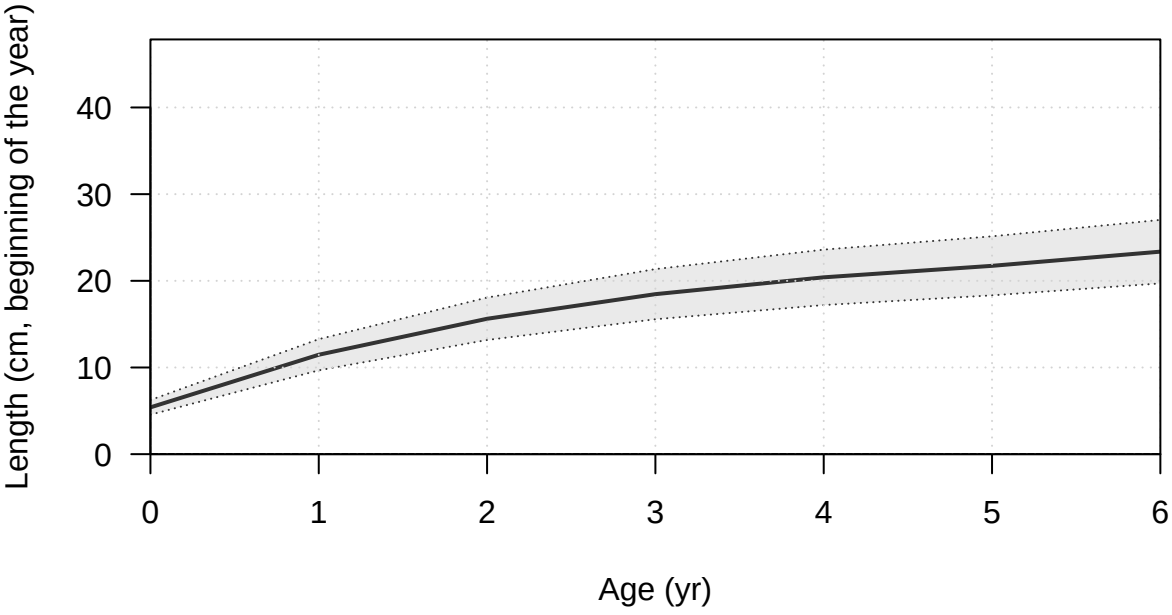
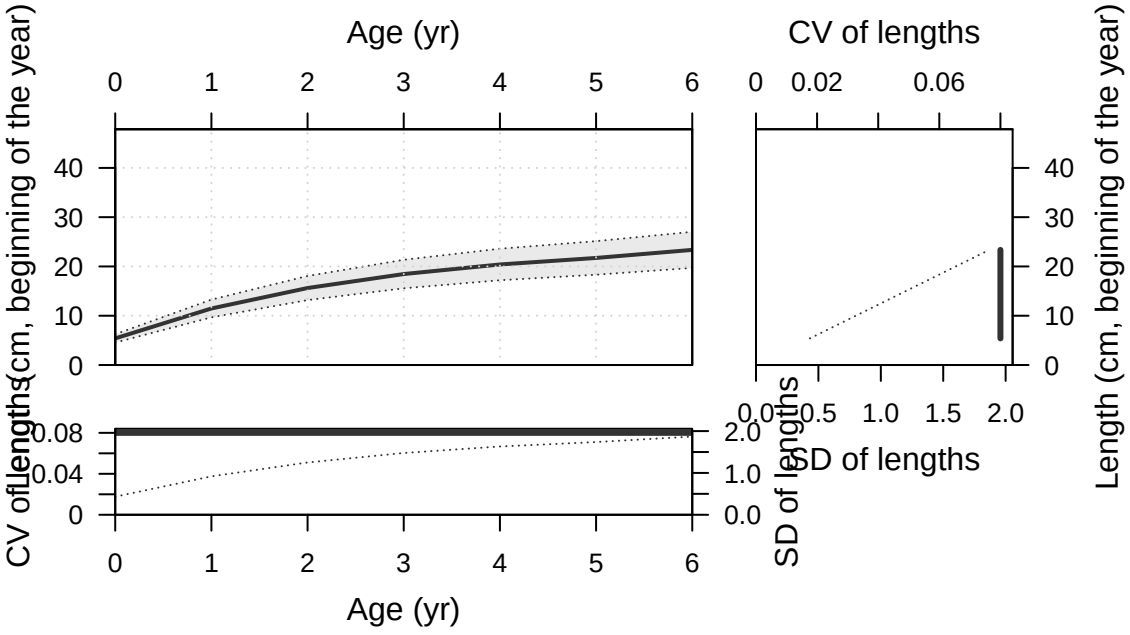
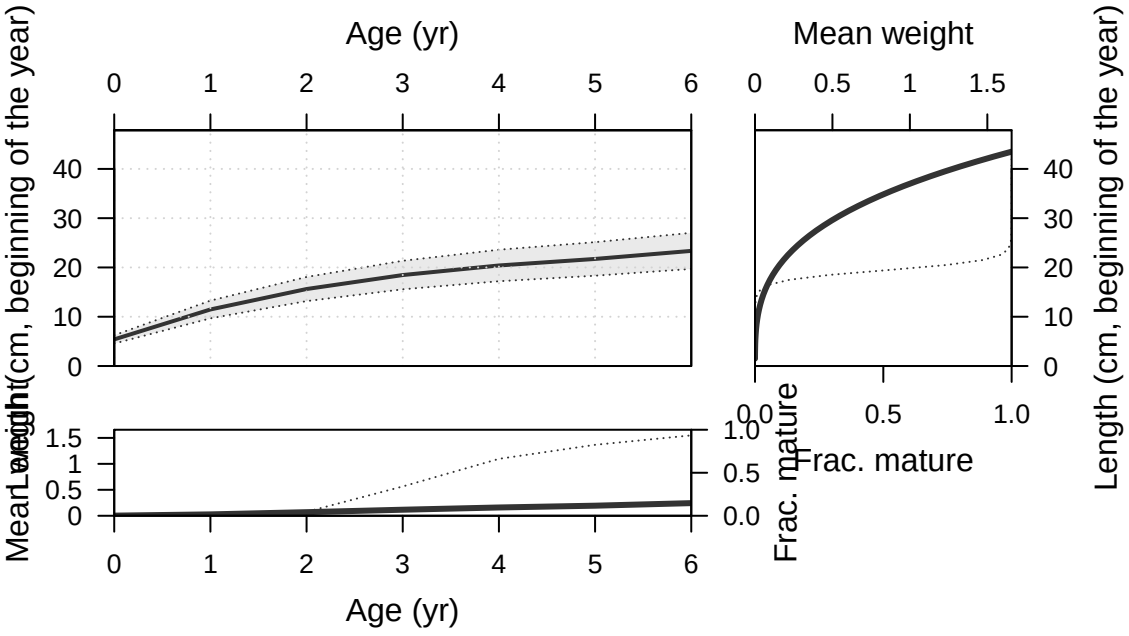
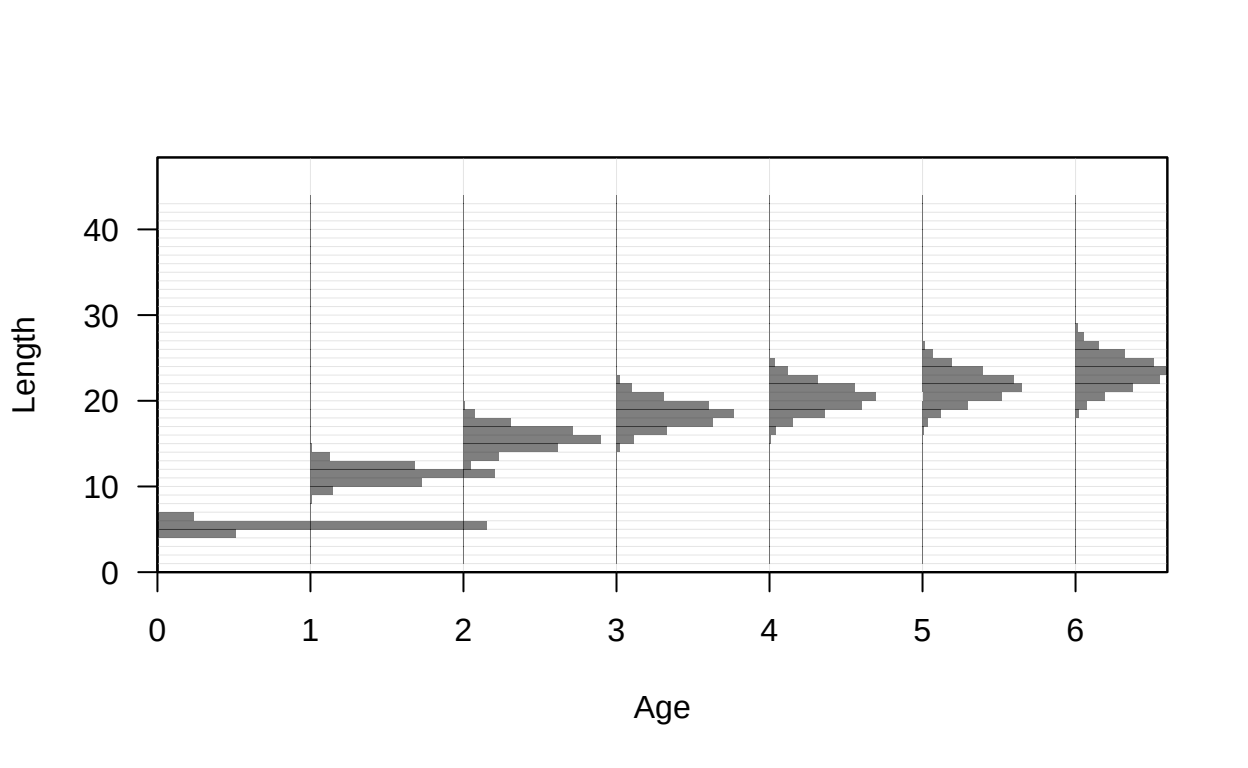
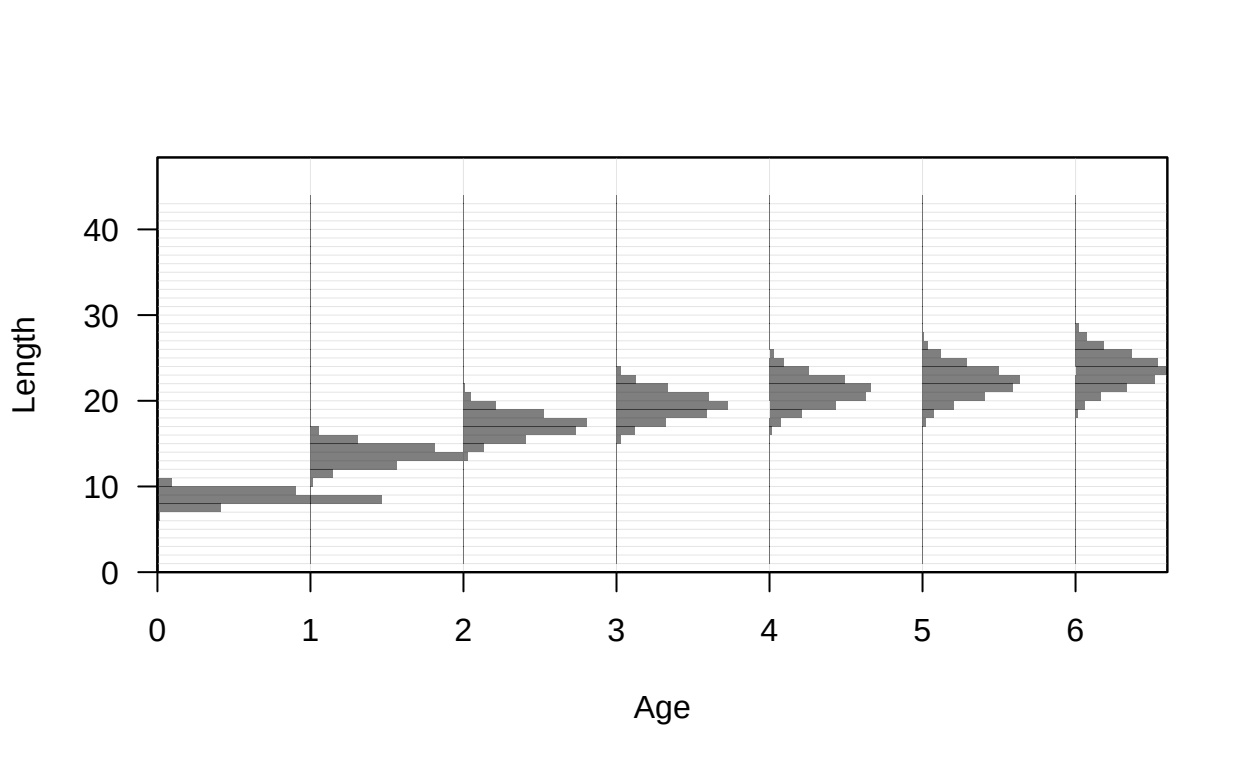
Plots created using the 'r4ss' package in R
Stock Synthesis version: 3.30.19.0
StartTime: Fri Jul 22 13:28:36 2022
Data_File: data.ss
Control_File: control.ss

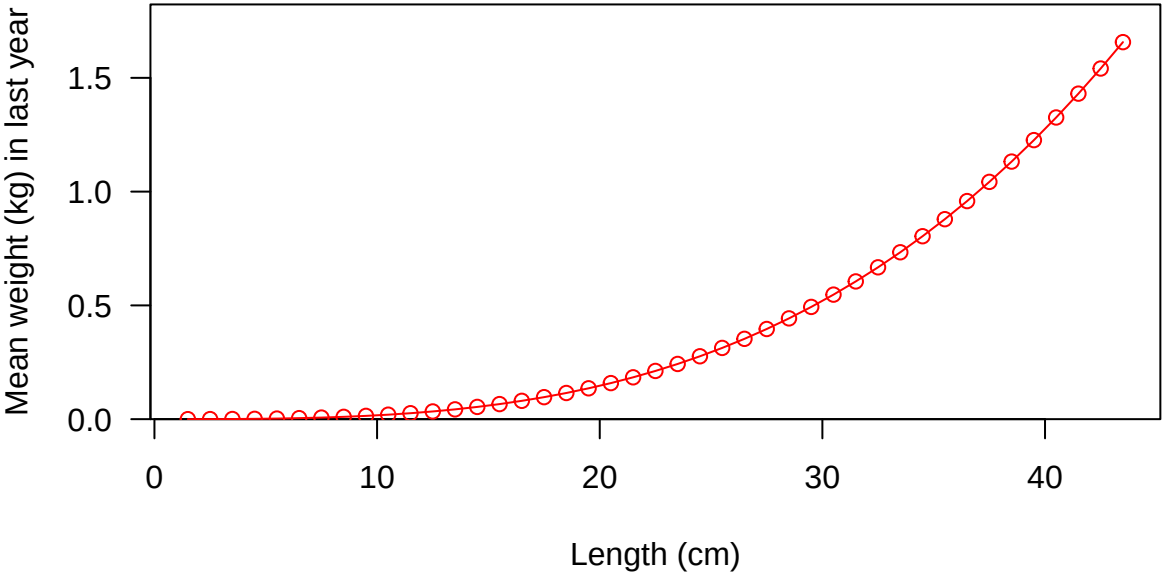

Length (cm, beginning of the year)
0
10
20
30
40
0
1
2
3
4
5
6
Age (yr)

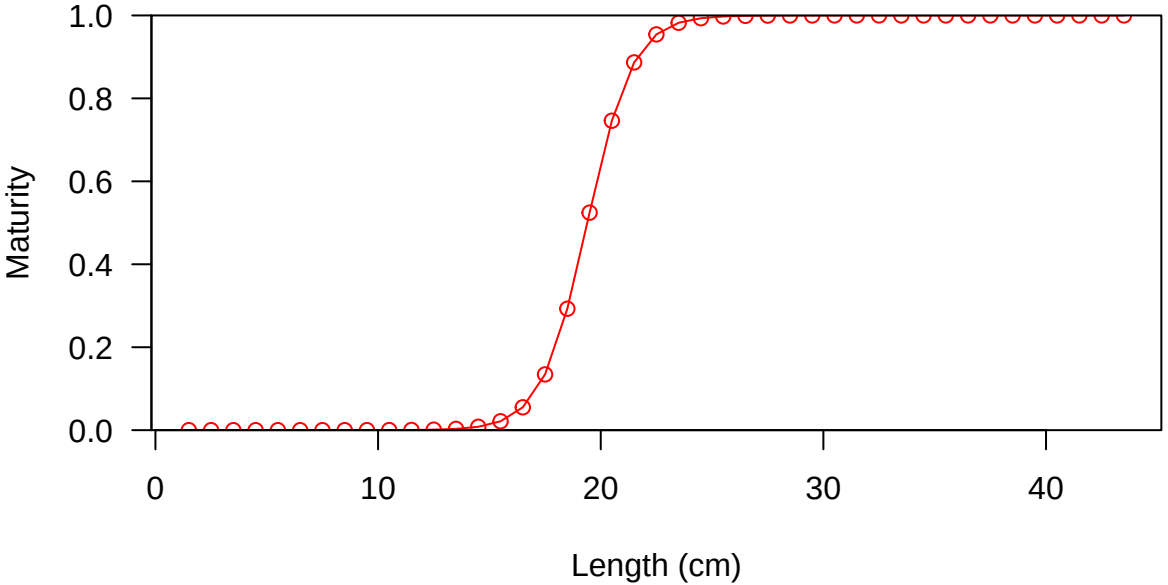

Age (yr)
0
1
2
3
4
5
6
Length (cm, beginning of the year)
0
10
20
30
40
CV of lengths
0
0.02
0.06
SD of lengths
0.0
0.5
1.0
1.5
2.0
CV of lengths
0
0.04
0.08
SD of lengths
0.0
1.0
2.0
Age (yr)

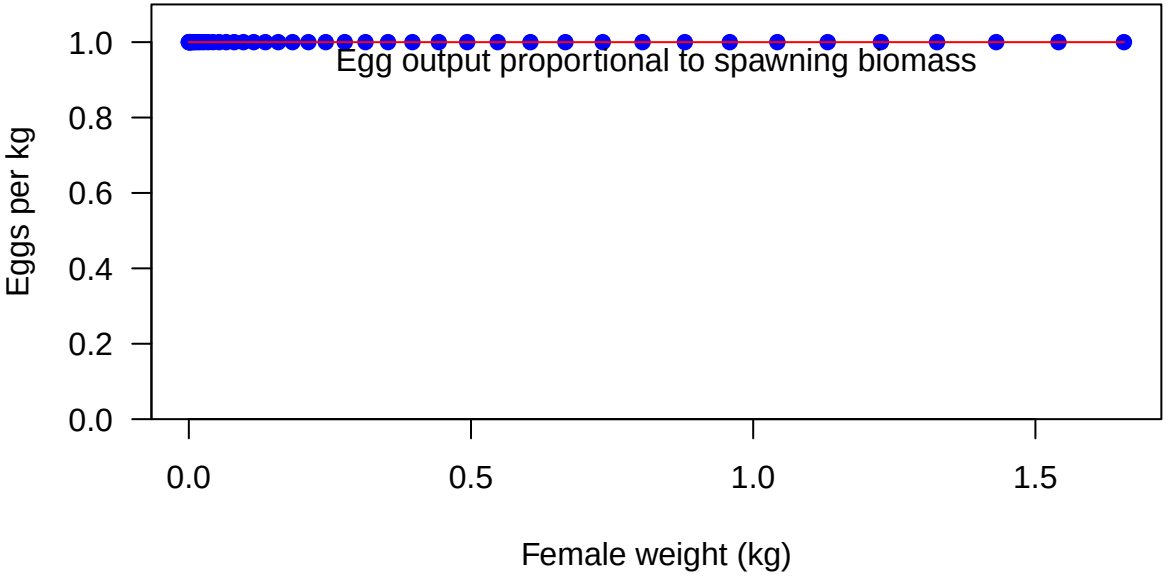

Age (yr)
0
1
2
3
4
5
6
Length (cm, beginning of the year)
0
10
20
30
40
Mean weight
0
0.5
1
1.5
Frac. mature
0.0
0.5
1.0
Mean weight
0
0.5
1
1.5
Age (yr)
0
1
2
3
4
5
6
Frac. mature
0.0
0.5
1.0

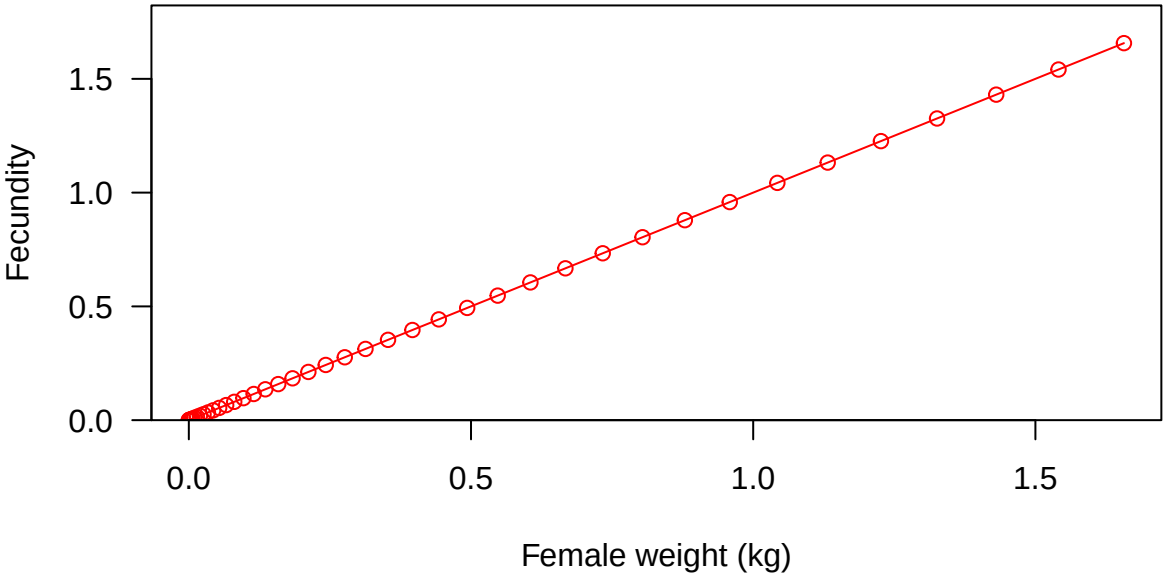

Length
0
10
20
30
40
0
1
2
3
4
5
6
Age

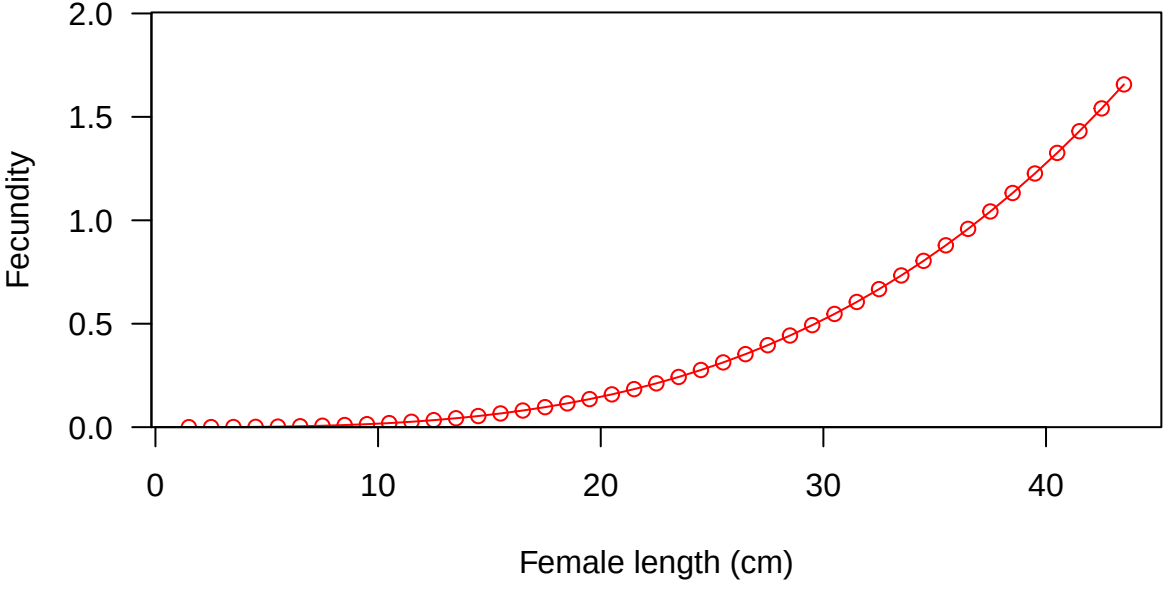

Length
0
10
20
30
40
0
1
2
3
4
5
6
Age

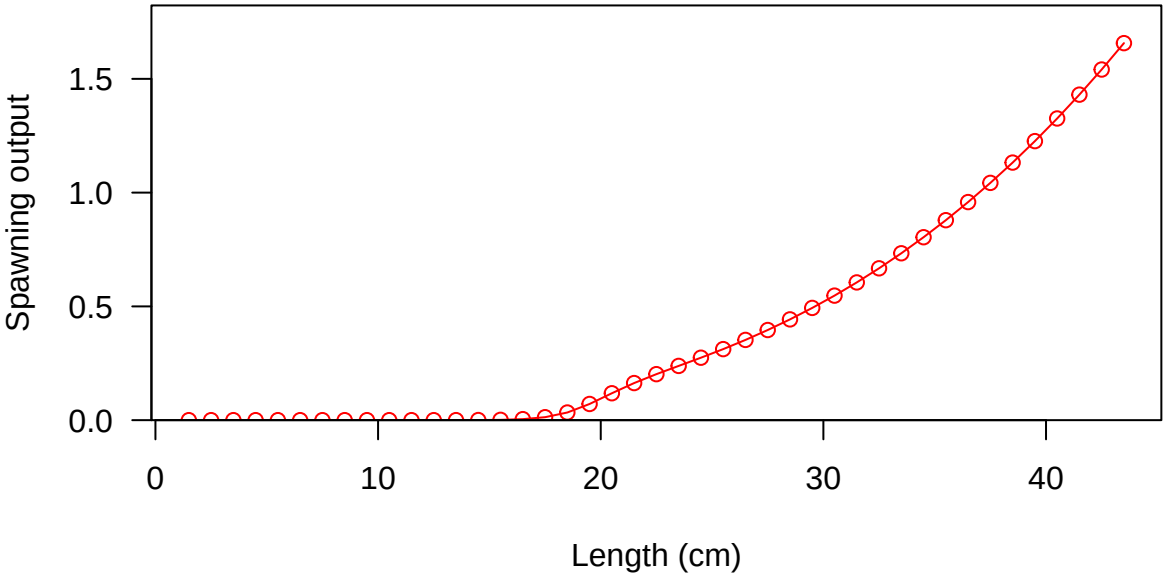

Mean weight (kg) in last year
0.0
0.5
1.0
1.5
0
10
20
30
40
Length (cm)

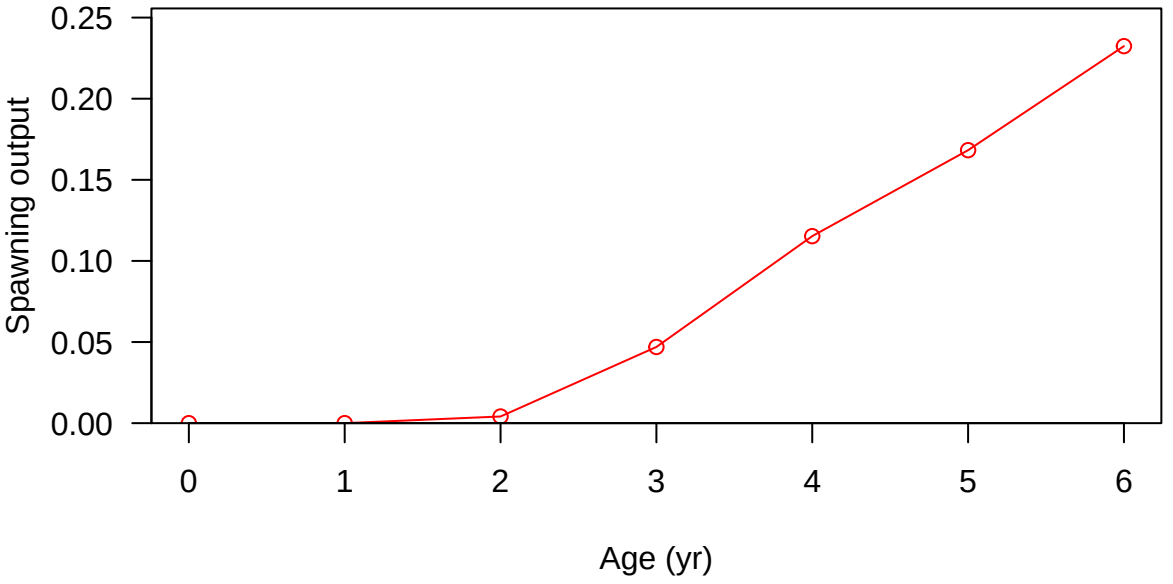

1.0
0.8
0.6
0.4
0.2
0.0
Maturity
0
10
20
30
40
Length (cm)

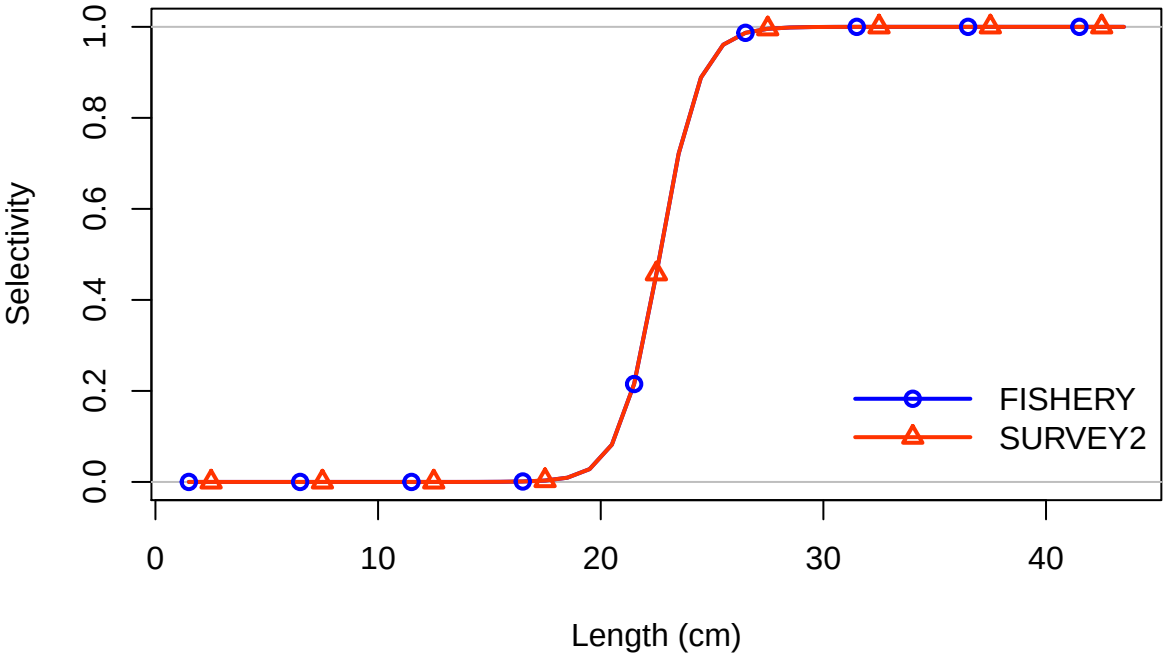

Egg output proportional to spawning biomass
Eggs per kg
1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.5
1.0
1.5
Female weight (kg)

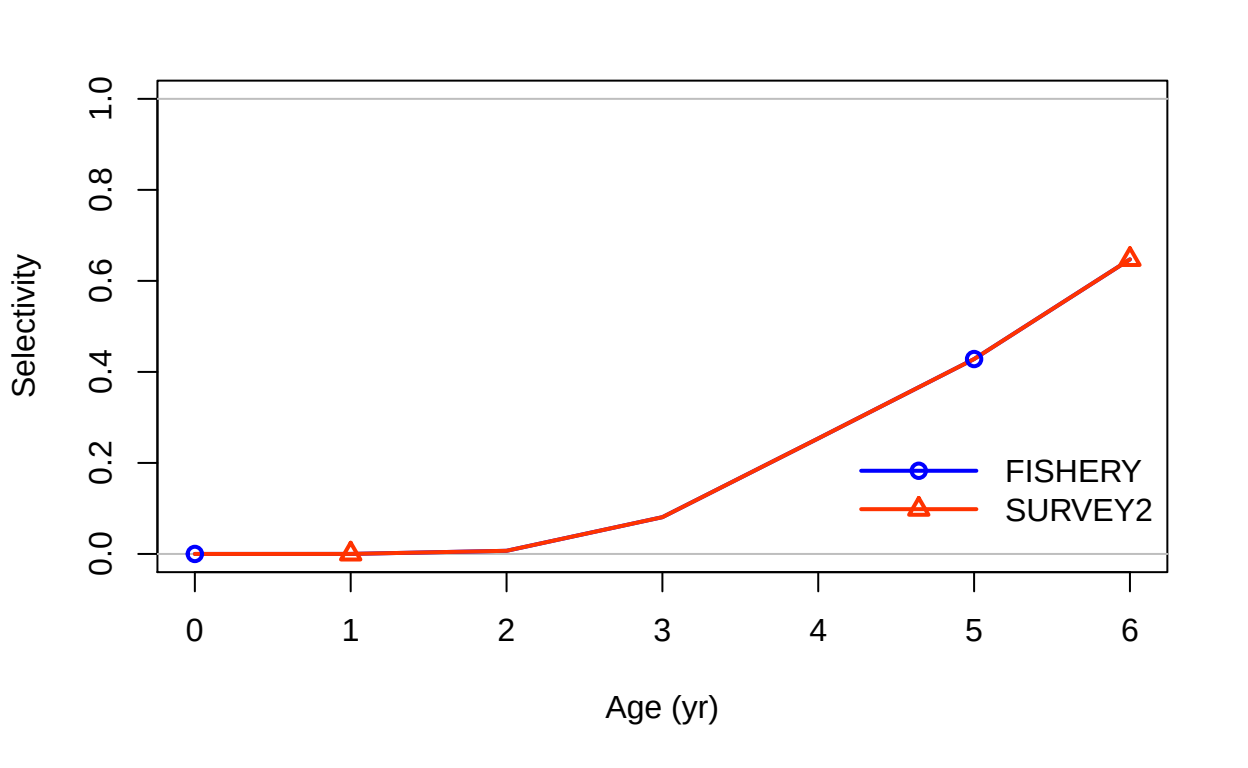

Fecundity
0.0
0.5
1.0
1.5
0.0
0.5
1.0
1.5
Female weight (kg)

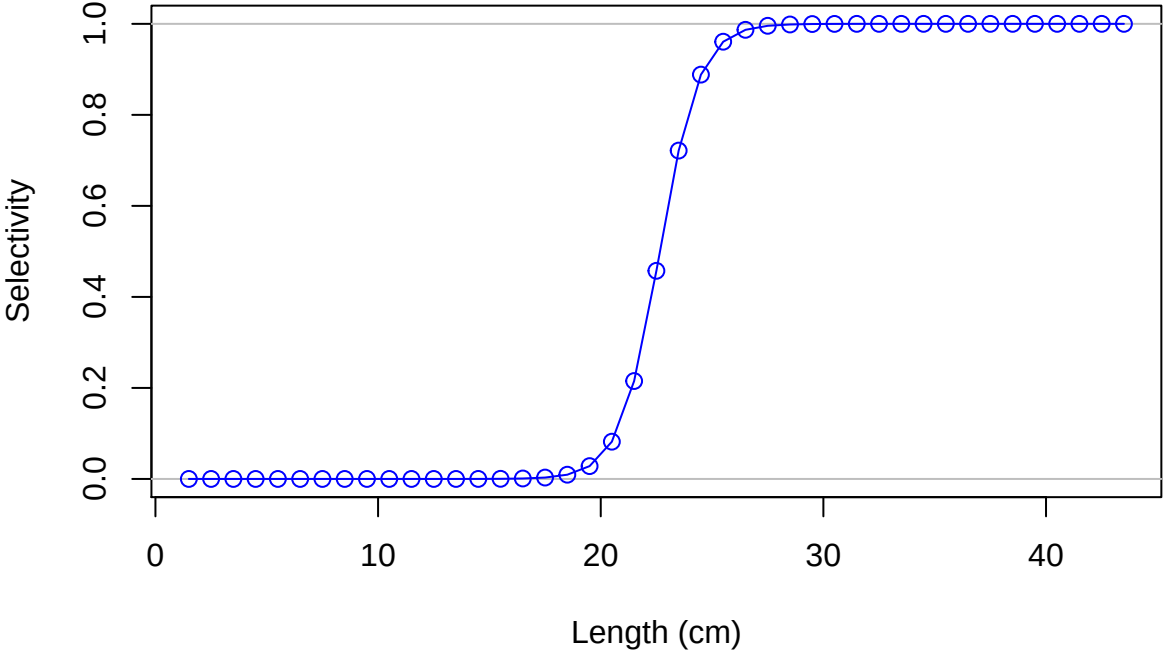

2.0
1.5
1.0
0.5
0.0
Fecundity
0
10
20
30
40
Female length (cm)

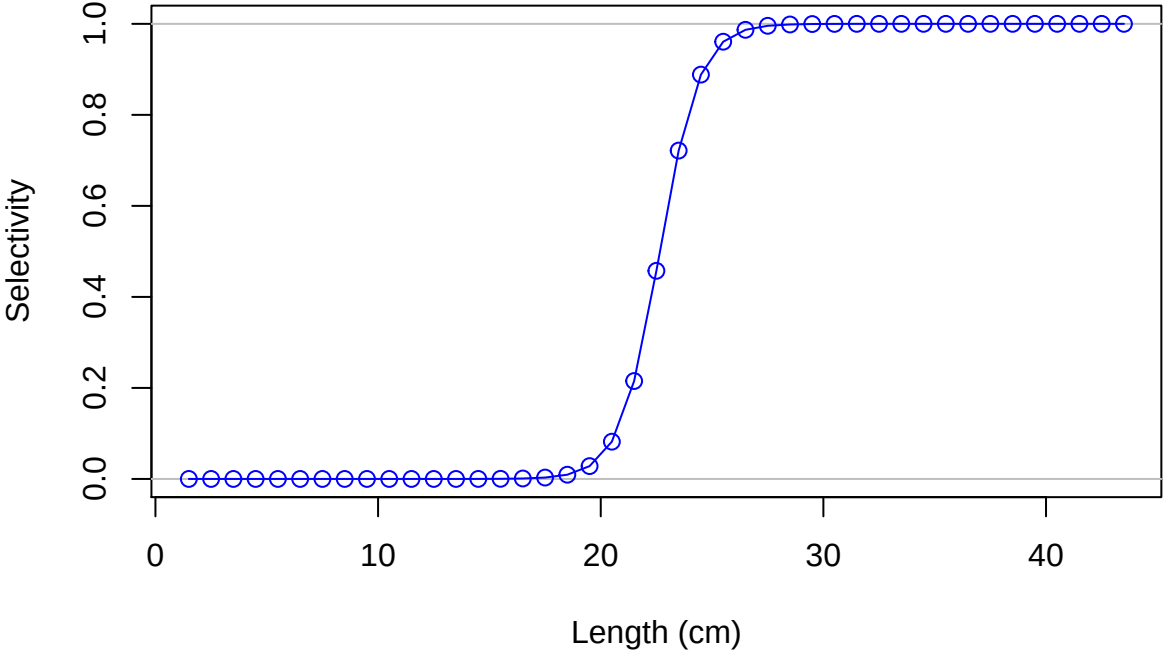

Spawning output
0.0
0.5
1.0
1.5
0
10
20
30
40
Length (cm)

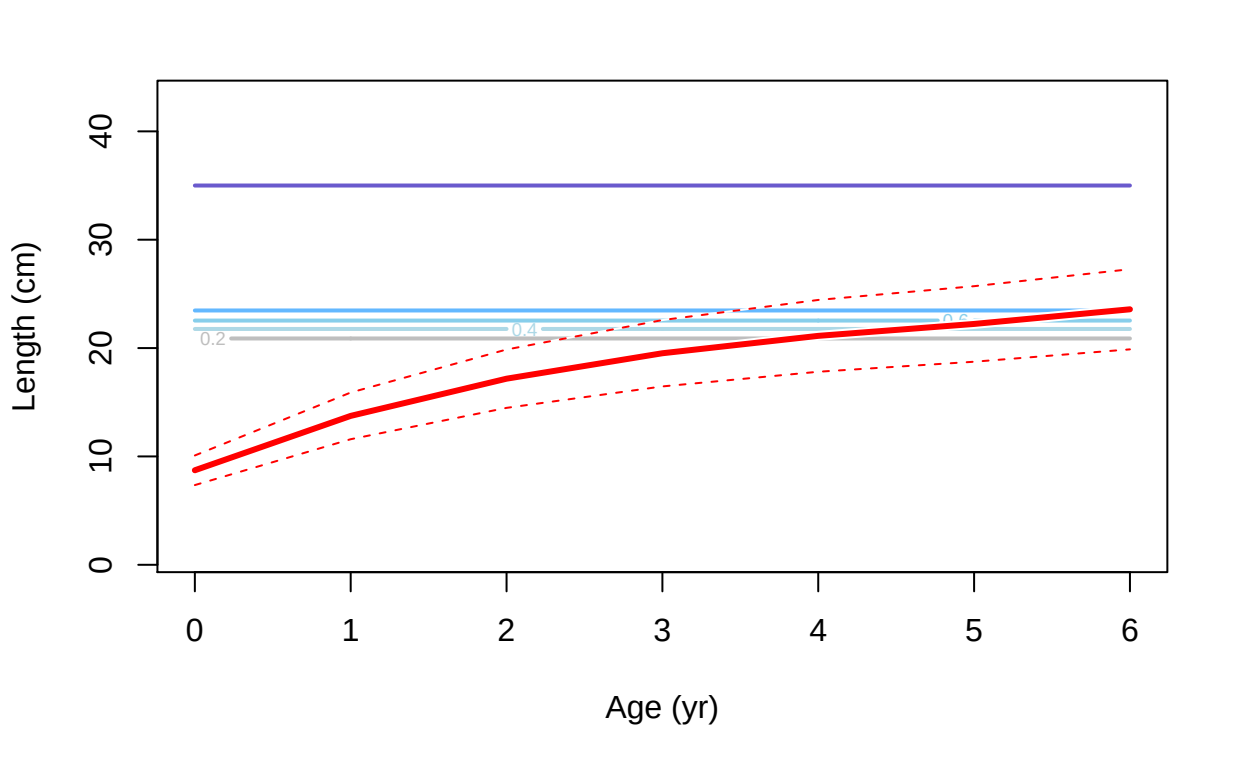

0.25
0.20
0.15
0.10
0.05
0.00
Spawning output
0
1
2
3
4
5
6
Age (yr)

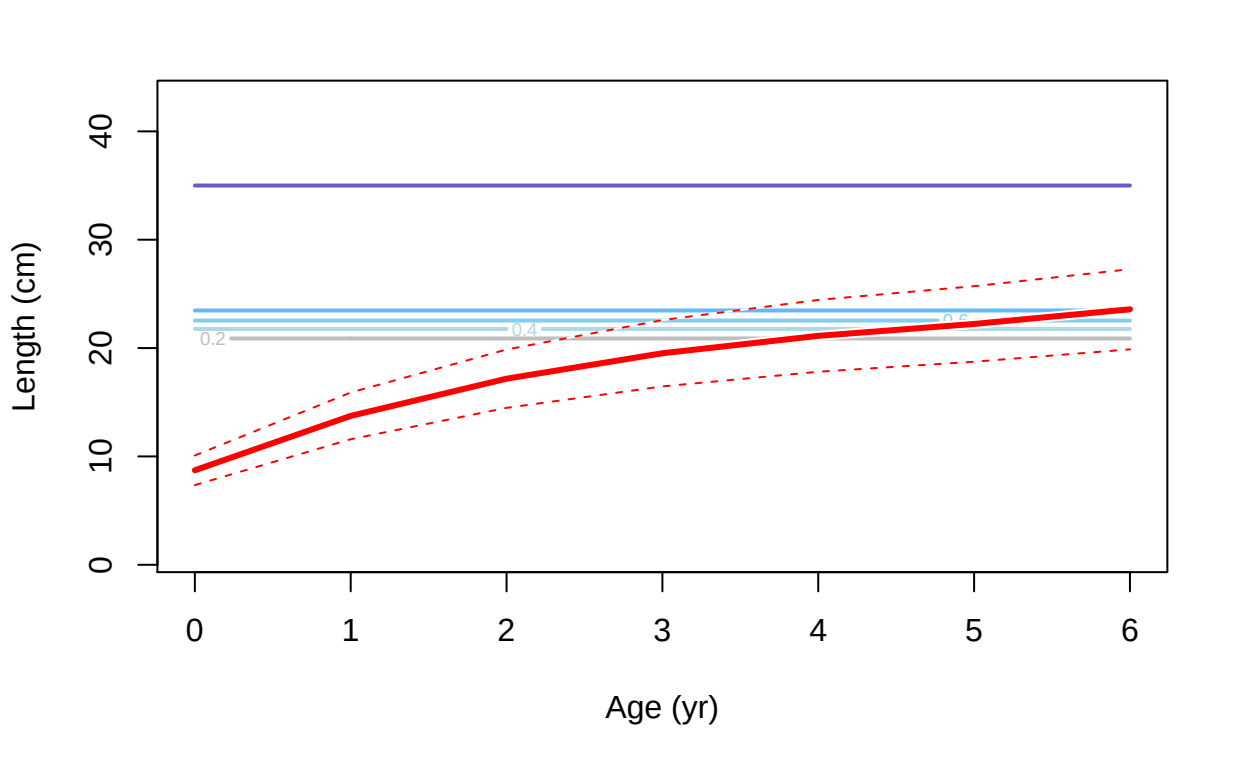

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
10
20
30
40
Length (cm)
FISHERY
SURVEY2

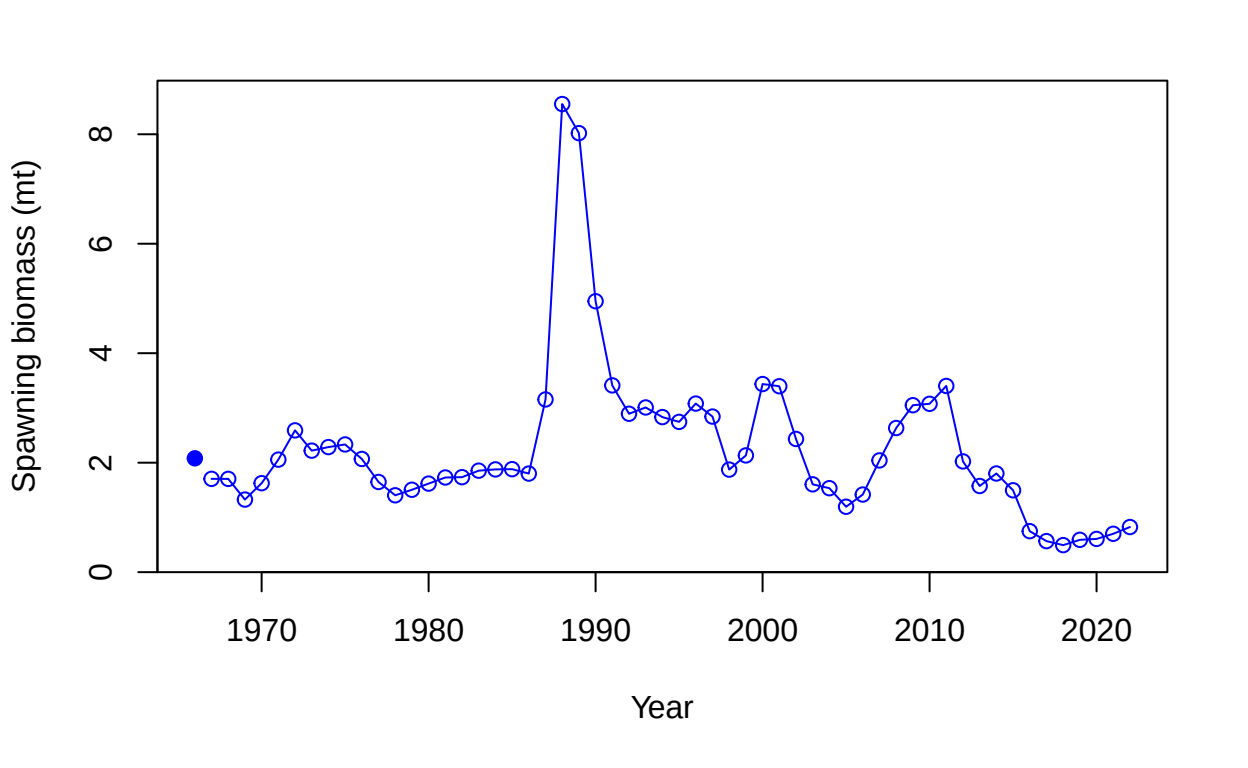

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
1
2
3
4
5
6
Age (yr)
FISHERY
SURVEY2

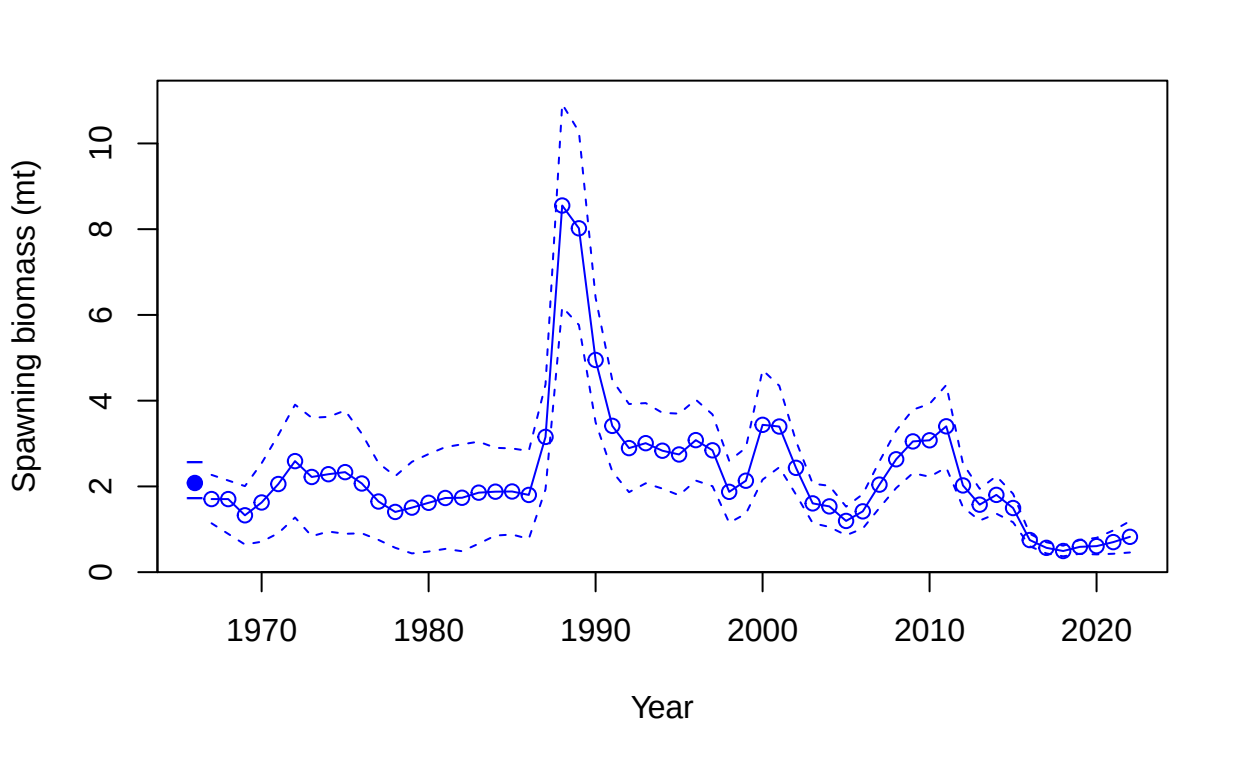

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
10
20
30
40
Length (cm)

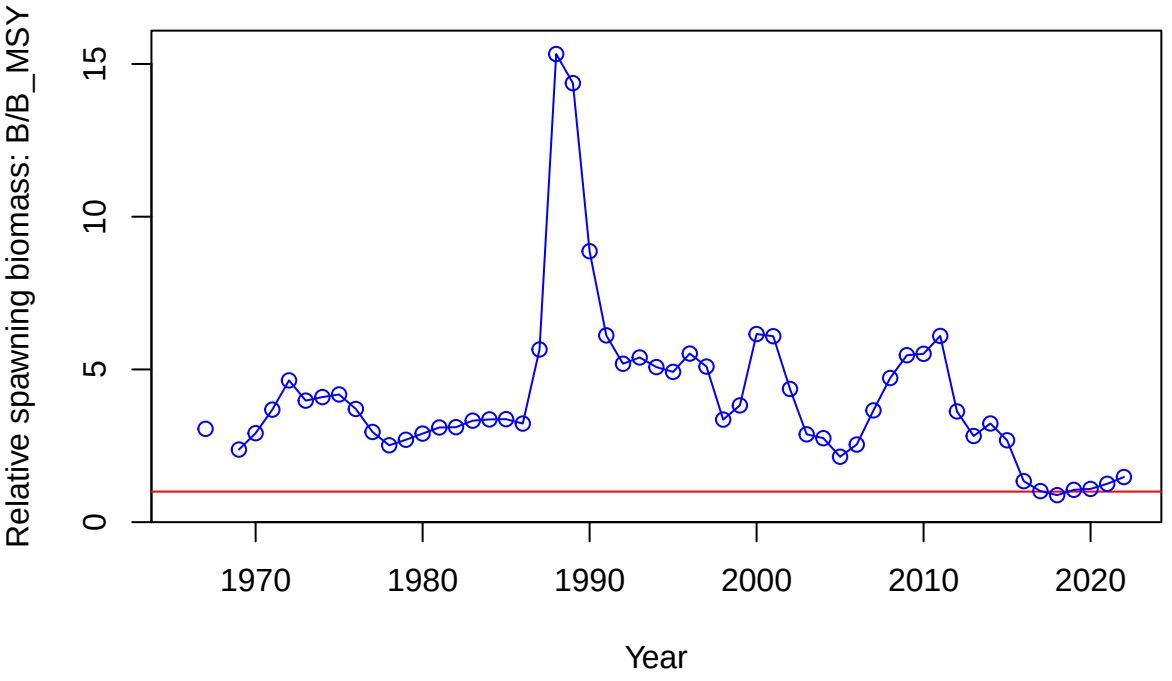

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
10
20
30
40
Length (cm)

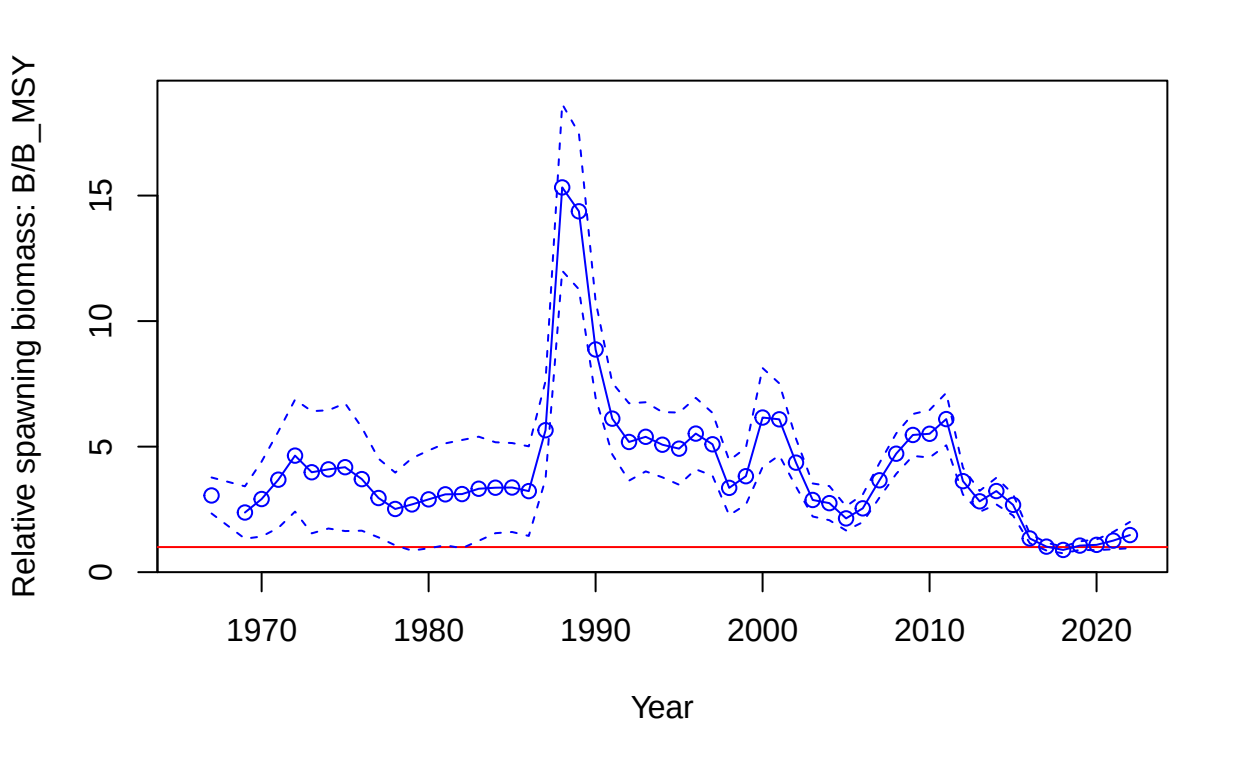

Length (cm)
0
10
20
30
40
0
1
2
3
4
5
6
Age (yr)
0.2
0.4
0.6

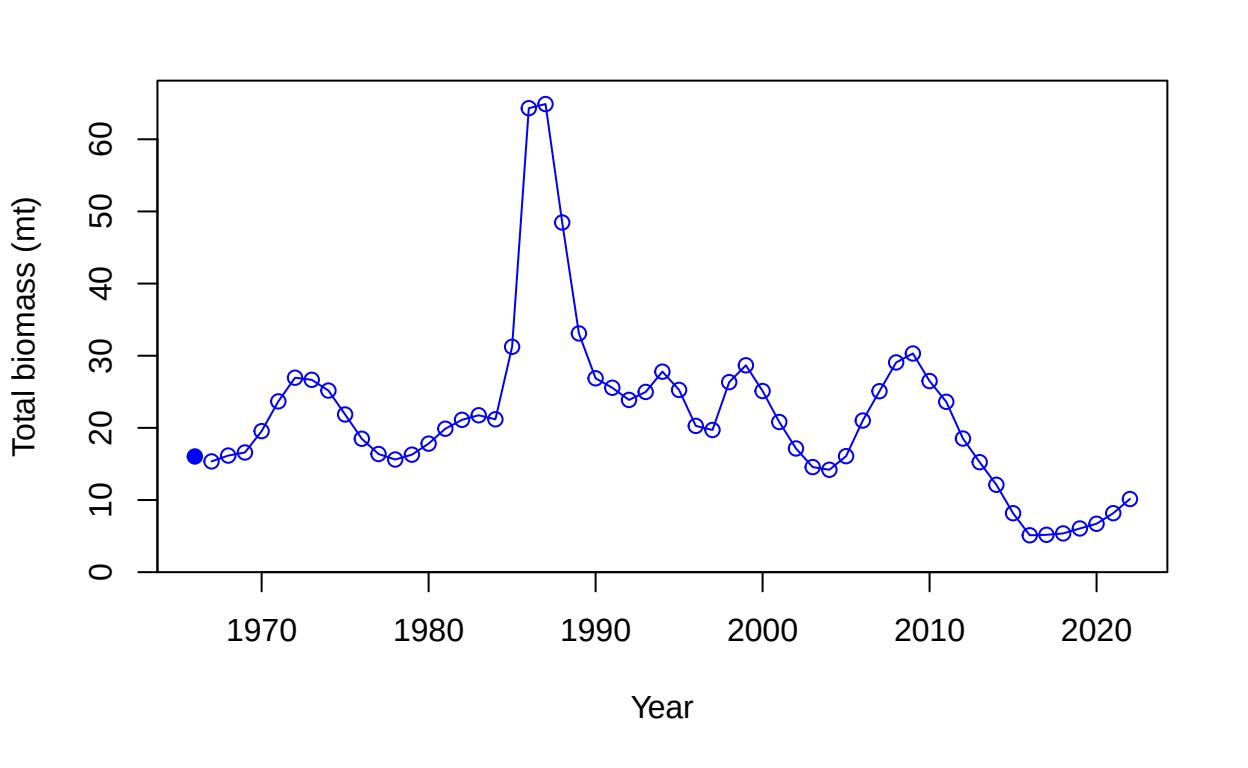

Length (cm)
0
10
20
30
40
0
1
2
3
4
5
6
Age (yr)
0.2
0.4
0.6

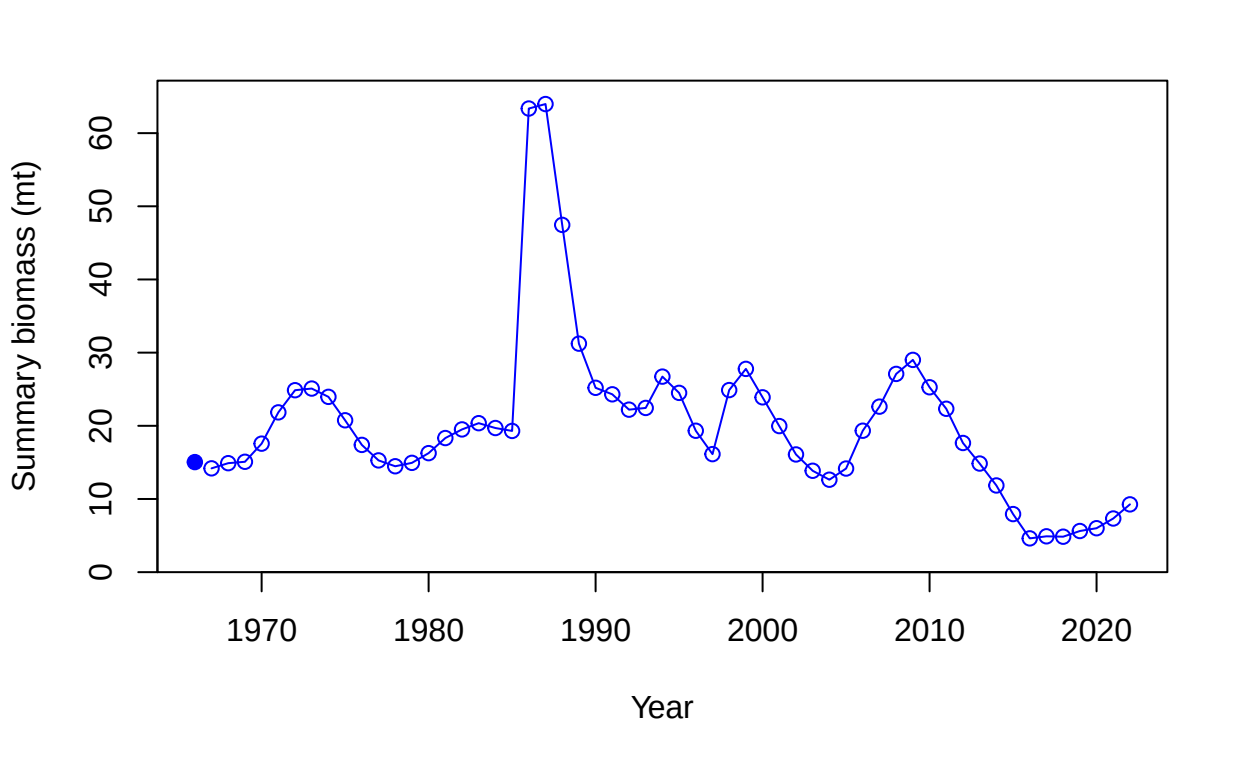

Spawning biomass (mt)
0
2
4
6
8
1970
1980
1990
2000
2010
2020
Year

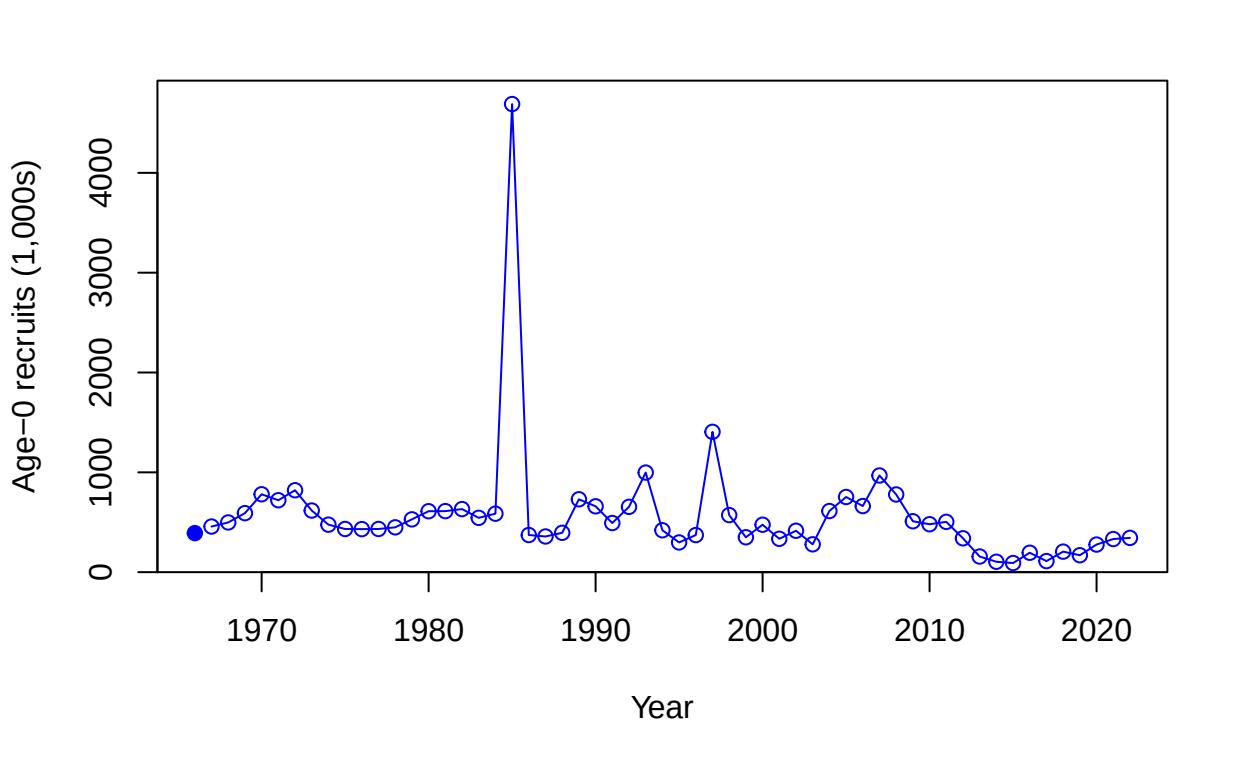

Spawning biomass (mt)
0
2
4
6
8
10
1970
1980
1990
2000
2010
2020
Year

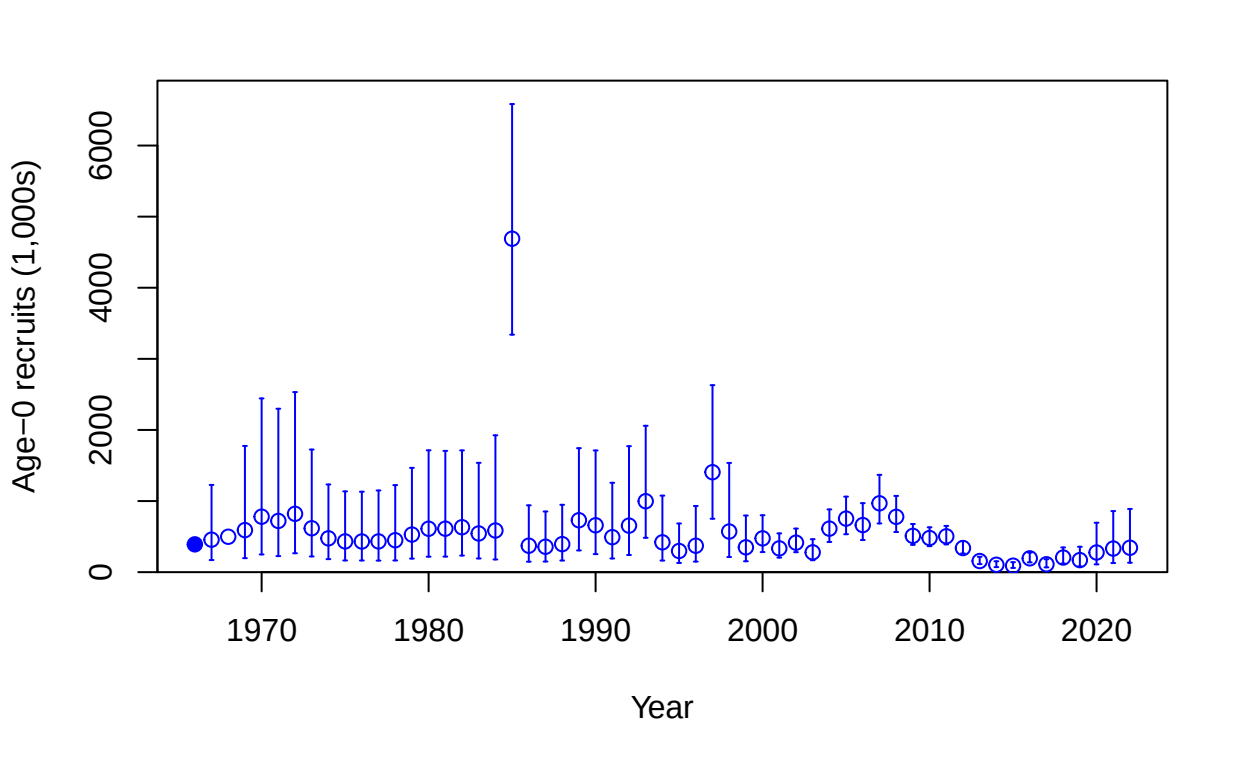

Relative spawning biomass: B/B_MSY
0
5
10
15
1970
1980
1990
2000
2010
2020
Year

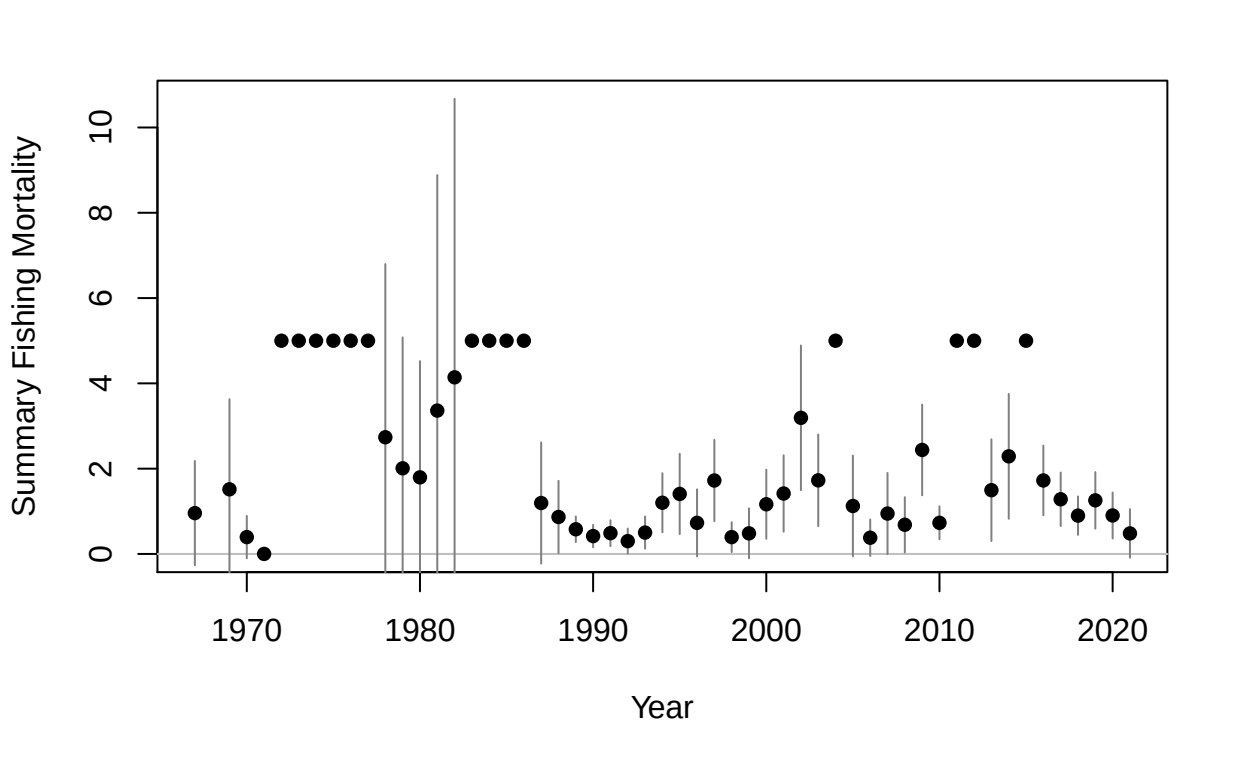

Relative spawning biomass: B/B_MSY
0
5
10
15
1970
1980
1990
2000
2010
2020
Year

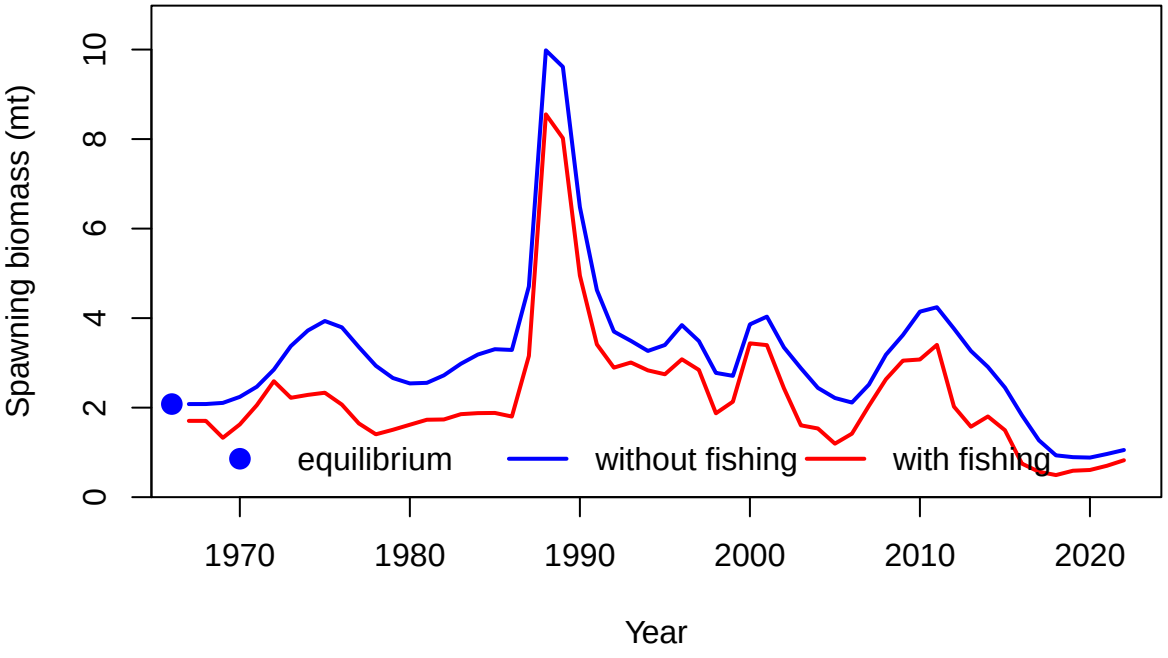

Total biomass (mt)
0
10
20
30
40
50
60
1970
1980
1990
2000
2010
2020
Year

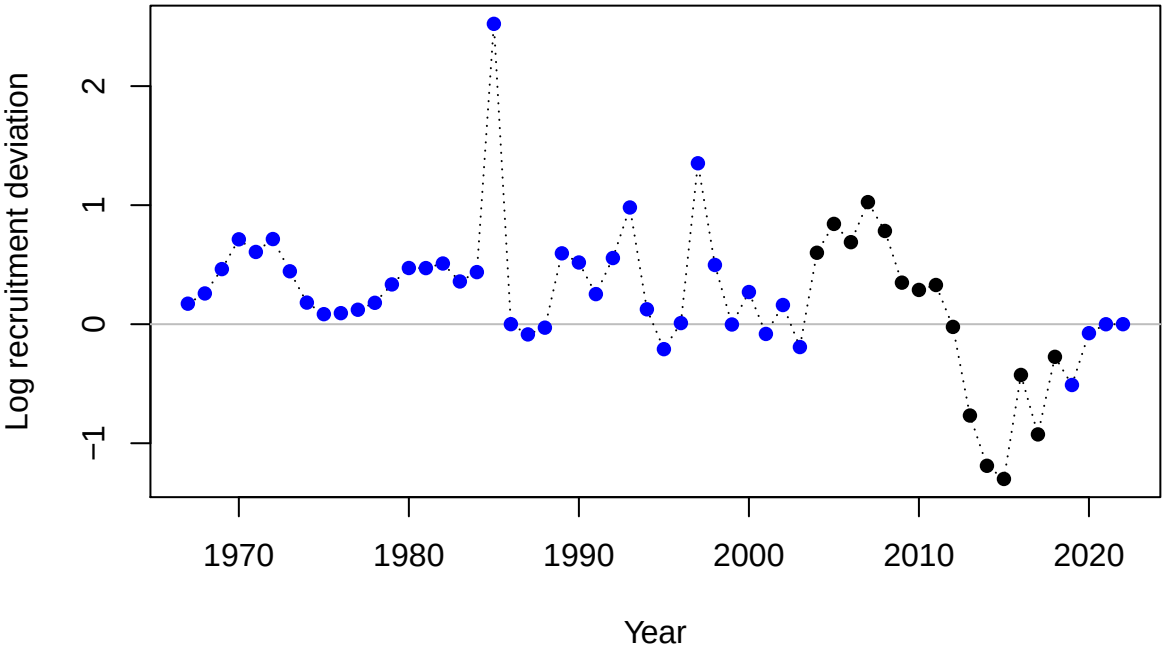

Summary biomass (mt)
0
10
20
30
40
50
60
1970
1980
1990
2000
2010
2020
Year

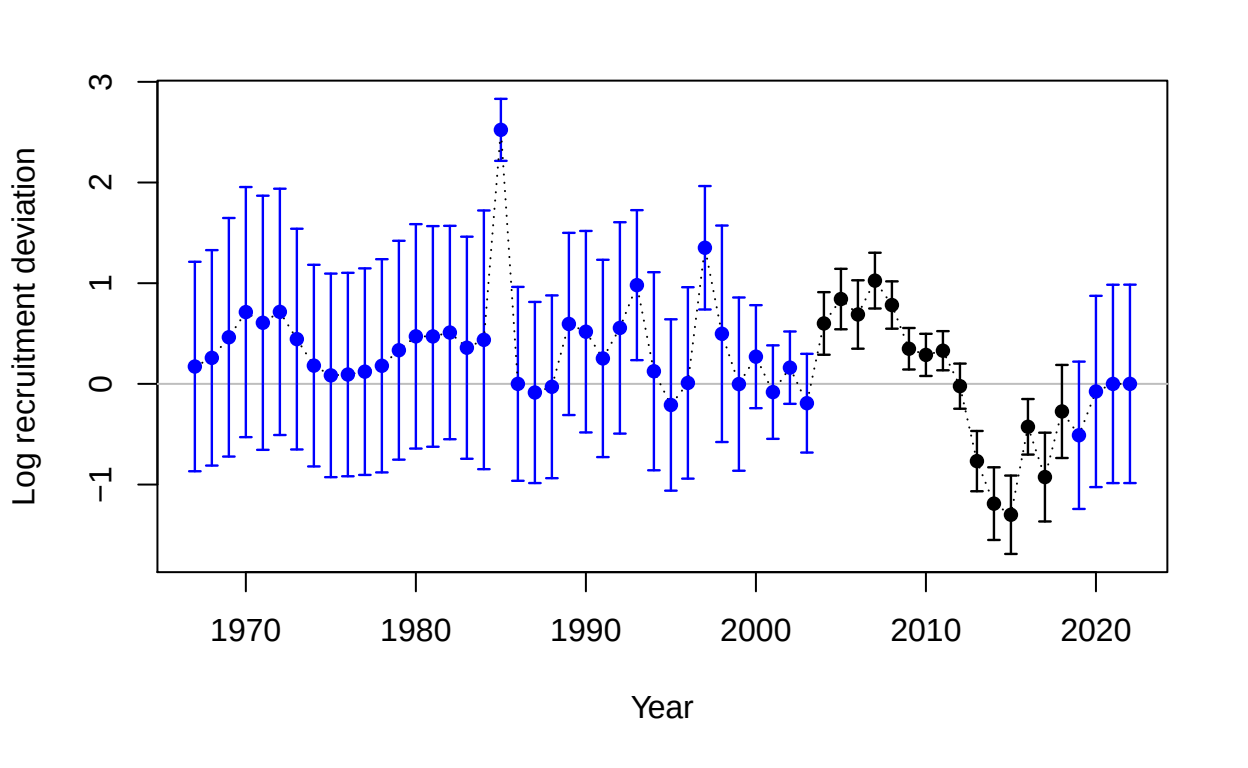

Age−0 recruits (1,000s)
0
1000
2000
3000
4000
1970
1980
1990
2000
2010
2020
Year

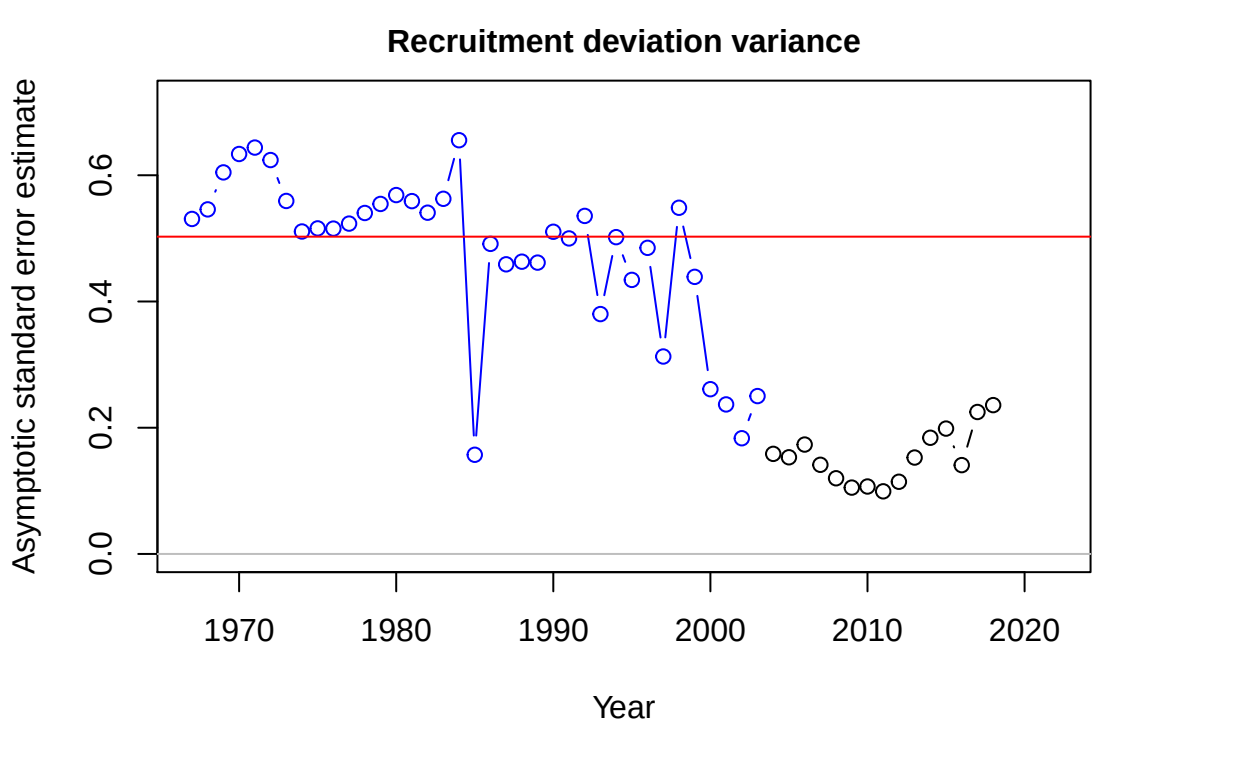

Age−0 recruits (1,000s)
0
2000
4000
6000
1970
1980
1990
2000
2010
2020
Year

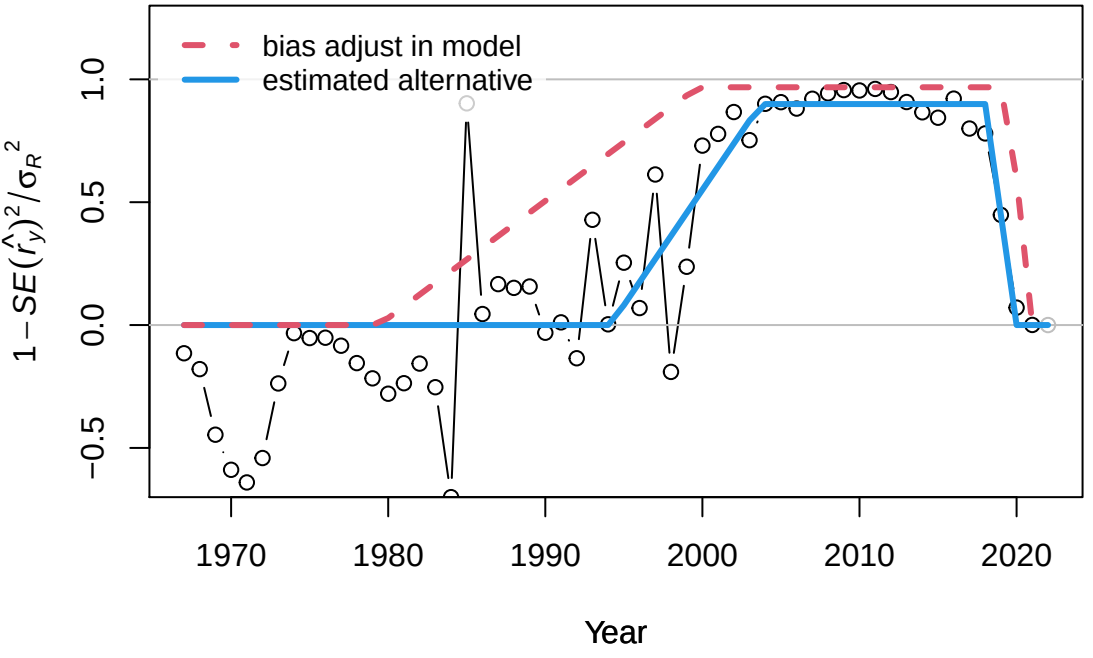

Summary Fishing Mortality
0
2
4
6
8
10
1970
1980
1990
2000
2010
2020
Year

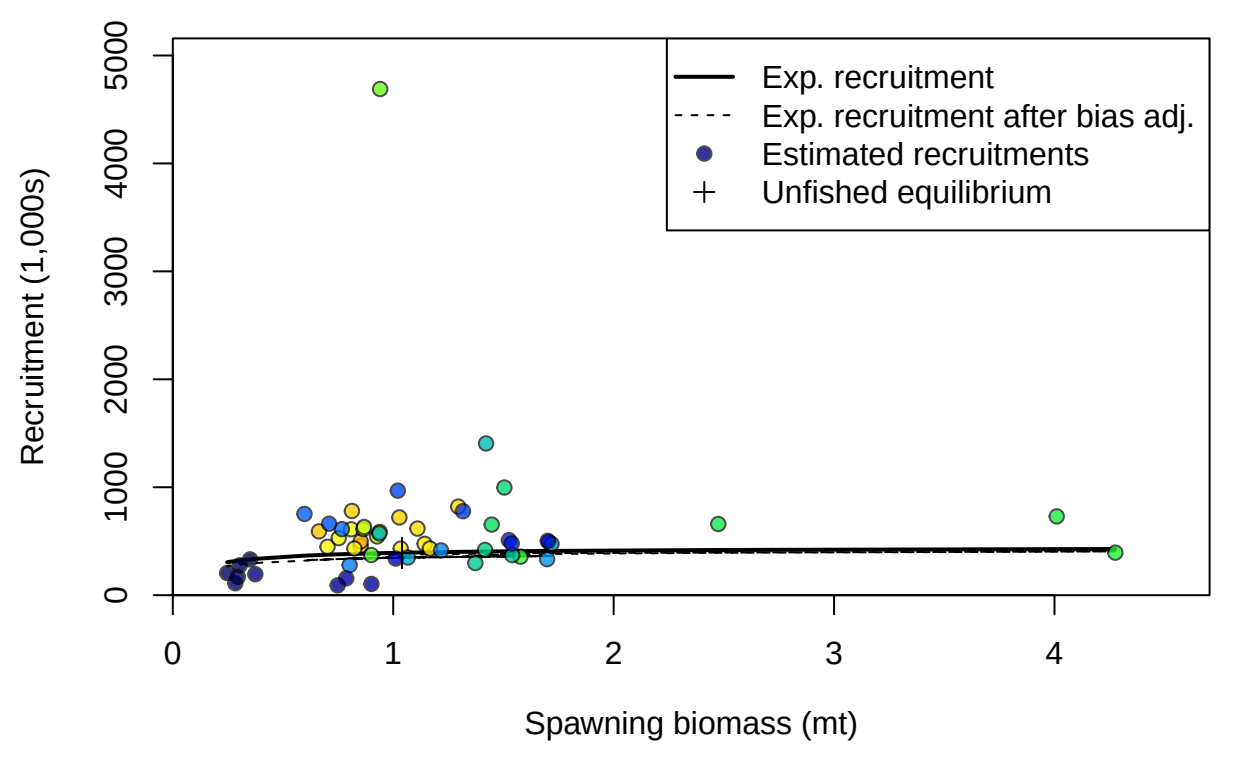

Spawning biomass (mt)
0
2
4
6
8
10
1970
1980
1990
2000
2010
2020
Year
equilibrium
without fishing
with fishing

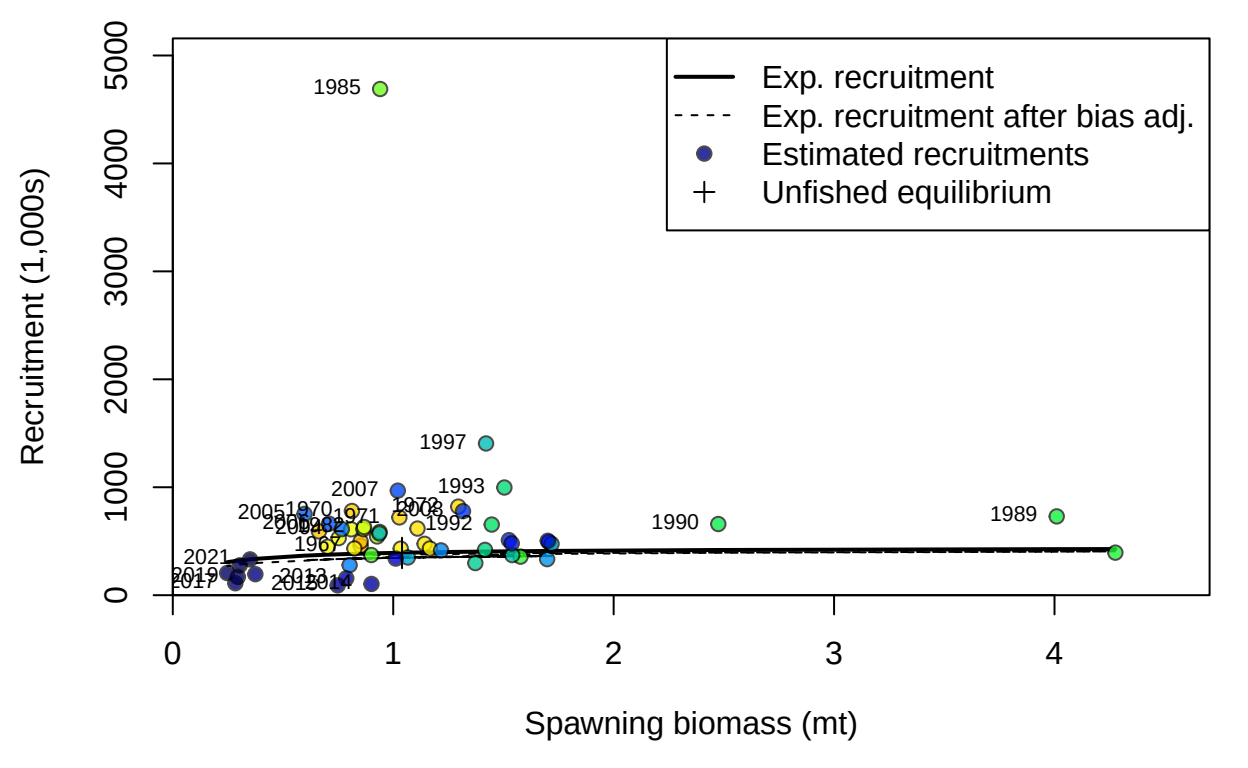

Log recruitment deviation
2
1
0
−1
1970
1980
1990
2000
2010
2020
Year

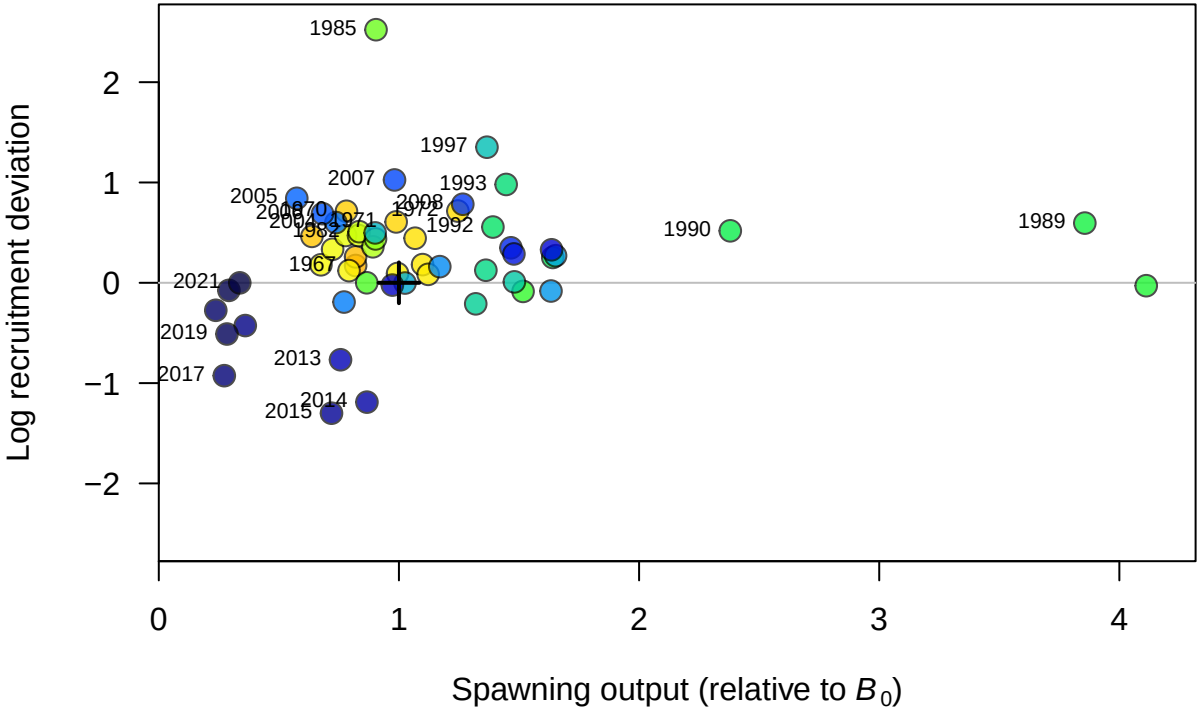

Log recruitment deviation
3
2
1
0
−1
1970
1980
1990
2000
2010
2020
Year

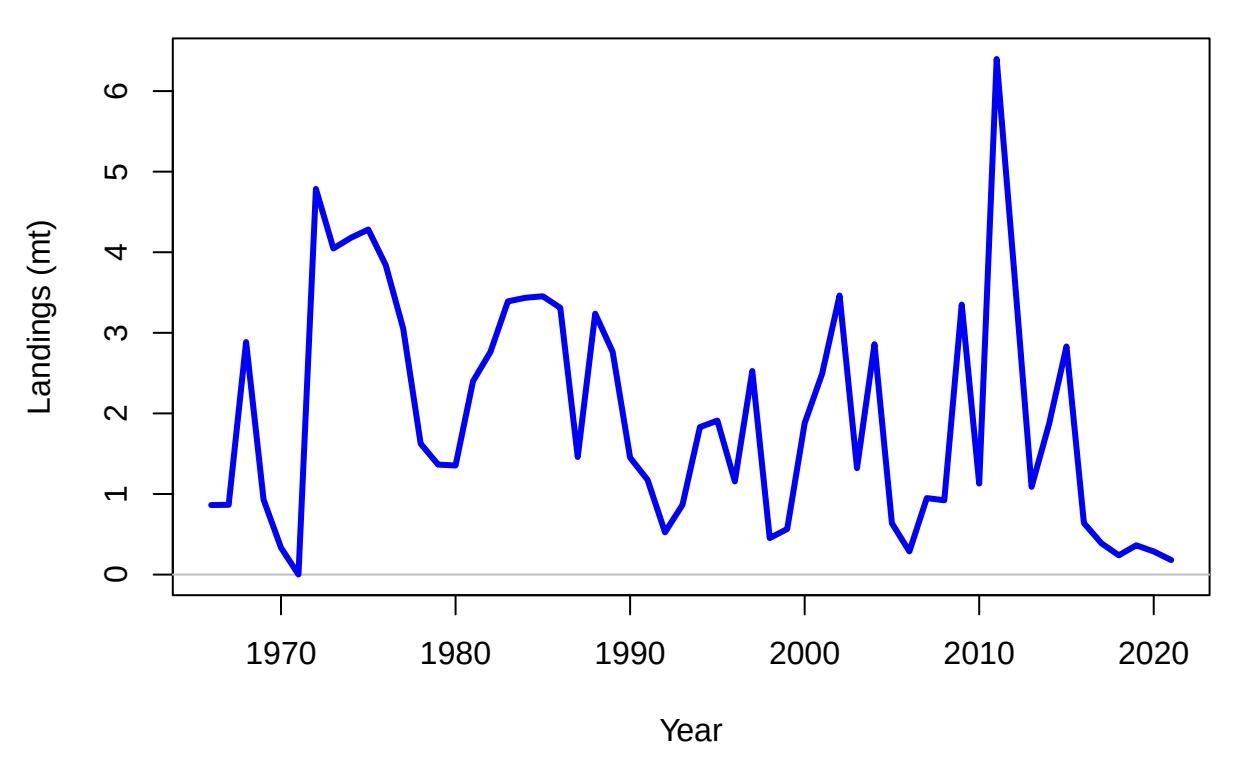

Recruitment deviation variance
Asymptotic standard error estimate
0.0
0.2
0.4
0.6
1970
1980
1990
2000
2010
2020
Year

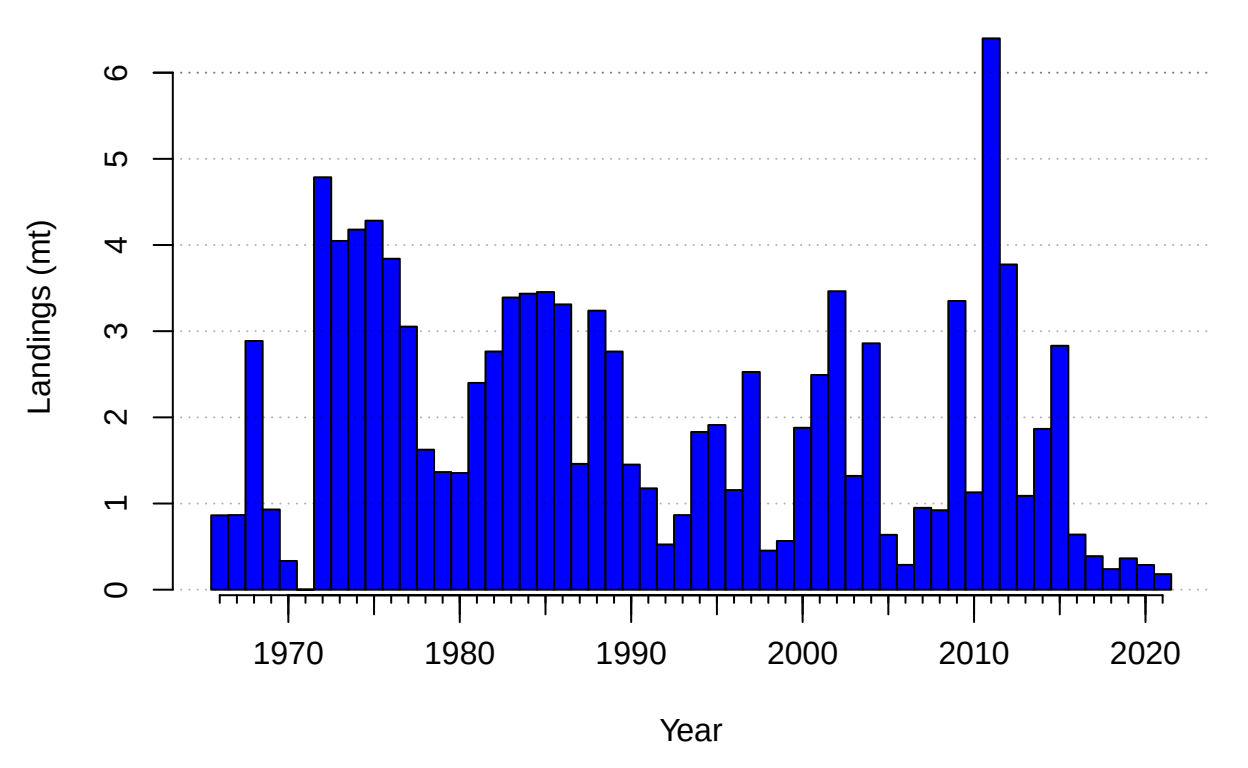

bias adjust in model
estimated alternative
1.0
0.5
0.0
−0.5
1970
1980
1990
2000
2010
2020
Year
$1-SE(\hat{r}_y)^2/\sigma_R{}^2$

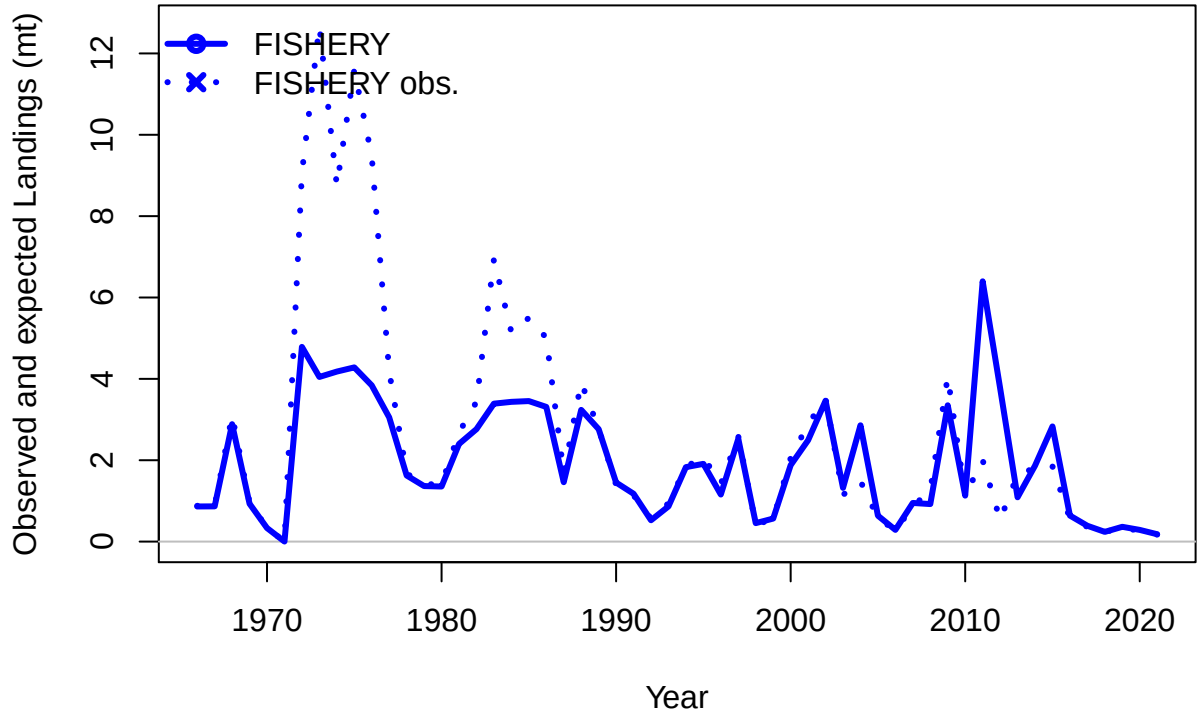

Exp. recruitment
Exp. recruitment after bias adj.
Estimated recruitments
Unfished equilibrium
Recruitment (1,000s)
0
1000
2000
3000
4000
5000
0
1
2
3
4
Spawning biomass (mt)

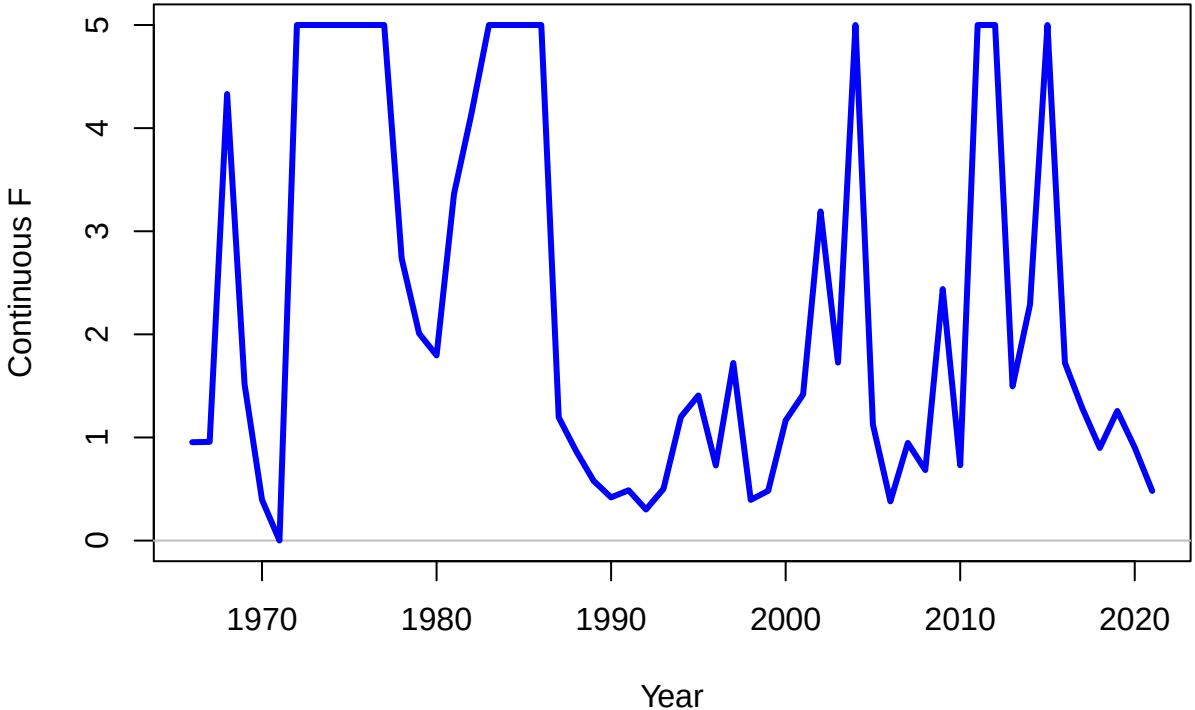

Exp. recruitment
Exp. recruitment after bias adj.
Estimated recruitments
Unfished equilibrium
Recruitment (1,000s)
Spawning biomass (mt)
0
1000
2000
3000
4000
5000
0
1
2
3
4
1985
1997
2007
1993
1990
1989
1992
2021

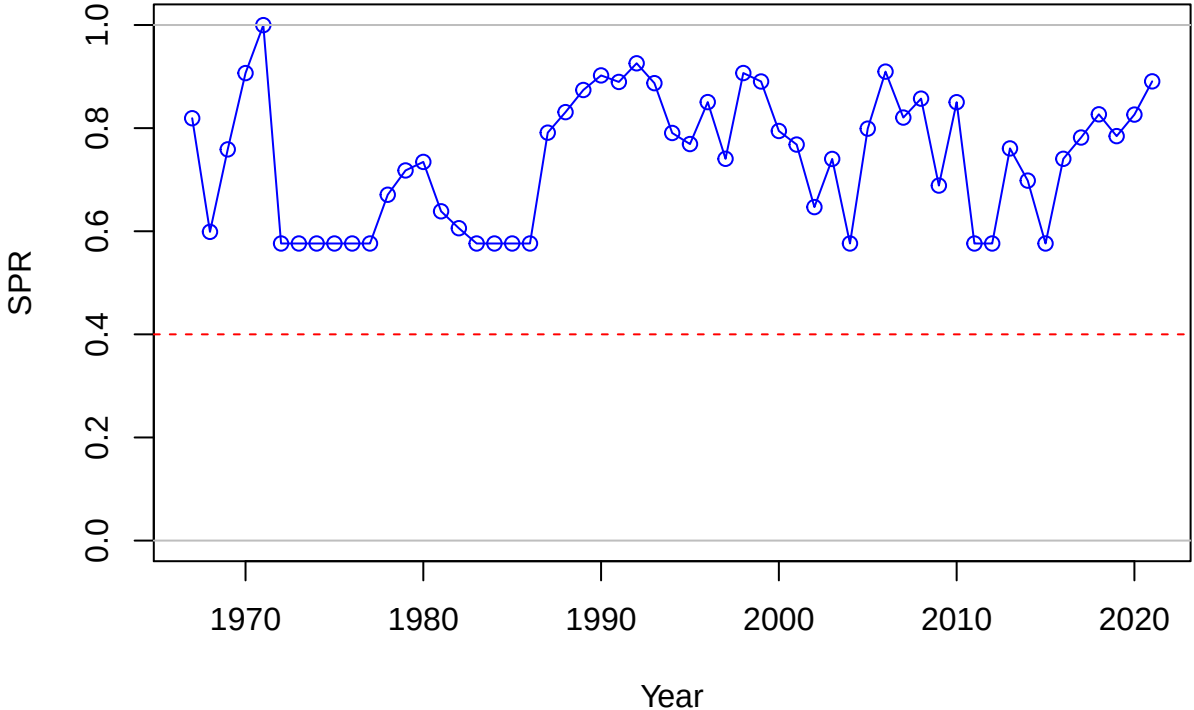

Log recruitment deviation
Spawning output (relative to B_0)
2
1
0
−1
−2
0
1
2
3
4
1985
1997
2007
1993
2005
2008
1972
1992
1990
1989
2021
2019
2017
2013
2014
2015
1967

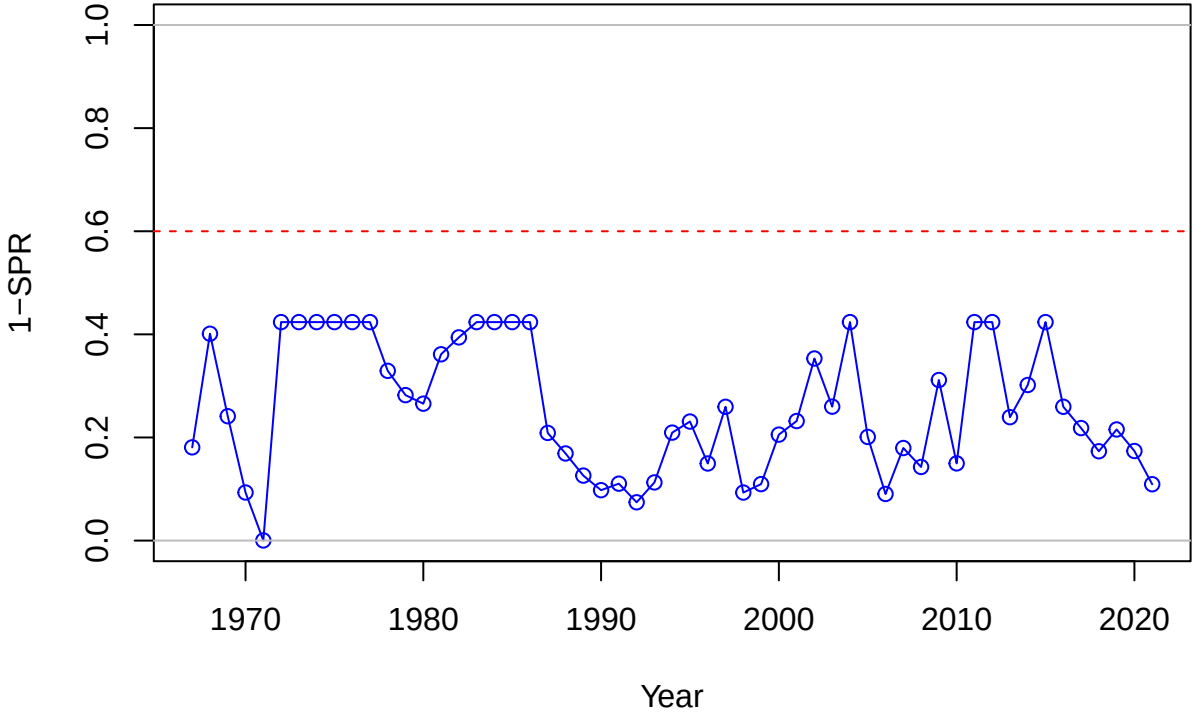

Landings (mt)
0
1
2
3
4
5
6
1970
1980
1990
2000
2010
2020
Year

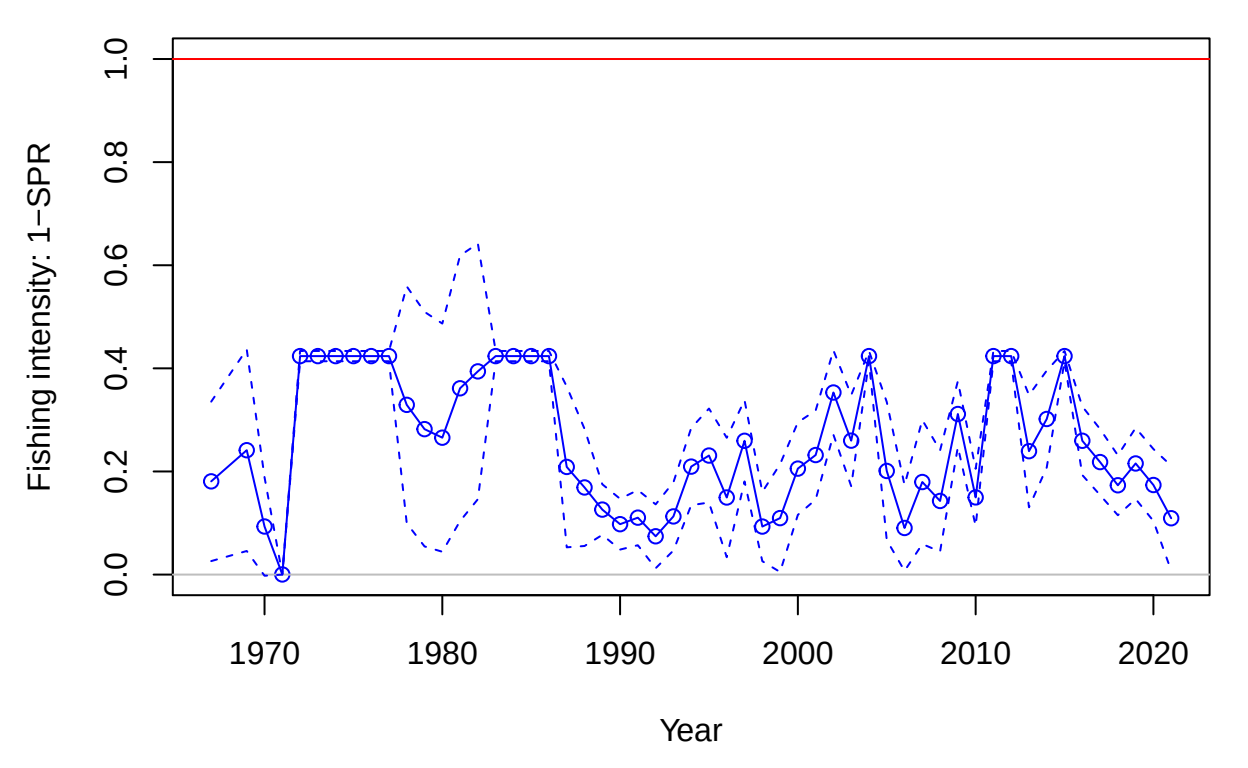

Landings (mt)
0
1
2
3
4
5
6
1970
1980
1990
2000
2010
2020
Year

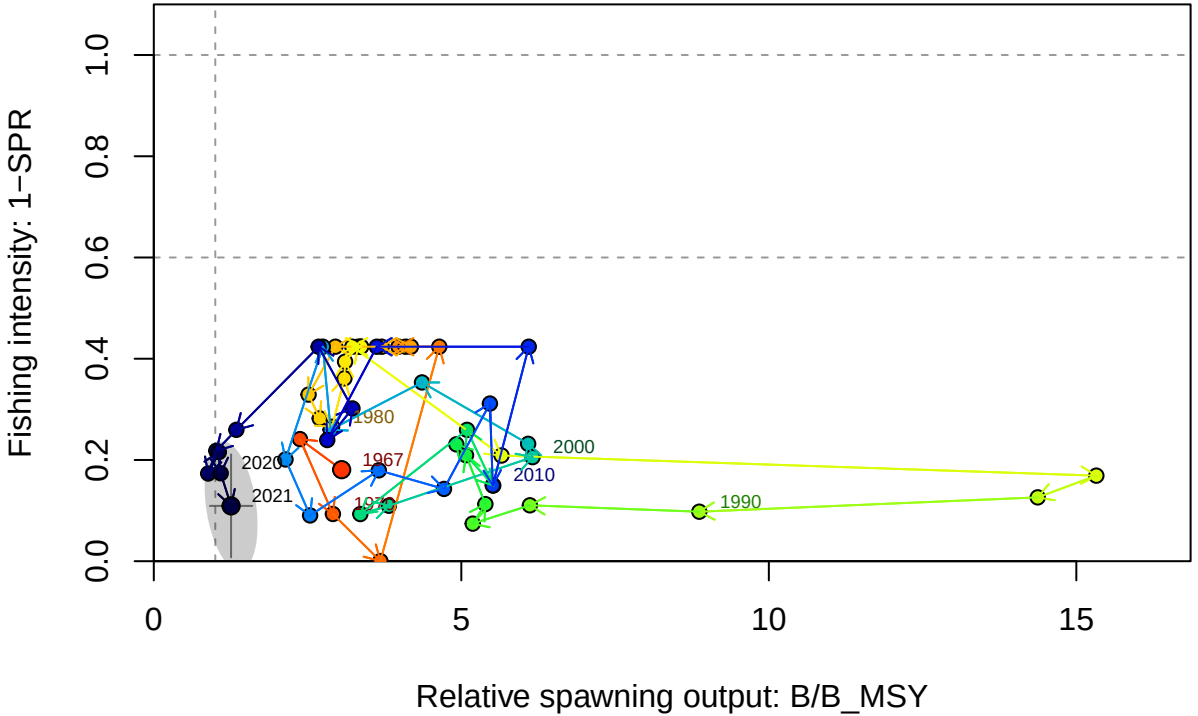

FISHERY
FISHERY obs.
Observed and expected Landings (mt)
0
2
4
6
8
10
12
1970
1980
1990
2000
2010
2020
Year

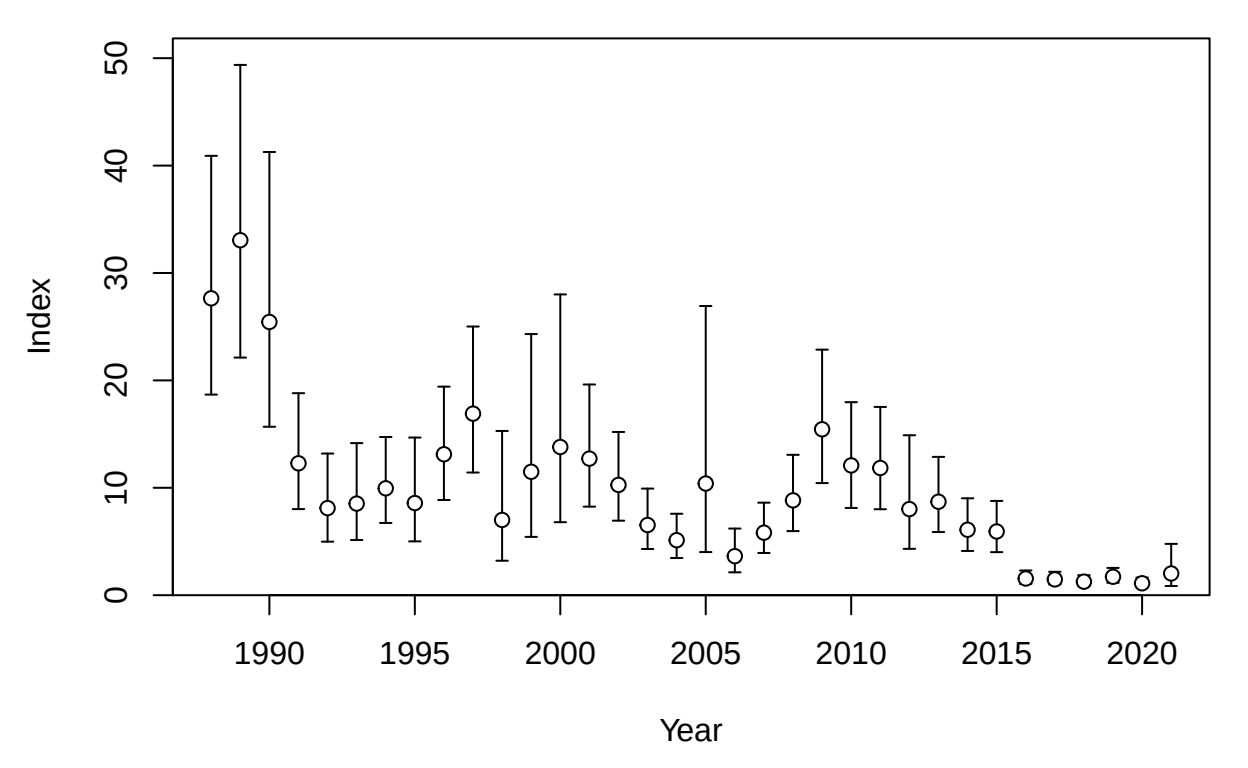

Continuous F
0
1
2
3
4
5
1970
1980
1990
2000
2010
2020
Year

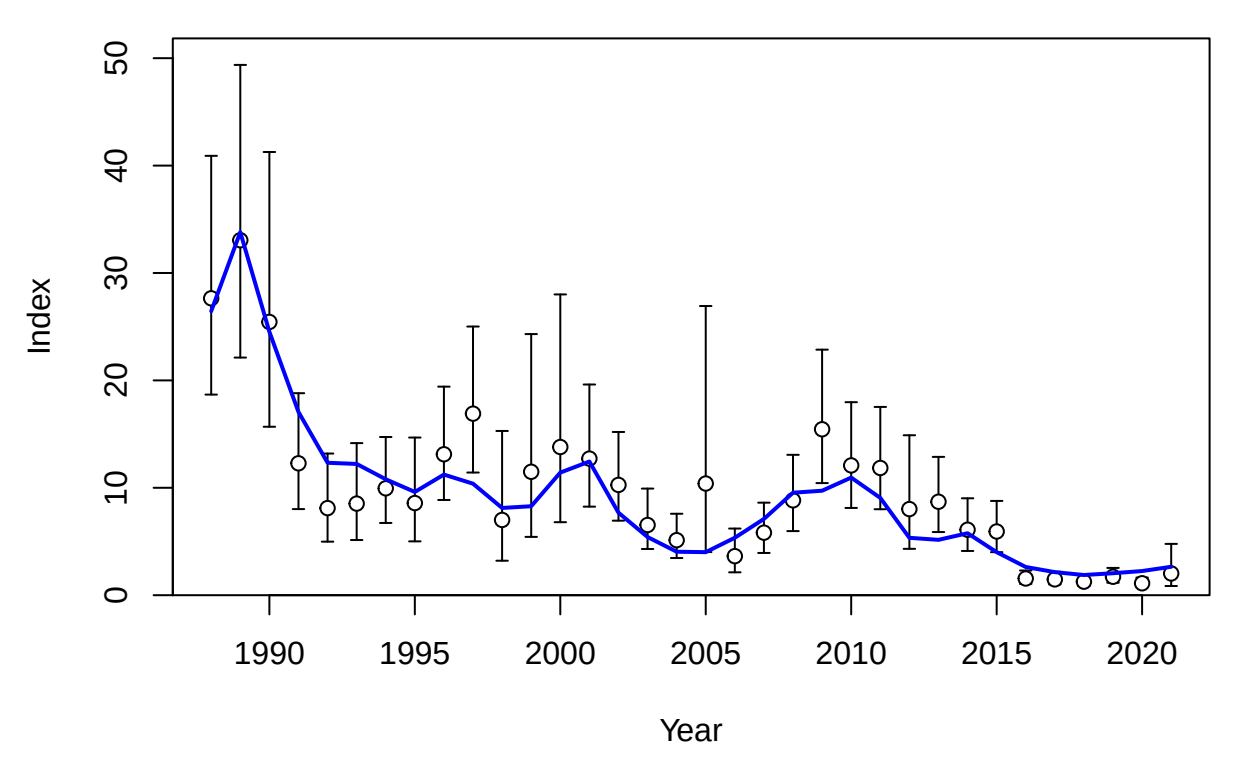

SPR
0.0
0.2
0.4
0.6
0.8
1.0
1970
1980
1990
2000
2010
2020
Year

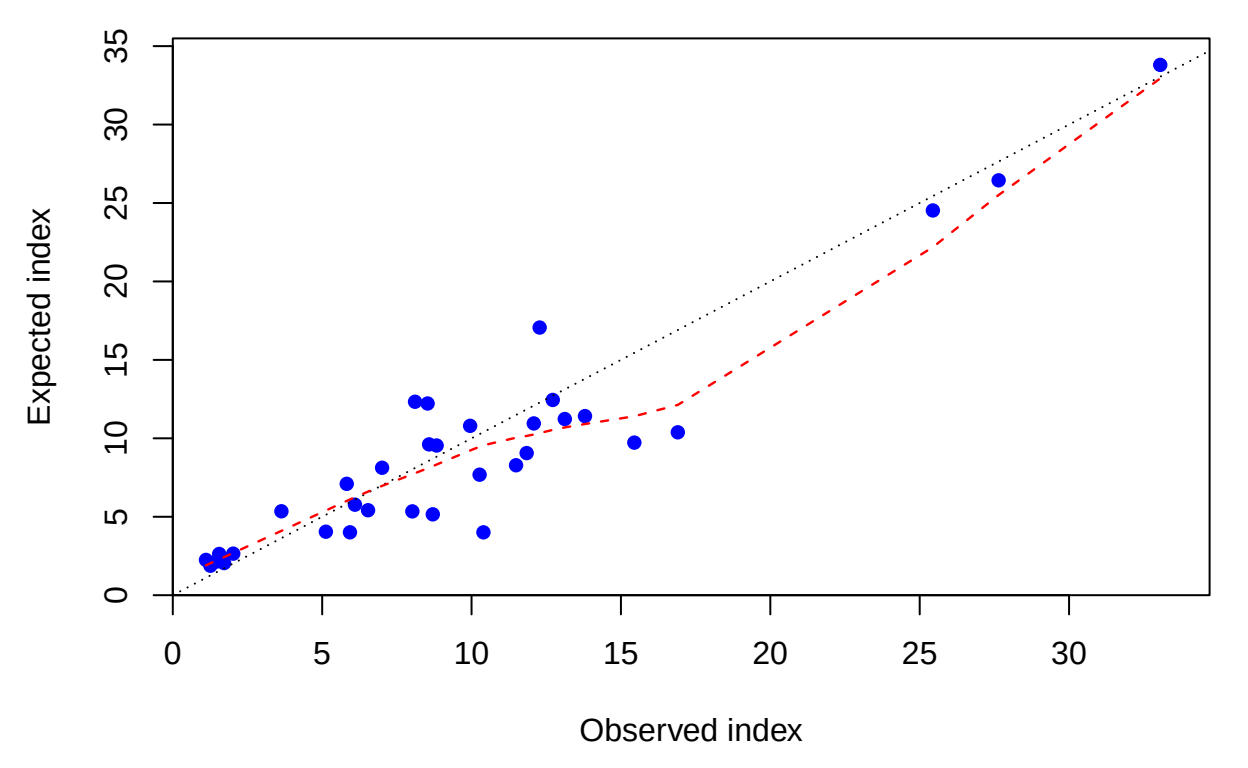

1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
1970
1980
1990
2000
2010
2020
Year

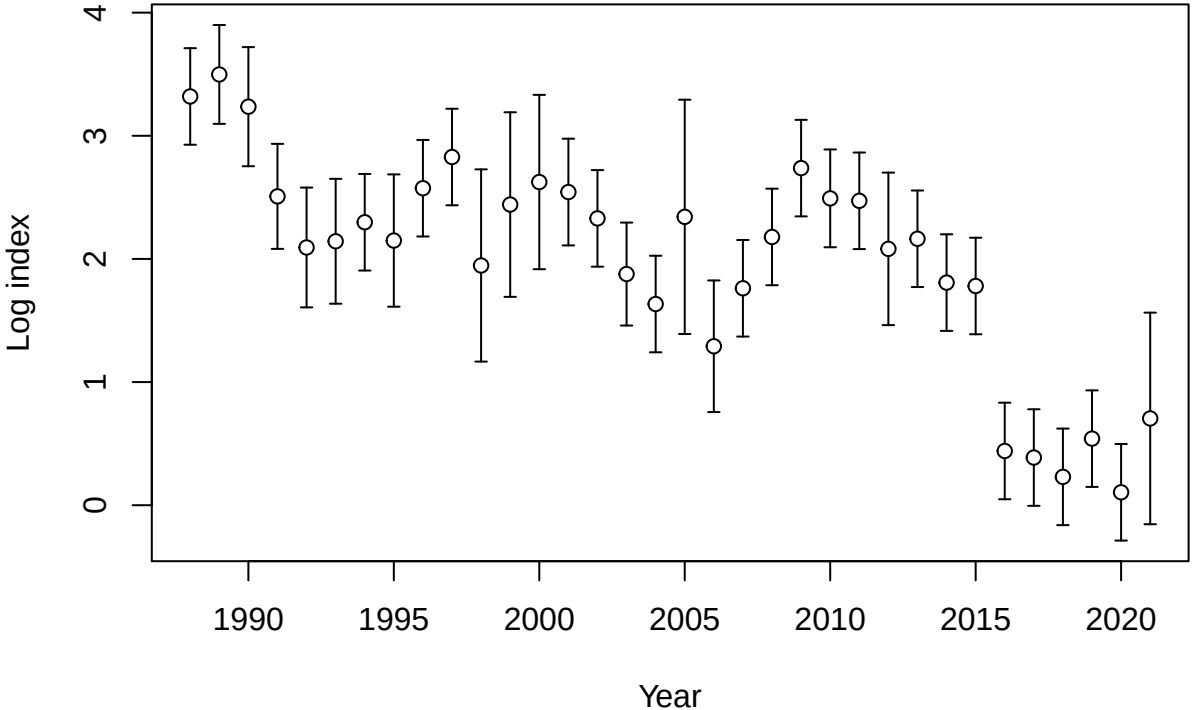

Fishing intensity: 1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
1970
1980
1990
2000
2010
2020
Year

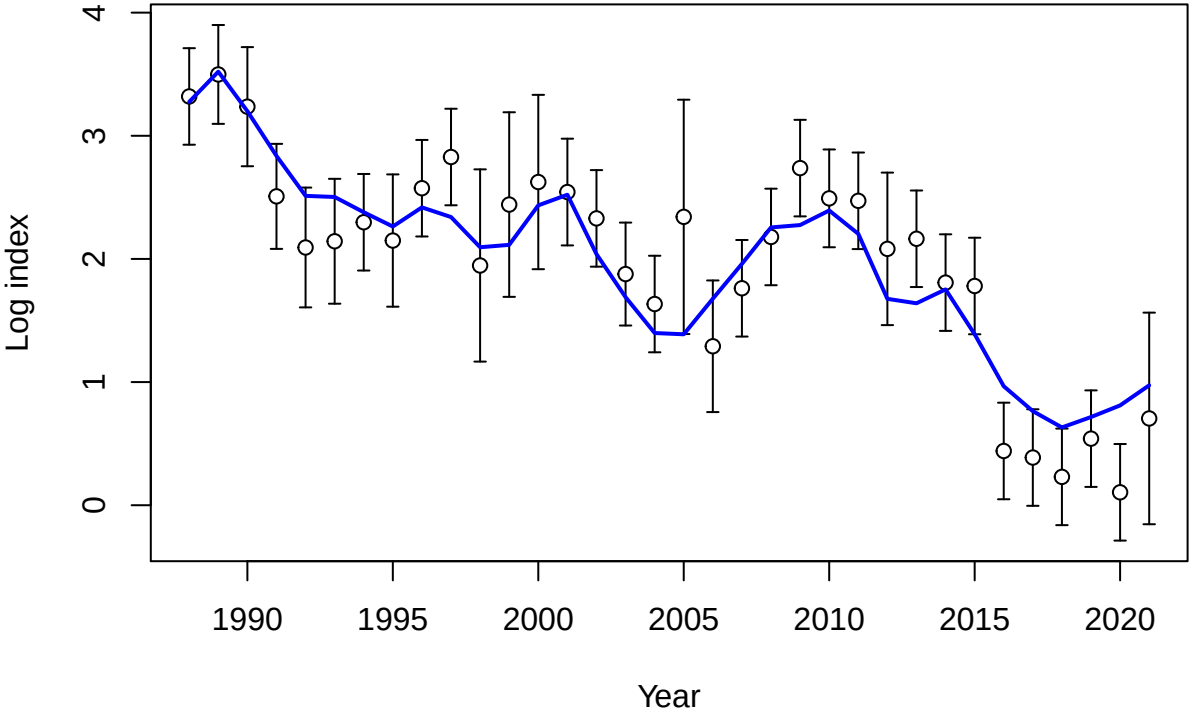

Fishing intensity: 1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
0
5
10
15
Relative spawning output: B/B_MSY
1980
2020
1967
2021
2000
2010
1990

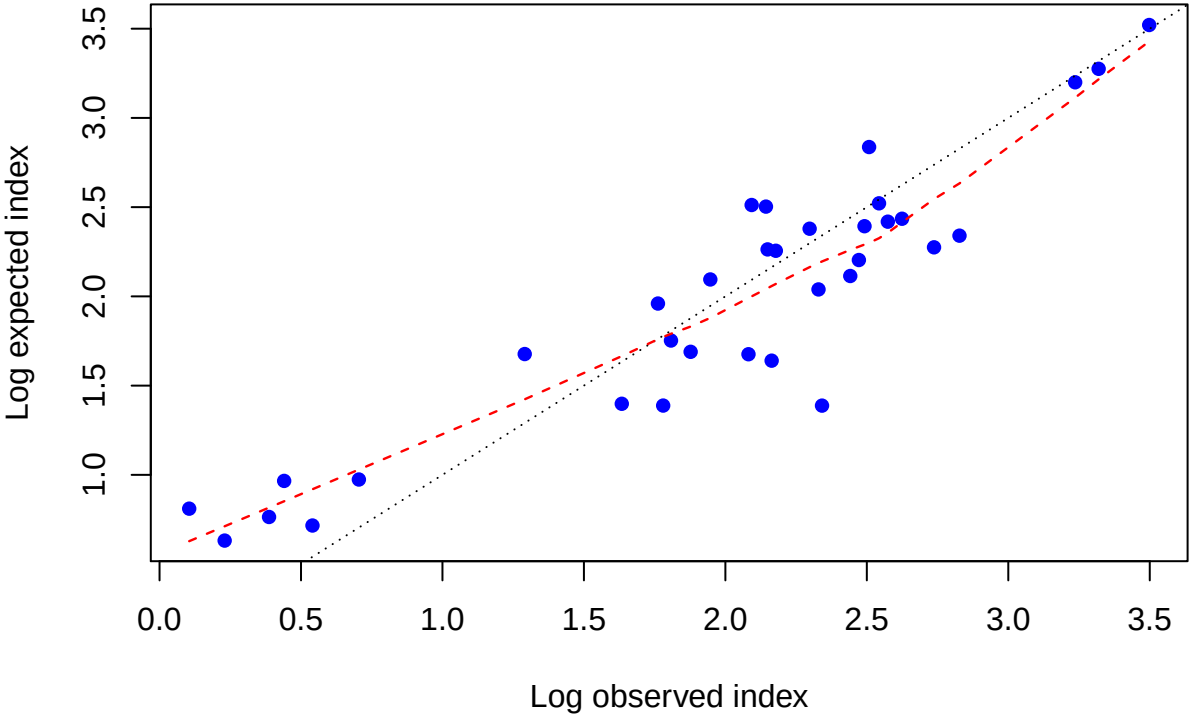

Index
0
10
20
30
40
50
1990
1995
2000
2005
2010
2015
2020
Year

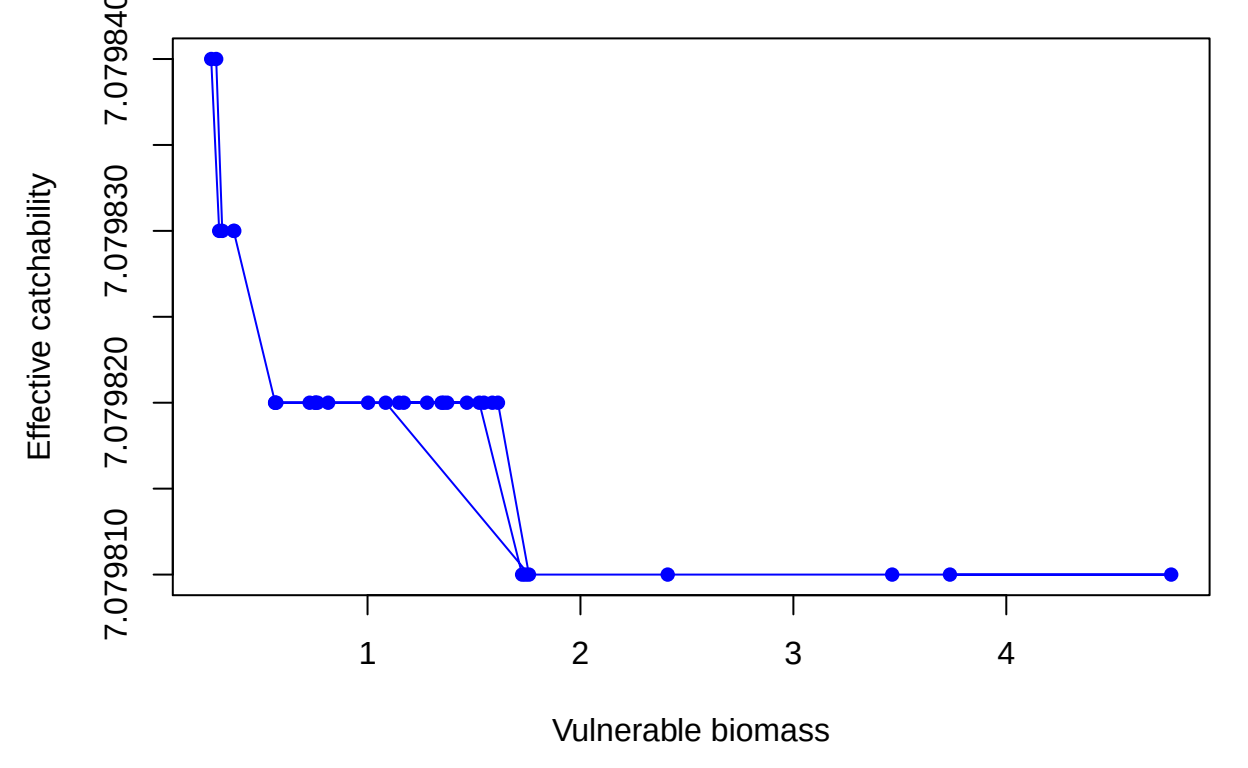

Index
0
10
20
30
40
50
1990
1995
2000
2005
2010
2015
2020
Year

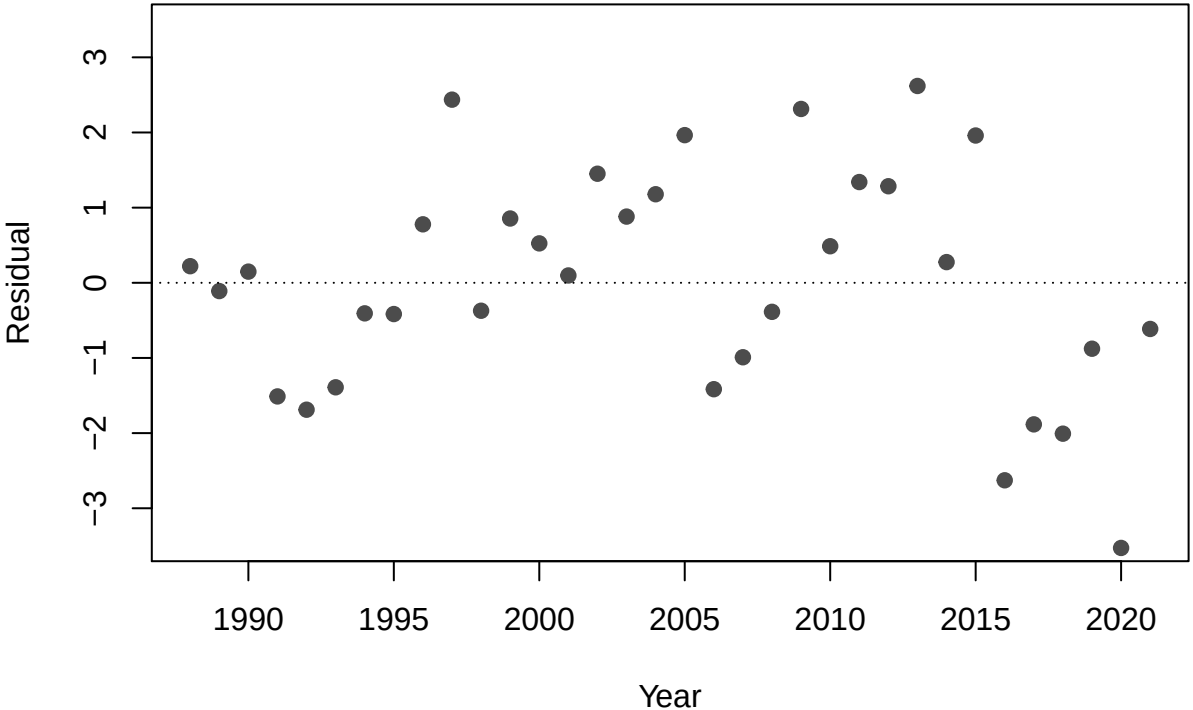

Expected index
Observed index
0
5
10
15
20
25
30
35

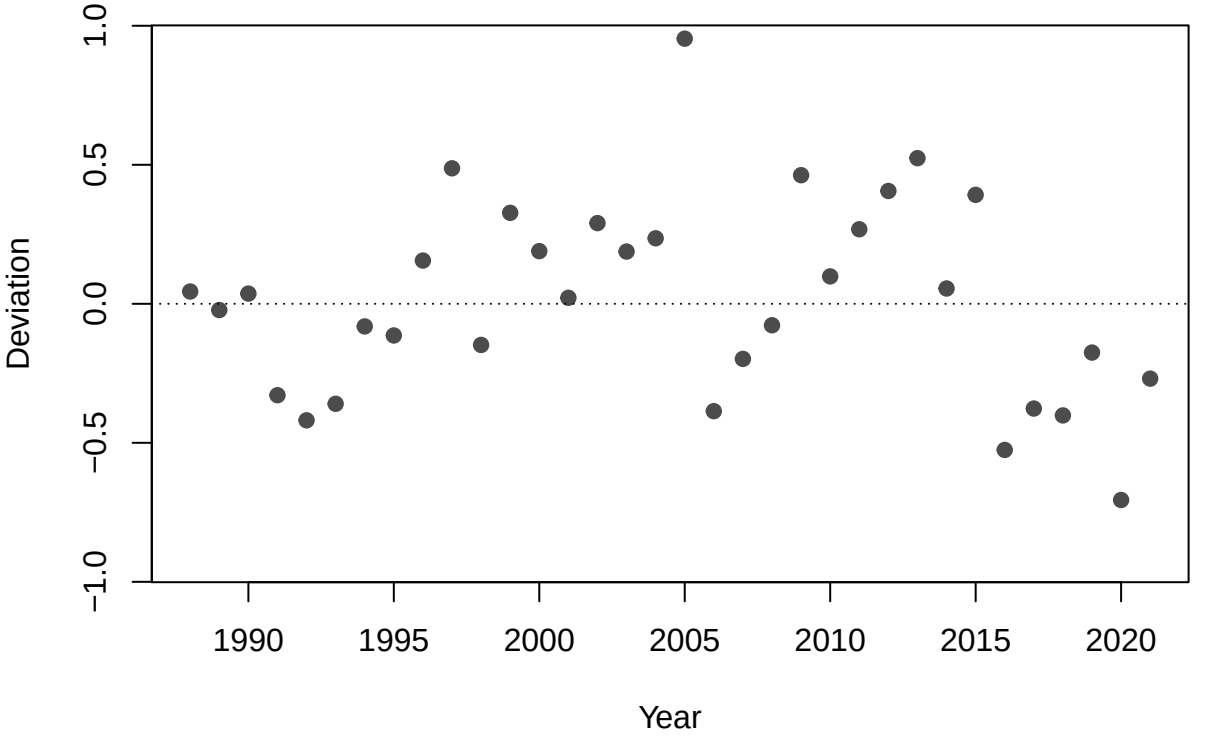

Log index
0
1
2
3
4
1990
1995
2000
2005
2010
2015
2020
Year

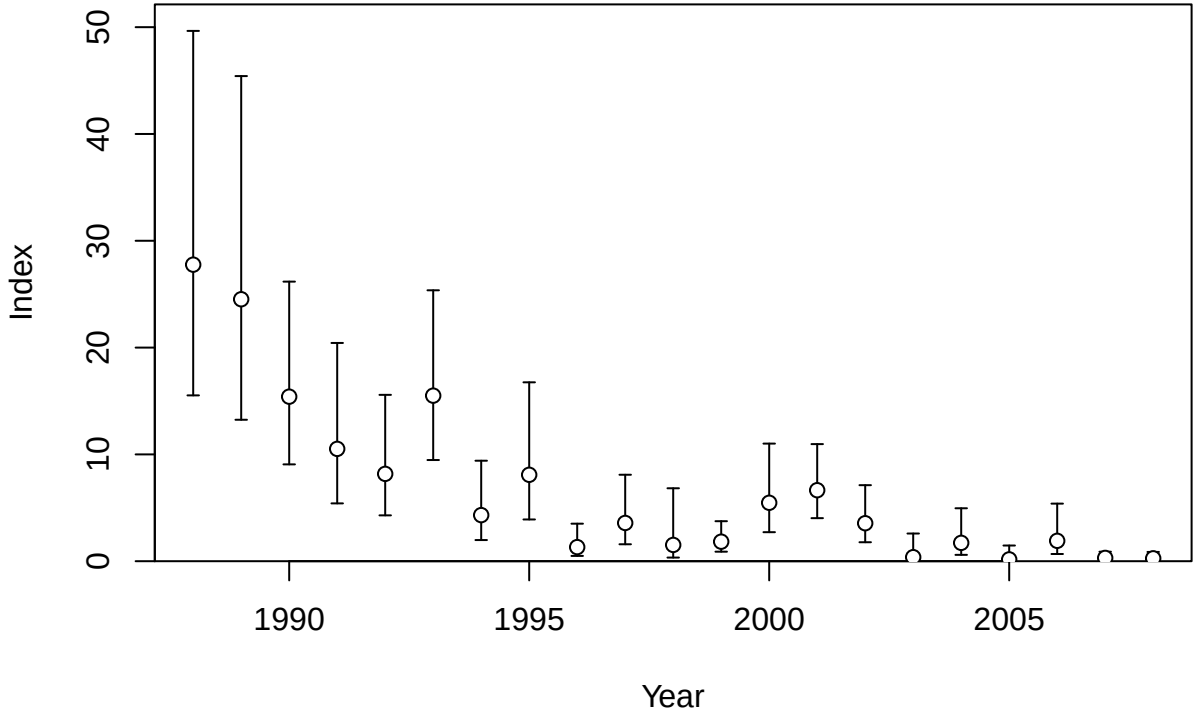

Log index
0
1
2
3
4
1990
1995
2000
2005
2010
2015
2020
Year

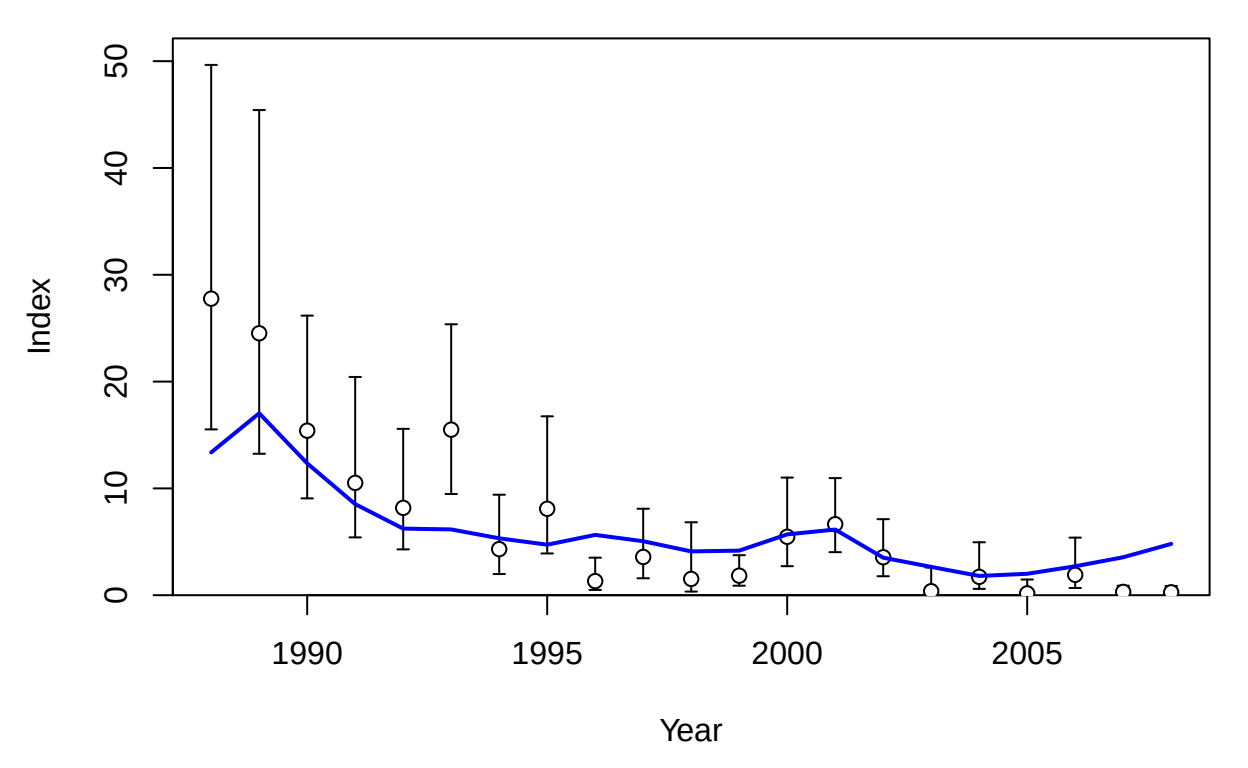

Log expected index
1.0
1.5
2.0
2.5
3.0
3.5
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
Log observed index

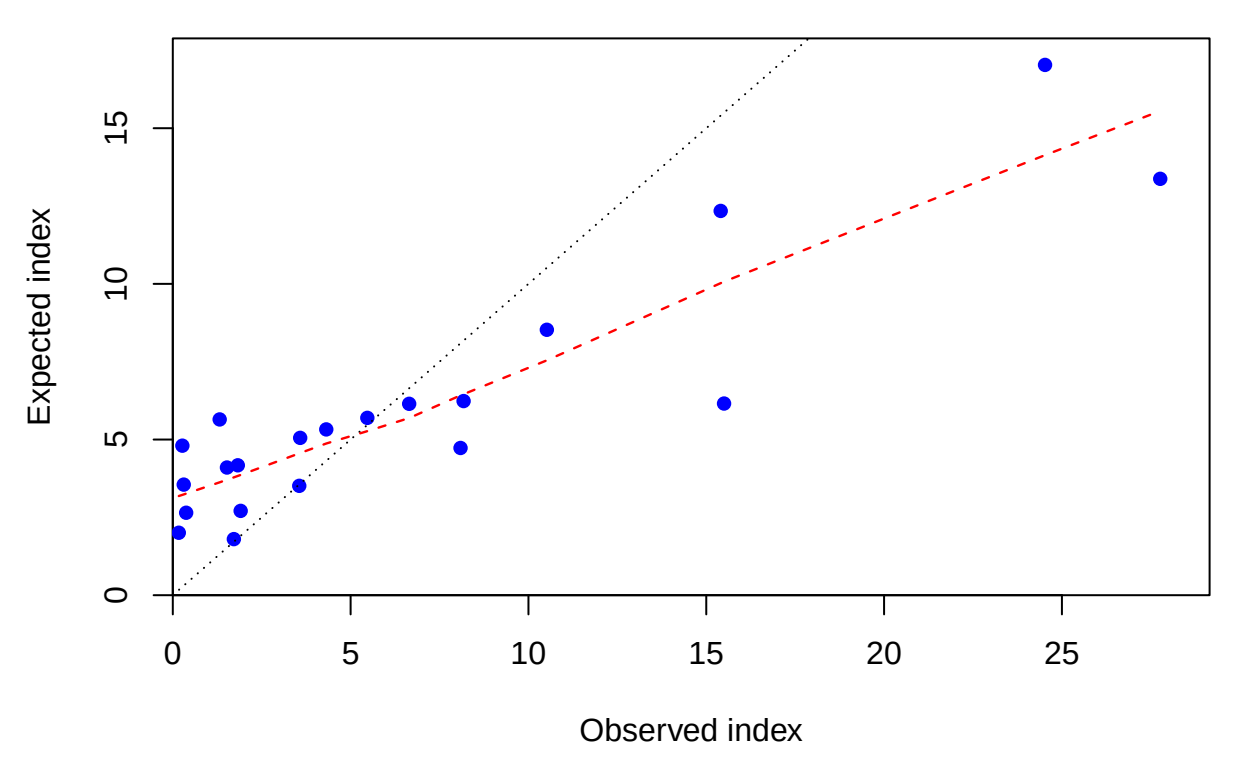

Effective catchability
7.079840
7.079830
7.079820
7.079810
1
2
3
4
Vulnerable biomass

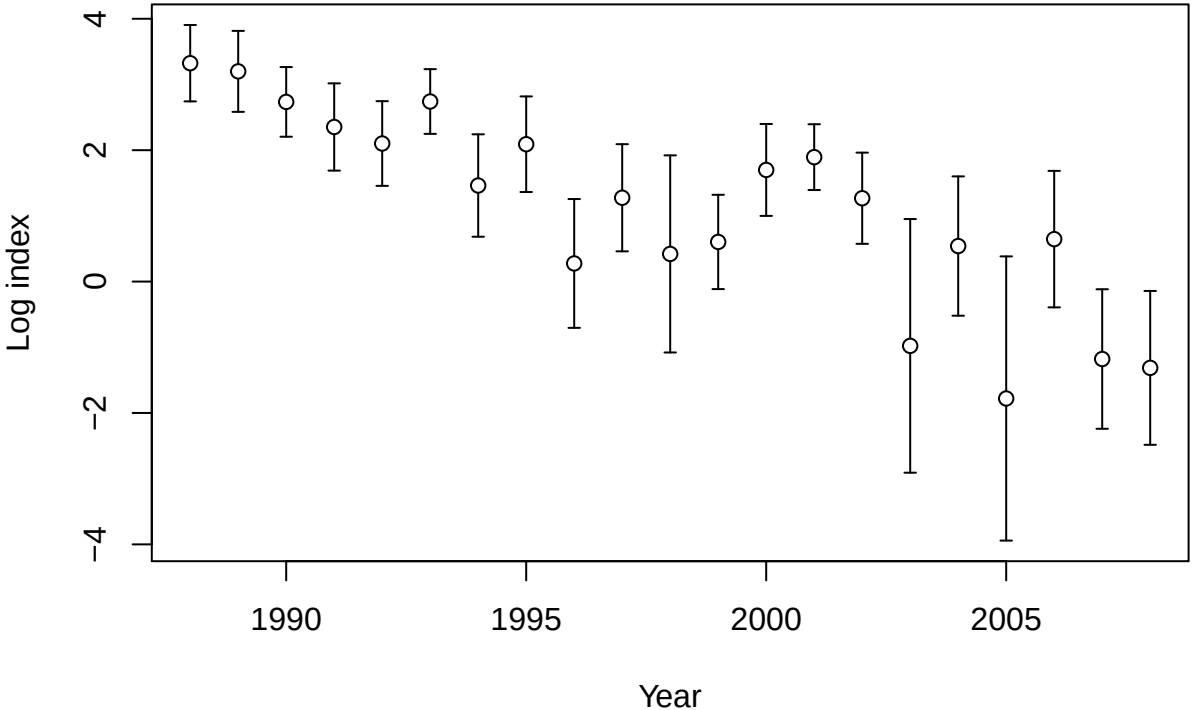

Residual
3
2
1
0
−1
−2
−3
1990
1995
2000
2005
2010
2015
2020
Year

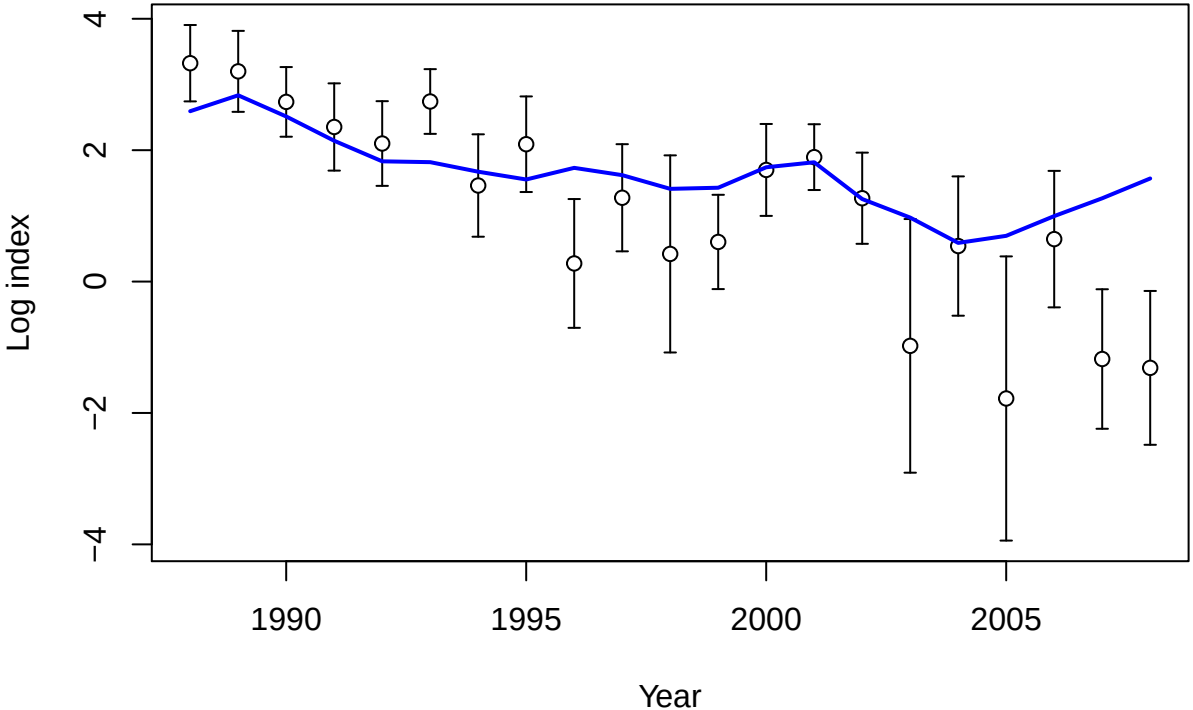

Deviation
1.0
0.5
0.0
−0.5
−1.0
1990
1995
2000
2005
2010
2015
2020
Year

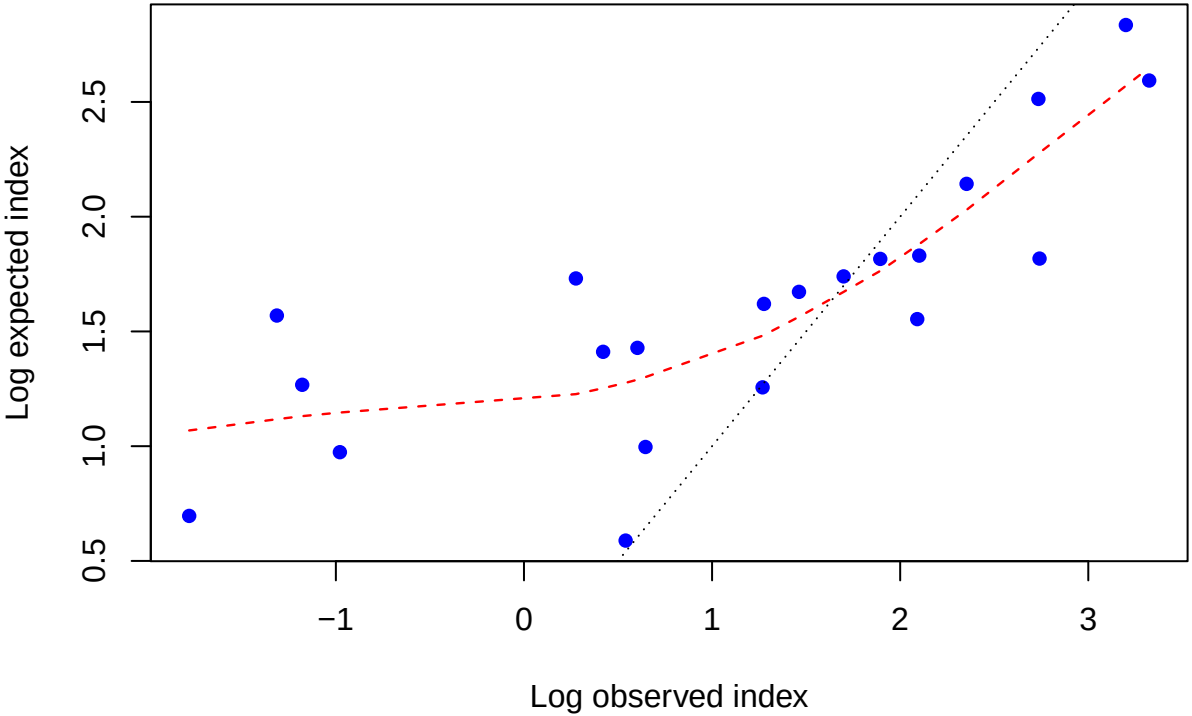

Index
0
10
20
30
40
50
1990
1995
2000
2005
Year

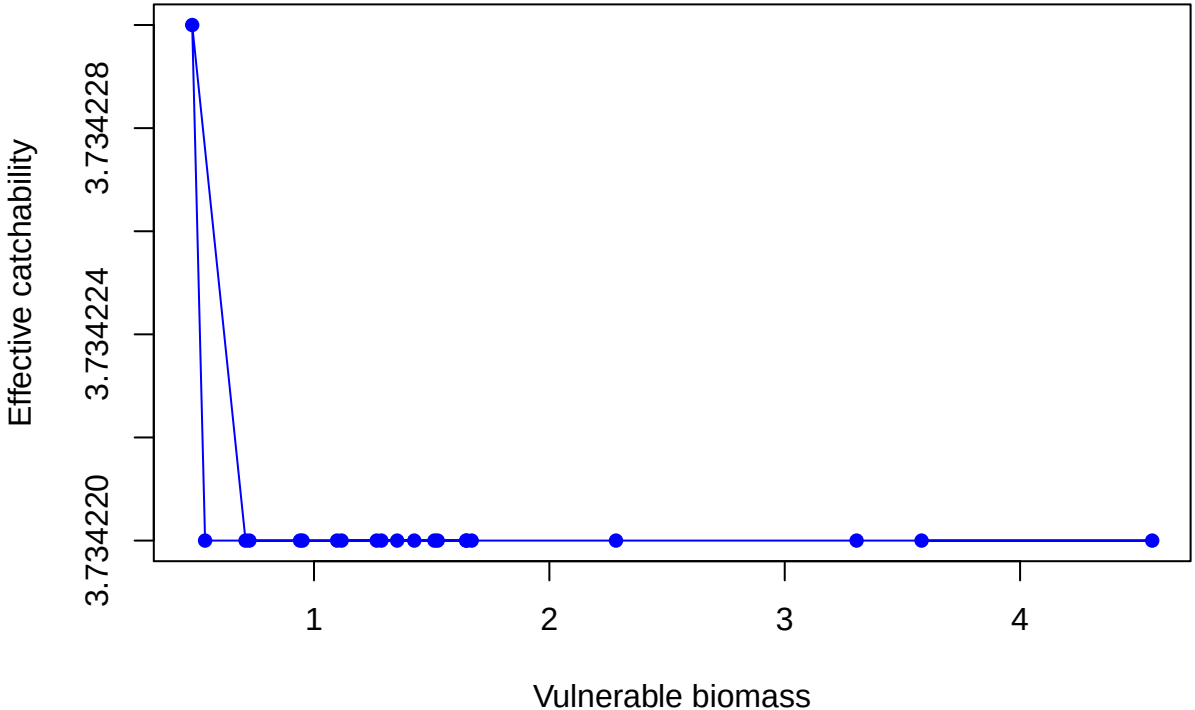

Index
0
10
20
30
40
50
1990
1995
2000
2005
Year

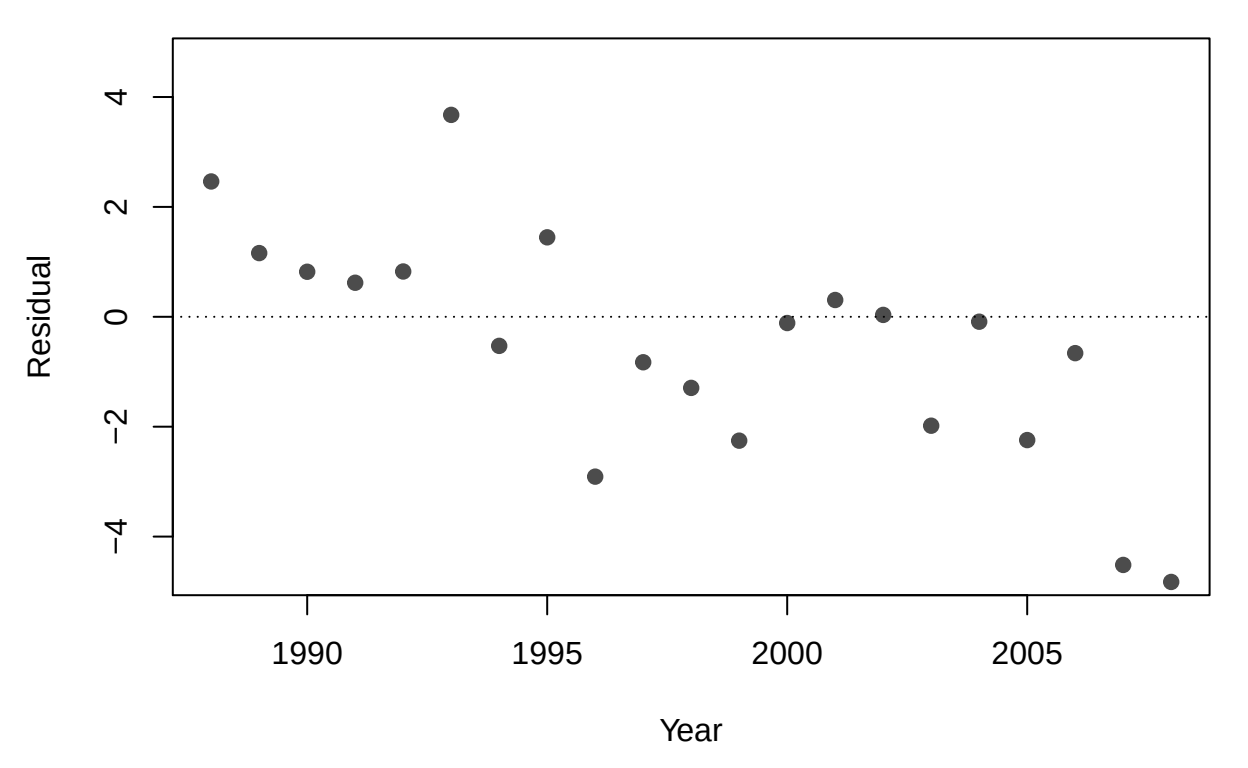

Expected index
Observed index
0
5
10
15
20
25
0
5
10
15

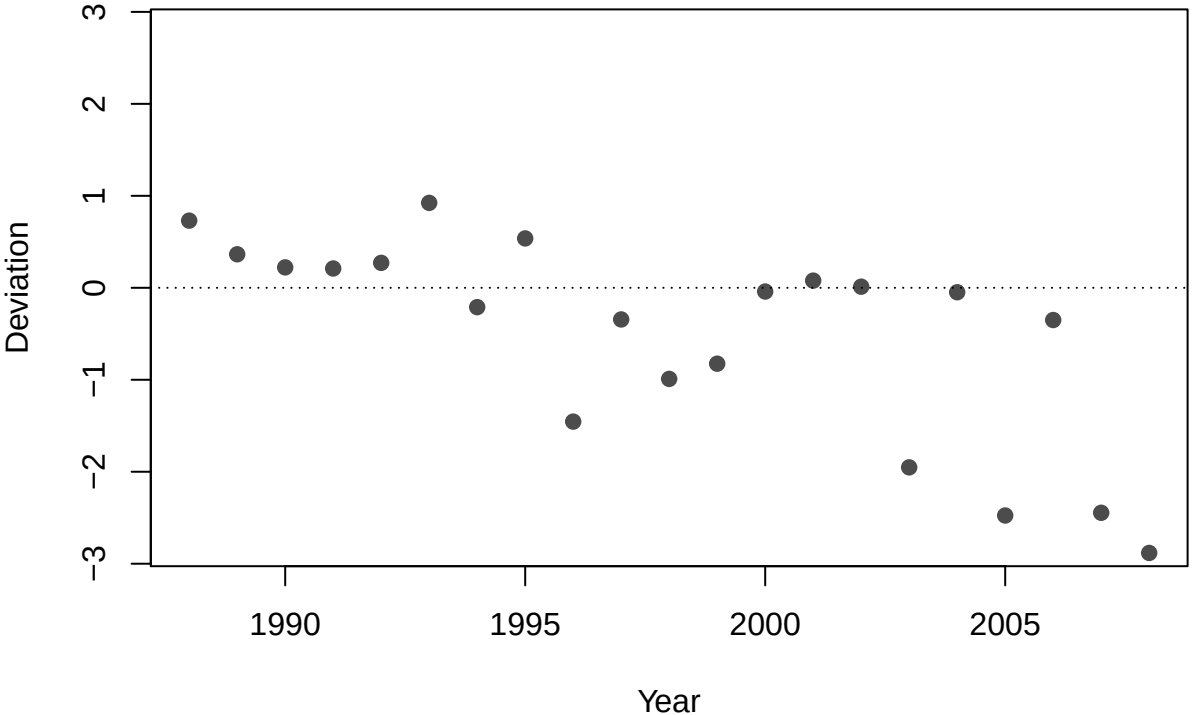

Log index
4
2
0
−2
−4
1990
1995
2000
2005
Year

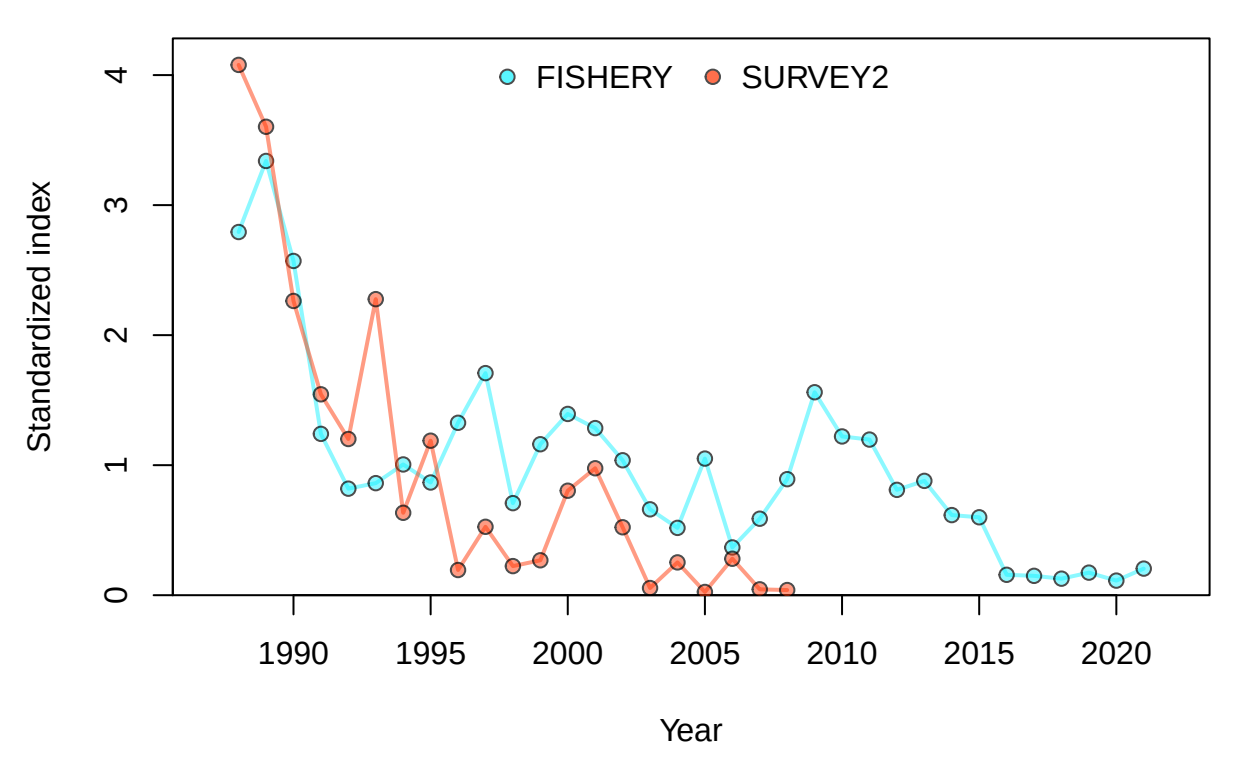

Log index
4
2
0
−2
−4
1990
1995
2000
2005
Year

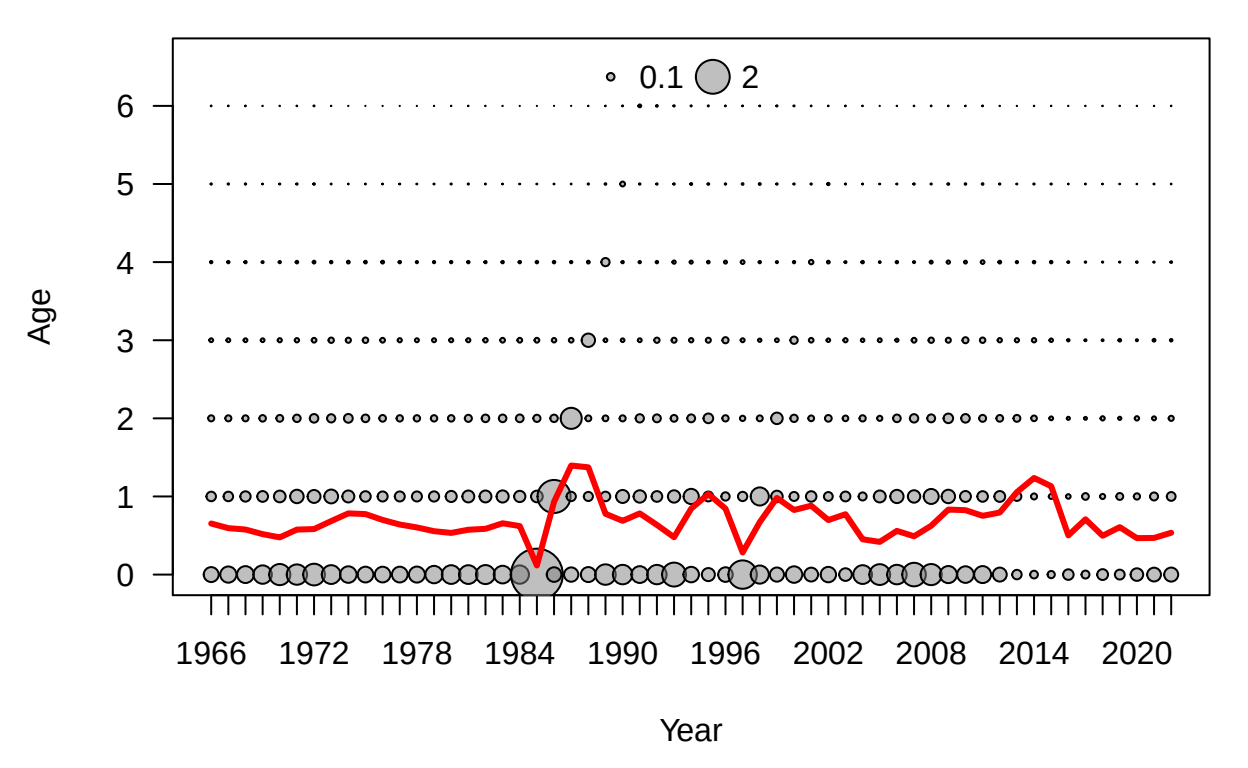

Log expected index
0.5
1.0
1.5
2.0
2.5
−1
0
1
2
3
Log observed index

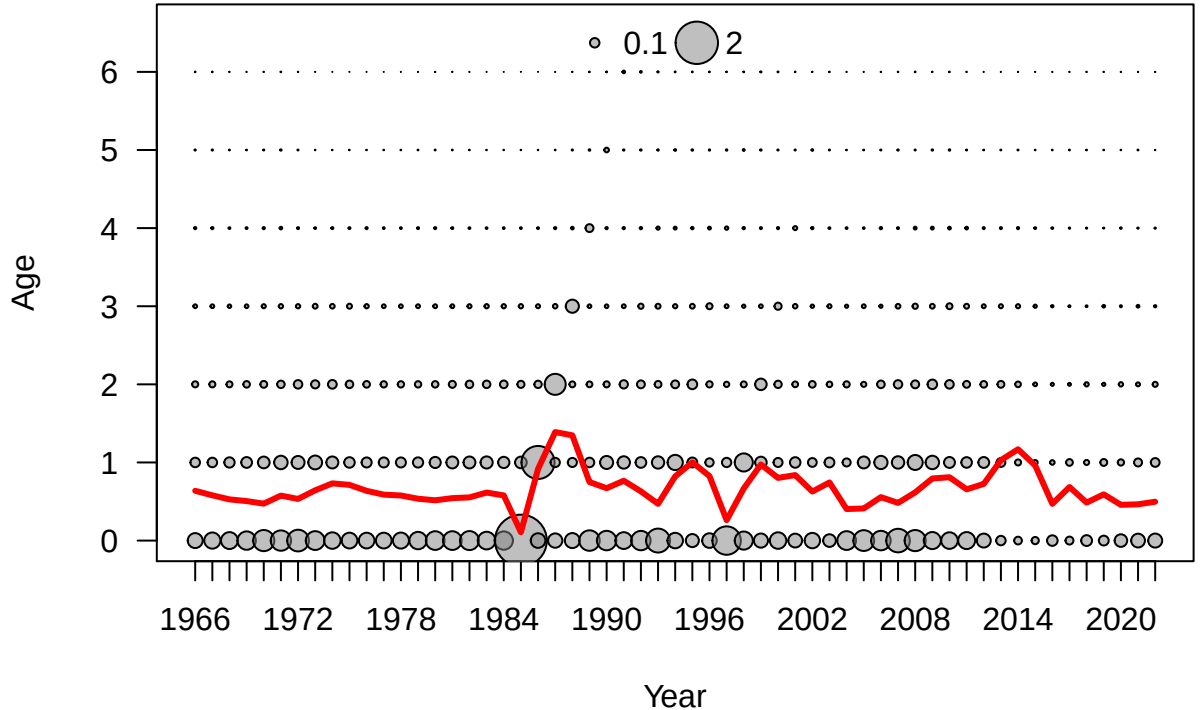

Effective catchability
3.734228
3.734224
3.734220
1
2
3
4
Vulnerable biomass

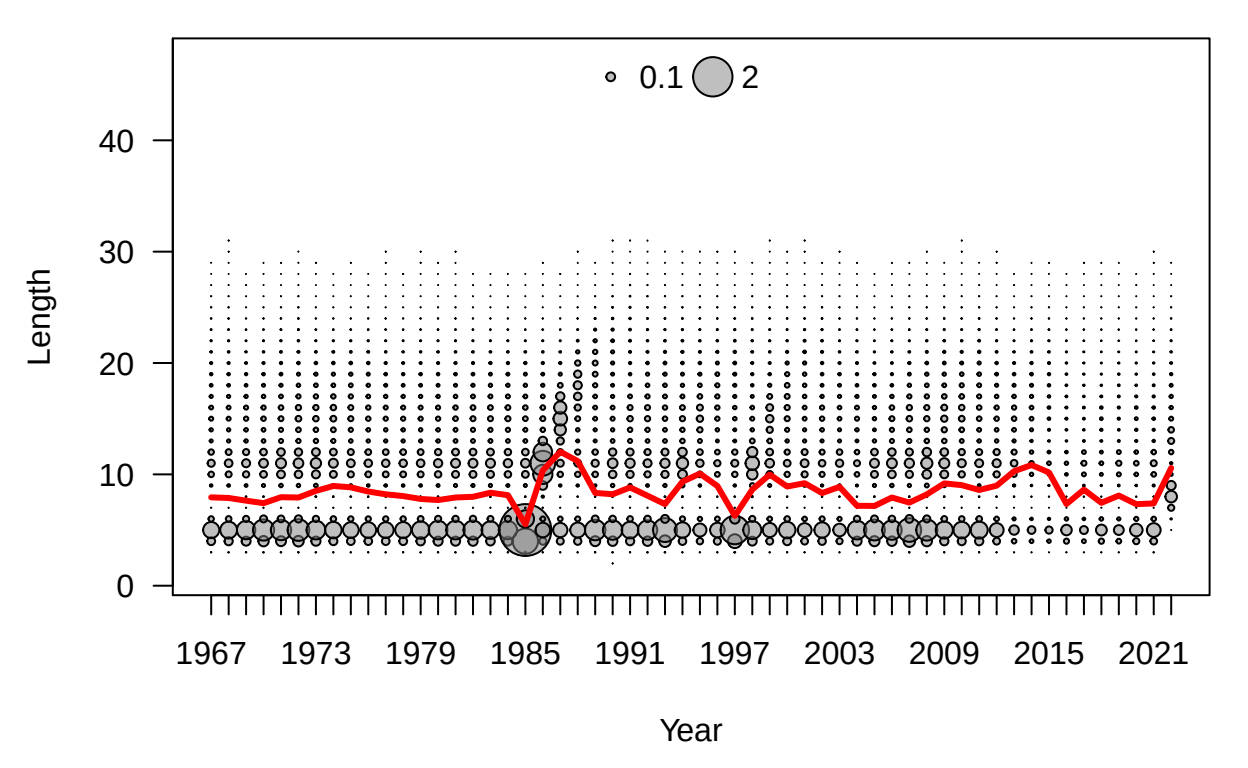

Residual
4
2
0
−2
−4
1990
1995
2000
2005
Year

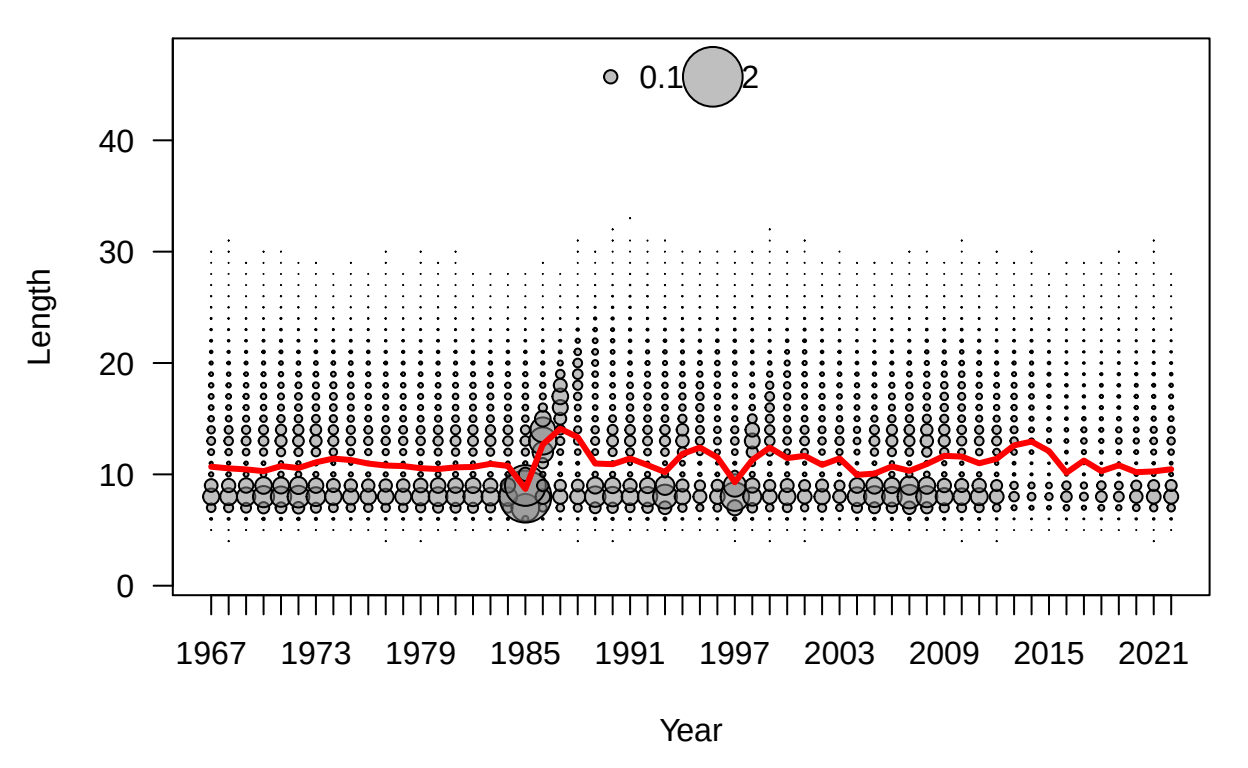

Deviation
3
2
1
0
−1
−2
−3
1990
1995
2000
2005
Year

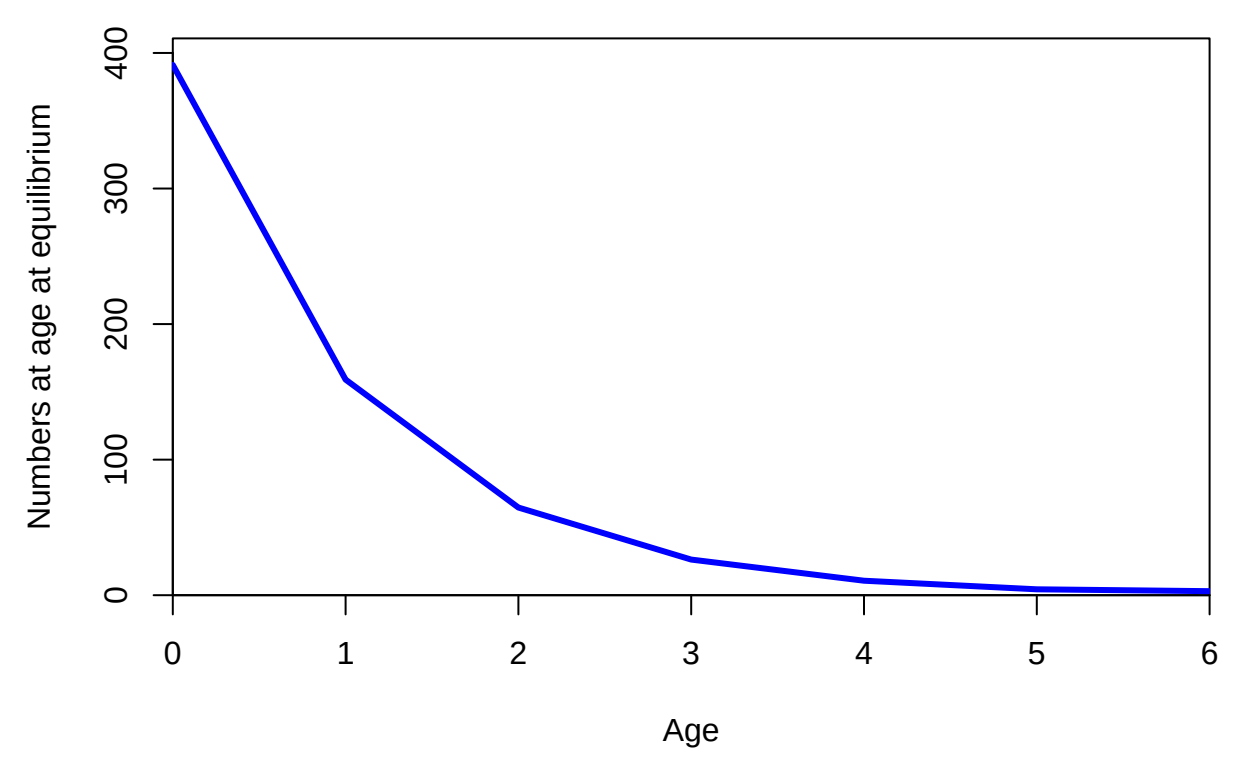

FISHERY
SURVEY2
Standardized index
Year
0
1
2
3
4
1990
1995
2000
2005
2010
2015
2020

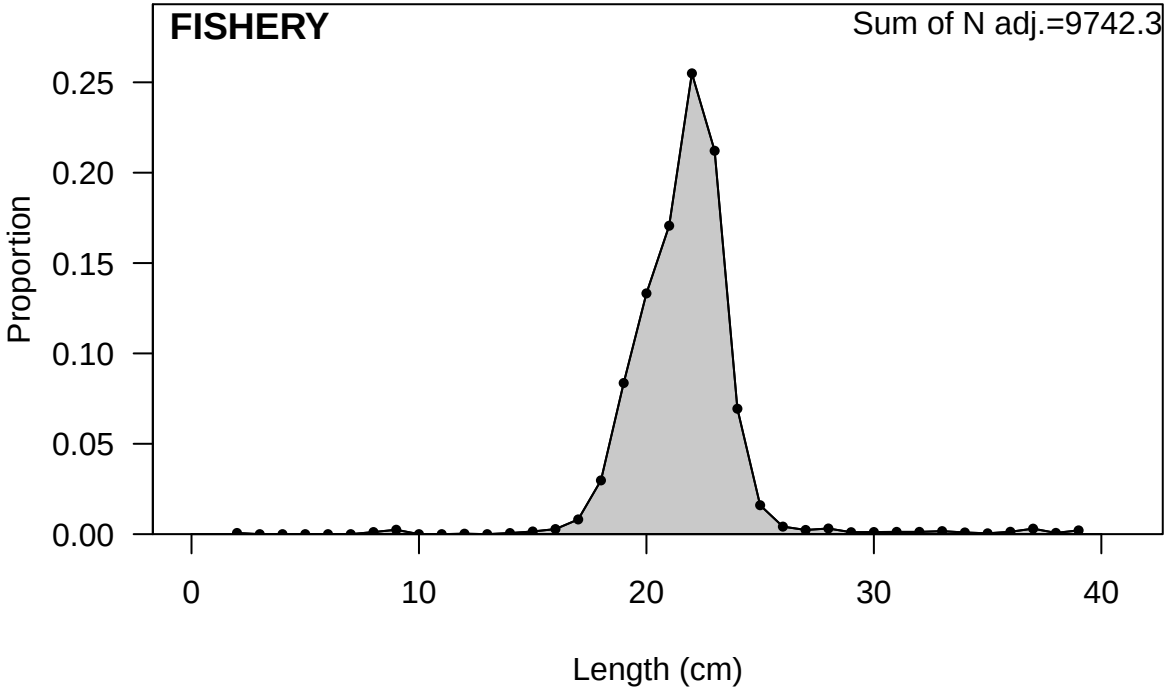

0.1
2
Age
6
5
4
3
2
1
0
1966
1972
1978
1984
1990
1996
2002
2008
2014
2020
Year

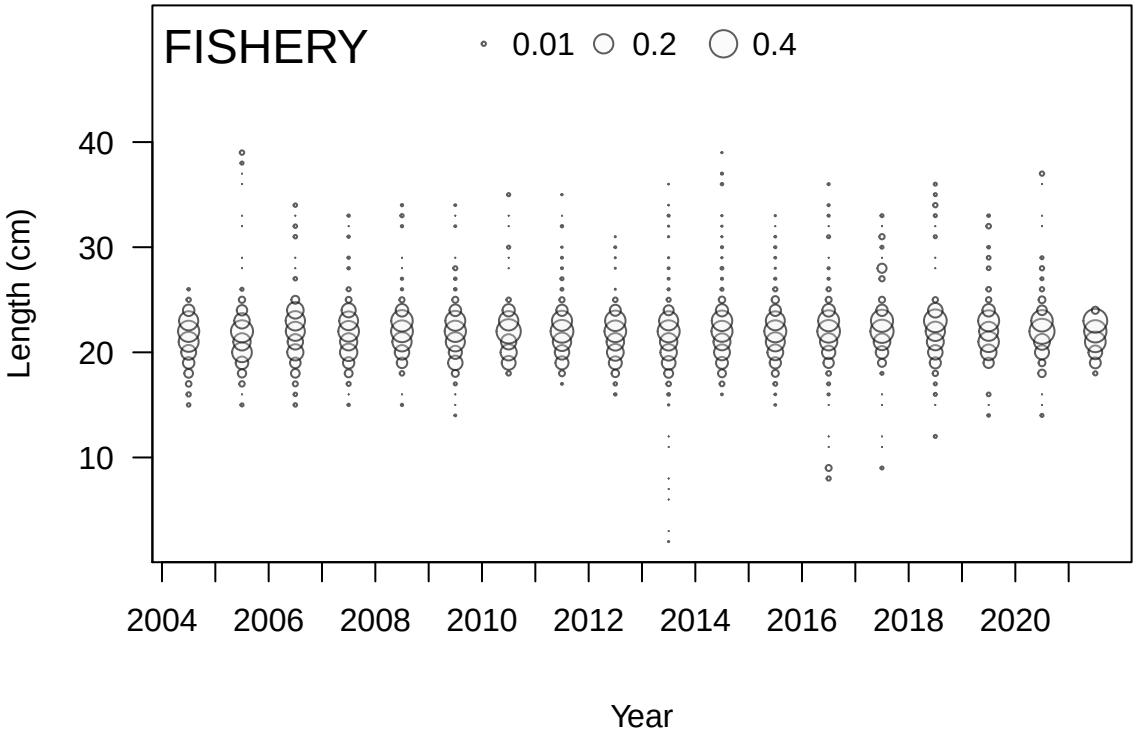

0.1
2
Age
6
5
4
3
2
1
0
1966
1972
1978
1984
1990
1996
2002
2008
2014
2020
Year

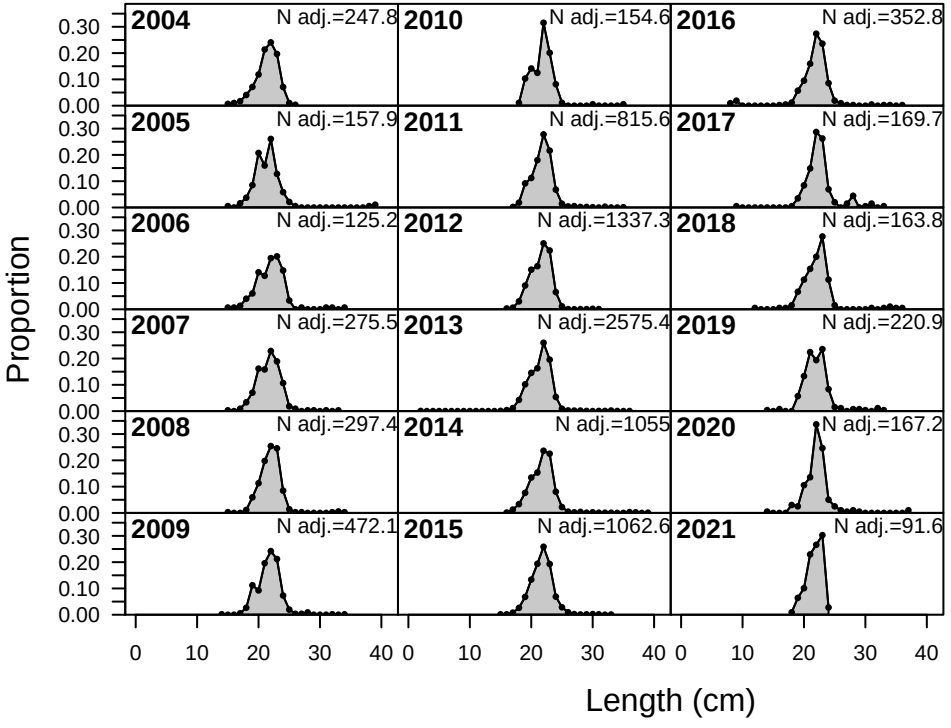

0.1
2
Length
0
10
20
30
40
1967
1973
1979
1985
1991
1997
2003
2009
2015
2021
Year

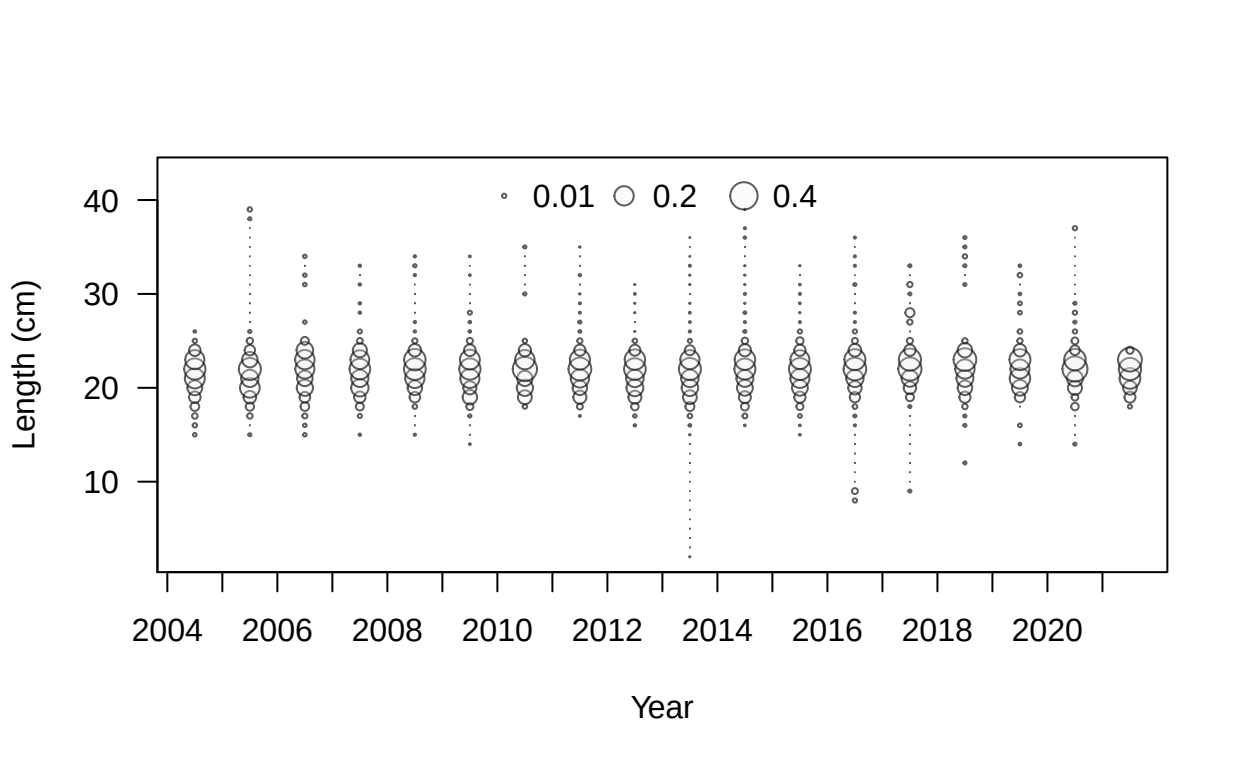

0.1
2
40
30
20
10
0
Length
1967
1973
1979
1985
1991
1997
2003
2009
2015
2021
Year

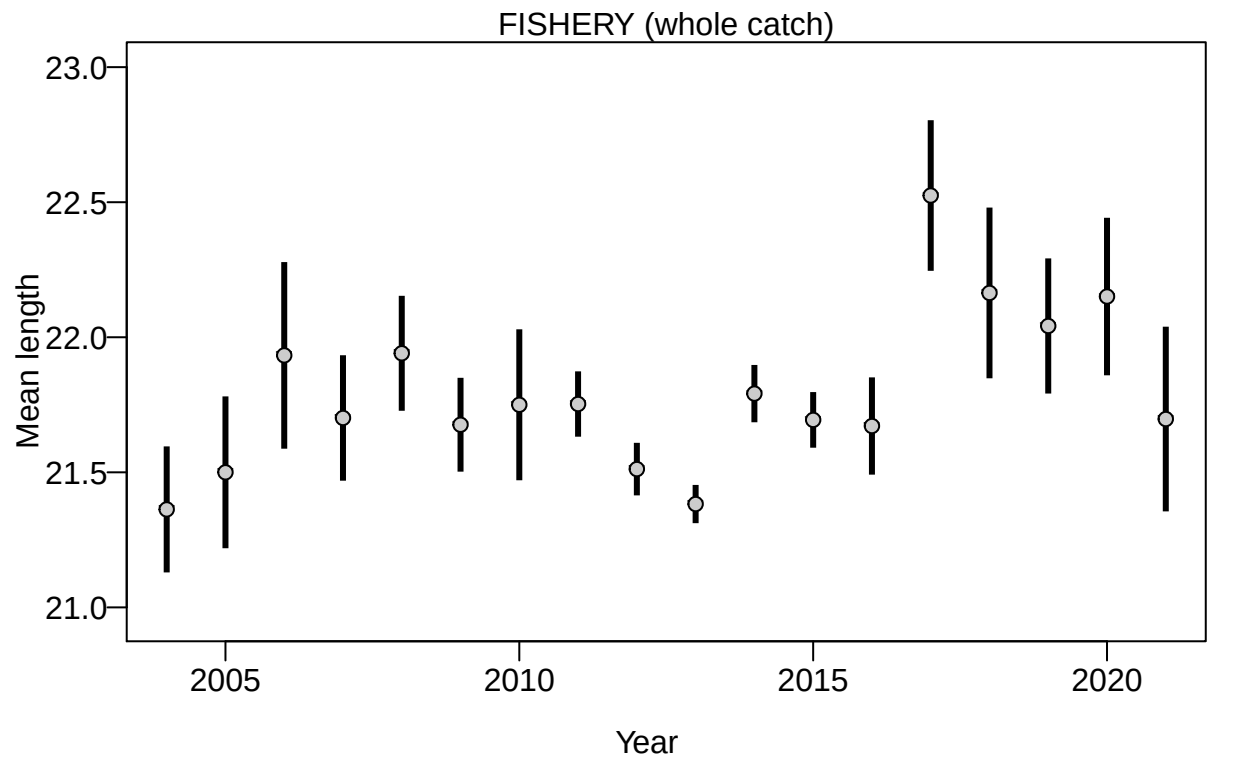

Numbers at age at equilibrium
0
100
200
300
400
0
1
2
3
4
5
6
Age

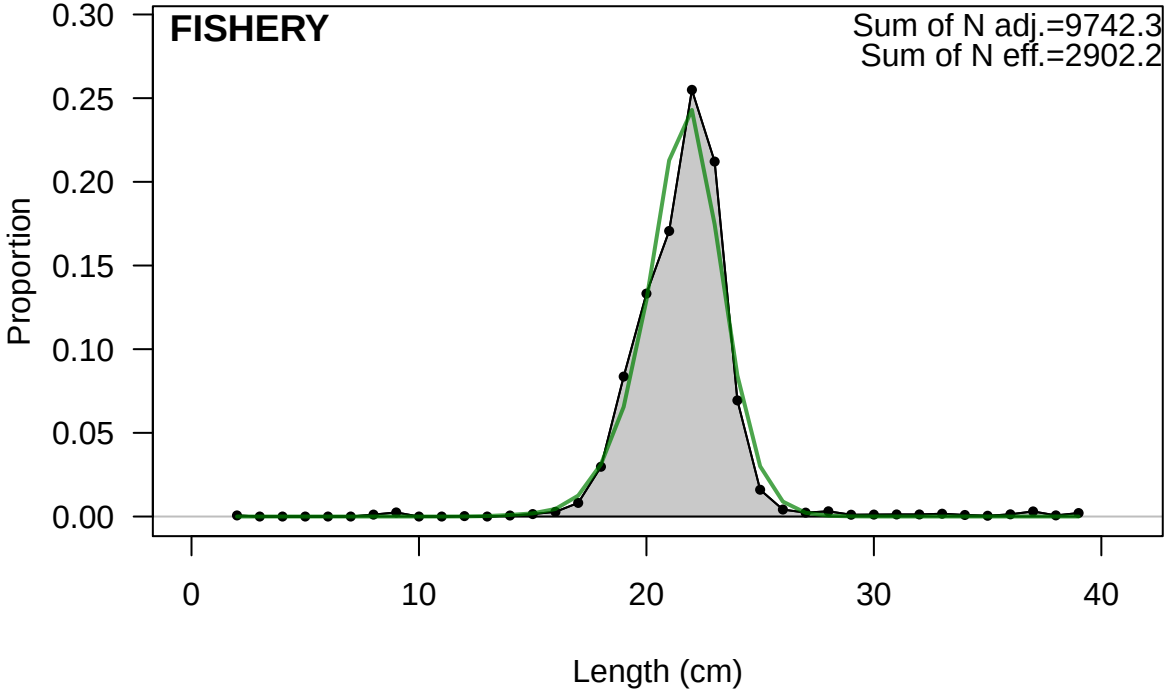

FISHERY
Sum of N adj.=9742.3
Proportion
0.25
0.20
0.15
0.10
0.05
0.00
0
10
20
30
40
Length (cm)

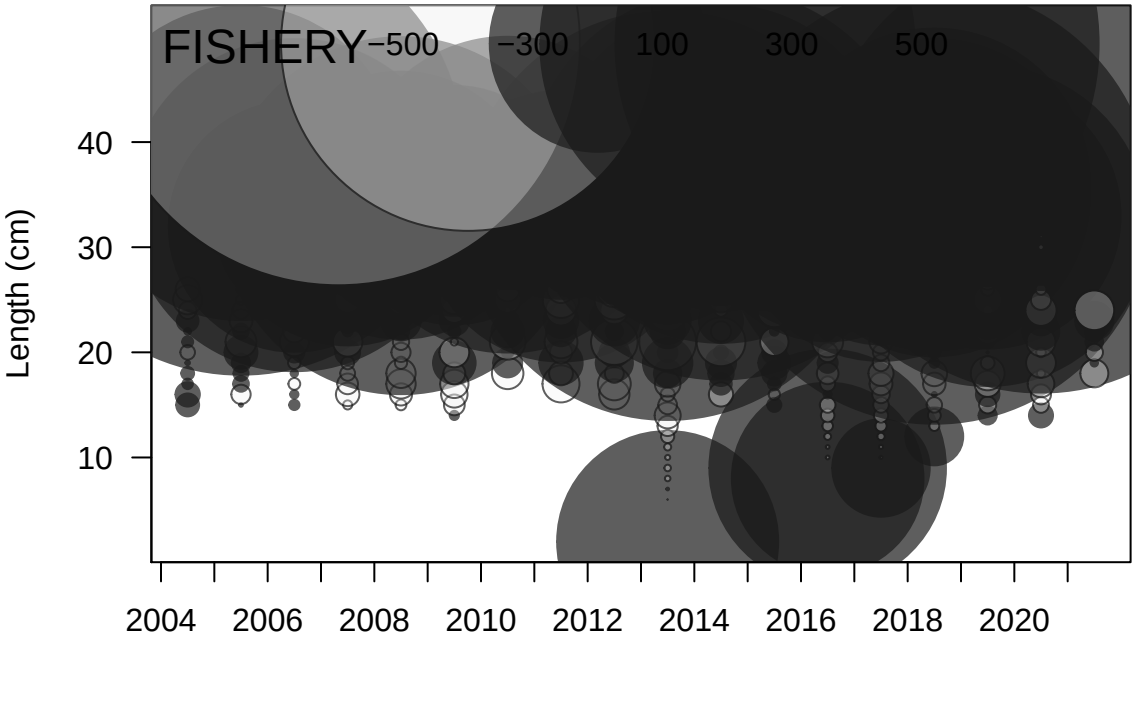

FISHERY
0.01
0.2
0.4
Length (cm)
40
30
20
10
2004
2006
2008
2010
2012
2014
2016
2018
2020
Year

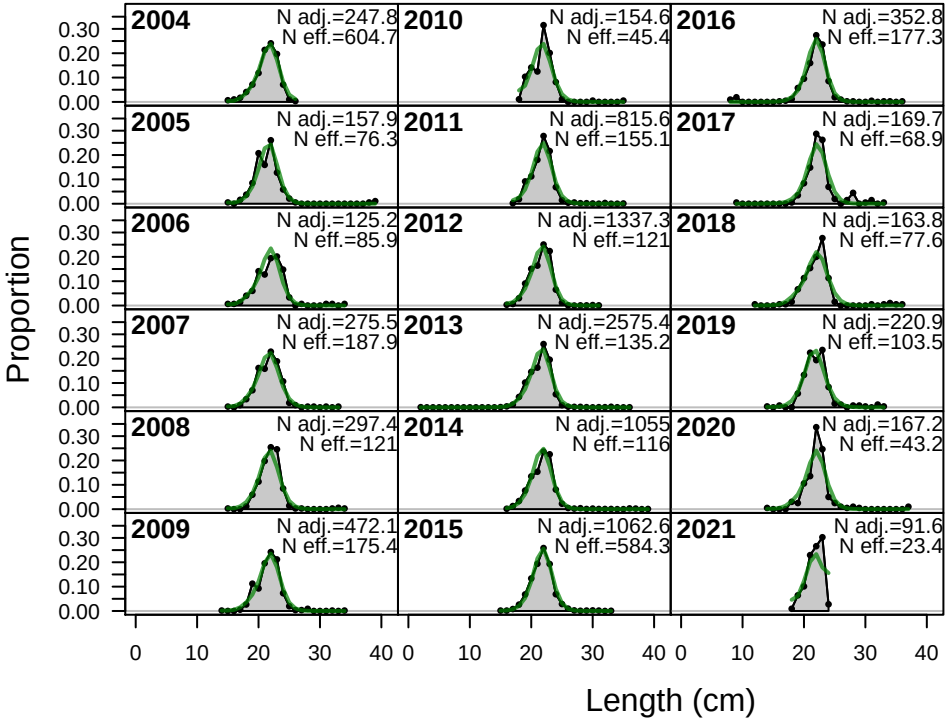

2004
N adj.=247.8
2010
N adj.=154.6
2016
N adj.=352.8
2005
N adj.=157.9
2011
N adj.=815.6
2017
N adj.=169.7
2006
N adj.=125.2
2012
N adj.=1337.3
2018
N adj.=163.8
2007
N adj.=275.5
2013
N adj.=2575.4
2019
N adj.=220.9
2008
N adj.=297.4
2014
N adj.=1055
2020
N adj.=167.2
2009
N adj.=472.1
2015
N adj.=1062.6
2021
N adj.=91.6
Proportion
0.00
0.10
0.20
0.30
0
10
20
30
40
Length (cm)

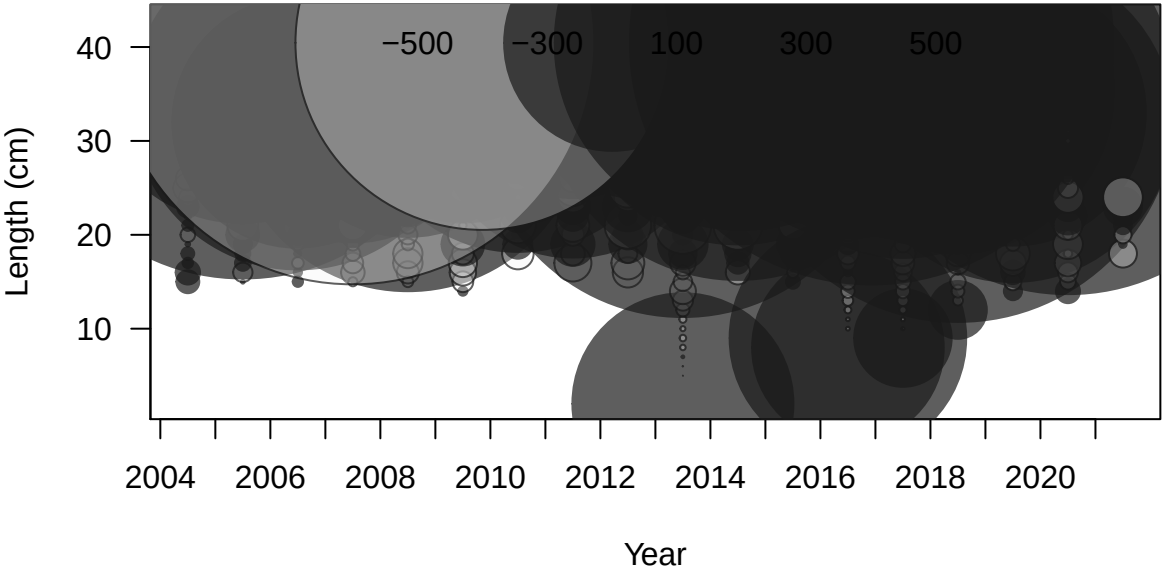

0.01
0.2
0.4
40
30
20
10
Length (cm)
2004
2006
2008
2010
2012
2014
2016
2018
2020
Year

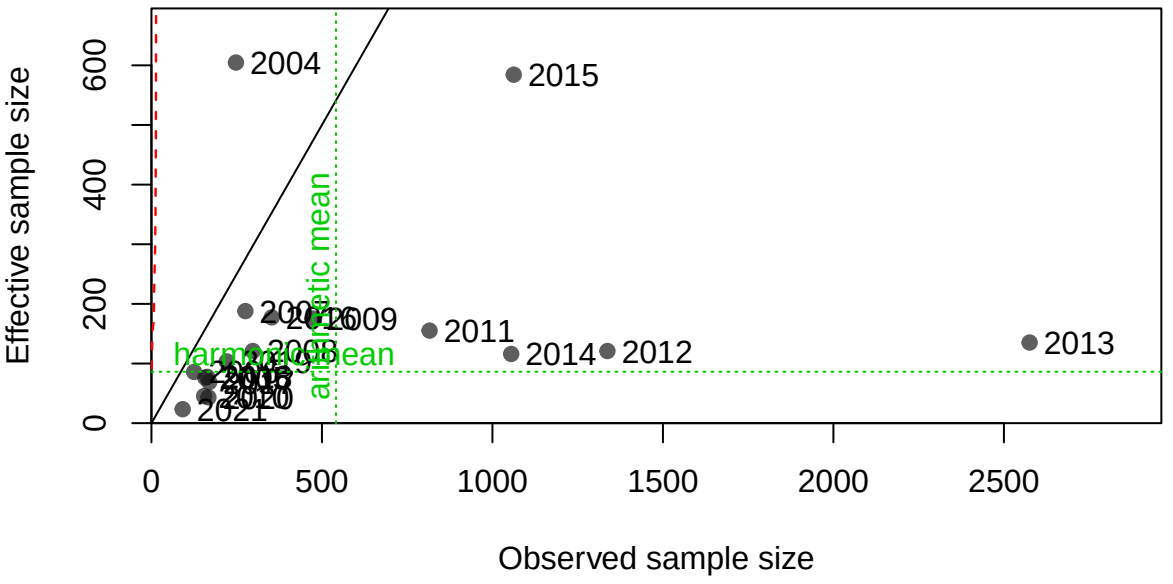

FISHERY (whole catch)
23.0
22.5
22.0
21.5
21.0
Mean length
2005
2010
2015
2020
Year

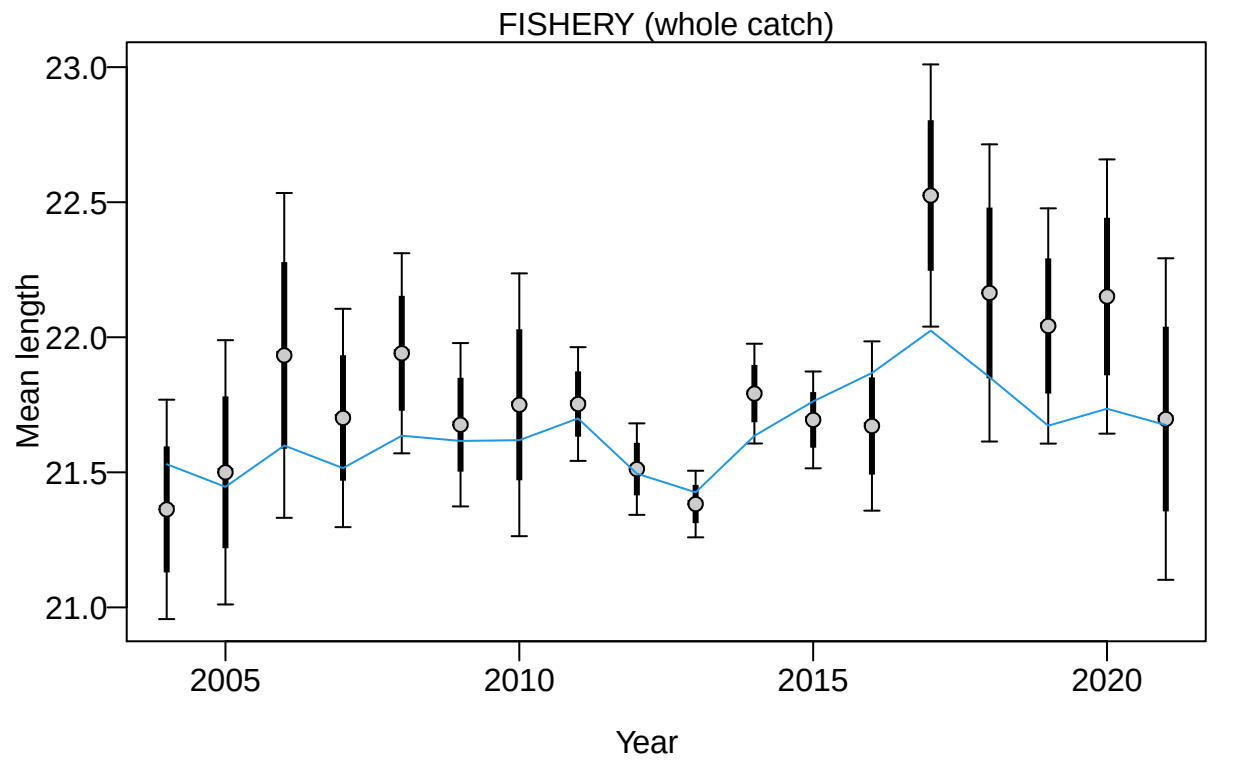

FISHERY
Sum of N adj.=9742.3
Sum of N eff.=2902.2
Proportion
0.30
0.25
0.20
0.15
0.10
0.05
0.00
0
10
20
30
40
Length (cm)

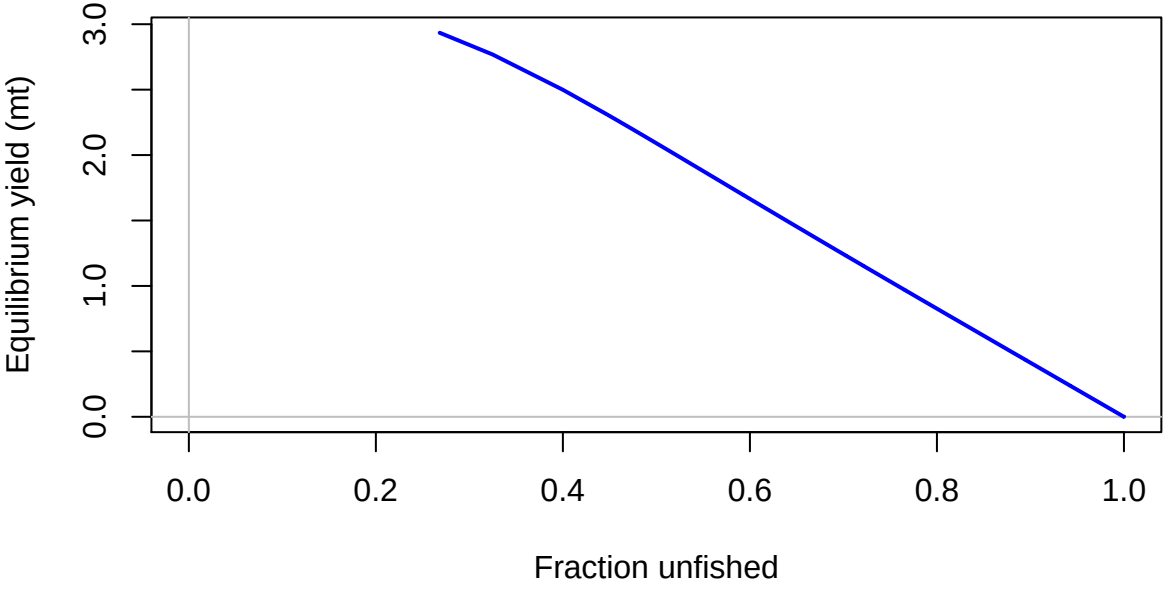

FISHERY
−500
−300
100
300
500
Length (cm)
40
30
20
10
2004
2006
2008
2010
2012
2014
2016
2018
2020
Year

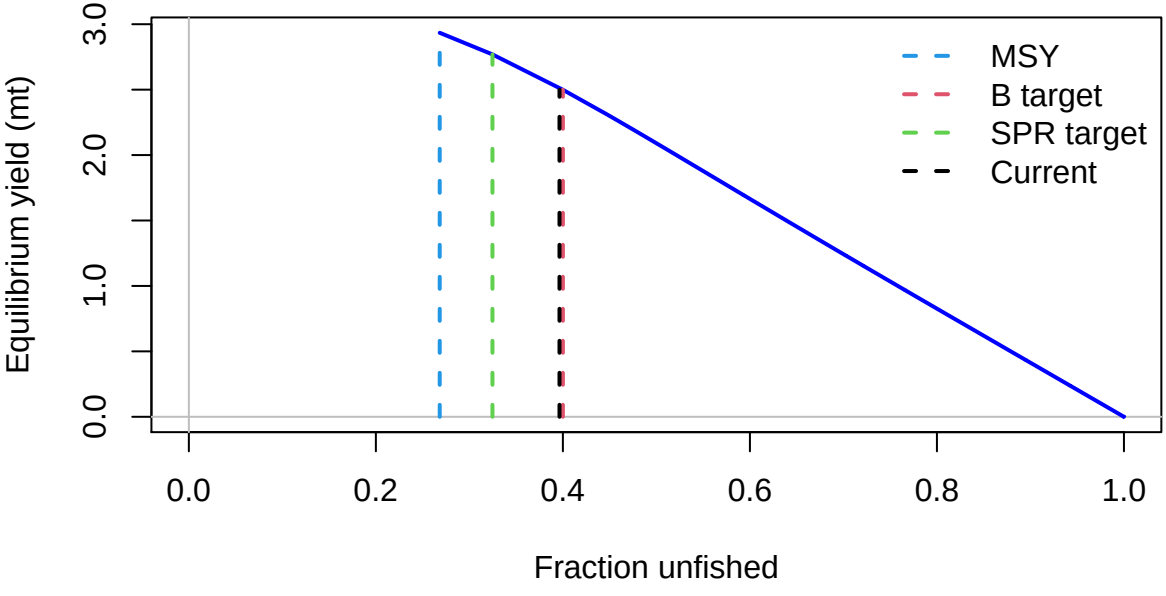

2004
N adj.=247.8
N eff.=604.7
2010
N adj.=154.6
N eff.=45.4
2016
N adj.=352.8
N eff.=177.3
2005
N adj.=157.9
N eff.=76.3
2011
N adj.=815.6
N eff.=155.1
2017
N adj.=169.7
N eff.=68.9
2006
N adj.=125.2
N eff.=85.9
2012
N adj.=1337.3
N eff.=121
2018
N adj.=163.8
N eff.=77.6
2007
N adj.=275.5
N eff.=187.9
2013
N adj.=2575.4
N eff.=135.2
2019
N adj.=220.9
N eff.=103.5
2008
N adj.=297.4
N eff.=121
2014
N adj.=1055
N eff.=116
2020
N adj.=167.2
N eff.=43.2
2009
N adj.=472.1
N eff.=175.4
2015
N adj.=1062.6
N eff.=584.3
2021
N adj.=91.6
N eff.=23.4
Proportion
0.00
0.10
0.20
0.30
0
10
20
30
40
Length (cm)

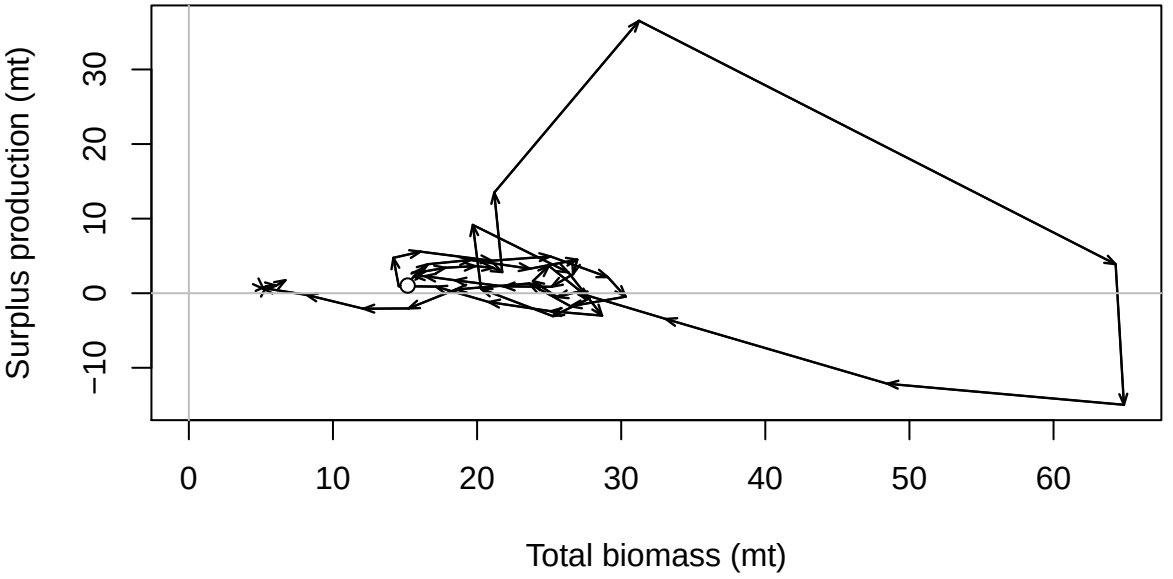

−500
−300
100
300
500
40
30
20
10
Length (cm)
2004
2006
2008
2010
2012
2014
2016
2018
2020
Year

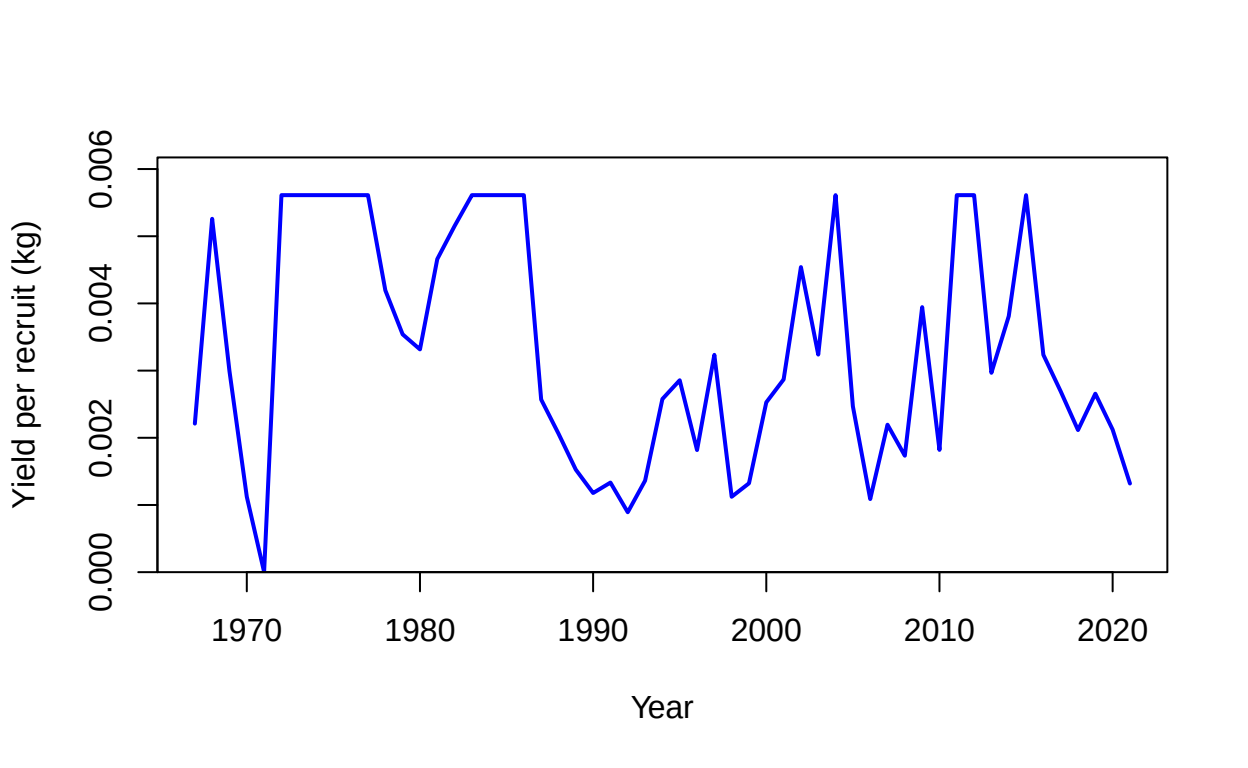

Effective sample size
Observed sample size
0
200
400
600
0
500
1000
1500
2000
2500
2004
2015
2009
2011
2014
2012
2013
2021
harmonic mean
arithmetic mean

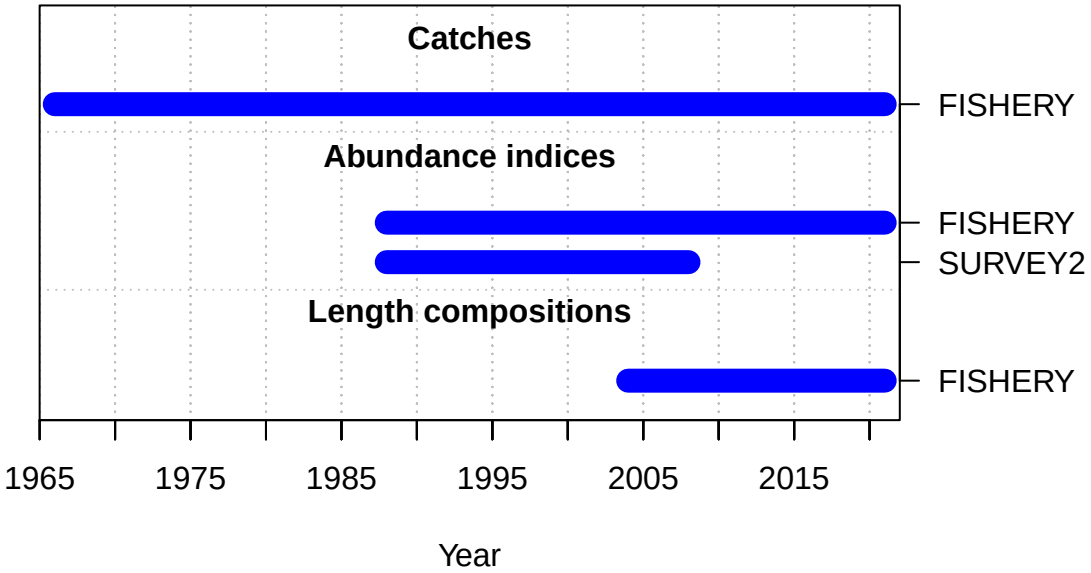

FISHERY (whole catch)
23.0
22.5
22.0
21.5
21.0
Mean length
2005
2010
2015
2020
Year

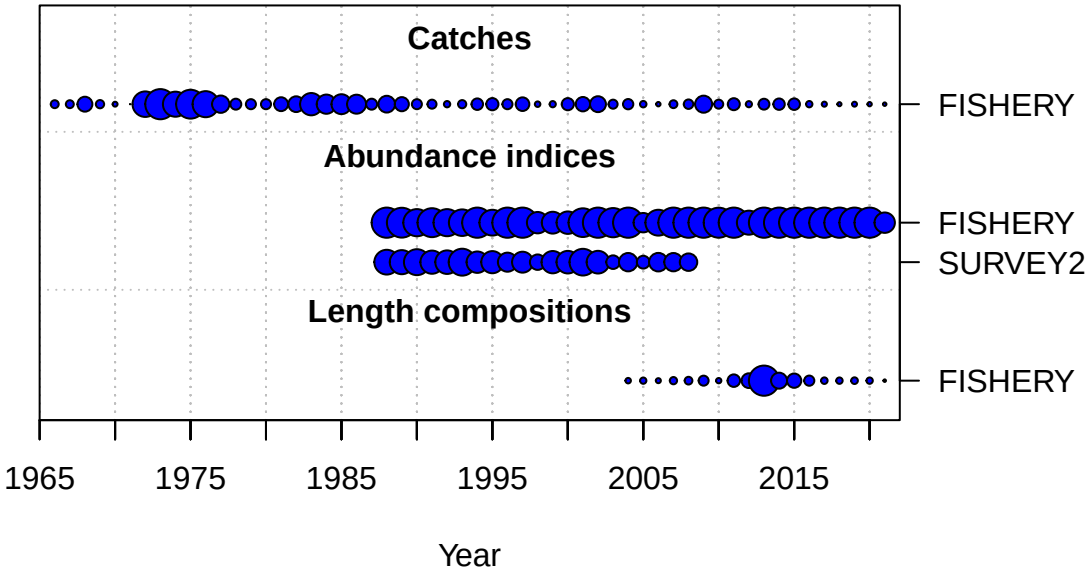

Equilibrium yield (mt)
0.0
1.0
2.0
3.0
0.0
0.2
0.4
0.6
0.8
1.0
Fraction unfished

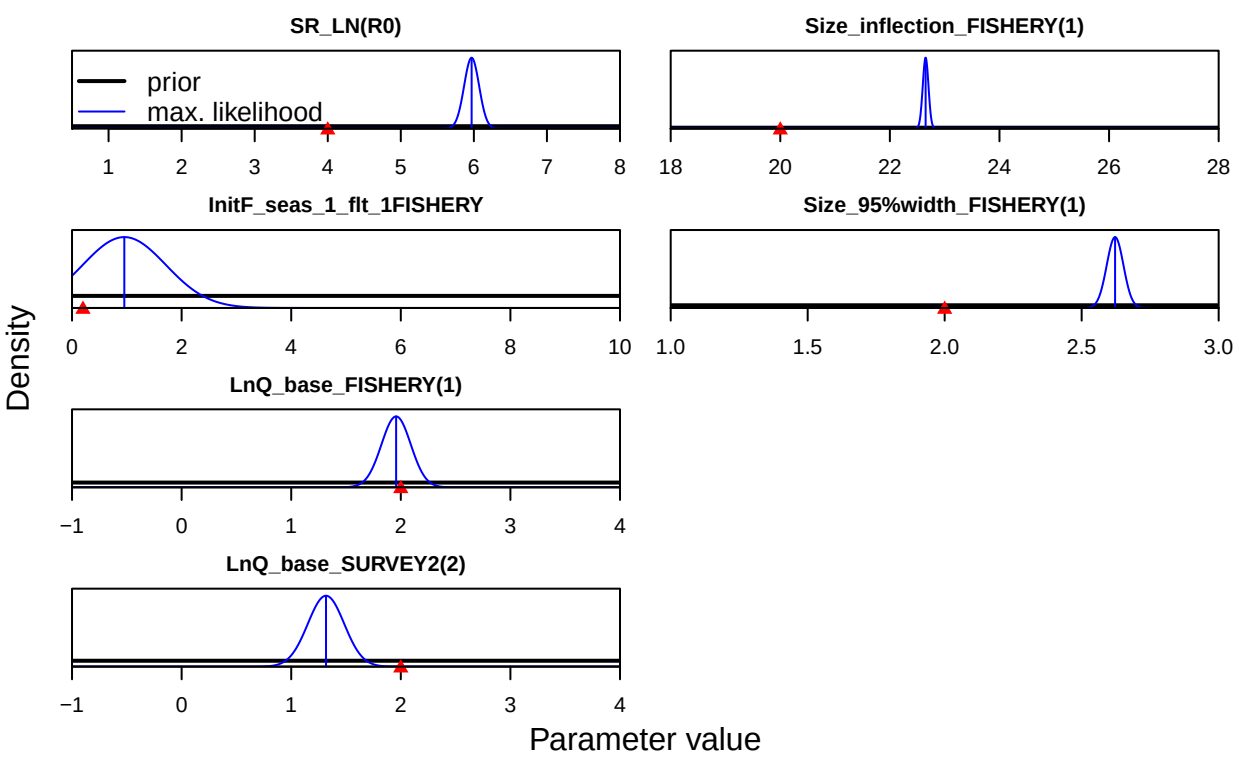

Equilibrium yield (mt)
3.0
2.0
1.0
0.0
0.0
0.2
0.4
0.6
0.8
1.0
Fraction unfished
MSY
B target
SPR target
Current


Surplus production (mt)
30
20
10
0
−10
0
10
20
30
40
50
60
Total biomass (mt)


Yield per recruit (kg)
0.000
0.002
0.004
0.006
1970
1980
1990
2000
2010
2020
Year


Catches
FISHERY
Abundance indices
FISHERY
SURVEY2
Length compositions
FISHERY
1965
1975
1985
1995
2005
2015
Year


Catches
FISHERY
Abundance indices
FISHERY
SURVEY2
Length compositions
FISHERY
1965
1975
1985
1995
2005
2015
Year


SR_LN(R0)
prior
max. likelihood
1
2
3
4
5
6
7
8
Size_inflection_FISHERY(1)
18
20
22
24
26
28
InitF_seas_1_flt_1FISHERY
0
2
4
6
8
10
Size_95%width_FISHERY(1)
1.0
1.5
2.0
2.5
3.0
LnQ_base_FISHERY(1)
−1
0
1
2
3
4
LnQ_base_SURVEY2(2)
−1
0
1
2
3
4
Density
Parameter value