Summary of U.S. Stock Assessment Workflows

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Tools, Templates, and other Resources

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1 Summary

Developing and producing a stock assessment report requires a considerable amount of data consolidation, analysis, and research. Reports can range from 10 pages to well over 300, but the goal of the process remains to provide management advice with the current and projected status of the stock, catches, and other important parameters to ensure its sustainability. There have been many efforts done to improve the reproducibility of workflows and reduce time it takes to produce these reports. So far, improvements and efforts have ranged considerably by region of the U.S. Specifically, each of the seven regional fishery science centers across the U.S. have their own workflows to assess a stock and produce its report. Many of these workflows are guided by requirements from fishery management councils and other involved managing bodies that utilize these reports to delegate fishery regulations.

Workflows across the country not only range from region to region, but from scientist to scientist. There is no current standardized or accepted best practice for producing a stock assessment report. Some centers rely on the use of latex, a common software to produce documents with in-text calculations, while others utilize more recently developed programs like Rmarkdown and quarto, which both use latex as a basis for their production. Others utilize the capacity of Microsoft word which restricts the reproducibility of a report as well as increases work time since figures, tables, and other associated resources must be compiled outside of the word document.

Description of interaction and list of fishery management councils across the US

2 General Stock Assessment Workflow (commonalities and process)

- Description of stock assessment workflows from input to bringing the report to the SSC and council(s) for evaluation and adoption of formal management measures resulting from recommendations

1. Gather data inputs for model

2. Configure assessment model with updated data (based on assessment need for that year)

3. Sensitivity runs and projections

4. Develop assessment report for SSC, councils, and/or RFMOs

5. Present assessment and recommendations to SSC and councils

6. Assessment accepted or not, create formal report for public release and adoption recommendations as designated by the councils

Identifiable issues:

- Inconsistent naming conventions for parameters
- Inconsistent format/no guidelines present for a U.S. assessment report

3 Stock Assessment Models

[Short descriptions of commonly used stock assessment models within the U.S. including acknowledgement of smaller used models and FIMS for the future]

- General use of assessment models in the workflow (self-explanatory)
- Short descriptions of various models used in the U.S. around the regions (purpose is so that the reader can understand the model when it is reference in the section later)
  - Categorize based on assessment type rather than assessment model (age-structured/catch-at-age, catch-at-length, VPA, Agg. Biomass Dynamics, Index-based, data-limited)
- Include link/reference to papers/repositories at end of summary for reader to reference (also refer to FIT)
- WHAM, SS, BAM, ASAP, AMAK, Bespoke, FIMS, ect

4 Tools and Resources

- Tools and templates available for different models and workflows (added as a list of tools in a way instead of by region since there are a lot of regions that use the same tools)

4.1 Tools

4.1.1 afscdata

4.1.2 afscassess

4.1.3 r4ss

4.1.4 ASAPplots

4.1.5 FishGraph

4.1.6 ADMB2R

4.1.7 SASINF

4.1.8 BrailleR

4.1.9 SW R Process Output

4.1.10 swfscMisc

4.2 Templates

4.2.1 safe Report Template

4.2.2 sa4ss - SS Report Template

4.2.3 MAFSC SAFE Reports Template

4.2.4 SEDAR-Assessement Report Template

4.2.5 SW Stock Assessment Template

4.2.6 NMFSReports

4.3 NOAA Tech Memo Template

4.4 Resources

4.4.1 pfmc-assessments

5 Region Specific Workflow

- Descriptions of the workflows by region and what separates them from other regions
- Advances made by this region and the tools they use
- Particular struggles or unique operations incorporated into their workflow
- Table of resources used for their workflows

Note: assessment reports and incorporated materials are all assessment author based outside of their regional requirements

Alternative way to reference section safe Report Template rather than Section 4.2.1 *Note doesn't work with html render.

5.1 AFSC

Process variations:

- Uses afscData (Section 4.1.1) for data extractions for model inputs

    - SQL for data query

- AFSCassess (Section 4.1.2) for cleaning up data, generating figures, and other associated processes with generating a stock assessment report
- Functions tailored to pull data/perform function for each species
- ADMB model outputs
- Utilizes 'safe' (Section 4.2.1) reporting template

    - Automated and reproducible, large effort put into making and maintaining

- Formalized guidelines for reports

Largest problems:

- Inheriting an assessment can be a challenge
- Data structures very different in GOA v. BSAI
- Input and output framework needs work
- Large amount of tables and figures (potential to clog the process; is this too many?)

5.2 NEFSC

Process variations:

- Informal/verbal agreement for TOR guidelines for each stock
- Standardized report template agreed upon by NOAA and the MAFMC AND NEFMC (agreed on in 2017)
    - Short and concise to make policy decisions (mgmt track specifically)
- Report template is not publicly available but all done in latex (modular workflow)
    - Figures rendered outside (saved as png) then reference in doc
    - Tables created into tex files and referenced as component in template
- Extensive work with 508 compliance
    - Contractors developing package for compliance to apply to template

Largest problems:

- Lots of processing variables for 508 compliance
- Even with all the work in the compliance, there is still a large effort into making it accessible (~2 week conversion for single analyst at the center)
- Workflow still labor intensive
- Large barrier to use template for new users
- Only automated for management track reports

5.3 NWFSC

Process Variations:

- Input data extractions are from an online database and state agencies

    - nwfscSurvey repo for west coast groundfish survey data

- Use of sa4ss (maintained by scientist at NWFSC), package to make a template in github

- All figures generated using r4ss functions

- Standardized tables

- Scripts are specific to species

- Use of SS in the NW led to huge developments for packages that are tuned to its output such as r4ss and sa4ss

- Process is not standardized for entire center (common among a lot of centers)

    - Some assessment scientists create a new repo for each assessment

Largest Issues:

- Reproducibility

- Iterative process of incorporating changes to models for report generation: not optomized for this part of the workflow

5.4 PIFSC

Process variations:

- "Template" report in github (private and not modular; international)

- No generalized workflow/process (aka each species is a little different)

- Workflow isn't specifically defined

- Process tables and figures in R then incorporate into a word document (domestic)

    - Reported out as a tech memo

Largest Issues:

- Work with international and species complexes that make it difficult to have a general reporting structure
- Barrier to entry with quarto
- Can't update .qmd file after changes made to word doc after render
- Parallelization of workflows

5.5 SEFSC

Process Variations:

- Follows requirements for SEDAR
- Figures and tables at the end of the report (SEDAR requirement)
- File system on server where data is stored

Caribbean:

- A lot of intermediaries in the process (aka figures and tables generated outside of the report)
- Incorporated some use of Rmarkdown with a modularized template system
- Prototype template using quarto books for SEDAR 57

Gulf of Mexico:

- Rmarkdown template used in process (private repository on GitHub)
- Work with SS report file and automate from there
- Some parameters are hard coded and changed per species
- New forked repo. for each stock assessment

South Atlantic:

- Data is gathered as an excel file - manually converted as inputs for the assessment model (potential for automation but analysts lack time)
- Model process includes: fine tuning, diagnostics, ADMB2R (Section 4.1.6), Fish-Graph (Section 4.1.5)

- Uses latex template with tables as outside tex doc (incorporated into the template) and figures produced outside of template into a folder then referenced into template

- Report not completely automated

- Organized on a species by species case

- Template not on github

- Previous reports are shared with analyst who next inherits it through backup drive

Largest Issues:

- Variable answer based on region (South Atlantic v. Gulf of Mexico v. Caribbean)

- Confidentiality (large recreational base)

- Data providers don't provide data in the same format

- Limited to no 508 compliance (other than minimum requirements)

  - Highly time intensive

Caribbean:

- Difficulty referencing tables and figures in Rmarkdown

- Limited abilities and knowledge with R/quarto

- Oftentimes updates seem to feel like benchmark assessments due to requests

Gulf of Mexico:

- Figures in regards to inputs cause most issues

- Long, large reports

- Steep learning curve for those not yet using markdown (all in the branch have at least used the Rmarkdown template once for an assessment)

- Large data sets/data takes a while to read in

- Cannot access others' SS output files dues to confidentiality (those outside of NOAA org)

- Projections aren't standardized

South Atlantic:

- Process is not automated
- Localized reporting template

5.6 SWFSC

Process Variations:

- Inherited workflow from analysts
- Use of 'sa4ss' (Section 4.2.2) for workflow with some modifications
- Centralized Rmarkdown for process
- Access to past assessments on PFMC GitHub

Largest Issues:

- Data acquisition and handling (also troubles associated with data confidentiality)
- Tough transition for new employees due GitHub used on an analyst-to-analyst bases and unclear workflow structure
- Model versioning and changes to the report through a non-linear process (common among other regions too)
- 508 compliance efforts sometimes break

Example in text reference (Clark 1993).

6 Conclusions

- Conclusions about how workflows operate in the U.S.

    - Both pros and pitfalls of current workflows

    - Incorporating perspectives from regional scientists?

- Additional hope for greater look into the inputs and pulling together the entire stock assessment workflow process

6.1 Future Work

- Discuss the upcoming/in development tool for automated workflows and plan for the future including stock assessment modelling for the future

References

Clark, W. G. 1993. "The Effect of Recruitment Variability on the Choice of a Target Level of Spawning Biomass Per Recruit." In, 233246. Alaska Sea Grant College Program AK–SG–93–02.