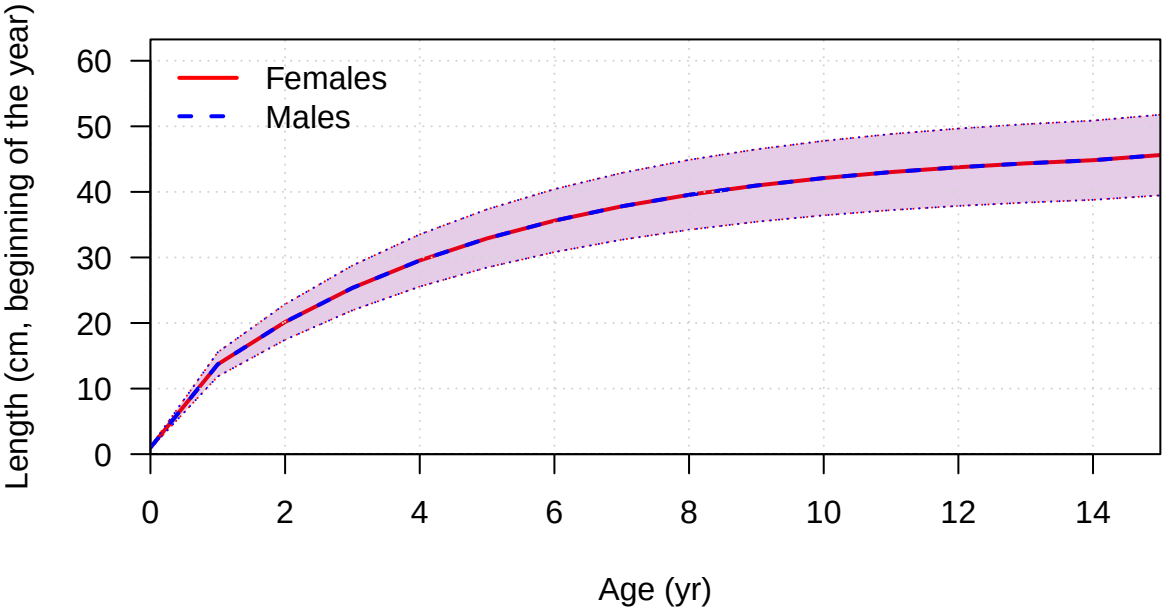
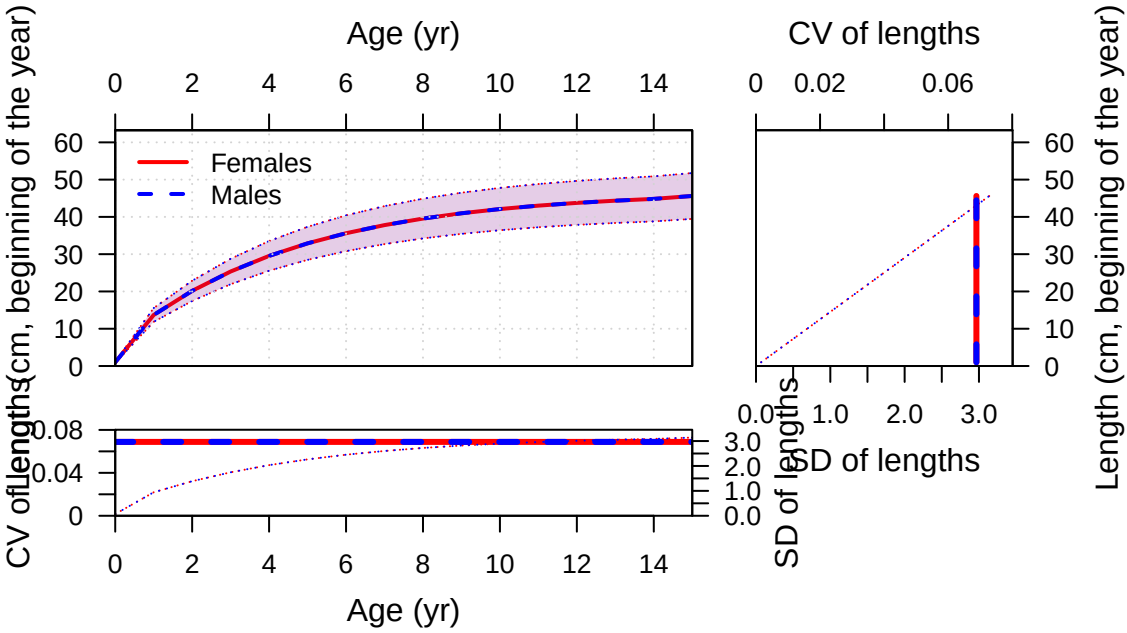
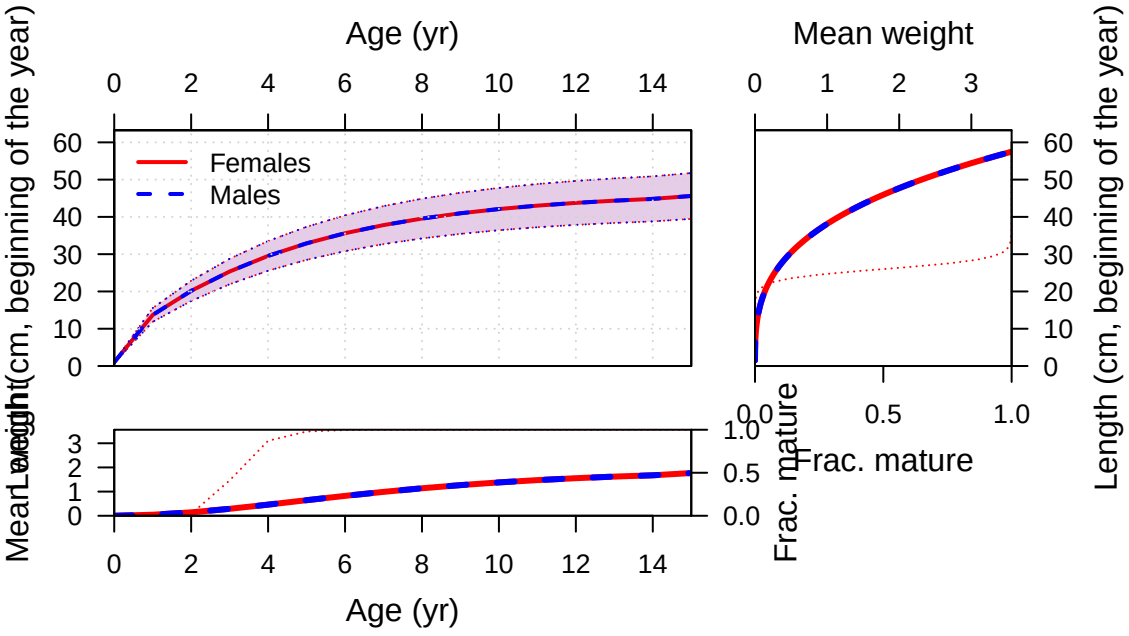
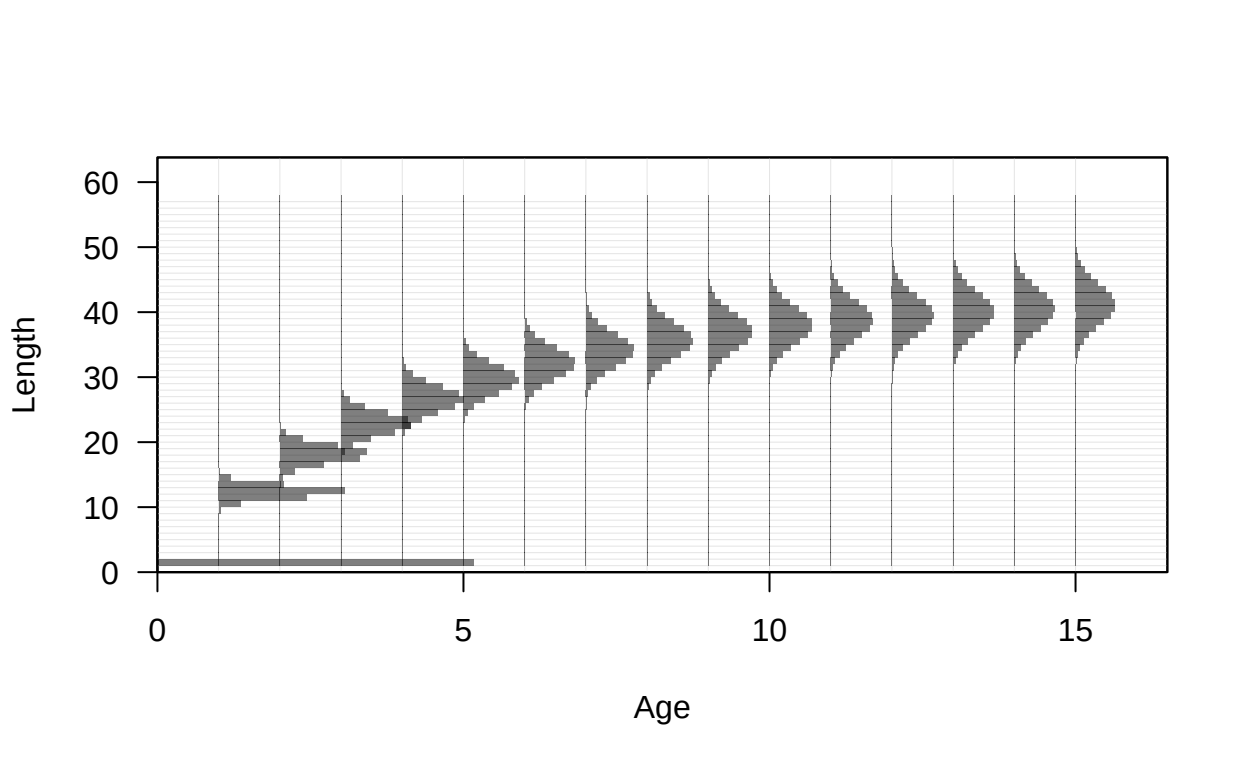
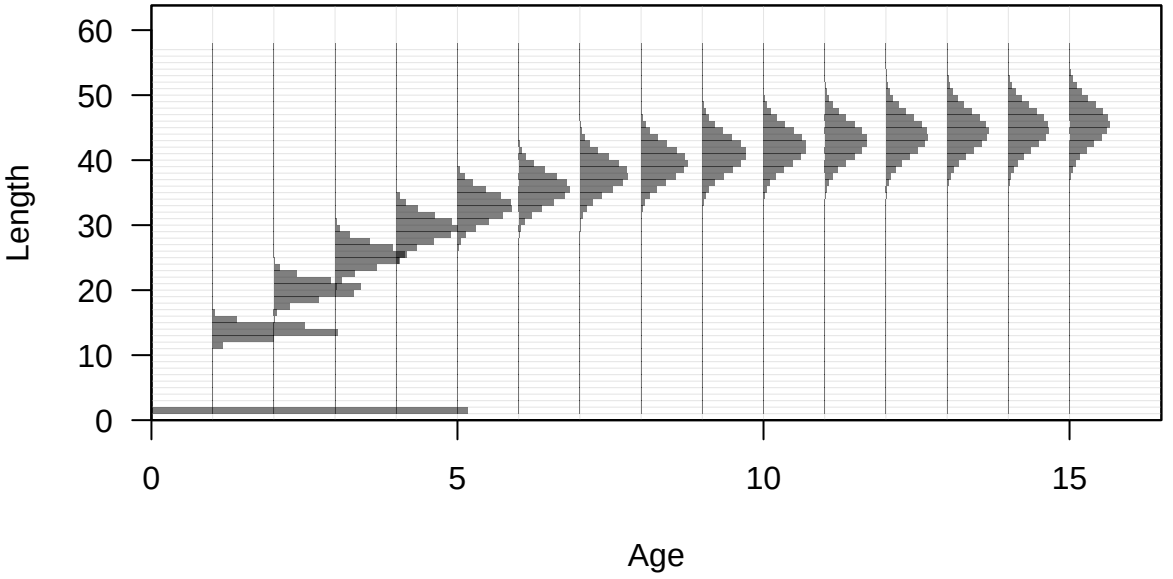
Plots created using the 'r4ss' package in R
Stock Synthesis version: 3.30.19.0
StartTime: Fri Oct 21 16:11:11 2022
Data_File: data.ss
Control_File: control.ss

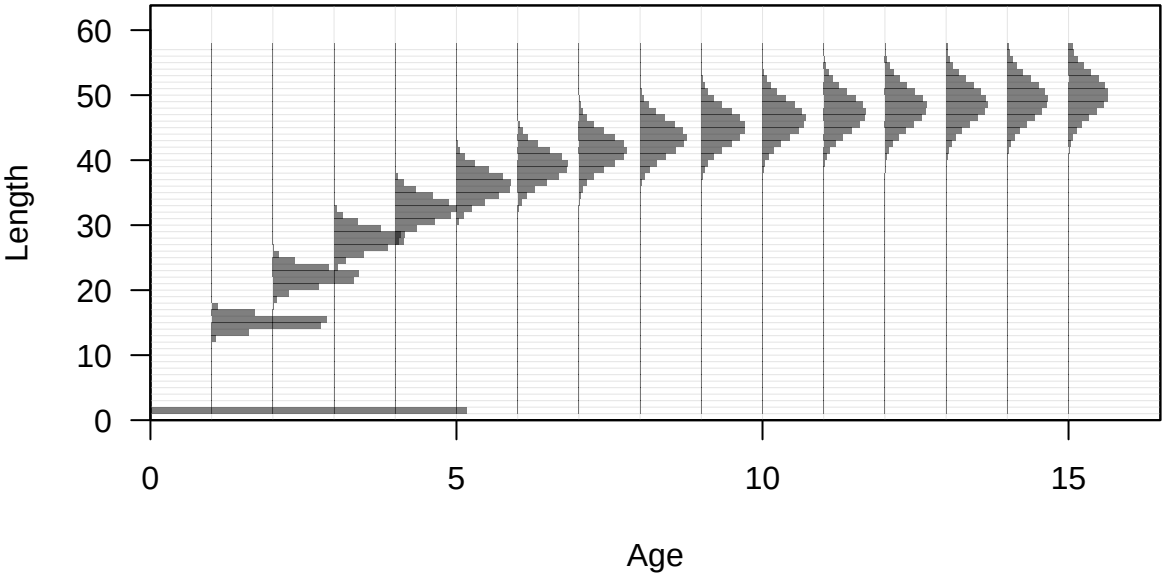

Females
Males
Length (cm, beginning of the year)
Age (yr)
0
10
20
30
40
50
60
0
2
4
6
8
10
12
14

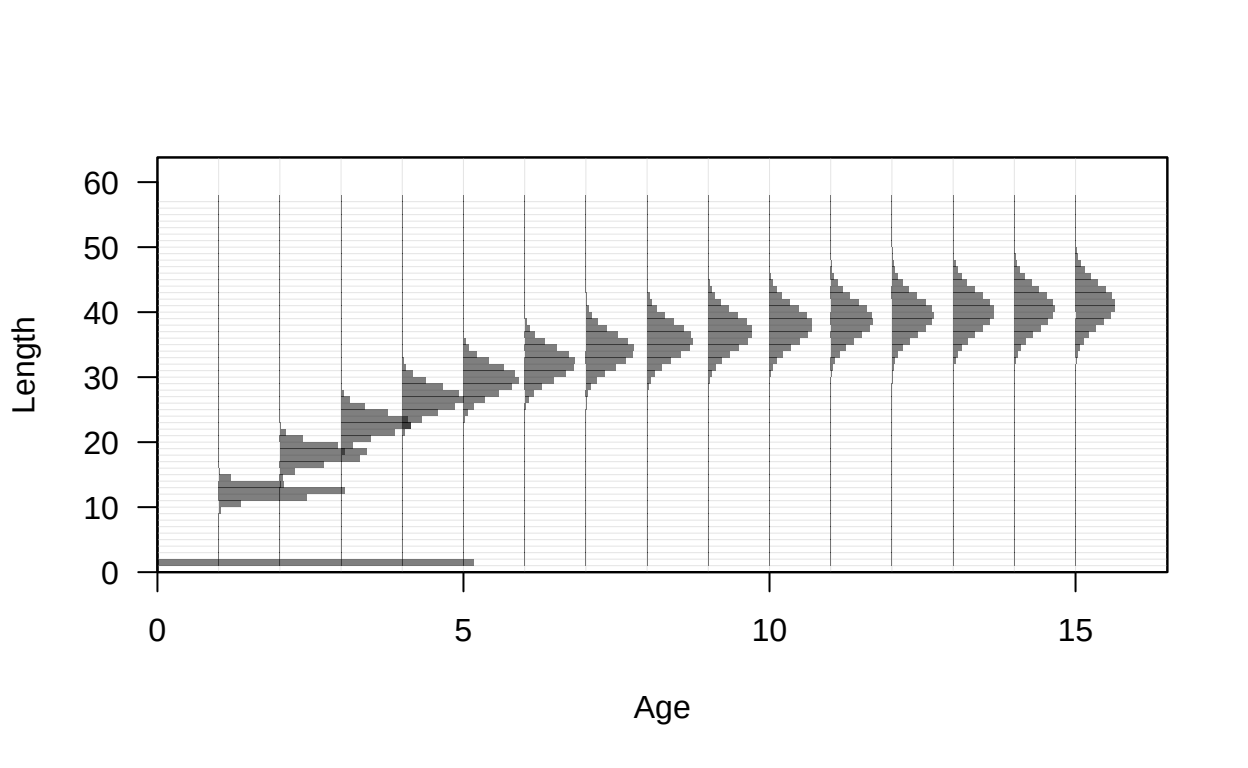

Age (yr)
0
2
4
6
8
10
12
14
Females
Males
Length (cm, beginning of the year)
60
50
40
30
20
10
0
CV of lengths
0
0.02
0.06
0.0
1.0
2.0
3.0
SD of lengths
0.08
0.04
0

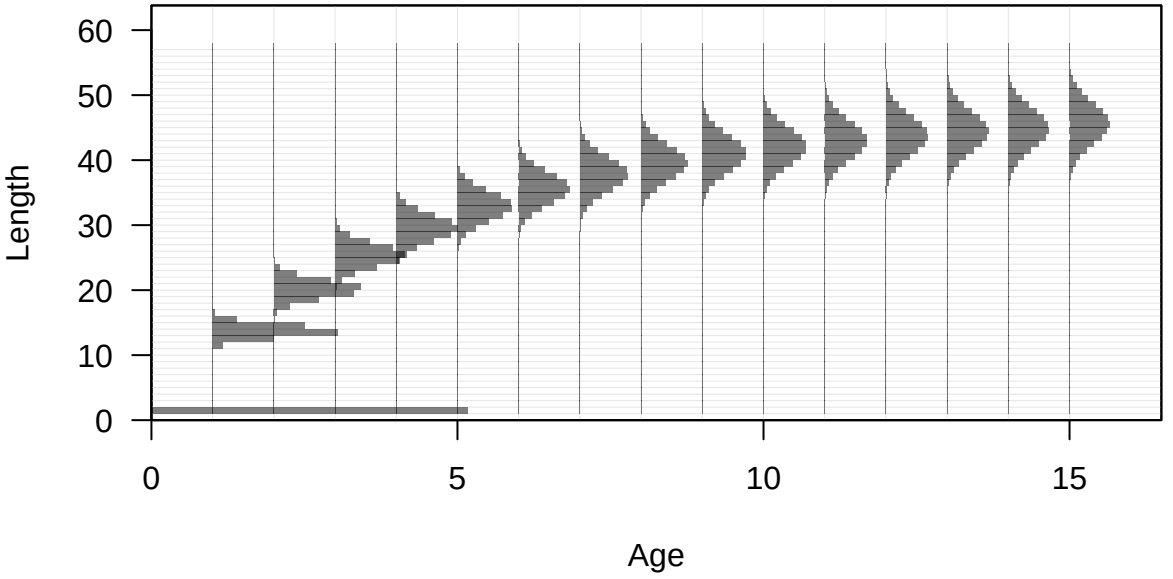

Age (yr)
Mean weight
Length (cm, beginning of the year)
Females
Males
Mean weight
Frac. mature
Age (yr)

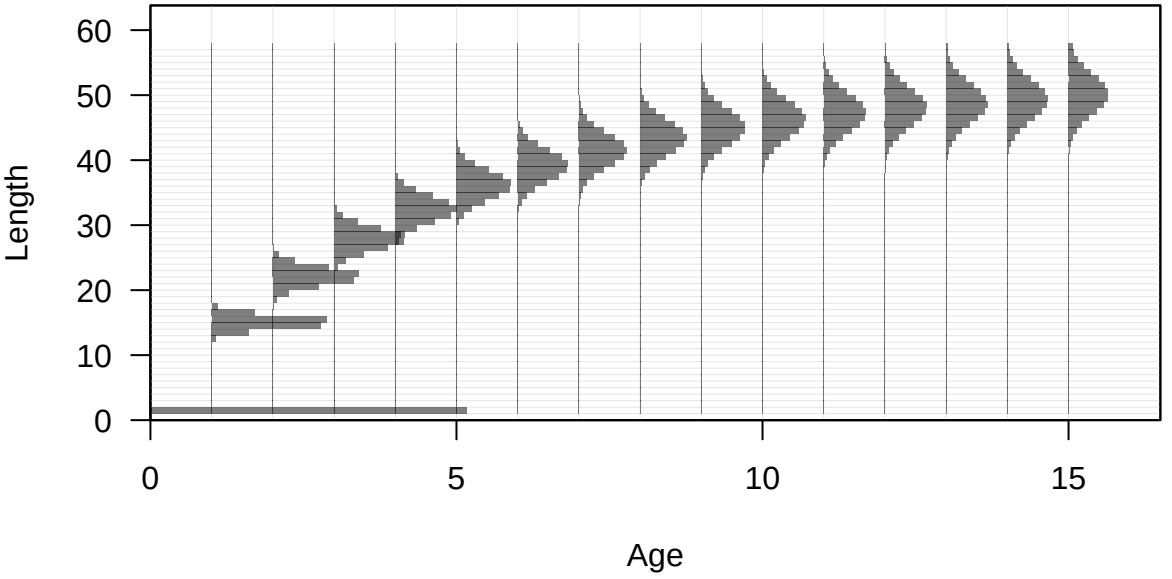

Length
60
50
40
30
20
10
0
0
5
10
15
Age

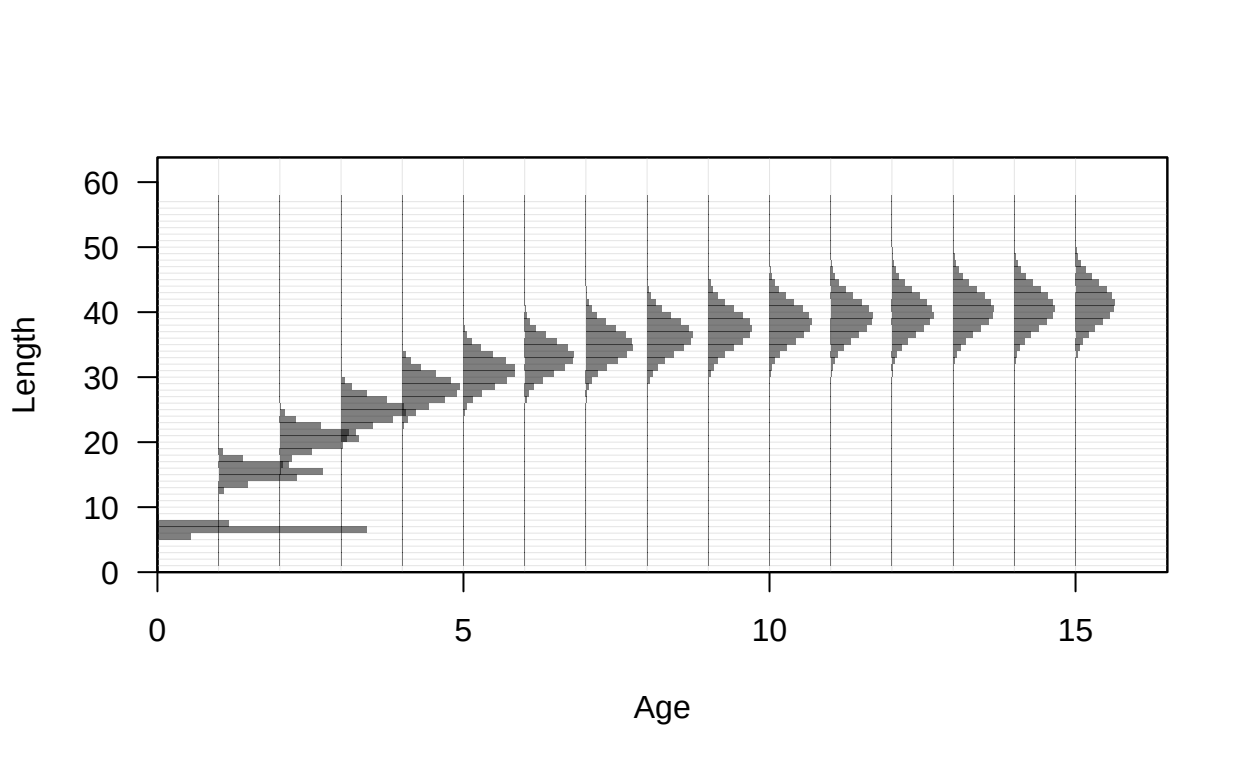

Length
60
50
40
30
20
10
0
0
5
10
15
Age

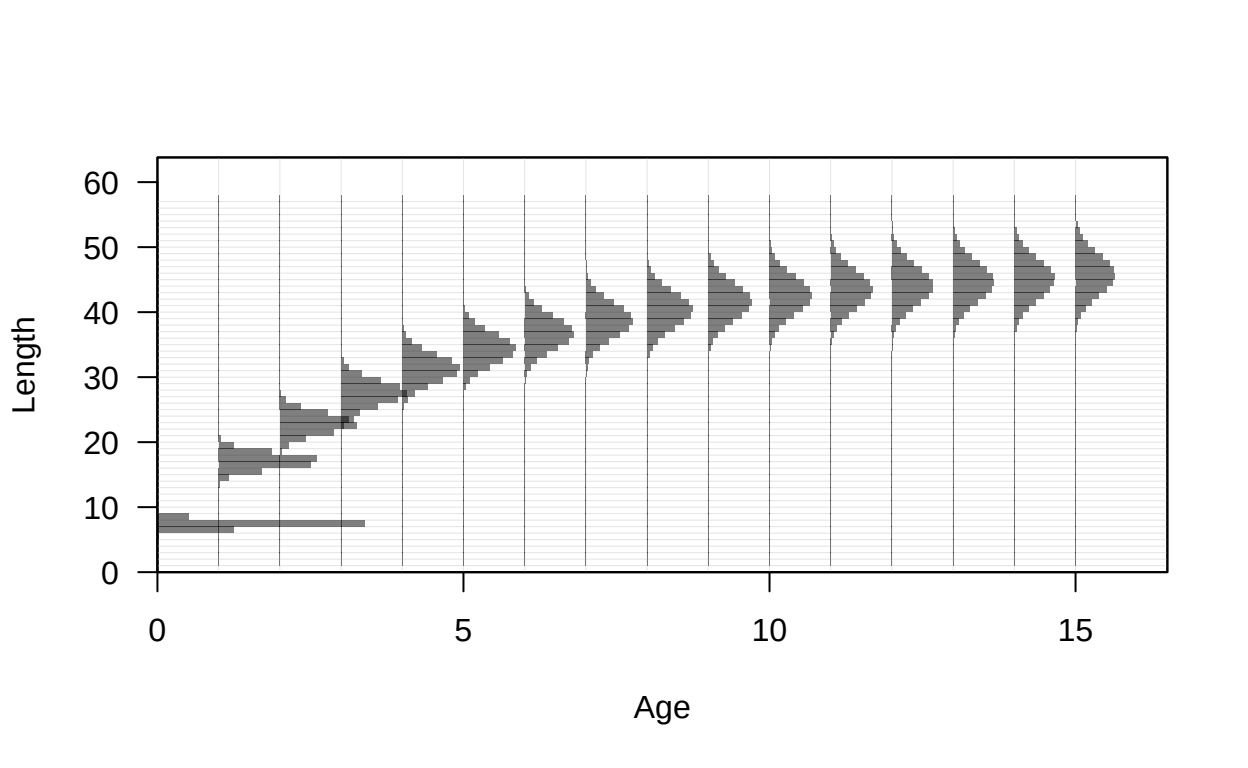

Length
60
50
40
30
20
10
0
0
5
10
15
Age

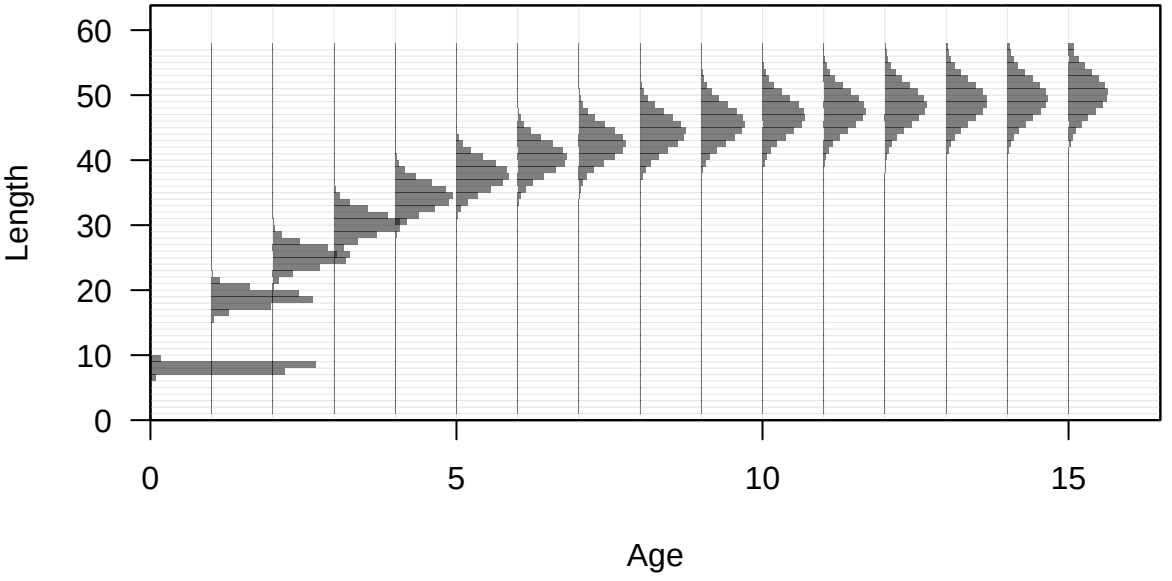

Length
60
50
40
30
20
10
0
0
5
10
15
Age

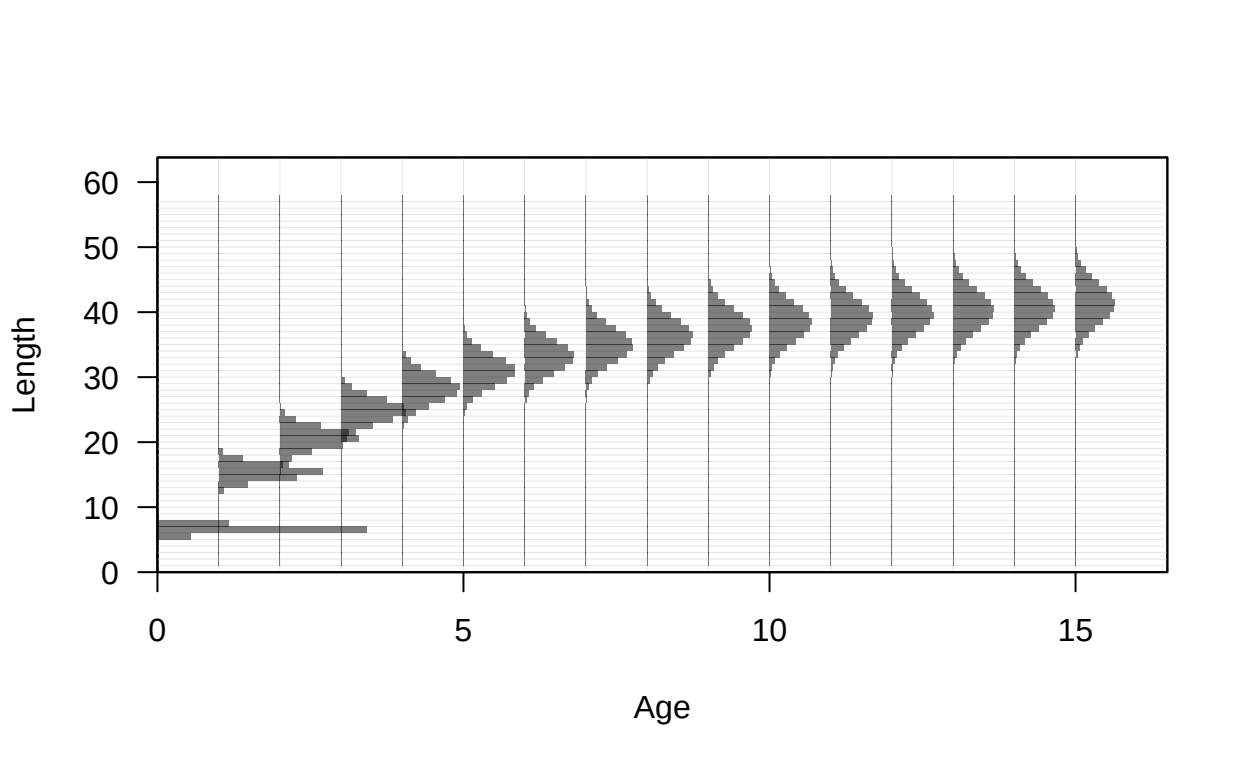

Length
60
50
40
30
20
10
0
0
5
10
15
Age

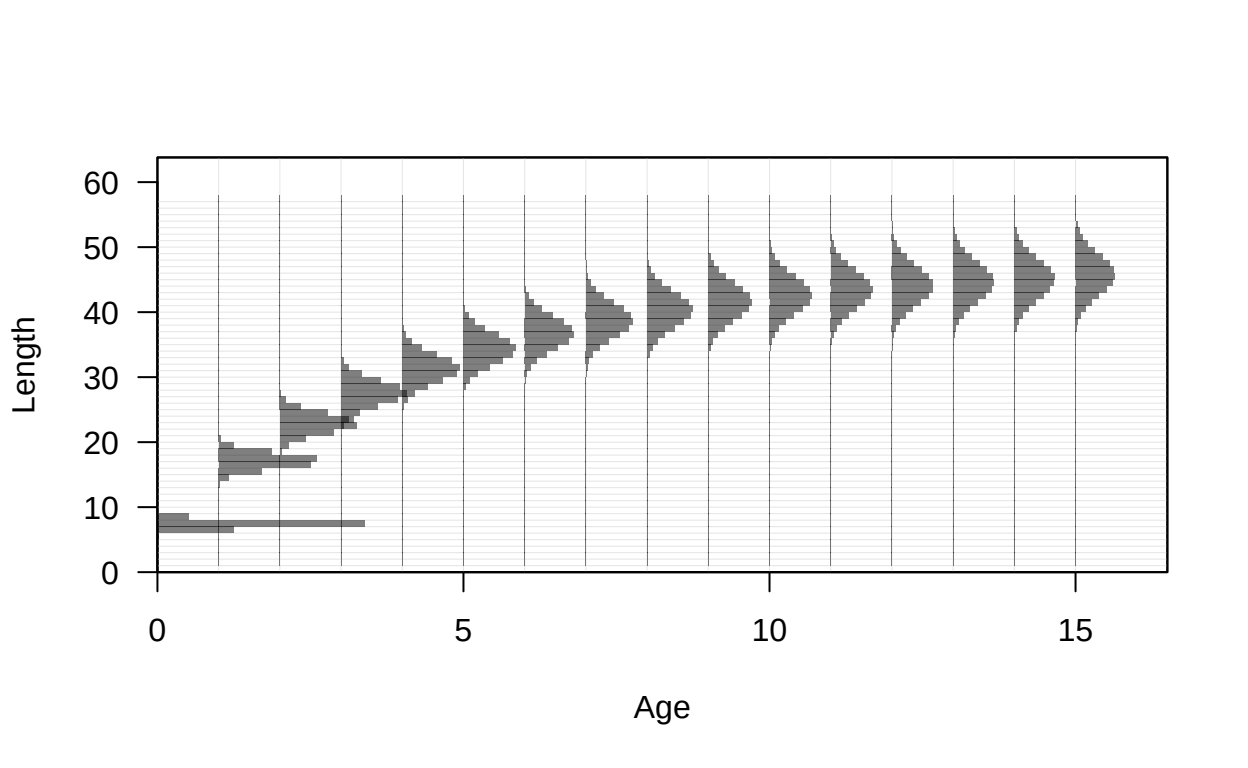

Length
60
50
40
30
20
10
0
0
5
10
15
Age

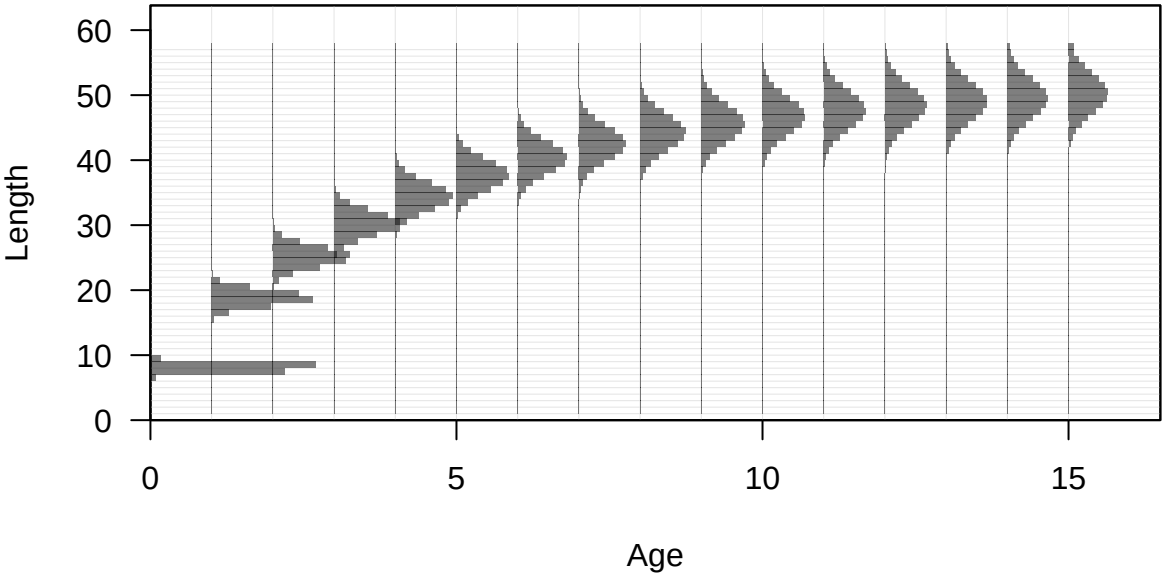

Length
60
50
40
30
20
10
0
0
5
10
15
Age

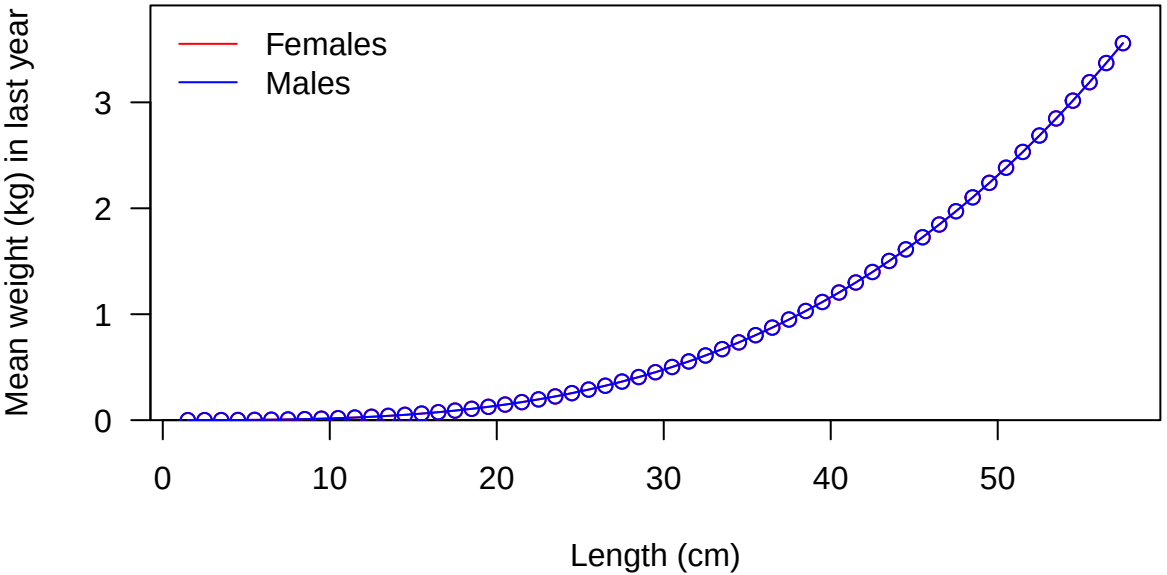

Length
60
50
40
30
20
10
0
0
5
10
15
Age

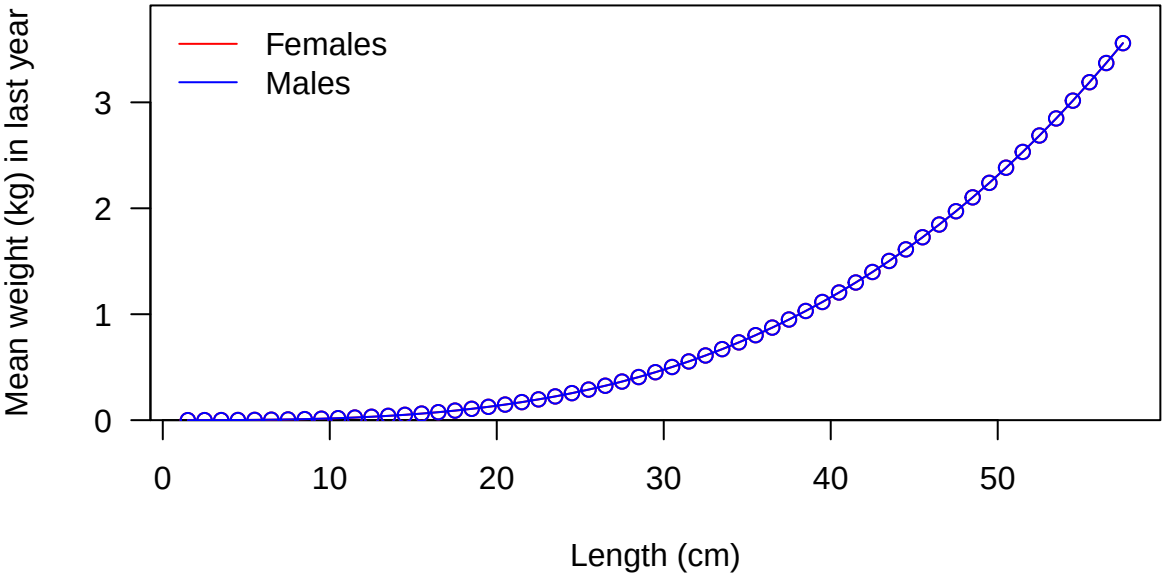

Length
60
50
40
30
20
10
0
0
5
10
15
Age

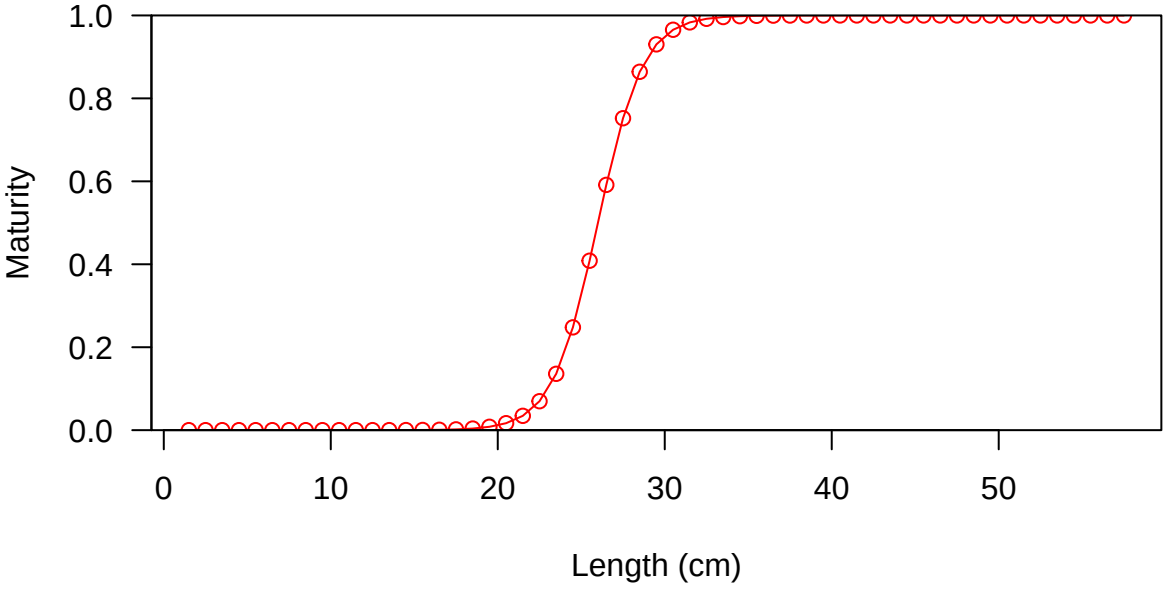

Length
60
50
40
30
20
10
0
0
5
10
15
Age

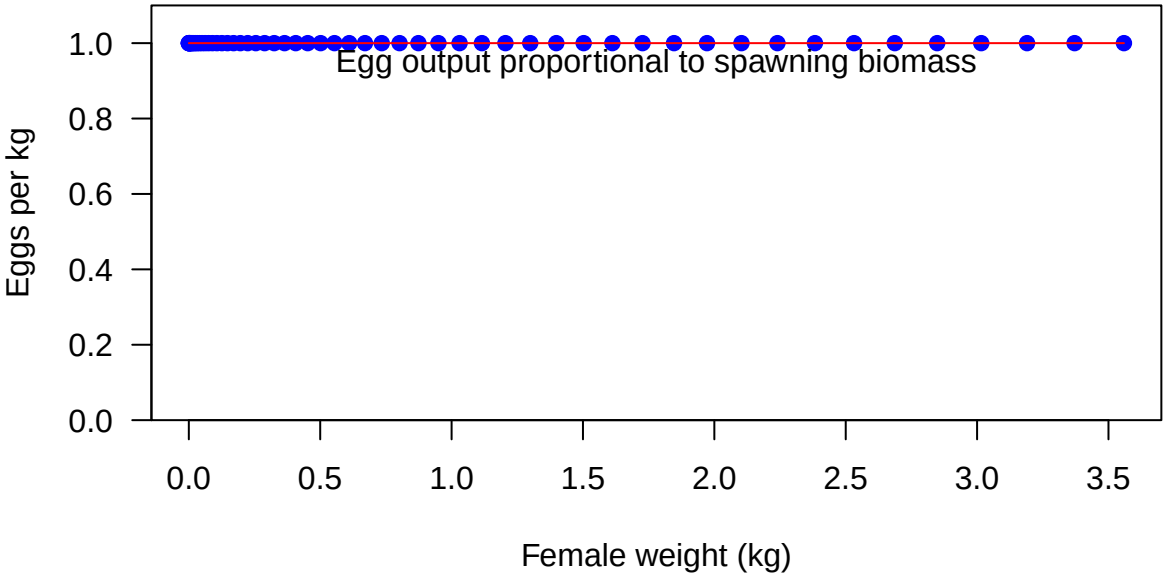

Length
60
50
40
30
20
10
0
0
5
10
15
Age

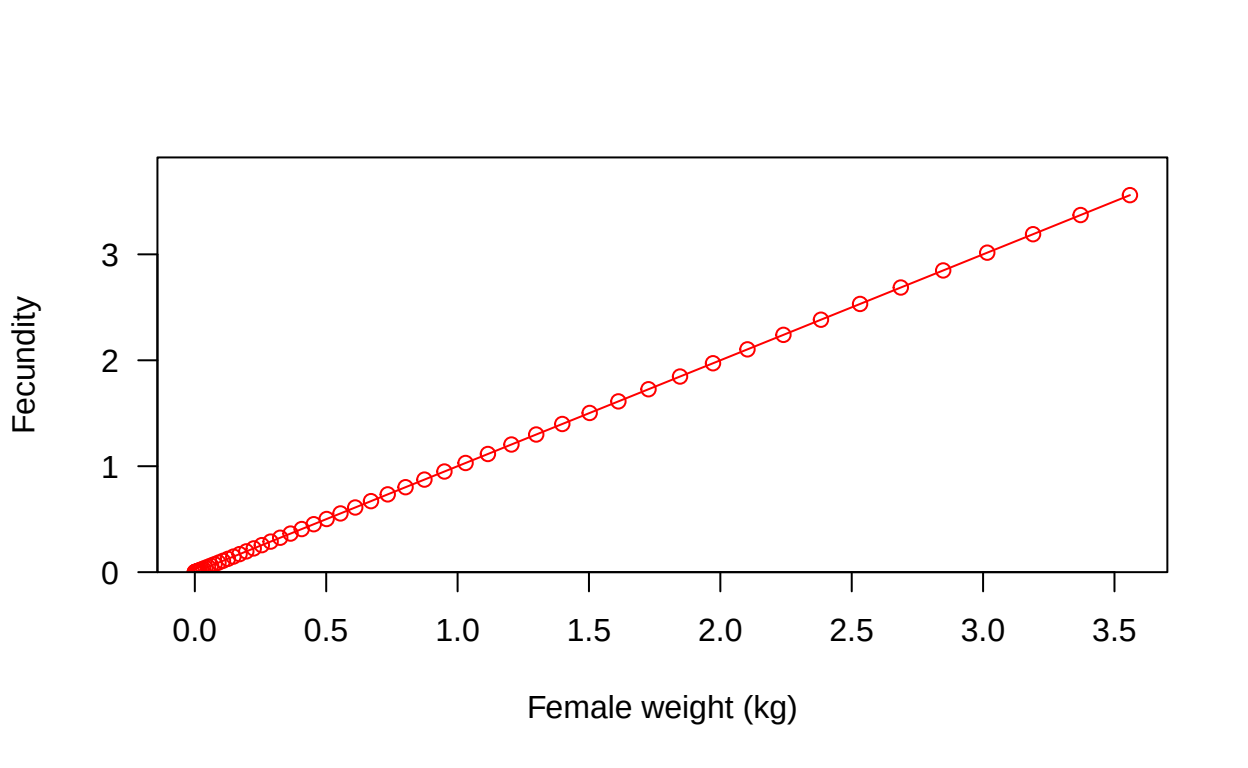

Length
60
50
40
30
20
10
0
0
5
10
15
Age

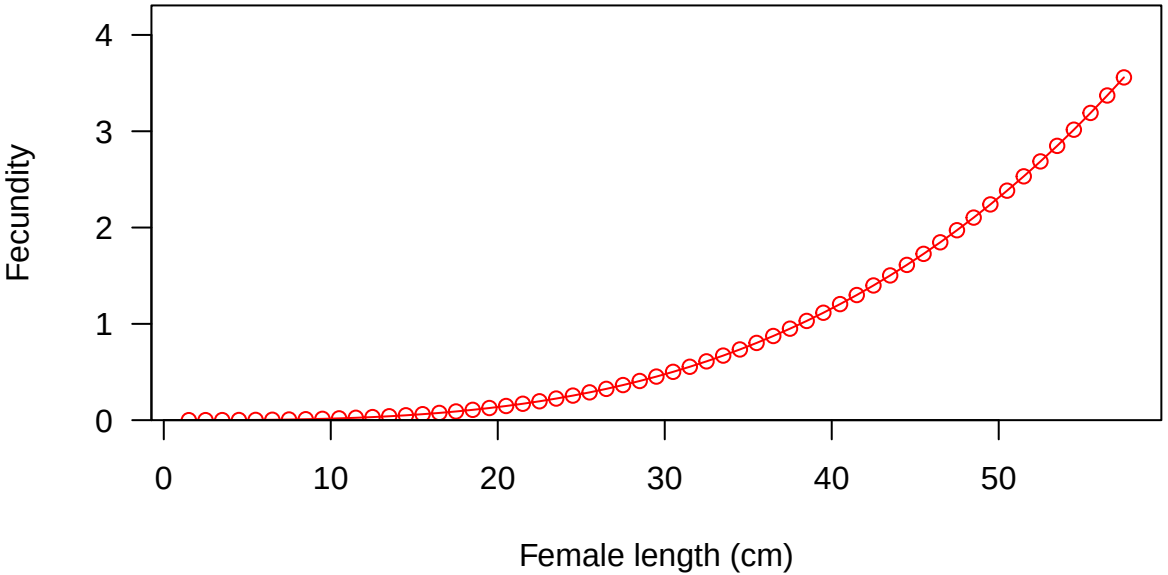

Females
Males
Mean weight (kg) in last year
0
1
2
3
0
10
20
30
40
50
Length (cm)

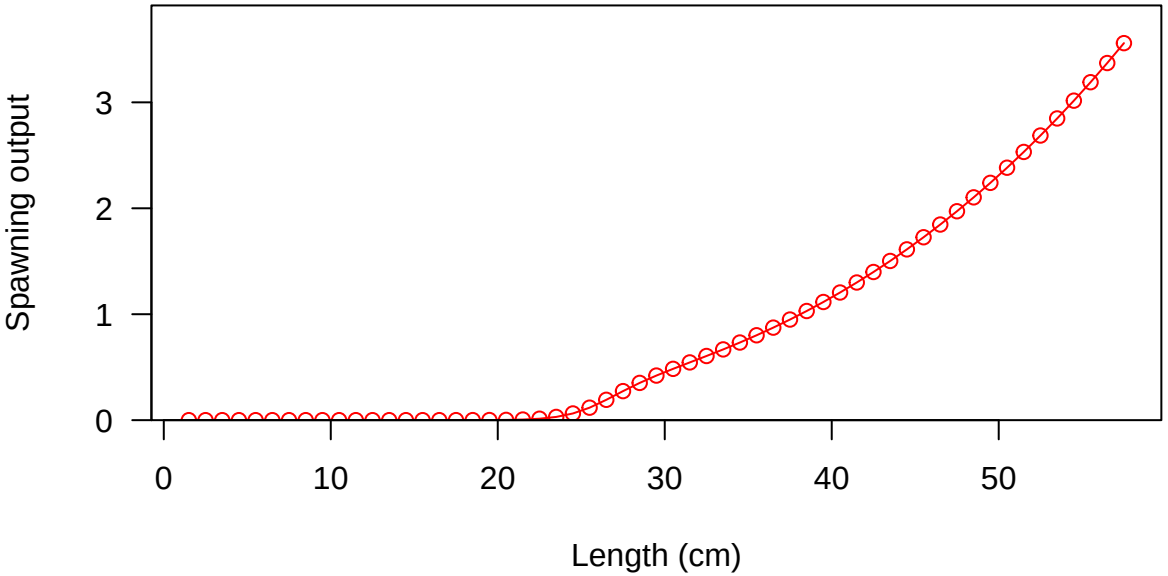

Females
Males
Mean weight (kg) in last year
0
1
2
3
0
10
20
30
40
50
Length (cm)

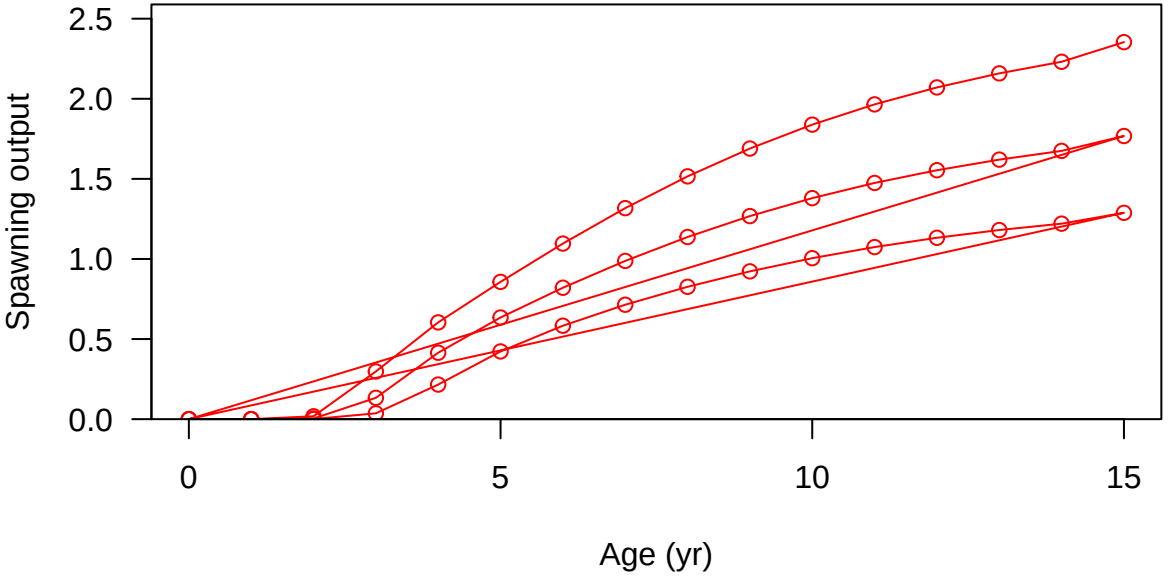

1.0
0.8
0.6
0.4
0.2
0.0
Maturity
0
10
20
30
40
50
Length (cm)

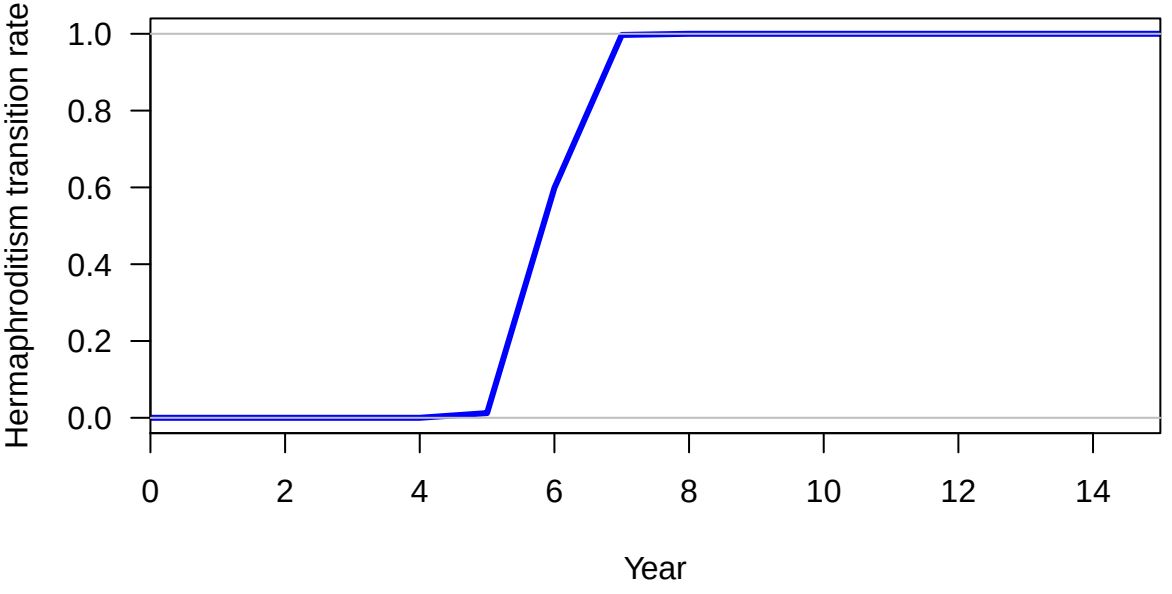

Egg output proportional to spawning biomass
Eggs per kg
1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
Female weight (kg)

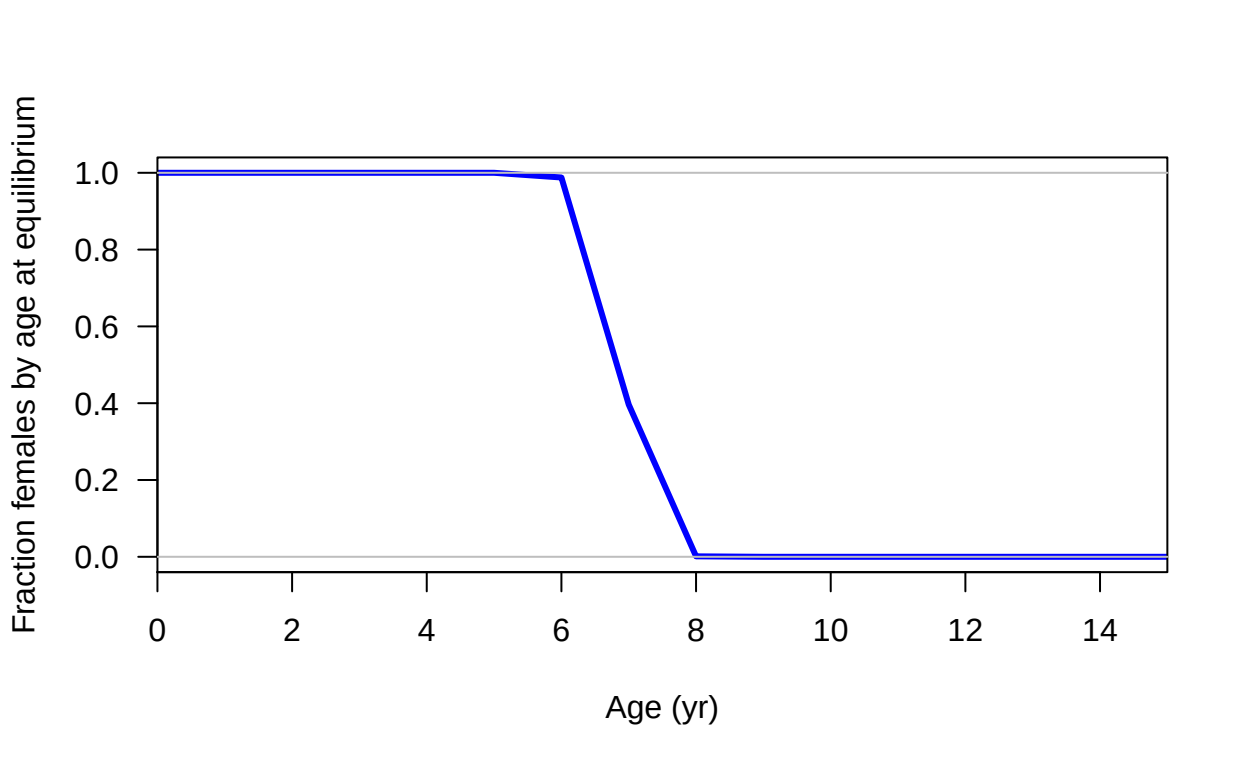

Fecundity
0
1
2
3
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
Female weight (kg)

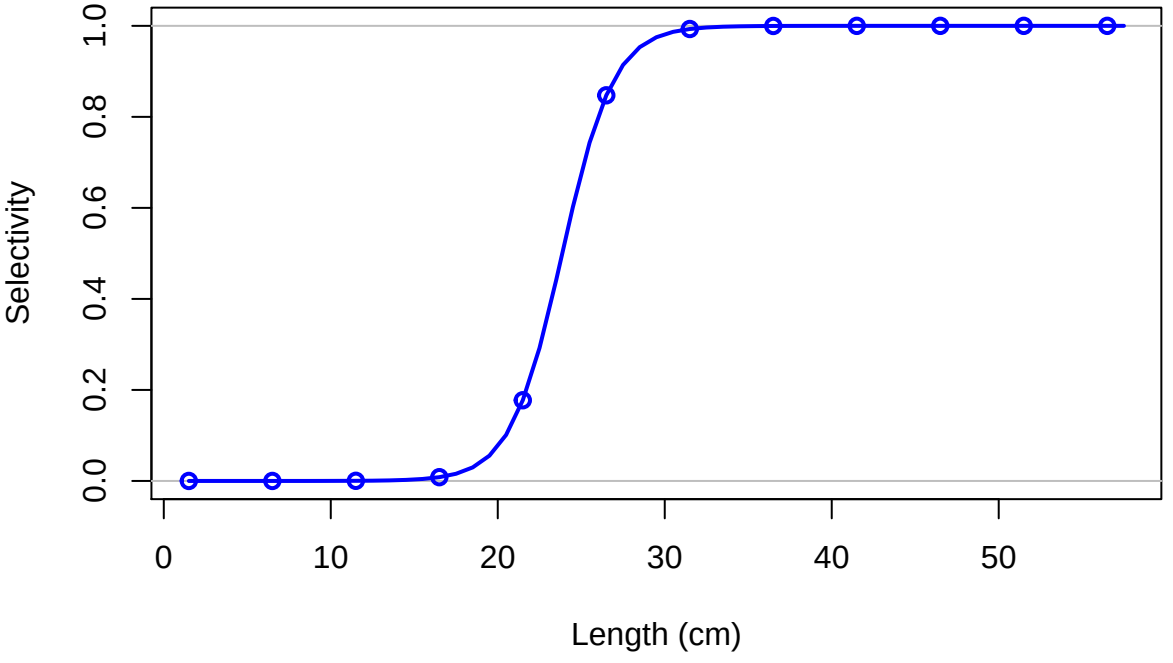

Fecundity
0
1
2
3
4
0
10
20
30
40
50
Female length (cm)

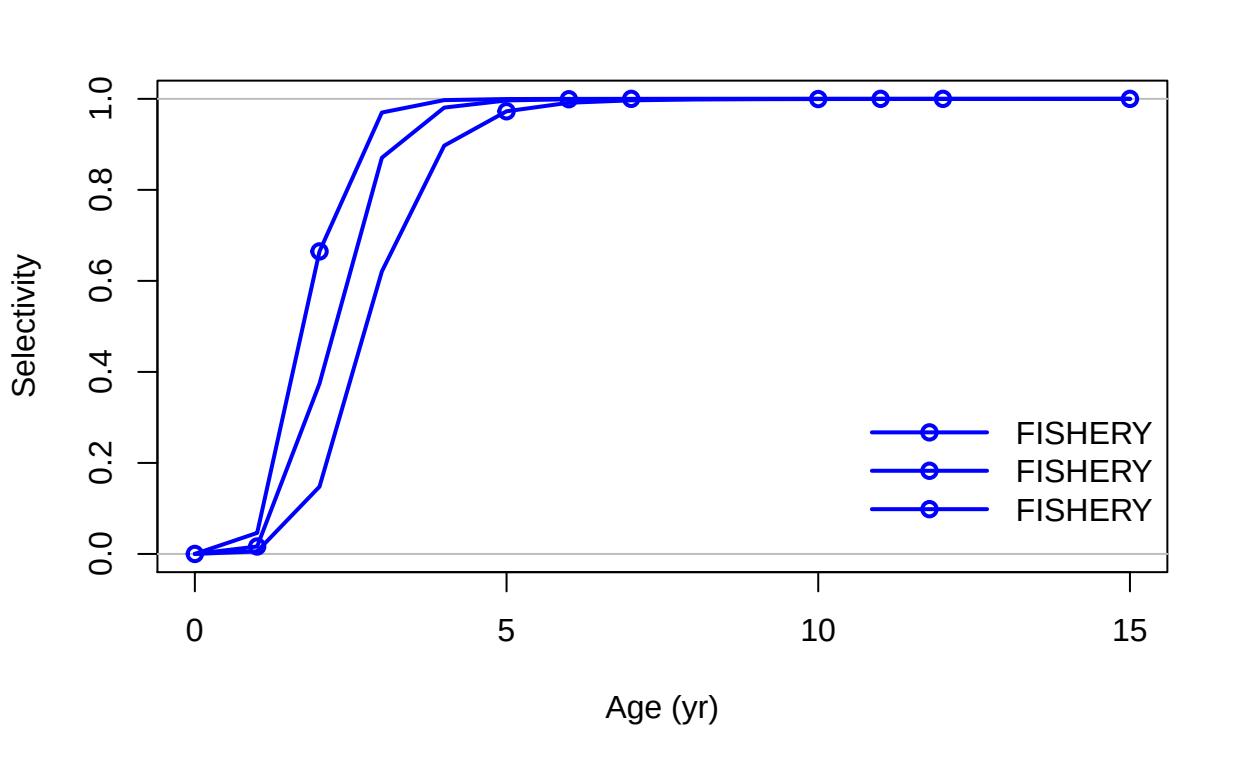

Spawning output
0
1
2
3
0
10
20
30
40
50
Length (cm)

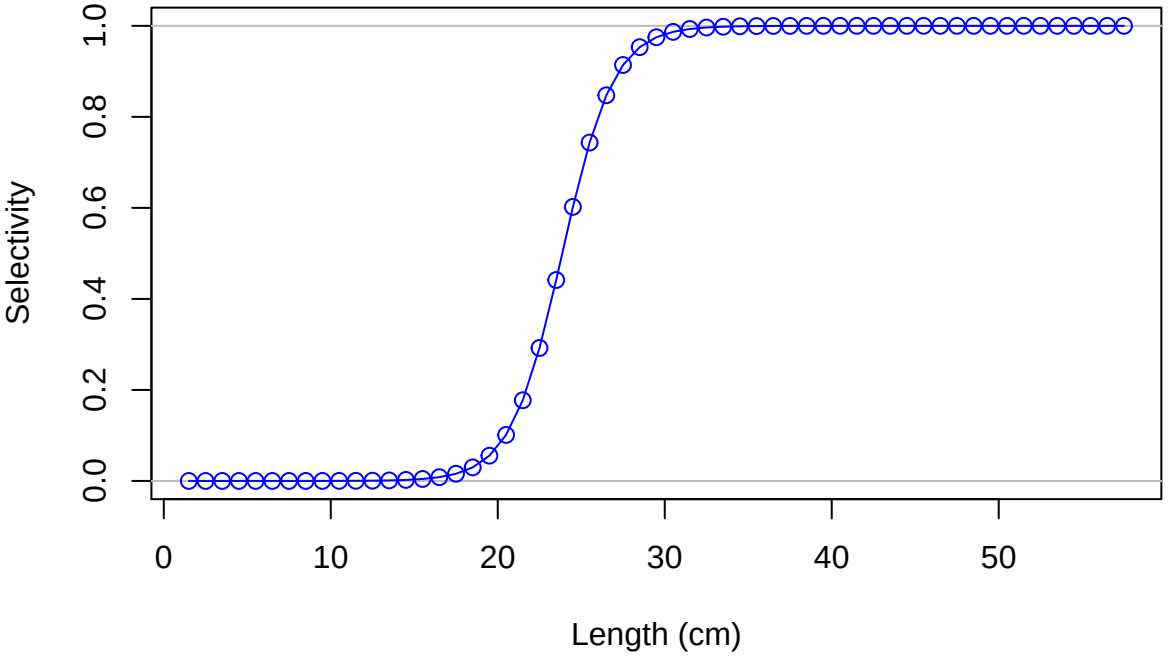

Spawning output
2.5
2.0
1.5
1.0
0.5
0.0
0
5
10
15
Age (yr)

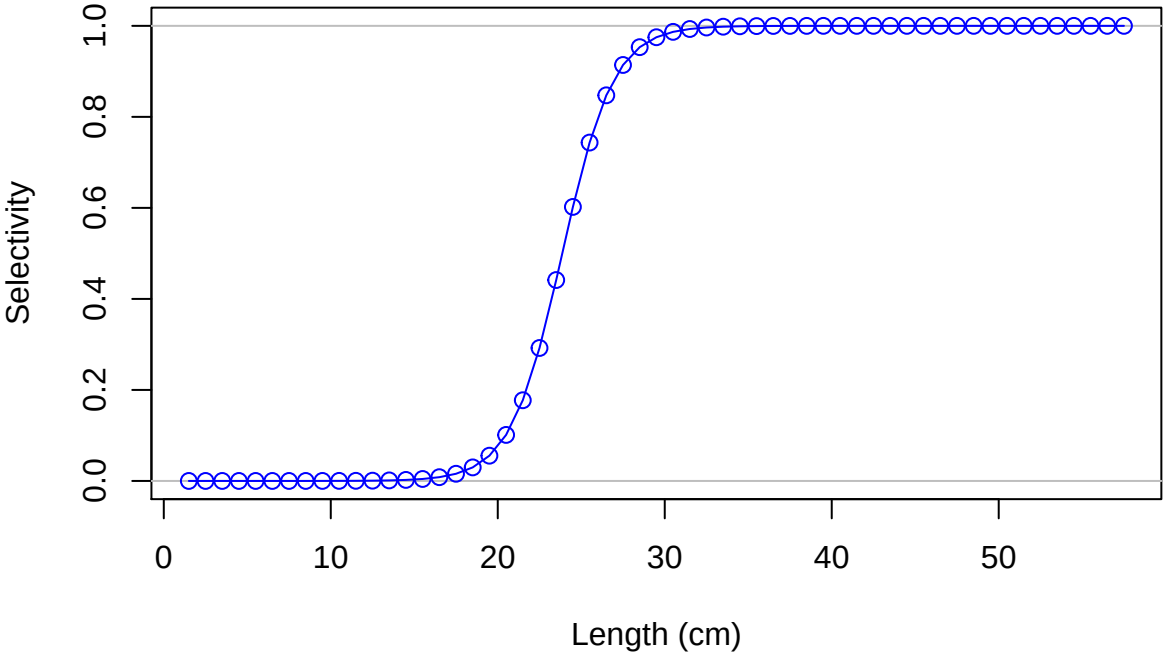

Hermaphroditism transition rate
1.0
0.8
0.6
0.4
0.2
0.0
0
2
4
6
8
10
12
14
Year

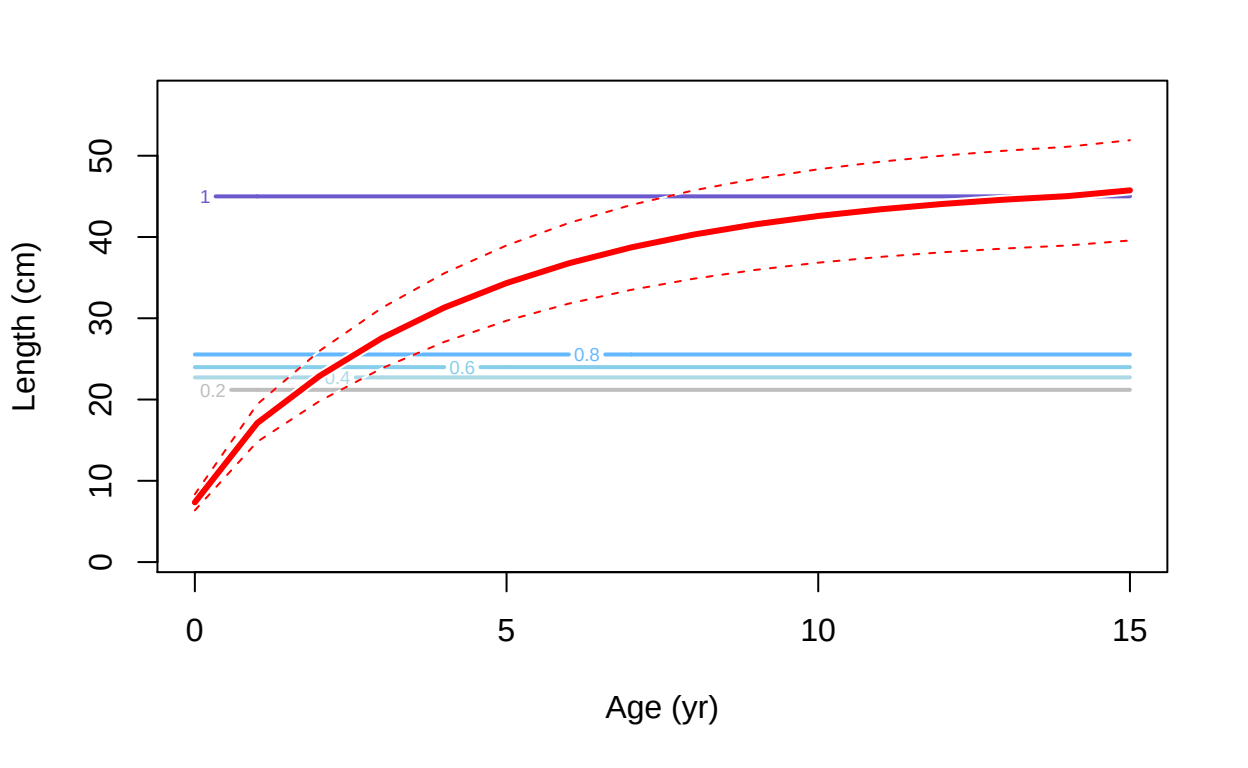

Fraction females by age at equilibrium
1.0
0.8
0.6
0.4
0.2
0.0
0
2
4
6
8
10
12
14
Age (yr)

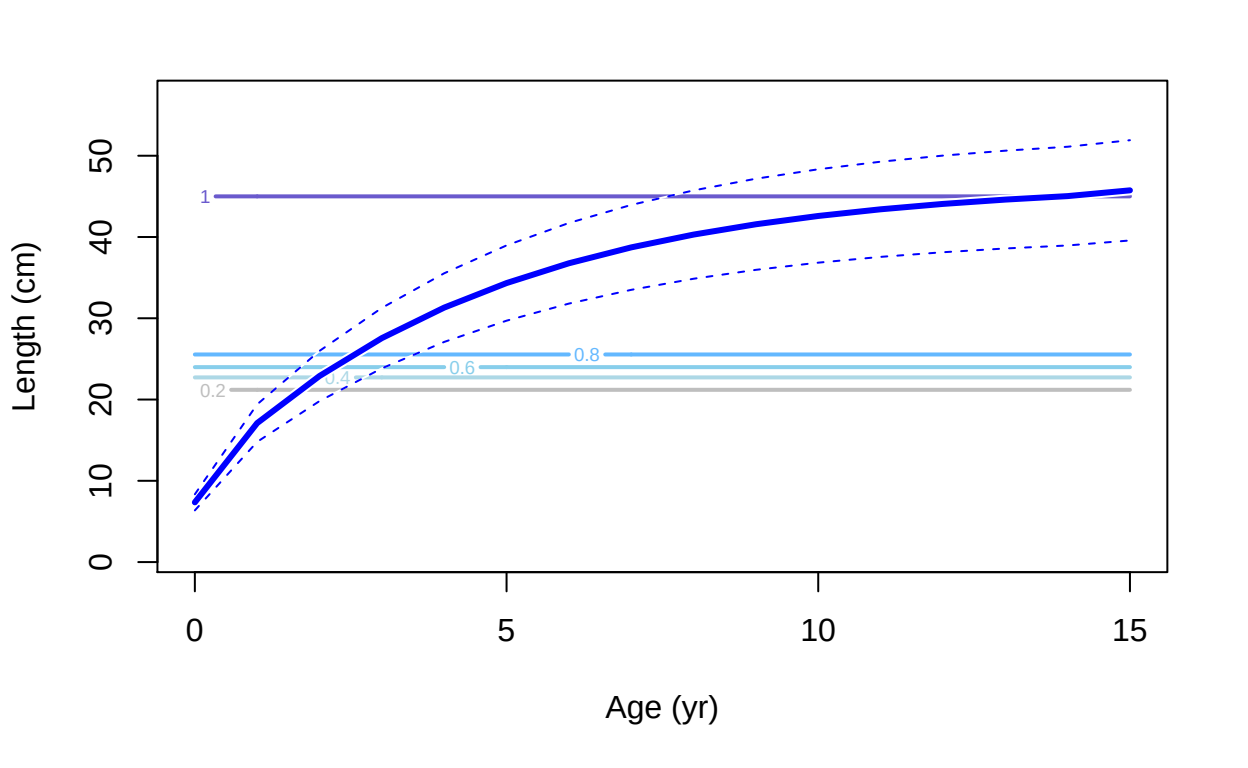

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
10
20
30
40
50
Length (cm)

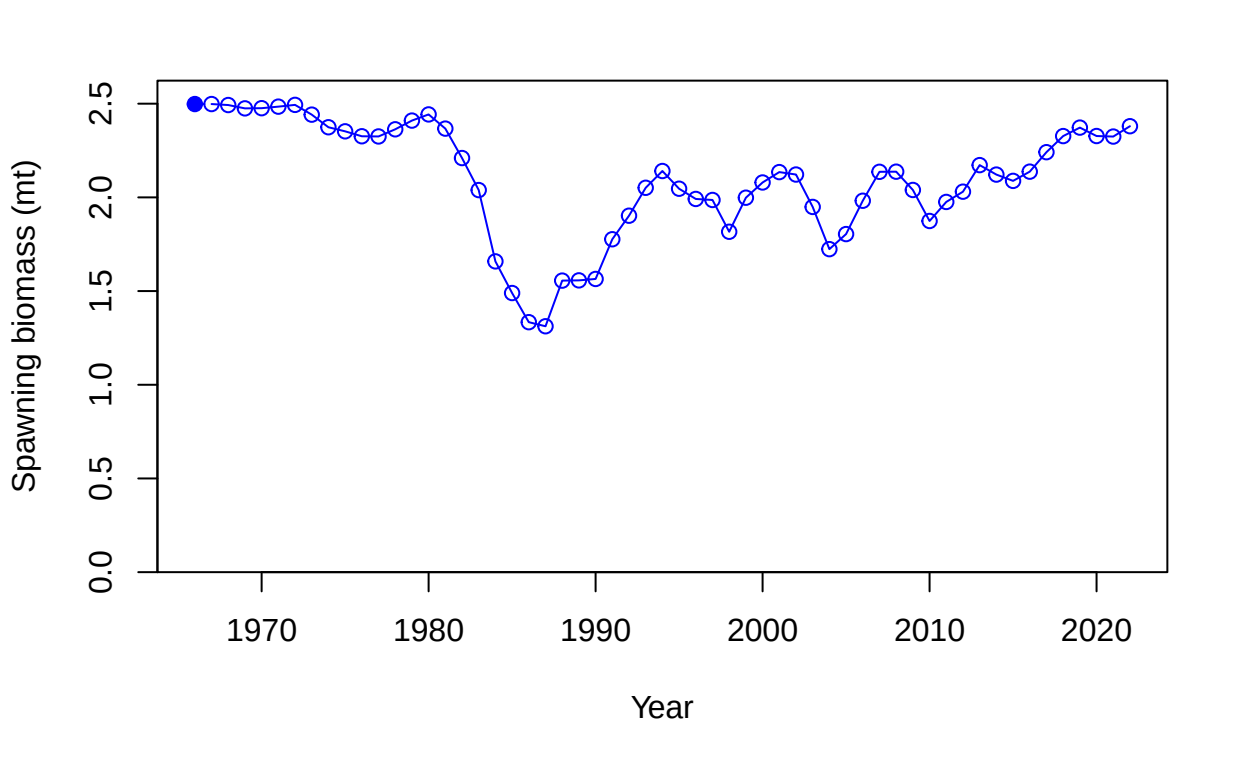

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
5
10
15
Age (yr)
FISHERY
FISHERY
FISHERY

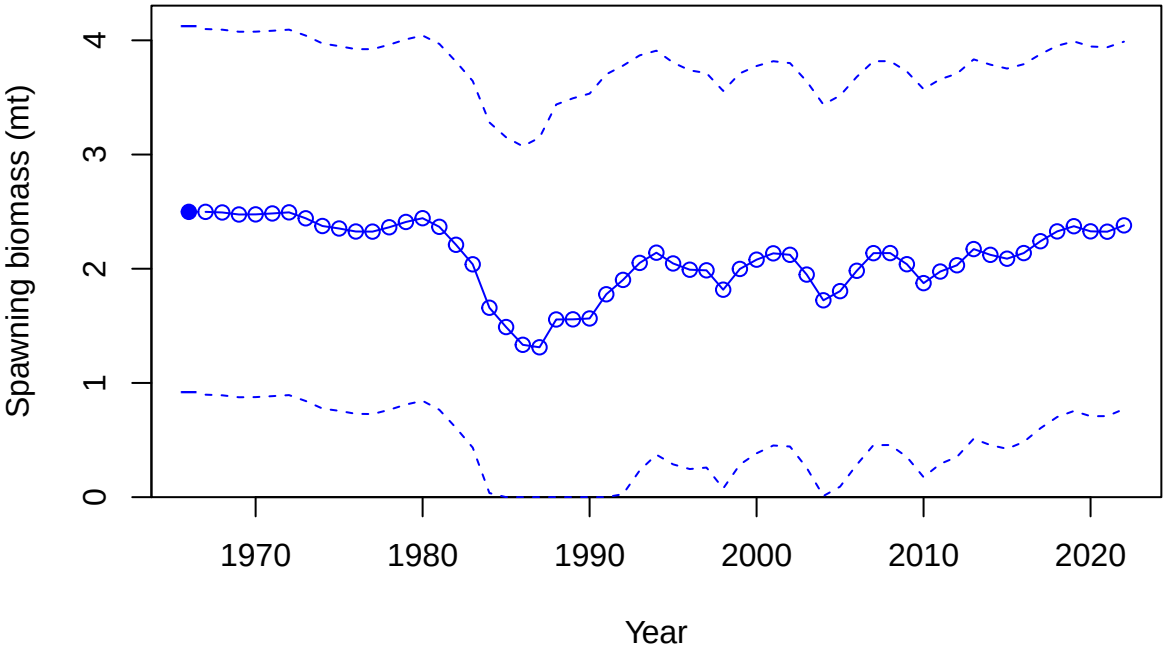

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
10
20
30
40
50
Length (cm)

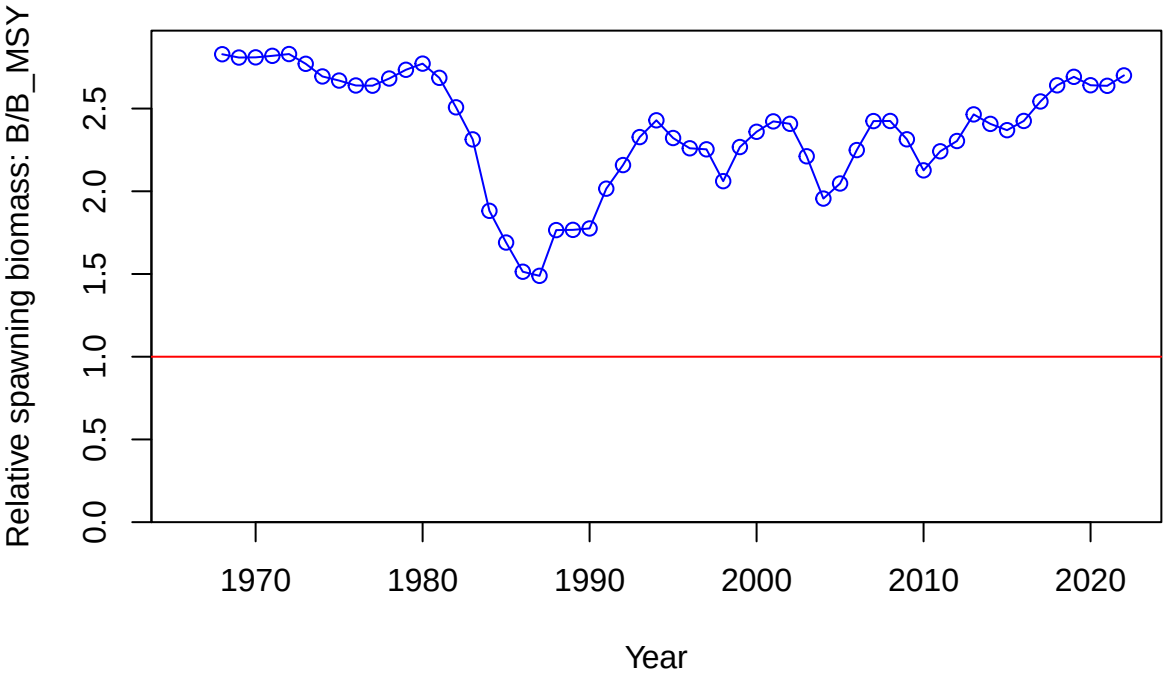

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
10
20
30
40
50
Length (cm)

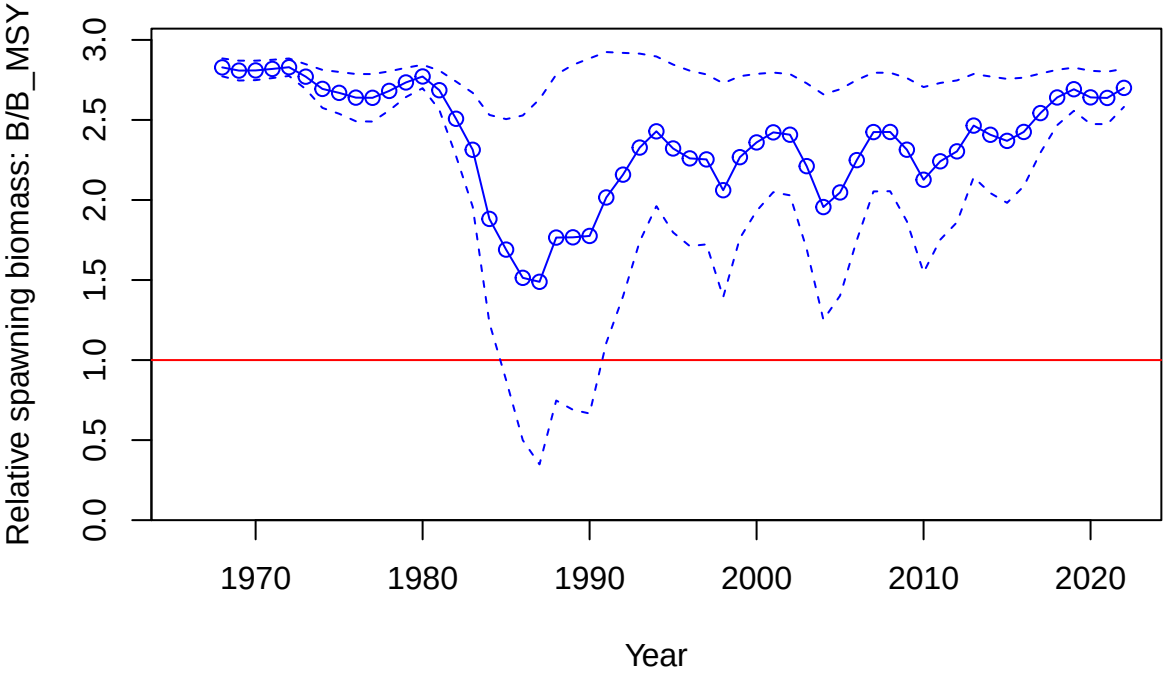

Length (cm)
0
10
20
30
40
50
0
5
10
15
Age (yr)
1
0.8
0.6
0.4
0.2

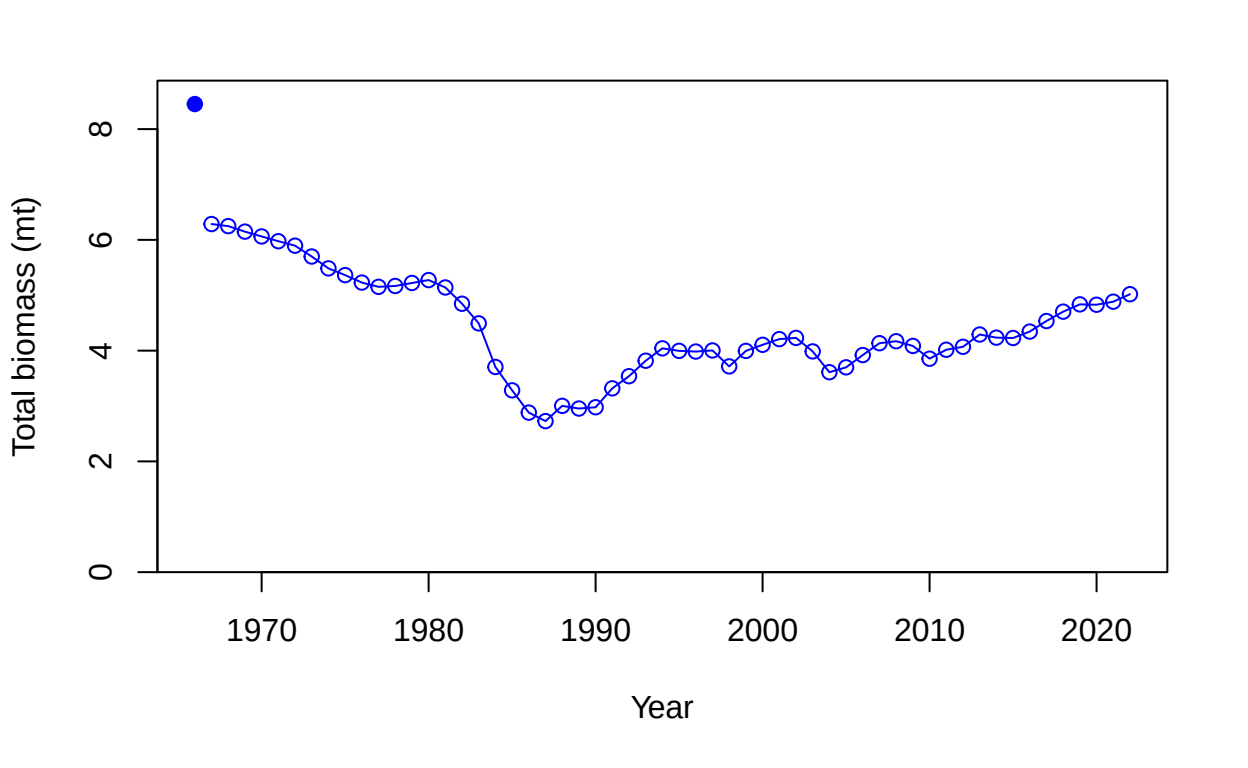

Length (cm)
0
10
20
30
40
50
0
5
10
15
Age (yr)
1
0.8
0.6
0.4
0.2

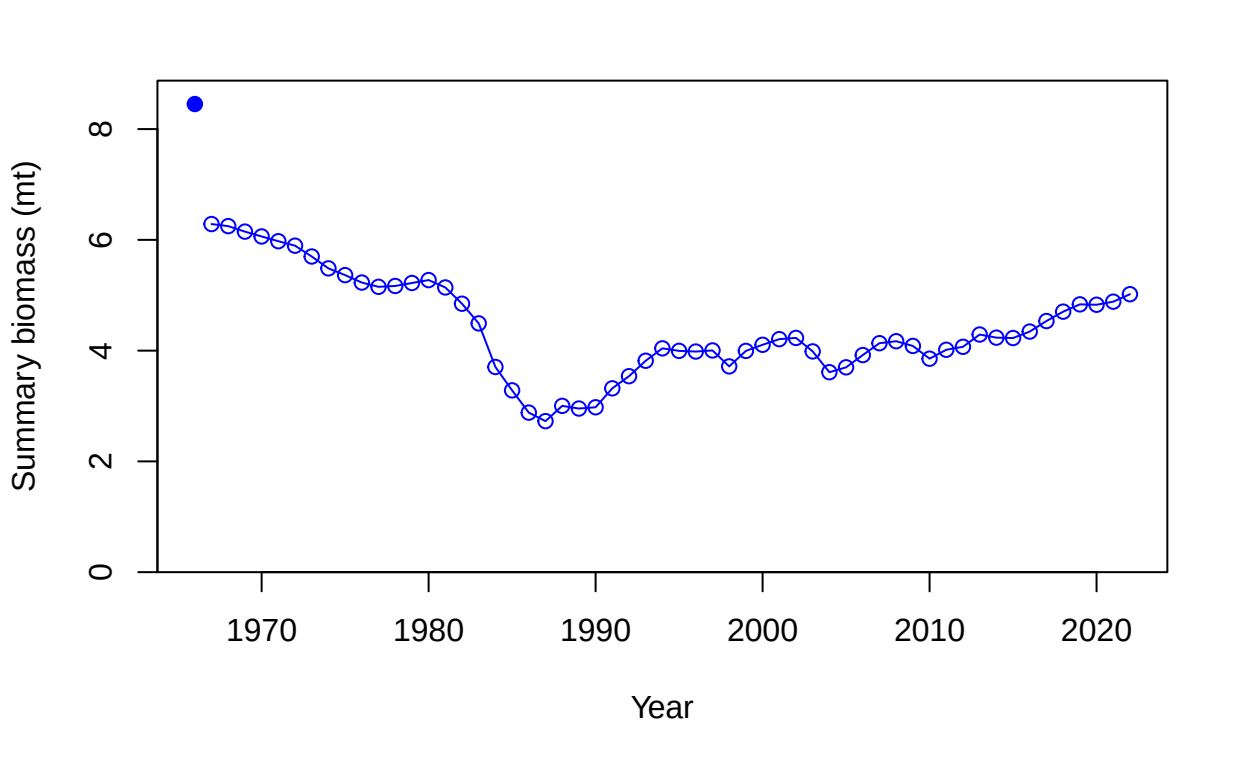

Spawning biomass (mt)
0.0
0.5
1.0
1.5
2.0
2.5
1970
1980
1990
2000
2010
2020
Year

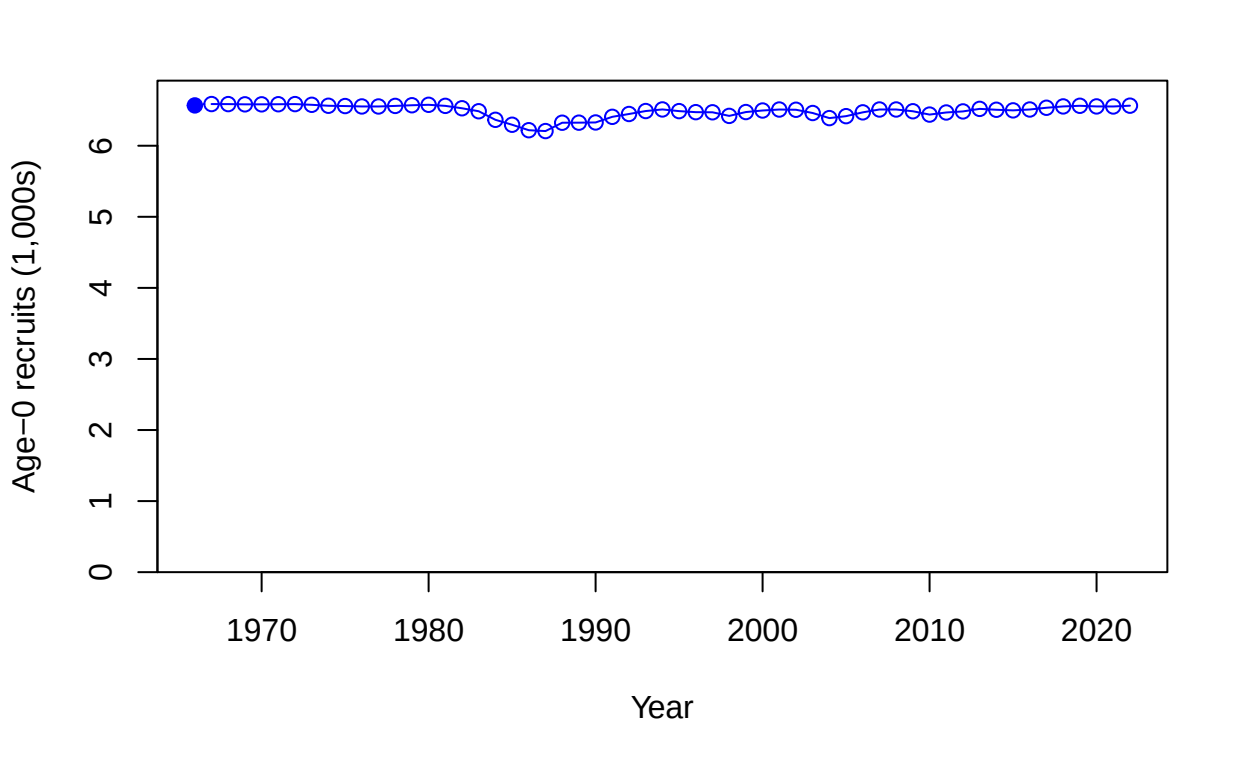

Spawning biomass (mt)
0
1
2
3
4
1970
1980
1990
2000
2010
2020
Year

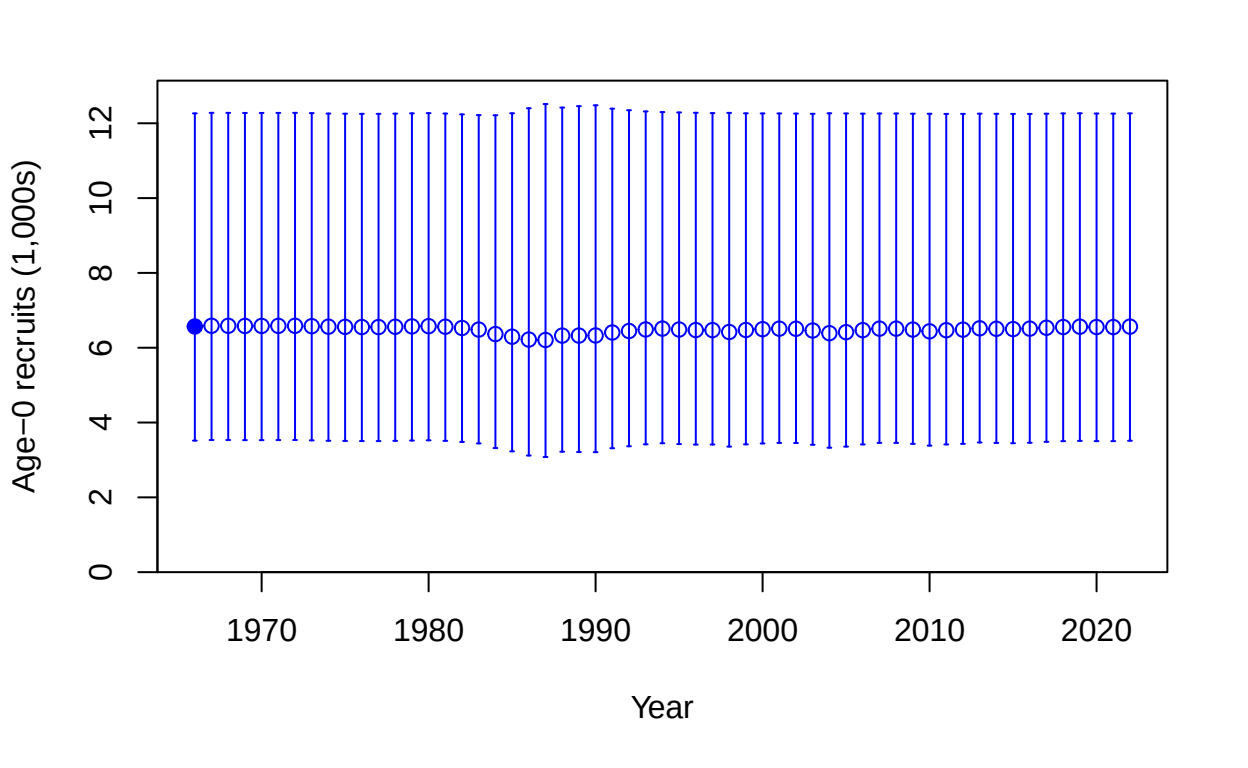

Relative spawning biomass: B/B_MSY
0.0
0.5
1.0
1.5
2.0
2.5
1970
1980
1990
2000
2010
2020
Year

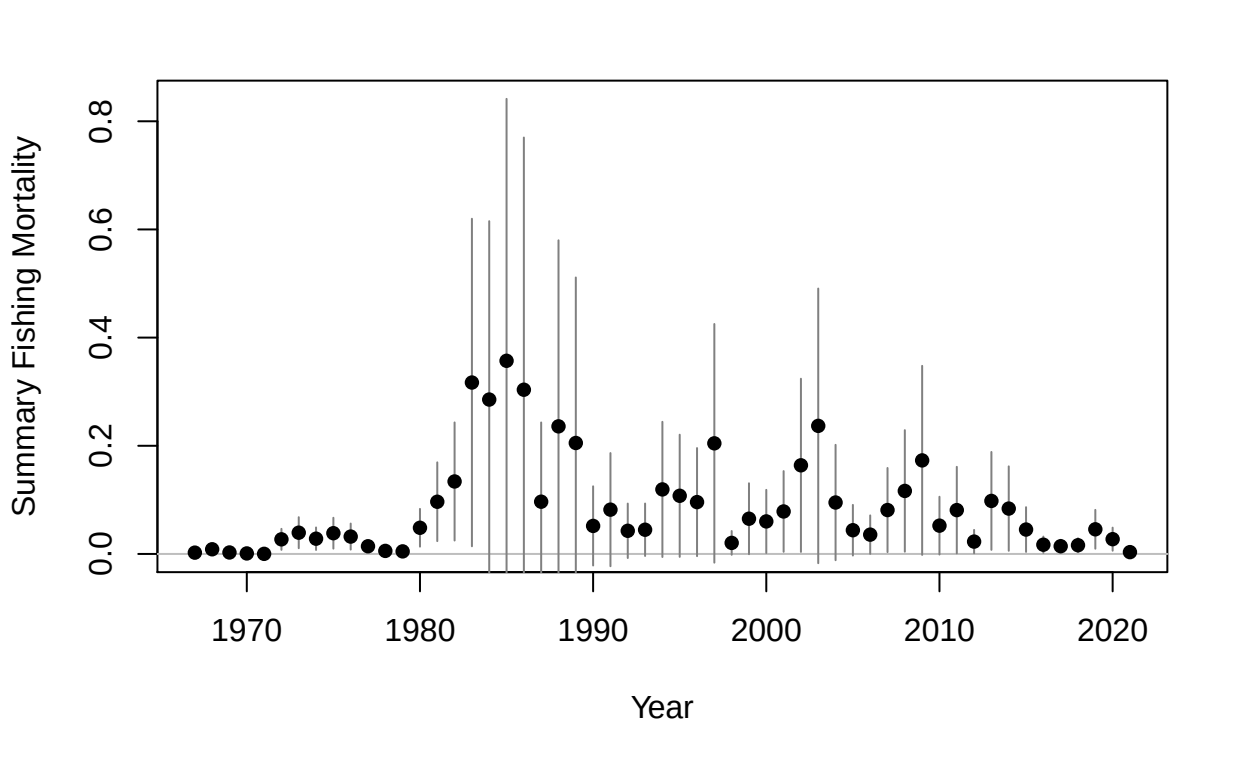

Relative spawning biomass: B/B_MSY
0.0
0.5
1.0
1.5
2.0
2.5
3.0
1970
1980
1990
2000
2010
2020
Year

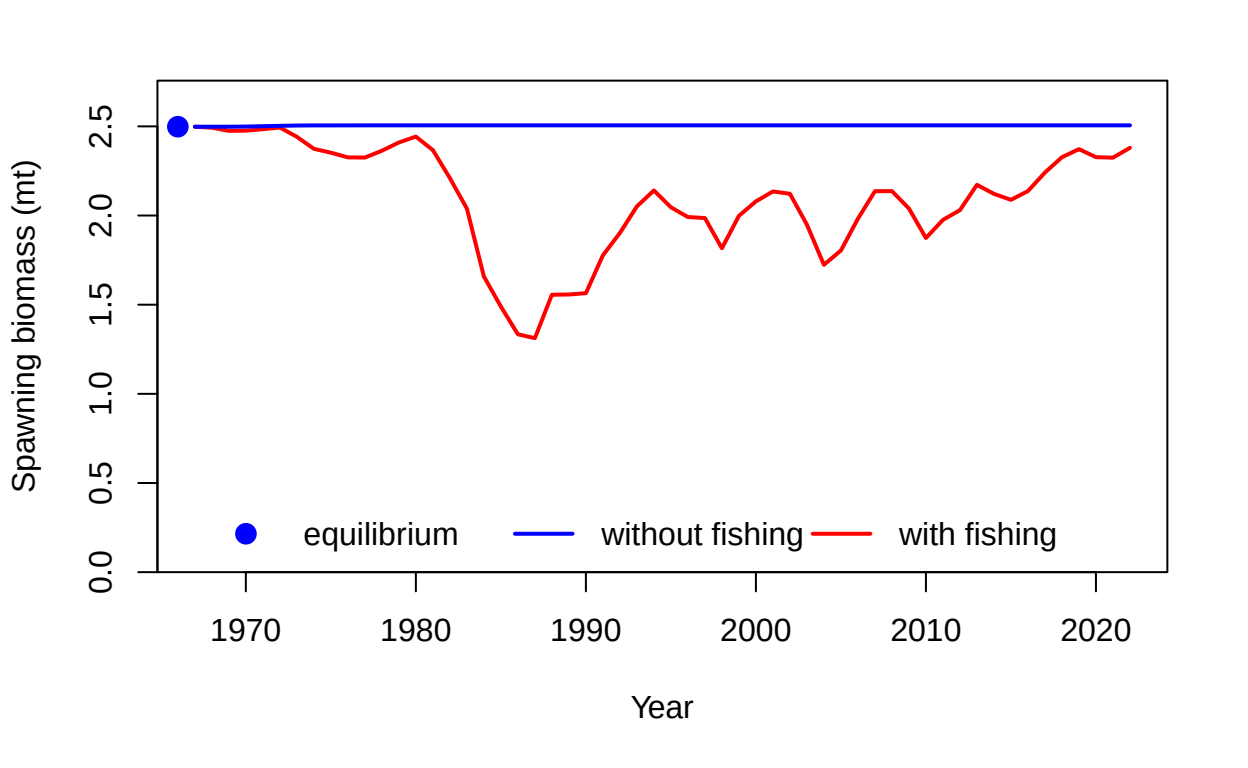

Total biomass (mt)
0
2
4
6
8
1970
1980
1990
2000
2010
2020
Year

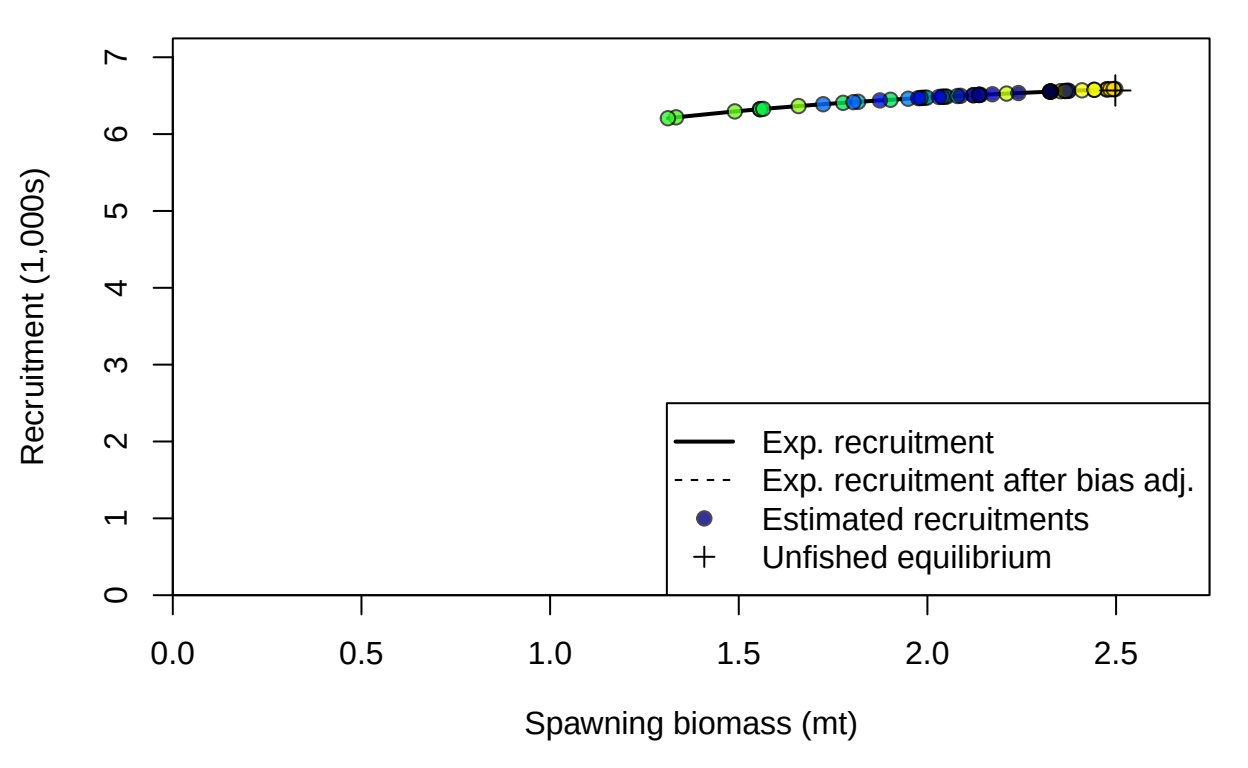

Summary biomass (mt)
0
2
4
6
8
1970
1980
1990
2000
2010
2020
Year

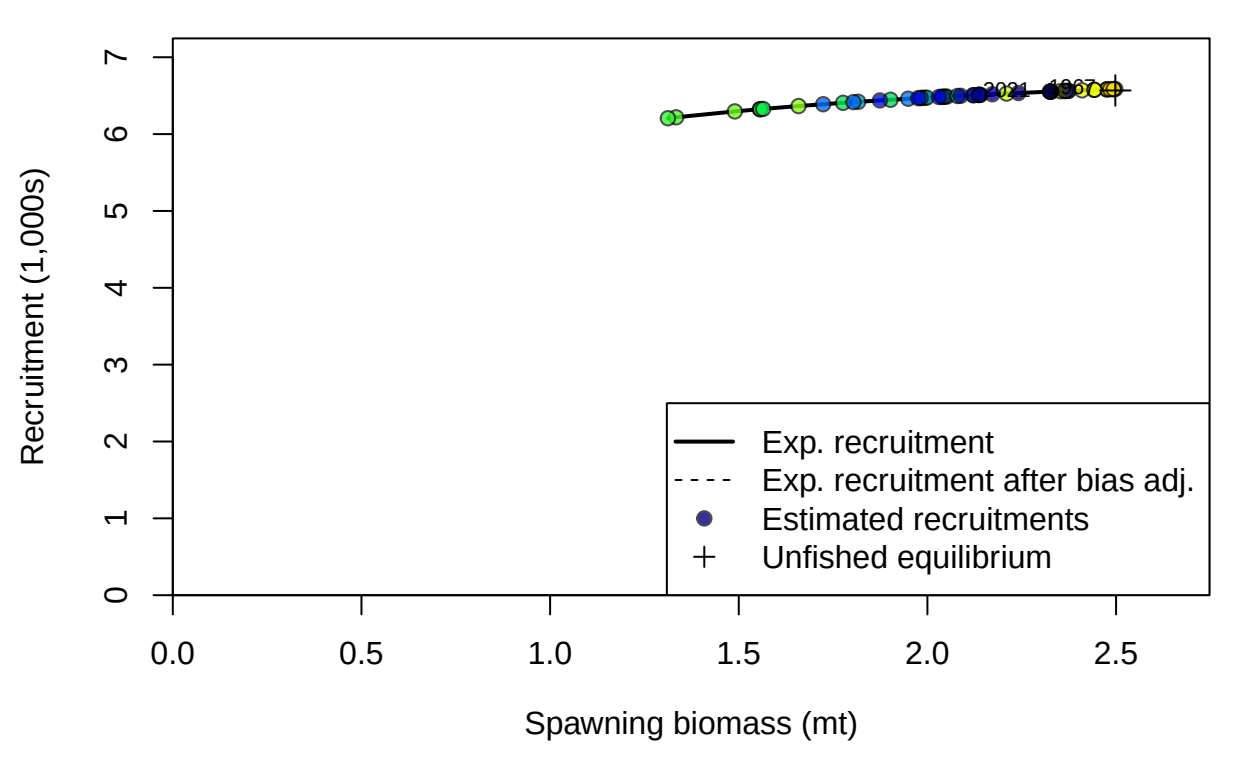

Age−0 recruits (1,000s)
0
1
2
3
4
5
6
1970
1980
1990
2000
2010
2020
Year

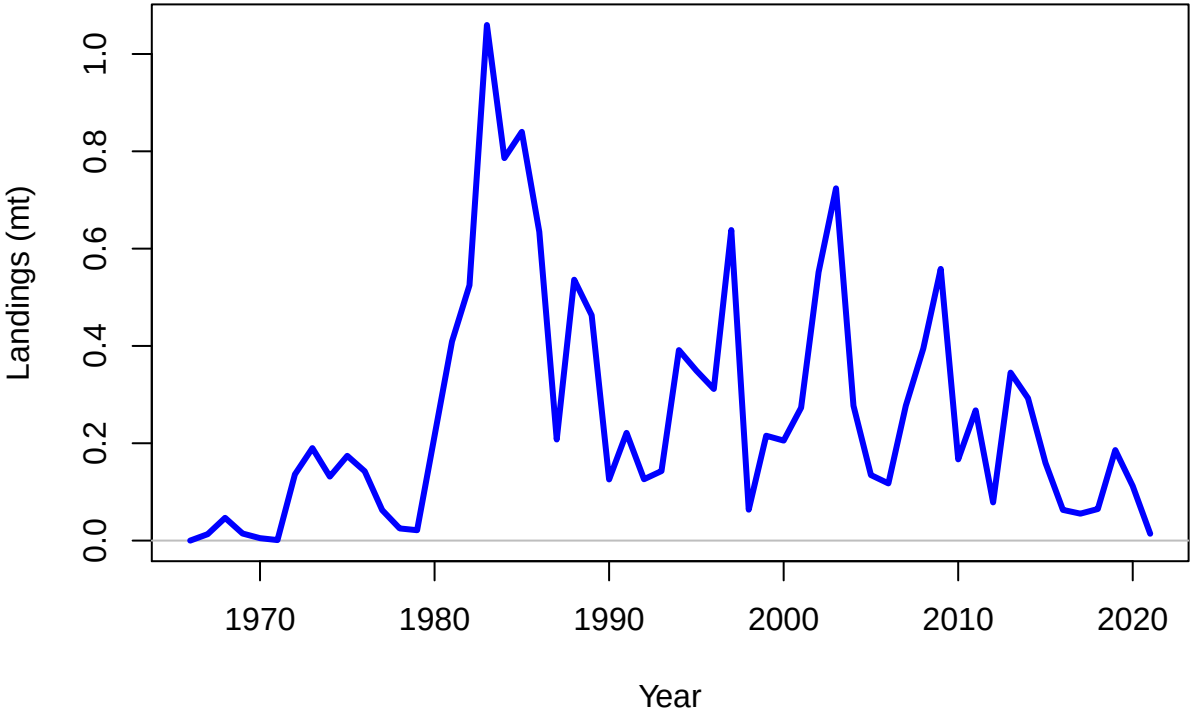

Age−0 recruits (1,000s)
0
2
4
6
8
10
12
1970
1980
1990
2000
2010
2020
Year

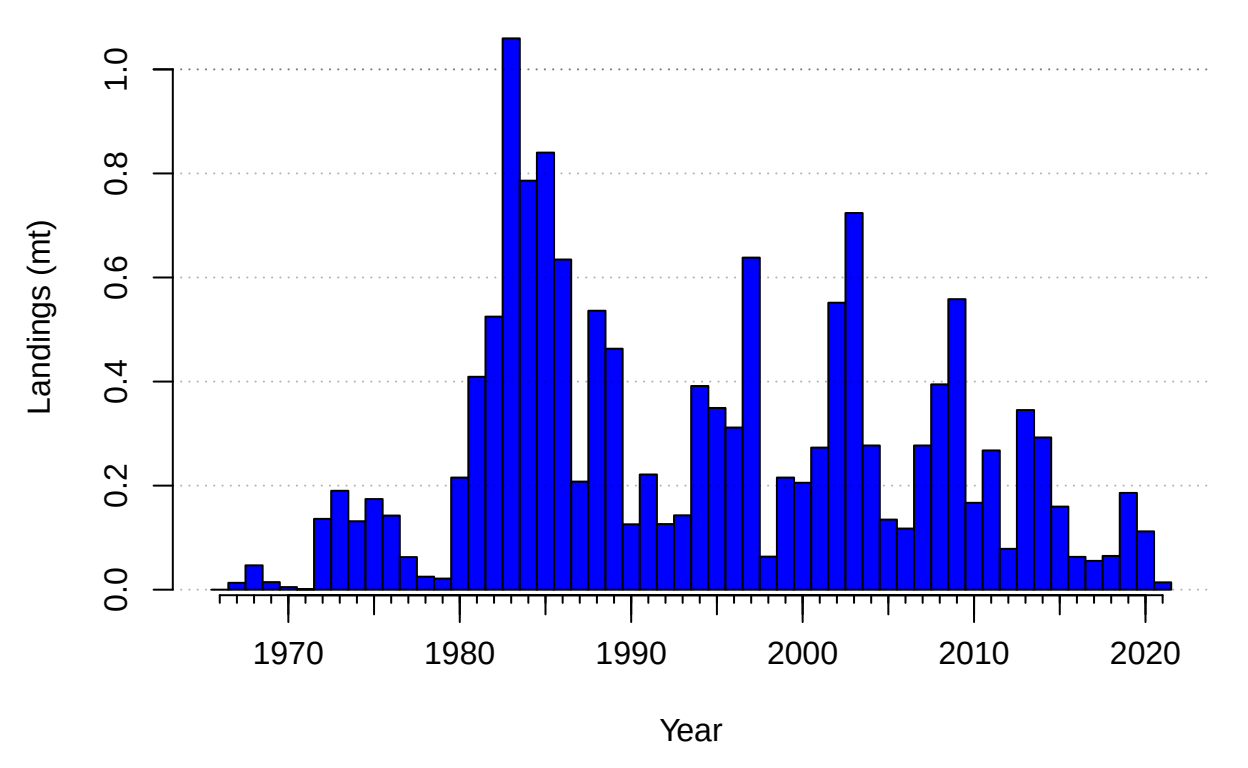

Summary Fishing Mortality
0.0
0.2
0.4
0.6
0.8
1970
1980
1990
2000
2010
2020
Year

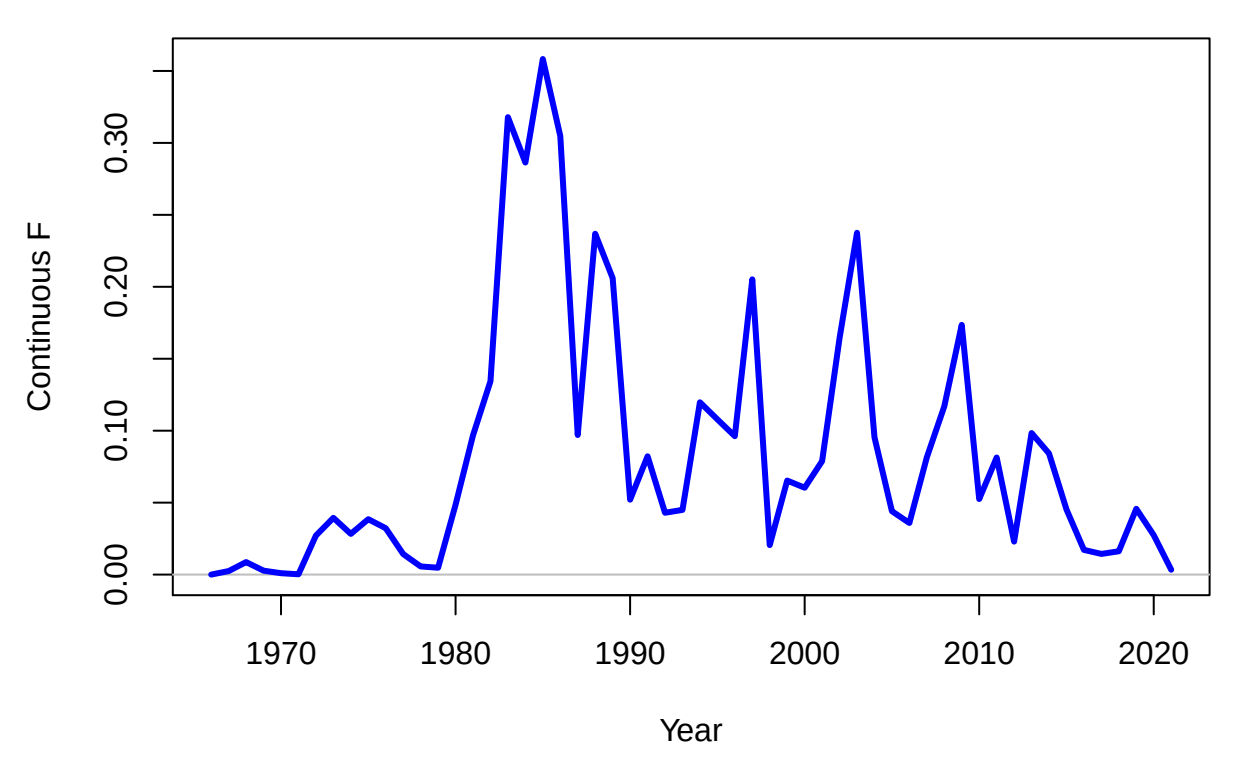

Spawning biomass (mt)
0.0
0.5
1.0
1.5
2.0
2.5
equilibrium
without fishing
with fishing
1970
1980
1990
2000
2010
2020
Year

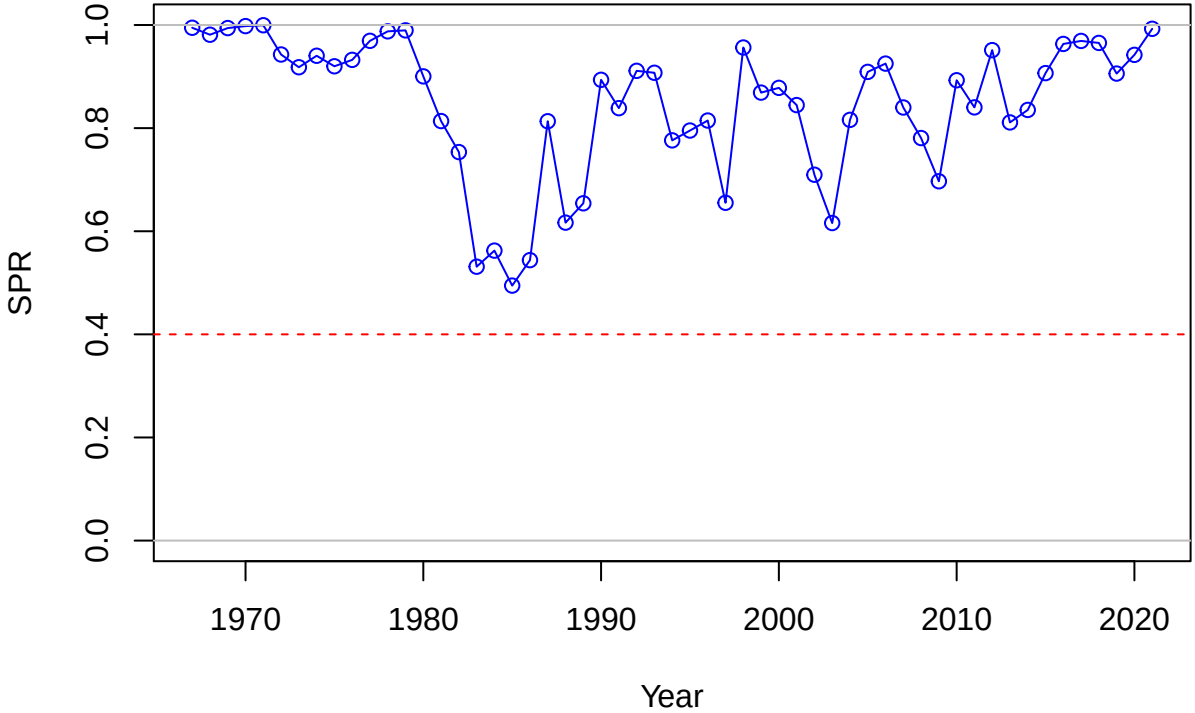

Recruitment (1,000s)
0
1
2
3
4
5
6
7
0.0
0.5
1.0
1.5
2.0
2.5
Spawning biomass (mt)
Exp. recruitment
Exp. recruitment after bias adj.
Estimated recruitments
Unfished equilibrium

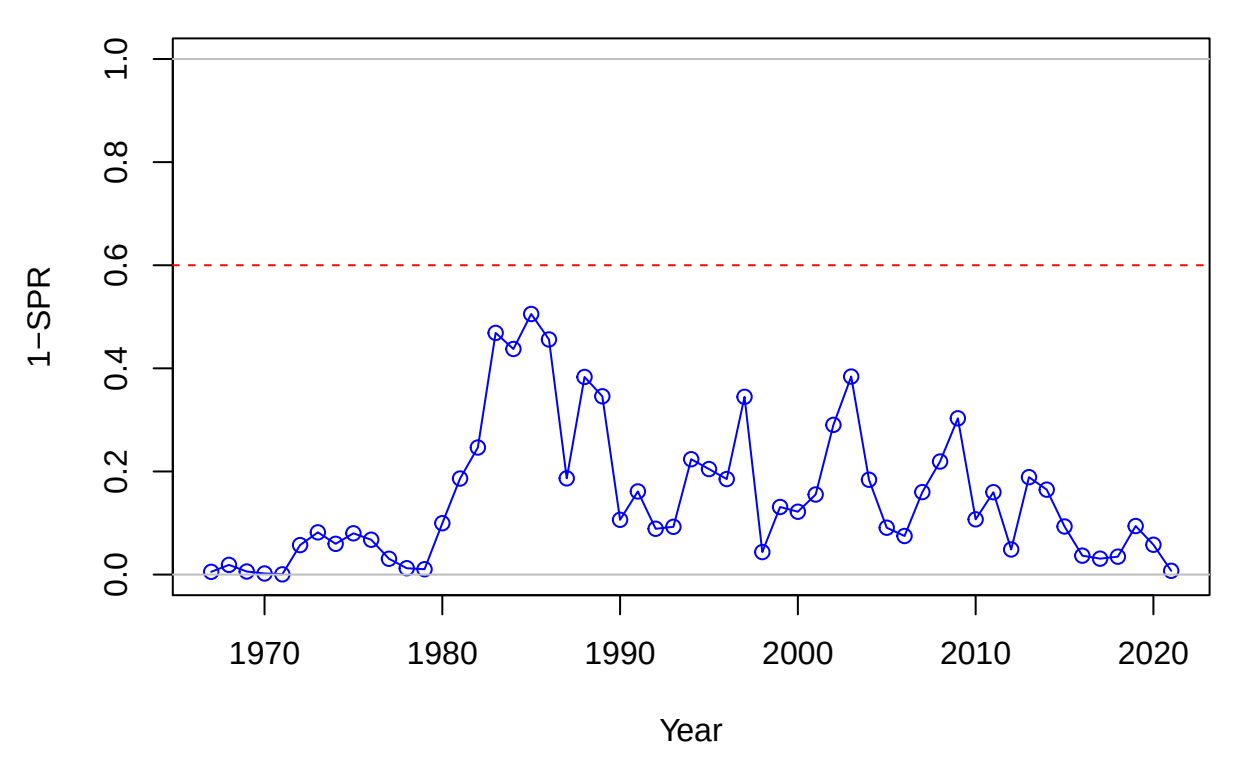

Recruitment (1,000s)
0
1
2
3
4
5
6
7
0.0
0.5
1.0
1.5
2.0
2.5
Spawning biomass (mt)
2021
1967
1907
Exp. recruitment
Exp. recruitment after bias adj.
Estimated recruitments
Unfished equilibrium

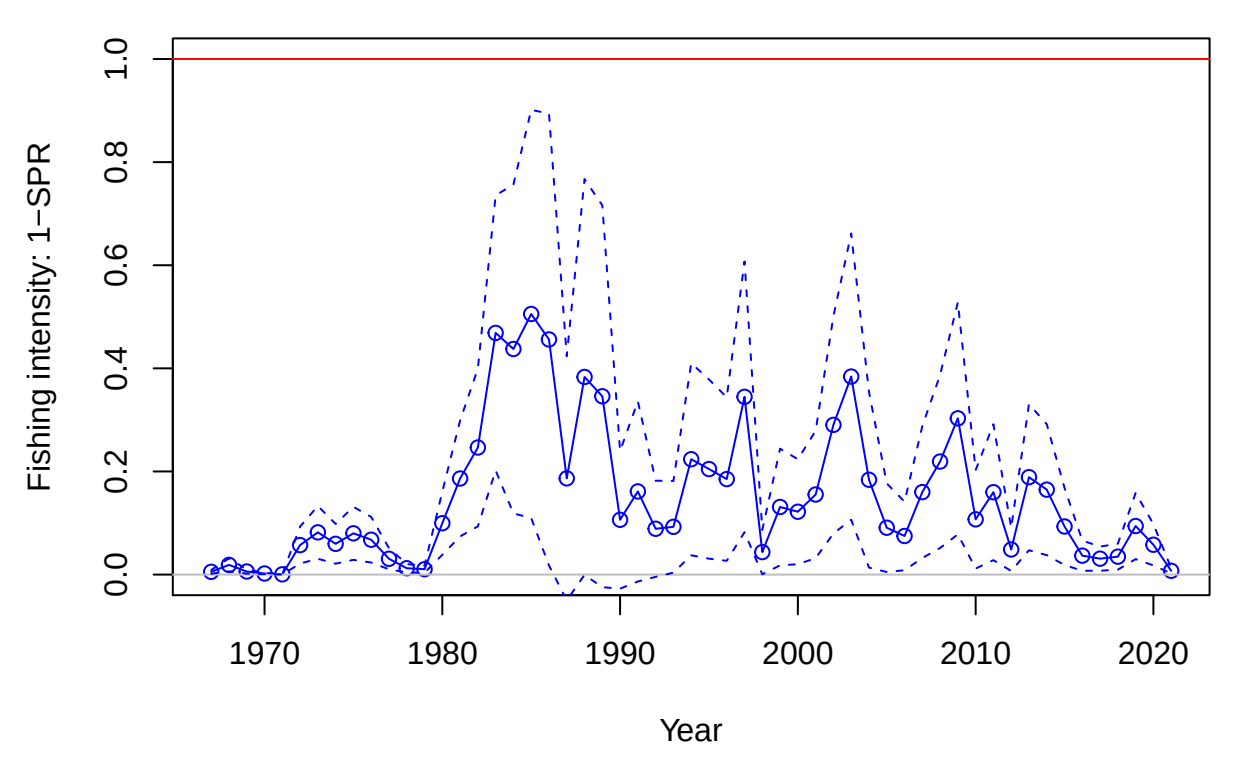

Landings (mt)
0.0
0.2
0.4
0.6
0.8
1.0
1970
1980
1990
2000
2010
2020
Year

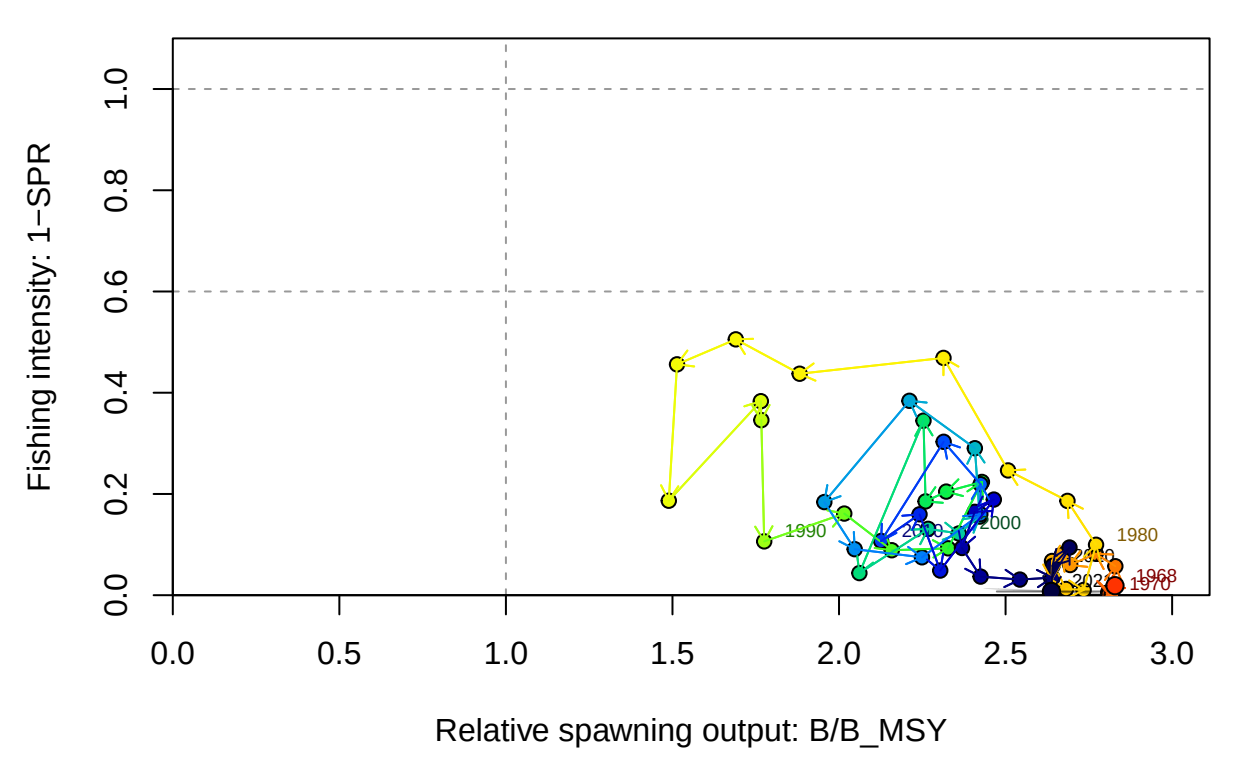

Landings (mt)
0.0
0.2
0.4
0.6
0.8
1.0
1970
1980
1990
2000
2010
2020
Year

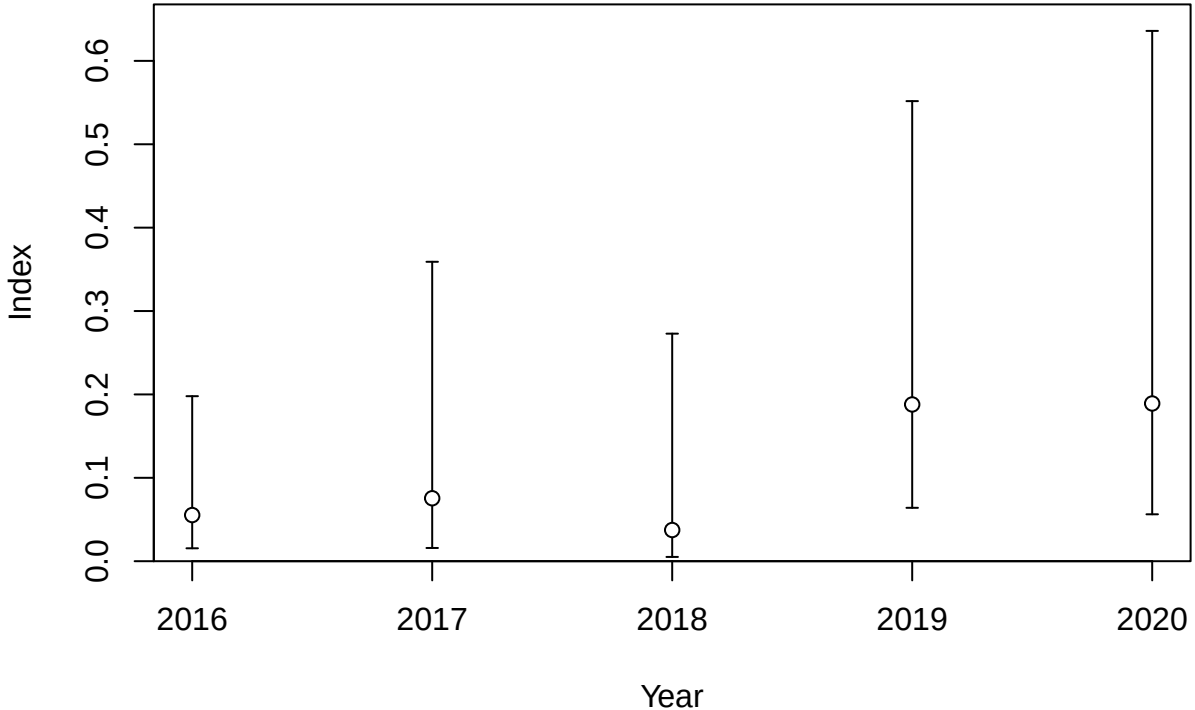

Continuous F
0.00
0.10
0.20
0.30
1970
1980
1990
2000
2010
2020
Year

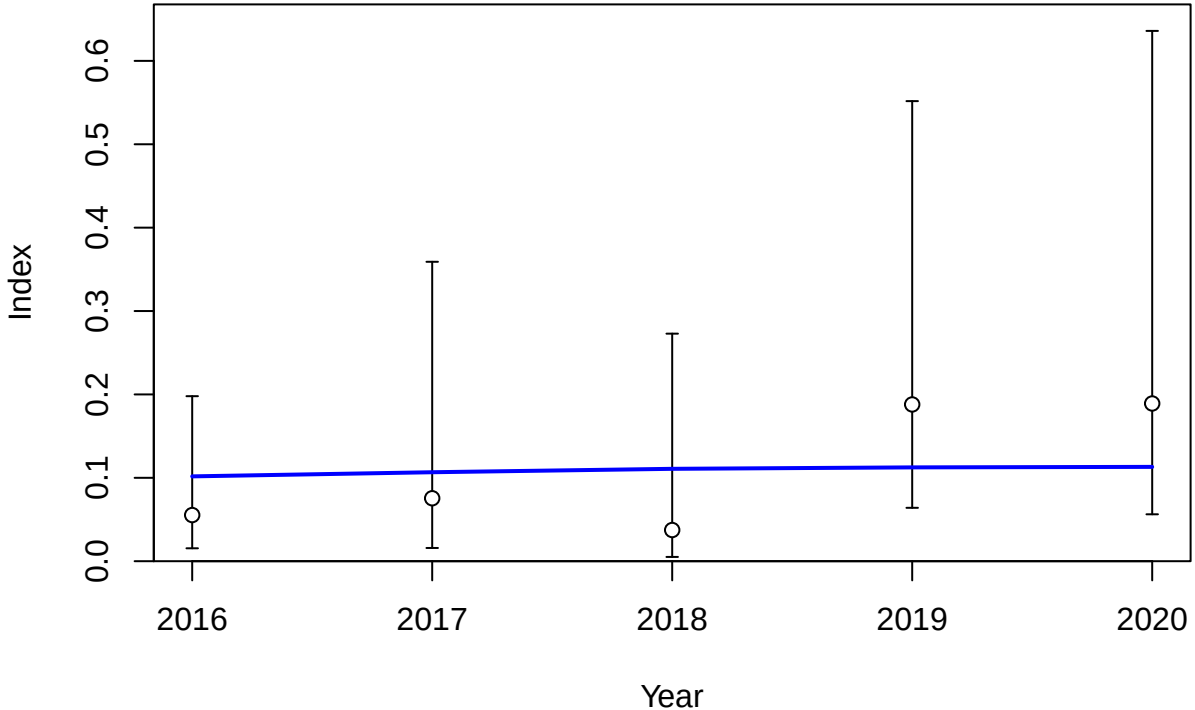

SPR
0.0
0.2
0.4
0.6
0.8
1.0
1970
1980
1990
2000
2010
2020
Year

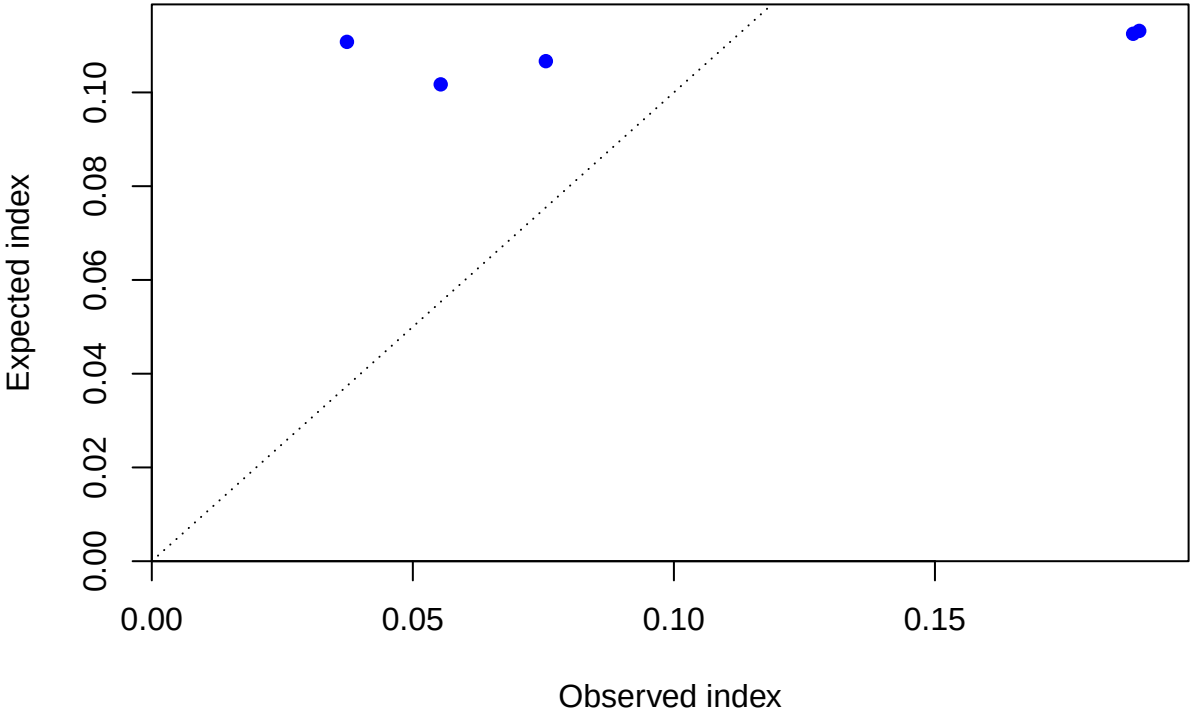

1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
1970
1980
1990
2000
2010
2020
Year

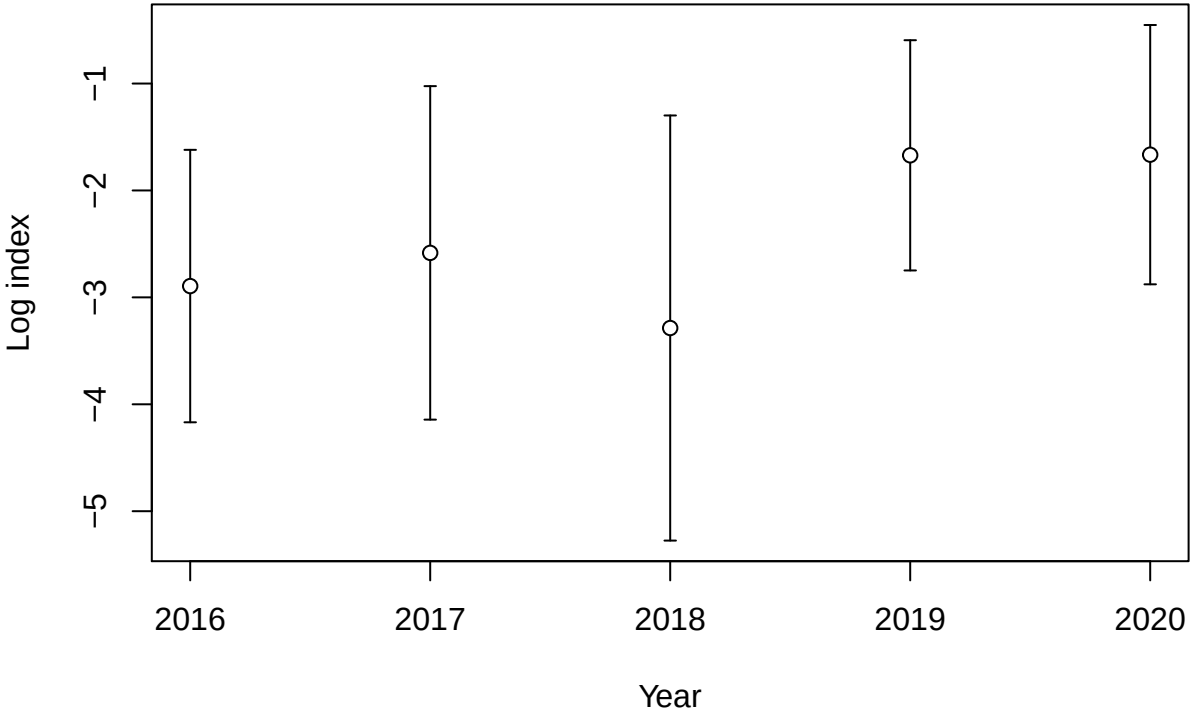

Fishing intensity: 1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
1970
1980
1990
2000
2010
2020
Year

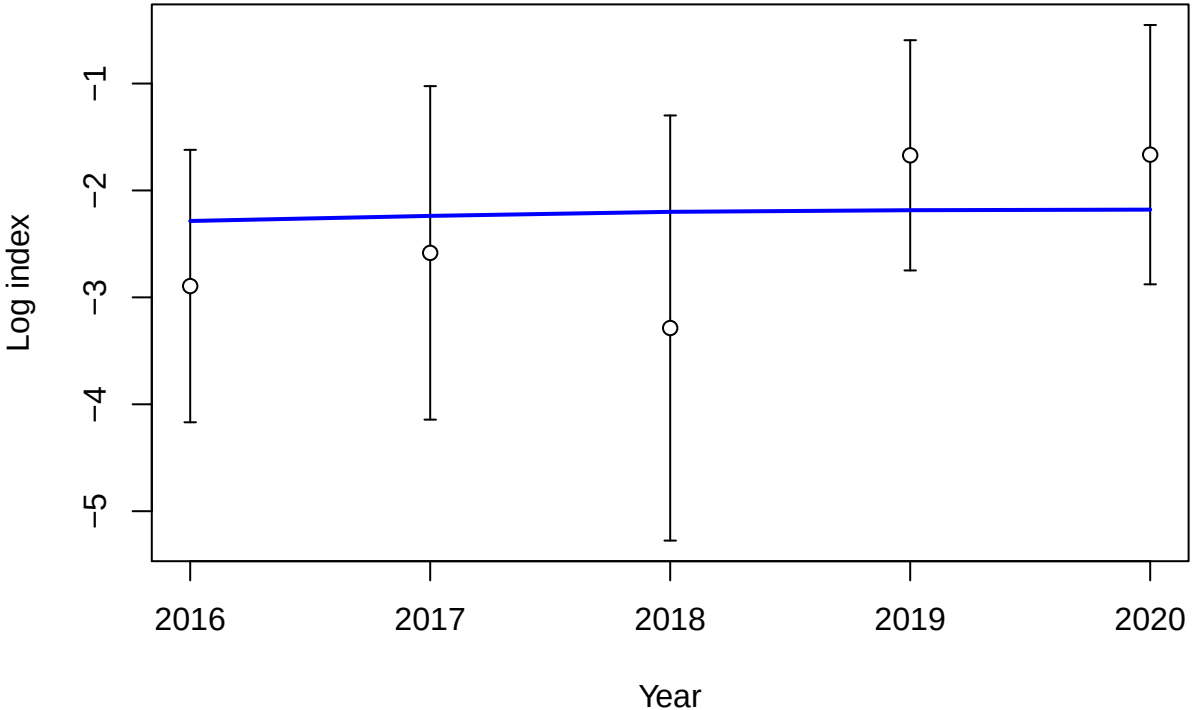

Fishing intensity: 1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
Relative spawning output: B/B_MSY
1990
2000
1980
1968
1970

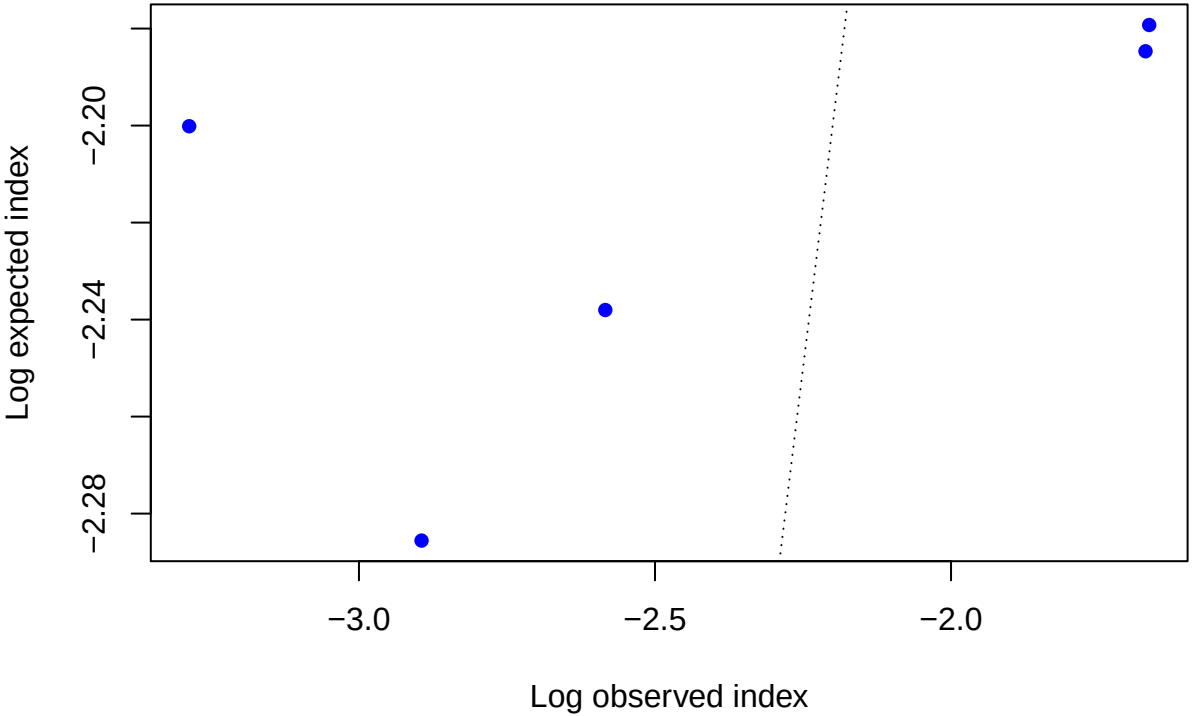

Index
0.0
0.1
0.2
0.3
0.4
0.5
0.6
2016
2017
2018
2019
2020
Year

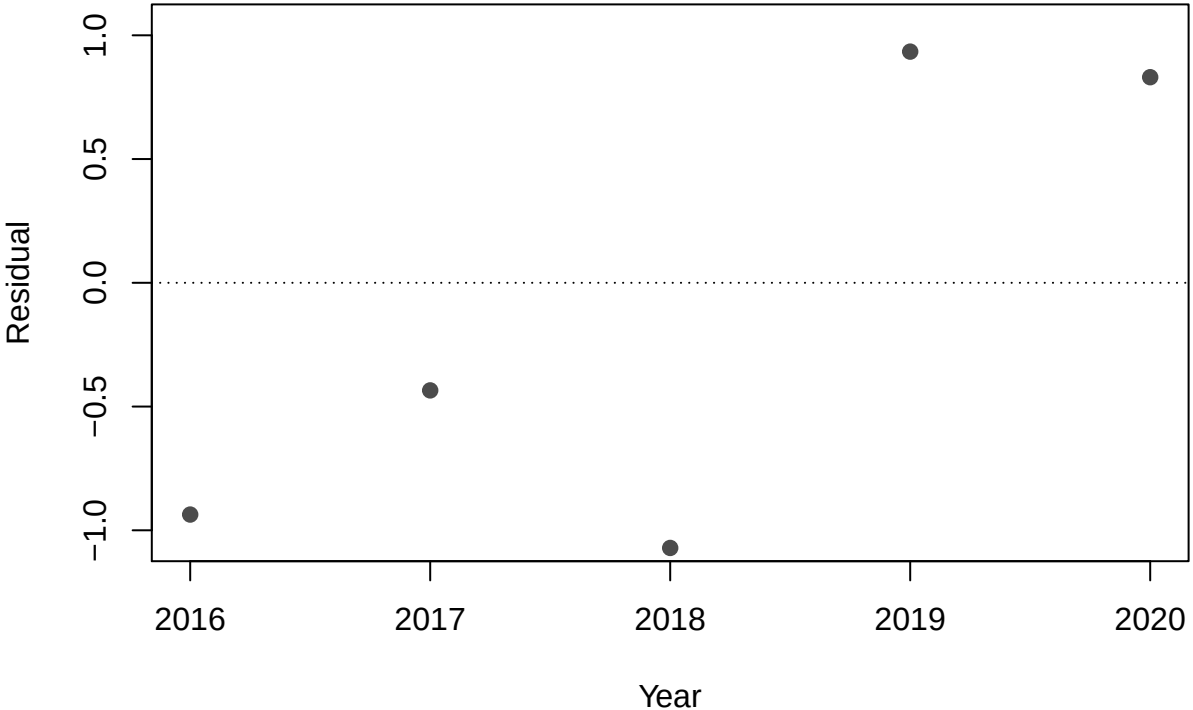

Index
0.0
0.1
0.2
0.3
0.4
0.5
0.6
2016
2017
2018
2019
2020
Year

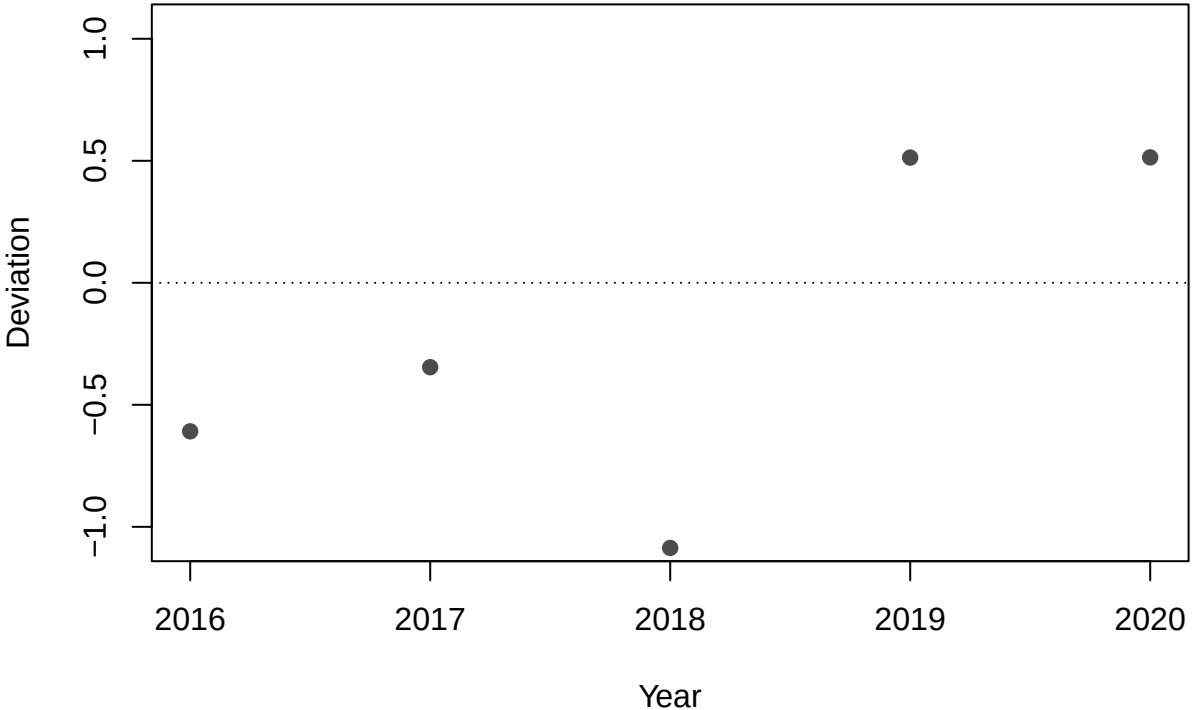

Expected index
0.00
0.02
0.04
0.06
0.08
0.10
0.00
0.05
0.10
0.15
Observed index

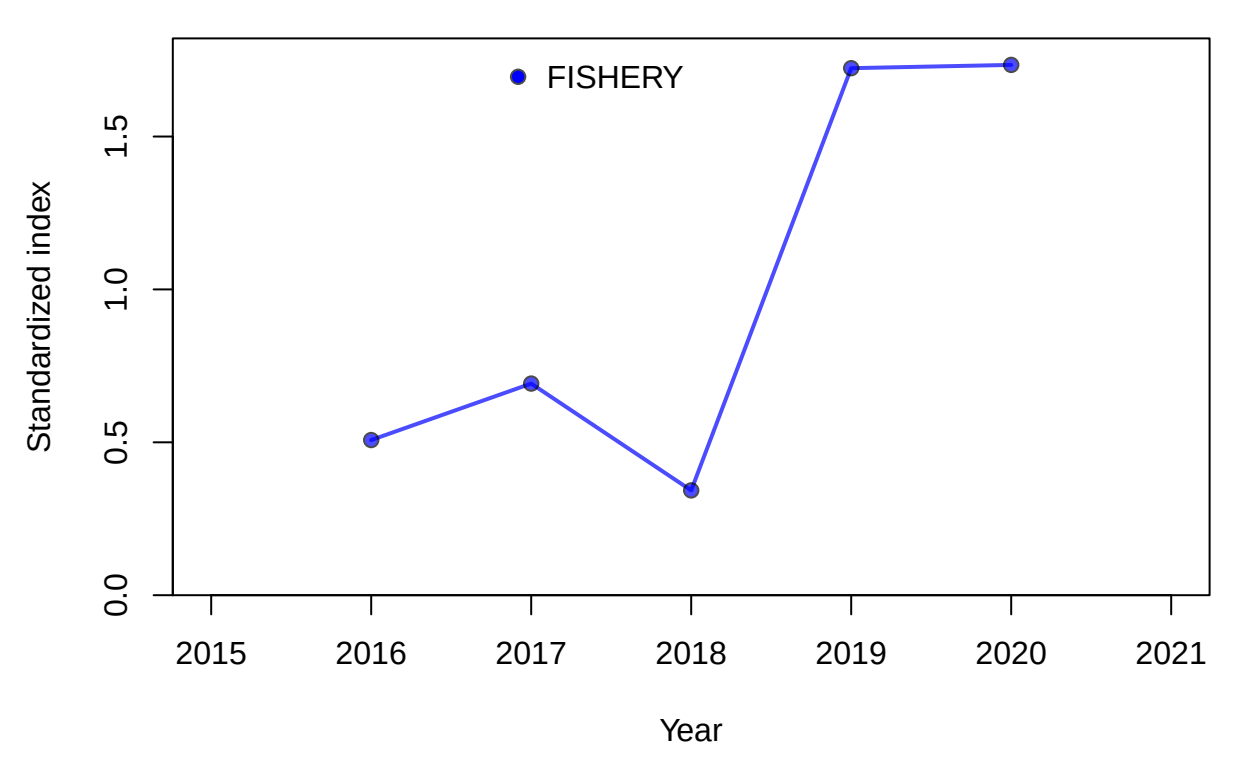

Log index
−1
−2
−3
−4
−5
2016
2017
2018
2019
2020
Year

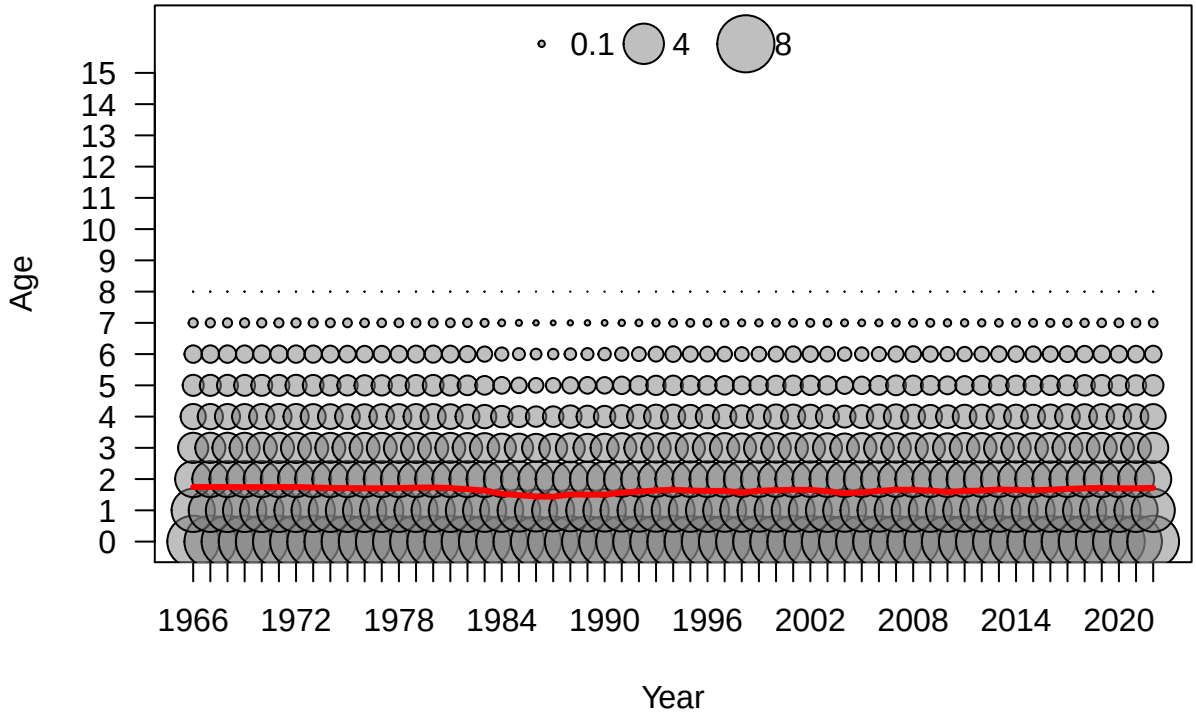

Log index
−1
−2
−3
−4
−5
2016
2017
2018
2019
2020
Year

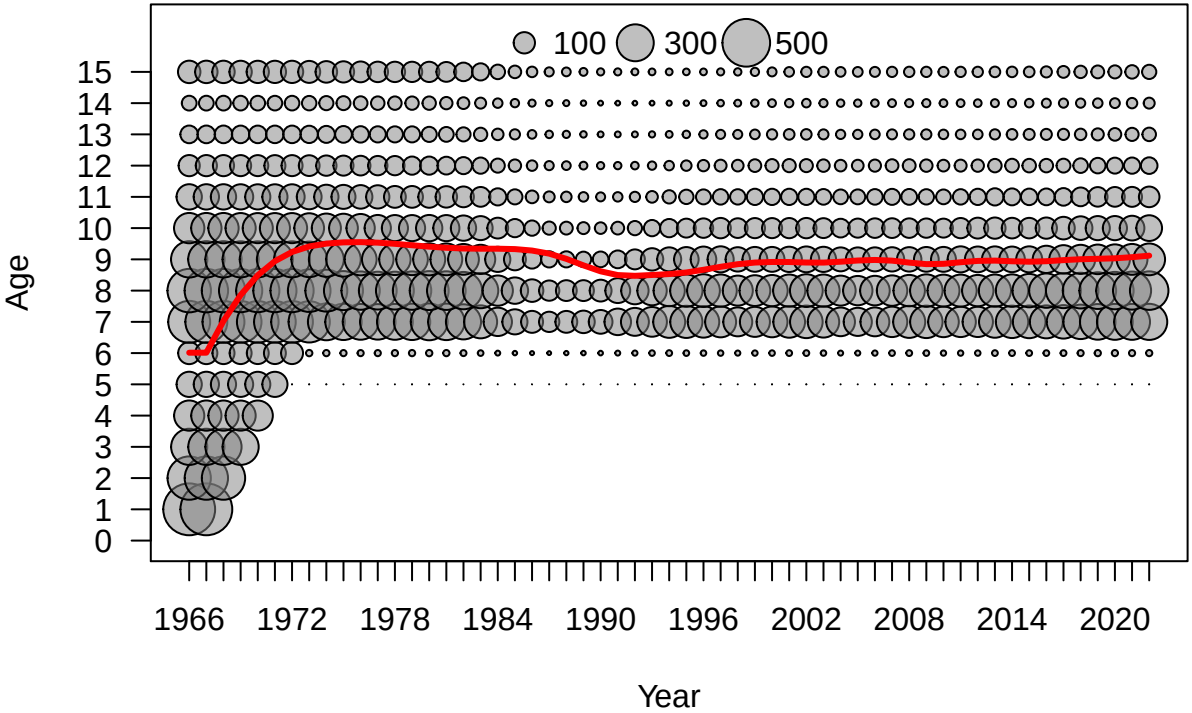

Log expected index
−2.20
−2.24
−2.28
−3.0
−2.5
−2.0
Log observed index

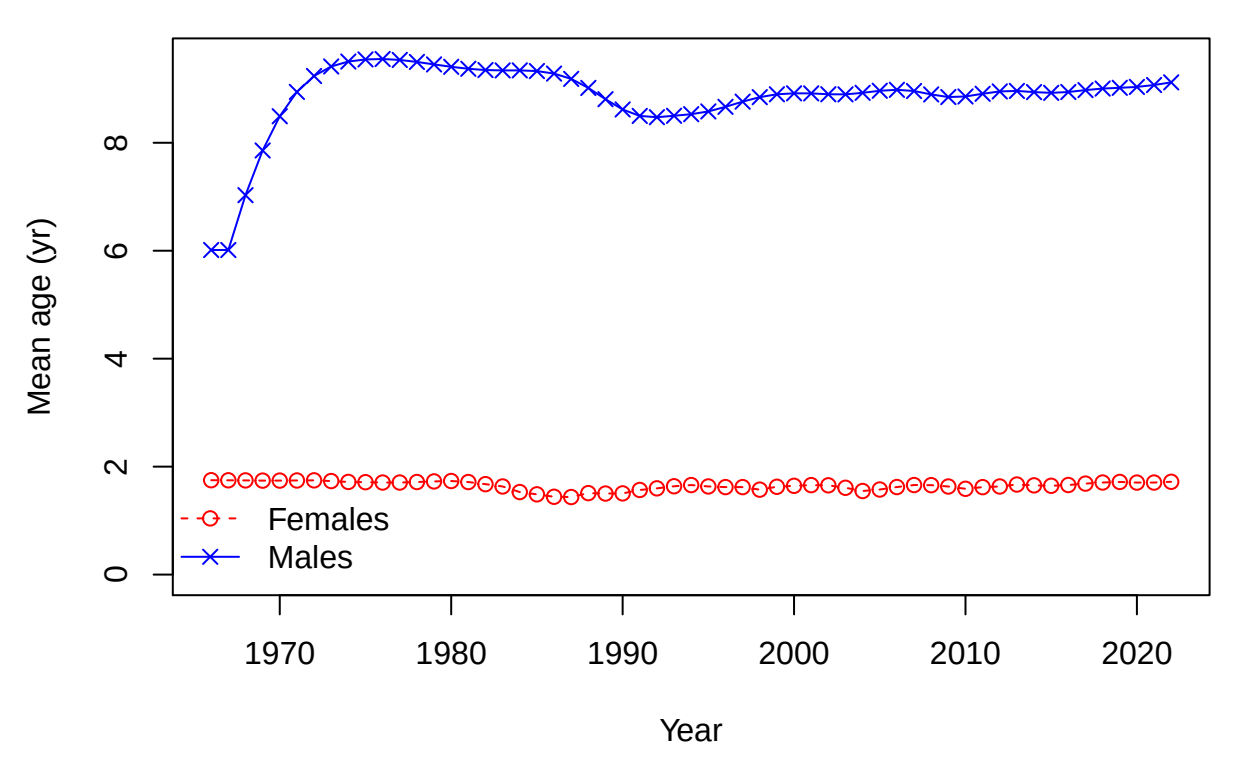

Residual
1.0
0.5
0.0
−0.5
−1.0
2016
2017
2018
2019
2020
Year

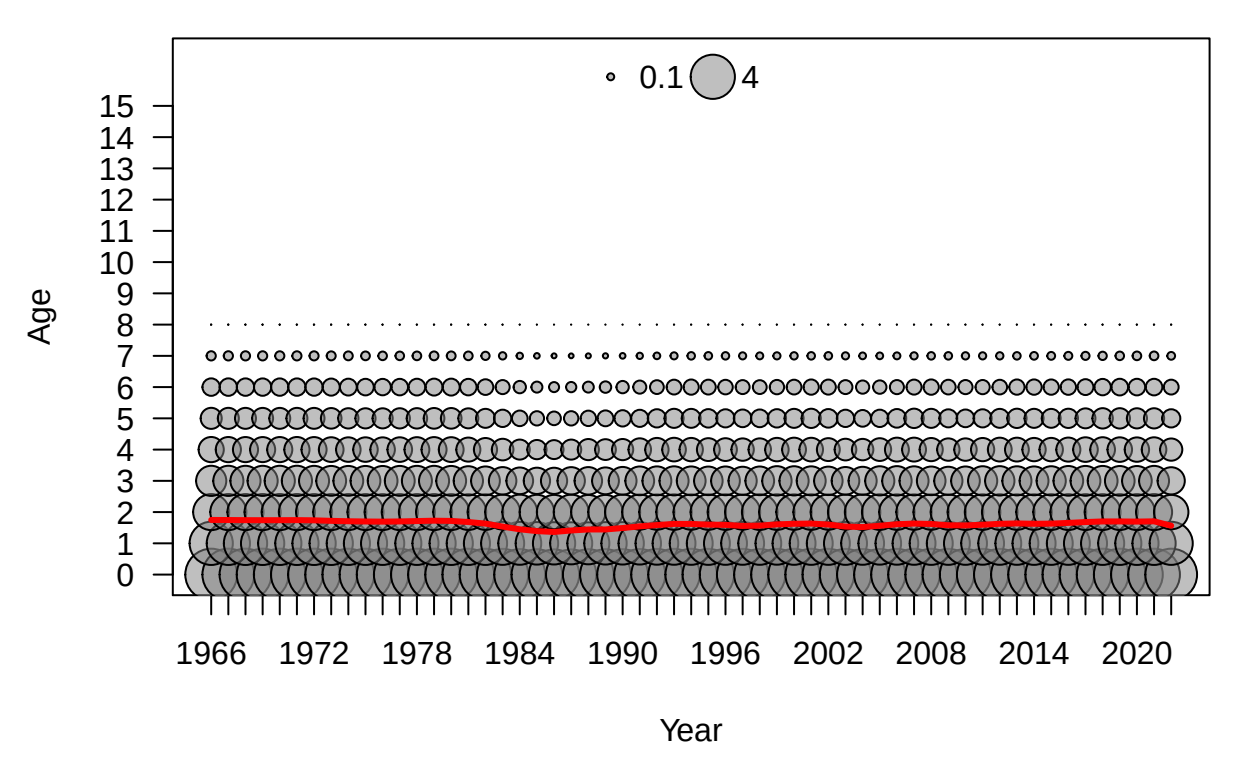

Deviation
1.0
0.5
0.0
−0.5
−1.0
2016
2017
2018
2019
2020
Year

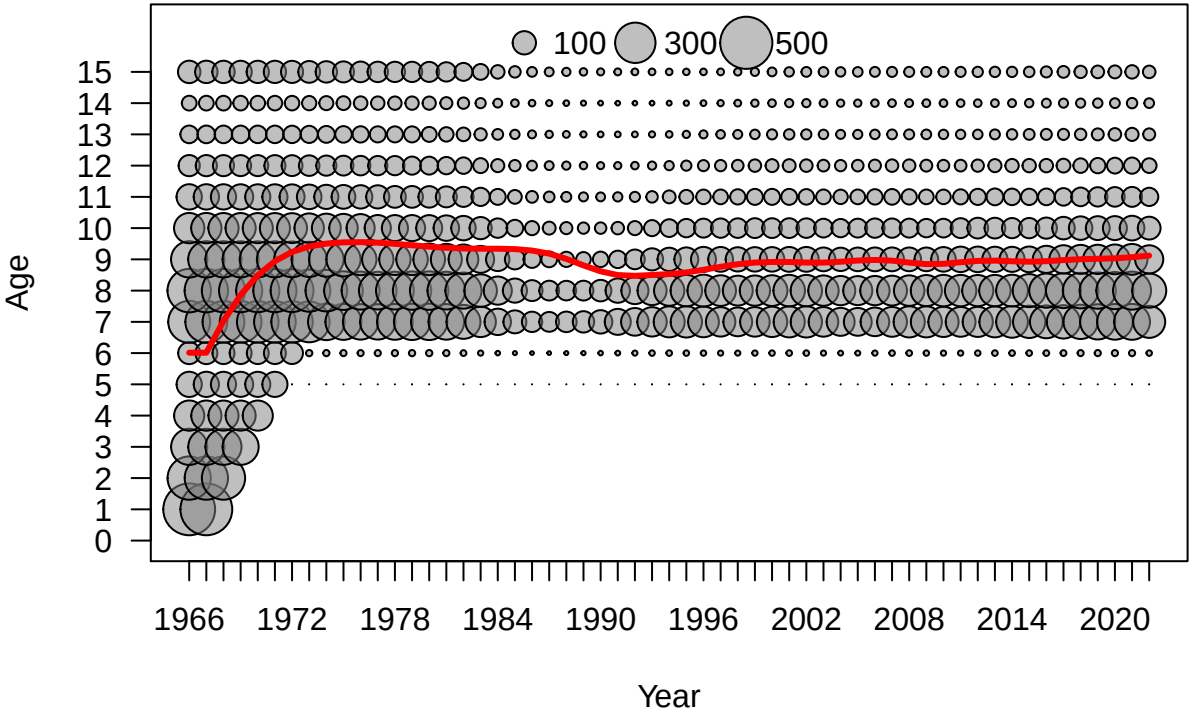

FISHERY
Standardized index
0.0
0.5
1.0
1.5
2015
2016
2017
2018
2019
2020
2021
Year

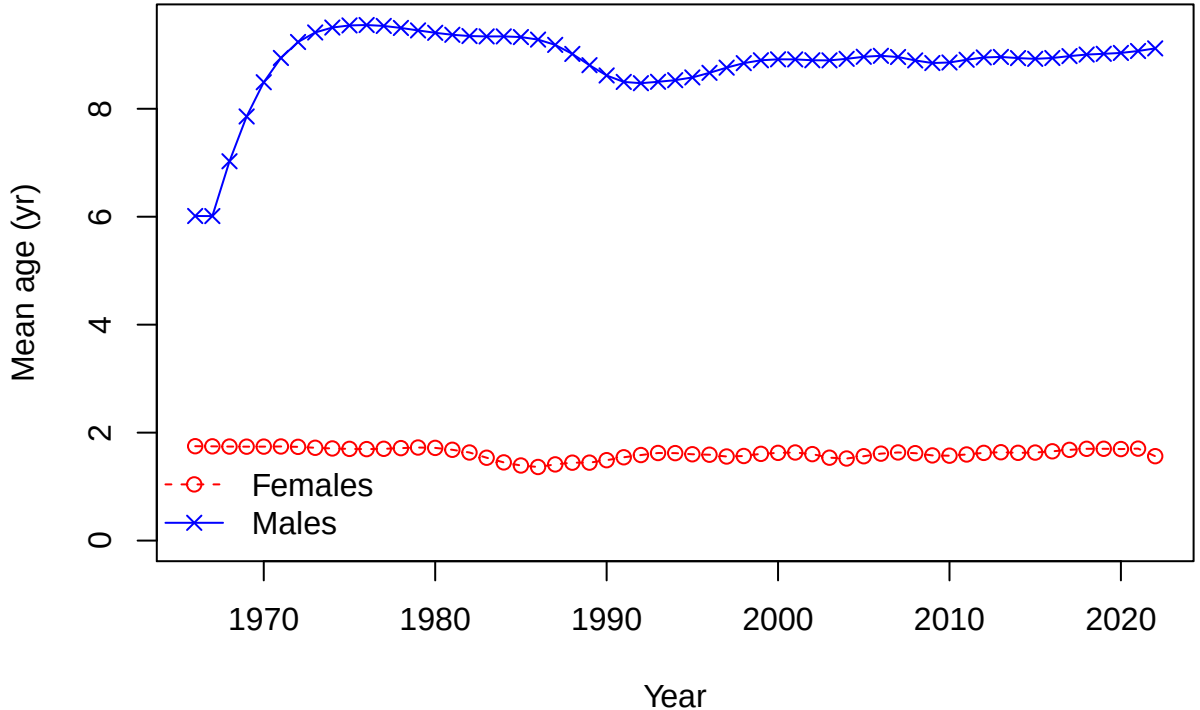

0.1
4
8
Age
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
1966
1972
1978
1984
1990
1996
2002
2008
2014
2020
Year

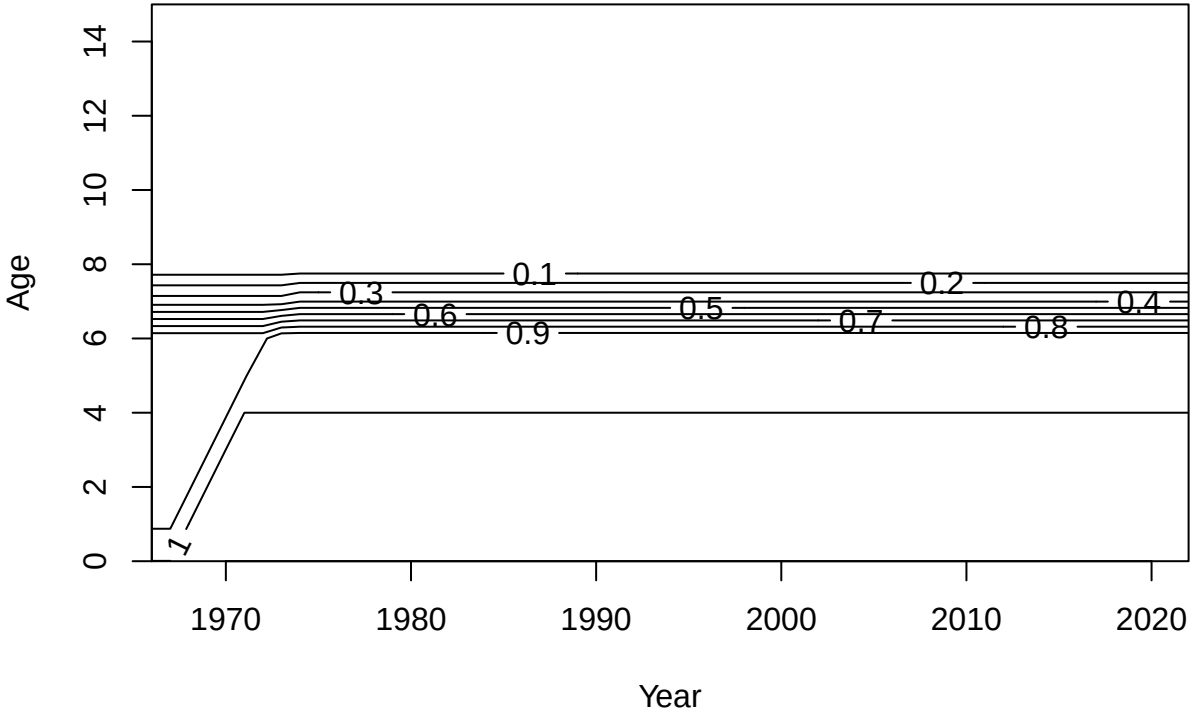

100
300
500
Age
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
1966
1972
1978
1984
1990
1996
2002
2008
2014
2020
Year

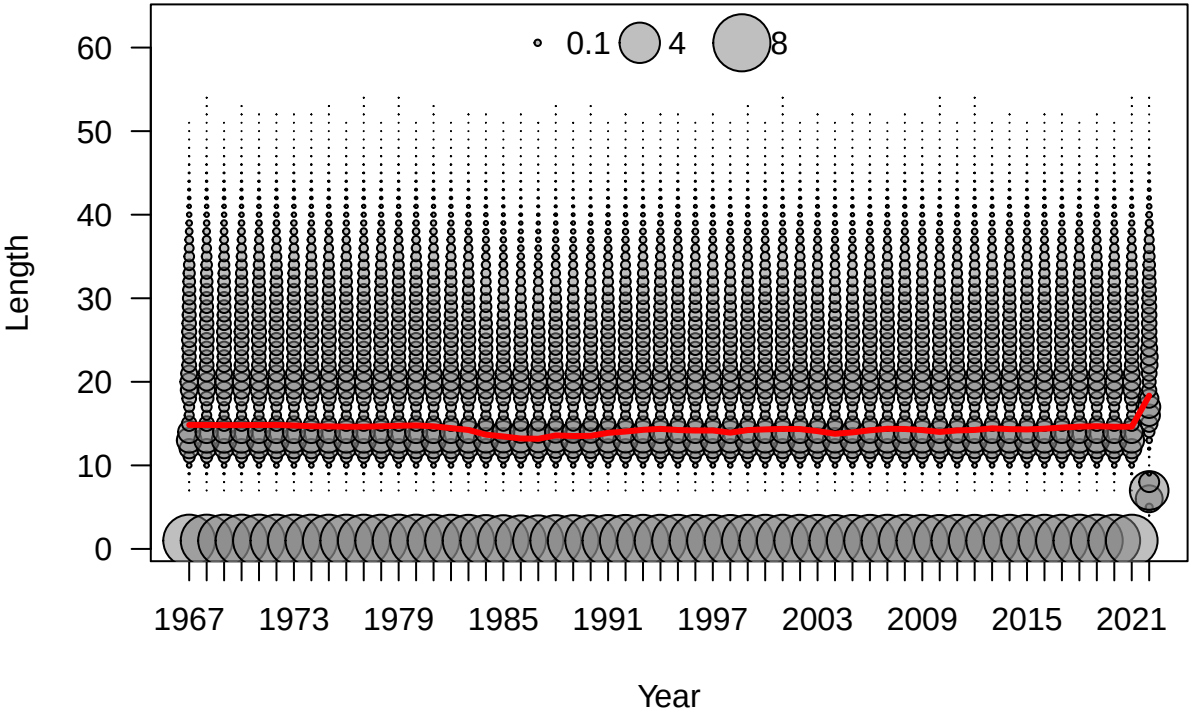

Mean age (yr)
0
2
4
6
8
1970
1980
1990
2000
2010
2020
Year
Females
Males

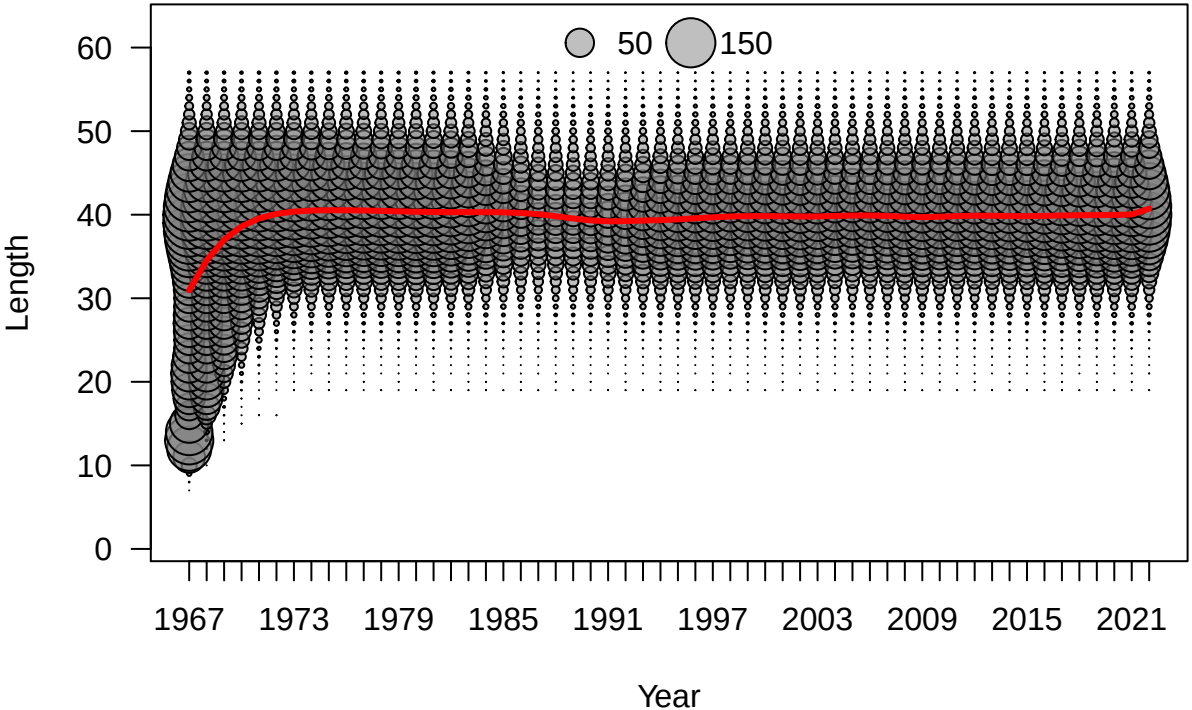

0.1
4
Age
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
1966
1972
1978
1984
1990
1996
2002
2008
2014
2020
Year

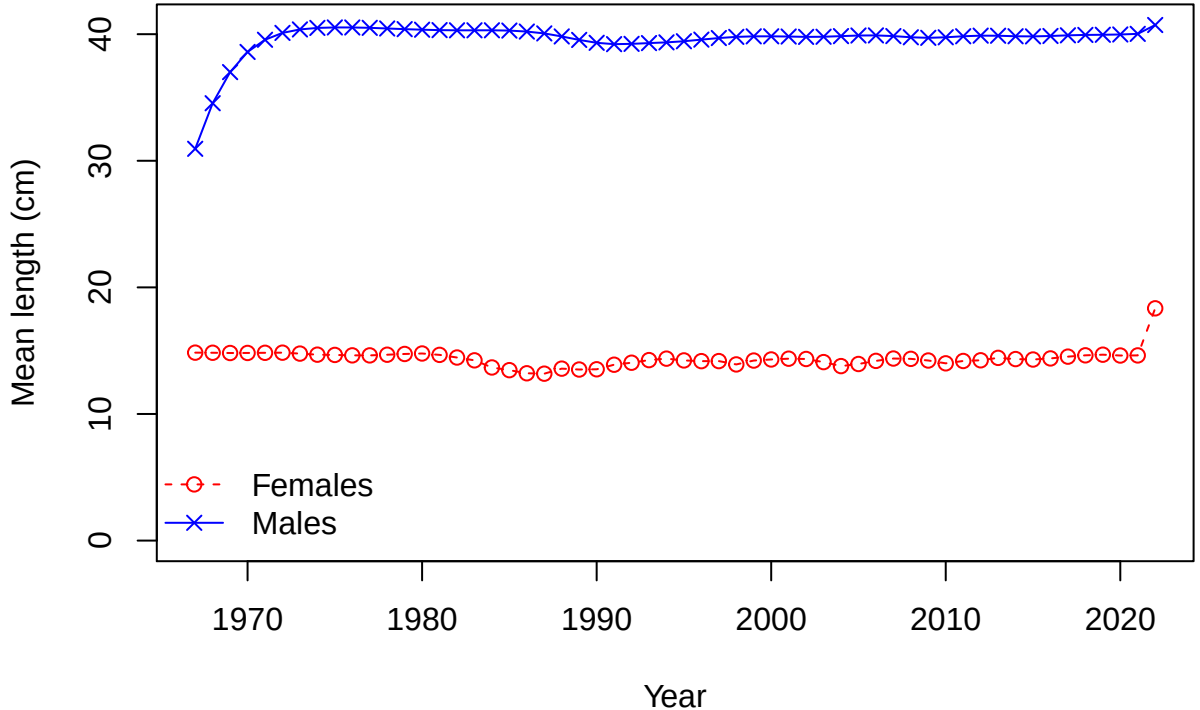

100
300
500
Age
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
1966
1972
1978
1984
1990
1996
2002
2008
2014
2020
Year

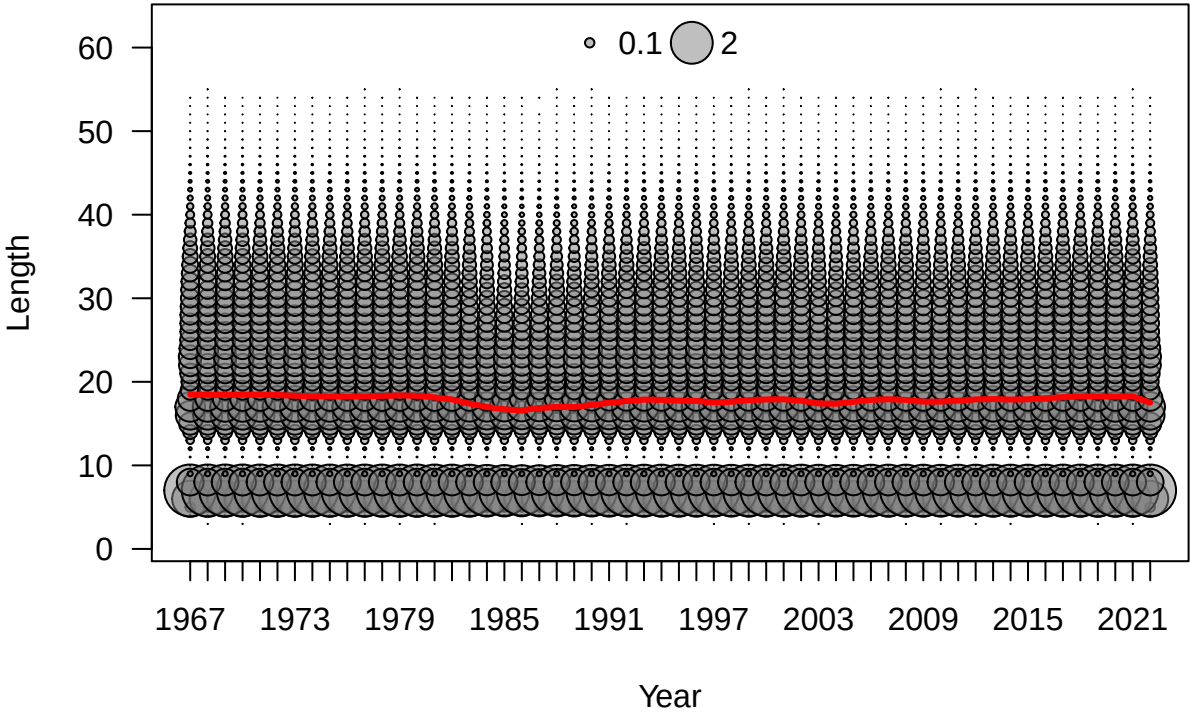

Mean age (yr)
0
2
4
6
8
1970
1980
1990
2000
2010
2020
Year
Females
Males

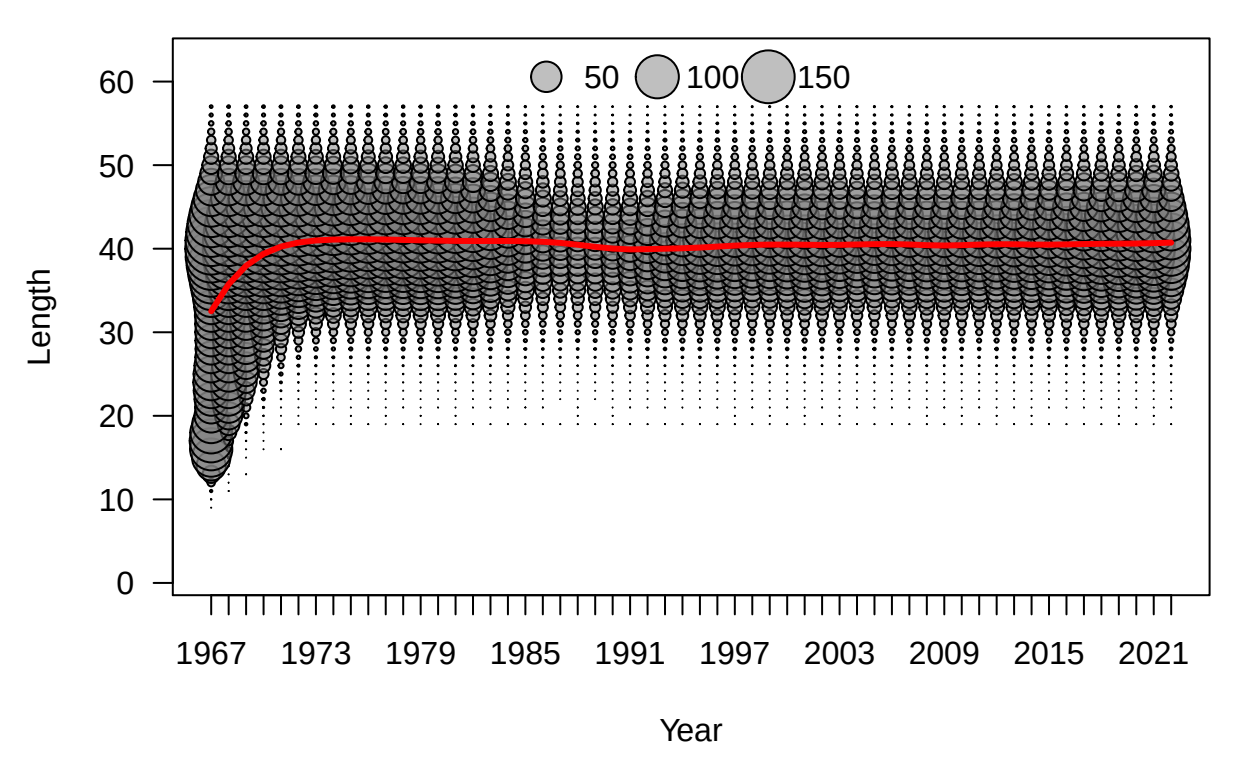

Age
0
2
4
6
8
10
12
14
1970
1980
1990
2000
2010
2020
Year
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

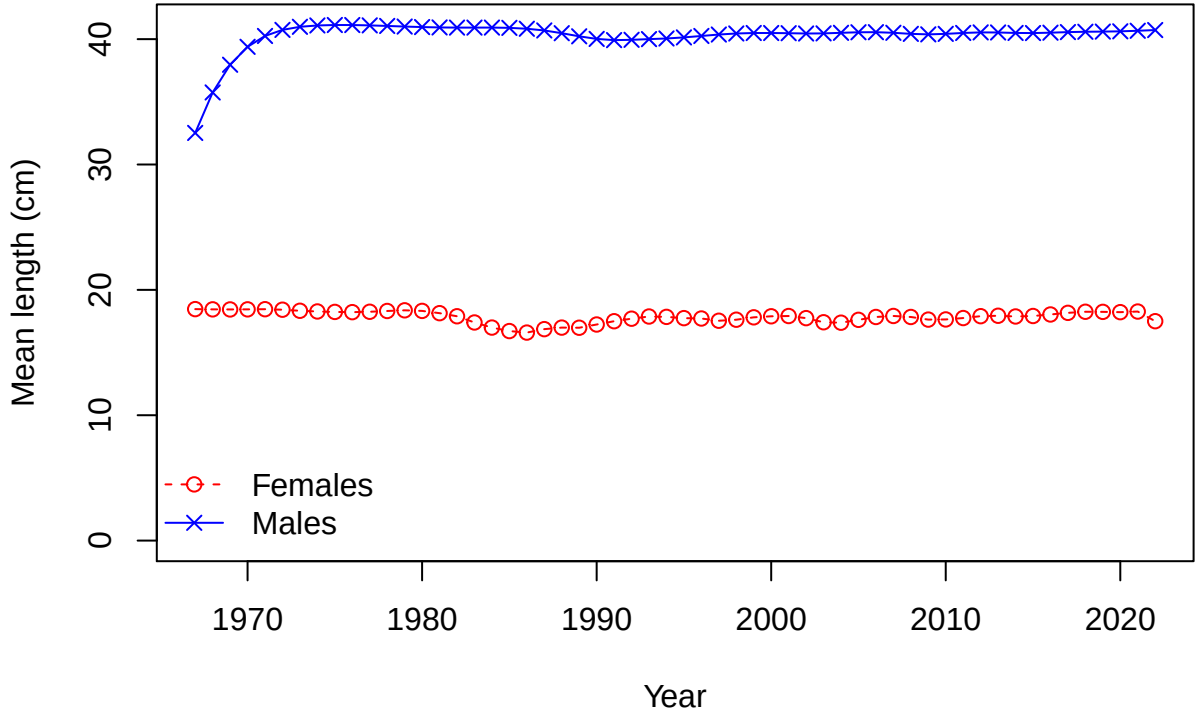

0.1
4
8
60
50
40
30
20
10
0
Length
1967
1973
1979
1985
1991
1997
2003
2009
2015
2021
Year

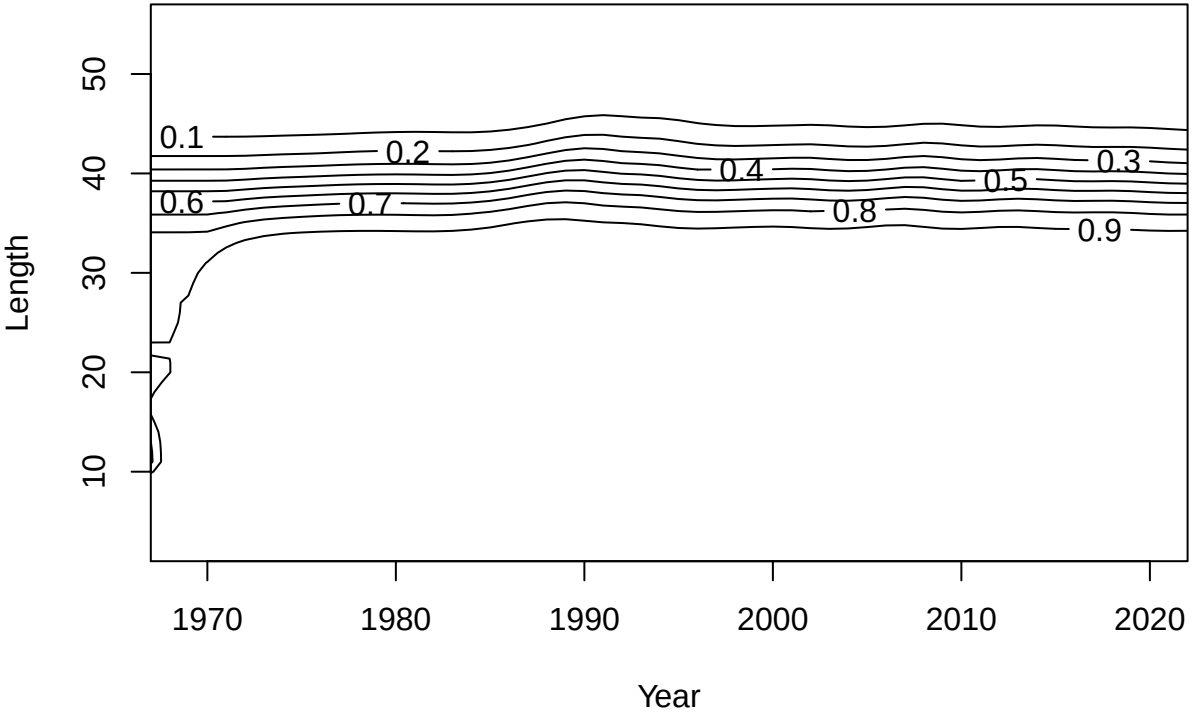

50
150
Length
Year
0
10
20
30
40
50
60
1967
1973
1979
1985
1991
1997
2003
2009
2015
2021

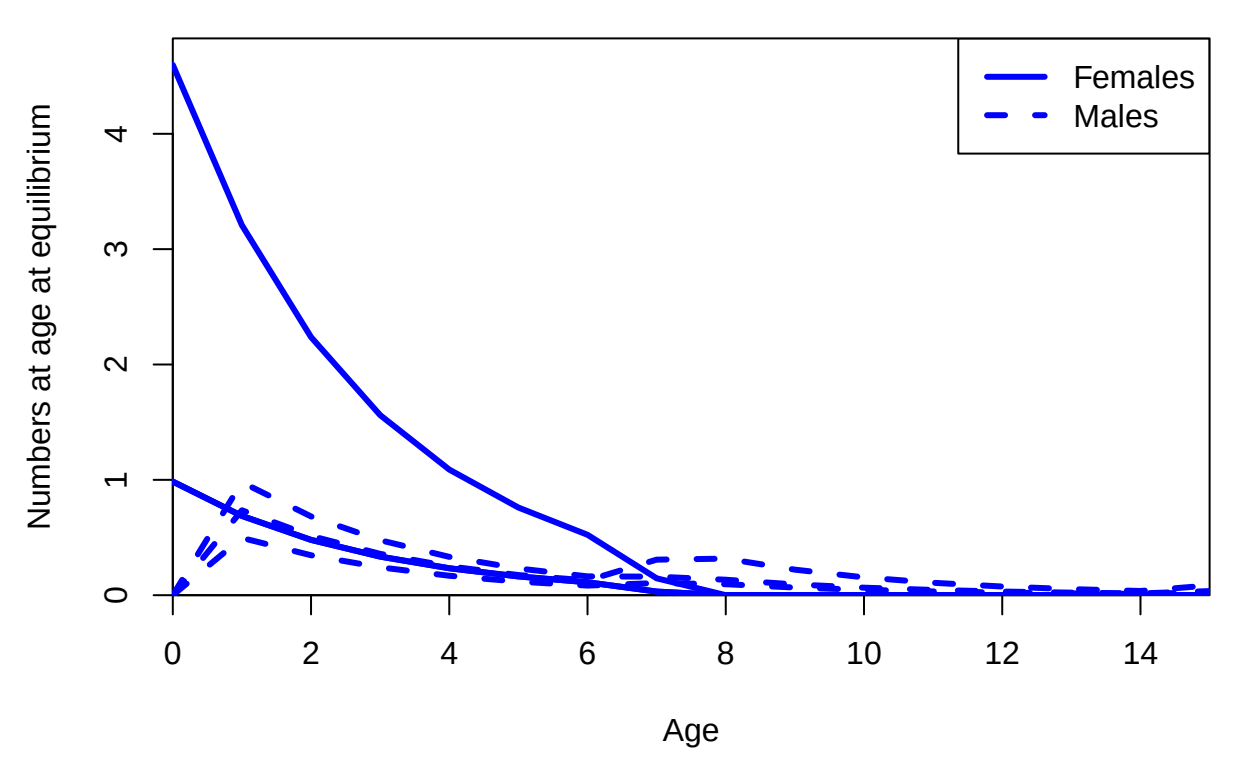

Mean length (cm)
0
10
20
30
40
1970
1980
1990
2000
2010
2020
Year
Females
Males

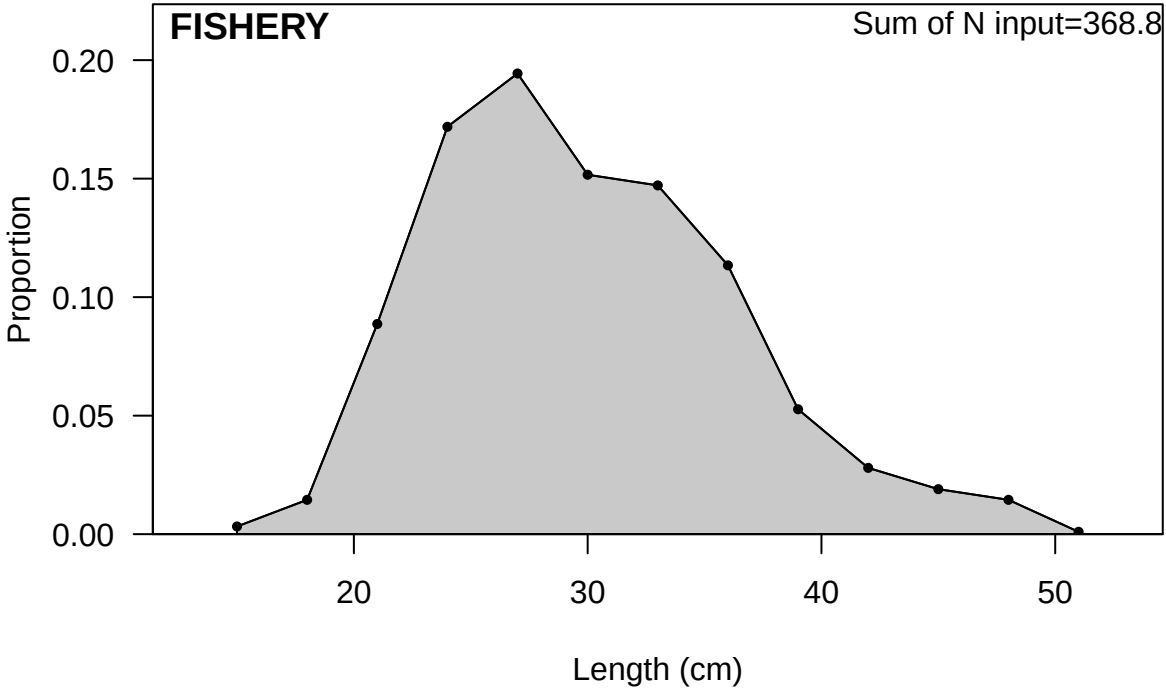

0.1
2
60
50
40
30
20
10
0
Length
1967
1973
1979
1985
1991
1997
2003
2009
2015
2021
Year

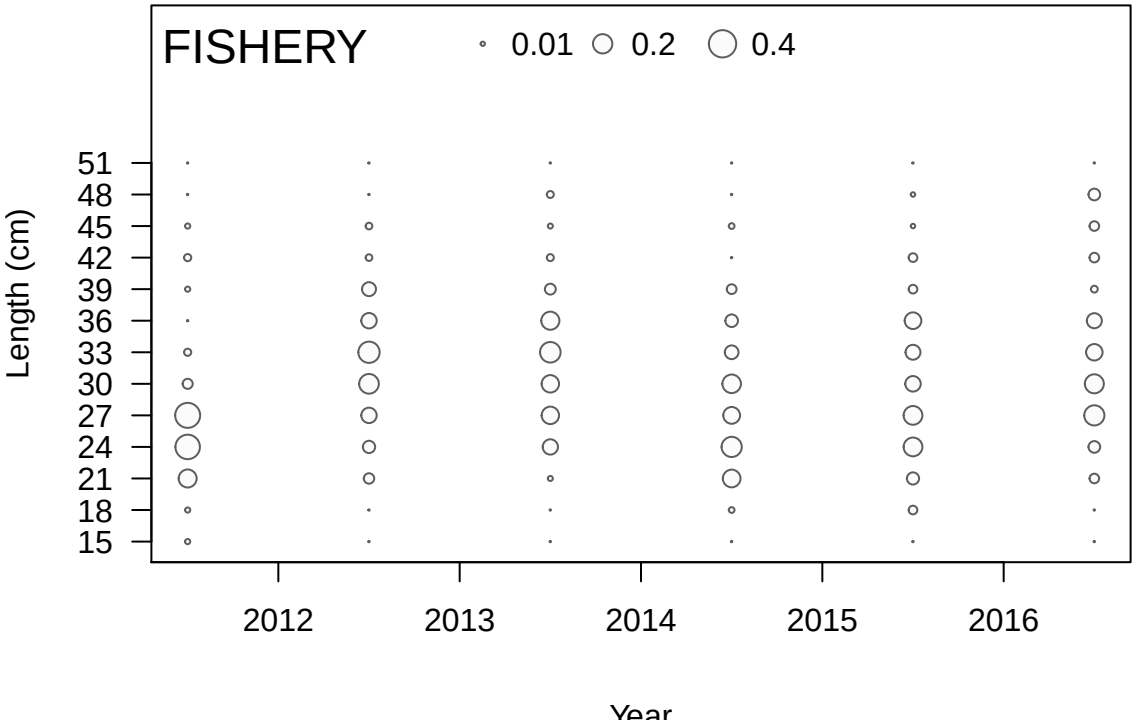

50
100
150
Length
0
10
20
30
40
50
60
1967
1973
1979
1985
1991
1997
2003
2009
2015
2021
Year

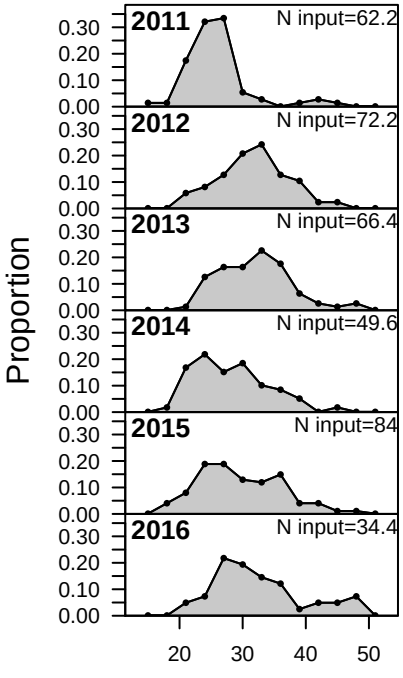

Mean length (cm)
0
10
20
30
40
1970
1980
1990
2000
2010
2020
Year
Females
Males

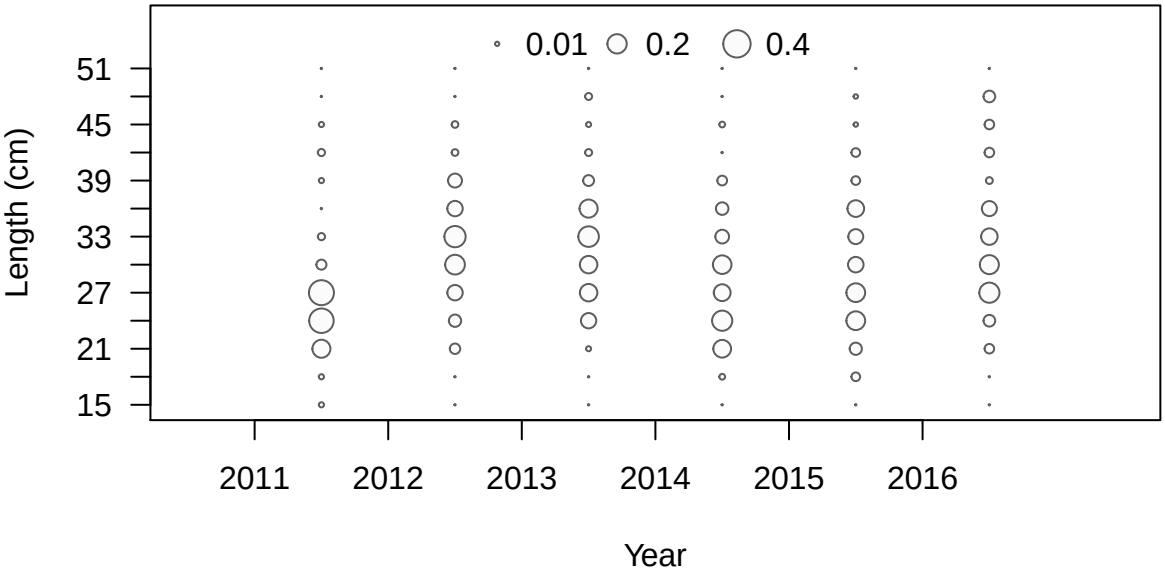

Length
10
20
30
40
50
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1970
1980
1990
2000
2010
2020
Year

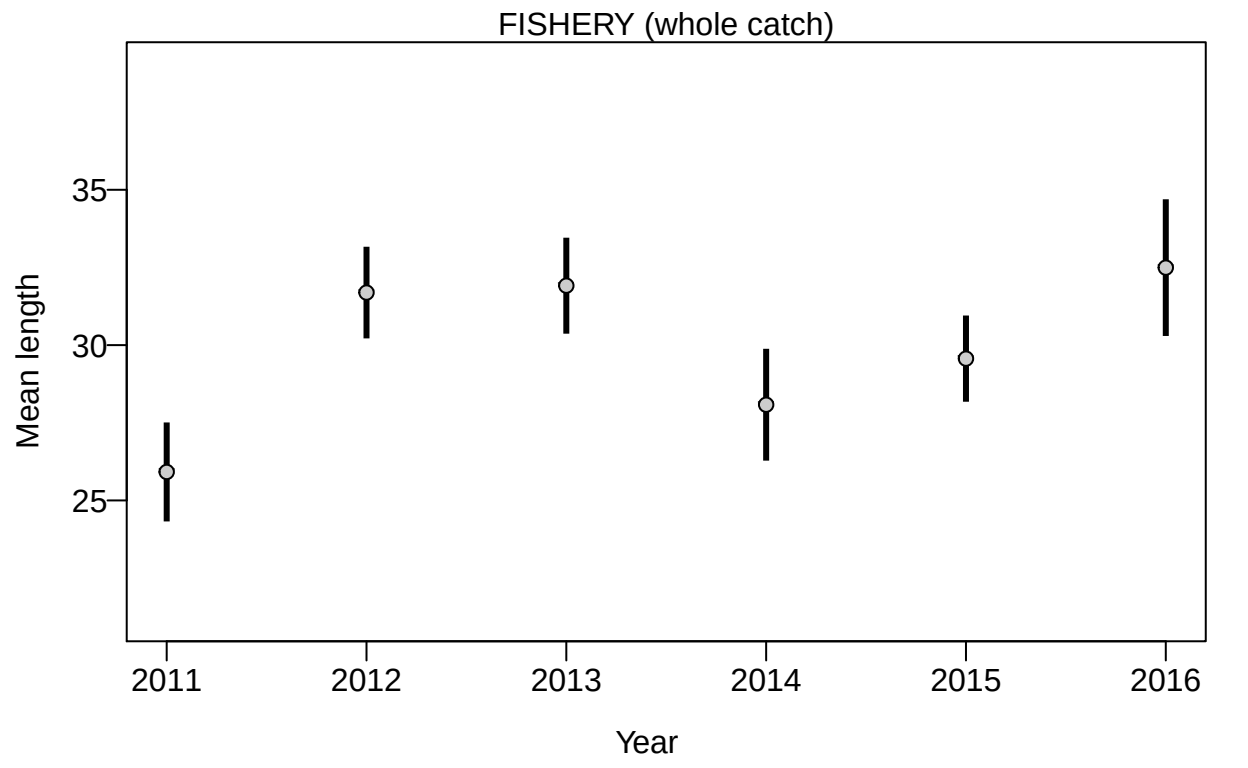

Females
Males
Numbers at age at equilibrium
0
1
2
3
4
0
2
4
6
8
10
12
14
Age

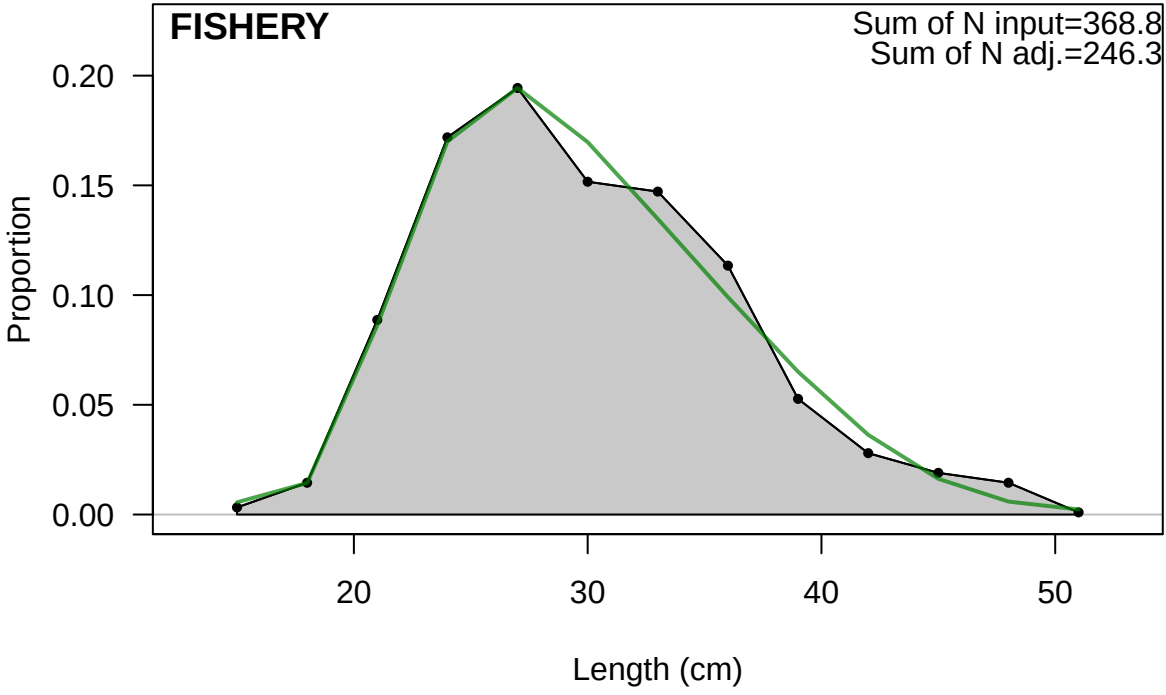

FISHERY
Sum of N input=368.8
0.20
0.15
0.10
0.05
0.00
Proportion
20
30
40
50
Length (cm)

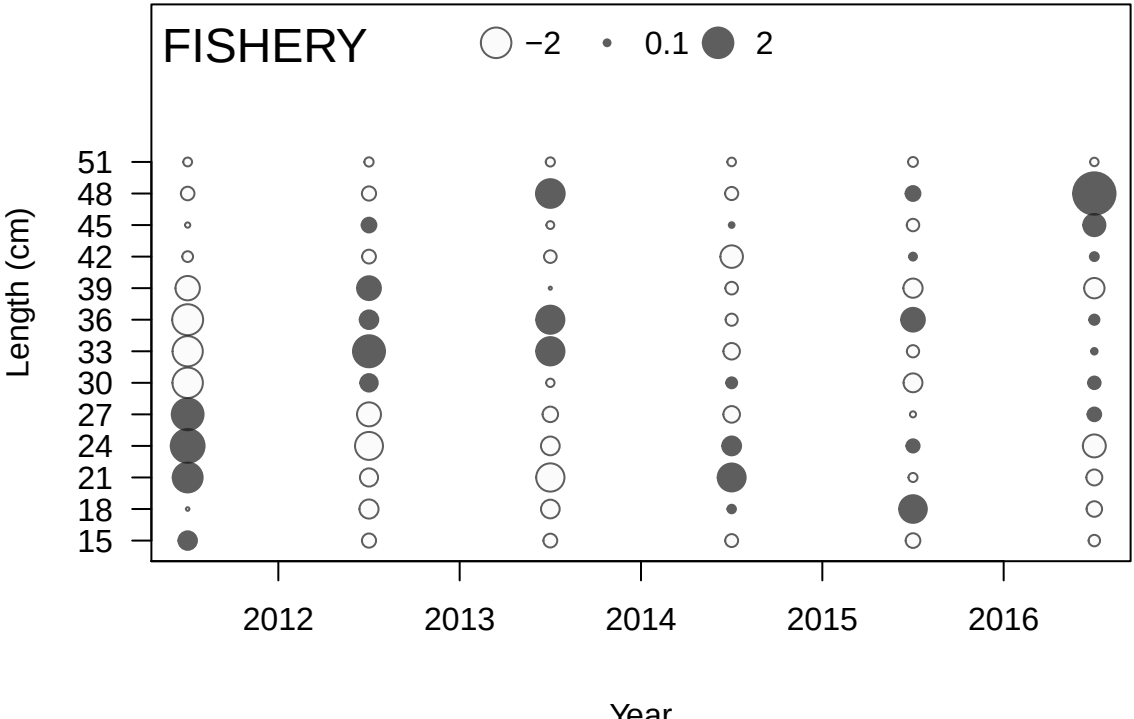

FISHERY
0.01
0.2
0.4
Length (cm)
51
48
45
42
39
36
33
30
27
24
21
18
15
2012
2013
2014
2015
2016
Year

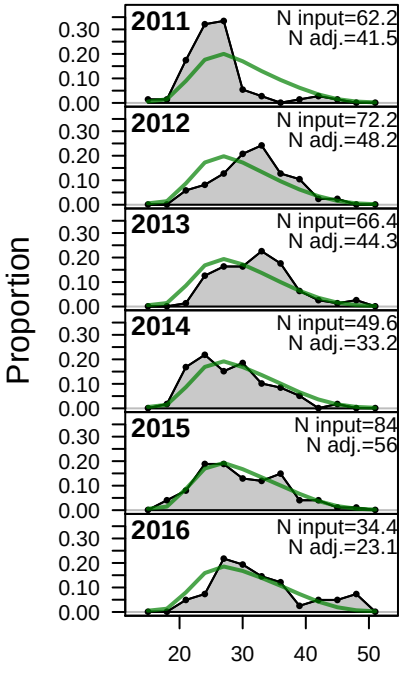

2011
N input=62.2
2012
N input=72.2
2013
N input=66.4
2014
N input=49.6
2015
N input=84
2016
N input=34.4
0.00
0.10
0.20
0.30
20
30
40
50
Proportion
Length (cm)

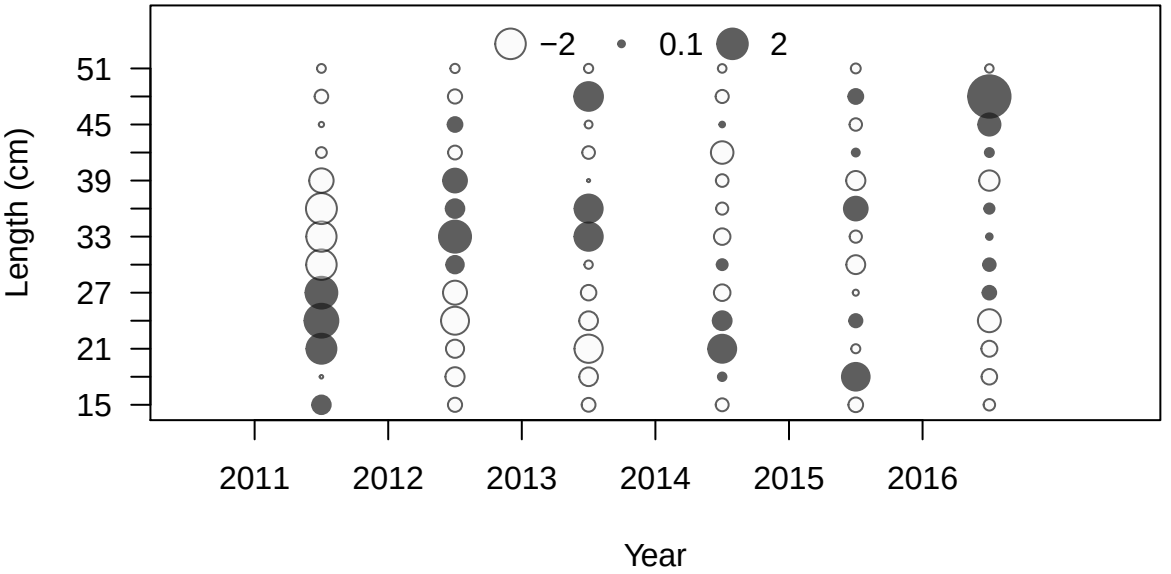

0.01
0.2
0.4
51
45
39
33
27
21
15
Length (cm)
2011
2012
2013
2014
2015
2016
Year

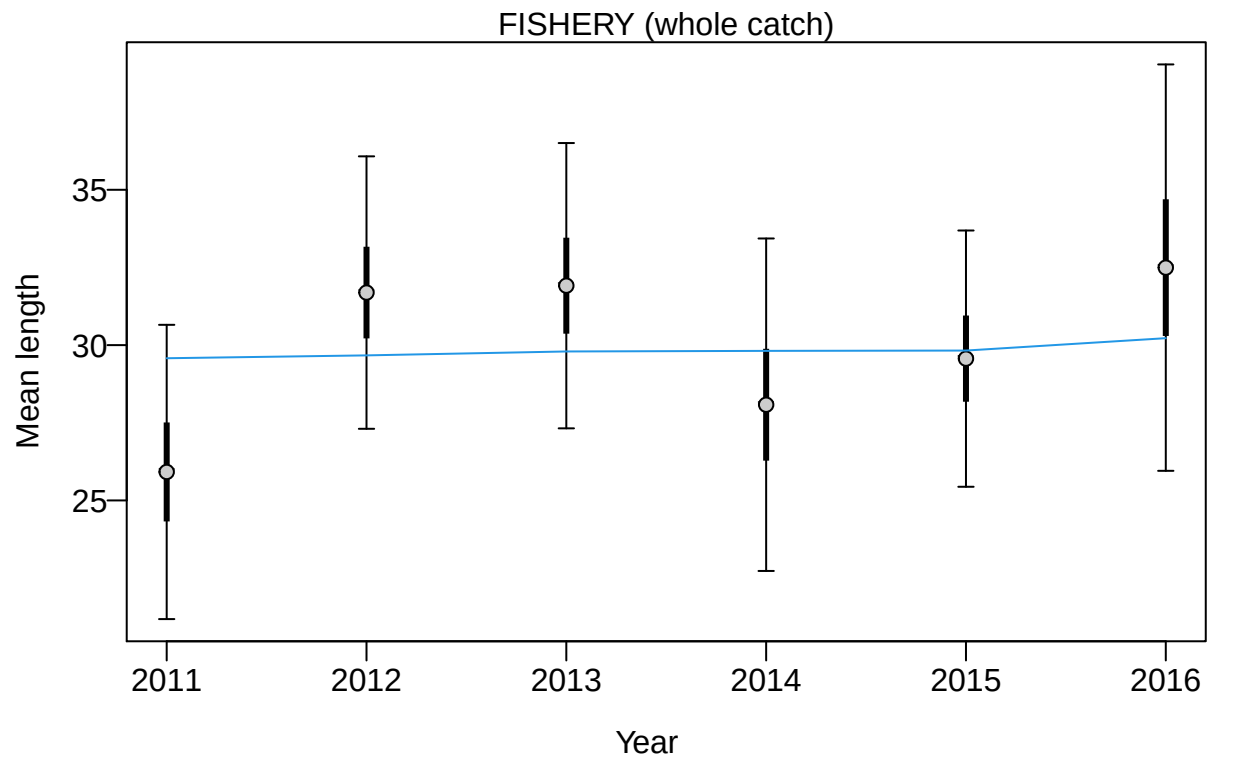

FISHERY (whole catch)
Mean length
35
30
25
2011
2012
2013
2014
2015
2016
Year

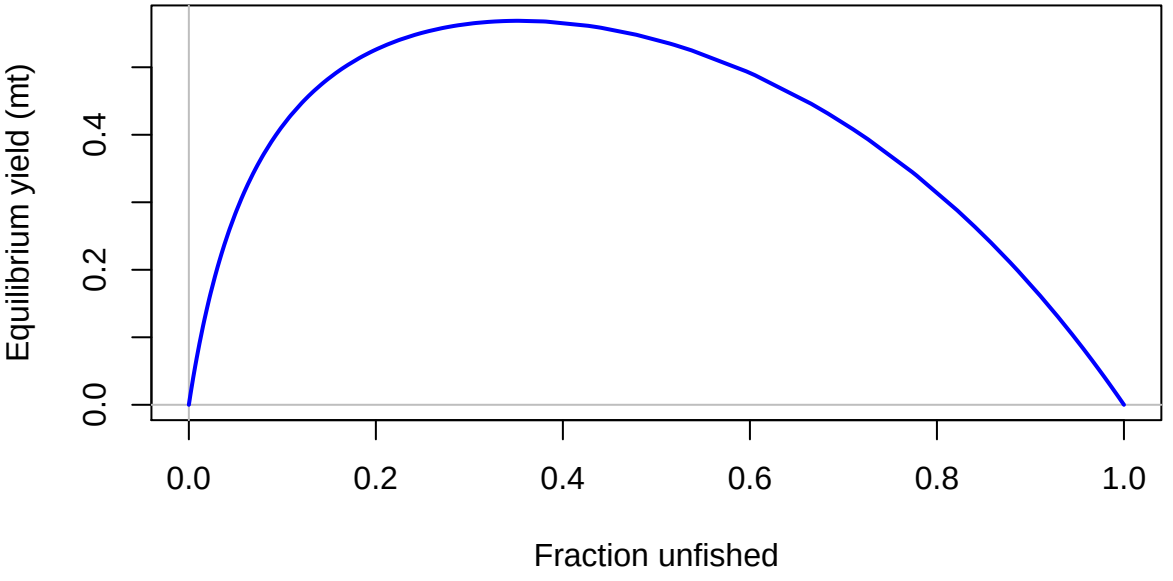

FISHERY
Sum of N input=368.8
Sum of N adj.=246.3
Proportion
0.20
0.15
0.10
0.05
0.00
20
30
40
50
Length (cm)

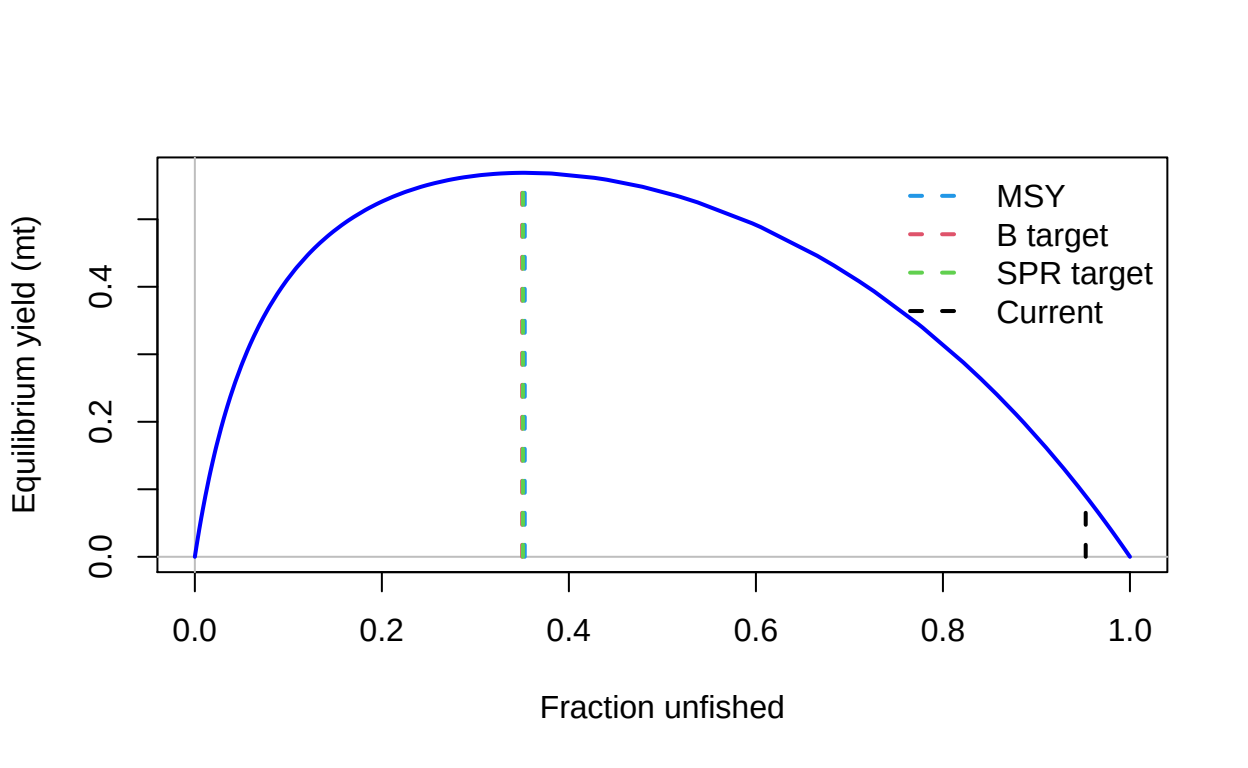

FISHERY
−2
0.1
2
Length (cm)
51
48
45
42
39
36
33
30
27
24
21
18
15
2012
2013
2014
2015
2016
Year

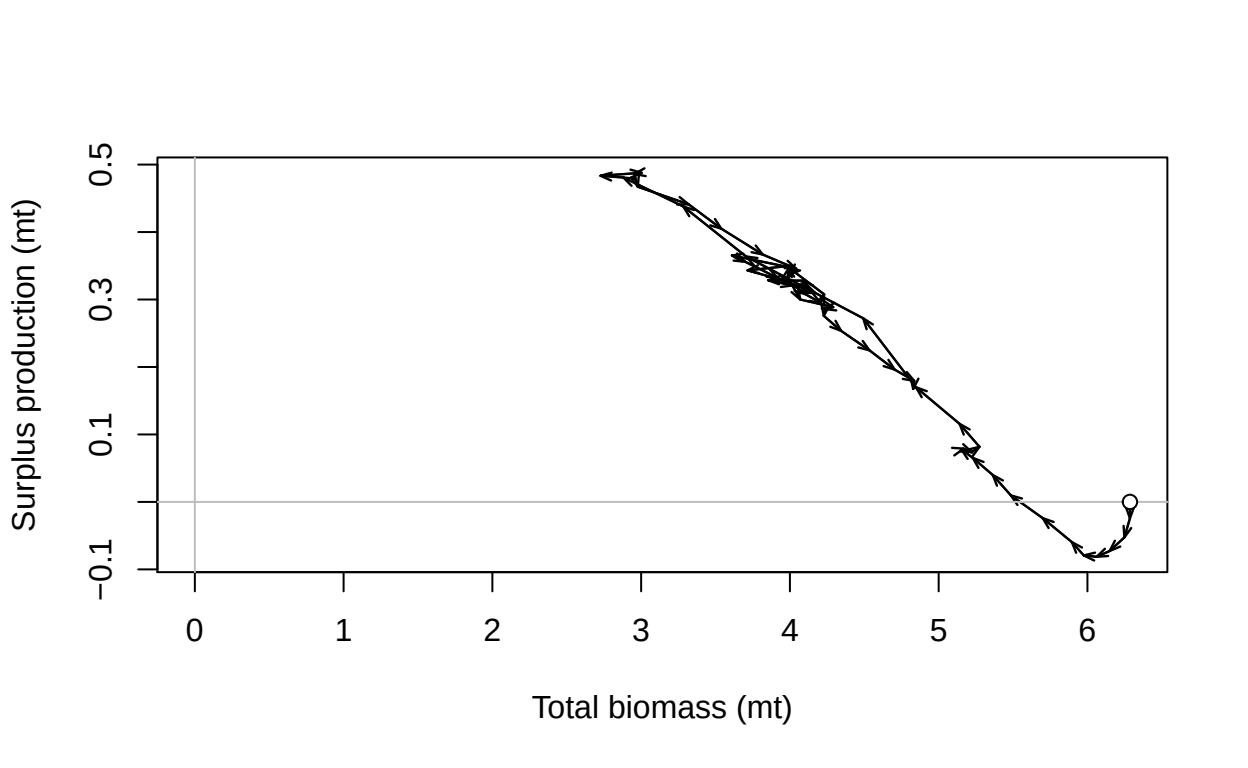

2011
N input=62.2
N adj.=41.5
2012
N input=72.2
N adj.=48.2
2013
N input=66.4
N adj.=44.3
2014
N input=49.6
N adj.=33.2
2015
N input=84
N adj.=56
2016
N input=34.4
N adj.=23.1
0.00
0.10
0.20
0.30
20
30
40
50
Proportion
Length (cm)

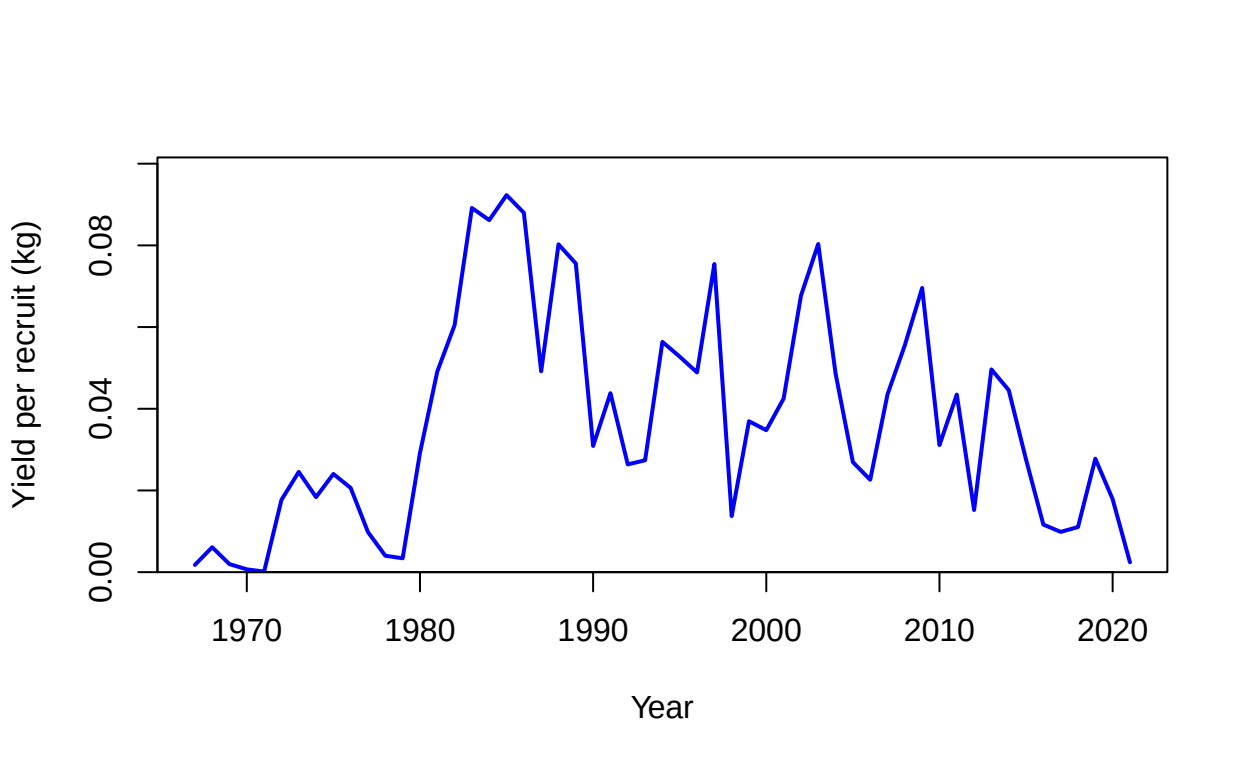

−2
0.1
2
51
45
39
33
27
21
15
Length (cm)
2011
2012
2013
2014
2015
2016
Year

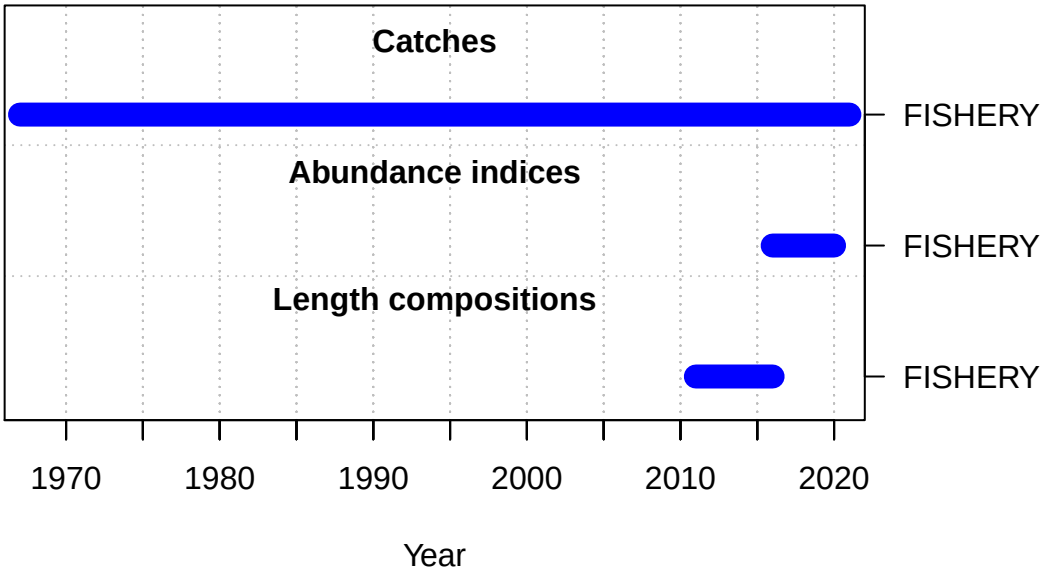

FISHERY (whole catch)
Mean length
35
30
25
2011
2012
2013
2014
2015
2016
Year

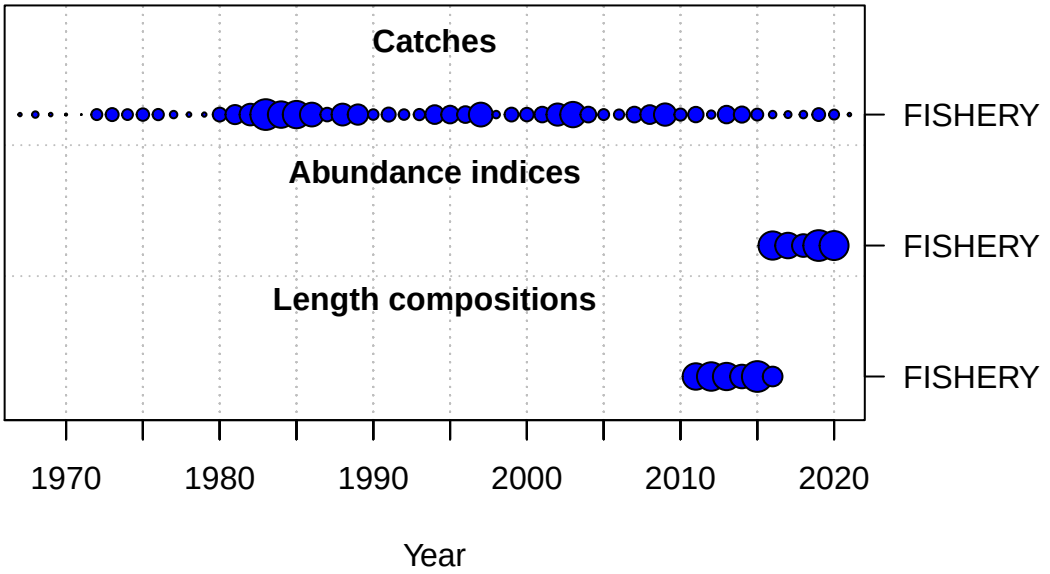

Equilibrium yield (mt)
0.0
0.2
0.4
0.0
0.2
0.4
0.6
0.8
1.0
Fraction unfished

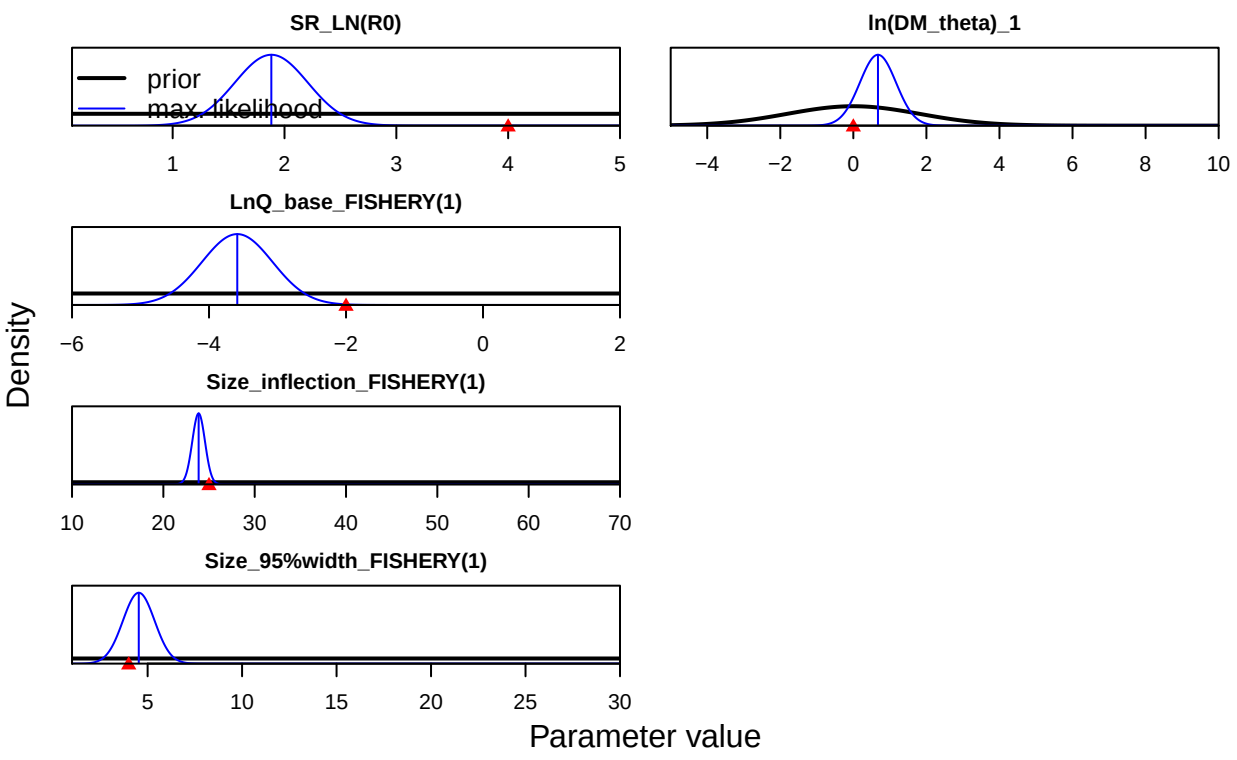

MSY
B target
SPR target
Current
Equilibrium yield (mt)
0.0
0.2
0.4
0.0
0.2
0.4
0.6
0.8
1.0
Fraction unfished


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
ln(DM_theta)_1
−4
−2
0
2
4
6
8
10
LnQ_base_FISHERY(1)
−6
−4
−2
0
2
Size_inflection_FISHERY(1)
10
20
30
40
50
60
70
Size_95%width_FISHERY(1)
5
10
15
20
25
30
Density
Parameter value