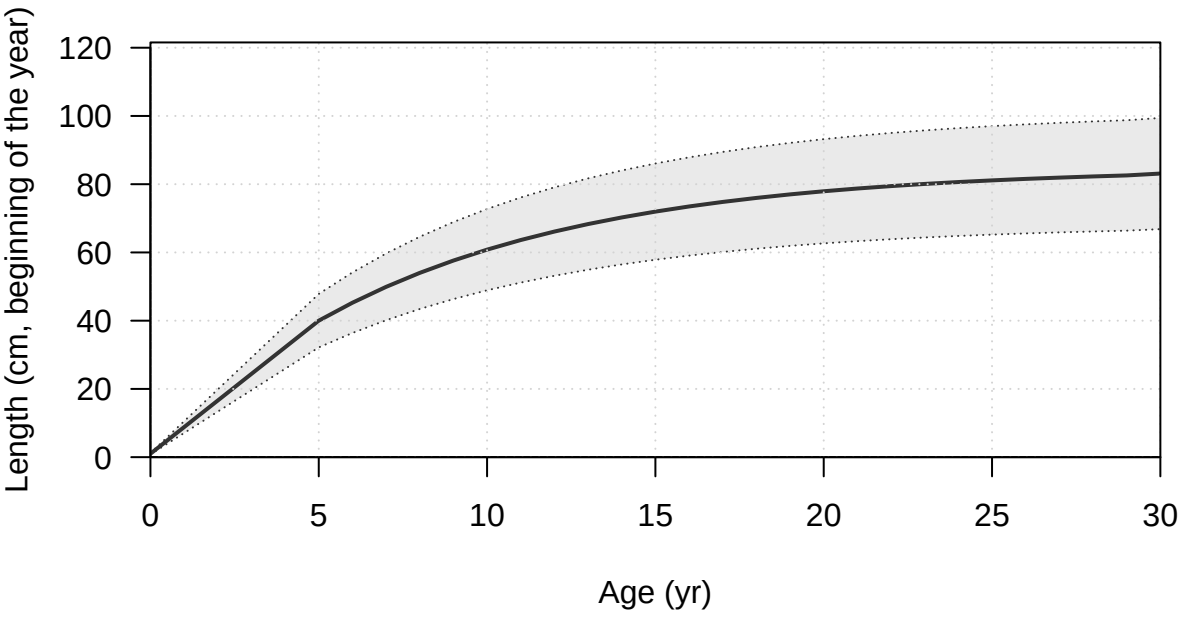
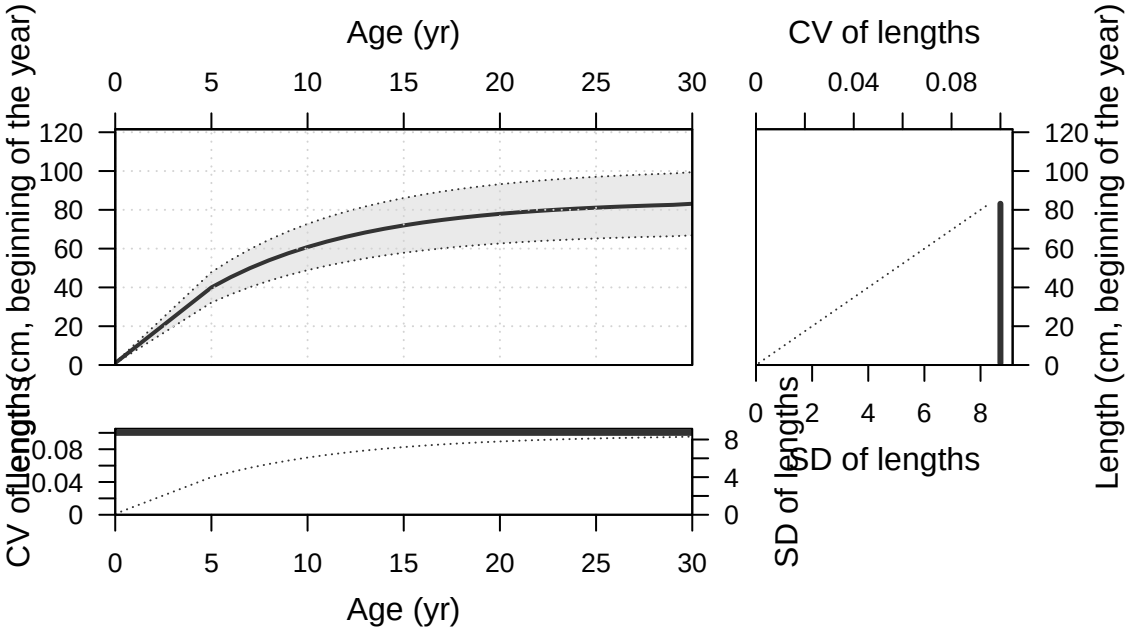
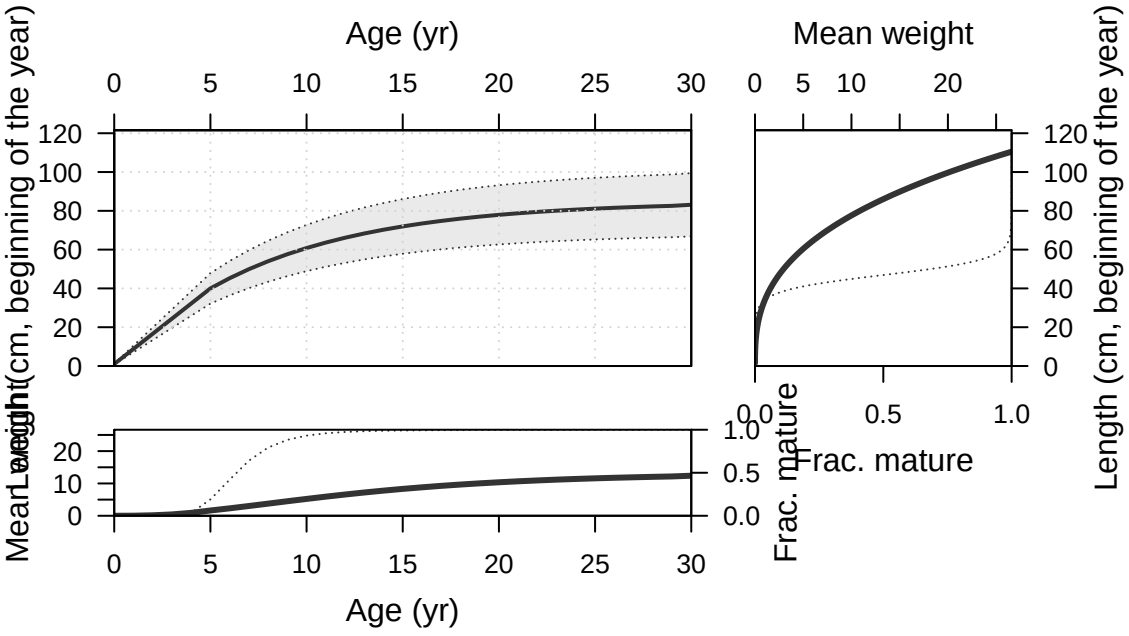
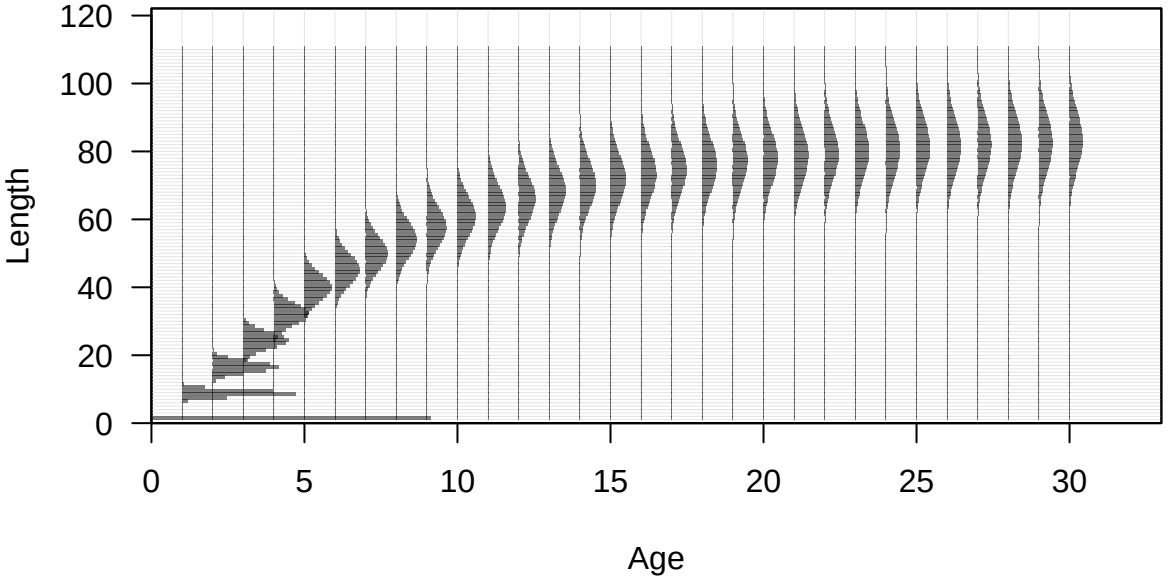
Plots created using the 'r4ss' package in R
Stock Synthesis version: 3.30.19.0
StartTime: Fri Jun 17 12:11:52 2022
Data_File: data.ss
Control_File: control.ss

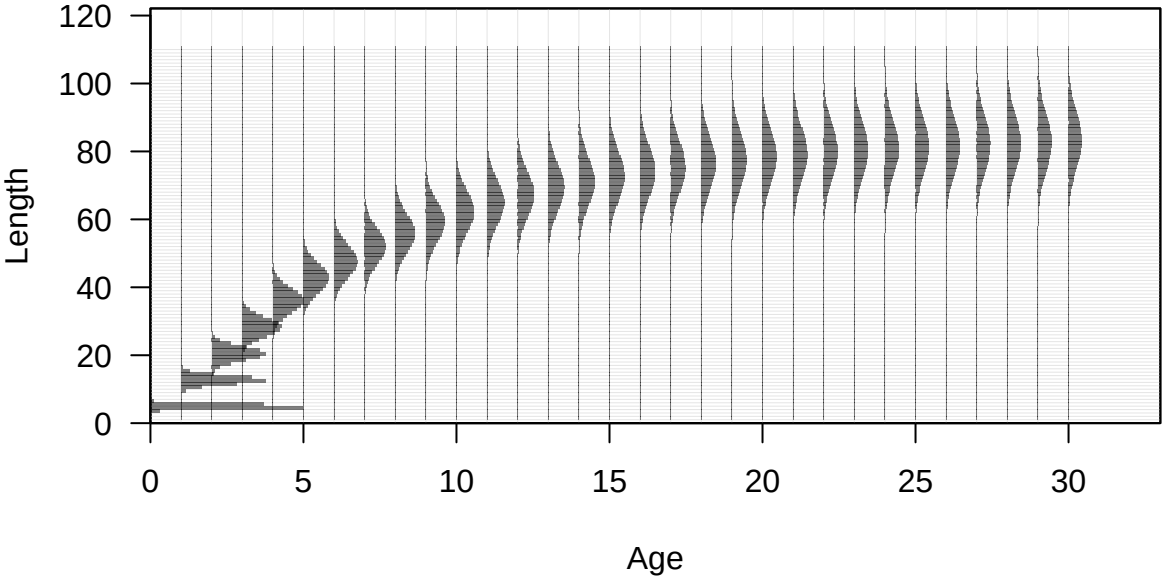

Length (cm, beginning of the year)
120
100
80
60
40
20
0
0
5
10
15
20
25
30
Age (yr)

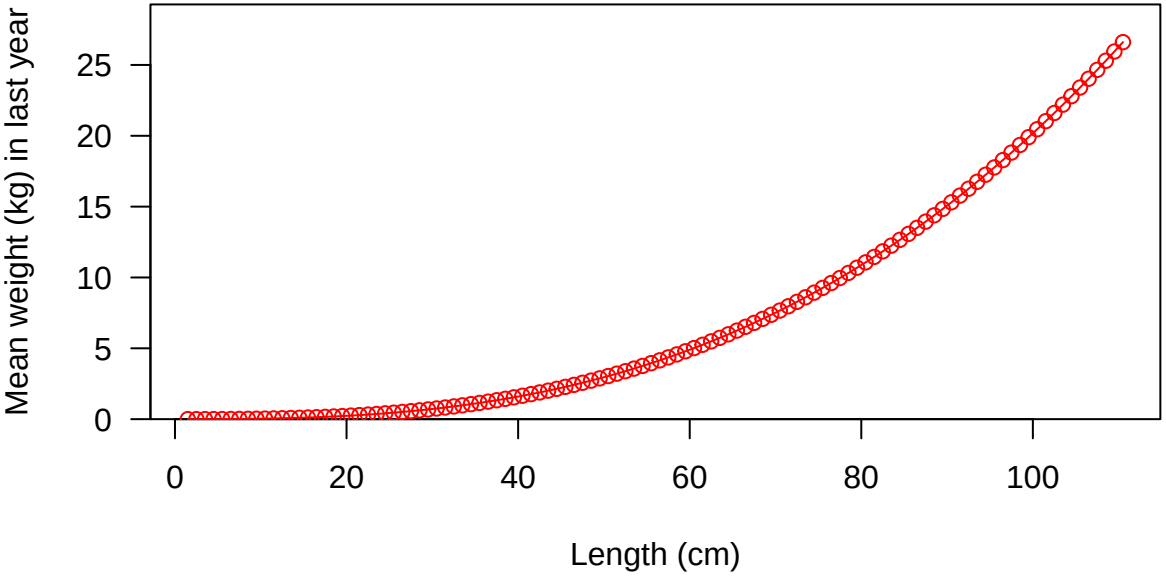


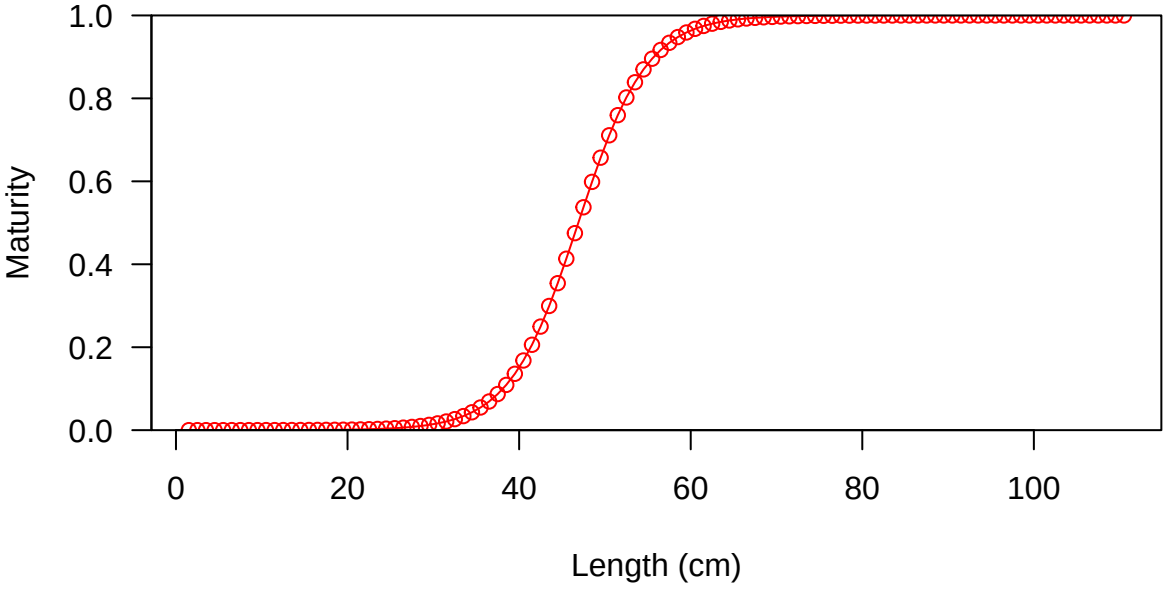
Age (yr)
0
5
10
15
20
25
30
CV of lengths
0
0.04
0.08
Length (cm, beginning of the year)
120
100
80
60
40
20
0
SD of lengths
0
2
4
6
8
CV of lengths
0.08
0.04
0
SD of lengths
8
4
0
Age (yr)

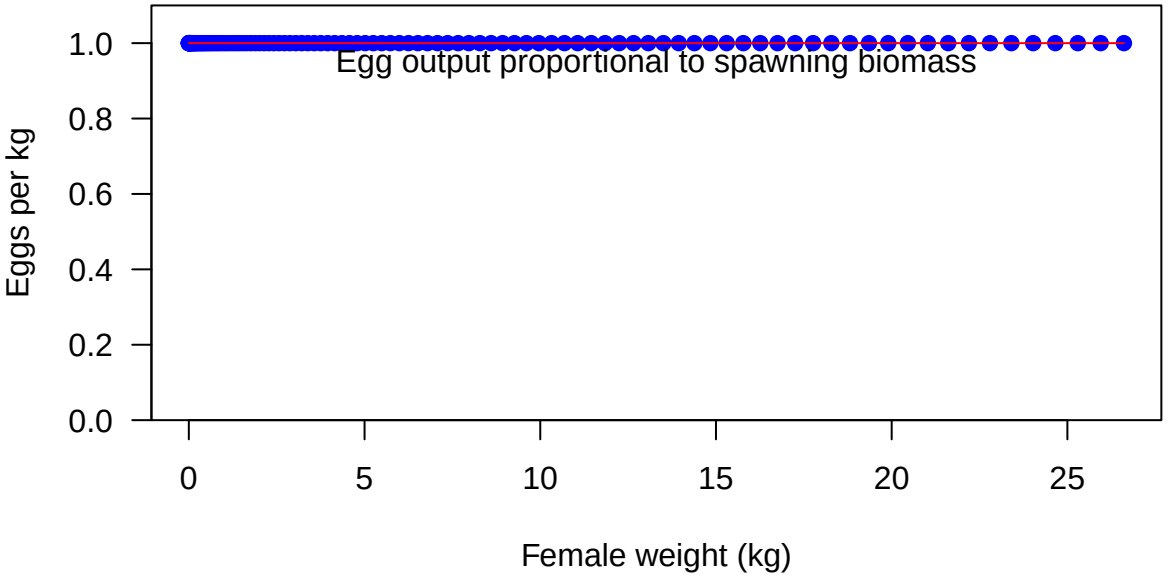

Age (yr)
Mean weight
Length (cm, beginning of the year)
Mean weight
Frac. mature
Age (yr)
Frac. mature

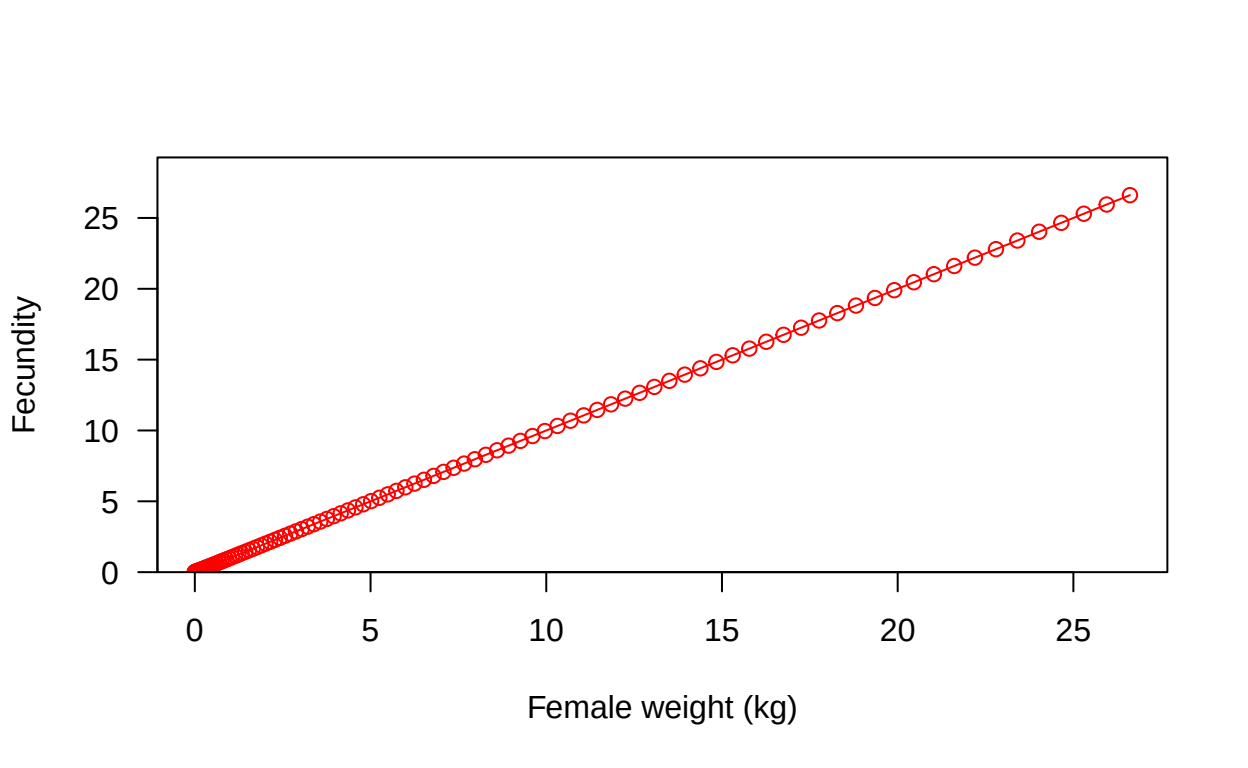

120
100
80
60
40
20
0
Length
0
5
10
15
20
25
30
Age

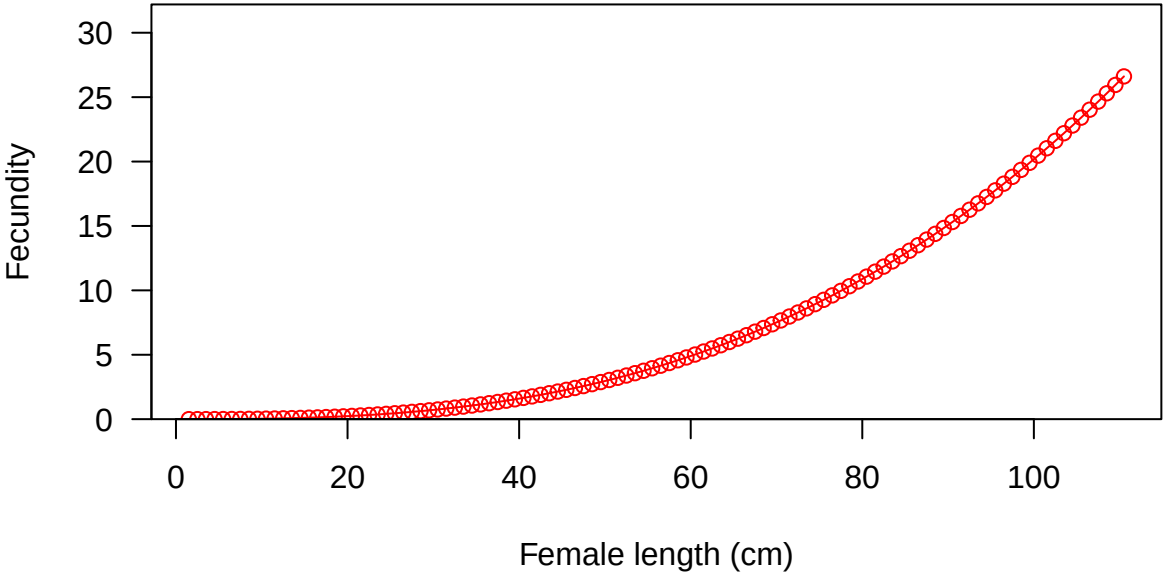

120
100
80
60
40
20
0
Length
0
5
10
15
20
25
30
Age

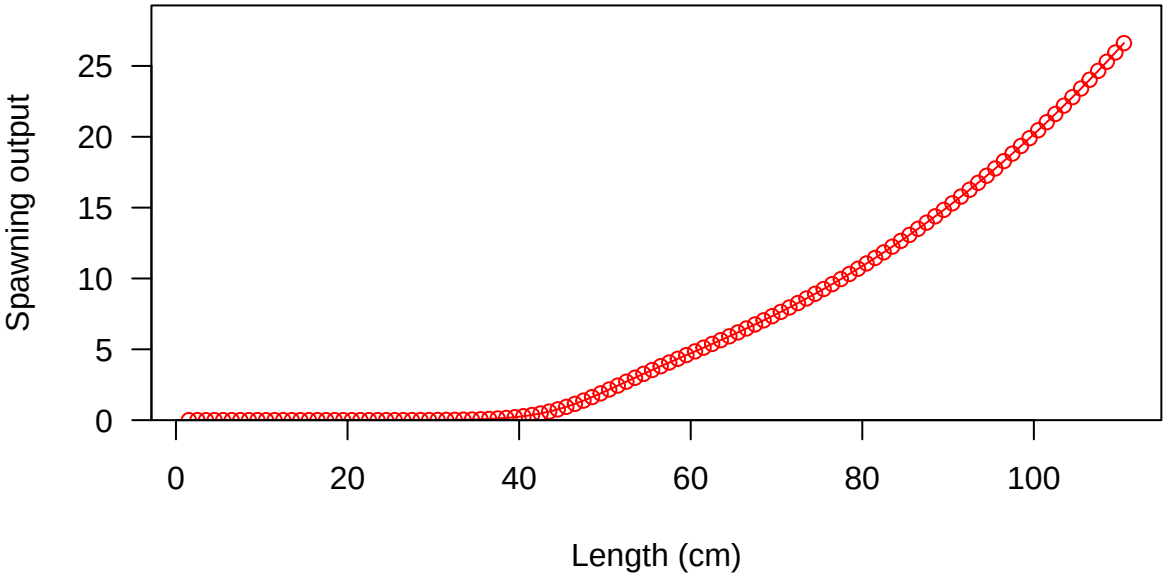

Mean weight (kg) in last year
0
5
10
15
20
25
0
20
40
60
80
100
Length (cm)

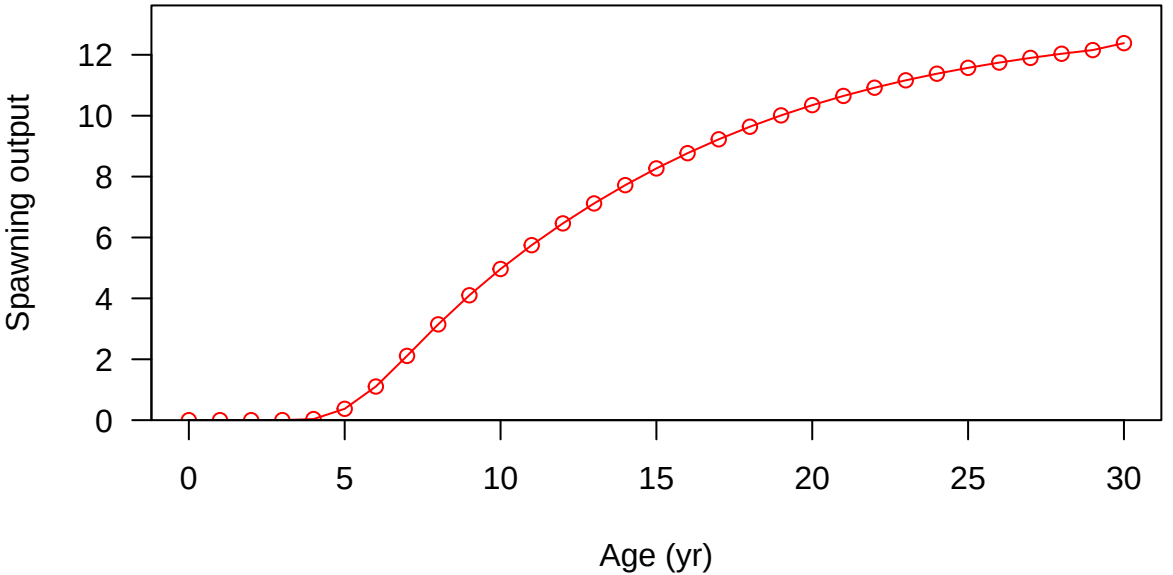

1.0
0.8
0.6
0.4
0.2
0.0
Maturity
0
20
40
60
80
100
Length (cm)

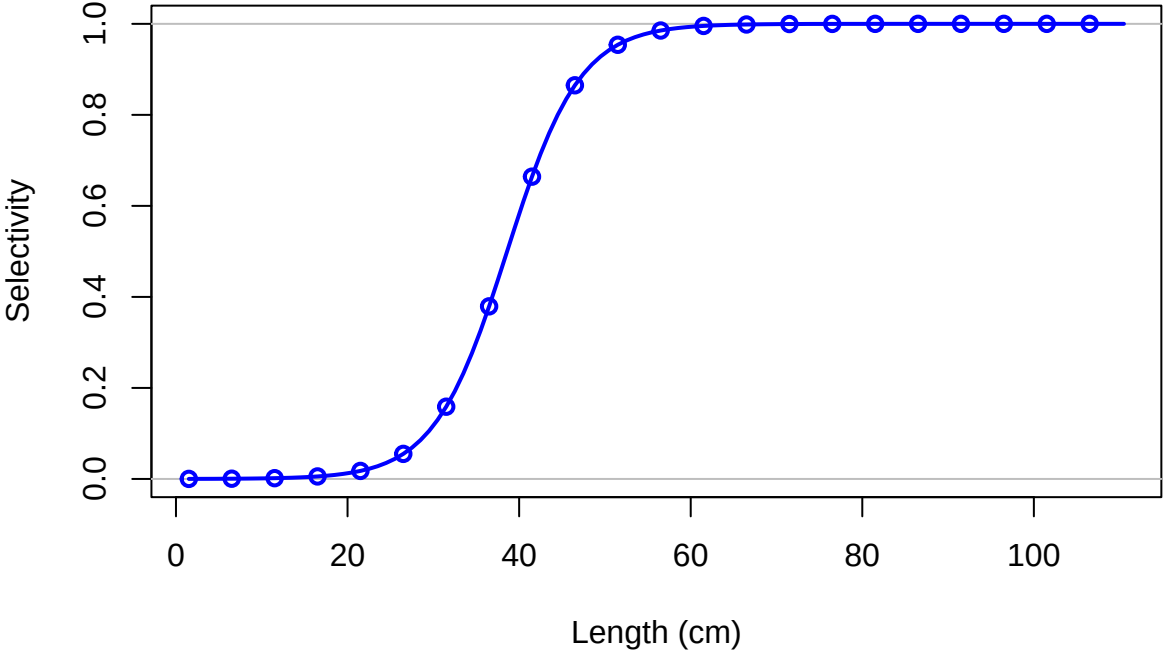

Egg output proportional to spawning biomass
Eggs per kg
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
Female weight (kg)

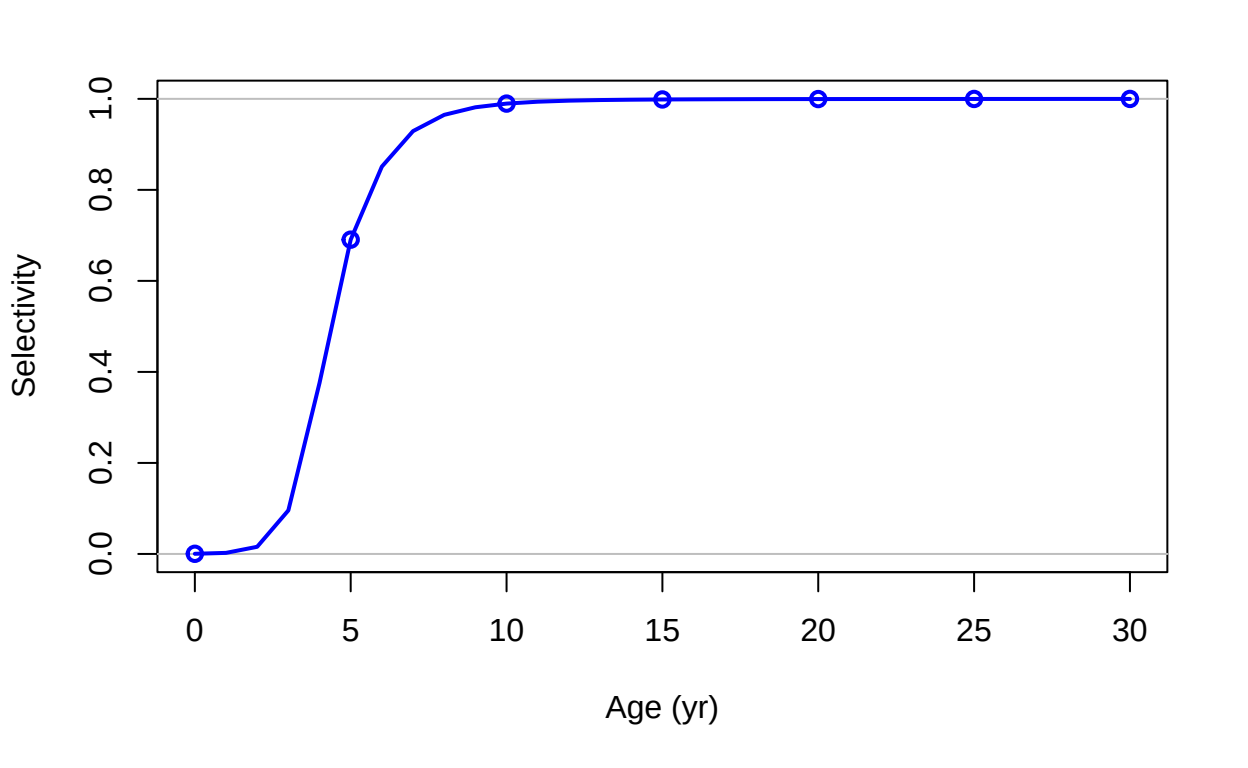

Fecundity
0
5
10
15
20
25
0
5
10
15
20
25
Female weight (kg)

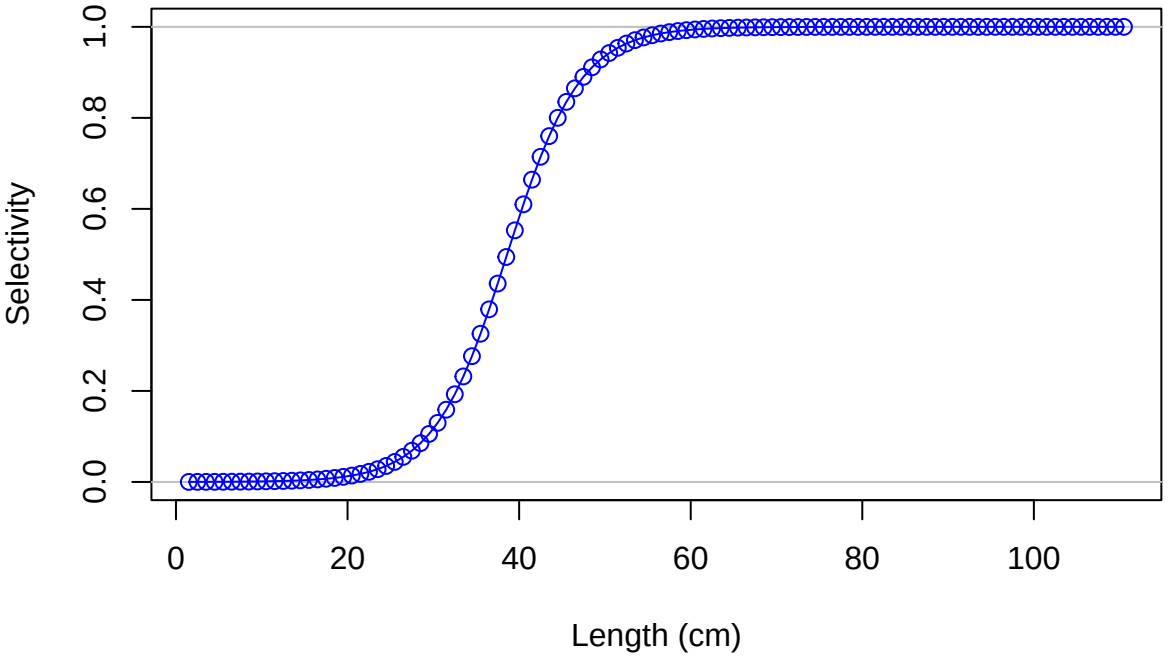

Fecundity
30
25
20
15
10
5
0
0
20
40
60
80
100
Female length (cm)

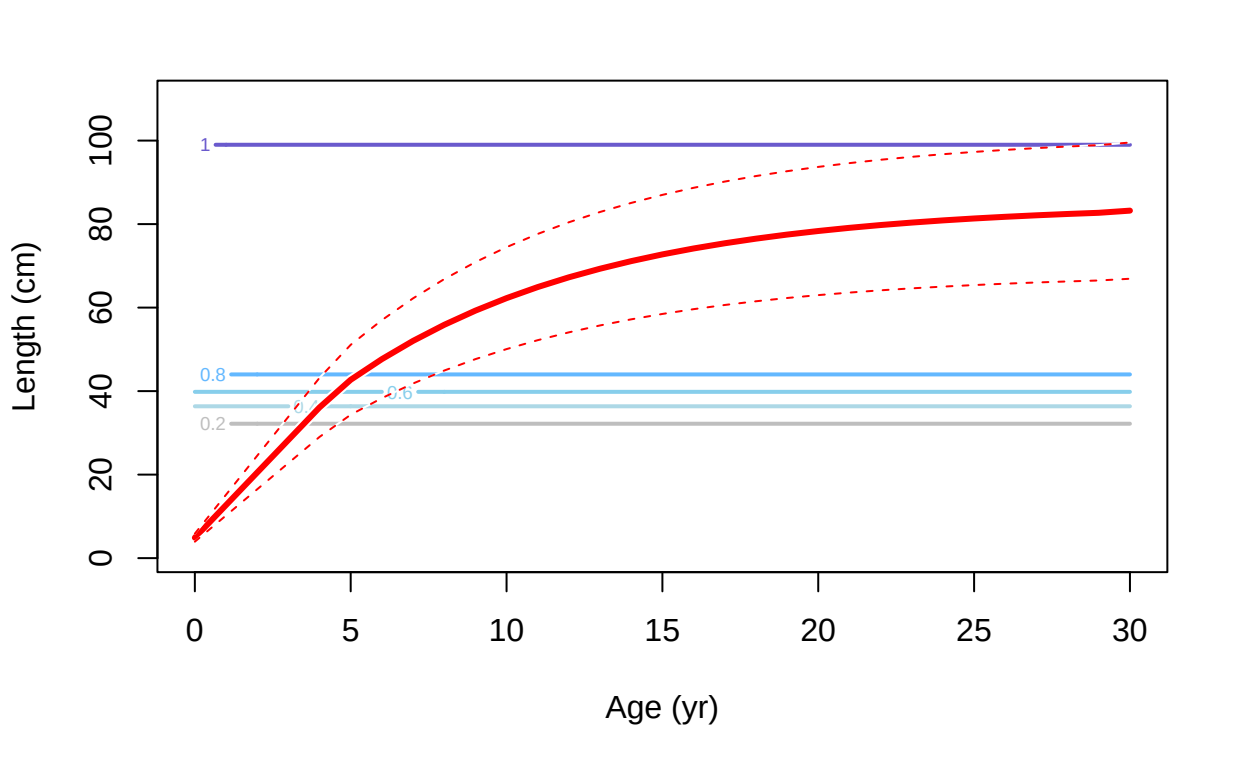

Spawning output
0
5
10
15
20
25
0
20
40
60
80
100
Length (cm)

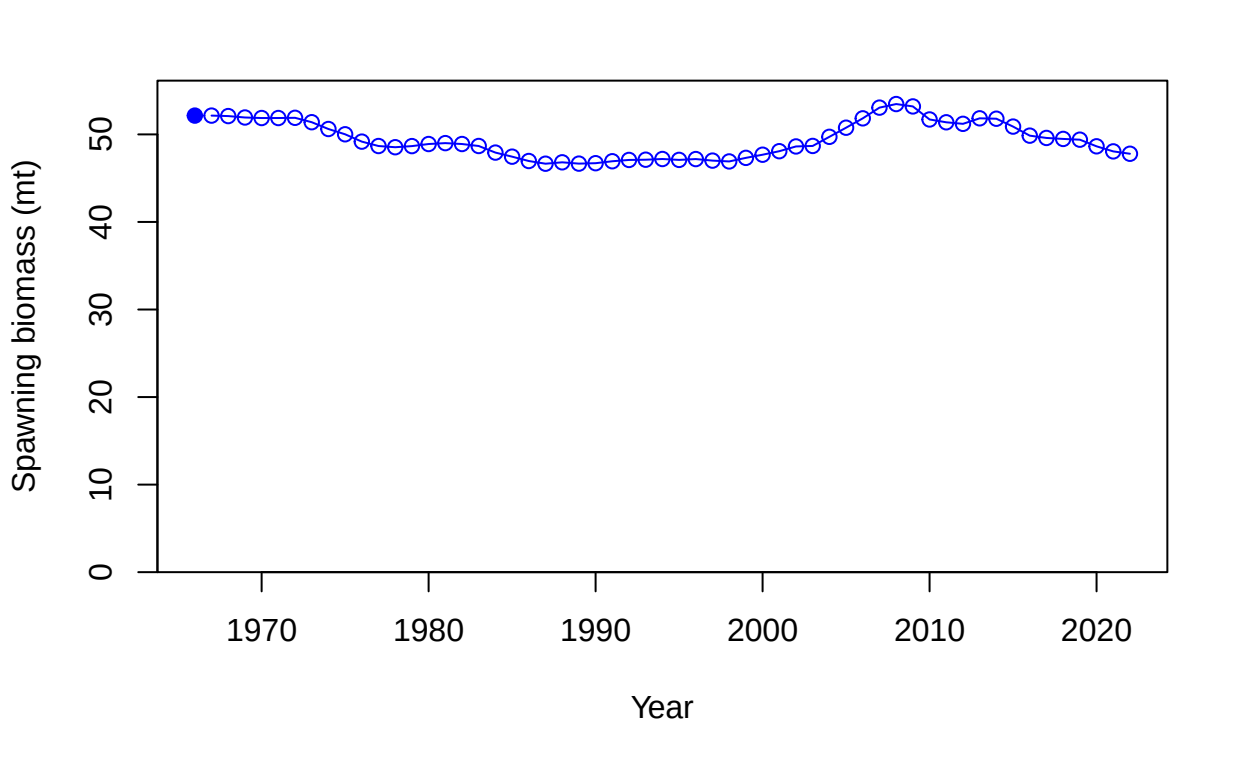

Spawning output
0
2
4
6
8
10
12
0
5
10
15
20
25
30
Age (yr)

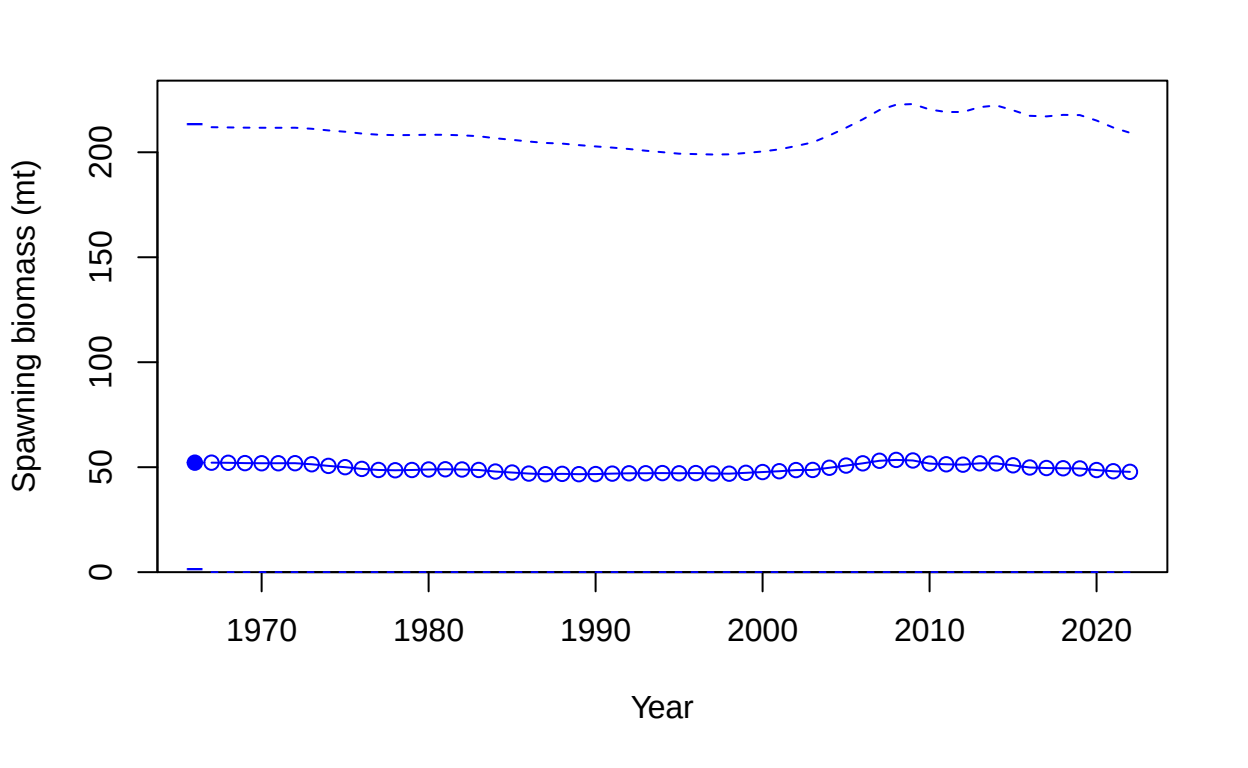

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
20
40
60
80
100
Length (cm)

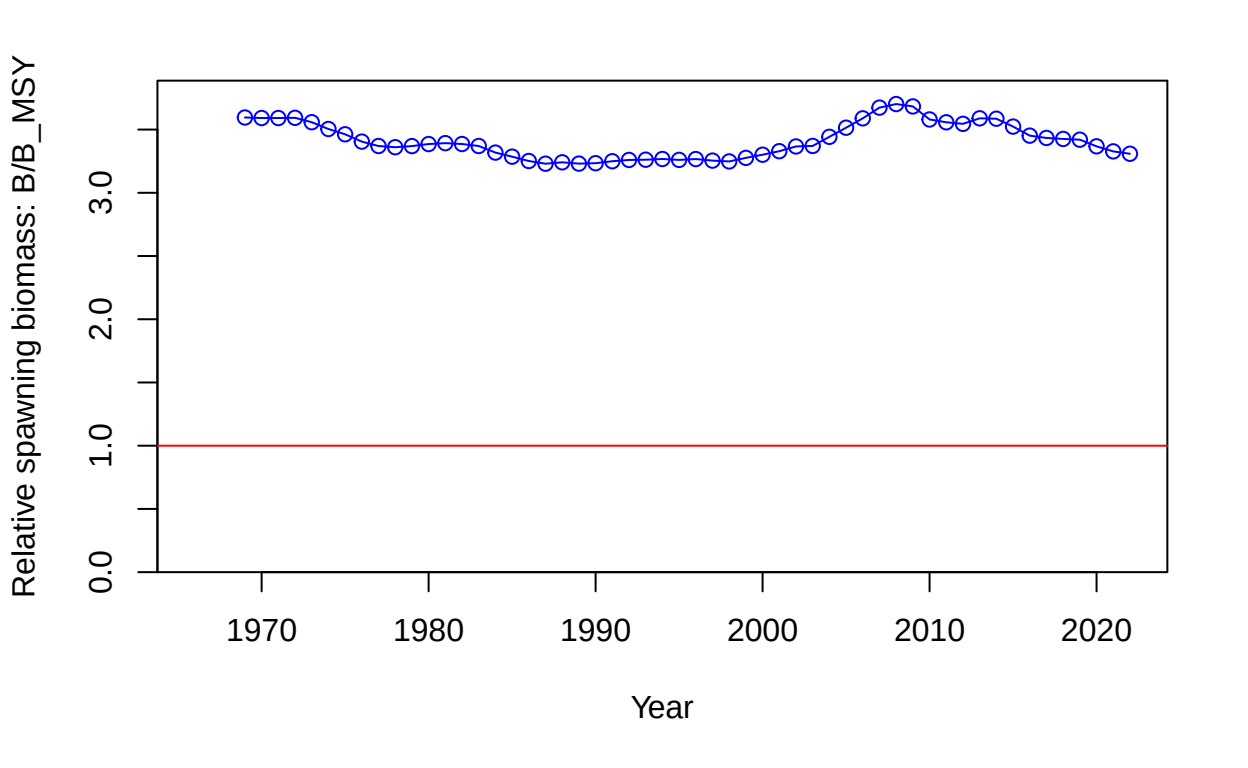

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
5
10
15
20
25
30
Age (yr)

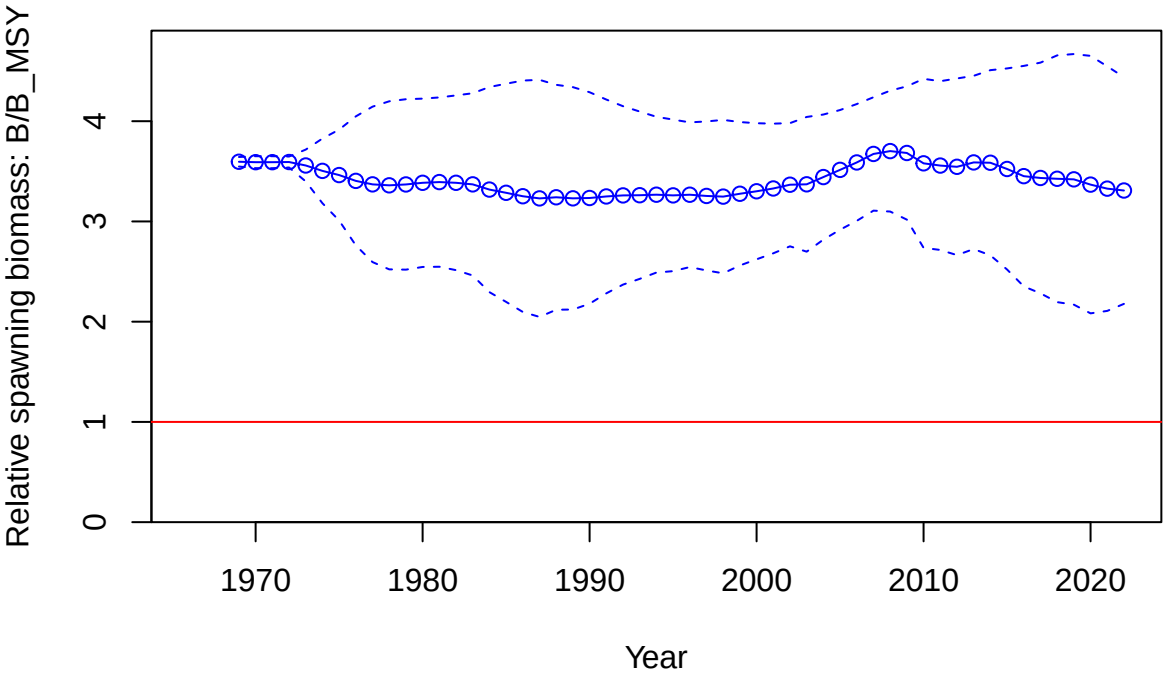

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
20
40
60
80
100
Length (cm)

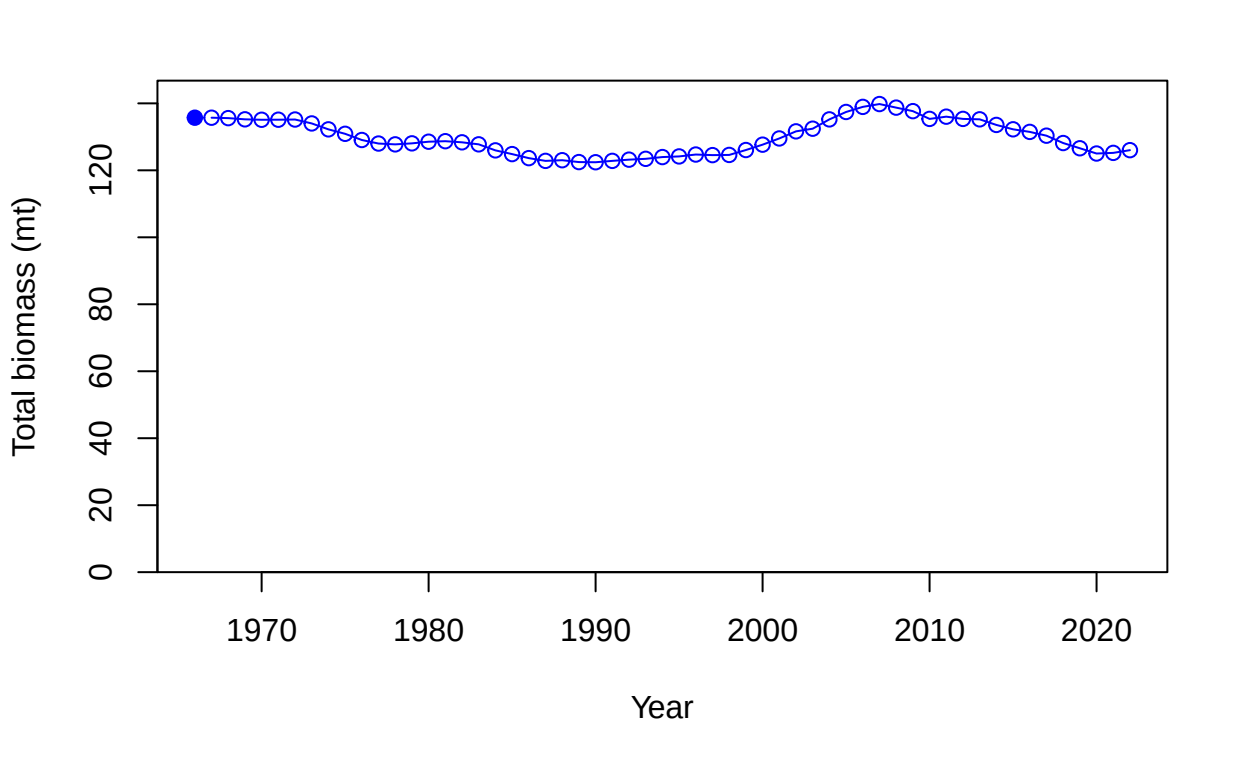

Length (cm)
0
20
40
60
80
100
1
0.8
0.6
0.4
0.2
0
5
10
15
20
25
30
Age (yr)

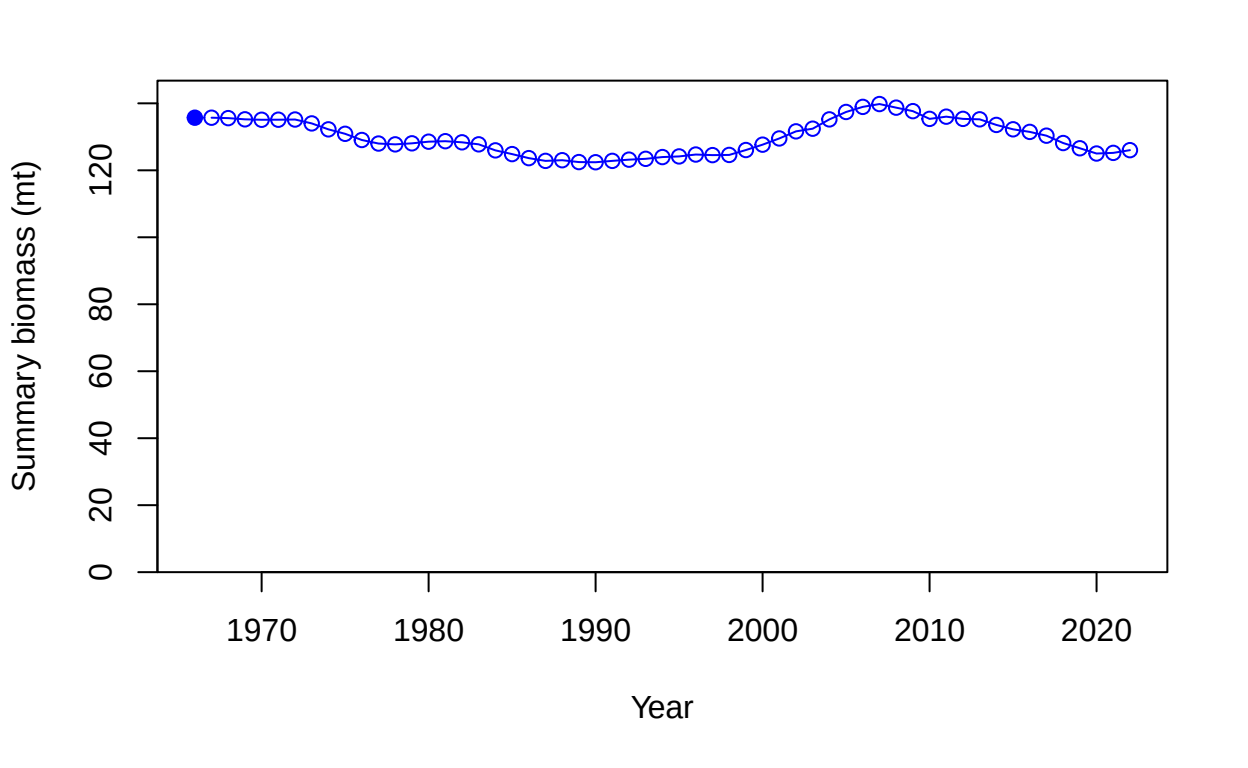

Spawning biomass (mt)
0
10
20
30
40
50
1970
1980
1990
2000
2010
2020
Year

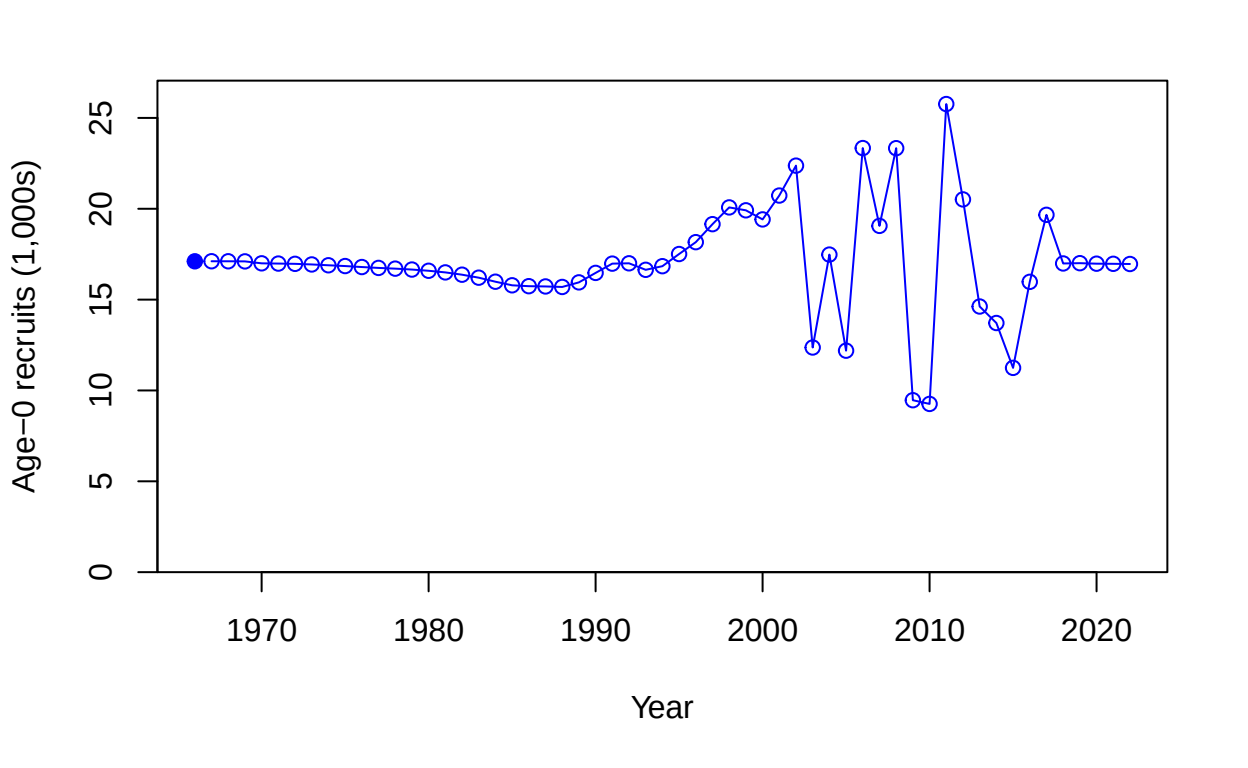

Spawning biomass (mt)
0
50
100
150
200
1970
1980
1990
2000
2010
2020
Year

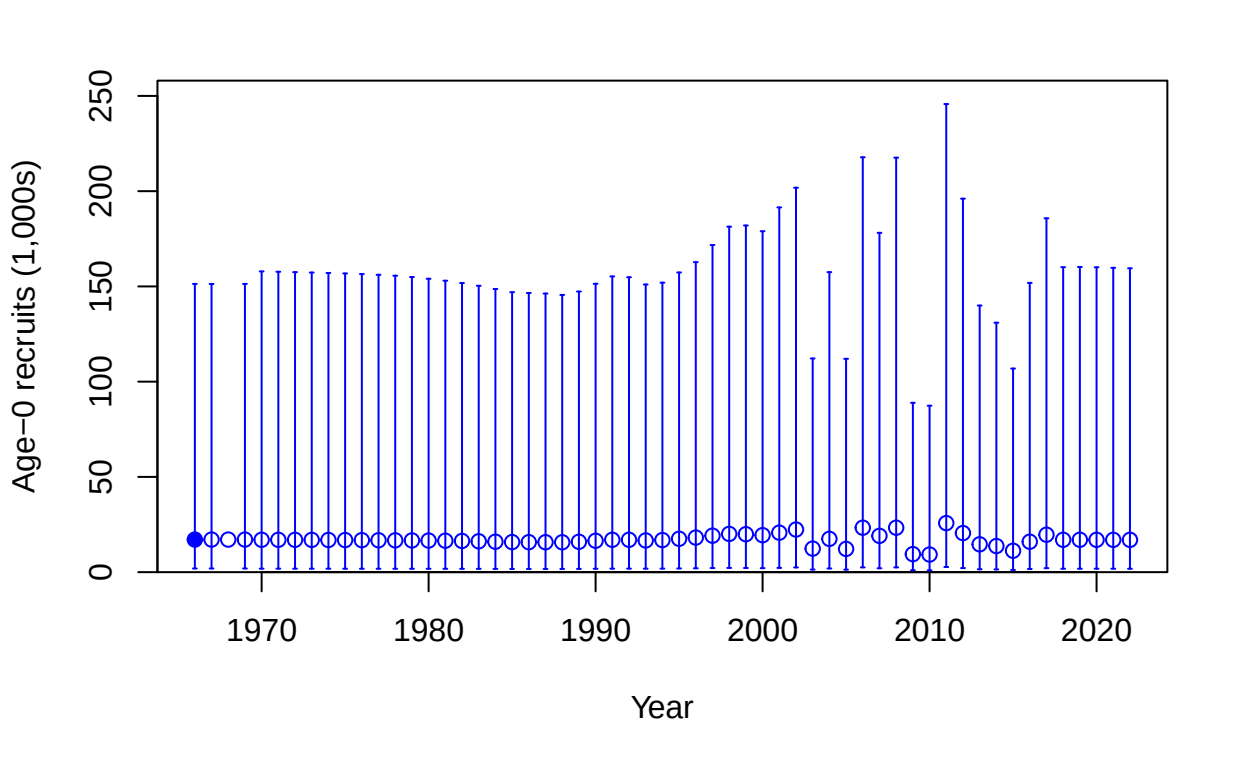

Relative spawning biomass: B/B_MSY
0.0
1.0
2.0
3.0
1970
1980
1990
2000
2010
2020
Year

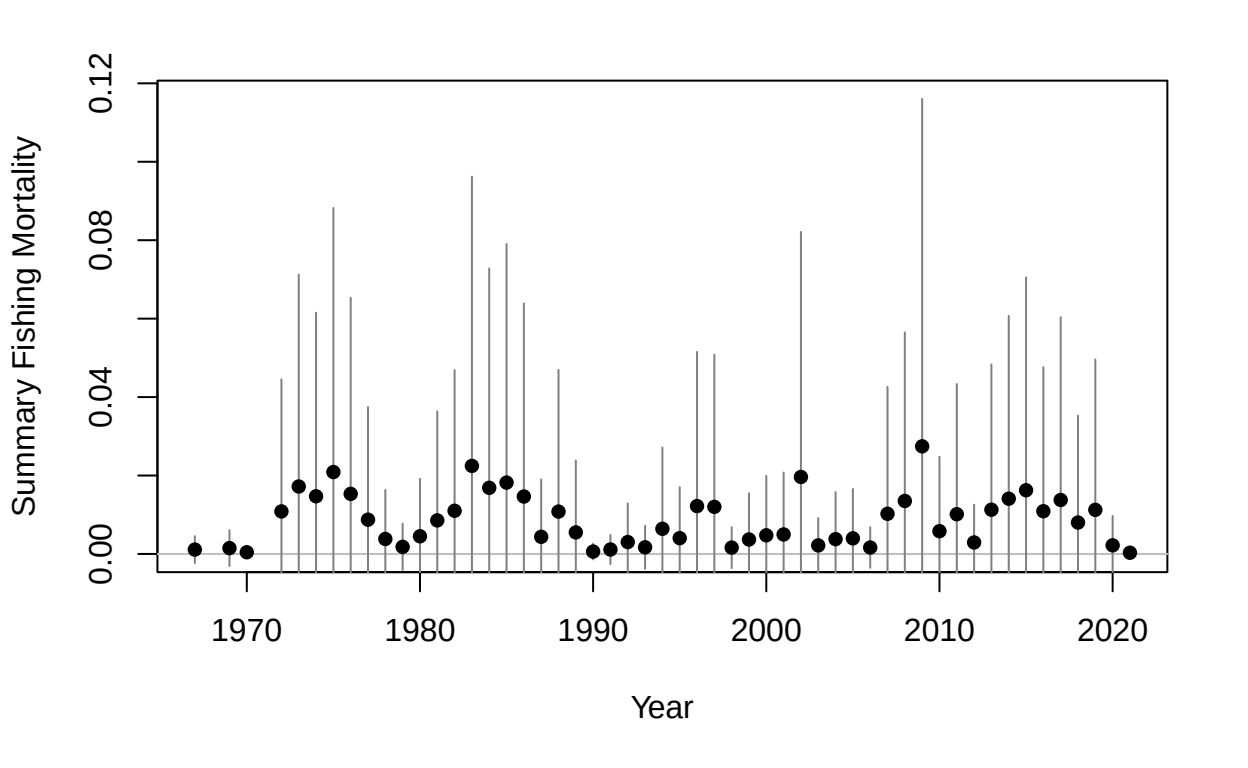

Relative spawning biomass: B/B_MSY
0
1
2
3
4
1970
1980
1990
2000
2010
2020
Year

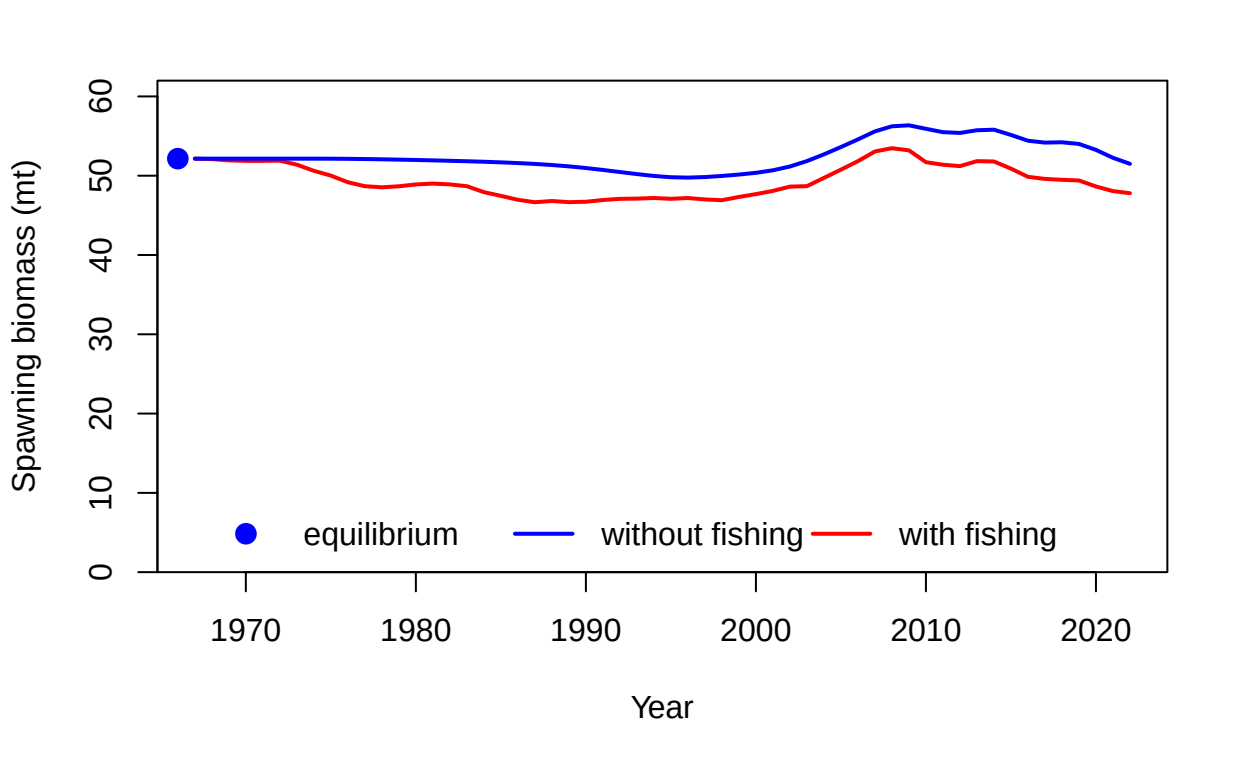

Total biomass (mt)
0
20
40
60
80
120
1970
1980
1990
2000
2010
2020
Year

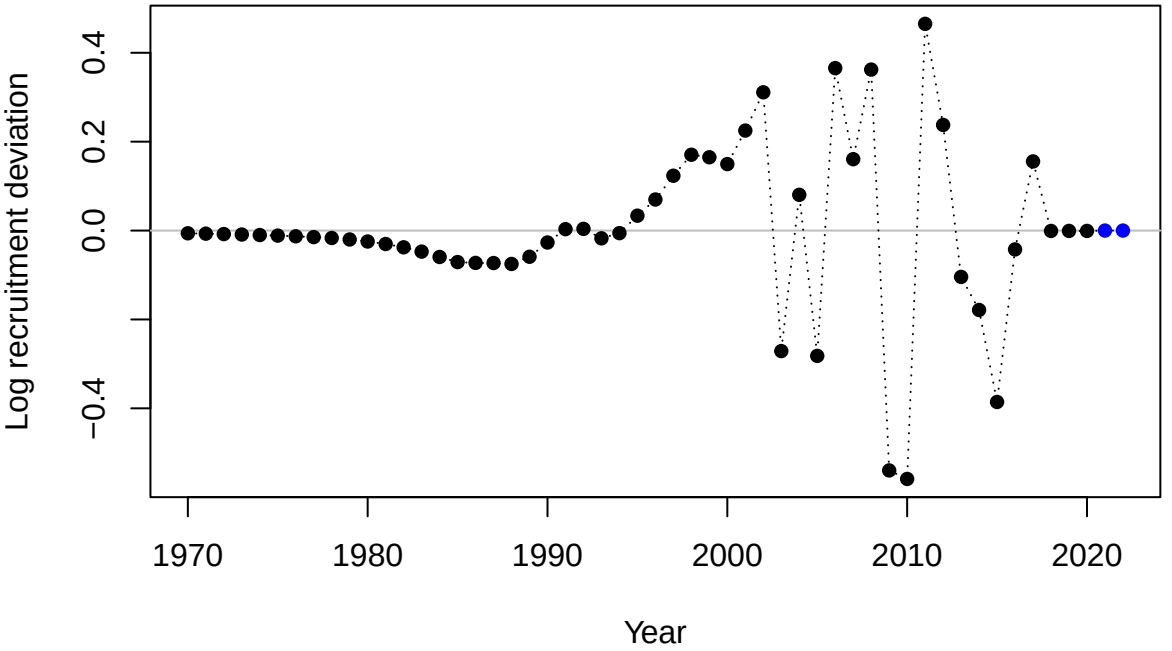

Summary biomass (mt)
0
20
40
60
80
120
1970
1980
1990
2000
2010
2020
Year

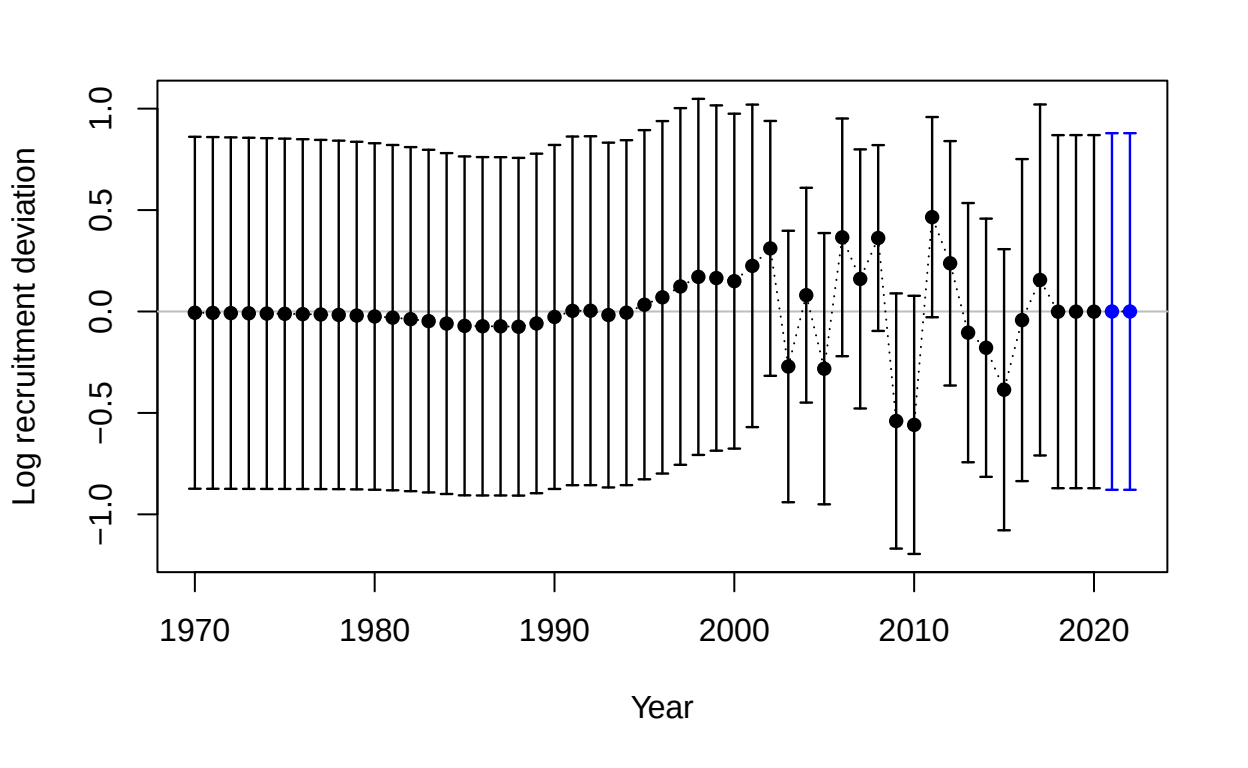

Age−0 recruits (1,000s)
0
5
10
15
20
25
1970
1980
1990
2000
2010
2020
Year

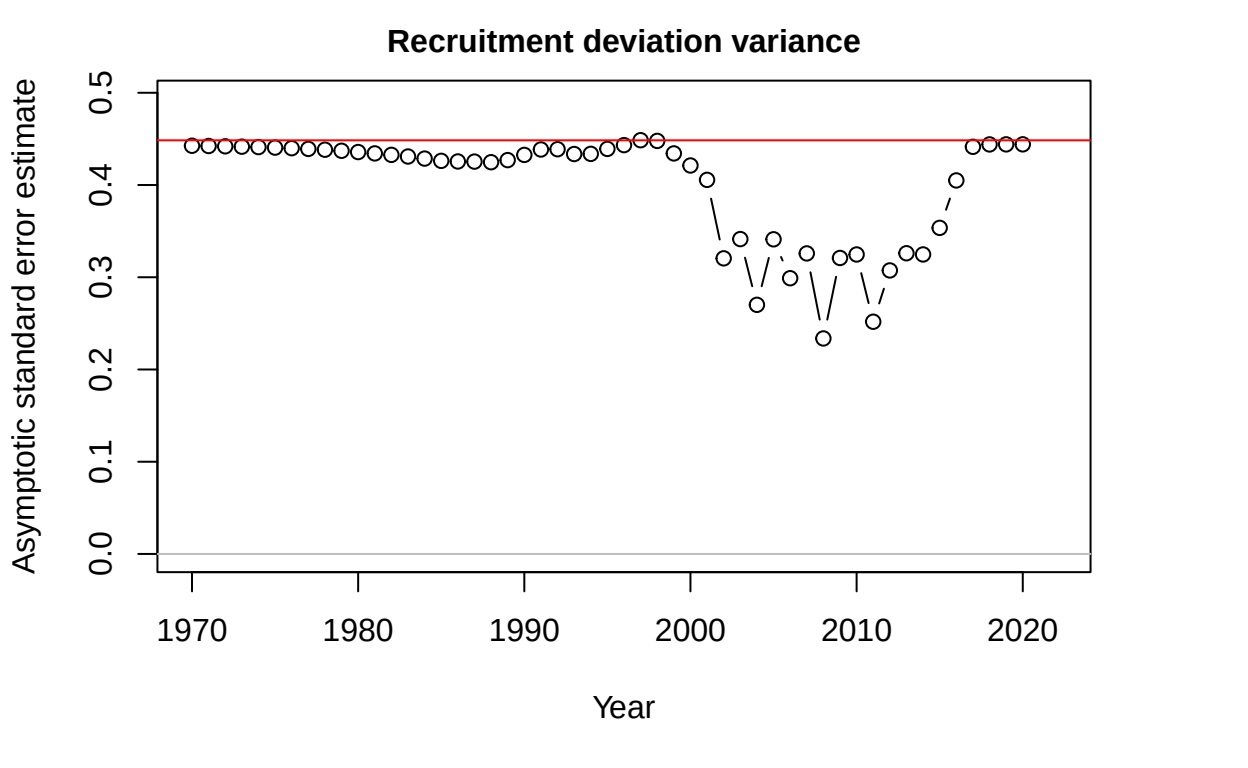

Age−0 recruits (1,000s)
0
50
100
150
200
250
1970
1980
1990
2000
2010
2020
Year

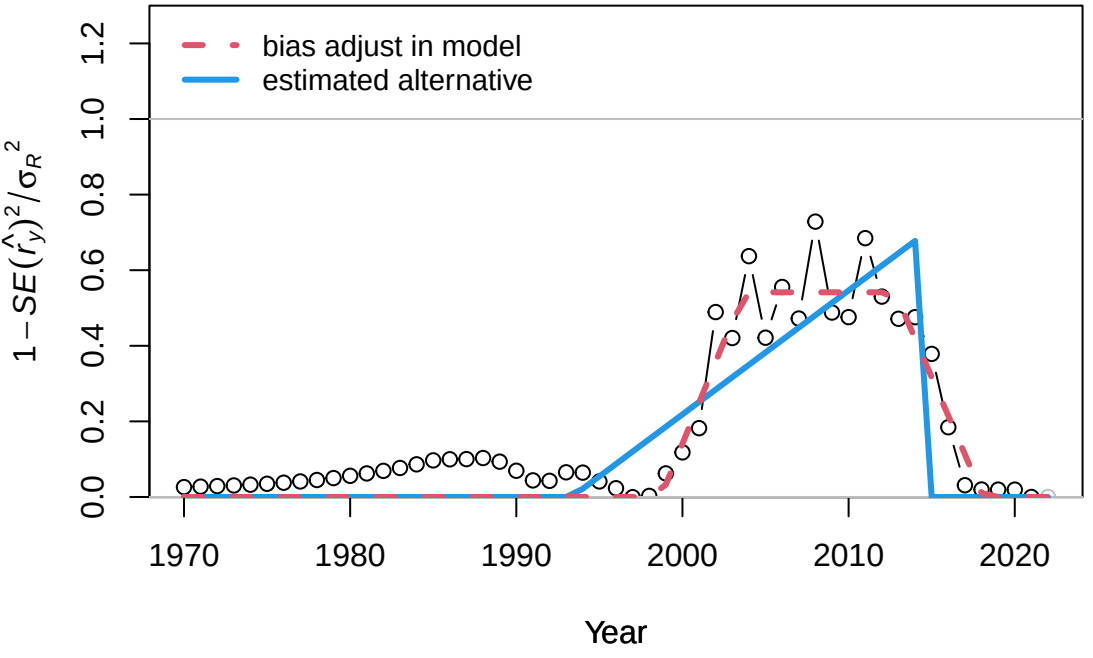

Summary Fishing Mortality
0.00
0.04
0.08
0.12
1970
1980
1990
2000
2010
2020
Year

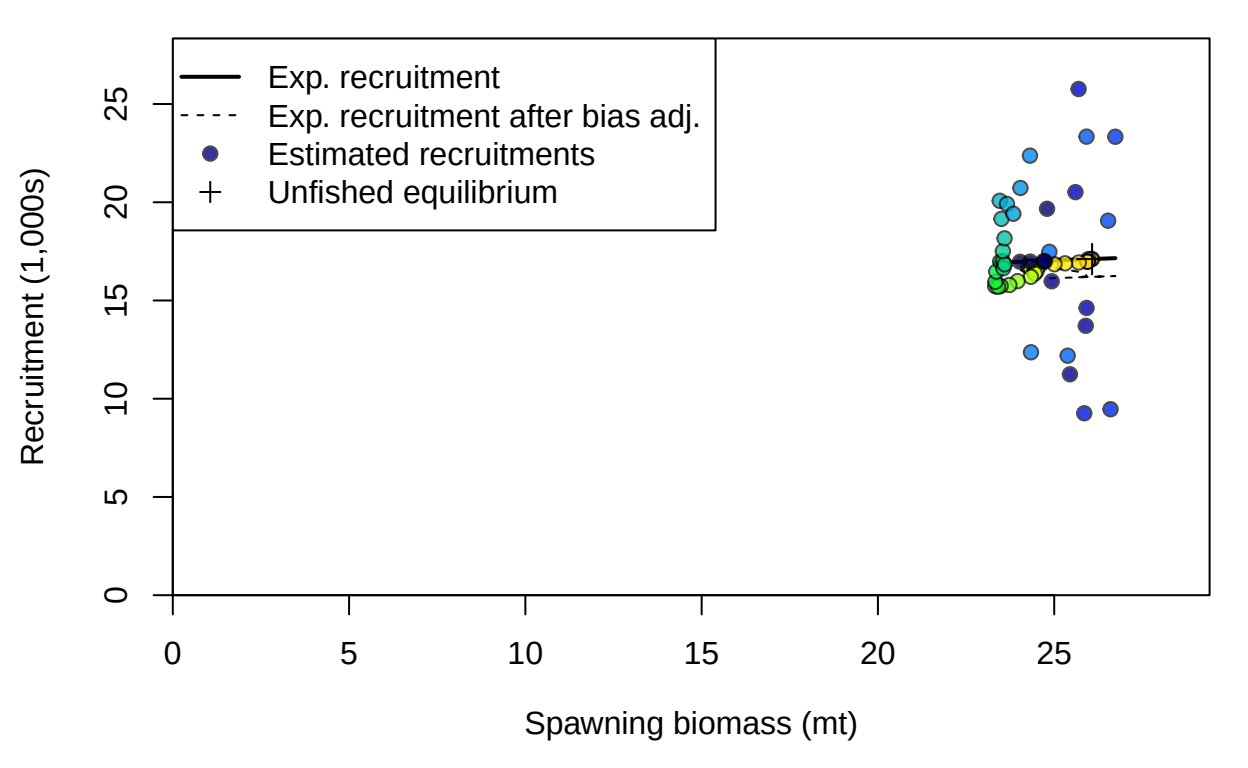

Spawning biomass (mt)
0
10
20
30
40
50
60
1970
1980
1990
2000
2010
2020
Year
equilibrium
without fishing
with fishing

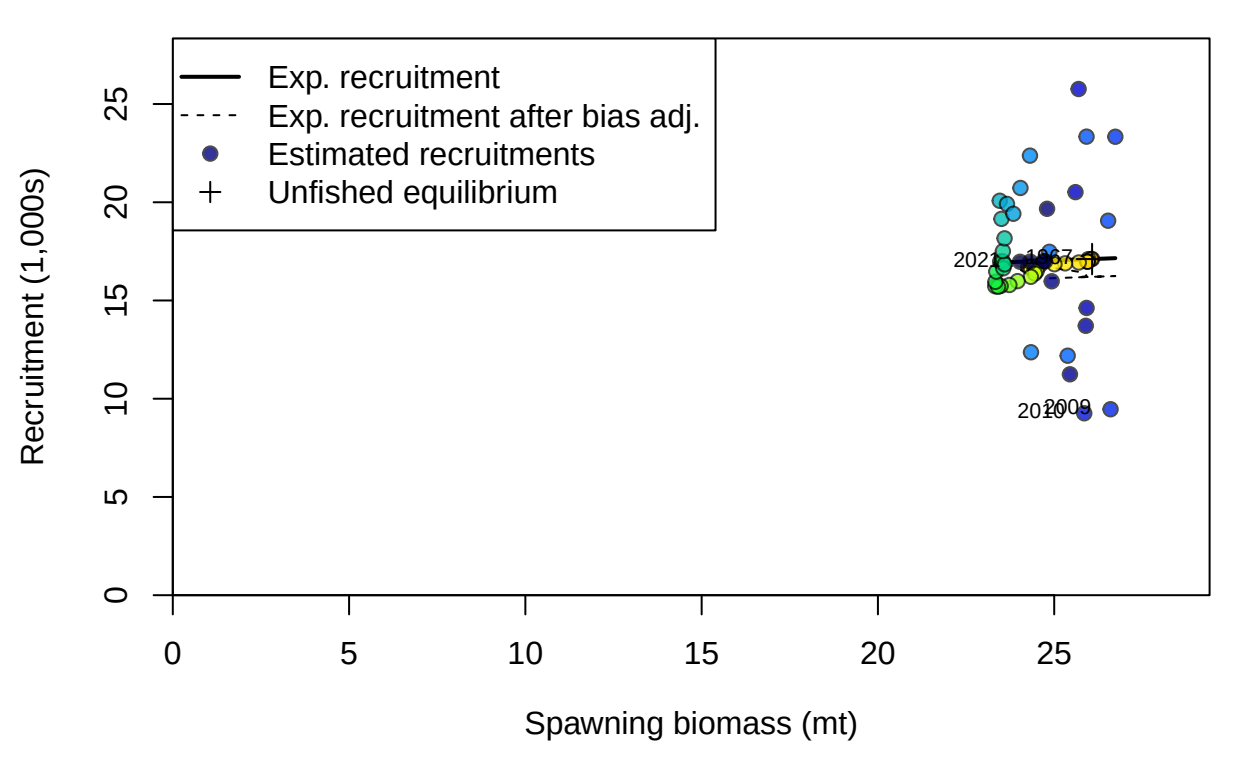

Log recruitment deviation
0.4
0.2
0.0
−0.4
1970
1980
1990
2000
2010
2020
Year

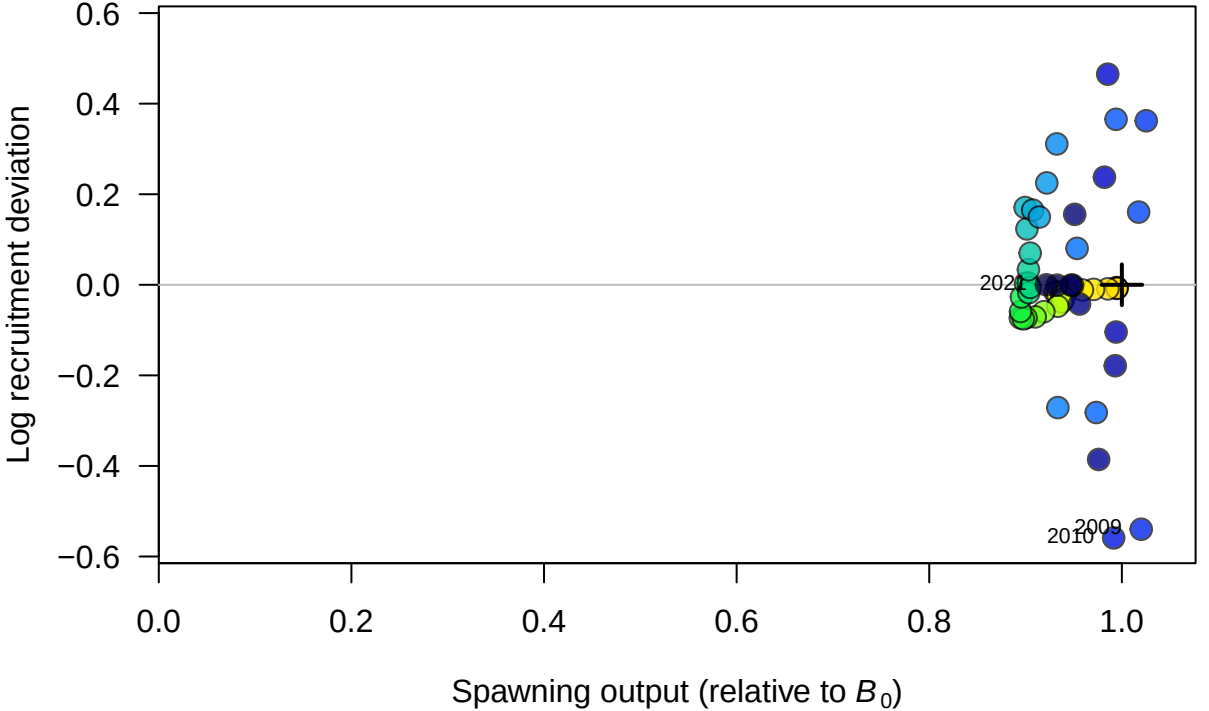

Log recruitment deviation
1.0
0.5
0.0
−0.5
−1.0
1970
1980
1990
2000
2010
2020
Year

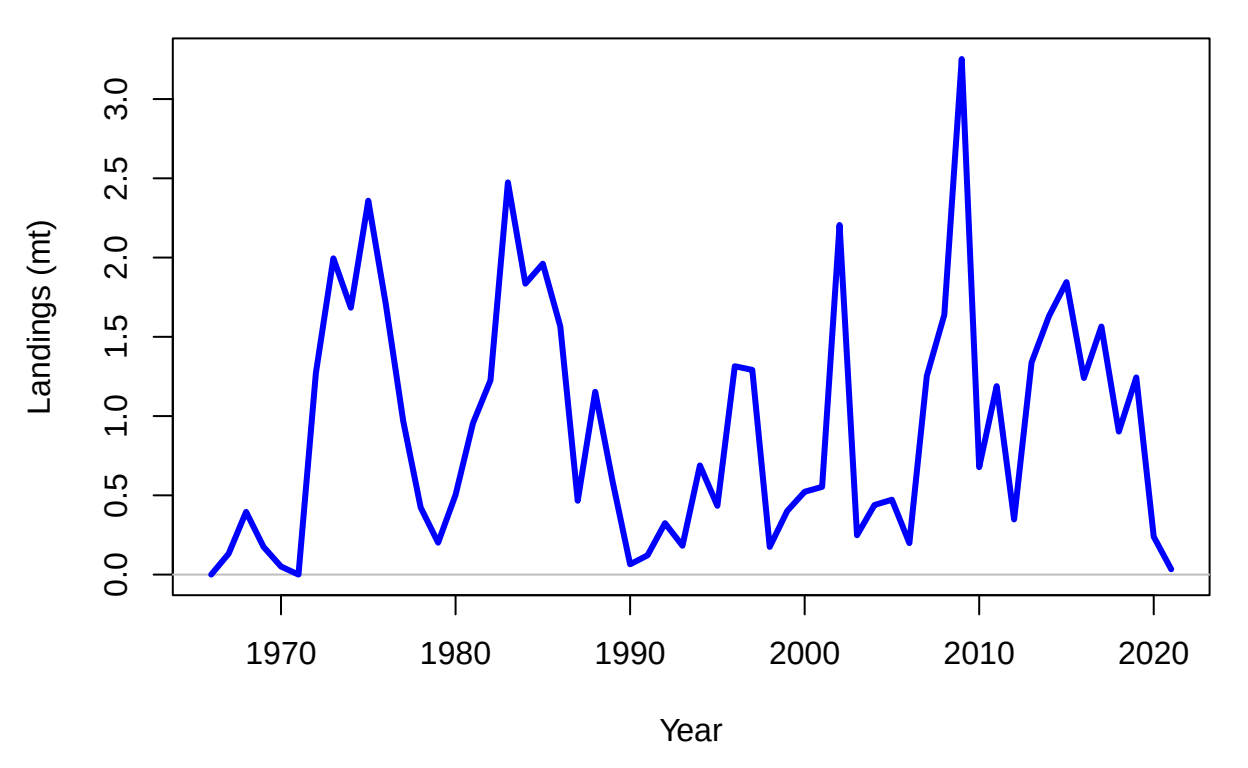

Recruitment deviation variance
Asymptotic standard error estimate
0.0
0.1
0.2
0.3
0.4
0.5
1970
1980
1990
2000
2010
2020
Year

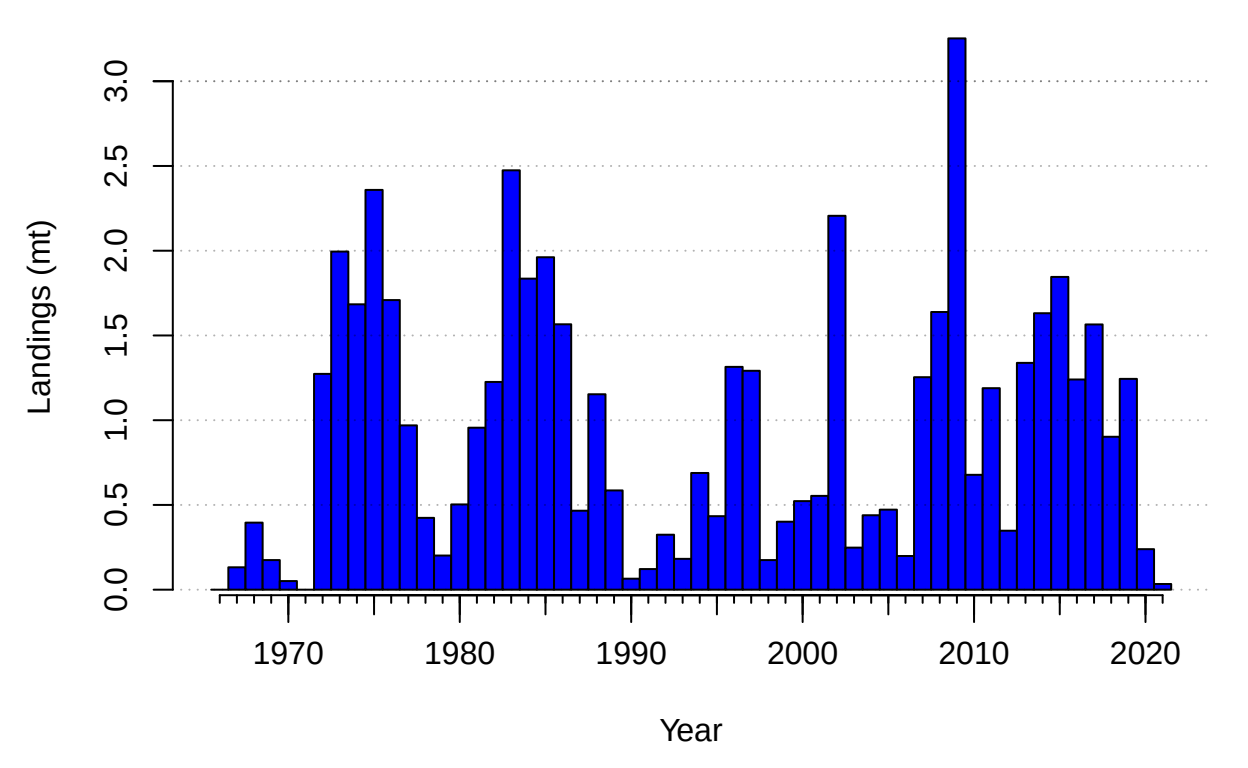

bias adjust in model
estimated alternative
$1-SE(\hat{r}_y)^2/\sigma_R{}^2$
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1970
1980
1990
2000
2010
2020
Year

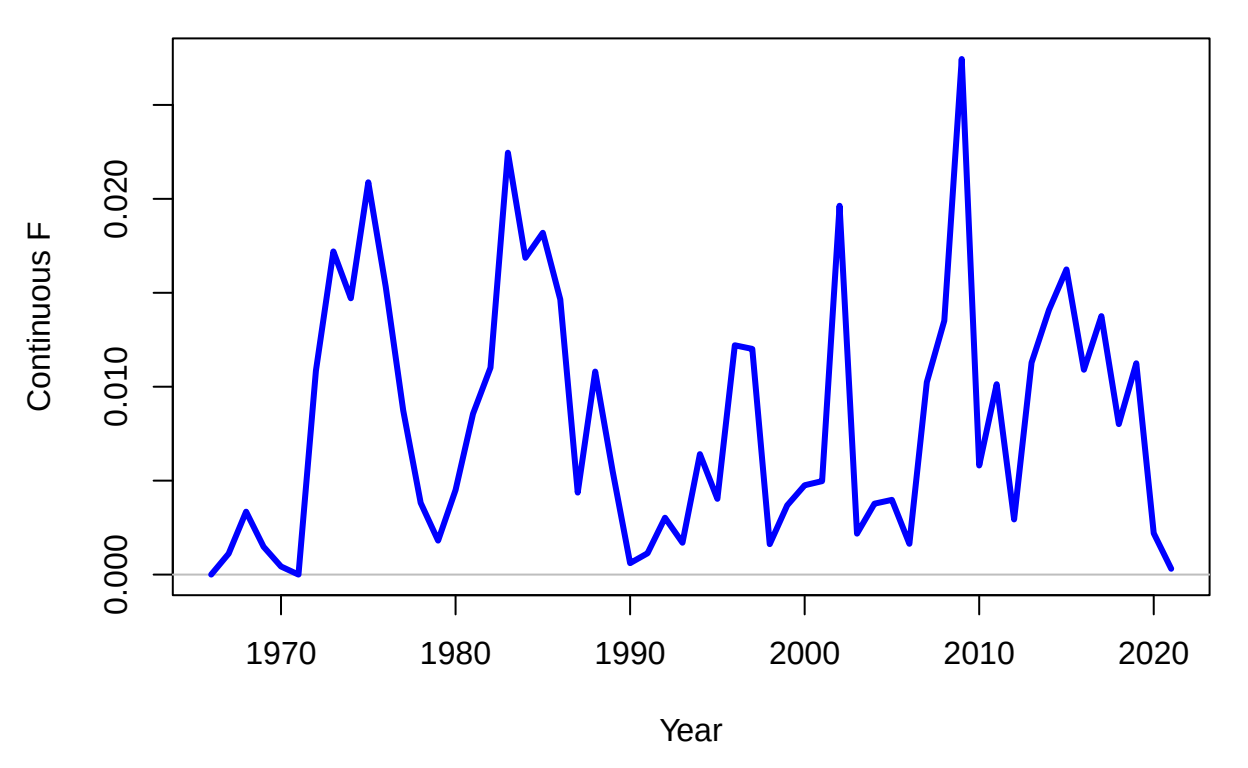

Exp. recruitment
Exp. recruitment after bias adj.
Estimated recruitments
Unfished equilibrium
Recruitment (1,000s)
0
5
10
15
20
25
Spawning biomass (mt)
0
5
10
15
20
25

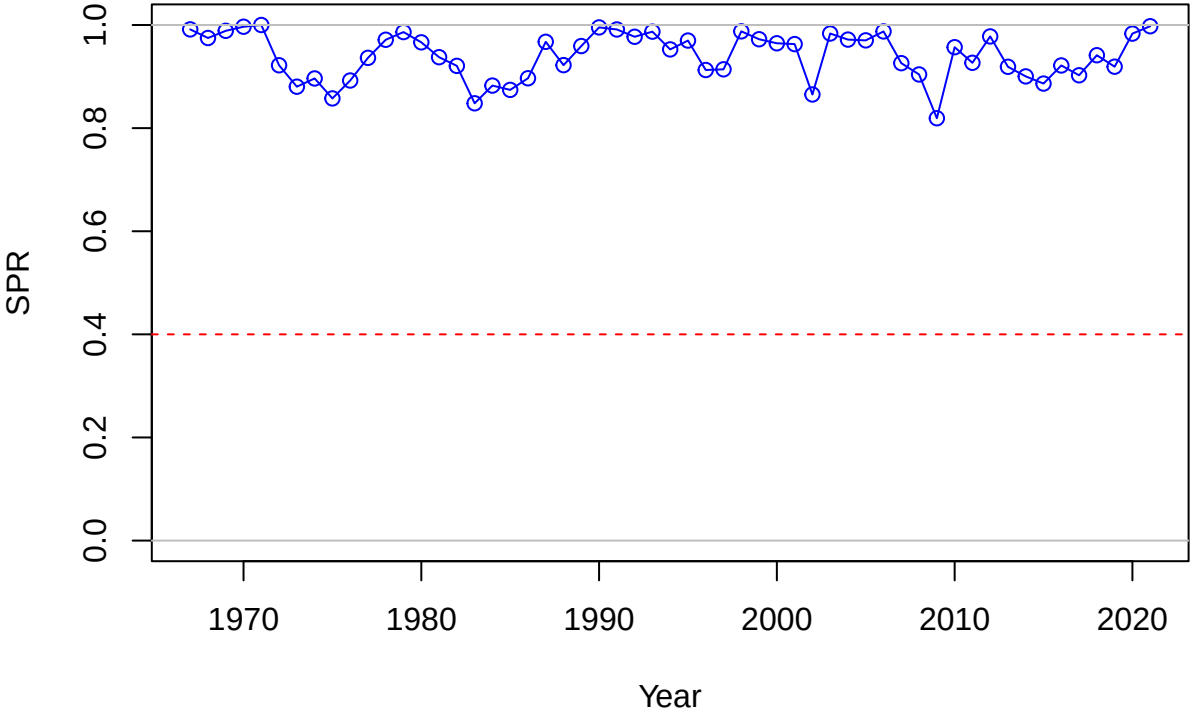

Exp. recruitment
Exp. recruitment after bias adj.
Estimated recruitments
Unfished equilibrium
Recruitment (1,000s)
0
5
10
15
20
25
Spawning biomass (mt)
2021
2009
2010

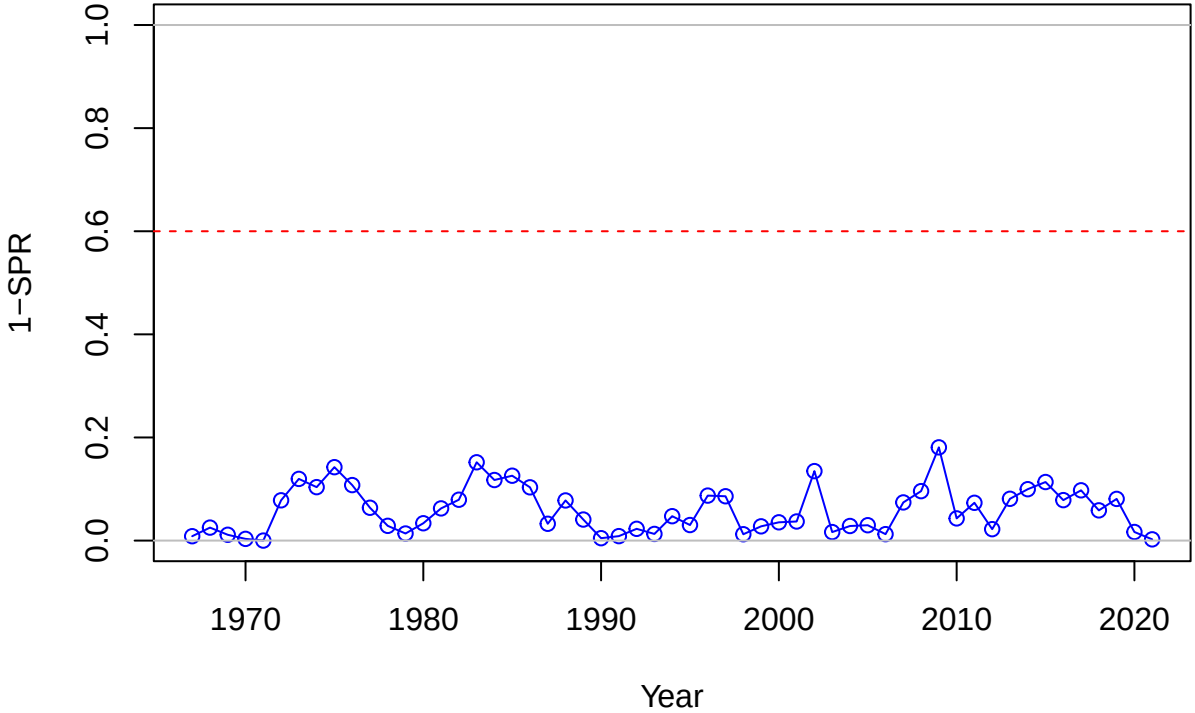

Log recruitment deviation
0.6
0.4
0.2
0.0
−0.2
−0.4
−0.6
2020
2009
2010
0.0
0.2
0.4
0.6
0.8
1.0
Spawning output (relative to B_0)

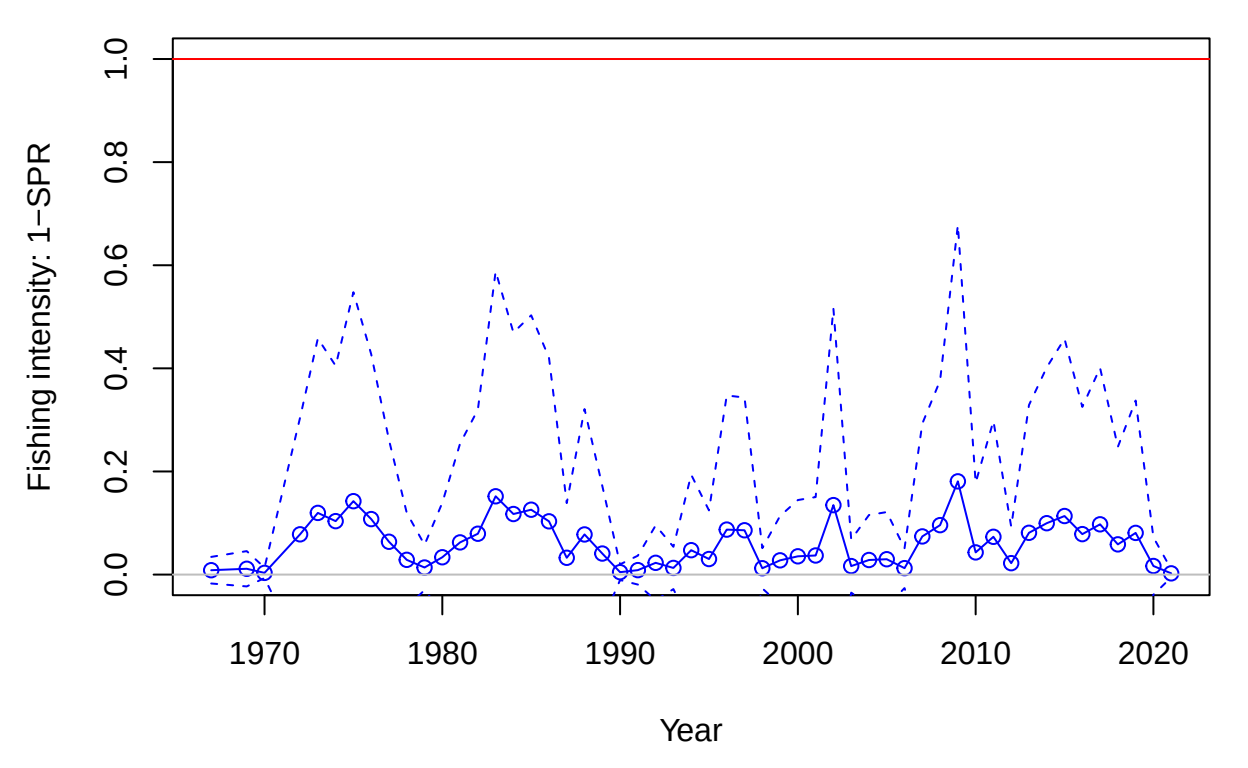

Landings (mt)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
1970
1980
1990
2000
2010
2020
Year

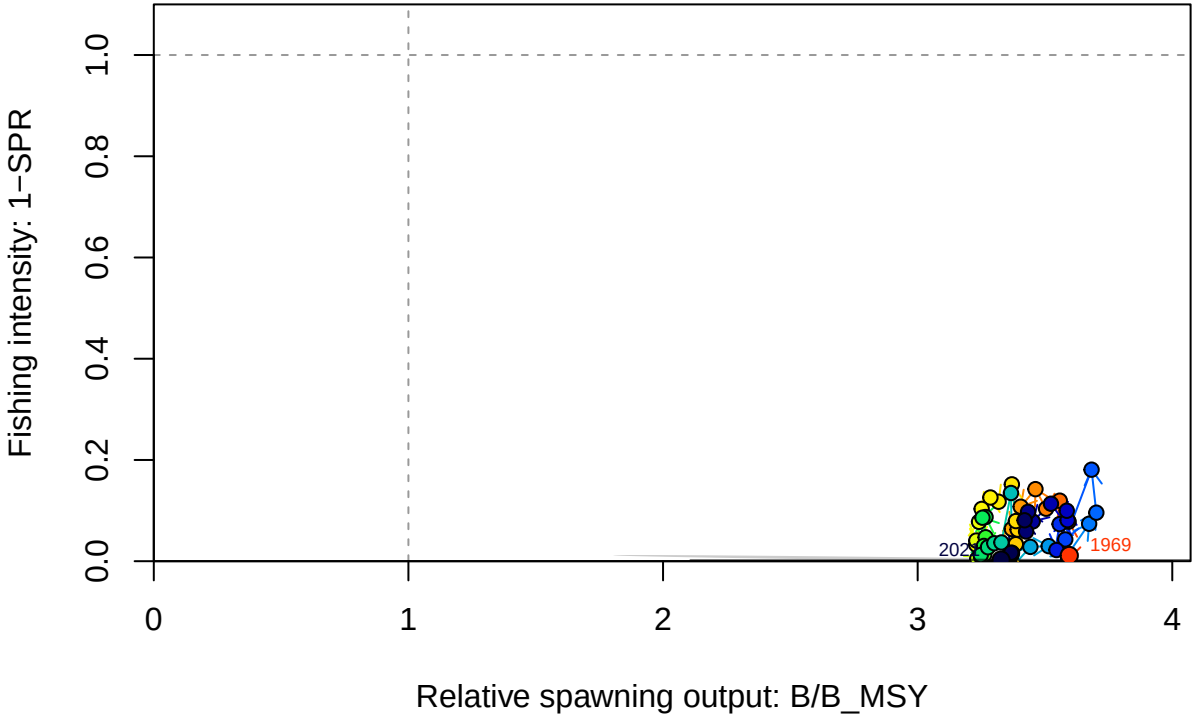

Landings (mt)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
1970
1980
1990
2000
2010
2020
Year

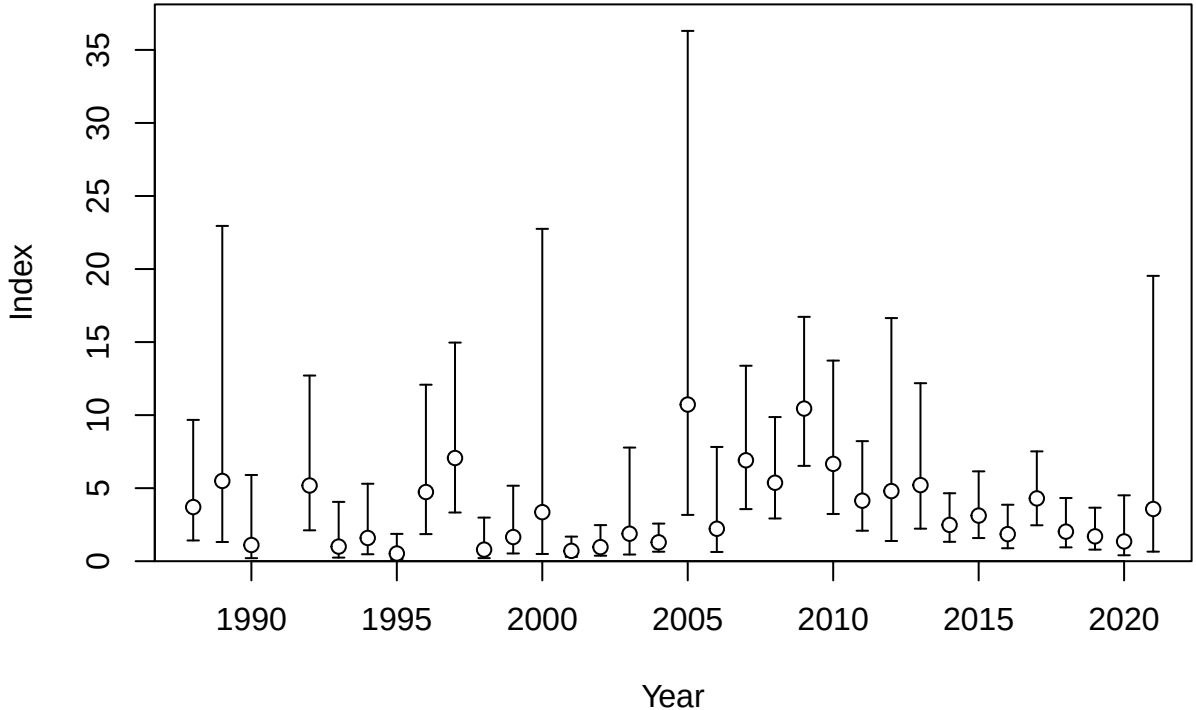

Continuous F
0.000
0.010
0.020
1970
1980
1990
2000
2010
2020
Year

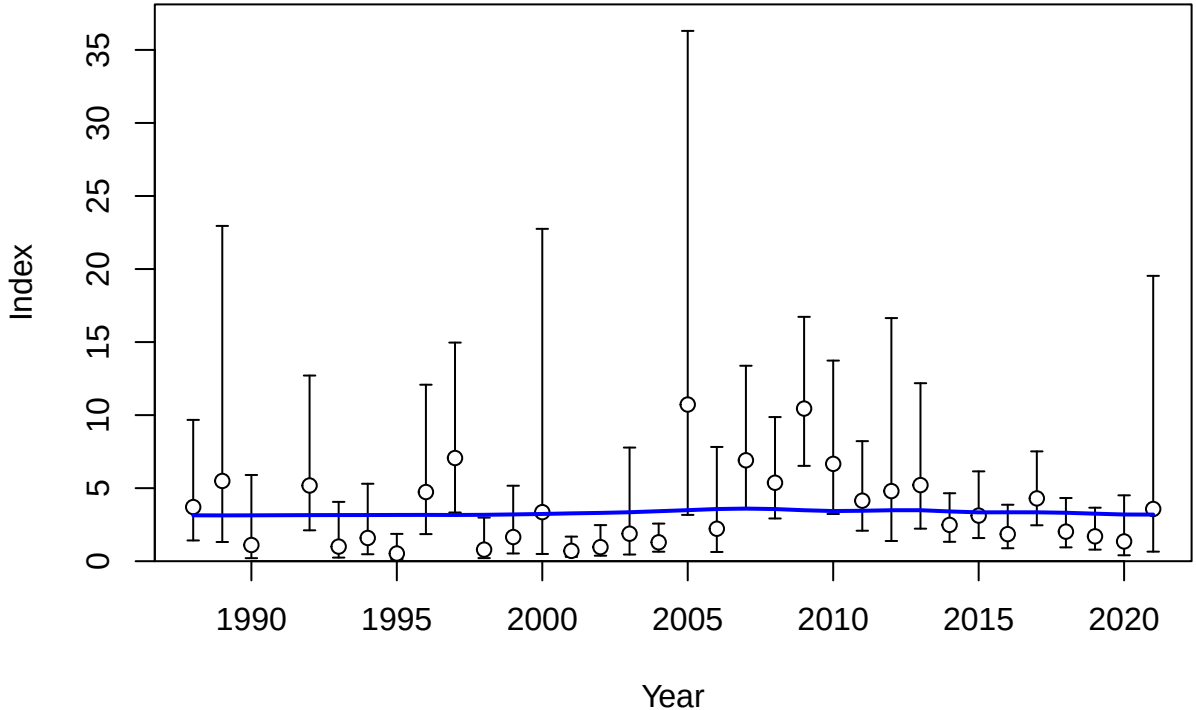

SPR
0.0
0.2
0.4
0.6
0.8
1.0
1970
1980
1990
2000
2010
2020
Year

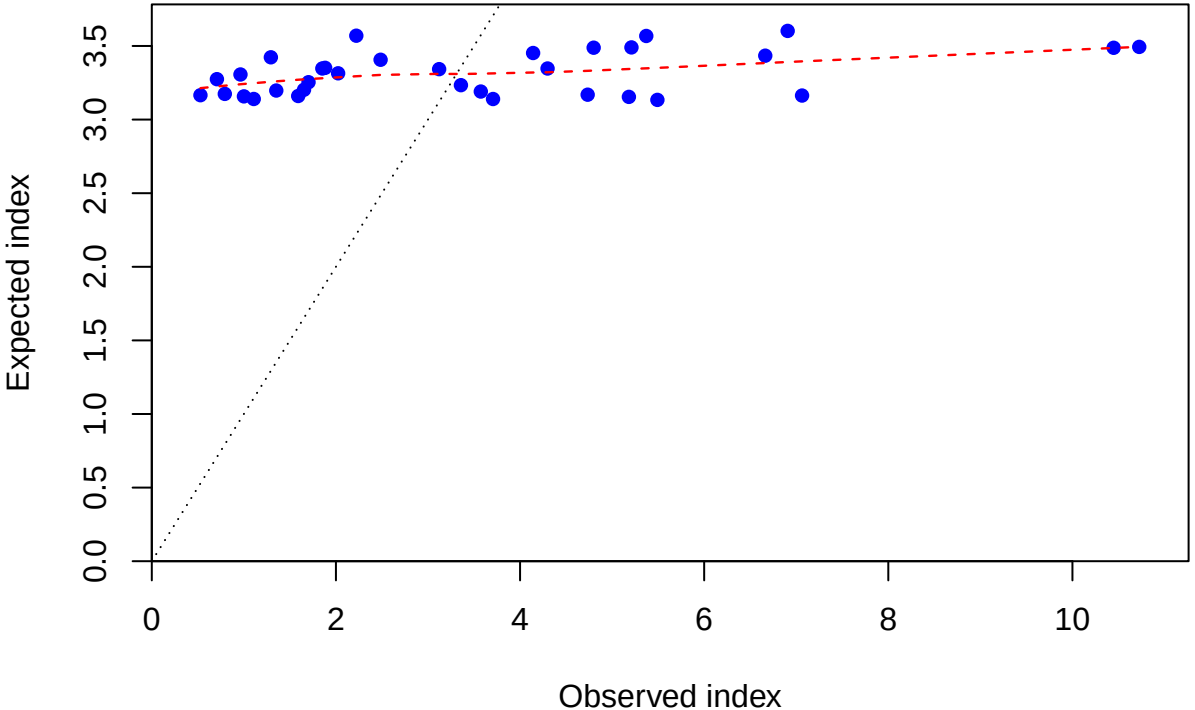

1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
1970
1980
1990
2000
2010
2020
Year

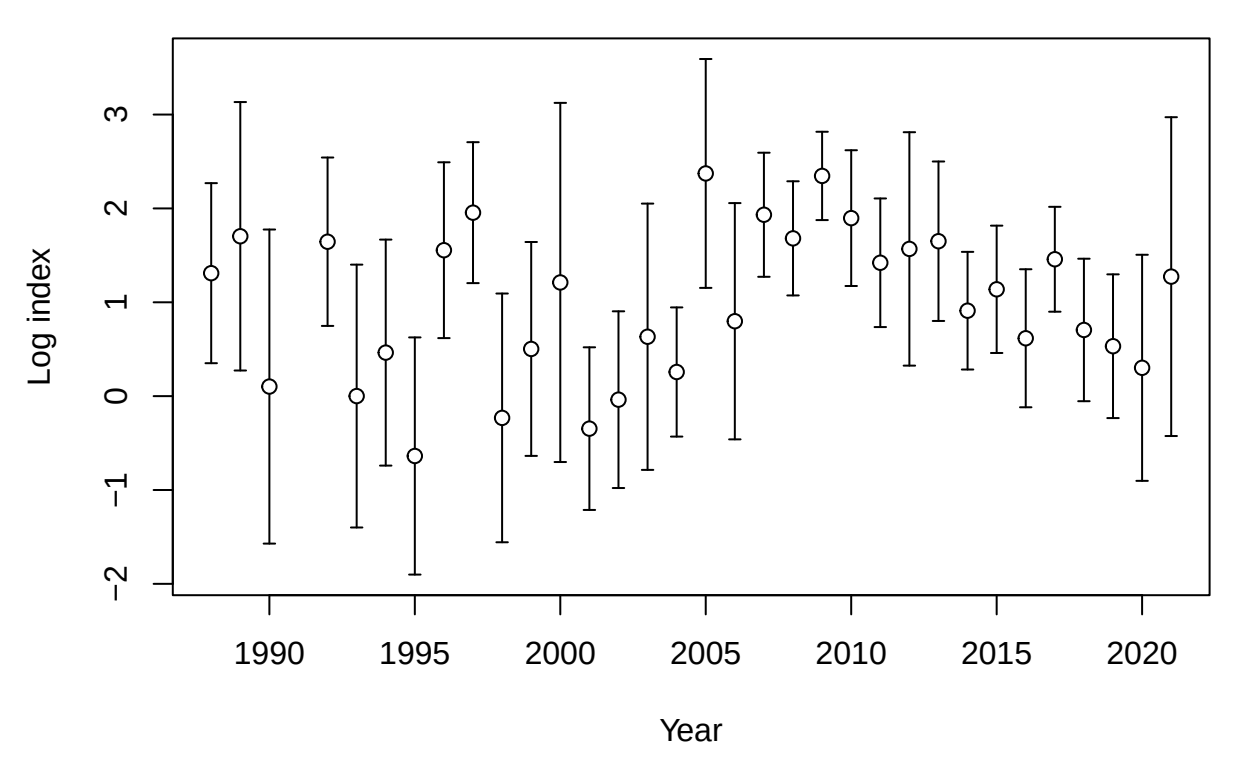

Fishing intensity: 1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
1970
1980
1990
2000
2010
2020
Year

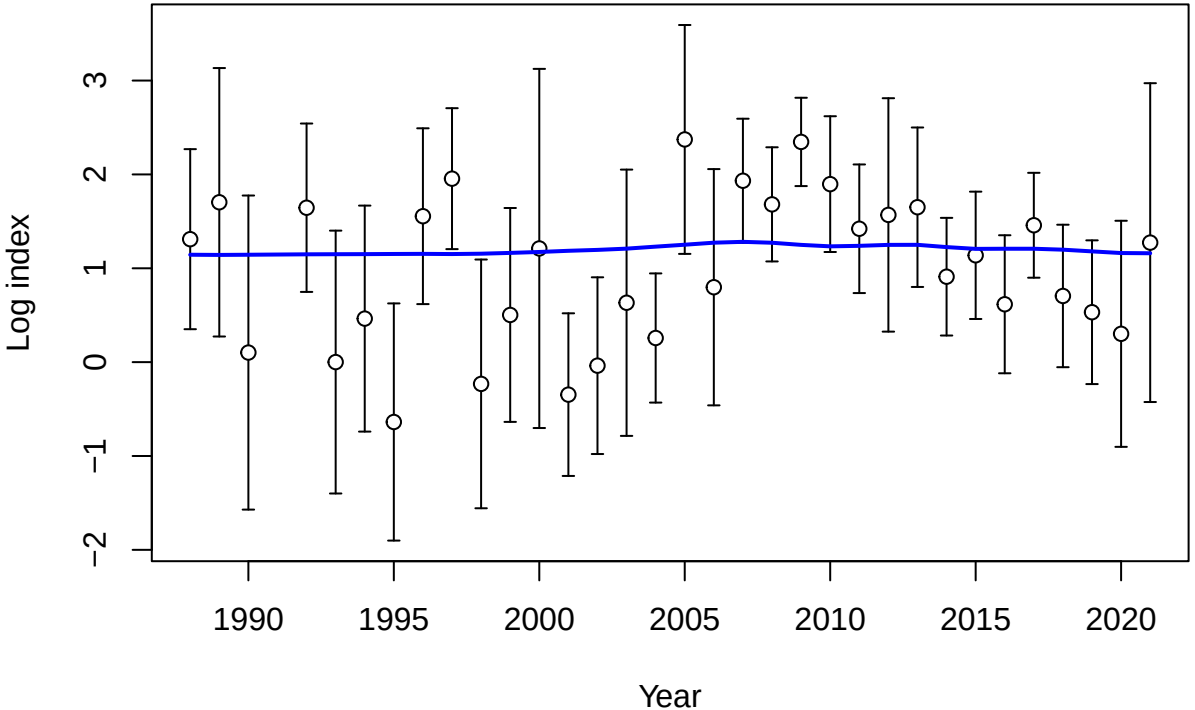

Fishing intensity: 1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
0
1
2
3
4
Relative spawning output: B/B_MSY
1969

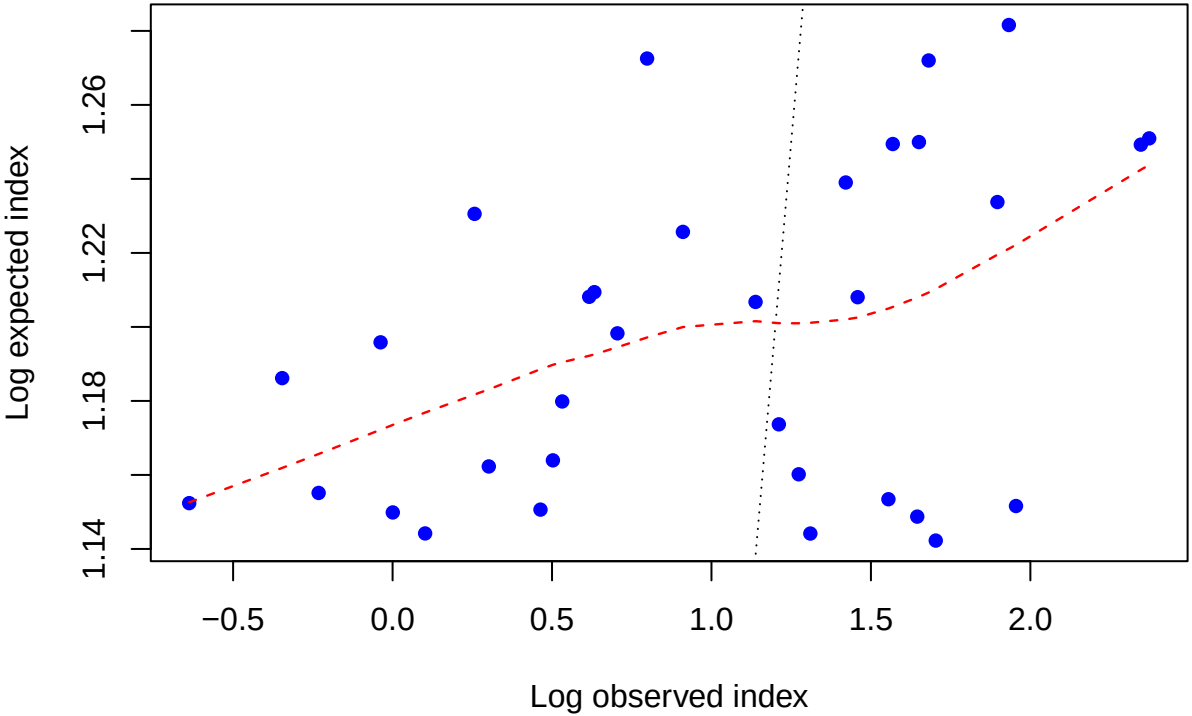

Index
0
5
10
15
20
25
30
35
1990
1995
2000
2005
2010
2015
2020
Year

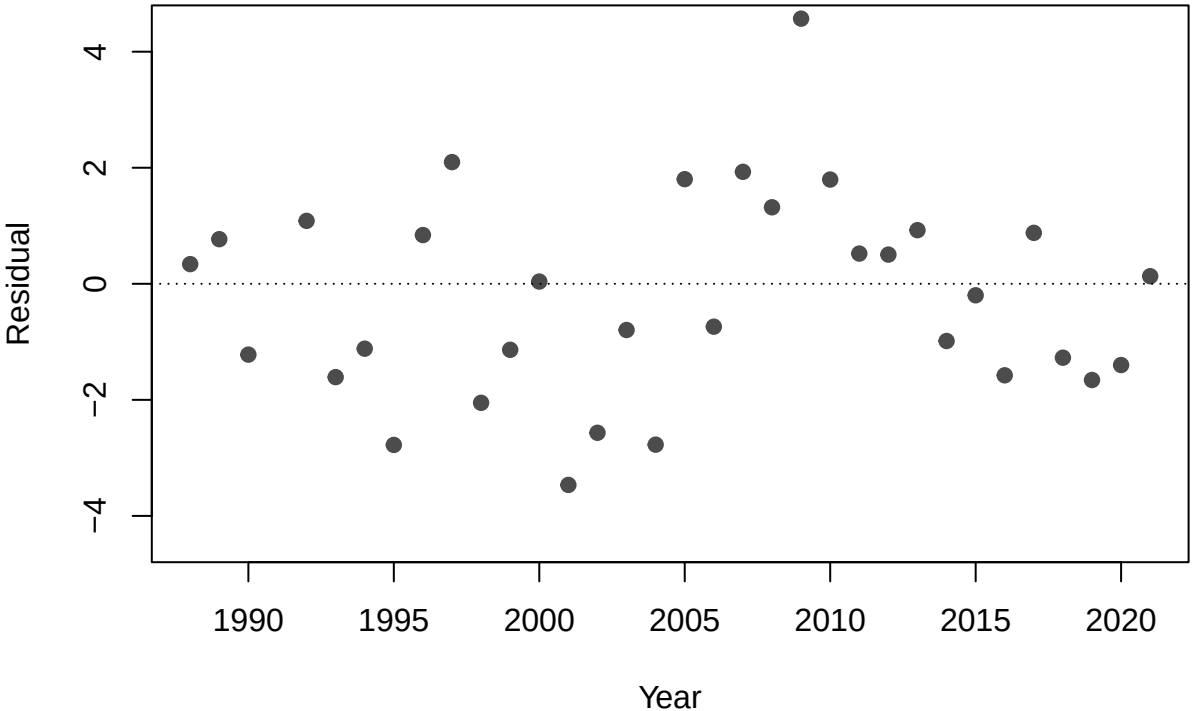

Index
0
5
10
15
20
25
30
35
1990
1995
2000
2005
2010
2015
2020
Year

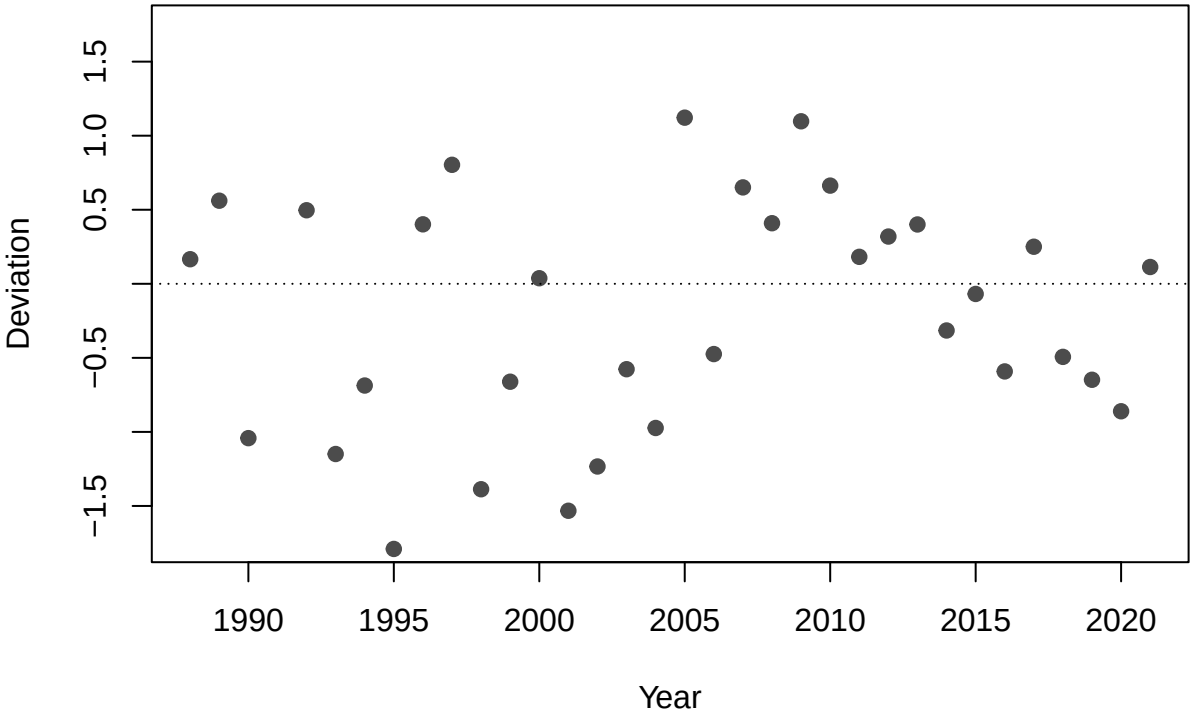

Expected index
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
0
2
4
6
8
10
Observed index

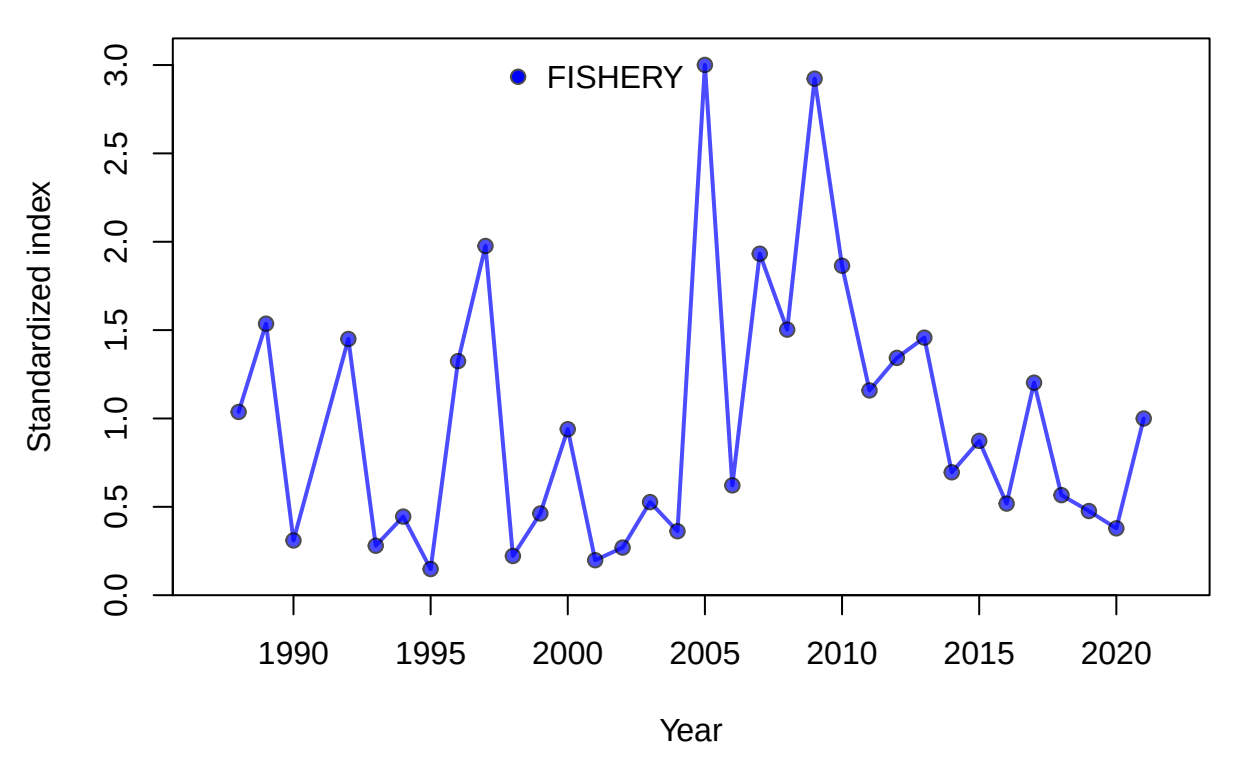

Log index
3
2
1
0
−1
−2
1990
1995
2000
2005
2010
2015
2020
Year

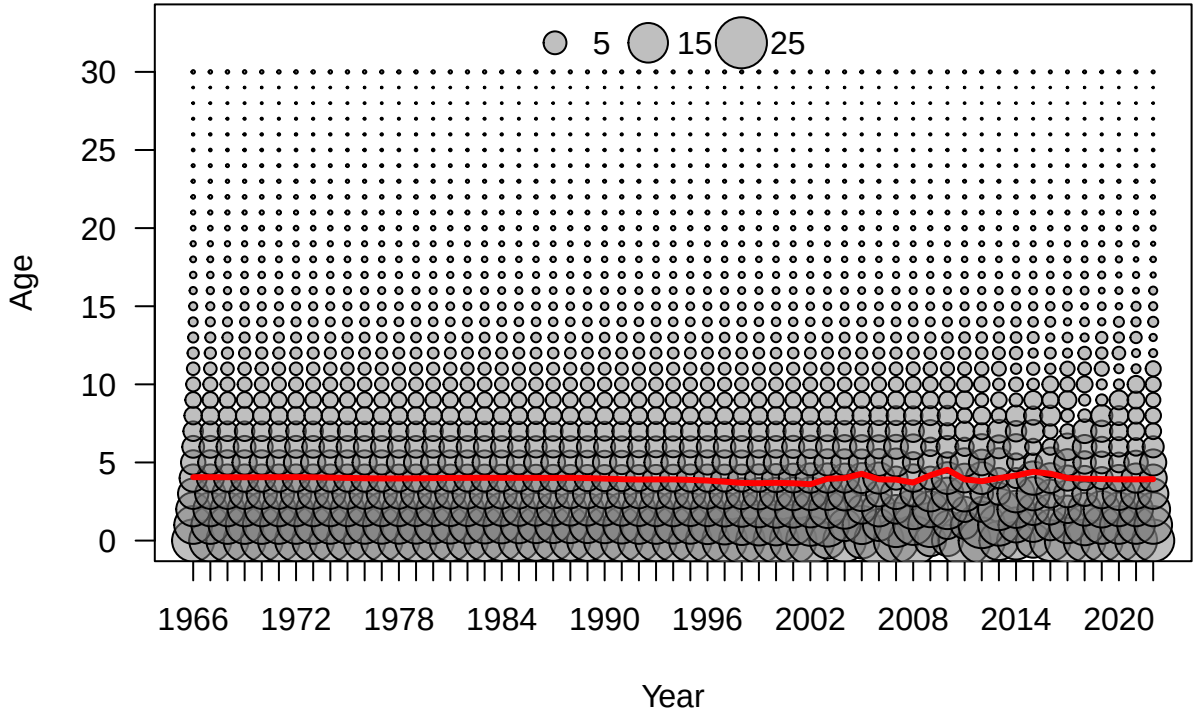

Log index
3
2
1
0
−1
−2
1990
1995
2000
2005
2010
2015
2020
Year

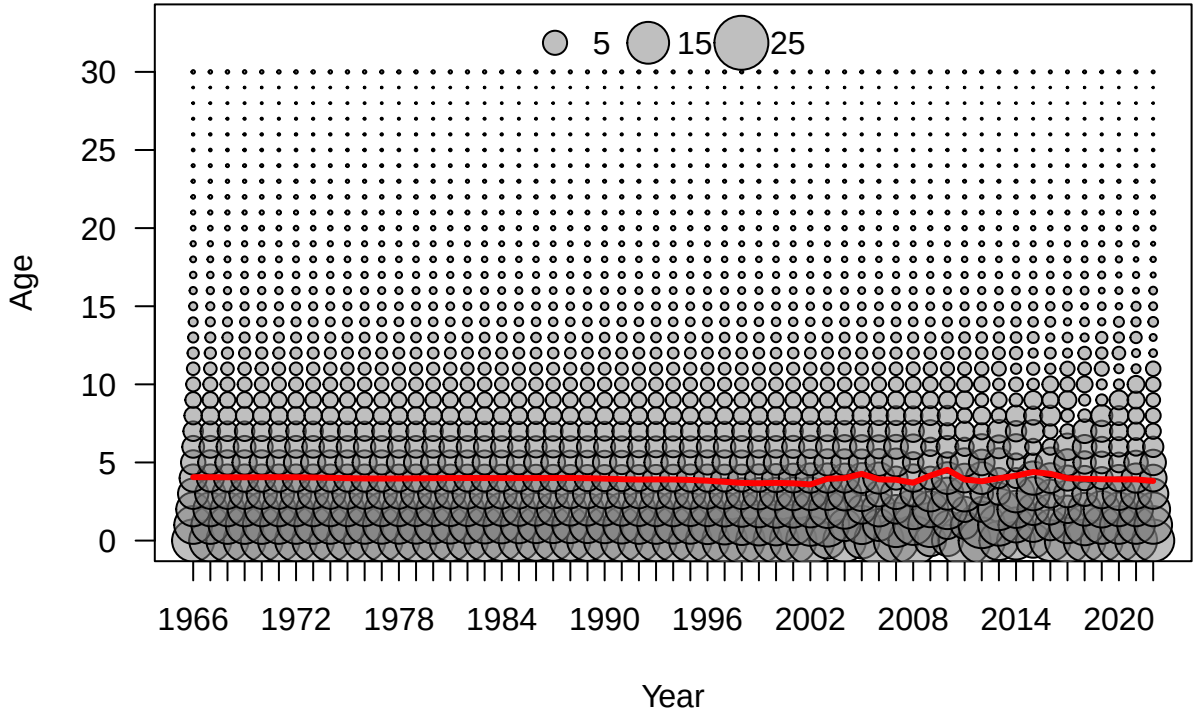

Log expected index
1.14
1.18
1.22
1.26
−0.5
0.0
0.5
1.0
1.5
2.0
Log observed index

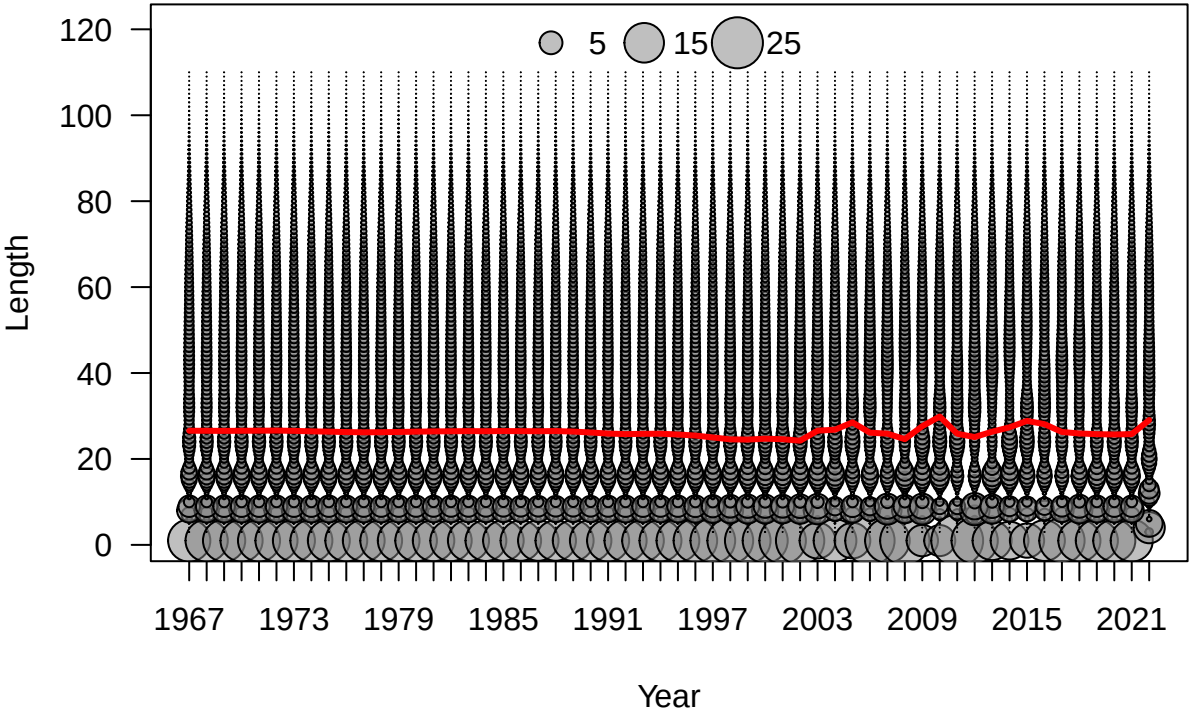

Residual
4
2
0
−2
−4
1990
1995
2000
2005
2010
2015
2020
Year

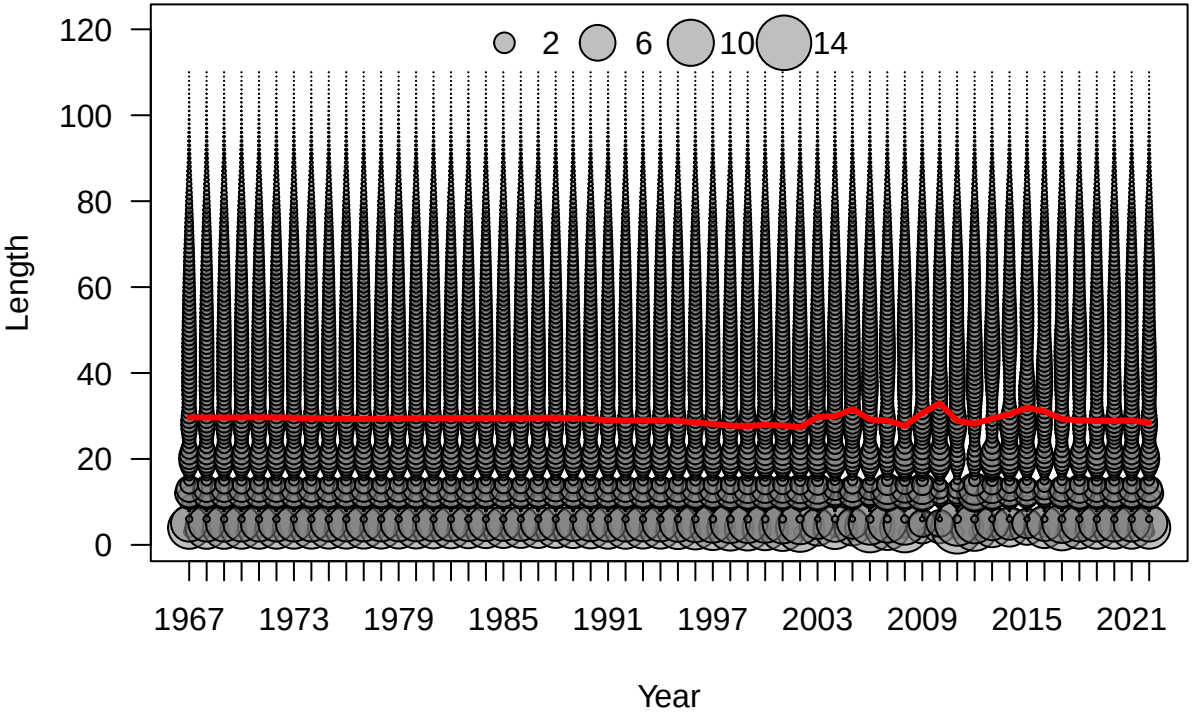

Deviation
1.5
1.0
0.5
−0.5
−1.5
1990
1995
2000
2005
2010
2015
2020
Year

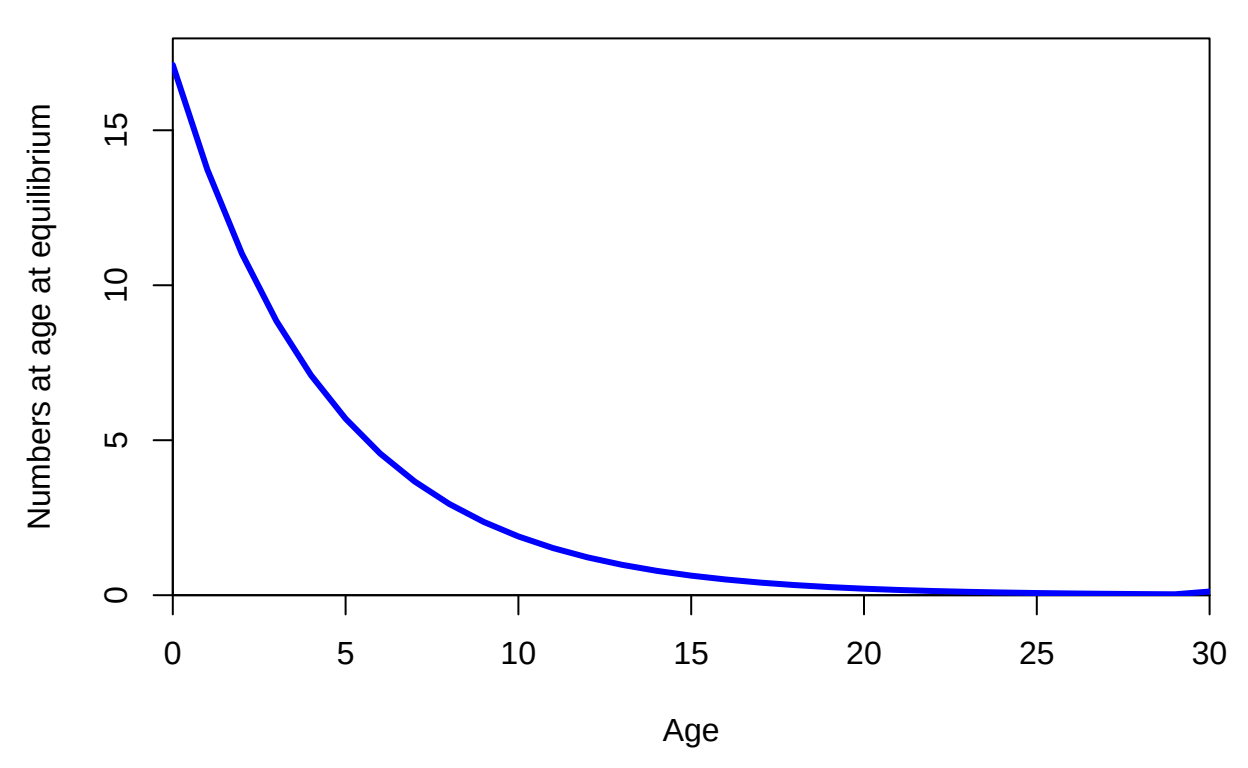

FISHERY
Standardized index
0.0
0.5
1.0
1.5
2.0
2.5
3.0
1990
1995
2000
2005
2010
2015
2020
Year

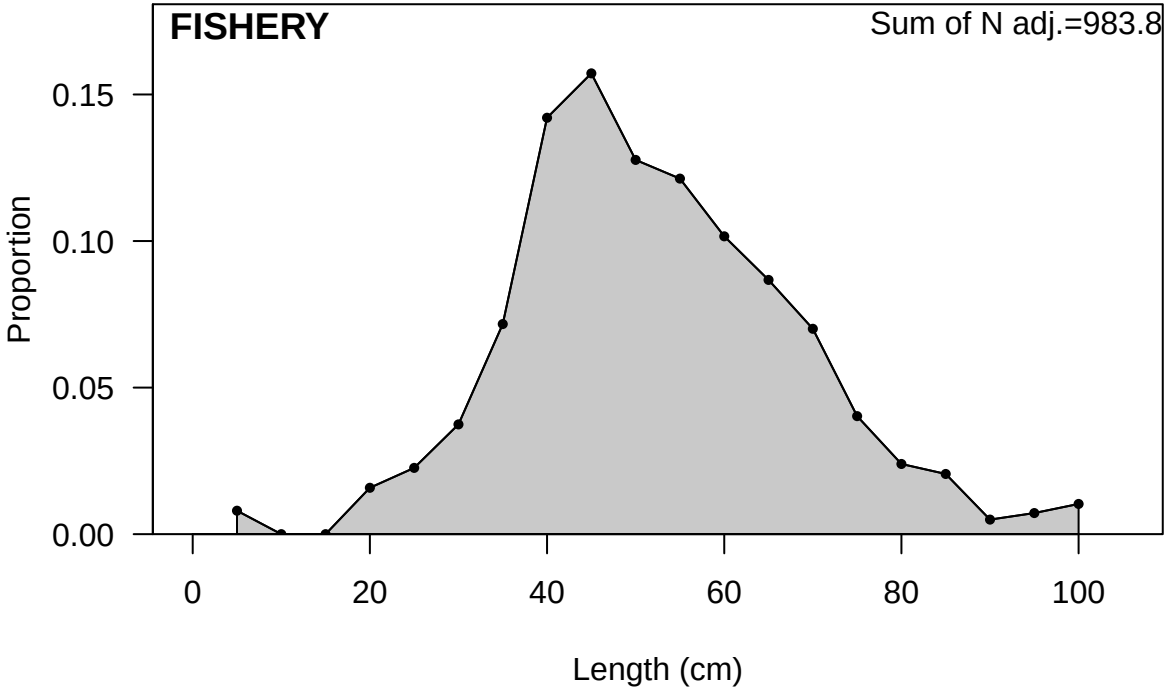

5
15
25
Age
30
25
20
15
10
5
0
1966
1972
1978
1984
1990
1996
2002
2008
2014
2020
Year

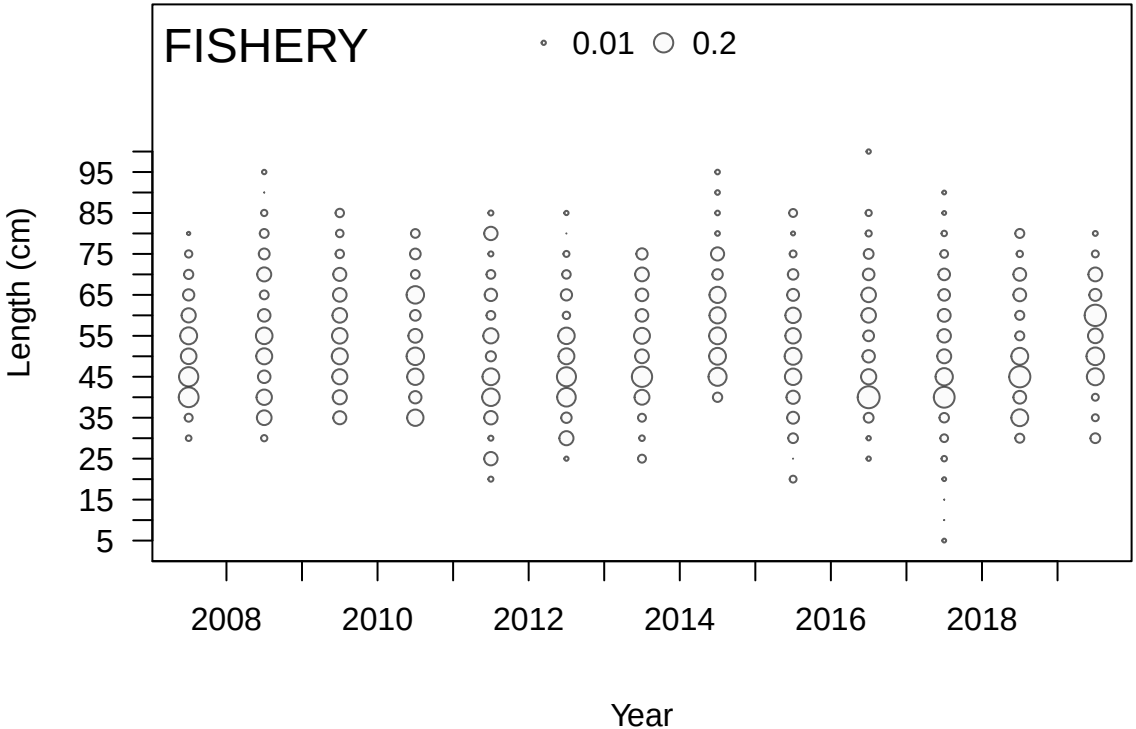

5
15
25
30
25
20
15
10
5
0
Age
1966
1972
1978
1984
1990
1996
2002
2008
2014
2020
Year

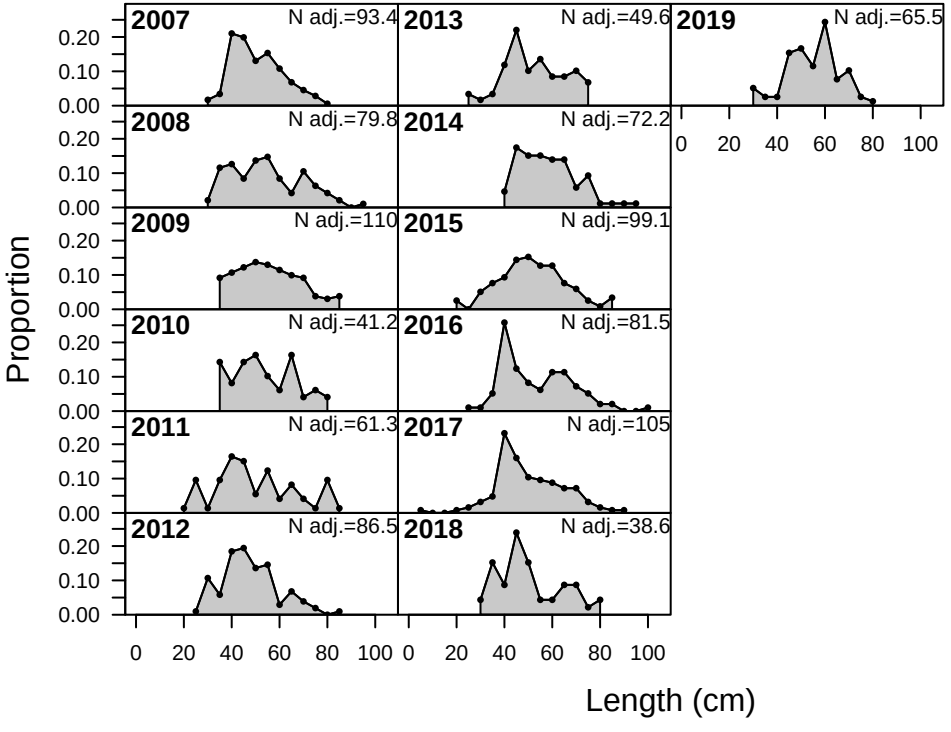

5
15
25
120
100
80
60
40
20
0
Length
1967
1973
1979
1985
1991
1997
2003
2009
2015
2021
Year

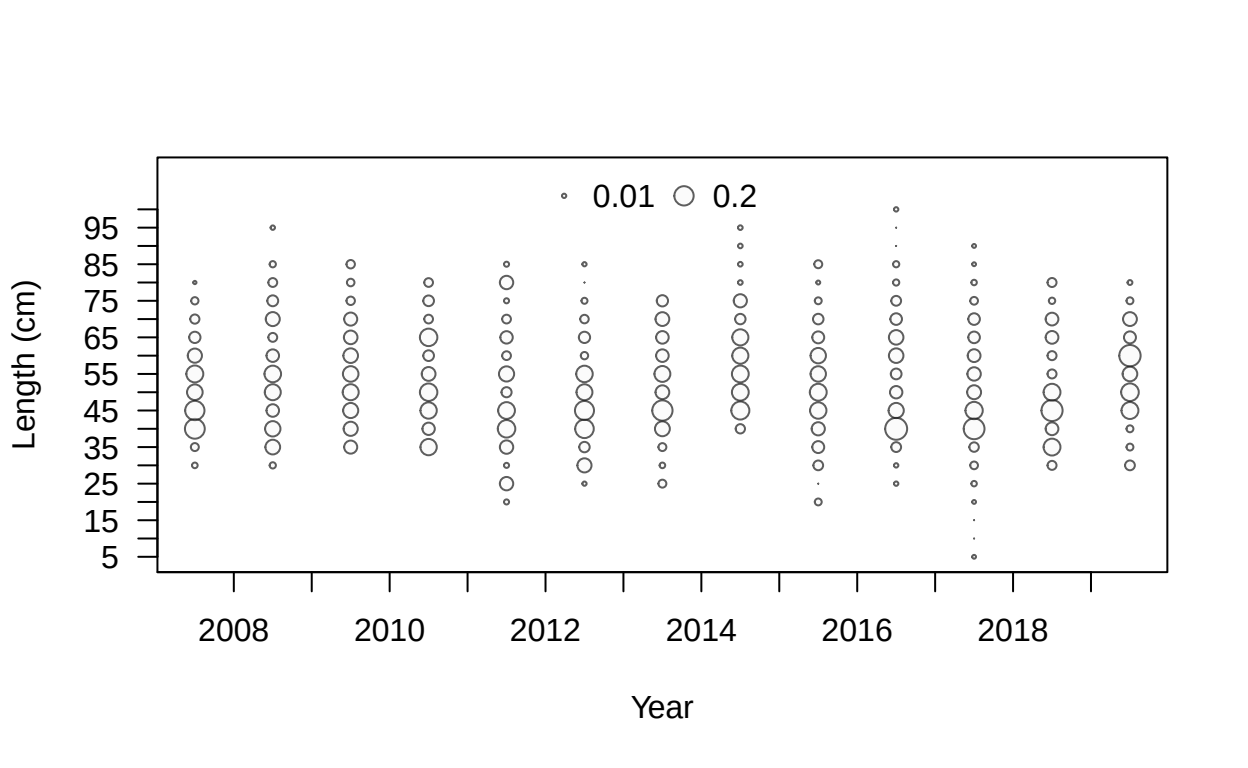

2
6
10
14
120
100
80
60
40
20
0
Length
1967
1973
1979
1985
1991
1997
2003
2009
2015
2021
Year

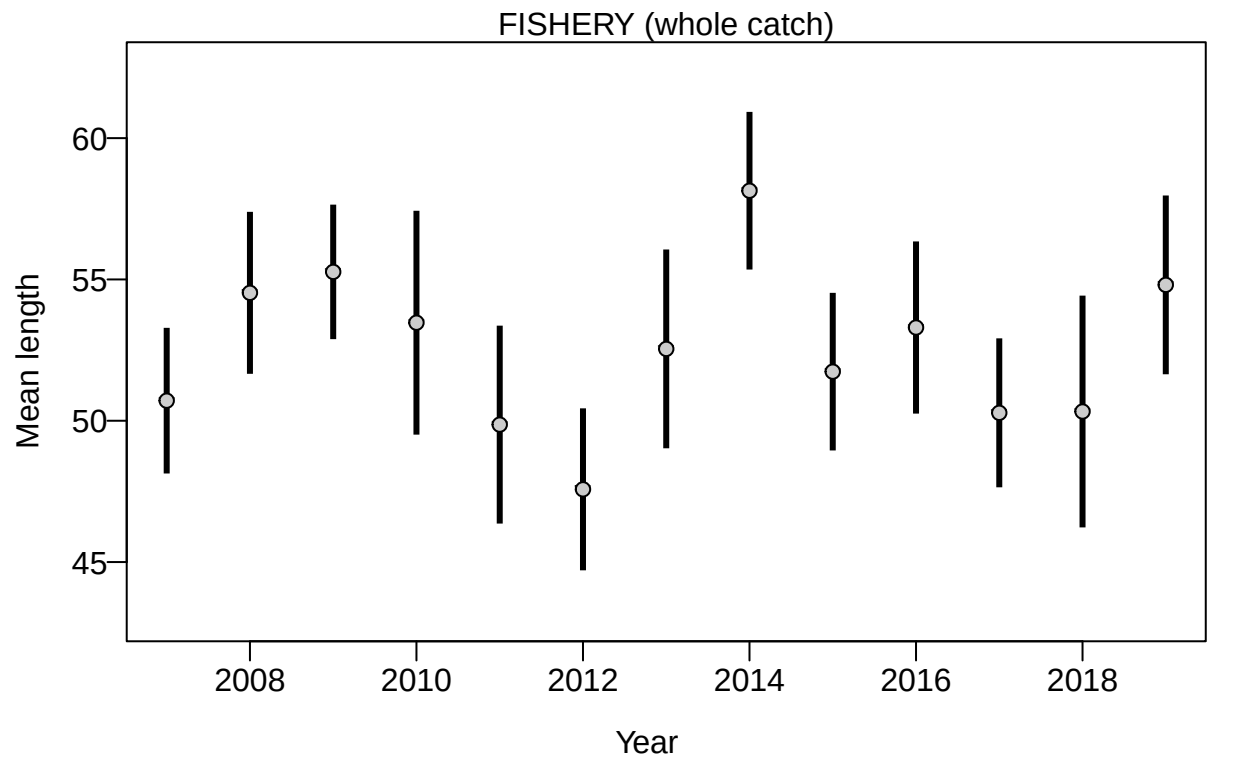

Numbers at age at equilibrium
0
5
10
15
0
5
10
15
20
25
30
Age

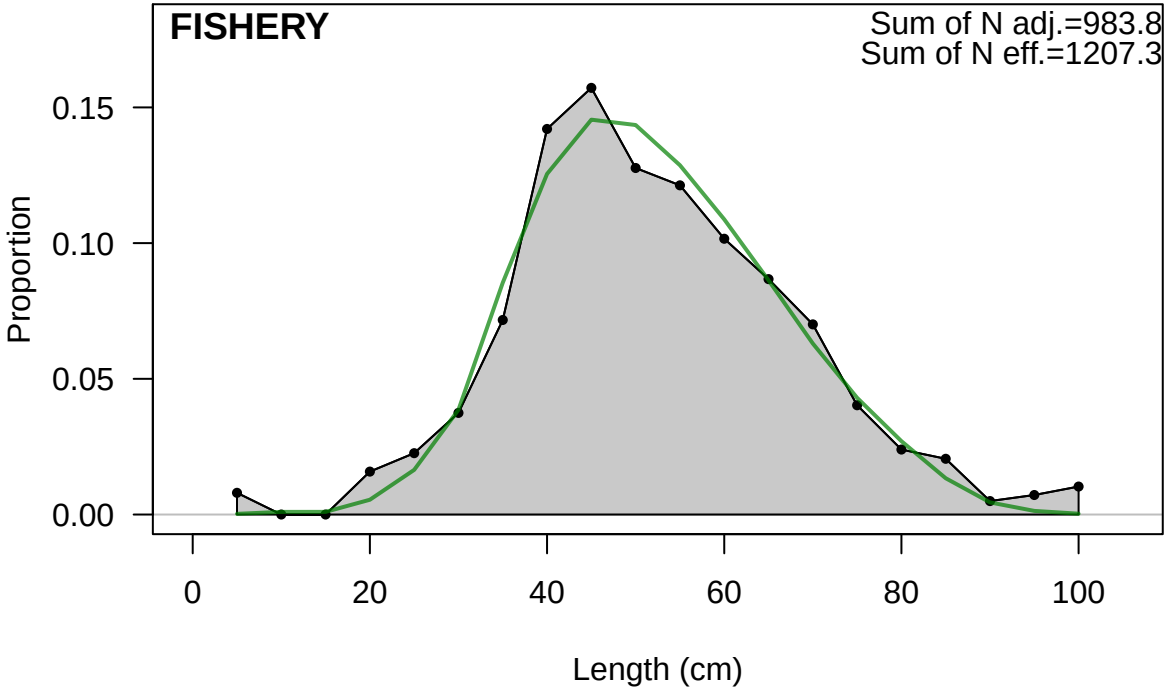

FISHERY
Sum of N adj.=983.8
Proportion
0.00
0.05
0.10
0.15
0
20
40
60
80
100
Length (cm)

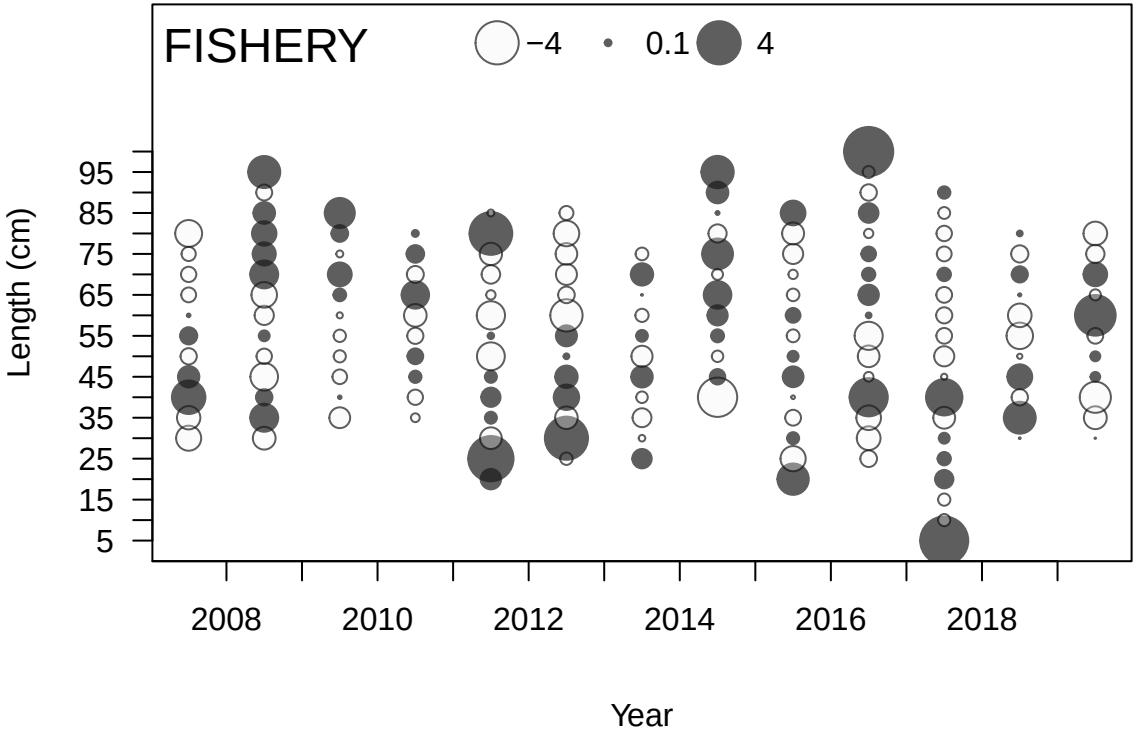

FISHERY
0.01
0.2
Length (cm)
95
85
75
65
55
45
35
25
15
5
2008
2010
2012
2014
2016
2018
Year

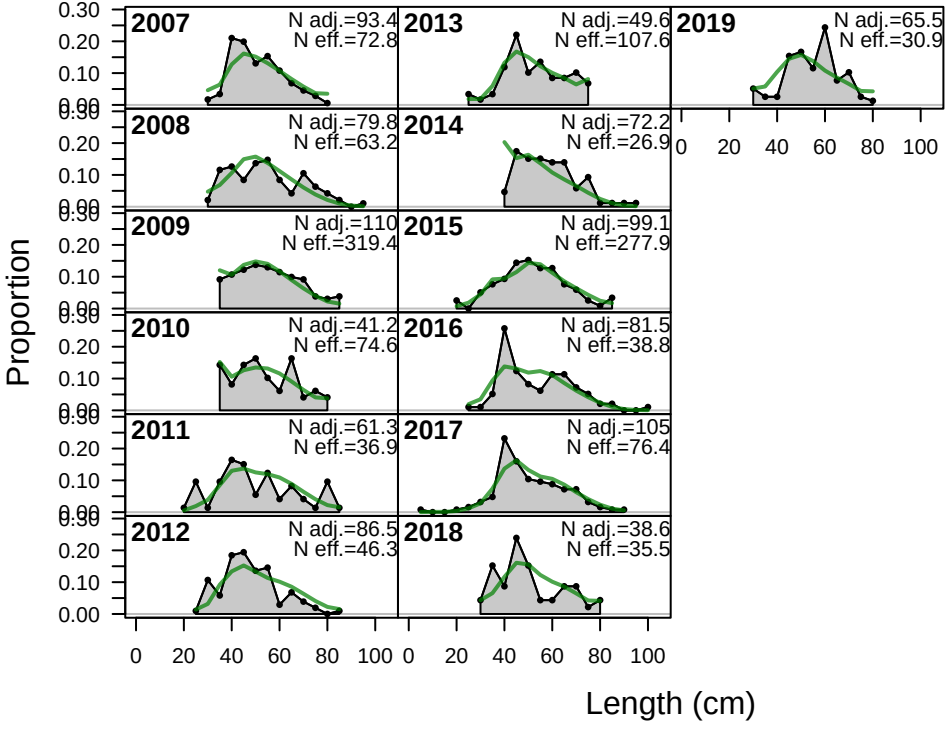

2007
N adj.=93.4
2013
N adj.=49.6
2019
N adj.=65.5
2008
N adj.=79.8
2014
N adj.=72.2
2009
N adj.=110
2015
N adj.=99.1
2010
N adj.=41.2
2016
N adj.=81.5
2011
N adj.=61.3
2017
N adj.=105
2012
N adj.=86.5
2018
N adj.=38.6
Proportion
0.00
0.10
0.20
0
20
40
60
80
100
Length (cm)

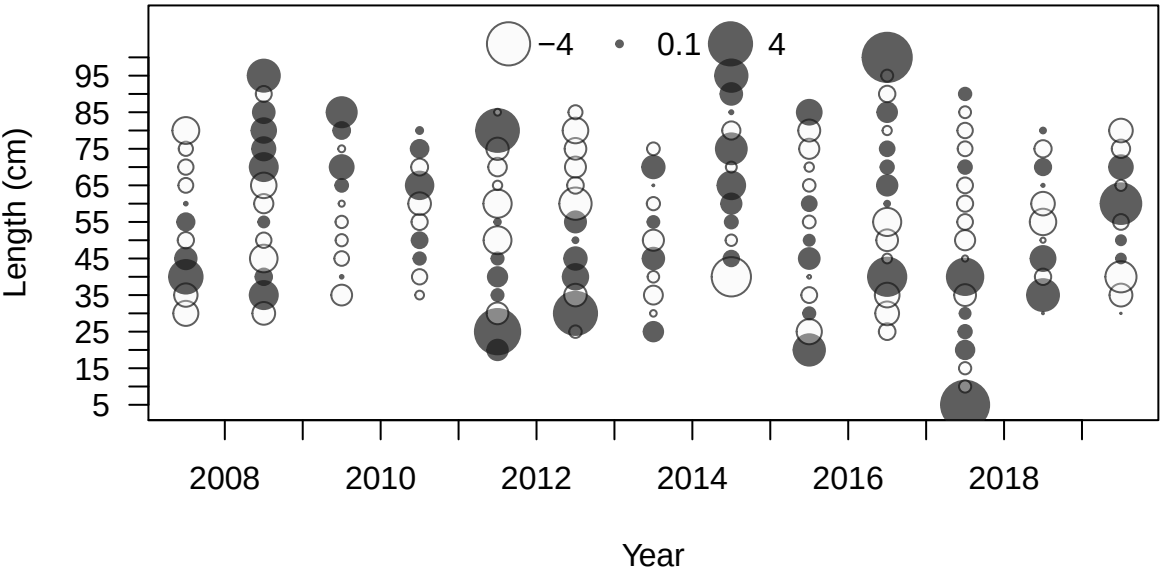

0.01
0.2
Length (cm)
95
85
75
65
55
45
35
25
15
5
2008
2010
2012
2014
2016
2018
Year

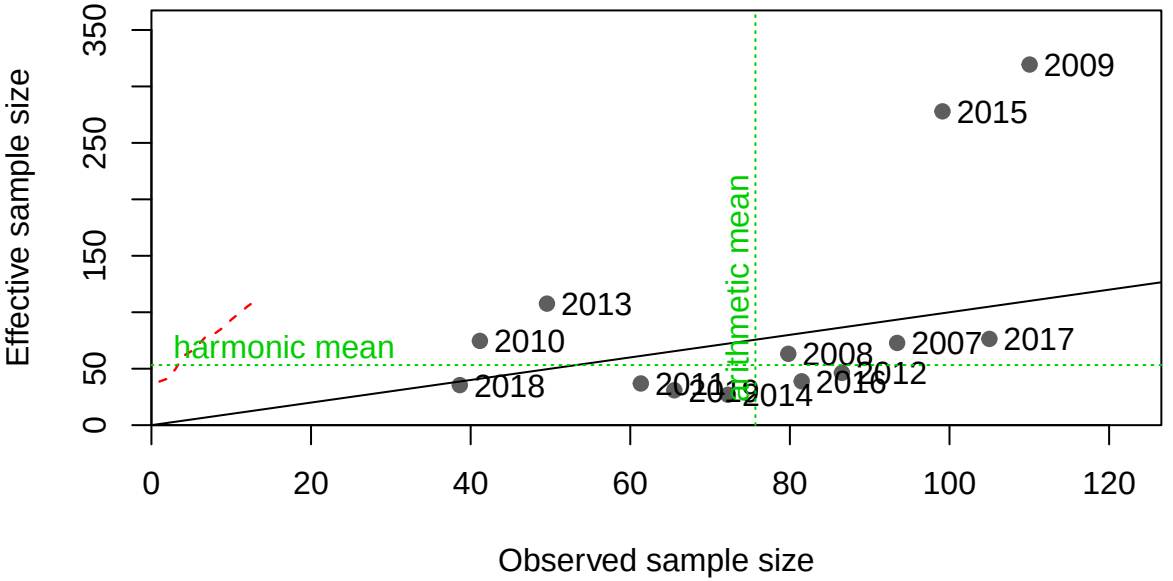

FISHERY (whole catch)
Mean length
60
55
50
45
2008
2010
2012
2014
2016
2018
Year

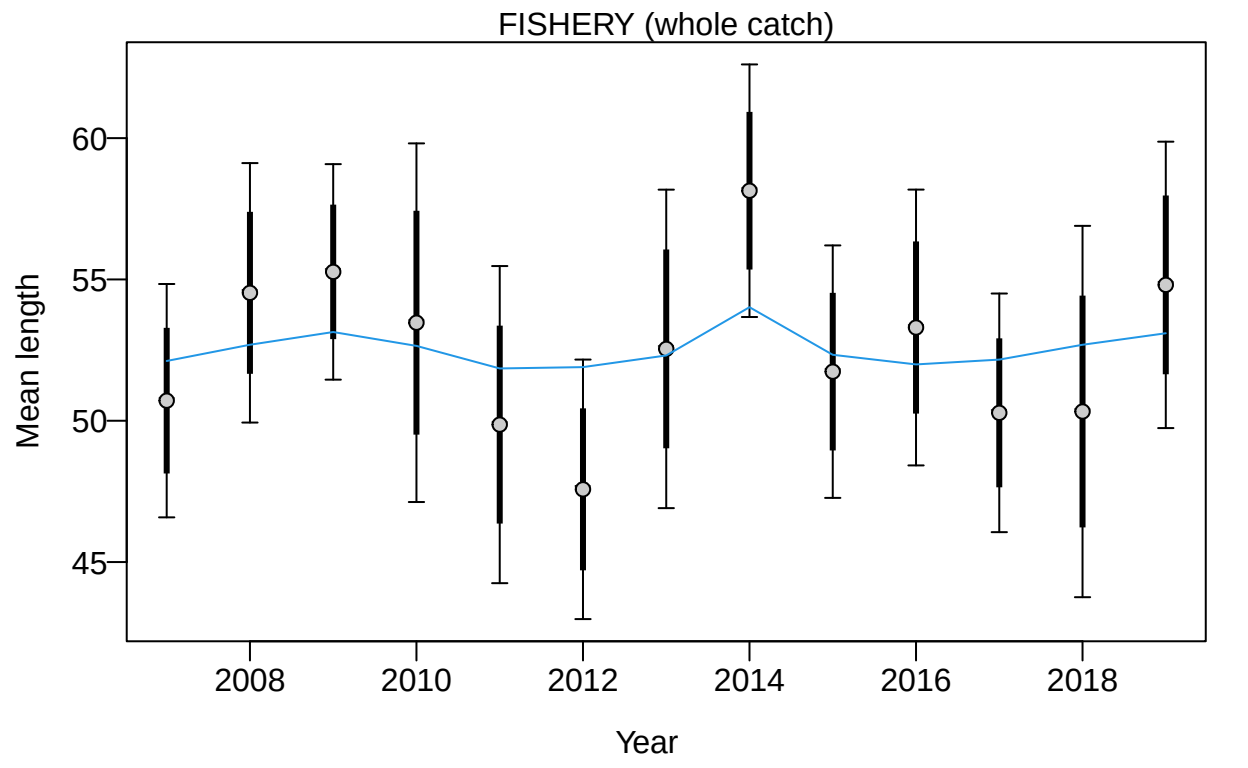

FISHERY
Sum of N adj.=983.8
Sum of N eff.=1207.3
Proportion
0.15
0.10
0.05
0.00
0
20
40
60
80
100
Length (cm)

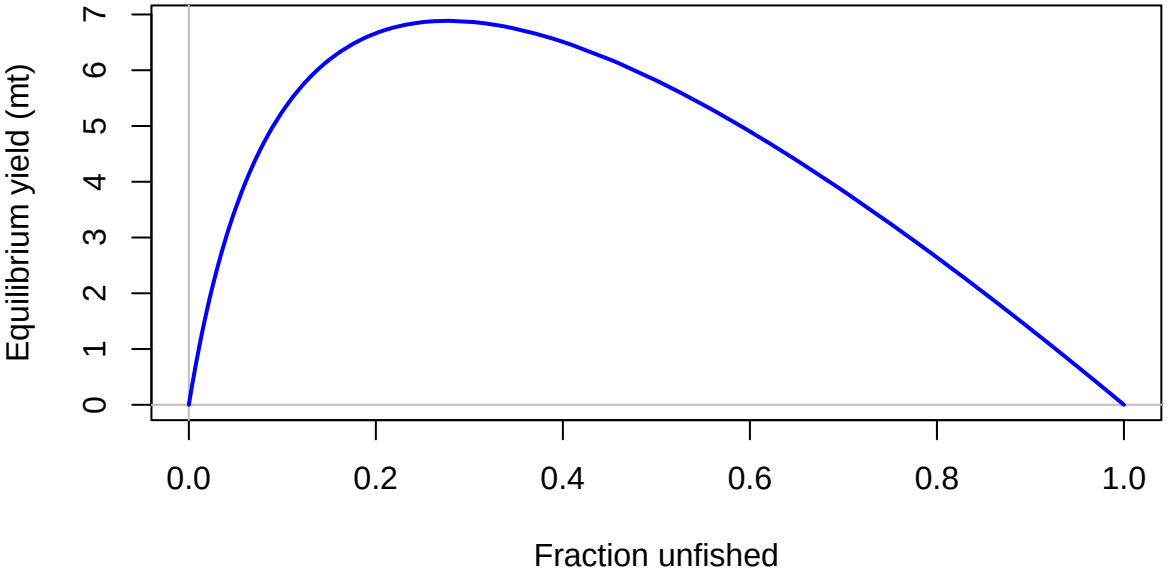

FISHERY
−4
0.1
4
Length (cm)
95
85
75
65
55
45
35
25
15
5
2008
2010
2012
2014
2016
2018
Year

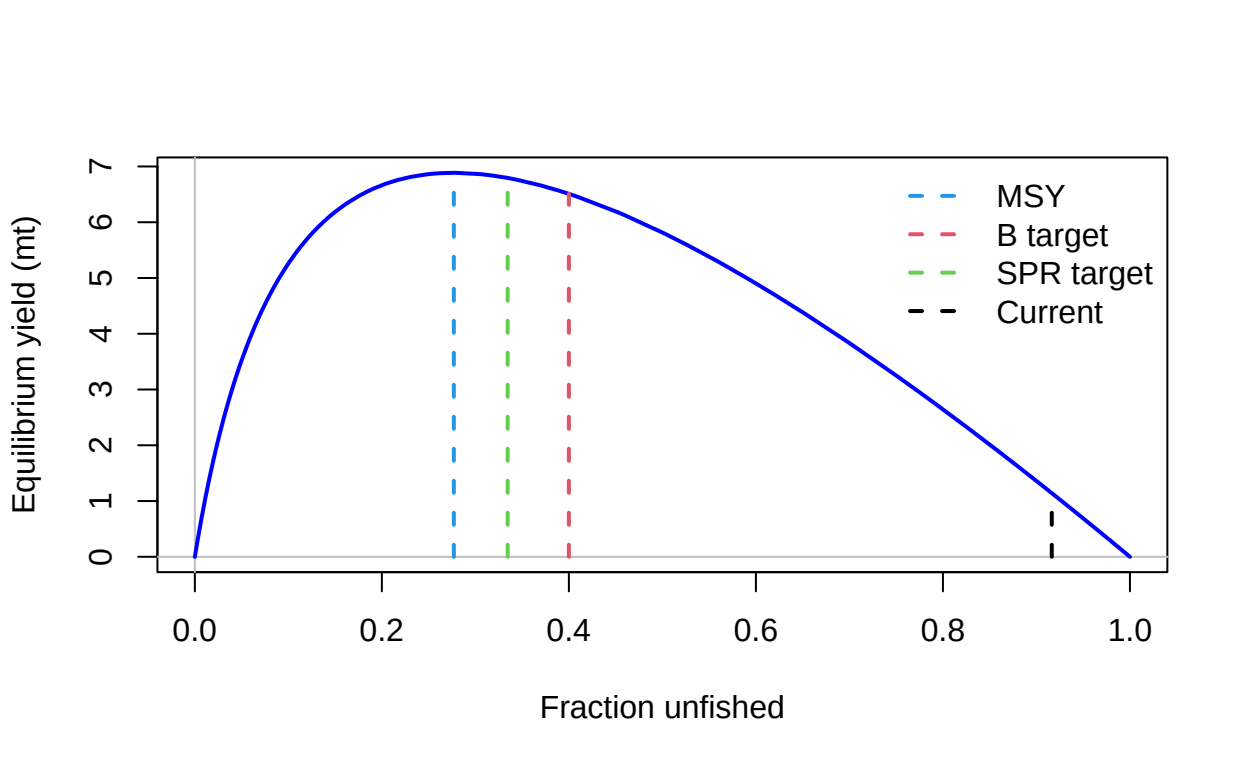

2007
N adj.=93.4
N eff.=72.8
2013
N adj.=49.6
N eff.=107.6
2019
N adj.=65.5
N eff.=30.9
2008
N adj.=79.8
N eff.=63.2
2014
N adj.=72.2
N eff.=26.9
2009
N adj.=110
N eff.=319.4
2015
N adj.=99.1
N eff.=277.9
2010
N adj.=41.2
N eff.=74.6
2016
N adj.=81.5
N eff.=38.8
2011
N adj.=61.3
N eff.=36.9
2017
N adj.=105
N eff.=76.4
2012
N adj.=86.5
N eff.=46.3
2018
N adj.=38.6
N eff.=35.5
Proportion
0.00
0.10
0.20
0.30
0
20
40
60
80
100
Length (cm)

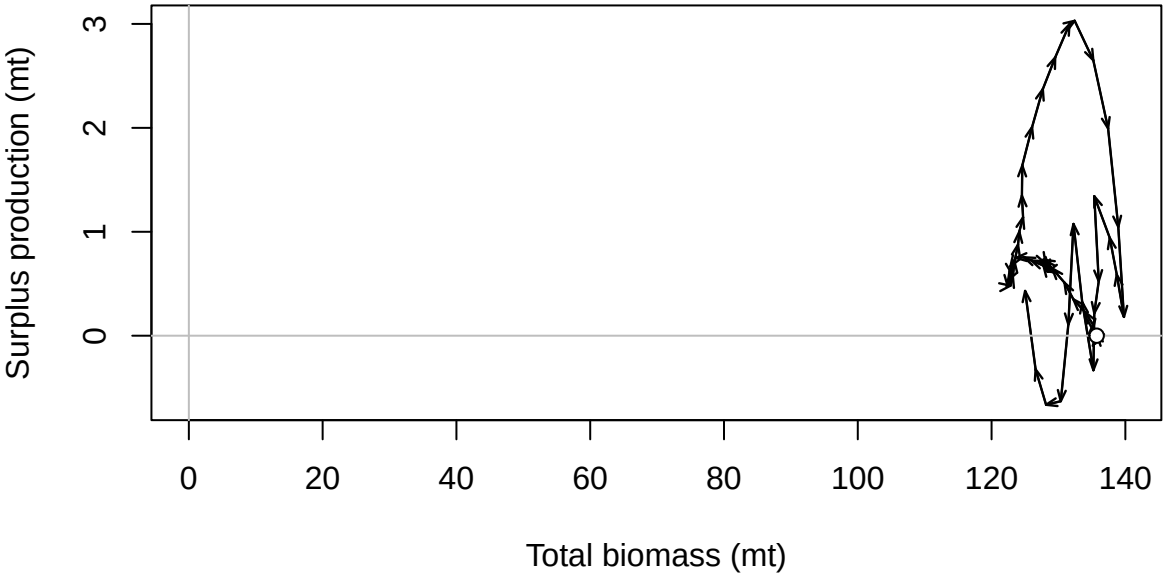

−4
0.1
4
95
85
75
65
55
45
35
25
15
5
Length (cm)
2008
2010
2012
2014
2016
2018
Year

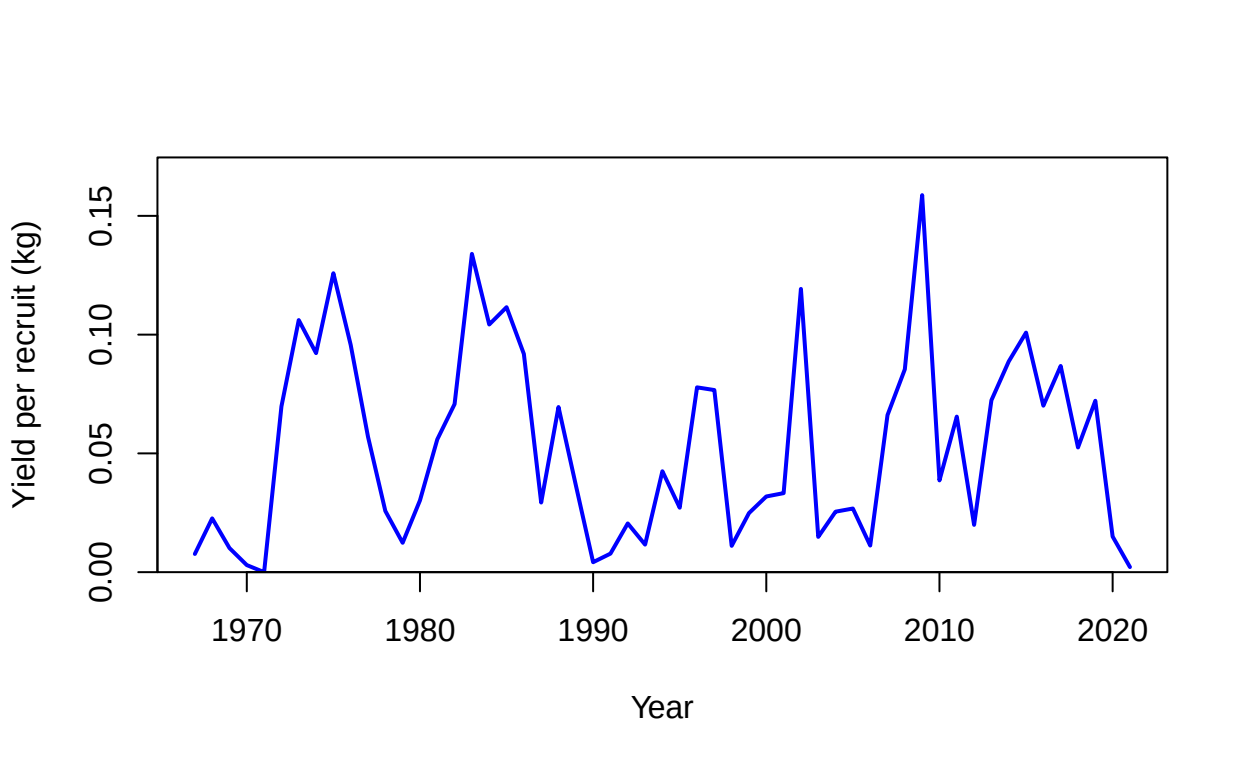

Effective sample size
0
50
150
250
350
0
20
40
60
80
100
120
Observed sample size
2009
2015
2013
2010
2017
2008
2007
2012
2016
2018
2014
harmonic mean
arithmetic mean

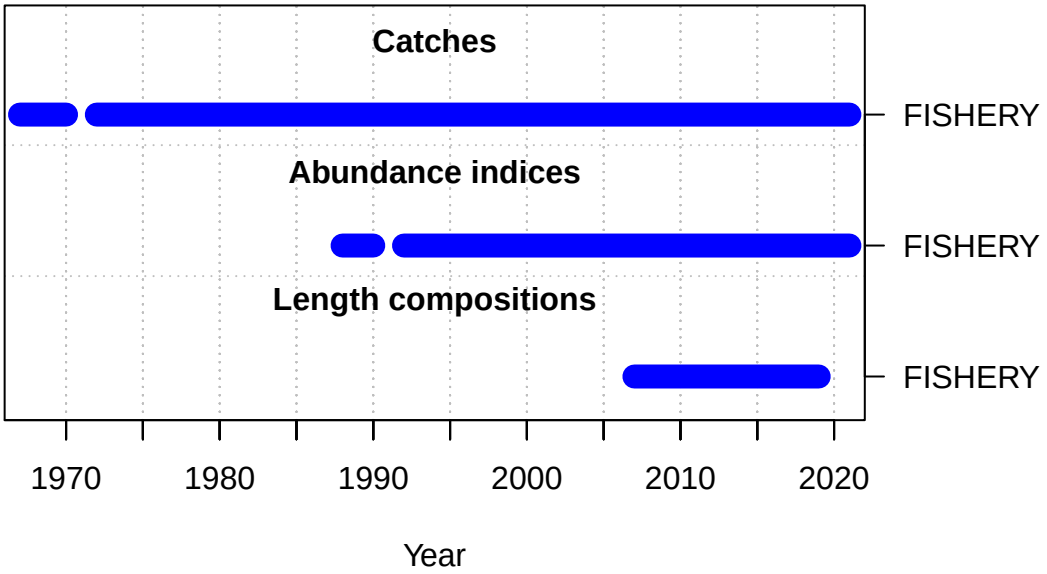

FISHERY (whole catch)
Mean length
60
55
50
45
2008
2010
2012
2014
2016
2018
Year

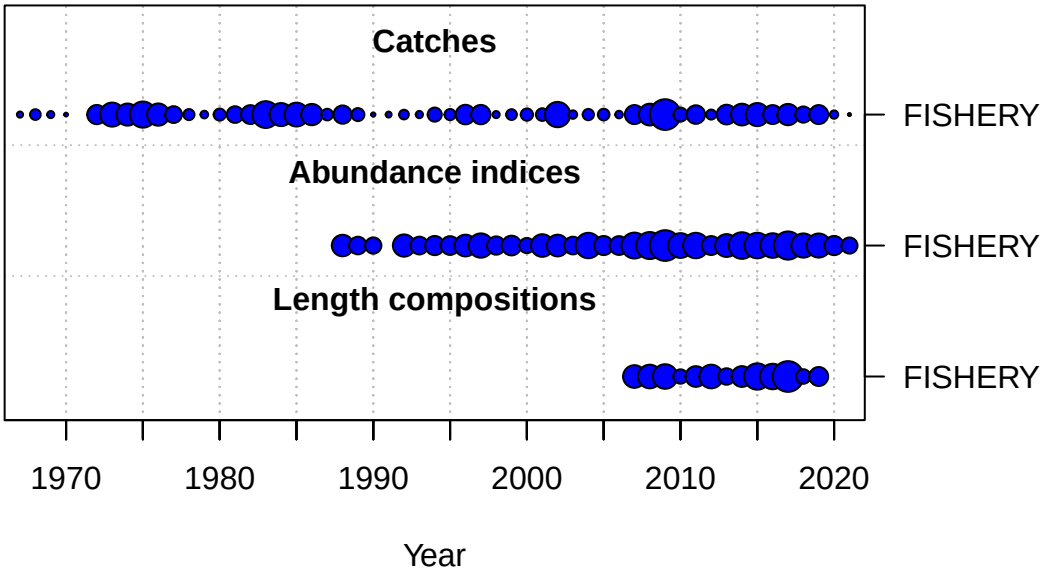

Equilibrium yield (mt)
0
1
2
3
4
5
6
7
0.0
0.2
0.4
0.6
0.8
1.0
Fraction unfished

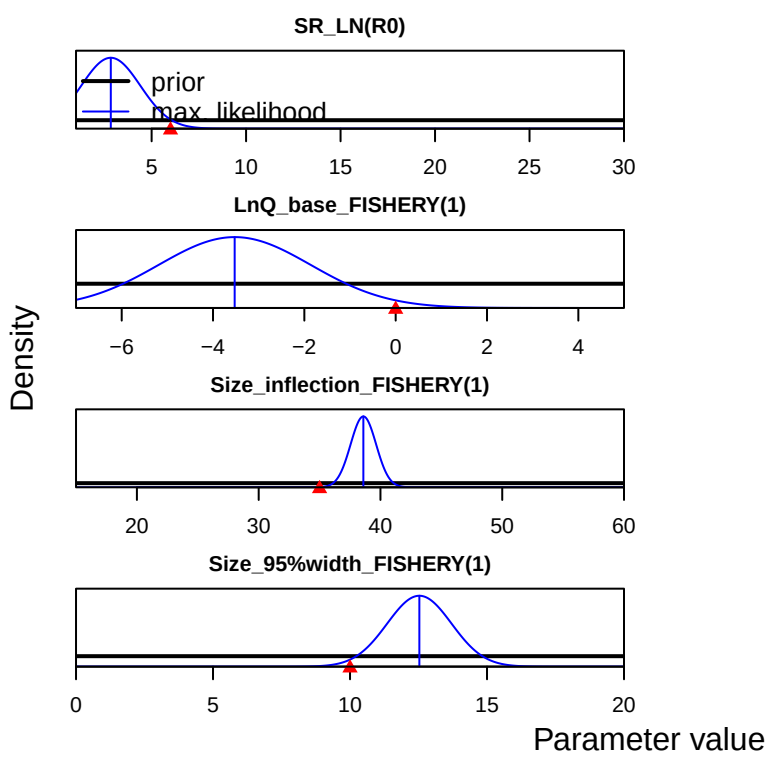

Equilibrium yield (mt)
0
1
2
3
4
5
6
7
0.0
0.2
0.4
0.6
0.8
1.0
Fraction unfished
MSY
B target
SPR target
Current


Surplus production (mt)
3
2
1
0
0
20
40
60
80
100
120
140
Total biomass (mt)


Yield per recruit (kg)
0.00
0.05
0.10
0.15
1970
1980
1990
2000
2010
2020
Year


Catches
FISHERY
Abundance indices
FISHERY
Length compositions
FISHERY
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
5
10
15
20
25
30
LnQ_base_FISHERY(1)
−6
−4
−2
0
2
4
Size_inflection_FISHERY(1)
20
30
40
50
60
Size_95%width_FISHERY(1)
0
5
10
15
20
Density
Parameter value