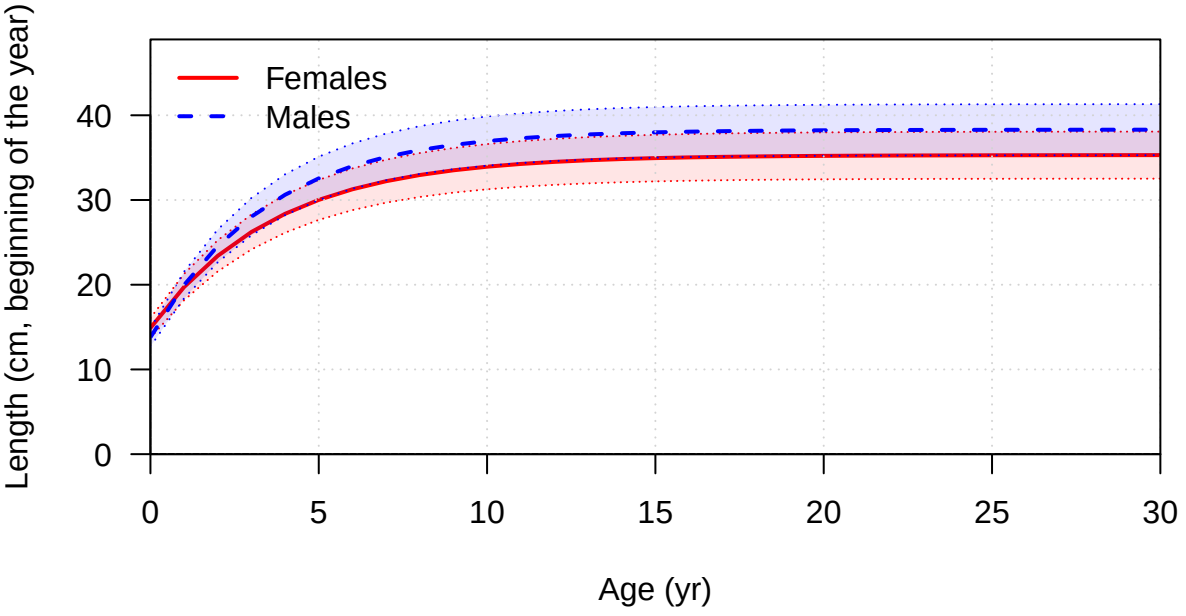
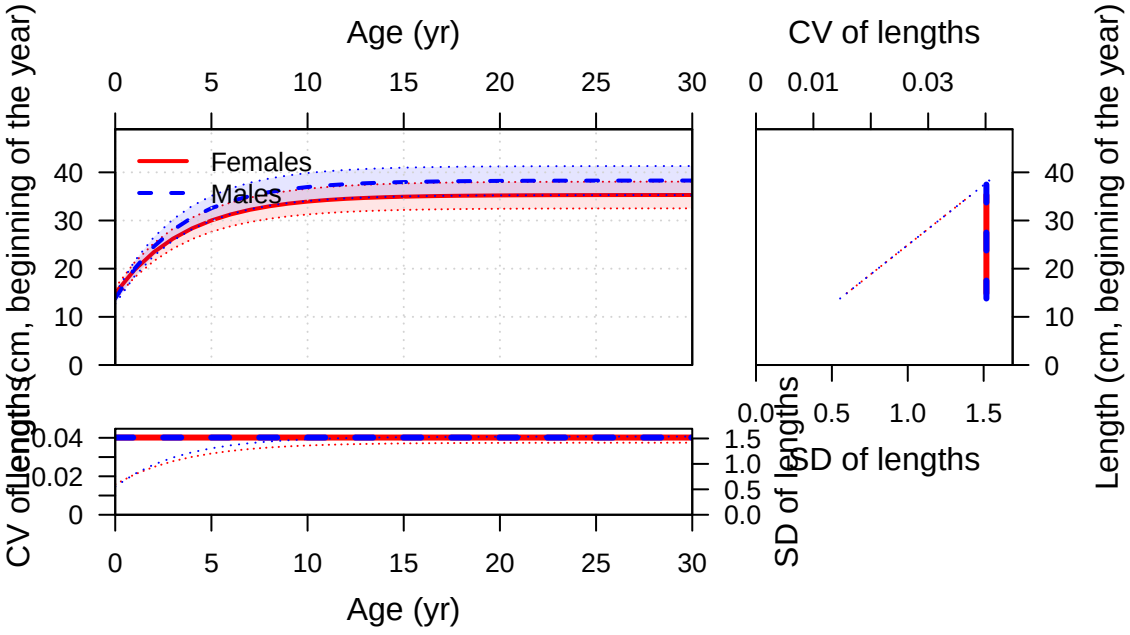
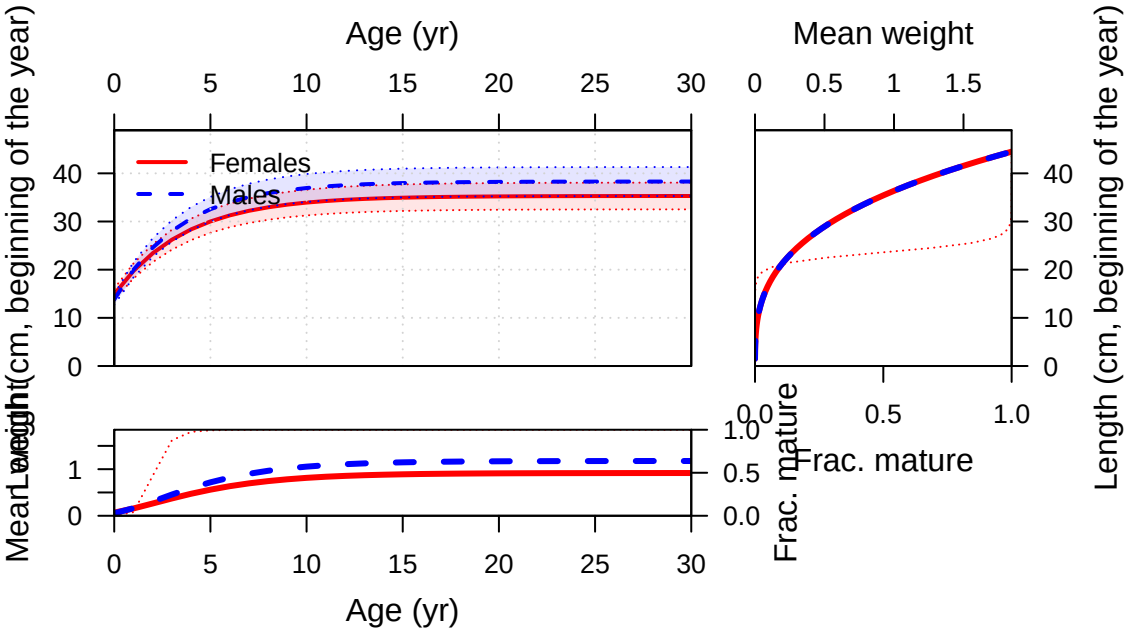
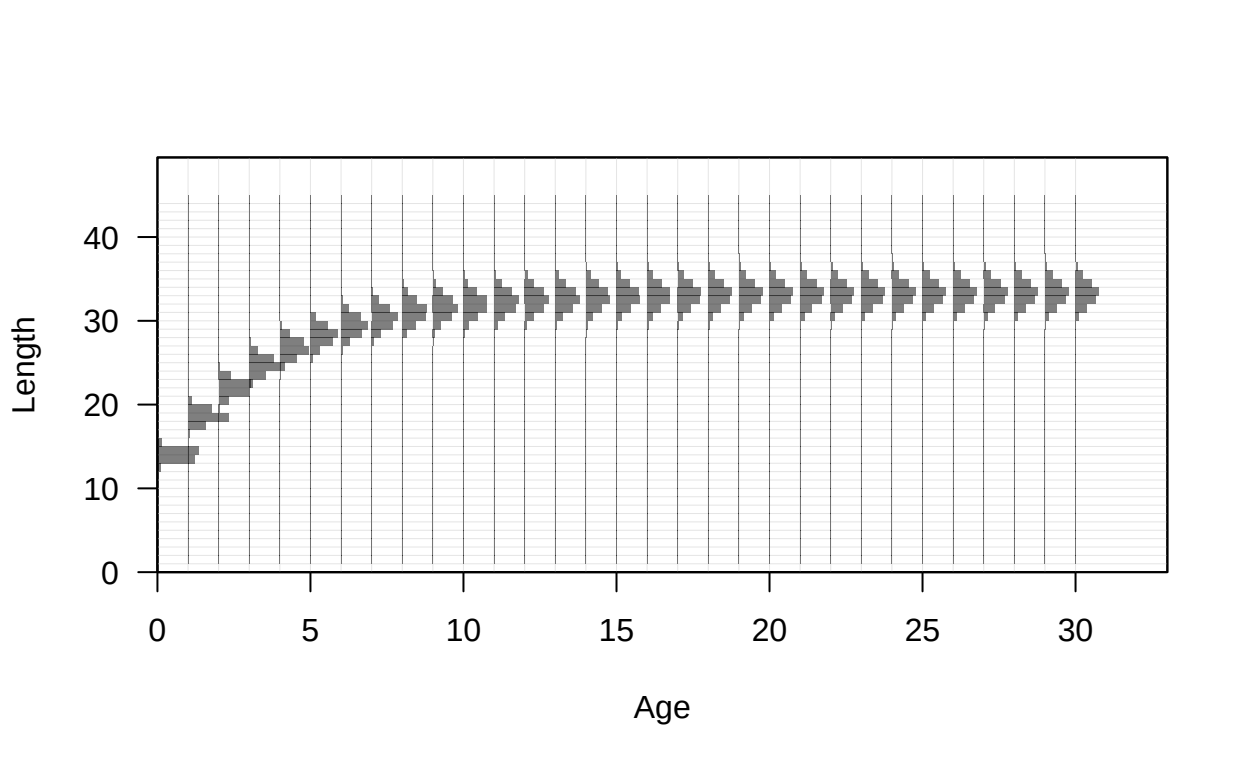
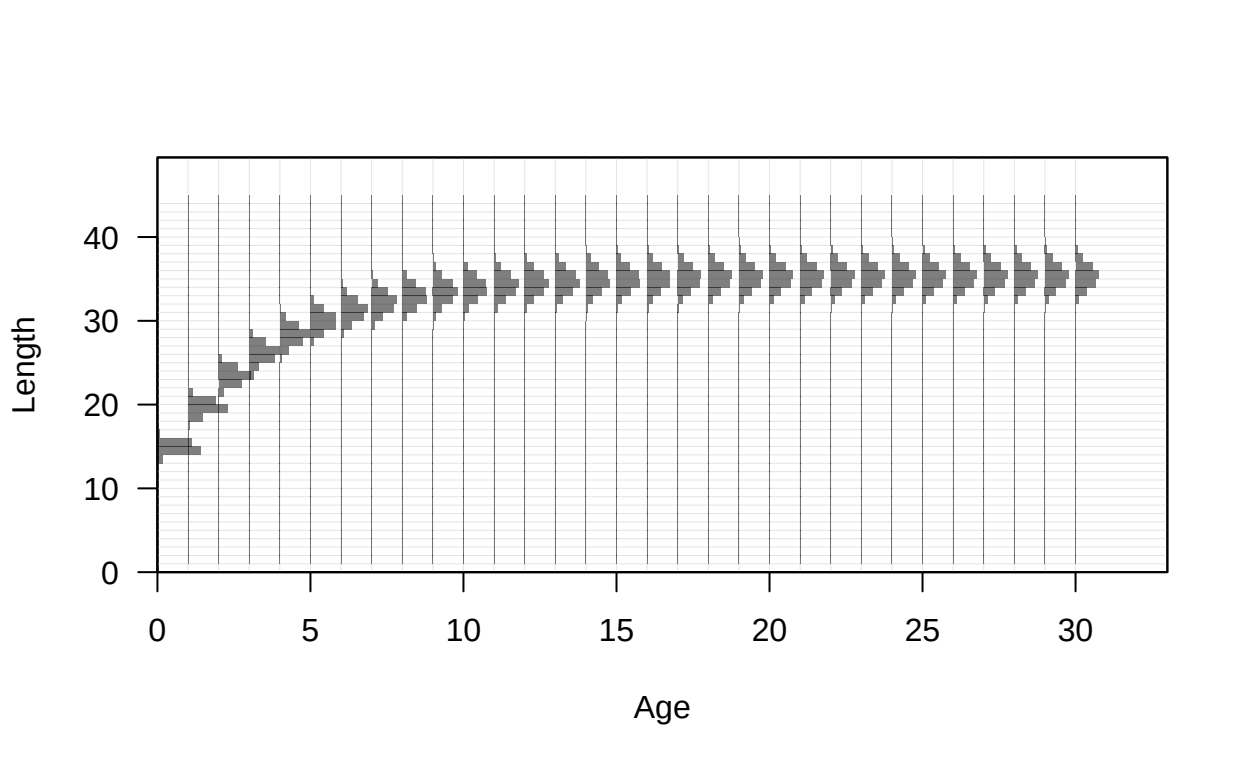
Plots created using the 'r4ss' package in R
Stock Synthesis version: 3.30.19.0
StartTime: Fri Aug 12 14:31:09 2022
Data_File: data.ss
Control_File: control.ss

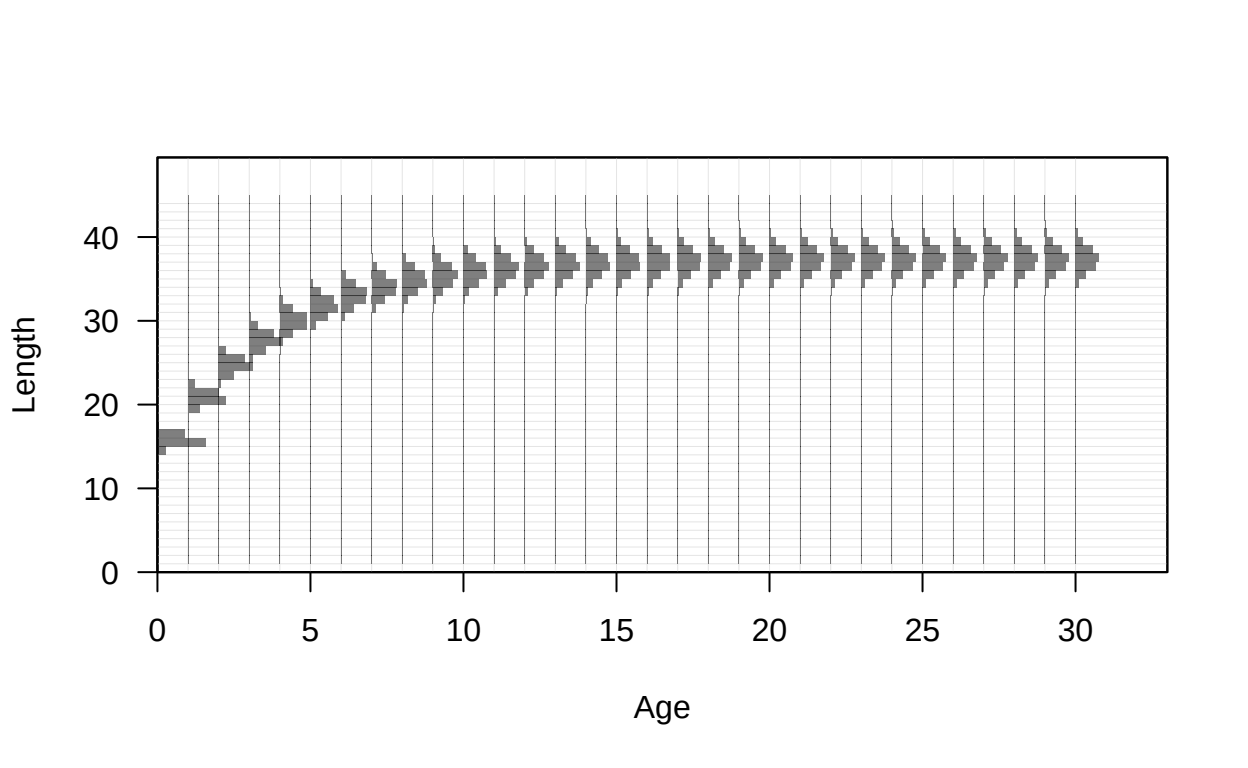

Females
Males
Length (cm, beginning of the year)
0
10
20
30
40
0
5
10
15
20
25
30
Age (yr)

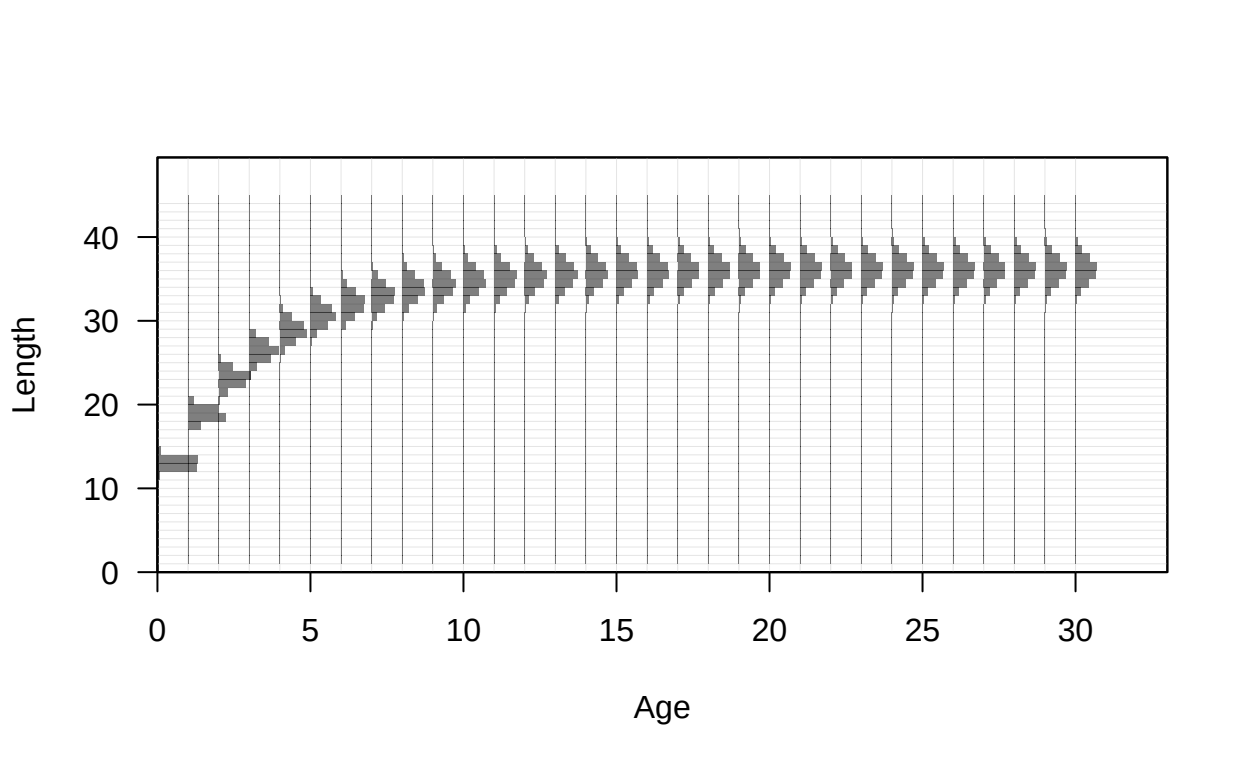

Age (yr)
0
5
10
15
20
25
30
Females
Males
Length (cm, beginning of the year)
0
10
20
30
40
CV of lengths
0
0.01
0.03
SD of lengths
0.0
0.5
1.0
1.5
CV of lengths
0
0.02
0.04
Age (yr)

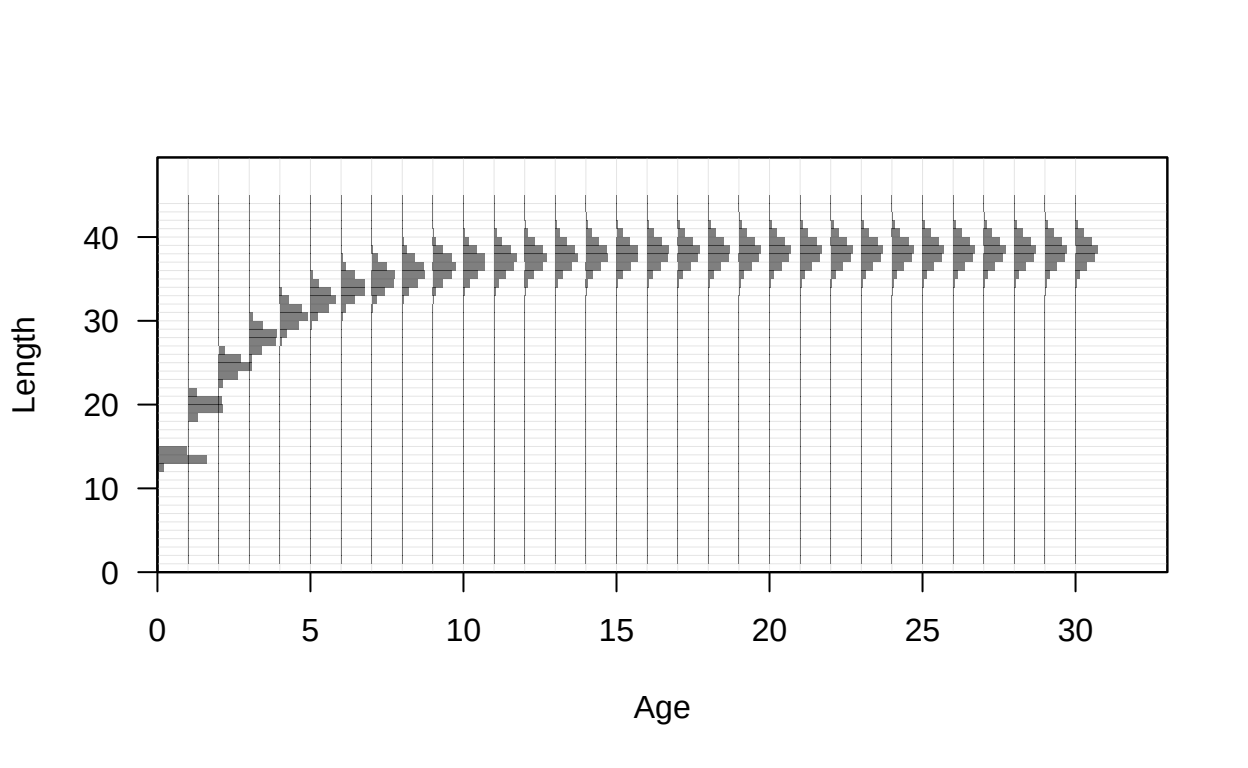

Age (yr)
Mean weight
Females
Males
Length (cm, beginning of the year)
Mean weight
Frac. mature
Age (yr)

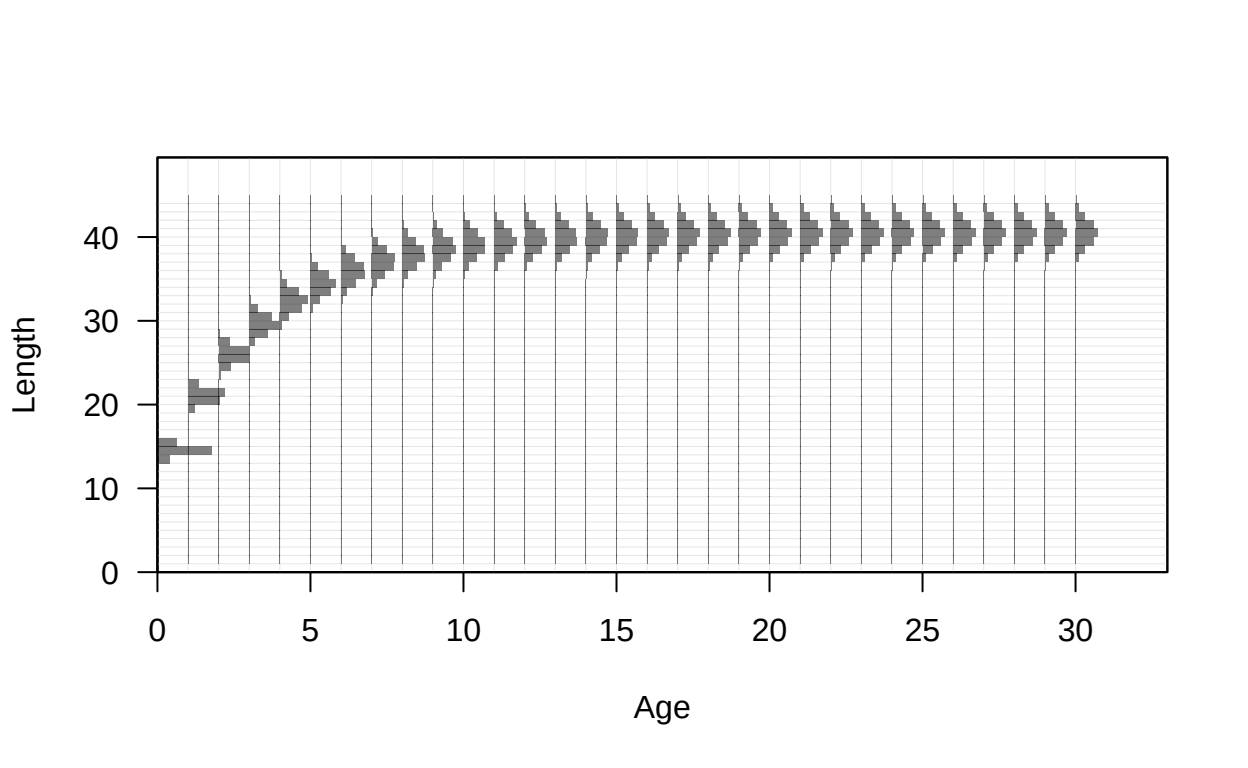

Length
0
10
20
30
40
0
5
10
15
20
25
30
Age


Length
0
10
20
30
40
0
5
10
15
20
25
30
Age


Length
0
10
20
30
40
0
5
10
15
20
25
30
Age


Length
0
10
20
30
40
0
5
10
15
20
25
30
Age


Length
0
10
20
30
40
0
5
10
15
20
25
30
Age


Length
0
10
20
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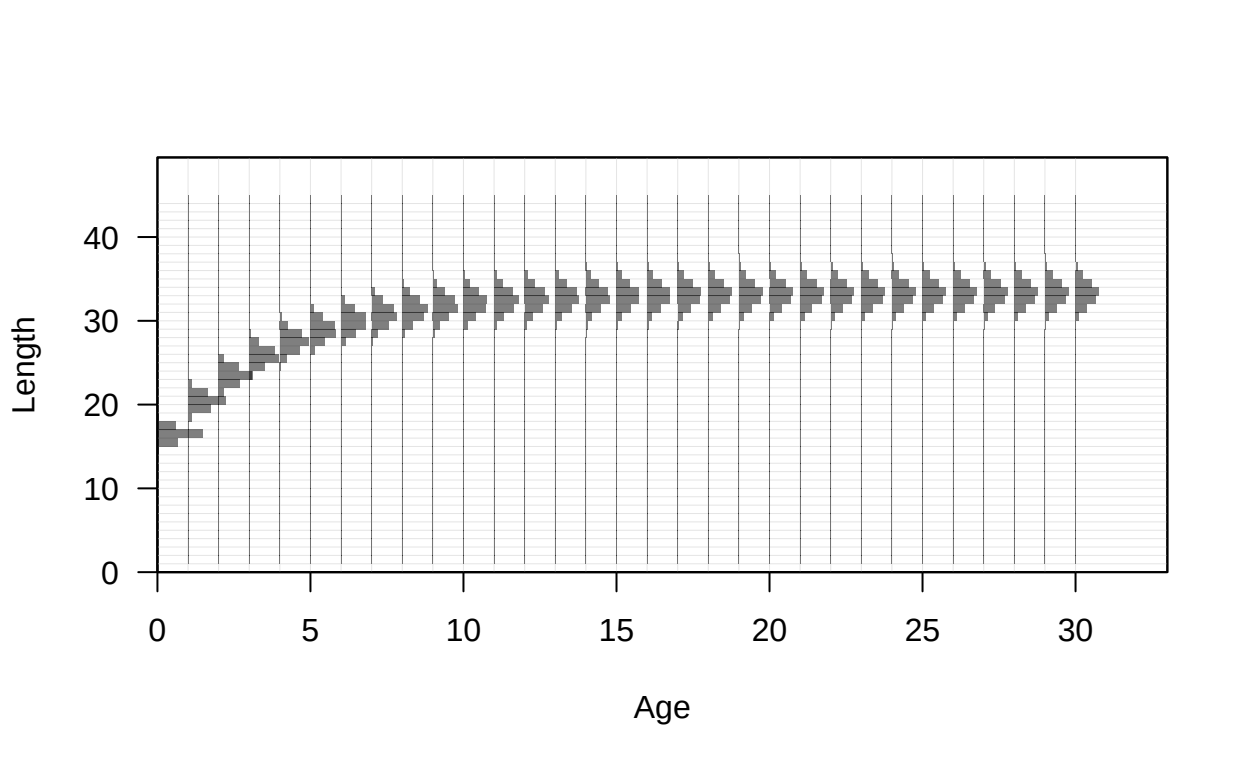
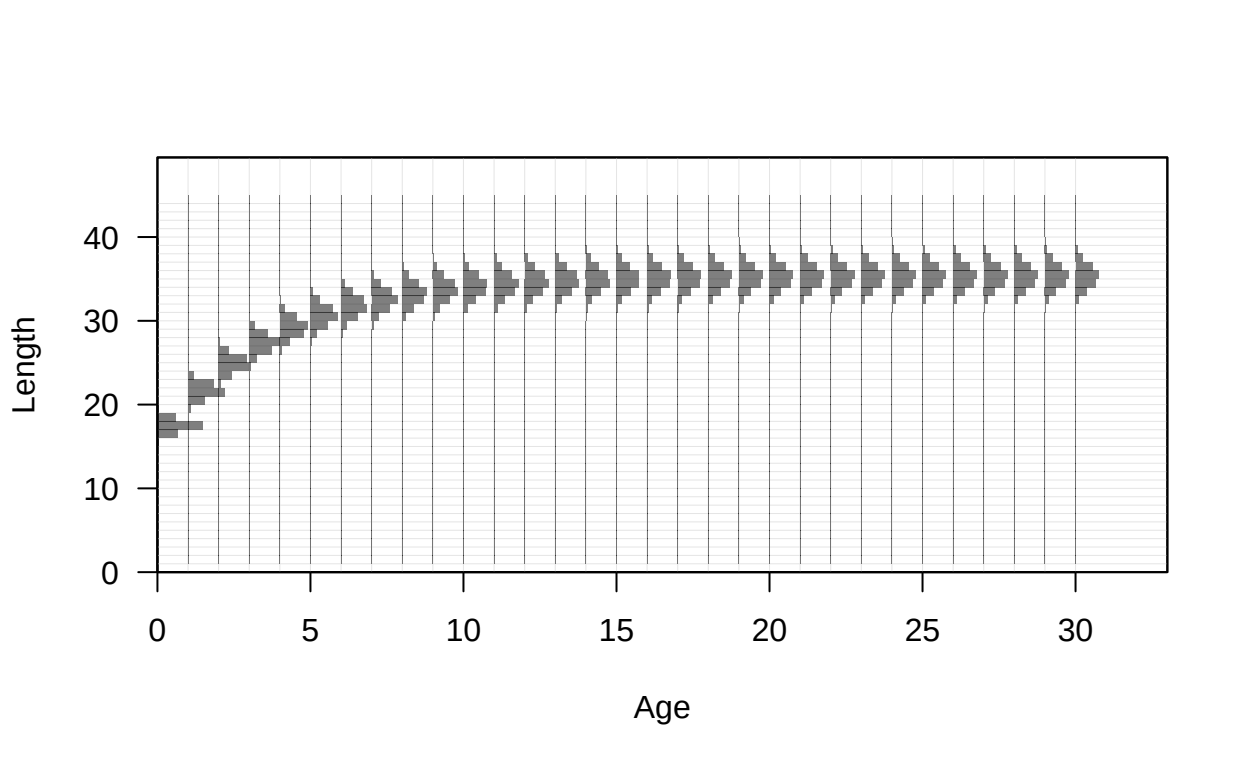
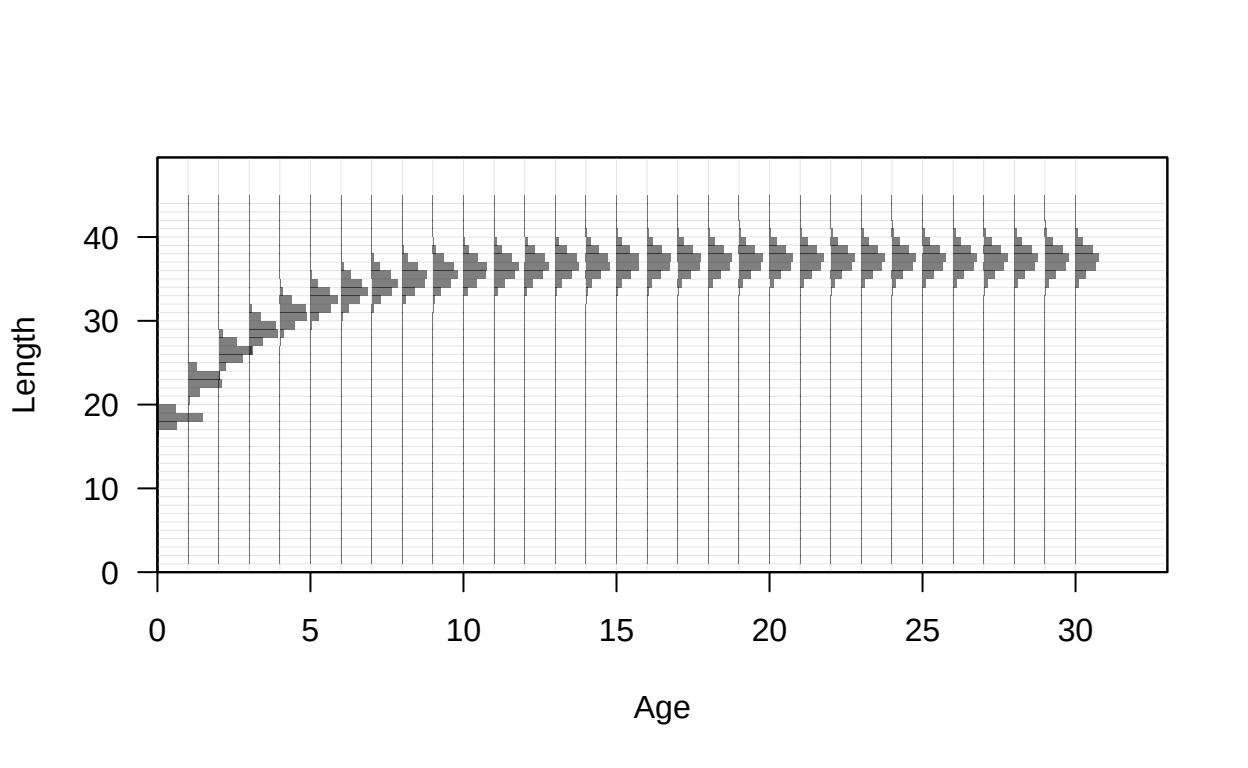
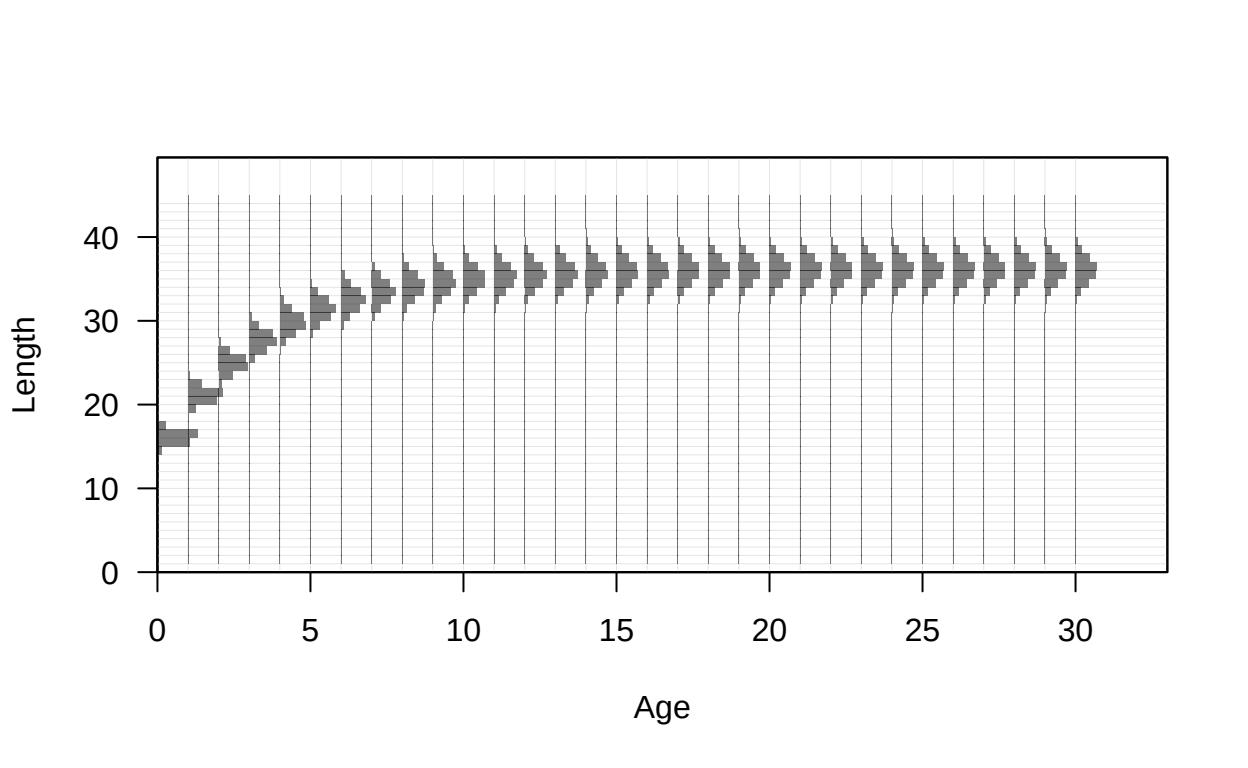
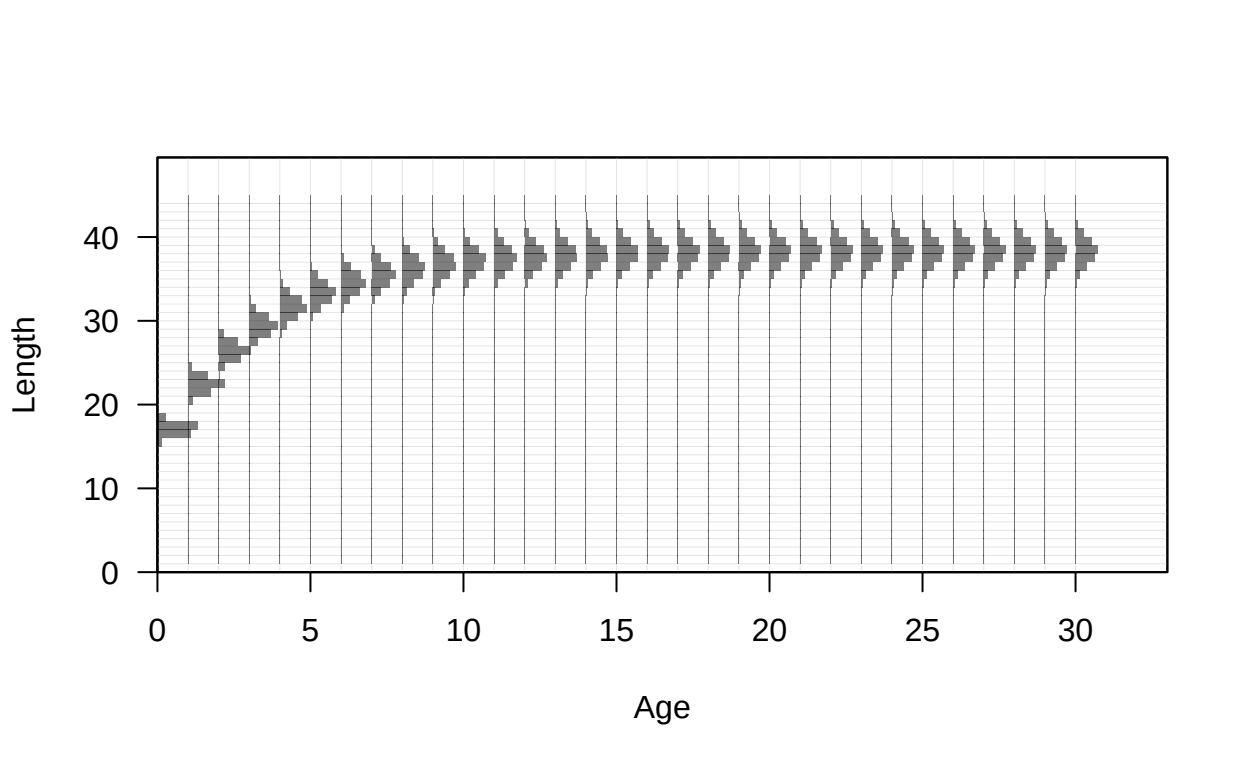
40
0
5
10
15
20
25
30
Age

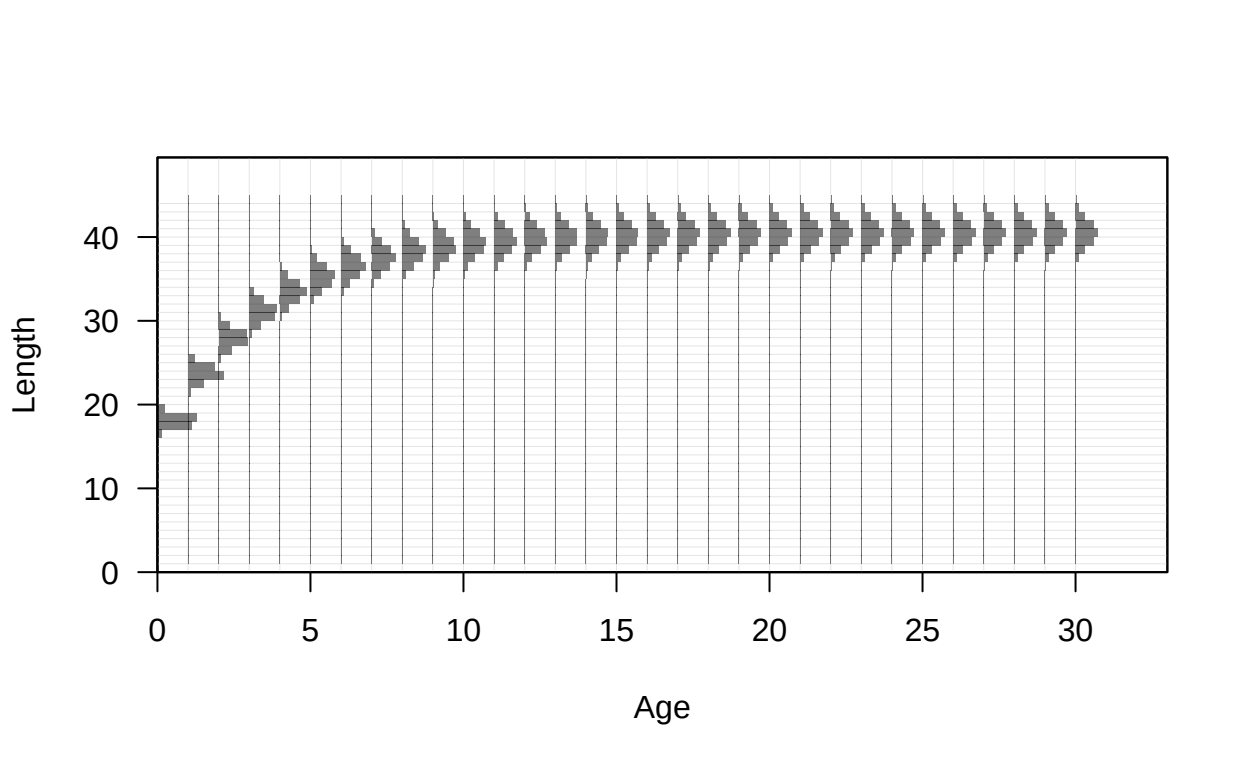

Length
0
10
20
30
40
0
5
10
15
20
25
30
Age

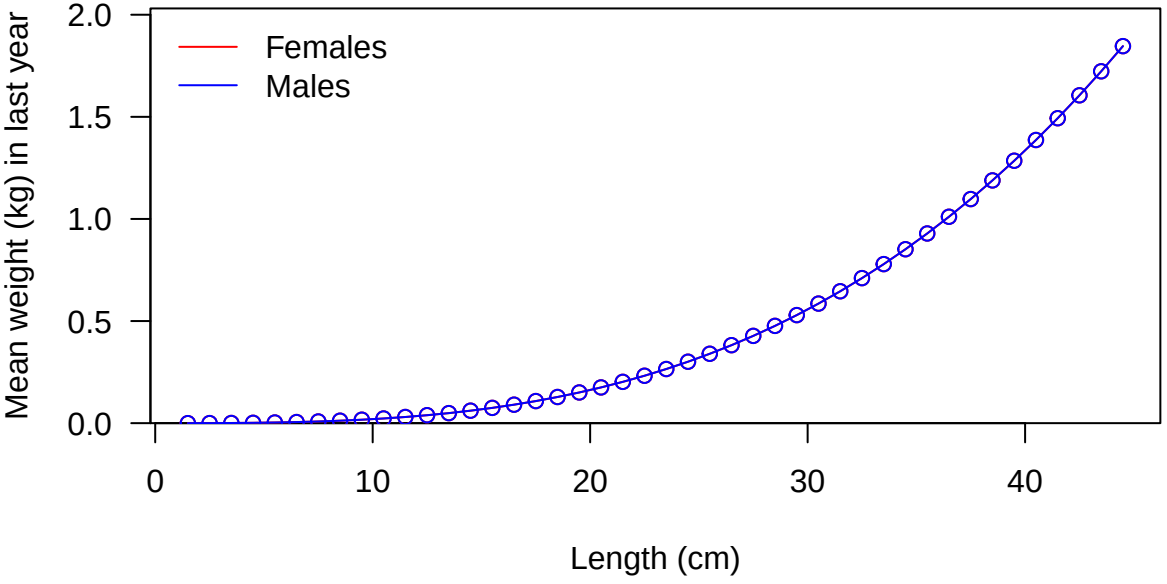

Length
0
10
20
30
40
0
5
10
15
20
25
30
Age

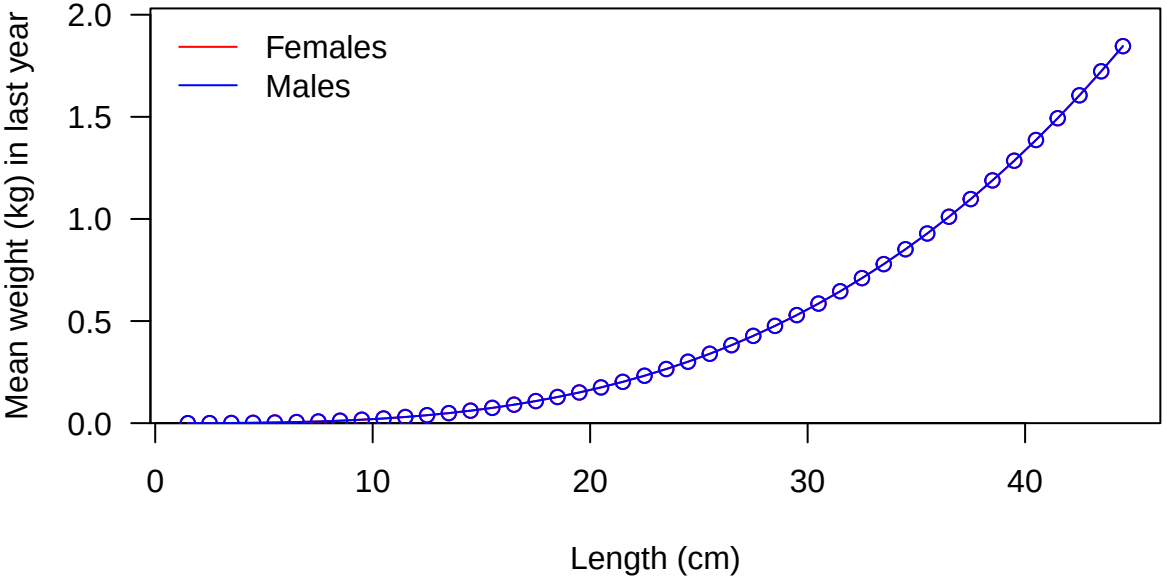

Length
0
10
20
30
40
0
5
10
15
20
25
30
Age

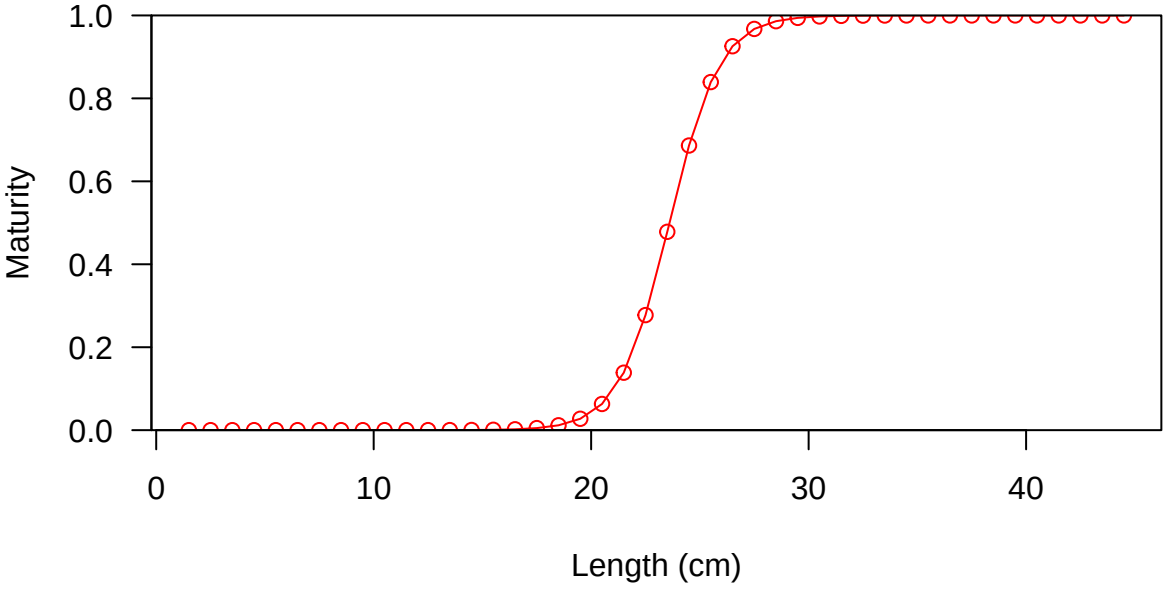

Length
0
10
20
30
40
0
5
10
15
20
25
30
Age

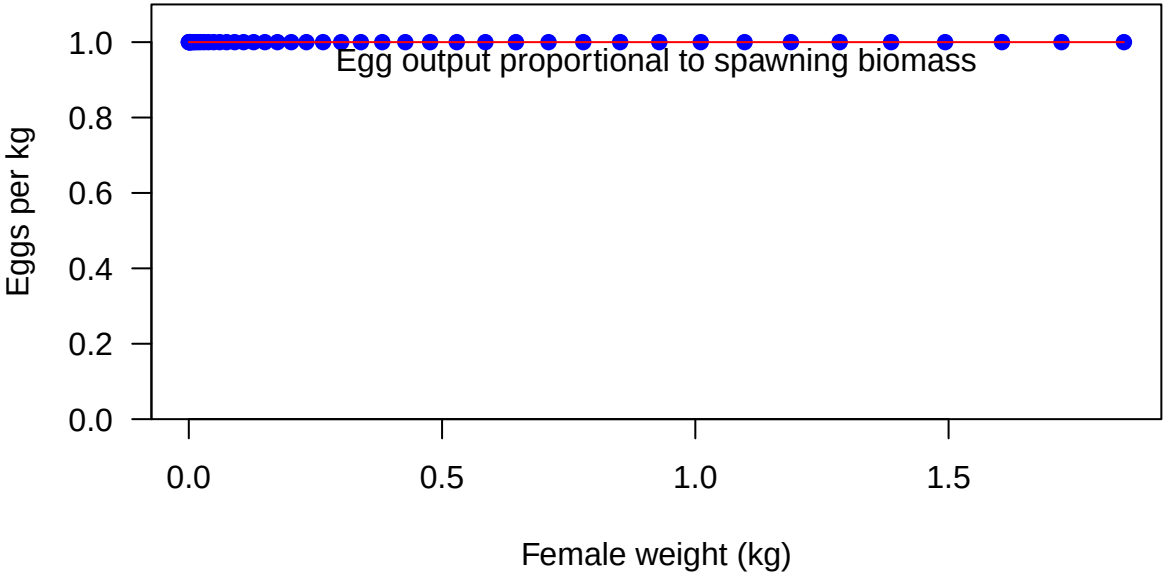

Length
0
10
20
30
40
0
5
10
15
20
25
30
Age

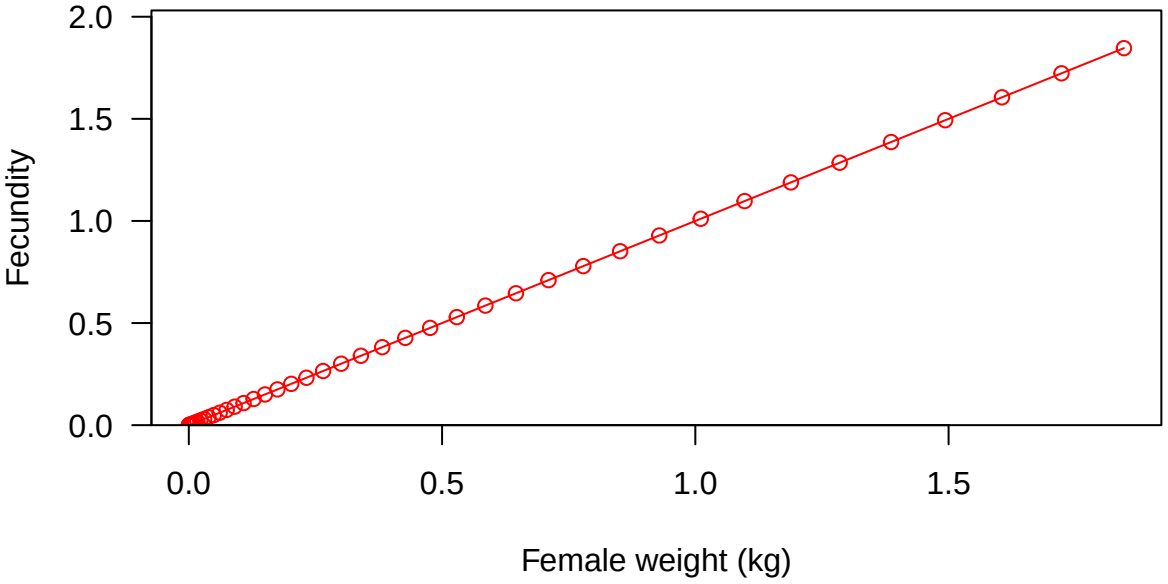

Length
0
10
20
30
40
0
5
10
15
20
25
30
Age

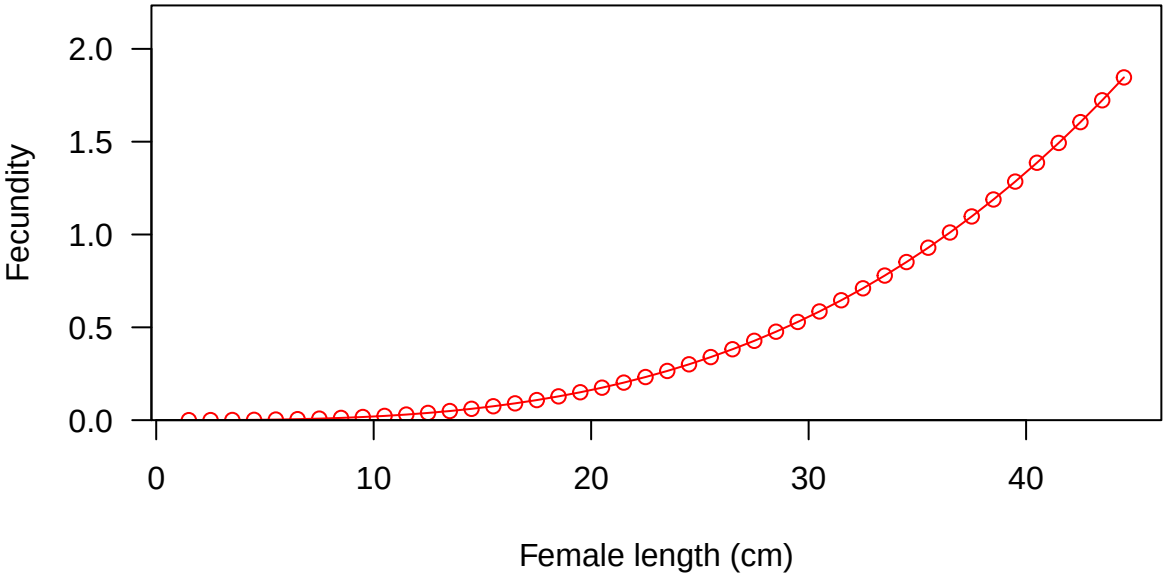

Females
Males
Mean weight (kg) in last year
2.0
1.5
1.0
0.5
0.0
0
10
20
30
40
Length (cm)

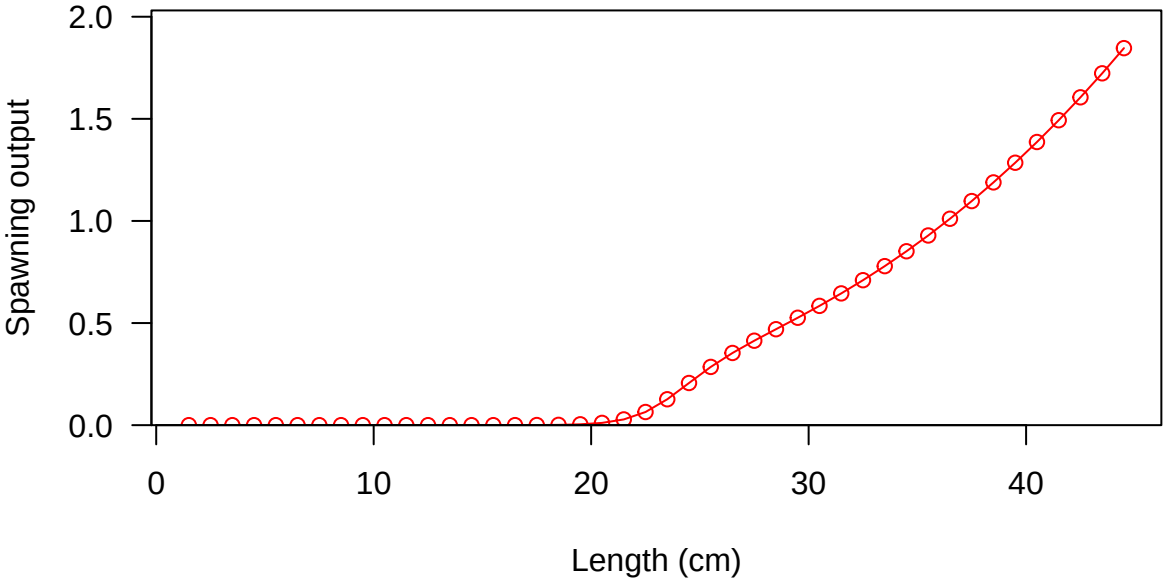

Females
Males
Mean weight (kg) in last year
2.0
1.5
1.0
0.5
0.0
0
10
20
30
40
Length (cm)

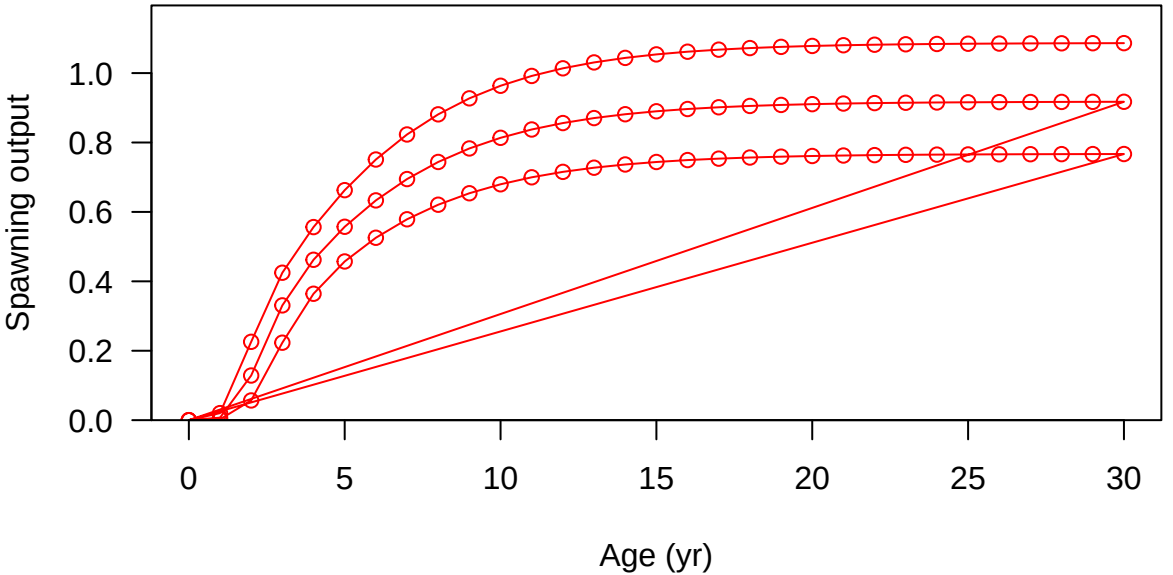

1.0
0.8
0.6
0.4
0.2
0.0
Maturity
0
10
20
30
40
Length (cm)

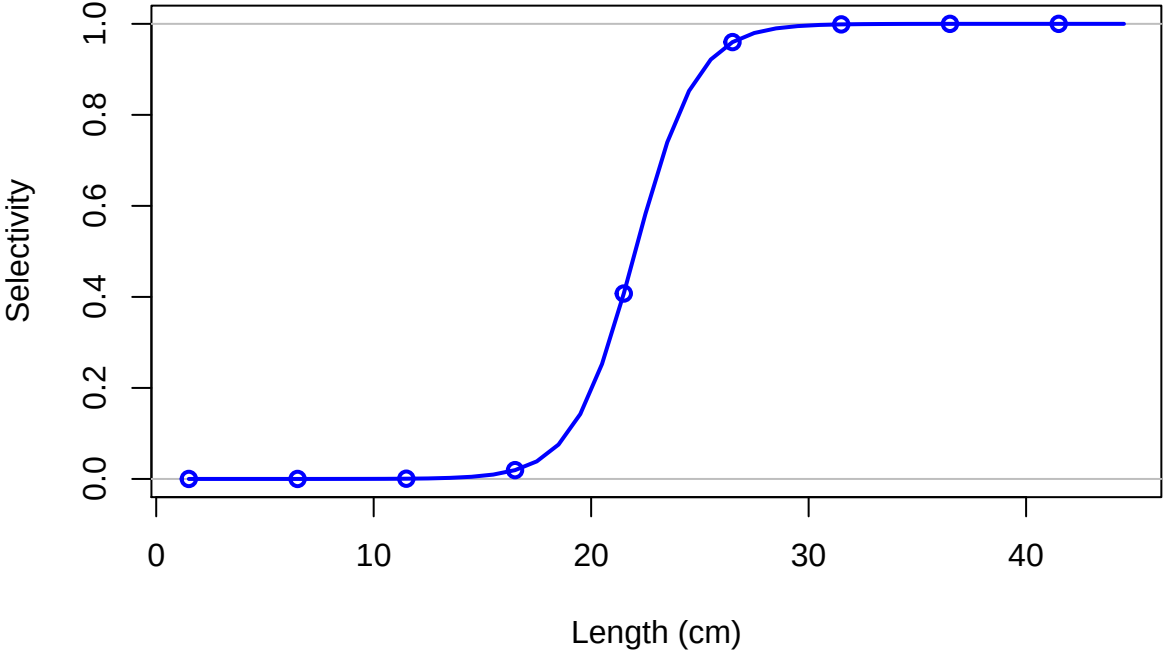

Egg output proportional to spawning biomass
Eggs per kg
1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.5
1.0
1.5
Female weight (kg)

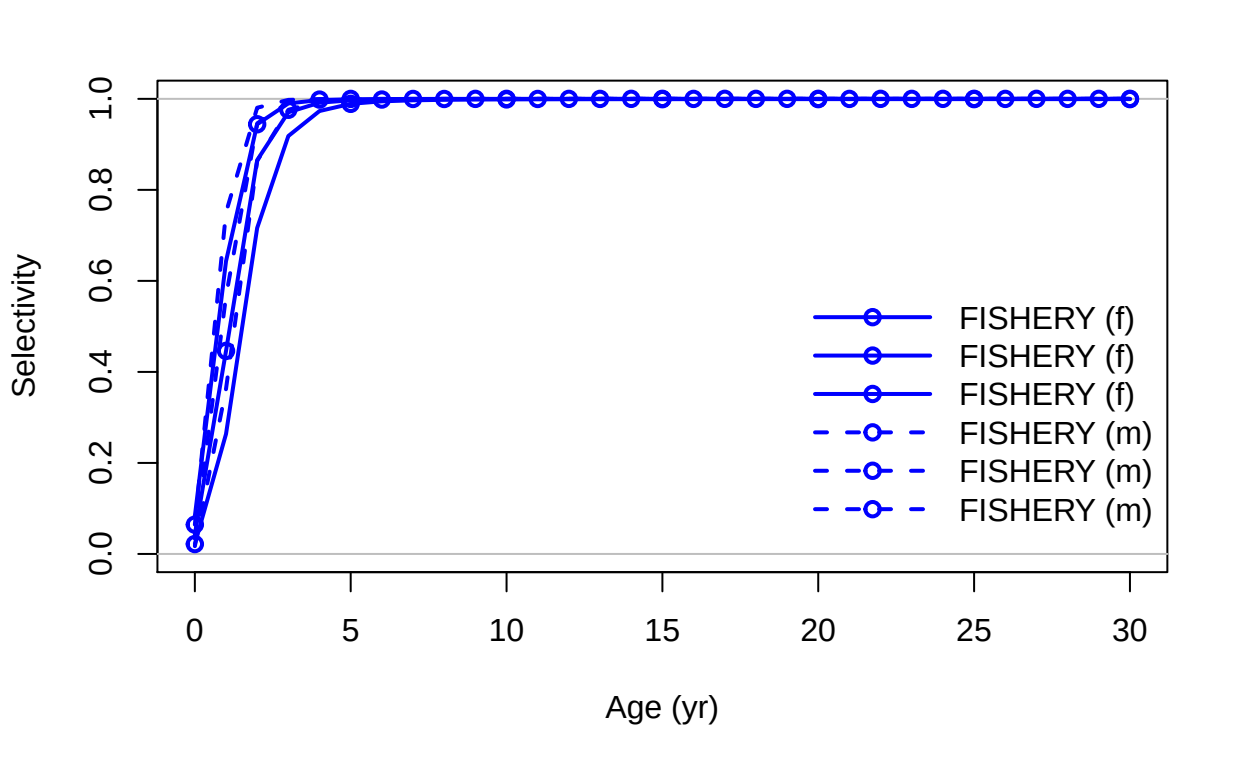

2.0
1.5
1.0
0.5
0.0
Fecundity
0.0
0.5
1.0
1.5
Female weight (kg)

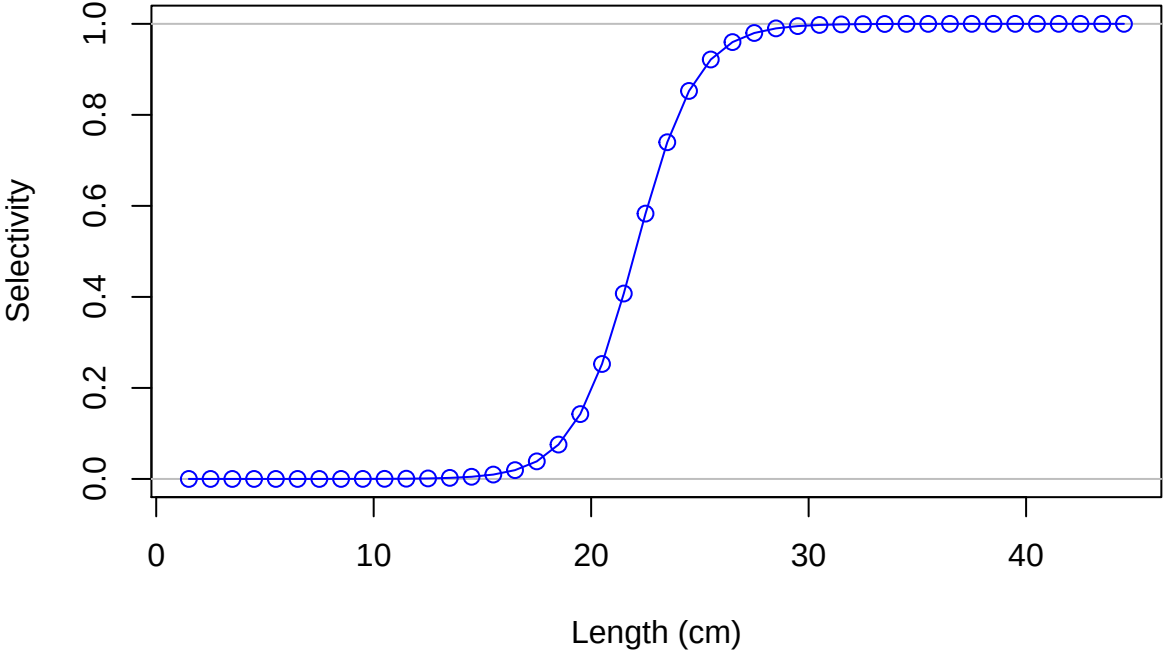

Fecundity
2.0
1.5
1.0
0.5
0.0
0
10
20
30
40
Female length (cm)

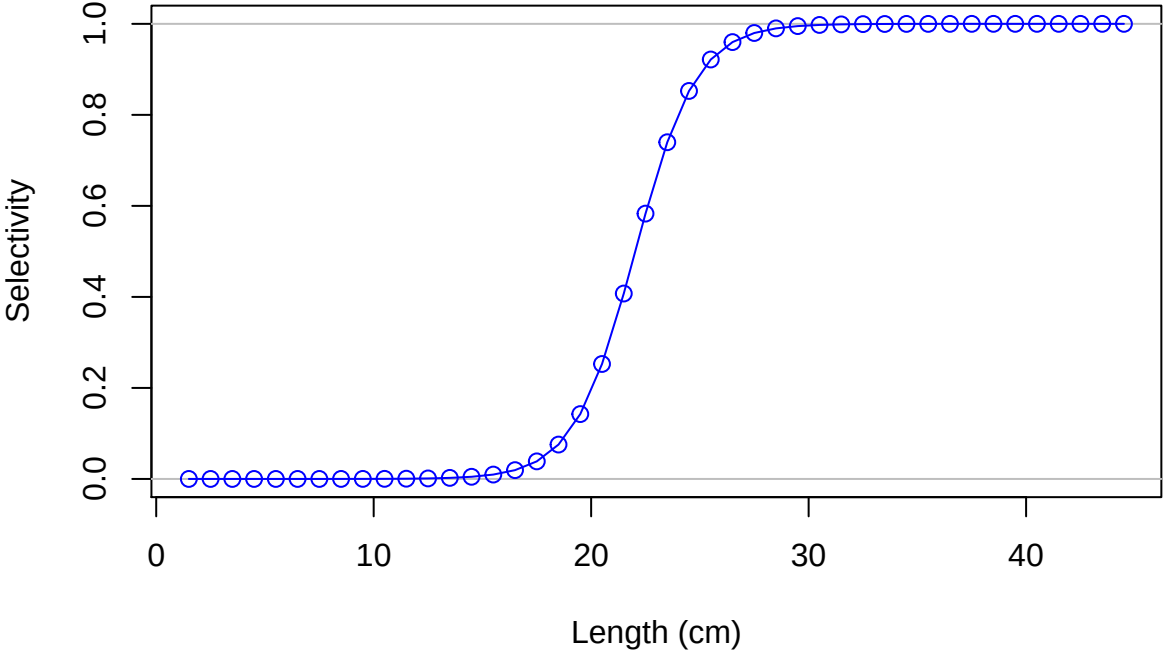

2.0
1.5
1.0
0.5
0.0
Spawning output
0
10
20
30
40
Length (cm)

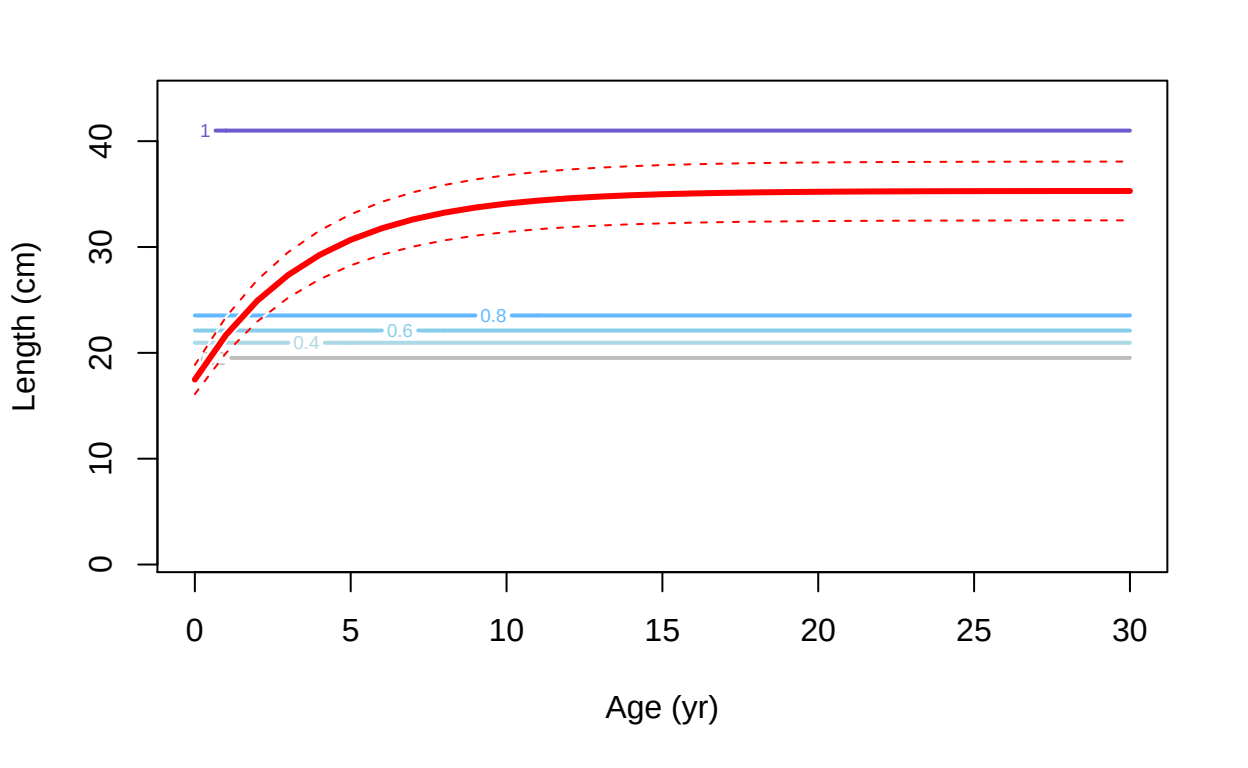

Spawning output
0.0
0.2
0.4
0.6
0.8
1.0
0
5
10
15
20
25
30
Age (yr)

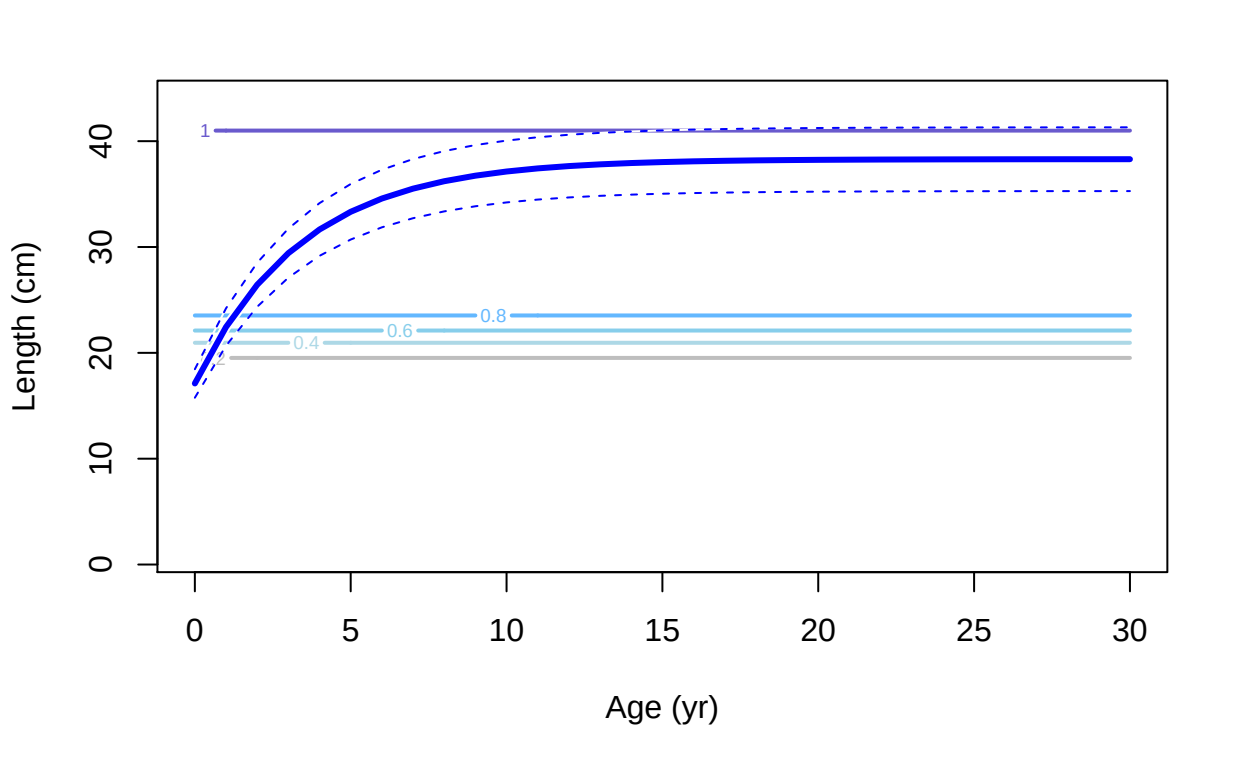

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
10
20
30
40
Length (cm)

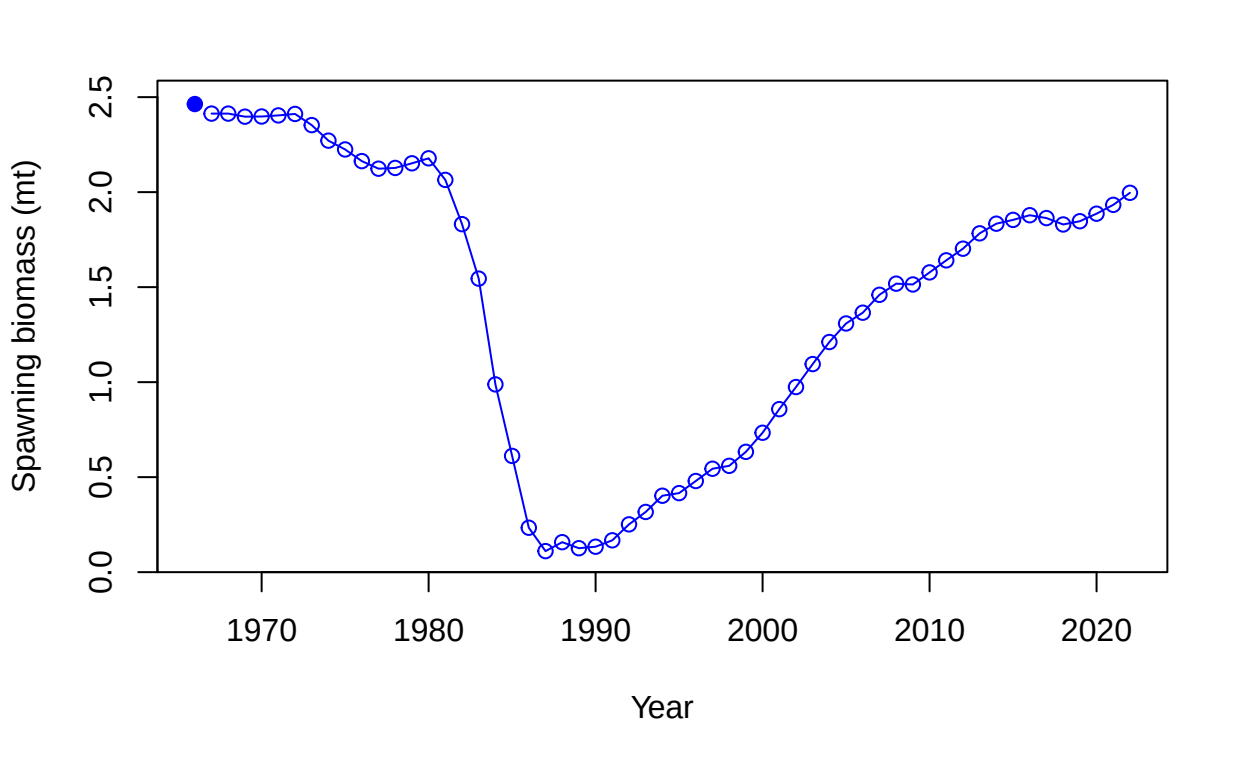

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
5
10
15
20
25
30
Age (yr)
FISHERY (f)
FISHERY (f)
FISHERY (f)
FISHERY (m)
FISHERY (m)
FISHERY (m)

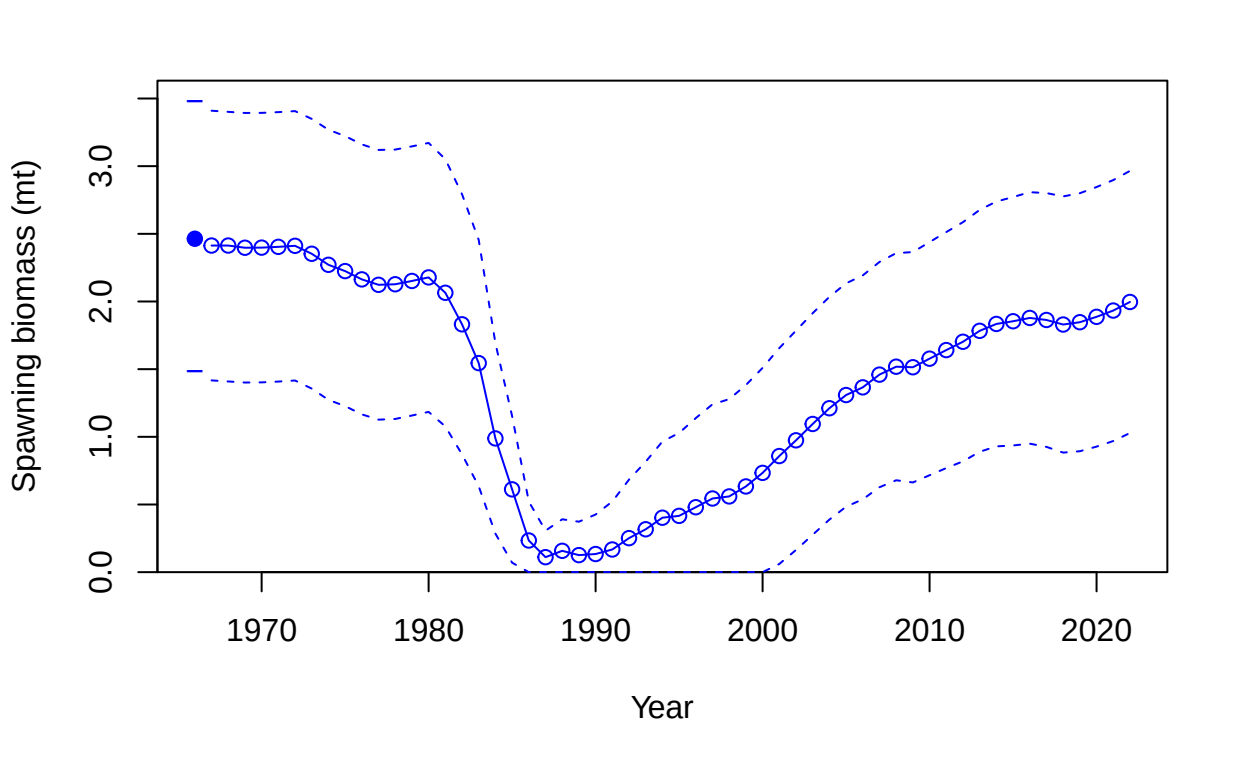

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
10
20
30
40
Length (cm)

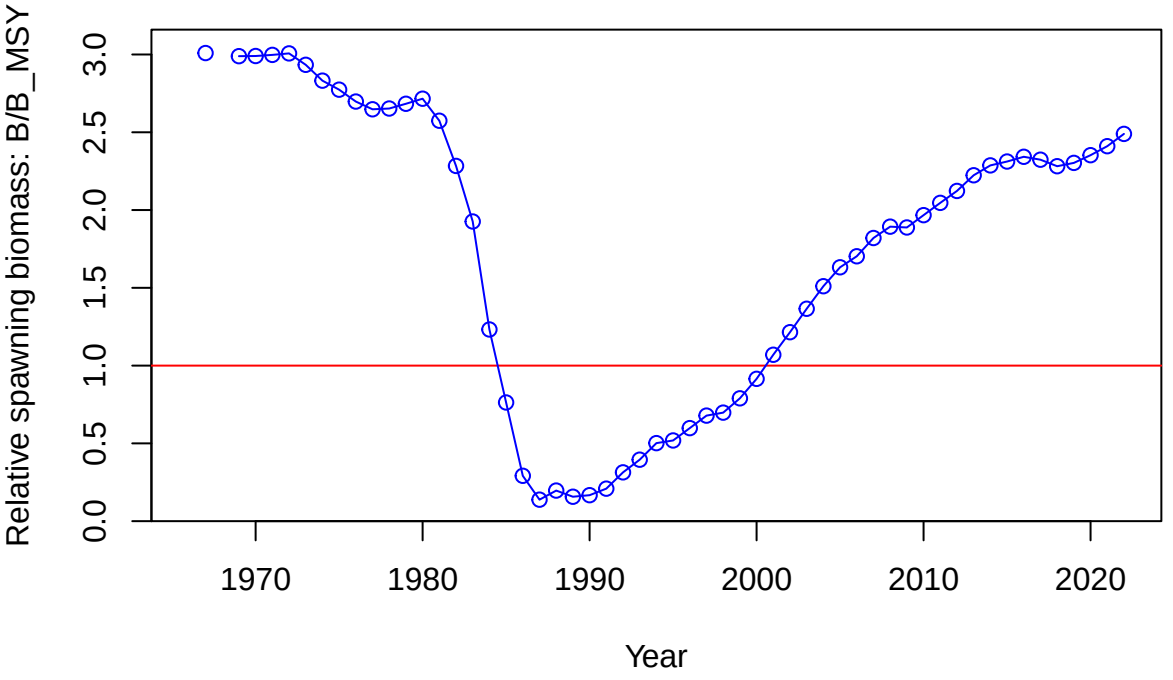

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
10
20
30
40
Length (cm)

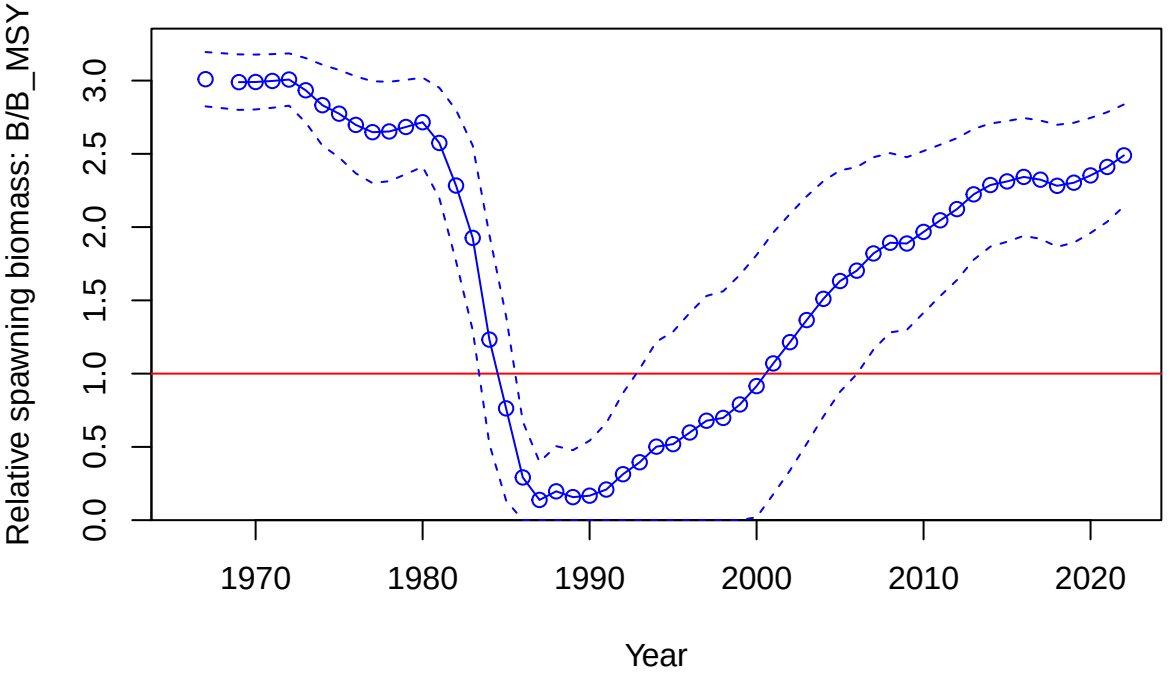

Length (cm)
0
10
20
30
40
Age (yr)
0
5
10
15
20
25
30
1
0.8
0.6
0.4

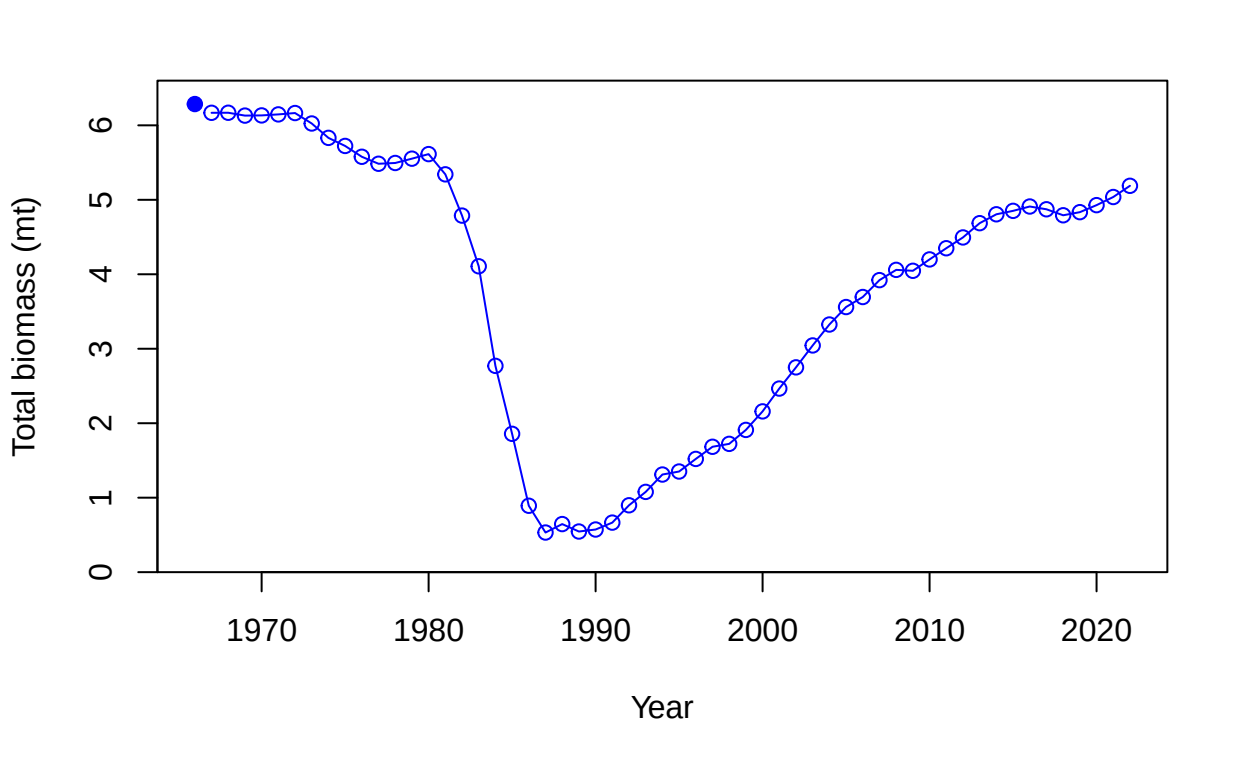

Length (cm)
0
10
20
30
40
1
0.8
0.6
0.4
0
5
10
15
20
25
30
Age (yr)

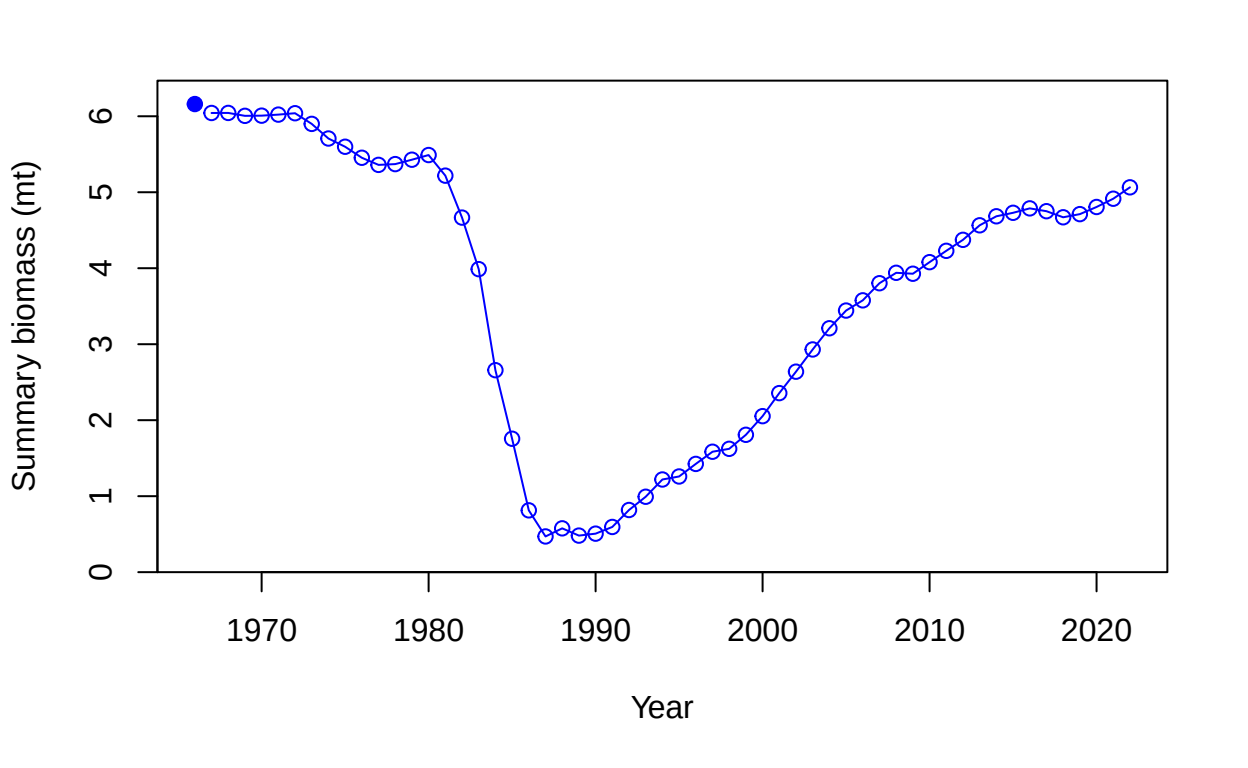

Spawning biomass (mt)
0.0
0.5
1.0
1.5
2.0
2.5
1970
1980
1990
2000
2010
2020
Year

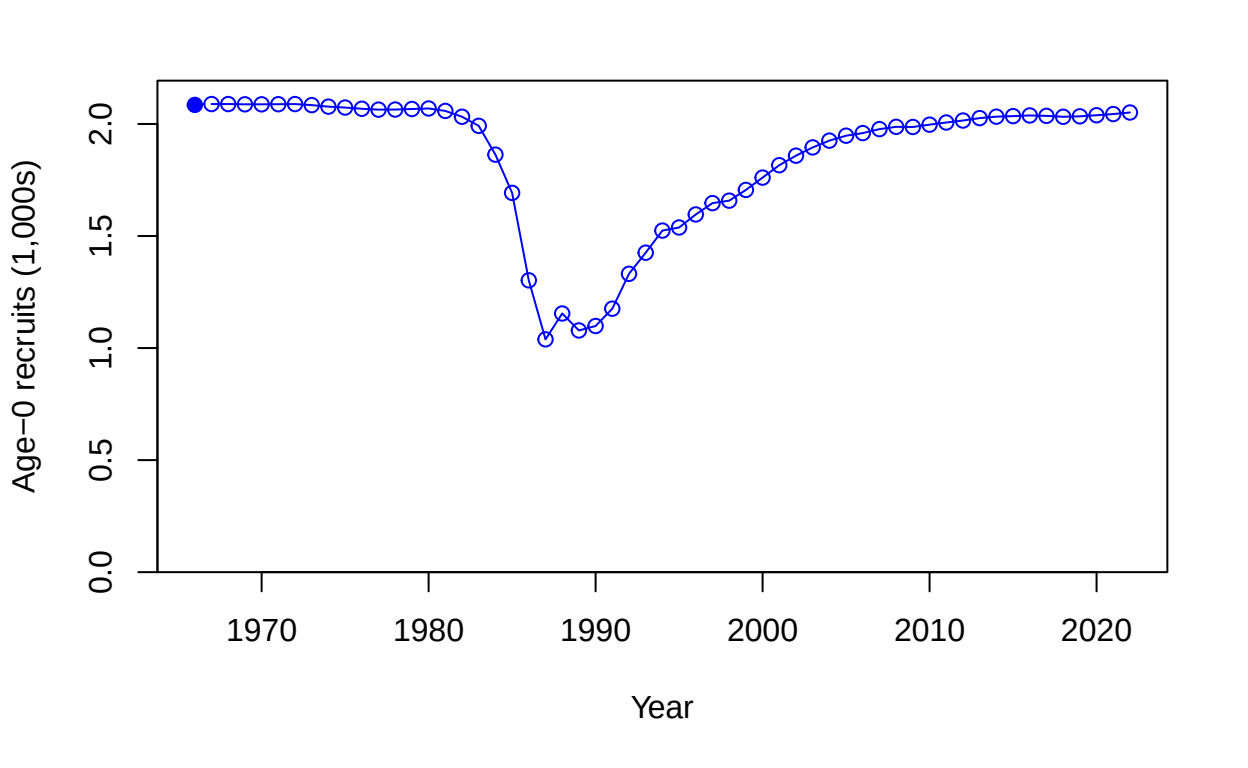

Spawning biomass (mt)
0.0
1.0
2.0
3.0
1970
1980
1990
2000
2010
2020
Year

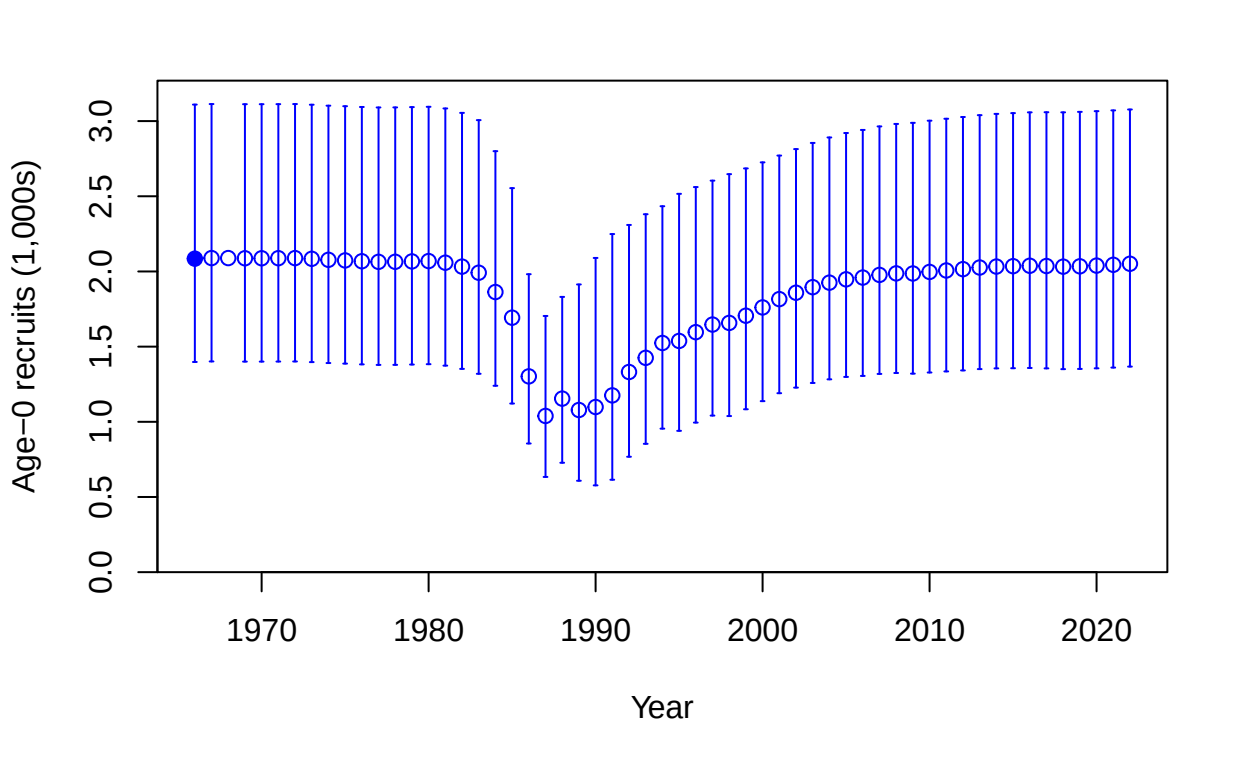

Relative spawning biomass: B/B_MSY
0.0
0.5
1.0
1.5
2.0
2.5
3.0
1970
1980
1990
2000
2010
2020
Year

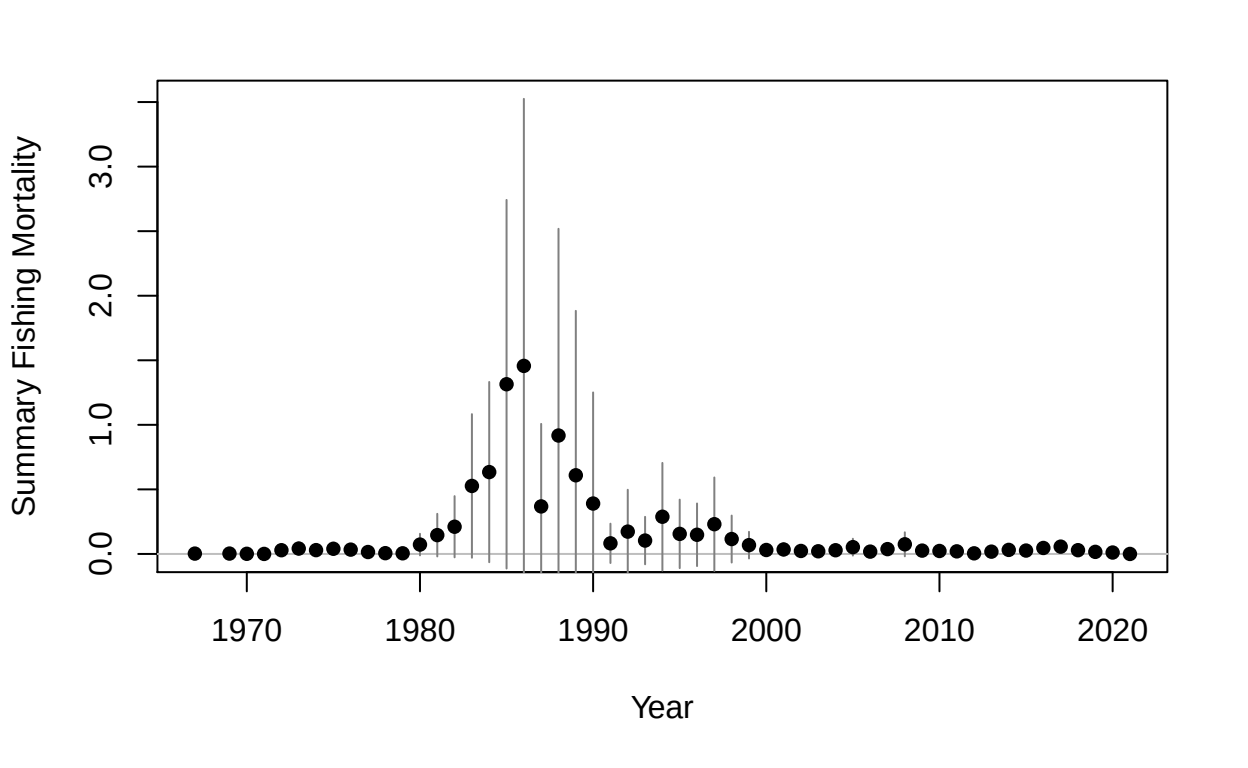

Relative spawning biomass: B/B_MSY
0.0
0.5
1.0
1.5
2.0
2.5
3.0
1970
1980
1990
2000
2010
2020
Year

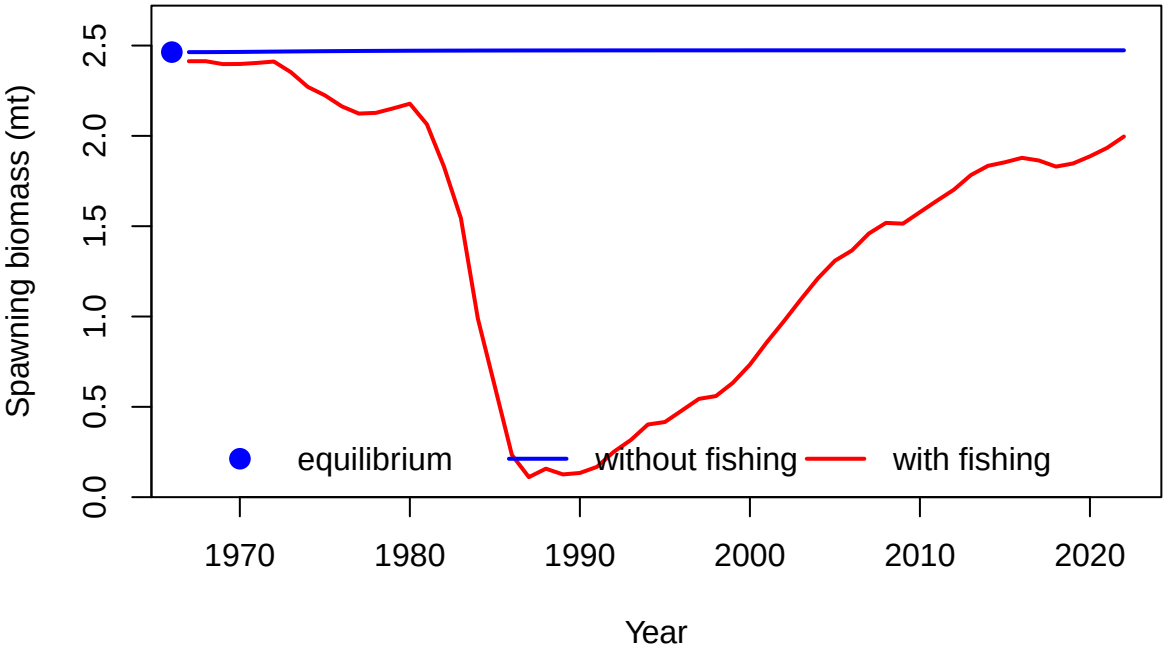

Total biomass (mt)
0
1
2
3
4
5
6
1970
1980
1990
2000
2010
2020
Year

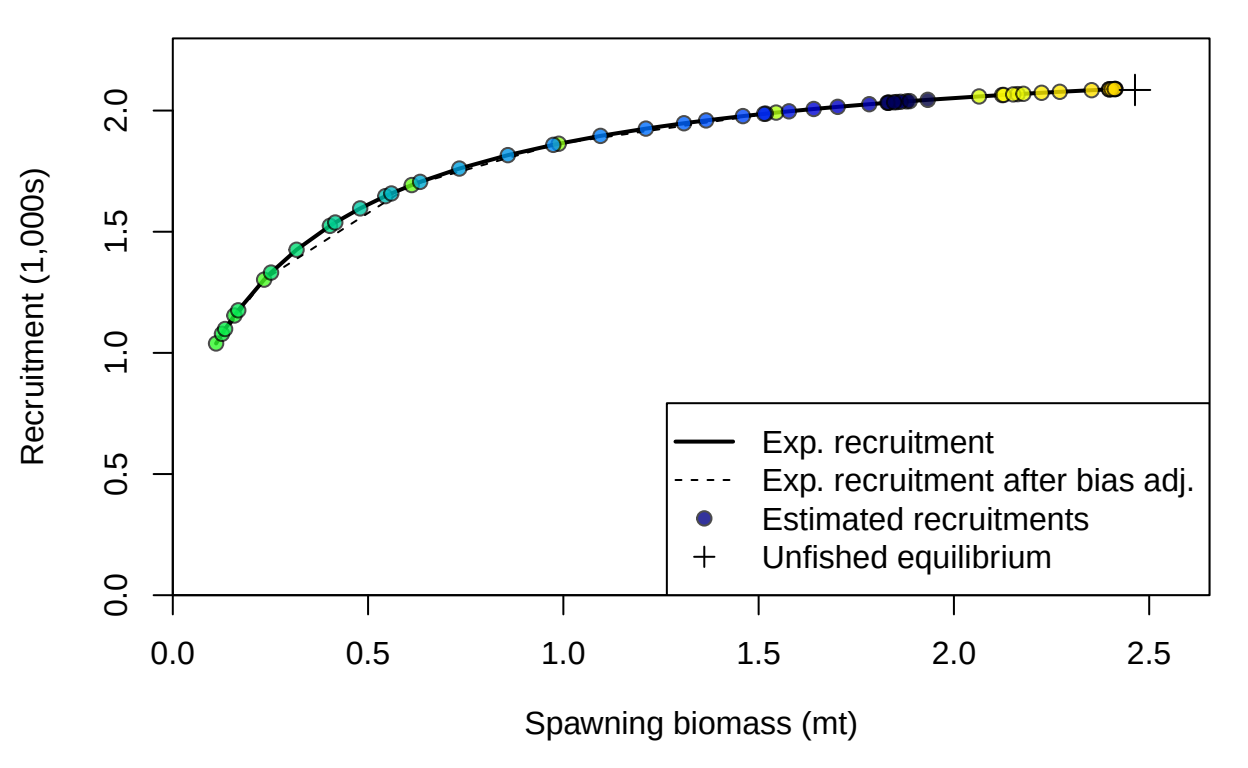

Summary biomass (mt)
0
1
2
3
4
5
6
1970
1980
1990
2000
2010
2020
Year

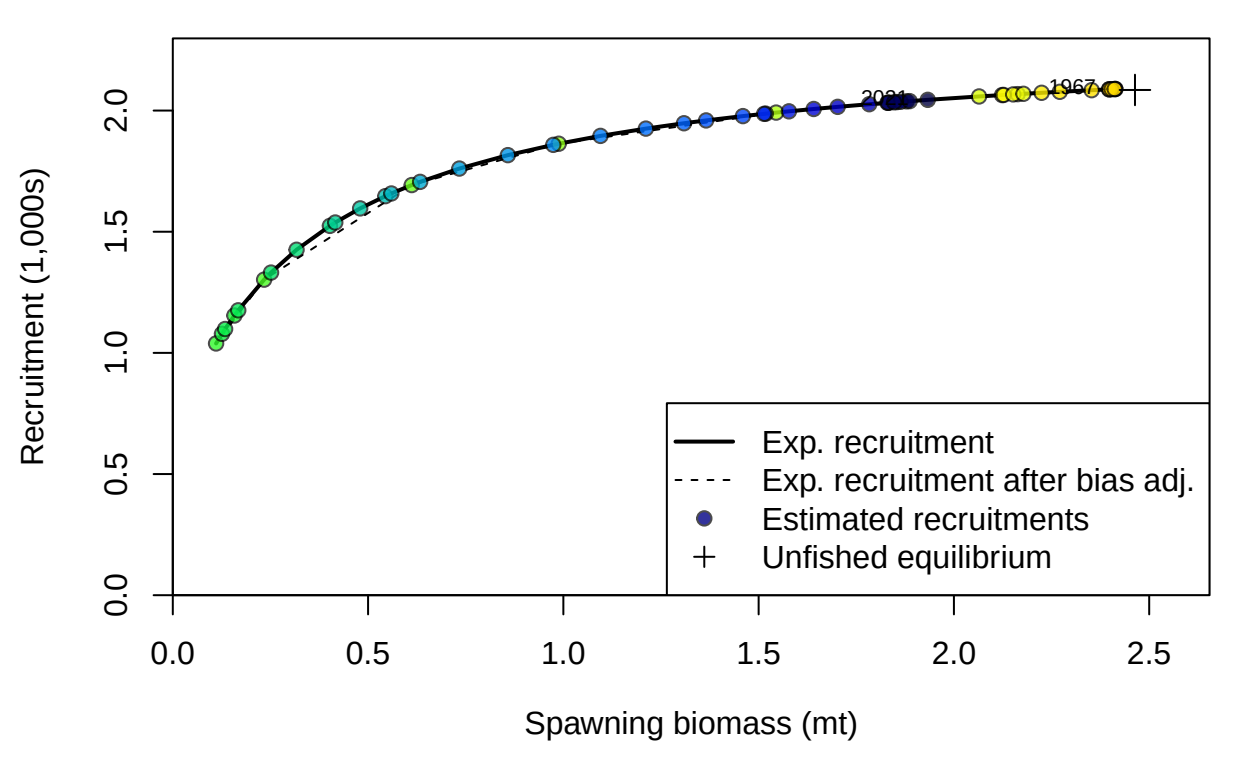

Age−0 recruits (1,000s)
0.0
0.5
1.0
1.5
2.0
1970
1980
1990
2000
2010
2020
Year

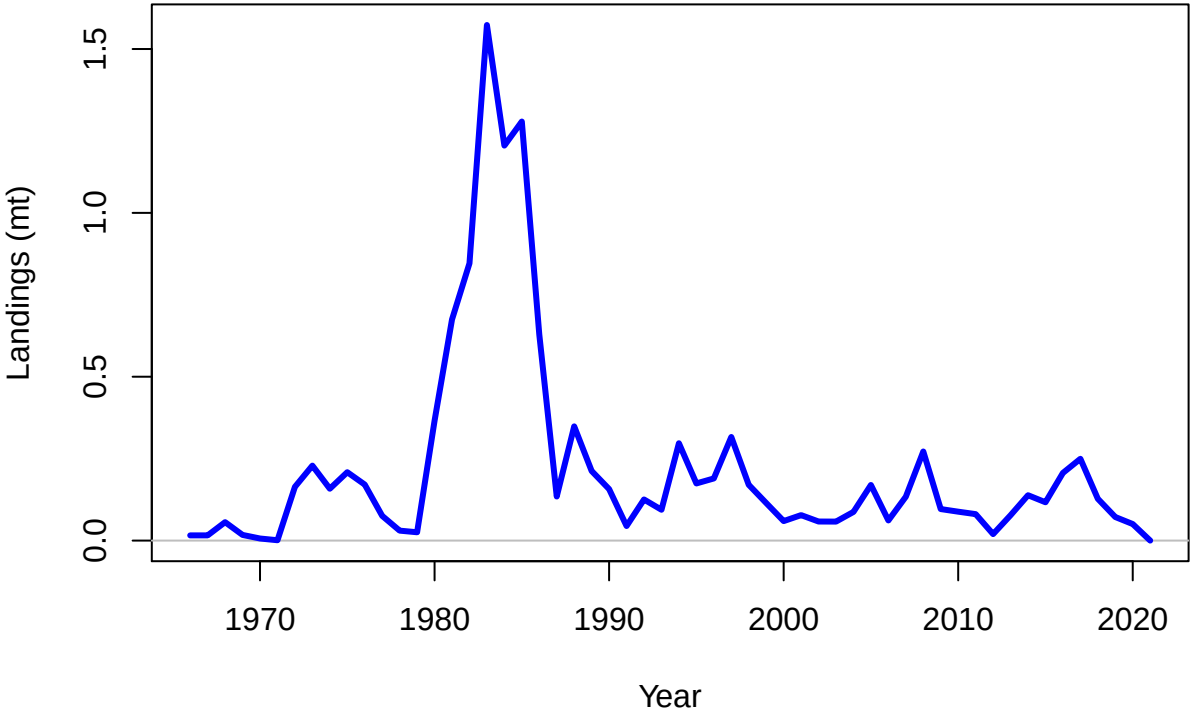

Age−0 recruits (1,000s)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
1970
1980
1990
2000
2010
2020
Year

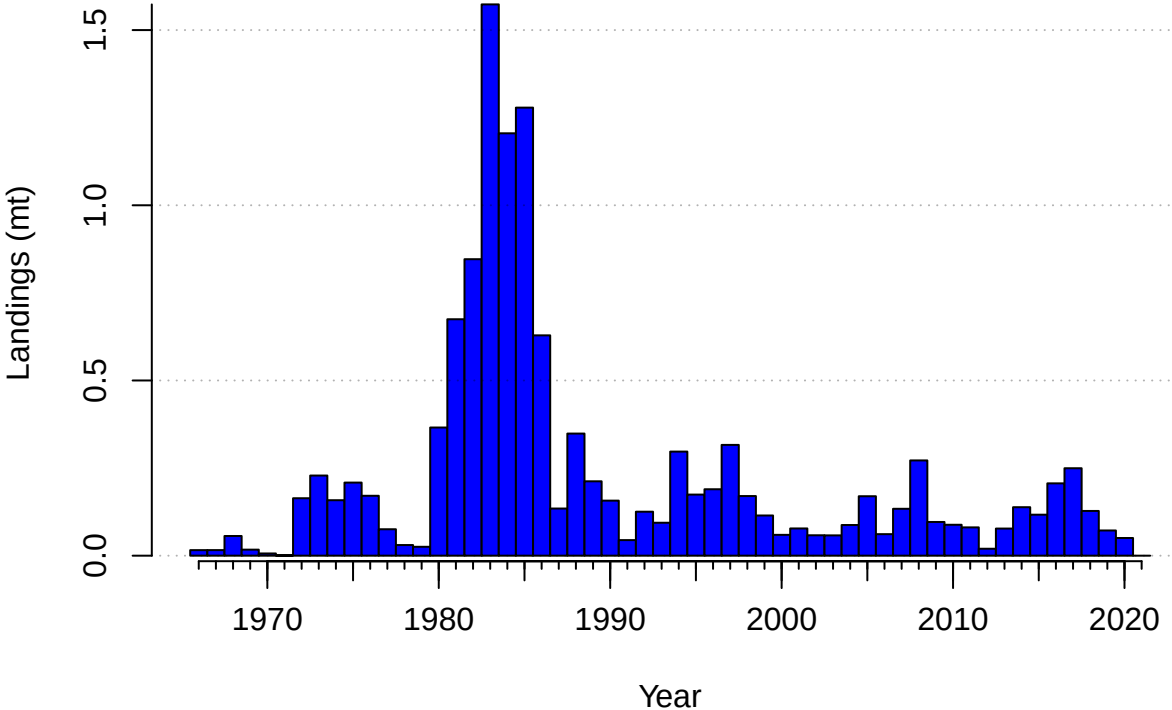

Summary Fishing Mortality
0.0
1.0
2.0
3.0
1970
1980
1990
2000
2010
2020
Year

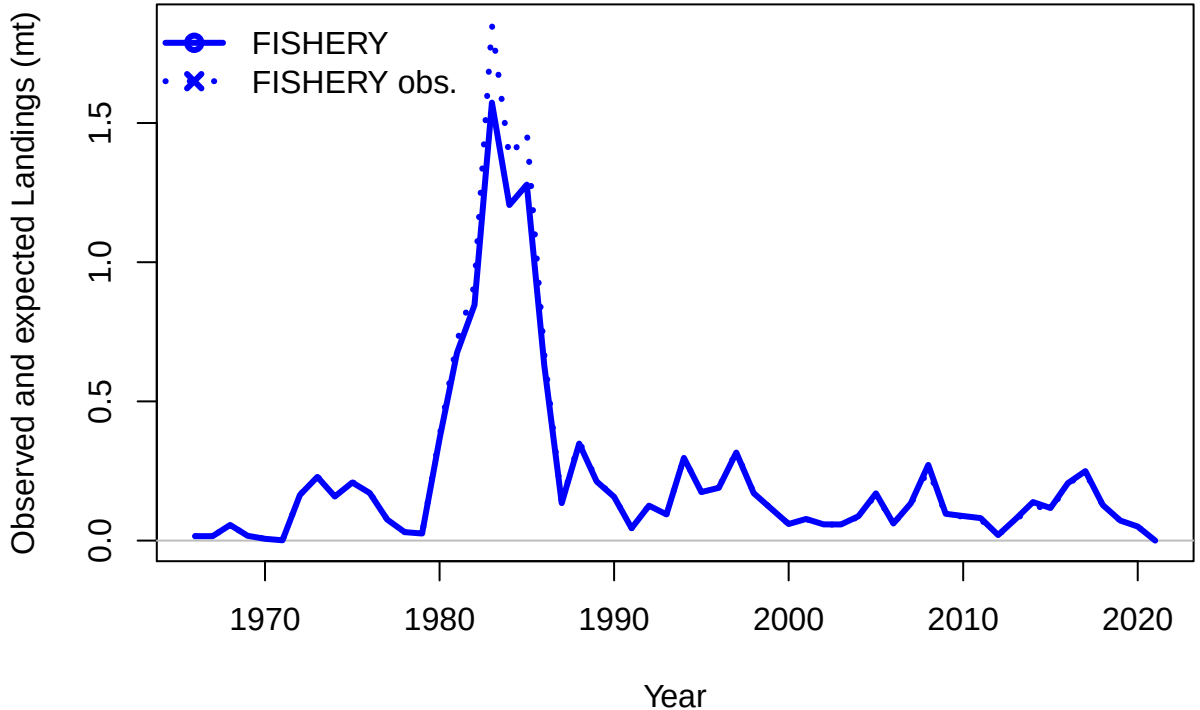

Spawning biomass (mt)
0.0
0.5
1.0
1.5
2.0
2.5
1970
1980
1990
2000
2010
2020
Year
equilibrium
without fishing
with fishing

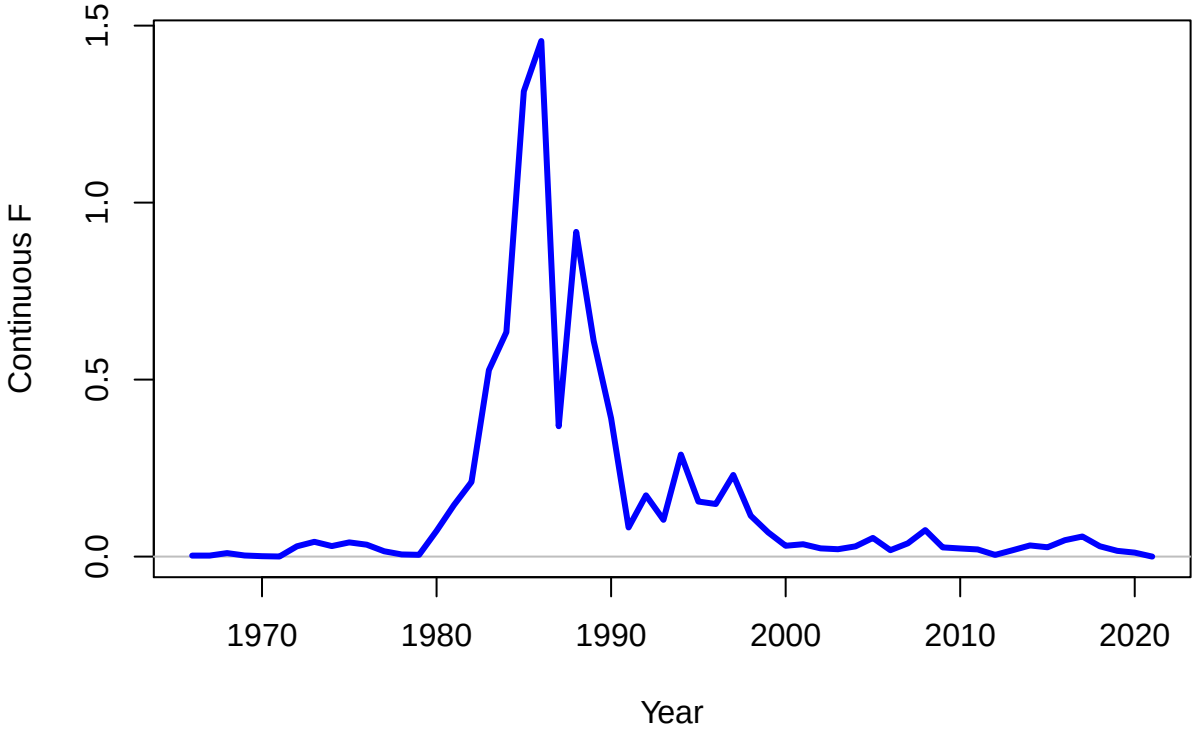

Recruitment (1,000s)
0.0
0.5
1.0
1.5
2.0
Spawning biomass (mt)
0.0
0.5
1.0
1.5
2.0
2.5
Exp. recruitment
Exp. recruitment after bias adj.
Estimated recruitments
Unfished equilibrium

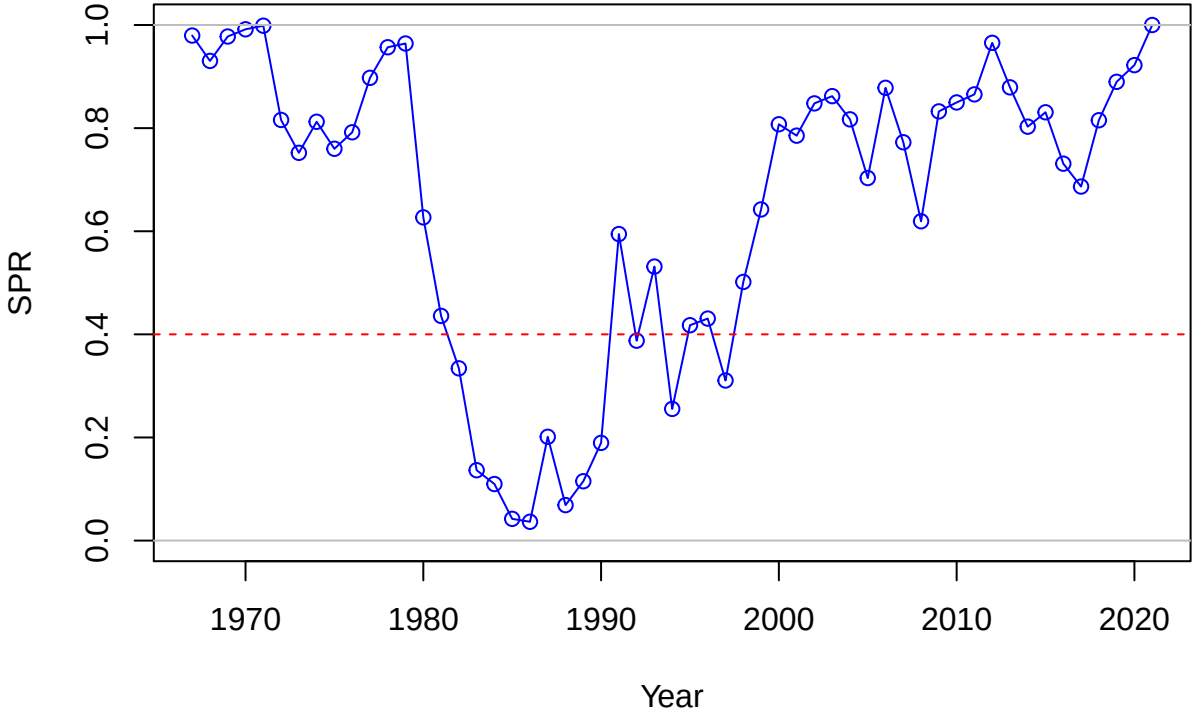

Recruitment (1,000s)
0.0
0.5
1.0
1.5
2.0
Spawning biomass (mt)
0.0
0.5
1.0
1.5
2.0
2.5
2021
1967
Exp. recruitment
Exp. recruitment after bias adj.
Estimated recruitments
Unfished equilibrium

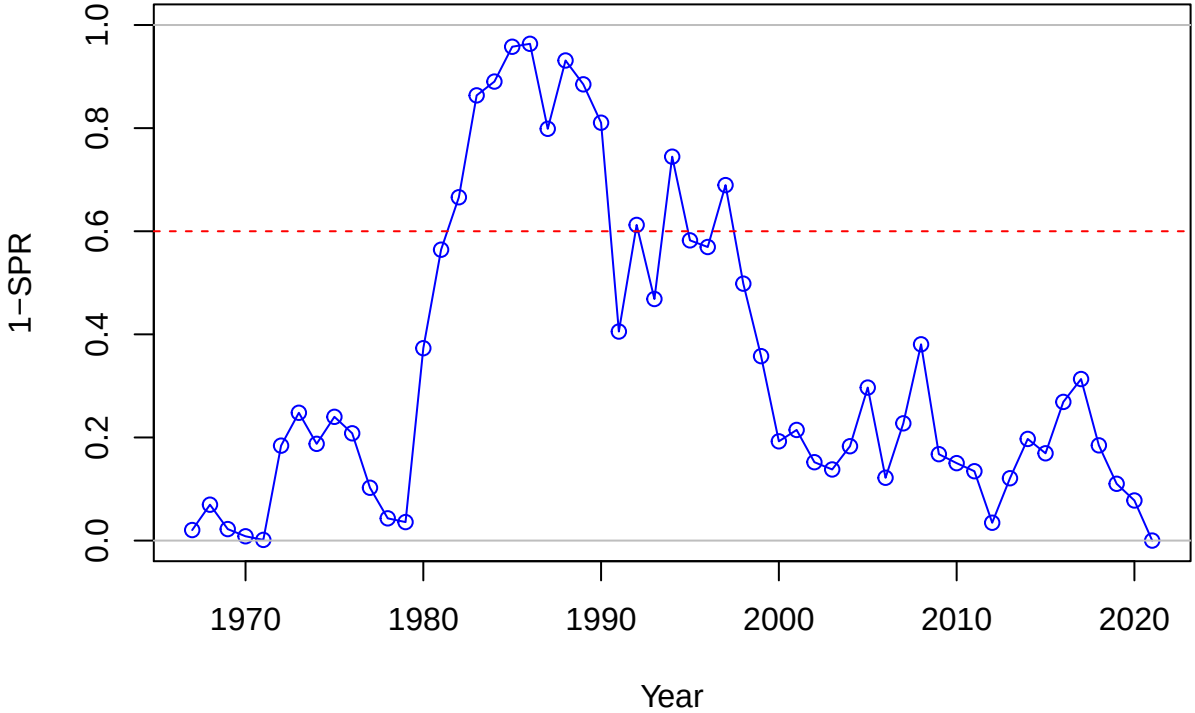

Landings (mt)
0.0
0.5
1.0
1.5
1970
1980
1990
2000
2010
2020
Year

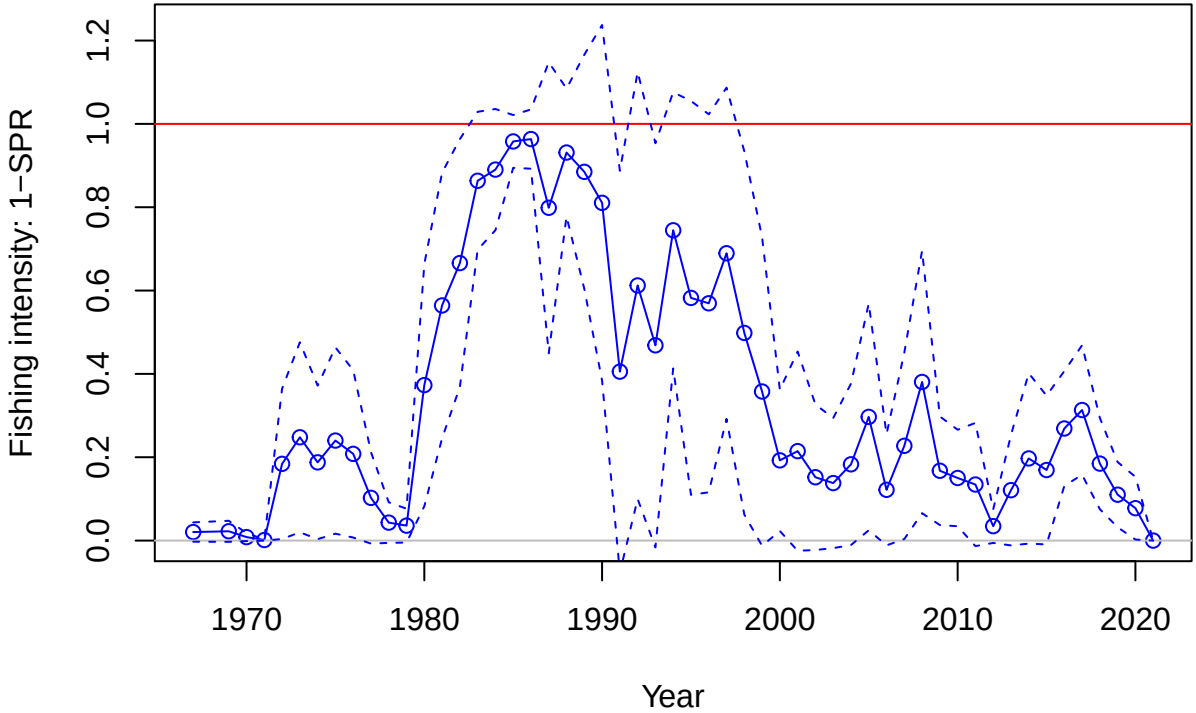

Landings (mt)
0.0
0.5
1.0
1.5
1970
1980
1990
2000
2010
2020
Year

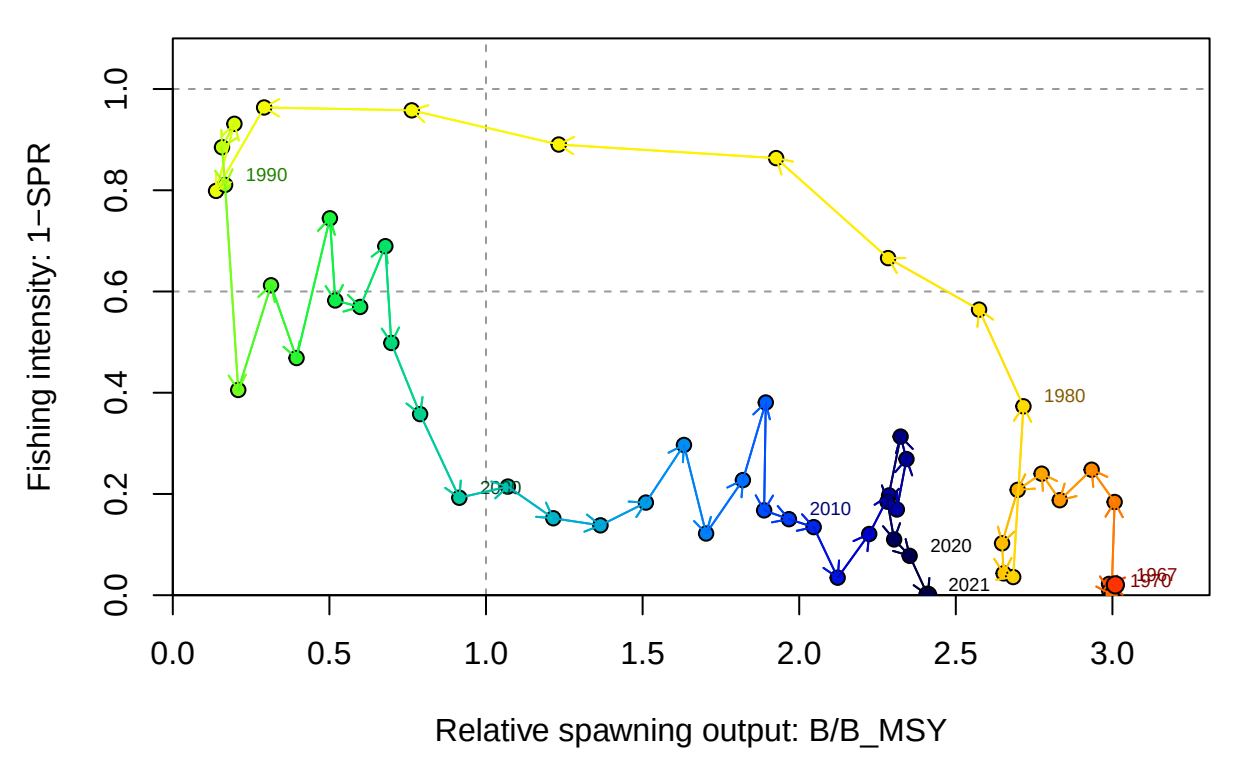

FISHERY
FISHERY obs.
Observed and expected Landings (mt)
0.0
0.5
1.0
1.5
1970
1980
1990
2000
2010
2020
Year

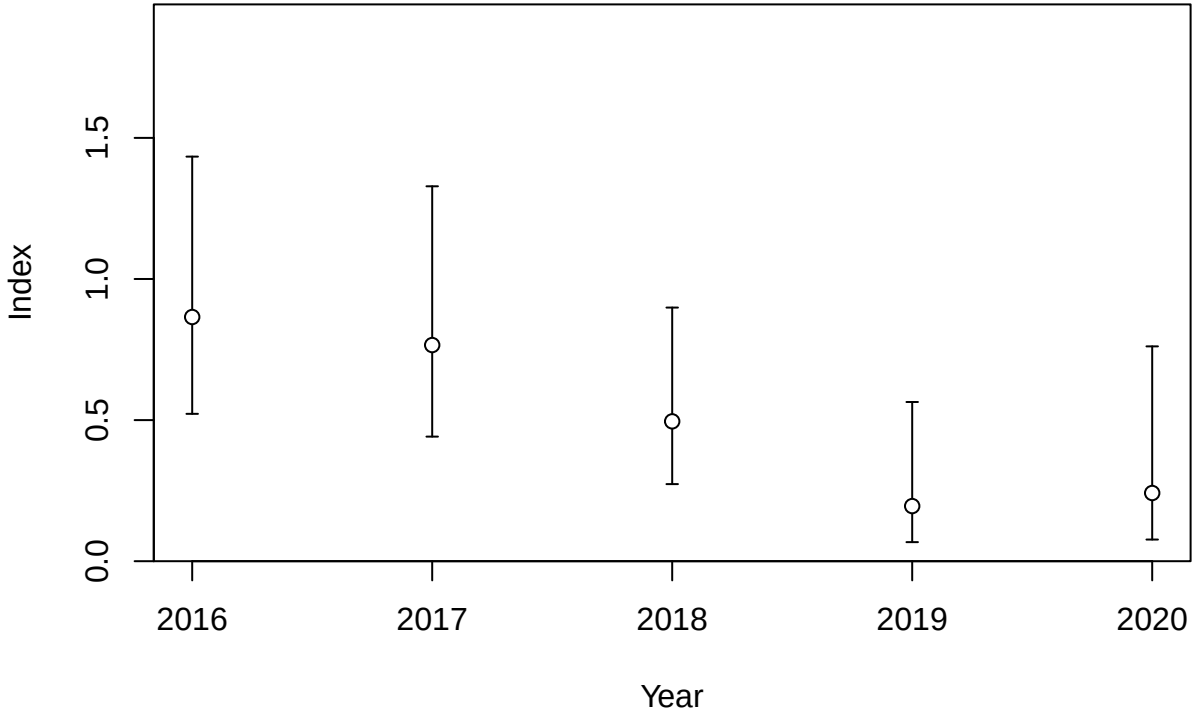

Continuous F
0.0
0.5
1.0
1.5
1970
1980
1990
2000
2010
2020
Year

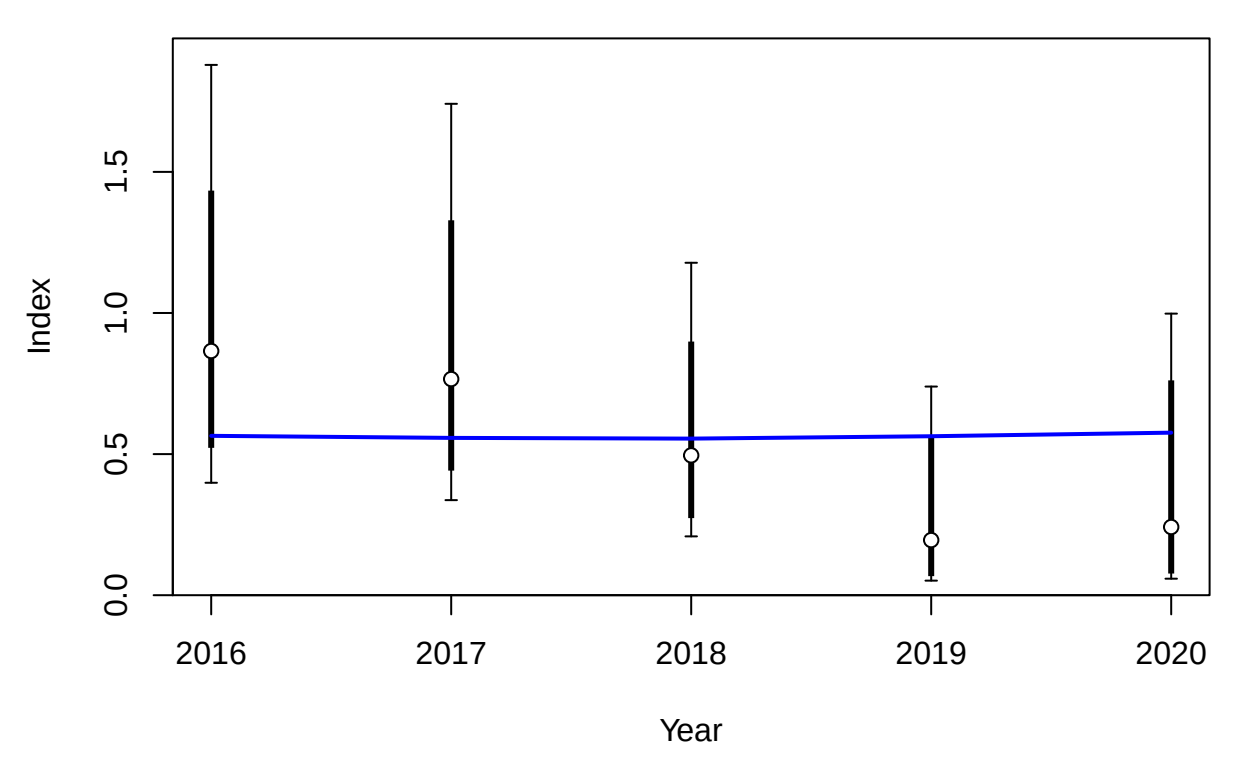

SPR
0.0
0.2
0.4
0.6
0.8
1.0
1970
1980
1990
2000
2010
2020
Year

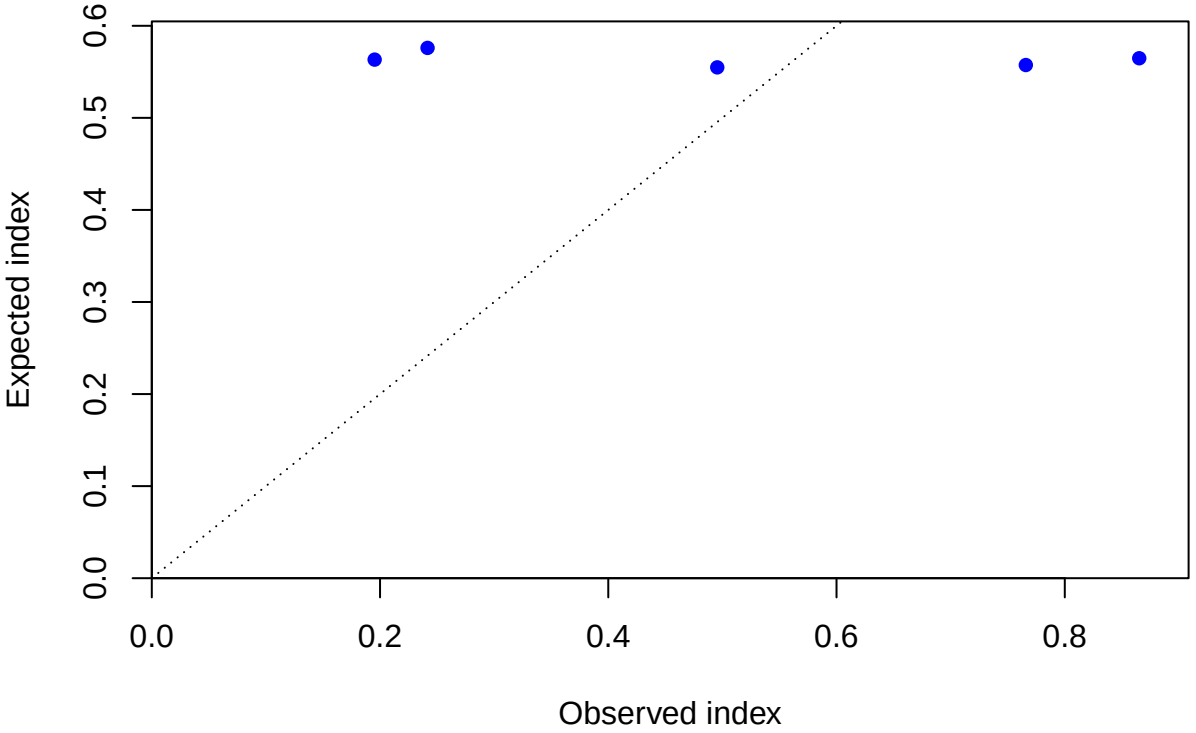

1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
1970
1980
1990
2000
2010
2020
Year

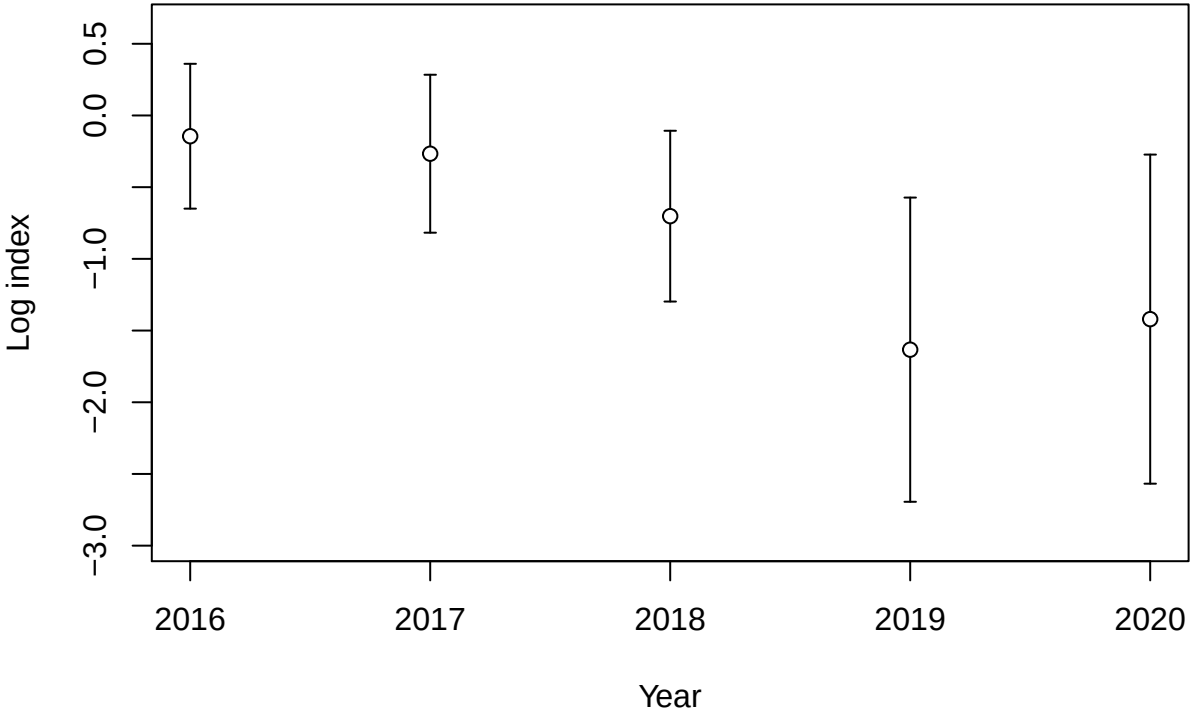

Fishing intensity: 1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1970
1980
1990
2000
2010
2020
Year

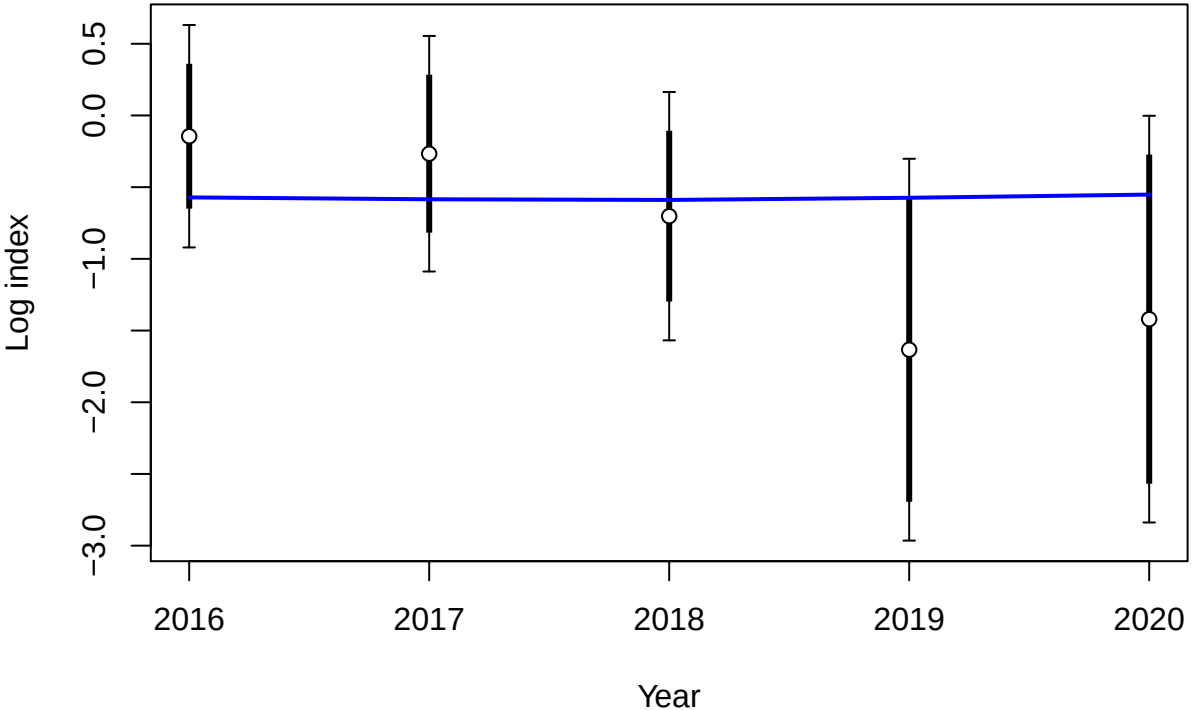

Fishing intensity: 1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
Relative spawning output: B/B_MSY
1990
2000
2010
2020
2021
1980
1967
1970

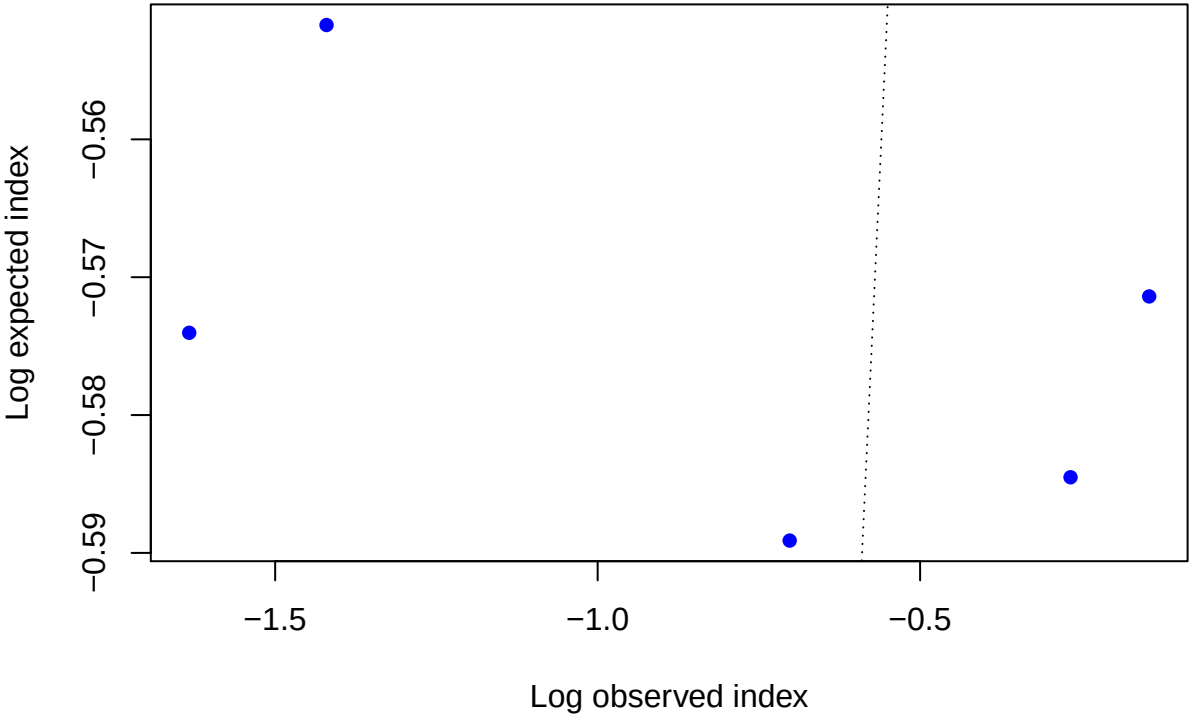

Index
0.0
0.5
1.0
1.5
2016
2017
2018
2019
2020
Year

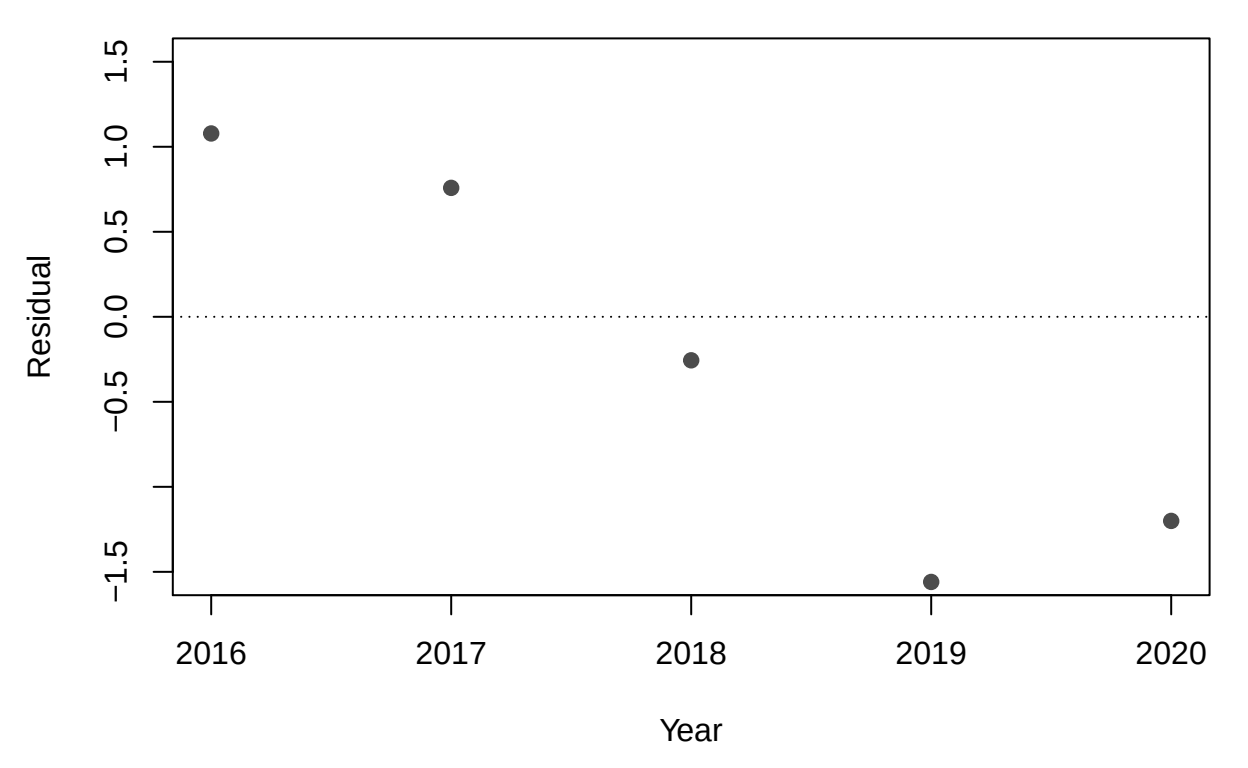

Index
0.0
0.5
1.0
1.5
2016
2017
2018
2019
2020
Year

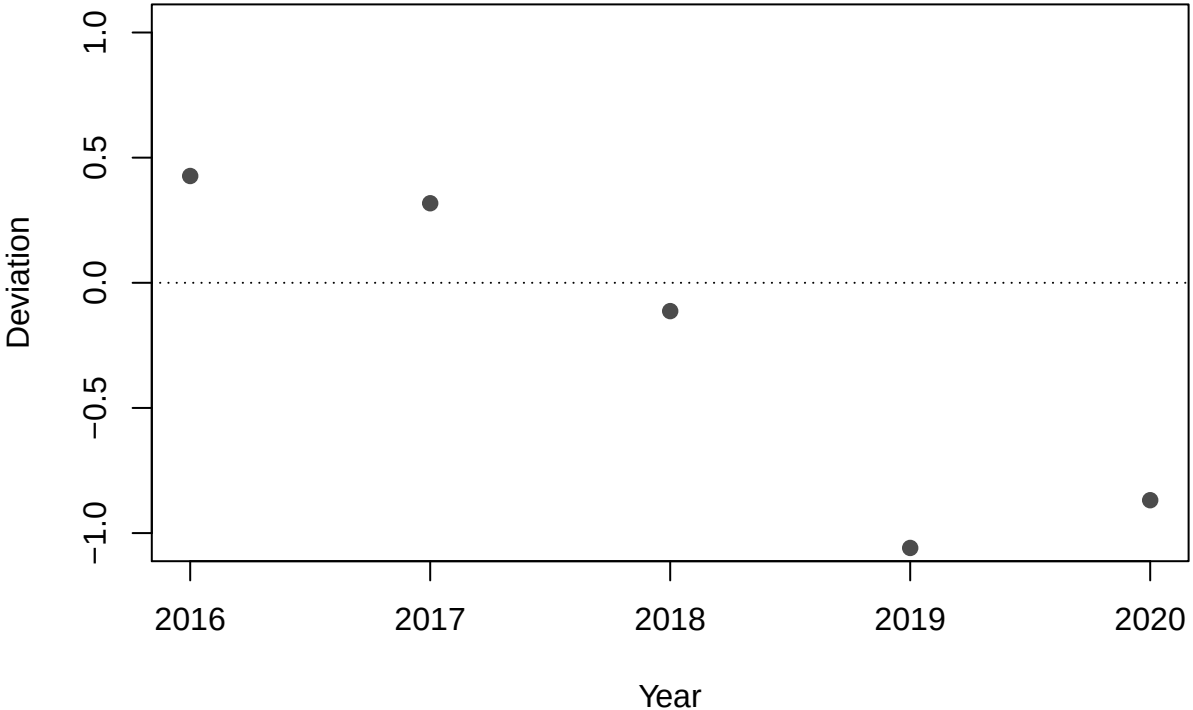

Expected index
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.0
0.2
0.4
0.6
0.8
Observed index

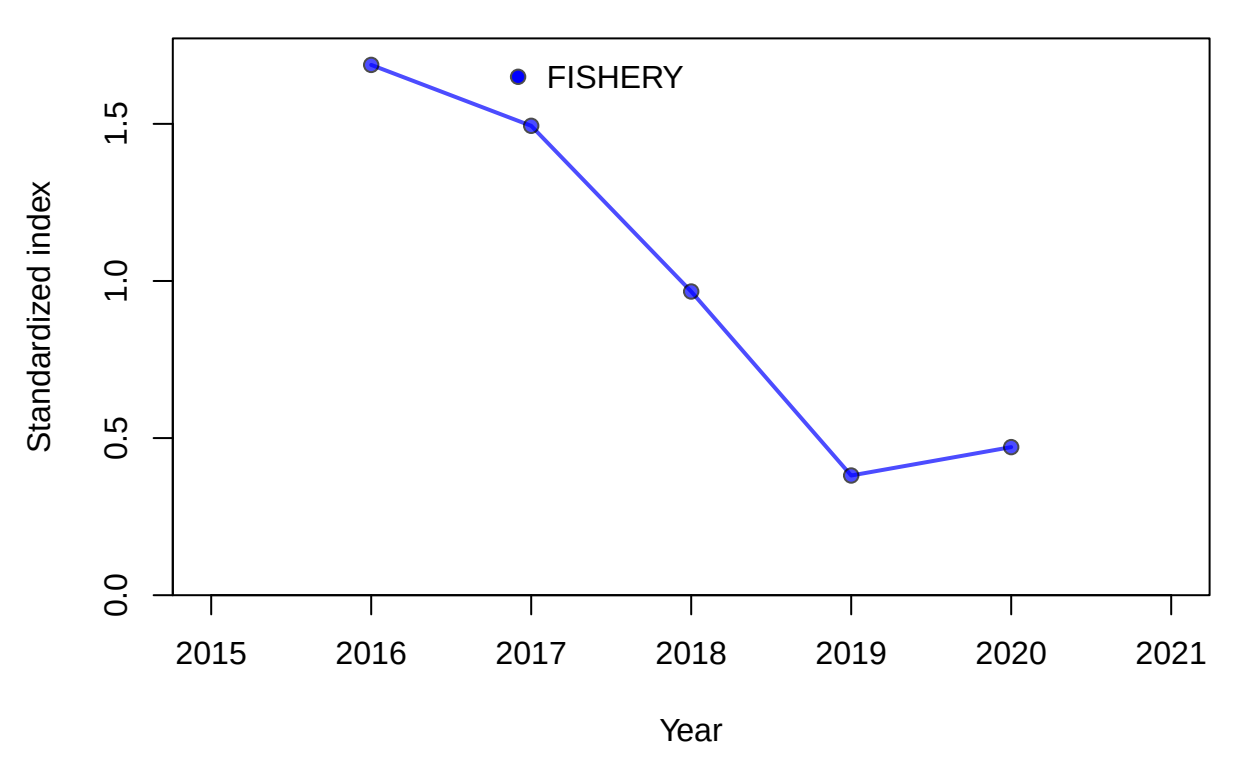

Log index
0.5
0.0
−1.0
−2.0
−3.0
2016
2017
2018
2019
2020
Year

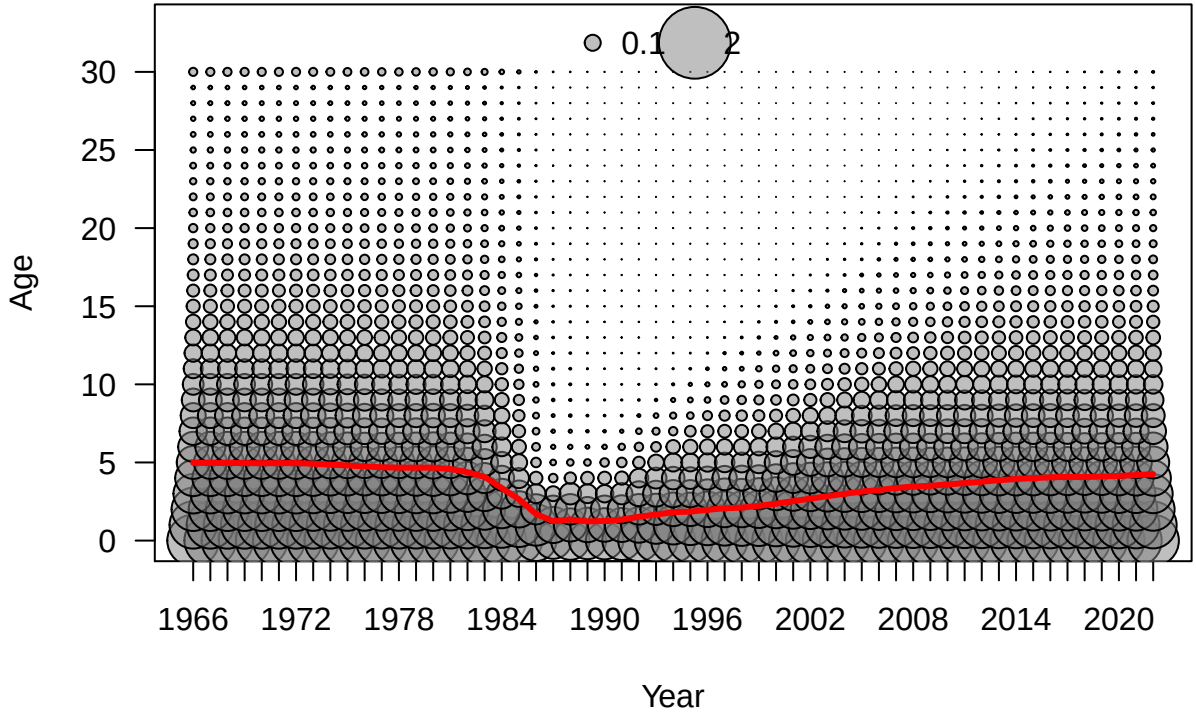

Log index
0.5
0.0
−1.0
−2.0
−3.0
2016
2017
2018
2019
2020
Year

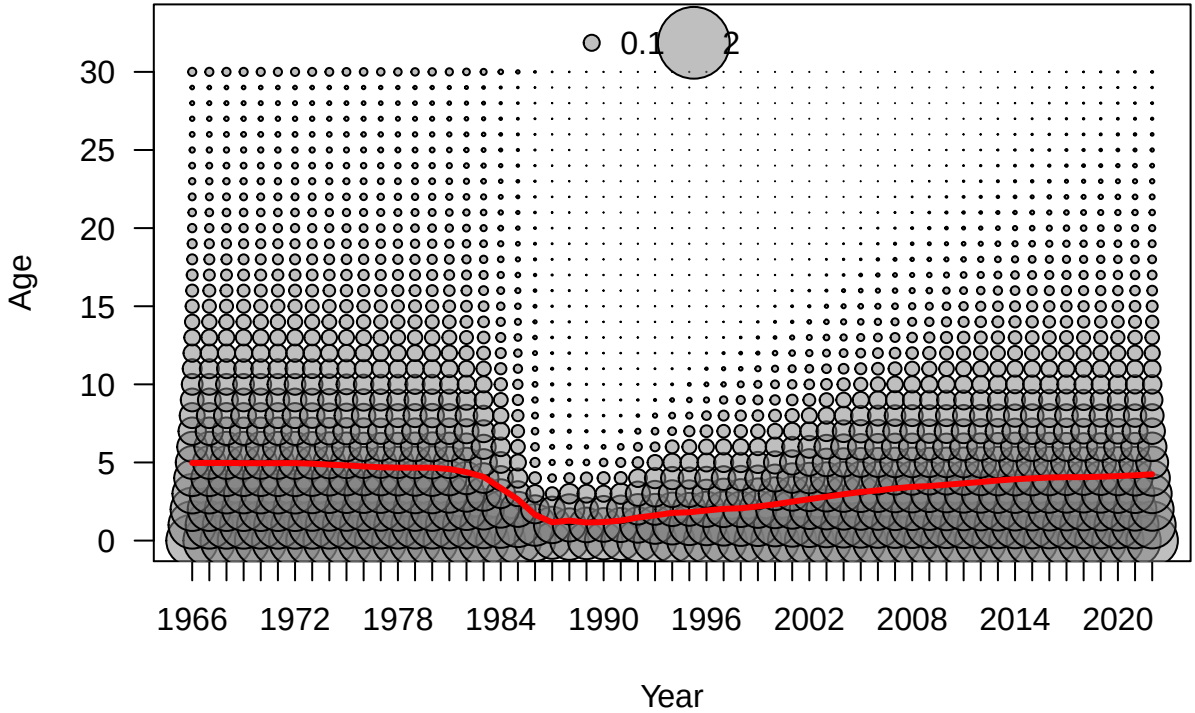

Log expected index
−0.56
−0.57
−0.58
−0.59
−1.5
−1.0
−0.5
Log observed index

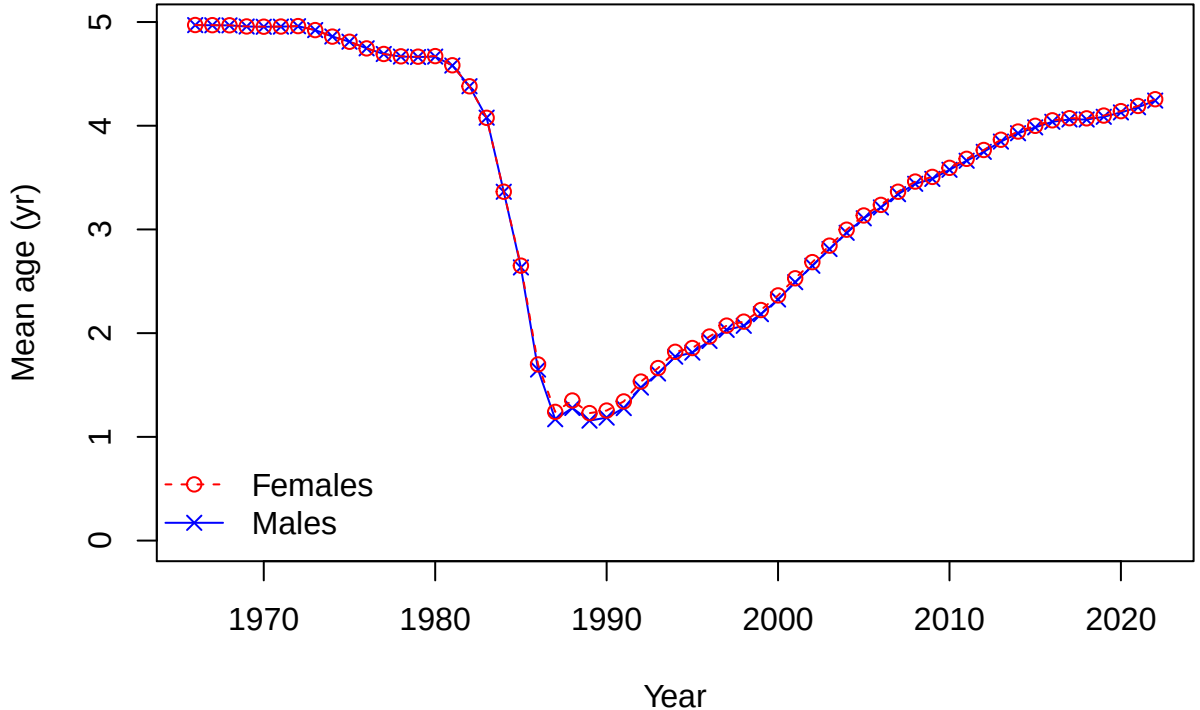

Residual
1.5
1.0
0.5
0.0
−0.5
−1.5
2016
2017
2018
2019
2020
Year

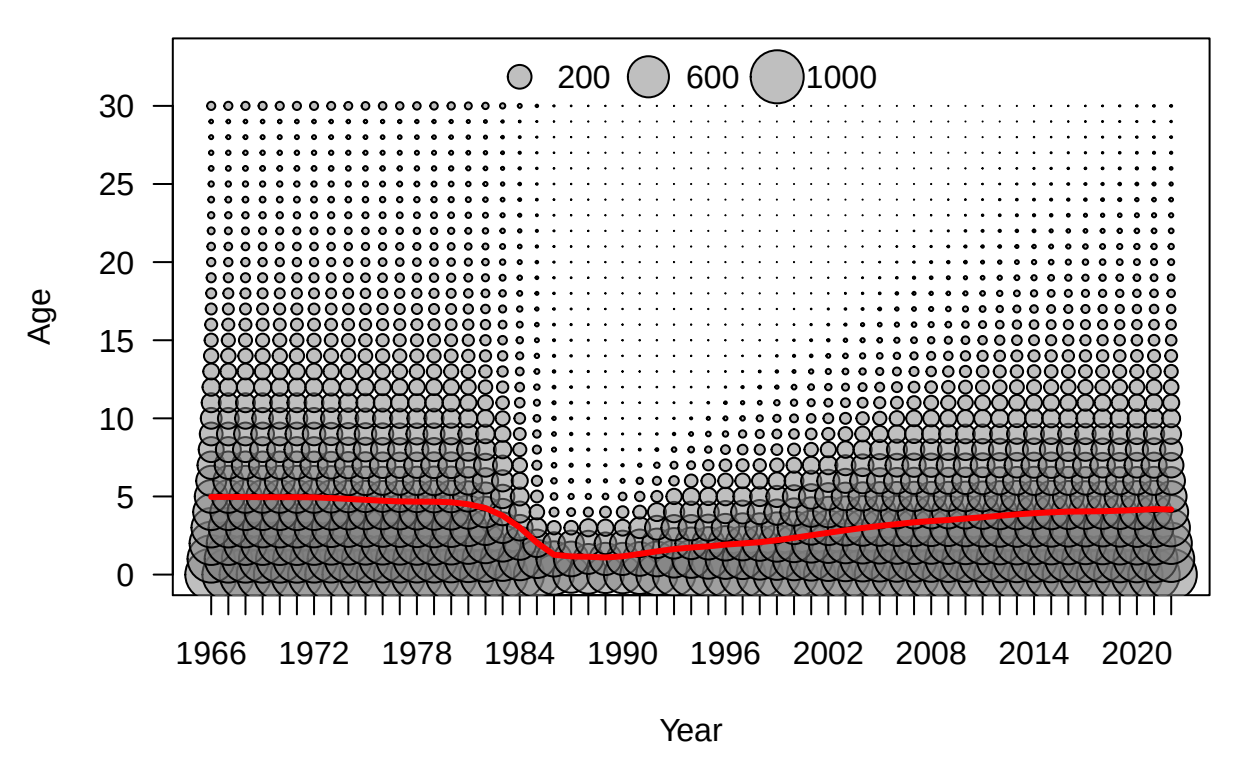

Deviation
1.0
0.5
0.0
−0.5
−1.0
2016
2017
2018
2019
2020
Year

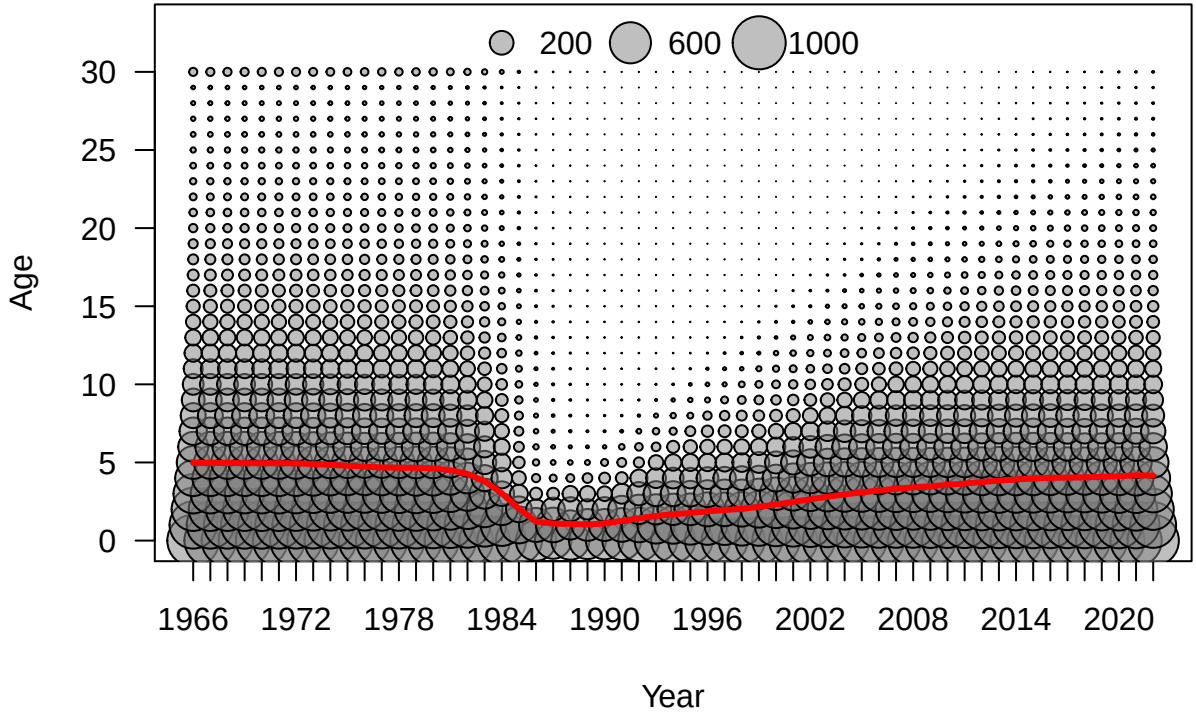

FISHERY
Standardized index
0.0
0.5
1.0
1.5
2015
2016
2017
2018
2019
2020
2021
Year

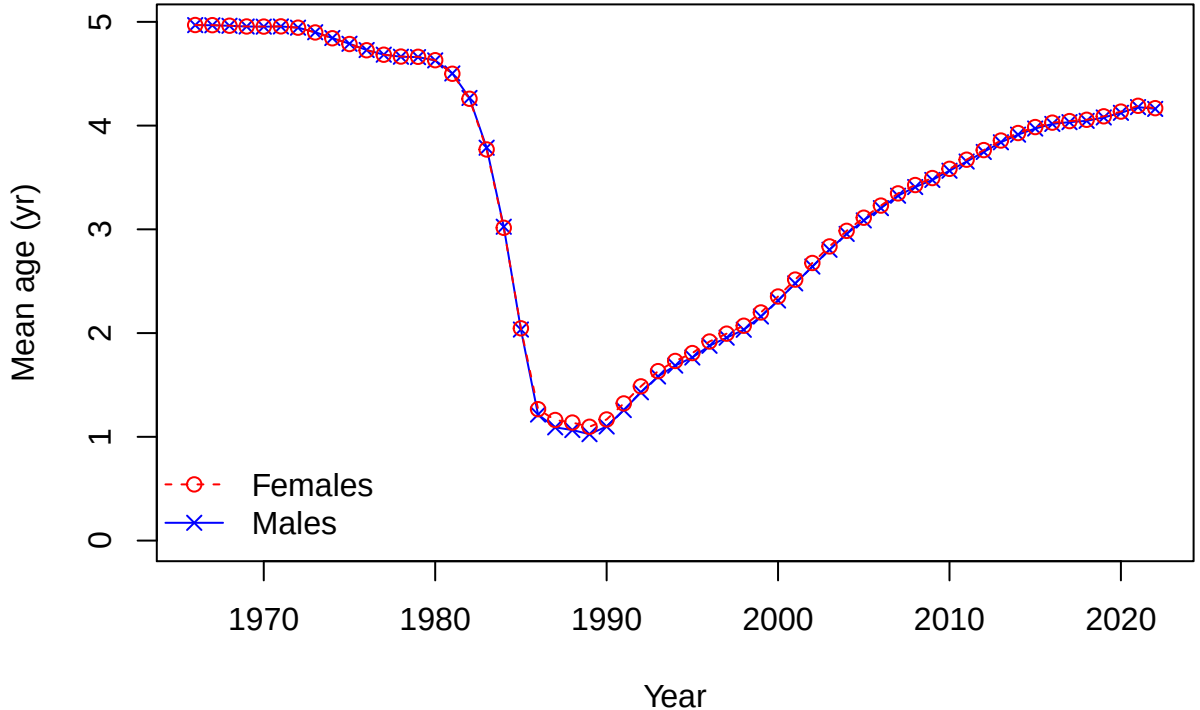

0.1
2
30
25
20
15
10
5
0
Age
1966
1972
1978
1984
1990
1996
2002
2008
2014
2020
Year

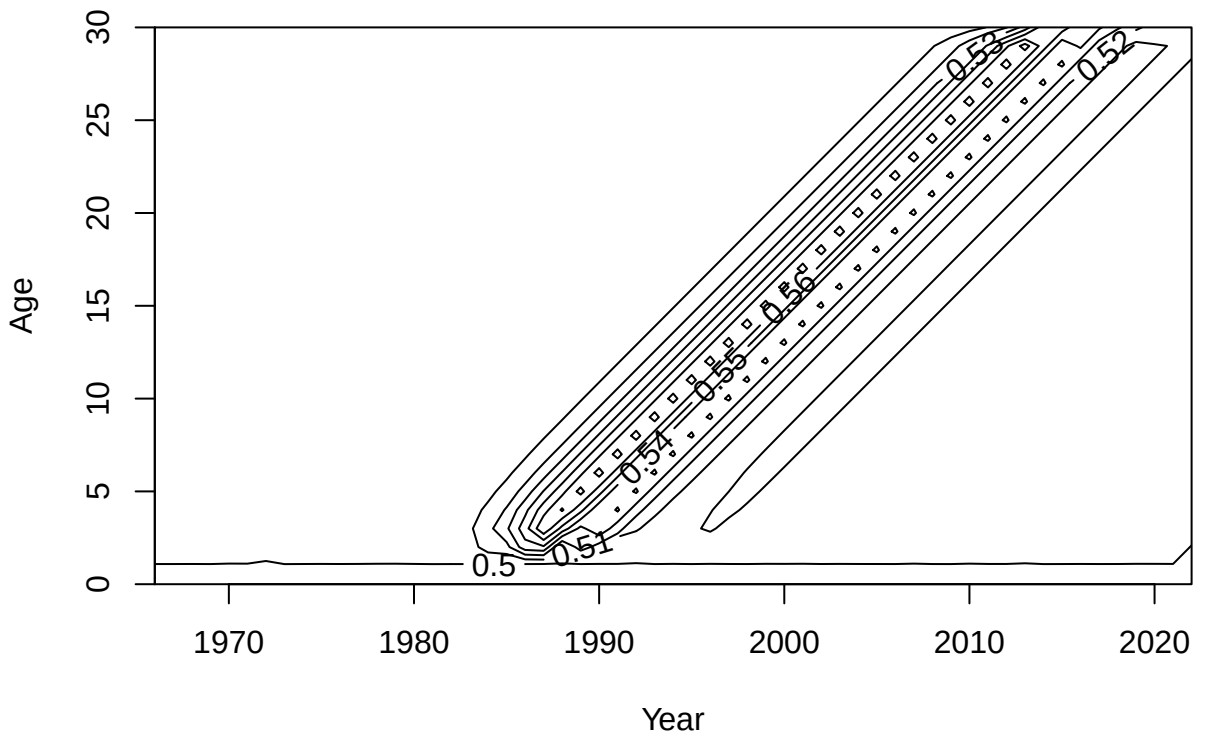

0.1
2
30
25
20
15
10
5
0
Age
1966
1972
1978
1984
1990
1996
2002
2008
2014
2020
Year

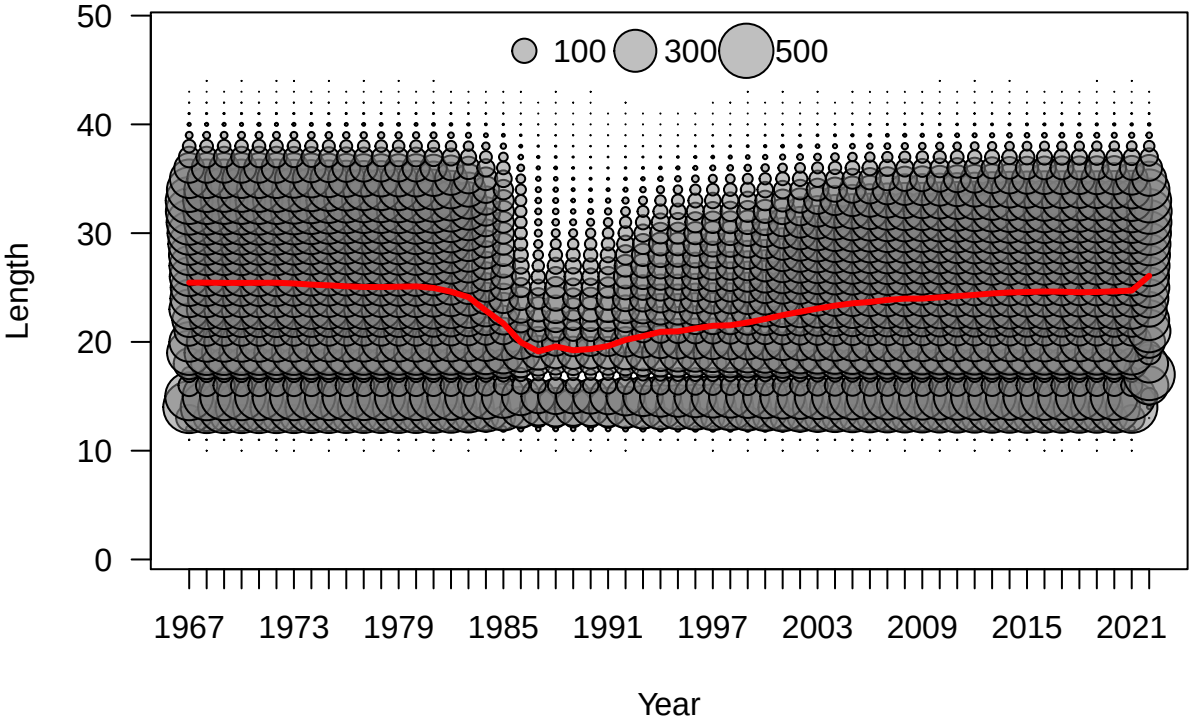

Mean age (yr)
0
1
2
3
4
5
1970
1980
1990
2000
2010
2020
Year
Females
Males

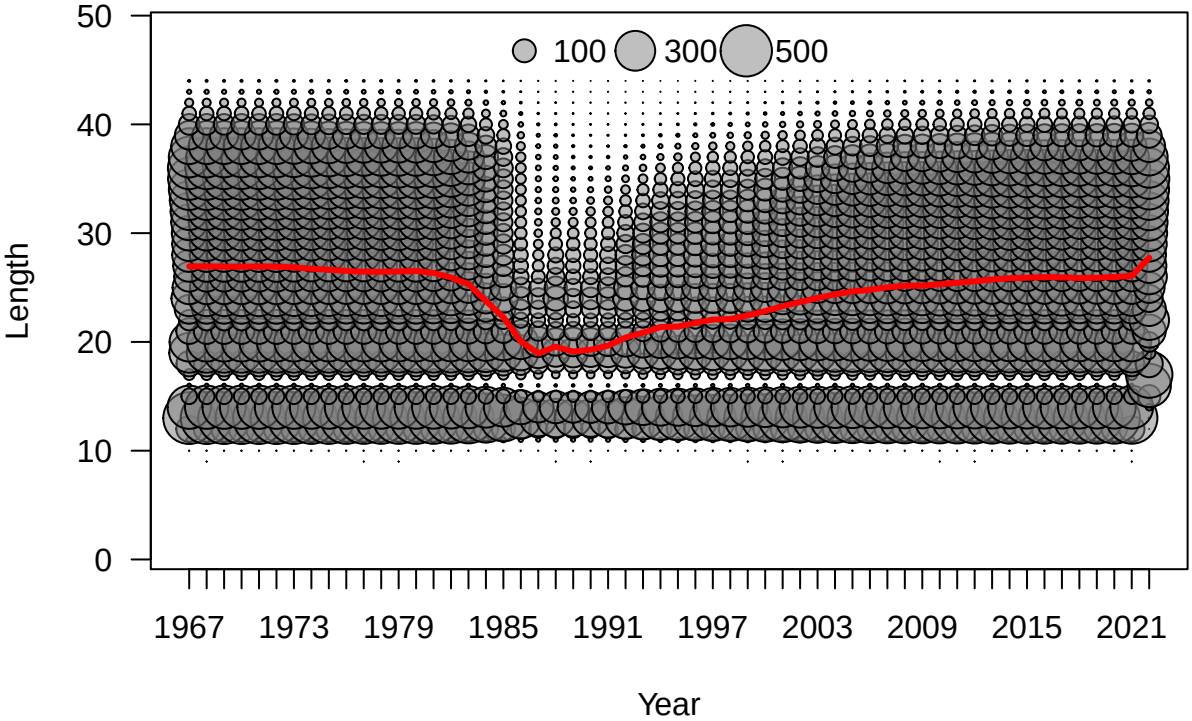

200
600
1000
Age
30
25
20
15
10
5
0
1966
1972
1978
1984
1990
1996
2002
2008
2014
2020
Year

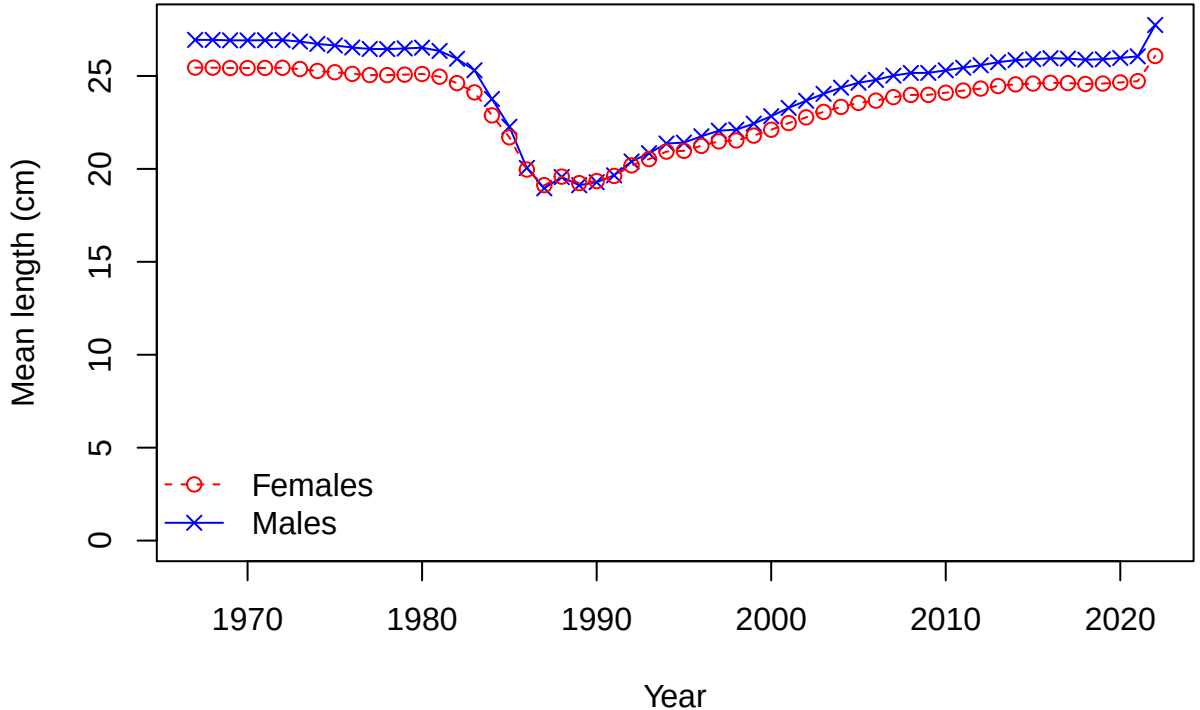

200
600
1000
30
25
20
15
10
5
0
Age
1966
1972
1978
1984
1990
1996
2002
2008
2014
2020
Year

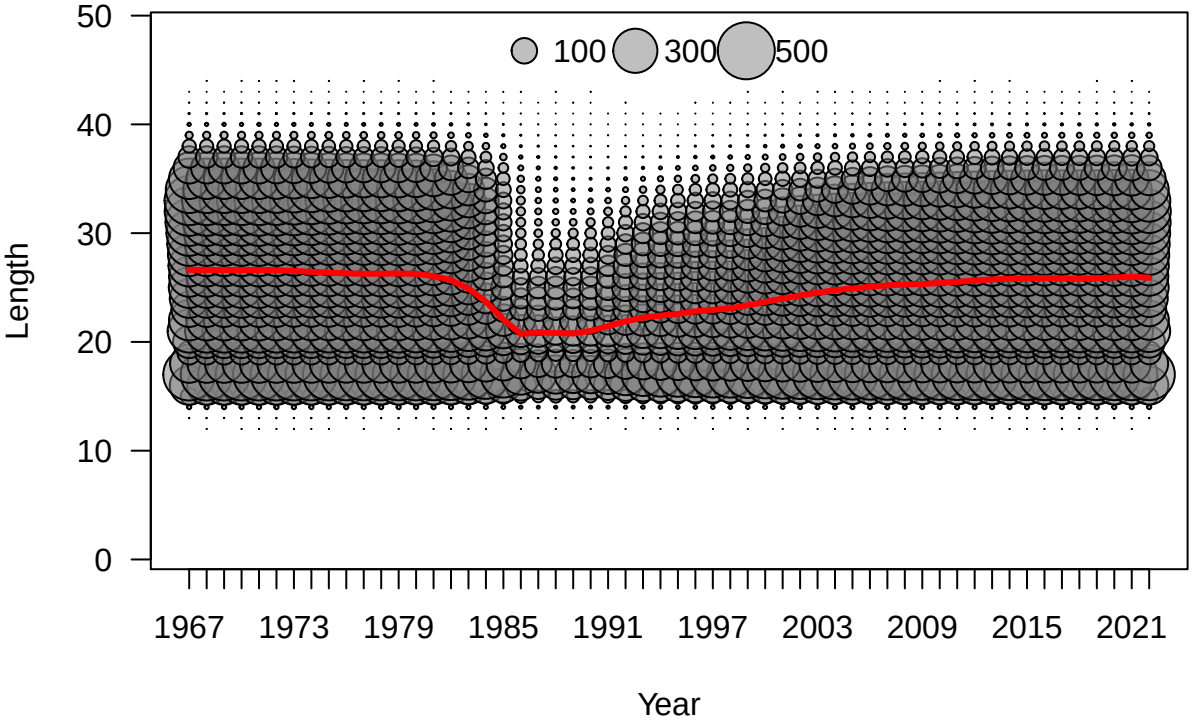

Mean age (yr)
0
1
2
3
4
5
1970
1980
1990
2000
2010
2020
Year
Females
Males

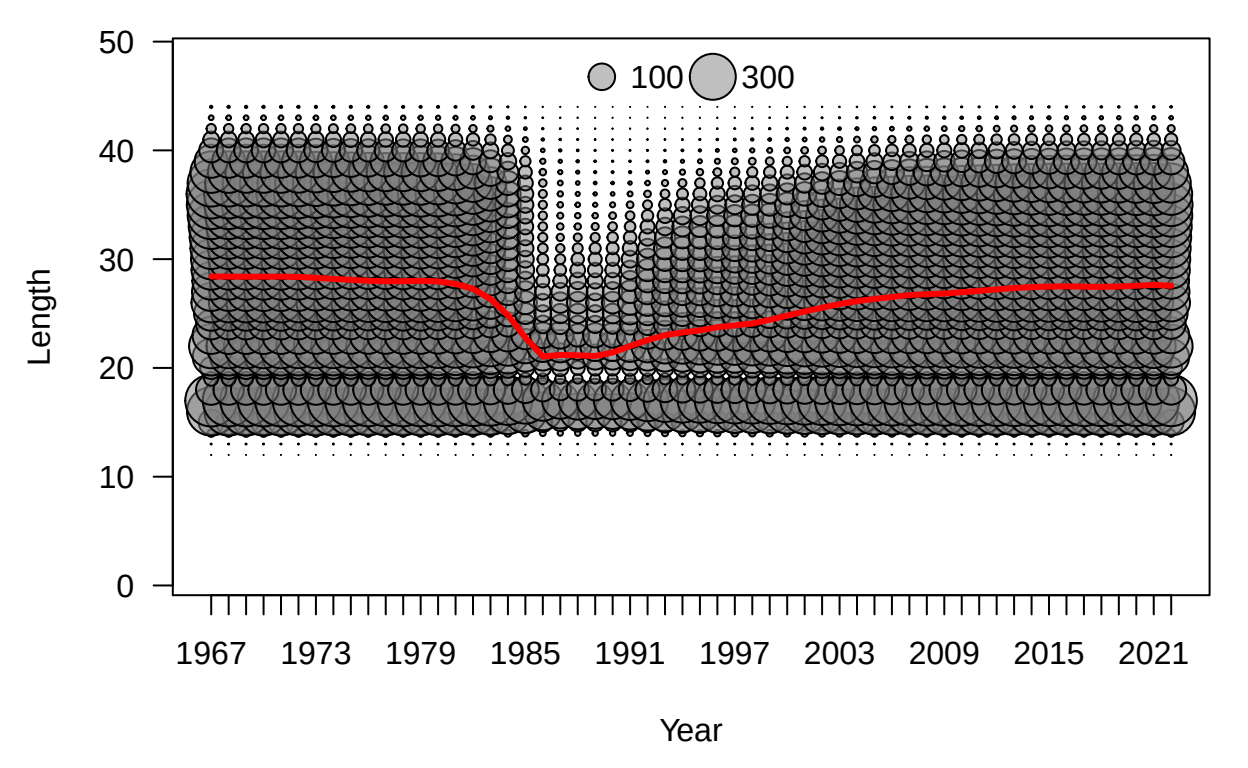

Age
Year
0
5
10
15
20
25
30
1970
1980
1990
2000
2010
2020
0.5
0.51
0.52
0.53
0.54
0.55
0.56

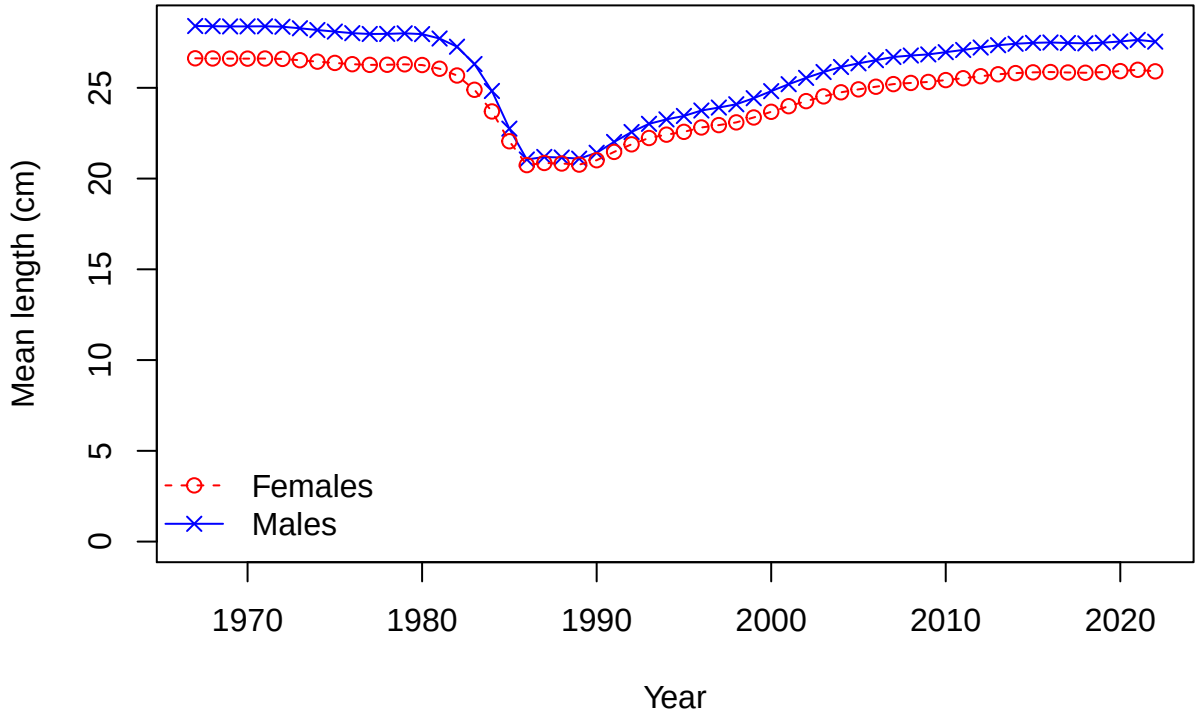

100
300
500
Length
Year
0
10
20
30
40
50
1967
1973
1979
1985
1991
1997
2003
2009
2015
2021

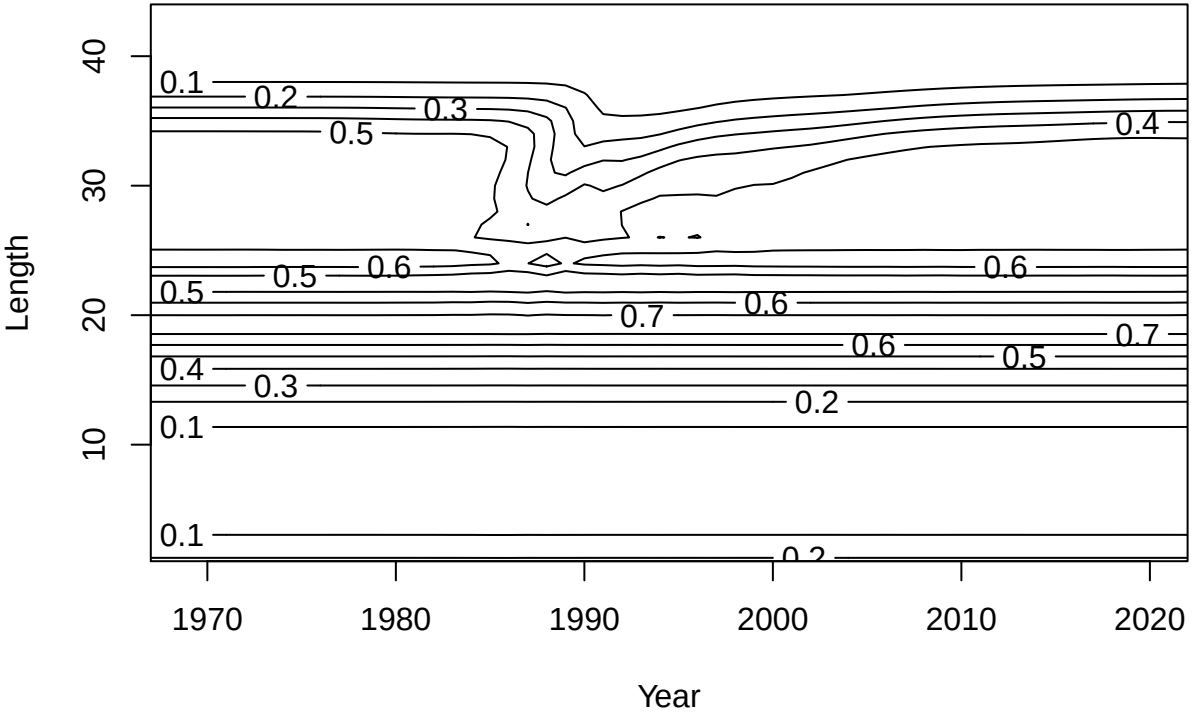

100
300
500
Length
Year
0
10
20
30
40
50
1967
1973
1979
1985
1991
1997
2003
2009
2015
2021

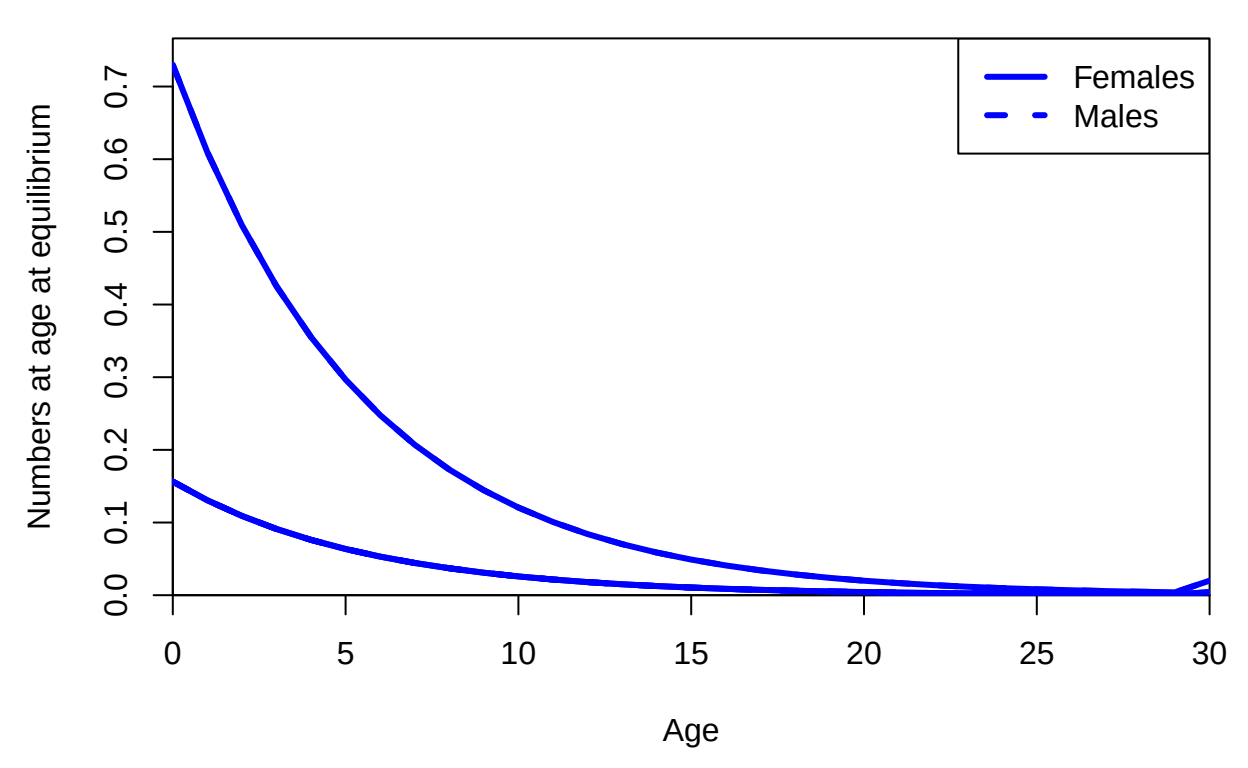

Mean length (cm)
0
5
10
15
20
25
1970
1980
1990
2000
2010
2020
Year
Females
Males

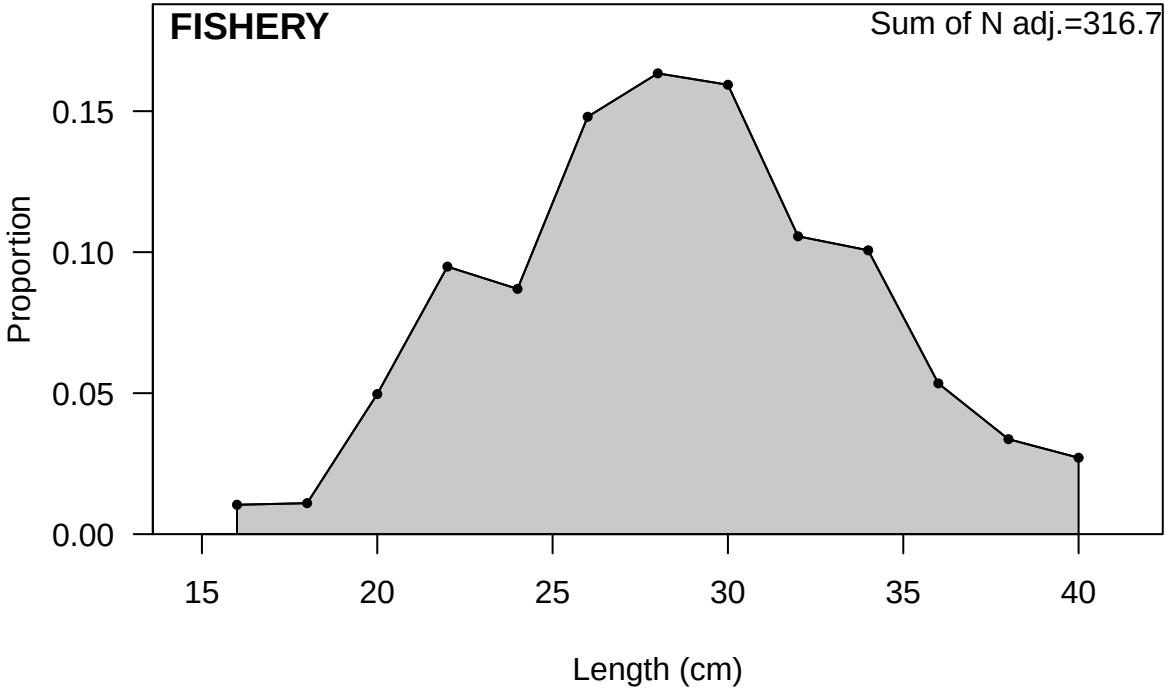

100
300
500
50
40
30
20
10
0
Length
1967
1973
1979
1985
1991
1997
2003
2009
2015
2021
Year

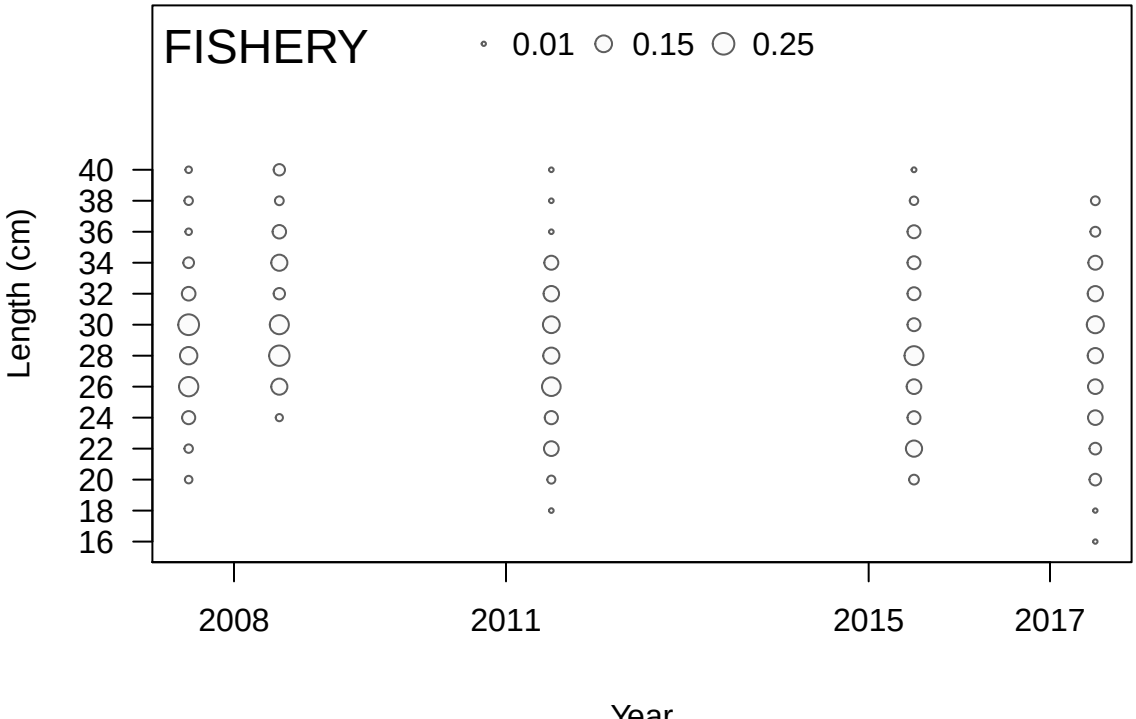

100
300
50
40
30
20
10
0
Length
1967
1973
1979
1985
1991
1997
2003
2009
2015
2021
Year

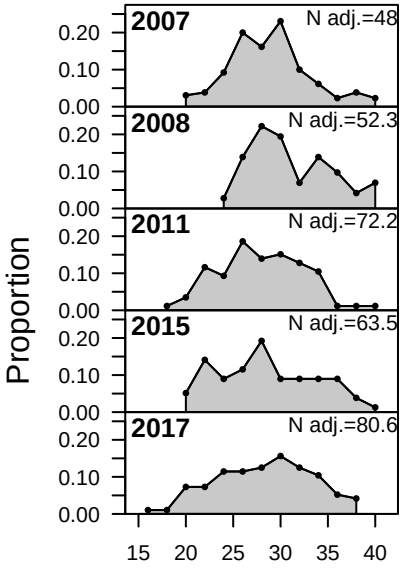

Mean length (cm)
0
5
10
15
20
25
1970
1980
1990
2000
2010
2020
Year
Females
Males

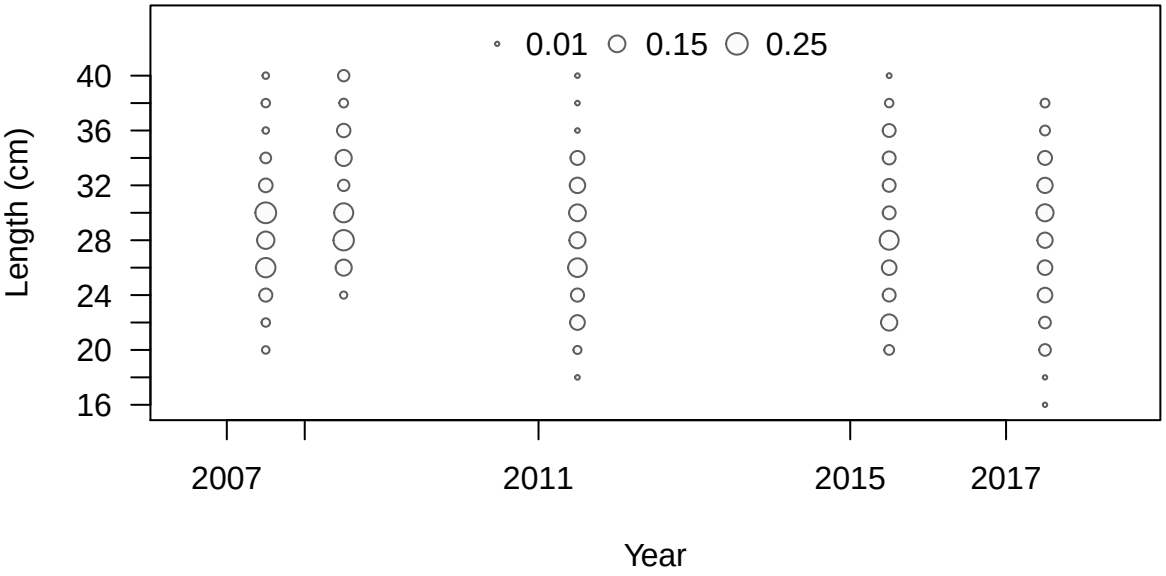

Length
40
30
20
10
0.1
0.2
0.3
0.5
0.4
0.5
0.6
0.6
0.5
0.7
0.6
0.6
0.7
0.4
0.3
0.2
0.1
0.1
0.2
1970
1980
1990
2000
2010
2020
Year

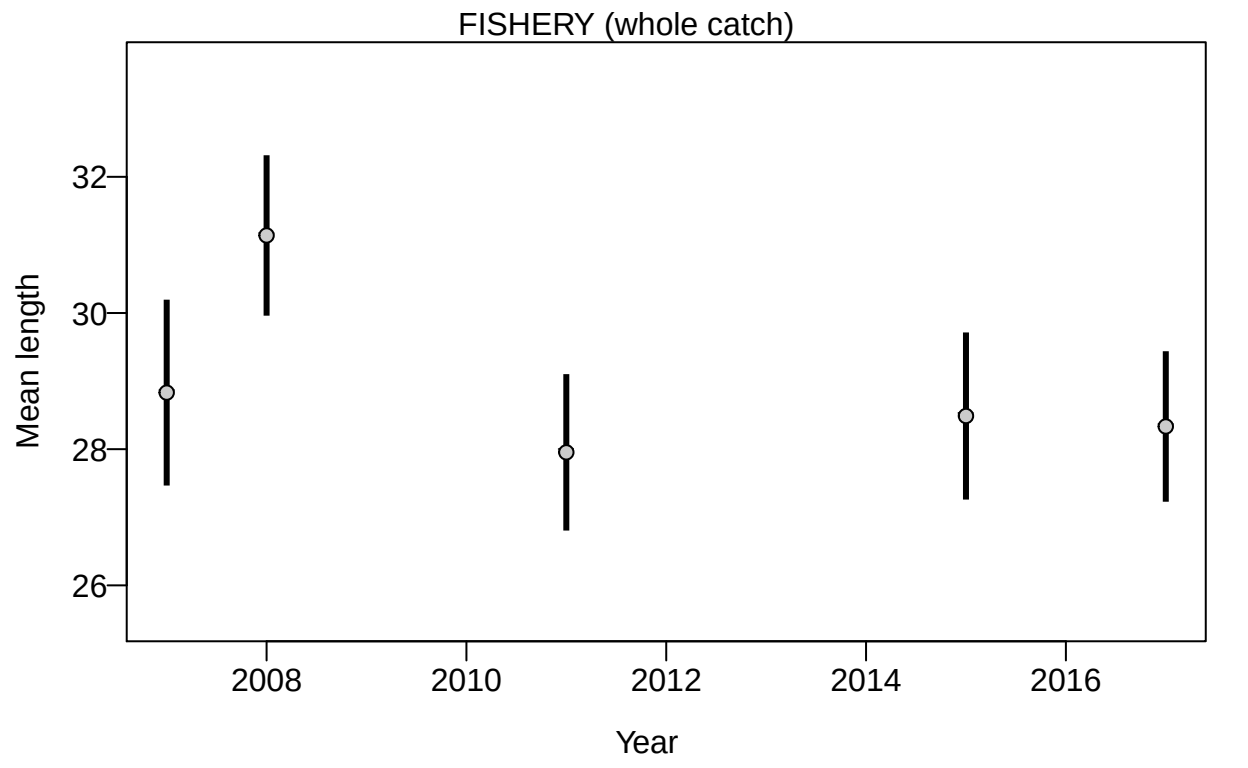

Females
Males
Numbers at age at equilibrium
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0
5
10
15
20
25
30
Age

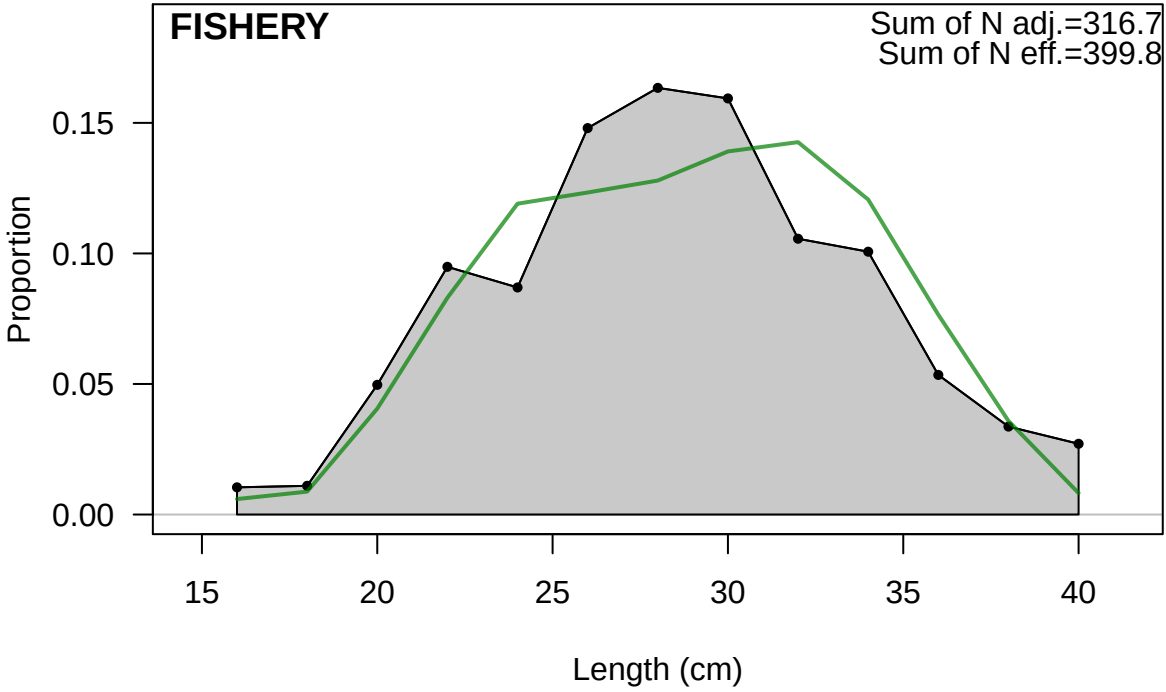

FISHERY
Sum of N adj.=316.7
Proportion
0.00
0.05
0.10
0.15
15
20
25
30
35
40
Length (cm)

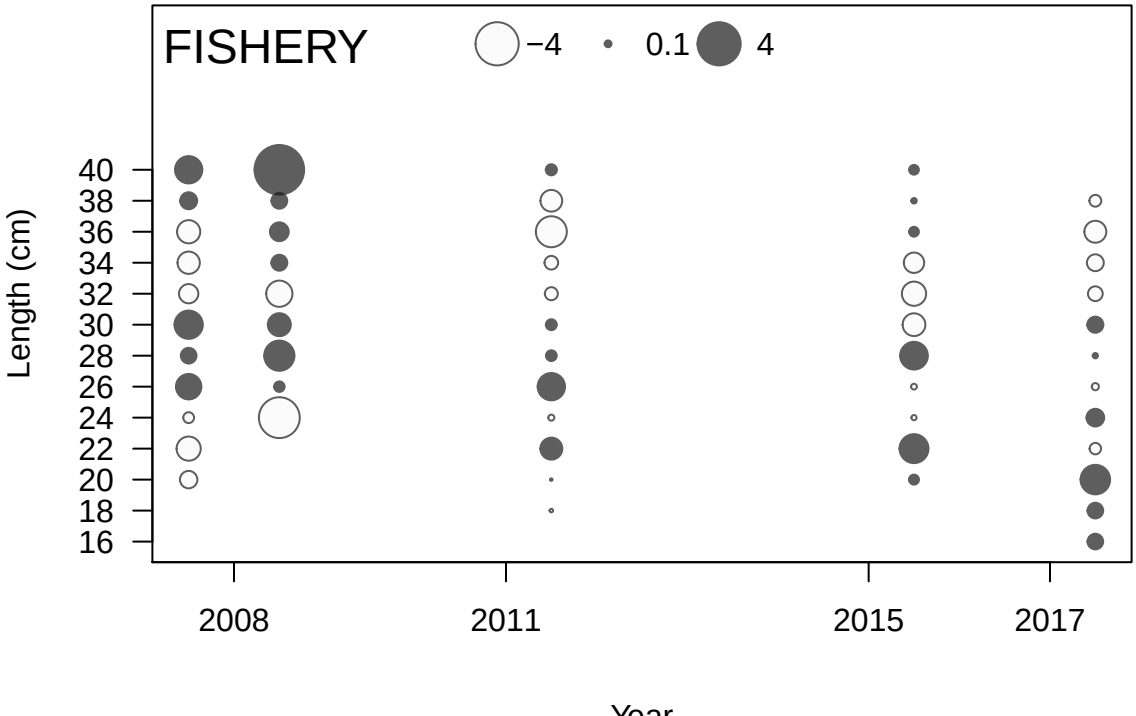

FISHERY
0.01
0.15
0.25
Length (cm)
40
38
36
34
32
30
28
26
24
22
20
18
16
2008
2011
2015
2017
Year

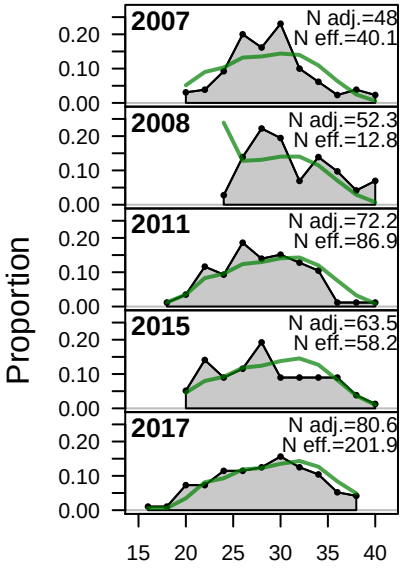

2007
N adj.=48
2008
N adj.=52.3
2011
N adj.=72.2
2015
N adj.=63.5
2017
N adj.=80.6
0.00
0.10
0.20
15
20
25
30
35
40
Proportion
Length (cm)

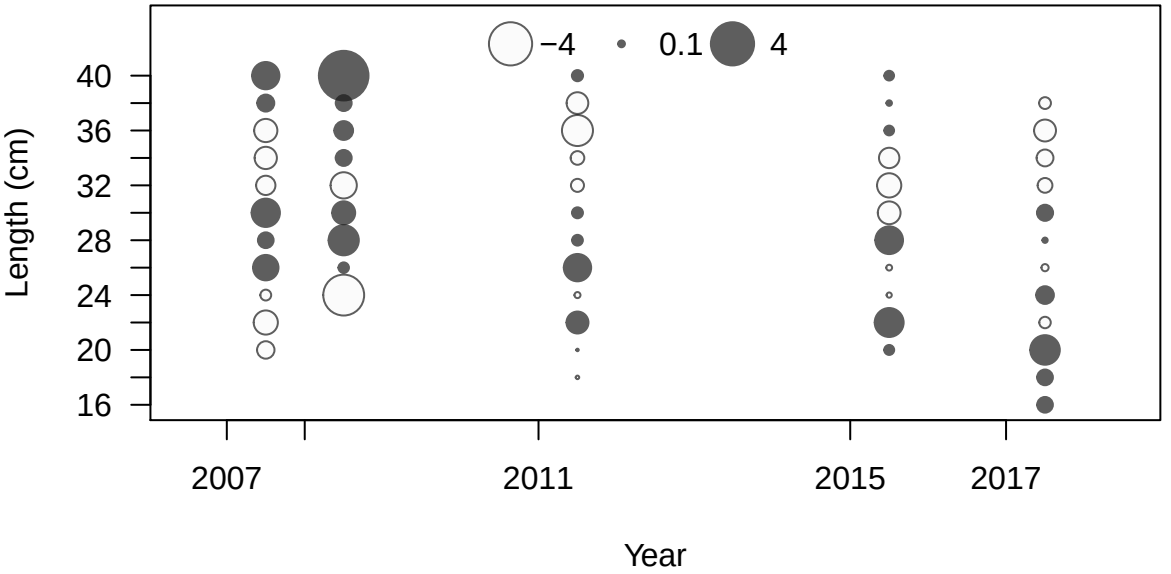

0.01
0.15
0.25
40
36
32
28
24
20
16
Length (cm)
2007
2011
2015
2017
Year

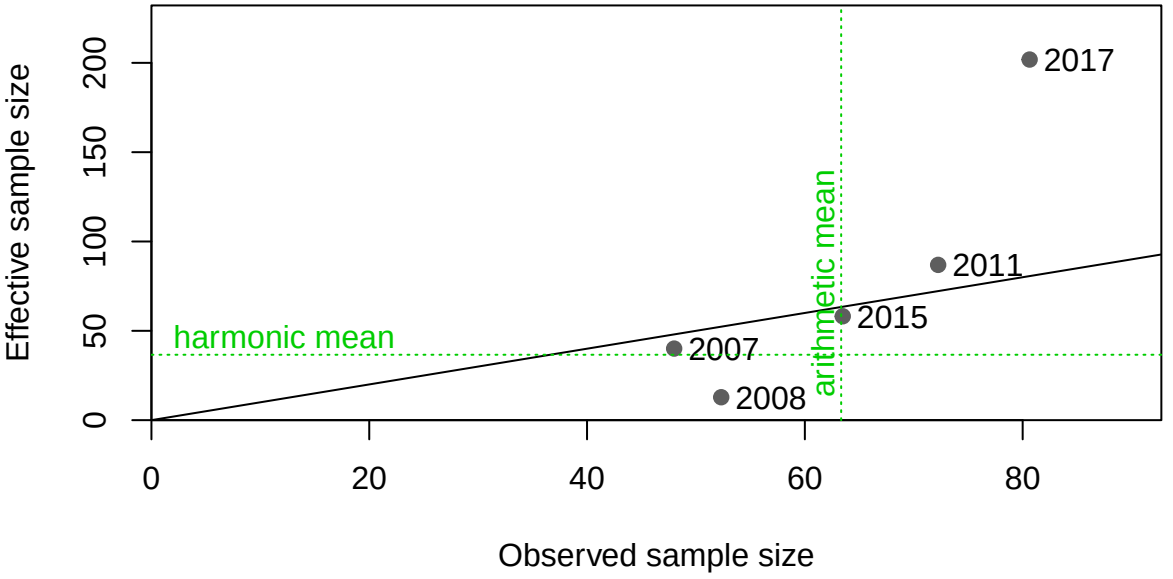

FISHERY (whole catch)
Mean length
32
30
28
26
2008
2010
2012
2014
2016
Year

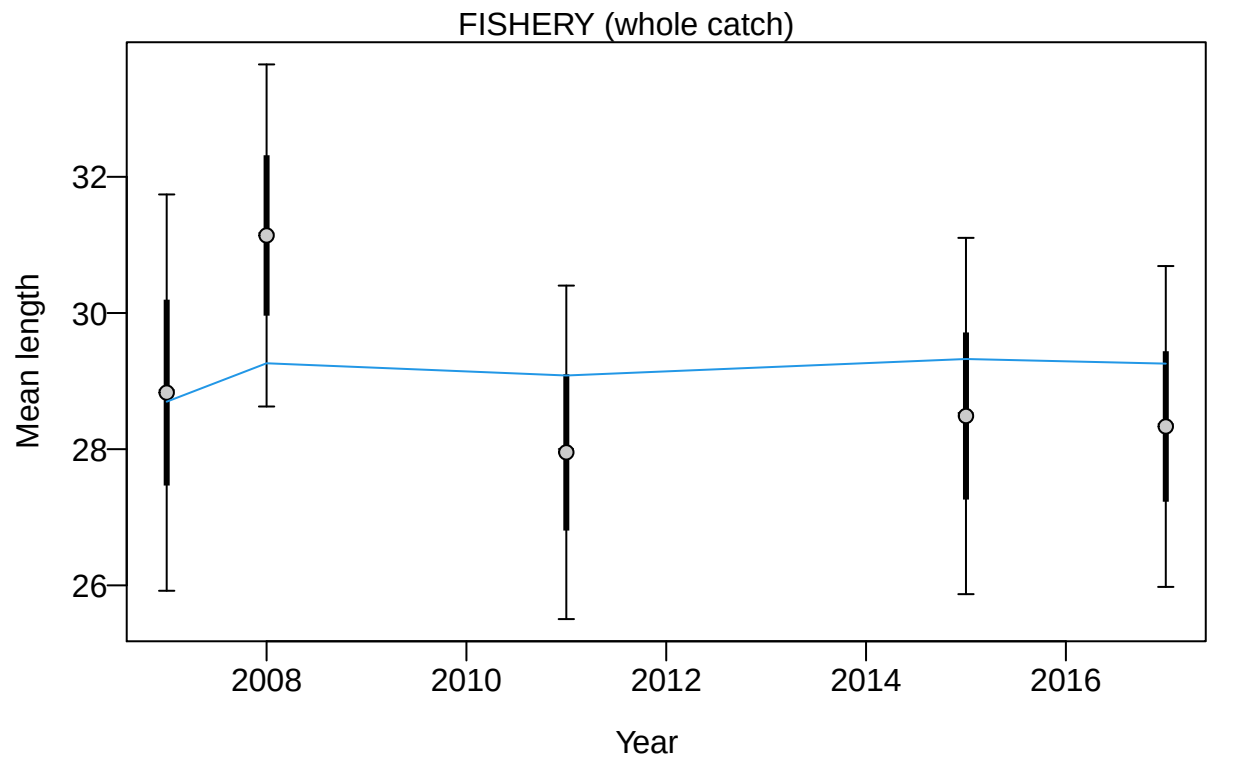

FISHERY
Sum of N adj.=316.7
Sum of N eff.=399.8
Proportion
0.00
0.05
0.10
0.15
15
20
25
30
35
40
Length (cm)

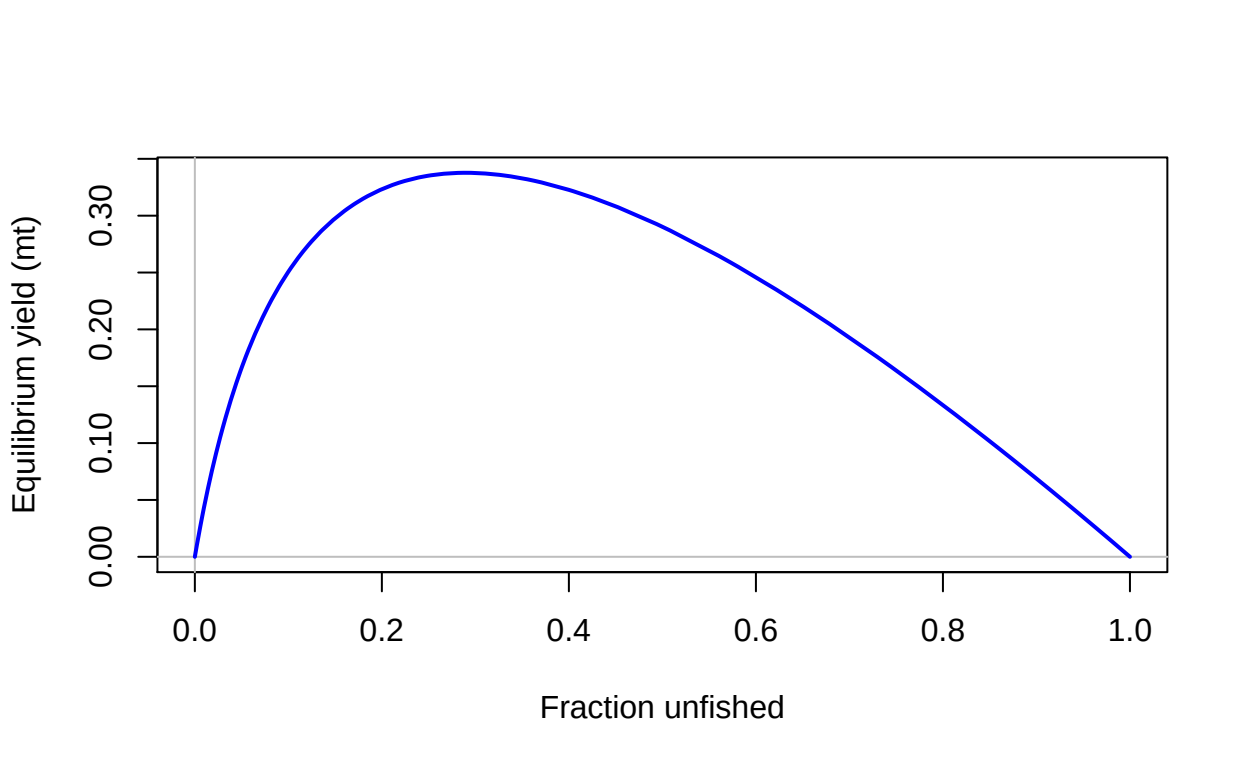

FISHERY
−4
0.1
4
Length (cm)
40
38
36
34
32
30
28
26
24
22
20
18
16
2008
2011
2015
2017
Year

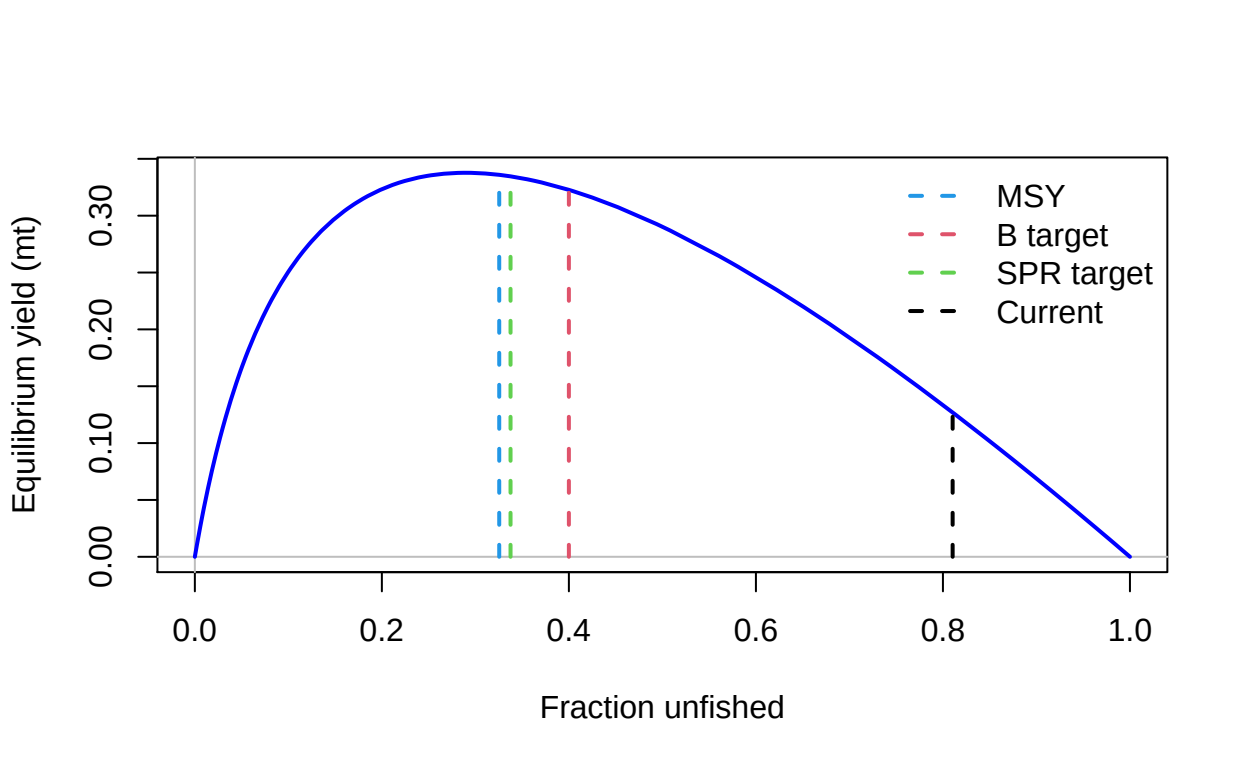

2007
N adj.=48
N eff.=40.1
2008
N adj.=52.3
N eff.=12.8
2011
N adj.=72.2
N eff.=86.9
2015
N adj.=63.5
N eff.=58.2
2017
N adj.=80.6
N eff.=201.9
0.00
0.10
0.20
15
20
25
30
35
40
Proportion
Length (cm)

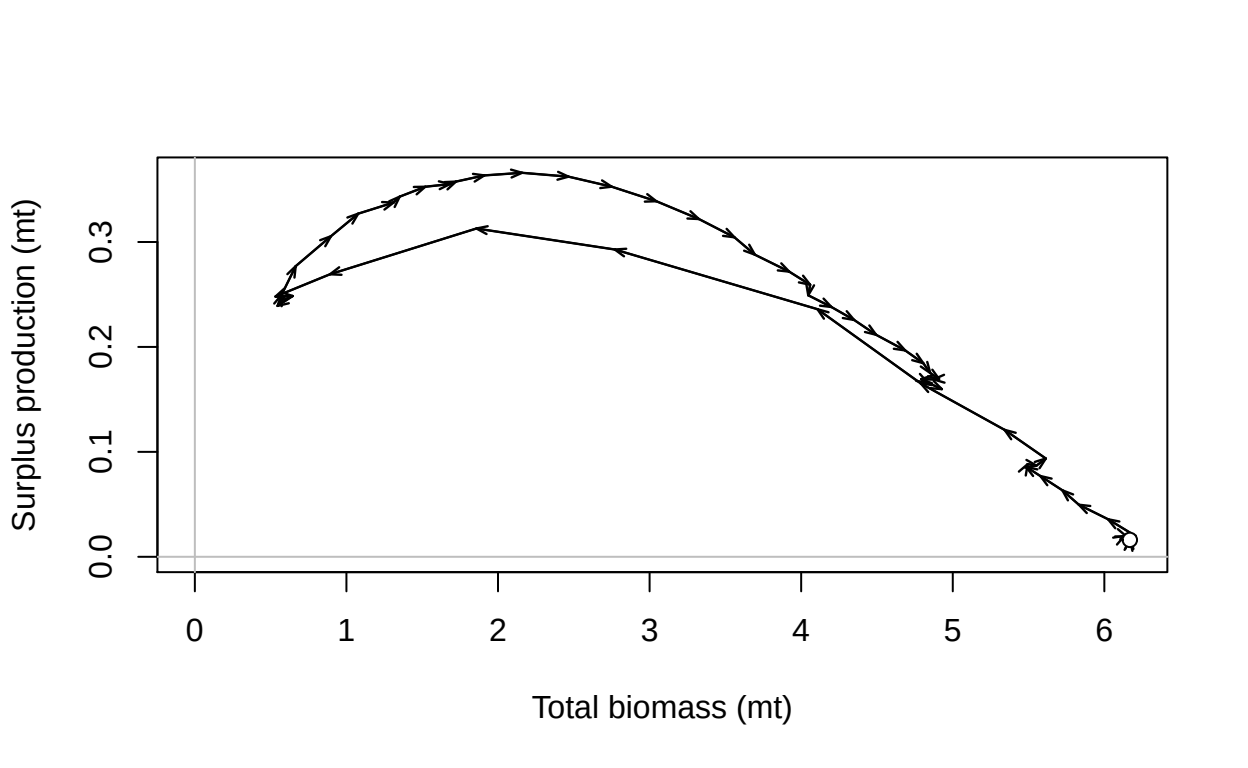

−4
0.1
4
Length (cm)
40
36
32
28
24
20
16
2007
2011
2015
2017
Year

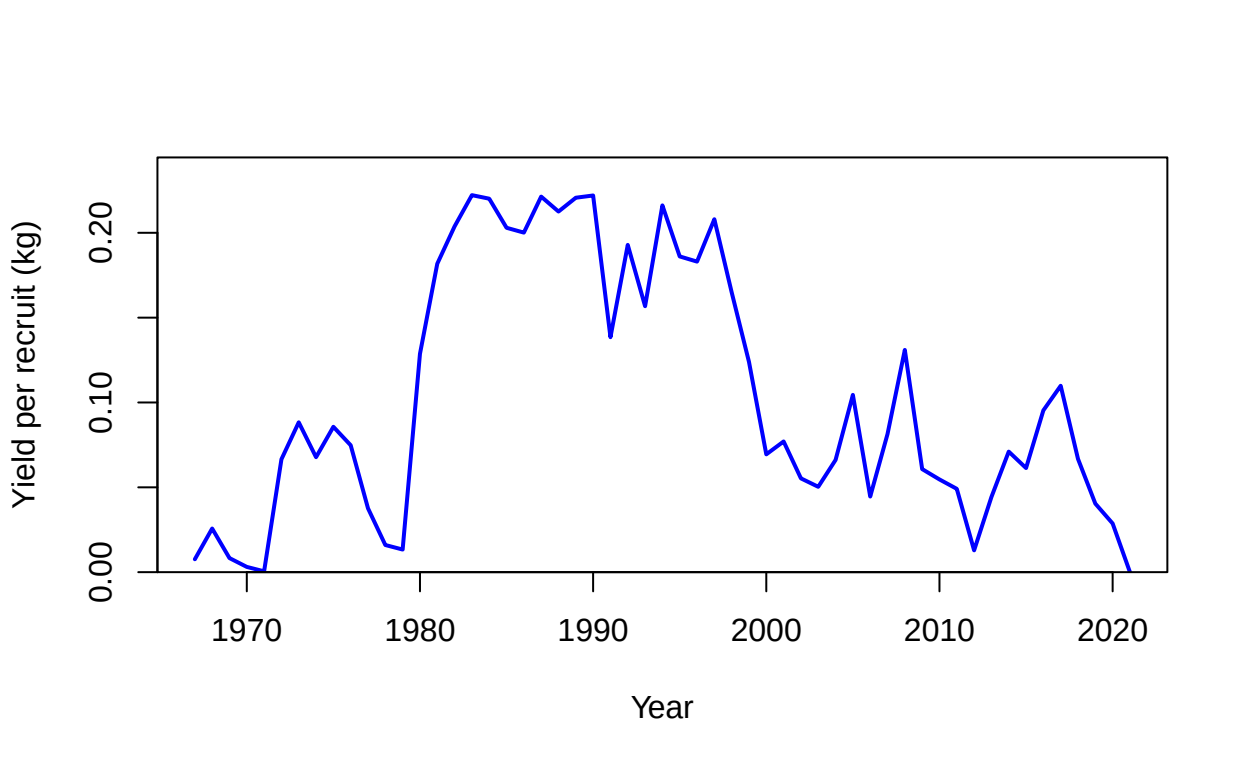

Effective sample size
0
50
100
150
200
0
20
40
60
80
Observed sample size
harmonic mean
arithmetic mean
2017
2011
2015
2007
2008

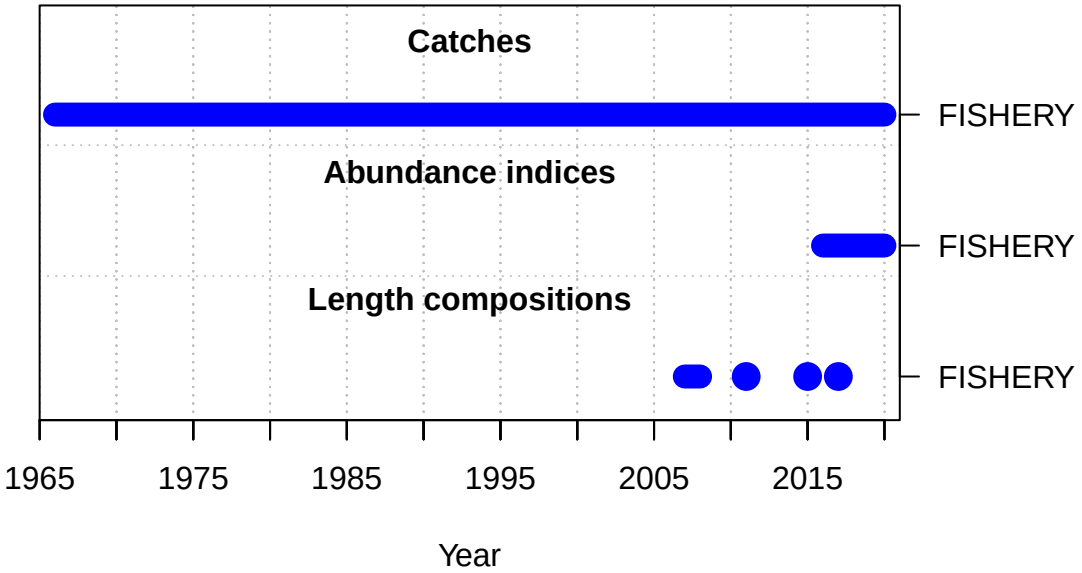

FISHERY (whole catch)
Mean length
32
30
28
26
2008
2010
2012
2014
2016
Year

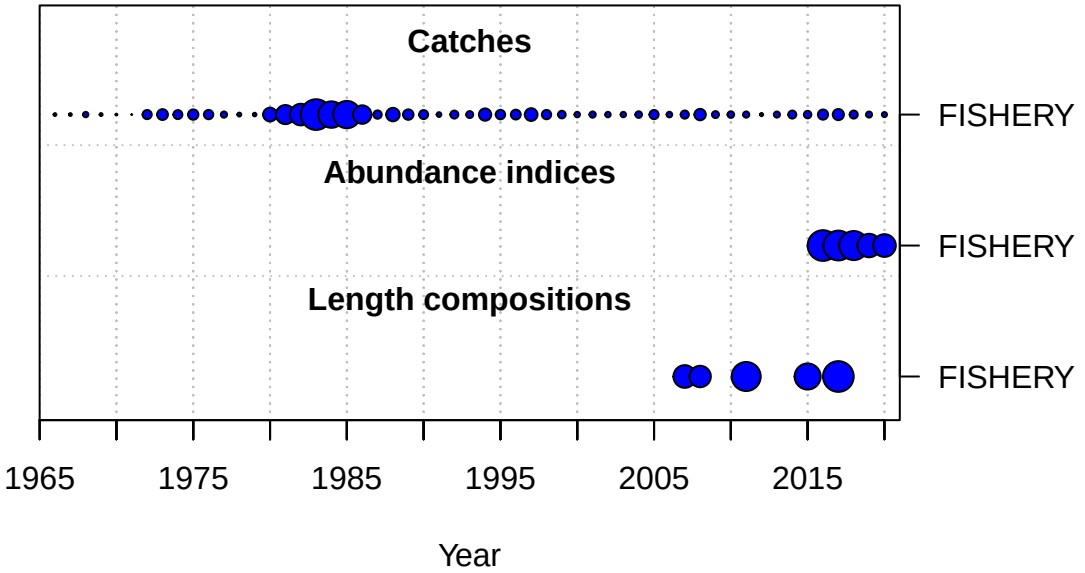

Equilibrium yield (mt)
0.00
0.10
0.20
0.30
0.0
0.2
0.4
0.6
0.8
1.0
Fraction unfished

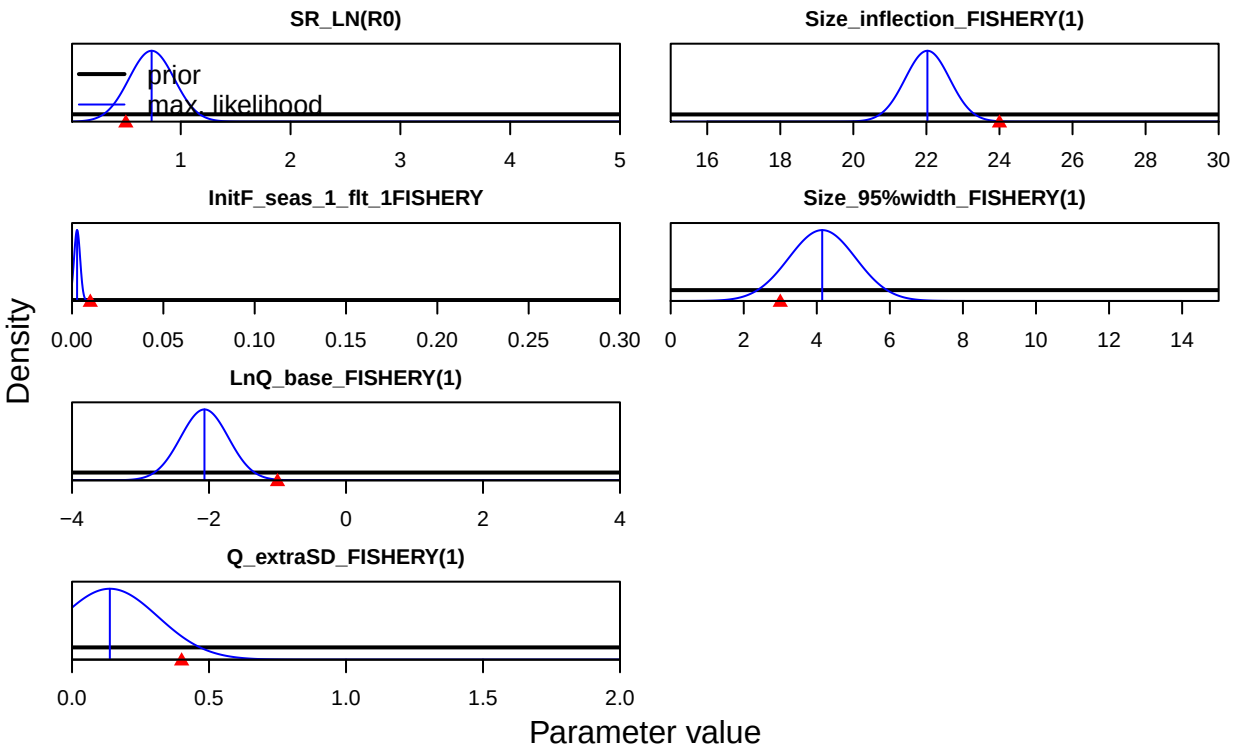

Equilibrium yield (mt)
0.00
0.10
0.20
0.30
0.0
0.2
0.4
0.6
0.8
1.0
Fraction unfished
MSY
B target
SPR target
Current


Surplus production (mt)
0.0
0.1
0.2
0.3
0
1
2
3
4
5
6
Total biomass (mt)


Yield per recruit (kg)
0.00
0.10
0.20
1970
1980
1990
2000
2010
2020
Year


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


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


SR_LN(R0)
prior
max_likelihood
1
2
3
4
5
Size_inflection_FISHERY(1)
16
18
20
22
24
26
28
30
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
2
4
6
8
10
12
14
LnQ_base_FISHERY(1)
−4
−2
0
2
4
Q_extraSD_FISHERY(1)
0.0
0.5
1.0
1.5
2.0
Density
Parameter value