

Detail on Management Strategy Application

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6/6/2022

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

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

scenarios <- c("MidSteepShortALKfix_RandRecHCR2",
               "MidSteepShortALKfixNewSamp_RandRecHCR2",
               "MidSteepShortALKfixMidN_RandRecHCR2",
               "MidSteepShortALKfixHiN_RandRecHCR2")

smryOutputList <- GetSumryOutput(dirSSMSE = mseDir,
                                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
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##
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## chr (2): model_run, scenario
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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.
```

```
# 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)

cnvrgCheck <- smryOutputList$sc1Smry %>% #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$HCR)
#exIters <- sample(termTS$iteration, size = 4)

cnvrgTS <- smryOutputList$tsSmry %>% mutate(HCR = sub(pattern = ".*Rec","", scenario),
                                           recScen = sub(pattern = "HCR.*","", scenario)) %>%
  mutate(recScen = sub(pattern = ".*OM","", recScen)) %>%
  left_join(y = cnvrgCheck, by = c("iteration", "model_run", "scenario", "HCR", "recScen")) %>%
  mutate(plotGroup = case_when(model_run %in% omName ~ "OM",
                               max_grad > 0.01 ~ "non-cnvrng",
                               max_grad < 0.01 ~ "cnvrng"))

# 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])
```

```
# }
#
# 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]))
# }
```

```
performanceList <- CalcPerformance(smryOutputList)
```

```
## '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.
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## 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$performanceMetrics
```

```
# 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 frqNonConv model_run yrsN closuresFreq
##   <int> <chr> <int> <dbl> <dbl> <chr> <int> <dbl>
## 1 1 MidSteepSh~ NA NA NA constGro~ 20 0.2
## 2 1 MidSteepSh~ NA NA NA constGro~ 20 0.25
## 3 1 MidSteepSh~ NA NA NA constGro~ 20 0.25
## 4 1 MidSteepSh~ NA NA NA constGro~ 20 0.2
## 5 2 MidSteepSh~ NA NA NA constGro~ 20 0.1
```

```
## 6      2 MidSteepSh~      NA      NA      NA constGro~      20      0.2
## 7      2 MidSteepSh~      NA      NA      NA constGro~      20      0.1
## 8      2 MidSteepSh~      NA      NA      NA constGro~      20      0.1
## 9      3 MidSteepSh~      NA      NA      NA constGro~      20      0.3
## 10     3 MidSteepSh~      NA      NA      NA constGro~      20      0.5
## 11     3 MidSteepSh~      NA      NA      NA constGro~      20      0.45
## 12     3 MidSteepSh~      NA      NA      NA constGro~      20      0.35
## # ... with 14 more variables: collapseFreq <dbl>, bonanzaFreq <dbl>,
## #   meanBiplus <dbl>, meanCollapseSever <dbl>, closure <lgl>,
## #   rebuildLengthMax <int>, bonanza <lgl>, bonanzaLengthMax <int>,
## #   meanCatch <dbl>, sdCatch <dbl>, minAge <dbl>, minLen <dbl>, HCR <chr>,
## #   recScen <chr>
```

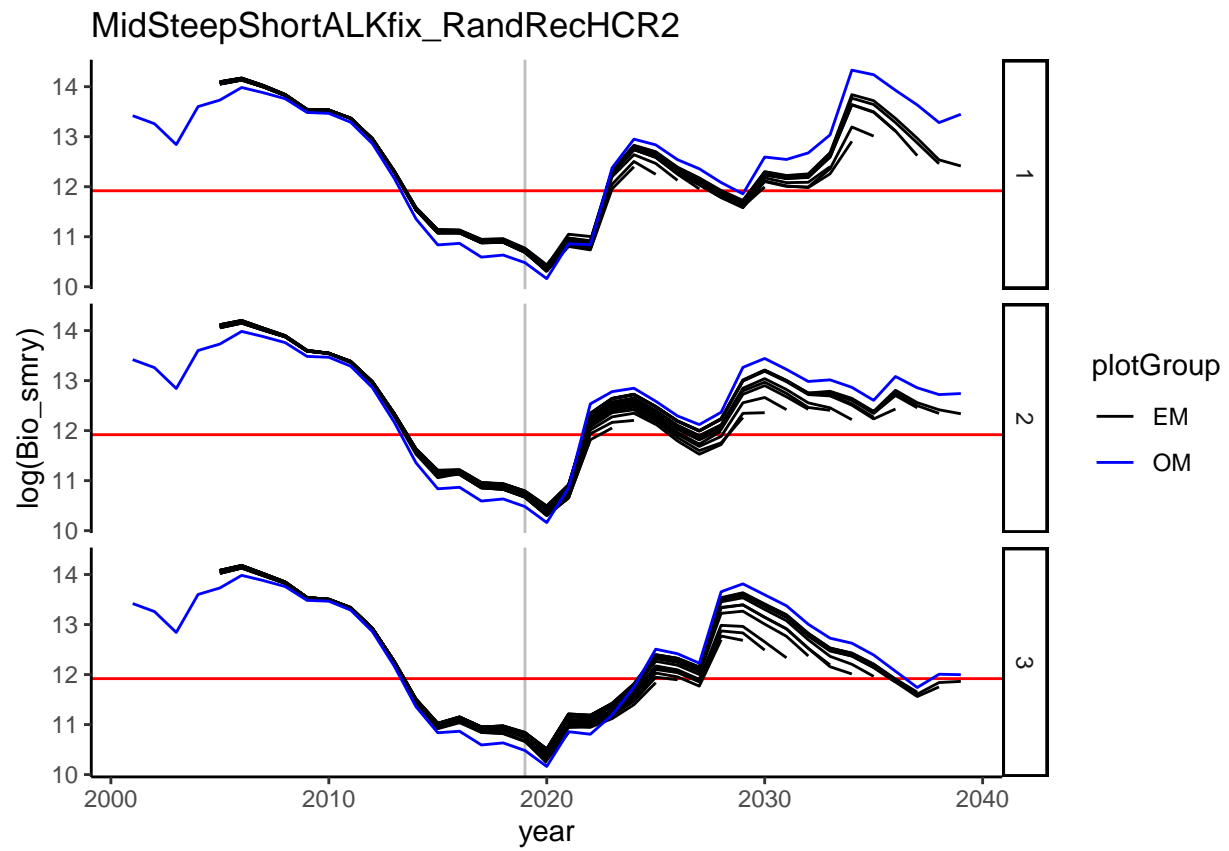
All iterations and scenarios converge for up to 20 yrs

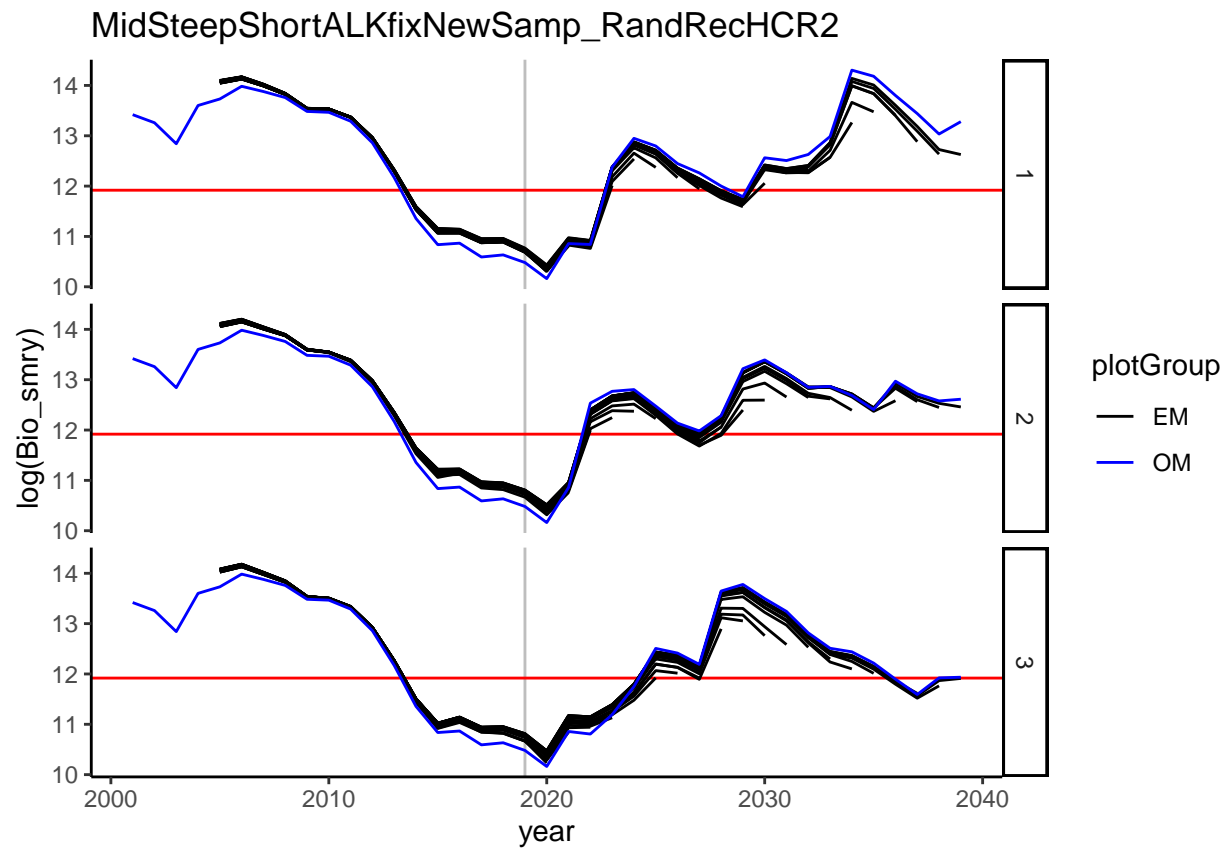
```
age1PlusBio <- smryOutputList$tsSmry %>% filter(Seas == 1) %>%
  select(year, Bio_smry, model_run, iteration, scenario) %>%
  mutate(plotGroup = case_when(grepl("_OM", model_run, fixed = TRUE) ~ "OM",
                                TRUE ~ "EM"))

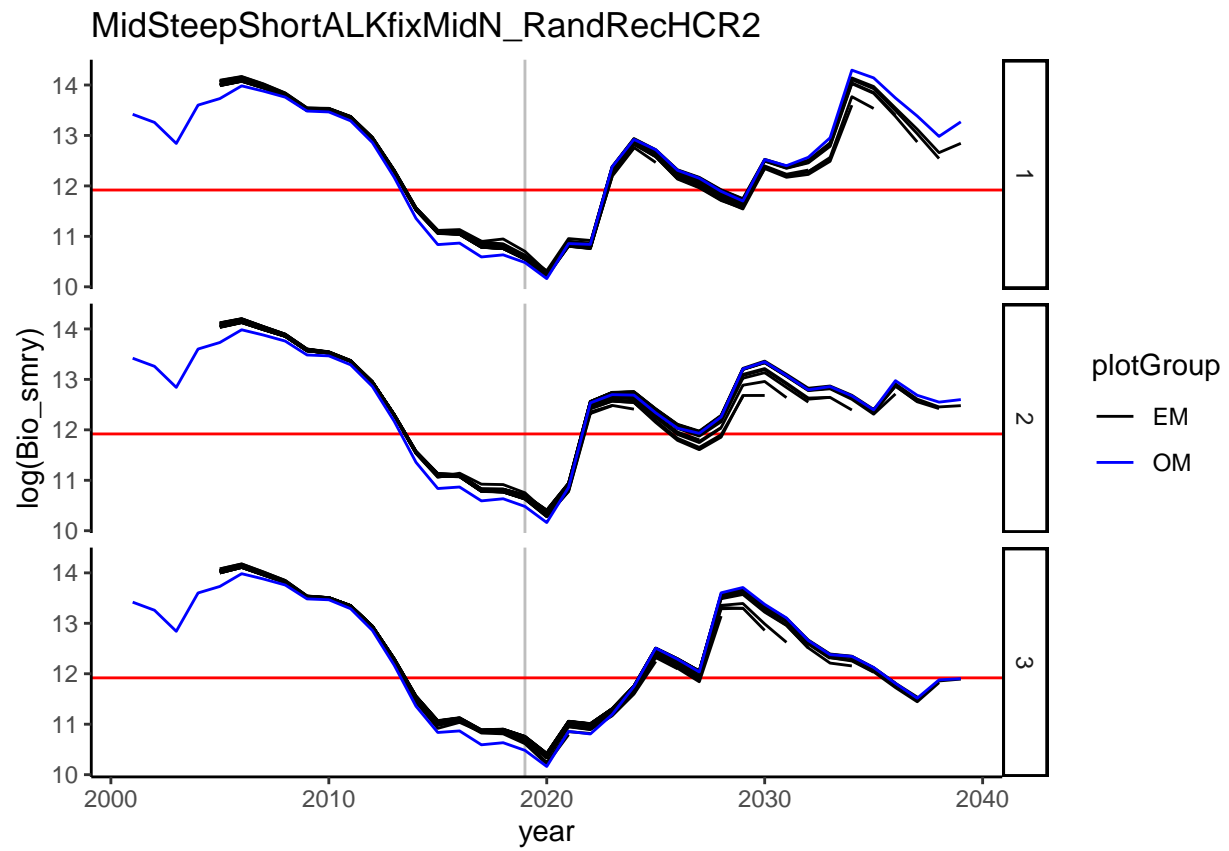
age1PlusRE <- age1PlusBio %>% filter(plotGroup != "OM")
age1PlusRE <- age1PlusRE %>% pivot_wider(names_from = "plotGroup", values_from = "Bio_smry") %>%
  left_join(y = convrgCheck,
            by = c("model_run", "iteration", "scenario")) %>%
  full_join(y = subset(age1PlusBio, subset = plotGroup == "OM"),
            by = c("iteration", "scenario", "year")) %>%
  mutate(convrg = case_when(max_grad > 0.01 ~ "non-convrg",
                            max_grad < 0.01 ~ "convrg",
                            TRUE ~ "OM"),
         emRE = (EM - Bio_smry)/Bio_smry * 100)

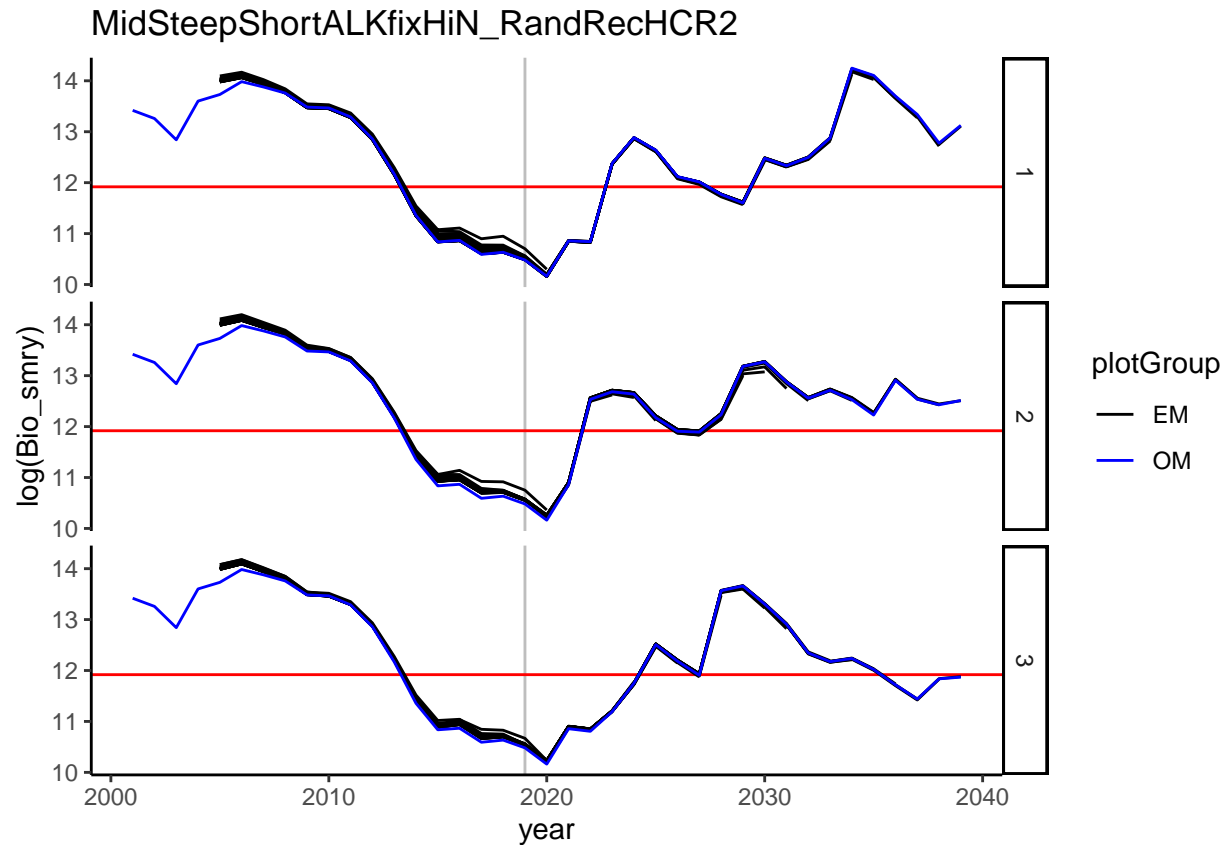
age1PlusBio <- age1PlusBio %>% left_join(y = convrgCheck,
                                         by = c("model_run", "iteration", "scenario")) %>%
  mutate(convrg = case_when(max_grad > 0.01 ~ "non-convrg",
                            max_grad < 0.01 ~ "convrg",
                            TRUE ~ "OM"))

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]))
}
```



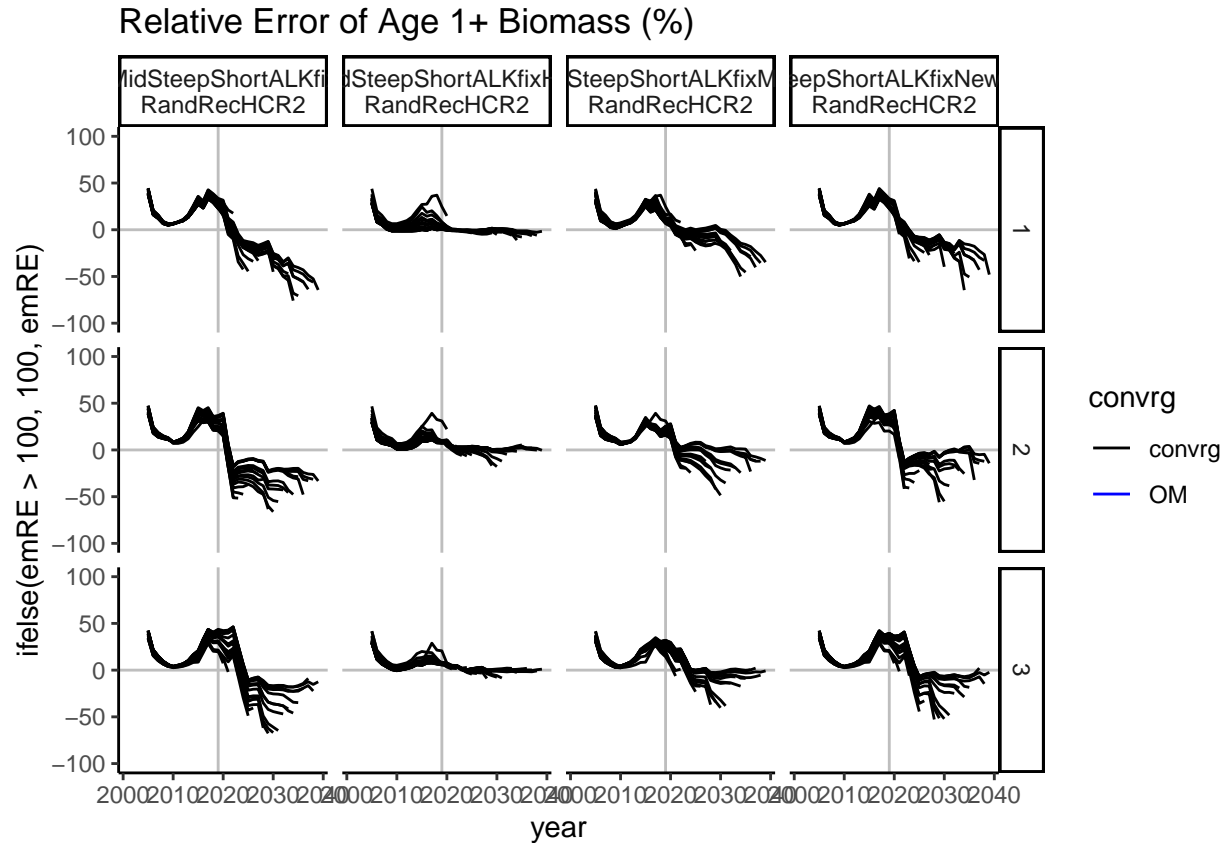




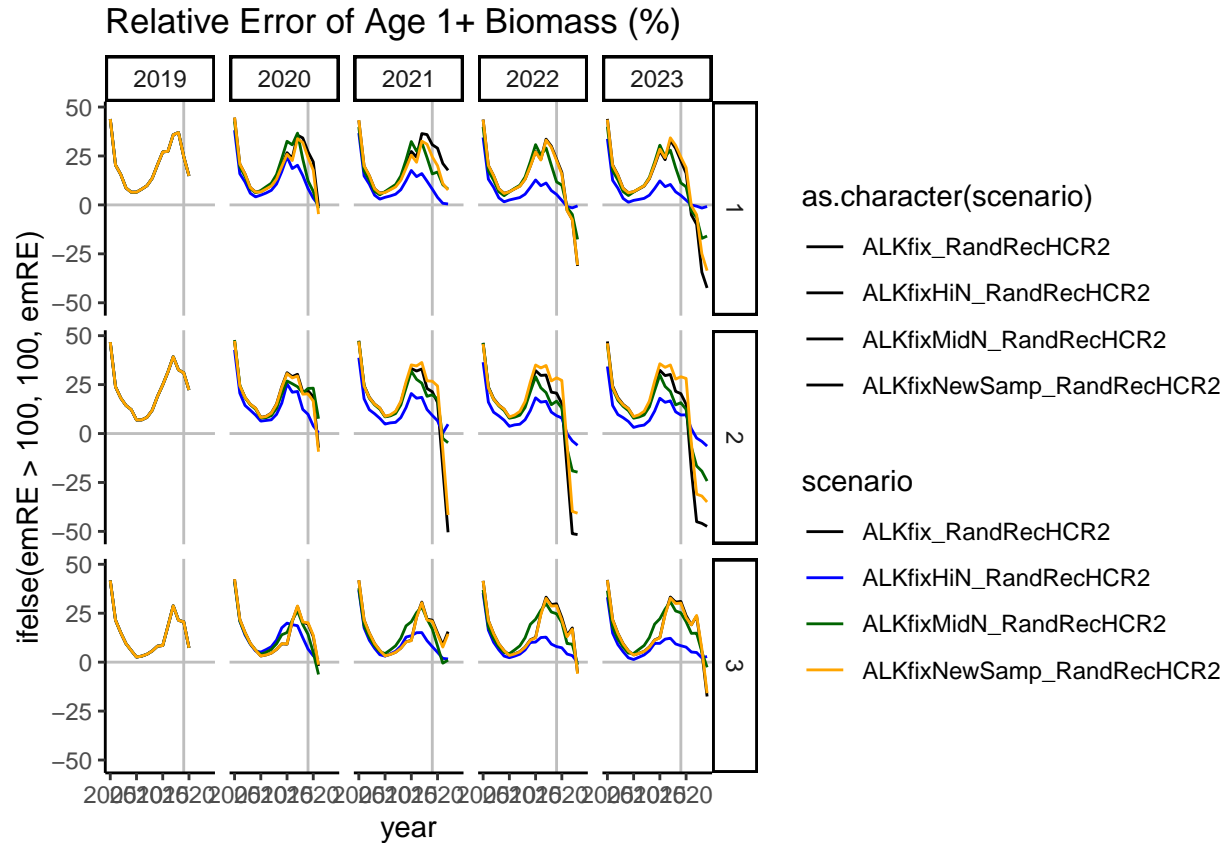


```
# Plot relative errors of biomass over time
age1PlusRE %>% #filter(HCR != "HCR0", emYear < 2024) %>%
  mutate(scenario = gsub("_", "\\n", scenario, fixed = TRUE)) %>%
  ggplot(aes(x = year, y = ifelse(emRE > 100, 100, emRE))) + #y = emRE)) +
  geom_vline(xintercept = 2019, color = "gray") +
  geom_hline(yintercept = 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).
```

```
age1PlusRE %>% filter(HCR != "HCR0", 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 (%)")
```



```
# age1PlusRE %>% filter(HCR != "HCR0", 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 (%)")

# 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"))

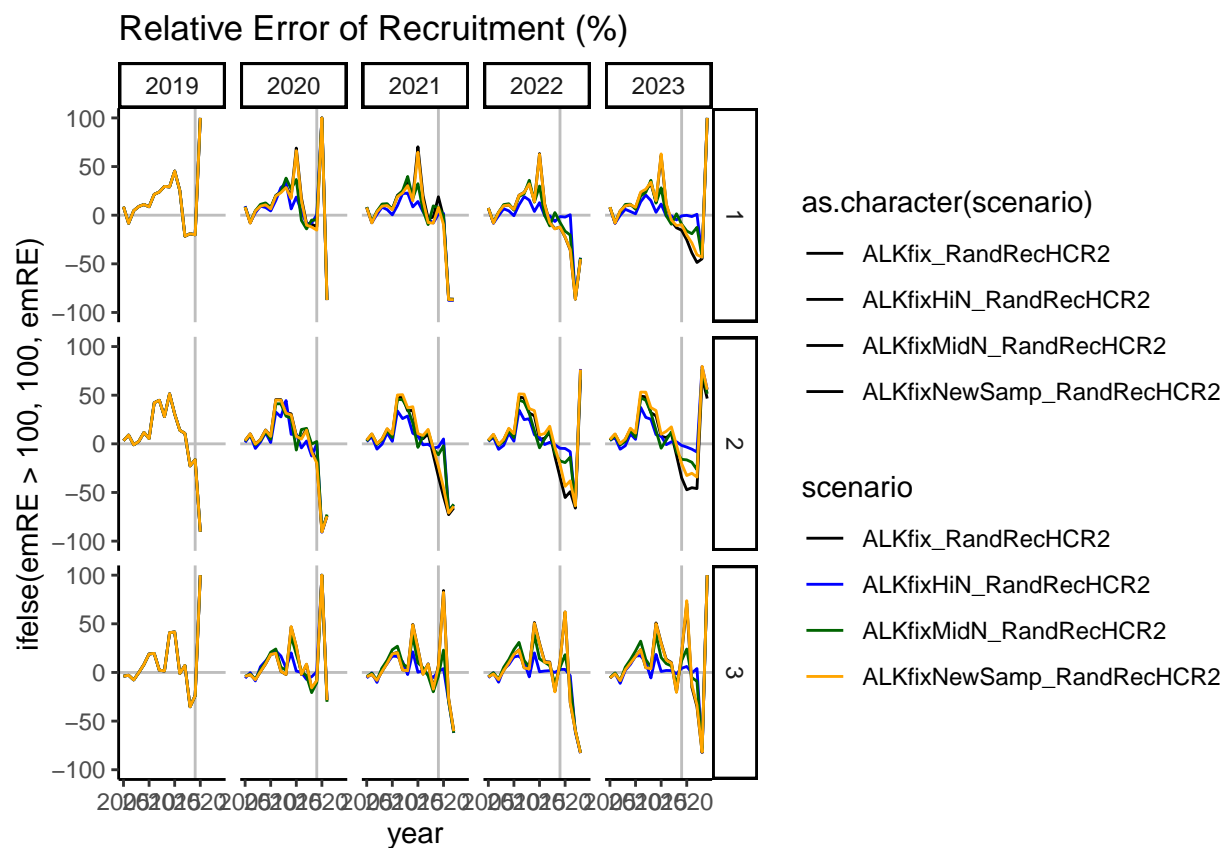
recRE <- recs %>% filter(plotGroup != "OM")
recRE <- recRE %>% pivot_wider(names_from = "plotGroup", values_from = "Value.Recr") %>%
  left_join(y = convrgCheck,
            by = c("model_run", "iteration", "scenario")) %>%
  full_join(y = subset(recs, subset = plotGroup == "OM",
                      by = c("iteration", "scenario", "year")) %>%
            mutate(convrg = case_when(max_grad > 0.01 ~ "non-convrg",
                                       max_grad < 0.01 ~ "convrg",
```

```

TRUE ~ "OM"),
emRE = (EM - Value.Recr)/Value.Recr * 100)

# Plot relative errors of rec devs over time
recRE %>% filter(HCR != "HCR0", 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", 5)) +
  # guides(linetype = "none") +
  facet_grid(rows = vars(iteration), cols = vars(emYear)) +
  theme_classic() + labs(title = "Relative Error of Recruitment (%)") +
  ylim(-100, 100)

```



```

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

```

```

## # A tibble: 3 x 2
##   scenario                                numBelowneg50
##   <chr>                                <int>
## 1 MidSteepShortALKfix_RandRecHCR2      33

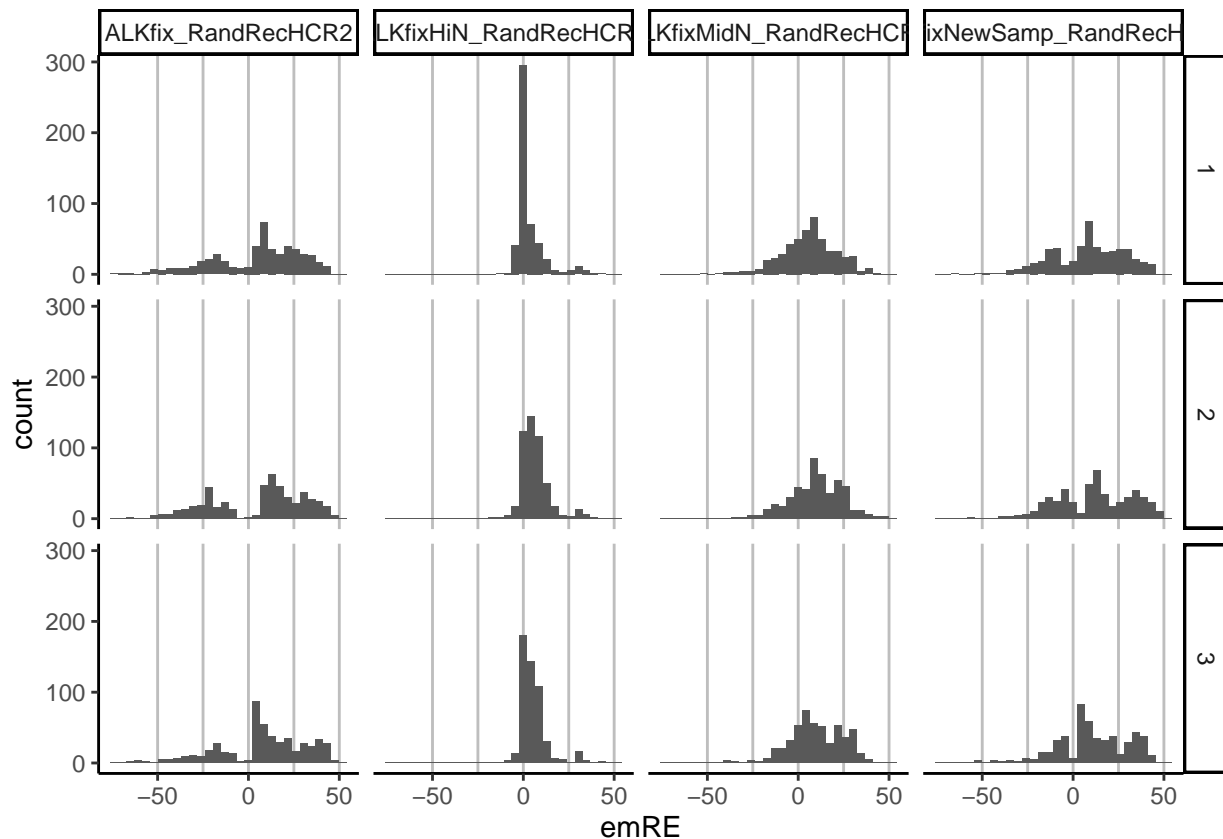
```

```
## 2 MidSteepShortALKfixMidN_RandRecHCR2 1
## 3 MidSteepShortALKfixNewSamp_RandRecHCR2 7
```

```
age1PlusRE %>% mutate(scenario = gsub("MidSteepShort", "", 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

- 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",
              "MidSteepShortALKfixNewSamp_RandRecHCR2",
              "LowSteepShortALKfixMidN_RandRecHCR2",
              "LowSteepShortALKfixNewSamp_RandRecHCR2")

smryOutputList <- GetSumryOutput(dirSSMSE = mseDir,
                                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.
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## Rows: 1650 Columns: 12
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## chr (2): model_run, scenario
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## Rows: 1650 Columns: 12
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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
## -- 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)

convrgeCheck <- smryOutputList$sc1Smry %>% #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$HCR)
#exIters <- sample(termTS$iteration, size = 4)

cnvrgeTS <- smryOutputList$tsSmry %>% mutate(HCR = sub(pattern = ".*Rec", "", scenario),
                                           recScen = sub(pattern = "HCR.*", "", scenario)) %>%
  mutate(recScen = sub(pattern = ".*OM_", "", recScen)) %>%
  left_join(y = convrgeCheck, by = c("iteration", "model_run", "scenario", "HCR", "recScen")) %>%
  mutate(plotGroup = case_when(model_run %in% omName ~ "OM",
                               max_grad > 0.01 ~ "non-convrge",
                               max_grad < 0.01 ~ "cnvrge"))

# for(mr in 1:length(scenarios)){
#   print(cnvrgeTS %>% 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(cnvrgeTS %>% 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]))
# }
```

```

# }

performanceList <- CalcPerformance(smryOutputList)

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

metricsTbl <- performanceList$performanceMetrics

# 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 frqNonConvng model_run  yrsN closuresFreq
##       <int> <chr>          <int> <dbl>      <dbl> <chr>      <int>      <dbl>
## 1         1 origMSEwALK~         1    20        0.05 constGro~    20        0.65
## 2         1 LowSteepSho~        NA    NA         NA  constGro~    20        0.65
## 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         NA  constGro~    20        0.45
## 6         2 origMSEwALK~        NA    NA         NA  constGro~    20         0.6
## 7         3 LowSteepSho~        NA    NA         NA  constGro~    20        0.65
## 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>,
## #   meanBiplus <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

```

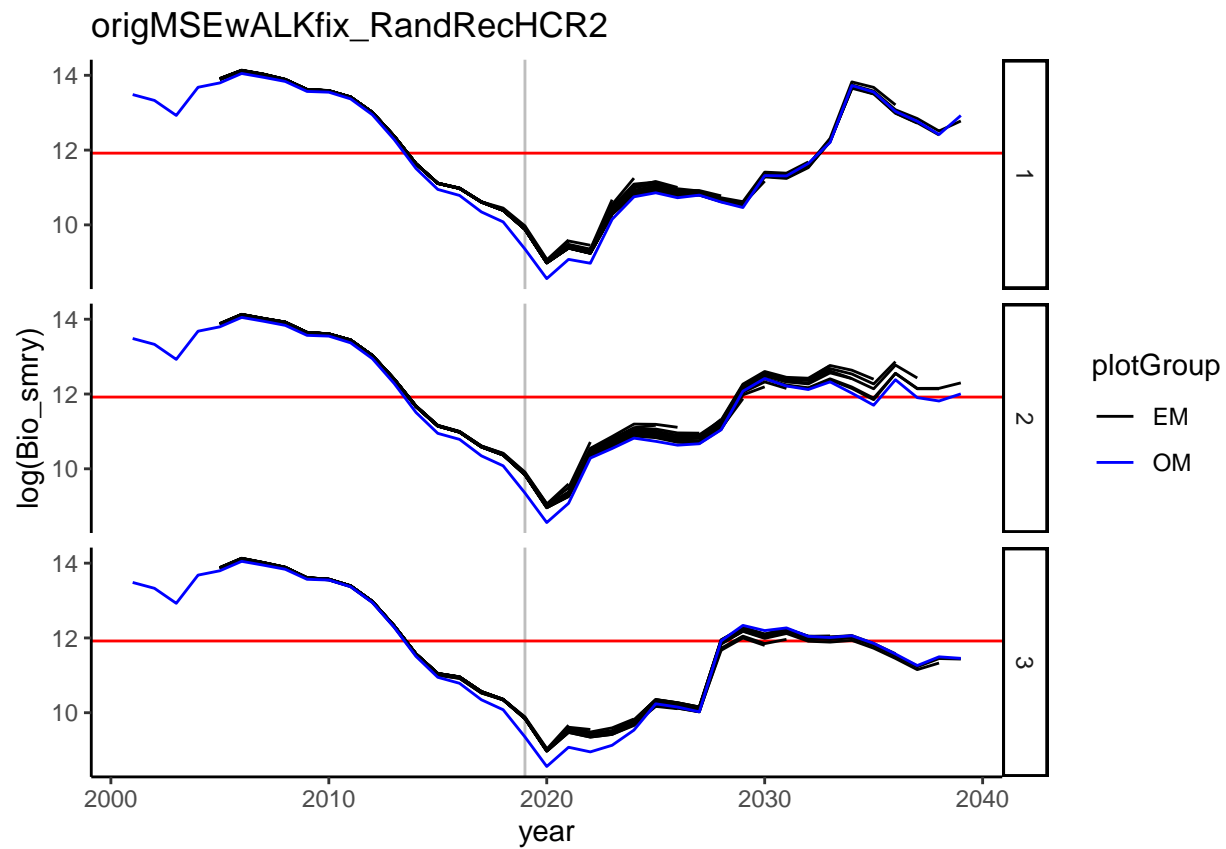
age1PlusBio <- smryOutputList$tsSmry %>% filter(Seas == 1) %>%
  select(year, Bio_smry, model_run, iteration, scenario) %>%
  mutate(plotGroup = case_when(grepl("_OM", model_run, fixed = TRUE) ~ "OM",
                                TRUE ~ "EM"))

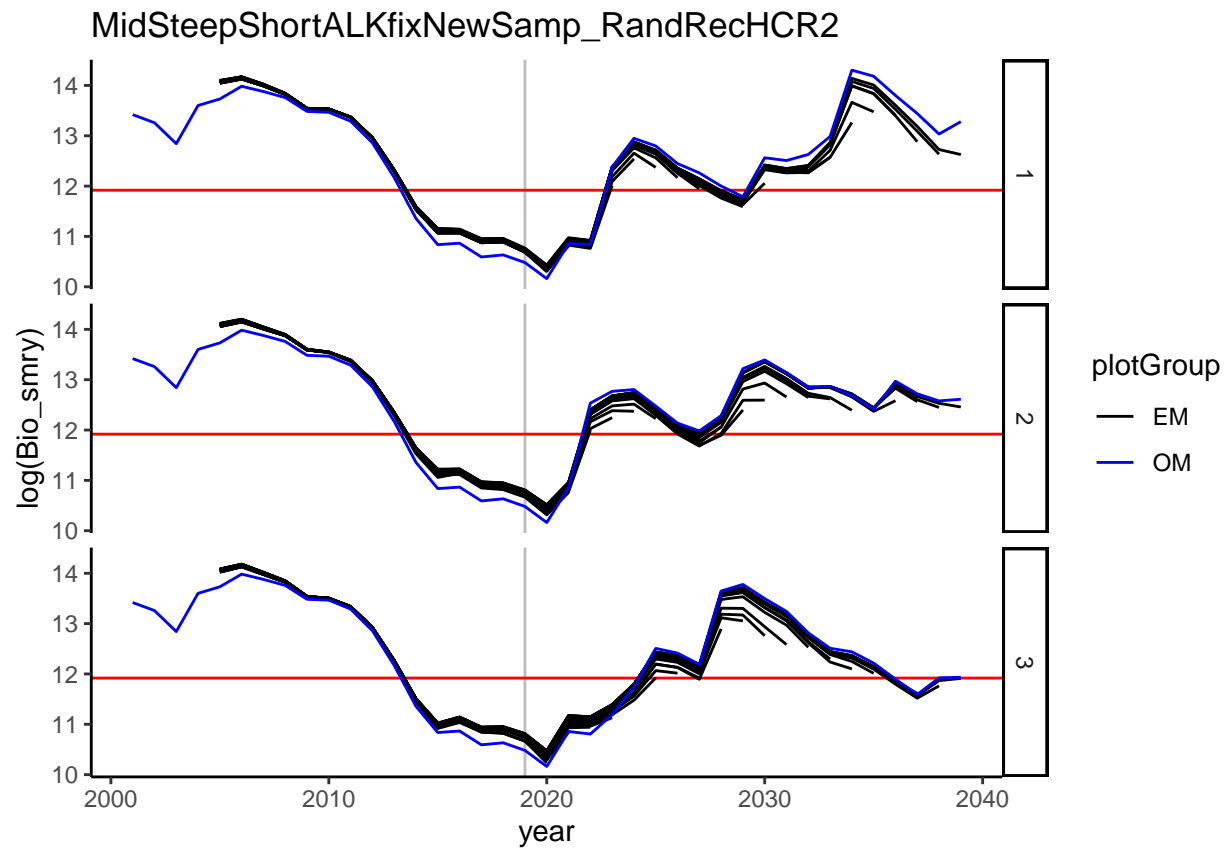
age1PlusRE <- age1PlusBio %>% filter(plotGroup != "OM")
age1PlusRE <- age1PlusRE %>% pivot_wider(names_from = "plotGroup", values_from = "Bio_smry") %>%
  left_join(y = convrgCheck,
            by = c("model_run", "iteration", "scenario")) %>%
  full_join(y = subset(age1PlusBio, subset = plotGroup == "OM"),
            by = c("iteration", "scenario", "year")) %>%
  mutate(convrg = case_when(max_grad > 0.01 ~ "non-convrg",
                            max_grad < 0.01 ~ "convrg",
                            TRUE ~ "OM"),
         emRE = (EM - Bio_smry)/Bio_smry * 100)

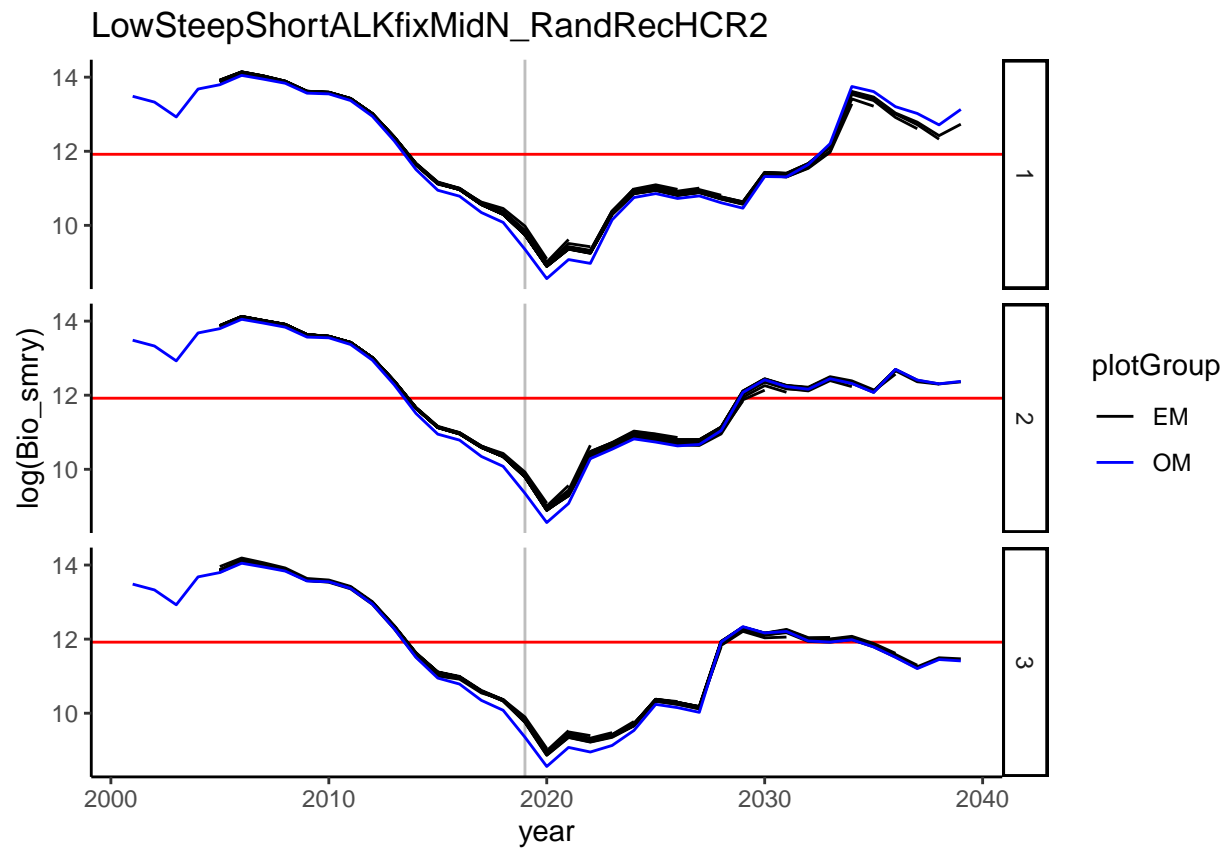
age1PlusBio <- age1PlusBio %>% left_join(y = convrgCheck,
                                         by = c("model_run", "iteration", "scenario")) %>%
  mutate(convrg = case_when(max_grad > 0.01 ~ "non-convrg",
                            max_grad < 0.01 ~ "convrg",
                            TRUE ~ "OM"))

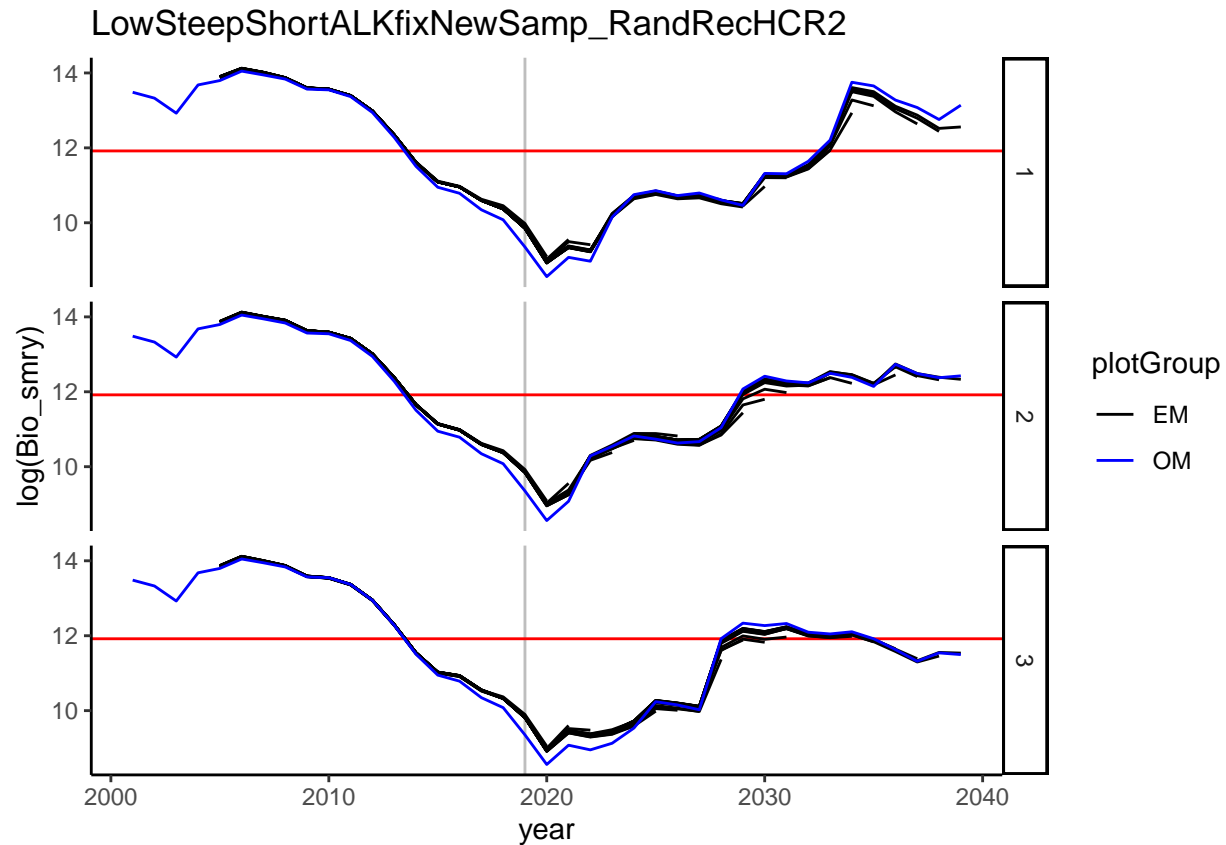
for(mr in 1:length(scenarios)){
  print(age1PlusBio %>% filter(scenario == scenarios[mr], plotGroup != "simData") %>%
    ggplot(aes(x = year, y = log(Bio_smry))) +
    ggplot2::geom_vline(xintercept = 2019, color = "gray") +
    geom_hline(yintercept = log(150000), color = "red") +
    ggplot2::geom_line(ggplot2::aes(linetype = 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]))
}

```

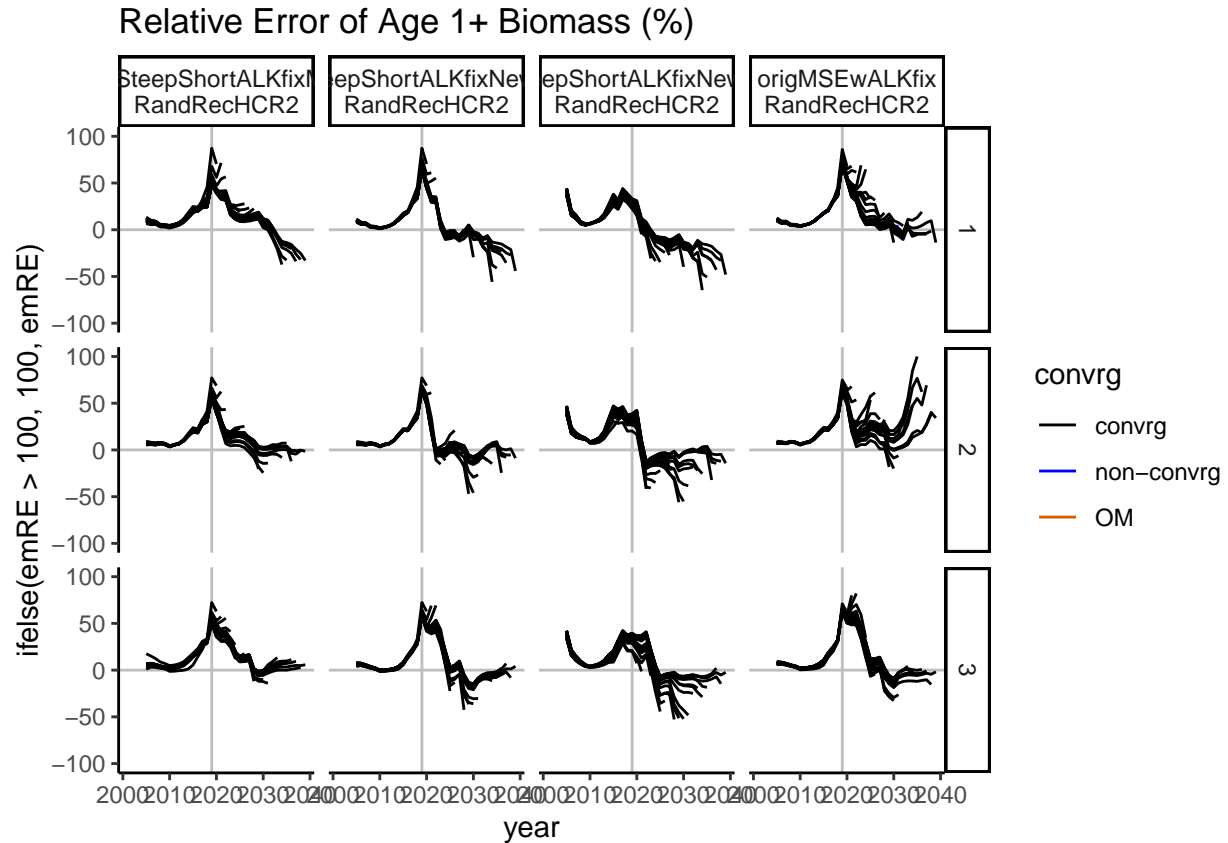




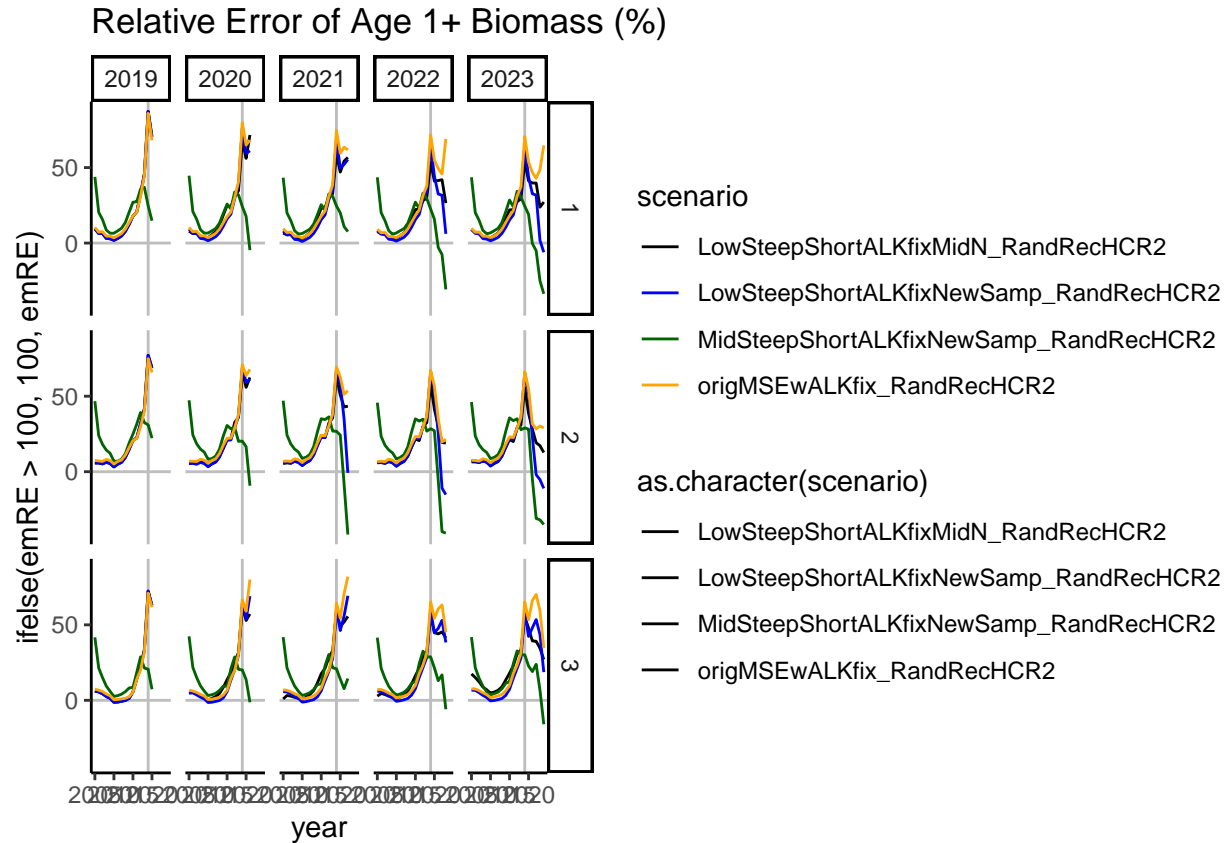


```
# Plot relative errors of biomass over time
age1PlusRE %>% #filter(HCR != "HCR0", emYear < 2024) %>%
  mutate(scenario = gsub("_", "\\n", scenario, fixed = TRUE)) %>%
  ggplot(aes(x = year, y = ifelse(emRE > 100, 100, emRE))) + #y = emRE)) +
  geom_vline(xintercept = 2019, color = "gray") +
  geom_hline(yintercept = 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).
```



```
age1PlusRE %>% filter(HCR != "HCR0", emYear < 2024, convr != "non-convr") %>%
  #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", 5)) +
  # guides(linetype = "none") +
  facet_grid(rows = vars(iteration), cols = vars(emYear)) +
  theme_classic() + labs(title = "Relative Error of Age 1+ Biomass (%)")
```



```
# age1PlusRE %>% filter(HCR != "HCR0", 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 (%)")

# 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"))

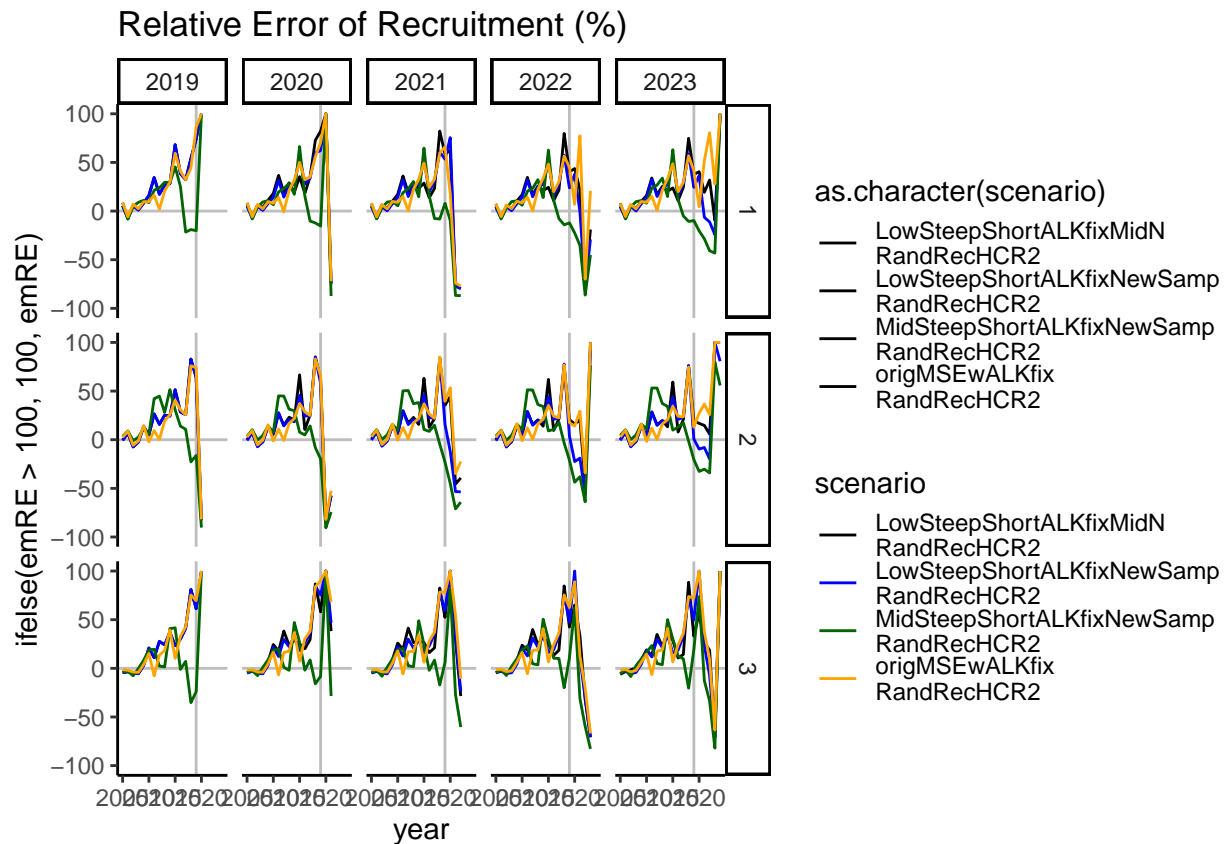
recRE <- recs %>% filter(plotGroup != "OM")
recRE <- recRE %>% pivot_wider(names_from = "plotGroup", values_from = "Value.Recr") %>%
  left_join(y = convrgCheck,
            by = c("model_run", "iteration", "scenario")) %>%
  full_join(y = subset(recs, subset = plotGroup == "OM",
                      by = c("iteration", "scenario", "year")) %>%
            mutate(convrg = case_when(max_grad > 0.01 ~ "non-convrg",
                                       max_grad < 0.01 ~ "convrg",
```

```

TRUE ~ "OM"),
emRE = (EM - Value.Recr)/Value.Recr * 100)

# Plot relative errors of rec devs over time
recRE %>% filter(HCR != "HCR0", 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", 5)) +
  # guides(linetype = "none") +
  facet_grid(rows = vars(iteration), cols = vars(emYear)) +
  theme_classic() + labs(title = "Relative Error of Recruitment (%)") +
  ylim(-100, 100)

```



```

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

```

```

## # A tibble: 2 x 2
##   scenario                               numBelowneg50
##   <chr>                                <int>

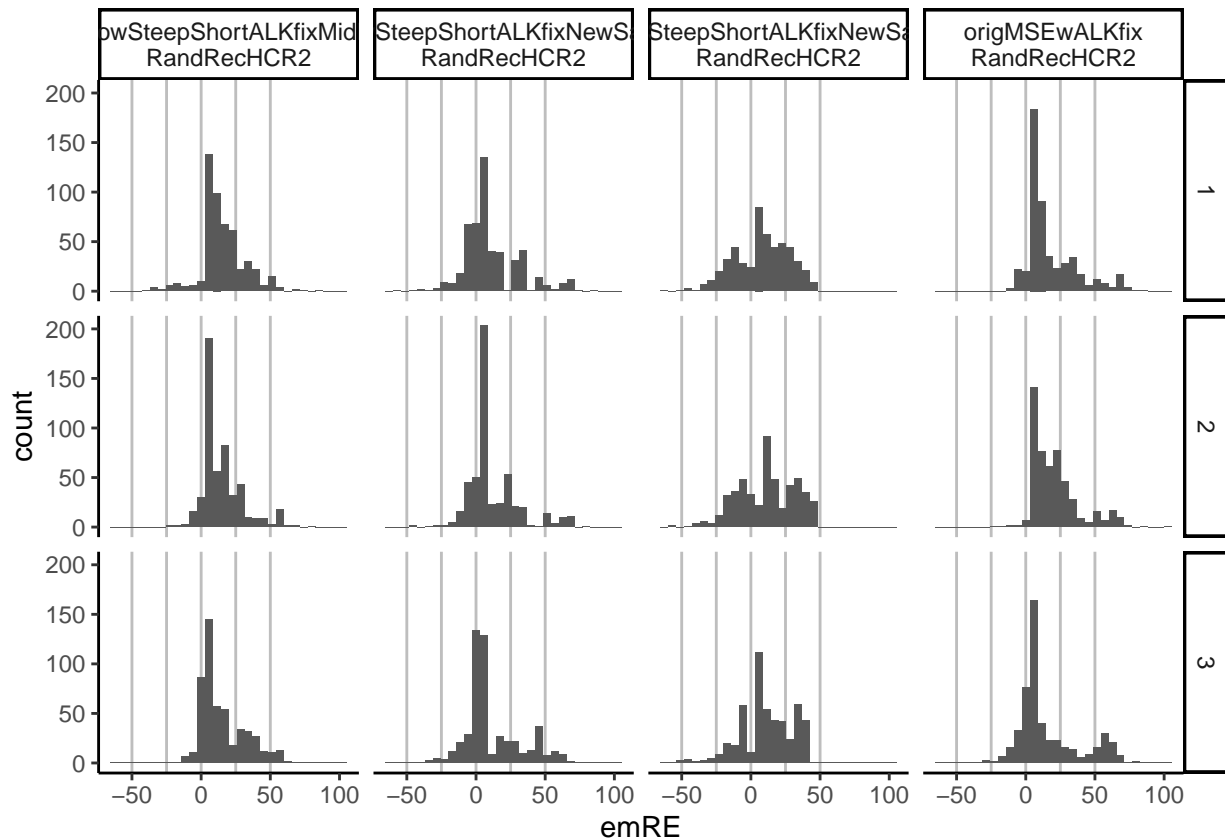
```

```
## 1 LowSteepShortALKfixNewSamp_RandRecHCR2 1
## 2 MidSteepShortALKfixNewSamp_RandRecHCR2 7
```

```
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",
              "MidSteepShortALKfix_RandRecHCR2")

smryOutputList <- GetSumryOutput(dirSSMSE = mseDir,
                                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,
              fixed = TRUE, value = TRUE)

convrCheck <- 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$HCR)
#exIters <- sample(termTS$iteration, size = 4)

cnvrgTS <- smryOutputList$tsSmry %>% mutate(HCR = sub(pattern = ".*Rec","", scenario),
                                             recScen = sub(pattern = "HCR.*","", scenario)) %>%
mutate(recScen = sub(pattern = ".*OM_","", recScen)) %>%
left_join(y = cnvrgCheck, 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") +
#     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(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]))
# }

```

```

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 = cnvrgCheck,
            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",
                            TRUE ~ "OM"),

```

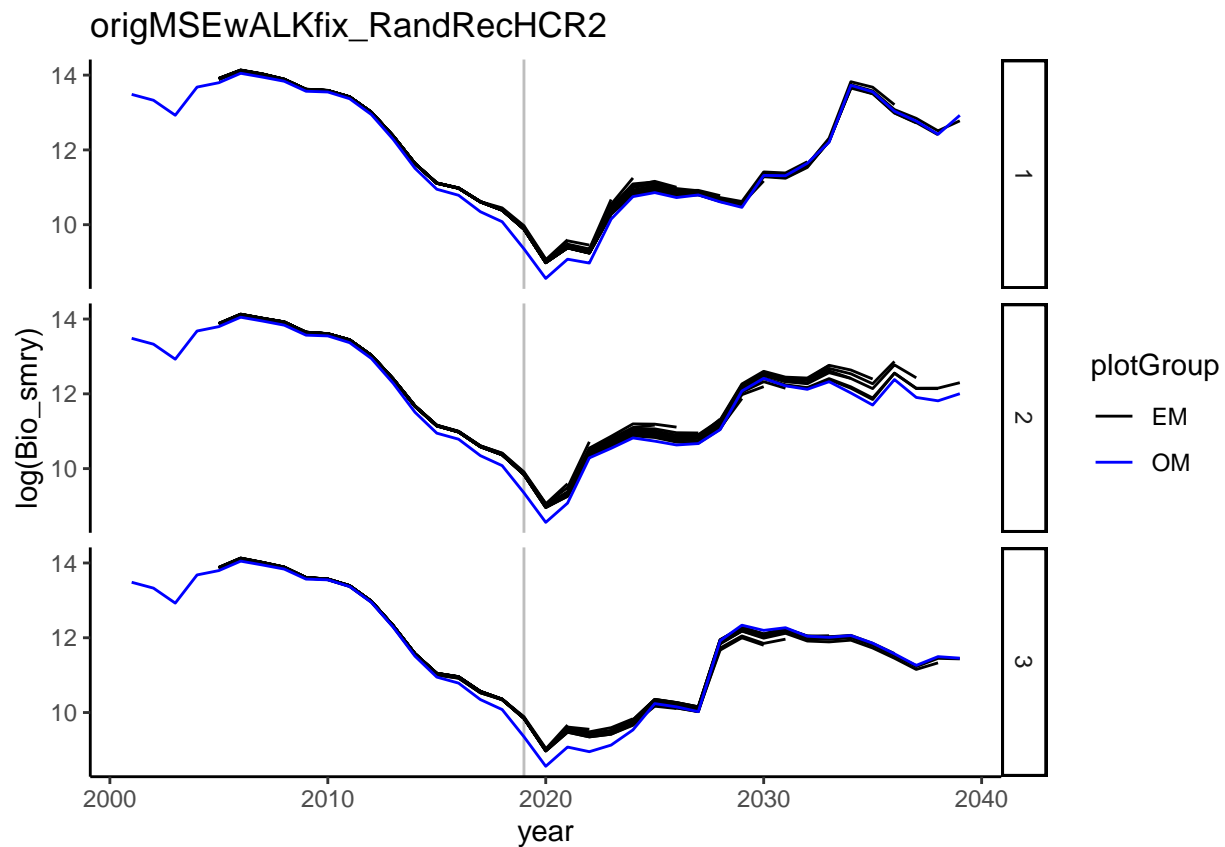
```

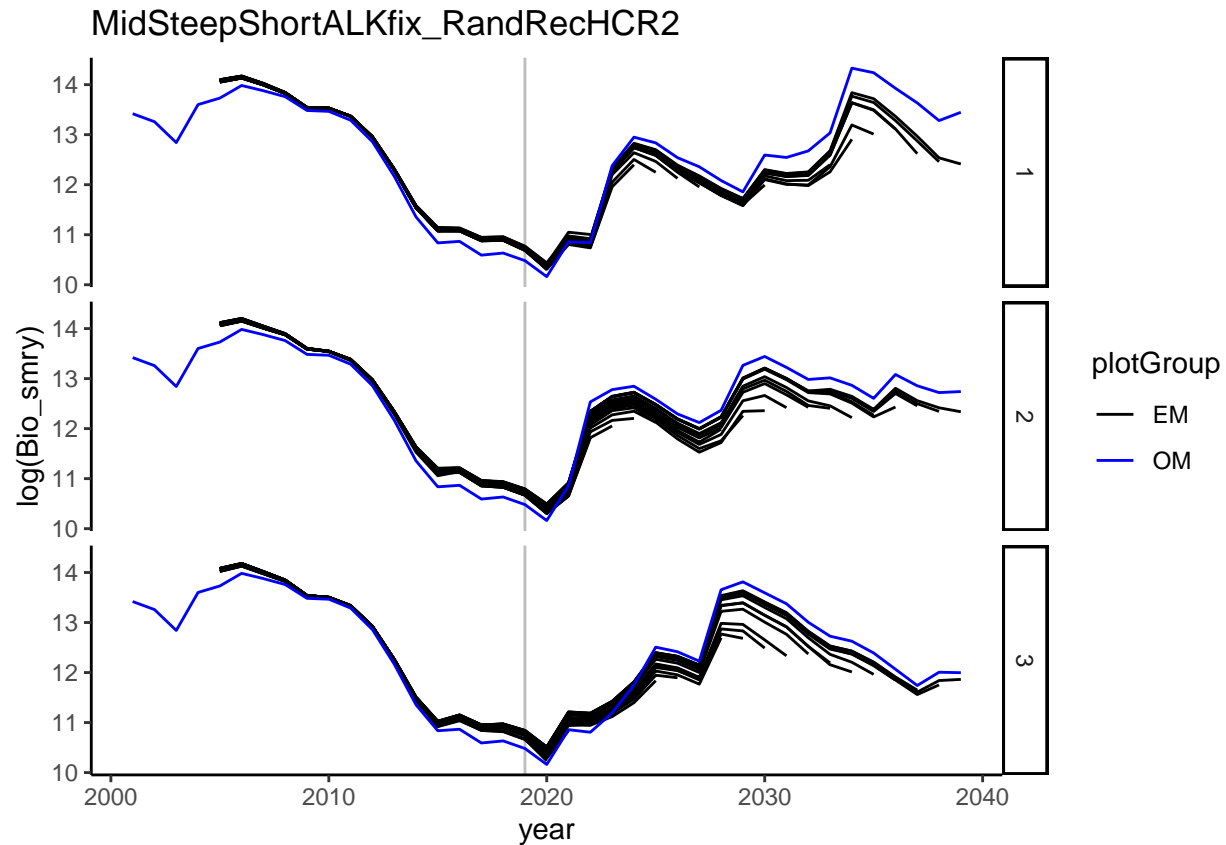
      emRE = (EM - Bio_smry)/Bio_smry * 100)

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",
                             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]))
}

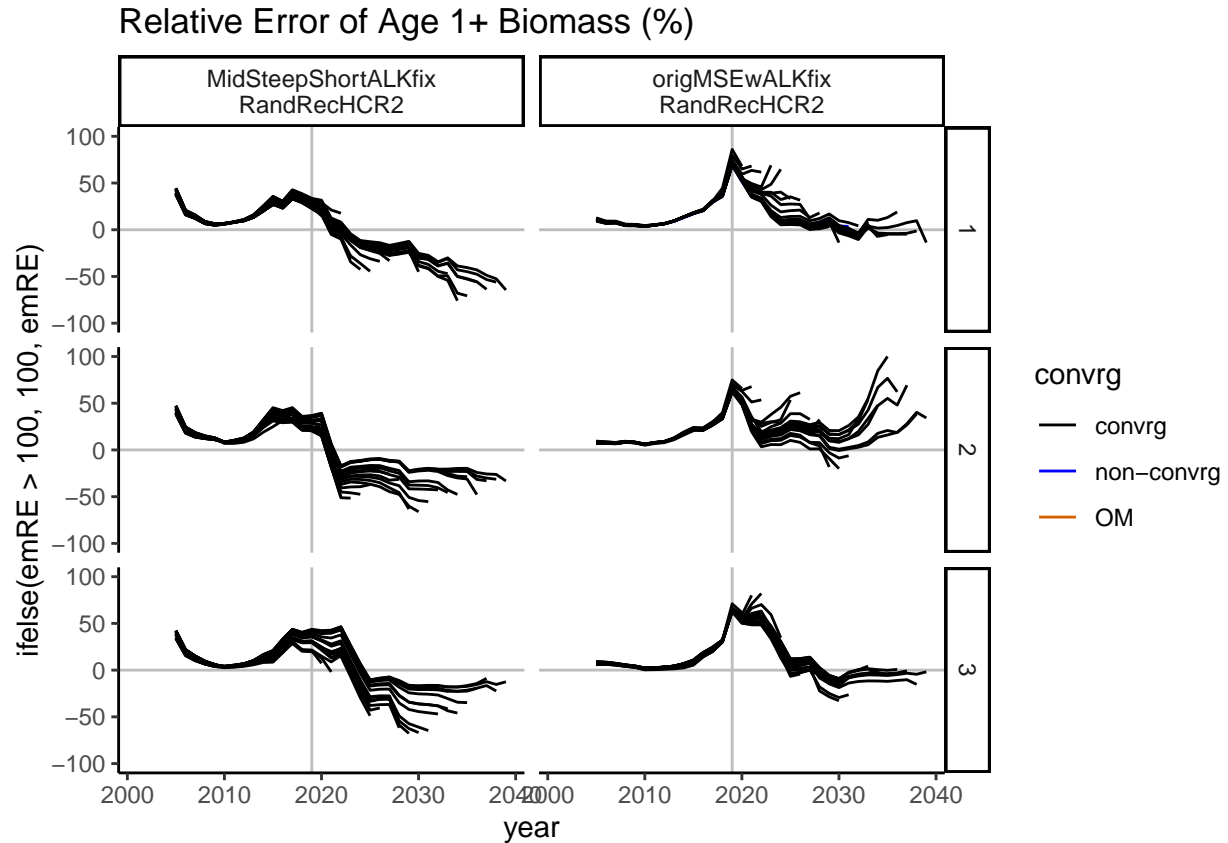
```



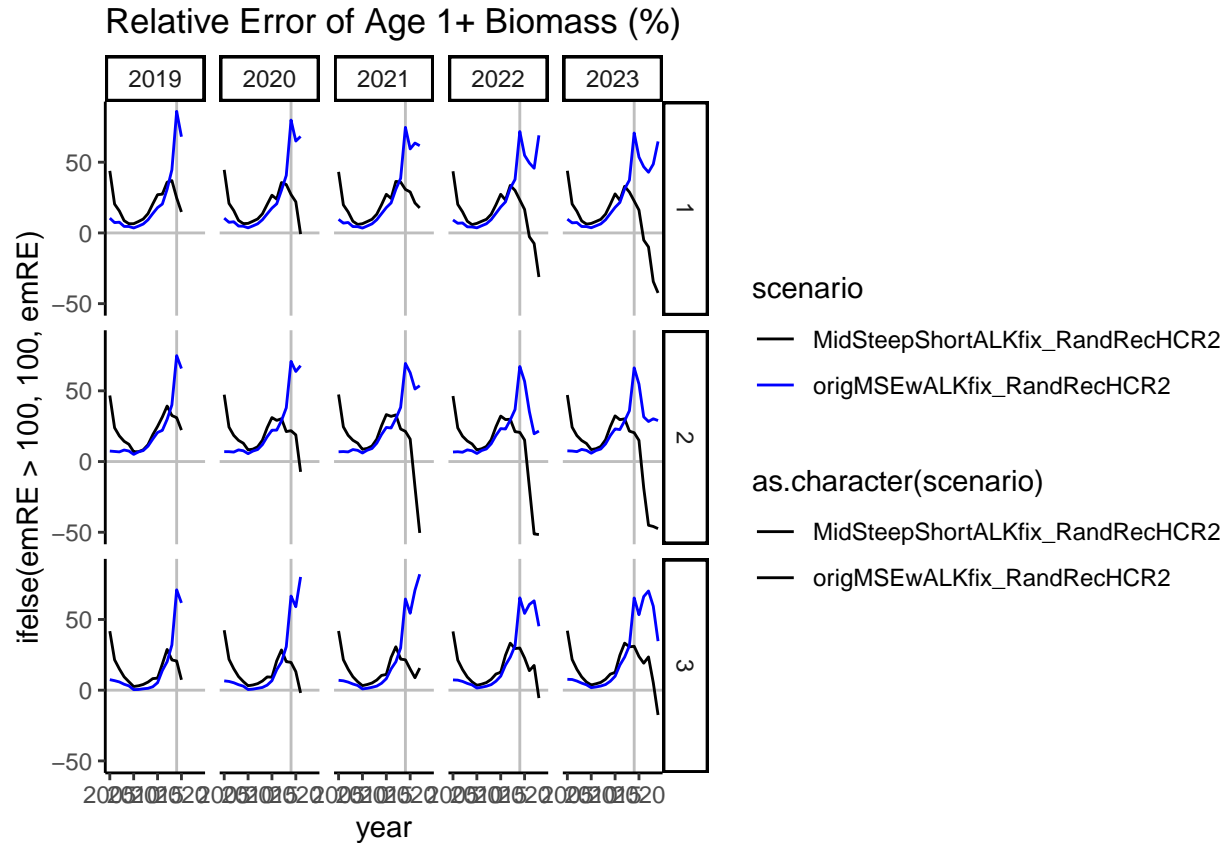


```
# Plot relative errors of biomass over time
age1PlusRE %>% #filter(HCR != "HCR0", emYear < 2024) %>%
  mutate(scenario = gsub("_", "\\n", scenario, fixed = TRUE)) %>%
  ggplot(aes(x = year, y = ifelse(emRE > 100, 100, emRE))) + #y = emRE)) +
  geom_vline(xintercept = 2019, color = "gray") +
  geom_hline(yintercept = 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).
```



```
age1PlusRE %>% filter(HCR != "HCR0", emYear < 2024, convrg != "non-converged") %>%
  #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", 5)) +
  # 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 (%)")

# Recruitment error
recs <- smryOutputList$ddqSmry %>% #filter(Seas == 1) %>%
  select(year, Value.Recr, model_run, iteration, scenario) %>%
  mutate(plotGroup = case_when(grepl("_OM", model_run, fixed = TRUE) ~ "OM",
                                TRUE ~ "EM"))

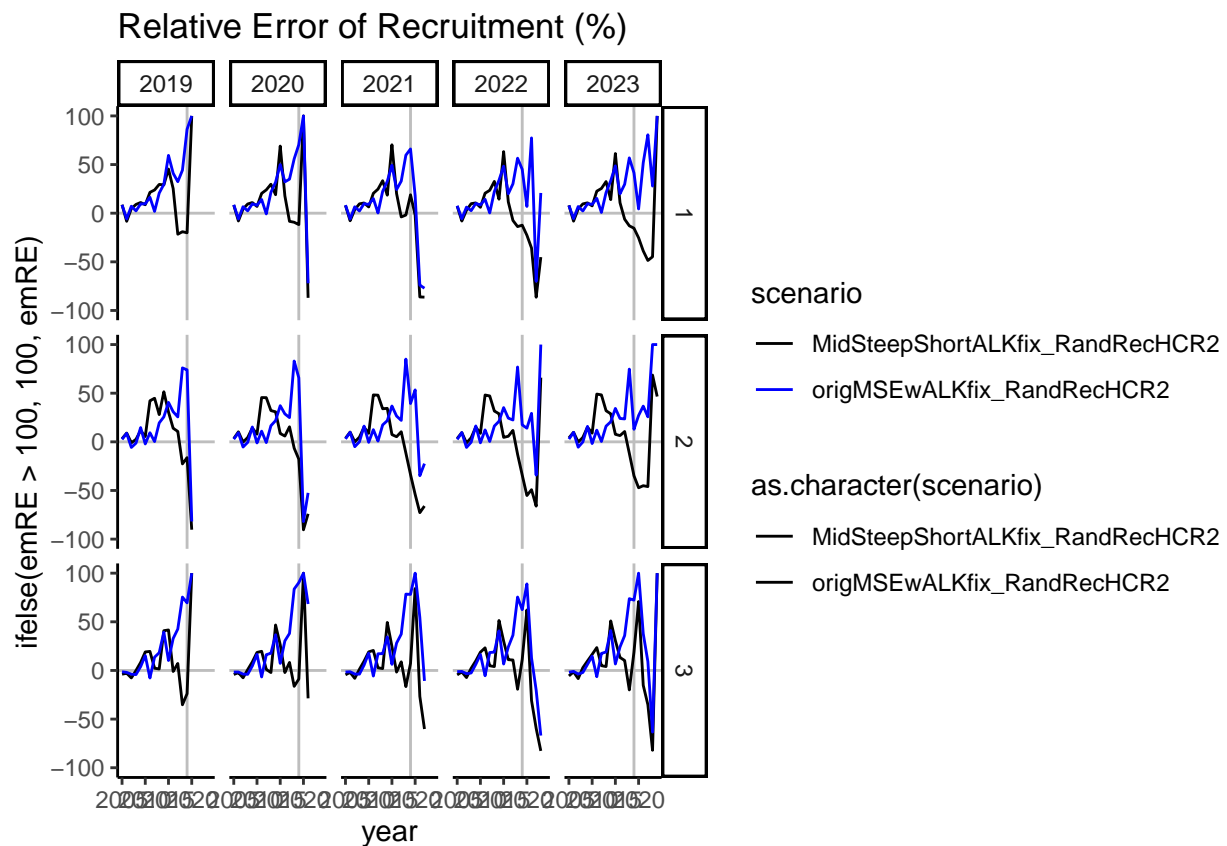
recRE <- recs %>% filter(plotGroup != "OM")
recRE <- recRE %>% pivot_wider(names_from = "plotGroup", values_from = "Value.Recr") %>%
  left_join(y = convrgCheck,
            by = c("model_run", "iteration", "scenario")) %>%
  full_join(y = subset(recs, subset = plotGroup == "OM",
                      by = c("iteration", "scenario", "year")) %>%
            mutate(convrg = case_when(max_grad > 0.01 ~ "non-convrg",
                                       max_grad < 0.01 ~ "convrg",
```

```

TRUE ~ "OM"),
emRE = (EM - Value.Recr)/Value.Recr * 100)

# Plot relative errors of rec devs over time
recRE %>% filter(HCR != "HCR0", 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", 5)) +
  # guides(linetype = "none") +
  facet_grid(rows = vars(iteration), cols = vars(emYear)) +
  theme_classic() + labs(title = "Relative Error of Recruitment (%)") +
  ylim(-100, 100)

```



```
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",
              "constGrow20010M_MidSteepALKfix_RandRecHCR2fore1yr",
              "constGrow20010M_LowSteepALKfix_RandRecHCR2fore1yr")

smryOutputList <- GetSumryOutput(dirSSMSE = mseDir,
                                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,
              fixed = TRUE, value = TRUE)

convrgeCheck <- smryOutputList$sc1Smry %>% #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$HCR)
#exIters <- sample(termTS$iteration, size = 4)

cnvrgeTS <- smryOutputList$tsSmry %>% mutate(HCR = sub(pattern = ".*Rec", "", scenario),
      recScen = sub(pattern = "HCR.*", "", scenario)) %>%
  mutate(recScen = sub(pattern = ".*OM_", "", recScen)) %>%
  left_join(y = convrgeCheck, by = c("iteration", "model_run", "scenario", "HCR", "recScen")) %>%
  mutate(plotGroup = case_when(model_run %in% omName ~ "OM",
                                max_grad > 0.01 ~ "non-convrge",
                                max_grad < 0.01 ~ "cnvrge"))

# for(mr in 1:length(scenarios)){
#   print(cnvrgeTS %>% 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(cnvrgeTS %>% 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]))
# }

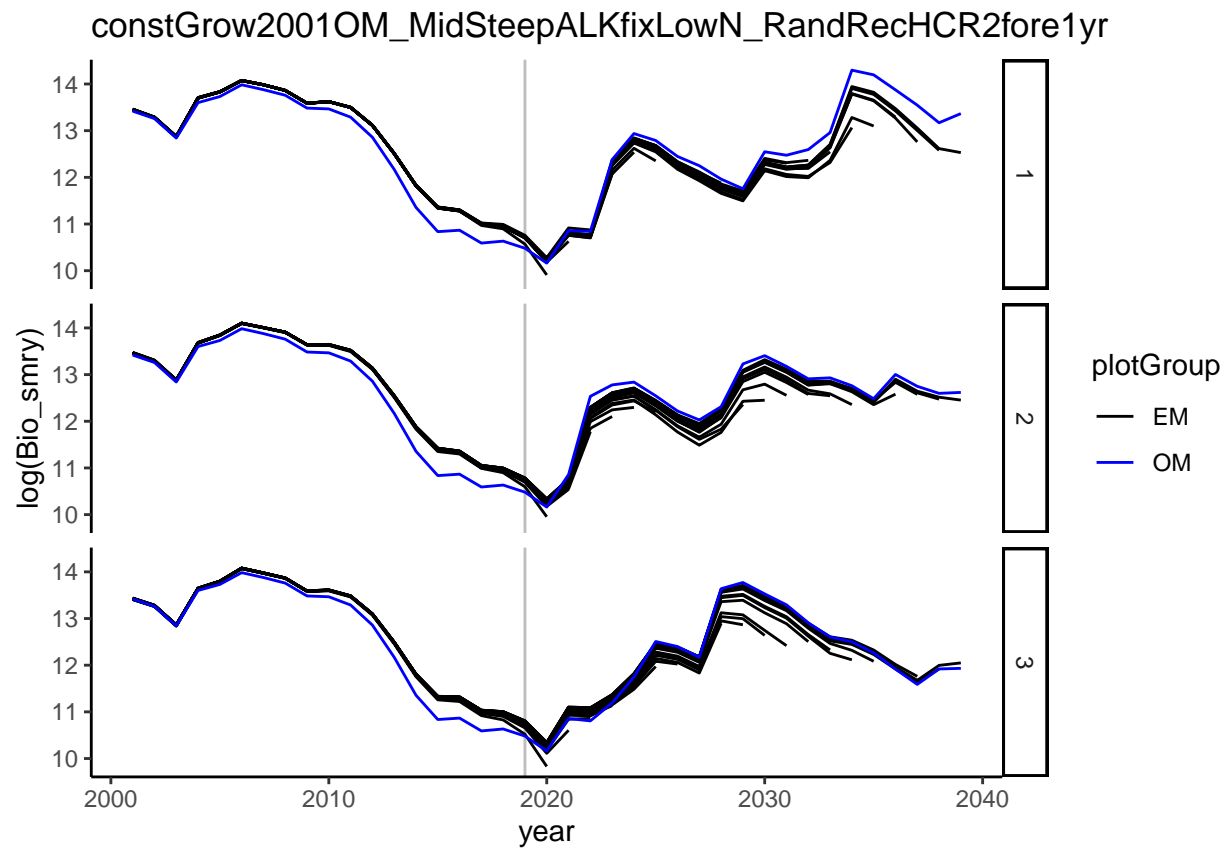
age1PlusBio <- smryOutputList$tsSmry %>% filter(Seas == 1) %>%
  select(year, Bio_smry, model_run, iteration, scenario) %>%
  mutate(plotGroup = case_when(grepl("_OM", model_run, fixed = TRUE) ~ "OM",
                                TRUE ~ "EM"))

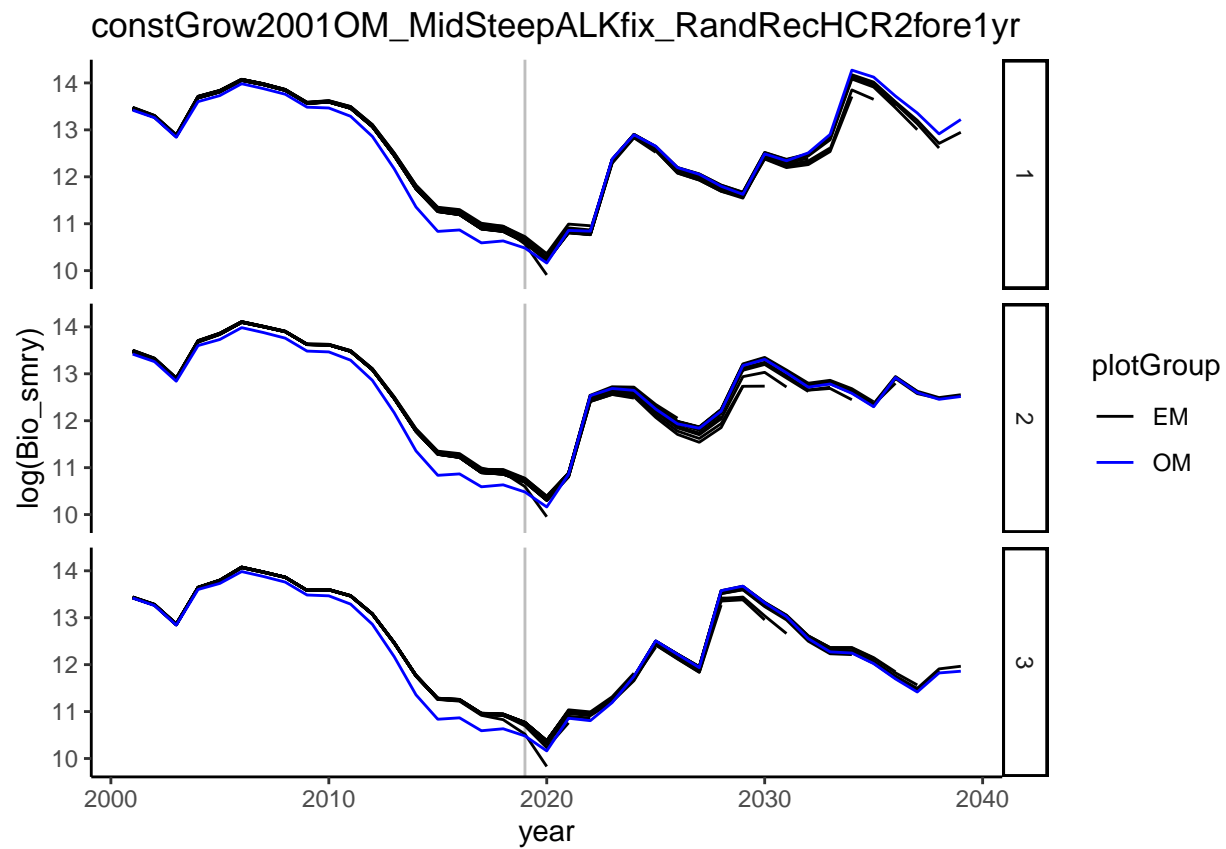
age1PlusRE <- age1PlusBio %>% filter(plotGroup != "OM")
age1PlusRE <- age1PlusRE %>% pivot_wider(names_from = "plotGroup", values_from = "Bio_smry") %>%
  left_join(y = convrgCheck,
            by = c("model_run", "iteration", "scenario")) %>%
  full_join(y = subset(age1PlusBio, subset = plotGroup == "OM"),
            by = c("iteration", "scenario", "year")) %>%
  mutate(convrg = case_when(max_grad > 0.01 ~ "non-convrg",
                             max_grad < 0.01 ~ "convrg",
                             TRUE ~ "OM"),
         emRE = (EM - Bio_smry)/Bio_smry * 100)

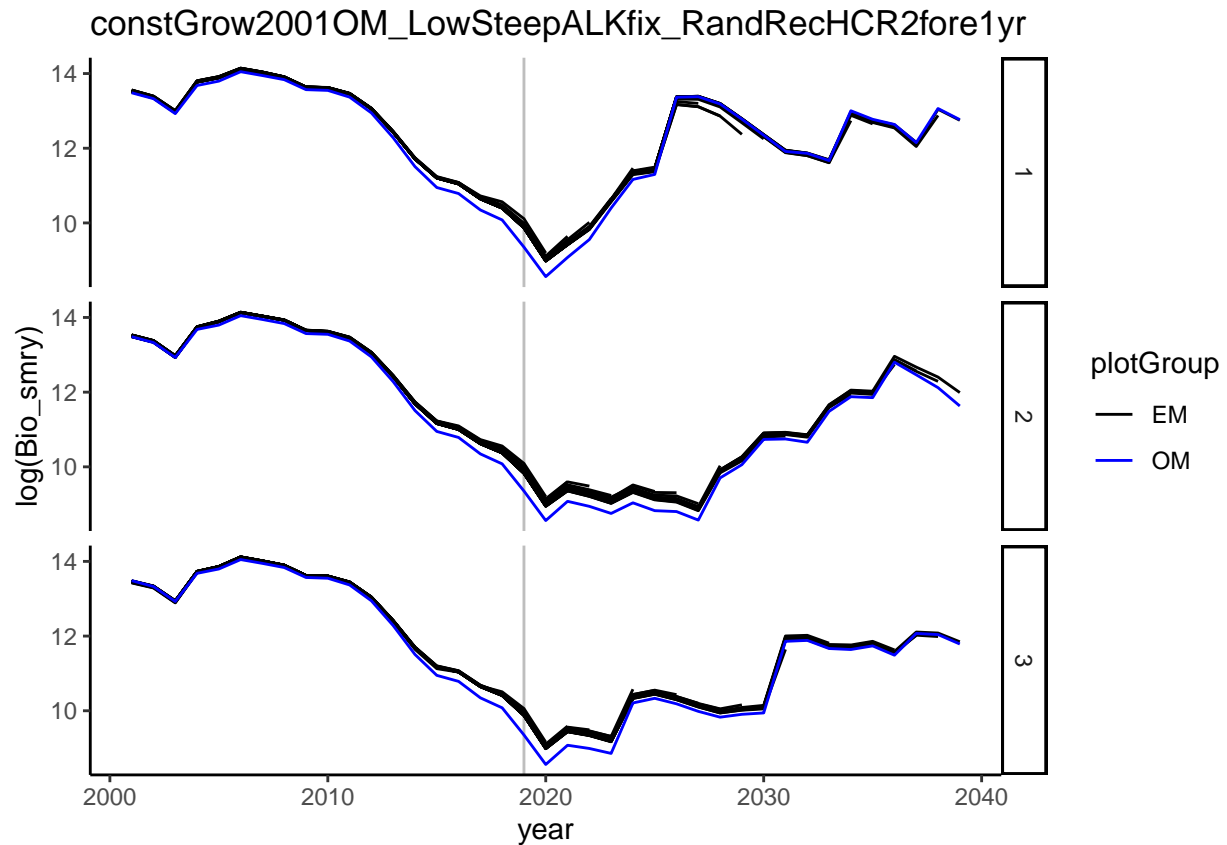
age1PlusBio <- age1PlusBio %>% left_join(y = convrgCheck,
                                         by = c("model_run", "iteration", "scenario")) %>%
  mutate(convrg = case_when(max_grad > 0.01 ~ "non-convrg",
                             max_grad < 0.01 ~ "convrg",
                             TRUE ~ "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]))
}

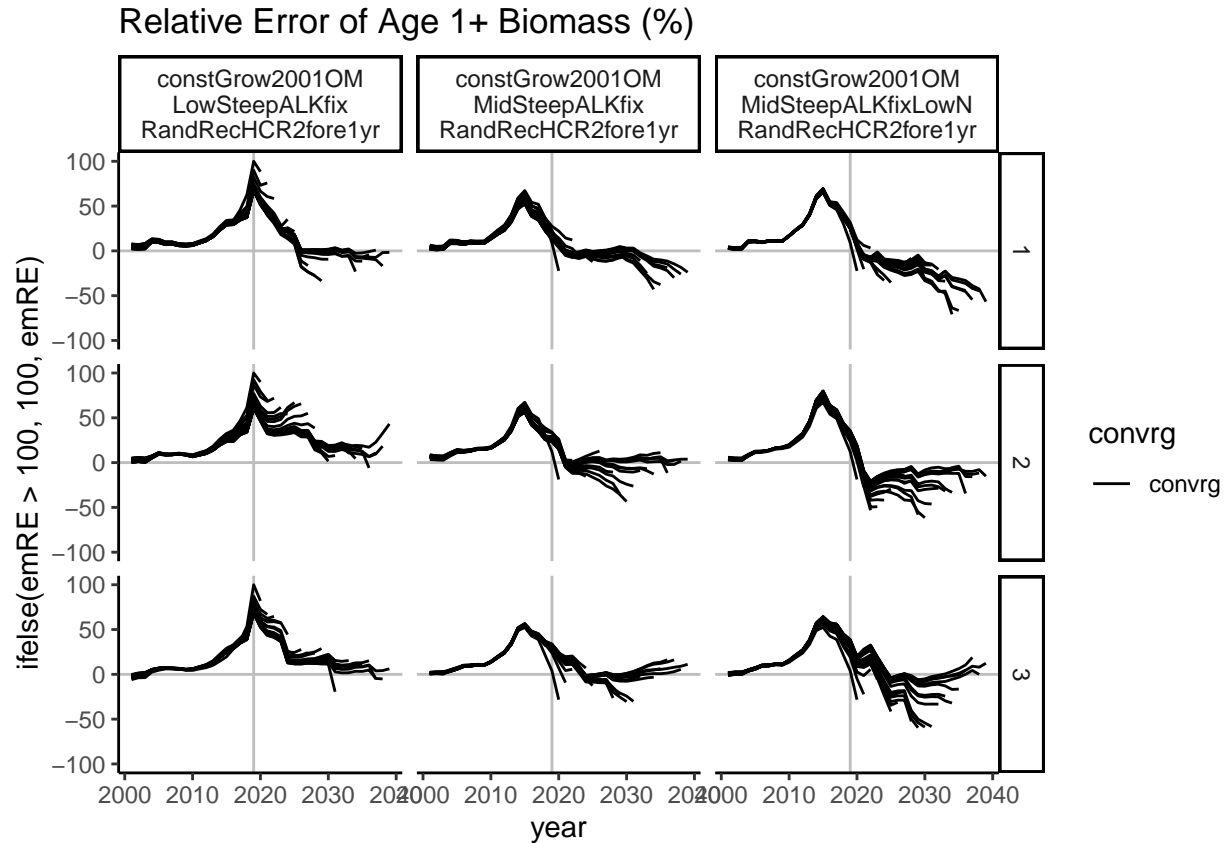
```



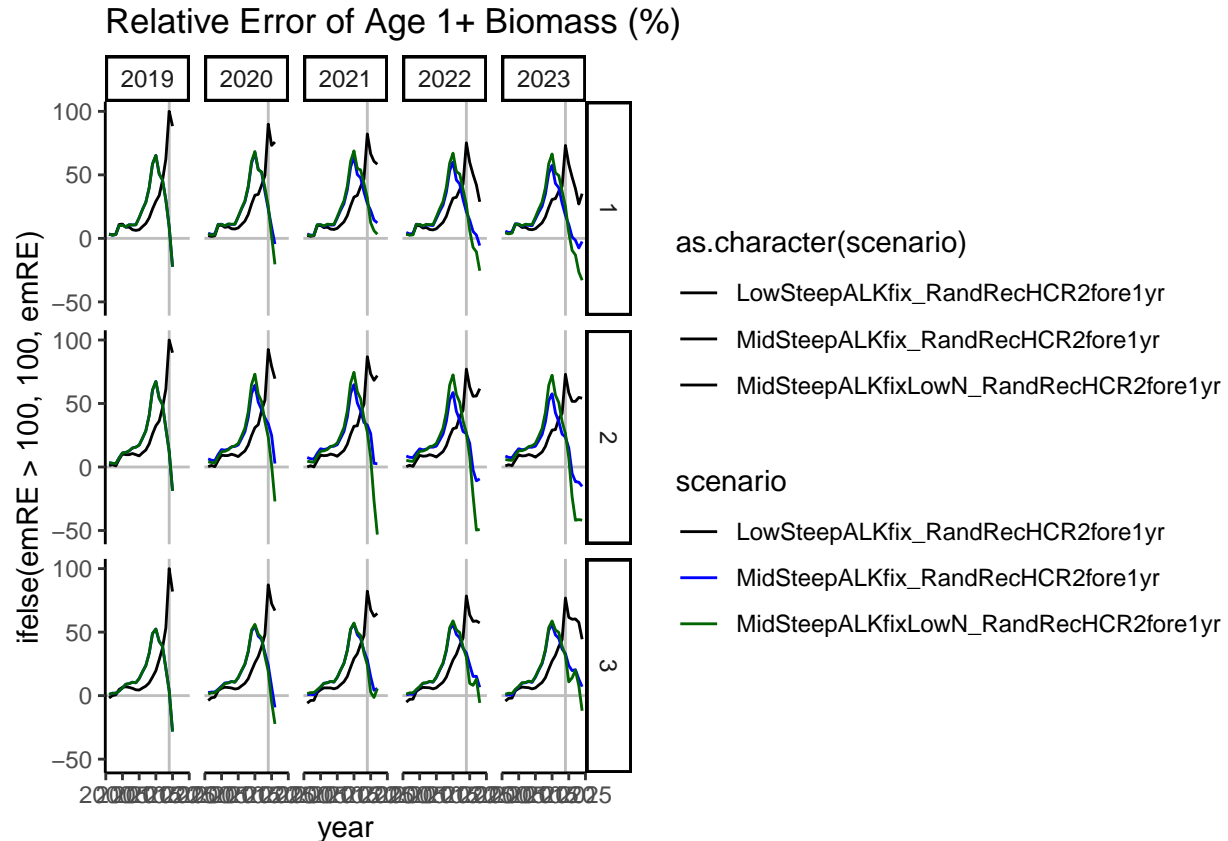




```
# Plot relative errors of biomass over time
age1PlusRE %>% #filter(HCR != "HCR0", emYear < 2024) %>%
  mutate(scenario = gsub("_", "\\n", scenario, fixed = TRUE)) %>%
  ggplot(aes(x = year, y = ifelse(emRE > 100, 100, emRE))) + #y = emRE)) +
  geom_vline(xintercept = 2019, color = "gray") +
  geom_hline(yintercept = 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)
```



```
age1PlusRE %>% filter(HCR != "HCR0", emYear < 2024, convrg != "non-convr") %>%
  mutate(scenario = gsub("constGrow2001OM_", "", 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", 5)) +
  # 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 (%)")

# Recruitment error
recs <- smryOutputList$ddqSmry %>% #filter(Seas == 1) %>%
  select(year, Value.Recr, model_run, iteration, scenario) %>%
  mutate(plotGroup = case_when(grepl("_OM", model_run, fixed = TRUE) ~ "OM",
                                TRUE ~ "EM"))

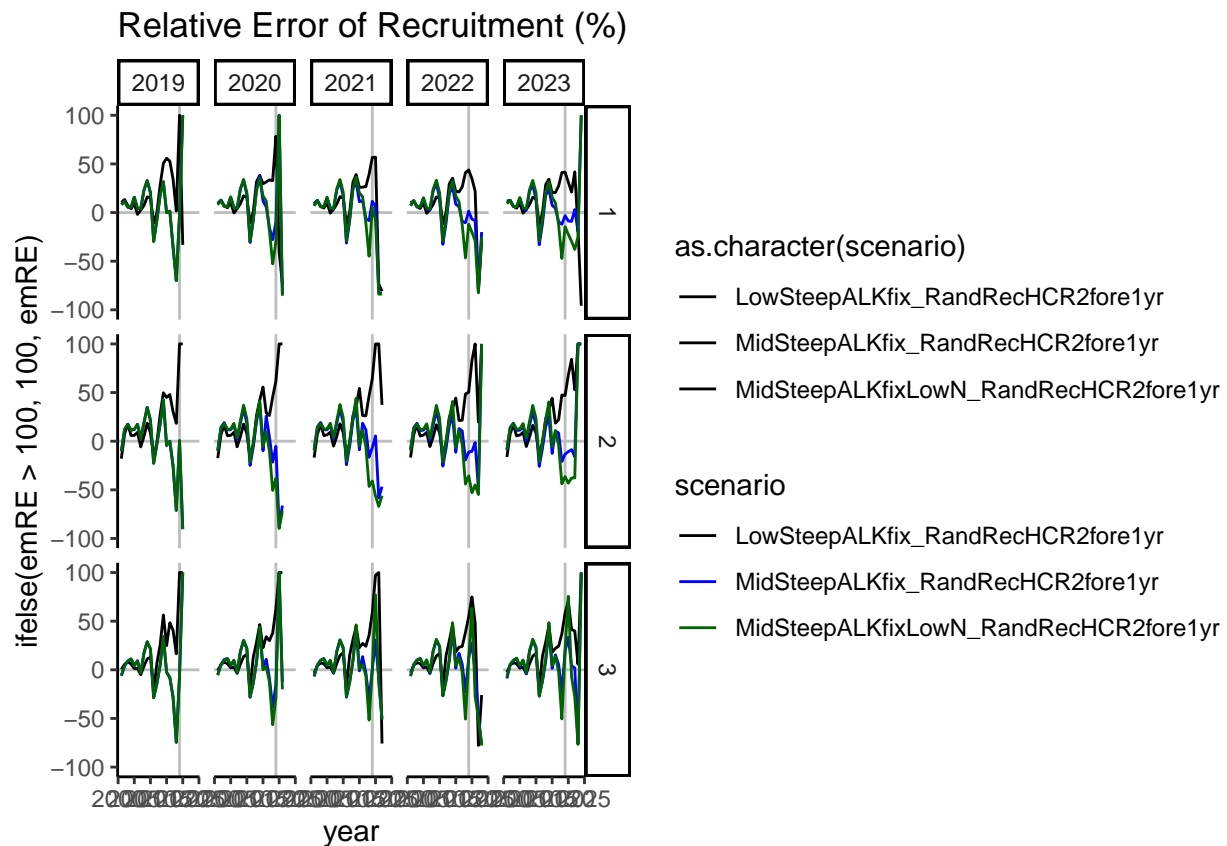
recRE <- recs %>% filter(plotGroup != "OM")
recRE <- recRE %>% pivot_wider(names_from = "plotGroup", values_from = "Value.Recr") %>%
  left_join(y = convrgCheck,
            by = c("model_run", "iteration", "scenario")) %>%
  full_join(y = subset(recs, subset = plotGroup == "OM",
                      by = c("iteration", "scenario", "year")) %>%
            mutate(convrg = case_when(max_grad > 0.01 ~ "non-convrg",
                                       max_grad < 0.01 ~ "convrg",
```

```

TRUE ~ "OM"),
emRE = (EM - Value.Recr)/Value.Recr * 100)

# Plot relative errors of rec devs over time
recRE %>% filter(HCR != "HCR0", 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", 5)) +
  # 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"
```



```

scenarios <- c("constGrow20010M_MidSteepALKfix_RandRecHCR2nofore",
              "constGrow20010M_MidSteepALKfix_RandRecHCR2fore1yr",
              "constGrow20010M_LowSteepALKfix_RandRecHCR2fore1yr",
              "constGrow20010M_MidSteep_RandRecHCR2nofore",
              "constGrow20010M_MidSteep_RandRecHCR2fore1yr")

smryOutputList <- GetSumryOutput(dirSSMSE = mseDir,
                                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.
## 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)

cnvrgCheck <- smryOutputList$sc1Smry %>% #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))

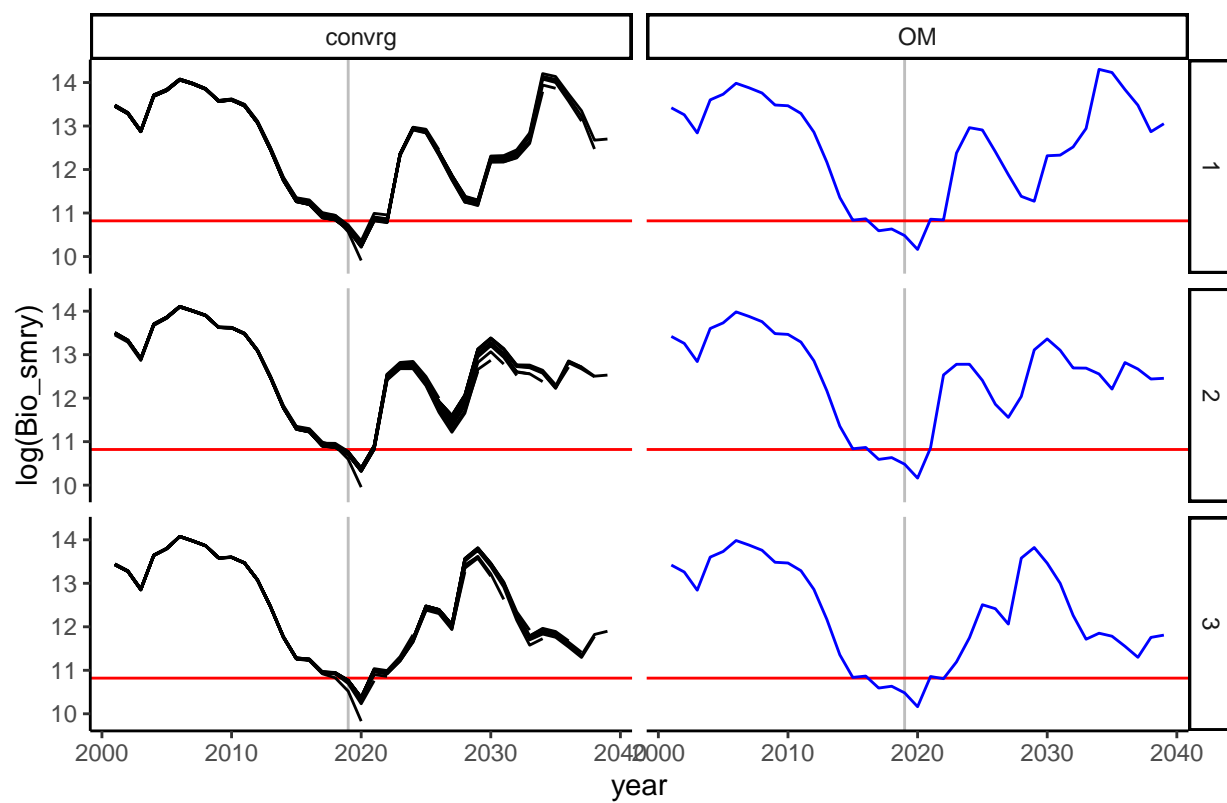
hcrs <- unique(termTS$HCR)
#exIters <- sample(termTS$iteration, size = 4)

cnvrgTS <- smryOutputList$tsSmry %>% mutate(HCR = sub(pattern = ".*Rec", "", scenario),
      recScen = sub(pattern = "HCR.*", "", scenario)) %>%
  mutate(recScen = sub(pattern = ".*OM_", "", recScen)) %>%
  left_join(y = cnvrgCheck, 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"))

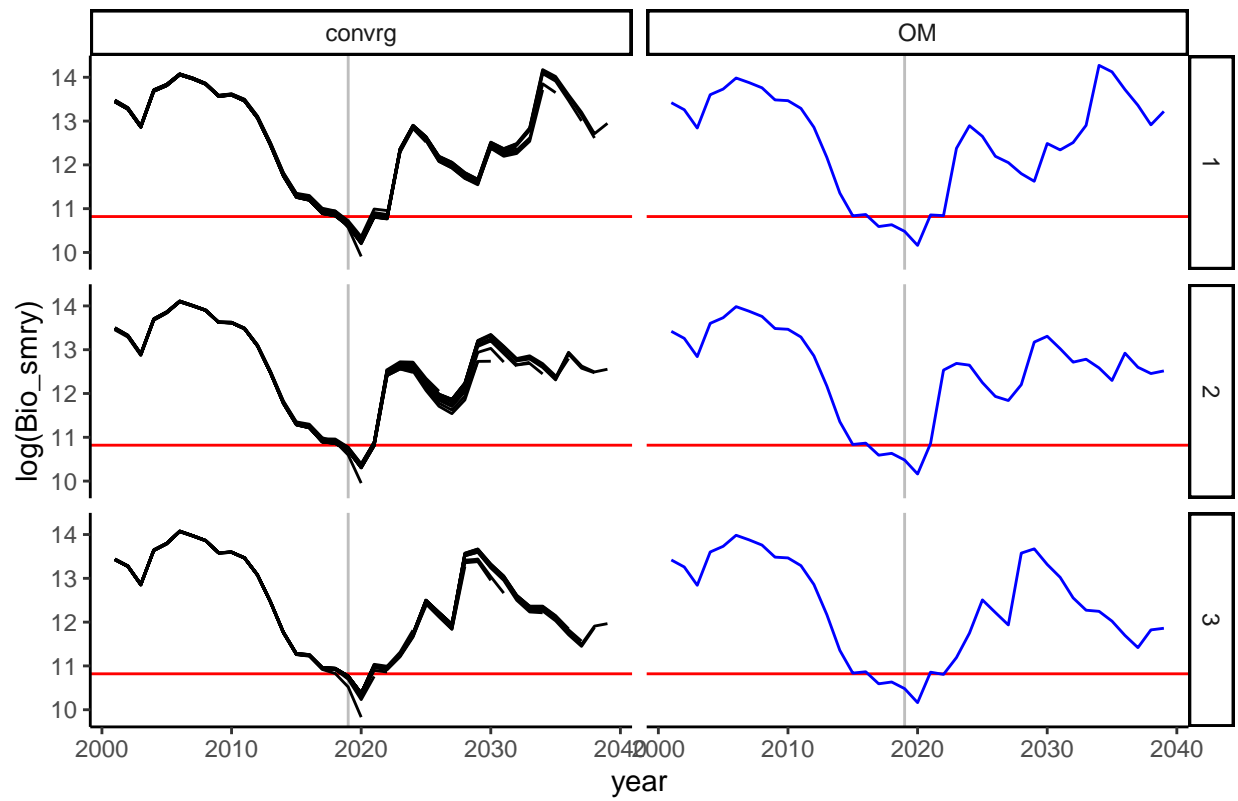
for(mr in 1:length(scenarios)){
  print(cnvrgTS %>% filter(scenario == scenarios[mr], Seas == 1) %>%
    ggplot(aes(x = year, y = log(Bio_smry))) +
    ggplot2::geom_vline(xintercept = 2019, color = "gray") +
    ggplot2::geom_hline(yintercept = log(50000), color = "red") +
    ggplot2::geom_line(aes(linetype = 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]))
}

```

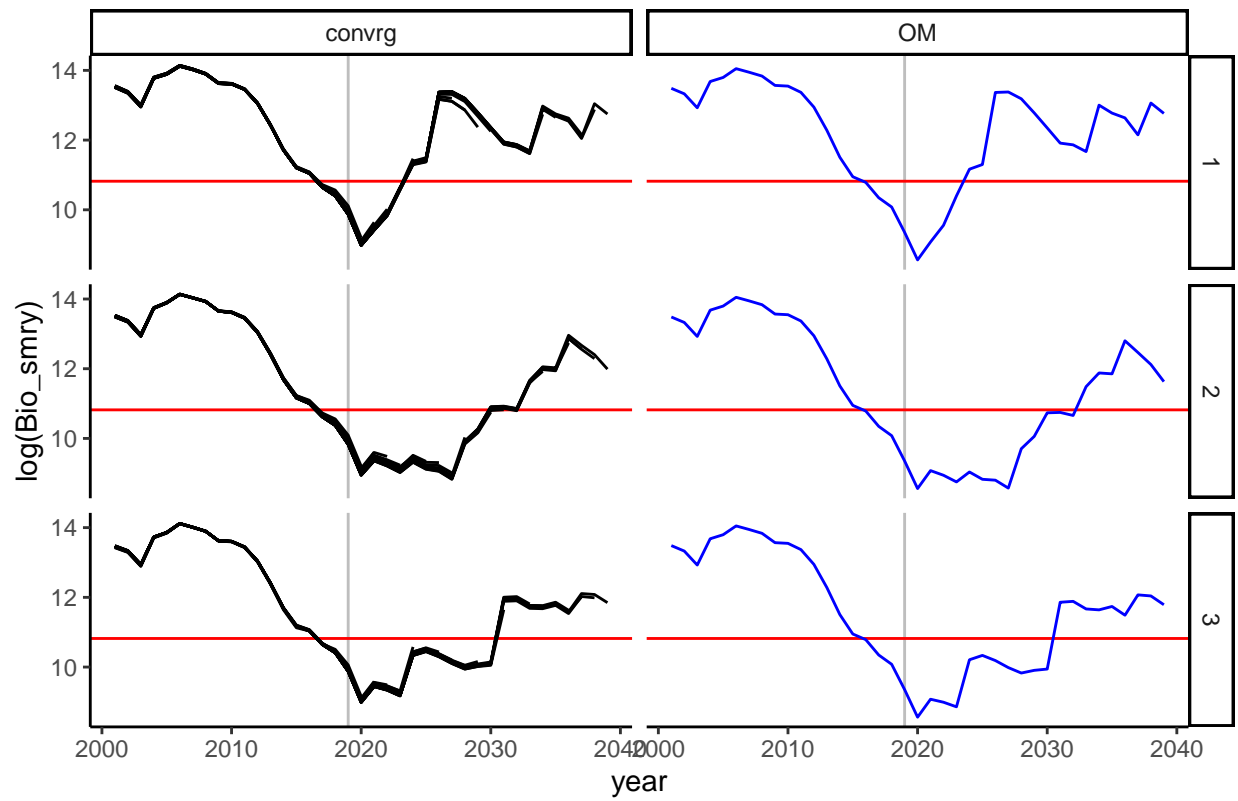
constGrow2001OM_MidSteepALKfix_RandRecHCR2nofore



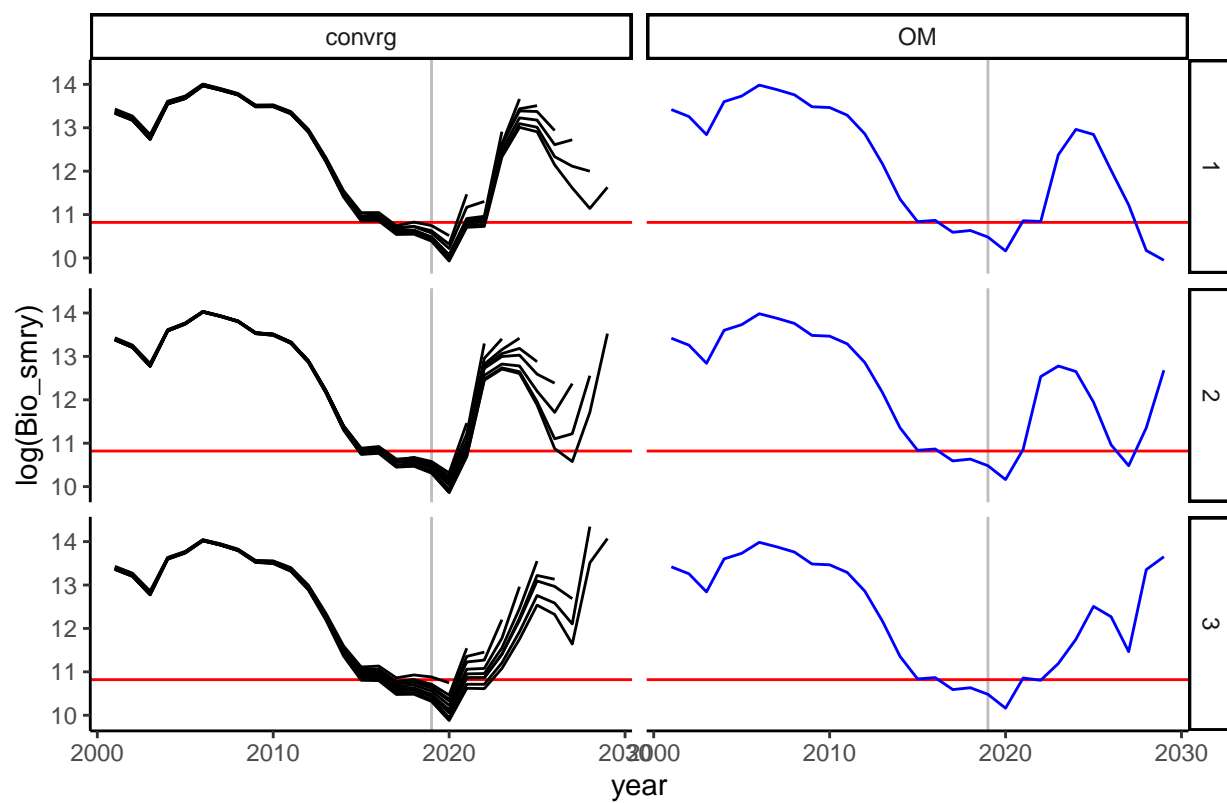
constGrow2001OM_MidSteepALKfix_RandRecHCR2fore1yr

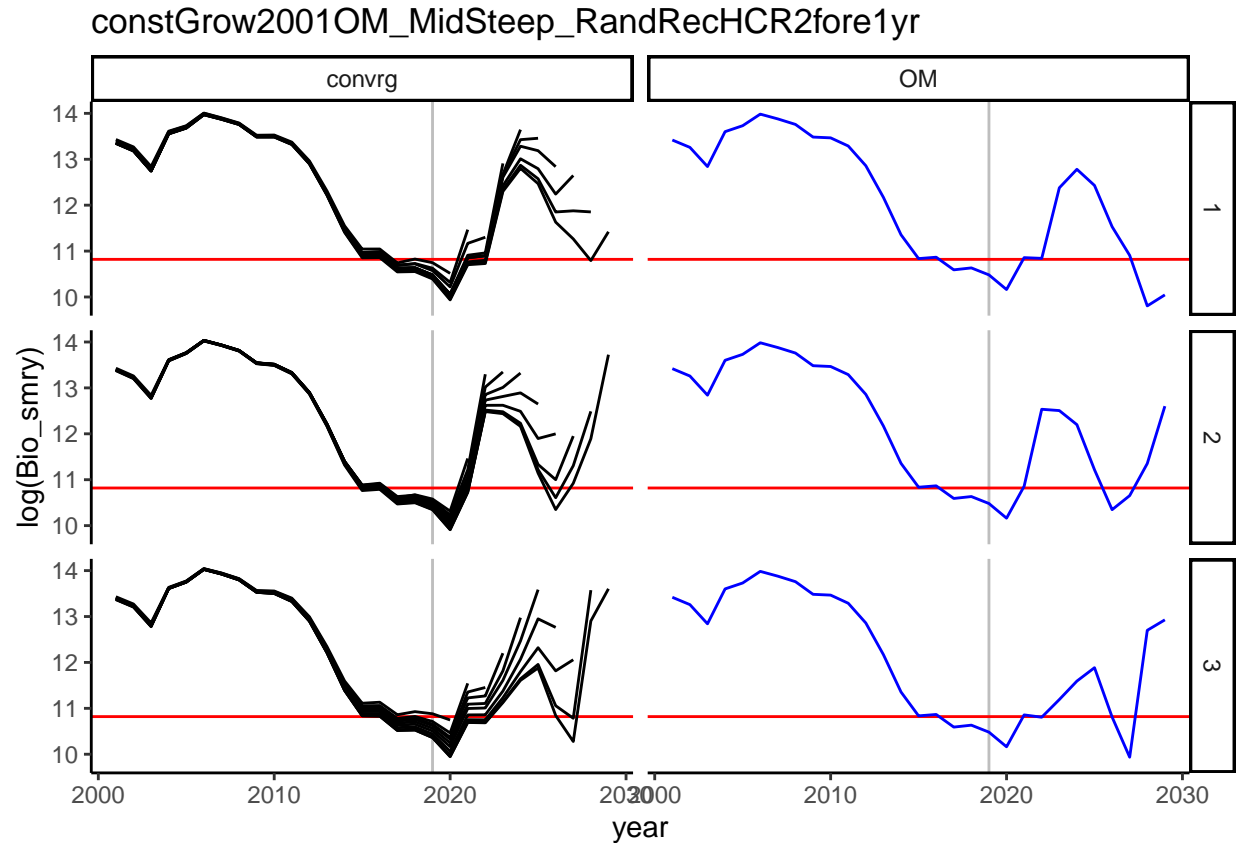


constGrow2001OM_LowSteepALKfix_RandRecHCR2fore1yr



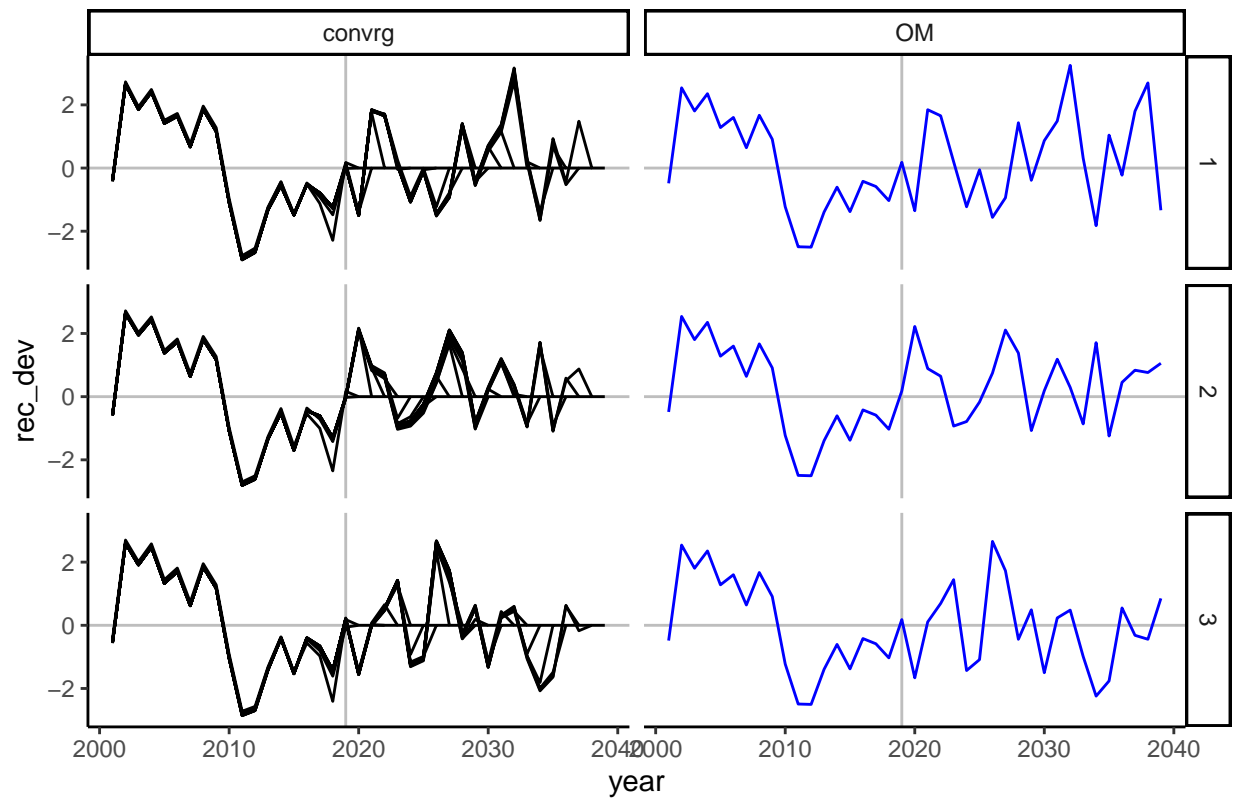
constGrow2001OM_MidSteep_RandRecHCR2nofore



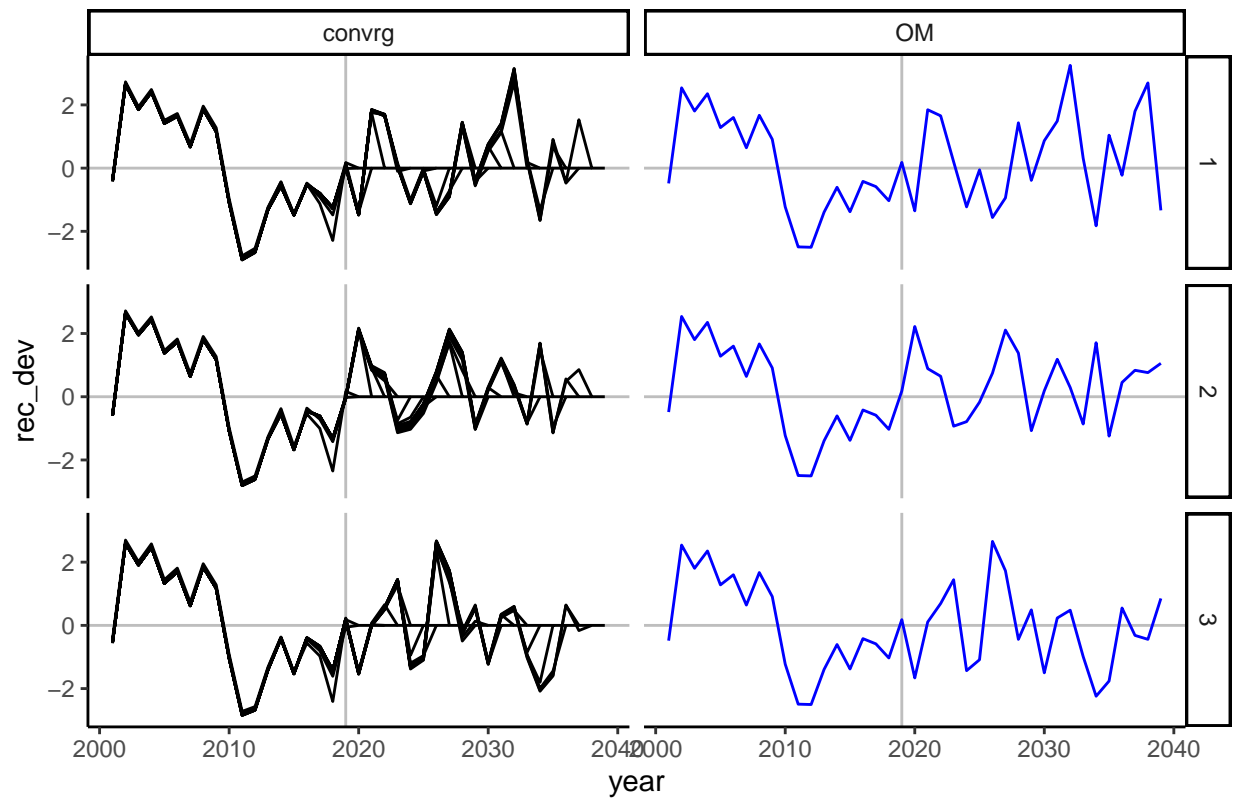


```
for(mr in 1:length(scenarios)){
  print(cnvrgTS %>% filter(scenario == scenarios[mr], Seas == 1) %>%
    ggplot(aes(x = year, y = rec_dev)) +
    ggplot2::geom_vline(xintercept = 2019, color = "gray") +
    ggplot2::geom_hline(yintercept = 0, color = "gray") +
    ggplot2::geom_line(aes(linetype = 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]))
}
```

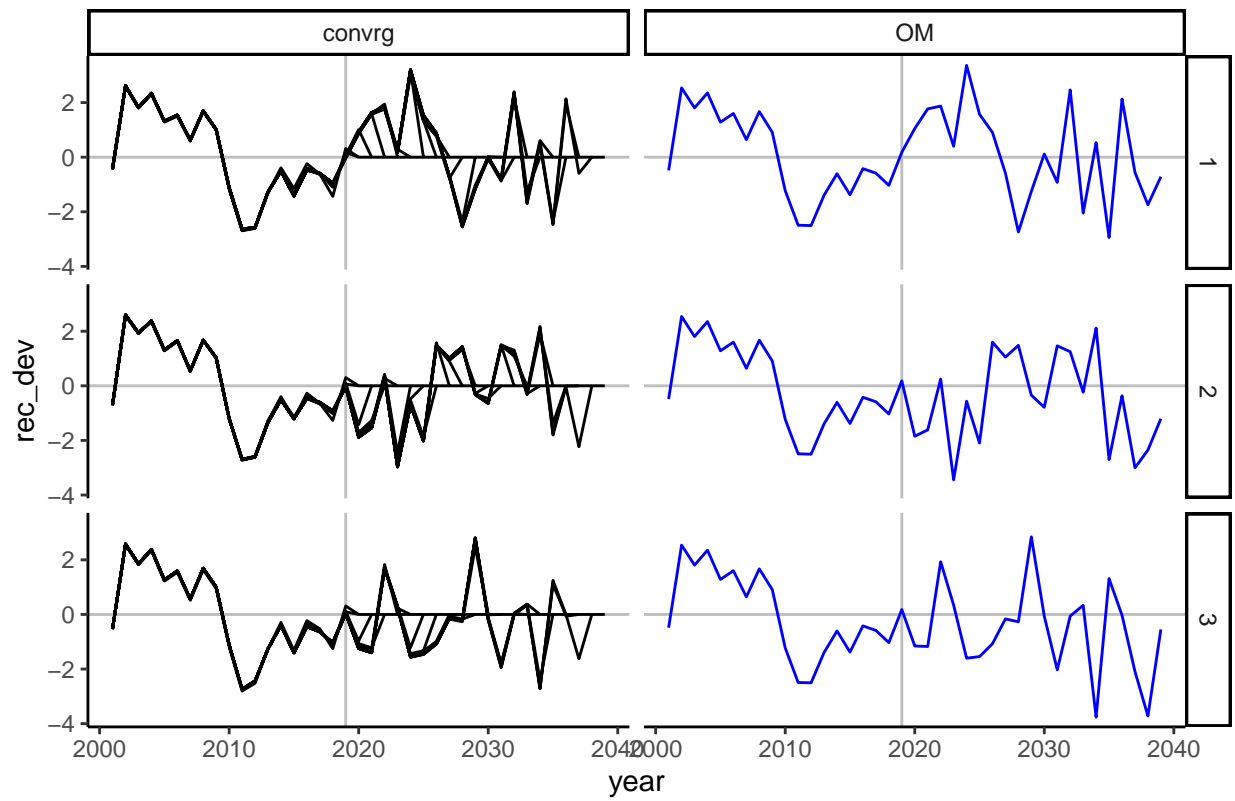
constGrow2001OM_MidSteepALKfix_RandRecHCR2nofore



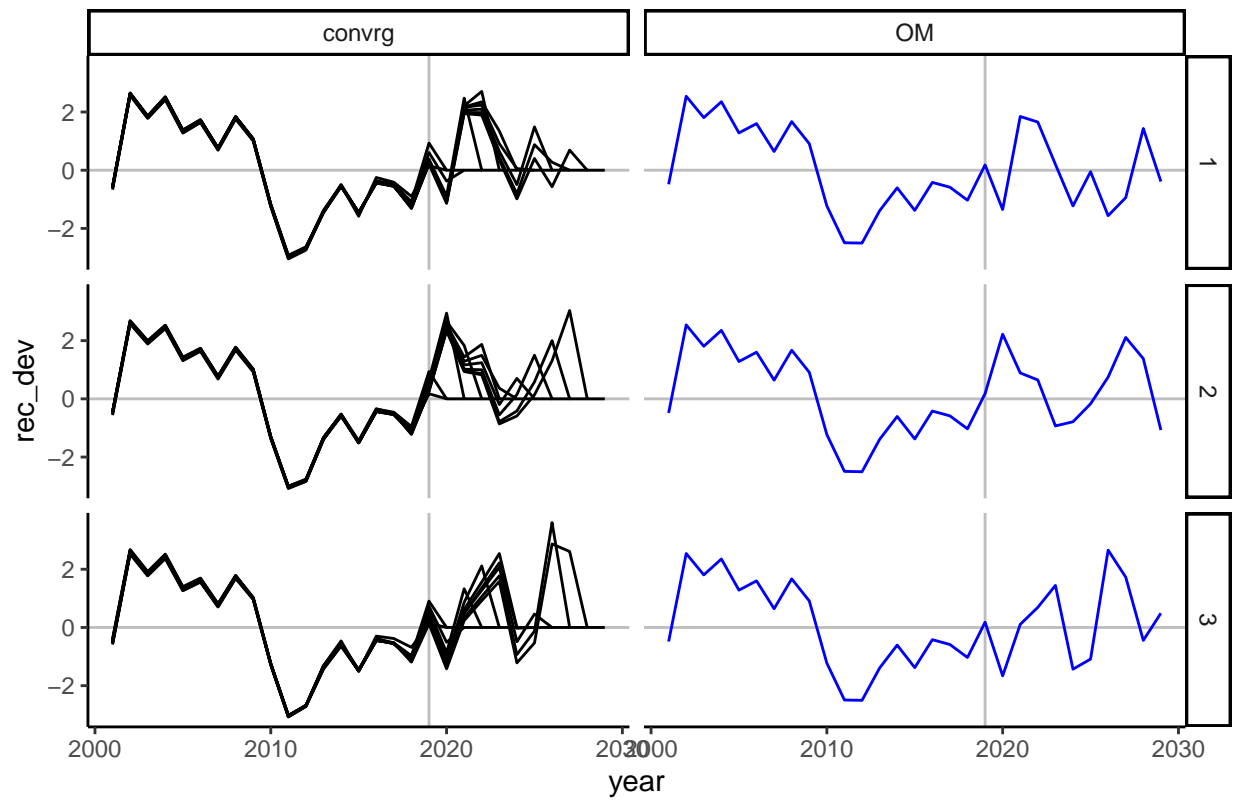
constGrow2001OM_MidSteepALKfix_RandRecHCR2fore1yr



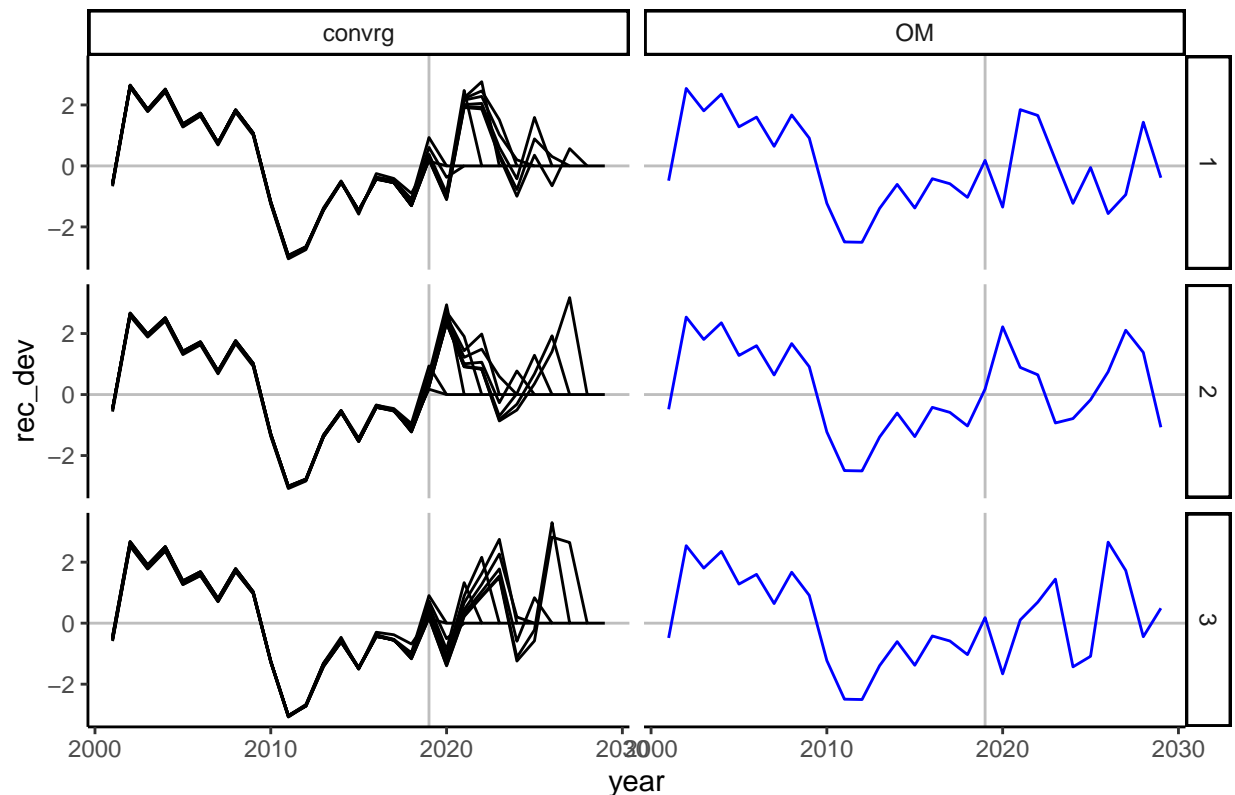
constGrow2001OM_LowSteepALKfix_RandRecHCR2fore1yr



constGrow2001OM_MidSteep_RandRecHCR2nofore



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-convr",
                                       max_grad < 0.01 ~ "convr",
                                       TRUE ~ "OM"),
                  emRE = (EM - Bio_smry)/Bio_smry * 100)

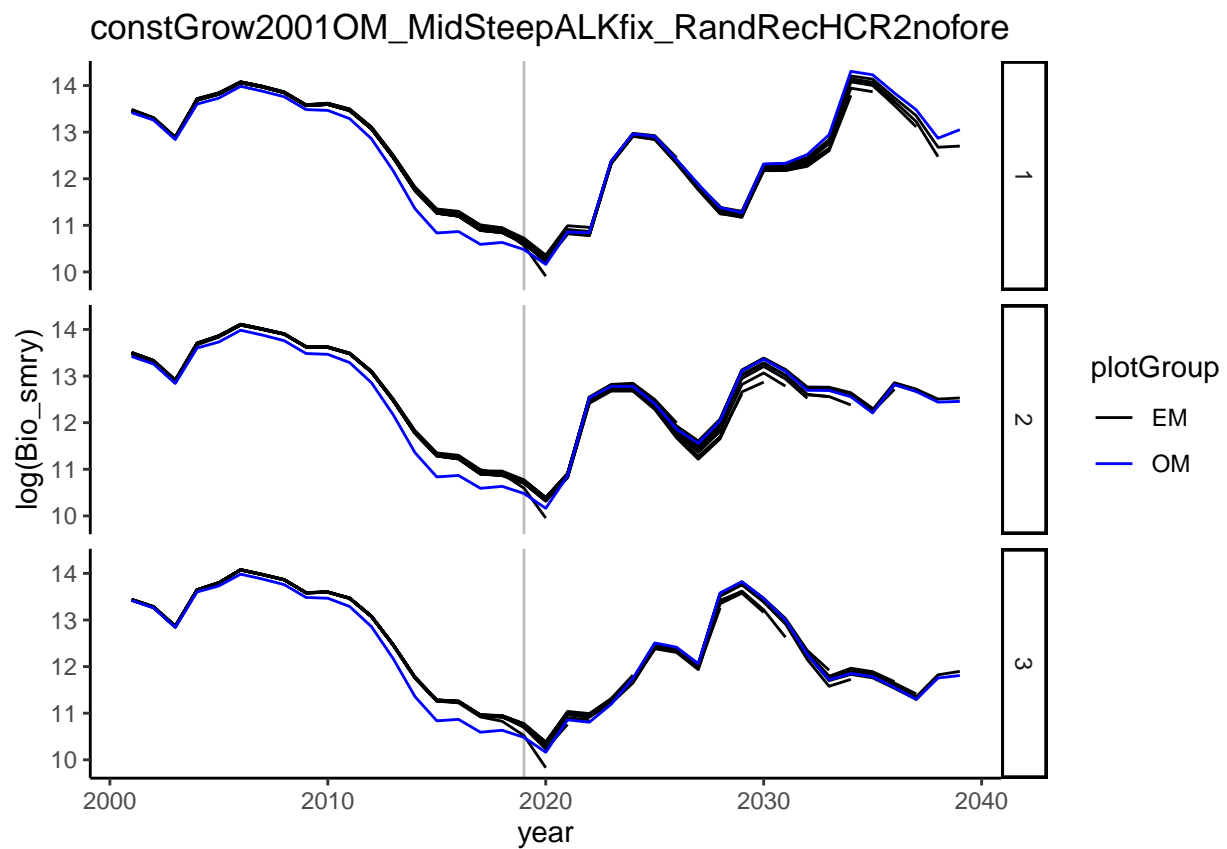
age1PlusBio <- age1PlusBio %>% left_join(y = convrgCheck,
                                         by = c("model_run", "iteration", "scenario")) %>%
  mutate(convrg = case_when(max_grad > 0.01 ~ "non-convr",
                           max_grad < 0.01 ~ "convr",
                           TRUE ~ "OM"))

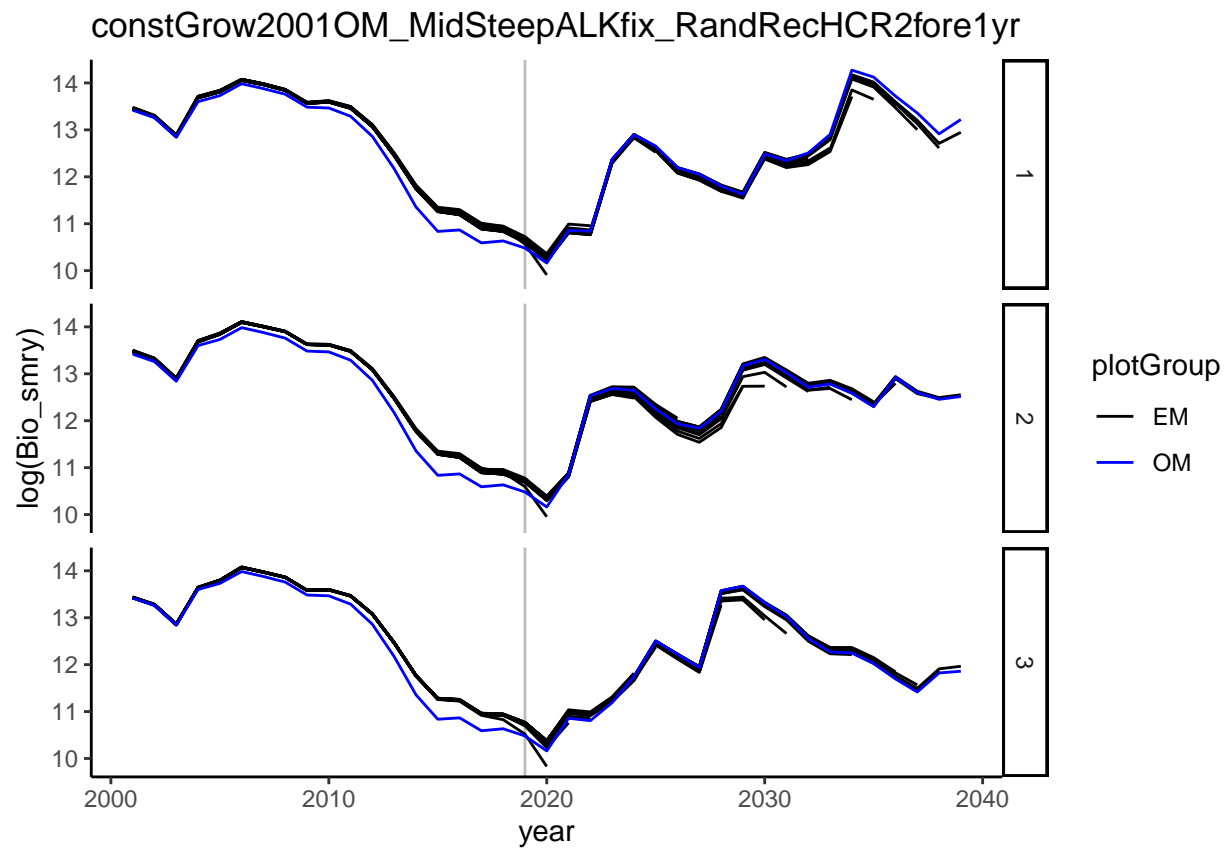
for(mr in 1:length(scenarios)){
  print(age1PlusBio %>% filter(scenario == scenarios[mr], plotGroup != "simData") %>%
    ggplot(aes(x = year, y = log(Bio_smry))) +
    ggplot2::geom_vline(xintercept = 2019, color = "gray") +
```

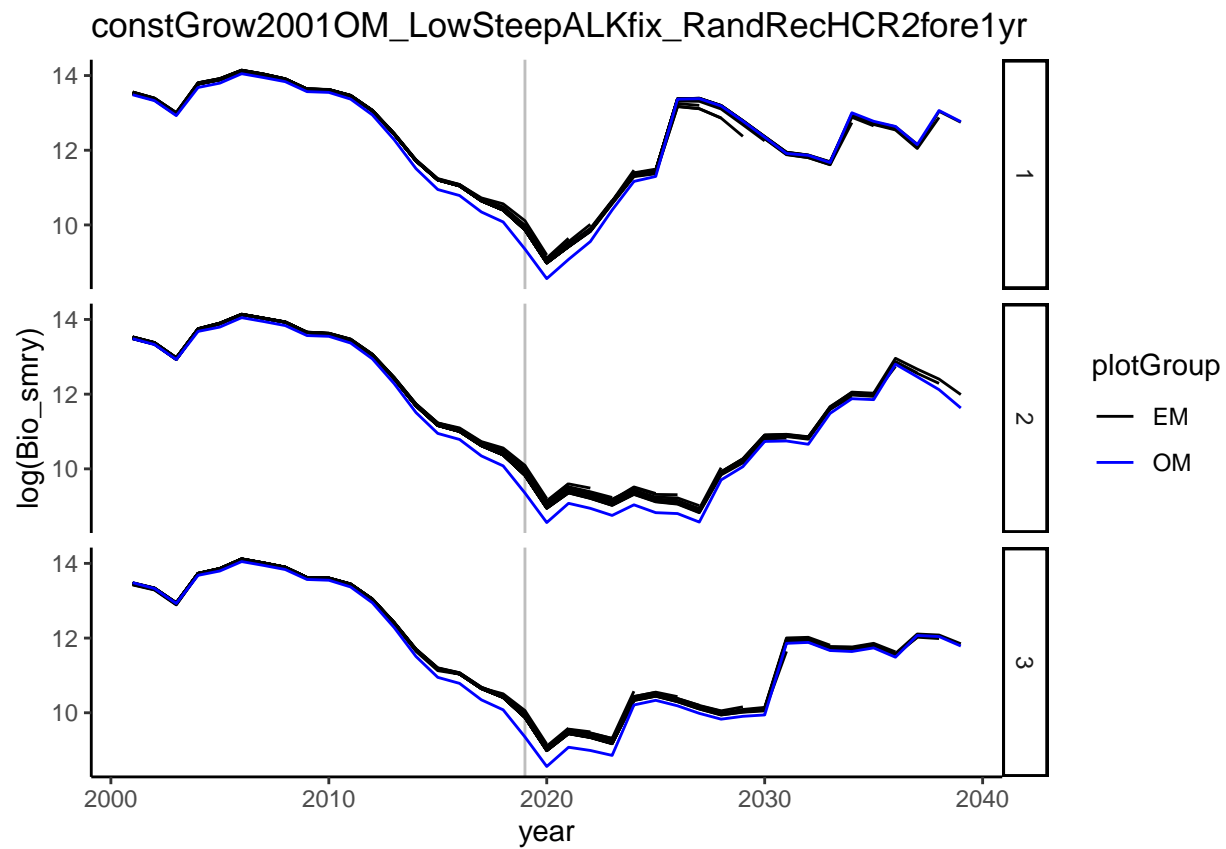
```

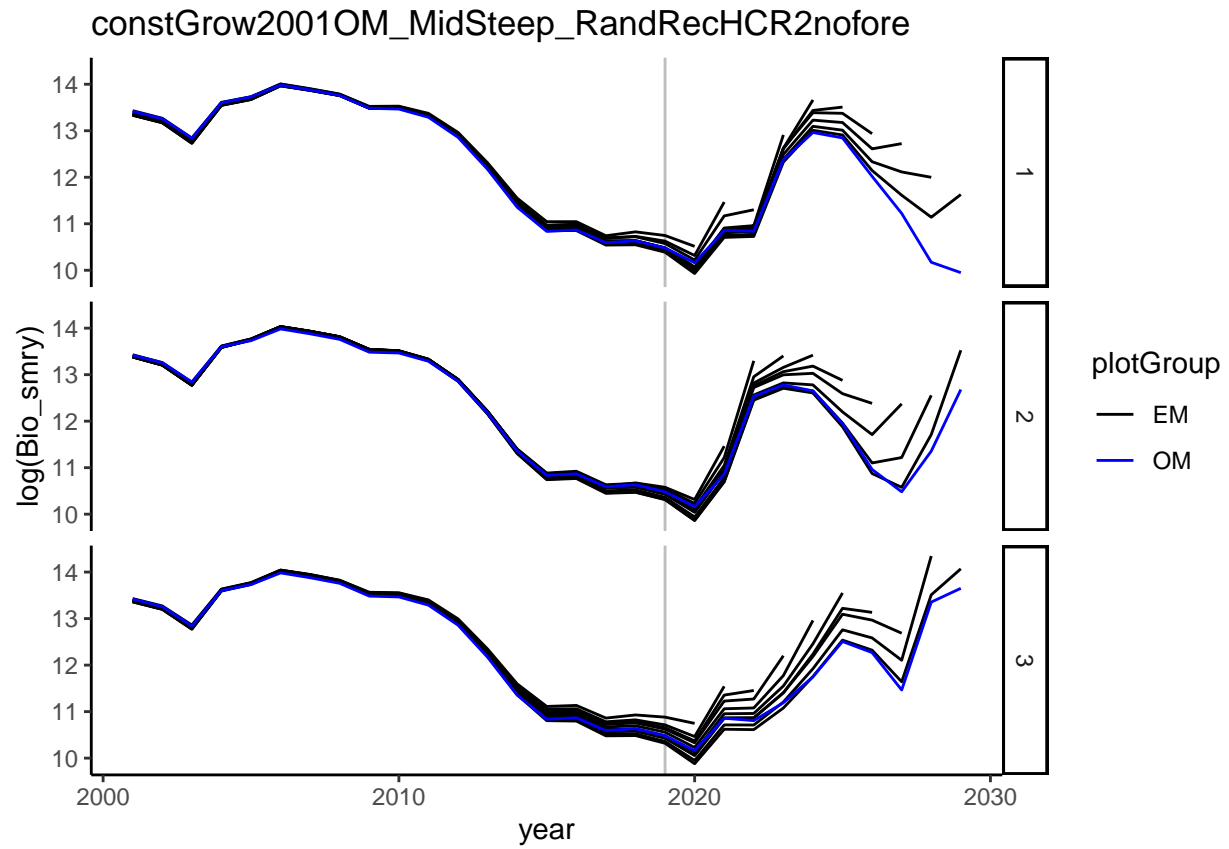
ggplot2::geom_line(ggplot2::aes(linetype = as.character(model_run), color = plotGroup))+
  ggplot2::scale_color_manual(values = c("black", "blue", "#D65F00")) +
  ggplot2::scale_linetype_manual(values = rep("solid", 51)) +
  ggplot2::guides(linetype = "none") +
  ggplot2::facet_grid(rows = vars(iteration))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

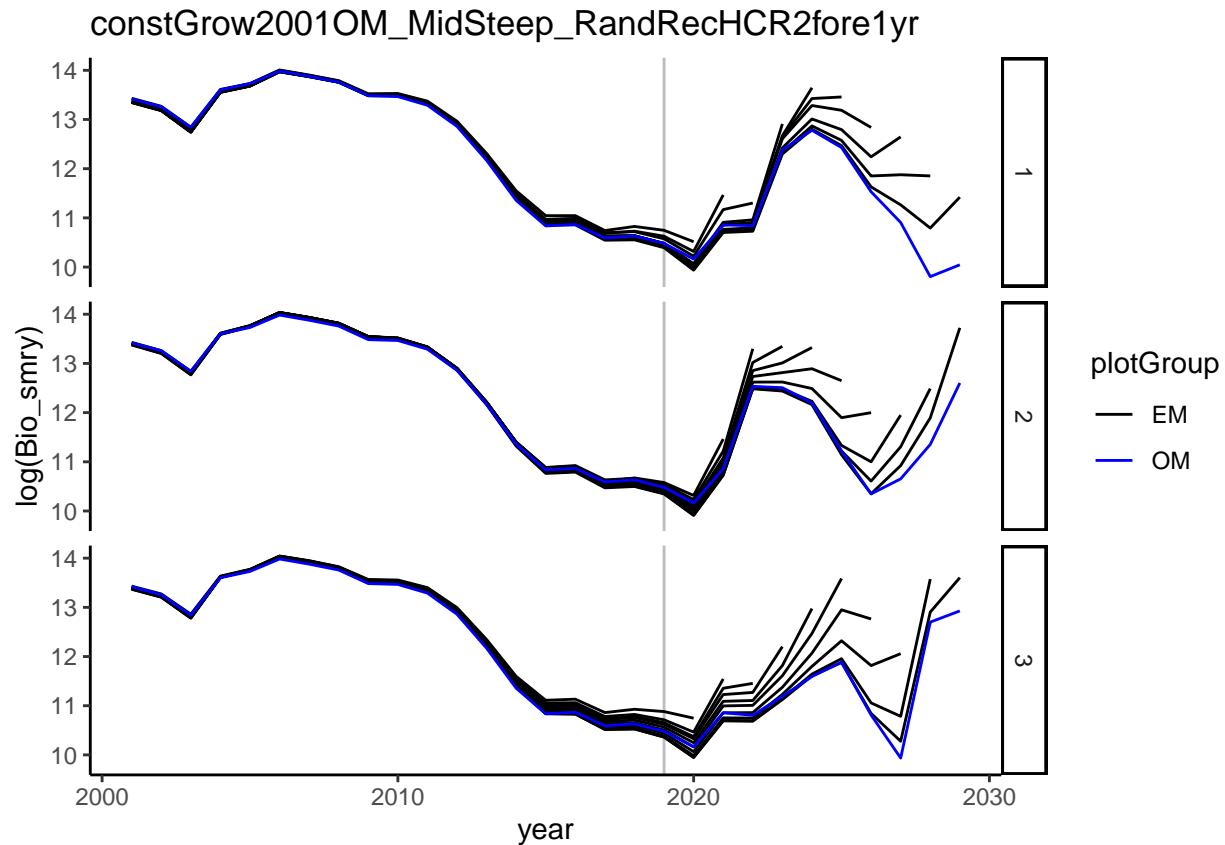
```



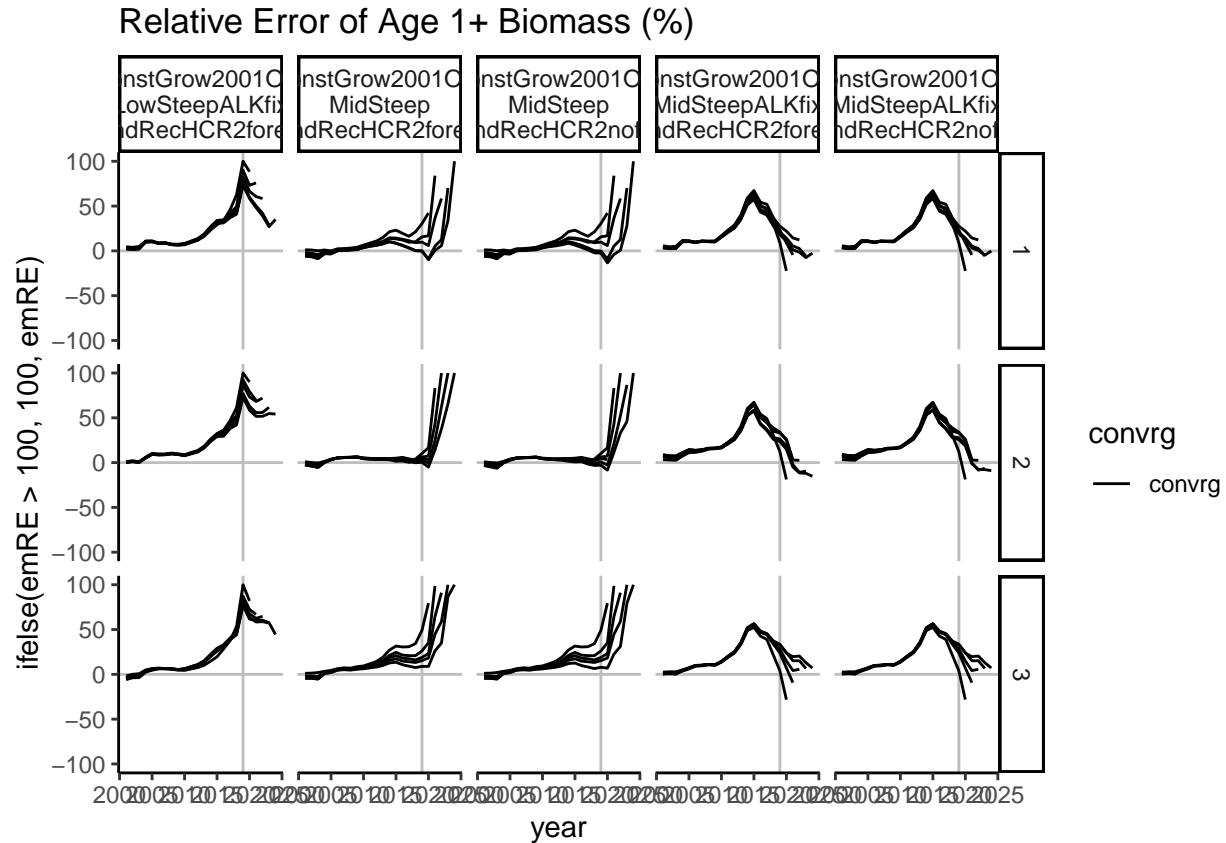




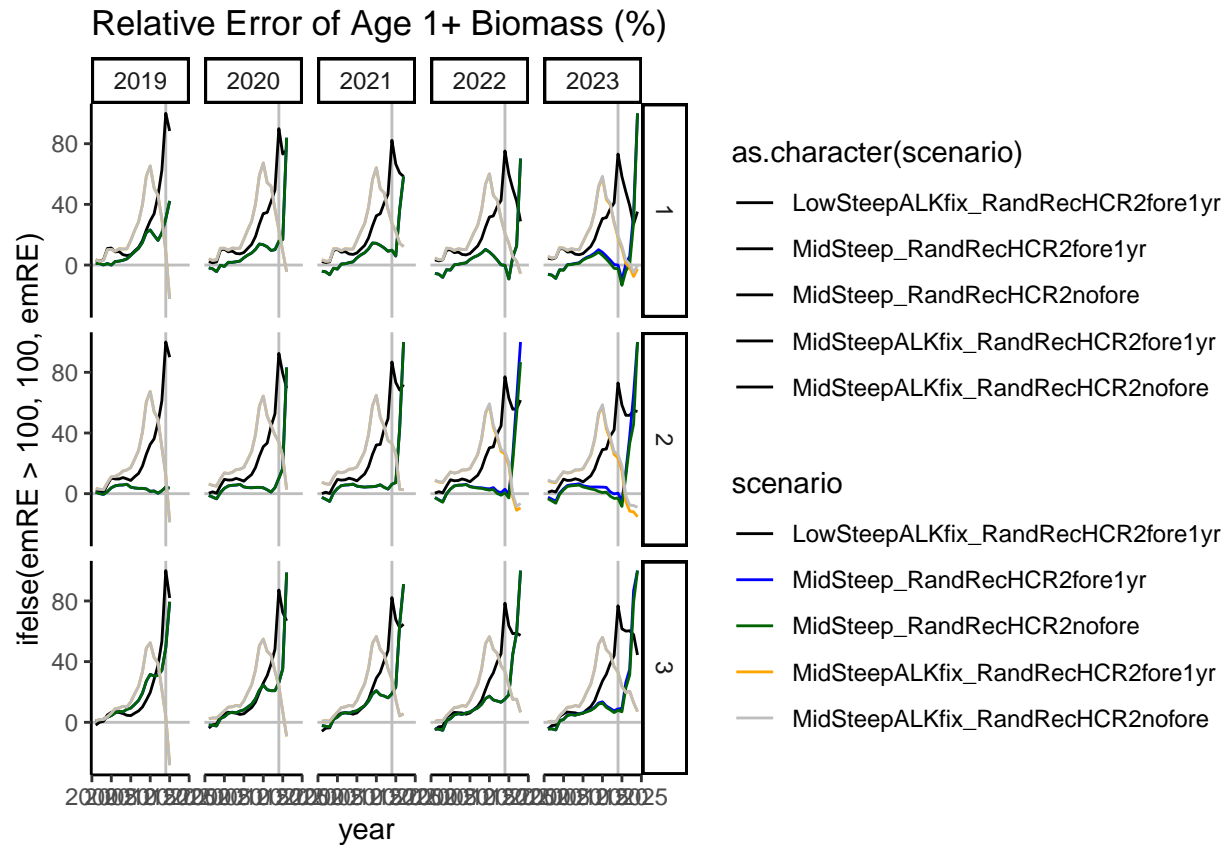




```
# Plot relative errors of biomass over time
age1PlusRE %>% filter(HCR != "HCR0", emYear < 2024) %>%
  mutate(scenario = gsub("_", "\\n", scenario, fixed = TRUE)) %>%
  ggplot(aes(x = year, y = ifelse(emRE > 100, 100, emRE))) + #y = emRE)) +
  geom_vline(xintercept = 2019, color = "gray") +
  geom_hline(yintercept = 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)
```

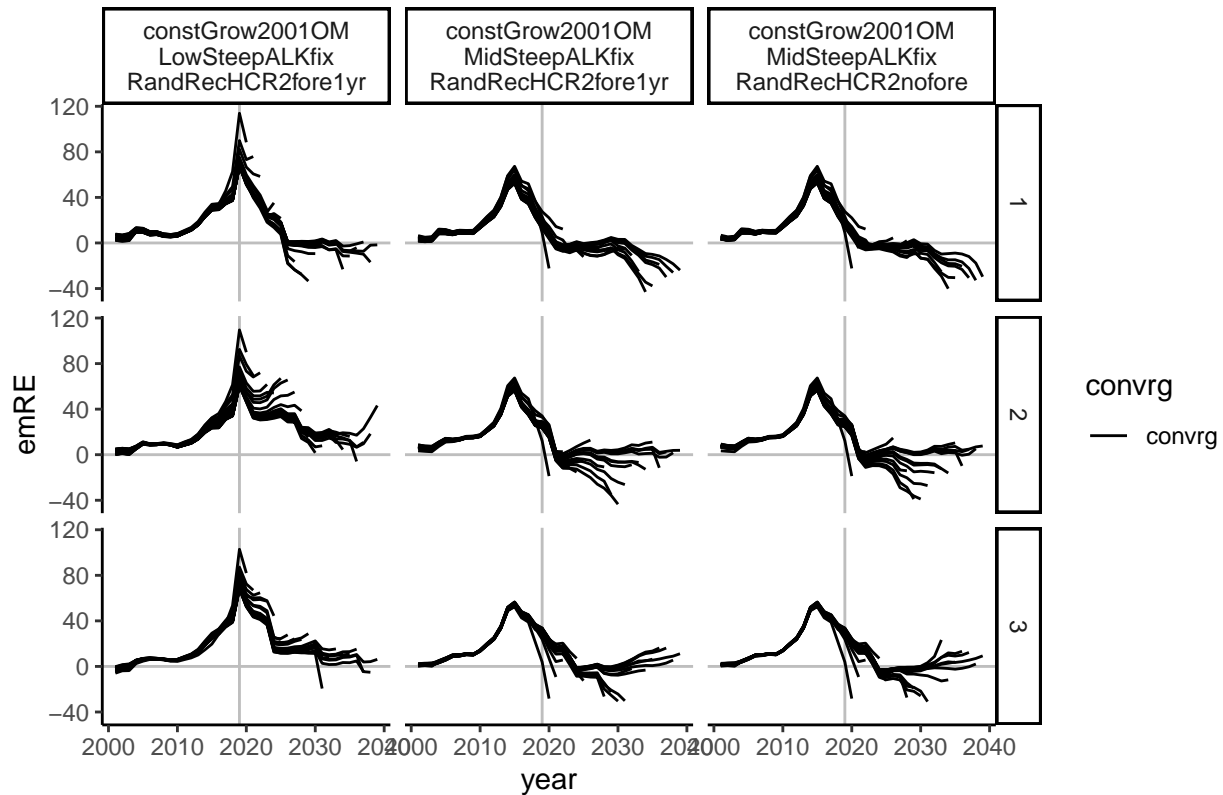


```
age1PlusRE %>% filter(HCR != "HCR0", emYear < 2024, convrg != "non-convg") %>%
  mutate(scenario = gsub("constGrow20010M_", "", scenario, fixed = TRUE)) %>%
  ggplot(aes(x = year, y = ifelse(emRE > 100, 100, emRE))) + #y = emRE)) +
  geom_vline(xintercept = 2019, color = "gray") +
  geom_hline(yintercept = 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", 5)) +
  # 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 (%)

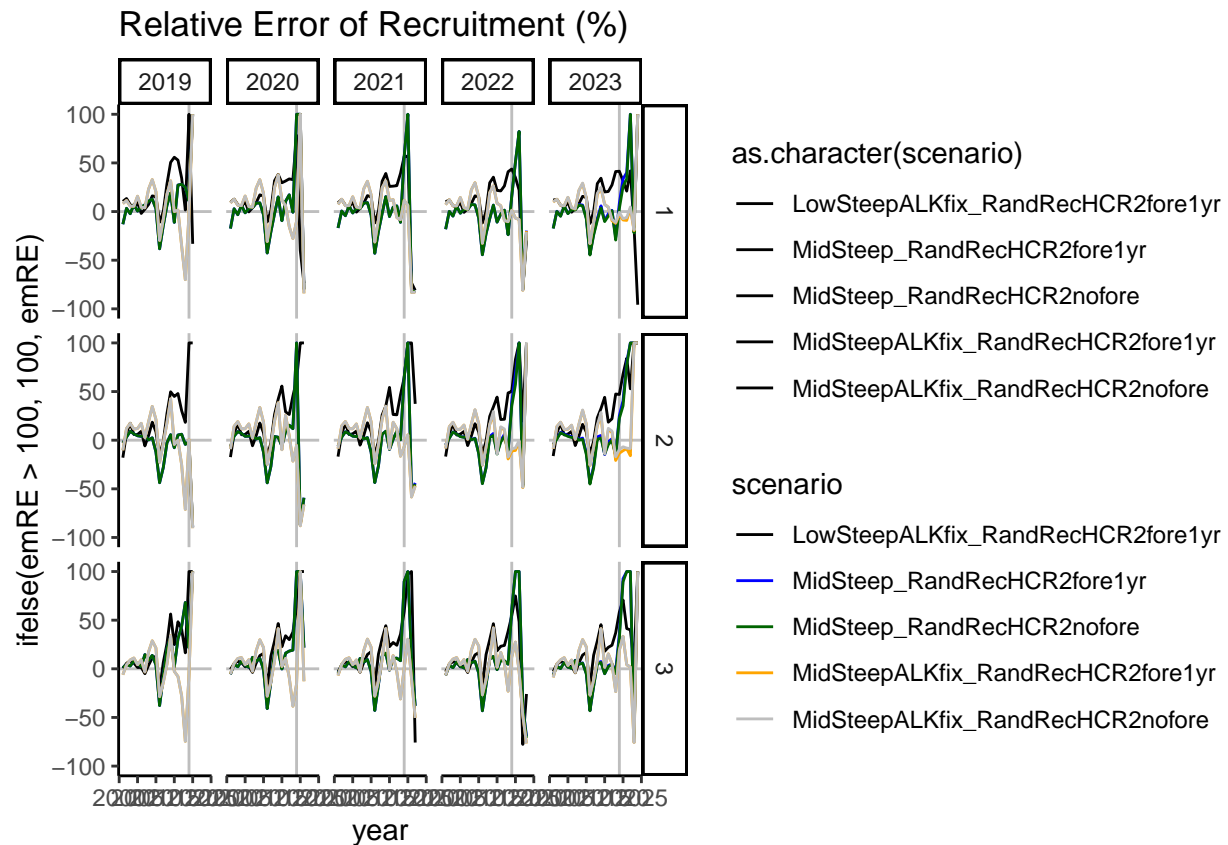


```
# Recruitment error
recs <- smryOutputList$dqSmry %>% #filter(Seas == 1) %>%
  select(year, Value.Recr, model_run, iteration, scenario) %>%
  mutate(plotGroup = case_when(grepl("_OM", model_run, fixed = TRUE) ~ "OM",
                                TRUE ~ "EM"))

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-convg",
                                       max_grad < 0.01 ~ "convrg",
                                       TRUE ~ "OM"),
                  emRE = (EM - Value.Recr)/Value.Recr * 100))

# Plot relative errors of rec devs over time
recRE %>% filter(HCR != "HCR0", emYear < 2024, convrg != "non-convg") %>%
  mutate(scenario = gsub("constGrow2001OM_", "", 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", 5)) +
```

```
# 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)

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

scenarios <- c("constGrow20010M_MidSteep_RandRecHCR2nofore",
               "constGrow20010M_MidSteep_RandRecHCR2fore1yr",
               "constGrow20010M_MidSteep_RandRecHCR2fore5yr",
               "constGrow20010M_MidSteep_RandRecHCR2bavg")

smryOutputList <- GetSmryOutput(dirSSMSE = mseDir,
                                scenarios = scenarios)
```

```
## 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,
              fixed = TRUE, value = TRUE)

convrgeCheck <- 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)
```

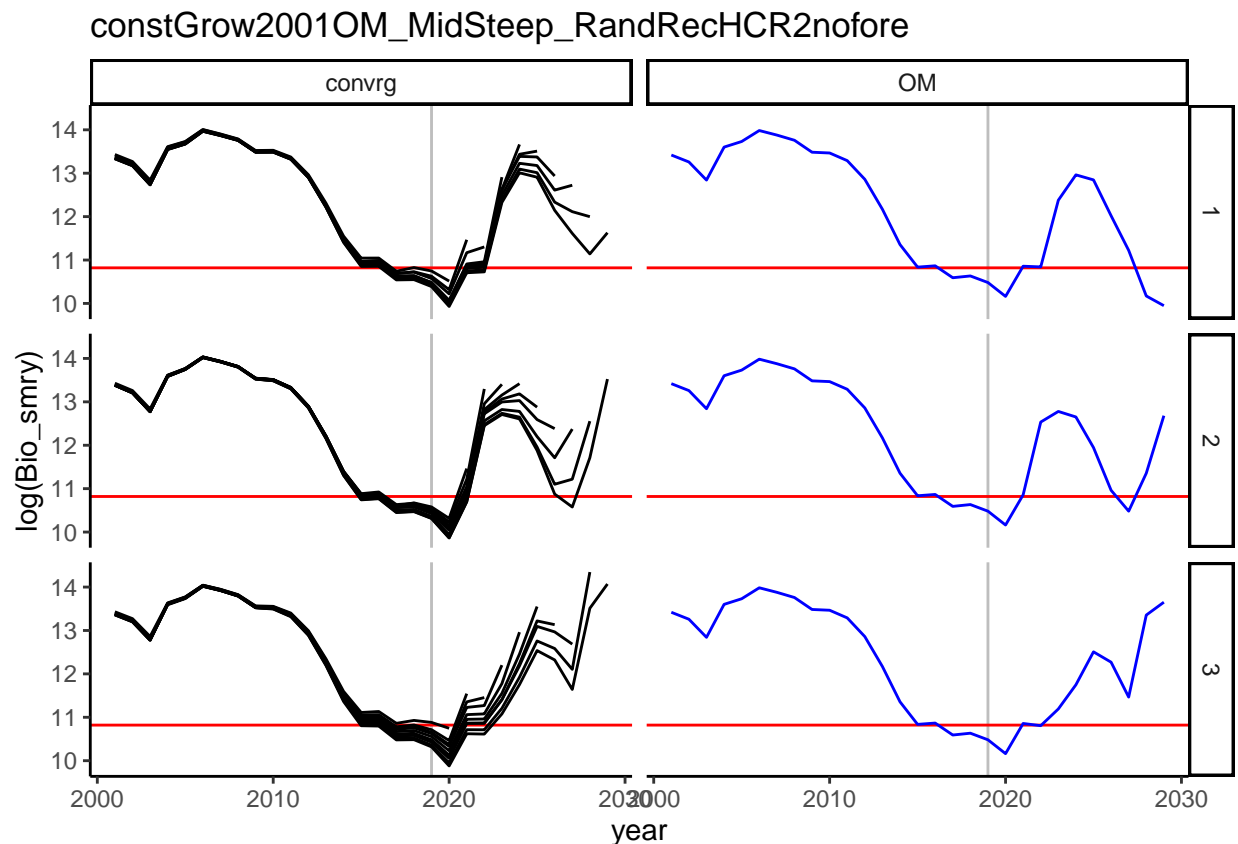
```

#exIters <- sample(termTS$iteration, size = 4)

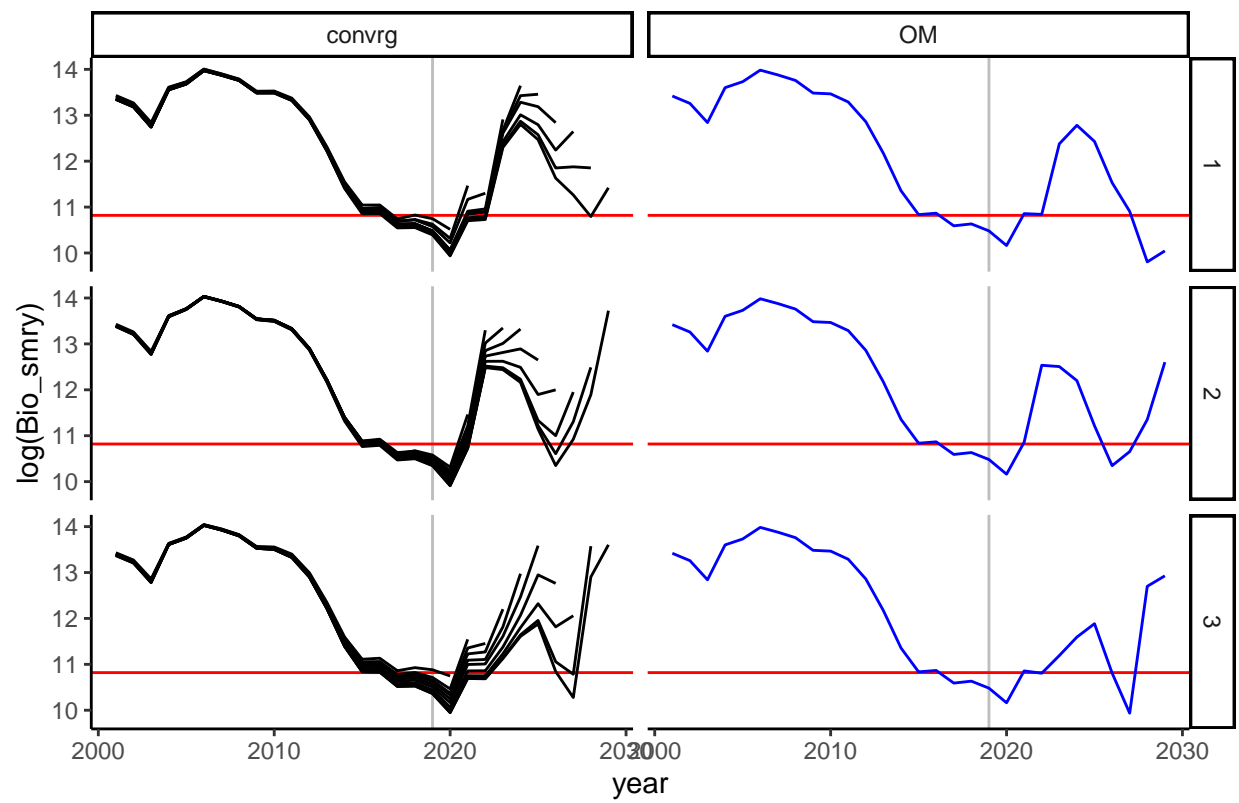
cnvrgTS <- smryOutputList$tsSmry %>% mutate(HCR = sub(pattern = ".*Rec","", scenario),
                                             recScen = sub(pattern = "HCR.*","", scenario)) %>%
  mutate(recScen = sub(pattern = ".*OM_","", recScen)) %>%
  left_join(y = cnvrgCheck, by = c("iteration", "model_run", "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") +
    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]))
}

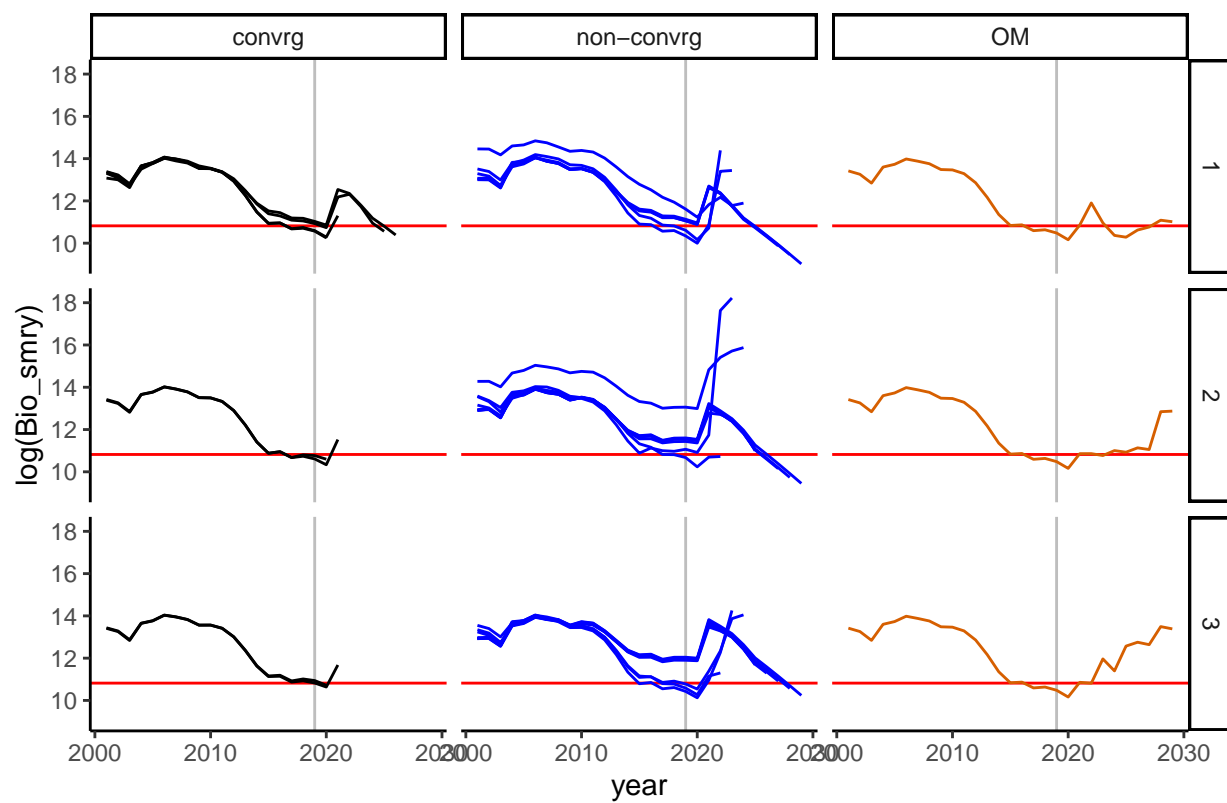
```



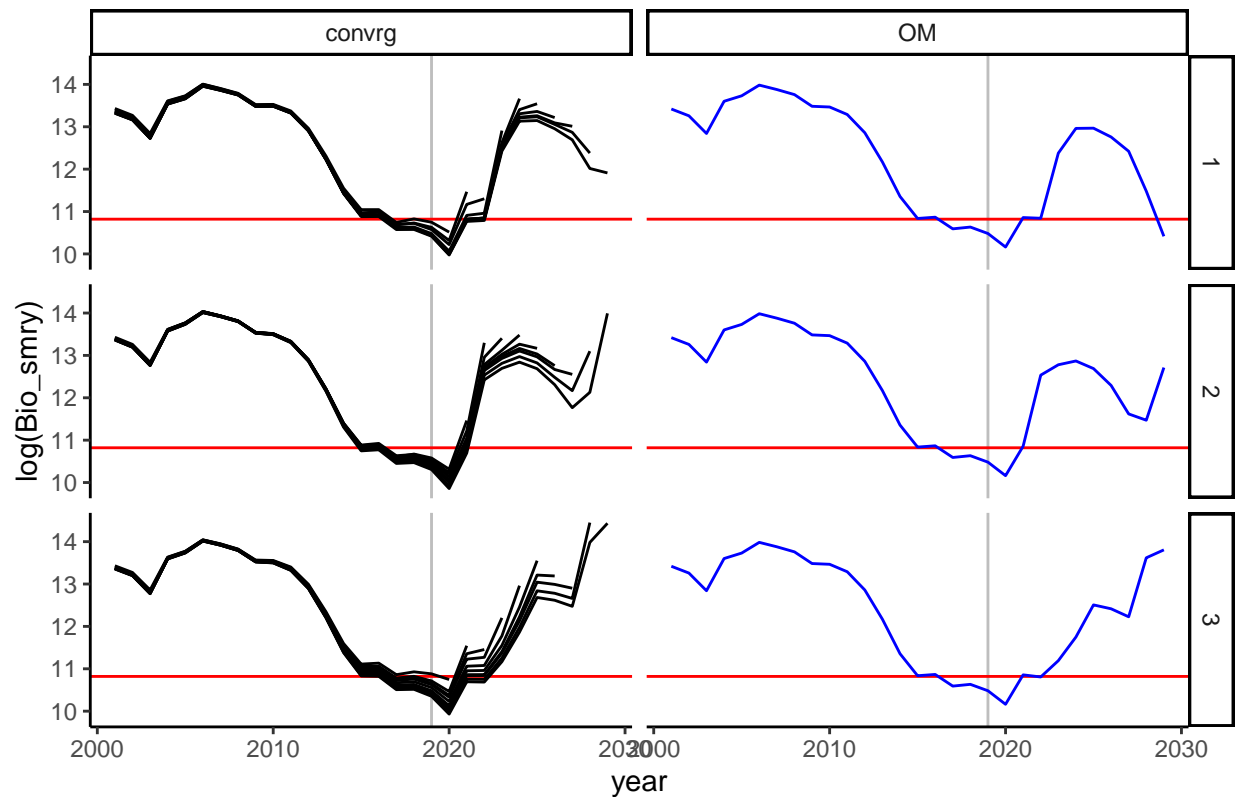
constGrow2001OM_MidSteep_RandRecHCR2fore1yr



constGrow2001OM_MidSteep_RandRecHCR2fore5yr

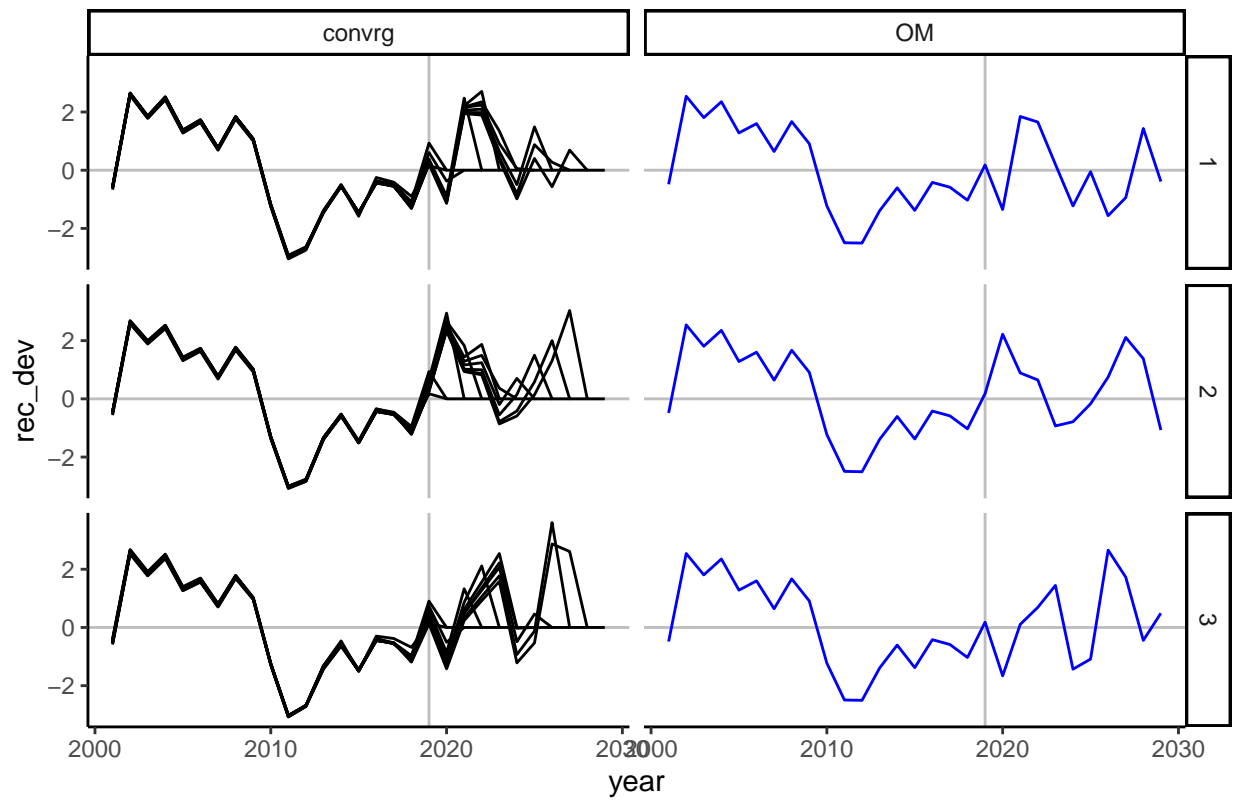


constGrow2001OM_MidSteep_RandRecHCR2bavg

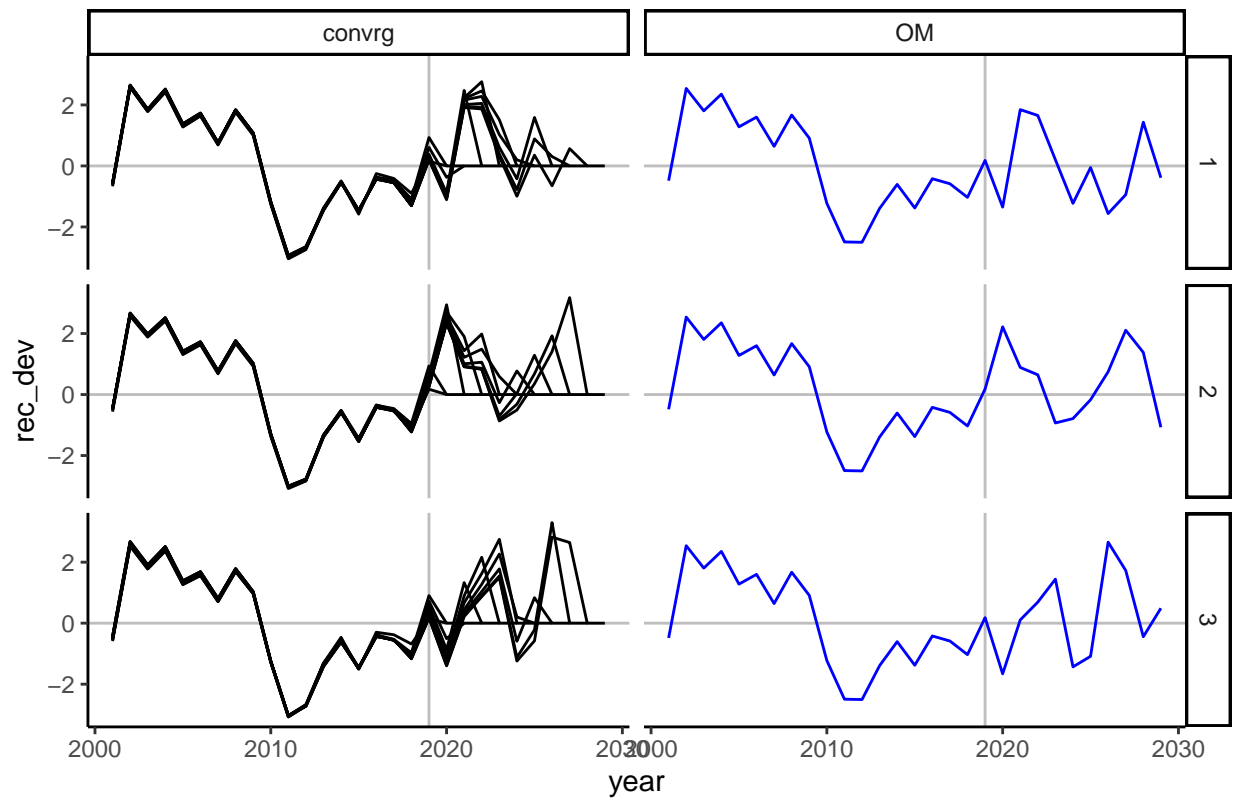


```
for(mr in 1:length(scenarios)){
  print(cnvrgTS %>% filter(scenario == scenarios[mr], Seas == 1) %>%
    ggplot(aes(x = year, y = rec_dev)) +
    ggplot2::geom_vline(xintercept = 2019, color = "gray") +
    ggplot2::geom_hline(yintercept = 0, color = "gray") +
    ggplot2::geom_line(aes(linetype = 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]))
}
```

constGrow2001OM_MidSteep_RandRecHCR2nofore

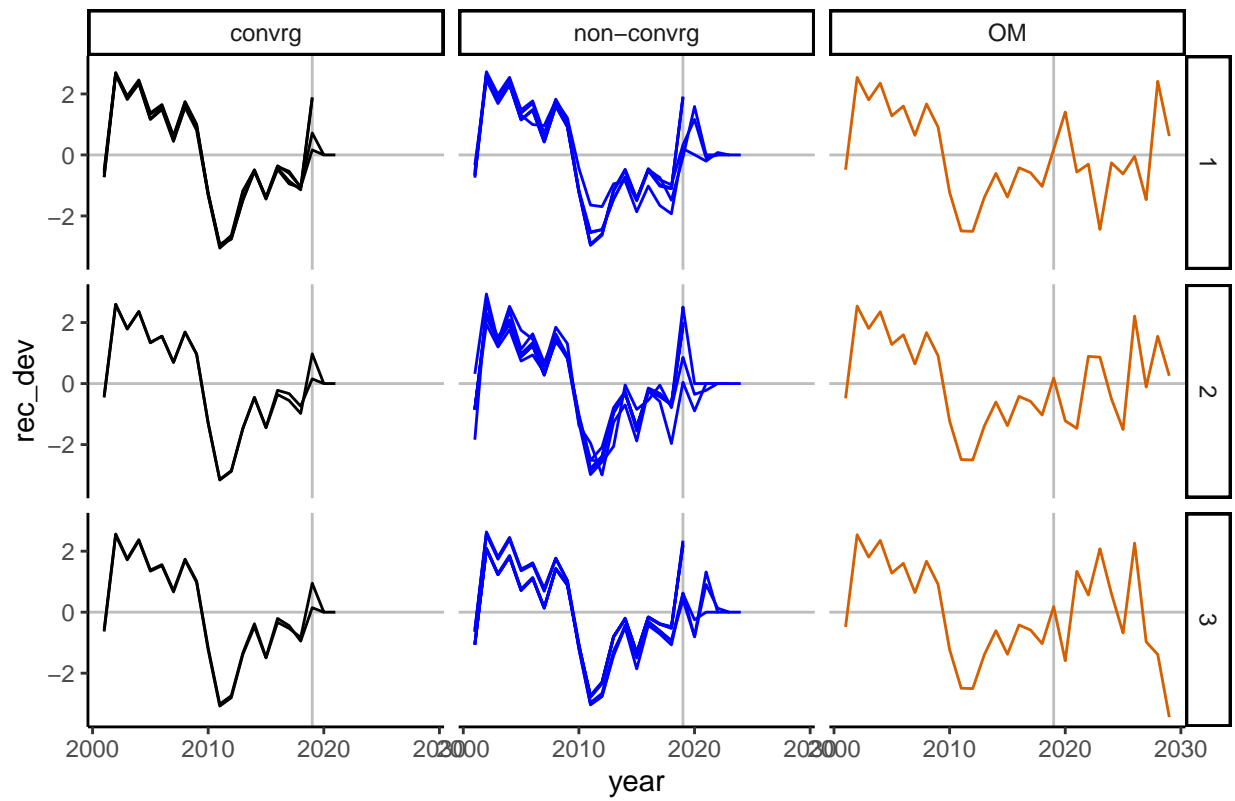


constGrow2001OM_MidSteep_RandRecHCR2fore1yr

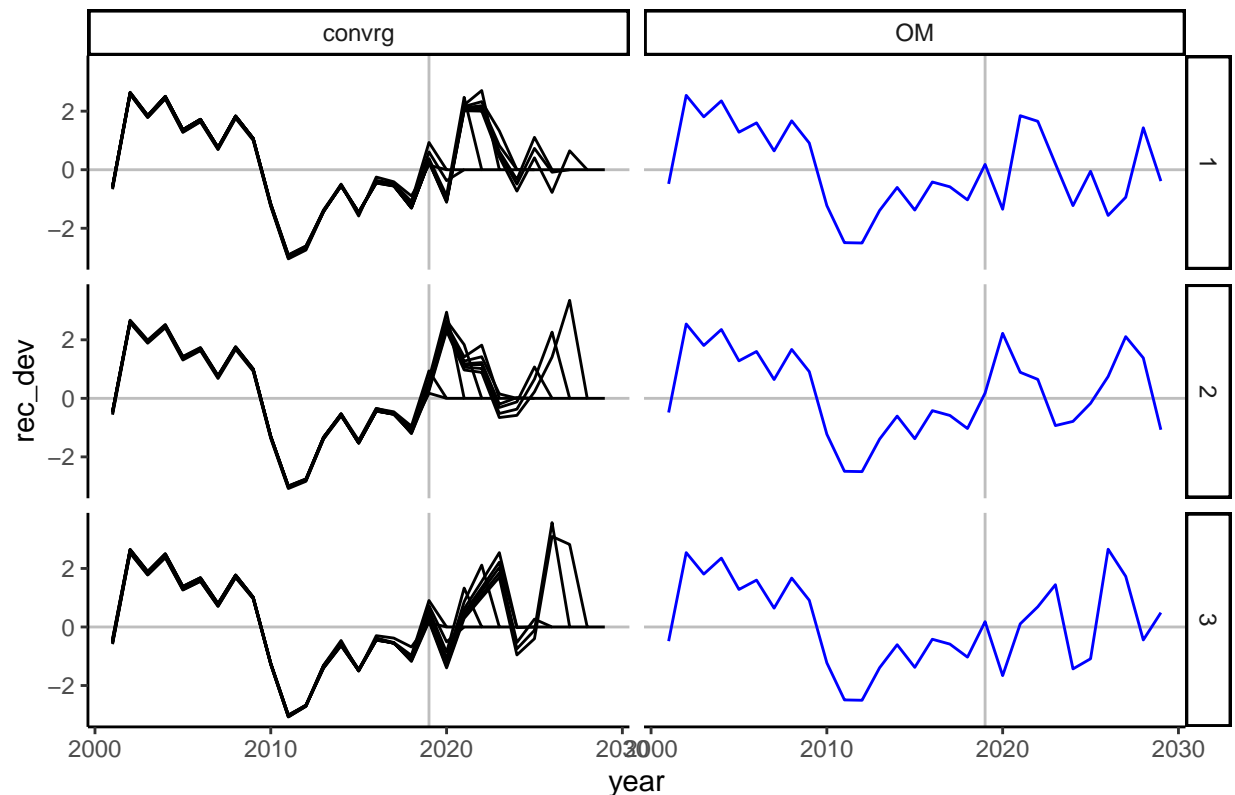


Warning: Removed 53 row(s) containing missing values (geom_path).

constGrow2001OM_MidSteep_RandRecHCR2fore5yr



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-convr",
                            max_grad < 0.01 ~ "convr",
                            TRUE ~ "OM"),
         emRE = (EM - Bio_smry)/Bio_smry * 100)

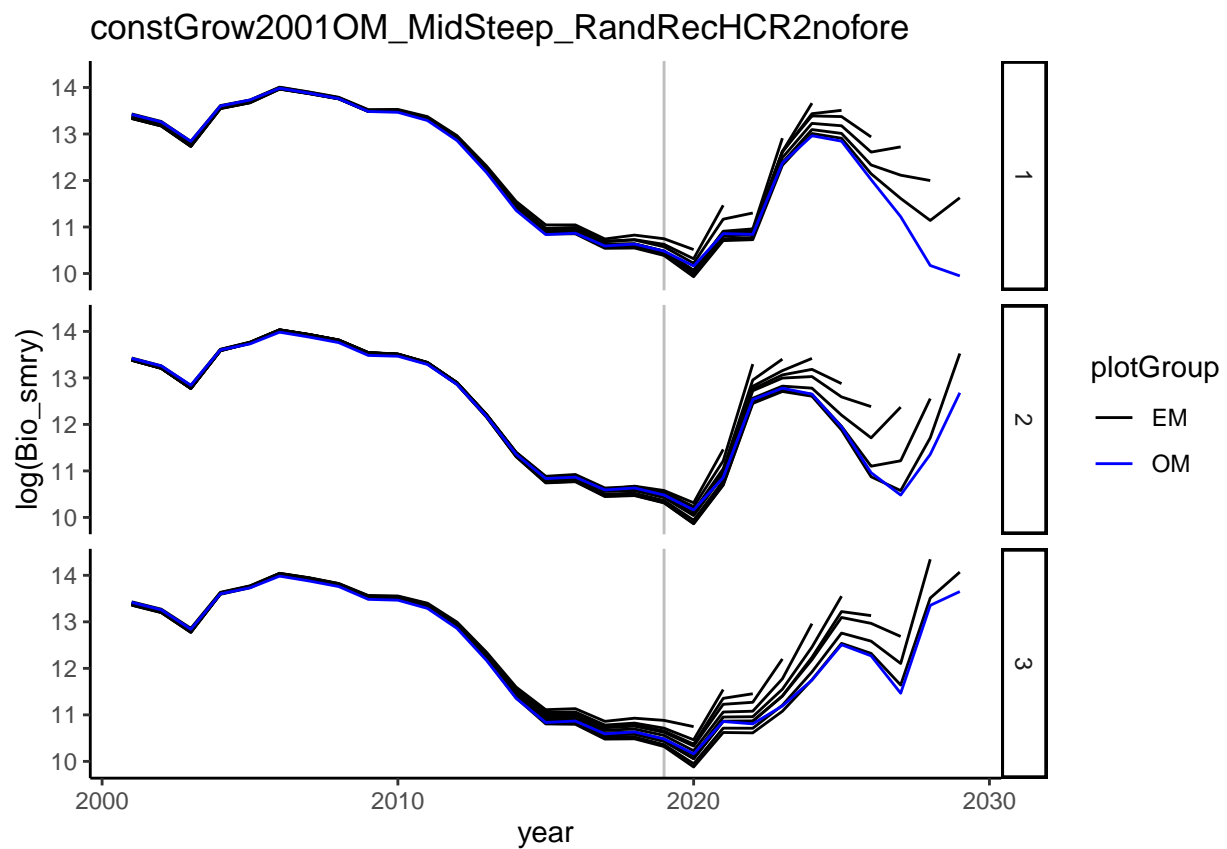
age1PlusBio <- age1PlusBio %>% left_join(y = convrgCheck,
                                         by = c("model_run", "iteration", "scenario")) %>%
  mutate(convrg = case_when(max_grad > 0.01 ~ "non-convr",
                            max_grad < 0.01 ~ "convr",
                            TRUE ~ "OM"))

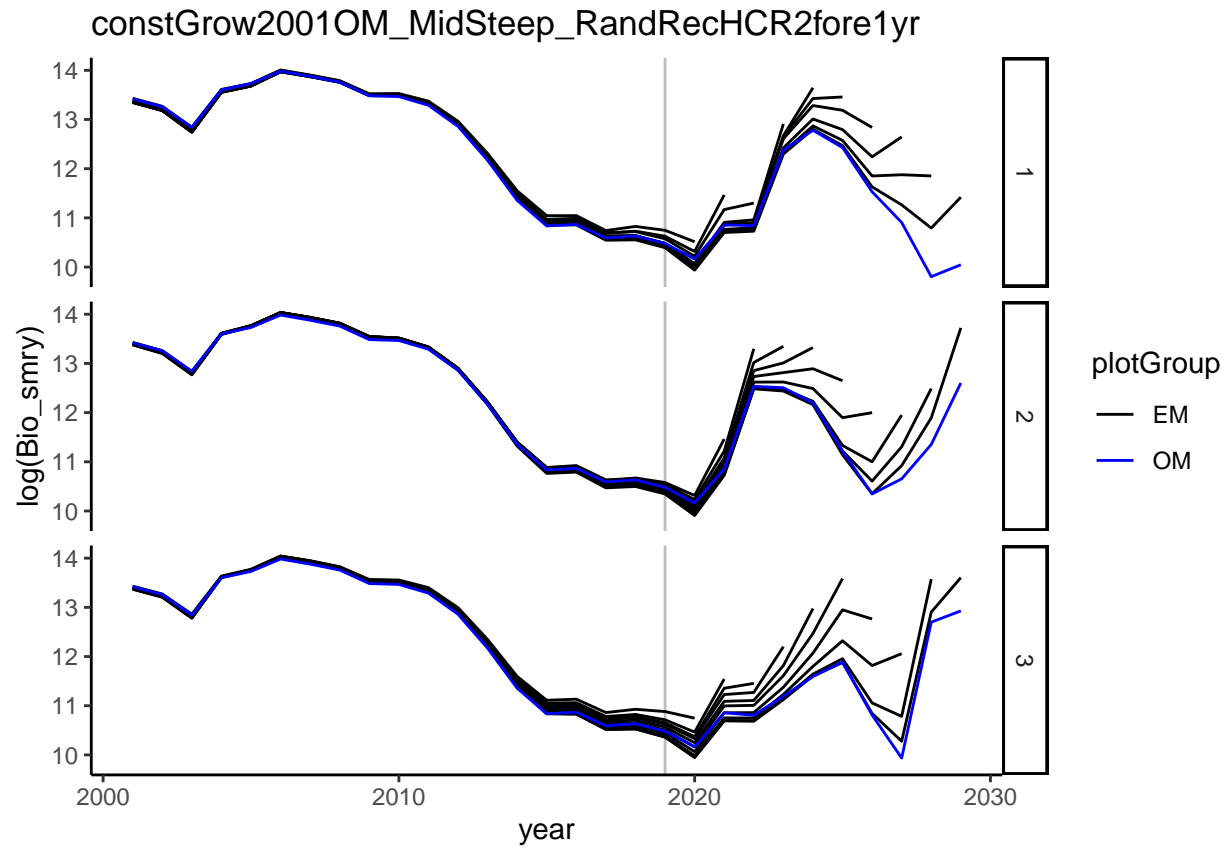
for(mr in 1:length(scenarios)){
  print(age1PlusBio %>% filter(scenario == scenarios[mr], plotGroup != "simData") %>%
    ggplot(aes(x = year, y = log(Bio_smry))) +
    ggplot2::geom_vline(xintercept = 2019, color = "gray") +
```

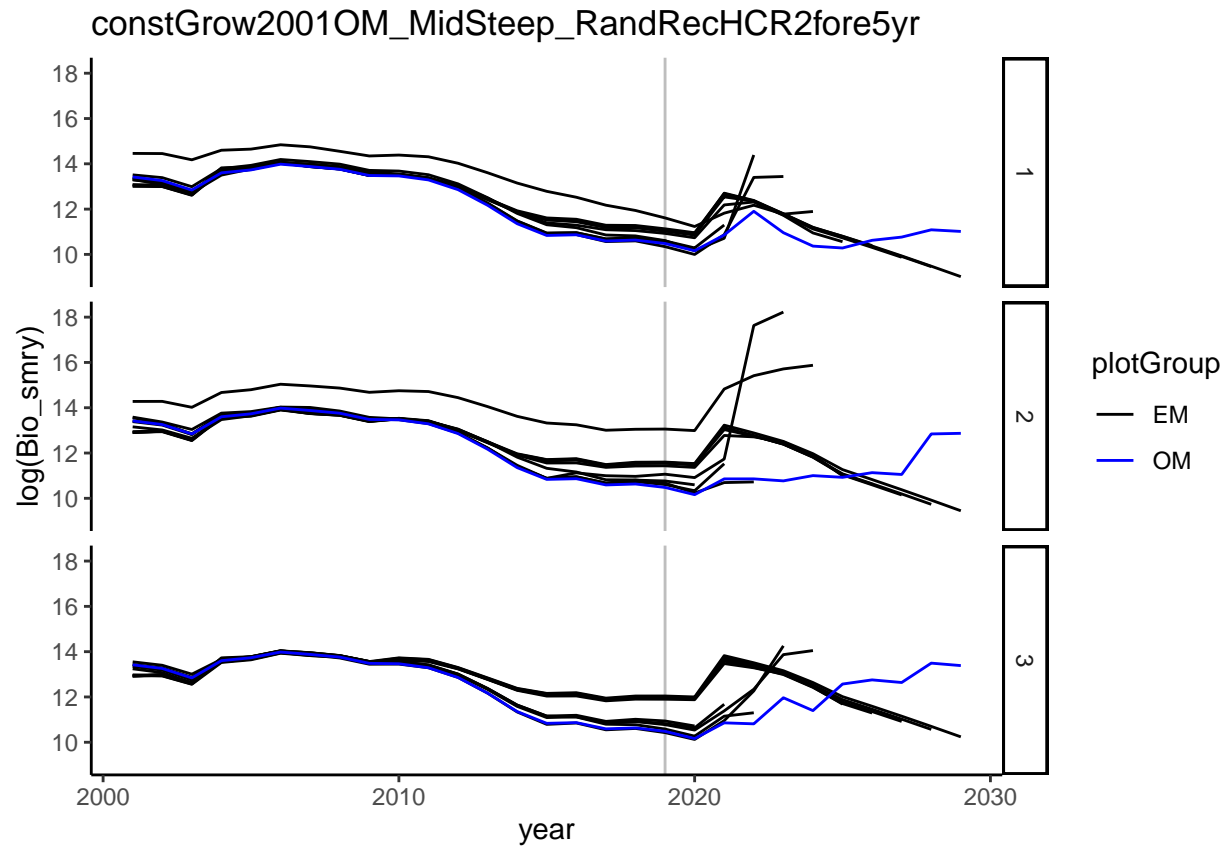
```

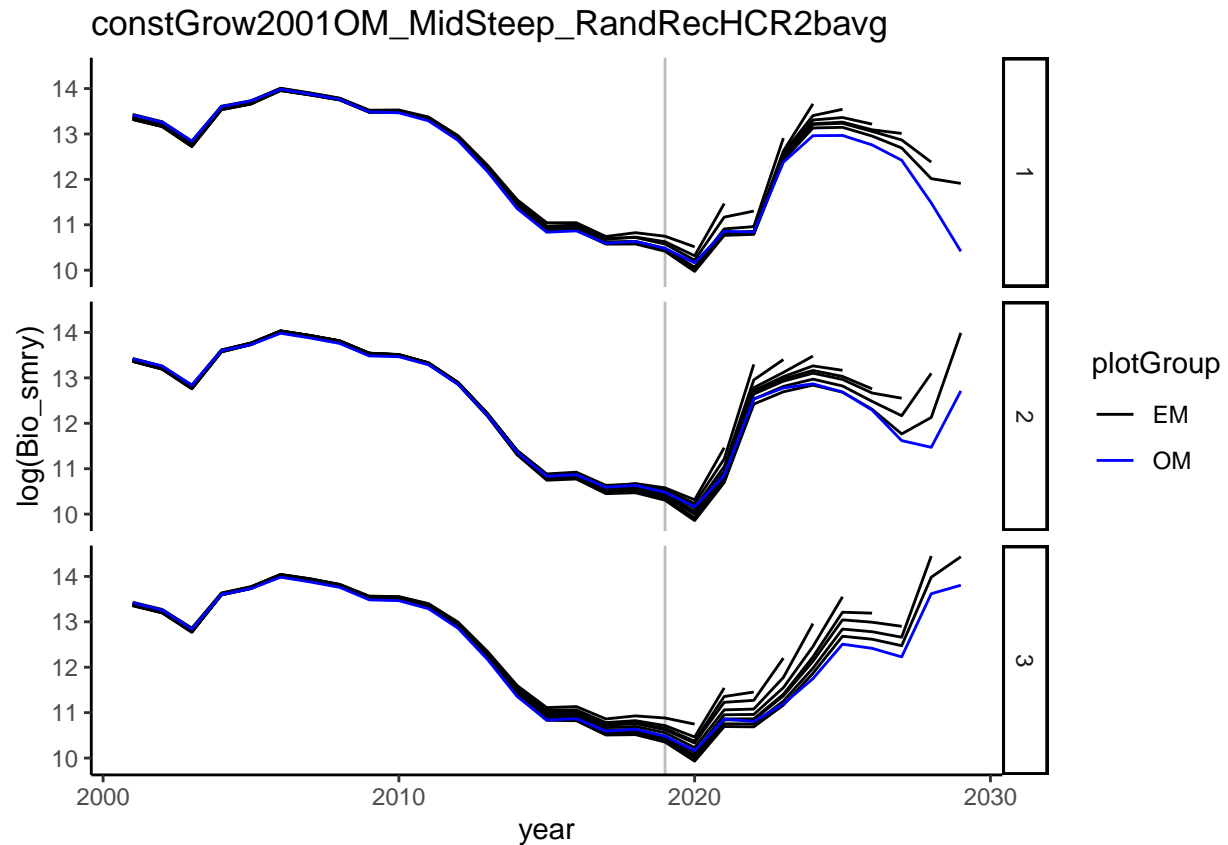
ggplot2::geom_line(ggplot2::aes(linetype = as.character(model_run), color = plotGroup))+
  ggplot2::scale_color_manual(values = c("black", "blue", "#D65F00")) +
  ggplot2::scale_linetype_manual(values = rep("solid", 51)) +
  ggplot2::guides(linetype = "none") +
  ggplot2::facet_grid(rows = vars(iteration))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

```

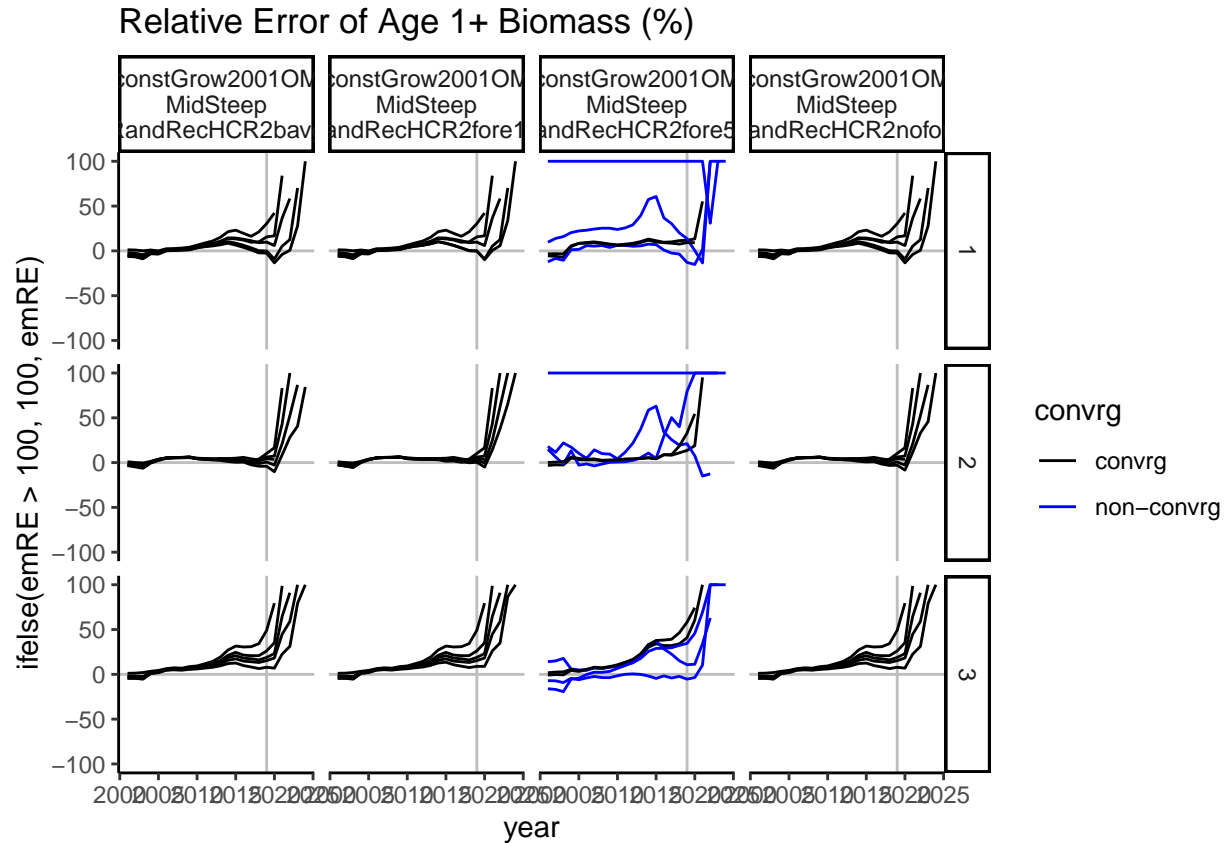




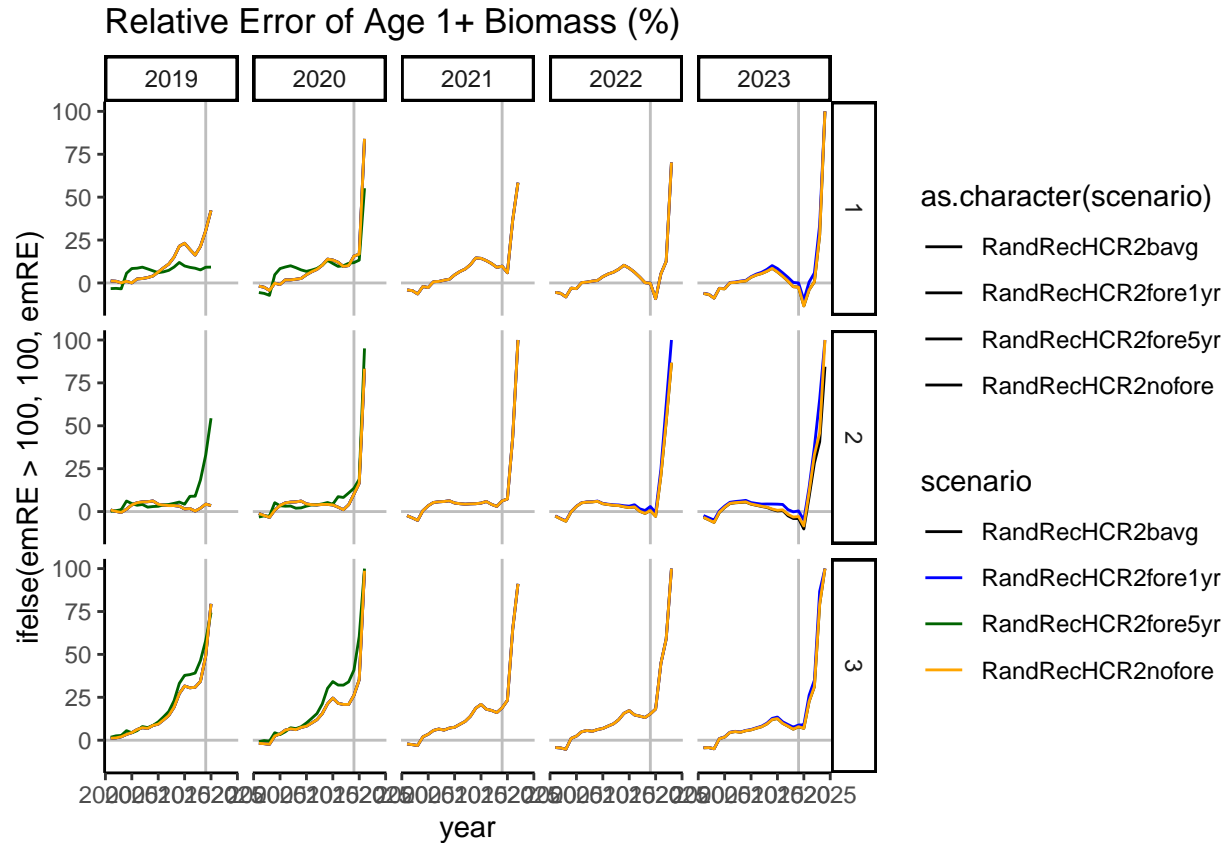




```
# Plot relative errors of biomass over time
age1PlusRE %>% filter(HCR != "HCR0", emYear < 2024) %>%
  mutate(scenario = gsub("_", "\\n", scenario, fixed = TRUE)) %>%
  ggplot(aes(x = year, y = ifelse(emRE > 100, 100, emRE))) + #y = emRE)) +
  geom_vline(xintercept = 2019, color = "gray") +
  geom_hline(yintercept = 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)
```



```
age1PlusRE %>% filter(HCR != "HCR0", emYear < 2024, convrg != "non-convr") %>%
  mutate(scenario = gsub("constGrow2001OM_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~      1 constGr~ 41552.  5.27e-5 2022 HCR2~ MidSte~
## 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 0.0 7.86 -1.259190 2018 1
## 2 36997.4 0.00 11819.4 2.51 NA 2018 2
## 3 41551.6 35.31 0.0 7.86 -1.259190 2018 1
## 4 36997.4 0.00 11819.4 2.51 NA 2018 2
## 5 40016.1 35.31 0.0 7.86 -0.981409 2018 1
## 6 35230.6 0.00 11819.4 2.51 NA 2018 2
## 7 41551.6 35.31 0.0 7.86 -1.259190 2018 1
## 8 36997.4 0.00 11819.4 2.51 NA 2018 2
## model_run iteration
## 1 constGrowSelfTest_EM_2022 1
## 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 1
## scenario
## 1 constGrow20010M_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
```

```
age1PlusRE %>% filter(emYear ==2020, iteration == 1, year == 2020)
```

```
## # 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 2020 constGrowSelfTe~ 1 constGr~ 30250. 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$ttsSmry %>% 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 1
## 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 1
## 4 755115.0 0.0 0.00 1088.56 NA 2024 2
## 5 146596.0 23154.4 6233.35 17582.80 0.00000e+00 2024 1
## 6 94168.7 0.0 0.00 1999.53 NA 2024 2
## 7 858668.0 0.0 0.00 0.00 -1.11022e-16 2024 1
## 8 836038.0 0.0 0.00 0.00 NA 2024 2
## model_run iteration
## 1 constGrowSelfTest_EM_2023 1
```

```
## 2 constGrowSelfTest_EM_2023      1
## 3 constGrowSelfTest_EM_2023      1
## 4 constGrowSelfTest_EM_2023      1
## 5 constGrowSelfTest_EM_2023      1
## 6 constGrowSelfTest_EM_2023      1
## 7 constGrowSelfTest_EM_2023      1
## 8 constGrowSelfTest_EM_2023      1
##                                  scenario
## 1 constGrow20010M_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)

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

```
scenarios <- c("constGrow20010M_MidSteepHiN_RandRecHCR2nofore",
               "constGrow20010M_MidSteepHiN_RandRecHCR2fore1yr",
               "constGrow20010M_MidSteepHiN_RandRecHCR2fore5yr",
               "constGrow20010M_MidSteepHiN_RandRecHCR2bavg")
```

```
smryOutputList <- GetSumryOutput(dirSSMSE = mseDir,
                                scenarios = scenarios)
```

```
## 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,
              fixed = TRUE, value = TRUE)

convrgeCheck <- smryOutputList$sc1Smry %>% #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$HCR)
#exIters <- sample(termTS$iteration, size = 4)

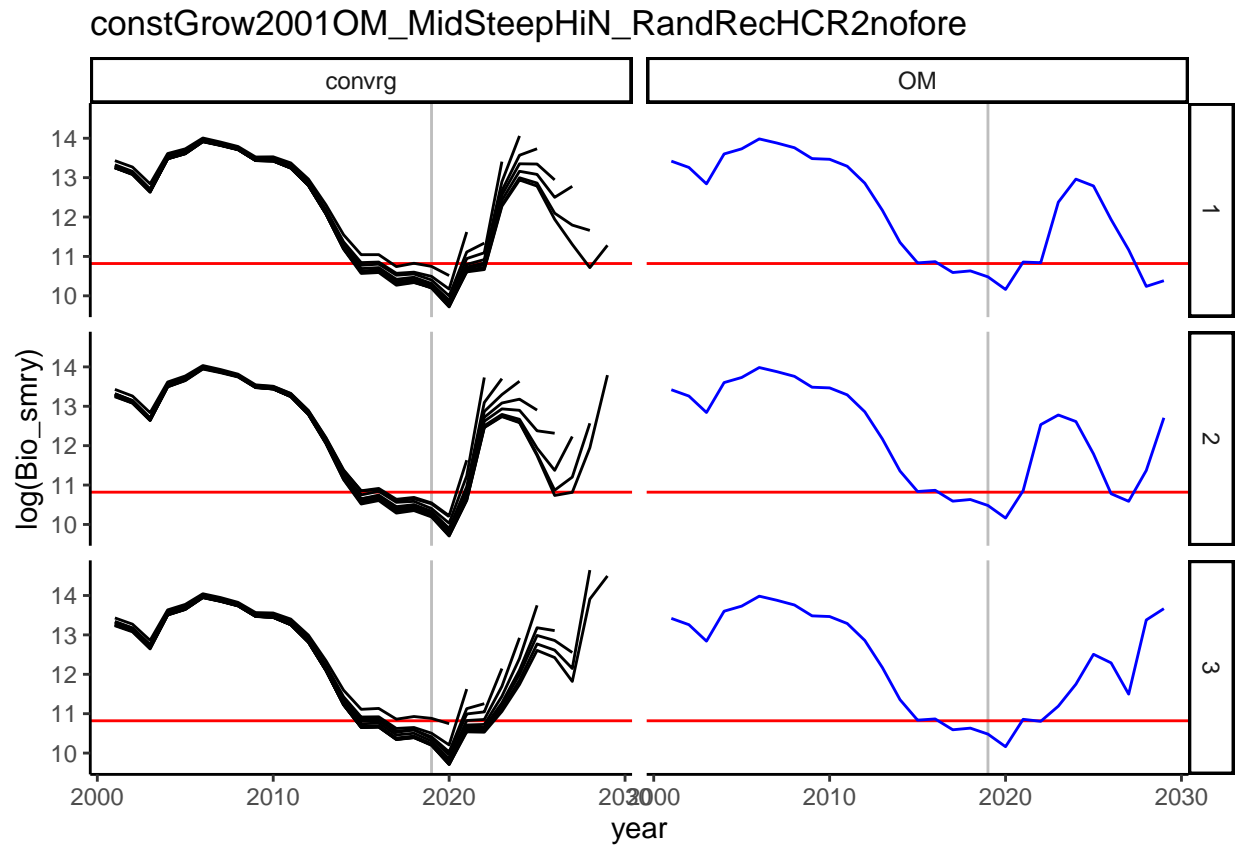
cnvrgeTS <- smryOutputList$tsSmry %>% mutate(HCR = sub(pattern = ".*Rec", "", scenario),
                                           recScen = sub(pattern = "HCR.*", "", scenario)) %>%
  mutate(recScen = sub(pattern = ".*OM_", "", recScen)) %>%
  left_join(y = convrgeCheck, by = c("iteration", "model_run", "scenario", "HCR", "recScen")) %>%
  mutate(plotGroup = case_when(model_run %in% omName ~ "OM",
                               max_grad > 0.01 ~ "non-convrge",
                               max_grad < 0.01 ~ "cnvrge"))

for(mr in 1:length(scenarios)){
  print(cnvrgeTS %>% 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")) +
```

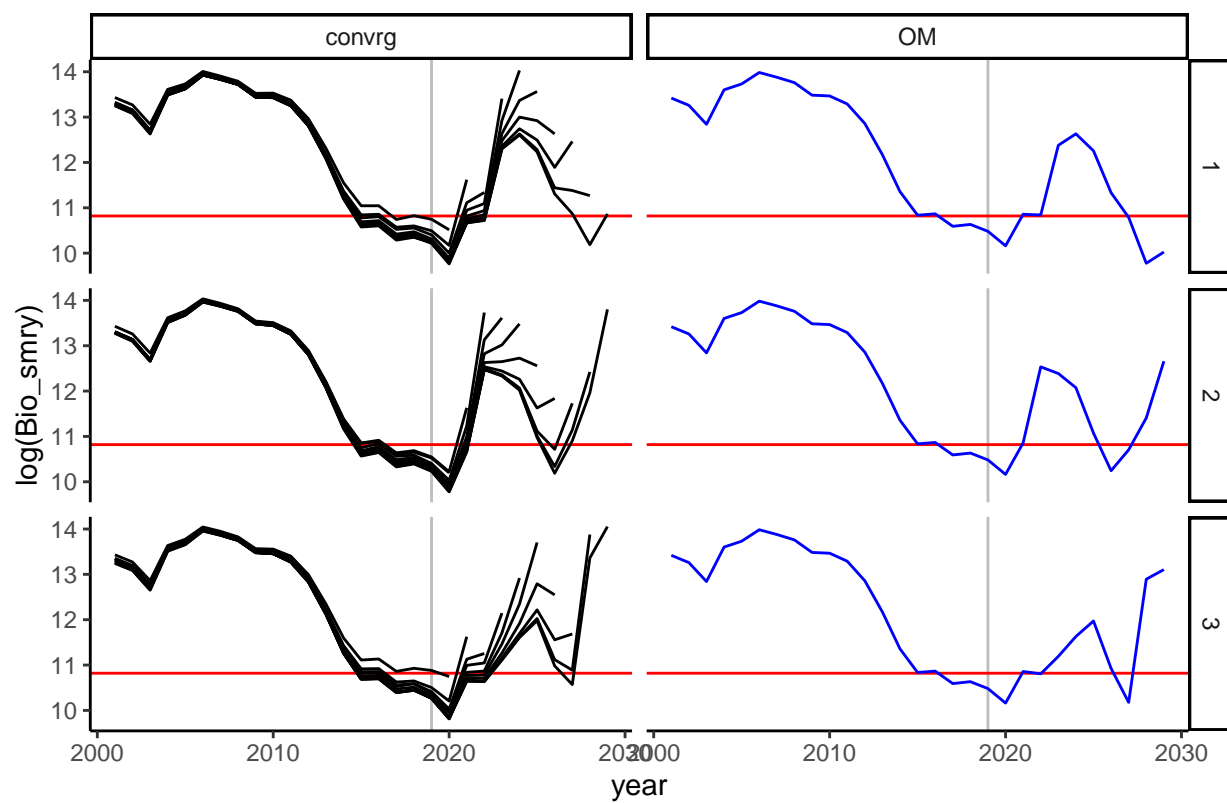
```

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]))
}

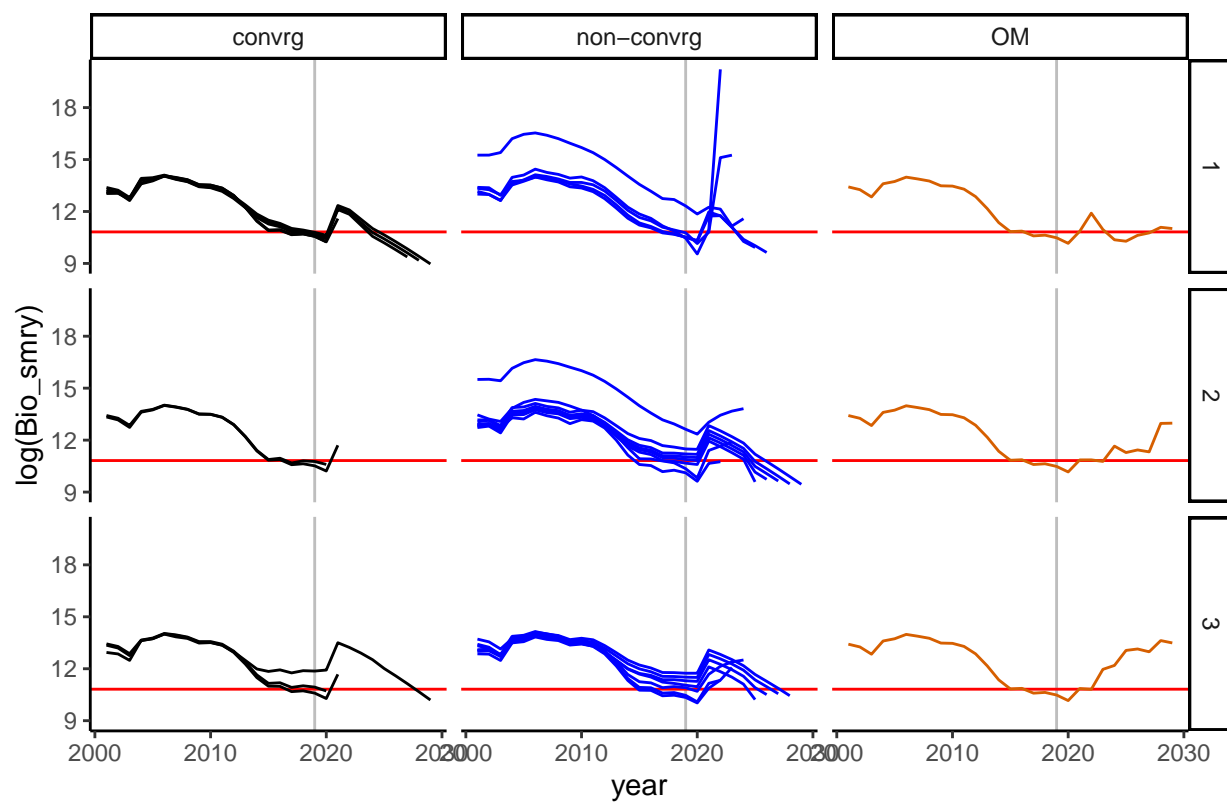
```



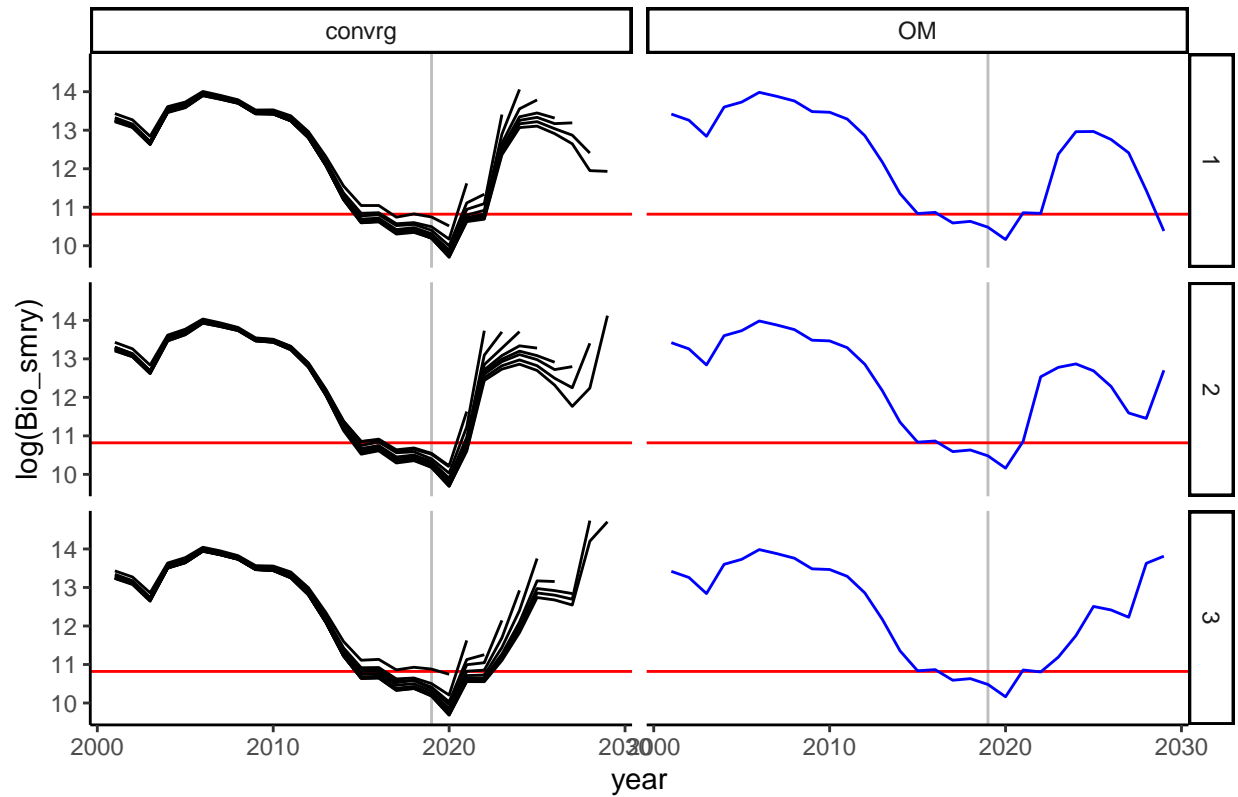
constGrow2001OM_MidSteepHiN_RandRecHCR2fore1yr



constGrow2001OM_MidSteepHiN_RandRecHCR2fore5yr

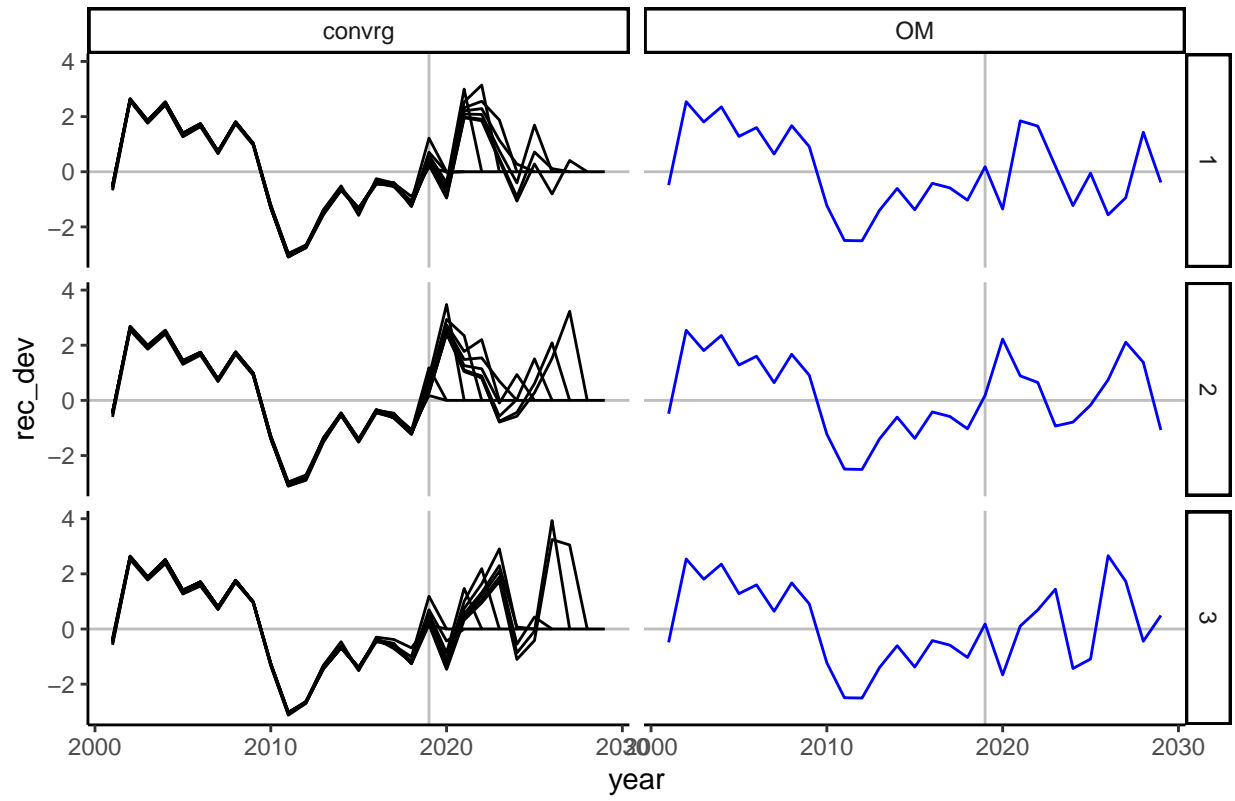


constGrow2001OM_MidSteepHiN_RandRecHCR2bavg

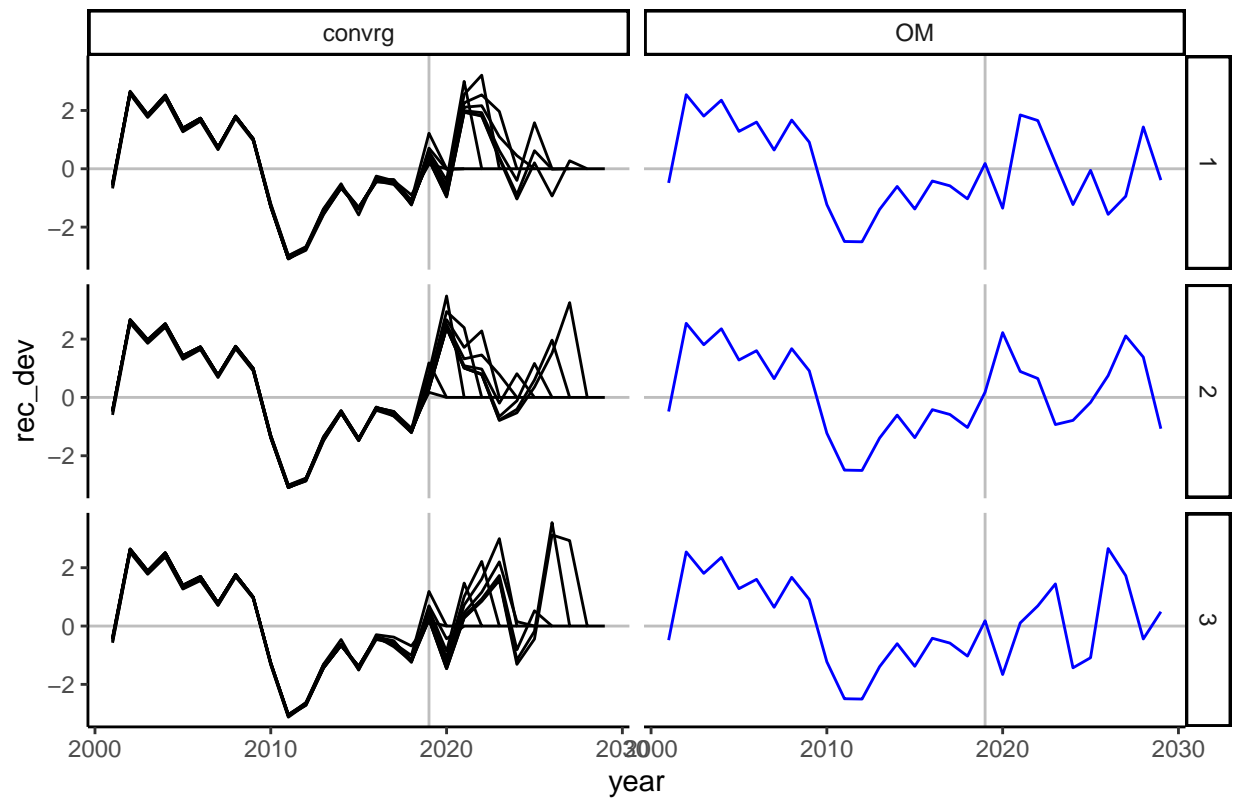


```
for(mr in 1:length(scenarios)){
  print(cnvrgTS %>% filter(scenario == scenarios[mr], Seas == 1) %>%
    ggplot(aes(x = year, y = rec_dev)) +
    ggplot2::geom_vline(xintercept = 2019, color = "gray") +
    ggplot2::geom_hline(yintercept = 0, color = "gray") +
    ggplot2::geom_line(aes(linetype = 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]))
}
```

constGrow2001OM_MidSteepHiN_RandRecHCR2nofore

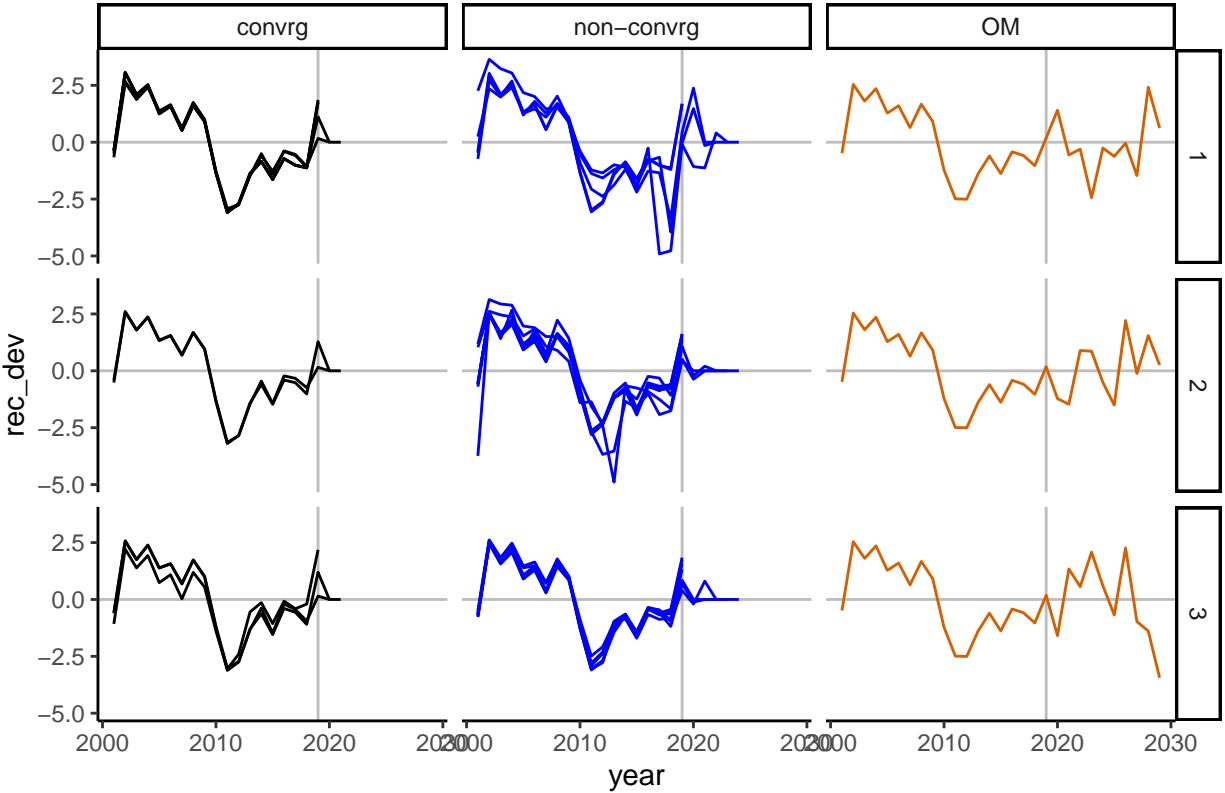


constGrow2001OM_MidSteepHiN_RandRecHCR2fore1yr

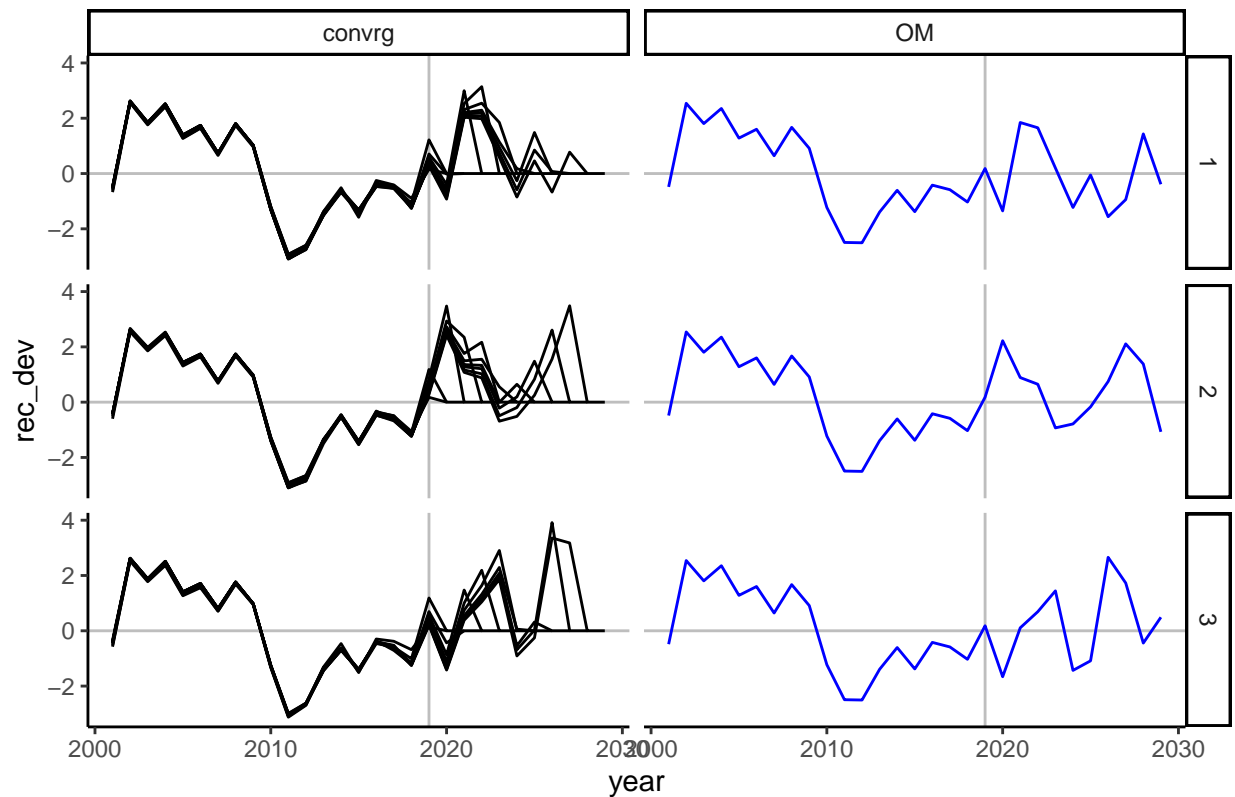


Warning: Removed 67 row(s) containing missing values (geom_path).

constGrow2001OM_MidSteepHiN_RandRecHCR2fore5yr



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-convr",
                                       max_grad < 0.01 ~ "convr",
                                       TRUE ~ "OM"),
                  emRE = (EM - Bio_smry)/Bio_smry * 100))

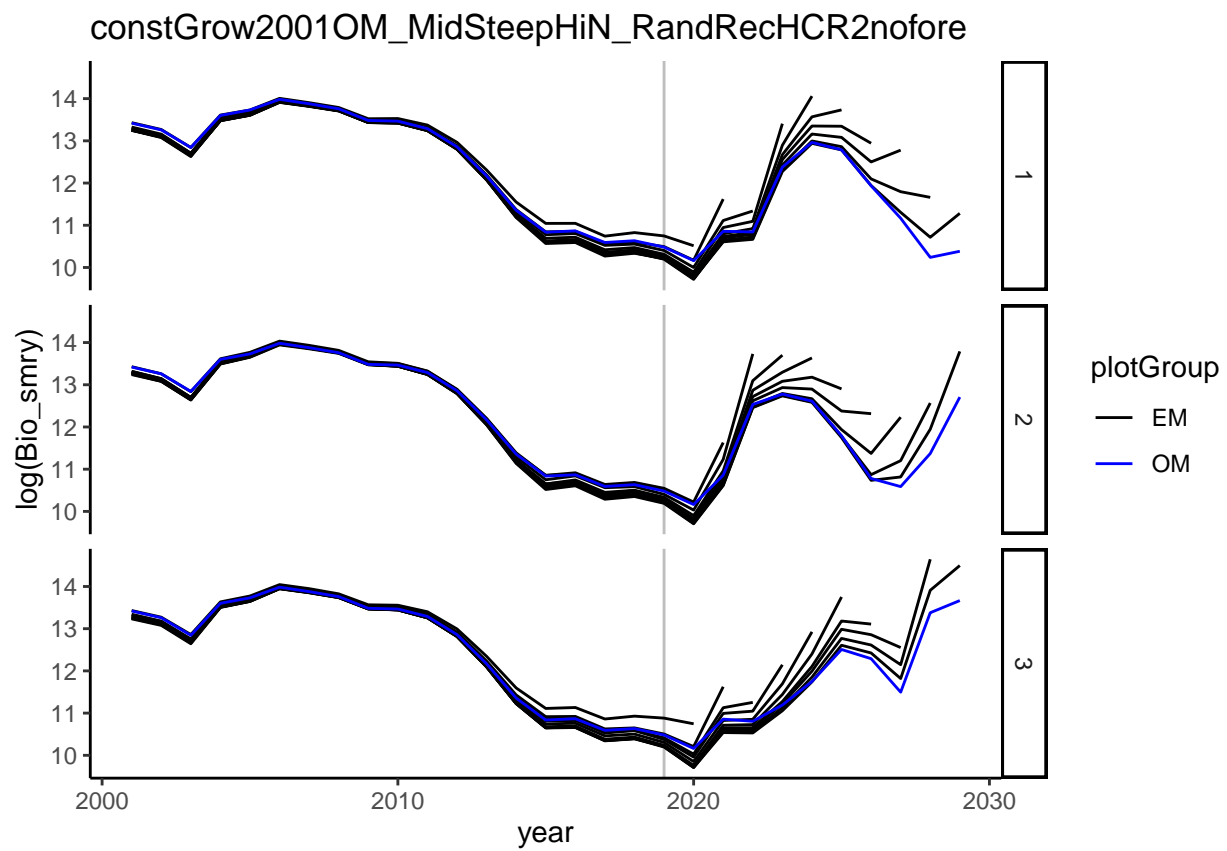
age1PlusBio <- age1PlusBio %>% left_join(y = convrgCheck,
                                         by = c("model_run", "iteration", "scenario")) %>%
  mutate(convrg = case_when(max_grad > 0.01 ~ "non-convr",
                           max_grad < 0.01 ~ "convr",
                           TRUE ~ "OM"))

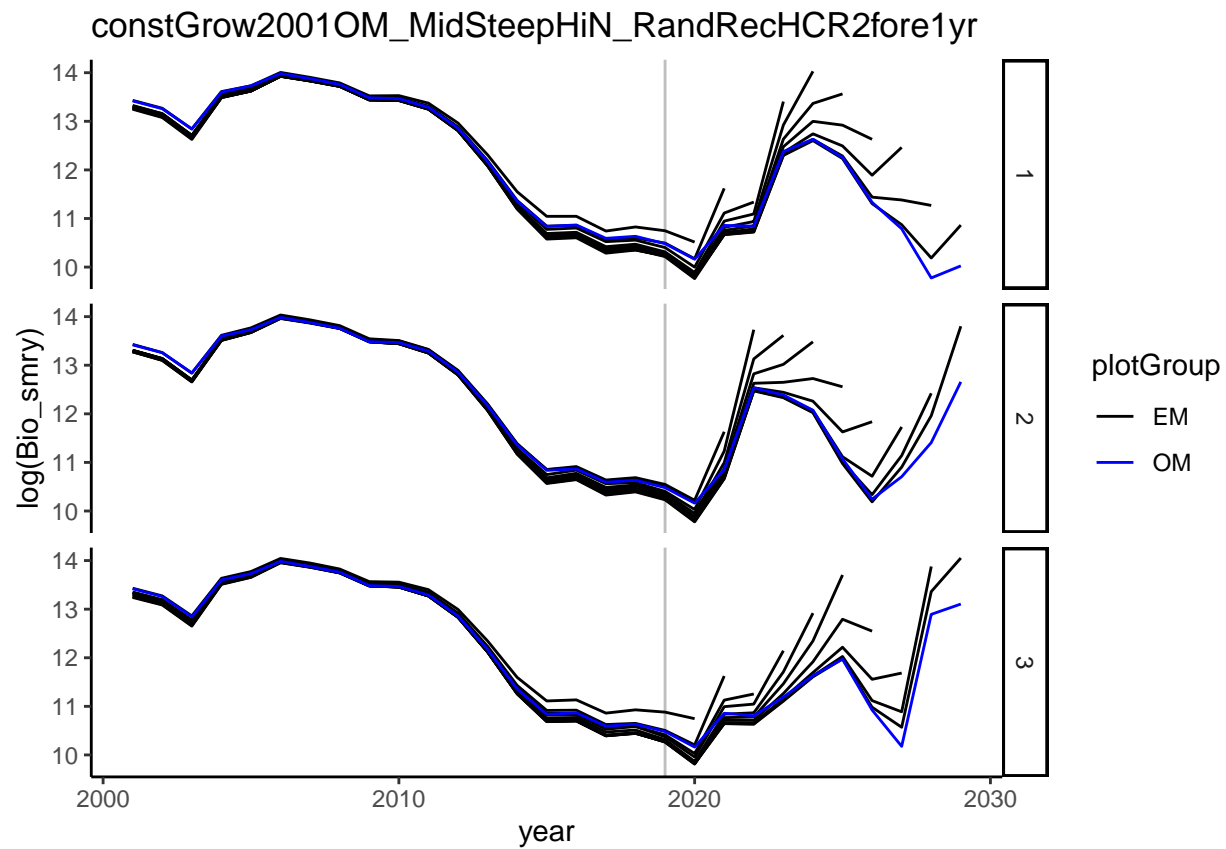
for(mr in 1:length(scenarios)){
  print(age1PlusBio %>% filter(scenario == scenarios[mr], plotGroup != "simData") %>%
    ggplot(aes(x = year, y = log(Bio_smry))) +
    ggplot2::geom_vline(xintercept = 2019, color = "gray") +
```

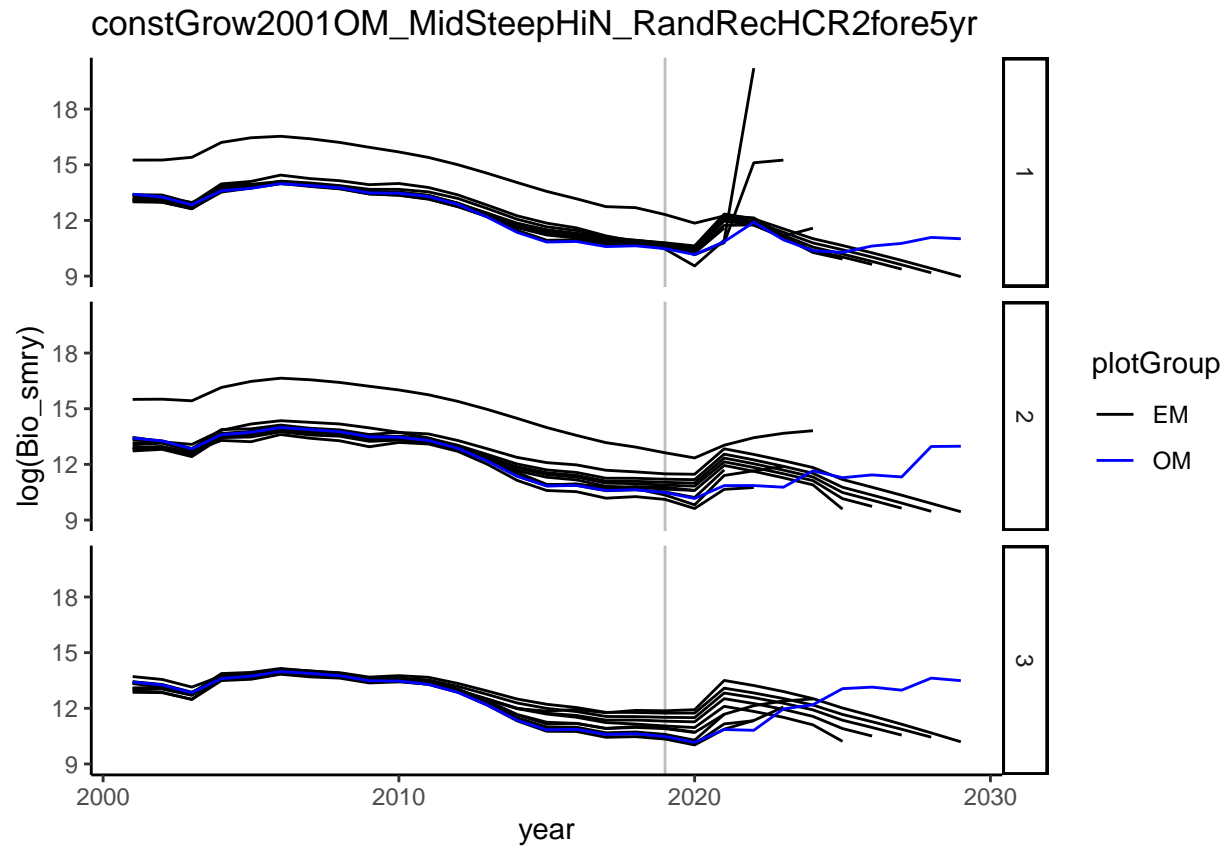
```

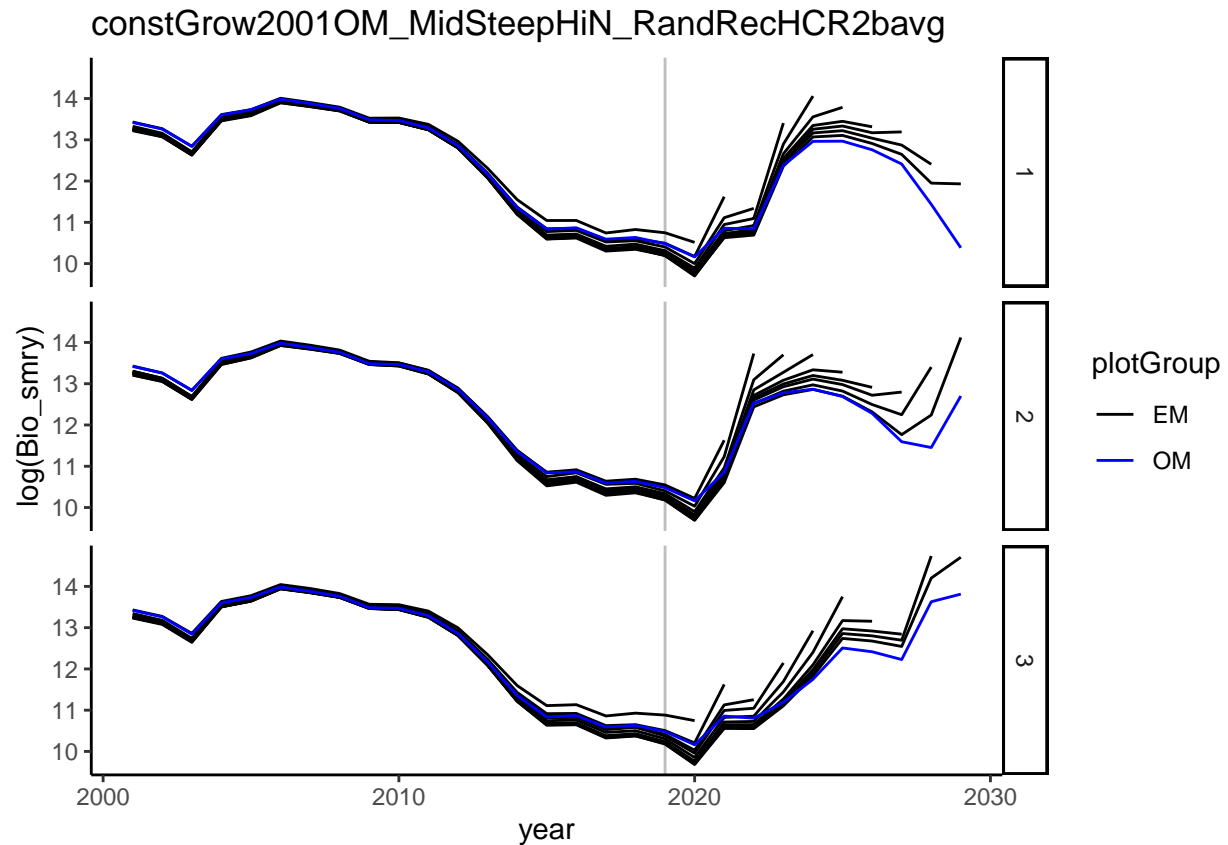
ggplot2::geom_line(ggplot2::aes(linetype = as.character(model_run), color = plotGroup))+
  ggplot2::scale_color_manual(values = c("black", "blue", "#D65F00")) +
  ggplot2::scale_linetype_manual(values = rep("solid", 51)) +
  ggplot2::guides(linetype = "none") +
  ggplot2::facet_grid(rows = vars(iteration))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

```

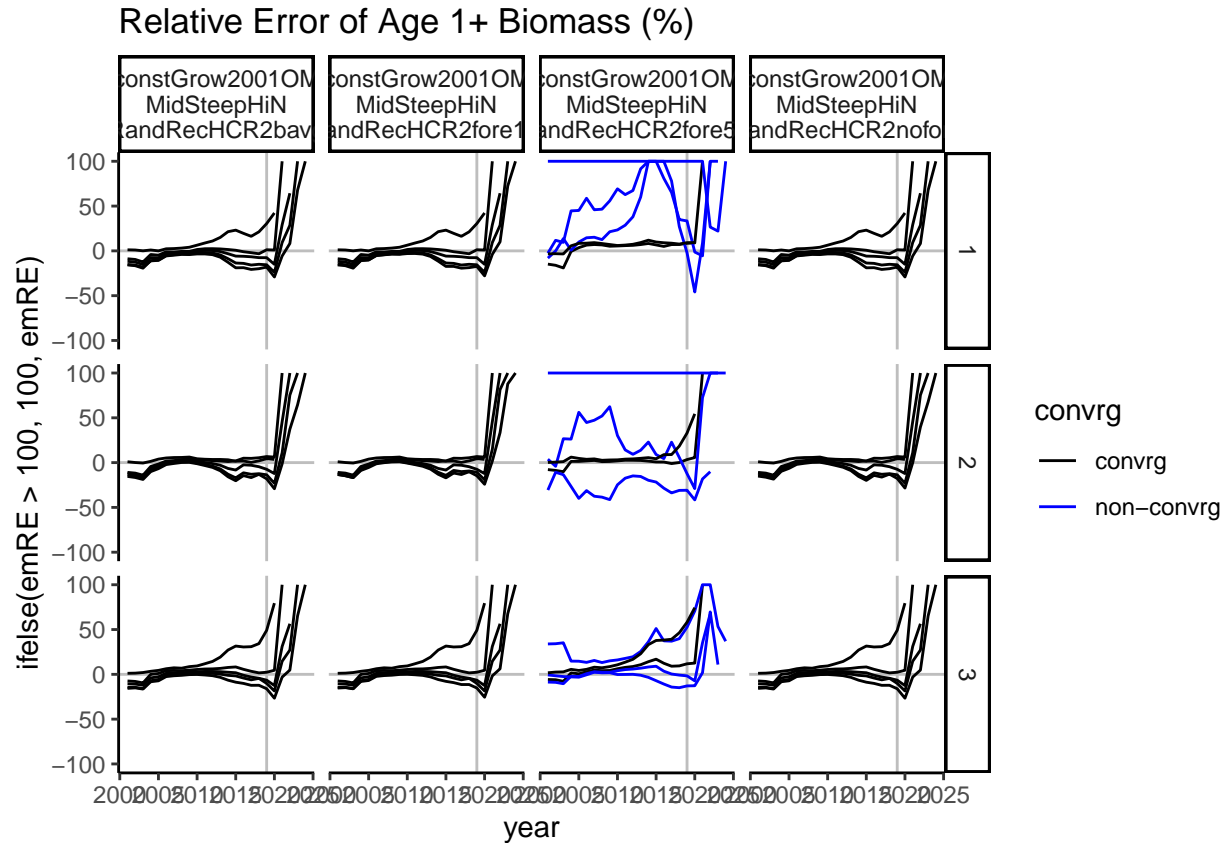




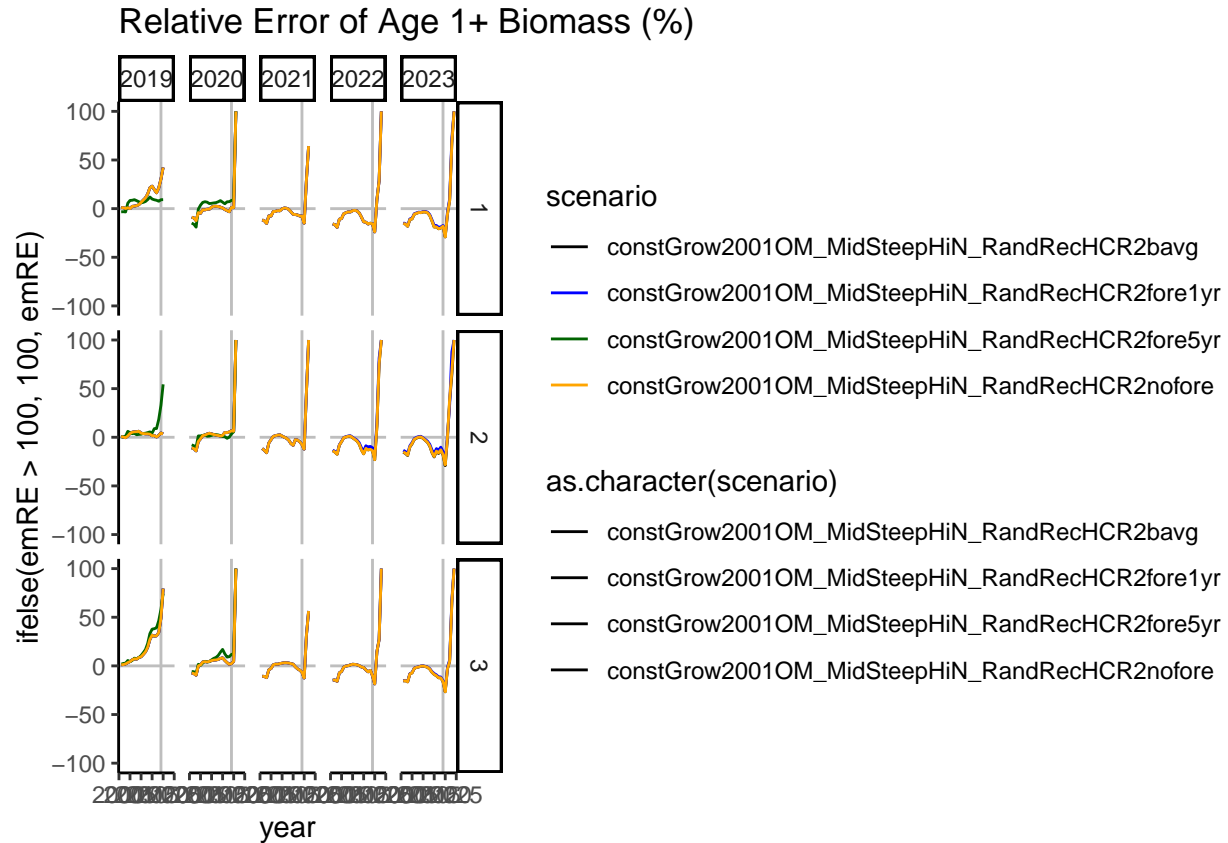




```
# Plot relative errors of biomass over time
age1PlusRE %>% filter(HCR != "HCR0", emYear < 2024) %>%
  mutate(scenario = gsub("_", "\\n", scenario, fixed = TRUE)) %>%
  ggplot(aes(x = year, y = ifelse(emRE > 100, 100, emRE))) + #y = emRE)) +
  geom_vline(xintercept = 2019, color = "gray") +
  geom_hline(yintercept = 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)
```



```
age1PlusRE %>% filter(HCR != "HCR0", emYear < 2024, convrg != "non-convr") %>%
  mutate(scenario = gsub("constGrow2001OM_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)
```

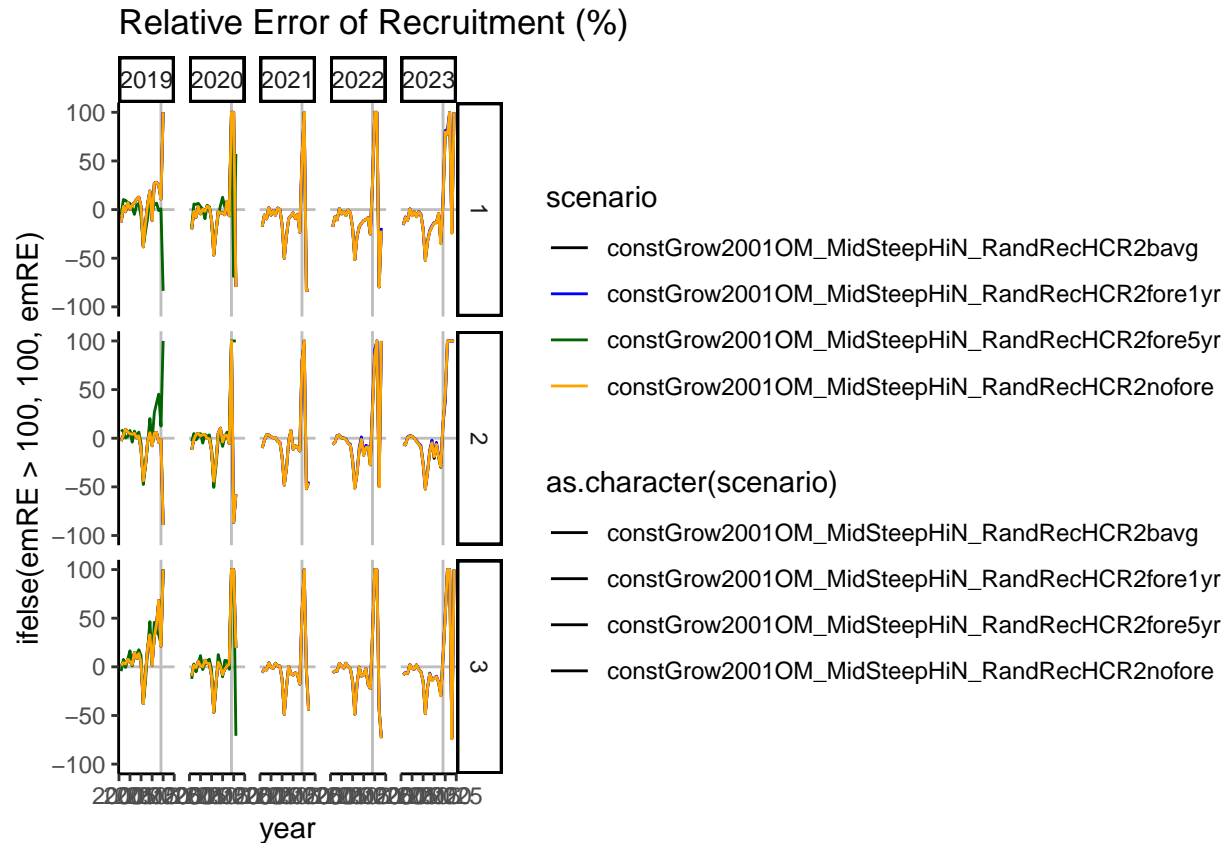


```
# Recruitment deviation error
recdevs <- smryOutputList$dqSmry %>% #filter(Seas == 1) %>%
  select(year, Value.Recr, model_run, iteration, scenario) %>%
  mutate(plotGroup = case_when(grepl("_OM", model_run, fixed = TRUE) ~ "OM",
                                TRUE ~ "EM"))

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",
                                      TRUE ~ "OM"),
                  emRE = (EM - Value.Recr)/Value.Recr * 100))

# Plot relative errors of rec devs over time
recdevRE %>% filter(HCR != "HCR0", emYear < 2024, convrg != "non-convrg") %>%
  mutate(scenario = gsub("constGrow2001OM_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

```
# No forecast 2019 assessment
OMnofore_dir <- "C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenarios/perfDatTests/constGrow2001OMnofore"

datOMnofore <- SS_readdat(file.path(OMnofore_dir, "data.ss_new"),
  verbose = FALSE,
  section = 2)

EMnofore2019_dir <- "C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenarios/perfDatTests/constGrow2001OMnofore2019"

datEMnofore2019 <- SS_readdat(file.path(EMnofore2019_dir, "init_dat.ss"),
  verbose = FALSE,
```

```

        section = 1)

datEMnfore2019$catch <- datOMnfore$catch %>% filter(year <= 2019)
datEMnfore2019$CPUE <- datOMnfore$CPUE %>% filter(year <= 2019) %>%
  mutate(index = abs(index))
datEMnfore2019$lencomp <- datOMnfore$lencomp %>% filter(Yr <= 2019) %>%
  mutate(FltSvy = case_when(FltSvy == -3 & Seas == 10 ~ FltSvy,
                           TRUE ~ abs(FltSvy)))
datEMnfore2019$agecomp <- datOMnfore$agecomp %>% filter(Yr <= 2019) %>%
  mutate(FltSvy = abs(FltSvy))

SS_writedat(datlist = datEMnfore2019,
            outfile = file.path(file.path(EMnfore2019_dir, "init_dat.ss")),
            overwrite = TRUE,
            verbose = FALSE)

# No forecast 2020 assessment
EMnfore2020_dir <- "C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenarios/perfDatTests/constGrow20010M_MidSteepH"

datEMnfore2020 <- SS_readat(file.path(EMnfore2020_dir, "init_dat.ss"),
                           verbose = FALSE,
                           section = 1)

datEMnfore2020$catch <- datOMnfore$catch %>% filter(year <= 2020)
datEMnfore2020$CPUE <- datOMnfore$CPUE %>% filter(year <= 2020) %>%
  mutate(index = abs(index))
datEMnfore2020$lencomp <- datOMnfore$lencomp %>% filter(Yr <= 2020) %>%
  mutate(FltSvy = case_when(FltSvy == -3 & Seas == 10 ~ FltSvy,
                           TRUE ~ abs(FltSvy)))
datEMnfore2020$agecomp <- datOMnfore$agecomp %>% filter(Yr <= 2020) %>%
  mutate(FltSvy = abs(FltSvy))

SS_writedat(datlist = datEMnfore2020,
            outfile = file.path(file.path(EMnfore2020_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
outOMnfore <- SS_output(OMnfore_dir)

## 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(OMnfore_dir): Some stats skipped because the .cor file not found:C:/Users/r.wi

```

```

## 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
## "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 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,
## 0 rows of generalized size comp data,
## 459 rows of age comp data,
## 0 rows of conditional age-at-length data,
## 360 rows of ghost fleet age comp data,
## 0 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,
## 0 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_ADMR
##
## $SS_versionshort
## [1] "3.30"
##
## $SS_versionNumeric
## [1] 3.3

```



```

##
## $StartTime
## [1] "StartTime: Mon Jun 06 17:08:12 2022"
##
## $RunTime
## [1] "0 hours, 0 minutes, 0 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 bins"
## [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    NA
## Equil_catch      0.0000000    NA
## Survey          -28.0180000    NA
## Length_comp      41.9452000    NA
## Age_comp         37.4688000    NA
## Recruitment      78.3199000     1
## InitEQ_Regime    0.0000000     0
## Forecast_Recruitment 30.1114000     1
## Parm_priors      0.0000000     1
## Parm_softbounds  0.0019748    NA
## Parm_devs        0.0000000     1
## Crash_Pen        0.0000000     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      ALL  MexCal_S1  MexCal_S2      PNW AT_Survey
## 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      NA      0.00000      0.00000      0.00000      1.00000
## 188      Init_equ_like      0.0000      0.00000      0.00000      0.00000      0.00000
## 189      Surv_lambda      NA      0.00000      0.00000      0.00000      1.00000
## 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
## 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      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      0.00000      0.0000
## 196      0.00000      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   1  10   4  22
##
## $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      4      1      59.69170 # 24  14      6      86.00      32.5914
## 1507      4      2      36.47650 # 24  14      9     108.80      59.3200
## 1508      4      3     111.35100 # 34  15      1     174.48      86.7573

```

```

## 1509      4      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      1
## 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
## 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      86.00
## 1608      5      2      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
## 1607      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      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      1 AT_Survey
##
## $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 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      NA
## 2      NA      2.729447      NA
## 3      NA      2.654107      NA
##      alternative_sigma_R

```

```

## 1          NA
## 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

outEMnofore2019 <- SS_output(EMnofore2019_dir)

## 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 threshold to 0.25 based on US west coast assumption associated with biomass

## !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 10 warnings in C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenarios

## 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,
## 0 rows of conditional age-at-length data,
## 0 rows of ghost fleet age comp data,
## 0 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,
## 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 = 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_ADMR"
##
## $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 bins"
## [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                        53.17179999999997510      NA
## Catch                        0.0000000000000391362      NA
## Equil_catch                  0.0000000000000000000      NA
## Survey                       -42.3108000000000000409      NA
## Length_comp                  25.373799999999999244      NA
## Age_comp                     16.1543999999999998983      NA
## Recruitment                   53.9525999999999996783       1
## InitEQ_Regime                 0.0000000000000000000       0
## Forecast_Recruitment          0.0000000000000000000       1
## Parm_priors                   0.0000000000000000000       1
## Parm_softbounds               0.0018333200000000000      NA
## Parm_devs                     0.0000000000000000000       1
## Crash_Pen                     0.0000000000000000000       1
##
## $likelihoods_laplace
##
##                                values lambdas
## NoBias_corr_Recruitment(info_only) 50.7840       1
## 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 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         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         Age_N_use          NA 1.40000e+01 1.40000e+01 1.40000e+01  9.0000
## 195         Age_N_skip          NA 0.00000e+00 0.00000e+00 0.00000e+00  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
##   1   1   1  10   4   2  21   6  16   3   1
##
## $estimated_non_dev_parameters
##
##           Value Phase    Min    Max      Init Status
## L_at_Amin_Fem_GP_1      12.8463000    3    3.00 30.00 12.8541000    OK
## L_at_Amax_Fem_GP_1      24.9297000    3   15.00 40.00 24.8415000    OK
## VonBert_K_Fem_GP_1       0.3052990    3    0.05  0.99  0.3075730    OK
## CV_young_Fem_GP_1       0.1135150    3    0.05  0.50  0.1053490    OK
## CV_old_Fem_GP_1        0.0199304    3    0.01  0.10  0.0237245    OK
## SR_LN(R0)              14.7700000    1    3.00 25.00 14.4668000    OK
## SR_regime_BLK1repl_2000  0.9815310    4  -15.00 15.00  1.2915300    OK
## Size_inflection_MexCal_S1(1) 10.9366000    3    0.00 30.00 10.9072000    OK
## Size_95%width_MexCal_S1(1)  0.7588860    3    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  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)  -1.1978500    3  -10.00 11.00 -1.1690800    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    4    0.00 10.00  2.8525100    OK

```

```

## Age_95%width_PNW(3)      1.2378300      4  -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
## L_at_Amax_Fem_GP_1      0.25106200  0.00000150313000 No_prior  NA
## 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(R0)                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  0.00000016215600 No_prior  NA
## AgeSel_P1_MexCal_S1(1)    234.78400000  0.00000000675916 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  0.00000005729660 No_prior  NA
## AgeSel_P3_MexCal_S2(2)    0.16758800  0.00000070821300 No_prior  NA
## AgeSel_P4_MexCal_S2(2)    0.27173700  0.00000066790300 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  NA
## Age_95%width_PNW(3)      0.06682090 -0.00000110157000 No_prior  NA
##                               Pr_SD Pr_Like Afterbound
## L_at_Amin_Fem_GP_1      NA      NA      OK
## L_at_Amax_Fem_GP_1      NA      NA      OK
## VonBert_K_Fem_GP_1      NA      NA      OK
## CV_young_Fem_GP_1       NA      NA      OK
## CV_old_Fem_GP_1         NA      NA      OK
## SR_LN(R0)                NA      NA      OK
## SR_regime_BLK1repl_2000  NA      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)    NA      NA      OK
## AgeSel_P3_MexCal_S1(1)    NA      NA      OK
## AgeSel_P4_MexCal_S1(1)    NA      NA      OK
## AgeSel_P5_MexCal_S1(1)    NA      NA      OK
## AgeSel_P2_MexCal_S2(2)    NA      NA      OK
## AgeSel_P3_MexCal_S2(2)    NA      NA      OK
## AgeSel_P4_MexCal_S2(2)    NA      NA      OK
## AgeSel_P5_MexCal_S2(2)    NA      NA      OK
## Age_inflection_PNW(3)     NA      NA      OK
## 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(R0)                    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
## 1158      4     3     136.133000 # 24  15      1    174.48      86.7573
## 1159      4     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
## 1156      32.5914      NA      NA 8292.820    2385.0500      1
## 1157      59.3200      NA      NA 10041.700    2378.6900      1
## 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
## 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
## 1218      5     2      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
## 1217     31.0686     31.0686      NA      NA 9573.260    471.1240
## 1218     58.3143     58.3143      NA      NA 11412.600    377.7720
## 1219     76.2971     76.2971      NA      NA 14103.900    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              2.345401              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) 0

```

```
## completed SS_output
```

```

EMssmse2019_dir <- "C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenarios/perfDatTests/constGrow20010M_MidSteepH
outEMssmse2019 <- SS_output(EMssmse2019_dir)

```

```
## 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 threshold to 0.25 based on US west coast assumption associated with biomass

## !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. There were 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,
## 0 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,
## 0 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,
## 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: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_ADMIRAL"
##
## $SS_versionshort
## [1] "3.30"
##
## $SS_versionNumeric
## [1] 3.3
##
## $StartTime
## [1] "StartTime: Mon Jun 06 16:57:21 2022"
##
## $RunTime
## [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_ADMIRAL"
## [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 bins"
## [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 estimated"
## [13] "4 1st iteration warning: ssb(endyr)/ssb(styr)= 3.87036e-07; suggest start with larger R0 to get"
## [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 NA

```

```

## Catch                0.00000000000038972      NA
## Equil_catch          0.00000000000000000      NA
## Survey               -28.40490000000000137      NA
## Length_comp          639.3229999999997908      NA
## Age_comp             25.74530000000000030      NA
## Recruitment          88.2305999999999548      1
## InitEQ_Regime        0.00000000000000000      0
## Forecast_Recruitment 0.00000000000000000      1
## Parm_priors           0.00000000000000000      1
## Parm_softbounds       0.00204515000000000      NA
## Parm_devs            0.00000000000000000      1
## Crash_Pen            0.00000000000000000      1
##
## $likelihoods_laplace
##                               values lambdas
## NoBias_corr_Recruitment(info_only) 85.0621      1
## Laplace_obj_fun(info_only)         721.7280      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 1.00000
## 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
## 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 1.00000
## 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 Age_N_use      NA 1.40000e+01 1.40000e+01 1.40000e+01 9.00000
## 195 Age_N_skip      NA 0.00000e+00 0.00000e+00 0.00000e+00 0.00000
##      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 -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 -4 -3 -2 -1 1 2 3 4 5
## 1 1 1 10 4 2 21 6 16 3 1
##
## $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
## CV_old_Fem_GP_1 0.028338 3 0.01 0.10 0.0237245 OK
## SR_LN(R0) 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 3 0.00 10.00 0.6599090 OK
## AgeSel_P1_MexCal_S1(1) 0.500023 3 -10.00 11.00 0.5000240 OK
## 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 OK
## AgeSel_P4_MexCal_S1(1) -1.559500 3 -10.00 11.00 -1.5494000 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 4 0.00 10.00 2.8525100 OK
## Age_95%width_PNW(3) 1.226510 4 -5.00 15.00 1.2152300 OK
##
## Parm_StDev Gradient Pr_type Prior Pr_SD
## L_at_Amin_Fem_GP_1 0 -0.00001361980000 No_prior NA NA
## 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 0 0.00000068867000 No_prior NA NA
## CV_old_Fem_GP_1 0 0.00000091321000 No_prior NA NA
## SR_LN(R0) 0 -0.00001281700000 No_prior NA NA
## SR_regime_BLK1repl_2000 0 -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 -0.00000010867000 No_prior NA NA
## AgeSel_P1_MexCal_S1(1) 0 0.00000000700412 No_prior NA NA
## AgeSel_P2_MexCal_S1(1) 0 0.00000013500200 No_prior NA NA
## AgeSel_P3_MexCal_S1(1) 0 -0.00000147724000 No_prior NA NA
## AgeSel_P4_MexCal_S1(1) 0 -0.00000070098700 No_prior NA NA
## AgeSel_P5_MexCal_S1(1) 0 -0.00000081456800 No_prior NA NA
## AgeSel_P2_MexCal_S2(2) 0 -0.00000294566000 No_prior NA NA
## 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 NA
##
## Pr_Like Afterbound
## L_at_Amin_Fem_GP_1 NA OK
## L_at_Amax_Fem_GP_1 NA OK

```

```

## VonBert_K_Fem_GP_1          NA          OK
## CV_young_Fem_GP_1           NA          OK
## CV_old_Fem_GP_1             NA          OK
## SR_LN(R0)                   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)      NA          OK
## AgeSel_P5_MexCal_S2(2)      NA          OK
## Age_inflection_PNW(3)       NA          OK
## 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(R0)          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      4     2      0.653439 # 14  14      9     108      59.0000
## 1158      4     3      0.127457 # 24  15      1     174      86.3333
## 1159      4     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      1
## 1157      59.0000      NA      NA 64.8646 38.55290      1
## 1158      86.3333      NA      NA 91.8304 11.00380      1
## 1159     19.8889      NA      NA 14.8765  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      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          NA          NA 14148.000        827.159
## 1219          100          100          NA          NA  1525.270      1122.660
## 1220          100          100          NA          NA   708.151        282.380
##      Curr_Var_Adj Fleet_name
## 1217          1 MexCal_S1
## 1218          1 MexCal_S2
## 1219          1      PNW
## 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      Main    20   1.610123   2.592496      0          0
## 2 Early+Main    26   1.435318   2.060136      0          0
## 3 Early+Main+Late 26   1.435318   2.060136      0          0
##      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 = outOMnfore,
                                   EMssmse2019 = outEMssmse2019,
                                   EMnfore2019 = outEMnfore2019))

```

```
## 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(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)

## 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 threshold to 0.25 based on US west coast assumption associated with biomass

## !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 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,
##   0 rows of conditional age-at-length data,
##   0 rows of ghost fleet age comp data,
##   0 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,
##   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 = 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_ADMR"
##
## $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_ADMR"
## [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 bins"
## [12] "3 settle_month is less than spawn_month, so logical age at settlement calculated to be: 1 for all"
## [13] "4 setting in starter does not request all priors, and 1 parameters have priors and are not estimated"
## [14] "5 1st iteration warning: ssb(endyr)/ssb(styr)= 4.77067e-07; suggest start with larger R0 to get better fit"
## [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                        161.94100000000002501      NA
## Catch                        0.000000000000599152      NA
## Equil_catch                  0.000000000000000000      NA
## Survey                       -48.280900000000002592      NA
## Length_comp                  76.386600000000001387      NA
## Age_comp                     66.973399999999998045      NA
## Recruitment                   66.8598000000000007003       1
## InitEQ_Regime                 0.000000000000000000       0
## Forecast_Recruitment          0.000000000000000000       1
## Parm_priors                   0.000000000000000000       1
## Parm_softbounds               0.0019289200000000000      NA
## Parm_devs                     0.000000000000000000       1
## Crash_Pen                     0.000000000000000000       1
##
## $likelihoods_laplace
##
##                                values lambdas
## NoBias_corr_Recruitment(info_only) 63.6913       1
## Laplace_obj_fun(info_only)         158.7720      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  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 Length_like  7.63866e+01 1.34910e+01 2.03074e+01 3.25584e+00 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
## 193 Age_like  6.69734e+01 6.91723e+00 2.77972e+01 3.93827e+00 28.3207
## 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      1.0000      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   1  10   4   2  21   6  16   3   2
##
## $estimated_non_dev_parameters
##
##      Value Phase      Min      Max      Init Status
## L_at_Amin_Fem_GP_1      12.8931000      3      3.00 30.00 12.8541000      OK
## L_at_Amax_Fem_GP_1      24.9354000      3      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      3      0.05  0.50  0.1053490      OK
## CV_old_Fem_GP_1      0.0209416      3      0.01  0.10  0.0237245      OK
## SR_LN(R0)      14.5863000      1      3.00 25.00 14.4668000      OK
## SR_regime_BLK1repl_2000      1.0969100      4     -15.00 15.00  1.2915300      OK
## Size_inflection_MexCal_S1(1) 10.8349000      3      0.00 30.00 10.9072000      OK
## Size_95%width_MexCal_S1(1)  0.6990270      3      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)  1.5290000      3     -10.00 11.00  0.2048810      OK
## 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) -0.6268860      3     -10.00 11.00 -0.4707320      OK
## Age_inflection_PNW(3)  2.8579400      4      0.00 10.00  2.8525100      OK
## Age_95%width_PNW(3)  1.1550600      4     -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  NA
## VonBert_K_Fem_GP_1  0.00735414 0.00000603161000 No_prior  NA
## CV_young_Fem_GP_1  0.00265329 -0.00000286378000 No_prior  NA

```

```

## CV_old_Fem_GP_1          0.00255814  0.00000013430100 No_prior  NA
## SR_LN(R0)                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  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  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)     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      NA      OK
## L_at_Amax_Fem_GP_1       NA      NA      OK
## VonBert_K_Fem_GP_1       NA      NA      OK
## CV_young_Fem_GP_1        NA      NA      OK
## CV_old_Fem_GP_1          NA      NA      OK
## SR_LN(R0)                NA      NA      OK
## SR_regime_BLK1repl_2000  NA      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)    NA      NA      OK
## AgeSel_P3_MexCal_S1(1)    NA      NA      OK
## AgeSel_P4_MexCal_S1(1)    NA      NA      OK
## AgeSel_P5_MexCal_S1(1)    NA      NA      OK
## AgeSel_P2_MexCal_S2(2)    NA      NA      OK
## AgeSel_P3_MexCal_S2(2)    NA      NA      OK
## AgeSel_P4_MexCal_S2(2)    NA      NA      OK
## AgeSel_P5_MexCal_S2(2)    NA      NA      OK
## Age_inflection_PNW(3)     NA      NA      OK
## 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(R0)                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      4      3      55.611200 # 25 16      1      1000      143.8350
## 1190      4      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
## 1189     143.8350      NA      NA 16878.900     7998.8400      1
## 1190     117.9000      NA      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
## 1253      5      2      0.579745 #      15 15      8.92      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     137.877      NA      NA 3565.740     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      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          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          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    0
## 30 AgeSel_P1_MexCal_S1(1)    0
```

```
## completed SS_output
```

```
EMssmse2020_dir <- "C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenarios/perfDatTests/constGrow20010M_MidSteepH
outEMssmse2020 <- SS_output(EMssmse2020_dir)
```

```
## 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 threshold to 0.25 based on US west coast assumption associated with biomass

## !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 11 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,
## 0 rows of generalized size comp data,
## 495 rows of age comp data,
## 0 rows of conditional age-at-length data,
## 0 rows of ghost fleet age comp data,
## 0 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,
## 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: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_ADMR"
##
## $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_ADMR"
## [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 bins"
## [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 estimated"
## [14] "5 1st iteration warning: ssb(endyr)/ssb(styr)= 4.77067e-07; suggest start with larger R0 to get"
## [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      NA
## Catch                  0.000000000000608191      NA
## Equil_catch            0.000000000000000000      NA

```

```

## Survey -33.279499999999998749 NA
## Length_comp 771.442000000000007276 NA
## Age_comp 113.2510000000000004775 NA
## Recruitment 93.349599999999995248 1
## InitEQ_Regime 0.000000000000000000 0
## Forecast_Recruitment 0.000000000000000000 1
## Parm_priors 0.000000000000000000 1
## Parm_softbounds 0.001895880000000000 NA
## 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
## 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 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
## 184 Surv_lambda NA 0.00000e+00 0.00000e+00 0.00000e+00 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 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
## 193 Age_like 1.13251e+02 2.49472e+01 4.15343e+01 1.02819e+01 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  -1   1   2   3   4   5
##   1   1   1  10   4   2  21   6  16   3   2
##
## $estimated_non_dev_parameters
##
##              Value Phase      Min      Max      Init Status
## L_at_Amin_Fem_GP_1      12.9188000      3      3.00 30.00 12.8541000      OK
## L_at_Amax_Fem_GP_1      24.7845000      3     15.00 40.00 24.8415000      OK
## VonBert_K_Fem_GP_1       0.3077450      3      0.05  0.99  0.3075730      OK
## CV_young_Fem_GP_1       0.1185600      3      0.05  0.50  0.1053490      OK
## CV_old_Fem_GP_1        0.0218696      3      0.01  0.10  0.0237245      OK
## SR_LN(R0)             14.4351000      1      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      3      0.00 30.00 10.9072000      OK
## Size_95%width_MexCal_S1(1)  0.7327170      3      0.00 10.00  0.6599090      OK
## AgeSel_P1_MexCal_S1(1)    0.5000220      3    -10.00 11.00  0.5000240      OK
## AgeSel_P2_MexCal_S1(1)    1.4981200      3    -10.00 11.00  0.2048810      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)    0.7533250      3    -10.00 15.00  0.4405260      OK
## 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
## Age_inflection_PNW(3)     2.8219500      4      0.00 10.00  2.8525100      OK
## Age_95%width_PNW(3)      1.1461700      4     -5.00 15.00  1.2152300      OK
##
##              Parm_StDev      Gradient  Pr_type Prior Pr_SD
## L_at_Amin_Fem_GP_1      0  0.00000001238880 No_prior  NA  NA
## L_at_Amax_Fem_GP_1      0  0.00000214538000 No_prior  NA  NA
## VonBert_K_Fem_GP_1      0  0.00000115591000 No_prior  NA  NA
## CV_young_Fem_GP_1      0 -0.00000011495400 No_prior  NA  NA
## CV_old_Fem_GP_1        0  0.00000010543100 No_prior  NA  NA
## SR_LN(R0)              0  0.00001248790000 No_prior  NA  NA
## SR_regime_BLK1repl_2000  0  0.00000140432000 No_prior  NA  NA
## Size_inflection_MexCal_S1(1) 0  0.00000254499000 No_prior  NA  NA
## Size_95%width_MexCal_S1(1) 0 -0.00000016337300 No_prior  NA  NA
## AgeSel_P1_MexCal_S1(1)    0  0.00000000658736 No_prior  NA  NA
## AgeSel_P2_MexCal_S1(1)    0  0.00000137300000 No_prior  NA  NA
## AgeSel_P3_MexCal_S1(1)    0  0.00000146040000 No_prior  NA  NA
## AgeSel_P4_MexCal_S1(1)    0  0.00000053827800 No_prior  NA  NA
## AgeSel_P5_MexCal_S1(1)    0  0.00000020581200 No_prior  NA  NA
## AgeSel_P2_MexCal_S2(2)    0  0.00000067622900 No_prior  NA  NA
## AgeSel_P3_MexCal_S2(2)    0  0.00000060302600 No_prior  NA  NA
## AgeSel_P4_MexCal_S2(2)    0  0.00000050171200 No_prior  NA  NA
## 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      NA      OK
## L_at_Amax_Fem_GP_1      NA      OK
## VonBert_K_Fem_GP_1      NA      OK
## CV_young_Fem_GP_1      NA      OK

```

```

## CV_old_Fem_GP_1          NA          OK
## SR_LN(R0)                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)   NA          OK
## AgeSel_P5_MexCal_S2(2)   NA          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
##
## Value Gradient
## SR_LN(R0)                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      4      3      0.0812390 # 25 16      1      1000     143.438
## 1190      4      4      0.0946217 # 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      75.5652      18.7323      1
## 1188     121.733      NA      NA      85.9834      38.8162      1
## 1189     143.438      NA      NA     163.5230     11.6527      1
## 1190     117.900      NA      NA     19.1287     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      100      1000
## 1253      5      2      0.595226 #      15 15      100      1000
## 1254      5      3      5.661630 #      15 15      100      1000
## 1255      5      4      0.665768 #      10 10      100      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          NA          NA  363.944      126.4960
##      Curr_Var_Adj Fleet_name
## 1252          1 MexCal_S1
## 1253          1 MexCal_S2
## 1254          1      PNW
## 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
## 3 Early+Main+Late 27  1.442026   2.079438      0          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

compNoFore2020 <- SSsummarize(list(OM2020 = outOMnofore,
                                   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_1

datOM5yr <- SS_readdat(file.path(OM5yr_dir, "data.ss_new"),
                      verbose = FALSE,
                      section = 2)

EM5yr2019_dir <- "C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenarios/perfDatTests/constGrow20010M_1

datEM5yr2019 <- SS_readdat(file.path(EM5yr2019_dir, "init_dat.ss"),
                          verbose = FALSE,
                          section = 1)

datEM5yr2019$catch <- datOM5yr$catch %>% filter(year <= 2019)
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/constGrow20010M_1

datEM5yr2020 <- SS_readdat(file.path(EM5yr2020_dir, "init_dat.ss"),
                          verbose = FALSE,
                          section = 1)

datEM5yr2020$catch <- datOM5yr$catch %>% filter(year <= 2020)
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$agecomp <- datOM5yr$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)
```

```
## 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
```

```
## "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 4 warnings in C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenarios
```

```
## 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,
```

```
## 0 rows of conditional age-at-length data,
```

```
## 360 rows of ghost fleet age comp data,
```

```
## 0 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,
```

```
## 0 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_ADMR"
##
## $SS_versionshort
## [1] "3.30"
##
## $SS_versionNumeric
## [1] 3.3
##
## $StartTime
## [1] "StartTime: Mon Jun 06 17:26:53 2022"
##
## $RunTime
## [1] "0 hours, 0 minutes, 0 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_ADMR"
## [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 bins"
## [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 estimated"
## [15] "N warnings: 4"
##
## $likelihoods_used
##
##          values lambdas
## TOTAL          61581.0000000    NA
## Catch           61416.9000000    NA
## Equil_catch         0.0000000    NA
## Survey          -28.0180000    NA
## Length_comp        41.9452000    NA
## Age_comp          37.4688000    NA
## Recruitment        78.3199000     1
## InitEQ_Regime       0.0000000     0
## Forecast_Recruitment 34.3168000     1

```

```

## Parm_priors          0.0000000    1
## Parm_softbounds     0.0019748    NA
## Parm_devs           0.0000000    1
## Crash_Pen           0.0000000    1
##
## $likelihoods_laplace
##                               values lambdas
## NoBias_corr_Recruitment(info_only)    75.1513    1
## Laplace_obj_fun(info_only)           61577.8000    NA
##
## $likelihoods_by_fleet
##           Label      ALL  MexCal_S1  MexCal_S2      PNW AT_Survey
## 185  Catch_lambda      NA    1.00000    1.00000    1.00000    1.00000
## 186  Catch_like 61416.9000 20767.40000 20955.40000 19694.10000    0.00000
## 187 Init_equ_lambda      NA    0.00000    0.00000    0.00000    1.00000
## 188 Init_equ_like    0.0000    0.00000    0.00000    0.00000    0.00000
## 189  Surv_lambda      NA    0.00000    0.00000    0.00000    1.00000
## 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
## 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      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 0.00000  0.0000
## 196 0.00000  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  1 10  4 22
##

```

```

## $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      4      1      59.69170 # 24 14      6      86.00      32.5914
## 1507      4      2      36.47650 # 24 14      9     108.80      59.3200
## 1508      4      3     111.35100 # 34 15      1     174.48      86.7573
## 1509      4      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      1
## 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
## 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      86.00
## 1608      5      2      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
## 1607      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     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      1 AT_Survey
##
## $SBzero
## [1] 80588.5
##
## $current_depletion
## [1] 0.6966317
##
## $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      Early+Main    26   1.364724   1.862471      NA      NA
## 3 Early+Main+Late    36   1.349487   1.821115      NA      NA
##  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                      NA
## 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)

## 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 threshold to 0.25 based on US west coast assumption associated with biomass

## !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 11 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,
## 0 rows of conditional age-at-length data,
## 0 rows of ghost fleet age comp data,
## 0 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,
## 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 = 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_ADMR"
##
## $SS_versionshort
## [1] "3.30"
##

```

```

## $SS_versionNumeric
## [1] 3.3
##
## $StartTime
## [1] "StartTime: Tue Jun 07 10:41:19 2022"
##
## $RunTime
## [1] "0 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 bins
## [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                             53.17179999999997510      NA
## Catch                             0.0000000000000391362      NA
## Equil_catch                        0.0000000000000000000      NA
## Survey                           -42.3108000000000000409      NA
## Length_comp                        25.373799999999999244      NA
## Age_comp                           16.1543999999999998983      NA
## Recruitment                        53.9525999999999996783       1
## InitEQ_Regime                      0.0000000000000000000       0
## Forecast_Recruitment                0.0000000000000000000       1
## Parm_priors                        0.0000000000000000000       1
## Parm_softbounds                    0.0018333200000000000      NA
## Parm_devs                          0.0000000000000000000       1
## Crash_Pen                          0.0000000000000000000       1
##

```

```

## $likelihoods_laplace
##                               values lambdas
## NoBias_corr_Recruitment(info_only) 50.7840      1
## 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   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   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   Age_N_use          NA 1.40000e+01 1.40000e+01 1.40000e+01      9.0000
## 195   Age_N_skip          NA 0.00000e+00 0.00000e+00 0.00000e+00      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
##   1   1   1  10   4   2  21   6  16   3   1
##
## $estimated_non_dev_parameters
##
##           Value Phase    Min    Max      Init Status
## L_at_Amin_Fem_GP_1    12.8463000    3    3.00 30.00 12.8541000    OK
## L_at_Amax_Fem_GP_1    24.9297000    3   15.00 40.00 24.8415000    OK
## VonBert_K_Fem_GP_1     0.3052990    3    0.05  0.99  0.3075730    OK

```


## CV_young_Fem_GP_1	0.1135150	3	0.05	0.50	0.1053490	OK
## CV_old_Fem_GP_1	0.0199304	3	0.01	0.10	0.0237245	OK
## SR_LN(R0)	14.7700000	1	3.00	25.00	14.4668000	OK
## SR_regime_BLK1repl_2000	0.9815310	4	-15.00	15.00	1.2915300	OK
## Size_inflection_MexCal_S1(1)	10.9366000	3	0.00	30.00	10.9072000	OK
## Size_95%width_MexCal_S1(1)	0.7588860	3	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	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)	-1.1978500	3	-10.00	11.00	-1.1690800	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	4	0.00	10.00	2.8525100	OK
## Age_95%width_PNW(3)	1.2378300	4	-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	
## L_at_Amax_Fem_GP_1	0.25106200	0.00000150313000	No_prior		NA	
## 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(R0)	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	0.00000016215600	No_prior		NA	
## AgeSel_P1_MexCal_S1(1)	234.78400000	0.00000000675916	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	0.00000005729660	No_prior		NA	
## AgeSel_P3_MexCal_S2(2)	0.16758800	0.00000070821300	No_prior		NA	
## AgeSel_P4_MexCal_S2(2)	0.27173700	0.00000066790300	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		NA	
## Age_95%width_PNW(3)	0.06682090	-0.00000110157000	No_prior		NA	
##	Pr_SD	Pr_Like	Afterbound			
## L_at_Amin_Fem_GP_1	NA	NA	OK			
## L_at_Amax_Fem_GP_1	NA	NA	OK			
## VonBert_K_Fem_GP_1	NA	NA	OK			
## CV_young_Fem_GP_1	NA	NA	OK			
## CV_old_Fem_GP_1	NA	NA	OK			
## SR_LN(R0)	NA	NA	OK			
## SR_regime_BLK1repl_2000	NA	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)	NA	NA	OK			
## AgeSel_P3_MexCal_S1(1)	NA	NA	OK			
## AgeSel_P4_MexCal_S1(1)	NA	NA	OK			
## AgeSel_P5_MexCal_S1(1)	NA	NA	OK			
## AgeSel_P2_MexCal_S2(2)	NA	NA	OK			

```

## AgeSel_P3_MexCal_S2(2)      NA      NA      OK
## AgeSel_P4_MexCal_S2(2)      NA      NA      OK
## AgeSel_P5_MexCal_S2(2)      NA      NA      OK
## Age_inflection_PNW(3)       NA      NA      OK
## 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
## 1158      4      3     136.133000 # 24 15      1     174.48      86.7573
## 1159      4      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
## 1156      32.5914      NA      NA 8292.820   2385.0500      1
## 1157      59.3200      NA      NA 10041.700   2378.6900      1
## 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
## 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
## 1218      5      2      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
## 1217     31.0686     31.0686      NA      NA 9573.260   471.1240
## 1218     58.3143     58.3143      NA      NA 11412.600   377.7720
## 1219     76.2971     76.2971      NA      NA 14103.900  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                2.345401                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)      0

## completed SS_output

EMssmse2019_dir <- "C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenarios/perfDatTests/constGrow2
outEMssmse2019 <- SS_output(EMssmse2019_dir)

## 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 threshold to 0.25 based on US west coast assumption associated with biomass

## !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 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,
##   0 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,
##   0 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,
##   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_ADMR"
##
## $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_ADMR"
## [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 bins"
## [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 phase"
## [13] "4 setting in starter does not request all priors, and 1 parameters have priors and are not estimated"
## [14] "5 1st iteration warning: ssb(endyr)/ssb(styr)= 3.87036e-07; suggest start with larger R0 to get"
## [15] "6 1st iteration warning: catch logL > 50% total logL; check configuration; suggest start with 1"
## [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          740.73199999999970896      NA
## Catch           0.000000000000471052      NA
## Equil_catch      0.000000000000000000      NA
## Survey          -24.20799999999998408      NA
## Length_comp      647.479000000000041837      NA
## Age_comp         26.583500000000000796      NA
## Recruitment      90.87539999999999068        1
## InitEQ_Regime    0.000000000000000000        0
## Forecast_Recruitment 0.000000000000000000        1
## Parm_priors      0.000000000000000000        1
## Parm_softbounds  0.001803910000000000      NA
## Parm_devs        0.000000000000000000        1
## Crash_Pen        0.000000000000000000        1
##
## $likelihoods_laplace
##
##              values lambdas
## NoBias_corr_Recruitment(info_only) 87.7068        1
## Laplace_obj_fun(info_only)         737.5630      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 1.00000
## 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
## 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 1.00000
## 185 Surv_like -2.42080e+01 0.00000e+00 0.00000e+00 0.00000e+00 -9.11442
## 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  6.47479e+02 1.65431e+02 1.86247e+02 1.68218e+02 127.58400
## 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  2.65835e+01 4.66667e+00 4.92733e+00 3.46460e+00 13.52490
## 194 Age_N_use      NA 1.40000e+01 1.40000e+01 1.40000e+01 9.00000
## 195 Age_N_skip      NA 0.00000e+00 0.00000e+00 0.00000e+00 0.00000
##
##      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 -1 1 2 3 4 5
## 1 1 1 10 4 2 21 6 16 3 1
##
## $estimated_non_dev_parameters
##
## Value Phase Min Max Init Status
## L_at_Amin_Fem_GP_1 12.7213000 3 3.00 30.00 12.8541000 OK
## L_at_Amax_Fem_GP_1 24.7291000 3 15.00 40.00 24.8415000 OK
## VonBert_K_Fem_GP_1 0.3186590 3 0.05 0.99 0.3075730 OK
## CV_young_Fem_GP_1 0.1131800 3 0.05 0.50 0.1053490 OK
## CV_old_Fem_GP_1 0.0202346 3 0.01 0.10 0.0237245 OK
## SR_LN(RO) 14.4286000 1 3.00 25.00 14.4668000 OK
## SR_regime_BLK1repl_2000 1.3174500 4 -15.00 15.00 1.2915300 OK
## Size_inflection_MexCal_S1(1) 10.9201000 3 0.00 30.00 10.9072000 OK
## Size_95%width_MexCal_S1(1) 0.7931200 3 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) 0.1680180 3 -10.00 11.00 0.2048810 OK
## AgeSel_P3_MexCal_S1(1) 0.3559430 3 -10.00 15.00 0.3827920 OK
## AgeSel_P4_MexCal_S1(1) -1.4832000 3 -10.00 11.00 -1.5494000 OK
## AgeSel_P5_MexCal_S1(1) -0.1920900 3 -10.00 11.00 -0.2361890 OK
## AgeSel_P2_MexCal_S2(2) 0.4075720 3 -10.00 15.00 0.4405260 OK
## AgeSel_P3_MexCal_S2(2) -1.1997600 3 -10.00 11.00 -1.1690800 OK
## AgeSel_P4_MexCal_S2(2) -0.2775540 3 -10.00 11.00 -0.1425740 OK
## AgeSel_P5_MexCal_S2(2) -0.2903910 3 -10.00 11.00 -0.4707320 OK
## Age_inflection_PNW(3) 2.8502400 4 0.00 10.00 2.8525100 OK
## Age_95%width_PNW(3) 1.2148000 4 -5.00 15.00 1.2152300 OK
##
## Param_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 0.00000500683000 No_prior NA NA
## VonBert_K_Fem_GP_1 0 -0.00000533821000 No_prior NA NA
## CV_young_Fem_GP_1 0 -0.00000073629400 No_prior NA NA
## CV_old_Fem_GP_1 0 0.00000146622000 No_prior NA NA
## SR_LN(RO) 0 -0.00002374860000 No_prior NA NA
## SR_regime_BLK1repl_2000 0 -0.00000215662000 No_prior NA NA
## Size_inflection_MexCal_S1(1) 0 0.00002911220000 No_prior NA NA

```

```

## Size_95%width_MexCal_S1(1)      0 -0.00000284785000 No_prior    NA    NA
## AgeSel_P1_MexCal_S1(1)          0  0.00000000696851 No_prior    NA    NA
## AgeSel_P2_MexCal_S1(1)          0  0.00000619038000 No_prior    NA    NA
## AgeSel_P3_MexCal_S1(1)          0  0.00000483263000 No_prior    NA    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  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    NA
##                                     Pr_Like Afterbound
## L_at_Amin_Fem_GP_1              NA      OK
## L_at_Amax_Fem_GP_1              NA      OK
## VonBert_K_Fem_GP_1              NA      OK
## CV_young_Fem_GP_1               NA      OK
## CV_old_Fem_GP_1                 NA      OK
## SR_LN(R0)                       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)          NA      OK
## AgeSel_P5_MexCal_S2(2)          NA      OK
## Age_inflection_PNW(3)           NA      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(R0)                    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
## AgeSel_P2_MexCal_S1(1)        0.168018  6.19038e-06
##
## $Length_Comp_Fit_Summary
##      Factor Fleet Recommend_var_adj #  N Npos min_Nsamp max_Nsamp mean_Nsamp_in
## 1156      4      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      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      NA  65.8339     34.8273      1

```



```

## 1158      86.3333      NA      NA  94.6086    12.2177      1
## 1159      19.8889      NA      NA  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      100      100
## 1218      5      2      6.16927 #      14      14      100      100
## 1219      5      3     17.18980 #      14      14      100      100
## 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
## 1219      100      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      1 MexCal_S2
## 1219      1      PNW
## 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      Main      20    1.63260    2.665384      0      0
## 2 Early+Main      26    1.45398    2.114057      0      0
## 3 Early+Main+Late    26    1.45398    2.114057      0      0
##      sqrt_sum_of_components SD_of_devs_over_sigma_R sqrt_sum_over_sigma_R
## 1      1.63260      3.265201      3.265201
## 2      1.45398      2.907960      2.907960
## 3      1.45398      2.907960      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,
                                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)

## 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 threshold to 0.25 based on US west coast assumption associated with biomass

## !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 11 warnings in C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenarios/perfDatTests/constGrow20010M_MidSteepH

## 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,
## 0 rows of conditional age-at-length data,
## 0 rows of ghost fleet age comp data,
## 0 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,
## 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 = 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_ADMR"
##
## $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 bins"
## [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 phase"
## [14] "5 setting in starter does not request all priors, and 1 parameters have priors and are not estimated"
## [15] "6 1st iteration warning: ssb(endyr)/ssb(styr)= 4.77067e-07; suggest start with larger R0 to get"
## [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      NA
## Catch                          0.0000000000000599152      NA
## Equil_catch                     0.000000000000000000      NA
## Survey                         -48.2809000000000002592      NA
## Length_comp                     76.3866000000000001387      NA
## Age_comp                        66.9733999999999998045      NA
## Recruitment                     66.8598000000000007003       1
## InitEQ_Regime                   0.000000000000000000       0
## Forecast_Recruitment            0.000000000000000000       1
## Parm_priors                     0.000000000000000000       1
## Parm_softbounds                 0.0019289200000000000      NA
## Parm_devs                       0.000000000000000000       1
## Crash_Pen                       0.000000000000000000       1
##
## $likelihoods_laplace
##
##                                     values lambdas

```

```

## NoBias_corr_Recruitment(info_only) 63.6913      1
## Laplace_obj_fun(info_only)      158.7720      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 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   Length_like 7.63866e+01 1.34910e+01 2.03074e+01 3.25584e+00     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
## 193   Age_like 6.69734e+01 6.91723e+00 2.77972e+01 3.93827e+00     28.3207
## 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  1.0000  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   1  10   4   2  21   6  16   3   2
##
## $estimated_non_dev_parameters
##           Value Phase    Min    Max    Init Status
## L_at_Amin_Fem_GP_1 12.8931000    3  3.00 30.00 12.8541000    OK
## L_at_Amax_Fem_GP_1 24.9354000    3 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    3  0.05  0.50  0.1053490    OK
## CV_old_Fem_GP_1    0.0209416    3  0.01  0.10  0.0237245    OK

```

## SR_LN(R0)	14.5863000	1	3.00	25.00	14.4668000	OK
## SR_regime_BLK1repl_2000	1.0969100	4	-15.00	15.00	1.2915300	OK
## Size_inflection_MexCal_S1(1)	10.8349000	3	0.00	30.00	10.9072000	OK
## Size_95%width_MexCal_S1(1)	0.6990270	3	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)	1.5290000	3	-10.00	11.00	0.2048810	OK
## 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)	-0.6268860	3	-10.00	11.00	-0.4707320	OK
## Age_inflection_PNW(3)	2.8579400	4	0.00	10.00	2.8525100	OK
## Age_95%width_PNW(3)	1.1550600	4	-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		NA	
## VonBert_K_Fem_GP_1	0.00735414	0.00000603161000	No_prior		NA	
## CV_young_Fem_GP_1	0.00265329	-0.00000286378000	No_prior		NA	
## CV_old_Fem_GP_1	0.00255814	0.00000013430100	No_prior		NA	
## SR_LN(R0)	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		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		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)	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	NA	OK			
## L_at_Amax_Fem_GP_1	NA	NA	OK			
## VonBert_K_Fem_GP_1	NA	NA	OK			
## CV_young_Fem_GP_1	NA	NA	OK			
## CV_old_Fem_GP_1	NA	NA	OK			
## SR_LN(R0)	NA	NA	OK			
## SR_regime_BLK1repl_2000	NA	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)	NA	NA	OK			
## AgeSel_P3_MexCal_S1(1)	NA	NA	OK			
## AgeSel_P4_MexCal_S1(1)	NA	NA	OK			
## AgeSel_P5_MexCal_S1(1)	NA	NA	OK			
## AgeSel_P2_MexCal_S2(2)	NA	NA	OK			
## AgeSel_P3_MexCal_S2(2)	NA	NA	OK			
## AgeSel_P4_MexCal_S2(2)	NA	NA	OK			

```

## AgeSel_P5_MexCal_S2(2)      NA      NA      OK
## Age_inflection_PNW(3)      NA      NA      OK
## 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(R0)      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      4      3     55.611200 # 25 16      1      1000     143.8350
## 1190      4      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
## 1189     143.8350      NA      NA 16878.900     7998.8400      1
## 1190     117.9000      NA      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
## 1253      5      2      0.579745 #      15 15      8.92      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     137.877      NA      NA    3565.740     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           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           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          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 0
## 30 AgeSel_P1_MexCal_S1(1) 0

## completed SS_output

EMssmse2020_dir <- "C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenarios/perfDatTests/constGrow20010M_MidSteepH
outEMssmse2020 <- SS_output(EMssmse2020_dir)

## 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 17:21:42 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 threshold to 0.25 based on US west coast assumption associated with biomass

## !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 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,
## 0 rows of generalized size comp data,
## 495 rows of age comp data,
## 0 rows of conditional age-at-length data,
## 0 rows of ghost fleet age comp data,
## 0 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,
## 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_ADMR"
##
## $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_ADMR"
## [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 bins"
## [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 phase"
## [14] "5 setting in starter does not request all priors, and 1 parameters have priors and are not estimated"
## [15] "6 1st iteration warning: ssb(endyr)/ssb(styr)= 4.77067e-07; suggest start with larger R0 to get"
## [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          979.32799999999974534      NA
## Catch           0.000000000000525423      NA
## Equil_catch      0.000000000000000000      NA
## Survey          -27.60739999999998386      NA
## Length_comp      800.927000000000020918      NA
## Age_comp         112.629000000000004889      NA
## Recruitment       93.377700000000004366       1
## InitEQ_Regime     0.000000000000000000       0
## Forecast_Recruitment 0.000000000000000000       1
## Parm_priors       0.000000000000000000       1
## Parm_softbounds   0.00204009000000000000      NA
## Parm_devs         0.000000000000000000       1
## Crash_Pen        0.000000000000000000       1
##
## $likelihoods_laplace
##
##              values lambdas
## NoBias_corr_Recruitment(info_only) 90.2091      1
## Laplace_obj_fun(info_only)         976.1600      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    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
## 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    -2.76074e+01 0.00000e+00 0.00000e+00 0.00000e+00 -12.6314
## 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    8.00927e+02 2.02287e+02 2.29441e+02 1.93703e+02 175.4960
## 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
## 193 Age_like    1.12629e+02 2.28733e+01 4.27931e+01 9.71992e+00 37.2428
## 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 1.00000
## 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 -1 1 2 3 4 5
## 1 1 1 10 4 2 21 6 16 3 2
##
## $estimated_non_dev_parameters
##
## Value Phase Min Max Init Status
## L_at_Amin_Fem_GP_1 12.8363000 3 3.00 30.00 12.8541000 OK
## L_at_Amax_Fem_GP_1 24.5884000 3 15.00 40.00 24.8415000 OK
## VonBert_K_Fem_GP_1 0.3238950 3 0.05 0.99 0.3075730 OK
## CV_young_Fem_GP_1 0.1230970 3 0.05 0.50 0.1053490 OK
## CV_old_Fem_GP_1 0.0259429 3 0.01 0.10 0.0237245 OK
## SR_LN(RO) 14.4624000 1 3.00 25.00 14.4668000 OK
## SR_regime_BLK1repl_2000 1.1478700 4 -15.00 15.00 1.2915300 OK
## Size_inflection_MexCal_S1(1) 10.7772000 3 0.00 30.00 10.9072000 OK
## Size_95%width_MexCal_S1(1) 0.6344040 3 0.00 10.00 0.6599090 OK
## AgeSel_P1_MexCal_S1(1) 0.5000220 3 -10.00 11.00 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 OK
## AgeSel_P4_MexCal_S1(1) -1.5433100 3 -10.00 11.00 -1.5494000 OK
## AgeSel_P5_MexCal_S1(1) -0.1786430 3 -10.00 11.00 -0.2361890 OK
## AgeSel_P2_MexCal_S2(2) 0.7715240 3 -10.00 15.00 0.4405260 OK
## AgeSel_P3_MexCal_S2(2) -1.2534000 3 -10.00 11.00 -1.1690800 OK
## AgeSel_P4_MexCal_S2(2) -0.1323180 3 -10.00 11.00 -0.1425740 OK
## AgeSel_P5_MexCal_S2(2) -0.4698480 3 -10.00 11.00 -0.4707320 OK
## Age_inflection_PNW(3) 2.8150600 4 0.00 10.00 2.8525100 OK
## Age_95%width_PNW(3) 1.0982600 4 -5.00 15.00 1.2152300 OK
##
## Param_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 0.00003339680000 No_prior NA NA
## VonBert_K_Fem_GP_1 0 0.00001355970000 No_prior NA NA
## CV_young_Fem_GP_1 0 0.00000075648400 No_prior NA NA
## CV_old_Fem_GP_1 0 0.00000132656000 No_prior NA NA
## SR_LN(RO) 0 0.00004827200000 No_prior NA NA
## SR_regime_BLK1repl_2000 0 0.00002574590000 No_prior NA NA
## Size_inflection_MexCal_S1(1) 0 0.00000062811500 No_prior NA NA

```

```

## Size_95%width_MexCal_S1(1)      0 -0.00000039065600 No_prior    NA    NA
## AgeSel_P1_MexCal_S1(1)          0  0.00000000657462 No_prior    NA    NA
## AgeSel_P2_MexCal_S1(1)          0 -0.00000260523000 No_prior    NA    NA
## AgeSel_P3_MexCal_S1(1)          0  0.00001181460000 No_prior    NA    NA
## AgeSel_P4_MexCal_S1(1)          0  0.00000163051000 No_prior    NA    NA
## AgeSel_P5_MexCal_S1(1)          0  0.00000069669100 No_prior    NA    NA
## AgeSel_P2_MexCal_S2(2)          0  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  0.00000828019000 No_prior    NA    NA
## Age_inflection_PNW(3)           0  0.00001576210000 No_prior    NA    NA
## Age_95%width_PNW(3)             0 -0.00005477310000 No_prior    NA    NA
##                                Pr_Like Afterbound
## L_at_Amin_Fem_GP_1              NA      OK
## L_at_Amax_Fem_GP_1              NA      OK
## VonBert_K_Fem_GP_1              NA      OK
## CV_young_Fem_GP_1               NA      OK
## CV_old_Fem_GP_1                 NA      OK
## SR_LN(R0)                       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)           NA      OK
## AgeSel_P5_MexCal_S2(2)           NA      OK
## Age_inflection_PNW(3)            NA      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(R0)                     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      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      NA      NA  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      100      1000
## 1253      5      2      0.531994 #      15      15      100      1000
## 1254      5      3      4.965550 #      15      15      100      1000
## 1255      5      4      0.709544 #      10      10      100      1000
##      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      1 MexCal_S2
## 1254      1      PNW
## 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      Main      20  1.648967  2.719092      0      0
## 2 Early+Main      26  1.471087  2.164097      0      0
## 3 Early+Main+Late  27  1.442526  2.080881      0      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
## 1  main 20 1.607210      10.33260      0.841539
## 2  early 6 0.639361      1.63513      0.766330

## completed SS_output

comp5yr2020 <- SSsummarize(list(OM2020 = outOM5yr,
                                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/constGrow20010M

datOMBavg <- SS_readdat(file.path(OMBavg_dir, "data.ss_new"),
                        verbose = FALSE,
                        section = 2)

EMBavg2019_dir <- "C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenarios/perfDatTests/constGrow20010M

datEMBavg2019 <- SS_readdat(file.path(EMBavg2019_dir, "init_dat.ss"),
                            verbose = FALSE,
                            section = 1)

datEMBavg2019$catch <- datOMBavg$catch %>% filter(year <= 2019)
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/constGrow20010M

datEMBavg2020 <- SS_readdat(file.path(EMBavg2020_dir, "init_dat.ss"),
                            verbose = FALSE,
                            section = 1)
```

```

datEMBavg2020$catch <- datOMBavg$catch %>% filter(year <= 2020)
datEMBavg2020$CPUE <- datOMBavg$CPUE %>% filter(year <= 2020) %>%
  mutate(index = abs(index))
datEMBavg2020$lencomp <- datOMBavg$lencomp %>% filter(Yr <= 2020) %>%
  mutate(FltSvy = case_when(FltSvy == -3 & Seas == 10 ~ FltSvy,
                             TRUE ~ abs(FltSvy)))
datEMBavg2020$agecomp <- datOMBavg$agecomp %>% filter(Yr <= 2020) %>%
  mutate(FltSvy = abs(FltSvy))

SS_writedat(datlist = datEMBavg2020,
            outfile = file.path(file.path(EMBavg2020_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
outOMBavg <- SS_output(OMBavg_dir)

```

```

## Getting header info from:
##   C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenarios/perfDatTests/constGrow2001OM_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
## "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 6 warnings in C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenarios

```

```

## 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,
##   0 rows of conditional age-at-length data,
##   360 rows of ghost fleet age comp data,
##   0 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,
##   0 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_ADMR"
##
## $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_ADMR"
## [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"

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```

## [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 bins"
## [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      NA
## Catch           51349.0000000      NA
## Equil_catch      0.0000000      NA
## Survey          -28.0180000      NA
## Length_comp      41.9452000      NA
## Age_comp         37.4688000      NA
## Recruitment      78.3199000      1
## InitEQ_Regime    0.0000000      0
## Forecast_Recruitment 30.1114000      1
## Parm_priors      0.0000000      1
## Parm_softbounds  0.0019748      NA
## Parm_devs        0.0000000      1
## Crash_Pen        0.0000000      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
## 185  Catch_lambda      NA    1.00000    1.00000    1.00000    1.00000
## 186  Catch_like 51349.0000 18550.10000 18632.70000 14166.20000    0.00000
## 187 Init_equ_lambda      NA    0.00000    0.00000    0.00000    1.00000
## 188 Init_equ_like    0.0000    0.00000    0.00000    0.00000    0.00000
## 189 Surv_lambda      NA    0.00000    0.00000    0.00000    1.00000
## 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
## 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      NA   10.00000   10.00000   10.00000   10.00000
##
##      DEPM  TEP_all
## 185 1.00000  1.0000
## 186 0.00000  0.0000

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## 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
## 196 0.00000 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 1 10 4 22
##
## $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 4 1 59.69170 # 24 14 6 86.00 32.5914
## 1507 4 2 36.47650 # 24 14 9 108.80 59.3200
## 1508 4 3 111.35100 # 34 15 1 174.48 86.7573
## 1509 4 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 1
## 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
## 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 86.00
## 1608 5 2 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

```

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##      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      NA      NA 8139.9400
## 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      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      Main      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      NA
## 2      NA      2.729447      NA
## 3      NA      2.654107      NA
##      alternative_sigma_R
## 1      NA
## 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

```

```

outEMBavg2019 <- SS_output(EMBavg2019_dir)

```

```

## 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 10:51:30 2022

## Reading full report file

## Got all columns using ncols = 62

## Got Report file

## Setting minimum biomass threshold to 0.25 based on US west coast assumption associated with biomass

## !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. There were 10 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,
## 0 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,
## 0 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,
## 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

```

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## 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_ADMR"
##
## $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
##
## $warnings
## [1] "#V3.30.18.00;_safe;_compile_date:_Sep 30 2021;_Stock_Synthesis_by_Richard_Methot_(NOAA)_using_ADMR"
## [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 bins"
## [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 estimated"
## [13] "4 1st iteration warning: ssb(endyr)/ssb(styr)= 3.87036e-07; suggest start with larger R0 to get"
## [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"

```



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## [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                        53.1717999999997510      NA
## Catch                        0.000000000000391362      NA
## Equil_catch                  0.000000000000000000      NA
## Survey                      -42.310800000000000409      NA
## Length_comp                  25.373799999999999244      NA
## Age_comp                     16.1543999999999998983      NA
## Recruitment                   53.9525999999999996783       1
## InitEQ_Regime                0.000000000000000000       0
## Forecast_Recruitment         0.000000000000000000       1
## Parm_priors                  0.000000000000000000       1
## Parm_softbounds              0.00183332000000000000      NA
## Parm_devs                    0.000000000000000000       1
## Crash_Pen                    0.000000000000000000       1
##
## $likelihoods_laplace
##
##                                values lambdas
## NoBias_corr_Recruitment(info_only) 50.7840       1
## 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 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 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 Age_N_use      NA 1.40000e+01 1.40000e+01 1.40000e+01 9.0000
## 195 Age_N_skip      NA 0.00000e+00 0.00000e+00 0.00000e+00 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

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```

## 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
## 1 1 1 10 4 2 21 6 16 3 1
##
## $estimated_non_dev_parameters
##
## Value Phase Min Max Init Status
## L_at_Amin_Fem_GP_1 12.8463000 3 3.00 30.00 12.8541000 OK
## L_at_Amax_Fem_GP_1 24.9297000 3 15.00 40.00 24.8415000 OK
## VonBert_K_Fem_GP_1 0.3052990 3 0.05 0.99 0.3075730 OK
## CV_young_Fem_GP_1 0.1135150 3 0.05 0.50 0.1053490 OK
## CV_old_Fem_GP_1 0.0199304 3 0.01 0.10 0.0237245 OK
## SR_LN(R0) 14.7700000 1 3.00 25.00 14.4668000 OK
## SR_regime_BLK1repl_2000 0.9815310 4 -15.00 15.00 1.2915300 OK
## Size_inflection_MexCal_S1(1) 10.9366000 3 0.00 30.00 10.9072000 OK
## Size_95%width_MexCal_S1(1) 0.7588860 3 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 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) -1.1978500 3 -10.00 11.00 -1.1690800 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 4 0.00 10.00 2.8525100 OK
## Age_95%width_PNW(3) 1.2378300 4 -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
## L_at_Amax_Fem_GP_1 0.25106200 0.00000150313000 No_prior NA
## 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(R0) 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 0.00000016215600 No_prior NA
## AgeSel_P1_MexCal_S1(1) 234.78400000 0.00000000675916 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 0.00000005729660 No_prior NA
## AgeSel_P3_MexCal_S2(2) 0.16758800 0.00000070821300 No_prior NA

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## AgeSel_P4_MexCal_S2(2)      0.27173700  0.00000066790300 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  NA
## Age_95%width_PNW(3)          0.06682090 -0.00000110157000 No_prior  NA
##                               Pr_SD Pr_Like Afterbound
## L_at_Amin_Fem_GP_1           NA      NA      OK
## L_at_Amax_Fem_GP_1           NA      NA      OK
## VonBert_K_Fem_GP_1           NA      NA      OK
## CV_young_Fem_GP_1            NA      NA      OK
## CV_old_Fem_GP_1              NA      NA      OK
## SR_LN(R0)                     NA      NA      OK
## SR_regime_BLK1repl_2000       NA      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)       NA      NA      OK
## AgeSel_P3_MexCal_S1(1)       NA      NA      OK
## AgeSel_P4_MexCal_S1(1)       NA      NA      OK
## AgeSel_P5_MexCal_S1(1)       NA      NA      OK
## AgeSel_P2_MexCal_S2(2)       NA      NA      OK
## AgeSel_P3_MexCal_S2(2)       NA      NA      OK
## AgeSel_P4_MexCal_S2(2)       NA      NA      OK
## AgeSel_P5_MexCal_S2(2)       NA      NA      OK
## Age_inflection_PNW(3)        NA      NA      OK
## 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(R0)                     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
## 1158      4      3     136.133000 # 24  15      1     174.48      86.7573
## 1159      4      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
## 1156      32.5914      NA      NA 8292.820    2385.0500      1
## 1157      59.3200      NA      NA 10041.700    2378.6900      1
## 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
## 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
## 1218      5      2      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
## 1217      31.0686      31.0686      NA      NA 9573.260     471.1240
## 1218      58.3143      58.3143      NA      NA 11412.600     377.7720
## 1219      76.2971      76.2971      NA      NA 14103.900    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      2.345401      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)  0

## completed SS_output

EMssmse2019_dir <- "C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenarios/perfDatTests/constGrow20010M_MidSteepH
outEMssmse2019 <- SS_output(EMssmse2019_dir)

## 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 threshold to 0.25 based on US west coast assumption associated with biomass

## !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 8 warnings in C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenarios

## 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,
## 0 rows of conditional age-at-length data,
## 0 rows of ghost fleet age comp data,
## 0 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,
## 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: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_ADMR"
##
## $SS_versionshort
## [1] "3.30"
##
## $SS_versionNumeric
## [1] 3.3

```

```

##
## $StartTime
## [1] "StartTime: Mon Jun 06 17:27:36 2022"
##
## $RunTime
## [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 bins"
## [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 get"
## [14] "5 1st iteration warning: catch logL > 50% total logL; check configuration; suggest start with 1"
## [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      NA
## Catch                        0.000000000000038972      NA
## Equil_catch                  0.000000000000000000      NA
## Survey                       -28.404900000000000137      NA
## Length_comp                  639.32299999999997908      NA
## Age_comp                     25.745300000000000030      NA
## Recruitment                   88.23059999999999548        1
## InitEQ_Regime                 0.000000000000000000        0
## Forecast_Recruitment          0.000000000000000000        1
## Parm_priors                   0.000000000000000000        1
## Parm_softbounds               0.002045150000000000      NA
## Parm_devs                     0.000000000000000000        1
## Crash_Pen                     0.000000000000000000        1
##
## $likelihoods_laplace
##
##                                values lambdas
## NoBias_corr_Recruitment(info_only) 85.0621        1
## Laplace_obj_fun(info_only)         721.7280      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 1.00000
## 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
## 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 1.00000
## 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   Age_N_use      NA 1.40000e+01 1.40000e+01 1.40000e+01 9.00000
## 195   Age_N_skip      NA 0.00000e+00 0.00000e+00 0.00000e+00 0.00000
##      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 -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 -4 -3 -2 -1 1 2 3 4 5
## 1 1 1 10 4 2 21 6 16 3 1
##
## $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
## CV_old_Fem_GP_1 0.028338 3 0.01 0.10 0.0237245 OK
## 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	3	0.00	10.00	0.6599090	OK
## AgeSel_P1_MexCal_S1(1)	0.500023	3	-10.00	11.00	0.5000240	OK
## 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	OK
## AgeSel_P4_MexCal_S1(1)	-1.559500	3	-10.00	11.00	-1.5494000	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	4	0.00	10.00	2.8525100	OK
## Age_95%width_PNW(3)	1.226510	4	-5.00	15.00	1.2152300	OK
##	Parm_StDev		Gradient	Pr_type	Prior	Pr_SD
## L_at_Amin_Fem_GP_1	0	-0.00001361980000	No_prior	NA	NA	
## 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	0	0.00000068867000	No_prior	NA	NA	
## CV_old_Fem_GP_1	0	0.00000091321000	No_prior	NA	NA	
## SR_LN(R0)	0	-0.00001281700000	No_prior	NA	NA	
## SR_regime_BLK1repl_2000	0	-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	-0.00000010867000	No_prior	NA	NA	
## AgeSel_P1_MexCal_S1(1)	0	0.00000000700412	No_prior	NA	NA	
## AgeSel_P2_MexCal_S1(1)	0	0.00000013500200	No_prior	NA	NA	
## AgeSel_P3_MexCal_S1(1)	0	-0.00000147724000	No_prior	NA	NA	
## AgeSel_P4_MexCal_S1(1)	0	-0.00000070098700	No_prior	NA	NA	
## AgeSel_P5_MexCal_S1(1)	0	-0.00000081456800	No_prior	NA	NA	
## AgeSel_P2_MexCal_S2(2)	0	-0.00000294566000	No_prior	NA	NA	
## 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	NA	
##	Pr_Like	Afterbound				
## L_at_Amin_Fem_GP_1	NA	OK				
## L_at_Amax_Fem_GP_1	NA	OK				
## VonBert_K_Fem_GP_1	NA	OK				
## CV_young_Fem_GP_1	NA	OK				
## CV_old_Fem_GP_1	NA	OK				
## SR_LN(R0)	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)	NA	OK				
## AgeSel_P5_MexCal_S2(2)	NA	OK				
## Age_inflection_PNW(3)	NA	OK				
## 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(R0)          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      4     2          0.653439 # 14  14         9       108        59.0000
## 1158      4     3          0.127457 # 24  15         1       174        86.3333
## 1159      4     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          1
## 1157          59.0000          NA      NA    64.8646    38.55290          1
## 1158          86.3333          NA      NA    91.8304    11.00380          1
## 1159          19.8889          NA      NA    14.8765     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           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          NA      NA 14148.000     827.159
## 1219          100          100          NA      NA 1525.270    1122.660
## 1220          100          100          NA      NA   708.151     282.380
##      Curr_Var_Adj Fleet_name
## 1217           1 MexCal_S1
## 1218           1 MexCal_S2
## 1219           1      PNW
## 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           Main    20   1.610123   2.592496      0           0
## 2      Early+Main    26   1.435318   2.060136      0           0
## 3 Early+Main+Late    26   1.435318   2.060136      0           0
##  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
```

```
compbavg2019 <- SSsummarize(list(OM2019 = outOMBavg,
                                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)

## 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 threshold to 0.25 based on US west coast assumption associated with biomass

## !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 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,
## 0 rows of conditional age-at-length data,
## 0 rows of ghost fleet age comp data,
## 0 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,
## 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 = 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_ADMR"
##
## $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_ADMR"
## [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 bins"
## [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 estimated"
## [14] "5 1st iteration warning: ssb(endyr)/ssb(styr)= 4.77067e-07; suggest start with larger R0 to get"
## [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                161.94100000000002501      NA
## Catch                  0.000000000000599152      NA
## Equil_catch            0.000000000000000000      NA

```

```

## Survey -48.280900000000002592 NA
## Length_comp 76.386600000000001387 NA
## Age_comp 66.973399999999998045 NA
## Recruitment 66.859800000000007003 1
## InitEQ_Regime 0.000000000000000000 0
## Forecast_Recruitment 0.000000000000000000 1
## Parm_priors 0.000000000000000000 1
## Parm_softbounds 0.001928920000000000 NA
## Parm_devs 0.000000000000000000 1
## Crash_Pen 0.000000000000000000 1
##
## $likelihoods_laplace
## values lambdas
## NoBias_corr_Recruitment(info_only) 63.6913 1
## Laplace_obj_fun(info_only) 158.7720 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 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 Length_like 7.63866e+01 1.34910e+01 2.03074e+01 3.25584e+00 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
## 193 Age_like 6.69734e+01 6.91723e+00 2.77972e+01 3.93827e+00 28.3207
## 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 1.0000 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   1  10   4   2  21  6  16  3  2
##
## $estimated_non_dev_parameters
##
## Value Phase   Min   Max   Init Status
## L_at_Amin_Fem_GP_1      12.8931000    3   3.00 30.00 12.8541000    OK
## L_at_Amax_Fem_GP_1      24.9354000    3  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    3   0.05  0.50  0.1053490    OK
## CV_old_Fem_GP_1        0.0209416    3   0.01  0.10  0.0237245    OK
## SR_LN(R0)              14.5863000    1   3.00 25.00 14.4668000    OK
## SR_regime_BLK1repl_2000  1.0969100    4 -15.00 15.00  1.2915300    OK
## Size_inflection_MexCal_S1(1) 10.8349000    3   0.00 30.00 10.9072000    OK
## Size_95%width_MexCal_S1(1)  0.6990270    3   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)    1.5290000    3 -10.00 11.00  0.2048810    OK
## 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)   -0.6268860    3 -10.00 11.00 -0.4707320    OK
## Age_inflection_PNW(3)     2.8579400    4   0.00 10.00  2.8525100    OK
## Age_95%width_PNW(3)      1.1550600    4  -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  NA
## VonBert_K_Fem_GP_1  0.00735414  0.00000603161000 No_prior  NA
## CV_young_Fem_GP_1   0.00265329 -0.00000286378000 No_prior  NA
## CV_old_Fem_GP_1     0.00255814  0.00000013430100 No_prior  NA
## SR_LN(R0)           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  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  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)   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      NA      OK
## L_at_Amax_Fem_GP_1      NA      NA      OK
## VonBert_K_Fem_GP_1      NA      NA      OK
## CV_young_Fem_GP_1       NA      NA      OK

```



```

## CV_old_Fem_GP_1          NA      NA      OK
## SR_LN(R0)                NA      NA      OK
## SR_regime_BLK1repl_2000  NA      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)    NA      NA      OK
## AgeSel_P3_MexCal_S1(1)    NA      NA      OK
## AgeSel_P4_MexCal_S1(1)    NA      NA      OK
## AgeSel_P5_MexCal_S1(1)    NA      NA      OK
## AgeSel_P2_MexCal_S2(2)    NA      NA      OK
## AgeSel_P3_MexCal_S2(2)    NA      NA      OK
## AgeSel_P4_MexCal_S2(2)    NA      NA      OK
## AgeSel_P5_MexCal_S2(2)    NA      NA      OK
## Age_inflection_PNW(3)     NA      NA      OK
## 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(R0)      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      4      3     55.611200 # 25 16      1      1000     143.8350
## 1190      4      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
## 1189     143.8350      NA      NA 16878.900     7998.8400      1
## 1190     117.9000      NA      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
## 1253      5      2      0.579745 #      15 15      8.92      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     137.877      NA      NA     3565.740     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      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           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      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    0
## 30 AgeSel_P1_MexCal_S1(1)    0

## completed SS_output

EMssmse2020_dir <- "C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenarios/perfDatTests/constGrow20010M_MidSteepH
outEMssmse2020 <- SS_output(EMssmse2020_dir)

## 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.wildermuth/Documents/FutureSeas/SardineScenarios/perfDatTests/constGrow20010M_MidSteepH

## 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 threshold to 0.25 based on US west coast assumption associated with biomass

## !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. There were 11 warnings in C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenarios/perfDatTests/constGrow20010M_MidSteepH

## 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,
##   0 rows of conditional age-at-length data,
##   0 rows of ghost fleet age comp data,
##   0 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,
##   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: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      NA
## Catch                        0.0000000000000608191      NA
## Equil_catch                  0.0000000000000000000      NA
## Survey                       -33.279499999999998749      NA
## Length_comp                  771.4420000000000007276      NA
## Age_comp                     113.2510000000000004775      NA
## Recruitment                   93.349599999999995248       1
## InitEQ_Regime                 0.0000000000000000000       0
## Forecast_Recruitment          0.0000000000000000000       1
## Parm_priors                   0.0000000000000000000       1
## Parm_softbounds               0.0018958800000000000      NA
## Parm_devs                     0.0000000000000000000       1
## Crash_Pen                     0.0000000000000000000       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
## 180  Catch_lambda      NA 1.00000e+00 1.00000e+00 1.00000e+00 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
## 184 Surv_lambda      NA 0.00000e+00 0.00000e+00 0.00000e+00 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 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
## 193 Age_like 1.13251e+02 2.49472e+01 4.15343e+01 1.02819e+01 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 -1 1 2 3 4 5
## 1 1 1 10 4 2 21 6 16 3 2
##
## $estimated_non_dev_parameters
##
## Value Phase Min Max Init Status
## L_at_Amin_Fem_GP_1 12.9188000 3 3.00 30.00 12.8541000 OK
## L_at_Amax_Fem_GP_1 24.7845000 3 15.00 40.00 24.8415000 OK
## VonBert_K_Fem_GP_1 0.3077450 3 0.05 0.99 0.3075730 OK
## CV_young_Fem_GP_1 0.1185600 3 0.05 0.50 0.1053490 OK
## CV_old_Fem_GP_1 0.0218696 3 0.01 0.10 0.0237245 OK
## SR_LN(R0) 14.4351000 1 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 3 0.00 30.00 10.9072000 OK
## Size_95%width_MexCal_S1(1) 0.7327170 3 0.00 10.00 0.6599090 OK
## AgeSel_P1_MexCal_S1(1) 0.5000220 3 -10.00 11.00 0.5000240 OK
## AgeSel_P2_MexCal_S1(1) 1.4981200 3 -10.00 11.00 0.2048810 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) 0.7533250 3 -10.00 15.00 0.4405260 OK
## 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

```

```

## Age_inflection_PNW(3)      2.8219500      4      0.00 10.00  2.8525100      OK
## Age_95%width_PNW(3)      1.1461700      4     -5.00 15.00  1.2152300      OK
##                               Parm_StDev      Gradient  Pr_type Prior Pr_SD
## L_at_Amin_Fem_GP_1        0  0.00000001238880 No_prior   NA   NA
## L_at_Amax_Fem_GP_1        0  0.00000214538000 No_prior   NA   NA
## VonBert_K_Fem_GP_1        0  0.00000115591000 No_prior   NA   NA
## CV_young_Fem_GP_1         0 -0.00000011495400 No_prior   NA   NA
## CV_old_Fem_GP_1           0  0.00000010543100 No_prior   NA   NA
## SR_LN(R0)                  0  0.00001248790000 No_prior   NA   NA
## SR_regime_BLK1repl_2000    0  0.00000140432000 No_prior   NA   NA
## Size_inflection_MexCal_S1(1) 0  0.00000254499000 No_prior   NA   NA
## Size_95%width_MexCal_S1(1) 0 -0.00000016337300 No_prior   NA   NA
## AgeSel_P1_MexCal_S1(1)     0  0.00000000658736 No_prior   NA   NA
## AgeSel_P2_MexCal_S1(1)     0  0.00000137300000 No_prior   NA   NA
## AgeSel_P3_MexCal_S1(1)     0  0.00000146040000 No_prior   NA   NA
## AgeSel_P4_MexCal_S1(1)     0  0.00000053827800 No_prior   NA   NA
## AgeSel_P5_MexCal_S1(1)     0  0.00000020581200 No_prior   NA   NA
## AgeSel_P2_MexCal_S2(2)     0  0.00000067622900 No_prior   NA   NA
## AgeSel_P3_MexCal_S2(2)     0  0.00000060302600 No_prior   NA   NA
## AgeSel_P4_MexCal_S2(2)     0  0.00000050171200 No_prior   NA   NA
## 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        NA      OK
## L_at_Amax_Fem_GP_1        NA      OK
## VonBert_K_Fem_GP_1        NA      OK
## CV_young_Fem_GP_1         NA      OK
## CV_old_Fem_GP_1           NA      OK
## SR_LN(R0)                  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)     NA      OK
## AgeSel_P5_MexCal_S2(2)     NA      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
##                               Value      Gradient
## SR_LN(R0)                    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      4      3      0.0812390 # 25 16      1      1000      143.438
## 1190      4      4      0.0946217 # 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      75.5652      18.7323      1
## 1188     121.733      NA      NA      85.9834      38.8162      1
## 1189     143.438      NA      NA     163.5230      11.6527      1
## 1190     117.900      NA      NA      19.1287      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      100      1000
## 1253      5      2      0.595226 #      15 15      100      1000
## 1254      5      3      5.661630 #      15 15      100      1000
## 1255      5      4      0.665768 #      10 10      100      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      NA      NA      363.944     126.4960
##      Curr_Var_Adj Fleet_name
## 1252      1 MexCal_S1
## 1253      1 MexCal_S2
## 1254      1      PNW
## 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
## 3 Early+Main+Late      27      1.442026      2.079438      0      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/constGrow20010M_MidSteepH
outEMalk2020 <- SS_output(EMalk2020_dir)
```

```
## 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 threshold to 0.25 based on US west coast assumption associated with biomass
```

```
## !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,
## 0 rows of generalized size comp data,
## 495 rows of age comp data,
## 0 rows of conditional age-at-length data,
## 0 rows of ghost fleet age comp data,
## 0 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,
## 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_ADMR"
##
## $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 bins"
## [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 get"
## [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                22.812899999999999068      NA
## Catch                 0.0000000000000512009      NA
## Equil_catch           0.0000000000000000000      NA
## Survey               -50.0675000000000002558      NA
## Length_comp           3.8605700000000000057      NA
## Age_comp              3.0469699999999999956      NA
## Recruitment           65.9709000000000000318        1
## InitEQ_Regime         0.0000000000000000000        0
## Forecast_Recruitment  0.0000000000000000000        1
## Parm_priors           0.0000000000000000000        1
## Parm_softbounds       0.0019612900000000000      NA
## Parm_devs             0.0000000000000000000        1
## Crash_Pen            0.0000000000000000000        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
## 180   Catch_lambda          NA 1.00000e+00 1.00000e+00 1.00000e+00 1.000000
## 181   Catch_like 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 0.000000
## 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
## 191 Length_N_skip          NA 0.00000e+00 0.00000e+00 9.00000e+00 0.000000
## 192   Age_lambda          NA 1.00000e+00 1.00000e+00 1.00000e+00 1.000000
## 193   Age_like 3.04697e+00 3.90204e-01 9.23142e-01 1.22167e+00 0.511953
## 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
##      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 -11.3394 -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
## 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   1  10   4   2  21   6  16   3   2
##
## $estimated_non_dev_parameters
##           Value Phase    Min    Max      Init Status
## L_at_Amin_Fem_GP_1 12.8534000    3  3.00 30.00 12.8541000    OK
## L_at_Amax_Fem_GP_1 24.9072000    3 15.00 40.00 24.8415000    OK
## 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    OK
## CV_old_Fem_GP_1    0.0229908    3  0.01  0.10  0.0237245    OK

```

## SR_LN(R0)	14.5352000	1	3.00	25.00	14.4668000	OK
## SR_regime_BLK1repl_2000	1.2254800	4	-15.00	15.00	1.2915300	OK
## Size_inflection_MexCal_S1(1)	10.9062000	3	0.00	30.00	10.9072000	OK
## Size_95%width_MexCal_S1(1)	0.6649890	3	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)	0.1921620	3	-10.00	11.00	0.2048810	OK
## 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
## AgeSel_P5_MexCal_S2(2)	-0.4491490	3	-10.00	11.00	-0.4707320	OK
## Age_inflection_PNW(3)	2.8661000	4	0.00	10.00	2.8525100	OK
## Age_95%width_PNW(3)	1.2322200	4	-5.00	15.00	1.2152300	OK
##	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	0.11787700	0.00000081602600	No_prior		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	0.00266475	0.00000016105800	No_prior		NA	
## SR_LN(R0)	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		NA	
## AgeSel_P1_MexCal_S1(1)	234.78400000	0.00000000690087	No_prior		NA	
## AgeSel_P2_MexCal_S1(1)	0.16319200	-0.00000157564000	No_prior		NA	
## AgeSel_P3_MexCal_S1(1)	0.08560890	-0.00000203303000	No_prior		NA	
## AgeSel_P4_MexCal_S1(1)	0.16842600	0.00000046105800	No_prior		NA	
## AgeSel_P5_MexCal_S1(1)	0.19815800	0.00000119422000	No_prior		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	
## AgeSel_P5_MexCal_S2(2)	0.22709700	0.00000019773700	No_prior		NA	
## Age_inflection_PNW(3)	0.06118530	-0.00000194706000	No_prior		NA	
## Age_95%width_PNW(3)	0.05204760	0.00000185804000	No_prior		NA	
##	Pr_SD	Pr_Like	Afterbound			
## L_at_Amin_Fem_GP_1	NA	NA	OK			
## L_at_Amax_Fem_GP_1	NA	NA	OK			
## VonBert_K_Fem_GP_1	NA	NA	OK			
## CV_young_Fem_GP_1	NA	NA	OK			
## CV_old_Fem_GP_1	NA	NA	OK			
## SR_LN(R0)	NA	NA	OK			
## SR_regime_BLK1repl_2000	NA	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)	NA	NA	OK			
## AgeSel_P3_MexCal_S1(1)	NA	NA	OK			
## AgeSel_P4_MexCal_S1(1)	NA	NA	OK			
## AgeSel_P5_MexCal_S1(1)	NA	NA	OK			
## AgeSel_P2_MexCal_S2(2)	NA	NA	OK			
## AgeSel_P3_MexCal_S2(2)	NA	NA	OK			
## AgeSel_P4_MexCal_S2(2)	NA	NA	OK			

```

## AgeSel_P5_MexCal_S2(2)      NA      NA      OK
## Age_inflection_PNW(3)      NA      NA      OK
## 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
##
##              Value      Gradient
## SR_regime_BLK1repl_2000    1.22548 -3.50871e-06
## Size_inflection_MexCal_S1(1) 10.90620 -3.40586e-06
## SR_LN(R0)                14.53520 -3.12192e-06
## L_at_Amin_Fem_GP_1        12.85340  2.32356e-06
## 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      4      2      53.3854 # 15  15      9      1000     122.0320
## 1189      4      3     183.8440 # 25  16      1      1000     143.8350
## 1190      4      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
## 1190     117.9000      NA      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
## 1253      5      2      5.89711 #      15  15      8.92      1000
## 1254      5      3     50.91710 #      15  15     26.88      1000
## 1255      5      4     15.54410 #      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 83753.0      880.883
## 1253     121.093     121.093      NA      NA 29773.2      714.100
## 1254     137.877     137.877      NA      NA 18681.1     7020.310
## 1255     117.900     117.900      NA      NA 19009.6     1832.650
##      Curr_Var_Adj Fleet_name
## 1252      1 MexCal_S1
## 1253      1 MexCal_S2
## 1254      1      PNW
## 1255      1 AT_Survey
##
## $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           Main    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           2.857248
## 2           1.279701           2.541894           2.559402
## 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  0
## 30 AgeSel_P1_MexCal_S1(1)  0

## completed SS_output

compbavg2020 <- SSsummarize(list(OM2020 = outOMBavg,
                                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/constGrow2020"

datEMBavg2025 <- SS_readat(file.path(EMBavg2025_dir, "init_dat.ss"),
                           verbose = FALSE,
                           section = 1)

datEMBavg2025$catch <- datOMBavg$catch %>% filter(year <= 2025)
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/constGrow2020"
outEMssmse2025 <- SS_output(EMssmse2025_dir)
```

```
## 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 threshold to 0.25 based on US west coast assumption associated with biomass

## !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 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,
## 0 rows of conditional age-at-length data,
## 0 rows of ghost fleet age comp data,
## 0 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,
## 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: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_ADMR"
##
## $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_ADMR"
## [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 bins"
## [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 estimated"
## [14] "5 1st iteration warning: ssb(endyr)/ssb(styr)= 1.36781e-05; suggest start with larger R0 to get"
## [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      NA
## Catch                  0.000000000000103544      NA
## Equil_catch            0.000000000000000000      NA

```

```

## Survey                61.26780000000000115      NA
## Length_comp          1680.82999999999992724      NA
## Age_comp             585.40499999999997272      NA
## Recruitment          93.196500000000000034       1
## InitEQ_Regime        0.000000000000000000       0
## Forecast_Recruitment 24.112700000000000024       1
## Parm_priors           0.000000000000000000       1
## Parm_softbounds       0.001865060000000000      NA
## Parm_devs             0.000000000000000000       1
## Crash_Pen            0.000000000000000000       1
##
## $likelihoods_laplace
##                               values lambdas
## NoBias_corr_Recruitment(info_only)  90.028      1
## Laplace_obj_fun(info_only)         2441.650     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 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
## 184 Surv_lambda      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 Length_lambda      NA 1.00000e+00 1.00000e+00 1.00000e+00 1.0000
## 189 Length_like 1.68083e+03 3.56128e+02 3.27080e+02 2.58807e+02 738.8170
## 190 Length_N_use      NA 2.00000e+01 2.00000e+01 2.10000e+01 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
## 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 -7.45063 -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
## 195 0.00000 0.0000
##
## $N_estimated_parameters
## [1] 53

```

```

##
## $table_of_phases
##
## -99  -5  -4  -3  -2  -1  1  2  3  4  5
##   1   1   1  10   4   2  21  6  16  3  7
##
## $estimated_non_dev_parameters
##
## Value Phase   Min   Max   Init Status
## L_at_Amin_Fem_GP_1      12.8407000    3   3.00 30.00 12.8541000    OK
## L_at_Amax_Fem_GP_1      24.7688000    3  15.00 40.00 24.8415000    OK
## VonBert_K_Fem_GP_1       0.3172710    3   0.05  0.99  0.3075730    OK
## CV_young_Fem_GP_1        0.1238410    3   0.05  0.50  0.1053490    OK
## CV_old_Fem_GP_1          0.0192670    3   0.01  0.10  0.0237245    OK
## SR_LN(RO)                14.2958000    1   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    3   0.00 30.00 10.9072000    OK
## Size_95%width_MexCal_S1(1)  0.7341760    3   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)    0.7992650    3 -10.00 11.00  0.2048810    OK
## AgeSel_P3_MexCal_S1(1)    0.6041370    3 -10.00 15.00  0.3827920    OK
## 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)    0.6752870    3 -10.00 15.00  0.4405260    OK
## 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
## Age_inflection_PNW(3)     2.8936500    4   0.00 10.00  2.8525100    OK
## Age_95%width_PNW(3)      1.1278100    4  -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  0.00007148970000 No_prior  NA  NA
## VonBert_K_Fem_GP_1      0  0.00003826540000 No_prior  NA  NA
## CV_young_Fem_GP_1       0  0.00001771160000 No_prior  NA  NA
## CV_old_Fem_GP_1         0  0.00000071223300 No_prior  NA  NA
## SR_LN(RO)                0  0.00092093400000 No_prior  NA  NA
## SR_regime_BLK1repl_2000  0 -0.00002583590000 No_prior  NA  NA
## Size_inflection_MexCal_S1(1) 0  0.00090458000000 No_prior  NA  NA
## Size_95%width_MexCal_S1(1) 0 -0.00007380740000 No_prior  NA  NA
## AgeSel_P1_MexCal_S1(1)   0  0.00000000369269 No_prior  NA  NA
## AgeSel_P2_MexCal_S1(1)   0  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  NA
## AgeSel_P5_MexCal_S1(1)   0  0.00007647480000 No_prior  NA  NA
## AgeSel_P2_MexCal_S2(2)   0 -0.00012016100000 No_prior  NA  NA
## AgeSel_P3_MexCal_S2(2)   0 -0.00002035220000 No_prior  NA  NA
## AgeSel_P4_MexCal_S2(2)   0  0.00012680100000 No_prior  NA  NA
## AgeSel_P5_MexCal_S2(2)   0  0.00008853800000 No_prior  NA  NA
## Age_inflection_PNW(3)    0  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      NA      OK
## L_at_Amax_Fem_GP_1      NA      OK
## VonBert_K_Fem_GP_1      NA      OK
## CV_young_Fem_GP_1       NA      OK

```

```

## CV_old_Fem_GP_1          NA          OK
## SR_LN(R0)                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)   NA          OK
## AgeSel_P5_MexCal_S2(2)   NA          OK
## Age_inflection_PNW(3)    NA          OK
## Age_95%width_PNW(3)     NA          OK
##
## $maximum_gradient_component
## [1] 0.000920934
##
## $parameters_with_highest_gradients
##
## Value Gradient
## SR_LN(R0)                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
## 1334      4      3      0.0434271 # 30 21      1      1000      347.381
## 1335      4      4      0.0324800 # 15 15     12      1000      411.933
## mean_Nsamp_adj mean_Nsamp_DM DM_theta mean_effN HarMean_effN Curr_Var_Adj
## 1332      322.600      NA      NA 238.4640      24.6962      1
## 1333      341.300      NA      NA 313.7670      49.8447      1
## 1334      347.381      NA      NA 380.0720      15.0858      1
## 1335      411.933      NA      NA 41.7506      13.3796      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      0.623141 #      20 20      100      1000
## 1418      5      2      0.425865 #      20 20      100      1000
## 1419      5      3      1.171920 #      20 20      100      1000
## 1420      5      4      0.063647 #      15 15      100      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          NA          NA    207.282    29.2776
##      Curr_Var_Adj Fleet_name
## 1417           1 MexCal_S1
## 1418           1 MexCal_S2
## 1419           1      PNW
## 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
## 3 Early+Main+Late 32  1.449362   2.100650      0          0
##      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
## 1  main 20 1.610800      10.37880      0.841539
## 2  early 6 0.595973      1.42074      0.766330

```

```
## completed SS_output
```

```

EMalk2025_dir <- "C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenarios/perfDatTests/constGrow20010M_MidSteepH
outEMalk2025 <- SS_output(EMalk2025_dir)

```

```
## 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 threshold to 0.25 based on US west coast assumption associated with biomass

## !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. There were 16 warnings in C:/Users/r.wildermuth/Documents/FutureSeas/SardineScenario

## 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,
## 0 rows of conditional age-at-length data,
## 0 rows of ghost fleet age comp data,
## 0 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,
## 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: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_ADMR"
##
## $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_ADMR"
## [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 bins"
## [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 estimated"
## [14] "5 1st iteration warning: ssb(endyr)/ssb(styr)= 1.35911e-05; suggest start with larger R0 to get"
## [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      NA
## Catch                        0.0000000000000514909      NA
## Equil_catch                  0.0000000000000000000      NA
## Survey                       -65.121999999999999886      NA
## Length_comp                  10.6941000000000000605      NA
## Age_comp                     3.3938500000000000033      NA
## Recruitment                   66.5037999999999998249       1
## InitEQ_Regime                0.0000000000000000000       0
## Forecast_Recruitment         18.617499999999999716       1
## Parm_priors                  0.0000000000000000000       1
## Parm_softbounds              0.0019638600000000000      NA
## Parm_devs                    0.0000000000000000000       1
## Crash_Pen                   0.0000000000000000000       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  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  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  Length_N_skip      NA 0.00000e+00 0.00000e+00 9.00000e+00 0.000000
## 192  Age_lambda      NA 1.00000e+00 1.00000e+00 1.00000e+00 1.000000
## 193  Age_like  3.39385e+00 5.07440e-01 1.13015e+00 1.19463e+00 0.561627
## 194  Age_N_use      NA 2.00000e+01 2.00000e+01 2.00000e+01 15.000000
## 195  Age_N_skip      NA 0.00000e+00 0.00000e+00 0.00000e+00 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
## 187  0.0000  0.0000
## 188  0.0000  0.0000

```

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## 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
##
## -99 -5 -4 -3 -2 -1 1 2 3 4 5
## 1 1 1 10 4 2 21 6 16 3 7
##
## $estimated_non_dev_parameters
##
## Value Phase Min Max Init Status
## L_at_Amin_Fem_GP_1 12.8532000 3 3.00 30.00 12.8541000 OK
## L_at_Amax_Fem_GP_1 24.8953000 3 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 3 0.05 0.50 0.1053490 OK
## CV_old_Fem_GP_1 0.0233984 3 0.01 0.10 0.0237245 OK
## SR_LN(R0) 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 3 0.00 30.00 10.9072000 OK
## Size_95%width_MexCal_S1(1) 0.6660160 3 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
## AgeSel_P3_MexCal_S1(1) 0.3811140 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) -0.1904530 3 -10.00 11.00 -0.2361890 OK
## AgeSel_P2_MexCal_S2(2) 0.4411220 3 -10.00 15.00 0.4405260 OK
## AgeSel_P3_MexCal_S2(2) -1.1655700 3 -10.00 11.00 -1.1690800 OK
## 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 4 0.00 10.00 2.8525100 OK
## Age_95%width_PNW(3) 1.2213800 4 -5.00 15.00 1.2152300 OK
##
## Parm_StDev Gradient Pr_type Prior
## L_at_Amin_Fem_GP_1 0.03040100 -0.00004753420000 No_prior 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 NA
## CV_young_Fem_GP_1 0.00109951 -0.00000247557000 No_prior NA
## CV_old_Fem_GP_1 0.00195809 0.00000052291600 No_prior NA
## SR_LN(R0) 0.02425630 0.00006948190000 No_prior NA
## 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 0.00000000344397 No_prior NA
## AgeSel_P2_MexCal_S1(1) 0.08310200 0.00000610122000 No_prior NA
## 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) 0.03061300 0.00000354060000 No_prior NA

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## AgeSel_P3_MexCal_S2(2)      0.05362030 -0.00002140140000 No_prior NA
## AgeSel_P4_MexCal_S2(2)      0.09010130 -0.00001424980000 No_prior NA
## AgeSel_P5_MexCal_S2(2)      0.14022800  0.00000162729000 No_prior NA
## Age_inflection_PNW(3)        0.02623280 -0.00001100530000 No_prior NA
## Age_95%width_PNW(3)         0.01840720  0.00001497610000 No_prior NA
##                               Pr_SD Pr_Like Afterbound
## L_at_Amin_Fem_GP_1          NA      NA      OK
## L_at_Amax_Fem_GP_1          NA      NA      OK
## VonBert_K_Fem_GP_1          NA      NA      OK
## CV_young_Fem_GP_1           NA      NA      OK
## CV_old_Fem_GP_1             NA      NA      OK
## SR_LN(R0)                   NA      NA      OK
## SR_regime_BLK1repl_2000      NA      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)       NA      NA      OK
## AgeSel_P3_MexCal_S1(1)       NA      NA      OK
## AgeSel_P4_MexCal_S1(1)       NA      NA      OK
## AgeSel_P5_MexCal_S1(1)       NA      NA      OK
## AgeSel_P2_MexCal_S2(2)       NA      NA      OK
## AgeSel_P3_MexCal_S2(2)       NA      NA      OK
## AgeSel_P4_MexCal_S2(2)       NA      NA      OK
## AgeSel_P5_MexCal_S2(2)       NA      NA      OK
## Age_inflection_PNW(3)        NA      NA      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
##                               Value      Gradient
## SR_LN(R0)                   14.532000  6.94819e-05
## 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      1      25.6091 # 20  20      6      1000      322.814
## 1333      4      2      22.6911 # 20  20      9      1000      341.524
## 1334      4      3      88.0937 # 30  21      1      1000      347.684
## 1335      4      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
## 1334      347.684      NA      NA      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      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      NA      112290.0      1201.420
## 1418      340.820      340.820      NA      NA      84409.9      878.113
## 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      1 MexCal_S1
## 1418      1 MexCal_S2
## 1419      1 PNW
## 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 Early+Main      26      1.275083      1.625837 0.12027802      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      2.550167      2.566827
## 3      1.278526      2.537079      2.557052
##      alternative_sigma_R
## 1      1.432477
## 2      1.283414
## 3      1.278526
##
## $rmse_table
##      ERA N      RMSE RMSE_over_sigmaR mean_BiasAdj
## 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
## 34      Late_RecrDev_2025  0
## 37 AgeSel_P1_MexCal_S1(1)  0

## completed SS_output

compbavg2025 <- SSsummarize(list(OM2020 = outOMBavg,
                                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
## 16	54477.6	44296.1	54513.8	SSB_2014	2014	0.06644933
## 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