LogitCheck

2024-05-09

Load in file and libraries

```
source("CWD_model_Cross/functions/est_beta_params.R")
source("CWD_model_Cross/functions/allocate_deaths.R")
source("CWD_model_Cross/functions/MyFunctions.R")
source("CWD_model_Cross/cwd_stoch_model_cal_act.r")
source("CWD_model_Cross/ArrivalVectors.R")
source("CWD_model_Cross/functions/cwd_stoch_wrapper_mod.r")
source("CWD_model_Cross/functions/ComHyposFunc.R")
source("CWD_model_Cross/functions/Plot_funcs.R")
library(foreach)
library(doParallel)
library(tidyverse)
library(reshape2)
library(patchwork)
```

Try turning on hunting actions on one by one

- not going to see impact of sharpshooting in hunting graphs because not collected as hunting just removed from larger population
- Also density dependent so action will only occur in until reach a power number
- When change parameters in model to more extreme values, see this is working *changed 300 removed to 1000, and changed stopping criteria from 1/3 to 1/6 of starting popn
- Lines 890 - 900 in model script

```
params <- list(fawn.an.sur = 0.7, juv.an.sur = 0.8, ad.an.f.sur = 0.82,
               ad.an.m.sur = 0.8, fawn.repro = 0.06, juv.repro = 1.3, ad.repro = 1.4,
               hunt.mort.fawn = 0.01, hunt.mort.juv.f = 0.1, hunt.mort.juv.m = 0.1,
               hunt.mort.ad.f = 0.12, hunt.mort.ad.m = 0.50,
                ini.fawn.prev = 0.01,
                ini.juv.prev = 0.03, ini.ad.f.prev = 0.04,  ini.ad.m.prev = 0.04,
               n.age.cats = 12,  n.age.cats.m = 10, n.age.cats.f = 15,
                p = 0.27, env.foi = 0,  beta.f = 0.028,  beta.m = 0.028,
               theta = 0.9, n0 = 10000, n.years = 25, rel.risk = 1.0,
               repro.var = 0.005, fawn.sur.var = 0.005, sur.var = 0.005, hunt.var = 0.0005,
               juv.sur.var = 0.005, ad.f.sur.var = 0.005, ad.m.sur.var = 0.005,
             juv.repro.var = 0.005, ad.repro.var = 0.005,
             WSI = 1,
             arrival_input = c(0,0,0,0,0,0,200,0,0,0,0,0,0,0,0,0,0,0,0,0, 0,1,0,0,0),
             Action_young_bucks = 0, Action_lib_harvest = 0, Action_targetrm = 0, Action_sharpshooting =
             nosampled = 460
)
```

```
simsout_H1 <- cwd_stoch_wrapper_setARV(params, nsims = 10, n.years = 25)

H1_prev <- plot_stoch_prev_single(simsout_H1$counts, all.lines = TRUE)
H1_abund <- plot_stoch_abundance(simsout_H1, all.lines = TRUE, error.bars)
H1_harv <- plot_stoch_harvest(simsout_H1, all.lines, error.bars, detectbar, harvesttype= 1)

#plot_stoch_harvest(simsout_H1, all.lines, error.bars, detectbar, harvesttype= 2)
#plot_stoch_harvest(simsout_H1, all.lines, error.bars, detectbar, harvesttype= 3)

H1_prev
```

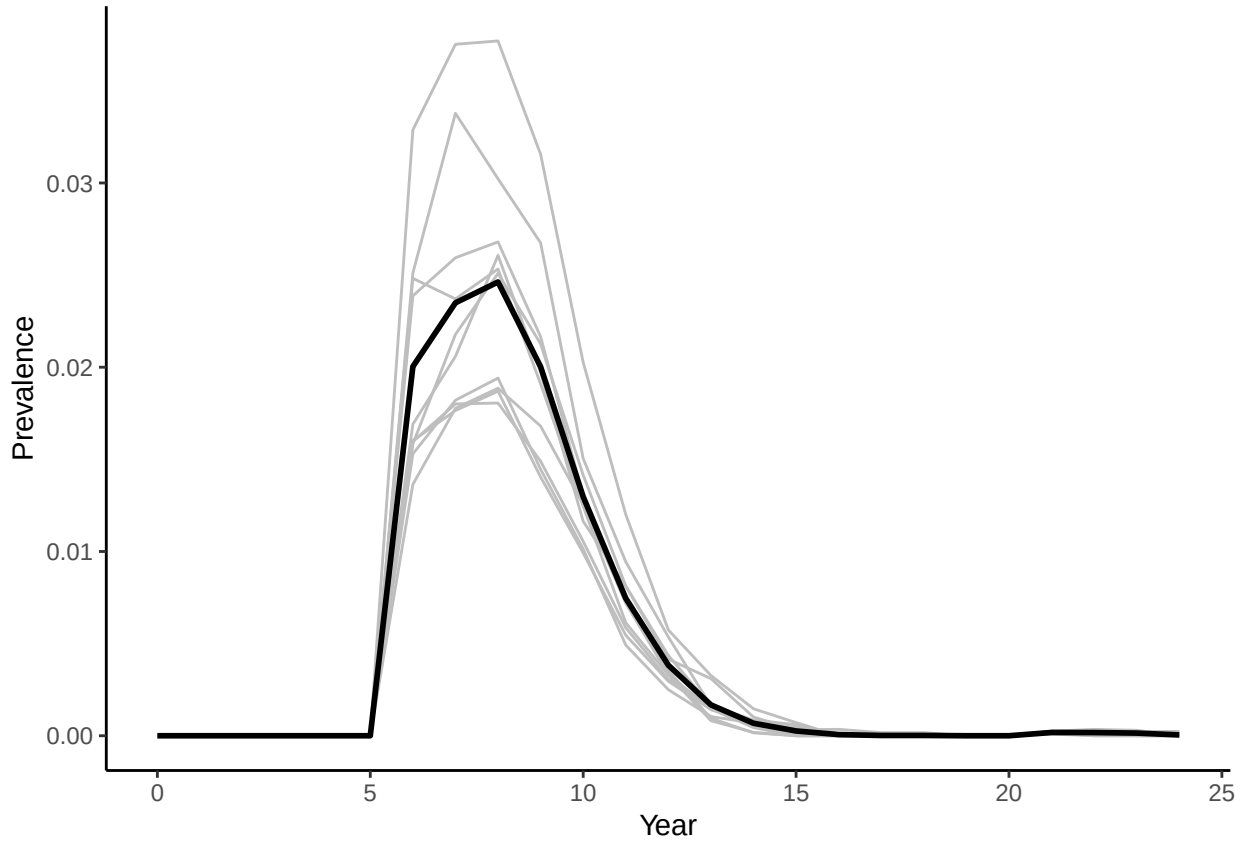


Figure 1: Figure 1: Test sharpshooting action

Action_targetrm changes relative risk of deer being removed by hunter from 1 to 1.5 (doubles likelihood) Not going to see that playout anywhere besides prevalence

```
params <- list(fawn.an.sur = 0.7, juv.an.sur = 0.8, ad.an.f.sur = 0.82,
               ad.an.m.sur = 0.8, fawn.repro = 0.06, juv.repro = 1.3, ad.repro = 1.4,
               hunt.mort.fawn = 0.01, hunt.mort.juv.f = 0.1, hunt.mort.juv.m = 0.1,
               hunt.mort.ad.f = 0.12, hunt.mort.ad.m = 0.50,
                ini.fawn.prev = 0.01,
                ini.juv.prev = 0.03, ini.ad.f.prev = 0.04,  ini.ad.m.prev = 0.04,
               n.age.cats = 12,  n.age.cats.m = 10, n.age.cats.f = 15,
                p = 0.27, env.foi = 0,  beta.f = 0.028,  beta.m = 0.028,
               theta = 0.9, n0 = 10000, n.years = 25, rel.risk = 1.0,
```

```
                repro.var = 0.005, fawn.sur.var = 0.005, sur.var = 0.005, hunt.var = 0.0005,
                juv.sur.var = 0.005, ad.f.sur.var = 0.005, ad.m.sur.var = 0.005,
              juv.repro.var = 0.005, ad.repro.var = 0.005,
              WSI = 1,
              arrival_input = c(0,0,0,0,0,0,200,0,0,0,0,0,0,0,0,0,0,0,0,0, 0,1,0,0,0),
              Action_young_bucks = 0, Action_lib_harvest = 0, Action_targetrm = 1, Action_sharpshooting =
              nosampled = 460
)

simsout_H1_w <- cwd_stoch_wrapper_setARV(params, nsims = 10, n.years = 25)

H1_prev_wAction <- plot_stoch_prev_single(simsout_H1_w$counts, all.lines = TRUE)



params$Action_targetrm <- 0

simsout_H1_wo <- cwd_stoch_wrapper_setARV(params, nsims = 10, n.years = 25)
H1_prev_woAction <- plot_stoch_prev_single(simsout_H1_wo$counts, all.lines = TRUE)


H1_prev_wAction + H1_prev_woAction
```

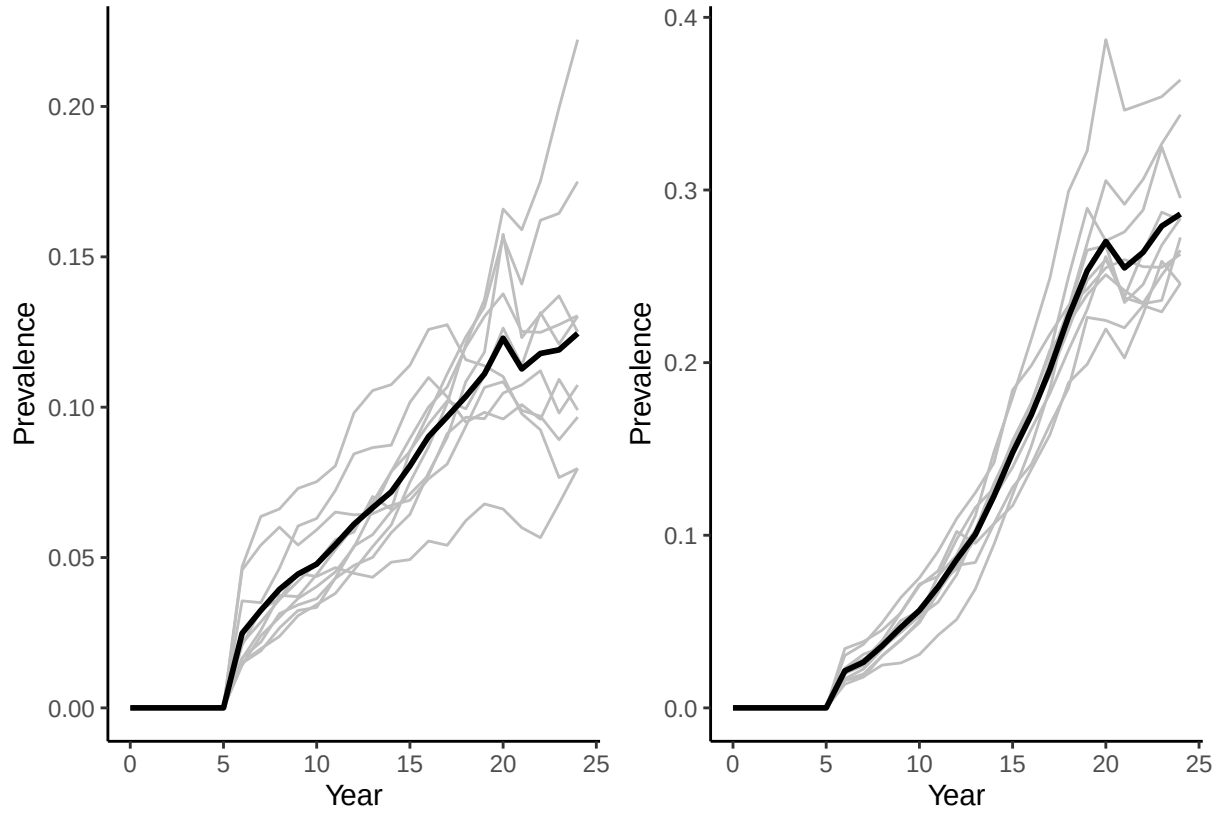


Figure 2: Figure 2: Test 'target removal' action (with action is on left)

Action_lib_harvest - Pulls an extra proportional amount of harvest (note this is pretty stochastic)

```
params <- list(fawn.an.sur = 0.7, juv.an.sur = 0.8, ad.an.f.sur = 0.82,
               ad.an.m.sur = 0.8, fawn.repro = 0.06, juv.repro = 1.3, ad.repro = 1.4,
               hunt.mort.fawn = 0.01, hunt.mort.juv.f = 0.1, hunt.mort.juv.m = 0.1,
               hunt.mort.ad.f = 0.12, hunt.mort.ad.m = 0.50,
                ini.fawn.prev = 0.01,
                ini.juv.prev = 0.03, ini.ad.f.prev = 0.04,  ini.ad.m.prev = 0.04,
               n.age.cats = 12,  n.age.cats.m = 10, n.age.cats.f = 15,
                p = 0.27, env.foi = 0,  beta.f = 0.028,  beta.m = 0.028,
               theta = 0.9, n0 = 10000, n.years = 25, rel.risk = 1.0,
               repro.var = 0.005, fawn.sur.var = 0.005, sur.var = 0.005, hunt.var = 0.0005,
               juv.sur.var = 0.005, ad.f.sur.var = 0.005, ad.m.sur.var = 0.005,
             juv.repro.var = 0.005, ad.repro.var = 0.005,
             WSI = 1,
             arrival_input = c(0,0,0,0,0,0,200,0,0,0,0,0,0,0,0,0,0,0,0,0, 0,1,0,0,0),
             Action_young_bucks = 0, Action_lib_harvest = 1, Action_targetrm = 0, Action_sharpshooting =
             nosampled = 460
)

simsout_w_act <- cwd_stoch_wrapper_setARV(params, nsims = 10, n.years = 25)
allharv_w <- plot_stoch_harvest(simsout_w_act, all.lines, error.bars, detectbar, harvesttype= 1)

juvharv_w <- plot_stoch_harvest(simsout_w_act, all.lines, error.bars, detectbar, harvesttype= 2)
antlerless_w <- plot_stoch_harvest(simsout_w_act, all.lines, error.bars, detectbar, harvesttype= 3)


params$Action_lib_harvest <- 0

simsout_wo_act <- cwd_stoch_wrapper_setARV(params, nsims = 10, n.years = 25)
allharv_wo <- plot_stoch_harvest(simsout_wo_act, all.lines, error.bars, detectbar, harvesttype= 1)

juvharv_wo <- plot_stoch_harvest(simsout_wo_act, all.lines, error.bars, detectbar, harvesttype= 2)
antlerless_wo <- plot_stoch_harvest(simsout_wo_act, all.lines, error.bars, detectbar, harvesttype= 3)

(allharv_w + allharv_wo) / (antlerless_w + antlerless_wo)
```

```
## Let's try setting hunter's take to 20% (aka amount of popn that hunters can remove - set high)
# line 782
# Now see pulses in harvest
```

Action_young_bucks - for each hunting season, takes the number of yearling buckets removed and multiples that set to *1.1 but I don't think this is working as expected

```
params <- list(fawn.an.sur = 0.7, juv.an.sur = 0.8, ad.an.f.sur = 0.82,
               ad.an.m.sur = 0.8, fawn.repro = 0.06, juv.repro = 1.3, ad.repro = 1.4,
               hunt.mort.fawn = 0.01, hunt.mort.juv.f = 0.1, hunt.mort.juv.m = 0.1,
               hunt.mort.ad.f = 0.12, hunt.mort.ad.m = 0.50,
                ini.fawn.prev = 0.01,
                ini.juv.prev = 0.03, ini.ad.f.prev = 0.04,  ini.ad.m.prev = 0.04,
               n.age.cats = 12,  n.age.cats.m = 10, n.age.cats.f = 15,
                p = 0.27, env.foi = 0,  beta.f = 0.028,  beta.m = 0.028,
               theta = 0.9, n0 = 10000, n.years = 25, rel.risk = 1.0,
```

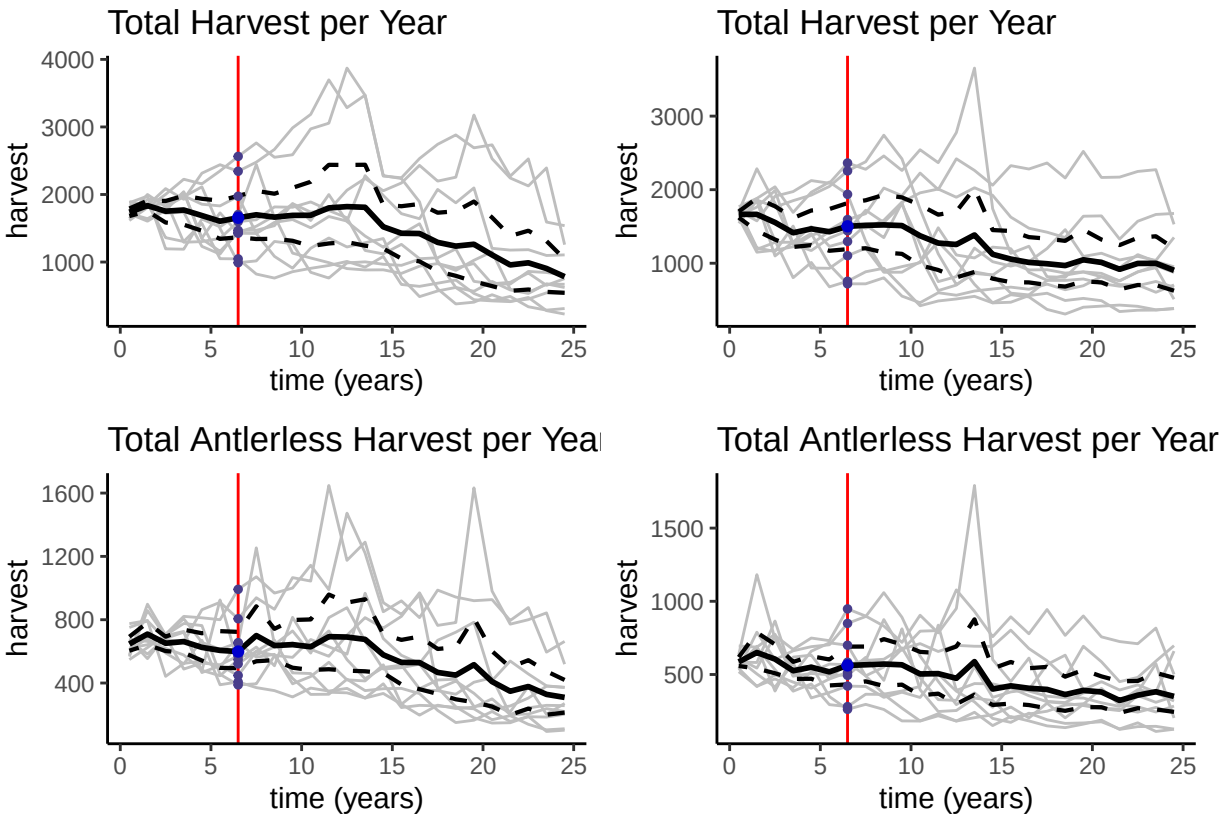


Figure 3: Figure 3: Test 'libharvest' action (with action is on left)

```
                repro.var = 0.005, fawn.sur.var = 0.005, sur.var = 0.005, hunt.var = 0.0005,
                juv.sur.var = 0.005, ad.f.sur.var = 0.005, ad.m.sur.var = 0.005,
              juv.repro.var = 0.005, ad.repro.var = 0.005,
              WSI = 1,
              arrival_input = c(0,0,0,0,0,0,200,0,0,0,0,0,0,0,0,0,0,0,0,0, 0,1,0,0,0),
              Action_young_bucks = 1, Action_lib_harvest = 0, Action_targetrm = 0, Action_sharpshooting =
              nosampled = 460
)

simsout_w_act <- cwd_stoch_wrapper_setARV(params, nsims = 30, n.years = 25)
allharv_w <- plot_stoch_harvest(simsout_w_act, all.lines, error.bars, detectbar, harvesttype= 1)

juvharv_w <- plot_stoch_harvest(simsout_w_act, all.lines, error.bars, detectbar, harvesttype= 2)
antlerless_w <- plot_stoch_harvest(simsout_w_act, all.lines, error.bars, detectbar, harvesttype= 3)

abund_w <- plot_stoch_abundance(simsout_w_act, all.lines = TRUE, error.bars)


params$Action_young_bucks <- 0

simsout_wo_act <- cwd_stoch_wrapper_setARV(params, nsims = 30, n.years = 25)
allharv_wo <- plot_stoch_harvest(simsout_wo_act, all.lines, error.bars, detectbar, harvesttype= 1)

juvharv_wo <- plot_stoch_harvest(simsout_wo_act, all.lines, error.bars, detectbar, harvesttype= 2)
antlerless_wo <- plot_stoch_harvest(simsout_wo_act, all.lines, error.bars, detectbar, harvesttype= 3)

abund_wo <- plot_stoch_abundance(simsout_wo_act, all.lines = TRUE, error.bars)


(allharv_w + allharv_wo) / (juvharv_w + juvharv_wo)
```

```
abund_w + abund_wo
```

```
## Let's try upping from 10% to 85% increase in harvest
# line 782
# Now see pulses in harvest
```

Check arrival times across strategies

copying function here so can set actions to OFF standardize the number of samples across all strategies

```
ComHypowSelectH <- function(selectstrat = "SQ", selecthypo = "H1"){

  ### Set the parameters based on the selected straetgy
  if(selectstrat == "SQ" | selectstrat == "SA" | selectstrat == "Ho"){
    params <- list(fawn.an.sur = 0.7, juv.an.sur = 0.8, ad.an.f.sur = 0.82, ad.an.m.sur = 0.8,
                   fawn.repro = 0.06, juv.repro = 1.3, ad.repro = 1.4,
                   hunt.mort.fawn = 0.01, hunt.mort.juv.f = 0.1, hunt.mort.juv.m = 0.1, hunt.mort.ad.f =
                   ini.fawn.prev = 0.01, ini.juv.prev = 0.03, ini.ad.f.prev = 0.04,  ini.ad.m.prev = 0.0
                   n.age.cats = 12,  n.age.cats.m = 10, n.age.cats.f = 15,
                   p = 0.27, env.foi = 0,  beta.f = 0.028,  beta.m = 0.028,
```

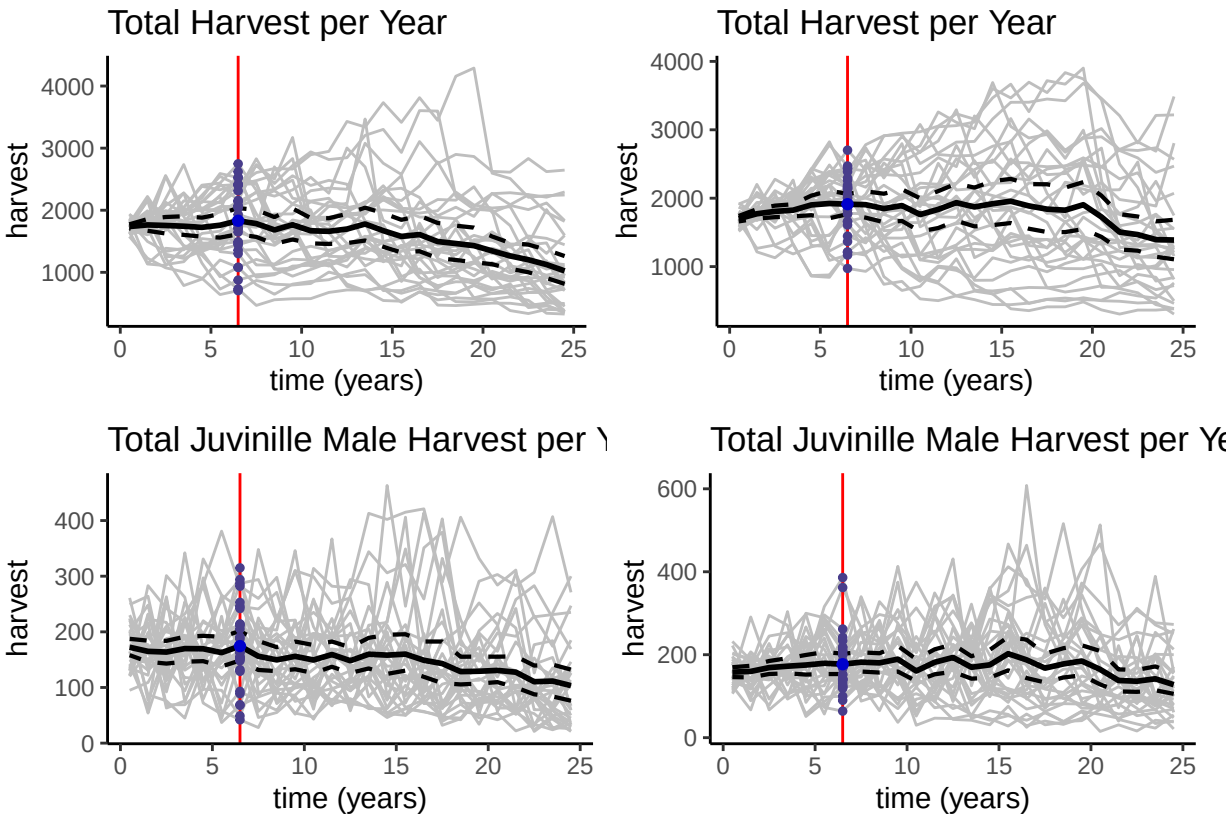


Figure 4: Figure 4: Test 'young buck removal' action (with action is on left)

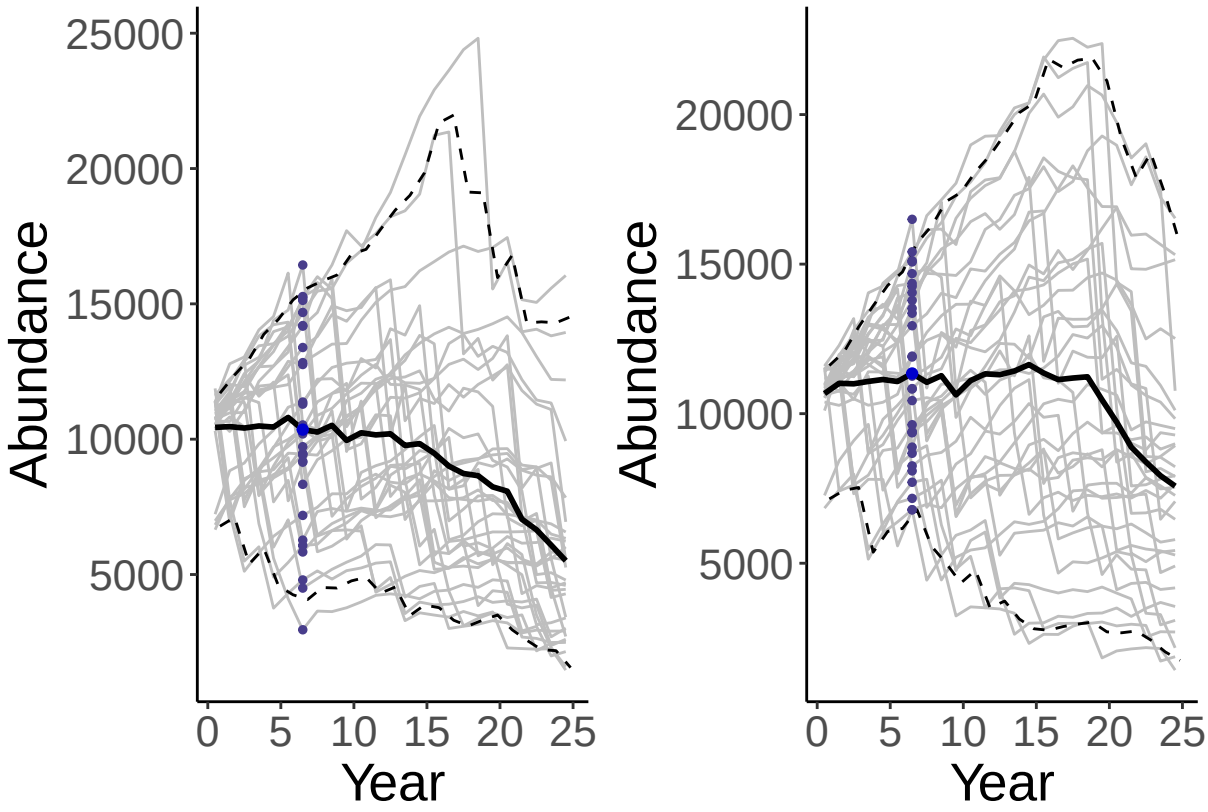
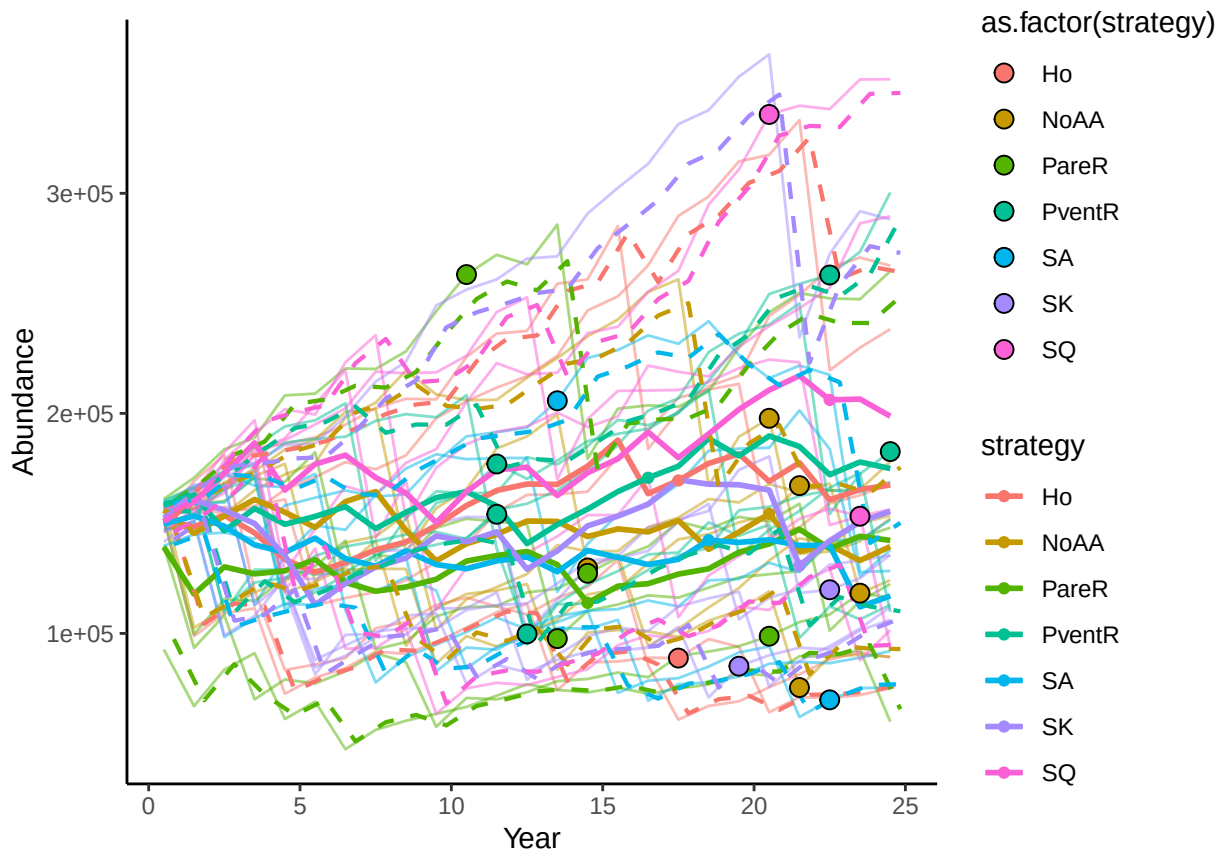
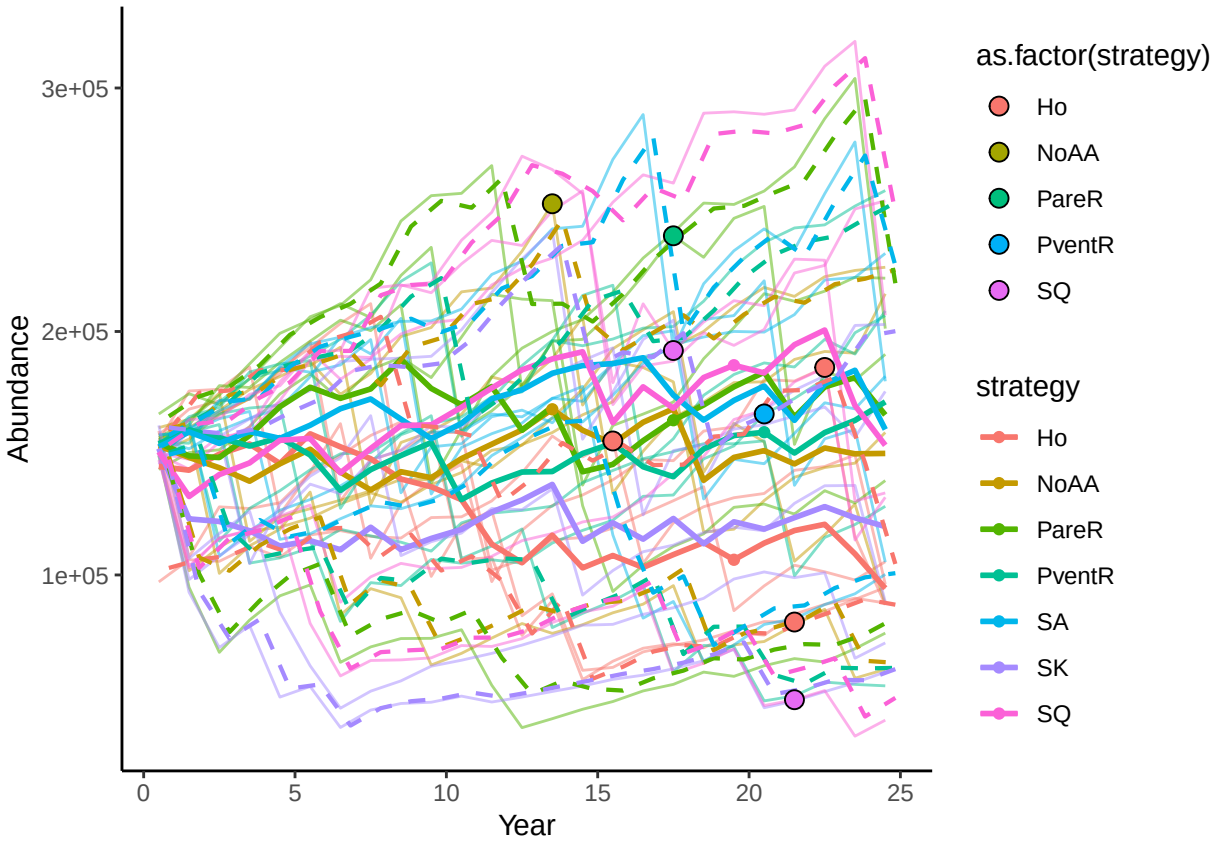
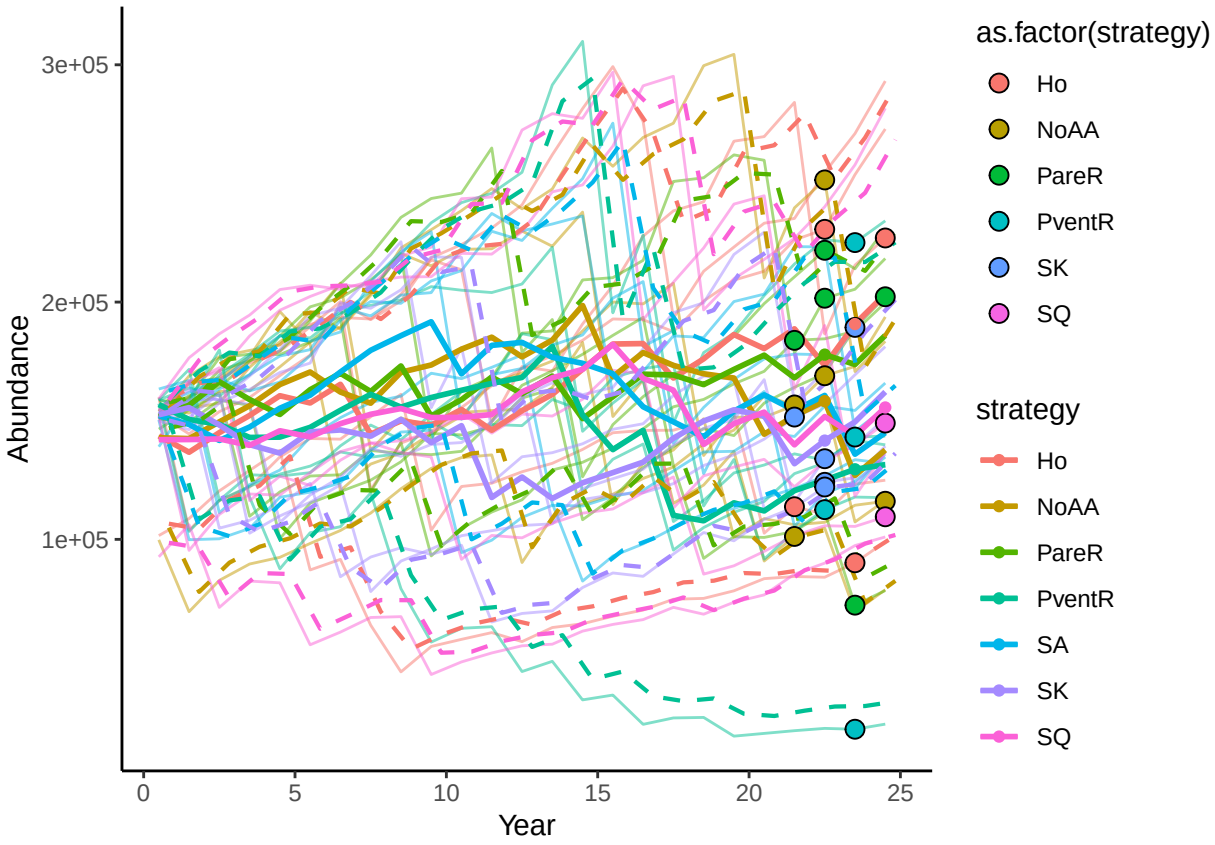


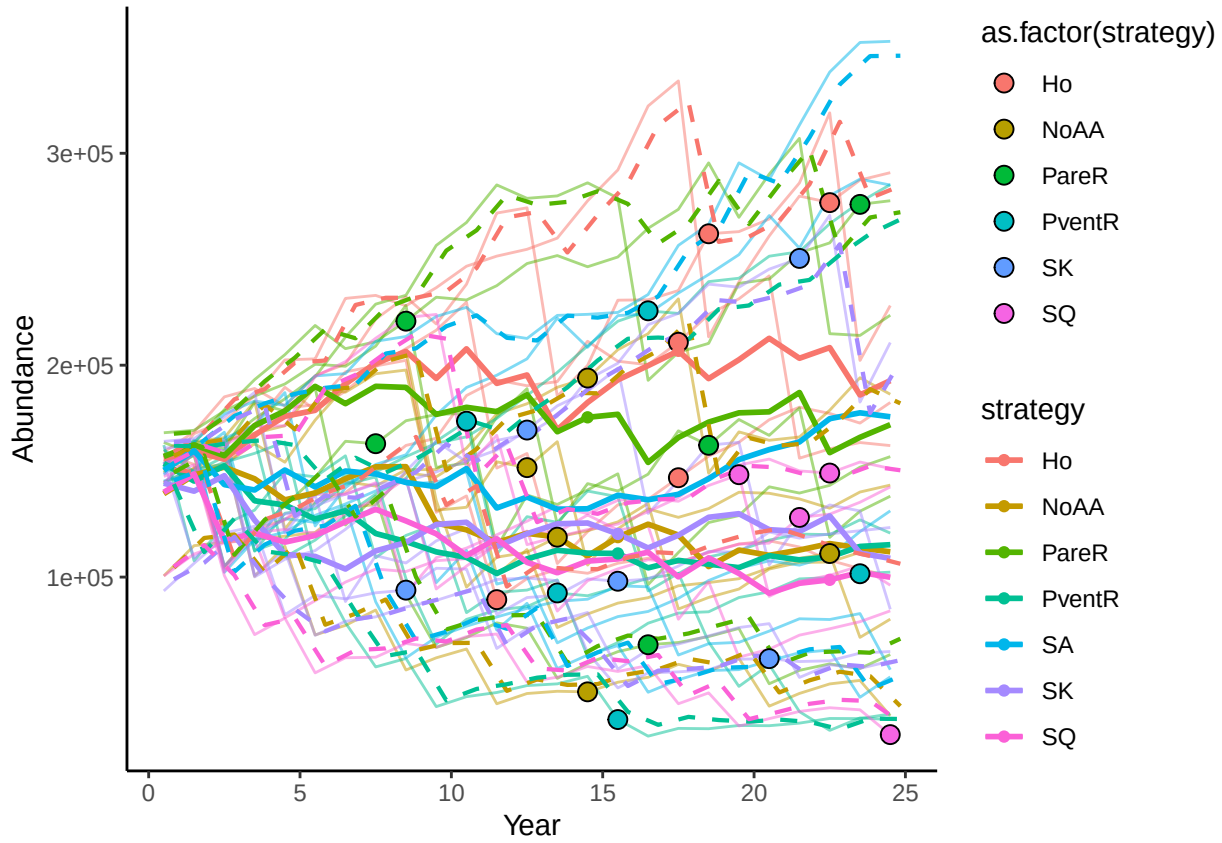
Figure 5: Figure 4: Test 'young buck removal' action (with action is on left)

```
                    theta = 0.9, n0 = 140000, n.years = 25, rel.risk = 1.0,
                    repro.var = 0.005, fawn.sur.var = 0.005, sur.var = 0.005, hunt.var = 0.0005, juv.sur
                    WSI = 1,
                    arrival_input = c(0,0,0,0,0,0,0, 0, 0, 0),
                    Action_young_bucks = 0, Action_lib_harvest = 0, Action_targetrm = 0, Action_sharpsho
                    nosampled = 100
    )
    if(selectstrat == "Ho"){
      params$nosampled <- 100 ## Need to overwrite number of samples in surviellance strategy tied to H
    }
  }else{ # other strategies have hunting actions turned on
    params <- list(fawn.an.sur = 0.7, juv.an.sur = 0.8, ad.an.f.sur = 0.82, ad.an.m.sur = 0.8,
                    fawn.repro = 0.06, juv.repro = 1.3, ad.repro = 1.4,
                    hunt.mort.fawn = 0.01, hunt.mort.juv.f = 0.1, hunt.mort.juv.m = 0.1, hunt.mort.ad.f =
                    ini.fawn.prev = 0.01, ini.juv.prev = 0.03, ini.ad.f.prev = 0.04,  ini.ad.m.prev = 0.0
                    n.age.cats = 12,  n.age.cats.m = 10, n.age.cats.f = 15,
                    p = 0.27, env.foi = 0,  beta.f = 0.028,  beta.m = 0.028,
                    theta = 0.9, n0 = 140000, n.years = 25, rel.risk = 1.0,
                    repro.var = 0.005, fawn.sur.var = 0.005, sur.var = 0.005, hunt.var = 0.0005, juv.sur
                    WSI = 1,
                    arrival_input = c(0,0,0,0,0,0,0, 0, 0, 0),
                    Action_young_bucks = 0, Action_lib_harvest = 0, Action_targetrm = 0, Action_sharpsho
                    nosampled = 100
    )
    if(selectstrat == "PareR" | selectstrat == "SK"){
      params$nosampled <- 100 ## Need to overwrite number of samples in surviellance strategy tied to P
    }
  }

simsout4 <- cwd_stoch_wrapper(params, nsims = 10, n.years = 25, strat = selectstrat, hypothesis = selec


  return(simsout4)
}


H1 <- CompareAltsFuncwSetH(setstrats = c("SQ", "Ho", "SK", "NoAA", "PareR", "PventR", "SA"), plottype =
H2 <- CompareAltsFuncwSetH(setstrats = c("SQ", "Ho", "SK", "NoAA", "PareR", "PventR", "SA"), plottype =
H3 <- CompareAltsFuncwSetH(setstrats = c("SQ", "Ho", "SK", "NoAA", "PareR", "PventR", "SA"), plottype =
H4 <- CompareAltsFuncwSetH(setstrats = c("SQ", "Ho", "SK", "NoAA", "PareR", "PventR", "SA"), plottype =

H1; H2; H3; H4
```


Abundance
3e+05
2e+05
1e+05
0
5
10
15
20
25
Year
as.factor(strategy)
Ho
NoAA
PareR
PventR
SA
SK
SQ
strategy
Ho
NoAA
PareR
PventR
SA
SK
SQ


3e+05
2e+05
1e+05
Abundance
0
5
10
15
20
25
Year
as.factor(strategy)
Ho
NoAA
PareR
PventR
SQ
strategy
Ho
NoAA
PareR
PventR
SA
SK
SQ


3e+05
2e+05
1e+05
Abundance
0
5
10
15
20
25
Year
as.factor(strategy)
Ho
NoAA
PareR
PventR
SK
SQ
strategy
Ho
NoAA
PareR
PventR
SA
SK
SQ

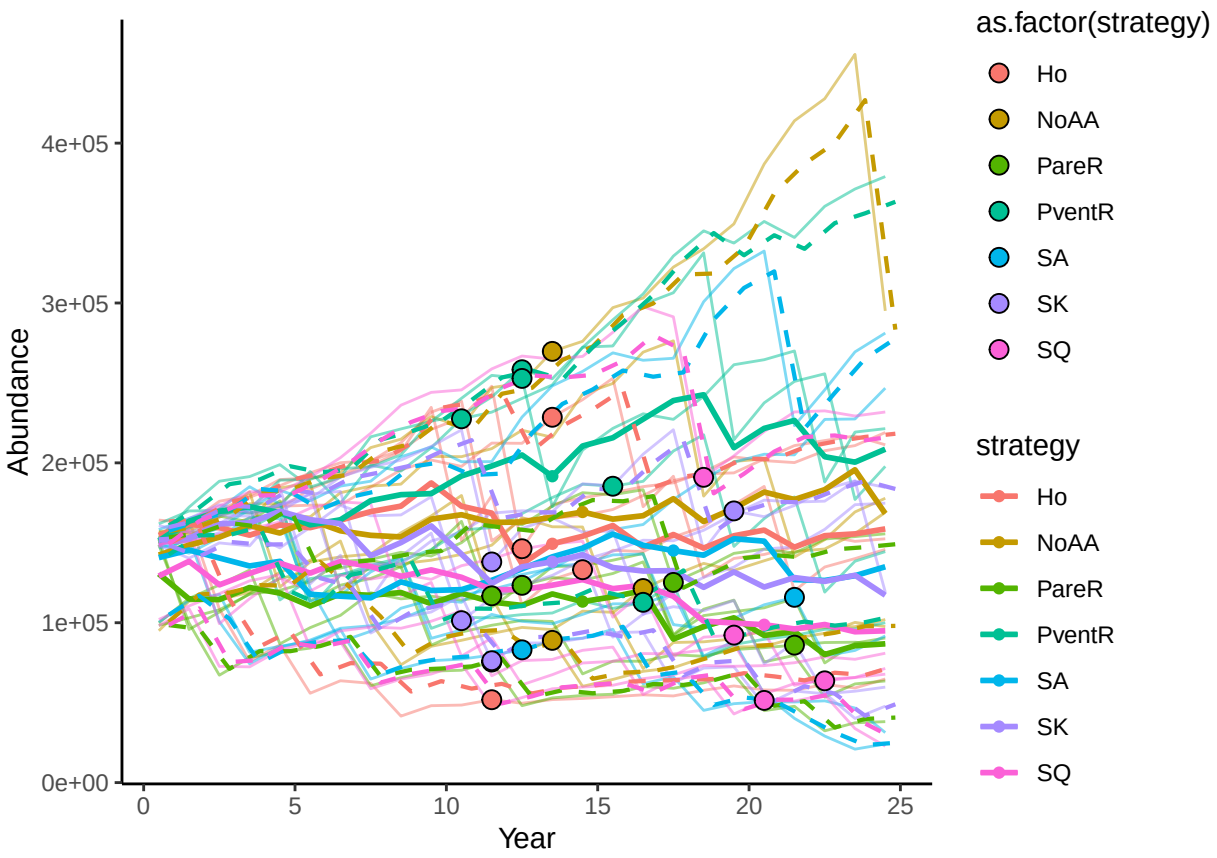


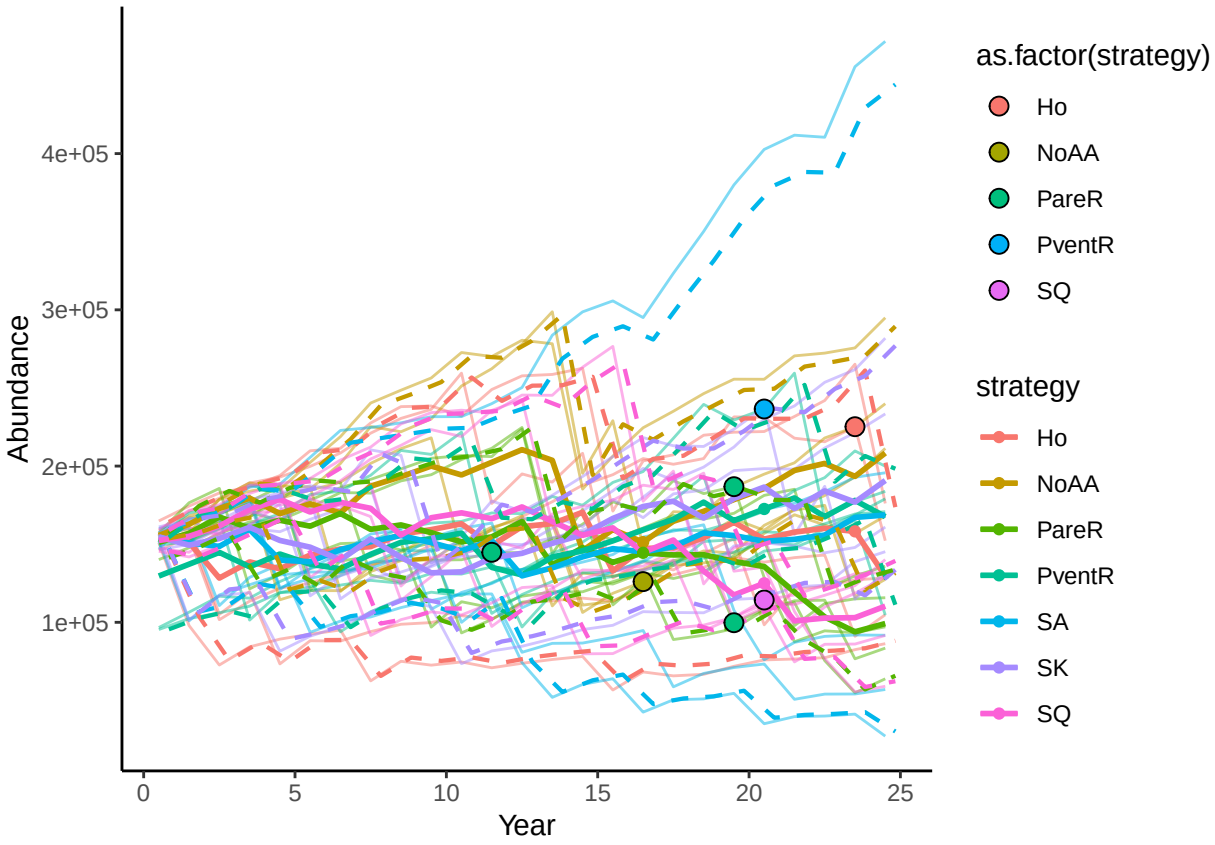
I think this shows that we need to turn stochasticity off.. should set each hypothesis as one vector

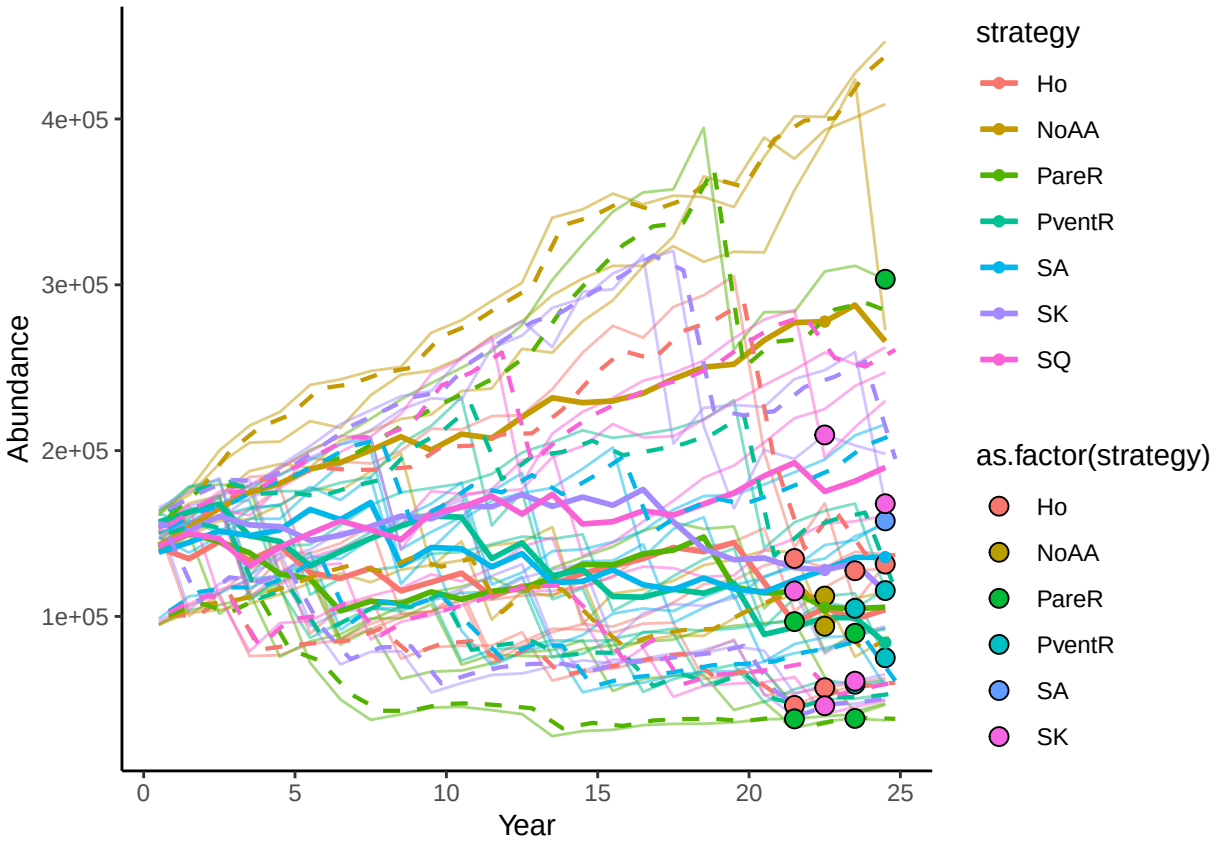
No actions are turned on.. Let the number of samples vary across all strategies

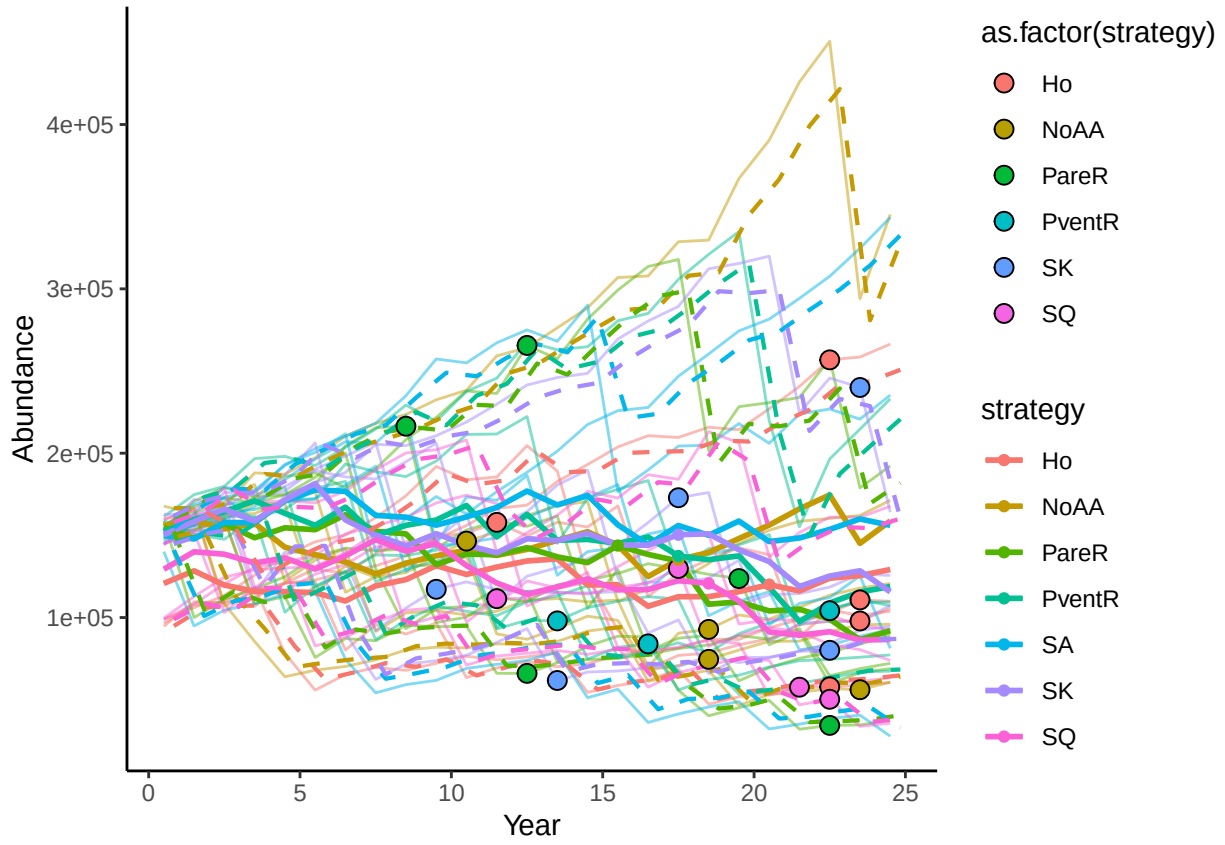
```
ComHypowSelectH <- function(selectstrat = "SQ", selecthypo = "H1"){

  ### Set the parameters based on the selected straetgy
  if(selectstrat == "SQ" | selectstrat == "SA" | selectstrat == "Ho"){
    params <- list(fawn.an.sur = 0.7, juv.an.sur = 0.8, ad.an.f.sur = 0.82, ad.an.m.sur = 0.8,
                   fawn.repro = 0.06, juv.repro = 1.3, ad.repro = 1.4,
                   hunt.mort.fawn = 0.01, hunt.mort.juv.f = 0.1, hunt.mort.juv.m = 0.1, hunt.mort.ad.f =
                   ini.fawn.prev = 0.01, ini.juv.prev = 0.03, ini.ad.f.prev = 0.04,  ini.ad.m.prev = 0.0
                   n.age.cats = 12,  n.age.cats.m = 10, n.age.cats.f = 15,
                   p = 0.27, env.foi = 0,  beta.f = 0.028,  beta.m = 0.028,
                   theta = 0.9, n0 = 140000, n.years = 25, rel.risk = 1.0,
                   repro.var = 0.005, fawn.sur.var = 0.005, sur.var = 0.005, hunt.var = 0.0005, juv.sur
                   WSI = 1,
                   arrival_input = c(0,0,0,0,0,0,0, 0, 0, 0),
                   Action_young_bucks = 0, Action_lib_harvest = 0, Action_targetrm = 0, Action_sharpsho
                   nosampled = 5
    )
    if(selectstrat == "Ho"){
      params$nosampled <- 230 ## Need to overwrite number of samples in surviellance strategy tied to H
    }
  }else{ # other strategies have hunting actions turned on
    params <- list(fawn.an.sur = 0.7, juv.an.sur = 0.8, ad.an.f.sur = 0.82, ad.an.m.sur = 0.8,
                   fawn.repro = 0.06, juv.repro = 1.3, ad.repro = 1.4,
```

```
                    hunt.mort.fawn = 0.01, hunt.mort.juv.f = 0.1, hunt.mort.juv.m = 0.1, hunt.mort.ad.f =
                    ini.fawn.prev = 0.01, ini.juv.prev = 0.03, ini.ad.f.prev = 0.04,  ini.ad.m.prev = 0.0
                    n.age.cats = 12,  n.age.cats.m = 10, n.age.cats.f = 15,
                    p = 0.27, env.foi = 0,  beta.f = 0.028,  beta.m = 0.028,
                    theta = 0.9, n0 = 140000, n.years = 25, rel.risk = 1.0,
                    repro.var = 0.005, fawn.sur.var = 0.005, sur.var = 0.005, hunt.var = 0.0005, juv.sur
                    WSI = 1,
                    arrival_input = c(0,0,0,0,0,0,0, 0, 0, 0),
                    Action_young_bucks = 0, Action_lib_harvest = 0, Action_targetrm = 0, Action_sharpsho
                    nosampled = 125
    )
    if(selectstrat == "PareR" | selectstrat == "SK"){
      params$nosampled <- 460 ## Need to overwrite number of samples in surviellance strategy tied to P
    }
  }

simsout4 <- cwd_stoch_wrapper(params, nsims = 10, n.years = 25, strat = selectstrat, hypothesis = selec


  return(simsout4)
}


H1 <- CompareAltsFuncwSetH(setstrats = c("SQ", "Ho", "SK", "NoAA", "PareR", "PventR", "SA"), plottype =
H2 <- CompareAltsFuncwSetH(setstrats = c("SQ", "Ho", "SK", "NoAA", "PareR", "PventR", "SA"), plottype =
H3 <- CompareAltsFuncwSetH(setstrats = c("SQ", "Ho", "SK", "NoAA", "PareR", "PventR", "SA"), plottype =
H4 <- CompareAltsFuncwSetH(setstrats = c("SQ", "Ho", "SK", "NoAA", "PareR", "PventR", "SA"), plottype =

H1; H2; H3; H4
```


Abundance
4e+05
3e+05
2e+05
1e+05
0e+00
0
5
10
15
20
25
Year
as.factor(strategy)
Ho
NoAA
PareR
PventR
SA
SK
SQ
strategy
Ho
NoAA
PareR
PventR
SA
SK
SQ


Abundance
4e+05
3e+05
2e+05
1e+05
0
5
10
15
20
25
Year
as.factor(strategy)
Ho
NoAA
PareR
PventR
SQ
strategy
Ho
NoAA
PareR
PventR
SA
SK
SQ


Abundance
4e+05
3e+05
2e+05
1e+05
0
5
10
15
20
25
Year
strategy
Ho
NoAA
PareR
PventR
SA
SK
SQ
as.factor(strategy)
Ho
NoAA
PareR
PventR
SA
SK



Compare Hypotheses for one strategy (Kitchen Sink)

```
params <- list(fawn.an.sur = 0.7, juv.an.sur = 0.8, ad.an.f.sur = 0.82,
               ad.an.m.sur = 0.8, fawn.repro = 0.06, juv.repro = 1.3, ad.repro = 1.4,
               hunt.mort.fawn = 0.01, hunt.mort.juv.f = 0.1, hunt.mort.juv.m = 0.1,
               hunt.mort.ad.f = 0.12, hunt.mort.ad.m = 0.50,
                ini.fawn.prev = 0.01,
                ini.juv.prev = 0.03, ini.ad.f.prev = 0.04,  ini.ad.m.prev = 0.04,
               n.age.cats = 12,  n.age.cats.m = 10, n.age.cats.f = 15,
                p = 0.27, env.foi = 0,  beta.f = 0.028,  beta.m = 0.028,
               theta = 0.9, n0 = 10000, n.years = 25, rel.risk = 1.0,
               repro.var = 0.005, fawn.sur.var = 0.005, sur.var = 0.005, hunt.var = 0.0005,
               juv.sur.var = 0.005, ad.f.sur.var = 0.005, ad.m.sur.var = 0.005,
             juv.repro.var = 0.005, ad.repro.var = 0.005,
             WSI = 1,
             arrival_input = c(0,0,0,0,0,0,200,0,0,0,0,0,0,0,0,0,0,0,0,0, 0,1,0,0,0),
             Action_young_bucks = 1, Action_lib_harvest = 1, Action_targetrm = 1, Action_sharpshooting =
             nosampled = 460
)

# simsout <- cwd_stoch_model(params)
simsout_H1 <- cwd_stoch_wrapper(params, nsims = 10, n.years = 25, strat = "SK", hypothesis = "H1")
simsout_H2 <- cwd_stoch_wrapper(params, nsims = 50, n.years = 25, strat = "SK", hypothesis = "H2")

simsout_H1 <- cwd_stoch_wrapper_setARV(params, nsims = 10, n.years = 25)
```

```
simsout_H1 <- output
H1_prev <- plot_stoch_prev_single(simsout_H1$counts, all.lines = TRUE)
H1_abund <- plot_stoch_abundance(simsout_H1, all.lines = TRUE, error.bars)
H1_harv <- plot_stoch_harvest(simsout_H1, all.lines, error.bars, detectbar, harvesttype= 1)

plot_stoch_harvest(simsout_H1, all.lines, error.bars, detectbar, harvesttype= 2)
plot_stoch_harvest(simsout_H1, all.lines, error.bars, detectbar, harvesttype= 3)
```