This is a working document describing how to convert a stock synthesis (SS) model to Rceattle. I am using the 2019 Pacific hake assessment because I found the stock synthesis files online on Nis’s MSE github (<https://github.com/nissandjac/PacifichakeMSE/tree/master/inst/extdata/SS32019>). All the information needed (apart from consumption and diet) for Rceattle should be within the SS data, wattage, and control files. Information in each of those can then be copied over to an Rceattle excel file. I am formatting this as if you are reading the SS files from top to bottom and adding to Rceattle. Rceattle variable names will be in italics.

**Starting with the SS data file (hake\_data.ss)**

For model controls

1. Copy styr (1966) to the *styr* on the Rceattle excel file (sheet “control”)
2. Copy endyr (2019) to the *endyr* on the Rceattle excel file (sheet “control”)
3. Copy Nsexes (1) to the *nsex* on the Rceattle excel file (sheet “control”)
4. Copy Nages (20) to the *nages* on the Rceattle excel file (sheet “control”)
5. copy \_spawn\_month to *spawn\_month* on the Rceattle excel file (sheet “control”)
6. Set *minage* on the Rceattle excel file (sheet “control”) to 1 (currently age-1 can only be used for the first age… need to fix on my end)
7. Set *projyr* on the Rceattle excel file (sheet “control”) to whatever year you want to project to

#fleetinfo on the SS data file and fleet\_control sheet on the Rceattle excel file

* On the Rceattle excel file sheet “fleet\_control” create a row for each fleet
* Copy fleetname to the *Fleet\_name* on Rceattle excel file (sheet “fleet\_control”)
* Give a unique number to each fleet on *Fleet\_code* (NOTE: The numbers must be in order)
* Set *fleet\_type* in Rceattle to 1 for fishery or 2 for survey or 0 for don’t fit
* Set Species in “fleet\_control” to the species the SS file is associated with
* Additional observation model parameterization set up can be found in the meta\_data sheet of the Excel Rceattle file

Copy the catch data in SS to “fsh\_biom” Rceattle excel sheet

* Copy year to *Year*
* Copy season to *Month* (doesn’t do anything because Rceattle uses the Baranov on an annual timestep)
* Copy fleet to *fleet\_code* (Note: may need to adjust if codes differ between Rceattle and SS)
  + Also add in *Fleet\_names* on Rceattle
* Copy catch in SS to *Catch* (NOTE: usually work with 1000 mt, but units are flexible, but you would need to adjust the units on the plotting functions)
* Copy catch\_se to *Log\_sd* (NOTE: Rceattle assumes a lognormal distribution and estimates annual F\_devs)

Copy the CPUE\_and\_surveyabundance\_observations data in SS to “fleet\_control” Rceattle excel sheet

* For units in SS, Rceattle can only do numbers or biomass. On the “fleet\_control” sheet in Rceattle set *Weight1\_Numbers2* to 1 if biomass or 2 if numbers
* Rceattle currently only has lognormal distribution implemented
* But you can estimate the SD of the index by adjusting *Estimate\_survey\_sd* on the “fleet\_control” sheet in Rceattle
  + For hake, survey SDs are derived from the acoustic survey and do not need to be estimated (*Estimate\_survey\_sd*

= 0)

CPUE data in SS to “srv\_biom” Rceattle excel sheet

* Copy index to *fleet\_code* (Note: may need to adjust if codes differ between Rceattle and SS)
  + Also add in *Fleet\_names* on Rceattle
  + NOTE: In SS, when an index observation is predicted, but not included in the model likelihood, the index is set to the negative (e.g. -2 for the acoustic survey of hake in 1996). In Rceattle you set the Year to the negative of the year to predict the observation, but not include it in the likelihood.
* Copy year to *Year*
* Copy season to *Month* (adjusts biomass or numbers based on mortality at that point in the year)
* Copy OBS to *Observation* (NOTE: usually work with 1000 mt, but units are flexible, but you would need to adjust the units on the plotting functions)
* Copy se\_log to *Log\_sd* (NOTE: Rceattle assumes a lognormal distribution)

Discards are currently not implemented in Rceattle (would have to include as an additional fishery)

\_meanbodywt in SS is similar to *pop\_wt\_index* on the “control” sheet of Rceattle (see below)

Length comp data (\_lencomp in SS) to “comp\_data” sheet in Rceattle

* \_N\_lbins (26) in SS to *nlengths* on the “control” sheet of Rceattle (see below).
* No length comp data in the hake model (but see \_agecomp set up below for same details)

Ageing error in SS to Rceattle

* Rceattle currently only supports 1 time/sex-invariant ageing error matrix for each species on the “age\_error” sheet
  + For the hake model, it looks like the ageing error matrices are the same across years (great!)
* Convert aging error to ageing error matrix (details in SS manual)
* Copy to “age\_error” sheet in Rceattle

*\_age\_info* in SS (age-comp data) to “fleet\_control” data in Rceattle

* addtocomp is by default 0.00001 in Rceattle
* combine\_M\_F is defined by “Sex” in the “comp\_data” Rceattle sheet
  + Hake is single-sex
* Not sure what CompressBins CompError ParmSelect minsamplesize do in SS?

Copy age comp data (under *\_age\_info* in SS) to the Rceattle sheet “comp\_data”. This would be similar for length data if there was some

* Copy FltSvy to *fleet\_code* (Note: may need to adjust if codes differ between Rceattle and SS)
  + Also add in *Fleet\_names* on Rceattle
* Copy year to *Year*
* Copy season to *Month* (adjusts comp based on mortality at that point in the year)
* Copy gender to *Sex* (see meta\_data on sex definitions in Rceattle)
* Part Ageerr Lbin\_lo Lbin\_hi in SS can be ignored (not implemented in Rceattle)
* Copy Nsamp to *Sample\_size* (note: Rceattle currently only supports the multinomial distribution for comp data)
* Copy columns a1, a2, …. in SS to columns *Comp\_1, Comp\_2*,….
  + NOTE: because the comp data only uses 15 ages, but nages is 20 in SS you can either 1) leave it be in Rceattle and it will assume the comp observations for ages 16 to 20 are 0, or 2) set *Accumulation\_age\_upper* on the “fleet\_control” sheet in Rceattle to 15 where all comp observations for ages 15 to 20 are grouped together into age 15. I would look at the assessment doc or ask the authors to see whats up.

\_MeanSize\_at\_Age\_obs and below

* Rceattle uses empirical weight at age.
* Look at “meta\_data” in Rceattle for more specifications

**Weight at age date from the SS data file (wtatage.ss)** **to “wt” in Rceattle**

* Rceattle uses empirical weight-at-age
  + If SS estimates weight-at-age you can copy data from wattage\_new.ss (although it is somewhat conditional on the SS population model)
* Copy wtatage data to the “wt” sheet in Rceattle
  + For each weight-at-age matrix in SS generate a *Wt\_name* and *Wt\_index* for Rceattle
  + Copy year to *Year*
  + Copy gender to *Sex* (see meta\_data on sex definitions in Rceattle)
  + Copy columns a1, a2, … to *Age1, Age 2,*…
* On the “fleet\_control” sheet in Rceattle set *Weight\_index* for each fleet to the appropriate *Wt\_index* generated above from the “wt” sheet
* On the “control” sheet in Rceattle set *pop\_wt\_index* and *ssb\_wt\_index* for each species to the appropriate *Wt\_index* generated above from the “wt” sheet
  + NOTE: for spawning stock biomass (SSB), SSB = sum across ages(N-at-age \* wt-at-age \* maturity-at-age). I hacked it a bit and set spawning weight (*ssb\_wt\_index*) to the weight\*maturity in the SS wattage.ss file. I then set maturity to 1 for all ages on the “pmature” sheet in Rceattle.

**Other bits in Rceattle**

* On the “sex\_ratio” sheet I set sex ratio to 0.5 for all ages (I think this is what the assessment does?)
* On the “M1\_base” sheet, I set M1 to the value from the assessment doc. You can also estimate it by adjusting est\_M1

on the control sheet

* On the “age\_trans\_matrix” sheet I set everything to 0 because there are no length data in the assessment. This sheet converts age to length.
* The “Mn\_LatAge” and “aLW” sheets are not used.

**Comparing the SS model to Rceattle**

* Run the stock synthesis model (Nis already did in this example)
  + open admb terminal
  + type “cd “ then drag the folder where the ss model is into the terminal then press enter
  + type “ss” then enter
* Using r4ss or the report.ss file. I copied selectivity for each fleet to the emp\_sel sheet and copied numbers-at-age to the “NByageFixed” sheet
* I then ran the hake model (setting Selectivity for each fleet to 0 and estDynamics to 1 to fix selectivity and numbers-at-age) without estimating