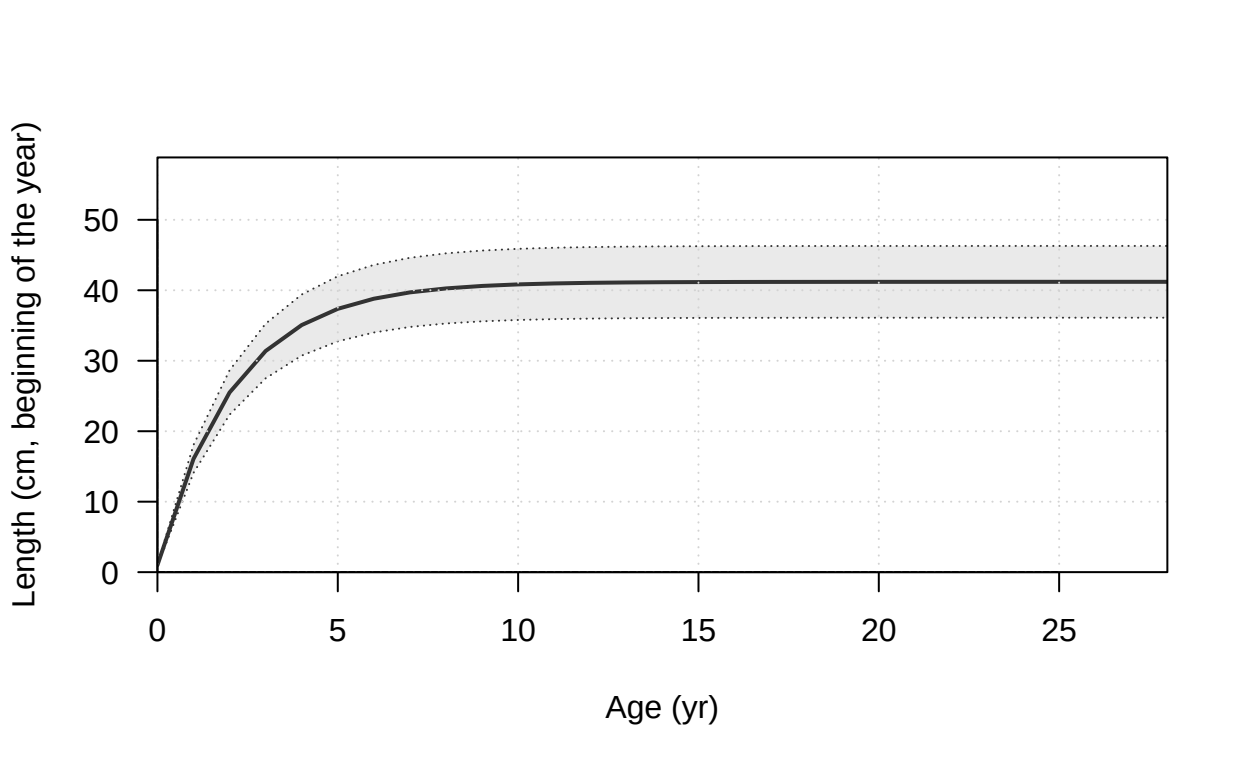
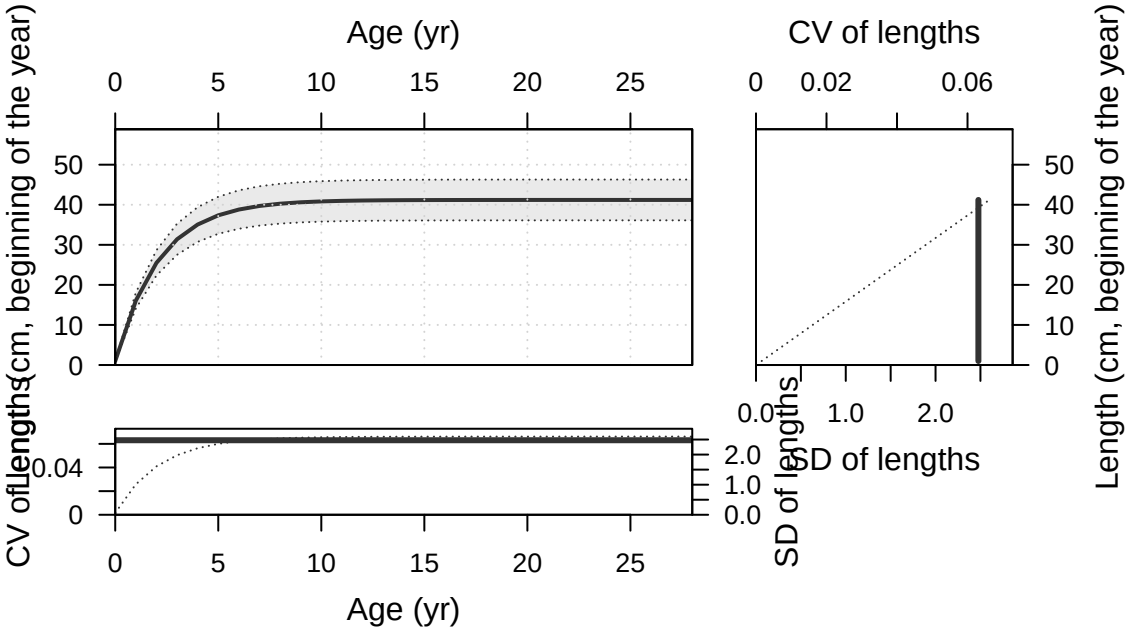
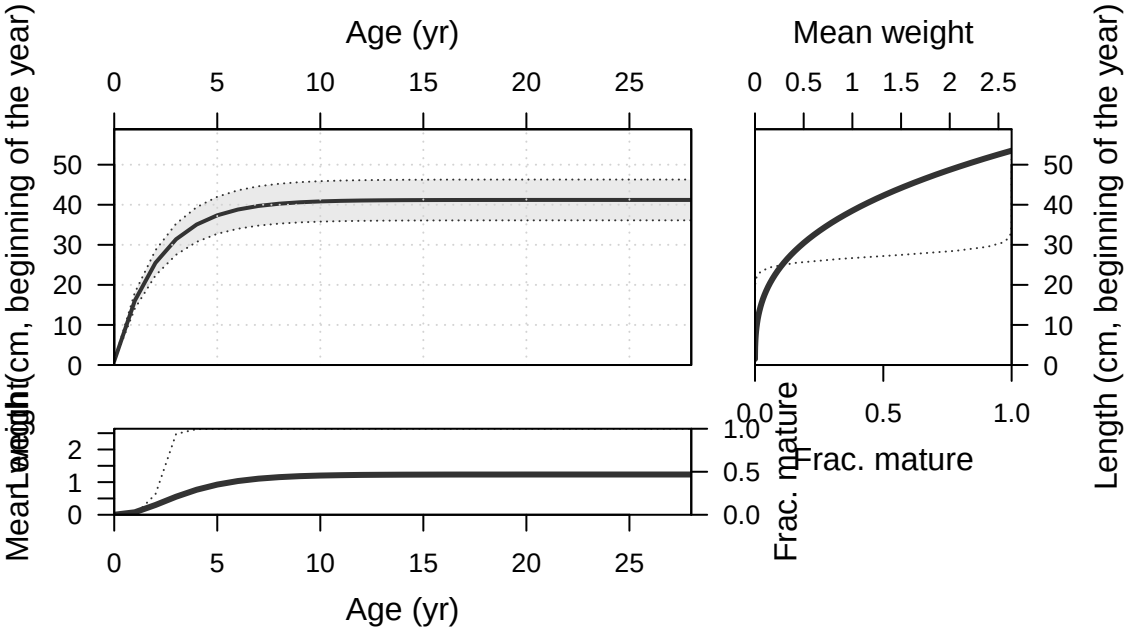
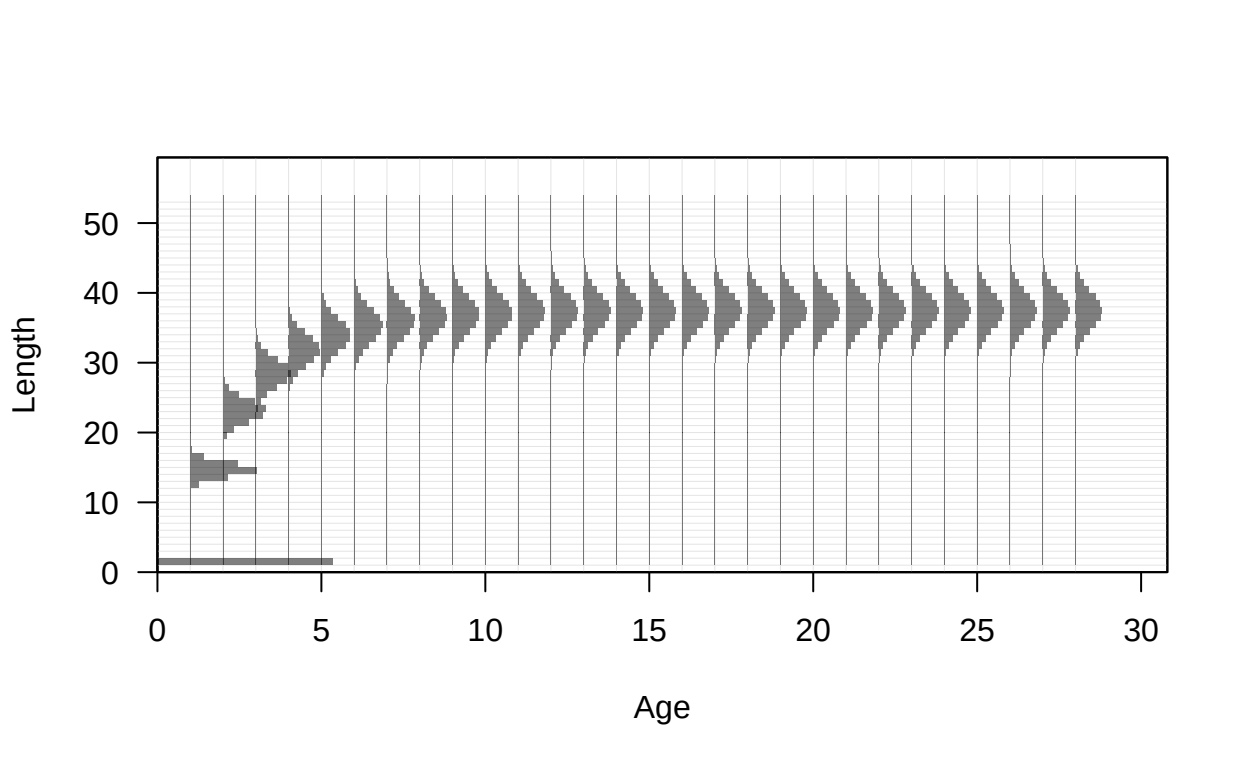
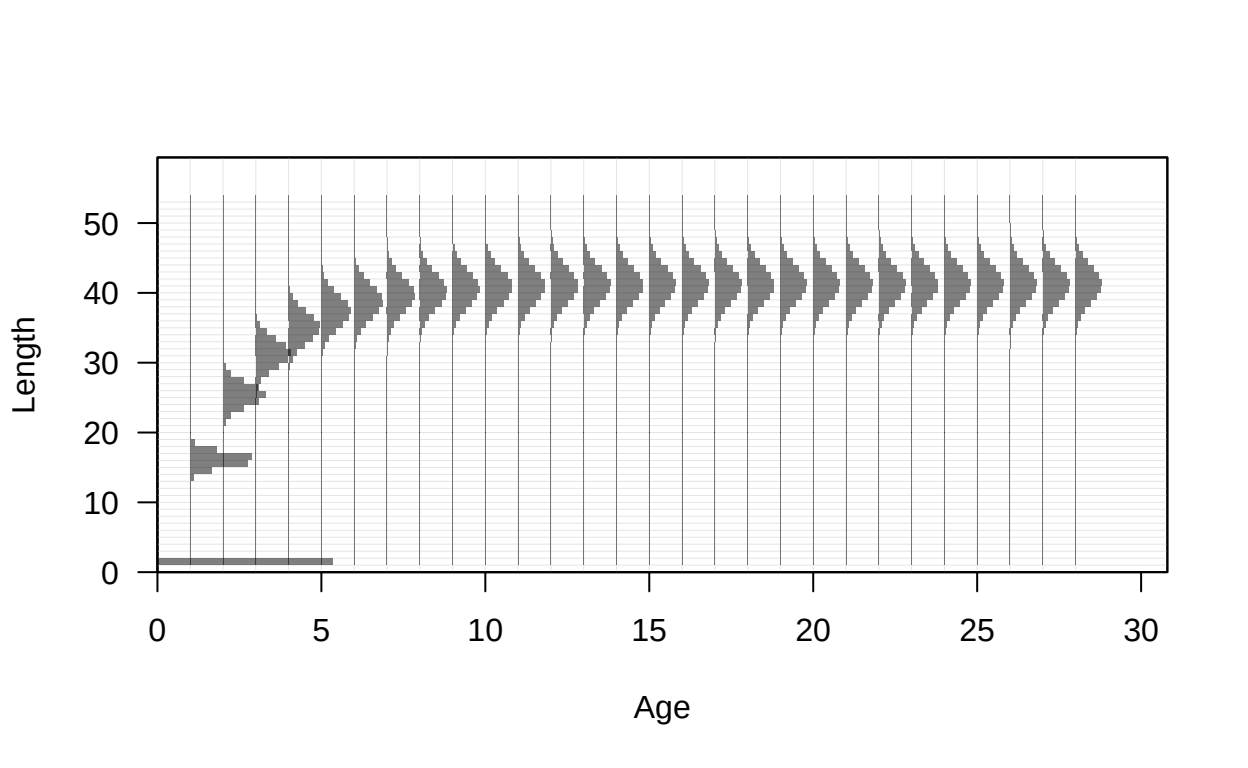
Plots created using the 'r4ss' package in R
Stock Synthesis version: 3.30.19.0
StartTime: Tue Jan 24 11:53:07 2023
Data_File: data.ss
Control_File: control.ss

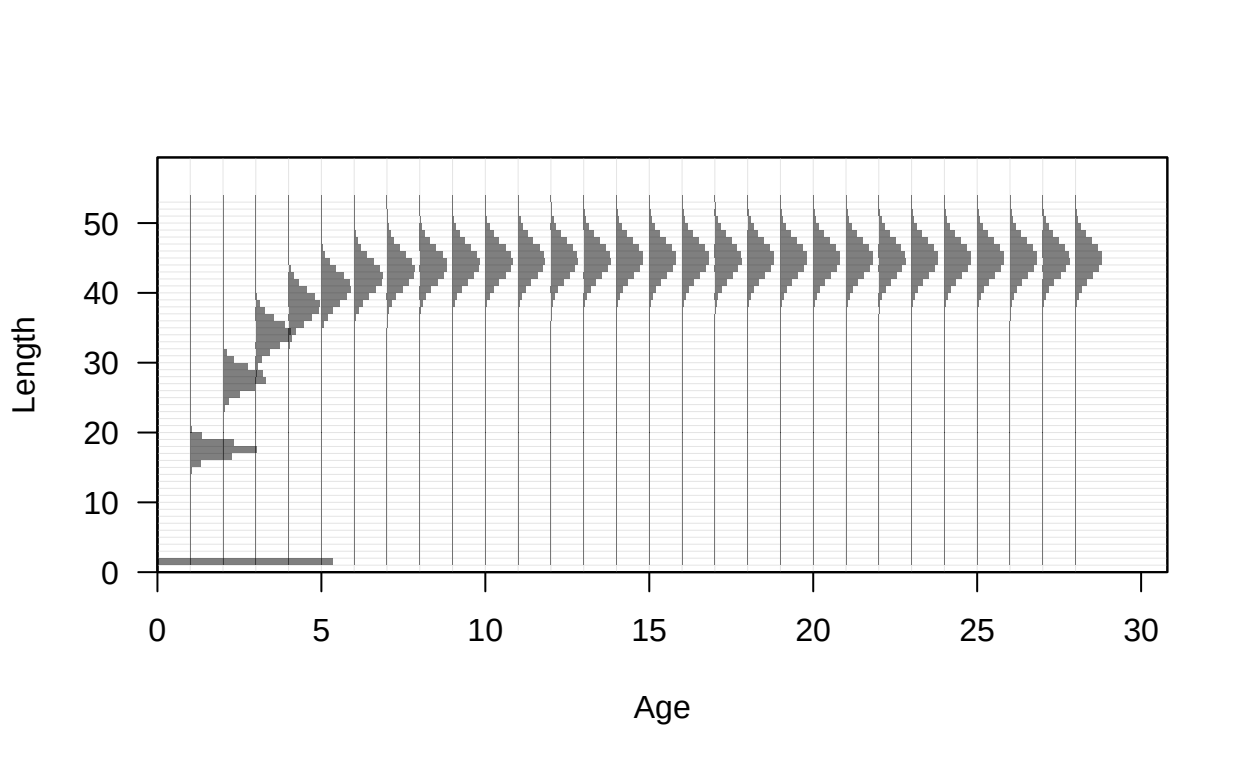

Length (cm, beginning of the year)
0
10
20
30
40
50
0
5
10
15
20
25
Age (yr)

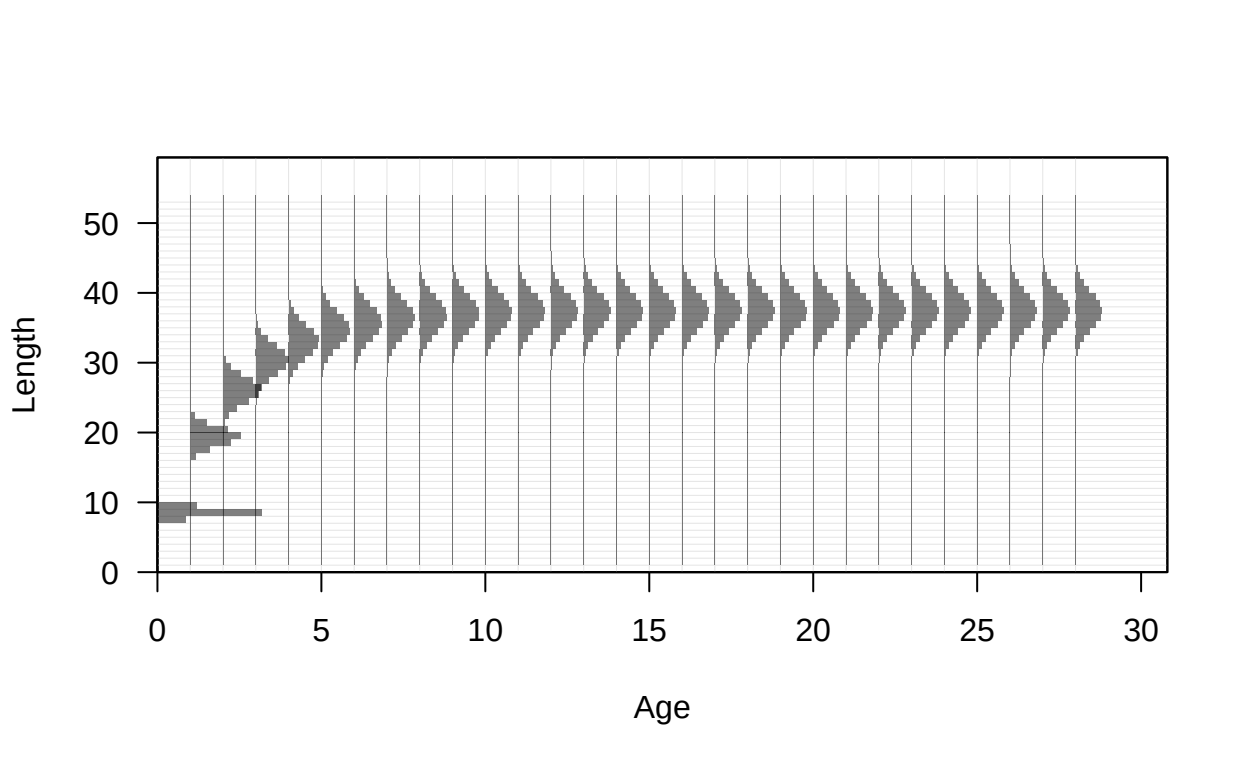

Age (yr)
0
5
10
15
20
25
Length (cm, beginning of the year)
50
40
30
20
10
0
CV of lengths
0.04
0
Age (yr)
CV of lengths
0
0.02
0.06
0.0
1.0
2.0
SD of lengths
2.0
1.0
0.0
SD of lengths
Length (cm, beginning of the year)

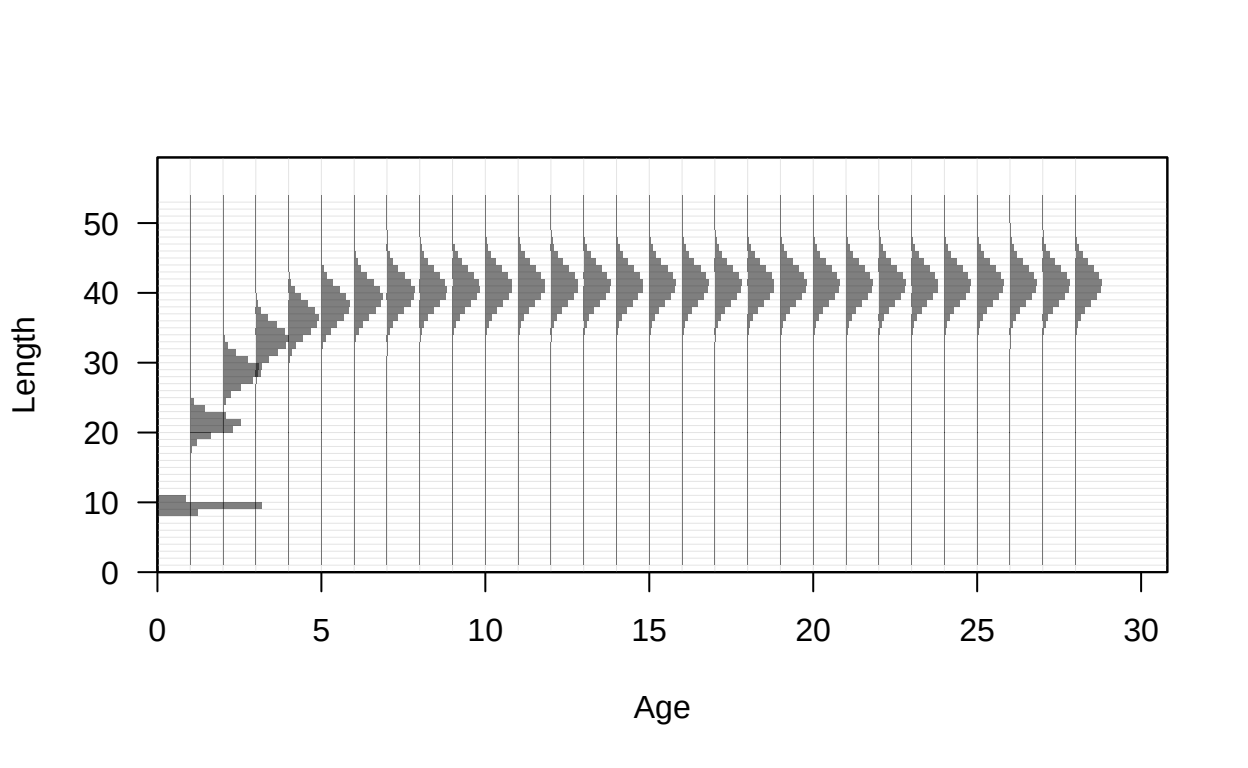

Age (yr)
Mean weight
Length (cm, beginning of the year)
Mean weight
Frac. mature
Age (yr)
Frac. mature
Length (cm, beginning of the year)

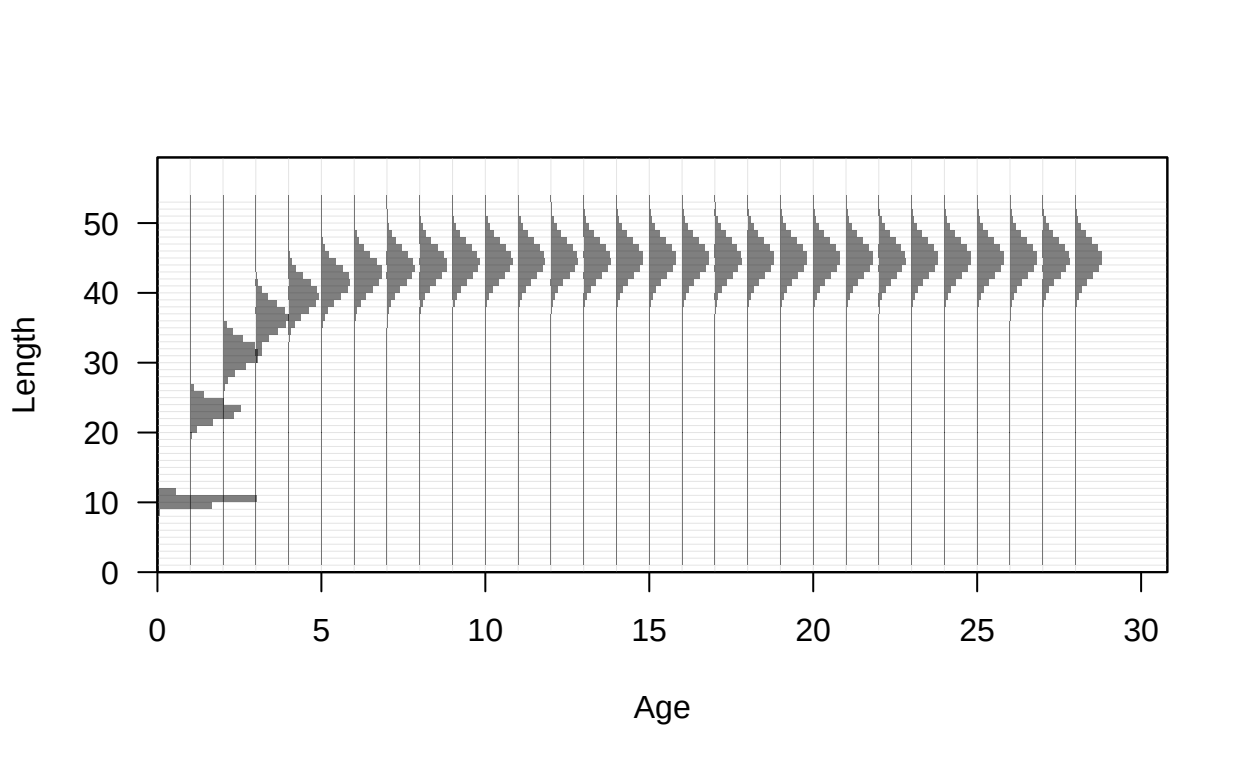

Length
0
10
20
30
40
50
0
5
10
15
20
25
30
Age

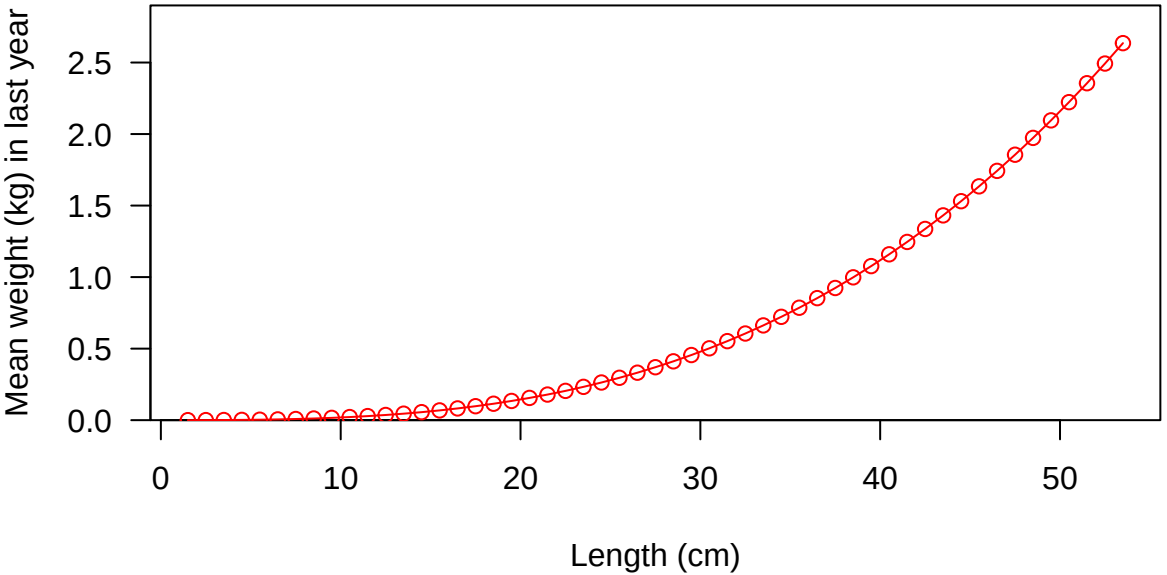

Length
0
10
20
30
40
50
0
5
10
15
20
25
30
Age

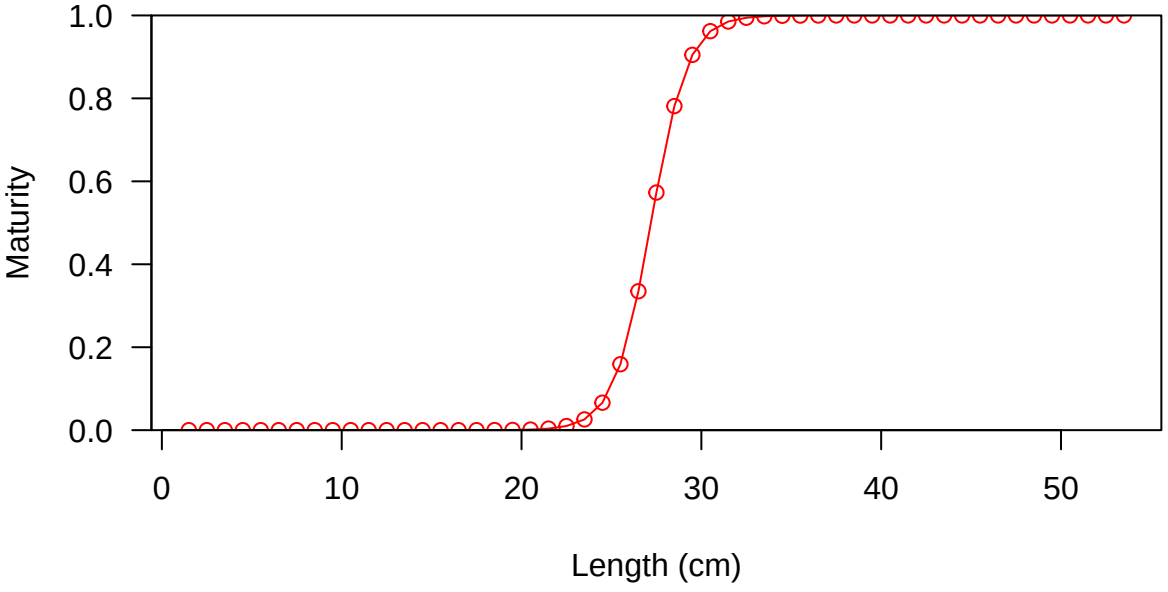

Length
0
10
20
30
40
50
0
5
10
15
20
25
30
Age

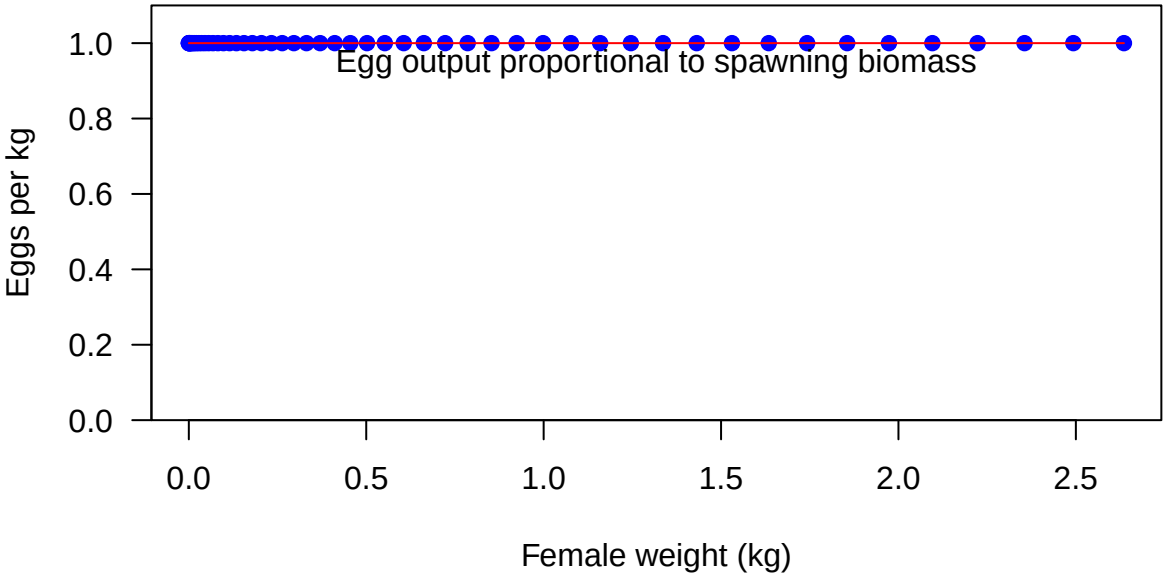

Length
0
10
20
30
40
50
0
5
10
15
20
25
30
Age

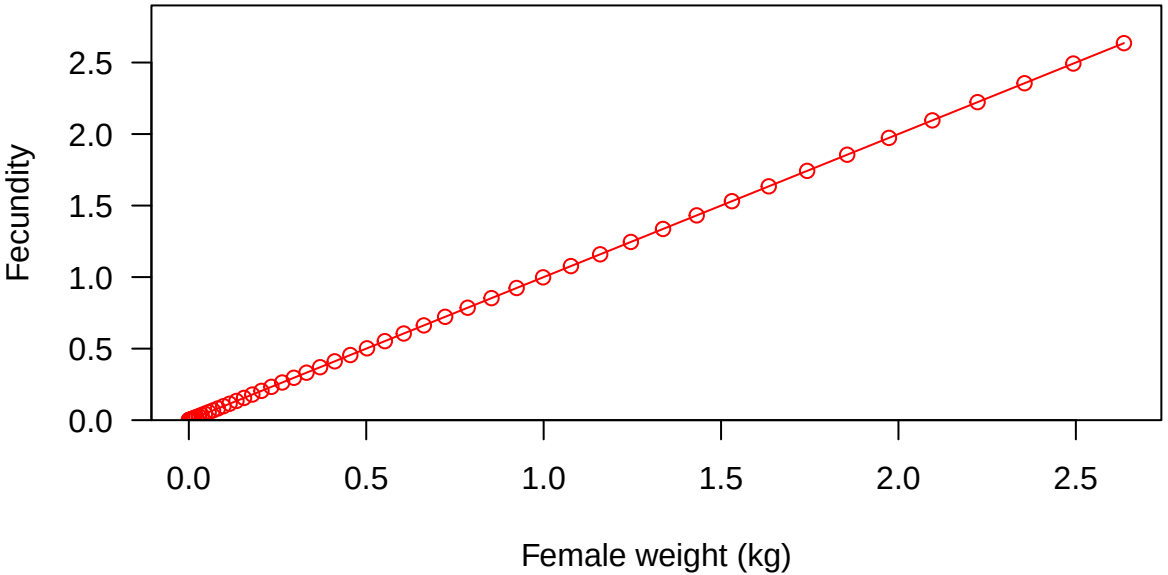

Length
0
10
20
30
40
50
0
5
10
15
20
25
30
Age

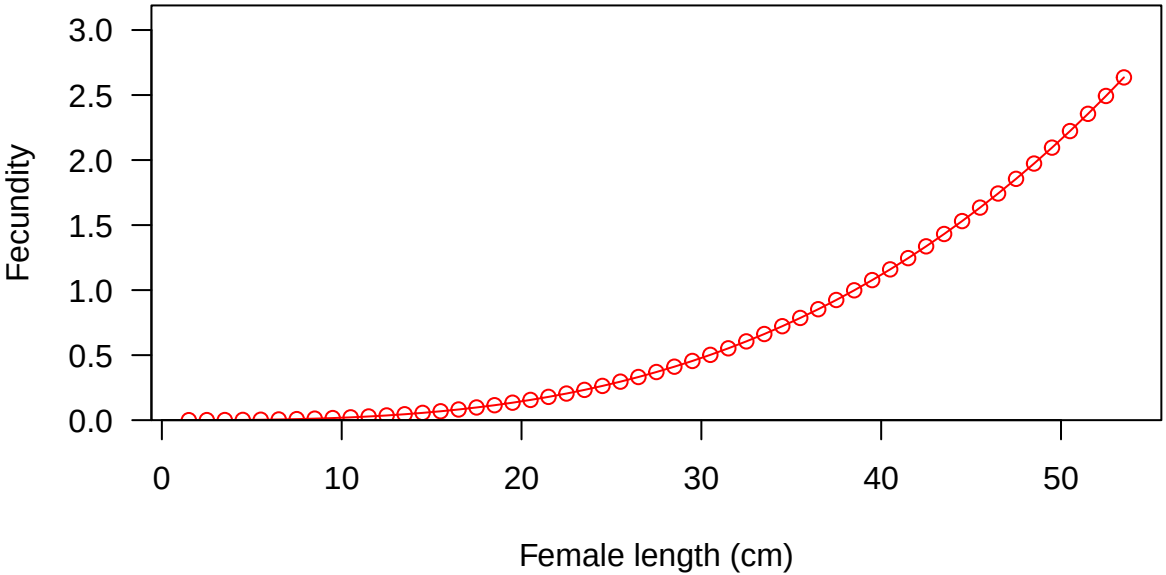

Length
0
10
20
30
40
50
0
5
10
15
20
25
30
Age

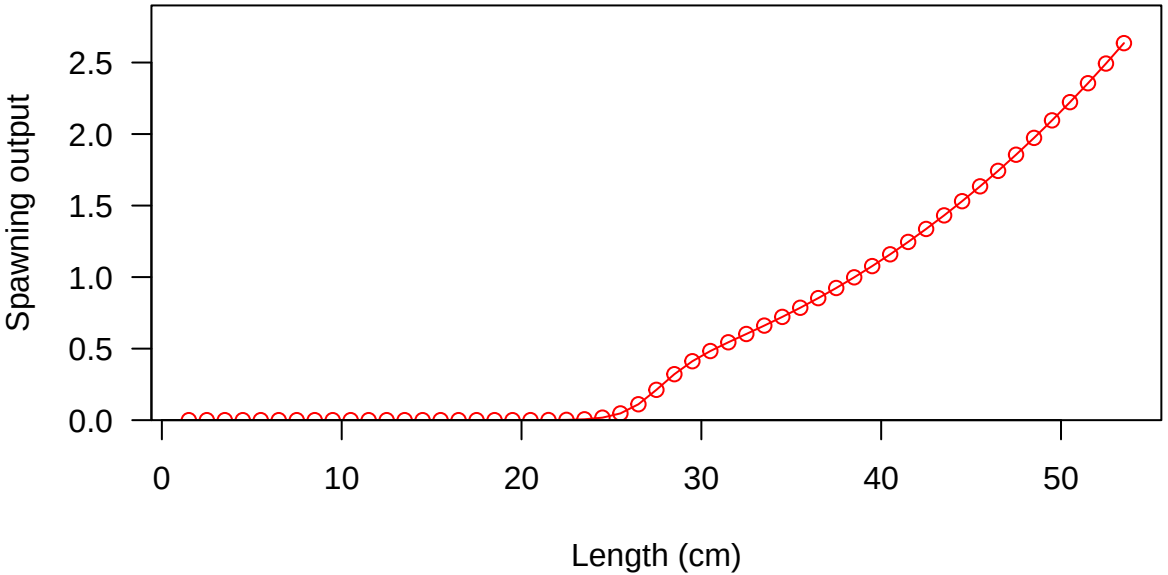

Mean weight (kg) in last year
0.0
0.5
1.0
1.5
2.0
2.5
0
10
20
30
40
50
Length (cm)

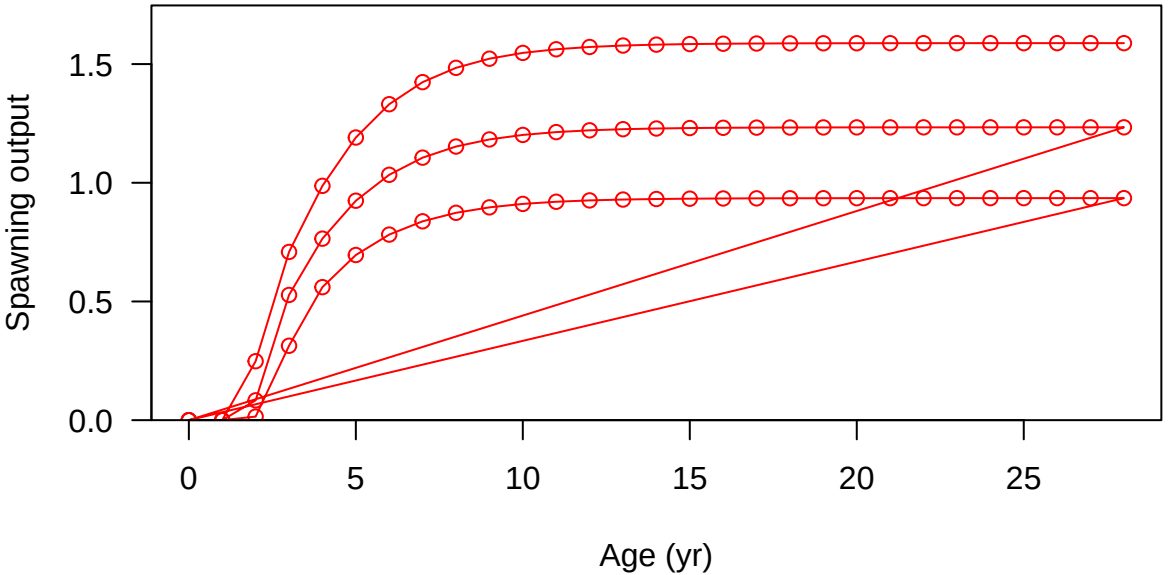

1.0
0.8
0.6
0.4
0.2
0.0
Maturity
0
10
20
30
40
50
Length (cm)

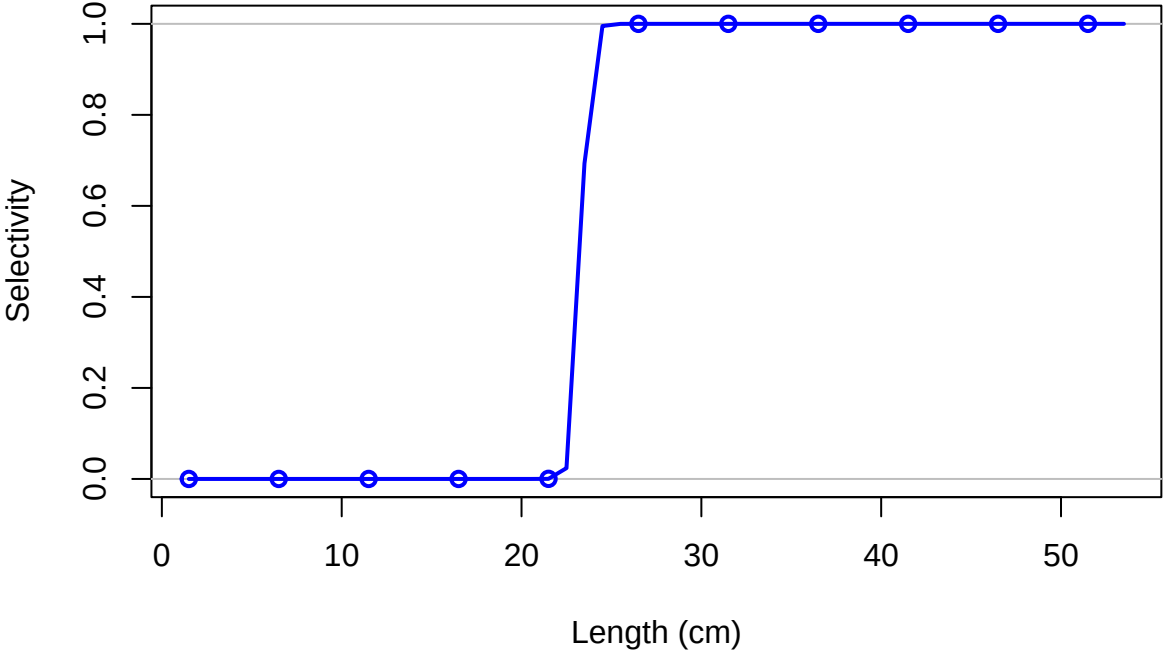

Egg output proportional to spawning biomass
Eggs per kg
1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.5
1.0
1.5
2.0
2.5
Female weight (kg)

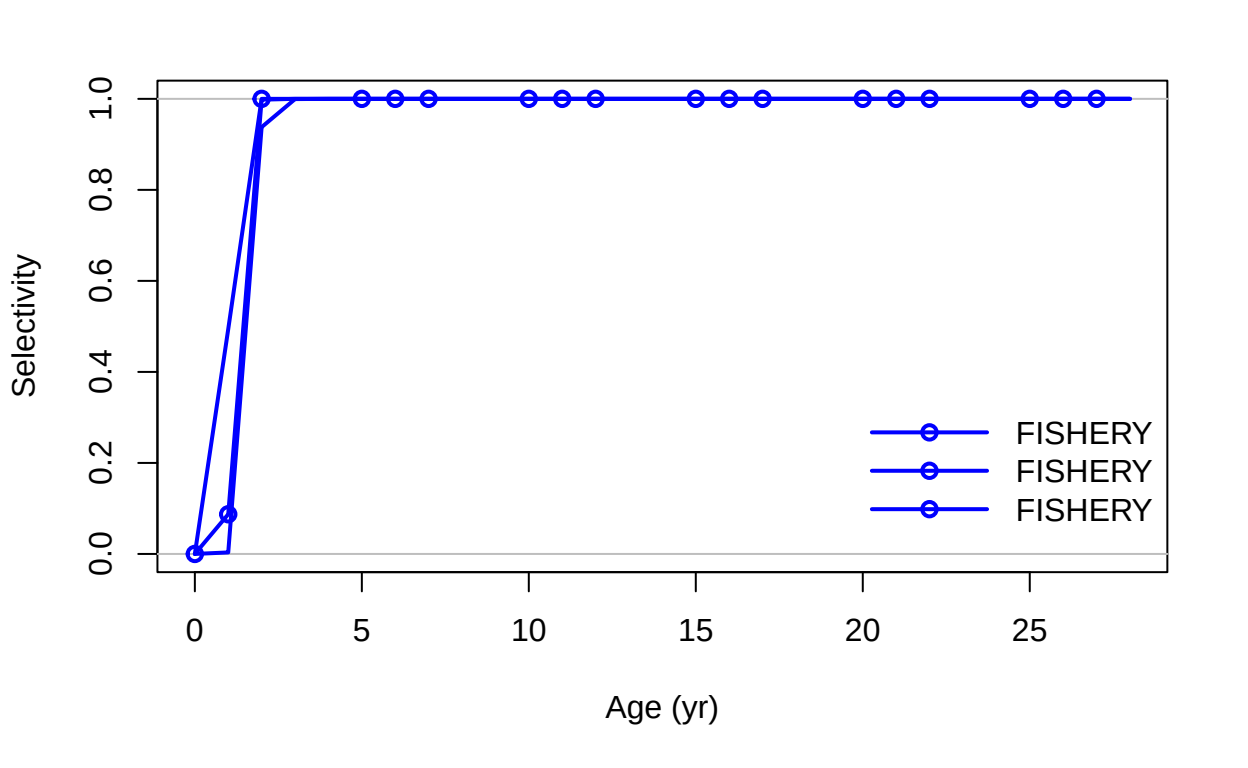

Fecundity
0.0
0.5
1.0
1.5
2.0
2.5
0.0
0.5
1.0
1.5
2.0
2.5
Female weight (kg)

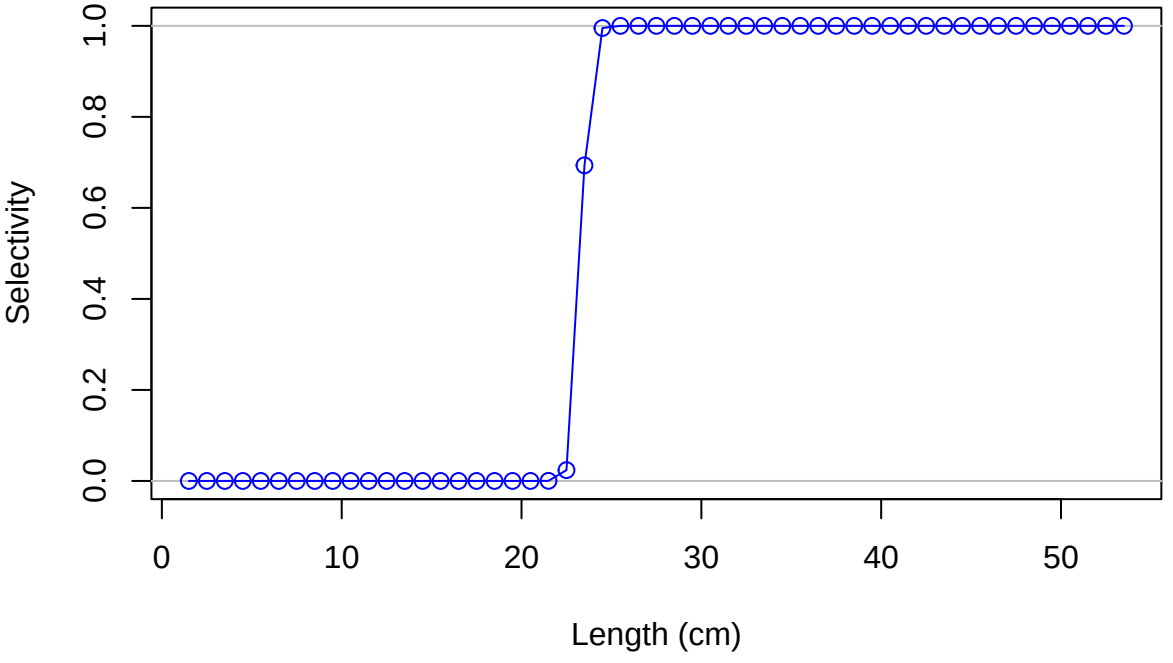

Fecundity
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
10
20
30
40
50
Female length (cm)

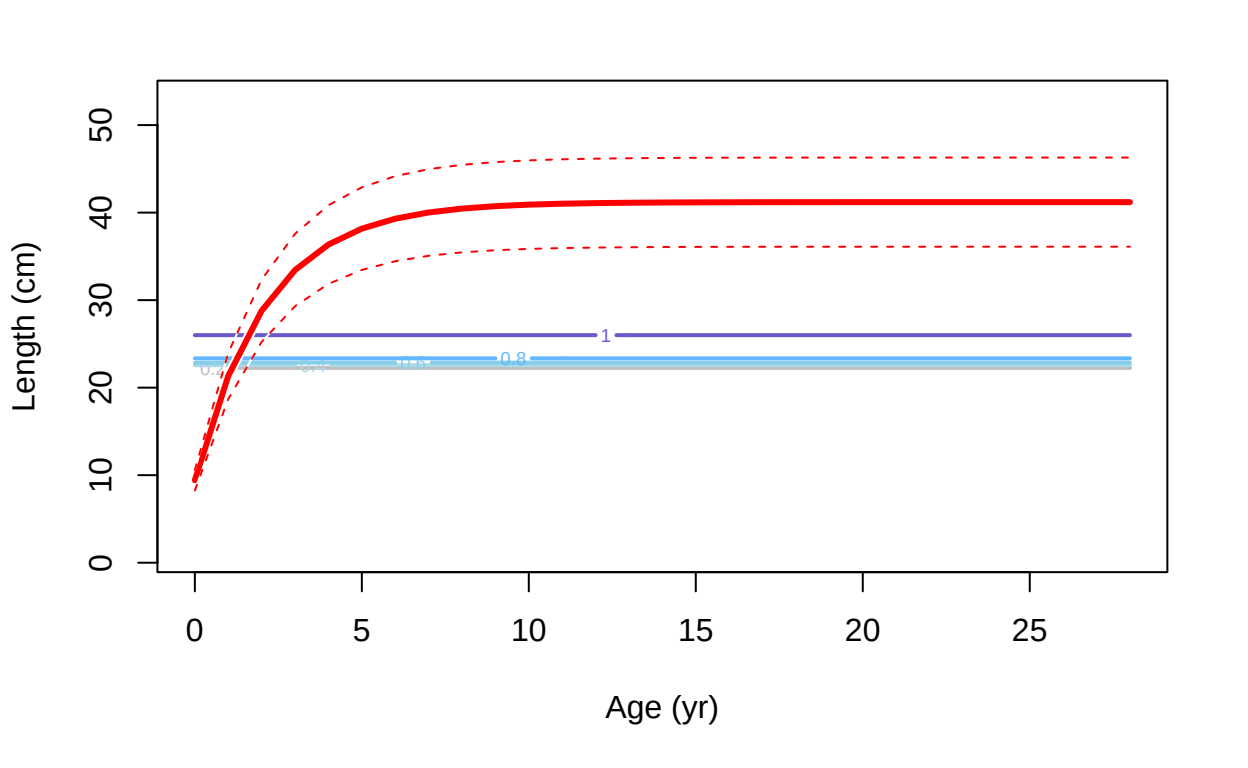

Spawning output
0.0
0.5
1.0
1.5
2.0
2.5
0
10
20
30
40
50
Length (cm)

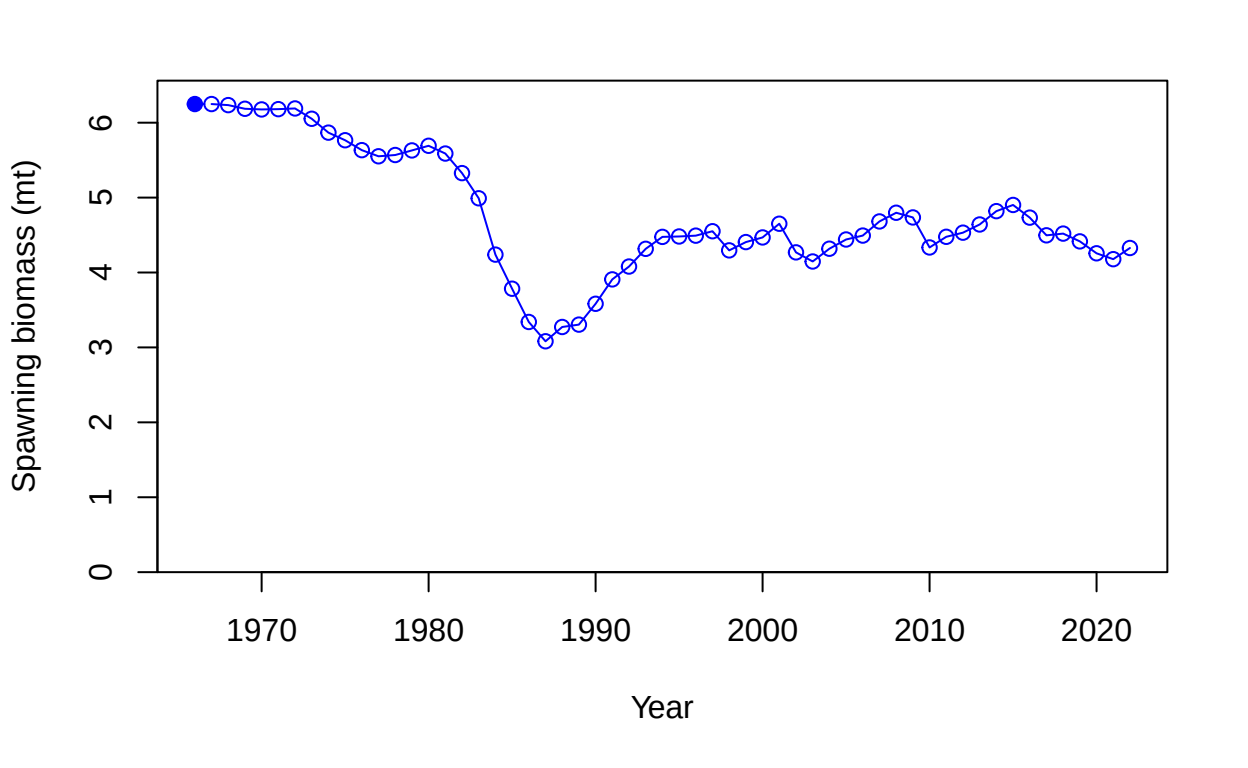

Spawning output
0.0
0.5
1.0
1.5
0
5
10
15
20
25
Age (yr)

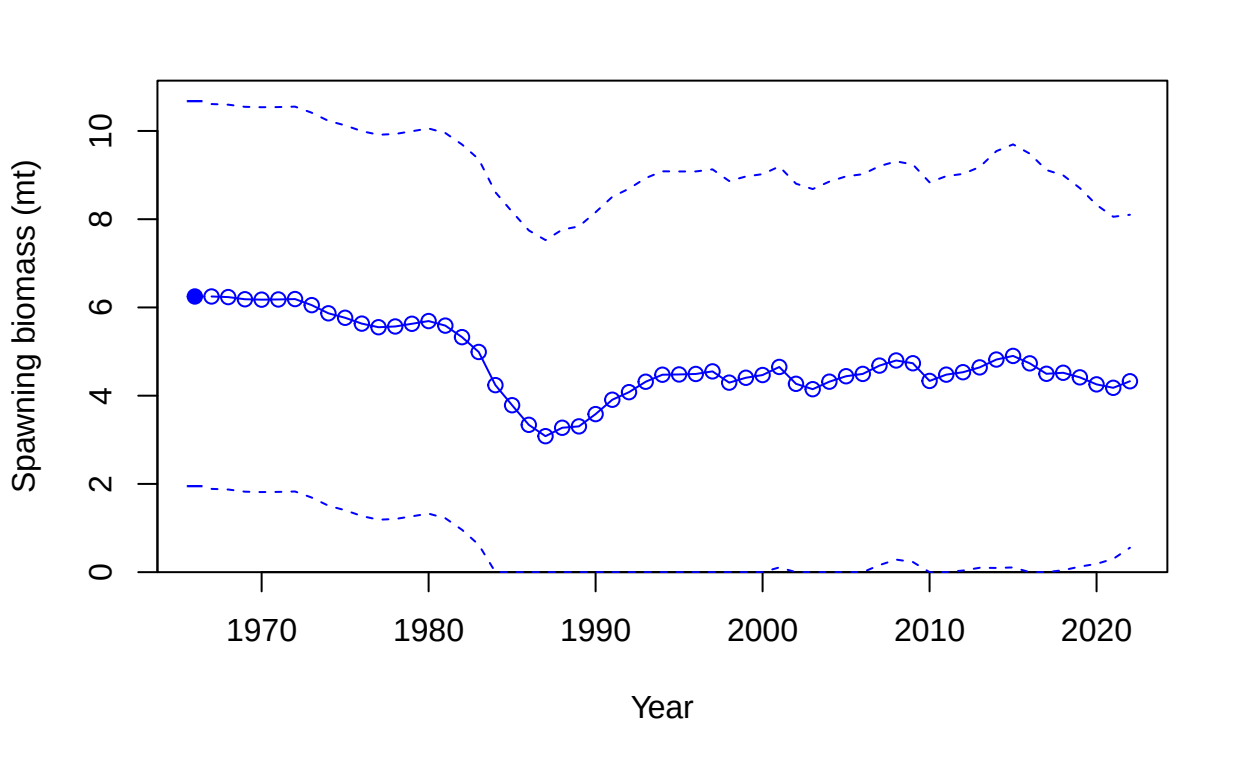

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
10
20
30
40
50
Length (cm)

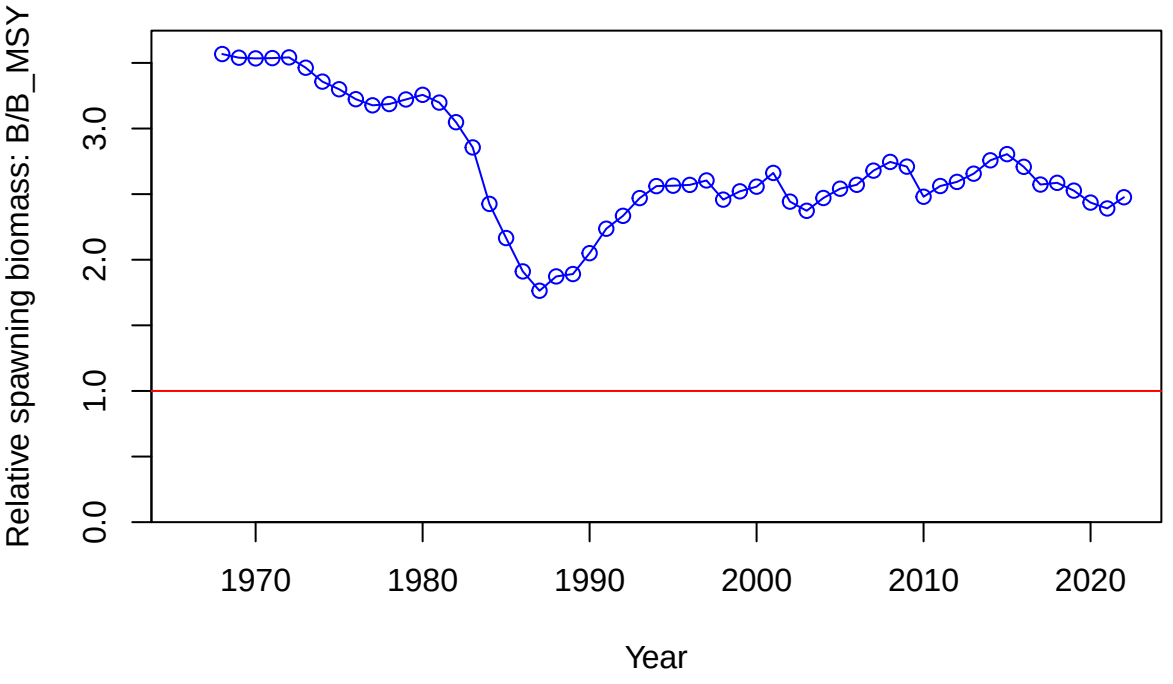

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
5
10
15
20
25
Age (yr)
FISHERY
FISHERY
FISHERY

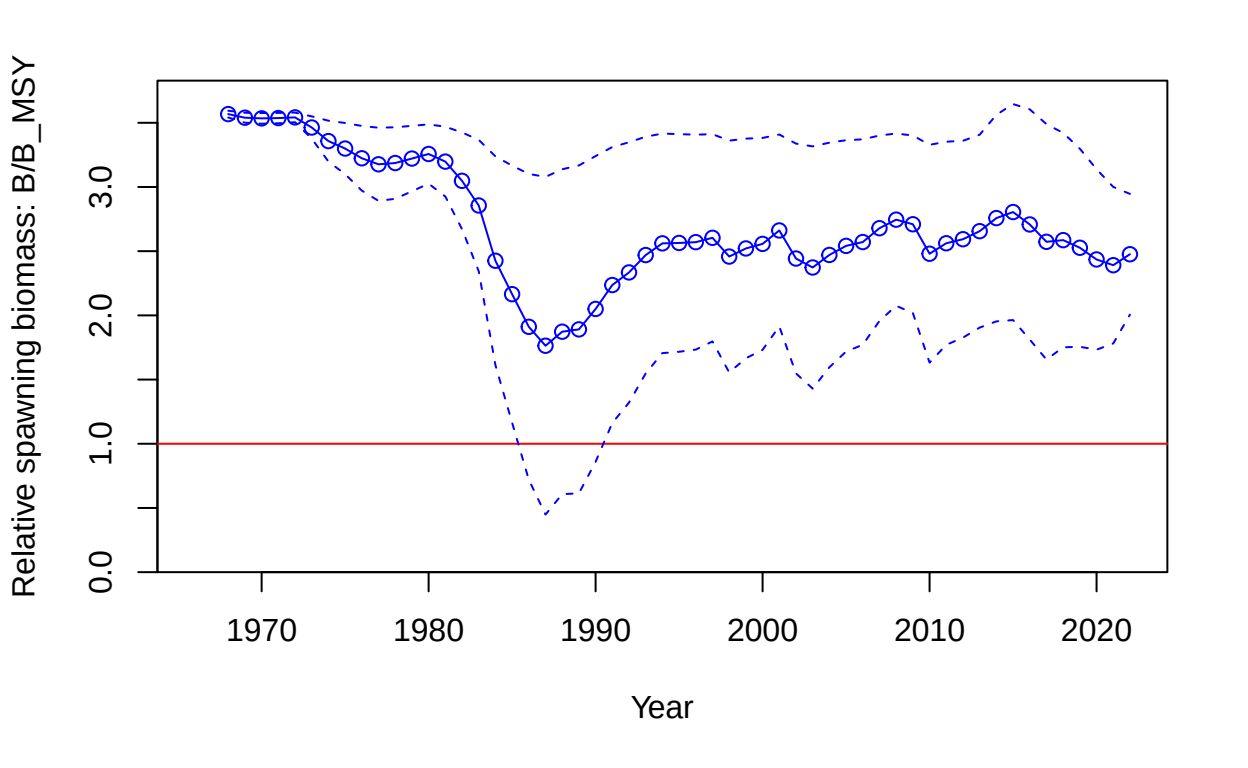

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
10
20
30
40
50
Length (cm)

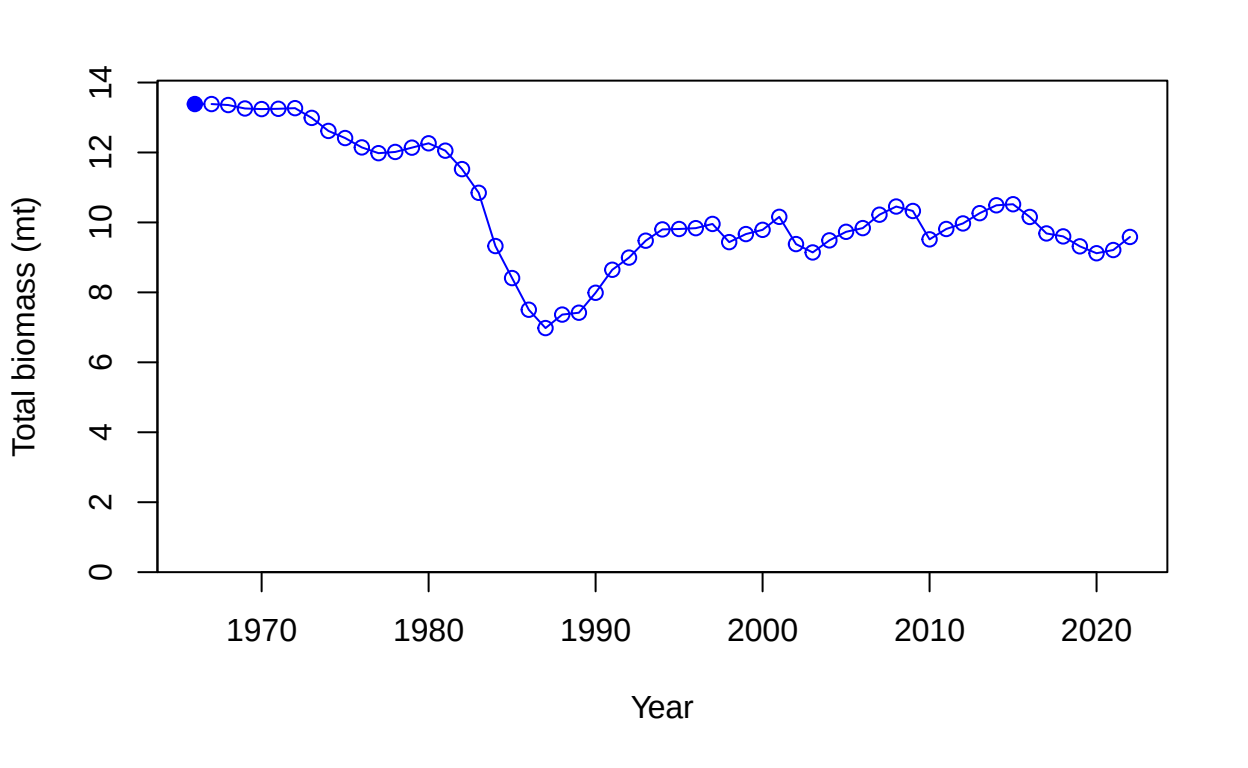

Length (cm)
0
10
20
30
40
50
0
5
10
15
20
25
Age (yr)
1
0.8

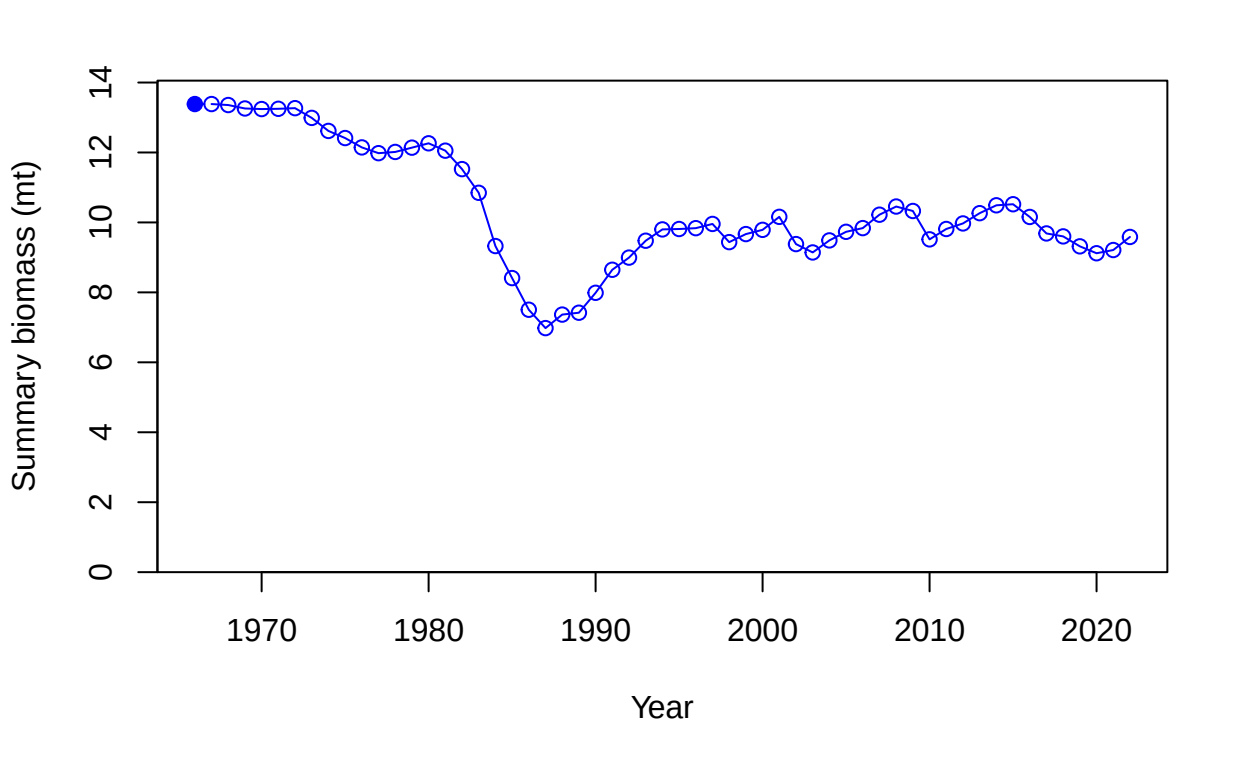

Spawning biomass (mt)
0
1
2
3
4
5
6
1970
1980
1990
2000
2010
2020
Year

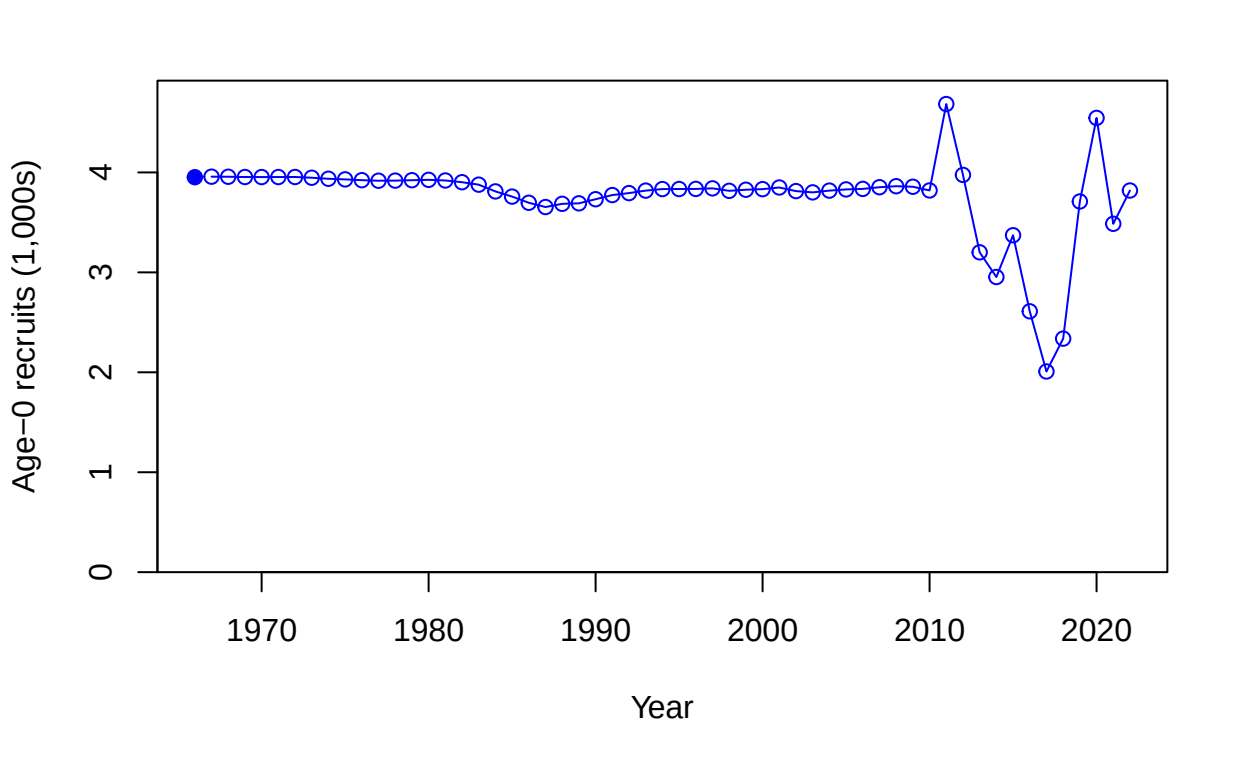

Spawning biomass (mt)
0
2
4
6
8
10
1970
1980
1990
2000
2010
2020
Year

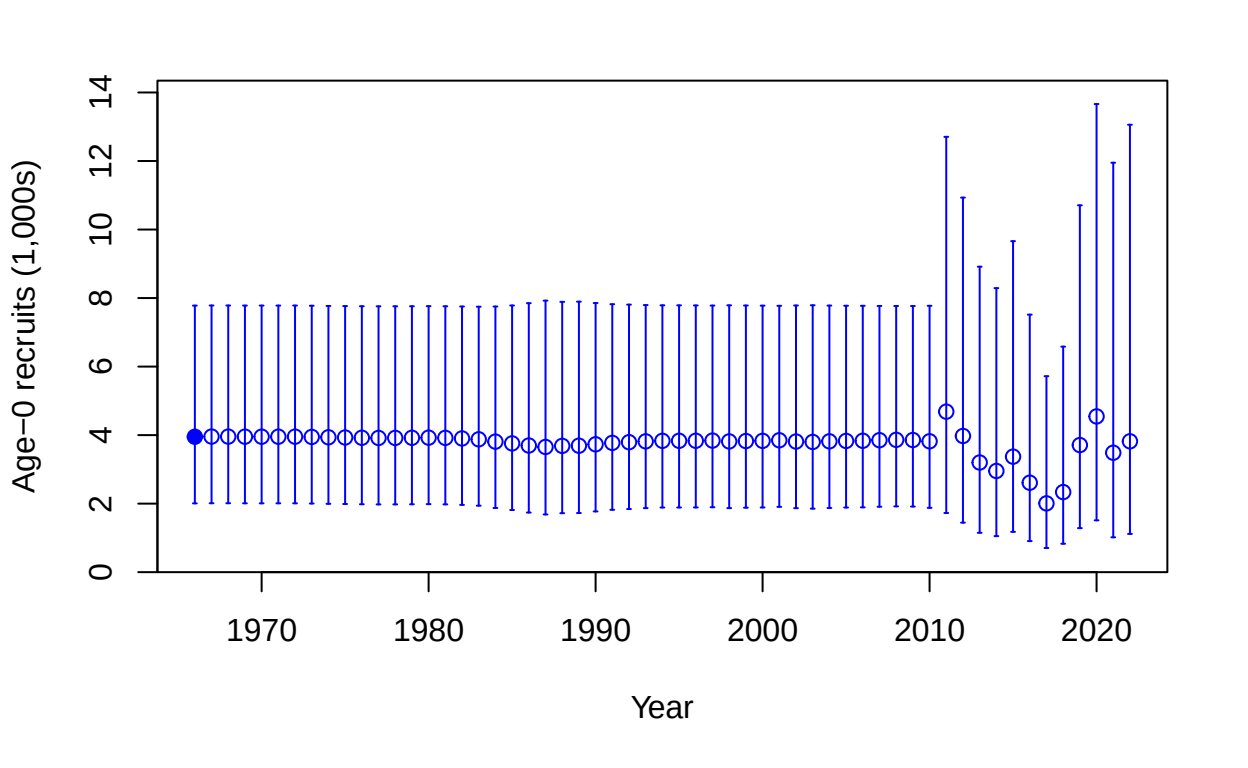

Relative spawning biomass: B/B_MSY
0.0
1.0
2.0
3.0
1970
1980
1990
2000
2010
2020
Year

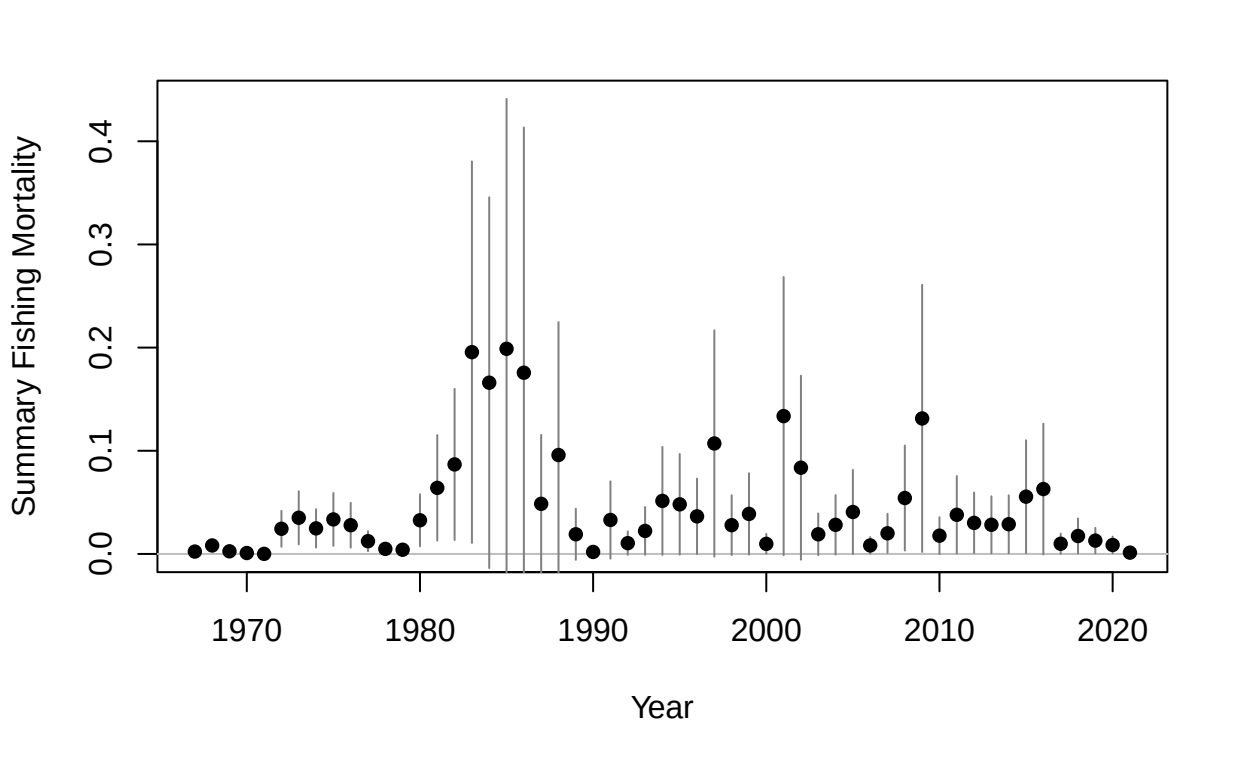

Relative spawning biomass: B/B_MSY
0.0
1.0
2.0
3.0
1970
1980
1990
2000
2010
2020
Year

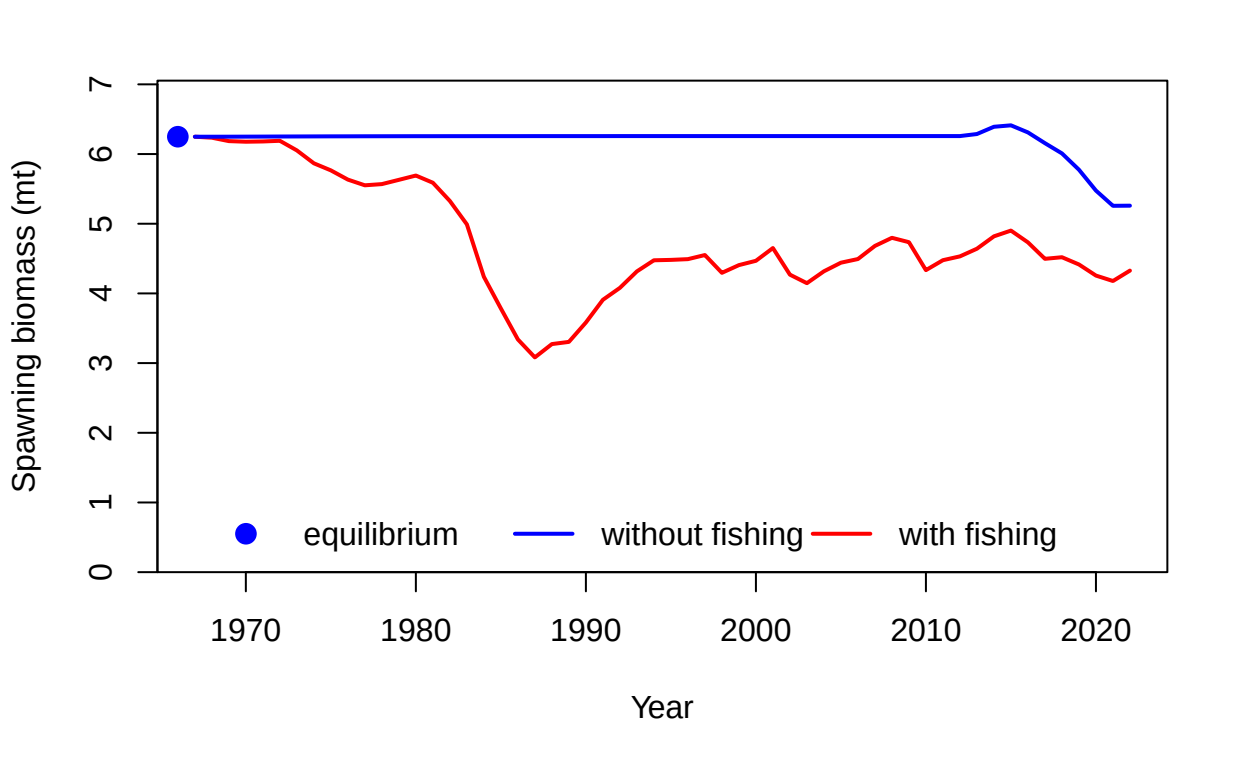

Total biomass (mt)
0
2
4
6
8
10
12
14
1970
1980
1990
2000
2010
2020
Year

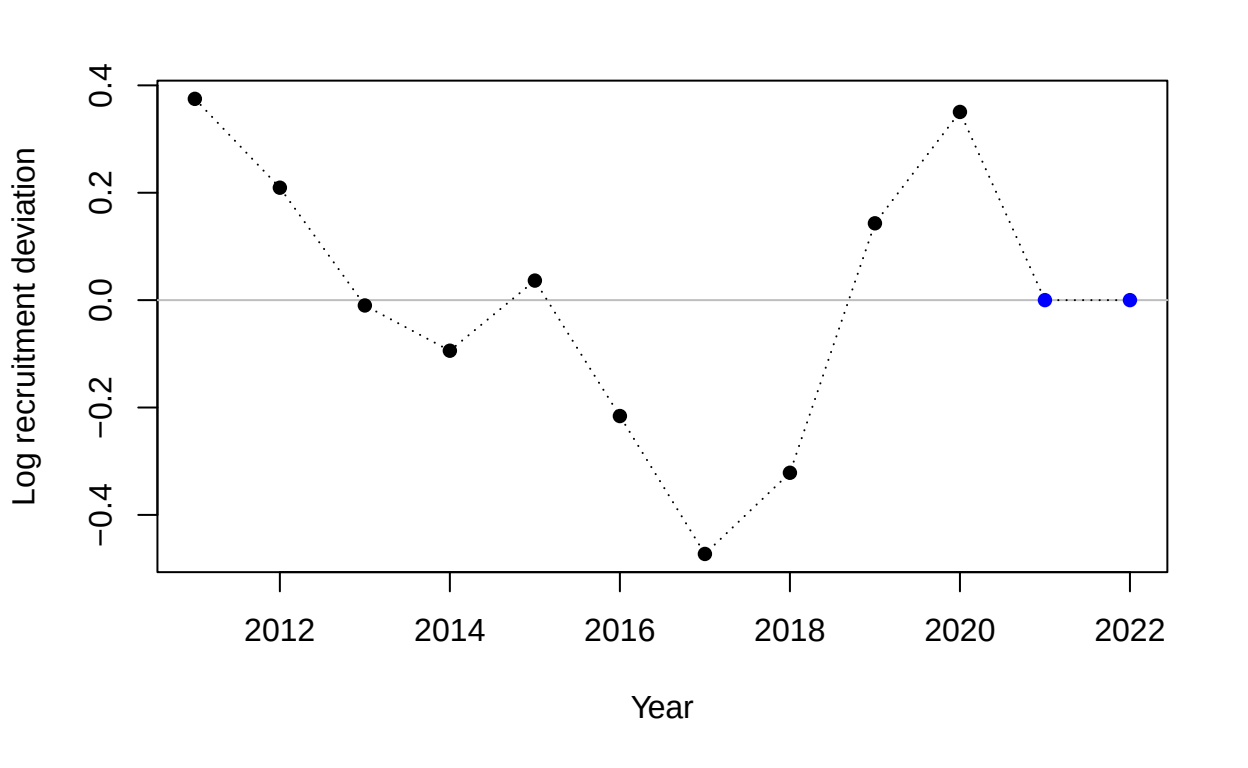

Summary biomass (mt)
0
2
4
6
8
10
12
14
1970
1980
1990
2000
2010
2020
Year

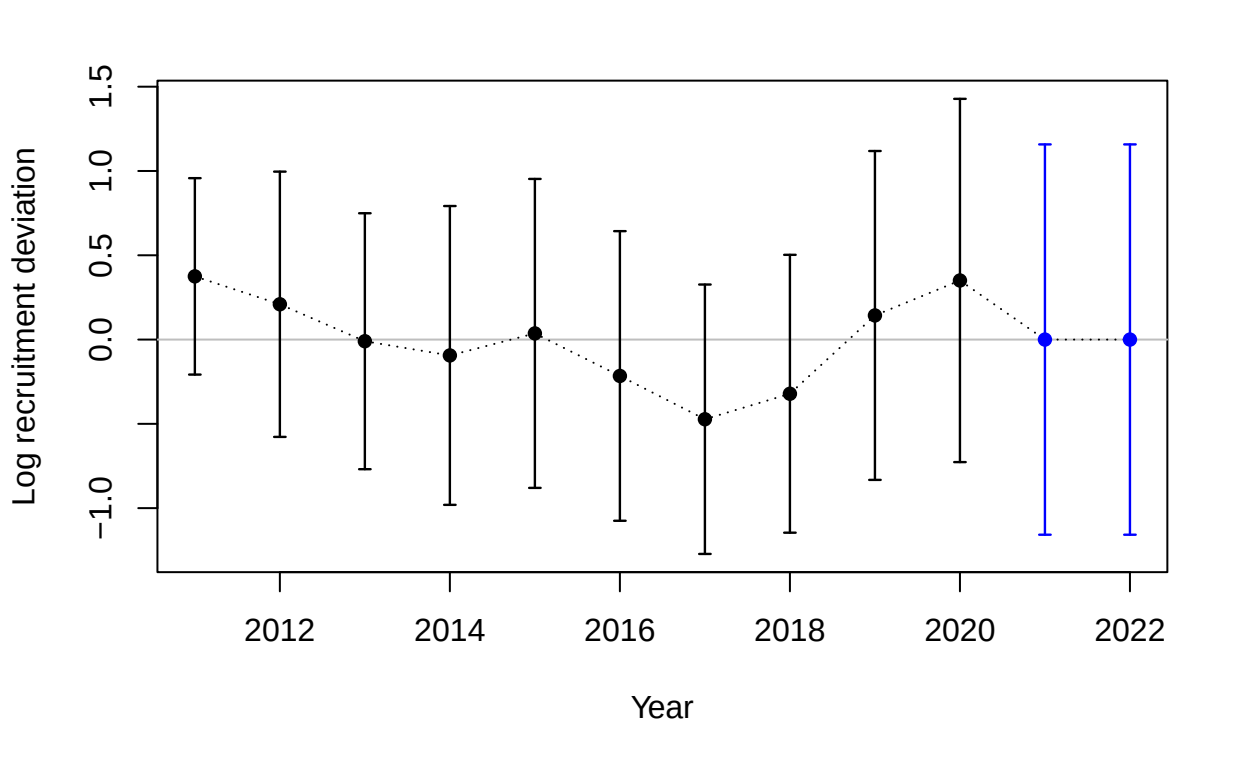

Age−0 recruits (1,000s)
0
1
2
3
4
1970
1980
1990
2000
2010
2020
Year

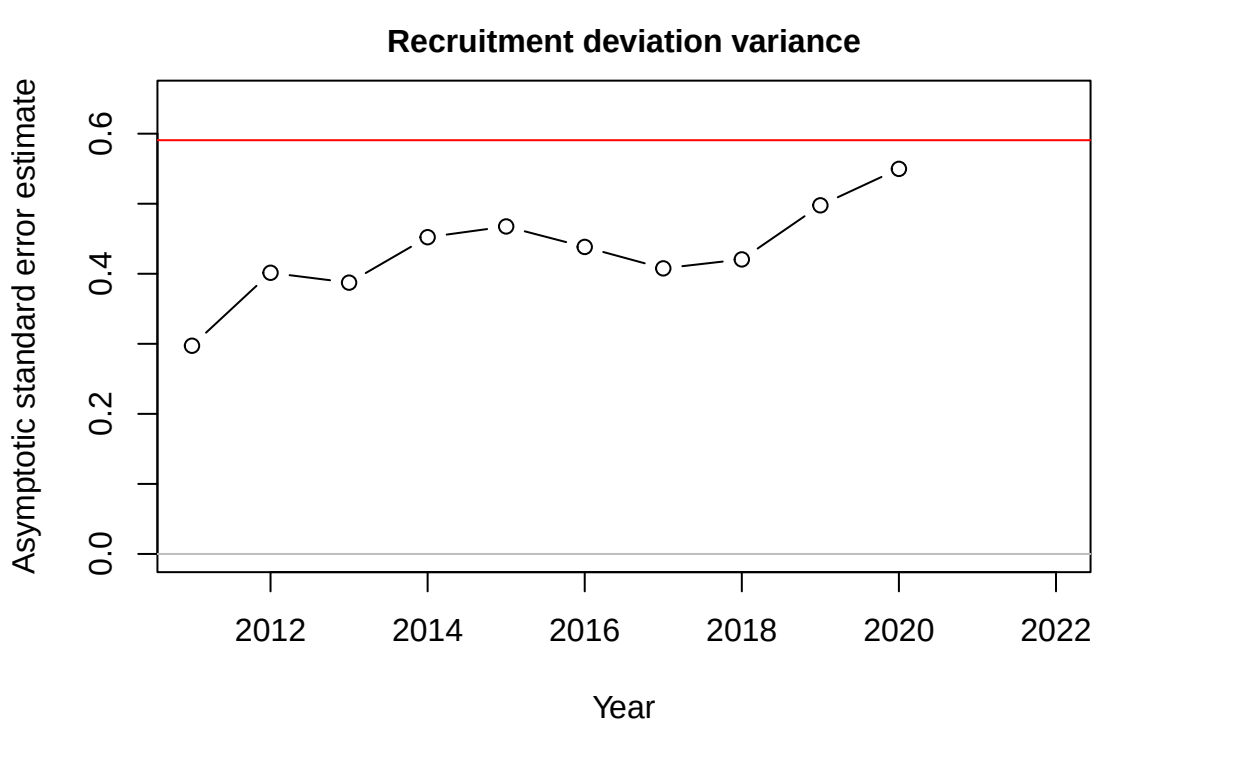

Age−0 recruits (1,000s)
0
2
4
6
8
10
12
14
1970
1980
1990
2000
2010
2020
Year

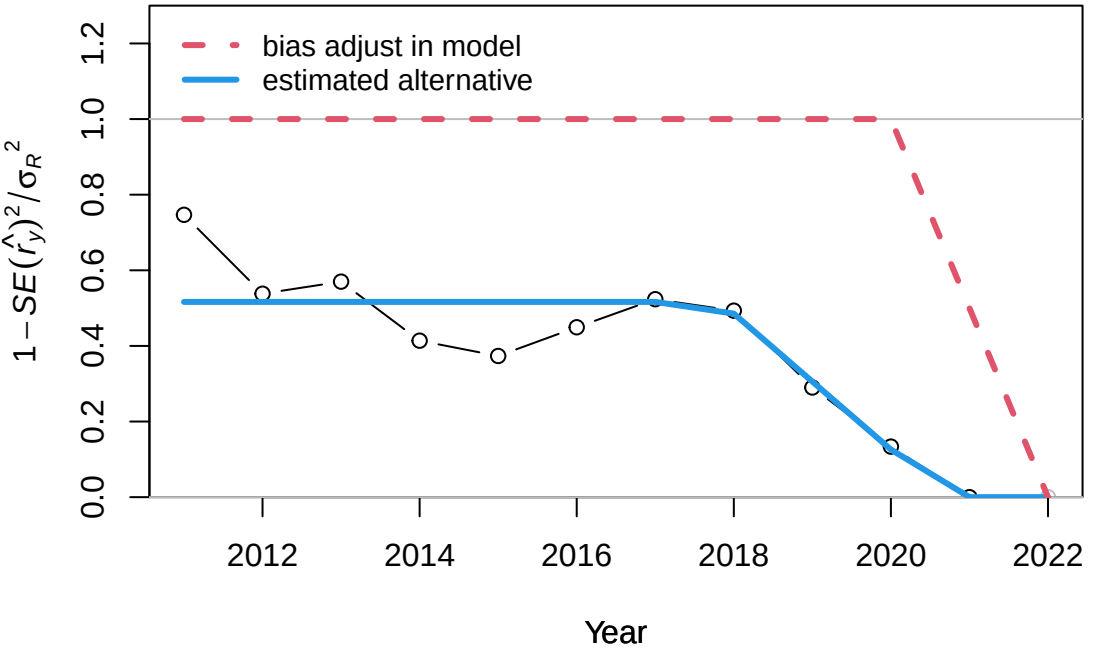

Summary Fishing Mortality
0.0
0.1
0.2
0.3
0.4
1970
1980
1990
2000
2010
2020
Year

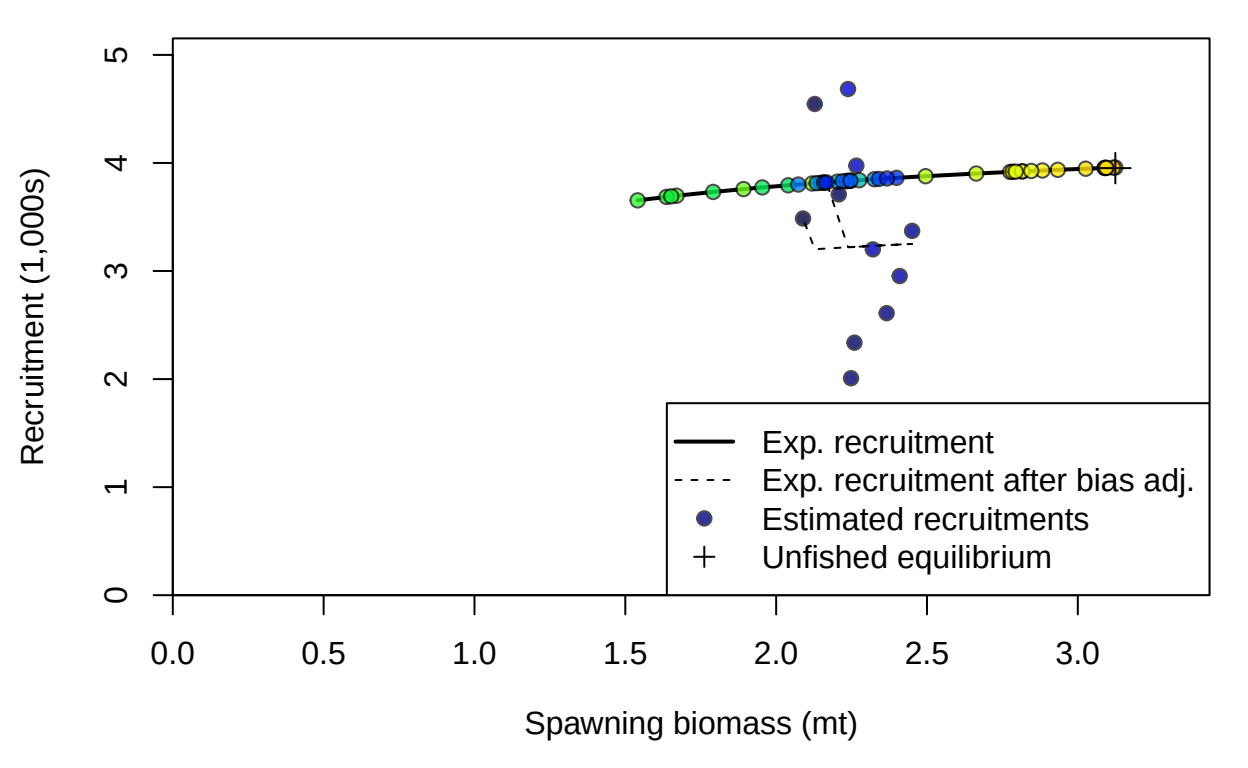

Spawning biomass (mt)
0
1
2
3
4
5
6
7
equilibrium
without fishing
with fishing
1970
1980
1990
2000
2010
2020
Year

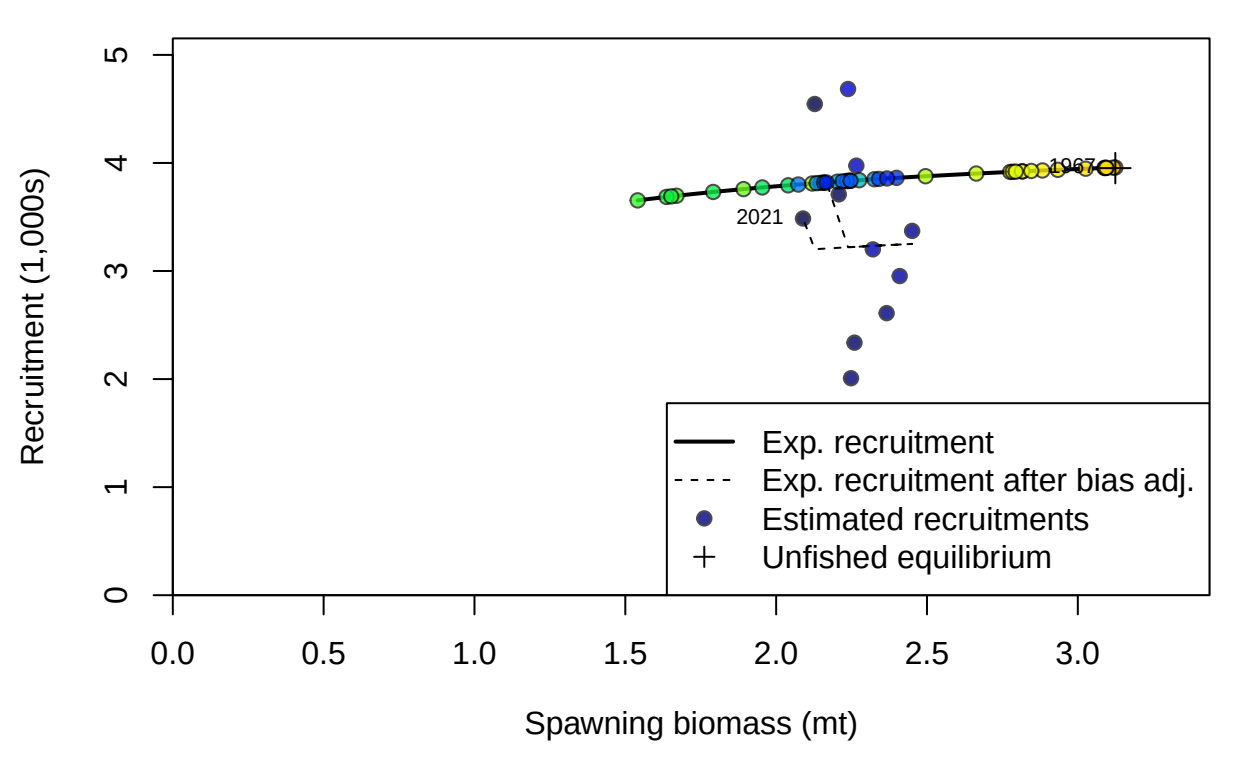

Log recruitment deviation
0.4
0.2
0.0
−0.2
−0.4
2012
2014
2016
2018
2020
2022
Year

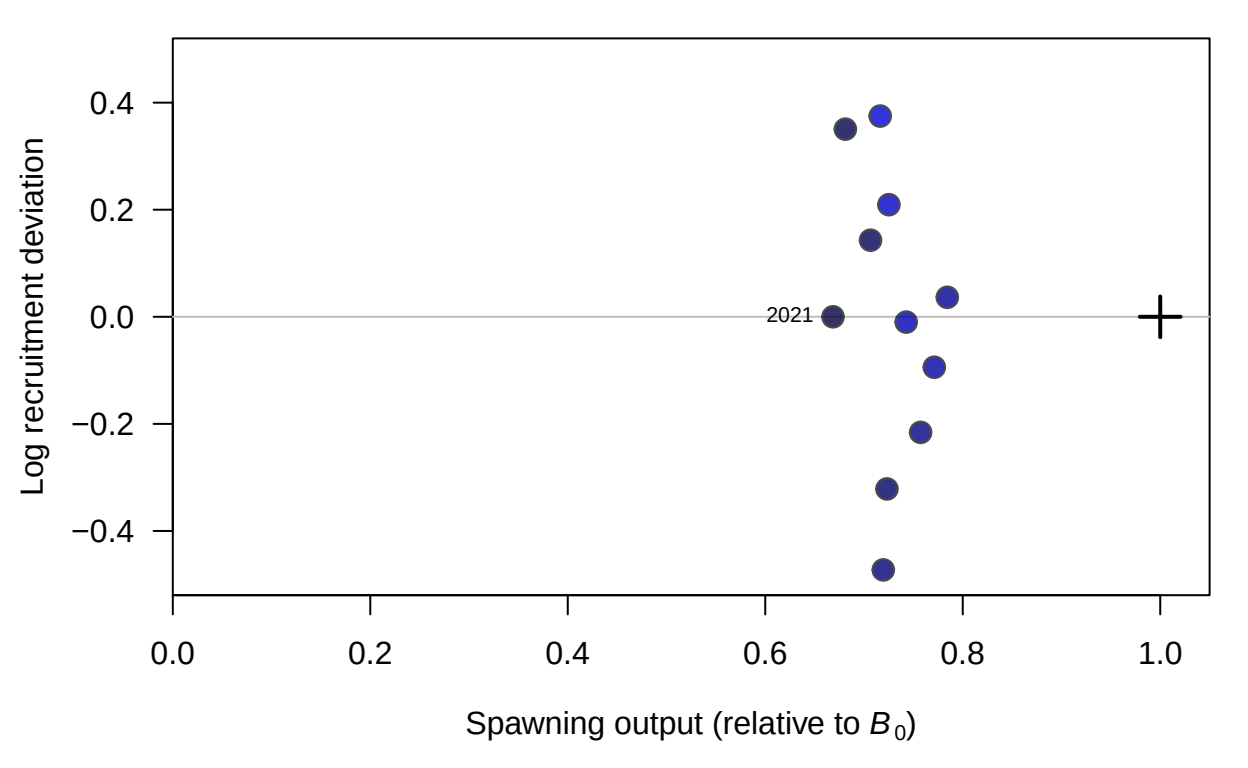

Log recruitment deviation
1.5
1.0
0.5
0.0
−1.0
2012
2014
2016
2018
2020
2022
Year

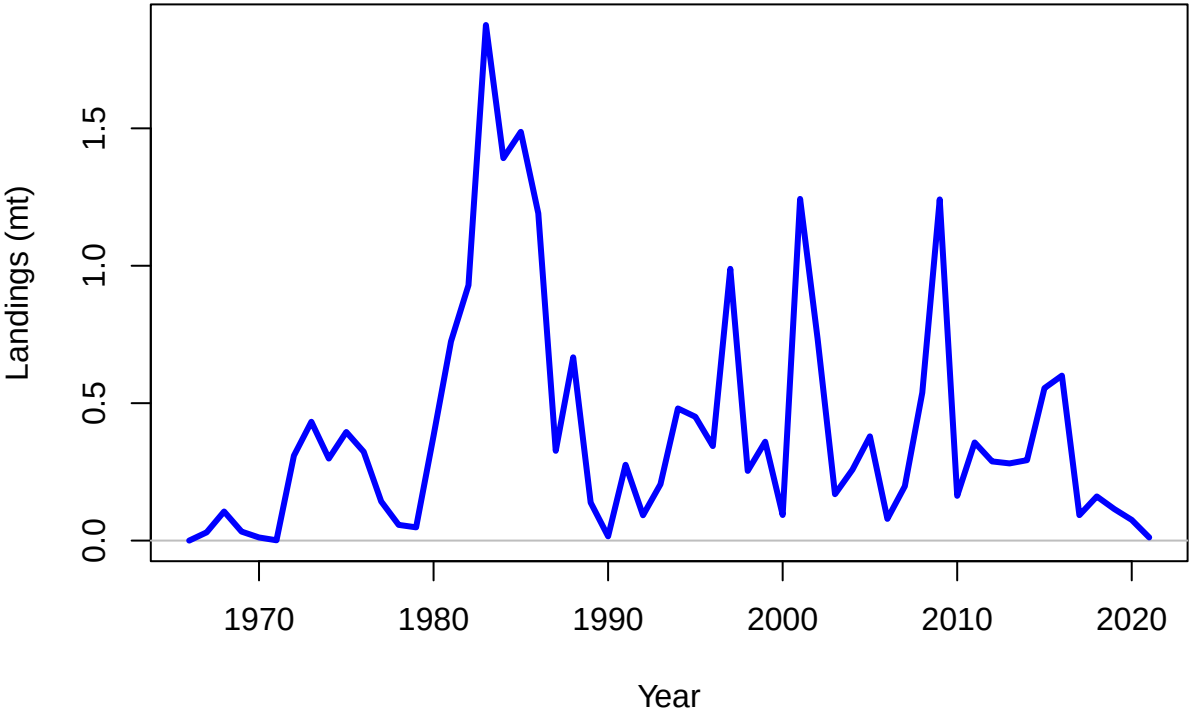

Recruitment deviation variance
Asymptotic standard error estimate
0.0
0.2
0.4
0.6
2012
2014
2016
2018
2020
2022
Year

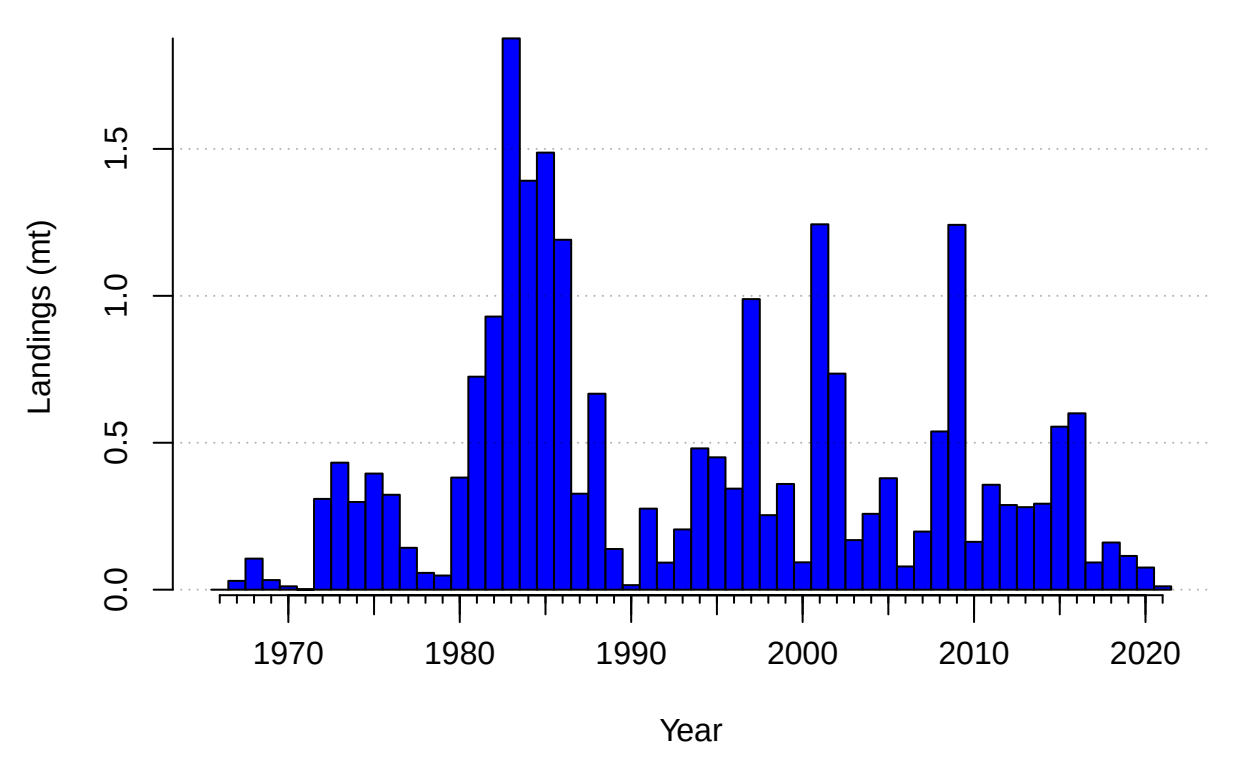

bias adjust in model
estimated alternative
$1-SE(\hat{r}_y)^2/\sigma_R{}^2$
0.0
0.2
0.4
0.6
0.8
1.0
1.2
2012
2014
2016
2018
2020
2022
Year

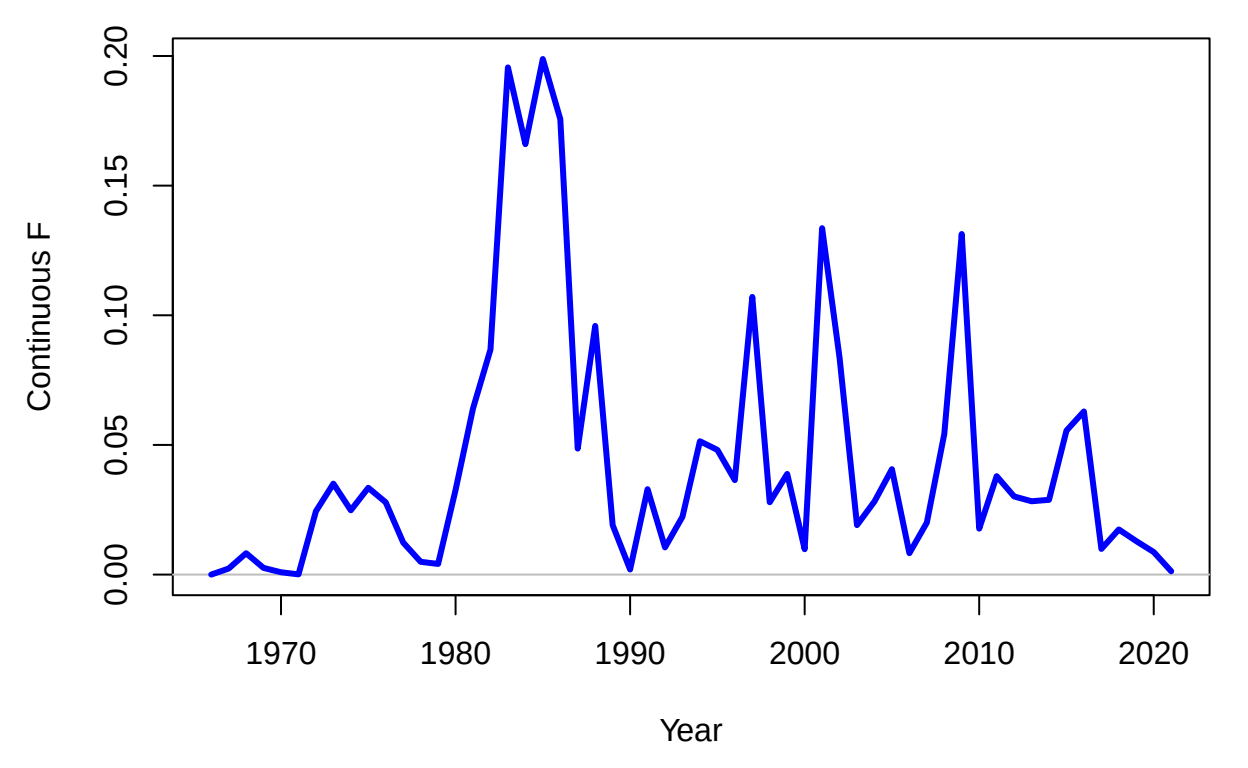

Recruitment (1,000s)
0
1
2
3
4
5
0.0
0.5
1.0
1.5
2.0
2.5
3.0
Spawning biomass (mt)
Exp. recruitment
Exp. recruitment after bias adj.
Estimated recruitments
Unfished equilibrium

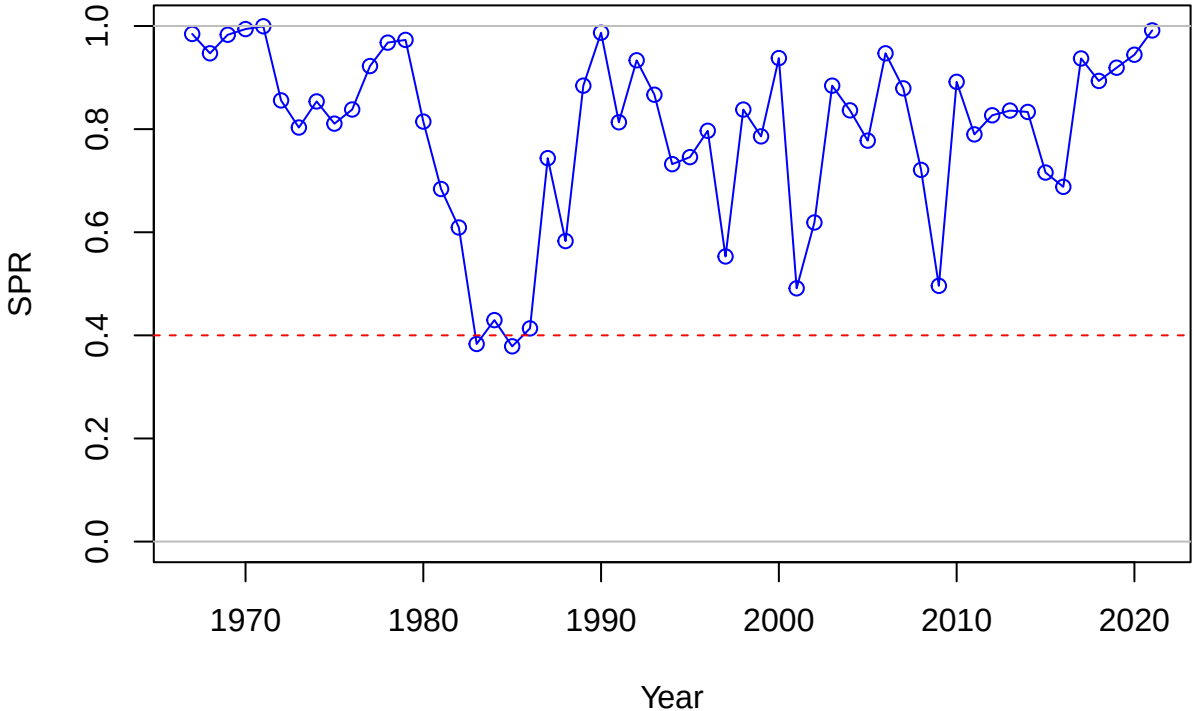

Recruitment (1,000s)
0
1
2
3
4
5
0.0
0.5
1.0
1.5
2.0
2.5
3.0
Spawning biomass (mt)
1967
2021
Exp. recruitment
Exp. recruitment after bias adj.
Estimated recruitments
Unfished equilibrium

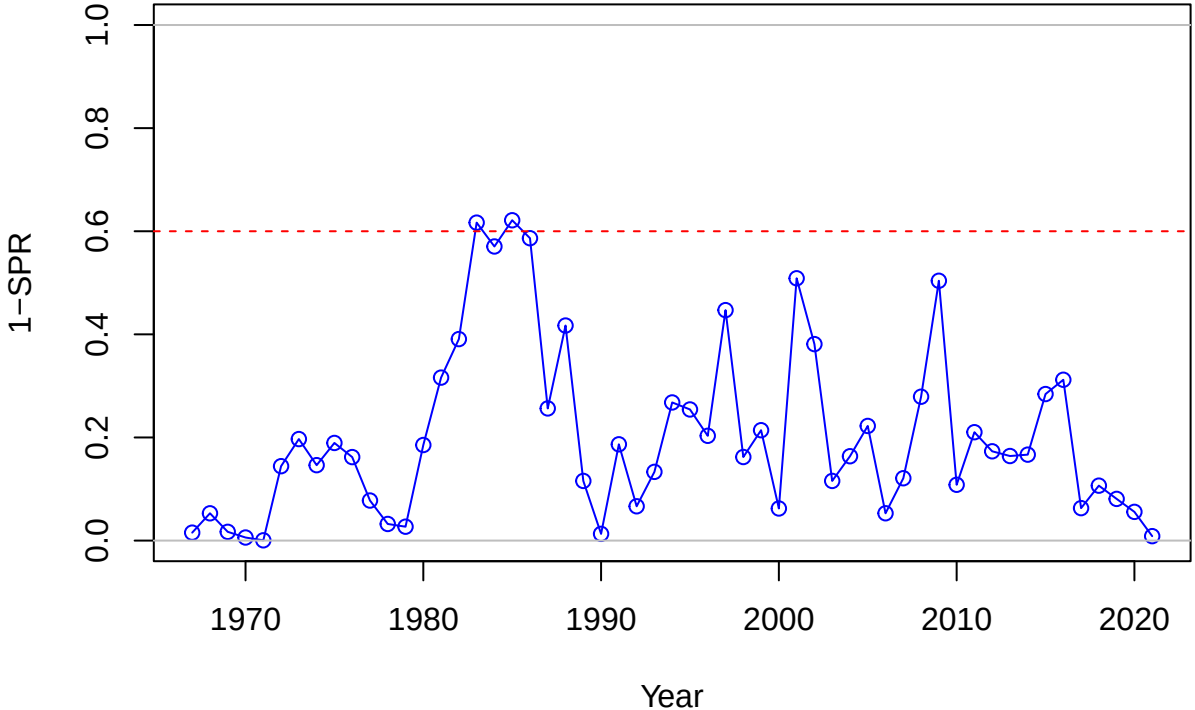

Log recruitment deviation
0.4
0.2
0.0
−0.2
−0.4
2021
0.0
0.2
0.4
0.6
0.8
1.0
Spawning output (relative to B_0)

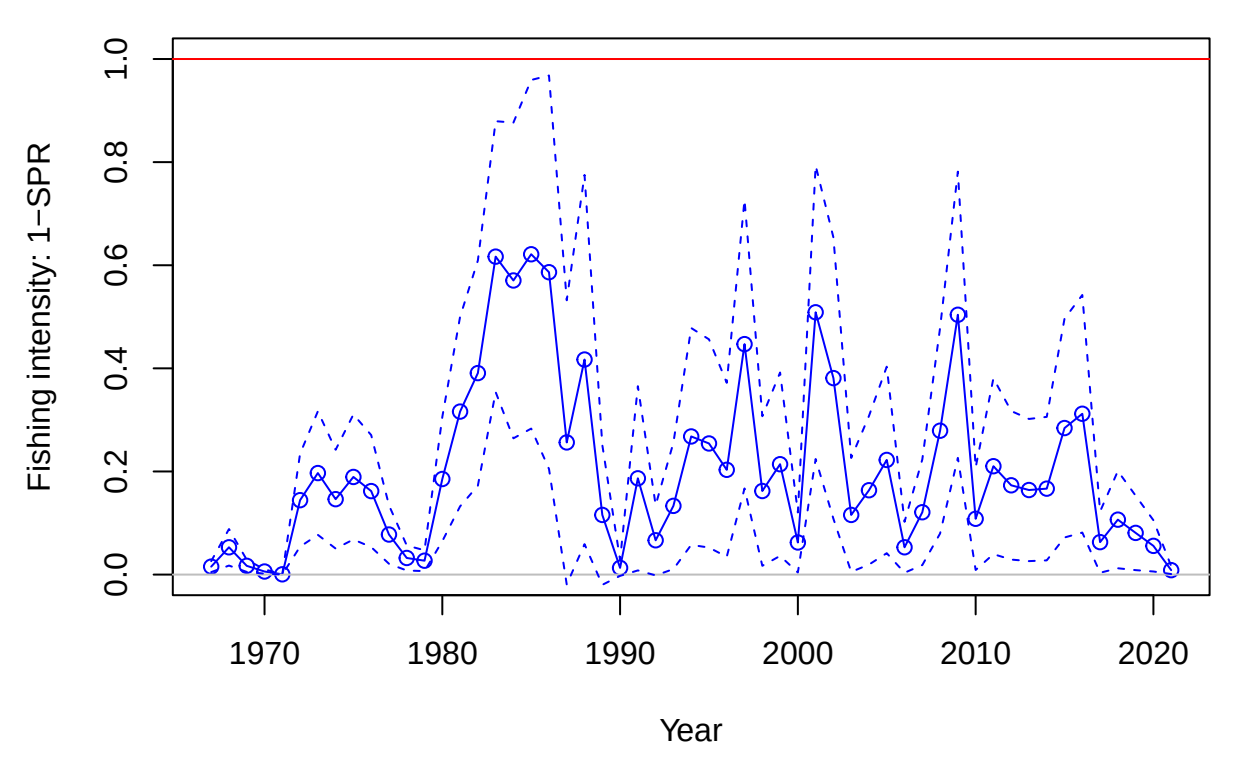

Landings (mt)
0.0
0.5
1.0
1.5
1970
1980
1990
2000
2010
2020
Year

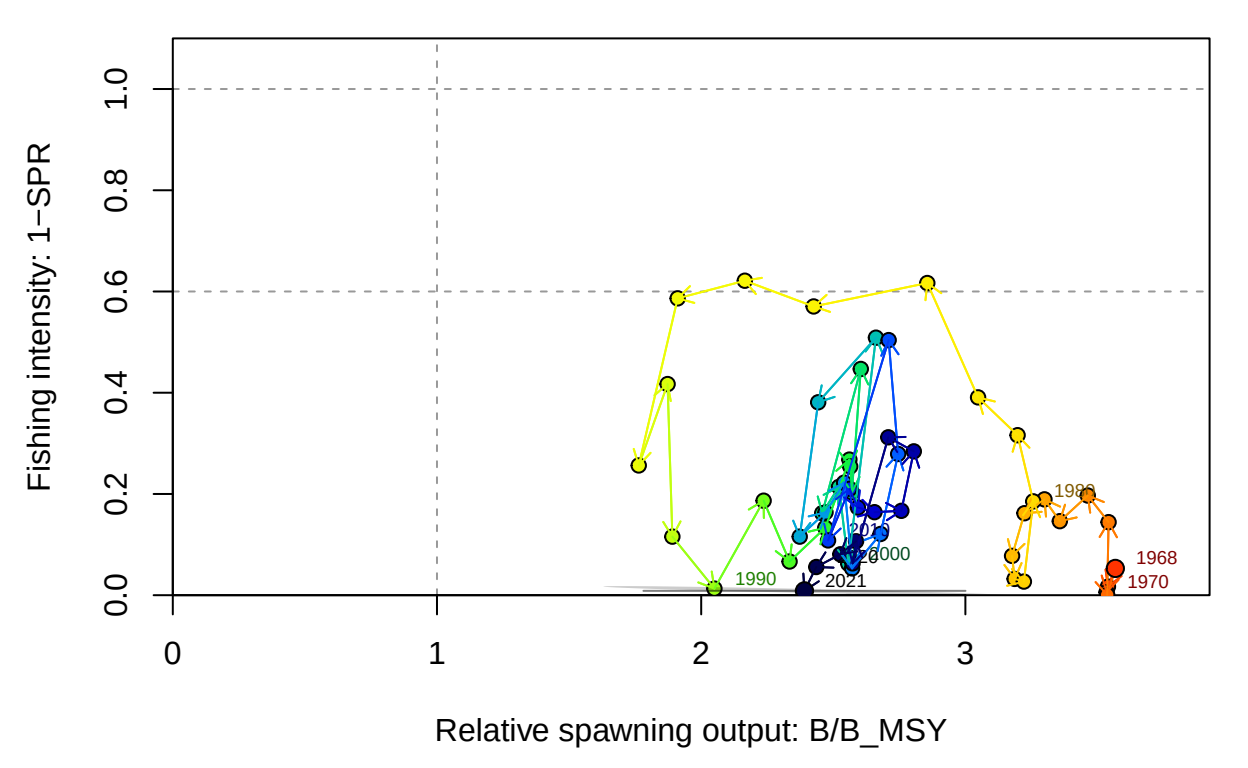

Landings (mt)
0.0
0.5
1.0
1.5
1970
1980
1990
2000
2010
2020
Year

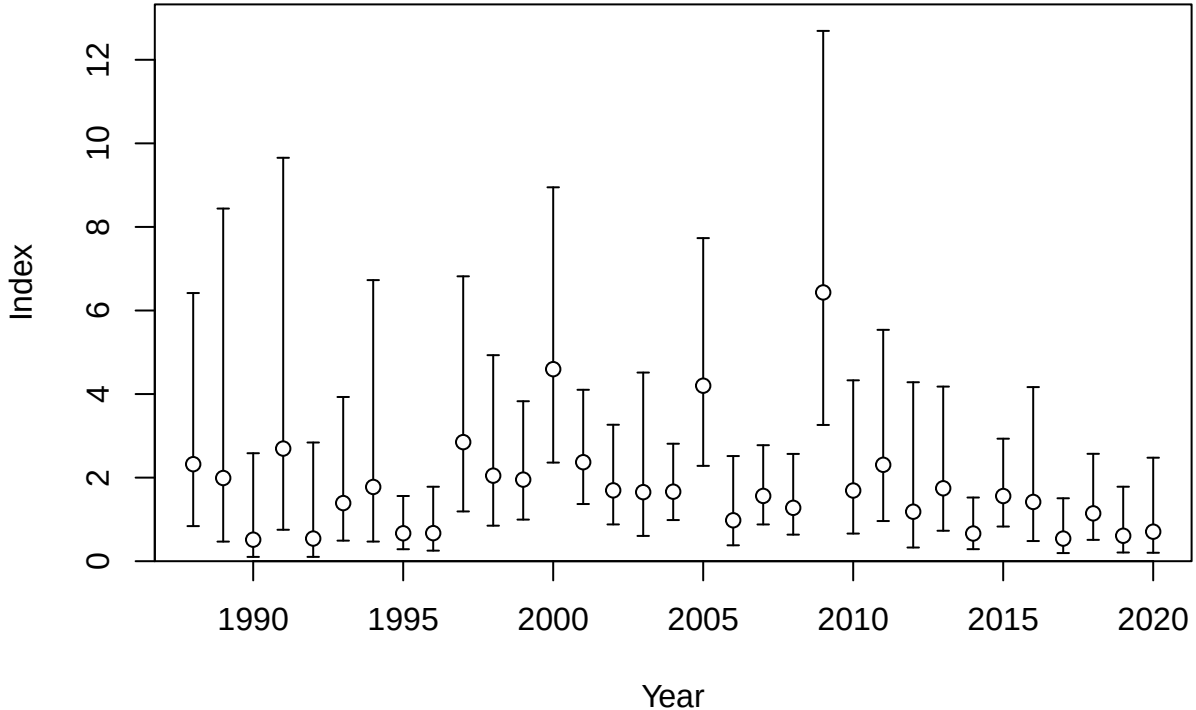

Continuous F
0.00
0.05
0.10
0.15
0.20
1970
1980
1990
2000
2010
2020
Year

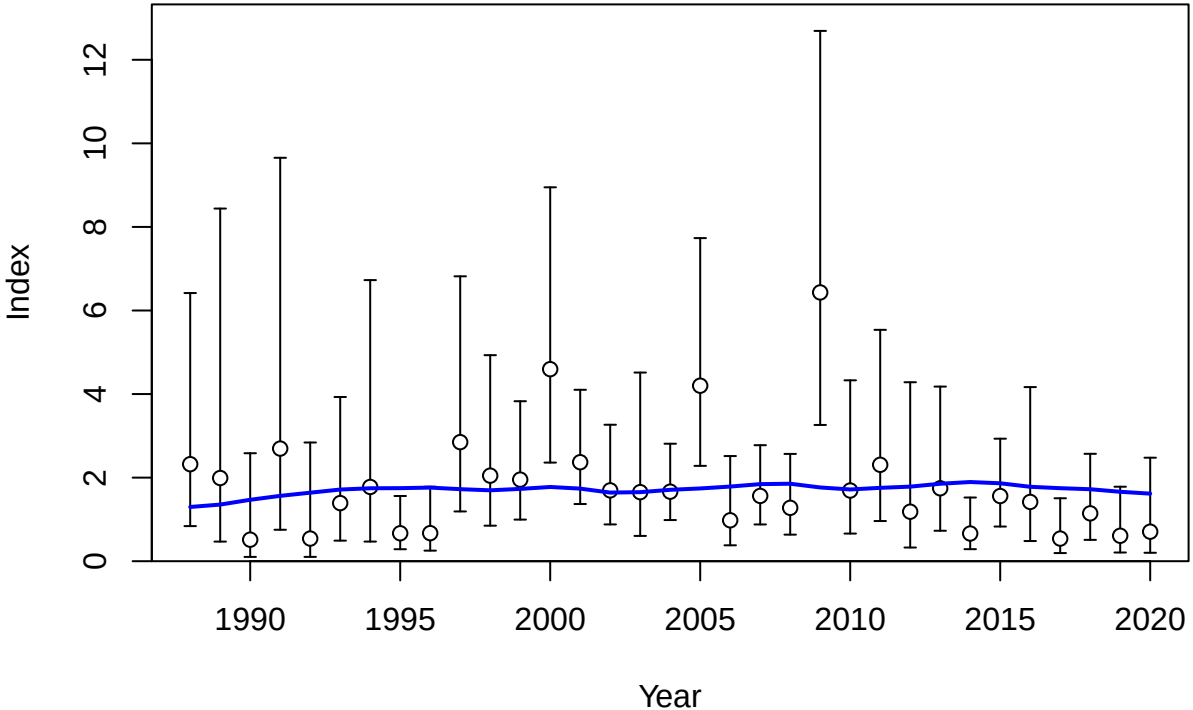

SPR
0.0
0.2
0.4
0.6
0.8
1.0
1970
1980
1990
2000
2010
2020
Year

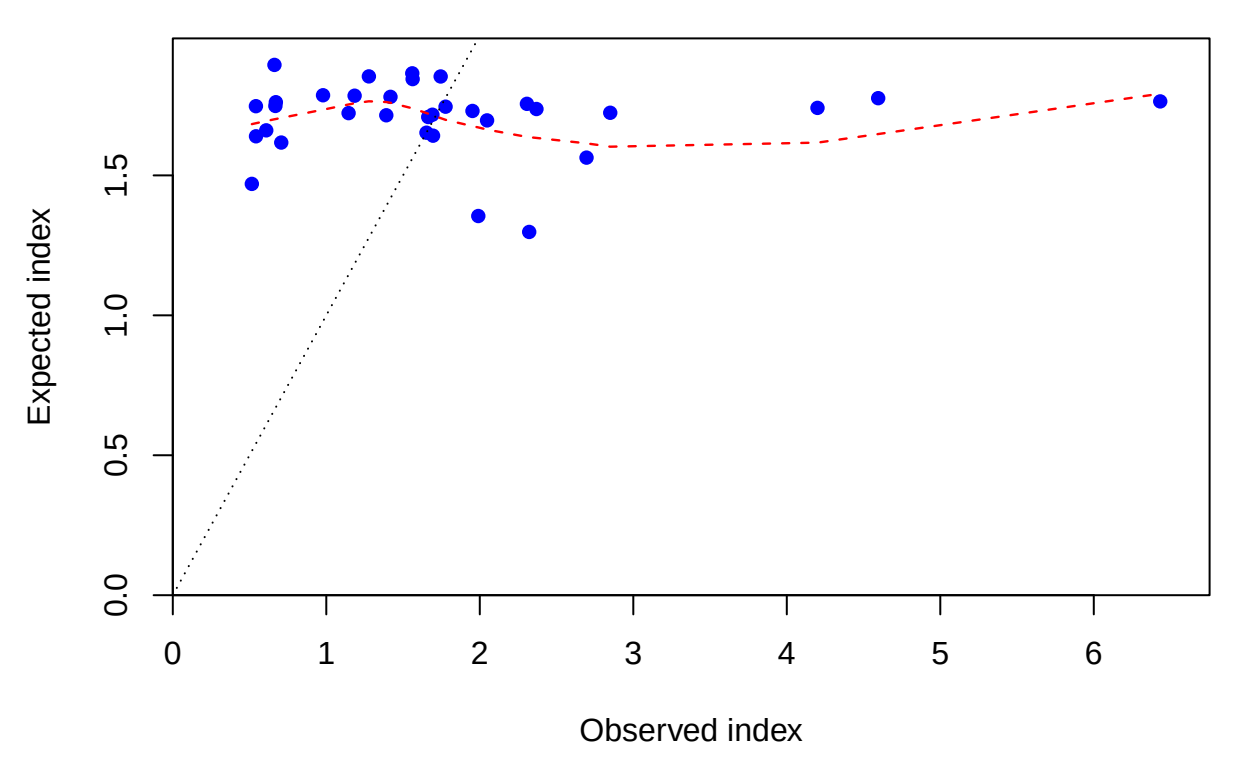

1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
1970
1980
1990
2000
2010
2020
Year

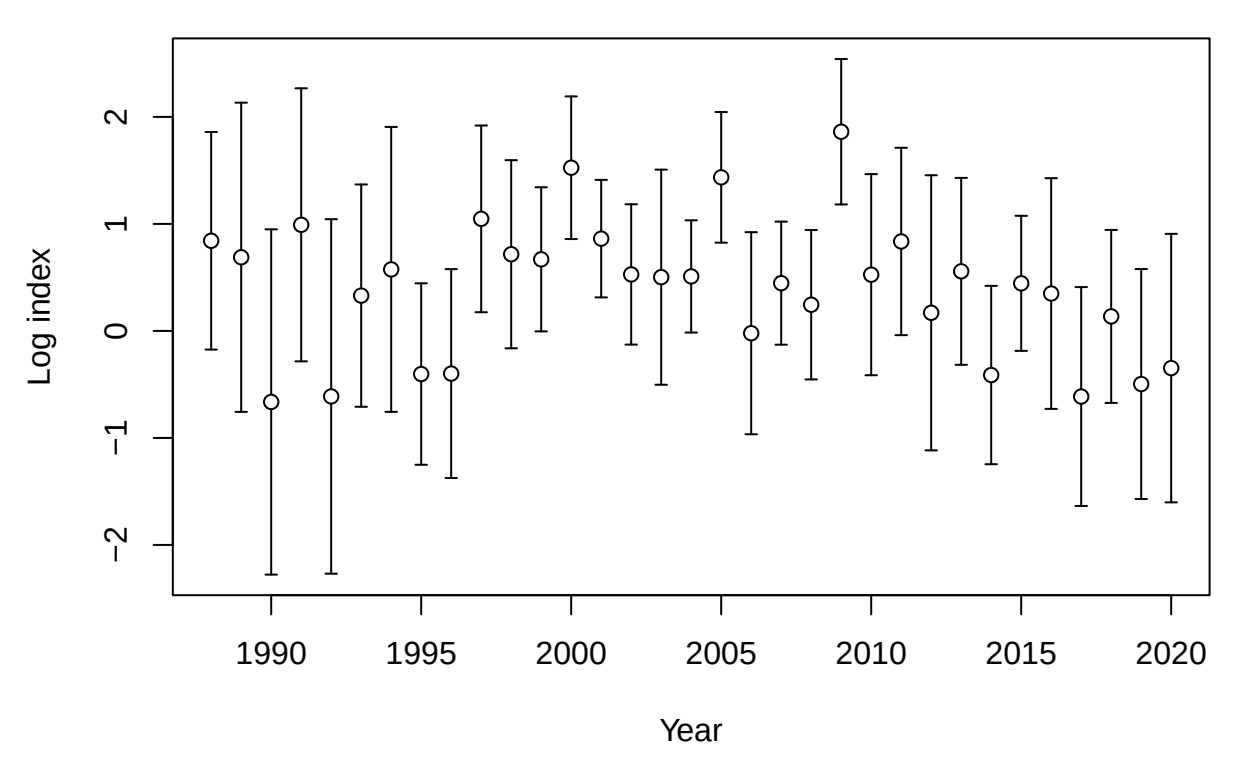

Fishing intensity: 1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
1970
1980
1990
2000
2010
2020
Year

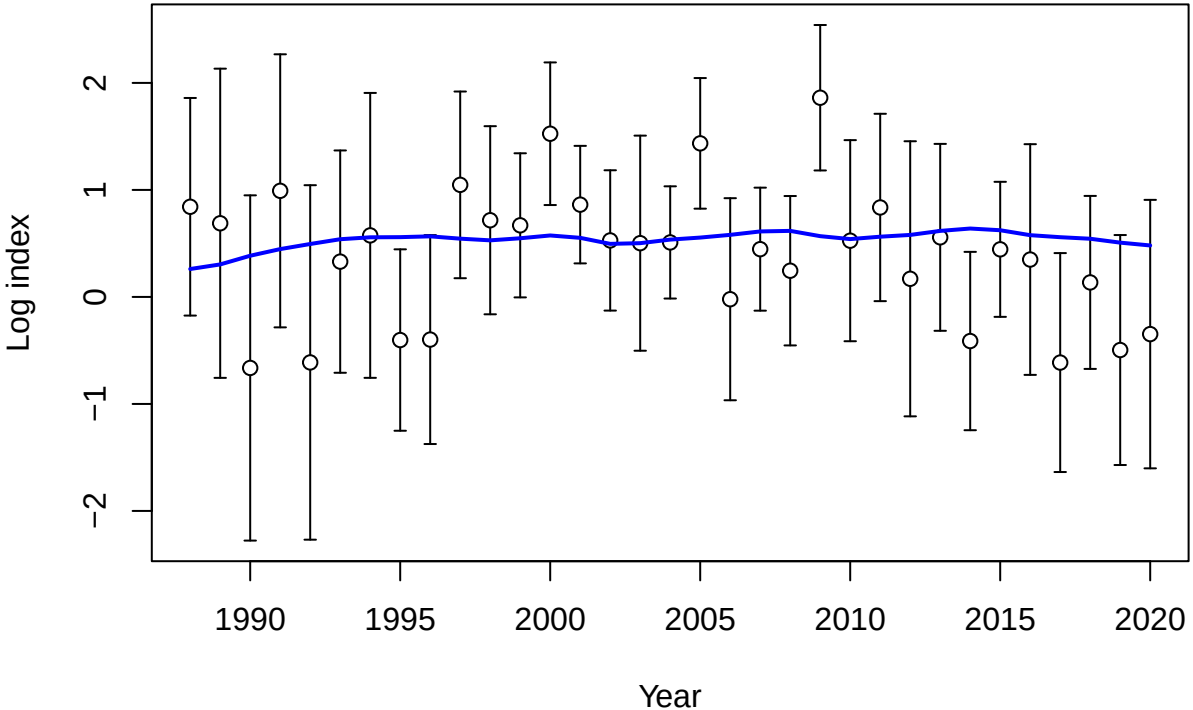

Fishing intensity: 1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
0
1
2
3
Relative spawning output: B/B_MSY
1968
1970
1990
2000
2021

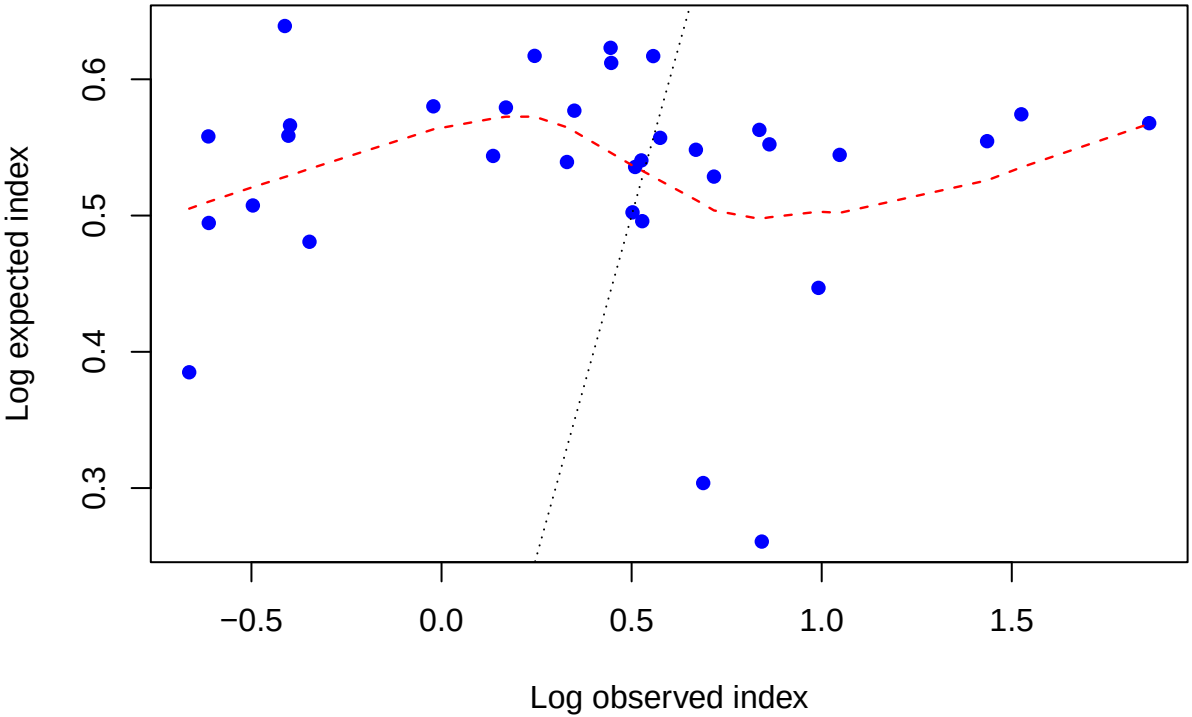

Index
0
2
4
6
8
10
12
1990
1995
2000
2005
2010
2015
2020
Year

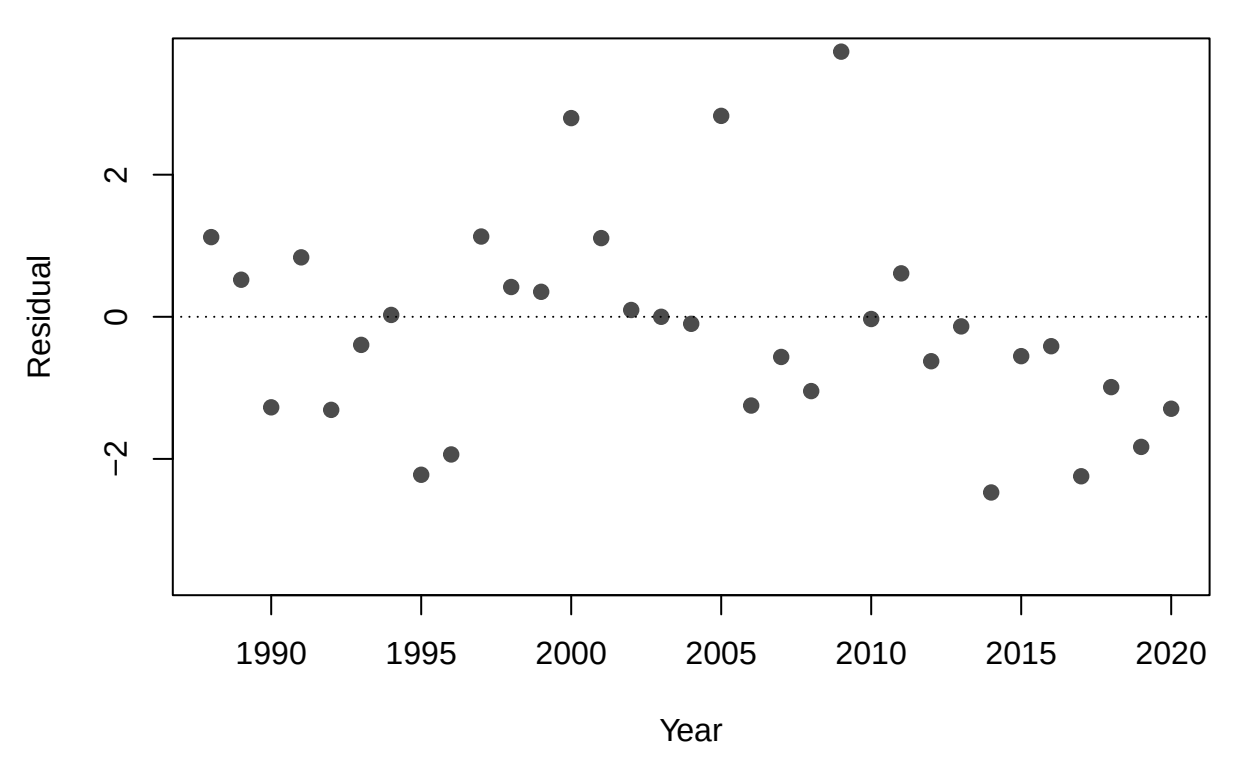

Index
0
2
4
6
8
10
12
1990
1995
2000
2005
2010
2015
2020
Year

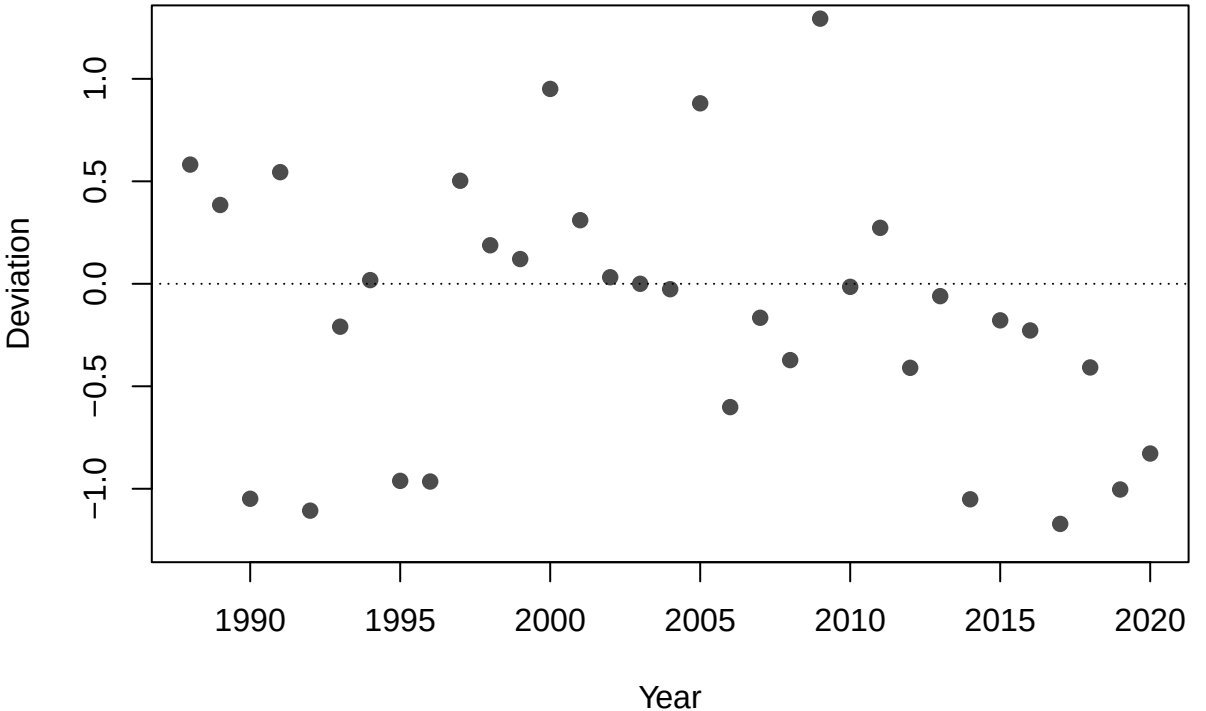

Expected index
0.0
0.5
1.0
1.5
0
1
2
3
4
5
6
Observed index

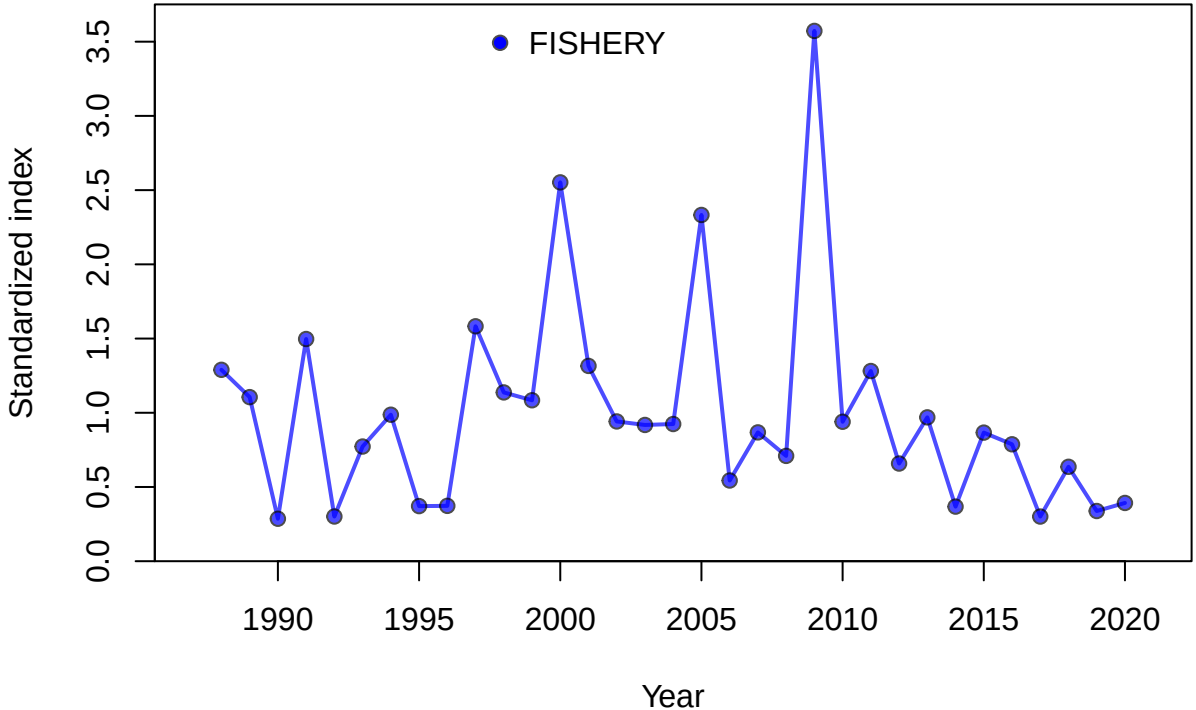

Log index
2
1
0
−1
−2
1990
1995
2000
2005
2010
2015
2020
Year

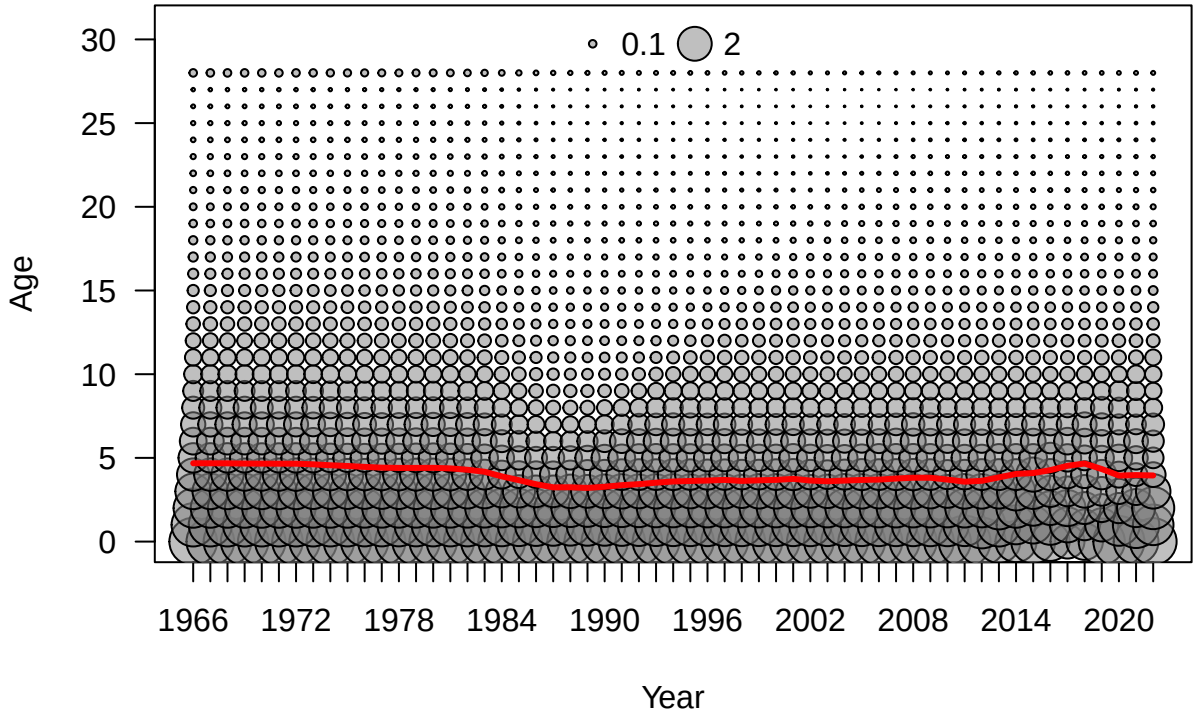

Log index
2
1
0
−1
−2
1990
1995
2000
2005
2010
2015
2020
Year

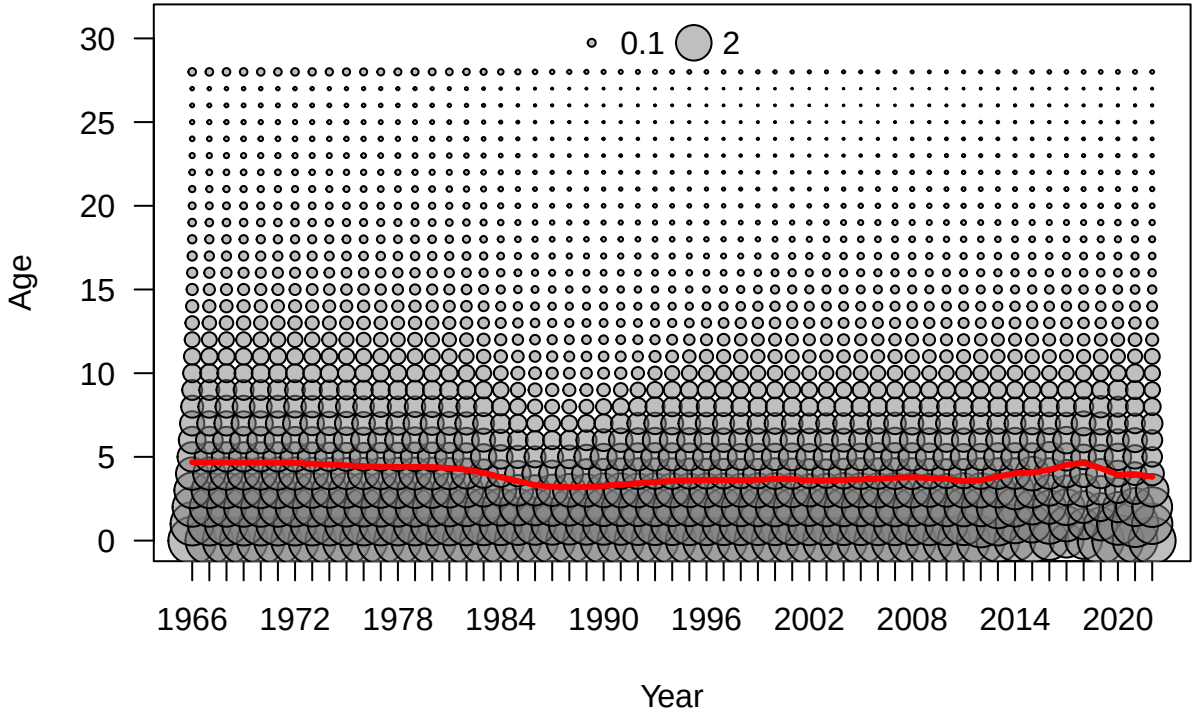

Log expected index
0.3
0.4
0.5
0.6
−0.5
0.0
0.5
1.0
1.5
Log observed index

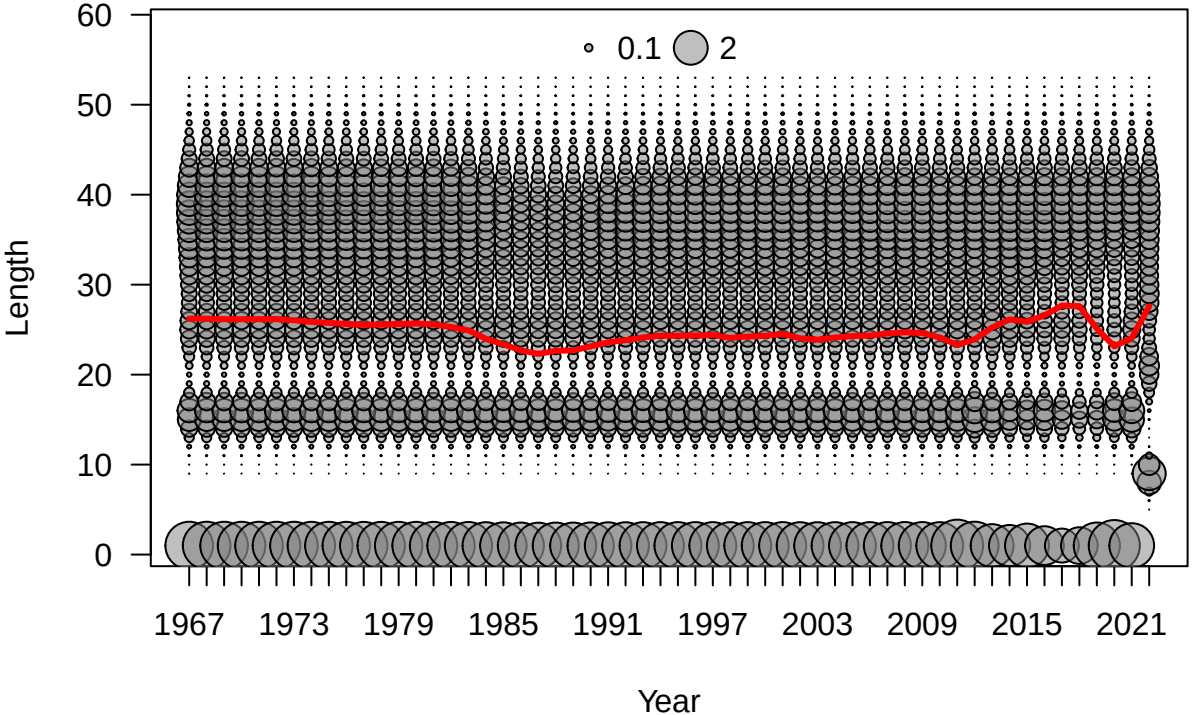

Residual
2
0
−2
1990
1995
2000
2005
2010
2015
2020
Year

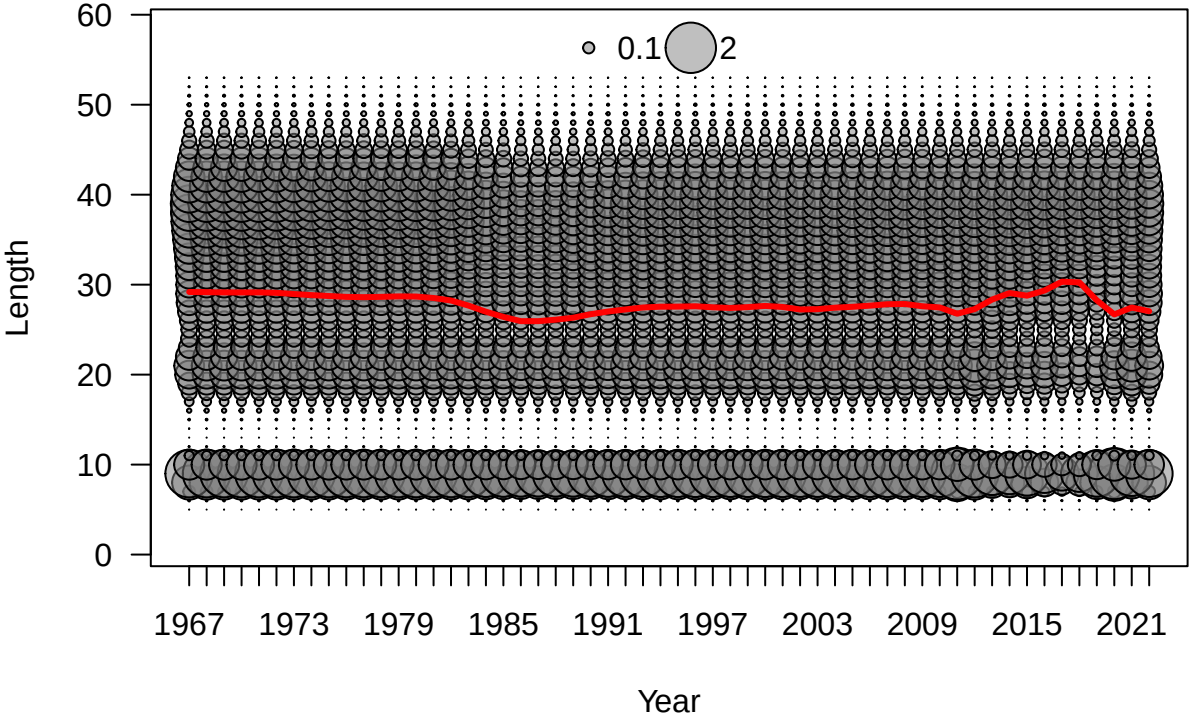

Deviation
1.0
0.5
0.0
−0.5
−1.0
1990
1995
2000
2005
2010
2015
2020
Year

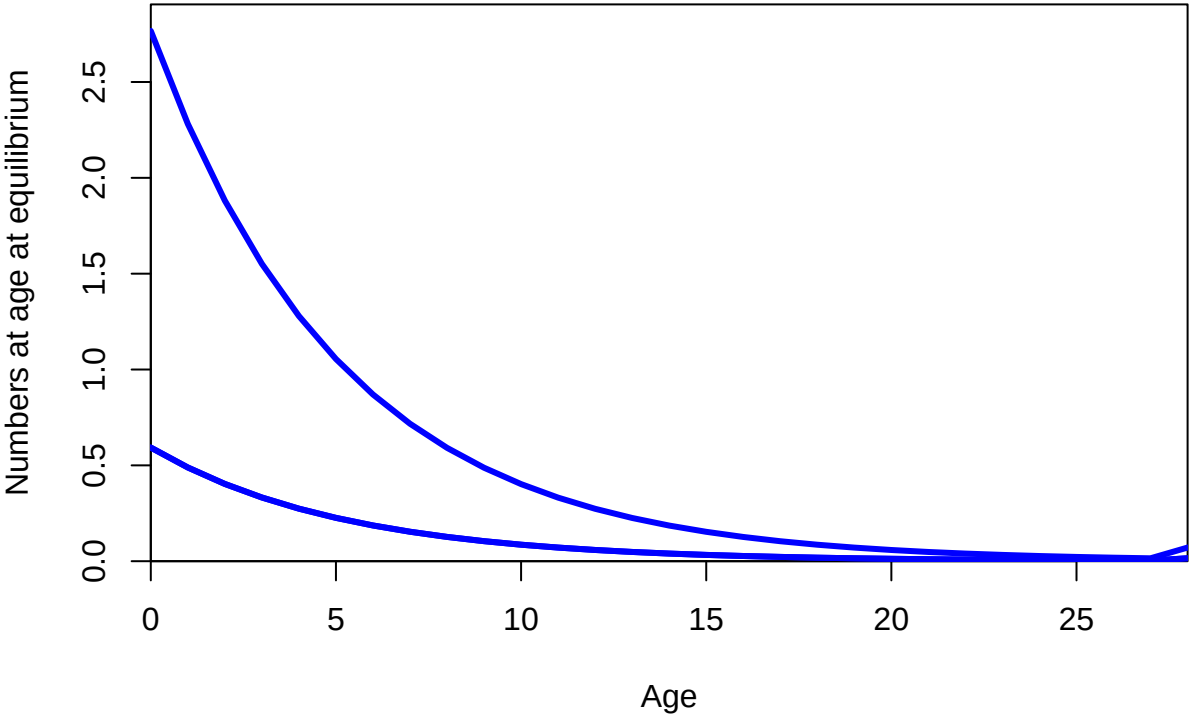

FISHERY
Standardized index
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1990
1995
2000
2005
2010
2015
2020
Year

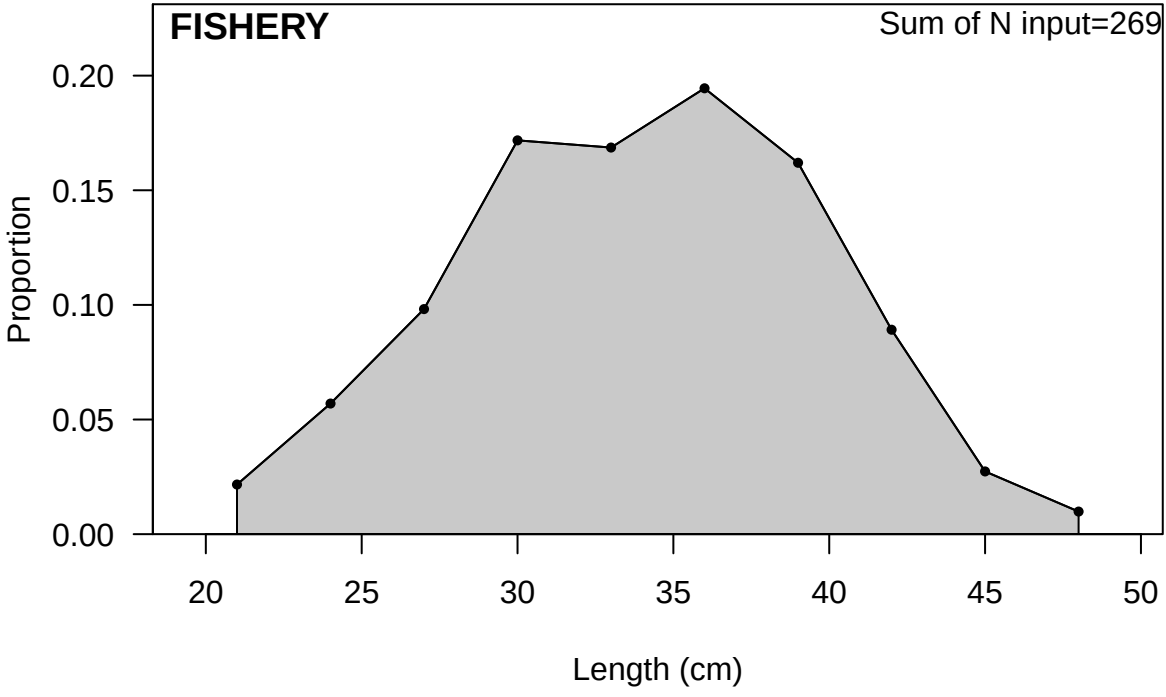

0.1
2
30
25
20
15
10
5
0
Age
1966
1972
1978
1984
1990
1996
2002
2008
2014
2020
Year


0.1
2
30
25
20
15
10
5
0
Age
1966
1972
1978
1984
1990
1996
2002
2008
2014
2020
Year

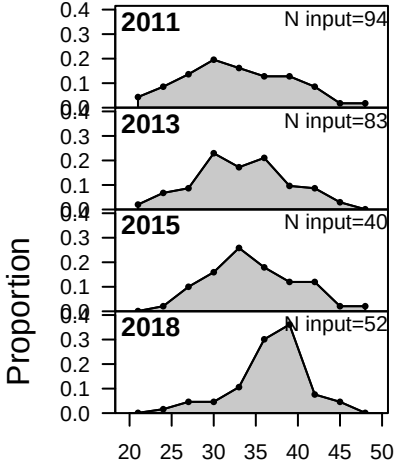

0.1
2
Length
Year
60
50
40
30
20
10
0
1967
1973
1979
1985
1991
1997
2003
2009
2015
2021

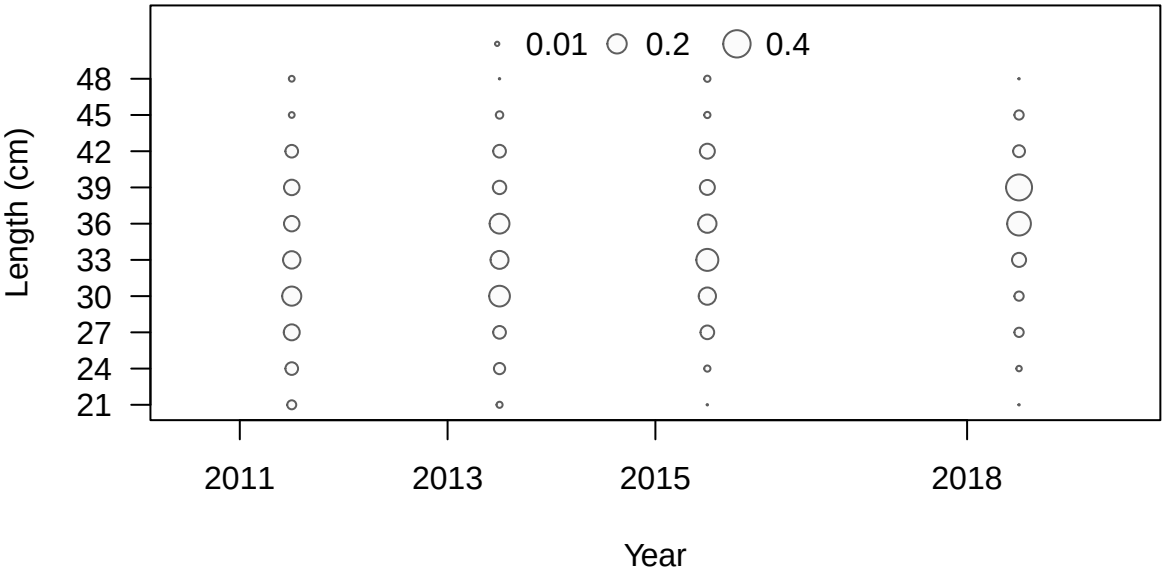

0.1
2
60
50
40
30
20
10
0
Length
1967
1973
1979
1985
1991
1997
2003
2009
2015
2021
Year

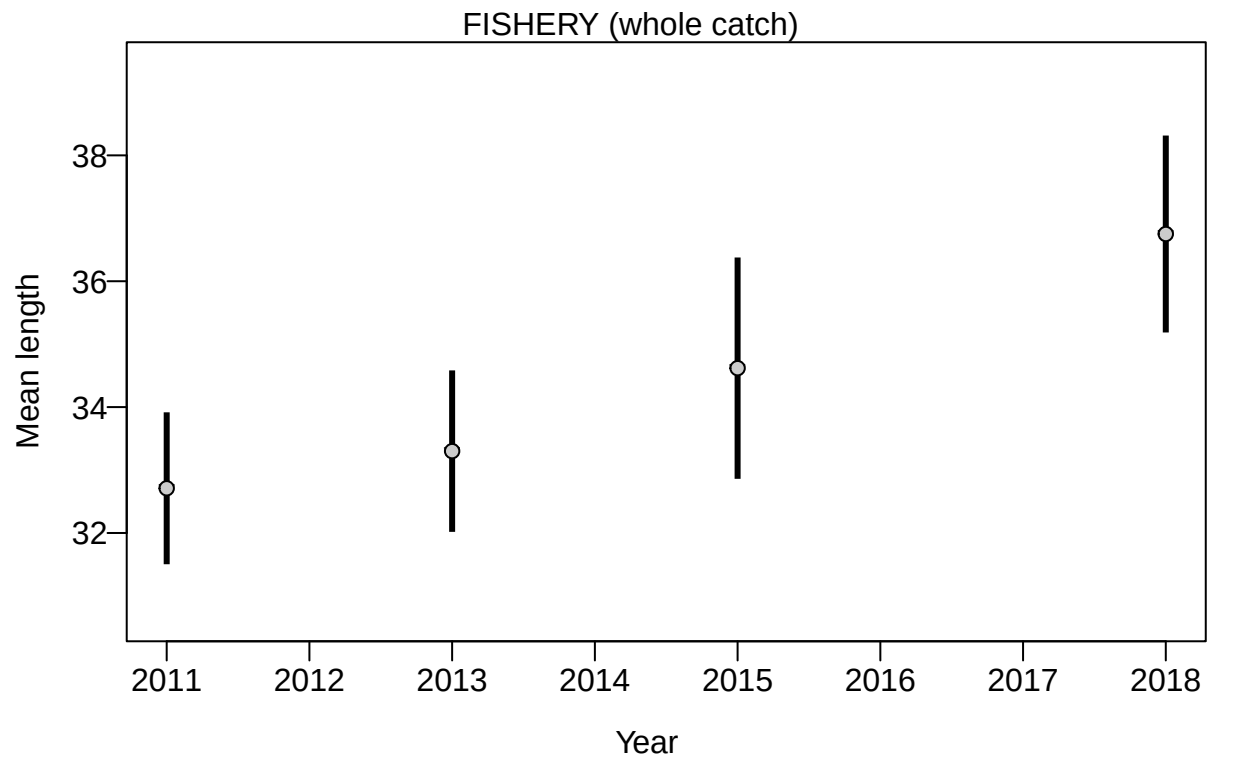

Numbers at age at equilibrium
0.0
0.5
1.0
1.5
2.0
2.5
0
5
10
15
20
25
Age

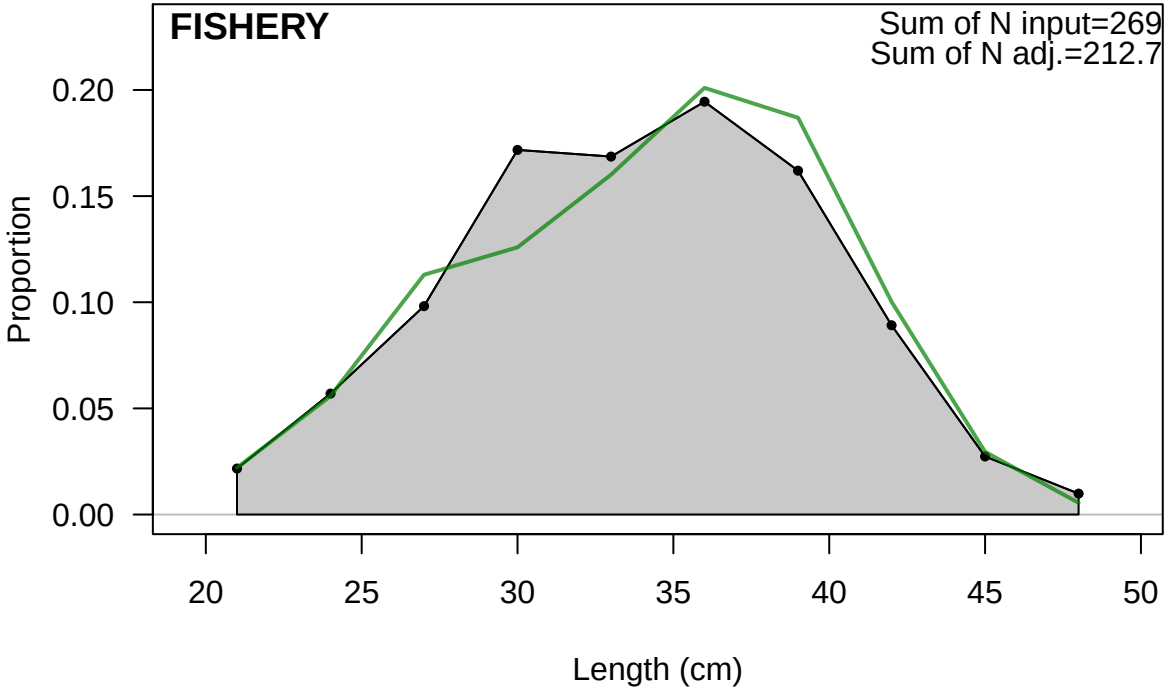

FISHERY
Sum of N input=269
Proportion
0.00
0.05
0.10
0.15
0.20
20
25
30
35
40
45
50
Length (cm)

FISHERY
0.01
0.2
0.4
Length (cm)
48
45
42
39
36
33
30
27
24
21
2013
2015
2018
Year

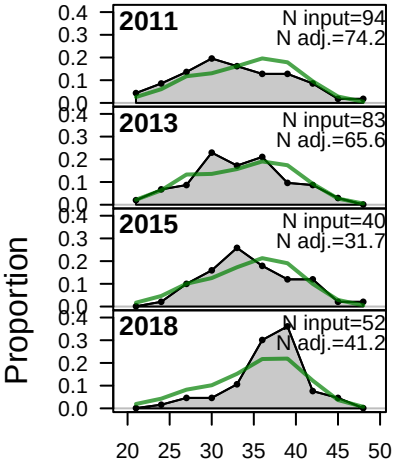

2011
N input=94
2013
N input=83
2015
N input=40
2018
N input=52
Proportion
0.0
0.1
0.2
0.3
0.4
20
25
30
35
40
45
50
Length (cm)

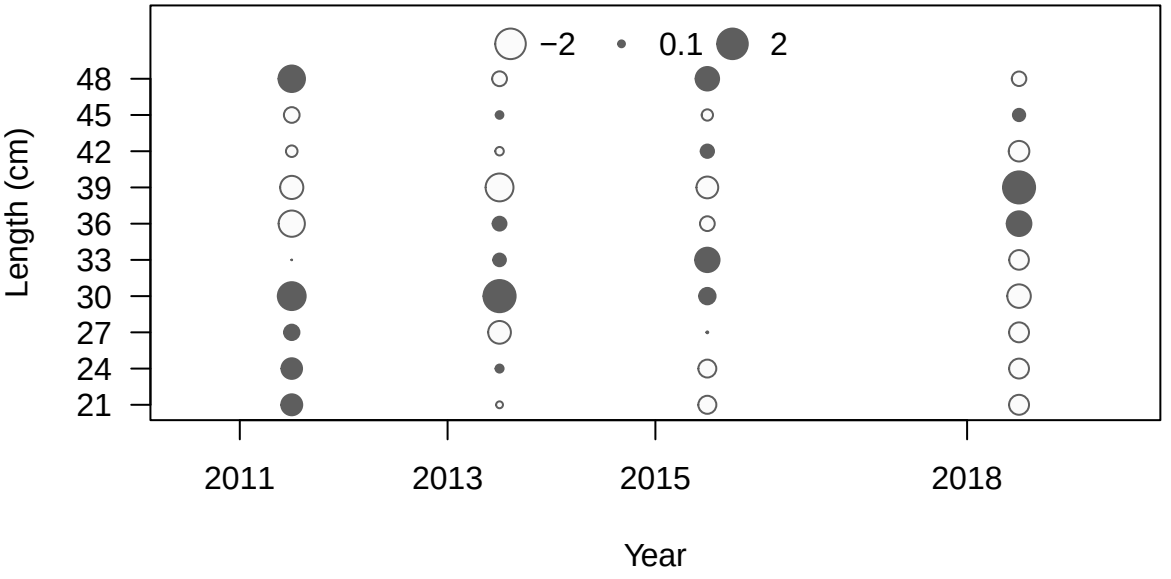

0.01
0.2
0.4
48
45
42
39
36
33
30
27
24
21
Length (cm)
2011
2013
2015
2018
Year

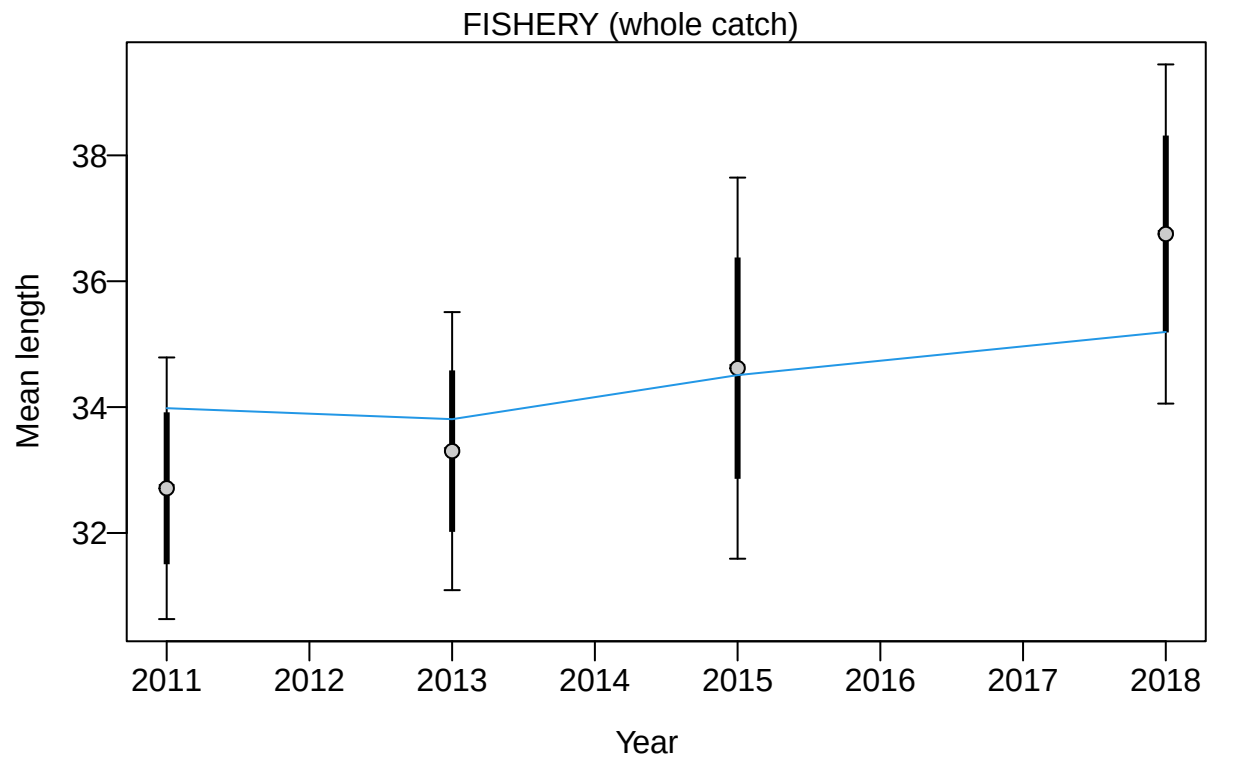

FISHERY (whole catch)
Mean length
38
36
34
32
2011
2012
2013
2014
2015
2016
2017
2018
Year

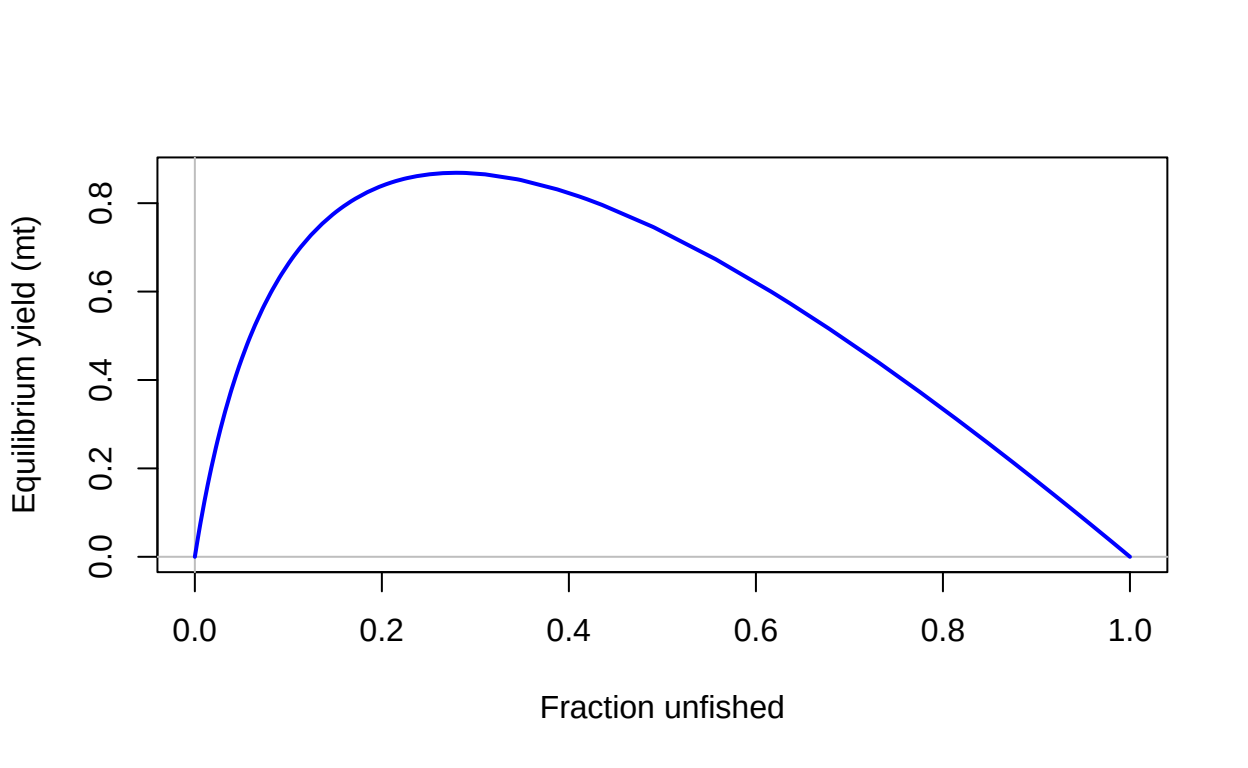

FISHERY
Sum of N input=269
Sum of N adj.=212.7
Proportion
0.00
0.05
0.10
0.15
0.20
20
25
30
35
40
45
50
Length (cm)

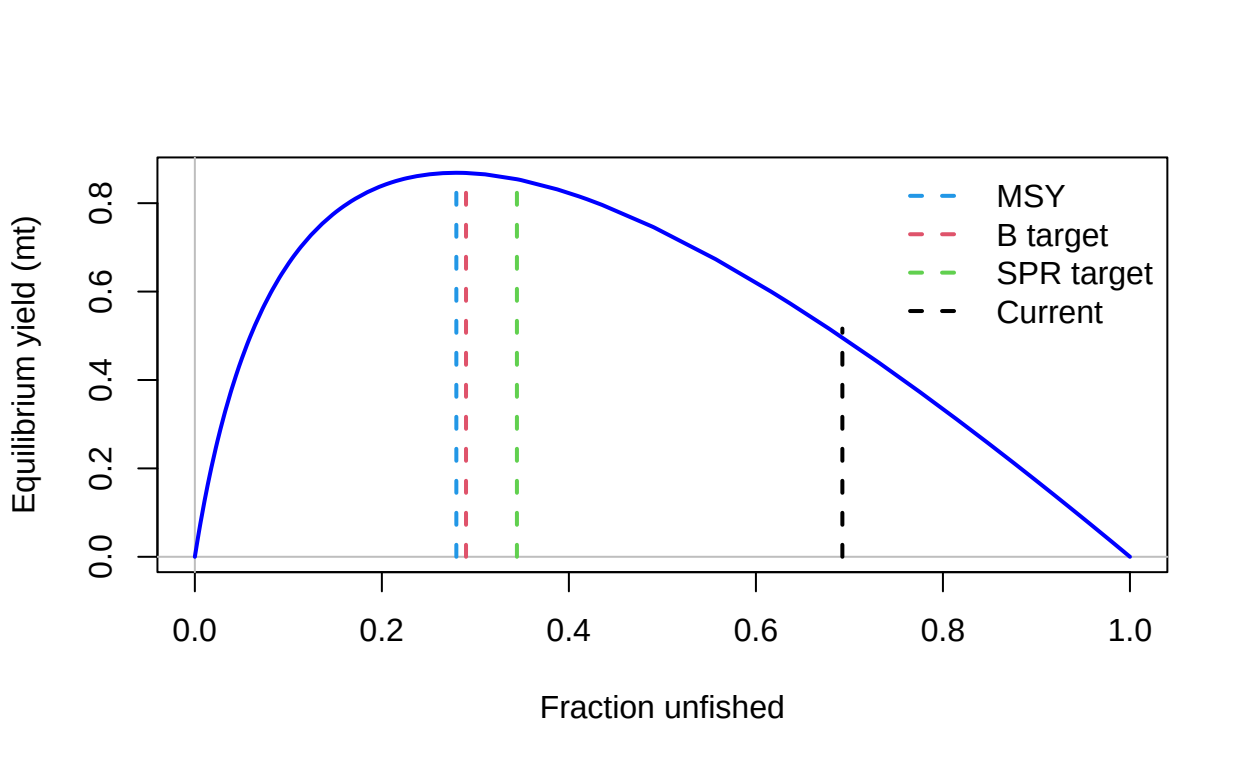
FISHERY
−2
0.1
2
Length (cm)
48
45
42
39
36
33
30
27
24
21
2013
2015
2018
Year

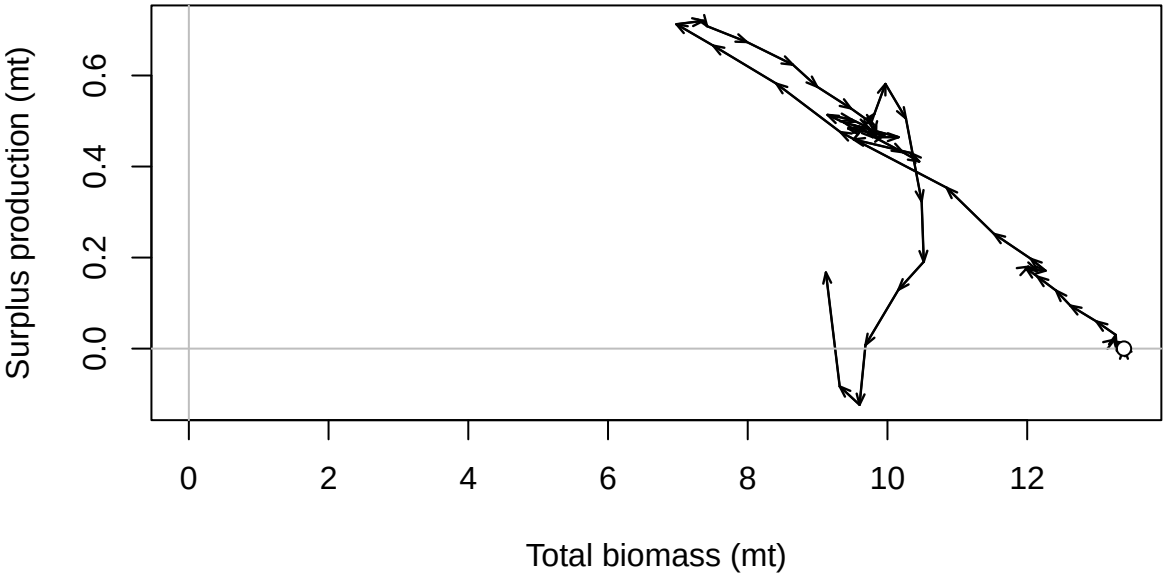

2011
N input=94
N adj.=74.2
2013
N input=83
N adj.=65.6
2015
N input=40
N adj.=31.7
2018
N input=52
N adj.=41.2
Proportion
0.0
0.1
0.2
0.3
0.4
20
25
30
35
40
45
50
Length (cm)

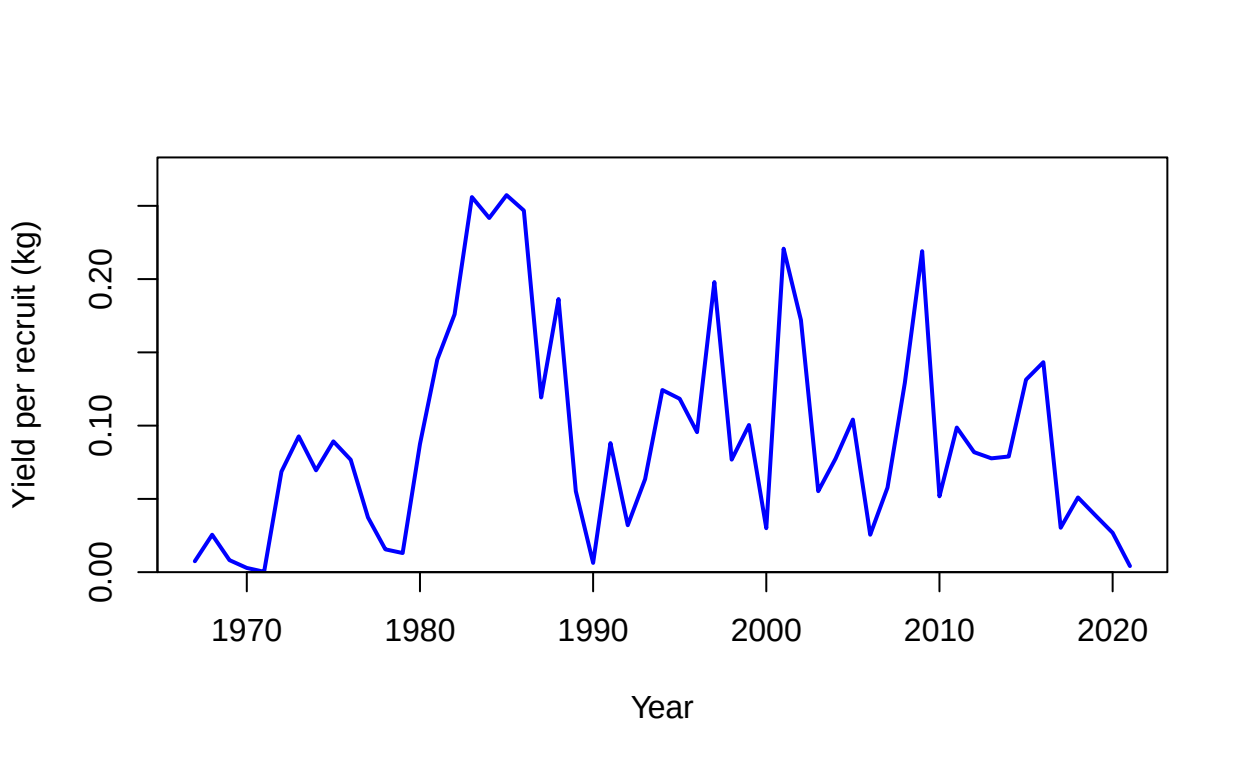

−2
0.1
2
48
45
42
39
36
33
30
27
24
21
Length (cm)
2011
2013
2015
2018
Year

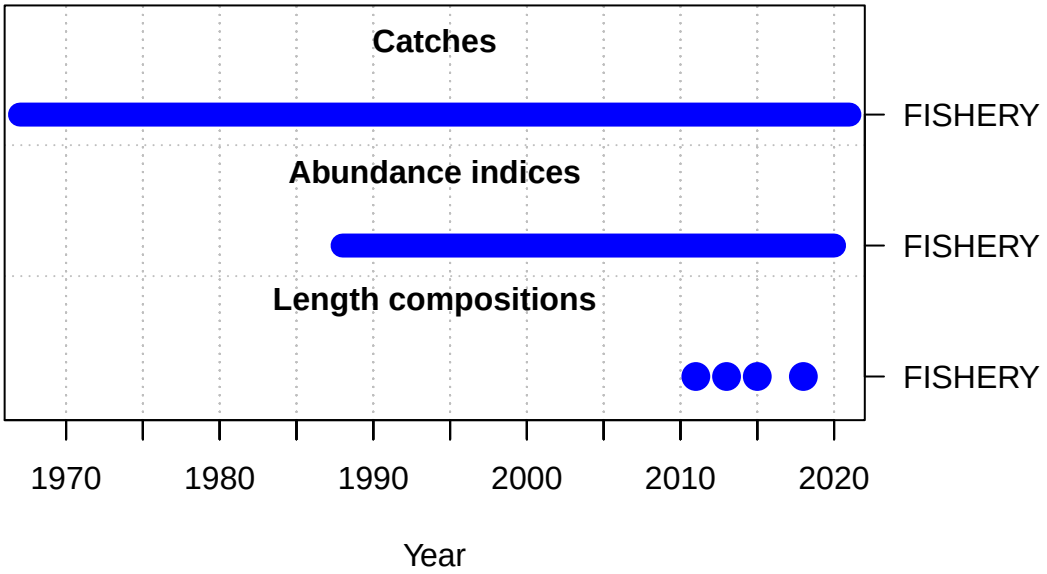

FISHERY (whole catch)
Mean length
38
36
34
32
2011
2012
2013
2014
2015
2016
2017
2018
Year

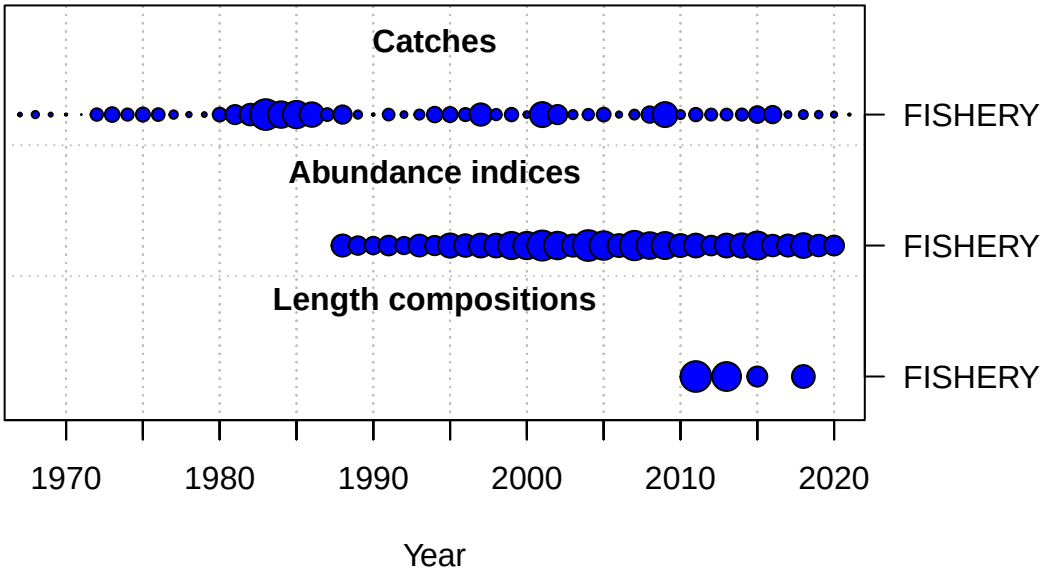

Equilibrium yield (mt)
0.0
0.2
0.4
0.6
0.8
0.0
0.2
0.4
0.6
0.8
1.0
Fraction unfished

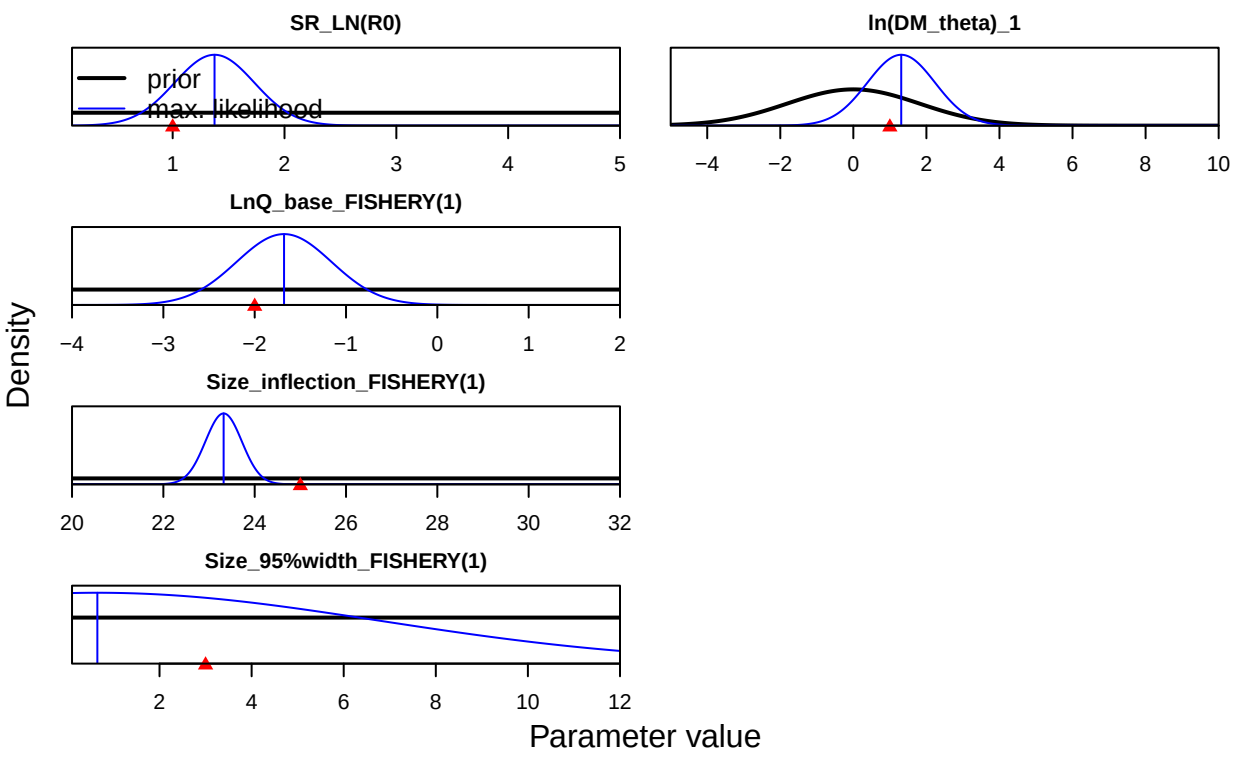

Equilibrium yield (mt)
0.0
0.2
0.4
0.6
0.8
0.0
0.2
0.4
0.6
0.8
1.0
Fraction unfished
MSY
B target
SPR target
Current


Surplus production (mt)
0.0
0.2
0.4
0.6
0
2
4
6
8
10
12
Total biomass (mt)


Yield per recruit (kg)
0.00
0.10
0.20
1970
1980
1990
2000
2010
2020
Year


Catches
FISHERY
Abundance indices
FISHERY
Length compositions
FISHERY
1970
1980
1990
2000
2010
2020
Year


Catches
FISHERY
Abundance indices
FISHERY
Length compositions
FISHERY
1970
1980
1990
2000
2010
2020
Year


SR_LN(R0)
prior
max. likelihood
1
2
3
4
5
ln(DM_theta)_1
−4
−2
0
2
4
6
8
10
LnQ_base_FISHERY(1)
−4
−3
−2
−1
0
1
2
Size_inflection_FISHERY(1)
20
22
24
26
28
30
32
Size_95%width_FISHERY(1)
2
4
6
8
10
12
Density
Parameter value