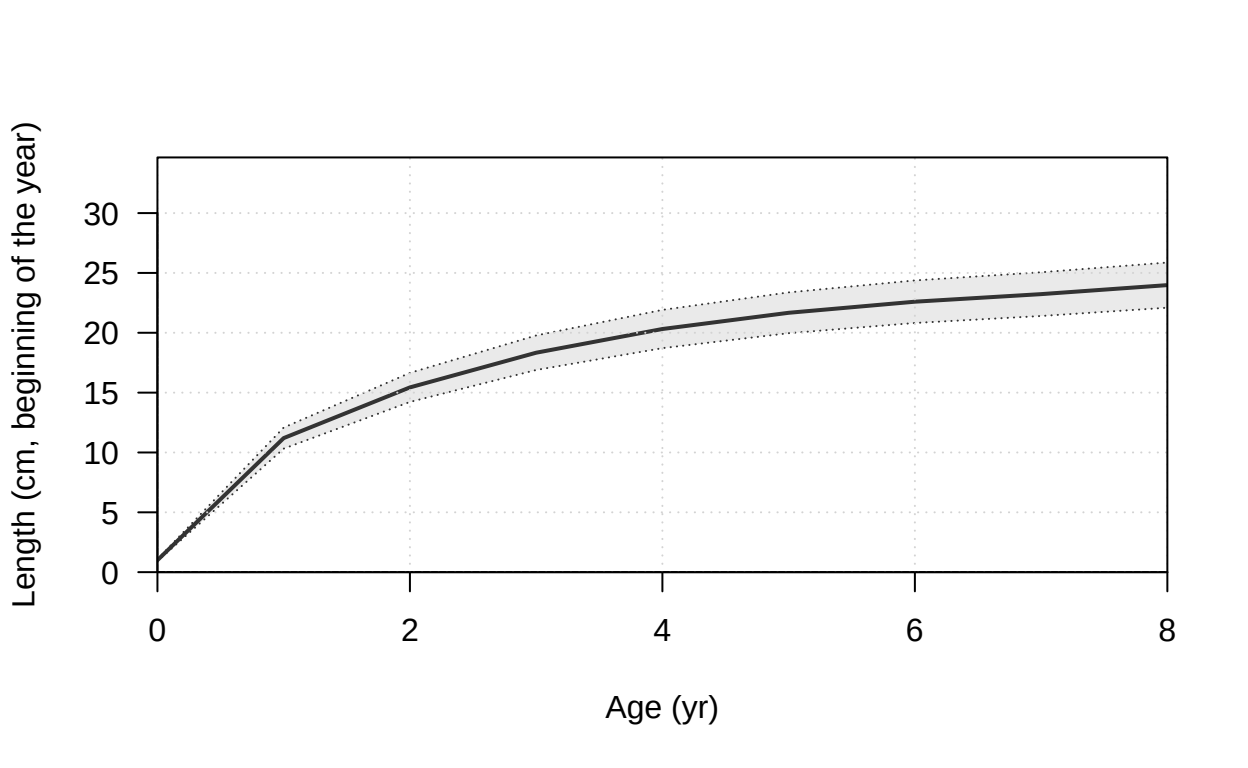
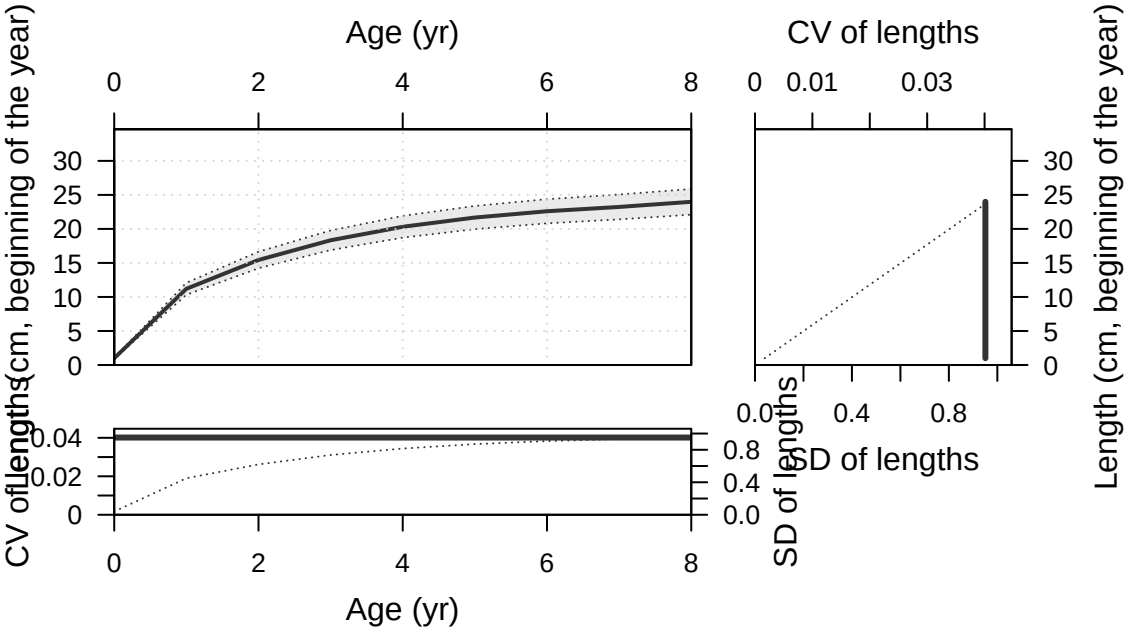
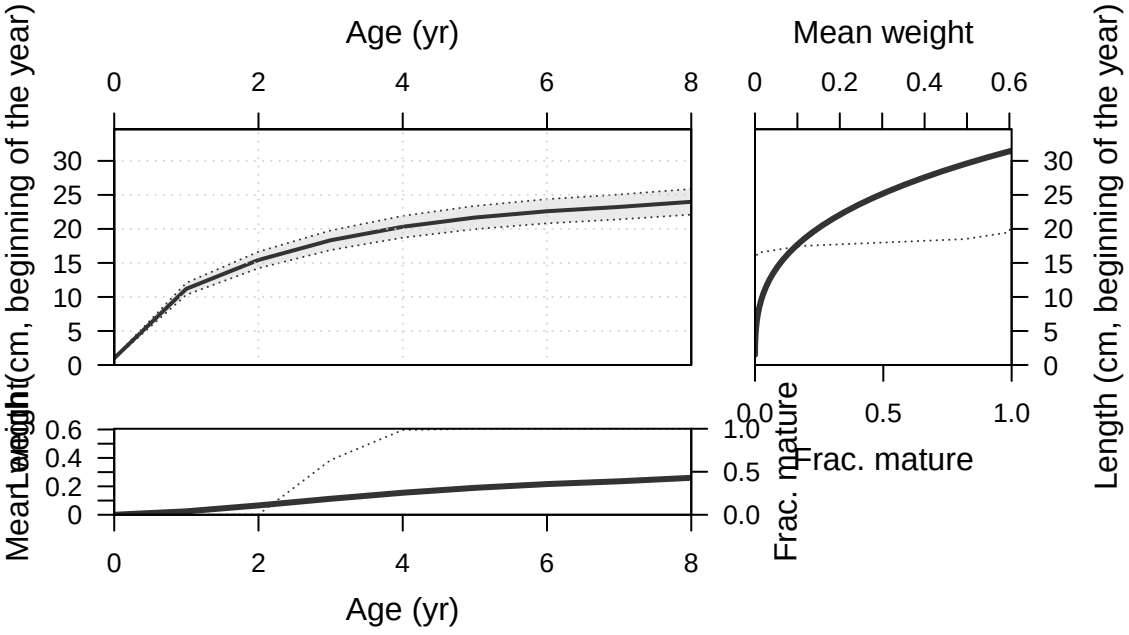
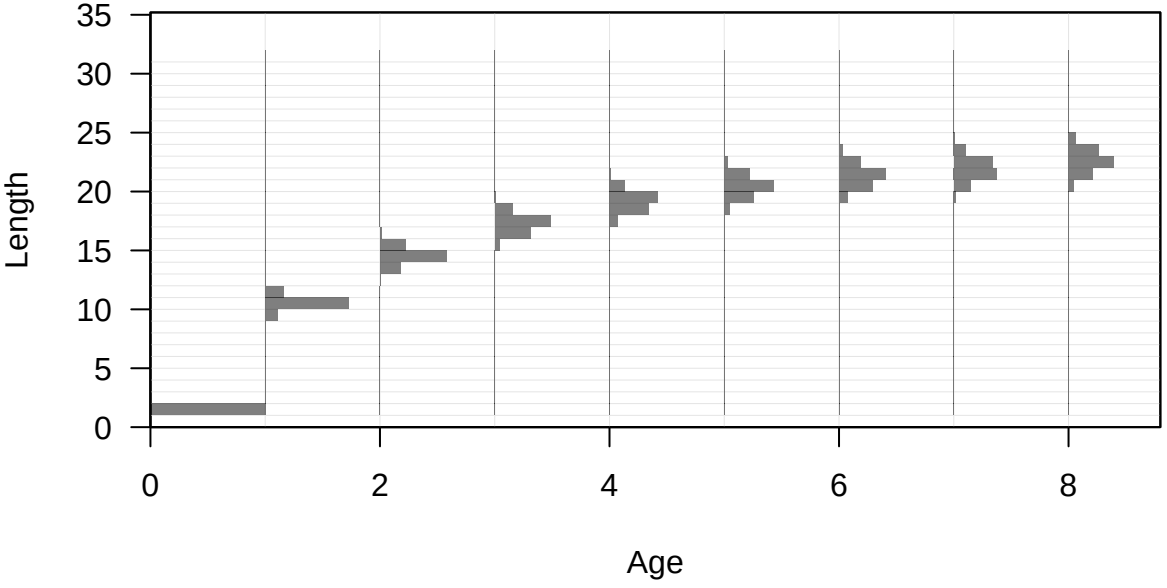
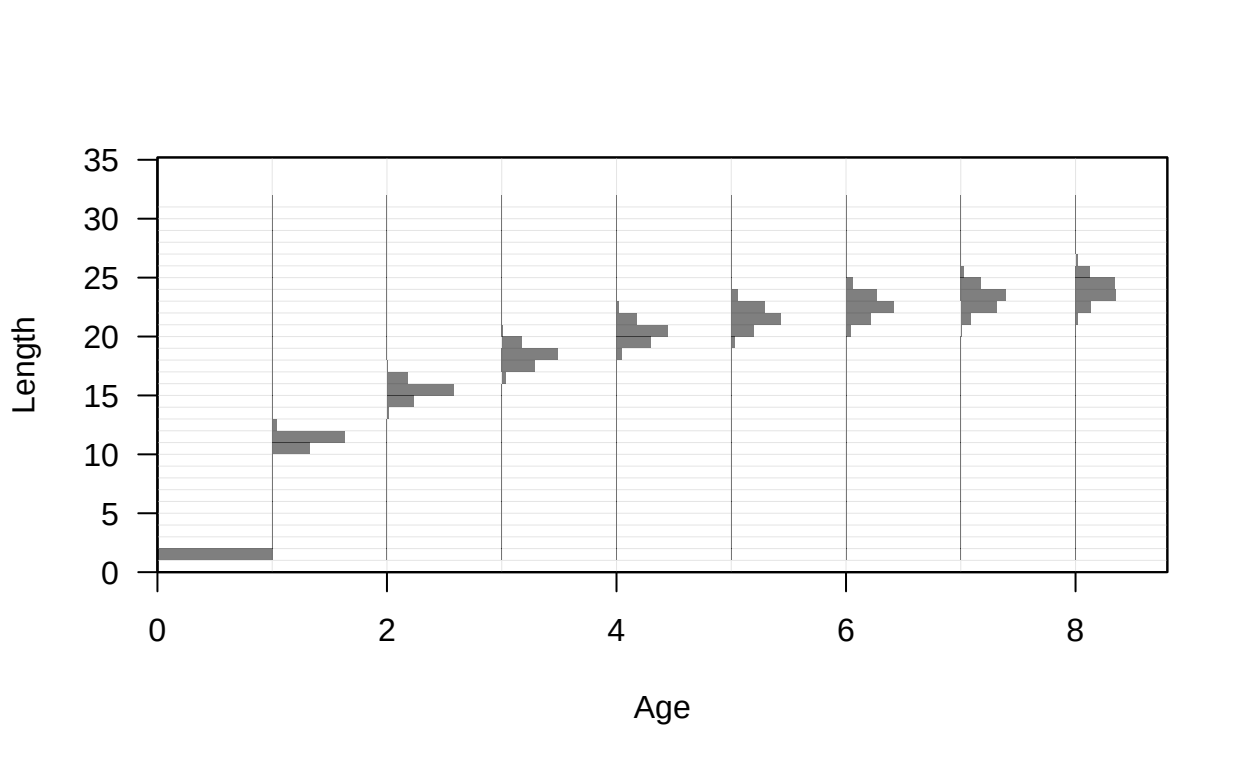
Plots created using the 'r4ss' package in R
Stock Synthesis version: 3.30.19.0
StartTime: Sun Feb 19 21:27:17 2023
Data_File: data.ss
Control_File: control.ss

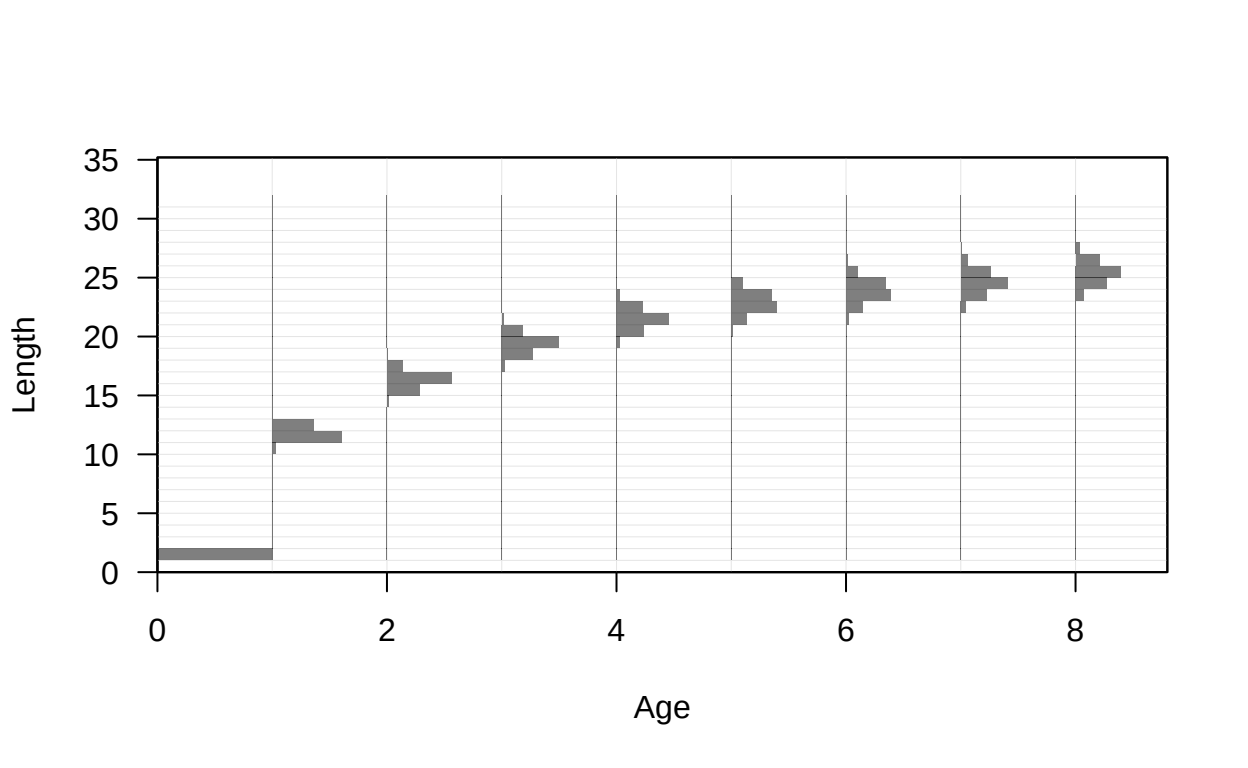

Length (cm, beginning of the year)
0
5
10
15
20
25
30
0
2
4
6
8
Age (yr)

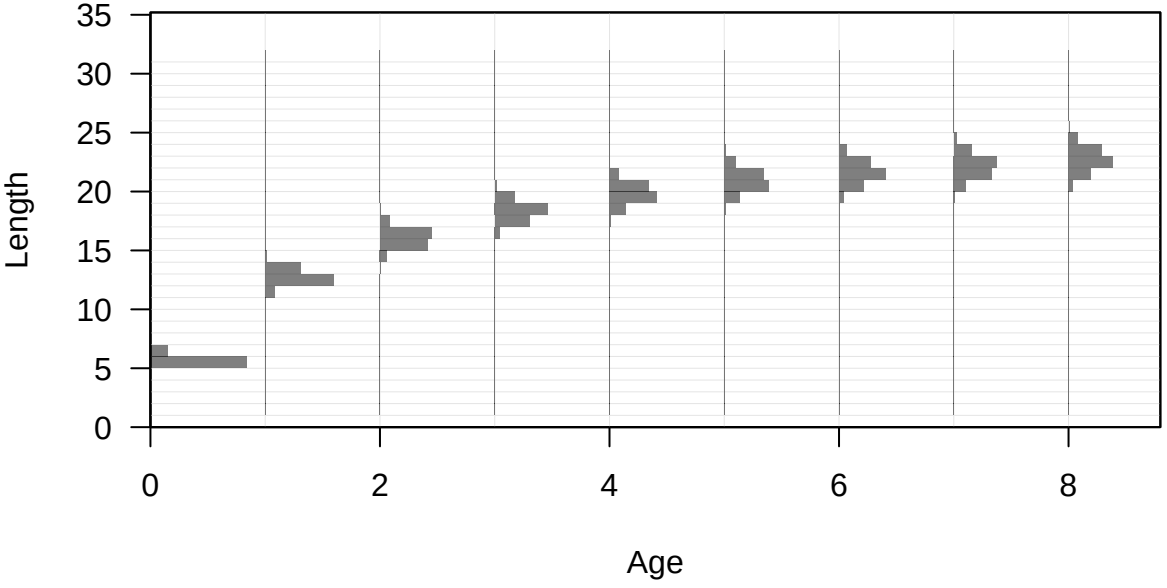

Age (yr)
0
2
4
6
8
CV of lengths
0
0.01
0.03
Length (cm, beginning of the year)
0
5
10
15
20
25
30
CV of lengths
0.00
0.02
0.04
SD of lengths
0.0
0.4
0.8
Age (yr)

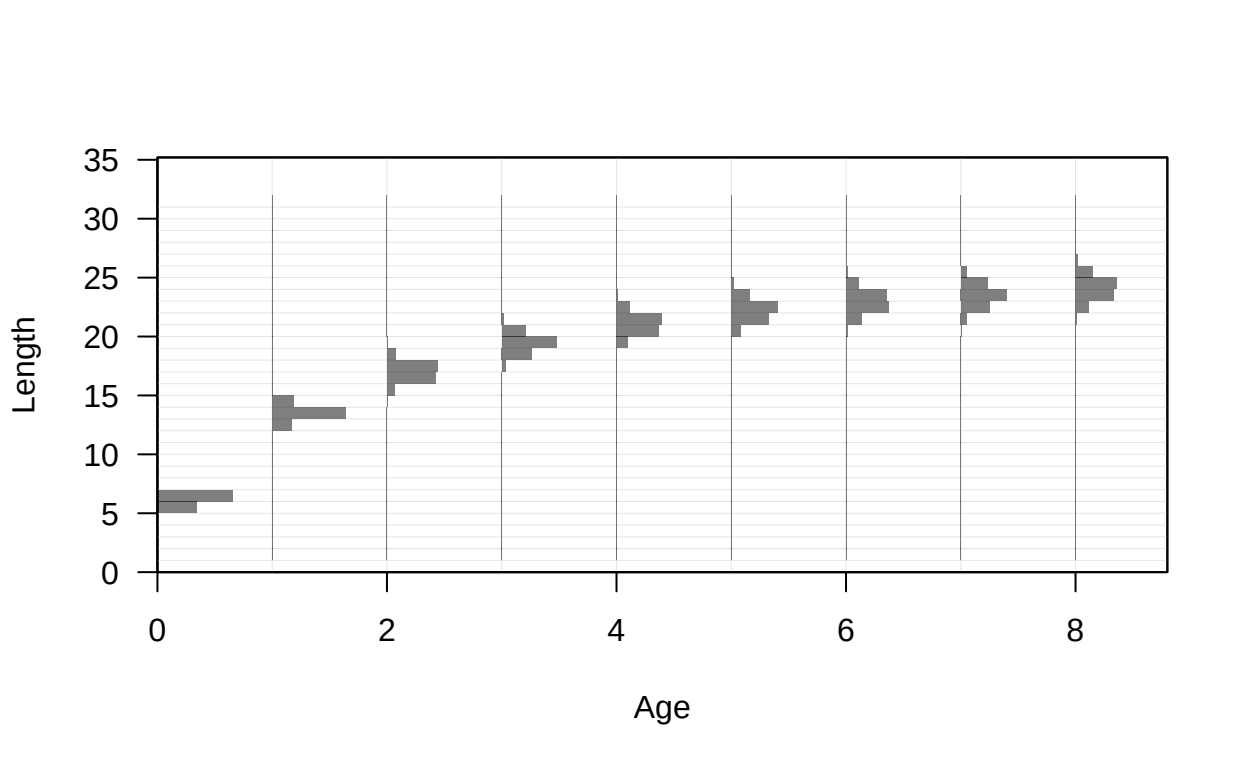

Age (yr)
Mean weight
Length (cm, beginning of the year)
Mean weight
Frac. mature
Age (yr)
Frac. mature
Length (cm, beginning of the year)

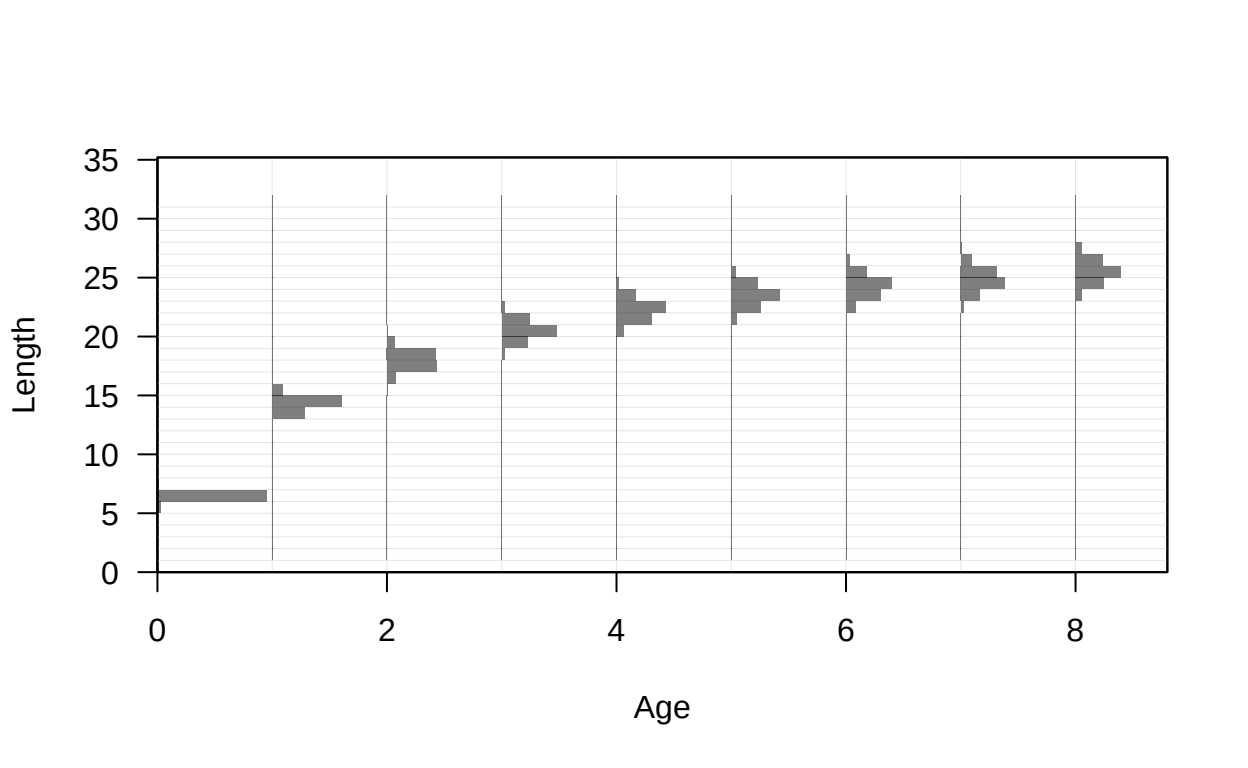

35
30
25
20
15
10
5
0
Length
0
2
4
6
8
Age

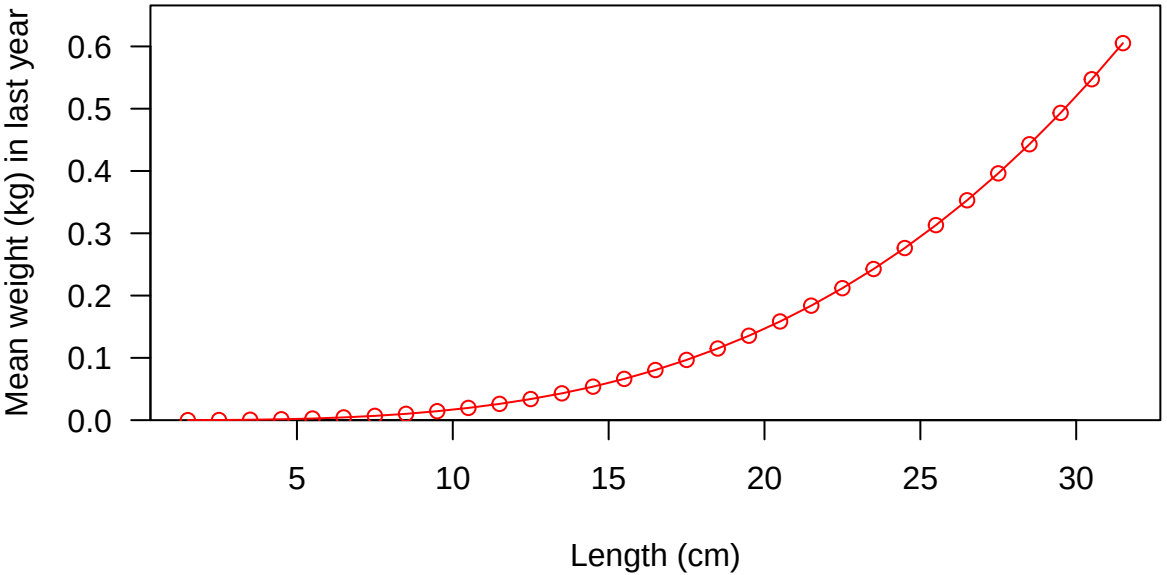

35
30
25
20
15
10
5
0
Length
0
2
4
6
8
Age

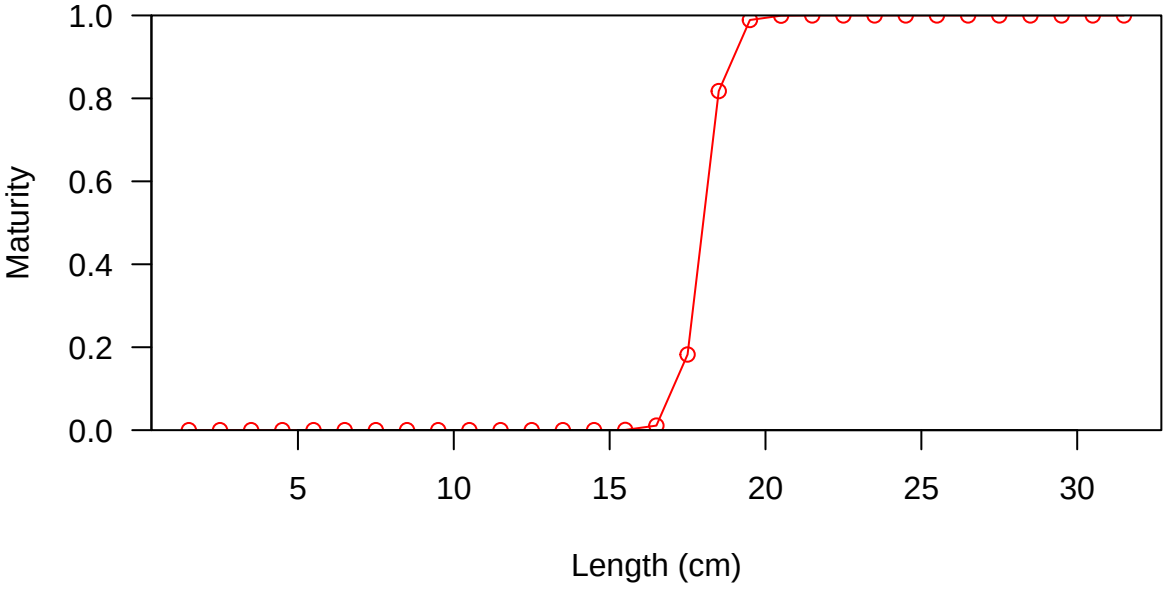

Length
35
30
25
20
15
10
5
0
0
2
4
6
8
Age

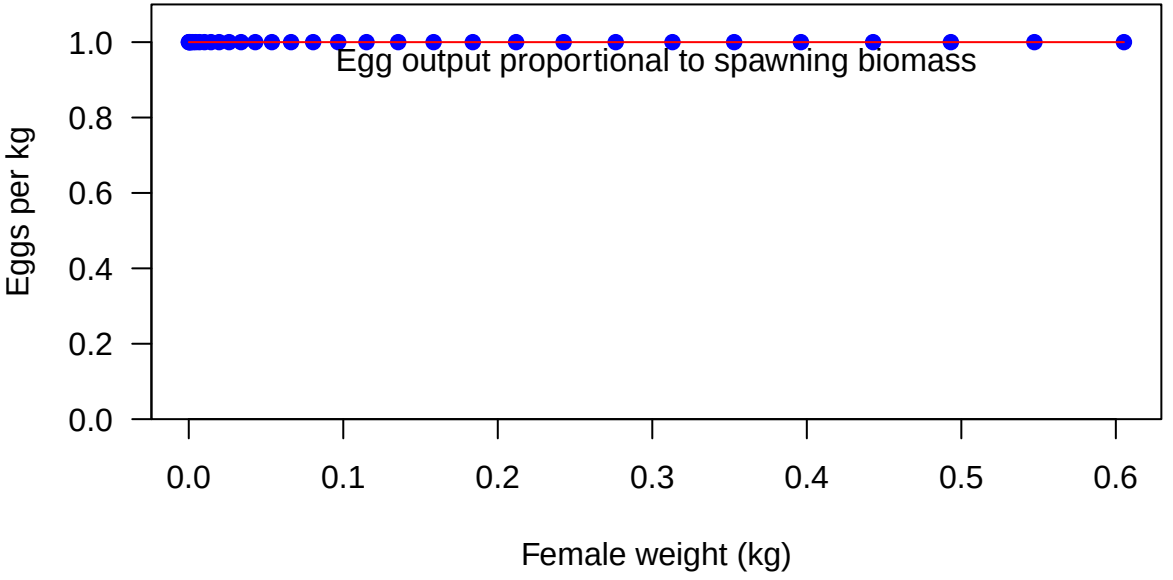

35
30
25
20
15
10
5
0
Length
0
2
4
6
8
Age

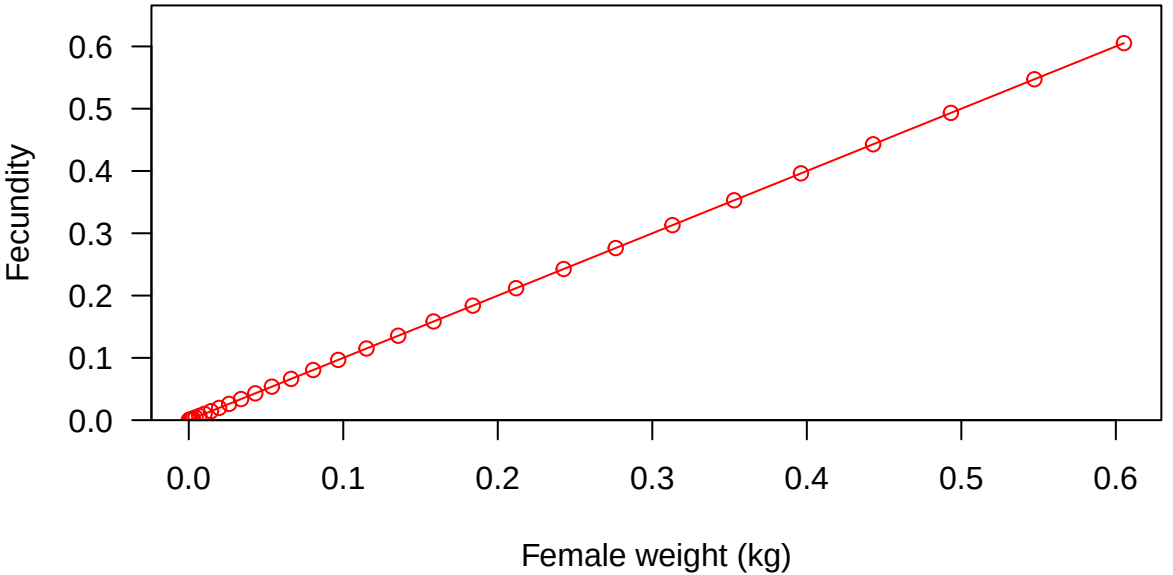

35
30
25
20
15
10
5
0
Length
0
2
4
6
8
Age

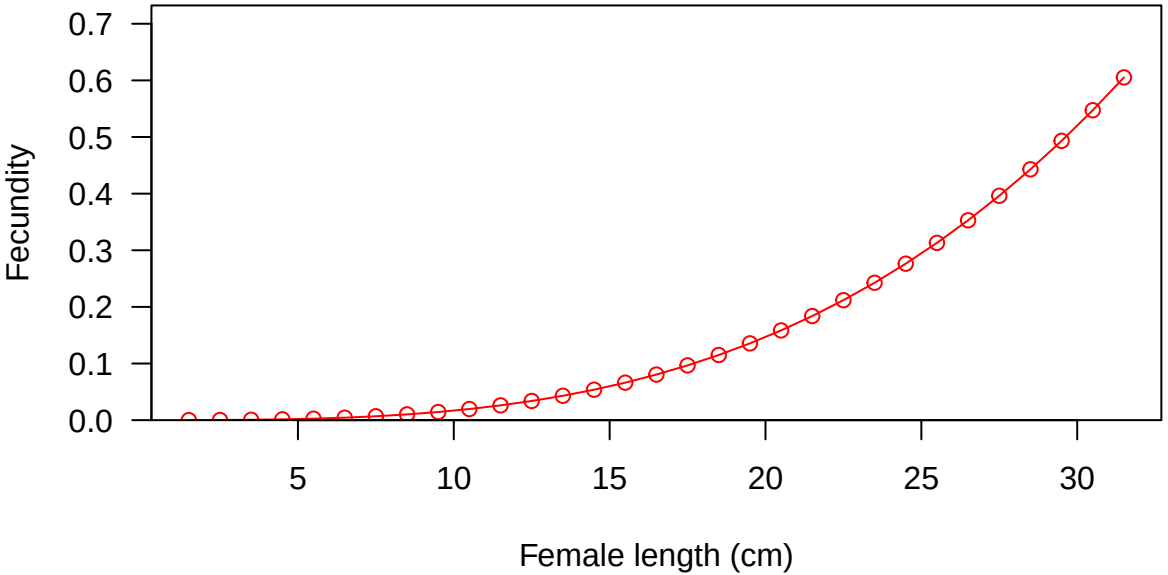

35
30
25
20
15
10
5
0
Length
0
2
4
6
8
Age

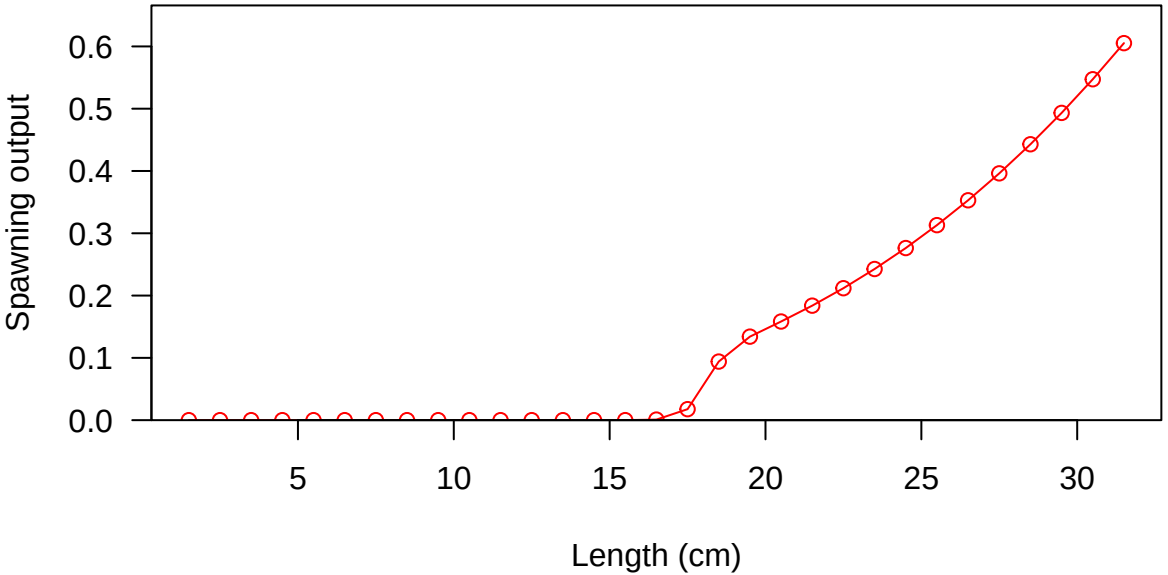

Mean weight (kg) in last year
0.0
0.1
0.2
0.3
0.4
0.5
0.6
5
10
15
20
25
30
Length (cm)

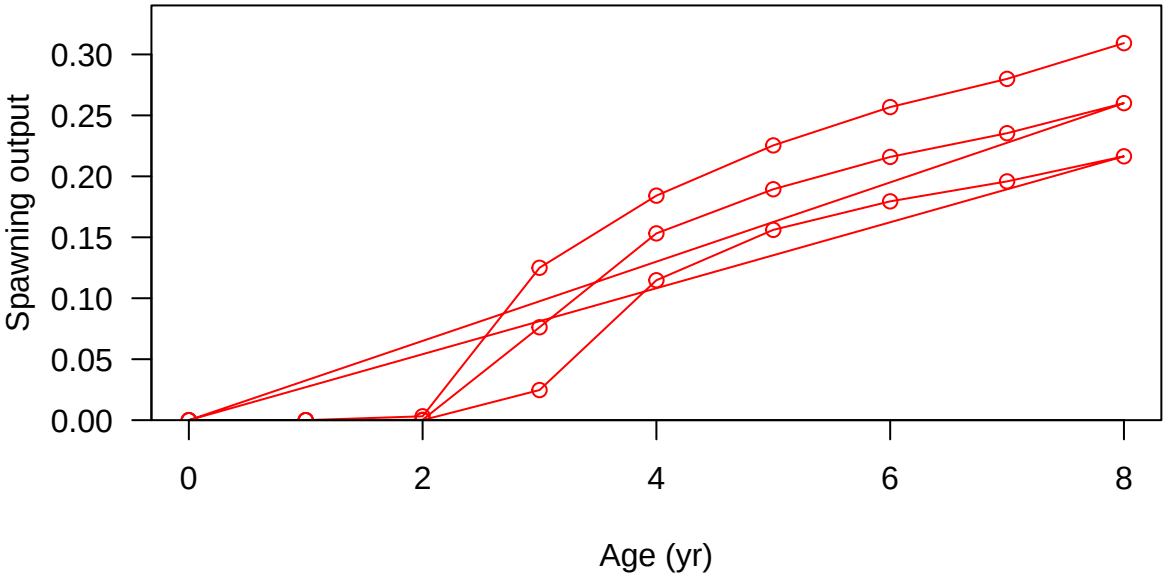

1.0
0.8
0.6
0.4
0.2
0.0
Maturity
5
10
15
20
25
30
Length (cm)

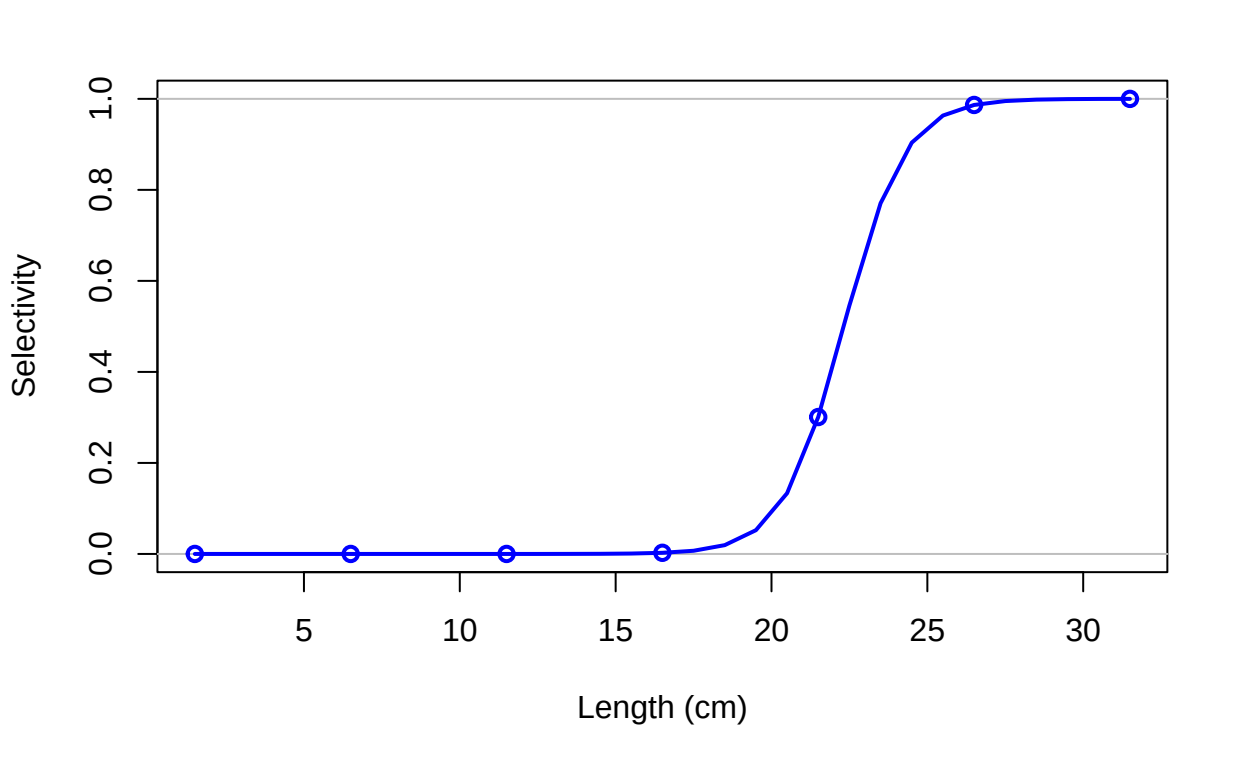

Egg output proportional to spawning biomass
Eggs per kg
1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Female weight (kg)

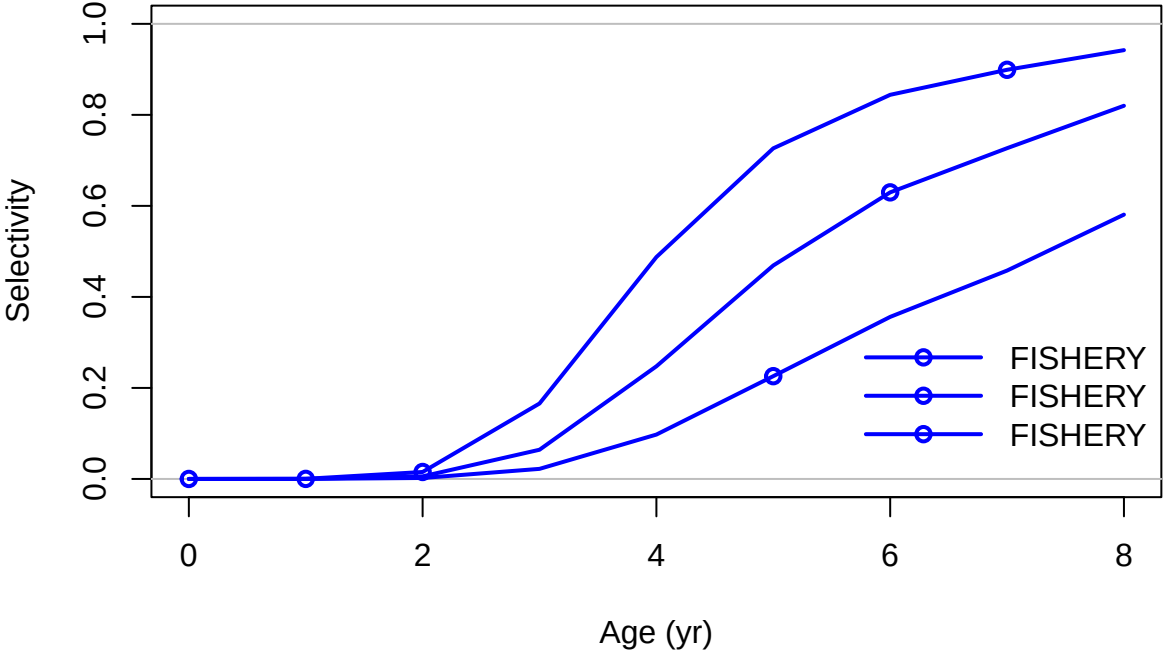

Fecundity
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Female weight (kg)

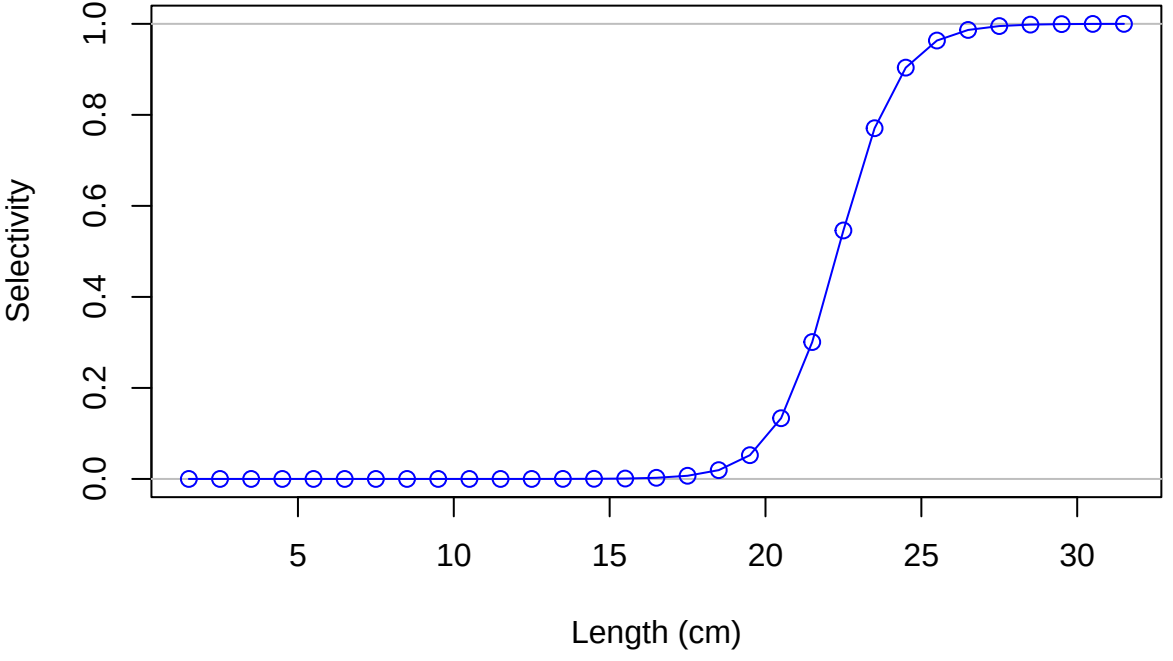

Fecundity
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
5
10
15
20
25
30
Female length (cm)

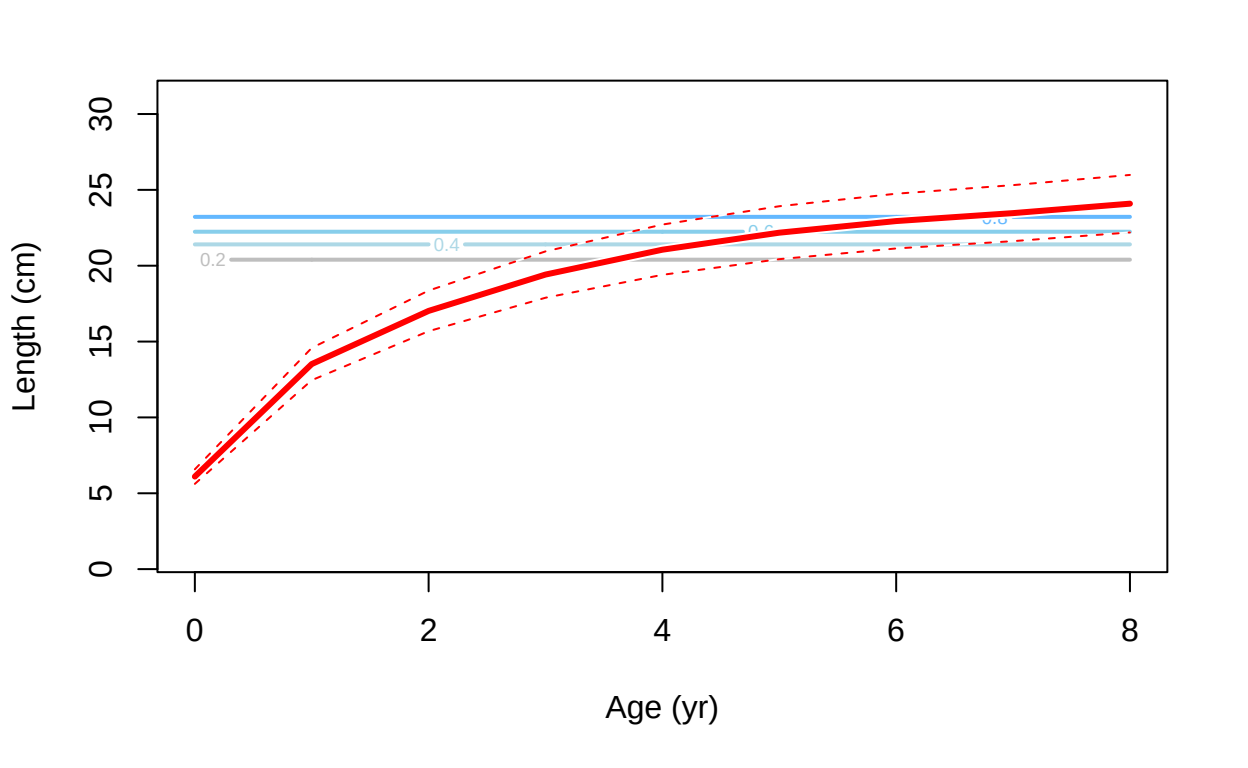

Spawning output
0.0
0.1
0.2
0.3
0.4
0.5
0.6
5
10
15
20
25
30
Length (cm)

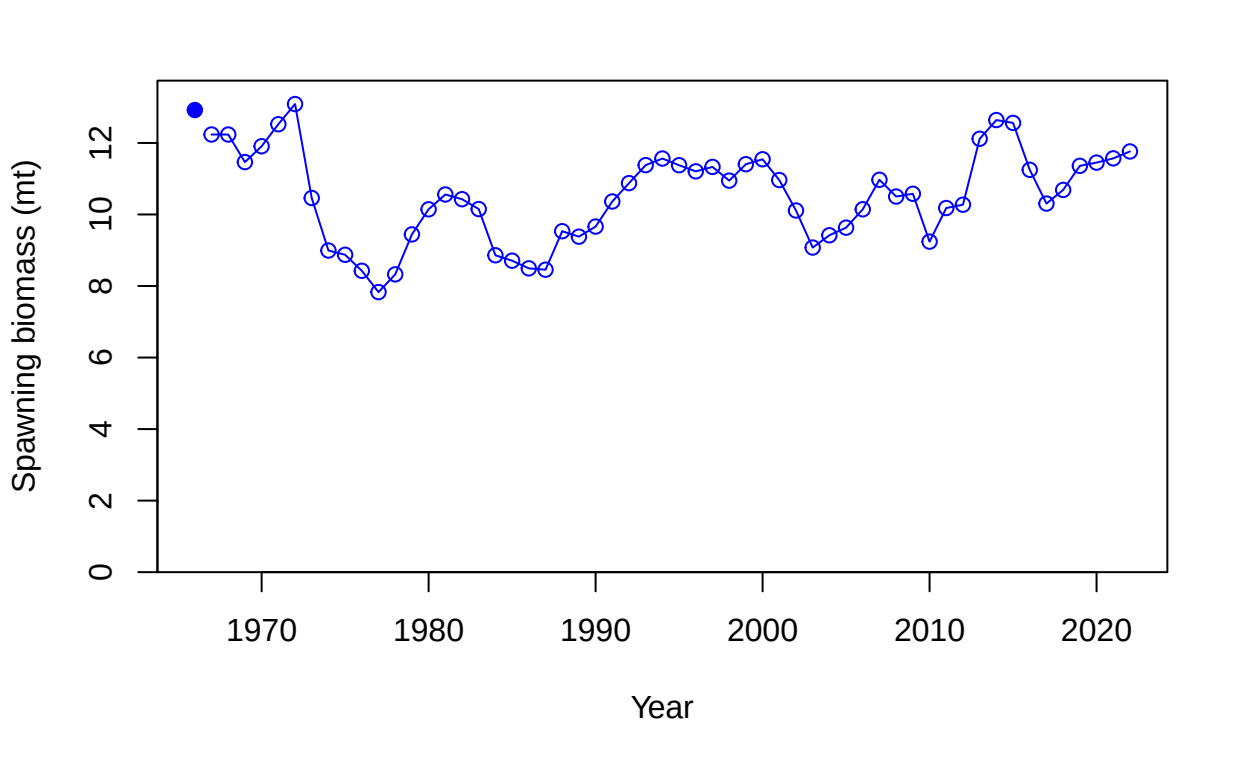

Spawning output
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0
2
4
6
8
Age (yr)

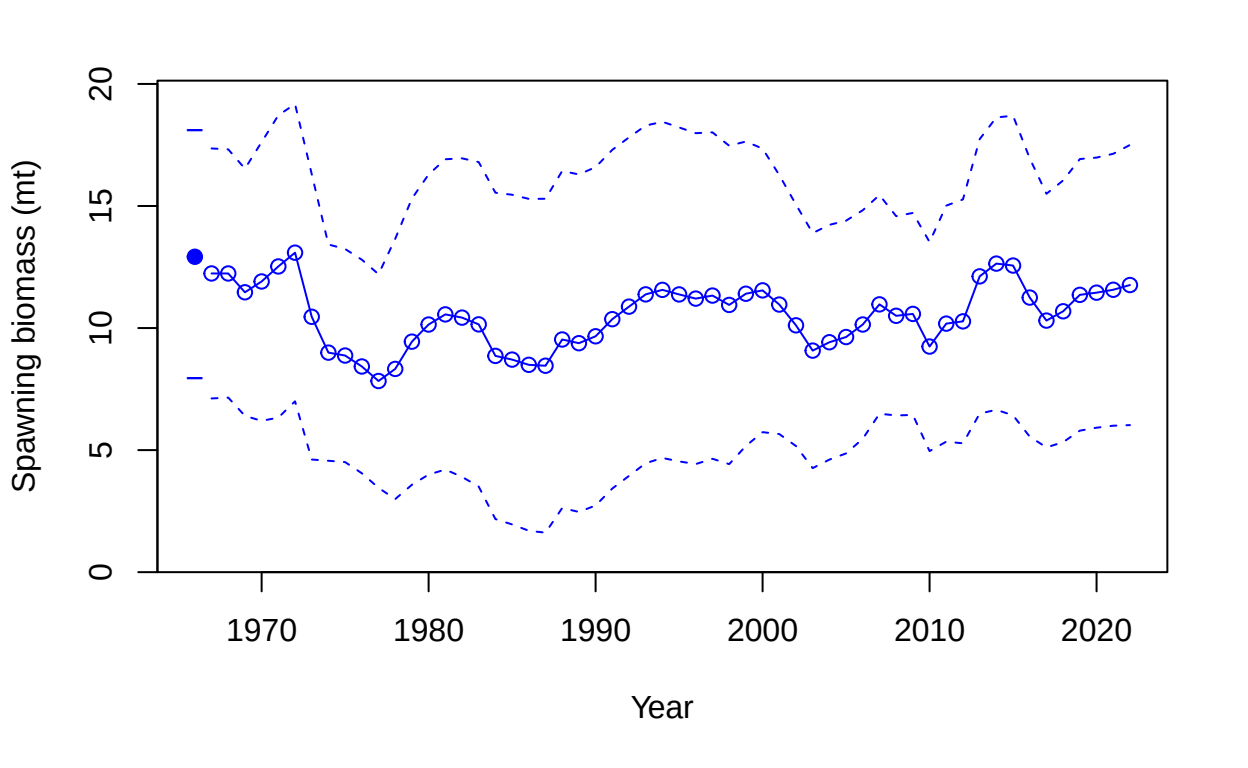

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
5
10
15
20
25
30
Length (cm)

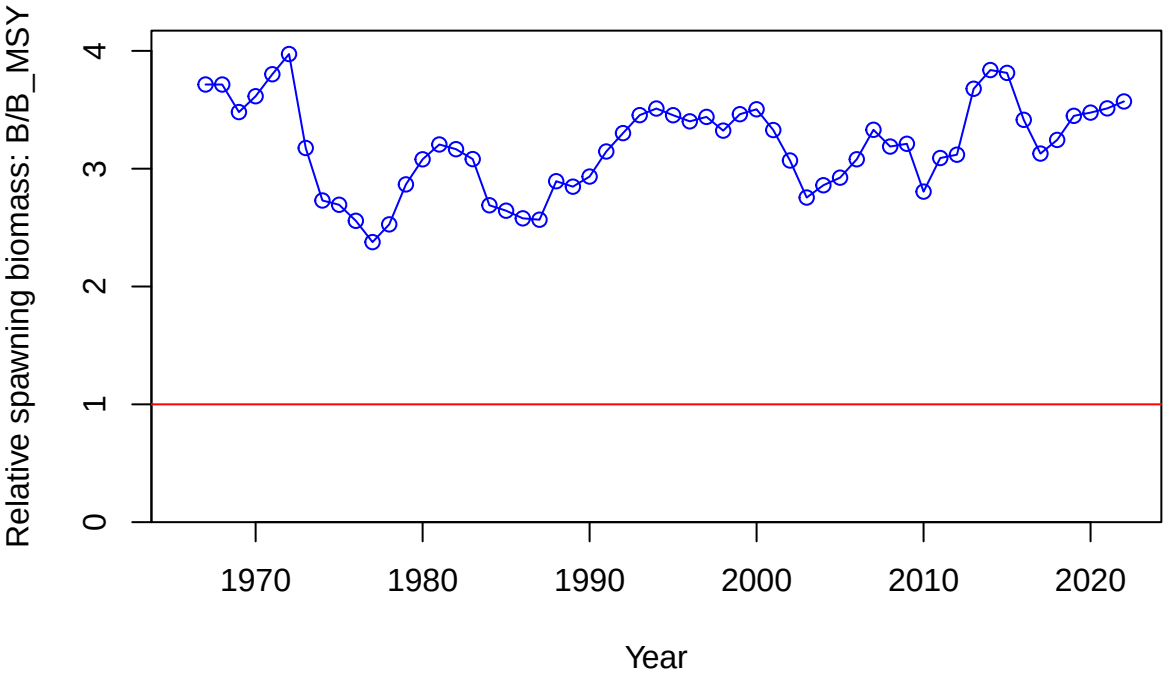

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
2
4
6
8
Age (yr)
FISHERY
FISHERY
FISHERY

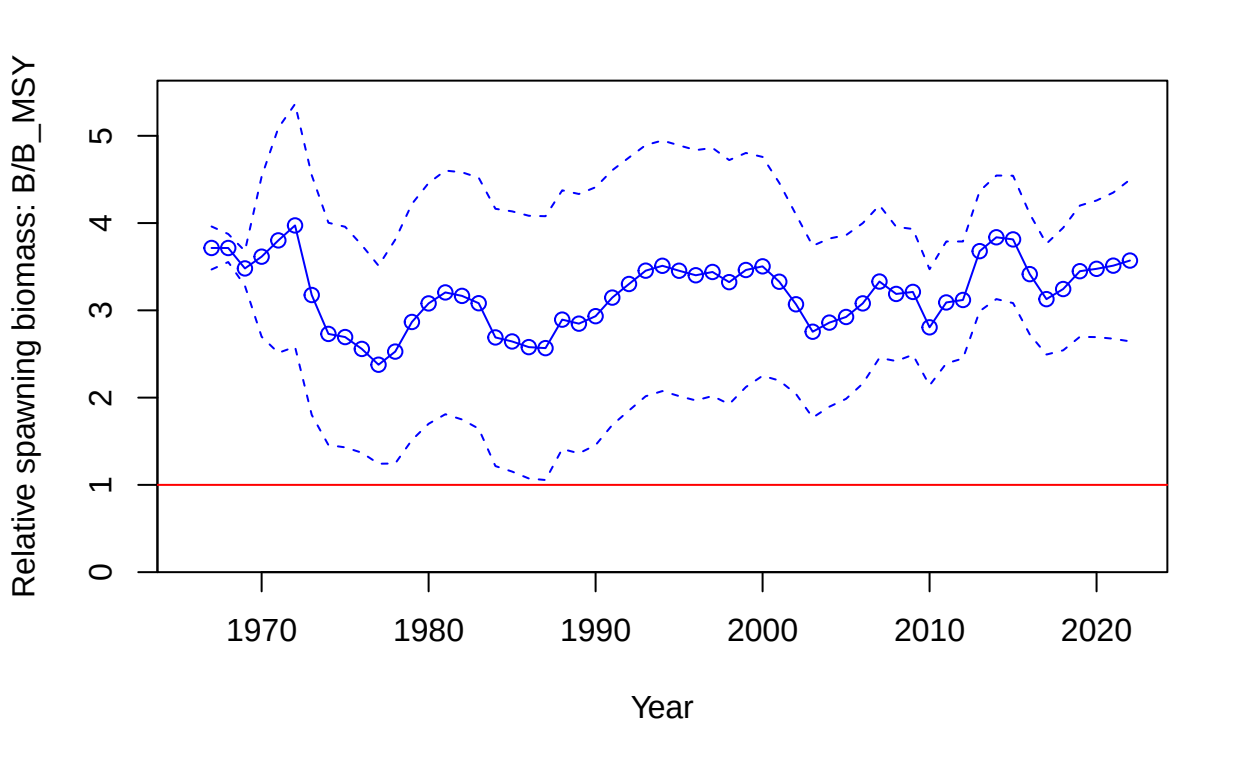

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
5
10
15
20
25
30
Length (cm)

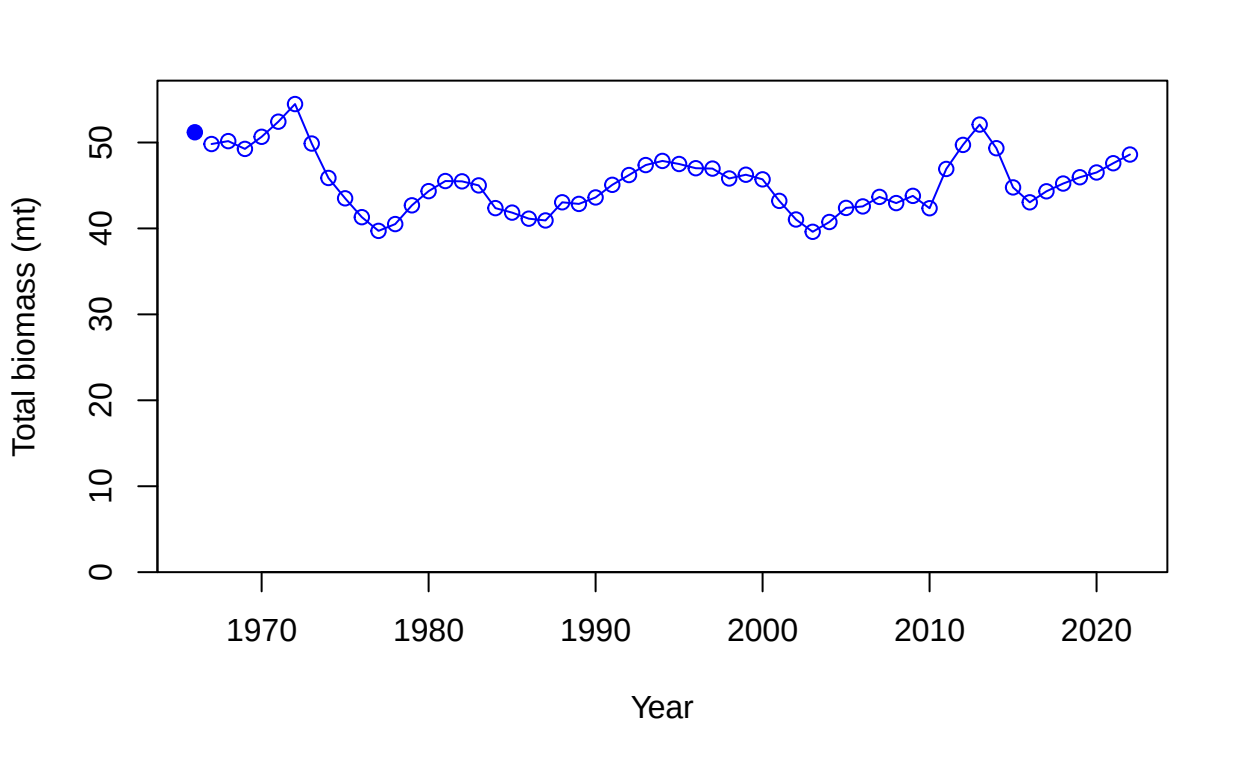

Length (cm)
0
5
10
15
20
25
30
0
2
4
6
8
Age (yr)
0.2
0.4

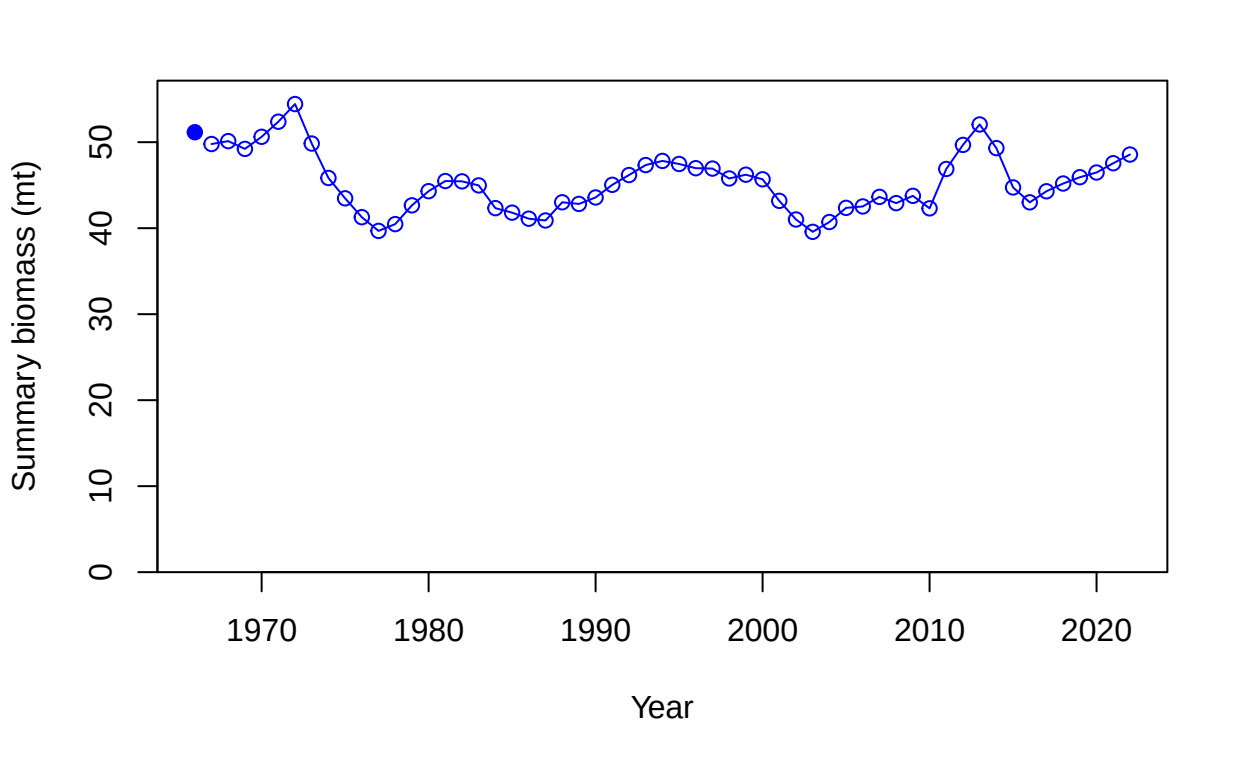

Spawning biomass (mt)
0
2
4
6
8
10
12
1970
1980
1990
2000
2010
2020
Year

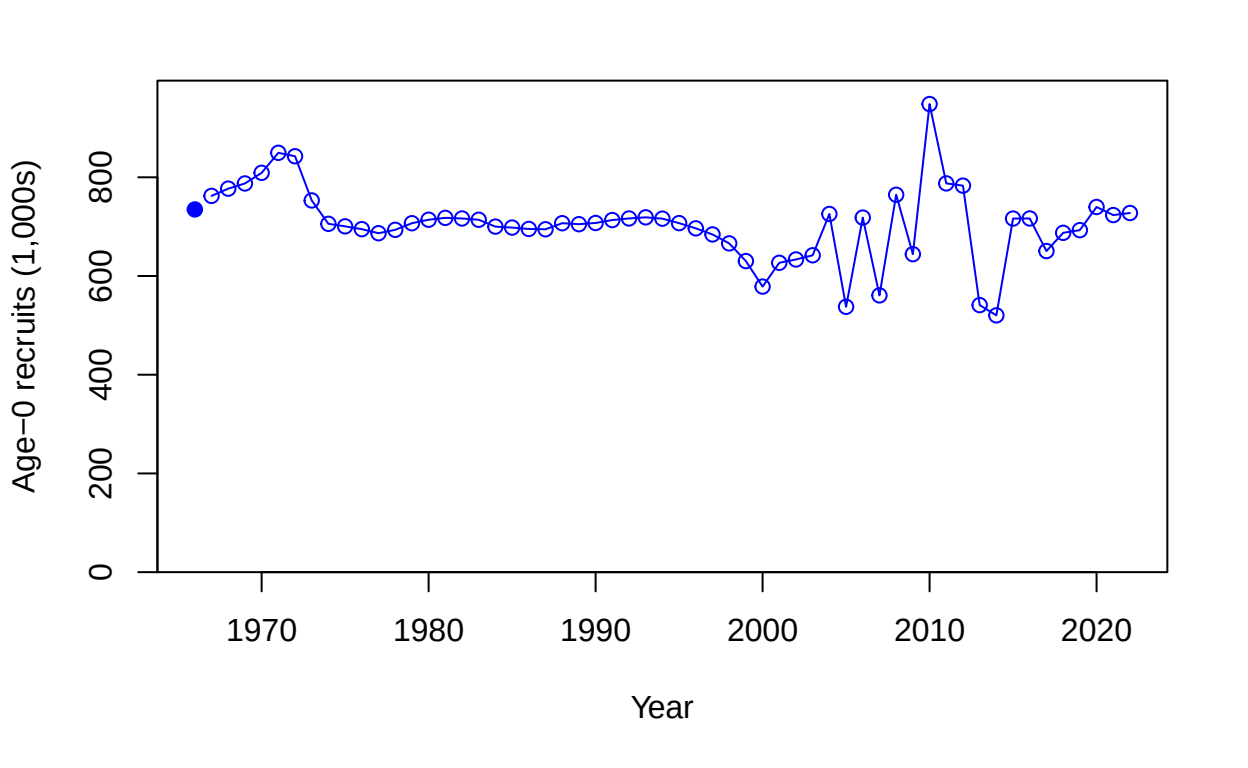

Spawning biomass (mt)
0
5
10
15
20
1970
1980
1990
2000
2010
2020
Year

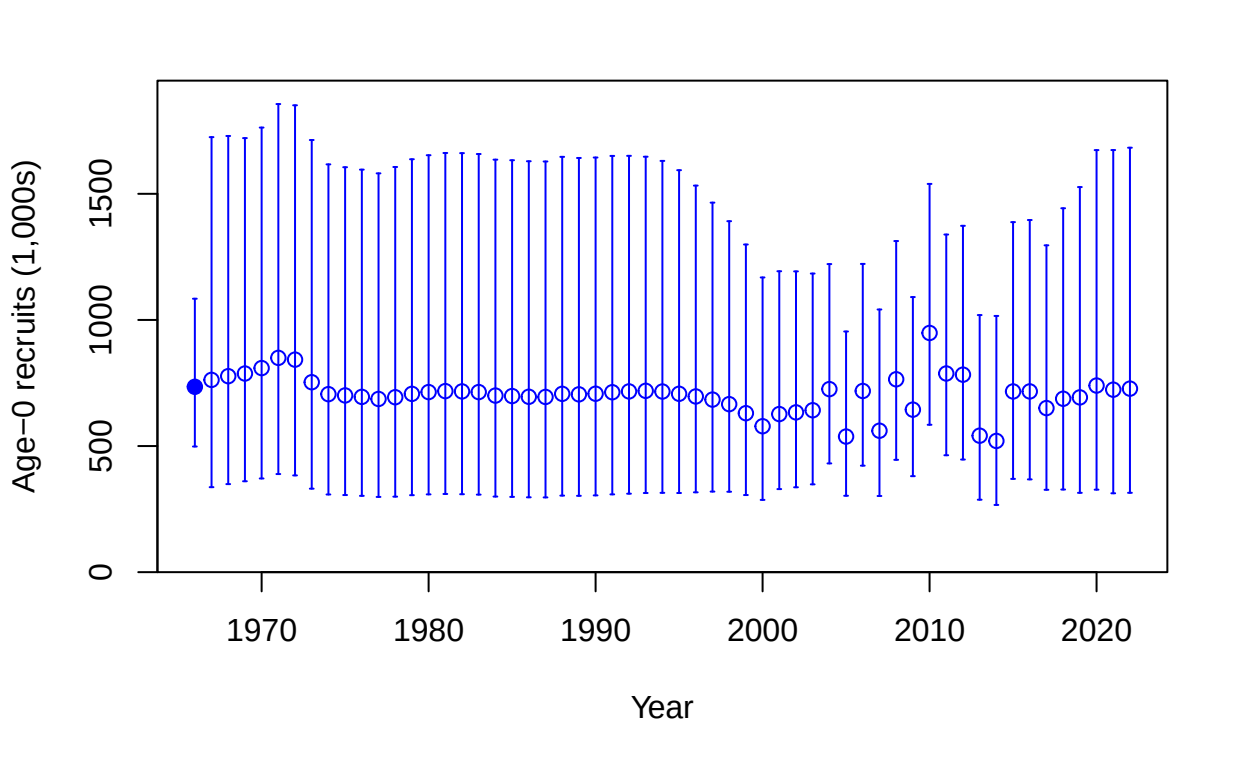

Relative spawning biomass: B/B_MSY
0
1
2
3
4
1970
1980
1990
2000
2010
2020
Year

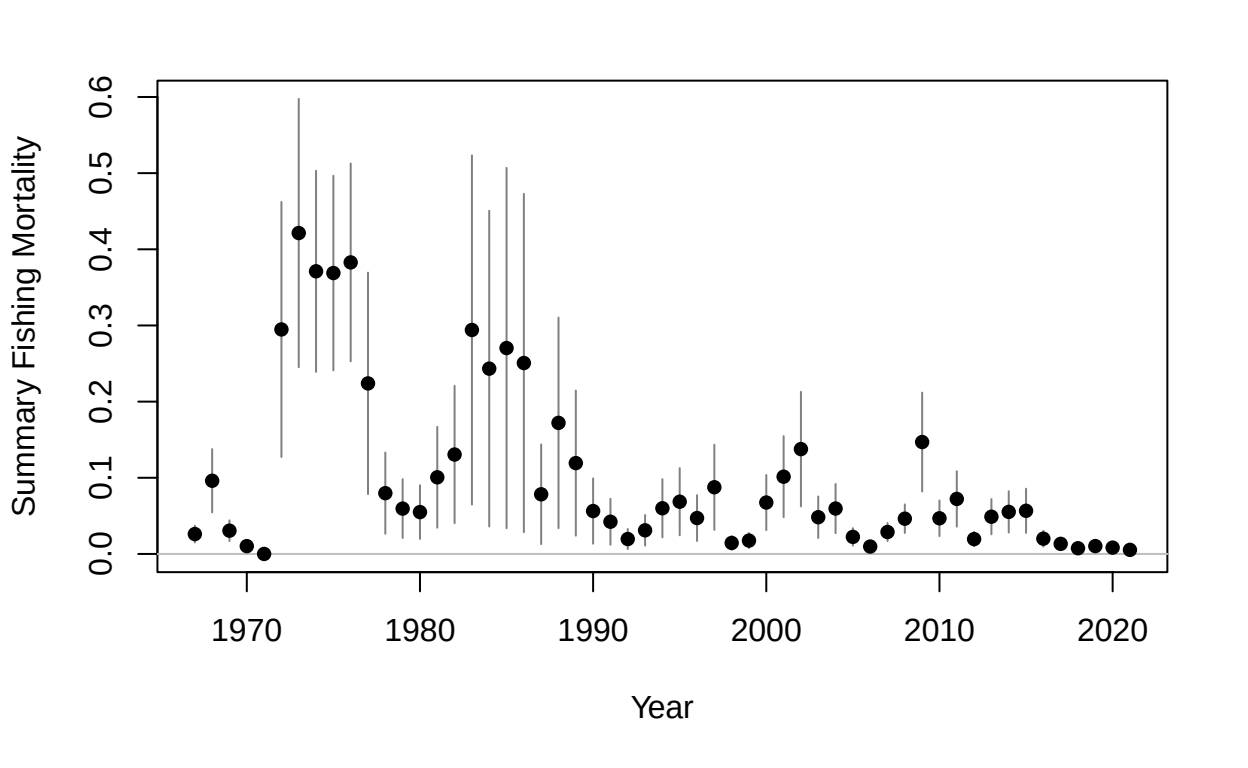

Relative spawning biomass: B/B_MSY
0
1
2
3
4
5
1970
1980
1990
2000
2010
2020
Year

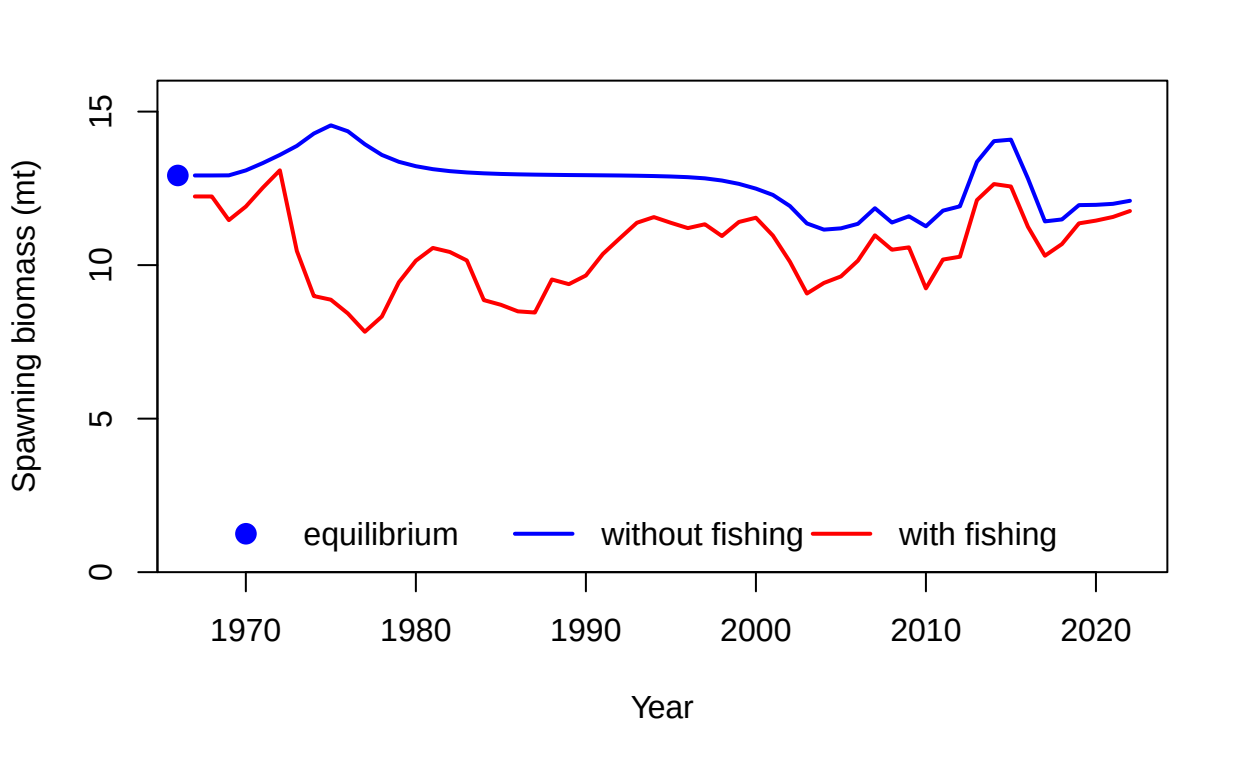

Total biomass (mt)
0
10
20
30
40
50
1970
1980
1990
2000
2010
2020
Year

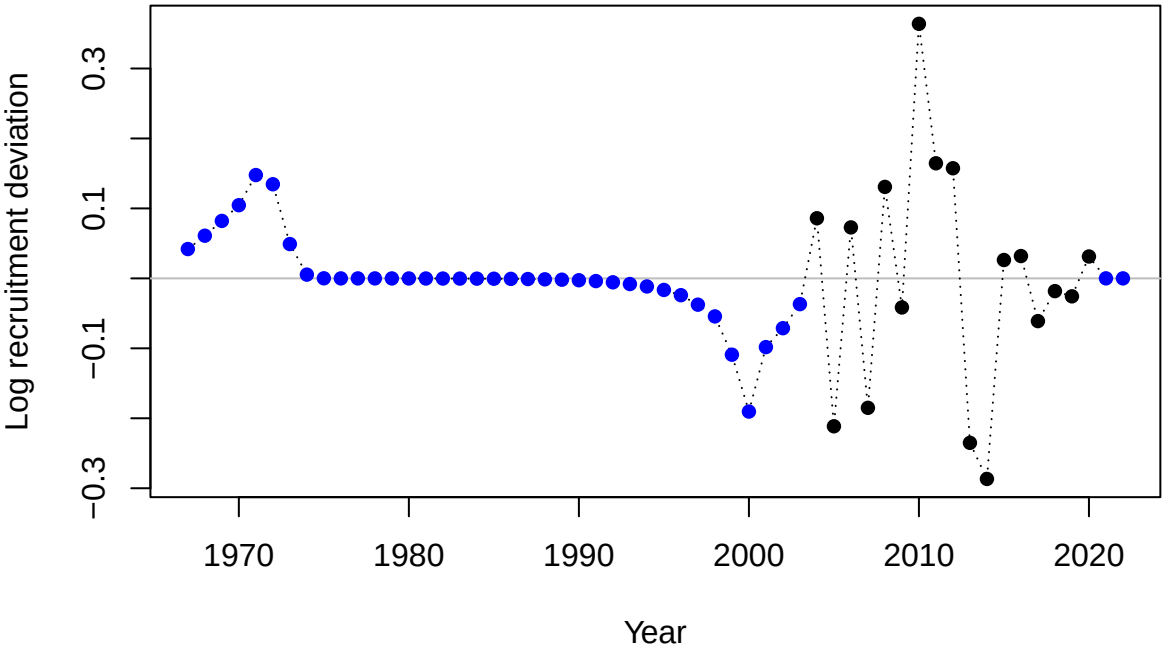

Summary biomass (mt)
0
10
20
30
40
50
1970
1980
1990
2000
2010
2020
Year

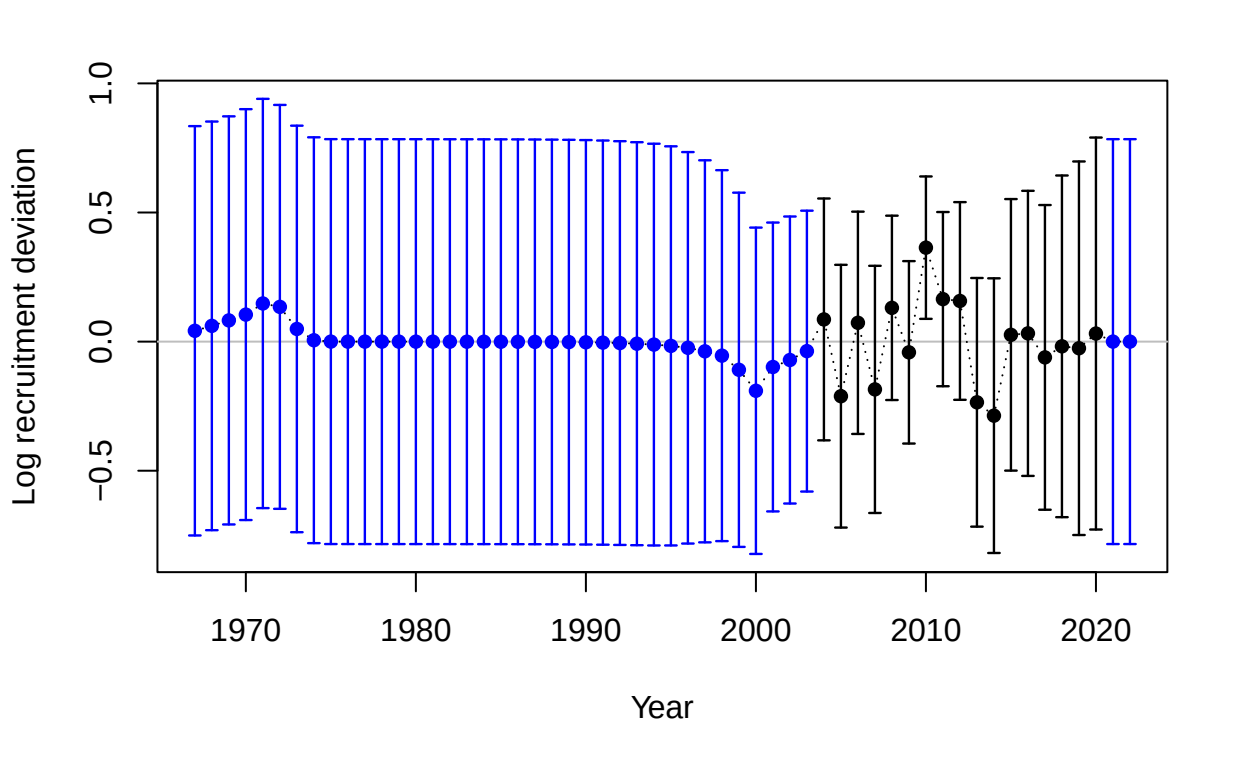

Age−0 recruits (1,000s)
0
200
400
600
800
1970
1980
1990
2000
2010
2020
Year

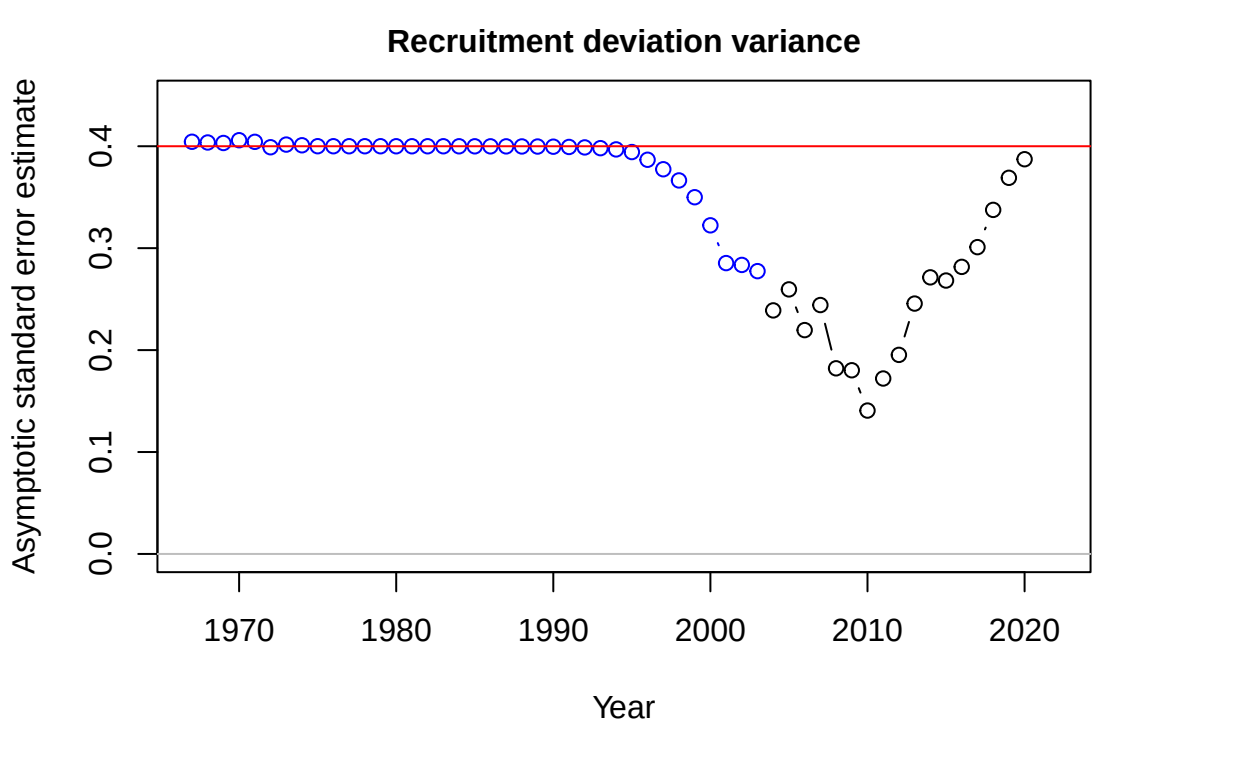

Age−0 recruits (1,000s)
0
500
1000
1500
1970
1980
1990
2000
2010
2020
Year

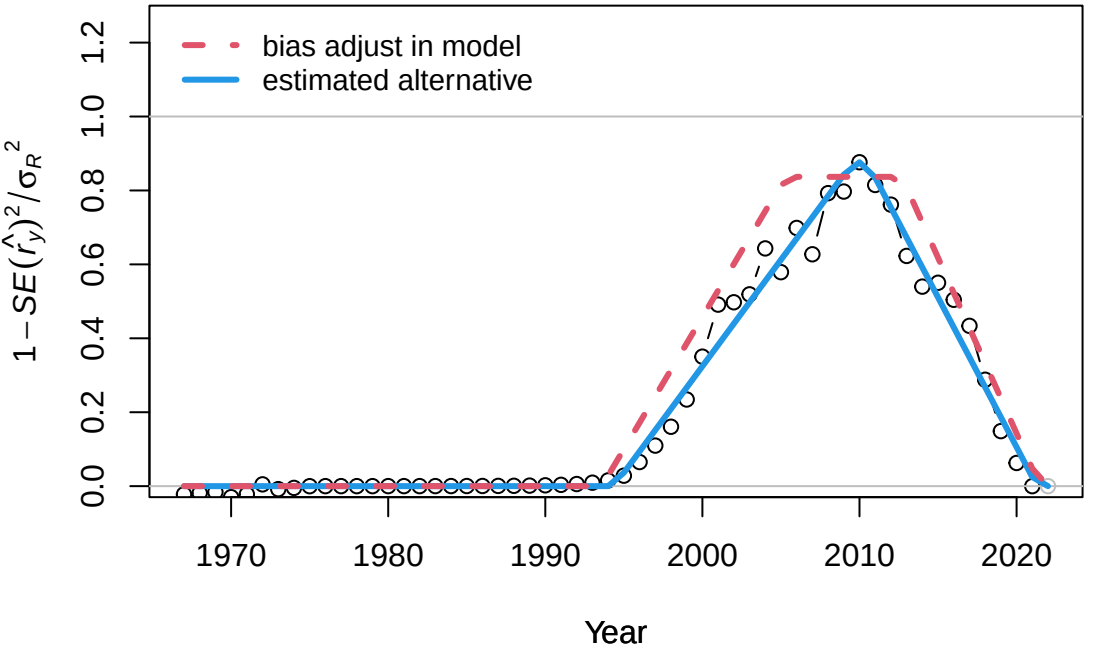

Summary Fishing Mortality
0.0
0.1
0.2
0.3
0.4
0.5
0.6
1970
1980
1990
2000
2010
2020
Year

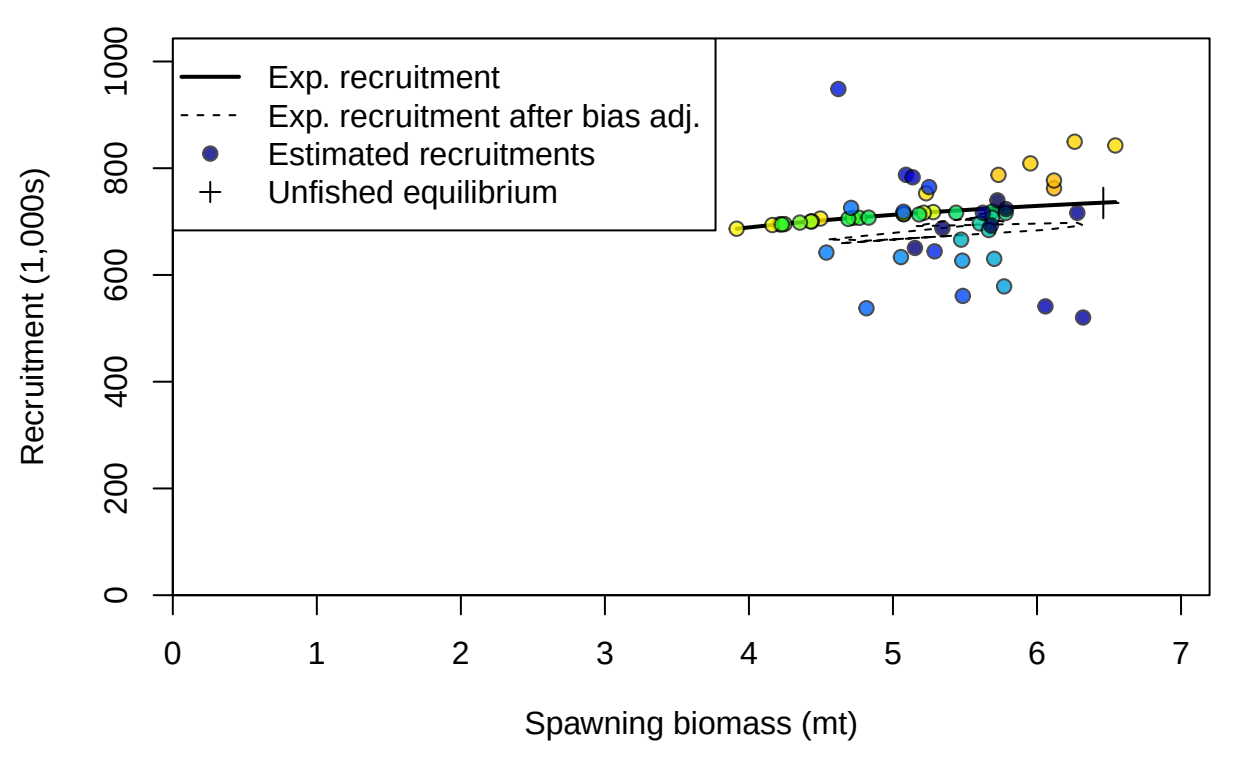

Spawning biomass (mt)
0
5
10
15
1970
1980
1990
2000
2010
2020
Year
equilibrium
without fishing
with fishing

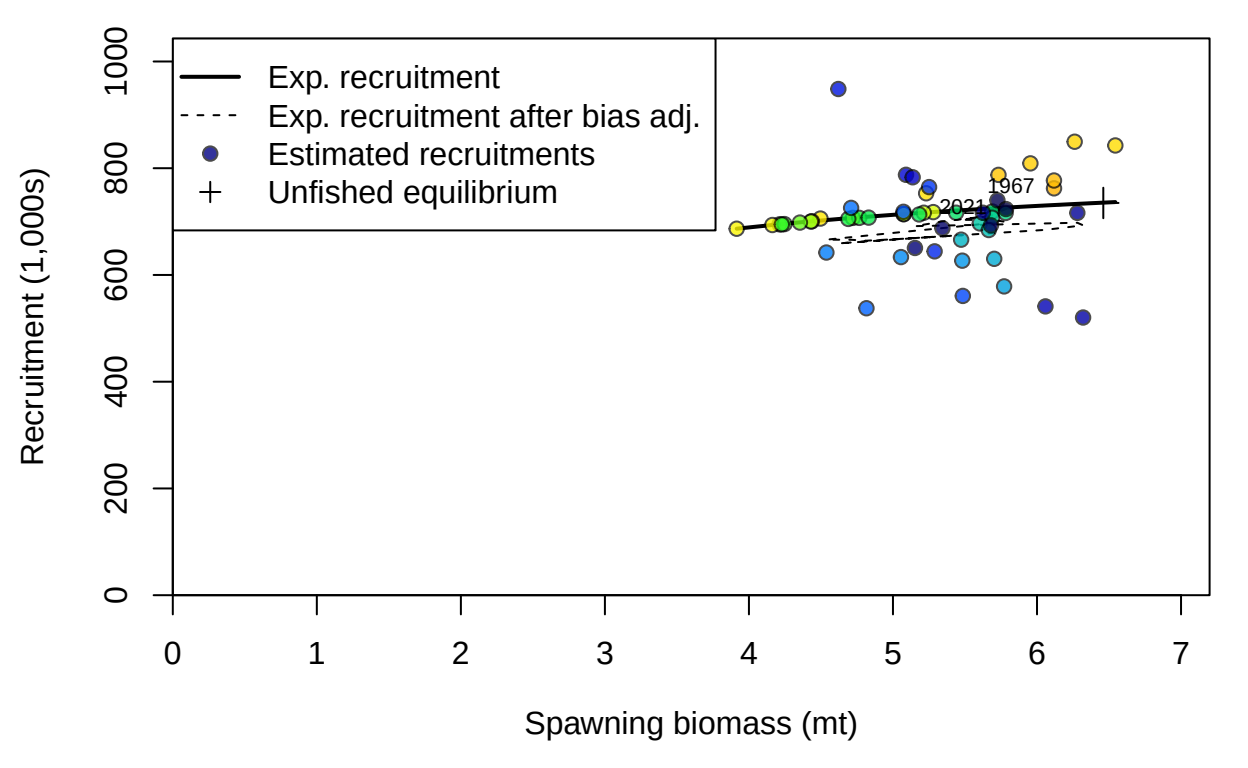

Log recruitment deviation
0.3
0.1
−0.1
−0.3
1970
1980
1990
2000
2010
2020
Year

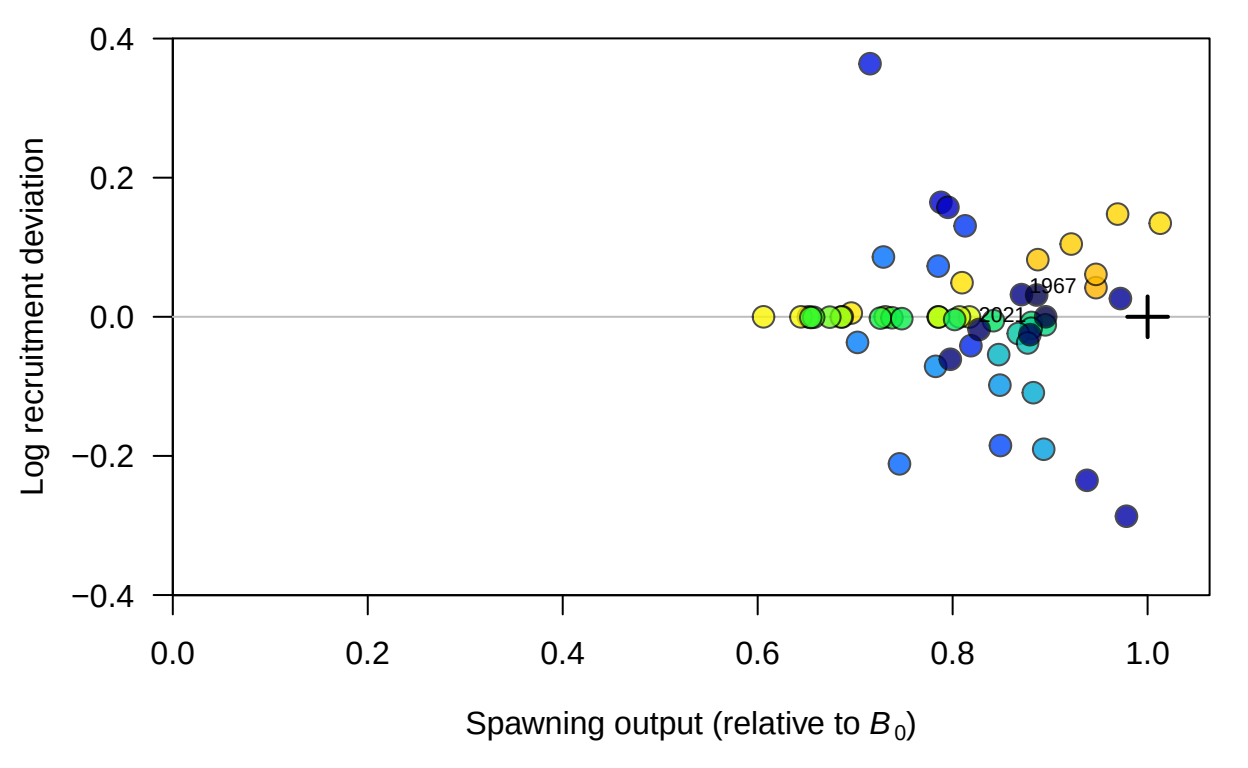

Log recruitment deviation
1.0
0.5
0.0
−0.5
1970
1980
1990
2000
2010
2020
Year

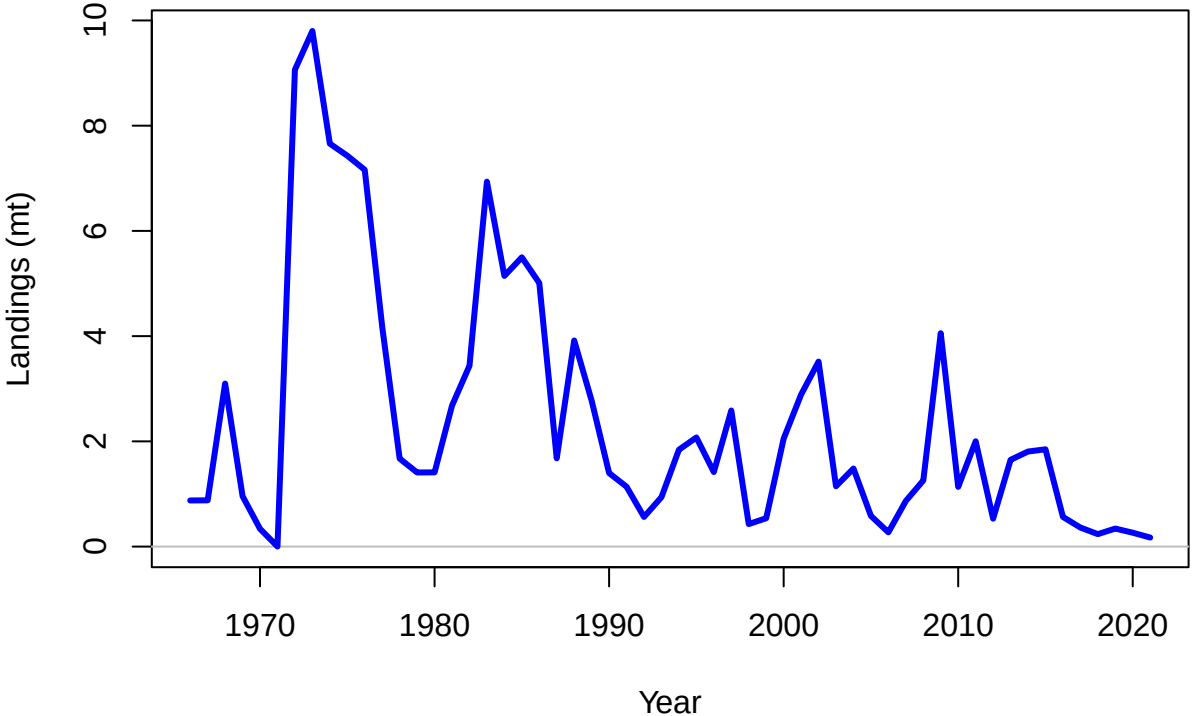

Recruitment deviation variance
Asymptotic standard error estimate
0.0
0.1
0.2
0.3
0.4
1970
1980
1990
2000
2010
2020
Year

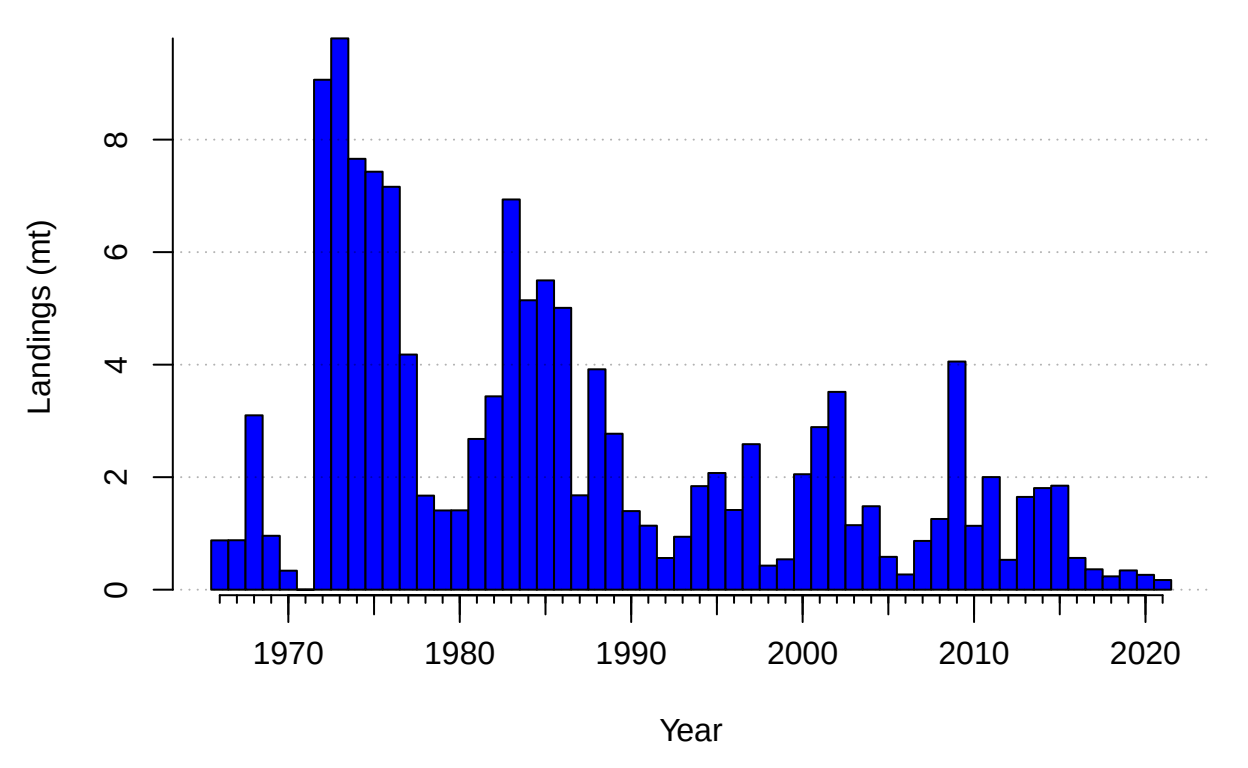

bias adjust in model
estimated alternative
$1-SE(\hat{r}_y)^2/\sigma_R{}^2$
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1970
1980
1990
2000
2010
2020
Year

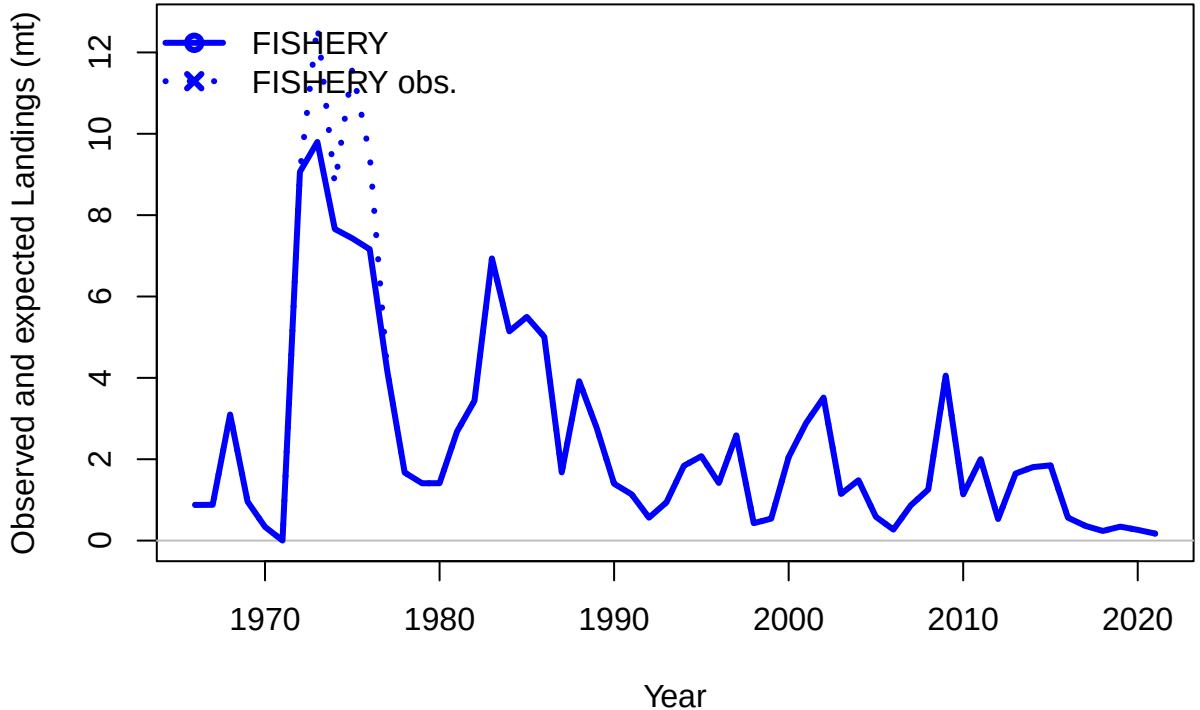

Exp. recruitment
Exp. recruitment after bias adj.
Estimated recruitments
Unfished equilibrium
Recruitment (1,000s)
0
200
400
600
800
1000
0
1
2
3
4
5
6
7
Spawning biomass (mt)

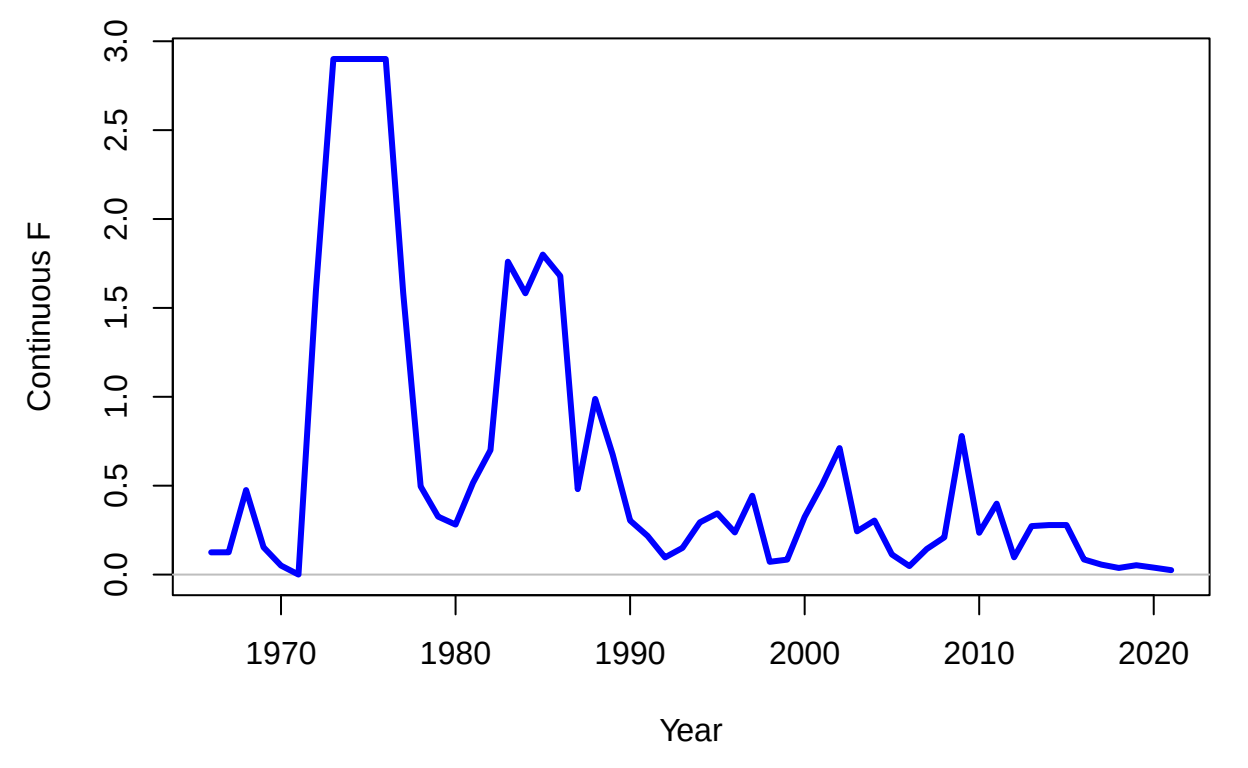

Exp. recruitment
Exp. recruitment after bias adj.
Estimated recruitments
Unfished equilibrium
1967
2021
Recruitment (1,000s)
0
200
400
600
800
1000
0
1
2
3
4
5
6
7
Spawning biomass (mt)

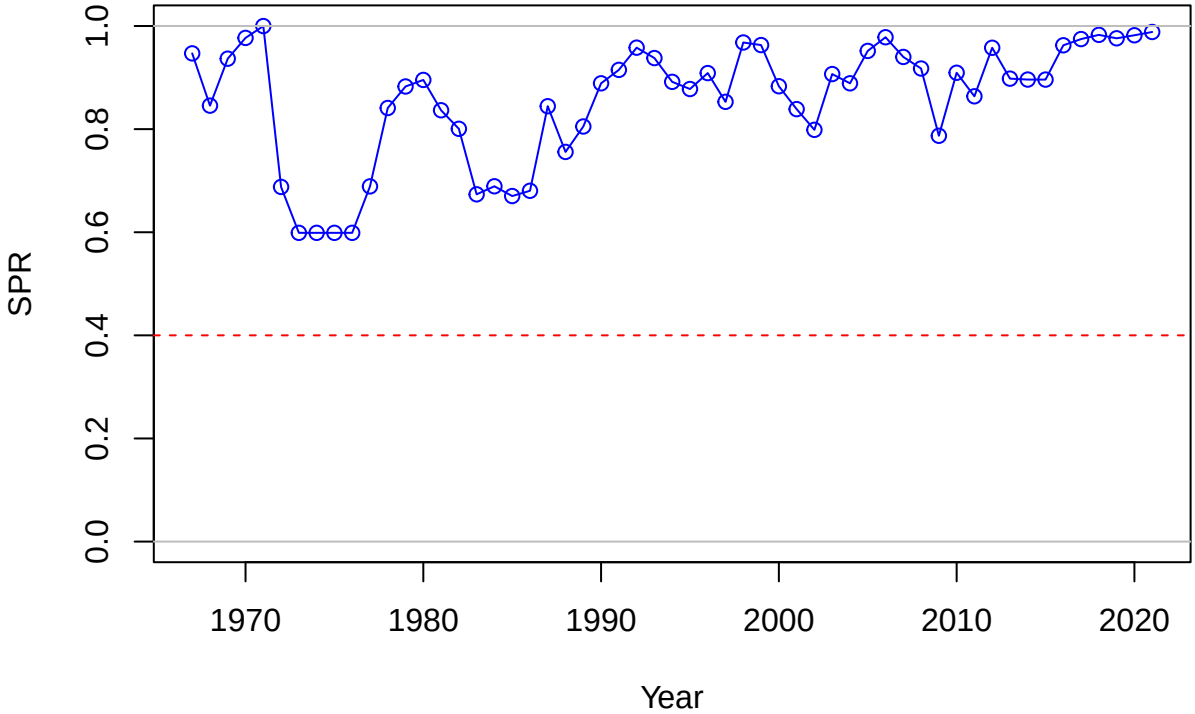

0.4
0.2
0.0
−0.2
−0.4
Log recruitment deviation
0.0
0.2
0.4
0.6
0.8
1.0
Spawning output (relative to B_0)
1967
2021

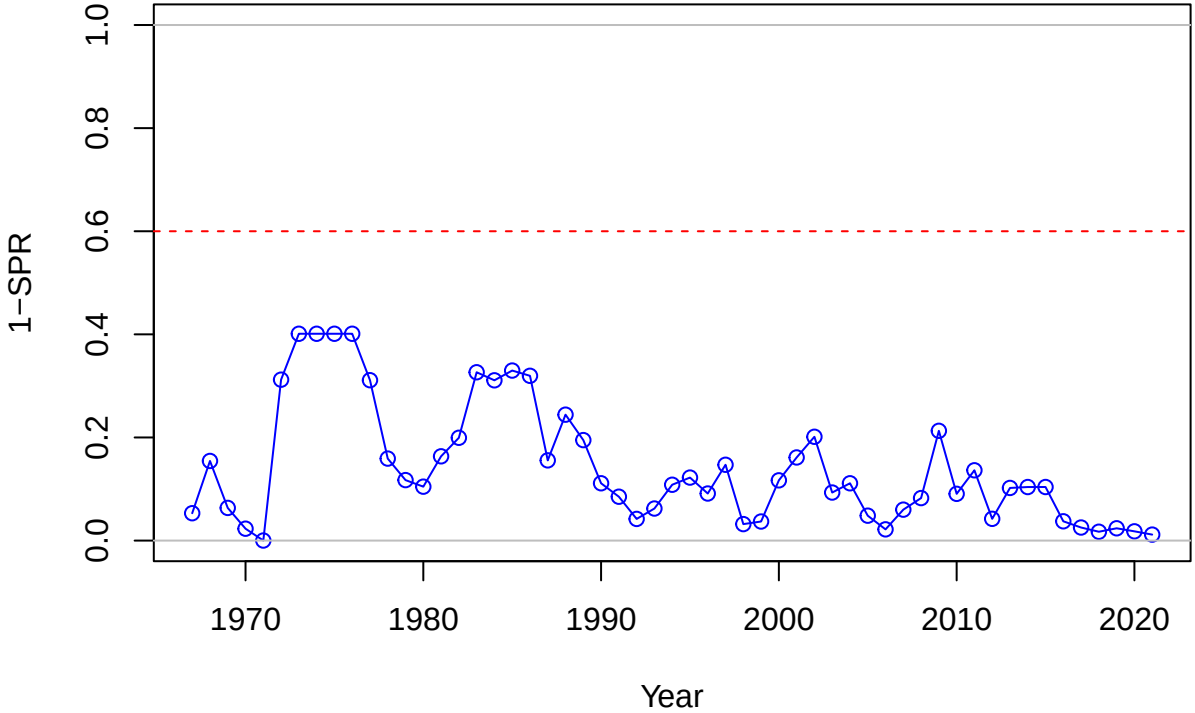

Landings (mt)
0
2
4
6
8
10
1970
1980
1990
2000
2010
2020
Year

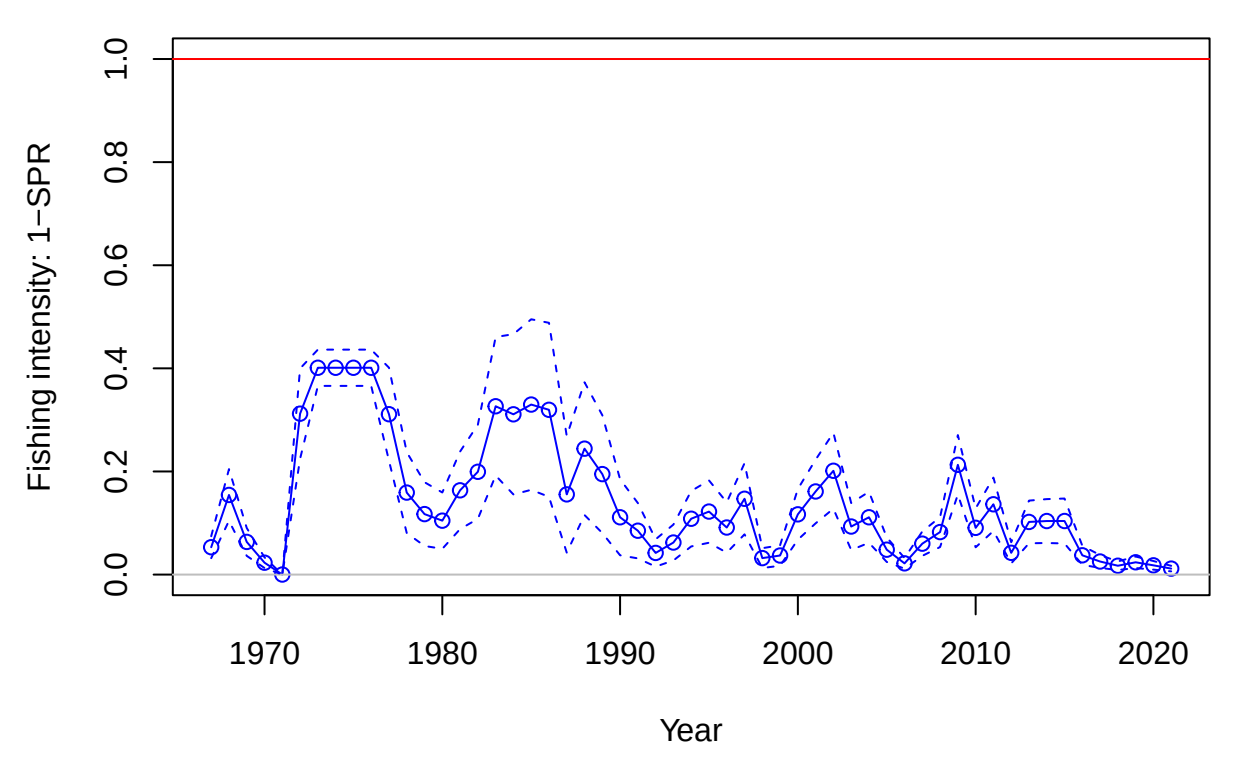

Landings (mt)
0
2
4
6
8
1970
1980
1990
2000
2010
2020
Year

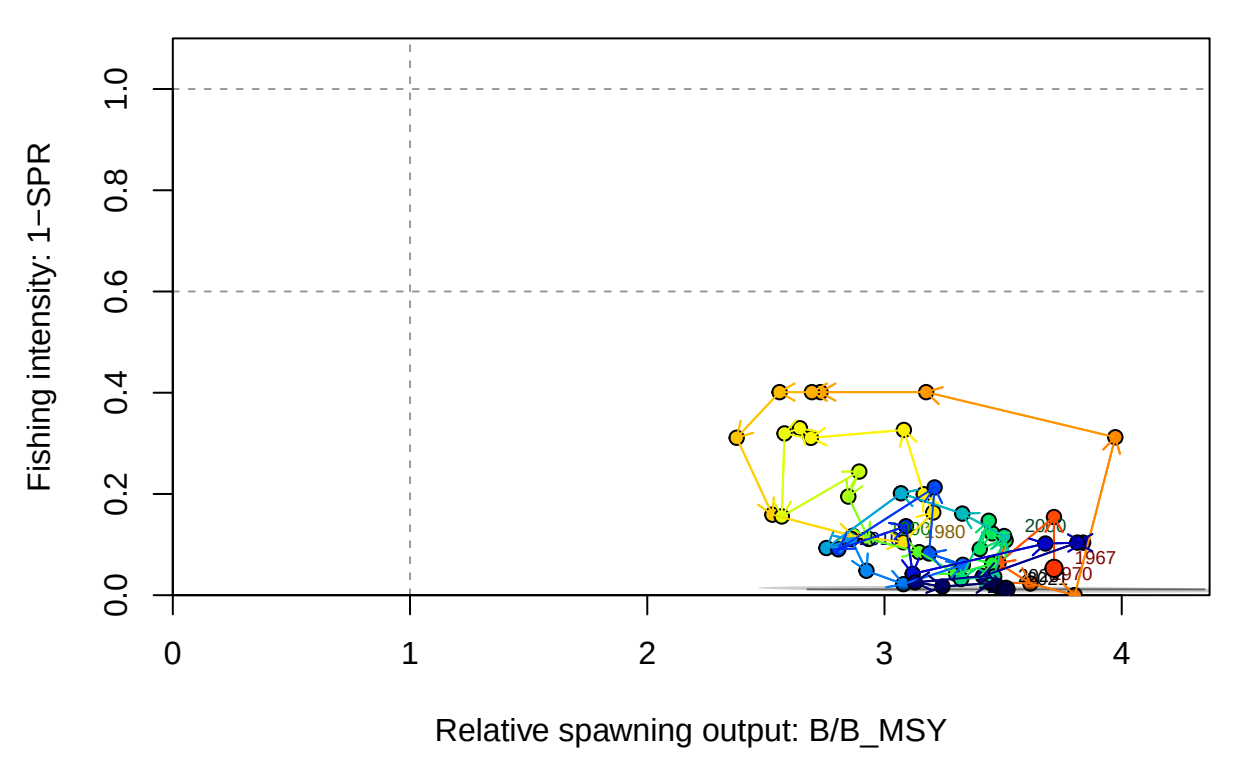

FISHERY
FISHERY obs.
Observed and expected Landings (mt)
0
2
4
6
8
10
12
1970
1980
1990
2000
2010
2020
Year

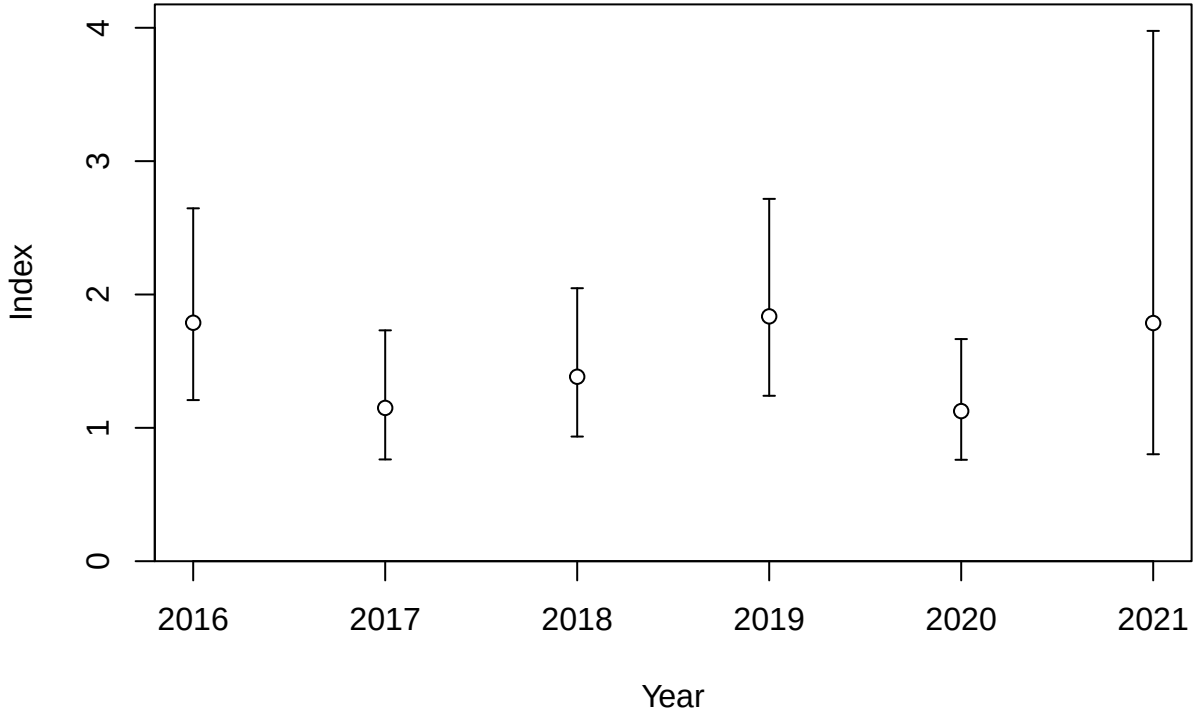

Continuous F
0.0
0.5
1.0
1.5
2.0
2.5
3.0
1970
1980
1990
2000
2010
2020
Year

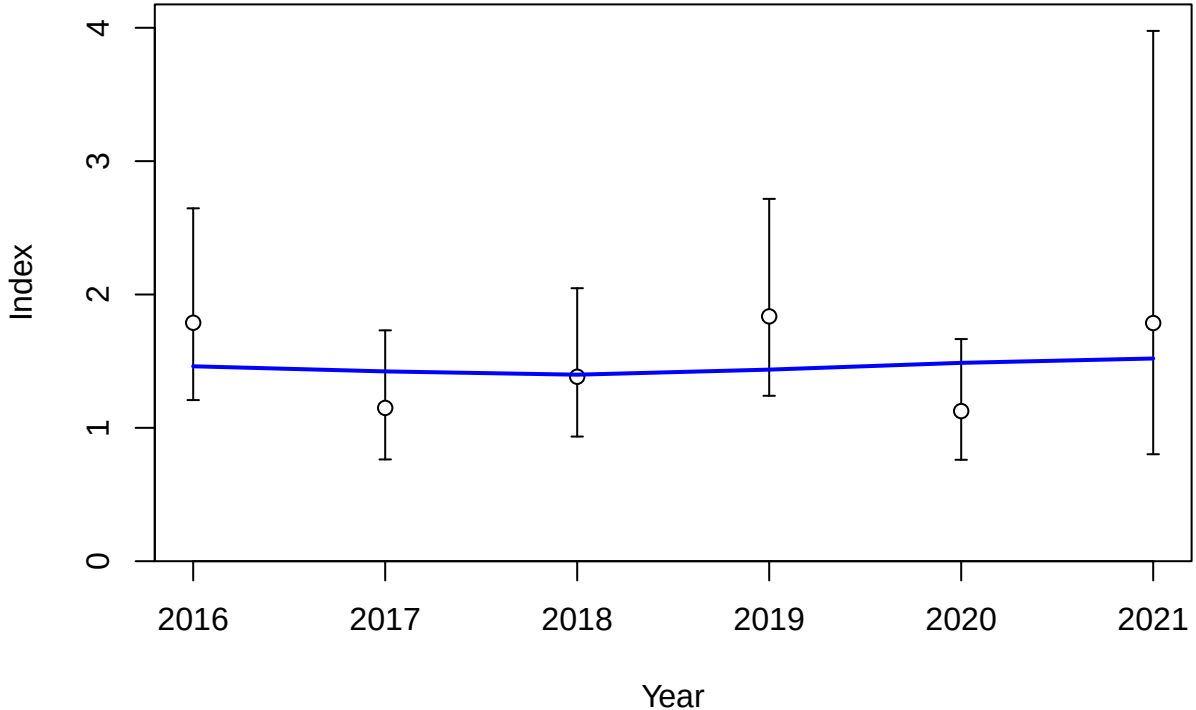

SPR
0.0
0.2
0.4
0.6
0.8
1.0
1970
1980
1990
2000
2010
2020
Year

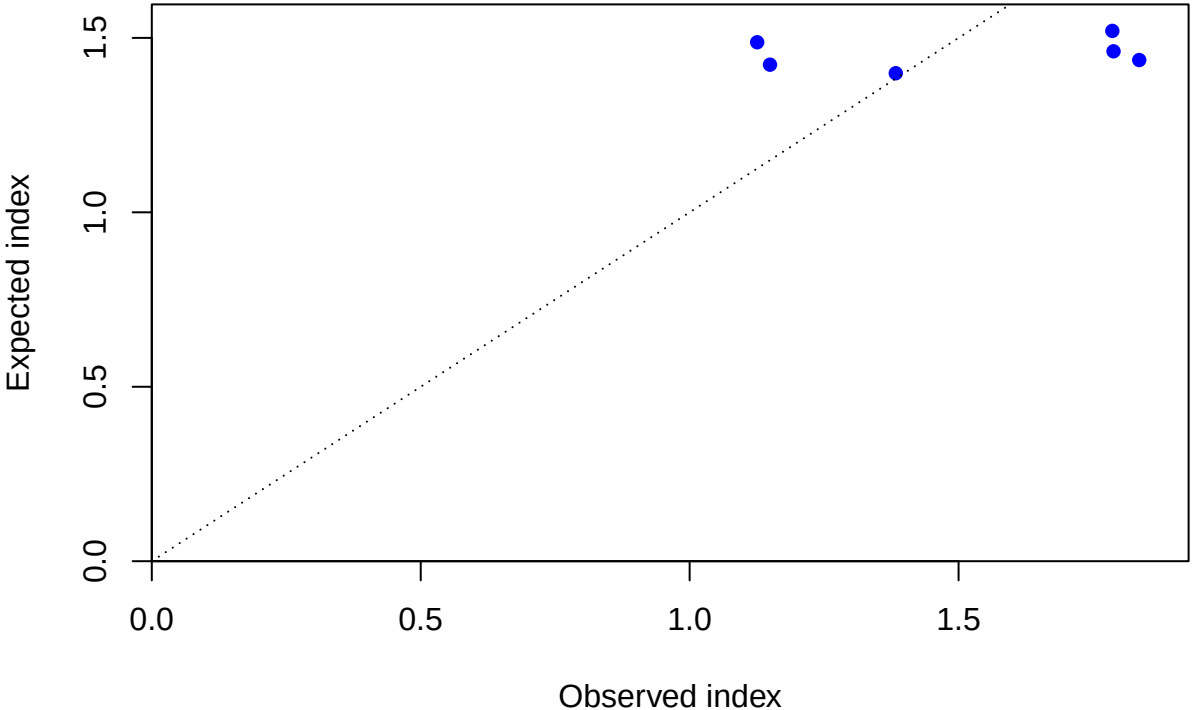

1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
1970
1980
1990
2000
2010
2020
Year

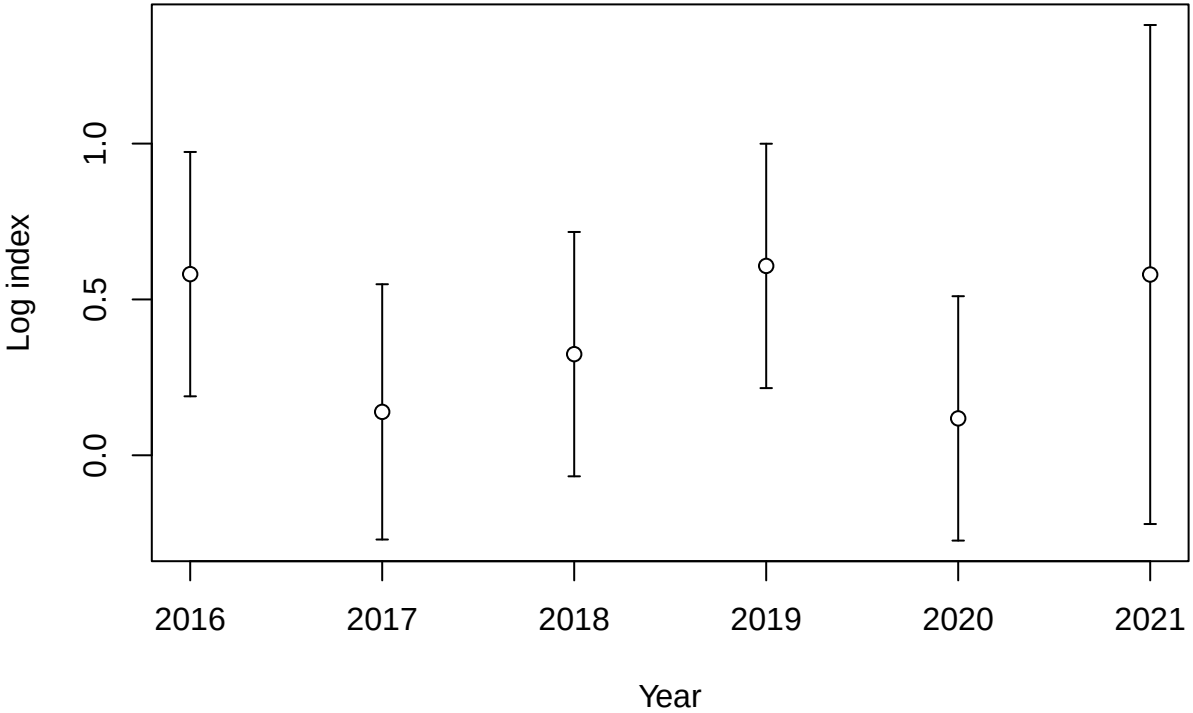

Fishing intensity: 1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
1970
1980
1990
2000
2010
2020
Year

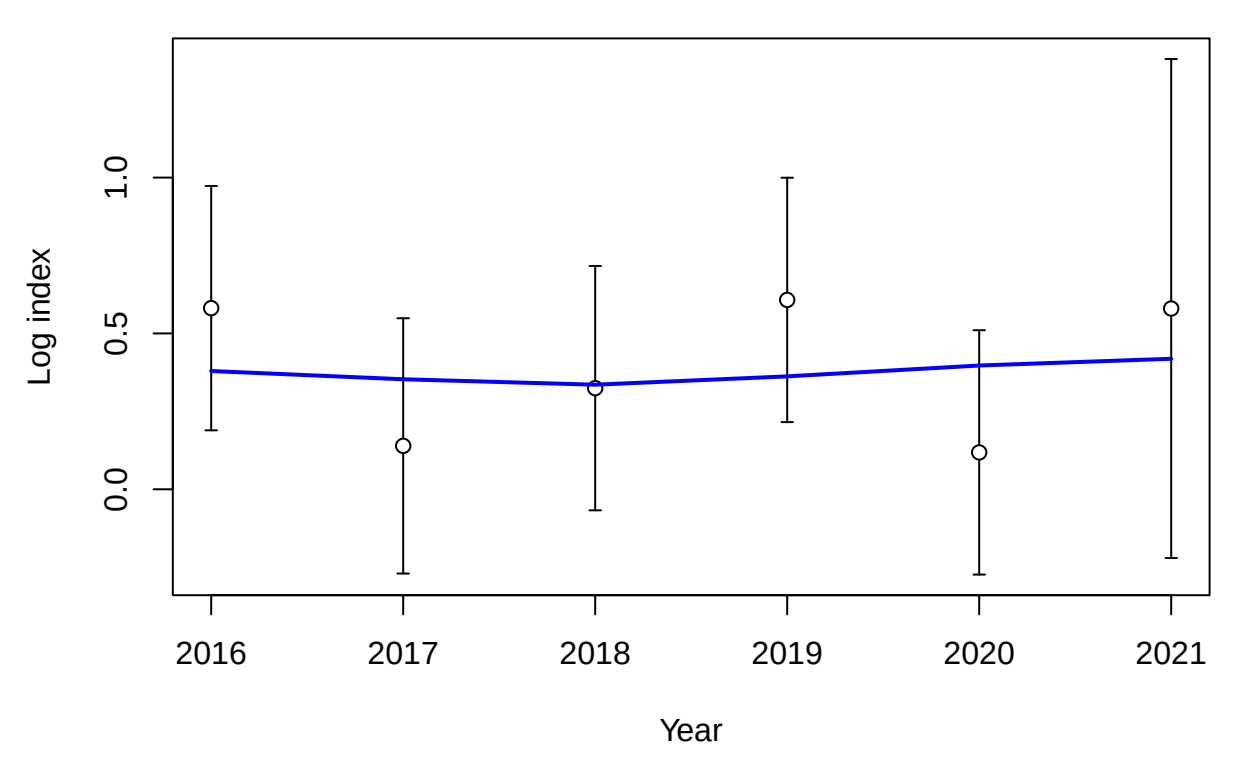

Fishing intensity: 1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
0
1
2
3
4
Relative spawning output: B/B_MSY
2000
1967
1970

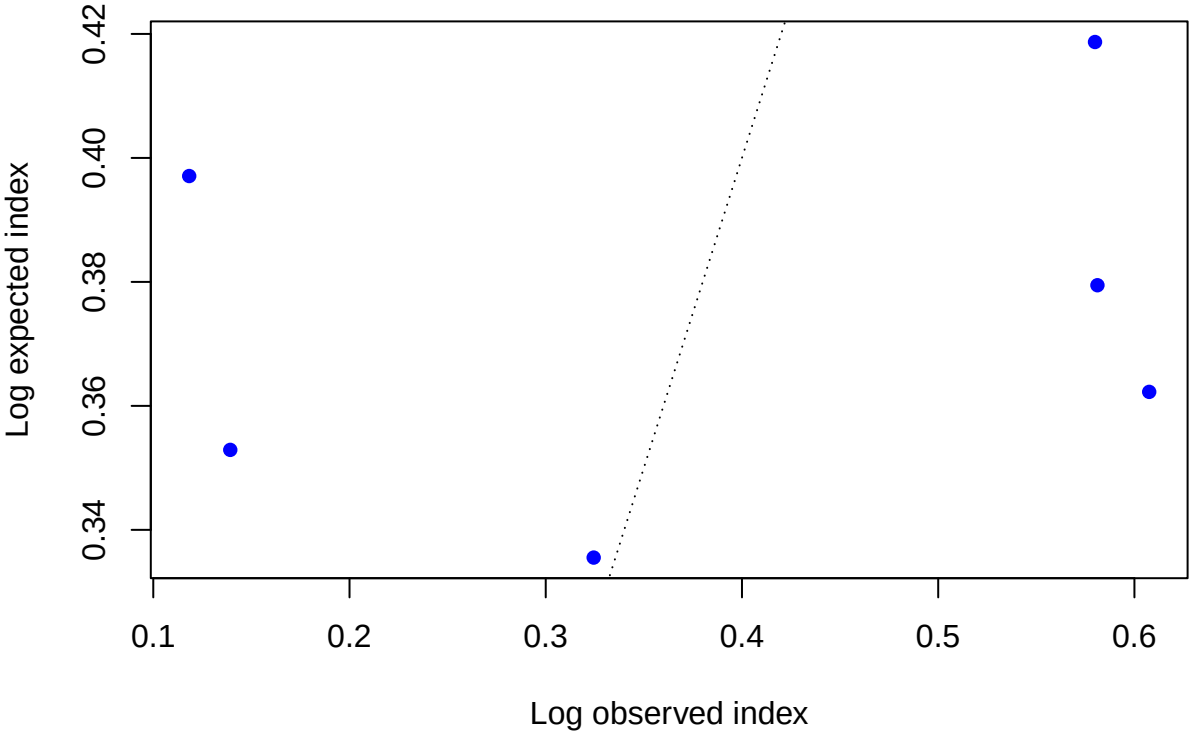

Index
0
1
2
3
4
2016
2017
2018
2019
2020
2021
Year

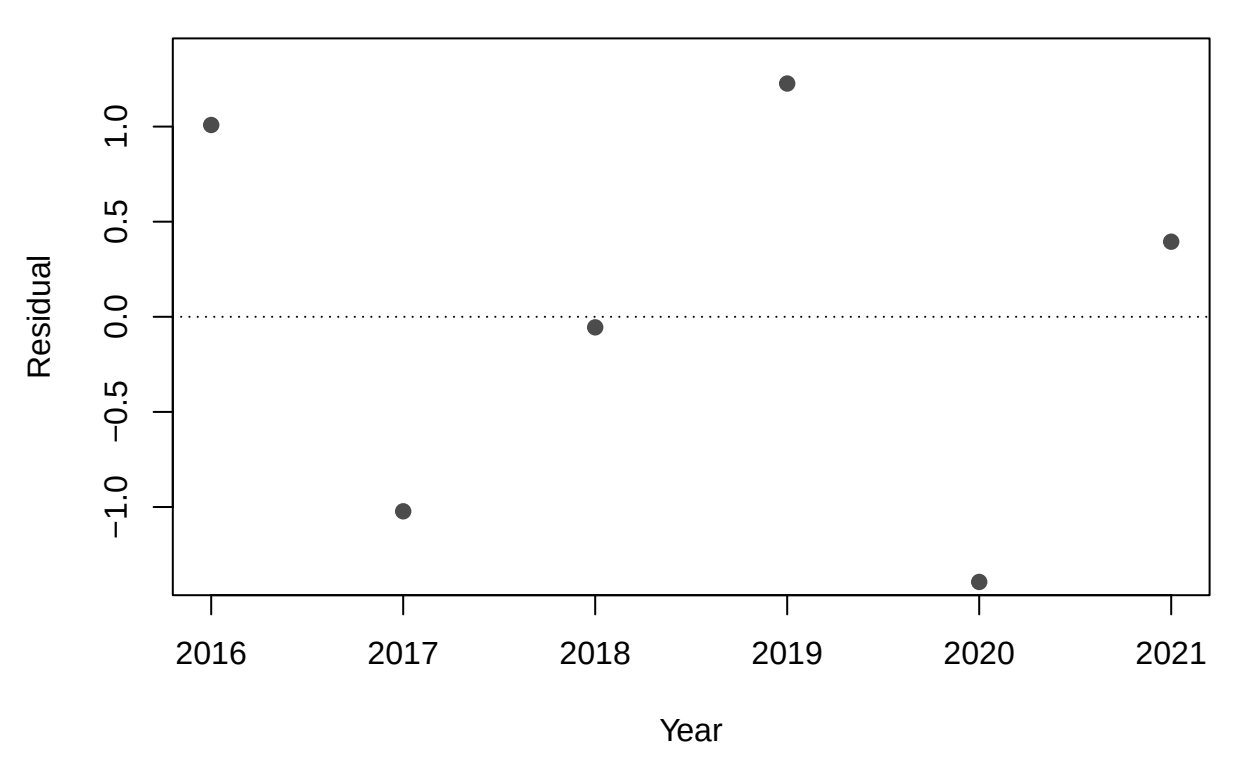

Index
0
1
2
3
4
2016
2017
2018
2019
2020
2021
Year

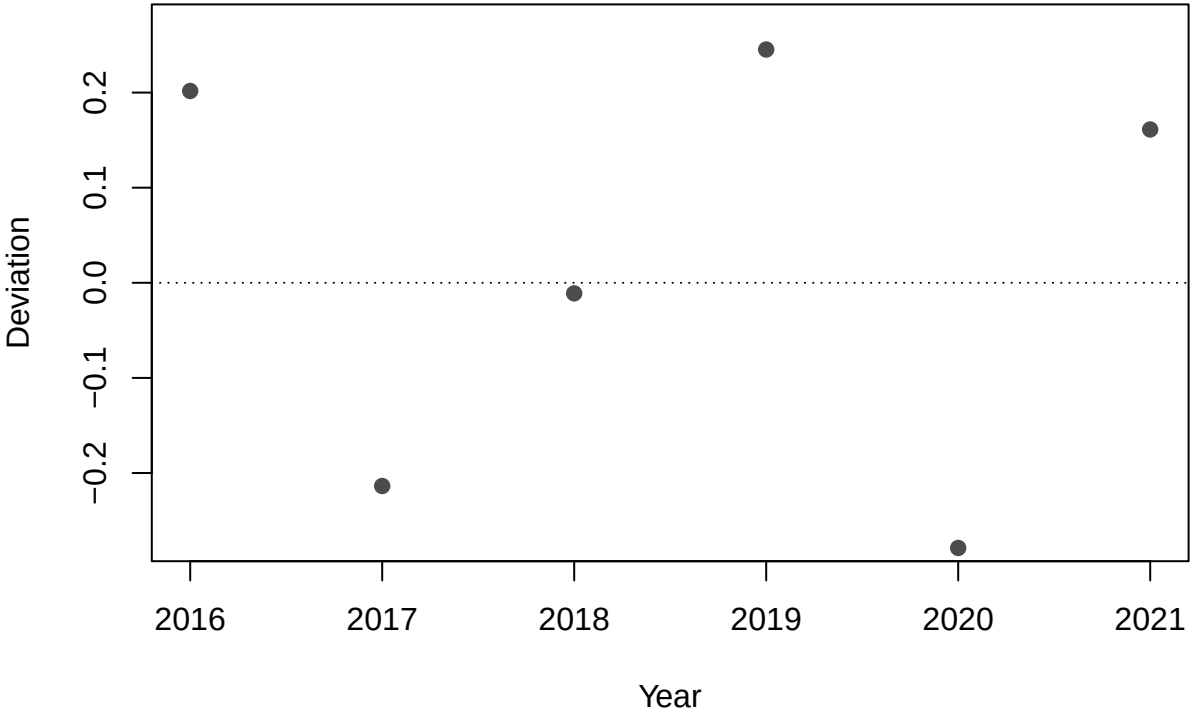

Expected index
0.0
0.5
1.0
1.5
0.0
0.5
1.0
1.5
Observed index

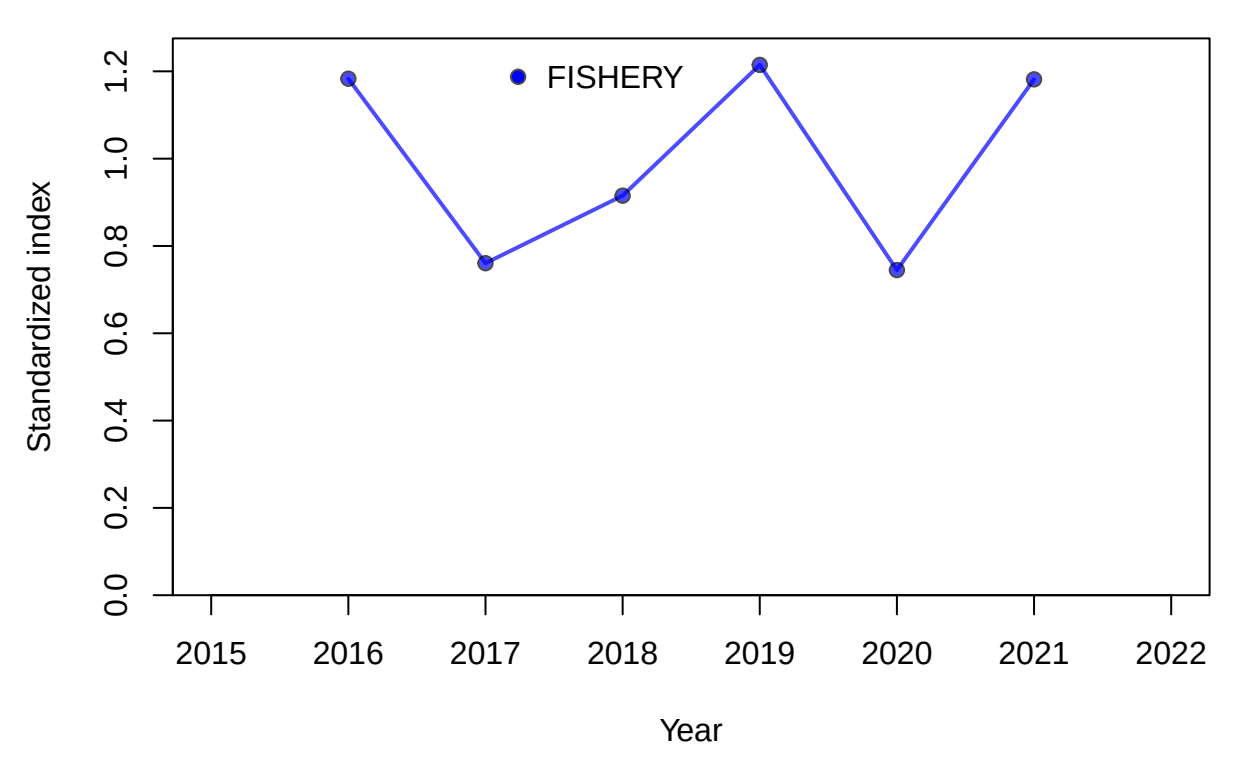

Log index
0.0
0.5
1.0
2016
2017
2018
2019
2020
2021
Year

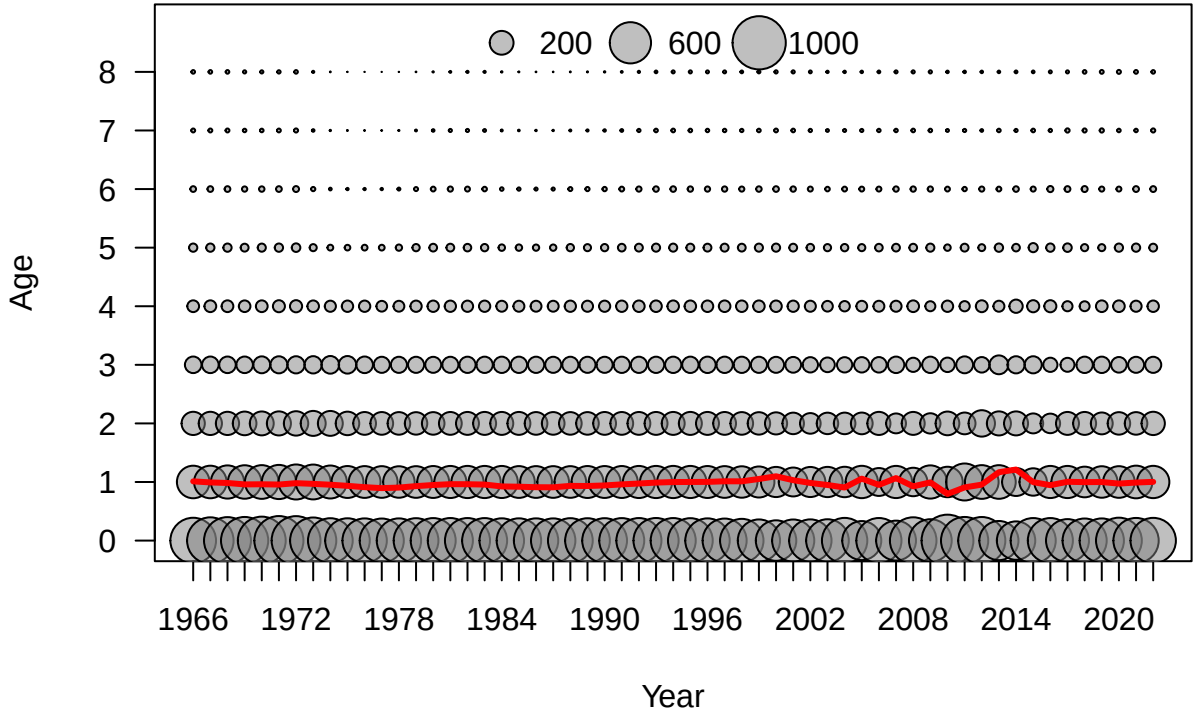

Log index
0.0
0.5
1.0
2016
2017
2018
2019
2020
2021
Year

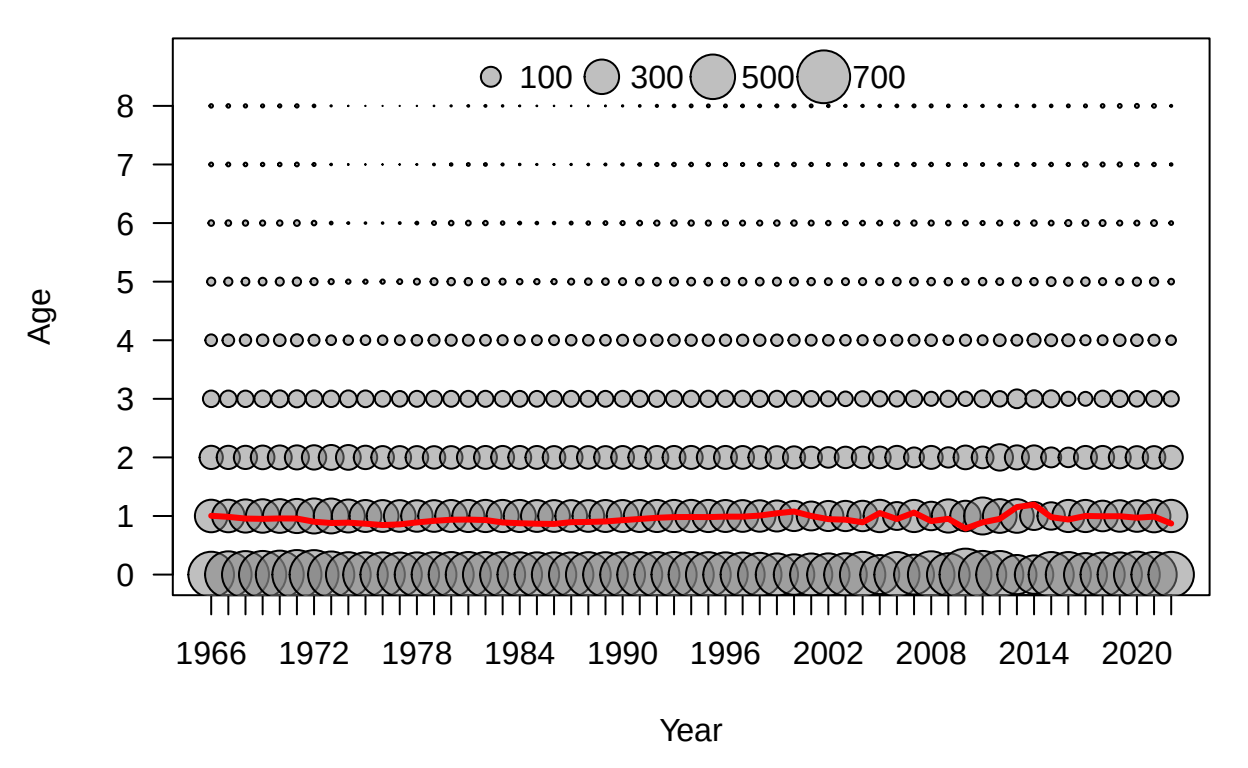

Log expected index
0.34
0.36
0.38
0.40
0.42
0.1
0.2
0.3
0.4
0.5
0.6
Log observed index

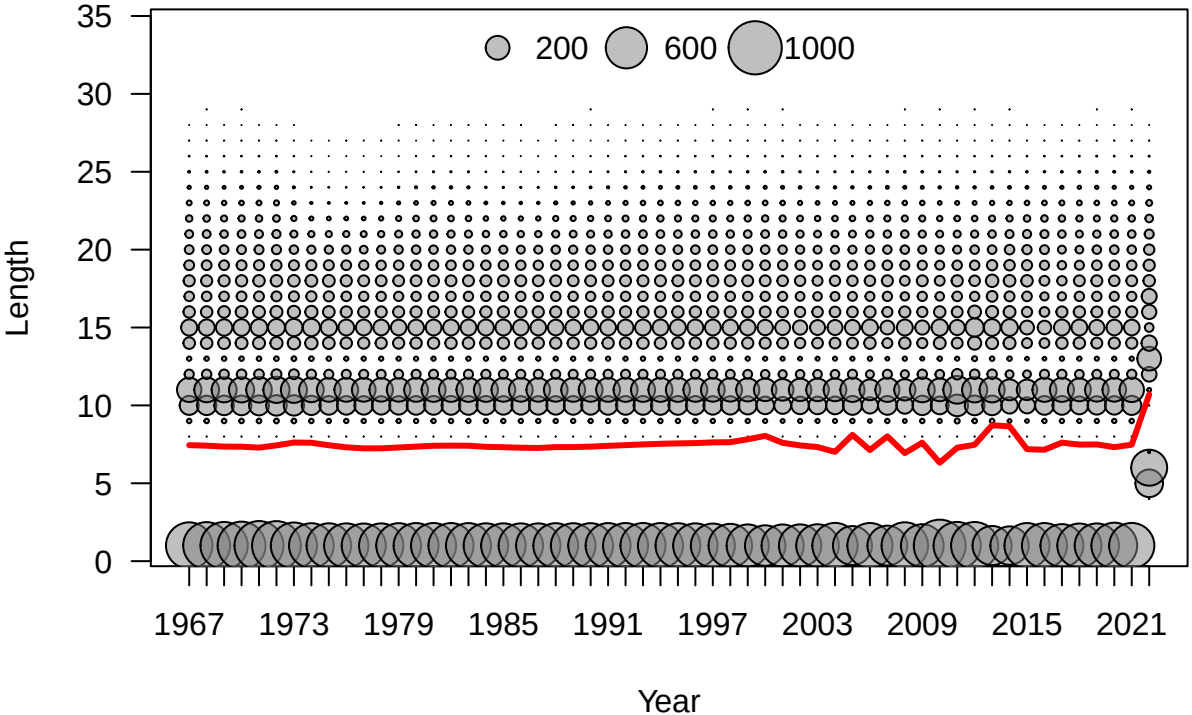

Residual
1.0
0.5
0.0
−0.5
−1.0
2016
2017
2018
2019
2020
2021
Year

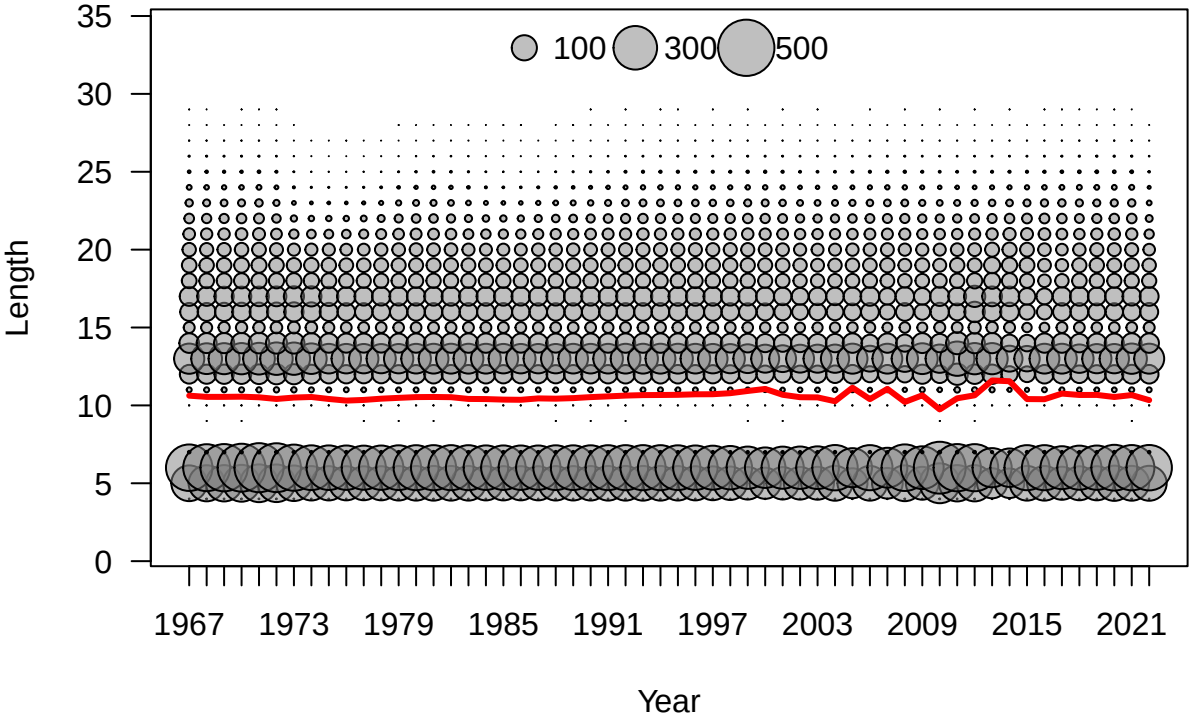

Deviation
0.2
0.1
0.0
−0.1
−0.2
2016
2017
2018
2019
2020
2021
Year

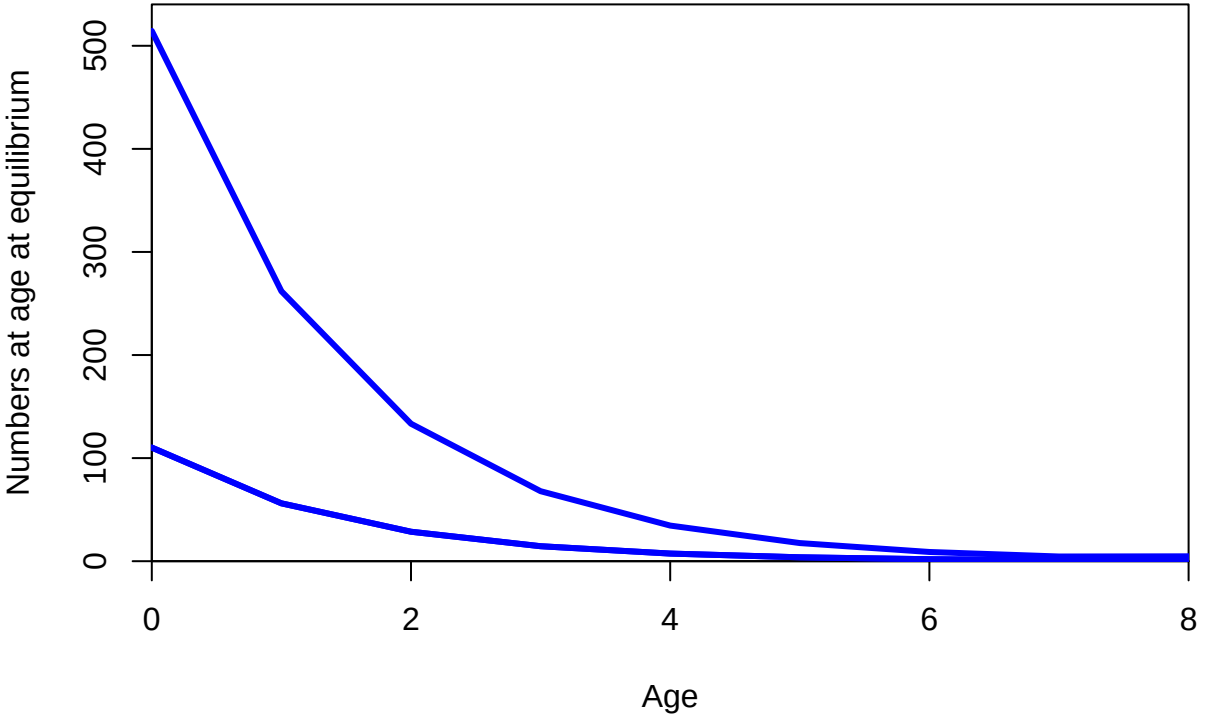

FISHERY
Standardized index
0.0
0.2
0.4
0.6
0.8
1.0
1.2
2015
2016
2017
2018
2019
2020
2021
2022
Year

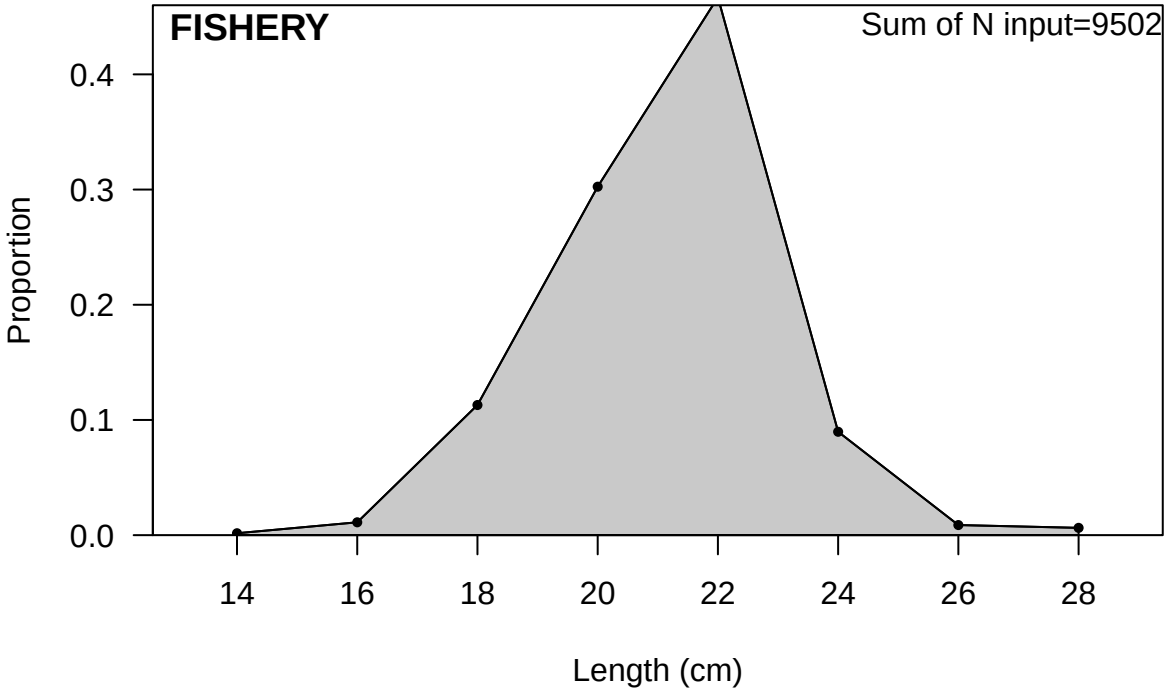

200
600
1000
Age
0
1
2
3
4
5
6
7
8
1966
1972
1978
1984
1990
1996
2002
2008
2014
2020
Year

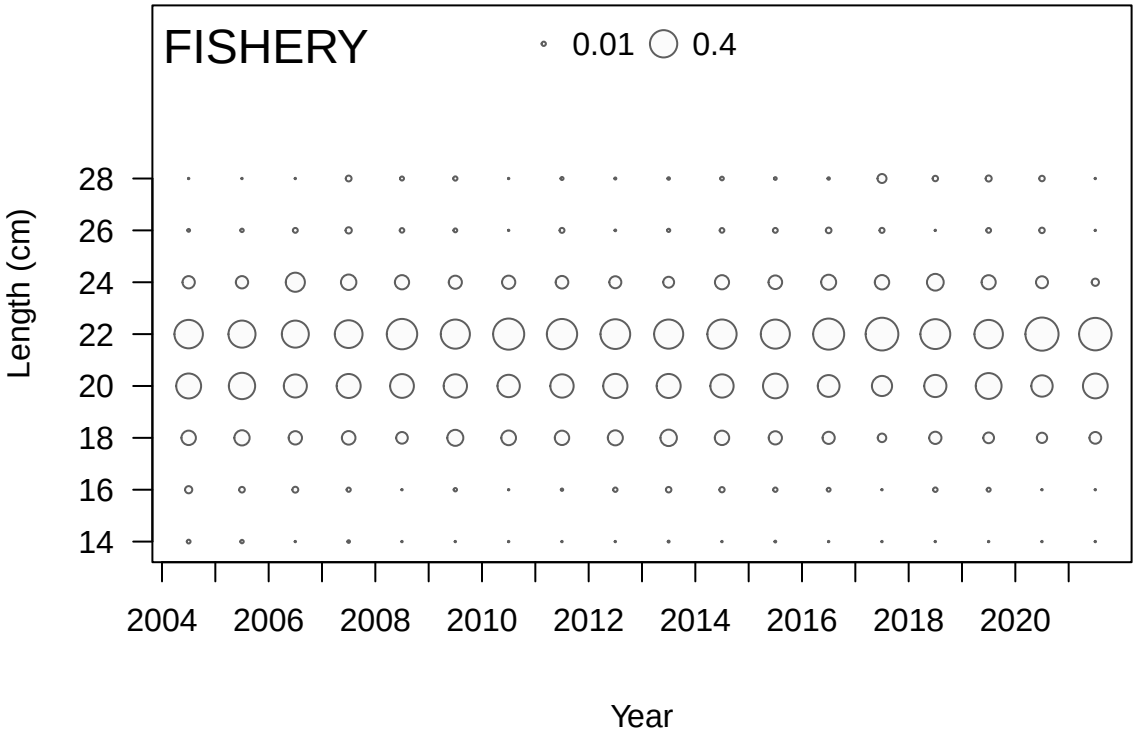

100
300
500
700
Age
0
1
2
3
4
5
6
7
8
1966
1972
1978
1984
1990
1996
2002
2008
2014
2020
Year

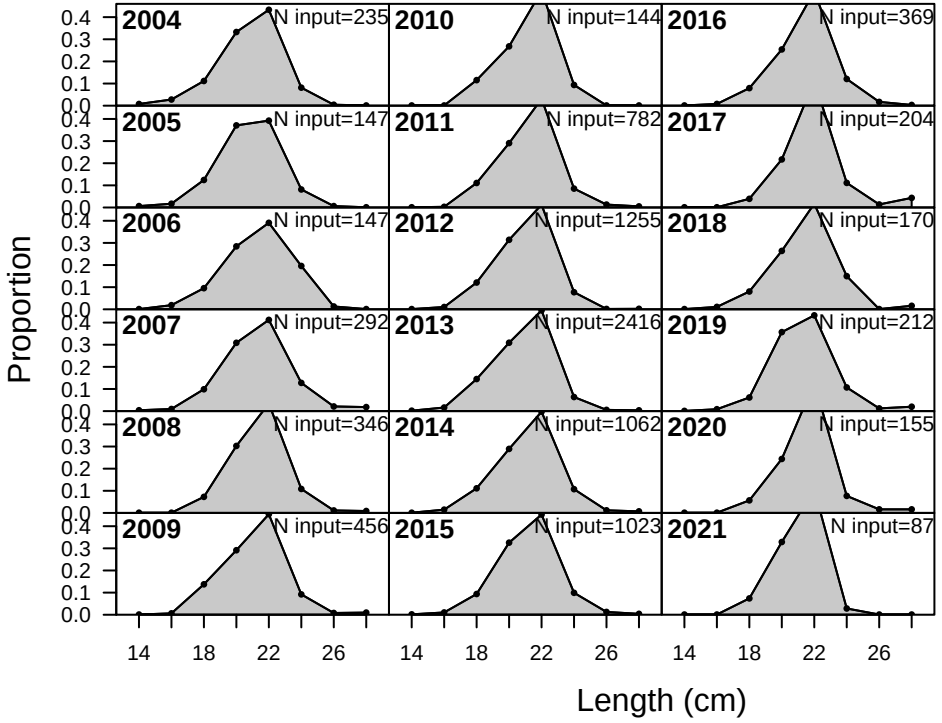

200
600
1000
Length
Year
0
5
10
15
20
25
30
35
1967
1973
1979
1985
1991
1997
2003
2009
2015
2021

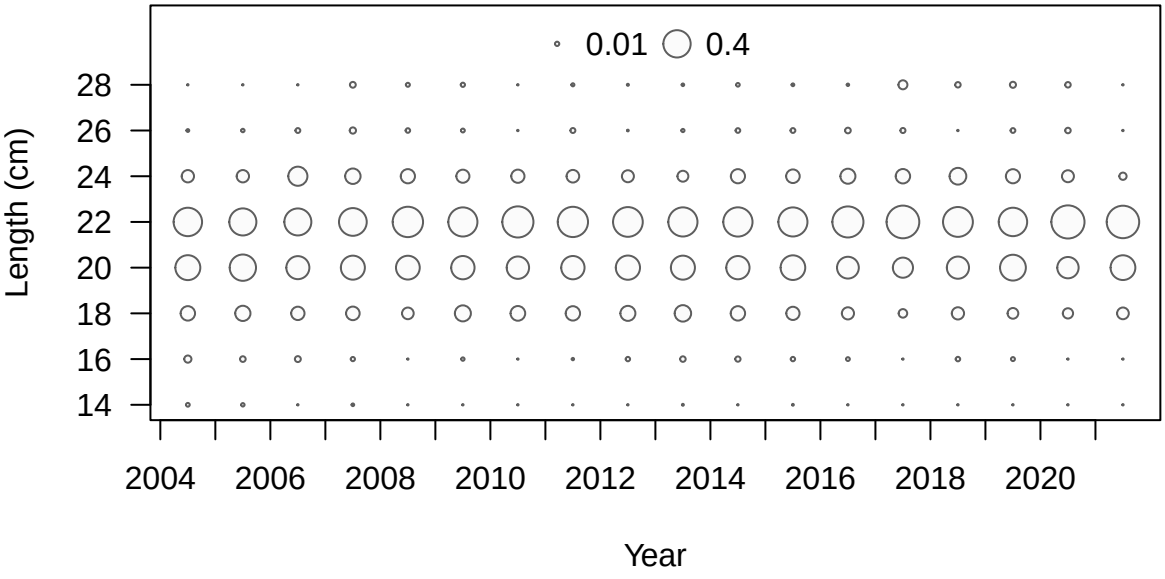

100
300
500
Length
0
5
10
15
20
25
30
35
1967
1973
1979
1985
1991
1997
2003
2009
2015
2021
Year

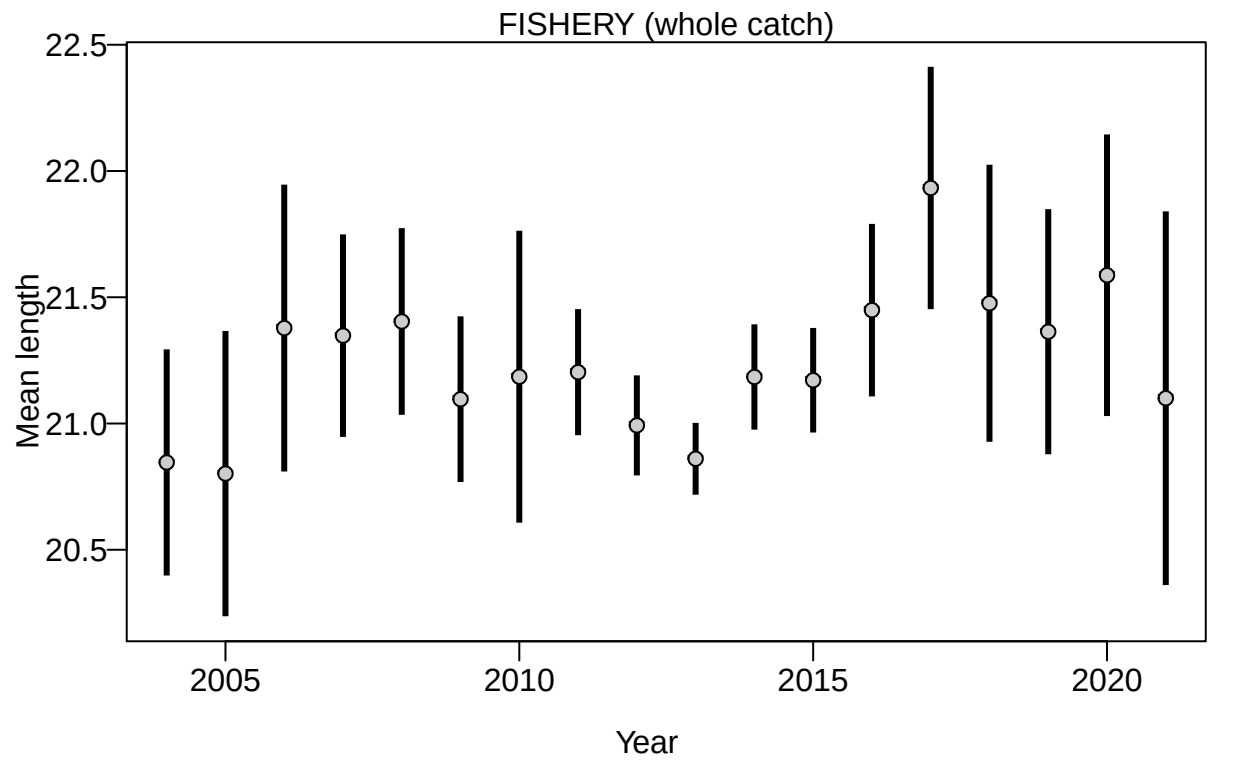

Numbers at age at equilibrium
0
100
200
300
400
500
0
2
4
6
8
Age

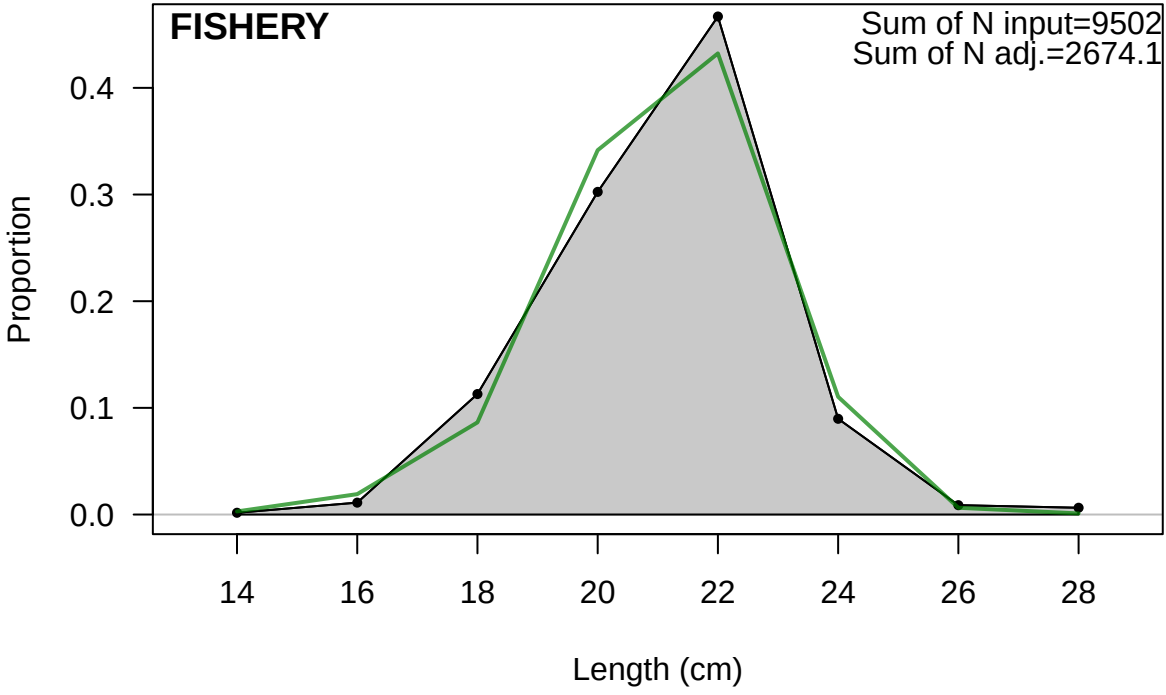

FISHERY
Sum of N input=9502
Proportion
0.0
0.1
0.2
0.3
0.4
14
16
18
20
22
24
26
28
Length (cm)

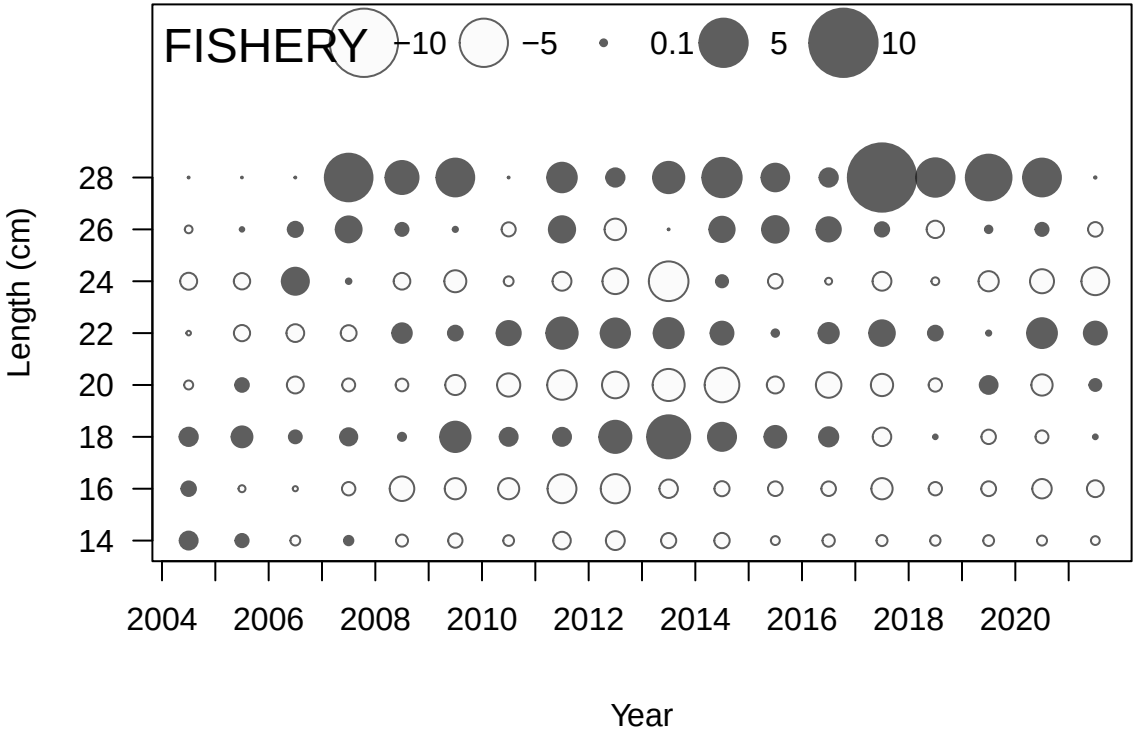

FISHERY
0.01
0.4
Length (cm)
28
26
24
22
20
18
16
14
2004
2006
2008
2010
2012
2014
2016
2018
2020
Year

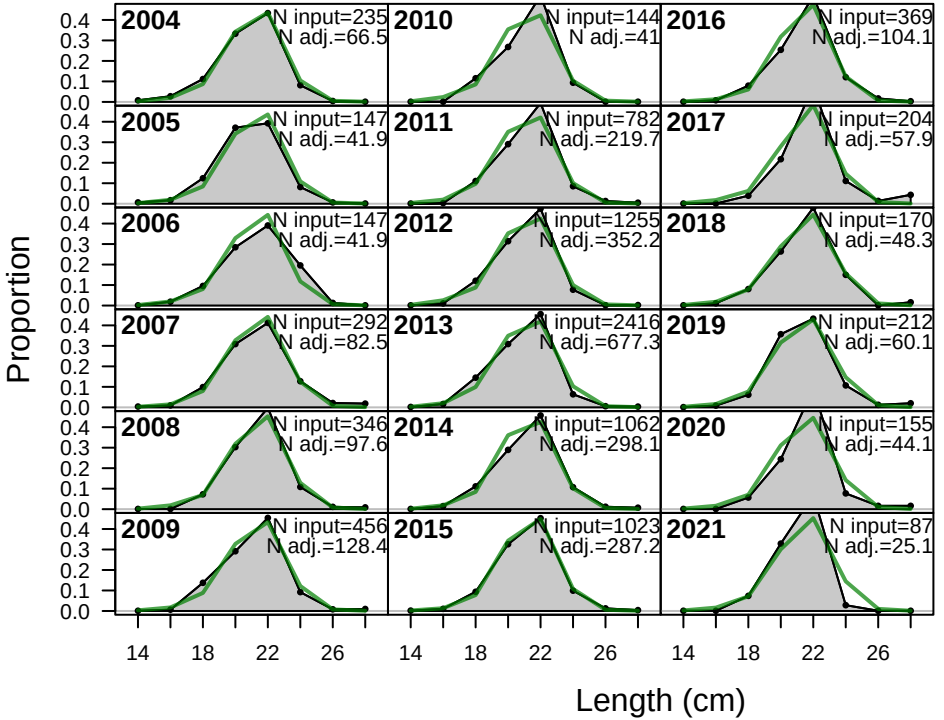

2004
N input=235
2010
N input=144
2016
N input=369
2005
N input=147
2011
N input=782
2017
N input=204
2006
N input=147
2012
N input=1255
2018
N input=170
2007
N input=292
2013
N input=2416
2019
N input=212
2008
N input=346
2014
N input=1062
2020
N input=155
2009
N input=456
2015
N input=1023
2021
N input=87
Proportion
0.0
0.1
0.2
0.3
0.4
14
18
22
26
Length (cm)

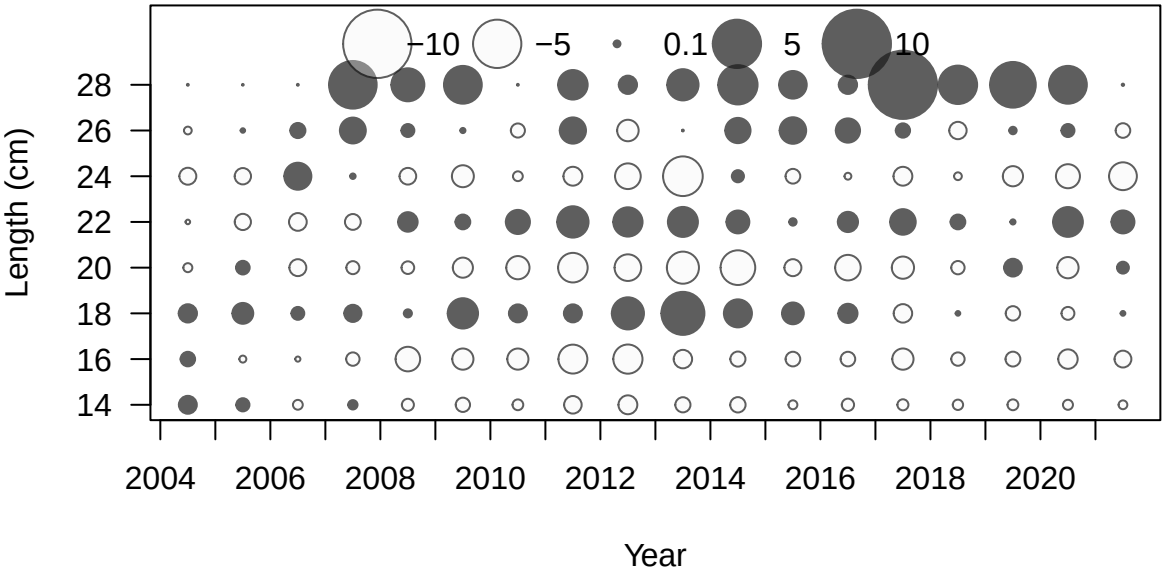

0.01
0.4
Length (cm)
28
26
24
22
20
18
16
14
2004
2006
2008
2010
2012
2014
2016
2018
2020
Year

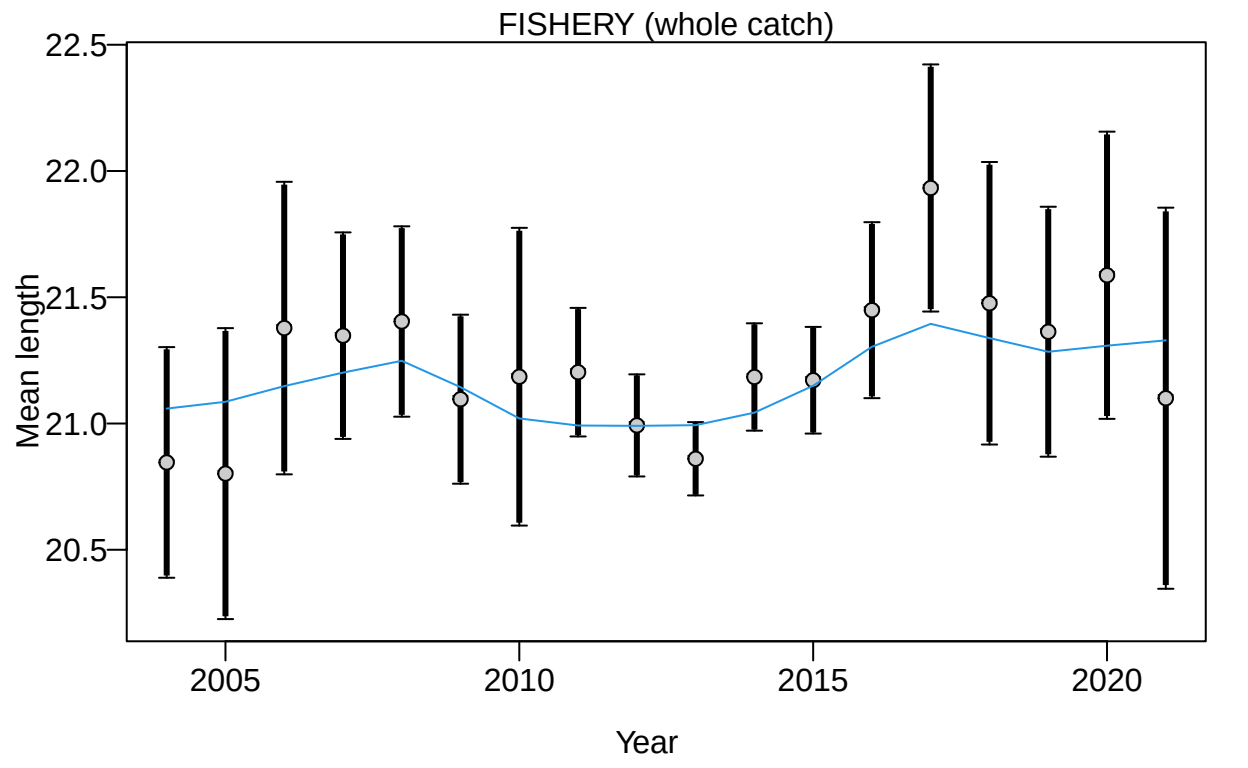

FISHERY (whole catch)
22.5
22.0
21.5
21.0
20.5
Mean length
2005
2010
2015
2020
Year

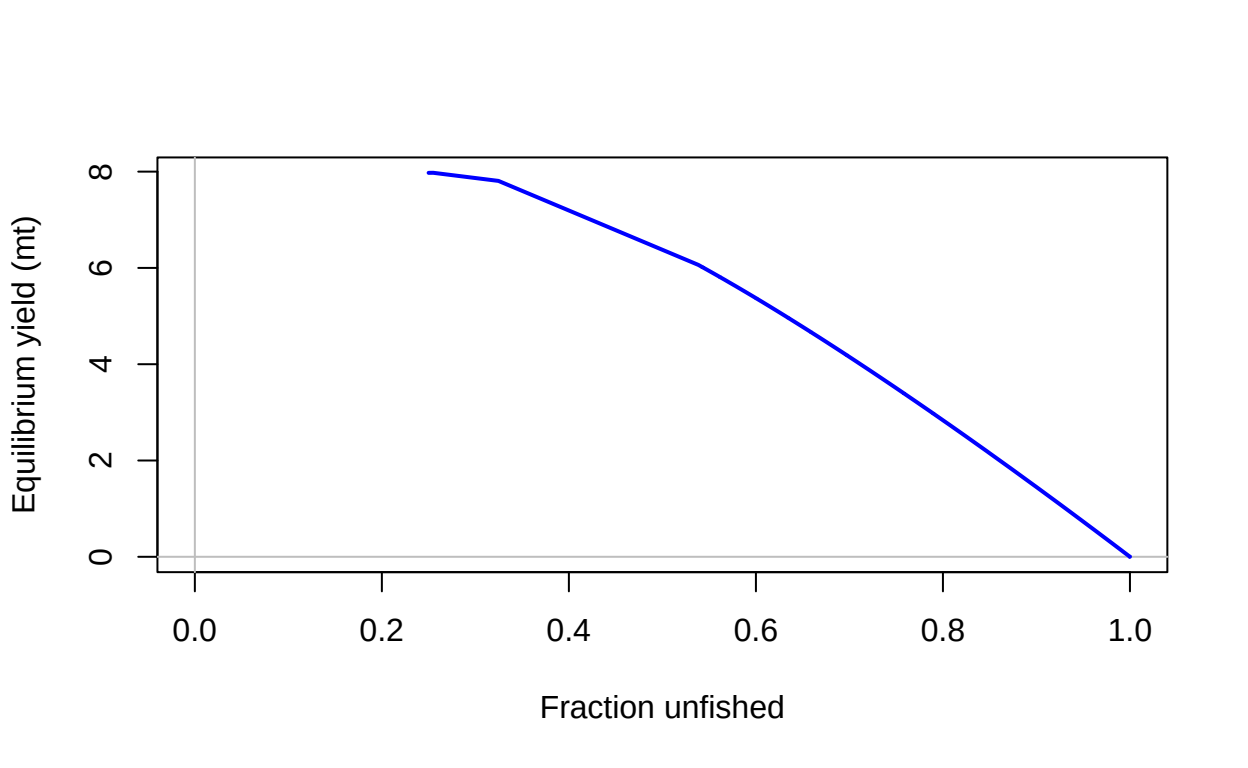

FISHERY
Sum of N input=9502
Sum of N adj.=2674.1
Proportion
0.0
0.1
0.2
0.3
0.4
14
16
18
20
22
24
26
28
Length (cm)

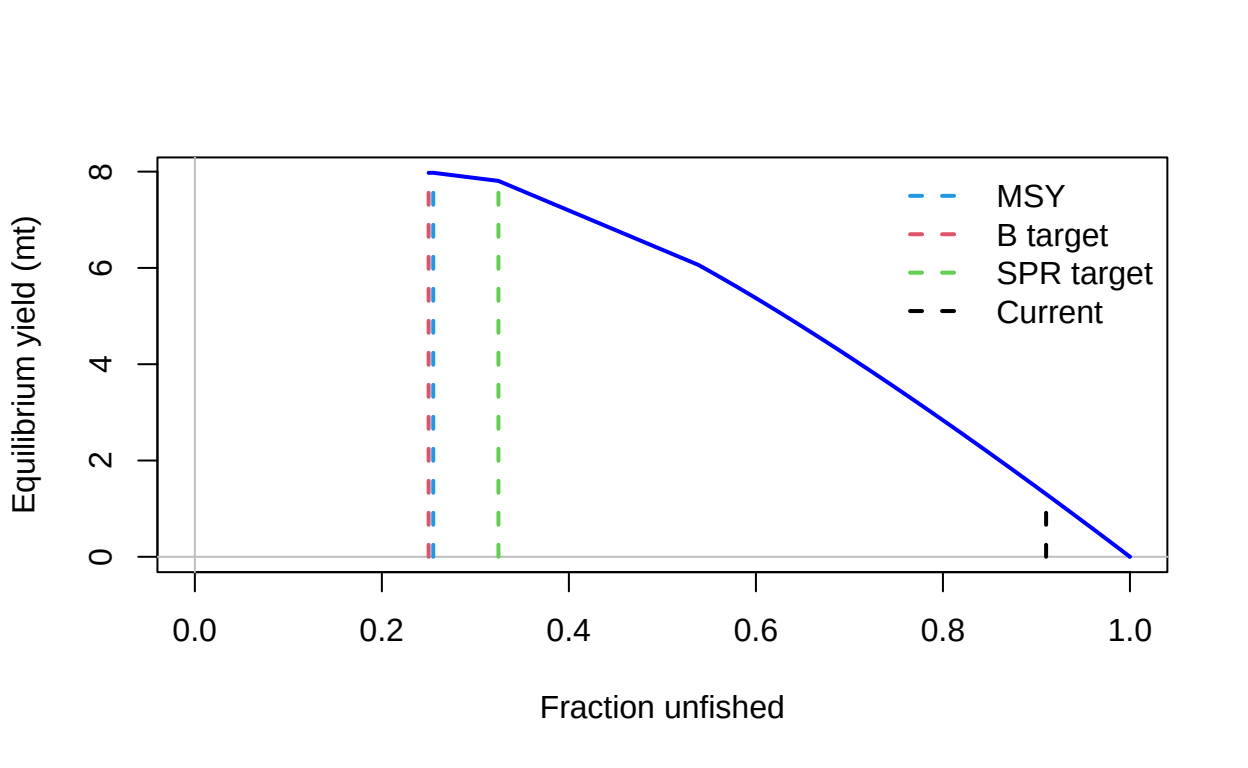

FISHERY
−10
−5
0.1
5
10
Length (cm)
28
26
24
22
20
18
16
14
2004
2006
2008
2010
2012
2014
2016
2018
2020
Year

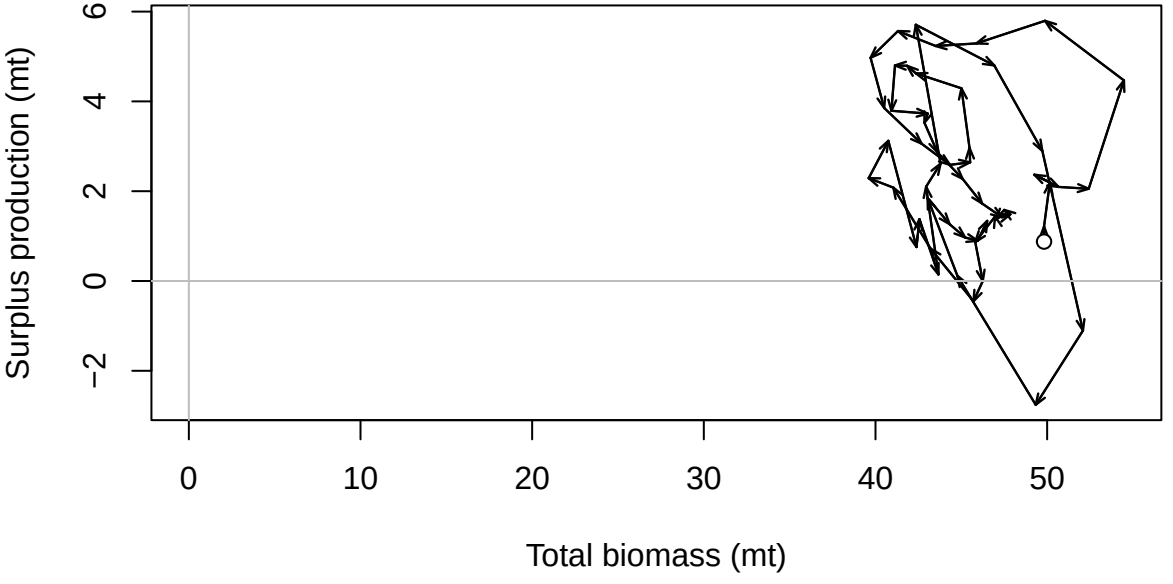

2004
N input=235
N adj.=66.5
2010
N input=144
N adj.=41
2016
N input=369
N adj.=104.1
2005
N input=147
N adj.=41.9
2011
N input=782
N adj.=219.7
2017
N input=204
N adj.=57.9
2006
N input=147
N adj.=41.9
2012
N input=1255
N adj.=352.2
2018
N input=170
N adj.=48.3
2007
N input=292
N adj.=82.5
2013
N input=2416
N adj.=677.3
2019
N input=212
N adj.=60.1
2008
N input=346
N adj.=97.6
2014
N input=1062
N adj.=298.1
2020
N input=155
N adj.=44.1
2009
N input=456
N adj.=128.4
2015
N input=1023
N adj.=287.2
2021
N input=87
N adj.=25.1
Proportion
0.0
0.1
0.2
0.3
0.4
14
18
22
26
Length (cm)

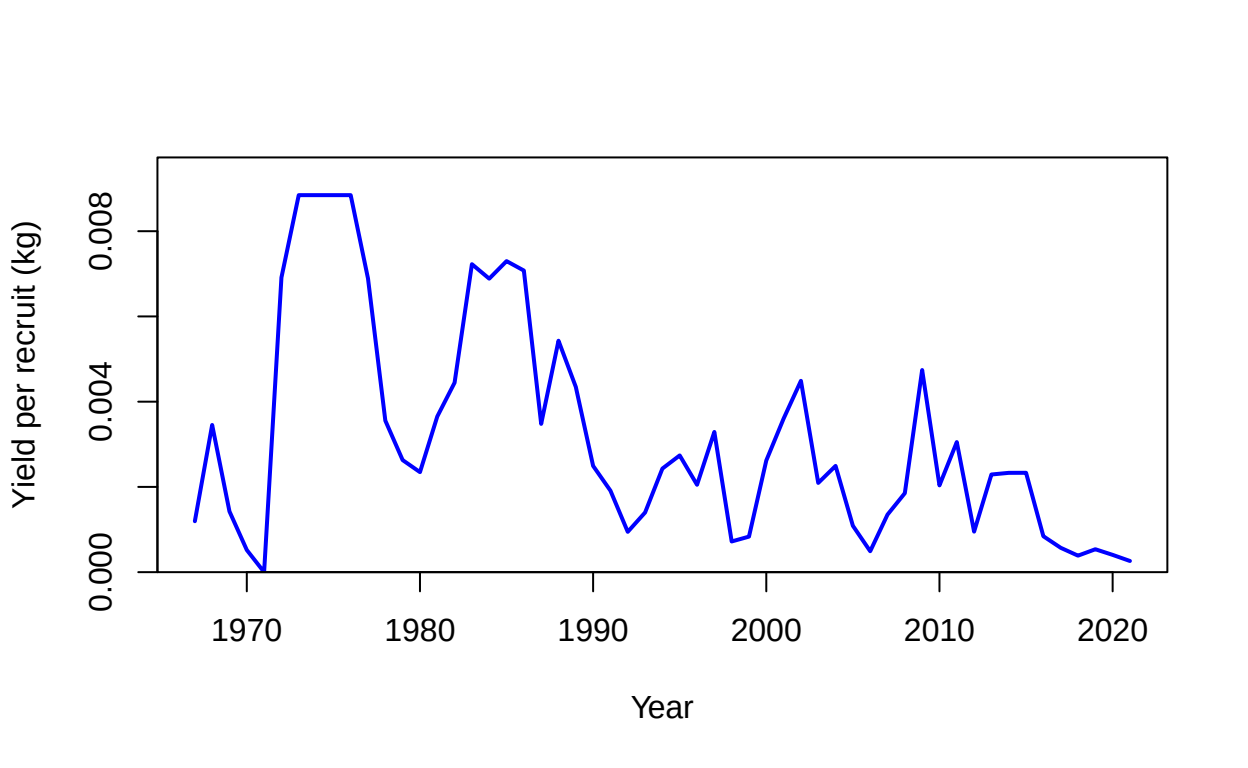

−10
−5
0.1
5
10
28
26
24
22
20
18
16
14
Length (cm)
2004
2006
2008
2010
2012
2014
2016
2018
2020
Year

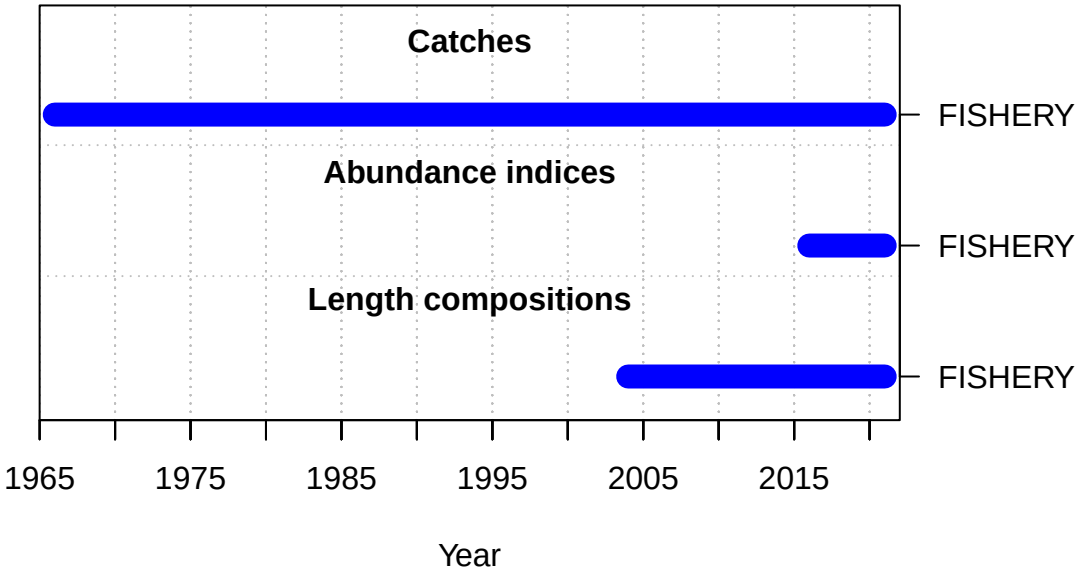

FISHERY (whole catch)
22.5
22.0
21.5
21.0
20.5
Mean length
2005
2010
2015
2020
Year

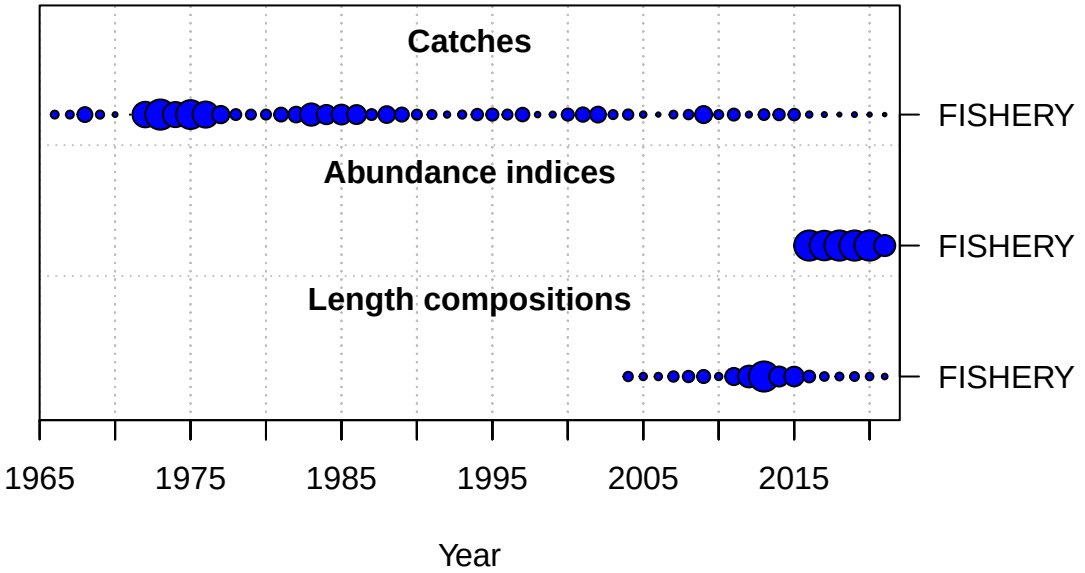

Equilibrium yield (mt)
0
2
4
6
8
0.0
0.2
0.4
0.6
0.8
1.0
Fraction unfished

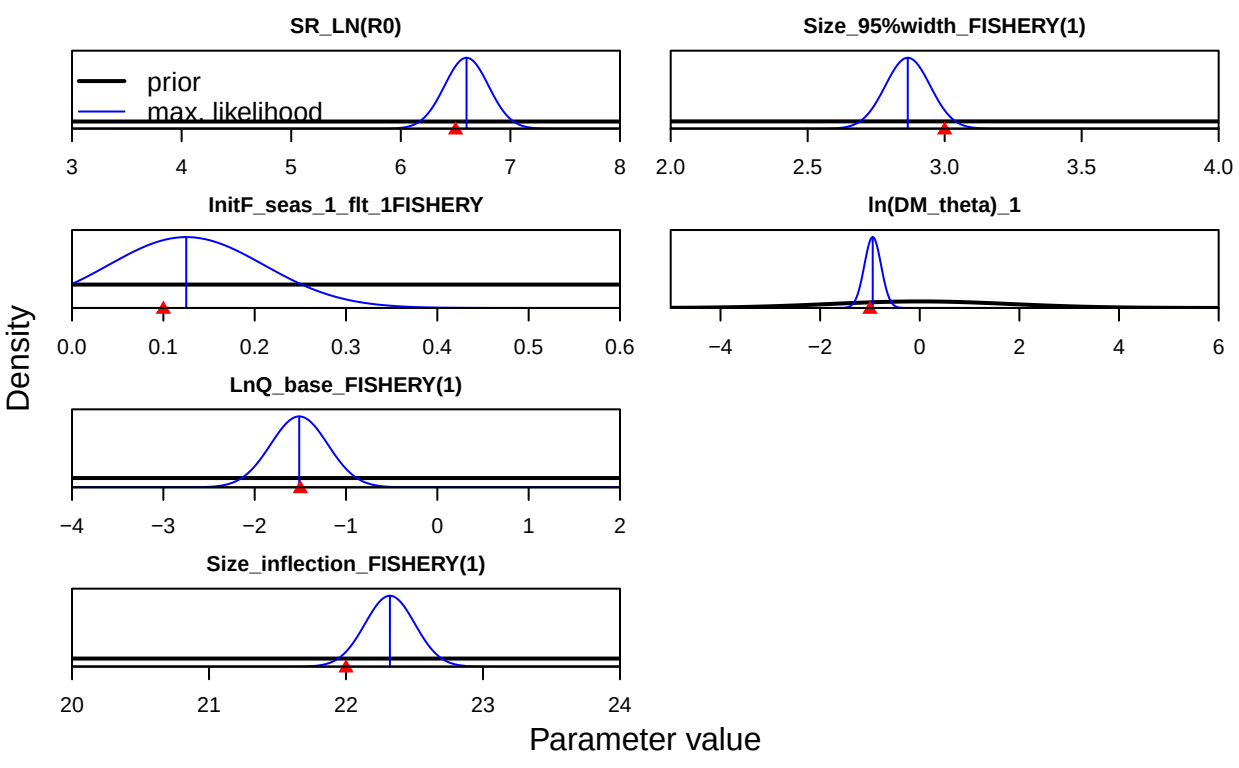

Equilibrium yield (mt)
0
2
4
6
8
0.0
0.2
0.4
0.6
0.8
1.0
Fraction unfished
MSY
B target
SPR target
Current


Surplus production (mt)
6
4
2
0
−2
0
10
20
30
40
50
Total biomass (mt)


Yield per recruit (kg)
0.000
0.004
0.008
1970
1980
1990
2000
2010
2020
Year


Catches
FISHERY
Abundance indices
FISHERY
Length compositions
FISHERY
1965
1975
1985
1995
2005
2015
Year


Catches
FISHERY
Abundance indices
FISHERY
Length compositions
FISHERY
1965
1975
1985
1995
2005
2015
Year


SR_LN(R0)
prior
max. likelihood
3
4
5
6
7
8
Size_95%width_FISHERY(1)
2.0
2.5
3.0
3.5
4.0
InitF_seas_1_flt_1FISHERY
0.0
0.1
0.2
0.3
0.4
0.5
0.6
ln(DM_theta)_1
−4
−2
0
2
4
6
LnQ_base_FISHERY(1)
−4
−3
−2
−1
0
1
2
Size_inflection_FISHERY(1)
20
21
22
23
24
Density
Parameter value