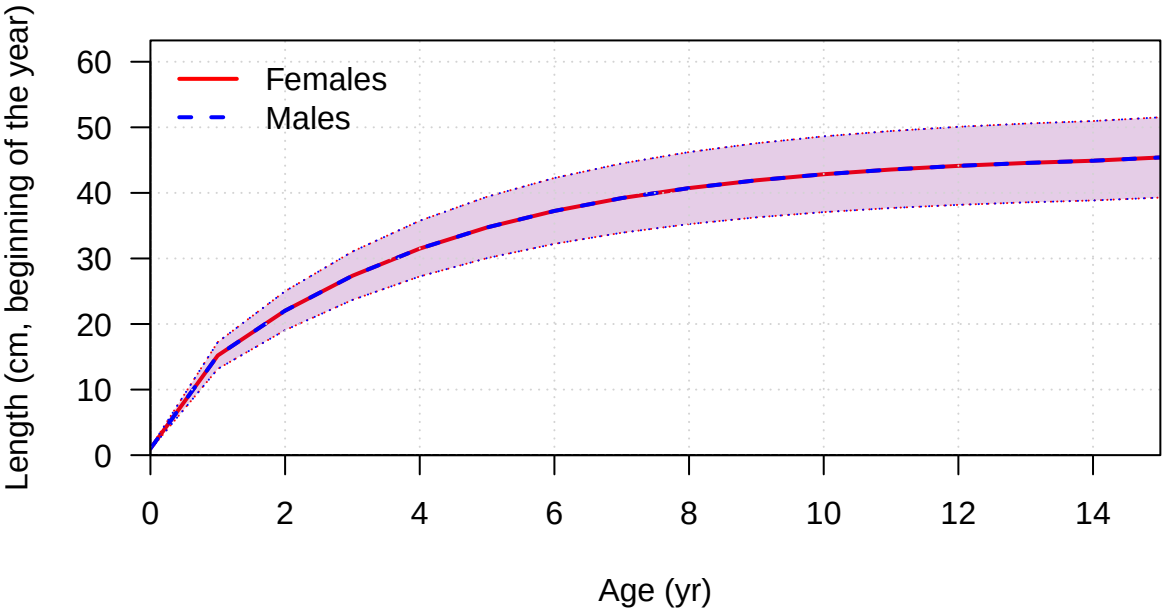
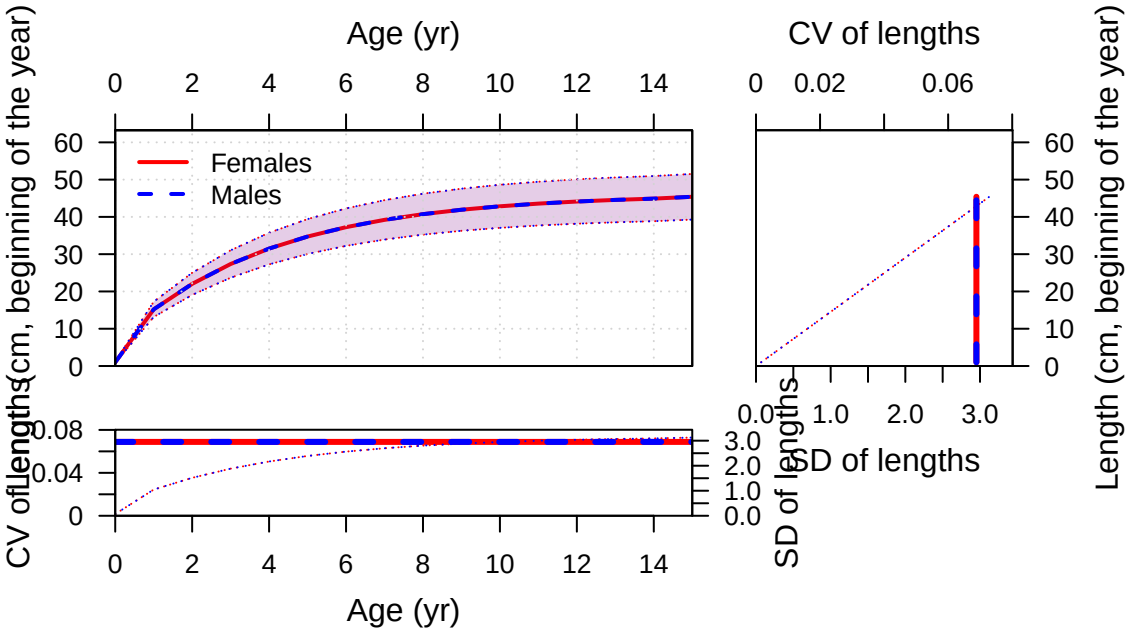
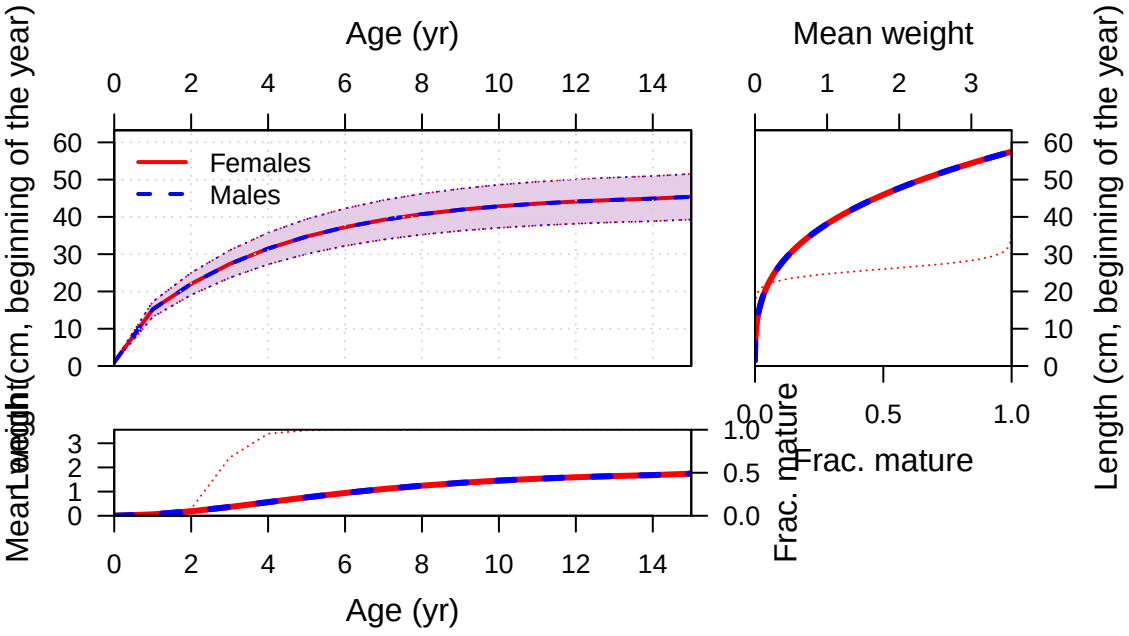
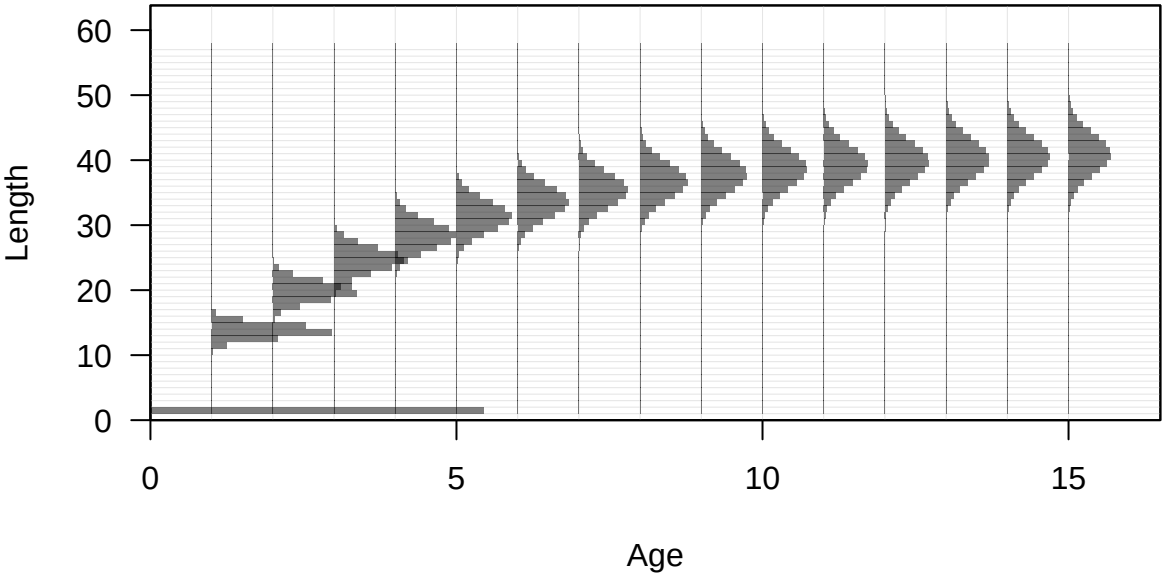
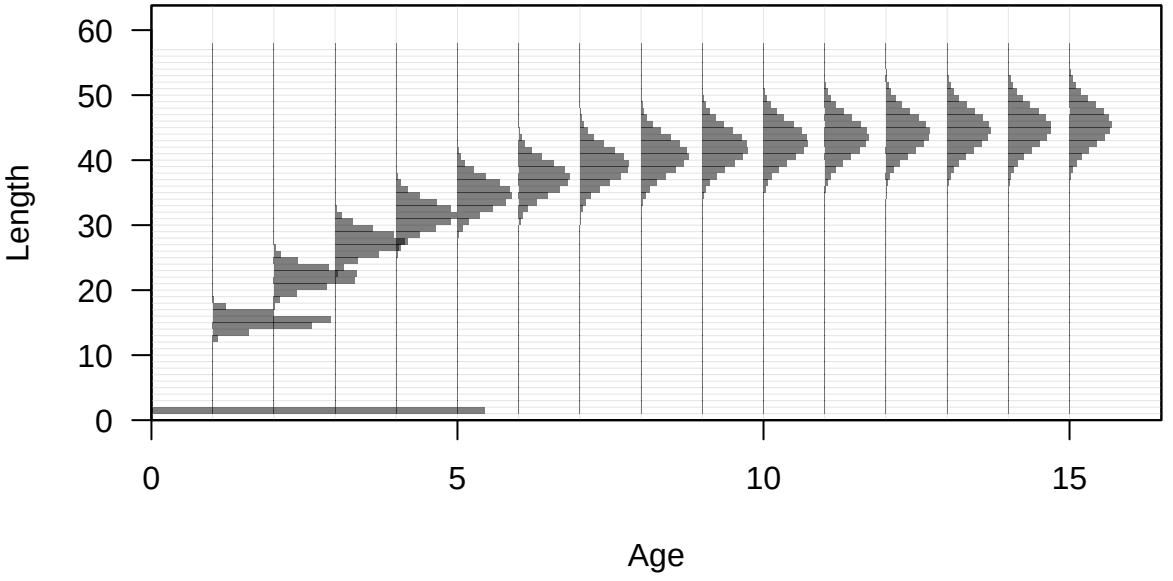
Plots created using the 'r4ss' package in R
Stock Synthesis version: 3.30.19.0
StartTime: Sun Feb 19 15:07:30 2023
Data_File: data.ss
Control_File: control.ss

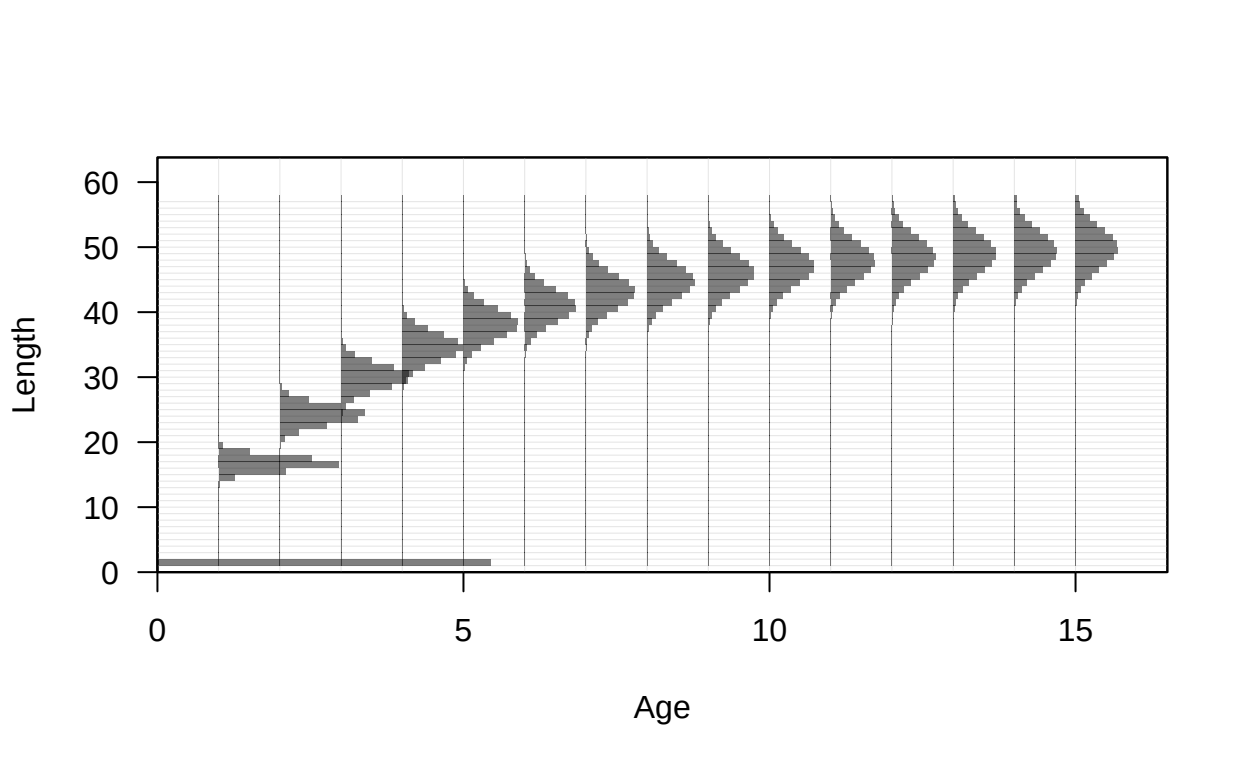

Females
Males
Length (cm, beginning of the year)
Age (yr)
0
10
20
30
40
50
60
0
2
4
6
8
10
12
14

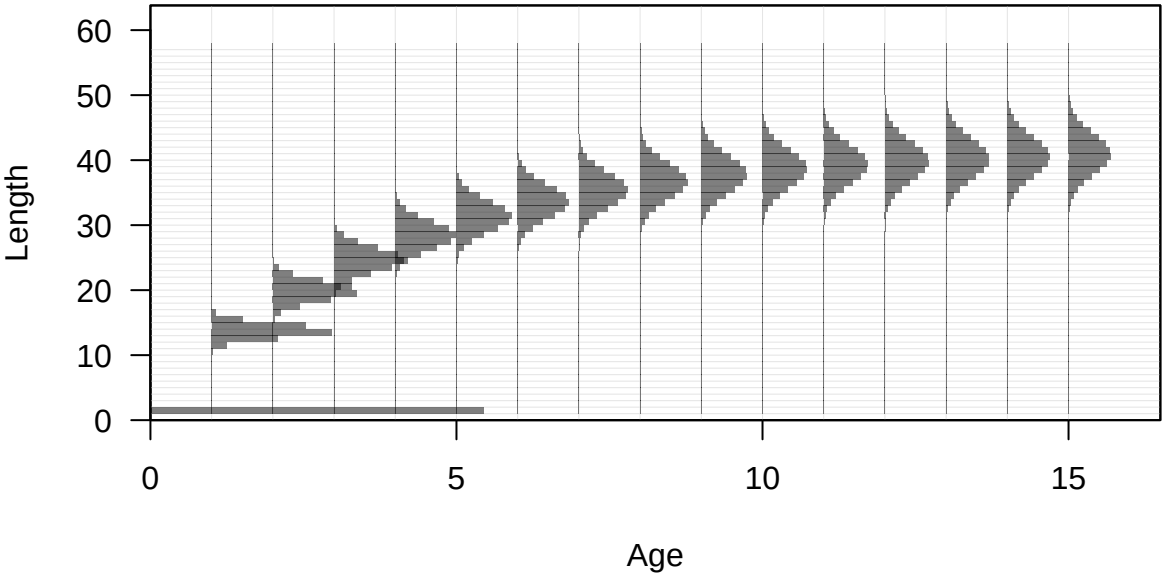

Age (yr)
0
2
4
6
8
10
12
14
Females
Males
Length (cm, beginning of the year)
0
10
20
30
40
50
60
CV of lengths
0.02
0.06
0.0
1.0
2.0
3.0
SD of lengths
0.08
0.04
0
3.0
2.0
1.0
0.0

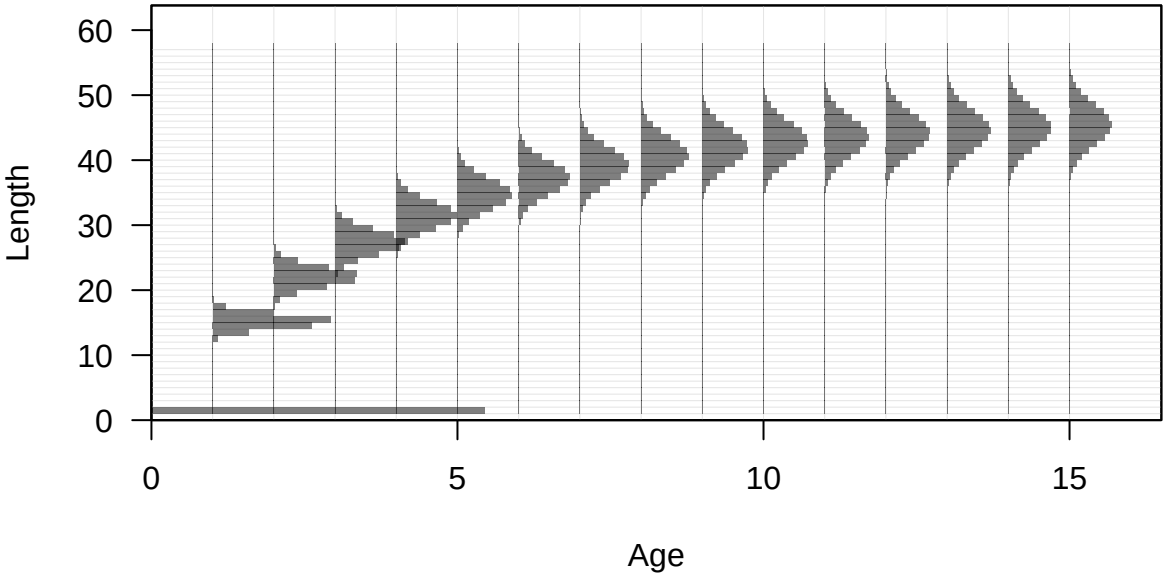

Age (yr)
Mean weight
Length (cm, beginning of the year)
Females
Males
Frac. mature
Age (yr)

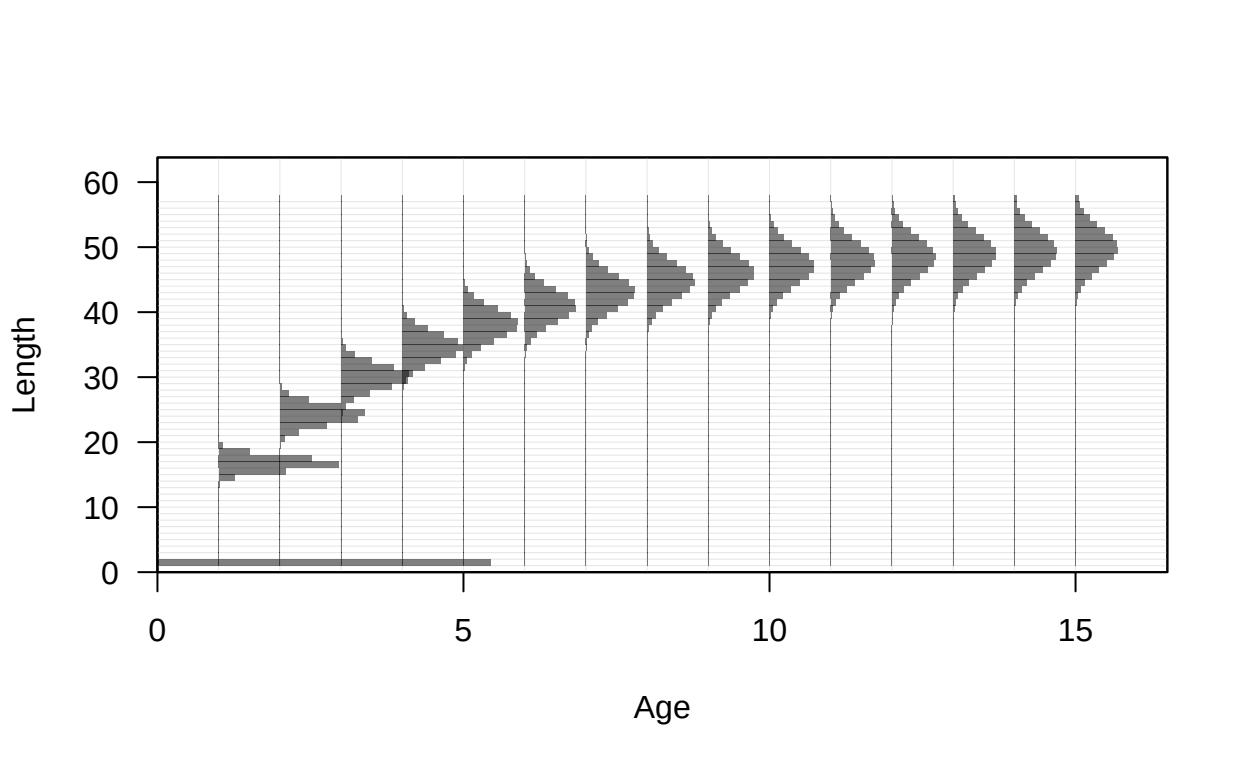

Length
60
50
40
30
20
10
0
0
5
10
15
Age

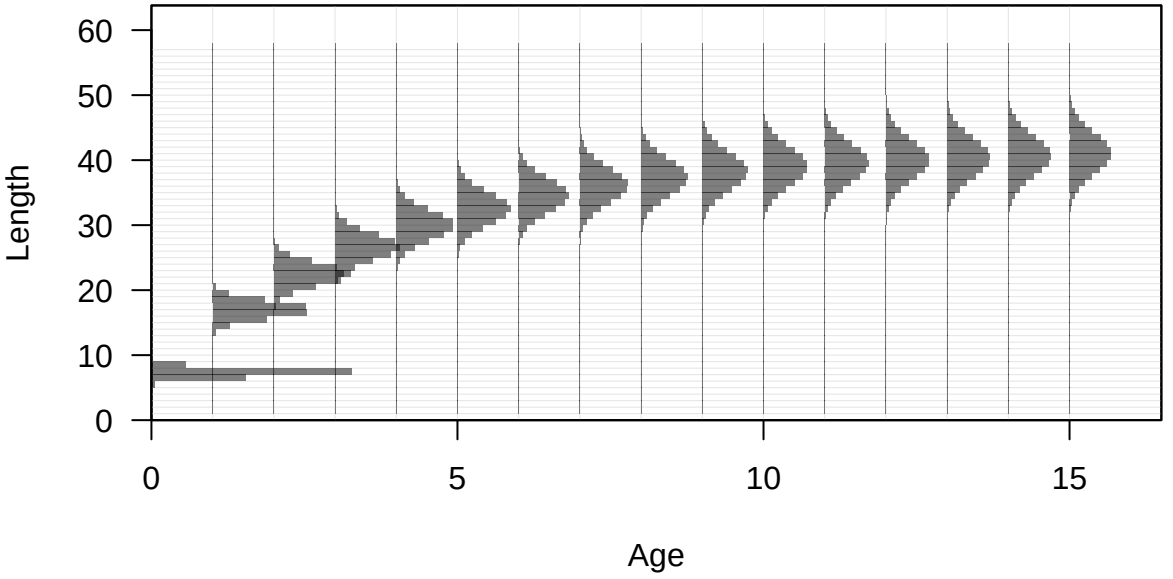

Length
60
50
40
30
20
10
0
0
5
10
15
Age

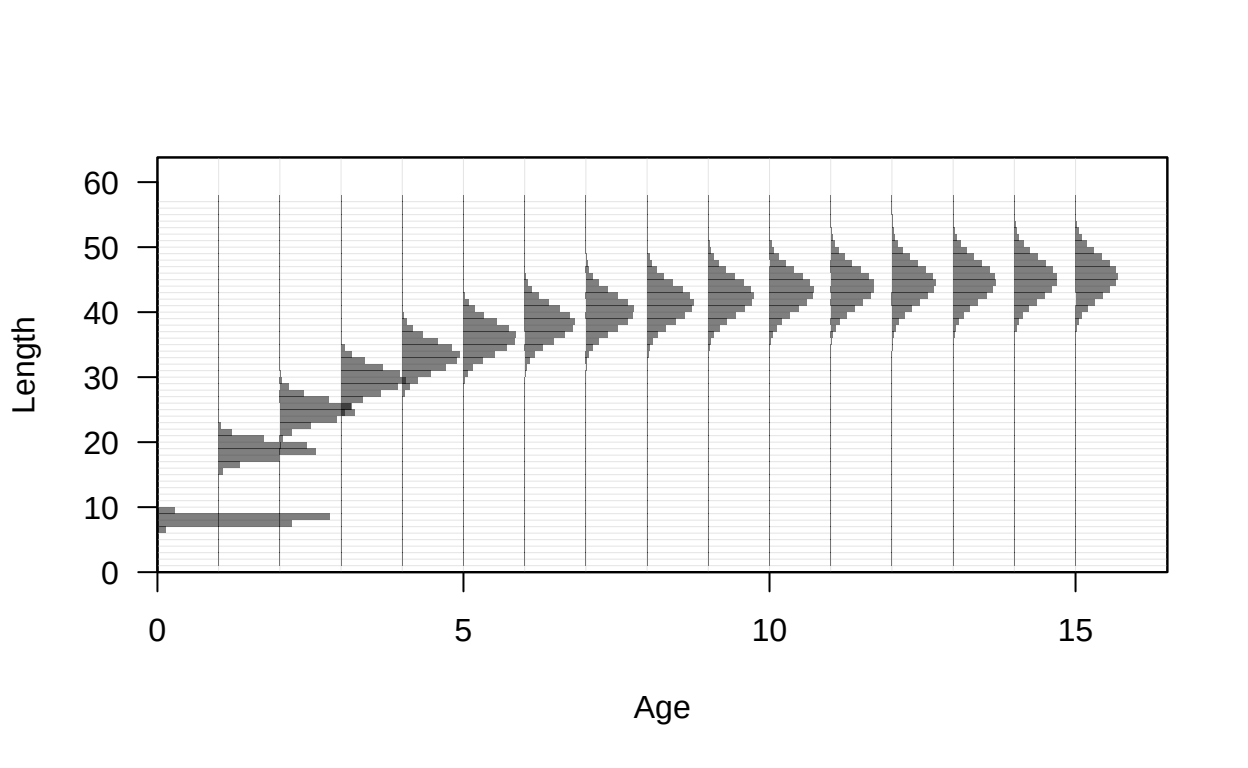

Length
60
50
40
30
20
10
0
0
5
10
15
Age

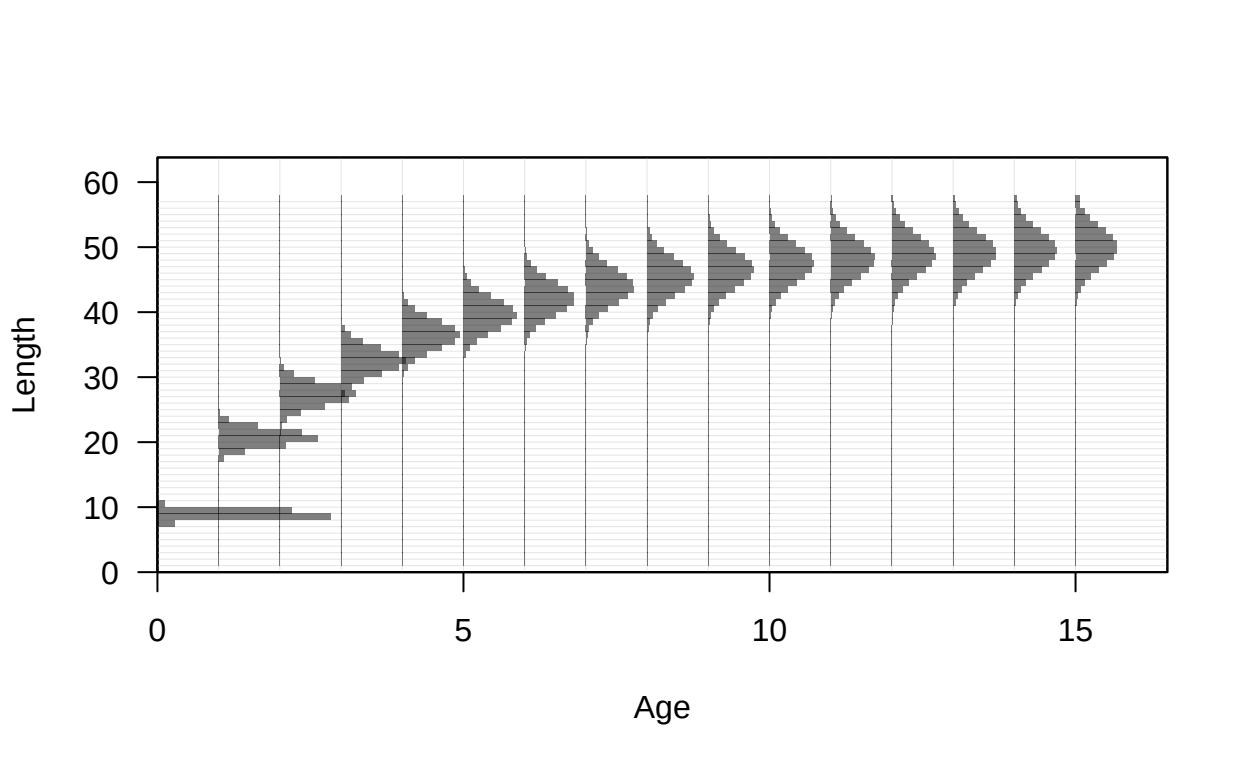

Length
60
50
40
30
20
10
0
0
5
10
15
Age

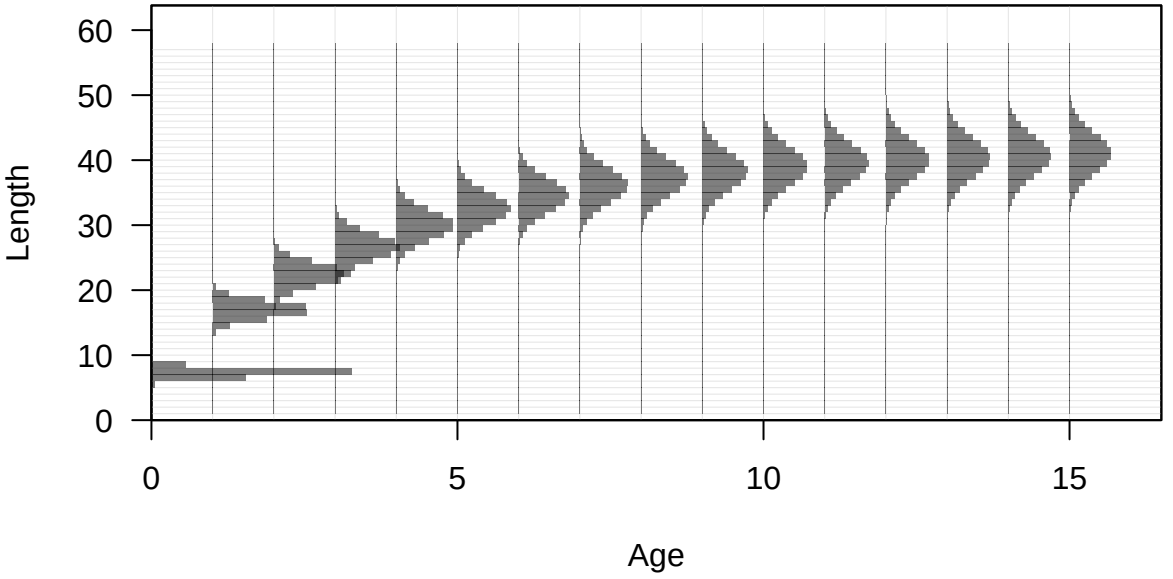

Length
60
50
40
30
20
10
0
0
5
10
15
Age

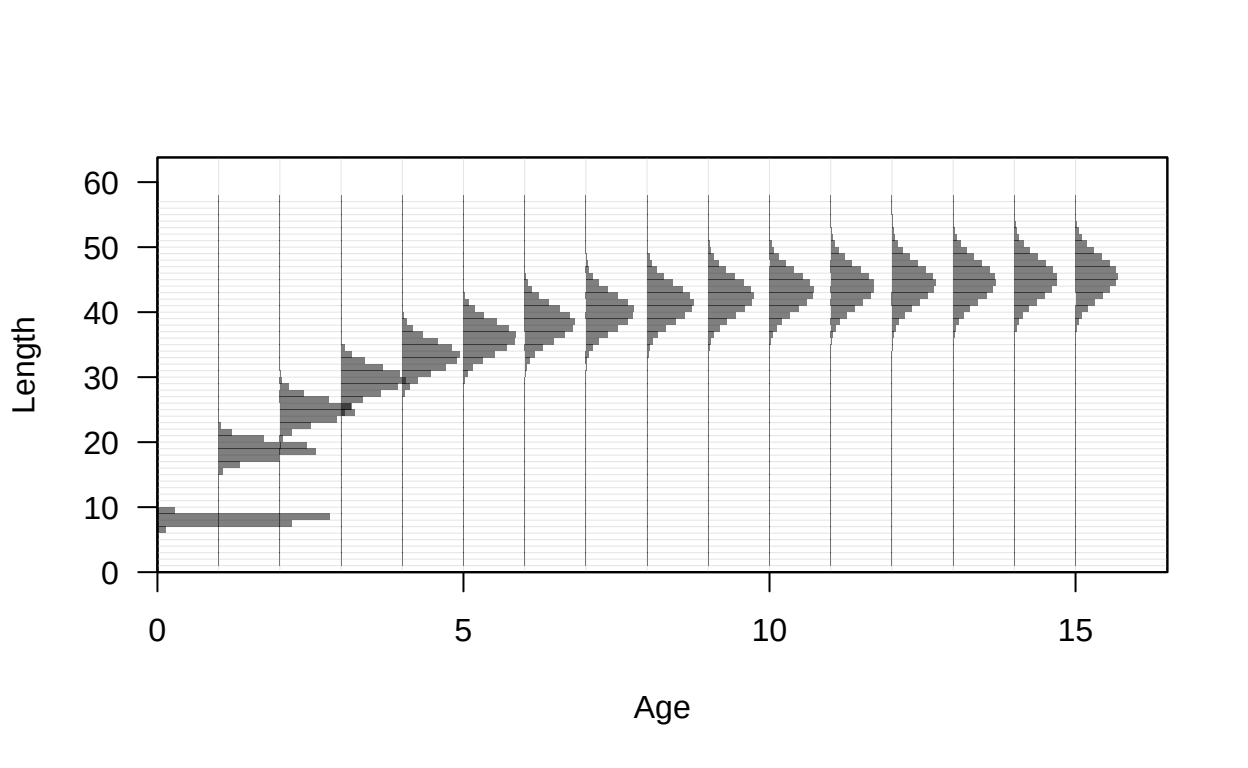

Length
60
50
40
30
20
10
0
0
5
10
15
Age

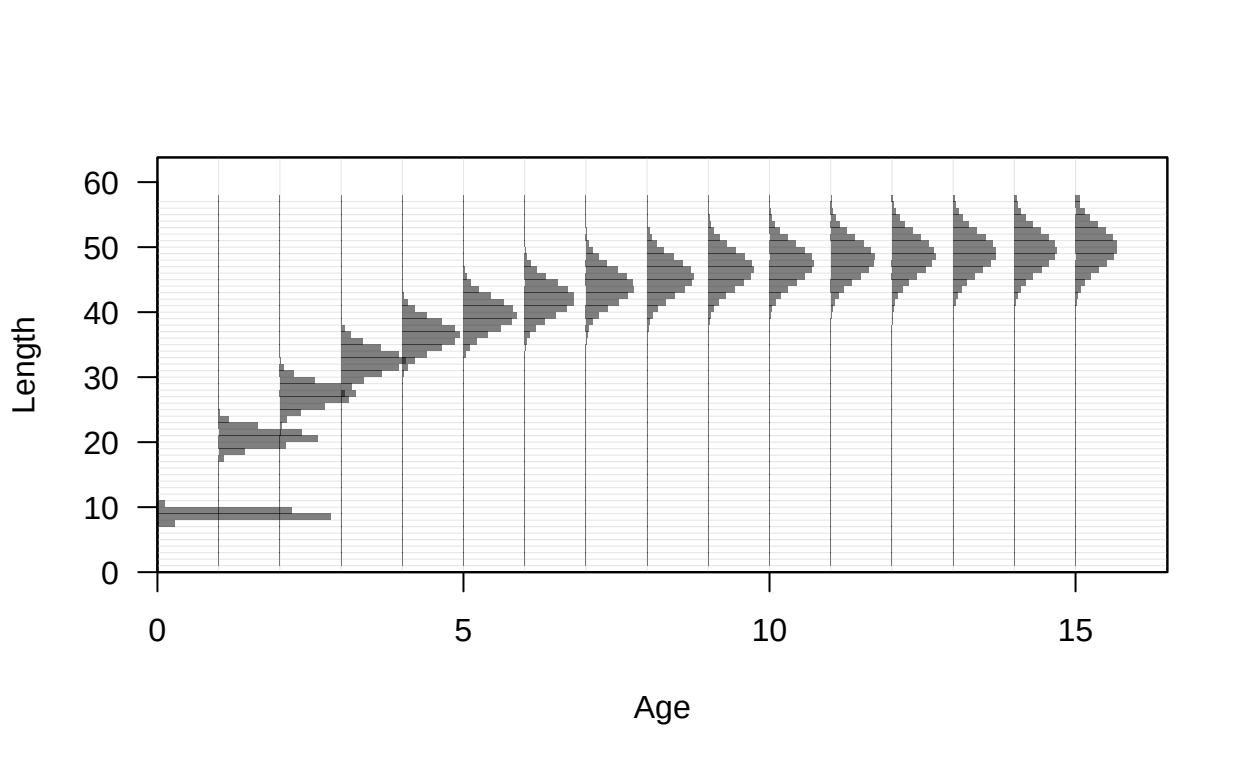

Length
60
50
40
30
20
10
0
0
5
10
15
Age

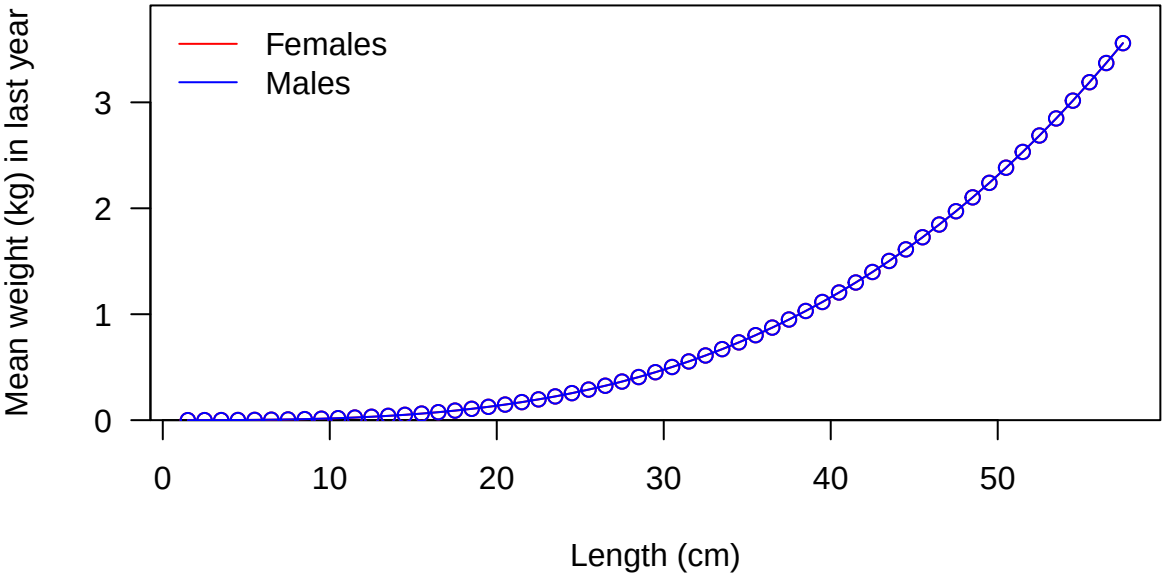

Length
60
50
40
30
20
10
0
0
5
10
15
Age

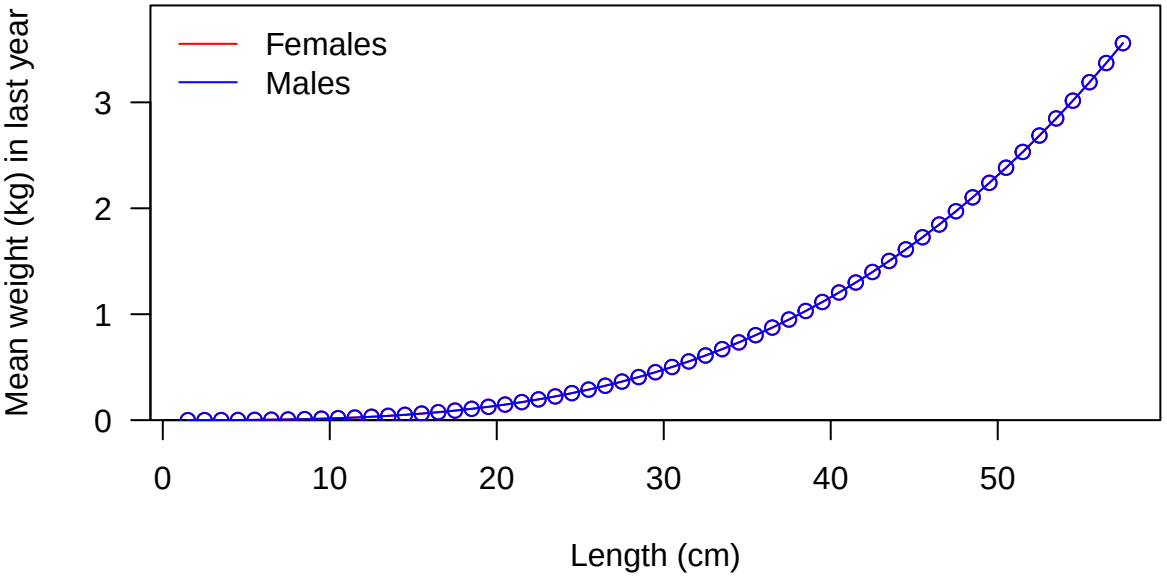

Length
60
50
40
30
20
10
0
0
5
10
15
Age

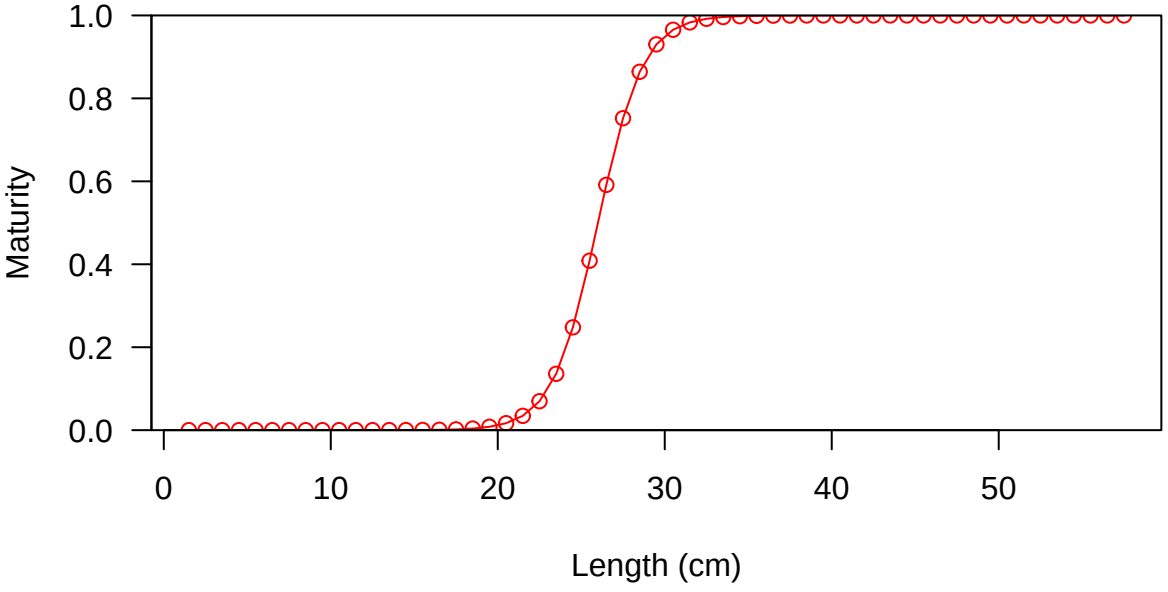

Length
60
50
40
30
20
10
0
0
5
10
15
Age

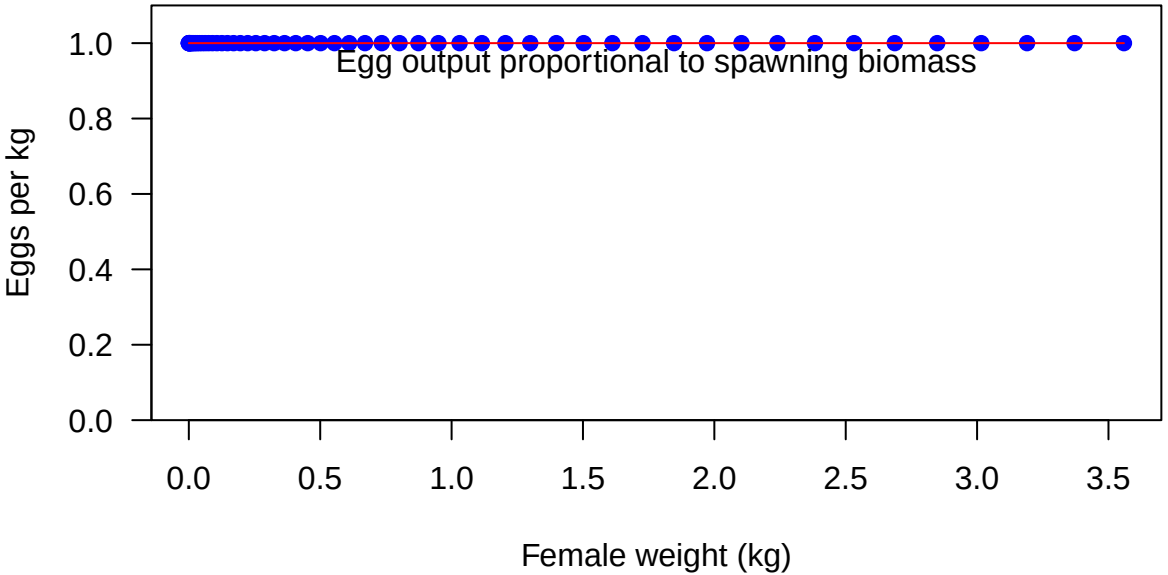

Length
60
50
40
30
20
10
0
0
5
10
15
Age

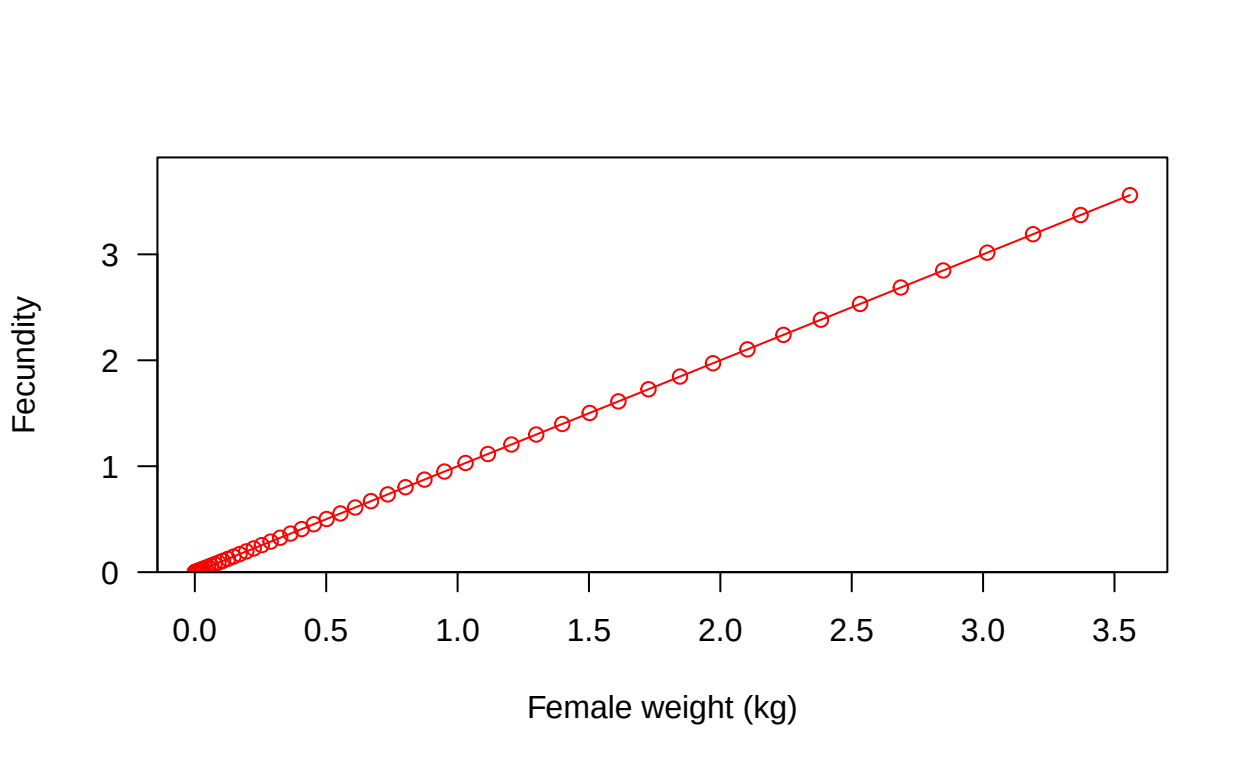

Length
60
50
40
30
20
10
0
0
5
10
15
Age

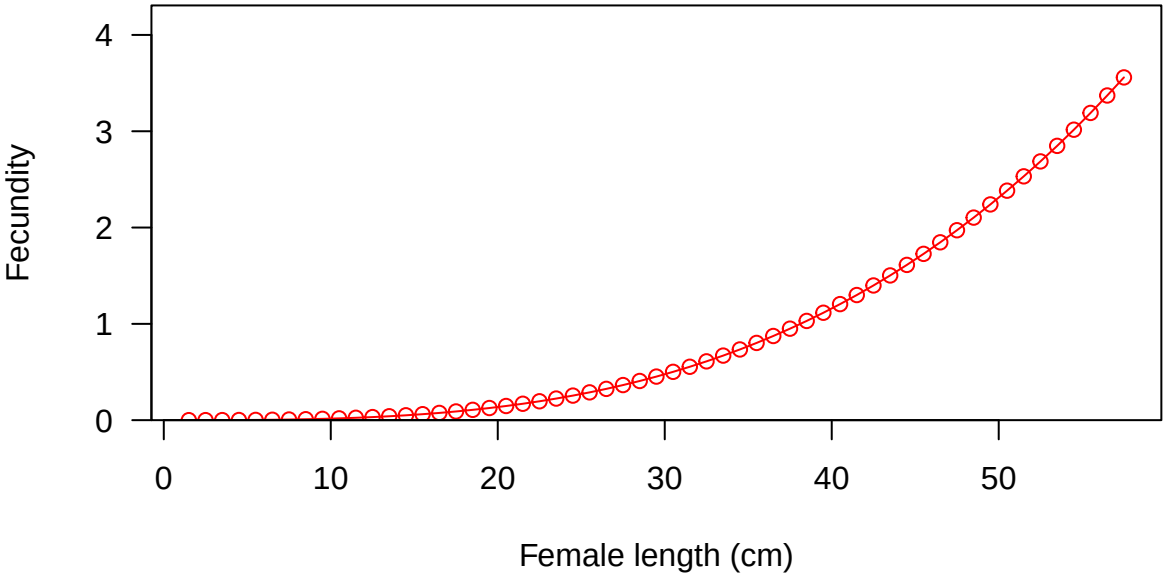

Females
Males
Mean weight (kg) in last year
0
1
2
3
0
10
20
30
40
50
Length (cm)

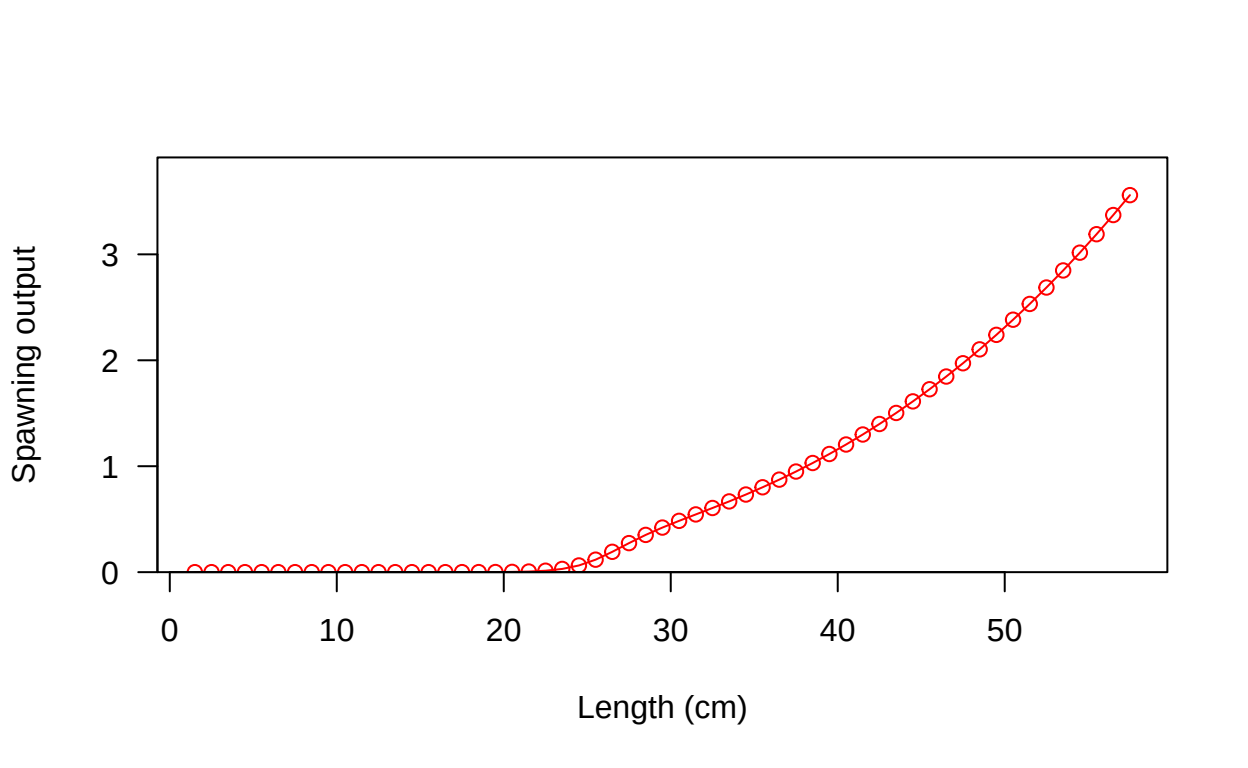

Females
Males
Mean weight (kg) in last year
0
1
2
3
0
10
20
30
40
50
Length (cm)

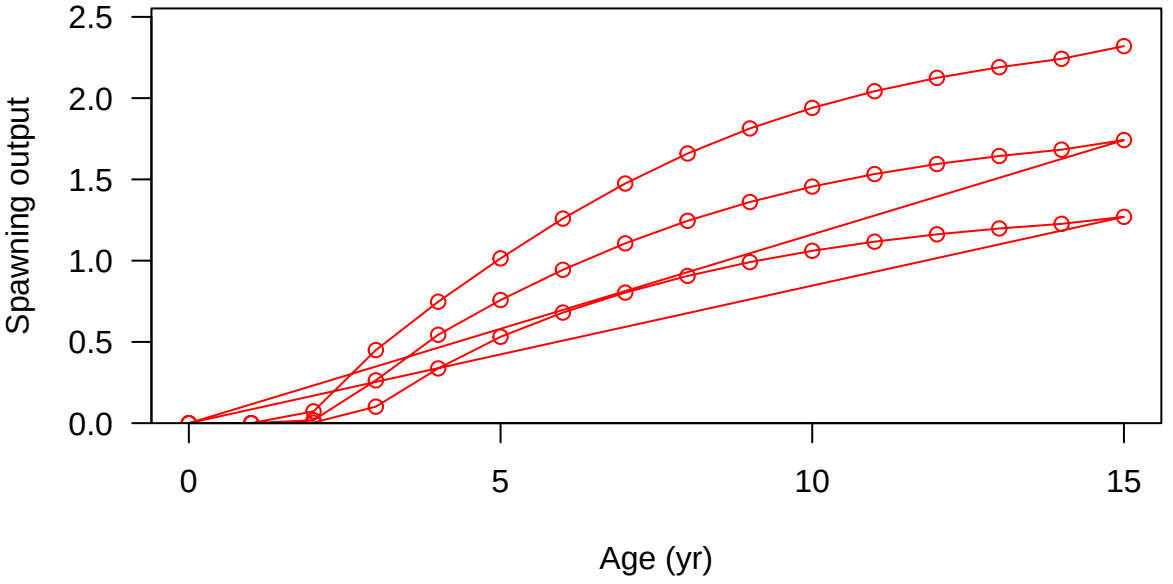

1.0
0.8
0.6
0.4
0.2
0.0
Maturity
0
10
20
30
40
50
Length (cm)

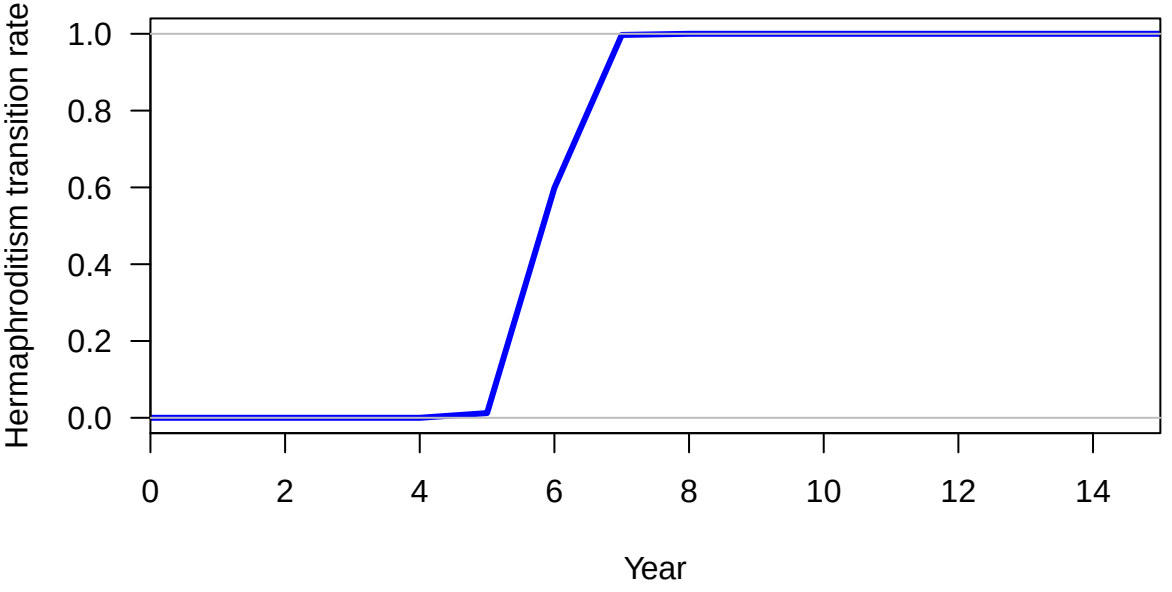

Egg output proportional to spawning biomass
Eggs per kg
1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
Female weight (kg)

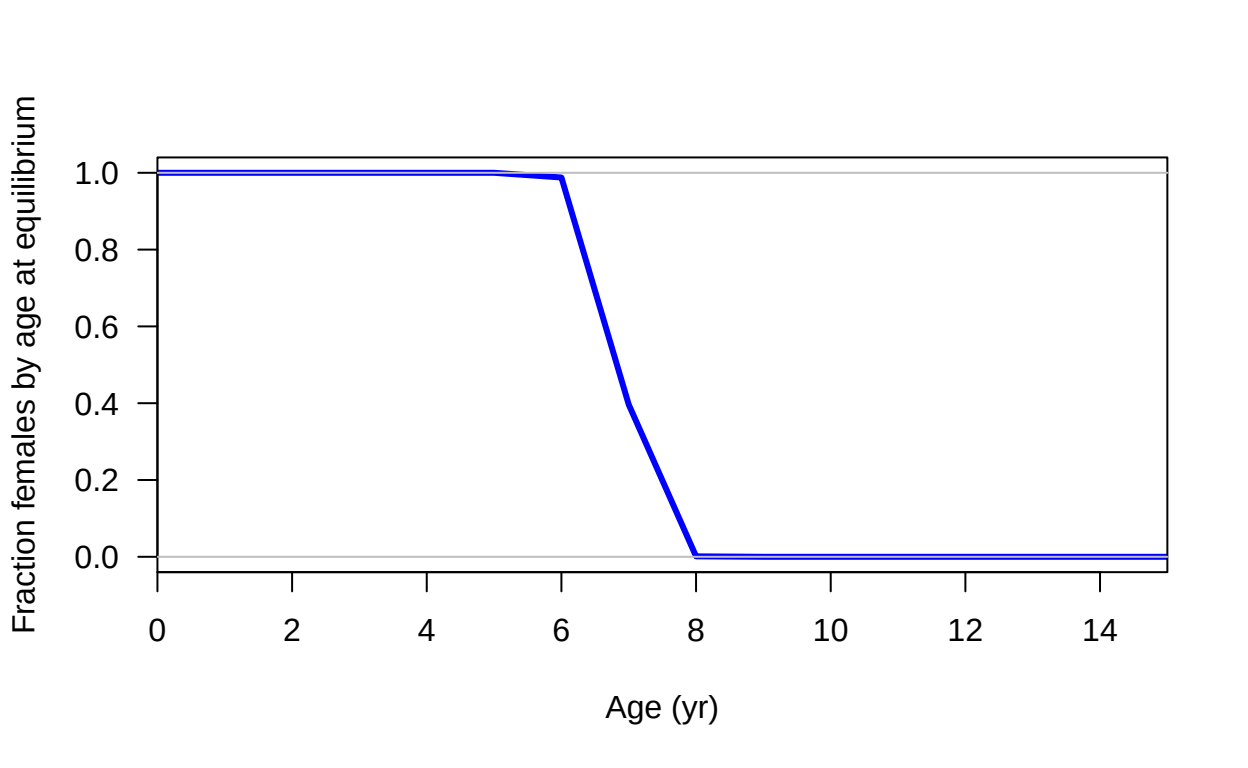

Fecundity
0
1
2
3
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
Female weight (kg)

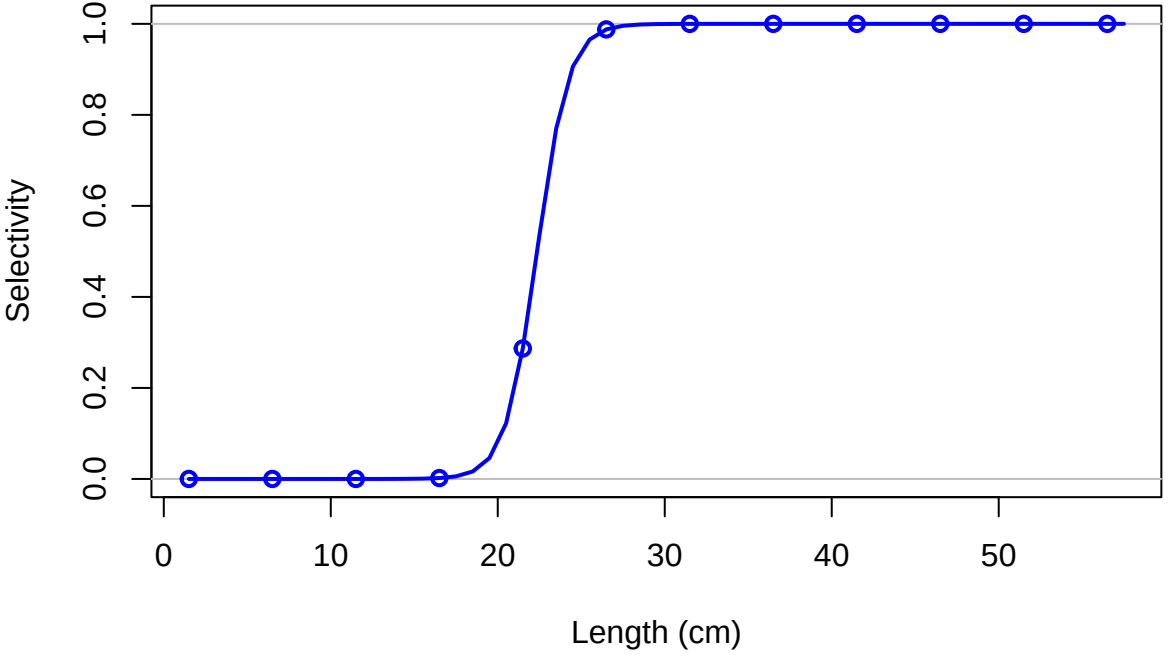

Fecundity
0
1
2
3
4
0
10
20
30
40
50
Female length (cm)

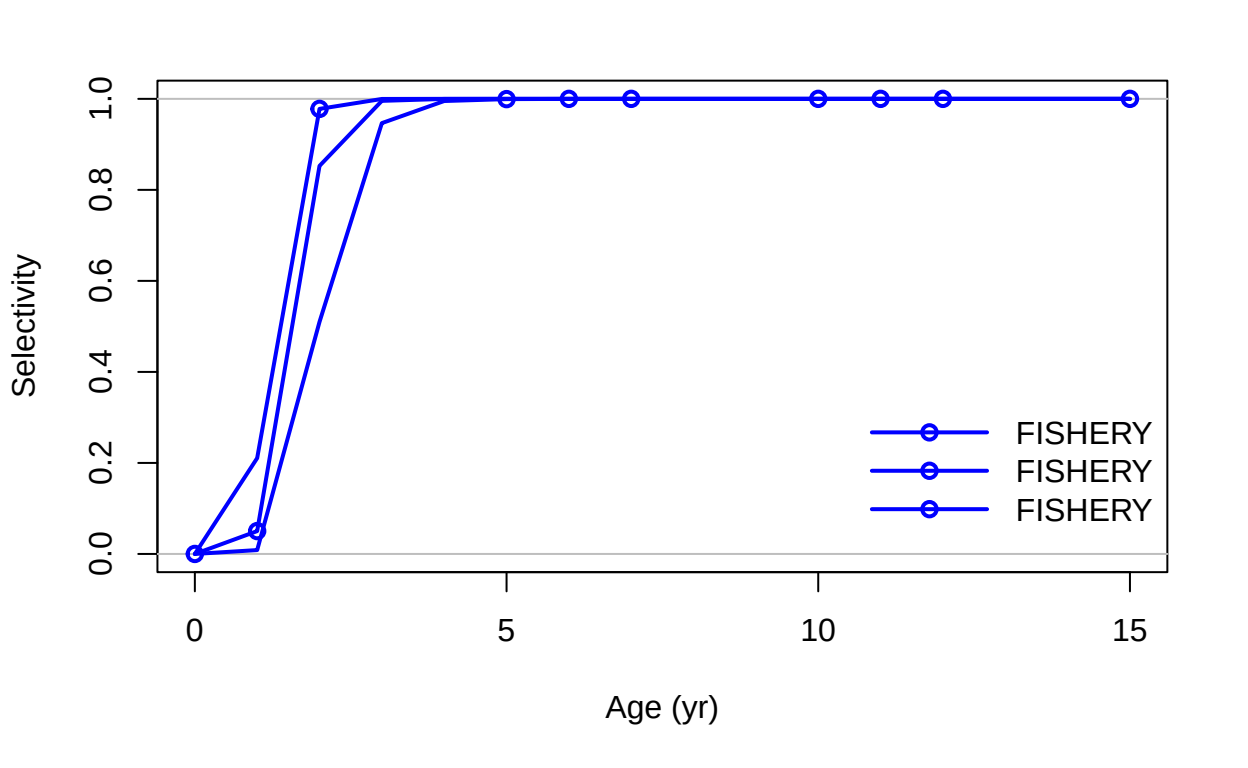

Spawning output
0
1
2
3
0
10
20
30
40
50
Length (cm)

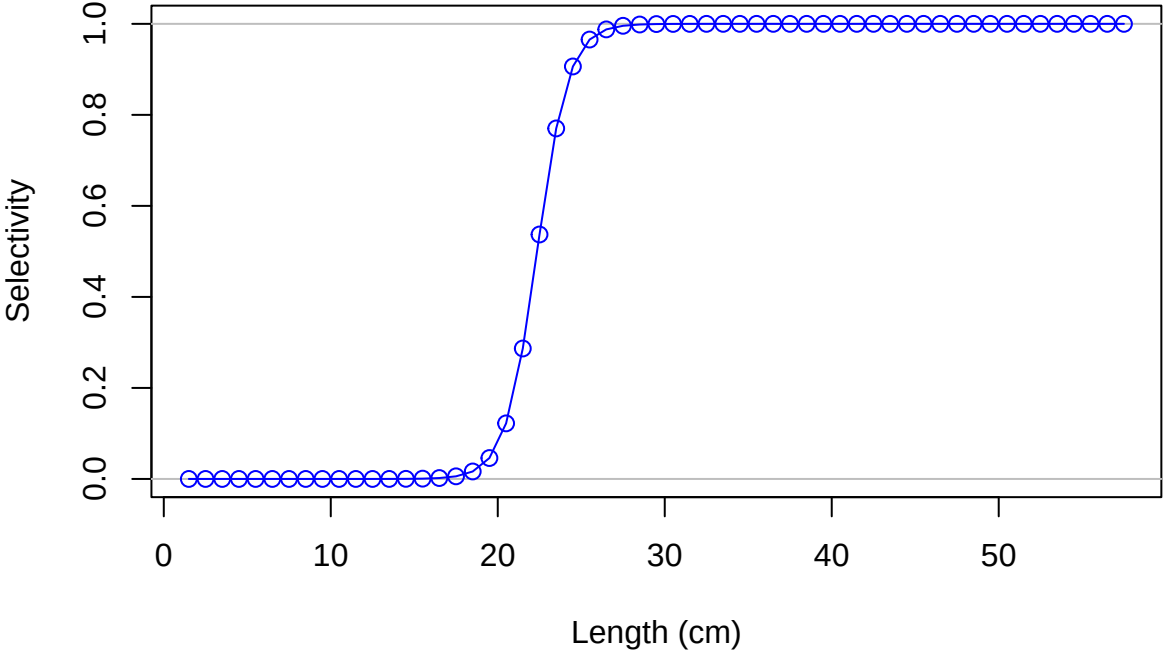

Spawning output
2.5
2.0
1.5
1.0
0.5
0.0
0
5
10
15
Age (yr)

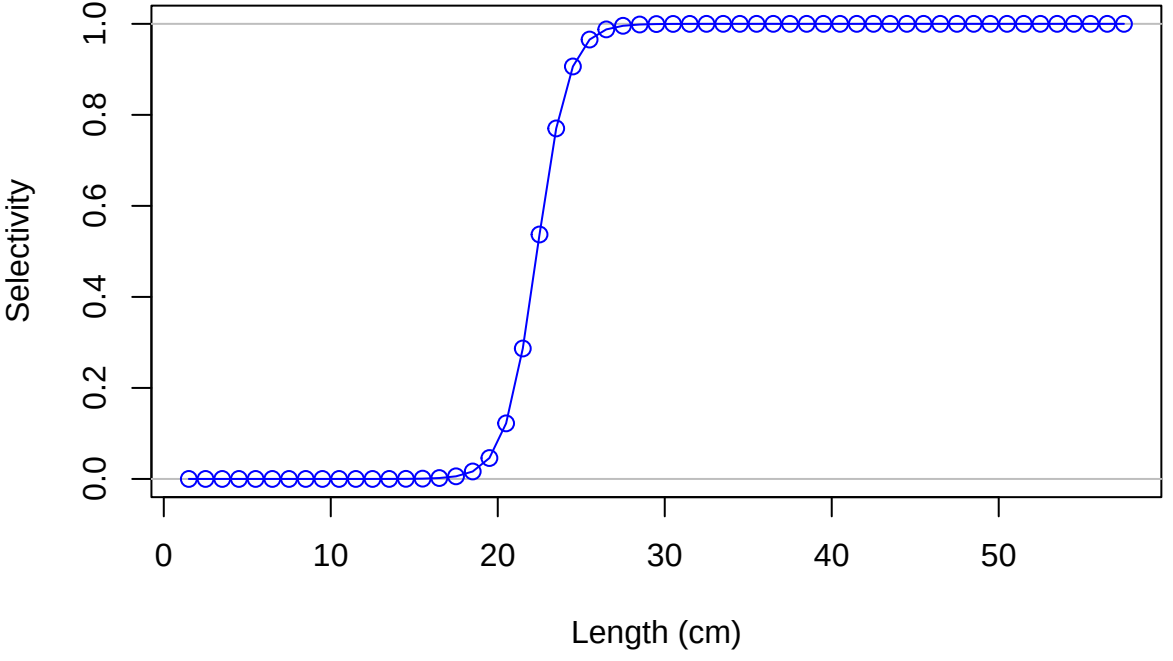

Hermaphroditism transition rate
1.0
0.8
0.6
0.4
0.2
0.0
0
2
4
6
8
10
12
14
Year

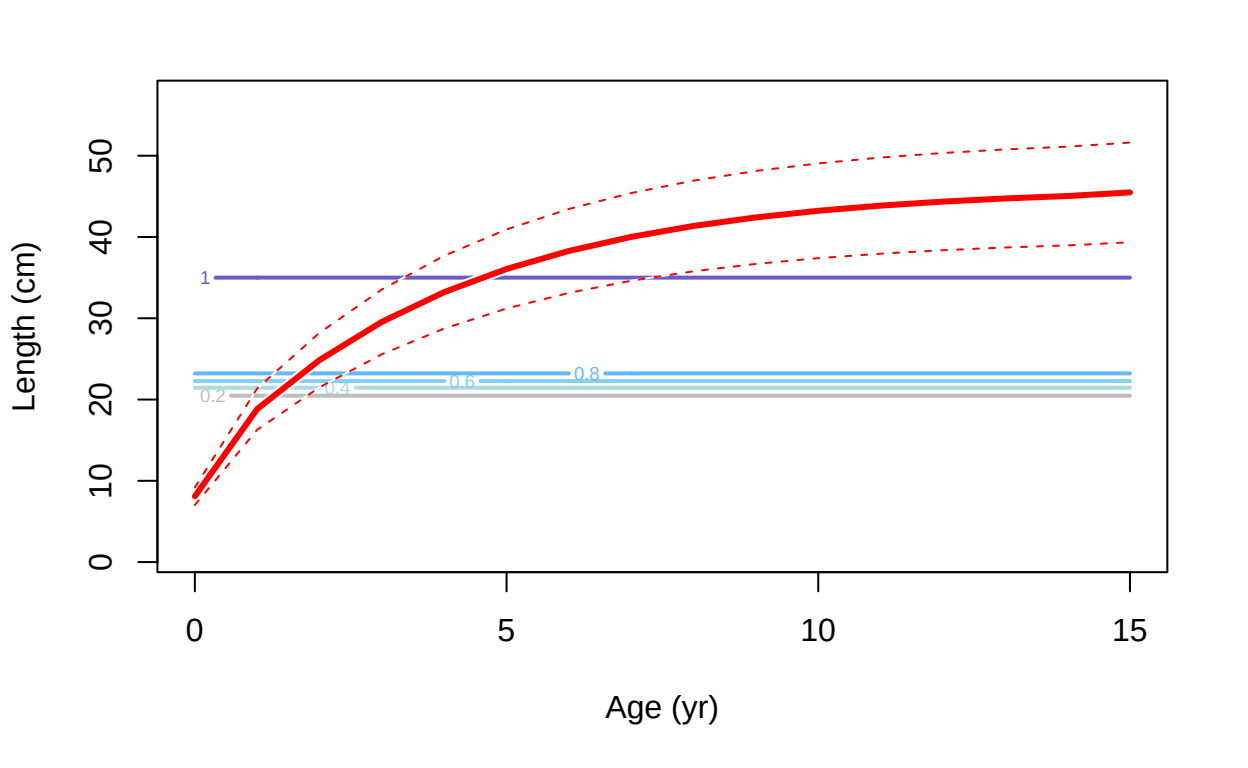

Fraction females by age at equilibrium
1.0
0.8
0.6
0.4
0.2
0.0
0
2
4
6
8
10
12
14
Age (yr)

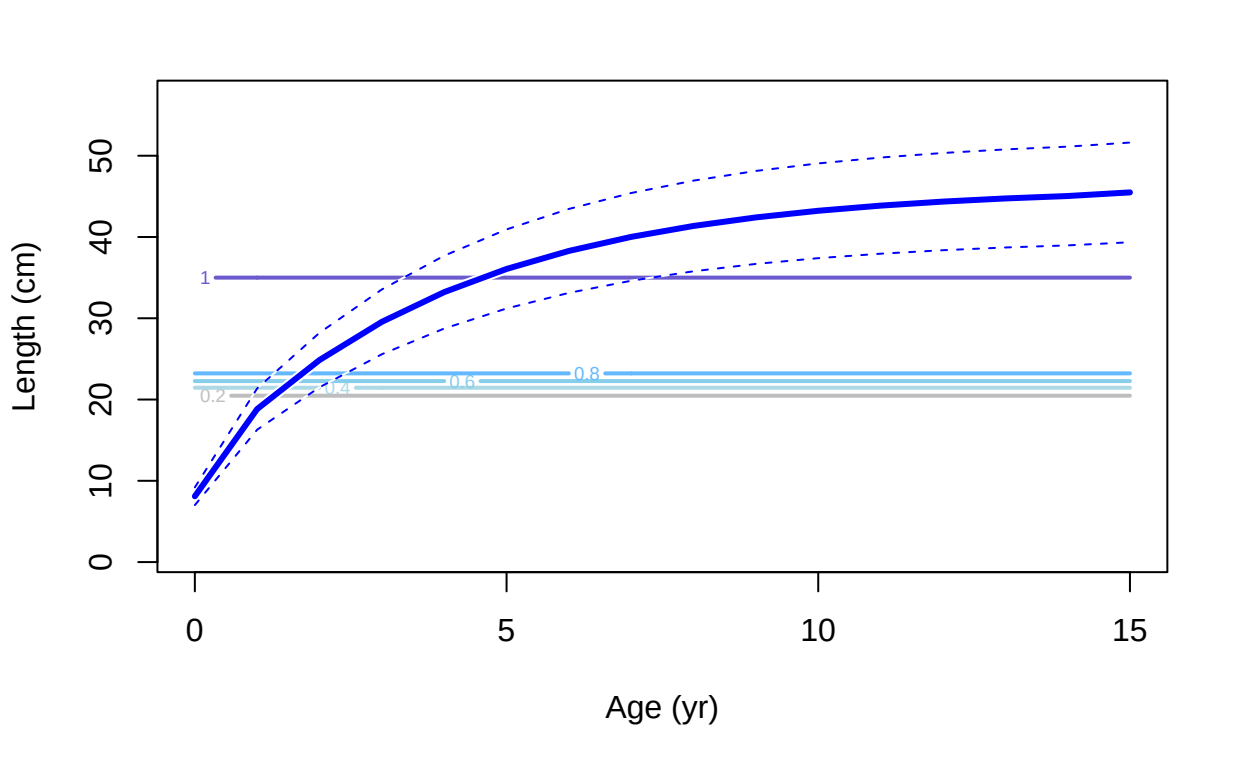

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
10
20
30
40
50
Length (cm)

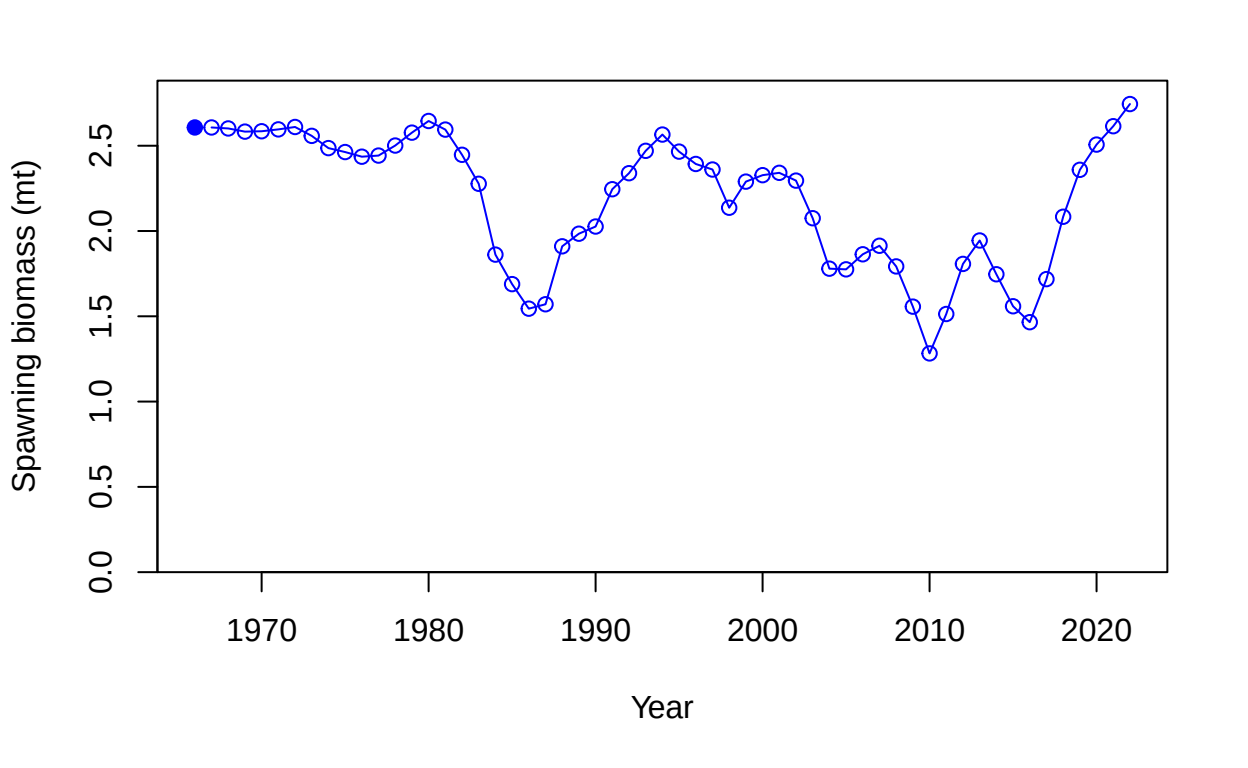

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
5
10
15
Age (yr)
FISHERY
FISHERY
FISHERY

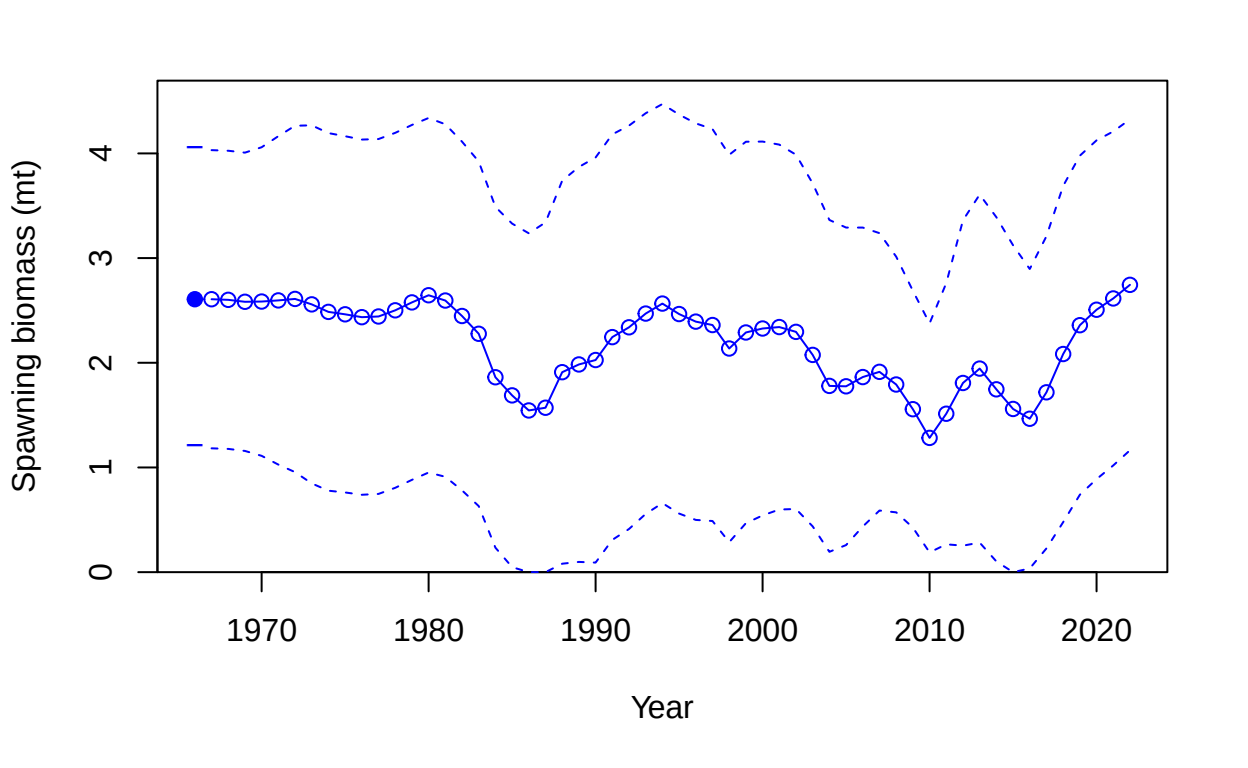

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
10
20
30
40
50
Length (cm)

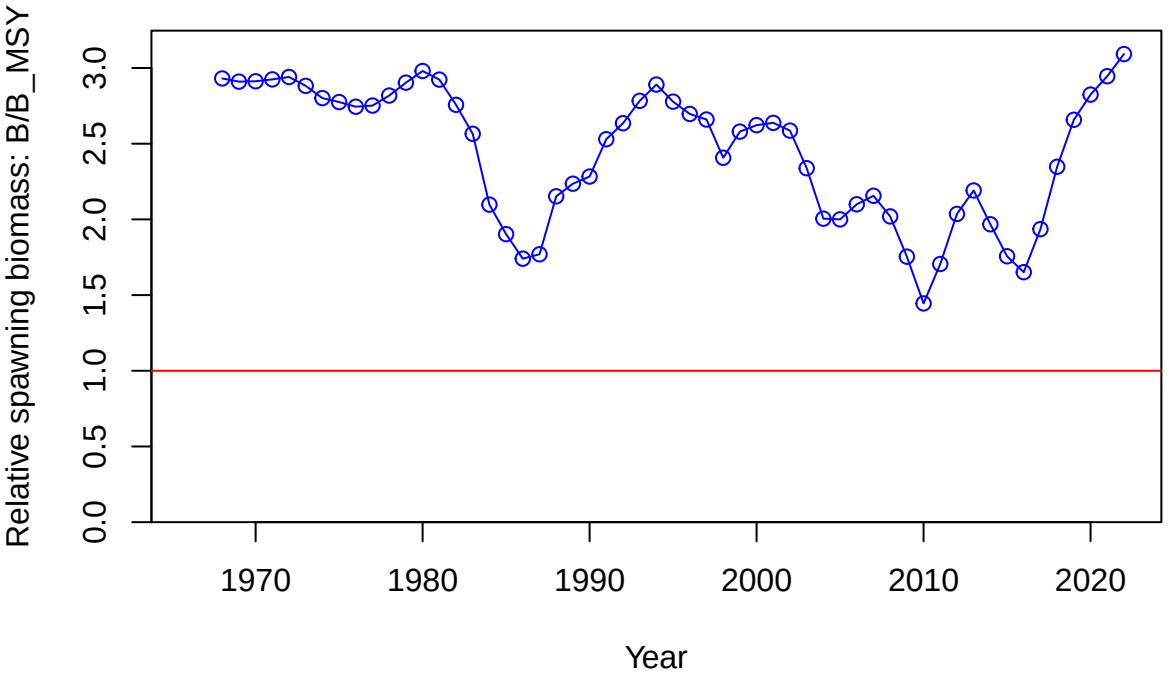

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
10
20
30
40
50
Length (cm)

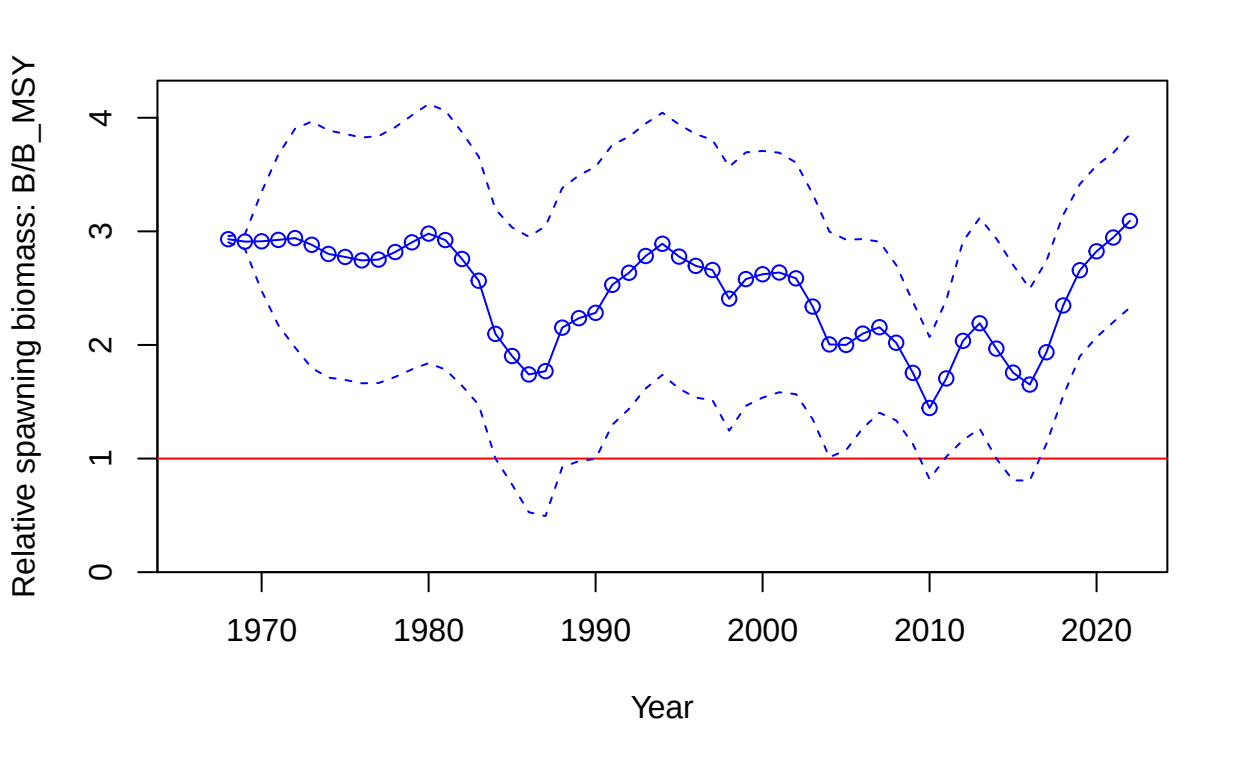

Length (cm)
0
10
20
30
40
50
0
5
10
15
Age (yr)
1
0.8
0.6
0.4
0.2

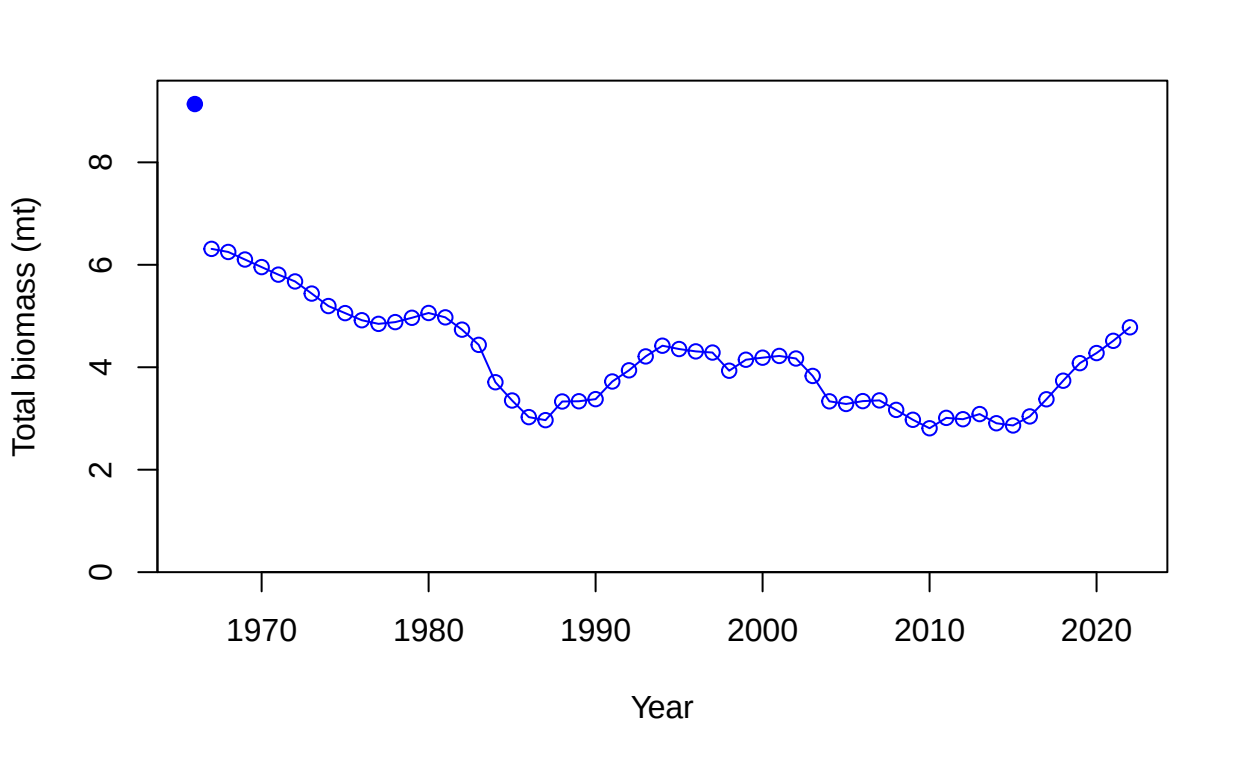

Length (cm)
0
10
20
30
40
50
0
5
10
15
Age (yr)
1
0.8
0.6
0.4
0.2

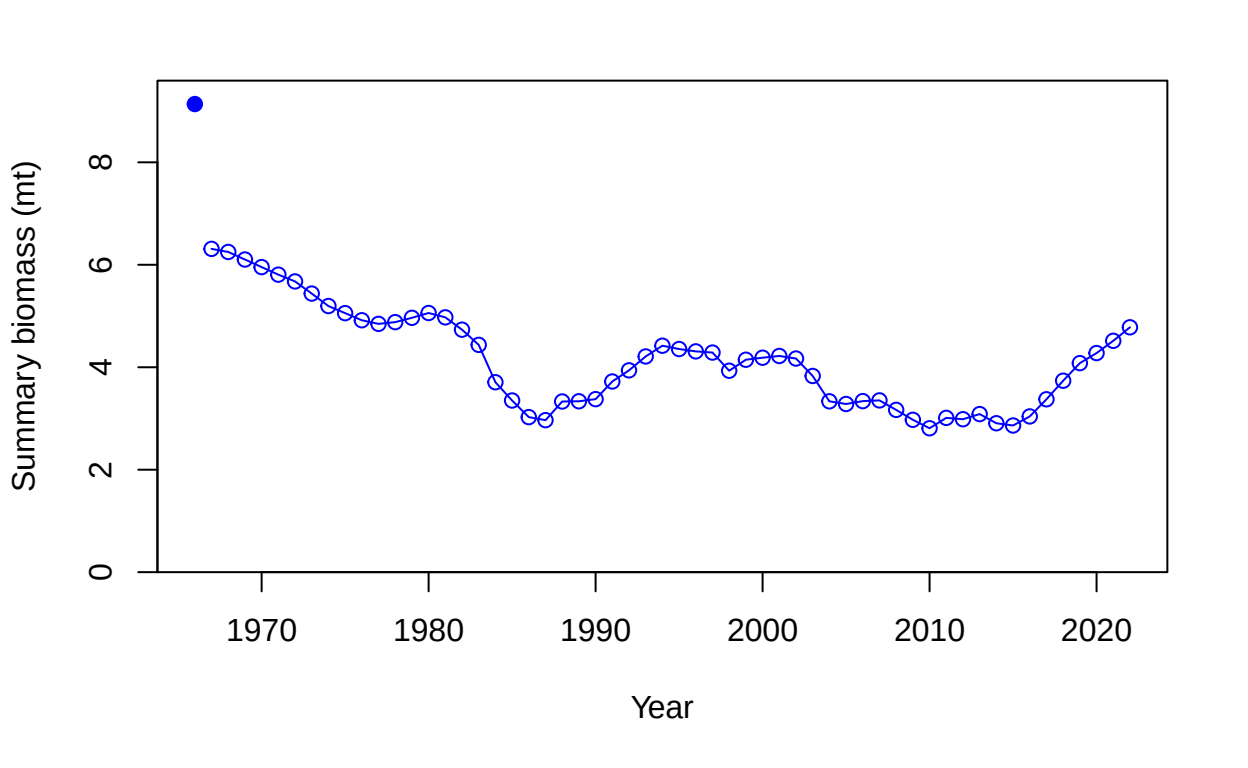

Spawning biomass (mt)
0.0
0.5
1.0
1.5
2.0
2.5
1970
1980
1990
2000
2010
2020
Year

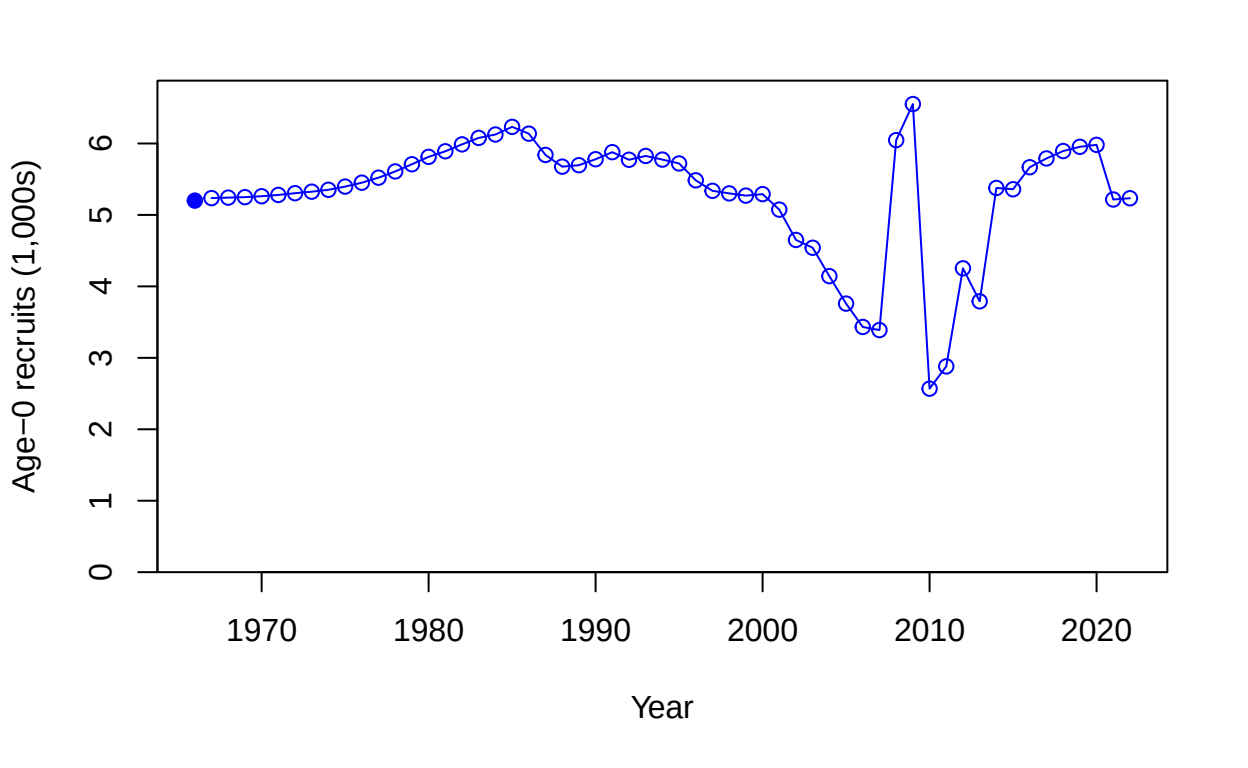

Spawning biomass (mt)
0
1
2
3
4
1970
1980
1990
2000
2010
2020
Year

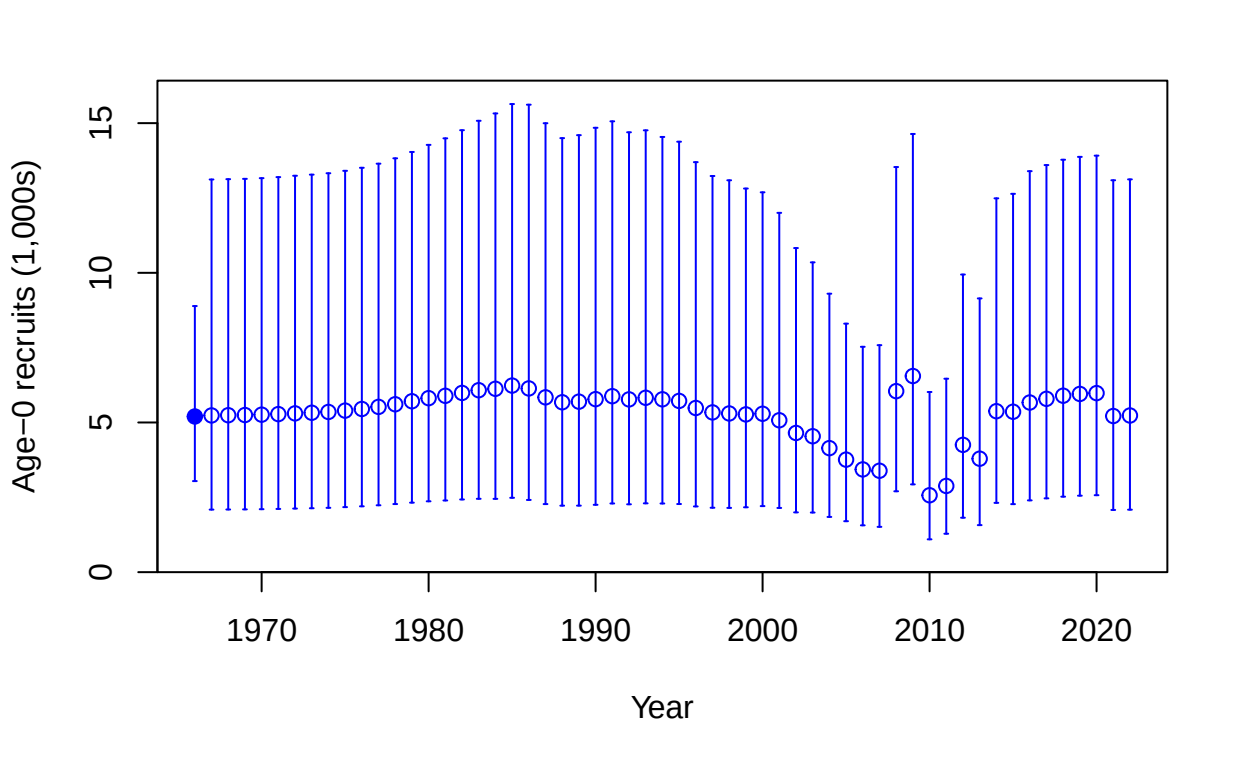

Relative spawning biomass: B/B_MSY
0.0
0.5
1.0
1.5
2.0
2.5
3.0
1970
1980
1990
2000
2010
2020
Year

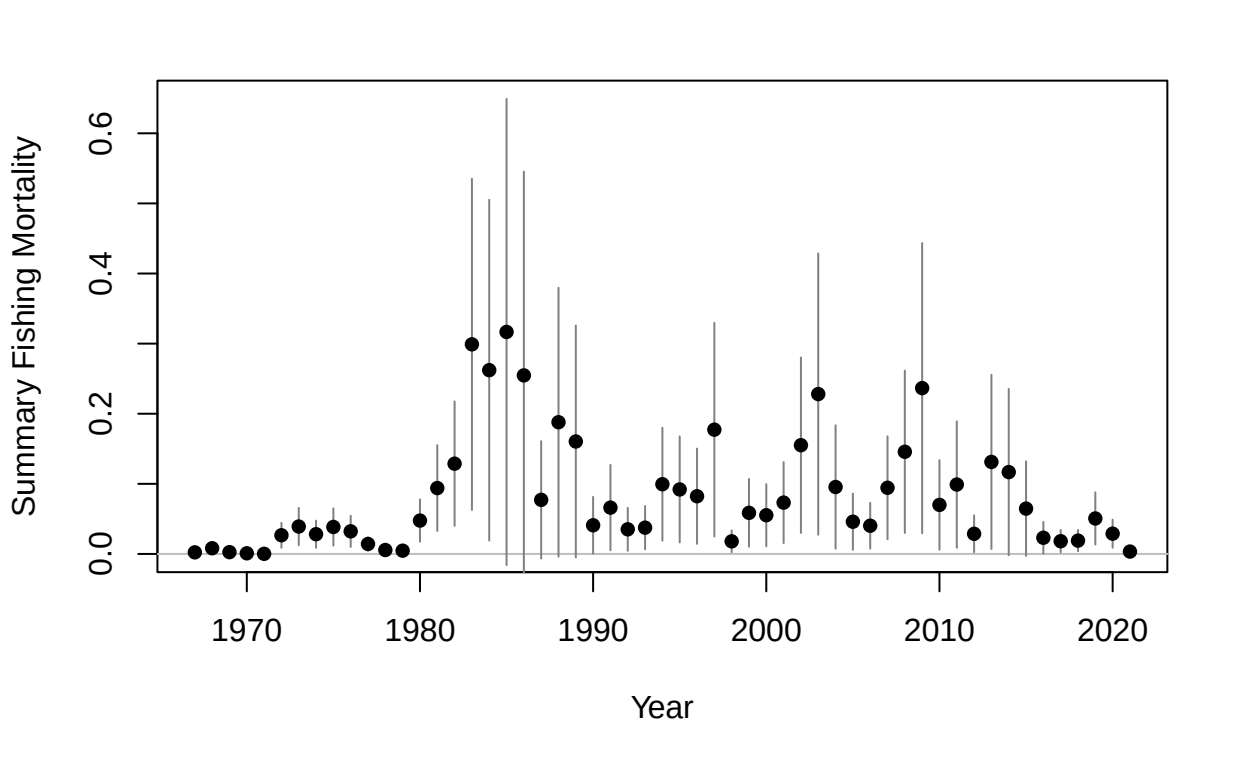

Relative spawning biomass: B/B_MSY
0
1
2
3
4
1970
1980
1990
2000
2010
2020
Year

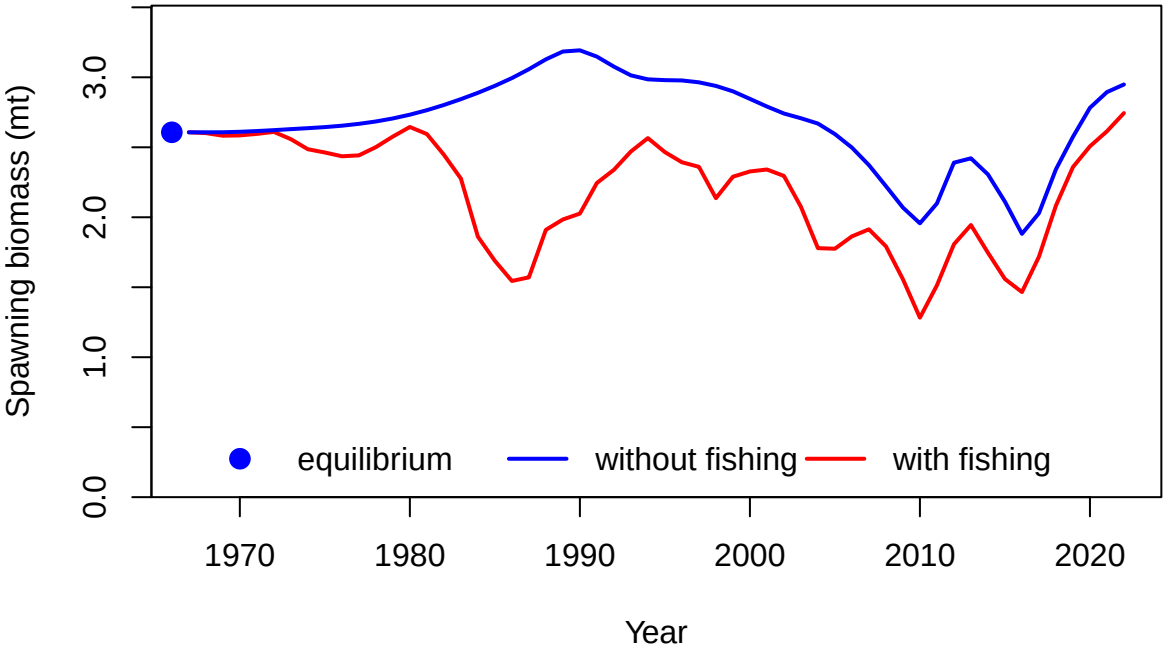

Total biomass (mt)
0
2
4
6
8
1970
1980
1990
2000
2010
2020
Year

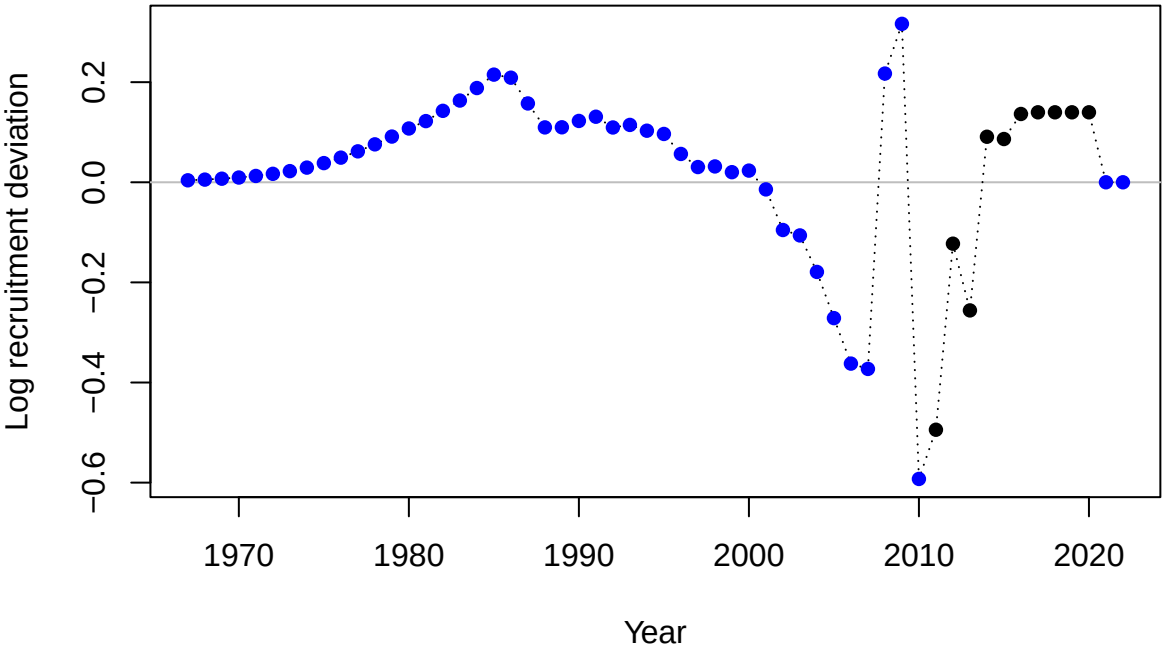

Summary biomass (mt)
0
2
4
6
8
1970
1980
1990
2000
2010
2020
Year

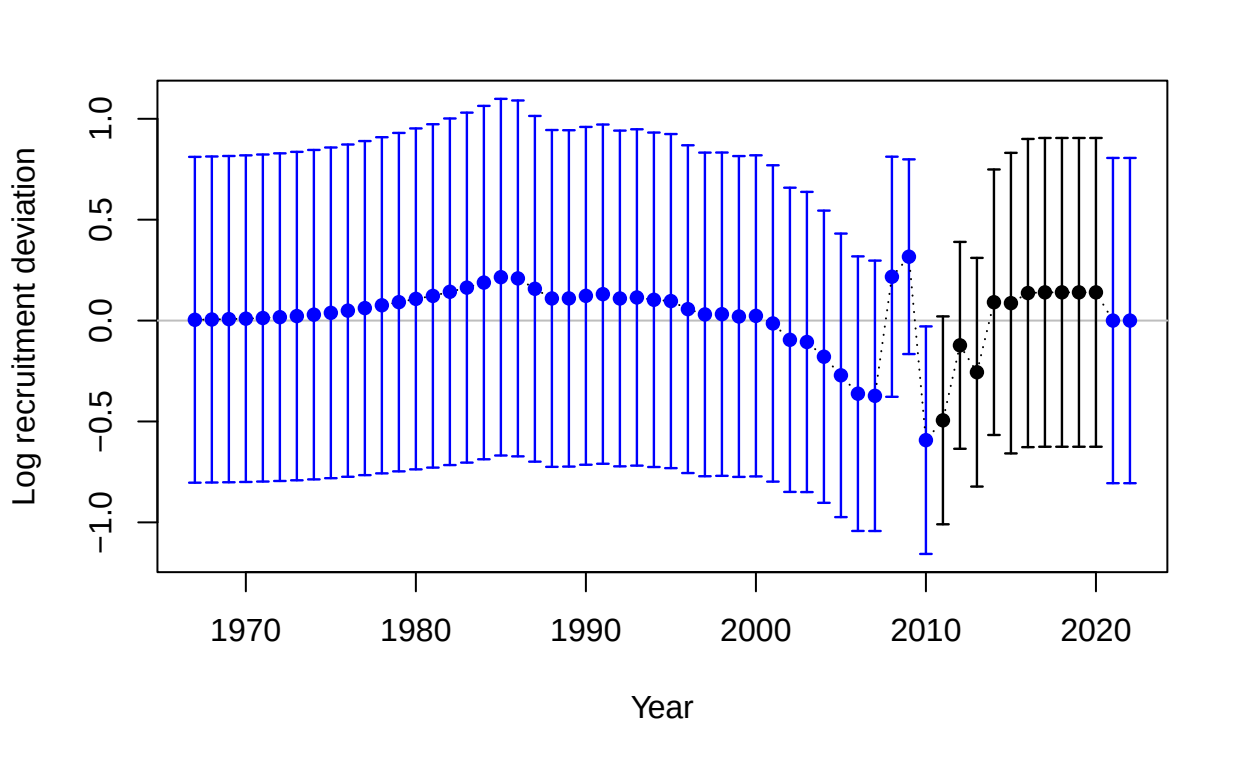

Age−0 recruits (1,000s)
0
1
2
3
4
5
6
1970
1980
1990
2000
2010
2020
Year

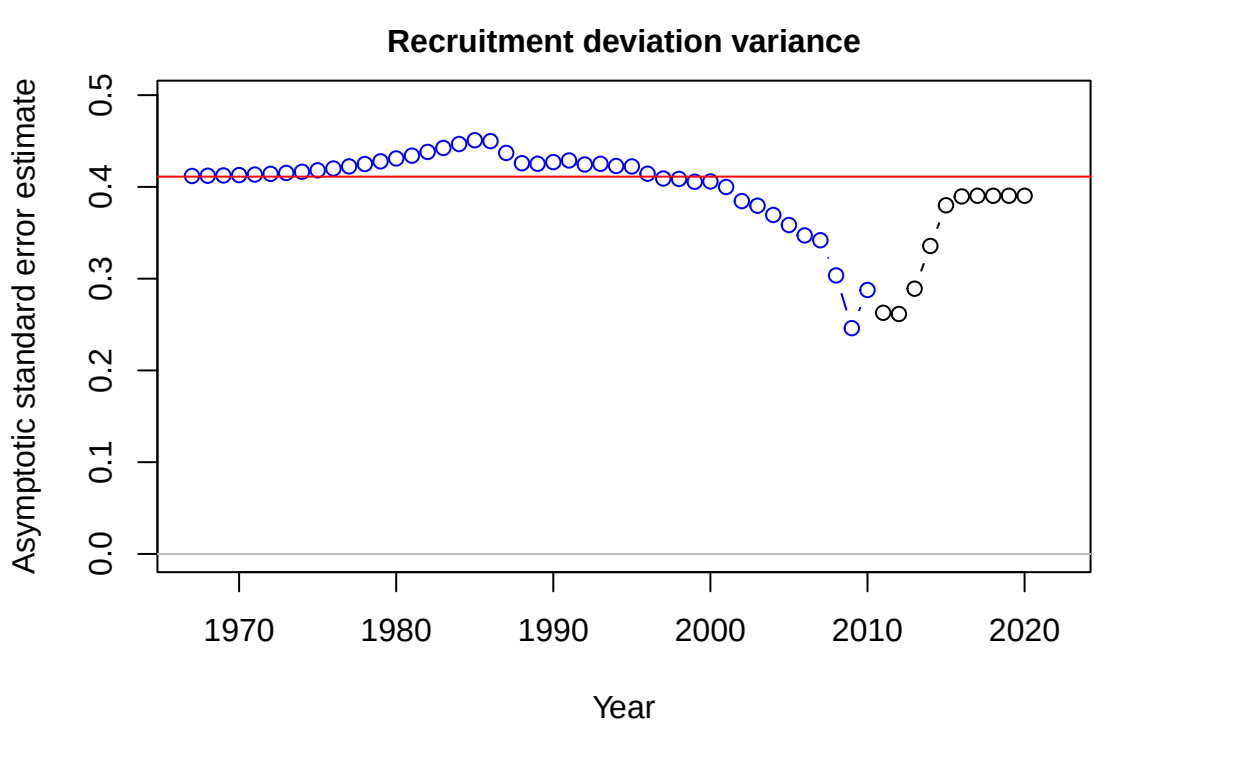

Age−0 recruits (1,000s)
0
5
10
15
1970
1980
1990
2000
2010
2020
Year

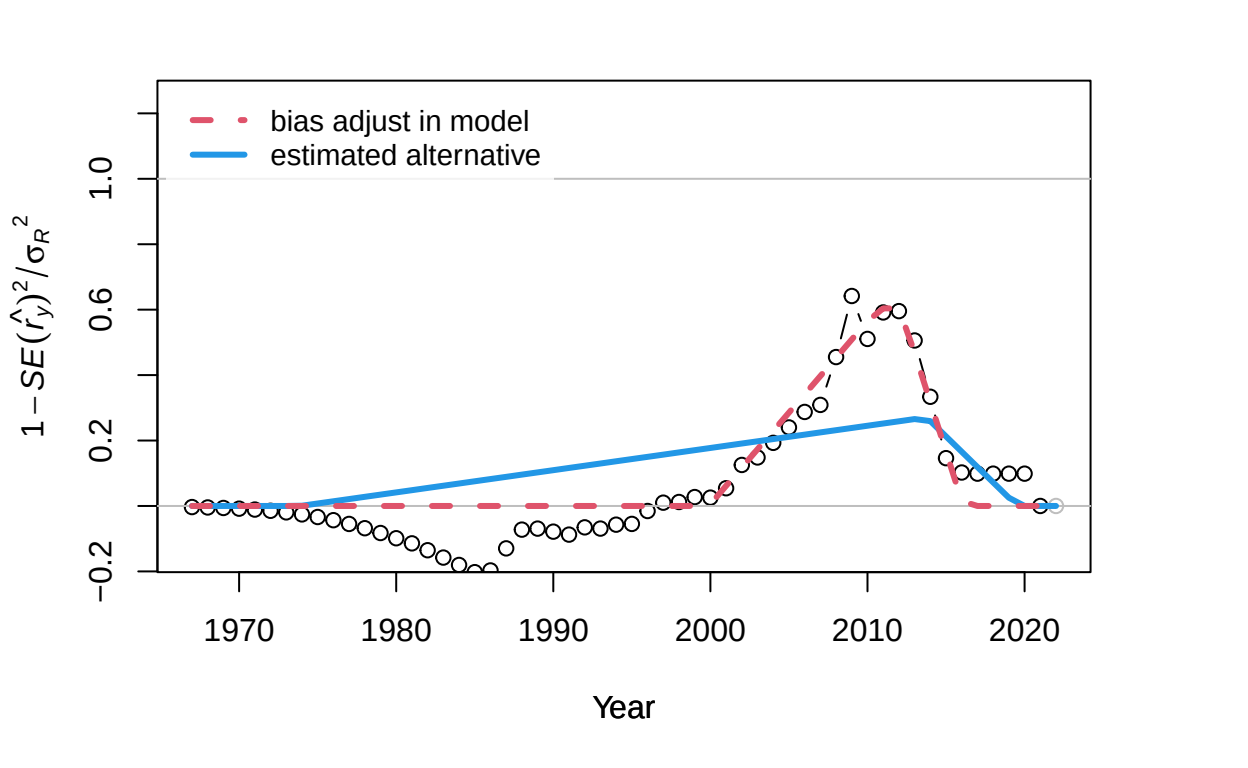

Summary Fishing Mortality
0.0
0.2
0.4
0.6
1970
1980
1990
2000
2010
2020
Year

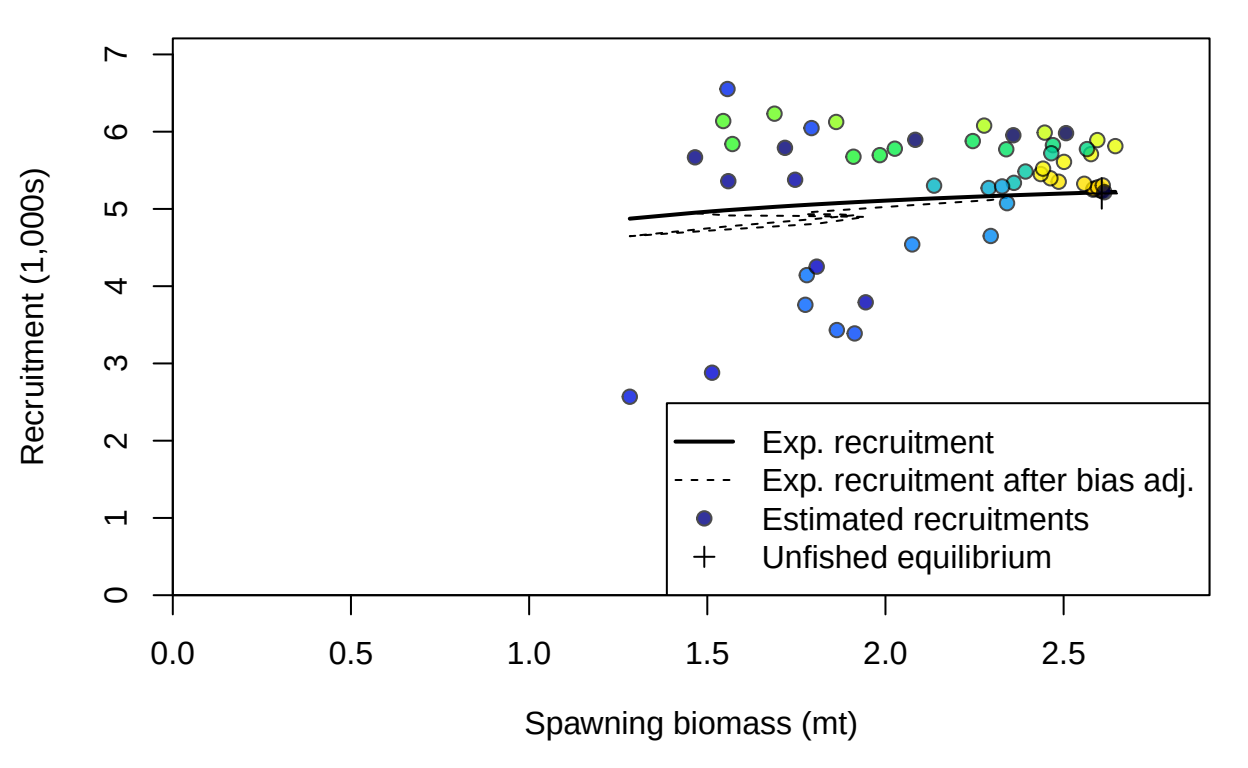

Spawning biomass (mt)
0.0
1.0
2.0
3.0
1970
1980
1990
2000
2010
2020
Year
equilibrium
without fishing
with fishing

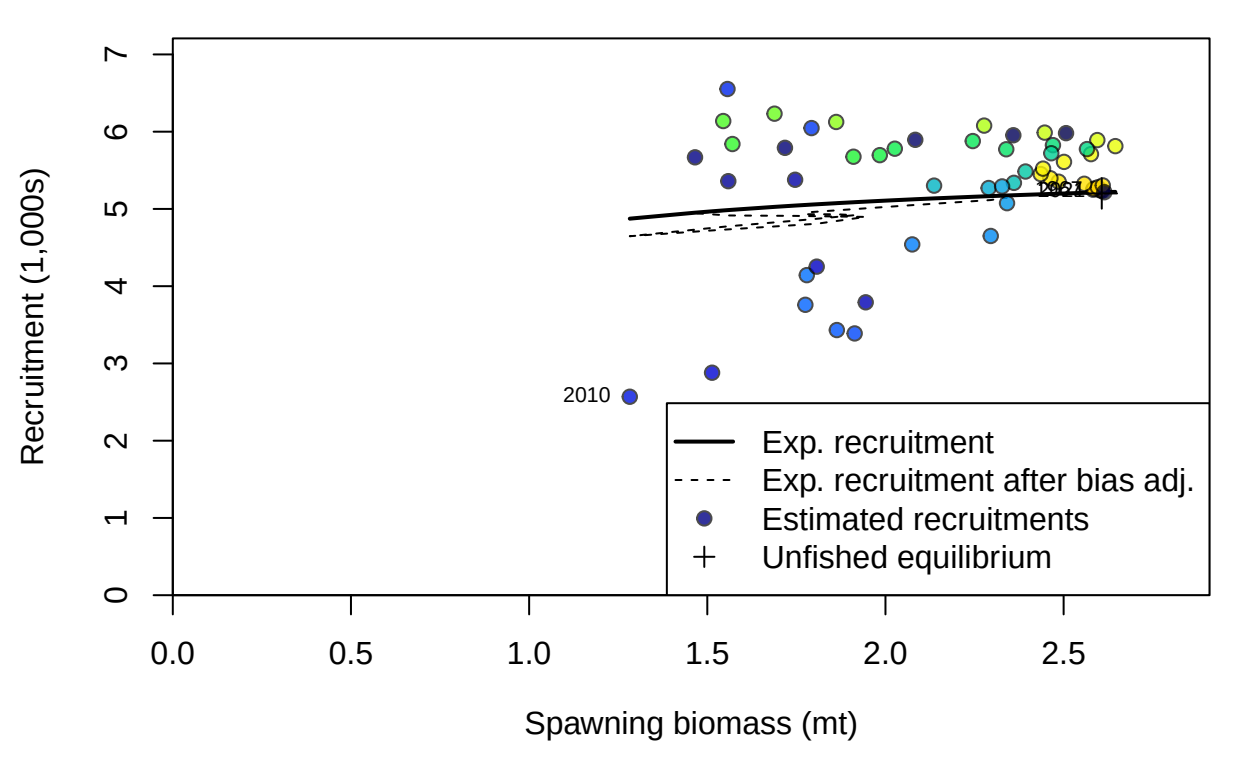

Log recruitment deviation
0.2
0.0
−0.2
−0.4
−0.6
1970
1980
1990
2000
2010
2020
Year

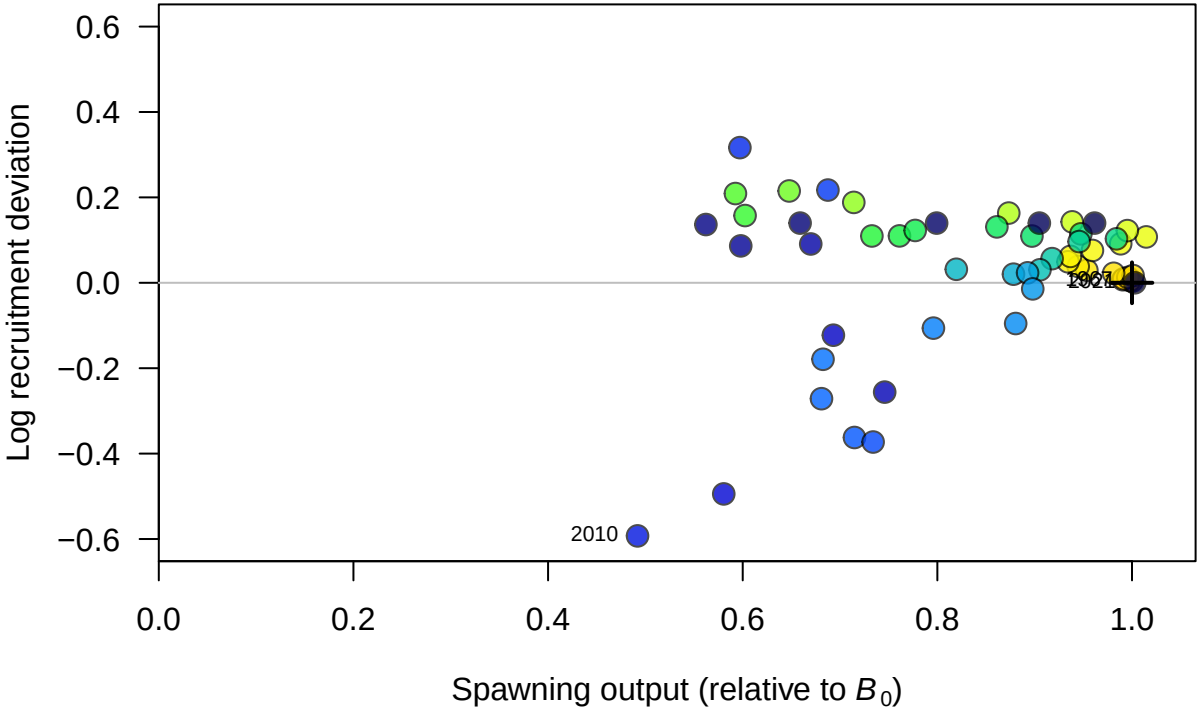

Log recruitment deviation
1.0
0.5
0.0
−0.5
−1.0
1970
1980
1990
2000
2010
2020
Year

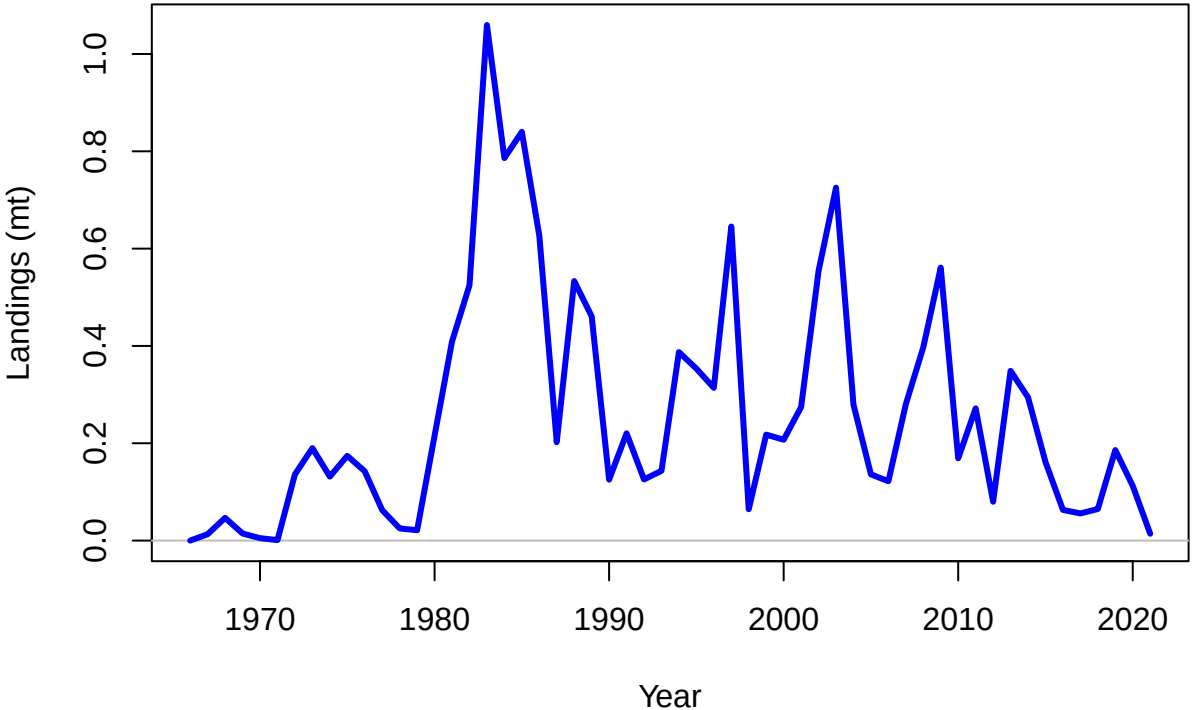

Recruitment deviation variance
Asymptotic standard error estimate
0.0
0.1
0.2
0.3
0.4
0.5
1970
1980
1990
2000
2010
2020
Year

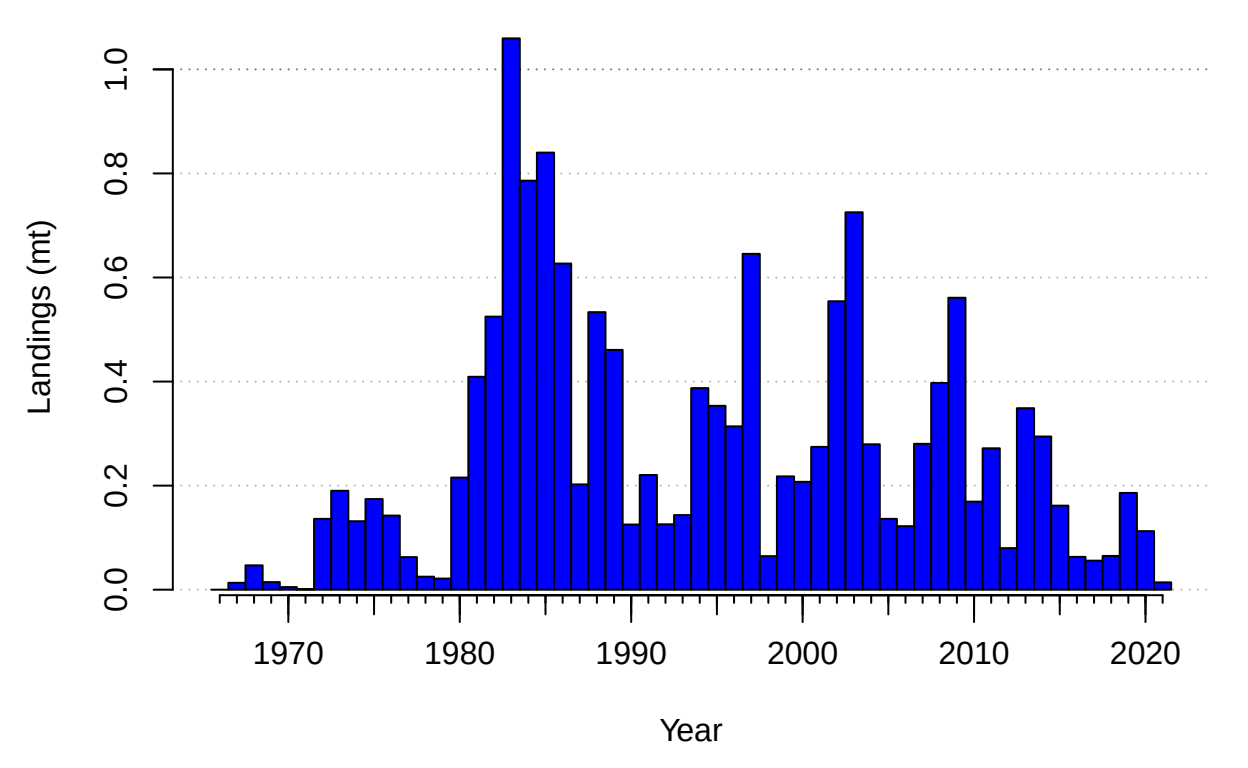

bias adjust in model
estimated alternative
$1 - SE(\hat{r_y})^2/\sigma_R^2$
1.0
0.6
0.2
−0.2
1970
1980
1990
2000
2010
2020
Year

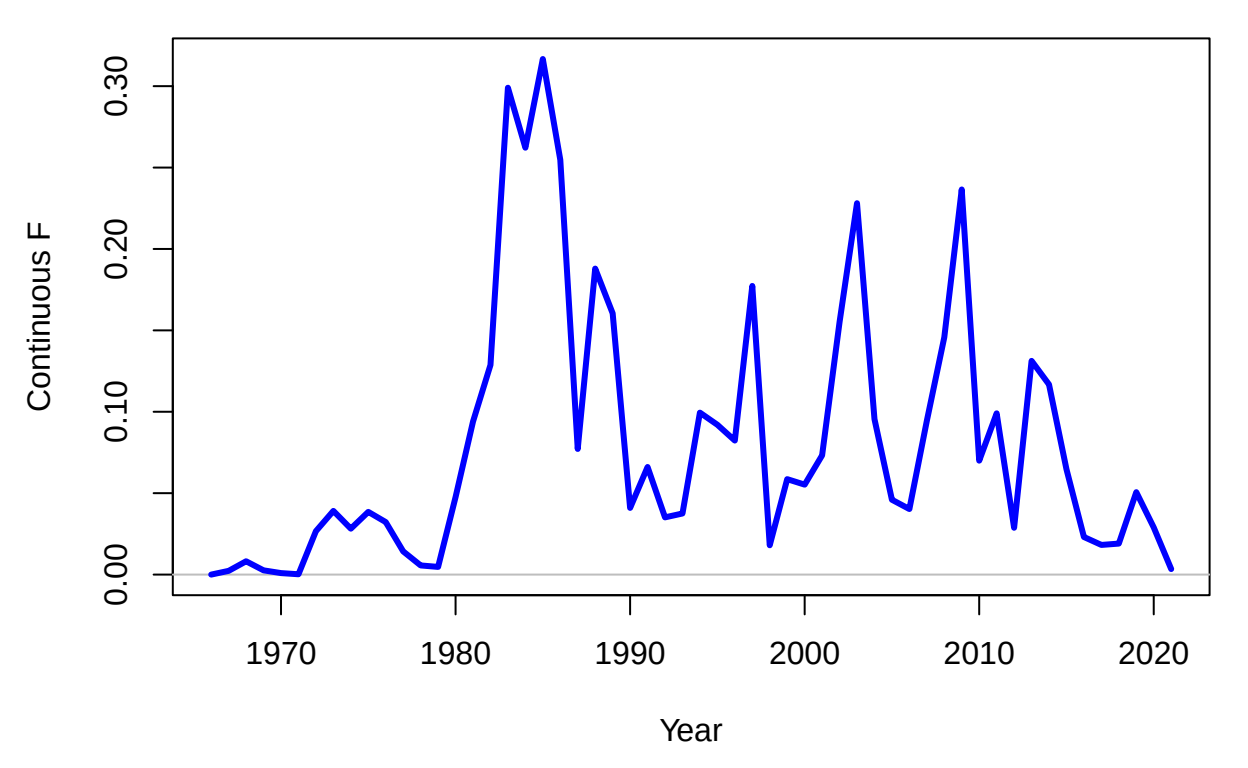

Recruitment (1,000s)
0
1
2
3
4
5
6
7
0.0
0.5
1.0
1.5
2.0
2.5
Spawning biomass (mt)
Exp. recruitment
Exp. recruitment after bias adj.
Estimated recruitments
Unfished equilibrium

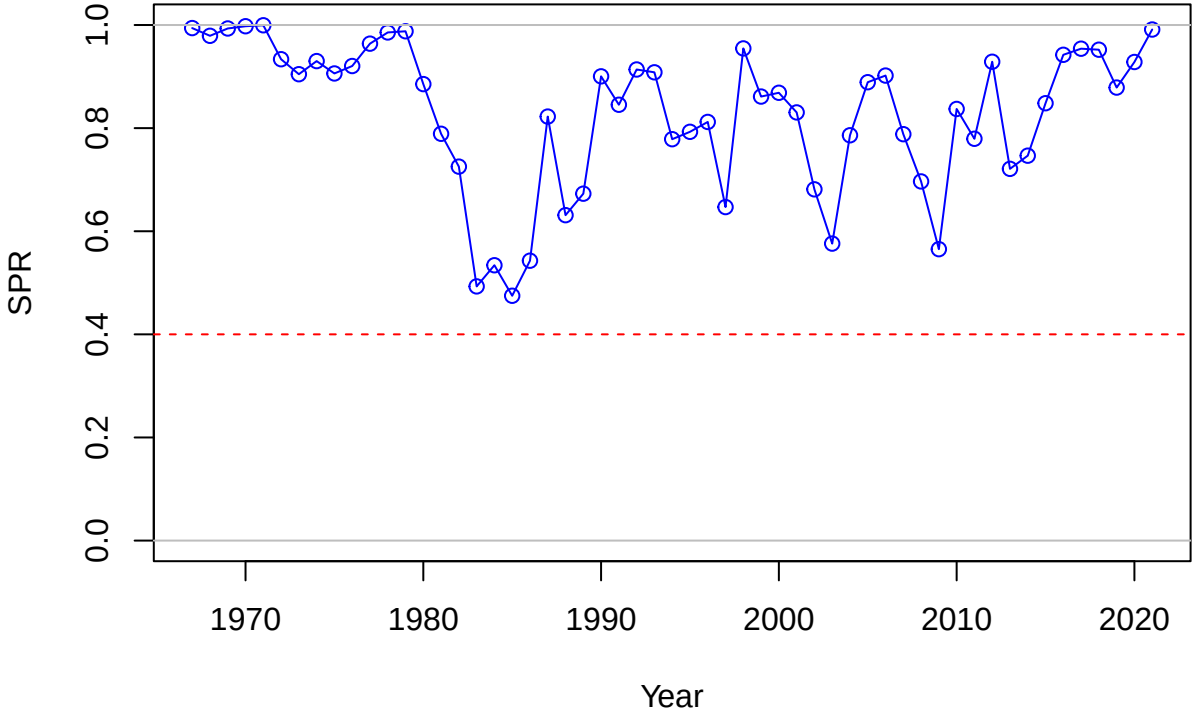

Recruitment (1,000s)
0
1
2
3
4
5
6
7
0.0
0.5
1.0
1.5
2.0
2.5
Spawning biomass (mt)
2010
Exp. recruitment
Exp. recruitment after bias adj.
Estimated recruitments
Unfished equilibrium

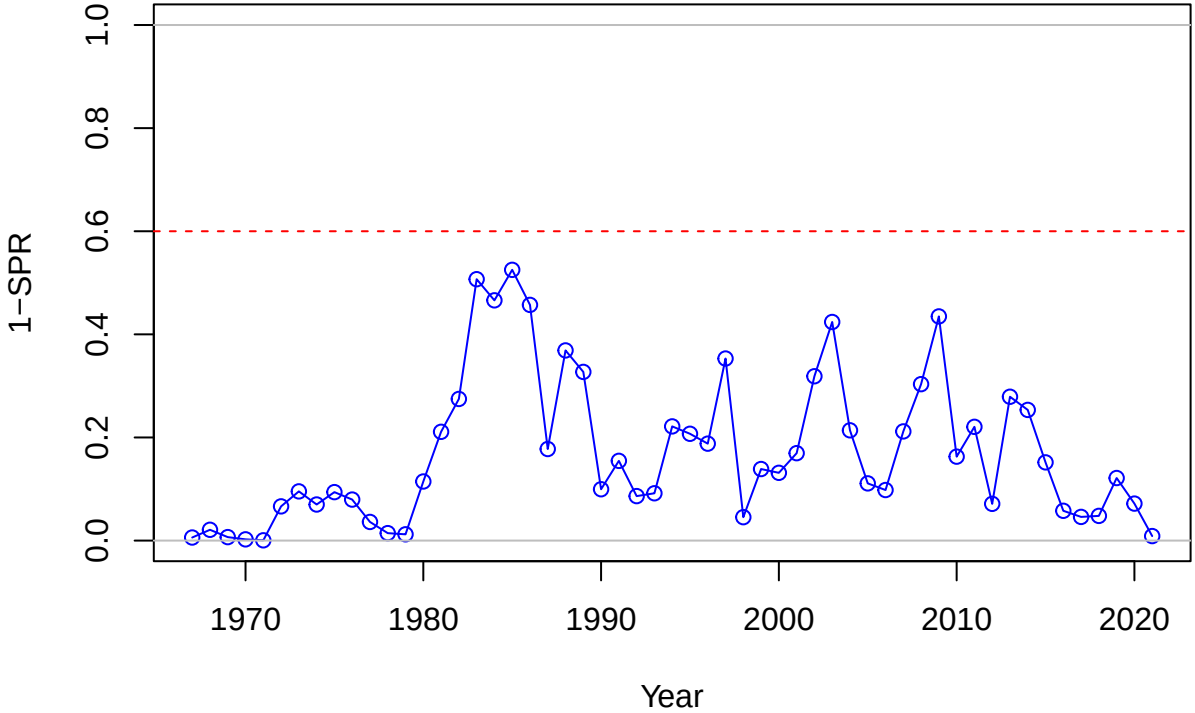

Log recruitment deviation
0.6
0.4
0.2
0.0
−0.2
−0.4
−0.6
2010
0.0
0.2
0.4
0.6
0.8
1.0
Spawning output (relative to B_0)

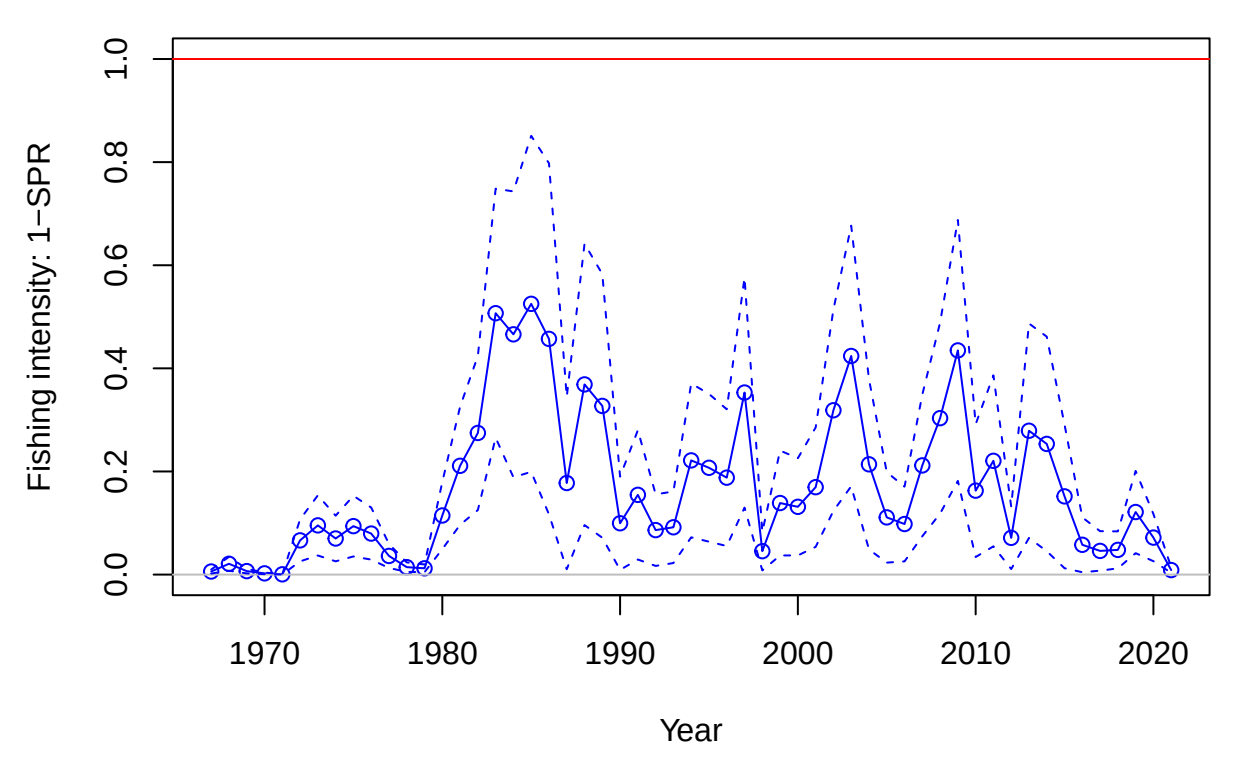

Landings (mt)
0.0
0.2
0.4
0.6
0.8
1.0
1970
1980
1990
2000
2010
2020
Year

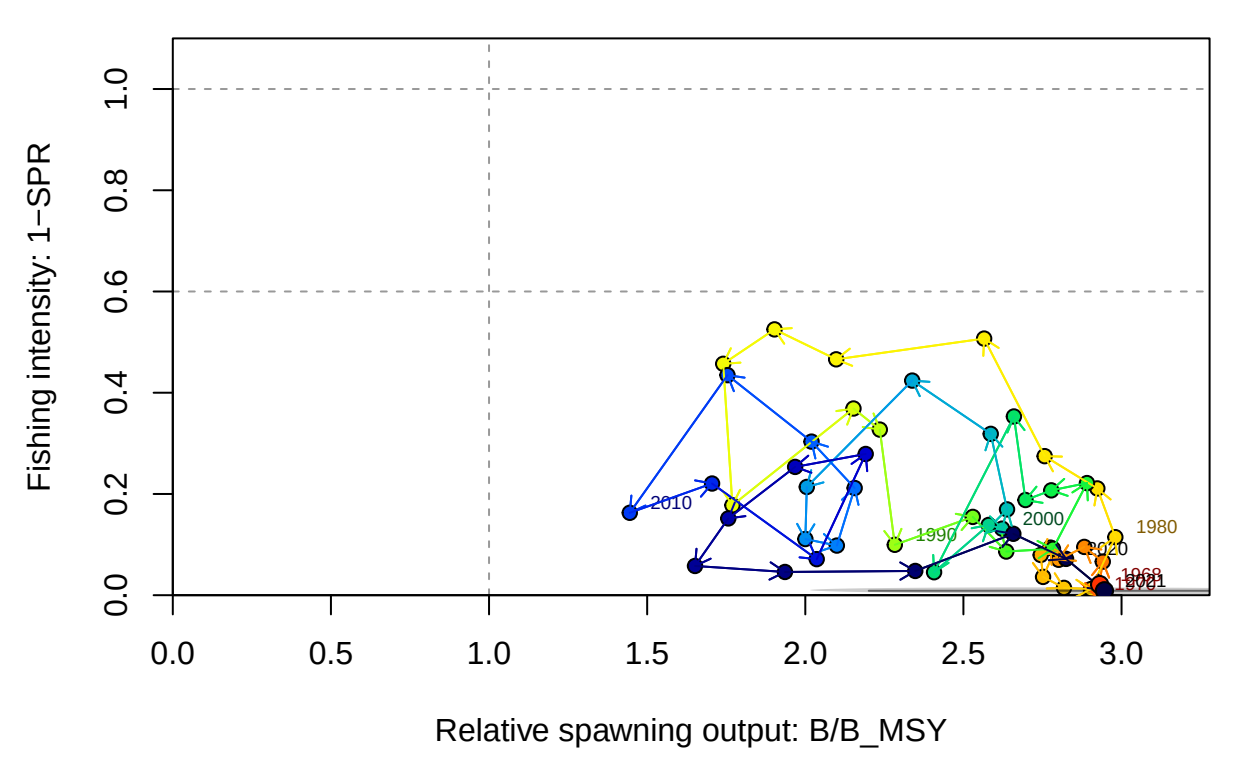

Landings (mt)
0.0
0.2
0.4
0.6
0.8
1.0
1970
1980
1990
2000
2010
2020
Year

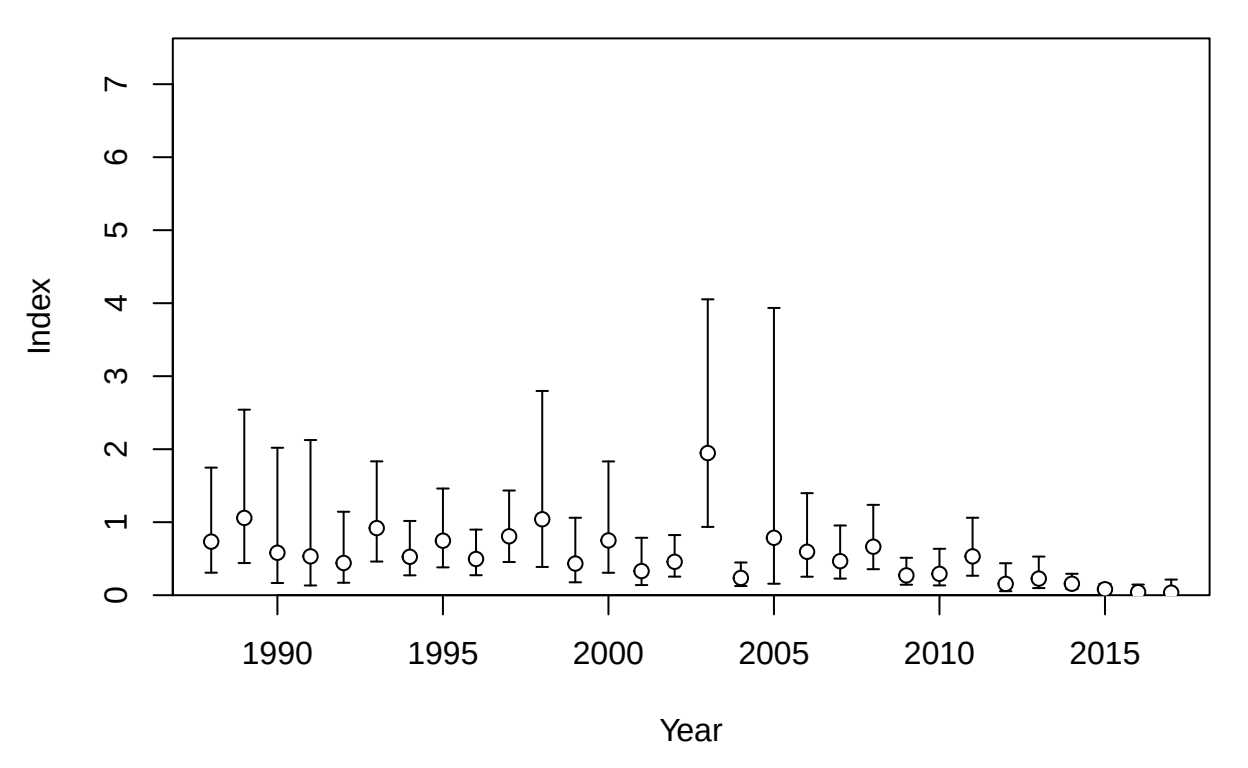

Continuous F
0.00
0.10
0.20
0.30
1970
1980
1990
2000
2010
2020
Year

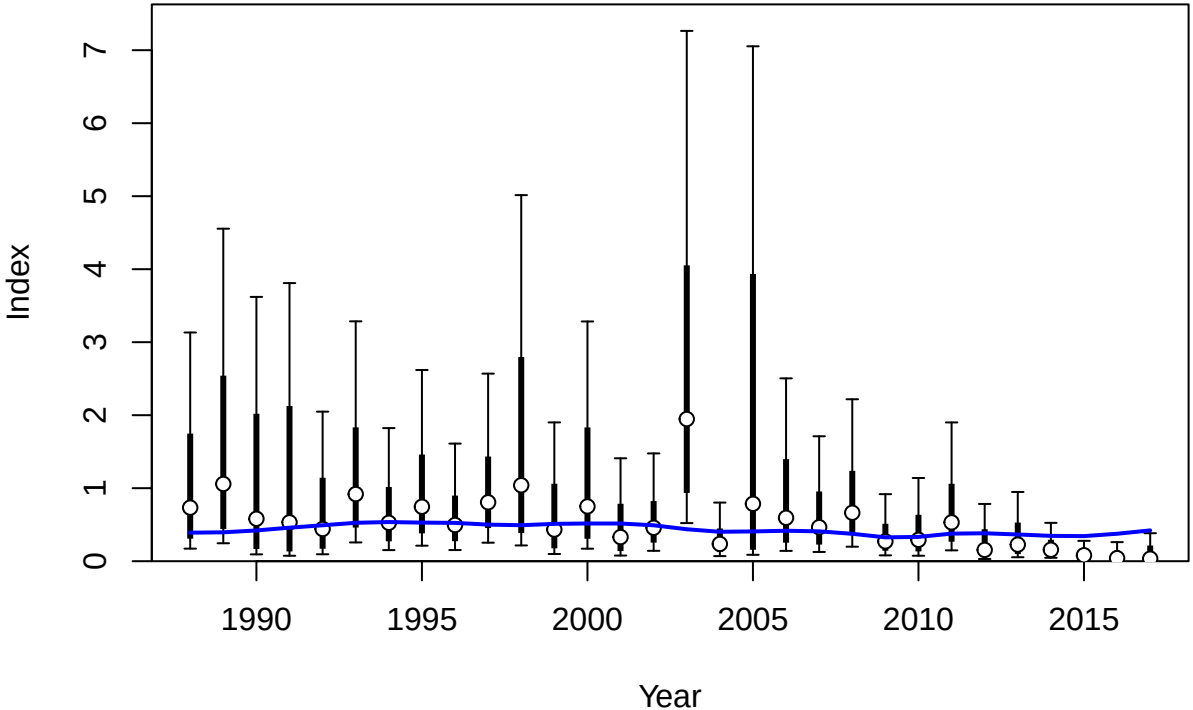

SPR
0.0
0.2
0.4
0.6
0.8
1.0
1970
1980
1990
2000
2010
2020
Year

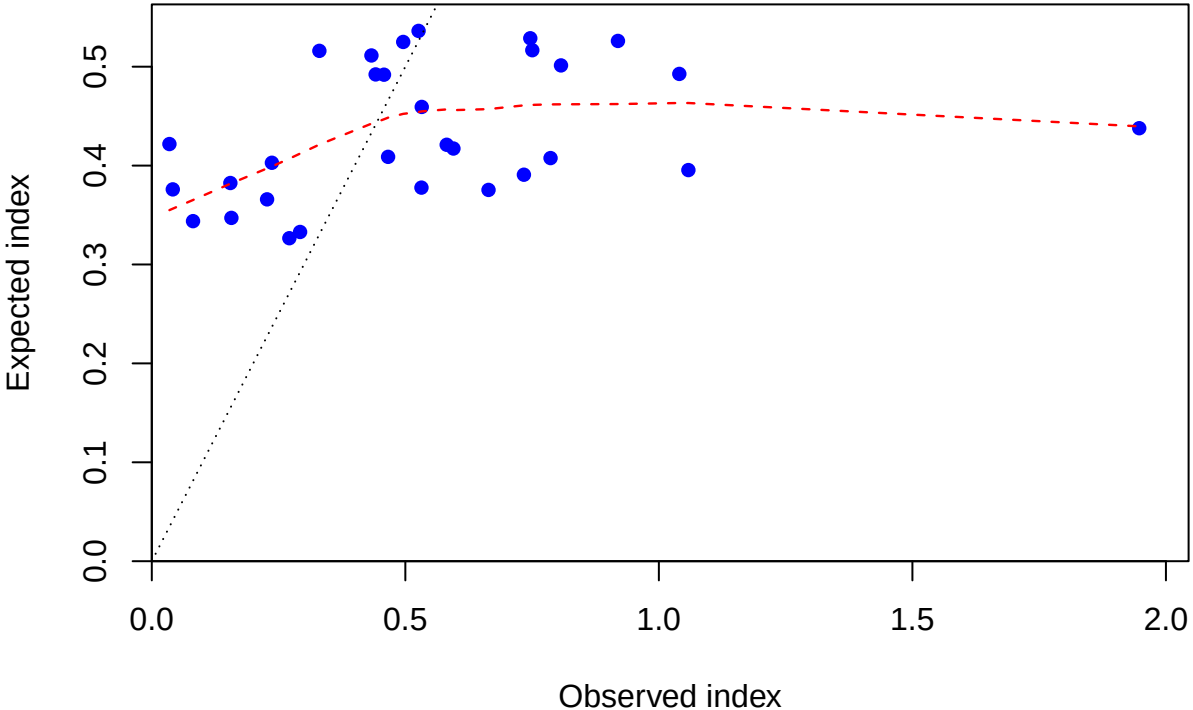

1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
1970
1980
1990
2000
2010
2020
Year

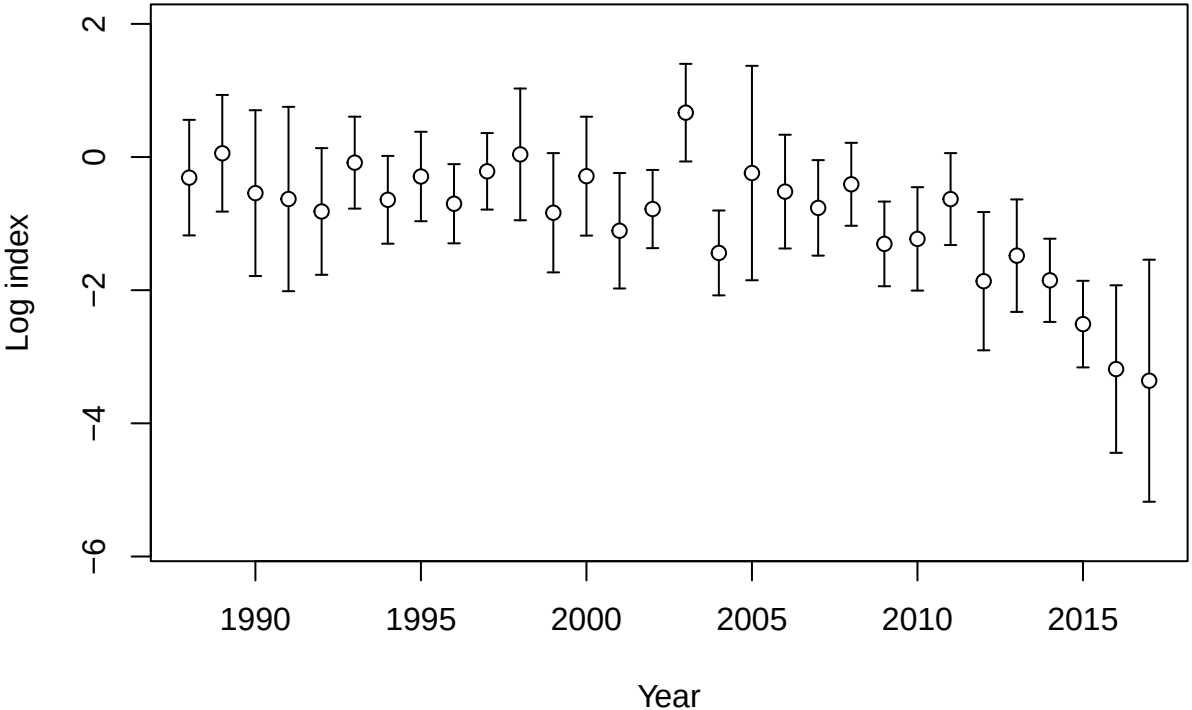

Fishing intensity: 1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
1970
1980
1990
2000
2010
2020
Year

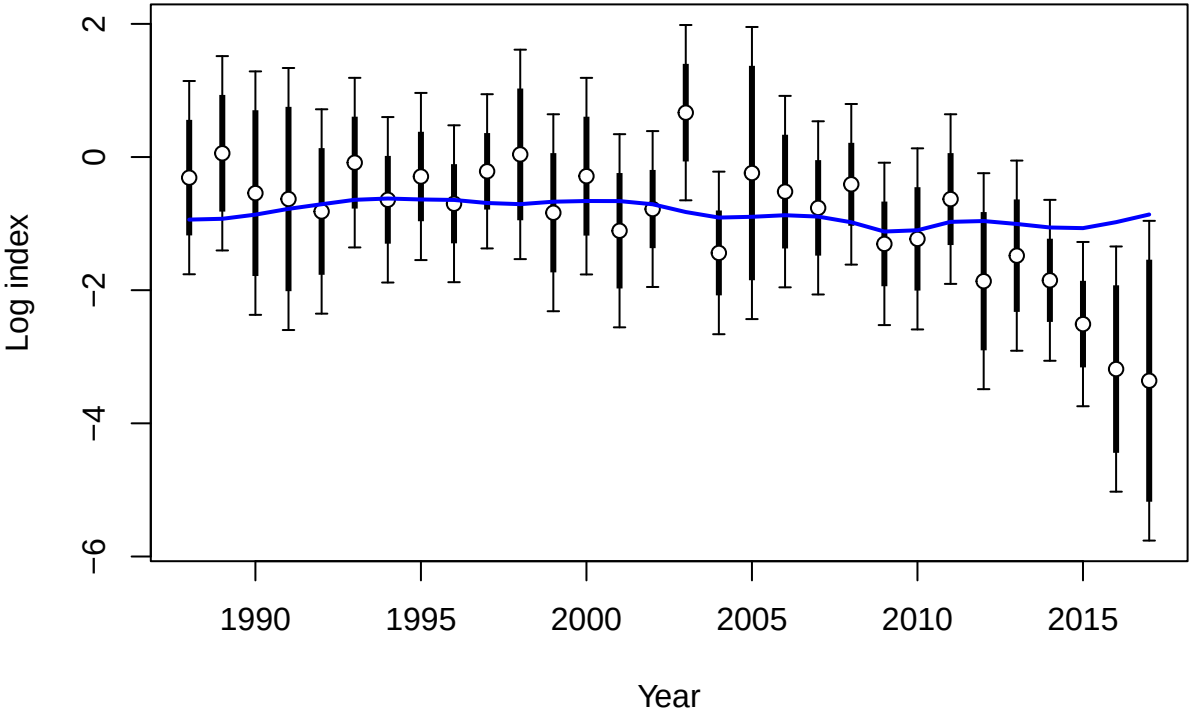

Fishing intensity: 1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
Relative spawning output: B/B_MSY
2010
1990
2000
1980
2020
1968
1971

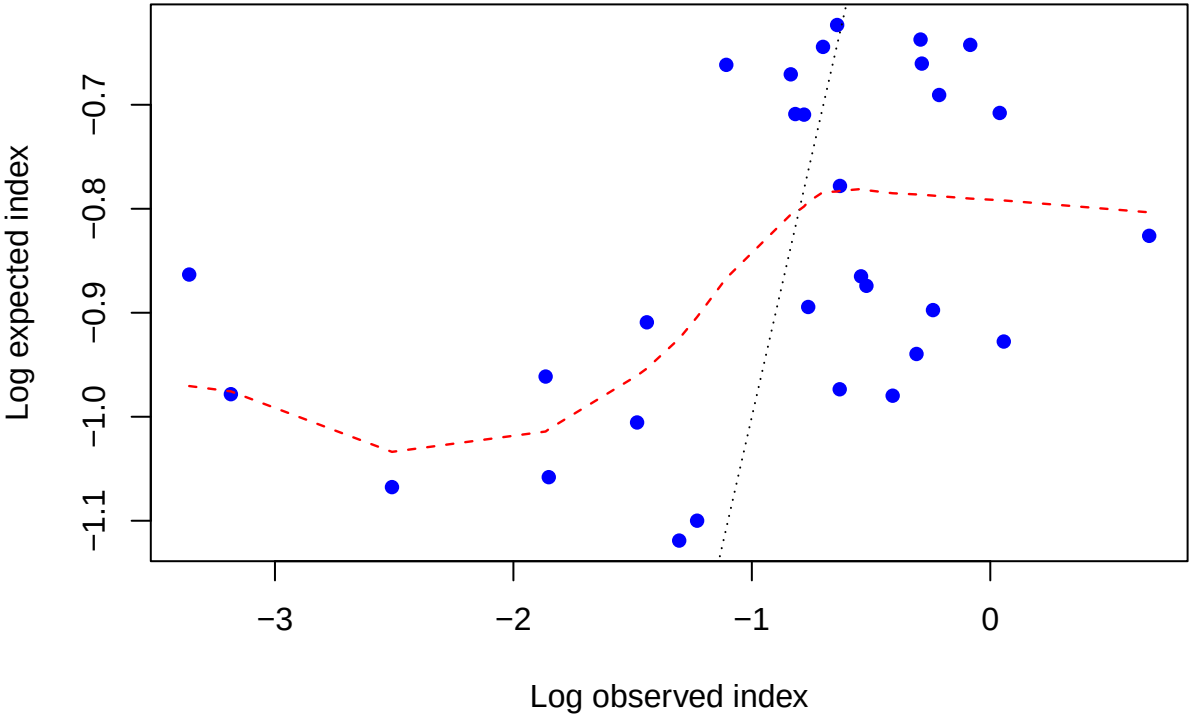

Index
0
1
2
3
4
5
6
7
1990
1995
2000
2005
2010
2015
Year

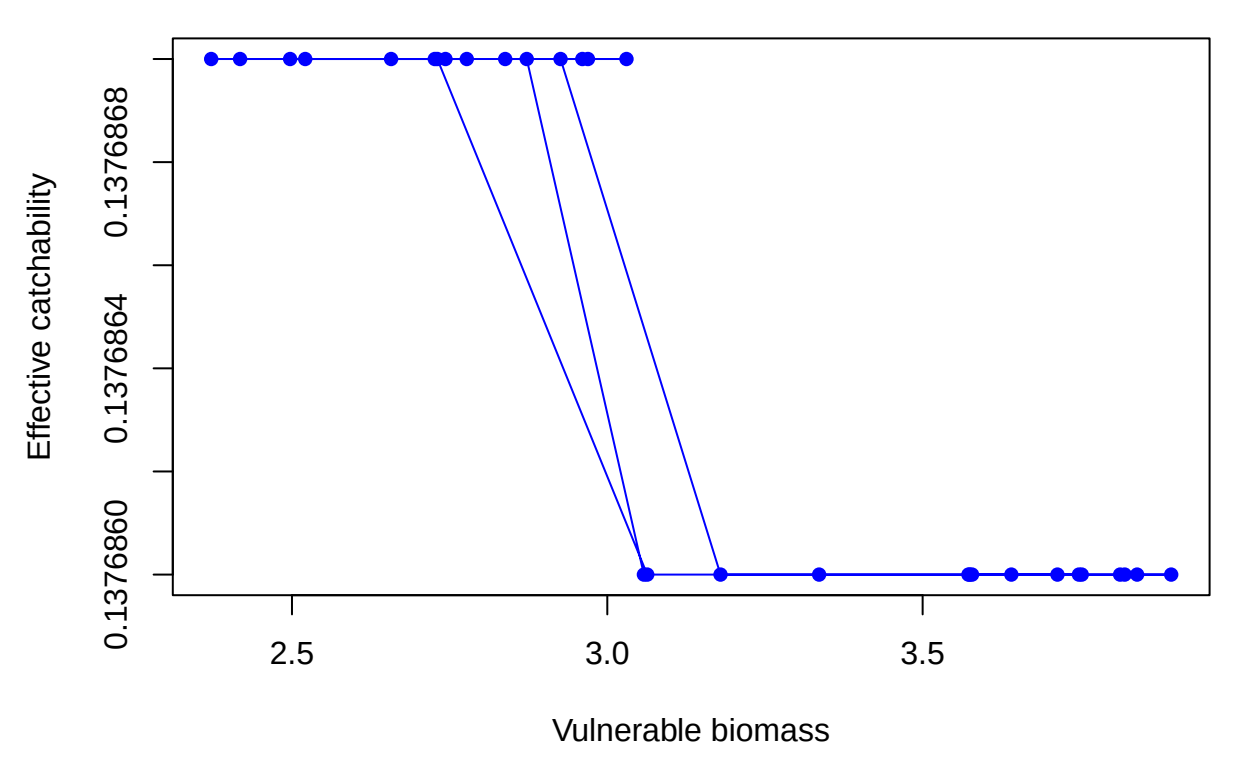

Index
0
1
2
3
4
5
6
7
1990
1995
2000
2005
2010
2015
Year

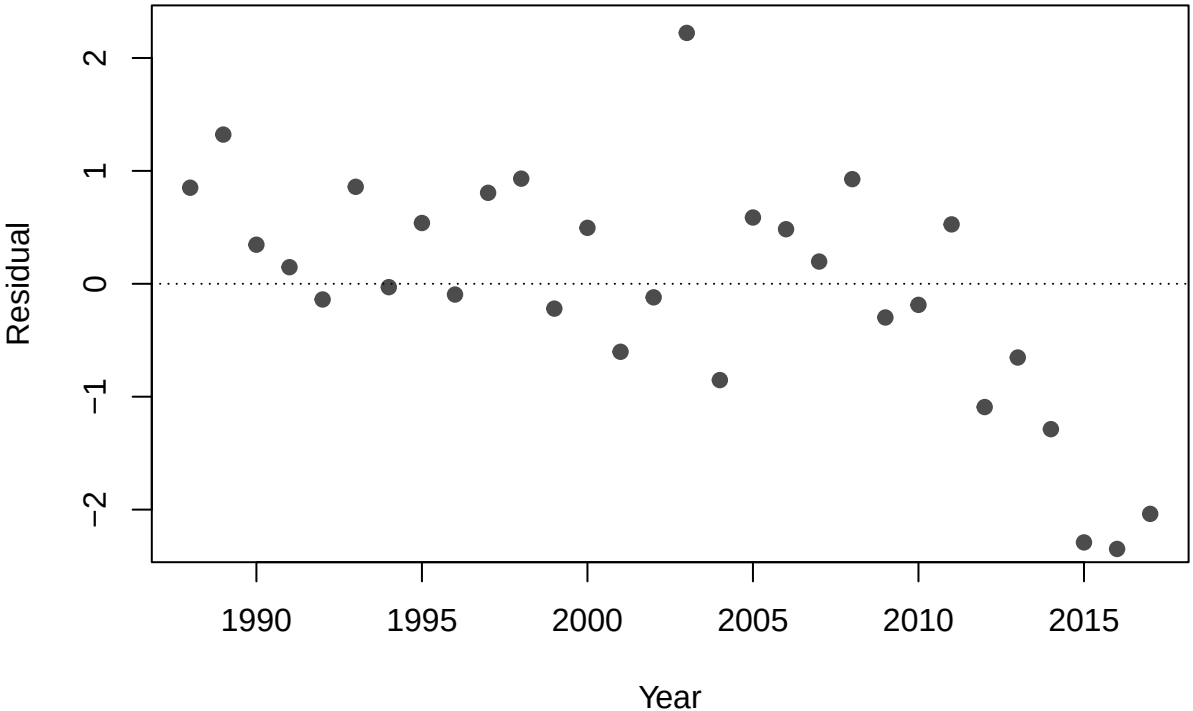

Expected index
0.0
0.1
0.2
0.3
0.4
0.5
0.0
0.5
1.0
1.5
2.0
Observed index

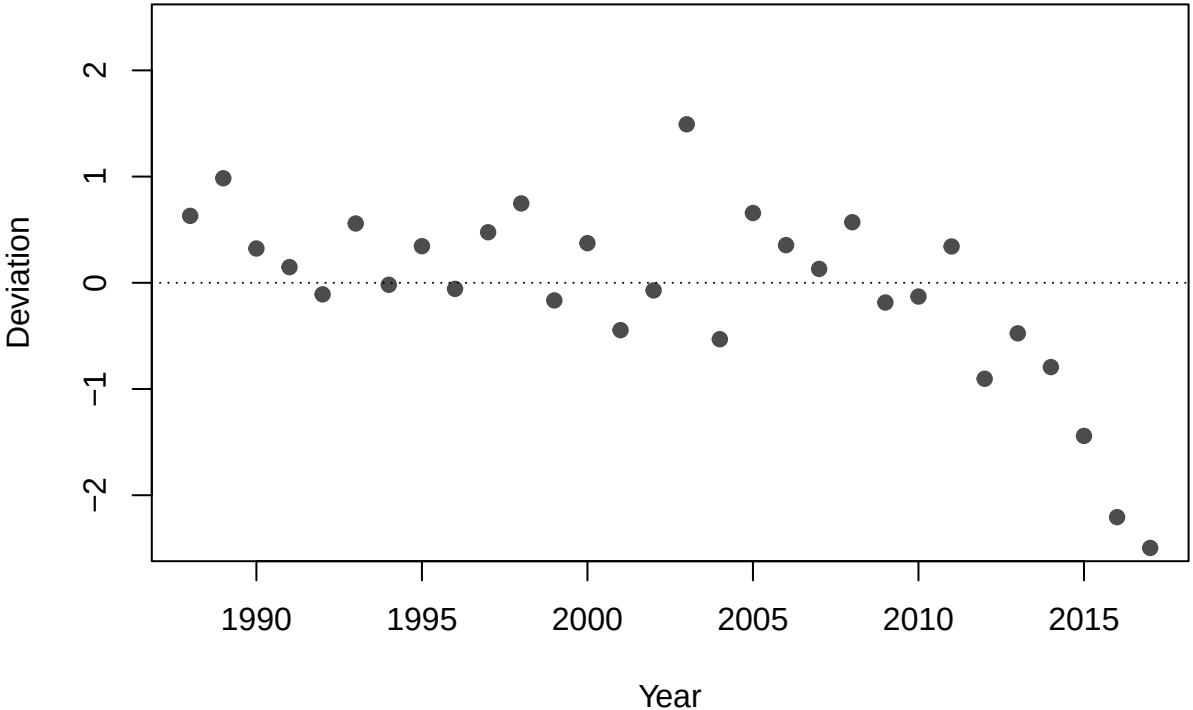

Log index
2
0
−2
−4
−6
1990
1995
2000
2005
2010
2015
Year

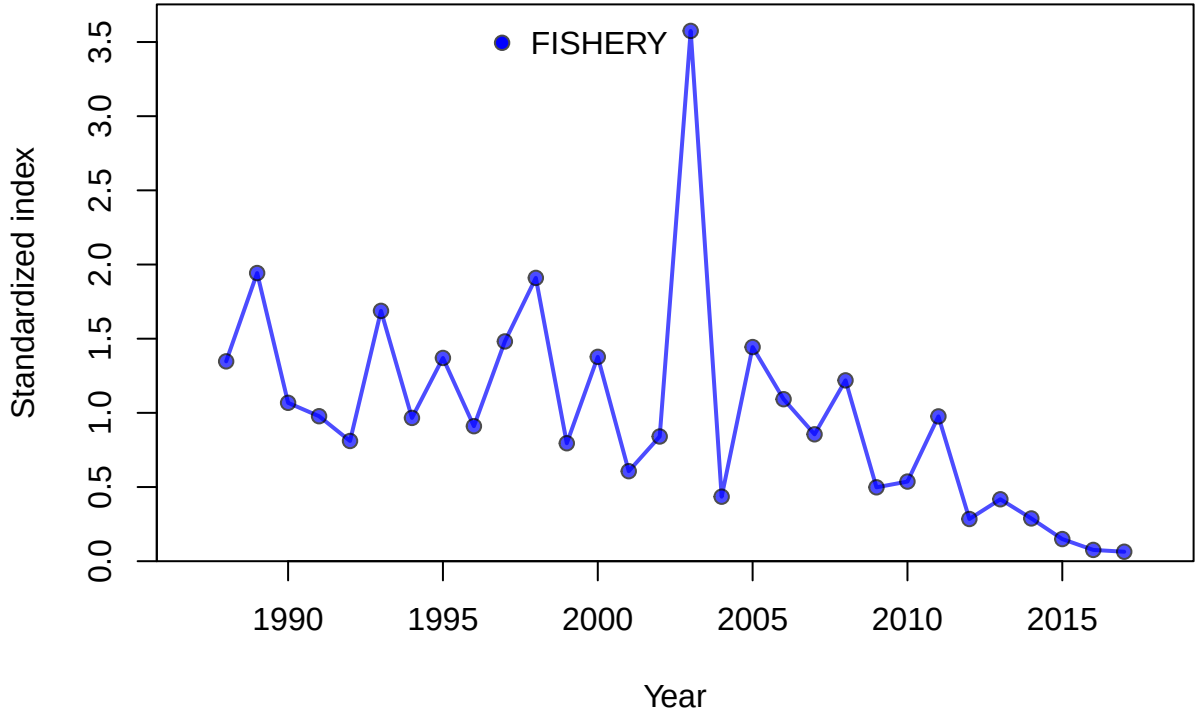

Log index
2
0
−2
−4
−6
1990
1995
2000
2005
2010
2015
Year

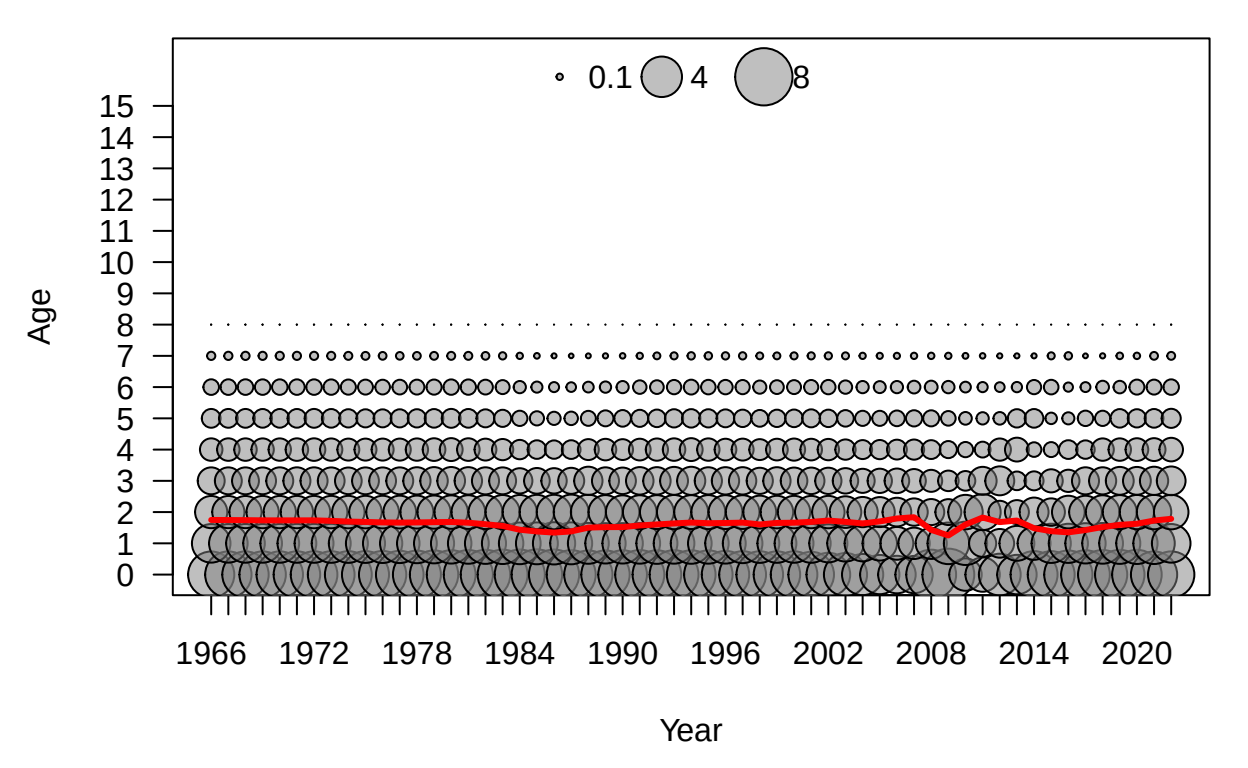

Log expected index
−0.7
−0.8
−0.9
−1.0
−1.1
−3
−2
−1
0
Log observed index

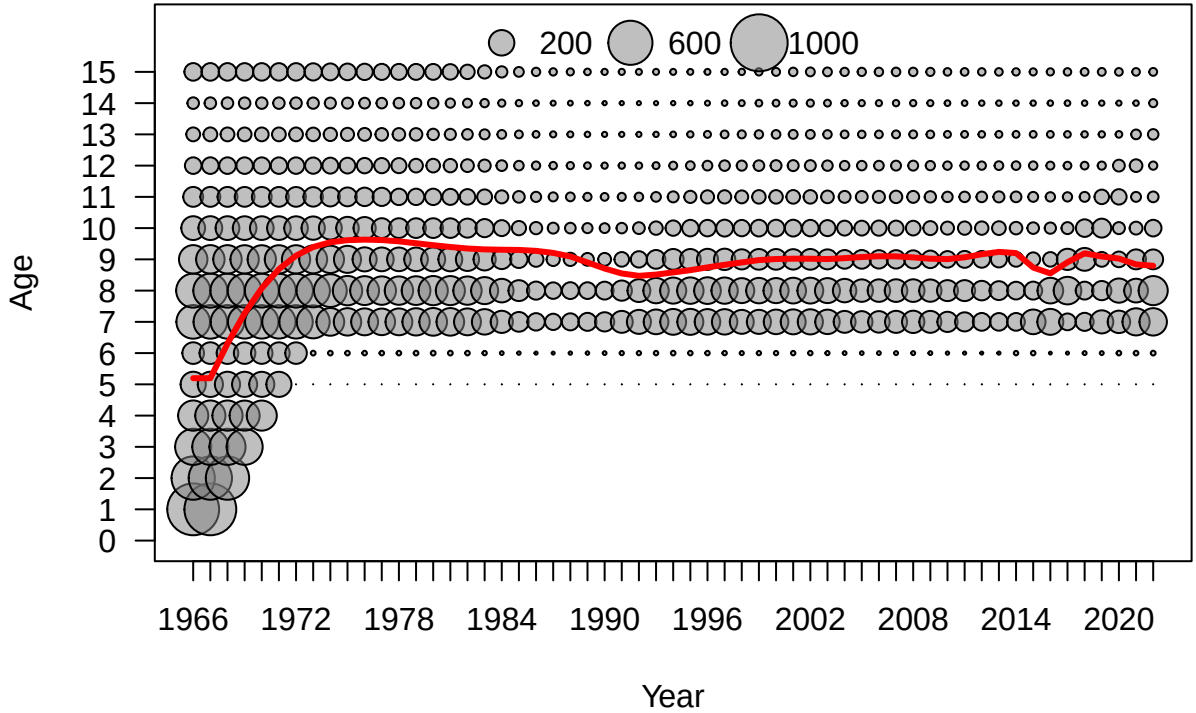

Effective catchability
0.1376868
0.1376864
0.1376860
2.5
3.0
3.5
Vulnerable biomass

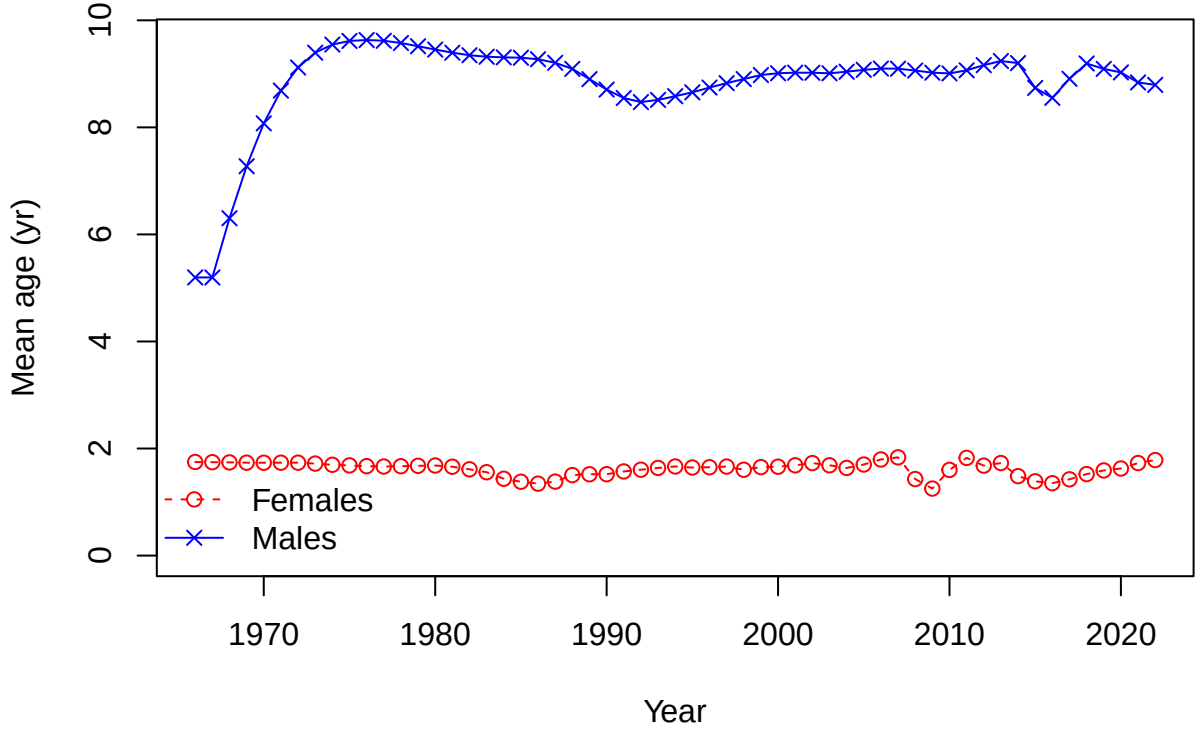

Residual
2
1
0
−1
−2
1990
1995
2000
2005
2010
2015
Year

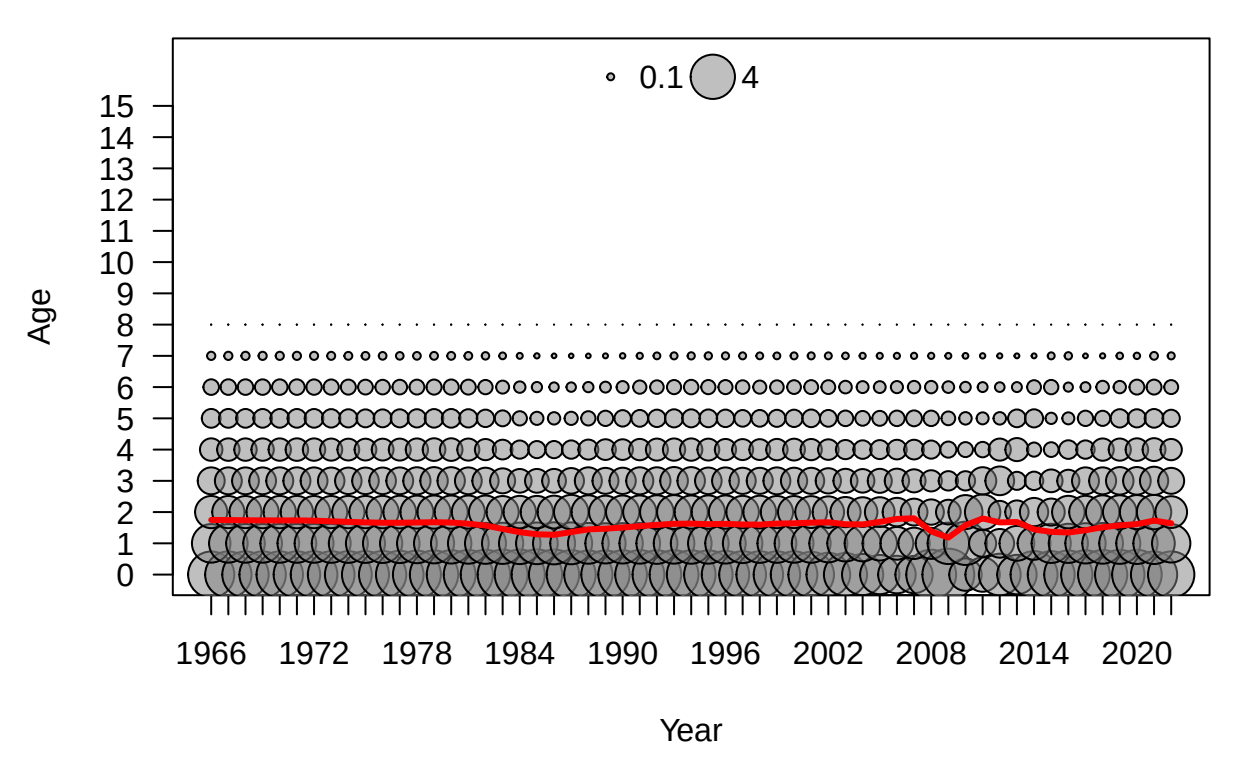

Deviation
2
1
0
−1
−2
1990
1995
2000
2005
2010
2015
Year

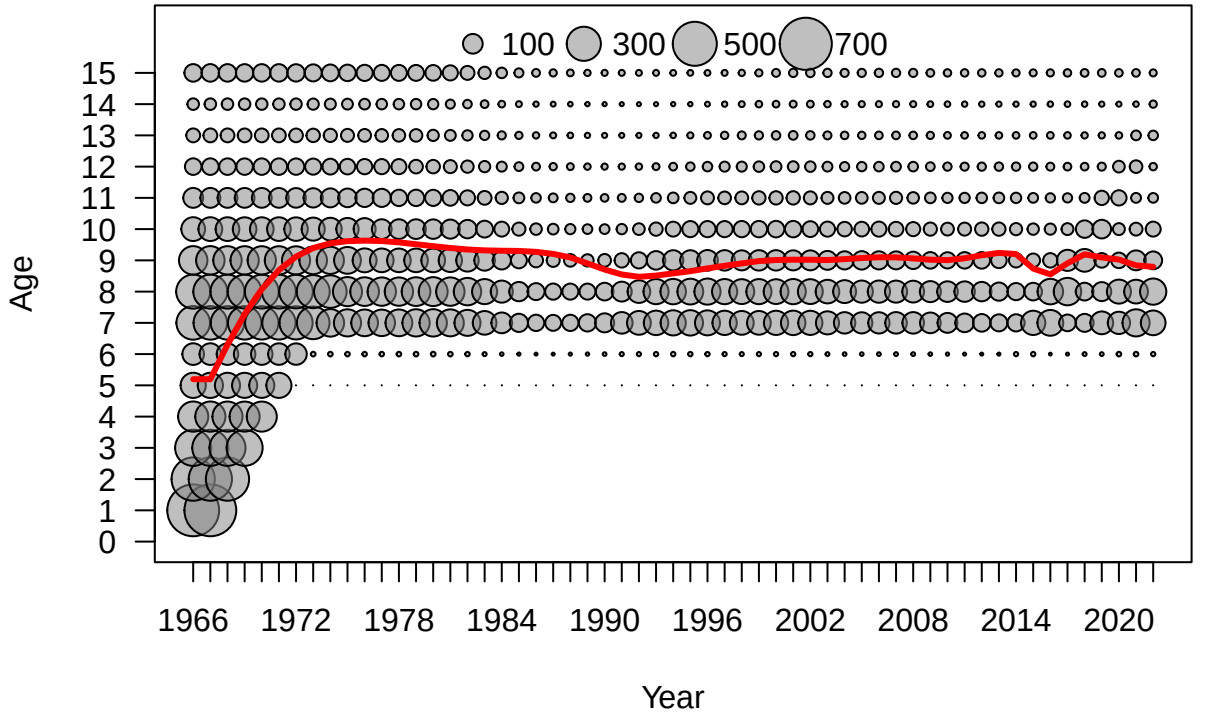

FISHERY
Standardized index
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1990
1995
2000
2005
2010
2015
Year

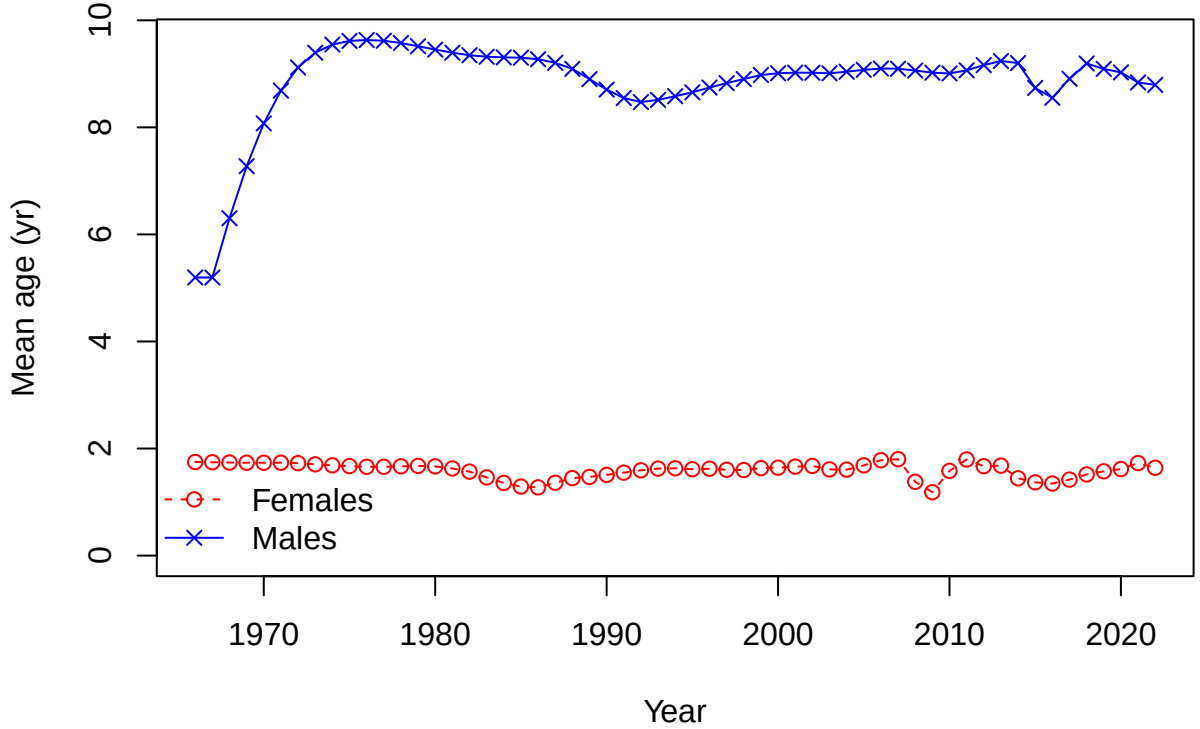

0.1
4
8
Age
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
1966
1972
1978
1984
1990
1996
2002
2008
2014
2020
Year

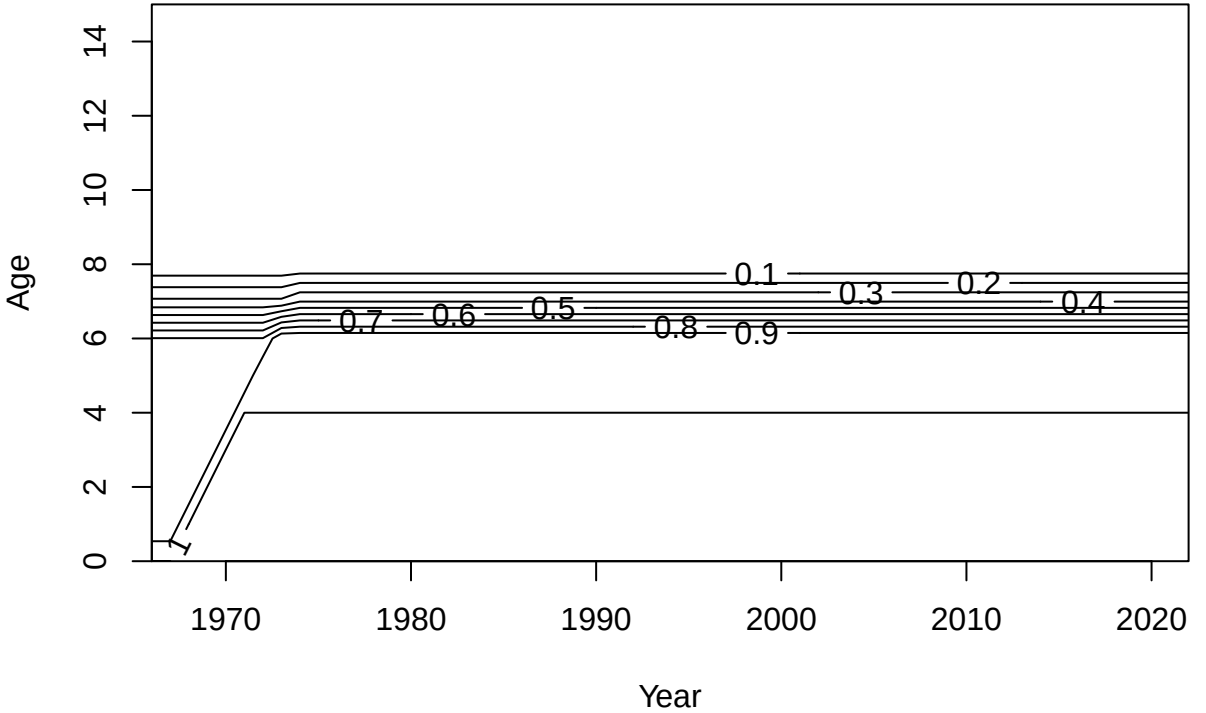

200
600
1000
Age
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
1966
1972
1978
1984
1990
1996
2002
2008
2014
2020
Year

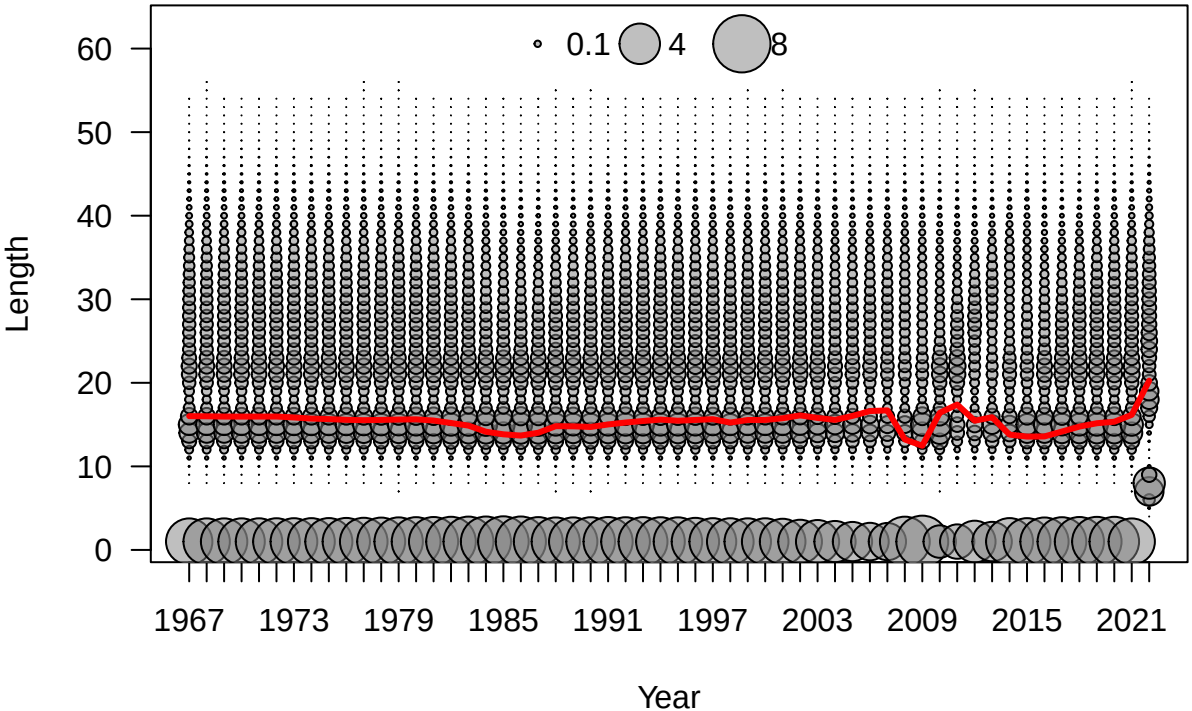

Mean age (yr)
0
2
4
6
8
10
1970
1980
1990
2000
2010
2020
Year
Females
Males

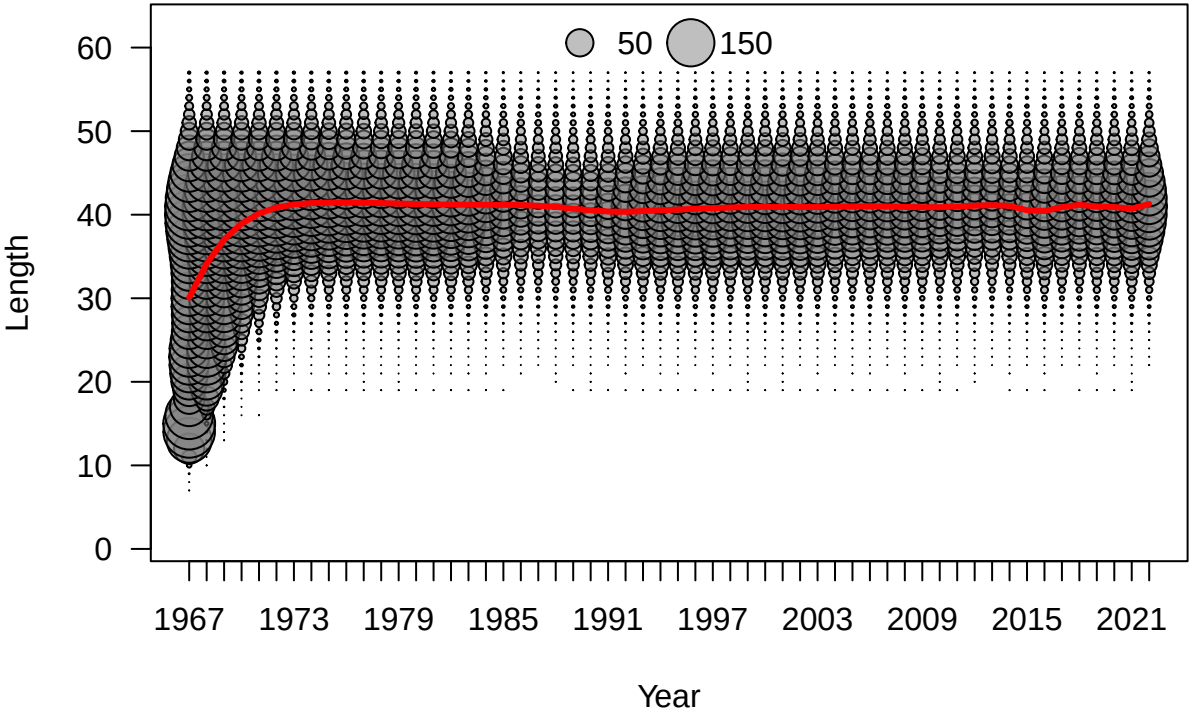

0.1
4
Age
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
1966
1972
1978
1984
1990
1996
2002
2008
2014
2020
Year

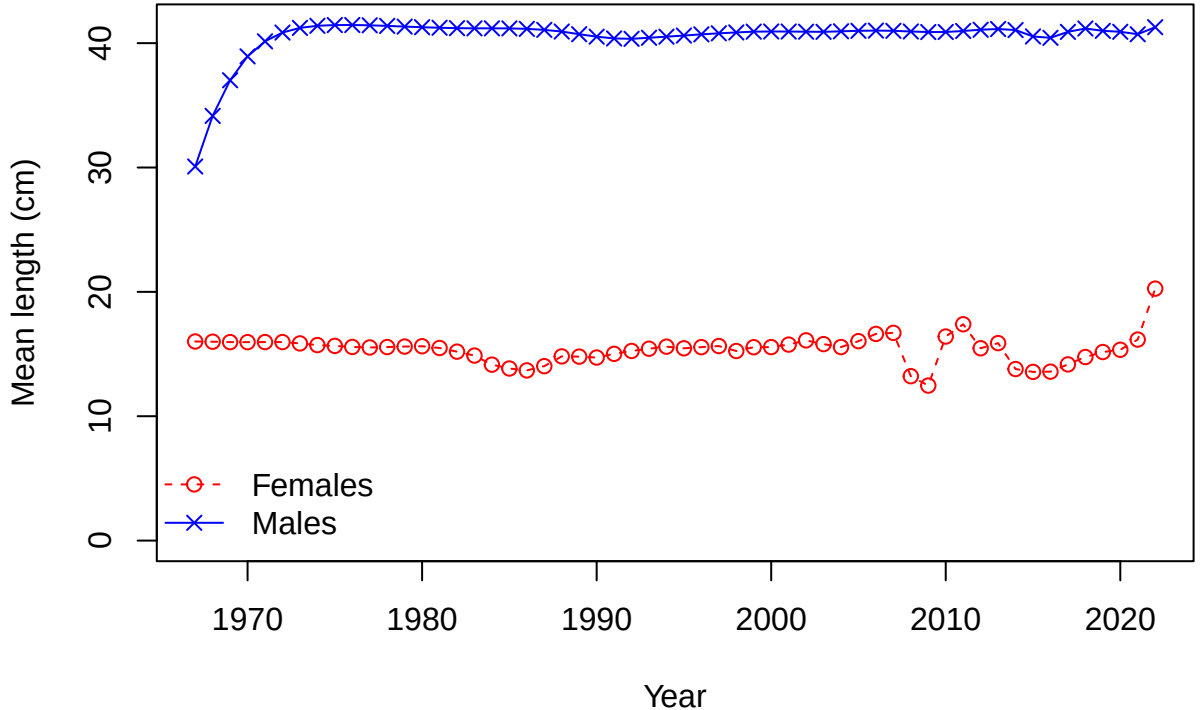

100
300
500
700
Age
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
1966
1972
1978
1984
1990
1996
2002
2008
2014
2020
Year

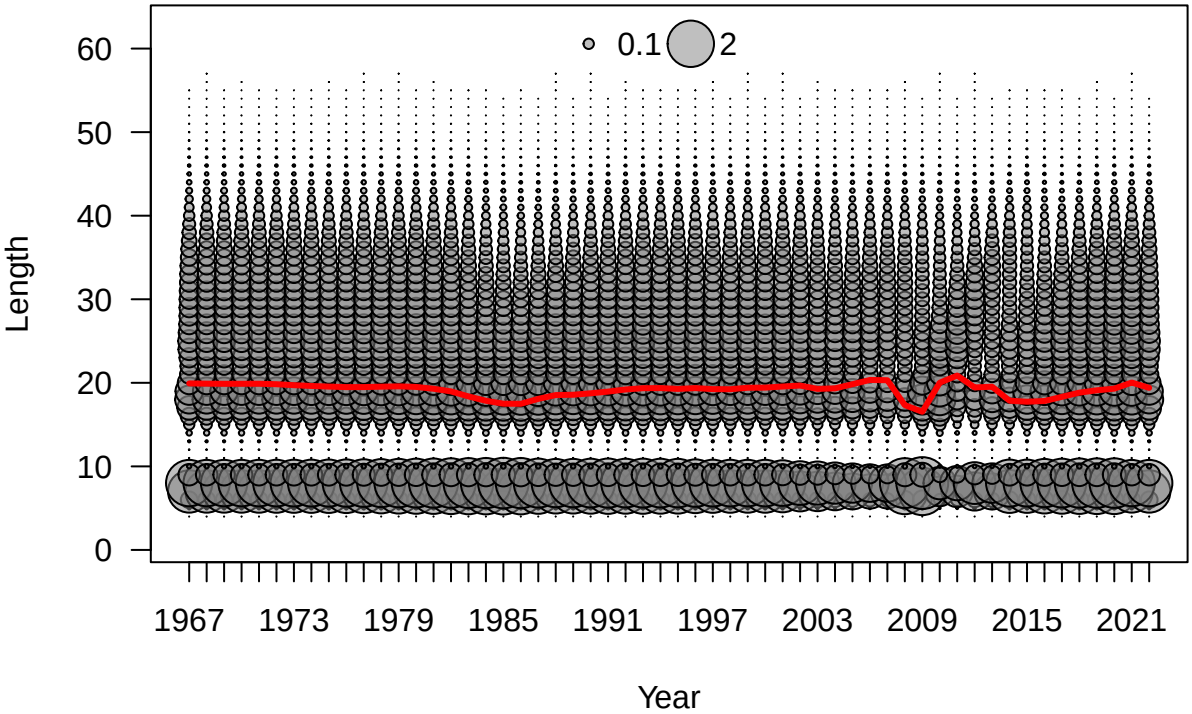

Mean age (yr)
0
2
4
6
8
10
1970
1980
1990
2000
2010
2020
Year
Females
Males

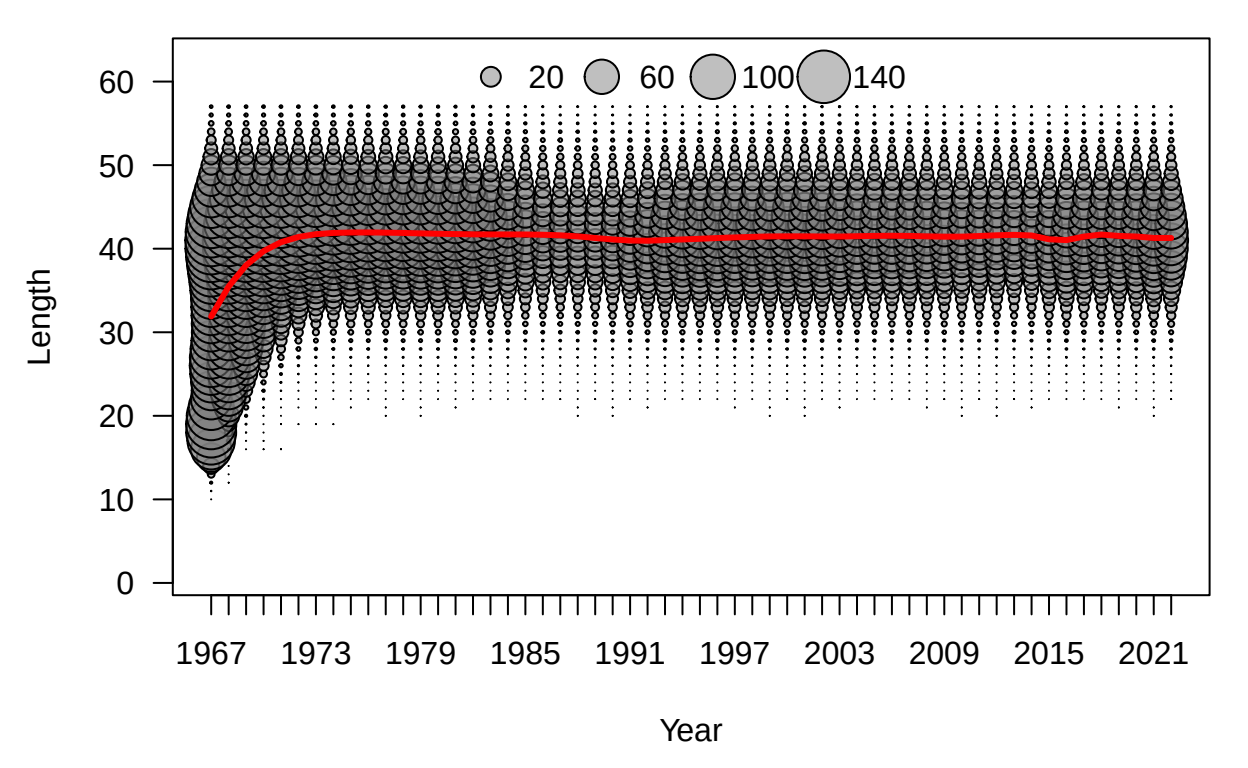

Age
0
2
4
6
8
10
12
14
1970
1980
1990
2000
2010
2020
Year
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

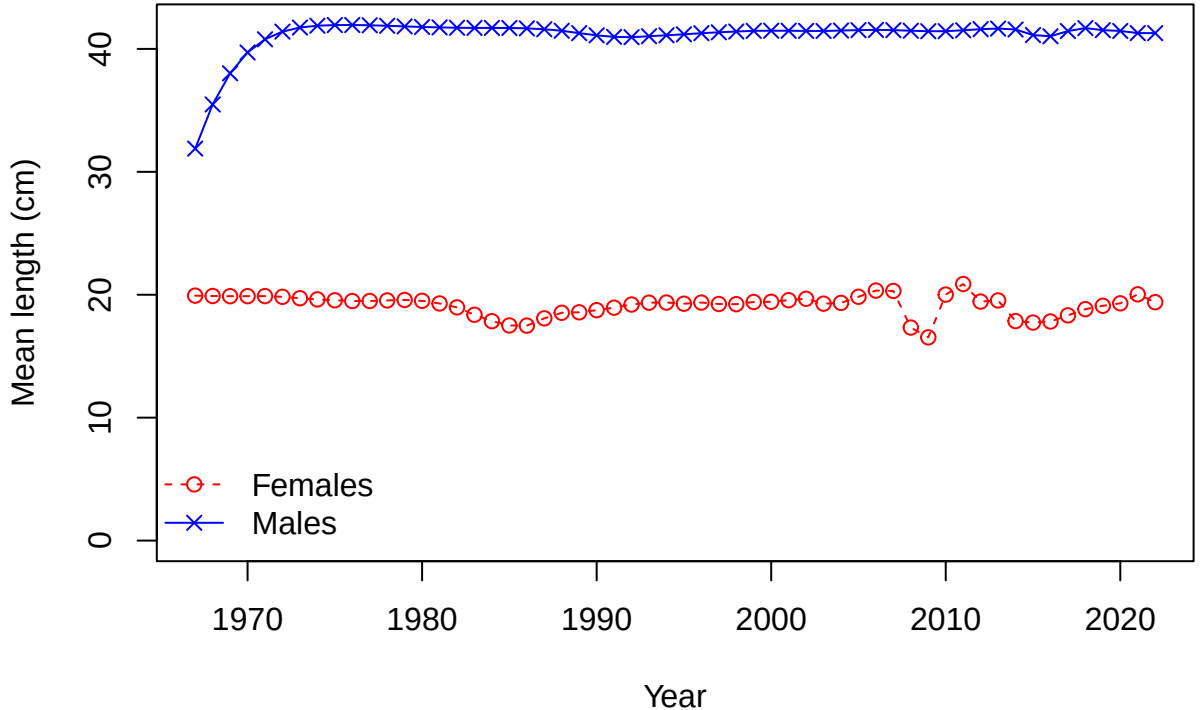

0.1
4
8
Length
Year
0
10
20
30
40
50
60
1967
1973
1979
1985
1991
1997
2003
2009
2015
2021

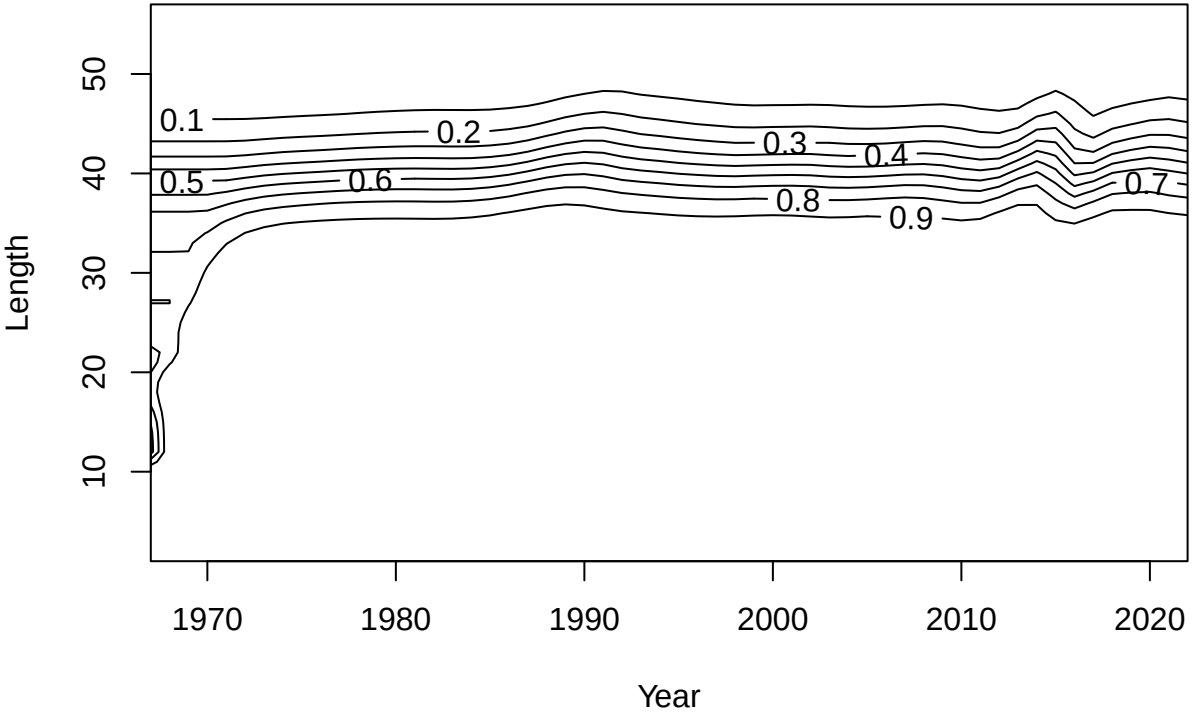

50
150
Length
0
10
20
30
40
50
60
1967
1973
1979
1985
1991
1997
2003
2009
2015
2021
Year

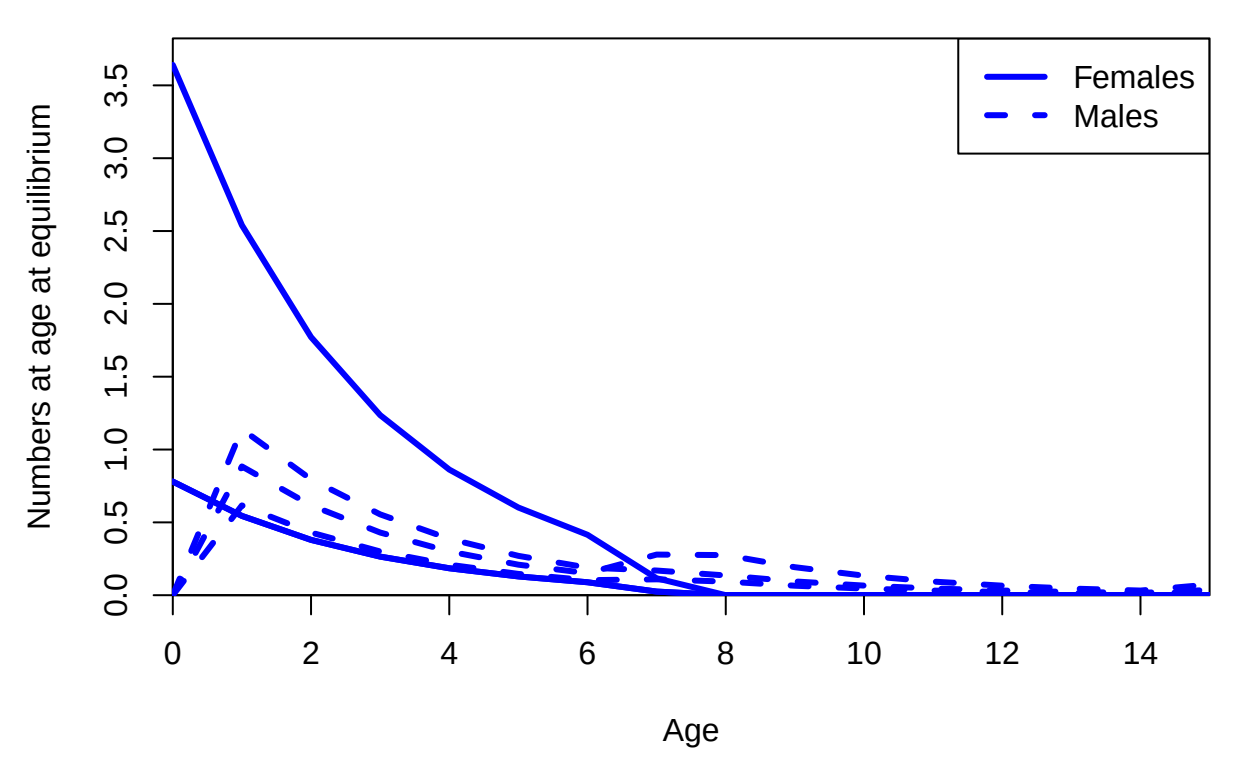

Mean length (cm)
0
10
20
30
40
1970
1980
1990
2000
2010
2020
Year
Females
Males

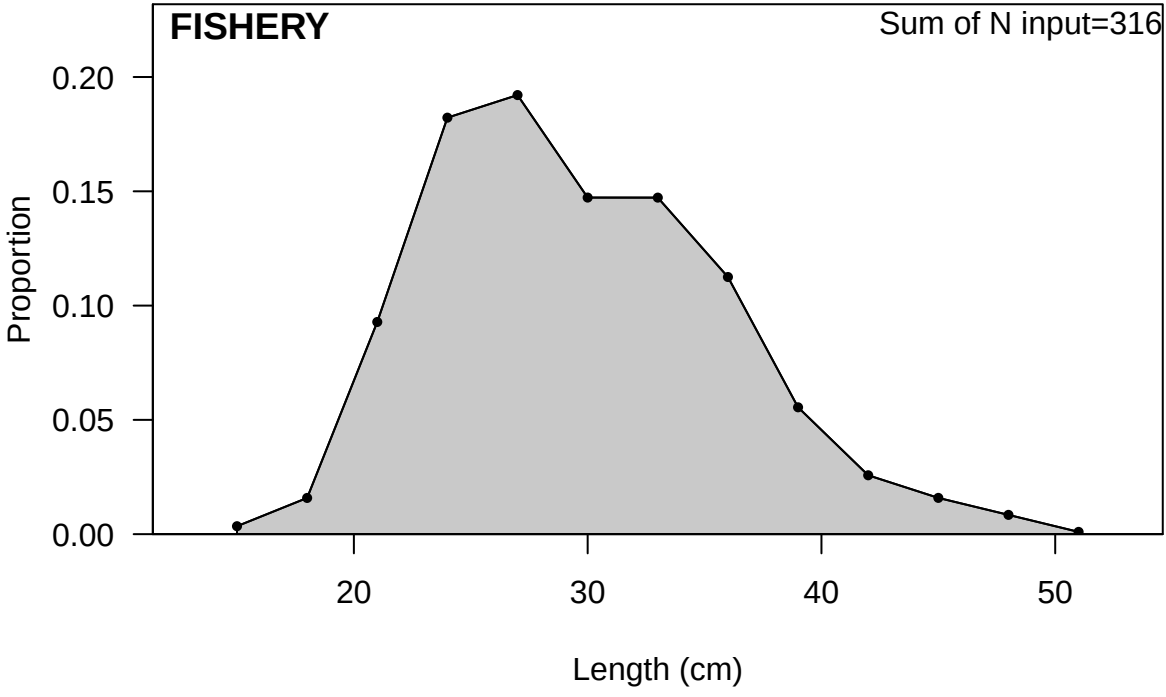

0.1
2
60
50
40
30
20
10
0
Length
1967
1973
1979
1985
1991
1997
2003
2009
2015
2021
Year

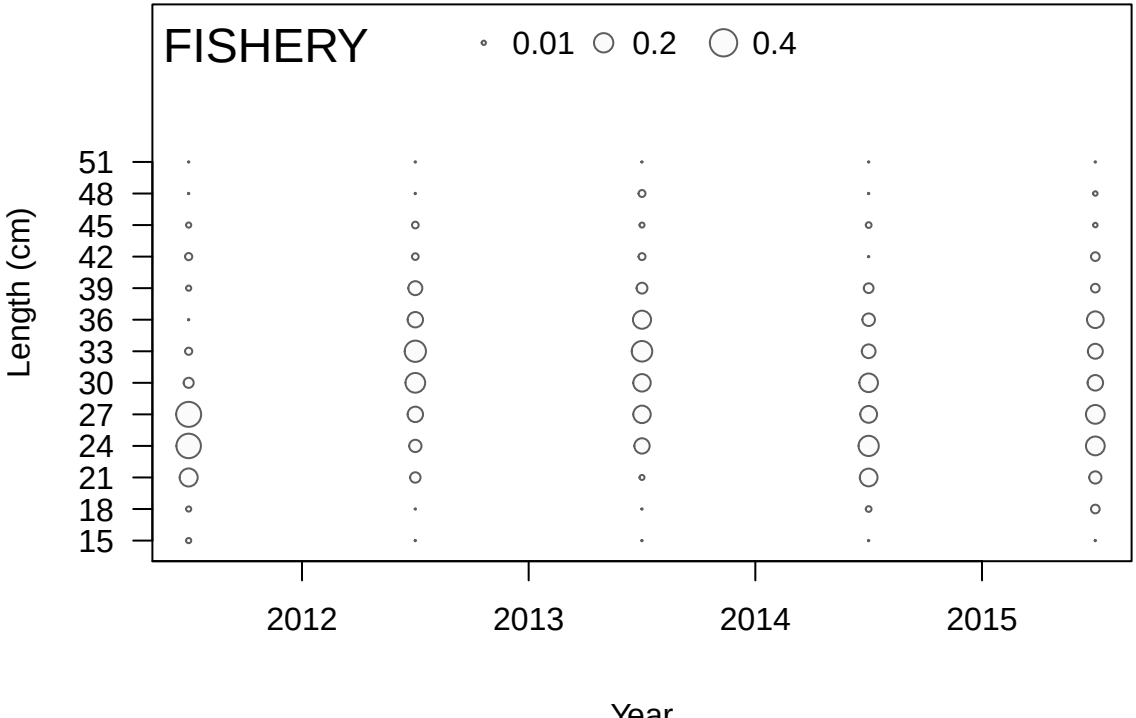

20
60
100
140
Length
0
10
20
30
40
50
60
1967
1973
1979
1985
1991
1997
2003
2009
2015
2021
Year

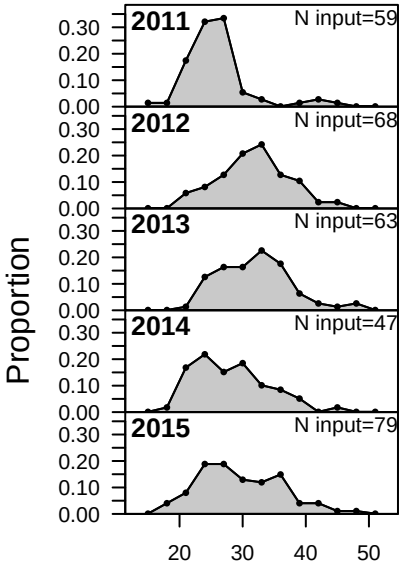

Mean length (cm)
0
10
20
30
40
1970
1980
1990
2000
2010
2020
Year
Females
Males

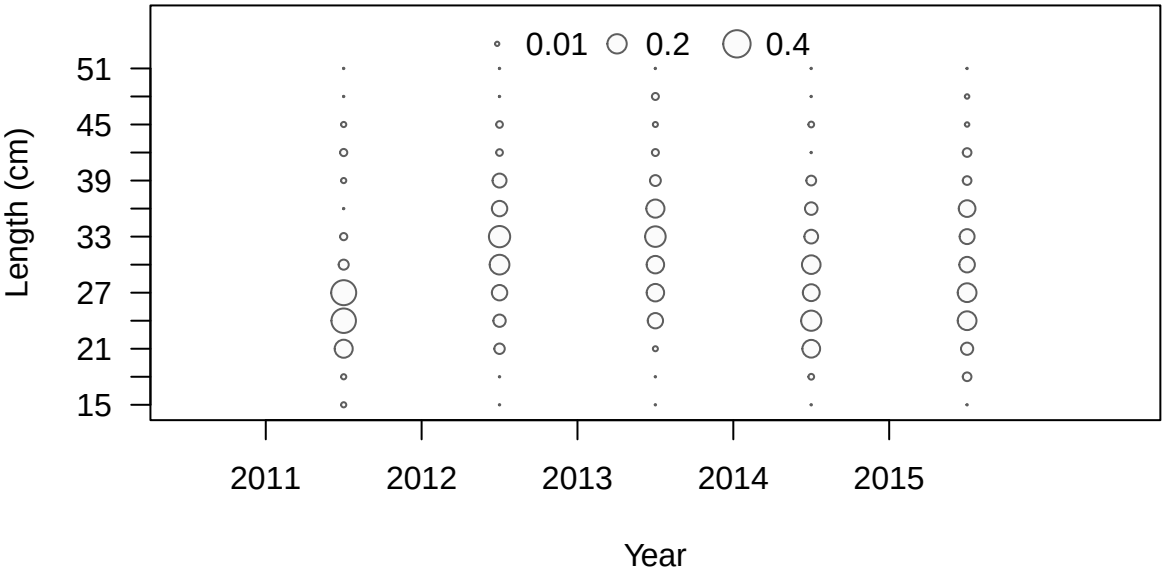

0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
Length
10
20
30
40
50
1970
1980
1990
2000
2010
2020
Year

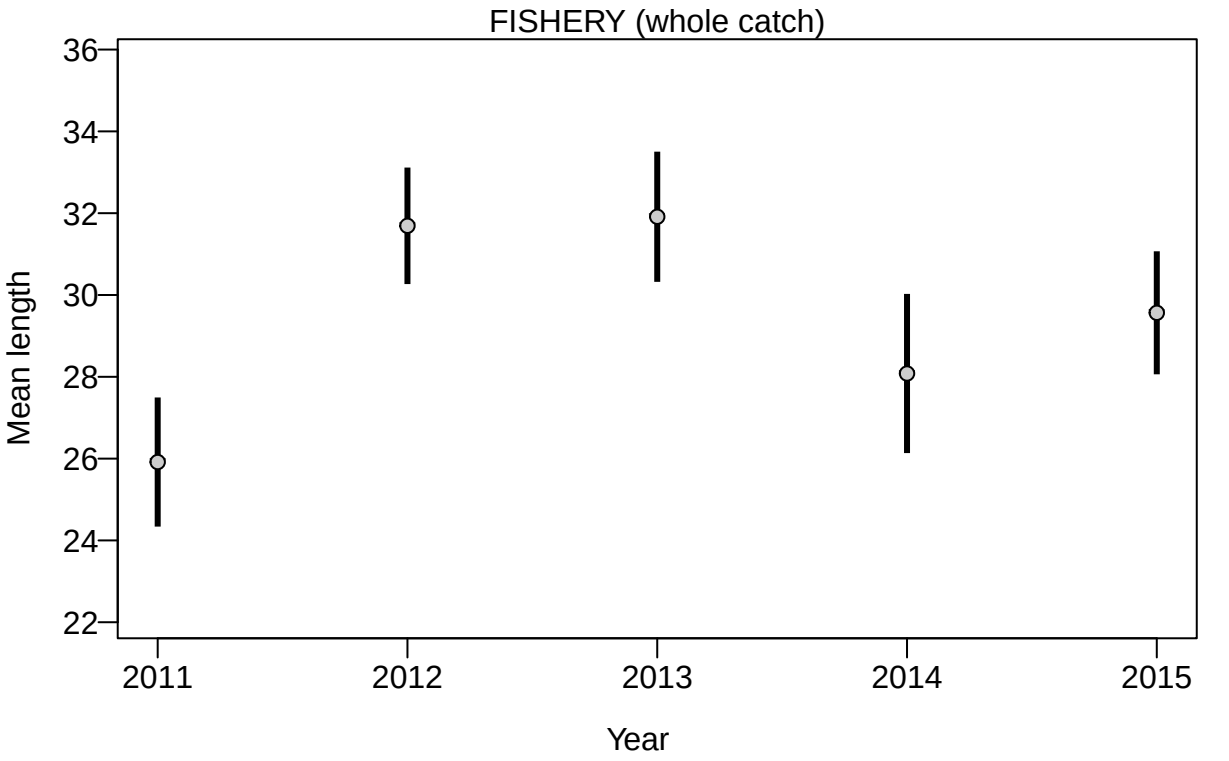

Numbers at age at equilibrium
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
0
2
4
6
8
10
12
14
Age
Females
Males

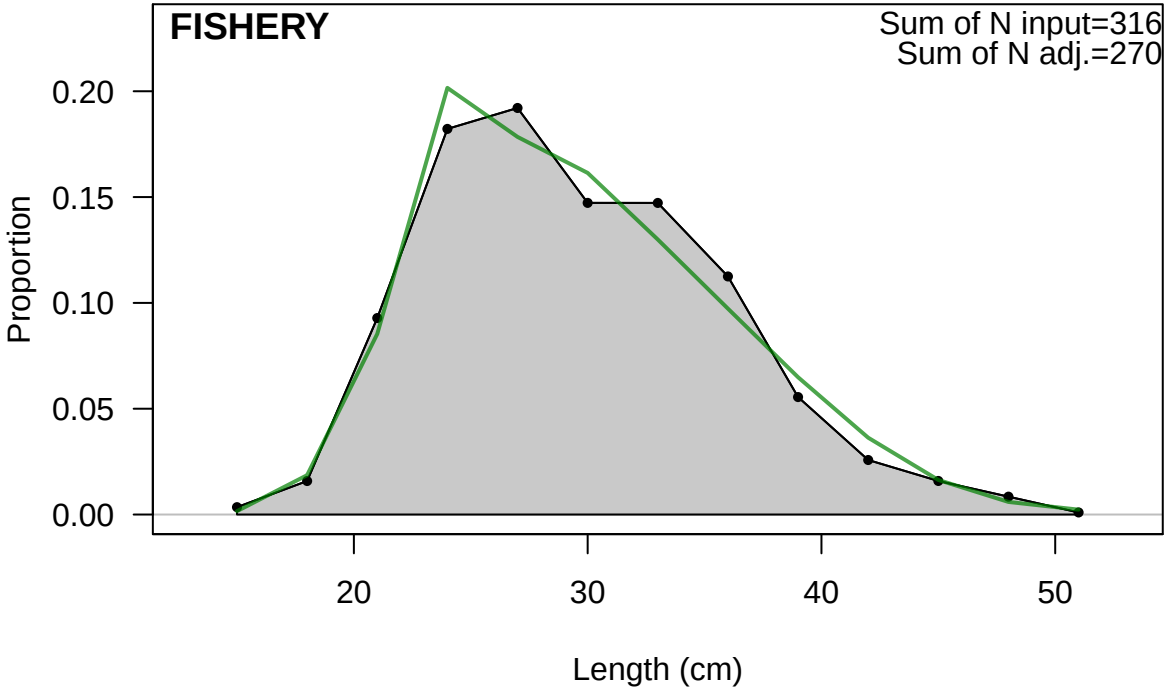

FISHERY
Sum of N input=316
0.20
0.15
0.10
0.05
0.00
Proportion
20
30
40
50
Length (cm)

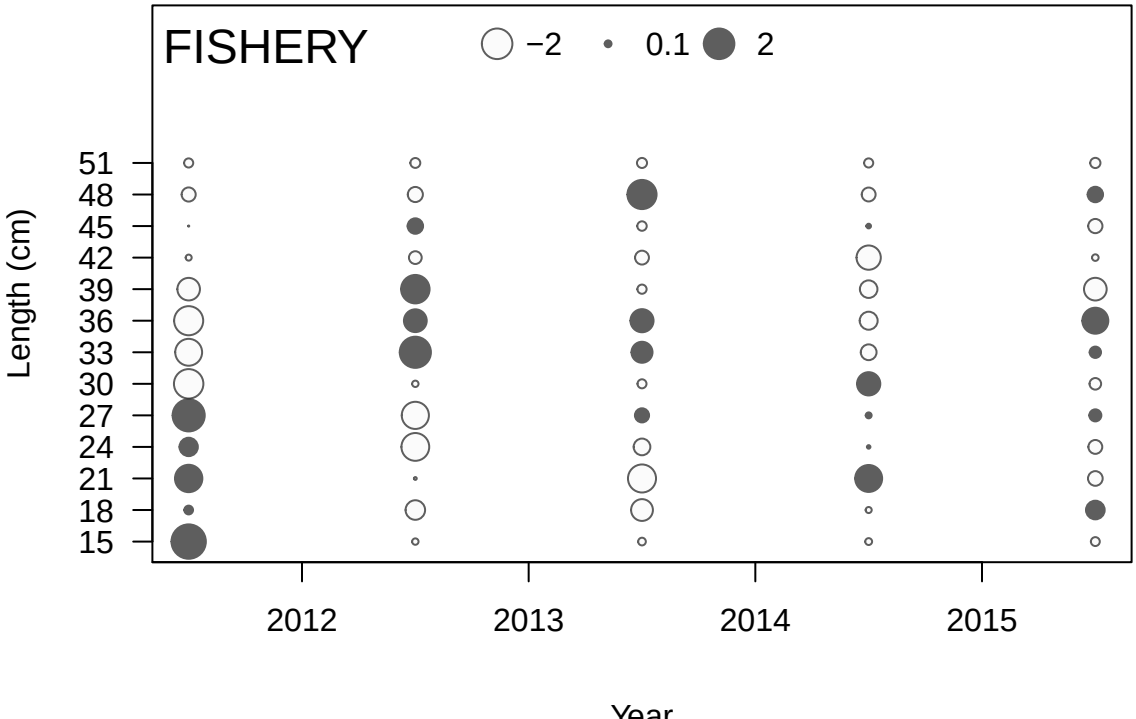

FISHERY
0.01
0.2
0.4
Length (cm)
51
48
45
42
39
36
33
30
27
24
21
18
15
2012
2013
2014
2015
Year

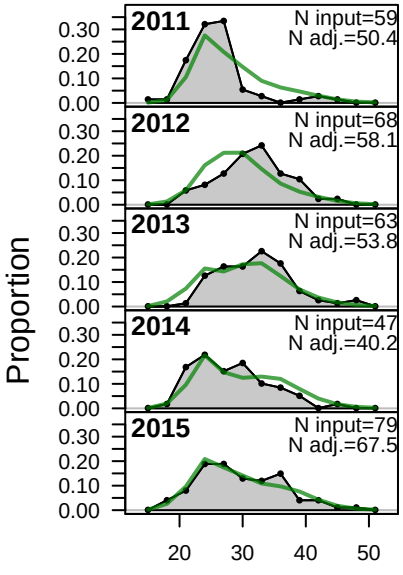

2011
N input=59
2012
N input=68
2013
N input=63
2014
N input=47
2015
N input=79
0.00
0.10
0.20
0.30
20
30
40
50
Proportion
Length (cm)

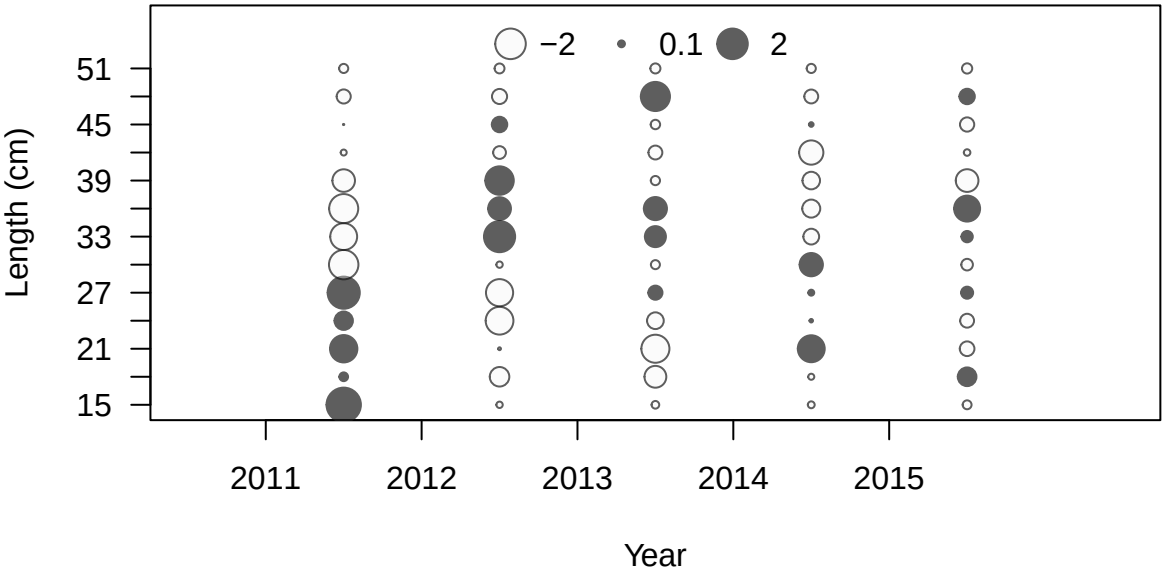

0.01
0.2
0.4
Length (cm)
51
45
39
33
27
21
15
2011
2012
2013
2014
2015
Year

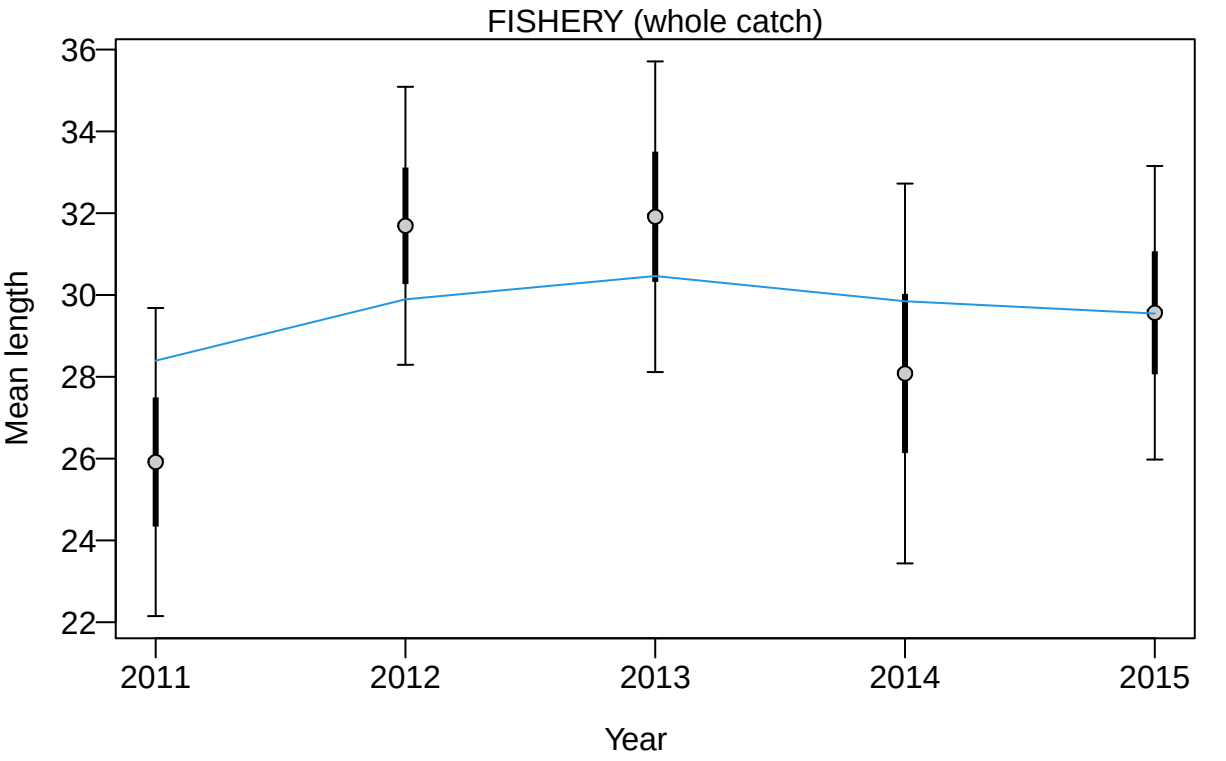

FISHERY (whole catch)
36
34
32
30
28
26
24
22
Mean length
2011
2012
2013
2014
2015
Year

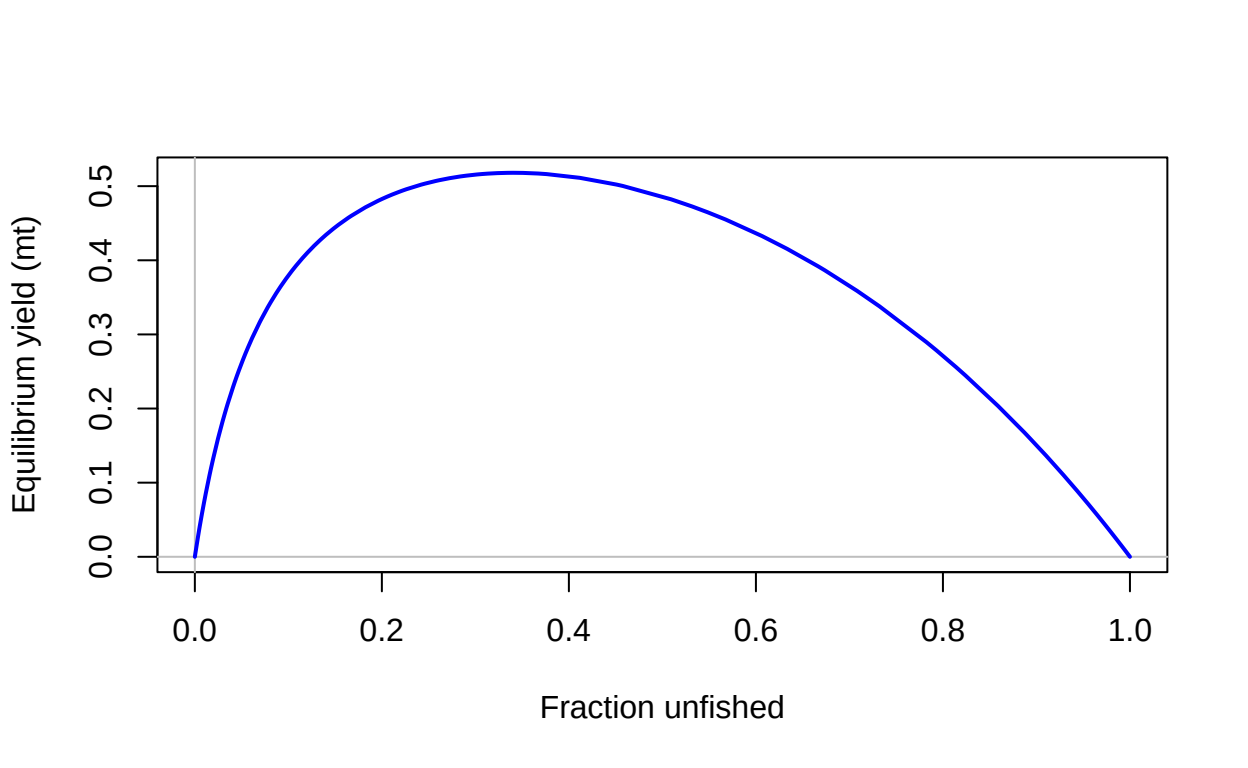

FISHERY
Sum of N input=316
Sum of N adj.=270
Proportion
0.00
0.05
0.10
0.15
0.20
20
30
40
50
Length (cm)

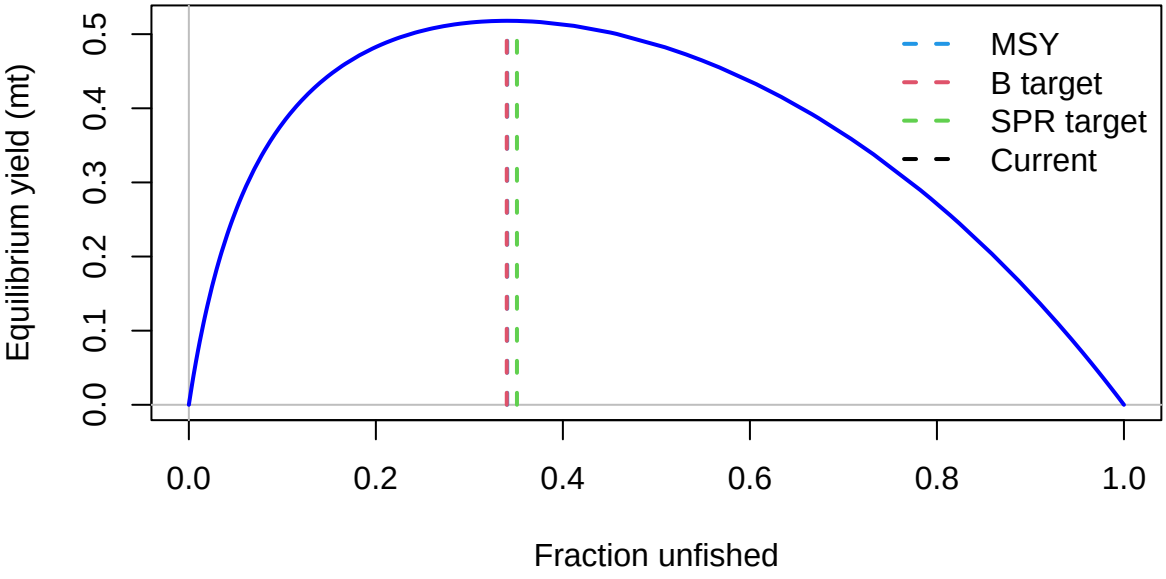

FISHERY
−2
0.1
2
Length (cm)
51
48
45
42
39
36
33
30
27
24
21
18
15
2012
2013
2014
2015
Year

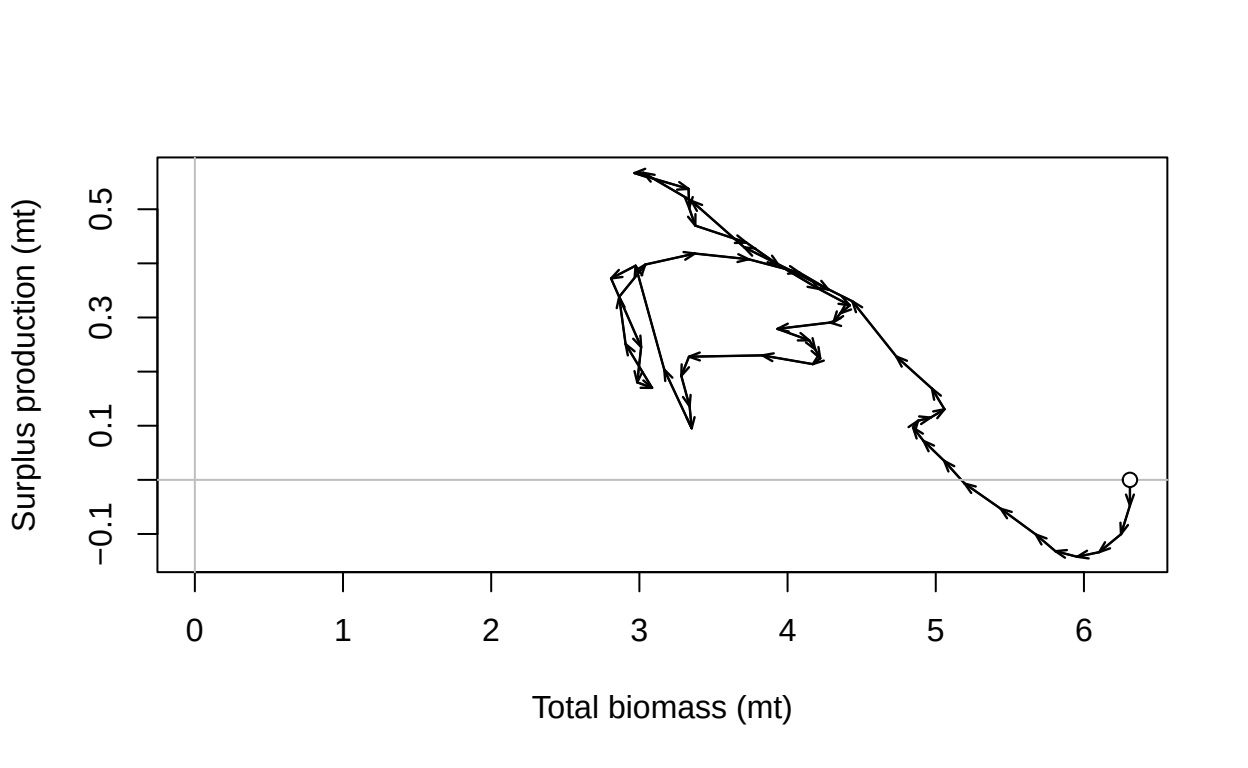

2011
N input=59
N adj.=50.4
2012
N input=68
N adj.=58.1
2013
N input=63
N adj.=53.8
2014
N input=47
N adj.=40.2
2015
N input=79
N adj.=67.5
0.00
0.10
0.20
0.30
20
30
40
50
Proportion
Length (cm)

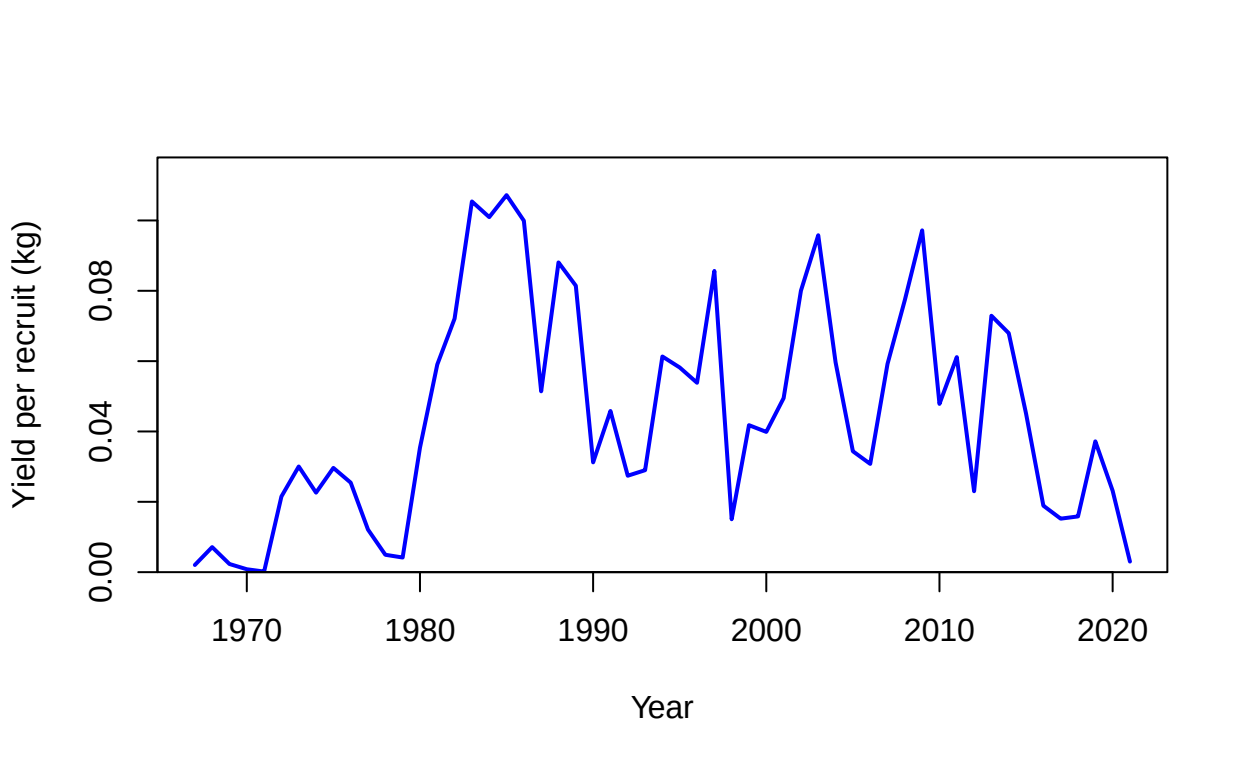

−2
0.1
2
51
45
39
33
27
21
15
Length (cm)
2011
2012
2013
2014
2015
Year

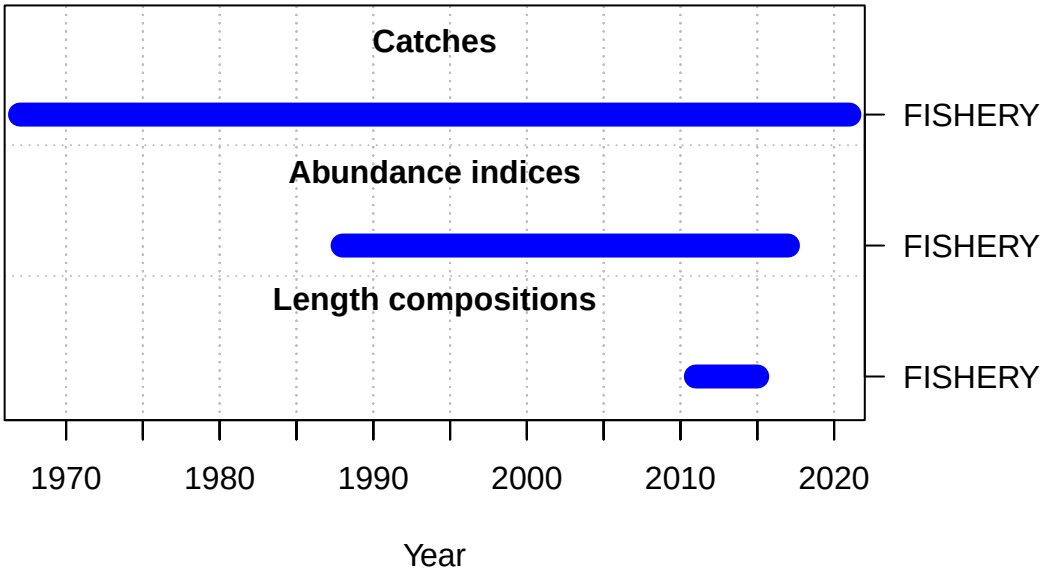

FISHERY (whole catch)
Mean length
36
34
32
30
28
26
24
22
2011
2012
2013
2014
2015
Year

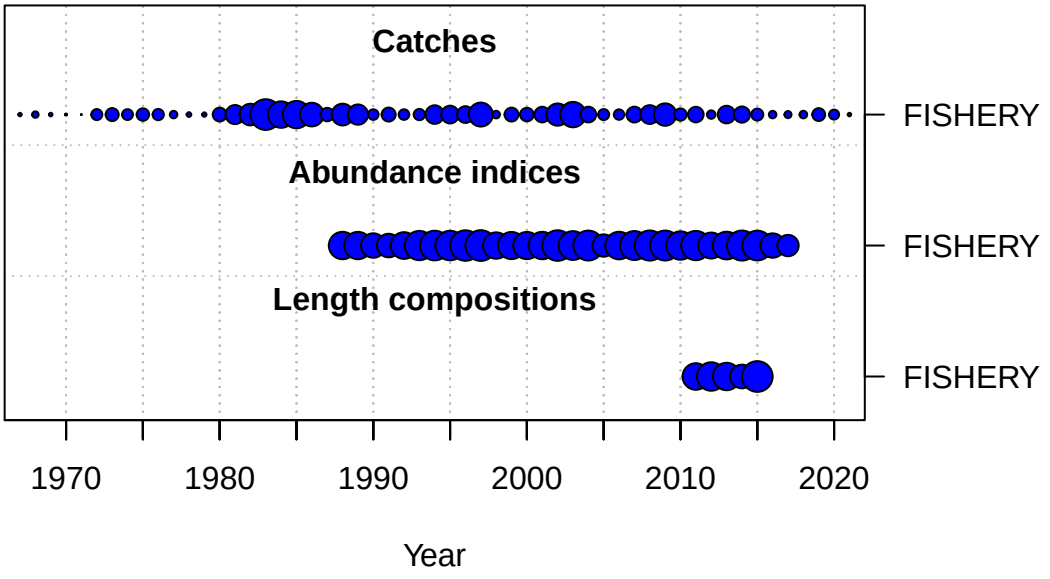

Equilibrium yield (mt)
0.0
0.1
0.2
0.3
0.4
0.5
0.0
0.2
0.4
0.6
0.8
1.0
Fraction unfished

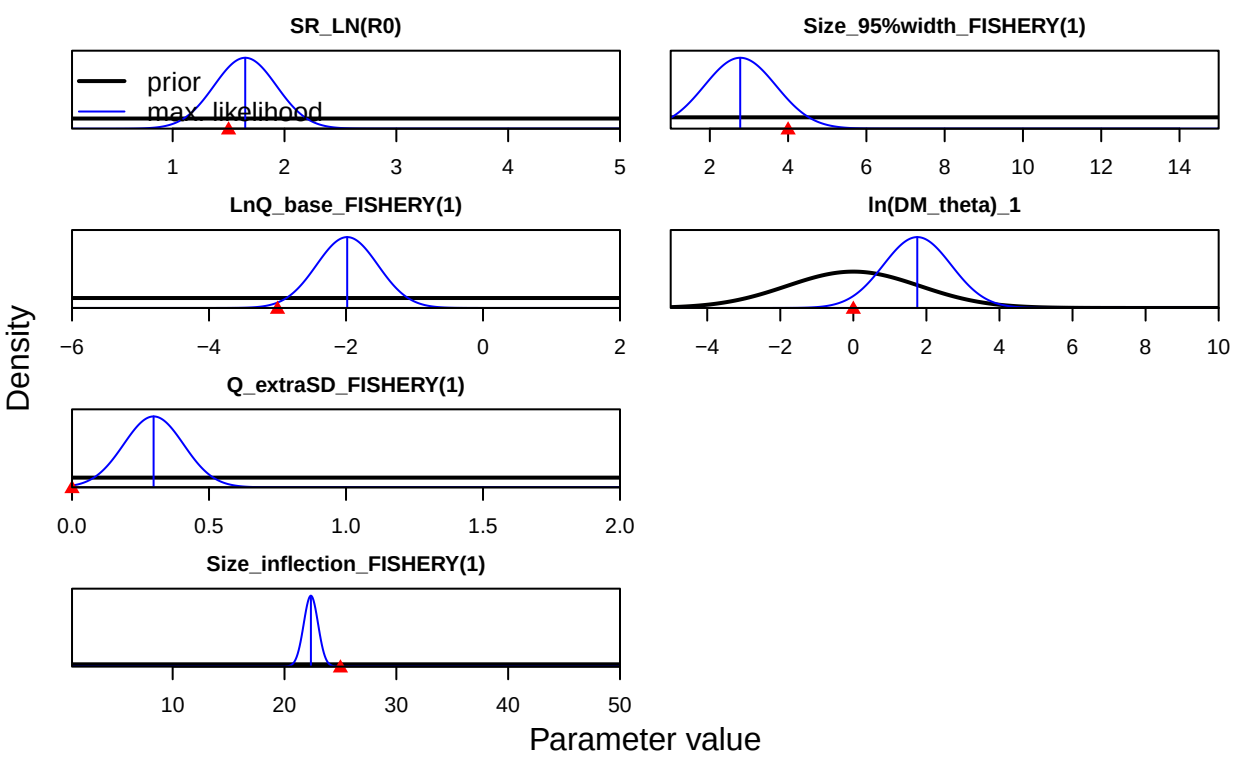

Equilibrium yield (mt)
0.0
0.1
0.2
0.3
0.4
0.5
0.0
0.2
0.4
0.6
0.8
1.0
Fraction unfished
MSY
B target
SPR target
Current


Surplus production (mt)
0.5
0.3
0.1
−0.1
0
1
2
3
4
5
6
Total biomass (mt)


Yield per recruit (kg)
0.00
0.04
0.08
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
Size_95%width_FISHERY(1)
2
4
6
8
10
12
14
LnQ_base_FISHERY(1)
−6
−4
−2
0
2
ln(DM_theta)_1
−4
−2
0
2
4
6
8
10
Q_extraSD_FISHERY(1)
0.0
0.5
1.0
1.5
2.0
Size_inflection_FISHERY(1)
10
20
30
40
50
Density
Parameter value