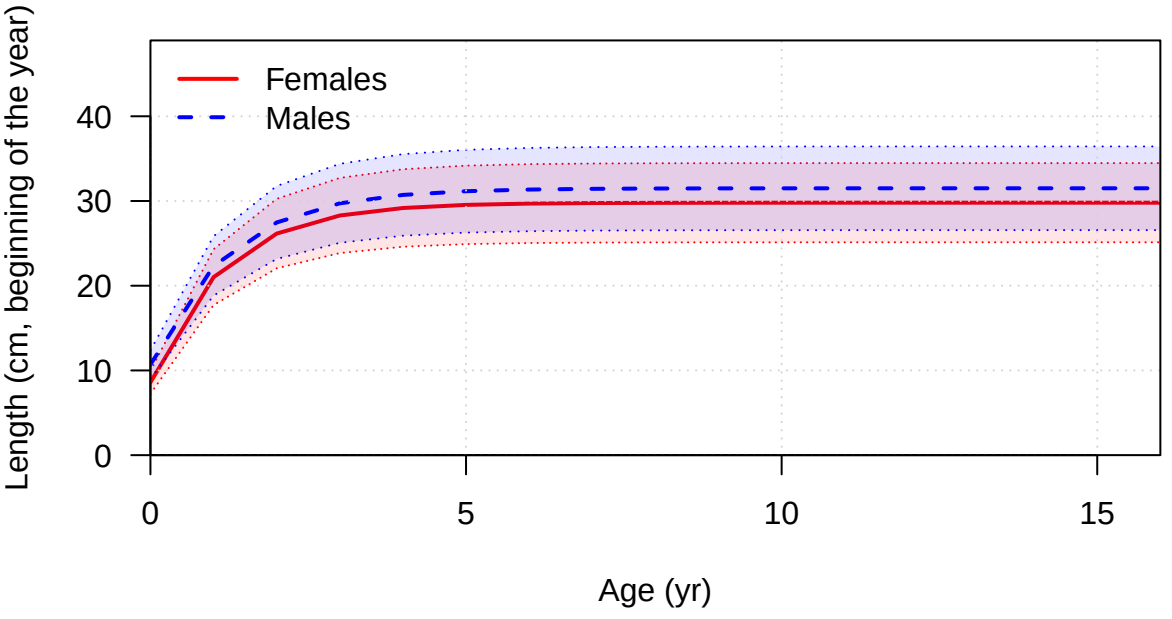
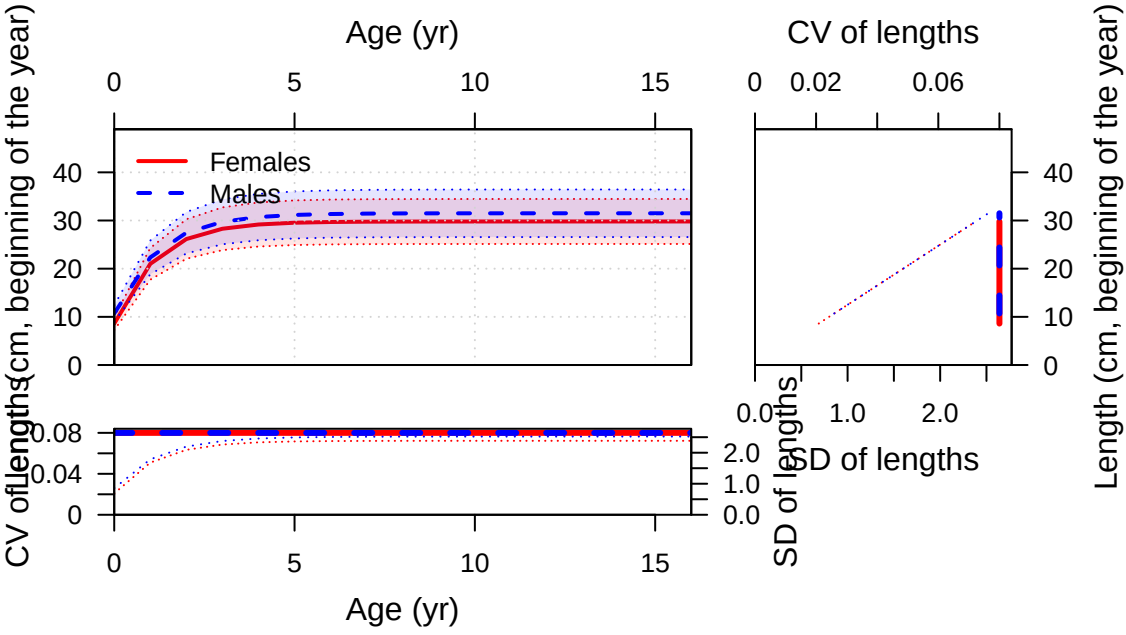
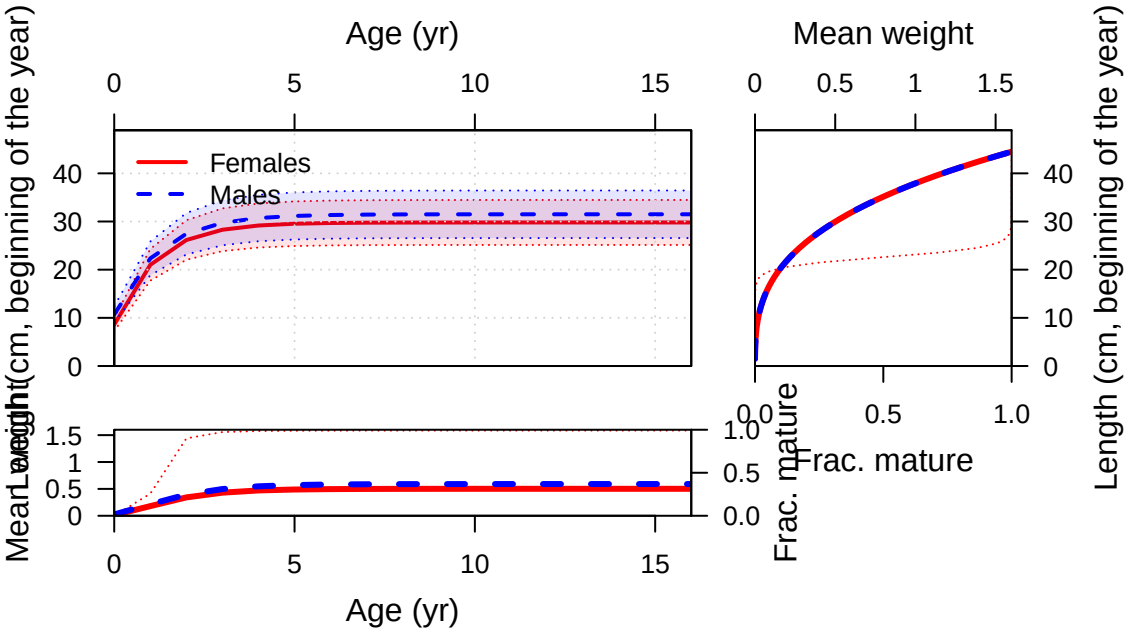
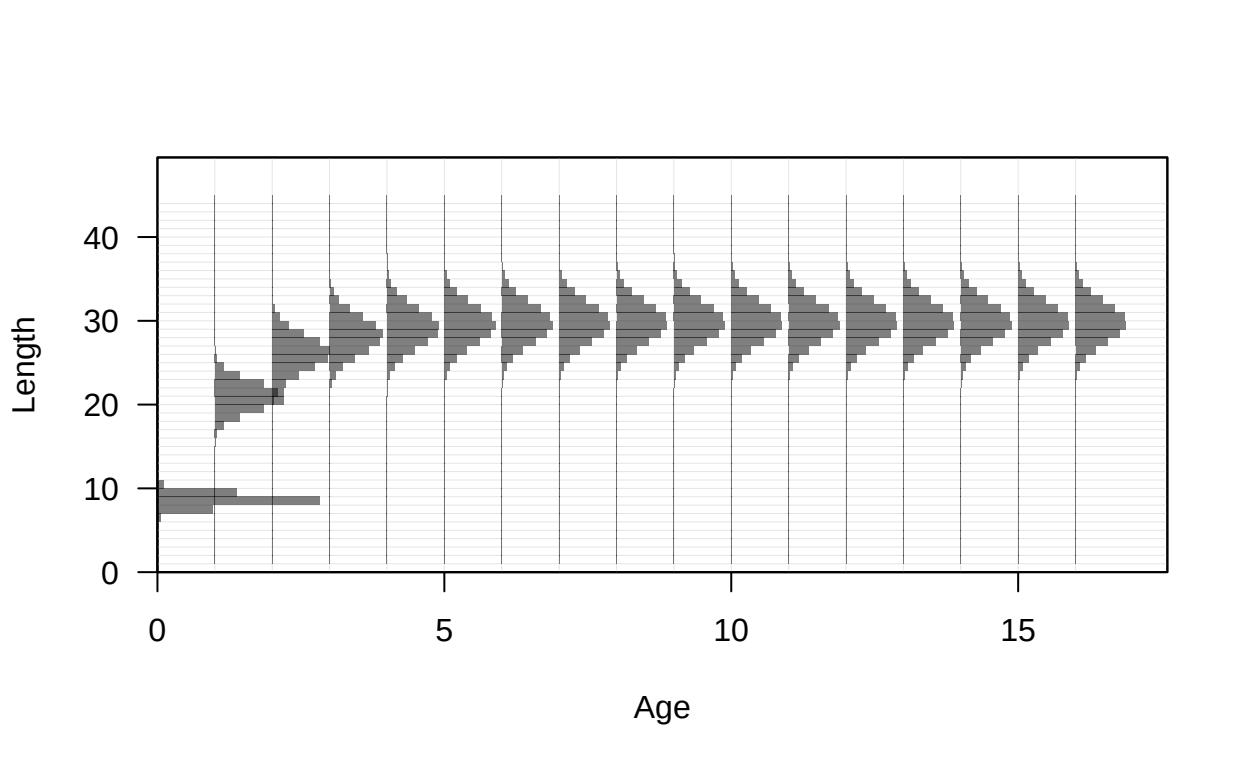
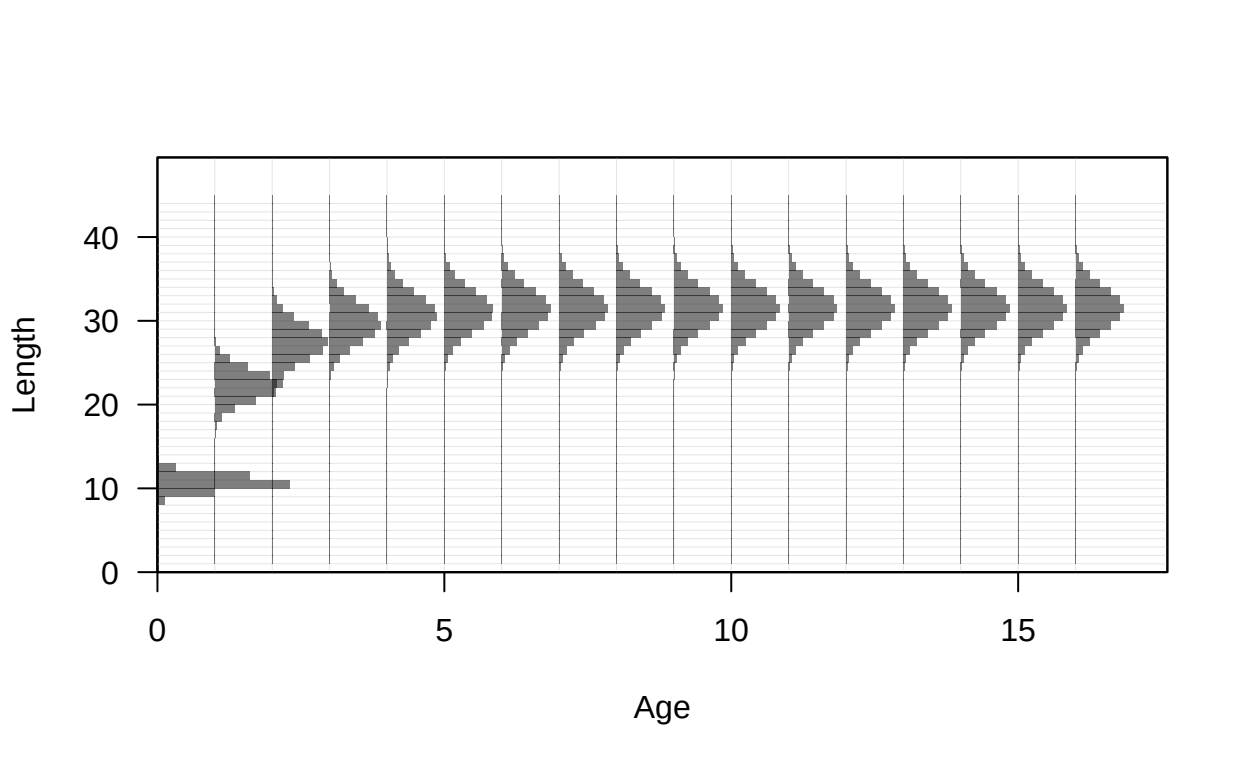
Plots created using the 'r4ss' package in R
Stock Synthesis version: 3.30.19.0
StartTime: Thu Jul 28 13:01:12 2022
Data_File: data.ss
Control_File: control.ss

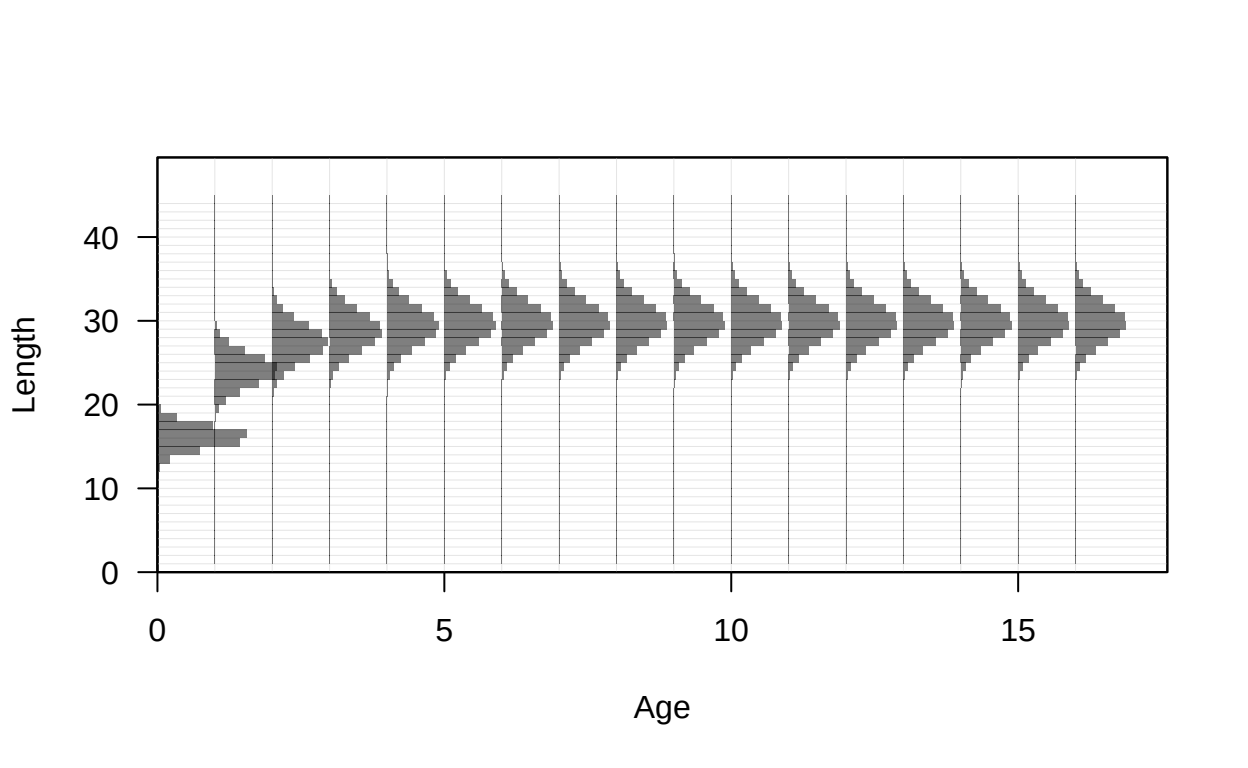

Females
Males
Length (cm, beginning of the year)
0
10
20
30
40
0
5
10
15
Age (yr)

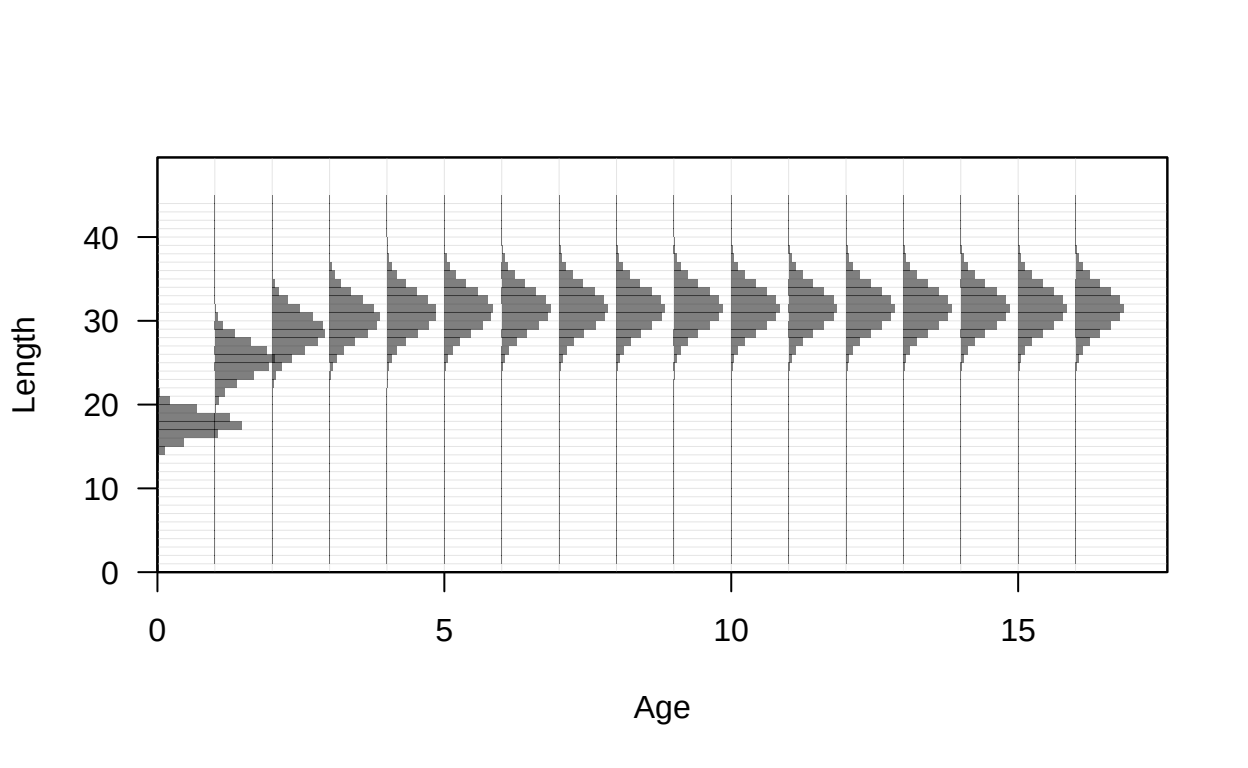

Age (yr)
0
5
10
15
Females
Males
Length (cm, beginning of the year)
40
30
20
10
0
CV of lengths
0.08
0.04
0
Age (yr)
CV of lengths
0
0.02
0.06
0.0
1.0
2.0
SD of lengths
2.0
1.0
0.0
SD of lengths
Length (cm, beginning of the year)

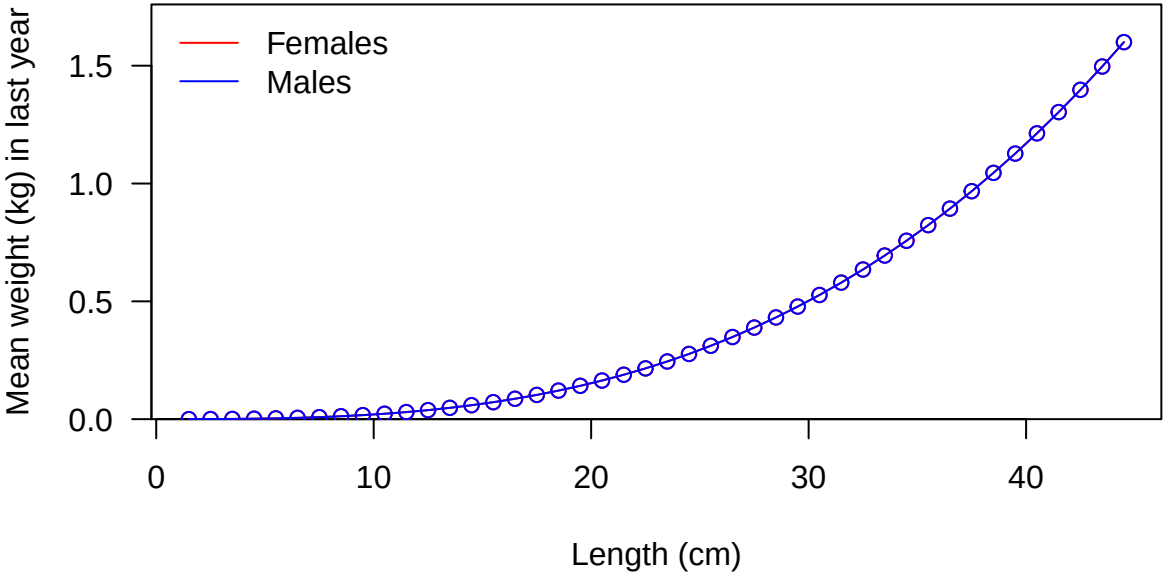

Age (yr)
Mean weight
Length (cm, beginning of the year)
Females
Males
Frac. mature
Mean weight
Age (yr)

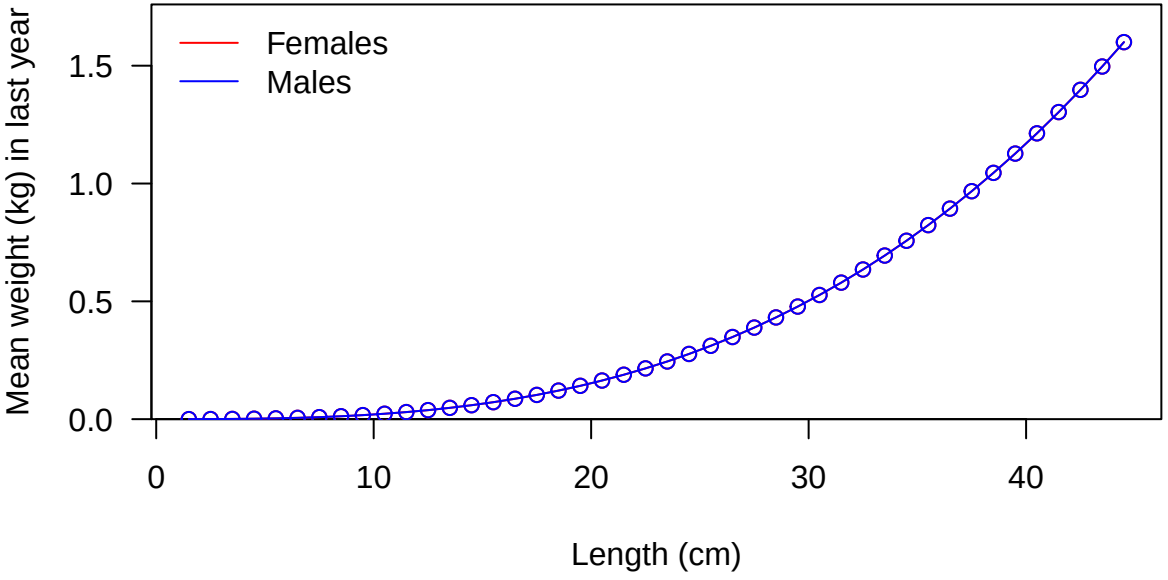

Length
0
10
20
30
40
0
5
10
15
Age

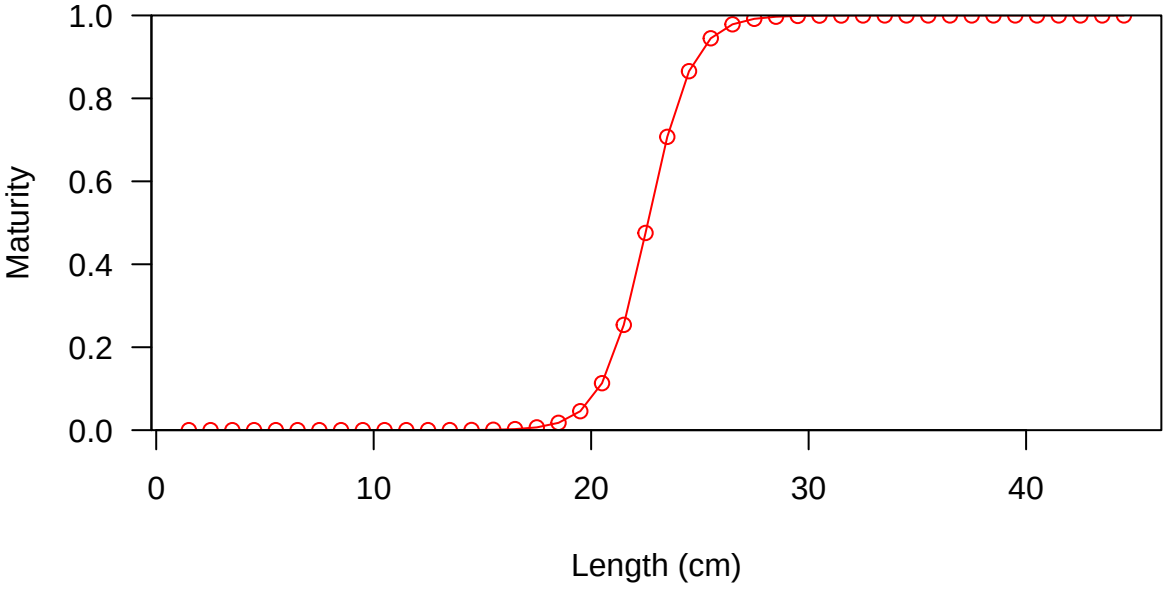

Length
0
10
20
30
40
0
5
10
15
Age

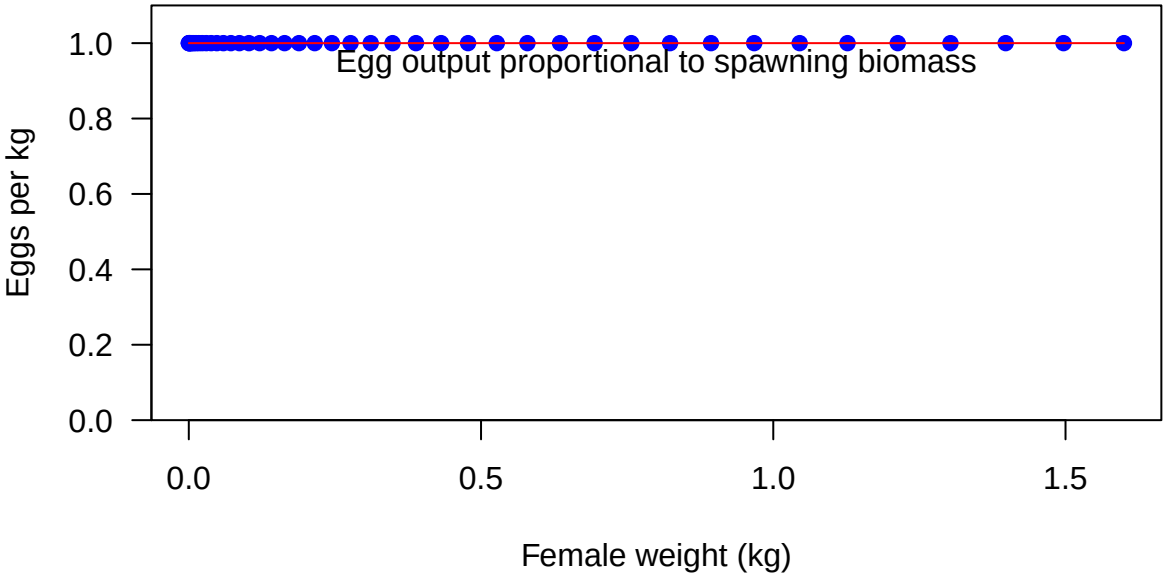

Length
0
10
20
30
40
0
5
10
15
Age

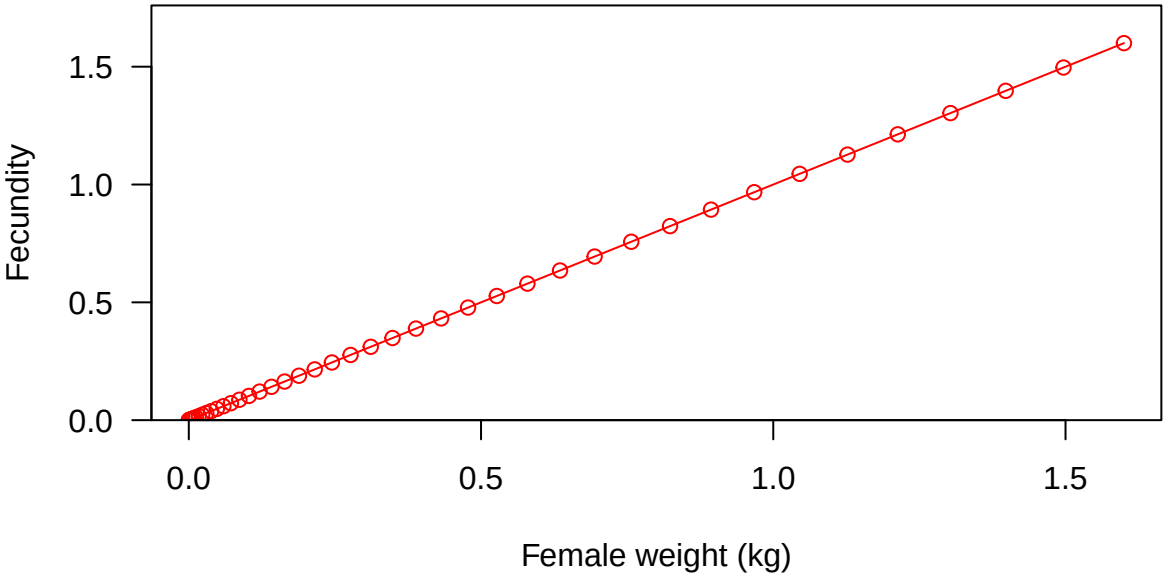

Length
0
10
20
30
40
0
5
10
15
Age

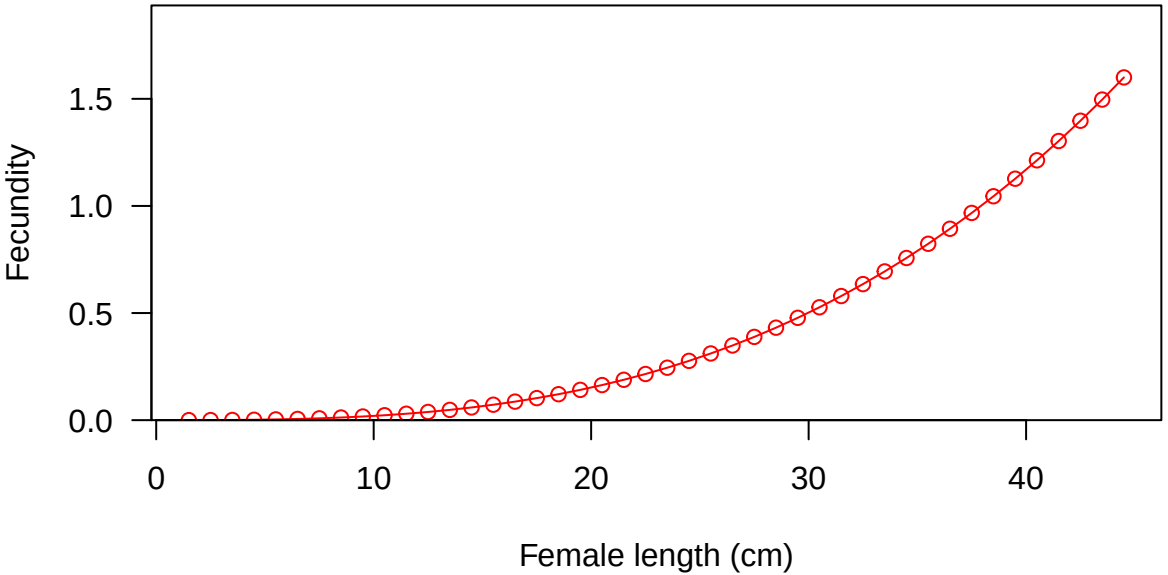

Females
Males
Mean weight (kg) in last year
0.0
0.5
1.0
1.5
0
10
20
30
40
Length (cm)

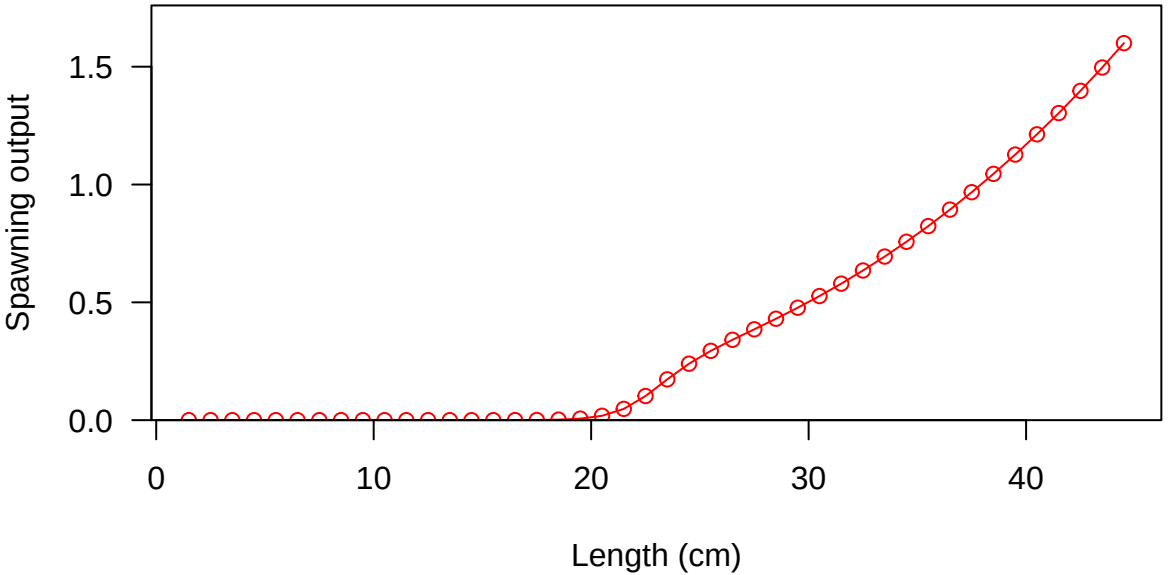

Females
Males
Mean weight (kg) in last year
0.0
0.5
1.0
1.5
0
10
20
30
40
Length (cm)

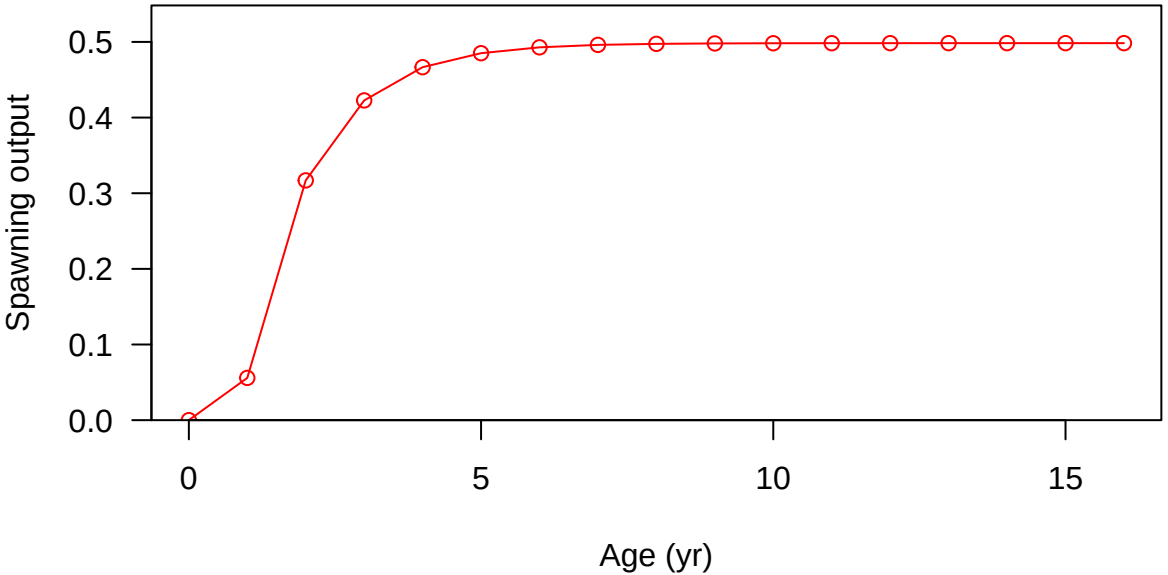

1.0
0.8
0.6
0.4
0.2
0.0
Maturity
0
10
20
30
40
Length (cm)

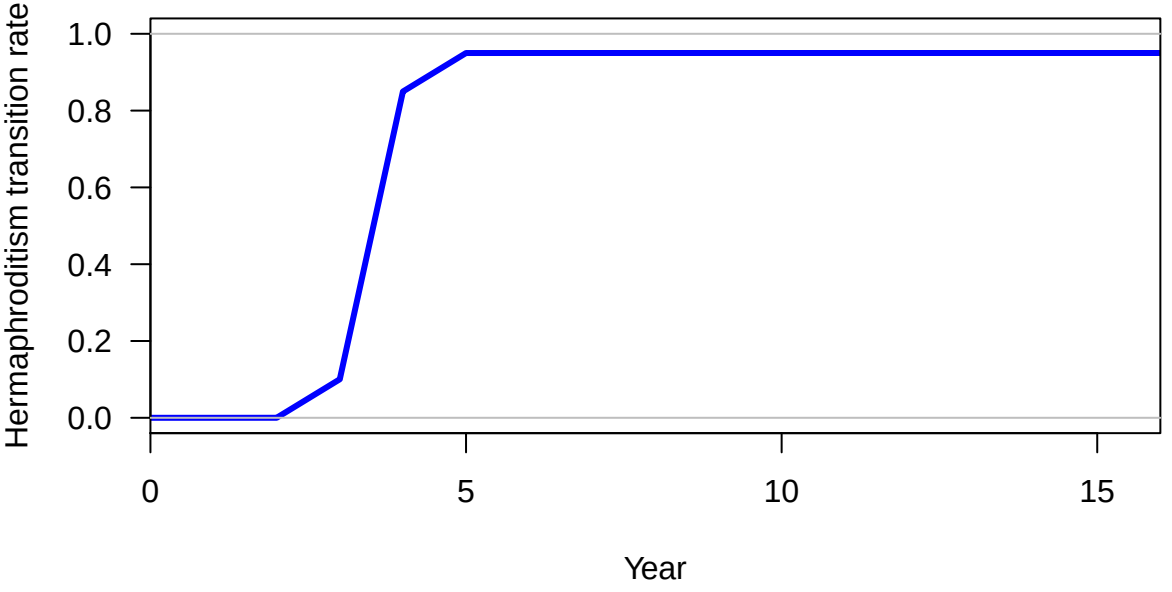

Egg output proportional to spawning biomass
Eggs per kg
1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.5
1.0
1.5
Female weight (kg)

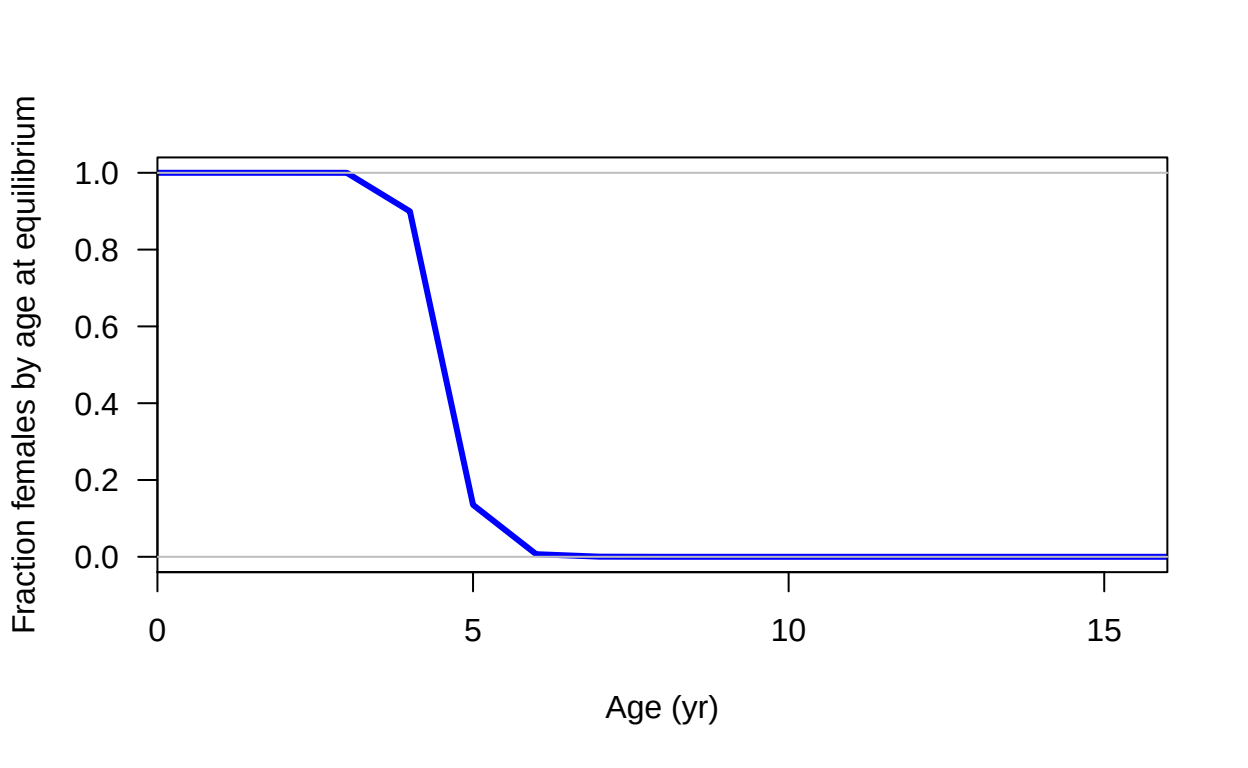

Fecundity
0.0
0.5
1.0
1.5
0.0
0.5
1.0
1.5
Female weight (kg)

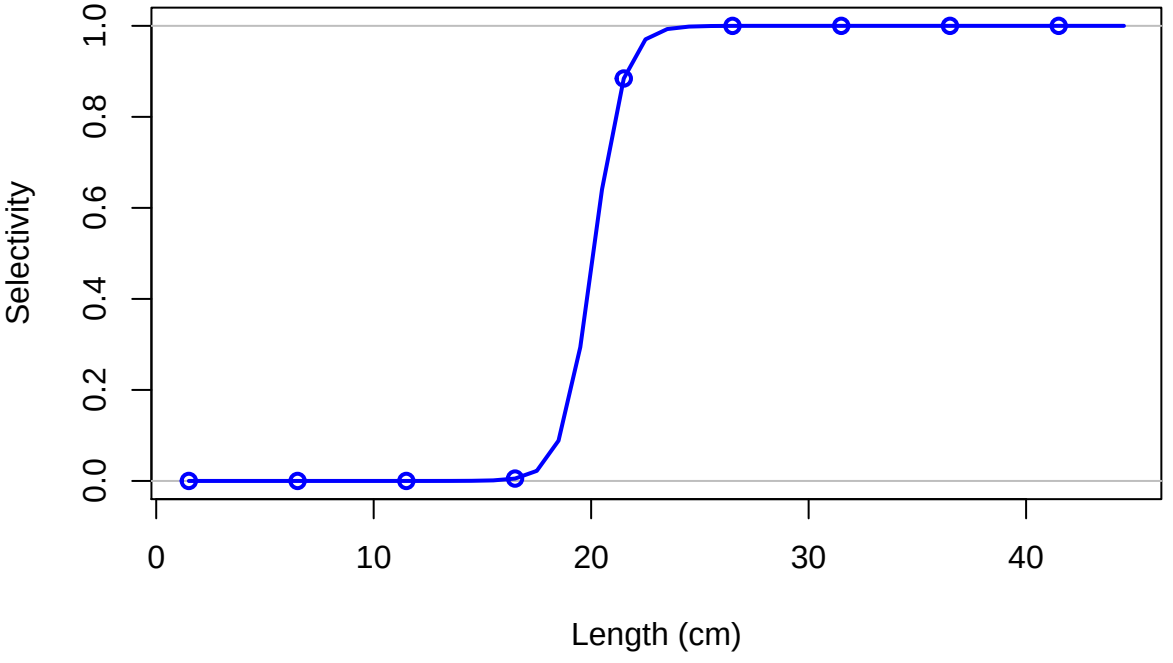

Fecundity
0.0
0.5
1.0
1.5
0
10
20
30
40
Female length (cm)

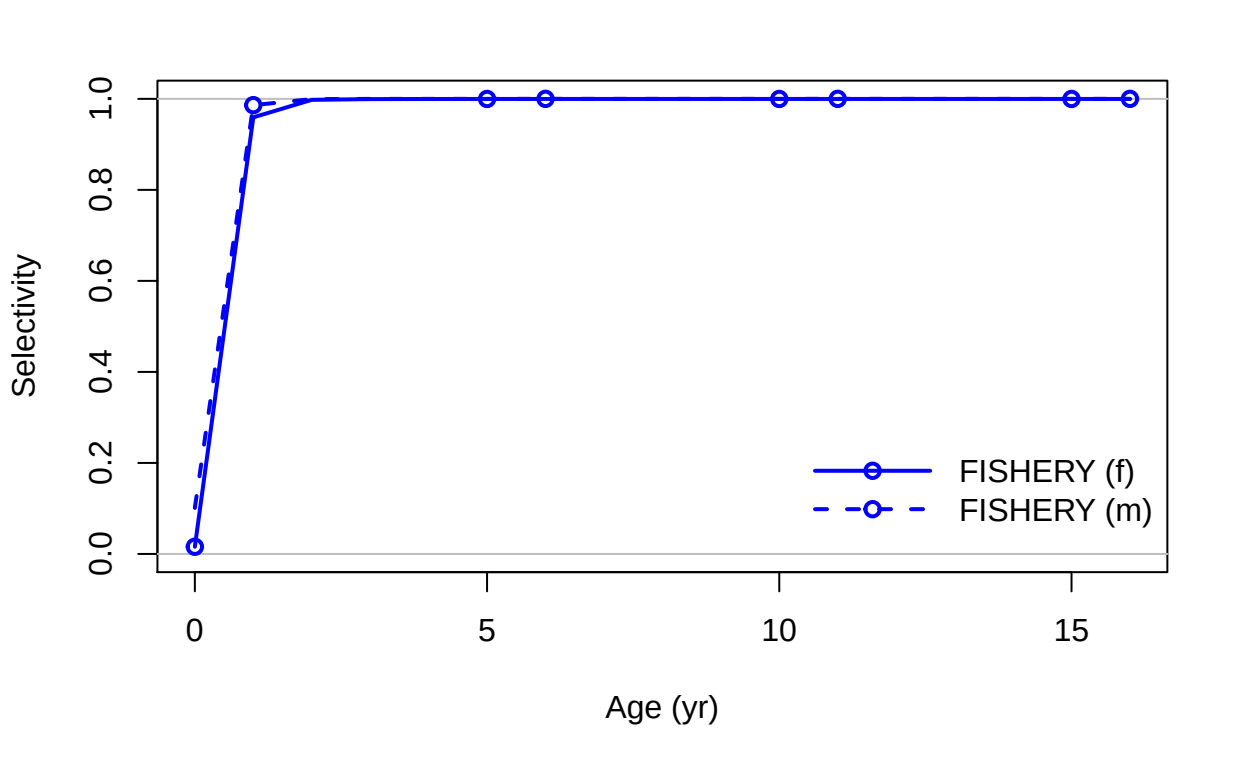

Spawning output
1.5
1.0
0.5
0.0
0
10
20
30
40
Length (cm)

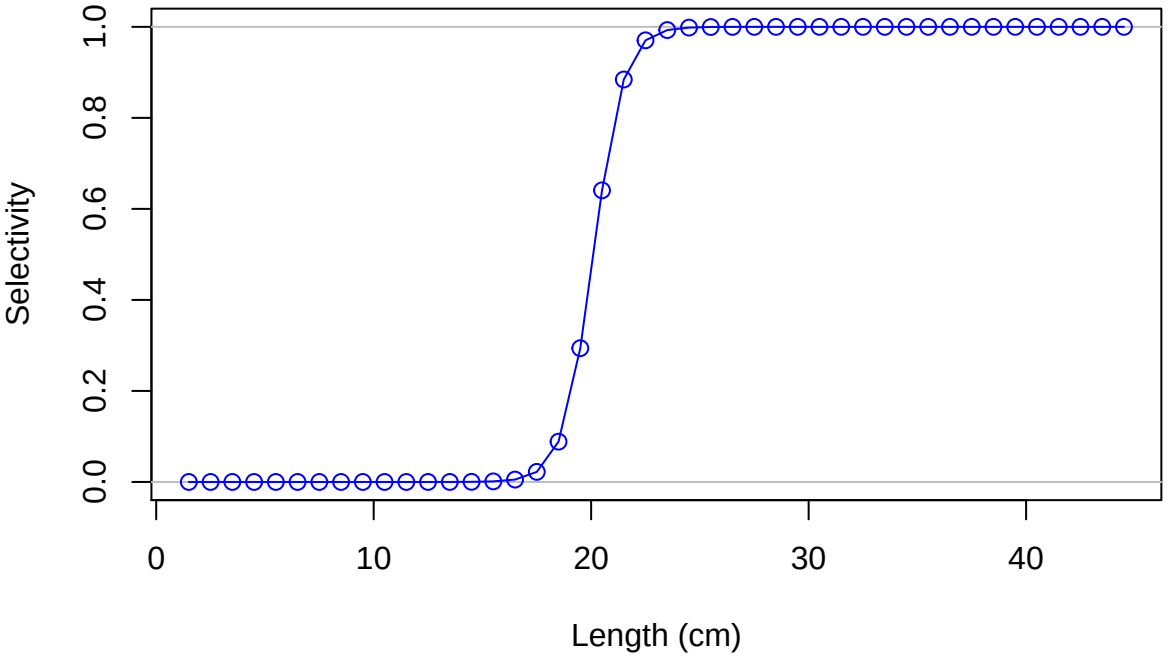

Spawning output
0.0
0.1
0.2
0.3
0.4
0.5
0
5
10
15
Age (yr)

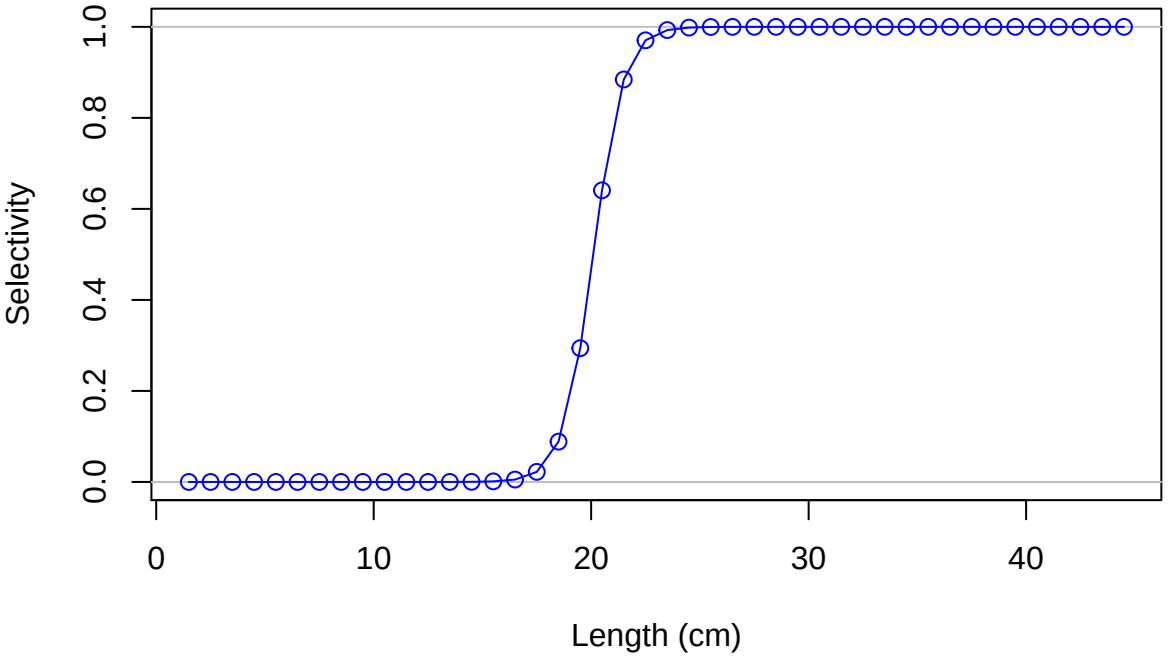

Hermaphroditism transition rate
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
Year

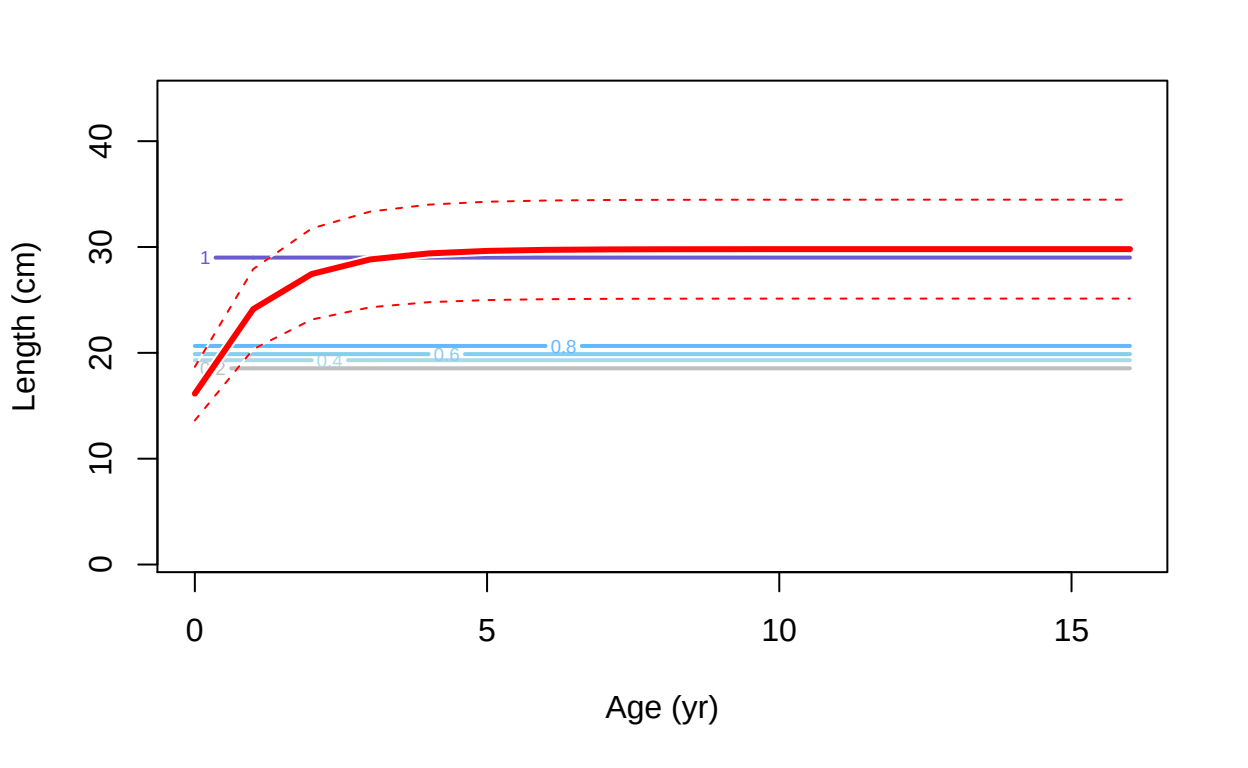

Fraction females by age at equilibrium
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
Age (yr)

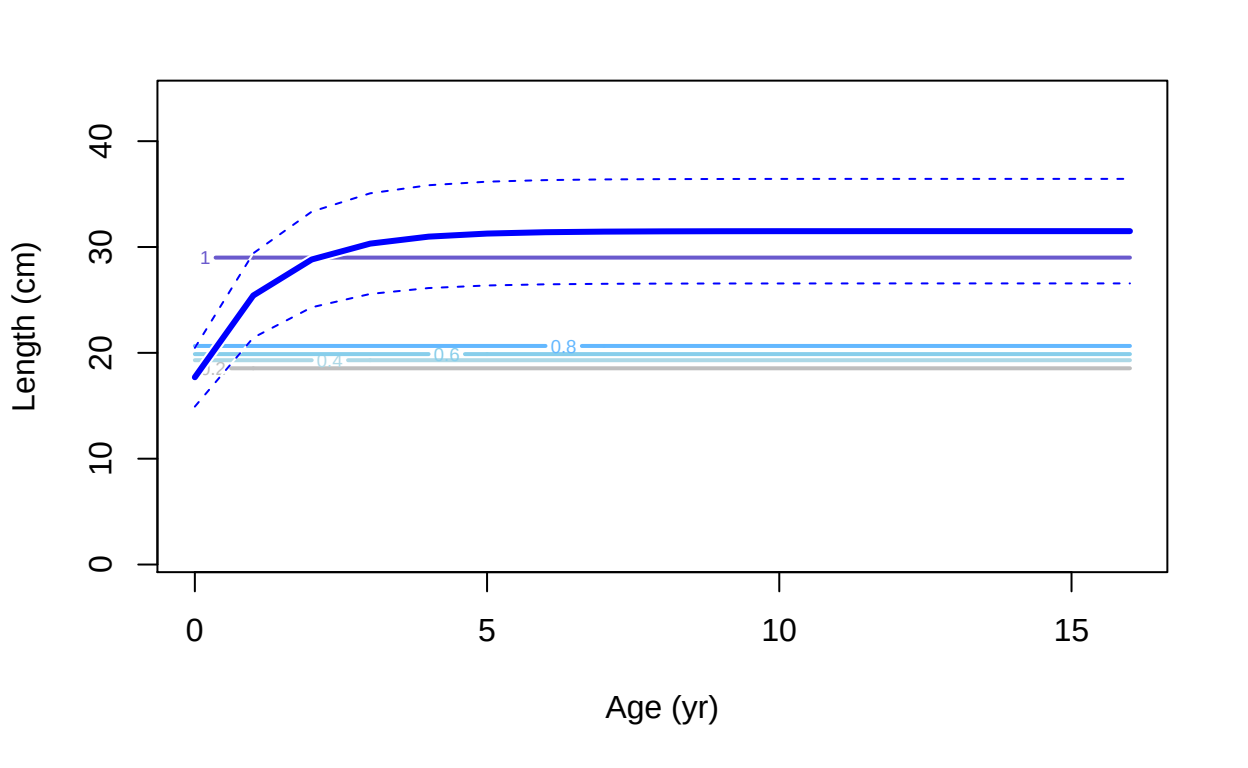

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
10
20
30
40
Length (cm)

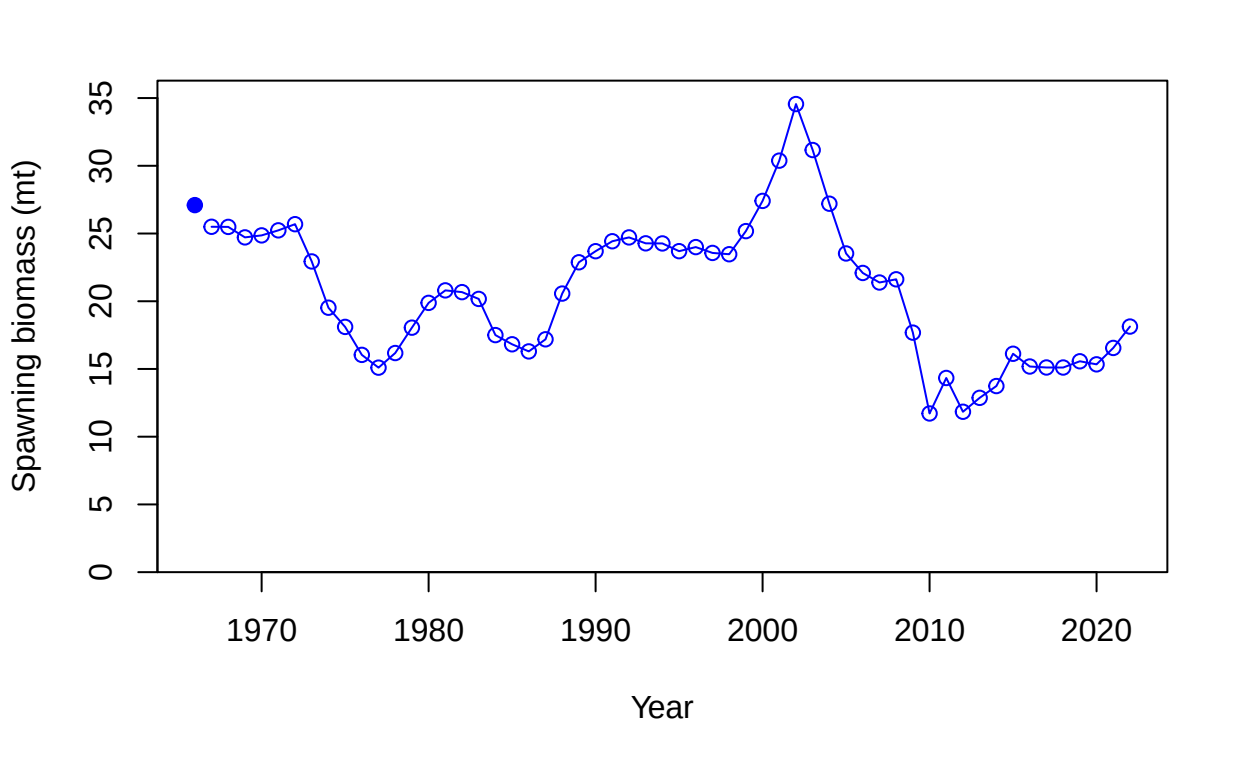

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
5
10
15
Age (yr)
FISHERY (f)
FISHERY (m)

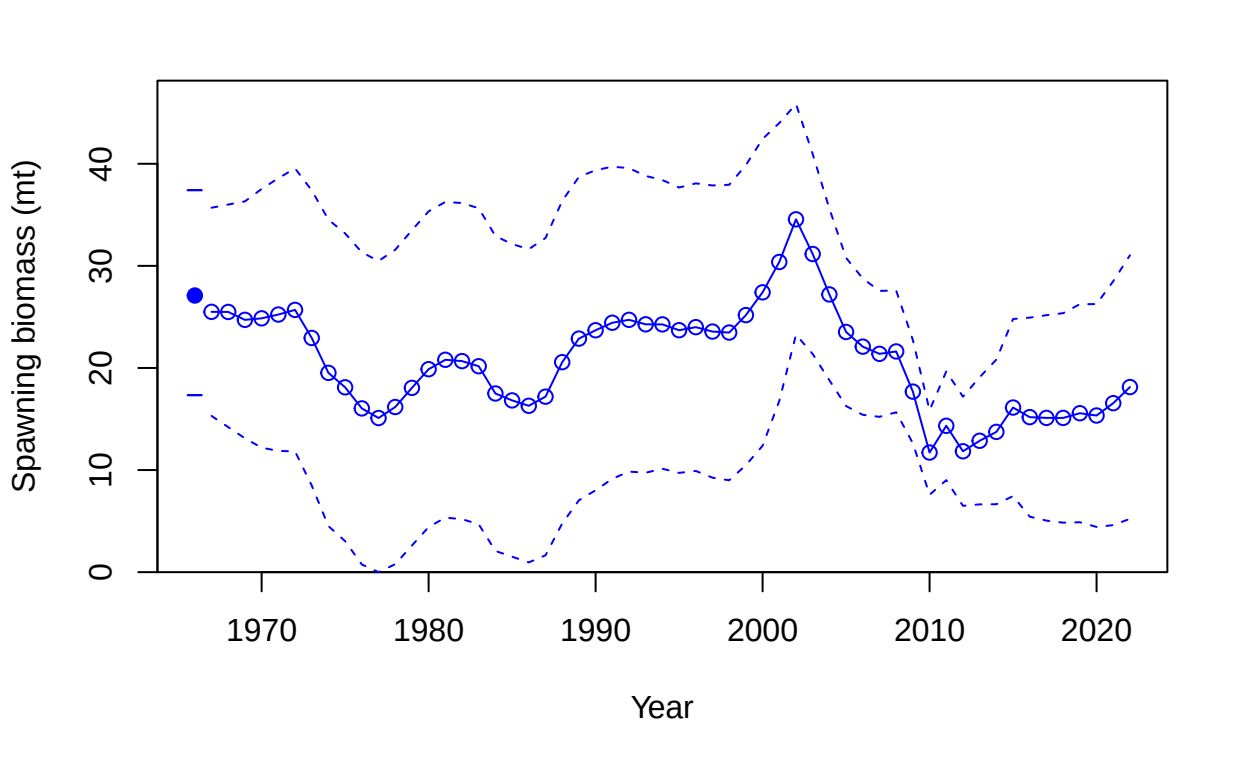

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
10
20
30
40
Length (cm)

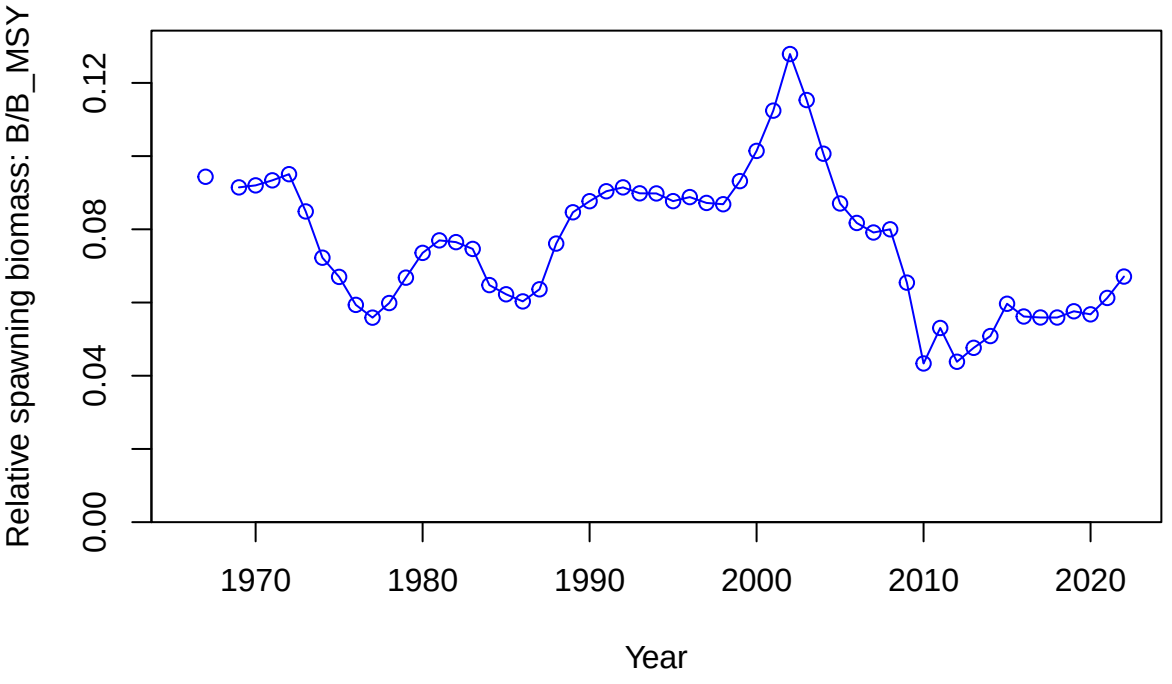

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
10
20
30
40
Length (cm)

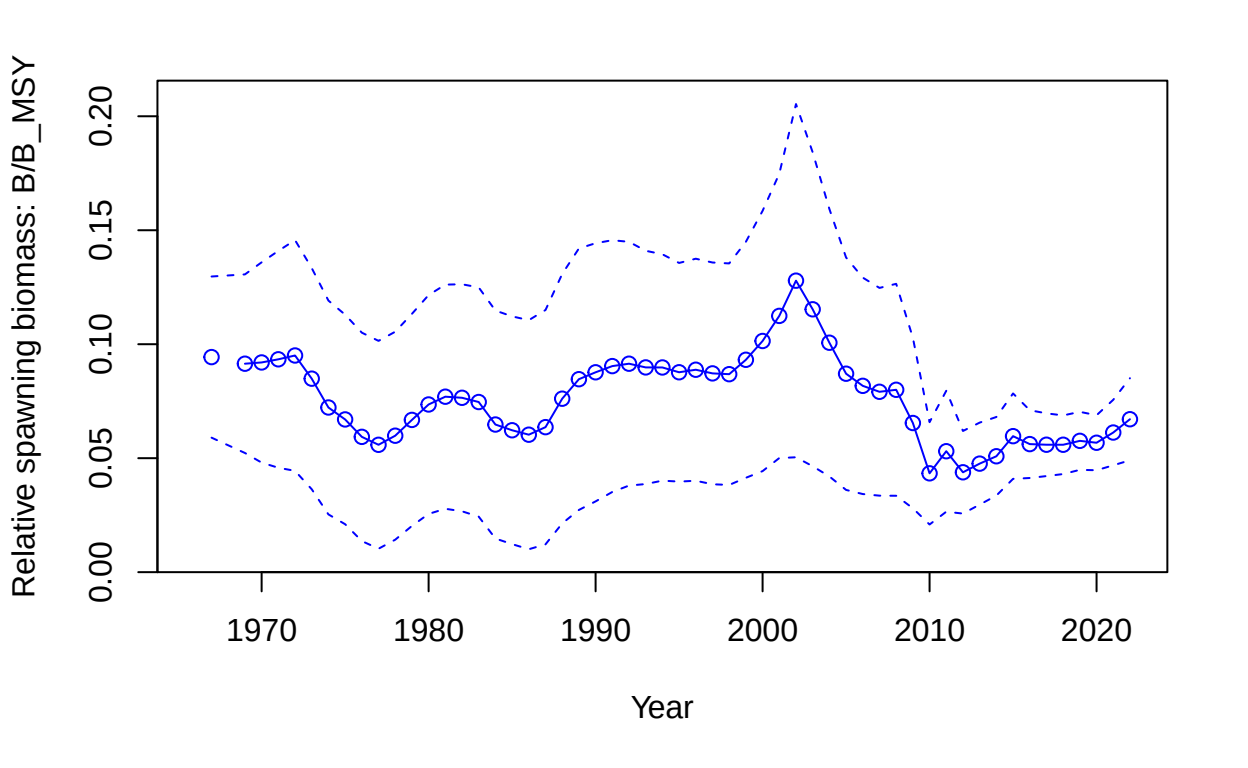

Length (cm)
0
10
20
30
40
0
5
10
15
Age (yr)
1
0.8
0.6
0.4

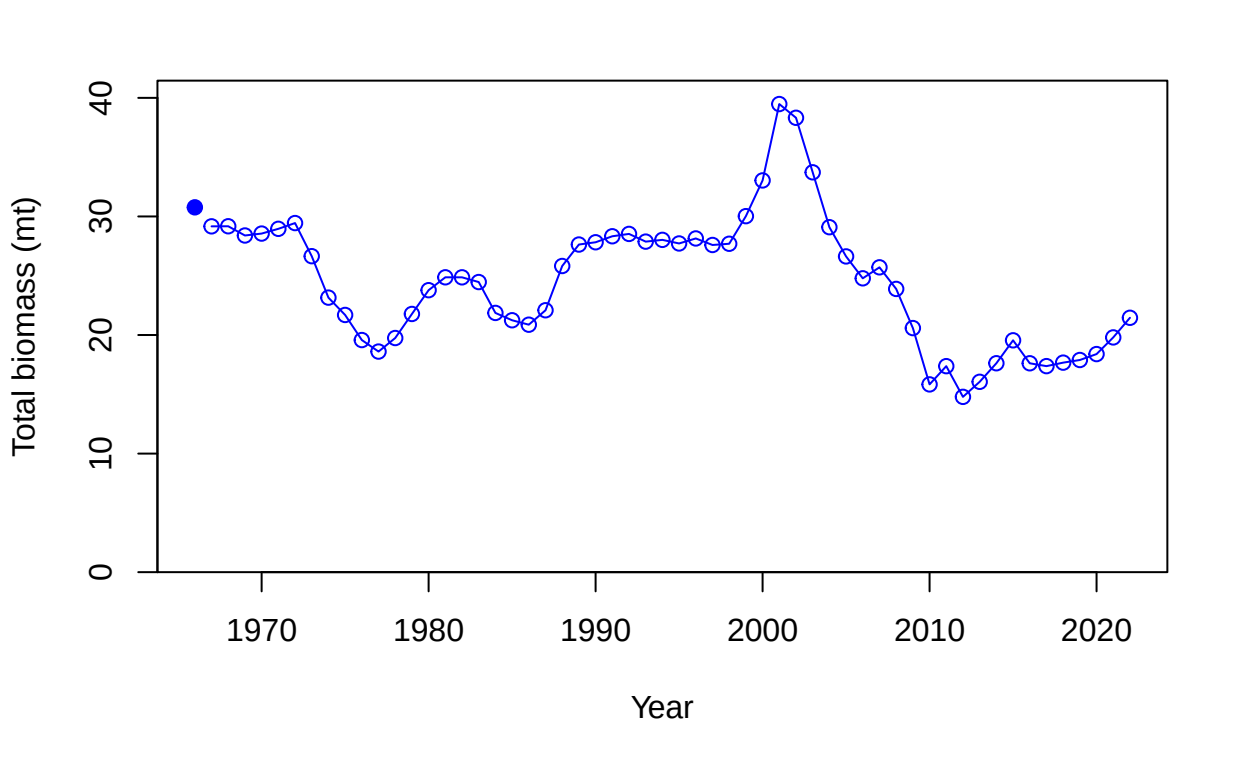

Length (cm)
0
10
20
30
40
0
5
10
15
Age (yr)
1
0.8
0.6
0.4

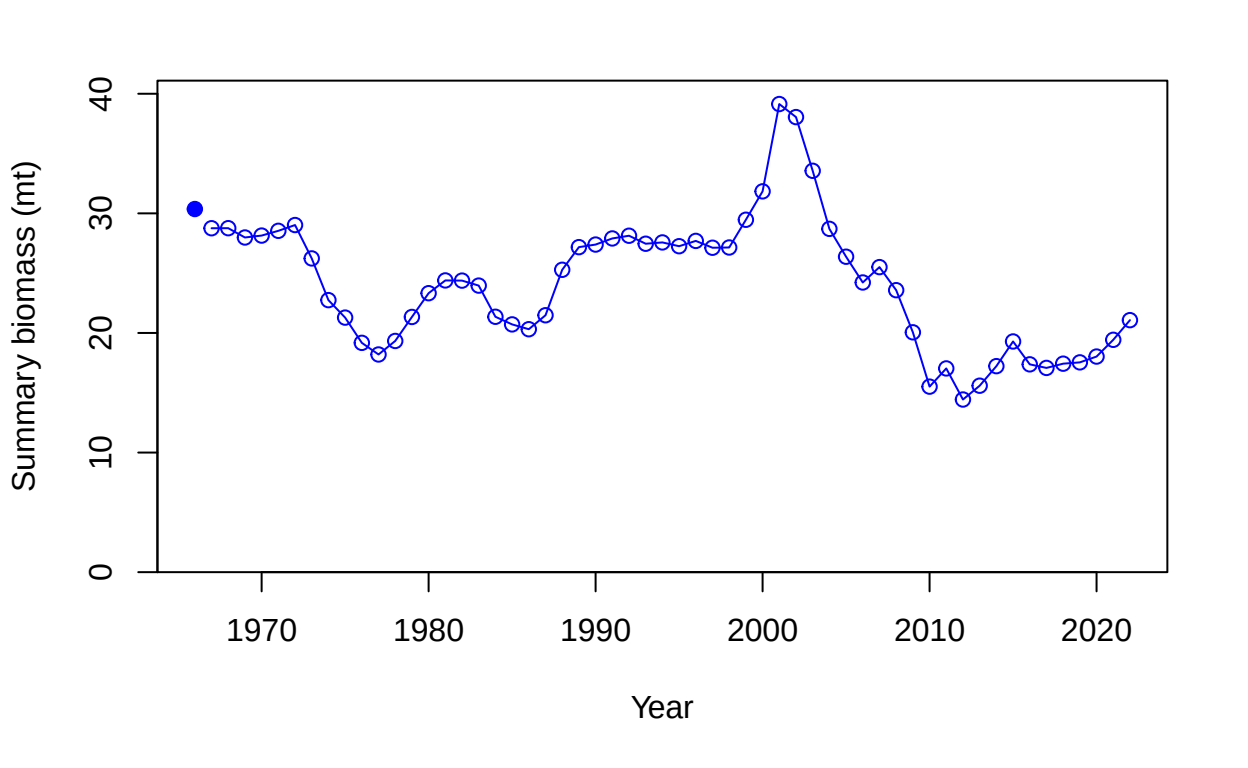

Spawning biomass (mt)
0
5
10
15
20
25
30
35
1970
1980
1990
2000
2010
2020
Year

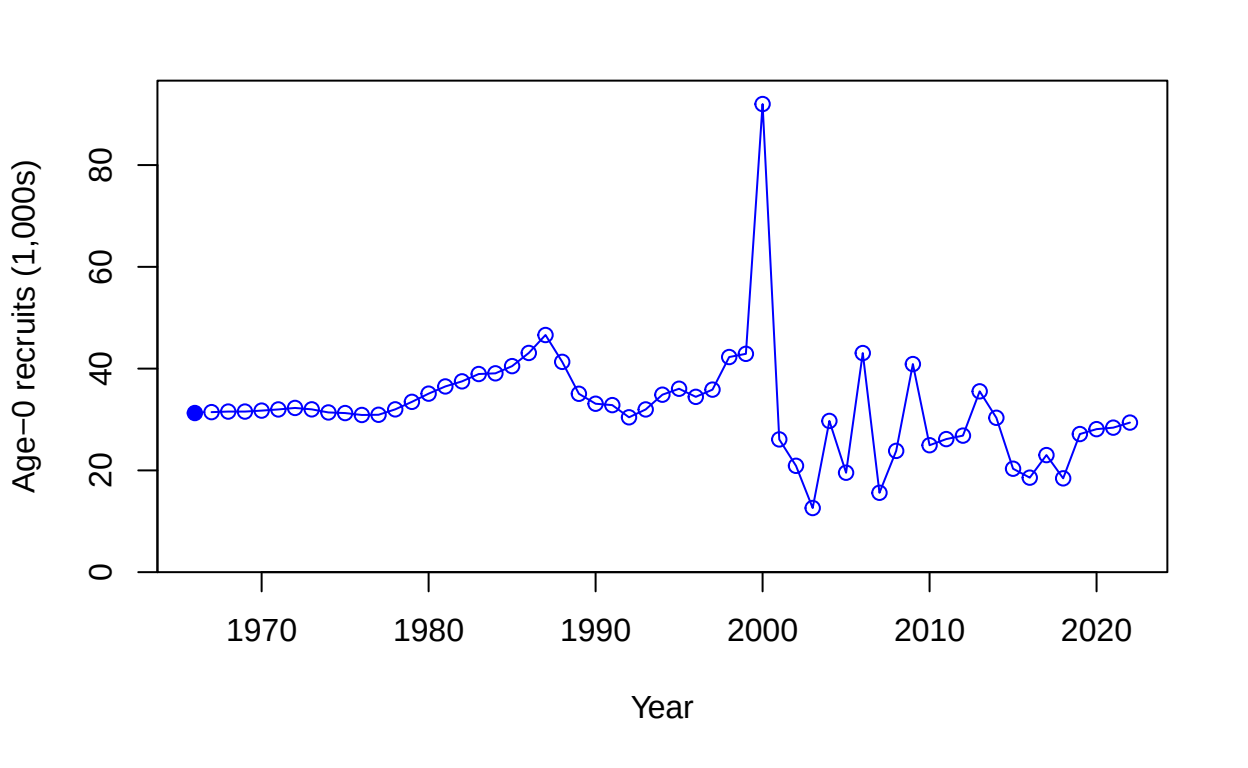

Spawning biomass (mt)
0
10
20
30
40
1970
1980
1990
2000
2010
2020
Year

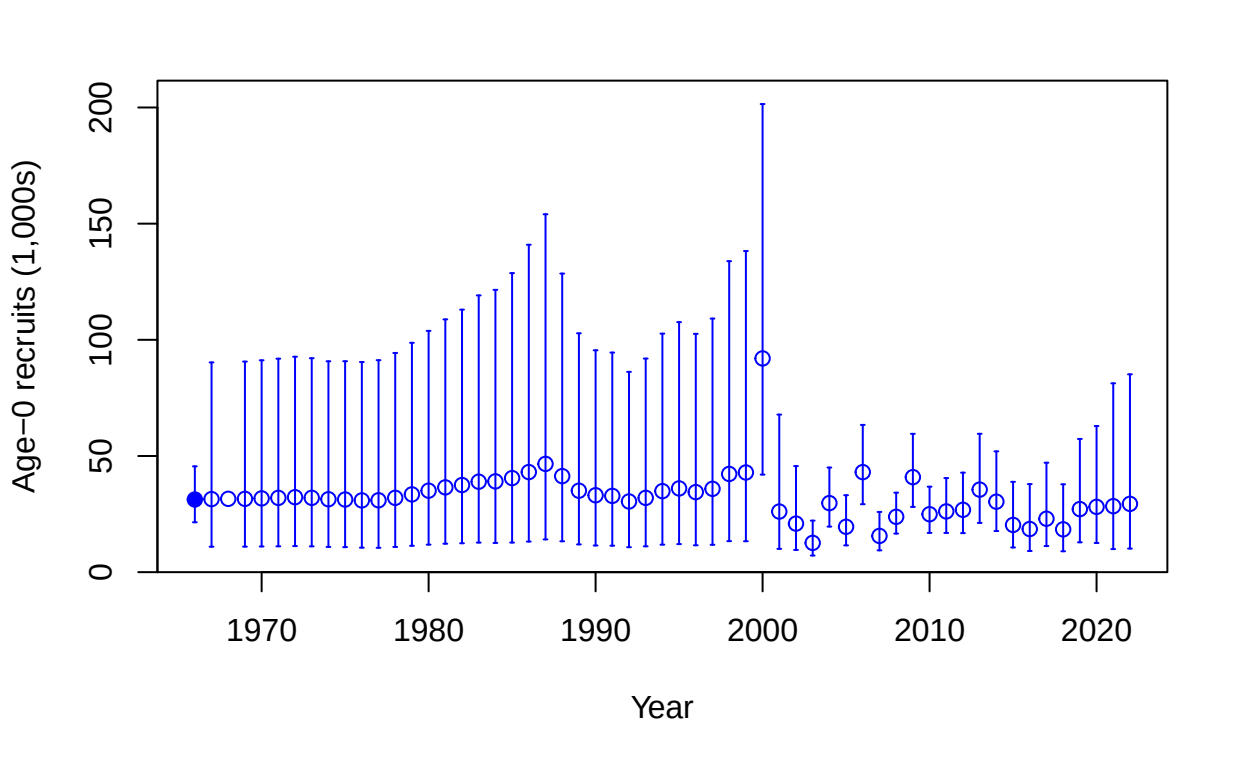

Relative spawning biomass: B/B_MSY
0.00
0.04
0.08
0.12
1970
1980
1990
2000
2010
2020
Year

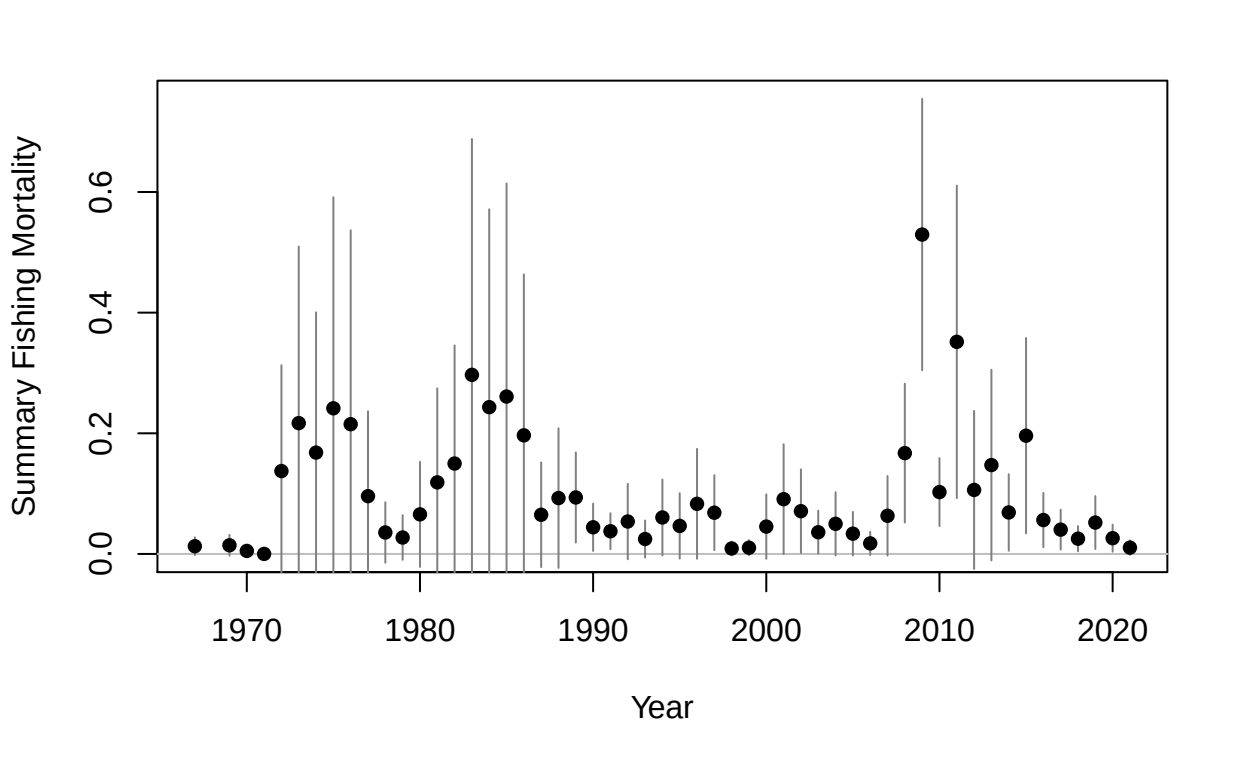

Relative spawning biomass: B/B_MSY
0.00
0.05
0.10
0.15
0.20
1970
1980
1990
2000
2010
2020
Year

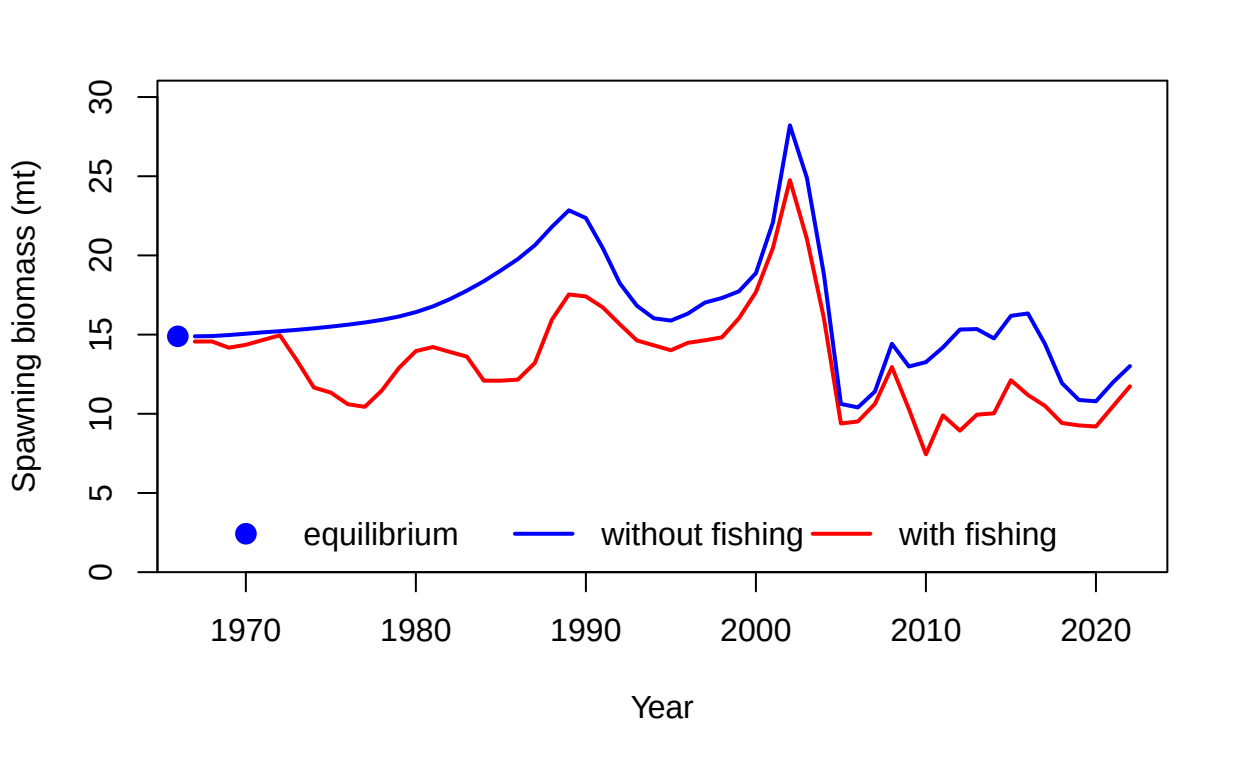

Total biomass (mt)
0
10
20
30
40
1970
1980
1990
2000
2010
2020
Year

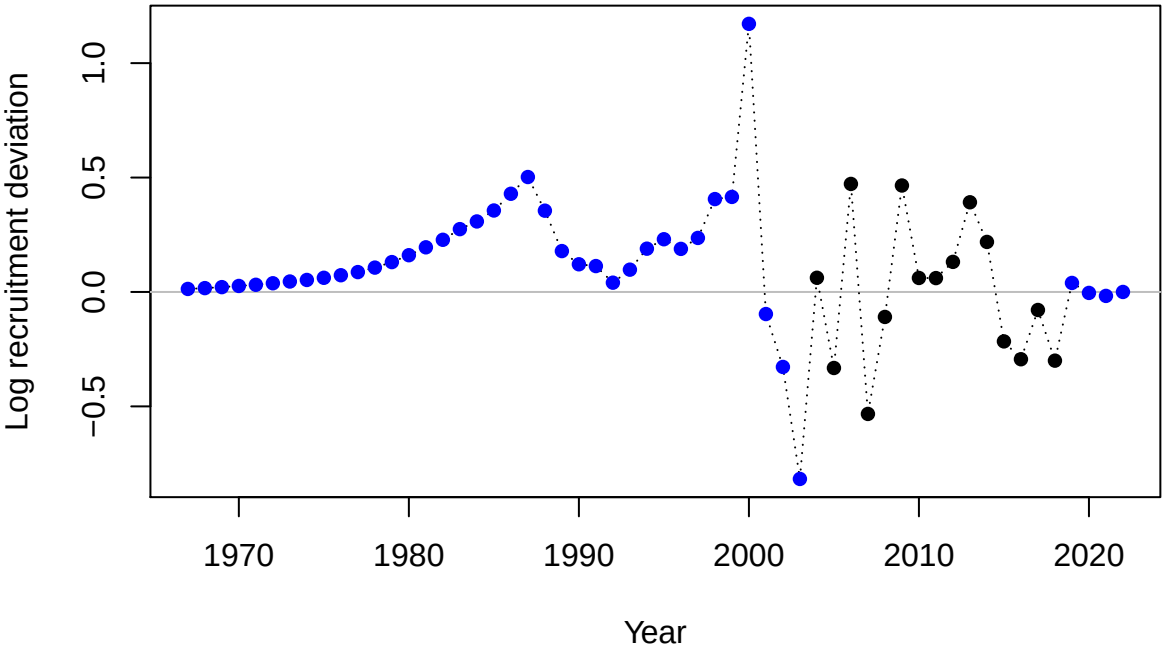

Summary biomass (mt)
0
10
20
30
40
1970
1980
1990
2000
2010
2020
Year

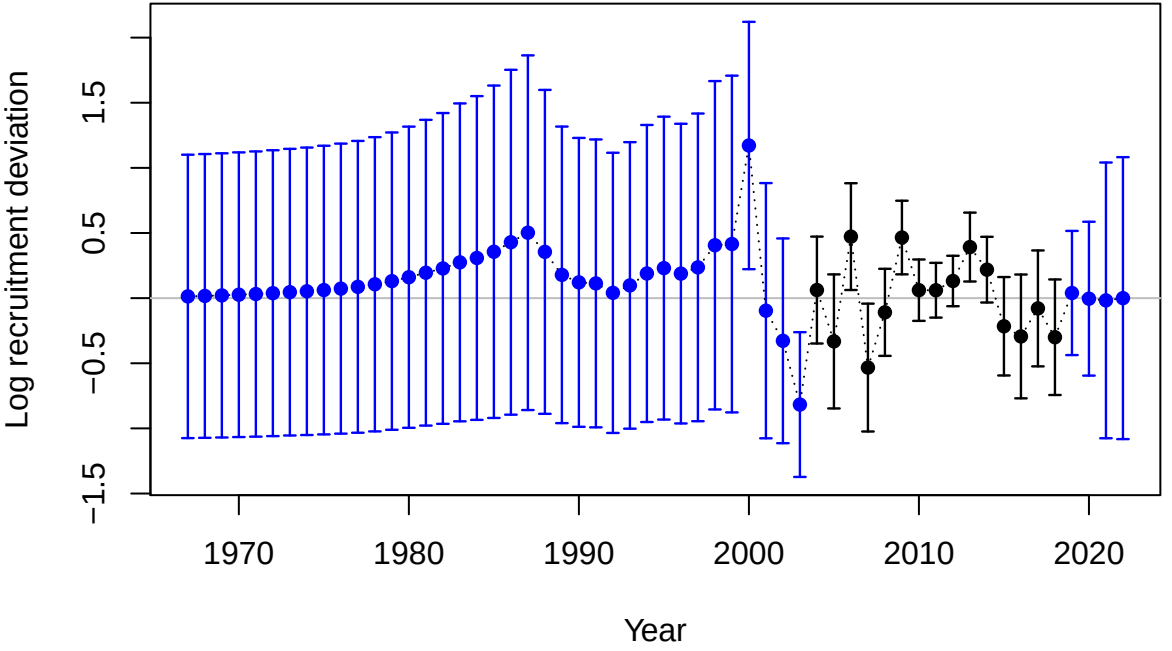

Age−0 recruits (1,000s)
0
20
40
60
80
1970
1980
1990
2000
2010
2020
Year

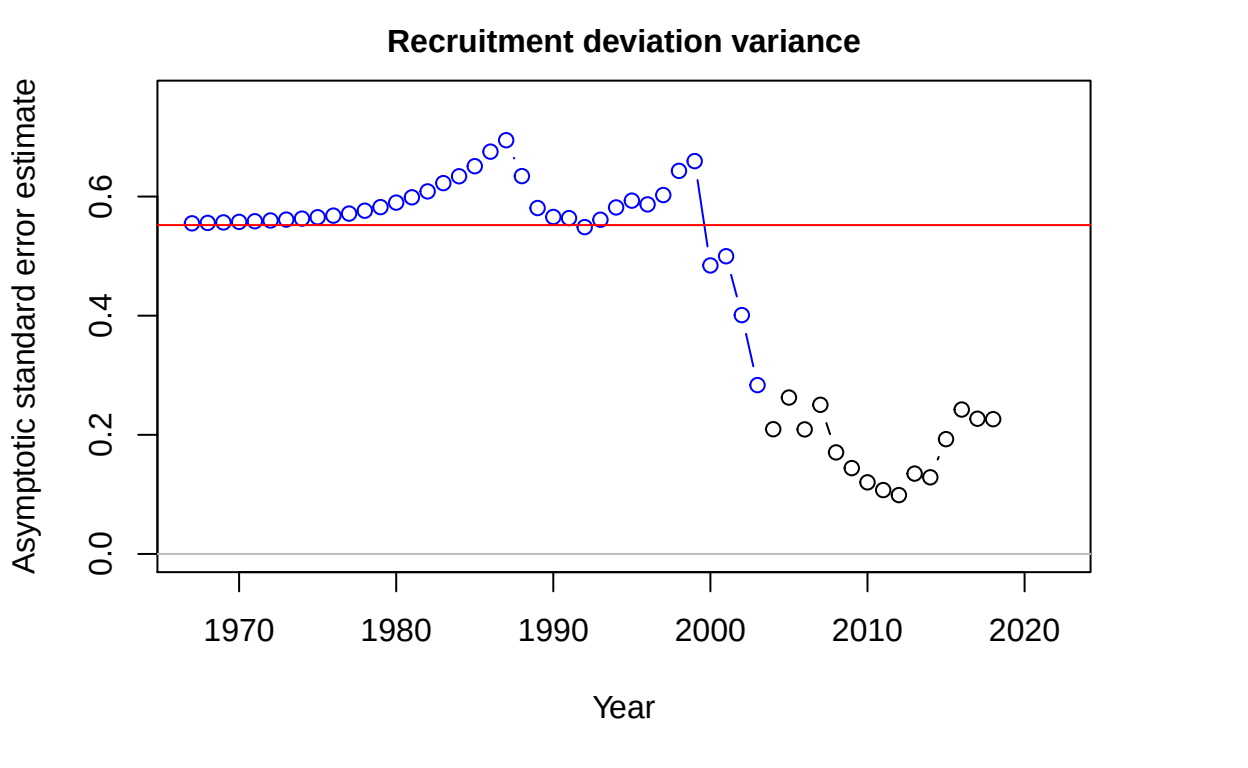

Age−0 recruits (1,000s)
0
50
100
150
200
1970
1980
1990
2000
2010
2020
Year

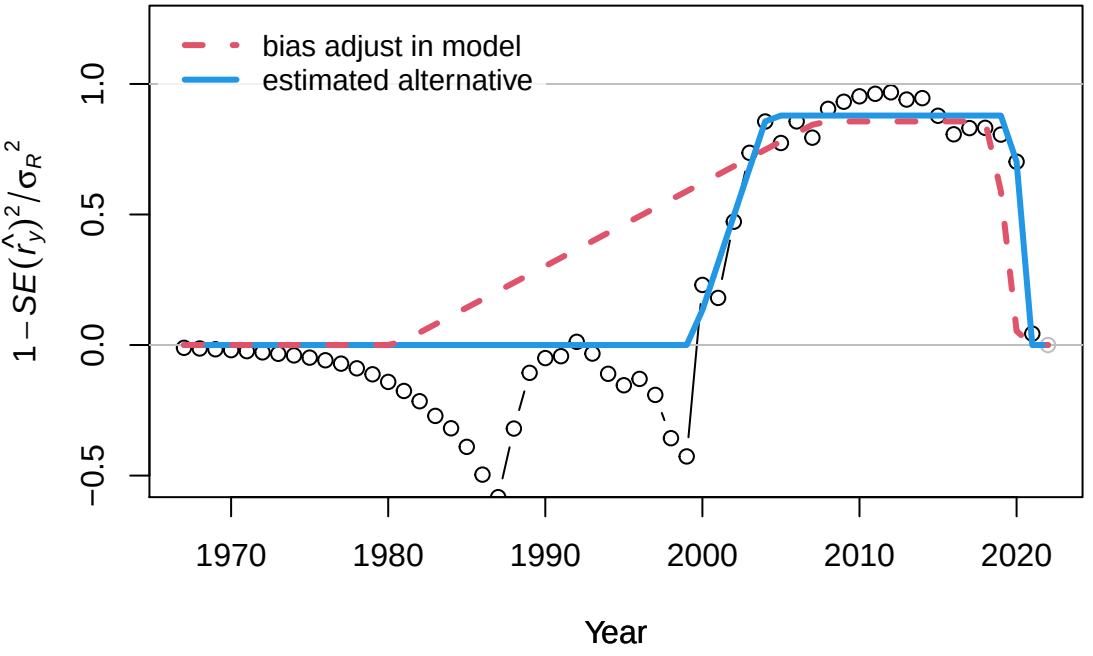

Summary Fishing Mortality
0.0
0.2
0.4
0.6
1970
1980
1990
2000
2010
2020
Year

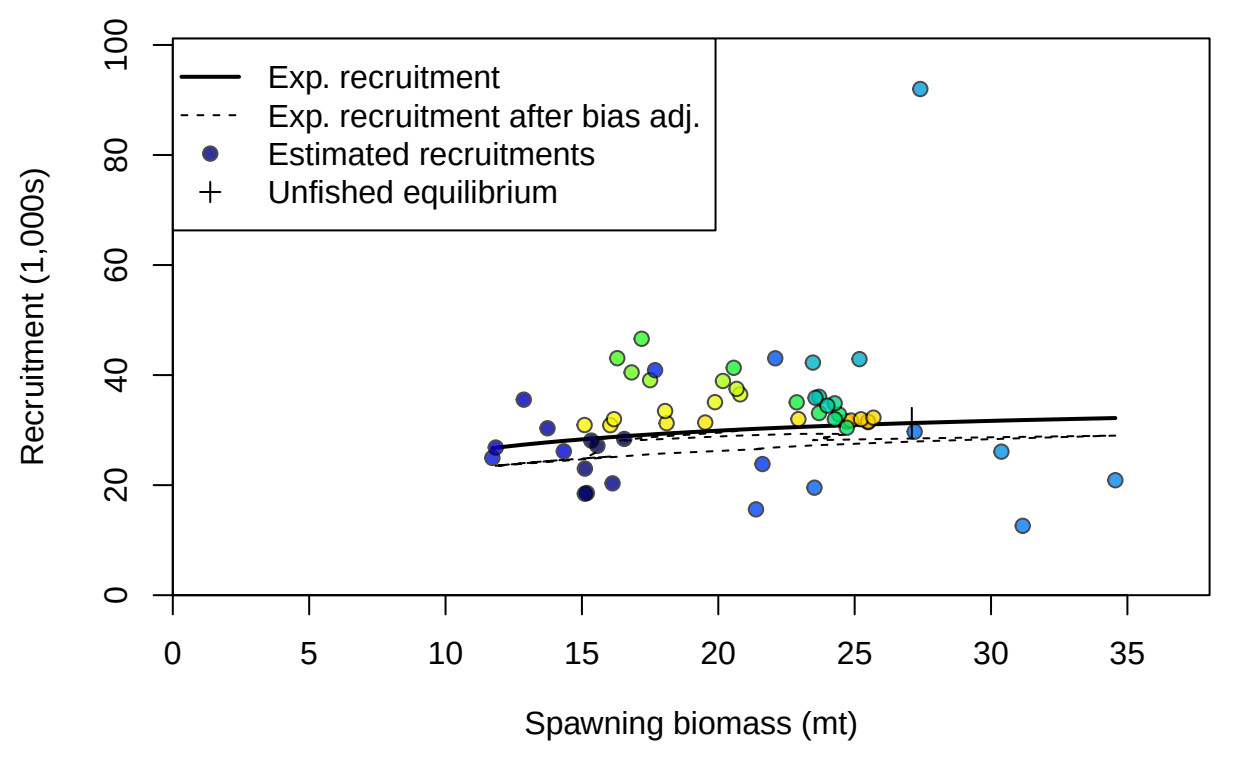

Spawning biomass (mt)
0
5
10
15
20
25
30
1970
1980
1990
2000
2010
2020
Year
equilibrium
without fishing
with fishing

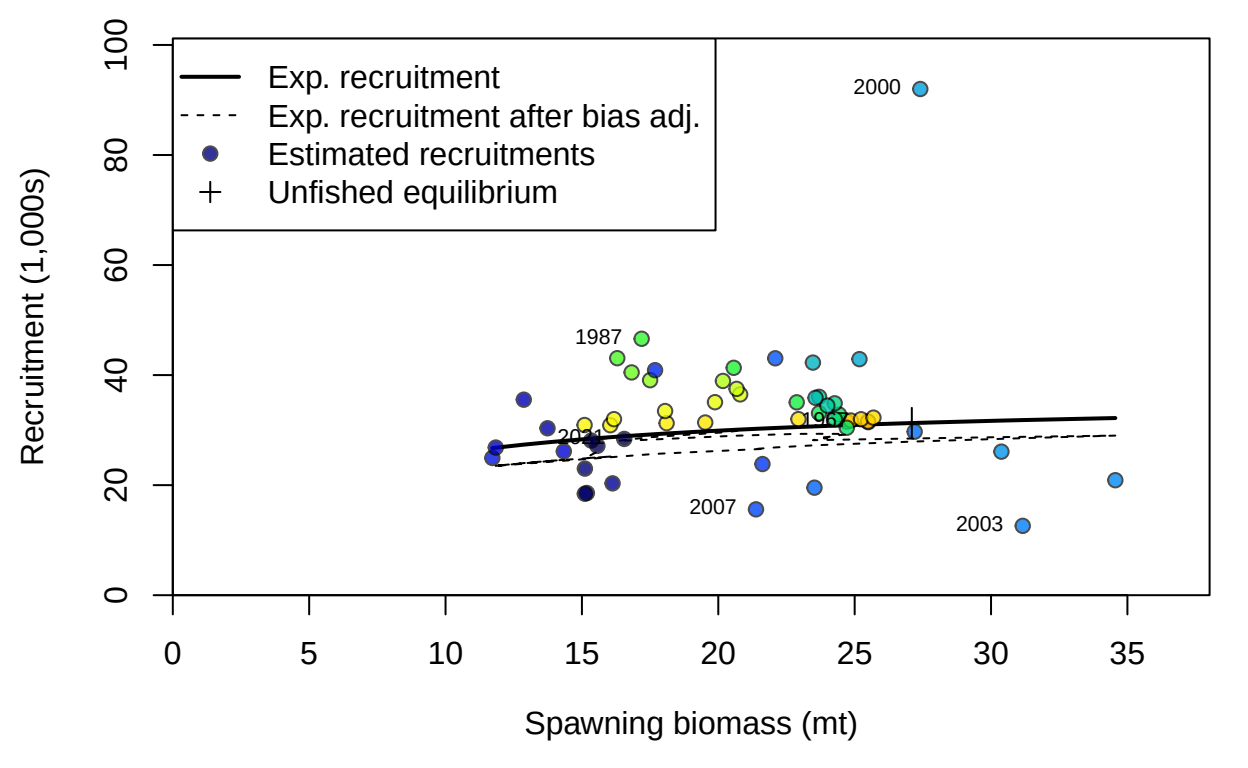

Log recruitment deviation
1.0
0.5
0.0
−0.5
1970
1980
1990
2000
2010
2020
Year

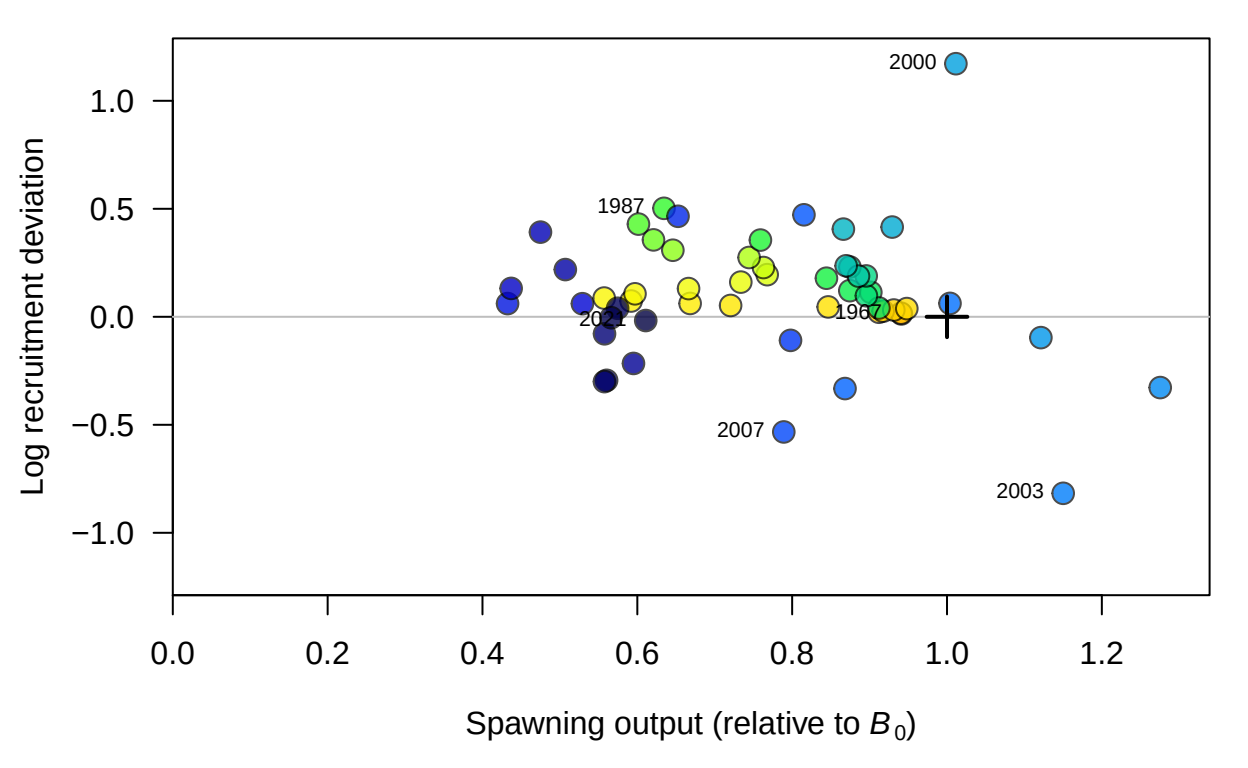

Log recruitment deviation
1.5
0.5
−0.5
−1.5
1970
1980
1990
2000
2010
2020
Year

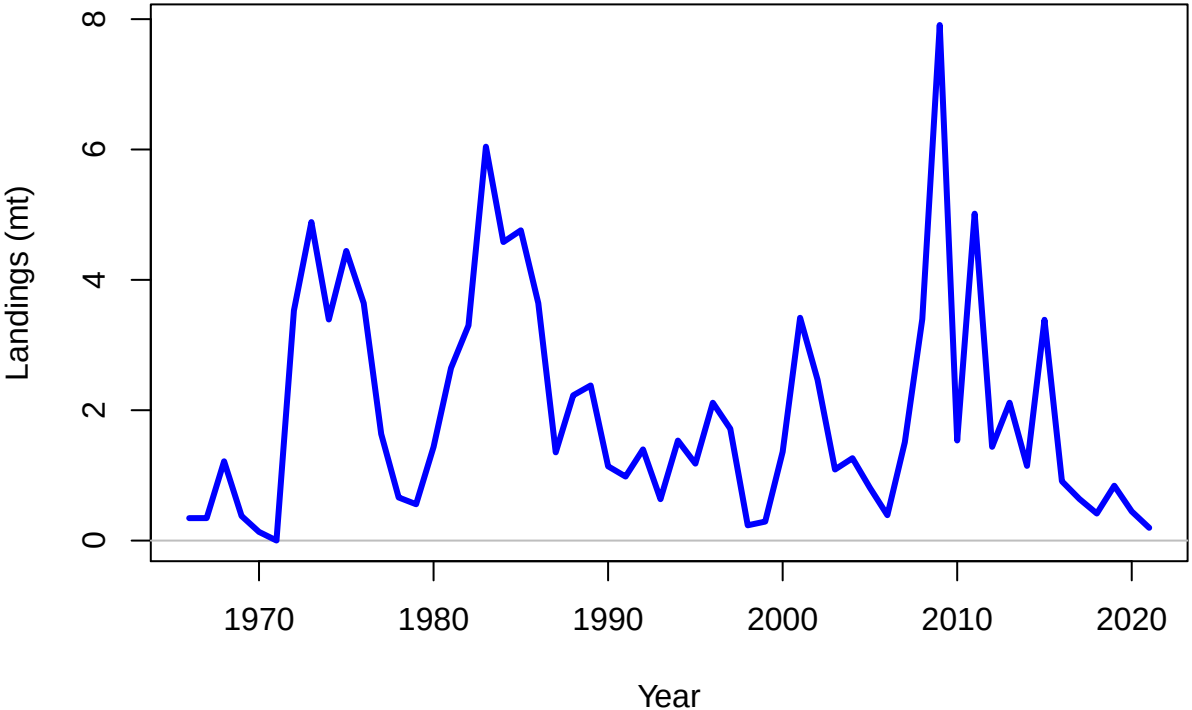

Recruitment deviation variance
Asymptotic standard error estimate
0.0
0.2
0.4
0.6
1970
1980
1990
2000
2010
2020
Year

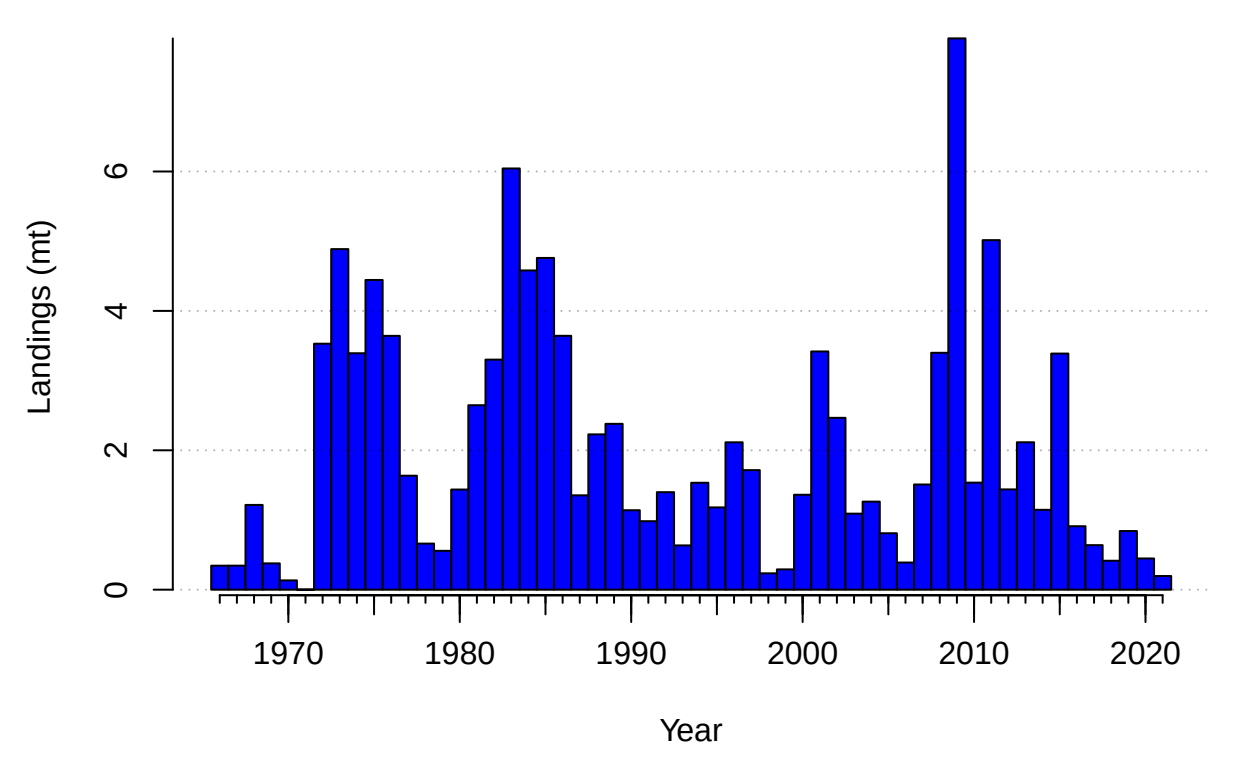

bias adjust in model
estimated alternative
1.0
0.5
0.0
−0.5
1970
1980
1990
2000
2010
2020
Year
$1-SE(\hat{r}_y)^2/\sigma_R{}^2$

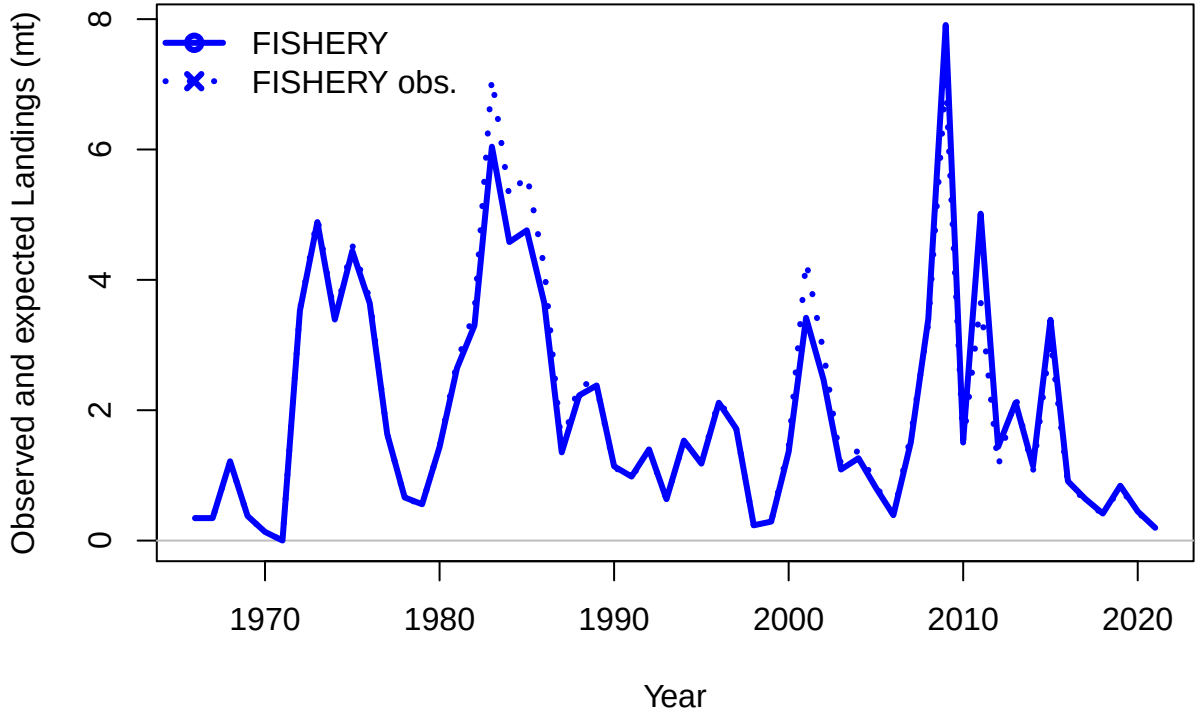

Exp. recruitment
Exp. recruitment after bias adj.
Estimated recruitments
Unfished equilibrium
Recruitment (1,000s)
0
20
40
60
80
100
0
5
10
15
20
25
30
35
Spawning biomass (mt)

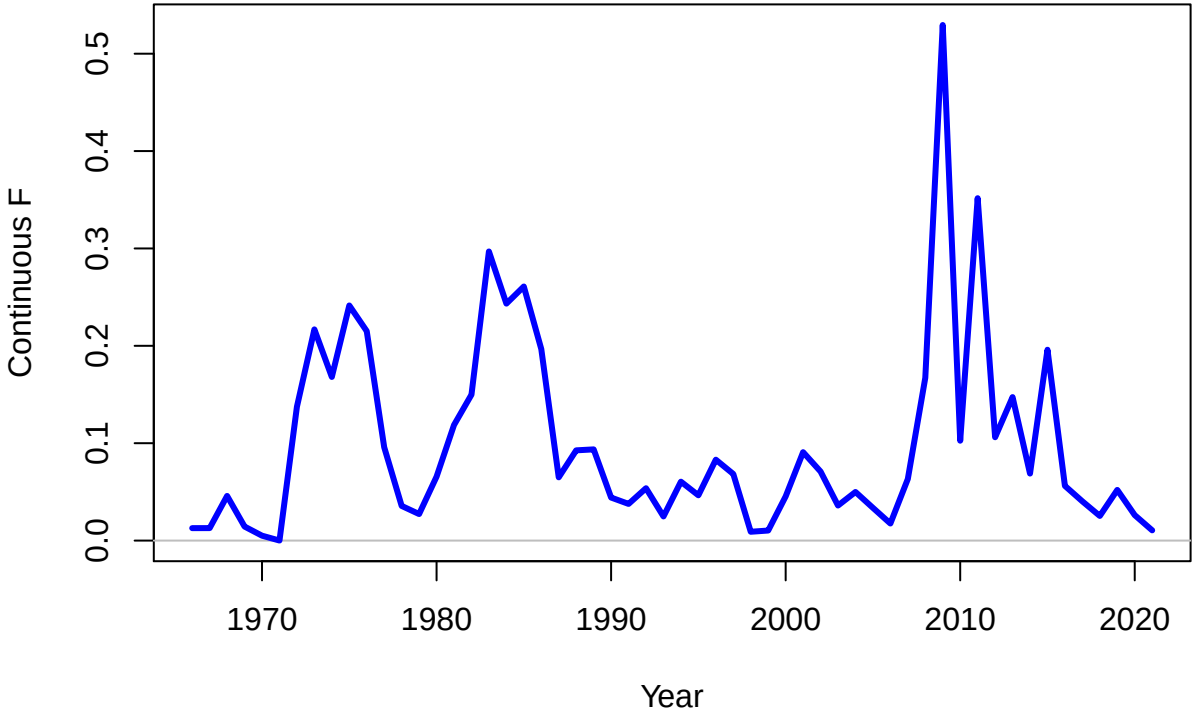

Exp. recruitment
Exp. recruitment after bias adj.
Estimated recruitments
Unfished equilibrium
2000
1987
2007
2003
Recruitment (1,000s)
Spawning biomass (mt)
0
20
40
60
80
100
0
5
10
15
20
25
30
35

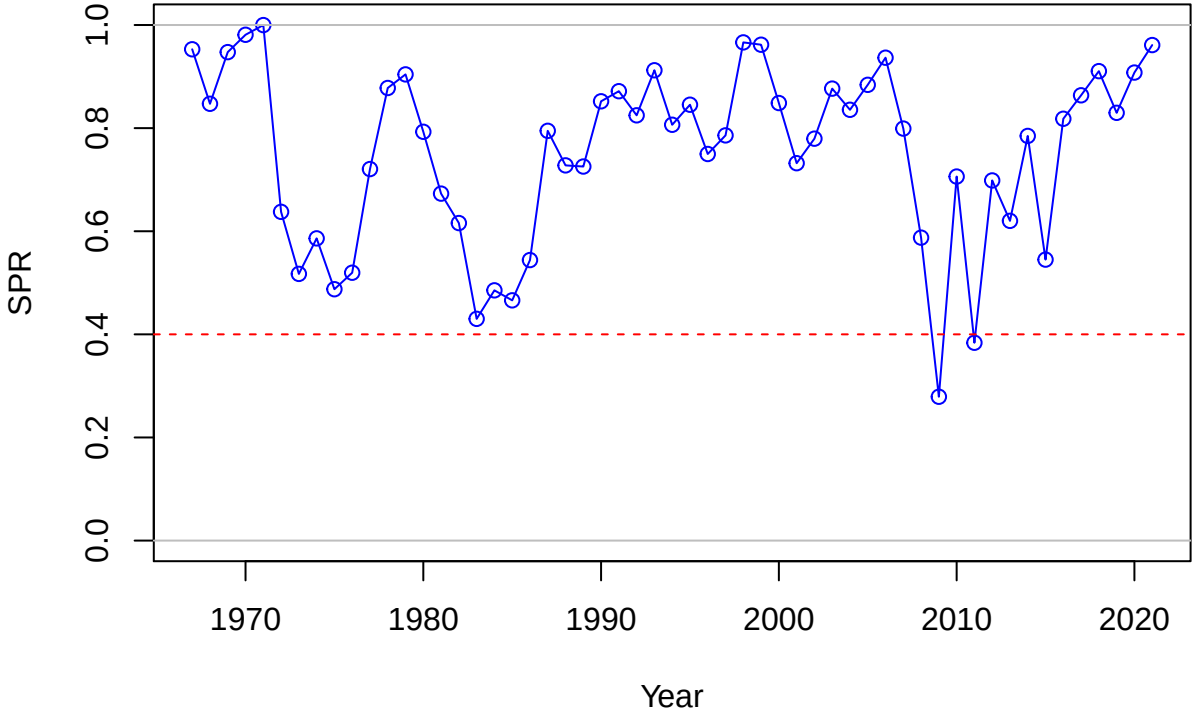

2000
1987
2021
1967
2007
2003
1.0
0.5
0.0
−0.5
−1.0
Log recruitment deviation
0.0
0.2
0.4
0.6
0.8
1.0
1.2
Spawning output (relative to B_0)

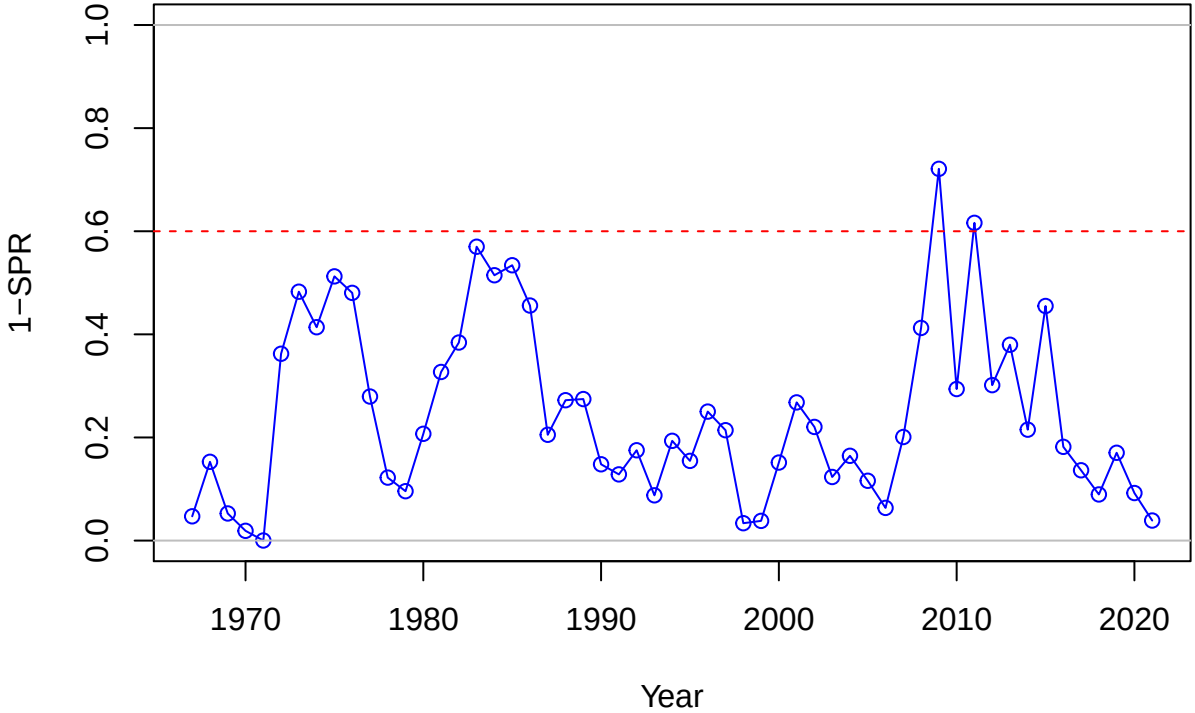

Landings (mt)
0
2
4
6
8
1970
1980
1990
2000
2010
2020
Year

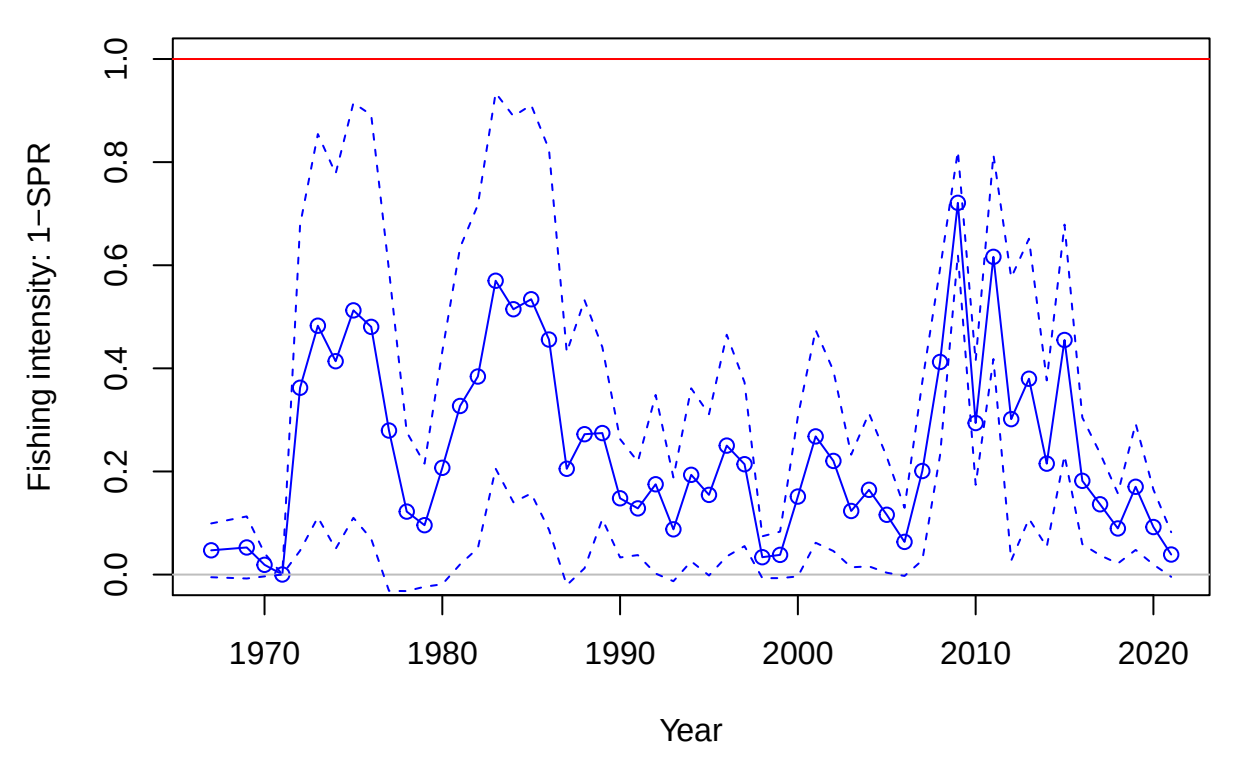

Landings (mt)
0
2
4
6
1970
1980
1990
2000
2010
2020
Year

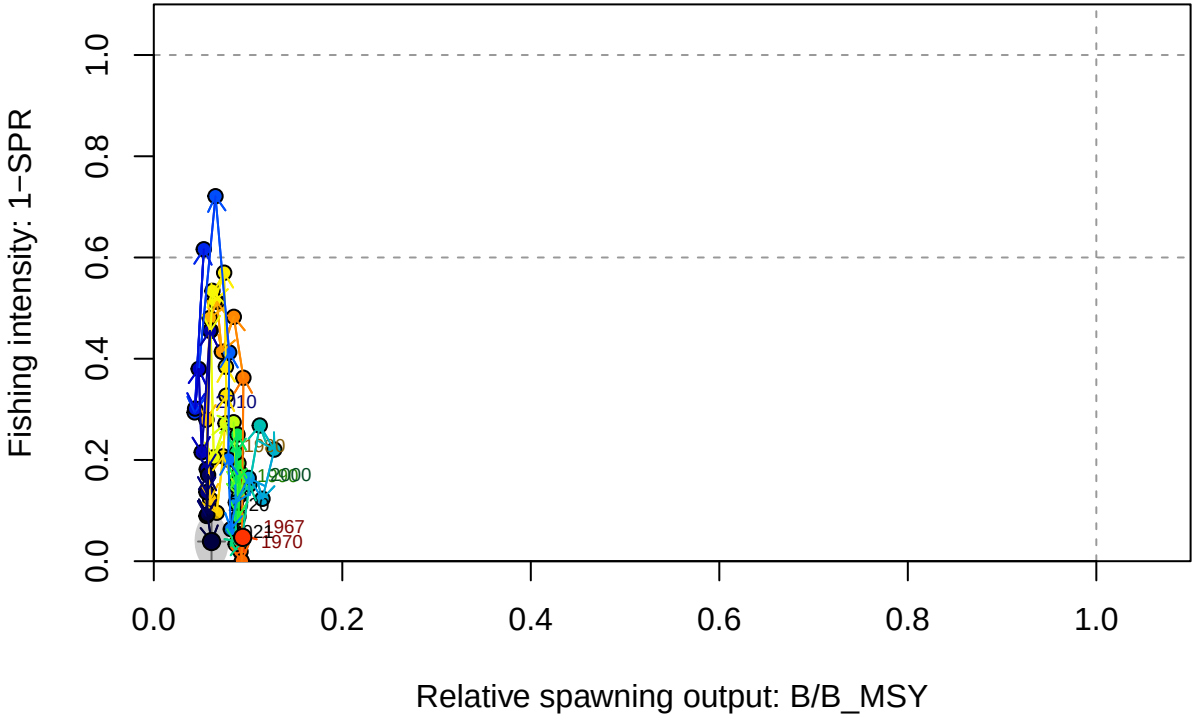

FISHERY
FISHERY obs.
Observed and expected Landings (mt)
0
2
4
6
8
1970
1980
1990
2000
2010
2020
Year

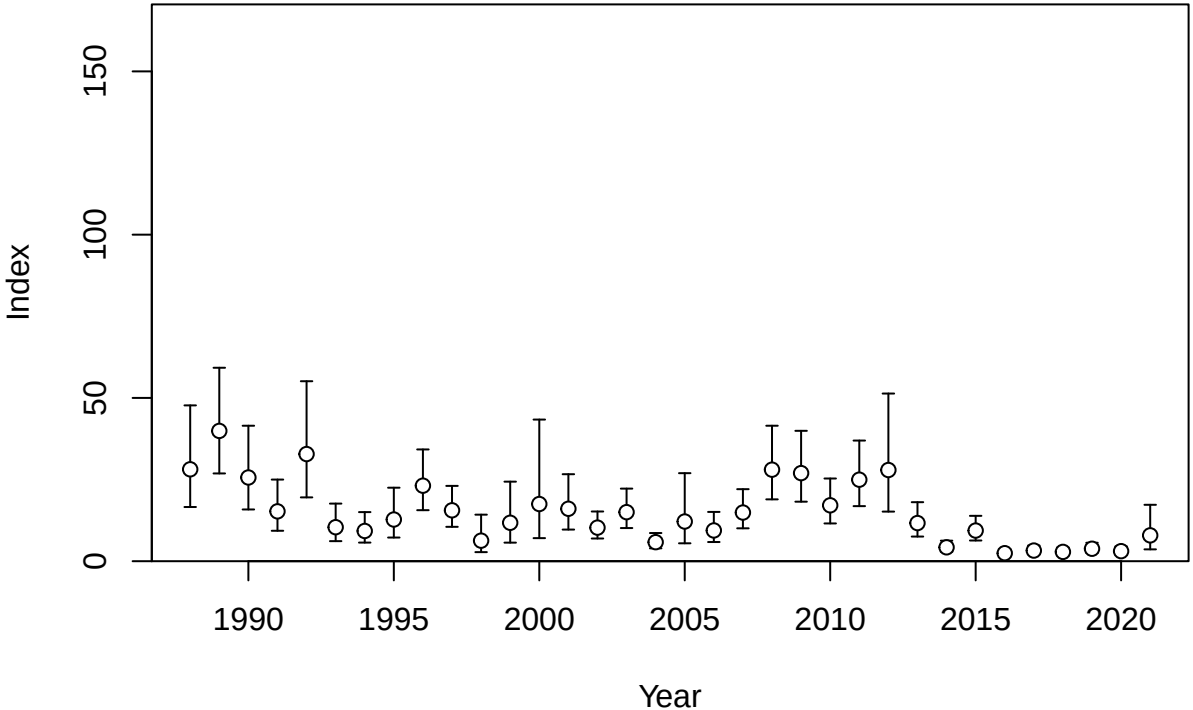

Continuous F
0.0
0.1
0.2
0.3
0.4
0.5
1970
1980
1990
2000
2010
2020
Year

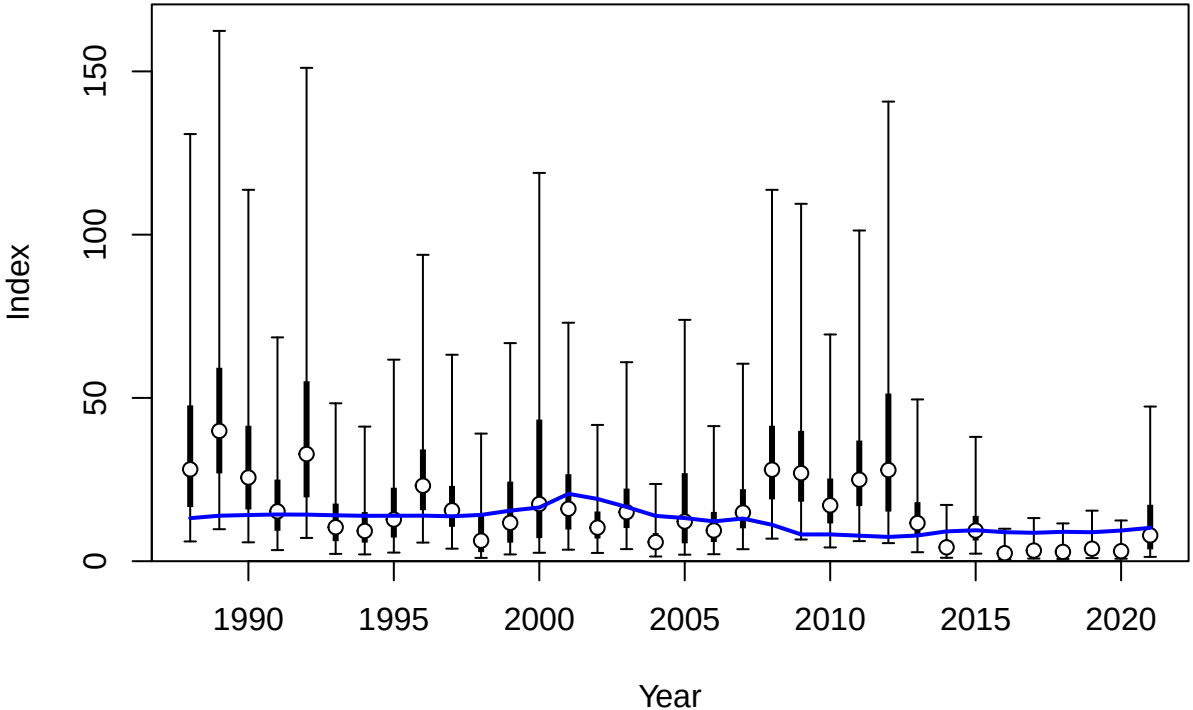

SPR
0.0
0.2
0.4
0.6
0.8
1.0
1970
1980
1990
2000
2010
2020
Year

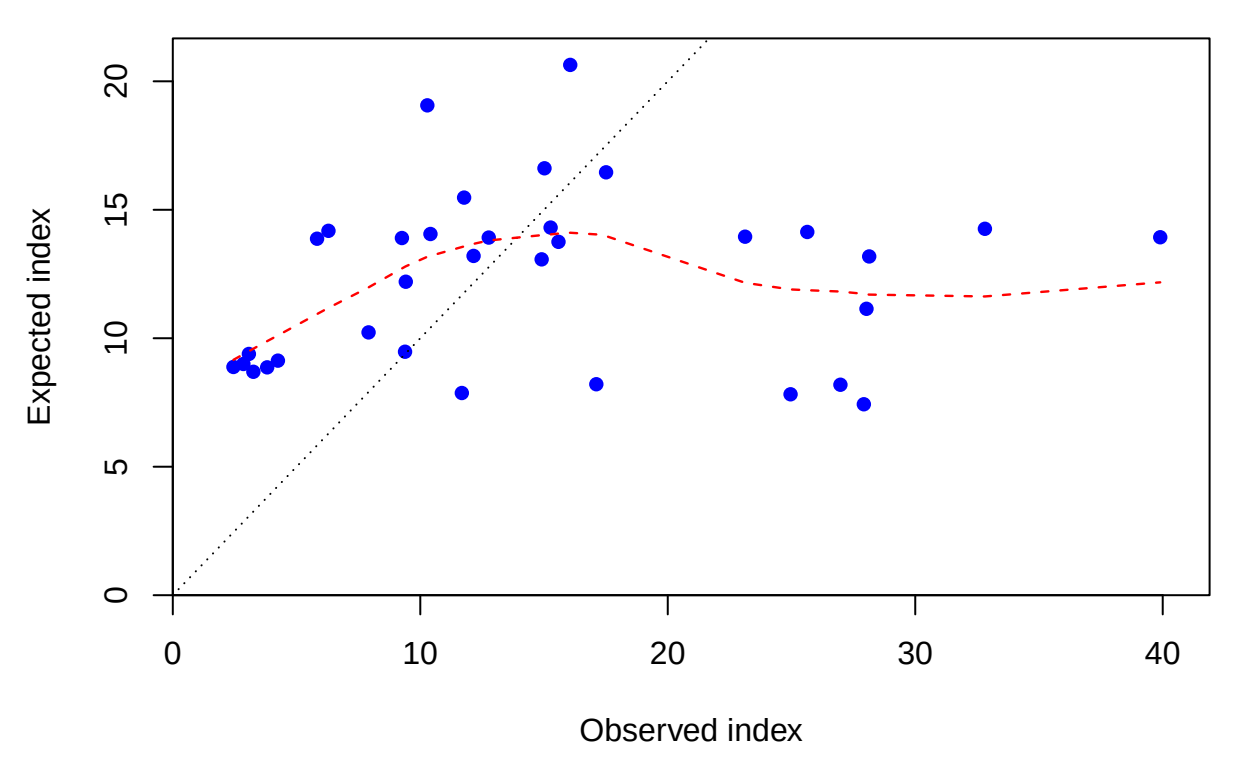

1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
1970
1980
1990
2000
2010
2020
Year

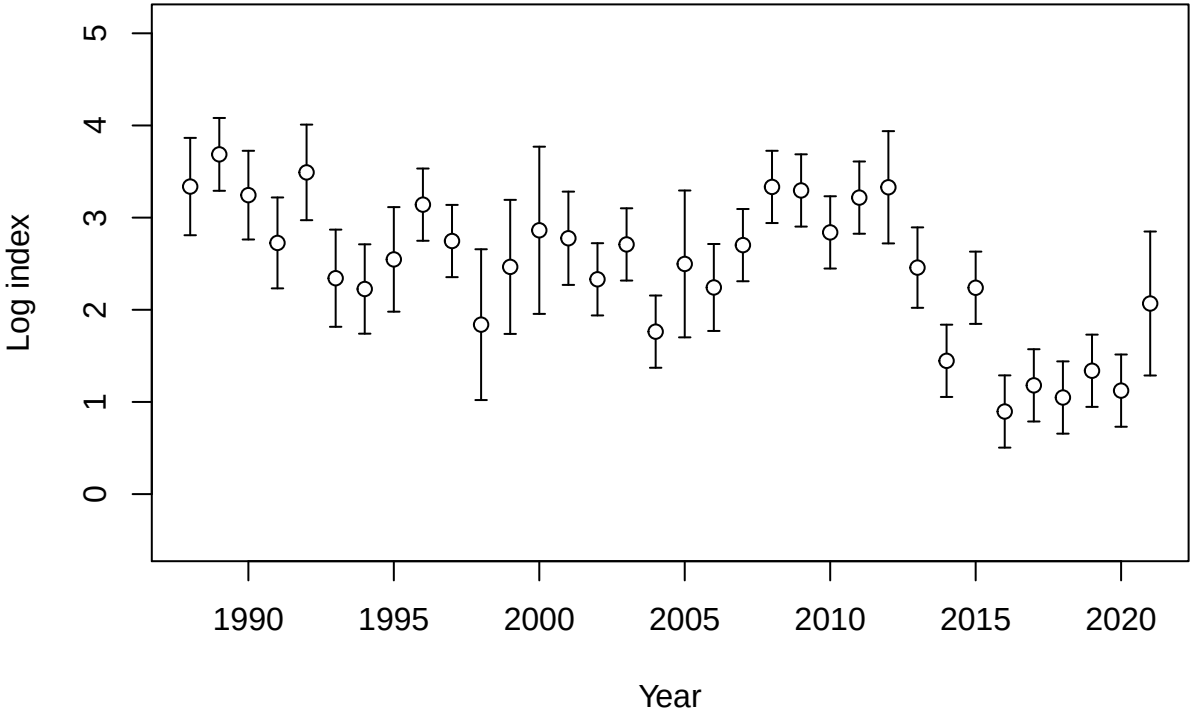

Fishing intensity: 1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
1970
1980
1990
2000
2010
2020
Year

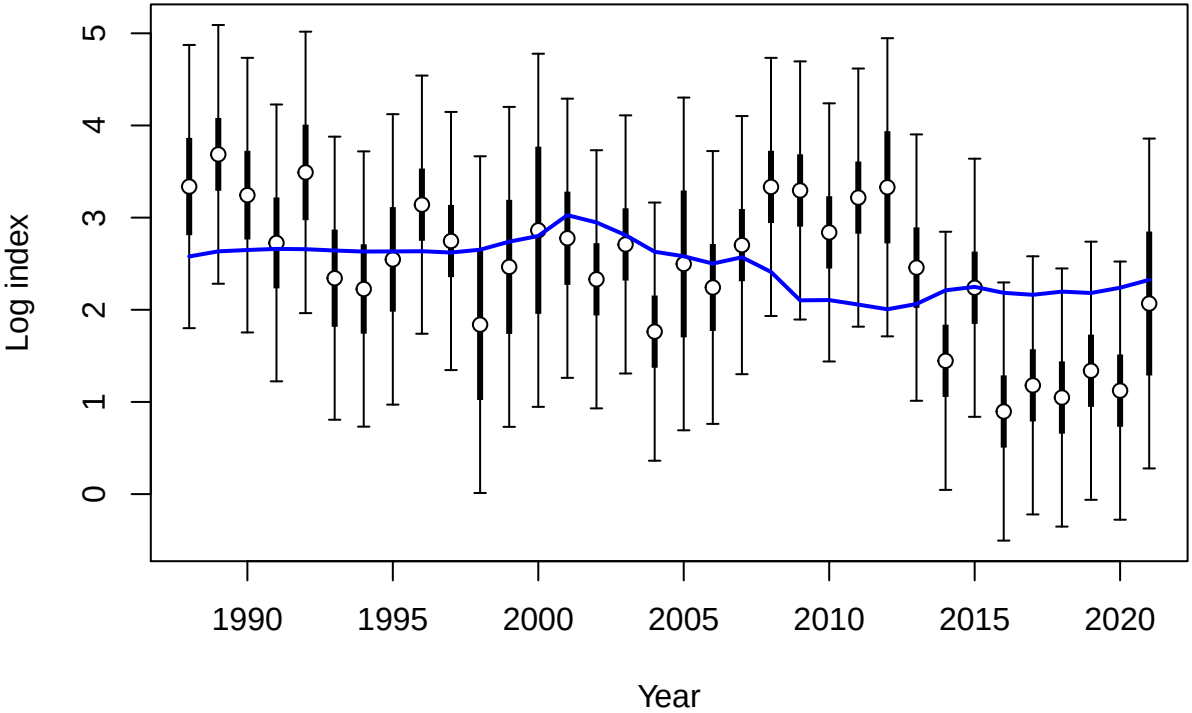

Fishing intensity: 1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
Relative spawning output: B/B_MSY
0.0
0.2
0.4
0.6
0.8
1.0
1967
1970

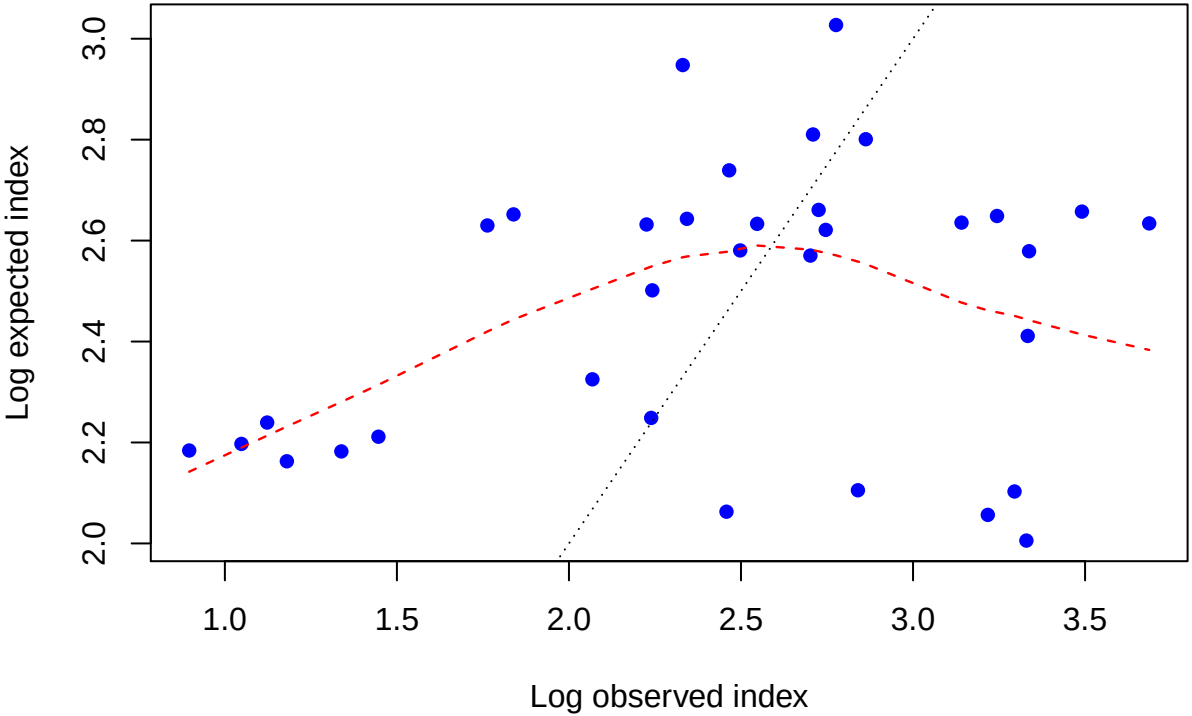

Index
0
50
100
150
1990
1995
2000
2005
2010
2015
2020
Year

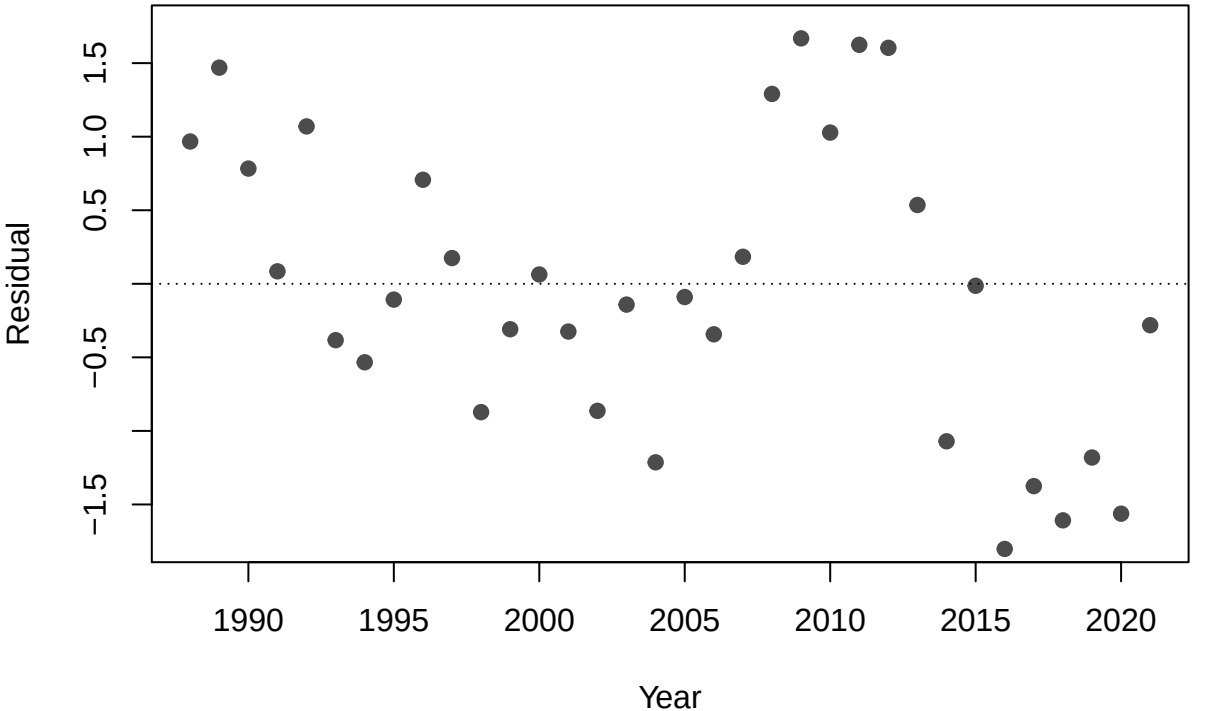

Index
0
50
100
150
1990
1995
2000
2005
2010
2015
2020
Year

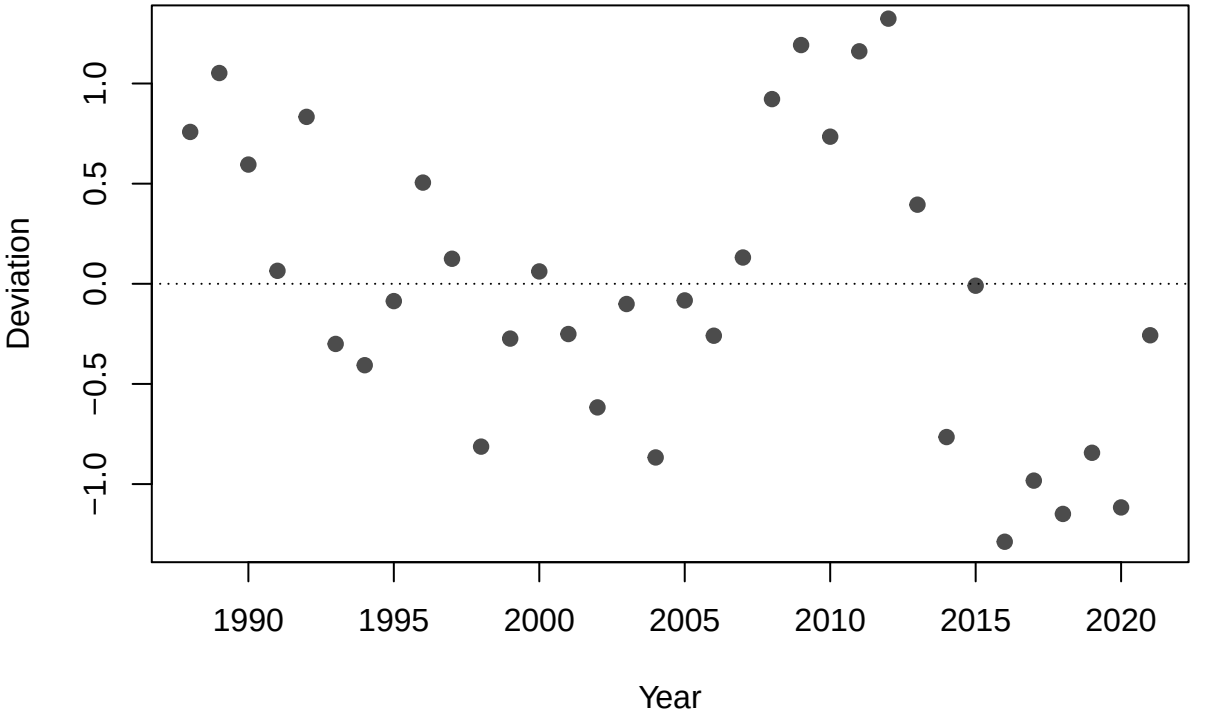

Expected index
Observed index
0
5
10
15
20
0
10
20
30
40

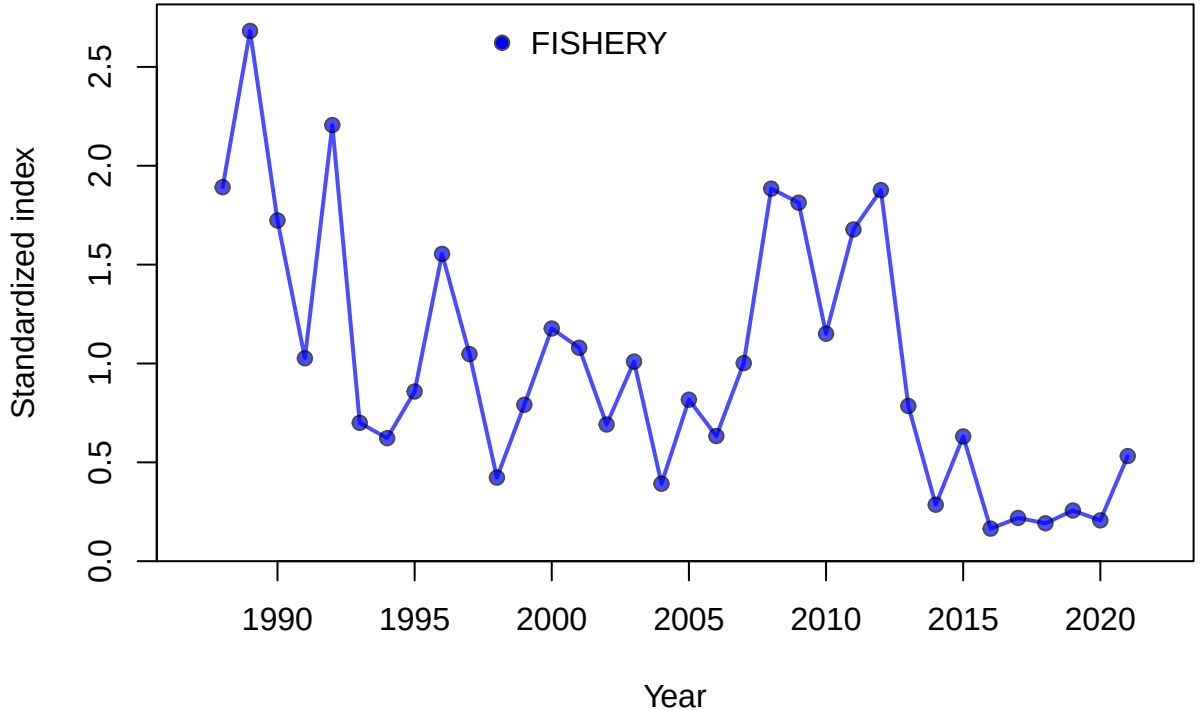

Log index
0
1
2
3
4
5
1990
1995
2000
2005
2010
2015
2020
Year

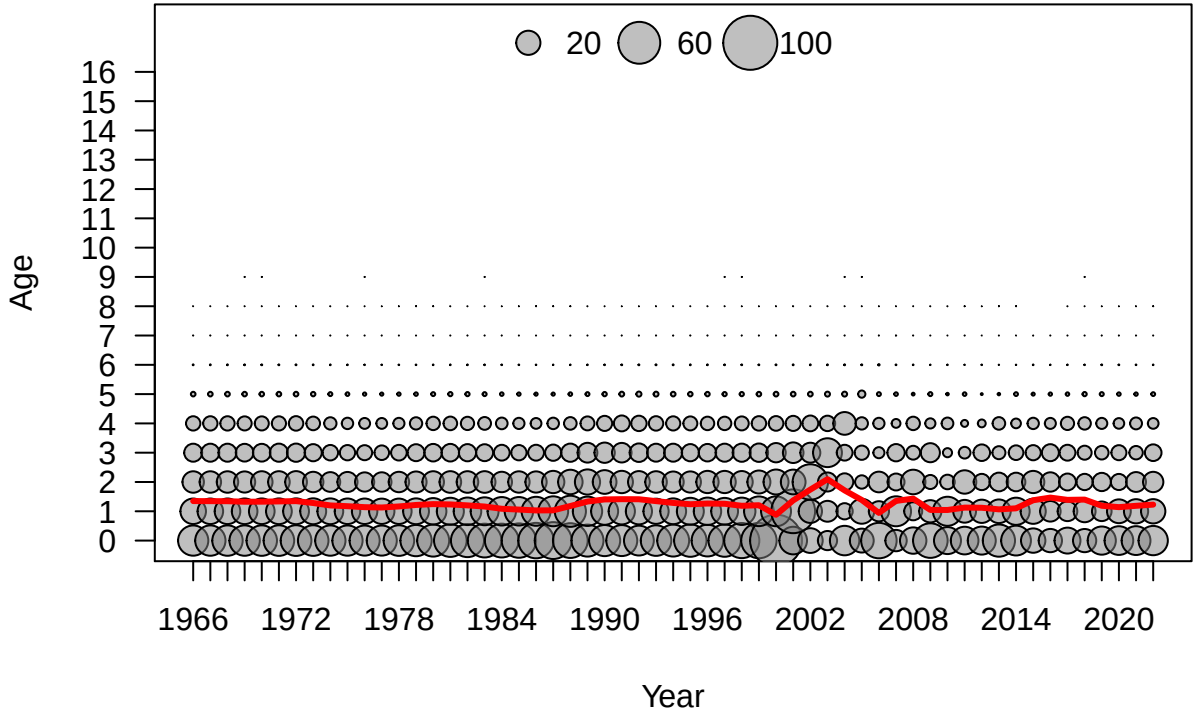

Log index
0
1
2
3
4
5
1990
1995
2000
2005
2010
2015
2020
Year

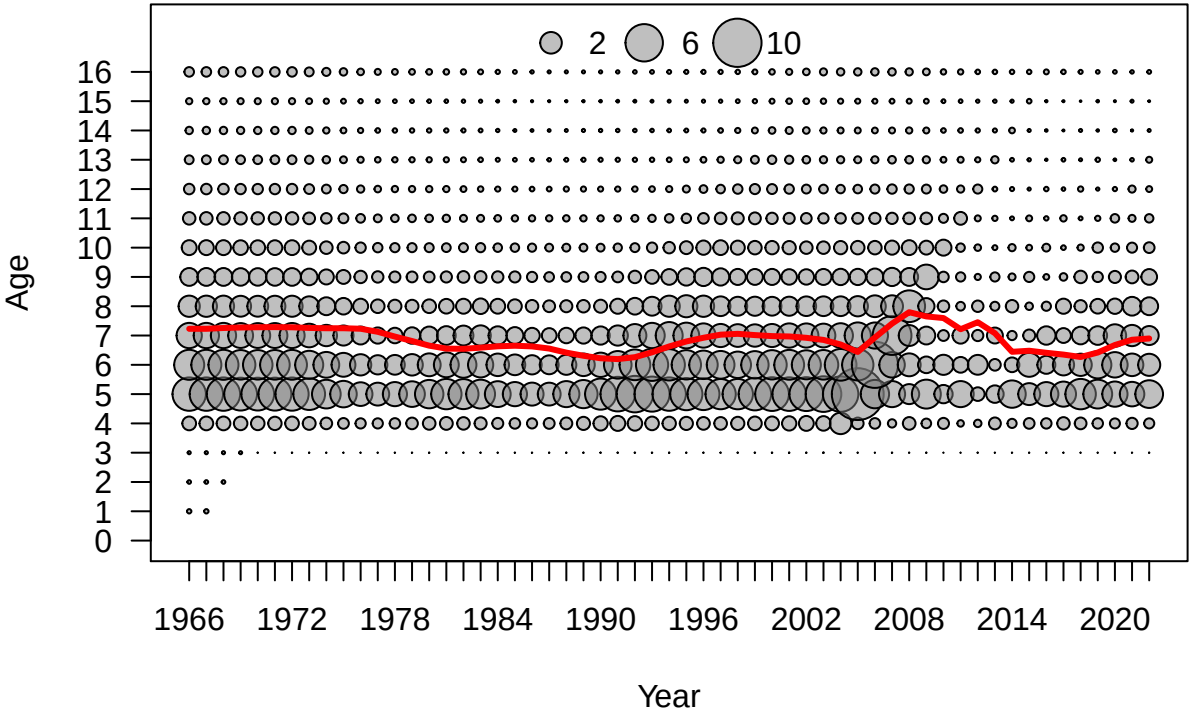

Log expected index
2.0
2.2
2.4
2.6
2.8
3.0
1.0
1.5
2.0
2.5
3.0
3.5
Log observed index

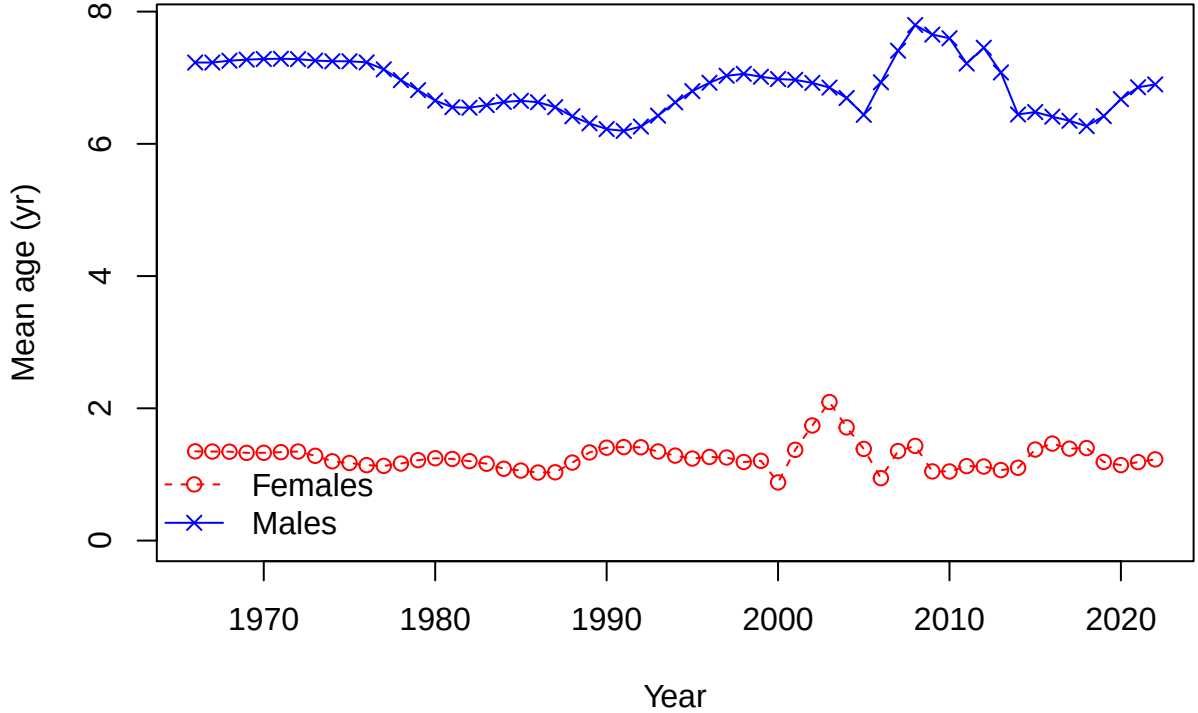

Residual
1.5
1.0
0.5
−0.5
−1.5
1990
1995
2000
2005
2010
2015
2020
Year

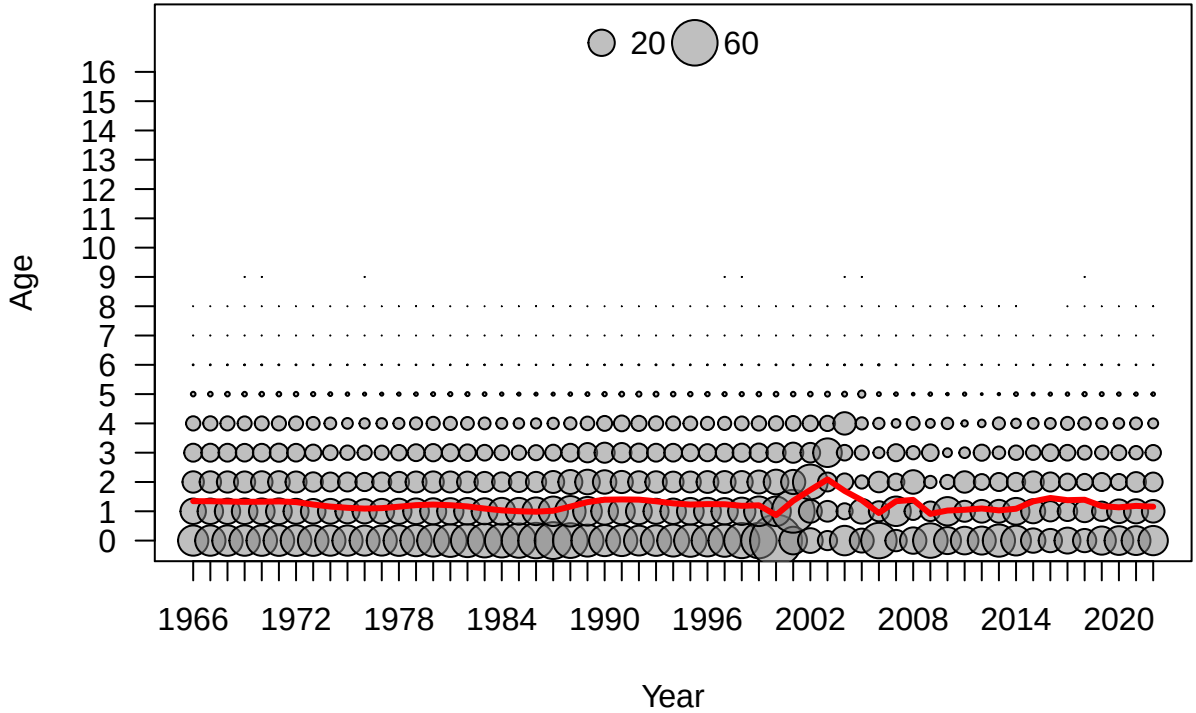

Deviation
1.0
0.5
0.0
−0.5
−1.0
1990
1995
2000
2005
2010
2015
2020
Year

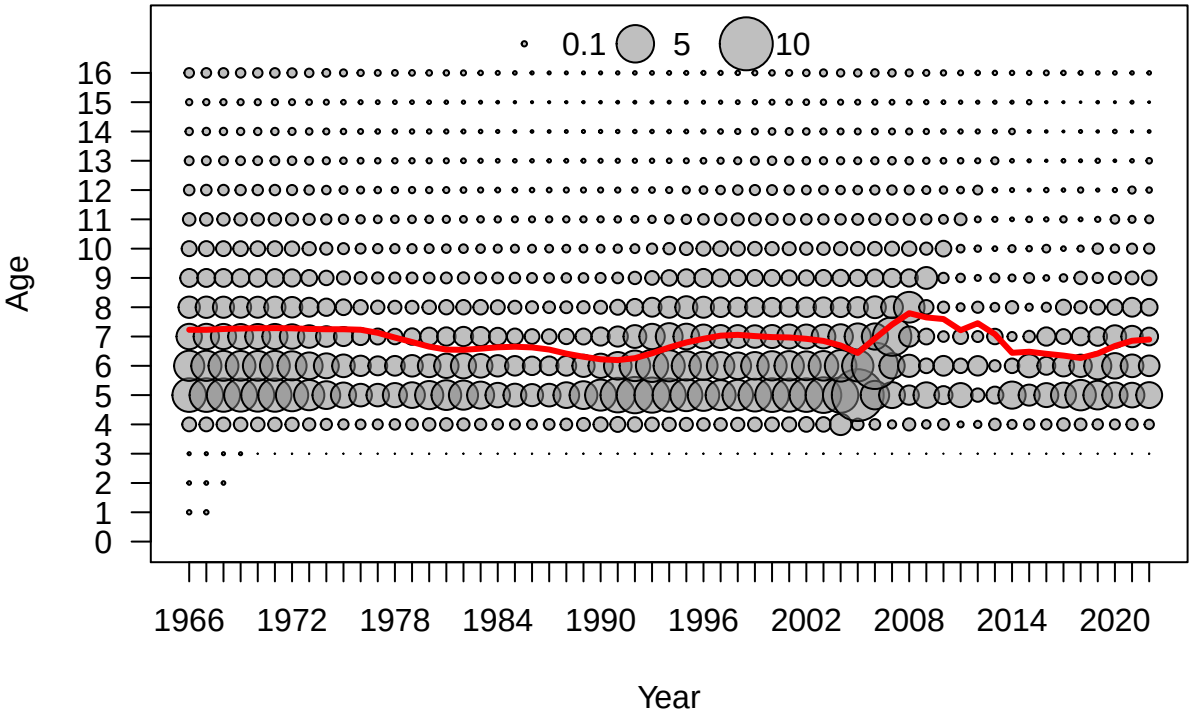

FISHERY
Standardized index
0.0
0.5
1.0
1.5
2.0
2.5
1990
1995
2000
2005
2010
2015
2020
Year

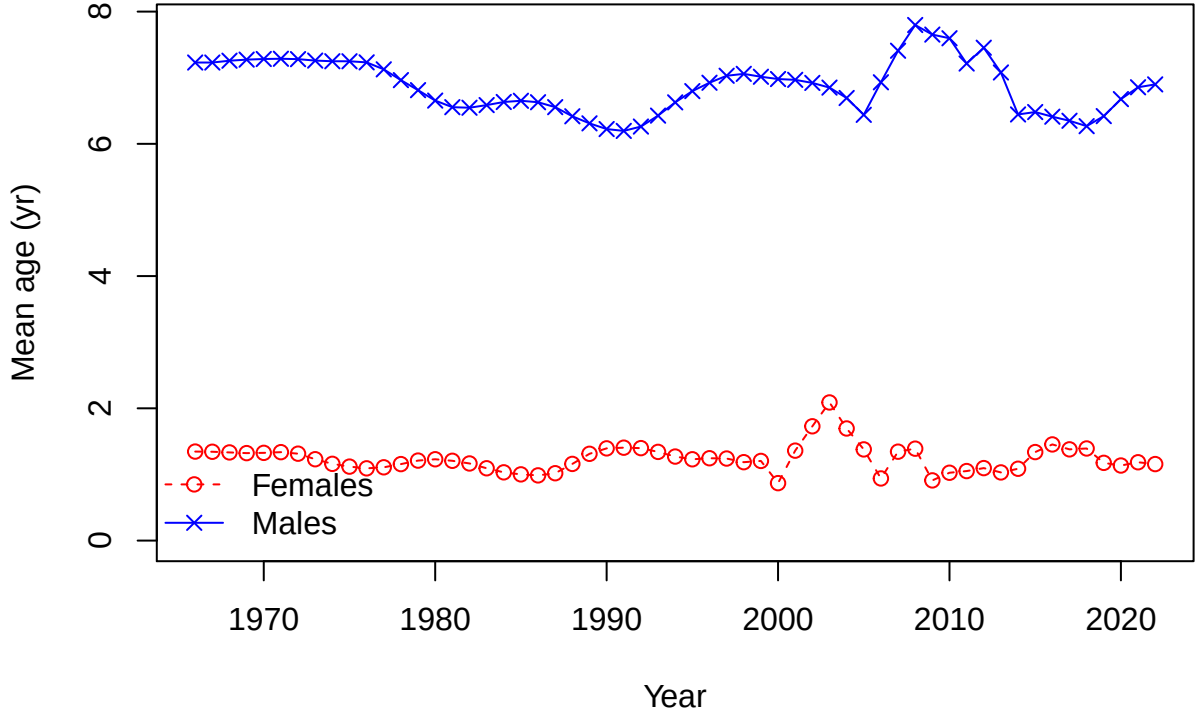

20
60
100
Age
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
1966
1972
1978
1984
1990
1996
2002
2008
2014
2020
Year

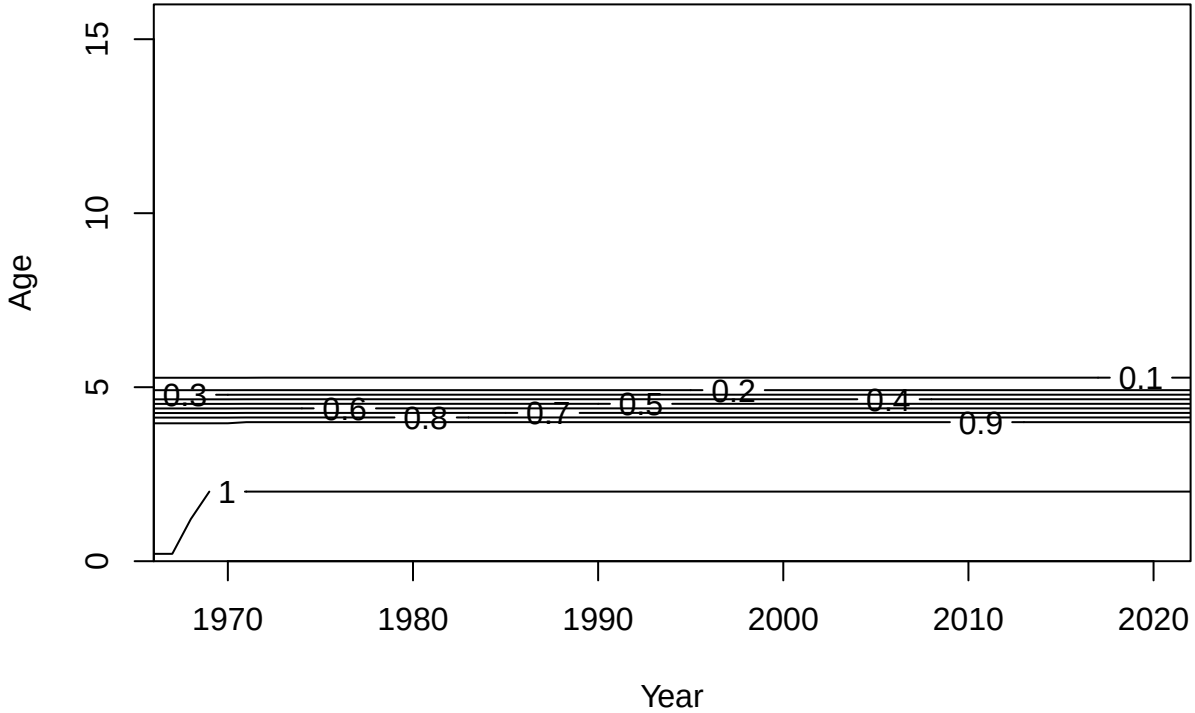

2
6
10
Age
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
1966
1972
1978
1984
1990
1996
2002
2008
2014
2020
Year

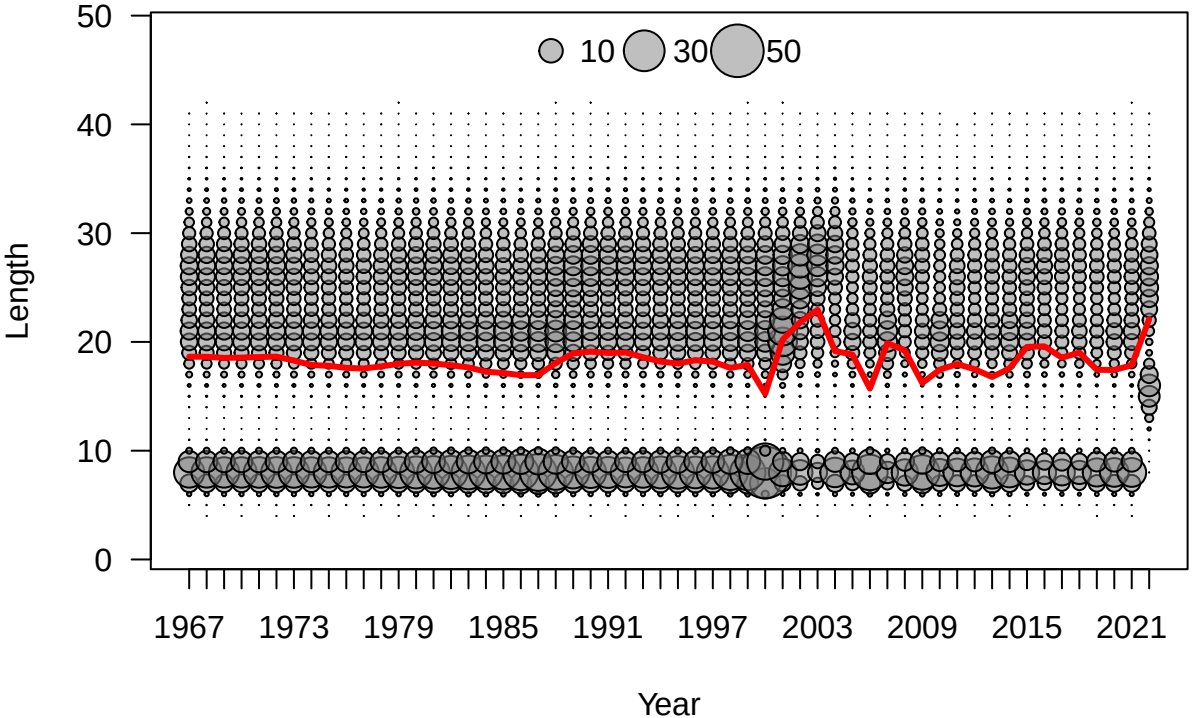

Mean age (yr)
0
2
4
6
8
1970
1980
1990
2000
2010
2020
Year
Females
Males

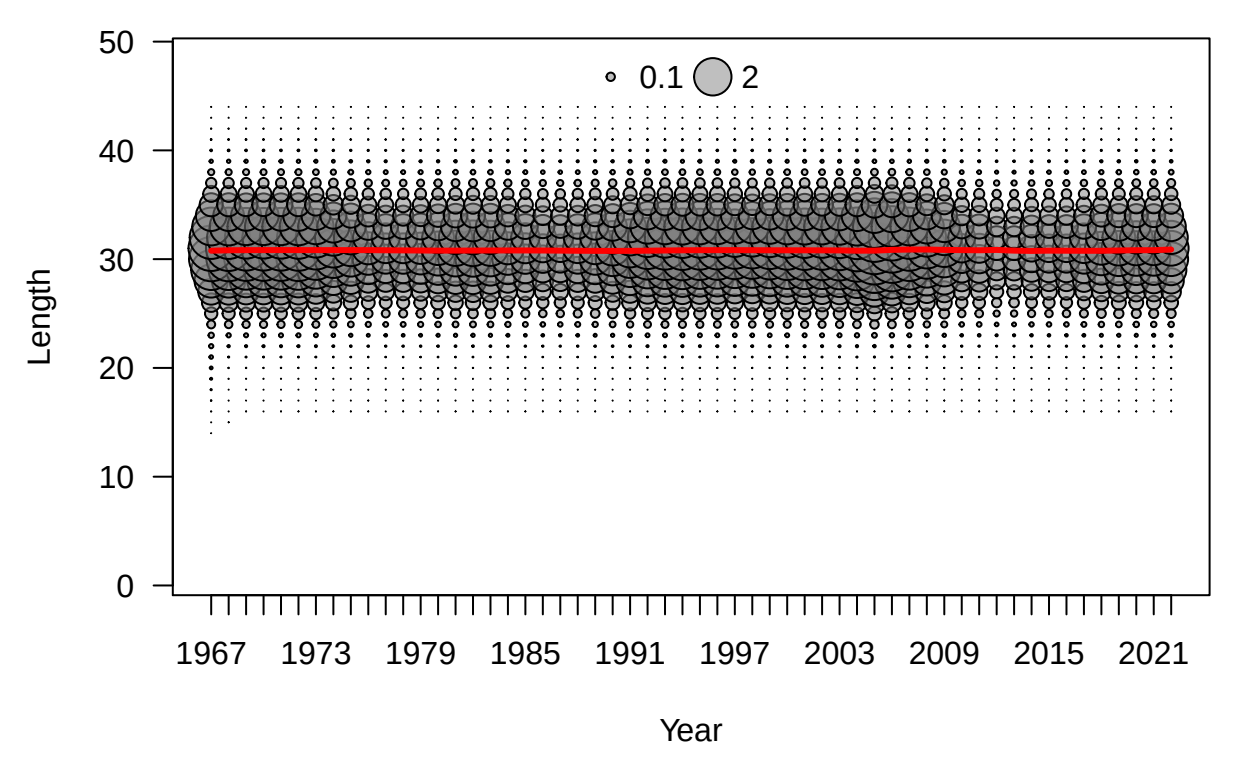

20
60
Age
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
1966
1972
1978
1984
1990
1996
2002
2008
2014
2020
Year

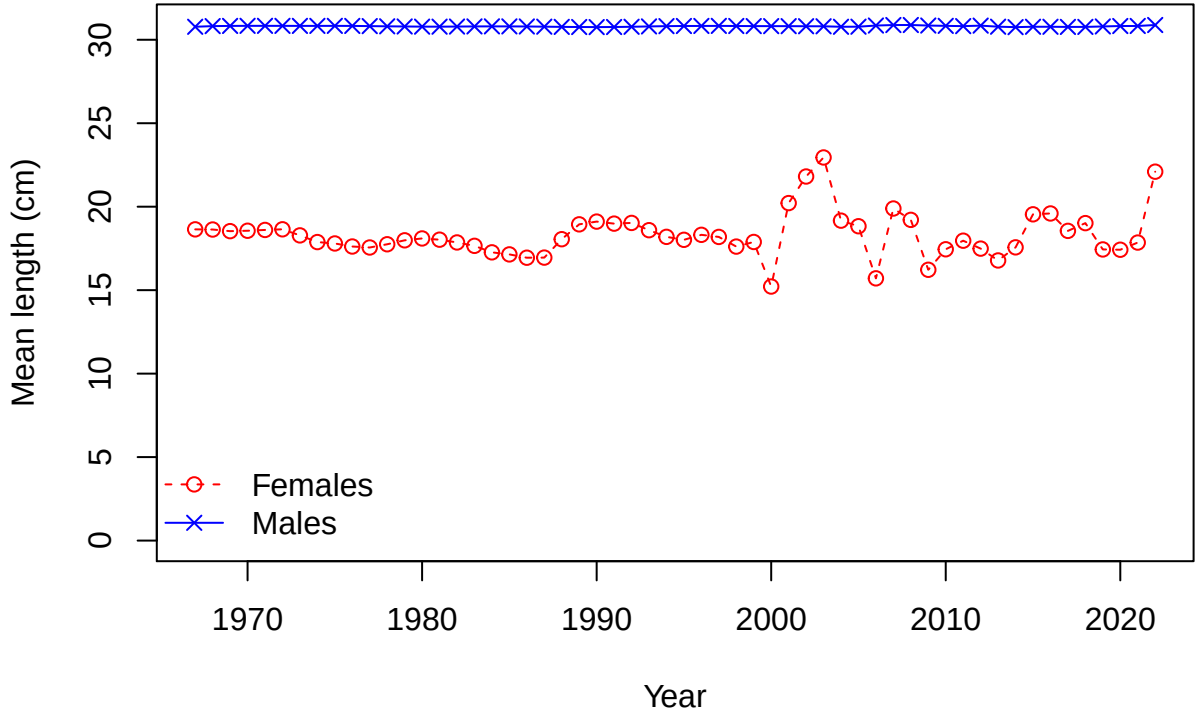

0.1
5
10
Age
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
1966
1972
1978
1984
1990
1996
2002
2008
2014
2020
Year

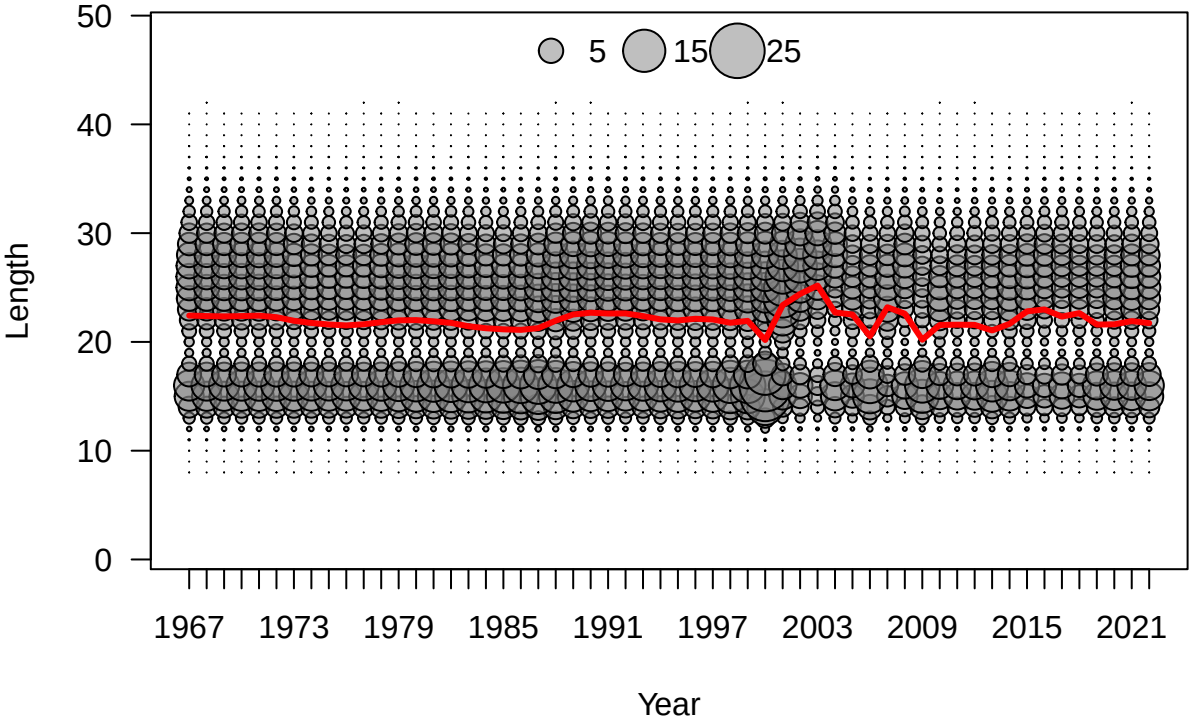

Mean age (yr)
0
2
4
6
8
1970
1980
1990
2000
2010
2020
Year
Females
Males

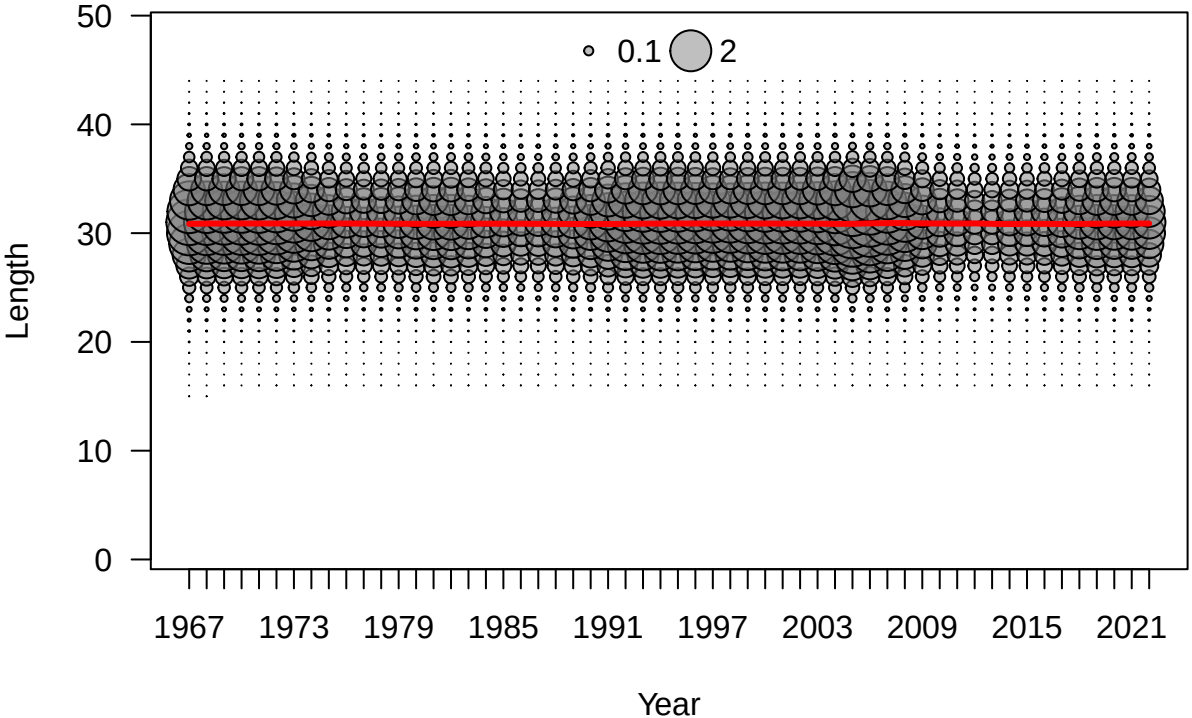

Age
0
5
10
15
1970
1980
1990
2000
2010
2020
Year
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

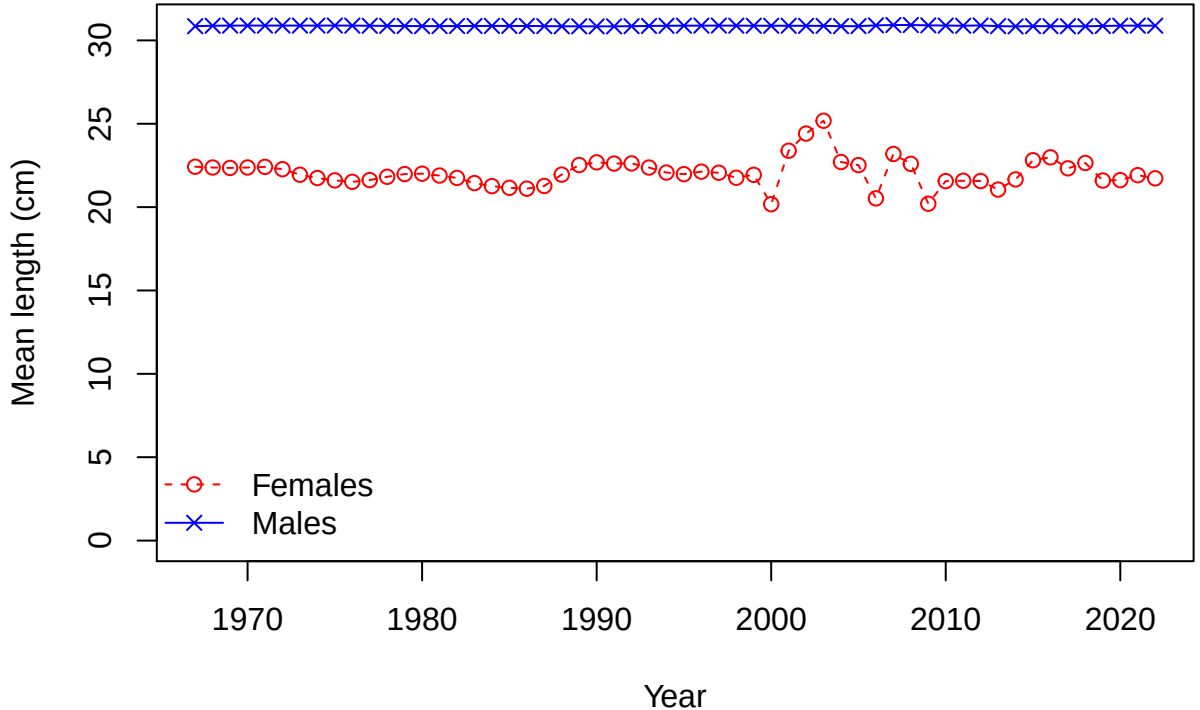

10
30
50
Length
0
10
20
30
40
50
1967
1973
1979
1985
1991
1997
2003
2009
2015
2021
Year

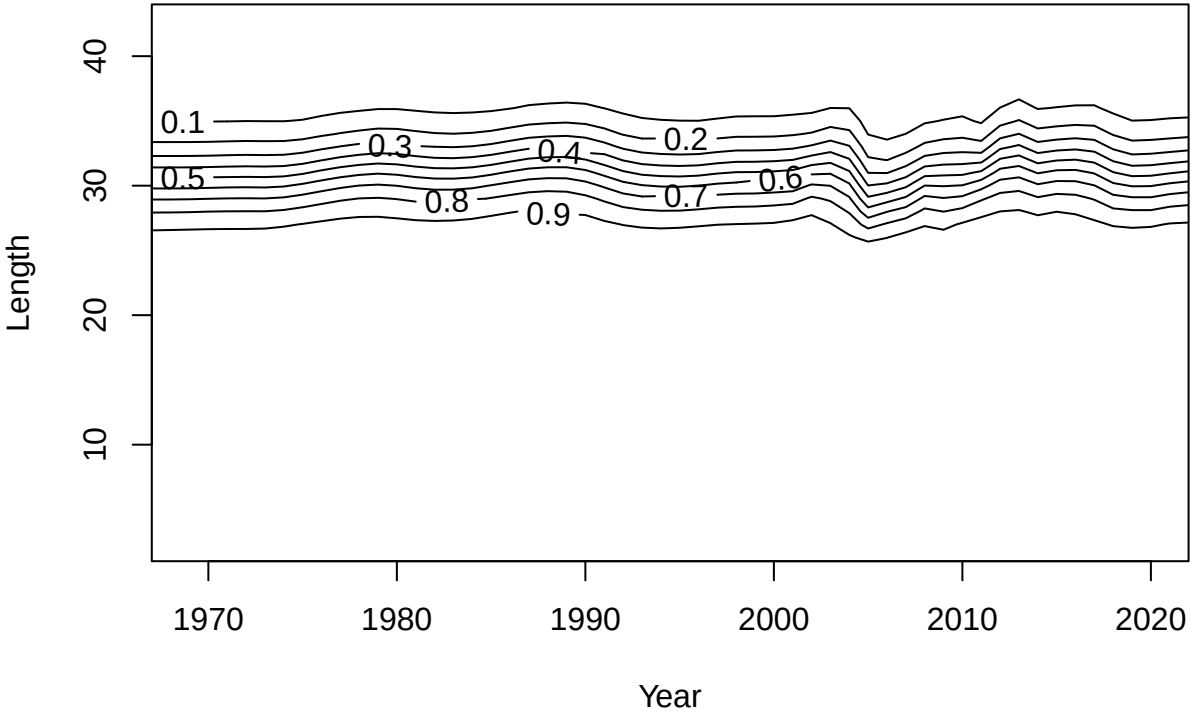

0.1
2
Length
Year
0
10
20
30
40
50
1967
1973
1979
1985
1991
1997
2003
2009
2015
2021

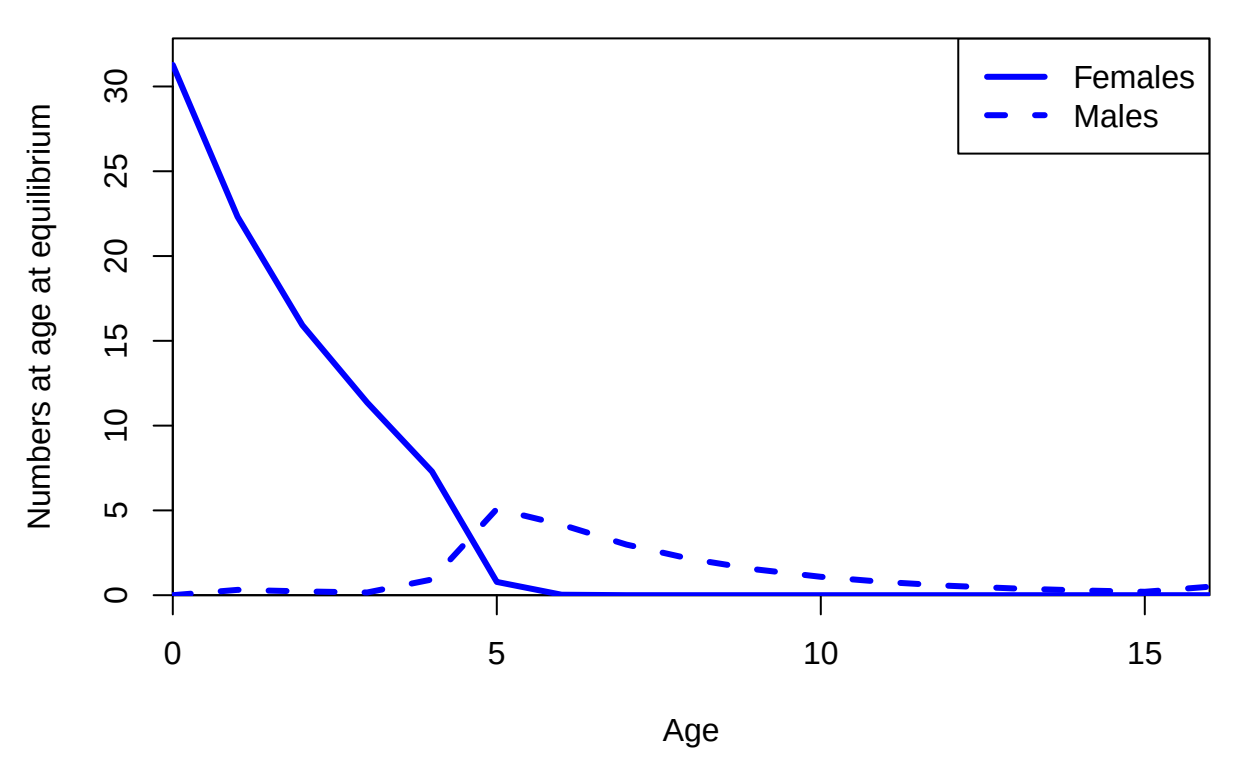

Mean length (cm)
0
5
10
15
20
25
30
1970
1980
1990
2000
2010
2020
Year
Females
Males

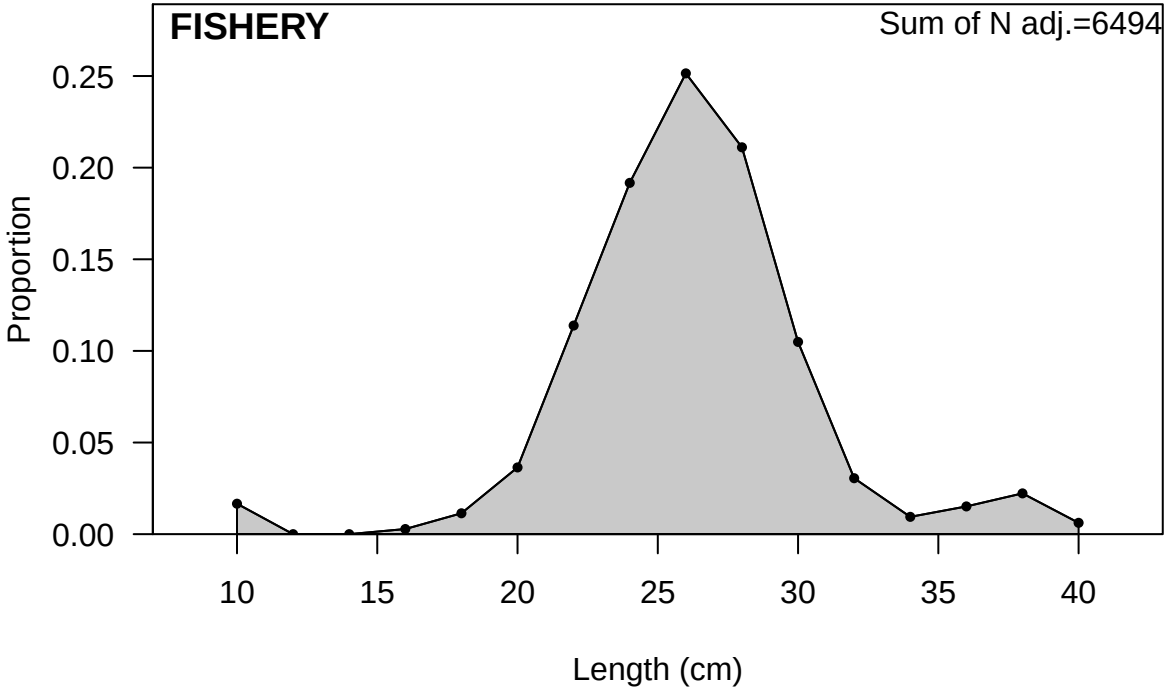

5
15
25
50
40
30
20
10
0
Length
1967
1973
1979
1985
1991
1997
2003
2009
2015
2021
Year

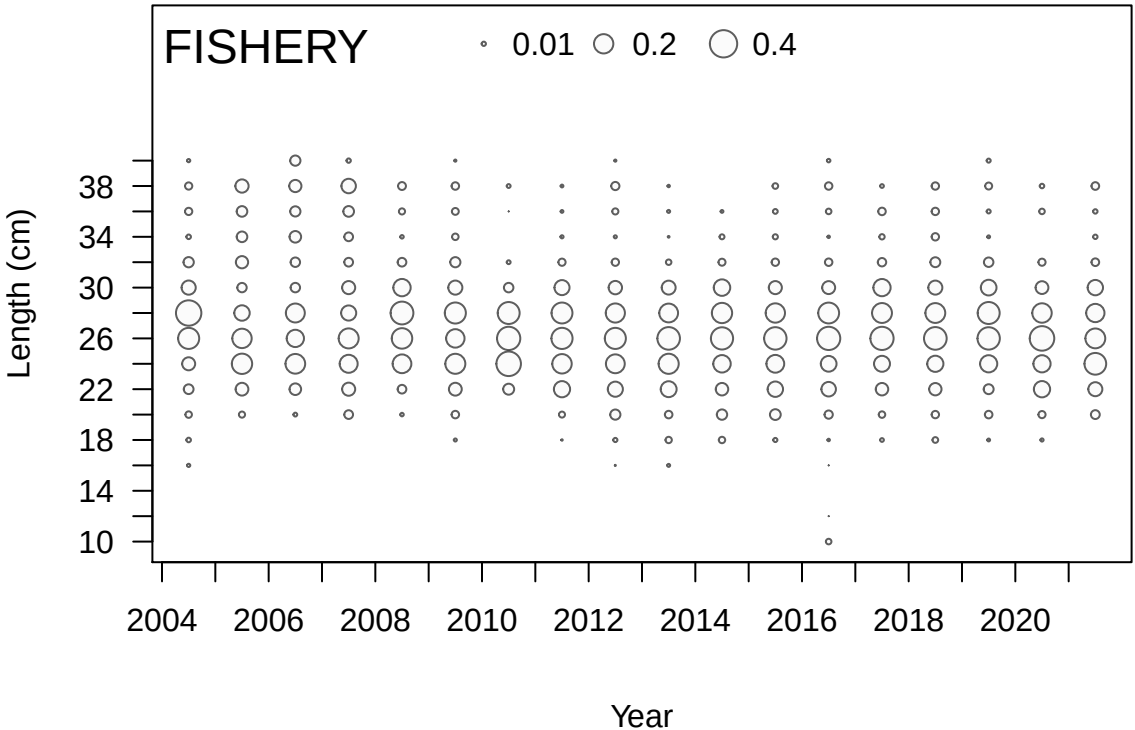

0.1
2
50
40
30
20
10
0
Length
1967
1973
1979
1985
1991
1997
2003
2009
2015
2021
Year

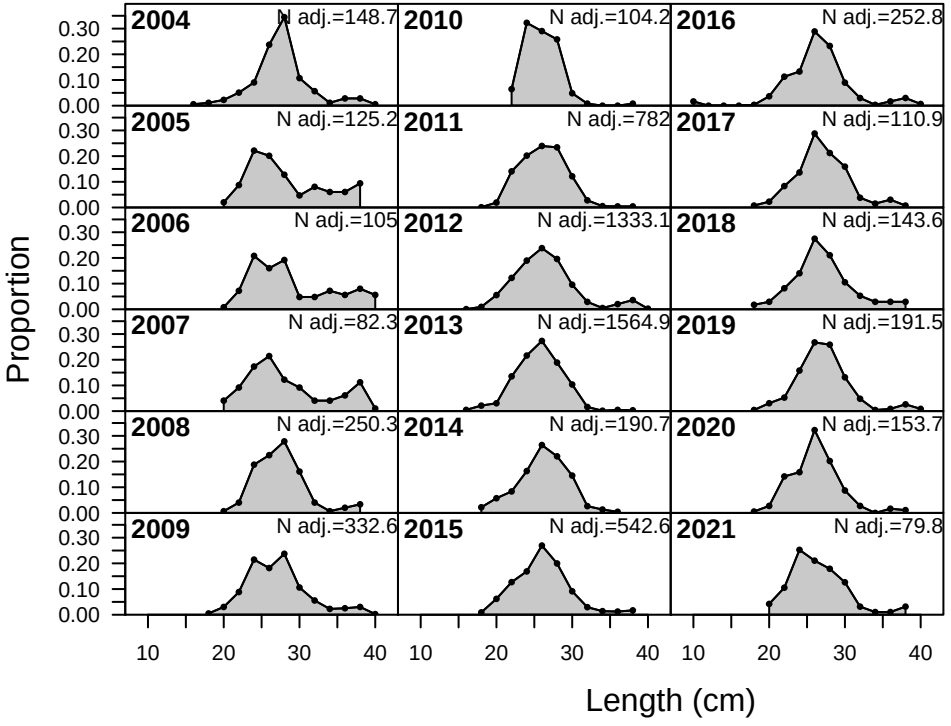

Mean length (cm)
0
5
10
15
20
25
30
1970
1980
1990
2000
2010
2020
Year
Females
Males

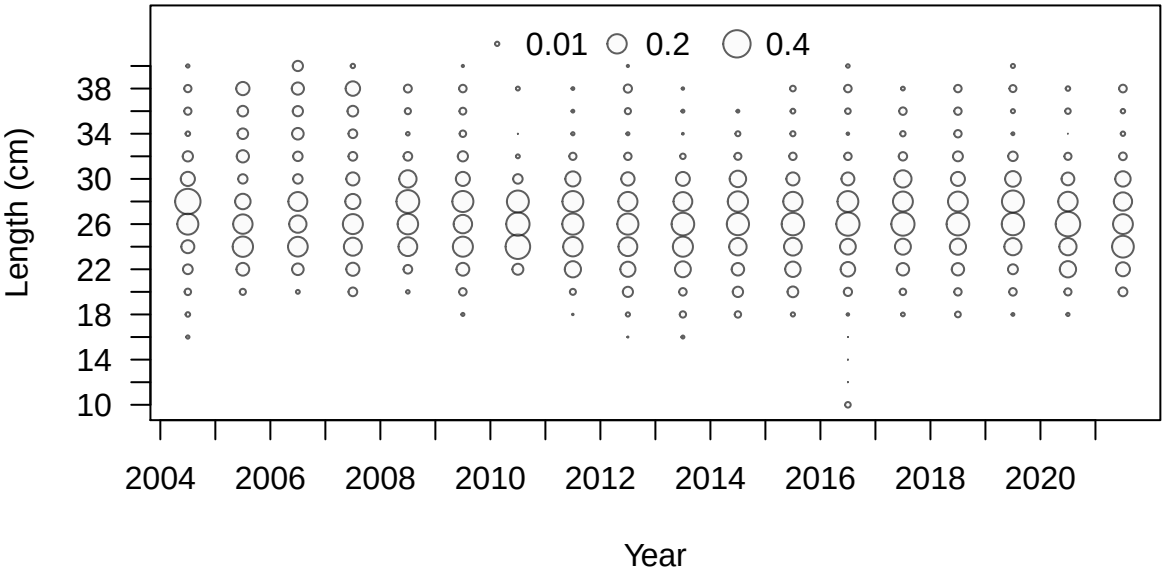

0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
Length
10
20
30
40
1970
1980
1990
2000
2010
2020
Year

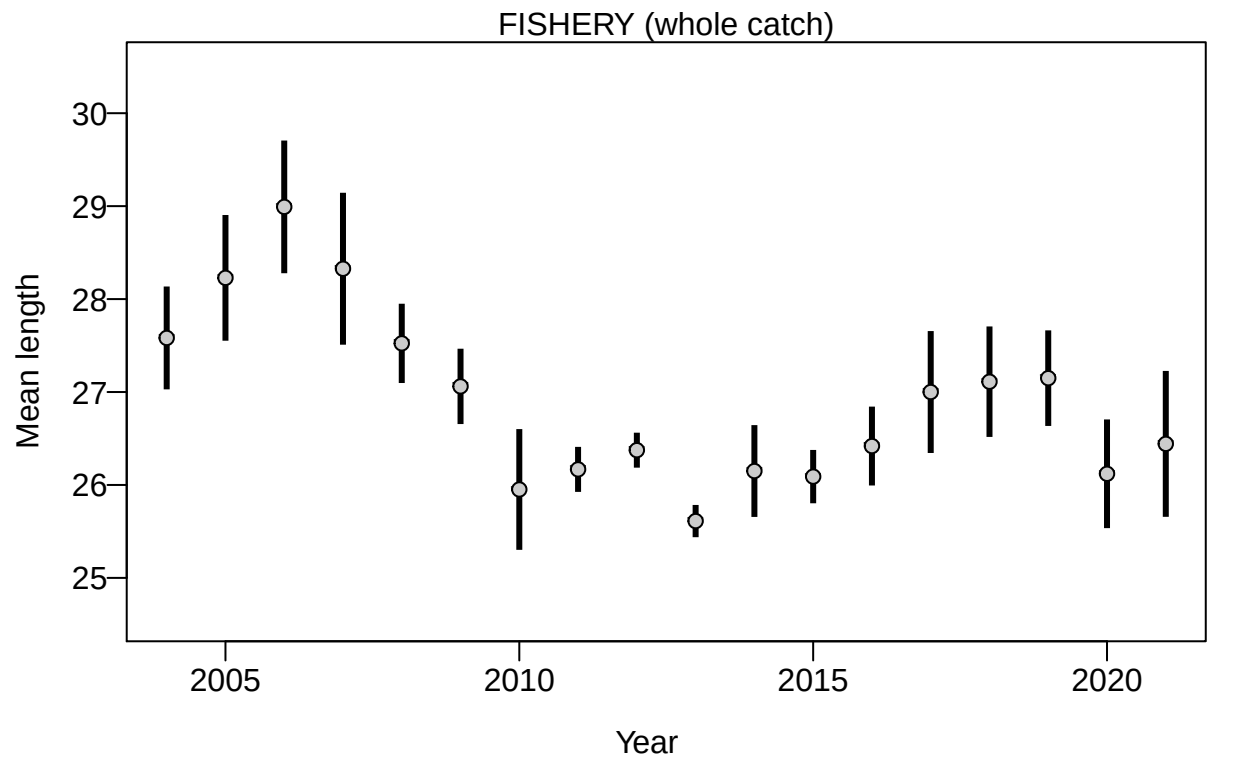

Numbers at age at equilibrium
0
5
10
15
20
25
30
0
5
10
15
Age
Females
Males

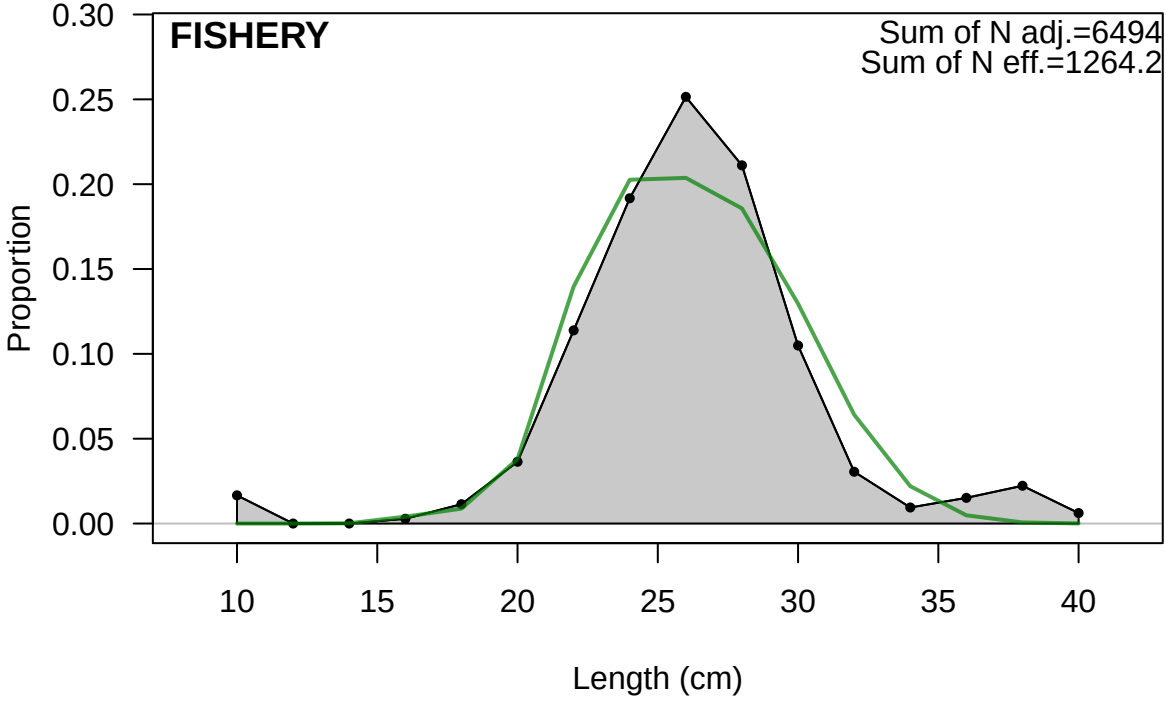

FISHERY
Sum of N adj.=6494
Proportion
0.25
0.20
0.15
0.10
0.05
0.00
10
15
20
25
30
35
40
Length (cm)

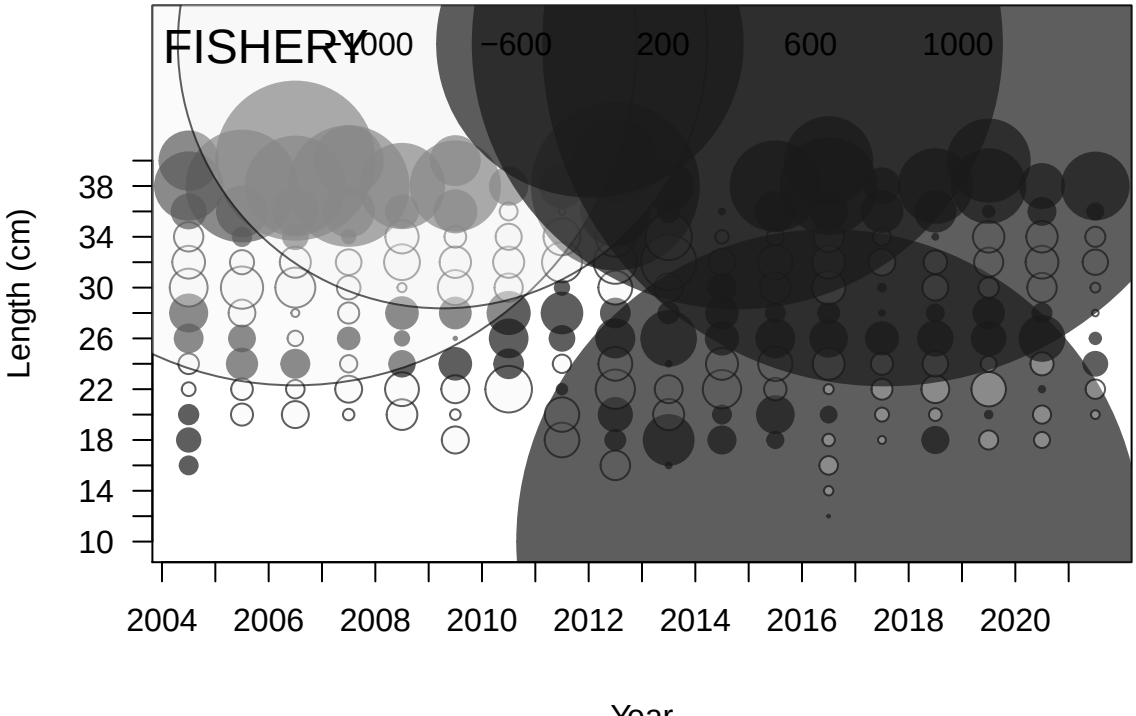

FISHERY
0.01
0.2
0.4
Length (cm)
38
34
30
26
22
18
14
10
2004
2006
2008
2010
2012
2014
2016
2018
2020
Year

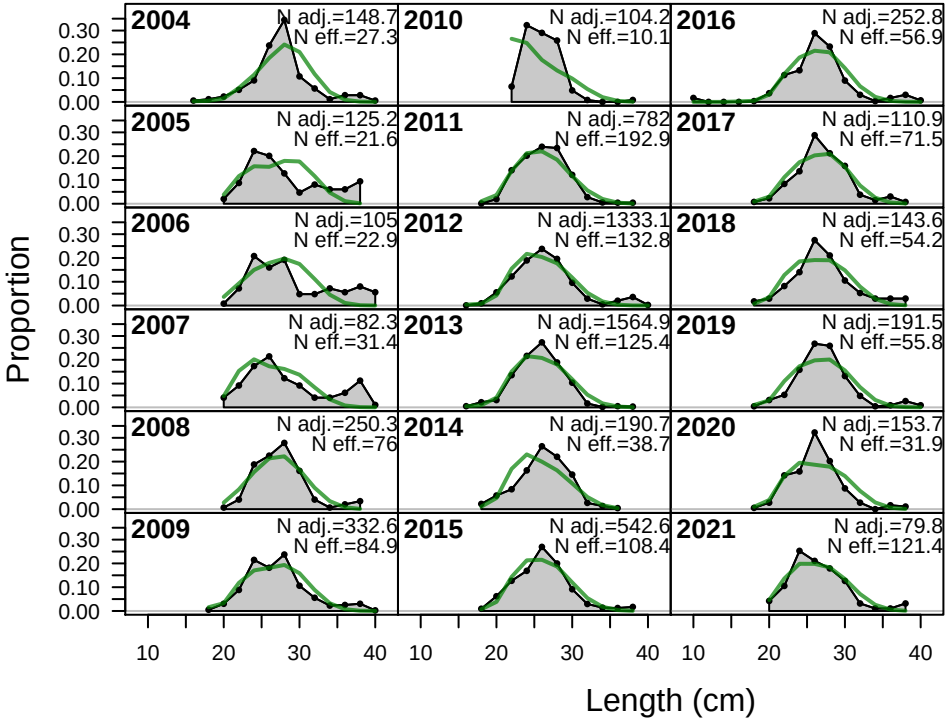

2004
N adj.=148.7
2010
N adj.=104.2
2016
N adj.=252.8
2005
N adj.=125.2
2011
N adj.=782
2017
N adj.=110.9
2006
N adj.=105
2012
N adj.=1333.1
2018
N adj.=143.6
2007
N adj.=82.3
2013
N adj.=1564.9
2019
N adj.=191.5
2008
N adj.=250.3
2014
N adj.=190.7
2020
N adj.=153.7
2009
N adj.=332.6
2015
N adj.=542.6
2021
N adj.=79.8
Proportion
0.00
0.10
0.20
0.30
10
20
30
40
Length (cm)

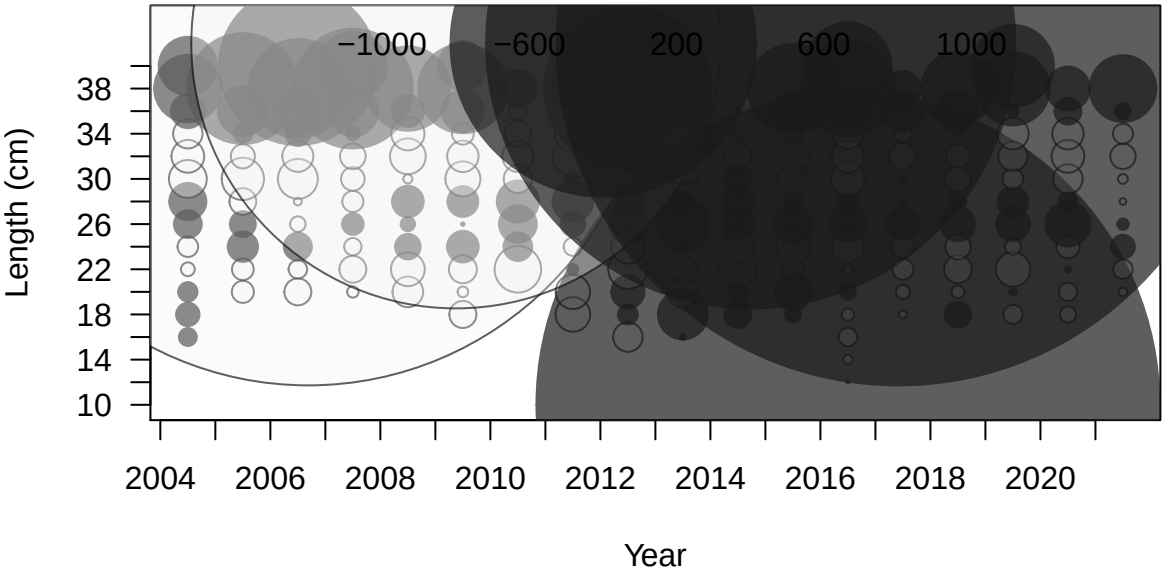

0.01
0.2
0.4
Length (cm)
38
34
30
26
22
18
14
10
2004
2006
2008
2010
2012
2014
2016
2018
2020
Year

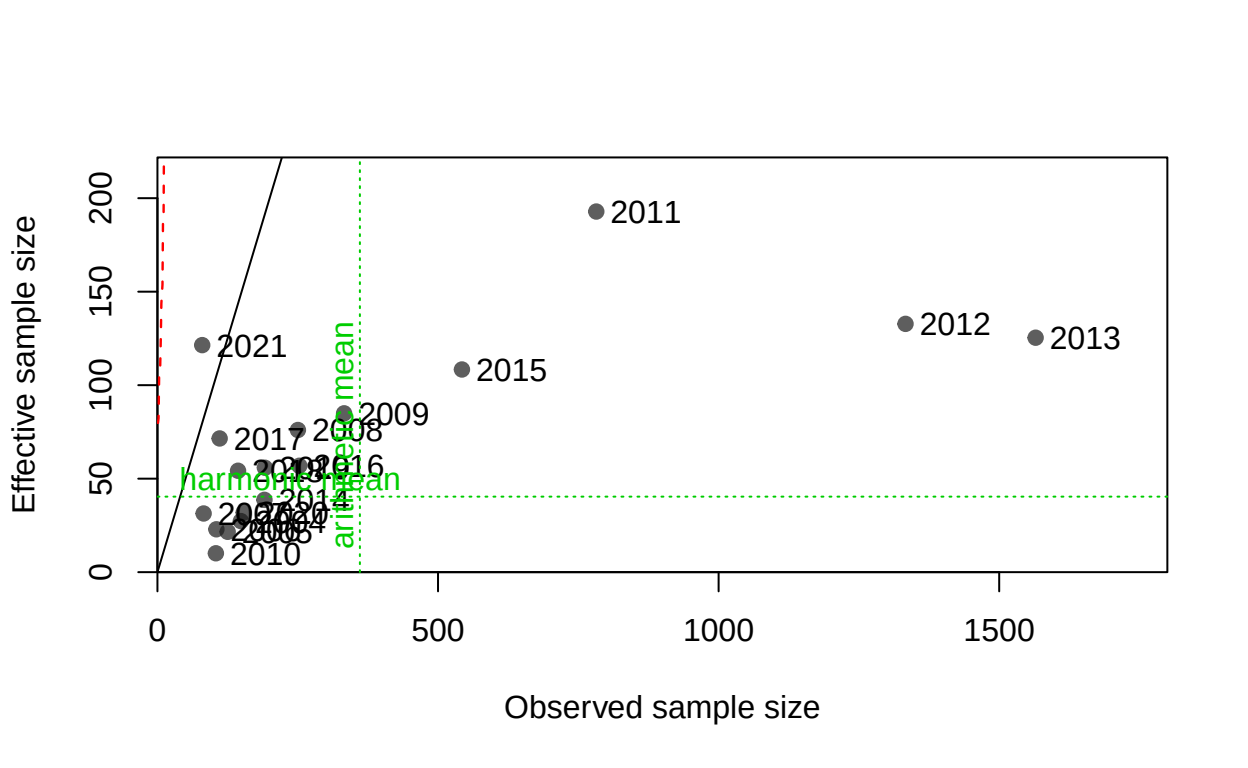

FISHERY (whole catch)
Mean length
30
29
28
27
26
25
2005
2010
2015
2020
Year

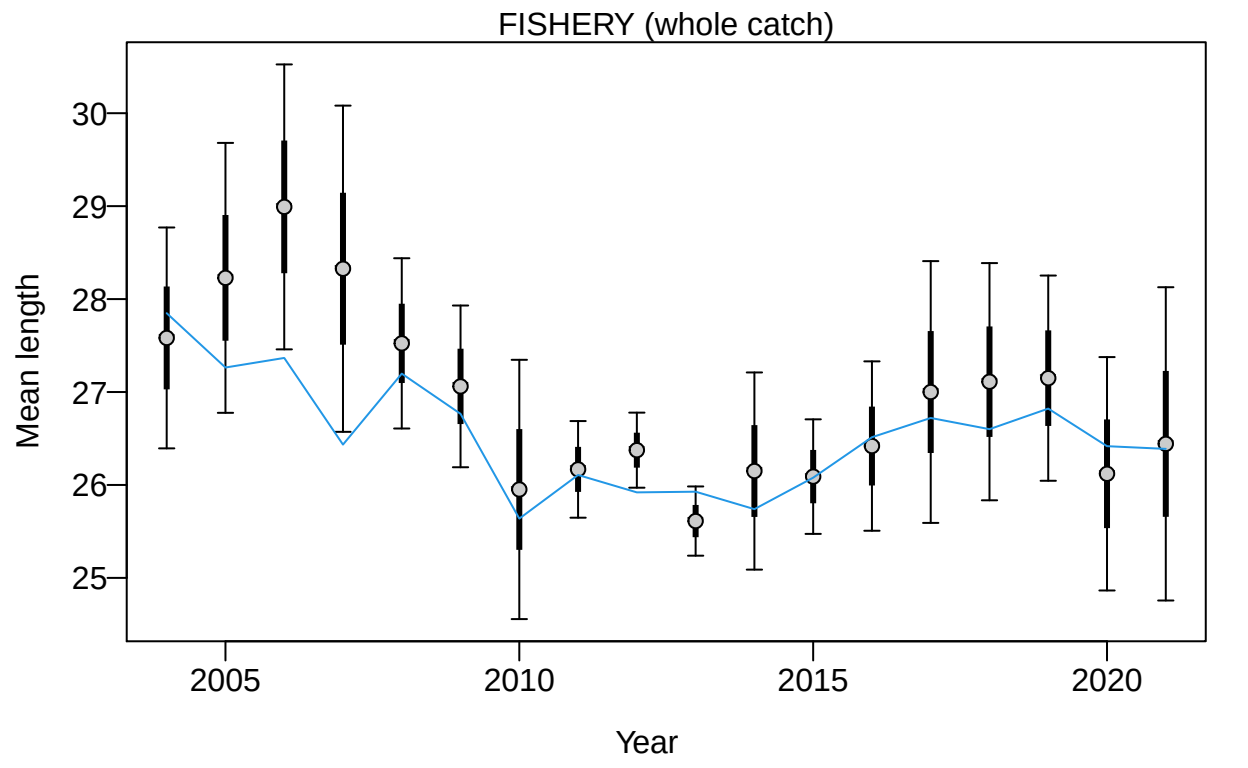

FISHERY
Sum of N adj.=6494
Sum of N eff.=1264.2
Proportion
0.30
0.25
0.20
0.15
0.10
0.05
0.00
10
15
20
25
30
35
40
Length (cm)

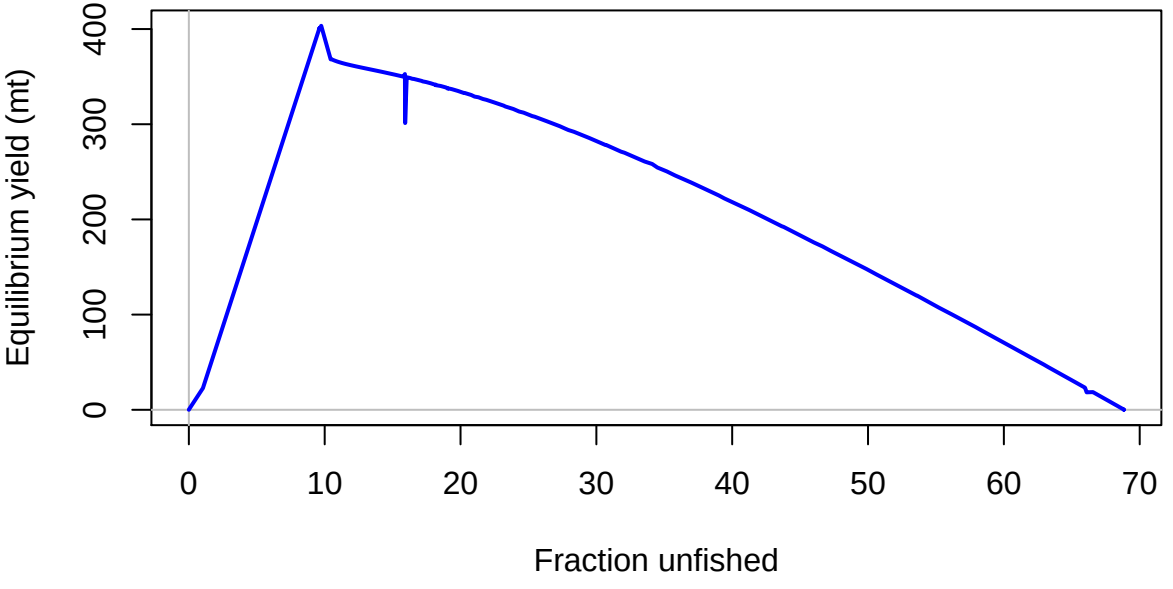

FISHERY
−1000
−600
200
600
1000
Length (cm)
38
34
30
26
22
18
14
10
2004
2006
2008
2010
2012
2014
2016
2018
2020
Year

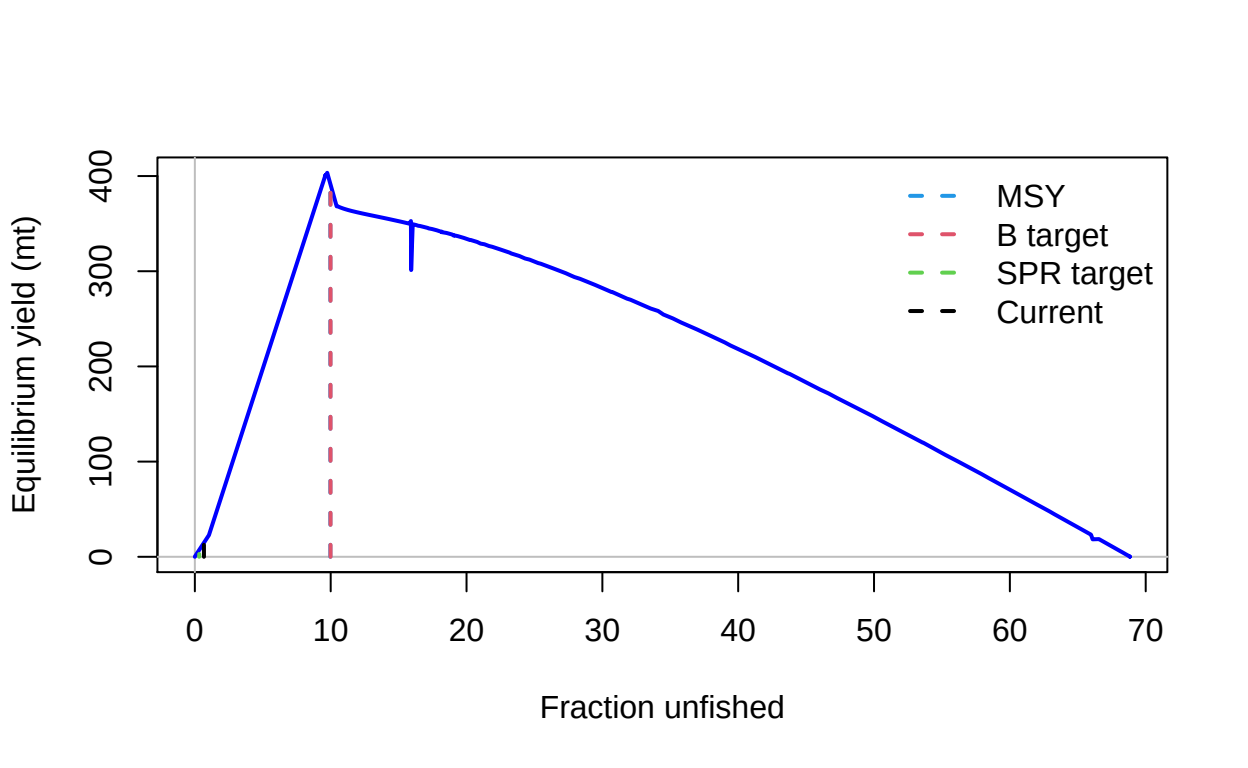

2004
N adj.=148.7
N eff.=27.3
2010
N adj.=104.2
N eff.=10.1
2016
N adj.=252.8
N eff.=56.9
2005
N adj.=125.2
N eff.=21.6
2011
N adj.=782
N eff.=192.9
2017
N adj.=110.9
N eff.=71.5
2006
N adj.=105
N eff.=22.9
2012
N adj.=1333.1
N eff.=132.8
2018
N adj.=143.6
N eff.=54.2
2007
N adj.=82.3
N eff.=31.4
2013
N adj.=1564.9
N eff.=125.4
2019
N adj.=191.5
N eff.=55.8
2008
N adj.=250.3
N eff.=76
2014
N adj.=190.7
N eff.=38.7
2020
N adj.=153.7
N eff.=31.9
2009
N adj.=332.6
N eff.=84.9
2015
N adj.=542.6
N eff.=108.4
2021
N adj.=79.8
N eff.=121.4
Proportion
0.00
0.10
0.20
0.30
10
20
30
40
Length (cm)

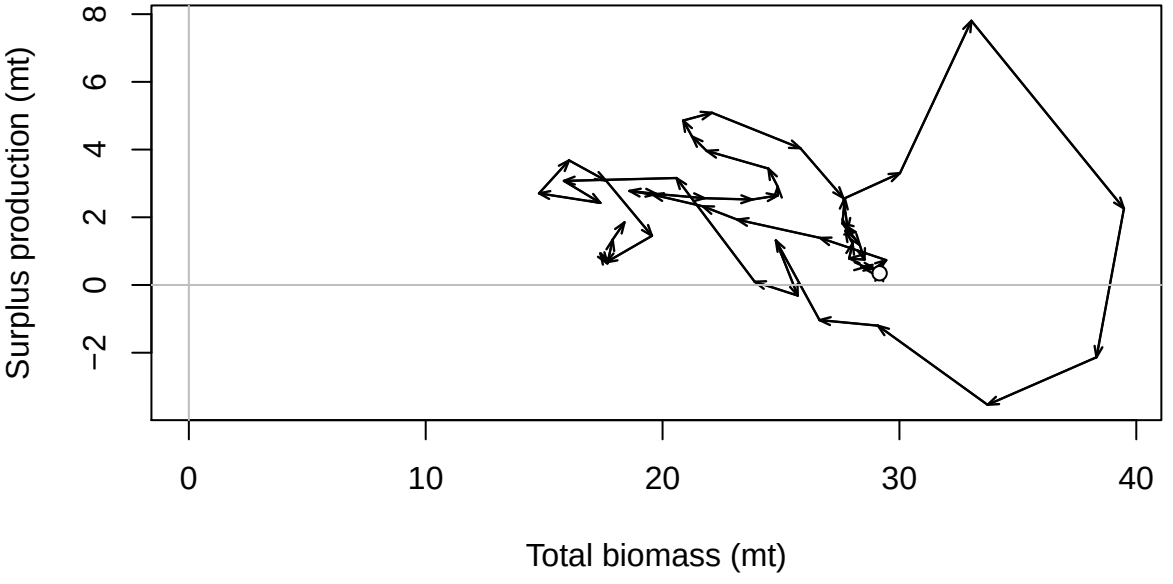

−1000
−600
200
600
1000
38
34
30
26
22
18
14
10
Length (cm)
2004
2006
2008
2010
2012
2014
2016
2018
2020
Year

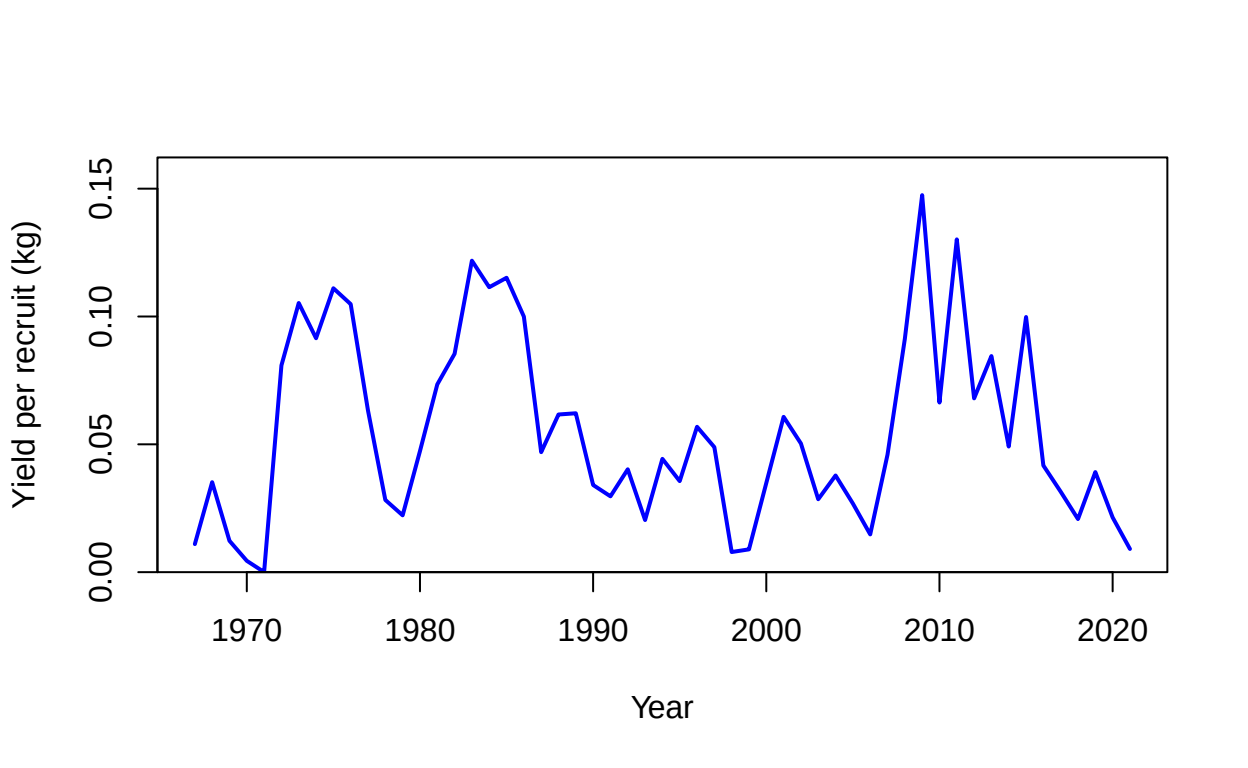

Effective sample size
Observed sample size
0
50
100
150
200
0
500
1000
1500
2011
2012
2013
2021
2015
2009
2017
2008
harmonic mean
arithmetic mean
2010

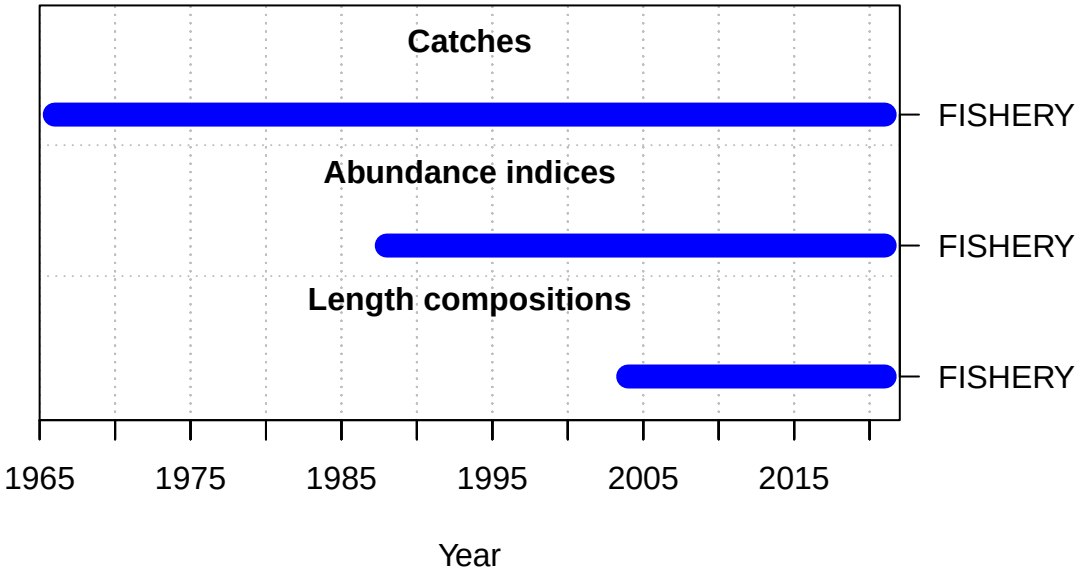

FISHERY (whole catch)
Mean length
30
29
28
27
26
25
2005
2010
2015
2020
Year

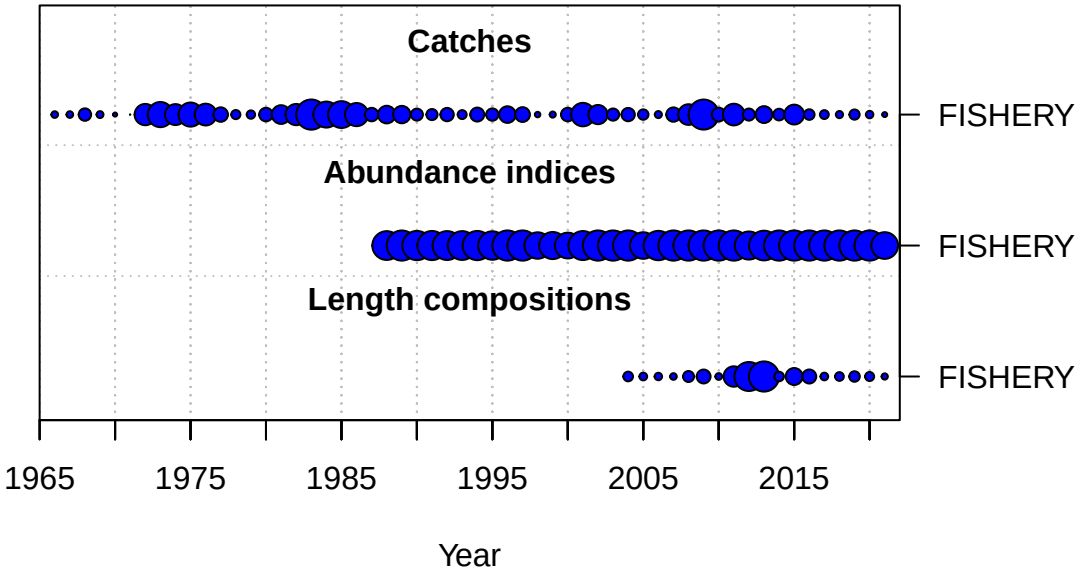

Equilibrium yield (mt)
0
100
200
300
400
0
10
20
30
40
50
60
70
Fraction unfished

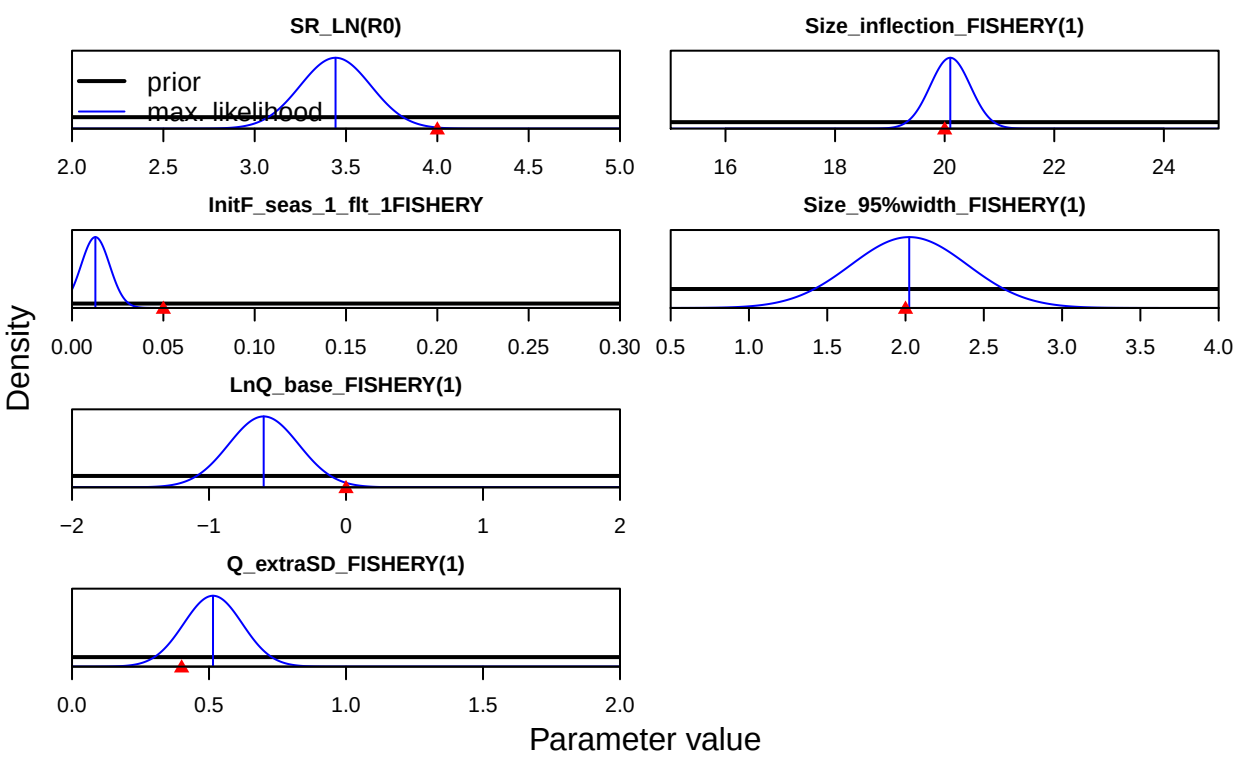

Equilibrium yield (mt)
0
100
200
300
400
0
10
20
30
40
50
60
70
Fraction unfished
MSY
B target
SPR target
Current


Surplus production (mt)
8
6
4
2
0
−2
0
10
20
30
40
Total biomass (mt)


Yield per recruit (kg)
0.00
0.05
0.10
0.15
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
2.0
2.5
3.0
3.5
4.0
4.5
5.0
Size_inflection_FISHERY(1)
16
18
20
22
24
InitF_seas_1_flt_1FISHERY
0.00
0.05
0.10
0.15
0.20
0.25
0.30
Size_95%width_FISHERY(1)
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
LnQ_base_FISHERY(1)
−2
−1
0
1
2
Q_extraSD_FISHERY(1)
0.0
0.5
1.0
1.5
2.0
Density
Parameter value