

Getting Started with Stock Synthesis and R4SS

Getting Stock Synthesis from the NOAA Fisheries Toolbox

- Go to
http://nft.nefsc.noaa.gov/Stock_Synthesis_3.htm
- Download “....Stock Synthesis 3 ...”
 - Find version you want
 - unzip file to get executable
- Download “Stock Synthesis 3 Documentation”
- Download “Stock Synthesis 3 Examples”

Files to run Stock Synthesis

- Directory must contain 4 files
 - starter.ss
 - Control File (must match name in starter.ss)
 - Data File (must match name in starter.ss)
 - forecast.ss
- Additional files needed depending on options
 - wtatage.ss (needed for empirical weights)
- Directory must also have ss3.exe or already in the system path

Putting SS3 in your path: Windows

1. Find the correct version of the ss3.exe binary on your computer
2. Record the folder location. E.g. C:/SS3.24o/
3. Click on the start menu and type environment
4. Choose Edit environment variables for your account under Control Panel
5. Click on PATH if it exists, create it if doesn't exist
6. Choose PATH and click edit
7. In the Edit User Variable window add to the end of the Variable value section a semicolon and the SS3 folder location you recorded earlier. E.g. ;C:/SS3.24o/. Do not overwrite what was previously in the PATH variable.
8. Restart your computer
9. Go back to the DOS prompt and try typing ss3 -? and hitting return again.

Putting SS3 in your path: Unix (OS X and Linux)

The easiest way is to move the SS3 binary to a folder that's already in your path. To find existing path folders type `echo $PATH` in the terminal and hit enter. Now move the SS3 binary to one of these folders. For example, in a Terminal window type:

```
sudo cp ~/Downloads/SS3 /usr/bin/
```

You will need to use `sudo` and enter your password after to have permission to move

it to a folder like `/usr/bin/`. If you've previously modified your path to add a non-standard location for the SS3 binary, you may need to also tell R about the new path. The path that R sees may not include additional paths that you've added

through a configuration file like `.bash` profile. You can add to the path that R sees by including a line like this in your `.Rprofile` file. (This is an invisible file in your home directory.)

```
Sys.setenv(PATH=paste(Sys.getenv("PATH"),"/my/folder",sep=":"))
```

Running Stock Synthesis

- Open command line:
 - In Windows: Start > Run > type “cmd”
 - or Shift & Right-click on folder and choose “Open command window here”
 - Microsoft's Command Prompt [FAQ](#)
 - navigate to directory using `cd`
`c:\directory`
- Run using optimized or safe mode:
`SS3.exe`

Advanced command line options

- Options can be added to command line (ADMB)
 - Run without estimating anything: `SS3 -noest`
 - Skip standard errors (needed to get Report.sso if Hessian does not invert): `SS3 -nohess`
 - Run MCMC:
 - `SS3 -mcmc 100000 -mcsave 100`
(runs 100,000 draws, saves every 100th)
 - `SS3 -mceval`
(evaluates saved draws)
 - List all command line options: `SS3 -?`
- More info in ADMB Manual (Chapter 12: Command line options) <http://admb-project.googlecode.com/files/admb.pdf>

What to do when it doesn't run?

- Look at warnings.sso
- Look at echoinput.sso
 - work backwards from the bottom
 - look for where it doesn't match your inputs
- If input files are read without errors
 - run with *–noest* or set `maxphase=0` (recommended option) in `starter.ss`, to get output based on initial parameter values

Output

- Many output files are created
 - Report.sso, Forecast-report.sso, ...
- R4SS can read these files into R
 - Creates a list of quantities
 - Can create plots

Installing R and getting R4SS

- **R (statistical software):** (www.r-project.org)
- **UCLA CRAN site:** <http://cran.stat.ucla.edu/>
- **R4SS (collection of R code for Stock Synthesis):**
 - install by running R then typing

```
> install.packages("r4ss")
> library(r4ss)
> update_r4ss_files()
```

More info: <http://code.google.com/p/r4ss/>

Email list: <http://groups.google.com/group/r4ss>

Core R4SS functions

- `SSv3_output`
 - Reads in results from a Stock Synthesis run
 - Prints diagnostic information about the results
- `SSv3_plots`
 - Prints a wide variety of plots
 - New plots, options being added

Functions related to input files

- `SS_parlines.R`
 - identify parameter lines in the control file
- `SS_changepars.R`
 - change parameters settings in the control file
- `selfit.R`
 - explore double normal & double logistic selectivity
- `movepars.R`
 - explore movement rates associated with parameters

Functions for model output

- `SSv3_plotpars.R`
 - plots distributions of estimated parameters with uncertainty, as well as initial value, prior, posterior
- `SS_fitbiasramp.R`
 - estimate bias adjustment settings (based on ongoing research—not guaranteed to be the best approach)

Functions for simulating data

- `SS_recdevs.R`
 - add vector of recruitment deviations to the control file
- `SS_splitdat.R`
 - split apart bootstrap data in the `data.ss_new` file into pieces that can be used as input

How to get help

- User manual
- Technical manual
- Other models
- Other users
- Fisheries Research Special Issue

AD Model Builder concepts

What is AD Model Builder

- Tool for developing nonlinear models
- Efficient estimation of model parameters
- C++ libraries
- Thousands of parameters
- Combining many data sets or analyses
- General Models
 - Stock Synthesis

Basic C++ and AD Model Builder skills

denotes a comment in input files, anything after in that line will be ignored

The order of parameters and elements matters

Advanced command line options

- Basic command line to run SS3.exe: `SS3`
- Options can be added to command line (ADMB)
 - Run without estimating anything: `SS3 -noest`
 - Skip standard errors (needed to get Report.sso if Hessian does not invert): `SS3 -nohess`
 - Run MCMC:
 - `SS3 -mcmc 100000 -mcsave 100`
(runs 100,000 draws, saves every 100th)
 - `SS3 -mceval`
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Some ADMB tips

- If you receive a memory allocation error
 - Try `SS3 -ams XXXXXX` (i.e., 200000)
 - Or free up memory on your computer
- If it runs slow
 - Probably writing to `cmpdiff.tmp` & `gradfil1.tmp`
 - Use `-cbs XXXXXXXX` until `cmpdiff.tmp=0 Mb`
 - Use `-gbs XXXXXXXX` until `gradfil.tmp=0 Mb`
- When the model is running:
 - Press 'n': immediately goes to next phase
 - Press 'q': immediately quits estimation

AD Model builder concepts

- Phases in estimation
- The modelling process begins with estimation, we may be estimating:
- R_0 q selectivities recruitment residuals
- in more complex applications we may be estimating changes in selectivity or q and deviations in initial age structure

What are phases

- Don't try to estimate all parameters at once
- Hold most fixed while fitting with R_0 and q 's
- Then step by step “free up” additional parameters
- In each phase, we find the minimum for those parameters that are free and all parameters from previous phases

Example of using Phases

- Phase 1 - q 's to fit the index data
- Phase 2 R_0 , to adjust the trajectory
- Phase 3 selectivity parameters
- Phase 4 recruitment residuals
- Phase 5 changes in selectivity
- Phase 6 deviations in initial conditions