A Quarto Template Repo to Create Big Reports and Very Long Title Because Long Titles are Common

Some tips on creating reports with Quarto with a focus on tables and replicated tables and figures

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The Publisher $\boxed{PL}$

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1. Open Issues

1.1. April 26, 2023 update

- Everything broken in the Aug 13, 2022 update is still broken.
- flextable cross-refs and captions are still not working in Word output
- The flextable 0.9.1 CRAN release broke PDF output in Quarto books. Known problem and fixed in the development version on GitHub (0.9.2) `devtools::install_github("davidgohel/flextable")`
- gt (v0.9.0) cross-refs still broken in Word

1.2. Aug 13, 2022 update

I have mostly figured out workarounds for the table package issues. The remaining big issues are

- For HTML, if you have two chapters (h1 level) in a single qmd it totally messes up the TOC. Word and PDF converters seem to figure it out ok and number things correctly.
  - I posted an issue https://github.com/quarto-dev/quarto-cli/issues/1712
  - This is important because we often don't know how many appendix chapters we will need. These are dynamically created based on the data. There is no good way to know this ahead of time. These report templates are used across very different regions and each region has a different number of appendices based on the number of, say, species or cities or whatever, in the region.
- When I have appendices so `appendices:` in my YAML, the HTML TOC is messed up.
  - see https://rverse-tutorials.github.io/QmdReport/ and look at TOC
  - why doesn't the HTML figure out that the appendix A title is CRchum.csv?? Word and PDF figure that out.
- When I have `appendices:`, the PDF TOC and levels look right, but if I click on "Appendices" in the TOC, I go to References.
  - Look here to see what I mean PDF version

  - I would like to be able to have a `appendices.qmd` that I would go to. Maybe I can. I haven't tried.

- No merge and knit option. :(so no memory across chapters. That is a "feature" in many cases but some report writers use memory across chapters heavily.

1.3. Aug 11, 2022 update

- flextable cross-refs don't work in pdf but kableExtra tables work and look better in some ways. So I use kableExtra for pdf's.
- flextable is best for Word but cross-refs are broken. The Quarto dev team knows about the problem.
- The Quarto {{include filename}} option for including files seems very limited or I don't know how to use it (most definitely true). The file has to be in same folder as the qmd that calls it.
- The Quarto {{include filename}} breaks if the thing you call is calling `knit_expand()`. Why? So weird. I might be doing something wrong.
- No merge and knit option. :(no sharing of variables across chapters
- Can't have two chapters (h1 level) in a single qmd so can't dynamically create chapters (one qmd with many h1 levels where that qmd is created dynamically)
- {gt} package and PDF table numbering don't mix! Breaks all numbering after a single `gt()` call. *Update. Fixed in the new gt update*

Citation

EE Holmes, 2022. Quarto Report Template. Northwest Fisheries Science Center.

2. Preface

Acknowledgements

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Abstract

Phasellus non diam posuere, laoreet velit sed, egestas felis. Etiam eget neque in tellus lacinia tincidunt. Pellentesque scelerisque odio velit, nec fringilla nibh iaculis non. Aenean sit amet nulla ipsum. Cras felis lacus, pulvinar ac nisi et, convallis pulvinar turpis. Morbi non nibh lacus. Morbi vitae lorem massa. Sed ut turpis vel felis posuere commodo lacinia ac mi. Donec finibus lectus sit amet elit finibus, vitae rhoncus ligula tincidunt. Phasellus vitae blandit lacus. Integer sed nisl fermentum, pulvinar mauris in, posuere enim. Proin sit amet semper urna. Vivamus aliquet rutrum diam ac luctus.

3. Tips

3.1. Overview

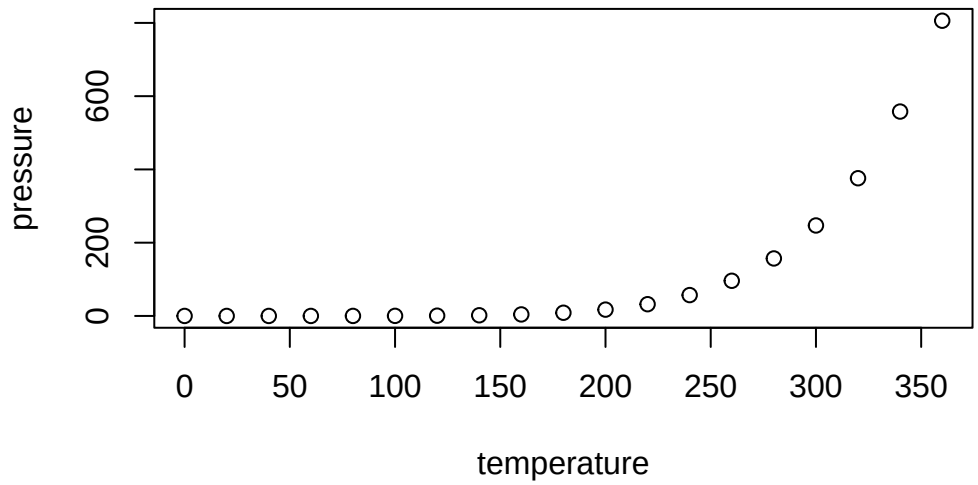

Figure 3.1.: chapter 1 plot

3.2. General set-up

- Be as modular and simple as you can.
- Don't make everyone in your team be the markdown wizard. You only need one person to build the framework.
- Use simple child Rmds so that other team members work only on simple Rmd/qmd flat files.

- Don't put all your tables or figures in one huge file: `Table xyz.Rmd/qmd`, `Table abc.Rmd/qmd`. Have your dedicated markdown wizard figure out the automatic numbering.
- Copy reports built by others who are doing something similar to you. TALK within your center or across centers and share work.

3.3. Tips

3.3.1. Cross-references

This can be really troublesome unless you use an output that already has cross-references as part of the design. For R Markdown,

- {bookdown} outputs for html and PDF
- {officedown} for Word

These output formats give you access to cross-referencing via the `\@ref(xxx:yyy)` format and if you use `bookdown::pdf_book`, this will also work with PDF.

However, Quarto makes cross-references, auto-numbering and cross-referencing of tables and figures super easy. Quarto cross-ref page.

For example, we can make a figure with the chunk label `fig-plot` like so.

````
```{r}
#| label: fig-plot
#| fig-cap: "Plot"

plot(cars)
```
````

The later in the text we use `@fig-plot` to get Figure 3.2.

3.3.2. Chunk labels

- When using R Markdown (or Quarto), it is best not to use chunk labels in the your Rmd/qmd children. It's too easy to get duplicate labels accidentally.

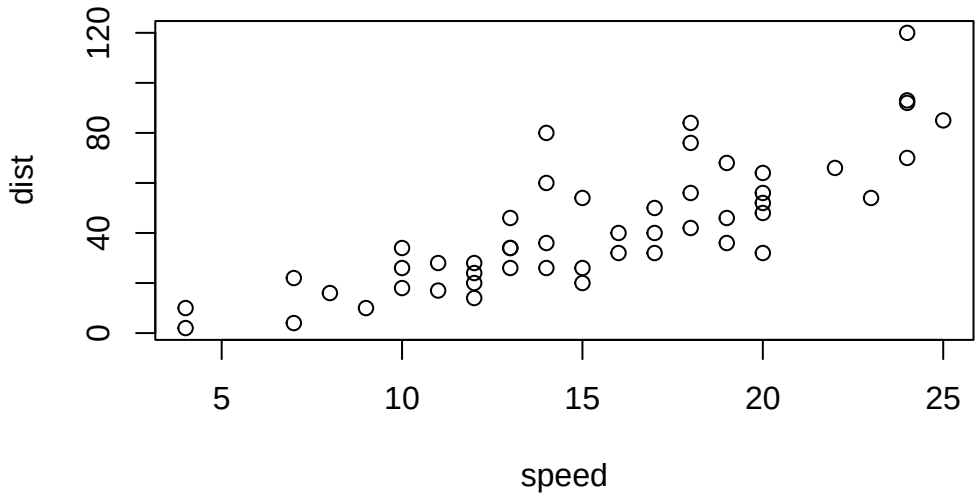

Figure 3.2.: This is a plot of some data

3.3.3. File paths

- if you need to reference a file in a folder, let R create the path so that it is compatible across systems:

```
file.path('figures', 'figure1.Rmd')
```

- I typically use the {here} package so that my code doesn't break if I happen to issue a change workspace directory command.

```
here::here('images', 'logo.png')
```

3.3.4. Tables in for loops

Making tables within `for` loops is tricky and it is different if you are outputting to Word versus html and also depends on what package that you use. See my Rmd/qmd files in the tables folder for examples of how to set it up, but also be prepared for things breaking in the future as package writers change things. This feature is really fluid. Web searches on stackoverflow are key for solving these problems.

3.4. Working with Word

For many of us, Word is part of our team's workflow. Here are some tips if that is the case for you:

- Check out the officeverse: officedown and flextable R packages.
- Quarto has greatly improved Word integration so many of the problems we faced with Word output may soon be solved.
- Don't build the whole report in one file. Work on individual text sections and then have RStudio (via pandoc/knitr) assemble the report (text, figures, tables) from the individual parts.
- How to deal with the team needing to review the assembled document (text, figures, tables):
  - Try to modularize. So maybe make individual chapters and have review happen at that level. Then you incorporate the changes into the plain text manually.
  - Use templates to make your Word doc look the way you want. The default Word template is bare bones. See my example and read about using Word templates with Quartro here and R Markdown here .

3.4.1. Making tables look nice in Word

The example in `Table_Counts.Rmd` and `Table_Counts_flex.Rmd` shows you tricks to make nice Word tables.

- how to include a page break in your Word doc between tables.
- using `format="pandoc"` for the table
- using `results='asis'` and `print()` so you can use `for` loops.
- centering your tables is next to impossible with `kable()`. Use the {flextable} package if you need that.

3.4.2. New pages

This is how to get a new page in Word. Make sure you are in print view on the word doc, otherwise you won't see any of the pages.

````
```{=openxml}
<w:p><w:r><w:br w:type="page"/></w:r></w:p>
```
````

3.5. Output templates with Quarto

Quarto is working on templates to make output to different formats easy. Here is an example of journal templates quarto-journals.

3.6. Weird Quarto quirks

- If you use

```
---
title: MyTitle
---
```

as your title spec, then you won't get the first header 2 in your pdf. Use `#` instead.

- If you have 2 `#` levels in a qmd file, you only the first chapter appearing in the TOC. The others appear weirdly as sub-chapters.
- with flextable, your table captions from knitr yaml disappear if the table breaks across a page.

4. Tables intro

This chapter shows a few simple examples of including tables and getting cross-referencing to work across formats (HTML, Word, PDF). See Chapter 6 for more examples and comparisons of different table outputs.

In this chapter, I am going to use {flextable} for Word and HTML and {kabelExtra} for PDF. See Chapter 6 for a comparison of {flextable}, {kableExtra} and {gt}. There is a current problem that Quarto is not processing the cross-references with {flextable} into PDF and Word. But this is a known problem and they are working on it. {flextable} is the only table package that I have found the tends to work as expected across platforms. The {officer} package uses it so it works well with Word and works well with LaTeX.

*Note, I am using some customized functions to be able have a uniform look for my tables. These are in `tables/_common.R`.

4.1. Example table

This is an example a table. We can reference Table 4.1 (note this is broken in Word output) easily and it is auto-numbered.

4.2. Including table files

It is often good to have your files in separate files so that when you edit your tables, you only have to work on the table code.

```
```{r child=here::here("tables", "Table_flex.Rmd")}
```
```

Table 4.2.: This table is created in `Table_flex.Rmd`. flextable.

	Df	Deviance	Resid. Df	Resid. Dev
NULL			99	129.5
ethnicty	3	47.2	96	82.2

Table 4.2.: This table is created in `Table_flex.Rmd`. flextable.

	Df	Deviance	Resid. Df	Resid. Dev
grade	1	1.7	95	80.5
ethnicty:grade	3	7.2	92	73.3

We can add a captions to a flextable with `set_caption` but then we won't have access to Quarto's cross-format (Word, HTML, PDF) cross-referencing engine. We can also use `tab.cap="caption"` in the chunk yaml but again we don't get the cross-referencing engine.

```
set_caption(ft,
  caption = "a table caption with set_caption",
  style = "Table Caption")
```

4.3. Cross-references

In Quarto, table links use the table label `@tbl-tablabel` where `tablabel` is the label you put on the table chunk. In the text it looks like this Table 4.3 (note this is broken in Word output). The chunk yaml looks like this

```
#| label: tbl-tablabel
#| tbl-cap: "my caption"
```

4.4. Dynamic table captions

You can create captions dynamically.

```
dt <- mtcars[1:10, 1:6]
tbl_cap <- paste("This is a dynamically created caption. The length of mtcars is", nro
```

Unfortunately you cannot dynamically create your chunk labels too.

Table 4.1.: This is a simple table.

	mpg	cyl	disp	hp	drat	wt
Mazda RX4	21.0	6	160.0	110	3.90	2.620
Mazda RX4 Wag	21.0	6	160.0	110	3.90	2.875
Datsun 710	22.8	4	108.0	93	3.85	2.320
Hornet 4 Drive	21.4	6	258.0	110	3.08	3.215
Hornet Sportabout	18.7	8	360.0	175	3.15	3.440
Valiant	18.1	6	225.0	105	2.76	3.460
Duster 360	14.3	8	360.0	245	3.21	3.570
Merc 240D	24.4	4	146.7	62	3.69	3.190
Merc 230	22.8	4	140.8	95	3.92	3.150
Merc 280	19.2	6	167.6	123	3.92	3.440

Note:
kable

Table 4.3.: This is a table with a number.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1954	NA	NA	NA	NA	NA	NA	0	2	4	5	4	4
1955	6	8	11	13	14	16	17	18	18	18	20	21
1956	23	24	25	27	29	29	29	31	32	32	34	37
1957	39	39	40	40	43	44	45	44	46	48	49	51
1958	52	54	55	57	57	58	59	59	60	59	60	62
1959	63	64	65	66	67	67	67	68	69	68	69	70
1960	71	74	74	74	75	76	76	75	76	78	78	79
1961	80	80	82	85	85	87	87	89	89	91	95	95
1962	98	97	98	98	100	101	102	105	104	105	NA	NA

Note:
kable

Table 4.4.: This is a dynamically created caption. The length of mtcars is 32 rows. Here we show 10 rows.

	mpg	cyl	disp	hp	drat	wt
Mazda RX4	21.0	6	160.0	110	3.90	2.620
Mazda RX4 Wag	21.0	6	160.0	110	3.90	2.875
Datsun 710	22.8	4	108.0	93	3.85	2.320
Hornet 4 Drive	21.4	6	258.0	110	3.08	3.215
Hornet Sportabout	18.7	8	360.0	175	3.15	3.440
Valiant	18.1	6	225.0	105	2.76	3.460
Duster 360	14.3	8	360.0	245	3.21	3.570
Merc 240D	24.4	4	146.7	62	3.69	3.190
Merc 230	22.8	4	140.8	95	3.92	3.150
Merc 280	19.2	6	167.6	123	3.92	3.440

Note:
kable

5. Tables in a for loop

Outputting tables (or figure) in a for loop works fine in Quarto, but there is no way to set the table numbers dynamically and get all the cross-references working in Word, HTML and PDF. We really need that dynamic numbering and cross-reference feature in a big report.

5.1. Example of tables produced in a for loop

Look at the Code (link at top in HTML output) to see the `cat(knitr::knit_print(tab))` trick for getting your tables to appear.

5.2. Getting the cross-reference links

We have to use a bit of magic to get our dynamic table numbers and links using Quarto's cross-referencing. The trick is to use a child Rmd (or qmd) in a for loop. This trick can be used for figures too but I'll just show it here with tables. This code inspired from this gist.

We use `knit_expand()` and make a child Rmd that uses double curly braces like `{{value.to.match}}` in the code. That way the value at the time this Rmd was embedded can be referenced. Note that if `value.to.match` were a string (which it is not in this example), we would need to add quotes around `{{value.to.match}}` in our code.

Table 5.1.: We can set a caption but no way to cross-reference it

	mpg	cyl	disp	hp
Mazda RX4	21	6	160	110
Mazda RX4 Wag	21	6	160	110

Note:
kable

Table 5.2.: We can set a caption but no way to cross-reference it

	mpg	cyl	disp	hp
Mazda RX4	21	6	160	110
Mazda RX4 Wag	21	6	160	110

Note:
kable

Table 5.3.: Cars with 4 cylinders. These tables have cross-ref links via @tbl-xyz.

	mpg	cyl	disp	hp
Datsun 710	22.8	4	108.0	93
Merc 240D	24.4	4	146.7	62
Merc 230	22.8	4	140.8	95

Note:
kable

With this approach we get our numbered tables and we can reference the tables usual such as Table 5.4 (note this is broken in Word output). Click on the Code link at top (HTML output) to see how it's done.

Table 5.4.: Cars with 8 cylinders. These tables have cross-ref links via @tbl-xyz.

	mpg	cyl	disp	hp
Hornet Sportabout	18.7	8	360.0	175
Duster 360	14.3	8	360.0	245
Merc 450SE	16.4	8	275.8	180

Note:
kable

6. Kable vs Flex vs qt

Here I compare a three different ways to make tables. Unfortunately the table numbers and cross-references are still not working as of Quarto version 1.2.335 (Feb 2023), but the developers are aware and a major revamp of cross-referencing is in the works to fix these problems.

6.1. Kable

Here is the {kable} table Table 6.1. Word output is often not good looking. This is a known issue with `kable`.

```
library(knitr)
library(kableExtra)
# note hold_position not working in Quarto v1.0.38.
kbl(dt, booktabs = TRUE) %>%
  kable_styling(latex_options = c("scale_down")) %>%
  kableExtra::footnote(symbol = c(f1, f2))
```

6.1.1. `kable` quirks

- Make sure to put `always_allow_html: true` in the yaml at the top of your Rmd or qmd file if outputting to Word. I can't figure out how to put it in the ‘
- Word output is often not good looking. This is a known issue with `kable`
- Do not pass in caption to `kbl()` if you want to use Quarto's cross-reference engine.
- `kbl(..., format="pandoc")` can help for Word if your templates stop working but destroys the PDF output.

6.2. `flextable`

Here is the {flextable} table Table 6.2 (note this is broken in Word output). {flextable} gives you a lot more control over your tables with a grammar format (like ggplot2). It also gives nice output to Word, PDF and HTML. Sadly in Quarto v1.2.335 cross-reference and table numbers for Word is broken, but the developers know about this. The {officer}

Table 6.1.: kable: This should have a number that follows the other tables.

	mpg	cyl	disp	hp	drat	wt	qsec	vs	am	gear	carb
Mazda RX4	21.0	6	160.0	110	3.90	2.620	16.46	0	1	4	4
Mazda RX4 Wag	21.0	6	160.0	110	3.90	2.875	17.02	0	1	4	4
Datsun 710	22.8	4	108.0	93	3.85	2.320	18.61	1	1	4	1
Hornet 4 Drive	21.4	6	258.0	110	3.08	3.215	19.44	1	0	3	1
Hornet Sportabout	18.7	8	360.0	175	3.15	3.440	17.02	0	0	3	2
Valiant	18.1	6	225.0	105	2.76	3.460	20.22	1	0	3	1
Duster 360	14.3	8	360.0	245	3.21	3.570	15.84	0	0	3	4
Merc 240D	24.4	4	146.7	62	3.69	3.190	20.00	1	0	4	2
Merc 230	22.8	4	140.8	95	3.92	3.150	22.90	1	0	4	2
Merc 280	19.2	6	167.6	123	3.92	3.440	18.30	1	0	4	4

* Here is a footnote about this table

† Here is a second footnote.

package, which I think Quarto is leaning on for Word generation, use {flextable} so I am hoping that {flextable} gets moved into the RStudio suite.

```
library(flextable)
dt %>%
  flextable() %>%
  autofit() %>%
  flextable::footnote(i = 1, j = 1:2,
            value = as_paragraph(c(f1, f2)),
            ref_symbols = c("a", "b"),
            part = "header") %>%
  font(fontname="Times New Roman", part="all") %>%
  fontsize(size=12)
```

Table 6.2.: flextable: This should have a number that follows the other tables.

mpg[a]	cyl[b]	disp	hp	drat	wt	qsec	vs	am	gear	carb
21.0	6	160.0	110	3.90	2.620	16.46	0	1	4	4
21.0	6	160.0	110	3.90	2.875	17.02	0	1	4	4
22.8	4	108.0	93	3.85	2.320	18.61	1	1	4	1
21.4	6	258.0	110	3.08	3.215	19.44	1	0	3	1
18.7	8	360.0	175	3.15	3.440	17.02	0	0	3	2

Table 6.2.: flextable: This should have a number that follows the other tables.

mpg[a]	cyl[b]	disp	hp	drat	wt	qsec	vs	am	gear	carb
18.1	6	225.0	105	2.76	3.460	20.22	1	0	3	1
14.3	8	360.0	245	3.21	3.570	15.84	0	0	3	4
24.4	4	146.7	62	3.69	3.190	20.00	1	0	4	2
22.8	4	140.8	95	3.92	3.150	22.90	1	0	4	2
19.2	6	167.6	123	3.92	3.440	18.30	1	0	4	4

[a]Here is a footnote about this table

[b]Here is a second footnote.

6.2.1. `flextable` quirks

- Table numbers and cross-refs broken in Word. Known issue.

6.3. `gt`

Here is the {gt} table Table 6.3 (note this is broken in Word output). {gt} has many of the same features as {flextable} and is in the RStudio suite so maybe it'll get more Quarto support in the long run. But like {kable}, the Word output is not good. In addition, currently table captions are broken in Quarto Word output.

```
dt %>%
  gt::gt() %>%
  gt::tab_source_note(source_note = f1) %>%
  gt::tab_source_note(source_note = f2) %>%
  gt::tab_options(
      table.font.size = gt::px(18),
      table.font.names = "Times New Roman",
      data_row.padding = gt::px(1))
```

Table 6.3.: gt: This should have a number that follows the other tables.

mpg	cyl	disp	hp	drat	wt	qsec	vs	am	gear	carb
21.0	6	160.0	110	3.90	2.620	16.46	0	1	4	4
21.0	6	160.0	110	3.90	2.875	17.02	0	1	4	4

22.8	4	108.0	93	3.85	2.320	18.61	1	1	4	1
21.4	6	258.0	110	3.08	3.215	19.44	1	0	3	1
18.7	8	360.0	175	3.15	3.440	17.02	0	0	3	2
18.1	6	225.0	105	2.76	3.460	20.22	1	0	3	1
14.3	8	360.0	245	3.21	3.570	15.84	0	0	3	4
24.4	4	146.7	62	3.69	3.190	20.00	1	0	4	2
22.8	4	140.8	95	3.92	3.150	22.90	1	0	4	2
19.2	6	167.6	123	3.92	3.440	18.30	1	0	4	4

Here is a footnote about this table
Here is a second footnote.

6.3.1. `gt` quirks

- I couldn't get {gt} to respect my font request for HTML unlike for {flextable}
- The footnotes look bad in Word. But I don't know {gt} so probably my error.
- Table captions and numbers broken in Word.

7. Figures intro

This chapter shows a few simple examples of including figures and getting cross-referencing to work across formats (HTML, Word, PDF).

7.1. `ggplot2`

We can see in Figure 7.1 that there are many time series. The number of panels is choosen automatically using {ggplot2}.

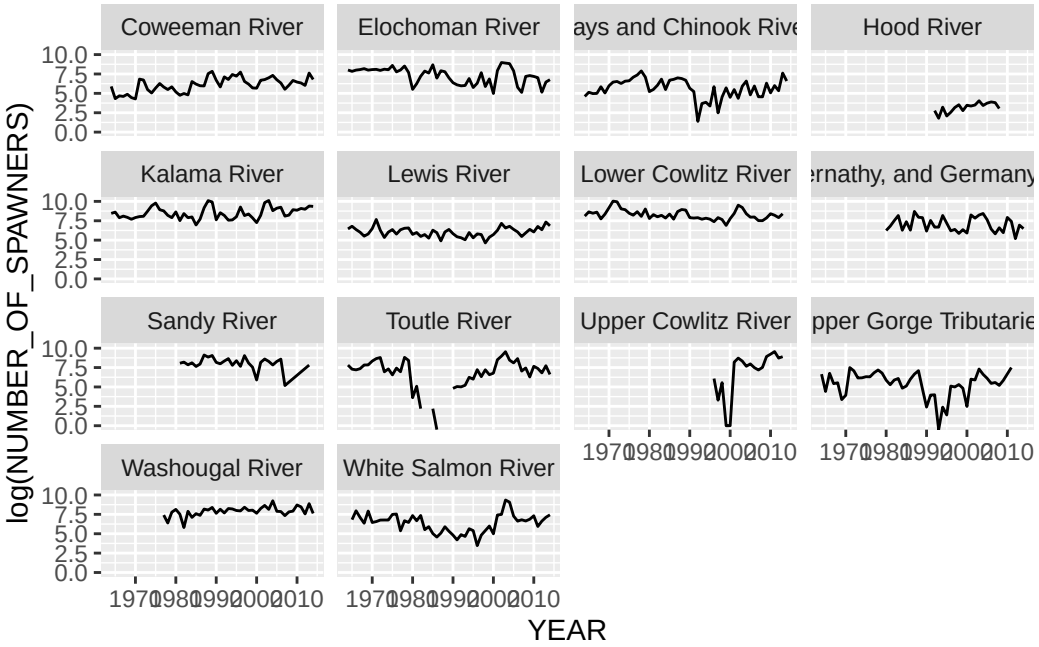

Figure 7.1.: Plot of the data

8. Conclusion

8.1. First off

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References

A. CRchum.csv

Table A.1.: Spawners and fracwild from Grays & Chinook Rs. for 2001 to 2010.

Year	Spawners	Fracwild
2001	4742	0.895
2002	11713	0.896
2003	16669	0.933
2004	13716	0.959
2005	4204	0.903
2006	6605	0.933
2007	3999	0.955
2008	2608	0.921
2009	2876	0.965
2010	6380	0.953

Note:
kable
** data file: CRchum.csv mod date: Sat Aug 13 16:58:50 2022 -0600
* These spawner counts are from river redd surveys.

Table A.2.: Spawners and fracwild from Washougal R. for 2005 to 2010.

	Year	Spawners	Fracwild
19	2005	923	0.977
20	2006	869	-99.000
21	2007	576	-99.000
22	2008	644	-99.000
23	2009	1154	0.969
24	2010	2148	-99.000

Note:
kable
** data file: CRchum.csv mod date: Sat Aug 13 16:58:50 2022 -0600
* These spawner counts are from river redd surveys.

B. HCchum.csv

Table B.1.: Spawners and fracwild from Strait of Juan de Fuca for 2000 to 2010.

	Year	Spawners	Fracwild
30	2000	801	0.49
31	2001	3733	0.36
32	2002	6791	0.61
33	2003	6752	0.62
34	2004	9280	0.60
35	2005	9619	0.62
36	2006	8181	0.82
37	2007	3219	0.93
38	2008	3449	0.86
39	2009	5029	0.59
40	2010	9179	0.65

Note:
kable
** data file: HCchum.csv mod date: Sat Aug 13 16:58:50 2022 -0600
* These spawner counts are from river redd surveys.

Table B.2.: Spawners and fracwild from Hood Canal for 2000 to 2010.

	Year	Spawners	Fracwild
82	2000	7987	0.67
83	2001	11491	0.60
84	2002	10818	0.60
85	2003	35173	0.77
86	2004	69565	0.86
87	2005	15311	0.72
88	2006	26418	0.80
89	2007	10539	0.87
90	2008	15112	0.88
91	2009	7236	0.89
92	2010	12533	0.91

Note:
kable
** data file: HCchum.csv mod date: Sat Aug 13 16:58:50 2022 -0600
* These spawner counts are from river redd surveys.