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Canadian Technical Report of Fisheries and Aquatic Sciences

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Technical reports may be cited as full publications. The correct citation appears above the abstract of each report. Each report is abstracted in the data base *Aquatic Sciences and Fisheries Abstracts*.

Technical reports are produced regionally but are numbered nationally. Requests for individual reports will be filled by the issuing establishment listed on the front cover and title page.

Numbers 1-456 in this series were issued as Technical Reports of the Fisheries Research Board of Canada. Numbers 457-714 were issued as Department of the Environment, Fisheries and Marine Service, Research and Development Directorate Technical Reports. Numbers 715-924 were issued as Department of Fisheries and Environment, Fisheries and Marine Service Technical Reports. The current series name was changed with report number 925.

Rapport technique canadien des sciences halieutiques et aquatiques

Les rapports techniques contiennent des renseignements scientifiques et techniques qui constituent une contribution aux connaissances actuelles, mais qui ne sont pas normalement appropriés pour la publication dans un journal scientifique. Les rapports techniques sont destinés essentiellement à un public international et ils sont distribués à cet échelon. II n'y a aucune restriction quant au sujet; de fait, la série reflète la vaste gamme des intérêts et des politiques de Pêches et Océans Canada, c'est-à-dire les sciences halieutiques et aquatiques.

Les rapports techniques peuvent être cités comme des publications à part entière. Le titre exact figure au-dessus du résumé de chaque rapport. Les rapports techniques sont résumés dans la base de données *Résumés des sciences aquatiques et halieutiques.*

Les rapports techniques sont produits à l'échelon régional, mais numérotés à l'échelon national. Les demandes de rapports seront satisfaites par l'établissement auteur dont le nom figure sur la couverture et la page du titre.

Les numéros 1 à 456 de cette série ont été publiés à titre de Rapports techniques de l'Office des recherches sur les pêcheries du Canada. Les numéros 457 à 714 sont parus à titre de Rapports techniques de la Direction générale de la recherche et du développement, Service des pêches et de la mer, ministère de l'Environnement. Les numéros 715 à 924 ont été publiés à titre de Rapports techniques du Service des pêches et de la mer, ministère des Pêches et de l'Environnement. Le nom actuel de la série a été établi lors de la parution du numéro 925.

Canadian Technical Report of
Fisheries and Aquatic Sciences nnn

20XX

TITLE HERE (*LATIN SPECIES NAME*)

by

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Another Galaxy

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CONTENTS

ABSTRACT

Last, F.M. and Smith, A.B. 20XX. Title Here (*Latin Species Name*). Can. Tech. Rep. Fish. Aquat. Sci. nnn: v + 18 p.

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RÉSUMÉ

Last, F.M. and Smith, A.B. 20XX. Title Here (*Latin Species Name*). Can. Tech. Rep. Fish. Aquat. Sci. nnn: v + 18 p.

Voici le résumé. Lorem ipsum dolor sit amet, consectetur adipisicing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum.

1 Introduction

Welcome to report generation using `csasdown`. Included in this example document are many useful bits of information on how to write a reproducible report document using the `csasdown` package, which is based on Rmarkdown and Bookdown. The information given in this example document should be used with all three `csasdown` document types: Research Document (`resdoc`), Science Response (`sr`), and Technical Report (`techreport`).

If you get stuck on anything, read the `csasdown` README carefully and all the Wiki pages. There are many tips and tricks located in those pages.

Inserting a hyperlink in Rmarkdown is easy, just look at the code for the paragraph above. It is located in **01_introduction.Rmd**

Include references in the **bib/refs.bib** file in the same format as the example that is already in the file. This is called *BiBLaTeX* format. Once you have added the reference, you can cite it using Rmarkdown in the following ways:

1. In parentheses: `[@edwards2013]` - renders as: (Edwards et al. 2014)
2. Inline: `@edwards2013` - renders as: Edwards et al. (2014)
3. Without author: `[-@edwards2013]` - renders as: (2014)

Some references: (Francis 2011 pp. @edwards2013, @swainbenoit2015).

Note that the year part of the citation is clickable and will take you directly to the reference in the References section.

Here is an example equation with the code used to generate it. Note that `csasdown` automatically numbers it on the right-hand side of the page. It does this consecutively throughout the document sections, but appendices are each numbered on their own, e.g. A.1, A.2, ... for Appendix A, and B.1, B.2, ... for Appendix B.

```
\begin{equation}
  1 + 1
  \label{eq:test}
\end{equation}
```

$$1 + 1 \tag{1}$$

A reference can be included anywhere in the text, to refer to a section or appendix. For the first appendix in this document, the code looks like this: `\@ref(app:first-appendix)`. Adding that code inline will create a clickable link in the output file: See Appendix A.

The code inside the parentheses comes from the tag after the header for the section. For the appendix, the whole header line looks like:

```
# THE FIRST APPENDIX {#app:first-appendix}
```

Everything in the curly braces except for the hash sign is the tag you use to reference a section.

This section's header line looks like this:

```
# Introduction {#sec:introduction}
```

And can be referenced like this: `\@ref(sec:introduction)` which renders to this: Section 1.

A reference to the equation above looks like this: `\@ref(eq:test)` and renders to this: Figure 1.
The labels for any type of reference (except for bibliography citations) are shown in Table 1.

Table 1. Reference types and their Rmarkdown reference codes.

Reference type	Rmarkdown code
Section	`\@ref(sec:section-label)`
Subsection	`\@ref(subsec:subsection-label)`
Appendix	`\@ref(app:appendix-label)`
Equation	`\@ref(eq:equation-label)`
Figure	`\@ref(fig:figure-label)`
Table	`\@ref(tab:table-label)`

2 Methods

To render the document in French, simply open `index.Rmd` and change this:

```
output:
 csasdown::techreport_pdf:
   french: false
```

to this:

```
output:
 csasdown::techreport_pdf:
   french: true
```

and render as usual. You can switch back and forth at any time to see the changes in the examples. If you develop your document with this in mind you will save yourself a lot of work when you receive the translations and it's time to publish the French version. Try it now, and once in awhile when you are developing your document.

> *Note that Technical Reports are not required to be in both languages, but Science Reponses and Research Documents are.*

Here is a simple figure plotted in a `knitr` code chunk. Look at the code (`02_methods.Rmd`) to see how all figure and table captions should be written to permit easy migration to French.

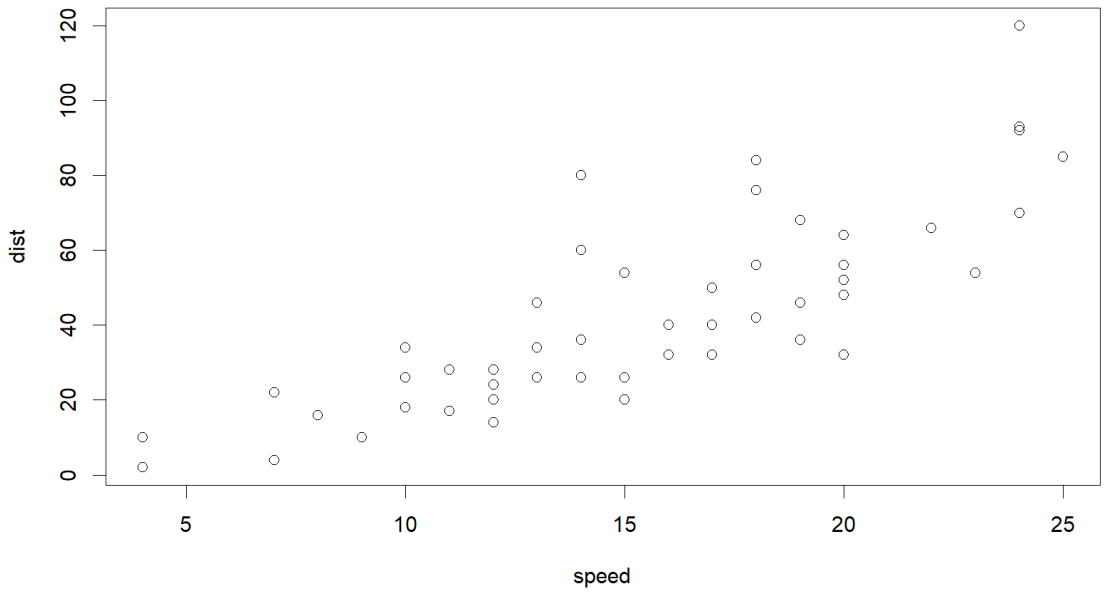

Figure 1. Test figure with a caption will be numbered automatically.

Here are two ways to make the same example data frame and simple `csas_table()` calls for each:

```
d <- structure(list(
  Year = c("2018", "2019", "2020"),
  `Value 1` = c(1.12, 2.32, 3.67),
  `Value 2` = c(31.9, 2.8, 112.2)),
  row.names = c(NA, -3L), class = "data.frame")
  names(d) <- c(en2fr("Year"),
                paste0(en2fr("Value"), 1),
                paste0(en2fr("Value"), 2))
csasdown::csas_table(d,
  align = c("c", "r", "r"),
  caption = ifelse(fr(),
                   "French goes here",
                   "Test table (data is d) with a caption will be numbered automatically."))
```

Table 2. Test table (data is d) with a caption will be numbered automatically.

Year	Value1	Value2
2018	1.12	31.9
2019	2.32	2.8
2020	3.67	112.2

```
d1 <- tribble(
  ~Year, ~`Value 1`, ~`Value 2`,
   2018,       1.12,       31.9,
   2019,       2.32,        2.8,
   2020,       3.67,      112.2)
names(d1) <- c(en2fr("Year"),
               paste0(en2fr("Value"), 1),
               paste0(en2fr("Value"), 2))
csasdown::csas_table(d1,
  align = c("c", "r", "r"),
  caption = ifelse(fr(),
                   "French goes here",
                   "Test table (data is d1) with a caption will be numbered automatically."))
```

Table 3. Test table (data is d1) with a caption will be numbered automatically.

Year	Value1	Value2
2018	1.12	31.9
2019	2.32	2.8
2020	3.67	112.2

Notice the difference in how the English and French captions are generated for tables compared to the way they are generated for figures.

To reference the tables and figures, just place code like this for tables: `\@ref(tab:testtab)` inline in text (`testtab` is the knitr code chunk name) and like this for figures: `\@ref(fig:testfig)`. Note the difference in the tag preceeding the colon in those code snippets, `tab` for table references and `fig` for figure references (See Table 1 for all types). Here are the table references so far in this document: Table 2 and Table 3, and the figure reference: Figure 1. The numbers are clickable.

Next we show a more complicated table with grouped rows and text wrapping. The code becomes more difficult when you want to make non-trivial tables, so it is recommended to think about how to keep tables as simple as possible to avoid this kind of code if you're not comfortable with it.

The code below works like this:

1. `read_csv(file.path("data", "multirow.csv"))` - reads data in from the data file
2. `mutate_all(function(x){gsub("\\\\n", "\n", x)})` - changes `\\n` to `\n` in all columns. Even though the data file contains only `\n`, the `readr::read_csv()` function changes these to `\\n`. The extra backslashes are required to escape the two, so four are needed
3. `mutate_all(kableExtra::linebreak)` - replaces `\n`'s in all columns with a special LaTeX command that causes newlines to be created
4. `mutate_all(function(x){gsub("%", "\\\\%", x)})` - replaces percent signs with an escaped version in all columns, as they are special characters in LaTeX
5. `mutate_all(function(x){gsub("emph\\{", "\\\\emph\\{", x)})` - replaces `emph{` with an escaped version in all columns so that LaTeX can run it as its own command `emph{}` (italicization)
6. Remove all NA's from the grouping column, replacing them with empty strings so `NA` doesn't appear in the output table
7. `csas_table()` command - makes the table from the input data
8. The 5 `kableExtra::row_spec(XX, hline_after = TRUE)` commands - insert a horizontal line across the whole table after each group.
9. The lines with `kableExtra::row_spec(1, extra_latex_after = "\\cmidrule(l){2-2}") %>%` commands - insert a horizontal line across the second column only (`{2-2}` signifies the column range)
10. The 2 `kableExtra::column_spec(XX, width = "XXem")` commands - change the width of the column to a set value. This has the effect of wrapping the text so it doesn't run off the page

Understanding how this table works will take you a long way in LaTex table generation. For example you could make any text bold that you want by using `\textbf{}` instead of `\emph{}`. To do that, you would just change the `emph` in the data file (`multirow.csv`) to `textbf` and add a the following new line into the code below, right before or after the line that deals with `emph`:

```
mutate_all(function(x){gsub("textbf\\{", "\\\\textbf\\{", x)}) %>%
```

```
read_csv(file.path("data", "multirow.csv")) %>%
  mutate_all(function(x){gsub("\\\\n", "\n", x)}) %>%
  mutate_all(kableExtra::linebreak) %>%
  mutate_all(function(x){gsub("%", "\\\\%", x)}) %>%
  mutate_all(function(x){gsub("emph\\{", "\\\\emph\\{", x)}) %>%
  mutate(`Overarching goal` = ifelse(is.na(`Overarching goal`),
                                     "",
                                     `Overarching goal`)) %>%
  csas_table(format = "latex",
             escape = FALSE,
             font_size = 11,
             caption = ifelse(fr(),
```

```
                              "French goes here",
                              "Goals and performance metrics")) %>%
kableExtra::row_spec(1, extra_latex_after = "\\cmidrule(l){2-2}") %>%
kableExtra::row_spec(2, extra_latex_after = "\\cmidrule(l){2-2}") %>%
kableExtra::row_spec(3, extra_latex_after = "\\cmidrule(l){2-2}") %>%
kableExtra::row_spec(4, hline_after = TRUE) %>%
kableExtra::row_spec(5, extra_latex_after = "\\cmidrule(l){2-2}") %>%
kableExtra::row_spec(6, extra_latex_after = "\\cmidrule(l){2-2}") %>%
kableExtra::row_spec(7, extra_latex_after = "\\cmidrule(l){2-2}") %>%
kableExtra::row_spec(8, extra_latex_after = "\\cmidrule(l){2-2}") %>%
kableExtra::row_spec(9, extra_latex_after = "\\cmidrule(l){2-2}") %>%
kableExtra::row_spec(10, hline_after = TRUE) %>%
kableExtra::row_spec(11, extra_latex_after = "\\cmidrule(l){2-2}") %>%
kableExtra::row_spec(12, extra_latex_after = "\\cmidrule(l){2-2}") %>%
kableExtra::row_spec(13, extra_latex_after = "\\cmidrule(l){2-2}") %>%
kableExtra::row_spec(14, extra_latex_after = "\\cmidrule(l){2-2}") %>%
kableExtra::row_spec(15, hline_after = TRUE) %>%
kableExtra::row_spec(16, hline_after = TRUE) %>%
kableExtra::row_spec(17, extra_latex_after = "\\cmidrule(l){2-2}") %>%
kableExtra::row_spec(18, extra_latex_after = "\\cmidrule(l){2-2}") %>%
kableExtra::row_spec(19, hline_after = TRUE) %>%
kableExtra::column_spec(1, width = "15em") %>%
kableExtra::column_spec(2, width = "30em")
```

Table 4. Goals and performance metrics

Overarching goal	**Performance metrics**
Rebuild depleted CUs (These performance metrics infer a relatively monotonic trajectory towards a rebuilding target)	Probability that all red-status CUs rebuild to above their lower rebuilding thresholds (e.g. lower WSP benchmark) within a given time frame.
	Probability that any one (or a specified proportion of) red-status CU(s) rebuilds to above its lower rebuilding threshold within a given time frame.
	Proportion of red-status CUs that rebuild to above their lower rebuilding thresholds with a specified probability within a given time frame. (Median over MC trials and 95% CIs)
	Number of years required to achieve lower rebuilding thresholds for one (a proportion of or all) red-listed CU(s) with a specific probability. (Median over MC trials and 95% CIs)
Minimize risk of loss (These metrics can be duplicated for numerous rebuilding and target thresholds)	Proportion of years that all CUs are above a quasi-extirpation threshold across the modelled time period. (Median over MC trials and 95% CIs)

Overarching goal	Performance metrics
	Proportion of years where all CUs are above their lower rebuilding thresholds within the modelled time period. (Median over MC trials and 95% CIs)
	Proportion of years where at least one (or a specified % of) CU(s) is(are) above their lower rebuilding thresholds within the modelled time period. (Median over MC trials and 95% CIs)
	Proportion of years where all CUs remain above their lower (or upper) rebuilding threshold across the modelled time period. (Median over MC trials and 95% CIs)
	Mean spawner abundances over the modelled time-period (or most recent generation) relative to lower rebuilding threshold. (Median over MC trials and 95% CIs)
	Variation in spawner abundances: CV of (or average % change between years in) spawner abundances over the modelled time period. (Median value over MC trials and 95% CIs) (suggested as indicator of extinction risk by Wainwright and Waples 1998)
Avoid COSEWIC listing	Short-term trends in spawner biomass over the last three generations. (Median over MC trials and 95% CIs) *COSEWIC Criterion A*
	Probability that short-term trends in abundances are > 30% (COSEWIC threshold) in the most recent time period. *COSEWIC Criterion A*
	Proportion of years where the short-term trend metrics < 30% for all CUs (or specified % of CUs). (Median over MC trials and 95% CIs) *COSEWIC Criterion A*
	Proportion of years where the short-term trend is stationary or positive and abundances are greater than 10,000. *COSEWIC Criterion C*
	Proportion of years where all CUs are above COSEWIC small population size thresholds; across the entire sampling period. (Median over MC trials and 95% CIs). *COSEWIC Criterion D*
Maintain exploitation rates below sustainable levels	Mean exploitation rate relative to current U_{MSY} for over the modelled time period. (Median value over MC trials and 95% CIs)
Maximize catch and stability in catch	Proportion of years that mean catch for the CU-aggregate is above a minimum acceptable level over the entire sampling period; in the short term (first 1-2 generations); or in the long term (last 1-2 generations). (Median value over MC trials and 95% CIs)
	Mean catch over the entire sampling period; in the short term (first 1-2 generations); or in the long term (last 1-2 generations); for totals and segregated into different fisheries (e.g. mixed-CU vs. terminal). (Median value over MC trials and 95% CIs)

Overarching goal	Performance metrics
	Catch variability: CV of (or average % change between years in) catch over the sampling period; for totals and segregated into different fisheries (e.g. mixed vs. terminal). (Median value over MC trials and 95% CIs)
Allocate catch to terminal vs. mixed-CU fisheries	Proportion of catch in mixed-CU vs terminal fisheries averaged over the entire sampling period (Median value over MC trials and 95% CIs)

While building complex tables you must take an iterative approach once you've made the basic table and want to add detailed elements: add one element; test; fix errors; fix logic/design issues; repeat. In the construction of Table 4, one line of code at a time was added with the results checked and made sure to be correct before adding the next line of code.

On the following pages we have an example of a long and wide table which is in landscape mode. This is accomplished by setting `landscape = TRUE` in the `csas_table()` call. You can change the font size if the table it still too large and overlaps the header and footer lines.

Table 5. A long and wide table

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	19.2945	20.0783	18.3885	21.0849	19.5094	19.5188	20.0956	20.9950	19.2739	19.5524	19.9415	20.3286	20.0884	20.9854	20.8130
2	19.6138	20.7246	19.8367	19.5113	21.4255	20.1802	20.9967	18.2081	20.4456	19.2236	21.5089	20.5368	19.9400	18.8615	20.5278
3	21.2993	20.9295	20.5407	20.3400	20.3993	21.0547	19.5937	19.8996	18.9012	19.9525	19.9867	20.2540	19.8954	19.3418	19.0946
4	19.1976	21.0345	19.9718	19.0058	20.3847	19.2715	21.2493	21.7159	20.4313	19.4879	20.9459	21.0735	18.9317	19.3583	18.5992
5	19.1060	19.3320	17.8000	18.8988	20.7733	17.8353	22.8237	19.5730	19.0778	20.7490	21.2872	20.7369	19.4671	20.7251	20.6114
6	21.1641	19.5378	18.2537	21.2098	17.1358	20.6269	19.7484	19.6186	19.4287	21.6134	21.2308	19.0991	21.9134	21.0028	19.1976
7	20.6153	19.6822	19.7492	20.5299	19.8677	19.2439	21.0202	20.9048	20.5354	21.0371	20.1016	21.2661	21.4075	21.2805	18.8605
8	19.5803	20.3447	19.9397	19.9583	20.2702	20.1996	20.2787	20.3665	19.3058	19.2481	20.1729	18.5816	20.4948	20.1627	18.8297
9	20.3948	20.3290	19.6829	20.0463	21.5498	20.9699	19.2761	19.1759	20.4740	21.0170	19.5554	19.9653	20.4603	20.0336	20.6291
10	19.7604	19.9900	20.0871	19.4124	18.8658	20.0890	21.5310	19.4667	21.5127	21.8366	21.6378	22.7040	21.1241	18.8725	20.5492
11	21.1691	18.6659	21.1362	18.3855	21.1660	18.4534	22.6189	19.9461	20.1775	19.6338	20.9667	19.1680	19.5854	20.5398	21.3611
12	20.1754	20.4253	19.3894	20.6281	19.9237	17.7636	19.4359	19.8561	22.2366	21.5369	18.4089	19.9981	18.7435	19.5481	20.4069
13	19.8207	19.8337	18.8942	19.7134	20.0806	19.9010	20.6344	19.6868	20.8847	19.7718	17.8216	19.9136	19.7588	21.0242	20.4173
14	18.8968	19.8241	19.8273	20.6584	19.2138	19.5857	19.2087	21.1448	19.8324	19.8648	18.8156	19.7014	20.5818	20.8197	19.9846
15	22.3793	20.5582	19.5175	20.5959	20.4945	20.5662	17.6221	19.9616	19.6026	18.6150	20.0133	21.1483	20.0999	21.0621	18.7993
16	20.1357	20.4483	20.1050	18.6833	20.1433	20.0137	16.7940	19.3772	19.8505	21.4433	21.4508	19.6914	20.5576	20.7131	19.9002
17	20.2276	20.6200	18.9243	19.3267	20.5909	21.5362	21.2135	20.4595	20.5707	18.7294	20.4500	19.3708	20.0472	21.0048	17.6091
18	19.3500	19.5308	19.1686	20.9185	21.4376	19.8589	20.2266	19.5545	20.6645	19.9376	20.8488	18.4138	20.9276	19.8937	21.4211
19	19.5133	19.2127	19.8504	19.0561	19.4466	20.7131	20.2334	18.6148	20.3895	20.1535	19.7007	20.4529	20.7970	19.3109	17.7610
20	19.4067	18.8264	18.7351	21.2896	22.1302	20.6233	21.5274	18.9767	19.8695	18.2360	18.1314	19.1543	19.9527	21.4218	18.6398
21	21.0872	19.6275	22.0529	20.2121	20.9051	20.6111	19.9596	19.8198	19.4182	21.1785	18.3201	18.5198	19.8255	18.8164	18.7744
22	19.5913	20.6280	19.8550	19.5438	20.6911	21.4120	20.6725	19.9955	20.0259	19.5748	19.3058	20.0004	20.7809	19.7429	20.4718
23	18.2183	20.4397	17.9572	19.9092	19.3208	20.4203	19.9316	20.1524	20.7332	18.7243	19.6459	20.4463	19.2849	19.2422	17.4515
24	21.0201	19.8599	20.4068	19.6031	18.8009	19.4865	20.0511	20.5272	21.0646	19.6132	19.9405	19.8011	20.4422	19.7138	19.8673
25	20.4959	21.9730	18.6596	19.5591	19.2398	20.0575	20.6048	20.0077	18.5807	19.5597	21.0500	20.3898	20.4584	19.4476	21.9346
26	20.3838	19.7763	20.1553	17.8492	20.0710	18.4519	19.9827	20.5555	19.7539	19.2484	19.6485	21.5067	20.6893	19.3159	20.1616
27	20.8177	20.1871	19.7231	18.8355	21.0108	21.1131	19.7970	19.2744	19.6245	21.2541	21.2804	19.3105	20.0141	20.4237	20.0689
28	20.0306	18.1022	21.2401	20.3261	20.4040	19.7178	17.8847	18.5815	20.5157	20.5719	19.2321	20.0895	20.7074	20.7723	21.5236
29	17.9927	19.9156	20.4639	20.5854	19.9557	21.1864	20.7307	18.7899	18.1194	19.4278	19.4719	18.3765	19.8021	19.6542	20.7838
30	23.2271	19.1728	18.8742	18.9496	18.9610	19.3453	19.0052	20.1516	19.1679	20.3806	20.4804	20.2804	20.0203	18.5597	20.0042
31	19.3821	18.9692	17.6517	17.5133	20.5922	18.5875	19.5540	22.2931	18.7117	19.4315	21.1828	20.4368	19.6305	20.4280	18.5591
32	20.2893	18.3762	20.8027	20.2135	19.9809	21.2379	21.4458	20.7475	18.8657	22.2480	19.4389	20.1865	18.7215	20.2914	20.6444
33	18.3477	21.3602	21.7709	19.5376	20.9580	21.3107	19.8521	21.3346	19.5819	20.7390	21.1291	19.3808	20.5295	20.9971	19.4116
34	18.8971	19.3054	18.7776	20.7793	17.5913	21.5564	19.1551	18.8920	18.8009	19.4942	19.6078	21.0921	22.1984	19.2942	18.4267
35	20.9554	20.9378	19.1511	19.2499	19.4040	20.6042	18.2313	20.5245	19.1561	18.2738	19.7946	18.4712	19.5137	20.6511	19.2126
36	19.7019	21.0781	18.9381	20.0948	19.4466	19.4177	19.4244	22.2668	19.8986	19.1039	21.6752	20.6683	19.8340	19.3189	19.9873
37	19.0401	20.3053	19.7937	17.9856	22.2786	20.4926	19.5009	20.3232	20.3239	19.9033	18.4473	20.6291	21.6733	21.5202	21.1263
38	19.6156	18.0019	18.7062	19.2000	21.5048	20.2674	20.3649	21.0814	21.6526	20.4029	19.2444	19.8729	20.4156	20.4405	20.1314
39	18.6750	18.4622	20.3632	19.4270	21.2530	21.1274	20.9870	18.8412	18.9053	20.5666	19.5082	18.8479	18.2582	18.2634	20.4962
40	19.5427	20.8089	18.6811	20.9626	19.8425	20.0779	20.8436	20.0869	21.1680	18.8261	19.6389	20.7975	18.9110	21.3468	19.4990
41	19.0557	20.3309	19.8836	20.7942	19.9204	19.4339	20.0280	20.8244	20.2167	21.0244	20.9282	20.2904	19.4620	22.0743	20.5637
42	20.2490	21.6809	20.4532	20.9894	19.1042	18.4278	19.0002	18.7608	20.5572	22.3703	19.8309	18.8515	20.2054	18.7583	18.9626

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
43	18.5754	20.0893	21.1661	18.7427	20.0875	20.2713	19.0077	20.1169	19.3831	20.1385	21.4798	18.8230	19.3769	18.2768	19.1214
44	21.2142	21.8300	21.6290	19.2954	19.2685	19.5042	18.4873	20.1813	20.4693	19.9282	18.6072	20.2020	20.9034	21.2570	20.8670
45	19.4208	21.9273	19.7034	18.7856	19.1293	20.5670	19.5968	17.9668	18.6362	19.9699	19.8696	19.9543	19.1288	19.9191	19.7131

3 Results

You can add new knitr code chunks with figure and tables in any section. csasdown links all these `.Rmd` files together into one large file. Keep track of your file order insertion follow the order in `_bookdown.yml`.

Here's another plot for fun:

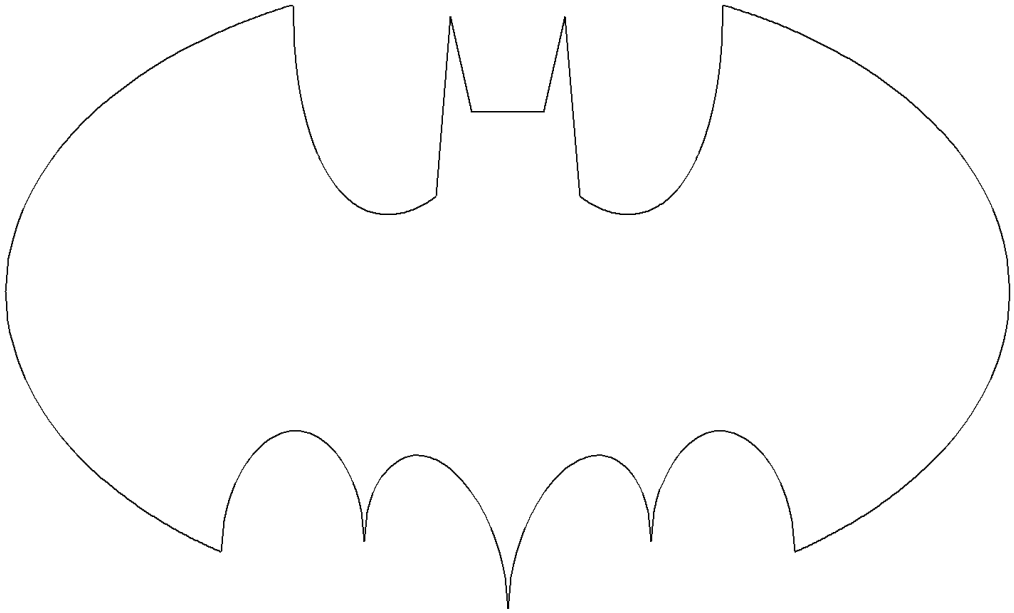

Figure 2. Batman!

Note that this figure is numbered consecutively even though the first figure appears in a different file and section. The figures, tables, and equations are numbered **after** all the files are stitched together by `csasdown`.

4 Discussion

To highlight the power of `csasdown` for French compilation we use the companion translation package rosettafish along with some non-classified herring data. Render the document in French to see how every aspect of the document can be controlled in both languages.

```
d <- readr::read_csv(file.path("data", "herring.csv"))

firstup <- function(x){
  substr(x, 1, 1) <- toupper(substr(x, 1, 1))
  x
```

```
}

firstlower <- function(x){
  substr(x, 1, 1) <- toupper(substr(x, 1, 1))
  x
}

input_data_table <- function(tab,
                             cap = "",
                             ...){
  # Source column
  tab$Source <- en2fr(tab$Source, allow_missing = TRUE)
  tmp <- tab$Source
  nonbracs <- stringr::str_extract(tmp, "[(\\w+ ) ]+(?= +\\()")
  bracs <- stringr::str_extract(tmp, "(?<=\\()\\w+(?=\\))")
  if(!all(is.na(bracs) == is.na(nonbracs))){
    warning("The match of bracketed items in the Source ",
            "column of the Input data table was incorrect.")
  }
  tmp[!is.na(bracs)] <- paste0(en2fr(firstup(nonbracs[!is.na(nonbracs)])),
                               " (",
                               firstlower(en2fr(firstup(bracs[!is.na(bracs)]))), ")")
  tab$Source <- tmp

  # Data column
  tmp <- strsplit(tab$Data, ": *")
  tmp <- lapply(tmp, function(x){
    j <- firstup(x)
    j <- en2fr(j, allow_missing = TRUE)
    if(length(j) > 1){
      j <- c(j[1], tolower(j[-1]))
      j <- paste(j, collapse = ": ")
    }
    j
  })
  tab$Data <- unlist(tmp)

  # Years column
  if(fr()){
    tmp <- tab$Years
    tmp <- strsplit(tab$Years, " *to *")
    tmp <- lapply(tmp, function(x){
      paste0("De ", x[1], " \U00E0 ", x[2])
    })
    tab$Years <- unlist(tmp)
  }
```

```
  names(tab) <- en2fr(names(tab))
  csas_table(tab,
             format = "latex",
             caption = cap,
             ...)
}
input_data_table(d)
```

Table 6

Source	Data	Years
Roe gillnet fishery	Catch	1972 to 2019
Roe seine fishery	Catch	1972 to 2019
Other fisheries	Catch	1951 to 2019
Test fishery (Seine)	Biological: number-at-age	1975 to 2019
Test fishery (Seine)	Biological: weight-at-age	1975 to 2019
Roe seine fishery	Biological: number-at-age	1972 to 2019
Roe seine fishery	Biological: weight-at-age	1972 to 2019
Roe gillnet fishery	Biological: number-at-age	1972 to 2019
Other fisheries	Biological: number-at-age	1951 to 2019
Other fisheries	Biological: weight-at-age	1951 to 2019
Surface survey	Abundance: spawn index	1951 to 1987
Dive survey	Abundance: spawn index	1988 to 2019

The code above appears quite complex at first, but essentially the data file is read in, and each column is translated with some rules, and finally the column names are translated. The `rosettafish` package has an English-French dictionary for DFO nationwide that you can contribute to by going to the GitHub repository for rosettafish and reading the README which tells you how.

When you choose how you want to present your table, you may (should) choose a simpler data format. This particular one has words which may or may not be inside parentheses in the `Source` column, and words which may be separated by colons in the `Data` column. Those are all parsed out in the function which makes the code complex. The `Years` column is also complex because it contains the word "to", e.g. `1972 to 2019` which when translated to French becomes `De 1972 à 2019` which is difficult to write code for. If you chose to have two columns for the year range instead (`Start year` and `End year`) and two columns to represent where the data came from (`Data type` and `Data`) this function would be much simpler. The next code chunk does exactly this.

```
d <- readr::read_csv(file.path("data", "herring-simple.csv"))
input_data_table <- function(tab,
                             cap = "",
                             ...){
  # Source column
```

```
  tab$Source <- en2fr(tab$Source, allow_missing = TRUE)
  tab$`Data type` <- en2fr(tab$`Data type`, allow_missing = TRUE)
  tab$Data <- en2fr(tab$Data, allow_missing = TRUE)
  tab$Data[is.na(tab$Data)] <- "--"
  names(tab) <- en2fr(names(tab))

  csas_table(tab,
             format = "latex",
             caption = cap,
             font_size = 10,
             ...)
}
input_data_table(d)
```

Table 7

Source	Data type	Data	Start year	End year
Roe gillnet fishery	Catch	–	1972	2019
Roe seine fishery	Catch	–	1972	2019
Other fisheries	Catch	–	1951	2019
Test fishery	Biological	number-at-age	1975	2019
Test fishery	Biological	weight-at-age	1975	2019
Roe seine fishery	Biological	number-at-age	1972	2019
Roe seine fishery	Biological	weight-at-age	1972	2019
Roe gillnet fishery	Biological	number-at-age	1972	2019
Other fisheries	Biological	number-at-age	1951	2019
Other fisheries	Biological	weight-at-age	1951	2019
Surface survey	Abundance	spawn index	1951	1987
Dive survey	Abundance	spawn index	1988	2019

Clearly, this code is much simpler. The `font_size` argument had to be added to the `csas_table()` call to make the table fit on the page, as there are now two extra columns.

The first time this code was run for the French version though, an error was issued:

> *Error: The following terms are not in the translation database: Data type, Start year, End year*

This means that `rosettafish` has no idea what the French translation is for these column names. At this point, we would either change the names of the columns in the data file and code to something `rosettafish` knows about, or add the translation of our terms into `rosettafish`. That is what we have done, so this should compile for you with a correct translation. In your workflow, once you have added your translation and re-installed the `rosettafish` package, your terms will be recognized and translated. A great online translator for this is DeepTL.

APPENDIX A THE FIRST APPENDIX

Appendices can be in one file, or if they are larger than a couple of pages you should add a new file for each new appendix. In the first appendix, you **must** include two special lines of code at the top to tell `csasdown` that you are now numbering sections as appendices. Look in `05_appendices.Rmd` to see these. The last line of your last appendix **must** be another special line of code which tells `csasdown` to end the appendices sections. In this document it can be found at the end of `05_appendices.Rmd`.

Figures and tables will now be prepended with the appendix letter:

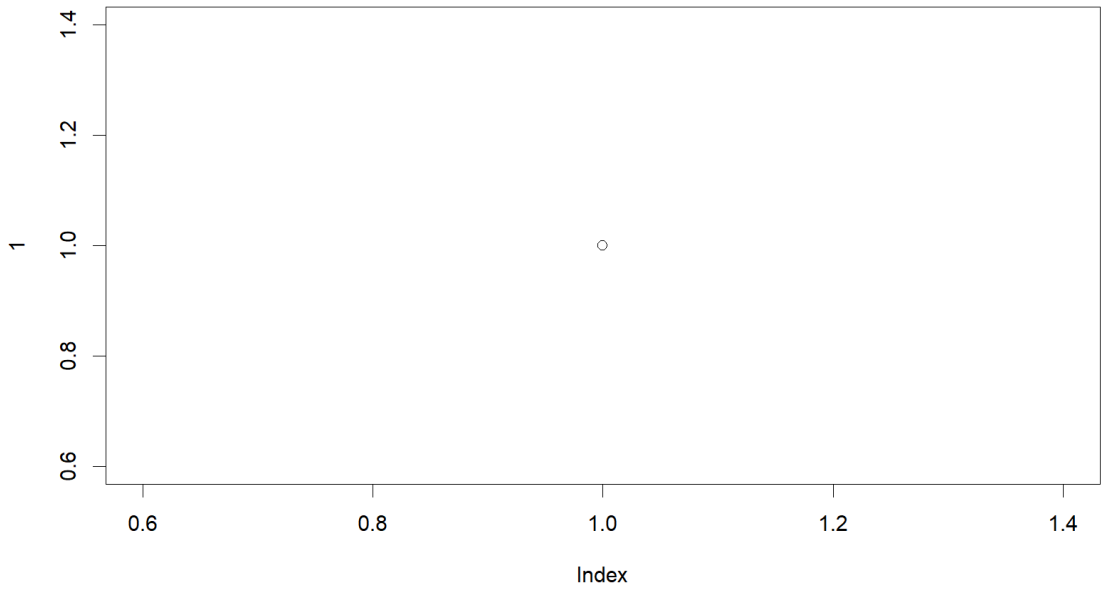

Figure A.1. English version of the test1 figure caption

Table A.1. English verion of the test2 table caption

x	y
a	1
a	2
b	3

Here's an equation. Note that it is automatically given a label on the right side of the page as in the main document, but it has the appendix letter before it. Each appendix will have its own set of equations starting at 1.

$$1 + 1 \tag{A.1}$$

See Equation A.1 for the example equation.

See Figure A.1 for the example appendix figure.

See Table A.1 for the example appendix table.

APPENDIX B THE SECOND APPENDIX, FOR FUN

The label `#app:` in the appendix section headers tell `csasdown` to start a new appendix, and the next letter in the alphabet will be used for the appendix, and prepended to figure and table names. For example, this appendix's whole section header looks like:

```
# THE SECOND APPENDIX, FOR FUN {#app:second-appendix}
```

To illustrate the new labeling of appendices, here are a table and figure:

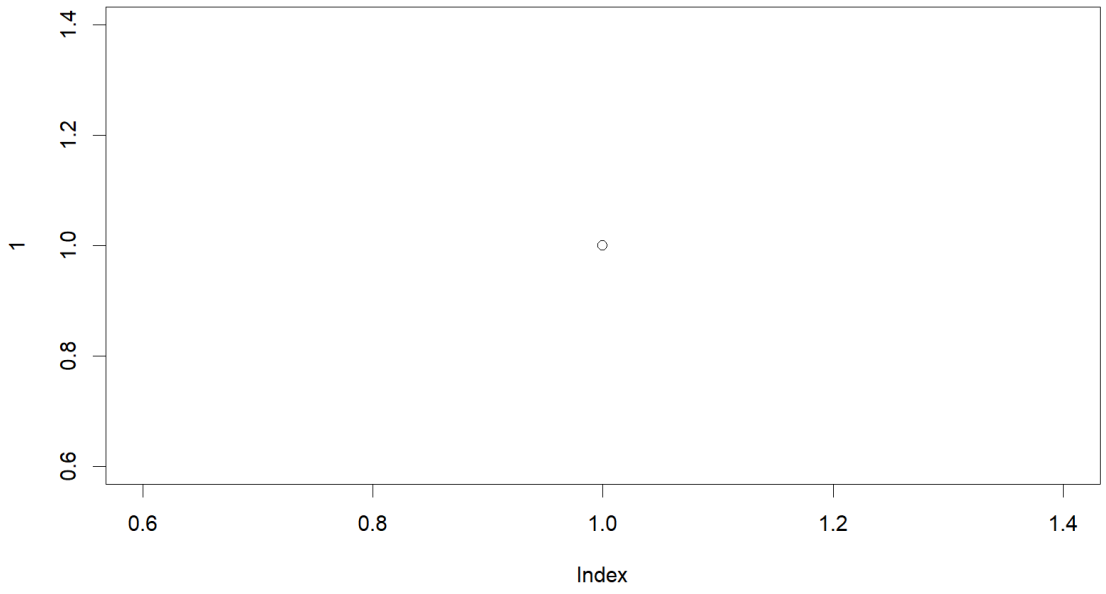

Figure B.1. English version of the test1b figure caption

Table B.1. English verion of the test2b table caption

x	y
a	1
a	2
b	3

And references to them. . .

See Figure B.1 for the example appendix figure.

See Table B.1 for the example appendix table.

5 References

Edwards, A.M., Haigh, R., and Starr, P.J. 2014. Pacific Ocean Perch (*Sebastes alutus*) stock assessment for the north and west coasts of Haida Gwaii, British Columbia. DFO Can. Sci. Advis. Sec. Res. Doc. 2013/092. vi + 126 p.

Francis, R.I.C.C. 2011. Data weighting in statistical fisheries stock assessment models. Can. J. Fish. Aquat. Sci. 68(6): 1124–1138.

Swain, D.P., and Benoît, H.P. 2015. Extreme increases in natural mortality prevent recovery of collapsed fish populations in a Northwest Atlantic ecosystem. Mar. Ecol. Prog. Ser. 519: 165–182.