of the second-greatest number of meetings (≥ 11%), more than in 2017 or 2018. Many of these meetings pertained to reviewing the environmental impacts of specific human activities, such as aquaculture siting.

In all years, most meetings held (88% to 94% in each year) did not result in publication of all expected documents within the CSAS policy timelines (Figure 2). For most meetings, at least one document was published late (>53%; Figure 2). Several meetings held each year (19% in 2017; 32% in 2018; 32% in 2019; 31% in 2020) failed to result in the publication any of the expected documents by Oceana Canada's cut-off date of July 1 the following year, more than one month past the longest deadline for publication under the CSAS timelines policy for meetings held at the end of the previous calendar year.

In all years, most of the external peer review meetings had failed to yield all expected Research Documents (72% of meetings expecting them in 2017; 84% in 2018; 80% in 2019; 84% in 2020) or Proceedings (61% of meetings expecting them in 2017; 78% in 2018; 76% in 2019; 80% in 2020) by the

annual benchmark cut-off date (July 1 of the following year). Publication rates were better for SARs. However, each year about one-third of external peer-review meetings expected to produce a SAR still had not published it by the annual benchmark cut-off date (27% of meetings expecting them in 2017; 35% in 2018; 32% in 2019; 42% in 2020). These important documents summarize the scientific evidence of management advice. Most of the meetings that failed to yield an expected SAR (47% of meetings expecting but missing them in 2017; 36% in 2018; 75% in 2019; 57% in 2020) pertained to stock or population assessments, either in support of fisheries management or the evaluation of potential species at risk.

The publication rates from SRPs was better. These urgent and unforeseen meetings involve less thorough review processes (i.e., internal peer review, usually with no external reviewers present). About a quarter of SRPs in each year resulted in the publication of all expected documents within the CSAS policy timelines (28% in 2017; 21% in 2018; 21% in 2019; 23% in 2020). Over the four years Oceana Canada analyzed, between 6 and 27 per cent of SRPs expected to produce SRs had failed to do so by halfway through the following year (9% in 2017; 27% in 2018; 15% in 2019; 6% in 2020). In nearly all years, most of these meetings that failed to yield an expected SR pertained to stock or population assessments, either in support of fisheries management or the evaluation of potential species at risk (50% of such meetings in 2017; 60% in 2018; 40% in 2019). But in 2020, all SRs expected from SRPs pertained to stock or population assessments were published (some late and some on time).

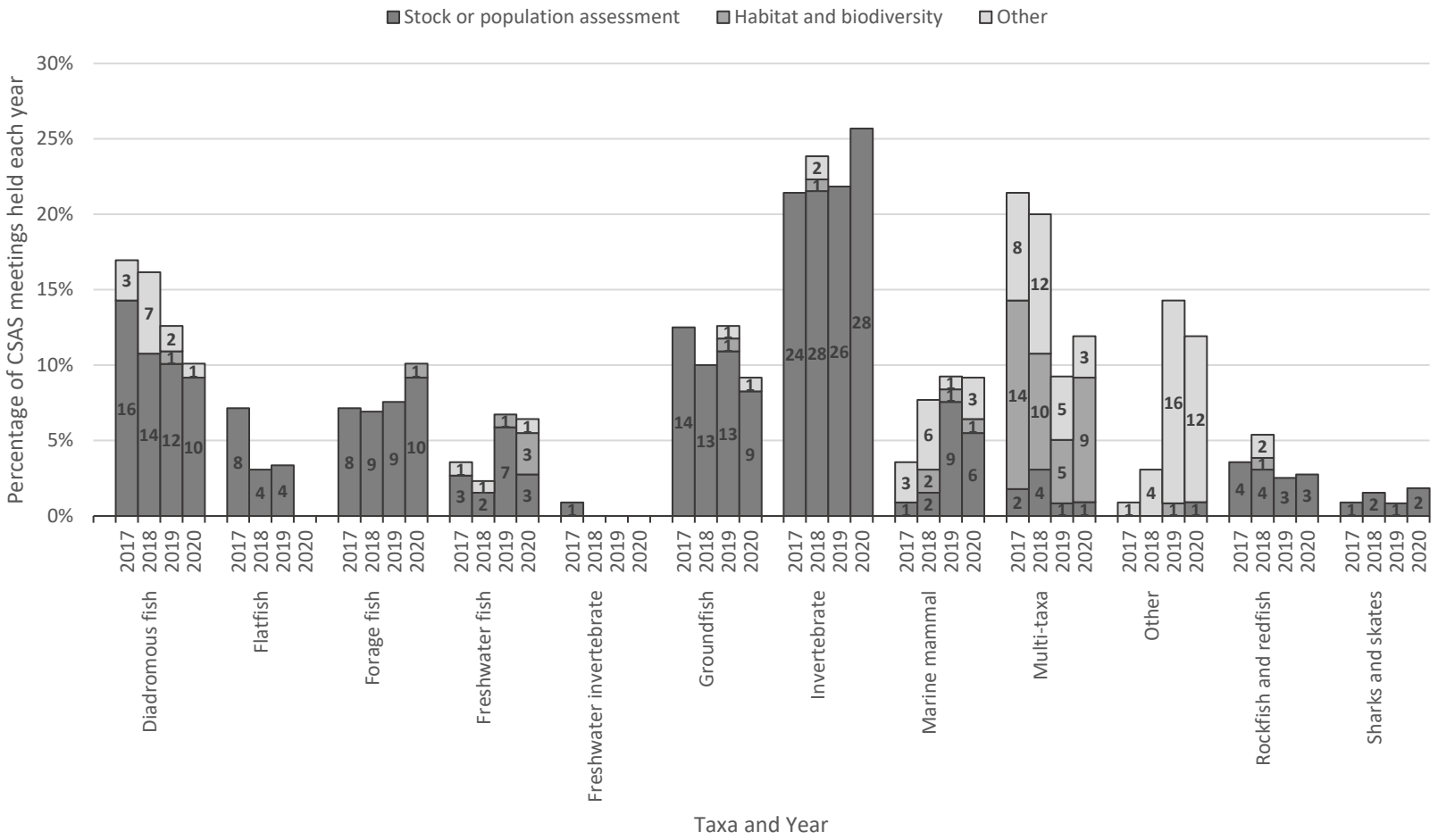

Figure 1. The percentage of Canadian Science Advisory Secretariat (CSAS) meetings held in 2017 (n = 112 meetings), 2018 (n = 130 meetings), 2019 (n = 119 meetings), and 2020 (n = 108 meetings) that pertained to stock or population assessments, habitat and biodiversity, or other subject matters among different taxonomic groups. The number of meetings in each category is indicated in bold black font within the bars.

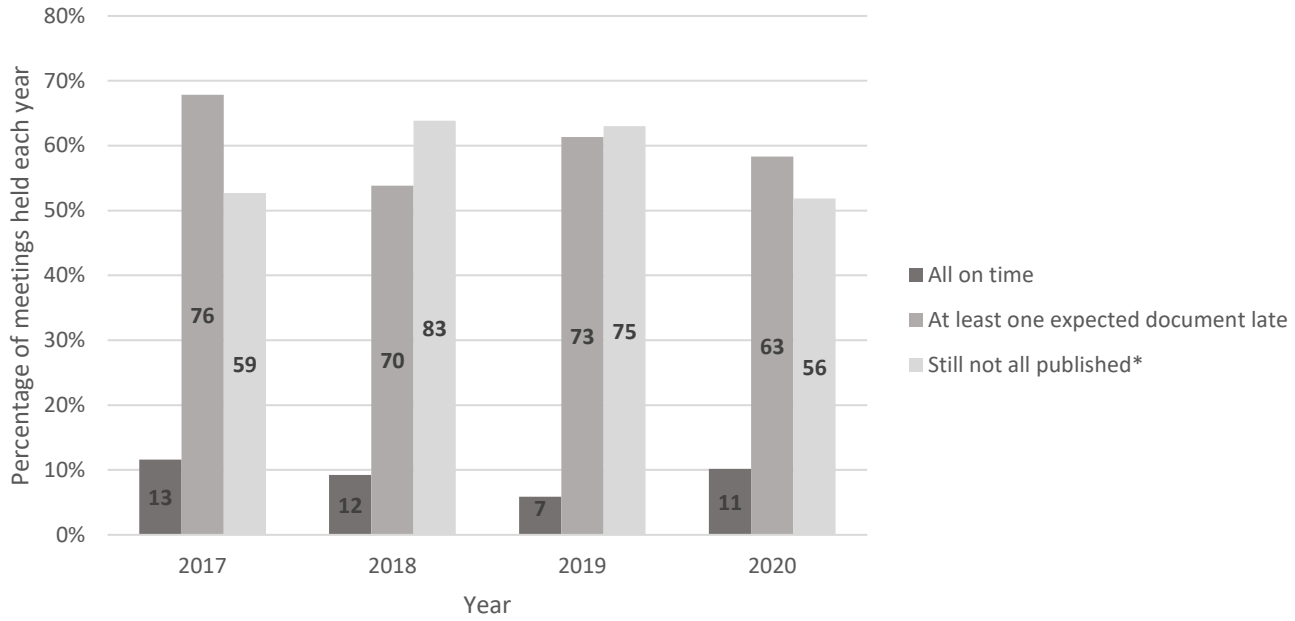

*Figure 2. The percentage of Canadian Science Advisory Secretariat (CSAS) meetings held in 2017 (n = 112 meetings), 2018 (n = 130 meetings), 2019 (n = 119 meetings,) and 2020 (n = 108 meetings) that had a) all their expected documents published within the CSAS policy timelines, b) at least one expected document published outside of the CSAS policy timelines, or c) at least one expected document still not published as of July 1st of the following year. The number of meetings in each category is indicated in bold black font within the bars. Note that categories are not exclusive (e.g., in the case where several publications are expected from a single meeting, some may have been published late and others may not have been published yet). *As of July 1st of the following year.*

Documents and timelines policy requirements

In each year, all meetings combined were expected to produce well over 200 documents (Table 1). In each year, however, few documents were published within the CSAS policy timelines (5–11 per cent), while most were published late (33–46 per cent) or were not yet available by the annual benchmark cut-off date used in this portion of the study (July 1st of the following year; 44–57 per cent) (Table 1).

Table 1. The number (and percentage) of documents expected to be published from Canadian Science Advisory Secretariat (CSAS) meetings held in 2017 (n = 112 meetings), 2018 (n = 130 meetings, 2019 (n = 119 meetings), and 2020 (n = 108 meetings) that were published within and outside of the CSAS policy timelines, as of July 1st of the following year.
**As of July 1st of the following year.*

Year meetings held	Total number of expected documents	Documents published on time	Documents published late	Documents not yet available*
2017	239	26 (11%)	109 (46%)	104 (44%)
2018	282	26 (9%)	94 (33%)	162 (57%)
2019	291	13 (5%)	121 (42%)	157 (54%)
2020	235	21 (9%)	93 (40%)	121 (52%)

Timeliness varied by document type: most SARs and SRs were late but were eventually published, while most Proceedings and Research Documents were still not available by the annual benchmark cut-off date (Figure 3). Publication rates (on-time and late) were better for most document types in 2017 when compared to the other three years (2018–2020), while publication rates in 2020 exceeded 2017 for SRs (Figure 3).

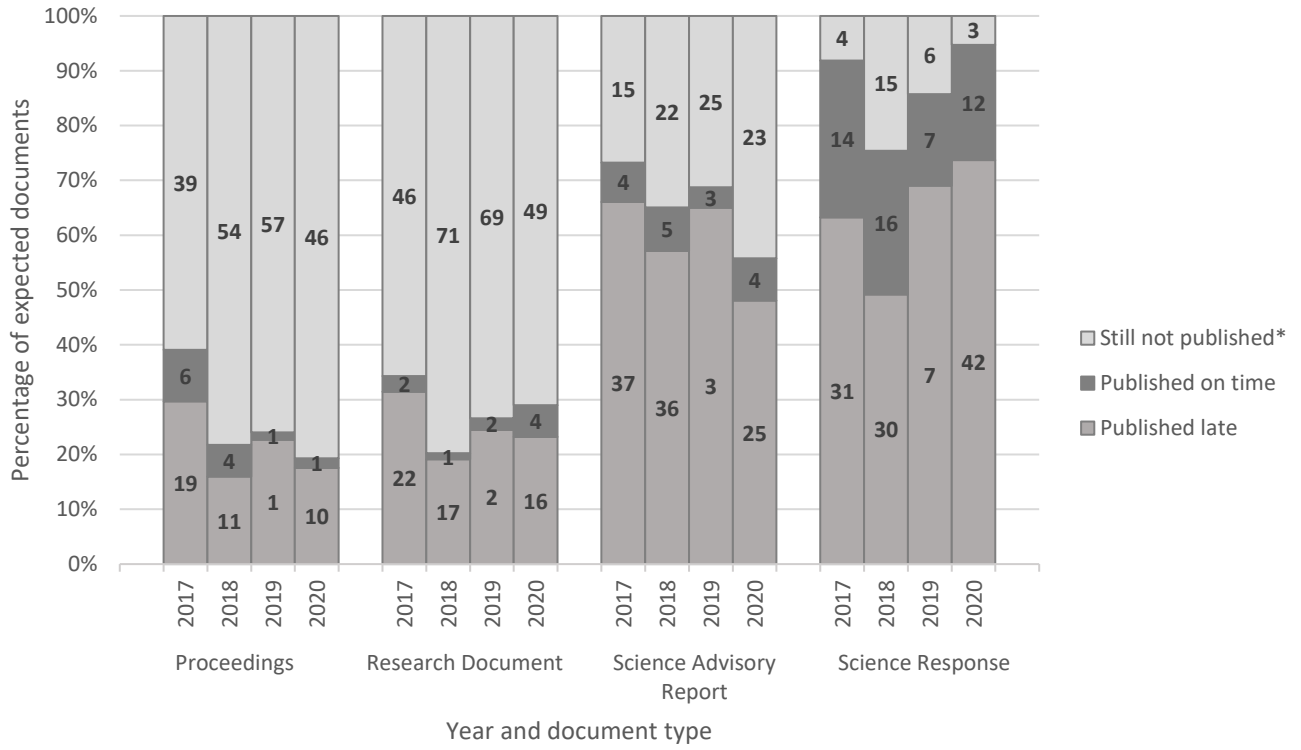

*Figure 3. The percentage of documents published within and outside of the CSAS policy timelines for each of the four document types expected to be published from Canadian Science Advisory Secretariat (CSAS) meetings held in each year, as of July 1st of the following year. The number of documents expected in 2017 (n = 112 meetings; n = 239 expected documents), 2018 (n = 130 meetings; n = 282 expected documents), 2019 (n = 119 meetings; n = 291 expected documents), and 2020 (n = 108 meetings; n = 235 expected documents) in each publication category is indicated in bold black font within the bars. *As of July 1st of the following year.*

Across all years the documents published late but by the benchmark date used in this report (July 1st of the year after the meeting was held) were published an average 131 days (minimum 1 day; maximum 402 days; median 107 days) after the CSAS policy timelines indicates they should have become available. Considering there were several documents of each type unpublished by the annual benchmark date used in this report, this is an underestimate of how late documents actually are in relation to CSAS policy timelines. Among all publications published (on time and late), average publication timing was consistently longer than CSAS policy timelines for each document type (Table 2).

Table 2. The CSAS policy on timelines requirements and average number of days after meeting end date until document publication (late and on time) for all document types resulting from Canadian Science Advisory Secretariat (CSAS) meetings held in 2017–2020. See Figure 3 for an indication of the percentage and number of expected documents of each type still not published from these meetings as of July 1st of the following year, which are excluded from summary statistics below.

Document type	Number of days after meeting end date until document publication				
	CSAS policy on timelines requirements	Realized publication timing			
		Mean	Minimum	Maximum	Median
Proceedings	145	252	36	499	247
Research Document	145	296	77	487	321
Science Advisory Report	70	186	11	451	158
Science Responses	70	138	6	472	117

Timing of fisheries science advice publication relative to management decision posting

Over the four years (2017–2020) included in this report there were 188 CSAS meetings held (48 in 2017; 53 in 2018; 42 in 2019; 45 in 2020) that pertained to fisheries within the area covered by the DFO fisheries management decision website (Atlantic Canada and eastern Arctic). Most of these meetings were external peer review processes (104 meetings), while the rest were SRPs (84 meetings). Combined, these meetings were expected to produce 105 SARs (25 in 2017; 28 in 2018; 31 in 2019; 21 in 2020) and 103 SRs (25 in 2017; 27 in 2018; 19 in 2019; 32 in 2020), hereafter combined as "science advice reports." Usually, only one science advice report was expected from each meeting, but occasionally more than one report (maximum seven) was published when advice was provided for more than one decision. Similarly, each advice report usually only had a single management decision associated with it that was posted online, but occasionally reports had advice for more than one management unit resulting in more than one decision associated with the report and posted online (11 science advice reports had more than one decision; three decisions was the maximum associated with a single report). In these specific cases the timing of the first decision posting was used in the analysis.

Across all years (2017–2020) only 24 per cent of science advice reports used for decision-making were published prior to the posting of the fisheries management decision online. Most often (41 per cent of science advice reports) either the science advice was not published or the fisheries management decision was not posted online. Of this 41 per cent, most were missing the management decisions rather than the science advice report: only seven expected science advice reports remained unpublished by July 1, 2021, while 78 were missing the corresponding management decision posting online. When both science advice reports and management decisions were available, most of the science advice reports (59 per cent) across all years included in this study were published after the management decision was posted. In terms of publication of science advice before decisions and overall publication rates (before and after management decision posting), performance was better in 2017 than 2018–2020 (Figure 4).

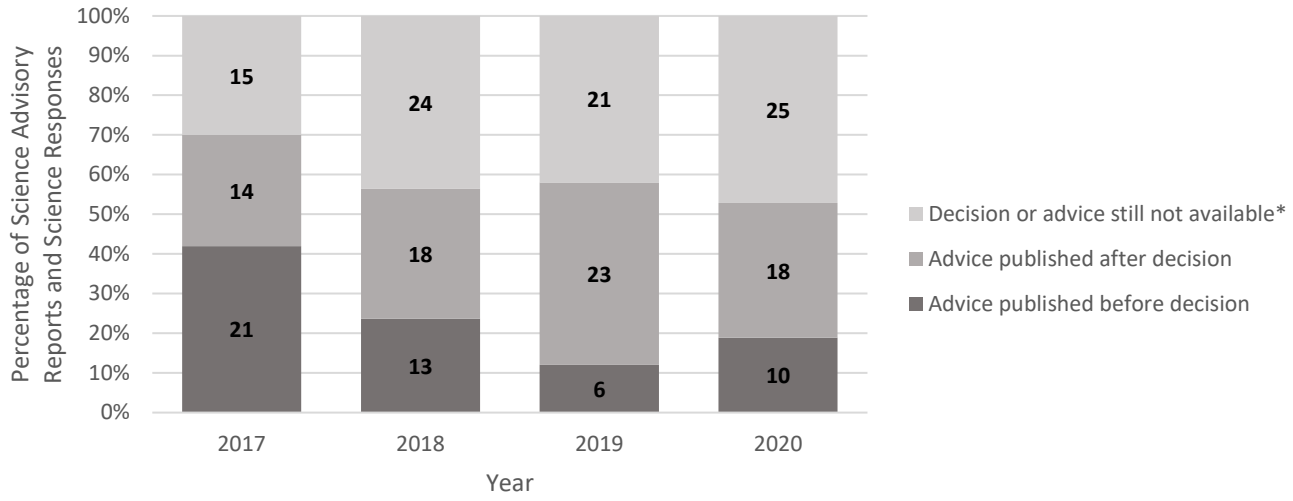

*Figure 4. The percentage of Science Advisory Reports and Science Reponses that outline science advice for decision-making expected to be published as a result of Canadian Science Advisory Secretariat (CSAS) meetings held in 2017 (n = 48 meetings; n = 50 science advice reports), 2018 (n = 53 meetings; n = 55 science advice reports), 2019 (n = 42 meetings; n = 50 science advice reports), 2020 (n = 45 meeting;, n = 53 science advice reports) pertaining to species and areas covered in the Fisheries and Oceans Canada (DFO) fisheries management decisions website. These are broken down into those published before the decision, those published after the decision, and those where either the advice had not been published or the decision had not been posted at the time of analysis (July 1, 2021). *In the majority of cases where the decision or advice was still not available, it was the decision that was missing; only seven science advice reports remain unpublished. The number of expected advice reports and associated decisions in each category is indicated in white font within the bars.*

On average, science advice reports published after the posting of the associated management decision became available 111 days after the decision was posted online (minimum 1 day; maximum 654 days; median 86 days). Eight meetings were held after the management decision was already posted, meaning there was no chance they could have developed and published advice in advance of decision posting. Six of these meetings pertained to inshore lobster fisheries in the DFO Maritimes administrative region; these are primarily input-controlled fisheries with different fishing seasons throughout the year for which stock statuses are assessed annually and decisions are posted in a single combined fishery management decision. Nearly all science advice documents published after management decisions were also late according to the CSAS policy timelines, with only one on time.

Science advice reports that were published before management decisions were posted online an average 82 days before the decision was posted (minimum 3 days; maximum 278 days; median 64 days). However, in a few cases, this only occurred because the fisheries management decision was posted late, well into or after the completion of the respective fishing seasons. For example, the 2020 management decision for Northeastern Nova Scotia snow crab (Crab Fishing Areas 20–22) in the DFO Maritimes administrative region was posted online on December 23, 2020, after the end of the fishing season (April 1 to August 18, 2020). Of the science advice reports published before management decisions were posted, 16 were published within the CSAS policy timelines while 34 were late.

Discussion

The Canadian Science Advisory Secretariat (CSAS) oversees the peer-review process that assesses science related to the management of Canada's fisheries and oceans (CSAS, 2020a). The resultant CSAS

publications and science advice are the main source of scientific information used in decision-making about Canada's oceans and their inhabitants. This formalized peer-review process and the transparency created by making documents publicly available is an exception among science-based federal departments in Canada (DFO, 2019). Thus, it is concerning that the requirements of the CSAS timelines policy were rarely met from 2017 to 2019. Nor did performance relative to policy requirements improve since revisions to the policy began in 2020 (revisions remain ongoing to present). The CSAS timelines policy itself indicates that delays in producing documents can create the impression that advice is either being withheld or influenced, which in turn can undermine the credibility of the process (CSAS, 2012). Thus, it is even more concerning that over half of the time, the science advice considered most during decision-making (SARs and SRs) was not publicly available until after the decision was made and communicated. This lack of adherence to policy and failure to provide functional transparency limits public engagement with decision-making and inhibits a common understanding of the scientific evidence underlying advice.

An internal DFO evaluation of the entire CSAS process found similar results in its analysis of the timeliness of publications from meetings held between fiscal year 2013/14 and 2017/18 (DFO, 2019). With access to internal DFO information, the internal evaluation was able to break down analysis of timeliness based on stages of the publication process: 1) submission to the CSAS by authors and 2) CSAS formatting and publishing of reports on the website once drafts were received. The evaluation found that most documents (62%) were not submitted to the CSAS within the required timelines as per CSAS policies and that once received, most documents (66%) were not published by the CSAS within the required timelines (DFO, 2019). It also found that approximately 33% of the time, CSAS documents were not received by clients (i.e., managers) within required timelines, limiting the extent to which advice could be used for management decisions. The internal DFO evaluation suggested several reasons for publication delays (DFO, 2019), which are also discussed in detail in Archibald et al. (2021), and previous Oceana Canada reports (Archibald et al., 2020b; Archibald and Rangeley, 2018, 2019).

The main recommendation of the internal evaluation pertaining to compliance with the CSAS timelines policy was to revisit and extend publication policy timelines. At the same time, the evaluation report reiterated the best practice of ensuring documents are publicly available in a timely manner. If timelines are to be extended, it should not result in publication timelines extending beyond current realized rates (see Table 1), particularly for SARs and SRs, which are heavily relied upon during decision-making. Final approved versions of these types of documents should be publicly available prior to decision-making, and preferably in time for discussions surrounding decisions with rights-holders and stakeholders. Currently, this is not happening; this report found that most science advice is not published until after decisions are posted online. When final documents are unavailable, managers often use draft versions, but the internal DFO evaluation indicated managers are often uncertain as to what extent drafts can be used or shared, because they are not approved and are supposed to remain confidential until published (DFO, 2019). Many of the same people involved in decision-making are often present when scientific evidence is reviewed at the CSAS meetings (Winter and Hutchings, 2020). Thus, they are armed with scientific information even if the publication of the reviewed science advice is too late for decisions. But if the publication of the final wording of advice is not available on time, it can create an imbalance between those involved in decision-making who were present during the CSAS processes and those who were not. Scientists also often present summaries of the CSAS meetings to management advisory committees composed of rights-holders and stakeholders. This is good practice and should continue, but it often occurs on the same day the advice is sought from members, limiting its utility if presented

without preceding documentation that would allow participants that represent organizations to share the advice with their membership and prepare questions.

The recent revisions to the *Fisheries Act* (Legislative Services Branch, 2019) and anticipated regulations associated with the new fish stock provisions (Public Works and Government Services Canada, 2021) arguably add new imperatives for transparency to both the science advice considered during decision-making and the communication of the resultant decisions. Section 6.1 of the revised act states: "*In the management of fisheries, the Minister shall implement measures to maintain major fish stocks at or above the level necessary to promote the sustainability of the stock, taking into account the biology of the fish and the environmental conditions affecting the stock.*" To evaluate if the Minister has accounted for the biology of the fish and environmental conditions affecting the stock when implementing measures (i.e., making decisions), it will be important that the science advice considered during decision-making is published and publicly available. Similarly, this change implies the transparency provided by the posting of fisheries management decisions online will only gain importance and suggests decisions should include a rationale for why they were made, outlining how these factors were considered. Over a third of the fisheries management decisions evaluated in this report were not posted online, and when they were, most often the science advice considered was not available until after the decision was posted. Important improvements to the transparency of both advice and decisions are required to enable evaluation of decisions relative to section 6.1 of the *Fisheries Act*.

Conclusions

When science advice and information in support of fisheries decision-making is produced and published in a timely fashion, the public can have increased confidence in the management of our oceans. Only then can decisions be independently evaluated in real time to ensure they promote the stability of healthy fisheries and the rebuilding of depleted populations for the benefit of marine ecosystems, coastal communities, and the fishing industry. In Canada, peer review of science related to the management of fisheries and oceans as overseen by the CSAS is valued and generally perceived as unique and important for developing and providing science advice (CSAS, 2020a; DFO, 2019). Until recently (2020) the CSAS had a policy intended to ensure transparency and timely dissemination of documents, providing the evidence behind science advice used in fisheries and oceans management. This policy is currently under revision, and its absence from the CSAS policies website suggests it is not intended to be adhered to while revisions are ongoing (CSAS, 2021a; DFO, 2019). Our report found that this policy was rarely met while in place (2017–2019), with most documents published late, and performance against its standards remains poor while revisions are ongoing (2020). Most often the science advice considered most during fisheries management decision-making was not publicly available until after the decision was made and communicated. This limits engagement in public policy and decision-making and inhibits a common understanding of the scientific evidence underlying advice. Furthermore, over a third of the fisheries management decisions evaluated in this report were not posted on the website intended to provide transparency. This compromises transparency (Archibald et al., 2021) at a time when transparency is becoming a cornerstone principle in modern fisheries management (Davis and Hanich, 2020; Fisheries Transparency Initiative, 2021; Harrison, 2020). Through an internal evaluation, the CSAS is aware of factors contributing to non-compliance towards its policy on timelines for the publication of science documents (DFO, 2019). It must take corrective action and use multiple modes of communicating science advice well in advance of final decision-making, while ensuring timely receipt of the detailed scientific evidence found in the CSAS documents. Meanwhile,

DFO must improve its performance with regards to timely posting of fisheries management decisions on its website intended to provide transparency on the outcomes of decisions.

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