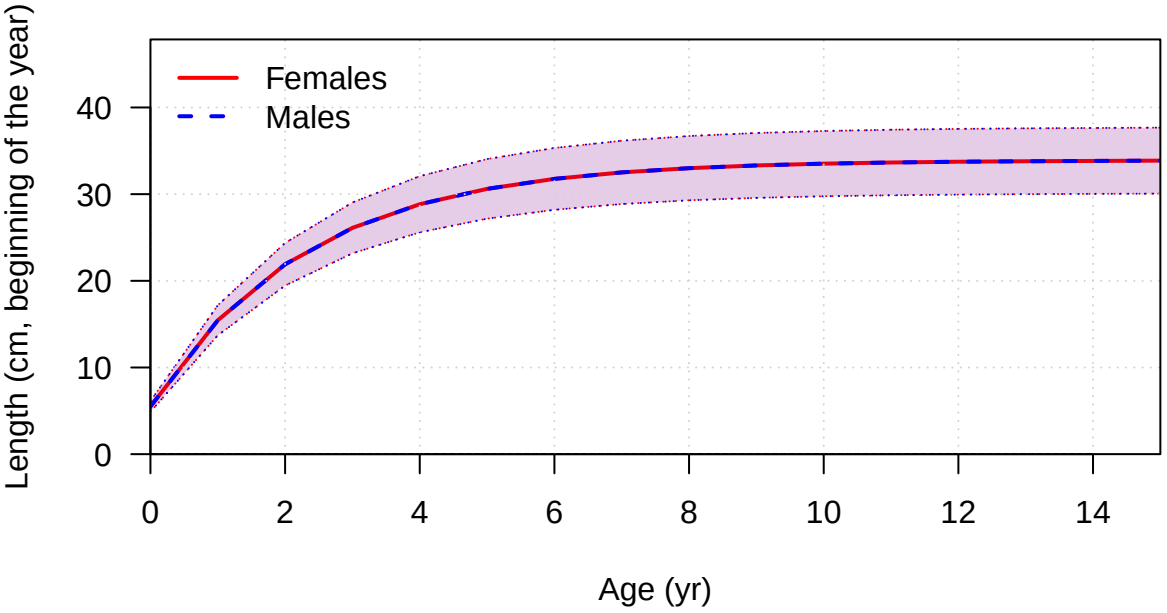
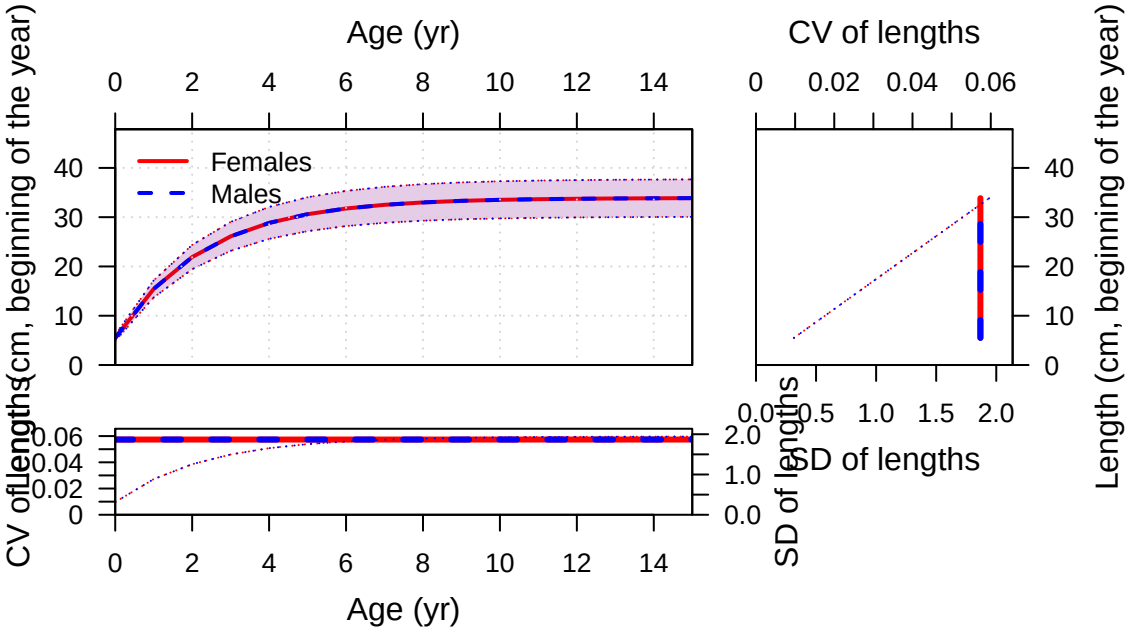
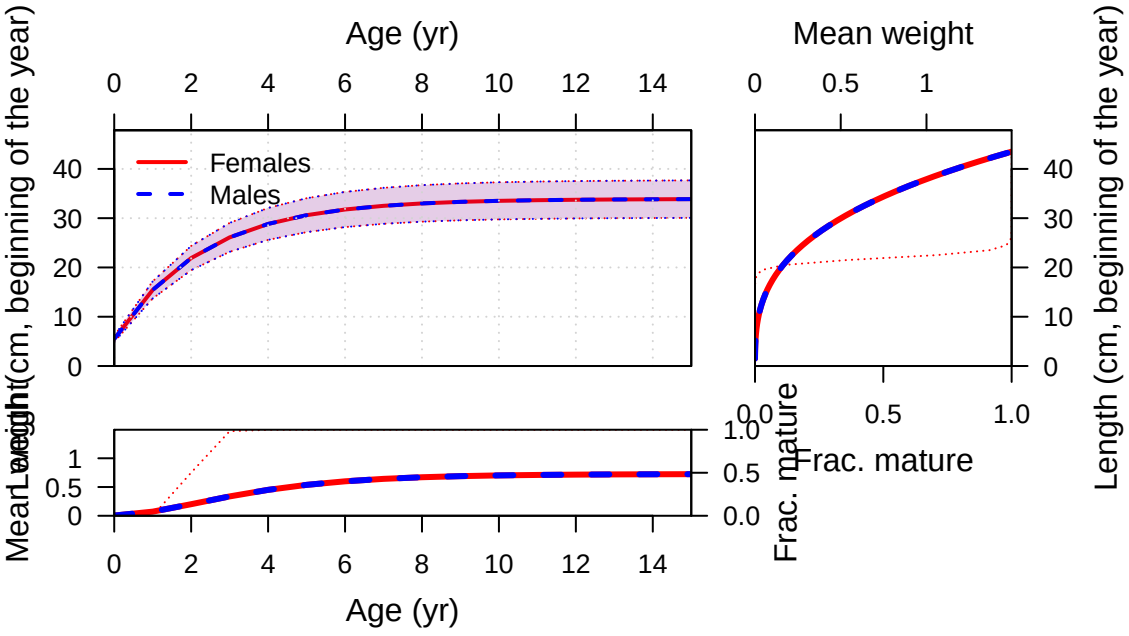
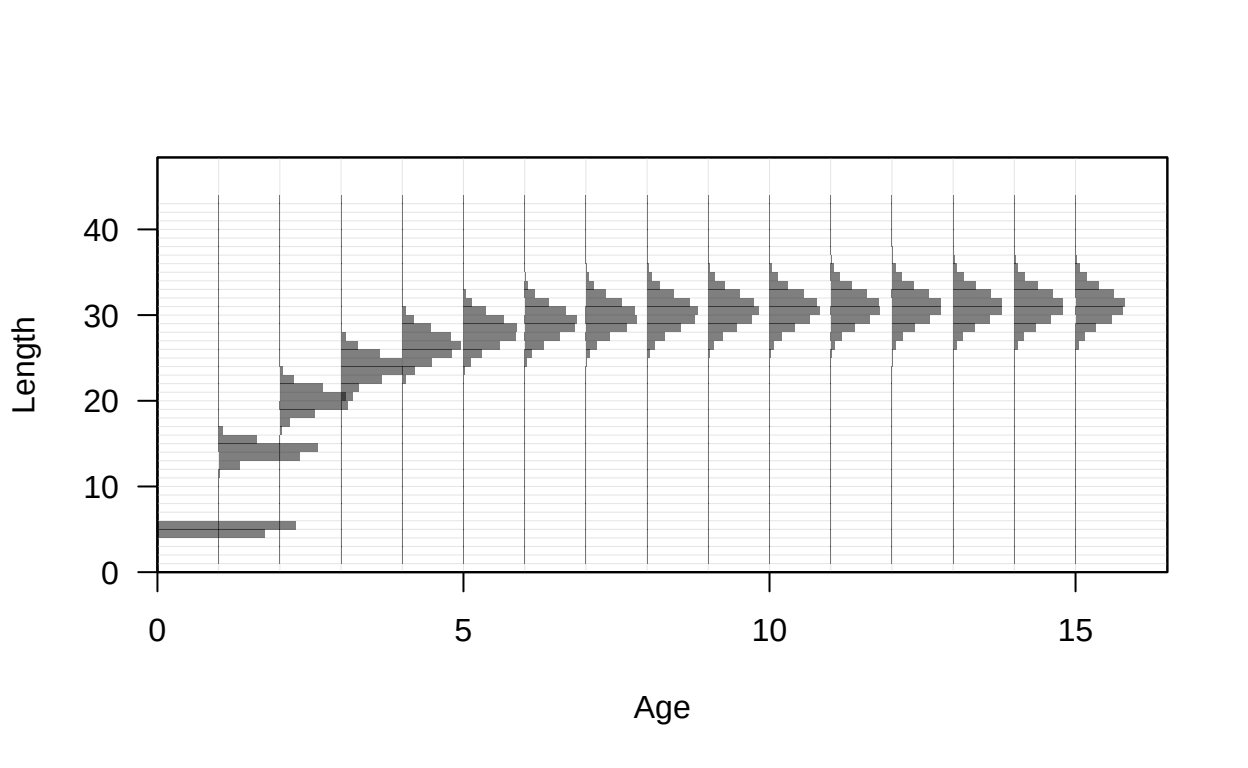
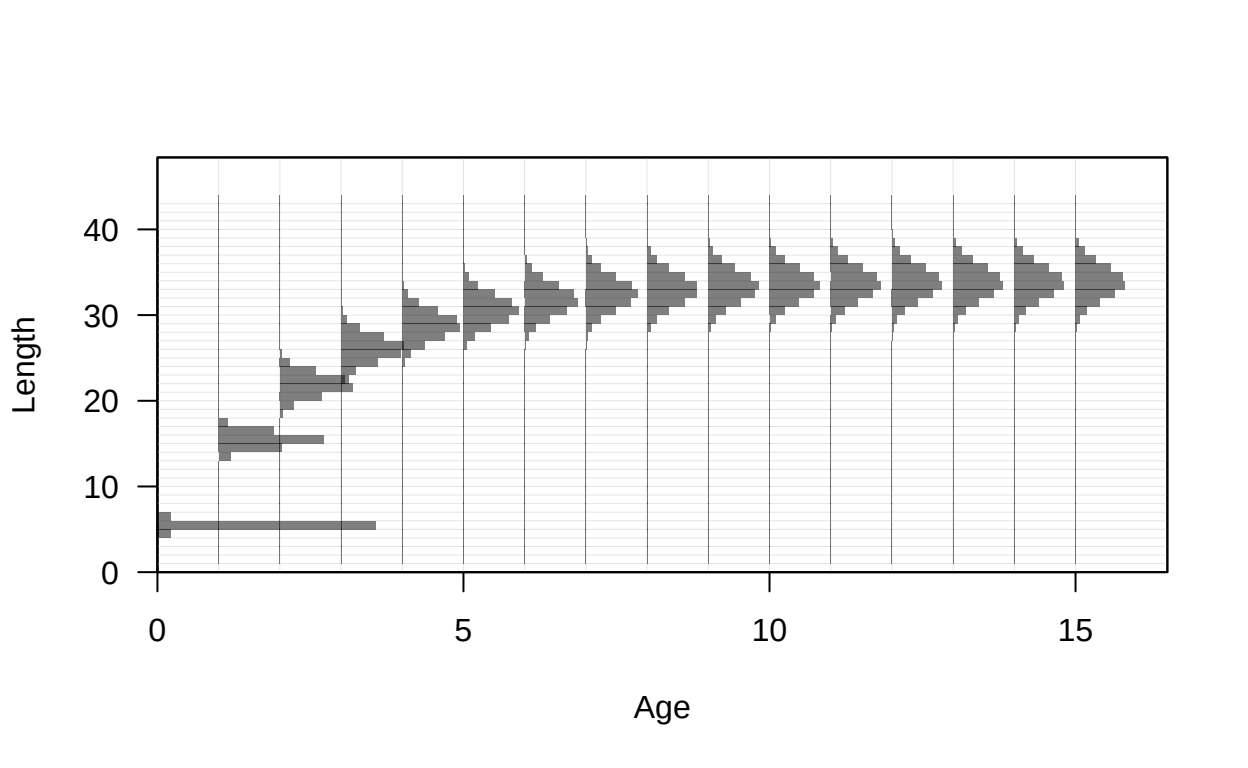
Plots created using the 'r4ss' package in R
Stock Synthesis version: 3.30.19.0
StartTime: Tue Jan 24 12:02:23 2023
Data_File: data.ss
Control_File: control.ss

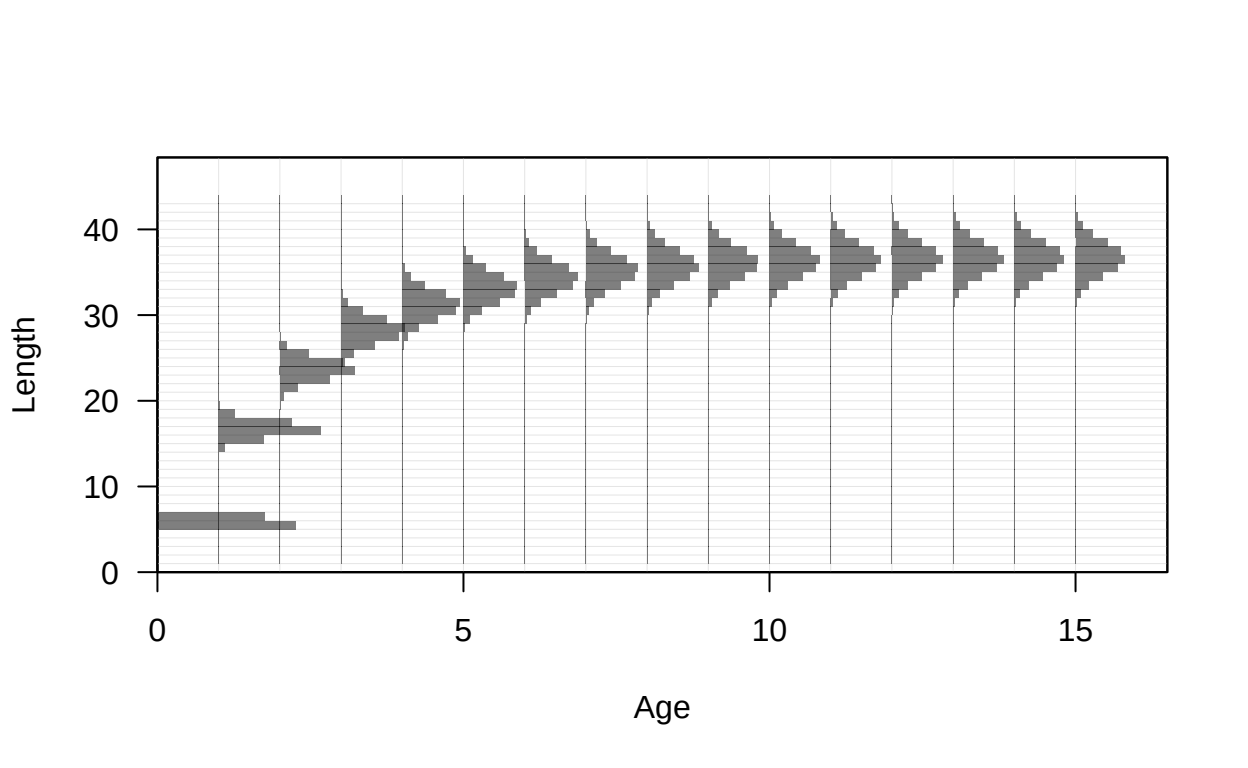

Females
Males
Length (cm, beginning of the year)
0
10
20
30
40
0
2
4
6
8
10
12
14
Age (yr)

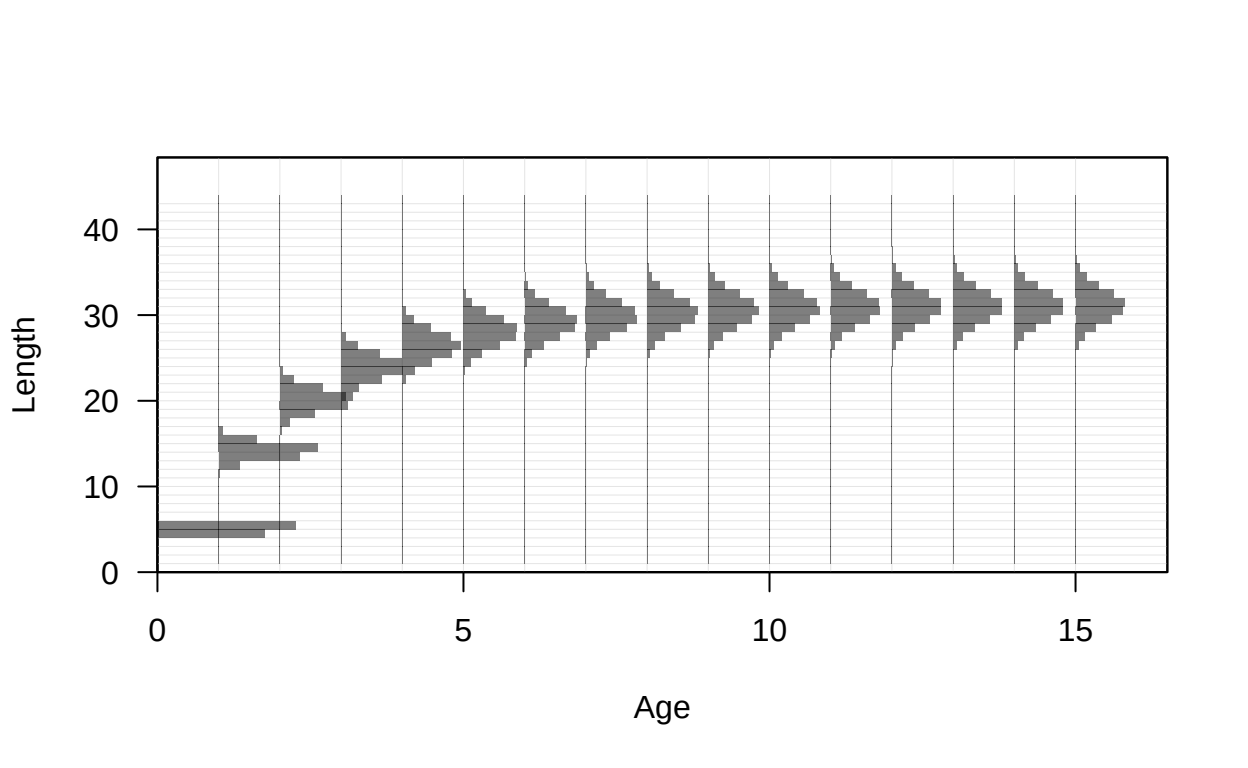

Age (yr)
0
2
4
6
8
10
12
14
Females
Males
Length (cm, beginning of the year)
0
10
20
30
40
CV of lengths
0
0.02
0.04
0.06
SD of lengths
0.0
0.5
1.0
1.5
2.0
Age (yr)

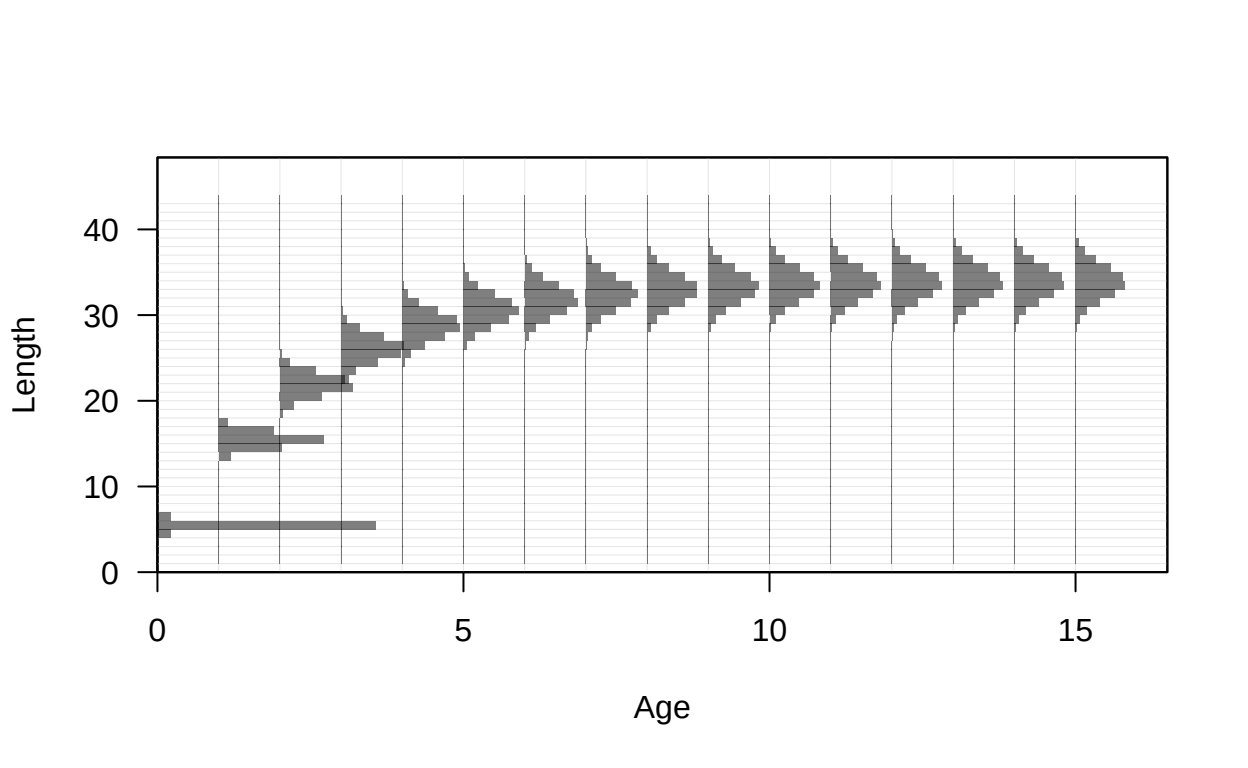

Age (yr)
Mean weight
Length (cm, beginning of the year)
Females
Males
Frac. mature
Age (yr)

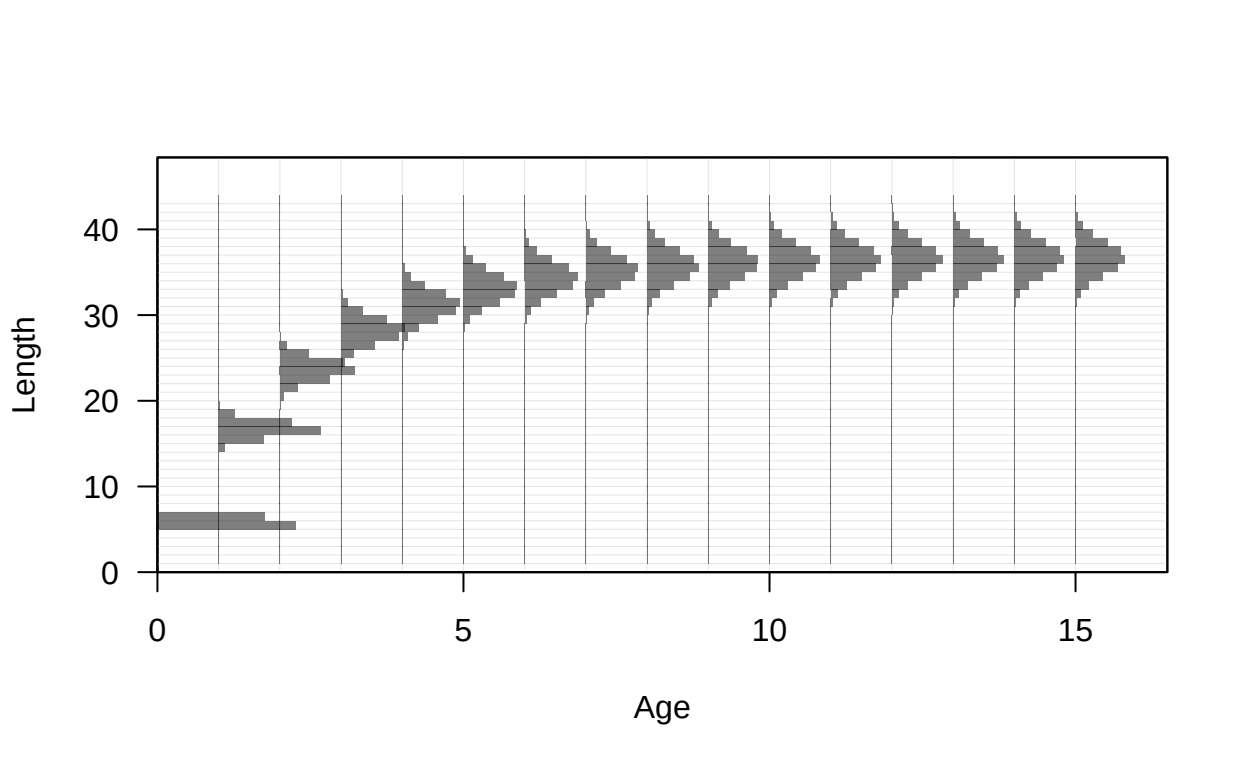

Length
0
10
20
30
40
0
5
10
15
Age

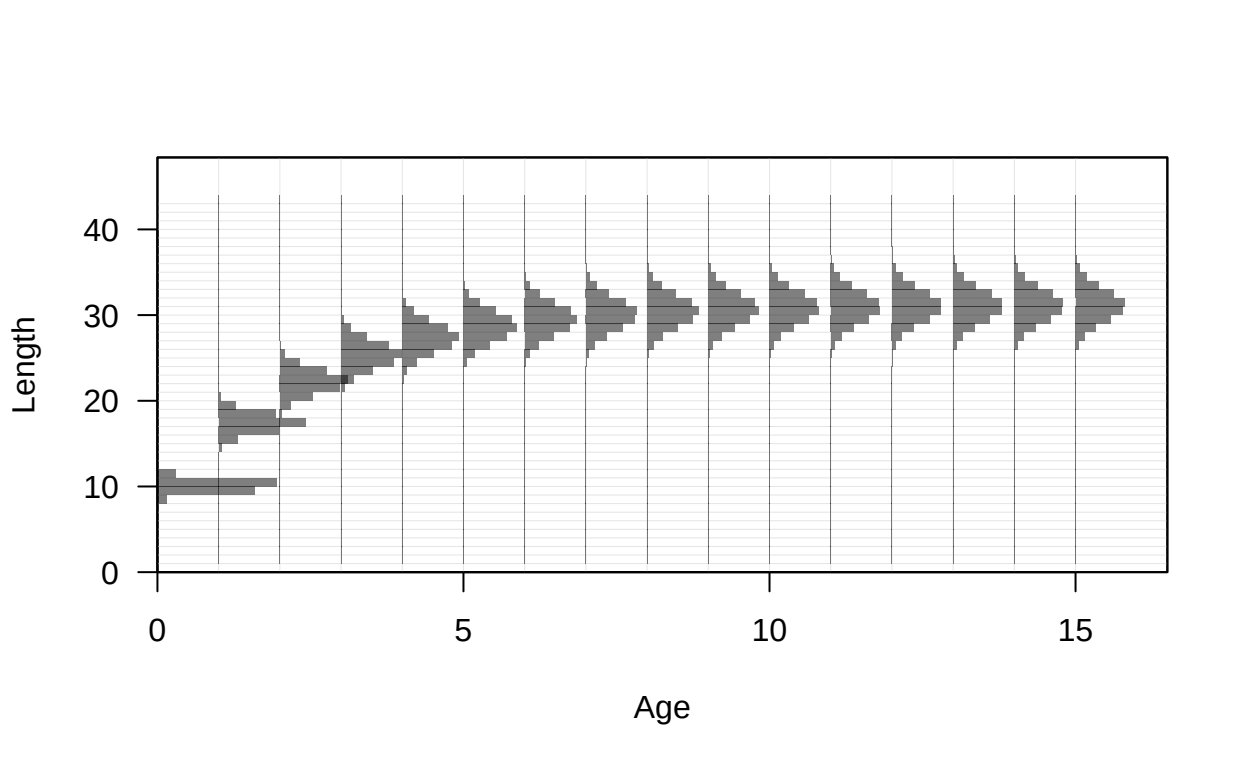

Length
0
10
20
30
40
0
5
10
15
Age

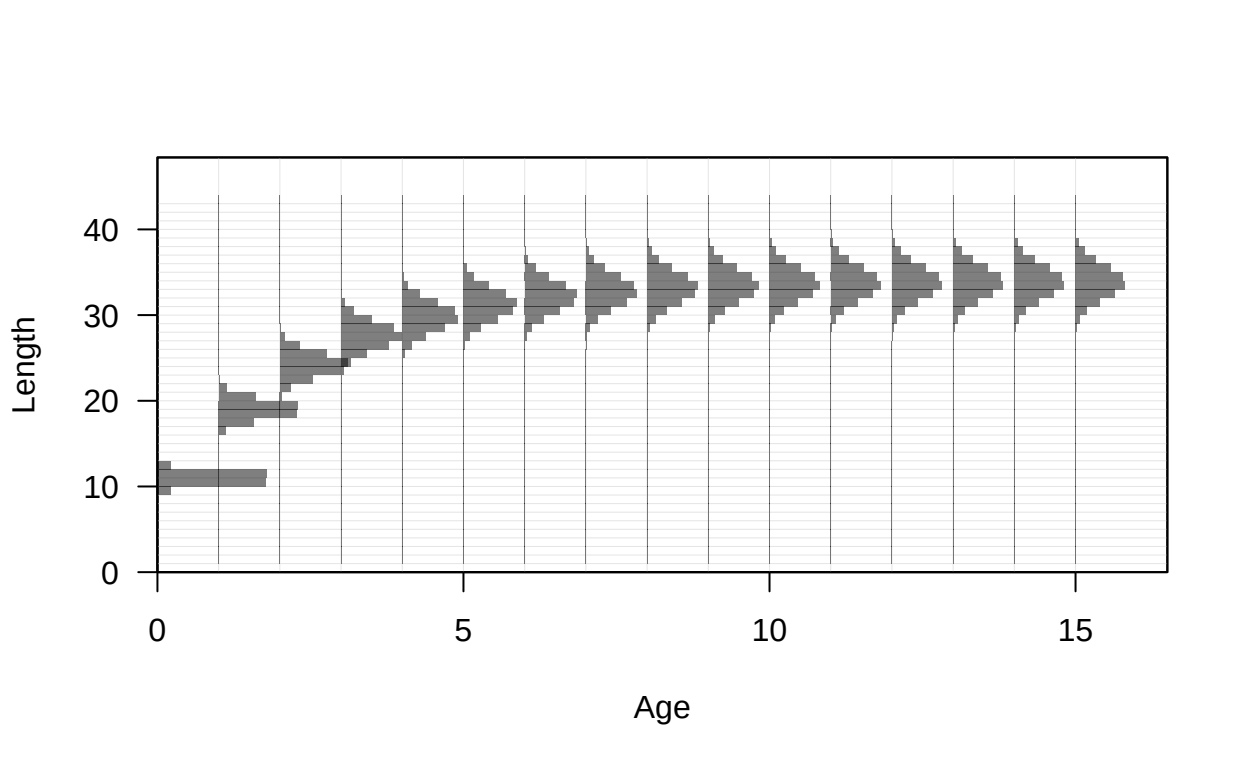

Length
0
10
20
30
40
0
5
10
15
Age

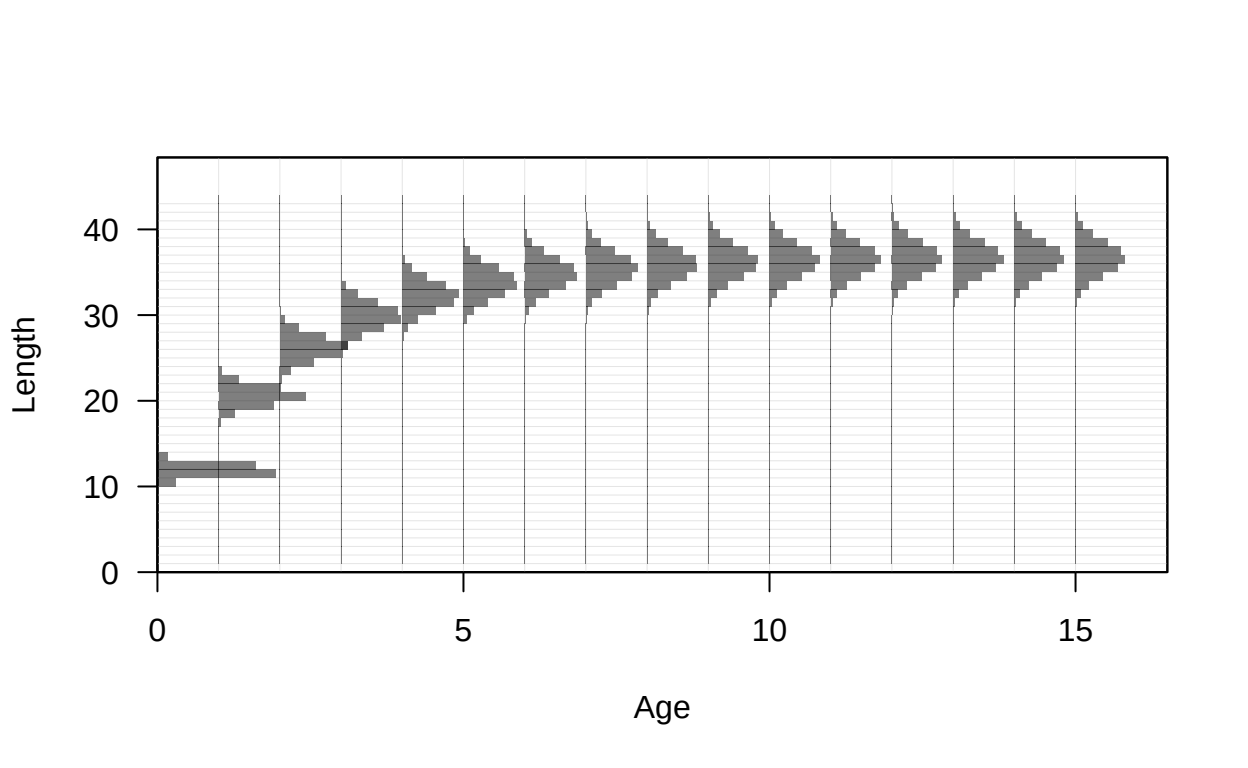

Length
0
10
20
30
40
0
5
10
15
Age

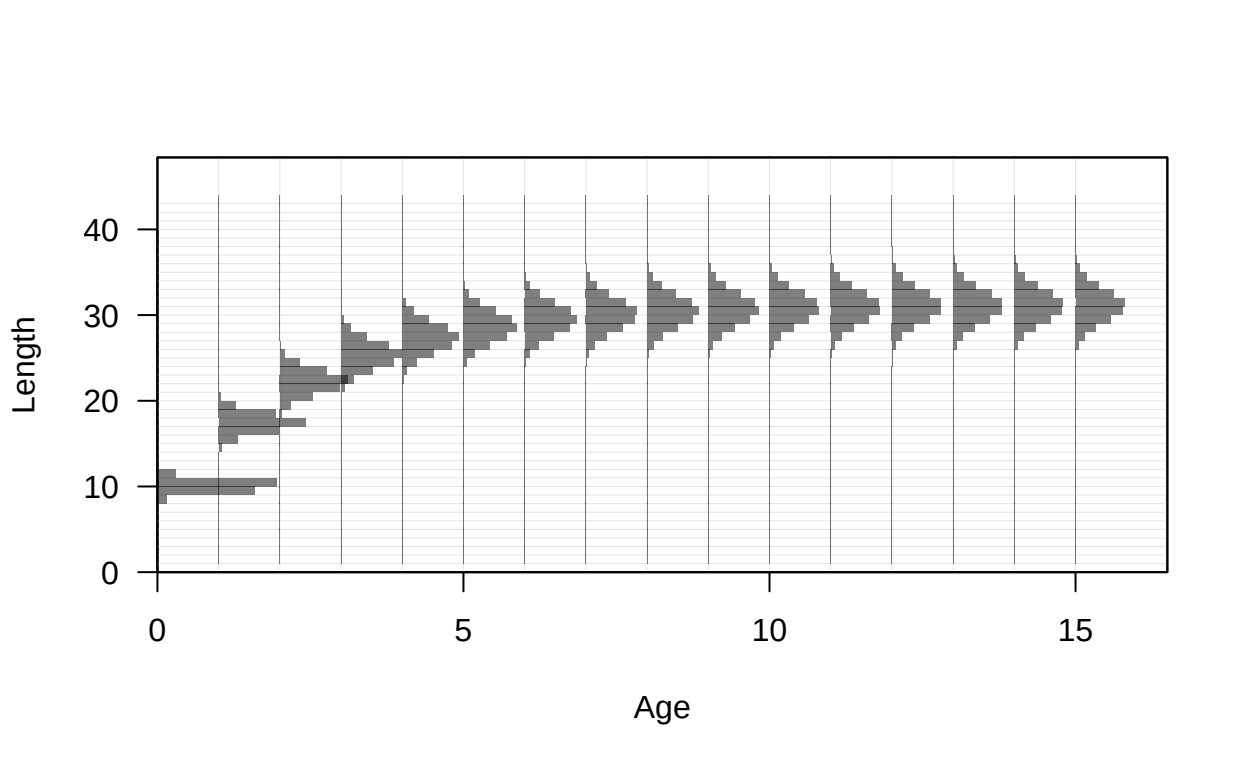

Length
0
10
20
30
40
0
5
10
15
Age

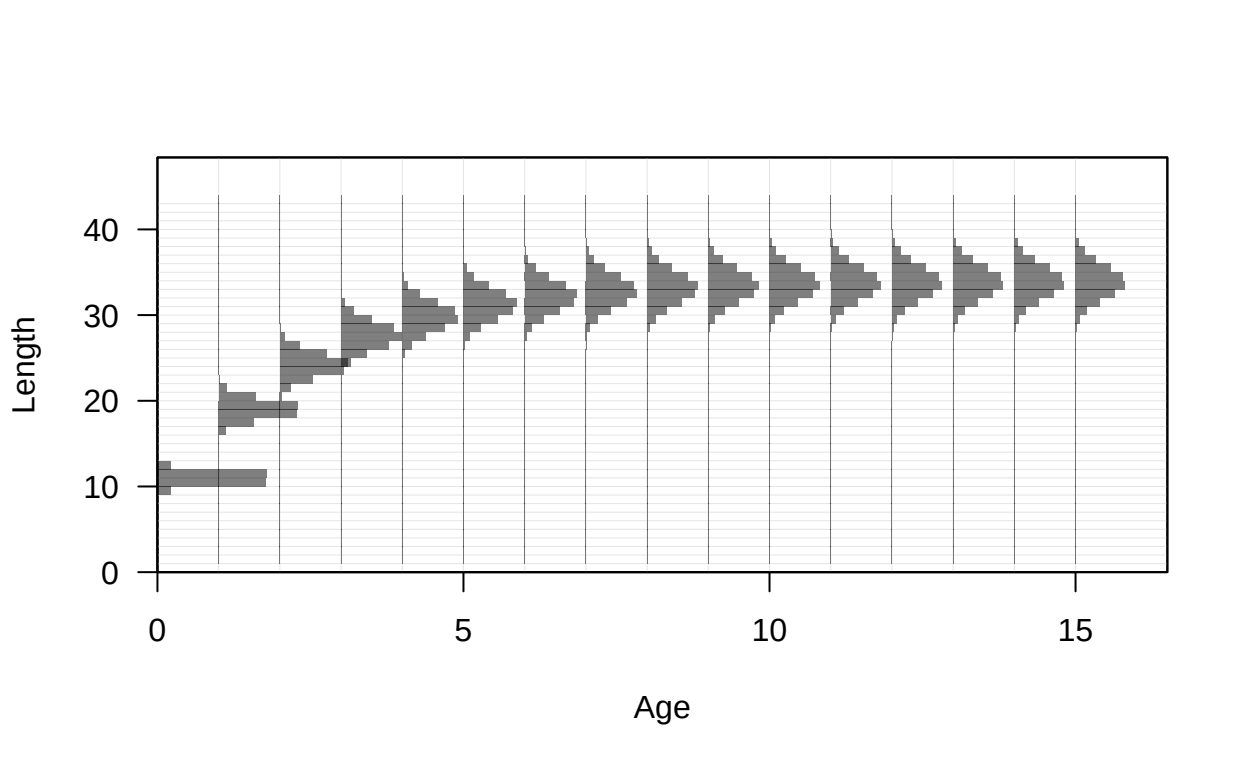

Length
0
10
20
30
40
0
5
10
15
Age

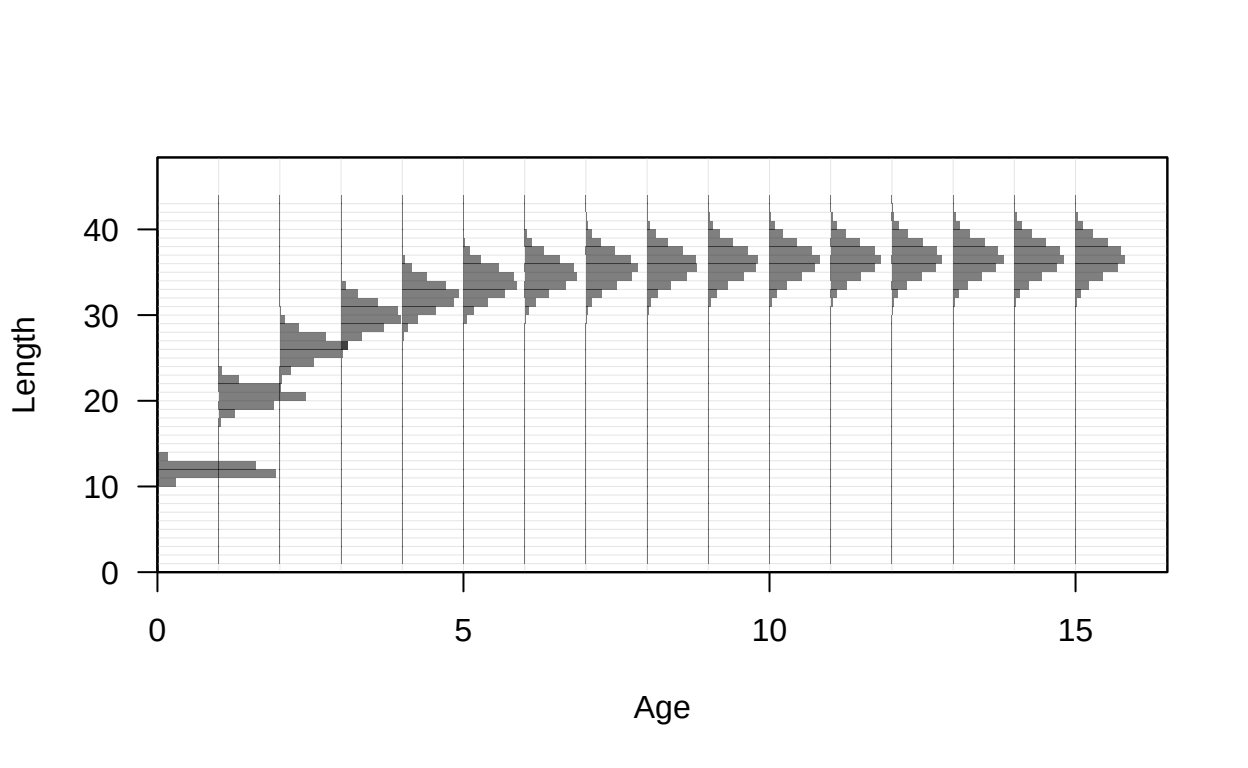

Length
0
10
20
30
40
0
5
10
15
Age

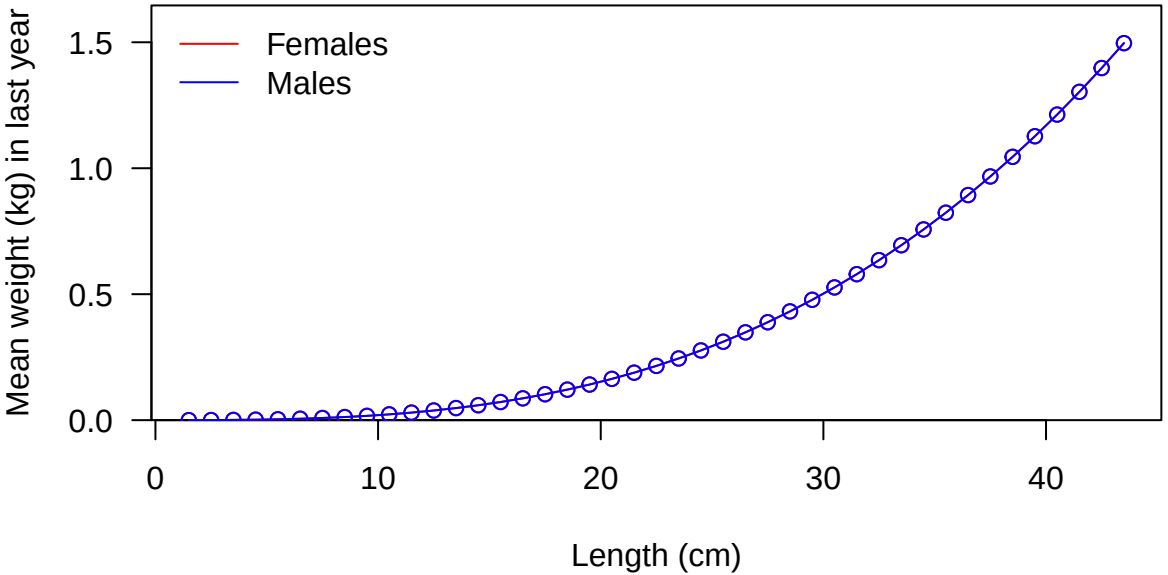

Length
0
10
20
30
40
0
5
10
15
Age

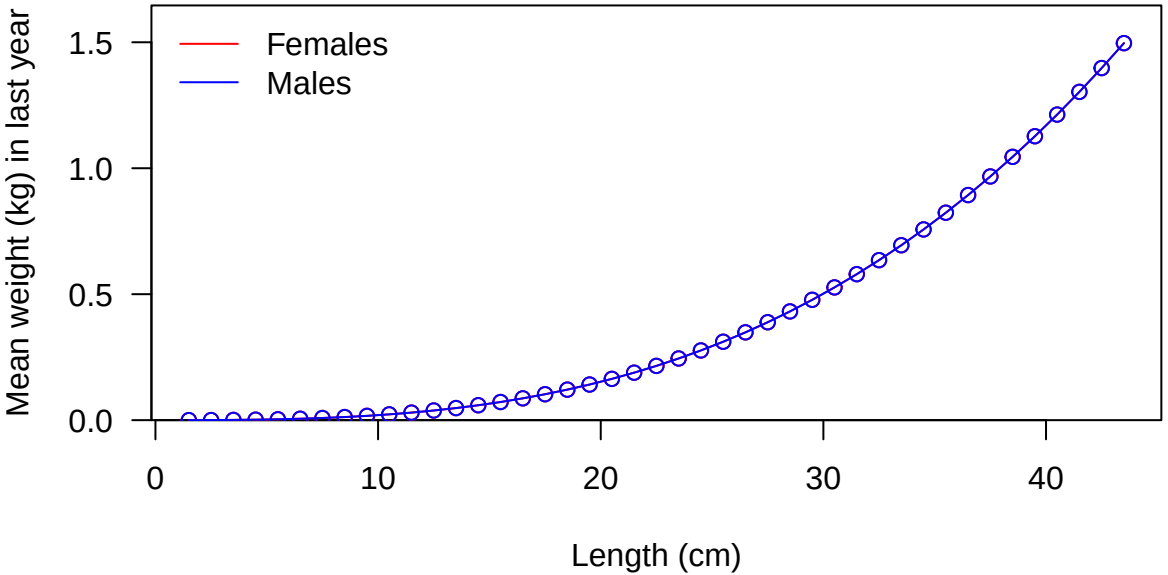

Length
0
10
20
30
40
0
5
10
15
Age

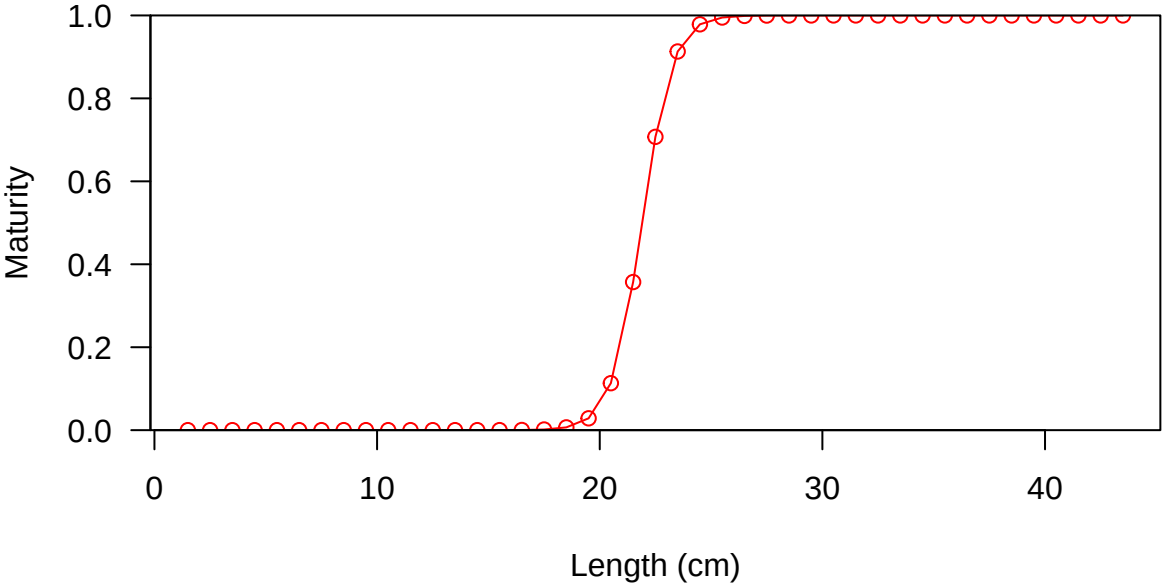

Length
0
10
20
30
40
0
5
10
15
Age

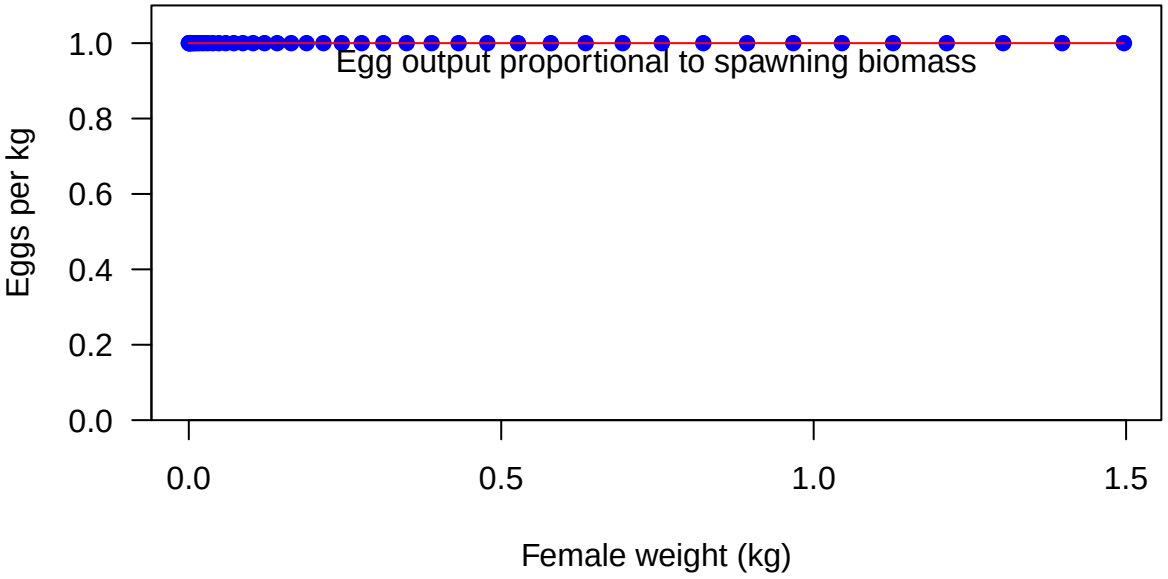

Length
0
10
20
30
40
0
5
10
15
Age

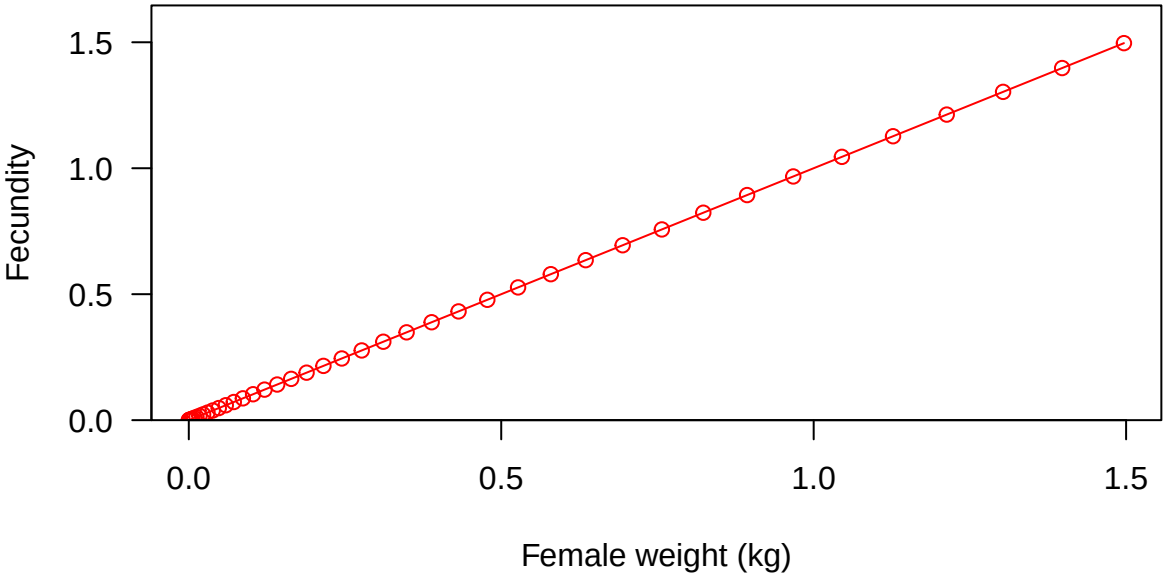

Length
0
10
20
30
40
0
5
10
15
Age

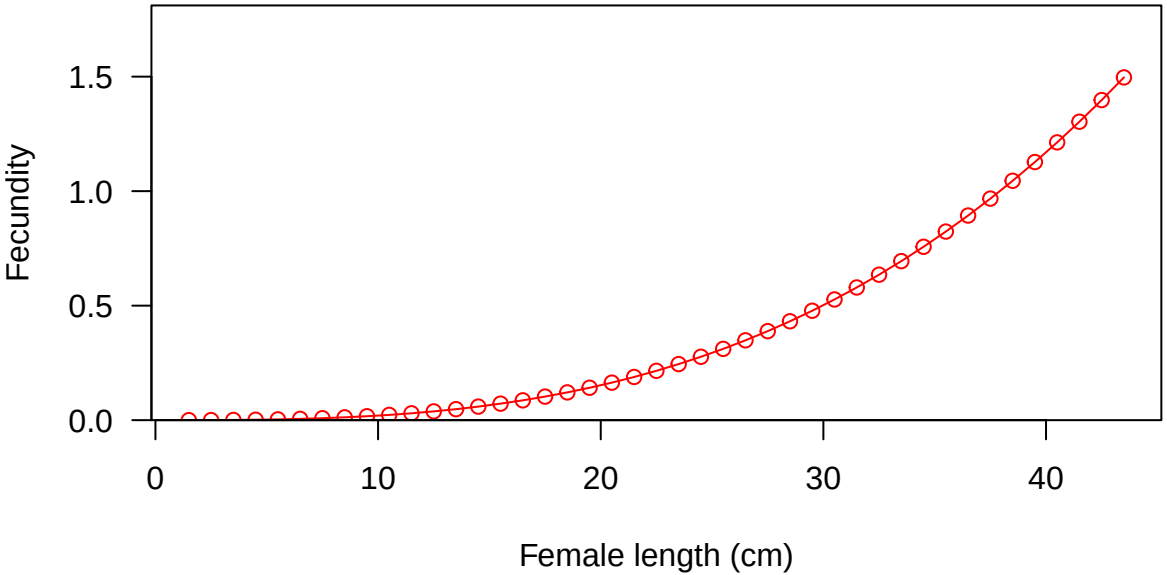

Females
Males
1.5
1.0
0.5
0.0
Mean weight (kg) in last year
0
10
20
30
40
Length (cm)

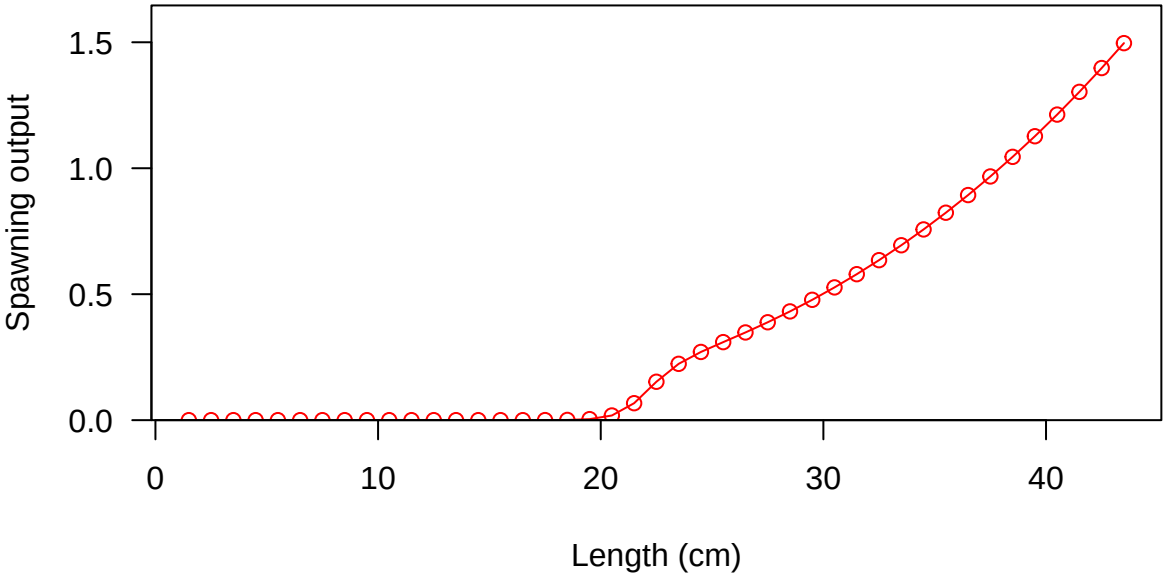

Females
Males
1.5
1.0
0.5
0.0
Mean weight (kg) in last year
0
10
20
30
40
Length (cm)

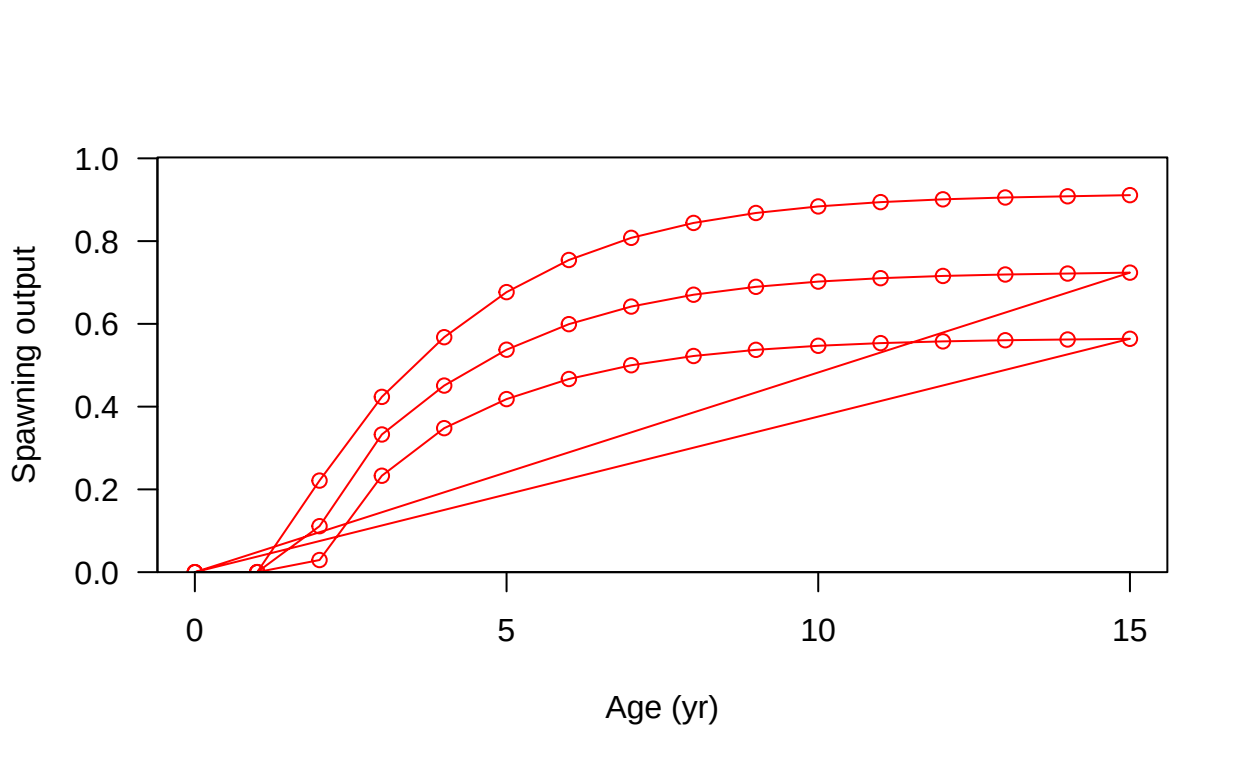

1.0
0.8
0.6
0.4
0.2
0.0
Maturity
0
10
20
30
40
Length (cm)

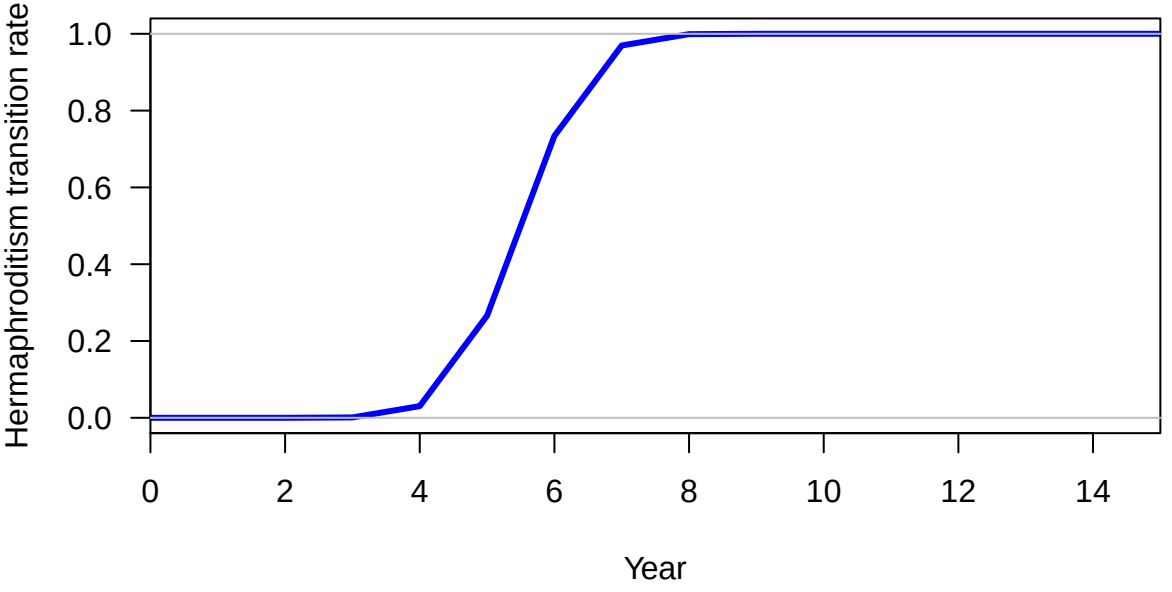

Egg output proportional to spawning biomass
Eggs per kg
1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.5
1.0
1.5
Female weight (kg)

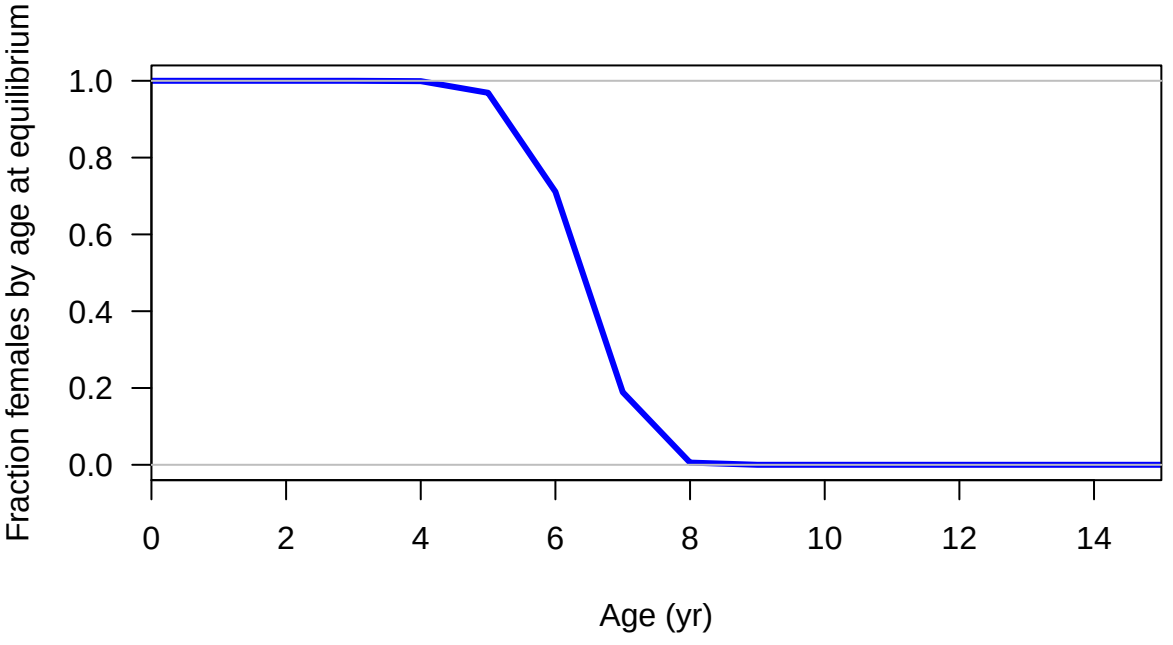

Fecundity
0.0
0.5
1.0
1.5
0.0
0.5
1.0
1.5
Female weight (kg)

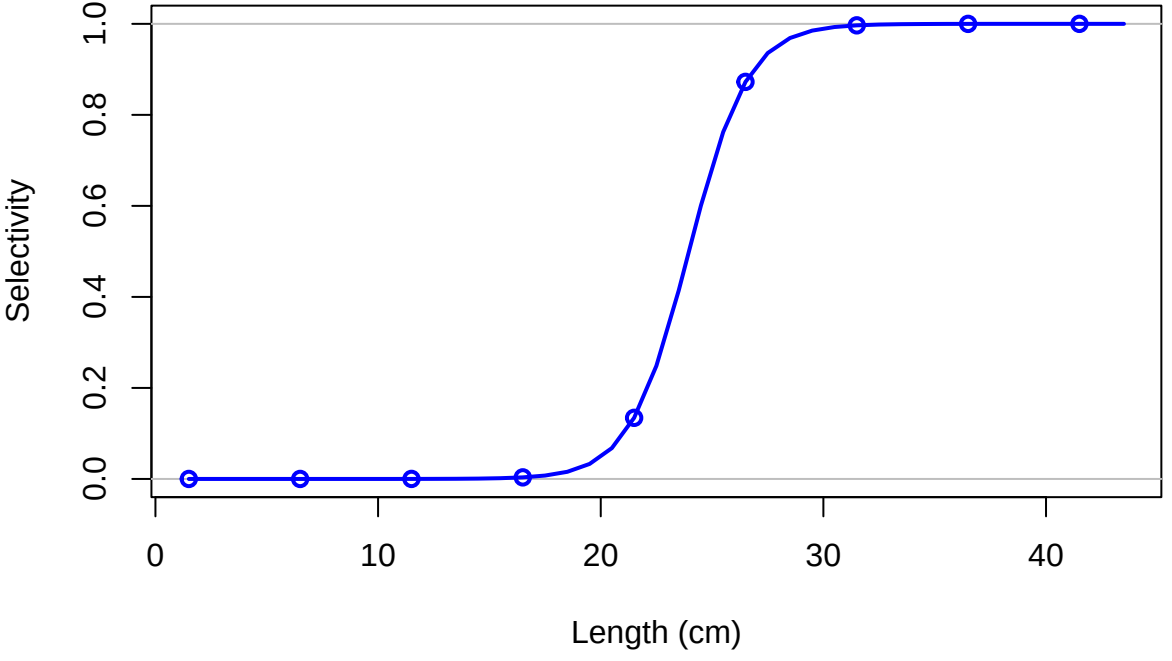

Fecundity
0.0
0.5
1.0
1.5
0
10
20
30
40
Female length (cm)

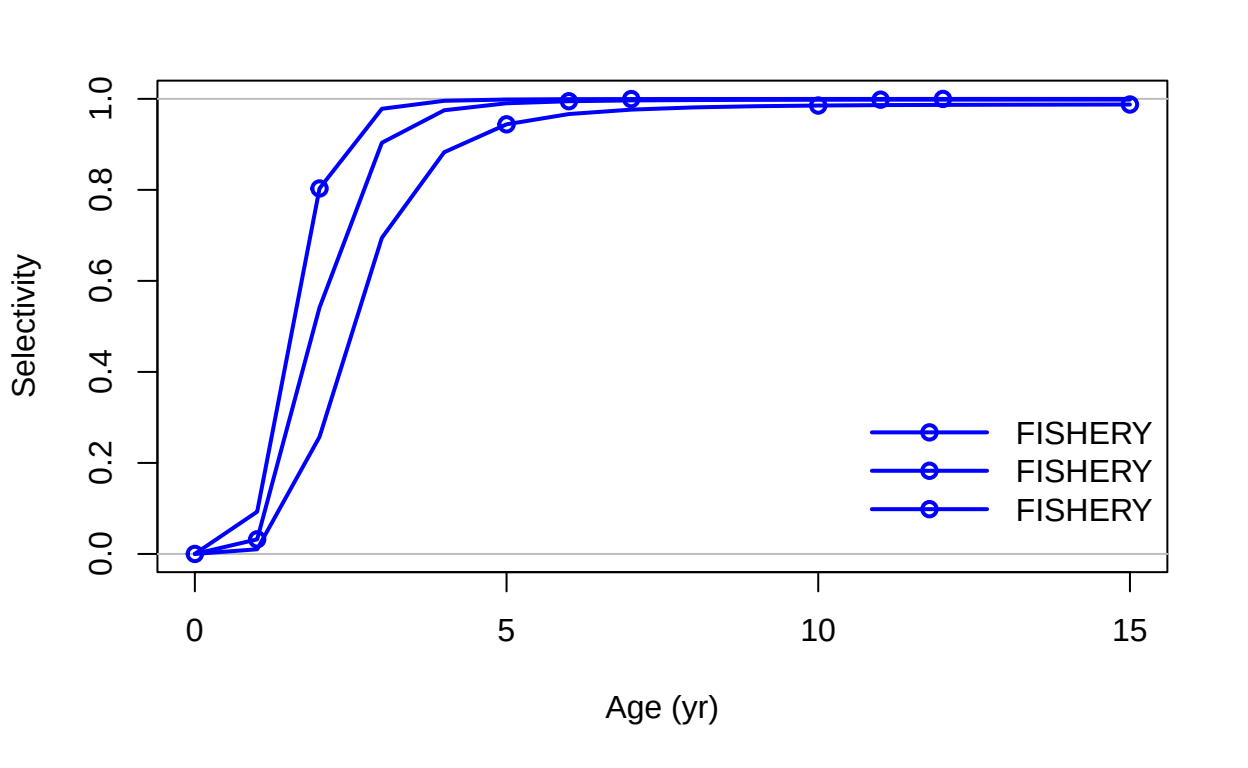

Spawning output
1.5
1.0
0.5
0.0
0
10
20
30
40
Length (cm)

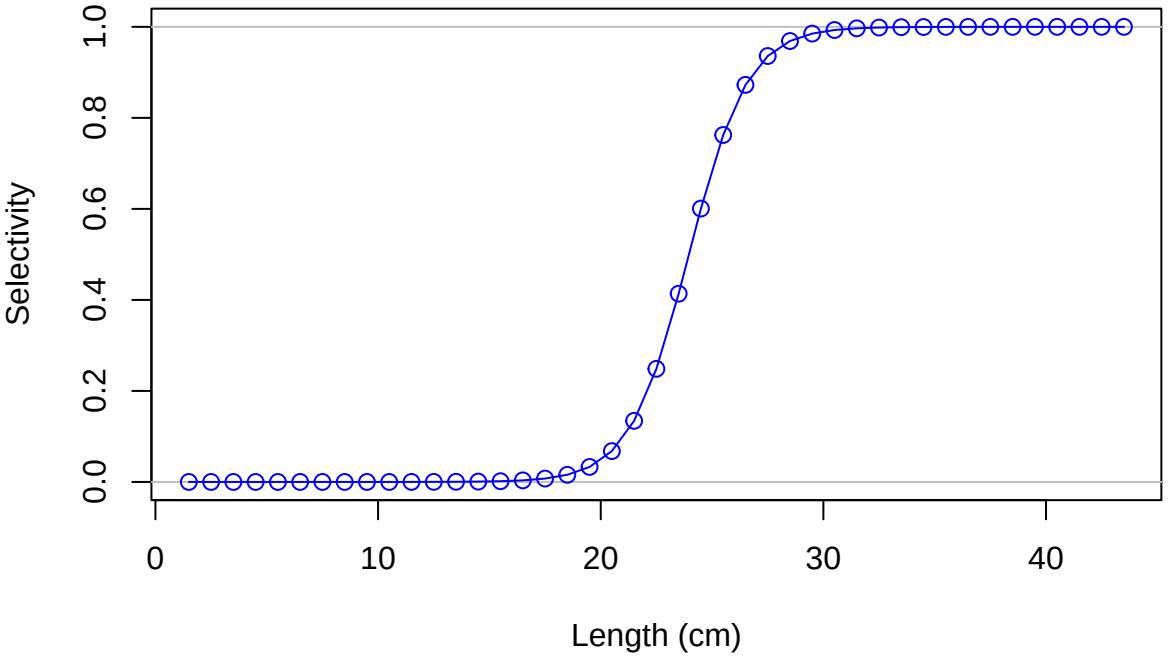

1.0
0.8
0.6
0.4
0.2
0.0
Spawning output
0
5
10
15
Age (yr)

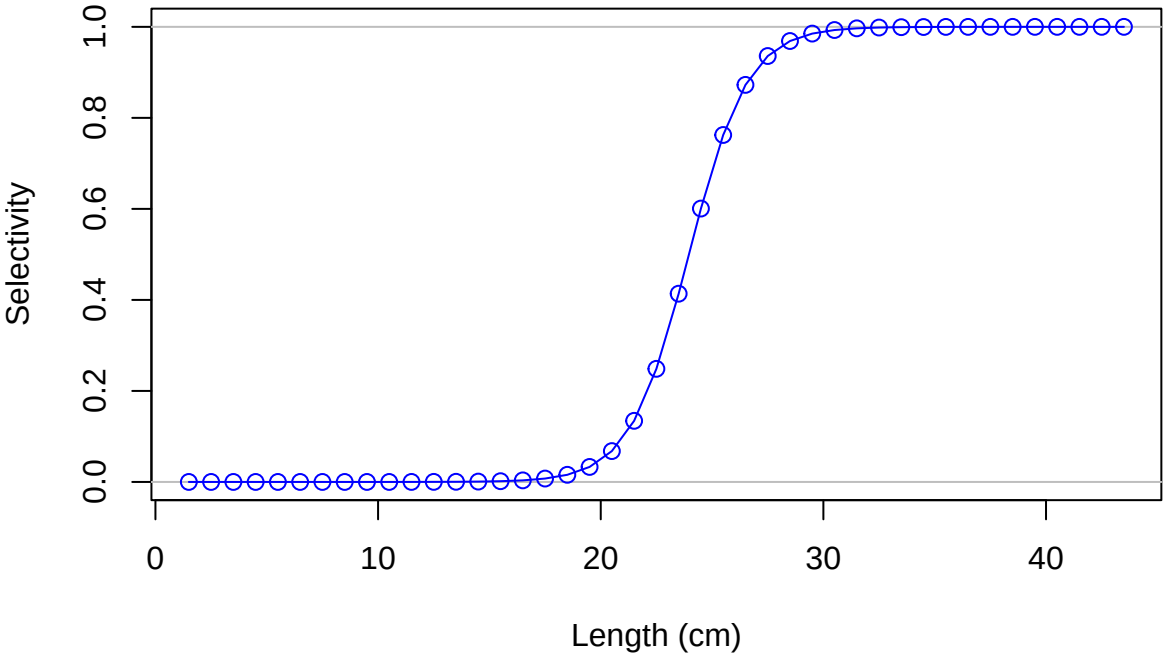

Hermaphroditism transition rate
1.0
0.8
0.6
0.4
0.2
0.0
0
2
4
6
8
10
12
14
Year

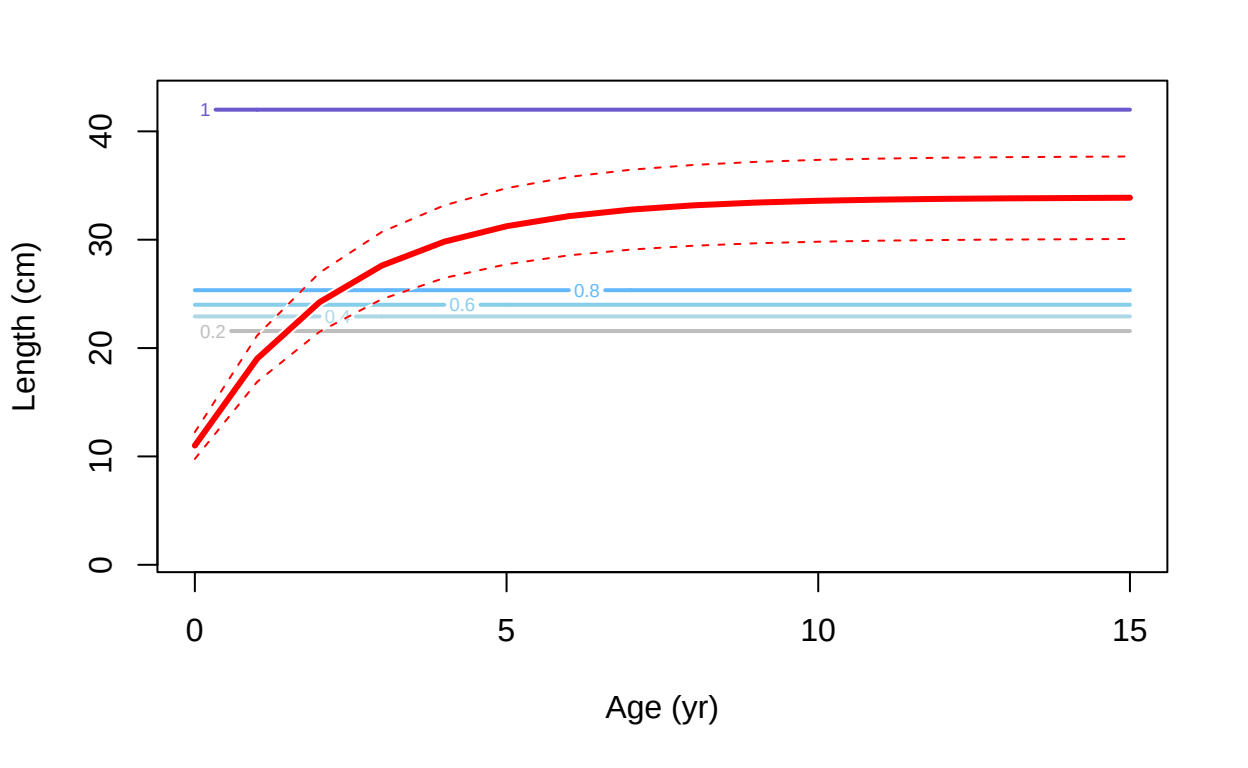

Fraction females by age at equilibrium
1.0
0.8
0.6
0.4
0.2
0.0
0
2
4
6
8
10
12
14
Age (yr)

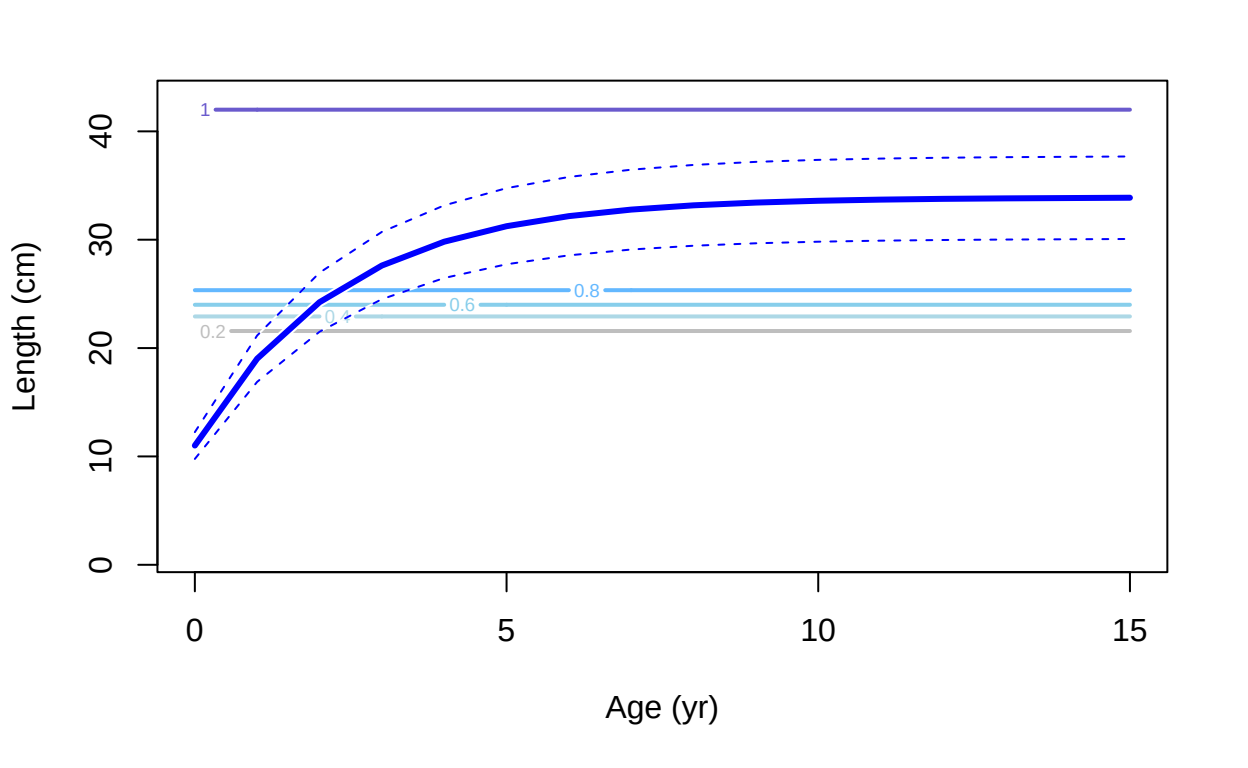

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
10
20
30
40
Length (cm)

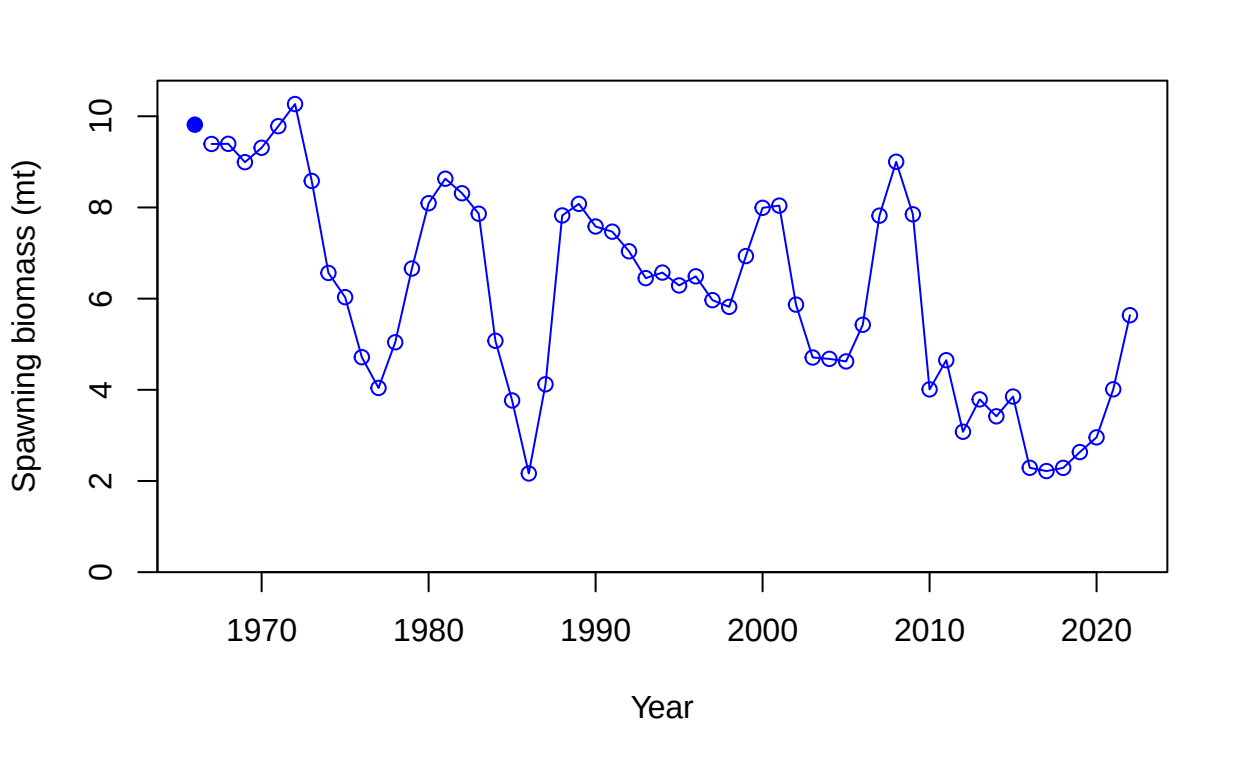

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
5
10
15
Age (yr)
FISHERY
FISHERY
FISHERY

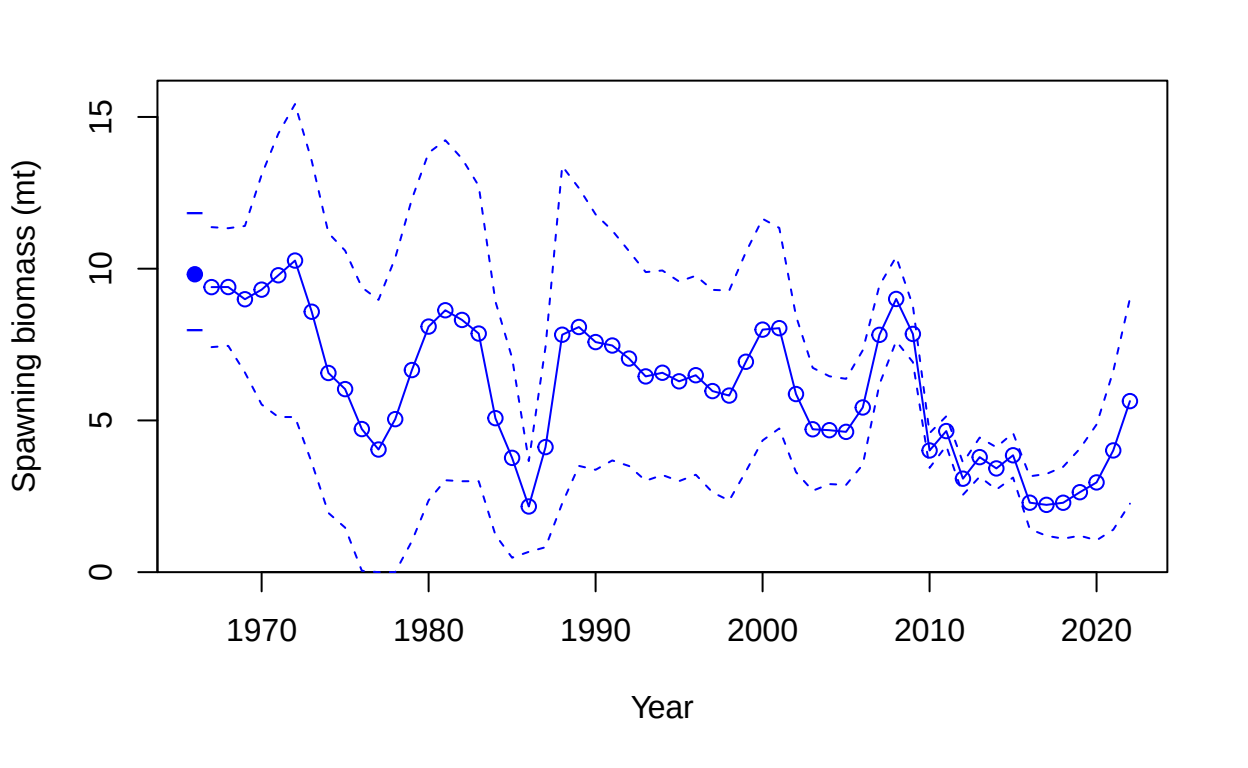

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
10
20
30
40
Length (cm)

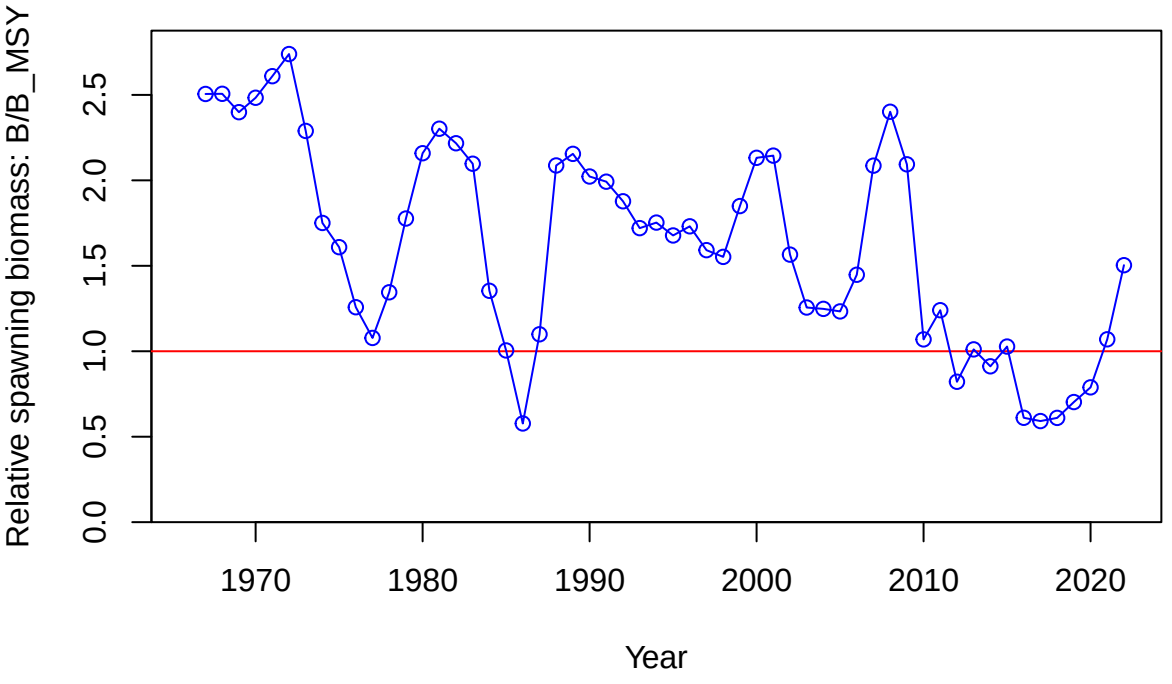

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
10
20
30
40
Length (cm)

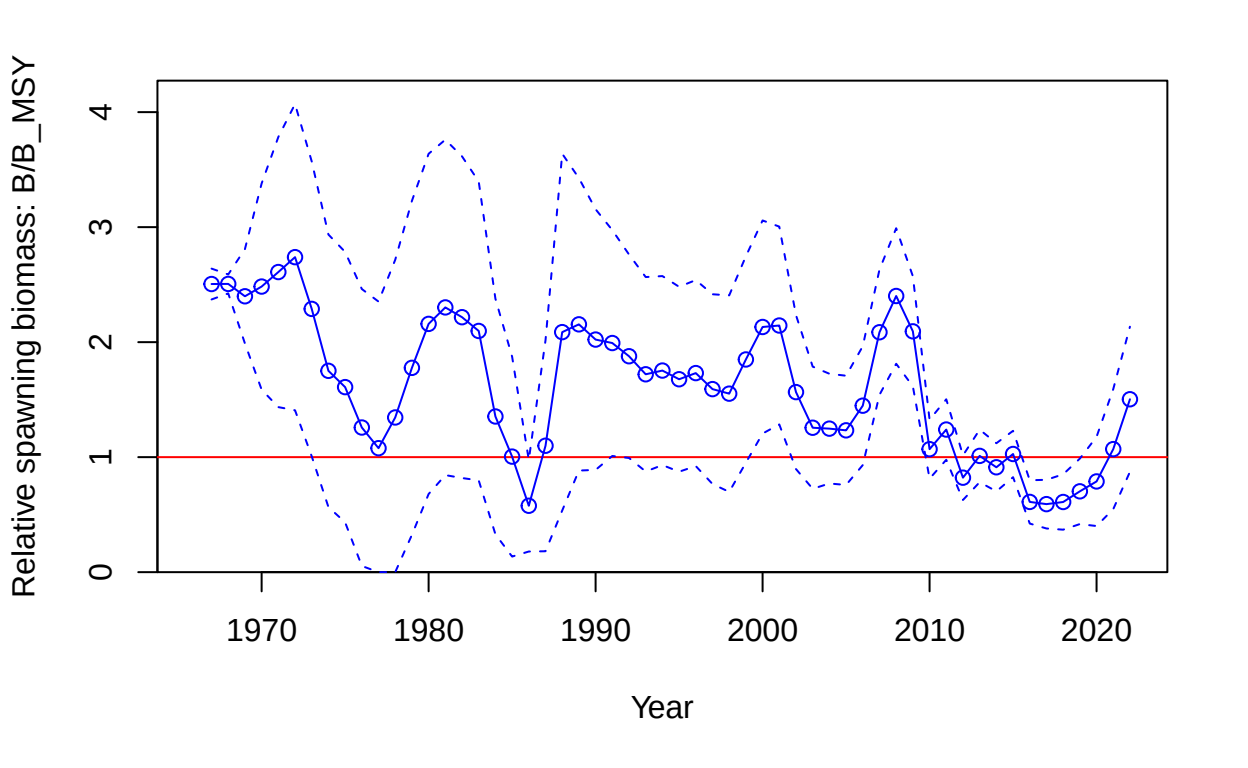

Length (cm)
0
10
20
30
40
1
0.8
0.6
0.4
0.2
0
5
10
15
Age (yr)

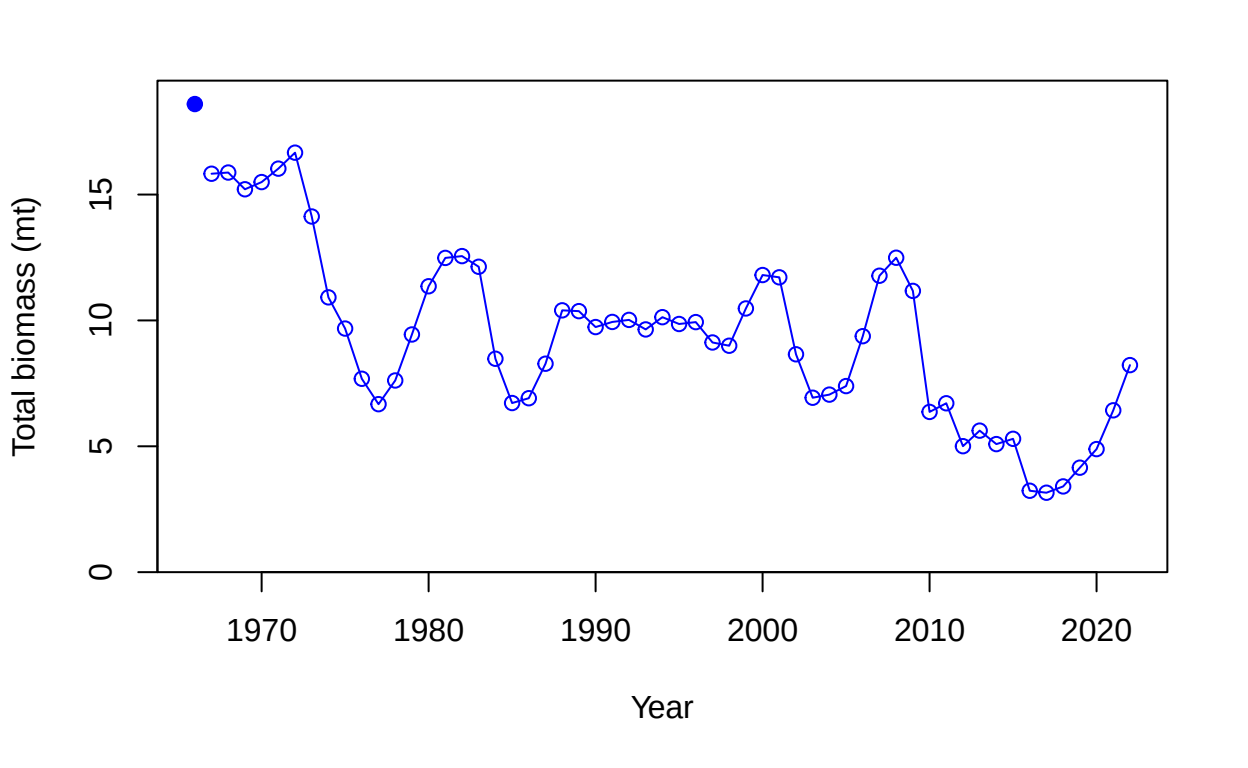

Length (cm)
0
10
20
30
40
Age (yr)
0
5
10
15
1
0.8
0.6
0.4
0.2

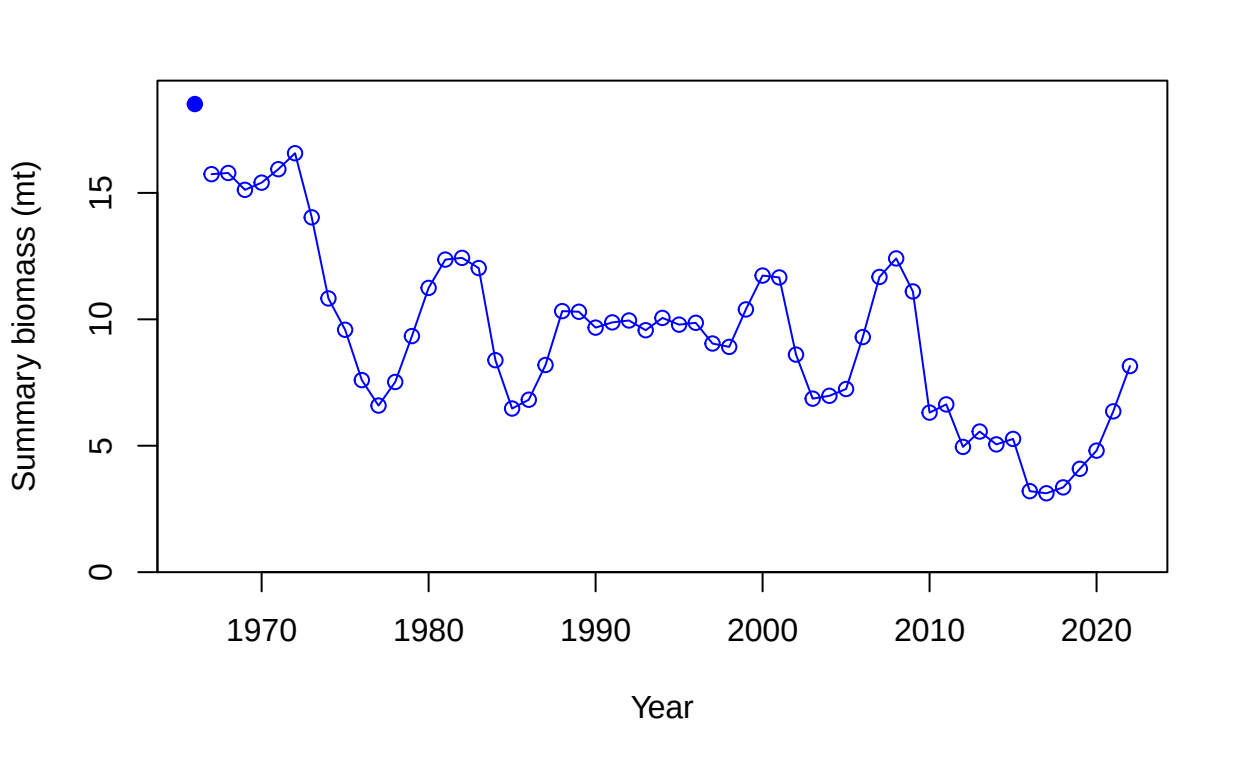

Spawning biomass (mt)
0
2
4
6
8
10
1970
1980
1990
2000
2010
2020
Year

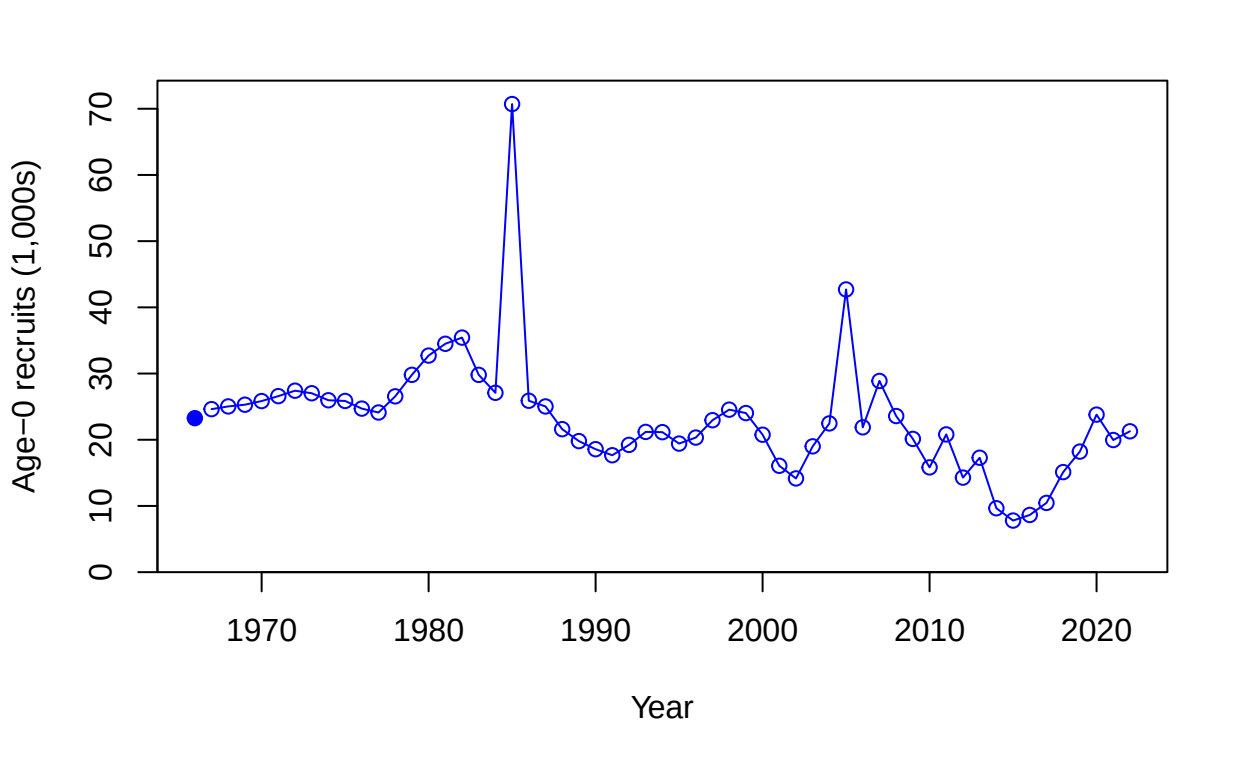

Spawning biomass (mt)
0
5
10
15
1970
1980
1990
2000
2010
2020
Year

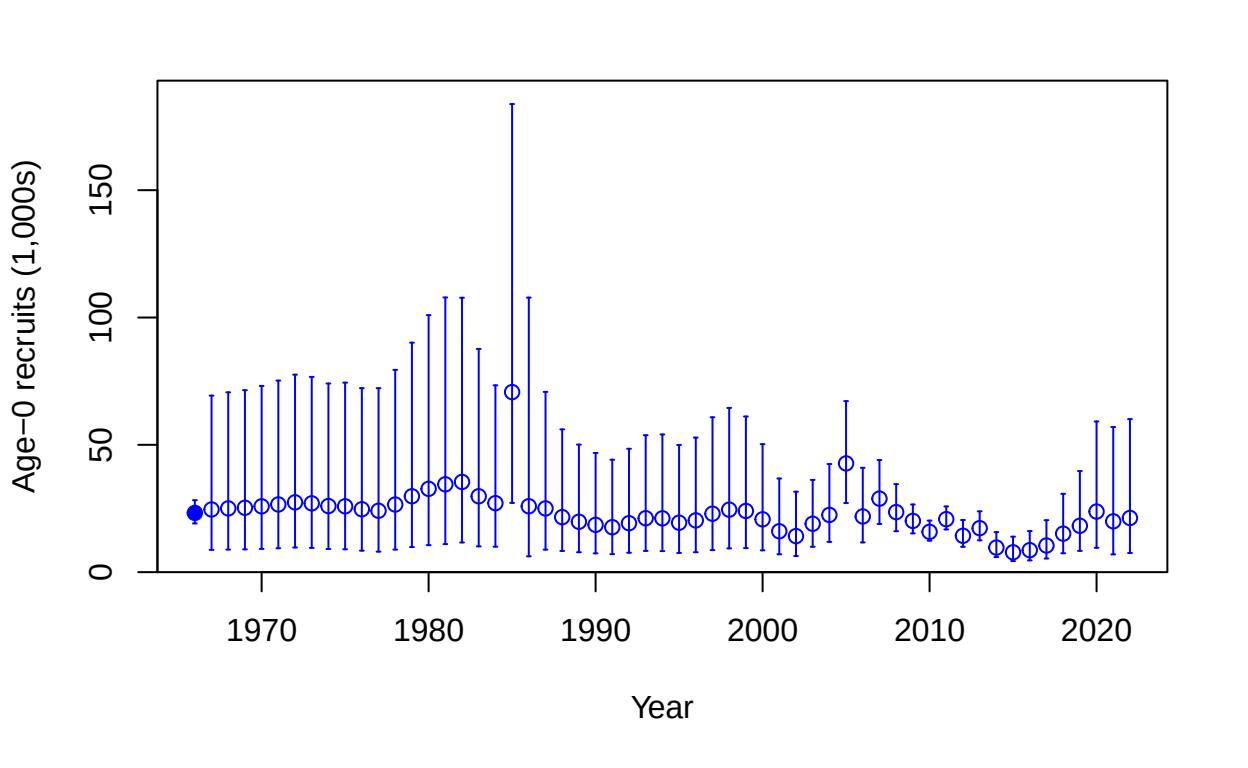

Relative spawning biomass: B/B_MSY
0.0
0.5
1.0
1.5
2.0
2.5
1970
1980
1990
2000
2010
2020
Year

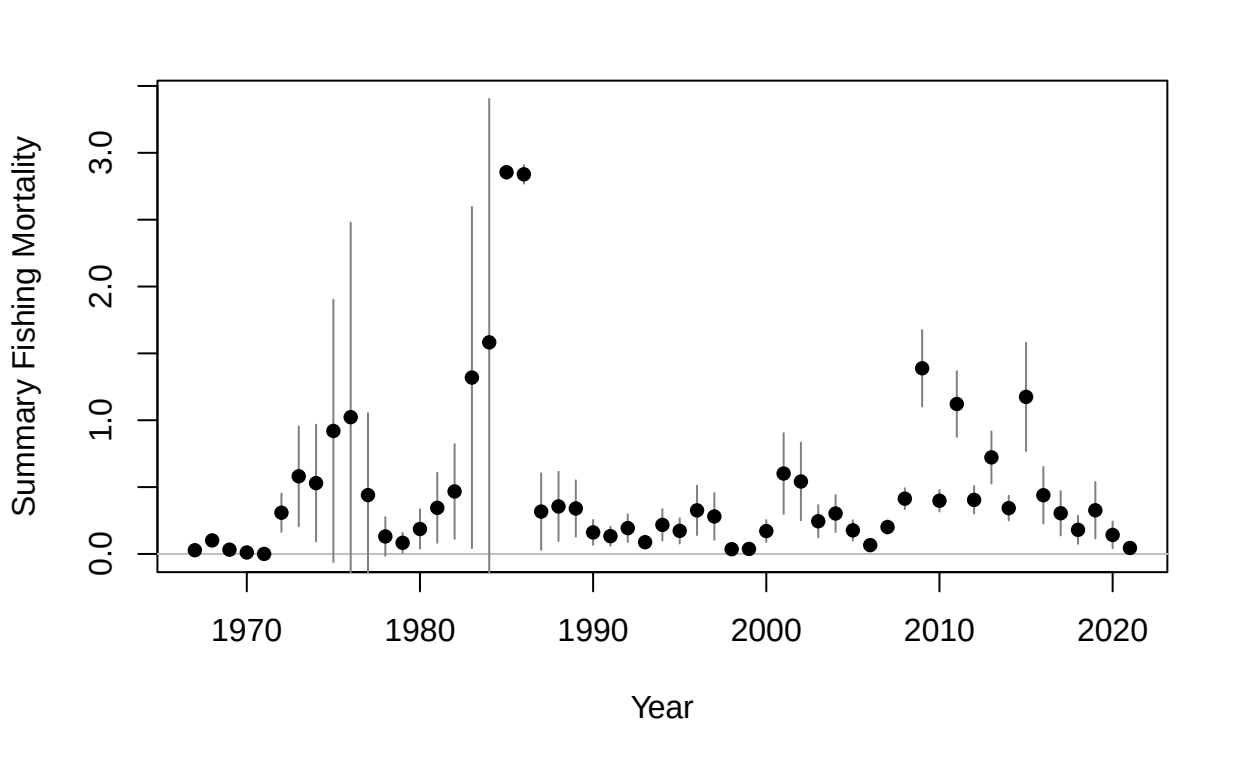

Relative spawning biomass: B/B_MSY
0
1
2
3
4
1970
1980
1990
2000
2010
2020
Year

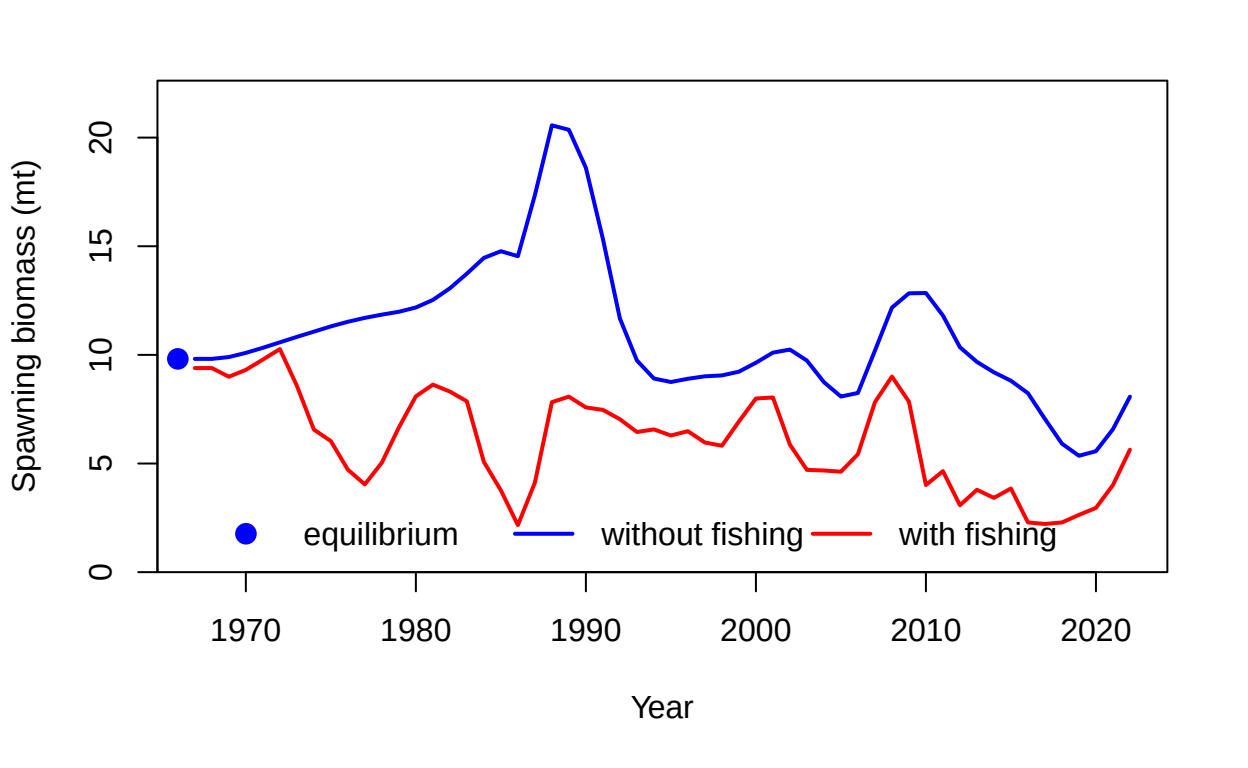

Total biomass (mt)
0
5
10
15
1970
1980
1990
2000
2010
2020
Year

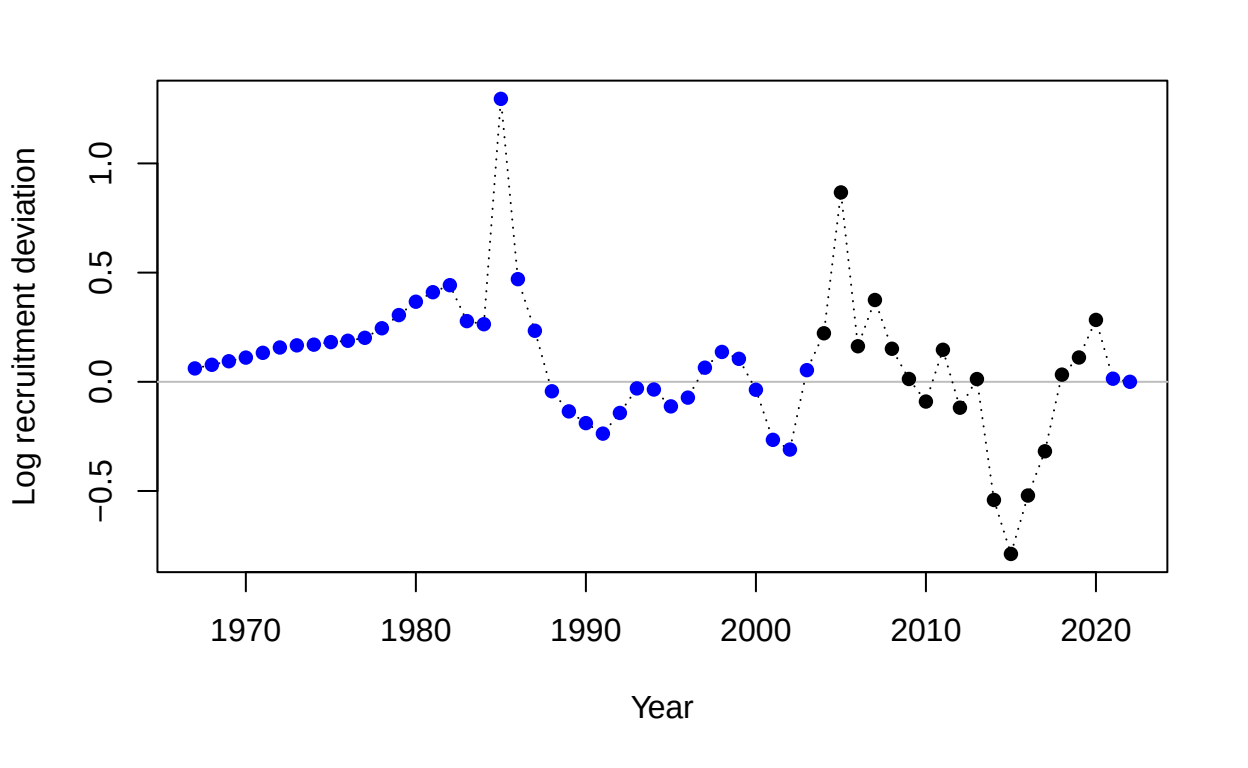

Summary biomass (mt)
0
5
10
15
1970
1980
1990
2000
2010
2020
Year

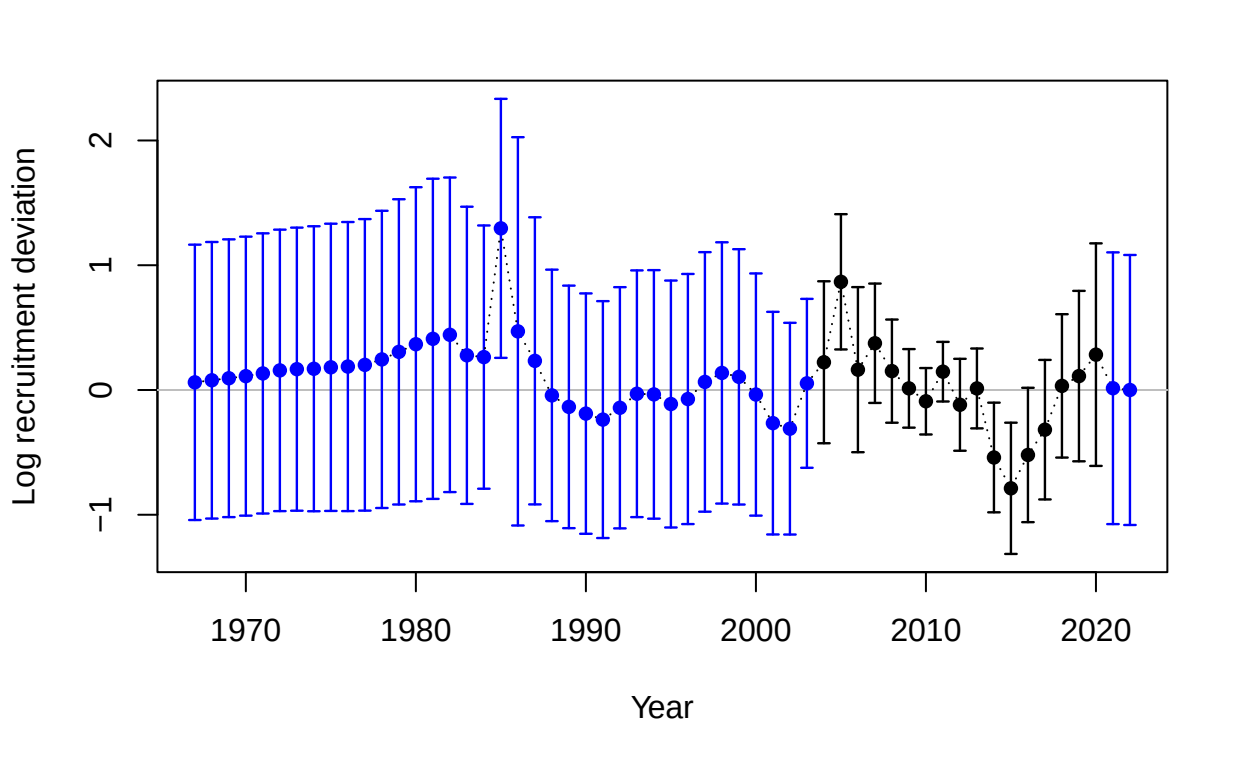

Age−0 recruits (1,000s)
0
10
20
30
40
50
60
70
1970
1980
1990
2000
2010
2020
Year

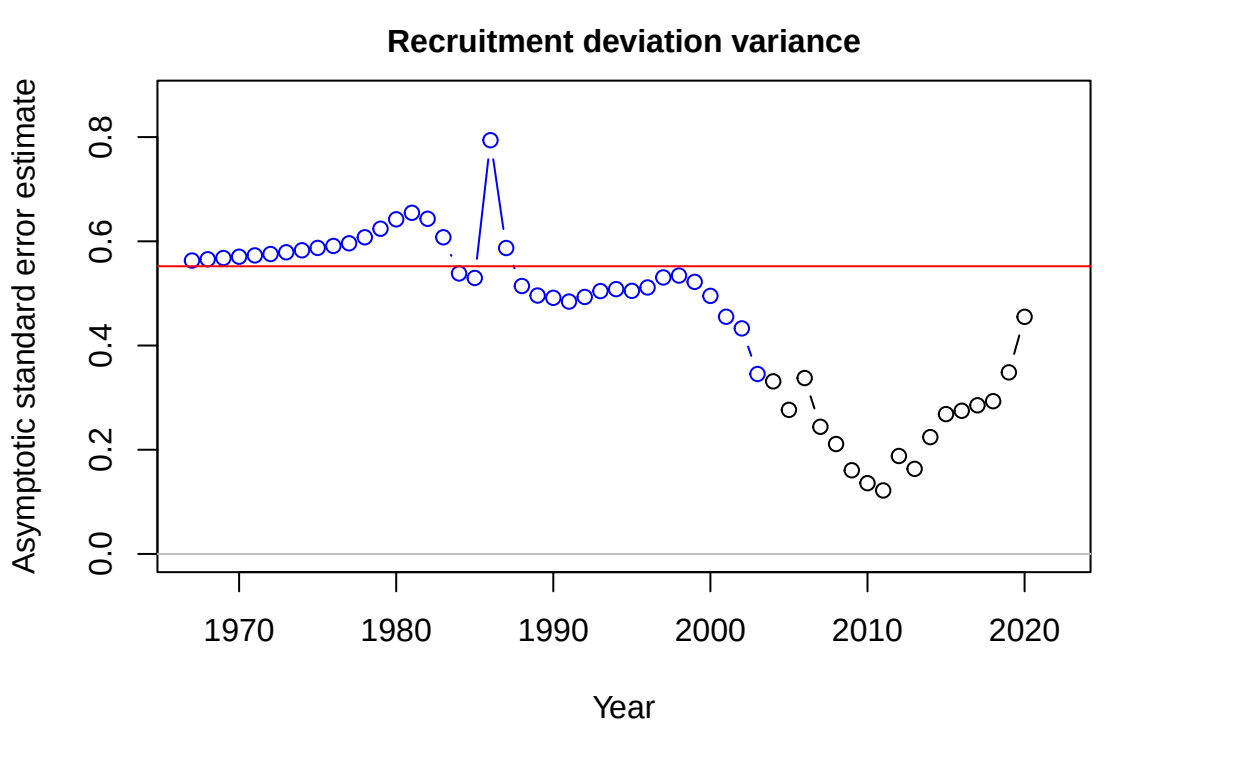

Age−0 recruits (1,000s)
0
50
100
150
1970
1980
1990
2000
2010
2020
Year

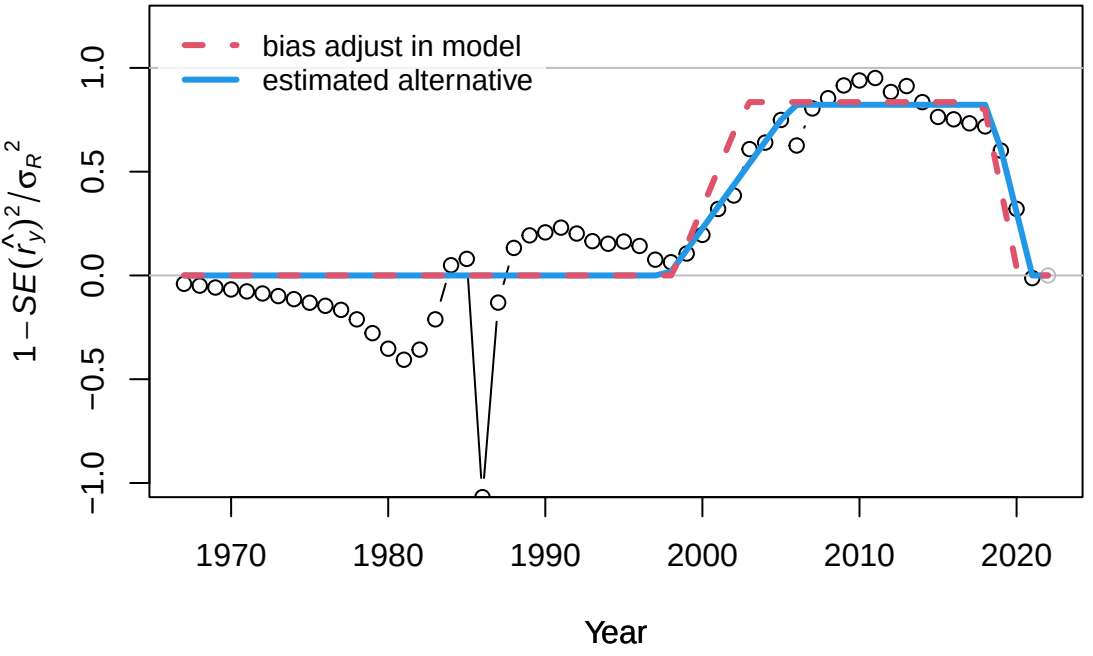

Summary Fishing Mortality
0.0
1.0
2.0
3.0
1970
1980
1990
2000
2010
2020
Year

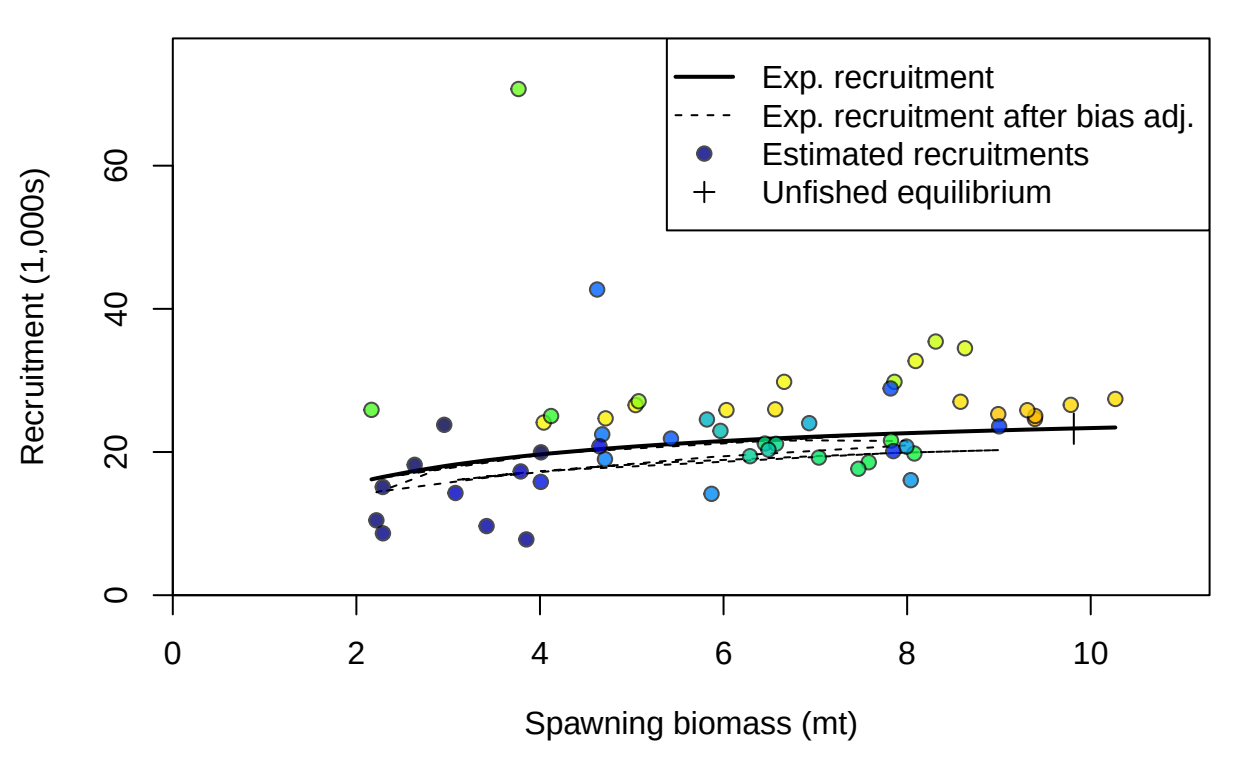

Spawning biomass (mt)
0
5
10
15
20
1970
1980
1990
2000
2010
2020
Year
equilibrium
without fishing
with fishing

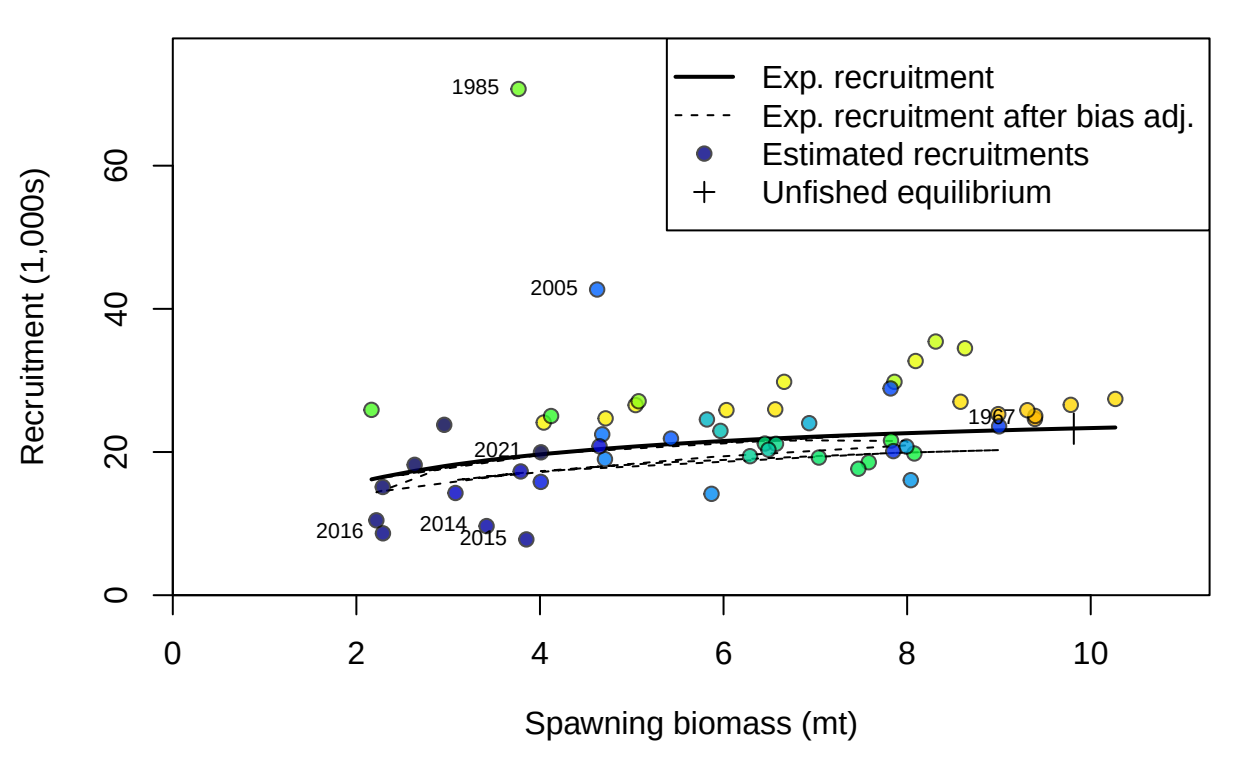

Log recruitment deviation
−0.5
0.0
0.5
1.0
1970
1980
1990
2000
2010
2020
Year

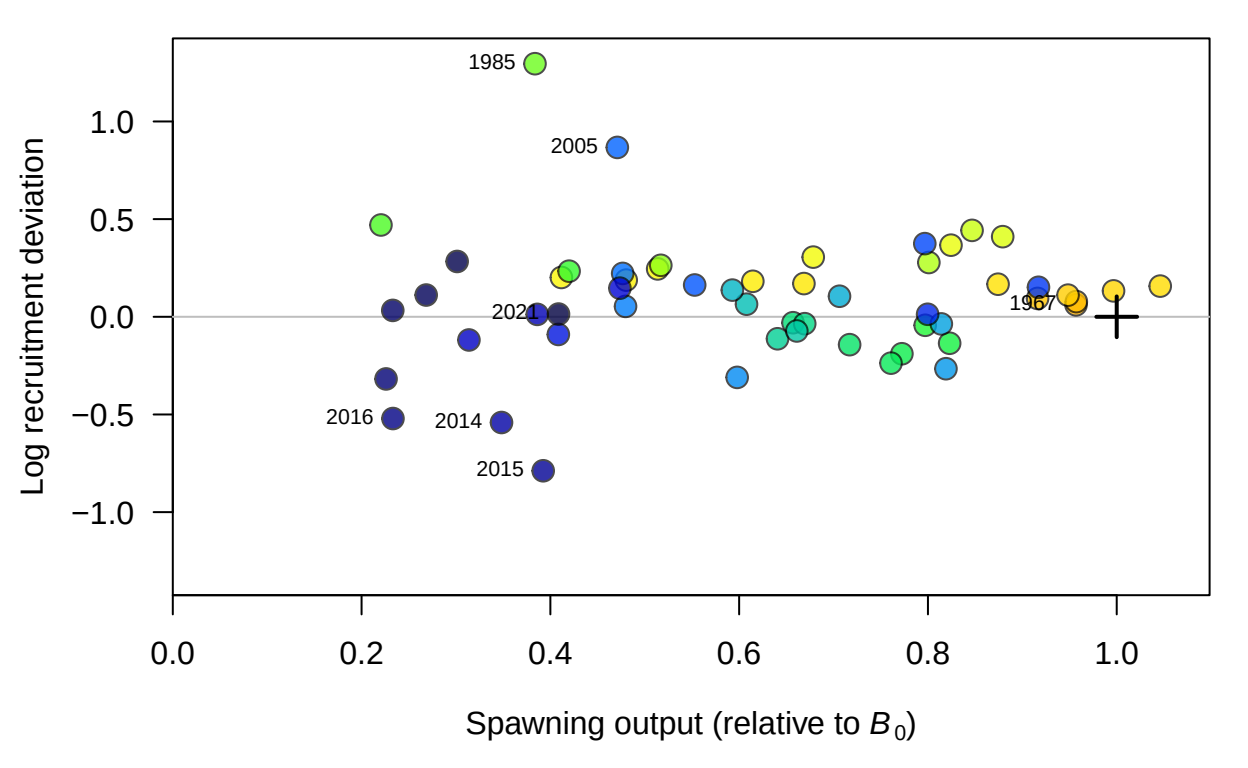

Log recruitment deviation
2
1
0
−1
1970
1980
1990
2000
2010
2020
Year

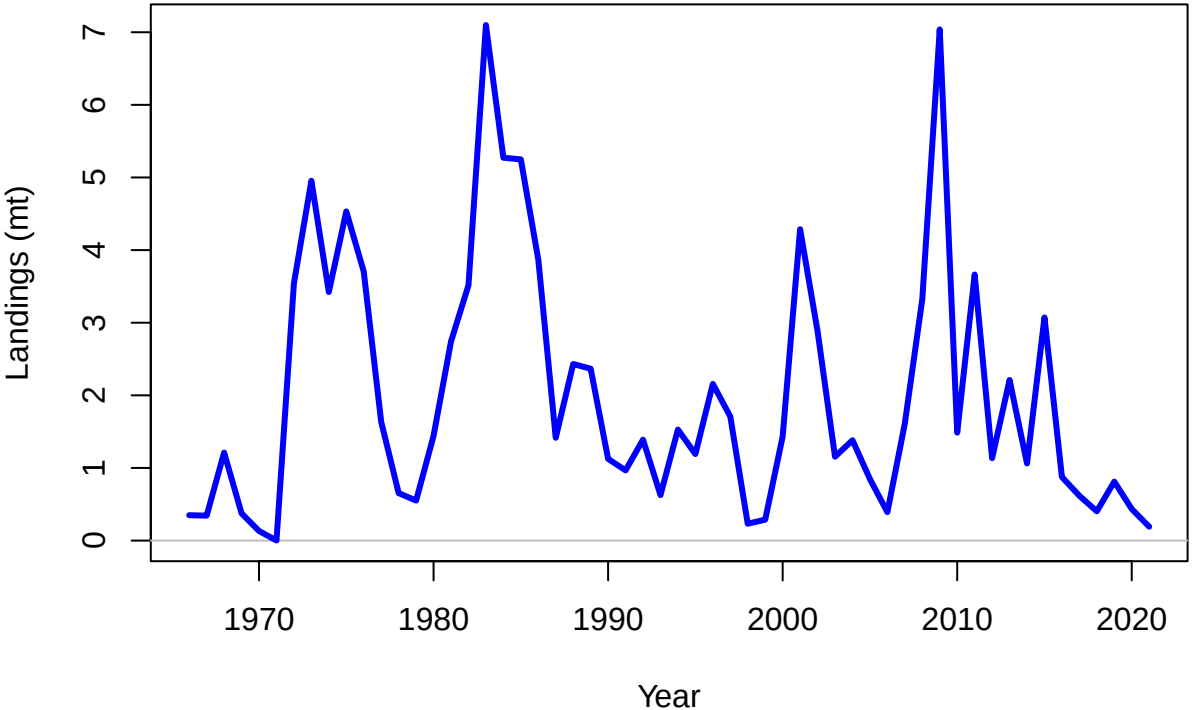

Recruitment deviation variance
Asymptotic standard error estimate
0.0
0.2
0.4
0.6
0.8
1970
1980
1990
2000
2010
2020
Year

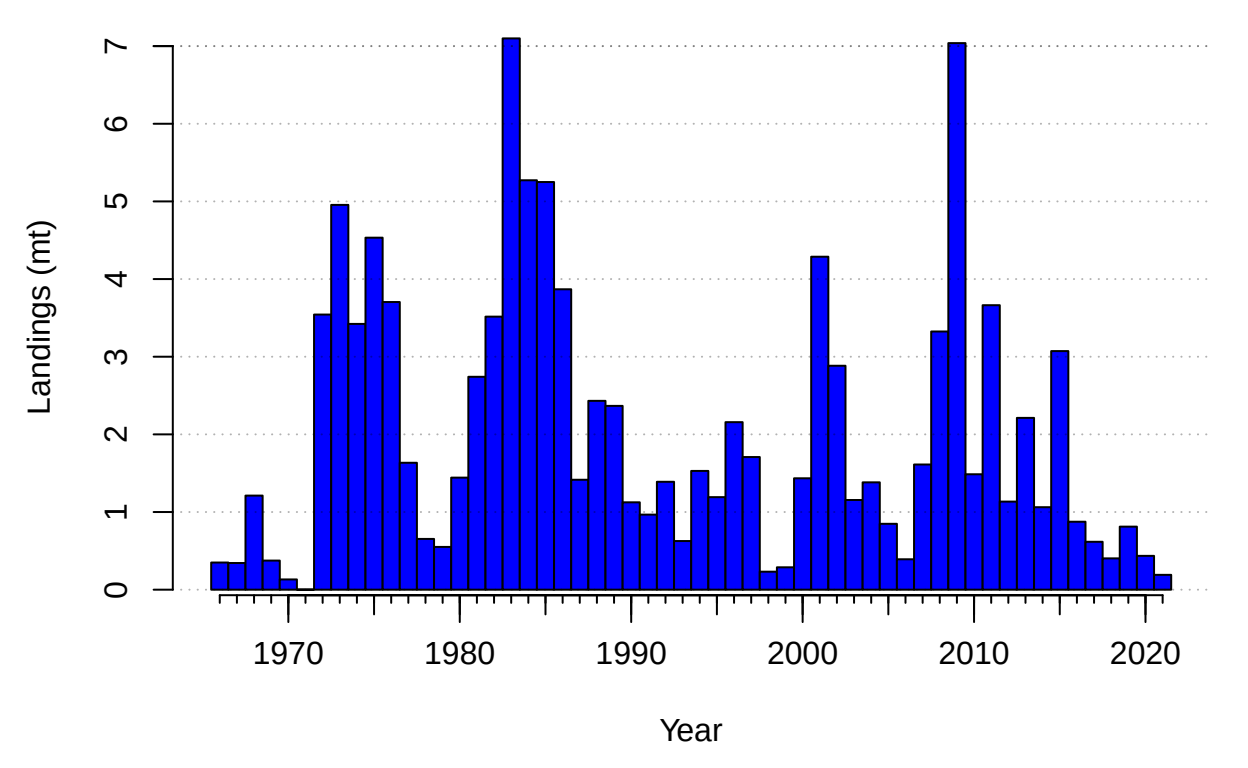

bias adjust in model
estimated alternative
1.0
0.5
0.0
−0.5
−1.0
$1-SE(\hat{r_y})^2/\sigma_R{}^2$
1970
1980
1990
2000
2010
2020
Year

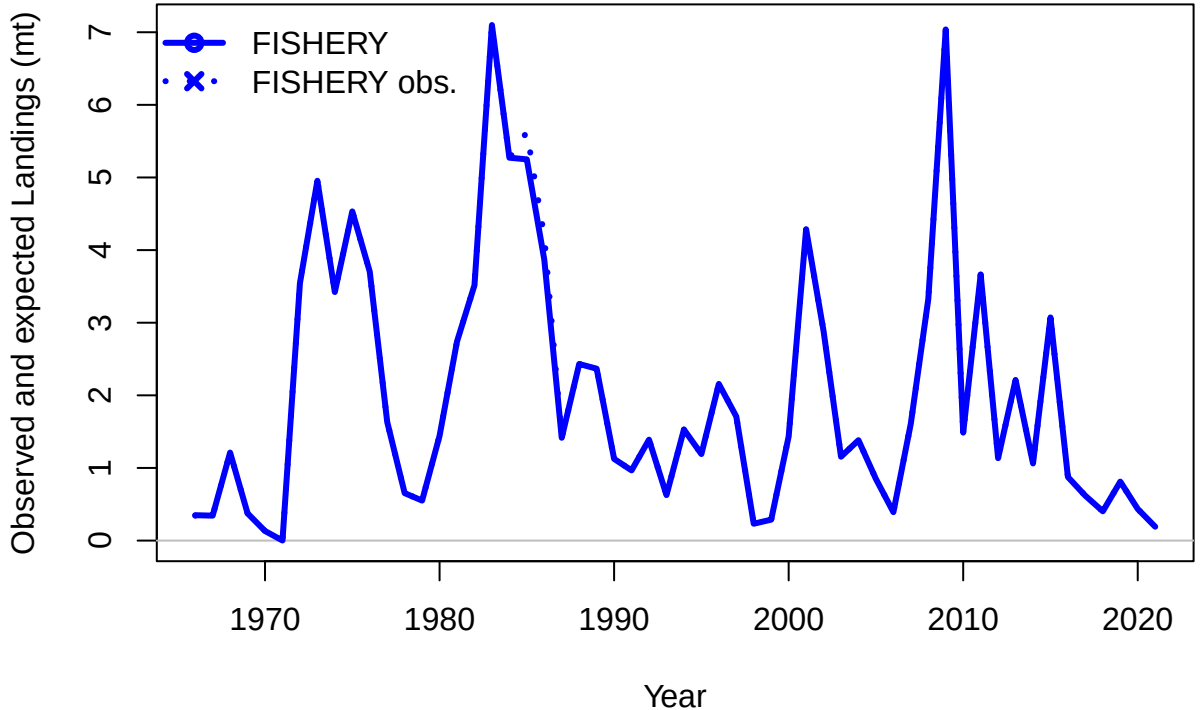

Exp. recruitment
Exp. recruitment after bias adj.
Estimated recruitments
Unfished equilibrium
Recruitment (1,000s)
0
20
40
60
0
2
4
6
8
10
Spawning biomass (mt)

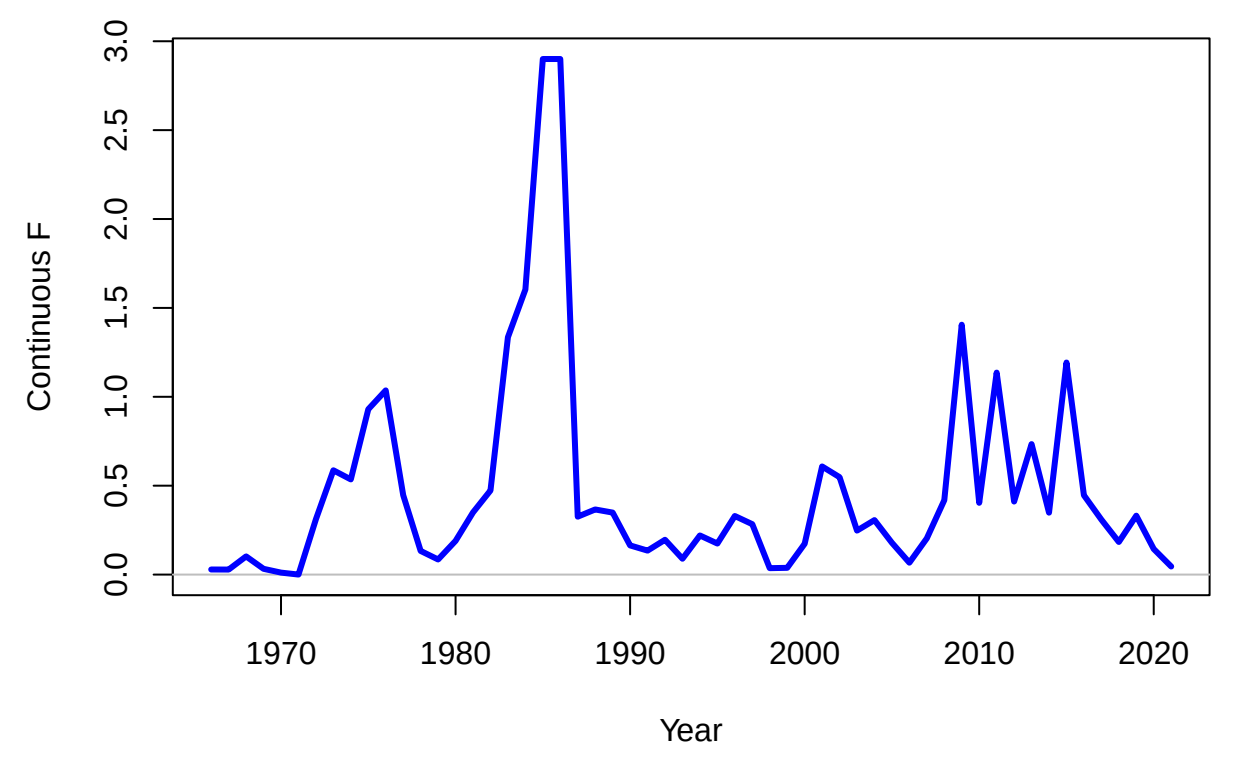

Exp. recruitment
Exp. recruitment after bias adj.
Estimated recruitments
Unfished equilibrium
1985
2005
1967
2021
2016
2014
2015
Recruitment (1,000s)
0
20
40
60
0
2
4
6
8
10
Spawning biomass (mt)

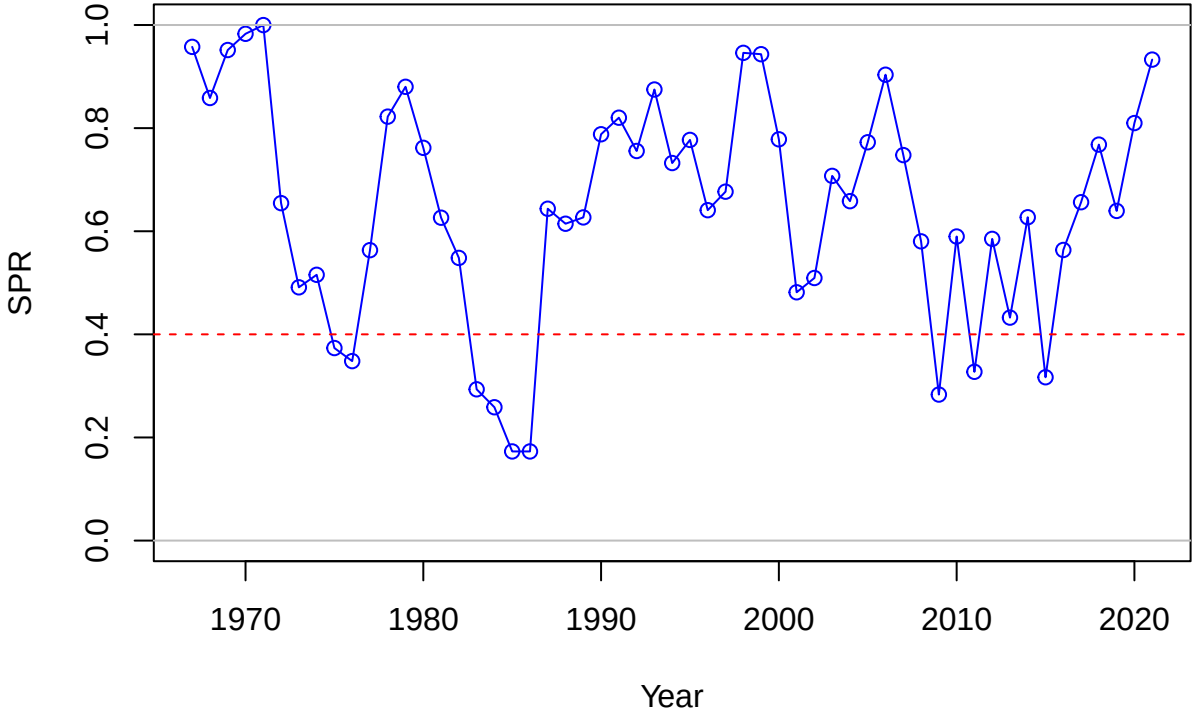

1985
2005
2021
1967
2016
2014
2015
1.0
0.5
0.0
−0.5
−1.0
Log recruitment deviation
0.0
0.2
0.4
0.6
0.8
1.0
Spawning output (relative to B_0)

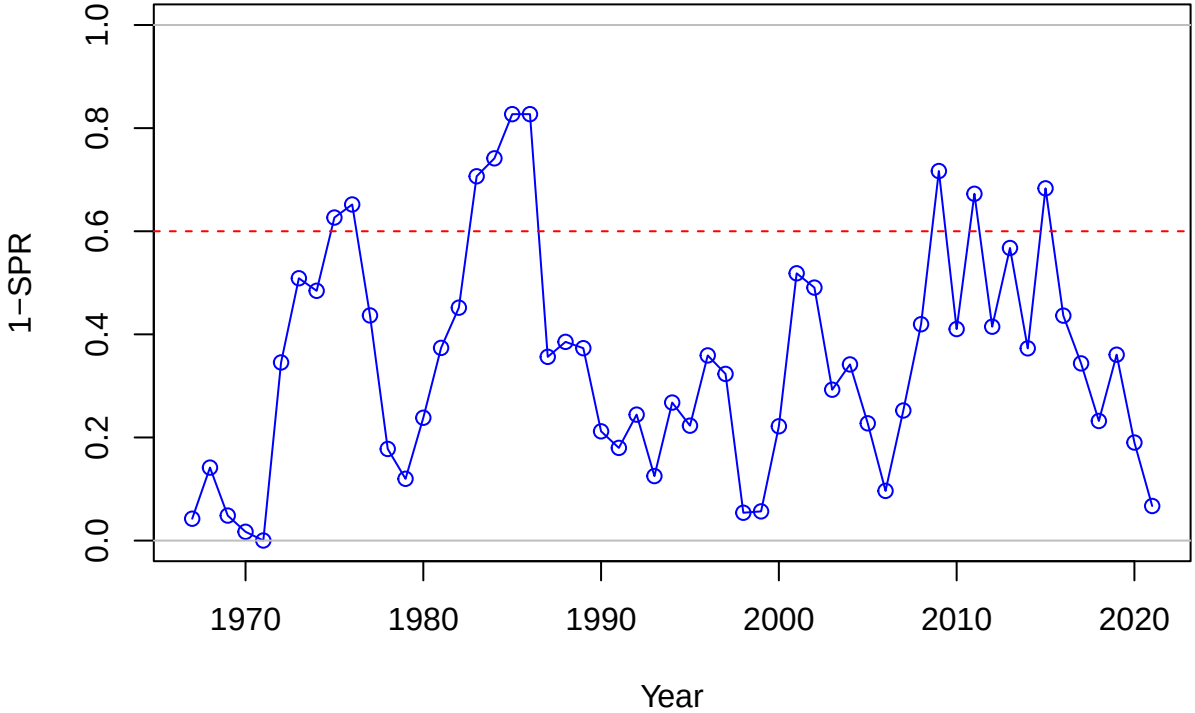

Landings (mt)
0
1
2
3
4
5
6
7
1970
1980
1990
2000
2010
2020
Year

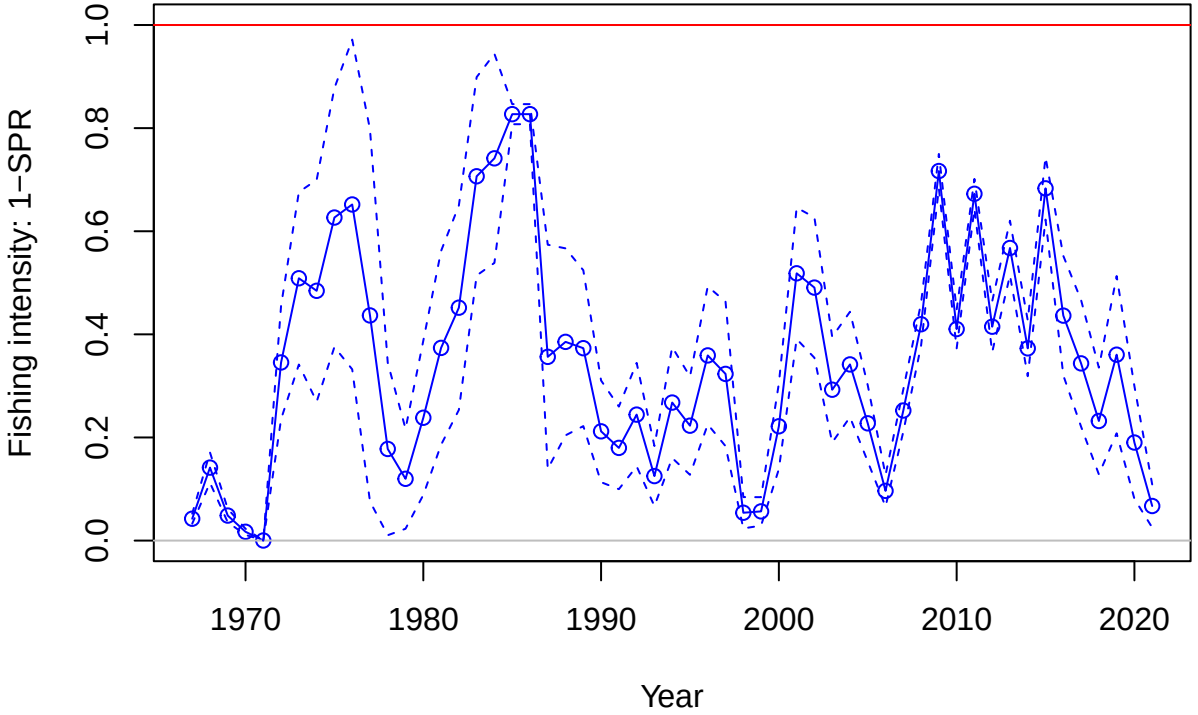

Landings (mt)
0
1
2
3
4
5
6
7
1970
1980
1990
2000
2010
2020
Year

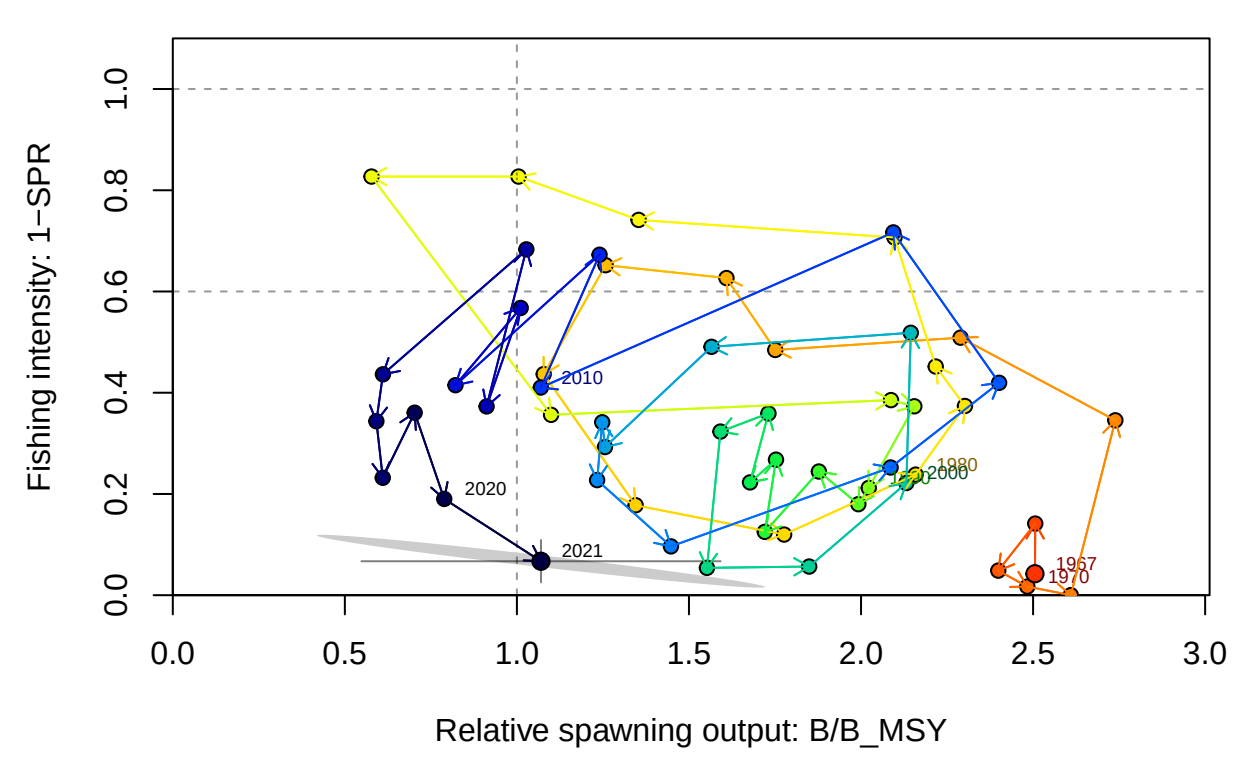

FISHERY
FISHERY obs.
Observed and expected Landings (mt)
0
1
2
3
4
5
6
7
1970
1980
1990
2000
2010
2020
Year

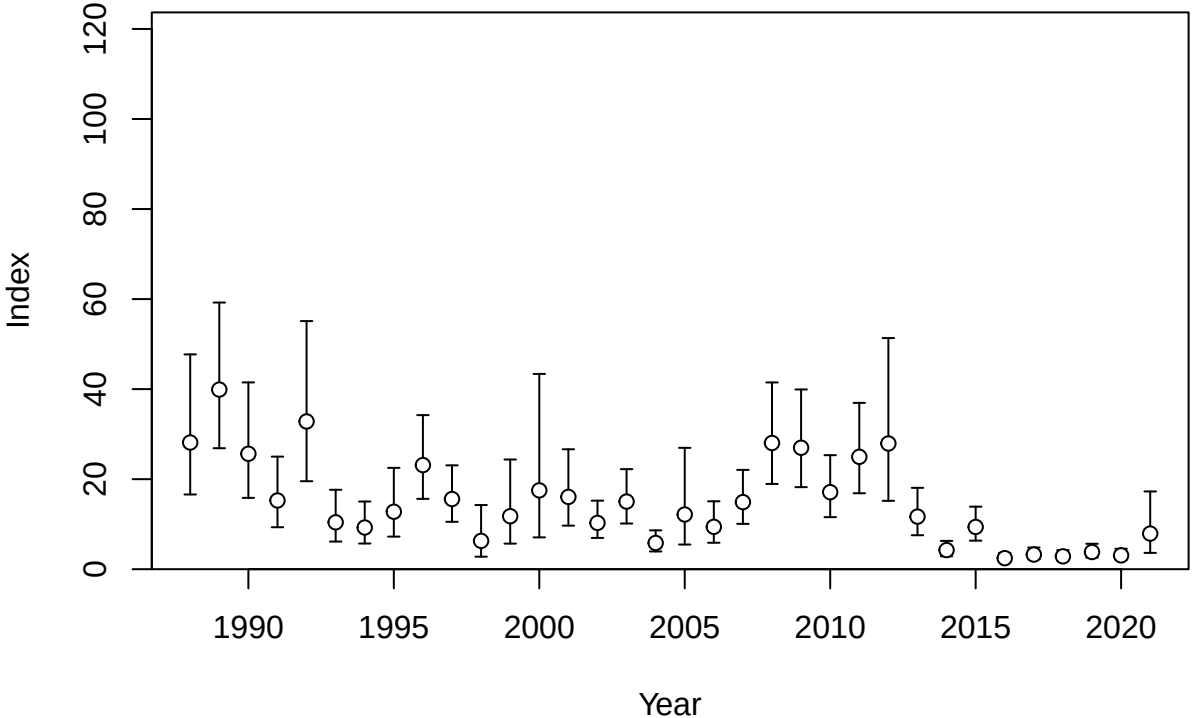

Continuous F
0.0
0.5
1.0
1.5
2.0
2.5
3.0
1970
1980
1990
2000
2010
2020
Year

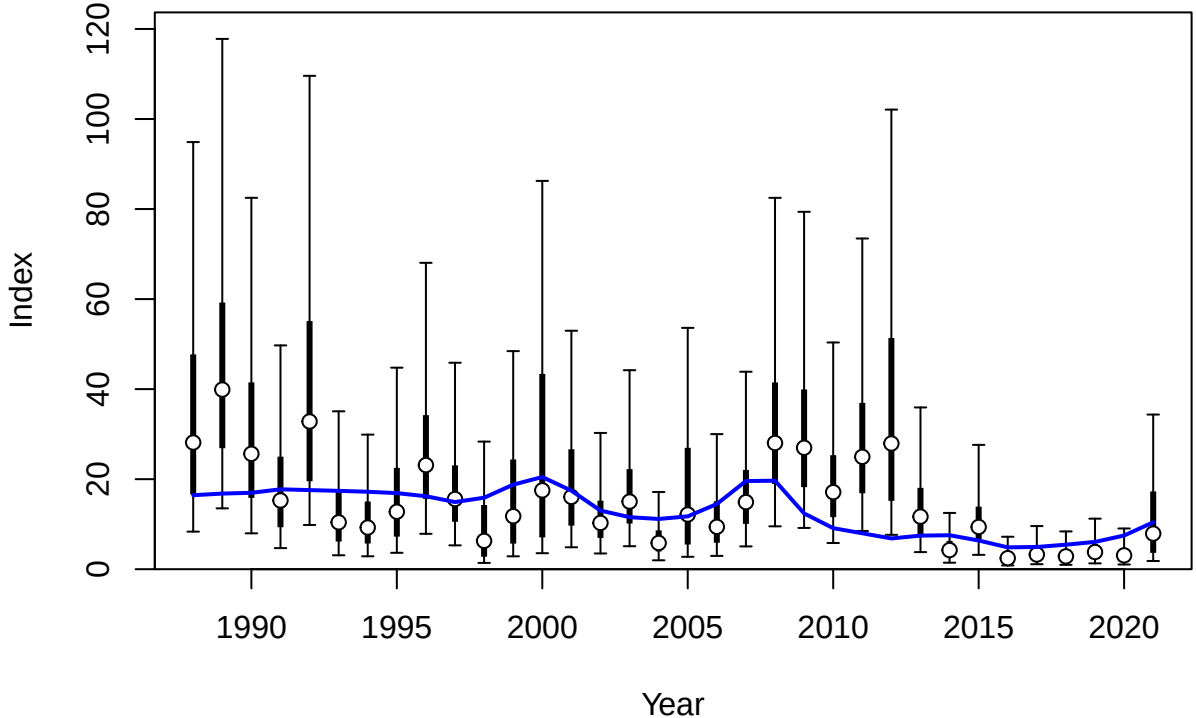

SPR
0.0
0.2
0.4
0.6
0.8
1.0
1970
1980
1990
2000
2010
2020
Year

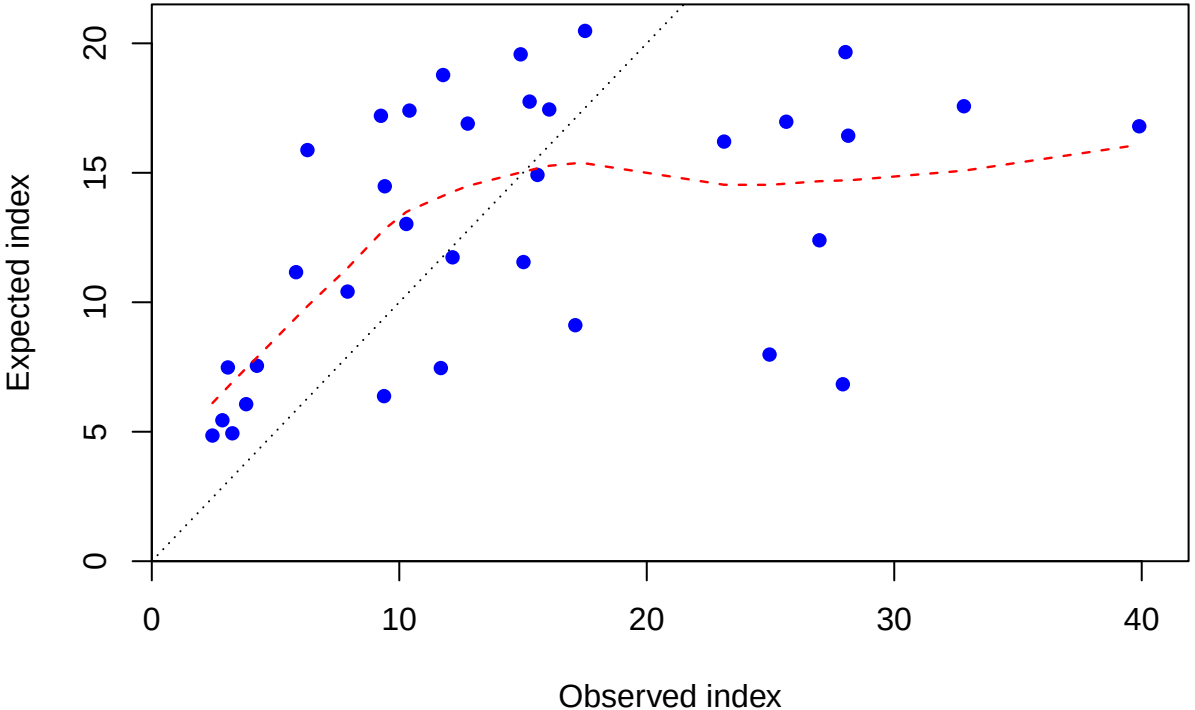

1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
1970
1980
1990
2000
2010
2020
Year

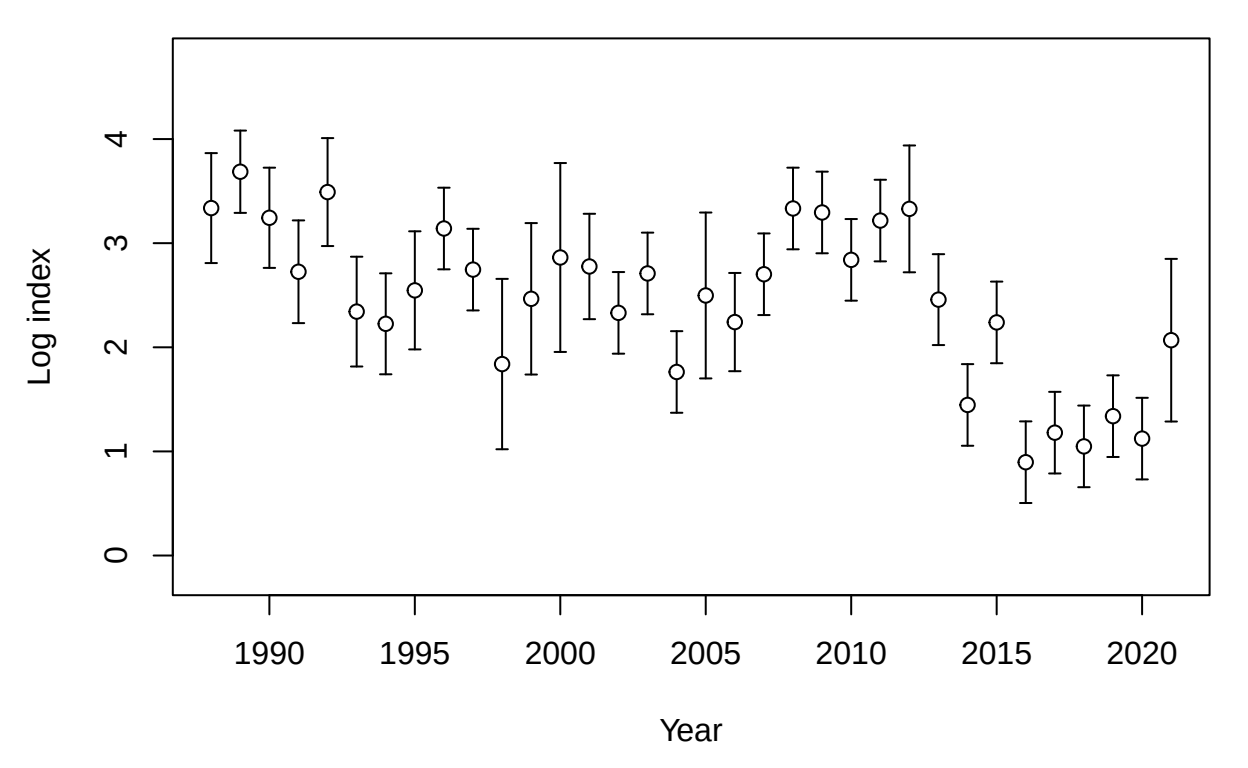

Fishing intensity: 1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
1970
1980
1990
2000
2010
2020
Year

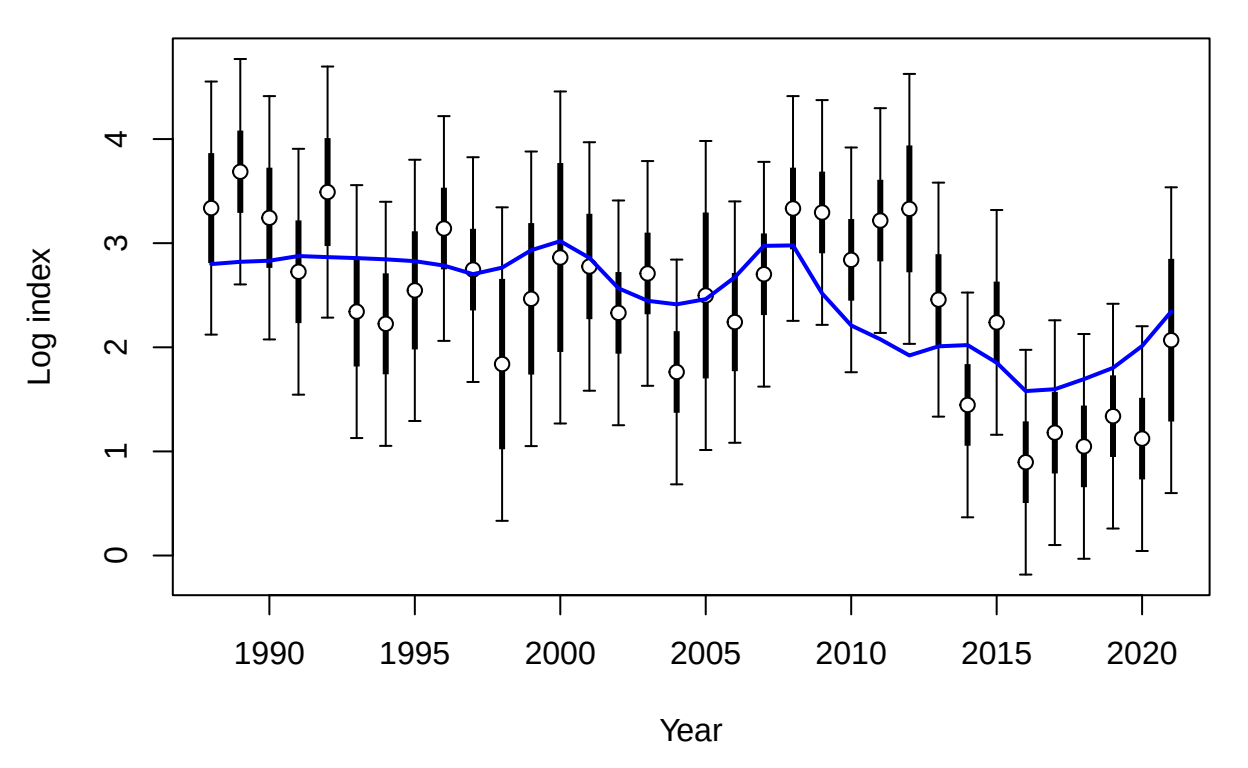

Fishing intensity: 1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
Relative spawning output: B/B_MSY
2010
2020
2021
1980
2000
1967
1970

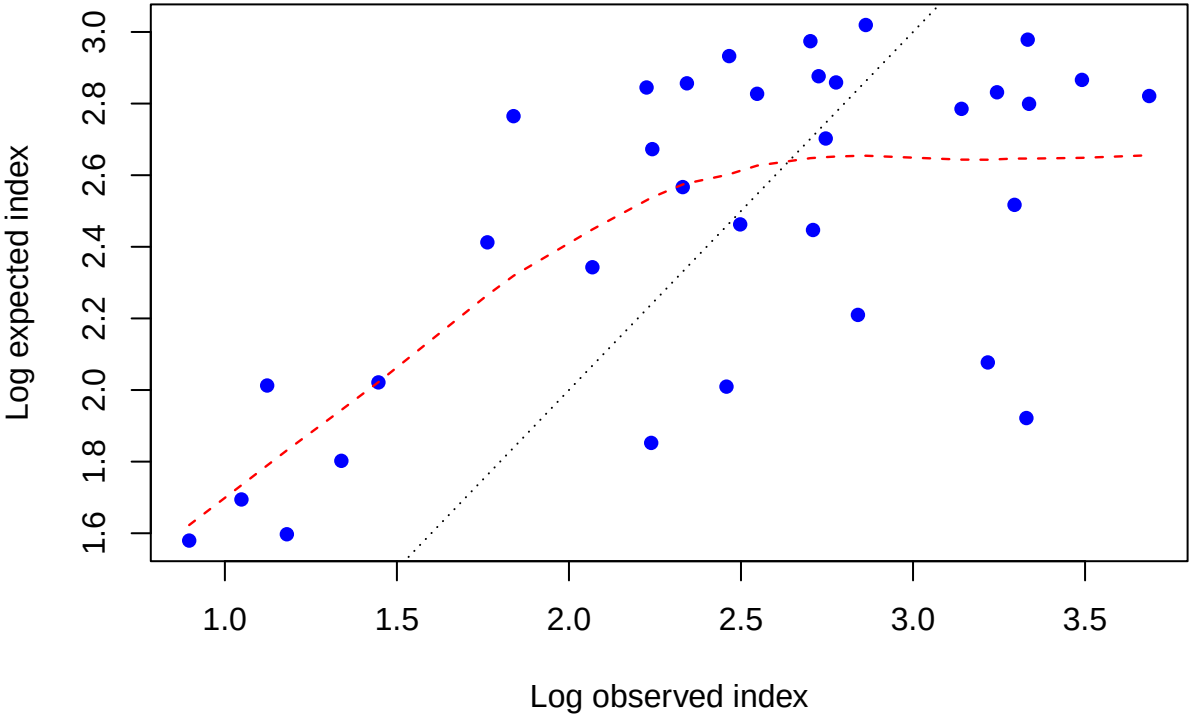

Index
0
20
40
60
80
100
120
1990
1995
2000
2005
2010
2015
2020
Year

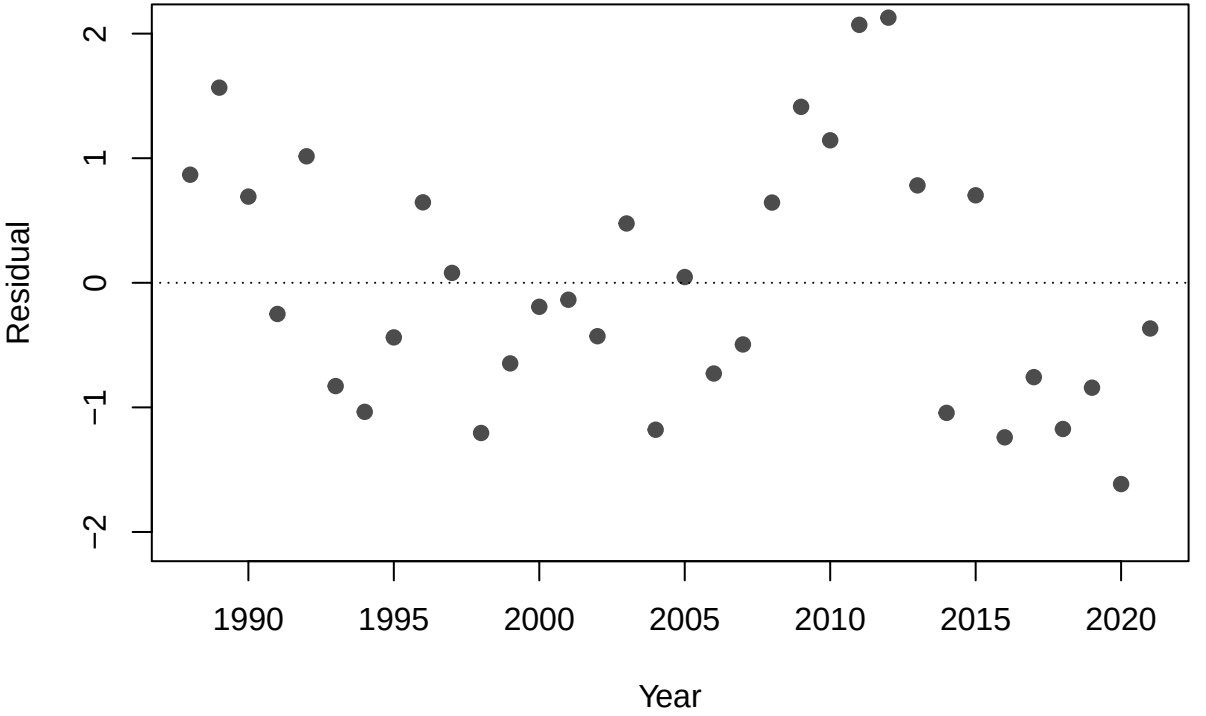

Index
0
20
40
60
80
100
120
1990
1995
2000
2005
2010
2015
2020
Year

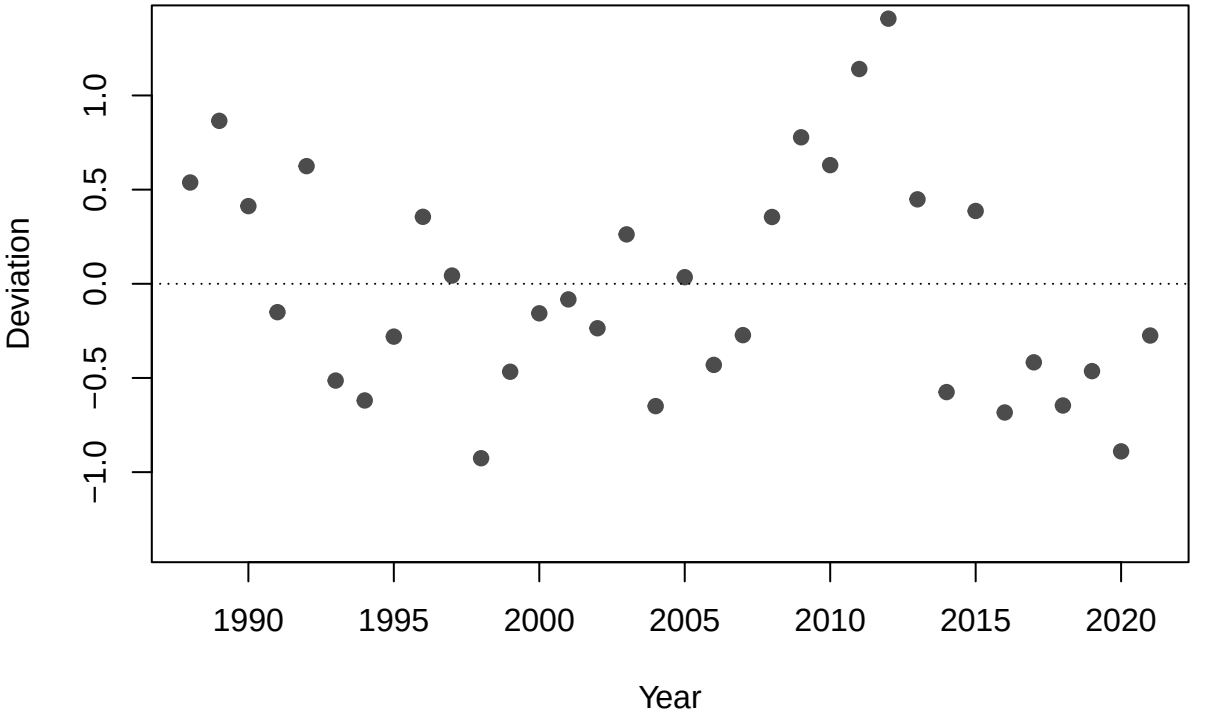

Expected index
0
5
10
15
20
0
10
20
30
40
Observed index

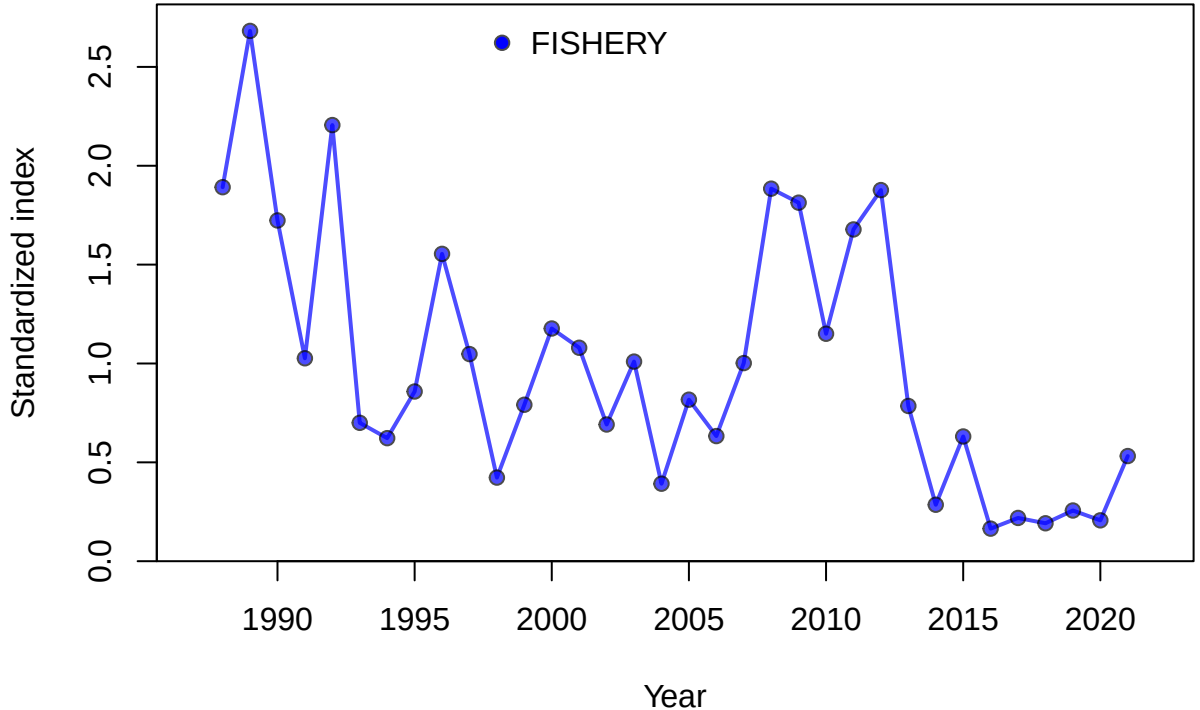

Log index
0
1
2
3
4
1990
1995
2000
2005
2010
2015
2020
Year

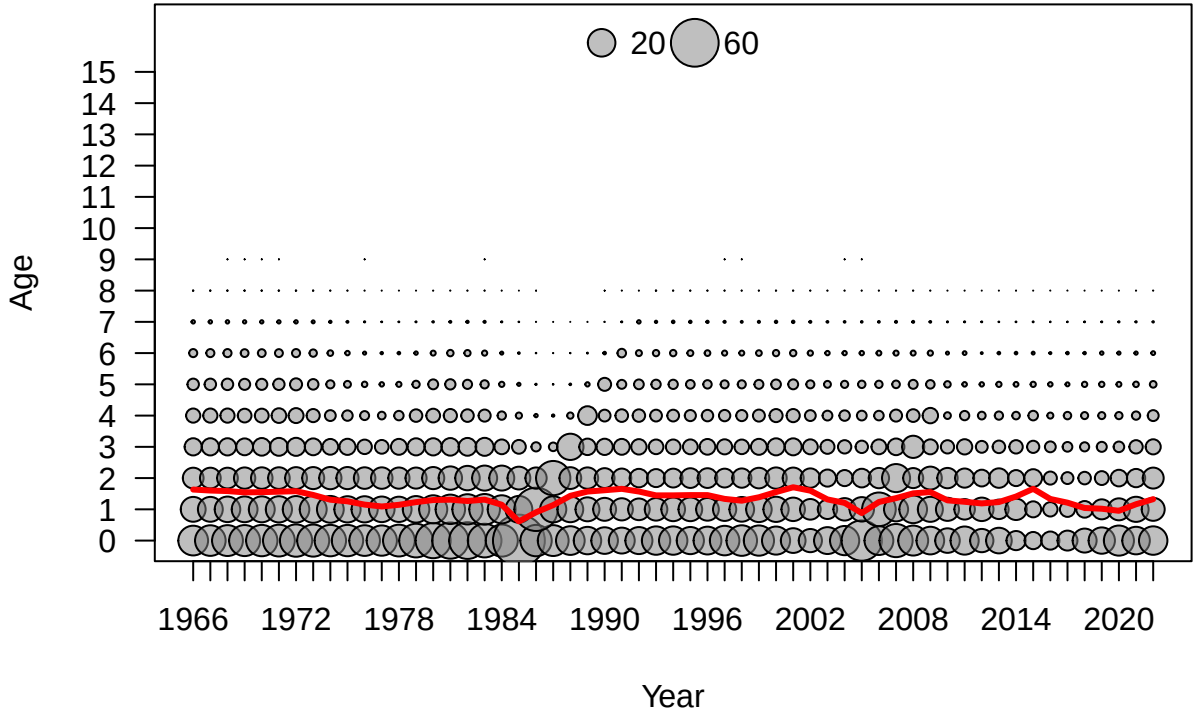

Log index
0
1
2
3
4
1990
1995
2000
2005
2010
2015
2020
Year

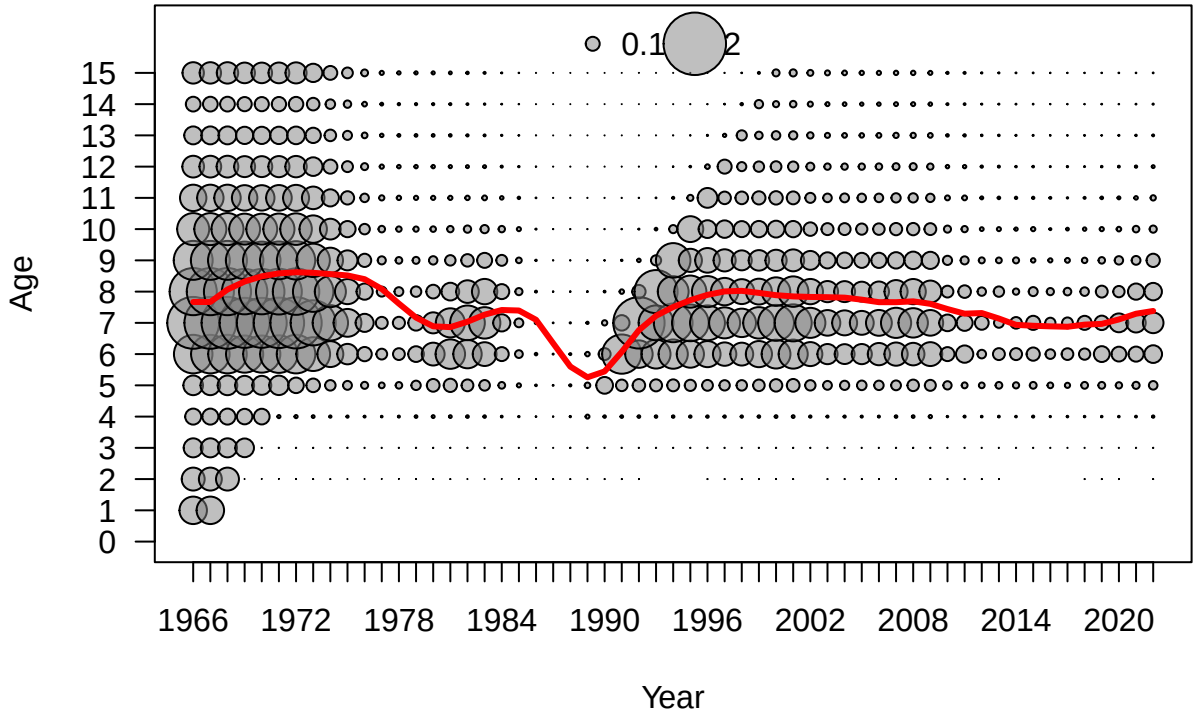

Log expected index
1.6
1.8
2.0
2.2
2.4
2.6
2.8
3.0
1.0
1.5
2.0
2.5
3.0
3.5
Log observed index

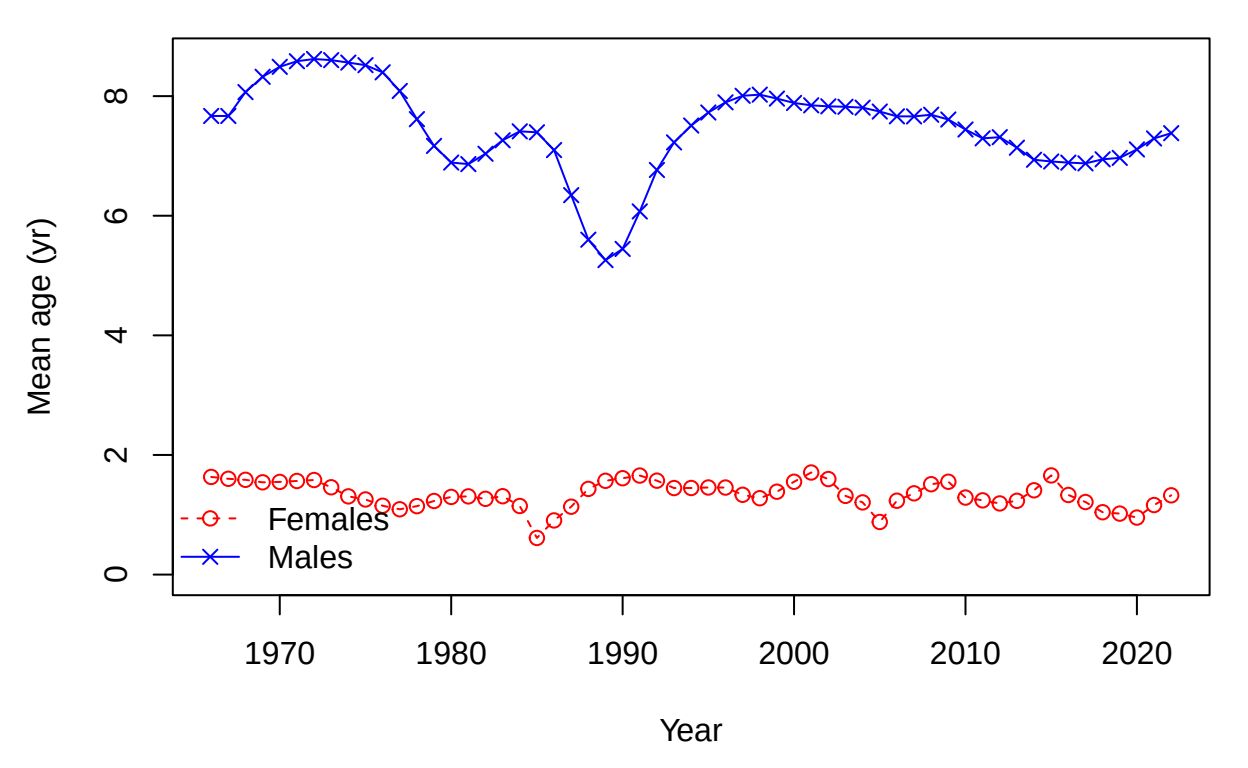

Residual
2
1
0
−1
−2
1990
1995
2000
2005
2010
2015
2020
Year

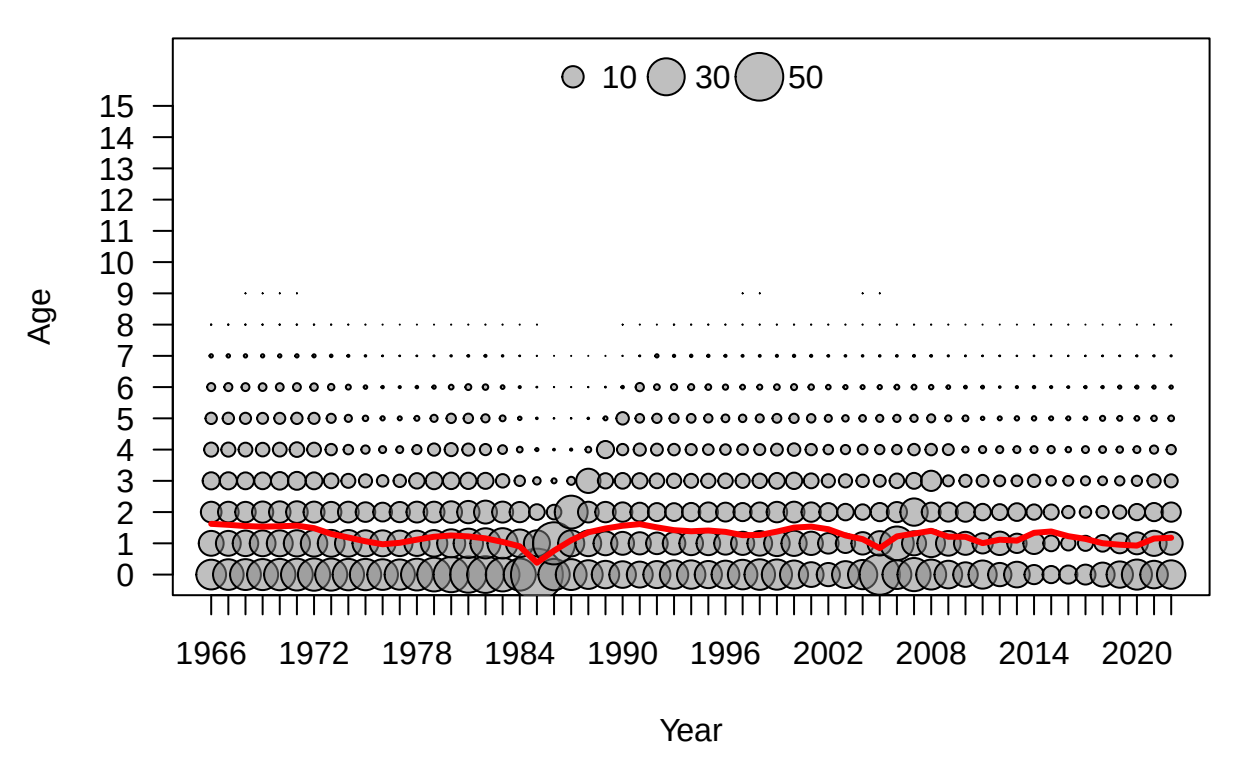

Deviation
1.0
0.5
0.0
−0.5
−1.0
1990
1995
2000
2005
2010
2015
2020
Year

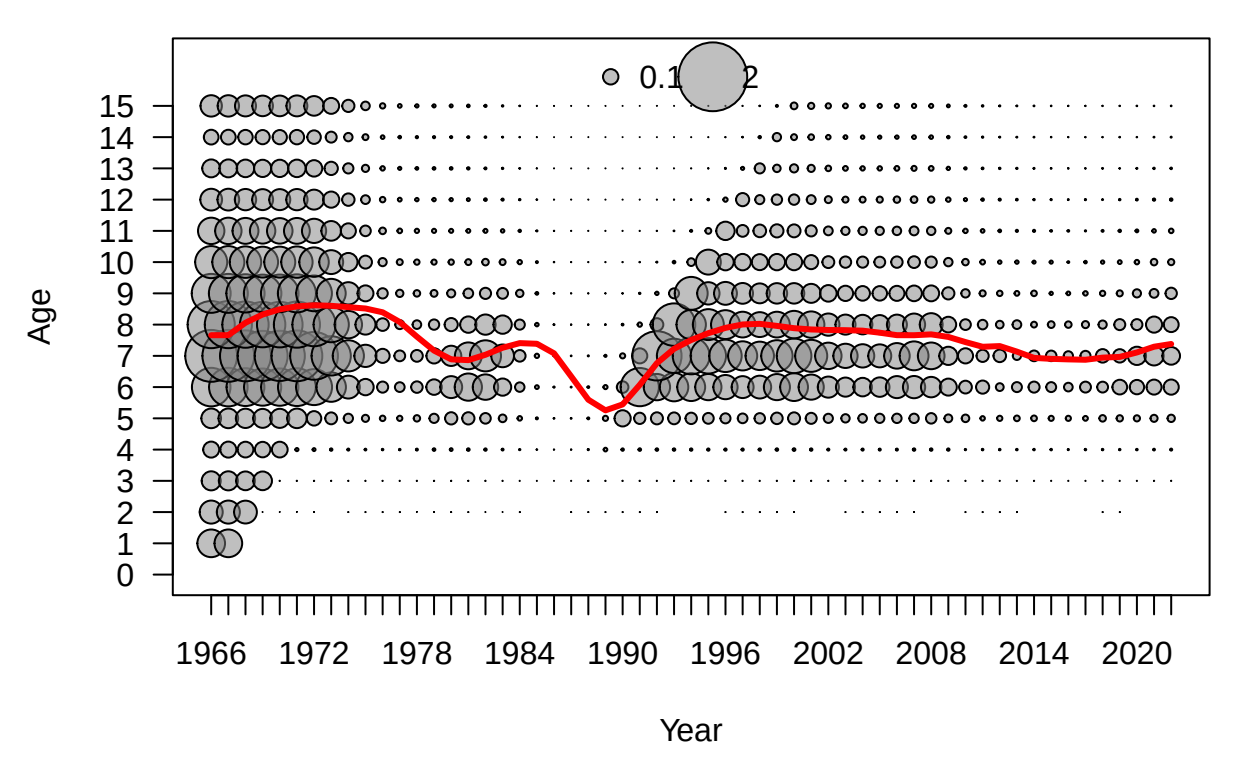

FISHERY
Standardized index
0.0
0.5
1.0
1.5
2.0
2.5
1990
1995
2000
2005
2010
2015
2020
Year

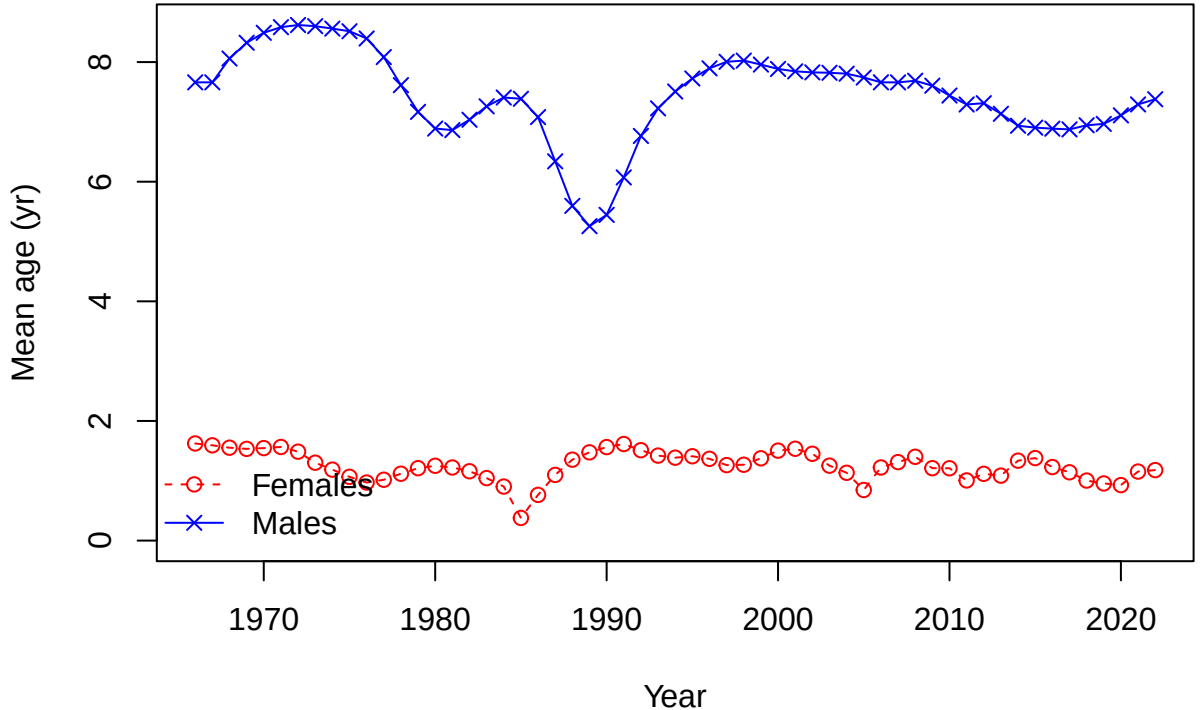

20
60
Age
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
1966
1972
1978
1984
1990
1996
2002
2008
2014
2020
Year

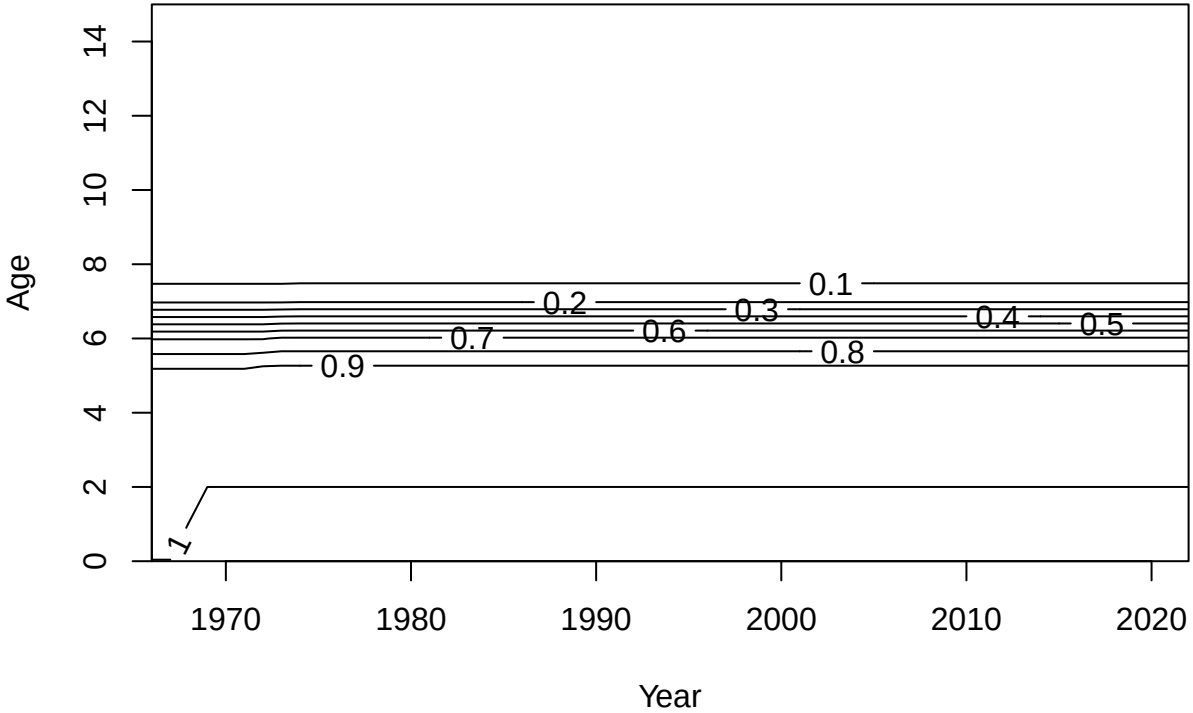

0.1
2
Age
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
1966
1972
1978
1984
1990
1996
2002
2008
2014
2020
Year

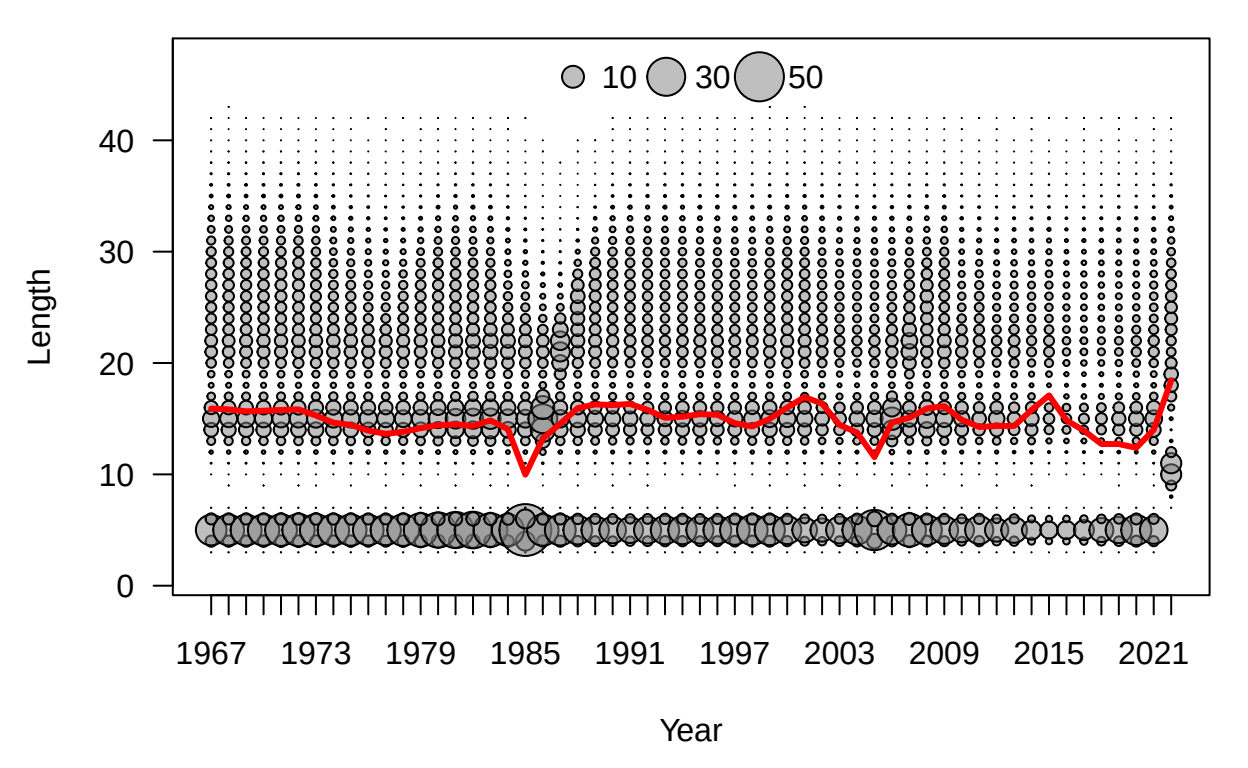

Mean age (yr)
0
2
4
6
8
1970
1980
1990
2000
2010
2020
Year
Females
Males

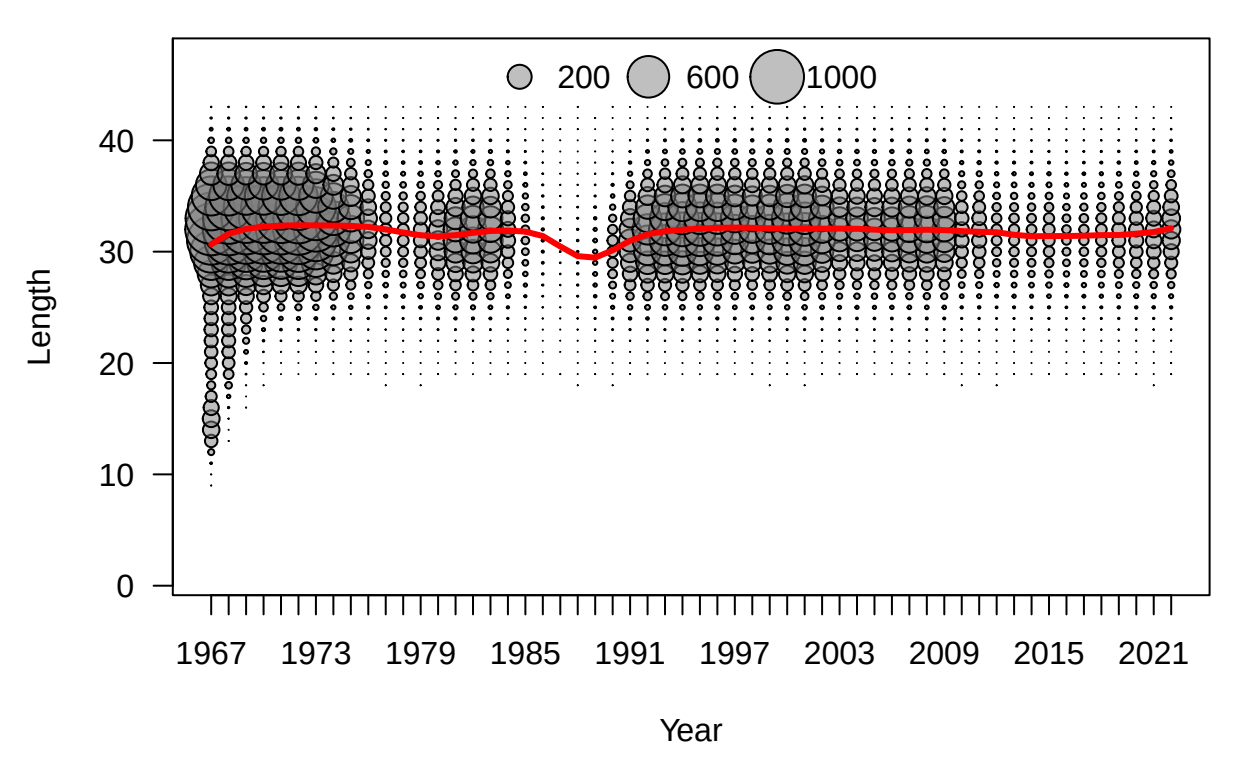

10
30
50
Age
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
1966
1972
1978
1984
1990
1996
2002
2008
2014
2020
Year

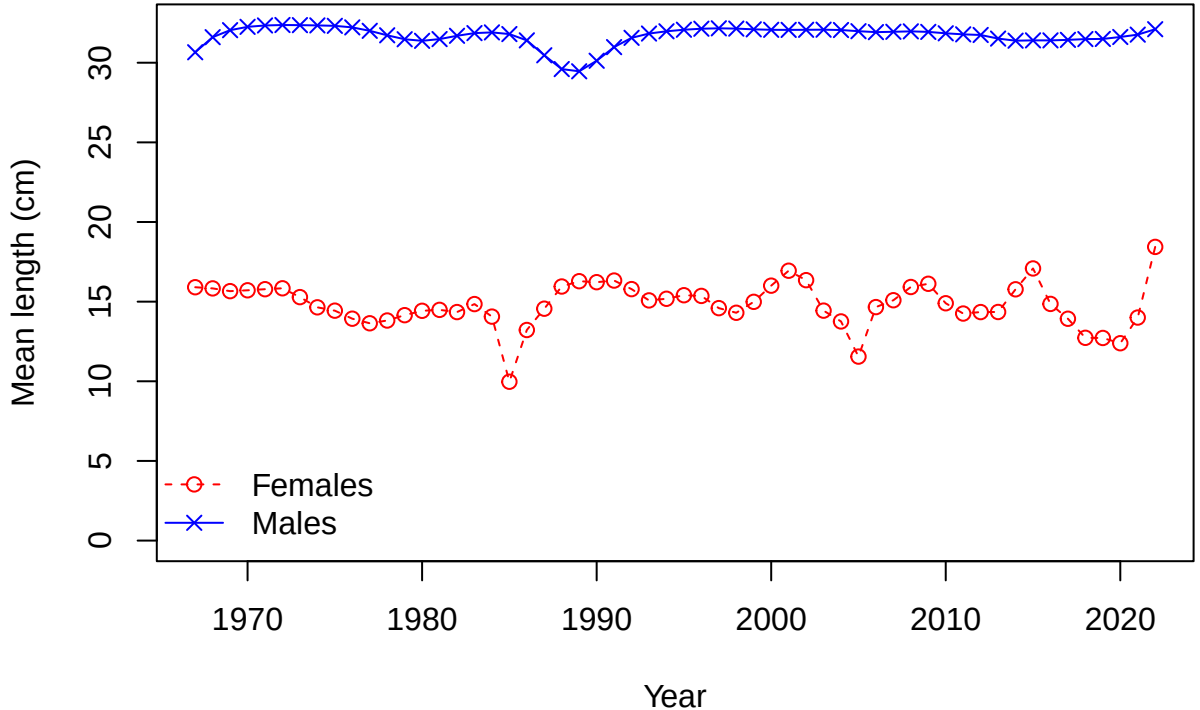

0.1
2
Age
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
1966
1972
1978
1984
1990
1996
2002
2008
2014
2020
Year

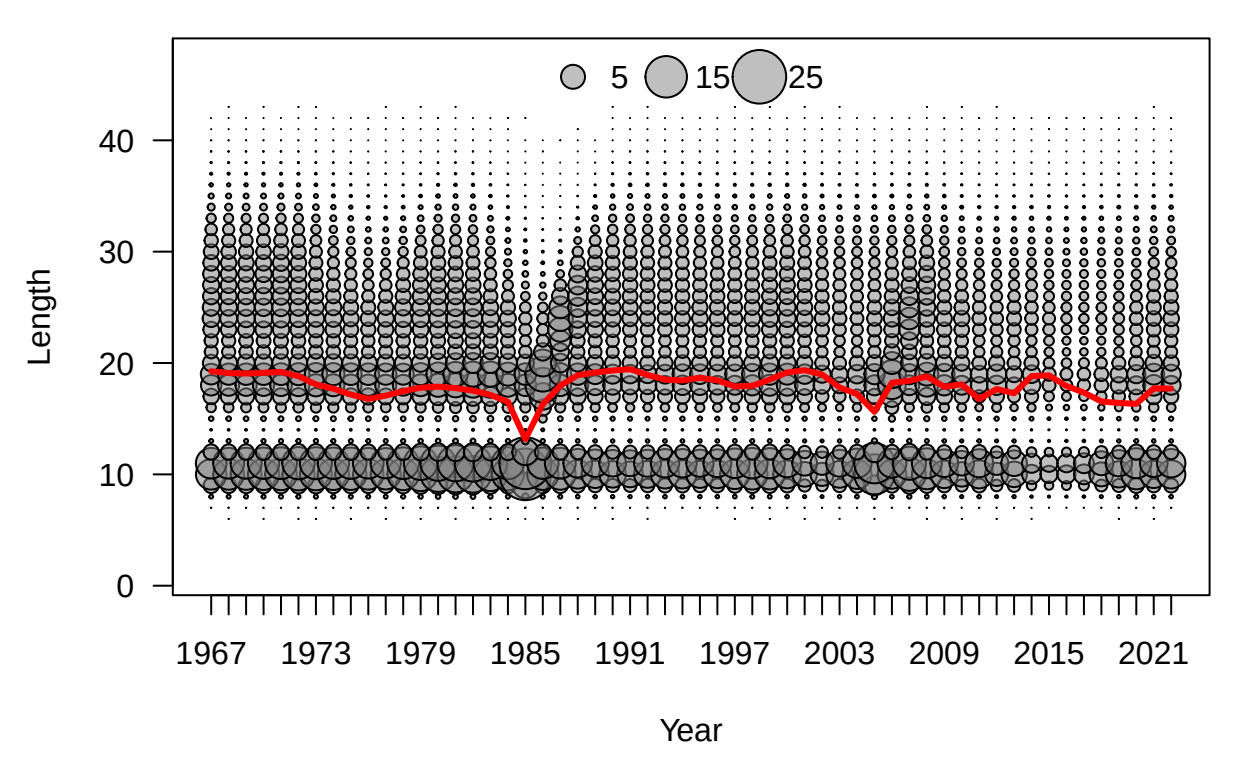

Mean age (yr)
0
2
4
6
8
1970
1980
1990
2000
2010
2020
Year
Females
Males

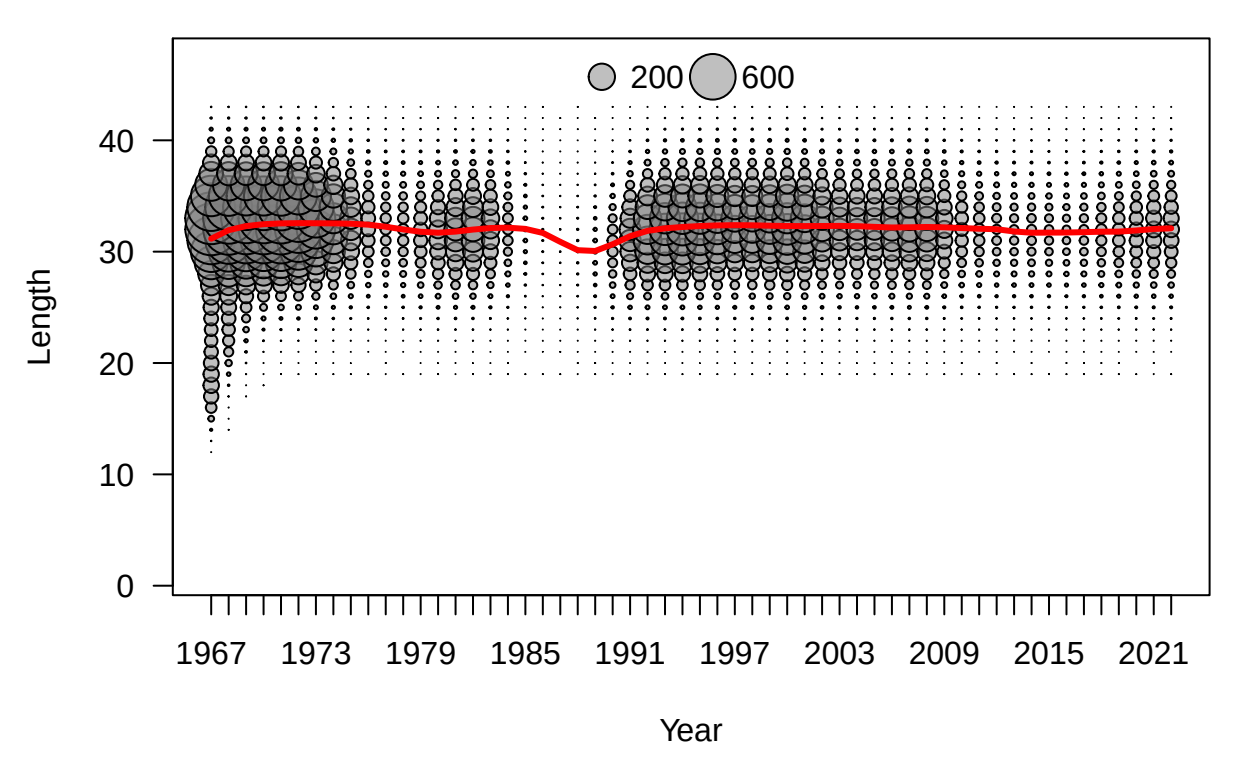

Age
0
2
4
6
8
10
12
14
1970
1980
1990
2000
2010
2020
Year
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

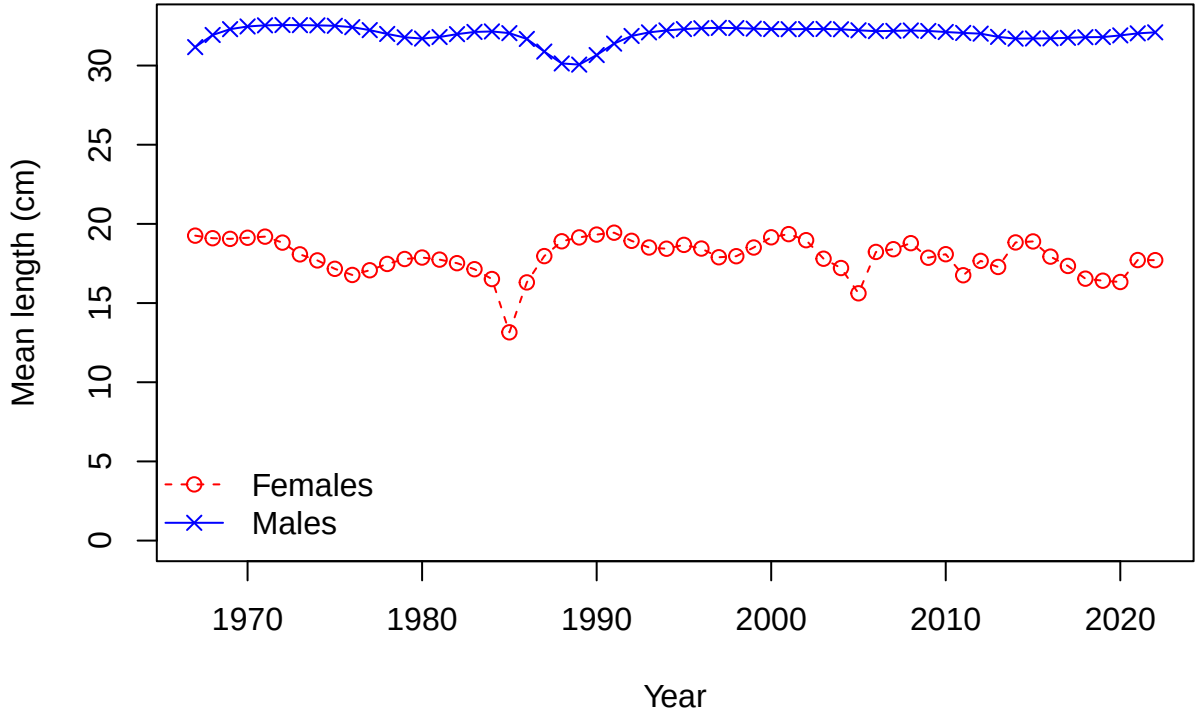

10
30
50
Length
0
10
20
30
40
1967
1973
1979
1985
1991
1997
2003
2009
2015
2021
Year

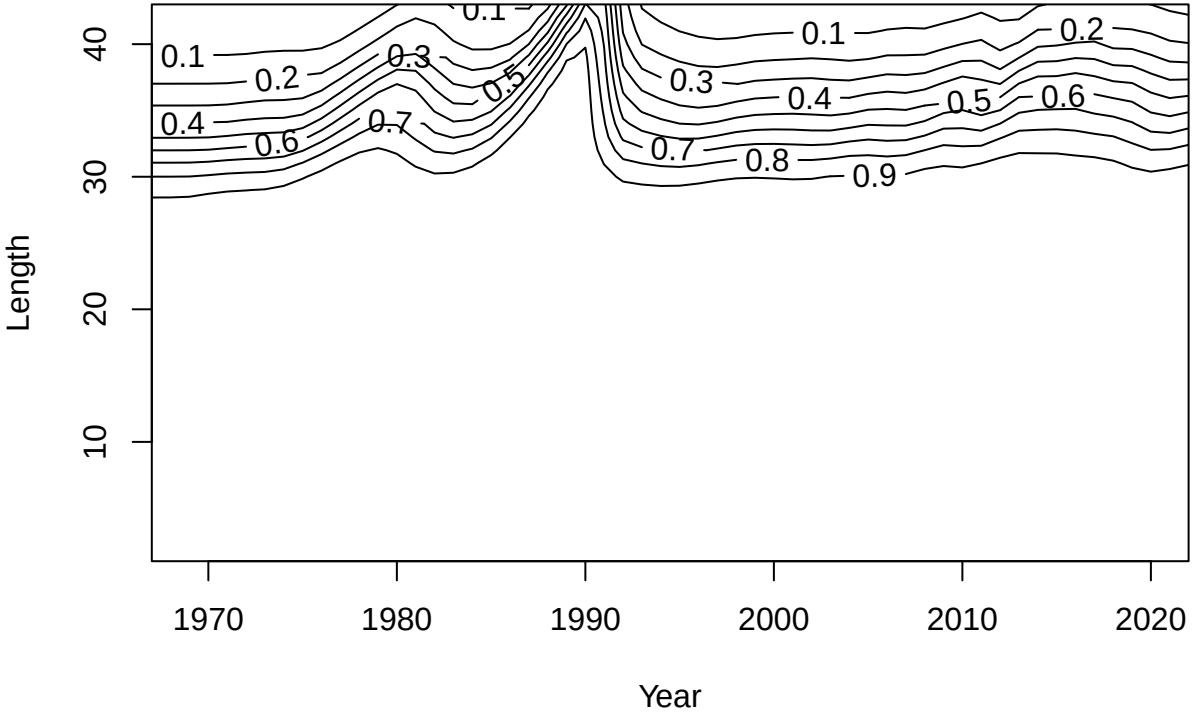

200
600
1000
Length
0
10
20
30
40
1967
1973
1979
1985
1991
1997
2003
2009
2015
2021
Year

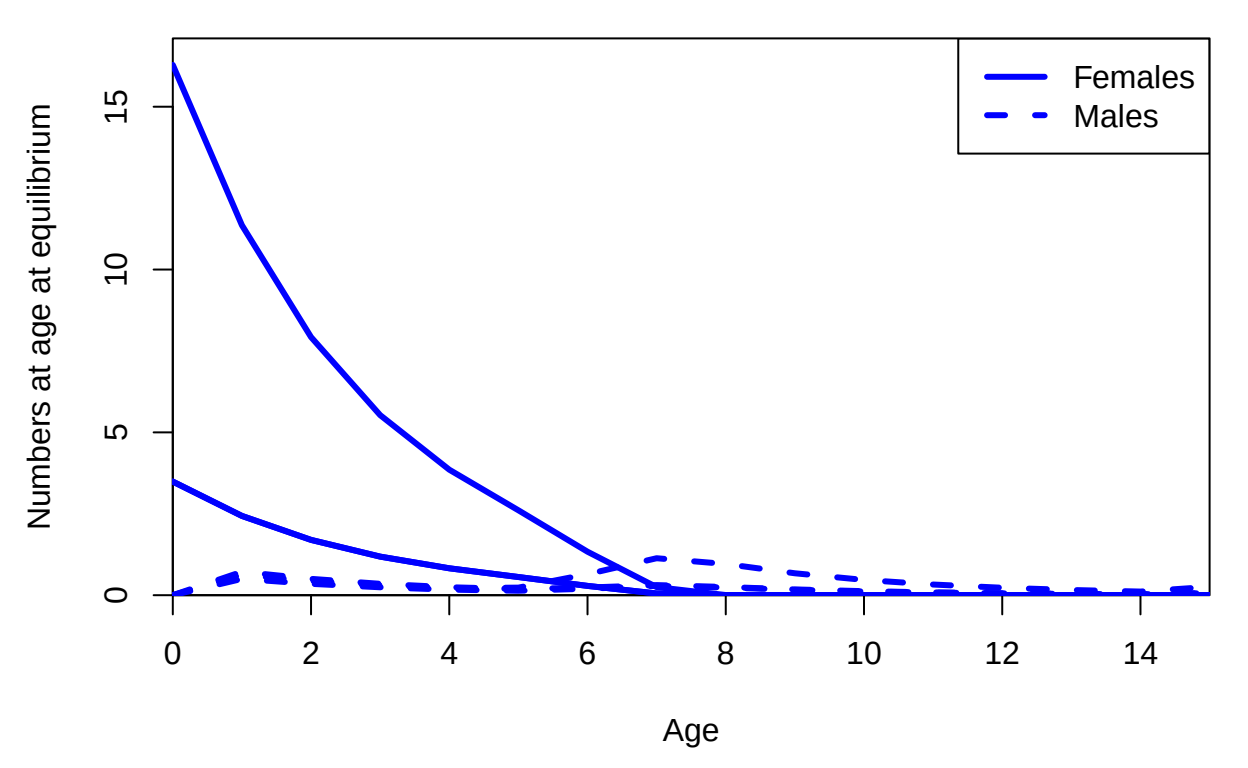

Mean length (cm)
0
5
10
15
20
25
30
1970
1980
1990
2000
2010
2020
Year
Females
Males

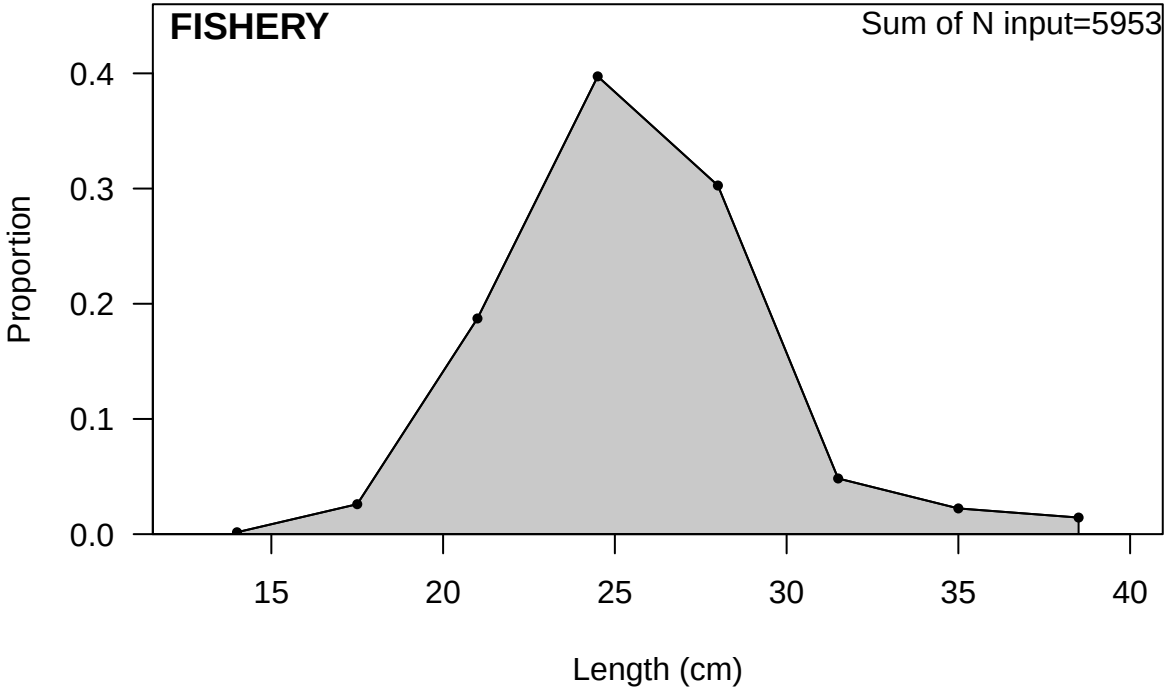

5
15
25
Length
0
10
20
30
40
1967
1973
1979
1985
1991
1997
2003
2009
2015
2021
Year

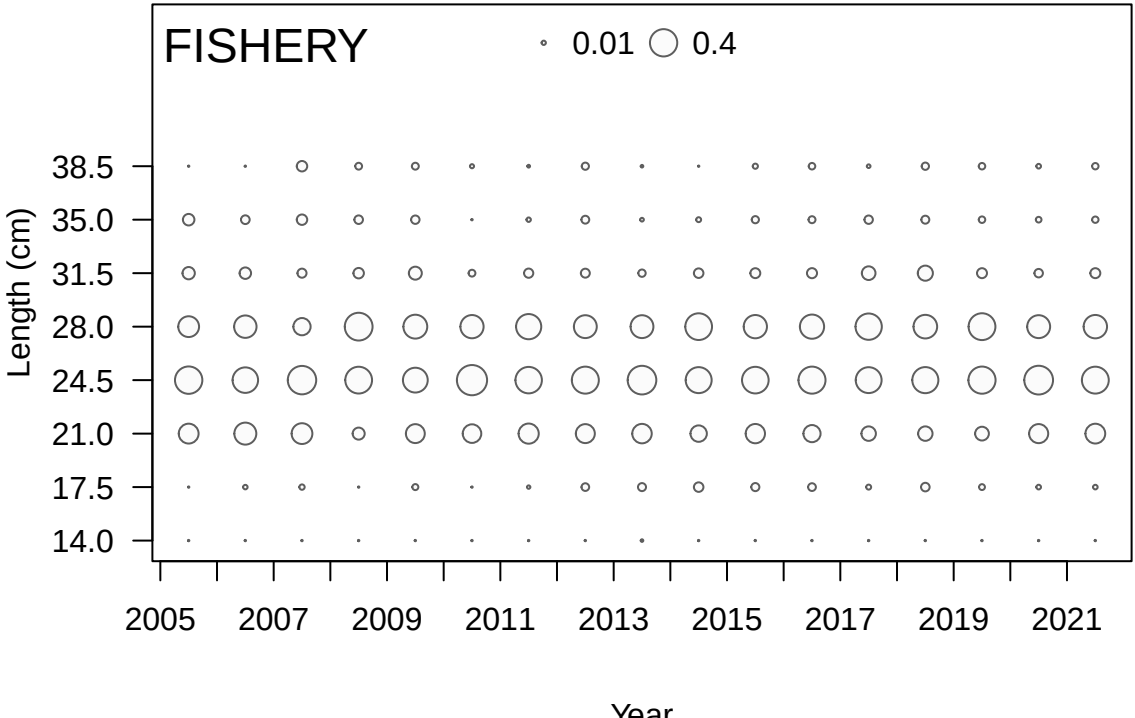

200
600
Length
0
10
20
30
40
1967
1973
1979
1985
1991
1997
2003
2009
2015
2021
Year

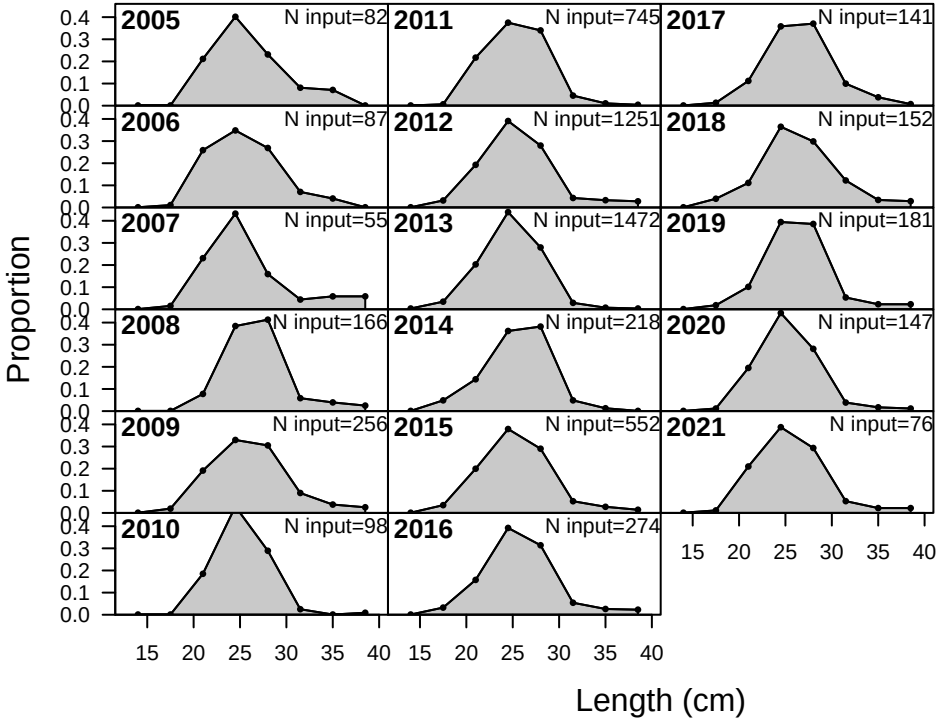

Mean length (cm)
0
5
10
15
20
25
30
1970
1980
1990
2000
2010
2020
Year
Females
Males

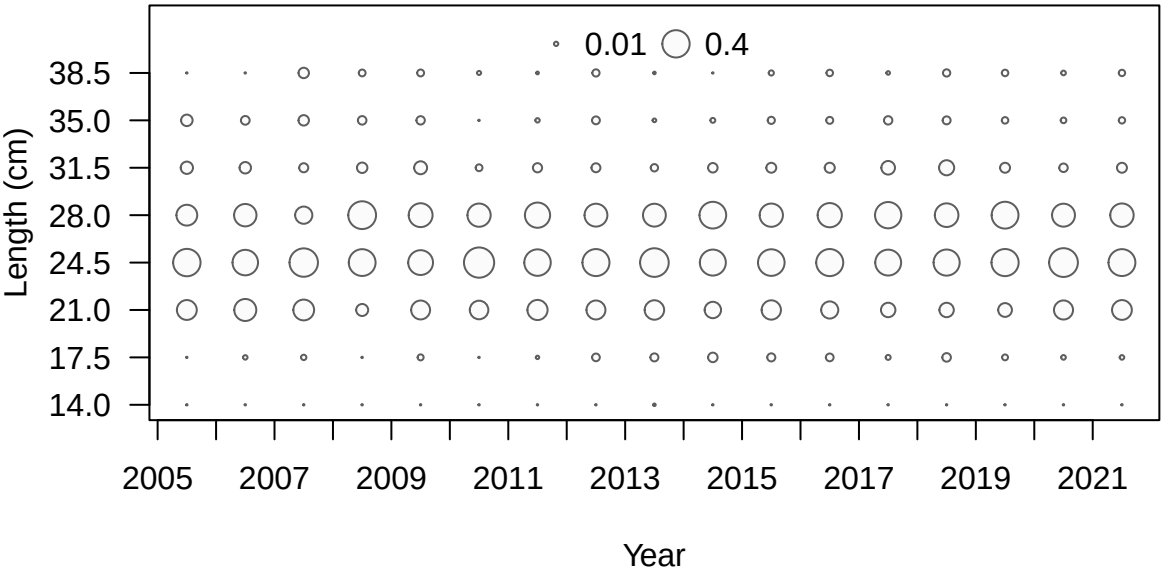

0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
Length
10
20
30
40
1970
1980
1990
2000
2010
2020
Year

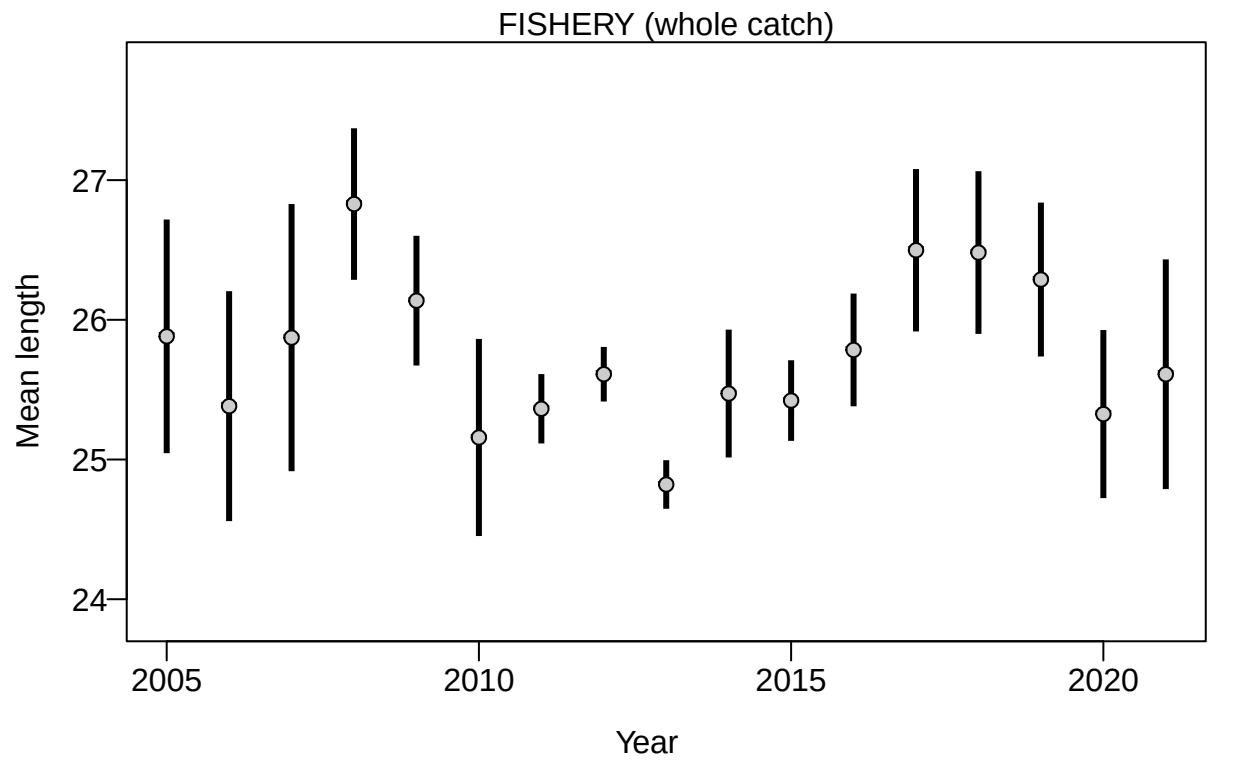

Females
Males
Numbers at age at equilibrium
0
5
10
15
0
2
4
6
8
10
12
14
Age

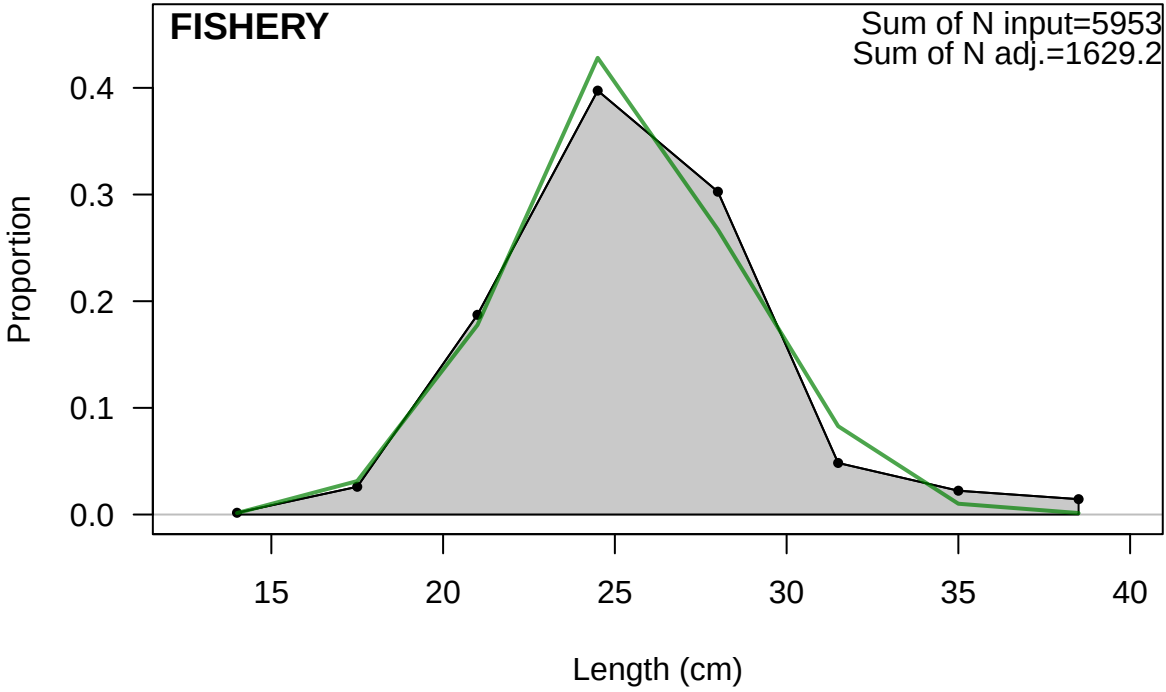

FISHERY
Sum of N input=5953
Proportion
0.0
0.1
0.2
0.3
0.4
15
20
25
30
35
40
Length (cm)

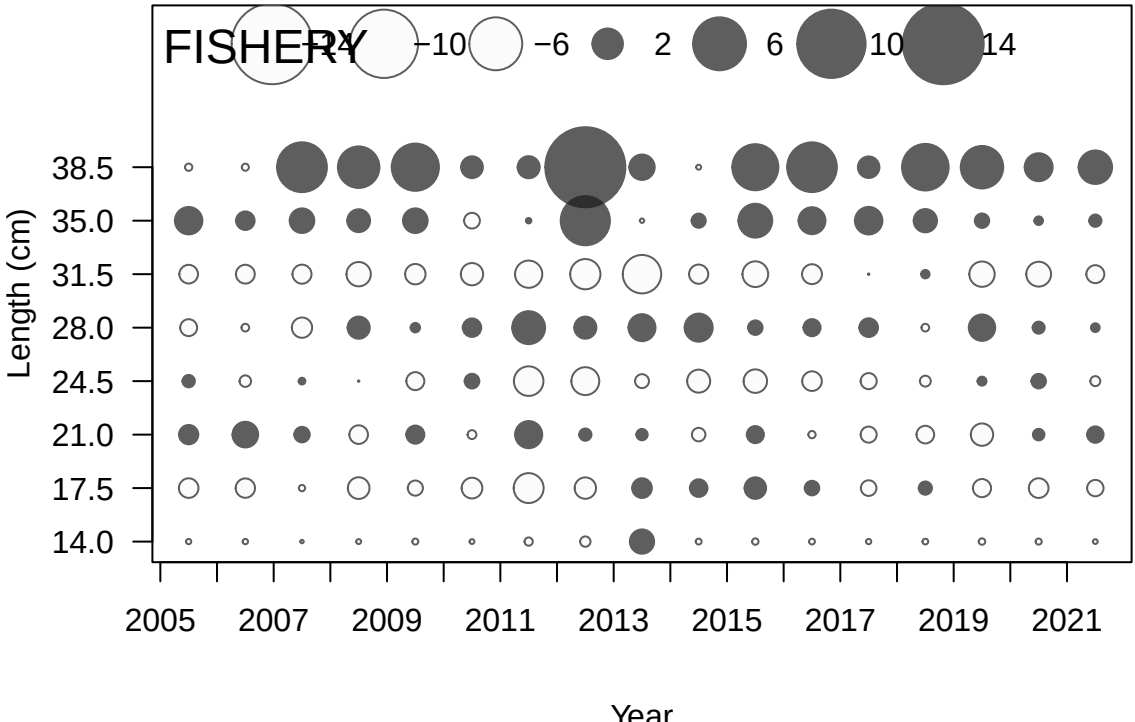

FISHERY
0.01
0.4
38.5
35.0
31.5
28.0
24.5
21.0
17.5
14.0
Length (cm)
2005
2007
2009
2011
2013
2015
2017
2019
2021
Year

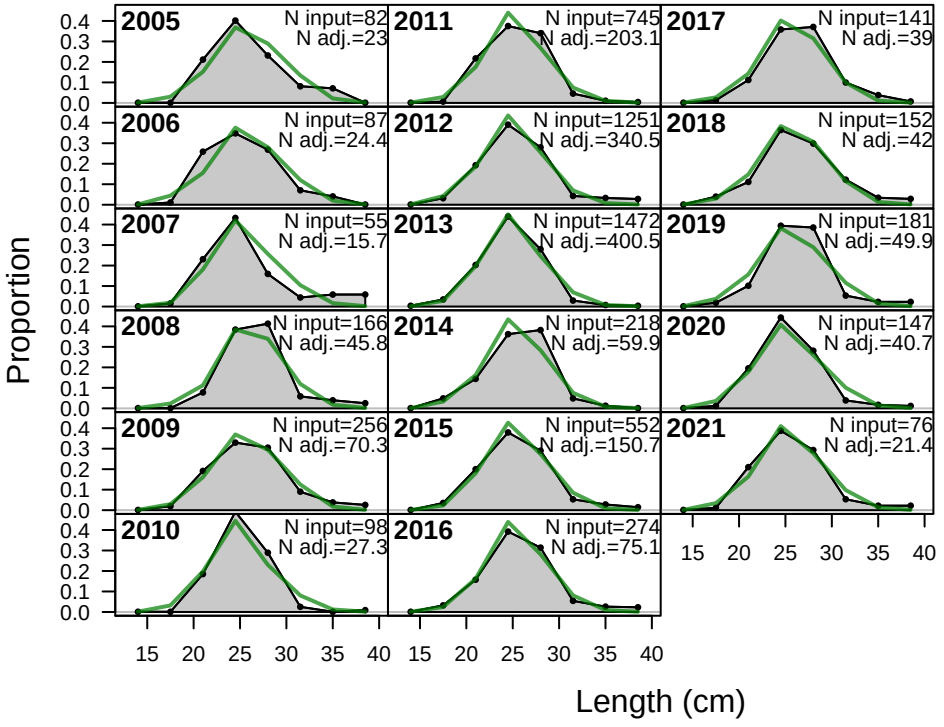

2005
N input=82
2011
N input=745
2017
N input=141
2006
N input=87
2012
N input=1251
2018
N input=152
2007
N input=55
2013
N input=1472
2019
N input=181
2008
N input=166
2014
N input=218
2020
N input=147
2009
N input=256
2015
N input=552
2021
N input=76
2010
N input=98
2016
N input=274
Proportion
Length (cm)

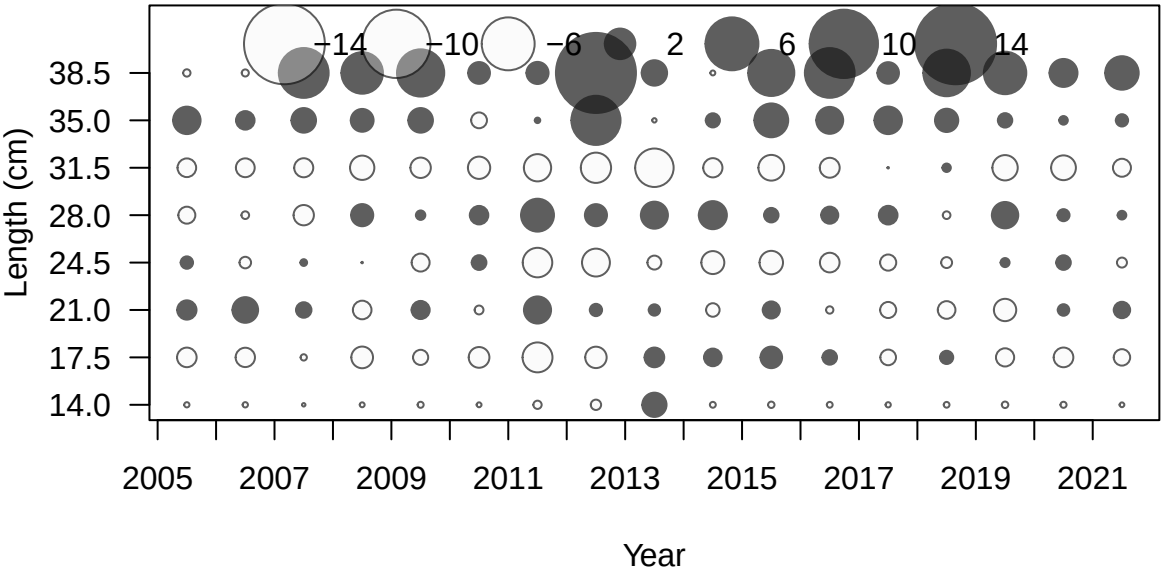

0.01
0.4
38.5
35.0
31.5
28.0
24.5
21.0
17.5
14.0
Length (cm)
2005
2007
2009
2011
2013
2015
2017
2019
2021
Year

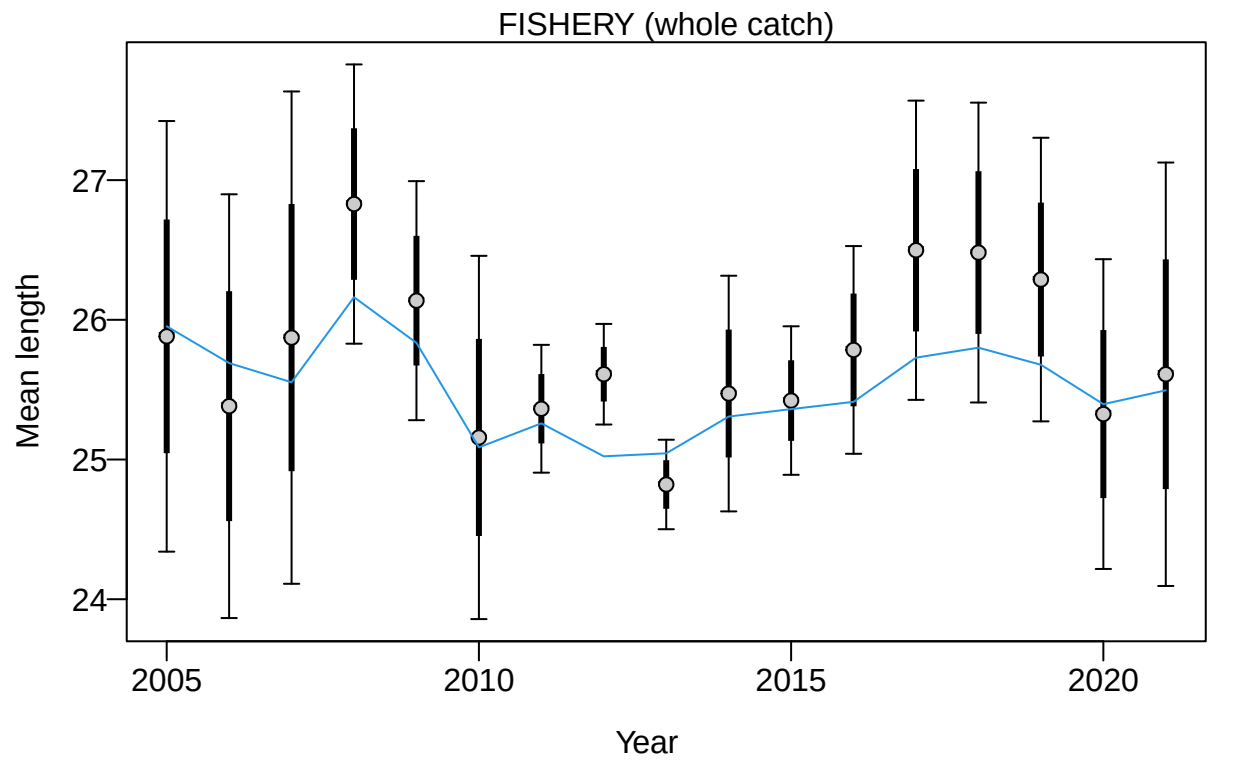

FISHERY (whole catch)
Mean length
27
26
25
24
2005
2010
2015
2020
Year

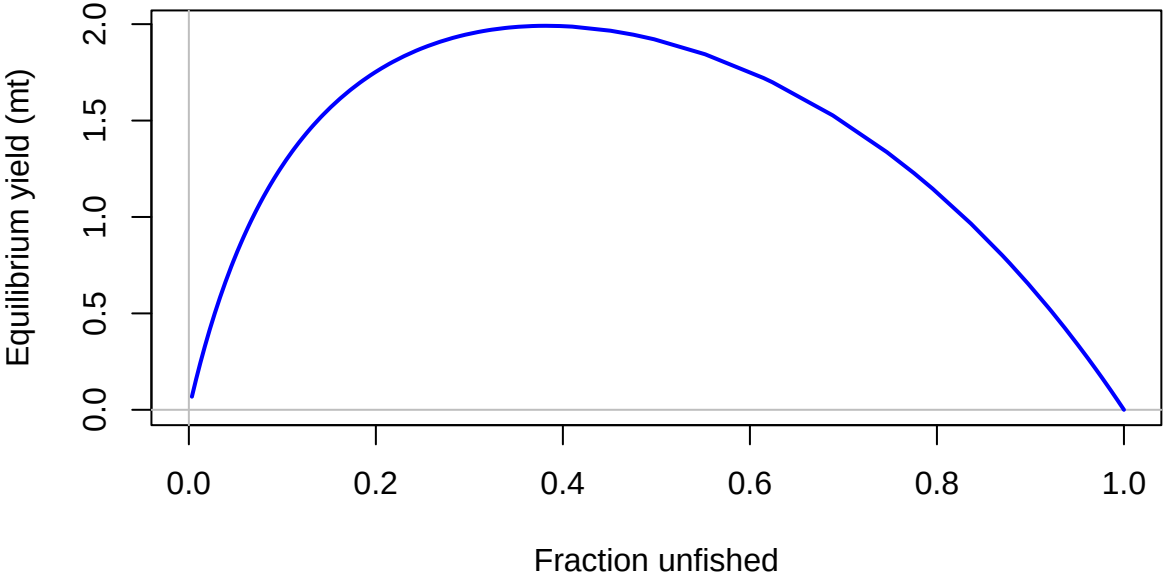

FISHERY
Sum of N input=5953
Sum of N adj.=1629.2
Proportion
0.0
0.1
0.2
0.3
0.4
15
20
25
30
35
40
Length (cm)

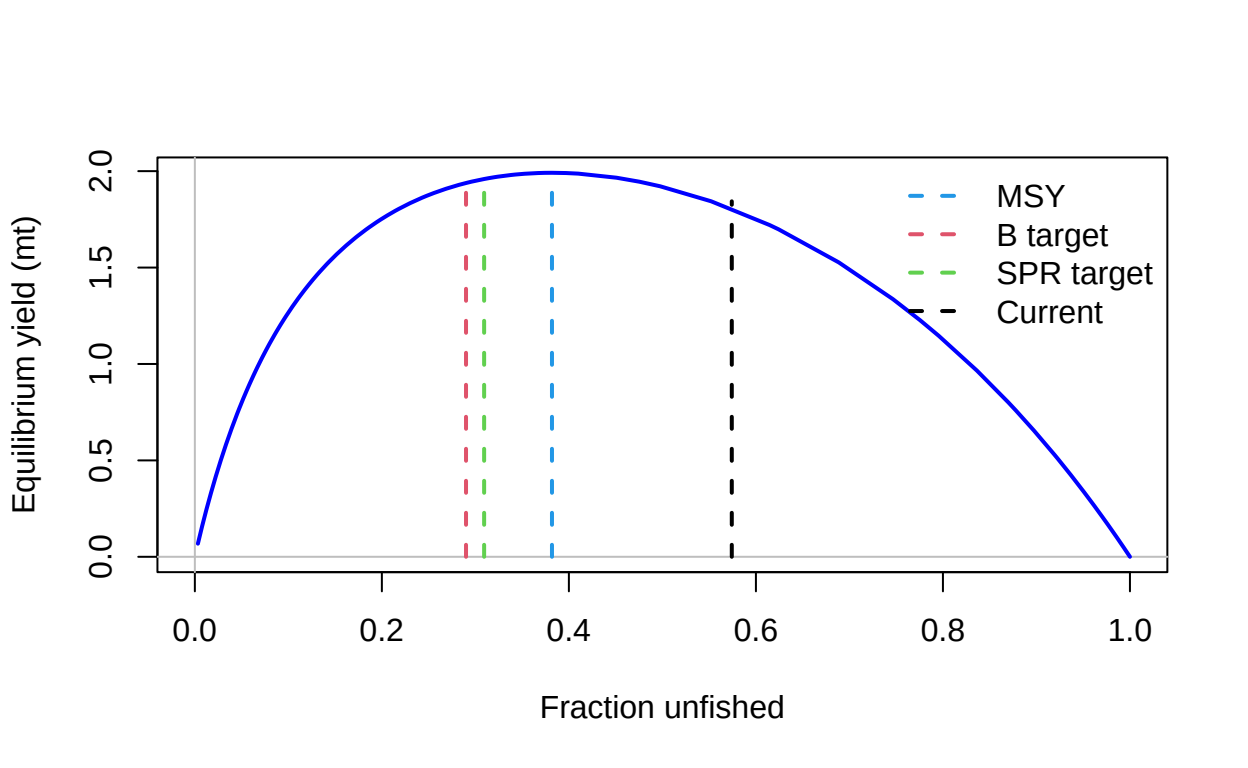

FISHERY
−14
−10
−6
2
6
10
14
38.5
35.0
31.5
28.0
24.5
21.0
17.5
14.0
Length (cm)
2005
2007
2009
2011
2013
2015
2017
2019
2021
Year

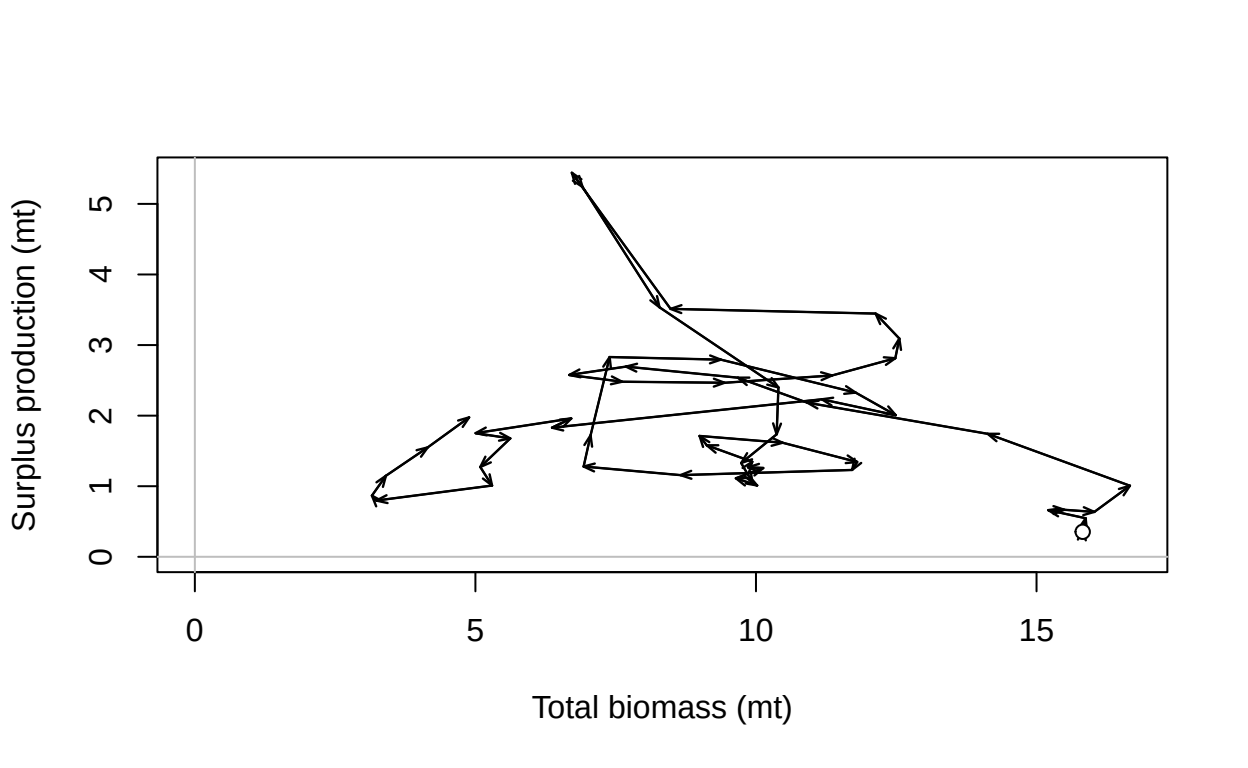

2005
N input=82
N adj.=23
2011
N input=745
N adj.=203.1
2017
N input=141
N adj.=39
2006
N input=87
N adj.=24.4
2012
N input=1251
N adj.=340.5
2018
N input=152
N adj.=42
2007
N input=55
N adj.=15.7
2013
N input=1472
N adj.=400.5
2019
N input=181
N adj.=49.9
2008
N input=166
N adj.=45.8
2014
N input=218
N adj.=59.9
2020
N input=147
N adj.=40.7
2009
N input=256
N adj.=70.3
2015
N input=552
N adj.=150.7
2021
N input=76
N adj.=21.4
2010
N input=98
N adj.=27.3
2016
N input=274
N adj.=75.1
Proportion
0.0
0.1
0.2
0.3
0.4
15
20
25
30
35
40
Length (cm)

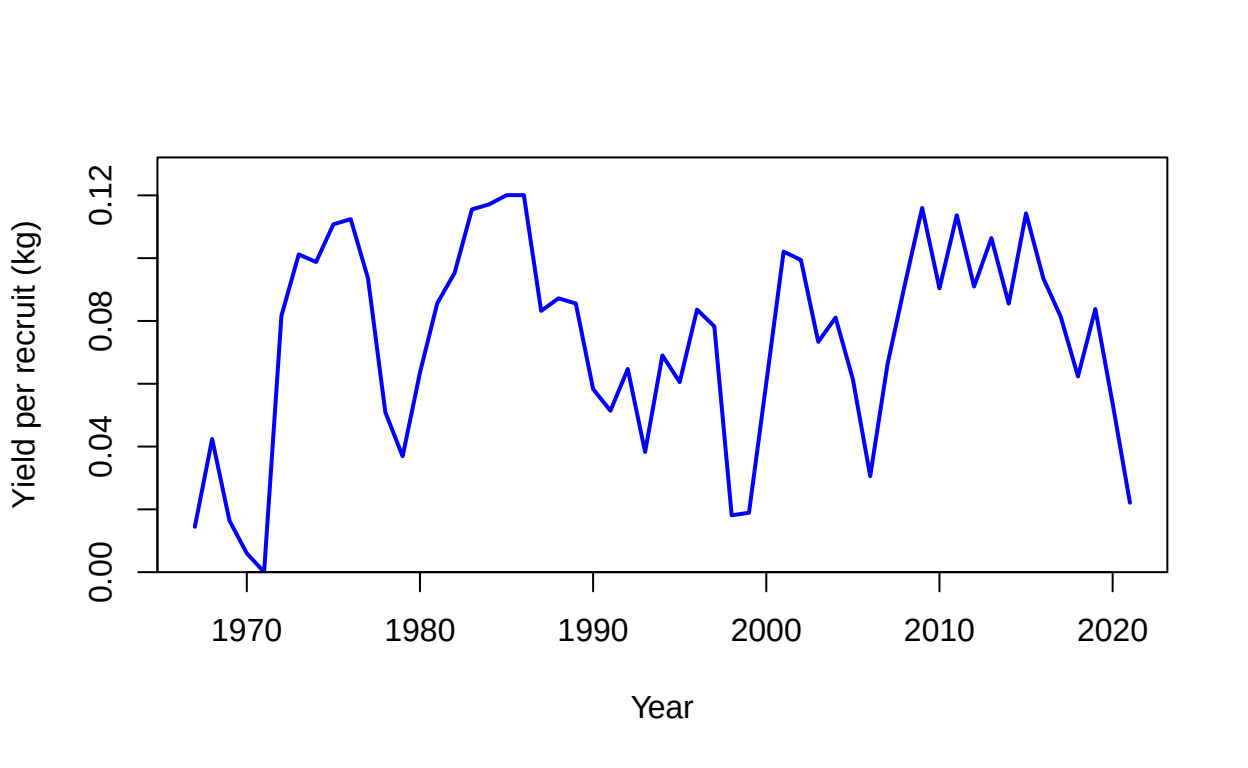

−14
−10
−6
2
6
10
14
38.5
35.0
31.5
28.0
24.5
21.0
17.5
14.0
Length (cm)
2005
2007
2009
2011
2013
2015
2017
2019
2021
Year

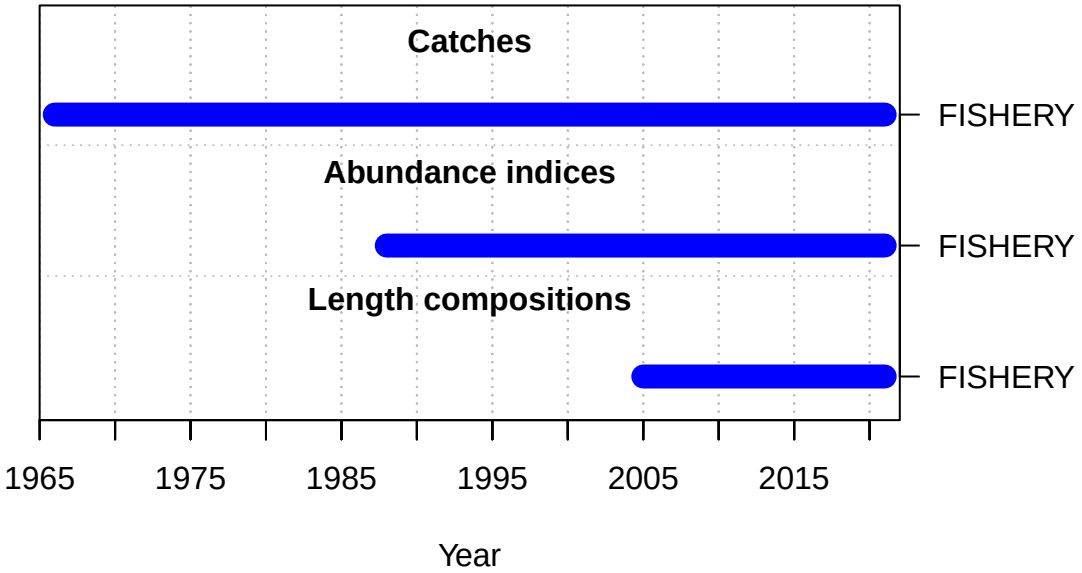

FISHERY (whole catch)
Mean length
27
26
25
24
2005
2010
2015
2020
Year

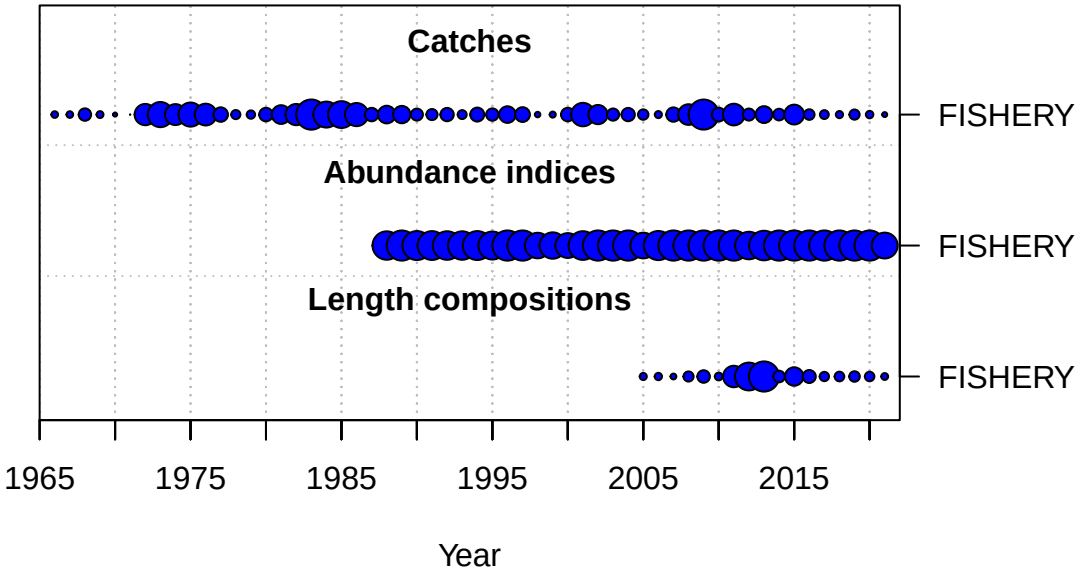

Equilibrium yield (mt)
0.0
0.5
1.0
1.5
2.0
0.0
0.2
0.4
0.6
0.8
1.0
Fraction unfished

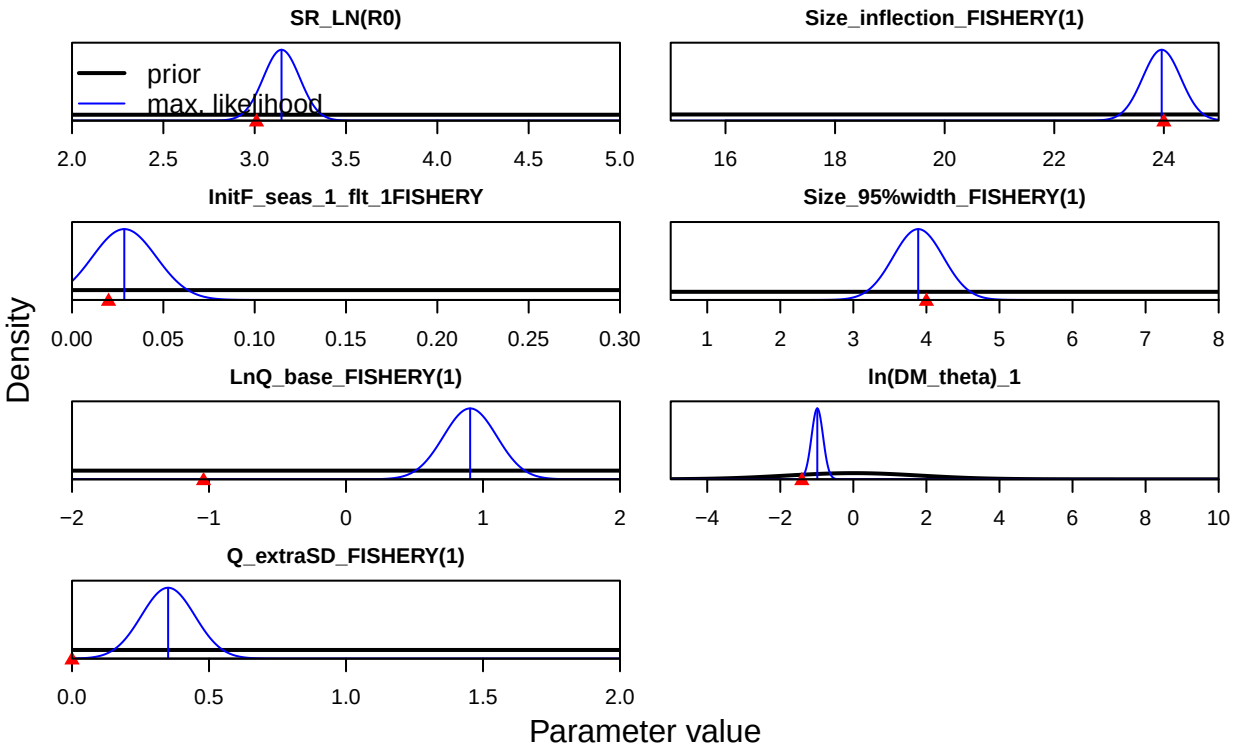

Equilibrium yield (mt)
0.0
0.5
1.0
1.5
2.0
0.0
0.2
0.4
0.6
0.8
1.0
Fraction unfished
MSY
B target
SPR target
Current


Surplus production (mt)
0
1
2
3
4
5
0
5
10
15
Total biomass (mt)


Yield per recruit (kg)
0.00
0.04
0.08
0.12
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)
1
2
3
4
5
6
7
8
LnQ_base_FISHERY(1)
−2
−1
0
1
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
Density
Parameter value