An Overview of GitHub for Data Analysis Projects

Emerging Technologies Information Sessions 2025 Webinar Series
Modeling and Analysis Session
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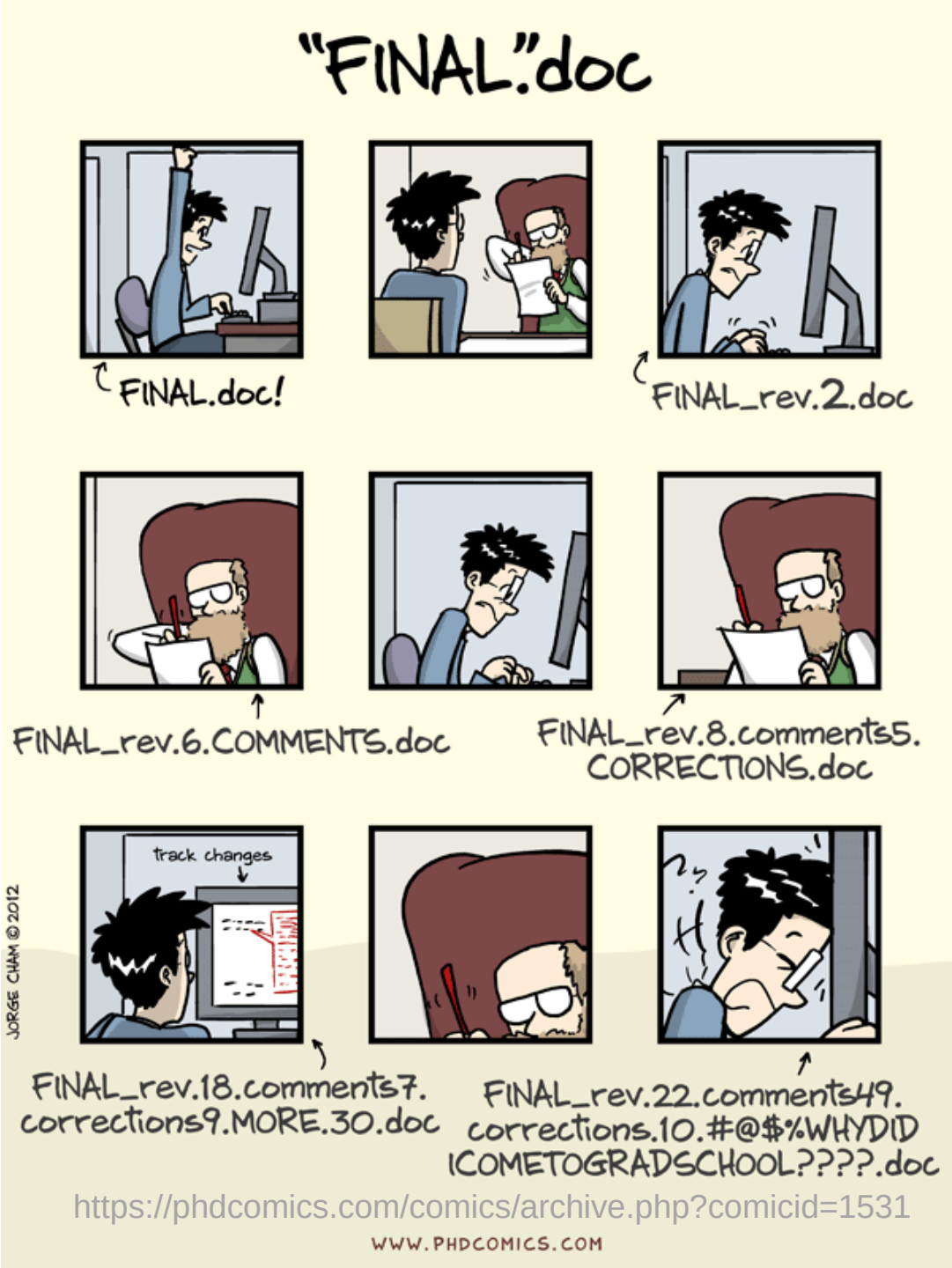
Ben Staton
Quantitative Fisheries Scientist
Columbia River Inter-Tribal Fish Commission
bstaton1
bstaton@critfc.org

Disclaimer: This overview is much more "what and why" of GitHub
See upcoming PNAMP FMWG Webinar Series for "How-To"

Why Version Control?

Especially for Data Analysis Projects?

Avoid this ➡



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  - Code & data files
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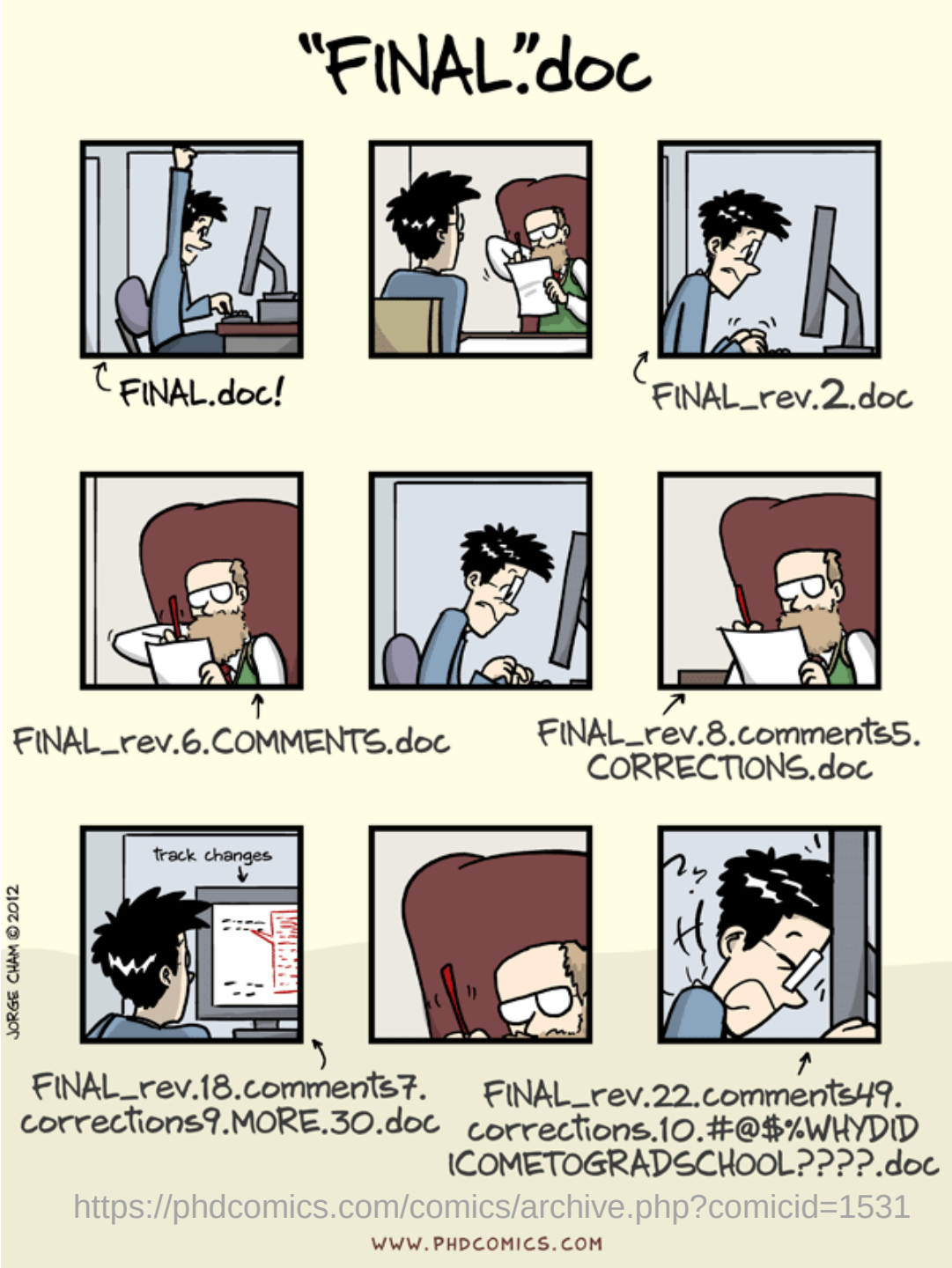

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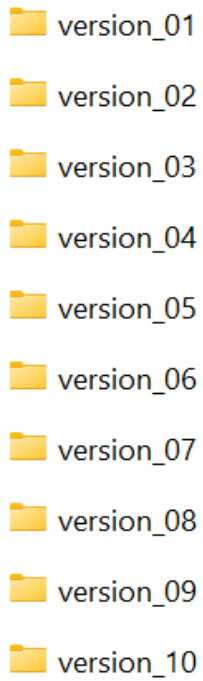

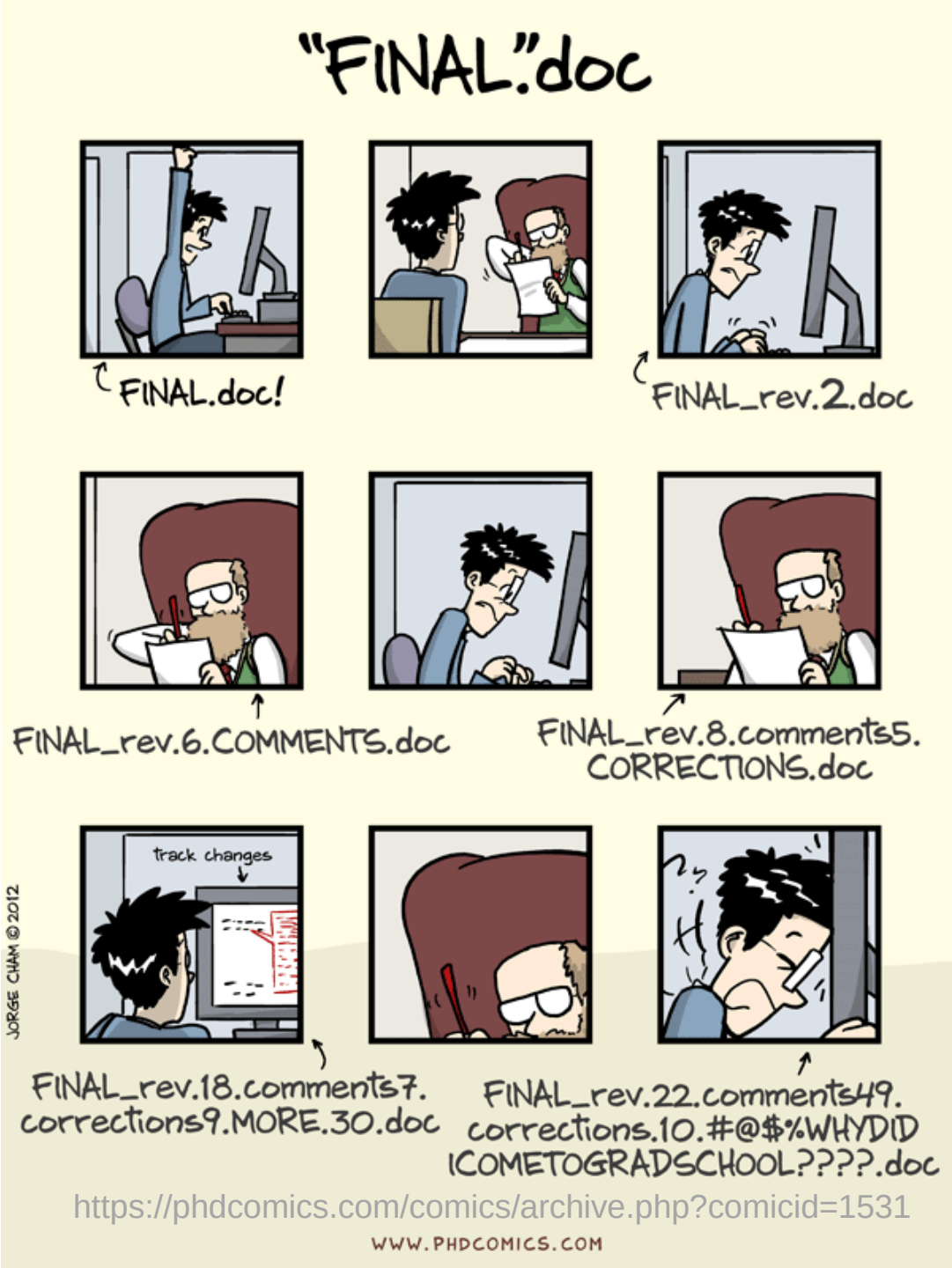

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  - Compare differences in versions?
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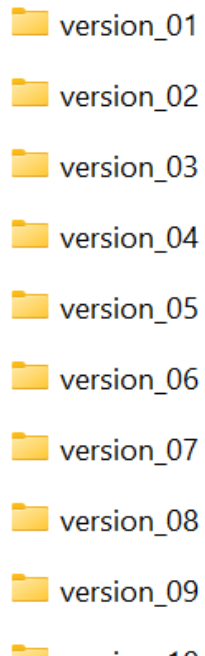

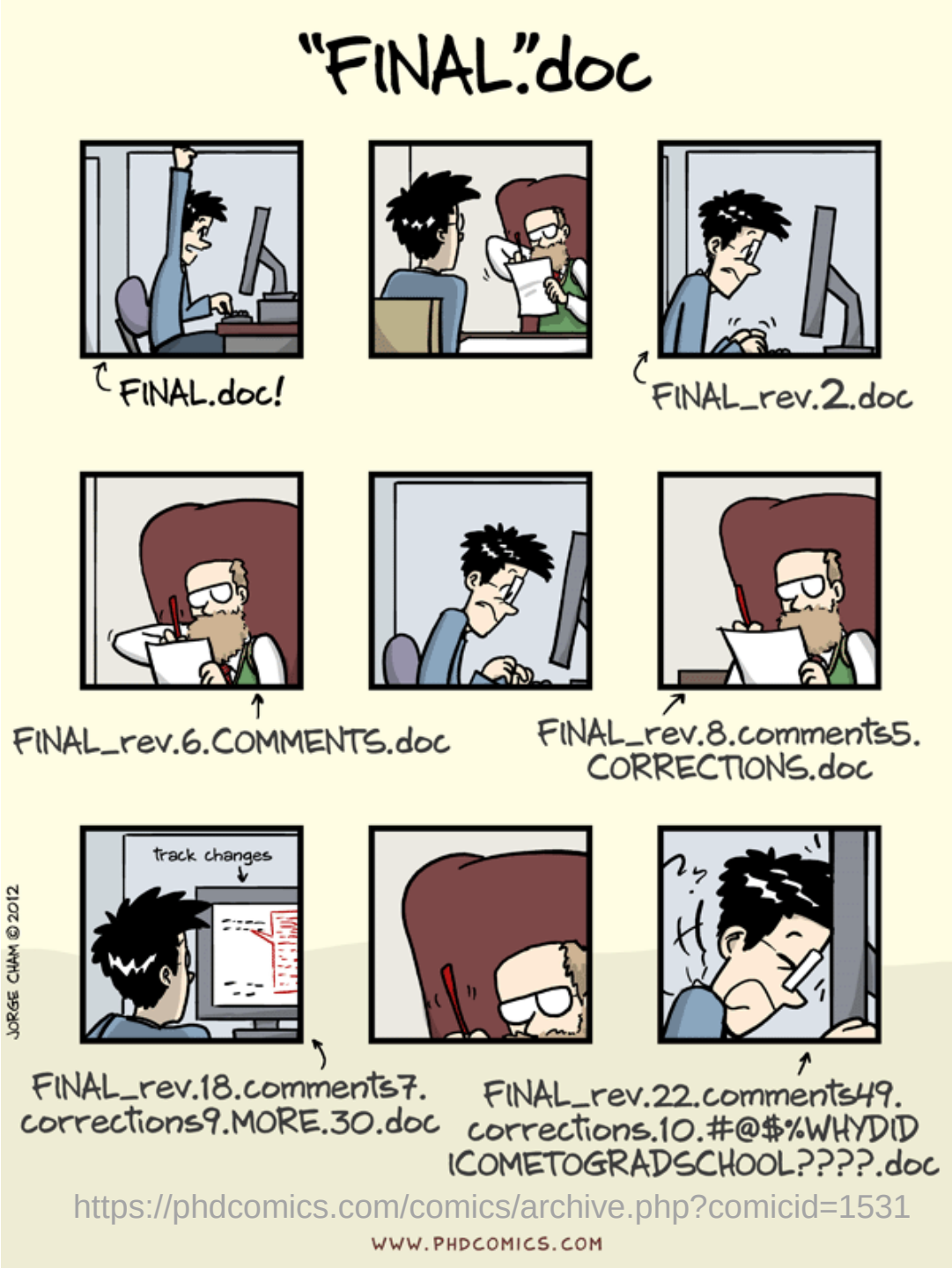

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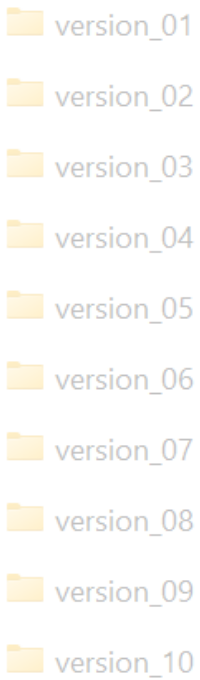

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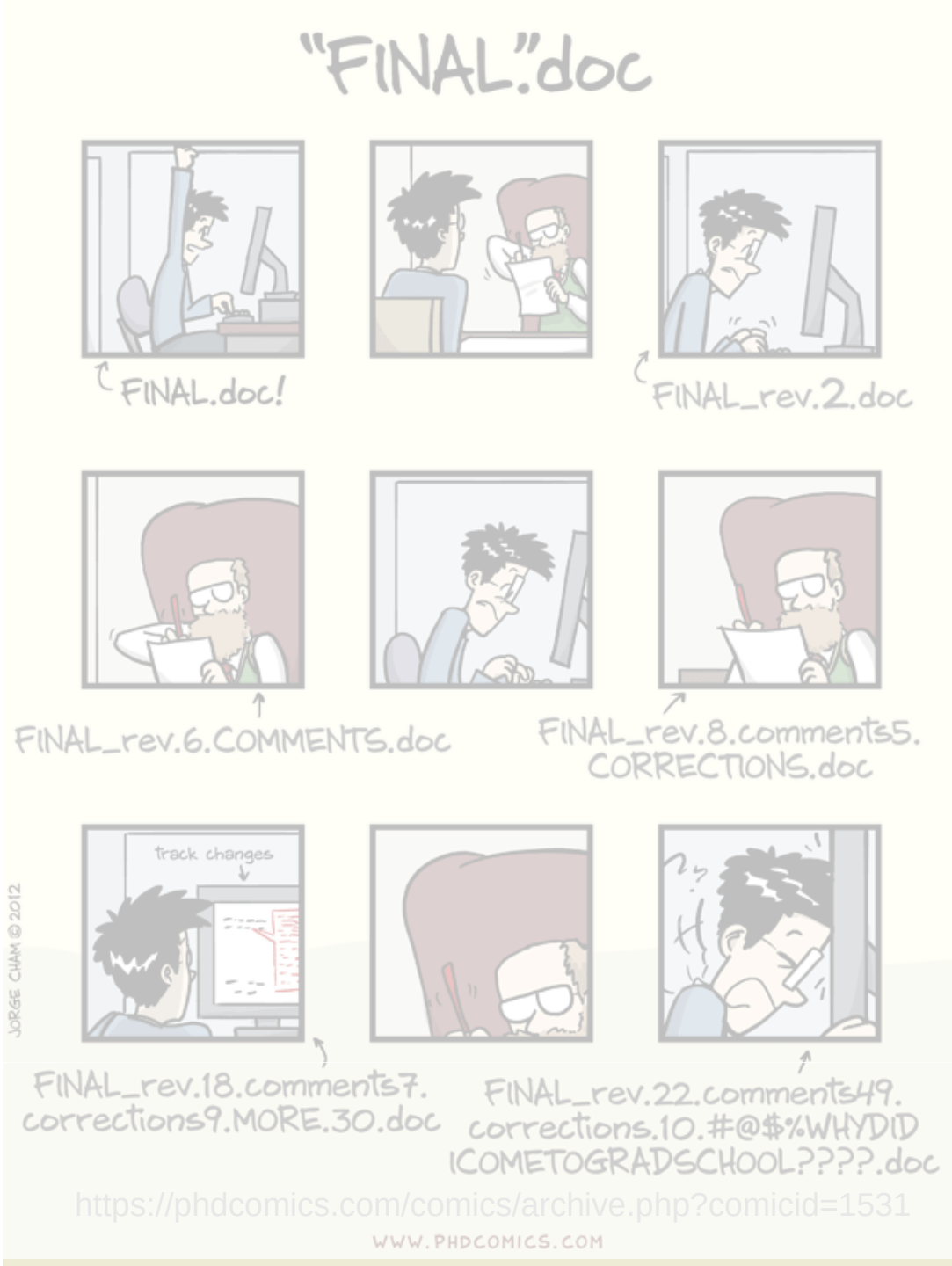
<u>This</u> is what version control systems (VCS) *are for* (and more!)



Why GitHub?

As the Version Control Platform?

- Old school git (Unix-like CLI) is hard
  - But this is where the VCS tools live
- GitHub offers:
  - All the VCS benefits of Git
  - Desktop GUI to interact with Git (*point/click*)
  - Online hosting (*centralized, most current version*)
  - Collaborative development
  - Project management
  - Project documentation
  - Free & pro versions (*no need for pro generally*)

VCS software "under the hood"

User-friendly, GUIs, collaboration, remote hosting

Other options: e.g., GitLab

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Tired of sending code/data back and forth, each time with different file names and describing what you changed?

Other options: e.g., GitLab

History of Changes

Who Made the Change, When, and What was the Purpose?

Commits on May 11, 2023

Merge pull request #195 from bstaton1/constant-prespawn-surv
bstaton1 authored on May 11, 2023

Remove time-varying prespawn mort from sim-vs-obs
bstaton1 committed on May 11, 2023

Remove time-varying prespawn mort from all output plots
bstaton1 committed on May 11, 2023

Update initial value generator
bstaton1 committed on May 11, 2023

Remove time-varying pre-spawn mortality in fitting script
bstaton1 committed on May 11, 2023

Remove time-varying pre-spawn mortality in JAGS model
bstaton1 committed on May 11, 2023

Merge pull request #194 from bstaton1/time-varying-fecundity
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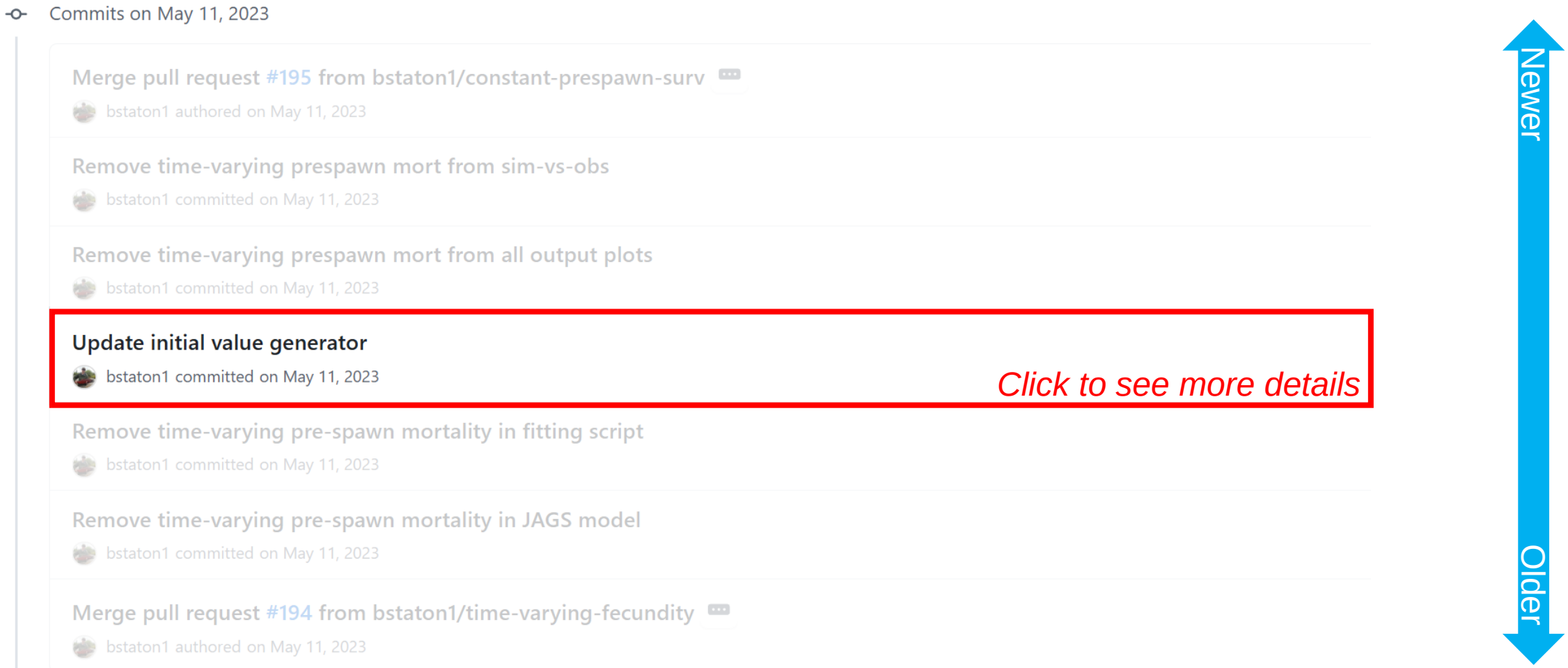

File Diffs

Easily View File Changes

Original Version

```
77  -     prespawn_surv = x_carcass_spawned/x_carcass_total
78  -     prespawn_surv[is.na(prespawn_surv)] = 0.75
79  -     prespawn_surv[prespawn_surv < 0.5] = 0.5
80
81        # get the age/origin compositon of the total adult return
82        # assume 60% pHOS and 20%, 60%, 20% of age 3, 4, and 5
    @@ -96,7 +94,7 @@ get_E_obs = function(jags_data, fill_missing = FALSE, append_sim_yrs = FALSE) {
96
97        # remove prespawn morts
98        age_origin_survived = lapply(1:nj, function(j) {
99  -       apply(age_origin_above_weir[,,j], 2, function(a) a *
    prespawn_surv[,j])
100       })
101       age_origin_survived = do.call(abind, append(age_origin_survived,
    list(along = 3)))
```

Changed Version

```
77  +     prespawn_surv = colSums(x_carcass_spawned, na.rm =
      TRUE)/colSums(x_carcass_total, na.rm = TRUE)
78
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What do you need to git started?

Beyond Patience…

- GitHub account (*free; info*)
- GitHub Desktop installed (*info*)
- A beginner's knowledge of markdown syntax (*info*)
- Working knowledge of terminology…

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Commit Messages

They Matter

https://xkcd.com/1296

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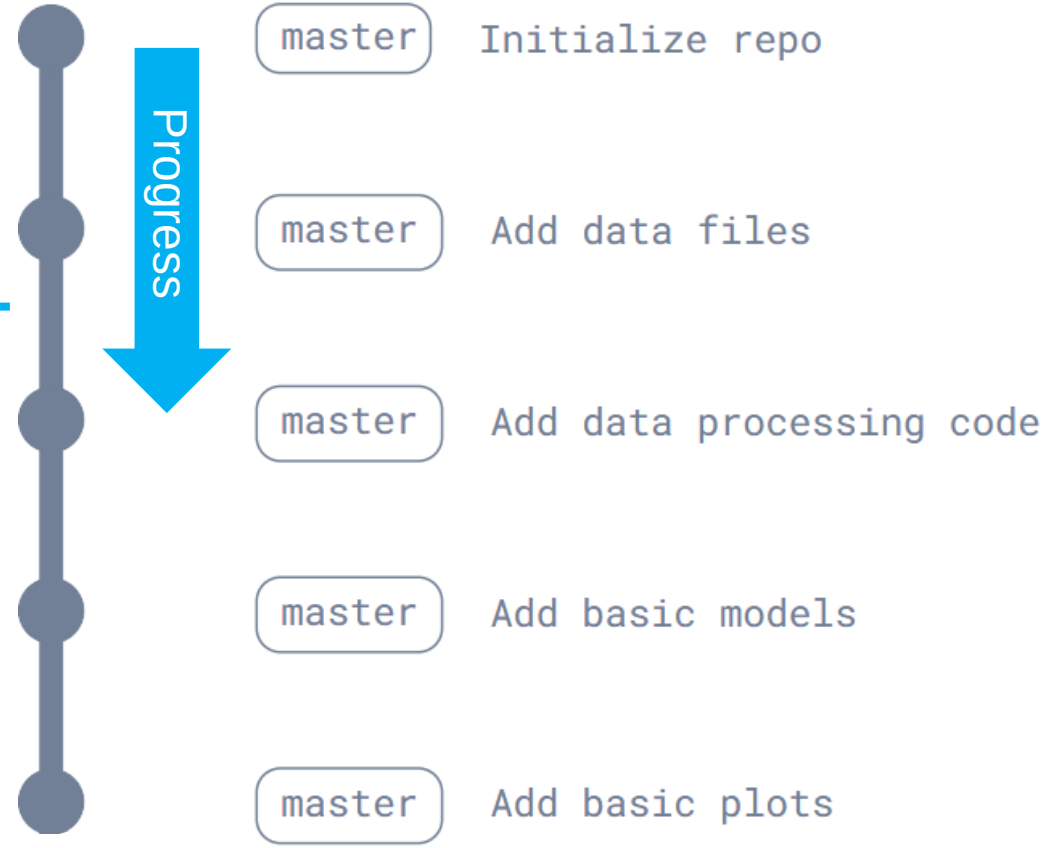
A “Git Graph”

Visualizes Development History

- Commits constitute progress
- “Master” = “Main” branch



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- Create a branch and add commits
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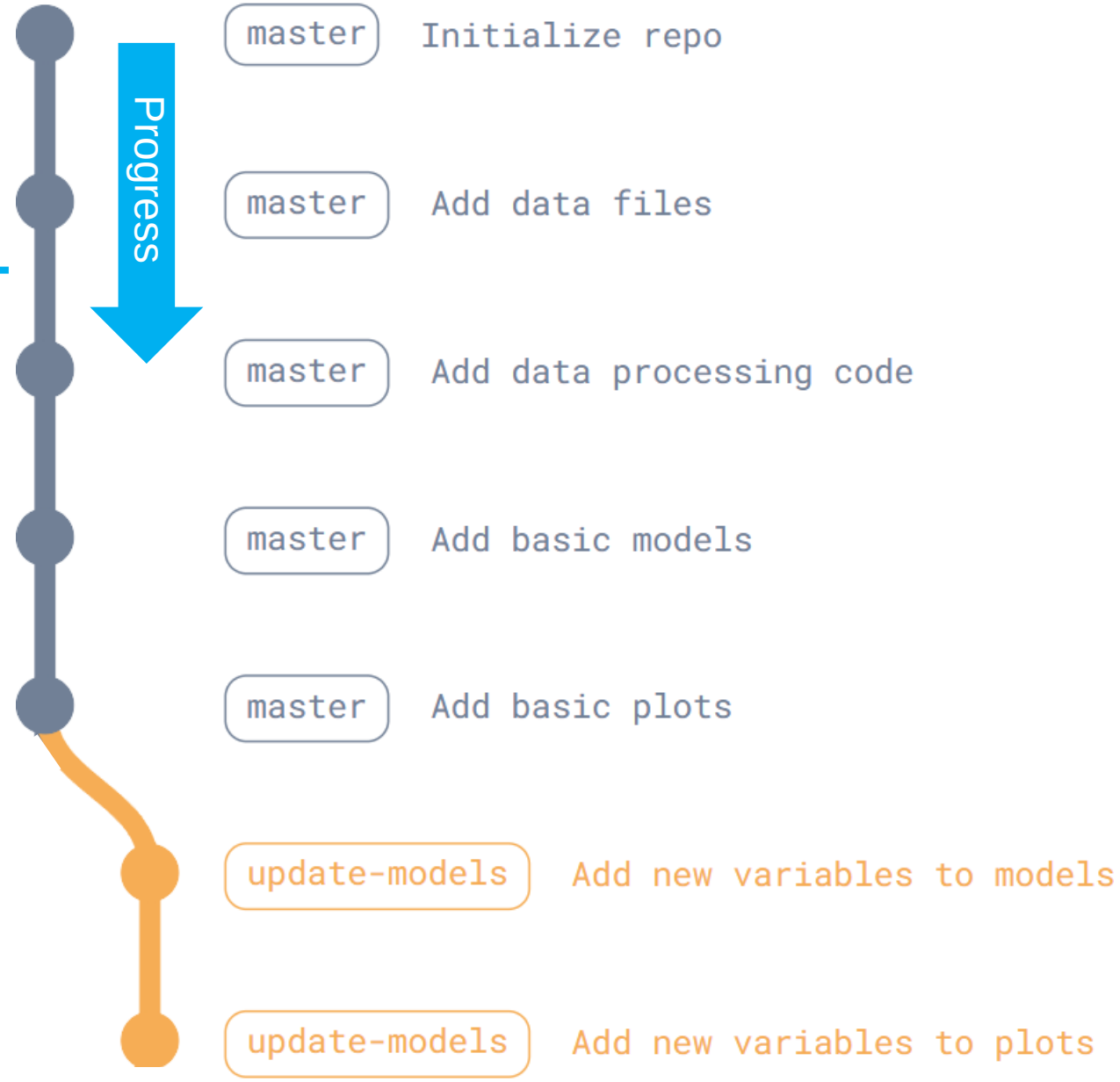

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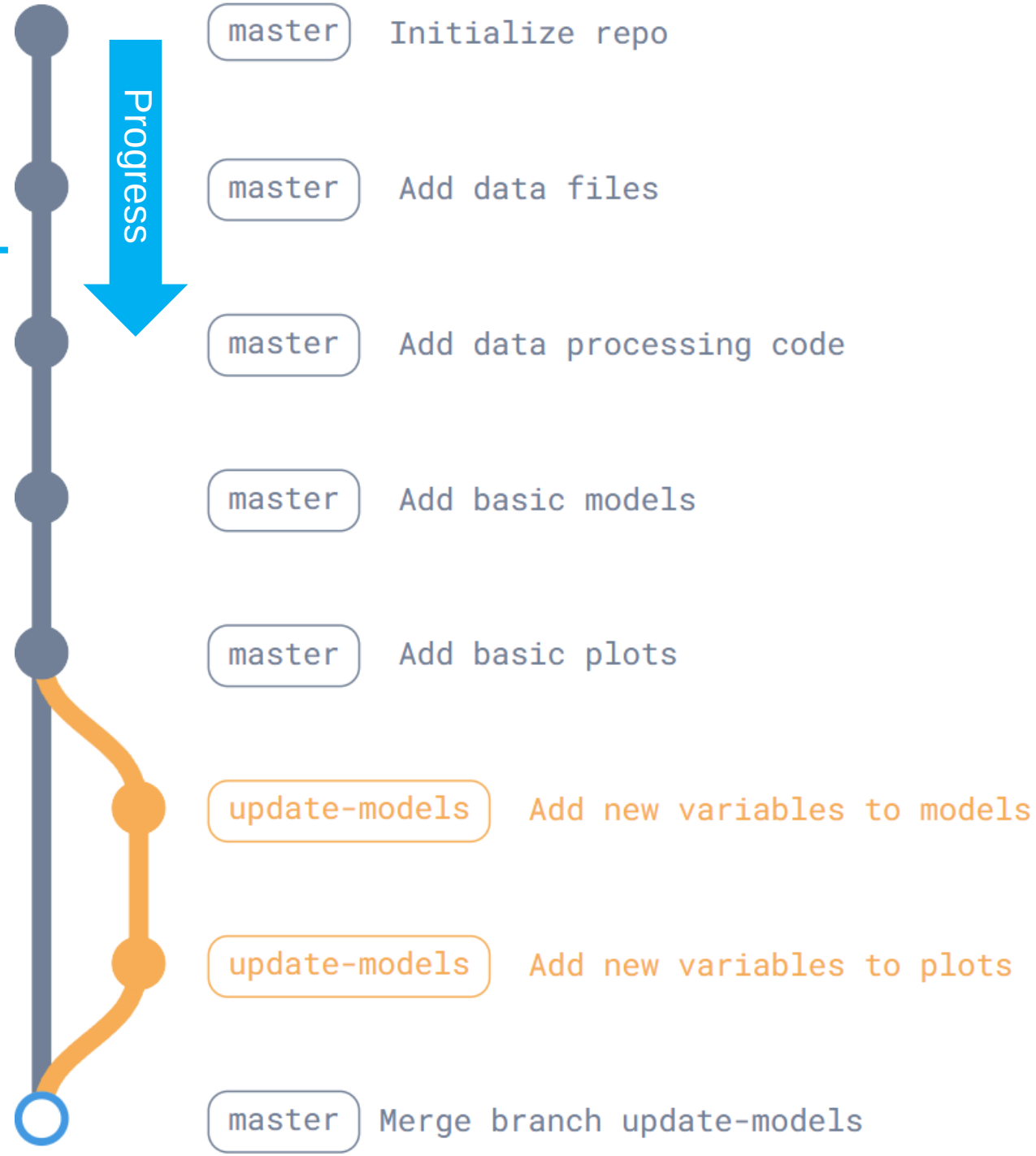
- If feature commits are beneficial, add them to main with merge
- After merge, delete feature branch



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Miscellaneous Topics

Time Allowing

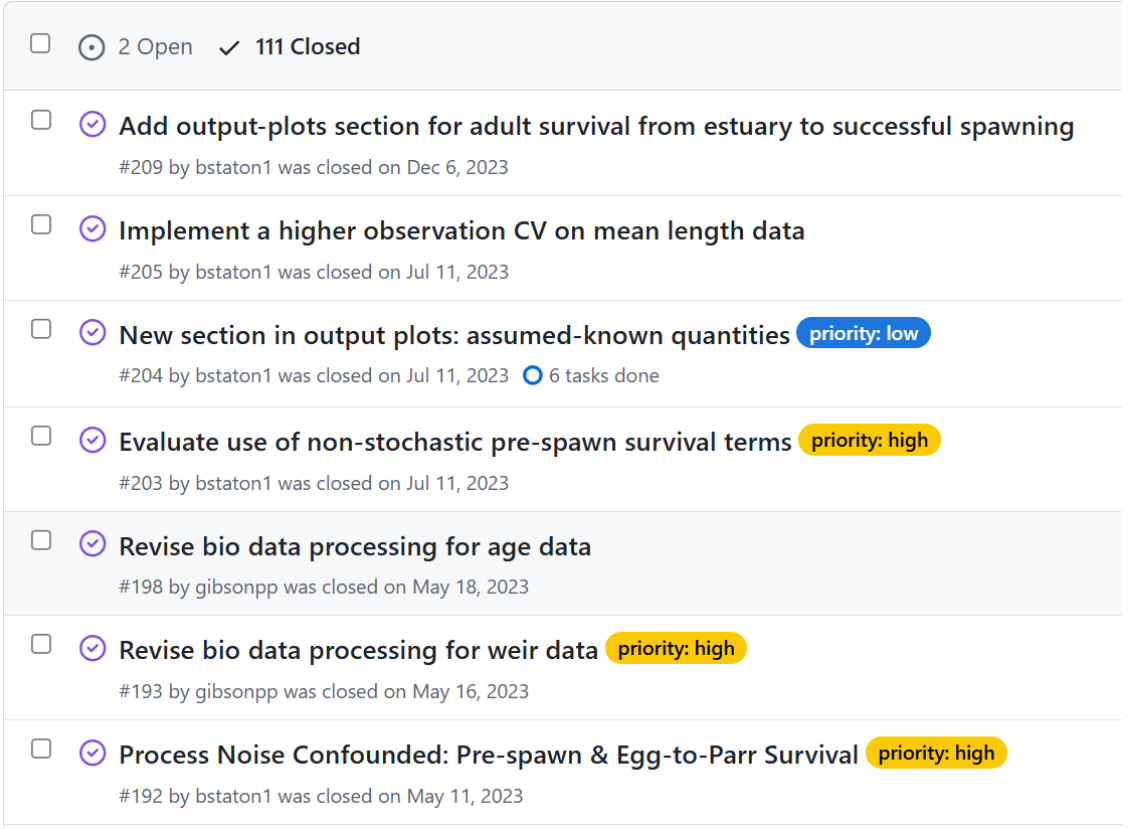
These Topics are More Advanced

Will Require Exploring Some on Your Own

Issue Tracker

Organize Ideas, Next Steps, Discuss Problems

- Online feature only
- “# system” allows cross-referencing
- Can use as something of a notebook
- Comment threads
- Can group issues, tag people
- Uses markdown syntax
- Open vs. closed issues
- Info



`.gitignore`

Exclude some files from tracking

- E.g.,
  - Large output files
  - Things that get re-written often
- Example `.gitignore` file ➡
- Place in main repo directory
  - Subdirectories can have separate ones
- Edits to ignored files cannot be committed, files cannot be pushed

```
# Files associated with R sessions/projects
.Rproj.user/
.Rhistory
.RData
.Ruserdata

# Saved R objects (e.g., large model output)
*.rds

# Temporary files created by Rmarkdown
*.utf8.md
*.knit.md

# HTML files (generated from Rmarkdown)
*.html

# Figure files (can be recreated from source)
*.pdf
*.png
*.jpg
*.jpeg

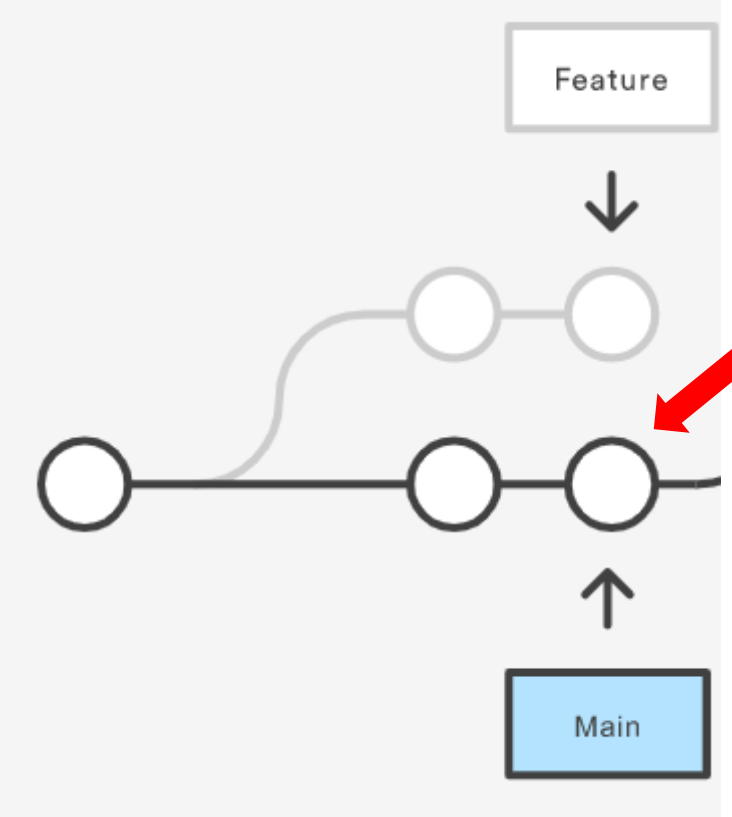
# Anything in scratch/ subdirectory
scratch/*
```

Merge Conflicts

When Things Go Wrong

- Occurs when merging branches with inconsistent commit history

In these cases, merging feature into main will often cause merge conflicts



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  - Otherwise, communicate & pull (*often*)
  - Rebase (*details here*)

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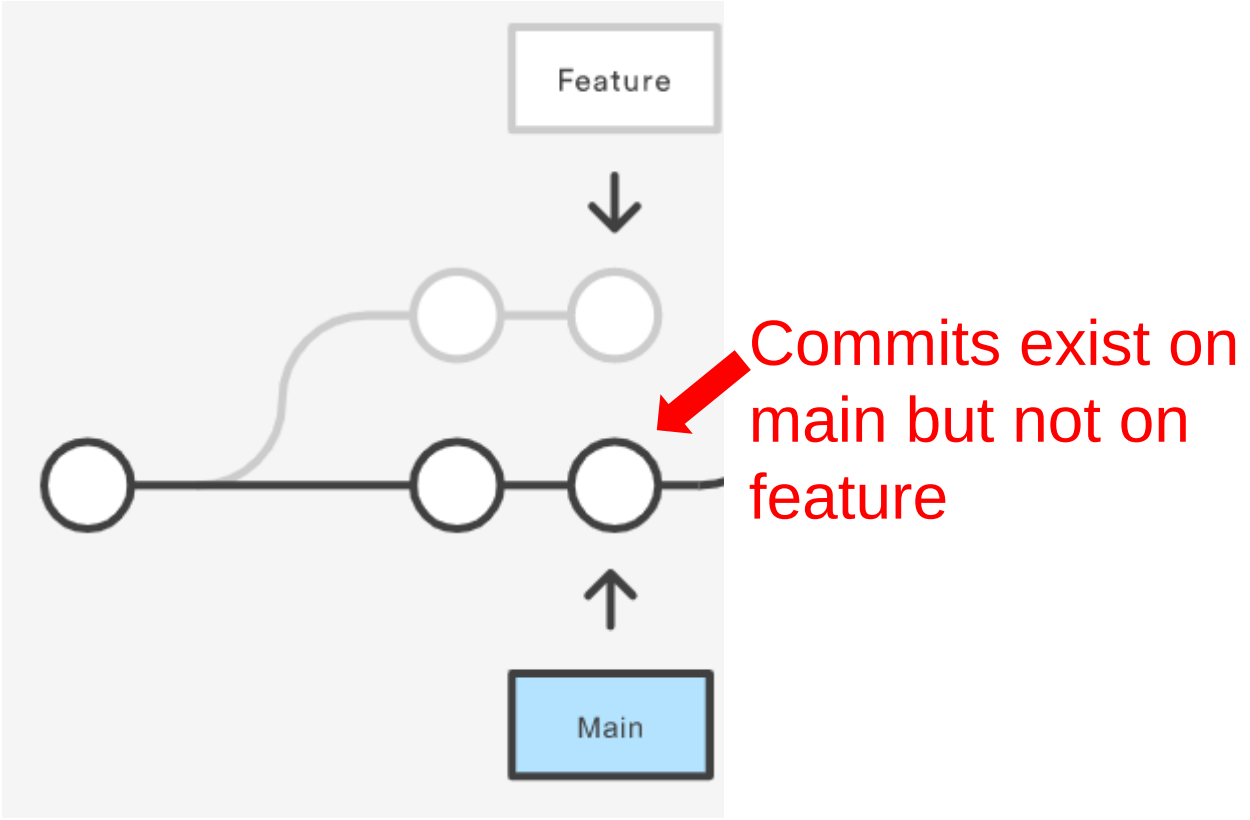

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- Resolve by selecting which version of conflicting file(s) to keep after merge

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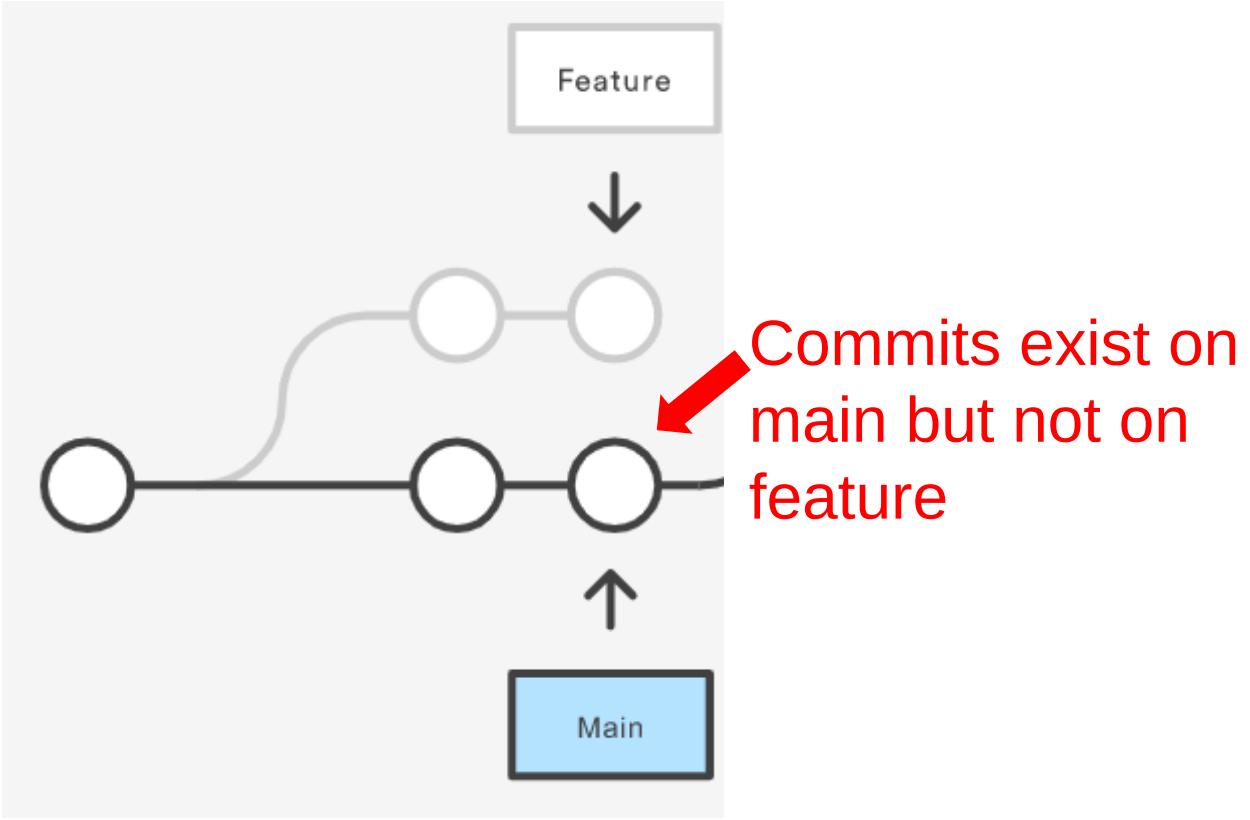


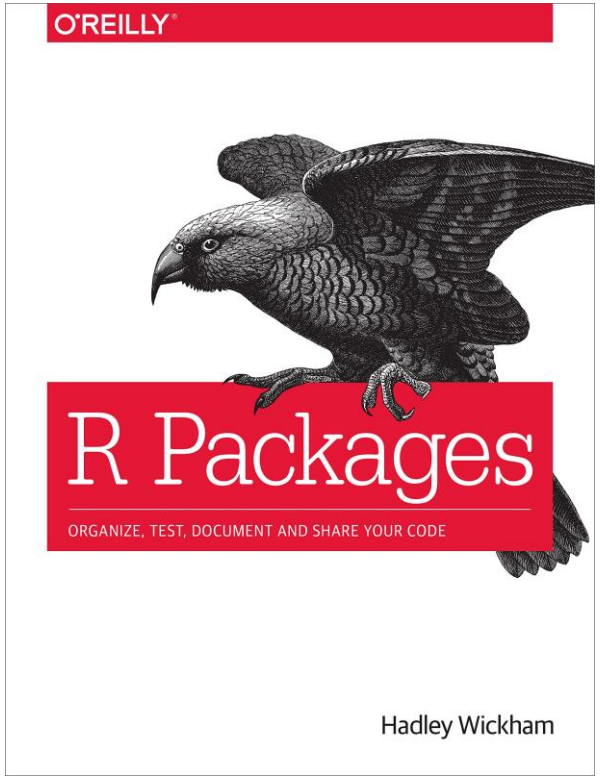
R Packages

Have an R Package? Host it on GitHub!

- R packages are a clean way of sharing code that will be called repeatedly by multiple users
- You could
  - Host it on CRAN (non-trivial)
  - Share the compiled package source files
  - Host it on GitHub!
- Users install via 1-2 lines of code:

```
# install remotes package
install.packages("remotes")

# install package from GitHub
remotes::install_github("user/packageName")
```



Free ebook: https://r-pkgs.org/

Cite Your Code

Need to make a version permanent?

- E.g., for journal article supplementary material
- Zenodo: archival service

Example of Staton et al. (2021)

Accounting for uncertainty when estimating drivers of imperfect detection: An integrated approach illustrated with snorkel surveys for riverine fishes

Article 10.1016/j.fishres.2021.106209

Code 10.5281/zenodo.3928691

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Need to make a version permanent?

- E.g., for journal article supplementary material
- Zenodo: archival service
- Steps (*more details*):
  1. Link Zenodo to GitHub account
  2. Make your GitHub repo public
  3. Sync Zenodo & turn on tracking
  4. Publish a GitHub release
  5. Each release will receive a DOI, archiving that exact version

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Practice Makes Perfect!

(And gives confidence that you won't mess something up)

But don't be too perfect.

Time spent documenting changes is time spent not making changes (progress).

Strongly *advise practicing on a toy analysis before applying to real new or existing analyses. Get the feel for how this works.*

Upcoming PNAMP FWMG Webinar
A "How-To" Tutorial

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