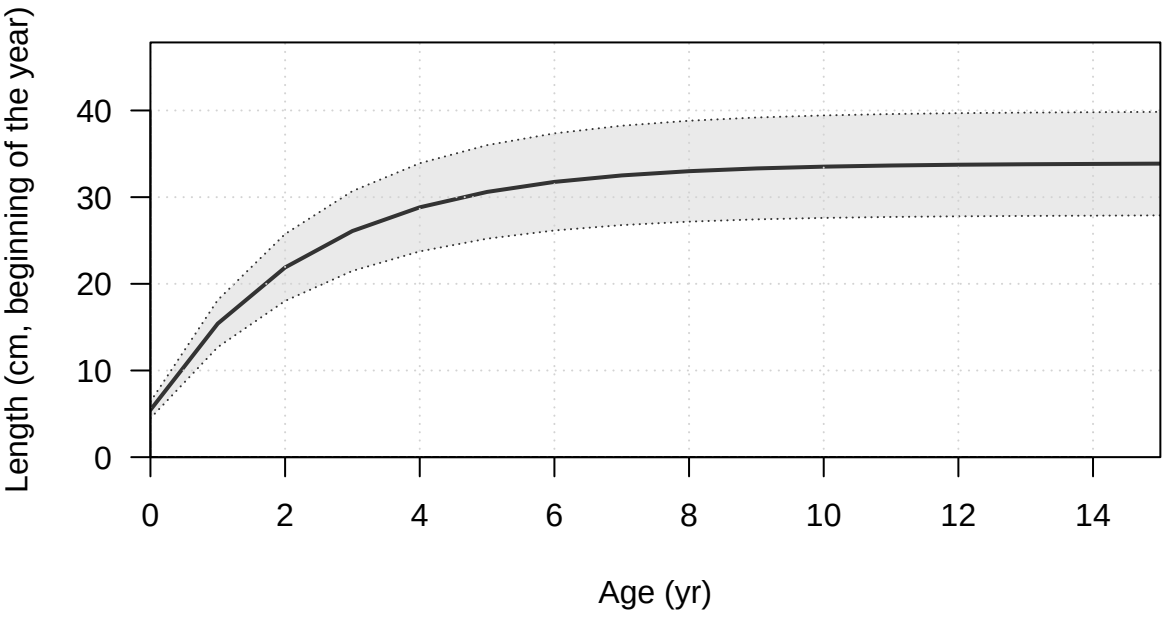
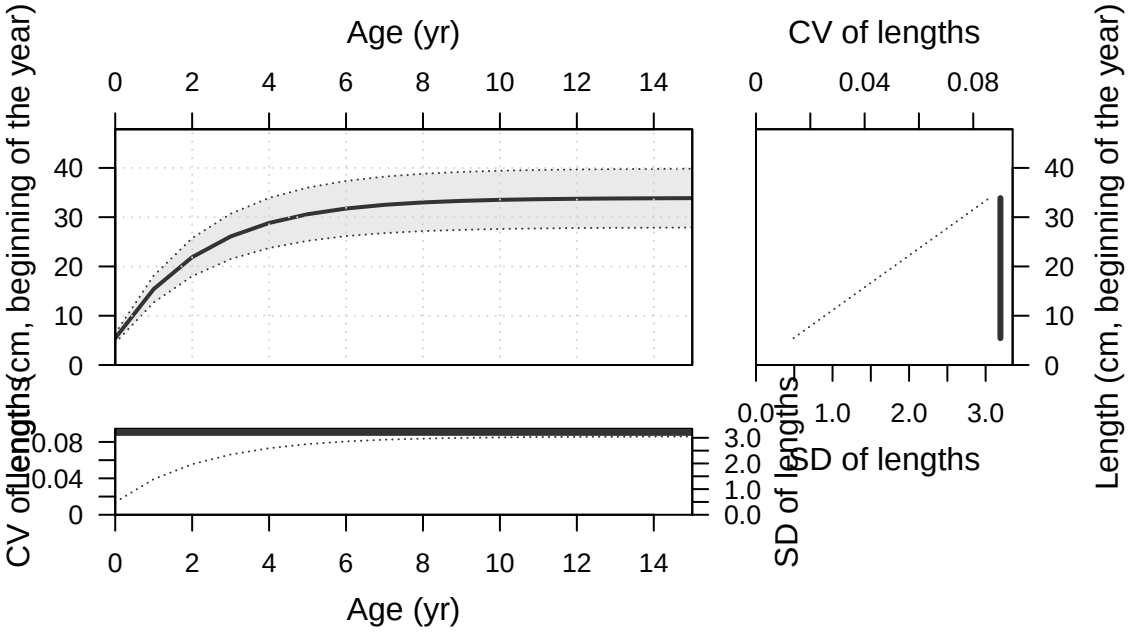
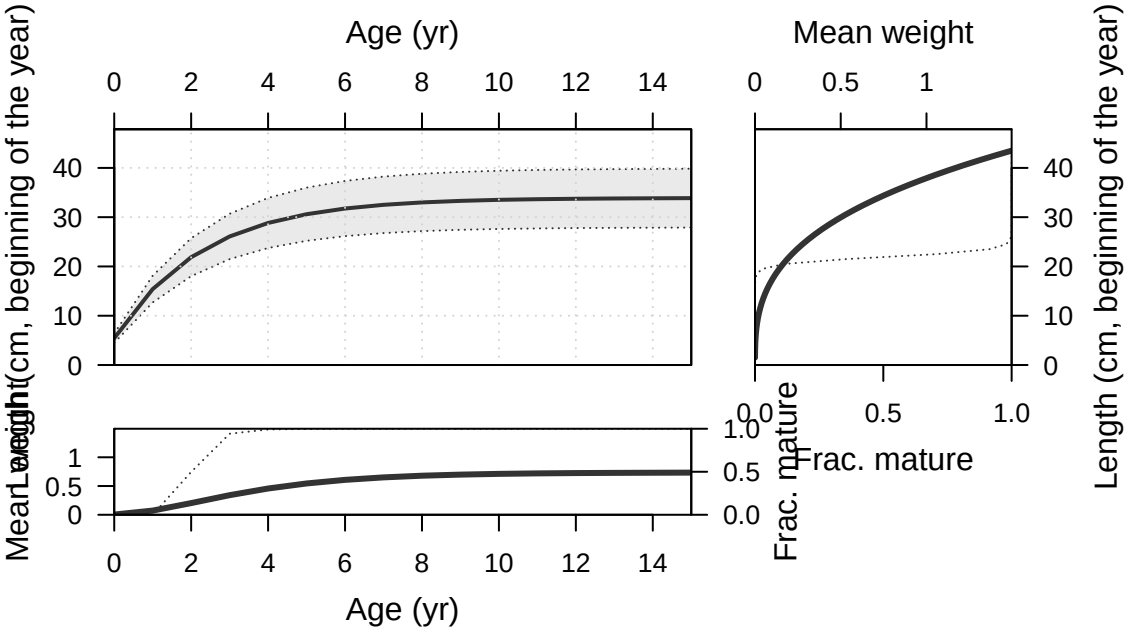
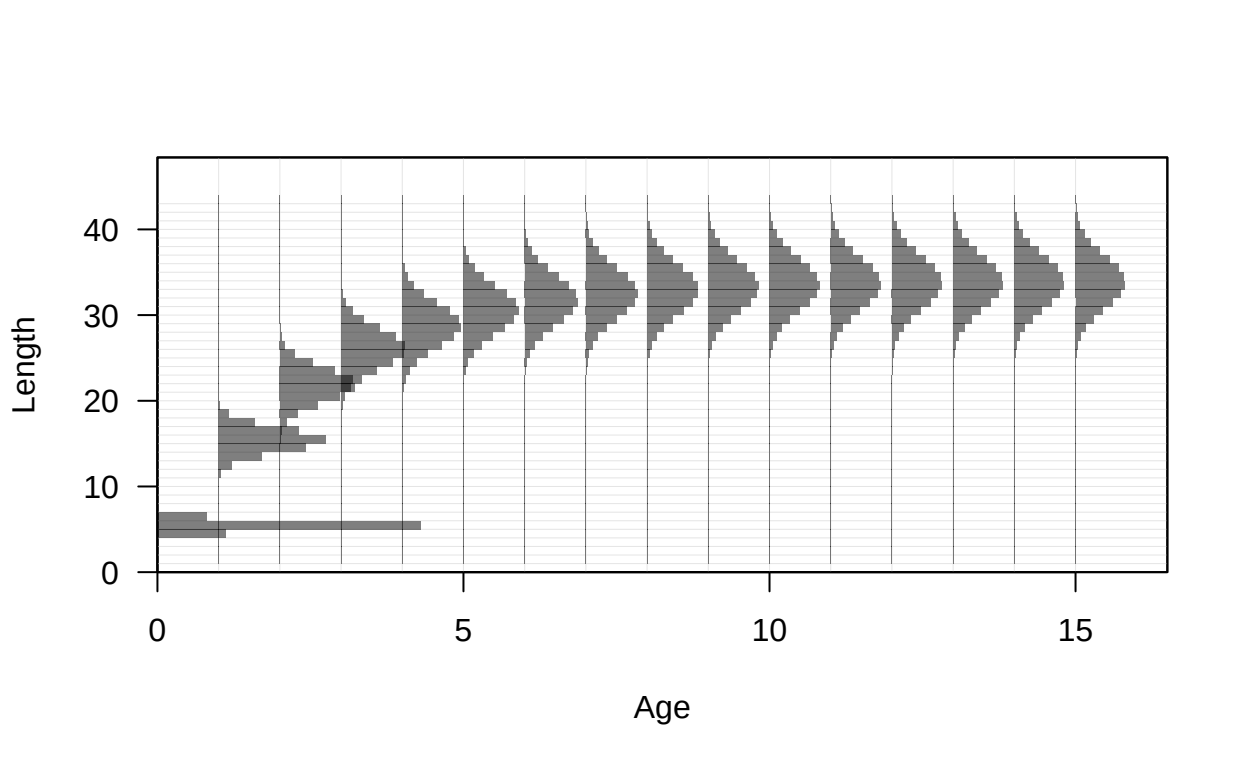
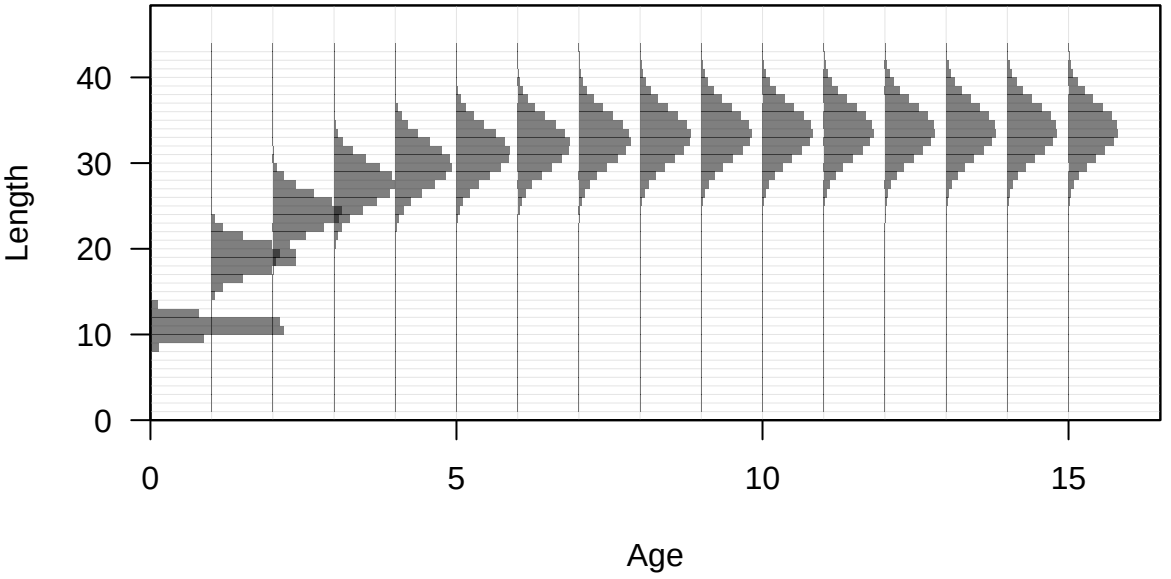
Plots created using the 'r4ss' package in R
Stock Synthesis version: 3.30.19.0
StartTime: Mon Aug 08 10:03:11 2022
Data_File: data.ss
Control_File: control.ss

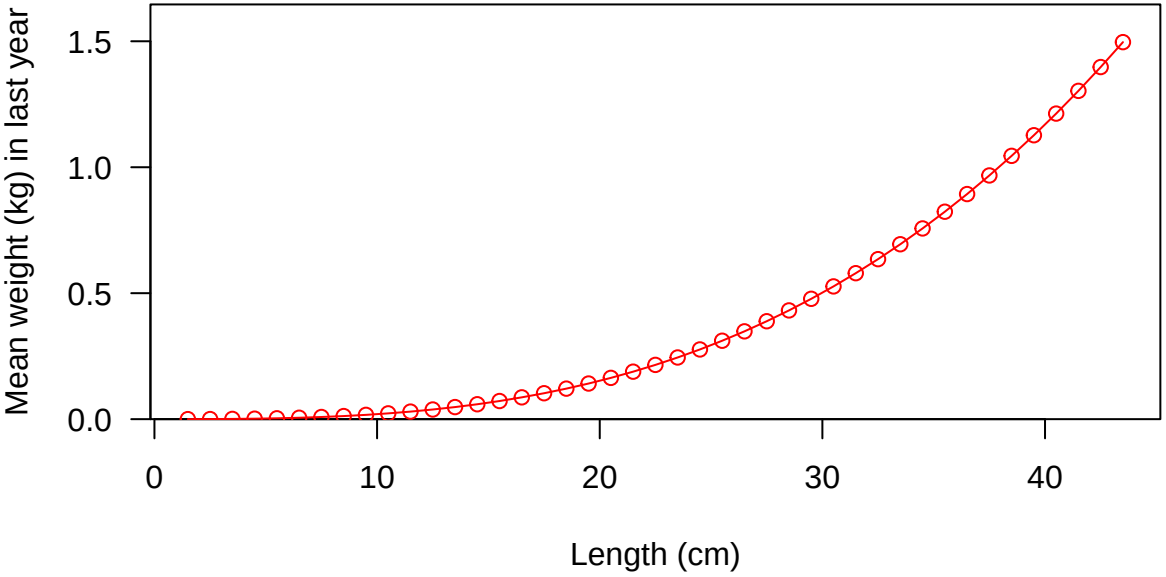

Length (cm, beginning of the year)
0
10
20
30
40
0
2
4
6
8
10
12
14
Age (yr)

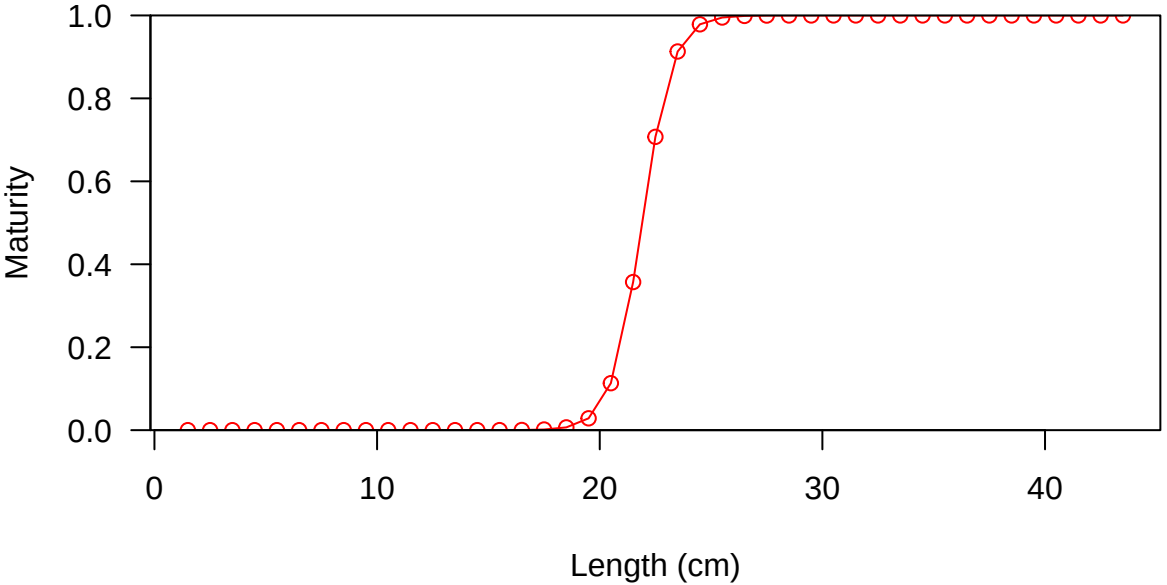

Age (yr)
0
2
4
6
8
10
12
14
Length (cm, beginning of the year)
0
10
20
30
40
CV of lengths
0
0.04
0.08
SD of lengths
0.0
1.0
2.0
3.0

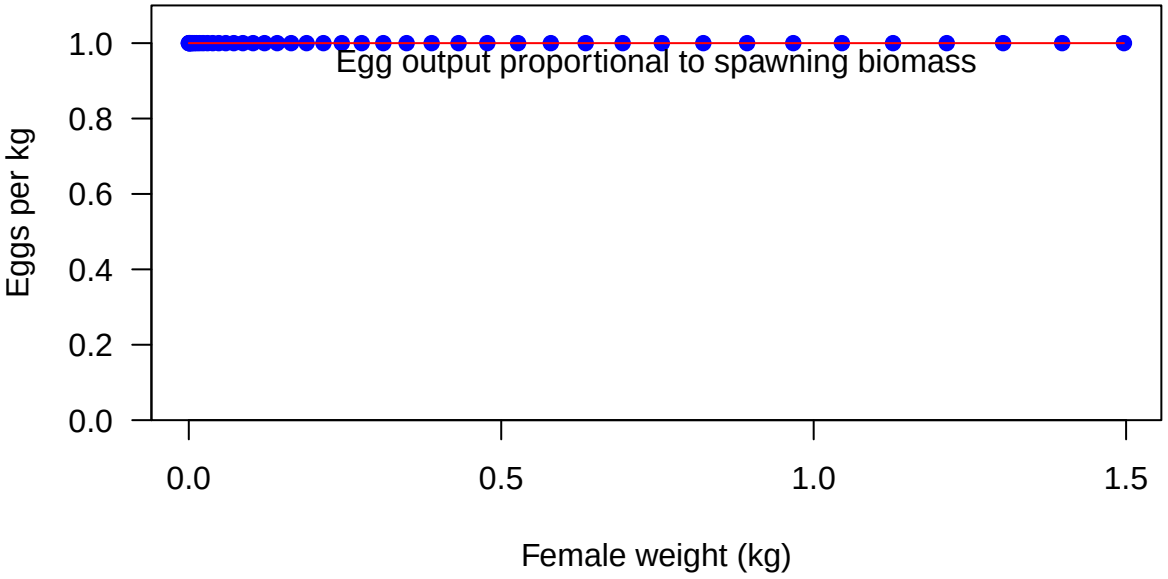

Age (yr)
Mean weight
Length (cm, beginning of the year)
Mean weight
Frac. mature
Age (yr)
0
2
4
6
8
10
12
14
0.5
1
20
30
40
0.0

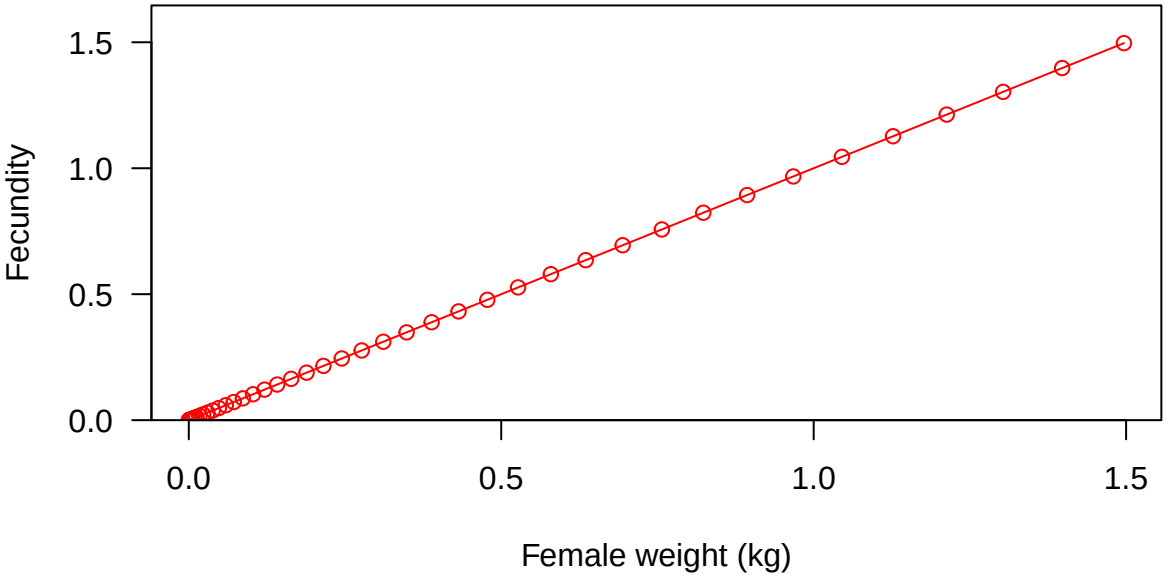

Length
0
10
20
30
40
0
5
10
15
Age

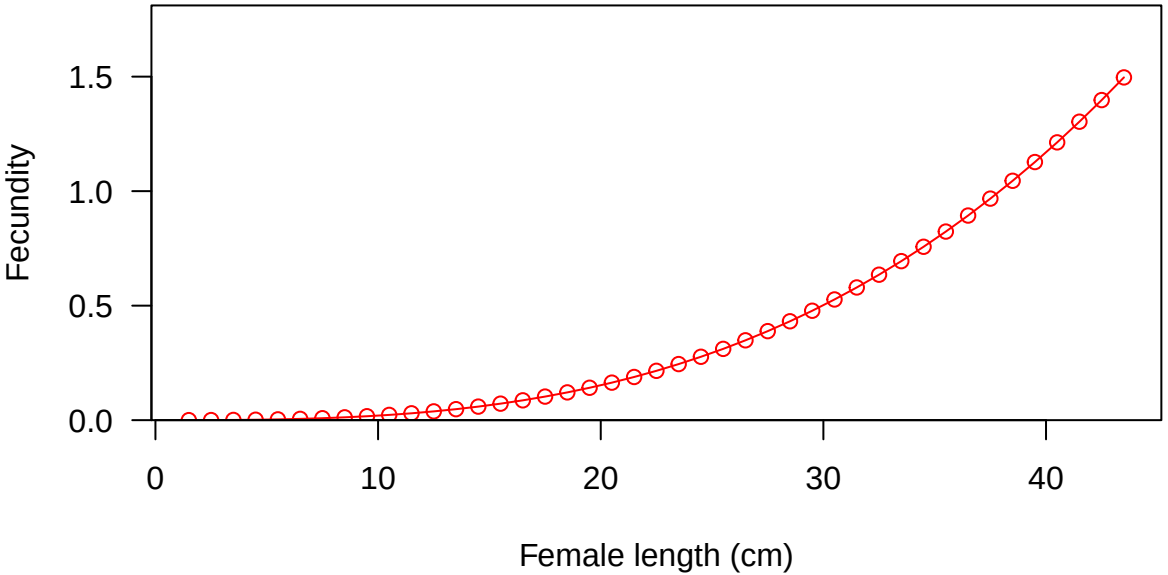

Length
0
10
20
30
40
0
5
10
15
Age

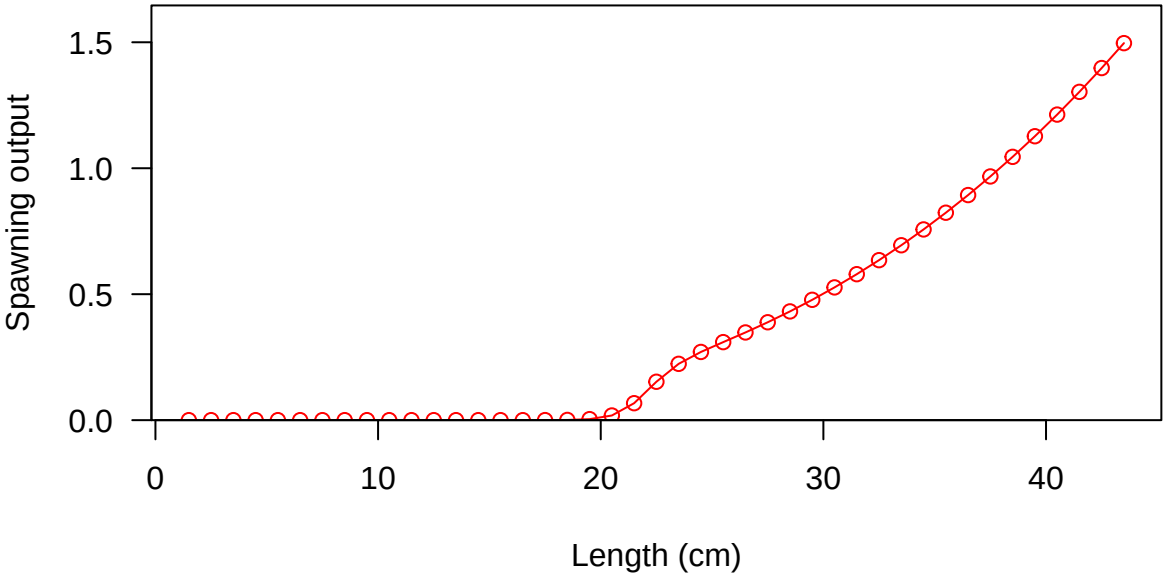

Mean weight (kg) in last year
1.5
1.0
0.5
0.0
0
10
20
30
40
Length (cm)

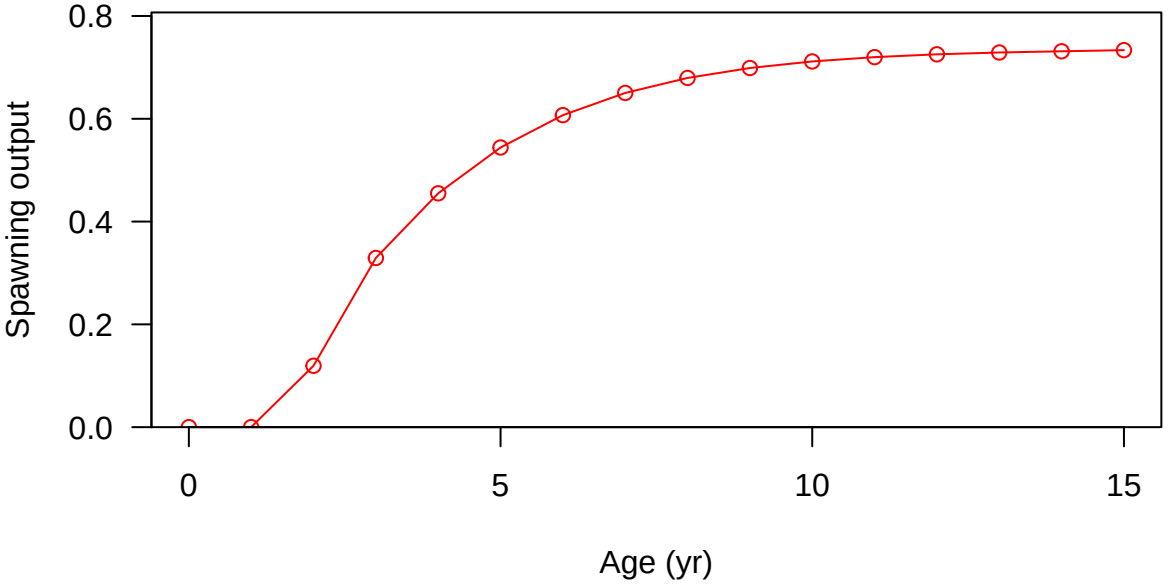

1.0
0.8
0.6
0.4
0.2
0.0
Maturity
0
10
20
30
40
Length (cm)

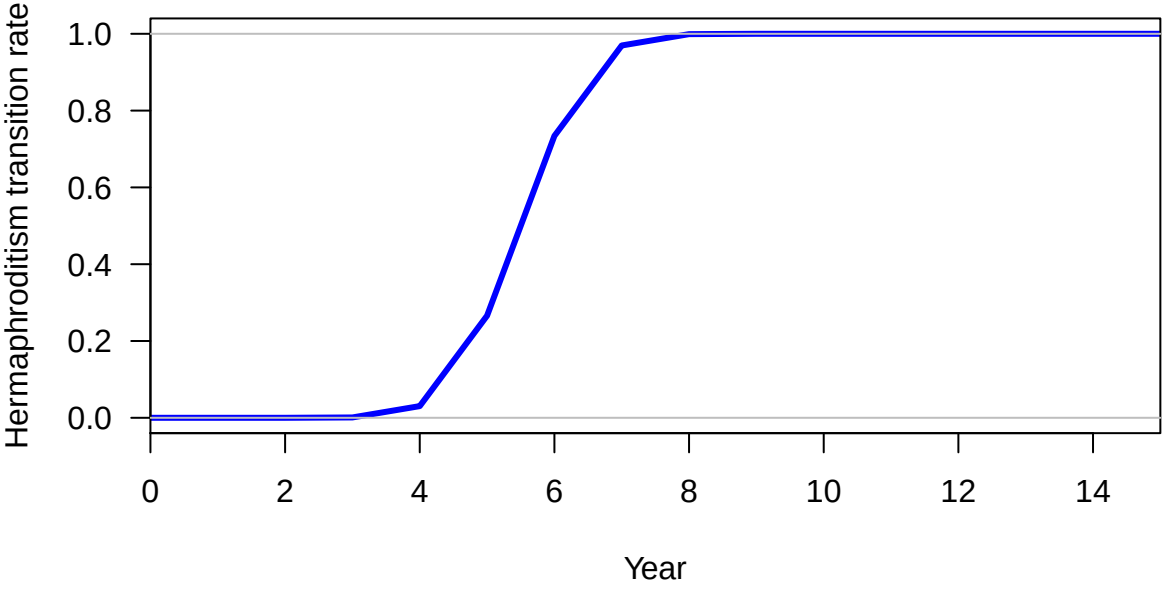

Egg output proportional to spawning biomass
Eggs per kg
1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.5
1.0
1.5
Female weight (kg)

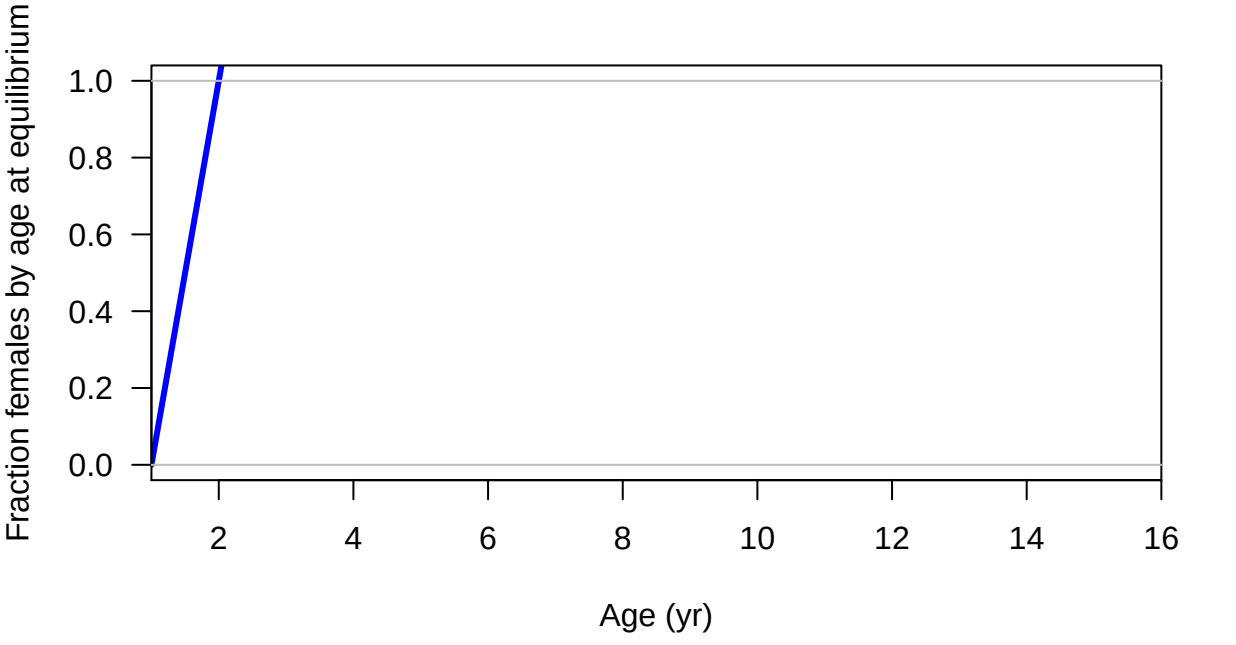

Fecundity
0.0
0.5
1.0
1.5
0.0
0.5
1.0
1.5
Female weight (kg)

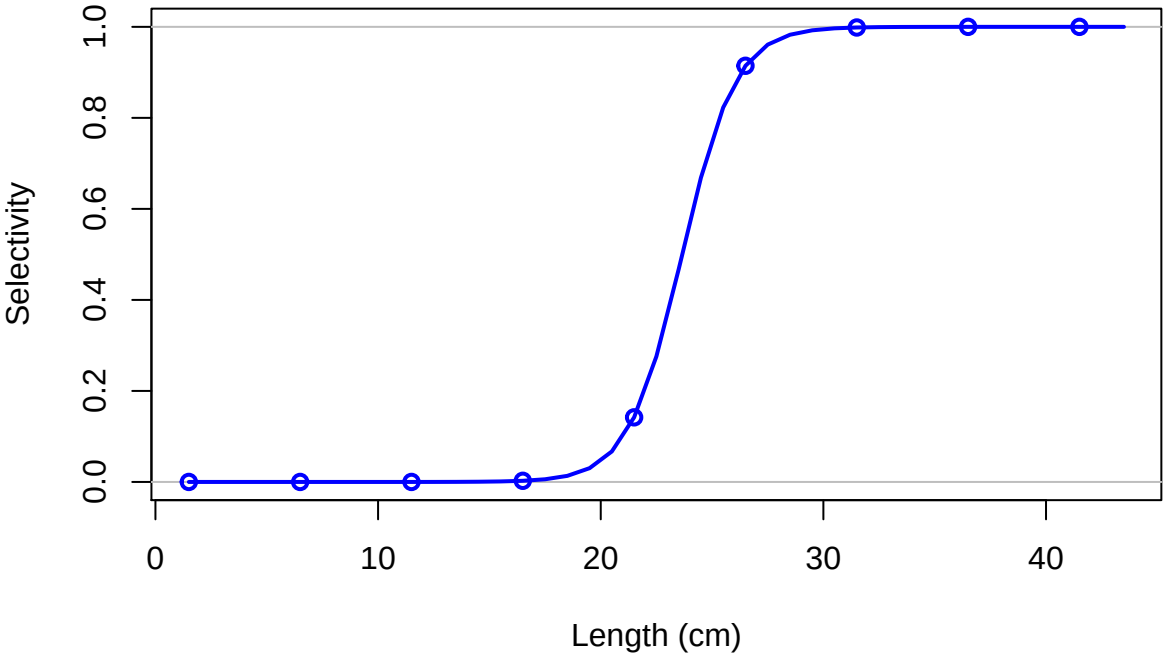

Fecundity
0.0
0.5
1.0
1.5
0
10
20
30
40
Female length (cm)

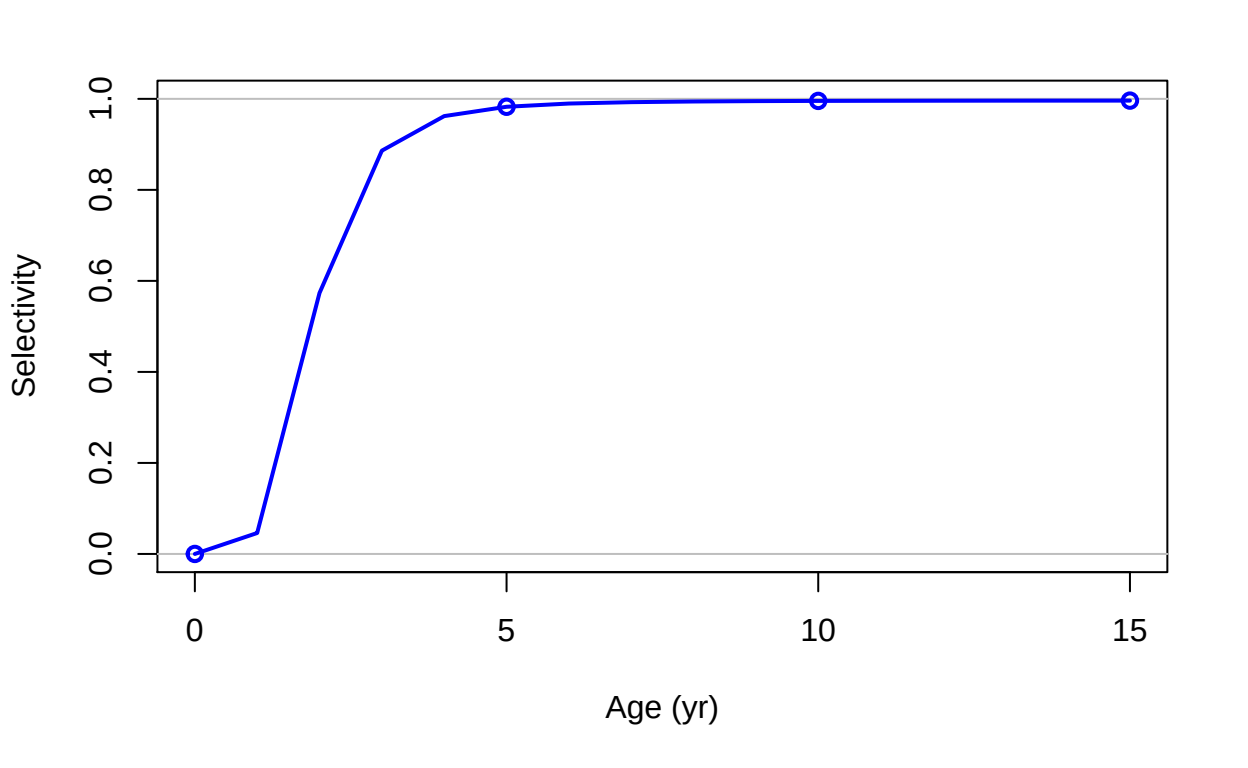

Spawning output
1.5
1.0
0.5
0.0
0
10
20
30
40
Length (cm)

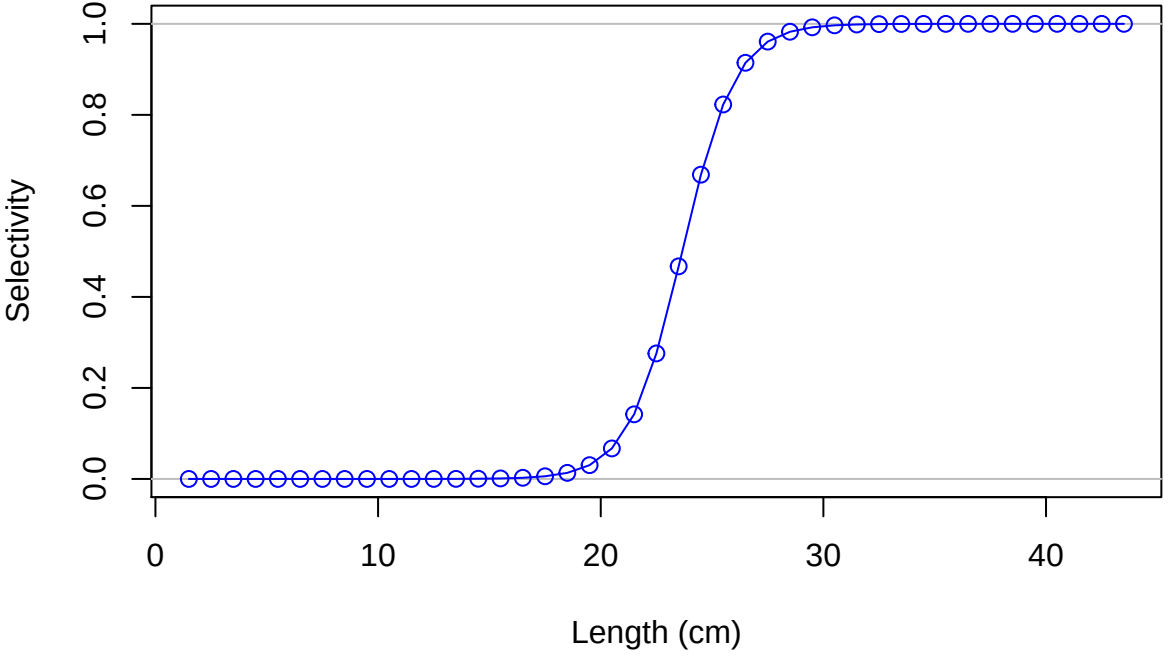

0.8
0.6
0.4
0.2
0.0
Spawning output
0
5
10
15
Age (yr)

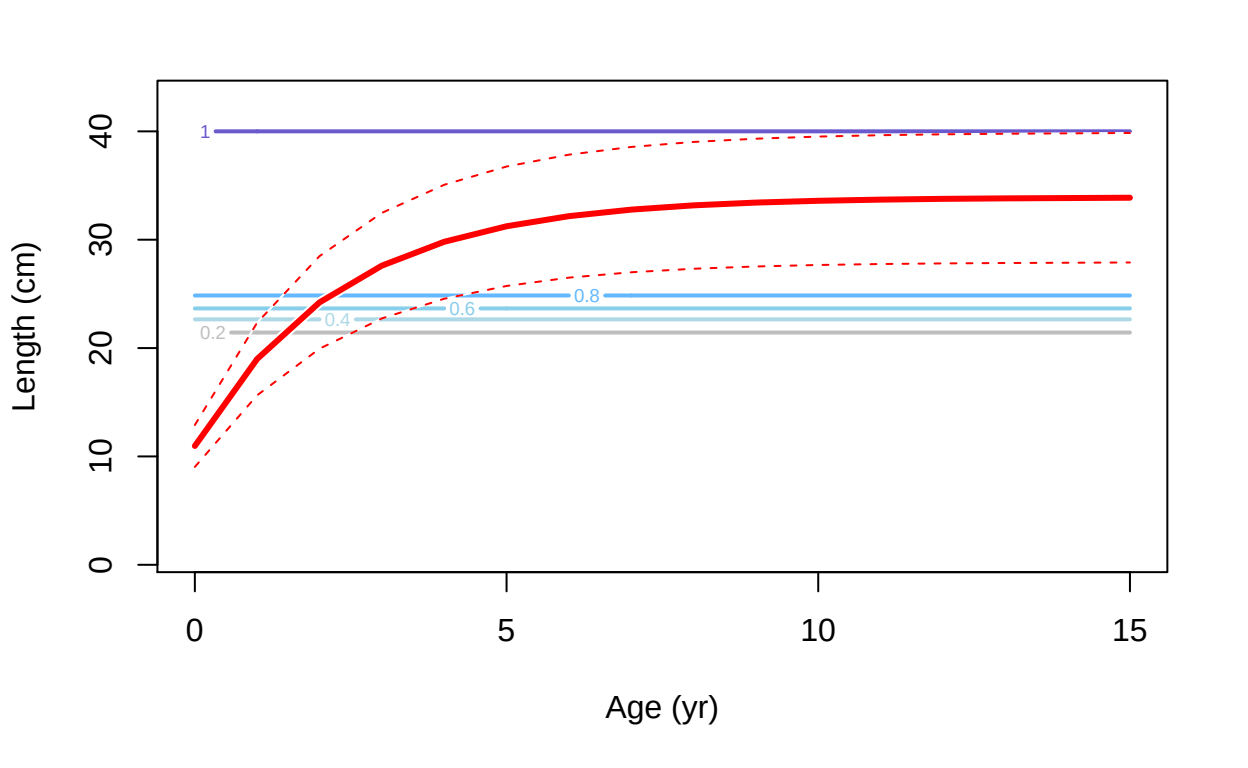

Hermaphroditism transition rate
1.0
0.8
0.6
0.4
0.2
0.0
0
2
4
6
8
10
12
14
Year

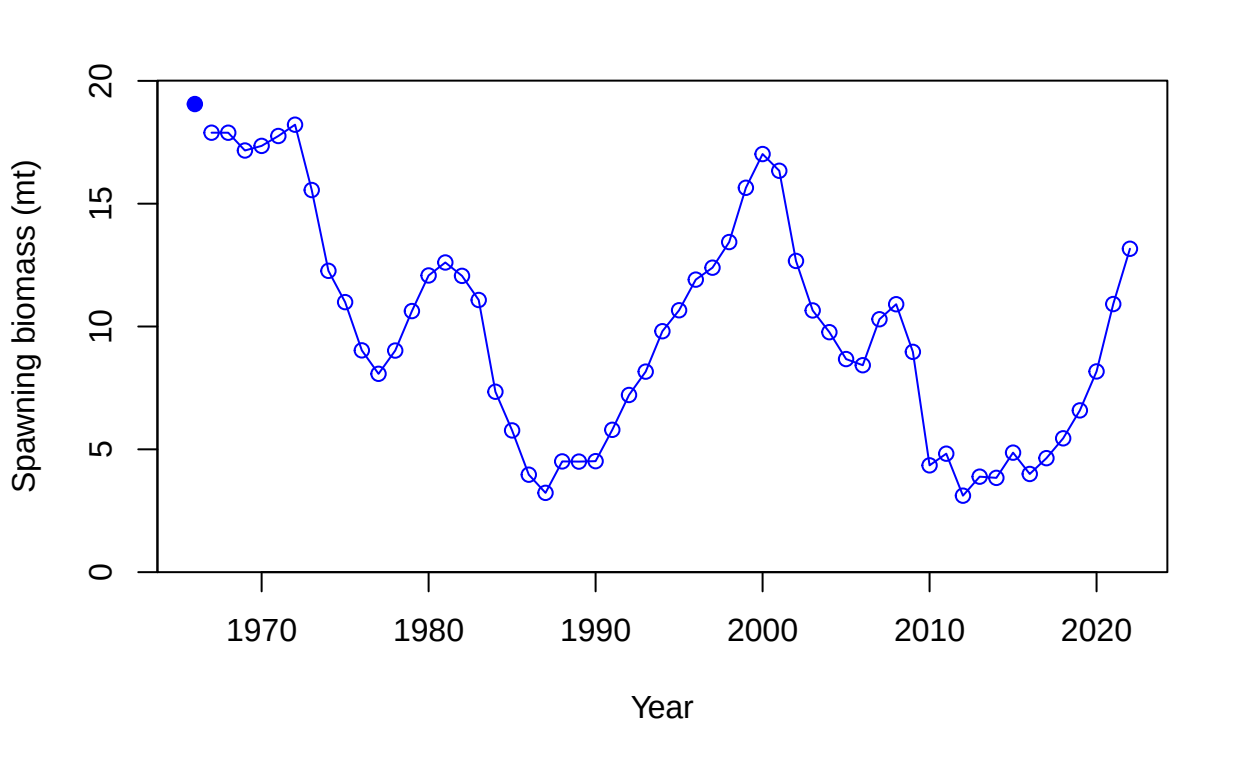

Fraction females by age at equilibrium
1.0
0.8
0.6
0.4
0.2
0.0
2
4
6
8
10
12
14
16
Age (yr)

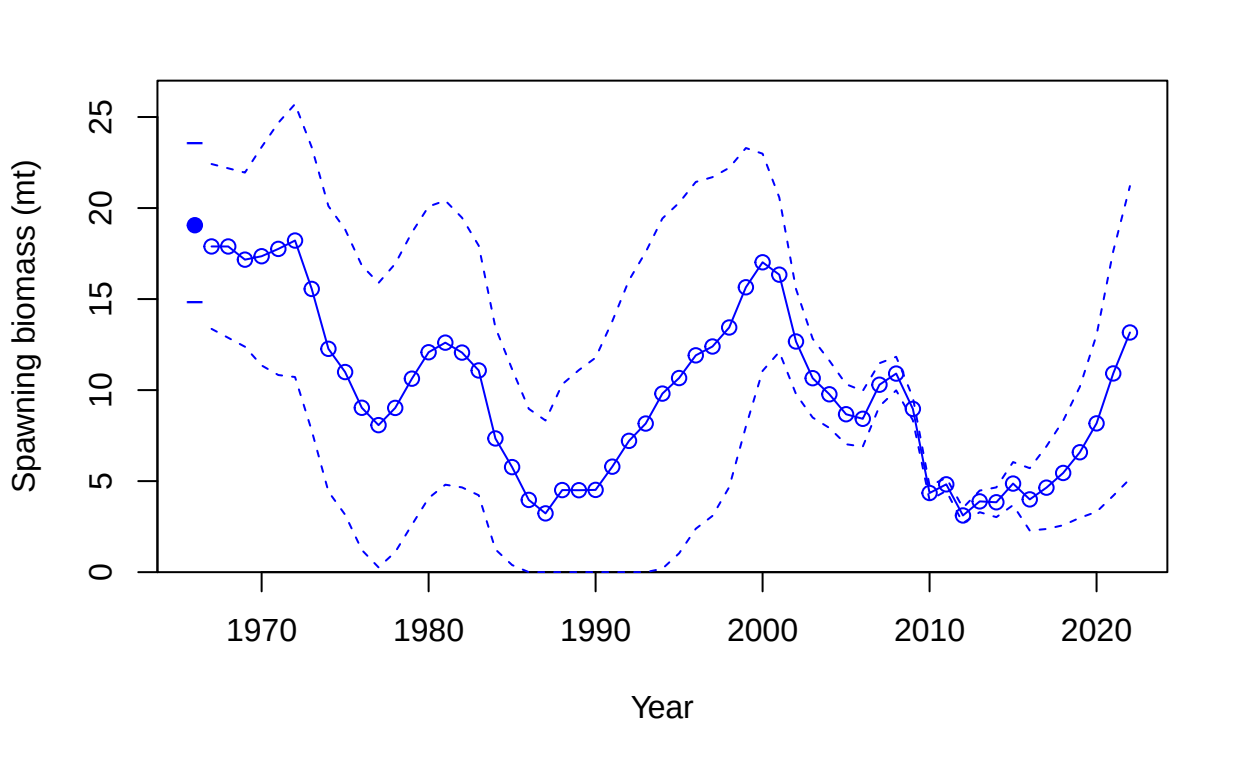

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
10
20
30
40
Length (cm)

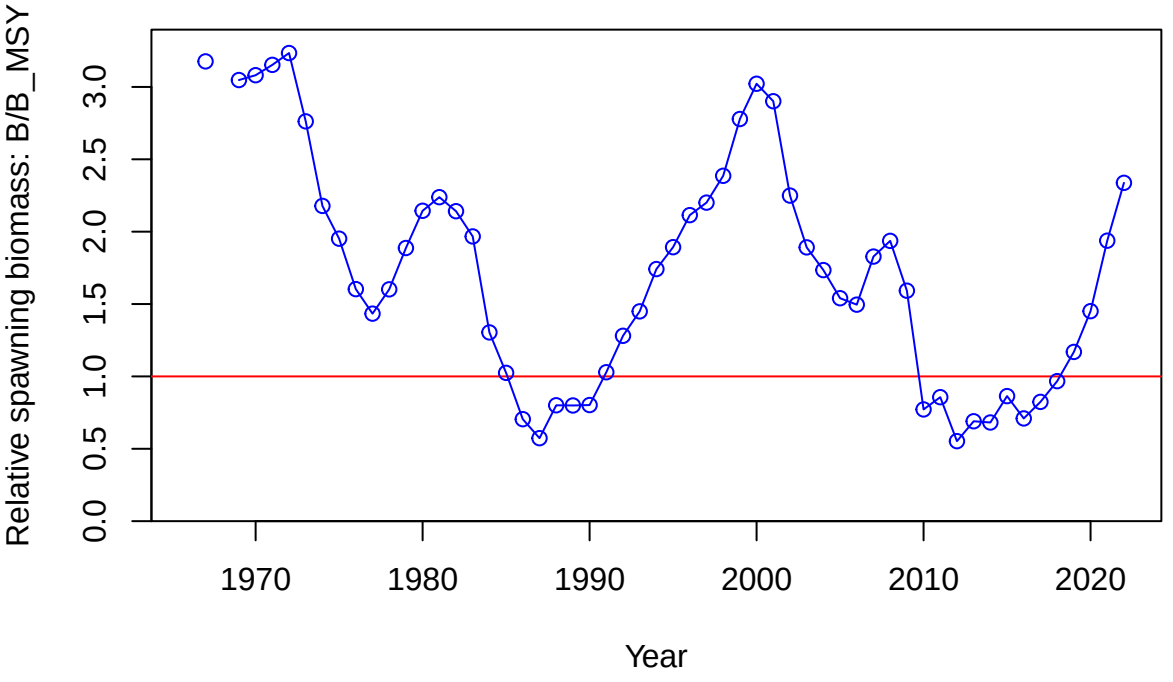

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
5
10
15
Age (yr)

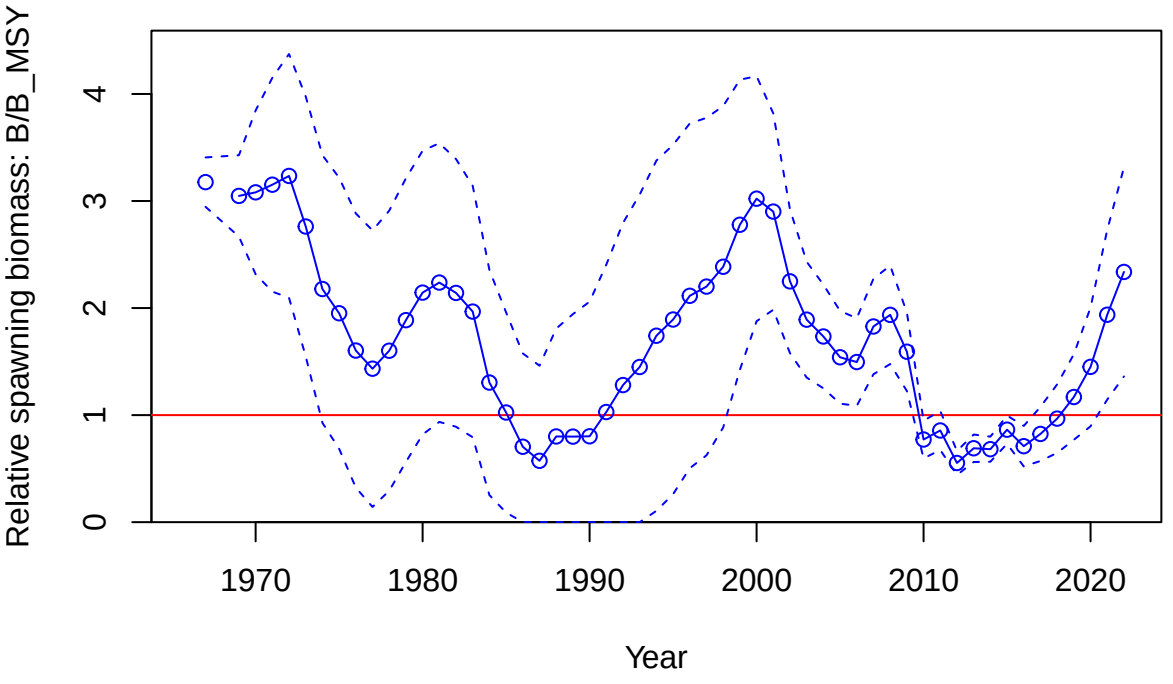

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
10
20
30
40
Length (cm)

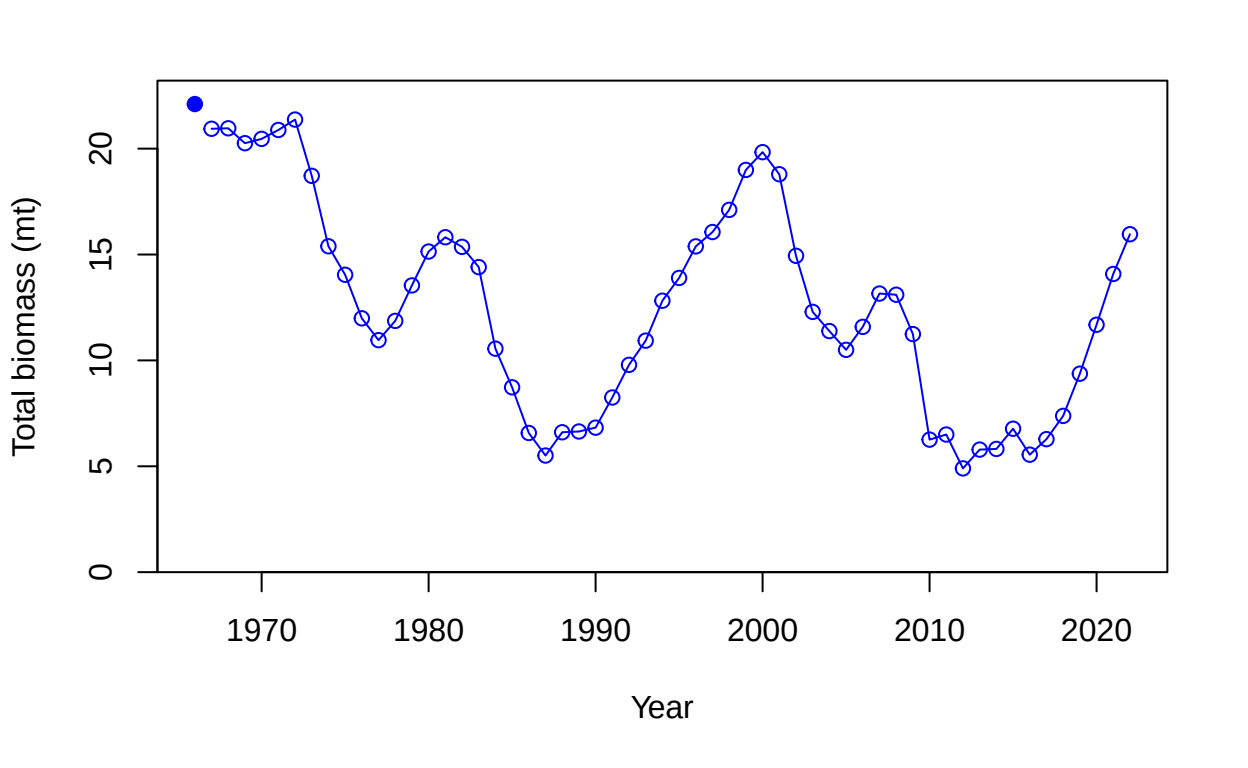

Length (cm)
0
10
20
30
40
1
0.8
0.6
0.4
0.2
0
5
10
15
Age (yr)

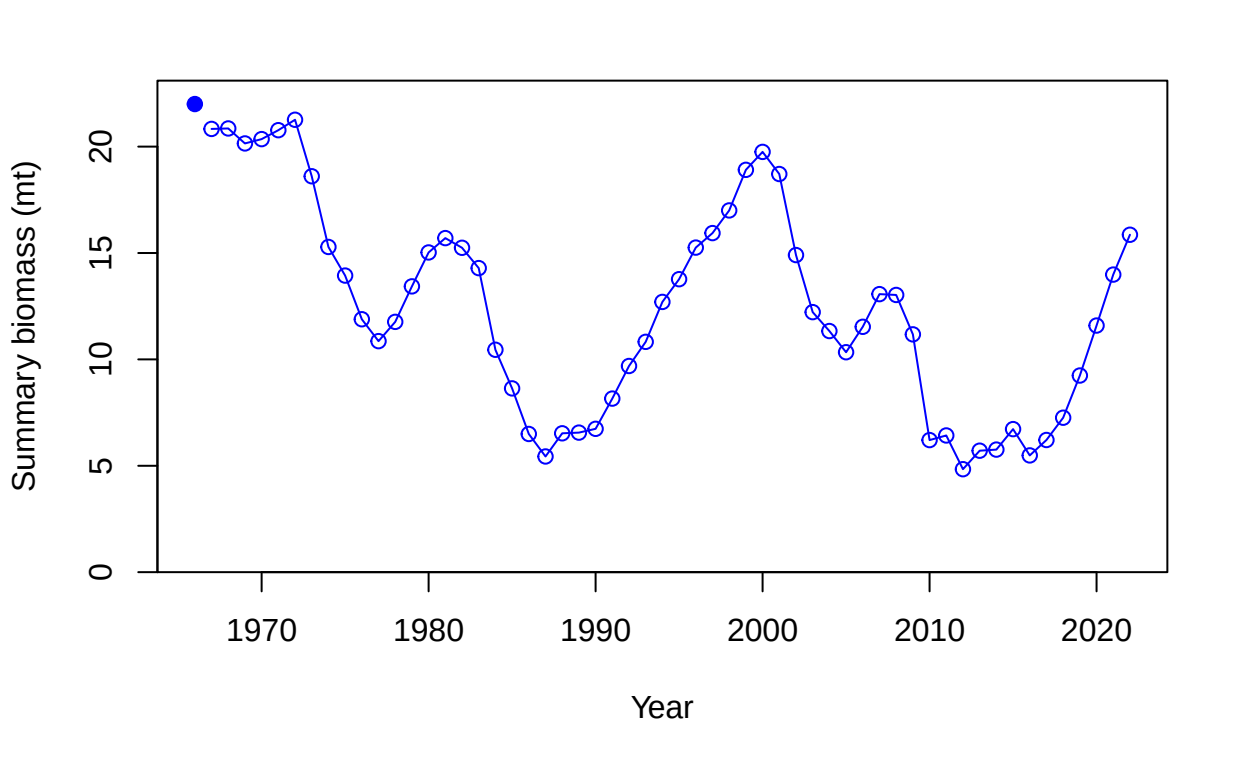

Spawning biomass (mt)
0
5
10
15
20
1970
1980
1990
2000
2010
2020
Year

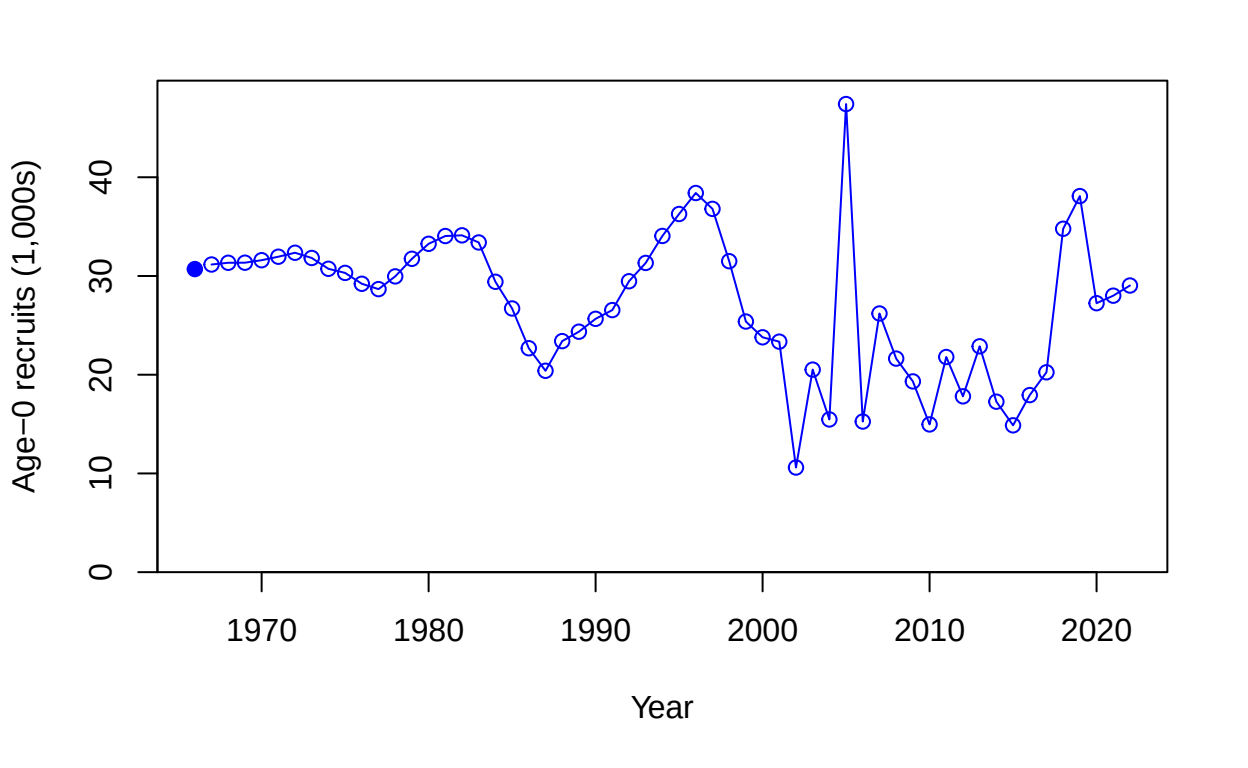

Spawning biomass (mt)
0
5
10
15
20
25
1970
1980
1990
2000
2010
2020
Year

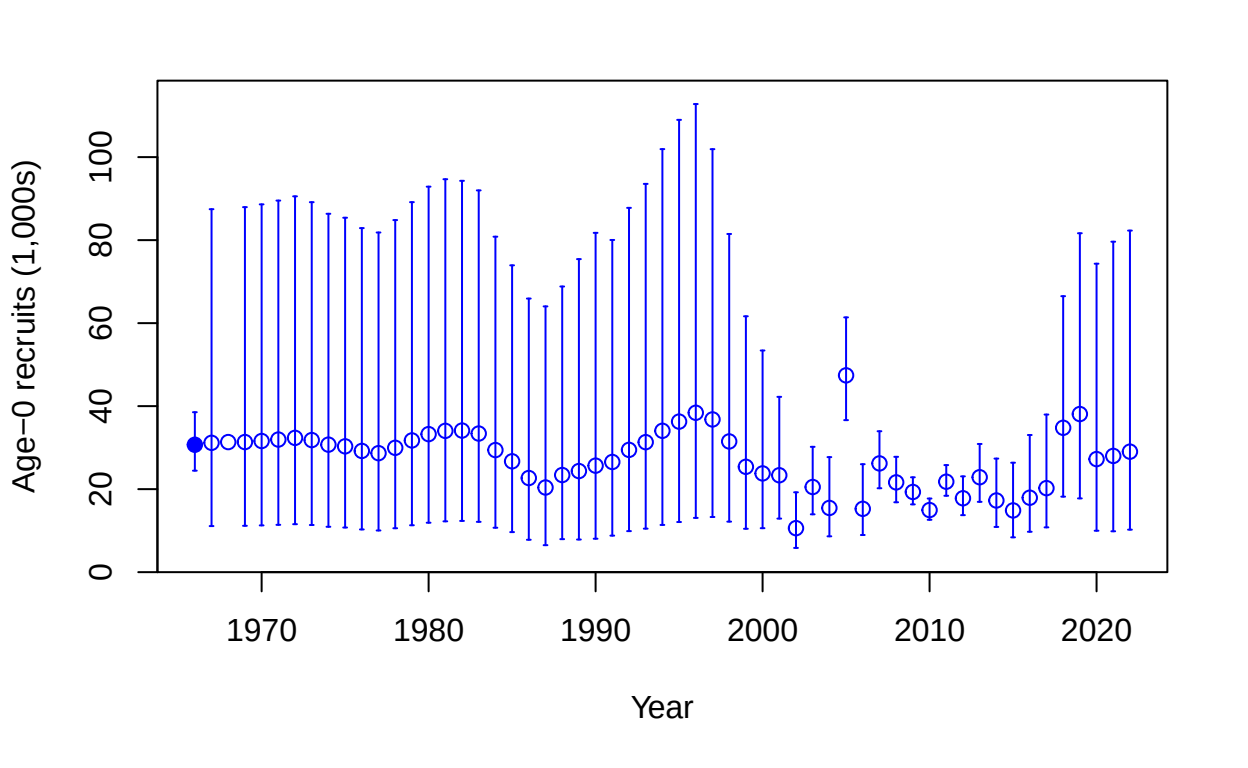

Relative spawning biomass: B/B_MSY
0.0
0.5
1.0
1.5
2.0
2.5
3.0
1970
1980
1990
2000
2010
2020
Year

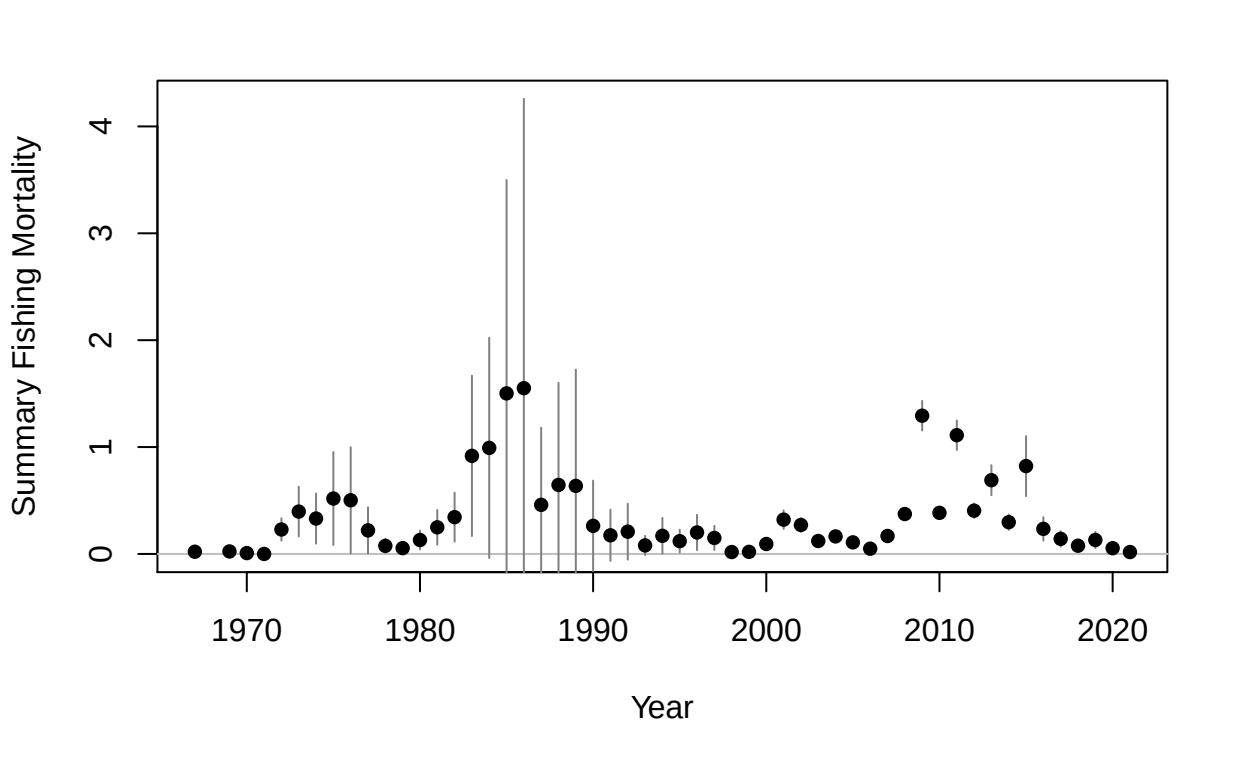

Relative spawning biomass: B/B_MSY
0
1
2
3
4
1970
1980
1990
2000
2010
2020
Year

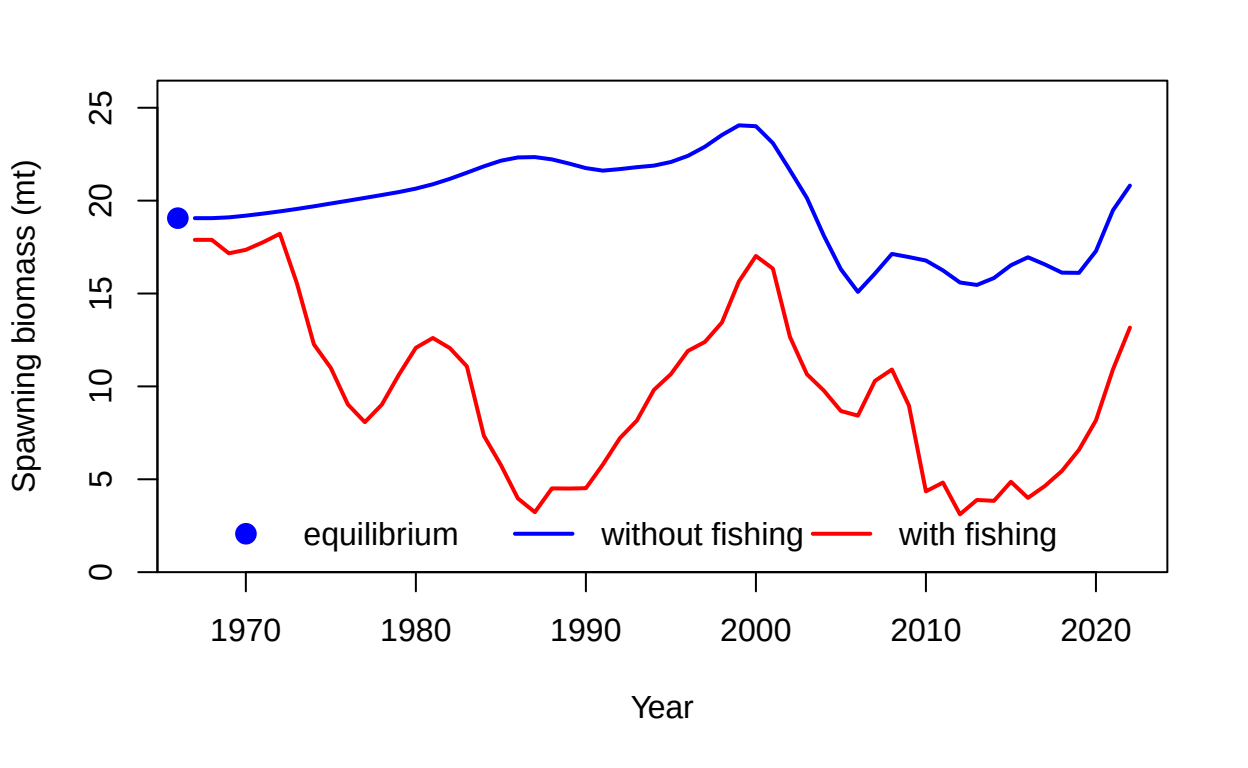

Total biomass (mt)
0
5
10
15
20
1970
1980
1990
2000
2010
2020
Year

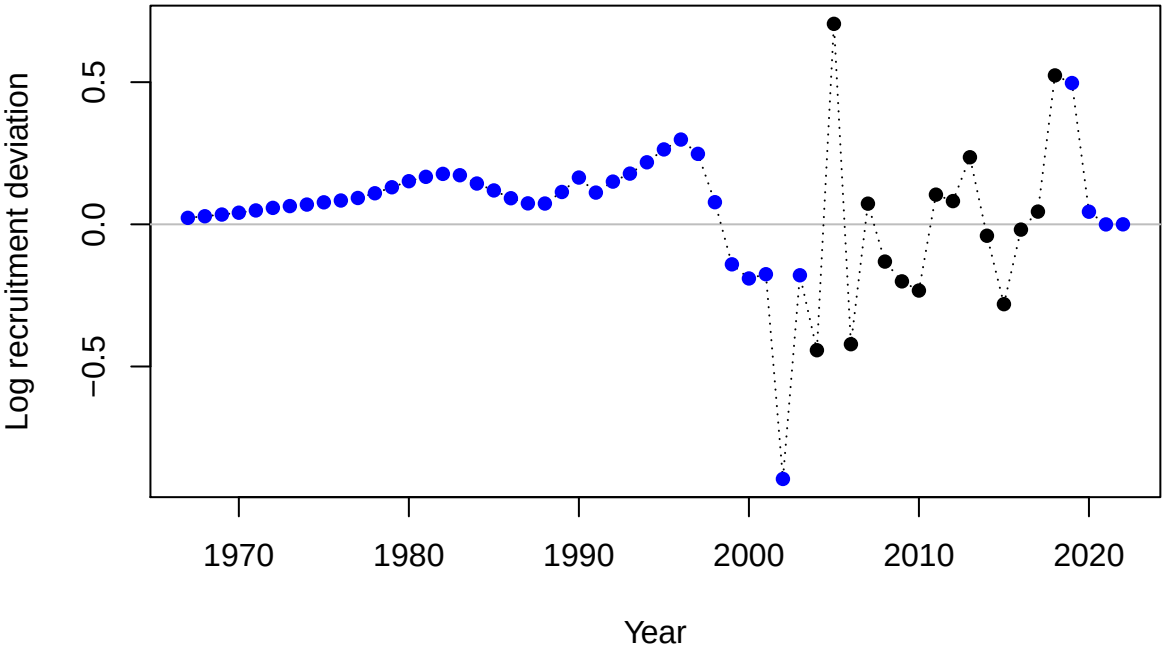

Summary biomass (mt)
0
5
10
15
20
1970
1980
1990
2000
2010
2020
Year

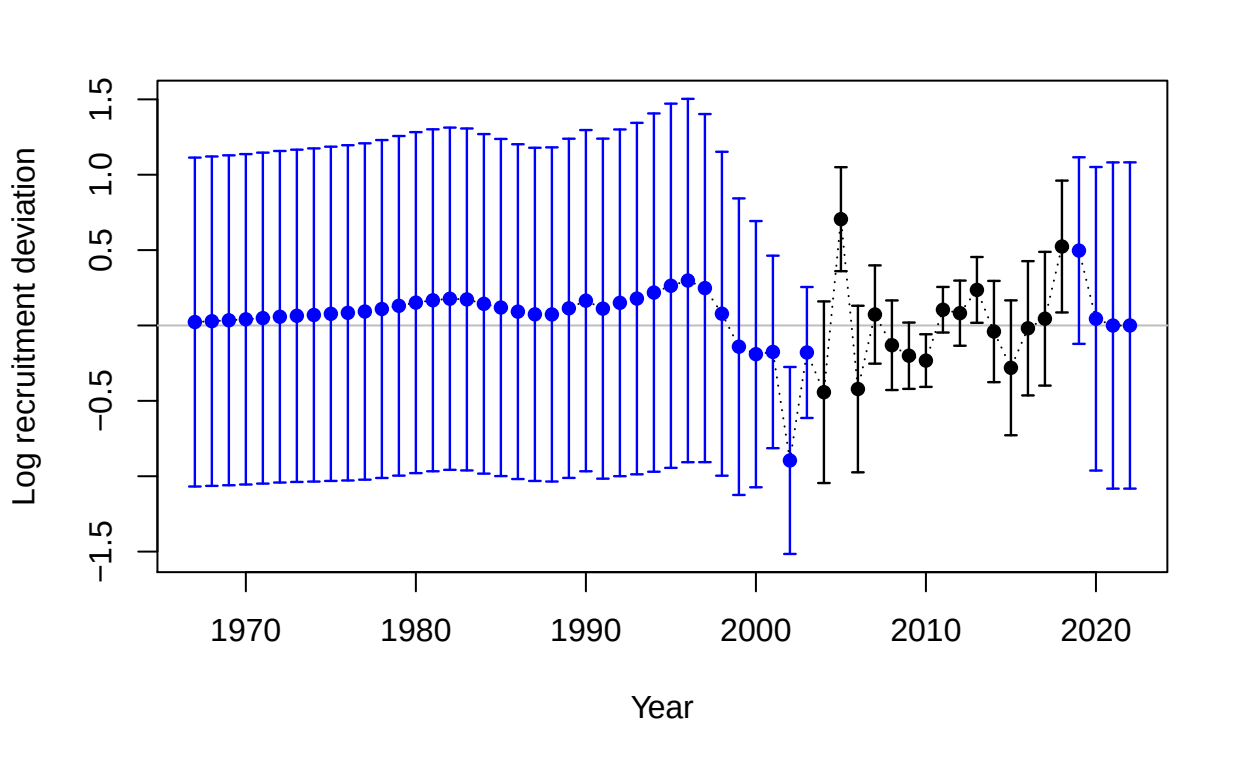

Age−0 recruits (1,000s)
0
10
20
30
40
1970
1980
1990
2000
2010
2020
Year

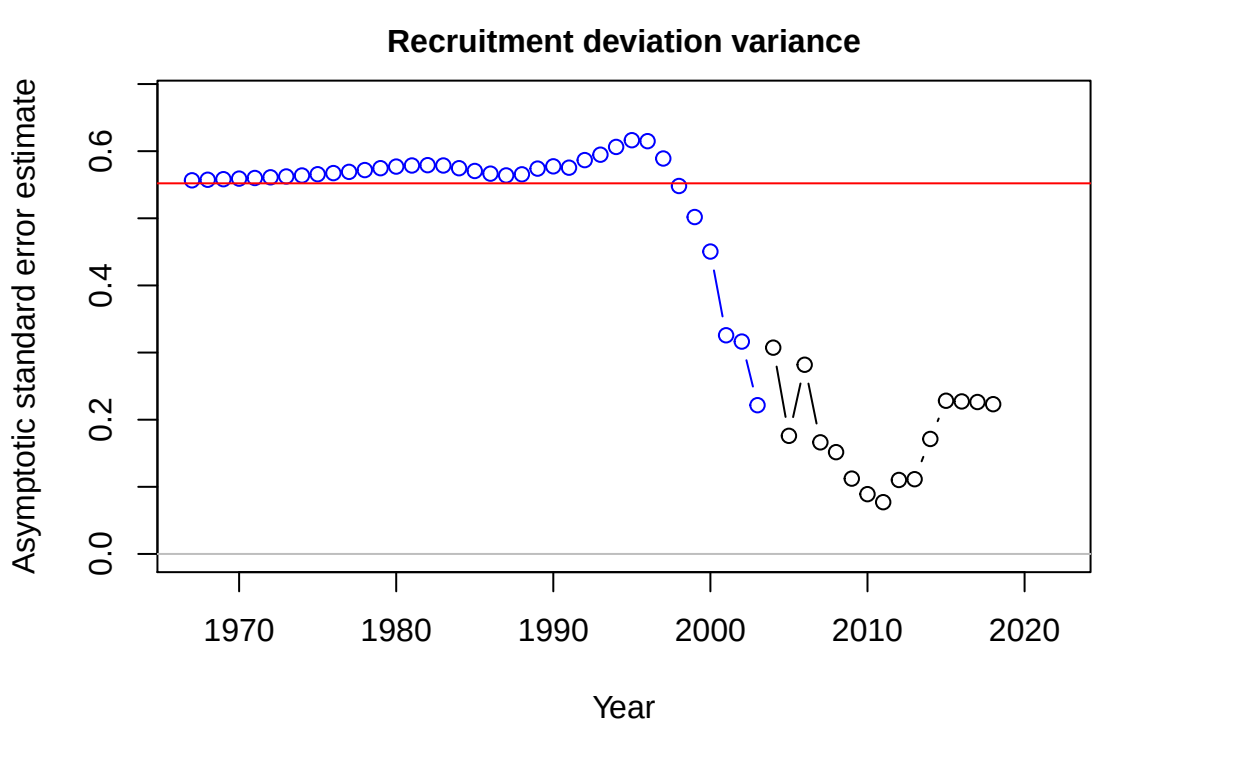

Age−0 recruits (1,000s)
0
20
40
60
80
100
1970
1980
1990
2000
2010
2020
Year

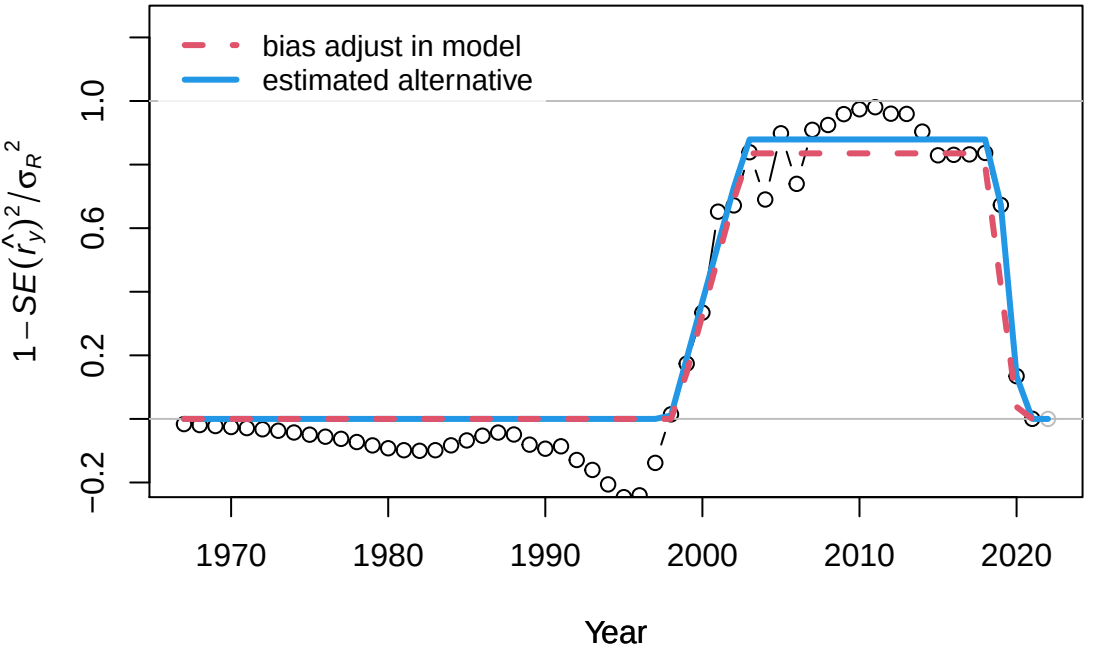

Summary Fishing Mortality
0
1
2
3
4
1970
1980
1990
2000
2010
2020
Year

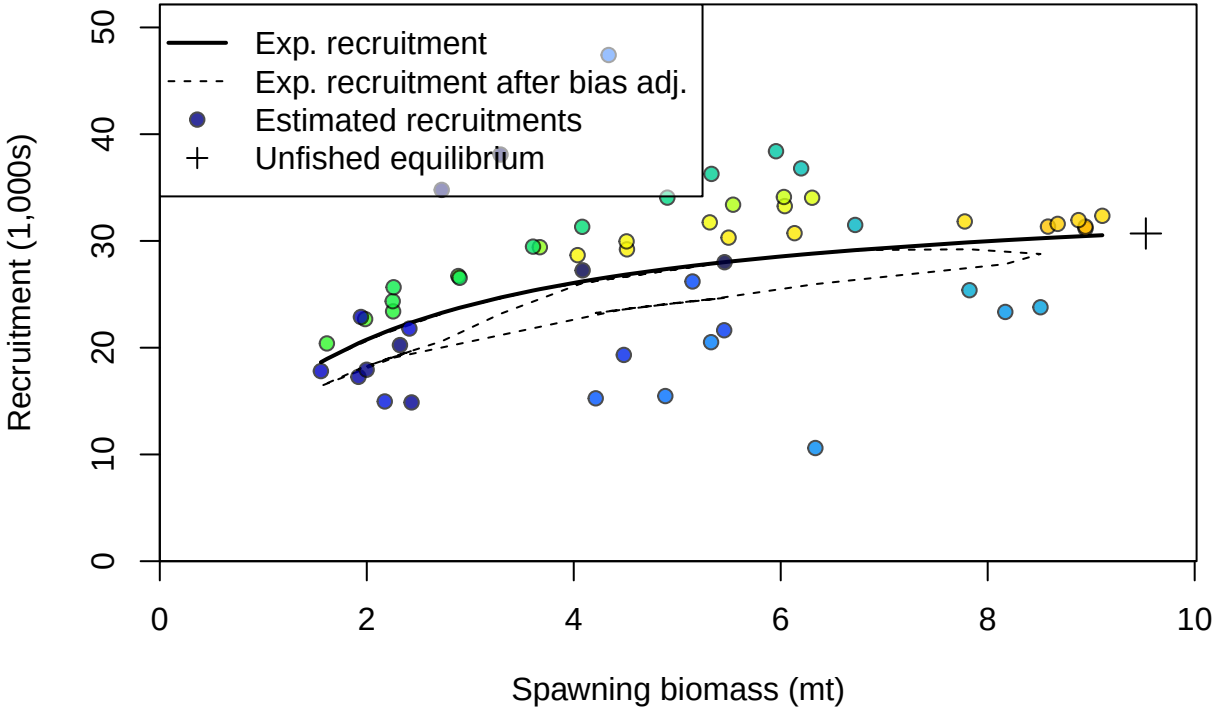

Spawning biomass (mt)
0
5
10
15
20
25
1970
1980
1990
2000
2010
2020
Year
equilibrium
without fishing
with fishing

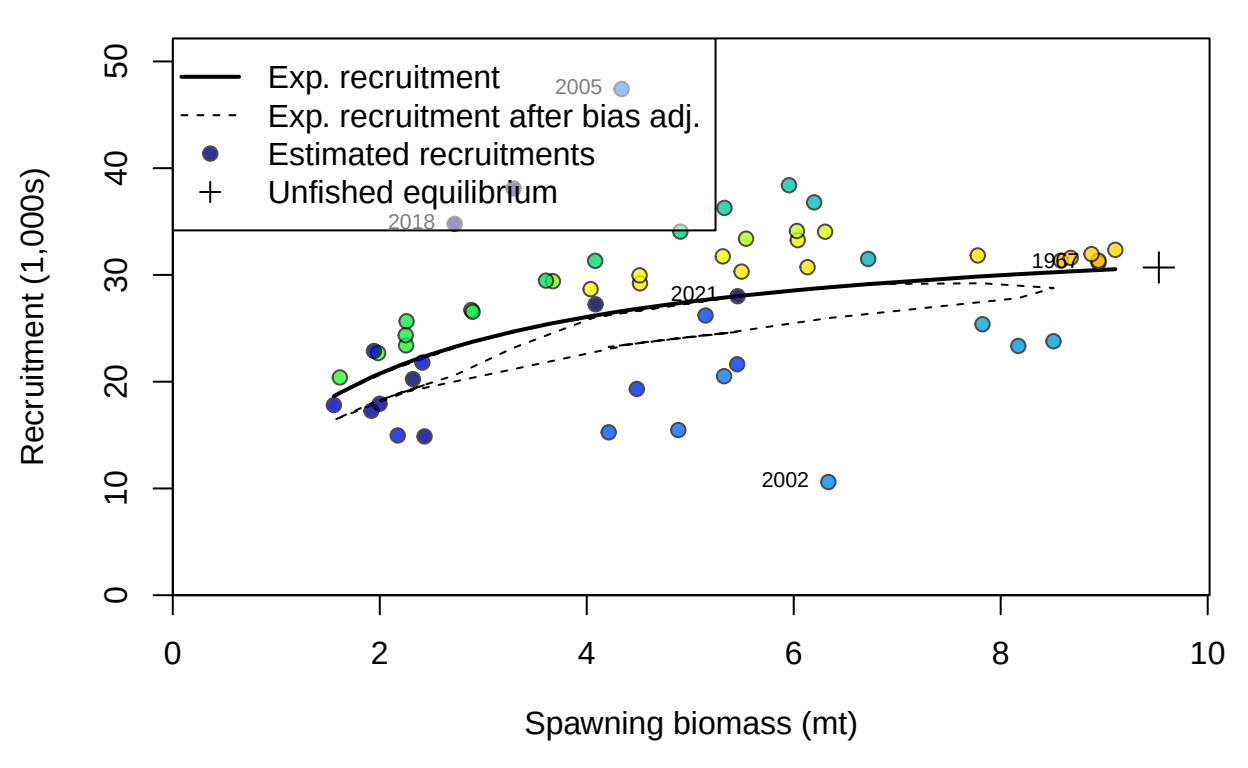

Log recruitment deviation
0.5
0.0
−0.5
1970
1980
1990
2000
2010
2020
Year

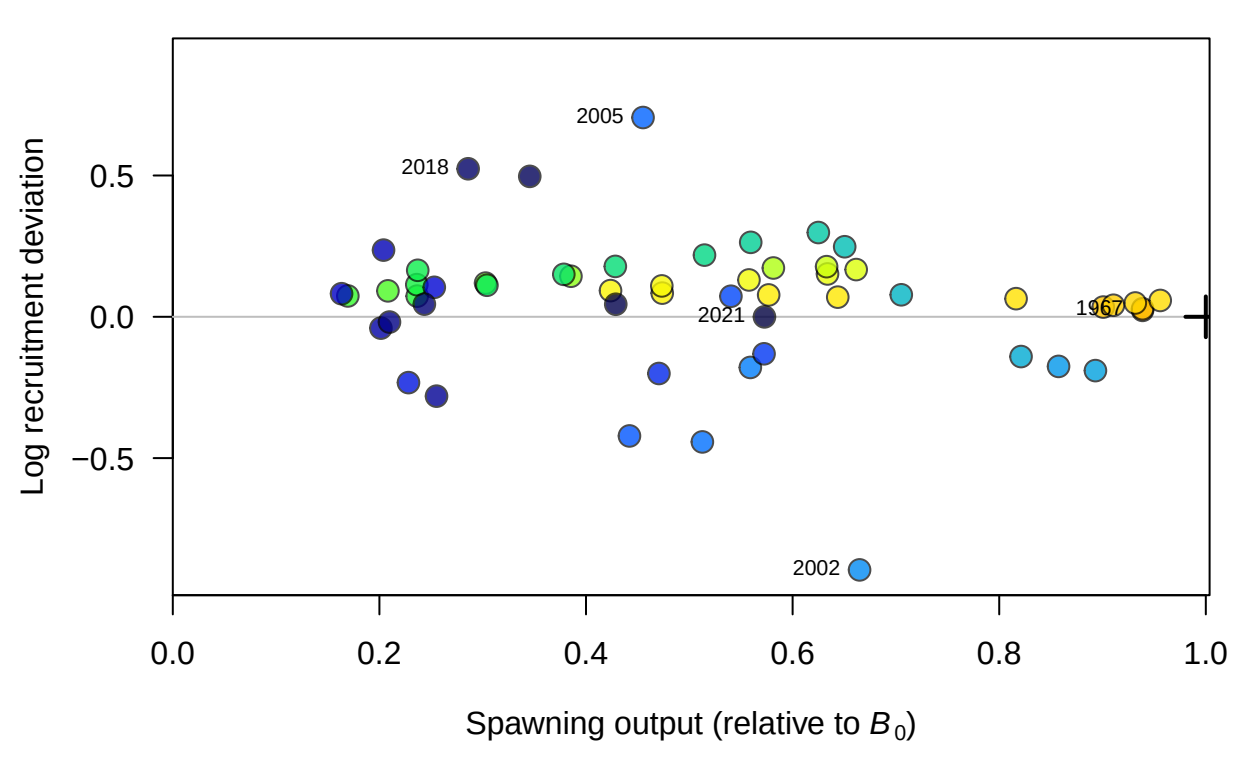

Log recruitment deviation
1.5
1.0
0.5
−0.5
−1.5
1970
1980
1990
2000
2010
2020
Year

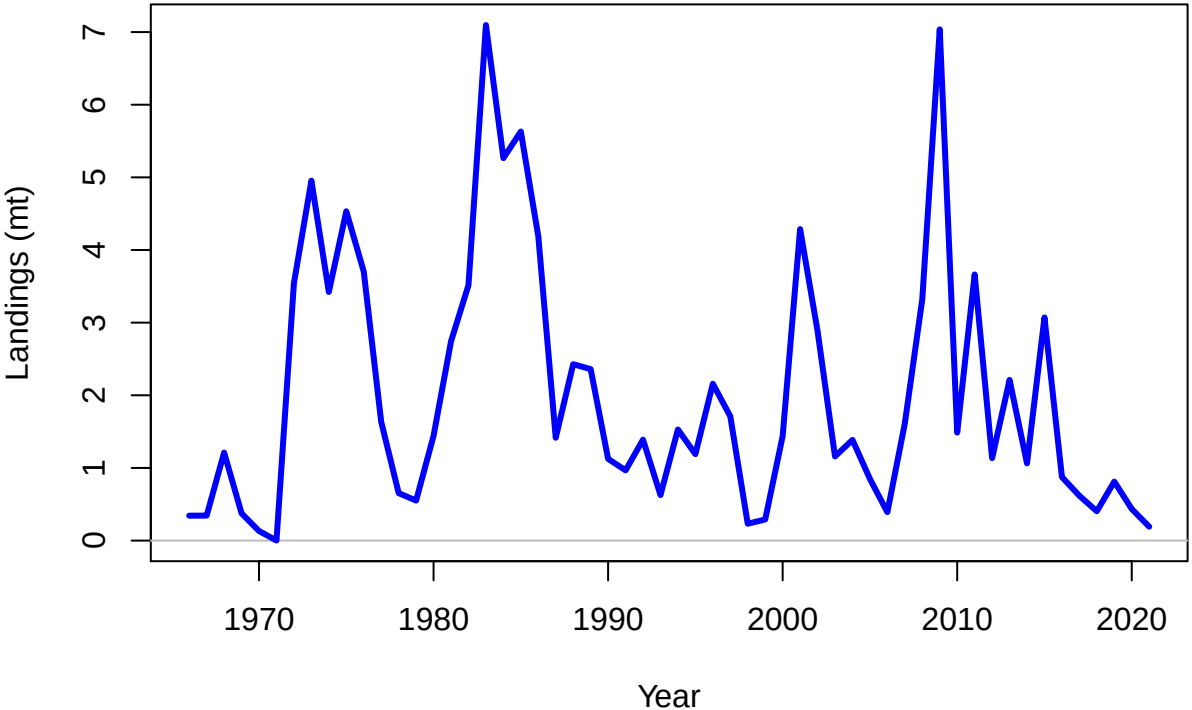

Recruitment deviation variance
Asymptotic standard error estimate
0.0
0.2
0.4
0.6
1970
1980
1990
2000
2010
2020
Year

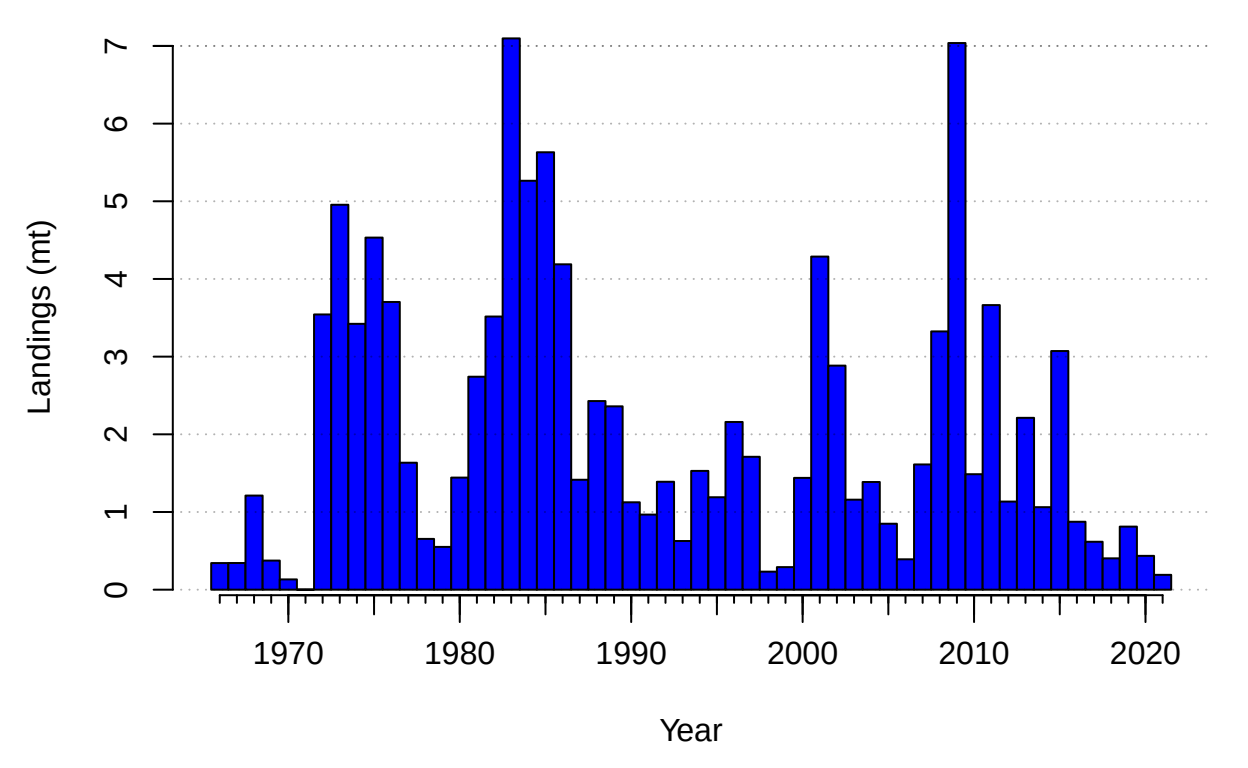

bias adjust in model
estimated alternative
$1 - SE(\hat{r_y})^2/\sigma_R^2$
1.0
0.6
0.2
−0.2
1970
1980
1990
2000
2010
2020
Year

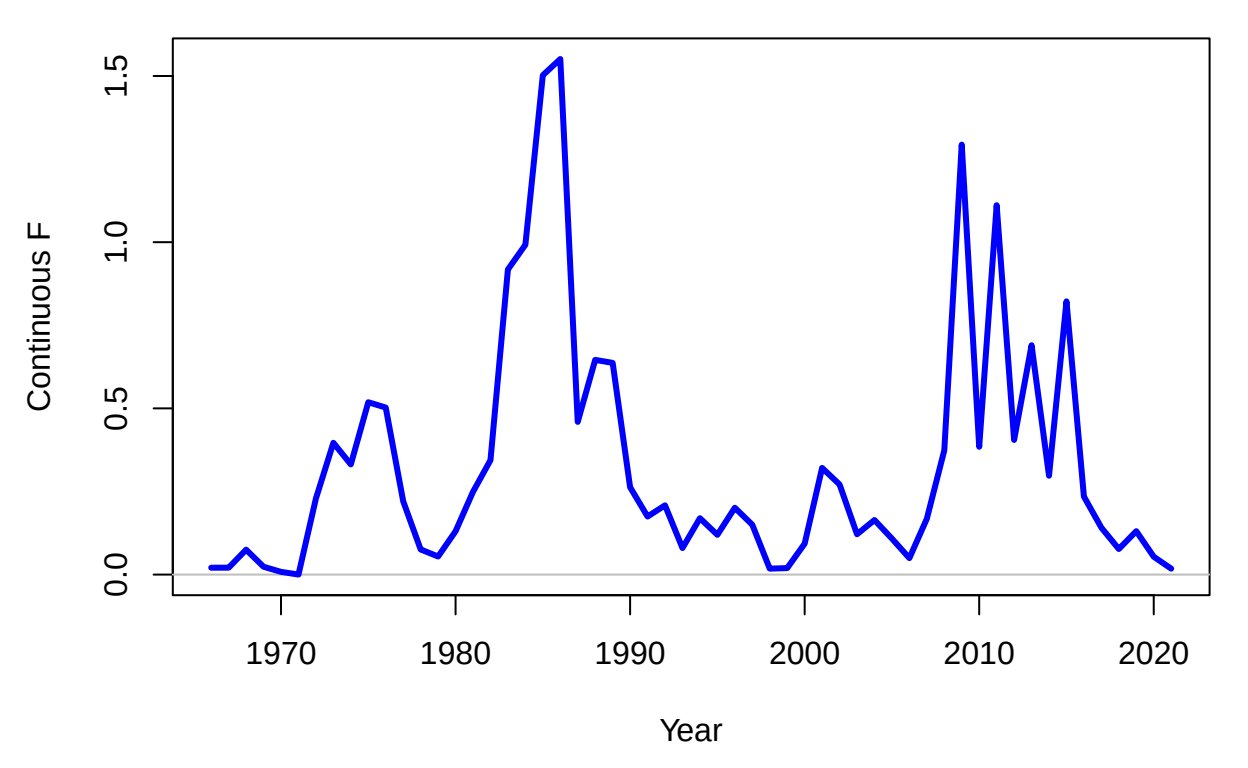

Exp. recruitment
Exp. recruitment after bias adj.
Estimated recruitments
Unfished equilibrium
Recruitment (1,000s)
0
10
20
30
40
50
0
2
4
6
8
10
Spawning biomass (mt)

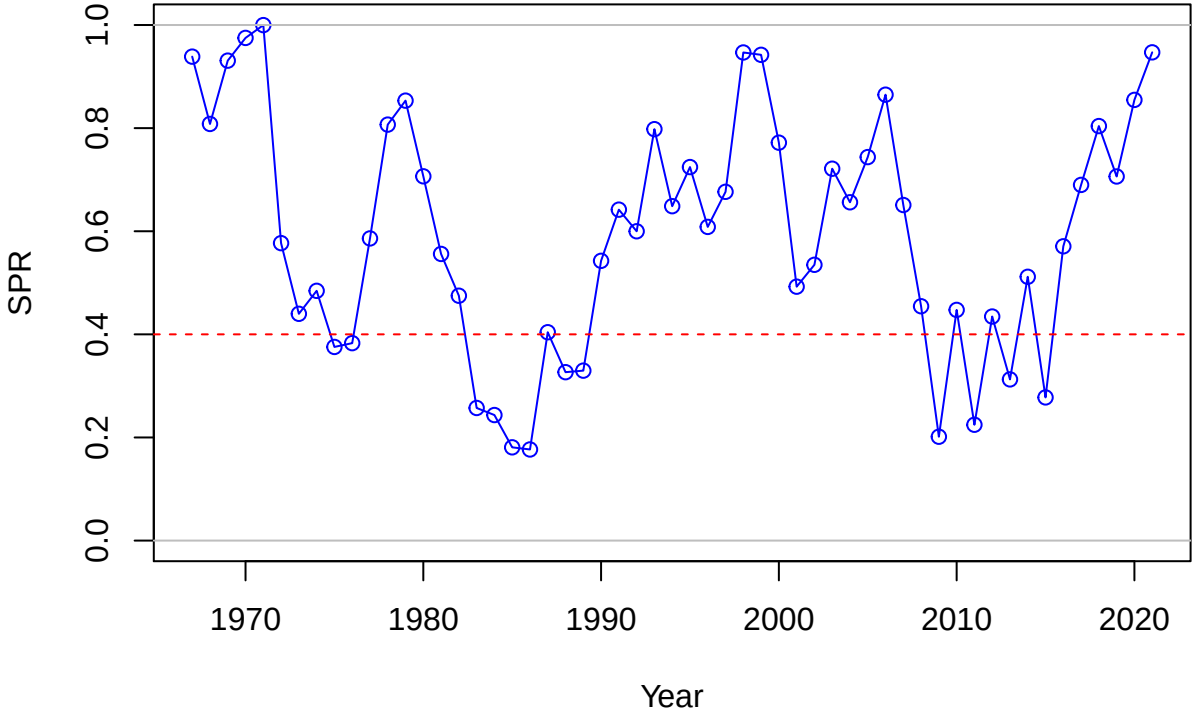

Exp. recruitment
Exp. recruitment after bias adj.
Estimated recruitments
Unfished equilibrium
2005
2018
2021
1967
2002
Recruitment (1,000s)
Spawning biomass (mt)
0
10
20
30
40
50
0
2
4
6
8
10

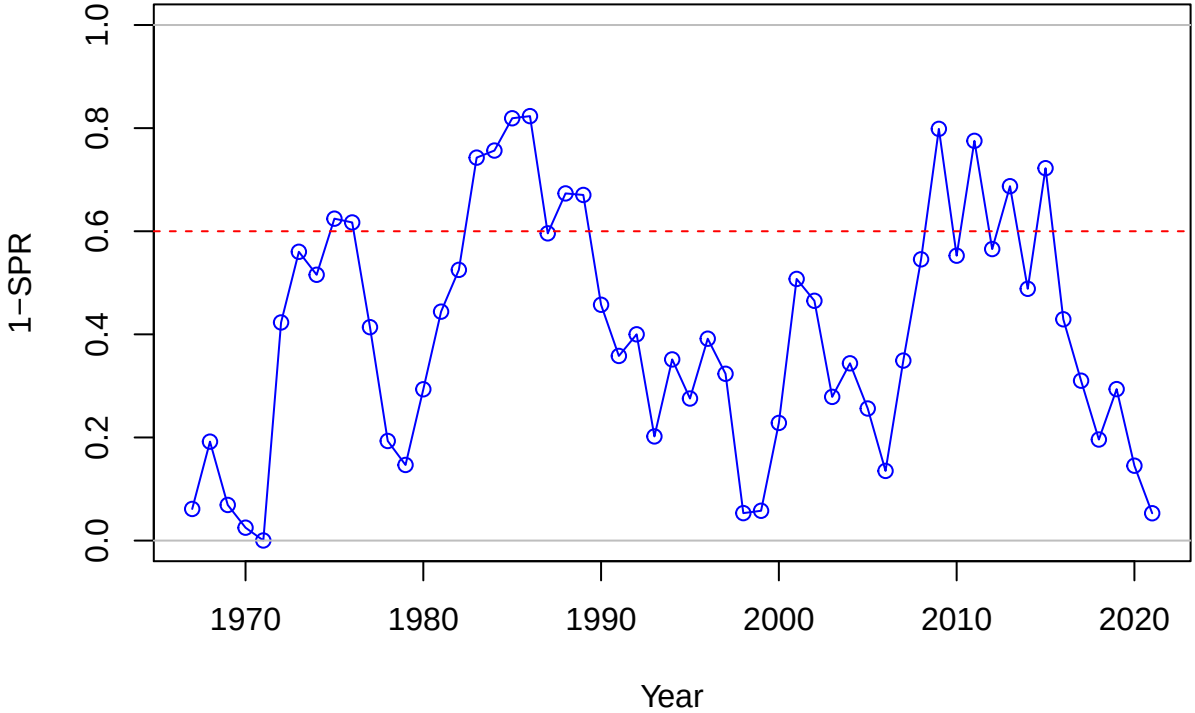

Log recruitment deviation
0.5
0.0
−0.5
2005
2018
2021
1967
2002
0.0
0.2
0.4
0.6
0.8
1.0
Spawning output (relative to B_0)

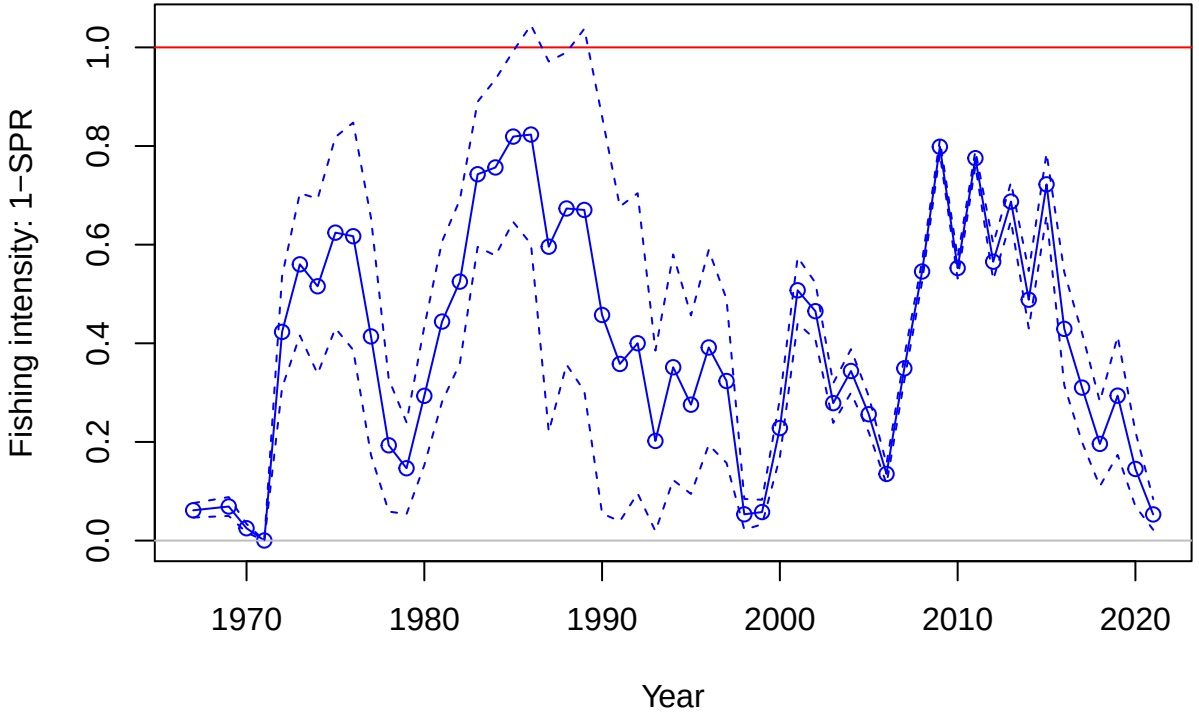

Landings (mt)
0
1
2
3
4
5
6
7
1970
1980
1990
2000
2010
2020
Year

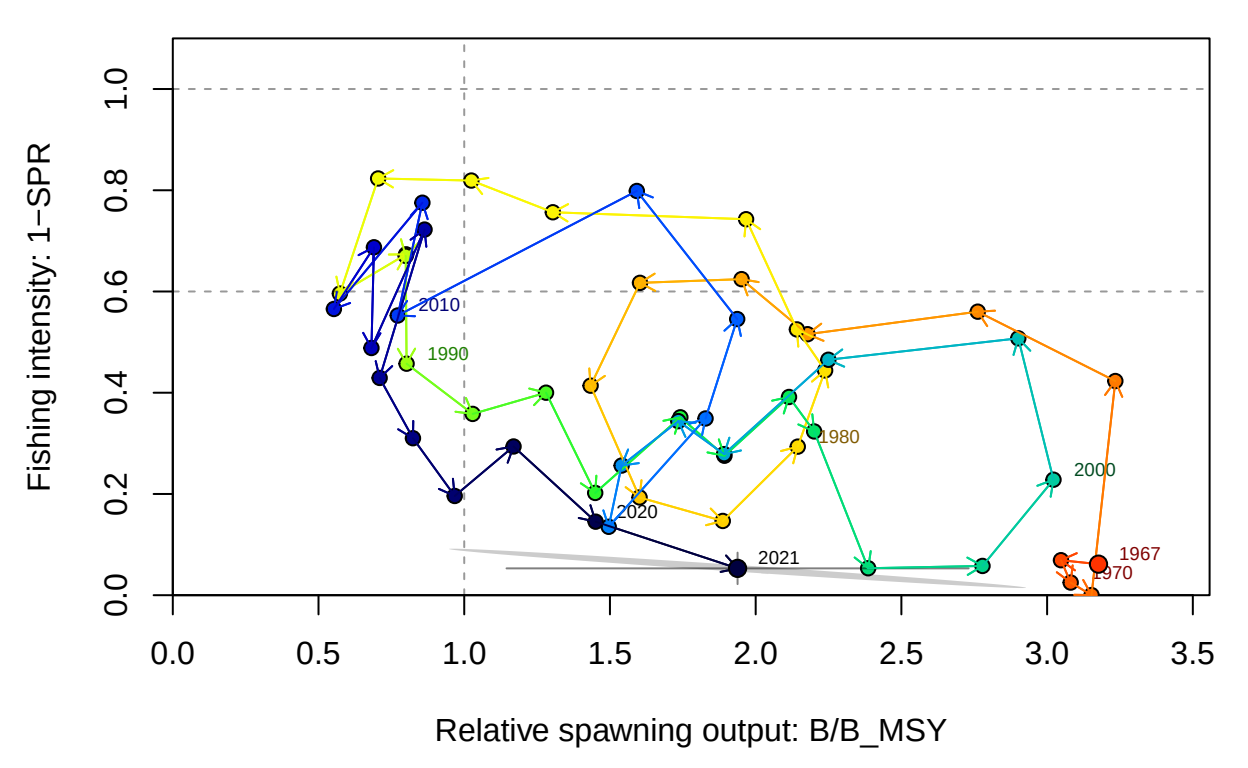

Landings (mt)
0
1
2
3
4
5
6
7
1970
1980
1990
2000
2010
2020
Year

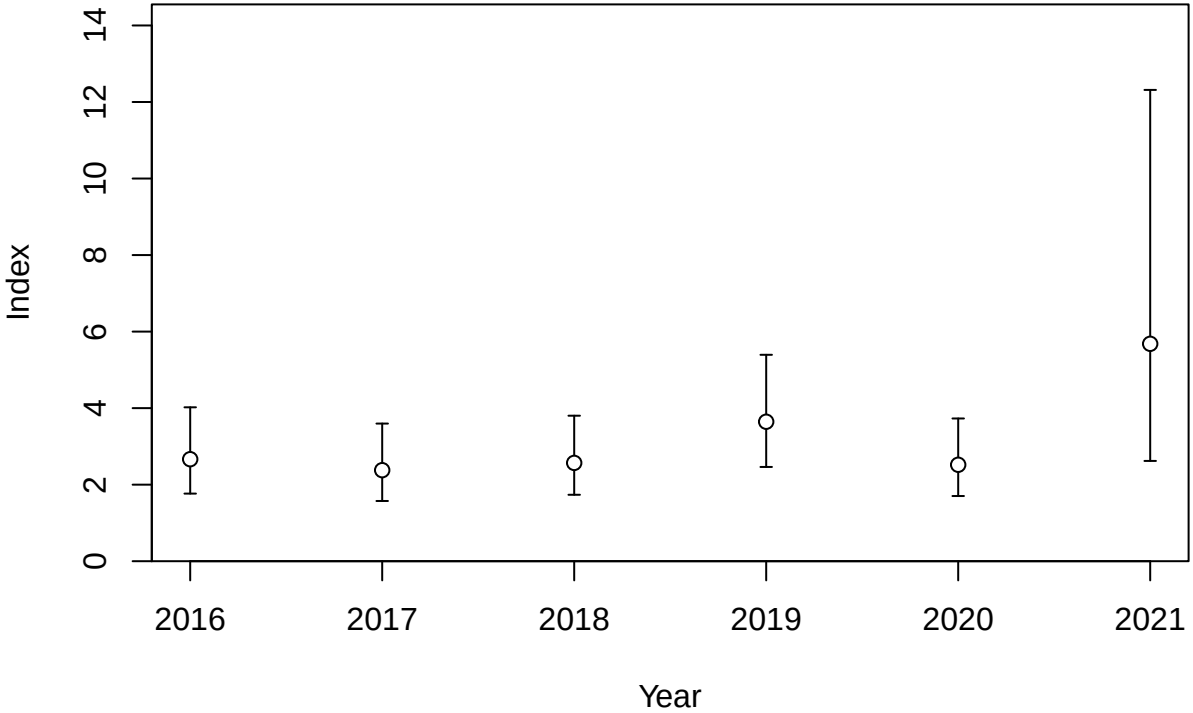

Continuous F
0.0
0.5
1.0
1.5
1970
1980
1990
2000
2010
2020
Year

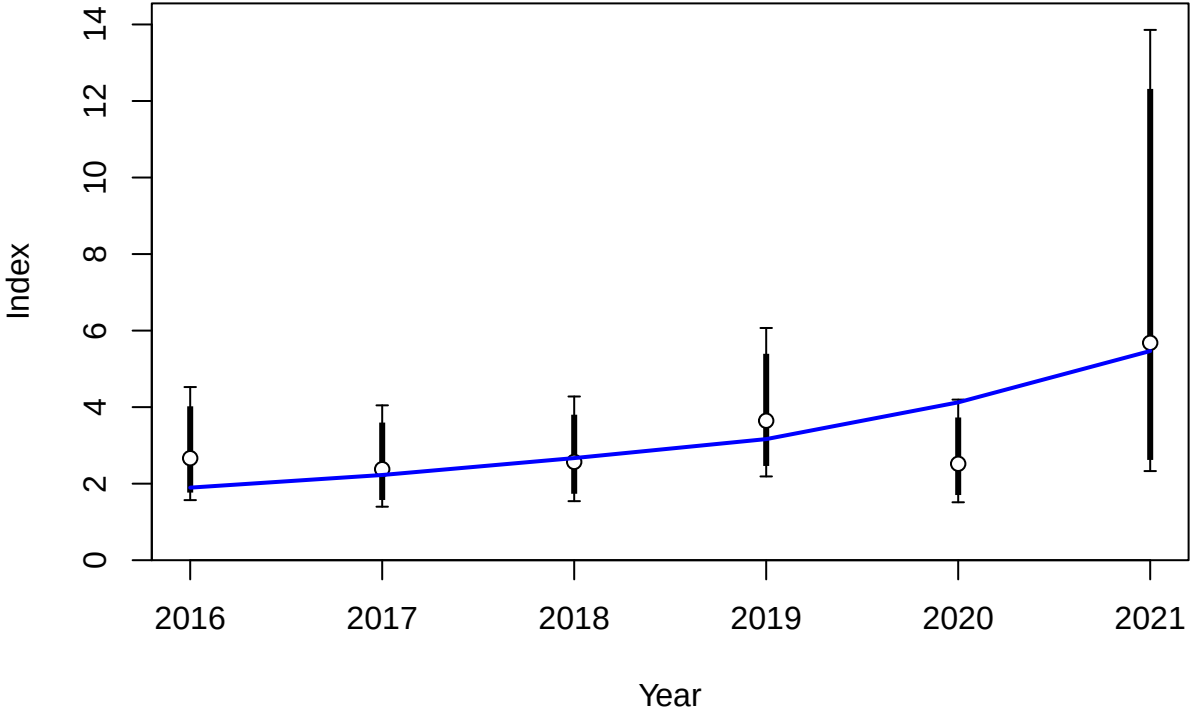

SPR
0.0
0.2
0.4
0.6
0.8
1.0
1970
1980
1990
2000
2010
2020
Year

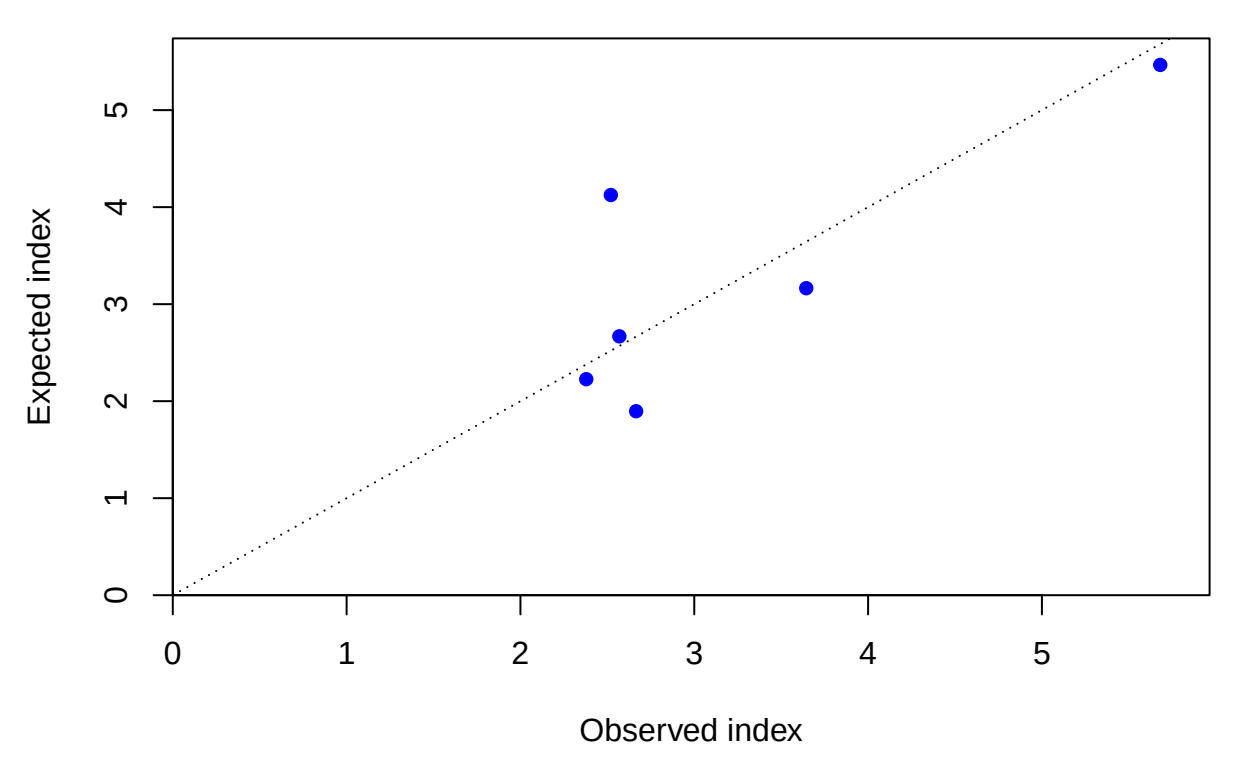

1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
1970
1980
1990
2000
2010
2020
Year

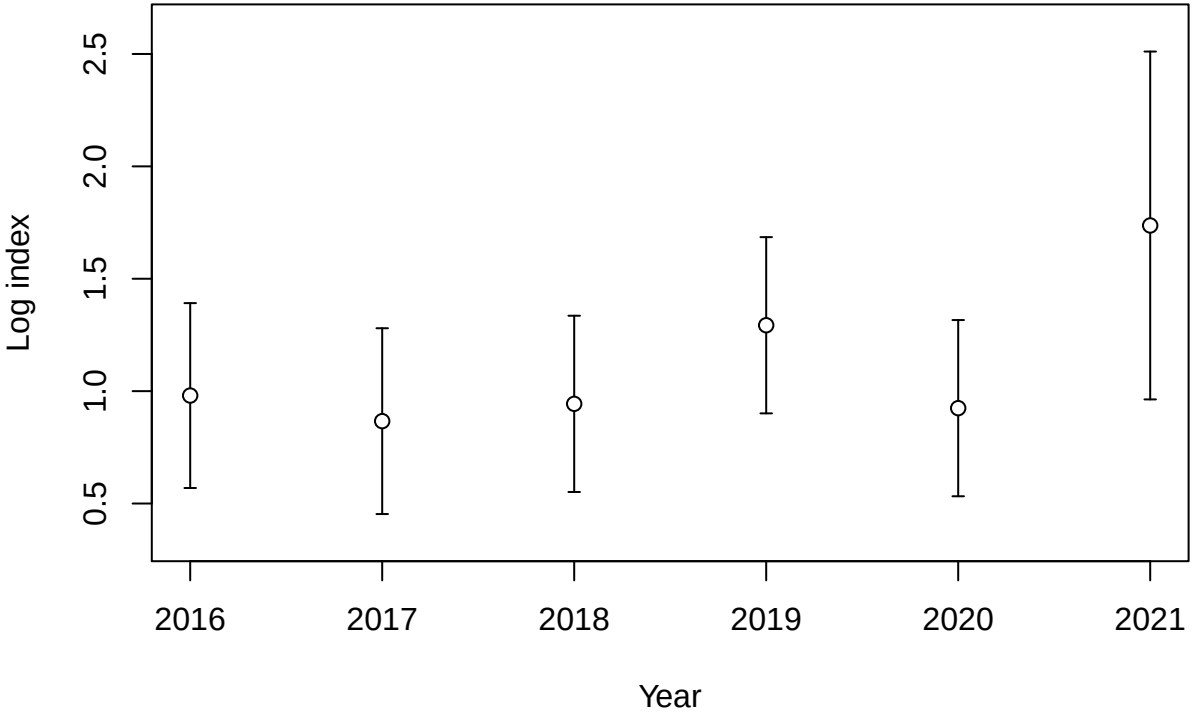

Fishing intensity: 1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
1970
1980
1990
2000
2010
2020
Year

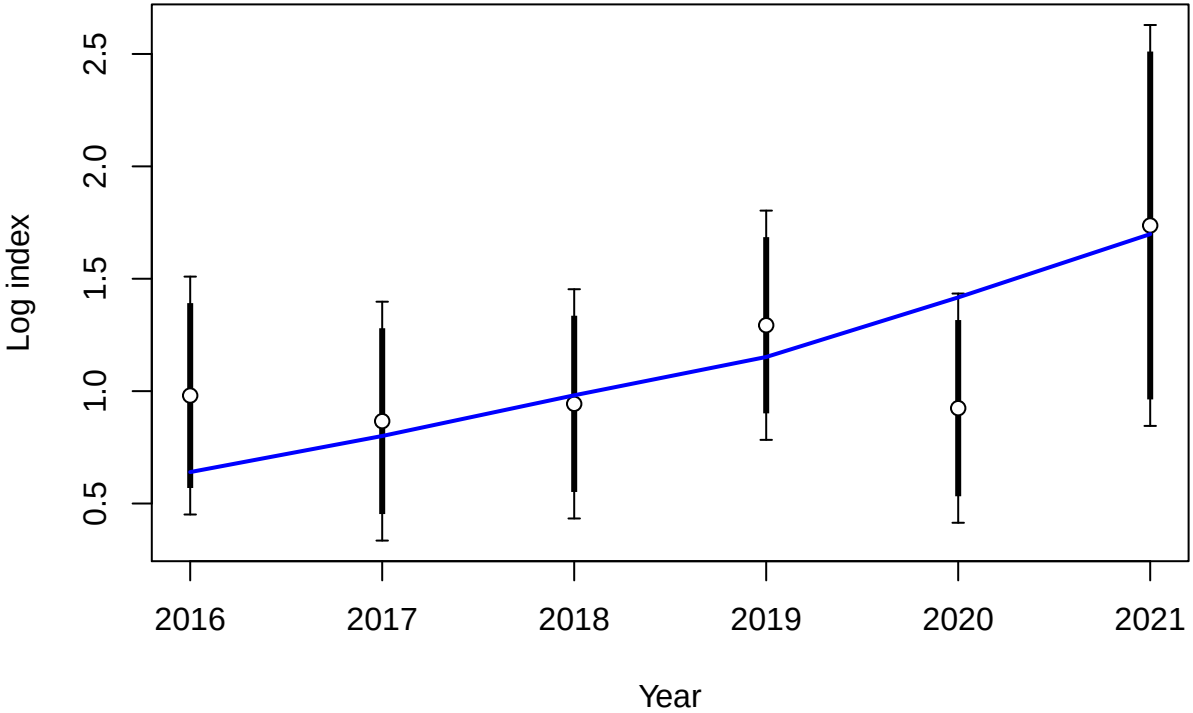

Fishing intensity: 1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
Relative spawning output: B/B_MSY
2010
1990
1980
2000
2020
2021
1967
1970

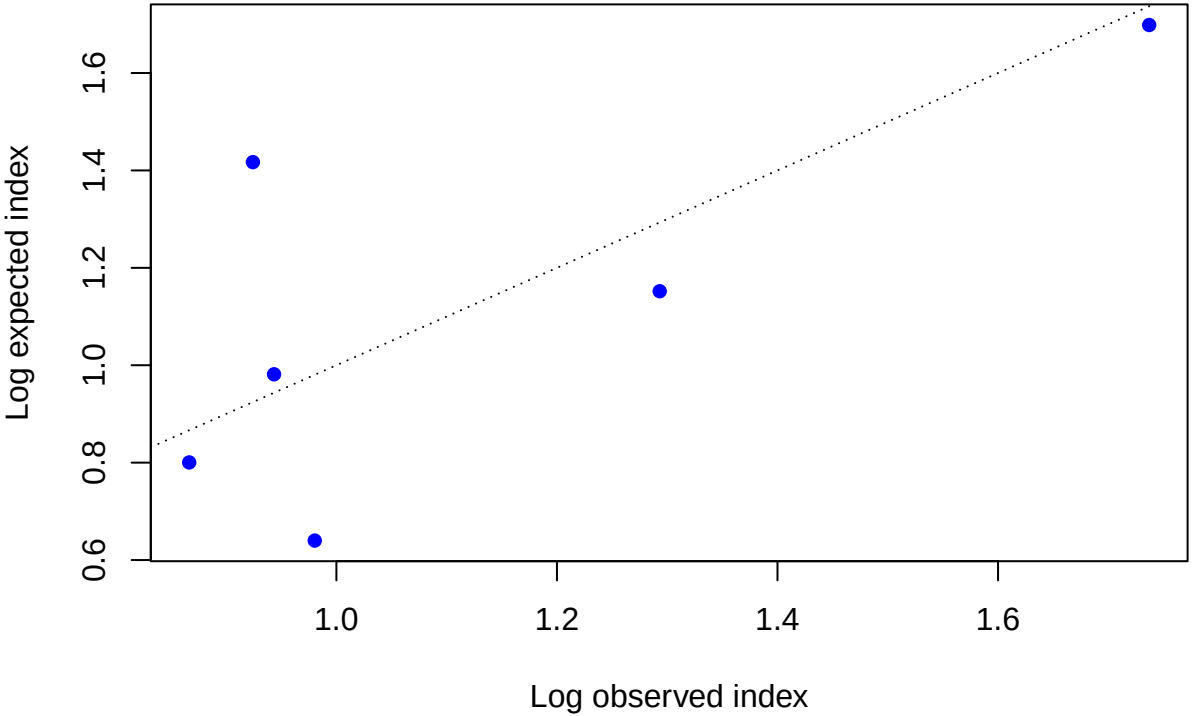

Index
0
2
4
6
8
10
12
14
2016
2017
2018
2019
2020
2021
Year

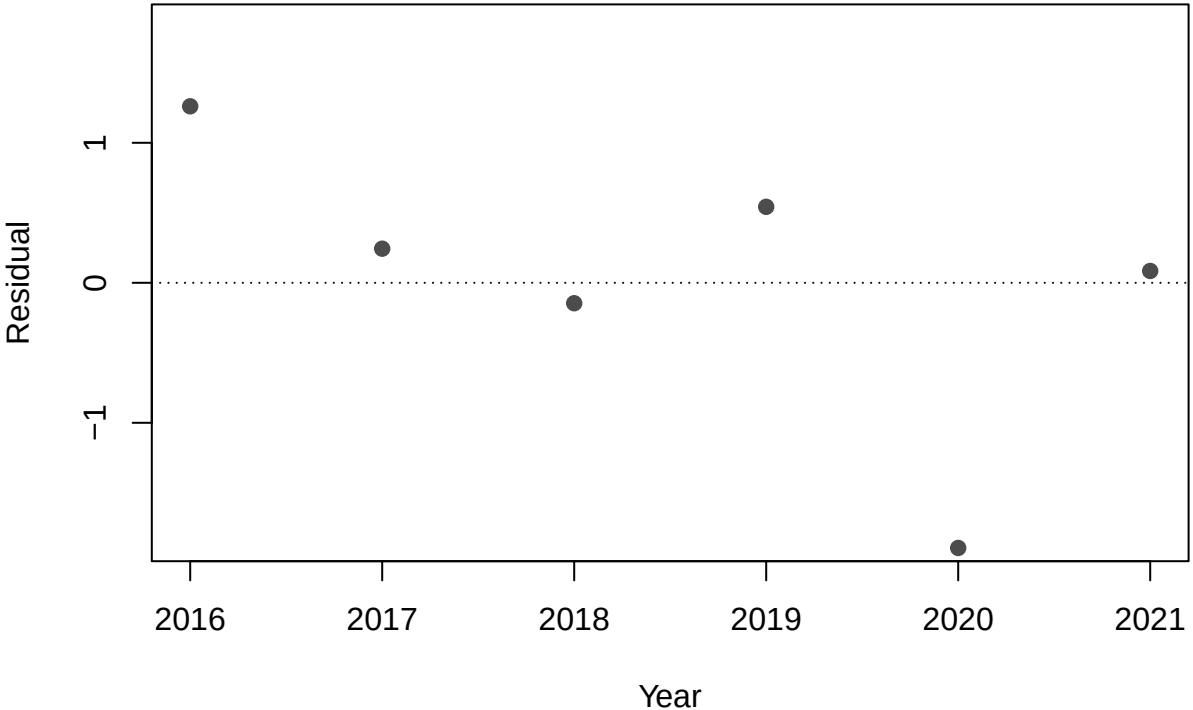

Index
0
2
4
6
8
10
12
14
2016
2017
2018
2019
2020
2021
Year

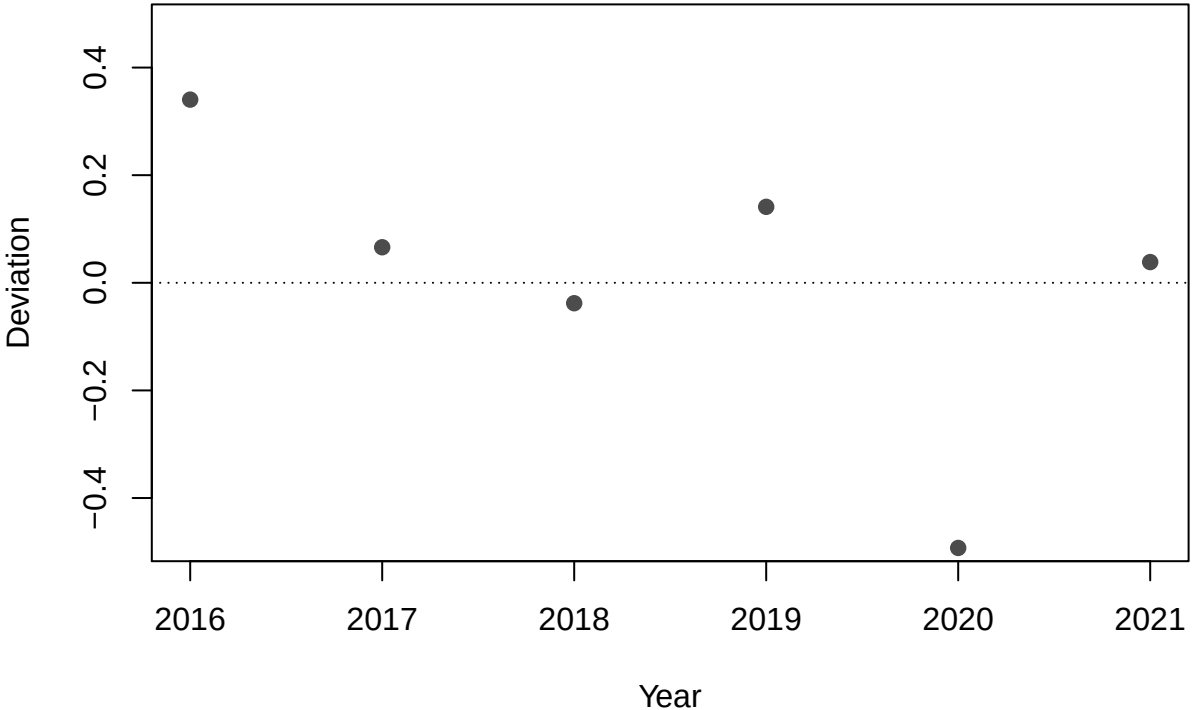

Expected index
Observed index
0
1
2
3
4
5

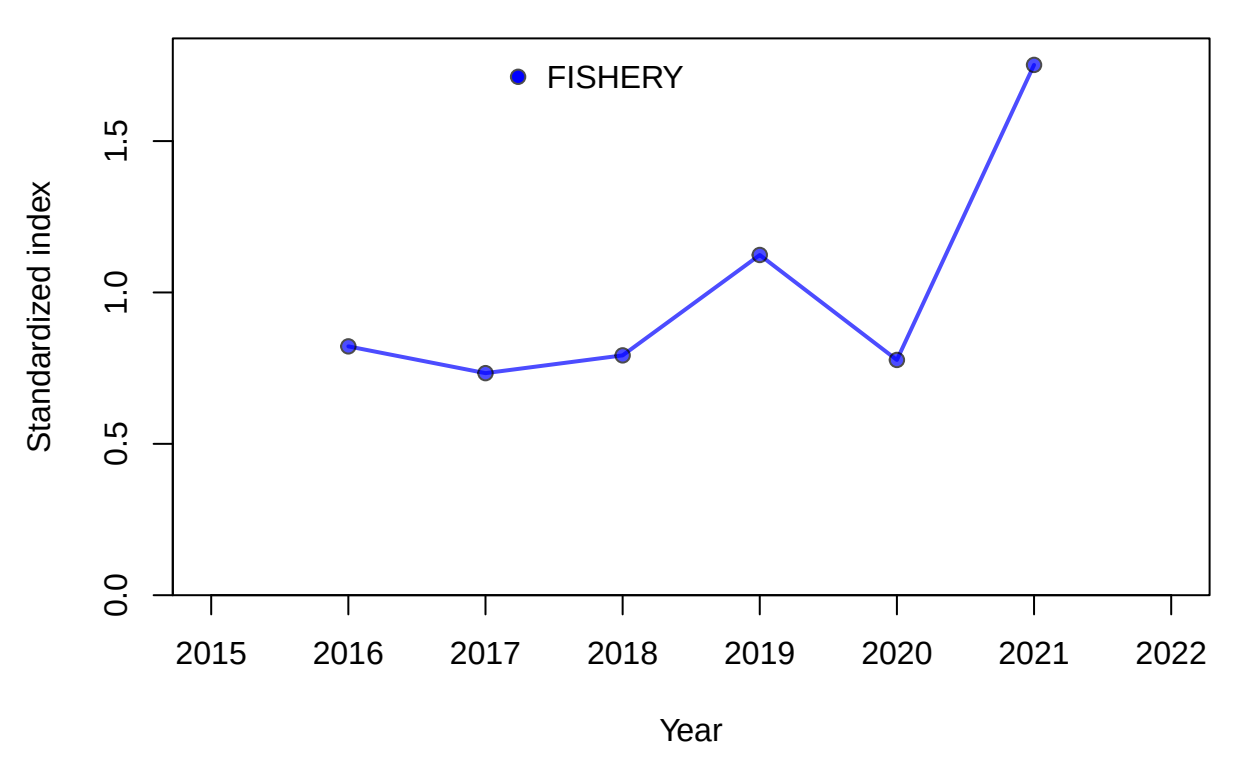

Log index
0.5
1.0
1.5
2.0
2.5
2016
2017
2018
2019
2020
2021
Year

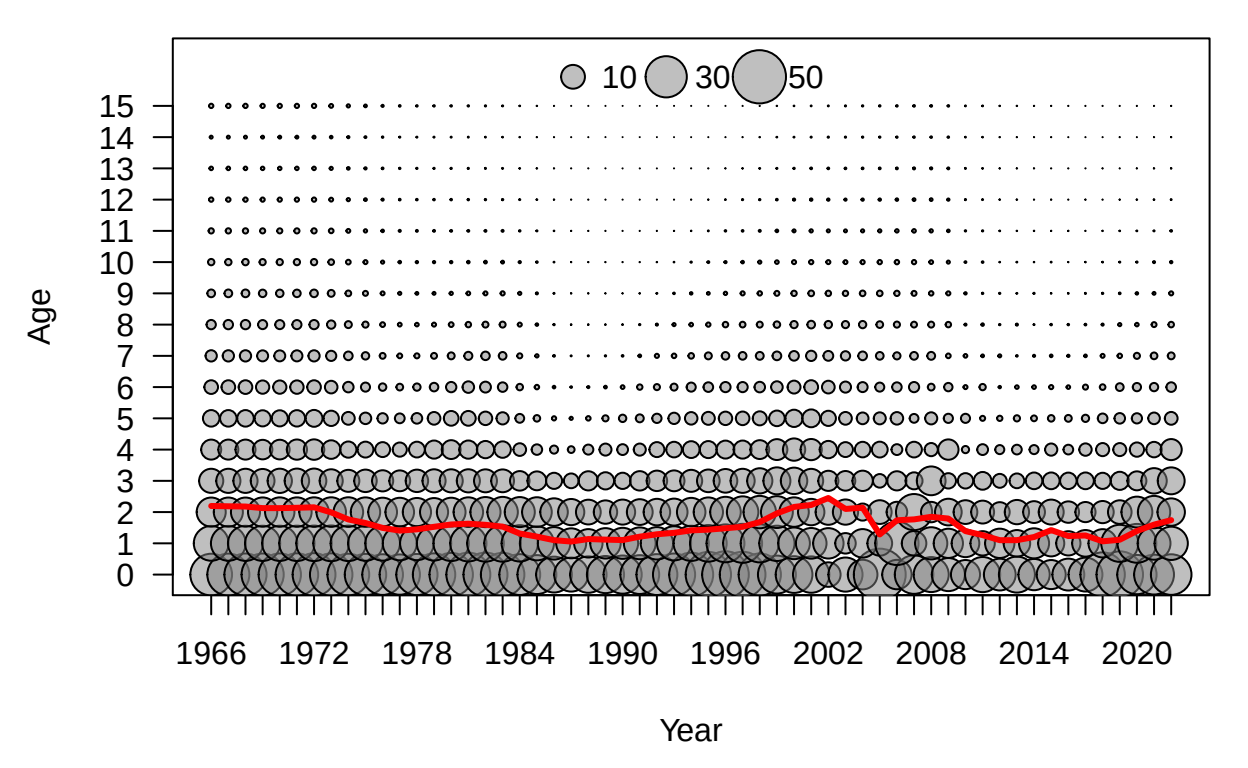

Log index
0.5
1.0
1.5
2.0
2.5
2016
2017
2018
2019
2020
2021
Year

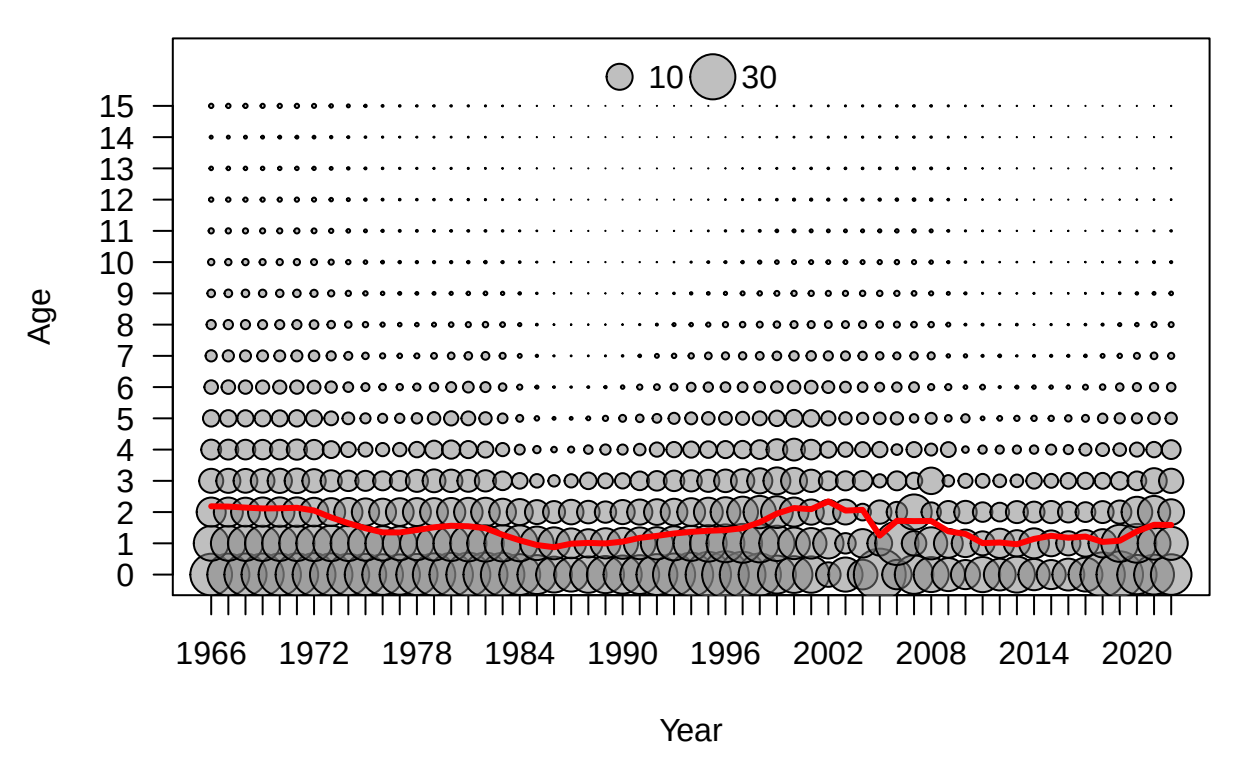

Log expected index
0.6
0.8
1.0
1.2
1.4
1.6
1.0
1.2
1.4
1.6
Log observed index

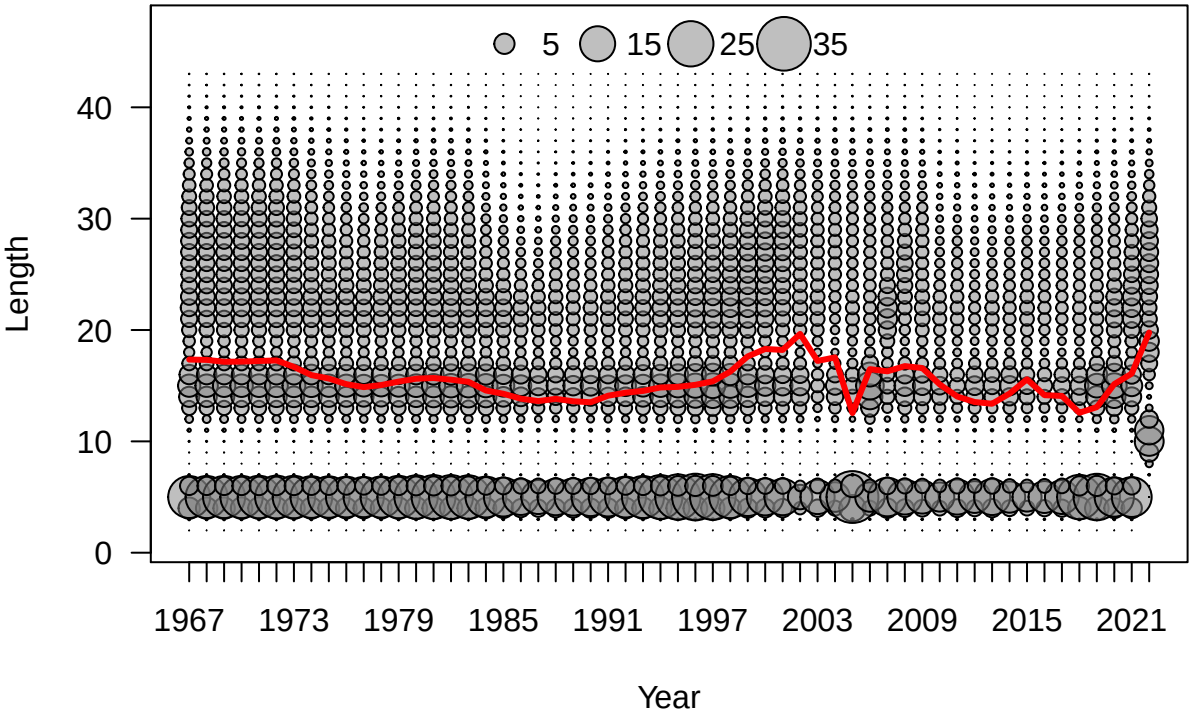

Residual
1
0
−1
2016
2017
2018
2019
2020
2021
Year

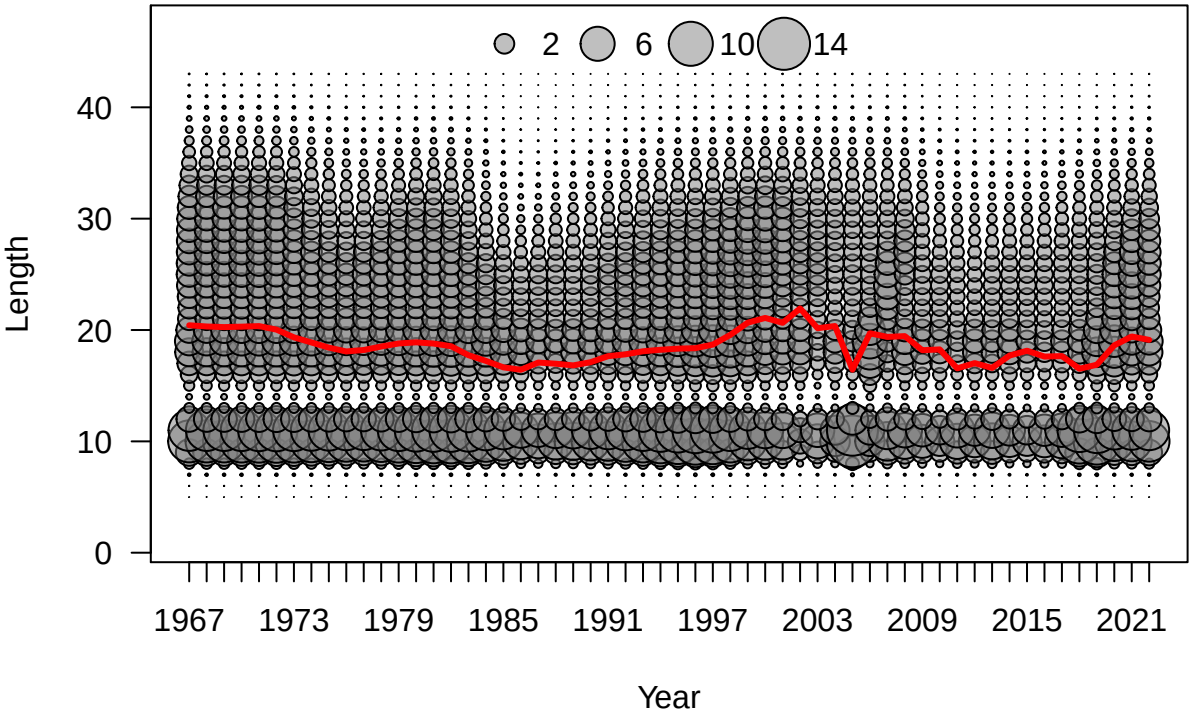

Deviation
0.4
0.2
0.0
−0.2
−0.4
2016
2017
2018
2019
2020
2021
Year

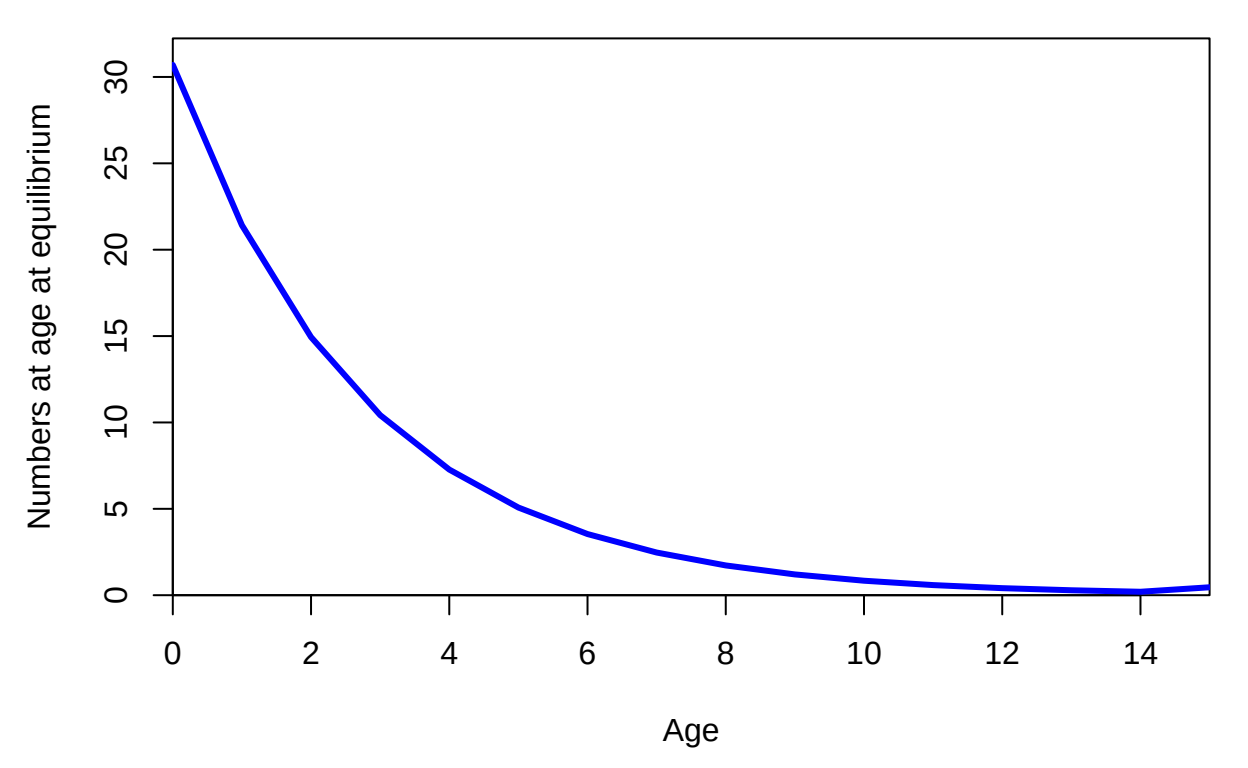

FISHERY
Standardized index
0.0
0.5
1.0
1.5
2015
2016
2017
2018
2019
2020
2021
2022
Year

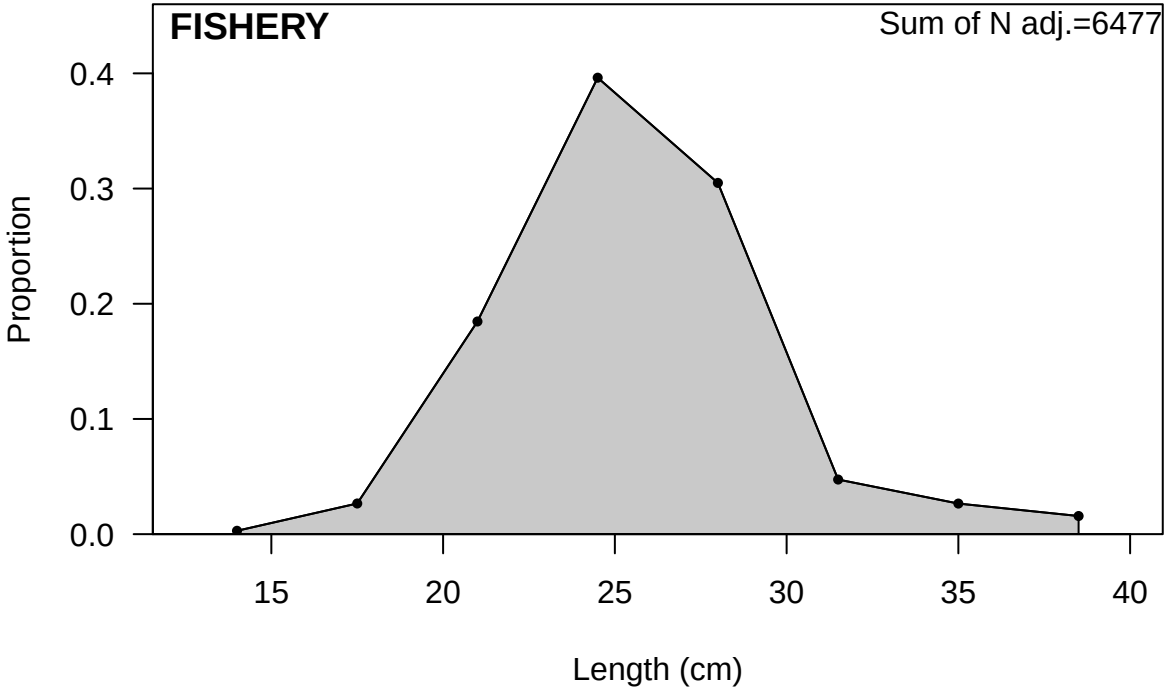

10
30
50
Age
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
1966
1972
1978
1984
1990
1996
2002
2008
2014
2020
Year

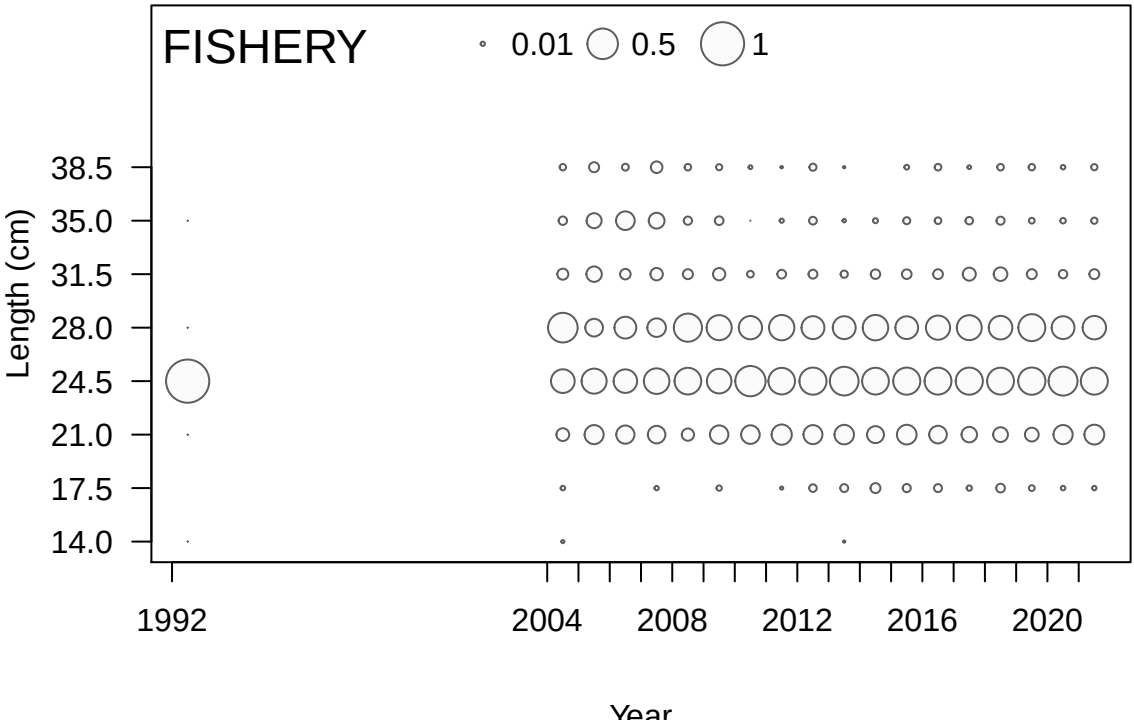

10
30
Age
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
1966
1972
1978
1984
1990
1996
2002
2008
2014
2020
Year

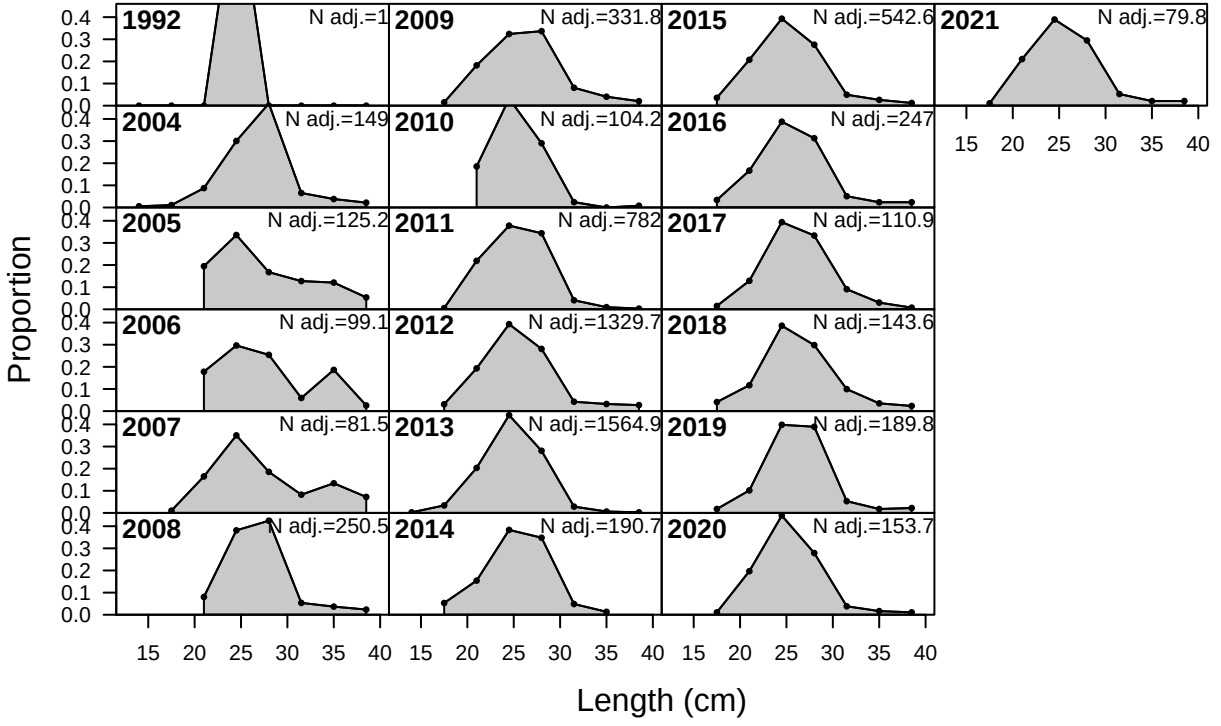

5
15
25
35
Length
0
10
20
30
40
1967
1973
1979
1985
1991
1997
2003
2009
2015
2021
Year

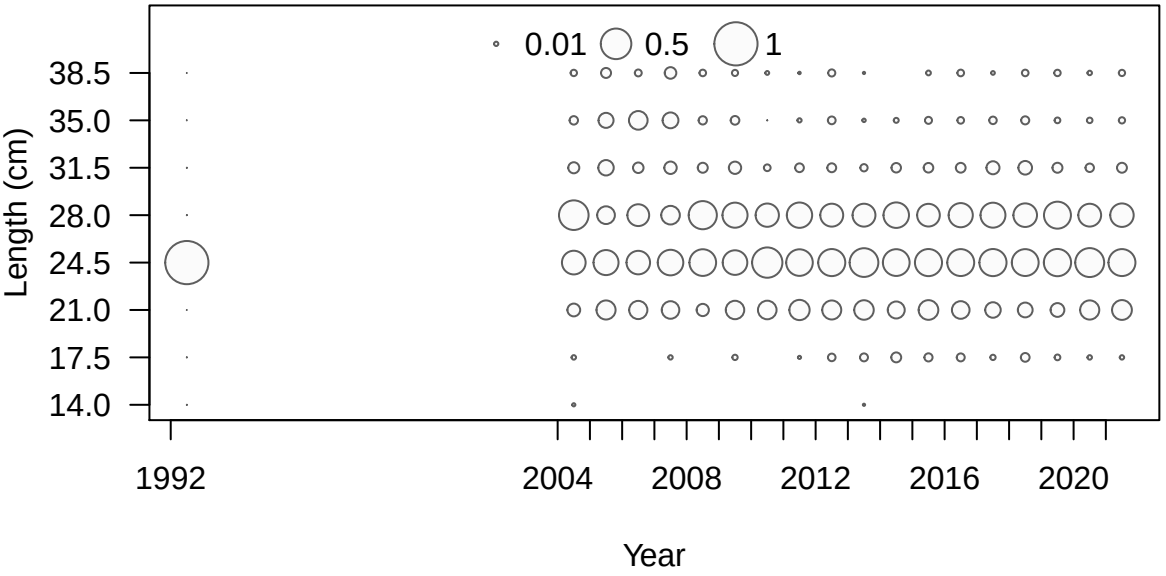

2
6
10
14
Length
0
10
20
30
40
1967
1973
1979
1985
1991
1997
2003
2009
2015
2021
Year

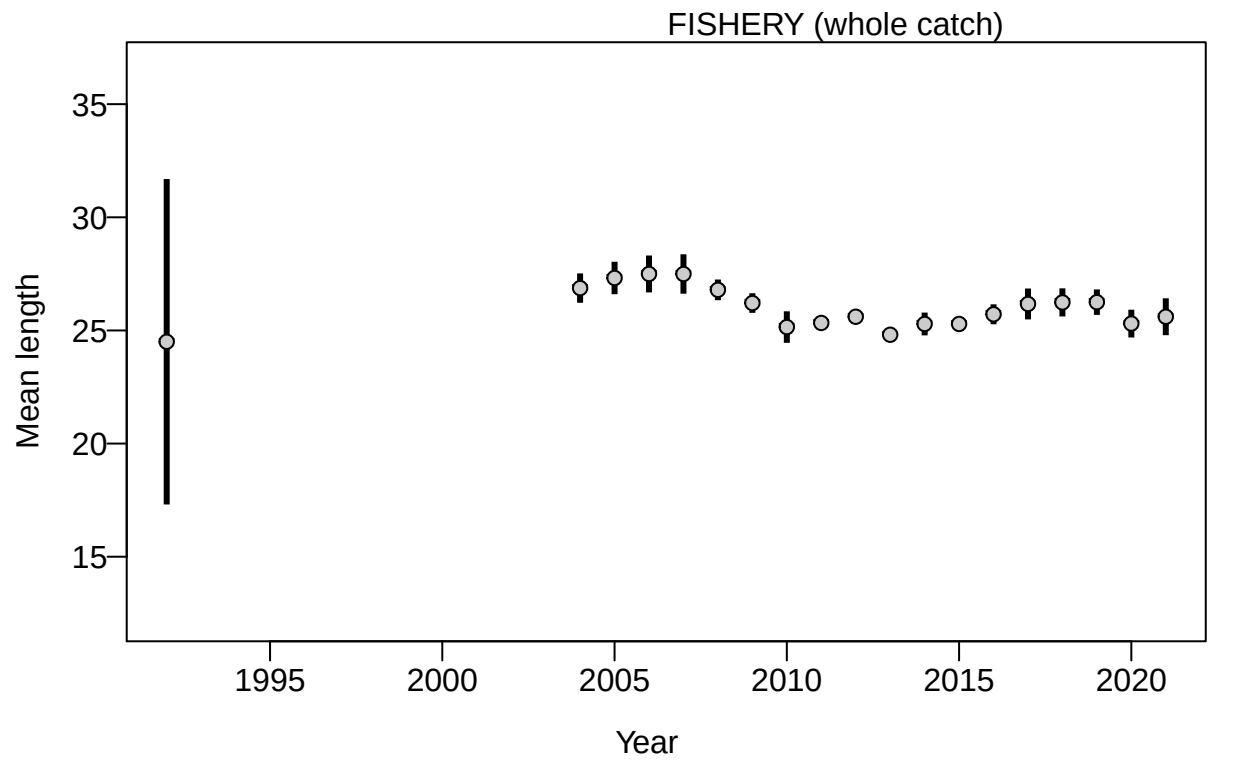

Numbers at age at equilibrium
0
5
10
15
20
25
30
0
2
4
6
8
10
12
14
Age

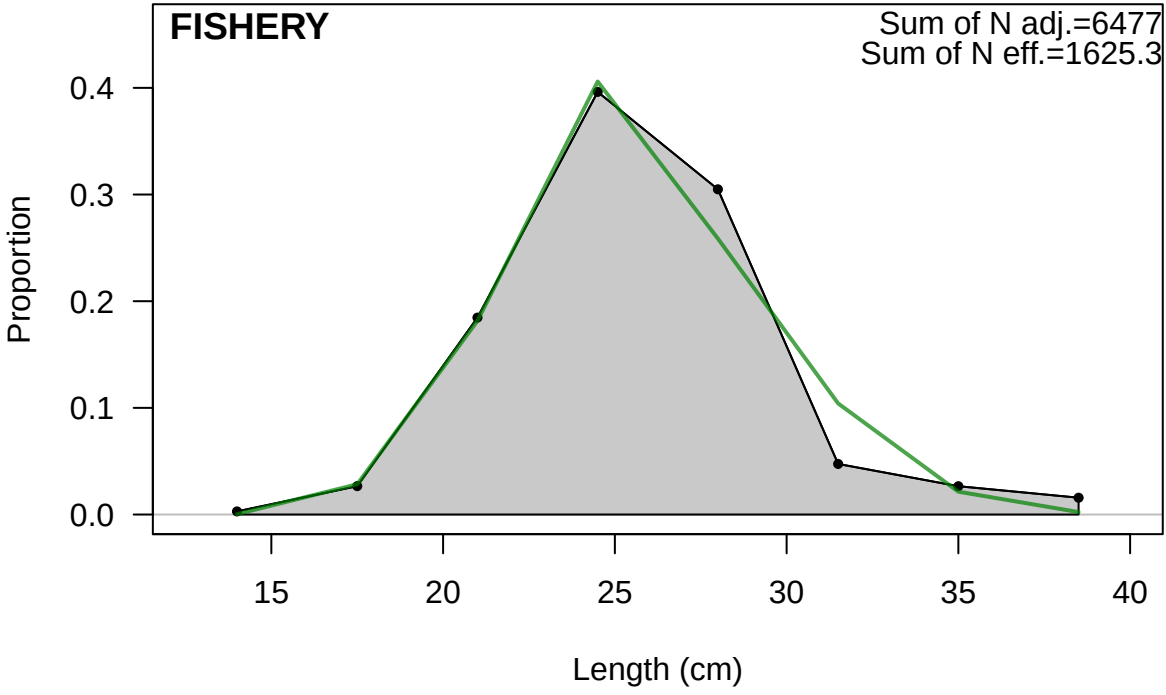

FISHERY
Sum of N adj.=6477
Proportion
0.0
0.1
0.2
0.3
0.4
15
20
25
30
35
40
Length (cm)

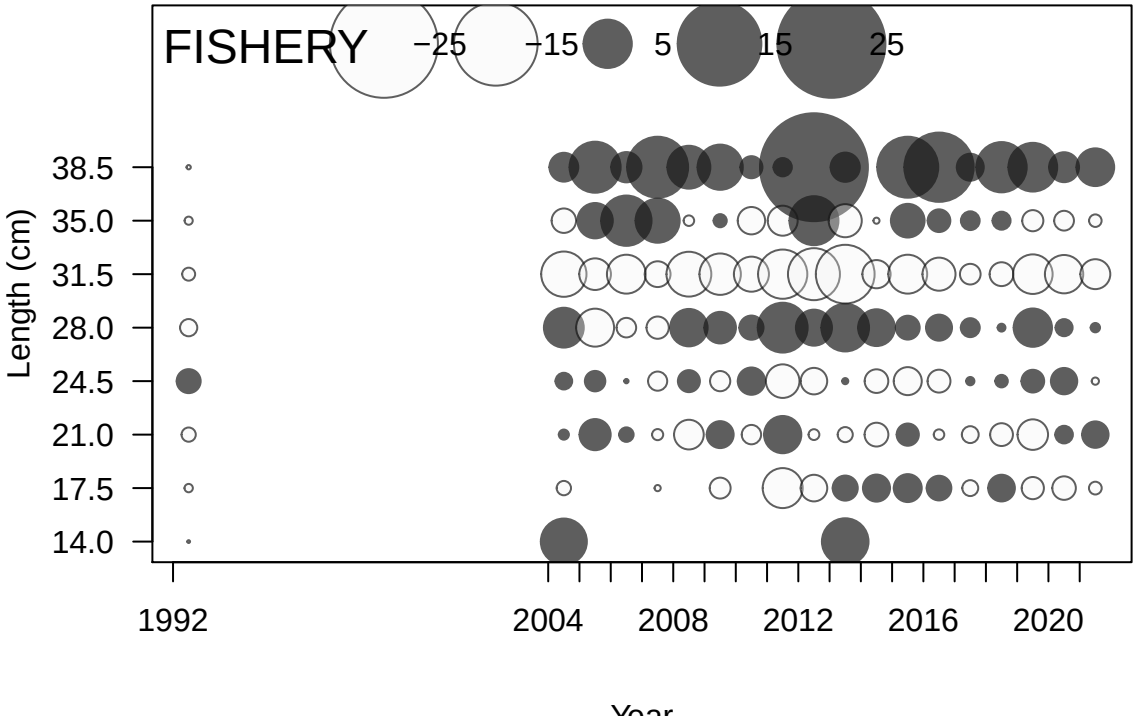

FISHERY
0.01
0.5
1
38.5
35.0
31.5
28.0
24.5
21.0
17.5
14.0
Length (cm)
1992
2004
2008
2012
2016
2020
Year

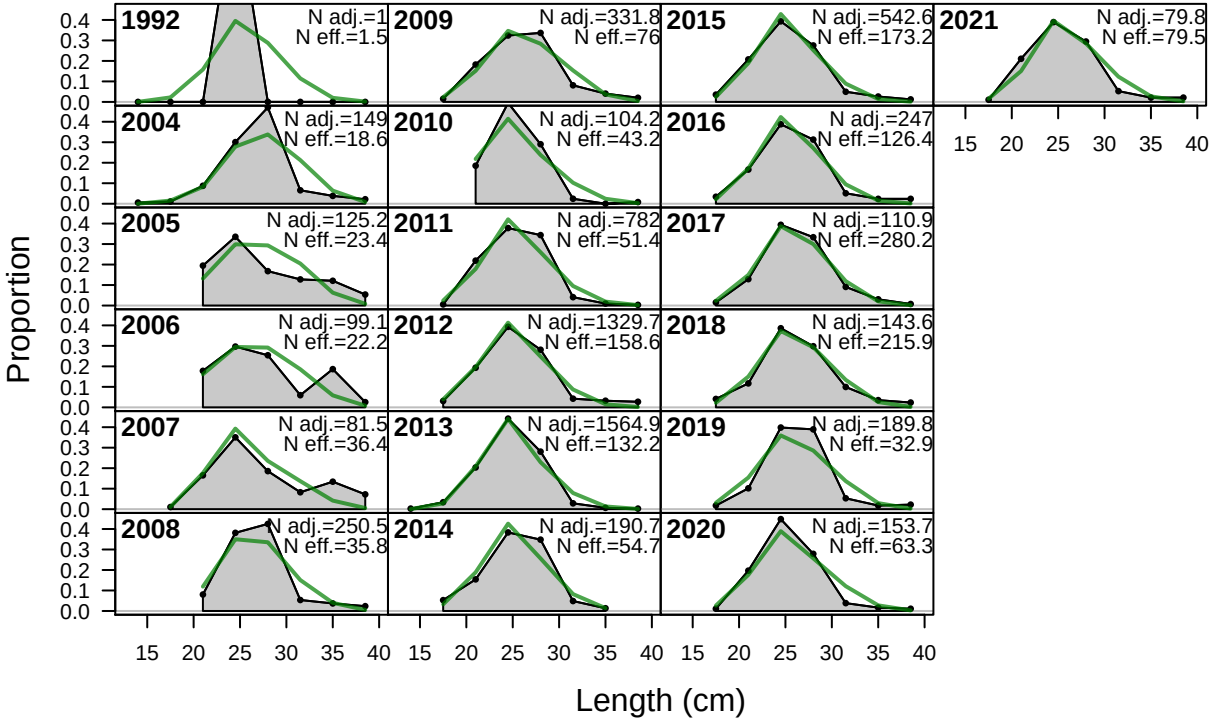

1992
N adj.=1
2009
N adj.=331.8
2015
N adj.=542.6
2021
N adj.=79.8
2004
N adj.=149
2010
N adj.=104.2
2016
N adj.=247
2005
N adj.=125.2
2011
N adj.=782
2017
N adj.=110.9
2006
N adj.=99.1
2012
N adj.=1329.7
2018
N adj.=143.6
2007
N adj.=81.5
2013
N adj.=1564.9
2019
N adj.=189.8
2008
N adj.=250.5
2014
N adj.=190.7
2020
N adj.=153.7
Proportion
0.0
0.1
0.2
0.3
0.4
15
20
25
30
35
40
Length (cm)

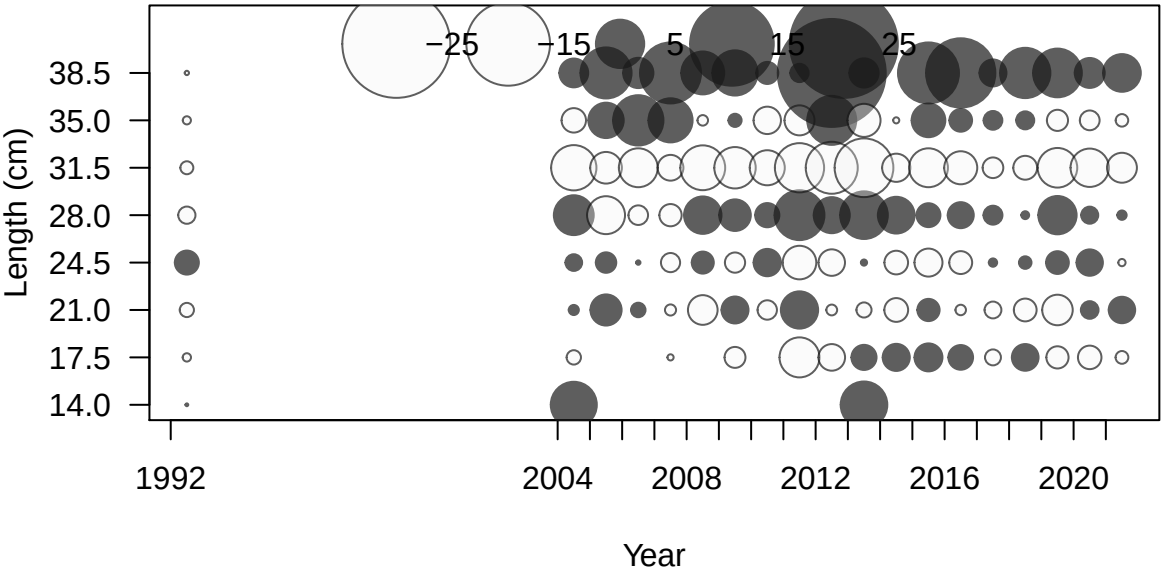

0.01
0.5
1
38.5
35.0
31.5
28.0
24.5
21.0
17.5
14.0
Length (cm)
1992
2004
2008
2012
2016
2020
Year

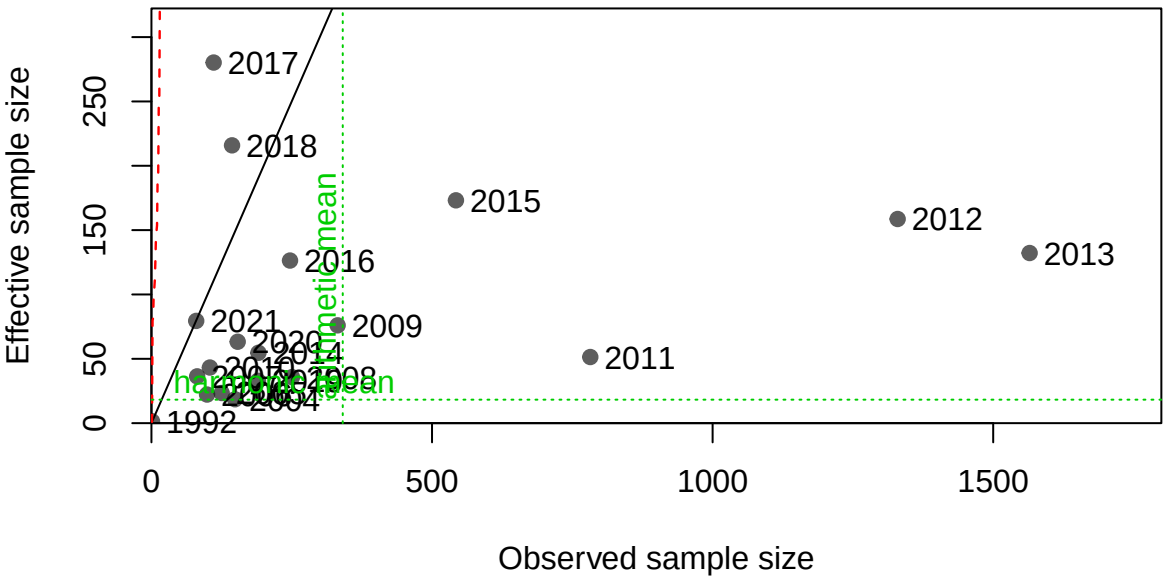

FISHERY (whole catch)
Mean length
35
30
25
20
15
1995
2000
2005
2010
2015
2020
Year


FISHERY
Sum of N adj.=6477
Sum of N eff.=1625.3
Proportion
0.0
0.1
0.2
0.3
0.4
15
20
25
30
35
40
Length (cm)

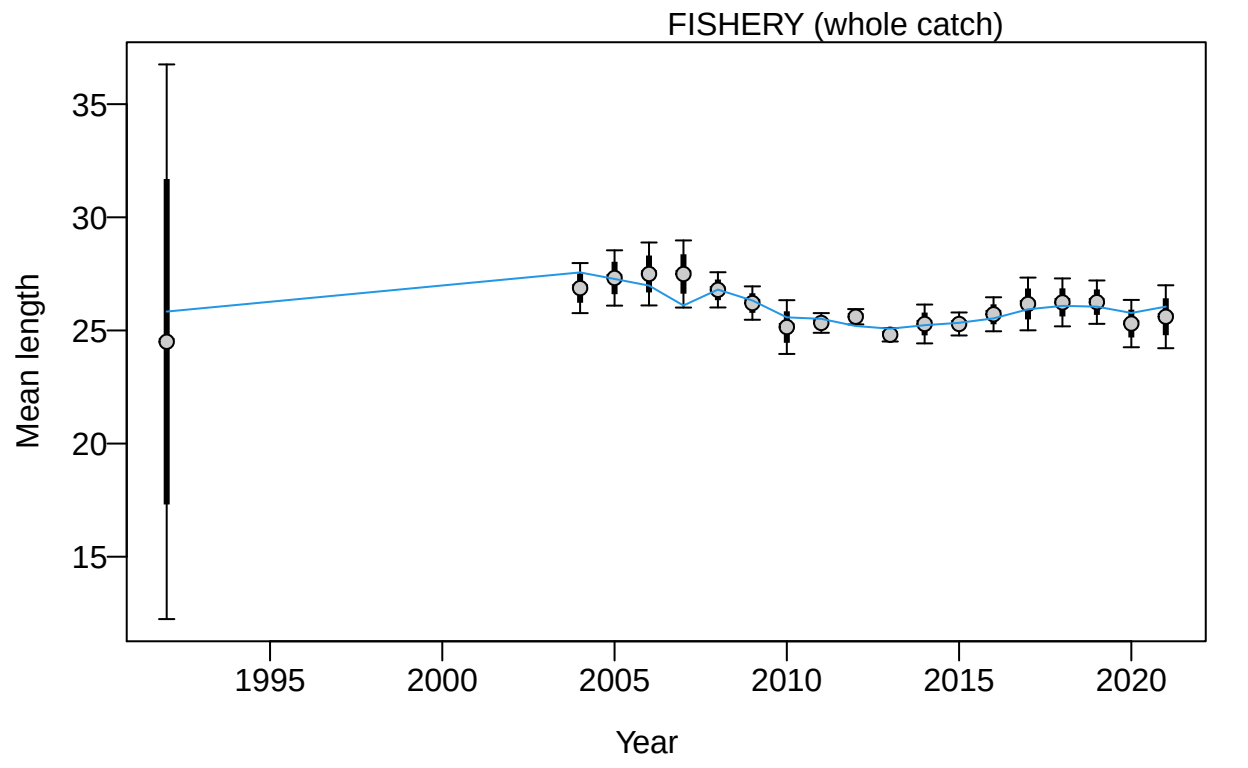

FISHERY
−25
−15
5
15
25
38.5
35.0
31.5
28.0
24.5
21.0
17.5
14.0
Length (cm)
1992
2004
2008
2012
2016
2020
Year

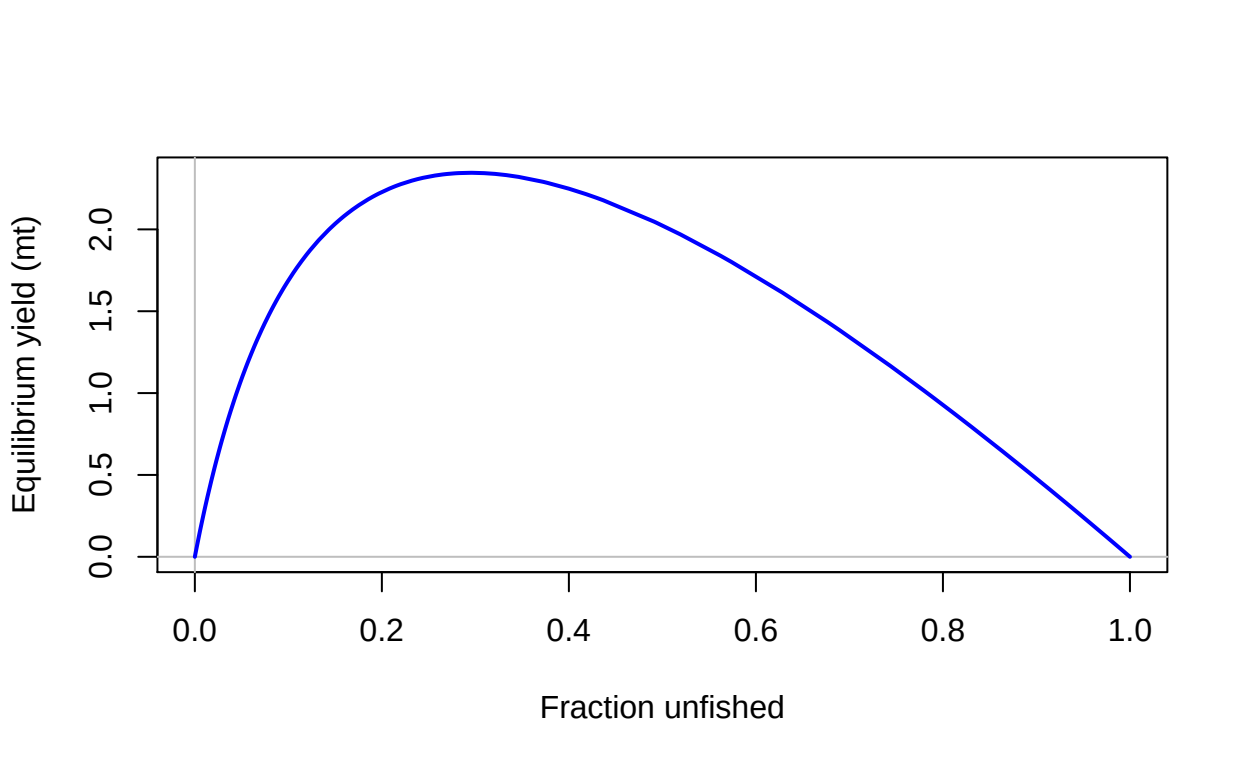

1992
N adj.=1
N eff.=1.5
2009
N adj.=331.8
N eff.=76
2015
N adj.=542.6
N eff.=173.2
2021
N adj.=79.8
N eff.=79.5
2004
N adj.=149
N eff.=18.6
2010
N adj.=104.2
N eff.=43.2
2016
N adj.=247
N eff.=126.4
2005
N adj.=125.2
N eff.=23.4
2011
N adj.=782
N eff.=51.4
2017
N adj.=110.9
N eff.=280.2
2006
N adj.=99.1
N eff.=22.2
2012
N adj.=1329.7
N eff.=158.6
2018
N adj.=143.6
N eff.=215.9
2007
N adj.=81.5
N eff.=36.4
2013
N adj.=1564.9
N eff.=132.2
2019
N adj.=189.8
N eff.=32.9
2008
N adj.=250.5
N eff.=35.8
2014
N adj.=190.7
N eff.=54.7
2020
N adj.=153.7
N eff.=63.3
0.0
0.1
0.2
0.3
0.4
15
20
25
30
35
40
Proportion
Length (cm)

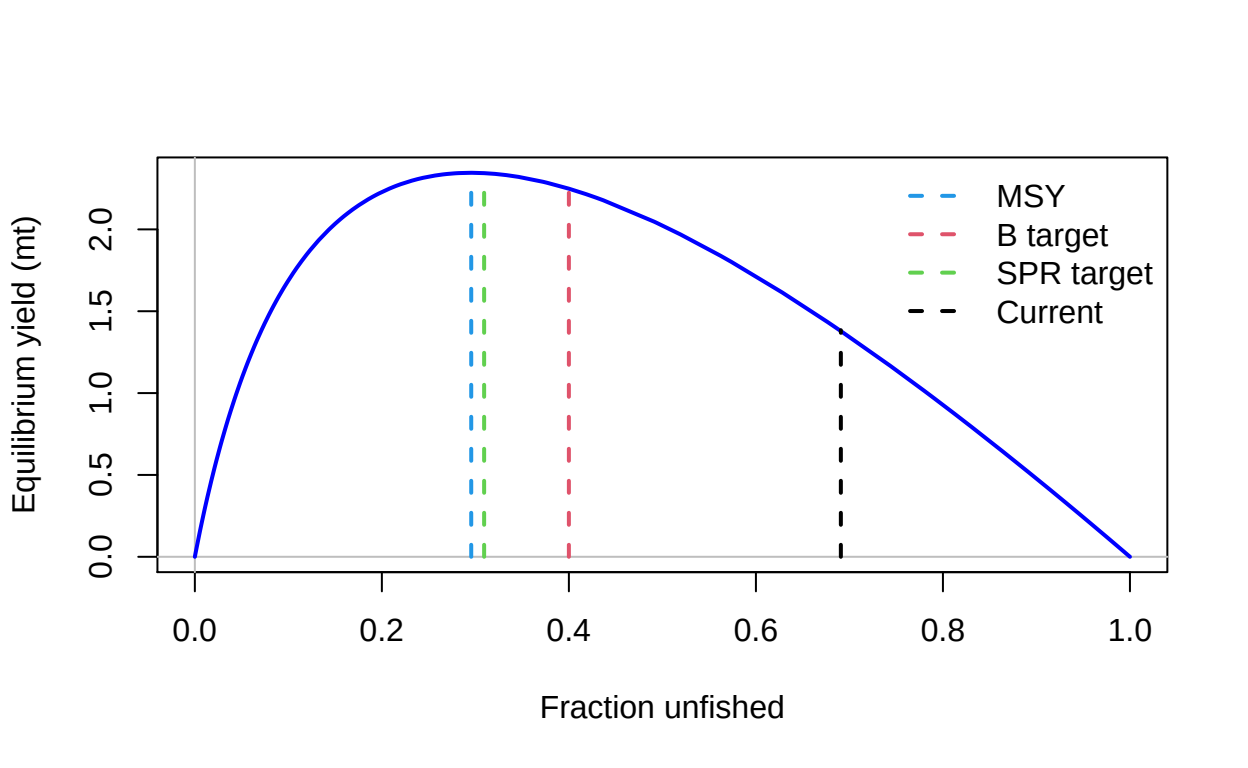

−25
−15
5
15
25
38.5
35.0
31.5
28.0
24.5
21.0
17.5
14.0
Length (cm)
1992
2004
2008
2012
2016
2020
Year

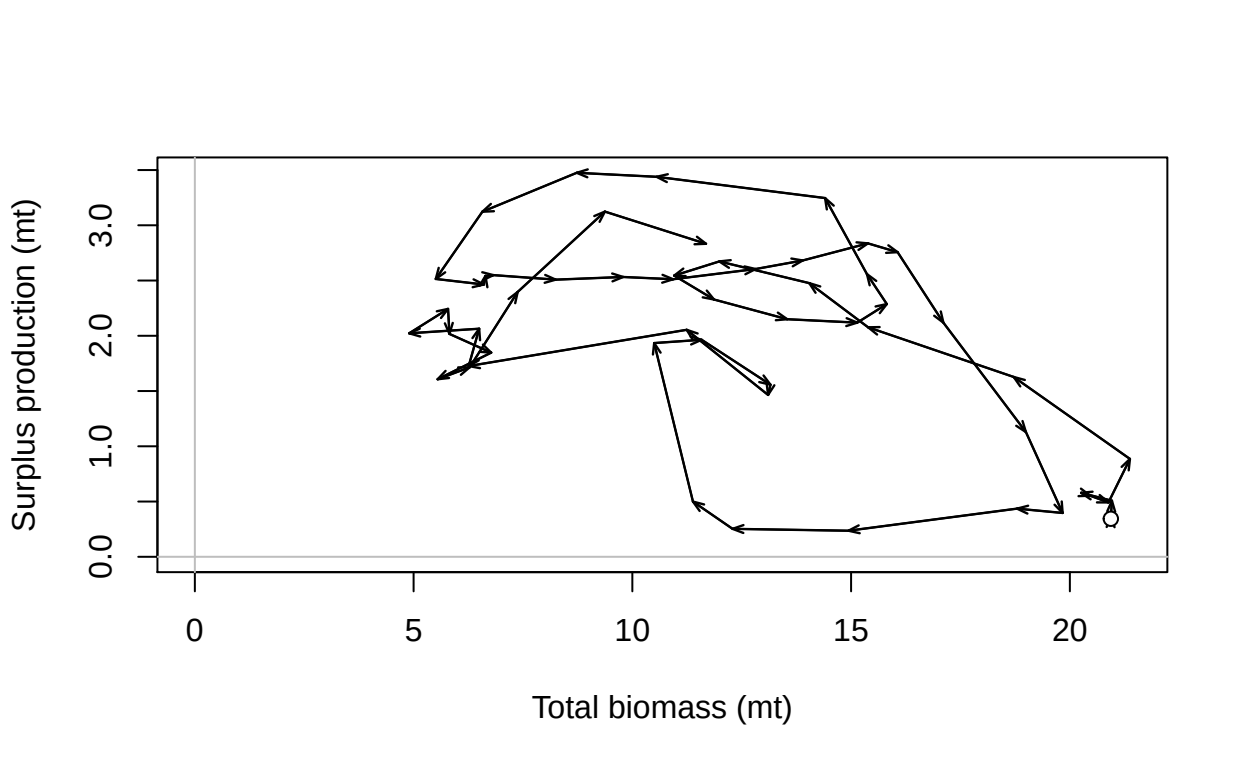


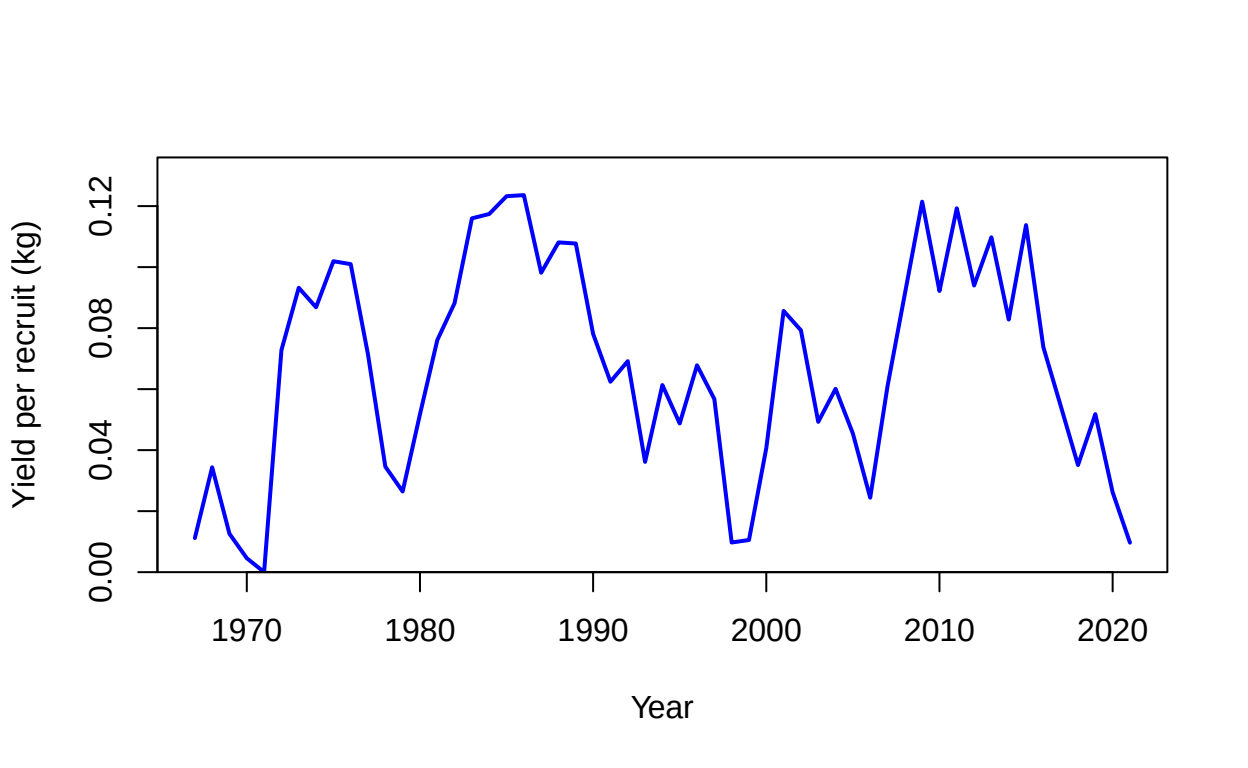
Effective sample size
Observed sample size
0
50
150
250
0
500
1000
1500
2017
2018
2015
2012
2013
2016
2021
2009
2011
1992
harmonic mean

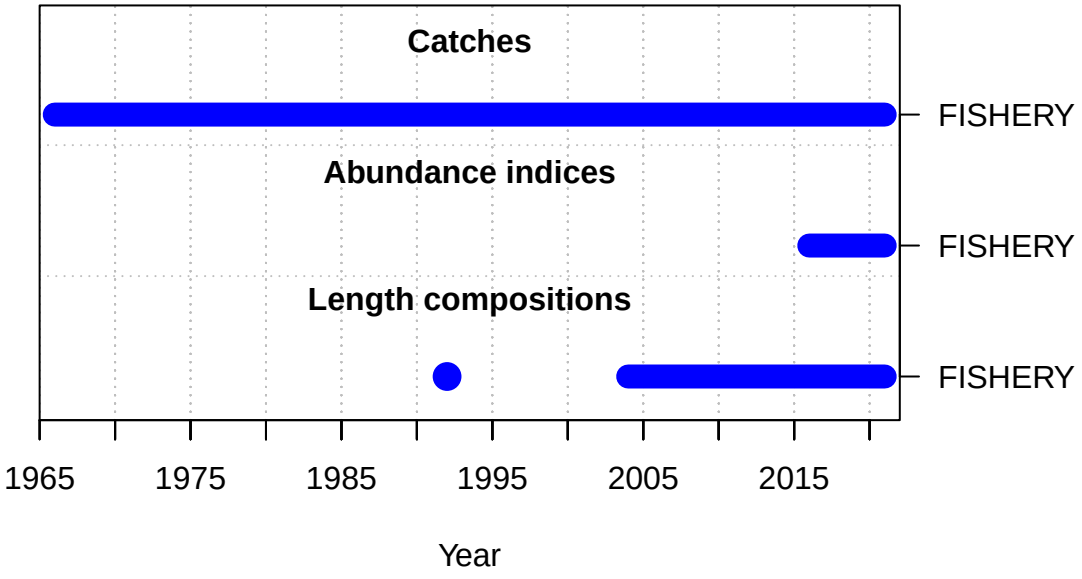

FISHERY (whole catch)
Mean length
35
30
25
20
15
1995
2000
2005
2010
2015
2020
Year

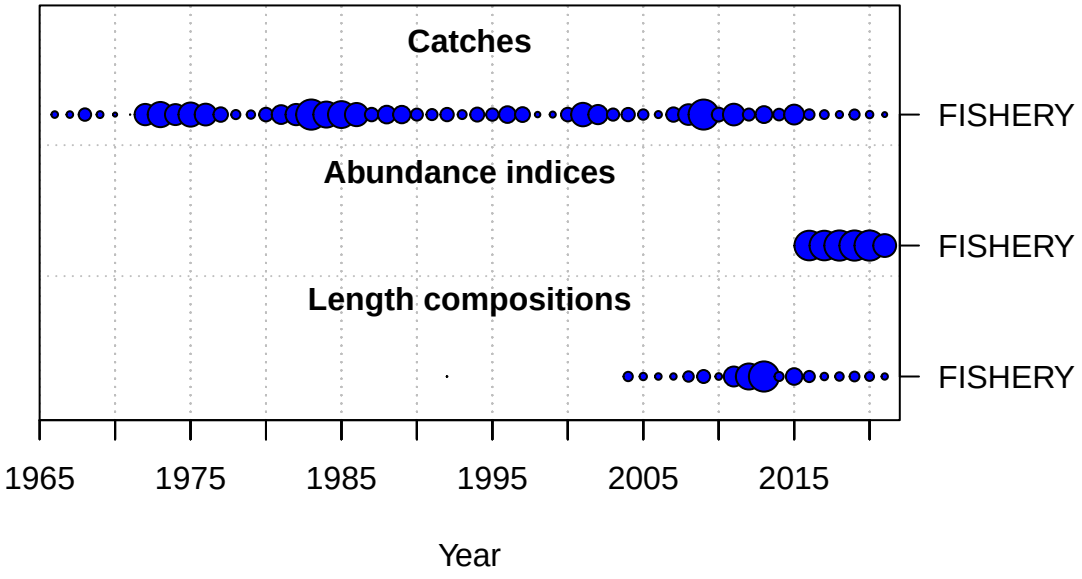

Equilibrium yield (mt)
0.0
0.5
1.0
1.5
2.0
0.0
0.2
0.4
0.6
0.8
1.0
Fraction unfished

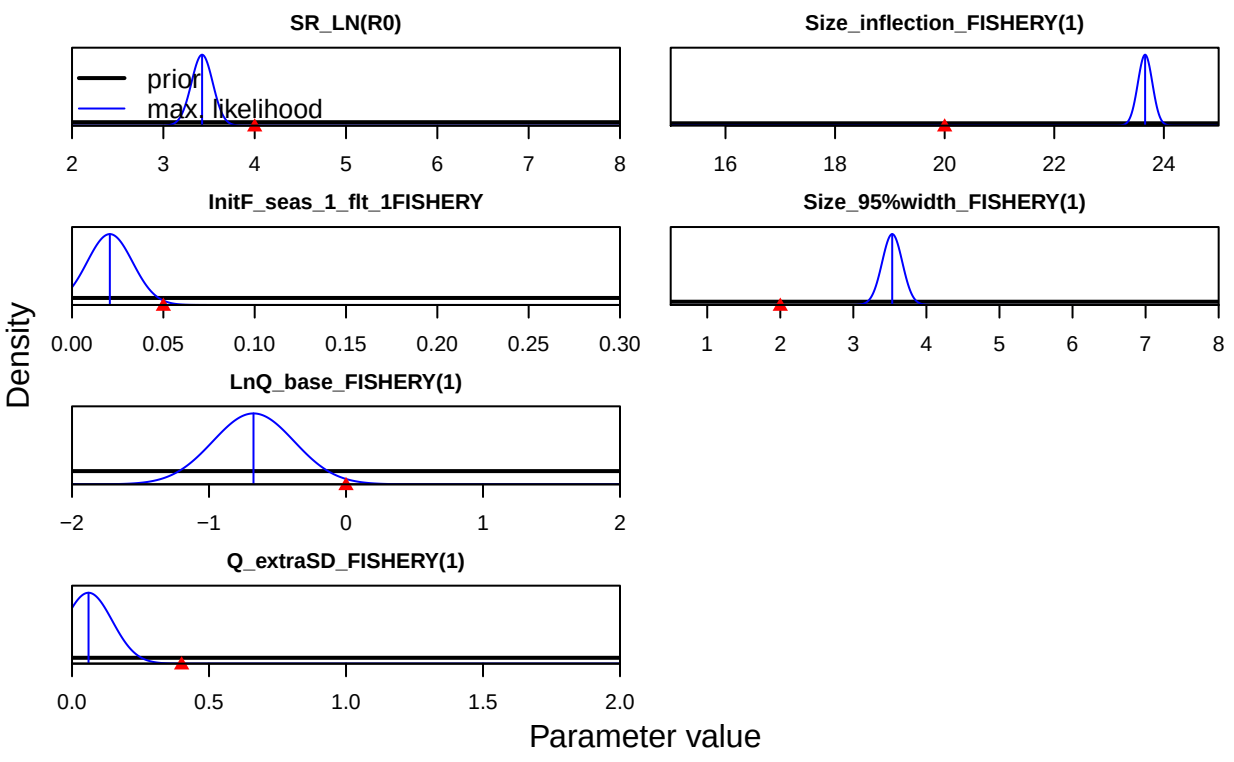

Equilibrium yield (mt)
0.0
0.5
1.0
1.5
2.0
0.0
0.2
0.4
0.6
0.8
1.0
Fraction unfished
MSY
B target
SPR target
Current


Surplus production (mt)
0.0
1.0
2.0
3.0
0
5
10
15
20
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
3
4
5
6
7
8
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
Density
LnQ_base_FISHERY(1)
−2
−1
0
1
2
Q_extraSD_FISHERY(1)
0.0
0.5
1.0
1.5
2.0
Parameter value