

Getting Started with Stock Synthesis (SS3)



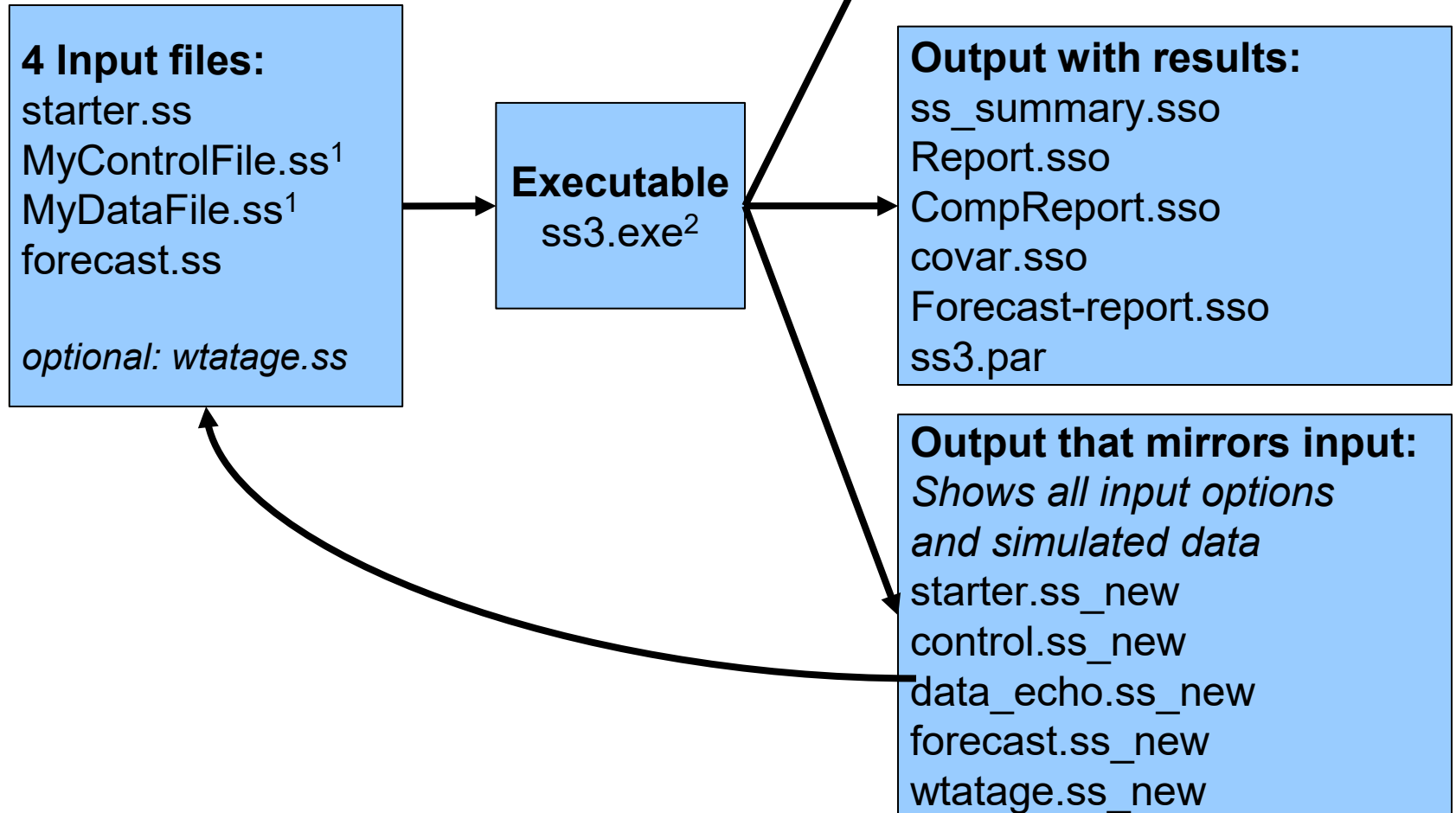
Background on Stock Synthesis (SS3)

- Initially developed by Rick Methot (NOAA) for anchovy in 1984
- Rewritten in ADMB in 2003 (previous versions were in FORTRAN)
- Probably the most commonly used assessment model in current use
 - Used for hundreds of production stock assessments and numerous research projects
 - No good way to count the total number of applications, track use, or access input or output files
 - All assessment models at NWFSC are stored in a non-public archive (files available on request)
 - Many recent assessments are stored on <https://github.com/pfmc-assessments/>

Background on Stock Synthesis (SS3)

- SS3 is more flexible than any other integrated assessment model in terms of options for
 - Mortality and Growth
 - Stock Recruitment
 - Selectivity and retention
 - Time-variation of parameters
- Flexibility comes with the cost of making it harder to learn
- Other models in common use: WHAM, SAM, BAM, AMAK, species-specific bespoke models
- NOAA is developing a SS3 replacement FIMS <https://github.com/noaa-fims/fims/> but probably won't be able to replace many SS3 models for at least a year

Main SS3 files



¹Can have any name, as long as specified in the starter file.

²The SS3 executable can have any name.

The four input files read by ss.exe

1. **starter.ss:** Required file containing file names of the data file and the control file plus other run controls. Must be named starter.ss.
2. **Data file:** File containing model dimensions and the data. Can have any name, but typically ends in .ss or .dat. Must match the name in the starter file.
3. **Control file:** File containing set-up for the parameters. Can have any name, but typically ends in .ss or .ctl. Must match the name in the starter file.
4. **forecast.ss:** File containing specifications for reference points and forecasts. Must be named forecast.ss.

Two optional input files

1. **ss3.par:** Text file with one line per parameter where order matters. Could be created from a previous model run. Read in ss.par to overwrite the initial parameter values in the control file (choose whether or not to read ss3.par in starter.ss).
2. **wtatage.ss:** File containing empirical input of body weight by fleet and population and empirical fecundity-at-age (choose whether or not to read in a line of the control file)

Downloading SS3

- Executable files for Windows, Mac, and Linux are available at <https://github.com/nmfs-ost/ss3-source-code/releases>
- The {r4ss} package (to be covered tomorrow) has a function `r4ss::get_ss3_exe()` that will download the executable for your operating system
- See the “[Running Stock Synthesis](#)” section of the SS3 User Manual for lots of detail on options for where to store the exe and how to run it.

Working with SS3 input files

- Input files are plain text files and can be edited in any text editor
- The r4ss package (covered tomorrow) has functions to read and write these files to/from lists in R
- Editing the text files directly is the better way to see the context of each setting
- Editing via R script is more reproducible and can be more accurate
- Both text files and R-based workflows are useful so it can be good to learn both approaches

Running SS3

Via the command window
(in Windows, Press Windows+R, type "cmd")

```
C:\Windows\system32\cmd.exe X + v
Microsoft Windows [Version 10.0.22631.4751]
(c) Microsoft Corporation. All rights reserved.

C:\Users\ian.taylor>cd c:\ss\Yellowtail\Yellowtail2025\yellowtail_2025\Model_Runs\1.02_base_2017_3.30.23\

c:\SS\Yellowtail\Yellowtail2025\yellowtail_2025\Model_Runs\1.02_base_2017_3.30.23>ss3
  reading from starter.ss
  reading from data file
Data read successful 999

  reading forecast file
  reading from control file
End of control file successful! 999
Begin setting up parameters ... end of parameter section
Evaluating biology calculations once ... done
Starting optimization of 'ss3' in phase 1 of 6 at Tue Feb  4 09:23:14 2025
1 1 -log(L): 2085.41  Spbio: 83.1323 70.0837
```

Via the the r4ss::run() function in R

```
r$> r4ss::run(dir = 'Model_Runs/1.02_base_2017_3.30.23/')
Executable found at C:\SS\SSv3.30.23.1_Dec5\ss3.exe
Changing working directory to Model_Runs/1.02_base_2017_3.30.23/ and running model using the command: ss3
.exe
Input 'show_in_console' = FALSE, so writing console output to console.output.txt
```

warning.sso file

- Always look at after running a model, regardless of whether the model run completed or not
- Contains a list of warnings generated during program execution.
- Note in command line if $N \text{ warnings} > 0$



```
C:\WINDOWS\system32\cmd.exe
selex OK, ready to call ALK and fishselex
ready for virgin age struc
ready for initial age struc

See warning.sso for N warnings: 1
Y:\h_itaylor\SS\course\SimpleTest>
```

- N warnings include:
 - Notification of errors in input files.
 - Some advice on parameter settings.

echoinput.sso file

- An annotated echo of the input files
- Start at bottom and read backward, looking for first mismatch with input files.
- Good things to find:
 - `finish reading starter.ss`
 - `data read successful`
 - `done reading forecast`
 - `999` If you see `999`, we got to the end of the control file successfully!

Command line options

- ADMB options can be added to command line (ADMB).
 - Skip standard errors (for quicker results, or to get Report.sso if Hessian does not invert): `ss3 -nohess`
 - List all command line options: `ss3 -?` OR `ss3 -help`
- SS3 option to run without estimating anything (short for “stop phase”: `ss3 -stopph 0`
- More info in ADMB Manual (Chapter 12: Command line options) <http://www.admb-project.org/docs/manuals>

How to get additional help?

- SS3 website: <https://nmfs-ost.github.io/ss3-website/>
- Fellow students and instructors
- SS3 Forum Google Group:
<https://groups.google.com/g/ss3-forum>
- [*Fisheries Research* special issue](#) on Stock Synthesis (vol 142 from 2013)

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Stock synthesis: A biological and statistical framework for fish stock assessment and fishery management

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