Detail on Management Strategy Application

Robert Wildermuth

6/6/2022

Compare effects on error with different sample uncertainties for h=0.6

```
## Rows: 1650 Columns: 12
## -- Column specification -------
## Delimiter: ","
## chr (2): model_run, scenario
## dbl (10): Value.SSB, Value.Recr, Value.SPRratio, Value.F, Value.Bratio, Valu...
## i Use 'spec()' to retrieve the full column specification for this data.
## i Specify the column types or set 'show_col_types = FALSE' to quiet this message.
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## i Use 'spec()' to retrieve the full column specification for this data.
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## i Use 'spec()' to retrieve the full column specification for this data.
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## Rows: 1650 Columns: 12
## -- Column specification ------
```

```
## chr (2): model_run, scenario
## dbl (10): Value.SSB, Value.Recr, Value.SPRratio, Value.F, Value.Bratio, Valu...
## i Use 'spec()' to retrieve the full column specification for this data.
## i Specify the column types or set 'show_col_types = FALSE' to quiet this message.
# get terminal estimates of these values for timeseries plots
termTS <- CalcTermTS(smryOutputList) %>%
              mutate(HCR = sub(pattern = ".*Rec","", scenario),
                               recScen = sub(pattern = "HCR.*","", scenario)) %>%
              mutate(recScen = sub(pattern = ".*OM_","", recScen))
## 'summarise()' has grouped output by 'year', 'model_run', 'iteration'. You can
## override using the '.groups' argument.
omName <- grep("_OM", smryOutputList$tsSmry$model run,</pre>
                 fixed = TRUE, value = TRUE)
convrgCheck <- smryOutputList$sclSmry %>% #filter(!model_run %in% omName) %>%
                  select(max_grad, model_run, iteration, scenario) %>%
                  mutate(emYear = as.numeric(regmatches(model_run,
                                                         gregexpr("[[:digit:]]+",
                                                                 model_run))),
                         HCR = sub(pattern = ".*Rec","", scenario),
                         recScen = sub(pattern = "HCR.*","", scenario)) %>%
                  mutate(recScen = sub(pattern = ".*OM_","", recScen),
                         emYear = case when(grep1(" init", model run, fixed = TRUE) ~ 2019,
                                            TRUE ~ emYear))
hcrs <- unique(termTS$HCR)</pre>
#exIters <- sample(termTS$iteration, size = 4)</pre>
cnvrgTS <- smryOutputList$tsSmry %>% mutate(HCR = sub(pattern = ".*Rec","", scenario),
                                   recScen = sub(pattern = "HCR.*","", scenario)) %>%
      mutate(recScen = sub(pattern = ".*OM_","", recScen)) %>%
      left_join(y = convrgCheck, by = c("iteration", "model_run", "scenario", "HCR", "recScen")) %%
      mutate(plotGroup = case_when(model_run %in% omName ~ "OM",
                                   max_grad > 0.01 ~ "non-convrg",
                                   max_grad < 0.01 ~ "convrg"))
# for(mr in 1:length(scenarios)){
   print(cnvrgTS %>% filter(scenario == scenarios[mr], Seas == 1) %>%
        ggplot(aes(x = year, y = log(Bio\_smry))) +
#
        qqplot2::geom vline(xintercept = 2019, color = "qray") +
#
#
        ggplot2::geom_hline(yintercept = log(50000), color = "red") +
#
        qqplot2::qeom_line(aes(linetype = model_run, color = plotGroup))+
#
        ggplot2::scale_color_manual(values = c("black", "blue", "#D65F00")) +
#
        ggplot2::scale_linetype_manual(values = rep("solid", 51)) +
        ggplot2::guides(linetype = "none") +
#
#
        facet_grid(rows = vars(iteration), cols = vars(plotGroup)) +
#
        qqplot2::theme_classic() + theme(legend.position="none") +
       labs(title = scenarios[mr]))
```

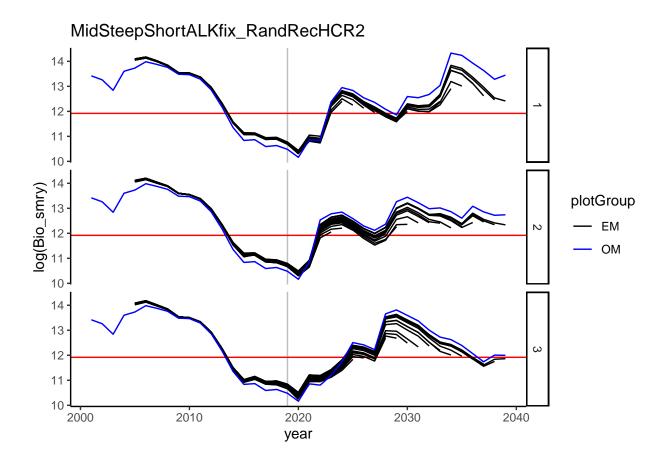
Delimiter: ","

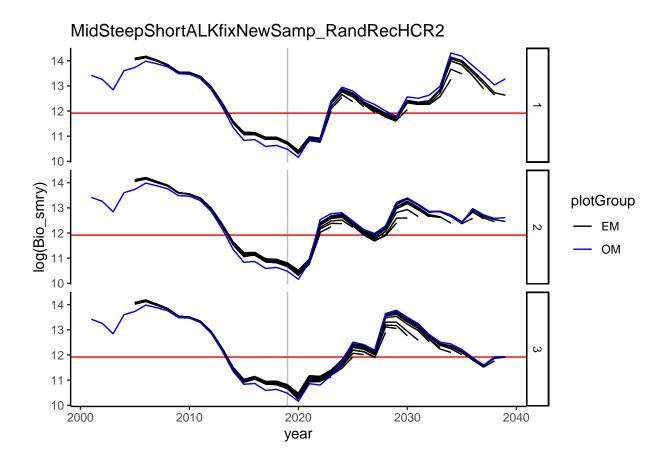
```
# }
#
# for(mr in 1:length(scenarios)){
   print(cnurgTS %>% filter(scenario == scenarios[mr], Seas == 1) %>%
#
       qqplot(aes(x = year, y = rec_dev)) +
#
       ggplot2::geom_vline(xintercept = 2019, color = "gray") +
#
       ggplot2::geom_hline(yintercept = 0, color = "gray") +
#
       qqplot2::qeom line(aes(linetype = model run, color = plotGroup))+
#
        qqplot2::scale color manual(values = c("black", "blue", "#D65F00")) +
       ggplot2::scale_linetype_manual(values = rep("solid", 51)) +
#
#
       ggplot2::guides(linetype = "none") +
#
       facet_grid(rows = vars(iteration), cols = vars(plotGroup)) +
#
       qqplot2::theme classic() + theme(legend.position="none") +
        labs(title = scenarios[mr]))
#
performanceList <- CalcPerformance(smryOutputList)</pre>
## 'summarise()' has grouped output by 'iteration'. You can override using the
## '.groups' argument.
## 'summarise()' has grouped output by 'model_run', 'iteration'. You can override
## using the '.groups' argument.
## 'summarise()' has grouped output by 'model run', 'iteration', 'scenario'. You
## can override using the '.groups' argument.
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## using the '.groups' argument.
## 'summarise()' has grouped output by 'model_run', 'iteration'. You can override
## using the '.groups' argument.
metricsTbl <- performanceList$perfomanceMetrics</pre>
# parse out HCR and recruitment scenario
metricsTbl <- metricsTbl %>% mutate(HCR = sub(pattern = ".*Rec","", scenario),
                                   recScen = sub(pattern = "HCR.*","", scenario)) %>%
               mutate(recScen = sub(pattern = ".*OM ","", recScen))
metricsTbl
## # A tibble: 12 x 22
## # Groups: iteration [3]
     iteration scenario nonconvg nYrs frqNonConvg model_run yrsN closuresFreq
##
##
         <int> <chr>
                              <int> <dbl>
                                                <dbl> <chr> <int>
                                                                             <dbl>
                                                                             0.2
## 1
             1 MidSteepSh~
                                NA
                                       NA
                                                   NA constGro~
                                                                   20
                                                   NA constGro~
## 2
             1 MidSteepSh~
                                 NA
                                       NA
                                                                   20
                                                                             0.25
                                                                   20
                                                                              0.25
## 3
            1 MidSteepSh~
                                 NA
                                       NA
                                                   NA constGro~
## 4
            1 MidSteepSh~
                                 NA
                                                   NA constGro~
                                                                   20
                                                                              0.2
                                       NA
            2 MidSteepSh~
                                       NA
                                                  NA constGro~
                                                                   20
                                                                              0.1
## 5
                                 NA
```

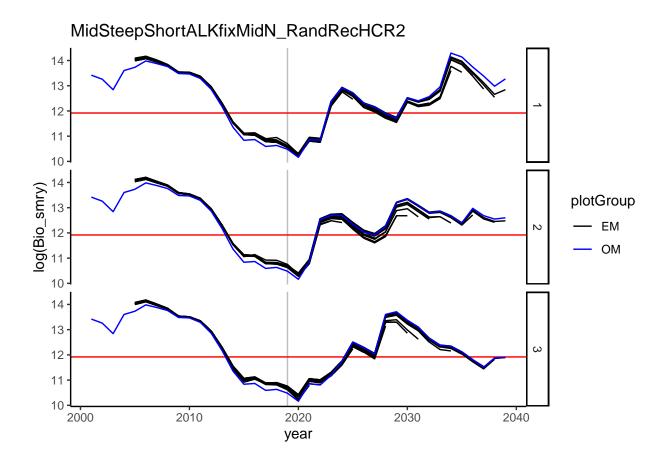
```
0.2
## 6
              2 MidSteepSh~
                                  NA
                                        NA
                                                     NA constGro~
                                                                     20
## 7
              2 MidSteepSh~
                                  NA
                                        NΑ
                                                     NA constGro~
                                                                     20
                                                                                 0.1
              2 MidSteepSh~
## 8
                                  NA
                                        NA
                                                     NA constGro~
                                                                     20
                                                                                 0.1
              3 MidSteepSh~
                                                     NA constGro~
                                                                                 0.3
## 9
                                  NA
                                        NA
                                                                     20
## 10
              3 MidSteepSh~
                                  NA
                                         NA
                                                     NA constGro~
                                                                     20
                                                                                 0.5
              3 MidSteepSh~
                                  NA
                                        NA
                                                     NA constGro~
                                                                     20
                                                                                 0.45
## 11
              3 MidSteepSh~
                                  NA
                                                     NA constGro~
                                                                     20
                                                                                 0.35
                                        NA
## # ... with 14 more variables: collapseFreq <dbl>, bonanzaFreq <dbl>,
## #
       meanB1plus <dbl>, meanCollapseSever <dbl>, closure <lgl>,
       rebuildLengthMax <int>, bonanza <lgl>, bonanzaLengthMax <int>,
## #
## #
       meanCatch <dbl>, sdCatch <dbl>, minAge <dbl>, minLen <dbl>, HCR <chr>,
       recScen <chr>
## #
```

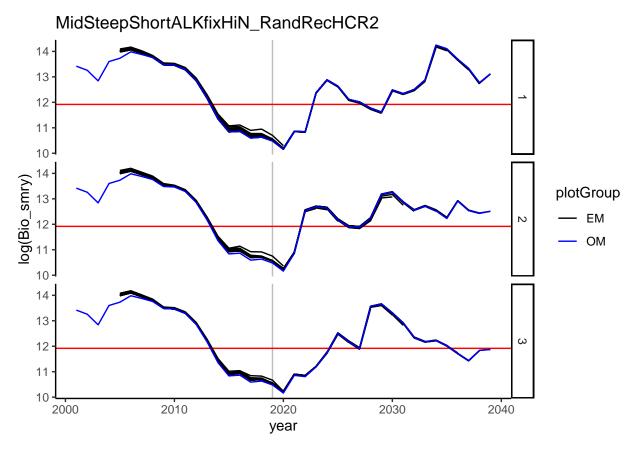
All iterations and scenarios converge for up to 20 yrs

```
age1PlusBio <- smryOutputList$tsSmry %>% filter(Seas == 1) %>%
                  select(year, Bio_smry, model_run, iteration, scenario) %>%
                  mutate(plotGroup = case_when(grepl("_OM", model_run, fixed = TRUE) ~ "OM",
                                               TRUE ~ "EM"))
age1PlusRE <- age1PlusBio %>% filter(plotGroup != "OM")
age1PlusRE <- age1PlusRE %>% pivot_wider(names_from = "plotGroup", values_from = "Bio_smry") %>%
                  left_join(y = convrgCheck,
                            by = c("model_run", "iteration", "scenario")) %>%
                  full join(y = subset(age1PlusBio, subset = plotGroup == "OM"),
                            by = c("iteration", "scenario", "year")) %>%
                  mutate(convrg = case_when(max_grad > 0.01 ~ "non-convrg",
                                            max_grad < 0.01 ~ "convrg",</pre>
                                            TRUE ~ "OM"),
                         emRE = (EM - Bio_smry)/Bio_smry * 100)
age1PlusBio <- age1PlusBio %>% left_join(y = convrgCheck,
                                         by = c("model_run", "iteration", "scenario")) %>%
                  mutate(convrg = case_when(max_grad > 0.01 ~ "non-convrg",
                                            max_grad < 0.01 ~ "convrg",</pre>
                                            TRUE ~ "OM"))
for(mr in 1:length(scenarios)){
  print(age1PlusBio %>% filter(scenario == scenarios[mr], plotGroup != "simData") %>%
   ggplot(aes(x = year, y = log(Bio_smry))) +
    ggplot2::geom_vline(xintercept = 2019, color = "gray") +
      geom_hline(yintercept = log(150000), color = "red") +
    ggplot2::geom line(ggplot2::aes(linetype = as.character(model run), color = plotGroup))+
      ggplot2::scale_color_manual(values = c("black", "blue", "#D65F00")) +
    ggplot2::scale_linetype_manual(values = rep("solid", 51)) +
    ggplot2::guides(linetype = "none") +
     ggplot2::facet_grid(rows = vars(iteration)) +
    ggplot2::theme_classic() +
  labs(title = scenarios[mr]))
}
```





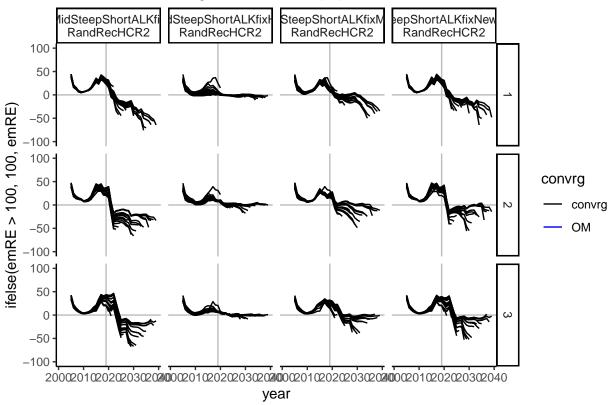




```
# Plot relative errors of biomass over time
age1PlusRE %>% #filter(HCR != "HCRO", emYear < 2024) %>%
mutate(scenario = gsub("_", "\n", scenario, fixed = TRUE)) %>%
ggplot(aes(x = year, y = ifelse(emRE > 100, 100, emRE))) + #y = emRE)) +
geom_vline(xintercept = 2019, color = "gray") +
geom_hline(yintercept = 0, color = "gray") +
geom_line(aes(linetype = as.character(model_run.x), color = convrg))+
scale_color_manual(values = c("black", "blue", "#D65F00")) +
scale_linetype_manual(values = rep("solid", 51)) +
guides(linetype = "none") +
facet_grid(rows = vars(iteration), cols = vars(scenario)) +
theme_classic() + labs(title = "Relative Error of Age 1+ Biomass (%)") +
ylim(-100, 100)
```

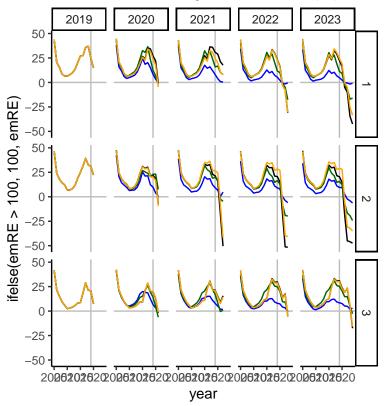
Warning: Removed 48 row(s) containing missing values (geom_path).

Relative Error of Age 1+ Biomass (%)



```
age1PlusRE %>% filter(HCR != "HCRO", emYear < 2024, convrg != "non-convrg") %>%
  mutate(scenario = gsub("MidSteepShort", "", scenario, fixed = TRUE)) %>%
  ggplot(aes(x = year, y = ifelse(emRE > 100, 100, emRE))) + #y = emRE)) +
  geom_vline(xintercept = 2019, color = "gray") +
  geom_hline(yintercept = 0, color = "gray") +
  geom_line(aes(linetype = as.character(scenario), color = scenario))+
  scale_color_manual(values = c("black", "blue", "darkgreen", "orange", "grey")) +
  scale_linetype_manual(values = rep("solid", 51)) +
  # guides(linetype = "none") +
  facet_grid(rows = vars(iteration), cols = vars(emYear)) +
  theme_classic() + labs(title = "Relative Error of Age 1+ Biomass (%)")
```





as.character(scenario)

- ALKfix RandRecHCR2
- ALKfixHiN_RandRecHCR2
- ALKfixMidN_RandRecHCR2
- ALKfixNewSamp_RandRecHCR2

scenario

- ALKfix_RandRecHCR2
- ALKfixHiN_RandRecHCR2
- ALKfixMidN_RandRecHCR2
- ALKfixNewSamp_RandRecHCR2

```
# aqe1PlusRE %>% filter(HCR != "HCRO", grepl("ALKfix", scenario, fixed = TRUE)) %>%
   mutate(scenario = qsub("_", "\n", scenario, fixed = TRUE)) %>%
#
      qqplot(aes(x = year, y = emRE)) +
#
      geom_vline(xintercept = 2019, color = "gray") +
#
      qeom_hline(yintercept = 0, color = "qray") +
#
      geom_line(aes(linetype = as.character(model_run.x), color = convrg))+
      scale color manual(values = c("black", "blue", "#D65F00")) +
#
#
      scale_linetype_manual(values = rep("solid", 51)) +
#
      quides(linetype = "none") +
#
      facet_grid(rows = vars(iteration), cols = vars(scenario)) +
      theme_classic() + labs(title = "Relative Error of Age 1+ Biomass (%)")
# Recruitment error
recs <- smryOutputList$dqSmry %>% #filter(Seas == 1) %>%
                  select(year, Value.Recr, model_run, iteration, scenario) %>%
                  mutate(plotGroup = case_when(grepl("_OM", model_run, fixed = TRUE) ~ "OM",
                                               TRUE ~ "EM"))
recRE <- recs %>% filter(plotGroup != "OM")
recRE <- recRE %% pivot_wider(names_from = "plotGroup", values_from = "Value.Recr") %>%
                  left_join(y = convrgCheck,
                            by = c("model_run", "iteration", "scenario")) %>%
                  full_join(y = subset(recs, subset = plotGroup == "OM"),
                            by = c("iteration", "scenario", "year")) %>%
                  mutate(convrg = case_when(max_grad > 0.01 ~ "non-convrg",
                                            max_grad < 0.01 ~ "convrg",</pre>
```

```
TRUE ~ "OM"),

emRE = (EM - Value.Recr)/Value.Recr * 100)

# Plot relative errors of rec devs over time

recRE %>% filter(HCR != "HCRO", emYear < 2024, convrg != "non-convrg") %>%

mutate(scenario = gsub("MidSteepShort", "", scenario, fixed = TRUE)) %>%

ggplot(aes(x = year, y = ifelse(emRE > 100, 100, emRE))) + #y = emRE)) +

geom_vline(xintercept = 2019, color = "gray") +

geom_line(yintercept = 0, color = "gray") +

geom_line(aes(linetype = as.character(scenario), color = scenario))+

scale_color_manual(values = c("black", "blue", "darkgreen", "orange", "grey")) +

scale_linetype_manual(values = rep("solid", 51)) +

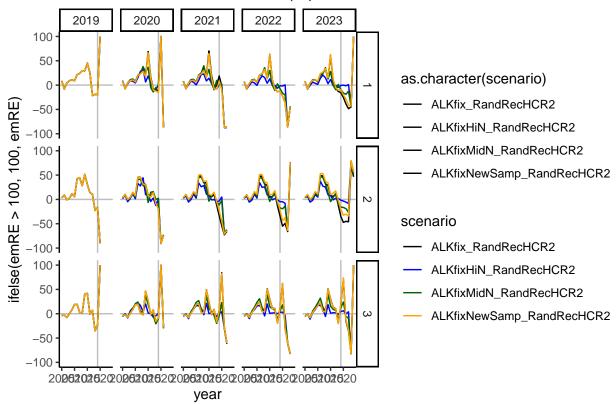
# guides(linetype = "none") +

facet_grid(rows = vars(iteration), cols = vars(emYear)) +

theme_classic() + labs(title = "Relative Error of Recruitment (%)") +

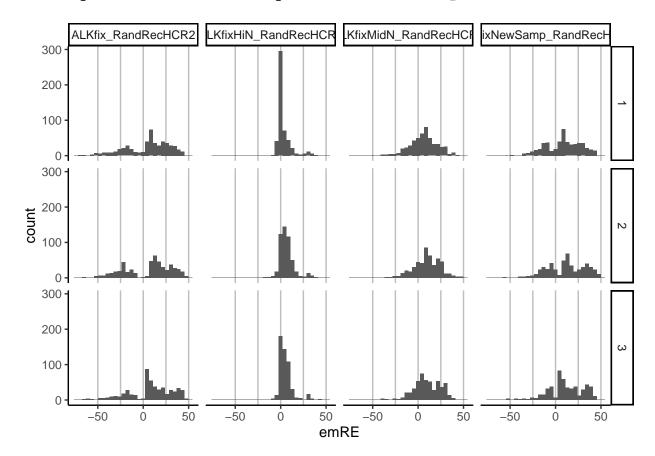
ylim(-100, 100)
```

Relative Error of Recruitment (%)



```
age1PlusRE %>% filter(emRE < -50) %>%
group_by(scenario) %>%
summarize(numBelowneg50 = n())
```

- ## 'stat_bin()' using 'bins = 30'. Pick better value with 'binwidth'.
- ## Warning: Removed 48 rows containing non-finite values (stat_bin).



Interpretation

- No issues with convergence within 20 yrs for any sampling scenario.
- Model/HCR combo allow for population to crash (OM below red line) and recover
- Overall general positive bias of the EM across scenarios (mode shifted to right in last plot)
- Positive bias when extant biomass is low, and negative bias after stock recovery
- High sampling (HiN) led to much lower relative errors, though not perfect fit to OM, with very few errors > |25|%
- Low sampling resulted in general negative bias in projection period
 - Mid/Low sampling (NewSamp) showed this too, but error progressed to 0 after more data added.
- Mid/Low sampling (NewSamp) allows for some realistic error but estimates improve over time

Compare effects on error with different sample uncertainties for h=0.3

```
mseDir <- "C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenarios"
scenarios <- c("origMSEwALKfix_RandRecHCR2",</pre>
             "MidSteepShortALKfixNewSamp RandRecHCR2",
             "LowSteepShortALKfixMidN RandRecHCR2",
             "LowSteepShortALKfixNewSamp_RandRecHCR2")
smryOutputList <- GetSumryOutput(dirSSMSE = mseDir,</pre>
                      scenarios = scenarios)
## Rows: 1650 Columns: 12
## Delimiter: ","
## chr (2): model run, scenario
## dbl (10): Value.SSB, Value.Recr, Value.SPRratio, Value.F, Value.Bratio, Valu...
## i Use 'spec()' to retrieve the full column specification for this data.
## i Specify the column types or set 'show_col_types = FALSE' to quiet this message.
## Rows: 1650 Columns: 12
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## Delimiter: ","
## chr (2): model_run, scenario
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## i Use 'spec()' to retrieve the full column specification for this data.
## i Specify the column types or set 'show_col_types = FALSE' to quiet this message.
## Rows: 1650 Columns: 12
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## chr (2): model_run, scenario
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## i Use 'spec()' to retrieve the full column specification for this data.
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## Rows: 1650 Columns: 12
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## Delimiter: ","
## chr (2): model_run, scenario
## dbl (10): Value.SSB, Value.Recr, Value.SPRratio, Value.F, Value.Bratio, Valu...
## i Use 'spec()' to retrieve the full column specification for this data.
## i Specify the column types or set 'show_col_types = FALSE' to quiet this message.
# get terminal estimates of these values for timeseries plots
termTS <- CalcTermTS(smryOutputList) %>%
            mutate(HCR = sub(pattern = ".*Rec","", scenario),
                           recScen = sub(pattern = "HCR.*","", scenario)) %>%
            mutate(recScen = sub(pattern = ".*OM_","", recScen))
```

```
## 'summarise()' has grouped output by 'year', 'model_run', 'iteration'. You can
## override using the '.groups' argument.
```

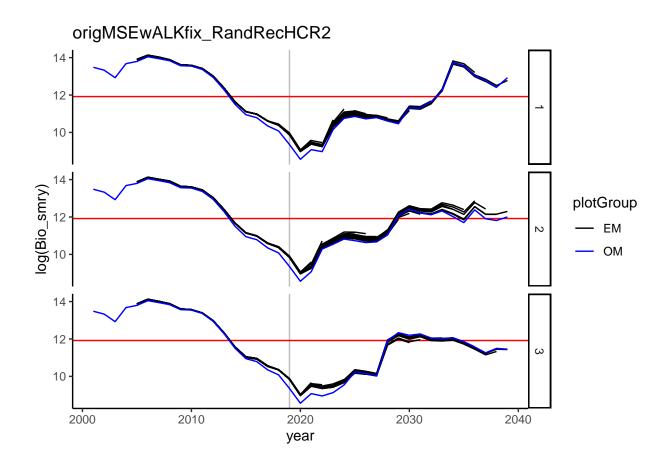
```
omName <- grep("_OM", smryOutputList$tsSmry$model_run,
                 fixed = TRUE, value = TRUE)
convrgCheck <- smryOutputList$sclSmry %>% #filter(!model_run %in% omName) %>%
                  select(max_grad, model_run, iteration, scenario) %>%
                  mutate(emYear = as.numeric(regmatches(model_run,
                                                         gregexpr("[[:digit:]]+",
                                                                  model_run))),
                         HCR = sub(pattern = ".*Rec","", scenario),
                         recScen = sub(pattern = "HCR.*","", scenario)) %>%
                  mutate(recScen = sub(pattern = ".*OM_","", recScen),
                         emYear = case_when(grepl("_init", model_run, fixed = TRUE) ~ 2019,
                                            TRUE ~ emYear))
hcrs <- unique(termTS$HCR)</pre>
#exIters <- sample(termTS$iteration, size = 4)</pre>
cnvrgTS <- smryOutputList$tsSmry %>% mutate(HCR = sub(pattern = ".*Rec","", scenario),
                                   recScen = sub(pattern = "HCR.*","", scenario)) %>%
      mutate(recScen = sub(pattern = ".*OM_","", recScen)) %>%
      left_join(y = convrgCheck, by = c("iteration", "model_run", "scenario", "HCR", "recScen")) %>%
      mutate(plotGroup = case_when(model_run %in% omName ~ "OM",
                                   max_grad > 0.01 ~ "non-convrg",
                                   max_grad < 0.01 ~ "convrg"))</pre>
# for(mr in 1:length(scenarios)){
    print(cnvrqTS %>% filter(scenario == scenarios[mr], Seas == 1) %>%
#
        ggplot(aes(x = year, y = log(Bio\_smry))) +
#
        ggplot2::geom_vline(xintercept = 2019, color = "gray") +
        ggplot2::geom_hline(yintercept = log(50000), color = "red") +
#
#
        ggplot2::geom_line(aes(linetype = model_run, color = plotGroup))+
        ggplot2::scale_color_manual(values = c("black", "blue", "#D65F00")) +
#
#
        ggplot2::scale_linetype_manual(values = rep("solid", 51)) +
#
        ggplot2::guides(linetype = "none") +
#
        facet_grid(rows = vars(iteration), cols = vars(plotGroup)) +
#
        ggplot2::theme_classic() + theme(legend.position="none") +
#
        labs(title = scenarios[mr]))
# }
#
# for(mr in 1:length(scenarios)){
    print(cnvrqTS %>% filter(scenario == scenarios[mr], Seas == 1) %>%
#
        ggplot(aes(x = year, y = rec_dev)) +
        qqplot2::qeom_vline(xintercept = 2019, color = "qray") +
#
#
        qqplot2::qeom_hline(yintercept = 0, color = "qray") +
#
        qqplot2::qeom_line(aes(linetype = model_run, color = plotGroup))+
#
        ggplot2::scale_color_manual(values = c("black", "blue", "#D65F00")) +
        ggplot2::scale_linetype_manual(values = rep("solid", 51)) +
#
#
        ggplot2::guides(linetype = "none") +
#
        facet grid(rows = vars(iteration), cols = vars(plotGroup)) +
#
        ggplot2::theme_classic() + theme(legend.position="none") +
       labs(title = scenarios[mr]))
```

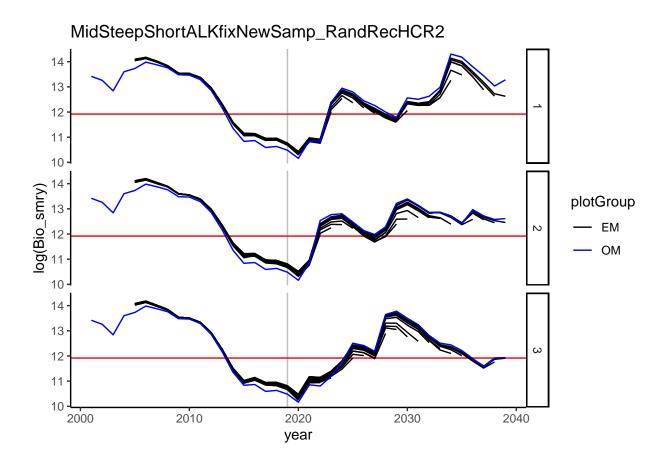
```
performanceList <- CalcPerformance(smryOutputList)</pre>
## 'summarise()' has grouped output by 'iteration'. You can override using the
## '.groups' argument.
## 'summarise()' has grouped output by 'model_run', 'iteration'. You can override
## using the '.groups' argument.
## 'summarise()' has grouped output by 'model_run', 'iteration', 'scenario'. You
## can override using the '.groups' argument.
## 'summarise()' has grouped output by 'model_run', 'iteration', 'scenario'. You
## can override using the '.groups' argument.
## 'summarise()' has grouped output by 'year', 'model_run', 'iteration'. You can
## override using the '.groups' argument.
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## 'summarise()' has grouped output by 'model_run', 'iteration'. You can override
## using the '.groups' argument.
## 'summarise()' has grouped output by 'model_run', 'iteration'. You can override
## using the '.groups' argument.
metricsTbl <- performanceList$perfomanceMetrics</pre>
# parse out HCR and recruitment scenario
metricsTbl <- metricsTbl %>% mutate(HCR = sub(pattern = ".*Rec","", scenario),
                                    recScen = sub(pattern = "HCR.*","", scenario)) %>%
                mutate(recScen = sub(pattern = ".*OM_","", recScen))
metricsTbl
## # A tibble: 9 x 22
## # Groups: iteration [3]
     iteration scenario
                            nonconvg nYrs frqNonConvg model_run yrsN closuresFreq
         <int> <chr>
                                                 <dbl> <chr>
##
                               <int> <dbl>
                                                                  <int>
                                                                               <dbl>
            1 origMSEwALK~
                                                  0.05 constGro~
                                                                                0.65
## 1
                                  1
                                        20
                                                                     20
## 2
             1 LowSteepSho~
                                  NA
                                        NA
                                                        constGro~
                                                                     20
                                                                                0.65
                                                 NA
## 3
             1 LowSteepSho~
                                  NA
                                        NA
                                                 NA
                                                        constGro~
                                                                     20
                                                                                0.65
## 4
             2 LowSteepSho~
                                  NA
                                        NA
                                                 NA
                                                        constGro~
                                                                     20
                                                                                0.45
## 5
             2 LowSteepSho~
                                  NA
                                        NA
                                                                     20
                                                                                0.45
                                                 NA
                                                        constGro~
## 6
             2 origMSEwALK~
                                  NA
                                        NA
                                                 NA
                                                        constGro~
                                                                     20
                                                                                0.6
## 7
             3 LowSteepSho~
                                                                                0.65
                                  NA
                                        NA
                                                 NA
                                                        constGro~
                                                                     20
## 8
             3 LowSteepSho~
                                  NA
                                        NA
                                                 NA
                                                        constGro~
                                                                     20
                                                                                0.65
## 9
             3 origMSEwALK~
                                  NA
                                        NA
                                                 NA
                                                        constGro~
                                                                     20
                                                                                0.65
## # ... with 14 more variables: collapseFreq <dbl>, bonanzaFreq <dbl>,
       meanB1plus <dbl>, meanCollapseSever <dbl>, closure <lgl>,
## #
       rebuildLengthMax <int>, bonanza <lgl>, bonanzaLengthMax <int>,
## #
       meanCatch <dbl>, sdCatch <dbl>, minAge <dbl>, minLen <dbl>, HCR <chr>,
## #
       recScen <chr>
```

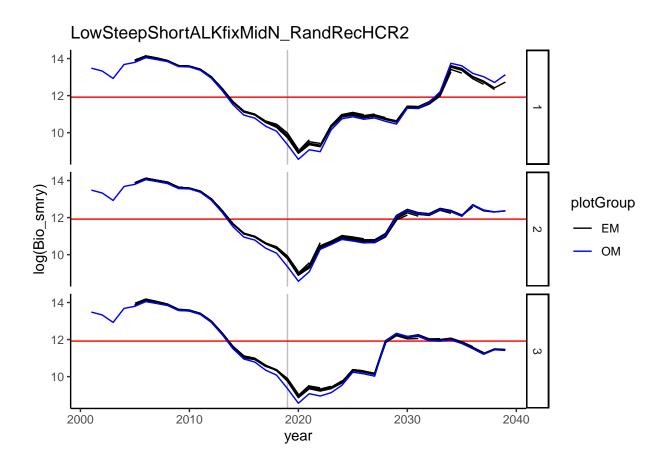
All iterations and scenarios converge for up to 20 yrs

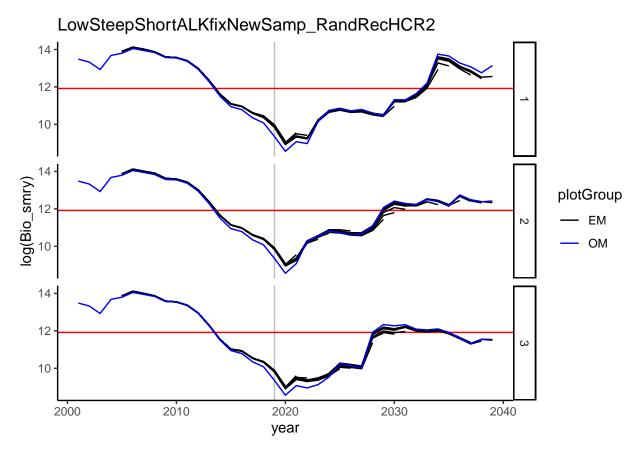
}

```
age1PlusBio <- smryOutputList$tsSmry %>% filter(Seas == 1) %>%
                  select(year, Bio smry, model run, iteration, scenario) %>%
                  mutate(plotGroup = case_when(grepl("_OM", model_run, fixed = TRUE) ~ "OM",
                                               TRUE ~ "EM"))
age1PlusRE <- age1PlusBio %>% filter(plotGroup != "OM")
age1PlusRE <- age1PlusRE %>% pivot_wider(names_from = "plotGroup", values_from = "Bio_smry") %>%
                  left join(y = convrgCheck,
                            by = c("model run", "iteration", "scenario")) %>%
                  full_join(y = subset(age1PlusBio, subset = plotGroup == "OM"),
                            by = c("iteration", "scenario", "year")) %>%
                  mutate(convrg = case_when(max_grad > 0.01 ~ "non-convrg",
                                            max_grad < 0.01 ~ "convrg",</pre>
                                            TRUE ~ "OM"),
                         emRE = (EM - Bio_smry)/Bio_smry * 100)
age1PlusBio <- age1PlusBio %>% left_join(y = convrgCheck,
                                         by = c("model_run", "iteration", "scenario")) %>%
                  mutate(convrg = case_when(max_grad > 0.01 ~ "non-convrg",
                                            max_grad < 0.01 ~ "convrg",</pre>
                                            TRUE ~ "OM"))
for(mr in 1:length(scenarios)){
  print(age1PlusBio %>% filter(scenario == scenarios[mr], plotGroup != "simData") %>%
   ggplot(aes(x = year, y = log(Bio smry))) +
    ggplot2::geom_vline(xintercept = 2019, color = "gray") +
     geom_hline(yintercept = log(150000), color = "red") +
    ggplot2::geom_line(ggplot2::aes(linetype = as.character(model_run), color = plotGroup))+
      ggplot2::scale_color_manual(values = c("black", "blue", "#D65F00")) +
    ggplot2::scale_linetype_manual(values = rep("solid", 51)) +
   ggplot2::guides(linetype = "none") +
     ggplot2::facet_grid(rows = vars(iteration)) +
    ggplot2::theme_classic() +
  labs(title = scenarios[mr]))
}
```





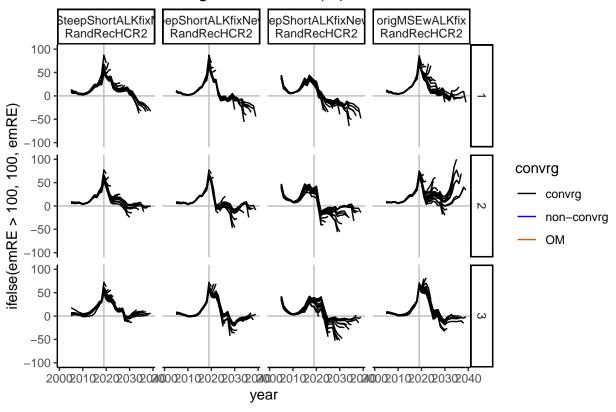




```
# Plot relative errors of biomass over time
age1PlusRE %>% #filter(HCR != "HCRO", emYear < 2024) %>%
mutate(scenario = gsub("_", "\n", scenario, fixed = TRUE)) %>%
ggplot(aes(x = year, y = ifelse(emRE > 100, 100, emRE))) + #y = emRE)) +
geom_vline(xintercept = 2019, color = "gray") +
geom_lline(yintercept = 0, color = "gray") +
geom_lline(aes(linetype = as.character(model_run.x), color = convrg))+
scale_color_manual(values = c("black", "blue", "#D65F00")) +
scale_linetype_manual(values = rep("solid", 51)) +
guides(linetype = "none") +
facet_grid(rows = vars(iteration), cols = vars(scenario)) +
theme_classic() + labs(title = "Relative Error of Age 1+ Biomass (%)") +
ylim(-100, 100)
```

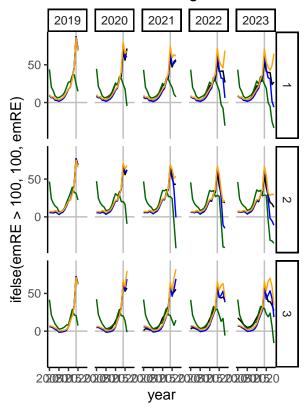
Warning: Removed 48 row(s) containing missing values (geom_path).

Relative Error of Age 1+ Biomass (%)



```
age1PlusRE %>% filter(HCR != "HCRO", emYear < 2024, convrg != "non-convrg") %>%
#mutate(scenario = gsub("MidSteepShort", "", scenario, fixed = TRUE)) %>%
ggplot(aes(x = year, y = ifelse(emRE > 100, 100, emRE))) + #y = emRE)) +
geom_vline(xintercept = 2019, color = "gray") +
geom_hline(yintercept = 0, color = "gray") +
geom_line(aes(linetype = as.character(scenario), color = scenario))+
scale_color_manual(values = c("black", "blue", "darkgreen", "orange", "grey")) +
scale_linetype_manual(values = rep("solid", 51)) +
# guides(linetype = "none") +
facet_grid(rows = vars(iteration), cols = vars(emYear)) +
theme_classic() + labs(title = "Relative Error of Age 1+ Biomass (%)")
```

Relative Error of Age 1+ Biomass (%)



scenario

- LowSteepShortALKfixMidN_RandRecHCR2
- LowSteepShortALKfixNewSamp_RandRecHCR2
- MidSteepShortALKfixNewSamp_RandRecHCR2
- origMSEwALKfix_RandRecHCR2

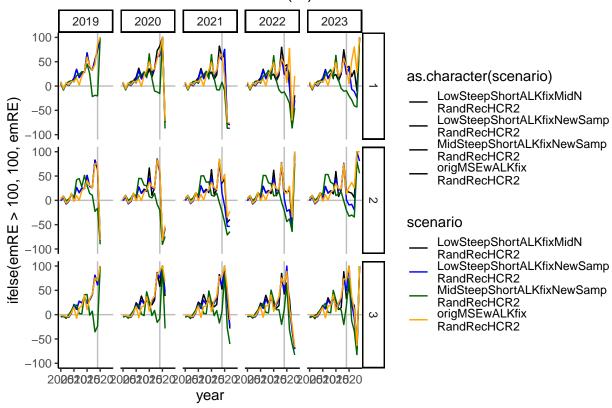
as.character(scenario)

- LowSteepShortALKfixMidN_RandRecHCR2
- LowSteepShortALKfixNewSamp_RandRecHCR2
- MidSteepShortALKfixNewSamp_RandRecHCR2
- origMSEwALKfix_RandRecHCR2

```
# aqe1PlusRE %>% filter(HCR != "HCRO", grepl("ALKfix", scenario, fixed = TRUE)) %>%
   mutate(scenario = gsub("_", "\n", scenario, fixed = TRUE)) %>%
#
      ggplot(aes(x = year, y = emRE)) +
#
      geom_vline(xintercept = 2019, color = "gray") +
#
      qeom_hline(yintercept = 0, color = "qray") +
#
      geom_line(aes(linetype = as.character(model_run.x), color = convrg))+
      scale_color_manual(values = c("black", "blue", "#D65F00")) +
#
#
      scale_linetype_manual(values = rep("solid", 51)) +
#
      quides(linetype = "none") +
#
      facet_grid(rows = vars(iteration), cols = vars(scenario)) +
      theme_classic() + labs(title = "Relative Error of Age 1+ Biomass (%)")
# Recruitment error
recs <- smryOutputList$dqSmry %>% #filter(Seas == 1) %>%
                  select(year, Value.Recr, model_run, iteration, scenario) %>%
                  mutate(plotGroup = case_when(grepl("_OM", model_run, fixed = TRUE) ~ "OM",
                                               TRUE ~ "EM"))
recRE <- recs %>% filter(plotGroup != "OM")
recRE <- recRE %% pivot_wider(names_from = "plotGroup", values_from = "Value.Recr") %>%
                  left_join(y = convrgCheck,
                            by = c("model_run", "iteration", "scenario")) %>%
                  full_join(y = subset(recs, subset = plotGroup == "OM"),
                            by = c("iteration", "scenario", "year")) %>%
                  mutate(convrg = case_when(max_grad > 0.01 ~ "non-convrg",
                                            max_grad < 0.01 ~ "convrg",</pre>
```

```
TRUE ~ "OM"),
                         emRE = (EM - Value.Recr)/Value.Recr * 100)
# Plot relative errors of rec devs over time
recRE %>% filter(HCR != "HCRO", emYear < 2024, convrg != "non-convrg") %>%
  #mutate(scenario = gsub("MidSteepShort", "", scenario, fixed = TRUE)) %>%
  mutate(scenario = gsub("_", "\n", scenario, fixed = TRUE)) %>%
    ggplot(aes(x = year, y = ifelse(emRE > 100, 100, emRE))) + #y = emRE)) +
    geom_vline(xintercept = 2019, color = "gray") +
    geom_hline(yintercept = 0, color = "gray") +
    geom_line(aes(linetype = as.character(scenario), color = scenario))+
    scale_color_manual(values = c("black", "blue", "darkgreen", "orange", "grey")) +
    scale linetype manual(values = rep("solid", 51)) +
    # quides(linetype = "none") +
   facet_grid(rows = vars(iteration), cols = vars(emYear)) +
    theme_classic() + labs(title = "Relative Error of Recruitment (%)") +
   ylim(-100, 100)
```

Relative Error of Recruitment (%)

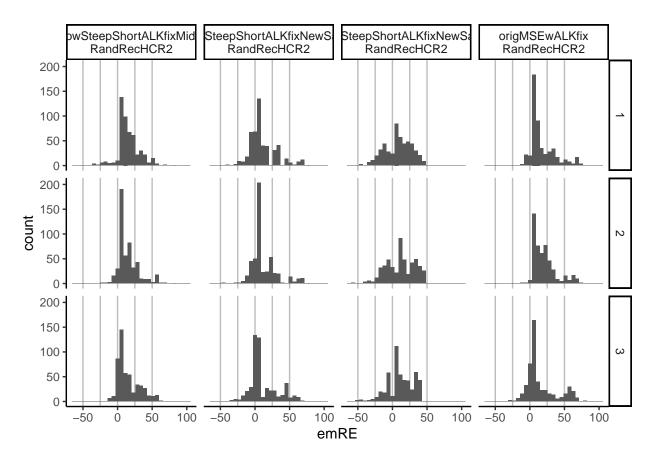


```
age1PlusRE %>% filter(emRE < -50) %>%
group_by(scenario) %>%
summarize(numBelowneg50 = n())
```

```
age1PlusRE %>% mutate(scenario = gsub("_", "\n", scenario, fixed = TRUE)) %>%
    ggplot(aes(x = emRE)) +
    geom_vline(xintercept = c(-50,-25,0,25,50), color = "gray") +
    geom_histogram() +
    facet_grid(rows = vars(iteration), cols = vars(scenario)) +
    theme_classic()
```

'stat_bin()' using 'bins = 30'. Pick better value with 'binwidth'.

Warning: Removed 48 rows containing non-finite values (stat_bin).



Interpretation

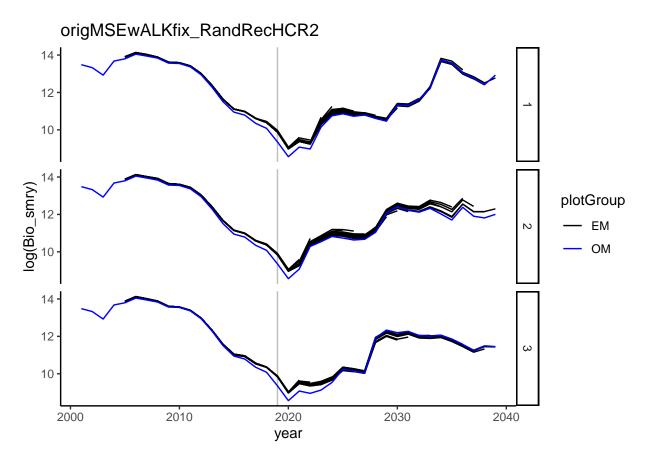
- Steepness of h=0.3 has higher spread of biomass estimation error
 - Peak of error surrounding transition from historical to projection periods, with high frequency of errors >50%
 - Greater frequency overall of small errors close to 0%
 - Better estimation of initial conditions than h=0.6 model
- Some tendency for positive bias across sampling scenarios
 - Low sampling (CPUE CV=0.5, Nsamp = 20) leaves potential for high error rates (> 50%) in projection period

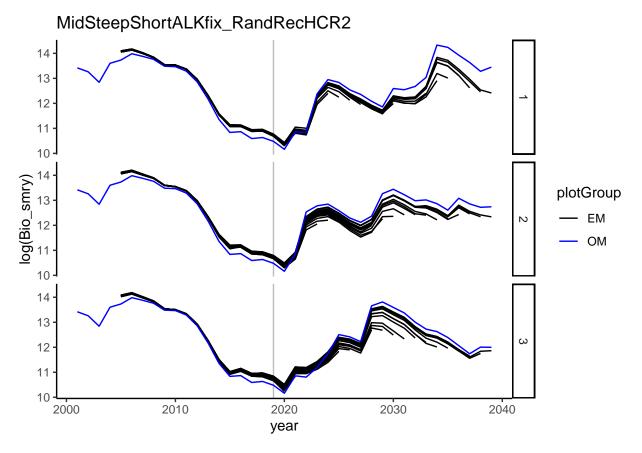
Look at original analysis w/ corrected ALK tolerance compared to h=0.6

```
mseDir <- "C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenarios"
scenarios <- c("origMSEwALKfix_RandRecHCR2",</pre>
               "MidSteepShortALKfix RandRecHCR2")
smryOutputList <- GetSumryOutput(dirSSMSE = mseDir,</pre>
                                scenarios = scenarios)
## Rows: 1650 Columns: 12
## -- Column specification -----
## Delimiter: ","
## chr (2): model_run, scenario
## dbl (10): Value.SSB, Value.Recr, Value.SPRratio, Value.F, Value.Bratio, Valu...
## i Use 'spec()' to retrieve the full column specification for this data.
## i Specify the column types or set 'show_col_types = FALSE' to quiet this message.
## Rows: 1650 Columns: 12
## -- Column specification ------
## Delimiter: ","
## chr (2): model_run, scenario
## dbl (10): Value.SSB, Value.Recr, Value.SPRratio, Value.F, Value.Bratio, Valu...
## i Use 'spec()' to retrieve the full column specification for this data.
## i Specify the column types or set 'show_col_types = FALSE' to quiet this message.
# get terminal estimates of these values for timeseries plots
termTS <- CalcTermTS(smryOutputList) %>%
             mutate(HCR = sub(pattern = ".*Rec","", scenario),
                              recScen = sub(pattern = "HCR.*","", scenario)) %>%
             mutate(recScen = sub(pattern = ".*OM_","", recScen))
## 'summarise()' has grouped output by 'year', 'model_run', 'iteration'. You can
## override using the '.groups' argument.
omName <- grep("_OM", smryOutputList$tsSmry$model_run,</pre>
                fixed = TRUE, value = TRUE)
convrgCheck <- smryOutputList$sclSmry %>% #filter(!model_run %in% omName) %>%
                 select(max_grad, model_run, iteration, scenario) %>%
                 mutate(emYear = as.numeric(regmatches(model_run,
                                                        gregexpr("[[:digit:]]+",
                                                                 model_run))),
                         HCR = sub(pattern = ".*Rec","", scenario),
                         recScen = sub(pattern = "HCR.*","", scenario)) %>%
                 mutate(recScen = sub(pattern = ".*OM ","", recScen),
                         emYear = case_when(grepl("_init", model_run, fixed = TRUE) ~ 2019,
                                            TRUE ~ emYear))
```

```
hcrs <- unique(termTS$HCR)</pre>
#exIters <- sample(termTS$iteration, size = 4)</pre>
cnvrgTS <- smryOutputList$tsSmry %>% mutate(HCR = sub(pattern = ".*Rec","", scenario),
                                   recScen = sub(pattern = "HCR.*","", scenario)) %>%
      mutate(recScen = sub(pattern = ".*OM_","", recScen)) %>%
     left_join(y = convrgCheck, by = c("iteration", "model_run", "scenario", "HCR", "recScen")) %>%
      mutate(plotGroup = case when(model run %in% omName ~ "OM",
                                   max_grad > 0.01 ~ "non-convrg",
                                   max_grad < 0.01 ~ "convrg"))
# for(mr in 1:length(scenarios)){
   print(cnvrgTS %>% filter(scenario == scenarios[mr], Seas == 1) %>%
        ggplot(aes(x = year, y = log(Bio\_smry))) +
#
        ggplot2::geom_vline(xintercept = 2019, color = "gray") +
        ggplot2::geom_hline(yintercept = log(50000), color = "red") +
#
#
        qqplot2::qeom_line(aes(linetype = model_run, color = plotGroup))+
        ggplot2::scale_color_manual(values = c("black", "blue", "#D65F00")) +
#
#
        qqplot2::scale_linetype_manual(values = rep("solid", 51)) +
#
        qqplot2::quides(linetype = "none") +
#
        facet_grid(rows = vars(iteration), cols = vars(plotGroup)) +
#
        ggplot2::theme_classic() + theme(legend.position="none") +
#
        labs(title = scenarios[mr]))
# }
#
# for(mr in 1:length(scenarios)){
   print(cnvrgTS %>% filter(scenario == scenarios[mr], Seas == 1) %>%
#
        ggplot(aes(x = year, y = rec_dev)) +
#
        ggplot2::geom_vline(xintercept = 2019, color = "gray") +
#
        ggplot2::geom_hline(yintercept = 0, color = "gray") +
#
        qqplot2::qeom_line(aes(linetype = model_run, color = plotGroup))+
        qqplot2::scale_color_manual(values = c("black", "blue", "#D65F00")) +
#
#
        ggplot2::scale_linetype_manual(values = rep("solid", 51)) +
#
        qqplot2::quides(linetype = "none") +
#
        facet_grid(rows = vars(iteration), cols = vars(plotGroup)) +
#
        qqplot2::theme_classic() + theme(legend.position="none") +
#
        labs(title = scenarios[mr]))
# }
age1PlusBio <- smryOutputList$tsSmry %>% filter(Seas == 1) %>%
                  select(year, Bio_smry, model_run, iteration, scenario) %>%
                  mutate(plotGroup = case_when(grepl("_OM", model_run, fixed = TRUE) ~ "OM",
                                               TRUE ~ "EM"))
age1PlusRE <- age1PlusBio %>% filter(plotGroup != "OM")
age1PlusRE <- age1PlusRE %>% pivot_wider(names_from = "plotGroup", values_from = "Bio_smry") %>%
                  left_join(y = convrgCheck,
                            by = c("model_run", "iteration", "scenario")) %>%
                  full_join(y = subset(age1PlusBio, subset = plotGroup == "OM"),
                            by = c("iteration", "scenario", "year")) %>%
                  mutate(convrg = case_when(max_grad > 0.01 ~ "non-convrg",
                                            max_grad < 0.01 ~ "convrg",</pre>
                                            TRUE ~ "OM"),
```

```
emRE = (EM - Bio_smry)/Bio_smry * 100)
age1PlusBio <- age1PlusBio %>% left_join(y = convrgCheck,
                                         by = c("model_run", "iteration", "scenario")) %>%
                  mutate(convrg = case_when(max_grad > 0.01 ~ "non-convrg",
                                            max_grad < 0.01 ~ "convrg",</pre>
                                            TRUE ~ "OM"))
for(mr in 1:length(scenarios)){
  print(age1PlusBio %>% filter(scenario == scenarios[mr], plotGroup != "simData") %>%
    ggplot(aes(x = year, y = log(Bio_smry))) +
    ggplot2::geom_vline(xintercept = 2019, color = "gray") +
    ggplot2::geom_line(ggplot2::aes(linetype = as.character(model_run), color = plotGroup))+
      ggplot2::scale_color_manual(values = c("black", "blue", "#D65F00")) +
    ggplot2::scale_linetype_manual(values = rep("solid", 51)) +
    ggplot2::guides(linetype = "none") +
     ggplot2::facet_grid(rows = vars(iteration)) +
    ggplot2::theme_classic() +
  labs(title = scenarios[mr]))
}
```

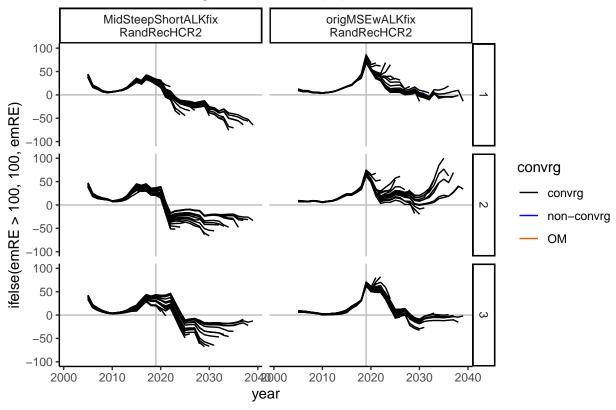




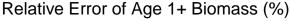
```
# Plot relative errors of biomass over time
age1PlusRE %>% #filter(HCR != "HCRO", emYear < 2024) %>%
mutate(scenario = gsub("_", "\n", scenario, fixed = TRUE)) %>%
ggplot(aes(x = year, y = ifelse(emRE > 100, 100, emRE))) + #y = emRE)) +
geom_vline(xintercept = 2019, color = "gray") +
geom_hline(yintercept = 0, color = "gray") +
geom_line(aes(linetype = as.character(model_run.x), color = convrg))+
scale_color_manual(values = c("black", "blue", "#D65F00")) +
scale_linetype_manual(values = rep("solid", 51)) +
guides(linetype = "none") +
facet_grid(rows = vars(iteration), cols = vars(scenario)) +
theme_classic() + labs(title = "Relative Error of Age 1+ Biomass (%)") +
ylim(-100, 100)
```

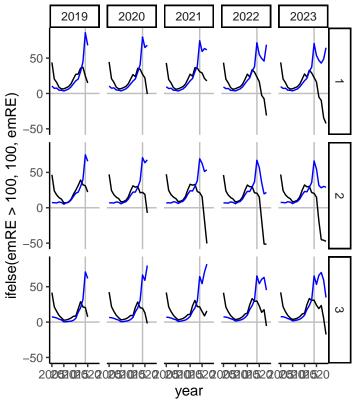
Warning: Removed 24 row(s) containing missing values (geom_path).

Relative Error of Age 1+ Biomass (%)



```
age1PlusRE %>% filter(HCR != "HCRO", emYear < 2024, convrg != "non-convrg") %>%
#mutate(scenario = gsub("constGrow20010M_", "", scenario, fixed = TRUE)) %>%
ggplot(aes(x = year, y = ifelse(emRE > 100, 100, emRE))) + #y = emRE)) +
geom_vline(xintercept = 2019, color = "gray") +
geom_hline(yintercept = 0, color = "gray") +
geom_line(aes(linetype = as.character(scenario), color = scenario))+
scale_color_manual(values = c("black", "blue", "darkgreen", "orange", "grey")) +
scale_linetype_manual(values = rep("solid", 51)) +
# guides(linetype = "none") +
facet_grid(rows = vars(iteration), cols = vars(emYear)) +
theme_classic() + labs(title = "Relative Error of Age 1+ Biomass (%)")
```





scenario

- MidSteepShortALKfix_RandRecHCR2
- origMSEwALKfix_RandRecHCR2

as.character(scenario)

- MidSteepShortALKfix_RandRecHCR2
- origMSEwALKfix_RandRecHCR2

```
# aqe1PlusRE %>% filter(HCR != "HCRO", grepl("ALKfix", scenario, fixed = TRUE)) %>%
   mutate(scenario = gsub("_", "\n", scenario, fixed = TRUE)) %>%
#
      ggplot(aes(x = year, y = emRE)) +
#
      geom_vline(xintercept = 2019, color = "gray") +
#
      qeom_hline(yintercept = 0, color = "qray") +
#
      geom_line(aes(linetype = as.character(model_run.x), color = convrg))+
      scale_color_manual(values = c("black", "blue", "#D65F00")) +
#
#
      scale_linetype_manual(values = rep("solid", 51)) +
#
      quides(linetype = "none") +
#
      facet_grid(rows = vars(iteration), cols = vars(scenario)) +
      theme_classic() + labs(title = "Relative Error of Age 1+ Biomass (%)")
# Recruitment error
recs <- smryOutputList$dqSmry %>% #filter(Seas == 1) %>%
                  select(year, Value.Recr, model_run, iteration, scenario) %>%
                  mutate(plotGroup = case_when(grepl("_OM", model_run, fixed = TRUE) ~ "OM",
                                               TRUE ~ "EM"))
recRE <- recs %>% filter(plotGroup != "OM")
recRE <- recRE %% pivot_wider(names_from = "plotGroup", values_from = "Value.Recr") %>%
                  left_join(y = convrgCheck,
                            by = c("model_run", "iteration", "scenario")) %>%
                  full_join(y = subset(recs, subset = plotGroup == "OM"),
                            by = c("iteration", "scenario", "year")) %>%
                  mutate(convrg = case_when(max_grad > 0.01 ~ "non-convrg",
                                            max_grad < 0.01 ~ "convrg",</pre>
```

```
TRUE ~ "OM"),

emRE = (EM - Value.Recr)/Value.Recr * 100)

# Plot relative errors of rec devs over time

recRE %>% filter(HCR != "HCRO", emYear < 2024, convrg != "non-convrg") %>%

#mutate(scenario = gsub("constGrow20010M_", "", scenario, fixed = TRUE)) %>%

ggplot(aes(x = year, y = ifelse(emRE > 100, 100, emRE))) + #y = emRE)) +

geom_vline(xintercept = 2019, color = "gray") +

geom_line(yintercept = 0, color = "gray") +

geom_line(aes(linetype = as.character(scenario), color = scenario))+

scale_color_manual(values = c("black", "blue", "darkgreen", "orange", "grey")) +

scale_linetype_manual(values = rep("solid", 51)) +

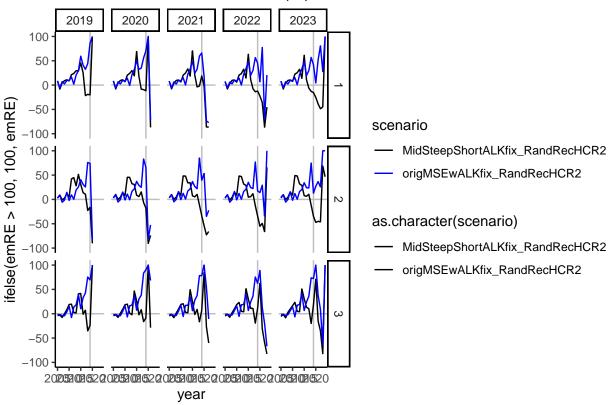
# guides(linetype = "none") +

facet_grid(rows = vars(iteration), cols = vars(emYear)) +

theme_classic() + labs(title = "Relative Error of Recruitment (%)") +

ylim(-100, 100)
```

Relative Error of Recruitment (%)



age1PlusRE %>% filter(emRE > 50)

```
## # A tibble: 171 x 14
##
      year model_run.x
                           iteration scenario
                                                  EM max_grad emYear HCR
                                                                           recScen
##
      <int> <chr>
                               <int> <chr>
                                               <dbl>
                                                        <dbl>
                                                               <dbl> <chr> <chr>
##
   1 2019 constGrowShort~
                                   1 origMSE~ 20728. 1.38e-4
                                                                2020 HCR2 origMS~
   2 2020 constGrowShort~
                                   1 origMSE~ 8627. 1.38e-4
                                                                2020 HCR2 origMS~
   3 2021 constGrowShort~
                                   1 origMSE~ 14719. 1.38e-4
                                                                2020 HCR2 origMS~
```

```
## 4 2019 constGrowShort~ 1 origMSE~ 20134. 6.62e-6 2021 HCR2 origMS~ ## 5 2020 constGrowShort~ 1 origMSE~ 8337. 6.62e-6 2021 HCR2 origMS~ ## 6 2021 constGrowShort~ 1 origMSE~ 14310. 6.62e-6 2021 HCR2 origMS~ ## 7 2022 constGrowShort~ 1 origMSE~ 12761. 6.62e-6 2021 HCR2 origMS~ ## 8 2019 constGrowShort~ 1 origMSE~ 19794. 1.45e-4 2022 HCR2 origMS~ ## 9 2020 constGrowShort~ 1 origMSE~ 8100. 1.45e-4 2022 HCR2 origMS~ ## 10 2023 constGrowShort~ 1 origMSE~ 43211. 1.45e-4 2022 HCR2 origMS~ ## # ... with 161 more rows, and 5 more variables: Bio_smry <dbl>, ## # model_run.y <chr>, plotGroup <chr>, convrg <chr>, emRE <dbl>
```

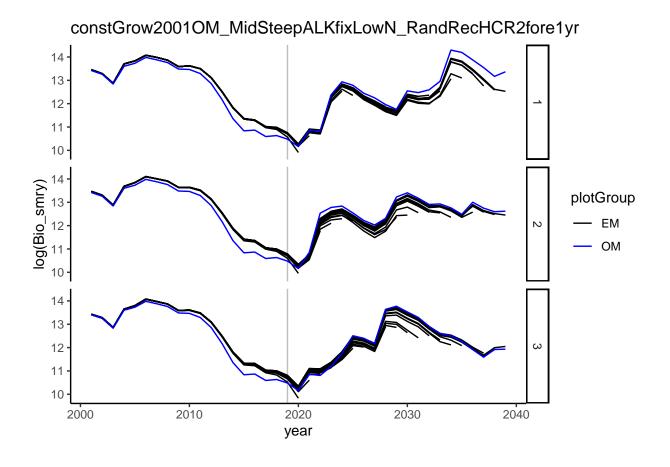
Compare corrected ALK tolerance with different sampling, also h=0.3 vs h=0.6

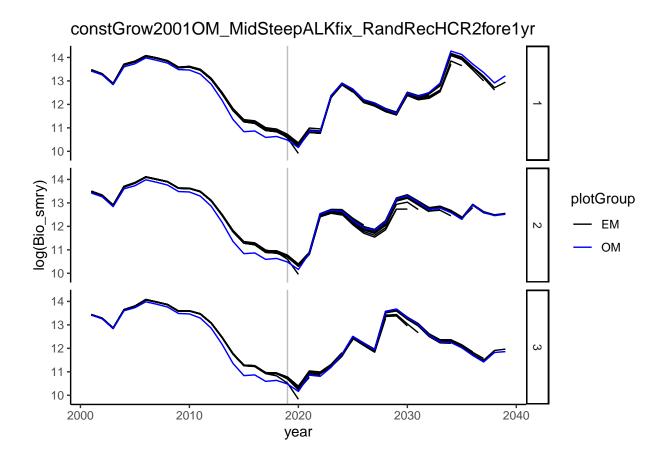
```
mseDir <- "C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenarios"
scenarios <- c("constGrow20010M_MidSteepALKfixLowN_RandRecHCR2fore1yr",</pre>
             "constGrow2001OM_MidSteepALKfix_RandRecHCR2fore1yr",
             "constGrow2001OM_LowSteepALKfix_RandRecHCR2fore1yr")
smryOutputList <- GetSumryOutput(dirSSMSE = mseDir,</pre>
                          scenarios = scenarios)
## Rows: 1890 Columns: 12
## -- Column specification -------
## Delimiter: ","
## chr (2): model run, scenario
## dbl (10): Value.SSB, Value.Recr, Value.SPRratio, Value.F, Value.Bratio, Valu...
## i Use 'spec()' to retrieve the full column specification for this data.
## i Specify the column types or set 'show_col_types = FALSE' to quiet this message.
## Rows: 1890 Columns: 12
## -- Column specification ------
## Delimiter: ","
## chr (2): model_run, scenario
## dbl (10): Value.SSB, Value.Recr, Value.SPRratio, Value.F, Value.Bratio, Valu...
## i Use 'spec()' to retrieve the full column specification for this data.
## i Specify the column types or set 'show_col_types = FALSE' to quiet this message.
## Rows: 1890 Columns: 12
## -- Column specification -----
## Delimiter: ","
## chr (2): model_run, scenario
## dbl (10): Value.SSB, Value.Recr, Value.SPRratio, Value.F, Value.Bratio, Valu...
## i Use 'spec()' to retrieve the full column specification for this data.
## i Specify the column types or set 'show_col_types = FALSE' to quiet this message.
# get terminal estimates of these values for timeseries plots
termTS <- CalcTermTS(smryOutputList) %>%
```

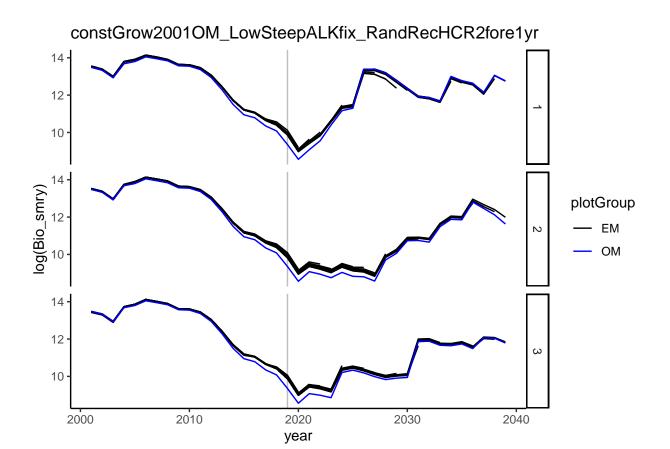
mutate(HCR = sub(pattern = ".*Rec","", scenario),

```
recScen = sub(pattern = "HCR.*","", scenario)) %>%
              mutate(recScen = sub(pattern = ".*OM_","", recScen))
## 'summarise()' has grouped output by 'year', 'model_run', 'iteration'. You can
## override using the '.groups' argument.
omName <- grep("_OM", smryOutputList$tsSmry$model_run,</pre>
                 fixed = TRUE, value = TRUE)
convrgCheck <- smryOutputList$sclSmry %>% #filter(!model_run %in% omName) %>%
                  select(max_grad, model_run, iteration, scenario) %>%
                  mutate(emYear = as.numeric(regmatches(model_run,
                                                         gregexpr("[[:digit:]]+",
                                                                  model_run))),
                         HCR = sub(pattern = ".*Rec","", scenario),
                         recScen = sub(pattern = "HCR.*","", scenario)) %>%
                  mutate(recScen = sub(pattern = ".*OM_","", recScen),
                         emYear = case_when(grepl("_init", model_run, fixed = TRUE) ~ 2019,
                                             TRUE ~ emYear))
hcrs <- unique(termTS$HCR)</pre>
#exIters <- sample(termTS$iteration, size = 4)</pre>
cnvrgTS <- smryOutputList$tsSmry %>% mutate(HCR = sub(pattern = ".*Rec","", scenario),
                                   recScen = sub(pattern = "HCR.*","", scenario)) %>%
      mutate(recScen = sub(pattern = ".*OM_","", recScen)) %>%
      left_join(y = convrgCheck, by = c("iteration", "model_run", "scenario", "HCR", "recScen")) %>%
      mutate(plotGroup = case_when(model_run %in% omName ~ "OM",
                                   max grad > 0.01 ~ "non-convrg",
                                   max_grad < 0.01 ~ "convrg"))</pre>
# for(mr in 1:length(scenarios)){
   print(cnvrqTS %>% filter(scenario == scenarios[mr], Seas == 1) %>%
        ggplot(aes(x = year, y = log(Bio\_smry))) +
#
#
        ggplot2::geom_vline(xintercept = 2019, color = "gray") +
#
        ggplot2::geom_hline(yintercept = log(50000), color = "red") +
#
        ggplot2::geom_line(aes(linetype = model_run, color = plotGroup))+
#
        ggplot2::scale_color_manual(values = c("black", "blue", "#D65F00")) +
        ggplot2::scale_linetype_manual(values = rep("solid", 51)) +
#
#
        ggplot2::guides(linetype = "none") +
#
        facet_grid(rows = vars(iteration), cols = vars(plotGroup)) +
#
        qqplot2::theme_classic() + theme(legend.position="none") +
#
        labs(title = scenarios[mr]))
# }
# for(mr in 1:length(scenarios)){
    print(cnvrqTS %>% filter(scenario == scenarios[mr], Seas == 1) %>%
#
        qqplot(aes(x = year, y = rec_dev)) +
#
        qqplot2::qeom_vline(xintercept = 2019, color = "qray") +
#
        ggplot2::geom_hline(yintercept = 0, color = "gray") +
#
        ggplot2::geom_line(aes(linetype = model_run, color = plotGroup))+
#
        qqplot2::scale color manual(values = c("black", "blue", "#D65F00")) +
        ggplot2::scale_linetype_manual(values = rep("solid", 51)) +
```

```
ggplot2::guides(linetype = "none") +
        facet grid(rows = vars(iteration), cols = vars(plotGroup)) +
#
#
        qqplot2::theme_classic() + theme(legend.position="none") +
        labs(title = scenarios[mr]))
#
# }
age1PlusBio <- smryOutputList$tsSmry %>% filter(Seas == 1) %>%
                  select(year, Bio_smry, model_run, iteration, scenario) %>%
                  mutate(plotGroup = case_when(grepl("_OM", model_run, fixed = TRUE) ~ "OM",
                                               TRUE ~ "EM"))
age1PlusRE <- age1PlusBio %>% filter(plotGroup != "OM")
age1PlusRE <- age1PlusRE %>% pivot_wider(names_from = "plotGroup", values_from = "Bio_smry") %>%
                  left_join(y = convrgCheck,
                            by = c("model_run", "iteration", "scenario")) %>%
                  full_join(y = subset(age1PlusBio, subset = plotGroup == "OM"),
                            by = c("iteration", "scenario", "year")) %>%
                  mutate(convrg = case_when(max_grad > 0.01 ~ "non-convrg",
                                            max_grad < 0.01 ~ "convrg",</pre>
                                            TRUE ~ "OM"),
                         emRE = (EM - Bio_smry)/Bio_smry * 100)
age1PlusBio <- age1PlusBio %>% left_join(y = convrgCheck,
                                         by = c("model_run", "iteration", "scenario")) %>%
                  mutate(convrg = case_when(max_grad > 0.01 ~ "non-convrg",
                                            max_grad < 0.01 ~ "convrg",</pre>
                                            TRUE ~ "OM"))
for(mr in 1:length(scenarios)){
  print(age1PlusBio %>% filter(scenario == scenarios[mr], plotGroup != "simData") %>%
   ggplot(aes(x = year, y = log(Bio_smry))) +
   ggplot2::geom_vline(xintercept = 2019, color = "gray") +
    ggplot2::geom_line(ggplot2::aes(linetype = as.character(model_run), color = plotGroup))+
      ggplot2::scale_color_manual(values = c("black", "blue", "#D65F00")) +
    ggplot2::scale_linetype_manual(values = rep("solid", 51)) +
    ggplot2::guides(linetype = "none") +
    ggplot2::facet_grid(rows = vars(iteration)) +
    ggplot2::theme_classic() +
  labs(title = scenarios[mr]))
}
```

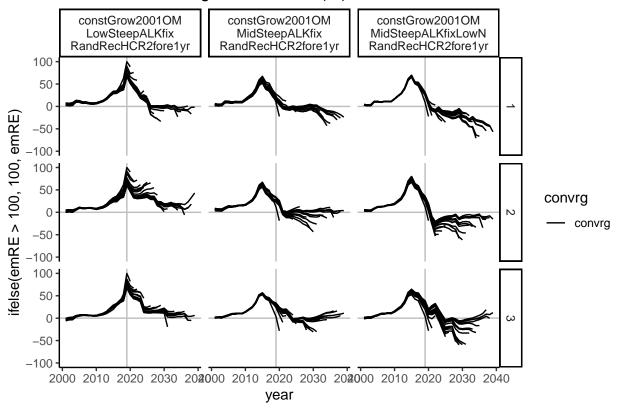






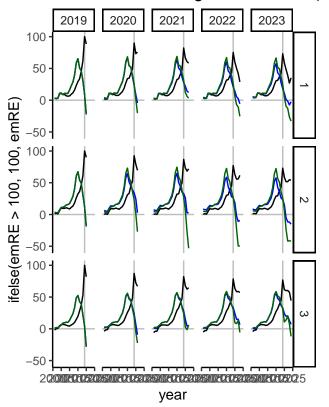
```
# Plot relative errors of biomass over time
age1PlusRE %>% #filter(HCR != "HCRO", emYear < 2024) %>%
mutate(scenario = gsub("_", "\n", scenario, fixed = TRUE)) %>%
ggplot(aes(x = year, y = ifelse(emRE > 100, 100, emRE))) + #y = emRE)) +
geom_vline(xintercept = 2019, color = "gray") +
geom_line(yintercept = 0, color = "gray") +
geom_line(aes(linetype = as.character(model_run.x), color = convrg))+
scale_color_manual(values = c("black", "blue", "#D65F00")) +
scale_linetype_manual(values = rep("solid", 51)) +
guides(linetype = "none") +
facet_grid(rows = vars(iteration), cols = vars(scenario)) +
theme_classic() + labs(title = "Relative Error of Age 1+ Biomass (%)") +
ylim(-100, 100)
```

Relative Error of Age 1+ Biomass (%)



```
age1PlusRE %>% filter(HCR != "HCRO", emYear < 2024, convrg != "non-convrg") %>%
  mutate(scenario = gsub("constGrow20010M_", "", scenario, fixed = TRUE)) %>%
  ggplot(aes(x = year, y = ifelse(emRE > 100, 100, emRE))) + #y = emRE)) +
  geom_vline(xintercept = 2019, color = "gray") +
  geom_hline(yintercept = 0, color = "gray") +
  geom_line(aes(linetype = as.character(scenario), color = scenario))+
  scale_color_manual(values = c("black", "blue", "darkgreen", "orange", "grey")) +
  scale_linetype_manual(values = rep("solid", 51)) +
  # guides(linetype = "none") +
  facet_grid(rows = vars(iteration), cols = vars(emYear)) +
  theme_classic() + labs(title = "Relative Error of Age 1+ Biomass (%)")
```

Relative Error of Age 1+ Biomass (%)



as.character(scenario)

- LowSteepALKfix_RandRecHCR2fore1yr
- MidSteepALKfix_RandRecHCR2fore1yr
- MidSteepALKfixLowN_RandRecHCR2fore1yr

scenario

- LowSteepALKfix_RandRecHCR2fore1yr
- MidSteepALKfix_RandRecHCR2fore1yr
- MidSteepALKfixLowN_RandRecHCR2fore1yr

```
# aqe1PlusRE %>% filter(HCR != "HCRO", grepl("ALKfix", scenario, fixed = TRUE)) %>%
    mutate(scenario = gsub("_", "\n", scenario, fixed = TRUE)) %>%
#
      ggplot(aes(x = year, y = emRE)) +
#
      geom_vline(xintercept = 2019, color = "gray") +
#
      qeom_hline(yintercept = 0, color = "qray") +
#
      geom_line(aes(linetype = as.character(model_run.x), color = convrg))+
      scale_color_manual(values = c("black", "blue", "#D65F00")) +
#
#
      scale_linetype_manual(values = rep("solid", 51)) +
#
      quides(linetype = "none") +
#
      facet_grid(rows = vars(iteration), cols = vars(scenario)) +
      theme_classic() + labs(title = "Relative Error of Age 1+ Biomass (%)")
# Recruitment error
recs <- smryOutputList$dqSmry %>% #filter(Seas == 1) %>%
                  select(year, Value.Recr, model_run, iteration, scenario) %>%
                  mutate(plotGroup = case_when(grepl("_OM", model_run, fixed = TRUE) ~ "OM",
                                               TRUE ~ "EM"))
recRE <- recs %>% filter(plotGroup != "OM")
recRE <- recRE %% pivot_wider(names_from = "plotGroup", values_from = "Value.Recr") %>%
                  left_join(y = convrgCheck,
                            by = c("model_run", "iteration", "scenario")) %>%
                  full_join(y = subset(recs, subset = plotGroup == "OM"),
                            by = c("iteration", "scenario", "year")) %>%
                  mutate(convrg = case_when(max_grad > 0.01 ~ "non-convrg",
                                            max_grad < 0.01 ~ "convrg",</pre>
```

```
TRUE ~ "OM"),

emRE = (EM - Value.Recr)/Value.Recr * 100)

# Plot relative errors of rec devs over time

recRE %>% filter(HCR != "HCRO", emYear < 2024, convrg != "non-convrg") %>%

mutate(scenario = gsub("constGrow20010M_", "", scenario, fixed = TRUE)) %>%

ggplot(aes(x = year, y = ifelse(emRE > 100, 100, emRE))) + #y = emRE)) +

geom_vline(xintercept = 2019, color = "gray") +

geom_line(aes(linetype = as.character(scenario), color = scenario))+

scale_color_manual(values = c("black", "blue", "darkgreen", "orange", "grey")) +

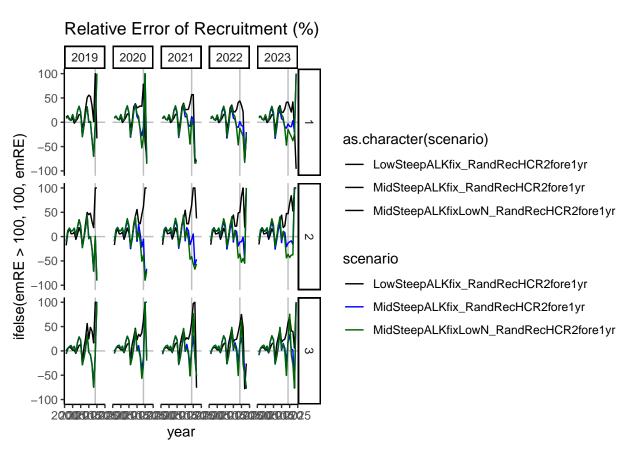
scale_linetype_manual(values = rep("solid", 51)) +

# guides(linetype = "none") +

facet_grid(rows = vars(iteration), cols = vars(emYear)) +

theme_classic() + labs(title = "Relative Error of Recruitment (%)") +

ylim(-100, 100)
```



Compare HCR applications when ALK tolerance is 0 with moderate survey sampling (AT Survey CV=0.25, Nsamp = 100)

```
mseDir <- "C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenarios"</pre>
```

```
scenarios <- c("constGrow20010M_MidSteepALKfix_RandRecHCR2nofore",</pre>
            "constGrow20010M_MidSteepALKfix_RandRecHCR2fore1yr",
            "constGrow20010M_LowSteepALKfix_RandRecHCR2fore1yr",
            "constGrow20010M_MidSteep_RandRecHCR2nofore",
            "constGrow20010M_MidSteep_RandRecHCR2fore1yr")
smryOutputList <- GetSumryOutput(dirSSMSE = mseDir,</pre>
                             scenarios = scenarios)
## Rows: 1890 Columns: 12
## Delimiter: ","
## chr (2): model_run, scenario
## dbl (10): Value.SSB, Value.Recr, Value.SPRratio, Value.F, Value.Bratio, Valu...
## i Use 'spec()' to retrieve the full column specification for this data.
## i Specify the column types or set 'show_col_types = FALSE' to quiet this message.
## Rows: 1890 Columns: 12
## -- Column specification -------
## Delimiter: ","
## chr (2): model_run, scenario
## dbl (10): Value.SSB, Value.Recr, Value.SPRratio, Value.F, Value.Bratio, Valu...
## i Use 'spec()' to retrieve the full column specification for this data.
## i Specify the column types or set 'show_col_types = FALSE' to quiet this message.
## Rows: 1890 Columns: 12
## -- Column specification ------
## Delimiter: ","
## chr (2): model_run, scenario
## dbl (10): Value.SSB, Value.Recr, Value.SPRratio, Value.F, Value.Bratio, Valu...
## i Use 'spec()' to retrieve the full column specification for this data.
## i Specify the column types or set 'show_col_types = FALSE' to quiet this message.
## Rows: 825 Columns: 12
## -- Column specification -------
## Delimiter: ","
## chr (2): model_run, scenario
## dbl (10): Value.SSB, Value.Recr, Value.SPRratio, Value.F, Value.Bratio, Valu...
## i Use 'spec()' to retrieve the full column specification for this data.
## i Specify the column types or set 'show_col_types = FALSE' to quiet this message.
## Rows: 825 Columns: 12
## -- Column specification ------
## Delimiter: ","
## chr (2): model_run, scenario
## dbl (10): Value.SSB, Value.Recr, Value.SPRratio, Value.F, Value.Bratio, Valu...
## i Use 'spec()' to retrieve the full column specification for this data.
## i Specify the column types or set 'show_col_types = FALSE' to quiet this message.
# get terminal estimates of these values for timeseries plots
termTS <- CalcTermTS(smryOutputList) %>%
```

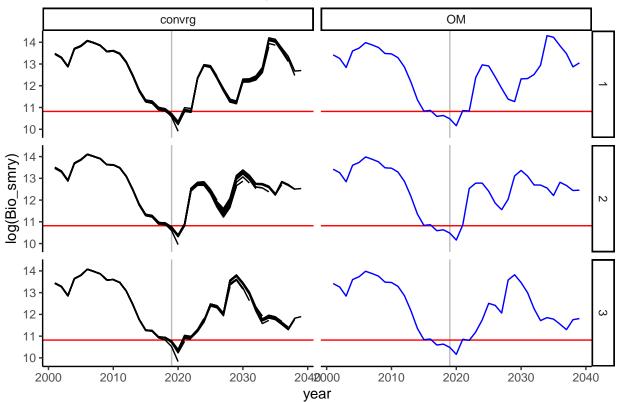
mutate(HCR = sub(pattern = ".*Rec","", scenario),

```
recScen = sub(pattern = "HCR.*","", scenario)) %>%
mutate(recScen = sub(pattern = ".*OM_","", recScen))
```

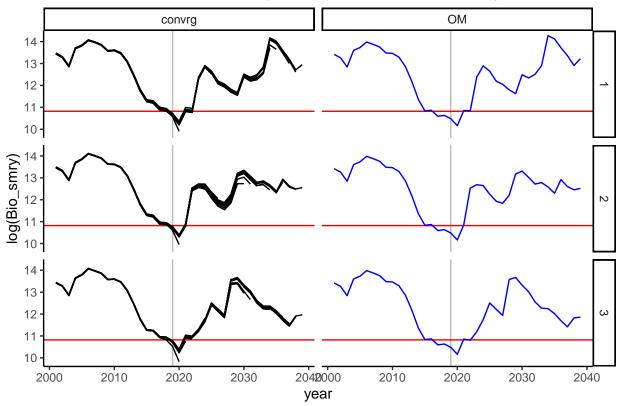
'summarise()' has grouped output by 'year', 'model_run', 'iteration'. You can
override using the '.groups' argument.

```
omName <- grep("_OM", smryOutputList$tsSmry$model_run,
                 fixed = TRUE, value = TRUE)
convrgCheck <- smryOutputList$sclSmry %>% #filter(!model_run %in% omName) %>%
                  select(max grad, model run, iteration, scenario) %>%
                  mutate(emYear = as.numeric(regmatches(model_run,
                                                         gregexpr("[[:digit:]]+",
                                                                  model run))),
                         HCR = sub(pattern = ".*Rec","", scenario),
                         recScen = sub(pattern = "HCR.*","", scenario)) %>%
                  mutate(recScen = sub(pattern = ".*OM_","", recScen),
                         emYear = case_when(grepl("_init", model_run, fixed = TRUE) ~ 2019,
                                            TRUE ~ emYear))
hcrs <- unique(termTS$HCR)</pre>
#exIters <- sample(termTS$iteration, size = 4)</pre>
cnvrgTS <- smryOutputList$tsSmry %>% mutate(HCR = sub(pattern = ".*Rec","", scenario),
                                   recScen = sub(pattern = "HCR.*","", scenario)) %>%
     mutate(recScen = sub(pattern = ".*OM ","", recScen)) %>%
     left_join(y = convrgCheck, by = c("iteration", "model_run", "scenario", "HCR", "recScen")) %%
     mutate(plotGroup = case_when(model_run %in% omName ~ "OM",
                                   max_grad > 0.01 ~ "non-convrg",
                                   max_grad < 0.01 ~ "convrg"))</pre>
for(mr in 1:length(scenarios)){
  print(cnvrgTS %>% filter(scenario == scenarios[mr], Seas == 1) %>%
      ggplot(aes(x = year, y = log(Bio_smry))) +
      ggplot2::geom_vline(xintercept = 2019, color = "gray") +
      ggplot2::geom_hline(yintercept = log(50000), color = "red") +
      ggplot2::geom_line(aes(linetype = model_run, color = plotGroup))+
      ggplot2::scale color manual(values = c("black", "blue", "#D65F00")) +
     ggplot2::scale_linetype_manual(values = rep("solid", 51)) +
      ggplot2::guides(linetype = "none") +
      facet_grid(rows = vars(iteration), cols = vars(plotGroup)) +
      ggplot2::theme_classic() + theme(legend.position="none") +
      labs(title = scenarios[mr]))
```

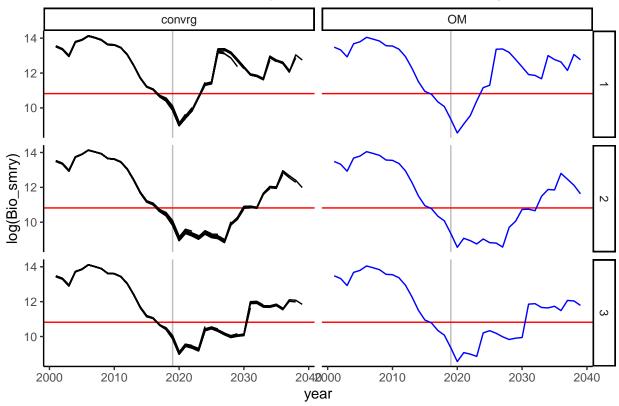




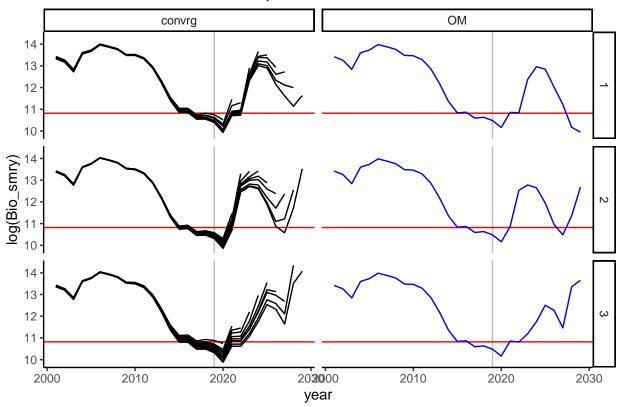




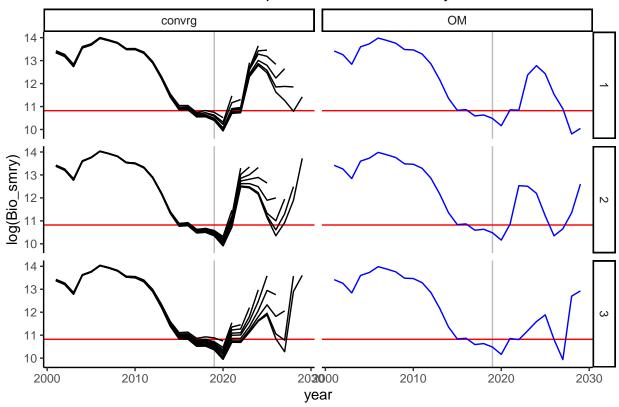




$constGrow 2001OM_MidSteep_RandRecHCR2 no fore$

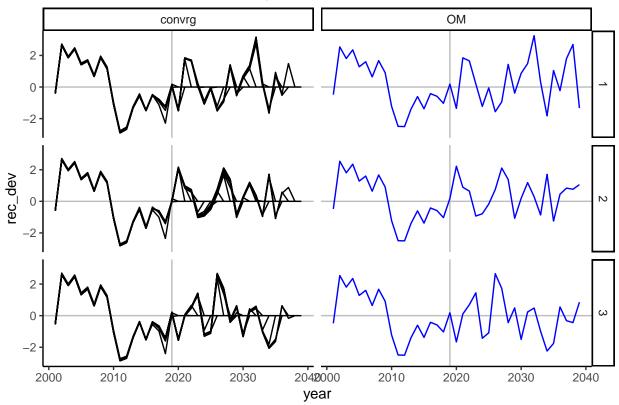


constGrow2001OM_MidSteep_RandRecHCR2fore1yr

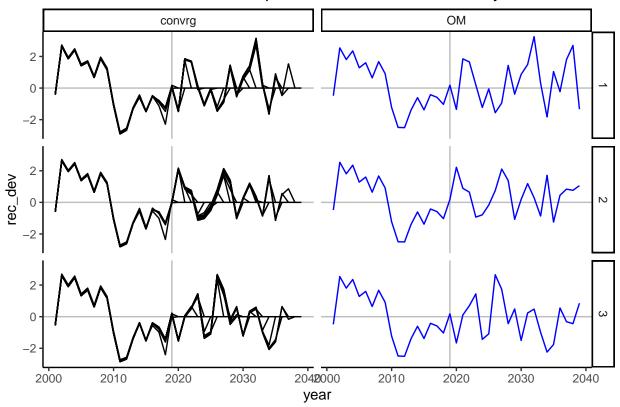


```
for(mr in 1:length(scenarios)){
    print(cnvrgTS %>% filter(scenario == scenarios[mr], Seas == 1) %>%
        ggplot(aes(x = year, y = rec_dev)) +
        ggplot2::geom_vline(xintercept = 2019, color = "gray") +
        ggplot2::geom_hline(yintercept = 0, color = "gray") +
        ggplot2::geom_line(aes(linetype = model_run, color = plotGroup))+
        ggplot2::scale_color_manual(values = c("black", "blue", "#D65F00")) +
        ggplot2::scale_linetype_manual(values = rep("solid", 51)) +
        ggplot2::guides(linetype = "none") +
        facet_grid(rows = vars(iteration), cols = vars(plotGroup)) +
        ggplot2::theme_classic() + theme(legend.position="none") +
        labs(title = scenarios[mr]))
}
```

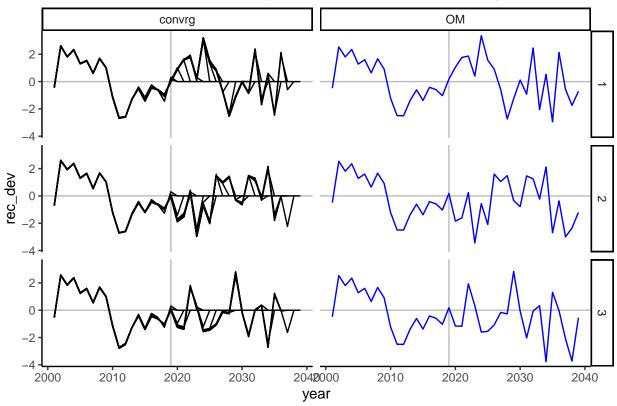
$constGrow 2001OM_MidSteep ALK fix_Rand RecHCR 2 no fore$



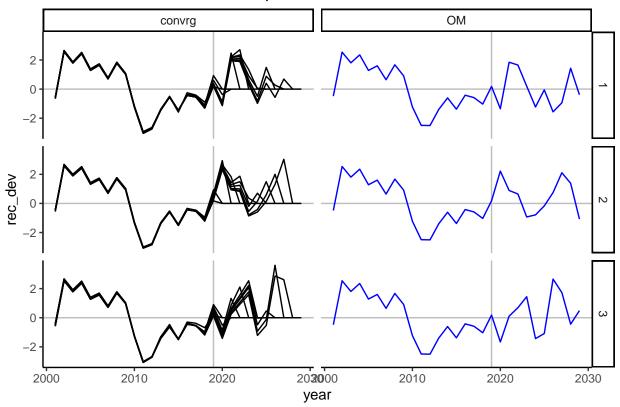
$constGrow 2001OM_MidSteep ALK fix_RandRecHCR2 for e1yr$



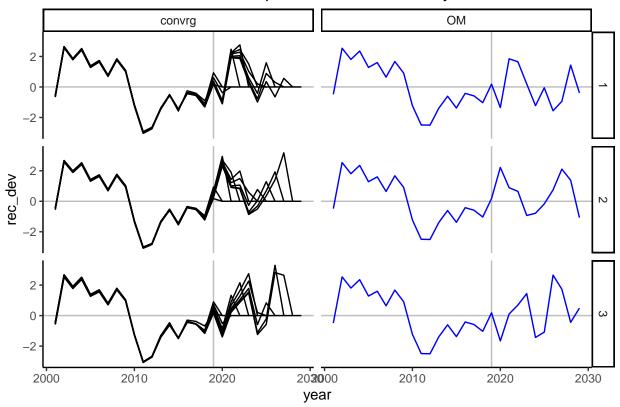




$constGrow 2001OM_MidSteep_RandRecHCR2 no fore$



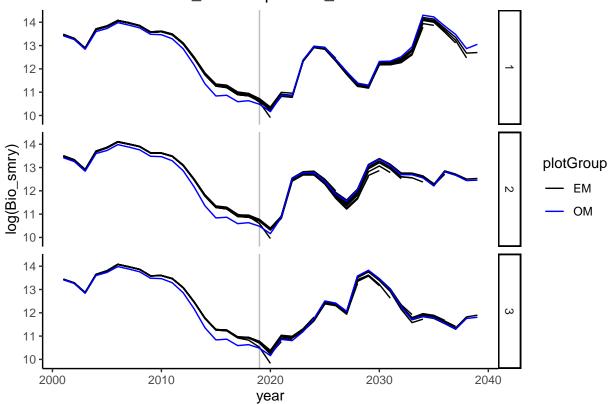
constGrow2001OM_MidSteep_RandRecHCR2fore1yr

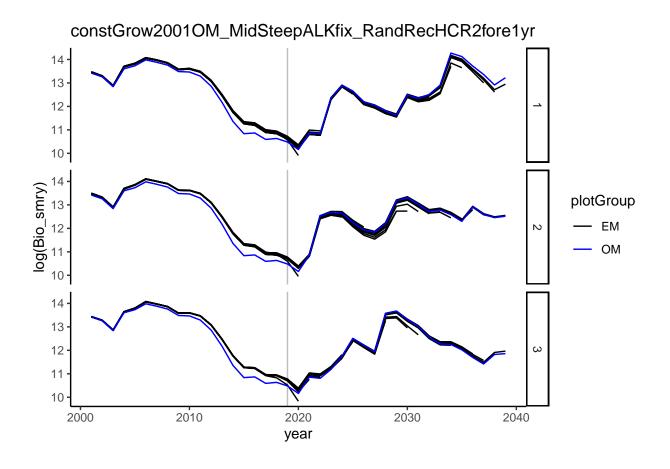


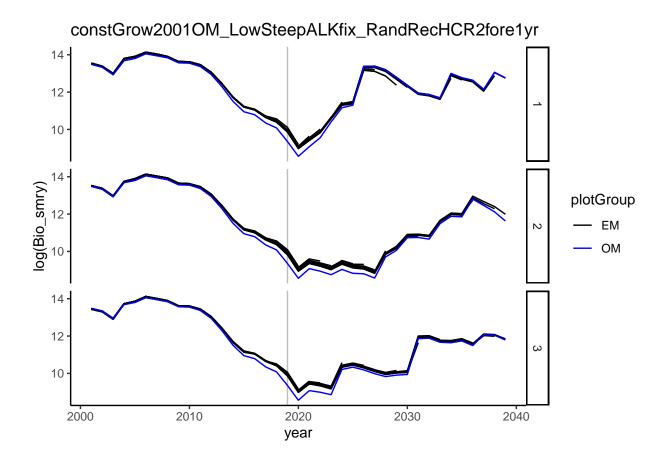
```
age1PlusBio <- smryOutputList$tsSmry %>% filter(Seas == 1) %>%
                  select(year, Bio_smry, model_run, iteration, scenario) %>%
                  mutate(plotGroup = case_when(grepl("_OM", model_run, fixed = TRUE) ~ "OM",
                                                TRUE ~ "EM"))
age1PlusRE <- age1PlusBio %>% filter(plotGroup != "OM")
age1PlusRE <- age1PlusRE %>% pivot_wider(names_from = "plotGroup", values_from = "Bio_smry") %>%
                  left_join(y = convrgCheck,
                            by = c("model run", "iteration", "scenario")) %>%
                  full_join(y = subset(age1PlusBio, subset = plotGroup == "OM"),
                            by = c("iteration", "scenario", "year")) %>%
                  mutate(convrg = case_when(max_grad > 0.01 ~ "non-convrg",
                                            max grad < 0.01 ~ "convrg",</pre>
                                            TRUE ~ "OM"),
                         emRE = (EM - Bio_smry)/Bio_smry * 100)
age1PlusBio <- age1PlusBio %>% left_join(y = convrgCheck,
                                          by = c("model_run", "iteration", "scenario")) %>%
                  mutate(convrg = case_when(max_grad > 0.01 ~ "non-convrg",
                                            max_grad < 0.01 ~ "convrg",</pre>
                                             TRUE ~ "OM"))
for(mr in 1:length(scenarios)){
  print(age1PlusBio %>% filter(scenario == scenarios[mr], plotGroup != "simData") %>%
    ggplot(aes(x = year, y = log(Bio_smry))) +
    ggplot2::geom_vline(xintercept = 2019, color = "gray") +
```

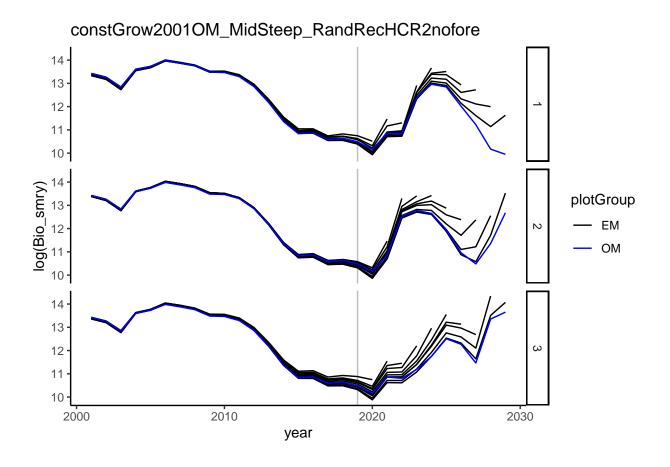
```
ggplot2::geom_line(ggplot2::aes(linetype = as.character(model_run), color = plotGroup))+
    ggplot2::scale_color_manual(values = c("black", "blue", "#D65F00")) +
    ggplot2::scale_linetype_manual(values = rep("solid", 51)) +
    ggplot2::guides(linetype = "none") +
    ggplot2::facet_grid(rows = vars(iteration)) +
    ggplot2::theme_classic() +
    labs(title = scenarios[mr]))
}
```

constGrow2001OM_MidSteepALKfix_RandRecHCR2nofore

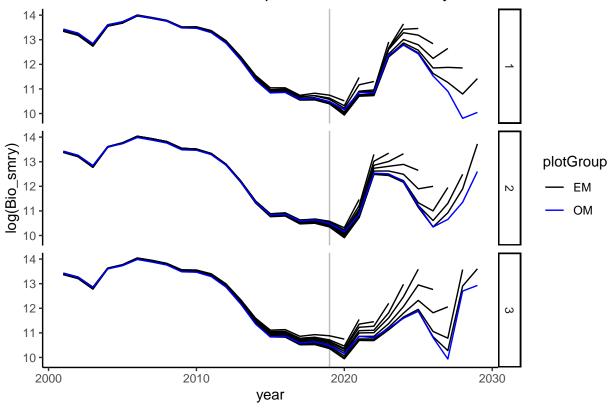






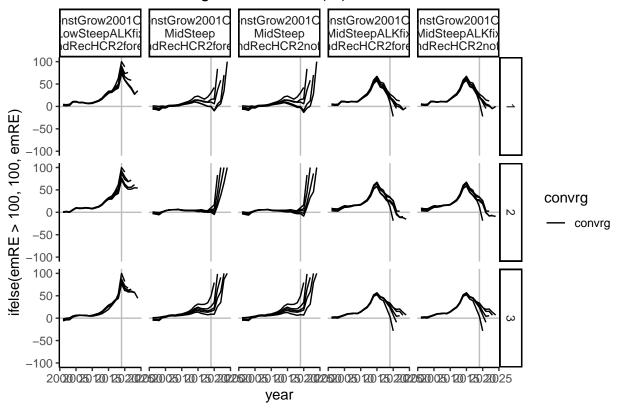




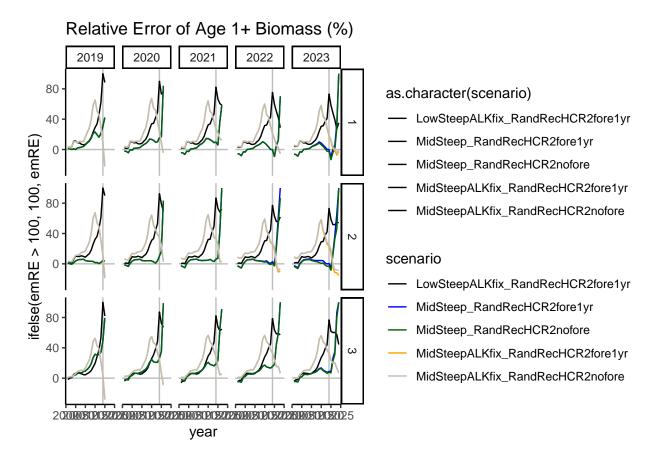


```
# Plot relative errors of biomass over time
age1PlusRE %>% filter(HCR != "HCRO", emYear < 2024) %>%
  mutate(scenario = gsub("_", "\n", scenario, fixed = TRUE)) %>%
  ggplot(aes(x = year, y = ifelse(emRE > 100, 100, emRE))) + #y = emRE)) +
  geom_vline(xintercept = 2019, color = "gray") +
  geom_line(yintercept = 0, color = "gray") +
  geom_line(aes(linetype = as.character(model_run.x), color = convrg))+
  scale_color_manual(values = c("black", "blue", "#D65F00")) +
  scale_linetype_manual(values = rep("solid", 51)) +
  guides(linetype = "none") +
  facet_grid(rows = vars(iteration), cols = vars(scenario)) +
  theme_classic() + labs(title = "Relative Error of Age 1+ Biomass (%)") +
  ylim(-100, 100)
```

Relative Error of Age 1+ Biomass (%)

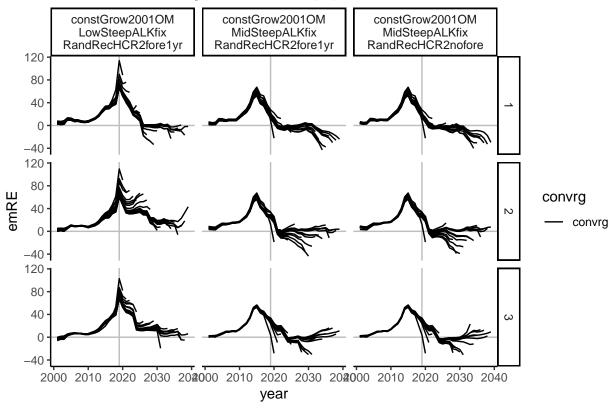


```
age1PlusRE %>% filter(HCR != "HCRO", emYear < 2024, convrg != "non-convrg") %>%
  mutate(scenario = gsub("constGrow20010M_", "", scenario, fixed = TRUE)) %>%
  ggplot(aes(x = year, y = ifelse(emRE > 100, 100, emRE))) + #y = emRE)) +
  geom_vline(xintercept = 2019, color = "gray") +
  geom_hline(yintercept = 0, color = "gray") +
  geom_line(aes(linetype = as.character(scenario), color = scenario))+
  scale_color_manual(values = c("black", "blue", "darkgreen", "orange", "grey")) +
  scale_linetype_manual(values = rep("solid", 51)) +
  # guides(linetype = "none") +
  facet_grid(rows = vars(iteration), cols = vars(emYear)) +
  theme_classic() + labs(title = "Relative Error of Age 1+ Biomass (%)")
```



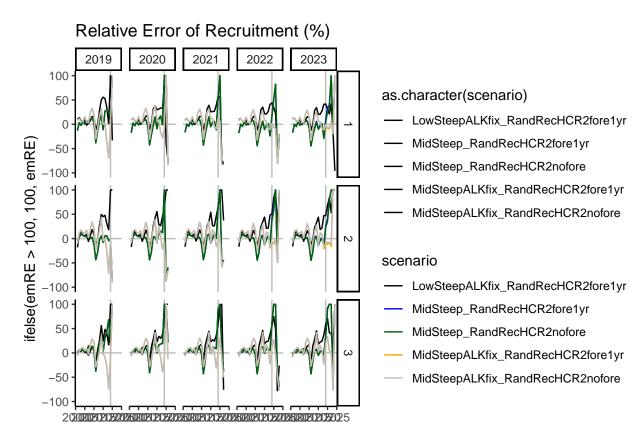
```
age1PlusRE %>% filter(HCR != "HCRO", grepl("ALKfix", scenario, fixed = TRUE)) %>%
  mutate(scenario = gsub("_", "\n", scenario, fixed = TRUE)) %>%
  ggplot(aes(x = year, y = emRE)) +
  geom_vline(xintercept = 2019, color = "gray") +
  geom_hline(yintercept = 0, color = "gray") +
  geom_line(aes(linetype = as.character(model_run.x), color = convrg))+
  scale_color_manual(values = c("black", "blue", "#D65F00")) +
  scale_linetype_manual(values = rep("solid", 51)) +
  guides(linetype = "none") +
  facet_grid(rows = vars(iteration), cols = vars(scenario)) +
  theme_classic() + labs(title = "Relative Error of Age 1+ Biomass (%)")
```

Relative Error of Age 1+ Biomass (%)



```
# Recruitment error
recs <- smryOutputList$dqSmry %>% #filter(Seas == 1) %>%
                  select(year, Value.Recr, model_run, iteration, scenario) %>%
                  mutate(plotGroup = case_when(grepl("_OM", model_run, fixed = TRUE) ~ "OM",
                                               TRUE ~ "EM"))
recRE <- recs %>% filter(plotGroup != "OM")
recRE <- recRE %% pivot wider(names from = "plotGroup", values from = "Value.Recr") %%
                  left_join(y = convrgCheck,
                            by = c("model_run", "iteration", "scenario")) %>%
                  full_join(y = subset(recs, subset = plotGroup == "OM"),
                            by = c("iteration", "scenario", "year")) %>%
                  mutate(convrg = case_when(max_grad > 0.01 ~ "non-convrg",
                                            max grad < 0.01 ~ "convrg",</pre>
                                            TRUE ~ "OM"),
                         emRE = (EM - Value.Recr)/Value.Recr * 100)
# Plot relative errors of rec devs over time
recRE %>% filter(HCR != "HCRO", emYear < 2024, convrg != "non-convrg") %>%
  mutate(scenario = gsub("constGrow20010M_", "", scenario, fixed = TRUE)) %>%
    ggplot(aes(x = year, y = ifelse(emRE > 100, 100, emRE))) + #y = emRE)) +
    geom_vline(xintercept = 2019, color = "gray") +
    geom_hline(yintercept = 0, color = "gray") +
   geom_line(aes(linetype = as.character(scenario), color = scenario))+
    scale color manual(values = c("black", "blue", "darkgreen", "orange", "grey")) +
    scale linetype manual(values = rep("solid", 51)) +
```

```
# guides(linetype = "none") +
facet_grid(rows = vars(iteration), cols = vars(emYear)) +
theme_classic() + labs(title = "Relative Error of Recruitment (%)") +
ylim(-100, 100)
```



Compare HCR applications with moderate survey sampling (AT Survey CV=0.25, Nsamp = 100)

year

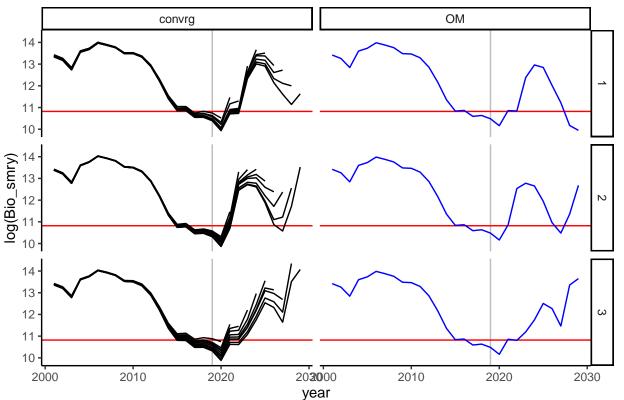
chr (2): model_run, scenario

```
##
## i Use 'spec()' to retrieve the full column specification for this data.
## i Specify the column types or set 'show_col_types = FALSE' to quiet this message.
## Rows: 825 Columns: 12
## -- Column specification -----
## Delimiter: ","
## chr (2): model_run, scenario
## dbl (10): Value.SSB, Value.Recr, Value.SPRratio, Value.F, Value.Bratio, Valu...
## i Use 'spec()' to retrieve the full column specification for this data.
## i Specify the column types or set 'show_col_types = FALSE' to quiet this message.
## Rows: 825 Columns: 12
## -- Column specification -----
## Delimiter: ","
## chr (2): model_run, scenario
## dbl (10): Value.SSB, Value.Recr, Value.SPRratio, Value.F, Value.Bratio, Valu...
## i Use 'spec()' to retrieve the full column specification for this data.
## i Specify the column types or set 'show_col_types = FALSE' to quiet this message.
## Rows: 825 Columns: 12
## -- Column specification ------
## Delimiter: ","
## chr (2): model_run, scenario
## dbl (10): Value.SSB, Value.Recr, Value.SPRratio, Value.F, Value.Bratio, Valu...
## i Use 'spec()' to retrieve the full column specification for this data.
## i Specify the column types or set 'show_col_types = FALSE' to quiet this message.
# get terminal estimates of these values for timeseries plots
termTS <- CalcTermTS(smryOutputList) %>%
             mutate(HCR = sub(pattern = ".*Rec","", scenario),
                             recScen = sub(pattern = "HCR.*","", scenario)) %>%
             mutate(recScen = sub(pattern = ".*OM_","", recScen))
## 'summarise()' has grouped output by 'year', 'model_run', 'iteration'. You can
## override using the '.groups' argument.
omName <- grep("_OM", smryOutputList$tsSmry$model_run,</pre>
                fixed = TRUE, value = TRUE)
convrgCheck <- smryOutputList$sclSmry %>% #filter(!model_run %in% omName) %>%
                 select(max_grad, model_run, iteration, scenario) %>%
                 mutate(emYear = as.numeric(regmatches(model_run,
                                                     gregexpr("[[:digit:]]+",
                                                             model_run))),
                       HCR = sub(pattern = ".*Rec","", scenario),
                       recScen = sub(pattern = "HCR.*","", scenario)) %>%
                 mutate(recScen = sub(pattern = ".*OM_","", recScen),
                       emYear = case_when(grepl("_init", model_run, fixed = TRUE) ~ 2019,
                                         TRUE ~ emYear))
hcrs <- unique(termTS$HCR)</pre>
```

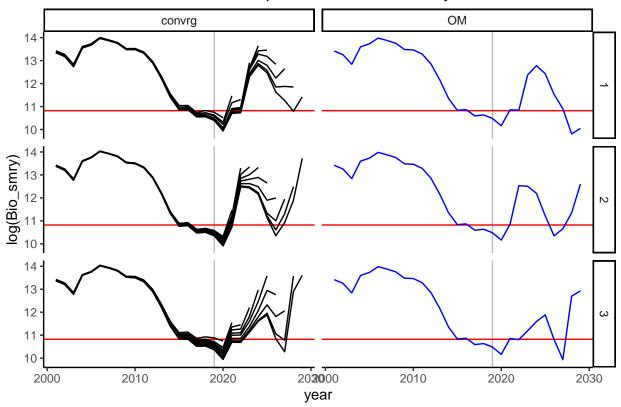
dbl (10): Value.SSB, Value.Recr, Value.SPRratio, Value.F, Value.Bratio, Valu...

```
#exIters <- sample(termTS$iteration, size = 4)</pre>
cnvrgTS <- smryOutputList$tsSmry %>% mutate(HCR = sub(pattern = ".*Rec","", scenario),
                                   recScen = sub(pattern = "HCR.*","", scenario)) %>%
      mutate(recScen = sub(pattern = ".*OM_","", recScen)) %>%
      left_join(y = convrgCheck, by = c("iteration", "model_run", "scenario", "HCR", "recScen")) %>%
      mutate(plotGroup = case_when(model_run %in% omName ~ "OM",
                                   max_grad > 0.01 ~ "non-convrg",
                                   max_grad < 0.01 ~ "convrg"))</pre>
for(mr in 1:length(scenarios)){
  print(cnvrgTS %>% filter(scenario == scenarios[mr], Seas == 1) %>%
      ggplot(aes(x = year, y = log(Bio_smry))) +
      ggplot2::geom_vline(xintercept = 2019, color = "gray") +
      ggplot2::geom_hline(yintercept = log(50000), color = "red") +
      ggplot2::geom_line(aes(linetype = model_run, color = plotGroup))+
      ggplot2::scale_color_manual(values = c("black", "blue", "#D65F00")) +
      ggplot2::scale_linetype_manual(values = rep("solid", 51)) +
      ggplot2::guides(linetype = "none") +
      facet_grid(rows = vars(iteration), cols = vars(plotGroup)) +
      ggplot2::theme_classic() + theme(legend.position="none") +
      labs(title = scenarios[mr]))
}
```

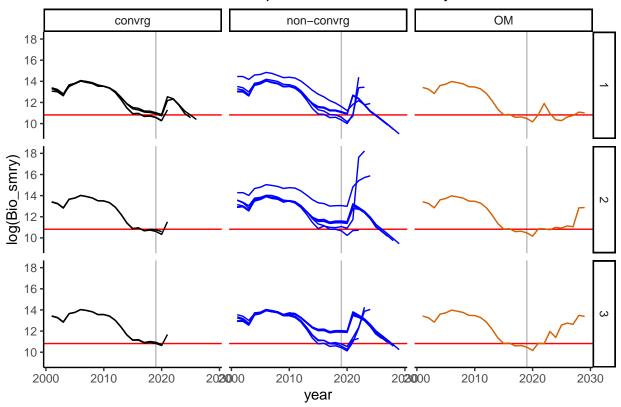
constGrow2001OM_MidSteep_RandRecHCR2nofore



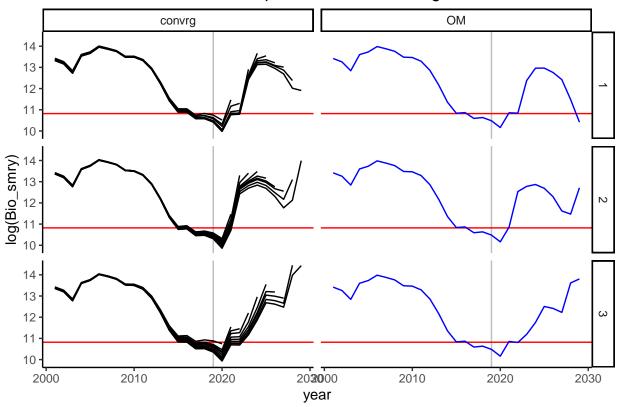
$constGrow 2001OM_MidSteep_RandRecHCR2 for e1yr$



constGrow2001OM_MidSteep_RandRecHCR2fore5yr

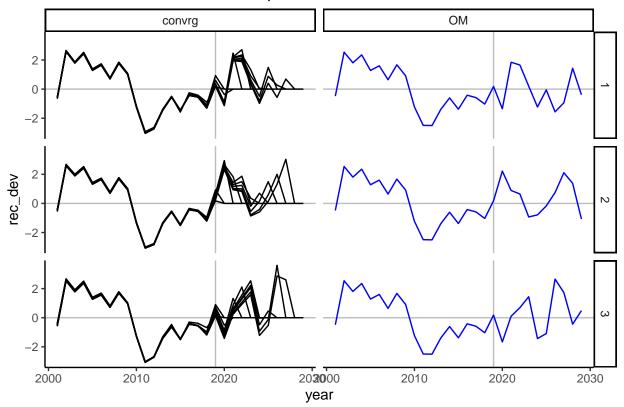


constGrow2001OM_MidSteep_RandRecHCR2bavg

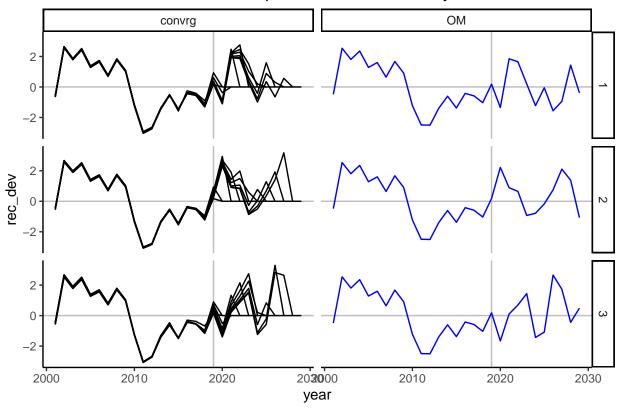


```
for(mr in 1:length(scenarios)){
    print(cnvrgTS %>% filter(scenario == scenarios[mr], Seas == 1) %>%
        ggplot(aes(x = year, y = rec_dev)) +
        ggplot2::geom_vline(xintercept = 2019, color = "gray") +
        ggplot2::geom_hline(yintercept = 0, color = "gray") +
        ggplot2::geom_line(aes(linetype = model_run, color = plotGroup))+
        ggplot2::scale_color_manual(values = c("black", "blue", "#D65F00")) +
        ggplot2::scale_linetype_manual(values = rep("solid", 51)) +
        ggplot2::guides(linetype = "none") +
        facet_grid(rows = vars(iteration), cols = vars(plotGroup)) +
        ggplot2::theme_classic() + theme(legend.position="none") +
        labs(title = scenarios[mr]))
}
```

$constGrow 2001OM_MidSteep_RandRecHCR2 no fore$

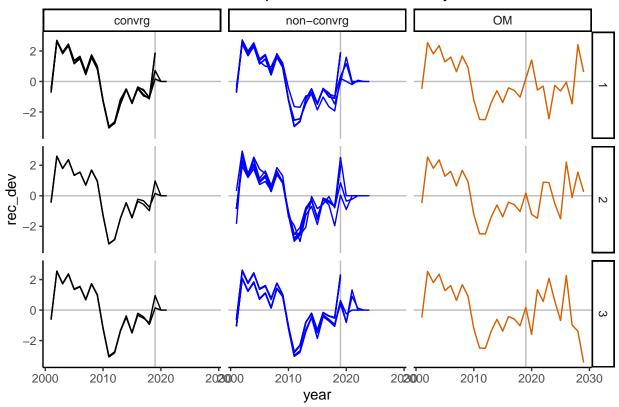


$constGrow 2001OM_MidSteep_RandRecHCR2 for e1yr$

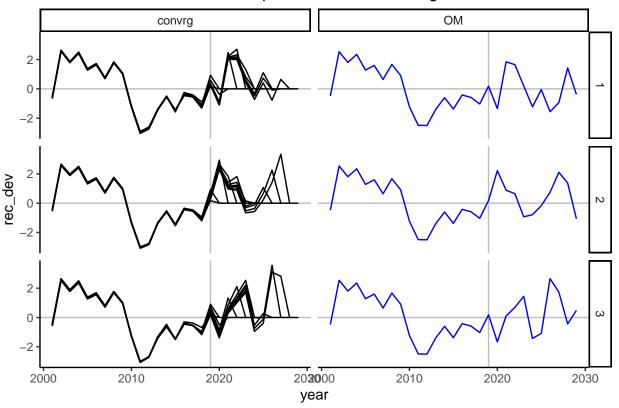


Warning: Removed 53 row(s) containing missing values (geom_path).

$constGrow 2001OM_MidSteep_RandRecHCR2 for e5yr$

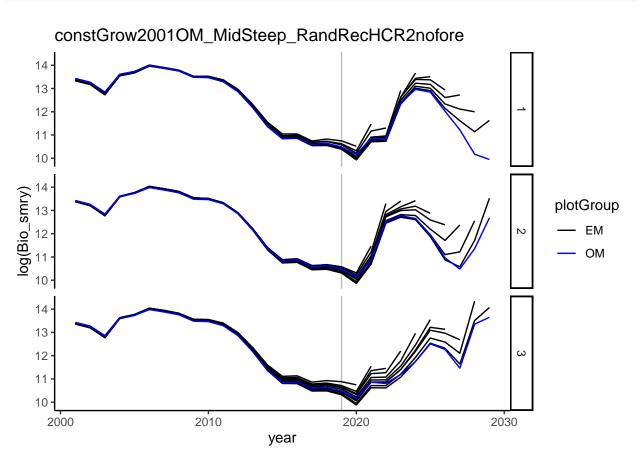


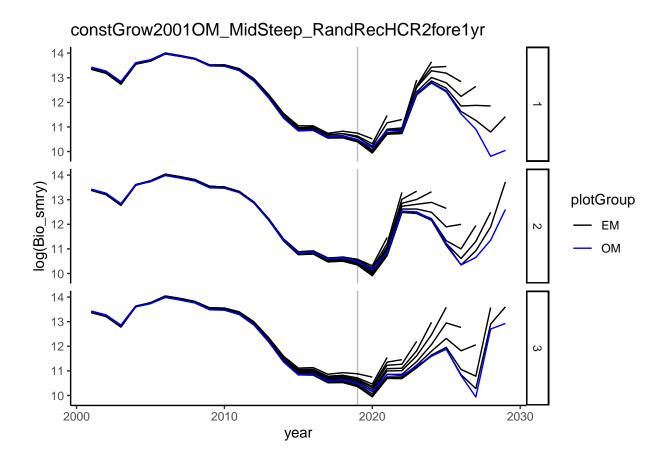
constGrow2001OM_MidSteep_RandRecHCR2bavg

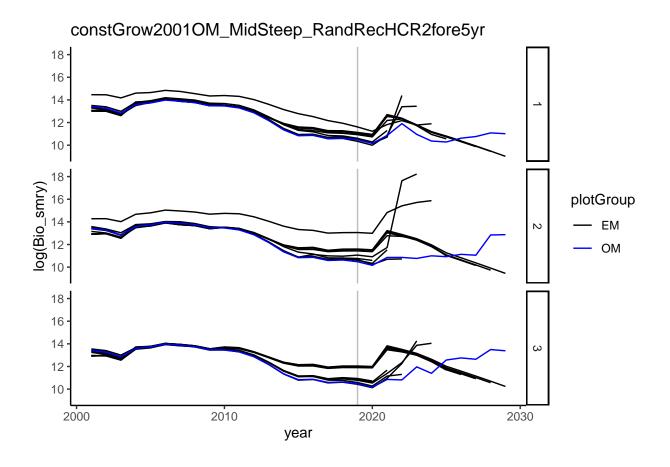


```
age1PlusBio <- smryOutputList$tsSmry %>% filter(Seas == 1) %>%
                  select(year, Bio_smry, model_run, iteration, scenario) %>%
                  mutate(plotGroup = case_when(grepl("_OM", model_run, fixed = TRUE) ~ "OM",
                                                TRUE ~ "EM"))
age1PlusRE <- age1PlusBio %>% filter(plotGroup != "OM")
age1PlusRE <- age1PlusRE %>% pivot_wider(names_from = "plotGroup", values_from = "Bio_smry") %>%
                  left_join(y = convrgCheck,
                            by = c("model run", "iteration", "scenario")) %>%
                  full_join(y = subset(age1PlusBio, subset = plotGroup == "OM"),
                            by = c("iteration", "scenario", "year")) %>%
                  mutate(convrg = case_when(max_grad > 0.01 ~ "non-convrg",
                                            max grad < 0.01 ~ "convrg",</pre>
                                            TRUE ~ "OM"),
                         emRE = (EM - Bio_smry)/Bio_smry * 100)
age1PlusBio <- age1PlusBio %>% left_join(y = convrgCheck,
                                          by = c("model_run", "iteration", "scenario")) %>%
                  mutate(convrg = case_when(max_grad > 0.01 ~ "non-convrg",
                                            max_grad < 0.01 ~ "convrg",</pre>
                                             TRUE ~ "OM"))
for(mr in 1:length(scenarios)){
  print(age1PlusBio %>% filter(scenario == scenarios[mr], plotGroup != "simData") %>%
    ggplot(aes(x = year, y = log(Bio_smry))) +
    ggplot2::geom_vline(xintercept = 2019, color = "gray") +
```

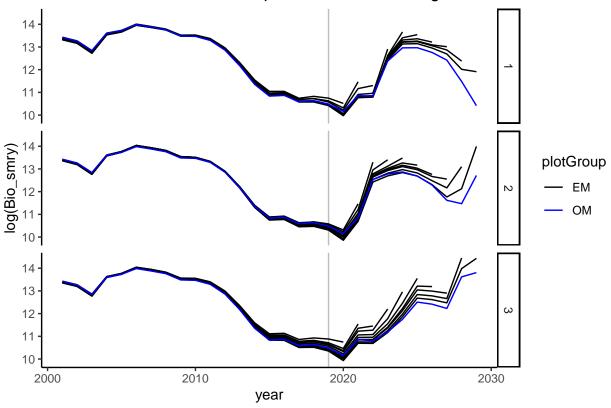
```
ggplot2::geom_line(ggplot2::aes(linetype = as.character(model_run), color = plotGroup))+
    ggplot2::scale_color_manual(values = c("black", "blue", "#D65F00")) +
    ggplot2::scale_linetype_manual(values = rep("solid", 51)) +
    ggplot2::guides(linetype = "none") +
    ggplot2::facet_grid(rows = vars(iteration)) +
    ggplot2::theme_classic() +
    labs(title = scenarios[mr]))
}
```





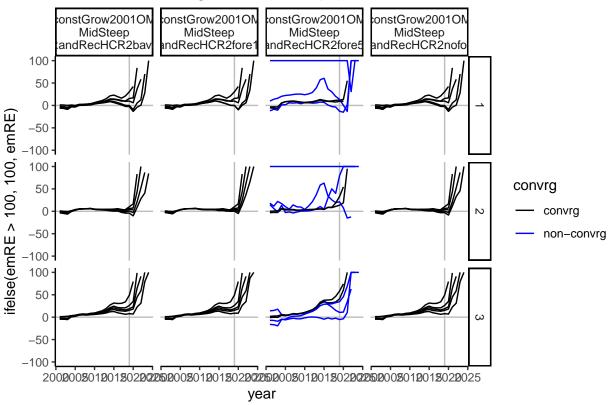


constGrow2001OM_MidSteep_RandRecHCR2bavg

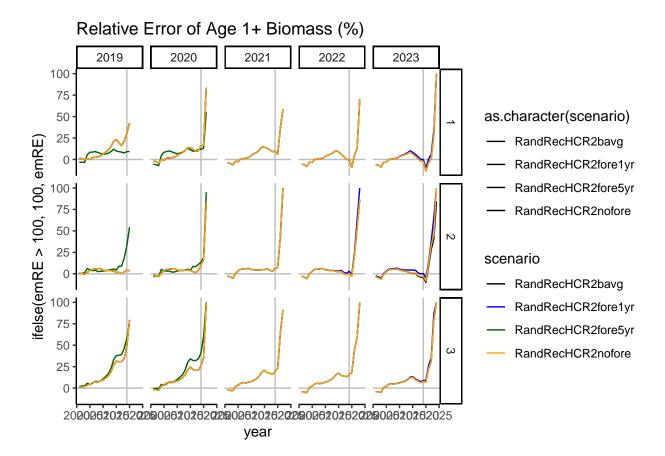


```
# Plot relative errors of biomass over time
age1PlusRE %>% filter(HCR != "HCRO", emYear < 2024) %>%
mutate(scenario = gsub("_", "\n", scenario, fixed = TRUE)) %>%
ggplot(aes(x = year, y = ifelse(emRE > 100, 100, emRE))) + #y = emRE)) +
geom_vline(xintercept = 2019, color = "gray") +
geom_line(yintercept = 0, color = "gray") +
geom_line(aes(linetype = as.character(model_run.x), color = convrg))+
scale_color_manual(values = c("black", "blue", "#D65F00")) +
scale_linetype_manual(values = rep("solid", 51)) +
guides(linetype = "none") +
facet_grid(rows = vars(iteration), cols = vars(scenario)) +
theme_classic() + labs(title = "Relative Error of Age 1+ Biomass (%)") +
ylim(-100, 100)
```

Relative Error of Age 1+ Biomass (%)



```
age1PlusRE %>% filter(HCR != "HCRO", emYear < 2024, convrg != "non-convrg") %>%
  mutate(scenario = gsub("constGrow20010M_MidSteep_", "", scenario, fixed = TRUE)) %>%
  ggplot(aes(x = year, y = ifelse(emRE > 100, 100, emRE))) + #y = emRE)) +
  geom_vline(xintercept = 2019, color = "gray") +
  geom_hline(yintercept = 0, color = "gray") +
  geom_line(aes(linetype = as.character(scenario), color = scenario))+
  scale_color_manual(values = c("black", "blue", "darkgreen", "orange")) +
  scale_linetype_manual(values = rep("solid", 51)) +
  # guides(linetype = "none") +
  facet_grid(rows = vars(iteration), cols = vars(emYear)) +
  theme_classic() + labs(title = "Relative Error of Age 1+ Biomass (%)")
```



Investigate errors across scenarios/applications

```
age1PlusRE %>% filter(is.na(emYear), iteration == 1, year == 2018)
## # A tibble: 0 x 14
## # ... with 14 variables: year <int>, model run.x <chr>, iteration <int>,
      scenario <chr>, EM <dbl>, max_grad <dbl>, emYear <dbl>, HCR <chr>,
      recScen <chr>, Bio_smry <dbl>, model_run.y <chr>, plotGroup <chr>,
## #
      convrg <chr>, emRE <dbl>
age1PlusRE %>% filter(emYear ==2022, iteration == 1, year == 2018)
## # A tibble: 4 x 14
##
      year model_run.x
                           iteration scenario
                                                   EM max_grad emYear HCR
                                                                            recScen
##
     <int> <chr>
                                <int> <chr>
                                                <dbl>
                                                         <dbl> <dbl> <chr> <chr>
## 1 2018 constGrowSelfTe~
                                    1 constGr~ 41552. 5.27e-5
                                                                 2022 HCR2~ MidSte~
## 2 2018 constGrowSelfTe~
                                                                 2022 HCR2~ MidSte~
                                    1 constGr~ 41552. 5.27e-5
## 3 2018 constGrowSelfTe~
                                    1 constGr~ 40016. 3.92e+3
                                                                 2022 HCR2~ MidSte~
## 4 2018 constGrowSelfTe~
                                    1 constGr~ 41552. 5.27e-5
                                                                 2022 HCR2~ MidSte~
## # ... with 5 more variables: Bio_smry <dbl>, model_run.y <chr>,
      plotGroup <chr>, convrg <chr>, emRE <dbl>
smryOutputList$tsSmry %>% filter(grepl("_2022", model_run), iteration == 1, year == 2018)
```

```
Bio_smry retainB_1 retainB_2 retainB_3
                                             rec dev year Seas
## 1 41551.6
                  35.31
                                       7.86 -1.259190 2018
                              0.0
                  0.00
                                       2.51
## 2
     36997.4
                          11819.4
                                                    NA 2018
## 3 41551.6
                  35.31
                                       7.86 -1.259190 2018
                              0.0
                                                               1
## 4
     36997.4
                   0.00
                          11819.4
                                       2.51
                                                    NA 2018
## 5
     40016.1
                  35.31
                                       7.86 -0.981409 2018
                              0.0
## 6
     35230.6
                   0.00
                          11819.4
                                       2.51
                                                   NA 2018
## 7
     41551.6
                  35.31
                                       7.86 -1.259190 2018
                              0.0
                                                               1
## 8
     36997.4
                   0.00
                          11819.4
                                       2.51
                                                   NA 2018
##
                     model_run iteration
## 1 constGrowSelfTest_EM_2022
## 2 constGrowSelfTest_EM_2022
                                       1
## 3 constGrowSelfTest_EM_2022
                                       1
## 4 constGrowSelfTest_EM_2022
                                       1
## 5 constGrowSelfTest_EM_2022
                                       1
## 6 constGrowSelfTest_EM_2022
                                       1
## 7 constGrowSelfTest_EM_2022
                                       1
## 8 constGrowSelfTest_EM_2022
##
                                        scenario
      constGrow20010M MidSteep RandRecHCR2nofore
## 1
     constGrow20010M_MidSteep_RandRecHCR2nofore
## 3 constGrow20010M MidSteep RandRecHCR2fore1yr
## 4 constGrow20010M_MidSteep_RandRecHCR2fore1yr
## 5 constGrow20010M MidSteep RandRecHCR2fore5yr
## 6 constGrow20010M MidSteep RandRecHCR2fore5yr
## 7
        constGrow20010M MidSteep RandRecHCR2bavg
## 8
        constGrow20010M_MidSteep_RandRecHCR2bavg
age1PlusRE %>% filter(emYear ==2020, iteration == 1, year == 2020)
## # A tibble: 4 x 14
                                                    EM max_grad emYear HCR
##
      year model_run.x
                            iteration scenario
                                                                             recScen
##
     <int> <chr>
                                <int> <chr>
                                                 <dbl>
                                                          <dbl>
                                                                 <dbl> <chr> <chr>
                                    1 constGr~ 30250.
## 1 2020 constGrowSelfTe~
                                                       1.74e-4
                                                                  2020 HCR2~ MidSte~
## 2 2020 constGrowSelfTe~
                                    1 constGr~ 30250.
                                                       1.74e-4
                                                                  2020 HCR2~ MidSte~
## 3 2020 constGrowSelfTe~
                                    1 constGr~ 29342. 4.33e-6
                                                                  2020 HCR2~ MidSte~
## 4 2020 constGrowSelfTe~
                                    1 constGr~ 30250.
                                                        1.74e-4
                                                                  2020 HCR2~ MidSte~
## # ... with 5 more variables: Bio smry <dbl>, model run.y <chr>,
       plotGroup <chr>, convrg <chr>, emRE <dbl>
smryOutputList$tsSmry %>% filter(grepl("_2023", model_run), iteration == 1, year == 2024)
     Bio_smry retainB_1 retainB_2 retainB_3
                                                  rec_dev year Seas
##
## 1 858668.0
                    0.0
                             0.00
                                       0.00 -1.11022e-16 2024
## 2 836038.0
                    0.0
                             0.00
                                       0.00
                                                      NA 2024
                                                                  2
## 3 843585.0
                24496.8 14197.20 35925.80 -1.11022e-16 2024
## 4 755115.0
                    0.0
                             0.00
                                    1088.56
                                                      NA 2024
## 5 146596.0
                23154.4
                          6233.35
                                  17582.80 0.00000e+00 2024
                             0.00
## 6 94168.7
                                    1999.53
                    0.0
                                                      NA 2024
## 7 858668.0
                    0.0
                             0.00
                                       0.00 -1.11022e-16 2024
                                                      NA 2024
## 8 836038.0
                             0.00
                    0.0
                                       0.00
                     model_run iteration
## 1 constGrowSelfTest_EM_2023
```

```
## 2 constGrowSelfTest EM 2023
## 3 constGrowSelfTest EM 2023
## 4 constGrowSelfTest EM 2023
## 5 constGrowSelfTest_EM_2023
                                       1
## 6 constGrowSelfTest EM 2023
## 7 constGrowSelfTest EM 2023
## 8 constGrowSelfTest EM 2023
                                        scenario
## 1 constGrow2001OM_MidSteep_RandRecHCR2nofore
## 2 constGrow20010M_MidSteep_RandRecHCR2nofore
## 3 constGrow20010M_MidSteep_RandRecHCR2fore1yr
## 4 constGrow20010M_MidSteep_RandRecHCR2fore1yr
## 5 constGrow20010M_MidSteep_RandRecHCR2fore5yr
## 6 constGrow20010M_MidSteep_RandRecHCR2fore5yr
## 7
       constGrow20010M_MidSteep_RandRecHCR2bavg
## 8
        constGrow20010M_MidSteep_RandRecHCR2bavg
```

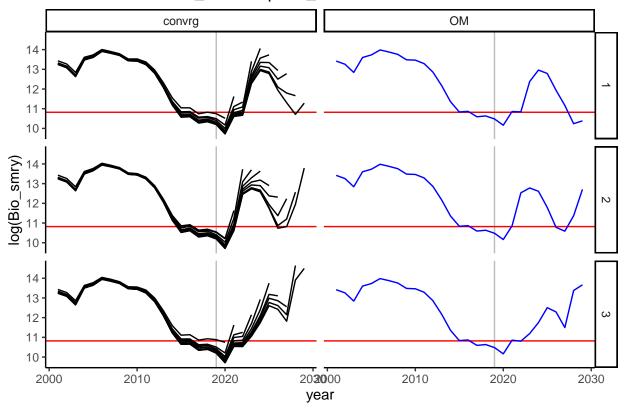
Compare HCR applications with high survey sampling (AT Survey CV=0.05, Nsamp = 1000)

```
## Rows: 825 Columns: 12
## -- Column specification -----
## Delimiter: ","
## chr (2): model run, scenario
## dbl (10): Value.SSB, Value.Recr, Value.SPRratio, Value.F, Value.Bratio, Valu...
## i Use 'spec()' to retrieve the full column specification for this data.
## i Specify the column types or set 'show_col_types = FALSE' to quiet this message.
## Rows: 825 Columns: 12
## -- Column specification ------
## Delimiter: ","
## chr (2): model_run, scenario
## dbl (10): Value.SSB, Value.Recr, Value.SPRratio, Value.F, Value.Bratio, Valu...
## i Use 'spec()' to retrieve the full column specification for this data.
## i Specify the column types or set 'show_col_types = FALSE' to quiet this message.
## Rows: 825 Columns: 12
## -- Column specification ------
## Delimiter: ","
## chr (2): model_run, scenario
## dbl (10): Value.SSB, Value.Recr, Value.SPRratio, Value.F, Value.Bratio, Valu...
```

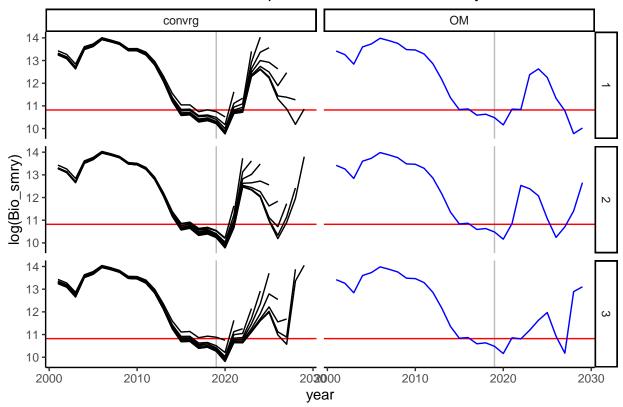
```
##
## i Use 'spec()' to retrieve the full column specification for this data.
## i Specify the column types or set 'show_col_types = FALSE' to quiet this message.
## Rows: 825 Columns: 12
## -- Column specification ---
## Delimiter: ","
## chr (2): model run, scenario
## dbl (10): Value.SSB, Value.Recr, Value.SPRratio, Value.F, Value.Bratio, Valu...
## i Use 'spec()' to retrieve the full column specification for this data.
## i Specify the column types or set 'show_col_types = FALSE' to quiet this message.
# get terminal estimates of these values for timeseries plots
termTS <- CalcTermTS(smryOutputList) %>%
              mutate(HCR = sub(pattern = ".*Rec","", scenario),
                               recScen = sub(pattern = "HCR.*","", scenario)) %>%
              mutate(recScen = sub(pattern = ".*OM_","", recScen))
## 'summarise()' has grouped output by 'year', 'model_run', 'iteration'. You can
## override using the '.groups' argument.
omName <- grep("_OM", smryOutputList$tsSmry$model_run,</pre>
                 fixed = TRUE, value = TRUE)
convrgCheck <- smryOutputList$sclSmry %>% #filter(!model_run %in% omName) %>%
                  select(max_grad, model_run, iteration, scenario) %>%
                  mutate(emYear = as.numeric(regmatches(model_run,
                                                         gregexpr("[[:digit:]]+",
                                                                  model_run))),
                         HCR = sub(pattern = ".*Rec","", scenario),
                         recScen = sub(pattern = "HCR.*","", scenario)) %>%
                  mutate(recScen = sub(pattern = ".*OM_","", recScen),
                         emYear = case_when(grepl("_init", model_run, fixed = TRUE) ~ 2019,
                                            TRUE ~ emYear))
hcrs <- unique(termTS$HCR)</pre>
#exIters <- sample(termTS$iteration, size = 4)</pre>
cnvrgTS <- smryOutputList$tsSmry %>% mutate(HCR = sub(pattern = ".*Rec","", scenario),
                                   recScen = sub(pattern = "HCR.*","", scenario)) %>%
      mutate(recScen = sub(pattern = ".*OM_","", recScen)) %>%
     left_join(y = convrgCheck, by = c("iteration", "model_run", "scenario", "HCR", "recScen")) %>%
      mutate(plotGroup = case_when(model_run %in% omName ~ "OM",
                                   max_grad > 0.01 ~ "non-convrg",
                                   max_grad < 0.01 ~ "convrg"))</pre>
for(mr in 1:length(scenarios)){
  print(cnvrgTS %>% filter(scenario == scenarios[mr], Seas == 1) %>%
      ggplot(aes(x = year, y = log(Bio_smry))) +
      ggplot2::geom_vline(xintercept = 2019, color = "gray") +
      ggplot2::geom_hline(yintercept = log(50000), color = "red") +
     ggplot2::geom line(aes(linetype = model run, color = plotGroup))+
      ggplot2::scale_color_manual(values = c("black", "blue", "#D65F00")) +
```

```
ggplot2::scale_linetype_manual(values = rep("solid", 51)) +
ggplot2::guides(linetype = "none") +
facet_grid(rows = vars(iteration), cols = vars(plotGroup)) +
ggplot2::theme_classic() + theme(legend.position="none") +
labs(title = scenarios[mr]))
}
```

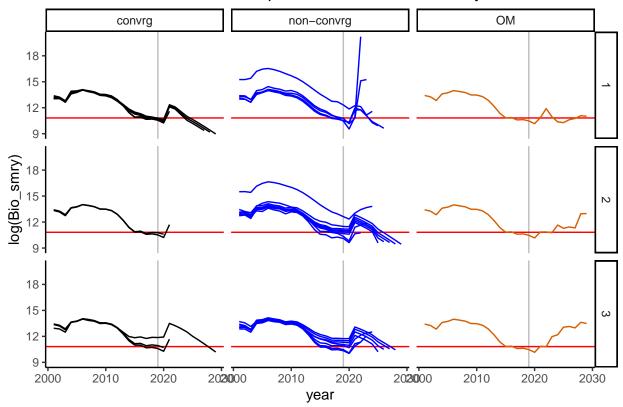
constGrow2001OM_MidSteepHiN_RandRecHCR2nofore



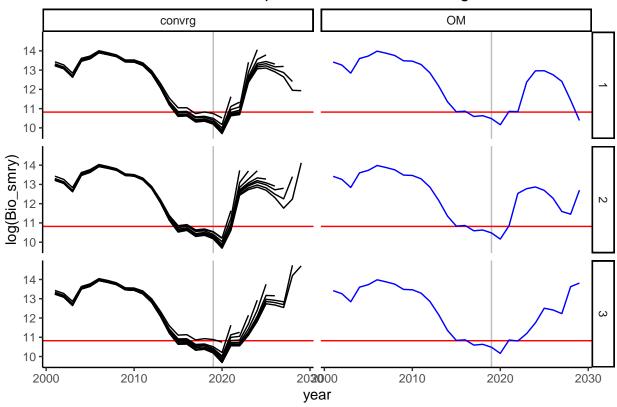
$constGrow 2001OM_MidSteepHiN_RandRecHCR2 for e1yr$



$constGrow 2001OM_MidSteepHiN_RandRecHCR2 for e5yr$

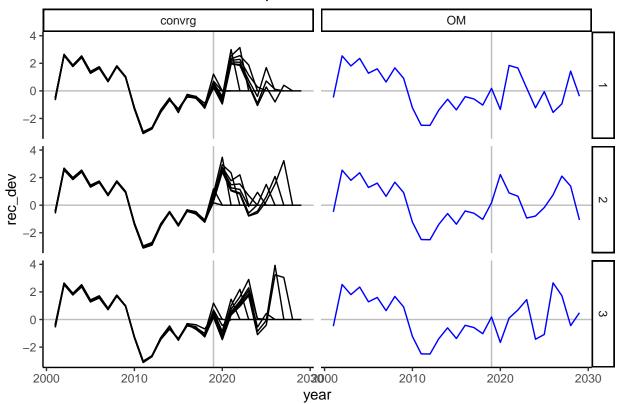


constGrow2001OM_MidSteepHiN_RandRecHCR2bavg

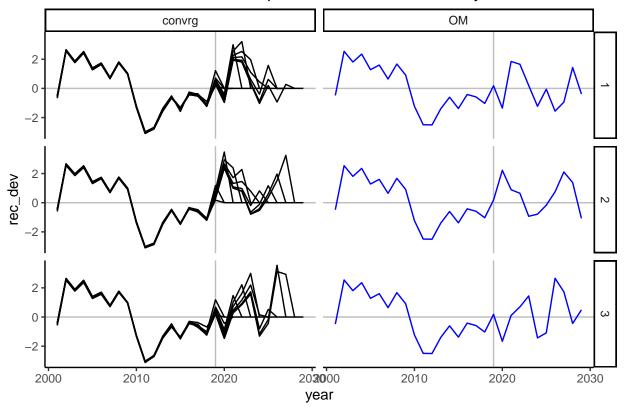


```
for(mr in 1:length(scenarios)){
    print(cnvrgTS %>% filter(scenario == scenarios[mr], Seas == 1) %>%
        ggplot(aes(x = year, y = rec_dev)) +
        ggplot2::geom_vline(xintercept = 2019, color = "gray") +
        ggplot2::geom_hline(yintercept = 0, color = "gray") +
        ggplot2::geom_line(aes(linetype = model_run, color = plotGroup))+
        ggplot2::scale_color_manual(values = c("black", "blue", "#D65F00")) +
        ggplot2::scale_linetype_manual(values = rep("solid", 51)) +
        ggplot2::guides(linetype = "none") +
        facet_grid(rows = vars(iteration), cols = vars(plotGroup)) +
        ggplot2::theme_classic() + theme(legend.position="none") +
        labs(title = scenarios[mr]))
}
```

$constGrow 2001OM_MidSteepHiN_RandRecHCR2 no fore$

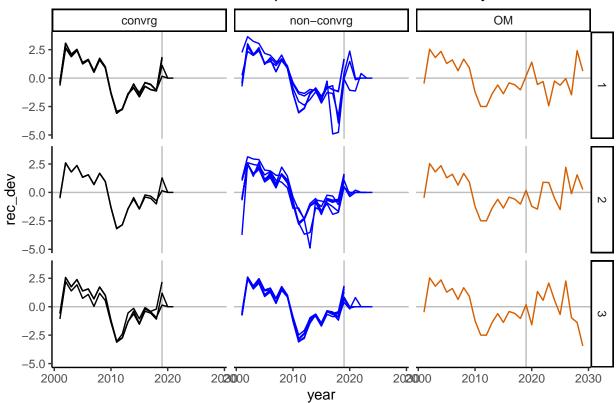


$constGrow 2001OM_MidSteepHiN_RandRecHCR2 for e1yr$

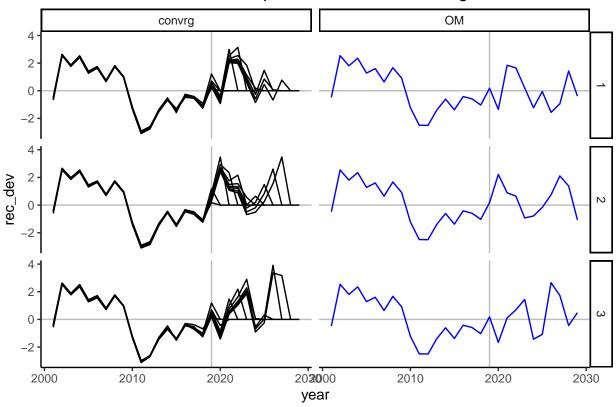


Warning: Removed 67 row(s) containing missing values (geom_path).

$constGrow 2001OM_MidSteepHiN_RandRecHCR2 for e5yr$

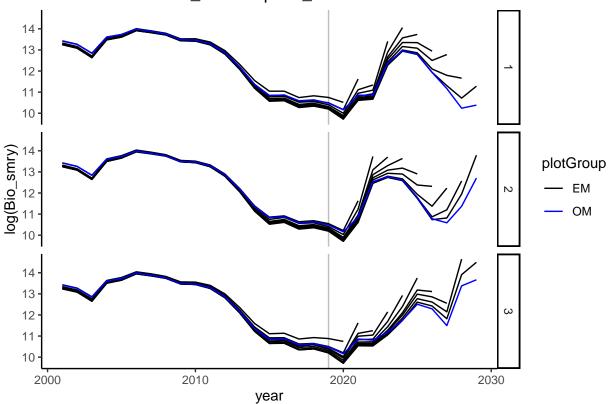


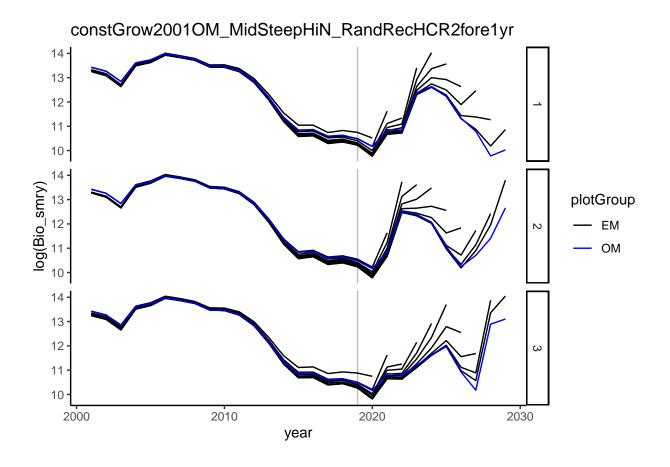
constGrow2001OM_MidSteepHiN_RandRecHCR2bavg

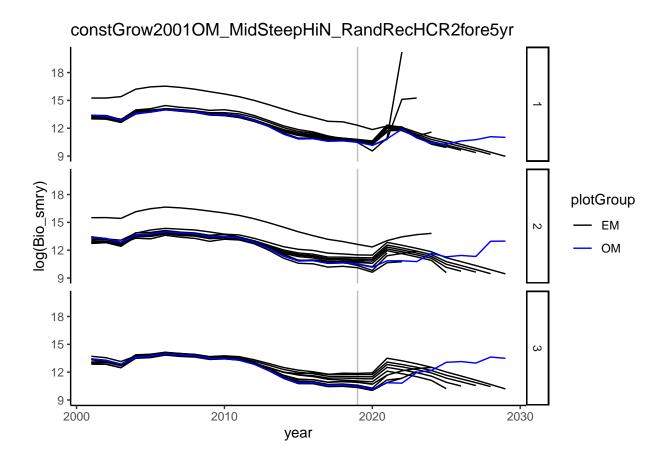


```
age1PlusBio <- smryOutputList$tsSmry %>% filter(Seas == 1) %>%
                  select(year, Bio_smry, model_run, iteration, scenario) %>%
                  mutate(plotGroup = case_when(grepl("_OM", model_run, fixed = TRUE) ~ "OM",
                                                TRUE ~ "EM"))
age1PlusRE <- age1PlusBio %>% filter(plotGroup != "OM")
age1PlusRE <- age1PlusRE %>% pivot_wider(names_from = "plotGroup", values_from = "Bio_smry") %>%
                  left_join(y = convrgCheck,
                            by = c("model run", "iteration", "scenario")) %>%
                  full_join(y = subset(age1PlusBio, subset = plotGroup == "OM"),
                            by = c("iteration", "scenario", "year")) %>%
                  mutate(convrg = case_when(max_grad > 0.01 ~ "non-convrg",
                                            max grad < 0.01 ~ "convrg",</pre>
                                            TRUE ~ "OM"),
                         emRE = (EM - Bio_smry)/Bio_smry * 100)
age1PlusBio <- age1PlusBio %>% left_join(y = convrgCheck,
                                         by = c("model_run", "iteration", "scenario")) %>%
                  mutate(convrg = case_when(max_grad > 0.01 ~ "non-convrg",
                                            max_grad < 0.01 ~ "convrg",</pre>
                                             TRUE ~ "OM"))
for(mr in 1:length(scenarios)){
  print(age1PlusBio %>% filter(scenario == scenarios[mr], plotGroup != "simData") %>%
    ggplot(aes(x = year, y = log(Bio_smry))) +
    ggplot2::geom_vline(xintercept = 2019, color = "gray") +
```

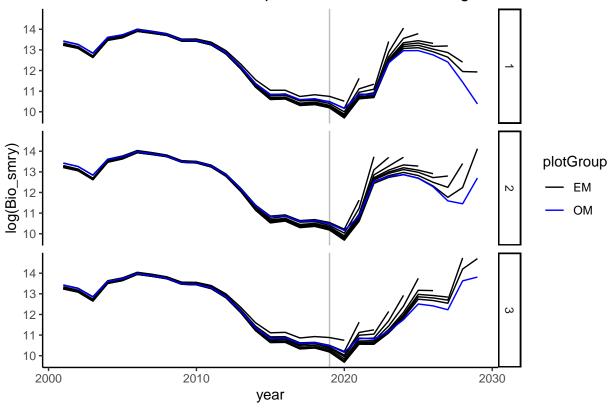
constGrow2001OM_MidSteepHiN_RandRecHCR2nofore





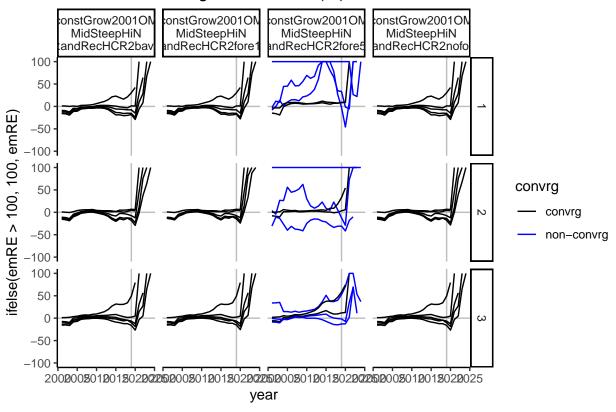


constGrow2001OM_MidSteepHiN_RandRecHCR2bavg



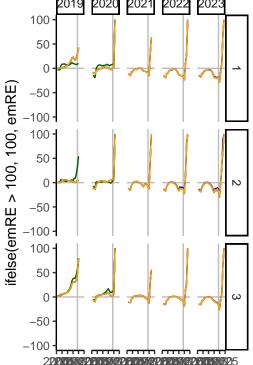
```
# Plot relative errors of biomass over time
age1PlusRE %>% filter(HCR != "HCRO", emYear < 2024) %>%
mutate(scenario = gsub("_", "\n", scenario, fixed = TRUE)) %>%
ggplot(aes(x = year, y = ifelse(emRE > 100, 100, emRE))) + #y = emRE)) +
geom_vline(xintercept = 2019, color = "gray") +
geom_hline(yintercept = 0, color = "gray") +
geom_line(aes(linetype = as.character(model_run.x), color = convrg))+
scale_color_manual(values = c("black", "blue", "#D65F00")) +
scale_linetype_manual(values = rep("solid", 51)) +
guides(linetype = "none") +
facet_grid(rows = vars(iteration), cols = vars(scenario)) +
theme_classic() + labs(title = "Relative Error of Age 1+ Biomass (%)") +
ylim(-100, 100)
```

Relative Error of Age 1+ Biomass (%)



```
age1PlusRE %>% filter(HCR != "HCRO", emYear < 2024, convrg != "non-convrg") %>%
  mutate(scenario = gsub("constGrow20010M_MidSteep_", "", scenario, fixed = TRUE)) %>%
  ggplot(aes(x = year, y = ifelse(emRE > 100, 100, emRE))) + #y = emRE)) +
  geom_vline(xintercept = 2019, color = "gray") +
  geom_hline(yintercept = 0, color = "gray") +
  geom_line(aes(linetype = as.character(scenario), color = scenario))+
  scale_color_manual(values = c("black", "blue", "darkgreen", "orange")) +
  scale_linetype_manual(values = rep("solid", 51)) +
  # guides(linetype = "none") +
  facet_grid(rows = vars(iteration), cols = vars(emYear)) +
  theme_classic() + labs(title = "Relative Error of Age 1+ Biomass (%)") +
  ylim(-100, 100)
```

Relative Error of Age 1+ Biomass (%) 2019 2020 2021 2022 2023



vear

scenario

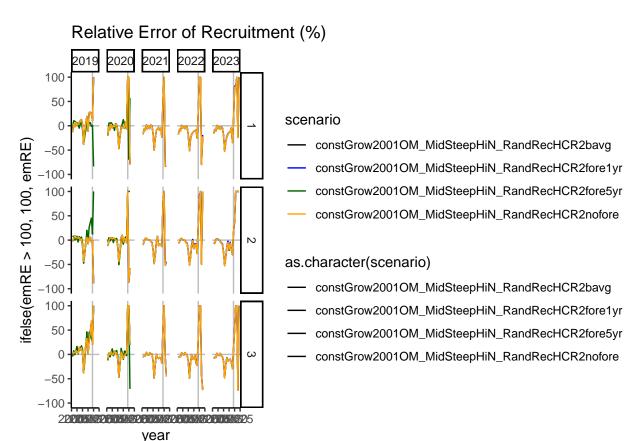
- constGrow2001OM_MidSteepHiN_RandRecHCR2bavg
- constGrow2001OM_MidSteepHiN_RandRecHCR2fore1yr
- constGrow2001OM_MidSteepHiN_RandRecHCR2fore5yr
- constGrow2001OM_MidSteepHiN_RandRecHCR2nofore

as.character(scenario)

- constGrow2001OM_MidSteepHiN_RandRecHCR2bavg
- constGrow2001OM_MidSteepHiN_RandRecHCR2fore1yr
- constGrow2001OM_MidSteepHiN_RandRecHCR2fore5yr
- constGrow2001OM_MidSteepHiN_RandRecHCR2nofore

```
# Recruitment deviation error
recdevs <- smryOutputList$dqSmry %>% #filter(Seas == 1) %>%
                  select(year, Value.Recr, model_run, iteration, scenario) %>%
                  mutate(plotGroup = case_when(grepl("_OM", model_run, fixed = TRUE) ~ "OM",
                                               TRUE ~ "EM"))
recdevRE <- recdevs %>% filter(plotGroup != "OM")
recdevRE <- recdevRE %>% pivot wider(names from = "plotGroup", values from = "Value.Recr") %>%
                  left_join(y = convrgCheck,
                            by = c("model_run", "iteration", "scenario")) %>%
                  full_join(y = subset(recdevs, subset = plotGroup == "OM"),
                            by = c("iteration", "scenario", "year")) %>%
                  mutate(convrg = case_when(max_grad > 0.01 ~ "non-convrg",
                                            max grad < 0.01 ~ "convrg",</pre>
                                            TRUE ~ "OM"),
                         emRE = (EM - Value.Recr)/Value.Recr * 100)
# Plot relative errors of rec devs over time
recdevRE %>% filter(HCR != "HCRO", emYear < 2024, convrg != "non-convrg") %>%
  mutate(scenario = gsub("constGrow20010M_MidSteep_", "", scenario, fixed = TRUE)) %>%
    ggplot(aes(x = year, y = ifelse(emRE > 100, 100, emRE))) + #y = emRE)) +
    geom_vline(xintercept = 2019, color = "gray") +
    geom_hline(yintercept = 0, color = "gray") +
   geom_line(aes(linetype = as.character(scenario), color = scenario))+
    scale color manual(values = c("black", "blue", "darkgreen", "orange")) +
    scale linetype manual(values = rep("solid", 51)) +
```

```
# guides(linetype = "none") +
facet_grid(rows = vars(iteration), cols = vars(emYear)) +
theme_classic() + labs(title = "Relative Error of Recruitment (%)") +
ylim(-100, 100)
```



Compare high sample runs with perfect data runs from outside SSMSE

For each scenario (EM forecast setup and HCR formulation) copy assessment folders for 2019 and 2020 and relabel as perfDatTest_EM_20XX. Then copy data from the OM directory into the init_dat.ss file for each perfDatTest assessment and run the assessments outside R. ## No forecast HCR application

```
datEMnofore2019$lencomp <- datOMnofore$lencomp %>% filter(Yr <= 2019) %>%
  mutate(FltSvy = case_when(FltSvy == -3 & Seas == 10 ~ FltSvy,
                            TRUE ~ abs(FltSvy)))
datEMnofore2019$agecomp <- datOMnofore$agecomp %>% filter(Yr <= 2019) %>%
  mutate(FltSvy = abs(FltSvy))
SS_writedat(datlist = datEMnofore2019,
            outfile = file.path(file.path(EMnofore2019_dir, "init_dat.ss")),
            overwrite = TRUE,
            verbose = FALSE)
# No forecast 2020 assessment
EMnofore2020_dir <- "C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenarios/perfDatTests/constGrow
datEMnofore2020 <- SS_readdat(file.path(EMnofore2020_dir, "init_dat.ss"),</pre>
                    verbose = FALSE,
                    section = 1)
datEMnofore2020$catch <- datOMnofore$catch %>% filter(year <= 2020)</pre>
datEMnofore2020$CPUE <- datOMnofore$CPUE %>% filter(year <= 2020) %>%
  mutate(index = abs(index))
datEMnofore2020$lencomp <- datOMnofore$lencomp %>% filter(Yr <= 2020) %>%
  mutate(FltSvy = case_when(FltSvy == -3 & Seas == 10 ~ FltSvy,
                            TRUE ~ abs(FltSvy)))
datEMnofore2020$agecomp <- datOMnofore$agecomp %>% filter(Yr <= 2020) %>%
  mutate(FltSvy = abs(FltSvy))
SS_writedat(datlist = datEMnofore2020,
            outfile = file.path(file.path(EMnofore2020_dir, "init_dat.ss")),
            overwrite = TRUE,
            verbose = FALSE)
# now run SS in each perfDatTest folder
Read in output and compare against the OM
# plot comparisons
outOMnofore <- SS_output(OMnofore_dir)</pre>
## Getting header info from:
   C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenarios/perfDatTests/constGrow20010M_MidSteepH
\#\# This function tested on SS versions 3.24 and 3.30.
    You are using 3.30.18.00 which SHOULD work with this package.
## Report file time:Mon Jun 06 17:08:12 2022
## Warning in SS_output(OMnofore_dir): Some stats skipped because the .cor file not found:C:/Users/r.wi
```

section = 1)

mutate(index = abs(index))

datEMnofore2019\$catch <- datOMnofore\$catch %% filter(year <= 2019)
datEMnofore2019\$CPUE <- datOMnofore\$CPUE %% filter(year <= 2019) %>%

```
## Warning in SS_output(OMnofore_dir): covar file contains the warning
##
        'Variances are 0.0 for first two elements, so do not write '
##
     input 'covar' changed to FALSE.
## Reading full report file
## Got all columns using ncols = 62
## Got Report file
## !warning: temporary files were written in this run:
                          TempFile
## "size of file gradfil1.tmp = 0" "size of file gradfil2.tmp = 0"
                              <NA>
## "size of file varssave.tmp = 0" "size of file cmpdiff.tmp = 0"
## Got warning file. Therewere 4 warnings in C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenario
## Finished reading files
## CompReport file separated by this code as follows (rows = Ncomps*Nbins):
     2028 rows of length comp data,
##
    O rows of generalized size comp data,
    459 rows of age comp data,
##
    O rows of conditional age-at-length data,
##
    360 rows of ghost fleet age comp data,
##
    O rows of ghost fleet conditional age-at-length data,
##
    1911 rows of ghost fleet length comp data,
    0 rows of mean length at age data,
##
    O rows of mean weight at age data,
    0 rows of 'TAG1' comp data, and
    0 rows of 'TAG2' comp data.
## Finished dimensioning
## You skipped the covar file
## Finished primary run statistics list
## Statistics shown below (to turn off, change input to printstats=FALSE)
## $SS_version
## [1] "3.30.18.00;_safe;_compile_date:_Sep 30 2021;_Stock_Synthesis_by_Richard_Methot_(NOAA)_using_ADM
## $SS_versionshort
## [1] "3.30"
##
## $SS_versionNumeric
## [1] 3.3
```

```
##
## $StartTime
## [1] "StartTime: Mon Jun 06 17:08:12 2022"
##
## $RunTime
## [1] "O hours, O minutes, O seconds."
## $Files_used
## [1] "Data_File: data.ss Control_File: control.ss"
##
## $Nwarnings
## [1] 4
##
## $warnings
##
   [1] "#V3.30.18.00; safe; compile_date: Sep 30 2021; Stock_Synthesis_by_Richard_Methot_(NOAA)_using_
##
    [2] "#_Stock_Synthesis_is_a_work_of_the_U.S._Government_and_is_not_subject_to_copyright_protection_
##
   [3] "#_Foreign_copyrights_may_apply._See_copyright.txt_for_more_information."
   [4] "#_User_support_available_at:NMFS.Stock.Synthesis@noaa.gov"
   [5] "#_User_info_available_at:https://vlab.noaa.gov/group/stock-synthesis"
##
##
    [6] "#_Source_code_at:_https://github.com/nmfs-stock-synthesis/stock-synthesis"
   [7] ""
##
   [8] "This file contains warnings, suggestions and notes generated as files are read and processed"
##
   [9] ""
##
## [10] "1 NOTE: Max data length bin: 28 < max pop len bins: 30; so will accumulate larger pop len bi
## [11] "2 Forecast=0 or -1, so rest of forecast file will not be read and can be omitted;"
## [12] "2 A one year forecast using recent F will be done automatically"
## [13] "3 settle_month is less than spawn_month, so logical age at settlement calculated to be: 1 for
## [14] "4 setting in starter does not request all priors, and 1 parameters have priors and are not est
## [15] "N warnings: 4"
##
## $likelihoods_used
##
                                values lambdas
## TOTAL
                        50938.7000000
                                            NA
## Catch
                        50778.9000000
                                            NΑ
## Equil_catch
                            0.000000
                                            NA
## Survey
                          -28.0180000
                                            NΑ
## Length_comp
                           41.9452000
                                            NA
## Age_comp
                                            NΔ
                           37.4688000
## Recruitment
                           78.3199000
                                             1
                                             0
## InitEQ_Regime
                            0.0000000
## Forecast_Recruitment
                           30.1114000
                                             1
## Parm_priors
                            0.0000000
                                             1
## Parm softbounds
                            0.0019748
                                            NA
## Parm_devs
                            0.000000
                                             1
## Crash_Pen
                            0.000000
                                             1
##
## $likelihoods_laplace
##
                                           values lambdas
## NoBias_corr_Recruitment(info_only)
                                          75.1513
                                                        1
## Laplace_obj_fun(info_only)
                                       50935.5000
                                                       NA
##
## $likelihoods_by_fleet
##
                 Label
                                    MexCal_S1
                                                 MexCal S2
                                                                   PNW AT_Survey
                              ALL
## 185
          Catch_lambda
                               NA
                                       1.00000
                                                   1.00000
                                                               1.00000
                                                                         1.00000
```

```
## 186
            Catch like 50778.9000 18418.60000 18471.10000 13889.10000
                                                                            0.00000
## 187 Init_equ_lambda
                                                     0.00000
                                                                  0.00000
                                                                            1.00000
                                 NA
                                        0.00000
## 188
         Init equ like
                            0.0000
                                        0.00000
                                                     0.00000
                                                                  0.00000
                                                                            0.00000
## 189
           Surv_lambda
                                        0.00000
                                                     0.00000
                                                                  0.00000
                                                                            1.00000
                                 NA
## 190
             Surv like
                          -28.0180
                                        0.00000
                                                     0.00000
                                                                  0.00000
                                                                           -9.94359
## 191
            Surv N use
                                        0.00000
                                                     0.00000
                                                                  0.00000
                                                                           18.00000
                                NA
## 192
           Surv N skip
                                NA
                                        0.00000
                                                     0.00000
                                                                  0.00000
                                                                           10.00000
## 193
         Length_lambda
                                NA
                                        1.00000
                                                     1.00000
                                                                  1.00000
                                                                            1.00000
## 194
           Length_like
                           41.9452
                                        0.98456
                                                     2.63440
                                                                  1.66827
                                                                           36.65790
## 195
          Length_N_use
                                 NA
                                       14.00000
                                                    14.00000
                                                                 15.00000
                                                                            9.00000
## 196
         Length_N_skip
                                 NA
                                       10.00000
                                                    10.00000
                                                                 19.00000
                                                                           10.00000
## 197
            Age_lambda
                                 NA
                                        1.00000
                                                     1.00000
                                                                  1.00000
                                                                            1.00000
## 198
              Age_like
                           37.4688
                                        1.16795
                                                     3.26694
                                                                  3.16781
                                                                           29.86610
## 199
             Age_N_use
                                 NA
                                       14.00000
                                                    14.00000
                                                                 14.00000
                                                                            9.00000
## 200
            Age_N_skip
                                       10.00000
                                                    10.00000
                                                                 10.00000
                                                                           10.00000
                                 NA
##
           DEPM
                 TEP_all
## 185
        1.00000
                   1.0000
  186
        0.00000
                   0.0000
## 187
        1.00000
                   1.0000
## 188
        0.00000
                   0.0000
## 189
        1.00000
                   1.0000
## 190 -1.76351 -16.3109
## 191 10.00000
                  13.0000
## 192
        0.00000
                   0.0000
## 193
        0.00000
                   0.0000
## 194
        0.00000
                   0.0000
## 195
        0.00000
                   0.0000
        0.00000
##
  196
                   0.0000
## 197
        0.00000
                   0.0000
## 198
        0.00000
                   0.0000
## 199
        0.00000
                   0.0000
## 200
        0.00000
                   0.0000
##
## $N_estimated_parameters
##
   [1] 1
##
##
  $table_of_phases
##
## -99
       -5
            -4
               -3
                    -2
                         -1
##
         1
             1 10
##
## $estimated_non_dev_parameters
    [1] Value
                    Phase
                               Min
                                           Max
                                                       Init
                                                                   Status
    [7] Parm_StDev Gradient
                                           Prior
                                                       Pr_SD
                                                                   Pr_Like
                               Pr_type
## <0 rows> (or 0-length row.names)
##
## $maximum_gradient_component
## [1] 0
##
## $Length_Comp_Fit_Summary
##
        Factor Fleet Recommend_var_adj # N Npos min_Nsamp max_Nsamp mean_Nsamp_in
## 1506
             4
                    1
                               59.69170 # 24
                                                14
                                                            6
                                                                   86.00
                                                                               32.5914
## 1507
             4
                    2
                               36.47650 # 24
                                                 14
                                                            9
                                                                  108.80
                                                                               59.3200
                    3
## 1508
             4
                               111.35100 # 34
                                                 15
                                                            1
                                                                  174.48
                                                                               86.7573
```

```
## 1509
                               0.43845 # 19
                                                         12
                                                                 31.00
        mean_Nsamp_adj mean_Nsamp_DM DM_theta mean_effN HarMean_effN Curr_Var_Adj
                                                             1945.44000
## 1506
               32.5914
                                   NA
                                            NA 74598.2000
## 1507
               59.3200
                                            NA 70693.4000
                                   NA
                                                             2163.79000
                                                                                    1
## 1508
               86.7573
                                   NA
                                            NA 22722.6000
                                                             9660.53000
                                                                                    1
## 1509
               19.8889
                                   NA
                                                  79.1256
                                                                8.72028
                                            NA
                                                                                    1
        Fleet name
## 1506 MexCal S1
## 1507
        MexCal S2
## 1508
               PNW
## 1509
        AT_Survey
## $Age_Comp_Fit_Summary
        Factor Fleet Recommend_var_adj # Nsamp_adj Npos min_Nsamp max_Nsamp
## 1607
             5
                   1
                              9.329390 #
                                                 24
                                                       14
                                                               5.92
                   2
## 1608
             5
                               4.260200 #
                                                 24
                                                       14
                                                               8.92
                                                                       105.16
## 1609
             5
                   3
                              17.893600 #
                                                 24
                                                       14
                                                              26.88
                                                                       138.12
## 1610
             5
                   4
                               0.428988 #
                                                  19
                                                       9
                                                              12.00
                                                                         31.00
        mean_Nsamp_in mean_Nsamp_adj mean_Nsamp_DM DM_theta mean_effN
              31.0686
                              31.0686
                                                 NA
                                                           NA 10076.4000
## 1608
              58.3143
                              58.3143
                                                 NA
                                                           NA 8139.9400
## 1609
              76.2971
                              76.2971
                                                 NA
                                                           NA 3175.6600
## 1610
              19.8889
                                                           NA
                                                                 60.1969
                              19.8889
                                                 NA
        HarMean_effN Curr_Var_Adj Fleet_name
           289.85100
                                 1 MexCal S1
## 1607
                                   MexCal S2
## 1608
           248.43000
                                 1
## 1609
          1365.23000
                                          PNW
                                 1
             8.53209
                                 1 AT_Survey
## 1610
##
## $SBzero
## [1] 80588.5
##
## $current_depletion
## [1] 0.2560961
## $last_years_SPR
## [1] NaN
##
## $SPRratioLabel
## [1] "raw_SPR"
## $sigma_R_in
## [1] 0.5
##
## $sigma_R_info
              period N_devs SD_of_devs Var_of_devs mean_SE mean_SEsquared
##
## 1
                Main
                         20
                               1.526787
                                           2.331078
                                                          NA
                                                                         NA
## 2
                         26
                               1.364724
                                                          NA
                                                                         NA
          Early+Main
                                           1.862471
## 3 Early+Main+Late
                         36
                               1.327054
                                           1.761071
                                                          NA
                                                                         NA
     sqrt_sum_of_components SD_of_devs_over_sigma_R sqrt_sum_over_sigma_R
## 1
                                            3.053573
                         NA
                                                                         NA
## 2
                         NA
                                            2.729447
                                                                         NA
## 3
                         NA
                                            2.654107
                                                                         NA
## alternative sigma R
```

```
## 1
                      NA
## 2
                      NΑ
## 3
                      NA
##
## $rmse_table
                  RMSE RMSE_over_sigmaR mean_BiasAdj
##
       ERA N
## 1 main 20 1.488130
                                8.85811
                                            0.841539
## 2 early 6 0.618608
                                1.53070
                                            0.766330
## completed SS_output
outEMnofore2019 <- SS_output(EMnofore2019_dir)</pre>
## Getting header info from:
    C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenarios/perfDatTests/constGrow20010M_MidSteepH
## This function tested on SS versions 3.24 and 3.30.
     You are using 3.30.18.00 which SHOULD work with this package.
## Report file time:Tue Jun 07 09:55:44 2022
## Reading full report file
## Got all columns using ncols = 62
## Got Report file
## Setting minimum biomass threshhold to 0.25 based on US west coast assumption associated with biomas
## !warning: temporary files were written in this run:
##
                          TempFile
                                                               Size
## "size of file gradfil1.tmp = 0" "size of file gradfil2.tmp = 0"
                              <NA>
## "size of file varssave.tmp = 0" "size of file cmpdiff.tmp = 0"
## Got warning file. Therewere 10 warnings in C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenari
## Finished reading files
## CompReport file separated by this code as follows (rows = Ncomps*Nbins):
##
     2028 rows of length comp data,
##
     O rows of generalized size comp data,
     459 rows of age comp data,
##
##
    O rows of conditional age-at-length data,
    O rows of ghost fleet age comp data,
##
     O rows of ghost fleet conditional age-at-length data,
    351 rows of ghost fleet length comp data,
##
    0 rows of mean length at age data,
##
##
    O rows of mean weight at age data,
    0 rows of 'TAG1' comp data, and
    O rows of 'TAG2' comp data.
##
```

```
## Finished dimensioning
## Got covar file.
## Finished primary run statistics list
## running SS_readstarter
     data, control files: init_dat.ss, control.ss
##
##
     converge_criterion = 1e-05
     SPR_basis = 4
##
    F_report_basis = 2
##
## Assuming version 3.30 based on number of numeric values.
    MCMC_output_detail = 0
##
##
     ALK_tolerance = 1e-04
## Reading a random seed value:6989337
## Read of starter file complete. Final value: 3.3
## Statistics shown below (to turn off, change input to printstats=FALSE)
## $SS version
## [1] "3.30.18.00; safe; compile_date: Sep 30 2021; Stock_Synthesis_by_Richard_Methot_(NOAA)_using_ADM
## $SS_versionshort
## [1] "3.30"
## $SS_versionNumeric
## [1] 3.3
##
## $StartTime
## [1] "StartTime: Tue Jun 07 09:55:44 2022"
##
## $RunTime
## [1] "0 hours, 2 minutes, 45 seconds."
## $Files_used
## [1] "Data_File: init_dat.ss Control_File: control.ss"
## $Nwarnings
## [1] 10
##
```

```
## $warnings
    [1] "#V3.30.18.00; safe; compile_date: Sep 30 2021; Stock_Synthesis_by_Richard_Methot_(NOAA)_using_
    [2] "#_Stock_Synthesis_is_a_work_of_the_U.S._Government_and_is_not_subject_to_copyright_protection_
    [3] "#_Foreign_copyrights_may_apply._See_copyright.txt_for_more_information."
##
##
    [4] "#_User_support_available_at:NMFS.Stock.Synthesis@noaa.gov"
    [5] "#_User_info_available_at:https://vlab.noaa.gov/group/stock-synthesis"
##
    [6] "#_Source_code_at:_https://github.com/nmfs-stock-synthesis/stock-synthesis"
##
    [7] ""
##
##
    [8] "This file contains warnings, suggestions and notes generated as files are read and processed"
   [9] ""
##
## [10] "1 NOTE: Max data length bin: 28 < max pop len bins: 30; so will accumulate larger pop len bi
  [11] "2 settle_month is less than spawn_month, so logical age at settlement calculated to be: 1 for
  [12] "3 setting in starter does not request all priors, and 1 parameters have priors and are not est
  [13] "4 1st iteration warning: ssb(endyr)/ssb(styr)= 3.87036e-07; suggest start with larger R0 to ge
## [14] "5 1st iteration warning: catch logL > 50% total logL; check configuration; suggest start with
## [15] "6 setting positive forecast relF for forecast only fleet: 1"
  [16] "7 setting positive forecast relF for forecast only fleet: 2"
  [17] "8 Final gradient: 2.26819e-05 is larger than final_conv: 1e-05"
  [18] "9 setting positive forecast relF for forecast only fleet: 1"
  [19] "10 setting positive forecast relF for forecast only fleet: 2"
  [20] "N warnings: 10"
##
##
## $likelihoods_used
##
                                         values lambdas
## TOTAL
                         53.171799999999997510
                                                     NΑ
## Catch
                          0.00000000000391362
                                                     MΔ
## Equil_catch
                          0.000000000000000000
                                                     NA
## Survey
                        -42.310800000000000409
                                                     NA
## Length_comp
                         25.373799999999999244
                                                     NA
## Age_comp
                         16.154399999999998983
                                                     NA
## Recruitment
                         53.95259999999996783
                                                      1
## InitEQ_Regime
                          0.00000000000000000
                                                      0
## Forecast_Recruitment
                          0.000000000000000000
                                                      1
## Parm_priors
                          0.00000000000000000
                                                      1
## Parm softbounds
                          0.001833320000000000
                                                     NA
## Parm devs
                          0.000000000000000000
                                                      1
## Crash Pen
                          0.00000000000000000
##
## $likelihoods_laplace
##
                                       values lambdas
## NoBias_corr_Recruitment(info_only) 50.7840
## Laplace_obj_fun(info_only)
                                       50.0033
                                                    NΑ
##
## $likelihoods_by_fleet
                 Label
                                ALL
                                      MexCal_S1
                                                   MexCal_S2
                                                                     PNW AT_Survey
## 180
                                 NA 1.00000e+00 1.00000e+00 1.00000e+00
                                                                            1.0000
          Catch_lambda
## 181
            Catch_like
                        3.91362e-13 8.73045e-14 6.11515e-14 2.42906e-13
                                                                            0.0000
## 182 Init_equ_lambda
                                 NA 0.00000e+00 0.00000e+00 0.00000e+00
                                                                            1.0000
## 183
         Init_equ_like
                        0.00000e+00 0.00000e+00 0.00000e+00 0.00000e+00
                                                                            0.0000
## 184
           Surv_lambda
                                 NA 0.00000e+00 0.00000e+00 0.00000e+00
                                                                            1.0000
## 185
             Surv_like -4.23108e+01 0.00000e+00 0.00000e+00 0.00000e+00
                                                                          -14.4919
## 186
            Surv_N_use
                                 NA 0.00000e+00 0.00000e+00 0.00000e+00
                                                                           18.0000
## 187
           Surv_N_skip
                                 NA 0.00000e+00 0.00000e+00 0.00000e+00
                                                                            0.0000
```

NA 1.00000e+00 1.00000e+00 1.00000e+00

1.0000

188

Length_lambda

```
## 189
                         2.53738e+01 1.24946e+00 2.42523e+00 1.13925e+00
                                                                              20.5598
           Length like
## 190
          Length_N_use
                                  NA 1.40000e+01 1.40000e+01 1.50000e+01
                                                                               9.0000
         Length_N_skip
                                   NA 0.00000e+00 0.00000e+00 9.00000e+00
## 191
                                                                               0.0000
## 192
                                  NA 1.00000e+00 1.00000e+00 1.00000e+00
            Age_lambda
                                                                               1.0000
##
  193
              Age_like
                         1.61544e+01 5.86516e-01 1.75501e+00 9.13011e-01
                                                                              12.8999
## 194
                                  NA 1.40000e+01 1.40000e+01 1.40000e+01
                                                                               9.0000
             Age N use
                                  NA 0.00000e+00 0.00000e+00 0.00000e+00
## 195
            Age_N_skip
                                                                               0.0000
##
           DEPM TEP_all
## 180
         1.0000
                   1.0000
##
  181
         0.0000
                  0.0000
##
  182
         1.0000
                   1.0000
##
  183
         0.0000
                  0.0000
##
  184
         1.0000
                   1.0000
  185 -11.1977 -16.6212
## 186
        10.0000
                  13.0000
## 187
         0.0000
                  0.0000
## 188
         0.0000
                  0.0000
  189
         0.0000
                  0.0000
## 190
         0.0000
                  0.0000
##
  191
         0.0000
                  0.0000
## 192
         0.0000
                  0.0000
## 193
         0.0000
                  0.0000
## 194
         0.0000
                  0.0000
         0.0000
##
  195
                  0.0000
##
   $N_estimated_parameters
##
   [1] 47
##
##
   $table_of_phases
##
##
   -99
        -5
            -4 -3
                    -2
                         -1
                                       3
                                               5
##
     1
         1
             1 10
                      4
                          2
                             21
                                   6
                                     16
                                           3
                                               1
##
##
   $estimated_non_dev_parameters
##
                                                                        Init Status
                                       Value Phase
                                                      Min
                                                             Max
                                                      3.00 30.00 12.8541000
## L_at_Amin_Fem_GP_1
                                 12.8463000
                                                                                 ΩK
## L at Amax Fem GP 1
                                 24.9297000
                                                     15.00 40.00 24.8415000
                                                                                 OK
                                                                  0.3075730
                                                                                 OK
## VonBert_K_Fem_GP_1
                                   0.3052990
                                                 3
                                                      0.05
                                                            0.99
                                                 3
## CV_young_Fem_GP_1
                                   0.1135150
                                                      0.05
                                                            0.50
                                                                  0.1053490
                                                                                 ΩK
## CV_old_Fem_GP_1
                                                      0.01
                                                            0.10
                                                                                 OK
                                  0.0199304
                                                                  0.0237245
## SR LN(RO)
                                 14.7700000
                                                 1
                                                      3.00 25.00 14.4668000
                                                                                 OK
                                                                                 OK
## SR_regime_BLK1repl_2000
                                   0.9815310
                                                 4 -15.00 15.00
                                                                 1.2915300
## Size_inflection_MexCal_S1(1) 10.9366000
                                                 3
                                                      0.00 30.00 10.9072000
                                                                                 OK
## Size_95%width_MexCal_S1(1)
                                  0.7588860
                                                      0.00 10.00
                                                                  0.6599090
                                                                                 OK
                                  0.5000230
## AgeSel_P1_MexCal_S1(1)
                                                 3 -10.00 11.00
                                                                  0.5000240
                                                                                 OK
## AgeSel_P2_MexCal_S1(1)
                                   0.3233490
                                                 3 -10.00 11.00
                                                                  0.2048810
                                                                                 OK
## AgeSel_P3_MexCal_S1(1)
                                  0.3943970
                                                 3 -10.00 15.00
                                                                  0.3827920
                                                                                 OK
## AgeSel_P4_MexCal_S1(1)
                                 -1.5376900
                                                 3 -10.00 11.00 -1.5494000
                                                                                 OK
## AgeSel_P5_MexCal_S1(1)
                                  -0.1495350
                                                 3 -10.00 11.00 -0.2361890
                                                                                 OK
## AgeSel_P2_MexCal_S2(2)
                                  0.4316430
                                                 3 -10.00 15.00 0.4405260
                                                                                 OK
                                                 3 -10.00 11.00 -1.1690800
## AgeSel_P3_MexCal_S2(2)
                                                                                 OK
                                 -1.1978500
## AgeSel_P4_MexCal_S2(2)
                                 -0.0155567
                                                 3 -10.00 11.00 -0.1425740
                                                                                 OK
## AgeSel_P5_MexCal_S2(2)
                                 -0.4560380
                                                 3 -10.00 11.00 -0.4707320
                                                                                 ΠK
## Age_inflection_PNW(3)
                                   2.8833700
                                                     0.00 10.00 2.8525100
                                                                                 OK
```

```
## Age_95%width_PNW(3)
                                                 4 -5.00 15.00 1.2152300
                                                                                OK
                                  1.2378300
##
                                   Parm_StDev
                                                        Gradient Pr_type Prior
## L at Amin Fem GP 1
                                   0.11758300
                                                0.00000377916000 No prior
## L_at_Amax_Fem_GP_1
                                   0.25106200
                                                0.00000150313000 No_prior
                                                                              NΑ
## VonBert_K_Fem_GP_1
                                   0.01443090
                                                0.00000416787000 No prior
                                                                              NΑ
## CV_young_Fem_GP_1
                                   0.00459528 -0.00000026741500 No prior
                                                                              NA
## CV old Fem GP 1
                                   0.00504098 -0.00000067019500 No prior
                                                                              NA
## SR LN(RO)
                                   0.06387110
                                                0.00002267830000 No prior
                                                                              NΑ
                                                0.00001207590000 No_prior
## SR_regime_BLK1repl_2000
                                   0.09877240
                                                                              NA
## Size_inflection_MexCal_S1(1)
                                   0.18739900 -0.00000047851600 No_prior
                                                                              NA
## Size_95%width_MexCal_S1(1)
                                   0.20762300
                                                0.00000016215600 No_prior
                                                                              NA
## AgeSel_P1_MexCal_S1(1)
                                 234.78400000
                                                0.00000000675916 No_prior
                                                                              NA
## AgeSel_P2_MexCal_S1(1)
                                                0.0000006007750 No_prior
                                                                              NA
                                   0.34312200
                                                0.00000134165000 No_prior
## AgeSel_P3_MexCal_S1(1)
                                   0.11721700
                                                                              NA
## AgeSel_P4_MexCal_S1(1)
                                   0.30404400
                                                0.00000065320200 No_prior
                                                                              NΑ
## AgeSel_P5_MexCal_S1(1)
                                   0.36487500
                                                0.00000030770200 No_prior
                                                                              NA
## AgeSel_P2_MexCal_S2(2)
                                                                              NA
                                   0.08510010
                                                0.0000005729660 No_prior
## AgeSel P3 MexCal S2(2)
                                                0.00000070821300 No prior
                                   0.16758800
                                                                              NA
## AgeSel_P4_MexCal_S2(2)
                                                0.00000066790300 No_prior
                                                                              NΑ
                                   0.27173700
## AgeSel_P5_MexCal_S2(2)
                                   0.28391100
                                                0.0000054389300 No prior
                                                                              NA
## Age_inflection_PNW(3)
                                   0.07557750
                                                0.00000345944000 No_prior
                                                                              NA
## Age_95%width_PNW(3)
                                   0.06682090 -0.00000110157000 No_prior
                                                                              NΑ
##
                                 Pr SD Pr Like Afterbound
## L_at_Amin_Fem_GP_1
                                    NA
                                             NΑ
                                                        OK
                                                        ΠK
## L_at_Amax_Fem_GP_1
                                    NA
                                             NΑ
## VonBert_K_Fem_GP_1
                                    NA
                                             NA
                                                        OK
## CV_young_Fem_GP_1
                                                        OK
                                    NA
                                             NA
## CV_old_Fem_GP_1
                                    NA
                                             NA
                                                        OK
## SR_LN(RO)
                                             NA
                                                        OK
## SR_regime_BLK1repl_2000
                                             NA
                                                        OK
                                    NA
## Size_inflection_MexCal_S1(1)
                                    NA
                                             NA
                                                        OK
## Size_95%width_MexCal_S1(1)
                                    NΑ
                                             NΑ
                                                        OK
## AgeSel_P1_MexCal_S1(1)
                                    NA
                                             NA
                                                        OK
## AgeSel_P2_MexCal_S1(1)
                                             NA
                                                        OK
                                    NA
## AgeSel_P3_MexCal_S1(1)
                                                        OK
## AgeSel_P4_MexCal_S1(1)
                                             NΑ
                                                        ΠK
## AgeSel P5 MexCal S1(1)
                                             NA
                                                        OK
## AgeSel_P2_MexCal_S2(2)
                                    NΑ
                                             NΑ
                                                        ΠK
## AgeSel_P3_MexCal_S2(2)
                                             NΑ
                                                        ΩK
## AgeSel_P4_MexCal_S2(2)
                                    NA
                                             NΑ
                                                        ΠK
## AgeSel_P5_MexCal_S2(2)
                                    NA
                                             NΑ
                                                        ΠK
                                                        OK
## Age_inflection_PNW(3)
                                    NΑ
                                             NΑ
## Age_95%width_PNW(3)
                                    NA
                                                        OK
##
## $log_det_hessian
  [1] 194.733
##
##
   $maximum_gradient_component
   [1] 2.26819e-05
##
##
   $parameters_with_highest_gradients
##
## SR LN(RO)
                            14.770000 2.26783e-05
## SR regime BLK1repl 2000 0.981531 1.20759e-05
```

```
## VonBert K Fem GP 1
                             0.305299 4.16787e-06
## L_at_Amin_Fem_GP_1
                            12.846300 3.77916e-06
## Age inflection PNW(3)
                             2.883370 3.45944e-06
##
## $Length_Comp_Fit_Summary
        Factor Fleet Recommend_var_adj # N Npos min_Nsamp max_Nsamp mean_Nsamp_in
## 1156
             4
                    1
                              73.180300 # 14
                                                14
                                                           6
                                                                  86.00
                    2
                              40.099200 # 14
                                                                               59.3200
## 1157
             4
                                                           9
                                                                 108.80
                                                14
## 1158
             4
                    3
                             136.133000 # 24
                                                15
                                                           1
                                                                 174.48
                                                                               86.7573
## 1159
             Δ
                    4
                               0.955435 # 9
                                                 9
                                                                  31.00
                                                           12
                                                                               19.8889
        mean_Nsamp_adj mean_Nsamp_DM DM_theta mean_effN HarMean_effN Curr_Var_Adj
               32.5914
## 1156
                                   NA
                                             NA 8292.820
                                                              2385.0500
                                                                                    1
               59.3200
                                   NA
                                             NA 10041.700
                                                                                    1
## 1157
                                                              2378,6900
                                   NA
## 1158
               86.7573
                                             NA 31510.800
                                                             11810.5000
                                                                                    1
## 1159
               19.8889
                                   NA
                                             NA
                                                  257.222
                                                                19.0025
                                                                                    1
##
        Fleet_name
## 1156 MexCal_S1
## 1157
         MexCal S2
## 1158
               PNW
## 1159
         AT Survey
##
## $Age_Comp_Fit_Summary
##
        Factor Fleet Recommend_var_adj # Nsamp_adj Npos min_Nsamp max_Nsamp
## 1217
             5
                   1
                              15.164000 #
                                                  14
                                                       14
                                                                5.92
                                                                         86.00
                    2
## 1218
             5
                               6.478200 #
                                                  14
                                                       14
                                                                8.92
                                                                        105.16
## 1219
             5
                    3
                              57.309000 #
                                                  14
                                                       14
                                                               26.88
                                                                        138.12
## 1220
             5
                    4
                               0.952764 #
                                                   9
                                                        9
                                                               12.00
                                                                         31.00
        mean_Nsamp_in mean_Nsamp_adj mean_Nsamp_DM DM_theta mean_effN HarMean_effN
              31.0686
                              31.0686
## 1217
                                                  NA
                                                           NA
                                                              9573.260
                                                                             471.1240
## 1218
              58.3143
                                                           NA 11412.600
                              58.3143
                                                  NA
                                                                             377.7720
              76.2971
## 1219
                              76.2971
                                                  NA
                                                           NA 14103.900
                                                                            4372.5200
## 1220
              19.8889
                              19.8889
                                                  NA
                                                           NA
                                                                 322.679
                                                                               18.9494
        Curr_Var_Adj Fleet_name
                      MexCal_S1
## 1217
                   1
## 1218
                    1
                      MexCal S2
## 1219
                             PNW
                   1
## 1220
                      AT Survey
##
## $SBzero
## [1] 109922
## $current depletion
## [1] 0.2618857
##
## $last_years_SPR
## [1] 0.809065
##
## $SPRratioLabel
## [1] "1-SPR"
##
## $sigma_R_in
## [1] 0.5
##
## $sigma R info
```

```
##
              period N_devs SD_of_devs Var_of_devs mean_SE mean_SEsquared
                                                                 0.03664718
## 1
                         20
                             1.310494
                                          1.717395 0.1688232
               Main
## 2
          Early+Main
                         26
                             1.172701
                                          1.375227 0.1816861
                                                                 0.04182880
                              1.172701 1.375227 0.1816861
## 3 Early+Main+Late
                         26
                                                                 0.04182880
##
    sqrt_sum_of_components SD_of_devs_over_sigma_R sqrt_sum_over_sigma_R
                                          2.620989
## 1
                   1.324403
                                                                 2.648805
## 2
                   1.190402
                                           2.345401
                                                                 2.380803
## 3
                   1.190402
                                           2.345401
                                                                 2.380803
   alternative_sigma_R
## 1
               1.324403
## 2
               1.190402
## 3
               1.190402
##
## $rmse_table
      ERA N
                  RMSE RMSE_over_sigmaR mean_BiasAdj
## 1 main 20 1.277310
                                6.52611
                                            0.841539
                                1.18158
                                            0.766330
## 2 early 6 0.543502
##
## $cormessage1
## [1] Range of abs(parameter correlations) is 0 to 0.932029
##
## $cormessage2
## [1] No correlations above threshold (cormax=0.95)
## $cormessage7
## [1] 1 uncorrelation below threshold (cormin=0.01)
## $cormessage8
##
                        name max
## 28 AgeSel_P1_MexCal_S1(1)
## completed SS_output
EMssmse2019_dir <- "C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenarios/perfDatTests/constGrow2
outEMssmse2019 <- SS_output(EMssmse2019_dir)</pre>
## Getting header info from:
    C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenarios/perfDatTests/constGrow20010M_MidSteepH
## This function tested on SS versions 3.24 and 3.30.
    You are using 3.30.18.00 which SHOULD work with this package.
## Report file time:Mon Jun 06 16:57:21 2022
## Warning in SS_output(EMssmse2019_dir): Some stats skipped because the .cor file not found:C:/Users/r
## Warning in SS_output(EMssmse2019_dir): covar file contains the warning
##
        'Variances are 0.0 for first two elements, so do not write '
     input 'covar' changed to FALSE.
## Reading full report file
```

```
## Got all columns using ncols = 62
## Got Report file
## Setting minimum biomass threshhold to 0.25 based on US west coast assumption associated with biomas
## !warning: temporary files were written in this run:
                          TempFile
## "size of file gradfil1.tmp = 0" "size of file gradfil2.tmp = 0"
## "size of file varssave.tmp = 0" "size of file cmpdiff.tmp = 0"
## Got warning file. Therewere 8 warnings in C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenario
## Finished reading files
## CompReport file separated by this code as follows (rows = Ncomps*Nbins):
##
     2028 rows of length comp data,
##
     O rows of generalized size comp data,
##
    459 rows of age comp data,
    O rows of conditional age-at-length data,
##
    O rows of ghost fleet age comp data,
    O rows of ghost fleet conditional age-at-length data,
##
    351 rows of ghost fleet length comp data,
##
    0 rows of mean length at age data,
    O rows of mean weight at age data,
##
    O rows of 'TAG1' comp data, and
##
    0 rows of 'TAG2' comp data.
## Finished dimensioning
## You skipped the covar file
## Finished primary run statistics list
## running SS_readstarter
##
     data, control files: init_dat.ss, control.ss
##
     converge_criterion = 1e-05
##
     SPR_basis = 4
    F_report_basis = 2
##
## Assuming version 3.30 based on number of numeric values.
```

MCMC_output_detail = 0

```
ALK_tolerance = 1e-04
## Reading a random seed value:6989337
## Read of starter file complete. Final value: 3.3
##
## Statistics shown below (to turn off, change input to printstats=FALSE)
## $SS_version
## [1] "3.30.18.00;_safe;_compile_date:_Sep 30 2021;_Stock_Synthesis_by_Richard_Methot_(NOAA)_using_ADM
## $SS_versionshort
## [1] "3.30"
##
## $SS_versionNumeric
## [1] 3.3
##
## $StartTime
## [1] "StartTime: Mon Jun 06 16:57:21 2022"
##
## $RunTime
## [1] "O hours, 1 minutes, 21 seconds."
## $Files used
## [1] "Data_File: init_dat.ss Control_File: control.ss"
##
## $Nwarnings
## [1] 8
##
## $warnings
   [1] "#V3.30.18.00; safe; compile_date: Sep 30 2021; Stock_Synthesis_by_Richard_Methot_(NOAA)_using_
   [2] "#_Stock_Synthesis_is_a_work_of_the_U.S._Government_and_is_not_subject_to_copyright_protection_
   [3] "#_Foreign_copyrights_may_apply._See_copyright.txt_for_more_information."
    [4] "#_User_support_available_at:NMFS.Stock.Synthesis@noaa.gov"
##
   [5] "#_User_info_available_at:https://vlab.noaa.gov/group/stock-synthesis"
   [6] "#_Source_code_at:_https://github.com/nmfs-stock-synthesis/stock-synthesis"
   [7] ""
##
   [8] "This file contains warnings, suggestions and notes generated as files are read and processed"
  [9] ""
##
## [10] "1 NOTE: Max data length bin: 28 < max pop len bins: 30; so will accumulate larger pop len bi
## [11] "2 settle_month is less than spawn_month, so logical age at settlement calculated to be: 1 for
## [12] "3 setting in starter does not request all priors, and 1 parameters have priors and are not est
## [13] "4 1st iteration warning: ssb(endyr)/ssb(styr)= 3.87036e-07; suggest start with larger R0 to ge
## [14] "5 1st iteration warning: catch logL > 50% total logL; check configuration; suggest start with
## [15] "6 Final gradient: 1.36978e-05 is larger than final_conv: 1e-05"
## [16] "7 setting positive forecast relF for forecast only fleet: 1"
## [17] "8 setting positive forecast relF for forecast only fleet: 2"
## [18] "N warnings: 8"
##
## $likelihoods_used
                                       values lambdas
```

724.8959999999995816

TOTAL

```
## Catch
                           0.0000000000038972
                                                     NA
## Equil_catch
                           0.00000000000000000
                                                     NΑ
## Survey
                         -28.40490000000000137
                                                     NA
## Length_comp
                         639.32299999999997908
                                                     NA
## Age_comp
                          25.74530000000000030
                                                     NA
## Recruitment
                          88.2305999999999548
                                                      1
## InitEQ Regime
                           0.0000000000000000
                                                      0
## Forecast_Recruitment
                           0.0000000000000000
                                                      1
  Parm_priors
                           0.00000000000000000
                                                      1
  Parm_softbounds
                           0.00204515000000000
                                                     NA
  Parm_devs
                           0.00000000000000000
                                                      1
                           0.0000000000000000
##
   Crash_Pen
                                                      1
##
##
   $likelihoods_laplace
##
                                          values lambdas
## NoBias_corr_Recruitment(info_only)
                                        85.0621
                                                       1
                                                      NA
   Laplace_obj_fun(info_only)
                                       721.7280
##
##
   $likelihoods_by_fleet
##
                 Label
                                 ALL
                                       MexCal S1
                                                    MexCal S2
                                                                       PNW AT Survey
## 180
          Catch_lambda
                                  NA 1.00000e+00 1.00000e+00 1.00000e+00
                                                                             1.00000
  181
            Catch like
                         3.89720e-13 1.04611e-13 8.41599e-14 2.00949e-13
                                                                             0.00000
##
## 182 Init_equ_lambda
                                  NA 0.00000e+00 0.00000e+00 0.00000e+00
                                                                             1.00000
         Init equ like
                         0.00000e+00 0.00000e+00 0.00000e+00 0.00000e+00
## 183
                                                                             0.00000
## 184
           Surv lambda
                                  NA 0.00000e+00 0.00000e+00 0.00000e+00
                                                                             1.00000
             Surv like -2.84049e+01 0.00000e+00 0.00000e+00 0.00000e+00
  185
                                                                            -8.00048
  186
            Surv_N_use
                                  NA 0.00000e+00 0.00000e+00 0.00000e+00
##
                                                                            18.00000
                                  NA 0.00000e+00 0.00000e+00 0.00000e+00
##
  187
           Surv_N_skip
                                                                             0.00000
## 188
                                  NA 1.00000e+00 1.00000e+00 1.00000e+00
         Length_lambda
                                                                             1.00000
## 189
           Length_like
                         6.39323e+02 1.79846e+02 1.75316e+02 1.61692e+02 122.47000
## 190
          Length_N_use
                                  NA 1.40000e+01 1.40000e+01 1.50000e+01
                                                                             9.00000
## 191
         Length_N_skip
                                  NA 0.00000e+00 0.00000e+00 9.00000e+00
                                                                             0.00000
##
  192
            Age_lambda
                                  NA 1.00000e+00 1.00000e+00 1.00000e+00
                                                                             1.00000
  193
                         2.57453e+01 3.99117e+00 4.16724e+00 4.04349e+00
##
                                                                            13.54340
              Age_like
   194
             Age_N_use
                                  NA 1.40000e+01 1.40000e+01 1.40000e+01
                                                                             9.00000
##
##
   195
                                  NA 0.00000e+00 0.00000e+00 0.00000e+00
                                                                             0.00000
            Age_N_skip
##
           DEPM
                 TEP all
## 180
        1.00000
                   1.0000
   181
        0.00000
                  0.0000
##
  182
                   1.0000
##
        1.00000
  183
        0.00000
                  0.0000
  184
        1.00000
                   1.0000
##
   185
      -6.81097 -13.5935
   186 10.00000
                 13.0000
  187
        0.00000
                  0.0000
## 188
        0.00000
                  0.0000
##
  189
        0.00000
                  0.0000
##
  190
        0.00000
                  0.0000
##
  191
        0.00000
                  0.0000
##
   192
        0.00000
                  0.0000
   193
        0.00000
                  0.0000
##
## 194
        0.00000
                   0.0000
## 195
        0.00000
                  0.0000
##
```

```
## $N_estimated_parameters
##
  [1] 47
##
##
   $table_of_phases
##
##
   -99
                -3
                                               5
        -5
            -4
                     -2
                         -1
                                       3
                                           4
                                   6
##
                 10
                             21
                                      16
                                           3
                                               1
##
##
   $estimated_non_dev_parameters
##
                                      Value Phase
                                                     Min
                                                            Max
                                                                       Init Status
                                 12.749200
                                                3
                                                     3.00 30.00 12.8541000
                                                                                OK
  L_at_Amin_Fem_GP_1
## L_at_Amax_Fem_GP_1
                                  24.762700
                                                3
                                                   15.00 40.00 24.8415000
                                                                                OK
                                                3
                                                                 0.3075730
                                                                                OK
## VonBert_K_Fem_GP_1
                                   0.310253
                                                    0.05
                                                           0.99
  CV_young_Fem_GP_1
                                   0.105531
                                                3
                                                    0.05
                                                          0.50
                                                                 0.1053490
                                                                                OK
## CV_old_Fem_GP_1
                                   0.028338
                                                3
                                                    0.01
                                                          0.10
                                                                 0.0237245
                                                                                OK
## SR_LN(RO)
                                                     3.00 25.00 14.4668000
                                                                                OK
                                  14.460300
                                                1
                                                                                OK
## SR_regime_BLK1repl_2000
                                   1.325350
                                                  -15.00 15.00
                                                                 1.2915300
## Size_inflection_MexCal_S1(1) 10.774600
                                                     0.00 30.00 10.9072000
                                                                                OK
                                                    0.00 10.00
                                                                                OK
## Size_95%width_MexCal_S1(1)
                                   0.611091
                                                                 0.6599090
## AgeSel_P1_MexCal_S1(1)
                                   0.500023
                                                3 -10.00 11.00
                                                                 0.5000240
                                                                                ΩK
## AgeSel_P2_MexCal_S1(1)
                                   0.299557
                                                3 -10.00 11.00
                                                                 0.2048810
                                                                                OK
## AgeSel_P3_MexCal_S1(1)
                                  0.357986
                                                3 -10.00 15.00 0.3827920
                                                                                ΠK
## AgeSel_P4_MexCal_S1(1)
                                                3 -10.00 11.00 -1.5494000
                                  -1.559500
                                                                                OK
## AgeSel_P5_MexCal_S1(1)
                                  -0.188955
                                                3 -10.00 11.00 -0.2361890
                                                                                OK
  AgeSel_P2_MexCal_S2(2)
                                  0.442009
                                                3 -10.00 15.00 0.4405260
                                                                                OK
## AgeSel_P3_MexCal_S2(2)
                                  -1.184170
                                                3 -10.00 11.00 -1.1690800
                                                                                OK
## AgeSel_P4_MexCal_S2(2)
                                  -0.184688
                                                3 -10.00 11.00 -0.1425740
                                                                                OK
## AgeSel_P5_MexCal_S2(2)
                                  -0.451425
                                                3 -10.00 11.00 -0.4707320
                                                                                OK
   Age_inflection_PNW(3)
                                   2.882450
                                                    0.00 10.00 2.8525100
                                                                                OK
   Age_95%width_PNW(3)
                                   1.226510
                                                   -5.00 15.00
                                                                 1.2152300
                                                                                OK
##
                                  Parm_StDev
                                                       Gradient
                                                                 Pr_type Prior Pr_SD
                                                                             NA
                                                                                   NA
## L_at_Amin_Fem_GP_1
                                           0 -0.00001361980000 No_prior
                                             -0.00001111210000 No_prior
                                                                             NA
                                                                                   NA
## L_at_Amax_Fem_GP_1
                                             -0.00000979544000 No_prior
## VonBert_K_Fem_GP_1
                                                                             NA
                                                                                   ΝA
## CV_young_Fem_GP_1
                                              0.00000068867000 No_prior
                                                                             NA
                                                                                   NA
## CV_old_Fem_GP_1
                                              0.00000091321000 No_prior
                                                                             NA
                                                                                   NA
## SR LN(RO)
                                             -0.00001281700000 No prior
                                                                             NΑ
                                                                                   NΑ
## SR_regime_BLK1repl_2000
                                             -0.00000620192000 No_prior
                                                                             NA
                                                                                   NA
## Size_inflection_MexCal_S1(1)
                                           0
                                              0.00000113857000 No_prior
                                                                             NA
                                                                                   NA
  Size_95%width_MexCal_S1(1)
                                             -0.00000010867000 No_prior
                                                                             NA
                                                                                   NA
                                              0.00000000700412 No_prior
## AgeSel_P1_MexCal_S1(1)
                                                                             NA
                                                                                   NA
   AgeSel_P2_MexCal_S1(1)
                                              0.00000013500200 No_prior
                                                                             NA
                                                                                   ΝA
                                           0 -0.00000147724000 No_prior
## AgeSel_P3_MexCal_S1(1)
                                                                             NA
                                                                                   NA
   AgeSel_P4_MexCal_S1(1)
                                           0 -0.00000070098700 No_prior
                                                                             NA
                                                                                   ΝA
## AgeSel_P5_MexCal_S1(1)
                                           0 -0.00000081456800 No_prior
                                                                             NA
                                                                                   NA
## AgeSel_P2_MexCal_S2(2)
                                           0 -0.00000294566000 No_prior
                                                                             NA
                                                                                   NΑ
## AgeSel_P3_MexCal_S2(2)
                                           0 -0.00000260373000 No_prior
                                                                             NA
                                                                                   NA
## AgeSel_P4_MexCal_S2(2)
                                           0 -0.00000264339000 No_prior
                                                                             NA
                                                                                   NA
## AgeSel_P5_MexCal_S2(2)
                                           0 -0.00000147524000 No_prior
                                                                             NA
                                                                                   NA
## Age_inflection_PNW(3)
                                           0 -0.00000643800000 No_prior
                                                                             NA
                                                                                   NA
##
   Age_95%width_PNW(3)
                                           0 0.00000853144000 No_prior
                                                                             NA
                                                                                   ΝA
##
                                 Pr_Like Afterbound
                                       NΑ
                                                  ΩK
## L_at_Amin_Fem_GP_1
## L_at_Amax_Fem_GP_1
                                                  OK
```

```
## VonBert_K_Fem_GP_1
                                       NA
                                                   OK
                                       NΑ
                                                   NΚ
## CV_young_Fem_GP_1
## CV old Fem GP 1
                                       NA
                                                   OK
## SR_LN(RO)
                                                   OK
                                       NΑ
## SR_regime_BLK1repl_2000
                                       NΑ
                                                   OK
## Size inflection MexCal S1(1)
                                       NA
                                                   OK
## Size 95%width MexCal S1(1)
                                       NA
                                                   OK
## AgeSel_P1_MexCal_S1(1)
                                       NA
                                                   OK
## AgeSel_P2_MexCal_S1(1)
                                       NA
                                                   OK
## AgeSel_P3_MexCal_S1(1)
                                       NA
                                                   OK
## AgeSel_P4_MexCal_S1(1)
                                       NA
                                                   OK
## AgeSel_P5_MexCal_S1(1)
                                                   OK
                                       NA
## AgeSel_P2_MexCal_S2(2)
                                       NA
                                                   OK
## AgeSel_P3_MexCal_S2(2)
                                       NA
                                                   OK
## AgeSel_P4_MexCal_S2(2)
                                                   OK
                                       NΑ
## AgeSel_P5_MexCal_S2(2)
                                       NA
                                                   OK
                                                   OK
## Age_inflection_PNW(3)
                                       NΑ
## Age_95%width_PNW(3)
                                       NA
                                                   OK
##
## $maximum gradient component
##
  [1] 1.36978e-05
##
## $parameters_with_highest_gradients
##
                            Value
                                       Gradient
## L_at_Amin_Fem_GP_1 12.749200 -1.36198e-05
## SR LN(RO)
                        14.460300 -1.28170e-05
## L_at_Amax_Fem_GP_1
                        24.762700 -1.11121e-05
## VonBert_K_Fem_GP_1
                         0.310253 -9.79544e-06
## Age_95%width_PNW(3)
                        1.226510 8.53144e-06
##
## $Length_Comp_Fit_Summary
##
        Factor Fleet Recommend_var_adj # N Npos min_Nsamp max_Nsamp mean_Nsamp_in
## 1156
             4
                    1
                               0.564622 # 14
                                                14
                                                            6
                                                                      86
                                                                               32.2857
## 1157
                    2
                               0.653439 # 14
                                                                     108
                                                                               59.0000
             4
                                                14
                                                            9
                    3
## 1158
             4
                               0.127457 # 24
                                                15
                                                            1
                                                                     174
                                                                               86.3333
## 1159
                    4
                               0.493959 # 9
                                                 9
                                                                      31
             4
                                                           12
                                                                               19.8889
##
        mean_Nsamp_adj mean_Nsamp_DM DM_theta mean_effN HarMean_effN Curr_Var_Adj
## 1156
               32.2857
                                   NA
                                             NA
                                                  35.6918
                                                               18.22920
                                                                                     1
## 1157
               59.0000
                                    NA
                                             NA
                                                   64.8646
                                                               38.55290
                                                                                     1
               86.3333
                                    NA
                                             NA
## 1158
                                                  91.8304
                                                               11.00380
                                                                                     1
                                                                                     1
## 1159
               19.8889
                                    NA
                                             NA
                                                   14.8765
                                                                9.82429
##
        Fleet name
## 1156
        MexCal S1
## 1157
         MexCal_S2
## 1158
               PNW
## 1159
         AT_Survey
##
  $Age_Comp_Fit_Summary
        Factor Fleet Recommend_var_adj # Nsamp_adj Npos min_Nsamp max_Nsamp
## 1217
             5
                    1
                               10.10040 #
                                                  14
                                                        14
                                                                 100
                                                                            100
## 1218
             5
                    2
                                8.27159 #
                                                   14
                                                        14
                                                                 100
                                                                            100
## 1219
             5
                    3
                               11.22660 #
                                                   14
                                                        14
                                                                 100
                                                                            100
## 1220
             5
                    4
                                2.82380 #
                                                   9
                                                         9
                                                                 100
                                                                            100
##
        mean_Nsamp_in mean_Nsamp_adj mean_Nsamp_DM DM_theta mean_effN HarMean_effN
```

```
## 1217
                  100
                                  100
                                                 NA
                                                          NA 13999.400
                                                                            1010.040
## 1218
                  100
                                  100
                                                 NΑ
                                                          NA 14148.000
                                                                             827.159
## 1219
                  100
                                  100
                                                 NA
                                                              1525.270
                                                                            1122.660
## 1220
                  100
                                  100
                                                                708.151
                                                                             282.380
                                                 NA
                                                          NA
        Curr_Var_Adj Fleet_name
## 1217
                 1 MexCal S1
## 1218
                  1
                      MexCal S2
## 1219
                            PNW
                   1
## 1220
                   1 AT_Survey
##
## $SBzero
## [1] 78593.5
## $current_depletion
## [1] 0.2354641
##
## $last_years_SPR
## [1] 0.549216
## $SPRratioLabel
## [1] "1-SPR"
##
## $sigma_R_in
## [1] 0.5
##
## $sigma_R_info
##
              period N_devs SD_of_devs Var_of_devs mean_SE mean_SEsquared
## 1
                         20
                             1.610123
                                           2.592496
                                                          0
                                                                          0
                Main
## 2
                                                          0
                                                                          0
                         26
          Early+Main
                              1.435318
                                           2.060136
                              1.435318
                                                          0
## 3 Early+Main+Late
                         26
                                           2.060136
     sqrt_sum_of_components SD_of_devs_over_sigma_R sqrt_sum_over_sigma_R
## 1
                   1.610123
                                            3.220246
                                                                   3.220246
## 2
                   1.435318
                                                                   2.870635
                                            2.870635
## 3
                   1.435318
                                            2.870635
                                                                   2.870635
##
   alternative_sigma_R
## 1
               1.610123
## 2
                1.435318
## 3
                1.435318
##
## $rmse_table
       ERA N
                  RMSE RMSE over sigmaR mean BiasAdj
## 1 main 20 1.569350
                                9.85148
                                             0.841539
## 2 early 6 0.617053
                                1.52302
                                             0.766330
## completed SS_output
compNoFore2019 <- SSsummarize(list(OM2019 = outOMnofore,</pre>
                                    EMssmse2019 = outEMssmse2019,
                                    EMnofore2019 = outEMnofore2019))
## Summarizing 3 models:
```

112

imodel=1/3

```
##
    N active pars = 0
## imodel=2/3
##
     N active pars = 47
## imodel=3/3
    N active pars = 47
## Summary finished. To avoid printing details above, use 'verbose = FALSE'.
SSplotComparisons(compNoFore2019, legendlabels = c("OM", "SSMSE 2019", "Perf 2019"),
                  subplots = c(2,10, 12, 13, 14))
## Warning in SSplotComparisons(compNoFore2019, legendlabels = c("OM", "SSMSE
## 2019", : setting btarg = -999 because models don't have matching values
## Warning in SSplotComparisons(compNoFore2019, legendlabels = c("OM", "SSMSE
## 2019", : setting minbthresh = -999 because models don't have matching values
## Warning in SSplotComparisons(compNoFore2019, legendlabels = c("OM", "SSMSE
## 2019", : setting sprtarg = -999 because models don't have matching values
## Warning in SSplotComparisons(compNoFore2019, legendlabels = c("OM", "SSMSE
## 2019", : setting label for SPR plot to 8th element of input 'labels' because the
## models don't have matching labels
## Warning in SSplotComparisons(compNoFore2019, legendlabels = c("OM", "SSMSE
## 2019", : setting label for F plot to 13th element of input 'labels' because the
## models don't have matching labels
## showing uncertainty for all models
## No uncertainty available for model 1
## No uncertainty available for model 2
## subplot 2: spawning biomass with uncertainty intervals
## subplot 10: recruits with uncertainty
## subplot 12: recruit devs with uncertainty
## subplot 13: index fits
## subplot 14: index fits on a log scale
```

```
# plot comparisons
outEMnofore2020 <- SS_output(EMnofore2020_dir)</pre>
## Getting header info from:
    C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenarios/perfDatTests/constGrow20010M_MidSteepH
## This function tested on SS versions 3.24 and 3.30.
   You are using 3.30.18.00 which SHOULD work with this package.
## Report file time:Tue Jun 07 09:59:22 2022
## Reading full report file
## Got all columns using ncols = 62
## Got Report file
## Setting minimum biomass threshhold to 0.25 based on US west coast assumption associated with biomas
## !warning: temporary files were written in this run:
                          TempFile
## "size of file gradfil1.tmp = 0" "size of file gradfil2.tmp = 0"
                              < NA >
## "size of file varssave.tmp = 0" "size of file cmpdiff.tmp = 0"
## Got warning file. Therewere 16 warnings in C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenari
## Finished reading files
## CompReport file separated by this code as follows (rows = Ncomps*Nbins):
     2184 rows of length comp data,
##
    O rows of generalized size comp data,
##
    495 rows of age comp data,
##
    O rows of conditional age-at-length data,
    O rows of ghost fleet age comp data,
##
##
    O rows of ghost fleet conditional age-at-length data,
##
     351 rows of ghost fleet length comp data,
    0 rows of mean length at age data,
    O rows of mean weight at age data,
##
    0 rows of 'TAG1' comp data, and
    O rows of 'TAG2' comp data.
## Finished dimensioning
## Got covar file.
## Finished primary run statistics list
```

```
## running SS_readstarter
##
     data, control files: init_dat.ss, control.ss
##
     converge_criterion = 1e-05
##
     SPR_basis = 4
     F_report_basis = 2
##
## Assuming version 3.30 based on number of numeric values.
##
    MCMC_output_detail = 0
     ALK_tolerance = 1e-04
## Reading a random seed value:12546802
## Read of starter file complete. Final value: 3.3
##
## Statistics shown below (to turn off, change input to printstats=FALSE)
## $SS_version
## [1] "3.30.18.00; safe; compile_date: Sep 30 2021; Stock_Synthesis_by_Richard_Methot_(NOAA) using_ADM
##
## $SS_versionshort
## [1] "3.30"
## $SS_versionNumeric
## [1] 3.3
##
## $StartTime
## [1] "StartTime: Tue Jun 07 09:59:22 2022"
## $RunTime
## [1] "0 hours, 0 minutes, 47 seconds."
## $Files_used
## [1] "Data_File: init_dat.ss Control_File: control.ss"
##
## $Nwarnings
## [1] 16
##
## $warnings
## [1] "#V3.30.18.00; safe; compile_date: Sep 30 2021; Stock_Synthesis_by_Richard_Methot_(NOAA)_using_
## [2] "#_Stock_Synthesis_is_a_work_of_the_U.S._Government_and_is_not_subject_to_copyright_protection_
   [3] "#_Foreign_copyrights_may_apply._See_copyright.txt_for_more_information."
##
##
  [4] "#_User_support_available_at:NMFS.Stock.Synthesis@noaa.gov"
  [5] "#_User_info_available_at:https://vlab.noaa.gov/group/stock-synthesis"
   [6] "#_Source_code_at:_https://github.com/nmfs-stock-synthesis/stock-synthesis"
```

```
[7] ""
##
   [8] "This file contains warnings, suggestions and notes generated as files are read and processed"
##
   [9] ""
## [10] "1 catch is 0.0 in endyr; this can cause problem in the benchmark and forecast calculations"
## [11] "2 NOTE: Max data length bin: 28 < max pop len bins: 30; so will accumulate larger pop len bi
## [12] "3 settle_month is less than spawn_month, so logical age at settlement calculated to be: 1 for
## [13] "4 setting in starter does not request all priors, and 1 parameters have priors and are not est
## [14] "5 1st iteration warning: ssb(endyr)/ssb(styr)= 4.77067e-07; suggest start with larger R0 to ge
## [15] "6 setting positive forecast relF for forecast only fleet: 1"
## [16] "7 setting positive forecast relF for forecast only fleet: 2"
## [17] "8 setting positive forecast relF for forecast only fleet: 2"
## [18] "9 setting positive forecast relF for forecast only fleet: 3"
## [19] "10 setting positive forecast relF for forecast only fleet: 3"
  [20] "11 Final gradient: 5.08901e-05 is larger than final_conv: 1e-05"
## [21] "Note: 6 additional lines truncated. Look in warning.sso file to see full list."
##
## $likelihoods_used
##
                                        values lambdas
## TOTAL
                        161.941000000000002501
                                                    NΑ
## Catch
                          0.00000000000599152
                                                    NA
## Equil_catch
                          NΔ
## Survey
                        -48.280900000000002592
## Length_comp
                         76.38660000000001387
                                                    NΑ
## Age_comp
                         66.97339999999998045
## Recruitment
                         66.85980000000007003
                                                     1
## InitEQ_Regime
                          0.000000000000000000
## Forecast_Recruitment
                                                     1
## Parm_priors
                          0.000000000000000000
                                                     1
                          0.001928920000000000
## Parm_softbounds
                                                    NA
## Parm_devs
                          0.000000000000000000
                                                     1
## Crash_Pen
                          0.000000000000000000
                                                     1
##
## $likelihoods_laplace
                                        values lambdas
## NoBias corr Recruitment(info only) 63.6913
## Laplace_obj_fun(info_only)
                                      158.7720
                                                    NA
## $likelihoods_by_fleet
                                ALL
                                                  MexCal S2
                                                                    PNW AT Survey
##
                 Label
                                      MexCal S1
                                 NA 1.00000e+00 1.00000e+00 1.00000e+00
## 180
          Catch_lambda
                                                                           1.0000
                        5.99152e-13 1.38470e-13 1.26074e-13 3.34608e-13
## 181
            Catch like
                                                                           0.0000
## 182 Init equ lambda
                                 NA 0.00000e+00 0.00000e+00 0.00000e+00
                                                                           1.0000
## 183
         Init equ like
                        0.00000e+00 0.00000e+00 0.00000e+00 0.00000e+00
                                                                           0.0000
## 184
                                 NA 0.00000e+00 0.00000e+00 0.00000e+00
           Surv_lambda
                                                                           1.0000
## 185
             Surv_like -4.82809e+01 0.00000e+00 0.00000e+00 0.00000e+00
                                                                         -21.3348
## 186
                                 NA 0.00000e+00 0.00000e+00 0.00000e+00
            Surv_N_use
                                                                          19.0000
## 187
           Surv_N_skip
                                 NA 0.00000e+00 0.00000e+00 0.00000e+00
                                                                           0.0000
## 188
         Length_lambda
                                 NA 1.00000e+00 1.00000e+00 1.00000e+00
                                                                           1.0000
                        7.63866e+01 1.34910e+01 2.03074e+01 3.25584e+00
## 189
           Length_like
                                                                          39.3323
## 190
          Length_N_use
                                 NA 1.50000e+01 1.50000e+01 1.60000e+01
                                                                          10.0000
## 191
         Length_N_skip
                                 NA 0.00000e+00 0.00000e+00 9.00000e+00
                                                                           0.0000
## 192
            Age_lambda
                                 NA 1.00000e+00 1.00000e+00 1.00000e+00
                                                                           1.0000
              Age_like 6.69734e+01 6.91723e+00 2.77972e+01 3.93827e+00
## 193
                                                                          28.3207
## 194
             Age_N_use
                                 NA 1.50000e+01 1.50000e+01 1.50000e+01
                                                                          10.0000
```

```
## 195
                                  NA 0.00000e+00 0.00000e+00 0.00000e+00
                                                                              0.0000
            Age_N_skip
##
           DEPM TEP_all
## 180
         1.0000
                  1.0000
## 181
         0.0000
                  0.0000
##
  182
         1.0000
                  1.0000
## 183
         0.0000
                  0.0000
## 184
         1.0000
                  1.0000
## 185 -11.0418 -15.9043
## 186
        10.0000
                 13.0000
## 187
         0.0000
                  0.0000
##
  188
         0.0000
                  0.0000
##
  189
         0.0000
                  0.0000
## 190
         0.0000
                  0.0000
## 191
         0.0000
                  0.0000
## 192
         0.0000
                  0.0000
## 193
         0.0000
                  0.0000
## 194
         0.0000
                  0.0000
##
  195
         0.0000
                  0.0000
##
## $N_estimated_parameters
##
   [1] 48
##
##
  $table_of_phases
##
##
   -99
       -5
            -4
               -3
                    -2
                        -1
                              1
                                  2
                                      3
                                           4
                                               5
##
         1
             1
                10
                          2
                             21
                                  6
                                     16
                                               2
##
##
   $estimated_non_dev_parameters
##
                                      Value Phase
                                                      Min
                                                             Max
                                                                       Init Status
                                 12.8931000
                                                     3.00 30.00 12.8541000
## L_at_Amin_Fem_GP_1
                                                                                OK
## L_at_Amax_Fem_GP_1
                                 24.9354000
                                                    15.00 40.00 24.8415000
                                                                                OK
## VonBert_K_Fem_GP_1
                                  0.3042250
                                                 3
                                                     0.05
                                                           0.99
                                                                 0.3075730
                                                                                OK
## CV_young_Fem_GP_1
                                  0.1193310
                                                     0.05
                                                           0.50
                                                                  0.1053490
                                                                                OK
## CV_old_Fem_GP_1
                                                     0.01
                                                           0.10
                                                                                OK
                                  0.0209416
                                                                 0.0237245
## SR LN(RO)
                                                     3.00 25.00 14.4668000
                                                                                OK
                                 14.5863000
## SR_regime_BLK1repl_2000
                                  1.0969100
                                                 4 -15.00 15.00 1.2915300
                                                                                OK
## Size inflection MexCal S1(1) 10.8349000
                                                     0.00 30.00 10.9072000
                                                                                OK
## Size_95%width_MexCal_S1(1)
                                                     0.00 10.00 0.6599090
                                  0.6990270
                                                                                ΠK
## AgeSel_P1_MexCal_S1(1)
                                                 3 -10.00 11.00
                                  0.5000230
                                                                  0.5000240
                                                                                ΩK
## AgeSel_P2_MexCal_S1(1)
                                                 3 -10.00 11.00 0.2048810
                                                                                OK
                                  1.5290000
## AgeSel P3 MexCal S1(1)
                                  0.4116330
                                                 3 -10.00 15.00 0.3827920
                                                                                OK
## AgeSel_P4_MexCal_S1(1)
                                                 3 -10.00 11.00 -1.5494000
                                                                                OK
                                 -1.4946700
## AgeSel_P5_MexCal_S1(1)
                                 -0.2022500
                                                 3 -10.00 11.00 -0.2361890
                                                                                OK
## AgeSel_P2_MexCal_S2(2)
                                  0.8203030
                                                 3 -10.00 15.00 0.4405260
                                                                                OK
## AgeSel_P3_MexCal_S2(2)
                                 -1.2874400
                                                 3 -10.00 11.00 -1.1690800
                                                                                OK
                                                 3 -10.00 11.00 -0.1425740
## AgeSel_P4_MexCal_S2(2)
                                  0.1509360
                                                                                OK
## AgeSel_P5_MexCal_S2(2)
                                 -0.6268860
                                                 3 -10.00 11.00 -0.4707320
                                                                                OK
## Age_inflection_PNW(3)
                                  2.8579400
                                                     0.00 10.00 2.8525100
                                                                                OK
  Age_95%width_PNW(3)
                                  1.1550600
                                                    -5.00 15.00 1.2152300
                                                                                OK
##
                                   Parm_StDev
                                                        Gradient Pr_type Prior
## L_at_Amin_Fem_GP_1
                                                0.00000239140000 No_prior
                                   0.06393300
                                                                              NA
## L_at_Amax_Fem_GP_1
                                   0.11909000
                                                0.00000523951000 No prior
## VonBert_K_Fem_GP_1
                                                0.00000603161000 No_prior
                                   0.00735414
                                                                              NA
## CV_young_Fem_GP_1
                                   0.00265329 -0.00000286378000 No_prior
```

```
## CV_old_Fem_GP_1
                                  0.00255814  0.00000013430100 No prior
                                                                           NA
## SR LN(RO)
                                  NΑ
## SR_regime_BLK1repl_2000
                                  0.08014820
                                              0.00000403482000 No prior
                                                                           NA
## Size_inflection_MexCal_S1(1)
                                  0.06619320
                                              0.00000165727000 No_prior
                                                                           NΑ
## Size_95%width_MexCal_S1(1)
                                  0.06971070 -0.00000070302800 No_prior
                                                                           NΑ
## AgeSel P1 MexCal S1(1)
                                234.78400000 0.00000000679385 No prior
                                                                           NA
## AgeSel P2 MexCal S1(1)
                                  0.13865400 -0.00000366784000 No_prior
                                                                           NA
## AgeSel_P3_MexCal_S1(1)
                                  0.08707730  0.00000404619000 No prior
                                                                           NA
## AgeSel_P4_MexCal_S1(1)
                                  0.17247300 -0.00000249066000 No_prior
                                                                           NA
## AgeSel_P5_MexCal_S1(1)
                                  0.20322600 -0.00000069336300 No_prior
                                                                           NA
## AgeSel_P2_MexCal_S2(2)
                                  0.07585290 -0.00000297140000 No_prior
                                                                           NA
## AgeSel_P3_MexCal_S2(2)
                                  0.15192900 -0.00000560017000 No_prior
                                                                           NA
## AgeSel_P4_MexCal_S2(2)
                                  0.22678200 -0.00000768801000 No_prior
                                                                           NA
## AgeSel_P5_MexCal_S2(2)
                                  0.23053000 -0.00000470461000 No_prior
                                                                           NA
## Age_inflection_PNW(3)
                                  NΑ
## Age_95%width_PNW(3)
                                  0.04485290 -0.00000448727000 No_prior
##
                                Pr_SD Pr_Like Afterbound
## L_at_Amin_Fem_GP_1
                                           NΑ
                                                      ΠK
## L_at_Amax_Fem_GP_1
                                   NΑ
## VonBert_K_Fem_GP_1
                                           NA
                                                      OK
## CV_young_Fem_GP_1
                                           NA
                                                      OK
## CV_old_Fem_GP_1
                                           NΑ
                                                      ΩK
## SR_LN(RO)
                                   NΑ
                                           NΑ
                                                      OK
## SR_regime_BLK1repl_2000
                                           NΑ
                                                      OK
## Size_inflection_MexCal_S1(1)
                                           NΑ
                                                      OK
## Size_95%width_MexCal_S1(1)
                                   NA
                                           NA
                                                      OK
## AgeSel_P1_MexCal_S1(1)
                                   NA
                                           NA
                                                      OK
## AgeSel_P2_MexCal_S1(1)
                                   NA
                                           NA
                                                      OK
## AgeSel_P3_MexCal_S1(1)
                                   NA
                                           NA
                                                      OK
## AgeSel_P4_MexCal_S1(1)
                                           NA
                                                      OK
                                   NA
## AgeSel_P5_MexCal_S1(1)
                                   NA
                                           NA
                                                      OK
## AgeSel_P2_MexCal_S2(2)
                                   NΑ
                                           NΑ
                                                      OK
## AgeSel_P3_MexCal_S2(2)
                                   NA
                                           NA
                                                      OK
## AgeSel_P4_MexCal_S2(2)
                                   NA
                                           NA
                                                      OK
## AgeSel_P5_MexCal_S2(2)
                                                      OK
## Age_inflection_PNW(3)
                                   NΑ
                                           NΑ
                                                      ΩK
## Age_95%width_PNW(3)
                                                      OK
##
## $log_det_hessian
  [1] 233.889
##
## $maximum_gradient_component
##
   [1] 5.08901e-05
##
  $parameters_with_highest_gradients
##
                              Value
                                        Gradient
## SR_LN(RO)
                          14.586300 5.08899e-05
## Main_RecrDev_2018
                          -1.064180 -8.09886e-06
## AgeSel_P4_MexCal_S2(2)
                          0.150936 -7.68801e-06
## Main_RecrDev_2016
                          -0.510400 -6.53673e-06
##
  VonBert_K_Fem_GP_1
                           0.304225 6.03161e-06
##
## $Length_Comp_Fit_Summary
##
        Factor Fleet Recommend_var_adj # N Npos min_Nsamp max_Nsamp mean_Nsamp_in
```

```
## 1187
             4
                   1
                              6.251470 # 15
                                               15
                                                          6
                                                                 1000
                                                                            97.0853
## 1188
             4
                   2
                              7.312770 # 15
                                               15
                                                          9
                                                                 1000
                                                                           122.0320
## 1189
                   3
             4
                             55.611200 # 25
                                               16
                                                          1
                                                                 1000
                                                                           143.8350
                   4
                              0.137046 # 10
                                                                 1000
## 1190
             4
                                               10
                                                         12
                                                                           117.9000
       mean_Nsamp_adj mean_Nsamp_DM DM_theta mean_effN HarMean_effN Curr_Var_Adj
## 1187
              97.0853
                                  NA
                                           NA 2256.480
                                                             606.9260
## 1188
              122.0320
                                  NA
                                           NA 1798.830
                                                             892.3920
                                                                                  1
                                           NA 16878.900
## 1189
              143.8350
                                  NA
                                                            7998.8400
                                                                                  1
## 1190
              117.9000
                                  NA
                                                 198.749
                                                              16.1578
                                                                                  1
##
        Fleet_name
## 1187 MexCal_S1
## 1188
        MexCal S2
## 1189
               PNW
## 1190 AT_Survey
##
## $Age_Comp_Fit_Summary
##
       Factor Fleet Recommend_var_adj # Nsamp_adj Npos min_Nsamp max_Nsamp
## 1252
             5
                1
                      1.182250 #
                                                15
                                                     15
                                                              5.92
## 1253
             5
                   2
                              0.579745 #
                                                 15
                                                      15
                                                              8.92
                                                                        1000
## 1254
                   3
             5
                             12.015400 #
                                                 15
                                                      15
                                                             26.88
                                                                        1000
## 1255
             5
                   4
                              0.127174 #
                                                 10
                                                      10
                                                             12.00
                                                                        1000
       mean_Nsamp_in mean_Nsamp_adj mean_Nsamp_DM DM_theta mean_effN HarMean_effN
               95.664
                             95.664
                                                NA
                                                          NA
                                                               768.824
## 1252
                                                                           113.0980
## 1253
              121.093
                             121.093
                                                NA
                                                          NA
                                                               202.334
                                                                            70.2032
## 1254
                                                          NA 3565.740
              137.877
                             137.877
                                                NA
                                                                          1656.6500
## 1255
              117.900
                             117.900
                                                NA
                                                          NA
                                                               240.866
                                                                            14.9938
       Curr_Var_Adj Fleet_name
## 1252
                   1 MexCal_S1
## 1253
                   1 MexCal_S2
## 1254
                   1
                            PNW
## 1255
                   1 AT_Survey
##
## $SBzero
## [1] 92465.5
## $current depletion
## [1] 0.2173292
##
## $last_years_SPR
## [1] 1
##
## $SPRratioLabel
## [1] "1-SPR"
##
## $sigma_R_in
## [1] 0.5
##
## $sigma_R_info
##
              period N_devs SD_of_devs Var_of_devs mean_SE mean_SEsquared
## 1
                         20
                             1.432984
                                          2.053443 0.1001396
                                                                  0.01182879
## 2
          Early+Main
                         26
                              1.278190
                                          1.633770 0.1285671
                                                                  0.02253679
                         27
                              1.253376
                                          1.570950 0.1423239
## 3 Early+Main+Late
                                                                  0.03096135
     sqrt_sum_of_components SD_of_devs_over_sigma_R sqrt_sum_over_sigma_R
## 1
                   1.437105
                                           2.865968
                                                                  2.874211
```

```
## 2
                  1.286976
                                           2.556380
                                                                 2.573952
## 3
                  1.265666
                                           2.506751
                                                                 2.531333
   alternative_sigma_R
## 1
               1.437105
## 2
               1.286976
## 3
               1.265666
## $rmse_table
      ERA N
                 RMSE RMSE_over_sigmaR mean_BiasAdj
                               7.80308
## 1 main 20 1.396700
                                            0.841539
## 2 early 6 0.553946
                               1.22742
                                            0.766330
## $cormessage1
## [1] Range of abs(parameter correlations) is 0 to 0.83492
## $cormessage2
## [1] No correlations above threshold (cormax=0.95)
## $cormessage7
## [1] 2 uncorrelated parameters below threshold (cormin=0.01)
## $cormessage8
##
                        name max
## 27
        Late RecrDev 2020
## 30 AgeSel_P1_MexCal_S1(1)
## completed SS_output
EMssmse2020_dir <- "C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenarios/perfDatTests/constGrow2
outEMssmse2020 <- SS_output(EMssmse2020_dir)</pre>
## Getting header info from:
    C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenarios/perfDatTests/constGrow20010M_MidSteepH
\#\# This function tested on SS versions 3.24 and 3.30.
   You are using 3.30.18.00 which SHOULD work with this package.
## Report file time:Mon Jun 06 16:58:45 2022
## Warning in SS_output(EMssmse2020_dir): Some stats skipped because the .cor file not found:C:/Users/r
## Warning in SS_output(EMssmse2020_dir): covar file contains the warning
##
        'Variances are 0.0 for first two elements, so do not write '
     input 'covar' changed to FALSE.
## Reading full report file
## Got all columns using ncols = 62
## Got Report file
```

```
## Setting minimum biomass threshhold to 0.25 based on US west coast assumption associated with biomas
## !warning: temporary files were written in this run:
##
                          TempFile
                                                               Size
## "size of file gradfil1.tmp = 0" "size of file gradfil2.tmp = 0"
                              <NA>
## "size of file varssave.tmp = 0" "size of file cmpdiff.tmp = 0"
## Got warning file. Therewere 11 warnings in C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenari
## Finished reading files
## CompReport file separated by this code as follows (rows = Ncomps*Nbins):
     2184 rows of length comp data,
##
##
    0 rows of generalized size comp data,
    495 rows of age comp data,
##
##
    O rows of conditional age-at-length data,
    O rows of ghost fleet age comp data,
##
    O rows of ghost fleet conditional age-at-length data,
    351 rows of ghost fleet length comp data,
##
    0 rows of mean length at age data,
##
##
    0 rows of mean weight at age data,
    O rows of 'TAG1' comp data, and
    O rows of 'TAG2' comp data.
##
## Finished dimensioning
## You skipped the covar file
## Finished primary run statistics list
## running SS_readstarter
##
     data, control files: init_dat.ss, control.ss
     converge_criterion = 1e-05
##
     SPR_basis = 4
##
##
     F_report_basis = 2
## Assuming version 3.30 based on number of numeric values.
    MCMC_output_detail = 0
##
     ALK_tolerance = 1e-04
## Reading a random seed value:12546802
```

```
## Read of starter file complete. Final value: 3.3
## Statistics shown below (to turn off, change input to printstats=FALSE)
## $SS_version
## [1] "3.30.18.00; safe; compile date: Sep 30 2021; Stock Synthesis by Richard Methot (NOAA) using ADM
## $SS_versionshort
## [1] "3.30"
##
## $SS_versionNumeric
## [1] 3.3
##
## $StartTime
## [1] "StartTime: Mon Jun 06 16:58:45 2022"
## $RunTime
## [1] "0 hours, 0 minutes, 10 seconds."
## $Files_used
## [1] "Data_File: init_dat.ss Control_File: control.ss"
## $Nwarnings
## [1] 11
##
## $warnings
   [1] "#V3.30.18.00; safe; compile_date: Sep 30 2021; Stock_Synthesis_by_Richard_Methot_(NOAA)_using_
   [2] "#_Stock_Synthesis_is_a_work_of_the_U.S._Government_and_is_not_subject_to_copyright_protection_
   [3] "#_Foreign_copyrights_may_apply._See_copyright.txt_for_more_information."
   [4] "#_User_support_available_at:NMFS.Stock.Synthesis@noaa.gov"
   [5] "#_User_info_available_at:https://vlab.noaa.gov/group/stock-synthesis"
  [6] "#_Source_code_at:_https://github.com/nmfs-stock-synthesis/stock-synthesis"
##
  [7] ""
##
## [8] "This file contains warnings, suggestions and notes generated as files are read and processed"
   [9] ""
## [10] "1 catch is 0.0 in endyr; this can cause problem in the benchmark and forecast calculations"
## [11] "2 NOTE: Max data length bin: 28 < max pop len bins: 30; so will accumulate larger pop len bi
## [12] "3 settle_month is less than spawn_month, so logical age at settlement calculated to be: 1 for
## [13] "4 setting in starter does not request all priors, and 1 parameters have priors and are not est
## [14] "5 1st iteration warning: ssb(endyr)/ssb(styr)= 4.77067e-07; suggest start with larger R0 to ge
## [15] "6 Final gradient: 1.24879e-05 is larger than final_conv: 1e-05"
## [16] "7 setting positive forecast relF for forecast only fleet: 1"
## [17] "8 setting positive forecast relF for forecast only fleet: 2"
## [18] "9 setting positive forecast relF for forecast only fleet: 2"
## [19] "10 setting positive forecast relF for forecast only fleet: 3"
## [20] "11 setting positive forecast relF for forecast only fleet: 3"
## [21] "Note: 1 additional lines truncated. Look in warning.sso file to see full list."
## $likelihoods_used
                                        values lambdas
##
## TOTAL
                        944.76499999999986358
                                                    MΔ
## Catch
                          0.00000000000608191
                                                    NΑ
```

NΑ

0.000000000000000000

Equil_catch

```
## Survey
                         -33.27949999999998749
                                                      NA
                                                      NΑ
## Length_comp
                        771.442000000000007276
## Age comp
                         113.251000000000004775
                                                      NA
## Recruitment
                          93.34959999999995248
                                                       1
## InitEQ Regime
                           0.000000000000000000
                                                       0
## Forecast Recruitment
                           0.00000000000000000
                                                       1
## Parm_priors
                           0.000000000000000000
                                                       1
## Parm softbounds
                           0.001895880000000000
                                                      NA
  Parm devs
                           1
                           0.000000000000000000
  Crash_Pen
                                                       1
##
##
   $likelihoods_laplace
##
                                         values lambdas
## NoBias_corr_Recruitment(info_only)
                                        90.1811
                                                       1
  Laplace_obj_fun(info_only)
                                       941.5960
                                                      NA
##
##
  $likelihoods_by_fleet
##
                 Label
                                 ALL
                                       MexCal S1
                                                    MexCal S2
                                                                      PNW AT Survey
                                  NA 1.00000e+00 1.00000e+00 1.00000e+00
## 180
          Catch lambda
                                                                              1.0000
##
  181
            Catch like
                         6.08191e-13 1.53679e-13 1.37784e-13 3.16728e-13
                                                                              0.0000
##
  182 Init_equ_lambda
                                  NA 0.00000e+00 0.00000e+00 0.00000e+00
                                                                              1.0000
## 183
         Init equ like
                         0.00000e+00 0.00000e+00 0.00000e+00 0.00000e+00
                                                                              0.0000
           Surv_lambda
                                  NA 0.00000e+00 0.00000e+00 0.00000e+00
## 184
                                                                              1.0000
             Surv like -3.32795e+01 0.00000e+00 0.00000e+00 0.00000e+00
## 185
                                                                            -11.5640
## 186
            Surv N use
                                  NA 0.00000e+00 0.00000e+00 0.00000e+00
                                                                             19.0000
## 187
           Surv_N_skip
                                  NA 0.00000e+00 0.00000e+00 0.00000e+00
                                                                              0.0000
## 188
                                  NA 1.00000e+00 1.00000e+00 1.00000e+00
         Length_lambda
                                                                              1.0000
##
  189
           Length_like
                        7.71442e+02 2.21935e+02 2.17655e+02 1.72514e+02
                                                                           159.3380
## 190
                                  NA 1.50000e+01 1.50000e+01 1.60000e+01
          Length_N_use
                                                                             10.0000
## 191
         Length_N_skip
                                  NA 0.00000e+00 0.00000e+00 9.00000e+00
                                                                              0.0000
## 192
            Age_lambda
                                  NA 1.00000e+00 1.00000e+00 1.00000e+00
                                                                              1.0000
## 193
              Age_like
                        1.13251e+02 2.49472e+01 4.15343e+01 1.02819e+01
                                                                             36.4875
             Age_N_use
  194
                                  NA 1.50000e+01 1.50000e+01 1.50000e+01
                                                                             10.0000
                                  NA 0.00000e+00 0.00000e+00 0.00000e+00
##
  195
                                                                              0.0000
            Age_N_skip
##
           DEPM
                 TEP all
## 180
        1.00000
                  1.0000
  181
        0.00000
                  0.0000
## 182
        1.00000
                  1.0000
## 183
        0.00000
                  0.0000
## 184
        1.00000
                  1.0000
  185 -7.37638
                -14.3391
  186 10.00000
                 13.0000
##
##
  187
        0.00000
                  0.0000
##
  188
        0.00000
                  0.0000
## 189
        0.00000
                  0.0000
## 190
        0.00000
                  0.0000
##
  191
        0.00000
                  0.0000
##
  192
        0.00000
                  0.0000
  193
        0.00000
                  0.0000
##
  194
        0.00000
                  0.0000
##
  195
        0.00000
                  0.0000
##
## $N_estimated_parameters
## [1] 48
```

```
##
##
   $table_of_phases
##
                                               5
##
   -99
        -5
            -4
                -3
                     -2
                         -1
                              1
                                   2
                                       3
                                           4
##
                10
                          2
                                   6
                                      16
                                           3
                                               2
##
##
   $estimated_non_dev_parameters
##
                                       Value Phase
                                                      Min
                                                             Max
                                                                       Init Status
                                 12.9188000
                                                 3
                                                     3.00 30.00 12.8541000
                                                                                 OK
## L_at_Amin_Fem_GP_1
  L_at_Amax_Fem_GP_1
                                 24.7845000
                                                    15.00 40.00 24.8415000
                                                                                 OK
## VonBert_K_Fem_GP_1
                                  0.3077450
                                                     0.05
                                                            0.99
                                                                  0.3075730
                                                                                 OK
  CV_young_Fem_GP_1
                                   0.1185600
                                                     0.05
                                                            0.50
                                                                  0.1053490
                                                                                 OK
## CV_old_Fem_GP_1
                                                 3
                                  0.0218696
                                                     0.01
                                                            0.10
                                                                  0.0237245
                                                                                 OK
## SR_LN(RO)
                                 14.4351000
                                                     3.00 25.00 14.4668000
                                                                                 OK
## SR_regime_BLK1repl_2000
                                   1.2445900
                                                 4 -15.00 15.00
                                                                 1.2915300
                                                                                 OK
## Size_inflection_MexCal_S1(1) 10.8461000
                                                     0.00 30.00 10.9072000
                                                                                 OK
## Size_95%width_MexCal_S1(1)
                                                                                 OK
                                   0.7327170
                                                     0.00 10.00
                                                                  0.6599090
## AgeSel P1 MexCal S1(1)
                                                 3 -10.00 11.00
                                   0.5000220
                                                                  0.5000240
                                                                                 OK
## AgeSel_P2_MexCal_S1(1)
                                                 3 -10.00 11.00
                                                                                 OK
                                   1.4981200
                                                                  0.2048810
## AgeSel_P3_MexCal_S1(1)
                                  0.3348340
                                                 3 -10.00 15.00
                                                                  0.3827920
                                                                                 OK
## AgeSel_P4_MexCal_S1(1)
                                                 3 -10.00 11.00 -1.5494000
                                                                                 OK
                                 -1.5724700
## AgeSel_P5_MexCal_S1(1)
                                 -0.1900890
                                                 3 -10.00 11.00 -0.2361890
                                                                                 ΩK
## AgeSel_P2_MexCal_S2(2)
                                                 3 -10.00 15.00 0.4405260
                                                                                 OK
                                  0.7533250
## AgeSel_P3_MexCal_S2(2)
                                 -1.1646100
                                                 3 -10.00 11.00 -1.1690800
                                                                                 OK
## AgeSel_P4_MexCal_S2(2)
                                 -0.1740880
                                                 3 -10.00 11.00 -0.1425740
                                                                                 OK
## AgeSel_P5_MexCal_S2(2)
                                 -0.4944460
                                                 3 -10.00 11.00 -0.4707320
                                                                                 OK
                                                                                 OK
## Age_inflection_PNW(3)
                                   2.8219500
                                                     0.00 10.00
                                                                  2.8525100
##
   Age_95%width_PNW(3)
                                   1.1461700
                                                    -5.00 15.00 1.2152300
                                                                                 OK
##
                                 Parm_StDev
                                                       Gradient Pr_type Prior Pr_SD
## L_at_Amin_Fem_GP_1
                                           0
                                              0.0000001238880 No_prior
                                                                             NA
                                                                                   NA
## L_at_Amax_Fem_GP_1
                                              0.00000214538000 No_prior
                                                                             NA
                                                                                   NA
## VonBert_K_Fem_GP_1
                                              0.00000115591000 No_prior
                                                                             NA
                                                                                   NA
## CV_young_Fem_GP_1
                                             -0.00000011495400 No_prior
                                                                             NA
                                                                                   NA
## CV_old_Fem_GP_1
                                              0.0000010543100 No_prior
                                                                             NA
                                                                                   ΝA
## SR LN(RO)
                                              0.00001248790000 No prior
                                                                             NA
                                                                                   NA
## SR_regime_BLK1repl_2000
                                              0.00000140432000 No_prior
                                                                             NA
                                                                                   NA
## Size inflection MexCal S1(1)
                                              0.00000254499000 No prior
                                                                             NΑ
                                                                                   NΑ
## Size_95%width_MexCal_S1(1)
                                             -0.00000016337300 No_prior
                                                                             NA
                                                                                   NA
## AgeSel_P1_MexCal_S1(1)
                                              0.0000000658736 No_prior
                                                                             NA
                                                                                   NA
## AgeSel_P2_MexCal_S1(1)
                                              0.00000137300000 No_prior
                                                                             NA
                                                                                   NA
## AgeSel P3 MexCal S1(1)
                                              0.00000146040000 No_prior
                                                                             NA
                                                                                   NA
## AgeSel_P4_MexCal_S1(1)
                                           0
                                              0.00000053827800 No prior
                                                                             NA
                                                                                   ΝA
                                              0.00000020581200 No_prior
## AgeSel_P5_MexCal_S1(1)
                                           0
                                                                             NA
                                                                                   NA
                                                                             NA
## AgeSel_P2_MexCal_S2(2)
                                              0.00000067622900 No_prior
                                                                                   ΝA
## AgeSel_P3_MexCal_S2(2)
                                              0.00000060302600 No_prior
                                                                             NA
                                                                                   NA
                                           0
## AgeSel_P4_MexCal_S2(2)
                                           0
                                              0.00000050171200 No_prior
                                                                             NA
                                                                                   ΝA
## AgeSel_P5_MexCal_S2(2)
                                              0.00000025707100 No_prior
                                                                             NA
                                                                                   NΑ
## Age_inflection_PNW(3)
                                             -0.00000007495750 No_prior
                                                                             NA
                                                                                   NA
   Age_95%width_PNW(3)
                                           0 -0.00000014256600 No_prior
                                                                             NA
                                                                                   NA
##
                                 Pr_Like Afterbound
## L_at_Amin_Fem_GP_1
                                                  OK
                                       NA
## L_at_Amax_Fem_GP_1
                                       NA
                                                  OK
## VonBert_K_Fem_GP_1
                                                  OK
                                       NA
## CV_young_Fem_GP_1
                                                  OK
```

```
## CV_old_Fem_GP_1
                                       NA
                                                   OK
## SR LN(RO)
                                       NΑ
                                                   NΚ
## SR regime BLK1repl 2000
                                       NA
                                                   OK
## Size_inflection_MexCal_S1(1)
                                                   OK
                                       NΑ
## Size_95%width_MexCal_S1(1)
                                       NΑ
                                                   OK
## AgeSel P1 MexCal S1(1)
                                       NA
                                                   OK
## AgeSel P2 MexCal S1(1)
                                       NA
                                                   OK
## AgeSel_P3_MexCal_S1(1)
                                       NA
                                                   OK
## AgeSel_P4_MexCal_S1(1)
                                       NA
                                                   OK
## AgeSel_P5_MexCal_S1(1)
                                       NA
                                                   OK
## AgeSel_P2_MexCal_S2(2)
                                       NA
                                                   OK
## AgeSel_P3_MexCal_S2(2)
                                       NA
                                                   OK
## AgeSel_P4_MexCal_S2(2)
                                       NA
                                                   OK
## AgeSel_P5_MexCal_S2(2)
                                       NA
                                                   OK
## Age_inflection_PNW(3)
                                                   OK
                                       NΑ
## Age_95%width_PNW(3)
                                       NA
                                                   OK
##
## $maximum_gradient_component
  [1] 1.24879e-05
##
##
  $parameters_with_highest_gradients
                                      Value
## SR_LN(RO)
                                  14.435100 1.24879e-05
## Size inflection MexCal S1(1) 10.846100 2.54499e-06
## L_at_Amax_Fem_GP_1
                                 24.784500 2.14538e-06
## AgeSel_P3_MexCal_S1(1)
                                   0.334834 1.46040e-06
## SR_regime_BLK1repl_2000
                                   1.244590 1.40432e-06
## $Length_Comp_Fit_Summary
##
        Factor Fleet Recommend_var_adj # N Npos min_Nsamp max_Nsamp mean_Nsamp_in
## 1187
             4
                    1
                              0.1935150 # 15
                                                 15
                                                            6
                                                                    1000
                                                                                 96.800
## 1188
             4
                    2
                              0.3188630 # 15
                                                 15
                                                            9
                                                                    1000
                                                                                121.733
                    3
## 1189
                              0.0812390 # 25
                                                 16
                                                            1
                                                                    1000
                                                                                143.438
                    4
                                                 10
                                                                    1000
## 1190
             4
                              0.0946217 # 10
                                                           12
                                                                               117.900
        mean_Nsamp_adj mean_Nsamp_DM DM_theta mean_effN HarMean_effN Curr_Var_Adj
                                                   75.5652
                                    NA
## 1187
                96.800
                                             NA
                                                                 18.7323
## 1188
                121.733
                                    NA
                                             NA
                                                   85.9834
                                                                 38.8162
                                                                                     1
## 1189
                143.438
                                    NA
                                                 163.5230
                                                                 11.6527
                                             NΑ
                                                                                     1
                117.900
                                                   19.1287
## 1190
                                    NA
                                                                 11.1559
##
        Fleet_name
## 1187
         MexCal S1
## 1188
         MexCal S2
## 1189
               PNW
##
  1190
         AT_Survey
## $Age_Comp_Fit_Summary
##
        Factor Fleet Recommend_var_adj # Nsamp_adj Npos min_Nsamp max_Nsamp
## 1252
             5
                    1
                               0.931461 #
                                                   15
                                                        15
                                                                  100
                                                                           1000
## 1253
             5
                    2
                               0.595226 #
                                                   15
                                                        15
                                                                  100
                                                                           1000
                    3
## 1254
             5
                               5.661630 #
                                                   15
                                                        15
                                                                  100
                                                                           1000
   1255
                    4
                               0.665768 #
                                                        10
                                                                  100
##
             5
                                                   10
                                                                           1000
##
        mean Nsamp in mean Nsamp adj mean Nsamp DM DM theta mean effN HarMean effN
## 1252
                   160
                                   160
                                                   NA
                                                            NA
                                                                1253.630
                                                                               149.0340
## 1253
                   160
                                   160
                                                   NA
                                                            NA
                                                                  320.289
                                                                               95.2361
```

```
## 1254
                  160
                                  160
                                                 NA
                                                          NA 1223.070
                                                                           905.8610
## 1255
                  190
                                  190
                                                 NΑ
                                                          NΑ
                                                               363.944
                                                                           126.4960
       Curr_Var_Adj Fleet_name
                 1 MexCal_S1
## 1252
## 1253
                  1 MexCal_S2
## 1254
                            PNW
                  1
## 1255
                  1 AT_Survey
##
## $SBzero
## [1] 79222
## $current_depletion
## [1] 0.2388125
##
## $last_years_SPR
## [1] 1
##
## $SPRratioLabel
## [1] "1-SPR"
## $sigma_R_in
## [1] 0.5
##
## $sigma R info
              period N_devs SD_of_devs Var_of_devs mean_SE mean_SEsquared
## 1
               Main
                         20
                             1.649686
                                           2.721464
                                                          0
                                                                         0
## 2
          Early+Main
                         26
                              1.470564
                                           2.162560
                                                          0
                                                                         0
                         27
                              1.442026
                                           2.079438
                                                          0
## 3 Early+Main+Late
     sqrt_sum_of_components SD_of_devs_over_sigma_R sqrt_sum_over_sigma_R
## 1
                                            3.299372
                   1.649686
                                                                  3.299372
## 2
                                            2.941129
                   1.470564
                                                                  2.941129
## 3
                   1.442026
                                            2.884051
                                                                  2.884051
   alternative_sigma_R
## 1
                1.649686
## 2
                1.470564
## 3
                1.442026
##
## $rmse_table
       ERA N
                  RMSE RMSE_over_sigmaR mean_BiasAdj
## 1 main 20 1.607920
                               10.34160
                                            0.841539
## 2 early 6 0.631615
                               1.59575
                                             0.766330
## completed SS_output
compNoFore2020 <- SSsummarize(list(OM2020 = outOMnofore,</pre>
                                   EMssmse2020 = outEMssmse2020,
                                    EMnofore2020 = outEMnofore2020))
## Summarizing 3 models:
## imodel=1/3
     N active pars = 0
```

```
## imodel=2/3
     N active pars = 48
## imodel=3/3
    N active pars = 48
##
## Summary finished. To avoid printing details above, use 'verbose = FALSE'.
SSplotComparisons(compNoFore2020, legendlabels = c("OM", "SSMSE 2020", "Perf 2020"),
                  subplots = c(2,10, 12, 13, 14))
## Warning in SSplotComparisons(compNoFore2020, legendlabels = c("OM", "SSMSE
## 2020", : setting btarg = -999 because models don't have matching values
## Warning in SSplotComparisons(compNoFore2020, legendlabels = c("OM", "SSMSE
## 2020", : setting minbthresh = -999 because models don't have matching values
## Warning in SSplotComparisons(compNoFore2020, legendlabels = c("OM", "SSMSE
## 2020", : setting sprtarg = -999 because models don't have matching values
## Warning in SSplotComparisons(compNoFore2020, legendlabels = c("OM", "SSMSE
## 2020", : setting label for SPR plot to 8th element of input 'labels' because the
## models don't have matching labels
## Warning in SSplotComparisons(compNoFore2020, legendlabels = c("OM", "SSMSE
## 2020", : setting label for F plot to 13th element of input 'labels' because the
## models don't have matching labels
## showing uncertainty for all models
## No uncertainty available for model 1
## No uncertainty available for model 2
## subplot 2: spawning biomass with uncertainty intervals
## subplot 10: recruits with uncertainty
## subplot 12: recruit devs with uncertainty
## subplot 13: index fits
## subplot 14: index fits on a log scale
```

5-yr average recruits w/ forecast HCR application

```
# 5 yr recruits w/ forecast 2019 assessment
OM5yr_dir <- "C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenarios/perfDatTests/constGrow20010M_
datOM5yr <- SS_readdat(file.path(OM5yr_dir, "data.ss_new"),</pre>
                    verbose = FALSE,
                    section = 2)
EM5yr2019_dir <- "C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenarios/perfDatTests/constGrow200
datEM5yr2019 <- SS_readdat(file.path(EM5yr2019_dir, "init_dat.ss"),</pre>
                    verbose = FALSE,
                    section = 1)
datEM5yr2019$catch <- datOM5yr$catch %>% filter(year <= 2019)</pre>
datEM5yr2019$CPUE <- datOM5yr$CPUE %>% filter(year <= 2019) %>%
  mutate(index = abs(index))
datEM5yr2019$lencomp <- datOM5yr$lencomp %>% filter(Yr <= 2019) %>%
  mutate(FltSvy = case_when(FltSvy == -3 & Seas == 10 ~ FltSvy,
                            TRUE ~ abs(FltSvy)))
datEM5yr2019$agecomp <- datOM5yr$agecomp %>% filter(Yr <= 2019) %>%
  mutate(FltSvy = abs(FltSvy))
SS_writedat(datlist = datEM5yr2019,
            outfile = file.path(file.path(EM5yr2019_dir, "init_dat.ss")),
            overwrite = TRUE,
            verbose = FALSE)
# 5 yr recruits w/ forecast 2020 assessment
EM5yr2020_dir <- "C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenarios/perfDatTests/constGrow200
datEM5yr2020 <- SS_readdat(file.path(EM5yr2020_dir, "init_dat.ss"),</pre>
                    verbose = FALSE,
                    section = 1)
datEM5yr2020$catch <- datOM5yr$catch %>% filter(year <= 2020)</pre>
datEM5yr2020$CPUE <- datOM5yr$CPUE %>% filter(year <= 2020) %>%
  mutate(index = abs(index))
datEM5yr2020$lencomp <- datOM5yr$lencomp %>% filter(Yr <= 2020) %>%
  mutate(FltSvy = case_when(FltSvy == -3 & Seas == 10 ~ FltSvy,
                            TRUE ~ abs(FltSvy)))
datEM5yr2020$agecomp <- dat0M5yr$agecomp %>% filter(Yr <= 2020) %>%
 mutate(FltSvy = abs(FltSvy))
SS_writedat(datlist = datEM5yr2020,
            outfile = file.path(file.path(EM5yr2020_dir, "init_dat.ss")),
            overwrite = TRUE,
            verbose = FALSE)
# now run SS in each perfDatTest folder
```

Read in output and compare against the OM

```
# plot comparisons
outOM5yr <- SS_output(OM5yr_dir)</pre>
## Getting header info from:
    C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenarios/perfDatTests/constGrow20010M_MidSteepH
\#\# This function tested on SS versions 3.24 and 3.30.
   You are using 3.30.18.00 which SHOULD work with this package.
## Report file time:Mon Jun 06 17:26:53 2022
## Warning in SS_output(OM5yr_dir): Some stats skipped because the .cor file not found:C:/Users/r.wilde
## Warning in SS_output(OM5yr_dir): covar file contains the warning
        'Variances are 0.0 for first two elements, so do not write '
     input 'covar' changed to FALSE.
##
## Reading full report file
## Got all columns using ncols = 62
## Got Report file
## !warning: temporary files were written in this run:
                          TempFile
## "size of file gradfil1.tmp = 0" "size of file gradfil2.tmp = 0"
                              < NA >
## "size of file varssave.tmp = 0" "size of file cmpdiff.tmp = 0"
## Got warning file. Therewere 4 warnings in C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenario
## Finished reading files
## CompReport file separated by this code as follows (rows = Ncomps*Nbins):
     2028 rows of length comp data,
##
    O rows of generalized size comp data,
##
    459 rows of age comp data,
    O rows of conditional age-at-length data,
##
##
     360 rows of ghost fleet age comp data,
    O rows of ghost fleet conditional age-at-length data,
##
    1911 rows of ghost fleet length comp data,
##
    0 rows of mean length at age data,
##
    O rows of mean weight at age data,
##
    O rows of 'TAG1' comp data, and
    O rows of 'TAG2' comp data.
## Finished dimensioning
```

You skipped the covar file

```
## Finished primary run statistics list
## Statistics shown below (to turn off, change input to printstats=FALSE)
## $SS_version
## [1] "3.30.18.00;_safe;_compile_date:_Sep 30 2021;_Stock_Synthesis_by_Richard_Methot_(NOAA)_using_ADM
## $SS_versionshort
## [1] "3.30"
##
## $SS_versionNumeric
## [1] 3.3
##
## $StartTime
## [1] "StartTime: Mon Jun 06 17:26:53 2022"
## $RunTime
## [1] "O hours, O minutes, O seconds."
##
## $Files_used
## [1] "Data_File: data.ss Control_File: control.ss"
## $Nwarnings
## [1] 4
##
## $warnings
   [1] "#V3.30.18.00; safe; compile_date: Sep 30 2021; Stock_Synthesis_by_Richard_Methot_(NOAA)_using_
   [2] "#_Stock_Synthesis_is_a_work_of_the_U.S._Government_and_is_not_subject_to_copyright_protection_
##
   [3] "#_Foreign_copyrights_may_apply._See_copyright.txt_for_more_information."
   [4] "#_User_support_available_at:NMFS.Stock.Synthesis@noaa.gov"
   [5] "#_User_info_available_at:https://vlab.noaa.gov/group/stock-synthesis"
## [6] "#_Source_code_at:_https://github.com/nmfs-stock-synthesis/stock-synthesis"
##
  [7] ""
## [8] "This file contains warnings, suggestions and notes generated as files are read and processed"
   [9] ""
## [10] "1 NOTE: Max data length bin: 28 < max pop len bins: 30; so will accumulate larger pop len bi
## [11] "2 Forecast=0 or -1, so rest of forecast file will not be read and can be omitted;"
## [12] "2 A one year forecast using recent F will be done automatically"
## [13] "3 settle_month is less than spawn_month, so logical age at settlement calculated to be: 1 for
## [14] "4 setting in starter does not request all priors, and 1 parameters have priors and are not est
## [15] "N warnings: 4"
## $likelihoods_used
##
                               values lambdas
## TOTAL
                        61581.0000000
                                           NΑ
## Catch
                        61416.9000000
                                           NA
## Equil_catch
                           0.0000000
                                           NA
## Survey
                          -28.0180000
                                           NA
                          41.9452000
## Length_comp
                                           NΔ
                           37.4688000
                                           NA
## Age_comp
## Recruitment
                           78.3199000
                                            1
## InitEQ_Regime
                           0.0000000
                                            0
```

1

34.3168000

Forecast_Recruitment

```
## Parm_priors
                              0.000000
                                               1
## Parm_softbounds
                                              NΑ
                              0.0019748
## Parm devs
                              0.000000
                                               1
  Crash_Pen
                                               1
##
                              0.000000
##
##
  $likelihoods_laplace
                                             values lambdas
##
## NoBias_corr_Recruitment(info_only)
                                            75.1513
                                                           1
## Laplace_obj_fun(info_only)
                                        61577.8000
                                                          NA
##
##
  $likelihoods_by_fleet
##
                                      MexCal_S1
                                                   MexCal_S2
                                                                       PNW AT_Survey
                  Label
                                ALL
## 185
          Catch_lambda
                                 NA
                                         1.00000
                                                      1.00000
                                                                  1.00000
                                                                             1.00000
                                    20767.40000 20955.40000 19694.10000
##
  186
            Catch_like 61416.9000
                                                                             0.00000
## 187 Init_equ_lambda
                                                                  0.00000
                                                                             1.00000
                                 NA
                                         0.00000
                                                     0.00000
## 188
         Init_equ_like
                             0.0000
                                         0.00000
                                                     0.00000
                                                                  0.00000
                                                                             0.00000
## 189
           Surv_lambda
                                        0.00000
                                                     0.00000
                                                                  0.00000
                                                                             1.00000
                                 NA
## 190
             Surv like
                           -28.0180
                                         0.00000
                                                     0.00000
                                                                  0.00000
                                                                            -9.94359
## 191
            Surv_N_use
                                 NA
                                        0.00000
                                                     0.00000
                                                                  0.00000
                                                                            18.00000
## 192
           Surv_N_skip
                                 NA
                                        0.00000
                                                     0.00000
                                                                  0.00000
                                                                            10.00000
## 193
         Length_lambda
                                 NA
                                         1.00000
                                                     1.00000
                                                                  1.00000
                                                                             1.00000
## 194
           Length_like
                            41.9452
                                        0.98456
                                                                  1.66827
                                                                            36.65790
                                                     2.63440
## 195
          Length_N_use
                                 NA
                                       14.00000
                                                    14.00000
                                                                 15.00000
                                                                             9.00000
## 196
         Length_N_skip
                                 NA
                                       10.00000
                                                    10.00000
                                                                 19.00000
                                                                            10.00000
## 197
            Age_lambda
                                 NA
                                        1.00000
                                                     1.00000
                                                                  1.00000
                                                                             1.00000
## 198
              Age_like
                            37.4688
                                        1.16795
                                                     3.26694
                                                                  3.16781
                                                                            29.86610
##
  199
              Age_N_use
                                       14.00000
                                                    14.00000
                                                                 14.00000
                                                                             9.00000
                                 NA
##
   200
            Age_N_skip
                                 NA
                                       10.00000
                                                    10.00000
                                                                 10.00000
                                                                            10.00000
           DEPM TEP_all
##
## 185
        1.00000
                   1.0000
##
   186
        0.00000
                   0.0000
##
  187
        1.00000
                   1.0000
  188
        0.00000
                   0.0000
##
  189
        1.00000
                   1.0000
   190
       -1.76351
                 -16.3109
## 191 10.00000
                  13.0000
## 192
        0.00000
                   0.0000
## 193
        0.00000
                   0.0000
## 194
        0.00000
                   0.0000
## 195
                   0.0000
        0.00000
  196
        0.00000
                   0.0000
##
  197
        0.00000
                   0.0000
##
  198
        0.00000
                   0.0000
  199
##
        0.00000
                   0.0000
        0.00000
                   0.0000
##
  200
##
## $N_estimated_parameters
##
   [1] 1
##
##
   $table_of_phases
##
##
   -99
        -5
            -4
                -3
                     -2
                         -1
##
     1
         1
              1
                 10
                      4
                         22
##
```

```
## $estimated_non_dev_parameters
  [1] Value
                   Phase
                               Min
                                           Max
                                                      Tnit
                                                                  Status
                               Pr type
## [7] Parm StDev Gradient
                                           Prior
                                                      Pr SD
                                                                  Pr Like
## <0 rows> (or 0-length row.names)
## $maximum_gradient_component
## [1] O
##
## $Length_Comp_Fit_Summary
##
        Factor Fleet Recommend_var_adj # N Npos min_Nsamp max_Nsamp mean_Nsamp_in
## 1506
                    1
                               59.69170 # 24
                                                14
                                                            6
                                                                  86.00
                                                                               32.5914
                    2
                               36.47650 # 24
                                                                 108.80
                                                                               59.3200
## 1507
             4
                                                14
                                                            9
                              111.35100 # 34
## 1508
                    3
             4
                                                15
                                                            1
                                                                 174.48
                                                                               86.7573
## 1509
                    4
                                0.43845 # 19
                                                                               19.8889
                                                 9
                                                           12
                                                                  31.00
        mean_Nsamp_adj mean_Nsamp_DM DM_theta mean_effN HarMean_effN Curr_Var_Adj
## 1506
               32.5914
                                   NA
                                             NA 74598.2000
                                                              1945.44000
## 1507
               59.3200
                                   NA
                                             NA 70693.4000
                                                              2163.79000
                                                                                     1
## 1508
               86.7573
                                   NA
                                             NA 22722.6000
                                                              9660.53000
                                                                                     1
## 1509
               19.8889
                                   NA
                                                   79.1256
                                                                 8.72028
                                                                                     1
                                             NΑ
        Fleet name
## 1506 MexCal_S1
## 1507
         MexCal S2
## 1508
               PNW
## 1509 AT_Survey
##
## $Age_Comp_Fit_Summary
        Factor Fleet Recommend_var_adj # Nsamp_adj Npos min_Nsamp max_Nsamp
             5
                    1
                               9.329390 #
                                                  24
                                                                5.92
## 1607
                                                       14
                                                                         86.00
                    2
## 1608
             5
                                                                8.92
                               4.260200 #
                                                  24
                                                        14
                                                                        105.16
## 1609
                    3
                              17.893600 #
             5
                                                  24
                                                       14
                                                               26.88
                                                                        138.12
## 1610
             5
                    4
                               0.428988 #
                                                  19
                                                        9
                                                               12.00
                                                                         31.00
##
        mean_Nsamp_in mean_Nsamp_adj mean_Nsamp_DM DM_theta
                                                                mean_effN
## 1607
              31.0686
                              31.0686
                                                  NA
                                                            NA 10076.4000
## 1608
              58.3143
                              58.3143
                                                                8139.9400
                                                  NA
                                                            NA
## 1609
              76.2971
                              76.2971
                                                  NA
                                                            NA
                                                                3175.6600
## 1610
              19.8889
                              19.8889
                                                  NA
                                                            NA
                                                                  60.1969
##
        HarMean effN Curr Var Adj Fleet name
## 1607
           289.85100
                                 1 MexCal S1
## 1608
           248.43000
                                 1
                                    MexCal S2
## 1609
          1365.23000
                                 1
                                           PNW
## 1610
             8.53209
                                    AT Survey
##
## $SBzero
## [1] 80588.5
## $current_depletion
## [1] 0.6966317
##
## $last_years_SPR
## [1] NaN
##
## $SPRratioLabel
## [1] "raw SPR"
##
```

```
## [1] 0.5
##
## $sigma_R_info
##
              period N_devs SD_of_devs Var_of_devs mean_SE mean_SEsquared
                              1.526787
                                          2.331078
## 1
                         20
                                                         NA
                              1.364724
## 2
          Early+Main
                         26
                                          1.862471
                                                         NA
                                                                        NΑ
                                                         NA
## 3 Early+Main+Late
                         36
                              1.349487
                                          1.821115
                                                                        NΑ
    sqrt_sum_of_components SD_of_devs_over_sigma_R sqrt_sum_over_sigma_R
## 1
                         NA
                                            3.053573
                                                                        NA
## 2
                         NA
                                            2.729447
                                                                        NA
## 3
                         NA
                                            2.698974
                                                                        NA
##
   alternative_sigma_R
## 1
## 2
                      NA
## 3
                      NA
##
## $rmse_table
       ERA N
                  RMSE RMSE_over_sigmaR mean_BiasAdj
## 1 main 20 1.488130
                                8.85811
                                             0.841539
## 2 early 6 0.618608
                                1.53070
                                            0.766330
## completed SS_output
outEM5yr2019 <- SS_output(EM5yr2019_dir)</pre>
## Getting header info from:
   C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenarios/perfDatTests/constGrow20010M_MidSteepH
\#\# This function tested on SS versions 3.24 and 3.30.
     You are using 3.30.18.00 which SHOULD work with this package.
## Report file time: Tue Jun 07 10:41:19 2022
## Reading full report file
## Got all columns using ncols = 62
## Got Report file
## Setting minimum biomass threshhold to 0.25 based on US west coast assumption associated with biomas
## !warning: temporary files were written in this run:
                          TempFile
## "size of file gradfil1.tmp = 0" "size of file gradfil2.tmp = 0"
                              <NA>
## "size of file varssave.tmp = 0" "size of file cmpdiff.tmp = 0"
## Got warning file. Therewere 11 warnings in C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenari
```

\$sigma_R_in

```
## Finished reading files
## CompReport file separated by this code as follows (rows = Ncomps*Nbins):
     2028 rows of length comp data,
##
    O rows of generalized size comp data,
##
    459 rows of age comp data,
##
    O rows of conditional age-at-length data,
    O rows of ghost fleet age comp data,
##
##
    O rows of ghost fleet conditional age-at-length data,
    351 rows of ghost fleet length comp data,
##
##
    0 rows of mean length at age data,
    O rows of mean weight at age data,
    O rows of 'TAG1' comp data, and
##
    0 rows of 'TAG2' comp data.
## Finished dimensioning
## Got covar file.
## Finished primary run statistics list
## running SS_readstarter
##
     data, control files: init_dat.ss, control.ss
##
     converge_criterion = 1e-05
##
    SPR_basis = 4
##
    F_report_basis = 2
## Assuming version 3.30 based on number of numeric values.
    MCMC_output_detail = 0
##
##
     ALK_tolerance = 1e-04
## Reading a random seed value:1988194
## Read of starter file complete. Final value: 3.3
## Statistics shown below (to turn off, change input to printstats=FALSE)
## $SS_version
## [1] "3.30.18.00;_safe;_compile_date:_Sep 30 2021;_Stock_Synthesis_by_Richard_Methot_(NOAA)_using_ADM
## $SS_versionshort
## [1] "3.30"
##
```

```
## $SS_versionNumeric
## [1] 3.3
##
## $StartTime
## [1] "StartTime: Tue Jun 07 10:41:19 2022"
##
## [1] "O hours, 2 minutes, 44 seconds."
##
## $Files_used
## [1] "Data_File: init_dat.ss Control_File: control.ss"
## $Nwarnings
## [1] 11
##
## $warnings
##
   [1] "#V3.30.18.00; safe; compile_date: Sep 30 2021; Stock_Synthesis_by_Richard_Methot_(NOAA)_using_
   [2] "#_Stock_Synthesis_is_a_work_of_the_U.S._Government_and_is_not_subject_to_copyright_protection_
   [3] "#_Foreign_copyrights_may_apply._See_copyright.txt_for_more_information."
   [4] "#_User_support_available_at:NMFS.Stock.Synthesis@noaa.gov"
##
   [5] "#_User_info_available_at:https://vlab.noaa.gov/group/stock-synthesis"
  [6] "#_Source_code_at:_https://github.com/nmfs-stock-synthesis/stock-synthesis"
   [7] ""
##
   [8] "This file contains warnings, suggestions and notes generated as files are read and processed"
##
##
  [9] ""
## [10] "1 NOTE: Max data length bin: 28 < max pop len bins: 30; so will accumulate larger pop len bi
## [11] "2 settle_month is less than spawn_month, so logical age at settlement calculated to be: 1 for
## [12] "3 mean recruitment for forecast is incompatible with pos. phase for forecast rec_devs; set pha
## [13] "4 setting in starter does not request all priors, and 1 parameters have priors and are not est
## [14] "5 1st iteration warning: ssb(endyr)/ssb(styr)= 3.87036e-07; suggest start with larger R0 to ge
## [15] "6 1st iteration warning: catch logL > 50% total logL; check configuration; suggest start with
## [16] "7 setting positive forecast relF for forecast only fleet: 1"
## [17] "8 setting positive forecast relF for forecast only fleet: 2"
## [18] "9 Final gradient: 2.26819e-05 is larger than final_conv: 1e-05"
## [19] "10 setting positive forecast relF for forecast only fleet: 1"
## [20] "11 setting positive forecast relF for forecast only fleet: 2"
## [21] "Note: 1 additional lines truncated. Look in warning.sso file to see full list."
##
## $likelihoods_used
##
                                        values lambdas
## TOTAL
                         53.171799999999997510
## Catch
                          0.00000000000391362
                                                    NΑ
## Equil_catch
                          0.00000000000000000
## Survey
                        -42.310800000000000409
                                                    NA
## Length_comp
                         25.373799999999999244
                                                    NA
## Age_comp
                        16.154399999999998983
                                                    NA
## Recruitment
                        53.952599999999996783
                                                     1
## InitEQ_Regime
                         0.00000000000000000
                                                     0
## Forecast_Recruitment
                         0.000000000000000000
                                                     1
## Parm_priors
                         0.000000000000000000
                                                     1
                         0.001833320000000000
## Parm_softbounds
                                                    NΑ
## Parm_devs
                         0.00000000000000000
                                                     1
## Crash Pen
                         1
```

##

```
## $likelihoods_laplace
##
                                         values lambdas
## NoBias corr Recruitment(info only) 50.7840
  Laplace_obj_fun(info_only)
                                        50.0033
                                                     NA
##
##
   $likelihoods by fleet
##
                 Label
                                 ALL
                                        MexCal S1
                                                    MexCal S2
                                                                       PNW AT Survey
## 180
          Catch lambda
                                  NA 1.00000e+00 1.00000e+00 1.00000e+00
                                                                               1.0000
## 181
            Catch like
                         3.91362e-13 8.73045e-14 6.11515e-14 2.42906e-13
                                                                               0.0000
## 182 Init_equ_lambda
                                   NA 0.00000e+00 0.00000e+00 0.00000e+00
                                                                               1.0000
## 183
         Init_equ_like
                         0.00000e+00 0.00000e+00 0.00000e+00 0.00000e+00
                                                                               0.0000
## 184
           Surv_lambda
                                   NA 0.00000e+00 0.00000e+00 0.00000e+00
                                                                               1.0000
## 185
             Surv_like -4.23108e+01 0.00000e+00 0.00000e+00 0.00000e+00
                                                                            -14.4919
## 186
            Surv_N_use
                                   NA 0.00000e+00 0.00000e+00 0.00000e+00
                                                                              18.0000
## 187
                                   NA 0.00000e+00 0.00000e+00 0.00000e+00
           Surv_N_skip
                                                                               0.0000
## 188
         Length_lambda
                                   NA 1.00000e+00 1.00000e+00 1.00000e+00
                                                                               1.0000
## 189
                         2.53738e+01 1.24946e+00 2.42523e+00 1.13925e+00
                                                                              20.5598
           Length_like
## 190
                                   NA 1.40000e+01 1.40000e+01 1.50000e+01
                                                                               9.0000
          Length N use
## 191
                                  NA 0.00000e+00 0.00000e+00 9.00000e+00
         Length_N_skip
                                                                               0.0000
## 192
            Age lambda
                                   NA 1.00000e+00 1.00000e+00 1.00000e+00
                                                                               1.0000
## 193
              Age_like
                         1.61544e+01 5.86516e-01 1.75501e+00 9.13011e-01
                                                                              12.8999
## 194
                                  NA 1.40000e+01 1.40000e+01 1.40000e+01
             Age_N_use
                                                                               9.0000
## 195
                                  NA 0.00000e+00 0.00000e+00 0.00000e+00
            Age_N_skip
                                                                               0.0000
           DEPM TEP all
##
## 180
         1.0000
                   1.0000
  181
         0.0000
                  0.0000
## 182
         1.0000
                   1.0000
##
  183
         0.0000
                  0.0000
## 184
         1.0000
                   1.0000
## 185 -11.1977 -16.6212
## 186
        10.0000
                  13.0000
## 187
         0.0000
                  0.0000
## 188
         0.0000
                  0.0000
## 189
         0.0000
                  0.0000
##
  190
         0.0000
                  0.0000
## 191
         0.0000
                  0.0000
## 192
         0.0000
                  0.0000
## 193
         0.0000
                  0.0000
## 194
         0.0000
                   0.0000
##
  195
         0.0000
                  0.0000
   $N_estimated_parameters
##
##
   [1] 47
##
##
   $table_of_phases
##
##
   -99
        -5
            -4
               -3
                    -2
                         -1
                              1
                                   2
                                       3
                                           4
                                               5
                          2
                             21
                                   6
                                     16
                                           3
##
                10
                                               1
##
##
   $estimated_non_dev_parameters
##
                                       Value Phase
                                                                       Init Status
                                                      Min
                                                             Max
## L at Amin Fem GP 1
                                 12.8463000
                                                     3.00 30.00 12.8541000
                                                                                 OK
## L_at_Amax_Fem_GP_1
                                 24.9297000
                                                 3
                                                    15.00 40.00 24.8415000
                                                                                 ΩK
## VonBert K Fem GP 1
                                   0.3052990
                                                 3
                                                     0.05 0.99 0.3075730
                                                                                 OK
```

```
0.05 0.50 0.1053490
## CV_young_Fem_GP_1
                                  0.1135150
                                                                                OK
                                                 3
                                                                                OK
## CV_old_Fem_GP_1
                                  0.0199304
                                                     0.01 0.10 0.0237245
                                 14.7700000
## SR LN(RO)
                                                     3.00 25.00 14.4668000
                                                                                ΩK
                                                                                OK
## SR_regime_BLK1repl_2000
                                  0.9815310
                                                 4 -15.00 15.00 1.2915300
## Size_inflection_MexCal_S1(1) 10.9366000
                                                     0.00 30.00 10.9072000
                                                                                OK
## Size 95%width MexCal S1(1)
                                                     0.00 10.00 0.6599090
                                                                                OK
                                  0.7588860
## AgeSel_P1_MexCal_S1(1)
                                  0.5000230
                                                 3 -10.00 11.00
                                                                 0.5000240
                                                                                OK
   AgeSel_P2_MexCal_S1(1)
                                  0.3233490
                                                 3 -10.00 11.00
                                                                  0.2048810
                                                                                OK
   AgeSel_P3_MexCal_S1(1)
                                  0.3943970
                                                 3 -10.00 15.00 0.3827920
                                                                                OK
   AgeSel_P4_MexCal_S1(1)
                                 -1.5376900
                                                 3 -10.00 11.00 -1.5494000
                                                                                OK
## AgeSel_P5_MexCal_S1(1)
                                 -0.1495350
                                                 3 -10.00 11.00 -0.2361890
                                                                                OK
## AgeSel_P2_MexCal_S2(2)
                                  0.4316430
                                                 3 -10.00 15.00 0.4405260
                                                                                OK
## AgeSel_P3_MexCal_S2(2)
                                                 3 -10.00 11.00 -1.1690800
                                 -1.1978500
                                                                                OK
## AgeSel_P4_MexCal_S2(2)
                                 -0.0155567
                                                 3 -10.00 11.00 -0.1425740
                                                                                OK
## AgeSel_P5_MexCal_S2(2)
                                 -0.4560380
                                                 3 -10.00 11.00 -0.4707320
                                                                                OK
## Age_inflection_PNW(3)
                                  2.8833700
                                                     0.00 10.00 2.8525100
                                                                                OK
  Age_95%width_PNW(3)
                                                    -5.00 15.00 1.2152300
                                                                                OK
                                  1.2378300
##
                                   Parm_StDev
                                                        Gradient Pr_type Prior
                                                0.00000377916000 No_prior
## L_at_Amin_Fem_GP_1
                                   0.11758300
                                                                              NA
## L_at_Amax_Fem_GP_1
                                   0.25106200
                                                0.00000150313000 No prior
                                                                              NΑ
## VonBert_K_Fem_GP_1
                                   0.01443090
                                                0.00000416787000 No_prior
                                                                              NA
## CV_young_Fem_GP_1
                                   0.00459528 -0.00000026741500 No_prior
                                                                              NA
## CV_old_Fem_GP_1
                                   0.00504098 -0.00000067019500 No_prior
                                                                              NA
## SR LN(RO)
                                   0.06387110
                                                0.00002267830000 No prior
                                                                              NA
## SR_regime_BLK1repl_2000
                                   0.09877240
                                                0.00001207590000 No prior
                                                                              NΑ
## Size_inflection_MexCal_S1(1)
                                   0.18739900 -0.00000047851600 No_prior
                                                                              NA
## Size_95%width_MexCal_S1(1)
                                   0.20762300
                                                0.00000016215600 No_prior
                                                                              NA
## AgeSel_P1_MexCal_S1(1)
                                 234.78400000
                                                0.0000000675916 No_prior
                                                                              NA
## AgeSel_P2_MexCal_S1(1)
                                   0.34312200
                                                0.00000006007750 No_prior
                                                                              NA
## AgeSel_P3_MexCal_S1(1)
                                   0.11721700
                                                0.00000134165000 No_prior
                                                                              NA
## AgeSel_P4_MexCal_S1(1)
                                   0.30404400
                                                0.00000065320200 No_prior
                                                                              NA
## AgeSel_P5_MexCal_S1(1)
                                   0.36487500
                                                0.00000030770200 No_prior
                                                                              NA
## AgeSel_P2_MexCal_S2(2)
                                   0.08510010
                                                0.0000005729660 No_prior
                                                                              NA
                                                0.00000070821300 No_prior
                                                                              NA
## AgeSel_P3_MexCal_S2(2)
                                   0.16758800
## AgeSel_P4_MexCal_S2(2)
                                   0.27173700
                                                0.0000066790300 No prior
                                                                              NA
## AgeSel_P5_MexCal_S2(2)
                                   0.28391100
                                                0.00000054389300 No_prior
                                                                              NA
## Age_inflection_PNW(3)
                                   0.07557750
                                                0.00000345944000 No prior
                                                                              NΑ
                                   0.06682090 -0.00000110157000 No_prior
## Age_95%width_PNW(3)
                                                                              NA
##
                                 Pr_SD Pr_Like Afterbound
## L_at_Amin_Fem_GP_1
                                            NΑ
                                                        OK
                                    NA
## L_at_Amax_Fem_GP_1
                                    NA
                                            NA
                                                        OK
                                                        OK
## VonBert_K_Fem_GP_1
                                    NA
                                            NΑ
## CV_young_Fem_GP_1
                                    NA
                                            NA
                                                        OK
## CV_old_Fem_GP_1
                                    NA
                                            NA
                                                        OK
## SR_LN(RO)
                                            NA
                                                        OK
                                    NA
## SR_regime_BLK1repl_2000
                                    ΝA
                                            NA
                                                        OK
## Size_inflection_MexCal_S1(1)
                                    NA
                                            NA
                                                        OK
## Size_95%width_MexCal_S1(1)
                                    NA
                                             NA
                                                        OK
## AgeSel_P1_MexCal_S1(1)
                                    NA
                                            NA
                                                        OK
## AgeSel_P2_MexCal_S1(1)
                                                        OK
                                    NA
                                             NA
## AgeSel_P3_MexCal_S1(1)
                                                        OK
                                    NA
                                            NA
## AgeSel P4 MexCal S1(1)
                                            NA
                                                        OK
## AgeSel_P5_MexCal_S1(1)
                                    NA
                                            NA
                                                        OK
## AgeSel_P2_MexCal_S2(2)
                                                        OK
```

```
## AgeSel P3 MexCal S2(2)
                                     NA
                                             NA
                                                         OK
## AgeSel_P4_MexCal_S2(2)
                                    NΑ
                                             NΑ
                                                         ΠK
## AgeSel P5 MexCal S2(2)
                                    NA
                                             NA
                                                         OK
                                                         OK
## Age_inflection_PNW(3)
                                    NA
                                             NA
## Age_95%width_PNW(3)
                                    NA
                                             NA
                                                         OK
##
## $log det hessian
## [1] 194.733
##
## $maximum_gradient_component
## [1] 2.26819e-05
##
## $parameters_with_highest_gradients
##
                                Value
                                          Gradient
## SR_LN(RO)
                            14.770000 2.26783e-05
## SR_regime_BLK1repl_2000
                             0.981531 1.20759e-05
## VonBert_K_Fem_GP_1
                             0.305299 4.16787e-06
## L at Amin Fem GP 1
                            12.846300 3.77916e-06
## Age_inflection_PNW(3)
                             2.883370 3.45944e-06
##
## $Length_Comp_Fit_Summary
        Factor Fleet Recommend_var_adj # N Npos min_Nsamp max_Nsamp mean_Nsamp_in
## 1156
             4
                    1
                              73.180300 # 14
                                                14
                                                            6
                                                                  86.00
                                                                               32.5914
## 1157
             4
                    2
                              40.099200 # 14
                                                14
                                                            9
                                                                 108.80
                                                                               59.3200
             4
                    3
                             136.133000 # 24
                                                15
                                                            1
## 1158
                                                                 174.48
                                                                               86.7573
## 1159
                    4
                               0.955435 # 9
                                                 9
                                                           12
                                                                  31.00
                                                                               19.8889
##
        mean_Nsamp_adj mean_Nsamp_DM DM_theta mean_effN HarMean_effN Curr_Var_Adj
               32.5914
                                                 8292.820
## 1156
                                   NA
                                             NA
                                                              2385.0500
                                                                                    1
                                    NA
                                                                                    1
## 1157
               59.3200
                                             NA 10041.700
                                                              2378.6900
## 1158
               86.7573
                                    NA
                                             NA 31510.800
                                                             11810.5000
                                                                                    1
## 1159
               19.8889
                                    NA
                                             NA
                                                  257.222
                                                                19.0025
                                                                                    1
##
        Fleet_name
## 1156 MexCal_S1
         MexCal_S2
## 1157
## 1158
               PNW
## 1159
        AT Survey
##
## $Age_Comp_Fit_Summary
        Factor Fleet Recommend_var_adj # Nsamp_adj Npos min_Nsamp max_Nsamp
             5
                              15.164000 #
## 1217
                    1
                                                  14
                                                        14
                                                                5.92
                                                                          86.00
## 1218
             5
                    2
                               6.478200 #
                                                  14
                                                                8.92
                                                                         105.16
                    3
                                                  14
                                                        14
## 1219
             5
                              57.309000 #
                                                               26.88
                                                                         138.12
## 1220
                    4
                               0.952764 #
                                                   9
                                                         9
             5
                                                               12.00
                                                                          31.00
##
        mean_Nsamp_in mean_Nsamp_adj mean_Nsamp_DM DM_theta mean_effN HarMean_effN
              31.0686
                              31.0686
                                                               9573.260
## 1217
                                                  NA
                                                            NA
                                                                              471.1240
## 1218
                                                            NA 11412.600
              58.3143
                              58.3143
                                                  NA
                                                                              377.7720
## 1219
              76.2971
                              76.2971
                                                  NA
                                                            NA 14103.900
                                                                             4372.5200
## 1220
                                                  NA
              19.8889
                              19.8889
                                                            NA
                                                                 322.679
                                                                               18.9494
        Curr_Var_Adj Fleet_name
## 1217
                    1
                       MexCal_S1
## 1218
                    1
                       MexCal_S2
## 1219
                             PNW
## 1220
                    1
                       AT_Survey
##
```

```
## $SBzero
## [1] 109922
## $current_depletion
## [1] 0.2618857
##
## $last_years_SPR
## [1] 0.809065
##
## $SPRratioLabel
## [1] "1-SPR"
## $sigma_R_in
## [1] 0.5
##
## $sigma_R_info
##
              period N_devs SD_of_devs Var_of_devs mean_SE mean_SEsquared
## 1
                            1.310494 1.717395 0.1688232
                                                                 0.03664718
## 2
                         26
                            1.172701
                                       1.375227 0.1816861
                                                                 0.04182880
         Early+Main
## 3 Early+Main+Late
                         26
                            1.172701
                                          1.375227 0.1816861
                                                                 0.04182880
   sqrt_sum_of_components SD_of_devs_over_sigma_R sqrt_sum_over_sigma_R
                   1.324403
                                          2.620989
                                                                 2.648805
## 2
                   1.190402
                                           2.345401
                                                                 2.380803
## 3
                   1.190402
                                           2.345401
                                                                 2.380803
   alternative_sigma_R
## 1
               1.324403
## 2
               1.190402
## 3
               1.190402
##
## $rmse_table
      ERA N
                 RMSE RMSE_over_sigmaR mean_BiasAdj
## 1 main 20 1.277310
                                6.52611
                                            0.841539
## 2 early 6 0.543502
                               1.18158
                                            0.766330
##
## $cormessage1
## [1] Range of abs(parameter correlations) is 0 to 0.932029
## $cormessage2
## [1] No correlations above threshold (cormax=0.95)
##
## $cormessage7
## [1] 1 uncorrelation below threshold (cormin=0.01)
## $cormessage8
                        name max
## 28 AgeSel_P1_MexCal_S1(1)
## completed SS_output
EMssmse2019_dir <- "C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenarios/perfDatTests/constGrow2
outEMssmse2019 <- SS_output(EMssmse2019_dir)</pre>
## Getting header info from:
## C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenarios/perfDatTests/constGrow20010M_MidSteepH
```

```
## This function tested on SS versions 3.24 and 3.30.
   You are using 3.30.18.00 which SHOULD work with this package.
## Report file time:Mon Jun 06 17:20:16 2022
## Warning in SS_output(EMssmse2019_dir): Some stats skipped because the .cor file not found:C:/Users/r
## Warning in SS_output(EMssmse2019_dir): covar file contains the warning
        'Variances are 0.0 for first two elements, so do not write '
##
     input 'covar' changed to FALSE.
## Reading full report file
## Got all columns using ncols = 62
## Got Report file
## Setting minimum biomass threshhold to 0.25 based on US west coast assumption associated with biomas
## !warning: temporary files were written in this run:
                          TempFile
## "size of file gradfil1.tmp = 0" "size of file gradfil2.tmp = 0"
                              <NA>
## "size of file varssave.tmp = 0" "size of file cmpdiff.tmp = 0"
## Got warning file. Therewere 9 warnings in C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenario
## Finished reading files
## CompReport file separated by this code as follows (rows = Ncomps*Nbins):
     2028 rows of length comp data,
     O rows of generalized size comp data,
##
    459 rows of age comp data,
##
    0 rows of conditional age-at-length data,
##
    0 rows of ghost fleet age comp data,
    O rows of ghost fleet conditional age-at-length data,
##
    351 rows of ghost fleet length comp data,
##
##
    0 rows of mean length at age data,
##
    O rows of mean weight at age data,
##
    0 rows of 'TAG1' comp data, and
    0 rows of 'TAG2' comp data.
## Finished dimensioning
## You skipped the covar file
## Finished primary run statistics list
## running SS_readstarter
```

```
##
     data, control files: init_dat.ss, control.ss
     converge_criterion = 1e-05
##
     SPR_basis = 4
##
    F_report_basis = 2
## Assuming version 3.30 based on number of numeric values.
##
     MCMC_output_detail = 0
##
     ALK_tolerance = 1e-04
## Reading a random seed value:1988194
## Read of starter file complete. Final value: 3.3
##
## Statistics shown below (to turn off, change input to printstats=FALSE)
## $SS version
## [1] "3.30.18.00;_safe;_compile_date:_Sep 30 2021;_Stock_Synthesis_by_Richard_Methot_(NOAA)_using_ADM
## $SS_versionshort
## [1] "3.30"
##
## $SS_versionNumeric
## [1] 3.3
##
## $StartTime
## [1] "StartTime: Mon Jun 06 17:20:16 2022"
## $RunTime
## [1] "0 hours, 1 minutes, 22 seconds."
## $Files_used
## [1] "Data_File: init_dat.ss Control_File: control.ss"
## $Nwarnings
## [1] 9
##
## $warnings
  [1] "#V3.30.18.00; safe; compile_date: Sep 30 2021; Stock_Synthesis_by_Richard_Methot_(NOAA)_using_
##
   [2] "#_Stock_Synthesis_is_a_work_of_the_U.S._Government_and_is_not_subject_to_copyright_protection_
##
   [3] "#_Foreign_copyrights_may_apply._See_copyright.txt_for_more_information."
   [4] "#_User_support_available_at:NMFS.Stock.Synthesis@noaa.gov"
   [5] "#_User_info_available_at:https://vlab.noaa.gov/group/stock-synthesis"
##
   [6] "#_Source_code_at:_https://github.com/nmfs-stock-synthesis/stock-synthesis"
   [7] ""
##
   [8] "This file contains warnings, suggestions and notes generated as files are read and processed"
```

```
[9] ""
## [10] "1 NOTE: Max data length bin: 28 < max pop len bins: 30; so will accumulate larger pop len bi
  [11] "2 settle_month is less than spawn_month, so logical age at settlement calculated to be: 1 for
  [12] "3 mean recruitment for forecast is incompatible with pos. phase for forecast rec_devs; set pha
  [13] "4 setting in starter does not request all priors, and 1 parameters have priors and are not est
  [14] "5 1st iteration warning: ssb(endyr)/ssb(styr)= 3.87036e-07; suggest start with larger R0 to ge
  [15] "6 1st iteration warning: catch logL > 50% total logL; check configuration; suggest start with
  [16] "7 Final gradient: 2.95504e-05 is larger than final_conv: 1e-05"
  [17] "8 setting positive forecast relF for forecast only fleet: 1"
  [18] "9 setting positive forecast relF for forecast only fleet: 2"
  [19] "N warnings: 9"
##
## $likelihoods_used
##
                                         values lambdas
## TOTAL
                        740.731999999999970896
                                                     NΑ
## Catch
                          0.00000000000471052
                                                     NA
                          0.000000000000000000
                                                     NΑ
## Equil_catch
## Survey
                        -24.20799999999998408
                                                     NA
## Length_comp
                        647.479000000000041837
                                                     NΑ
## Age_comp
                         26.583500000000000796
## Recruitment
                         90.87539999999999068
                                                      1
## InitEQ_Regime
                          0.00000000000000000
                                                      0
## Forecast_Recruitment
                          0.00000000000000000
                                                      1
## Parm_priors
                          0.000000000000000000
                                                      1
## Parm softbounds
                          0.001803910000000000
                                                     NΑ
## Parm devs
                          1
                          0.000000000000000000
##
  Crash_Pen
                                                      1
## $likelihoods_laplace
##
                                         values lambdas
## NoBias_corr_Recruitment(info_only)
                                       87.7068
## Laplace_obj_fun(info_only)
                                      737.5630
                                                     NA
##
## $likelihoods_by_fleet
                 Label
                                      MexCal S1
                                                   MexCal S2
                                                                     PNW AT_Survey
##
                                ALL
          Catch_lambda
                                                                           1.00000
## 180
                                 NA 1.00000e+00 1.00000e+00 1.00000e+00
## 181
            Catch like
                        4.71052e-13 1.22666e-13 1.04449e-13 2.43937e-13
                                                                           0.00000
## 182 Init_equ_lambda
                                 NA 0.00000e+00 0.00000e+00 0.00000e+00
                                                                           1.00000
         Init_equ_like
## 183
                        0.00000e+00 0.00000e+00 0.00000e+00 0.00000e+00
                                                                           0.00000
## 184
           Surv_lambda
                                 NA 0.00000e+00 0.00000e+00 0.00000e+00
                                                                           1.00000
## 185
             Surv like -2.42080e+01 0.00000e+00 0.00000e+00 0.00000e+00
                                                                          -9.11442
                                 NA 0.00000e+00 0.00000e+00 0.00000e+00
## 186
            Surv_N_use
                                                                          18.00000
## 187
           Surv_N_skip
                                 NA 0.00000e+00 0.00000e+00 0.00000e+00
                                                                           0.00000
                                 NA 1.00000e+00 1.00000e+00 1.00000e+00
## 188
         Length_lambda
                                                                           1.00000
## 189
           Length_like
                        6.47479e+02 1.65431e+02 1.86247e+02 1.68218e+02 127.58400
## 190
                                 NA 1.40000e+01 1.40000e+01 1.50000e+01
          Length_N_use
                                                                           9.00000
## 191
         Length_N_skip
                                 NA 0.00000e+00 0.00000e+00 9.00000e+00
                                                                           0.00000
## 192
            Age_lambda
                                 NA 1.00000e+00 1.00000e+00 1.00000e+00
                                                                           1.00000
## 193
                        2.65835e+01 4.66667e+00 4.92733e+00 3.46460e+00
                                                                          13.52490
              Age_like
## 194
                                 NA 1.40000e+01 1.40000e+01 1.40000e+01
                                                                           9.00000
             Age_N_use
                                 NA 0.00000e+00 0.00000e+00 0.00000e+00
##
  195
                                                                           0.00000
            Age_N_skip
##
           DEPM TEP_all
## 180
        1.00000
                1.00000
## 181
       0.00000 0.00000
```

```
## 182
        1.00000
                1.00000
## 183
        0.00000 0.00000
  184
        1.00000
                 1.00000
  185 -6.14031 -8.95326
  186 10.00000 13.00000
  187
        0.00000
                0.00000
## 188
        0.00000
                 0.00000
## 189
        0.00000
                 0.00000
## 190
        0.00000
                 0.00000
  191
        0.00000
                 0.00000
  192
        0.00000
                 0.00000
##
   193
        0.00000
                 0.00000
##
   194
        0.00000
                 0.00000
##
   195
        0.00000
                 0.00000
##
## $N_estimated_parameters
##
   [1] 47
##
##
   $table_of_phases
##
##
   -99
        -5
            -4
                -3
                    -2
                                  2
                                      3
                                           4
                                               5
                         -1
                              1
                          2
                                  6
                                           3
##
                10
                             21
                                     16
##
## $estimated_non_dev_parameters
##
                                      Value Phase
                                                      Min
                                                            Max
                                                                       Init Status
## L_at_Amin_Fem_GP_1
                                 12.7213000
                                                     3.00 30.00 12.8541000
                                                                                OK
                                                                                OK
## L_at_Amax_Fem_GP_1
                                 24.7291000
                                                    15.00 40.00 24.8415000
## VonBert_K_Fem_GP_1
                                  0.3186590
                                                 3
                                                     0.05
                                                           0.99
                                                                  0.3075730
                                                                                OK
## CV_young_Fem_GP_1
                                  0.1131800
                                                     0.05
                                                           0.50
                                                                  0.1053490
                                                                                OK
## CV_old_Fem_GP_1
                                                           0.10
                                  0.0202346
                                                     0.01
                                                                  0.0237245
                                                                                OK
## SR_LN(RO)
                                 14.4286000
                                                 1
                                                     3.00 25.00 14.4668000
                                                                                OK
## SR_regime_BLK1repl_2000
                                                 4 -15.00 15.00
                                                                 1.2915300
                                                                                OK
                                  1.3174500
## Size_inflection_MexCal_S1(1) 10.9201000
                                                     0.00 30.00 10.9072000
                                                                                OK
## Size_95%width_MexCal_S1(1)
                                                     0.00 10.00
                                                                                OK
                                  0.7931200
                                                                  0.6599090
                                                 3 -10.00 11.00
## AgeSel_P1_MexCal_S1(1)
                                  0.5000230
                                                                  0.5000240
                                                                                OK
## AgeSel_P2_MexCal_S1(1)
                                  0.1680180
                                                 3 -10.00 11.00
                                                                  0.2048810
                                                                                OK
## AgeSel P3 MexCal S1(1)
                                  0.3559430
                                                 3 -10.00 15.00 0.3827920
                                                                                ΩK
                                                 3 -10.00 11.00 -1.5494000
## AgeSel_P4_MexCal_S1(1)
                                                                                ΠK
                                 -1.4832000
                                                 3 -10.00 11.00 -0.2361890
## AgeSel_P5_MexCal_S1(1)
                                 -0.1920900
                                                                                ΩK
## AgeSel_P2_MexCal_S2(2)
                                                 3 -10.00 15.00 0.4405260
                                                                                OK
                                  0.4075720
## AgeSel P3 MexCal S2(2)
                                 -1.1997600
                                                 3 -10.00 11.00 -1.1690800
                                                                                OK
                                                 3 -10.00 11.00 -0.1425740
                                                                                OK
## AgeSel_P4_MexCal_S2(2)
                                 -0.2775540
## AgeSel_P5_MexCal_S2(2)
                                 -0.2903910
                                                 3 -10.00 11.00 -0.4707320
                                                                                OK
                                                                                OK
## Age_inflection_PNW(3)
                                  2.8502400
                                                     0.00 10.00 2.8525100
## Age_95%width_PNW(3)
                                  1.2148000
                                                   -5.00 15.00 1.2152300
                                                                                OK
##
                                 Parm_StDev
                                                      Gradient Pr_type Prior Pr_SD
## L_at_Amin_Fem_GP_1
                                           0 -0.00002249980000 No_prior
                                                                            NA
                                                                                   NA
## L_at_Amax_Fem_GP_1
                                              0.00000500683000 No_prior
                                                                            NA
                                                                                   NA
## VonBert_K_Fem_GP_1
                                            -0.00000533821000 No_prior
                                                                            NA
                                                                                  NA
## CV_young_Fem_GP_1
                                             -0.00000073629400 No_prior
                                                                            NA
                                                                                   NA
## CV_old_Fem_GP_1
                                                                            NA
                                             0.00000146622000 No_prior
                                                                                  NA
## SR_LN(RO)
                                           0 -0.00002374860000 No_prior
                                                                            NA
                                                                                  NA
## SR_regime_BLK1repl_2000
                                           0 -0.00000215662000 No_prior
                                                                            NA
                                                                                  ΝA
## Size inflection MexCal S1(1)
                                           0 0.00002911220000 No prior
                                                                                   NΑ
```

```
## Size_95%width_MexCal_S1(1)
                                           0 -0.00000284785000 No prior
                                                                            NA
                                                                                   NA
## AgeSel_P1_MexCal_S1(1)
                                                                            NA
                                                                                   ΝA
                                           0 0.00000000696851 No_prior
## AgeSel P2 MexCal S1(1)
                                              0.00000619038000 No prior
                                                                            NA
                                                                                   NA
                                                                            NA
## AgeSel_P3_MexCal_S1(1)
                                             0.00000483263000 No_prior
                                                                                   NA
## AgeSel_P4_MexCal_S1(1)
                                           0
                                              0.00000130655000 No_prior
                                                                            NA
                                                                                   NA
## AgeSel P5 MexCal S1(1)
                                           0 0.00000012381000 No prior
                                                                            NA
                                                                                   NA
## AgeSel P2 MexCal S2(2)
                                             0.00000170608000 No_prior
                                                                            NA
                                                                                   NA
## AgeSel_P3_MexCal_S2(2)
                                           0 -0.00000078830700 No_prior
                                                                            NA
                                                                                   NA
## AgeSel_P4_MexCal_S2(2)
                                           0 -0.00000030863000 No_prior
                                                                            NA
                                                                                   NA
## AgeSel_P5_MexCal_S2(2)
                                           0 -0.00000098073800 No_prior
                                                                            NA
                                                                                   NA
## Age_inflection_PNW(3)
                                           0 -0.00000500619000 No_prior
                                                                            NA
                                                                                   NA
## Age_95%width_PNW(3)
                                           0 0.00000656588000 No_prior
                                                                            NA
                                                                                   ΝA
                                 Pr_Like Afterbound
##
## L_at_Amin_Fem_GP_1
                                       NA
                                                  OK
                                                  OK
## L_at_Amax_Fem_GP_1
                                       NA
## VonBert_K_Fem_GP_1
                                       NA
                                                  OK
## CV_young_Fem_GP_1
                                       NA
                                                  OK
## CV_old_Fem_GP_1
                                                  OK
                                       NA
## SR_LN(RO)
                                                  OK
                                       NA
## SR_regime_BLK1repl_2000
                                       NΑ
                                                  OK
## Size_inflection_MexCal_S1(1)
                                       NΑ
                                                  OK
## Size_95%width_MexCal_S1(1)
                                       NA
                                                  OK
## AgeSel P1 MexCal S1(1)
                                       NA
                                                  OK
## AgeSel_P2_MexCal_S1(1)
                                       NA
                                                  OK
## AgeSel_P3_MexCal_S1(1)
                                       NΑ
                                                  OK
## AgeSel_P4_MexCal_S1(1)
                                       NA
                                                  OK
## AgeSel_P5_MexCal_S1(1)
                                       NA
                                                  OK
## AgeSel_P2_MexCal_S2(2)
                                       NA
                                                  OK
## AgeSel_P3_MexCal_S2(2)
                                       NA
                                                  OK
## AgeSel_P4_MexCal_S2(2)
                                       NA
                                                  OK
## AgeSel_P5_MexCal_S2(2)
                                       NA
                                                  OK
## Age_inflection_PNW(3)
                                       NΑ
                                                  OK
   Age_95%width_PNW(3)
                                       NA
                                                  OK
##
## $maximum_gradient_component
   [1] 2.95504e-05
##
##
## $parameters_with_highest_gradients
##
                                      Value
                                                Gradient
## Size_inflection_MexCal_S1(1) 10.920100
                                             2.91122e-05
## SR LN(RO)
                                 14.428600 -2.37486e-05
## L_at_Amin_Fem_GP_1
                                 12.721300 -2.24998e-05
## Age_95%width_PNW(3)
                                  1.214800
                                             6.56588e-06
                                  0.168018 6.19038e-06
##
   AgeSel_P2_MexCal_S1(1)
   $Length_Comp_Fit_Summary
##
        Factor Fleet Recommend_var_adj # N Npos min_Nsamp max_Nsamp mean_Nsamp_in
## 1156
                    1
                               0.751864 # 14
                                                14
                                                            6
                                                                     86
                                                                               32.2857
## 1157
             4
                    2
                               0.590294 # 14
                                                14
                                                            9
                                                                    108
                                                                               59.0000
  1158
             4
                    3
                               0.141518 # 24
                                                15
                                                            1
                                                                    174
                                                                               86.3333
##
##
   1159
                    4
                               0.508464 # 9
                                                 9
                                                           12
                                                                     31
                                                                               19.8889
##
        mean Nsamp adj mean Nsamp DM DM theta mean effN HarMean effN Curr Var Adj
## 1156
               32.2857
                                   NA
                                             NA
                                                  39.7681
                                                                24.2745
                                                                                    1
## 1157
               59.0000
                                   NA
                                                  65.8339
                                                                34.8273
                                                                                    1
```

```
86.3333
## 1158
                                   NA
                                             NA
                                                  94.6086
                                                                12.2177
                                                                                    1
## 1159
               19.8889
                                   NΑ
                                             NΑ
                                                  17.1909
                                                                10.1128
                                                                                    1
        Fleet name
##
## 1156 MexCal_S1
## 1157
         MexCal S2
## 1158
               PNW
## 1159 AT Survey
##
## $Age_Comp_Fit_Summary
##
        Factor Fleet Recommend_var_adj # Nsamp_adj Npos min_Nsamp max_Nsamp
## 1217
             5
                    1
                                6.46537 #
                                                  14
                                                       14
## 1218
             5
                    2
                                6.16927 #
                                                  14
                                                                 100
                                                                            100
                                                        14
## 1219
             5
                    3
                               17.18980 #
                                                       14
                                                                 100
                                                                            100
                                                  14
## 1220
             5
                    4
                                2.40954 #
                                                   9
                                                        9
                                                                 100
                                                                            100
        mean_Nsamp_in mean_Nsamp_adj mean_Nsamp_DM DM_theta mean_effN HarMean_effN
## 1217
                  100
                                   100
                                                  NA
                                                            NA
                                                                 2424.42
                                                                               646.537
## 1218
                  100
                                   100
                                                  NA
                                                            NA
                                                                 7734.76
                                                                               616.927
                  100
## 1219
                                   100
                                                  NA
                                                            NA
                                                                 6179.68
                                                                              1718.980
## 1220
                  100
                                   100
                                                  NA
                                                            NA
                                                                 1390.91
                                                                               240.954
        Curr_Var_Adj Fleet_name
## 1217
                    1 MexCal S1
## 1218
                       MexCal S2
## 1219
                             PNW
                    1
## 1220
                    1 AT_Survey
##
## $SBzero
## [1] 77502
## $current_depletion
## [1] 0.2015264
##
## $last_years_SPR
## [1] 0.49354
##
## $SPRratioLabel
## [1] "1-SPR"
##
## $sigma_R_in
## [1] 0.5
##
## $sigma R info
              period N_devs SD_of_devs Var_of_devs mean_SE mean_SEsquared
##
## 1
                          20
                                1.63260
                                            2.665384
                                                            0
## 2
          Early+Main
                          26
                                1.45398
                                            2.114057
                                                            0
                                                                            0
## 3 Early+Main+Late
                          26
                                1.45398
                                            2.114057
                                                            0
     sqrt_sum_of_components SD_of_devs_over_sigma_R sqrt_sum_over_sigma_R
                                             3.265201
## 1
                     1.63260
                                                                    3.265201
## 2
                     1.45398
                                             2.907960
                                                                    2.907960
                                             2.907960
## 3
                     1.45398
                                                                    2.907960
##
     alternative_sigma_R
## 1
                 1.63260
## 2
                 1.45398
## 3
                  1.45398
##
```

```
## $rmse table
      ERA N
                RMSE RMSE_over_sigmaR mean_BiasAdj
## 1 main 20 1.59126
                            10.12850
                                           0.841539
## 2 early 6 0.60855
                              1.48133
                                           0.766330
## completed SS_output
comp5yr2019 <- SSsummarize(list(OM2019 = outOM5yr,</pre>
                                   EMssmse2019 = outEMssmse2019,
                                   EM5yr2019 = outEM5yr2019))
## Summarizing 3 models:
## imodel=1/3
    N active pars = 0
##
## imodel=2/3
     N active pars = 47
## imodel=3/3
    N active pars = 47
## Summary finished. To avoid printing details above, use 'verbose = FALSE'.
SSplotComparisons(comp5yr2019, legendlabels = c("OM", "SSMSE 2019", "Perf 2019"),
                  subplots = c(2,10, 12, 13, 14))
## Warning in SSplotComparisons(comp5yr2019, legendlabels = c("OM", "SSMSE 2019", :
## setting btarg = -999 because models don't have matching values
## Warning in SSplotComparisons(comp5yr2019, legendlabels = c("OM", "SSMSE 2019", :
## setting minbthresh = -999 because models don't have matching values
## Warning in SSplotComparisons(comp5yr2019, legendlabels = c("OM", "SSMSE 2019", :
## setting sprtarg = -999 because models don't have matching values
## Warning in SSplotComparisons(comp5yr2019, legendlabels = c("OM", "SSMSE 2019", :
## setting label for SPR plot to 8th element of input 'labels' because the models
## don't have matching labels
## Warning in SSplotComparisons(comp5yr2019, legendlabels = c("OM", "SSMSE 2019", :
## setting label for F plot to 13th element of input 'labels' because the models
## don't have matching labels
## showing uncertainty for all models
```

```
## No uncertainty available for model 1
## No uncertainty available for model 2
## subplot 2: spawning biomass with uncertainty intervals
## subplot 10: recruits with uncertainty
## subplot 12: recruit devs with uncertainty
## subplot 13: index fits
## subplot 14: index fits on a log scale
# plot comparisons
outEM5yr2020 <- SS_output(EM5yr2020_dir)</pre>
## Getting header info from:
    C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenarios/perfDatTests/constGrow20010M_MidSteepH
\#\# This function tested on SS versions 3.24 and 3.30.
   You are using 3.30.18.00 which SHOULD work with this package.
## Report file time:Tue Jun 07 10:41:10 2022
## Reading full report file
## Got all columns using ncols = 62
## Got Report file
## Setting minimum biomass threshhold to 0.25 based on US west coast assumption associated with biomas
## !warning: temporary files were written in this run:
                          TempFile
## "size of file gradfil1.tmp = 0" "size of file gradfil2.tmp = 0"
                              <NA>
## "size of file varssave.tmp = 0" "size of file cmpdiff.tmp = 0"
## Got warning file. Therewere 11 warnings in C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenari
## Finished reading files
```

```
## CompReport file separated by this code as follows (rows = Ncomps*Nbins):
##
     2184 rows of length comp data,
    O rows of generalized size comp data,
##
    495 rows of age comp data,
##
##
    O rows of conditional age-at-length data,
    O rows of ghost fleet age comp data,
##
    O rows of ghost fleet conditional age-at-length data,
    351 rows of ghost fleet length comp data,
##
##
    0 rows of mean length at age data,
    O rows of mean weight at age data,
##
   0 rows of 'TAG1' comp data, and
    O rows of 'TAG2' comp data.
## Finished dimensioning
## Got covar file.
## Finished primary run statistics list
## running SS_readstarter
##
     data, control files: init_dat.ss, control.ss
##
     converge_criterion = 1e-05
    SPR_basis = 4
##
    F_report_basis = 2
##
## Assuming version 3.30 based on number of numeric values.
    MCMC_output_detail = 0
##
##
     ALK_tolerance = 1e-04
## Reading a random seed value:7545659
## Read of starter file complete. Final value: 3.3
## Statistics shown below (to turn off, change input to printstats=FALSE)
## $SS_version
## [1] "3.30.18.00; safe; compile_date: Sep 30 2021; Stock_Synthesis_by_Richard_Methot_(NOAA) using_ADM
## $SS_versionshort
## [1] "3.30"
##
## $SS_versionNumeric
## [1] 3.3
```

```
##
## $StartTime
## [1] "StartTime: Tue Jun 07 10:41:10 2022"
##
## $RunTime
## [1] "0 hours, 1 minutes, 8 seconds."
## $Files used
## [1] "Data_File: init_dat.ss Control_File: control.ss"
##
## $Nwarnings
## [1] 11
##
## $warnings
##
   [1] "#V3.30.18.00; safe; compile_date: Sep 30 2021; Stock_Synthesis_by_Richard_Methot_(NOAA)_using_
    [2] "#_Stock_Synthesis_is_a_work_of_the_U.S._Government_and_is_not_subject_to_copyright_protection_
##
   [3] "#_Foreign_copyrights_may_apply._See_copyright.txt_for_more_information."
   [4] "#_User_support_available_at:NMFS.Stock.Synthesis@noaa.gov"
   [5] "#_User_info_available_at:https://vlab.noaa.gov/group/stock-synthesis"
##
    [6] "#_Source_code_at:_https://github.com/nmfs-stock-synthesis/stock-synthesis"
##
   [7] ""
   [8] "This file contains warnings, suggestions and notes generated as files are read and processed"
   [9] ""
##
## [10] "1 catch is 0.0 in endyr; this can cause problem in the benchmark and forecast calculations"
## [11] "2 NOTE: Max data length bin: 28 < max pop len bins: 30; so will accumulate larger pop len bi
## [12] "3 settle_month is less than spawn_month, so logical age at settlement calculated to be: 1 for
## [13] "4 mean recruitment for forecast is incompatible with pos. phase for forecast rec_devs; set pha
## [14] "5 setting in starter does not request all priors, and 1 parameters have priors and are not est
## [15] "6 1st iteration warning: ssb(endyr)/ssb(styr)= 4.77067e-07; suggest start with larger R0 to ge
## [16] "7 setting positive forecast relF for forecast only fleet: 1"
## [17] "8 setting positive forecast relF for forecast only fleet: 2"
## [18] "9 Final gradient: 5.08901e-05 is larger than final_conv: 1e-05"
## [19] "10 setting positive forecast relF for forecast only fleet: 1"
## [20] "11 setting positive forecast relF for forecast only fleet: 2"
## [21] "Note: 1 additional lines truncated. Look in warning.sso file to see full list."
##
## $likelihoods used
##
                                        values lambdas
## TOTAL
                        161.941000000000002501
## Catch
                          0.00000000000599152
                                                    NA
## Equil_catch
                          0.00000000000000000
                                                    NΑ
## Survey
                        -48.28090000000002592
                                                    NΑ
## Length_comp
                         76.38660000000001387
                                                    NA
## Age_comp
                         66.97339999999998045
                                                    NA
## Recruitment
                         66.85980000000007003
                                                     1
## InitEQ_Regime
                          0.00000000000000000
                                                     0
## Forecast_Recruitment
                          0.00000000000000000
                                                     1
## Parm_priors
                          0.000000000000000000
                                                     1
## Parm_softbounds
                          0.001928920000000000
                                                    NΑ
## Parm_devs
                          0.00000000000000000
                                                     1
## Crash_Pen
                          0.00000000000000000
                                                     1
## $likelihoods_laplace
##
                                        values lambdas
```

```
## NoBias_corr_Recruitment(info_only) 63.6913
                                                        1
                                                       NΑ
## Laplace_obj_fun(info_only)
                                        158.7720
##
##
   $likelihoods_by_fleet
##
                 Label
                                 ALL
                                        MexCal S1
                                                    MexCal S2
                                                                       PNW AT_Survey
                                  NA 1.00000e+00 1.00000e+00 1.00000e+00
## 180
          Catch lambda
                                                                               1.0000
            Catch like
## 181
                         5.99152e-13 1.38470e-13 1.26074e-13 3.34608e-13
                                                                               0.0000
## 182 Init equ lambda
                                   NA 0.00000e+00 0.00000e+00 0.00000e+00
                                                                               1.0000
## 183
         Init_equ_like
                         0.00000e+00 0.00000e+00 0.00000e+00 0.00000e+00
                                                                               0.0000
## 184
           Surv_lambda
                                   NA 0.00000e+00 0.00000e+00 0.00000e+00
                                                                               1.0000
## 185
             Surv_like
                        -4.82809e+01 0.00000e+00 0.00000e+00 0.00000e+00
                                                                             -21.3348
  186
            Surv_N_use
##
                                   NA 0.00000e+00 0.00000e+00 0.00000e+00
                                                                              19.0000
##
  187
           Surv_N_skip
                                   NA 0.00000e+00 0.00000e+00 0.00000e+00
                                                                               0.0000
## 188
         Length_lambda
                                   NA 1.00000e+00 1.00000e+00 1.00000e+00
                                                                               1.0000
## 189
                         7.63866e+01 1.34910e+01 2.03074e+01 3.25584e+00
                                                                              39.3323
           Length_like
## 190
          Length_N_use
                                   NA 1.50000e+01 1.50000e+01 1.60000e+01
                                                                              10.0000
## 191
                                   NA 0.00000e+00 0.00000e+00 9.00000e+00
                                                                               0.0000
         Length_N_skip
## 192
                                   NA 1.00000e+00 1.00000e+00 1.00000e+00
                                                                               1.0000
            Age_lambda
                                                                              28.3207
## 193
                         6.69734e+01 6.91723e+00 2.77972e+01 3.93827e+00
              Age_like
##
  194
             Age_N_use
                                   NA 1.50000e+01 1.50000e+01 1.50000e+01
                                                                              10.0000
##
   195
            Age_N_skip
                                   NA 0.00000e+00 0.00000e+00 0.00000e+00
                                                                               0.0000
##
                TEP all
           DEPM
         1.0000
                   1.0000
## 180
         0.0000
                   0.0000
##
   181
## 182
         1.0000
                   1.0000
  183
         0.0000
                   0.0000
  184
         1.0000
##
                   1.0000
##
   185
       -11.0418 -15.9043
  186
        10.0000
##
                 13.0000
## 187
         0.0000
                   0.0000
## 188
         0.0000
                   0.0000
##
  189
         0.0000
                   0.0000
##
  190
         0.0000
                   0.0000
         0.0000
##
  191
                   0.0000
##
   192
         0.0000
                   0.0000
  193
         0.0000
                   0.0000
##
## 194
         0.0000
                   0.0000
## 195
         0.0000
                   0.0000
##
##
   $N_estimated_parameters
   [1] 48
##
##
   $table_of_phases
##
        -5
            -4
               -3
                     -2
                              1
                                   2
                                       3
                                               5
                                   6
                                               2
##
                10
                          2
                             21
                                      16
                                           3
     1
         1
             1
##
##
   $estimated_non_dev_parameters
##
                                       Value Phase
                                                       Min
                                                             Max
                                                                        Init Status
## L_at_Amin_Fem_GP_1
                                 12.8931000
                                                      3.00 30.00 12.8541000
                                                                                 OK
                                                 3
                                                                                 OK
## L_at_Amax_Fem_GP_1
                                 24.9354000
                                                     15.00 40.00 24.8415000
## VonBert K Fem GP 1
                                   0.3042250
                                                 3
                                                      0.05
                                                            0.99
                                                                  0.3075730
                                                                                 OK
## CV_young_Fem_GP_1
                                   0.1193310
                                                 3
                                                      0.05
                                                            0.50
                                                                  0.1053490
                                                                                 ΠK
## CV_old_Fem_GP_1
                                   0.0209416
                                                 3
                                                      0.01
                                                            0.10
                                                                  0.0237245
                                                                                 OK
```

```
## SR LN(RO)
                                                    3.00 25.00 14.4668000
                                                                               OK
                                 14.5863000
## SR_regime_BLK1repl_2000
                                                4 -15.00 15.00 1.2915300
                                                                               OK
                                  1.0969100
## Size inflection MexCal S1(1) 10.8349000
                                                    0.00 30.00 10.9072000
                                                                               OK
                                                                               OK
## Size_95%width_MexCal_S1(1)
                                  0.6990270
                                                    0.00 10.00
                                                                0.6599090
## AgeSel_P1_MexCal_S1(1)
                                  0.5000230
                                                3 -10.00 11.00
                                                                 0.5000240
                                                                               OK
## AgeSel P2 MexCal S1(1)
                                                3 -10.00 11.00
                                                                               OK
                                  1.5290000
                                                                0.2048810
## AgeSel P3 MexCal S1(1)
                                  0.4116330
                                                3 -10.00 15.00 0.3827920
                                                                               OK
## AgeSel_P4_MexCal_S1(1)
                                 -1.4946700
                                                3 -10.00 11.00 -1.5494000
                                                                               OK
  AgeSel_P5_MexCal_S1(1)
                                 -0.2022500
                                                3 -10.00 11.00 -0.2361890
                                                                               OK
  AgeSel_P2_MexCal_S2(2)
                                  0.8203030
                                                3 -10.00 15.00 0.4405260
                                                                               OK
## AgeSel_P3_MexCal_S2(2)
                                 -1.2874400
                                                3 -10.00 11.00 -1.1690800
                                                                               OK
## AgeSel_P4_MexCal_S2(2)
                                  0.1509360
                                                3 -10.00 11.00 -0.1425740
                                                                               OK
## AgeSel_P5_MexCal_S2(2)
                                                3 -10.00 11.00 -0.4707320
                                                                               OK
                                 -0.6268860
## Age_inflection_PNW(3)
                                  2.8579400
                                                    0.00 10.00 2.8525100
                                                                               OK
## Age_95%width_PNW(3)
                                  1.1550600
                                                   -5.00 15.00 1.2152300
                                                                               ΠK
##
                                   Parm_StDev
                                                        Gradient Pr_type Prior
## L_at_Amin_Fem_GP_1
                                   0.06393300
                                               0.00000239140000 No_prior
                                                                             NA
## L at Amax Fem GP 1
                                               0.00000523951000 No prior
                                   0.11909000
                                                                             NA
## VonBert_K_Fem_GP_1
                                               0.00000603161000 No_prior
                                   0.00735414
                                                                             NA
## CV_young_Fem_GP_1
                                   0.00265329 -0.00000286378000 No prior
                                                                             NA
## CV_old_Fem_GP_1
                                   0.00255814
                                               0.00000013430100 No_prior
                                                                             NΑ
## SR LN(RO)
                                   0.02801730
                                               0.00005088990000 No_prior
                                                                             NA
## SR_regime_BLK1repl_2000
                                   0.08014820
                                               0.00000403482000 No_prior
                                                                             NA
## Size inflection MexCal S1(1)
                                   0.06619320
                                               0.00000165727000 No prior
                                                                             NA
## Size_95%width_MexCal_S1(1)
                                   0.06971070 -0.00000070302800 No prior
                                                                             NΑ
## AgeSel_P1_MexCal_S1(1)
                                 234.78400000
                                               0.00000000679385 No_prior
                                                                             NA
## AgeSel_P2_MexCal_S1(1)
                                   0.13865400 -0.00000366784000 No_prior
                                                                             NA
## AgeSel_P3_MexCal_S1(1)
                                   NA
## AgeSel_P4_MexCal_S1(1)
                                   0.17247300 -0.00000249066000 No_prior
                                                                             NA
## AgeSel_P5_MexCal_S1(1)
                                   0.20322600 -0.00000069336300 No_prior
                                                                             NA
## AgeSel_P2_MexCal_S2(2)
                                   0.07585290 -0.00000297140000 No_prior
                                                                             NA
## AgeSel_P3_MexCal_S2(2)
                                   0.15192900 -0.00000560017000 No_prior
                                                                             NA
## AgeSel_P4_MexCal_S2(2)
                                   0.22678200 -0.00000768801000 No_prior
                                                                             NA
                                   0.23053000 -0.00000470461000 No_prior
                                                                             NA
## AgeSel_P5_MexCal_S2(2)
                                   0.05740490 0.00000221659000 No prior
## Age_inflection_PNW(3)
                                                                             NA
## Age_95%width_PNW(3)
                                   0.04485290 -0.00000448727000 No_prior
                                                                             NA
##
                                 Pr SD Pr Like Afterbound
## L_at_Amin_Fem_GP_1
                                    NΑ
                                            NΑ
                                                       OK
## L_at_Amax_Fem_GP_1
                                    NA
                                            NΑ
                                                       OK
                                    NA
                                            NA
## VonBert_K_Fem_GP_1
## CV_young_Fem_GP_1
                                    NA
                                            NA
                                                       OK
## CV_old_Fem_GP_1
                                    NΑ
                                            NΑ
                                                       OK
## SR LN(RO)
                                    NA
                                            NA
                                                       OK
## SR_regime_BLK1repl_2000
                                            NA
                                                       OK
## Size_inflection_MexCal_S1(1)
                                            NA
                                                       OK
                                    NA
## Size_95%width_MexCal_S1(1)
                                    ΝA
                                            NA
                                                       OK
## AgeSel_P1_MexCal_S1(1)
                                    NA
                                            NA
                                                       OK
## AgeSel_P2_MexCal_S1(1)
                                    NA
                                            NA
                                                       OK
## AgeSel_P3_MexCal_S1(1)
                                    NA
                                            NA
                                                       OK
## AgeSel_P4_MexCal_S1(1)
                                            NA
                                                       OK
                                    NA
## AgeSel_P5_MexCal_S1(1)
                                                       OK
                                    NA
                                            NA
## AgeSel_P2_MexCal_S2(2)
                                            NA
                                                       OK
## AgeSel_P3_MexCal_S2(2)
                                            NΑ
                                                       OK
                                    NA
## AgeSel_P4_MexCal_S2(2)
                                                       OK
```

```
## AgeSel P5 MexCal S2(2)
                                    NA
                                             NA
                                                        OK
## Age_inflection_PNW(3)
                                    NΑ
                                             NΑ
                                                        ΠK
## Age_95%width_PNW(3)
                                    NA
                                             NA
                                                        OK
##
## $log_det_hessian
## [1] 233.889
## $maximum_gradient_component
## [1] 5.08901e-05
##
## $parameters_with_highest_gradients
##
                                          Gradient
                               Value
## SR LN(RO)
                           14.586300 5.08899e-05
## Main_RecrDev_2018
                           -1.064180 -8.09886e-06
## AgeSel_P4_MexCal_S2(2) 0.150936 -7.68801e-06
## Main_RecrDev_2016
                           -0.510400 -6.53673e-06
## VonBert_K_Fem_GP_1
                            0.304225 6.03161e-06
##
## $Length_Comp_Fit_Summary
        Factor Fleet Recommend var adj # N Npos min Nsamp max Nsamp mean Nsamp in
## 1187
             4
                    1
                               6.251470 # 15
                                                15
                                                           6
                                                                   1000
                                                                              97.0853
## 1188
             4
                    2
                               7.312770 # 15
                                                15
                                                           9
                                                                   1000
                                                                             122.0320
## 1189
                   3
                              55.611200 # 25
                                                16
                                                                   1000
                                                                             143.8350
             4
                                                           1
## 1190
                    4
                               0.137046 # 10
                                                10
                                                          12
                                                                   1000
                                                                             117.9000
##
        mean_Nsamp_adj mean_Nsamp_DM DM_theta mean_effN HarMean_effN Curr_Var_Adj
## 1187
               97.0853
                                   NA
                                             NA 2256.480
                                                               606.9260
                                                                                    1
## 1188
              122.0320
                                   NA
                                             NA 1798.830
                                                               892.3920
                                                                                    1
              143.8350
                                   NA
                                             NA 16878.900
                                                             7998.8400
                                                                                    1
## 1189
                                   NA
## 1190
              117.9000
                                             NA
                                                  198.749
                                                                16.1578
                                                                                    1
##
        Fleet name
## 1187 MexCal_S1
## 1188
        MexCal_S2
## 1189
               PNW
## 1190
        AT_Survey
## $Age_Comp_Fit_Summary
        Factor Fleet Recommend var adj # Nsamp adj Npos min Nsamp max Nsamp
## 1252
             5
                    1
                               1.182250 #
                                                  15
                                                       15
                                                               5.92
                                                                          1000
                    2
## 1253
             5
                               0.579745 #
                                                  15
                                                       15
                                                                8.92
                                                                          1000
## 1254
             5
                    3
                                                       15
                                                               26.88
                              12.015400 #
                                                  15
                                                                          1000
## 1255
                    4
                               0.127174 #
                                                  10
                                                       10
                                                               12.00
                                                                          1000
        mean_Nsamp_in mean_Nsamp_adj mean_Nsamp_DM DM_theta mean_effN HarMean_effN
               95.664
                              95.664
                                                  NA
                                                                768.824
## 1252
                                                           NA
                                                                             113.0980
## 1253
              121.093
                                                           NA
                                                                 202.334
                              121.093
                                                  NA
                                                                              70.2032
## 1254
              137.877
                                                               3565.740
                                                                            1656.6500
                              137.877
                                                  NA
                                                           NA
                                                                 240.866
## 1255
              117.900
                              117.900
                                                  NA
                                                           NA
                                                                              14.9938
##
        Curr_Var_Adj Fleet_name
## 1252
                      MexCal S1
                    1
## 1253
                    1
                      MexCal_S2
## 1254
                    1
                             PNW
## 1255
                      AT_Survey
                   1
##
## $SBzero
## [1] 92465.5
```

```
##
## $last_years_SPR
## [1] 1
## $SPRratioLabel
## [1] "1-SPR"
##
## $sigma_R_in
## [1] 0.5
##
## $sigma_R_info
##
             period N_devs SD_of_devs Var_of_devs mean_SE mean_SEsquared
## 1
                Main
                         20 1.432984
                                          2.053443 0.1001396
                                                                 0.01182879
## 2
         Early+Main
                         26
                            1.278190
                                          1.633770 0.1285671
                                                                 0.02253679
## 3 Early+Main+Late
                         27
                            1.253376 1.570950 0.1423239
                                                                 0.03096135
    sqrt_sum_of_components SD_of_devs_over_sigma_R sqrt_sum_over_sigma_R
## 1
                   1.437105
                                          2.865968
                                                                 2.874211
## 2
                   1.286976
                                           2.556380
                                                                 2.573952
## 3
                   1.265666
                                           2.506751
                                                                 2.531333
##
   alternative_sigma_R
               1.437105
## 1
## 2
               1.286976
## 3
              1.265666
##
## $rmse_table
                 RMSE RMSE_over_sigmaR mean_BiasAdj
      ERA N
## 1 main 20 1.396700
                               7.80308
                                            0.841539
## 2 early 6 0.553946
                                1.22742
                                            0.766330
##
## $cormessage1
## [1] Range of abs(parameter correlations) is 0 to 0.83492
## $cormessage2
## [1] No correlations above threshold (cormax=0.95)
##
## $cormessage7
## [1] 2 uncorrelated parameters below threshold (cormin=0.01)
## $cormessage8
                        name max
## 27
           Late_RecrDev_2020
## 30 AgeSel_P1_MexCal_S1(1)
## completed SS_output
EMssmse2020_dir <- "C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenarios/perfDatTests/constGrow2
outEMssmse2020 <- SS_output(EMssmse2020_dir)</pre>
## Getting header info from:
   C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenarios/perfDatTests/constGrow20010M_MidSteepH
```

##

\$current_depletion
[1] 0.2173292

```
## This function tested on SS versions 3.24 and 3.30.
   You are using 3.30.18.00 which SHOULD work with this package.
## Report file time:Mon Jun 06 17:21:42 2022
## Warning in SS_output(EMssmse2020_dir): Some stats skipped because the .cor file not found:C:/Users/r
## Warning in SS_output(EMssmse2020_dir): covar file contains the warning
        'Variances are 0.0 for first two elements, so do not write '
##
     input 'covar' changed to FALSE.
## Reading full report file
## Got all columns using ncols = 62
## Got Report file
## Setting minimum biomass threshhold to 0.25 based on US west coast assumption associated with biomas
## !warning: temporary files were written in this run:
                          TempFile
## "size of file gradfil1.tmp = 0" "size of file gradfil2.tmp = 0"
                              <NA>
## "size of file varssave.tmp = 0" "size of file cmpdiff.tmp = 0"
## Got warning file. Therewere 9 warnings in C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenario
## Finished reading files
## CompReport file separated by this code as follows (rows = Ncomps*Nbins):
     2184 rows of length comp data,
     O rows of generalized size comp data,
##
    495 rows of age comp data,
##
    O rows of conditional age-at-length data,
##
    0 rows of ghost fleet age comp data,
##
    O rows of ghost fleet conditional age-at-length data,
    351 rows of ghost fleet length comp data,
##
    0 rows of mean length at age data,
##
##
    O rows of mean weight at age data,
##
    0 rows of 'TAG1' comp data, and
    0 rows of 'TAG2' comp data.
## Finished dimensioning
## You skipped the covar file
## Finished primary run statistics list
## running SS_readstarter
```

```
##
     data, control files: init_dat.ss, control.ss
     converge_criterion = 1e-05
##
     SPR_basis = 4
##
    F_report_basis = 2
## Assuming version 3.30 based on number of numeric values.
##
     MCMC_output_detail = 0
##
     ALK_tolerance = 1e-04
## Reading a random seed value:7545659
## Read of starter file complete. Final value: 3.3
##
## Statistics shown below (to turn off, change input to printstats=FALSE)
## $SS version
## [1] "3.30.18.00;_safe;_compile_date:_Sep 30 2021;_Stock_Synthesis_by_Richard_Methot_(NOAA)_using_ADM
## $SS_versionshort
## [1] "3.30"
##
## $SS_versionNumeric
## [1] 3.3
##
## $StartTime
## [1] "StartTime: Mon Jun 06 17:21:42 2022"
## $RunTime
## [1] "0 hours, 0 minutes, 13 seconds."
## $Files_used
## [1] "Data_File: init_dat.ss Control_File: control.ss"
## $Nwarnings
## [1] 9
##
## $warnings
  [1] "#V3.30.18.00; safe; compile_date: Sep 30 2021; Stock_Synthesis_by_Richard_Methot_(NOAA)_using_
##
   [2] "#_Stock_Synthesis_is_a_work_of_the_U.S._Government_and_is_not_subject_to_copyright_protection_
##
   [3] "#_Foreign_copyrights_may_apply._See_copyright.txt_for_more_information."
   [4] "#_User_support_available_at:NMFS.Stock.Synthesis@noaa.gov"
   [5] "#_User_info_available_at:https://vlab.noaa.gov/group/stock-synthesis"
##
   [6] "#_Source_code_at:_https://github.com/nmfs-stock-synthesis/stock-synthesis"
   [7] ""
##
##
   [8] "This file contains warnings, suggestions and notes generated as files are read and processed"
```

```
[9] ""
## [10] "1 catch is 0.0 in endyr; this can cause problem in the benchmark and forecast calculations"
  [11] "2 NOTE: Max data length bin: 28 < max pop len bins: 30; so will accumulate larger pop len bin
  [12] "3 settle_month is less than spawn_month, so logical age at settlement calculated to be: 1 for
  [13] "4 mean recruitment for forecast is incompatible with pos. phase for forecast rec_devs; set pha
  [14] "5 setting in starter does not request all priors, and 1 parameters have priors and are not est
## [15] "6 1st iteration warning: ssb(endyr)/ssb(styr)= 4.77067e-07; suggest start with larger R0 to ge
## [16] "7 Final gradient: 5.60127e-05 is larger than final_conv: 1e-05"
  [17] "8 setting positive forecast relF for forecast only fleet: 1"
  [18] "9 setting positive forecast relF for forecast only fleet: 2"
  [19] "N warnings: 9"
##
## $likelihoods_used
##
                                         values lambdas
## TOTAL
                        979.327999999999974534
                                                     NΑ
## Catch
                          0.00000000000525423
                                                     NA
## Equil_catch
                          0.000000000000000000
                                                     NΑ
## Survey
                        -27.60739999999998386
                                                     NA
## Length_comp
                        800.927000000000020918
                                                     NΑ
## Age_comp
                        112.629000000000004889
## Recruitment
                         93.377700000000004366
                                                      1
                          0.000000000000000000
                                                      0
## InitEQ_Regime
## Forecast_Recruitment
                          0.00000000000000000
                                                      1
## Parm_priors
                          0.000000000000000000
                                                      1
## Parm softbounds
                          0.002040090000000000
                                                     NΑ
## Parm devs
                          1
## Crash_Pen
                          0.000000000000000000
                                                      1
## $likelihoods_laplace
##
                                         values lambdas
## NoBias_corr_Recruitment(info_only)
                                       90.2091
## Laplace_obj_fun(info_only)
                                      976.1600
                                                     NA
##
## $likelihoods_by_fleet
                 Label
                                      MexCal S1
                                                   MexCal S2
                                                                     PNW AT Survey
##
                                ALL
## 180
          Catch lambda
                                 NA 1.00000e+00 1.00000e+00 1.00000e+00
                                                                            1.0000
## 181
            Catch like
                        5.25423e-13 1.27569e-13 1.29479e-13 2.68375e-13
                                                                            0.0000
## 182 Init_equ_lambda
                                 NA 0.00000e+00 0.00000e+00 0.00000e+00
                                                                            1.0000
         Init_equ_like
                        0.00000e+00 0.00000e+00 0.00000e+00 0.00000e+00
## 183
                                                                            0.0000
## 184
           Surv_lambda
                                 NA 0.00000e+00 0.00000e+00 0.00000e+00
                                                                            1.0000
## 185
             Surv like -2.76074e+01 0.00000e+00 0.00000e+00 0.00000e+00
                                                                          -12.6314
            Surv_N_use
                                 NA 0.00000e+00 0.00000e+00 0.00000e+00
## 186
                                                                           19.0000
## 187
           Surv_N_skip
                                 NA 0.00000e+00 0.00000e+00 0.00000e+00
                                                                            0.0000
                                 NA 1.00000e+00 1.00000e+00 1.00000e+00
## 188
         Length_lambda
                                                                            1.0000
## 189
           Length_like
                        8.00927e+02 2.02287e+02 2.29441e+02 1.93703e+02
                                                                         175.4960
## 190
                                 NA 1.50000e+01 1.50000e+01 1.60000e+01
          Length_N_use
                                                                           10.0000
## 191
         Length_N_skip
                                 NA 0.00000e+00 0.00000e+00 9.00000e+00
                                                                            0.0000
## 192
            Age_lambda
                                 NA 1.00000e+00 1.00000e+00 1.00000e+00
                                                                            1.0000
## 193
                        1.12629e+02 2.28733e+01 4.27931e+01 9.71992e+00
                                                                           37.2428
              Age_like
## 194
                                 NA 1.50000e+01 1.50000e+01 1.50000e+01
                                                                           10.0000
             Age_N_use
                                 NA 0.00000e+00 0.00000e+00 0.00000e+00
##
  195
                                                                            0.0000
            Age_N_skip
##
           DEPM TEP all
## 180
        1.00000
                 1.00000
## 181
       0.00000 0.00000
```

```
## 182
        1.00000
                1.00000
## 183
        0.00000 0.00000
  184
        1.00000
                 1.00000
  185 -6.01839 -8.95759
  186 10.00000 13.00000
  187
        0.00000
                0.00000
## 188
        0.00000
                 0.00000
## 189
        0.00000
                 0.00000
## 190
        0.00000
                 0.00000
  191
        0.00000
                 0.00000
  192
        0.00000
                 0.00000
##
   193
        0.00000
                 0.00000
##
   194
        0.00000
                 0.00000
##
   195
        0.00000
                 0.00000
##
## $N_estimated_parameters
##
   [1] 48
##
##
   $table_of_phases
##
##
   -99
        -5
            -4
                -3
                    -2
                                  2
                                      3
                                           4
                                               5
                         -1
                              1
                          2
                                  6
                                     16
                                           3
                                               2
##
                10
                             21
##
## $estimated_non_dev_parameters
##
                                      Value Phase
                                                      Min
                                                            Max
                                                                       Init Status
## L_at_Amin_Fem_GP_1
                                 12.8363000
                                                     3.00 30.00 12.8541000
                                                                                OK
                                                                                OK
## L_at_Amax_Fem_GP_1
                                 24.5884000
                                                    15.00 40.00 24.8415000
## VonBert_K_Fem_GP_1
                                  0.3238950
                                                 3
                                                     0.05
                                                           0.99
                                                                  0.3075730
                                                                                OK
## CV_young_Fem_GP_1
                                  0.1230970
                                                     0.05
                                                           0.50
                                                                  0.1053490
                                                                                OK
## CV_old_Fem_GP_1
                                  0.0259429
                                                           0.10
                                                     0.01
                                                                  0.0237245
                                                                                OK
## SR_LN(RO)
                                 14.4624000
                                                 1
                                                     3.00 25.00 14.4668000
                                                                                OK
## SR_regime_BLK1repl_2000
                                                 4 -15.00 15.00
                                                                 1.2915300
                                                                                OK
                                  1.1478700
## Size_inflection_MexCal_S1(1) 10.7772000
                                                     0.00 30.00 10.9072000
                                                                                OK
## Size_95%width_MexCal_S1(1)
                                                     0.00 10.00
                                                                                OK
                                  0.6344040
                                                                  0.6599090
## AgeSel_P1_MexCal_S1(1)
                                                 3 -10.00 11.00
                                  0.5000220
                                                                  0.5000240
                                                                                OK
## AgeSel_P2_MexCal_S1(1)
                                  1.5395100
                                                 3 -10.00 11.00
                                                                 0.2048810
                                                                                OK
## AgeSel P3 MexCal S1(1)
                                  0.2970670
                                                 3 -10.00 15.00 0.3827920
                                                                                ΩK
                                                 3 -10.00 11.00 -1.5494000
## AgeSel_P4_MexCal_S1(1)
                                 -1.5433100
                                                                                ΩK
                                                 3 -10.00 11.00 -0.2361890
## AgeSel_P5_MexCal_S1(1)
                                 -0.1786430
                                                                                ΩK
## AgeSel_P2_MexCal_S2(2)
                                                 3 -10.00 15.00 0.4405260
                                                                                OK
                                  0.7715240
## AgeSel P3 MexCal S2(2)
                                 -1.2534000
                                                 3 -10.00 11.00 -1.1690800
                                                                                OK
                                                 3 -10.00 11.00 -0.1425740
                                                                                OK
## AgeSel_P4_MexCal_S2(2)
                                 -0.1323180
## AgeSel_P5_MexCal_S2(2)
                                 -0.4698480
                                                 3 -10.00 11.00 -0.4707320
                                                                                OK
                                                                                OK
## Age_inflection_PNW(3)
                                  2.8150600
                                                     0.00 10.00 2.8525100
## Age_95%width_PNW(3)
                                  1.0982600
                                                   -5.00 15.00 1.2152300
                                                                                OK
##
                                 Parm_StDev
                                                      Gradient Pr_type Prior Pr_SD
## L_at_Amin_Fem_GP_1
                                           0
                                              0.00002512010000 No_prior
                                                                            NA
                                                                                   NA
## L_at_Amax_Fem_GP_1
                                              0.00003339680000 No_prior
                                                                            NA
                                                                                   NA
## VonBert_K_Fem_GP_1
                                              0.00001355970000 No_prior
                                                                            NA
                                                                                  NA
## CV_young_Fem_GP_1
                                              0.00000075648400 No_prior
                                                                            NA
                                                                                   NA
## CV_old_Fem_GP_1
                                              0.00000132656000 No_prior
                                                                            NA
                                                                                  NA
## SR_LN(RO)
                                              0.00004827200000 No_prior
                                                                            NA
                                                                                  NA
## SR_regime_BLK1repl_2000
                                              0.00002574590000 No_prior
                                                                            NA
                                                                                  ΝA
## Size inflection MexCal S1(1)
                                             0.00000062811500 No prior
                                                                                   NΑ
```

```
## Size_95%width_MexCal_S1(1)
                                           0 -0.00000039065600 No prior
                                                                             NA
                                                                                   NA
## AgeSel_P1_MexCal_S1(1)
                                                                             NA
                                                                                   ΝA
                                           0 0.00000000657462 No_prior
## AgeSel P2 MexCal S1(1)
                                           0 -0.00000260523000 No prior
                                                                             NA
                                                                                   NA
                                                                             NA
## AgeSel_P3_MexCal_S1(1)
                                              0.00001181460000 No_prior
                                                                                   NA
## AgeSel_P4_MexCal_S1(1)
                                           0
                                              0.00000163051000 No_prior
                                                                             NA
                                                                                   NA
## AgeSel P5 MexCal S1(1)
                                              0.00000069669100 No prior
                                                                             NA
                                                                                   NA
## AgeSel P2 MexCal S2(2)
                                              0.00000288194000 No_prior
                                                                             NA
                                                                                   NA
## AgeSel_P3_MexCal_S2(2)
                                           0
                                              0.00000889265000 No_prior
                                                                             NA
                                                                                   NA
## AgeSel_P4_MexCal_S2(2)
                                           0
                                              0.00000444016000 No_prior
                                                                             NA
                                                                                   NA
## AgeSel_P5_MexCal_S2(2)
                                              0.00000828019000 No_prior
                                                                             NA
                                                                                   NA
## Age_inflection_PNW(3)
                                              0.00001576210000 No_prior
                                                                             NA
                                                                                   NA
## Age_95%width_PNW(3)
                                           0 -0.00005477310000 No_prior
                                                                             NA
                                                                                   ΝA
                                 Pr_Like Afterbound
##
## L_at_Amin_Fem_GP_1
                                       NA
                                                  OK
                                                  OK
## L_at_Amax_Fem_GP_1
                                       NA
## VonBert_K_Fem_GP_1
                                       NA
                                                  OK
## CV_young_Fem_GP_1
                                       NA
                                                  OK
## CV_old_Fem_GP_1
                                                  OK
                                       NA
## SR_LN(RO)
                                                  OK
                                       NA
## SR_regime_BLK1repl_2000
                                       NΑ
                                                  OK
## Size_inflection_MexCal_S1(1)
                                       NΑ
                                                  OK
## Size_95%width_MexCal_S1(1)
                                       NA
                                                  OK
## AgeSel_P1_MexCal_S1(1)
                                       NA
                                                  OK
## AgeSel_P2_MexCal_S1(1)
                                       NA
                                                  OK
## AgeSel_P3_MexCal_S1(1)
                                       NΑ
                                                  OK
## AgeSel_P4_MexCal_S1(1)
                                       NA
                                                  OK
## AgeSel_P5_MexCal_S1(1)
                                       NA
                                                  OK
## AgeSel_P2_MexCal_S2(2)
                                       NA
                                                  OK
## AgeSel_P3_MexCal_S2(2)
                                       NA
                                                  OK
## AgeSel_P4_MexCal_S2(2)
                                       NA
                                                  OK
## AgeSel_P5_MexCal_S2(2)
                                       NA
                                                  OK
## Age_inflection_PNW(3)
                                       NΑ
                                                  OK
   Age_95%width_PNW(3)
                                       NA
                                                  OK
##
## $maximum_gradient_component
   [1] 5.60127e-05
##
##
## $parameters_with_highest_gradients
##
                               Value
                                          Gradient
## Age_95%width_PNW(3)
                             1.09826 -5.47731e-05
## SR LN(RO)
                            14.46240
                                      4.82720e-05
## L_at_Amax_Fem_GP_1
                            24.58840
                                       3.33968e-05
## SR_regime_BLK1repl_2000
                            1.14787
                                       2.57459e-05
## L_at_Amin_Fem_GP_1
                            12.83630 2.51201e-05
##
   $Length_Comp_Fit_Summary
##
        Factor Fleet Recommend_var_adj # N Npos min_Nsamp max_Nsamp mean_Nsamp_in
## 1187
             4
                    1
                              0.2616840 # 15
                                                15
                                                            6
                                                                   1000
                                                                                96.800
## 1188
             4
                    2
                              0.2898890 # 15
                                                15
                                                            9
                                                                   1000
                                                                               121.733
  1189
             4
                    3
                              0.0924150 # 25
                                                16
                                                            1
                                                                   1000
                                                                               143.438
##
   1190
                    4
                              0.0978699 # 10
                                                10
                                                           12
                                                                   1000
                                                                               117.900
##
        mean_Nsamp_adj mean_Nsamp_DM DM_theta mean_effN HarMean_effN Curr_Var_Adj
## 1187
                96.800
                                   NA
                                             NA
                                                  85.4177
                                                                25.3310
                                                                                    1
## 1188
               121.733
                                   NA
                                             NA
                                                  86.3953
                                                                35.2892
                                                                                    1
```

```
## 1189
               143.438
                                   NA
                                             NA 116.5010
                                                                13.2558
                                                                                    1
## 1190
               117.900
                                   NΑ
                                             NΑ
                                                  21.4393
                                                                11.5389
                                                                                    1
        Fleet name
##
## 1187 MexCal_S1
## 1188
         MexCal S2
## 1189
               PNW
## 1190 AT Survey
##
## $Age_Comp_Fit_Summary
##
        Factor Fleet Recommend_var_adj # Nsamp_adj Npos min_Nsamp max_Nsamp
## 1252
             5
                    1
                               1.168670 #
                                                  15
                                                       15
## 1253
             5
                    2
                               0.531994 #
                                                                 100
                                                                           1000
                                                  15
                                                       15
## 1254
             5
                    3
                               4.965550 #
                                                                 100
                                                                           1000
                                                  15
                                                       15
                               0.709544 #
## 1255
             5
                    4
                                                       10
                                                                 100
                                                                           1000
                                                  10
        mean_Nsamp_in mean_Nsamp_adj mean_Nsamp_DM DM_theta mean_effN HarMean_effN
## 1252
                  160
                                   160
                                                  NA
                                                            NA
                                                                 647.648
                                                                              186.9870
## 1253
                  160
                                   160
                                                  NA
                                                            NA
                                                                 307.313
                                                                               85.1191
## 1254
                   160
                                   160
                                                  NA
                                                            NA
                                                                1053.460
                                                                              794.4880
## 1255
                  190
                                   190
                                                  NA
                                                            NA
                                                                 660.085
                                                                              134.8130
        Curr_Var_Adj Fleet_name
## 1252
                    1 MexCal S1
## 1253
                       MexCal S2
                             PNW
## 1254
                    1
## 1255
                    1 AT_Survey
##
## $SBzero
## [1] 82148.5
## $current_depletion
## [1] 0.2326263
##
## $last_years_SPR
## [1] 1
##
## $SPRratioLabel
## [1] "1-SPR"
##
## $sigma_R_in
## [1] 0.5
##
## $sigma R info
##
              period N_devs SD_of_devs Var_of_devs mean_SE mean_SEsquared
## 1
                          20
                               1.648967
                                            2.719092
                                                            0
                Main
## 2
          Early+Main
                          26
                               1.471087
                                            2.164097
                                                            0
                                                                            0
## 3 Early+Main+Late
                          27
                               1.442526
                                            2.080881
                                                            0
     sqrt_sum_of_components SD_of_devs_over_sigma_R sqrt_sum_over_sigma_R
## 1
                    1.648967
                                             3.297934
                                                                    3.297934
## 2
                    1.471087
                                             2.942174
                                                                    2.942174
## 3
                    1.442526
                                             2.885052
                                                                    2.885052
##
     alternative_sigma_R
## 1
                1.648967
## 2
                1.471087
## 3
                1.442526
##
```

```
## $rmse table
      ERA N
                 RMSE RMSE_over_sigmaR mean_BiasAdj
                                          0.841539
## 1 main 20 1.607210
                             10.33260
## 2 early 6 0.639361
                               1.63513
                                            0.766330
## completed SS_output
comp5yr2020 <- SSsummarize(list(OM2020 = outOM5yr,</pre>
                                   EMssmse2020 = outEMssmse2020,
                                   EM5yr2020 = outEM5yr2020)
## Summarizing 3 models:
## imodel=1/3
    N active pars = 0
##
## imodel=2/3
    N active pars = 48
## imodel=3/3
    N active pars = 48
## Summary finished. To avoid printing details above, use 'verbose = FALSE'.
SSplotComparisons(comp5yr2020, legendlabels = c("OM", "SSMSE 2020", "Perf 2020"),
                  subplots = c(2,10, 12, 13, 14))
## Warning in SSplotComparisons(comp5yr2020, legendlabels = c("OM", "SSMSE 2020", :
## setting btarg = -999 because models don't have matching values
## Warning in SSplotComparisons(comp5yr2020, legendlabels = c("OM", "SSMSE 2020", :
## setting minbthresh = -999 because models don't have matching values
## Warning in SSplotComparisons(comp5yr2020, legendlabels = c("OM", "SSMSE 2020", :
## setting sprtarg = -999 because models don't have matching values
## Warning in SSplotComparisons(comp5yr2020, legendlabels = c("OM", "SSMSE 2020", :
## setting label for SPR plot to 8th element of input 'labels' because the models
## don't have matching labels
## Warning in SSplotComparisons(comp5yr2020, legendlabels = c("OM", "SSMSE 2020", :
## setting label for F plot to 13th element of input 'labels' because the models
## don't have matching labels
## showing uncertainty for all models
```

```
## No uncertainty available for model 1
## No uncertainty available for model 2
## subplot 2: spawning biomass with uncertainty intervals
## subplot 10: recruits with uncertainty
## subplot 12: recruit devs with uncertainty
## subplot 13: index fits
## subplot 14: index fits on a log scale
```

Biomass average w/ forecast HCR application

```
# Biomass average w/ forecast 2019 assessment
OMbavg_dir <- "C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenarios/perfDatTests/constGrow2001OM
datOMbavg <- SS_readdat(file.path(OMbavg_dir, "data.ss_new"),</pre>
                    verbose = FALSE,
                    section = 2)
EMbavg2019_dir <- "C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenarios/perfDatTests/constGrow20
datEMbavg2019 <- SS_readdat(file.path(EMbavg2019_dir, "init_dat.ss"),</pre>
                    verbose = FALSE,
                    section = 1)
datEMbavg2019$catch <- datOMbavg$catch %>% filter(year <= 2019)</pre>
datEMbavg2019$CPUE <- datOMbavg$CPUE %>% filter(year <= 2019) %>%
  mutate(index = abs(index))
datEMbavg2019$lencomp <- datOMbavg$lencomp %>% filter(Yr <= 2019) %>%
 mutate(FltSvy = case_when(FltSvy == -3 & Seas == 10 ~ FltSvy,
                            TRUE ~ abs(FltSvy)))
datEMbavg2019$agecomp <- datOMbavg$agecomp %>% filter(Yr <= 2019) %>%
  mutate(FltSvy = abs(FltSvy))
SS_writedat(datlist = datEMbavg2019,
            outfile = file.path(file.path(EMbavg2019_dir, "init_dat.ss")),
            overwrite = TRUE,
            verbose = FALSE)
# Biomass average w/ forecast 2020 assessment
EMbavg2020_dir <- "C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenarios/perfDatTests/constGrow20
datEMbavg2020 <- SS_readdat(file.path(EMbavg2020_dir, "init_dat.ss"),</pre>
                    verbose = FALSE,
                    section = 1)
```

Read in output and compare against the OM

```
# plot comparisons
outOMbavg <- SS_output(OMbavg_dir)</pre>
## Getting header info from:
    C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenarios/perfDatTests/constGrow20010M_MidSteepH
## This function tested on SS versions 3.24 and 3.30.
    You are using 3.30.18.00 which SHOULD work with this package.
## Report file time:Mon Jun 06 17:38:08 2022
## Warning in SS_output(OMbavg_dir): Some stats skipped because the .cor file not found:C:/Users/r.wild
## Warning in SS_output(OMbavg_dir): covar file contains the warning
        'Variances are 0.0 for first two elements, so do not write '
##
     input 'covar' changed to FALSE.
## Reading full report file
## Got all columns using ncols = 62
## Got Report file
## !warning: temporary files were written in this run:
                          TempFile
## "size of file gradfil1.tmp = 0" "size of file gradfil2.tmp = 0"
                              < NA >
## "size of file varssave.tmp = 0" "size of file cmpdiff.tmp = 0"
## Got warning file. Therewere 6 warnings in C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenario
```

```
## Finished reading files
## CompReport file separated by this code as follows (rows = Ncomps*Nbins):
     2028 rows of length comp data,
##
     O rows of generalized size comp data,
    459 rows of age comp data,
##
    O rows of conditional age-at-length data,
##
     360 rows of ghost fleet age comp data,
     O rows of ghost fleet conditional age-at-length data,
##
##
    1911 rows of ghost fleet length comp data,
    0 rows of mean length at age data,
##
    O rows of mean weight at age data,
    0 rows of 'TAG1' comp data, and
##
    0 rows of 'TAG2' comp data.
## Finished dimensioning
## You skipped the covar file
## Finished primary run statistics list
##
## Statistics shown below (to turn off, change input to printstats=FALSE)
## $SS_version
## [1] "3.30.18.00; safe; compile_date: Sep 30 2021; Stock_Synthesis_by_Richard_Methot_(NOAA)_using_ADM
## $SS_versionshort
## [1] "3.30"
##
## $SS_versionNumeric
## [1] 3.3
## $StartTime
## [1] "StartTime: Mon Jun 06 17:38:08 2022"
##
## $RunTime
## [1] "0 hours, 0 minutes, 0 seconds."
## $Files_used
## [1] "Data_File: data.ss Control_File: control.ss"
##
## $Nwarnings
## [1] 6
##
## $warnings
## [1] "#V3.30.18.00;_safe;_compile_date:_Sep 30 2021;_Stock_Synthesis_by_Richard_Methot_(NOAA)_using_
   [2] "#_Stock_Synthesis_is_a_work_of_the_U.S._Government_and_is_not_subject_to_copyright_protection_
## [3] "#_Foreign_copyrights_may_apply._See_copyright.txt_for_more_information."
## [4] "#_User_support_available_at:NMFS.Stock.Synthesis@noaa.gov"
## [5] "#_User_info_available_at:https://vlab.noaa.gov/group/stock-synthesis"
## [6] "#_Source_code_at:_https://github.com/nmfs-stock-synthesis/stock-synthesis"
```

```
[7] ""
##
##
    [8] "This file contains warnings, suggestions and notes generated as files are read and processed"
   [9] ""
## [10] "1 NOTE: Max data length bin: 28 < max pop len bins: 30; so will accumulate larger pop len bi
## [11] "2 Forecast=0 or -1, so rest of forecast file will not be read and can be omitted;"
## [12] "2 A one year forecast using recent F will be done automatically"
## [13] "3 settle_month is less than spawn_month, so logical age at settlement calculated to be: 1 for
## [14] "4 setting in starter does not request all priors, and 1 parameters have priors and are not est
  [15] "5 Forecast F capped by max possible F from control file: 4"
   [16] "6 Forecast F capped by max possible F from control file: 4"
  [17] "N warnings: 6"
##
## $likelihoods_used
                                values lambdas
##
## TOTAL
                         51508.8000000
                                             NΑ
## Catch
                         51349.0000000
                                             NA
                                             NA
## Equil_catch
                             0.000000
## Survey
                           -28.0180000
                                             NA
## Length_comp
                            41.9452000
                                             NΑ
## Age_comp
                            37.4688000
                                             NΑ
## Recruitment
                            78.3199000
                                              1
## InitEQ_Regime
                             0.000000
                                              0
## Forecast_Recruitment
                                              1
                            30.1114000
## Parm_priors
                             0.000000
                                              1
## Parm softbounds
                             0.0019748
                                             NΑ
## Parm devs
                             0.000000
                                              1
## Crash_Pen
                             0.000000
                                              1
##
## $likelihoods_laplace
##
                                            values lambdas
## NoBias_corr_Recruitment(info_only)
                                           75.1513
                                                         1
## Laplace_obj_fun(info_only)
                                       51505.6000
                                                        NA
##
## $likelihoods_by_fleet
##
                 Label
                               ALL
                                     MexCal S1
                                                  MexCal S2
                                                                     PNW AT_Survey
                                        1.00000
## 185
          Catch lambda
                                NA
                                                    1.00000
                                                                 1.00000
                                                                           1.00000
## 186
            Catch like 51349.0000
                                   18550.10000 18632.70000 14166.20000
                                                                           0.00000
## 187 Init_equ_lambda
                                                                 0.00000
                                                                           1.00000
                                       0.00000
                                                    0.00000
                                NA
         Init_equ_like
                            0.0000
## 188
                                        0.00000
                                                    0.00000
                                                                 0.00000
                                                                           0.00000
## 189
           Surv_lambda
                                                                 0.00000
                                                                           1.00000
                                NA
                                       0.00000
                                                    0.00000
## 190
             Surv like
                          -28.0180
                                       0.00000
                                                    0.00000
                                                                 0.00000
                                                                          -9.94359
## 191
            Surv_N_use
                                NA
                                       0.00000
                                                    0.00000
                                                                 0.00000
                                                                          18.00000
## 192
           Surv_N_skip
                                NA
                                       0.00000
                                                    0.00000
                                                                 0.00000
                                                                          10.00000
## 193
         Length_lambda
                                NA
                                       1.00000
                                                    1.00000
                                                                 1.00000
                                                                           1.00000
## 194
           Length_like
                           41.9452
                                       0.98456
                                                    2.63440
                                                                 1.66827
                                                                          36.65790
## 195
          Length_N_use
                                NA
                                      14.00000
                                                   14.00000
                                                                15.00000
                                                                           9.00000
         Length_N_skip
## 196
                                NA
                                      10.00000
                                                   10.00000
                                                                19.00000
                                                                          10.00000
## 197
            Age_lambda
                                NA
                                       1.00000
                                                    1.00000
                                                                 1.00000
                                                                           1.00000
## 198
              Age_like
                           37.4688
                                       1.16795
                                                    3.26694
                                                                 3.16781
                                                                          29.86610
## 199
             Age_N_use
                                       14.00000
                                                   14.00000
                                                                14.00000
                                                                           9.00000
                                NA
##
  200
                                      10.00000
                                                   10.00000
                                                                10.00000
                                                                          10.00000
            Age_N_skip
                                NA
##
           DEPM TEP_all
## 185
        1.00000
                  1.0000
## 186
        0.00000
                  0.0000
```

```
## 187 1.00000
                  1.0000
## 188 0.00000
                  0.0000
                  1.0000
## 189 1.00000
## 190 -1.76351 -16.3109
## 191 10.00000
                 13.0000
## 192 0.00000
                  0.0000
## 193 0.00000
                  0.0000
## 194
       0.00000
                  0.0000
## 195
        0.00000
                  0.0000
## 196
        0.00000
                  0.0000
## 197
        0.00000
                  0.0000
## 198
        0.00000
                  0.0000
        0.00000
## 199
                  0.0000
## 200
       0.00000
                  0.0000
##
## $N_estimated_parameters
## [1] 1
##
## $table_of_phases
##
## -99 -5
           -4 -3 -2 -1
##
             1 10
##
## $estimated_non_dev_parameters
## [1] Value
                   Phase
                               Min
                                          Max
                                                      Init
                                                                 Status
  [7] Parm StDev Gradient
                               Pr_type
                                          Prior
                                                     Pr_SD
                                                                 Pr_Like
## <0 rows> (or 0-length row.names)
## $maximum_gradient_component
## [1] 0
##
## $Length_Comp_Fit_Summary
##
        Factor Fleet Recommend_var_adj # N Npos min_Nsamp max_Nsamp mean_Nsamp_in
## 1506
                               59.69170 # 24
                                                                 86.00
                                                                             32.5914
             4
                                               14
                                                           6
                   1
                   2
## 1507
             4
                               36.47650 # 24
                                               14
                                                           9
                                                                108.80
                                                                             59.3200
## 1508
             4
                   3
                              111.35100 # 34
                                               15
                                                           1
                                                                174.48
                                                                             86.7573
## 1509
                   4
                                0.43845 # 19
                                                9
                                                          12
                                                                 31.00
                                                                              19.8889
##
        mean_Nsamp_adj mean_Nsamp_DM DM_theta mean_effN HarMean_effN Curr_Var_Adj
## 1506
               32.5914
                                   NA
                                            NA 74598.2000
                                                             1945.44000
## 1507
               59.3200
                                   NA
                                            NA 70693.4000
                                                             2163.79000
                                                                                    1
## 1508
               86.7573
                                   NA
                                            NA 22722.6000
                                                             9660.53000
                                                                                    1
## 1509
               19.8889
                                   NA
                                            NA
                                                  79.1256
                                                                8.72028
                                                                                    1
        Fleet name
## 1506 MexCal_S1
## 1507
         MexCal_S2
               PNW
## 1508
## 1509 AT_Survey
##
## $Age_Comp_Fit_Summary
        Factor Fleet Recommend_var_adj # Nsamp_adj Npos min_Nsamp max_Nsamp
## 1607
             5
                               9.329390 #
                                                 24
                                                               5.92
                                                                        86.00
                   1
                                                       14
## 1608
                   2
                                                               8.92
             5
                               4.260200 #
                                                 24
                                                       14
                                                                       105.16
## 1609
             5
                   3
                              17.893600 #
                                                 24
                                                       14
                                                              26.88
                                                                       138.12
## 1610
             5
                   4
                               0.428988 #
                                                  19
                                                       9
                                                              12.00
                                                                        31.00
```

```
## 1608
              58.3143
                              58.3143
                                                  NA
                                                           NA
                                                               8139.9400
              76.2971
                              76.2971
                                                                3175.6600
## 1609
                                                  NA
                                                           NA
##
  1610
              19.8889
                              19.8889
                                                  NA
                                                           NA
                                                                  60.1969
##
        HarMean_effN Curr_Var_Adj Fleet_name
           289.85100
                                 1 MexCal S1
## 1607
## 1608
           248.43000
                                 1
                                    MexCal S2
## 1609
          1365.23000
                                 1
                                           PNW
## 1610
             8.53209
                                 1
                                    AT_Survey
##
## $SBzero
## [1] 80588.5
##
## $current_depletion
## [1] 0.1957041
##
## $last_years_SPR
## [1] NaN
##
## $SPRratioLabel
## [1] "raw_SPR"
##
## $sigma_R_in
## [1] 0.5
## $sigma_R_info
##
              period N_devs SD_of_devs Var_of_devs mean_SE mean_SEsquared
## 1
                          20
                               1.526787
                                            2.331078
                                                          NA
                                                                          NA
## 2
          Early+Main
                          26
                               1.364724
                                            1.862471
                                                          NA
                                                                          NA
## 3 Early+Main+Late
                          36
                               1.327054
                                            1.761071
                                                          NA
                                                                          NA
     sqrt_sum_of_components SD_of_devs_over_sigma_R sqrt_sum_over_sigma_R
## 1
                          NA
                                             3.053573
## 2
                          NA
                                             2.729447
                                                                          NA
## 3
                          NA
                                             2.654107
                                                                          NA
##
     alternative_sigma_R
## 1
## 2
                       NA
## 3
                       NA
##
## $rmse table
##
                  RMSE RMSE_over_sigmaR mean_BiasAdj
       ERA N
## 1 main 20 1.488130
                                 8.85811
                                              0.841539
                                              0.766330
## 2 early 6 0.618608
                                 1.53070
## completed SS_output
outEMbavg2019 <- SS_output(EMbavg2019_dir)</pre>
## Getting header info from:
     C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenarios/perfDatTests/constGrow20010M_MidSteepH
## This function tested on SS versions 3.24 and 3.30.
     You are using 3.30.18.00 which SHOULD work with this package.
```

mean_Nsamp_in mean_Nsamp_adj mean_Nsamp_DM DM_theta mean_effN

NA

NA 10076.4000

31.0686

1607

31.0686

```
## Report file time: Tue Jun 07 10:51:30 2022
## Reading full report file
## Got all columns using ncols = 62
## Got Report file
## Setting minimum biomass threshhold to 0.25 based on US west coast assumption associated with biomas
## !warning: temporary files were written in this run:
                          TempFile
## "size of file gradfil1.tmp = 0" "size of file gradfil2.tmp = 0"
## "size of file varssave.tmp = 0" "size of file cmpdiff.tmp = 0"
## Got warning file. Therewere 10 warnings in C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenari
## Finished reading files
## CompReport file separated by this code as follows (rows = Ncomps*Nbins):
     2028 rows of length comp data,
##
##
    0 rows of generalized size comp data,
    459 rows of age comp data,
##
##
    O rows of conditional age-at-length data,
    O rows of ghost fleet age comp data,
##
    O rows of ghost fleet conditional age-at-length data,
     351 rows of ghost fleet length comp data,
##
    0 rows of mean length at age data,
##
##
    O rows of mean weight at age data,
    0 rows of 'TAG1' comp data, and
    O rows of 'TAG2' comp data.
## Finished dimensioning
## Got covar file.
## Finished primary run statistics list
## running SS_readstarter
##
     data, control files: init_dat.ss, control.ss
     converge_criterion = 1e-05
##
     SPR basis = 4
    F_report_basis = 2
```

```
## Assuming version 3.30 based on number of numeric values.
     MCMC_output_detail = 0
##
     ALK_tolerance = 1e-04
## Reading a random seed value:6989337
## Read of starter file complete. Final value: 3.3
##
## Statistics shown below (to turn off, change input to printstats=FALSE)
## $SS_version
## [1] "3.30.18.00; safe; compile_date: Sep 30 2021; Stock_Synthesis_by_Richard_Methot_(NOAA)_using_ADM
## $SS_versionshort
## [1] "3.30"
##
## $SS_versionNumeric
## [1] 3.3
## $StartTime
## [1] "StartTime: Tue Jun 07 10:51:30 2022"
## $RunTime
## [1] "0 hours, 2 minutes, 49 seconds."
##
## $Files_used
## [1] "Data_File: init_dat.ss Control_File: control.ss"
## $Nwarnings
## [1] 10
##
  [1] "#V3.30.18.00; safe; compile_date: Sep 30 2021; Stock_Synthesis_by_Richard_Methot_(NOAA)_using_
   [2] "#_Stock_Synthesis_is_a_work_of_the_U.S._Government_and_is_not_subject_to_copyright_protection_
   [3] "#_Foreign_copyrights_may_apply._See_copyright.txt_for_more_information."
##
   [4] "#_User_support_available_at:NMFS.Stock.Synthesis@noaa.gov"
   [5] "#_User_info_available_at:https://vlab.noaa.gov/group/stock-synthesis"
##
   [6] "#_Source_code_at:_https://github.com/nmfs-stock-synthesis/stock-synthesis"
##
   [7] ""
##
  [8] "This file contains warnings, suggestions and notes generated as files are read and processed"
## [9] ""
## [10] "1 NOTE: Max data length bin: 28 < max pop len bins: 30; so will accumulate larger pop len bi
## [11] "2 settle_month is less than spawn_month, so logical age at settlement calculated to be: 1 for
## [12] "3 setting in starter does not request all priors, and 1 parameters have priors and are not est
## [13] "4 1st iteration warning: ssb(endyr)/ssb(styr)= 3.87036e-07; suggest start with larger R0 to ge
## [14] "5 1st iteration warning: catch logL > 50% total logL; check configuration; suggest start with
## [15] "6 setting positive forecast relF for forecast only fleet: 1"
## [16] "7 setting positive forecast relF for forecast only fleet: 2"
## [17] "8 Final gradient: 2.26819e-05 is larger than final_conv: 1e-05"
```

```
## [18] "9 setting positive forecast relF for forecast only fleet: 1"
   [19] "10 setting positive forecast relF for forecast only fleet: 2"
   [20] "N warnings: 10"
##
##
  $likelihoods_used
##
                                        values lambdas
## TOTAL
                         53.171799999999997510
## Catch
                          0.00000000000391362
                                                    NΑ
## Equil_catch
                          NΔ
## Survey
                        -42.310800000000000409
                                                    NΑ
## Length_comp
                         25.373799999999999244
                                                    NA
## Age_comp
                         16.154399999999998983
                                                    NA
## Recruitment
                         53.95259999999996783
                                                     1
                          0.000000000000000000
  InitEQ_Regime
                                                     0
                          ## Forecast_Recruitment
                                                     1
## Parm_priors
                          0.000000000000000000
                                                     1
## Parm_softbounds
                          0.001833320000000000
                                                    NΑ
## Parm devs
                          0.000000000000000000
                                                     1
                          ##
  Crash Pen
                                                     1
##
##
  $likelihoods_laplace
                                       values lambdas
## NoBias_corr_Recruitment(info_only) 50.7840
                                                    1
## Laplace_obj_fun(info_only)
                                      50.0033
                                                   NA
##
##
  $likelihoods_by_fleet
##
                                ALL
                                      MexCal_S1
                                                  MexCal_S2
                                                                     PNW AT_Survey
                 Label
## 180
          Catch_lambda
                                 NA 1.00000e+00 1.00000e+00 1.00000e+00
                                                                            1.0000
## 181
                        3.91362e-13 8.73045e-14 6.11515e-14 2.42906e-13
                                                                            0.0000
            Catch_like
## 182 Init_equ_lambda
                                 NA 0.00000e+00 0.00000e+00 0.00000e+00
                                                                            1.0000
## 183
         Init_equ_like
                        0.00000e+00 0.00000e+00 0.00000e+00 0.00000e+00
                                                                            0.0000
## 184
           Surv_lambda
                                 NA 0.00000e+00 0.00000e+00 0.00000e+00
                                                                            1.0000
## 185
             Surv_like -4.23108e+01 0.00000e+00 0.00000e+00 0.00000e+00
                                                                          -14.4919
## 186
            Surv_N_use
                                 NA 0.00000e+00 0.00000e+00 0.00000e+00
                                                                           18.0000
  187
           Surv_N_skip
                                 NA 0.00000e+00 0.00000e+00 0.00000e+00
                                                                            0.0000
## 188
         Length_lambda
                                 NA 1.00000e+00 1.00000e+00 1.00000e+00
                                                                            1.0000
## 189
           Length like
                        2.53738e+01 1.24946e+00 2.42523e+00 1.13925e+00
                                                                           20.5598
## 190
          Length_N_use
                                 NA 1.40000e+01 1.40000e+01 1.50000e+01
                                                                            9.0000
## 191
         Length_N_skip
                                 NA 0.00000e+00 0.00000e+00 9.00000e+00
                                                                            0.0000
## 192
                                 NA 1.00000e+00 1.00000e+00 1.00000e+00
            Age_lambda
                                                                            1.0000
## 193
                        1.61544e+01 5.86516e-01 1.75501e+00 9.13011e-01
              Age like
                                                                           12.8999
## 194
             Age_N_use
                                 NA 1.40000e+01 1.40000e+01 1.40000e+01
                                                                            9.0000
                                 NA 0.00000e+00 0.00000e+00 0.00000e+00
##
  195
            Age_N_skip
                                                                            0.0000
##
           DEPM TEP_all
## 180
         1.0000
                  1.0000
## 181
         0.0000
                  0.0000
## 182
         1.0000
                  1.0000
## 183
         0.0000
                  0.0000
## 184
         1.0000
                  1.0000
  185 -11.1977 -16.6212
  186
        10.0000
##
                 13.0000
## 187
         0.0000
                  0.0000
## 188
         0.0000
                  0.0000
## 189
         0.0000
                  0.0000
```

```
## 190
         0.0000
                  0.0000
## 191
         0.0000
                  0.0000
  192
         0.0000
                  0.0000
##
   193
         0.0000
                  0.0000
##
   194
         0.0000
                   0.0000
   195
         0.0000
                  0.0000
##
##
## $N_estimated_parameters
##
   [1] 47
##
##
   $table_of_phases
##
##
                -3
                                               5
   -99
        -5
            -4
                    -2
                                  2
                                      3
                                           4
                         -1
                              1
##
                10
                          2
                                  6
                                      16
                                           3
##
   $estimated_non_dev_parameters
##
                                      Value Phase
                                                      Min
                                                             Max
                                                                       Init Status
                                                     3.00 30.00 12.8541000
## L_at_Amin_Fem_GP_1
                                 12.8463000
                                                                                 OK
                                 24.9297000
                                                    15.00 40.00 24.8415000
                                                                                OK
## L_at_Amax_Fem_GP_1
## VonBert_K_Fem_GP_1
                                  0.3052990
                                                     0.05
                                                           0.99
                                                                  0.3075730
                                                                                 OK
## CV_young_Fem_GP_1
                                                 3
                                                     0.05
                                                           0.50
                                                                  0.1053490
                                                                                OK
                                  0.1135150
## CV_old_Fem_GP_1
                                  0.0199304
                                                     0.01
                                                           0.10
                                                                  0.0237245
                                                                                 ΩK
## SR_LN(RO)
                                                     3.00 25.00 14.4668000
                                                                                OK
                                 14.7700000
                                                 1
## SR_regime_BLK1repl_2000
                                  0.9815310
                                                 4 -15.00 15.00
                                                                 1.2915300
                                                                                 OK
## Size_inflection_MexCal_S1(1) 10.9366000
                                                     0.00 30.00 10.9072000
                                                                                OK
## Size_95%width_MexCal_S1(1)
                                  0.7588860
                                                     0.00 10.00
                                                                  0.6599090
                                                                                OK
## AgeSel_P1_MexCal_S1(1)
                                  0.5000230
                                                 3 -10.00 11.00
                                                                  0.5000240
                                                                                 OK
## AgeSel_P2_MexCal_S1(1)
                                  0.3233490
                                                 3 -10.00 11.00
                                                                                 OK
                                                                  0.2048810
## AgeSel_P3_MexCal_S1(1)
                                  0.3943970
                                                 3 -10.00 15.00 0.3827920
                                                                                 OK
## AgeSel_P4_MexCal_S1(1)
                                                 3 -10.00 11.00 -1.5494000
                                 -1.5376900
                                                                                 OK
## AgeSel_P5_MexCal_S1(1)
                                 -0.1495350
                                                 3 -10.00 11.00 -0.2361890
                                                                                 OK
## AgeSel_P2_MexCal_S2(2)
                                                 3 -10.00 15.00 0.4405260
                                                                                 OK
                                  0.4316430
## AgeSel_P3_MexCal_S2(2)
                                 -1.1978500
                                                 3 -10.00 11.00 -1.1690800
                                                                                 OK
## AgeSel_P4_MexCal_S2(2)
                                                 3 -10.00 11.00 -0.1425740
                                                                                 OK
                                 -0.0155567
## AgeSel_P5_MexCal_S2(2)
                                 -0.4560380
                                                 3 -10.00 11.00 -0.4707320
                                                                                 OK
## Age_inflection_PNW(3)
                                  2.8833700
                                                     0.00 10.00 2.8525100
                                                                                 OK
  Age_95%width_PNW(3)
                                  1.2378300
                                                    -5.00 15.00 1.2152300
                                                                                 OK
##
                                   Parm_StDev
                                                        Gradient Pr_type Prior
## L_at_Amin_Fem_GP_1
                                   0.11758300
                                                0.00000377916000 No_prior
                                                                               NA
                                                0.00000150313000 No_prior
                                                                               NA
## L_at_Amax_Fem_GP_1
                                   0.25106200
## VonBert_K_Fem_GP_1
                                   0.01443090
                                                0.00000416787000 No prior
                                                                              NA
## CV_young_Fem_GP_1
                                   0.00459528 -0.00000026741500 No prior
                                                                               NΑ
                                   0.00504098 -0.00000067019500 No_prior
## CV_old_Fem_GP_1
                                                                               NA
## SR_LN(RO)
                                   0.06387110
                                                0.00002267830000 No_prior
                                                                               NA
## SR_regime_BLK1repl_2000
                                   0.09877240
                                                0.00001207590000 No_prior
                                                                               NA
## Size_inflection_MexCal_S1(1)
                                   0.18739900 -0.00000047851600 No_prior
                                                                               NA
## Size_95%width_MexCal_S1(1)
                                   0.20762300
                                                0.0000016215600 No_prior
                                                                               NA
## AgeSel_P1_MexCal_S1(1)
                                 234.78400000
                                                0.00000000675916 No_prior
                                                                               NA
## AgeSel_P2_MexCal_S1(1)
                                   0.34312200
                                                0.0000006007750 No_prior
                                                                               NΑ
## AgeSel_P3_MexCal_S1(1)
                                                0.00000134165000 No_prior
                                                                               NA
                                   0.11721700
## AgeSel_P4_MexCal_S1(1)
                                                                               NA
                                   0.30404400
                                                0.00000065320200 No_prior
## AgeSel P5 MexCal S1(1)
                                   0.36487500
                                                0.00000030770200 No_prior
                                                                               NA
## AgeSel_P2_MexCal_S2(2)
                                                0.00000005729660 No_prior
                                   0.08510010
                                                                               NA
## AgeSel_P3_MexCal_S2(2)
                                                0.00000070821300 No_prior
                                   0.16758800
```

```
## AgeSel_P4_MexCal_S2(2)
                                   0.27173700 0.00000066790300 No prior
                                                                             NA
                                                                             NΑ
## AgeSel_P5_MexCal_S2(2)
                                   ## Age inflection PNW(3)
                                   0.07557750 0.00000345944000 No prior
                                                                             NA
## Age_95%width_PNW(3)
                                   0.06682090 -0.00000110157000 No_prior
                                                                             NA
                                 Pr SD Pr Like Afterbound
                                            NA
## L at Amin Fem GP 1
                                    NA
                                            NA
## L at Amax Fem GP 1
                                                        ΩK
## VonBert_K_Fem_GP_1
                                    NΑ
                                            NA
                                                       OK
## CV_young_Fem_GP_1
                                    NA
                                            NA
                                                        OK
                                                        OK
## CV_old_Fem_GP_1
                                    NA
                                            NA
## SR_LN(RO)
                                    NA
                                            NA
                                                        OK
## SR_regime_BLK1repl_2000
                                                        OK
                                    NA
                                            NA
## Size_inflection_MexCal_S1(1)
                                    NA
                                            NΑ
                                                        OK
## Size_95%width_MexCal_S1(1)
                                    NA
                                            NA
                                                        OK
## AgeSel_P1_MexCal_S1(1)
                                                        OK
                                    NA
                                            NΑ
## AgeSel_P2_MexCal_S1(1)
                                    NA
                                            NA
                                                        OK
                                                        OK
## AgeSel_P3_MexCal_S1(1)
                                    NA
                                            NA
## AgeSel P4 MexCal S1(1)
                                            NA
                                                        OK
## AgeSel_P5_MexCal_S1(1)
                                    NA
                                            NΑ
                                                       OK
## AgeSel P2 MexCal S2(2)
                                    NA
                                            NA
                                                       OK
## AgeSel_P3_MexCal_S2(2)
                                    NA
                                            NA
                                                       OK
## AgeSel P4 MexCal S2(2)
                                            NΑ
                                                       ΠK
## AgeSel_P5_MexCal_S2(2)
                                                       OK
                                    NA
                                            NΑ
## Age inflection PNW(3)
                                                        OK
                                    NA
                                            NΑ
                                                        OK
## Age_95%width_PNW(3)
                                    NA
                                            NΑ
## $log_det_hessian
##
  [1] 194.733
##
## $maximum_gradient_component
  [1] 2.26819e-05
##
  $parameters_with_highest_gradients
##
                                Value
                                         Gradient
## SR LN(RO)
                           14.770000 2.26783e-05
                            0.981531 1.20759e-05
## SR_regime_BLK1repl_2000
## VonBert K Fem GP 1
                             0.305299 4.16787e-06
## L_at_Amin_Fem_GP_1
                            12.846300 3.77916e-06
## Age_inflection_PNW(3)
                             2.883370 3.45944e-06
##
  $Length_Comp_Fit_Summary
        Factor Fleet Recommend_var_adj # N Npos min_Nsamp max_Nsamp mean_Nsamp_in
##
## 1156
             4
                   1
                             73.180300 # 14
                                               14
                                                           6
                                                                 86.00
                                                                             32.5914
                   2
                                                           9
## 1157
             4
                              40.099200 # 14
                                               14
                                                                108.80
                                                                             59.3200
                   3
## 1158
             4
                             136.133000 # 24
                                               15
                                                           1
                                                                174.48
                                                                             86.7573
                   4
                               0.955435 # 9
                                                9
                                                          12
                                                                             19.8889
## 1159
                                                                 31.00
##
        mean_Nsamp_adj mean_Nsamp_DM DM_theta mean_effN HarMean_effN Curr_Var_Adj
## 1156
               32.5914
                                   NA
                                            NA
                                                8292.820
                                                             2385.0500
## 1157
               59.3200
                                   NΑ
                                            NA 10041.700
                                                             2378.6900
                                                                                  1
## 1158
               86.7573
                                   NA
                                            NA 31510.800
                                                            11810.5000
                                                                                  1
                                                                                  1
##
  1159
               19.8889
                                   NA
                                            NA
                                                 257.222
                                                               19.0025
##
        Fleet_name
## 1156 MexCal S1
## 1157 MexCal S2
```

```
## 1158
               PNW
## 1159 AT_Survey
## $Age_Comp_Fit_Summary
       Factor Fleet Recommend_var_adj # Nsamp_adj Npos min_Nsamp max_Nsamp
## 1217
            5
                  1
                         15.164000 #
                                                14
                                                     14
                                                             5.92
## 1218
            5
                   2
                             6.478200 #
                                                14
                                                     14
                                                             8.92
                                                                      105.16
## 1219
                                                             26.88
                   3
                             57.309000 #
                                                14
                                                     14
                                                                      138.12
            5
## 1220
             5
                   4
                              0.952764 #
                                                 9
                                                      9
                                                             12.00
                                                                       31.00
       mean_Nsamp_in mean_Nsamp_adj mean_Nsamp_DM DM_theta mean_effN HarMean_effN
## 1217
              31.0686
                             31.0686
                                                NA
                                                         NA 9573.260
## 1218
              58.3143
                             58.3143
                                                         NA 11412.600
                                                NA
                                                                           377.7720
## 1219
              76.2971
                             76.2971
                                                         NA 14103.900
                                                NA
                                                                          4372.5200
## 1220
              19.8889
                             19.8889
                                                NA
                                                         NA
                                                              322.679
                                                                            18.9494
       Curr_Var_Adj Fleet_name
## 1217
                   1 MexCal_S1
## 1218
                   1 MexCal_S2
## 1219
                  1
                            PNW
## 1220
                  1 AT_Survey
##
## $SBzero
## [1] 109922
##
## $current depletion
## [1] 0.2618857
## $last_years_SPR
## [1] 0.809065
##
## $SPRratioLabel
## [1] "1-SPR"
##
## $sigma_R_in
## [1] 0.5
## $sigma_R_info
              period N_devs SD_of_devs Var_of_devs mean_SE mean_SEsquared
##
## 1
               Main
                         20
                             1.310494
                                          1.717395 0.1688232
                                                                 0.03664718
## 2
         Early+Main
                         26
                              1.172701
                                          1.375227 0.1816861
                                                                  0.04182880
## 3 Early+Main+Late
                         26
                              1.172701
                                          1.375227 0.1816861
                                                                  0.04182880
     sqrt_sum_of_components SD_of_devs_over_sigma_R sqrt_sum_over_sigma_R
## 1
                   1.324403
                                           2.620989
                                                                 2.648805
## 2
                   1.190402
                                           2.345401
                                                                 2.380803
## 3
                   1.190402
                                                                 2.380803
                                           2.345401
    alternative_sigma_R
## 1
               1.324403
## 2
                1.190402
## 3
                1.190402
## $rmse_table
       ERA N
                  RMSE RMSE_over_sigmaR mean_BiasAdj
## 1 main 20 1.277310
                              6.52611
                                            0.841539
## 2 early 6 0.543502
                                1.18158
                                            0.766330
##
```

```
## $cormessage1
## [1] Range of abs(parameter correlations) is 0 to 0.932029
## $cormessage2
## [1] No correlations above threshold (cormax=0.95)
##
## $cormessage7
## [1] 1 uncorrelation below threshold (cormin=0.01)
## $cormessage8
##
                        name max
## 28 AgeSel_P1_MexCal_S1(1)
## completed SS output
EMssmse2019_dir <- "C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenarios/perfDatTests/constGrow2
outEMssmse2019 <- SS_output(EMssmse2019_dir)</pre>
## Getting header info from:
    C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenarios/perfDatTests/constGrow20010M_MidSteepH
## This function tested on SS versions 3.24 and 3.30.
    You are using 3.30.18.00 which SHOULD work with this package.
## Report file time:Mon Jun 06 17:27:36 2022
## Warning in SS_output(EMssmse2019_dir): Some stats skipped because the .cor file not found:C:/Users/r
## Warning in SS_output(EMssmse2019_dir): covar file contains the warning
        'Variances are 0.0 for first two elements, so do not write '
     input 'covar' changed to FALSE.
## Reading full report file
## Got all columns using ncols = 62
## Got Report file
## Setting minimum biomass threshhold to 0.25 based on US west coast assumption associated with biomas
## !warning: temporary files were written in this run:
                          TempFile
                                                               Size
## "size of file gradfil1.tmp = 0" "size of file gradfil2.tmp = 0"
                              <NA>
## "size of file varssave.tmp = 0" "size of file cmpdiff.tmp = 0"
## Got warning file. Therewere 8 warnings in C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenario
## Finished reading files
```

```
## CompReport file separated by this code as follows (rows = Ncomps*Nbins):
##
     2028 rows of length comp data,
    O rows of generalized size comp data,
##
    459 rows of age comp data,
##
##
    O rows of conditional age-at-length data,
    O rows of ghost fleet age comp data,
##
    O rows of ghost fleet conditional age-at-length data,
    351 rows of ghost fleet length comp data,
##
##
    0 rows of mean length at age data,
    O rows of mean weight at age data,
##
   0 rows of 'TAG1' comp data, and
    O rows of 'TAG2' comp data.
## Finished dimensioning
## You skipped the covar file
## Finished primary run statistics list
## running SS_readstarter
##
     data, control files: init_dat.ss, control.ss
##
     converge_criterion = 1e-05
##
    SPR_basis = 4
    F_report_basis = 2
##
## Assuming version 3.30 based on number of numeric values.
    MCMC_output_detail = 0
##
##
     ALK_tolerance = 1e-04
## Reading a random seed value:6989337
## Read of starter file complete. Final value: 3.3
## Statistics shown below (to turn off, change input to printstats=FALSE)
## $SS_version
## [1] "3.30.18.00; safe; compile_date: Sep 30 2021; Stock_Synthesis_by_Richard_Methot_(NOAA) using_ADM
## $SS_versionshort
## [1] "3.30"
##
## $SS versionNumeric
## [1] 3.3
```

```
##
## $StartTime
## [1] "StartTime: Mon Jun 06 17:27:36 2022"
##
## [1] "0 hours, 1 minutes, 21 seconds."
## $Files used
## [1] "Data_File: init_dat.ss Control_File: control.ss"
##
## $Nwarnings
## [1] 8
##
## $warnings
   [1] "#V3.30.18.00; safe; compile_date: Sep 30 2021; Stock_Synthesis_by_Richard_Methot_(NOAA)_using_
##
    [2] "#_Stock_Synthesis_is_a_work_of_the_U.S._Government_and_is_not_subject_to_copyright_protection_
   [3] "#_Foreign_copyrights_may_apply._See_copyright.txt_for_more_information."
##
   [4] "#_User_support_available_at:NMFS.Stock.Synthesis@noaa.gov"
   [5] "#_User_info_available_at:https://vlab.noaa.gov/group/stock-synthesis"
   [6] "#_Source_code_at:_https://github.com/nmfs-stock-synthesis/stock-synthesis"
   [7] ""
##
  [8] "This file contains warnings, suggestions and notes generated as files are read and processed"
##
  [9] ""
##
## [10] "1 NOTE: Max data length bin: 28 < max pop len bins: 30; so will accumulate larger pop len bi
## [11] "2 settle_month is less than spawn_month, so logical age at settlement calculated to be: 1 for
## [12] "3 setting in starter does not request all priors, and 1 parameters have priors and are not est
## [13] "4 1st iteration warning: ssb(endyr)/ssb(styr)= 3.87036e-07; suggest start with larger R0 to ge
## [14] "5 1st iteration warning: catch logL > 50% total logL; check configuration; suggest start with
## [15] "6 Final gradient: 1.36978e-05 is larger than final_conv: 1e-05"
## [16] "7 setting positive forecast relF for forecast only fleet: 1"
## [17] "8 setting positive forecast relF for forecast only fleet: 2"
## [18] "N warnings: 8"
## $likelihoods_used
##
                                       values lambdas
## TOTAL
                        724.8959999999995816
                                                   NΑ
## Catch
                          0.0000000000038972
## Equil_catch
                          0.00000000000000000
                                                   NΑ
                        -28.4049000000000137
## Survey
                                                   NA
                                                   NA
## Length_comp
                        639.3229999999997908
## Age comp
                         25.74530000000000030
                                                   NA
                         88.2305999999999548
## Recruitment
                                                    1
## InitEQ Regime
                          0.0000000000000000
                                                    Ω
                          0.00000000000000000
## Forecast_Recruitment
                                                    1
                          0.0000000000000000
## Parm_priors
                                                    1
## Parm_softbounds
                          0.00204515000000000
                                                   NA
## Parm devs
                          0.0000000000000000
                                                    1
                          0.0000000000000000
## Crash_Pen
                                                    1
## $likelihoods_laplace
                                        values lambdas
## NoBias corr Recruitment(info only) 85.0621
## Laplace_obj_fun(info_only)
                                      721.7280
                                                    NA
```

##

```
## $likelihoods_by_fleet
##
                 Label
                                 ALL
                                        MexCal S1
                                                    MexCal S2
                                                                       PNW AT Survey
          Catch lambda
                                  NA 1.00000e+00 1.00000e+00 1.00000e+00
## 180
                                                                              1.00000
## 181
            Catch_like
                         3.89720e-13 1.04611e-13 8.41599e-14 2.00949e-13
                                                                              0.00000
##
  182 Init_equ_lambda
                                   NA 0.00000e+00 0.00000e+00 0.00000e+00
                                                                              1.00000
         Init equ like
                         0.00000e+00 0.00000e+00 0.00000e+00 0.00000e+00
## 183
                                                                              0.00000
## 184
           Surv lambda
                                   NA 0.00000e+00 0.00000e+00 0.00000e+00
                                                                              1.00000
## 185
             Surv_like -2.84049e+01 0.00000e+00 0.00000e+00 0.00000e+00
                                                                             -8.00048
## 186
            Surv_N_use
                                   NA 0.00000e+00 0.00000e+00 0.00000e+00
                                                                             18.00000
## 187
           Surv_N_skip
                                   NA 0.00000e+00 0.00000e+00 0.00000e+00
                                                                              0.00000
  188
         Length_lambda
                                   NA 1.00000e+00 1.00000e+00 1.00000e+00
                                                                              1.00000
## 189
           Length_like
                         6.39323e+02 1.79846e+02 1.75316e+02 1.61692e+02 122.47000
## 190
          Length_N_use
                                   NA 1.40000e+01 1.40000e+01 1.50000e+01
                                                                              9.00000
## 191
         Length_N_skip
                                   NA 0.00000e+00 0.00000e+00 9.00000e+00
                                                                              0.00000
## 192
            Age_lambda
                                  NA 1.00000e+00 1.00000e+00 1.00000e+00
                                                                              1.00000
## 193
              Age_like
                         2.57453e+01 3.99117e+00 4.16724e+00 4.04349e+00
                                                                             13.54340
## 194
                                  NA 1.40000e+01 1.40000e+01 1.40000e+01
                                                                              9.00000
             Age_N_use
##
  195
                                   NA 0.00000e+00 0.00000e+00 0.00000e+00
                                                                              0.00000
            Age N skip
##
                TEP all
           DEPM
##
  180
        1.00000
                   1.0000
##
  181
        0.00000
                  0.0000
        1.00000
                   1.0000
  182
## 183
        0.00000
                  0.0000
  184
        1.00000
                   1.0000
## 185 -6.81097 -13.5935
  186 10.00000
                  13.0000
  187
        0.00000
##
                  0.0000
##
   188
        0.00000
                  0.0000
##
  189
        0.00000
                  0.0000
## 190
        0.00000
                  0.0000
## 191
        0.00000
                   0.0000
##
  192
        0.00000
                  0.0000
   193
        0.00000
                   0.0000
##
  194
        0.00000
                   0.0000
   195
        0.00000
                   0.0000
##
##
## $N estimated parameters
##
   [1] 47
##
   $table_of_phases
##
##
##
   -99
        -5
                -3
                                   2
                                       3
                                           4
                                               5
            -4
                    -2
                         -1
                              1
                          2
                                   6
                                           3
##
         1
                10
                      4
                             21
                                     16
##
## $estimated_non_dev_parameters
##
                                      Value Phase
                                                     Min
                                                            Max
                                                                       Init Status
## L_at_Amin_Fem_GP_1
                                 12.749200
                                                3
                                                    3.00 30.00 12.8541000
                                                                                OK
## L_at_Amax_Fem_GP_1
                                 24.762700
                                                3
                                                    15.00 40.00 24.8415000
                                                                                OK
## VonBert_K_Fem_GP_1
                                   0.310253
                                                3
                                                    0.05
                                                           0.99
                                                                 0.3075730
                                                                                OK
## CV_young_Fem_GP_1
                                   0.105531
                                                3
                                                    0.05
                                                           0.50
                                                                 0.1053490
                                                                                OK
                                                3
                                                                                OK
## CV_old_Fem_GP_1
                                                    0.01
                                                           0.10
                                                                 0.0237245
                                  0.028338
## SR_LN(RO)
                                  14.460300
                                                1
                                                     3.00 25.00 14.4668000
                                                                                OK
## SR_regime_BLK1repl_2000
                                   1.325350
                                                4 -15.00 15.00 1.2915300
                                                                                OK
## Size inflection MexCal S1(1) 10.774600
                                                3
                                                    0.00 30.00 10.9072000
                                                                                OK
```

```
## Size_95%width_MexCal_S1(1)
                                  0.611091
                                                    0.00 10.00 0.6599090
                                                                               OK
                                  0.500023
                                                                               OK
## AgeSel_P1_MexCal_S1(1)
                                                3 -10.00 11.00 0.5000240
                                                3 -10.00 11.00
## AgeSel P2 MexCal S1(1)
                                  0.299557
                                                                0.2048810
                                                                               OK
## AgeSel_P3_MexCal_S1(1)
                                  0.357986
                                                3 -10.00 15.00
                                                                0.3827920
                                                                               OK
## AgeSel_P4_MexCal_S1(1)
                                 -1.559500
                                                3 -10.00 11.00 -1.5494000
                                                                               OK
## AgeSel P5 MexCal S1(1)
                                                3 -10.00 11.00 -0.2361890
                                                                               OK
                                 -0.188955
## AgeSel P2 MexCal S2(2)
                                  0.442009
                                                3 -10.00 15.00 0.4405260
                                                                               OK
## AgeSel_P3_MexCal_S2(2)
                                 -1.184170
                                                3 -10.00 11.00 -1.1690800
                                                                               OK
  AgeSel_P4_MexCal_S2(2)
                                 -0.184688
                                                3 -10.00 11.00 -0.1425740
                                                                               OK
   AgeSel_P5_MexCal_S2(2)
                                 -0.451425
                                                3 -10.00 11.00 -0.4707320
                                                                               OK
## Age_inflection_PNW(3)
                                  2.882450
                                                    0.00 10.00 2.8525100
                                                                               OK
   Age_95%width_PNW(3)
                                  1.226510
                                                   -5.00 15.00
                                                                1.2152300
                                                                               OK
##
                                 Parm_StDev
                                                      Gradient Pr_type Prior Pr_SD
                                           0 -0.00001361980000 No_prior
## L_at_Amin_Fem_GP_1
## L_at_Amax_Fem_GP_1
                                           0 -0.00001111210000 No_prior
                                                                            NA
                                                                                   NA
## VonBert_K_Fem_GP_1
                                           0 -0.00000979544000 No_prior
                                                                            NA
                                                                                   NA
## CV_young_Fem_GP_1
                                                                            NA
                                                                                  NA
                                             0.00000068867000 No_prior
                                              0.00000091321000 No prior
                                                                            NA
## CV_old_Fem_GP_1
                                                                                  NA
## SR_LN(RO)
                                           0 -0.00001281700000 No_prior
                                                                            NA
                                                                                  NA
## SR_regime_BLK1repl_2000
                                           0 -0.00000620192000 No prior
                                                                            NA
                                                                                  NΑ
## Size_inflection_MexCal_S1(1)
                                             0.00000113857000 No_prior
                                                                            NA
                                                                                  NA
## Size_95%width_MexCal_S1(1)
                                           0 -0.00000010867000 No_prior
                                                                            NA
                                                                                  NA
## AgeSel P1 MexCal S1(1)
                                              0.00000000700412 No_prior
                                                                            NA
                                                                                  NA
## AgeSel_P2_MexCal_S1(1)
                                              0.0000013500200 No prior
                                                                            NA
                                                                                  NA
## AgeSel_P3_MexCal_S1(1)
                                           0 -0.00000147724000 No prior
                                                                            NA
                                                                                  ΝA
## AgeSel_P4_MexCal_S1(1)
                                           0 -0.00000070098700 No_prior
                                                                            NA
                                                                                  NΑ
                                                                            NA
## AgeSel_P5_MexCal_S1(1)
                                           0 -0.00000081456800 No_prior
                                                                                  ΝA
## AgeSel_P2_MexCal_S2(2)
                                           0 -0.00000294566000 No_prior
                                                                            NA
                                                                                  NA
                                                                            NA
## AgeSel_P3_MexCal_S2(2)
                                           0 -0.00000260373000 No_prior
                                                                                  ΝA
## AgeSel_P4_MexCal_S2(2)
                                           0 -0.00000264339000 No_prior
                                                                            NA
                                                                                  NA
## AgeSel_P5_MexCal_S2(2)
                                           0 -0.00000147524000 No_prior
                                                                            NA
                                                                                   NA
  Age_inflection_PNW(3)
                                           0 -0.00000643800000 No_prior
                                                                            NA
                                                                                  NA
   Age_95%width_PNW(3)
                                             0.00000853144000 No_prior
                                                                            NA
                                                                                  NA
##
                                 Pr_Like Afterbound
## L_at_Amin_Fem_GP_1
                                                  OK
## L_at_Amax_Fem_GP_1
                                      NΑ
## VonBert_K_Fem_GP_1
                                      NΑ
                                                  OK
## CV_young_Fem_GP_1
                                      NA
                                                  OK
## CV_old_Fem_GP_1
                                      NA
                                                  OK
## SR_LN(RO)
                                      NA
                                                  OK
## SR_regime_BLK1repl_2000
                                      NA
                                                  OK
## Size_inflection_MexCal_S1(1)
                                      NA
                                                  OK
## Size_95%width_MexCal_S1(1)
                                      NA
                                                  OK
## AgeSel_P1_MexCal_S1(1)
                                      NA
                                                  OK
## AgeSel_P2_MexCal_S1(1)
                                      NA
                                                  OK
## AgeSel_P3_MexCal_S1(1)
                                      NA
                                                  OK
## AgeSel_P4_MexCal_S1(1)
                                      NA
                                                  OK
## AgeSel_P5_MexCal_S1(1)
                                      NA
                                                  OK
## AgeSel_P2_MexCal_S2(2)
                                      NA
                                                  OK
## AgeSel_P3_MexCal_S2(2)
                                      NA
                                                  OK
## AgeSel_P4_MexCal_S2(2)
                                                  OK
                                      NA
## AgeSel_P5_MexCal_S2(2)
                                      NA
                                                  OK
## Age_inflection_PNW(3)
                                                  OK
                                      NA
## Age_95%width_PNW(3)
                                                  OK
                                      NΑ
```

```
##
## $maximum_gradient_component
## [1] 1.36978e-05
##
## $parameters_with_highest_gradients
##
                           Value
                                      Gradient
## L at Amin Fem GP 1 12.749200 -1.36198e-05
## SR LN(RO)
                        14.460300 -1.28170e-05
## L_at_Amax_Fem_GP_1 24.762700 -1.11121e-05
## VonBert_K_Fem_GP_1
                        0.310253 -9.79544e-06
## Age_95%width_PNW(3) 1.226510 8.53144e-06
## $Length_Comp_Fit_Summary
##
        Factor Fleet Recommend_var_adj # N Npos min_Nsamp max_Nsamp mean_Nsamp_in
## 1156
                   1
                               0.564622 # 14
                                               14
                                                           6
                                                                    86
                                                                              32.2857
                   2
## 1157
             4
                               0.653439 # 14
                                               14
                                                           9
                                                                   108
                                                                             59.0000
## 1158
             4
                   3
                               0.127457 # 24
                                               15
                                                           1
                                                                   174
                                                                             86.3333
## 1159
                   4
                               0.493959 # 9
                                                9
                                                          12
                                                                    31
                                                                              19.8889
        mean_Nsamp_adj mean_Nsamp_DM DM_theta mean_effN HarMean_effN Curr_Var_Adj
## 1156
               32.2857
                                   NA
                                            NA
                                                 35.6918
                                                              18.22920
## 1157
               59.0000
                                   NΑ
                                            NΑ
                                                 64.8646
                                                              38.55290
                                                                                   1
## 1158
               86.3333
                                   NA
                                            NA
                                                 91.8304
                                                              11.00380
                                                                                   1
                                                 14.8765
## 1159
               19.8889
                                   NA
                                            NA
                                                               9.82429
                                                                                   1
        Fleet name
## 1156 MexCal S1
## 1157 MexCal S2
## 1158
               PNW
## 1159
        AT_Survey
##
## $Age_Comp_Fit_Summary
##
        Factor Fleet Recommend_var_adj # Nsamp_adj Npos min_Nsamp max_Nsamp
## 1217
             5
                   1
                               10.10040 #
                                                 14
                                                       14
                                                                100
                                                                           100
## 1218
             5
                   2
                                                  14
                                                       14
                                                                100
                                                                           100
                               8.27159 #
## 1219
             5
                   3
                               11.22660 #
                                                  14
                                                       14
                                                                100
                                                                           100
## 1220
             5
                   4
                                2.82380 #
                                                  9
                                                        9
                                                                100
                                                                           100
        mean_Nsamp_in mean_Nsamp_adj mean_Nsamp_DM DM_theta mean_effN HarMean_effN
## 1217
                  100
                                  100
                                                 NA
                                                           NA 13999.400
                                                                             1010.040
## 1218
                  100
                                  100
                                                 NA
                                                           NA 14148.000
                                                                             827.159
## 1219
                  100
                                  100
                                                 NA
                                                           NA 1525.270
                                                                             1122.660
                  100
                                  100
## 1220
                                                 NA
                                                           NA
                                                                708.151
                                                                             282.380
        Curr Var Adj Fleet name
## 1217
                   1 MexCal S1
## 1218
                      MexCal S2
                   1
## 1219
                             PNW
                   1
## 1220
                   1 AT_Survey
##
## $SBzero
## [1] 78593.5
## $current_depletion
## [1] 0.2354641
##
## $last_years_SPR
## [1] 0.549216
```

```
##
## $SPRratioLabel
## [1] "1-SPR"
##
## $sigma_R_in
## [1] 0.5
## $sigma_R_info
##
              period N_devs SD_of_devs Var_of_devs mean_SE mean_SEsquared
## 1
                               1.610123
                                           2.592496
                Main
                         20
                                                          0
                                                                          0
## 2
          Early+Main
                         26
                               1.435318
                                           2.060136
                                                           0
                                                                          0
                                                           0
                                                                          0
## 3 Early+Main+Late
                         26
                               1.435318
                                           2.060136
     sqrt_sum_of_components SD_of_devs_over_sigma_R sqrt_sum_over_sigma_R
## 1
                                            3.220246
                   1.610123
                                                                   3.220246
## 2
                   1.435318
                                            2.870635
                                                                   2.870635
## 3
                   1.435318
                                            2.870635
                                                                   2.870635
##
    alternative_sigma_R
                1.610123
## 2
                1.435318
## 3
                1.435318
##
## $rmse_table
##
       ERA N
                  RMSE RMSE_over_sigmaR mean_BiasAdj
## 1 main 20 1.569350
                                 9.85148
                                             0.841539
## 2 early 6 0.617053
                                 1.52302
                                             0.766330
## completed SS_output
compbavg2019 <- SSsummarize(list(OM2019 = outOMbavg,</pre>
                                    EMssmse2019 = outEMssmse2019,
                                    EMbavg2019 = outEMbavg2019))
## Summarizing 3 models:
## imodel=1/3
     N active pars = 0
##
## imodel=2/3
     N active pars = 47
## imodel=3/3
     N active pars = 47
## Summary finished. To avoid printing details above, use 'verbose = FALSE'.
SSplotComparisons(compbavg2019, legendlabels = c("OM", "SSMSE 2019", "Perf 2019"),
                  subplots = c(2,10, 12, 13, 14))
```

```
## Warning in SSplotComparisons(compbavg2019, legendlabels = c("OM", "SSMSE
## 2019", : setting btarg = -999 because models don't have matching values
## Warning in SSplotComparisons(compbavg2019, legendlabels = c("OM", "SSMSE
## 2019", : setting minbthresh = -999 because models don't have matching values
## Warning in SSplotComparisons(compbavg2019, legendlabels = c("OM", "SSMSE
## 2019", : setting sprtarg = -999 because models don't have matching values
## Warning in SSplotComparisons(compbavg2019, legendlabels = c("OM", "SSMSE
## 2019", : setting label for SPR plot to 8th element of input 'labels' because the
## models don't have matching labels
## Warning in SSplotComparisons(compbavg2019, legendlabels = c("OM", "SSMSE
## 2019", : setting label for F plot to 13th element of input 'labels' because the
## models don't have matching labels
## showing uncertainty for all models
## No uncertainty available for model 1
## No uncertainty available for model 2
## subplot 2: spawning biomass with uncertainty intervals
## subplot 10: recruits with uncertainty
## subplot 12: recruit devs with uncertainty
## subplot 13: index fits
## subplot 14: index fits on a log scale
# plot comparisons
outEMbavg2020 <- SS_output(EMbavg2020_dir)</pre>
## Getting header info from:
    C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenarios/perfDatTests/constGrow20010M_MidSteepH
## This function tested on SS versions 3.24 and 3.30.
    You are using 3.30.18.00 which SHOULD work with this package.
## Report file time: Tue Jun 07 10:51:38 2022
## Reading full report file
## Got all columns using ncols = 62
```

Got Report file

```
## Setting minimum biomass threshhold to 0.25 based on US west coast assumption associated with biomas
## !warning: temporary files were written in this run:
##
                          TempFile
                                                               Size
## "size of file gradfil1.tmp = 0" "size of file gradfil2.tmp = 0"
                              <NA>
## "size of file varssave.tmp = 0" "size of file cmpdiff.tmp = 0"
## Got warning file. Therewere 16 warnings in C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenari
## Finished reading files
## CompReport file separated by this code as follows (rows = Ncomps*Nbins):
     2184 rows of length comp data,
##
##
    0 rows of generalized size comp data,
    495 rows of age comp data,
##
##
    O rows of conditional age-at-length data,
    O rows of ghost fleet age comp data,
##
    O rows of ghost fleet conditional age-at-length data,
    351 rows of ghost fleet length comp data,
##
    0 rows of mean length at age data,
##
    O rows of mean weight at age data,
##
    O rows of 'TAG1' comp data, and
    O rows of 'TAG2' comp data.
##
## Finished dimensioning
## Got covar file.
## Finished primary run statistics list
## running SS_readstarter
##
     data, control files: init_dat.ss, control.ss
     converge_criterion = 1e-05
##
     SPR_basis = 4
##
##
     F_report_basis = 2
## Assuming version 3.30 based on number of numeric values.
    MCMC_output_detail = 0
##
     ALK_tolerance = 1e-04
## Reading a random seed value:12546802
```

```
## Read of starter file complete. Final value: 3.3
## Statistics shown below (to turn off, change input to printstats=FALSE)
## $SS_version
## [1] "3.30.18.00; safe; compile date: Sep 30 2021; Stock Synthesis by Richard Methot (NOAA) using ADM
## $SS_versionshort
## [1] "3.30"
##
## $SS_versionNumeric
## [1] 3.3
##
## $StartTime
## [1] "StartTime: Tue Jun 07 10:51:38 2022"
## $RunTime
## [1] "0 hours, 1 minutes, 28 seconds."
## $Files_used
## [1] "Data_File: init_dat.ss Control_File: control.ss"
## $Nwarnings
## [1] 16
##
## $warnings
   [1] "#V3.30.18.00; safe; compile_date: Sep 30 2021; Stock_Synthesis_by_Richard_Methot_(NOAA)_using_
   [2] "#_Stock_Synthesis_is_a_work_of_the_U.S._Government_and_is_not_subject_to_copyright_protection_
   [3] "#_Foreign_copyrights_may_apply._See_copyright.txt_for_more_information."
   [4] "#_User_support_available_at:NMFS.Stock.Synthesis@noaa.gov"
   [5] "#_User_info_available_at:https://vlab.noaa.gov/group/stock-synthesis"
  [6] "#_Source_code_at:_https://github.com/nmfs-stock-synthesis/stock-synthesis"
##
  [7] ""
##
## [8] "This file contains warnings, suggestions and notes generated as files are read and processed"
   [9] ""
## [10] "1 catch is 0.0 in endyr; this can cause problem in the benchmark and forecast calculations"
## [11] "2 NOTE: Max data length bin: 28 < max pop len bins: 30; so will accumulate larger pop len bi
## [12] "3 settle_month is less than spawn_month, so logical age at settlement calculated to be: 1 for
## [13] "4 setting in starter does not request all priors, and 1 parameters have priors and are not est
## [14] "5 1st iteration warning: ssb(endyr)/ssb(styr)= 4.77067e-07; suggest start with larger R0 to ge
## [15] "6 setting positive forecast relF for forecast only fleet: 1"
## [16] "7 setting positive forecast relF for forecast only fleet: 2"
## [17] "8 setting positive forecast relF for forecast only fleet: 2"
## [18] "9 setting positive forecast relF for forecast only fleet: 3"
## [19] "10 setting positive forecast relF for forecast only fleet: 3"
## [20] "11 Final gradient: 5.08901e-05 is larger than final_conv: 1e-05"
## [21] "Note: 6 additional lines truncated. Look in warning.sso file to see full list."
## $likelihoods_used
                                        values lambdas
##
## TOTAL
                        161.941000000000002501
                                                    MΔ
## Catch
                         0.00000000000599152
                                                    NΑ
```

NΑ

0.000000000000000000

Equil_catch

```
## Survey
                         -48.280900000000002592
                                                      NA
                                                      NΑ
## Length_comp
                          76.38660000000001387
## Age comp
                          66.97339999999998045
                                                      NA
## Recruitment
                          66.859800000000007003
                                                       1
  InitEQ Regime
                           0.000000000000000000
                                                       0
## Forecast Recruitment
                           0.00000000000000000
                                                       1
## Parm_priors
                           0.000000000000000000
                                                       1
## Parm softbounds
                           0.001928920000000000
                                                      NA
  Parm devs
                           1
                           0.000000000000000000
  Crash_Pen
                                                       1
##
##
   $likelihoods_laplace
##
                                         values lambdas
## NoBias_corr_Recruitment(info_only)
                                        63.6913
                                                       1
  Laplace_obj_fun(info_only)
                                                      NA
                                       158.7720
##
##
  $likelihoods_by_fleet
##
                 Label
                                 ALL
                                       MexCal S1
                                                    MexCal S2
                                                                       PNW AT Survey
                                  NA 1.00000e+00 1.00000e+00 1.00000e+00
## 180
          Catch lambda
                                                                              1.0000
##
  181
            Catch like
                         5.99152e-13 1.38470e-13 1.26074e-13 3.34608e-13
                                                                              0.0000
##
  182 Init_equ_lambda
                                  NA 0.00000e+00 0.00000e+00 0.00000e+00
                                                                              1.0000
## 183
         Init equ like
                         0.00000e+00 0.00000e+00 0.00000e+00 0.00000e+00
                                                                              0.0000
                                  NA 0.00000e+00 0.00000e+00 0.00000e+00
           Surv_lambda
## 184
                                                                              1.0000
             Surv like -4.82809e+01 0.00000e+00 0.00000e+00 0.00000e+00
## 185
                                                                            -21.3348
## 186
            Surv N use
                                  NA 0.00000e+00 0.00000e+00 0.00000e+00
                                                                             19.0000
  187
           Surv_N_skip
                                  NA 0.00000e+00 0.00000e+00 0.00000e+00
                                                                              0.0000
  188
         Length_lambda
                                  NA 1.00000e+00 1.00000e+00 1.00000e+00
##
                                                                              1.0000
##
  189
           Length_like
                         7.63866e+01 1.34910e+01 2.03074e+01 3.25584e+00
                                                                             39.3323
## 190
                                  NA 1.50000e+01 1.50000e+01 1.60000e+01
          Length_N_use
                                                                             10.0000
                                                                              0.0000
## 191
         Length_N_skip
                                  NA 0.00000e+00 0.00000e+00 9.00000e+00
## 192
            Age_lambda
                                  NA 1.00000e+00 1.00000e+00 1.00000e+00
                                                                              1.0000
## 193
              Age_like
                         6.69734e+01 6.91723e+00 2.77972e+01 3.93827e+00
                                                                             28.3207
             Age_N_use
##
  194
                                  NA 1.50000e+01 1.50000e+01 1.50000e+01
                                                                             10.0000
                                  NA 0.00000e+00 0.00000e+00 0.00000e+00
##
  195
            Age_N_skip
                                                                              0.0000
##
           DEPM
                 TEP_all
## 180
         1.0000
                  1.0000
## 181
         0.0000
                  0.0000
## 182
         1.0000
                  1.0000
## 183
         0.0000
                  0.0000
## 184
         1.0000
                   1.0000
  185
       -11.0418 -15.9043
  186
        10.0000
                 13.0000
##
##
  187
         0.0000
                  0.0000
##
  188
         0.0000
                  0.0000
         0.0000
## 189
                  0.0000
## 190
         0.0000
                  0.0000
## 191
         0.0000
                  0.0000
## 192
         0.0000
                  0.0000
## 193
         0.0000
                  0.0000
##
  194
         0.0000
                  0.0000
  195
##
         0.0000
                  0.0000
##
## $N_estimated_parameters
## [1] 48
```

```
##
##
   $table_of_phases
##
                                               5
##
   -99
        -5
            -4
                -3
                    -2
                         -1
                              1
                                      3
                                           4
##
                10
                          2
                                  6
                                     16
                                           3
                                               2
##
##
   $estimated_non_dev_parameters
##
                                      Value Phase
                                                      Min
                                                            Max
                                                                       Init Status
                                 12.8931000
                                                 3
                                                     3.00 30.00 12.8541000
                                                                                OK
## L_at_Amin_Fem_GP_1
  L_at_Amax_Fem_GP_1
                                 24.9354000
                                                    15.00 40.00 24.8415000
                                                                                OK
## VonBert_K_Fem_GP_1
                                  0.3042250
                                                     0.05
                                                           0.99
                                                                  0.3075730
                                                                                OK
  CV_young_Fem_GP_1
                                  0.1193310
                                                     0.05
                                                           0.50
                                                                  0.1053490
                                                                                OK
## CV_old_Fem_GP_1
                                                 3
                                  0.0209416
                                                     0.01
                                                           0.10
                                                                  0.0237245
                                                                                OK
                                                     3.00 25.00 14.4668000
## SR_LN(RO)
                                 14.5863000
                                                                                OK
## SR_regime_BLK1repl_2000
                                  1.0969100
                                                 4 -15.00 15.00
                                                                1.2915300
                                                                                OK
## Size_inflection_MexCal_S1(1) 10.8349000
                                                     0.00 30.00 10.9072000
                                                                                OK
                                                                                OK
## Size_95%width_MexCal_S1(1)
                                  0.6990270
                                                     0.00 10.00
                                                                  0.6599090
## AgeSel P1 MexCal S1(1)
                                  0.5000230
                                                 3 -10.00 11.00
                                                                  0.5000240
                                                                                OK
## AgeSel_P2_MexCal_S1(1)
                                                 3 -10.00 11.00
                                                                                OK
                                  1.5290000
                                                                  0.2048810
## AgeSel_P3_MexCal_S1(1)
                                  0.4116330
                                                 3 -10.00 15.00
                                                                 0.3827920
                                                                                OK
## AgeSel_P4_MexCal_S1(1)
                                                 3 -10.00 11.00 -1.5494000
                                                                                OK
                                 -1.4946700
## AgeSel_P5_MexCal_S1(1)
                                 -0.2022500
                                                 3 -10.00 11.00 -0.2361890
                                                                                OK
## AgeSel_P2_MexCal_S2(2)
                                                 3 -10.00 15.00 0.4405260
                                                                                OK
                                  0.8203030
## AgeSel_P3_MexCal_S2(2)
                                 -1.2874400
                                                 3 -10.00 11.00 -1.1690800
                                                                                OK
## AgeSel_P4_MexCal_S2(2)
                                  0.1509360
                                                 3 -10.00 11.00 -0.1425740
                                                                                OK
## AgeSel_P5_MexCal_S2(2)
                                 -0.6268860
                                                 3 -10.00 11.00 -0.4707320
                                                                                OK
                                                                                OK
## Age_inflection_PNW(3)
                                  2.8579400
                                                     0.00 10.00
                                                                 2.8525100
##
   Age_95%width_PNW(3)
                                  1.1550600
                                                    -5.00 15.00 1.2152300
                                                                                OK
##
                                   Parm_StDev
                                                        Gradient Pr_type Prior
## L_at_Amin_Fem_GP_1
                                   0.06393300
                                                0.00000239140000 No_prior
                                                                              NA
## L_at_Amax_Fem_GP_1
                                   0.11909000
                                                0.00000523951000 No_prior
                                   0.00735414
                                                                              NA
## VonBert_K_Fem_GP_1
                                                0.00000603161000 No_prior
## CV_young_Fem_GP_1
                                               -0.00000286378000 No_prior
                                                                              NA
                                   0.00265329
## CV_old_Fem_GP_1
                                                                              NA
                                   0.00255814
                                                0.00000013430100 No_prior
## SR_LN(RO)
                                   0.02801730
                                                0.00005088990000 No prior
                                                                              NA
## SR_regime_BLK1repl_2000
                                   0.08014820
                                                0.00000403482000 No_prior
                                                                              NA
## Size inflection MexCal S1(1)
                                   0.06619320
                                                0.00000165727000 No prior
                                                                              NΑ
## Size_95%width_MexCal_S1(1)
                                   0.06971070 -0.00000070302800 No_prior
                                                                              NA
## AgeSel_P1_MexCal_S1(1)
                                 234.78400000
                                                0.00000000679385 No_prior
                                                                              NA
## AgeSel_P2_MexCal_S1(1)
                                   0.13865400 -0.00000366784000 No_prior
                                                                              NA
## AgeSel_P3_MexCal_S1(1)
                                   0.08707730  0.00000404619000 No prior
                                                                              NA
## AgeSel_P4_MexCal_S1(1)
                                   0.17247300 -0.00000249066000 No prior
                                                                              NΑ
## AgeSel_P5_MexCal_S1(1)
                                   0.20322600 -0.00000069336300 No_prior
                                                                              NA
## AgeSel_P2_MexCal_S2(2)
                                   0.07585290 -0.00000297140000 No_prior
                                                                              ΝA
                                   0.15192900 -0.00000560017000 No_prior
## AgeSel_P3_MexCal_S2(2)
                                                                              NA
## AgeSel_P4_MexCal_S2(2)
                                   0.22678200 -0.00000768801000 No_prior
                                                                              NA
## AgeSel_P5_MexCal_S2(2)
                                   0.23053000 -0.00000470461000 No_prior
                                                                              NA
## Age_inflection_PNW(3)
                                   0.05740490  0.00000221659000 No_prior
                                                                               NA
   Age_95%width_PNW(3)
                                   0.04485290 -0.00000448727000 No_prior
                                                                              NA
                                 Pr_SD Pr_Like Afterbound
## L_at_Amin_Fem_GP_1
                                             NA
                                                        OK
                                    NA
## L_at_Amax_Fem_GP_1
                                             NA
                                                        OK
## VonBert_K_Fem_GP_1
                                                        OK
                                    NA
                                             NΑ
## CV_young_Fem_GP_1
                                                        OK
```

```
## CV_old_Fem_GP_1
                                     NA
                                             NA
                                                         OK
## SR LN(RO)
                                             NΑ
                                                         ΠK
                                     NΑ
## SR regime BLK1repl 2000
                                     NA
                                             NA
                                                         OK
## Size_inflection_MexCal_S1(1)
                                                         OK
                                     NΑ
                                             NΑ
## Size_95%width_MexCal_S1(1)
                                                         OK
## AgeSel P1 MexCal S1(1)
                                     NA
                                                         OK
                                             NΑ
## AgeSel P2 MexCal S1(1)
                                             NΑ
                                                         OK
## AgeSel_P3_MexCal_S1(1)
                                     NA
                                             NA
                                                         OK
## AgeSel_P4_MexCal_S1(1)
                                     NA
                                             NA
                                                         OK
                                                         OK
## AgeSel_P5_MexCal_S1(1)
                                     NA
                                             NA
## AgeSel_P2_MexCal_S2(2)
                                     NA
                                             NA
                                                         OK
## AgeSel_P3_MexCal_S2(2)
                                                         OK
                                     NA
                                             NA
## AgeSel_P4_MexCal_S2(2)
                                     NA
                                             NA
                                                         OK
## AgeSel_P5_MexCal_S2(2)
                                     NA
                                             NA
                                                         OK
## Age_inflection_PNW(3)
                                                         OK
                                     NA
                                             NΑ
## Age_95%width_PNW(3)
                                     NA
                                             NA
                                                         OK
##
## $log_det_hessian
  [1] 233.889
##
##
## $maximum_gradient_component
## [1] 5.08901e-05
##
## $parameters_with_highest_gradients
##
                               Value
                                          Gradient
## SR LN(RO)
                           14.586300 5.08899e-05
## Main_RecrDev_2018
                           -1.064180 -8.09886e-06
## AgeSel_P4_MexCal_S2(2)
                           0.150936 -7.68801e-06
## Main_RecrDev_2016
                           -0.510400 -6.53673e-06
## VonBert_K_Fem_GP_1
                            0.304225 6.03161e-06
##
   $Length_Comp_Fit_Summary
##
        Factor Fleet Recommend_var_adj # N Npos min_Nsamp max_Nsamp mean_Nsamp_in
                                                                                97.0853
             4
## 1187
                               6.251470 # 15
                                                15
                                                            6
                                                                    1000
                    1
                    2
## 1188
             4
                               7.312770 # 15
                                                 15
                                                            9
                                                                    1000
                                                                               122.0320
## 1189
             4
                    3
                              55.611200 # 25
                                                            1
                                                                    1000
                                                 16
                                                                               143.8350
## 1190
                               0.137046 # 10
                                                 10
                                                           12
                                                                    1000
                                                                               117.9000
        mean_Nsamp_adj mean_Nsamp_DM DM_theta mean_effN HarMean_effN Curr_Var_Adj
##
## 1187
               97.0853
                                             NA
                                                 2256.480
                                                                606.9260
                                    NA
                                                                                     1
                                    NA
## 1188
               122.0320
                                                 1798.830
                                                               892.3920
                                                                                     1
                                    NA
                                                                                     1
## 1189
               143.8350
                                             NA 16878.900
                                                              7998.8400
  1190
              117.9000
                                    NA
                                                   198.749
                                                                 16.1578
                                                                                     1
##
                                             NΑ
        Fleet name
         MexCal_S1
## 1187
## 1188
         MexCal_S2
               PNW
## 1189
## 1190 AT_Survey
##
   $Age_Comp_Fit_Summary
        Factor Fleet Recommend_var_adj # Nsamp_adj Npos min_Nsamp max_Nsamp
## 1252
             5
                               1.182250 #
                                                                 5.92
                                                                           1000
                    1
                                                   15
                                                        15
             5
                    2
                                                                 8.92
## 1253
                               0.579745 #
                                                   15
                                                        15
                                                                           1000
## 1254
             5
                    3
                               12.015400 #
                                                   15
                                                        15
                                                                26.88
                                                                           1000
## 1255
             5
                    4
                               0.127174 #
                                                   10
                                                        10
                                                                12.00
                                                                           1000
```

```
mean_Nsamp_in mean_Nsamp_adj mean_Nsamp_DM DM_theta mean_effN HarMean_effN
## 1252
               95.664
                              95.664
                                                 NA
                                                          NA
                                                                768.824
                                                                            113.0980
## 1253
              121.093
                             121.093
                                                 NA
                                                          NA
                                                                202.334
                                                                             70.2032
## 1254
                             137.877
                                                               3565.740
              137.877
                                                 NA
                                                          NA
                                                                           1656.6500
## 1255
              117.900
                             117.900
                                                 NA
                                                          NA
                                                                240.866
                                                                             14.9938
##
        Curr_Var_Adj Fleet_name
                   1 MexCal S1
## 1252
                      MexCal S2
## 1253
                   1
## 1254
                   1
                             PNW
## 1255
                   1
                      AT_Survey
##
## $SBzero
## [1] 92465.5
##
## $current_depletion
## [1] 0.2173292
##
## $last_years_SPR
## [1] 1
##
## $SPRratioLabel
## [1] "1-SPR"
##
## $sigma R in
## [1] 0.5
## $sigma_R_info
##
              period N_devs SD_of_devs Var_of_devs
                                                      mean_SE mean_SEsquared
                              1.432984
                                           2.053443 0.1001396
## 1
                         20
                                                                   0.01182879
                               1.278190
                                           1.633770 0.1285671
## 2
          Early+Main
                         26
                                                                   0.02253679
## 3 Early+Main+Late
                         27
                               1.253376
                                           1.570950 0.1423239
                                                                   0.03096135
     sqrt_sum_of_components SD_of_devs_over_sigma_R sqrt_sum_over_sigma_R
## 1
                   1.437105
                                            2.865968
                                                                   2.874211
## 2
                   1.286976
                                            2.556380
                                                                   2.573952
## 3
                   1.265666
                                            2.506751
                                                                   2.531333
##
    alternative_sigma_R
## 1
                1.437105
## 2
                1.286976
## 3
                1.265666
##
## $rmse table
       ERA N
                  RMSE RMSE_over_sigmaR mean_BiasAdj
## 1 main 20 1.396700
                                7.80308
                                             0.841539
## 2 early 6 0.553946
                                             0.766330
                                 1.22742
## $cormessage1
## [1] Range of abs(parameter correlations) is 0 to 0.83492
##
## $cormessage2
## [1] No correlations above threshold (cormax=0.95)
##
## $cormessage7
## [1] 2 uncorrelated parameters below threshold (cormin=0.01)
##
```

```
## $cormessage8
##
                        name max
## 27
          Late RecrDev 2020
## 30 AgeSel_P1_MexCal_S1(1)
## completed SS_output
EMssmse2020_dir <- "C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenarios/perfDatTests/constGrow2
outEMssmse2020 <- SS output(EMssmse2020 dir)</pre>
## Getting header info from:
    C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenarios/perfDatTests/constGrow20010M_MidSteepH
## This function tested on SS versions 3.24 and 3.30.
    You are using 3.30.18.00 which SHOULD work with this package.
## Report file time:Mon Jun 06 17:29:00 2022
## Warning in SS_output(EMssmse2020_dir): Some stats skipped because the .cor file not found:C:/Users/r
## Warning in SS_output(EMssmse2020_dir): covar file contains the warning
##
        'Variances are 0.0 for first two elements, so do not write '
     input 'covar' changed to FALSE.
## Reading full report file
## Got all columns using ncols = 62
## Got Report file
## Setting minimum biomass threshhold to 0.25 based on US west coast assumption associated with biomas
## !warning: temporary files were written in this run:
                          TempFile
## "size of file gradfil1.tmp = 0" "size of file gradfil2.tmp = 0"
                              <NA>
## "size of file varssave.tmp = 0" "size of file cmpdiff.tmp = 0"
## Got warning file. Therewere 11 warnings in C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenari
## Finished reading files
## CompReport file separated by this code as follows (rows = Ncomps*Nbins):
##
     2184 rows of length comp data,
##
     O rows of generalized size comp data,
##
     495 rows of age comp data,
    O rows of conditional age-at-length data,
    0 rows of ghost fleet age comp data,
##
     O rows of ghost fleet conditional age-at-length data,
    351 rows of ghost fleet length comp data,
##
    0 rows of mean length at age data,
##
##
    O rows of mean weight at age data,
    0 rows of 'TAG1' comp data, and
    O rows of 'TAG2' comp data.
##
```

```
## Finished dimensioning
## You skipped the covar file
## Finished primary run statistics list
## running SS_readstarter
     data, control files: init_dat.ss, control.ss
##
##
     converge_criterion = 1e-05
    SPR_basis = 4
##
    F_report_basis = 2
##
## Assuming version 3.30 based on number of numeric values.
    MCMC_output_detail = 0
##
##
    ALK_tolerance = 1e-04
## Reading a random seed value:12546802
## Read of starter file complete. Final value: 3.3
## Statistics shown below (to turn off, change input to printstats=FALSE)
## $SS version
## [1] "3.30.18.00; safe; compile_date: Sep 30 2021; Stock_Synthesis_by_Richard_Methot_(NOAA)_using_ADM
## $SS_versionshort
## [1] "3.30"
## $SS_versionNumeric
## [1] 3.3
##
## $StartTime
## [1] "StartTime: Mon Jun 06 17:29:00 2022"
##
## $RunTime
## [1] "0 hours, 0 minutes, 11 seconds."
## $Files_used
## [1] "Data_File: init_dat.ss Control_File: control.ss"
## $Nwarnings
## [1] 11
##
```

```
## $warnings
   [1] "#V3.30.18.00; safe; compile_date: Sep 30 2021; Stock_Synthesis_by_Richard_Methot_(NOAA)_using_
    [2] "#_Stock_Synthesis_is_a_work_of_the_U.S._Government_and_is_not_subject_to_copyright_protection_
   [3] "#_Foreign_copyrights_may_apply._See_copyright.txt_for_more_information."
##
    [4] "#_User_support_available_at:NMFS.Stock.Synthesis@noaa.gov"
   [5] "#_User_info_available_at:https://vlab.noaa.gov/group/stock-synthesis"
##
   [6] "#_Source_code_at:_https://github.com/nmfs-stock-synthesis/stock-synthesis"
   [7] ""
##
##
   [8] "This file contains warnings, suggestions and notes generated as files are read and processed"
   [9] ""
##
## [10] "1 catch is 0.0 in endyr; this can cause problem in the benchmark and forecast calculations"
## [11] "2 NOTE: Max data length bin: 28 < max pop len bins: 30; so will accumulate larger pop len bi
## [12] "3 settle_month is less than spawn_month, so logical age at settlement calculated to be: 1 for
## [13] "4 setting in starter does not request all priors, and 1 parameters have priors and are not est
## [14] "5 1st iteration warning: ssb(endyr)/ssb(styr)= 4.77067e-07; suggest start with larger R0 to ge
## [15] "6 Final gradient: 1.24879e-05 is larger than final_conv: 1e-05"
## [16] "7 setting positive forecast relF for forecast only fleet: 1"
## [17] "8 setting positive forecast relF for forecast only fleet: 2"
## [18] "9 setting positive forecast relF for forecast only fleet: 2"
## [19] "10 setting positive forecast relF for forecast only fleet: 3"
## [20] "11 setting positive forecast relF for forecast only fleet: 3"
## [21] "Note: 1 additional lines truncated. Look in warning.sso file to see full list."
##
## $likelihoods used
##
                                        values lambdas
## TOTAL
                        944.76499999999986358
## Catch
                          0.00000000000608191
                                                    NΑ
## Equil_catch
                          0.000000000000000000
## Survey
                        -33.279499999999998749
                                                    NA
## Length_comp
                        771.442000000000007276
                                                    NA
## Age_comp
                        113.251000000000004775
                                                    NA
## Recruitment
                         93.34959999999995248
                                                      1
## InitEQ_Regime
                          0.00000000000000000
## Forecast_Recruitment
                          0.00000000000000000
                                                      1
## Parm priors
                          0.000000000000000000
                                                      1
## Parm_softbounds
                                                    NA
                          0.001895880000000000
## Parm devs
                          0.000000000000000000
                                                      1
## Crash_Pen
                          0.000000000000000000
                                                      1
##
## $likelihoods_laplace
                                        values lambdas
## NoBias_corr_Recruitment(info_only) 90.1811
                                                      1
## Laplace_obj_fun(info_only)
                                      941.5960
                                                    NA
##
## $likelihoods_by_fleet
                                ALL
                                      MexCal_S1
                                                  MexCal_S2
                                                                     PNW AT_Survey
##
                 Label
## 180
          Catch_lambda
                                 NA 1.00000e+00 1.00000e+00 1.00000e+00
                                                                            1.0000
                        6.08191e-13 1.53679e-13 1.37784e-13 3.16728e-13
## 181
            Catch_like
                                                                            0.0000
## 182 Init_equ_lambda
                                 NA 0.00000e+00 0.00000e+00 0.00000e+00
                                                                            1.0000
## 183
         Init_equ_like
                        0.00000e+00 0.00000e+00 0.00000e+00 0.00000e+00
                                                                            0.0000
## 184
                                 NA 0.00000e+00 0.00000e+00 0.00000e+00
           Surv_lambda
                                                                            1.0000
## 185
             Surv_like -3.32795e+01 0.00000e+00 0.00000e+00 0.00000e+00 -11.5640
## 186
            Surv_N_use
                                 NA 0.00000e+00 0.00000e+00 0.00000e+00
                                                                           19.0000
```

187

Surv N skip

NA 0.00000e+00 0.00000e+00 0.00000e+00

0.0000

```
## 188
         Length_lambda
                                  NA 1.00000e+00 1.00000e+00 1.00000e+00
                                                                              1.0000
## 189
           Length_like
                        7.71442e+02 2.21935e+02 2.17655e+02 1.72514e+02
                                                                            159.3380
## 190
                                  NA 1.50000e+01 1.50000e+01 1.60000e+01
          Length N use
                                                                             10.0000
## 191
                                  NA 0.00000e+00 0.00000e+00 9.00000e+00
         Length_N_skip
                                                                              0.0000
## 192
            Age_lambda
                                  NA 1.00000e+00 1.00000e+00 1.00000e+00
                                                                              1.0000
## 193
                        1.13251e+02 2.49472e+01 4.15343e+01 1.02819e+01
              Age like
                                                                             36.4875
## 194
             Age N use
                                  NA 1.50000e+01 1.50000e+01 1.50000e+01
                                                                             10.0000
## 195
            Age_N_skip
                                  NA 0.00000e+00 0.00000e+00 0.00000e+00
                                                                              0.0000
##
           DEPM TEP_all
## 180
        1.00000
                  1.0000
  181
        0.00000
                  0.0000
  182
        1.00000
                  1.0000
##
  183
        0.00000
                  0.0000
## 184
        1.00000
                   1.0000
## 185 -7.37638 -14.3391
  186 10.00000
                 13.0000
## 187
        0.00000
                  0.0000
  188
        0.00000
                  0.0000
  189
##
        0.00000
                  0.0000
  190
        0.00000
                  0.0000
## 191
        0.00000
                  0.0000
## 192
        0.00000
                  0.0000
## 193
        0.00000
                  0.0000
## 194
        0.00000
                  0.0000
## 195
       0.00000
                  0.0000
  $N_estimated_parameters
##
   [1] 48
##
##
   $table_of_phases
##
##
   -99
       -5
            -4 -3
                    -2
                                  2
                                      3
                                          4
                                               5
                        -1
                              1
                10
##
##
   $estimated_non_dev_parameters
##
                                      Value Phase
##
                                                      Min
                                                            Max
                                                                       Init Status
## L at Amin Fem GP 1
                                 12.9188000
                                                     3.00 30.00 12.8541000
                                                    15.00 40.00 24.8415000
                                                                                OK
## L_at_Amax_Fem_GP_1
                                 24.7845000
                                                           0.99
## VonBert_K_Fem_GP_1
                                  0.3077450
                                                     0.05
                                                                 0.3075730
                                                                                ΩK
## CV_young_Fem_GP_1
                                                     0.05
                                                           0.50
                                                                 0.1053490
                                                                                OK
                                  0.1185600
## CV_old_Fem_GP_1
                                  0.0218696
                                                     0.01
                                                           0.10
                                                                 0.0237245
                                                                                OK
## SR LN(RO)
                                                     3.00 25.00 14.4668000
                                                                                OK
                                 14.4351000
                                                 1
## SR_regime_BLK1repl_2000
                                  1.2445900
                                                 4 -15.00 15.00 1.2915300
                                                                                OK
## Size_inflection_MexCal_S1(1) 10.8461000
                                                     0.00 30.00 10.9072000
                                                                                OK
## Size_95%width_MexCal_S1(1)
                                  0.7327170
                                                     0.00 10.00
                                                                 0.6599090
                                                                                OK
                                                 3 -10.00 11.00
## AgeSel_P1_MexCal_S1(1)
                                  0.5000220
                                                                 0.5000240
                                                                                OK
                                                                 0.2048810
## AgeSel_P2_MexCal_S1(1)
                                  1.4981200
                                                 3 -10.00 11.00
                                                                                OK
## AgeSel_P3_MexCal_S1(1)
                                  0.3348340
                                                 3 -10.00 15.00
                                                                 0.3827920
                                                                                OK
## AgeSel_P4_MexCal_S1(1)
                                 -1.5724700
                                                 3 -10.00 11.00 -1.5494000
                                                                                OK
## AgeSel_P5_MexCal_S1(1)
                                 -0.1900890
                                                 3 -10.00 11.00 -0.2361890
                                                                                OK
## AgeSel_P2_MexCal_S2(2)
                                                 3 -10.00 15.00 0.4405260
                                                                                OK
                                  0.7533250
## AgeSel_P3_MexCal_S2(2)
                                 -1.1646100
                                                 3 -10.00 11.00 -1.1690800
                                                                                OK
## AgeSel_P4_MexCal_S2(2)
                                 -0.1740880
                                                 3 -10.00 11.00 -0.1425740
                                                                                ΠK
## AgeSel_P5_MexCal_S2(2)
                                 -0.4944460
                                                 3 -10.00 11.00 -0.4707320
                                                                                OK
```

```
## Age_inflection_PNW(3)
                                  2.8219500
                                                     0.00 10.00 2.8525100
                                                                                OK
## Age_95%width_PNW(3)
                                  1.1461700
                                                   -5.00 15.00 1.2152300
                                                                                ΩK
##
                                 Parm StDev
                                                      Gradient Pr type Prior Pr SD
## L_at_Amin_Fem_GP_1
                                              0.0000001238880 No_prior
                                                                                  ΝA
## L_at_Amax_Fem_GP_1
                                           0
                                              0.00000214538000 No_prior
                                                                            NΑ
                                                                                  NΑ
## VonBert K Fem GP 1
                                             0.00000115591000 No prior
                                                                            NA
                                                                                  NA
## CV young Fem GP 1
                                           0 -0.00000011495400 No_prior
                                                                            NA
                                                                                  NA
## CV_old_Fem_GP_1
                                              0.0000010543100 No prior
                                                                            NA
                                                                                  NA
                                              0.00001248790000 No_prior
## SR_LN(RO)
                                                                            NA
                                                                                  NA
                                           0
## SR_regime_BLK1repl_2000
                                              0.00000140432000 No_prior
                                                                            NA
                                                                                  ΝA
## Size_inflection_MexCal_S1(1)
                                             0.00000254499000 No_prior
                                                                            NA
                                                                                  NA
## Size_95%width_MexCal_S1(1)
                                           0 -0.00000016337300 No_prior
                                                                            NA
                                                                                  ΝA
## AgeSel_P1_MexCal_S1(1)
                                             0.0000000658736 No_prior
                                                                            NA
                                                                                  NΑ
## AgeSel_P2_MexCal_S1(1)
                                             0.00000137300000 No_prior
                                                                            NA
                                                                                  NA
## AgeSel_P3_MexCal_S1(1)
                                           0 0.00000146040000 No_prior
                                                                            NA
                                                                                  NA
## AgeSel_P4_MexCal_S1(1)
                                              0.00000053827800 No_prior
                                                                            NA
                                                                                  NA
## AgeSel_P5_MexCal_S1(1)
                                                                            NA
                                             0.00000020581200 No_prior
                                                                                  NA
## AgeSel P2 MexCal S2(2)
                                             0.00000067622900 No prior
                                                                            NA
                                                                                  NA
## AgeSel_P3_MexCal_S2(2)
                                             0.0000060302600 No_prior
                                                                            NA
                                                                                  ΝA
## AgeSel P4 MexCal S2(2)
                                             0.00000050171200 No prior
                                                                            NA
                                                                                  NΑ
## AgeSel_P5_MexCal_S2(2)
                                           0 0.00000025707100 No_prior
                                                                            NA
                                                                                  NA
## Age_inflection_PNW(3)
                                           0 -0.00000007495750 No_prior
                                                                            NA
                                                                                  NA
## Age_95%width_PNW(3)
                                           0 -0.00000014256600 No_prior
                                                                            NA
                                                                                  NA
##
                                 Pr Like Afterbound
## L_at_Amin_Fem_GP_1
                                      NΑ
                                                  ΠK
## L_at_Amax_Fem_GP_1
                                      NA
                                                  OK
                                                  OK
## VonBert_K_Fem_GP_1
                                      NA
## CV_young_Fem_GP_1
                                      NA
                                                  OK
## CV_old_Fem_GP_1
                                      NA
                                                  OK
## SR_LN(RO)
                                                  OK
                                      NA
## SR_regime_BLK1repl_2000
                                      NA
                                                  OK
## Size_inflection_MexCal_S1(1)
                                      NΑ
                                                  OK
## Size_95%width_MexCal_S1(1)
                                      NA
                                                  OK
## AgeSel_P1_MexCal_S1(1)
                                                  OK
                                      NA
## AgeSel P2 MexCal S1(1)
                                      NA
                                                  OK
## AgeSel_P3_MexCal_S1(1)
                                      NΑ
                                                  OK
## AgeSel P4 MexCal S1(1)
                                      NΑ
                                                  ΩK
## AgeSel_P5_MexCal_S1(1)
                                      NΑ
                                                  ΩK
## AgeSel_P2_MexCal_S2(2)
                                      NA
                                                  OK
## AgeSel_P3_MexCal_S2(2)
                                      NA
                                                  OK
## AgeSel P4 MexCal S2(2)
                                      NA
                                                  OK
## AgeSel_P5_MexCal_S2(2)
                                      NΑ
                                                  OK
## Age_inflection_PNW(3)
                                      NA
                                                  OK
## Age_95%width_PNW(3)
                                      NA
                                                  OK
##
## $maximum_gradient_component
##
   [1] 1.24879e-05
##
   $parameters_with_highest_gradients
                                               Gradient
                                     Value
## SR_LN(RO)
                                 14.435100 1.24879e-05
## Size inflection MexCal S1(1) 10.846100 2.54499e-06
## L_at_Amax_Fem_GP_1
                                 24.784500 2.14538e-06
## AgeSel P3 MexCal S1(1)
                                  0.334834 1.46040e-06
```

```
## SR_regime_BLK1repl_2000
                              1.244590 1.40432e-06
##
## $Length Comp Fit Summary
       Factor Fleet Recommend_var_adj # N Npos min_Nsamp max_Nsamp mean_Nsamp_in
## 1187
             4
                  1
                             0.1935150 # 15
                                               15
                                                          6
                                                                 1000
                                                                              96.800
## 1188
             4
                   2
                             0.3188630 # 15
                                               15
                                                          9
                                                                 1000
                                                                             121.733
## 1189
                   3
                             0.0812390 # 25
                                               16
                                                          1
                                                                 1000
                                                                             143.438
## 1190
                             0.0946217 # 10
                                               10
             4
                   4
                                                         12
                                                                 1000
                                                                             117.900
       mean_Nsamp_adj mean_Nsamp_DM DM_theta mean_effN HarMean_effN Curr_Var_Adj
## 1187
               96.800
                                  NA
                                            NA 75.5652
                                                              18.7323
## 1188
               121.733
                                  NA
                                            NA
                                                85.9834
                                                              38.8162
                                                                                  1
                                            NA 163.5230
## 1189
               143.438
                                  NA
                                                              11.6527
                                                                                  1
                                               19.1287
## 1190
               117.900
                                  NΑ
                                            NΑ
                                                              11.1559
                                                                                  1
##
       Fleet_name
## 1187 MexCal_S1
## 1188
        MexCal_S2
## 1189
               PNW
## 1190 AT_Survey
## $Age Comp Fit Summary
       Factor Fleet Recommend_var_adj # Nsamp_adj Npos min_Nsamp max_Nsamp
## 1252
             5
                  1
                              0.931461 #
                                                 15
                                                      15
                   2
## 1253
             5
                              0.595226 #
                                                      15
                                                                100
                                                                         1000
                                                 15
## 1254
             5
                   3
                              5.661630 #
                                                 15
                                                      15
                                                                100
                                                                         1000
## 1255
             5
                   4
                                                 10
                                                      10
                                                               100
                                                                         1000
                              0.665768 #
       mean_Nsamp_in mean_Nsamp_adj mean_Nsamp_DM DM_theta mean_effN HarMean_effN
## 1252
                  160
                                  160
                                                 NA
                                                          NA 1253.630
                                                                            149.0340
## 1253
                  160
                                  160
                                                          NA
                                                               320.289
                                                 NA
                                                                             95.2361
## 1254
                  160
                                  160
                                                 NA
                                                          NA 1223.070
                                                                            905.8610
                                                               363.944
## 1255
                  190
                                  190
                                                 NA
                                                          NA
                                                                            126.4960
##
       Curr_Var_Adj Fleet_name
## 1252
                   1 MexCal_S1
## 1253
                      MexCal_S2
                   1
## 1254
                            PNW
                   1
## 1255
                   1 AT_Survey
## $SBzero
## [1] 79222
##
## $current_depletion
## [1] 0.2388125
## $last_years_SPR
## [1] 1
## $SPRratioLabel
## [1] "1-SPR"
##
## $sigma_R_in
## [1] 0.5
##
## $sigma R info
##
              period N_devs SD_of_devs Var_of_devs mean_SE mean_SEsquared
## 1
                Main
                         20 1.649686
                                           2.721464
```

```
1.470564
         Early+Main
                        26
                                         2.162560
                                                         0
## 3 Early+Main+Late
                        27
                             1.442026
                                         2.079438
                                                         0
   sqrt_sum_of_components SD_of_devs_over_sigma_R sqrt_sum_over_sigma_R
## 1
                  1.649686
                                           3.299372
                                                                 3.299372
## 2
                  1.470564
                                           2.941129
                                                                 2.941129
## 3
                  1.442026
                                           2.884051
                                                                 2.884051
## alternative_sigma_R
## 1
               1.649686
## 2
               1.470564
## 3
               1.442026
##
## $rmse_table
      ERA N
                 RMSE RMSE_over_sigmaR mean_BiasAdj
## 1 main 20 1.607920
                             10.34160
                                            0.841539
## 2 early 6 0.631615
                               1.59575
                                            0.766330
## completed SS_output
EMalk2020_dir <- "C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenarios/perfDatTests/constGrow200
outEMalk2020 <- SS_output(EMalk2020_dir)</pre>
## Getting header info from:
   C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenarios/perfDatTests/constGrow20010M_MidSteepH
## This function tested on SS versions 3.24 and 3.30.
    You are using 3.30.18.00 which SHOULD work with this package.
## Report file time: Tue Jun 07 15:08:08 2022
## Reading full report file
## Got all columns using ncols = 62
## Got Report file
## Setting minimum biomass threshhold to 0.25 based on US west coast assumption associated with biomas
## !warning: temporary files were written in this run:
                         TempFile
                                                              Size
## "size of file gradfil1.tmp = 0" "size of file gradfil2.tmp = 0"
                                                              <NA>
                              <NA>
## "size of file varssave.tmp = 0" "size of file cmpdiff.tmp = 0"
## Got warning file. Therewere 15 warnings in C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenari
## Finished reading files
```

```
## CompReport file separated by this code as follows (rows = Ncomps*Nbins):
##
     2184 rows of length comp data,
    O rows of generalized size comp data,
##
    495 rows of age comp data,
##
##
    O rows of conditional age-at-length data,
    O rows of ghost fleet age comp data,
##
    O rows of ghost fleet conditional age-at-length data,
    351 rows of ghost fleet length comp data,
##
##
    0 rows of mean length at age data,
    O rows of mean weight at age data,
##
   0 rows of 'TAG1' comp data, and
    0 rows of 'TAG2' comp data.
## Finished dimensioning
## Got covar file.
## Finished primary run statistics list
## running SS_readstarter
##
     data, control files: init_dat.ss, control.ss
##
     converge_criterion = 1e-05
    SPR_basis = 4
##
    F_report_basis = 2
##
## Assuming version 3.30 based on number of numeric values.
    MCMC_output_detail = 0
##
##
     ALK_tolerance = 0
## Reading a random seed value:12546802
## Read of starter file complete. Final value: 3.3
## Statistics shown below (to turn off, change input to printstats=FALSE)
## $SS_version
## [1] "3.30.18.00; safe; compile_date: Sep 30 2021; Stock_Synthesis_by_Richard_Methot_(NOAA) using_ADM
## $SS_versionshort
## [1] "3.30"
##
## $SS_versionNumeric
## [1] 3.3
```

```
##
## $StartTime
## [1] "StartTime: Tue Jun 07 15:08:08 2022"
##
## $RunTime
## [1] "0 hours, 0 minutes, 53 seconds."
## $Files used
## [1] "Data_File: init_dat.ss Control_File: control.ss"
##
## $Nwarnings
## [1] 15
##
## $warnings
   [1] "#V3.30.18.00; safe; compile_date: Sep 30 2021; Stock_Synthesis_by_Richard_Methot_(NOAA)_using_
    [2] "#_Stock_Synthesis_is_a_work_of_the_U.S._Government_and_is_not_subject_to_copyright_protection_
##
##
   [3] "#_Foreign_copyrights_may_apply._See_copyright.txt_for_more_information."
   [4] "#_User_support_available_at:NMFS.Stock.Synthesis@noaa.gov"
   [5] "#_User_info_available_at:https://vlab.noaa.gov/group/stock-synthesis"
##
    [6] "#_Source_code_at:_https://github.com/nmfs-stock-synthesis/stock-synthesis"
##
   [7] ""
   [8] "This file contains warnings, suggestions and notes generated as files are read and processed"
   [9] ""
##
## [10] "1 catch is 0.0 in endyr; this can cause problem in the benchmark and forecast calculations"
## [11] "2 NOTE: Max data length bin: 28 < max pop len bins: 30; so will accumulate larger pop len bi
## [12] "3 settle_month is less than spawn_month, so logical age at settlement calculated to be: 1 for
## [13] "4 setting in starter does not request all priors, and 1 parameters have priors and are not est
## [14] "5 1st iteration warning: ssb(endyr)/ssb(styr)= 4.73756e-07; suggest start with larger R0 to ge
## [15] "6 setting positive forecast relF for forecast only fleet: 1"
## [16] "7 setting positive forecast relF for forecast only fleet: 2"
## [17] "8 setting positive forecast relF for forecast only fleet: 2"
## [18] "9 setting positive forecast relF for forecast only fleet: 3"
## [19] "10 setting positive forecast relF for forecast only fleet: 3"
## [20] "11 setting positive forecast relF for forecast only fleet: 1"
## [21] "Note: 5 additional lines truncated. Look in warning.sso file to see full list."
##
## $likelihoods used
##
                                        values lambdas
## TOTAL
                         22.81289999999999968
## Catch
                          0.00000000000512009
                                                    NΔ
## Equil_catch
                          0.00000000000000000
                                                    NΑ
## Survey
                        -50.067500000000002558
                                                    NΑ
## Length_comp
                          3.860570000000000057
                                                    MΔ
## Age_comp
                          3.04696999999999956
                                                    NA
## Recruitment
                         65.97090000000000318
                                                     1
## InitEQ_Regime
                          0.00000000000000000
                                                     0
## Forecast_Recruitment
                          0.00000000000000000
                                                     1
## Parm_priors
                          0.000000000000000000
                                                     1
## Parm_softbounds
                          0.001961290000000000
                                                    NΑ
## Parm_devs
                          0.00000000000000000
                                                     1
## Crash_Pen
                          0.00000000000000000
                                                     1
## $likelihoods_laplace
##
                                       values lambdas
```

```
## NoBias_corr_Recruitment(info_only) 62.8024
                                                       1
## Laplace_obj_fun(info_only)
                                        19.6443
                                                      NA
##
##
   $likelihoods_by_fleet
##
                 Label
                                 ALL
                                        MexCal S1
                                                    MexCal S2
                                                                       PNW
                                                                             AT_Survey
                                  NA 1.00000e+00 1.00000e+00 1.00000e+00
                                                                              1.000000
## 180
          Catch lambda
            Catch like
## 181
                         5.12009e-13 1.30107e-13 9.78789e-14 2.84023e-13
                                                                              0.000000
## 182 Init equ lambda
                                   NA 0.00000e+00 0.00000e+00 0.00000e+00
                                                                              1.000000
##
  183
         Init_equ_like
                         0.00000e+00 0.00000e+00 0.00000e+00 0.00000e+00
                                                                              0.00000
## 184
           Surv_lambda
                                   NA 0.00000e+00 0.00000e+00 0.00000e+00
                                                                              1.000000
##
  185
             Surv_like
                        -5.00675e+01 0.00000e+00 0.00000e+00 0.00000e+00 -21.920600
  186
##
            Surv_N_use
                                   NA 0.00000e+00 0.00000e+00 0.00000e+00
                                                                             19.000000
##
  187
           Surv_N_skip
                                   NA 0.00000e+00 0.00000e+00 0.00000e+00
                                                                              0.000000
##
  188
         Length_lambda
                                   NA 1.00000e+00 1.00000e+00 1.00000e+00
                                                                              1.000000
## 189
           Length_like
                         3.86057e+00 6.09158e-01 1.25514e+00 1.10062e+00
                                                                              0.895658
## 190
          Length_N_use
                                   NA 1.50000e+01 1.50000e+01 1.60000e+01
                                                                             10.000000
                                                                              0.00000
## 191
                                   NA 0.00000e+00 0.00000e+00 9.00000e+00
         Length_N_skip
  192
                                   NA 1.00000e+00 1.00000e+00 1.00000e+00
                                                                              1.000000
            Age_lambda
## 193
                         3.04697e+00 3.90204e-01 9.23142e-01 1.22167e+00
                                                                              0.511953
              Age_like
##
   194
             Age_N_use
                                   NA 1.50000e+01 1.50000e+01 1.50000e+01
                                                                             10.000000
##
   195
            Age_N_skip
                                  NA 0.00000e+00 0.00000e+00 0.00000e+00
                                                                              0.000000
##
                TEP all
           DEPM
         1.0000
                   1.0000
## 180
         0.0000
                   0.0000
##
   181
## 182
         1.0000
                   1.0000
  183
         0.0000
                   0.0000
  184
         1.0000
##
                   1.0000
##
   185
       -11.3394 -16.8075
##
  186
        10.0000
                 13.0000
## 187
         0.0000
                   0.0000
## 188
         0.0000
                   0.0000
##
  189
         0.0000
                   0.0000
##
  190
         0.0000
                   0.0000
         0.0000
##
  191
                   0.0000
   192
         0.0000
                   0.0000
##
  193
         0.0000
##
                   0.0000
## 194
         0.0000
                   0.0000
## 195
         0.0000
                   0.0000
##
##
   $N_estimated_parameters
   [1] 48
##
##
   $table_of_phases
##
        -5
            -4
               -3
                    -2
                              1
                                   2
                                       3
                                               5
                                   6
                                               2
##
                10
                          2
                             21
                                      16
                                           3
     1
         1
             1
##
##
   $estimated_non_dev_parameters
##
                                       Value Phase
                                                       Min
                                                             Max
                                                                        Init Status
## L_at_Amin_Fem_GP_1
                                 12.8534000
                                                      3.00 30.00 12.8541000
                                                                                 OK
                                                 3
                                                                                 OK
## L_at_Amax_Fem_GP_1
                                 24.9072000
                                                     15.00 40.00 24.8415000
## VonBert_K_Fem_GP_1
                                  0.3056280
                                                 3
                                                      0.05
                                                            0.99
                                                                  0.3075730
                                                                                 OK
## CV_young_Fem_GP_1
                                  0.1054430
                                                 3
                                                      0.05
                                                            0.50
                                                                  0.1053490
                                                                                 ΠK
## CV_old_Fem_GP_1
                                   0.0229908
                                                 3
                                                      0.01
                                                            0.10
                                                                  0.0237245
                                                                                 OK
```

```
## SR LN(RO)
                                14.5352000
                                                    3.00 25.00 14.4668000
                                                                              OK
## SR_regime_BLK1repl_2000
                                                4 -15.00 15.00 1.2915300
                                                                              OK
                                 1.2254800
## Size inflection MexCal S1(1) 10.9062000
                                                    0.00 30.00 10.9072000
                                                                              OK
                                                                              OK
## Size_95%width_MexCal_S1(1)
                                 0.6649890
                                                    0.00 10.00
                                                                0.6599090
## AgeSel_P1_MexCal_S1(1)
                                 0.5000230
                                                3 -10.00 11.00
                                                                0.5000240
                                                                              OK
## AgeSel P2 MexCal S1(1)
                                                3 -10.00 11.00
                                                                              OK
                                 0.1921620
                                                               0.2048810
## AgeSel P3 MexCal S1(1)
                                 0.3904400
                                                3 -10.00 15.00 0.3827920
                                                                              OK
## AgeSel_P4_MexCal_S1(1)
                                -1.5356700
                                                3 -10.00 11.00 -1.5494000
                                                                              OK
  AgeSel_P5_MexCal_S1(1)
                                -0.2069910
                                                3 -10.00 11.00 -0.2361890
                                                                              OK
  AgeSel_P2_MexCal_S2(2)
                                 0.4291180
                                                3 -10.00 15.00 0.4405260
                                                                              OK
## AgeSel_P3_MexCal_S2(2)
                                -1.1633000
                                                3 -10.00 11.00 -1.1690800
                                                                              OK
## AgeSel_P4_MexCal_S2(2)
                                -0.0731465
                                                3 -10.00 11.00 -0.1425740
                                                                              OK
                                                3 -10.00 11.00 -0.4707320
                                                                              OK
## AgeSel_P5_MexCal_S2(2)
                                -0.4491490
## Age_inflection_PNW(3)
                                 2.8661000
                                                    0.00 10.00 2.8525100
                                                                              OK
## Age_95%width_PNW(3)
                                 1.2322200
                                                  -5.00 15.00 1.2152300
                                                                              ΠK
##
                                  Parm_StDev
                                                       Gradient Pr_type Prior
## L_at_Amin_Fem_GP_1
                                  0.05829290
                                              0.00000232356000 No_prior
                                                                            NA
## L at Amax Fem GP 1
                                              0.00000081602600 No prior
                                  0.11787700
                                                                            NA
## VonBert_K_Fem_GP_1
                                  0.00712823 -0.00000027961300 No_prior
                                                                            NA
## CV_young_Fem_GP_1
                                  0.00236443 -0.00000002797120 No prior
                                                                            NA
## CV_old_Fem_GP_1
                                  NA
## SR LN(RO)
                                  0.02726590 -0.00000312192000 No_prior
                                                                            NA
## SR_regime_BLK1repl_2000
                                  0.07958390 -0.00000350871000 No_prior
                                                                            NA
## Size inflection MexCal S1(1)
                                  0.06298480 -0.00000340586000 No prior
                                                                            NA
## Size_95%width_MexCal_S1(1)
                                  0.05720450
                                              0.00000034308900 No prior
                                                                            NΑ
## AgeSel_P1_MexCal_S1(1)
                                234.78400000
                                              0.00000000690087 No_prior
                                                                            NA
## AgeSel_P2_MexCal_S1(1)
                                  0.16319200 -0.00000157564000 No_prior
                                                                            NA
                                  0.08560890 -0.00000203303000 No_prior
## AgeSel_P3_MexCal_S1(1)
                                                                            NA
## AgeSel_P4_MexCal_S1(1)
                                  0.16842600
                                              0.00000046105800 No_prior
                                                                            NA
                                              0.00000119422000 No_prior
## AgeSel_P5_MexCal_S1(1)
                                  0.19815800
                                                                            NA
## AgeSel_P2_MexCal_S2(2)
                                  0.06663610
                                              0.00000073861400 No_prior
                                                                            NA
## AgeSel_P3_MexCal_S2(2)
                                  0.14003900 -0.00000061018200 No_prior
                                                                            NA
## AgeSel_P4_MexCal_S2(2)
                                  0.21950000 -0.00000020519800 No_prior
                                                                            NA
                                  NA
## AgeSel_P5_MexCal_S2(2)
                                  0.06118530 -0.00000194706000 No prior
## Age_inflection_PNW(3)
                                                                            NA
## Age_95%width_PNW(3)
                                  0.05204760  0.00000185804000 No_prior
                                                                            NA
##
                                Pr SD Pr Like Afterbound
## L_at_Amin_Fem_GP_1
                                   NΑ
                                           NΑ
                                                       OK
## L_at_Amax_Fem_GP_1
                                   NA
                                           NΑ
                                                       OK
                                   NA
                                           NA
## VonBert_K_Fem_GP_1
## CV_young_Fem_GP_1
                                   NA
                                           NA
                                                       OK
## CV_old_Fem_GP_1
                                   NΑ
                                           NΑ
                                                       OK
## SR LN(RO)
                                   NA
                                           NA
                                                       OK
## SR_regime_BLK1repl_2000
                                           NA
                                                       OK
## Size_inflection_MexCal_S1(1)
                                           NA
                                                       OK
                                   NA
## Size_95%width_MexCal_S1(1)
                                   ΝA
                                           NA
                                                       OK
## AgeSel_P1_MexCal_S1(1)
                                   NA
                                           NA
                                                       OK
## AgeSel_P2_MexCal_S1(1)
                                   NA
                                           NA
                                                       OK
## AgeSel_P3_MexCal_S1(1)
                                   NA
                                           NA
                                                       OK
## AgeSel_P4_MexCal_S1(1)
                                                       OK
                                   NA
                                           NA
## AgeSel_P5_MexCal_S1(1)
                                                       OK
                                   NA
                                           NA
## AgeSel P2 MexCal S2(2)
                                           NA
                                                       OK
## AgeSel_P3_MexCal_S2(2)
                                           NΑ
                                                       OK
                                   NA
## AgeSel_P4_MexCal_S2(2)
                                                       OK
```

```
## AgeSel P5 MexCal S2(2)
                                    NA
                                             NA
                                                        OK
## Age_inflection_PNW(3)
                                    NΑ
                                             NΑ
                                                        ΠK
## Age_95%width_PNW(3)
                                    NA
                                             NA
                                                        OK
##
## $log_det_hessian
## [1] 235.651
## $maximum_gradient_component
## [1] 3.50871e-06
##
## $parameters_with_highest_gradients
##
                                               Gradient
                                    Value
                                  1.22548 -3.50871e-06
## SR_regime_BLK1repl_2000
## Size_inflection_MexCal_S1(1) 10.90620 -3.40586e-06
## SR_LN(RO)
                                 14.53520 -3.12192e-06
                                 12.85340 2.32356e-06
## L_at_Amin_Fem_GP_1
## AgeSel_P3_MexCal_S1(1)
                                  0.39044 -2.03303e-06
##
## $Length_Comp_Fit_Summary
        Factor Fleet Recommend_var_adj # N Npos min_Nsamp max_Nsamp mean_Nsamp_in
## 1187
             4
                    1
                                62.8391 # 15
                                                15
                                                           6
                                                                   1000
                                                                              97.0853
## 1188
                    2
                                53.3854 # 15
                                                15
                                                           9
                                                                   1000
                                                                             122.0320
## 1189
                    3
                               183.8440 # 25
                                                16
                                                                   1000
                                                                             143.8350
             4
                                                           1
## 1190
                    4
                                28.1711 # 10
                                                10
                                                          12
                                                                   1000
                                                                             117.9000
##
        mean_Nsamp_adj mean_Nsamp_DM DM_theta mean_effN HarMean_effN Curr_Var_Adj
## 1187
               97.0853
                                   NA
                                             NA 292622.0
                                                               6100.76
                                                                                    1
## 1188
              122.0320
                                   NA
                                             NA 232248.0
                                                                6514.72
                                                                                    1
## 1189
              143.8350
                                   NA
                                             NA 119880.0
                                                               26443.20
                                                                                    1
                                   NA
## 1190
              117.9000
                                             NA
                                                  24708.7
                                                                3321.37
                                                                                    1
##
        Fleet_name
## 1187 MexCal_S1
## 1188
        MexCal_S2
## 1189
               PNW
## 1190
        AT_Survey
## $Age_Comp_Fit_Summary
        Factor Fleet Recommend var adj # Nsamp adj Npos min Nsamp max Nsamp
## 1252
             5
                    1
                                9.20809 #
                                                  15
                                                       15
                                                               5.92
                                                                          1000
                    2
## 1253
             5
                                5.89711 #
                                                  15
                                                       15
                                                                8.92
                                                                          1000
## 1254
                    3
                                                       15
                                                               26.88
             5
                               50.91710 #
                                                  15
                                                                          1000
## 1255
                    4
                               15.54410 #
                                                  10
                                                       10
                                                               12.00
                                                                          1000
        mean_Nsamp_in mean_Nsamp_adj mean_Nsamp_DM DM_theta mean_effN HarMean_effN
               95.664
                              95.664
                                                                 83753.0
## 1252
                                                  NA
                                                           NA
                                                                              880.883
## 1253
              121.093
                                                                 29773.2
                              121.093
                                                  NA
                                                           NA
                                                                              714.100
## 1254
              137.877
                                                           NA
                                                                 18681.1
                                                                             7020.310
                              137.877
                                                  NA
## 1255
                                                                 19009.6
              117.900
                              117.900
                                                  NA
                                                           NA
                                                                             1832.650
##
        Curr_Var_Adj Fleet_name
## 1252
                      MexCal S1
                    1
## 1253
                    1
                      MexCal_S2
## 1254
                    1
                             PNW
## 1255
                      AT_Survey
                   1
##
## $SBzero
## [1] 86461
```

```
##
## $current_depletion
## [1] 0.1516481
##
## $last_years_SPR
## [1] 1
## $SPRratioLabel
## [1] "1-SPR"
##
## $sigma_R_in
## [1] 0.5
##
## $sigma_R_info
##
              period N_devs SD_of_devs Var_of_devs
                                                    mean_SE mean_SEsquared
## 1
                         20
                            1.424623
                                          2.029549 0.09862103
                                                                   0.01141750
## 2
          Early+Main
                         26
                              1.270947
                                          1.615307 0.12745553
                                                                   0.02232781
## 3 Early+Main+Late
                         27
                              1.246283 1.553221 0.14125347
                                                                   0.03076011
    sqrt_sum_of_components SD_of_devs_over_sigma_R sqrt_sum_over_sigma_R
## 1
                   1.428624
                                          2.849245
                                                                  2.559402
## 2
                   1.279701
                                           2.541894
## 3
                   1.258563
                                           2.492566
                                                                  2.517127
##
   alternative_sigma_R
## 1
               1.428624
## 2
               1.279701
## 3
               1.258563
##
## $rmse_table
       ERA N
                  RMSE RMSE_over_sigmaR mean_BiasAdj
## 1 main 20 1.388550
                                7.71229
                                            0.841539
## 2 early 6 0.555376
                                1.23377
                                            0.766330
##
## $cormessage1
## [1] Range of abs(parameter correlations) is 0 to 0.845131
## $cormessage2
## [1] No correlations above threshold (cormax=0.95)
##
## $cormessage7
## [1] 2 uncorrelated parameters below threshold (cormin=0.01)
## $cormessage8
                        name max
## 27
           Late_RecrDev_2020
## 30 AgeSel_P1_MexCal_S1(1)
## completed SS_output
compbavg2020 <- SSsummarize(list(OM2020 = outOMbavg,</pre>
                                   EMssmse2020 = outEMssmse2020,
                                   EMbavg2020 = outEMbavg2020,
                                 EMalk2020 = outEMalk2020))
```

Summarizing 4 models:

```
## imodel=1/4
    N active pars = 0
## imodel=2/4
    N active pars = 48
##
## imodel=3/4
    N active pars = 48
## imodel=4/4
    N active pars = 48
## Summary finished. To avoid printing details above, use 'verbose = FALSE'.
SSplotComparisons(compbavg2020, legendlabels = c("OM", "SSMSE 2020", "Perf 2020", "Perf ALK 2020"),
                  subplots = c(2,10, 12, 13, 14))
## Warning in SSplotComparisons(compbavg2020, legendlabels = c("OM", "SSMSE
## 2020", : setting btarg = -999 because models don't have matching values
## Warning in SSplotComparisons(compbavg2020, legendlabels = c("OM", "SSMSE
## 2020", : setting minbthresh = -999 because models don't have matching values
## Warning in SSplotComparisons(compbavg2020, legendlabels = c("OM", "SSMSE
## 2020", : setting sprtarg = -999 because models don't have matching values
## Warning in SSplotComparisons(compbavg2020, legendlabels = c("OM", "SSMSE
## 2020", : setting label for SPR plot to 8th element of input 'labels' because the
## models don't have matching labels
## Warning in SSplotComparisons(compbavg2020, legendlabels = c("OM", "SSMSE
## 2020", : setting label for F plot to 13th element of input 'labels' because the
## models don't have matching labels
## showing uncertainty for all models
## No uncertainty available for model 1
## No uncertainty available for model 2
## subplot 2: spawning biomass with uncertainty intervals
## subplot 10: recruits with uncertainty
## subplot 12: recruit devs with uncertainty
```

```
## subplot 13: index fits
## subplot 14: index fits on a log scale
Try another year w/ higher OM biomass
# Biomass average w/ forecast 2020 assessment
EMbavg2025_dir <- "C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenarios/perfDatTests/constGrow20
datEMbavg2025 <- SS_readdat(file.path(EMbavg2025_dir, "init_dat.ss"),</pre>
                    verbose = FALSE,
                    section = 1)
datEMbavg2025$catch <- datOMbavg$catch %>% filter(year <= 2025)</pre>
datEMbavg2025$CPUE <- datOMbavg$CPUE %>% filter(year <= 2025) %>%
  mutate(index = abs(index))
datEMbavg2025$lencomp <- datOMbavg$lencomp %>% filter(Yr <= 2025) %>%
  mutate(FltSvy = case_when(FltSvy == -3 & Seas == 10 ~ FltSvy,
                            TRUE ~ abs(FltSvy)))
datEMbavg2025$agecomp <- datOMbavg$agecomp %>% filter(Yr <= 2025) %>%
  mutate(FltSvy = abs(FltSvy))
SS_writedat(datlist = datEMbavg2025,
            outfile = file.path(file.path(EMbavg2025_dir, "init_dat.ss")),
            overwrite = TRUE,
            verbose = FALSE)
# plot comparisons
EMssmse2025_dir <- "C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenarios/perfDatTests/constGrow2
outEMssmse2025 <- SS_output(EMssmse2025_dir)</pre>
## Getting header info from:
    C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenarios/perfDatTests/constGrow20010M_MidSteepH
## This function tested on SS versions 3.24 and 3.30.
     You are using 3.30.18.00 which SHOULD work with this package.
## Report file time:Mon Jun 06 17:34:47 2022
## Warning in SS_output(EMssmse2025_dir): Some stats skipped because the .cor file not found:C:/Users/r
## Warning in SS_output(EMssmse2025_dir): covar file contains the warning
        'Variances are 0.0 for first two elements, so do not write '
##
     input 'covar' changed to FALSE.
## Reading full report file
## Got all columns using ncols = 62
## Got Report file
```

```
## Setting minimum biomass threshhold to 0.25 based on US west coast assumption associated with biomas
## !warning: temporary files were written in this run:
##
                          TempFile
                                                               Size
## "size of file gradfil1.tmp = 0" "size of file gradfil2.tmp = 0"
                              <NA>
## "size of file varssave.tmp = 0" "size of file cmpdiff.tmp = 0"
## Got warning file. Therewere 11 warnings in C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenari
## Finished reading files
## CompReport file separated by this code as follows (rows = Ncomps*Nbins):
##
     2964 rows of length comp data,
##
    0 rows of generalized size comp data,
    675 rows of age comp data,
##
##
    O rows of conditional age-at-length data,
    O rows of ghost fleet age comp data,
##
    O rows of ghost fleet conditional age-at-length data,
    351 rows of ghost fleet length comp data,
##
    0 rows of mean length at age data,
##
##
    0 rows of mean weight at age data,
    O rows of 'TAG1' comp data, and
    O rows of 'TAG2' comp data.
##
## Finished dimensioning
## You skipped the covar file
## Finished primary run statistics list
## running SS_readstarter
##
     data, control files: init_dat.ss, control.ss
     converge_criterion = 1e-05
##
##
     SPR_basis = 4
##
     F_report_basis = 2
## Assuming version 3.30 based on number of numeric values.
##
    MCMC_output_detail = 0
     ALK_tolerance = 1e-04
## Reading a random seed value:12546807
```

```
## Read of starter file complete. Final value: 3.3
## Statistics shown below (to turn off, change input to printstats=FALSE)
## $SS_version
## [1] "3.30.18.00;_safe;_compile_date:_Sep 30 2021;_Stock_Synthesis_by_Richard_Methot_(NOAA)_using_ADM
## $SS_versionshort
## [1] "3.30"
##
## $SS_versionNumeric
## [1] 3.3
##
## $StartTime
## [1] "StartTime: Mon Jun 06 17:34:47 2022"
## $RunTime
## [1] "0 hours, 0 minutes, 18 seconds."
## $Files_used
## [1] "Data_File: init_dat.ss Control_File: control.ss"
## $Nwarnings
## [1] 11
##
## $warnings
   [1] "#V3.30.18.00; safe; compile_date: Sep 30 2021; Stock_Synthesis_by_Richard_Methot_(NOAA)_using_
   [2] "#_Stock_Synthesis_is_a_work_of_the_U.S._Government_and_is_not_subject_to_copyright_protection_
   [3] "#_Foreign_copyrights_may_apply._See_copyright.txt_for_more_information."
   [4] "#_User_support_available_at:NMFS.Stock.Synthesis@noaa.gov"
   [5] "#_User_info_available_at:https://vlab.noaa.gov/group/stock-synthesis"
  [6] "#_Source_code_at:_https://github.com/nmfs-stock-synthesis/stock-synthesis"
##
  [7] ""
##
##
  [8] "This file contains warnings, suggestions and notes generated as files are read and processed"
   [9] ""
## [10] "1 catch is 0.0 in endyr; this can cause problem in the benchmark and forecast calculations"
## [11] "2 NOTE: Max data length bin: 28 < max pop len bins: 30; so will accumulate larger pop len bi
## [12] "3 settle_month is less than spawn_month, so logical age at settlement calculated to be: 1 for
## [13] "4 setting in starter does not request all priors, and 1 parameters have priors and are not est
## [14] "5 1st iteration warning: ssb(endyr)/ssb(styr)= 1.36781e-05; suggest start with larger R0 to ge
## [15] "6 Final gradient: 0.000920934 is larger than final_conv: 1e-05"
## [16] "7 setting positive forecast relF for forecast only fleet: 1"
## [17] "8 setting positive forecast relF for forecast only fleet: 2"
## [18] "9 setting positive forecast relF for forecast only fleet: 2"
## [19] "10 setting positive forecast relF for forecast only fleet: 3"
## [20] "11 setting positive forecast relF for forecast only fleet: 3"
## [21] "Note: 1 additional lines truncated. Look in warning.sso file to see full list."
## $likelihoods_used
                                        values lambdas
##
## TOTAL
                        2444.82000000000016371
                                                    MΔ
## Catch
                           0.0000000000103544
                                                    NΑ
```

NΑ

0.00000000000000000

Equil_catch

```
## Survey
                           61.26780000000000115
                                                      NA
                                                      NΑ
## Length_comp
                         1680.8299999999992724
## Age comp
                          585.4049999999997272
                                                      NA
## Recruitment
                           93.19650000000000034
                                                       1
## InitEQ Regime
                            0.0000000000000000
                                                       0
## Forecast Recruitment
                           24.11270000000000024
                                                       1
## Parm_priors
                            0.00000000000000000
                                                       1
## Parm softbounds
                            0.00186506000000000
                                                      NA
  Parm devs
                            0.00000000000000000
                                                       1
   Crash_Pen
                            0.0000000000000000
                                                       1
##
##
   $likelihoods_laplace
##
                                          values lambdas
## NoBias_corr_Recruitment(info_only)
                                          90.028
                                                       1
  Laplace_obj_fun(info_only)
                                                      NA
                                       2441.650
##
##
   $likelihoods_by_fleet
##
                                ALL
                                      MexCal S1
                                                   MexCal S2
                                                                      PNW AT Survey
                 Label
                                 NA 1.00000e+00 1.00000e+00 1.00000e+00
                                                                             1.0000
## 180
          Catch lambda
##
  181
            Catch like 1.03544e-12 2.77655e-13 1.74892e-13 5.82889e-13
                                                                             0.0000
##
  182 Init_equ_lambda
                                 NA 0.00000e+00 0.00000e+00 0.00000e+00
                                                                             1.0000
## 183
         Init equ like 0.00000e+00 0.00000e+00 0.00000e+00 0.00000e+00
                                                                             0.0000
           Surv_lambda
## 184
                                 NA 0.00000e+00 0.00000e+00 0.00000e+00
                                                                             1.0000
## 185
             Surv like 6.12678e+01 0.00000e+00 0.00000e+00 0.00000e+00
                                                                            82.6516
## 186
            Surv N use
                                 NA 0.00000e+00 0.00000e+00 0.00000e+00
                                                                            24.0000
## 187
           Surv_N_skip
                                 NA 0.00000e+00 0.00000e+00 0.00000e+00
                                                                             0.0000
## 188
                                 NA 1.00000e+00 1.00000e+00 1.00000e+00
         Length_lambda
                                                                             1.0000
##
  189
           Length_like 1.68083e+03 3.56128e+02 3.27080e+02 2.58807e+02
                                                                           738.8170
## 190
                                 NA 2.00000e+01 2.00000e+01 2.10000e+01
          Length_N_use
                                                                            15.0000
## 191
         Length_N_skip
                                 NA 0.00000e+00 0.00000e+00 9.00000e+00
                                                                             0.0000
## 192
            Age_lambda
                                 NA 1.00000e+00 1.00000e+00 1.00000e+00
                                                                             1.0000
## 193
              Age_like 5.85405e+02 5.32843e+01 5.00507e+01 6.70230e+01
                                                                           415.0470
  194
             Age_N_use
                                 NA 2.00000e+01 2.00000e+01 2.00000e+01
                                                                            15.0000
                                                                             0.0000
                                 NA 0.00000e+00 0.00000e+00 0.00000e+00
##
  195
            Age_N_skip
##
           DEPM
                TEP_all
## 180
        1.00000
                  1.0000
  181
        0.00000
                  0.0000
## 182
        1.00000
                  1.0000
## 183
        0.00000
                  0.0000
## 184
        1.00000
                  1.0000
  185 -7.45063 -13.9332
  186 10.00000
##
                 13.0000
##
  187
        0.00000
                  0.0000
##
  188
        0.00000
                  0.0000
## 189
        0.00000
                  0.0000
## 190
        0.00000
                  0.0000
##
  191
        0.00000
                  0.0000
##
  192
        0.00000
                  0.0000
  193
        0.00000
                  0.0000
##
   194
        0.00000
                  0.0000
##
        0.00000
                  0.0000
   195
##
## $N_estimated_parameters
## [1] 53
```

```
##
##
   $table_of_phases
##
                                               5
##
   -99
        -5
            -4
                -3
                     -2
                         -1
                              1
                                   2
                                       3
                                           4
##
                10
                          2
                                   6
                                      16
                                           3
                                               7
##
##
   $estimated_non_dev_parameters
##
                                       Value Phase
                                                      Min
                                                             Max
                                                                       Init Status
                                 12.8407000
                                                 3
                                                     3.00 30.00 12.8541000
                                                                                 OK
## L_at_Amin_Fem_GP_1
  L_at_Amax_Fem_GP_1
                                 24.7688000
                                                    15.00 40.00 24.8415000
                                                                                 OK
## VonBert_K_Fem_GP_1
                                   0.3172710
                                                            0.99
                                                                  0.3075730
                                                                                 OK
                                                     0.05
  CV_young_Fem_GP_1
                                   0.1238410
                                                     0.05
                                                            0.50
                                                                  0.1053490
                                                                                 OK
## CV_old_Fem_GP_1
                                                 3
                                  0.0192670
                                                     0.01
                                                            0.10
                                                                  0.0237245
                                                                                 OK
## SR_LN(RO)
                                 14.2958000
                                                     3.00 25.00 14.4668000
                                                                                 OK
## SR_regime_BLK1repl_2000
                                   1.3551900
                                                 4 -15.00 15.00
                                                                 1.2915300
                                                                                 OK
## Size_inflection_MexCal_S1(1) 10.8528000
                                                     0.00 30.00 10.9072000
                                                                                 OK
## Size_95%width_MexCal_S1(1)
                                                                                 OK
                                   0.7341760
                                                     0.00 10.00
                                                                  0.6599090
## AgeSel P1 MexCal S1(1)
                                                 3 -10.00 11.00
                                   0.5000120
                                                                  0.5000240
                                                                                 OK
## AgeSel_P2_MexCal_S1(1)
                                                 3 -10.00 11.00
                                                                                 OK
                                   0.7992650
                                                                  0.2048810
## AgeSel_P3_MexCal_S1(1)
                                  0.6041370
                                                 3 -10.00 15.00
                                                                  0.3827920
                                                                                 ΩK
## AgeSel_P4_MexCal_S1(1)
                                 -1.6308000
                                                 3 -10.00 11.00 -1.5494000
                                                                                 OK
## AgeSel_P5_MexCal_S1(1)
                                 -0.1734180
                                                 3 -10.00 11.00 -0.2361890
                                                                                 OK
## AgeSel_P2_MexCal_S2(2)
                                                 3 -10.00 15.00 0.4405260
                                                                                 OK
                                  0.6752870
## AgeSel_P3_MexCal_S2(2)
                                 -0.9947750
                                                 3 -10.00 11.00 -1.1690800
                                                                                 OK
## AgeSel_P4_MexCal_S2(2)
                                 -0.0660845
                                                 3 -10.00 11.00 -0.1425740
                                                                                 OK
## AgeSel_P5_MexCal_S2(2)
                                 -0.6175890
                                                 3 -10.00 11.00 -0.4707320
                                                                                 OK
                                                                                 OK
## Age_inflection_PNW(3)
                                   2.8936500
                                                     0.00 10.00
                                                                  2.8525100
##
   Age_95%width_PNW(3)
                                   1.1278100
                                                    -5.00 15.00 1.2152300
                                                                                 OK
##
                                 Parm_StDev
                                                       Gradient Pr_type Prior Pr_SD
## L_at_Amin_Fem_GP_1
                                           0 -0.00024517800000 No_prior
                                                                             NA
                                                                                   NA
## L_at_Amax_Fem_GP_1
                                              0.00007148970000 No_prior
                                                                             NA
                                                                                   NA
## VonBert_K_Fem_GP_1
                                              0.00003826540000 No_prior
                                                                             NA
                                                                                   NA
## CV_young_Fem_GP_1
                                              0.00001771160000 No_prior
                                                                             NA
                                                                                   NA
                                              0.00000071223300 No_prior
## CV_old_Fem_GP_1
                                           0
                                                                             NA
                                                                                   ΝA
## SR_LN(RO)
                                              0.00092093400000 No_prior
                                                                             NA
                                                                                   NA
## SR_regime_BLK1repl_2000
                                             -0.00002583590000 No_prior
                                                                             NA
                                                                                   NA
## Size inflection MexCal S1(1)
                                              0.00090458000000 No prior
                                                                             NΑ
                                                                                   NΑ
## Size_95%width_MexCal_S1(1)
                                           0 -0.00007380740000 No_prior
                                                                             NA
                                                                                   NA
## AgeSel_P1_MexCal_S1(1)
                                              0.0000000369269 No_prior
                                                                             NA
                                                                                   NA
## AgeSel_P2_MexCal_S1(1)
                                              0.00024527500000 No_prior
                                                                             NA
                                                                                   NA
## AgeSel P3 MexCal S1(1)
                                           0 -0.00019744100000 No_prior
                                                                             NA
                                                                                   NA
## AgeSel_P4_MexCal_S1(1)
                                           0 -0.00003051430000 No prior
                                                                             NA
                                                                                   ΝA
                                              0.00007647480000 No_prior
## AgeSel_P5_MexCal_S1(1)
                                           0
                                                                             NA
                                                                                   NA
## AgeSel_P2_MexCal_S2(2)
                                           0 -0.00012016100000 No_prior
                                                                             NA
                                                                                   ΝA
## AgeSel_P3_MexCal_S2(2)
                                           0 -0.00002035220000 No_prior
                                                                             NA
                                                                                   NA
## AgeSel_P4_MexCal_S2(2)
                                              0.00012680100000 No_prior
                                                                             NA
                                                                                   ΝA
## AgeSel_P5_MexCal_S2(2)
                                              0.00008853800000 No_prior
                                                                             NA
                                                                                   NΑ
## Age_inflection_PNW(3)
                                              0.00017086500000 No_prior
                                                                             NA
                                                                                   NA
   Age_95%width_PNW(3)
                                           0 -0.00018571600000 No_prior
                                                                             NA
                                                                                   NA
##
                                 Pr_Like Afterbound
## L_at_Amin_Fem_GP_1
                                                  OK
                                       NA
## L_at_Amax_Fem_GP_1
                                       NA
                                                  OK
## VonBert_K_Fem_GP_1
                                                  OK
                                       NA
## CV_young_Fem_GP_1
                                                  OK
                                       NΑ
```

```
## CV_old_Fem_GP_1
                                       NA
                                                   OK
## SR LN(RO)
                                       NΑ
                                                   NΚ
## SR regime BLK1repl 2000
                                       NA
                                                   OK
## Size_inflection_MexCal_S1(1)
                                                   OK
                                       NΑ
## Size_95%width_MexCal_S1(1)
                                       NA
                                                   OK
## AgeSel P1 MexCal S1(1)
                                       NA
                                                   OK
## AgeSel P2 MexCal S1(1)
                                       NA
                                                   OK
## AgeSel_P3_MexCal_S1(1)
                                       NA
                                                   OK
## AgeSel_P4_MexCal_S1(1)
                                       NA
                                                   OK
## AgeSel_P5_MexCal_S1(1)
                                       NA
                                                   OK
## AgeSel_P2_MexCal_S2(2)
                                       NA
                                                   OK
## AgeSel_P3_MexCal_S2(2)
                                       NA
                                                   OK
## AgeSel_P4_MexCal_S2(2)
                                       NA
                                                   OK
## AgeSel_P5_MexCal_S2(2)
                                       NA
                                                   OK
                                                   OK
## Age_inflection_PNW(3)
                                       NΑ
## Age_95%width_PNW(3)
                                       NA
                                                   OK
##
## $maximum_gradient_component
   [1] 0.000920934
##
##
##
  $parameters_with_highest_gradients
                                      Value
                                                 Gradient
## SR_LN(RO)
                                  14.295800
                                             0.000920934
## Size inflection MexCal S1(1) 10.852800
                                             0.000904580
## AgeSel_P2_MexCal_S1(1)
                                   0.799265
                                             0.000245275
## L_at_Amin_Fem_GP_1
                                 12.840700 -0.000245178
## AgeSel_P3_MexCal_S1(1)
                                   0.604137 -0.000197441
##
##
  $Length_Comp_Fit_Summary
##
        Factor Fleet Recommend_var_adj # N Npos min_Nsamp max_Nsamp mean_Nsamp_in
## 1332
             4
                    1
                              0.0765535 # 20
                                                 20
                                                            6
                                                                    1000
                                                                                322.600
## 1333
             4
                    2
                              0.1460440 # 20
                                                 20
                                                            9
                                                                    1000
                                                                                341.300
                    3
## 1334
                              0.0434271 # 30
                                                 21
                                                            1
                                                                    1000
                                                                                347.381
  1335
                    4
                                                 15
                                                                    1000
##
             4
                              0.0324800 # 15
                                                           12
                                                                                411.933
        mean_Nsamp_adj mean_Nsamp_DM DM_theta mean_effN HarMean_effN Curr_Var_Adj
                                                 238.4640
                                    NA
## 1332
               322.600
                                             NA
                                                                 24.6962
## 1333
                341.300
                                    NA
                                             NA
                                                 313.7670
                                                                 49.8447
                                                                                     1
## 1334
               347.381
                                    NA
                                                 380.0720
                                             NΑ
                                                                 15.0858
                                                                                     1
                411.933
                                                   41.7506
##
  1335
                                    NA
                                                                 13.3796
##
        Fleet_name
## 1332
        MexCal S1
         MexCal S2
## 1333
  1334
               PNW
##
  1335
         AT_Survey
## $Age_Comp_Fit_Summary
##
        Factor Fleet Recommend_var_adj # Nsamp_adj Npos min_Nsamp max_Nsamp
                                                        20
## 1417
             5
                    1
                               0.623141 #
                                                   20
                                                                  100
                                                                           1000
## 1418
             5
                    2
                               0.425865 #
                                                   20
                                                        20
                                                                  100
                                                                           1000
                    3
## 1419
             5
                               1.171920 #
                                                   20
                                                        20
                                                                  100
                                                                           1000
                    4
                                                                  100
##
   1420
             5
                               0.063647 #
                                                   15
                                                        15
                                                                           1000
##
        mean_Nsamp_in mean_Nsamp_adj mean_Nsamp_DM DM_theta mean_effN HarMean_effN
## 1417
                   370
                                   370
                                                   NA
                                                            NA
                                                                  688.495
                                                                              230.5620
## 1418
                   370
                                   370
                                                   NA
                                                            NA
                                                                  328.871
                                                                               157.5700
```

```
## 1419
                  370
                                 370
                                                NA
                                                         NA
                                                               614.849
                                                                           433.6090
## 1420
                  460
                                 460
                                                NΑ
                                                         NΑ
                                                               207.282
                                                                            29.2776
       Curr_Var_Adj Fleet_name
## 1417
               1 MexCal_S1
## 1418
                  1 MexCal S2
## 1419
                            PNW
                  1
## 1420
                  1 AT_Survey
##
## $SBzero
## [1] 69841
## $current_depletion
## [1] 4.038967
##
## $last_years_SPR
## [1] 1
##
## $SPRratioLabel
## [1] "1-SPR"
## $sigma_R_in
## [1] 0.5
##
## $sigma R info
             period N_devs SD_of_devs Var_of_devs mean_SE mean_SEsquared
## 1
               Main
                         20 1.652651
                                          2.731255
                                                         0
                                                                         0
## 2
         Early+Main
                         26
                              1.469895
                                          2.160592
                                                         0
                                                                         0
                         32
                              1.449362
                                          2.100650
                                                         0
## 3 Early+Main+Late
     sqrt_sum_of_components SD_of_devs_over_sigma_R sqrt_sum_over_sigma_R
## 1
                  1.652651
                                           3.305302
                                                                  3.305302
## 2
                   1.469895
                                           2.939790
                                                                  2.939790
## 3
                   1.449362
                                           2.898724
                                                                  2.898724
    alternative_sigma_R
## 1
               1.652651
## 2
                1.469895
## 3
                1.449362
##
## $rmse_table
       ERA N
                  RMSE RMSE_over_sigmaR mean_BiasAdj
                              10.37880
## 1 main 20 1.610800
                                            0.841539
## 2 early 6 0.595973
                               1.42074
                                            0.766330
## completed SS_output
EMalk2025_dir <- "C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenarios/perfDatTests/constGrow200
outEMalk2025 <- SS_output(EMalk2025_dir)</pre>
## Getting header info from:
    C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenarios/perfDatTests/constGrow20010M_MidSteepH
## This function tested on SS versions 3.24 and 3.30.
## You are using 3.30.18.00 which SHOULD work with this package.
```

```
## Report file time: Tue Jun 07 15:17:08 2022
## Reading full report file
## Got all columns using ncols = 62
## Got Report file
## Setting minimum biomass threshhold to 0.25 based on US west coast assumption associated with biomas
## !warning: temporary files were written in this run:
                          TempFile
## "size of file gradfil1.tmp = 0" "size of file gradfil2.tmp = 0"
## "size of file varssave.tmp = 0" "size of file cmpdiff.tmp = 0"
## Got warning file. Therewere 16 warnings in C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenari
## Finished reading files
## CompReport file separated by this code as follows (rows = Ncomps*Nbins):
##
     2964 rows of length comp data,
##
    0 rows of generalized size comp data,
    675 rows of age comp data,
##
##
    O rows of conditional age-at-length data,
    O rows of ghost fleet age comp data,
##
    O rows of ghost fleet conditional age-at-length data,
     351 rows of ghost fleet length comp data,
##
    0 rows of mean length at age data,
##
##
    O rows of mean weight at age data,
    O rows of 'TAG1' comp data, and
    O rows of 'TAG2' comp data.
## Finished dimensioning
## Got covar file.
## Finished primary run statistics list
## running SS_readstarter
##
     data, control files: init_dat.ss, control.ss
##
     converge_criterion = 1e-05
     SPR basis = 4
    F_report_basis = 2
```

```
## Assuming version 3.30 based on number of numeric values.
##
     MCMC_output_detail = 0
     ALK_tolerance = 0
## Reading a random seed value:12546807
## Read of starter file complete. Final value: 3.3
##
## Statistics shown below (to turn off, change input to printstats=FALSE)
## $SS_version
## [1] "3.30.18.00; safe; compile_date: Sep 30 2021; Stock_Synthesis_by_Richard_Methot_(NOAA)_using_ADM
## $SS_versionshort
## [1] "3.30"
##
## $SS_versionNumeric
## [1] 3.3
## $StartTime
## [1] "StartTime: Tue Jun 07 15:17:08 2022"
## $RunTime
## [1] "0 hours, 1 minutes, 6 seconds."
##
## $Files_used
## [1] "Data_File: init_dat.ss Control_File: control.ss"
## $Nwarnings
## [1] 16
##
## $warnings
  [1] "#V3.30.18.00; safe; compile_date: Sep 30 2021; Stock_Synthesis_by_Richard_Methot_(NOAA)_using_
   [2] "#_Stock_Synthesis_is_a_work_of_the_U.S._Government_and_is_not_subject_to_copyright_protection_
##
   [3] "#_Foreign_copyrights_may_apply._See_copyright.txt_for_more_information."
   [4] "#_User_support_available_at:NMFS.Stock.Synthesis@noaa.gov"
   [5] "#_User_info_available_at:https://vlab.noaa.gov/group/stock-synthesis"
##
   [6] "#_Source_code_at:_https://github.com/nmfs-stock-synthesis/stock-synthesis"
##
   [7] ""
##
  [8] "This file contains warnings, suggestions and notes generated as files are read and processed"
## [9] ""
## [10] "1 catch is 0.0 in endyr; this can cause problem in the benchmark and forecast calculations"
## [11] "2 NOTE: Max data length bin: 28 < max pop len bins: 30; so will accumulate larger pop len bi
## [12] "3 settle_month is less than spawn_month, so logical age at settlement calculated to be: 1 for
## [13] "4 setting in starter does not request all priors, and 1 parameters have priors and are not est
## [14] "5 1st iteration warning: ssb(endyr)/ssb(styr)= 1.35911e-05; suggest start with larger R0 to ge
## [15] "6 setting positive forecast relF for forecast only fleet: 1"
## [16] "7 setting positive forecast relF for forecast only fleet: 2"
## [17] "8 setting positive forecast relF for forecast only fleet: 2"
```

```
## [18] "9 setting positive forecast relF for forecast only fleet: 3"
  [19] "10 setting positive forecast relF for forecast only fleet: 3"
  [20] "11 Final gradient: 6.94819e-05 is larger than final conv: 1e-05"
  [21] "Note: 6 additional lines truncated. Look in warning.sso file to see full list."
##
##
  $likelihoods used
                                         values lambdas
##
## TOTAL
                         34.08919999999998170
## Catch
                          0.00000000000514909
                                                     NΔ
## Equil_catch
                          0.00000000000000000
                                                     NΑ
## Survey
                         -65.12199999999999886
                                                     NA
## Length_comp
                         10.694100000000000605
                                                     NA
## Age_comp
                          3.393850000000000033
                                                     NA
## Recruitment
                         66.50379999999998249
                                                      1
                                                      0
## InitEQ_Regime
                          0.000000000000000000
## Forecast_Recruitment
                         18.617499999999999716
                                                      1
## Parm_priors
                          0.00000000000000000
                                                      1
## Parm softbounds
                          0.001963860000000000
                                                     NA
## Parm devs
                          1
  Crash Pen
                          0.00000000000000000
                                                      1
##
## $likelihoods_laplace
                                        values lambdas
##
## NoBias corr Recruitment(info only) 63.3352
                                                     1
  Laplace_obj_fun(info_only)
                                       30.9207
                                                    NA
##
  $likelihoods_by_fleet
##
                 Label
                                 ALL
                                       MexCal_S1
                                                   MexCal_S2
                                                                      PNW
                                                                           AT_Survey
## 180
          Catch_lambda
                                 NA 1.00000e+00 1.00000e+00 1.00000e+00
                                                                            1.000000
## 181
            Catch_like
                        5.14909e-13 1.30435e-13 1.00585e-13 2.83889e-13
                                                                            0.000000
## 182 Init_equ_lambda
                                  NA 0.00000e+00 0.00000e+00 0.00000e+00
                                                                            1.000000
## 183
         Init_equ_like
                        0.00000e+00 0.00000e+00 0.00000e+00 0.00000e+00
                                                                            0.000000
## 184
           Surv_lambda
                                  NA 0.00000e+00 0.00000e+00 0.00000e+00
                                                                            1.000000
## 185
             Surv_like -6.51220e+01 0.00000e+00 0.00000e+00 0.00000e+00 -36.957500
## 186
            Surv N use
                                  NA 0.00000e+00 0.00000e+00 0.00000e+00
                                                                           24,000000
## 187
                                  NA 0.00000e+00 0.00000e+00 0.00000e+00
           Surv_N_skip
                                                                            0.000000
## 188
         Length lambda
                                  NA 1.00000e+00 1.00000e+00 1.00000e+00
                                                                            1.000000
## 189
           Length_like
                        1.06941e+01 2.18745e+00 3.23169e+00 2.79111e+00
                                                                            2.483870
## 190
          Length N use
                                  NA 2.00000e+01 2.00000e+01 2.10000e+01
                                                                           15.000000
## 191
                                  NA 0.00000e+00 0.00000e+00 9.00000e+00
         Length_N_skip
                                                                            0.000000
## 192
                                  NA 1.00000e+00 1.00000e+00 1.00000e+00
            Age lambda
                                                                            1.000000
## 193
                        3.39385e+00 5.07440e-01 1.13015e+00 1.19463e+00
              Age_like
                                                                            0.561627
##
  194
             Age_N_use
                                  NA 2.00000e+01 2.00000e+01 2.00000e+01
                                                                           15.000000
  195
                                  NA 0.00000e+00 0.00000e+00 0.00000e+00
##
            Age_N_skip
                                                                            0.000000
##
           DEPM TEP_all
## 180
         1.0000
                  1.0000
##
  181
         0.0000
                  0.0000
## 182
         1.0000
                  1.0000
## 183
         0.0000
                  0.0000
  184
         1.0000
                  1.0000
  185 -11.3455 -16.8189
## 186
        10.0000
                 13.0000
         0.0000
## 187
                  0.0000
## 188
         0.0000
                  0.0000
```

```
## 189
         0.0000
                  0.0000
## 190
         0.0000
                  0.0000
  191
         0.0000
                  0.0000
  192
         0.0000
##
                  0.0000
##
  193
         0.0000
                  0.0000
  194
         0.0000
                  0.0000
##
## 195
         0.0000
                  0.0000
##
  $N_estimated_parameters
   [1] 53
##
##
   $table_of_phases
##
##
        -5
            -4
                -3
                    -2
                                      3
                                              5
                10
                         2
                                  6
                                          3
                                              7
##
         1
             1
                            21
                                     16
##
##
  $estimated_non_dev_parameters
                                                                      Init Status
##
                                      Value Phase
                                                            Max
                                 12.8532000
                                                    3.00 30.00 12.8541000
                                                                               ΩK
## L_at_Amin_Fem_GP_1
## L_at_Amax_Fem_GP_1
                                 24.8953000
                                                   15.00 40.00 24.8415000
                                                                               OK
## VonBert_K_Fem_GP_1
                                  0.3057960
                                                3
                                                    0.05
                                                          0.99
                                                                0.3075730
                                                                               OK
## CV_young_Fem_GP_1
                                  0.1056010
                                                    0.05
                                                          0.50
                                                                 0.1053490
                                                                               ΩK
## CV_old_Fem_GP_1
                                                          0.10
                                                                               OK
                                  0.0233984
                                                    0.01
                                                                 0.0237245
## SR LN(RO)
                                 14.5320000
                                                1
                                                    3.00 25.00 14.4668000
                                                                               OK
## SR_regime_BLK1repl_2000
                                  1.2291300
                                                4 -15.00 15.00 1.2915300
                                                                               OK
## Size_inflection_MexCal_S1(1) 10.9048000
                                                    0.00 30.00 10.9072000
                                                                               OK
## Size_95%width_MexCal_S1(1)
                                  0.6660160
                                                    0.00 10.00
                                                                 0.6599090
                                                                               OK
## AgeSel_P1_MexCal_S1(1)
                                  0.5000120
                                                3 -10.00 11.00
                                                                 0.5000240
                                                                               OK
## AgeSel_P2_MexCal_S1(1)
                                  0.2024570
                                                3 -10.00 11.00
                                                                0.2048810
                                                                               OK
                                  0.3811140
## AgeSel_P3_MexCal_S1(1)
                                                3 -10.00 15.00 0.3827920
                                                                               OK
## AgeSel_P4_MexCal_S1(1)
                                 -1.5453500
                                                3 -10.00 11.00 -1.5494000
                                                                               OK
## AgeSel_P5_MexCal_S1(1)
                                                3 -10.00 11.00 -0.2361890
                                                                               OK
                                 -0.1904530
## AgeSel_P2_MexCal_S2(2)
                                                3 -10.00 15.00 0.4405260
                                                                               OK
                                  0.4411220
## AgeSel_P3_MexCal_S2(2)
                                                3 -10.00 11.00 -1.1690800
                                                                               OK
                                 -1.1655700
## AgeSel_P4_MexCal_S2(2)
                                 -0.1315550
                                                3 -10.00 11.00 -0.1425740
                                                                               OK
## AgeSel_P5_MexCal_S2(2)
                                 -0.3923240
                                                3 -10.00 11.00 -0.4707320
                                                                               OK
## Age inflection PNW(3)
                                  2.8508500
                                                    0.00 10.00 2.8525100
                                                                               OK
## Age_95%width_PNW(3)
                                  1.2213800
                                                   -5.00 15.00 1.2152300
                                                                               ΩK
##
                                   Parm_StDev
                                                       Gradient Pr_type Prior
                                   0.03040100 -0.00004753420000 No_prior
## L_at_Amin_Fem_GP_1
                                                                             NA
## L_at_Amax_Fem_GP_1
                                   0.08684780 -0.00001981340000 No prior
                                                                             NA
## VonBert_K_Fem_GP_1
                                   0.00434833 -0.00001388750000 No_prior
                                                                             NΑ
                                   0.00109951 -0.00000247557000 No_prior
## CV_young_Fem_GP_1
                                                                             NA
## CV_old_Fem_GP_1
                                   0.00195809
                                               0.00000052291600 No_prior
                                                                             ΝA
## SR_LN(RO)
                                               0.00006948190000 No_prior
                                                                             NA
                                   0.02425630
## SR_regime_BLK1repl_2000
                                   0.07787140 -0.00000299179000 No_prior
                                                                             NA
## Size_inflection_MexCal_S1(1)
                                   0.03551680 -0.00001435120000 No_prior
                                                                             NA
## Size_95%width_MexCal_S1(1)
                                   0.03281390
                                               0.00000995765000 No_prior
                                                                             NA
## AgeSel_P1_MexCal_S1(1)
                                 234.78400000
                                               0.0000000344397 No_prior
                                                                             NΑ
## AgeSel_P2_MexCal_S1(1)
                                               0.00000610122000 No_prior
                                                                             NA
                                   0.08310200
## AgeSel_P3_MexCal_S1(1)
                                   0.03220270 -0.00001507760000 No_prior
                                                                             NA
## AgeSel P4 MexCal S1(1)
                                   0.09058050 -0.00000579358000 No_prior
                                                                             NA
## AgeSel_P5_MexCal_S1(1)
                                   0.12939300 -0.00000296238000 No_prior
                                                                             NA
## AgeSel_P2_MexCal_S2(2)
```

```
## AgeSel_P3_MexCal_S2(2)
                                  0.05362030 -0.00002140140000 No prior
                                                                            NA
                                                                            NΑ
## AgeSel_P4_MexCal_S2(2)
                                  0.09010130 -0.00001424980000 No_prior
## AgeSel P5 MexCal S2(2)
                                  NA
## Age_inflection_PNW(3)
                                  0.02623280 -0.00001100530000 No_prior
                                                                            NA
## Age_95%width_PNW(3)
                                  NA
##
                                Pr SD Pr Like Afterbound
## L_at_Amin_Fem_GP_1
                                   NA
                                           NΑ
                                           NA
## L_at_Amax_Fem_GP_1
                                   NA
                                                       OK
## VonBert_K_Fem_GP_1
                                   NA
                                           NA
                                                       OK
                                                       OK
## CV_young_Fem_GP_1
                                   NA
                                           NA
## CV_old_Fem_GP_1
                                   NA
                                           NA
                                                       OK
                                                       OK
## SR_LN(RO)
                                   NA
                                           NA
## SR_regime_BLK1repl_2000
                                   NA
                                           NA
                                                       OK
## Size_inflection_MexCal_S1(1)
                                   NA
                                           NA
                                                       OK
## Size_95%width_MexCal_S1(1)
                                   NA
                                           NΑ
                                                       OK
## AgeSel_P1_MexCal_S1(1)
                                   NA
                                            NA
                                                       OK
                                                       OK
## AgeSel_P2_MexCal_S1(1)
                                   NA
                                           NA
## AgeSel P3 MexCal S1(1)
                                   NA
                                           NA
                                                       OK
## AgeSel_P4_MexCal_S1(1)
                                   NΑ
                                           NΑ
                                                       OK
## AgeSel P5 MexCal S1(1)
                                   NA
                                           NA
                                                       OK
## AgeSel_P2_MexCal_S2(2)
                                   NA
                                           NA
                                                       OK
## AgeSel P3 MexCal S2(2)
                                           NΑ
                                                       OK
## AgeSel_P4_MexCal_S2(2)
                                   NA
                                           NΑ
                                                       OK
## AgeSel P5 MexCal S2(2)
                                   NA
                                           NΑ
                                                       OK
## Age_inflection_PNW(3)
                                   NA
                                           NΑ
                                                       OK
## Age_95%width_PNW(3)
                                   NA
                                           NA
                                                       OK
##
## $log_det_hessian
  [1] 298.629
##
## $maximum_gradient_component
   [1] 6.94819e-05
##
##
  $parameters_with_highest_gradients
##
                                         Gradient
                              Value
                          14.532000 6.94819e-05
## SR LN(RO)
## L at Amin Fem GP 1
                          12.853200 -4.75342e-05
## AgeSel_P3_MexCal_S2(2) -1.165570 -2.14014e-05
## L_at_Amax_Fem_GP_1
                          24.895300 -1.98134e-05
## Main_RecrDev_2019
                           0.151775 -1.54032e-05
##
## $Length_Comp_Fit_Summary
        Factor Fleet Recommend_var_adj # N Npos min_Nsamp max_Nsamp mean_Nsamp_in
## 1332
             4
                               25.6091 # 20
                                               20
                   1
                                                          6
                                                                 1000
                                                                            322.814
                   2
                                                          9
## 1333
             4
                               22.6911 # 20
                                               20
                                                                 1000
                                                                            341.524
## 1334
                   3
                               88.0937 # 30
                                               21
                                                                            347.684
             4
                                                          1
                                                                 1000
## 1335
                   4
                               13.3131 # 15
                                               15
                                                         12
                                                                 1000
                                                                            411.933
##
        mean_Nsamp_adj mean_Nsamp_DM DM_theta mean_effN HarMean_effN Curr_Var_Adj
## 1332
               322.814
                                  NA
                                           NA
                                                  355624
                                                              8266.96
                                                                                 1
## 1333
               341.524
                                  NA
                                           NA
                                                  369908
                                                              7749.54
                                                                                 1
               347.684
## 1334
                                  NA
                                           NΑ
                                                  176651
                                                             30628.80
                                                                                 1
## 1335
               411.933
                                  NA
                                           NA
                                                  101382
                                                              5484.11
                                                                                 1
##
        Fleet name
## 1332 MexCal S1
```

```
## 1333 MexCal S2
## 1334
               PNW
## 1335 AT_Survey
##
## $Age_Comp_Fit_Summary
        Factor Fleet Recommend_var_adj # Nsamp_adj Npos min_Nsamp max_Nsamp
## 1417
             5
                   1
                               3.73403 #
                                                 20
                                                               5.92
                                                                         1000
## 1418
             5
                   2
                               2.57647 #
                                                 20
                                                       20
                                                               8.92
                                                                         1000
## 1419
             5
                   3
                               27.90270 #
                                                  20
                                                       20
                                                              26.88
                                                                         1000
## 1420
             5
                   4
                               7.28223 #
                                                 15
                                                       15
                                                              12.00
                                                                         1000
        mean_Nsamp_in mean_Nsamp_adj mean_Nsamp_DM DM_theta mean_effN HarMean_effN
## 1417
              321.748
                              321.748
                                                           NA 112290.0
                                                                            1201.420
                                                 NA
              340.820
                              340.820
                                                                84409.9
                                                                              878.113
## 1418
                                                 NA
                                                           NA
## 1419
              353.408
                              353.408
                                                 NA
                                                           NA
                                                                52269.2
                                                                             9861.020
## 1420
              411.933
                              411.933
                                                 NA
                                                           NA
                                                                92815.7
                                                                             2999.790
##
        Curr_Var_Adj Fleet_name
## 1417
                      MexCal_S1
                   1
## 1418
                      MexCal S2
                   1
## 1419
                             PNW
                   1
## 1420
                   1 AT Survey
##
## $SBzero
## [1] 86126.5
## $current_depletion
## [1] 2.001178
##
## $last_years_SPR
## [1] 1
##
## $SPRratioLabel
## [1] "1-SPR"
##
## $sigma_R_in
## [1] 0.5
##
## $sigma R info
##
              period N_devs SD_of_devs Var_of_devs
                                                       mean_SE mean_SEsquared
## 1
                Main
                         20
                               1.428896
                                           2.041744 0.08965487
                                                                    0.01024535
## 2
                          26
                               1.275083
                                           1.625837 0.12027802
          Early+Main
                                                                    0.02131329
## 3 Early+Main+Late
                          32
                               1.268539
                                           1.609192 0.11995297
                                                                    0.02543637
     sqrt_sum_of_components SD_of_devs_over_sigma_R sqrt_sum_over_sigma_R
##
## 1
                   1.432477
                                            2.857792
                                                                   2.864953
## 2
                   1.283414
                                                                   2.566827
                                            2.550167
## 3
                   1.278526
                                            2.537079
                                                                   2.557052
##
     alternative_sigma_R
## 1
                1.432477
## 2
                1.283414
## 3
                1.278526
##
## $rmse_table
                  RMSE RMSE over sigmaR mean BiasAdj
       ERA N
## 1 main 20 1.392710
                                 7.75862
                                             0.841539
## 2 early 6 0.560572
                                 1.25696
                                             0.766330
```

```
##
## $cormessage1
## [1] Range of abs(parameter correlations) is 0 to 0.881185
##
## $cormessage2
## [1] No correlations above threshold (cormax=0.95)
## $cormessage7
## [1] 2 uncorrelated parameters below threshold (cormin=0.01)
##
## $cormessage8
##
                        name max
           Late_RecrDev_2025
## 34
## 37 AgeSel_P1_MexCal_S1(1)
## completed SS_output
compbavg2025 <- SSsummarize(list(OM2020 = outOMbavg,</pre>
                                   EMssmse2020 = outEMssmse2025,
                                 EMalk2020 = outEMalk2025)
## Summarizing 3 models:
## imodel=1/3
##
     N active pars = 0
## imodel=2/3
##
    N active pars = 53
## imodel=3/3
    N active pars = 53
##
## Summary finished. To avoid printing details above, use 'verbose = FALSE'.
SSplotComparisons(compbavg2025, legendlabels = c("OM", "SSMSE 2025", "Perf ALK 2025"),
                  subplots = c(2,10, 12, 13, 14))
## Warning in SSplotComparisons(compbavg2025, legendlabels = c("OM", "SSMSE
## 2025", : setting btarg = -999 because models don't have matching values
## Warning in SSplotComparisons(compbavg2025, legendlabels = c("OM", "SSMSE
## 2025", : setting minbthresh = -999 because models don't have matching values
## Warning in SSplotComparisons(compbavg2025, legendlabels = c("OM", "SSMSE
## 2025", : setting sprtarg = -999 because models don't have matching values
```

```
## Warning in SSplotComparisons(compbavg2025, legendlabels = c("OM", "SSMSE
## 2025", : setting label for SPR plot to 8th element of input 'labels' because the
## models don't have matching labels

## Warning in SSplotComparisons(compbavg2025, legendlabels = c("OM", "SSMSE
## 2025", : setting label for F plot to 13th element of input 'labels' because the
## models don't have matching labels

## showing uncertainty for all models

## No uncertainty available for model 1

## No uncertainty available for model 2

## subplot 2: spawning biomass with uncertainty intervals

## subplot 10: recruits with uncertainty

## subplot 12: recruit devs with uncertainty

## subplot 13: index fits

## subplot 14: index fits on a log scale

compbavg2025$SpawnBio %>% mutate(emRE = ((EMalk2020 - OM2020)/ OM2020)*100)
```

```
##
       OM2020 EMssmse2020 EMalk2020
                                        Label
                                               Yr
                                                         emRE
## 1 161177.0
                139682.0 172253.0 SSB_Virgin 1999
                                                   6.87194823
## 2 586418.0
                541618.0 588804.0 SSB_Initial 2000
                                                   0.40687701
## 3 533405.0
                452366.0 533679.0
                                     SSB_2001 2001
                                                   0.05136810
## 4 398523.0
                331488.0 401772.0
                                     SSB 2002 2002 0.81526035
## 5 356706.0
                310735.0 359196.0
                                     SSB_2003 2003 0.69805386
## 6 564216.0
                504194.0 553900.0
                                     SSB_2004 2004 -1.82837778
## 7 737440.0
                672283.0 715310.0
                                     SSB 2005 2005 -3.00092211
## 8 875019.0
                820323.0 846296.0
                                     SSB 2006 2006 -3.28255729
## 9 808514.0
                768636.0 780431.0
                                     SSB_2007 2007 -3.47340924
## 10 694814.0
                665029.0 670858.0
                                     SSB_2008 2008 -3.44782920
## 11 561609.0
                543087.0 542885.0
                                     SSB_2009 2009 -3.33399215
## 12 499099.0
                483936.0 483261.0
                                     SSB_2010 2010 -3.17331832
## 13 410329.0
                392722.0 397314.0
                                     SSB_2011 2011 -3.17184503
## 14 230052.0
                213627.0 222225.0
                                     SSB_2012 2012 -3.40227427
## 15 105100.0
                91776.2 102266.0
                                     SSB_2013 2013 -2.69647954
                                     SSB_2014 2014 0.06644933
## 16 54477.6
                 44296.1
                          54513.8
## 17 41746.0
                 33487.4
                          42759.6
                                     SSB_2015 2015 2.42801706
## 18 40147.7
                 32307.1
                          41278.0
                                     SSB_2016 2016 2.81535430
## 19 34057.8
                 27149.6
                           35103.5
                                     SSB 2017 2017 3.07036861
## 20 33614.9
                 27140.5
                           34443.8
                                     SSB_2018 2018 2.46587079
## 21 28743.1
                 22308.7
                           29369.1
                                     SSB 2019 2019
                                                   2.17791400
## 22 25346.1
                19301.2
                           25929.5
                                     SSB_2020 2020 2.30173478
## 23 38483.8
                33498.2 39160.5
                                     SSB 2021 2021 1.75840224
## 24 73117.6
                84289.0 73635.6
                                     SSB 2022 2022 0.70844776
```

##	25	198520.0	267347.0	197827.0	SSB_2023 2023 -0.34908322
##	26	328430.0	492608.0	326368.0	SSB_2024 2024 -0.62783546
##	27	346870.0	564171.0	344709.0	SSB_2025 2025 -0.62299997
##	28	255535.0	500591.0	290734.0	SSB_2026 2026 13.77462970
##	29	126080.0	NA	NA	SSB_2027 2027 NA
##	30	34991.7	NA	NA	SSB_2028 2028 NA
##	31	31543.0	NA	NA	SSB_2029 2029 NA
##	32	44029.5	NA	NA	SSB_2030 2030 NA