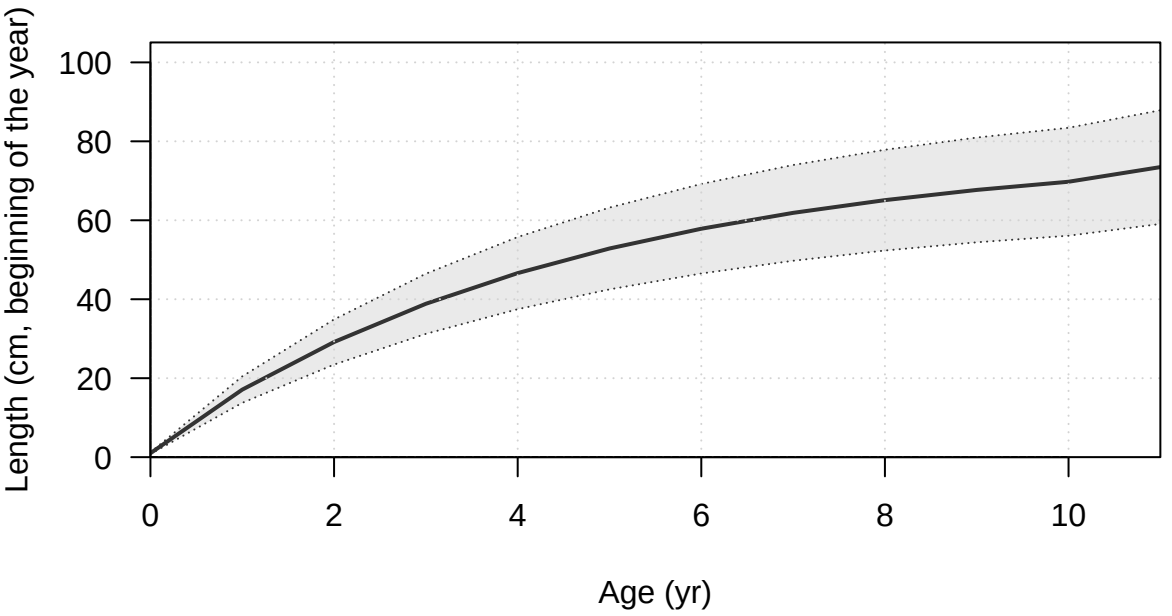
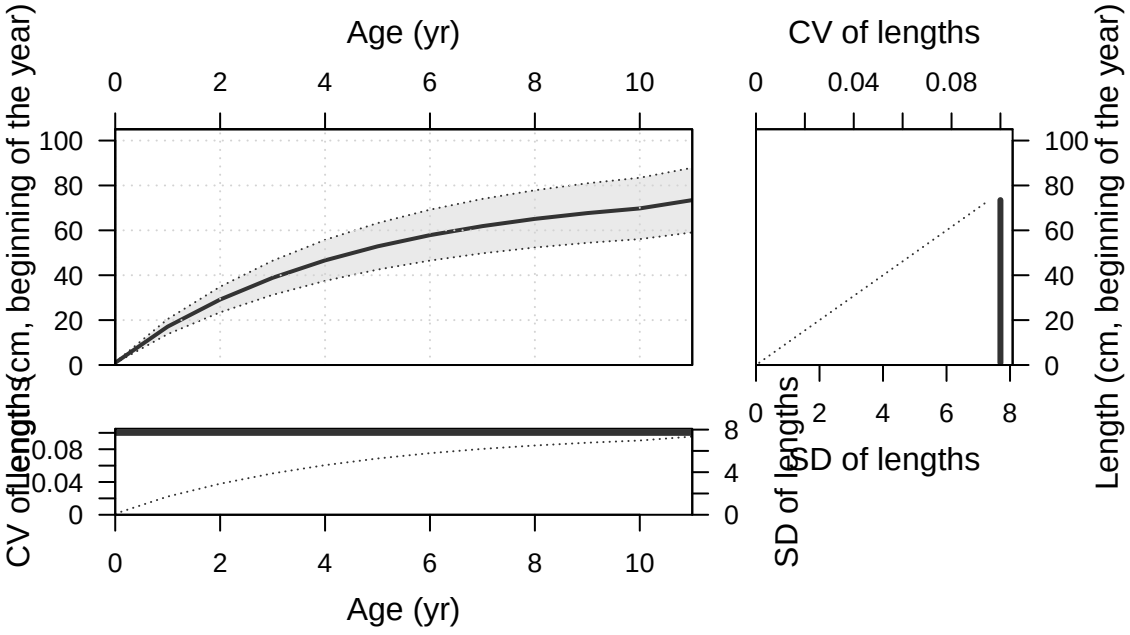
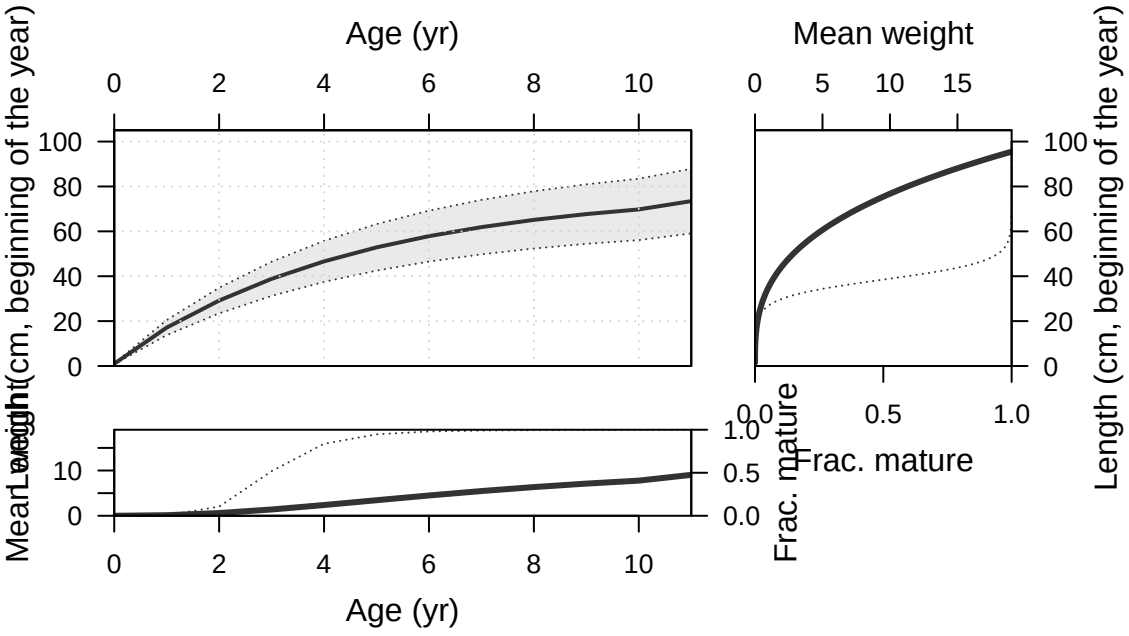
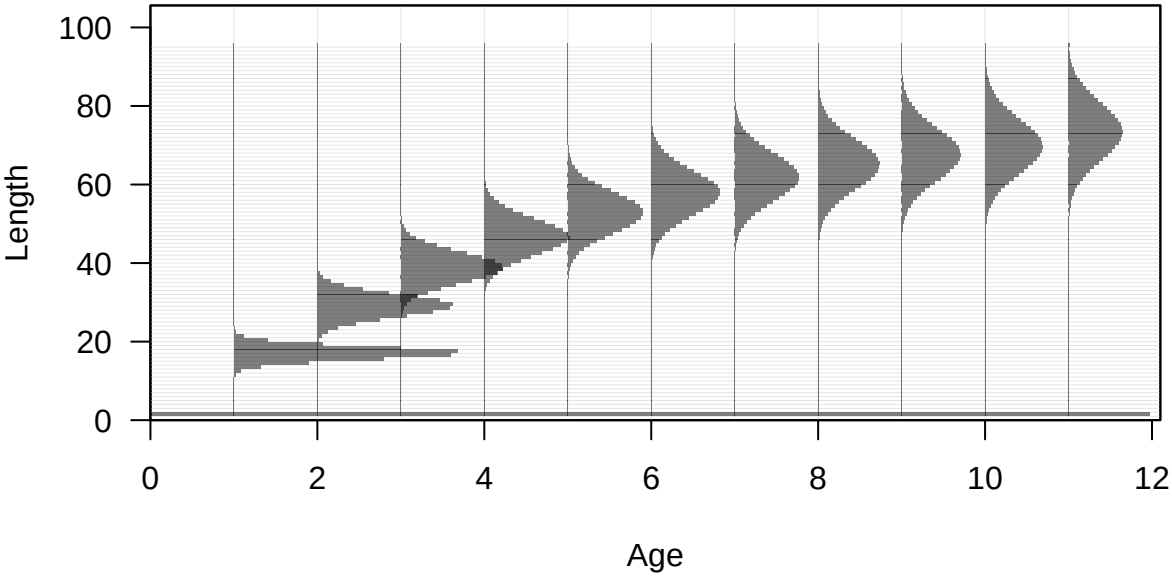
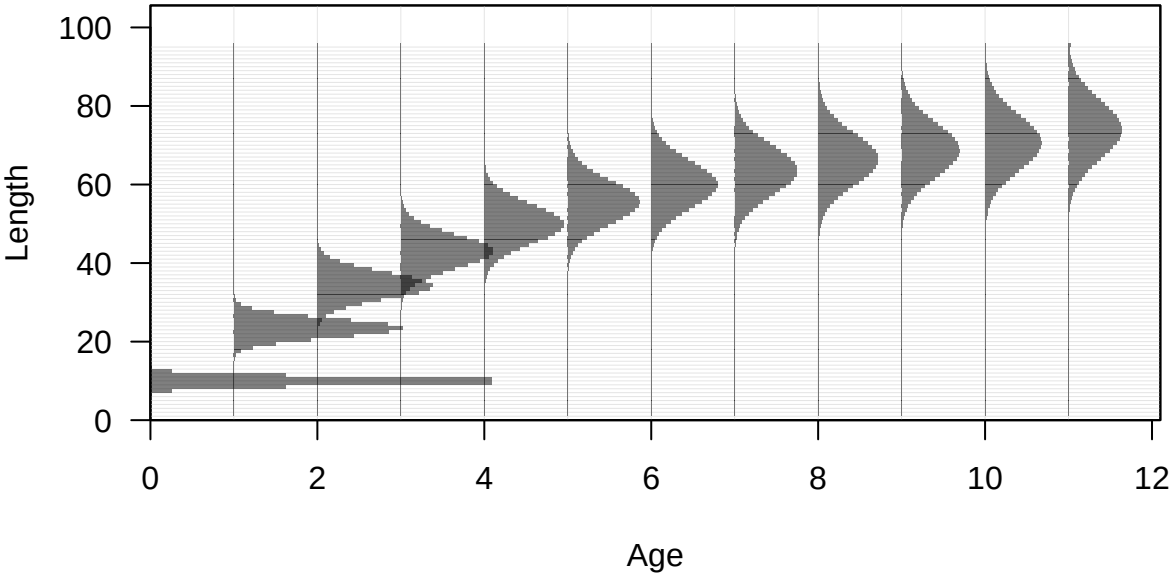
Plots created using the 'r4ss' package in R
Stock Synthesis version: 3.30.19.0
StartTime: Wed Jun 29 11:51:04 2022
Data_File: data.ss
Control_File: control.ss

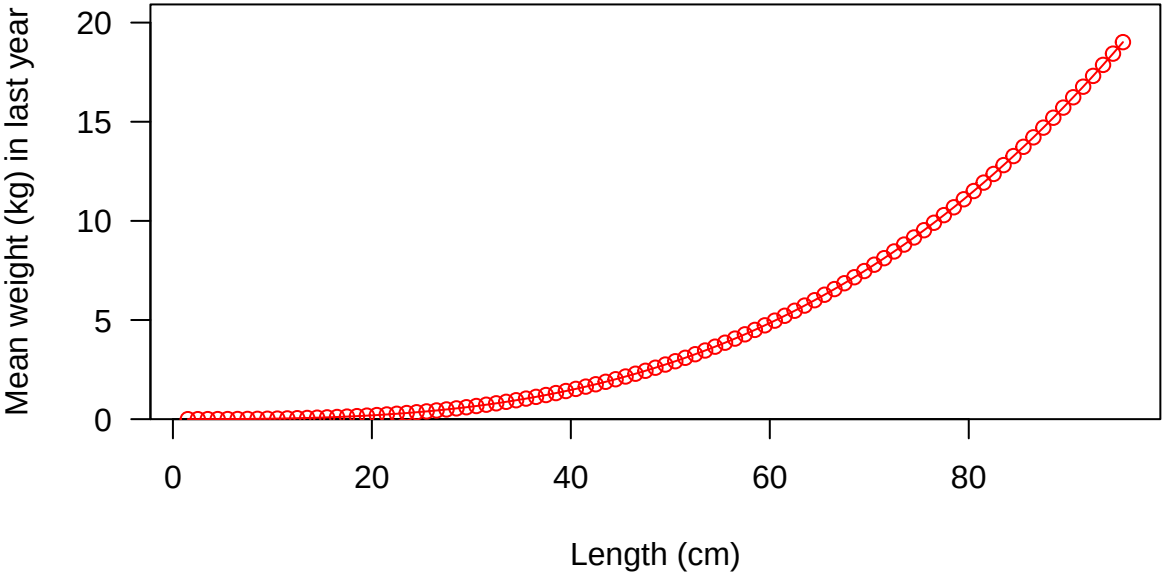

Length (cm, beginning of the year)
100
80
60
40
20
0
0
2
4
6
8
10
Age (yr)

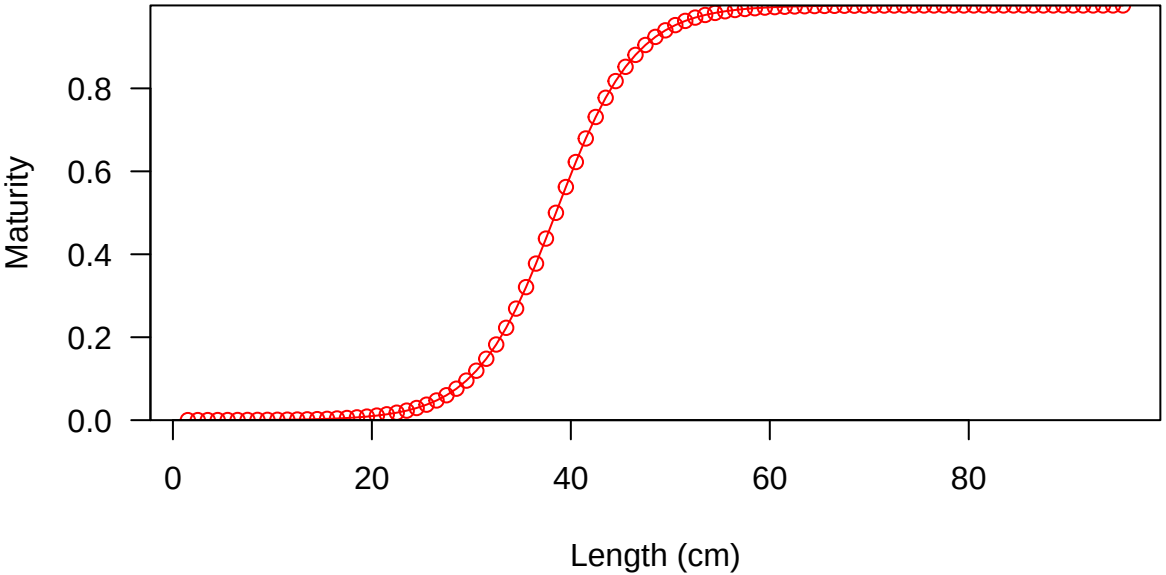

Age (yr)
0
2
4
6
8
10
Length (cm, beginning of the year)
100
80
60
40
20
0
CV of lengths
0.08
0.04
0
SD of lengths
8
4
0
Age (yr)
CV of lengths
0
0.04
0.08
SD of lengths
0
2
4
6
8
Length (cm, beginning of the year)

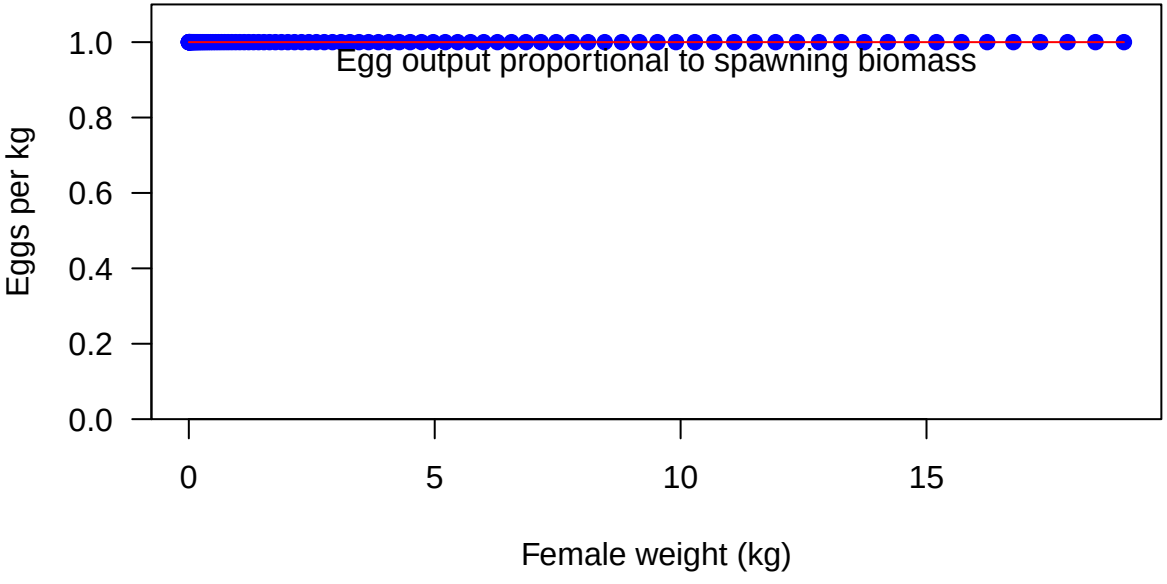

Age (yr)
Mean weight
Length (cm, beginning of the year)
Mean weight
Frac. mature
Age (yr)
Frac. mature
Length (cm, beginning of the year)

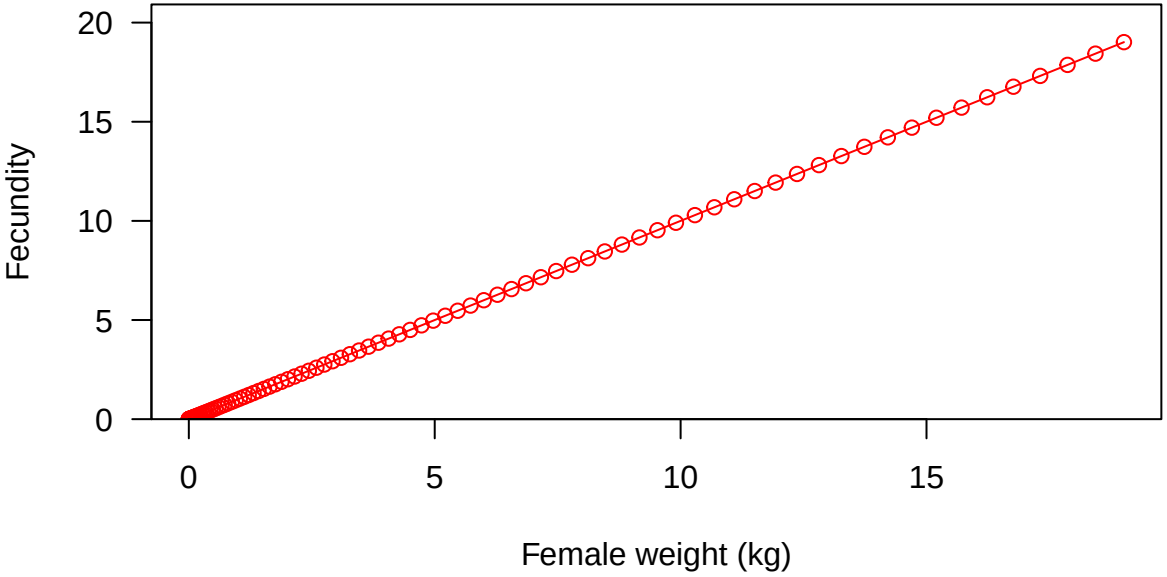

Length
100
80
60
40
20
0
0
2
4
6
8
10
12
Age

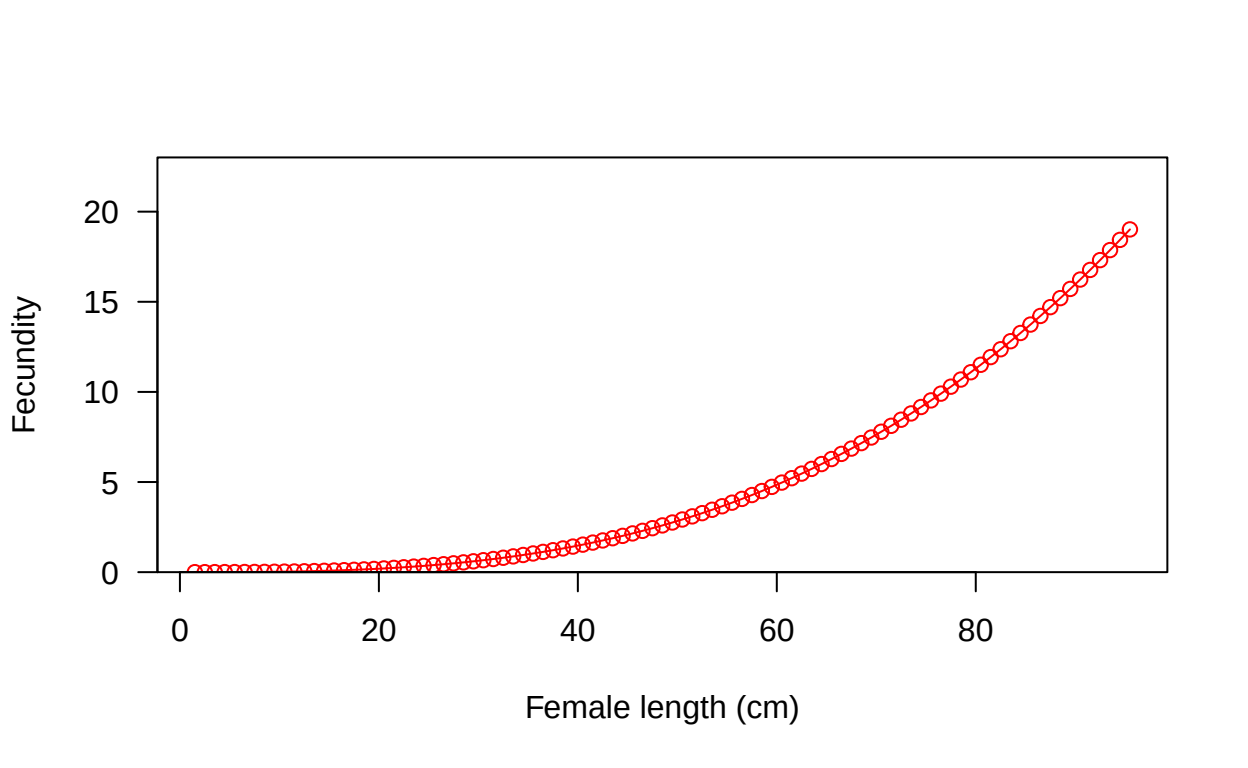

Length
100
80
60
40
20
0
0
2
4
6
8
10
12
Age

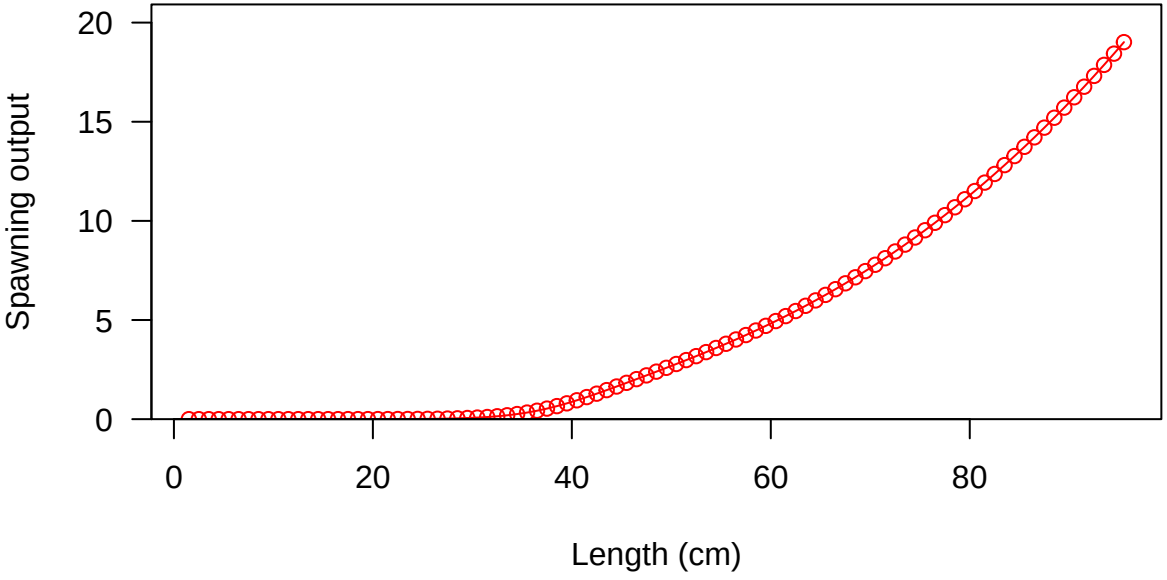

Mean weight (kg) in last year
20
15
10
5
0
0
20
40
60
80
Length (cm)

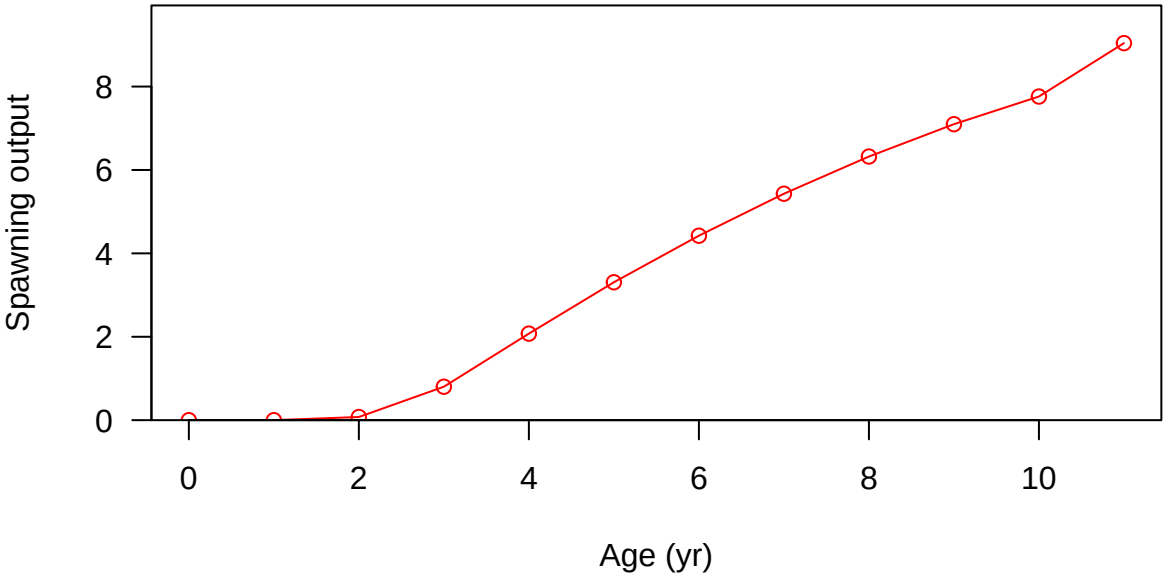

Maturity
0.0
0.2
0.4
0.6
0.8
0
20
40
60
80
Length (cm)

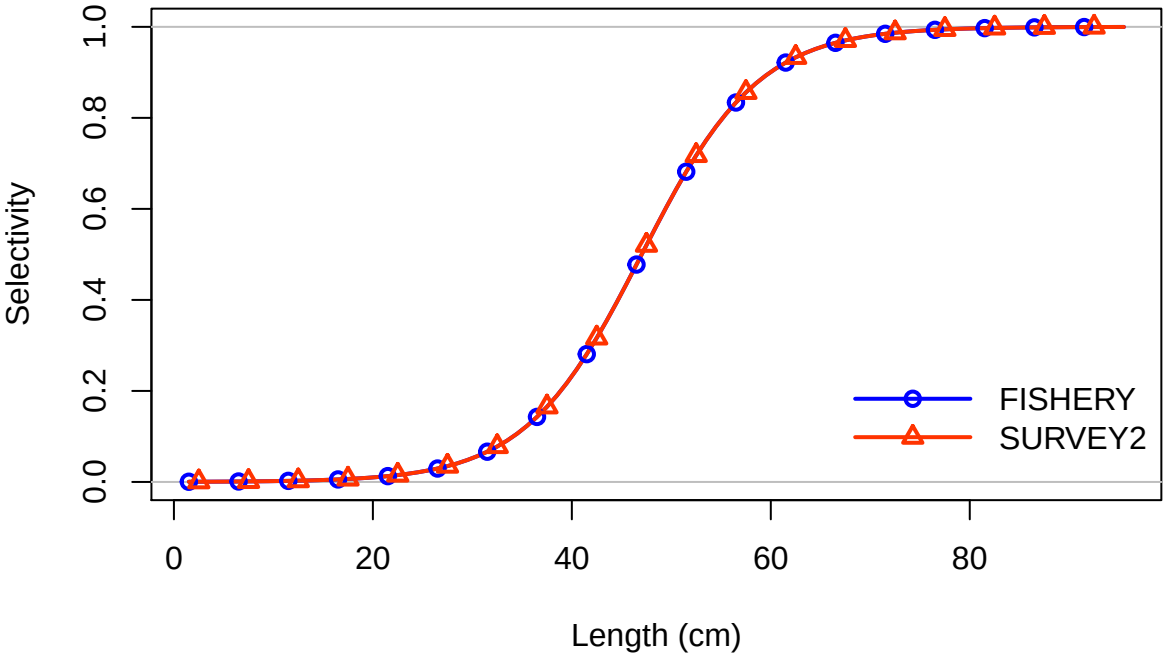

Egg output proportional to spawning biomass
Eggs per kg
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
Female weight (kg)

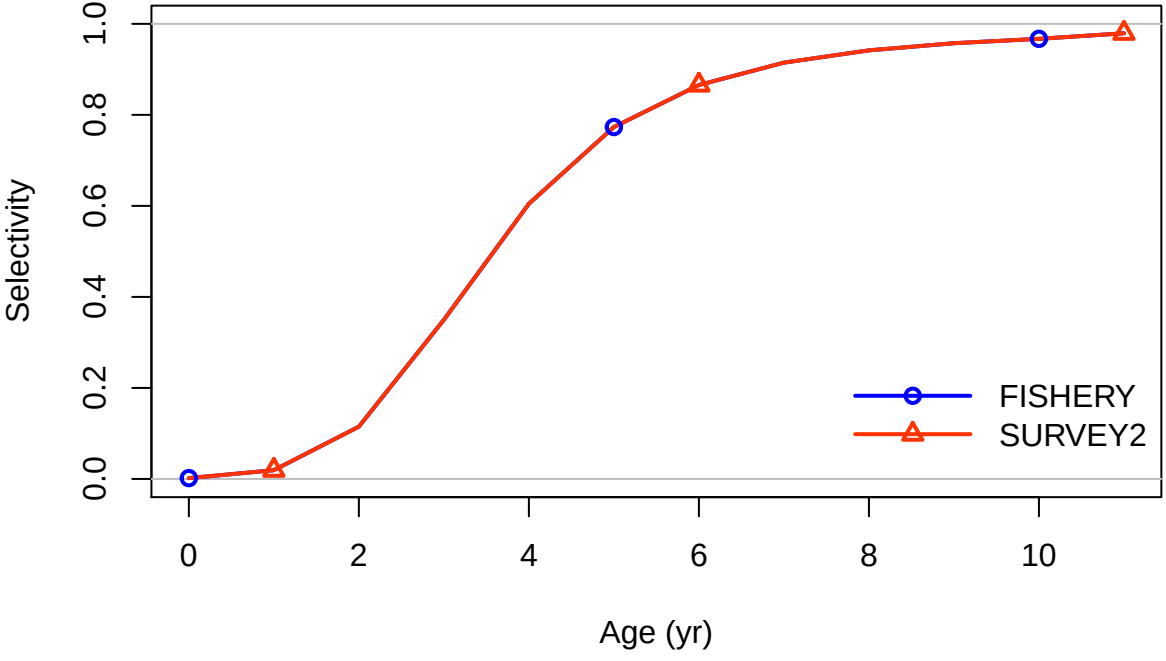

Fecundity
20
15
10
5
0
0
5
10
15
Female weight (kg)

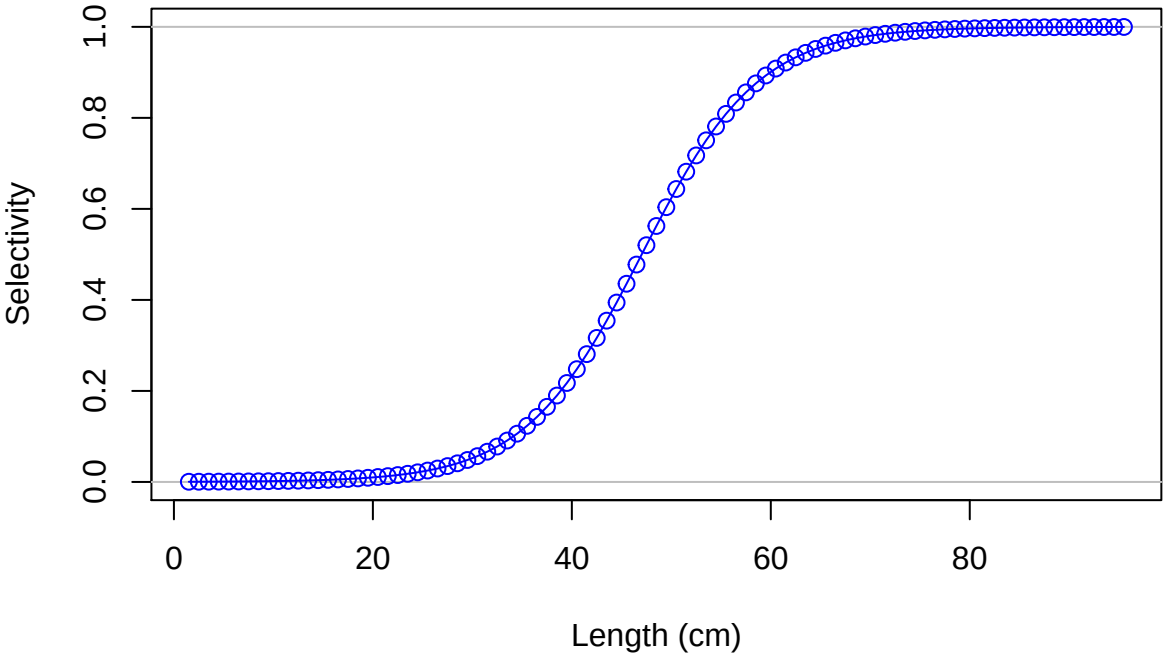

Fecundity
0
5
10
15
20
0
20
40
60
80
Female length (cm)

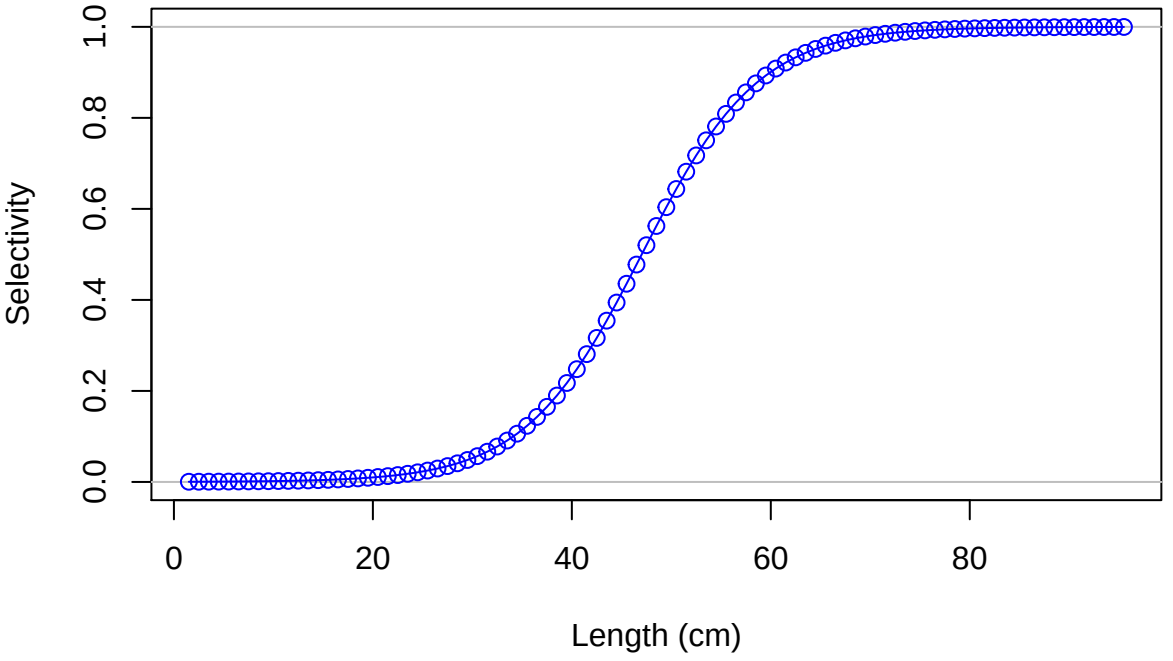

Spawning output
20
15
10
5
0
0
20
40
60
80
Length (cm)

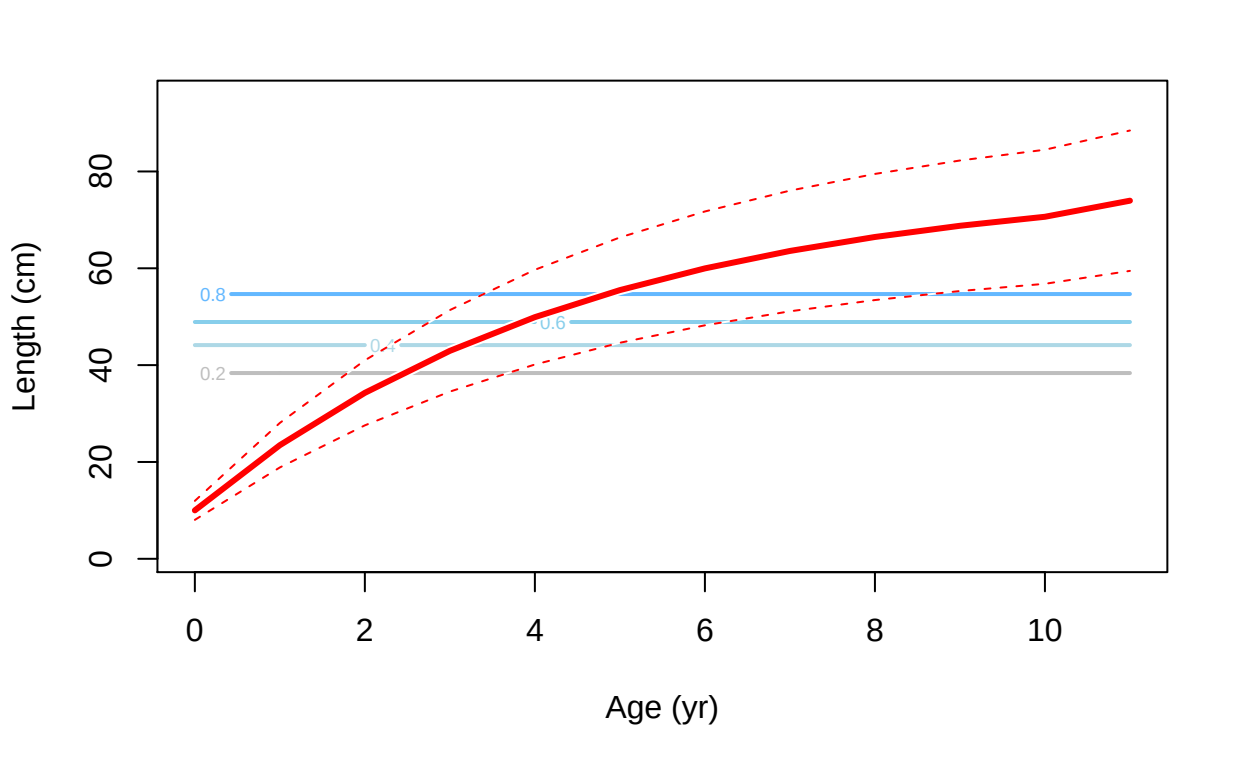

Spawning output
0
2
4
6
8
0
2
4
6
8
10
Age (yr)

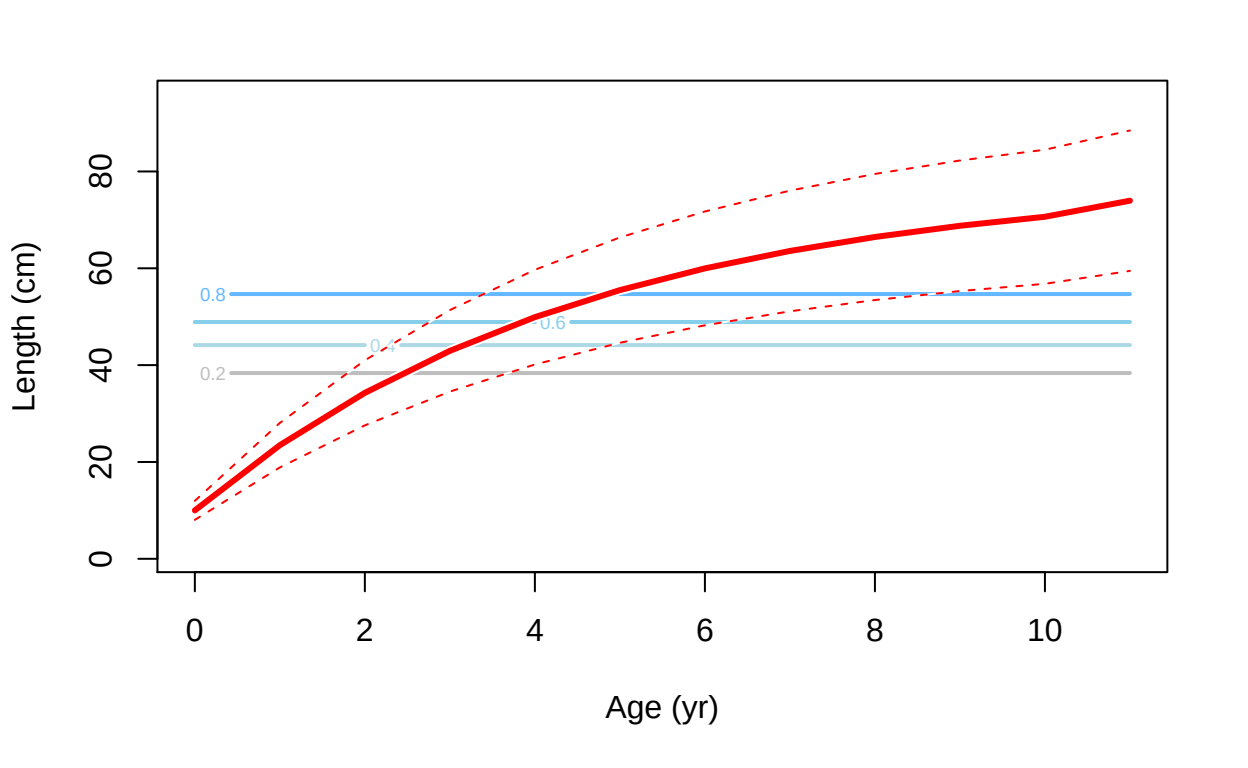

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
20
40
60
80
Length (cm)
FISHERY
SURVEY2

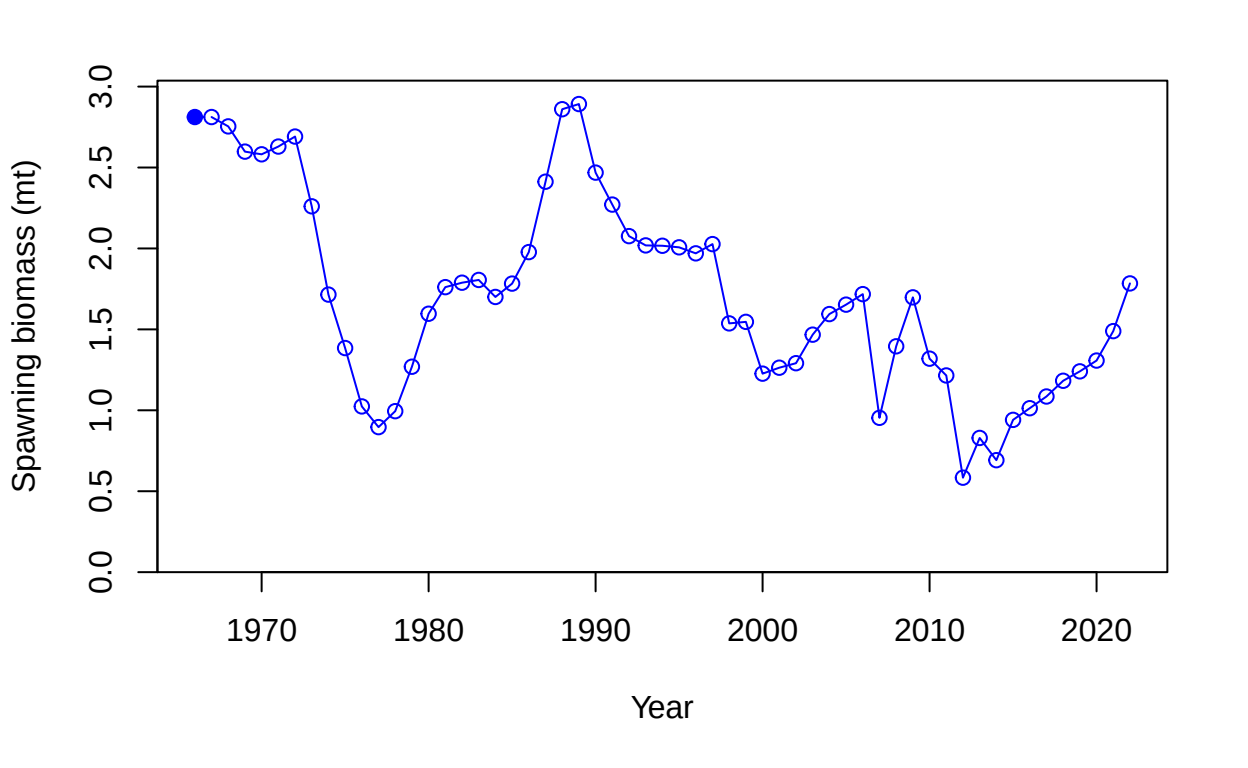

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
2
4
6
8
10
Age (yr)
FISHERY
SURVEY2

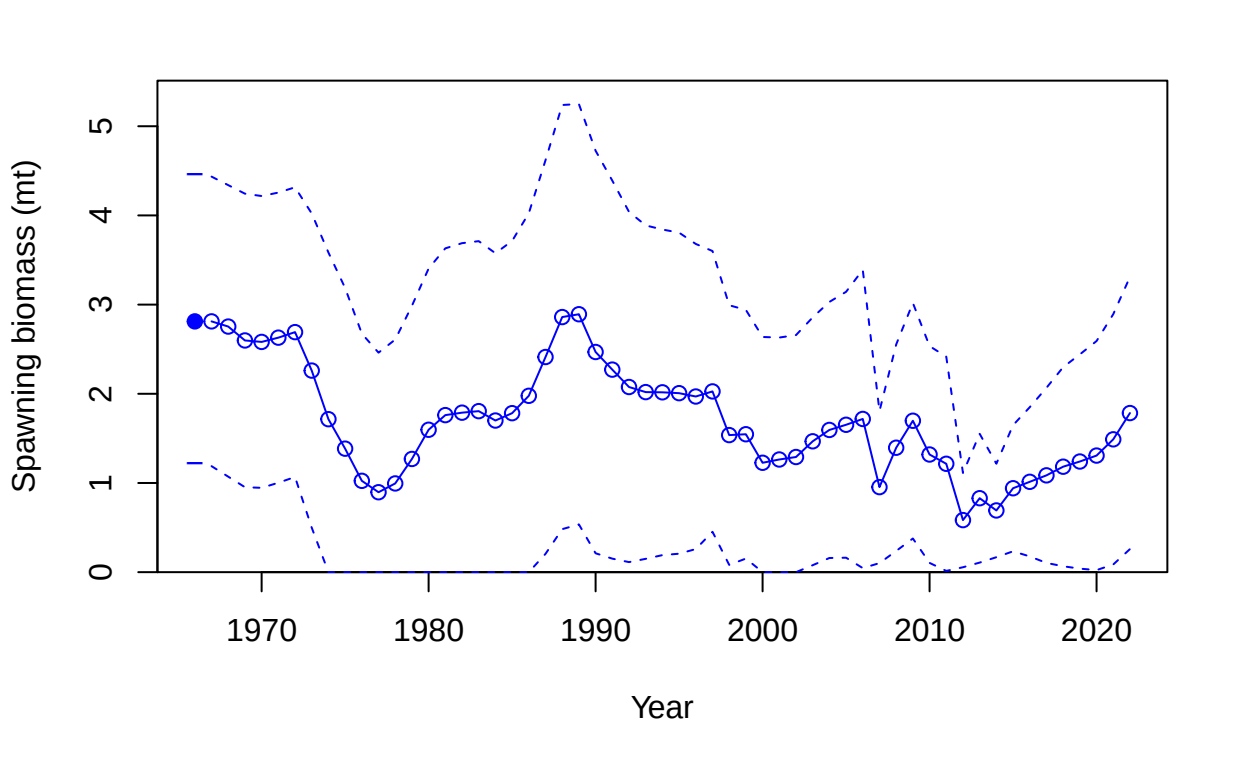

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
20
40
60
80
Length (cm)

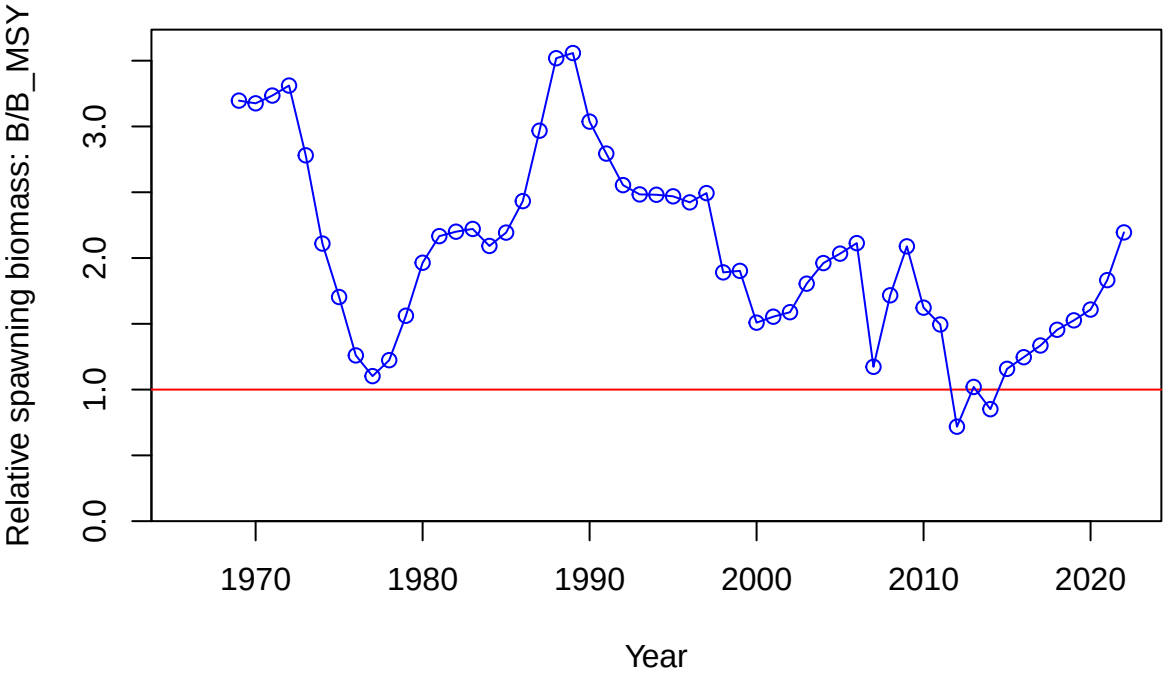

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
20
40
60
80
Length (cm)

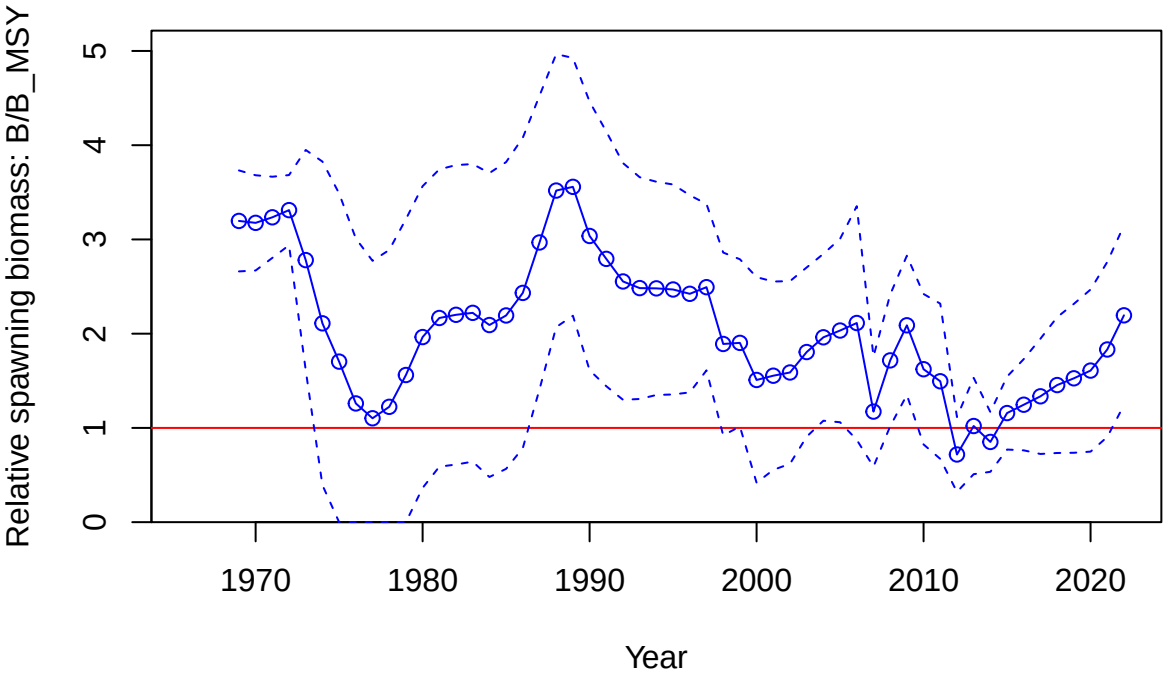

Length (cm)
0
20
40
60
80
0.8
0.6
0.4
0.2
0
2
4
6
8
10
Age (yr)

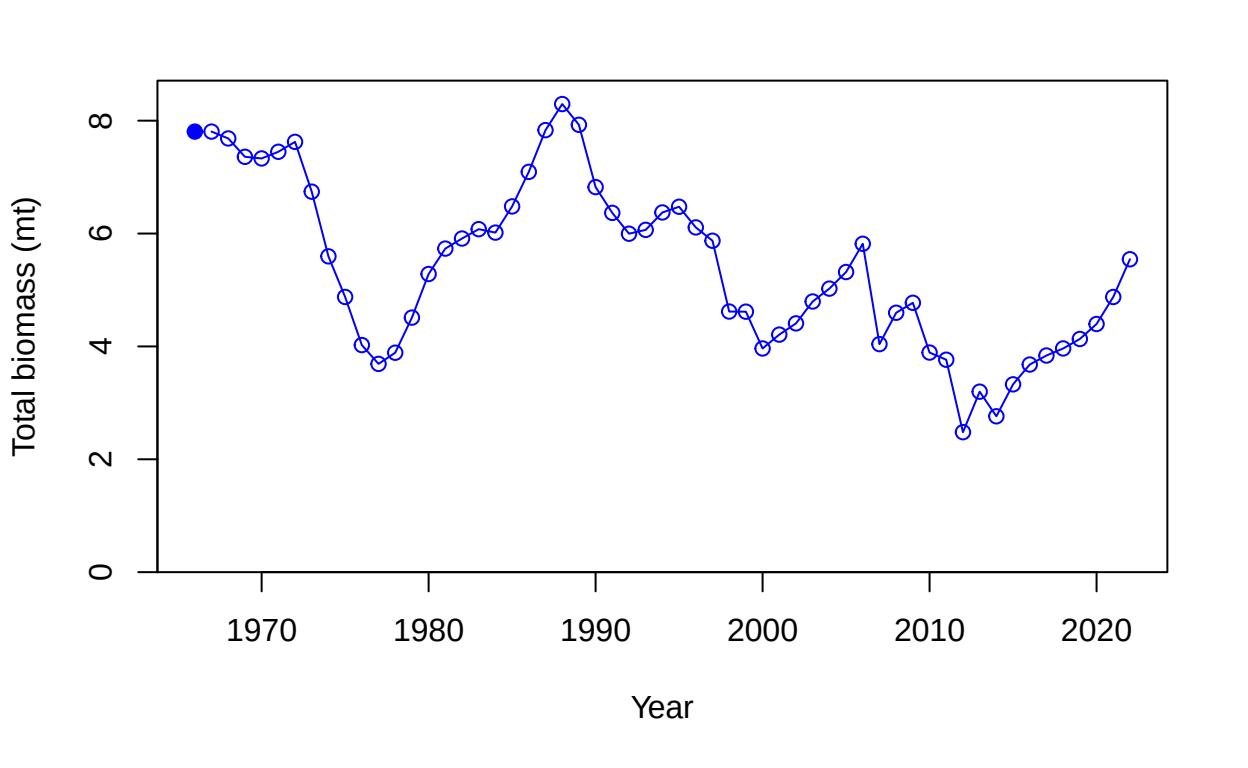

Length (cm)
0
20
40
60
80
0.8
0.6
0.4
0.2
0
2
4
6
8
10
Age (yr)

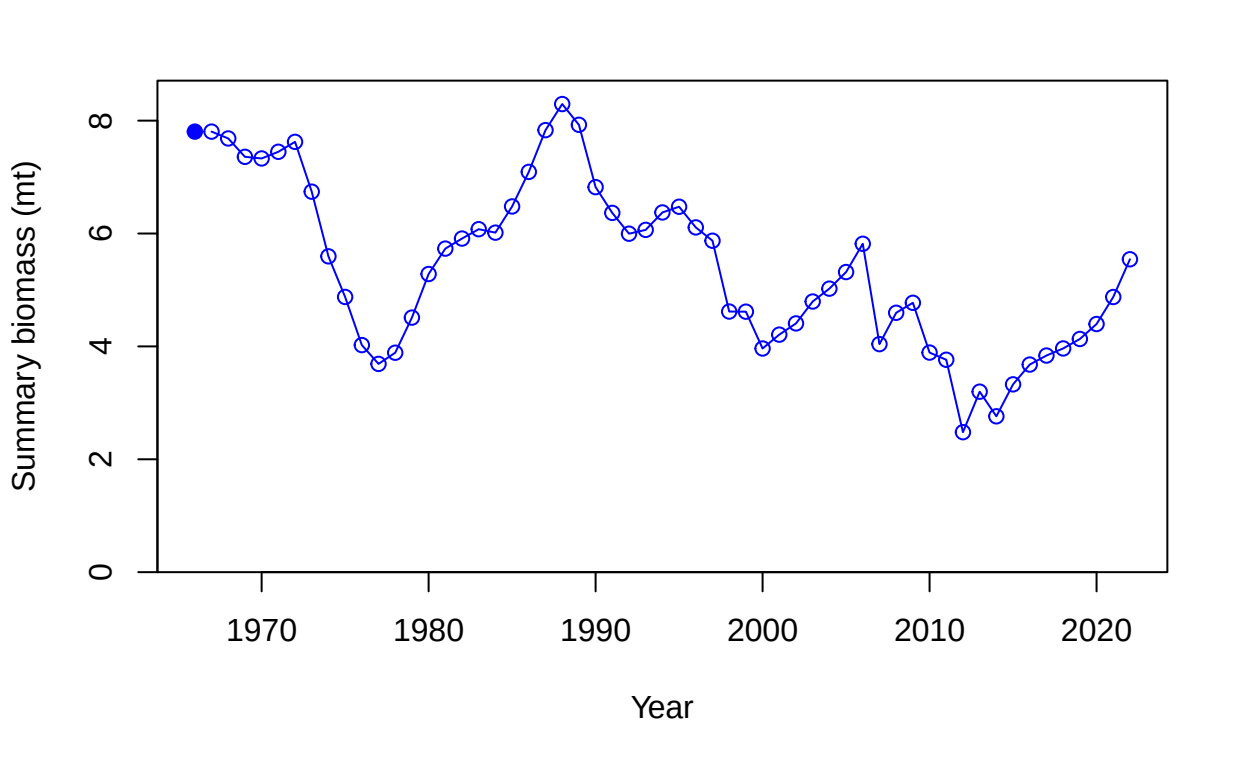

Spawning biomass (mt)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
1970
1980
1990
2000
2010
2020
Year

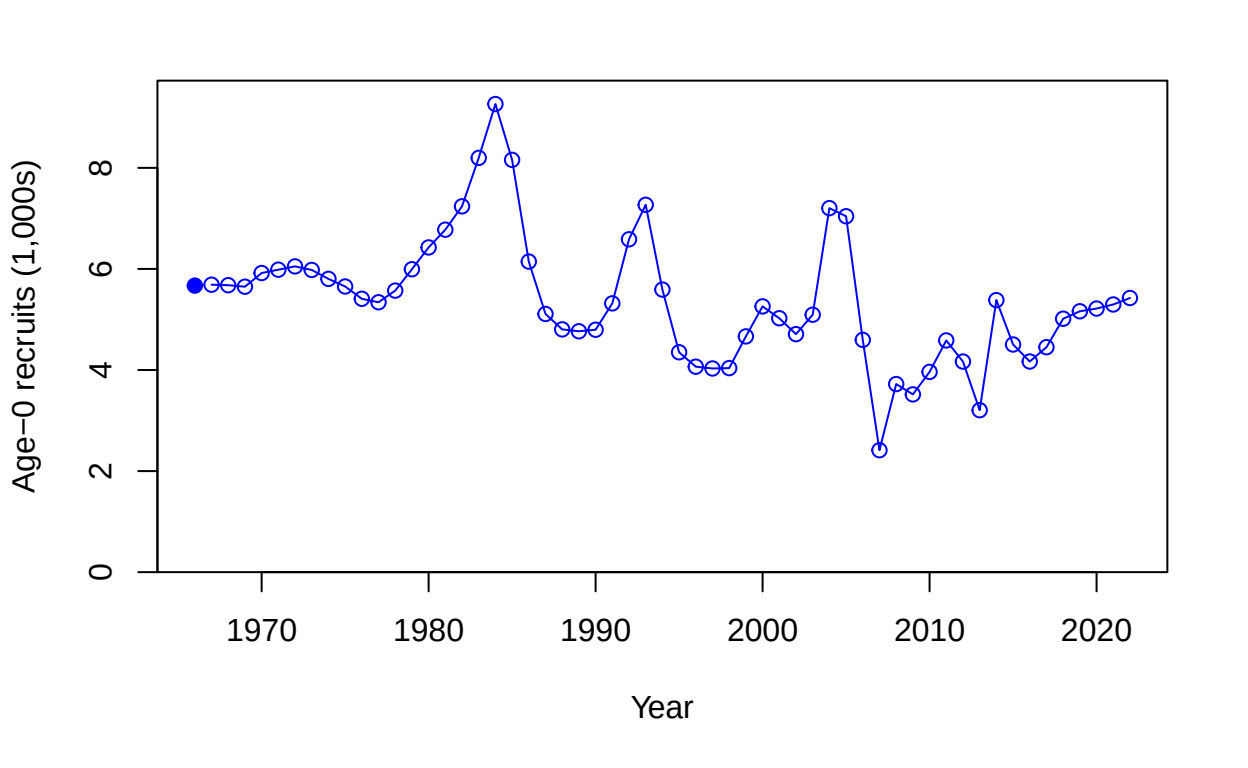

Spawning biomass (mt)
0
1
2
3
4
5
1970
1980
1990
2000
2010
2020
Year

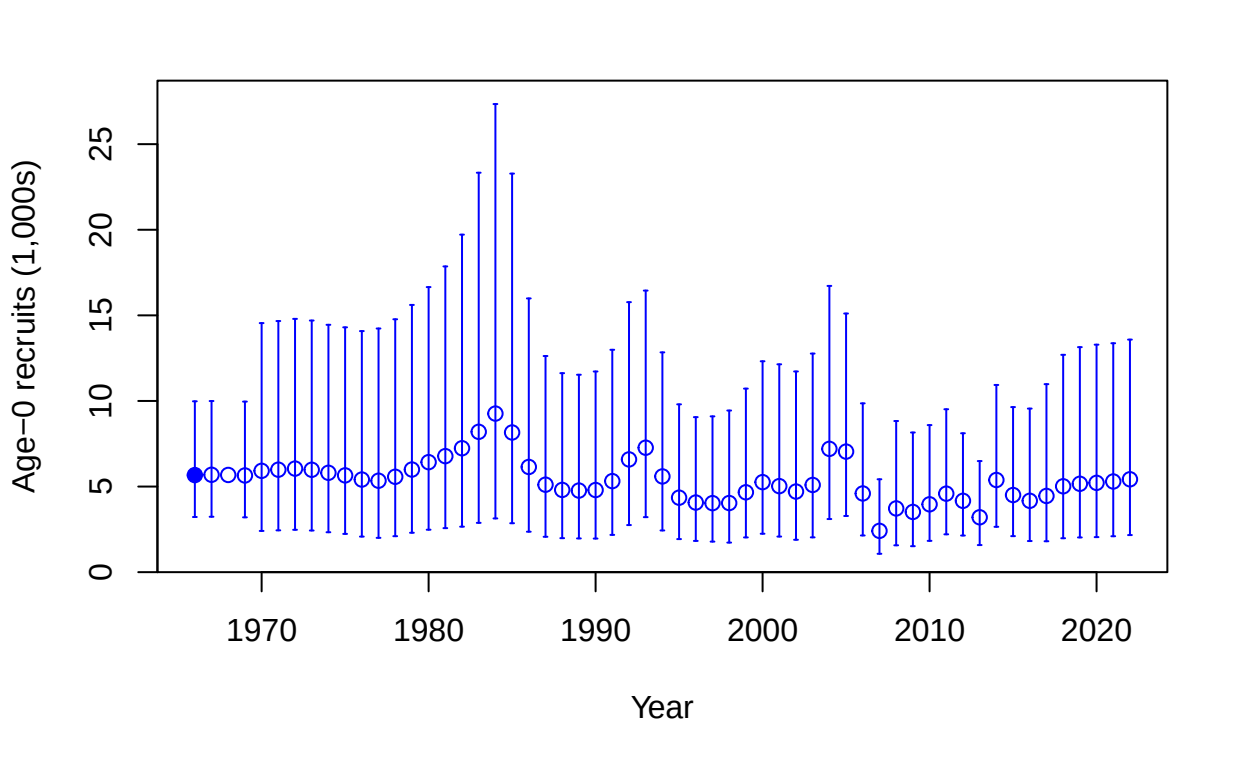

Relative spawning biomass: B/B_MSY
0.0
1.0
2.0
3.0
1970
1980
1990
2000
2010
2020
Year

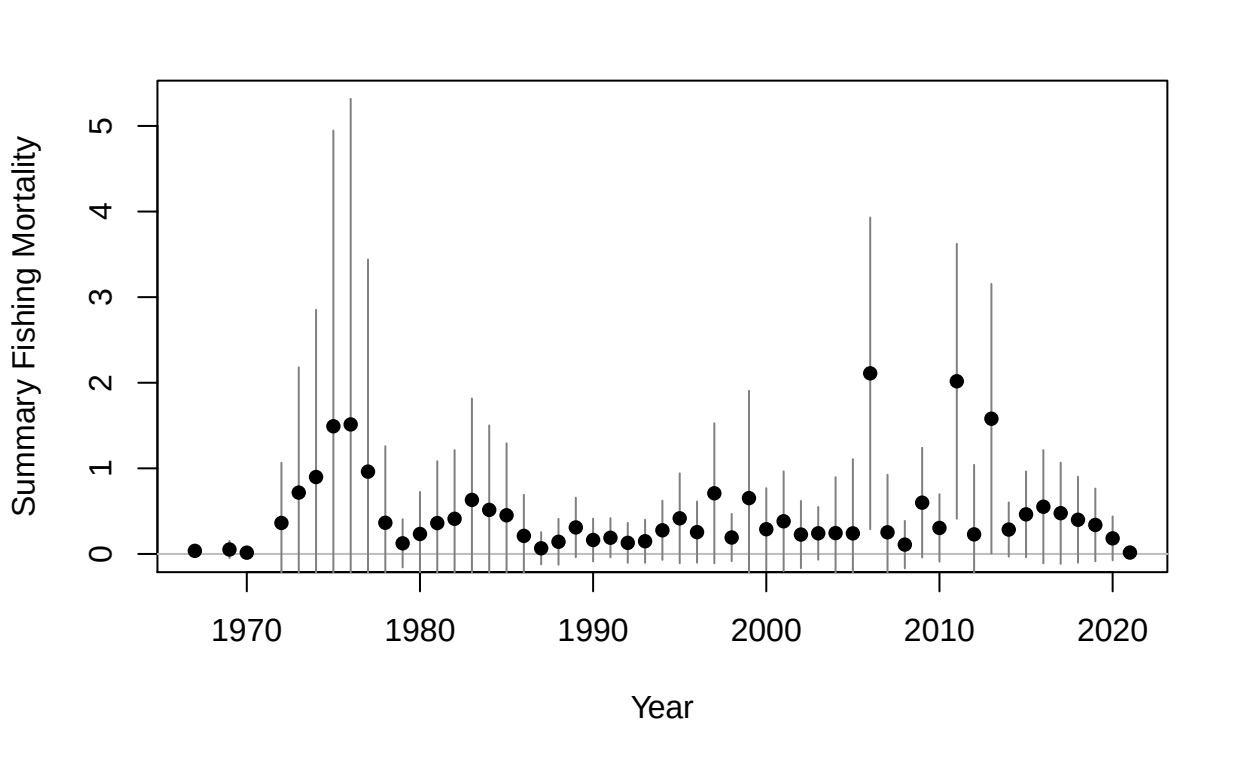

Relative spawning biomass: B/B_MSY
0
1
2
3
4
5
1970
1980
1990
2000
2010
2020
Year

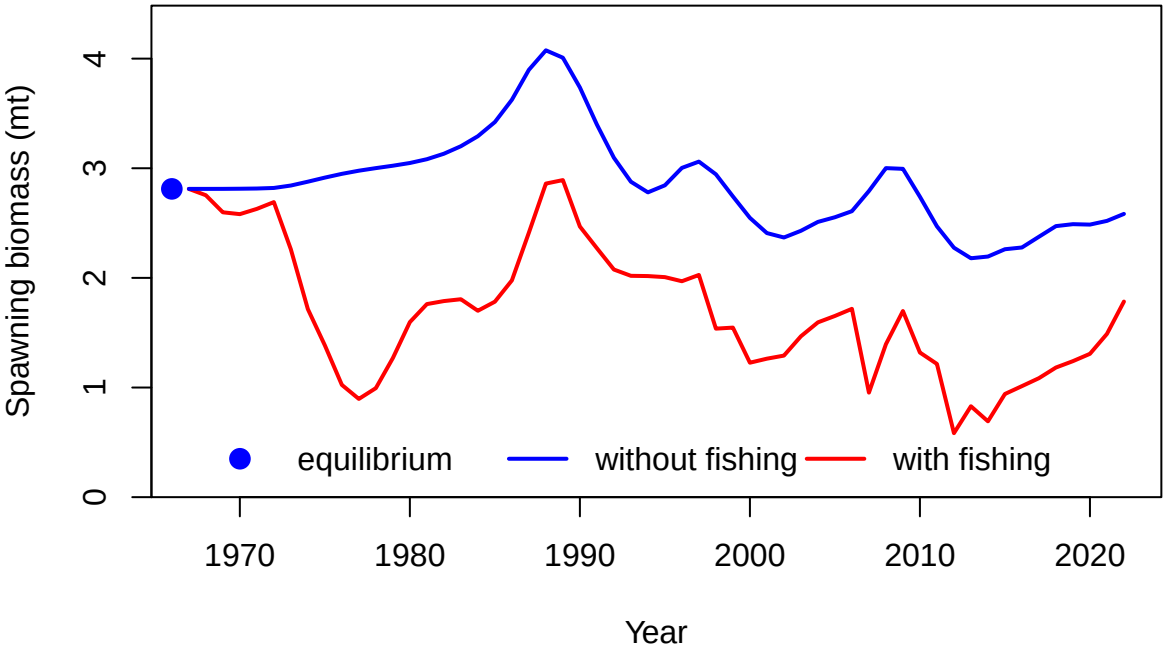

Total biomass (mt)
0
2
4
6
8
1970
1980
1990
2000
2010
2020
Year

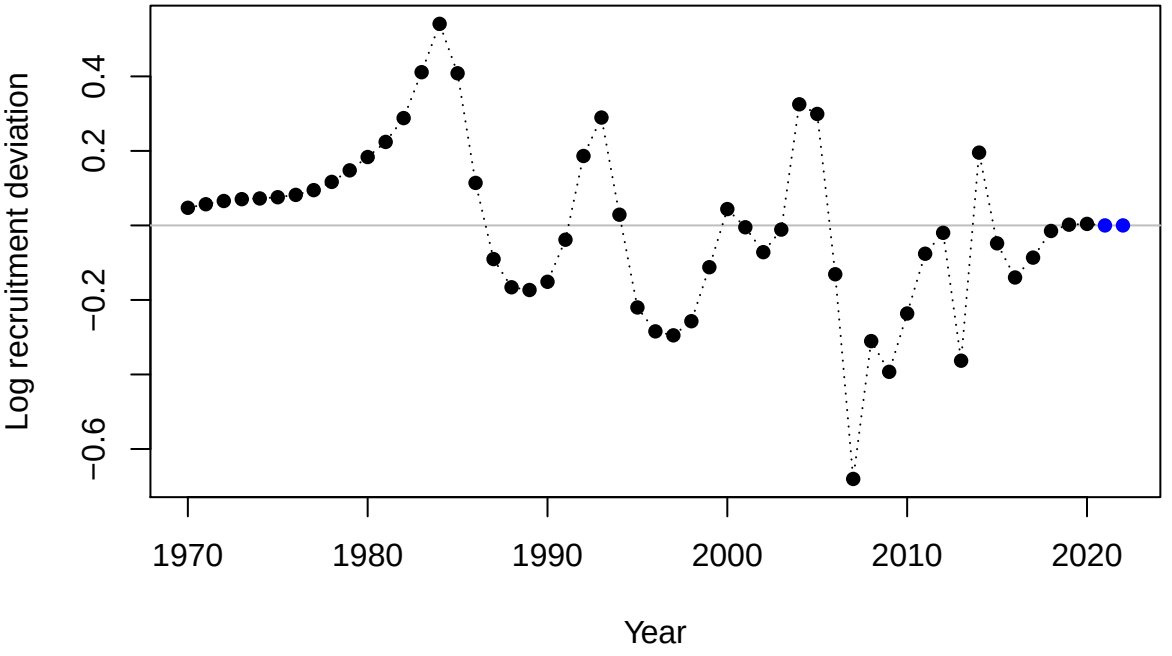

Summary biomass (mt)
0
2
4
6
8
1970
1980
1990
2000
2010
2020
Year

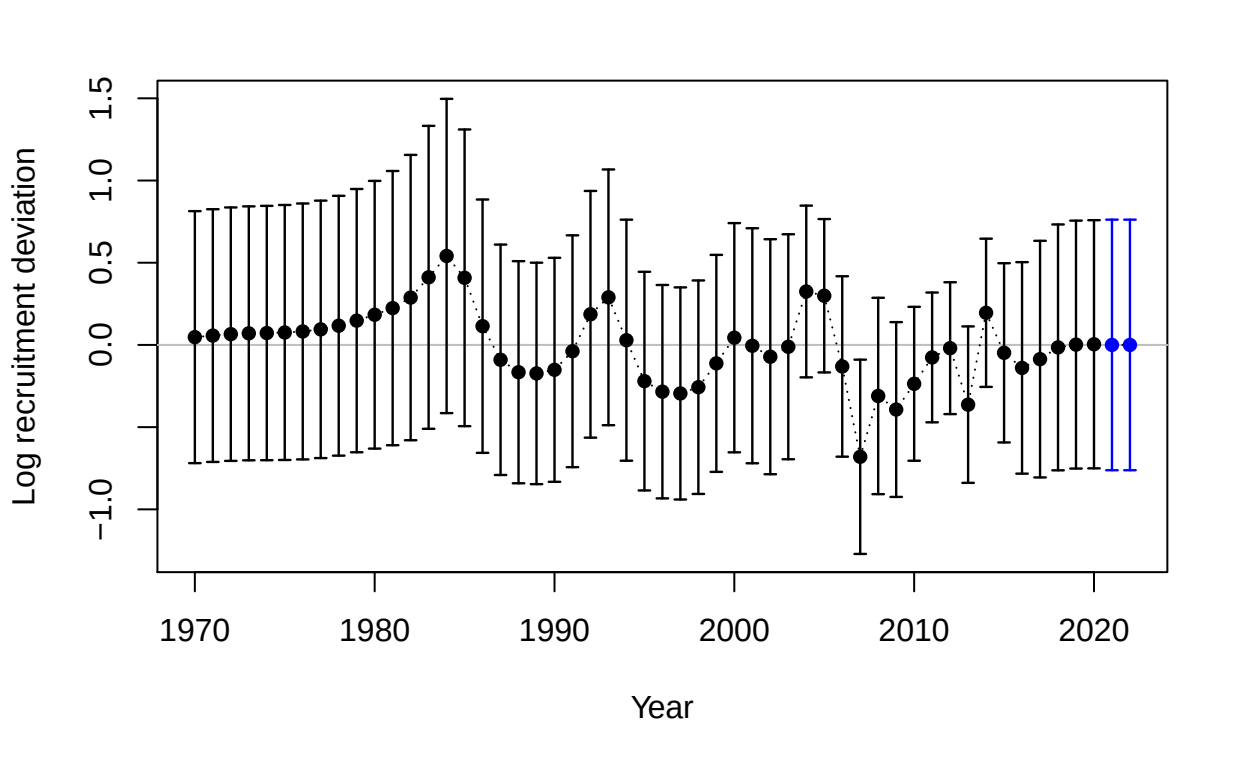

Age−0 recruits (1,000s)
0
2
4
6
8
1970
1980
1990
2000
2010
2020
Year

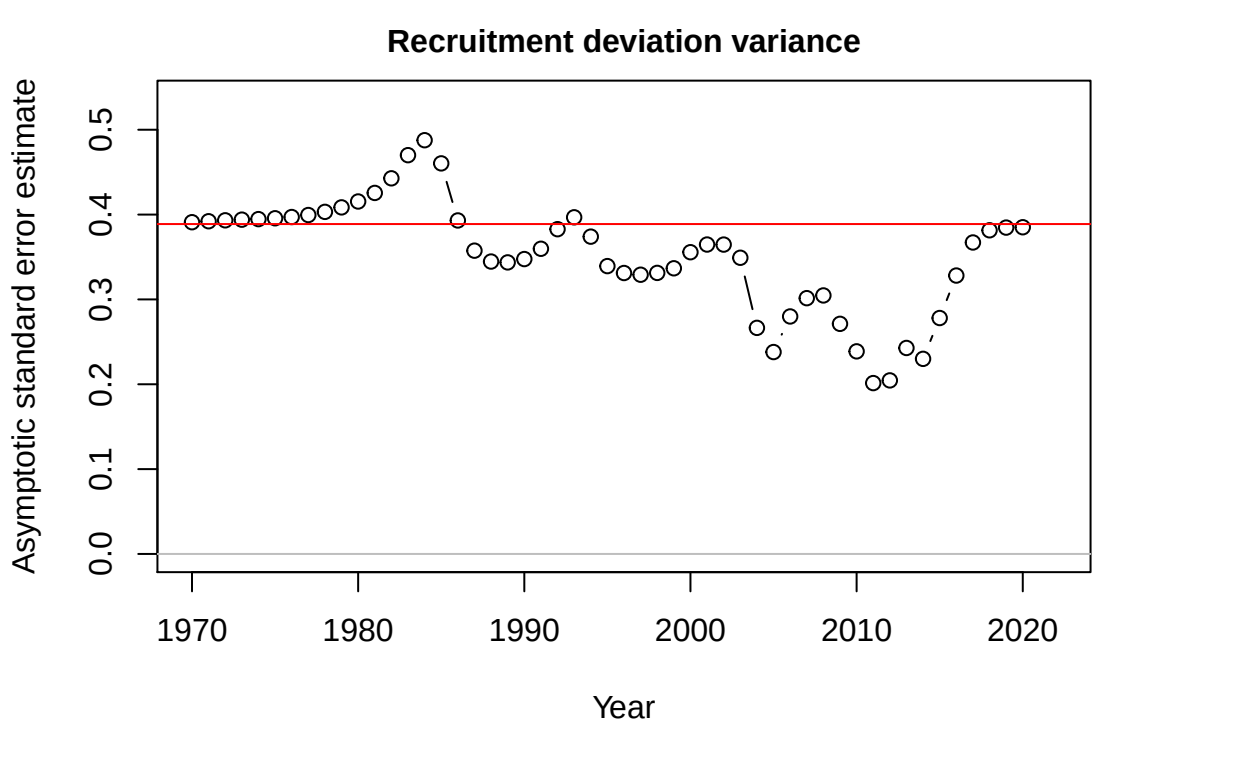

Age−0 recruits (1,000s)
0
5
10
15
20
25
1970
1980
1990
2000
2010
2020
Year

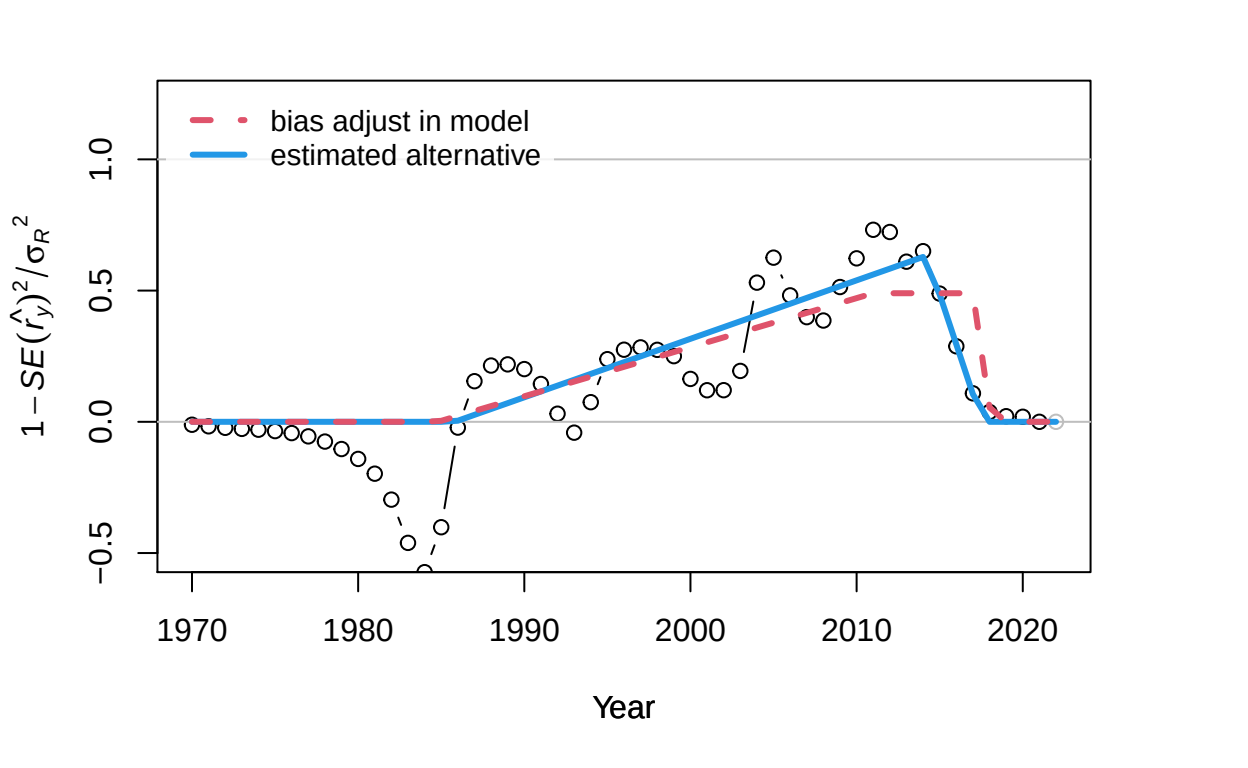

Summary Fishing Mortality
0
1
2
3
4
5
1970
1980
1990
2000
2010
2020
Year

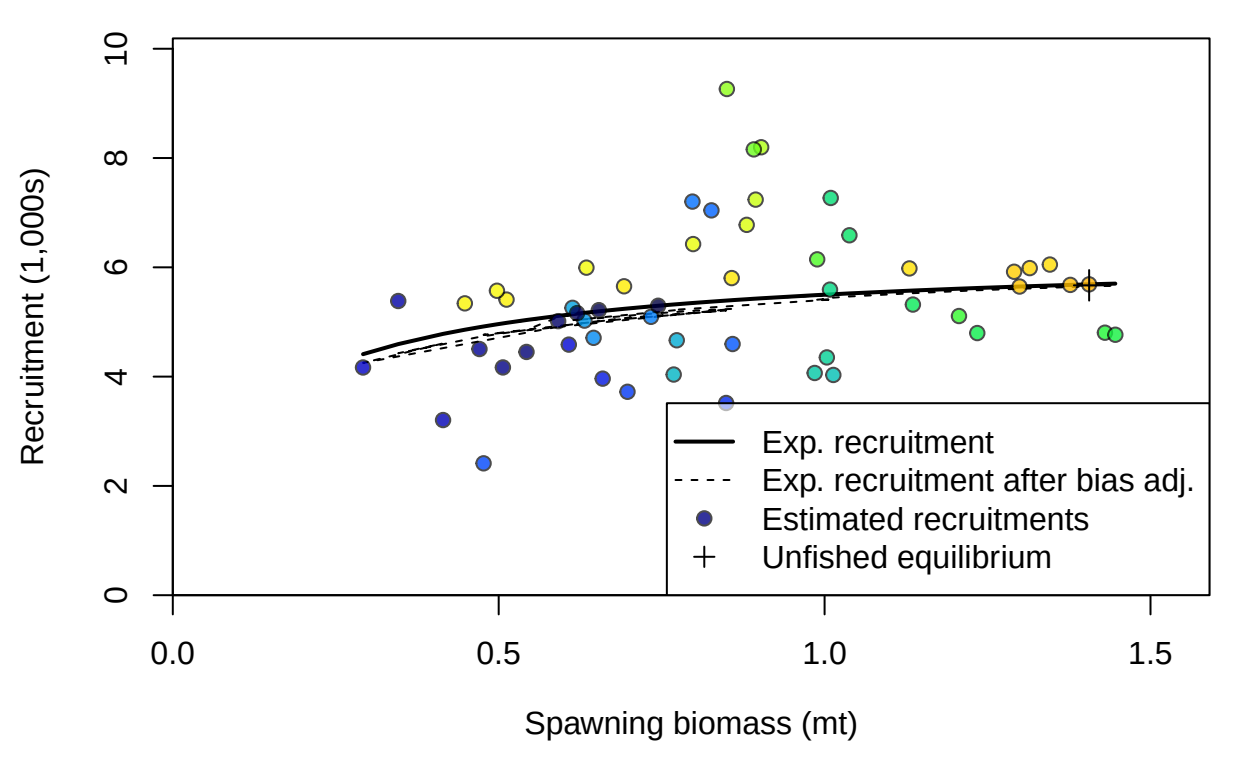

Spawning biomass (mt)
0
1
2
3
4
1970
1980
1990
2000
2010
2020
Year
equilibrium
without fishing
with fishing

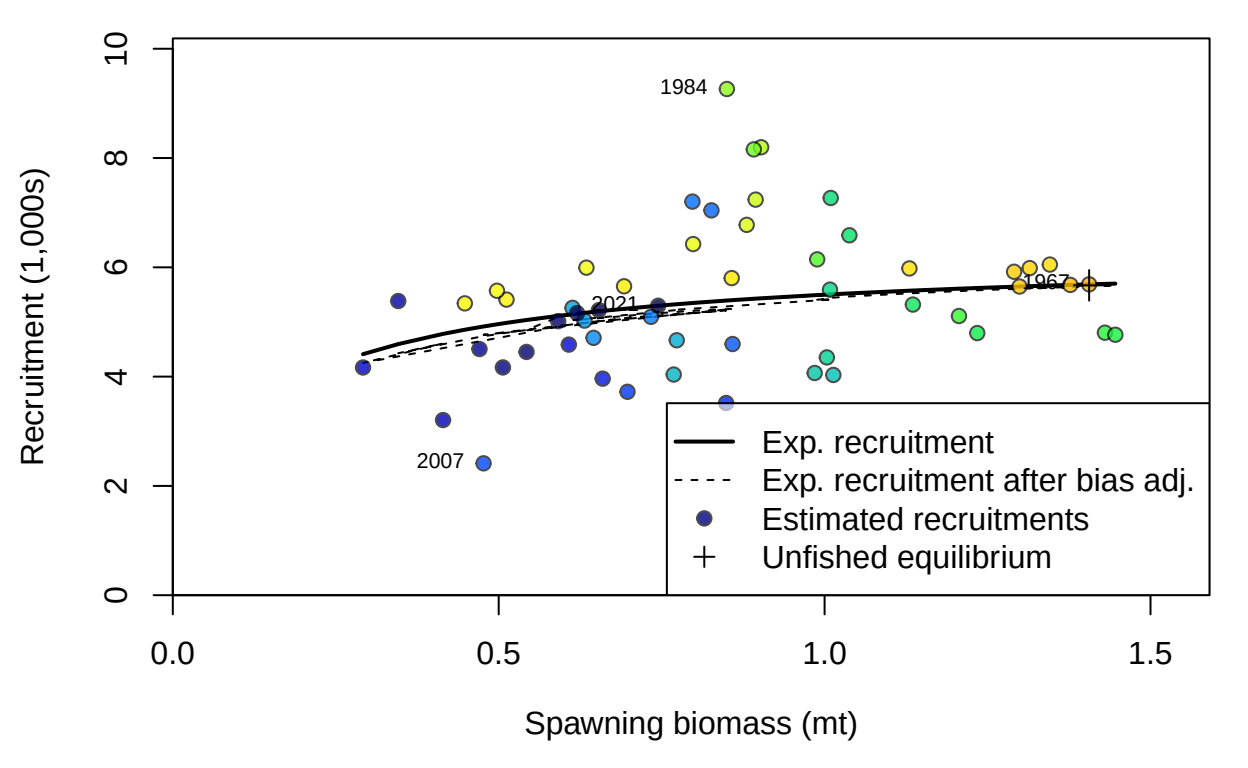

Log recruitment deviation
0.4
0.2
−0.2
−0.6
1970
1980
1990
2000
2010
2020
Year

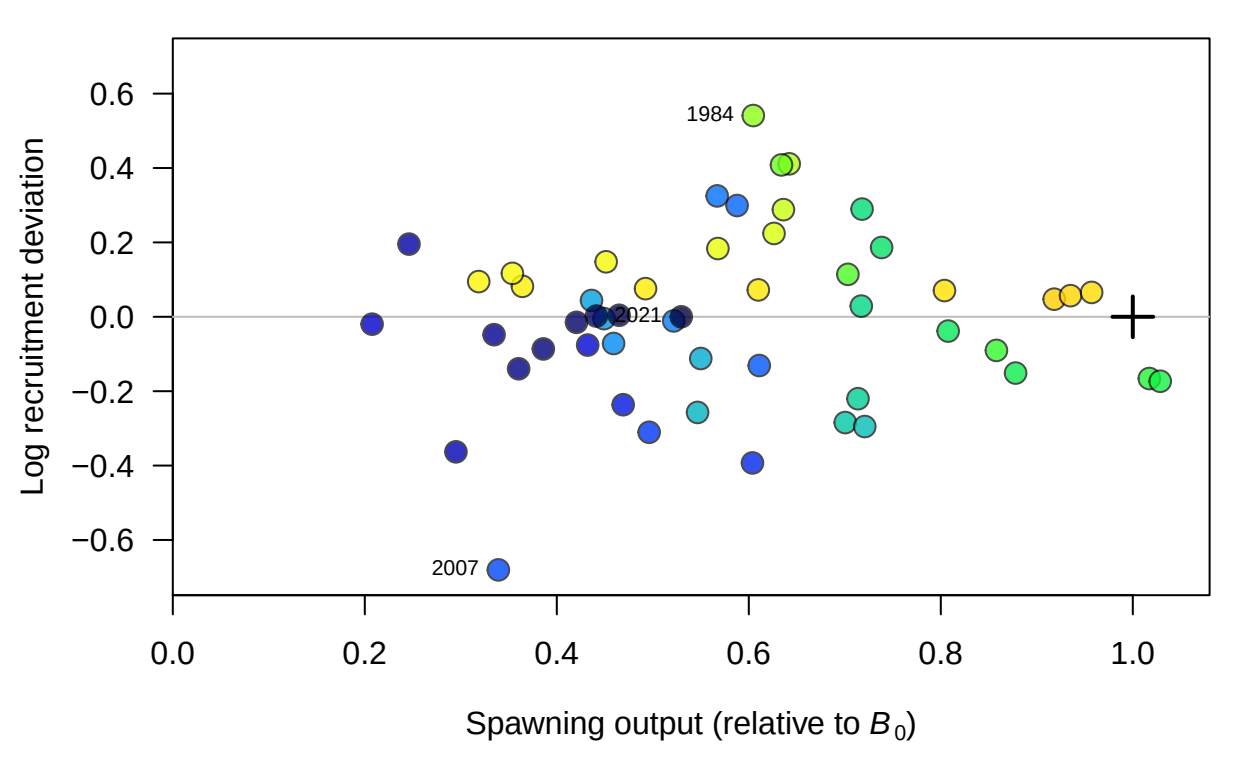

Log recruitment deviation
1.5
1.0
0.5
0.0
−1.0
1970
1980
1990
2000
2010
2020
Year

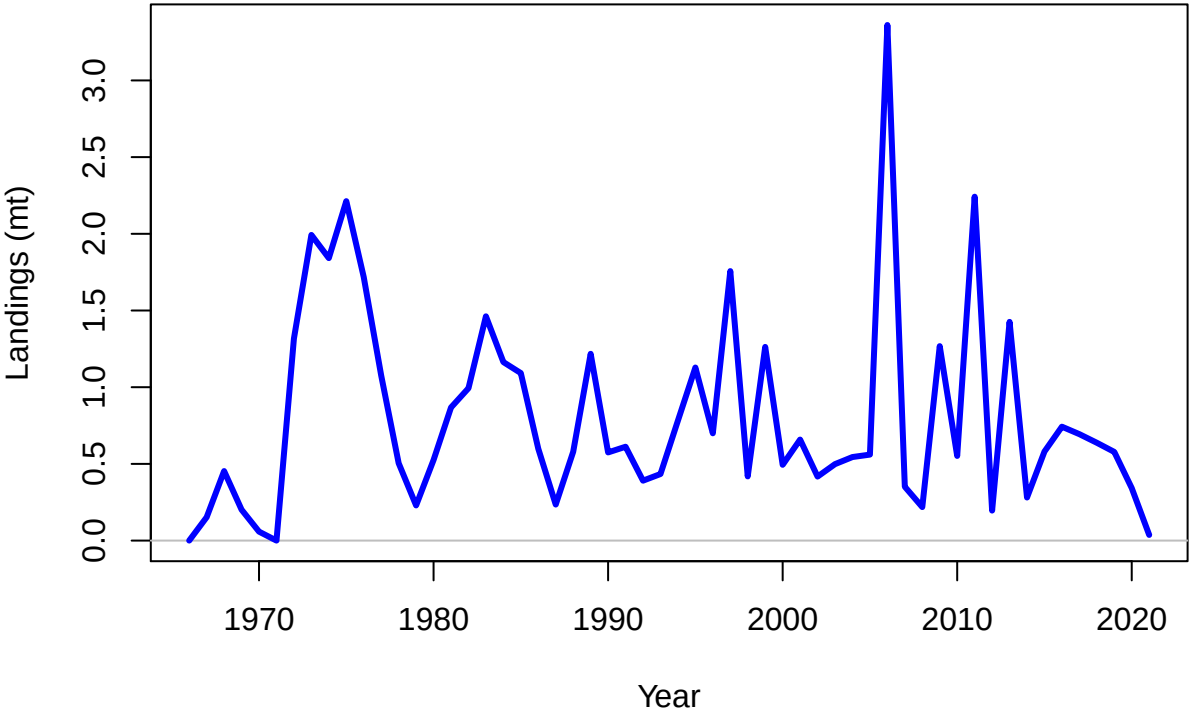

Recruitment deviation variance
Asymptotic standard error estimate
0.0
0.1
0.2
0.3
0.4
0.5
1970
1980
1990
2000
2010
2020
Year

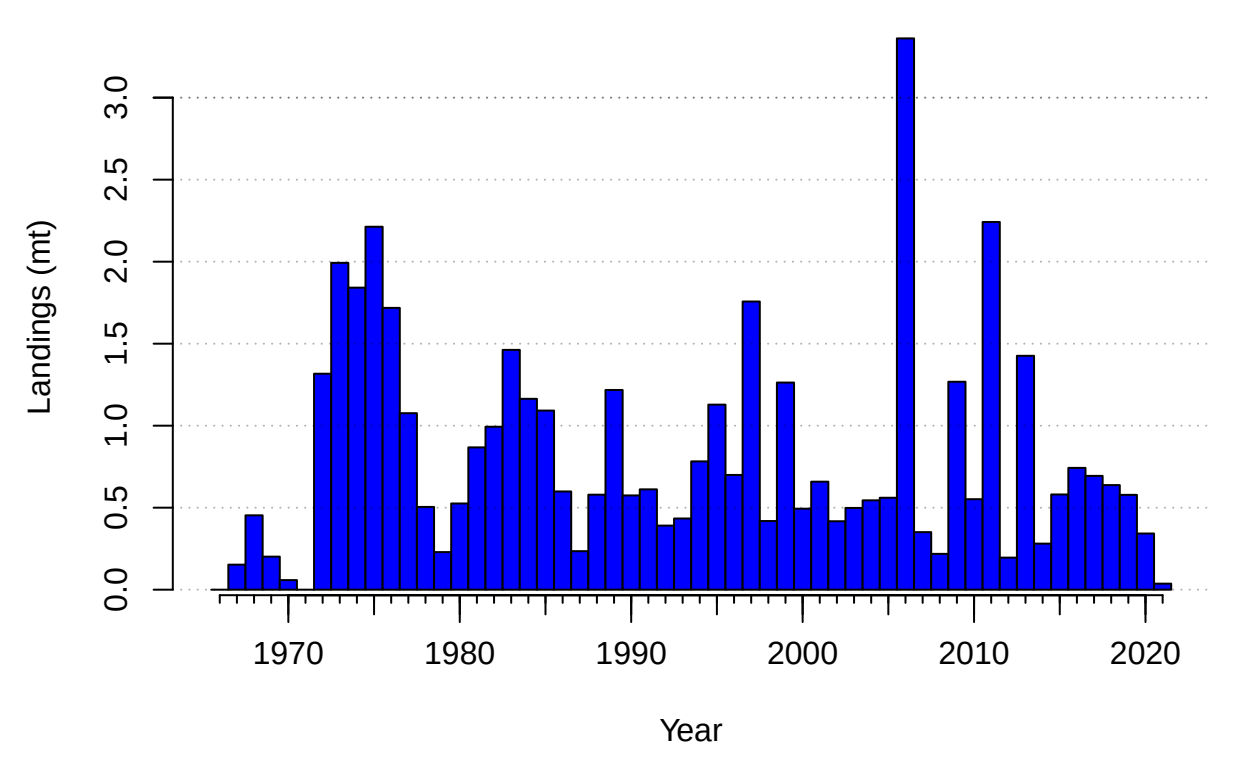

bias adjust in model
estimated alternative
$1 - SE(\hat{r}_y)^2/\sigma_R^2$
1.0
0.5
0.0
−0.5
1970
1980
1990
2000
2010
2020
Year

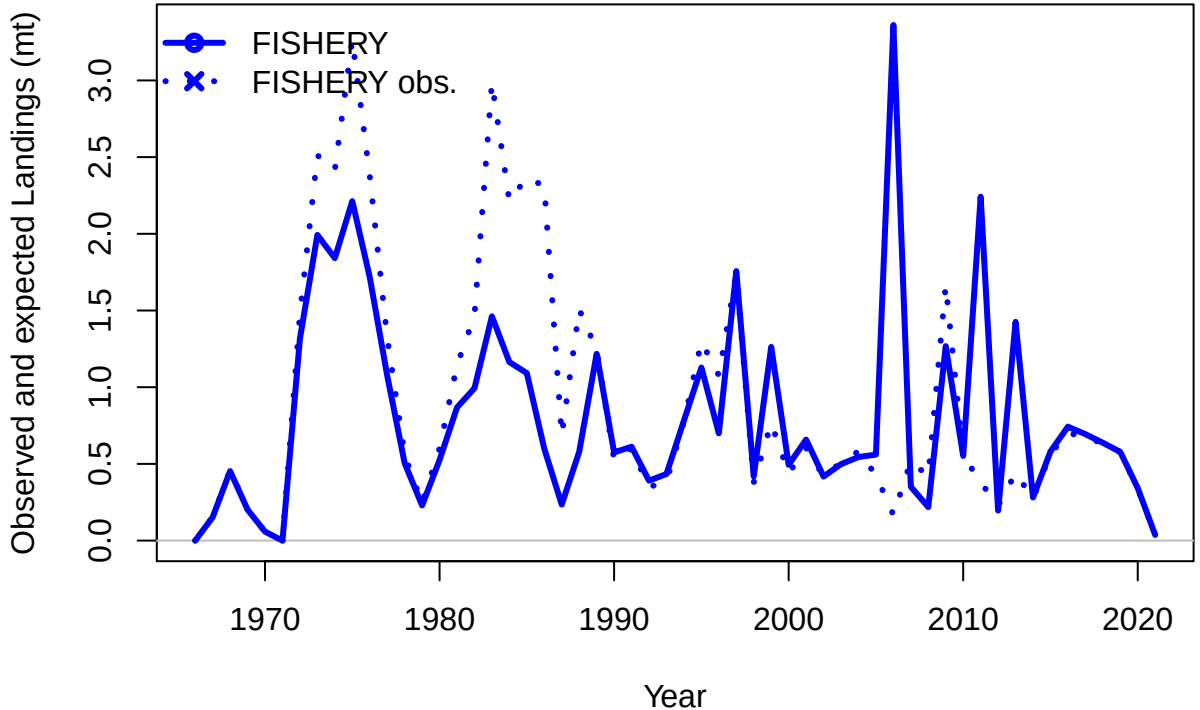

Recruitment (1,000s)
0
2
4
6
8
10
0.0
0.5
1.0
1.5
Spawning biomass (mt)
Exp. recruitment
Exp. recruitment after bias adj.
Estimated recruitments
Unfished equilibrium

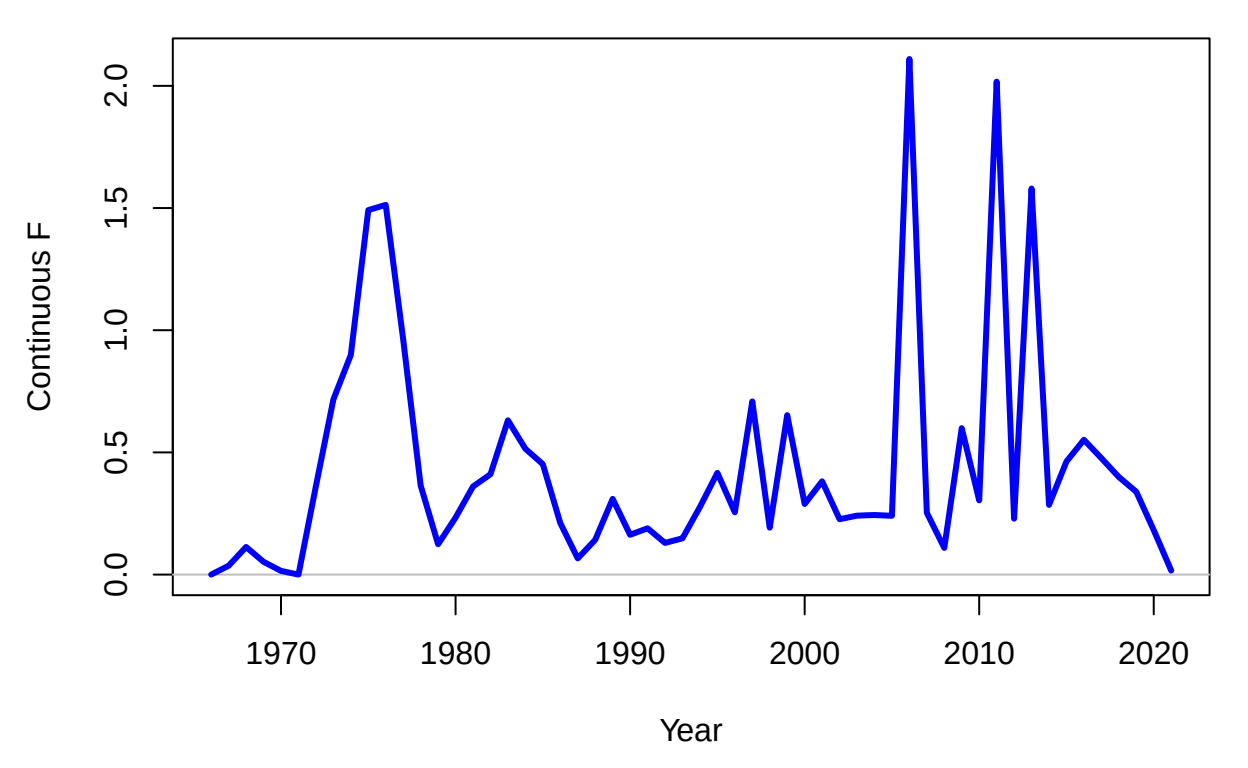

Recruitment (1,000s)
0
2
4
6
8
10
0.0
0.5
1.0
1.5
Spawning biomass (mt)
1984
2021
1967
2007
Exp. recruitment
Exp. recruitment after bias adj.
Estimated recruitments
Unfished equilibrium

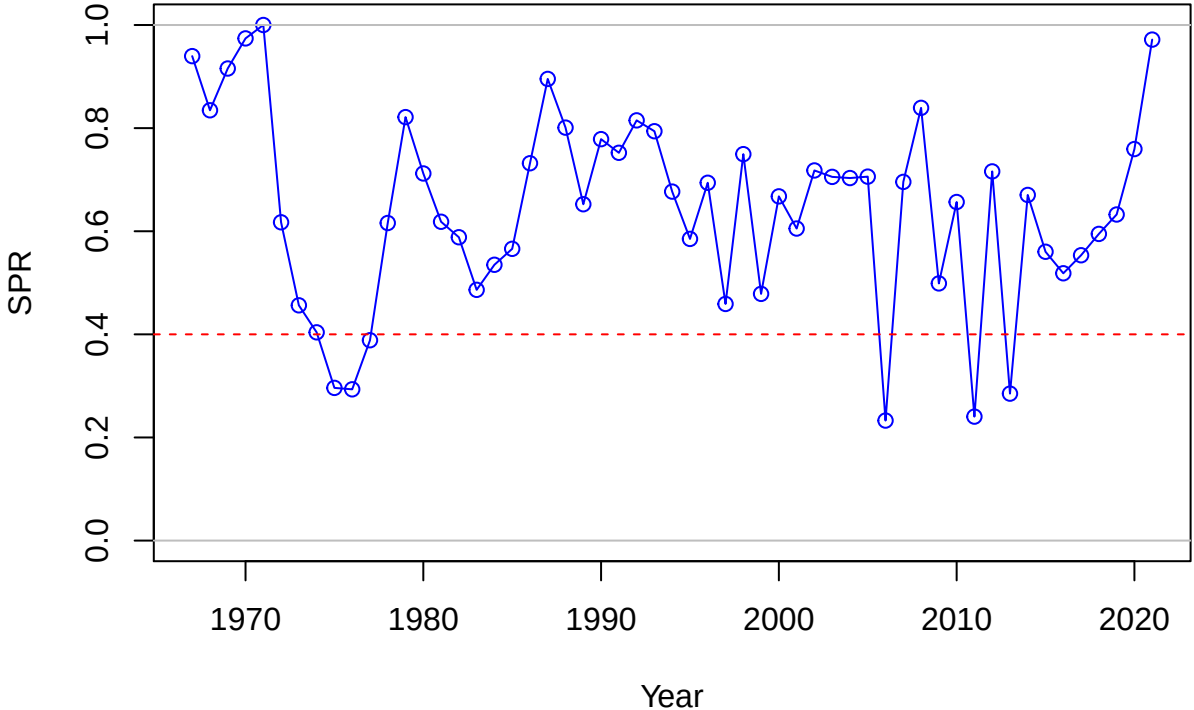

Log recruitment deviation
0.6
0.4
0.2
0.0
−0.2
−0.4
−0.6
1984
2021
2007
0.0
0.2
0.4
0.6
0.8
1.0
Spawning output (relative to B_0)

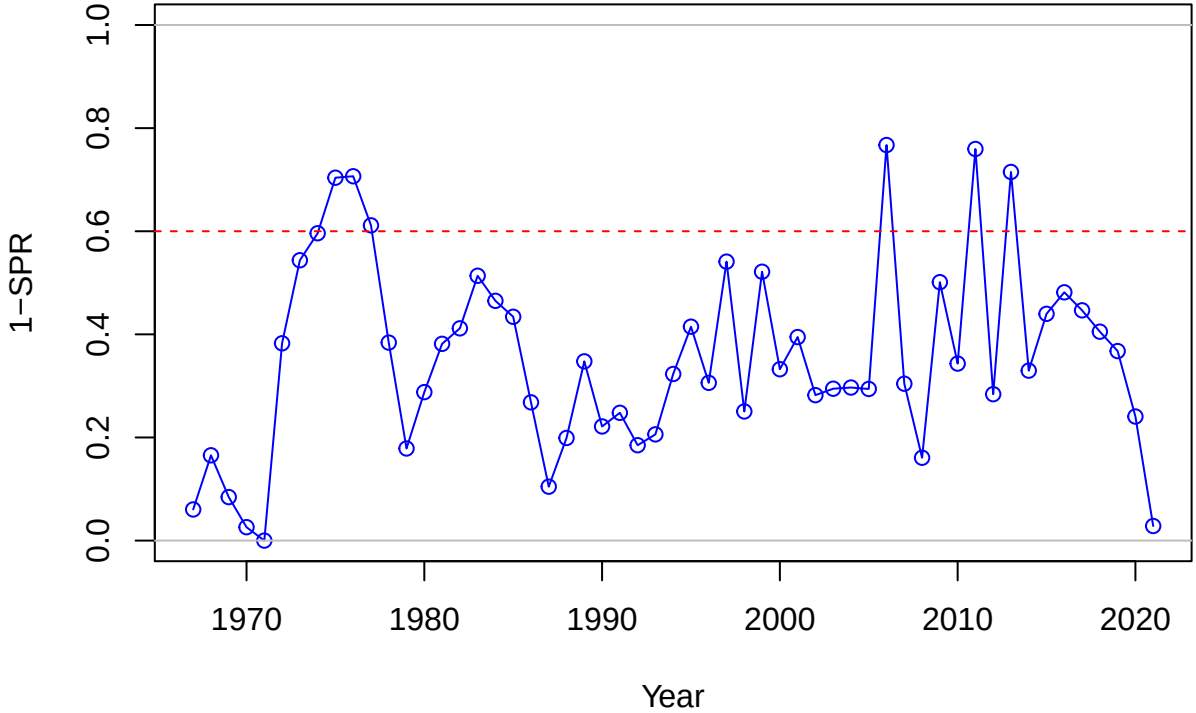

Landings (mt)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
1970
1980
1990
2000
2010
2020
Year

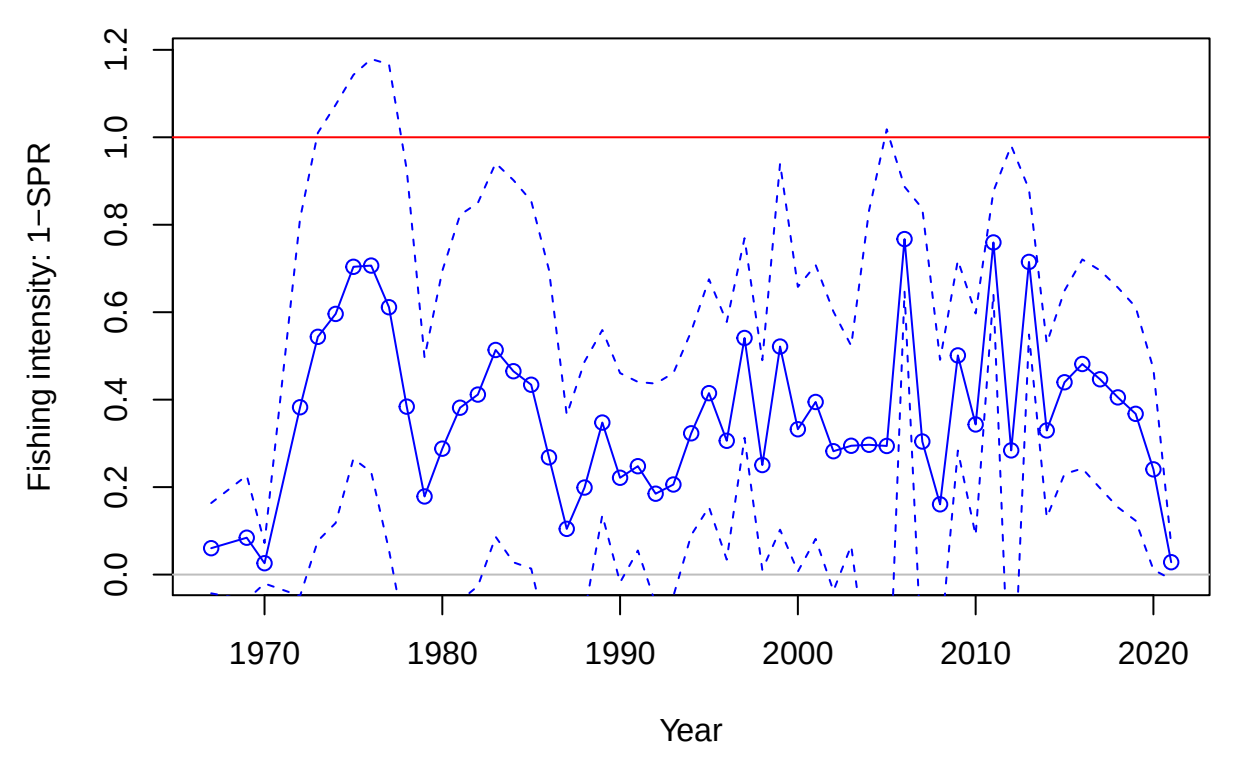

Landings (mt)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
1970
1980
1990
2000
2010
2020
Year

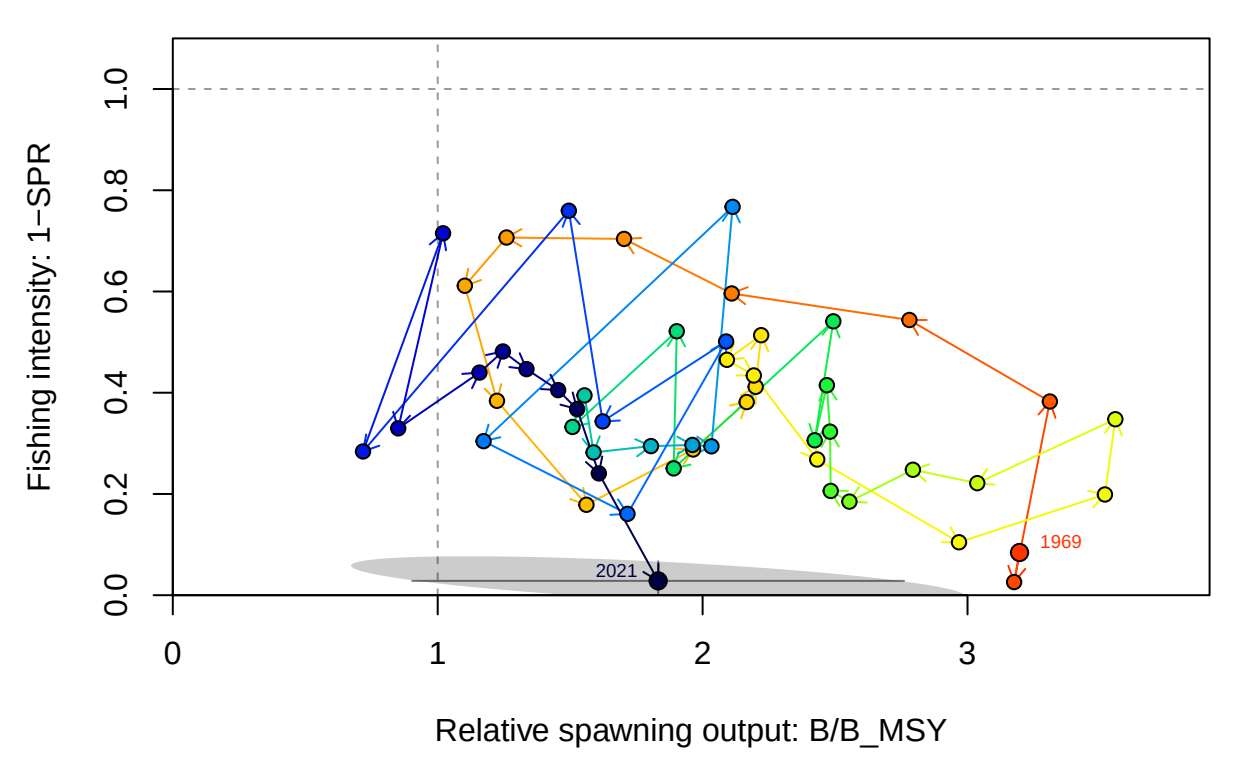

FISHERY
FISHERY obs.
Observed and expected Landings (mt)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
1970
1980
1990
2000
2010
2020
Year

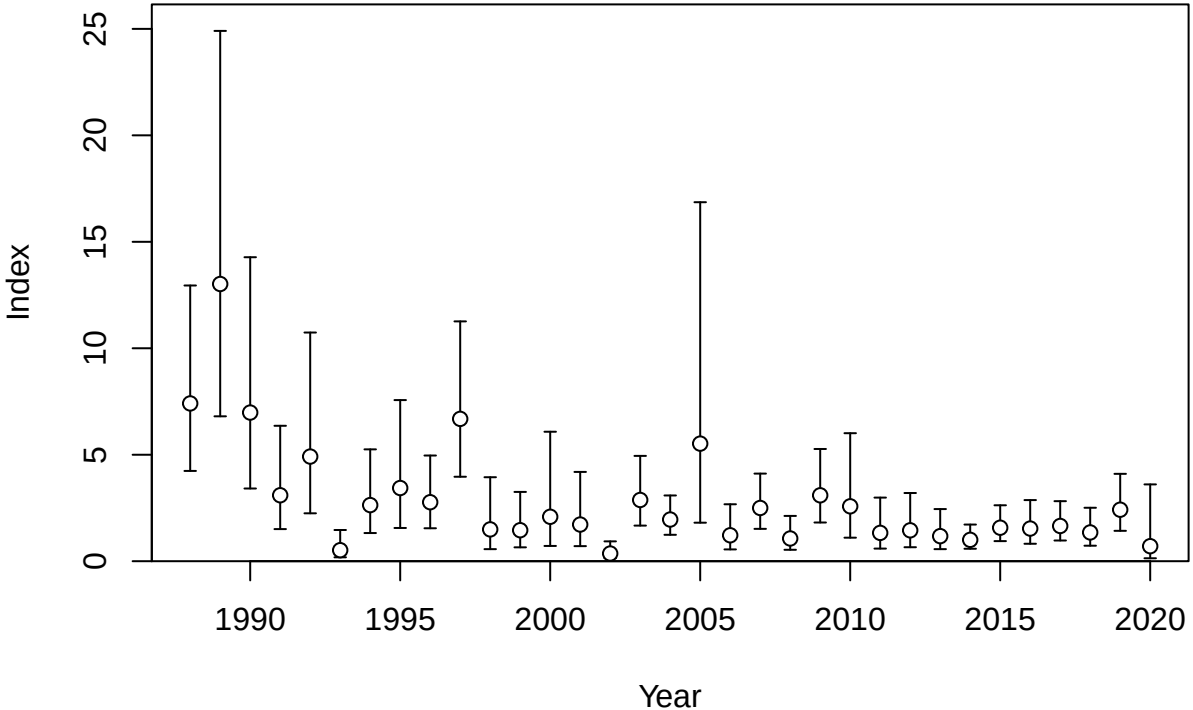

Continuous F
0.0
0.5
1.0
1.5
2.0
1970
1980
1990
2000
2010
2020
Year

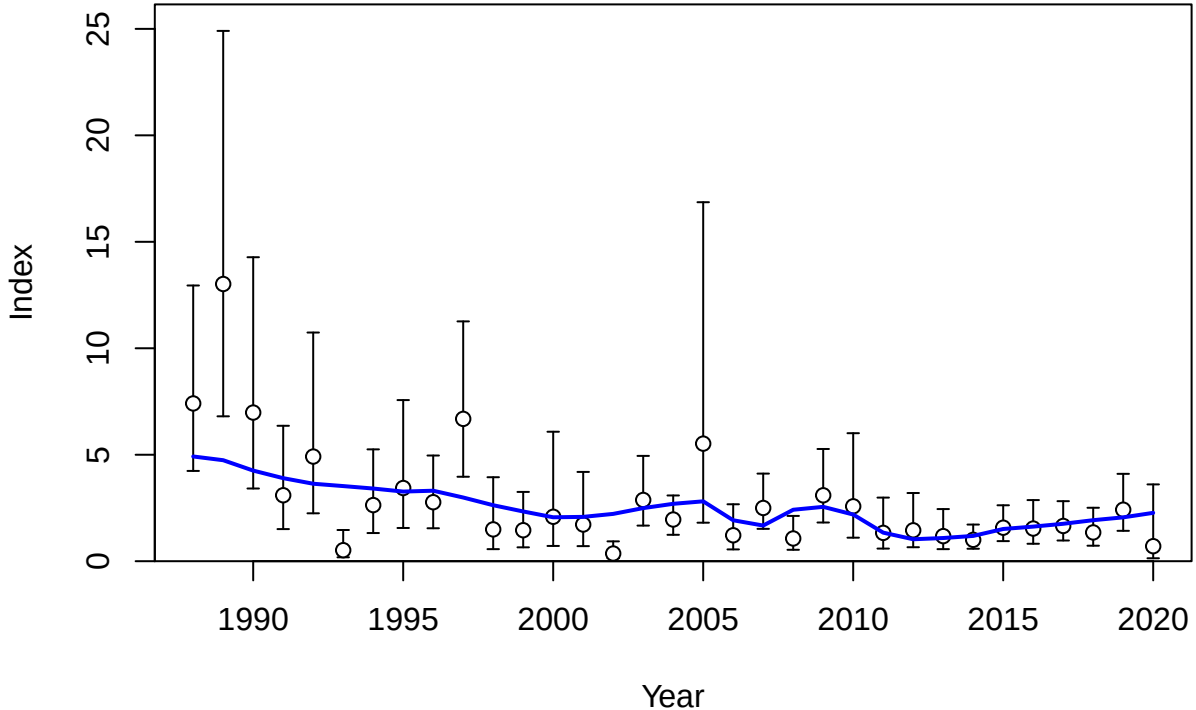

SPR
0.0
0.2
0.4
0.6
0.8
1.0
1970
1980
1990
2000
2010
2020
Year

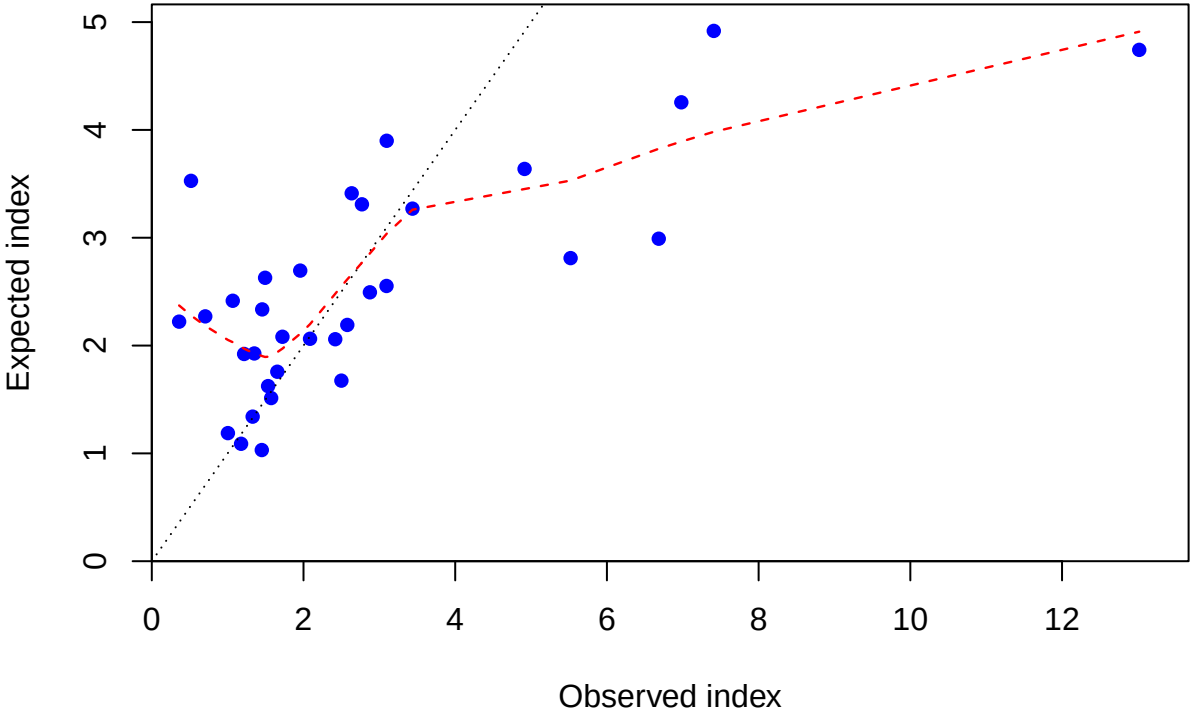

1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
1970
1980
1990
2000
2010
2020
Year

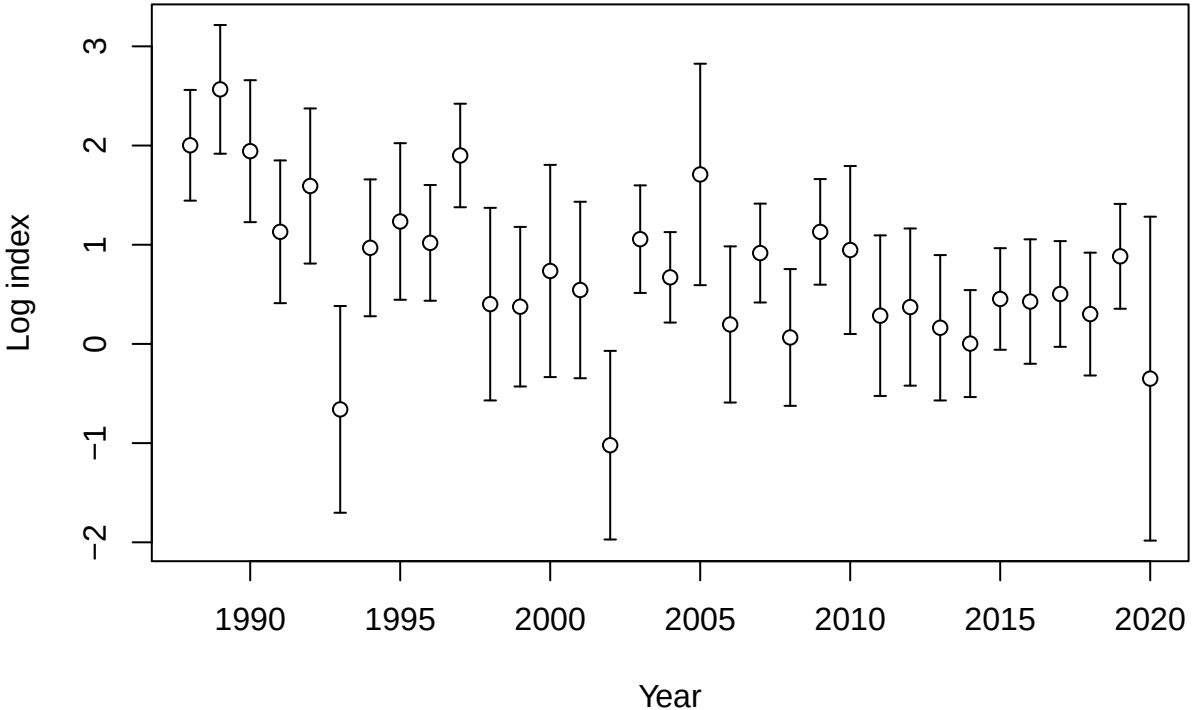

Fishing intensity: 1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1970
1980
1990
2000
2010
2020
Year

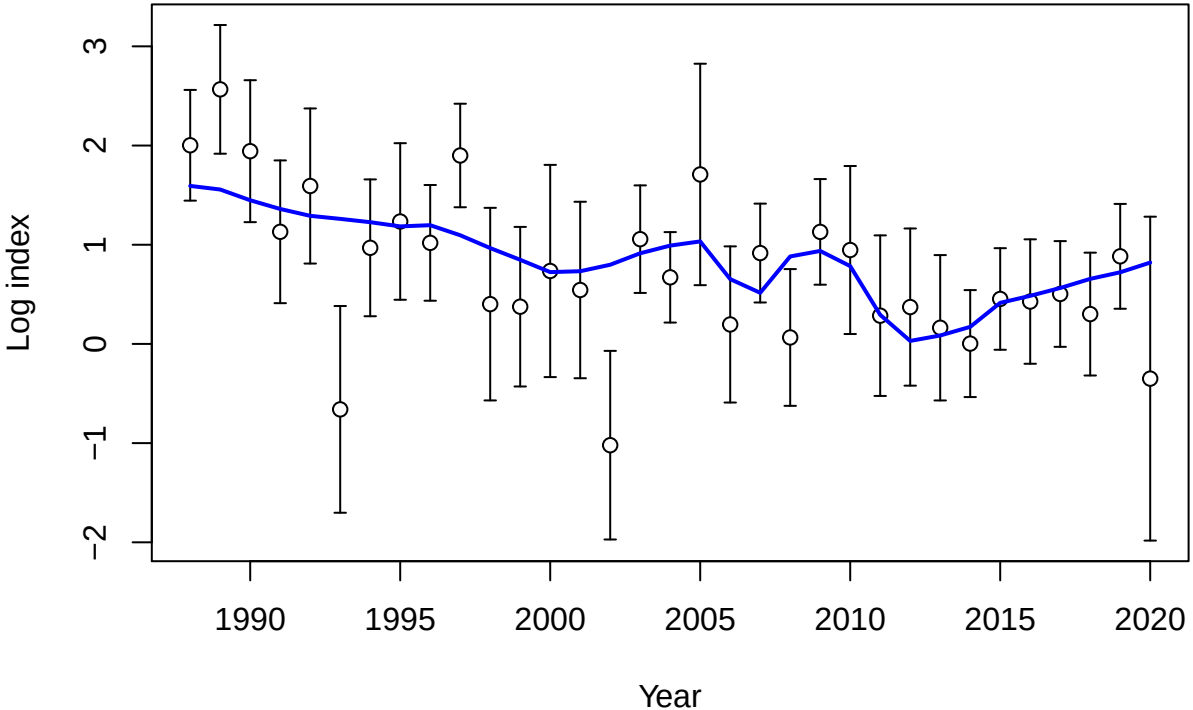

Fishing intensity: 1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
0
1
2
3
Relative spawning output: B/B_MSY
2021
1969

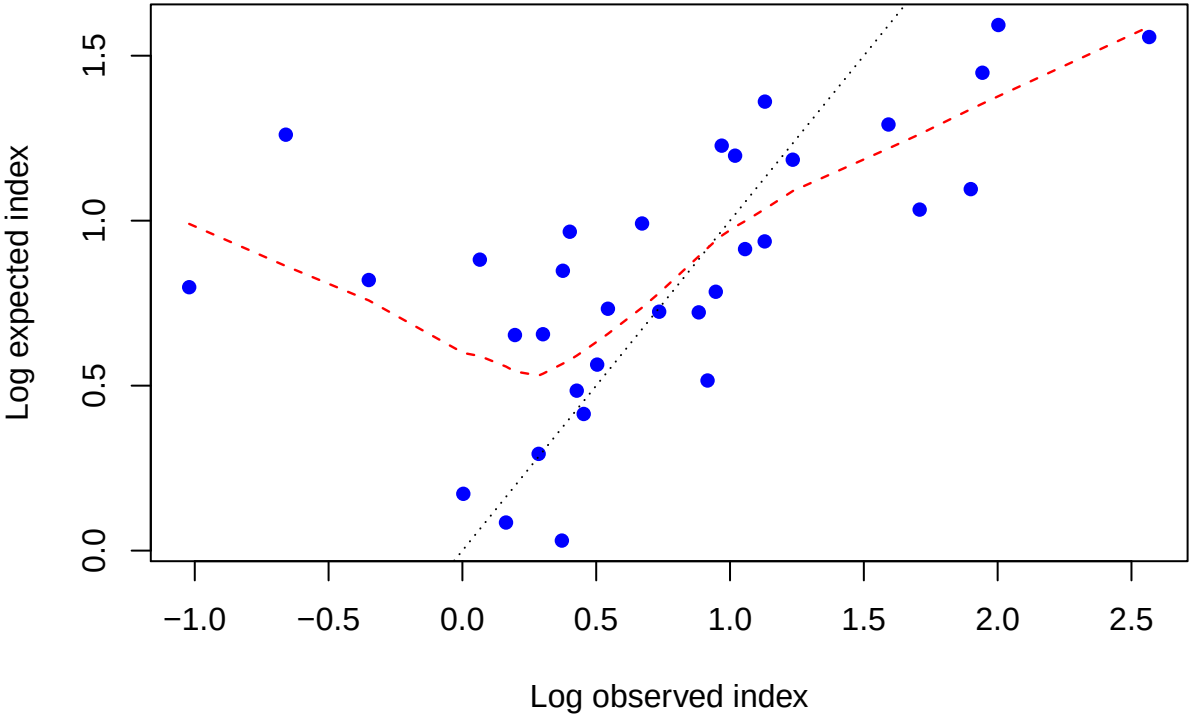

Index
0
5
10
15
20
25
1990
1995
2000
2005
2010
2015
2020
Year

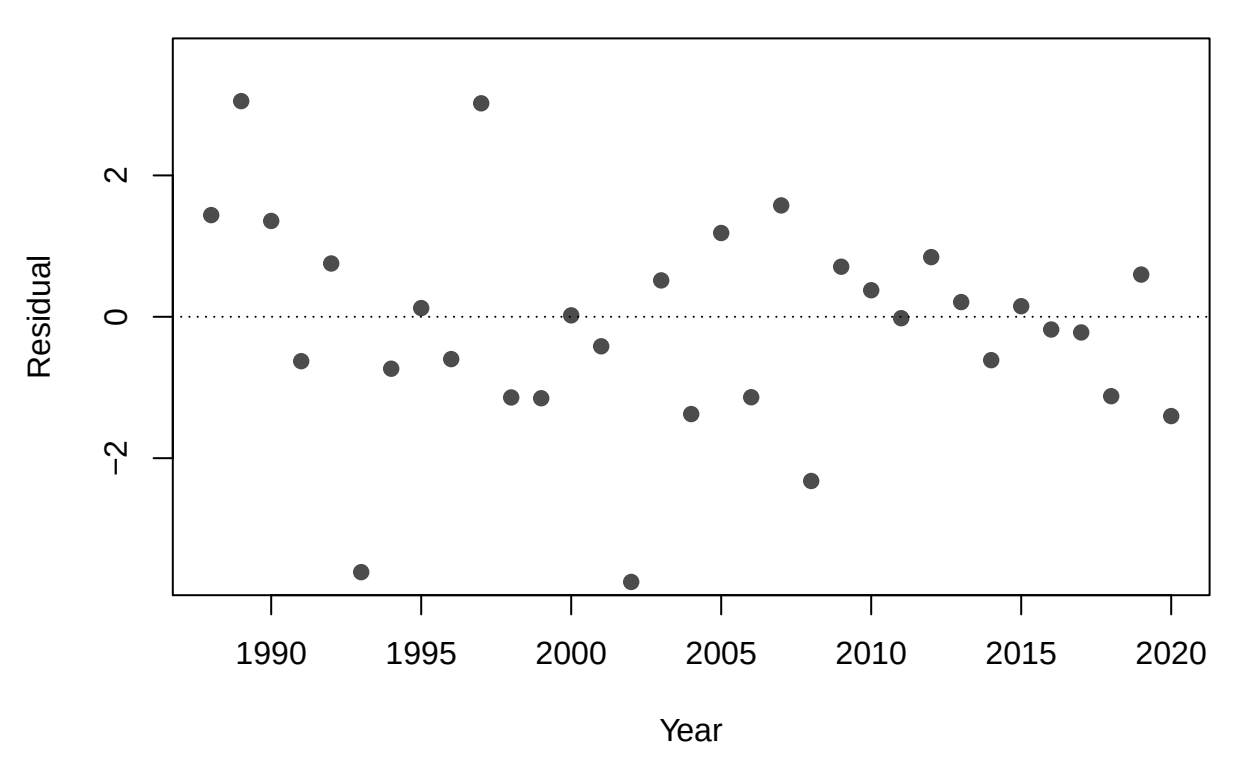

Index
0
5
10
15
20
25
1990
1995
2000
2005
2010
2015
2020
Year

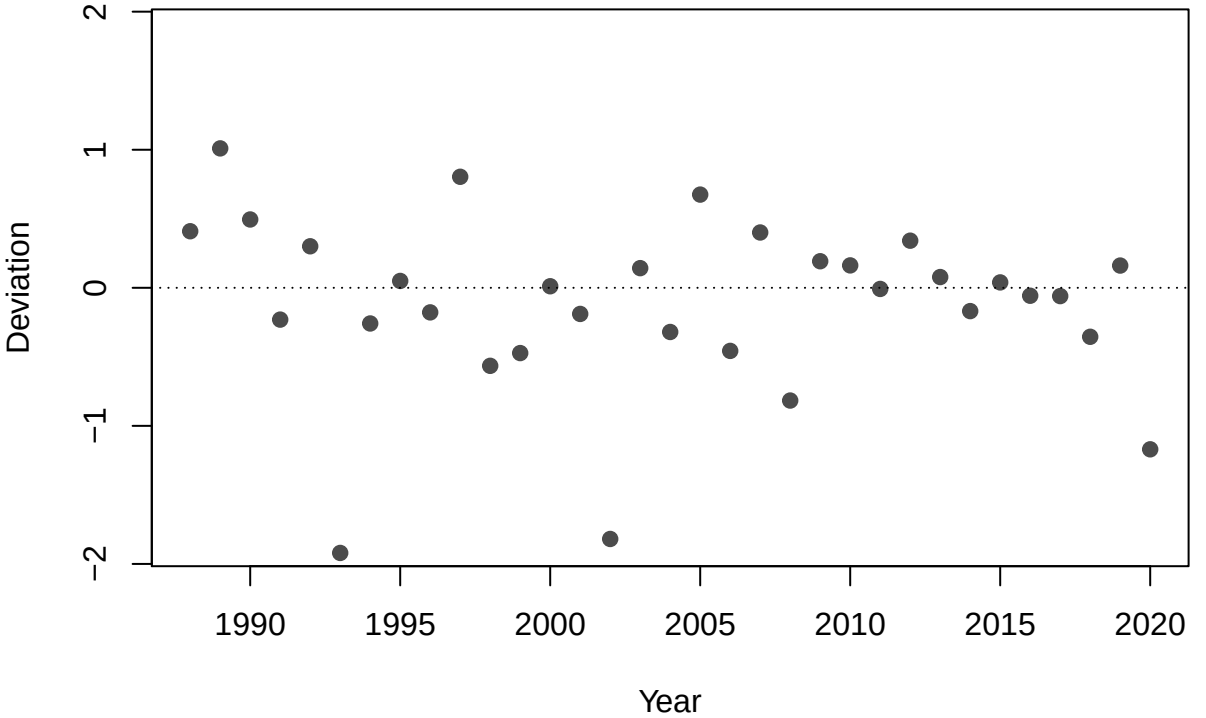

Expected index
Observed index
0
1
2
3
4
5
0
2
4
6
8
10
12

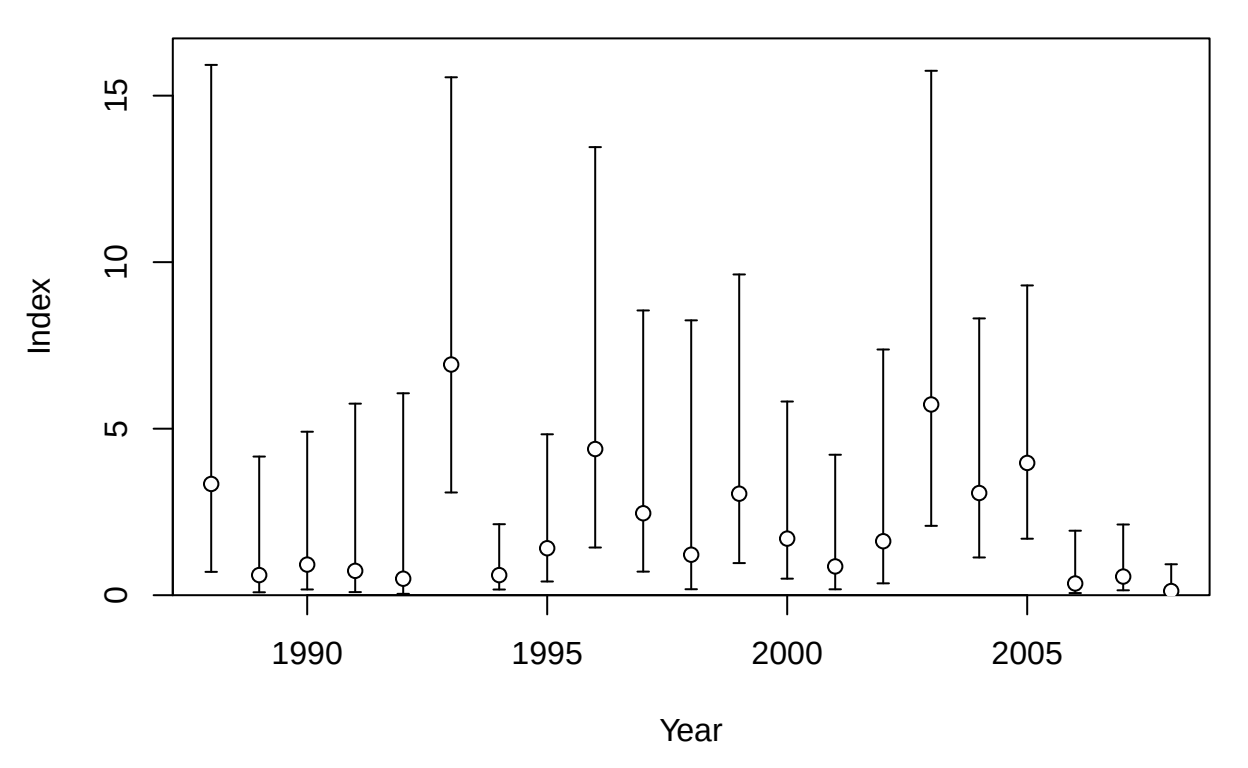

Log index
3
2
1
0
−1
−2
1990
1995
2000
2005
2010
2015
2020
Year

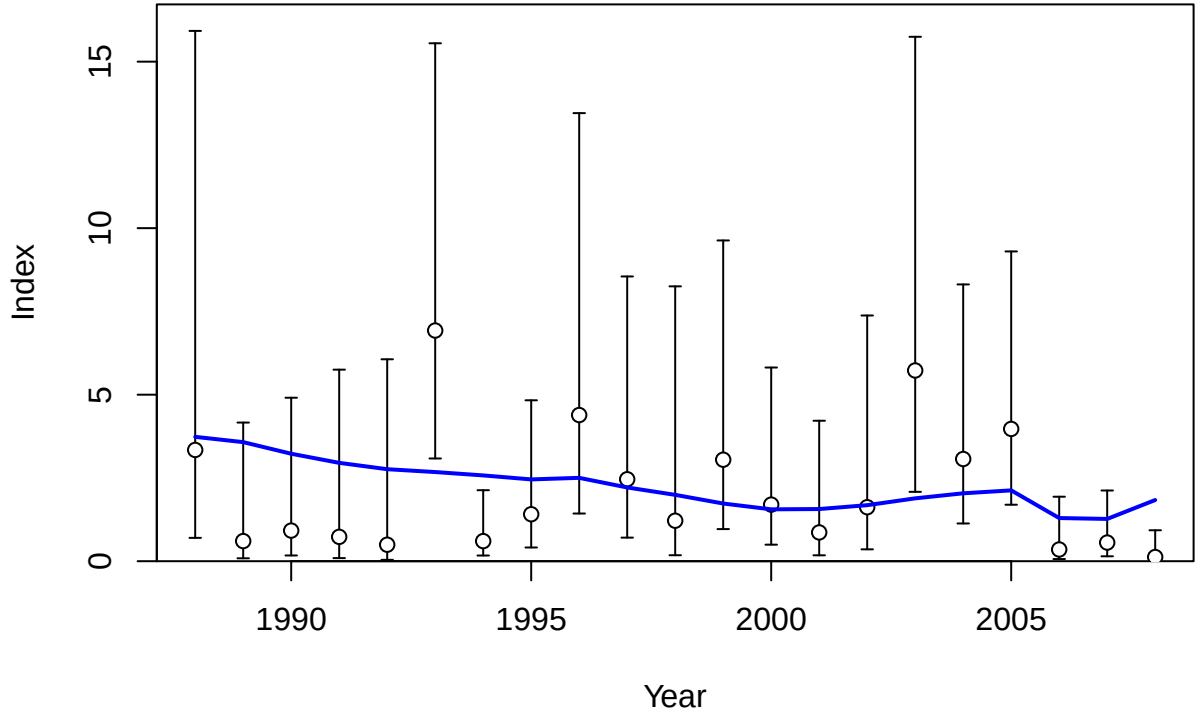

Log index
3
2
1
0
−1
−2
1990
1995
2000
2005
2010
2015
2020
Year

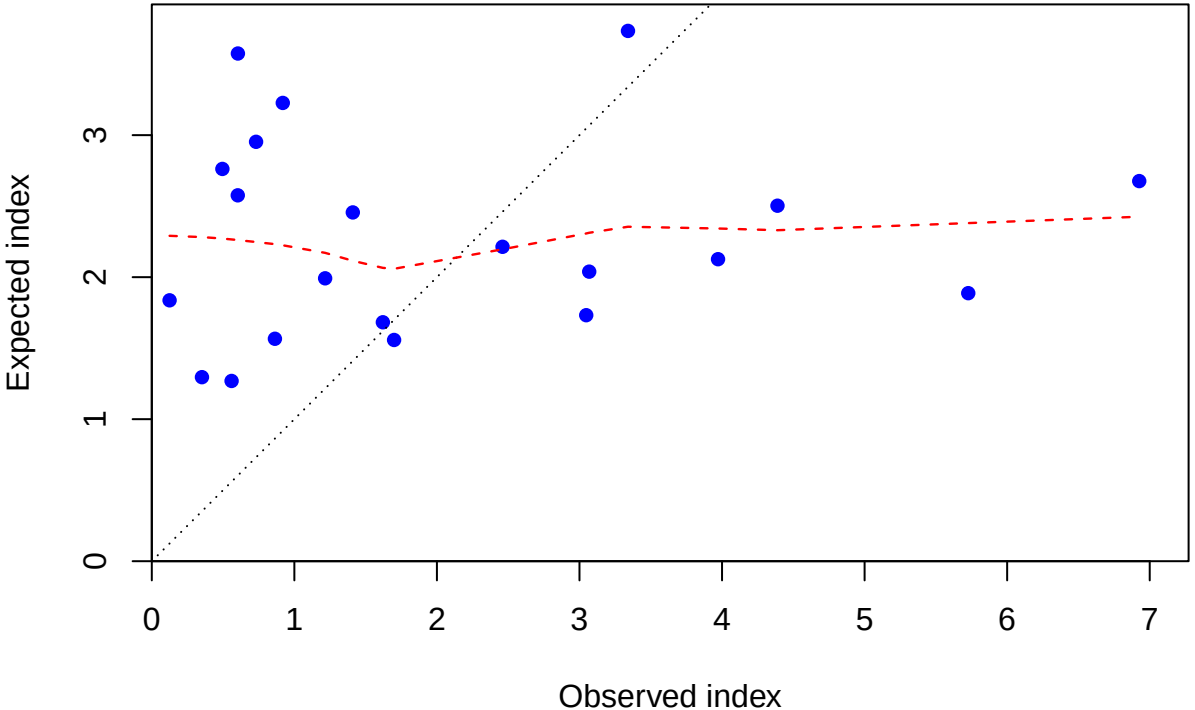

Log expected index
0.0
0.5
1.0
1.5
−1.0
−0.5
0.0
0.5
1.0
1.5
2.0
2.5
Log observed index

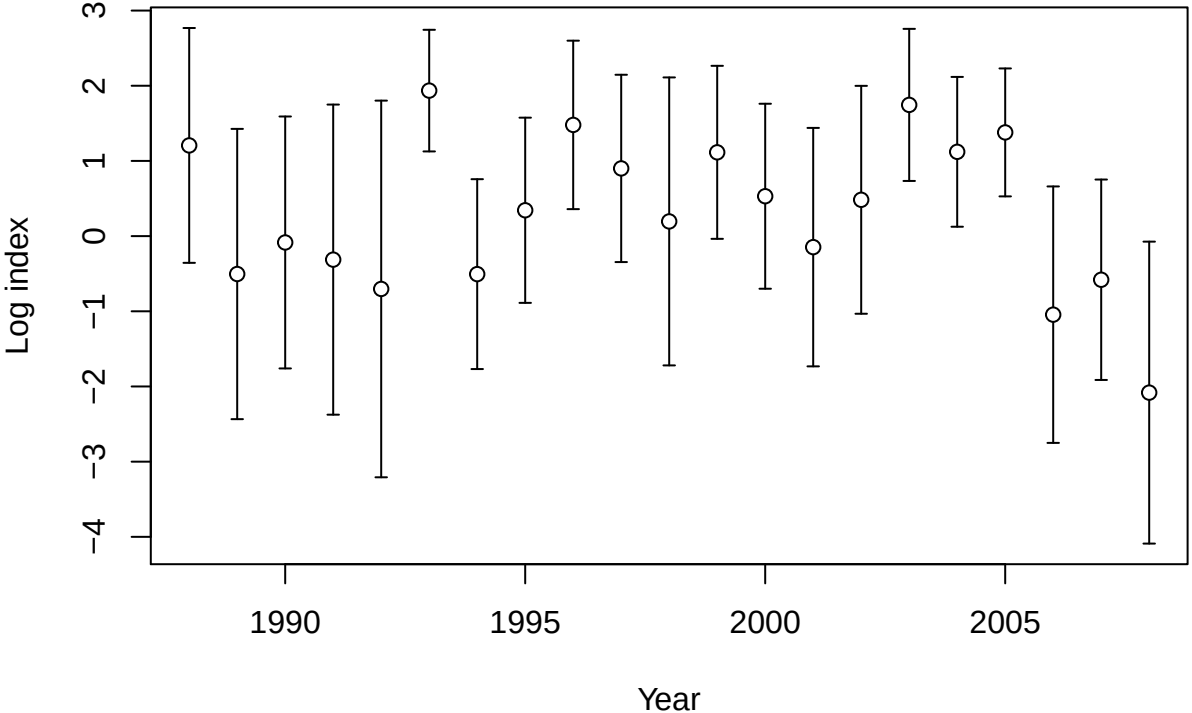

Residual
2
0
−2
1990
1995
2000
2005
2010
2015
2020
Year

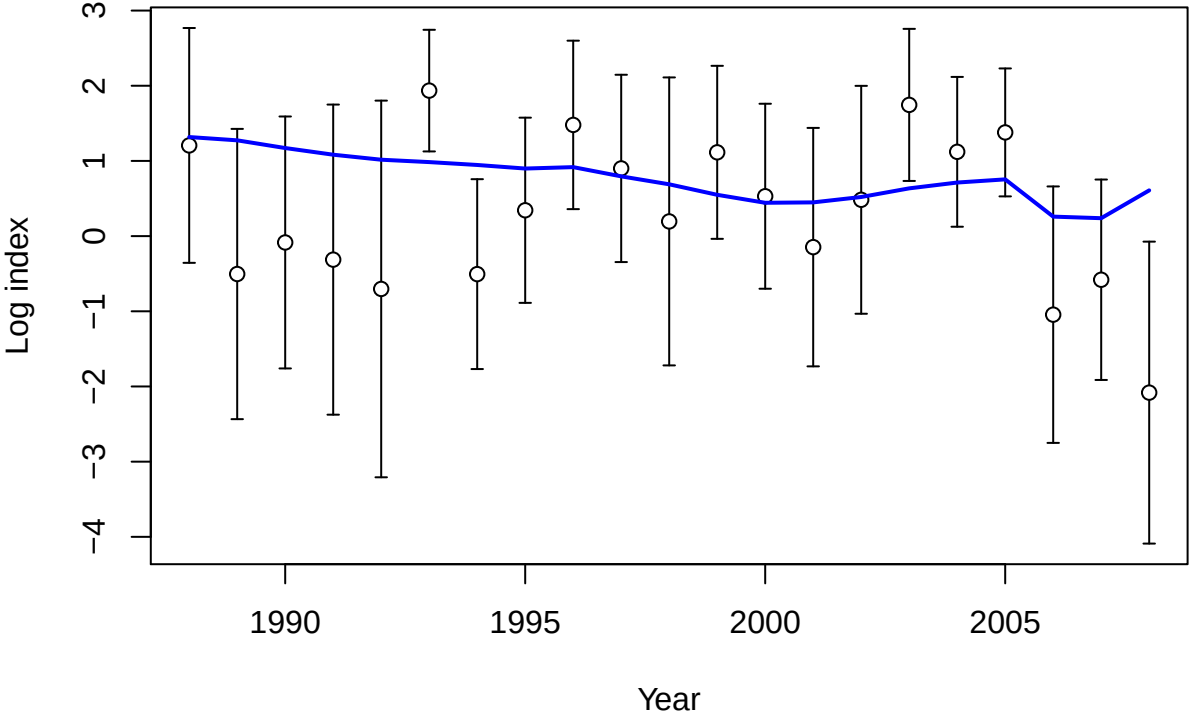

Deviation
2
1
0
−1
−2
1990
1995
2000
2005
2010
2015
2020
Year

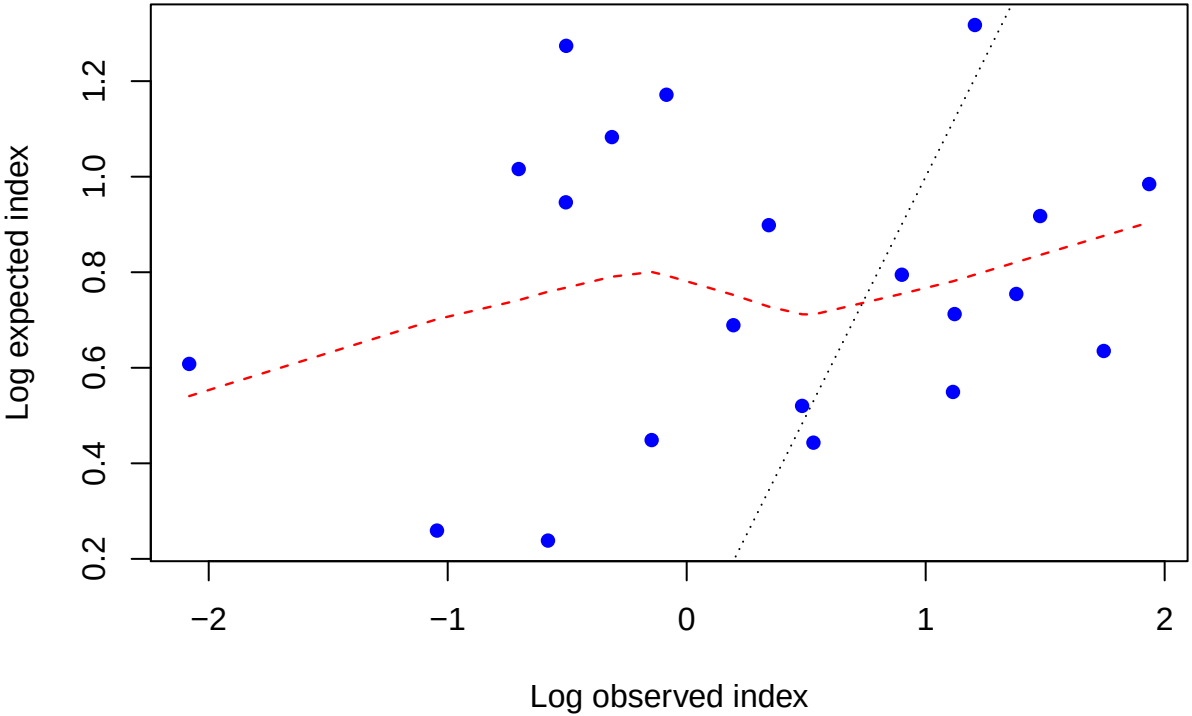

Index
0
5
10
15
1990
1995
2000
2005
Year

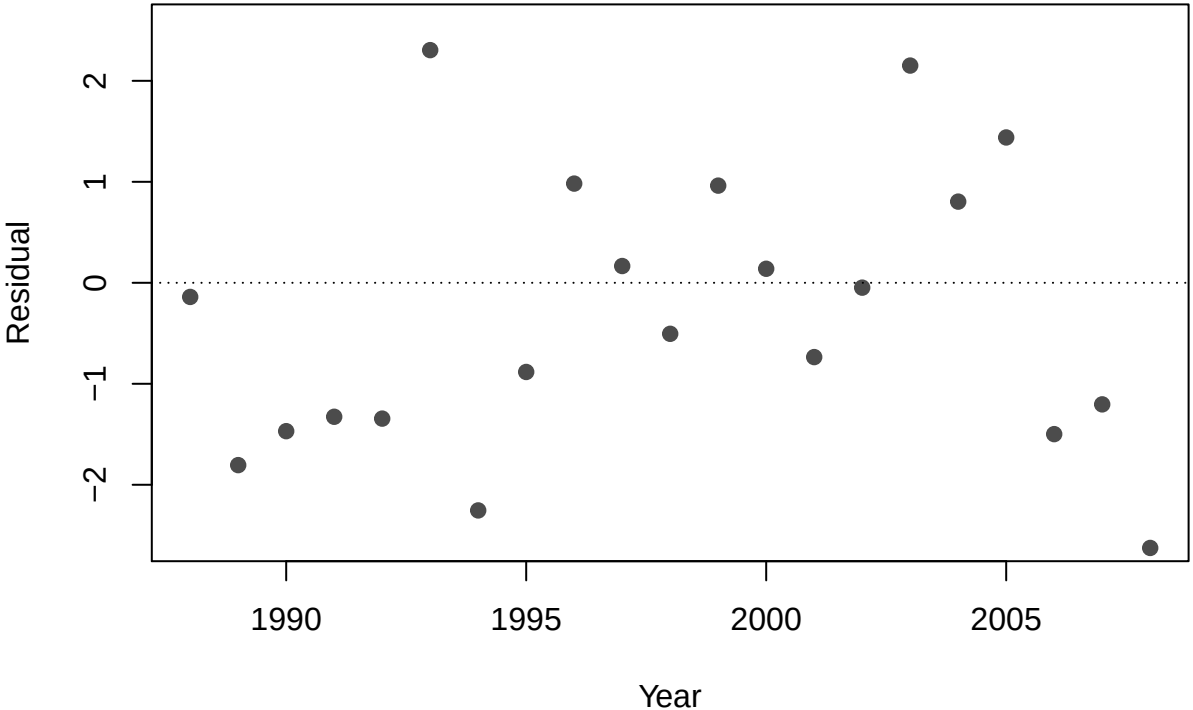

Index
0
5
10
15
1990
1995
2000
2005
Year

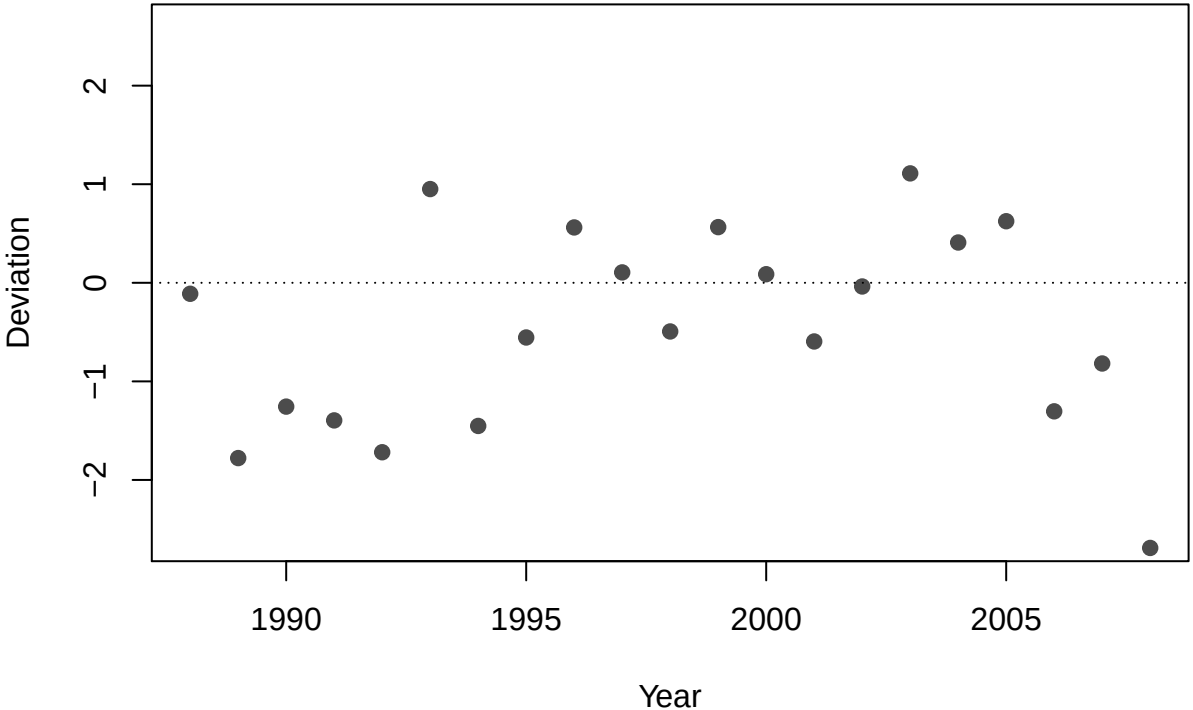

Expected index
Observed index
0
1
2
3
4
5
6
7

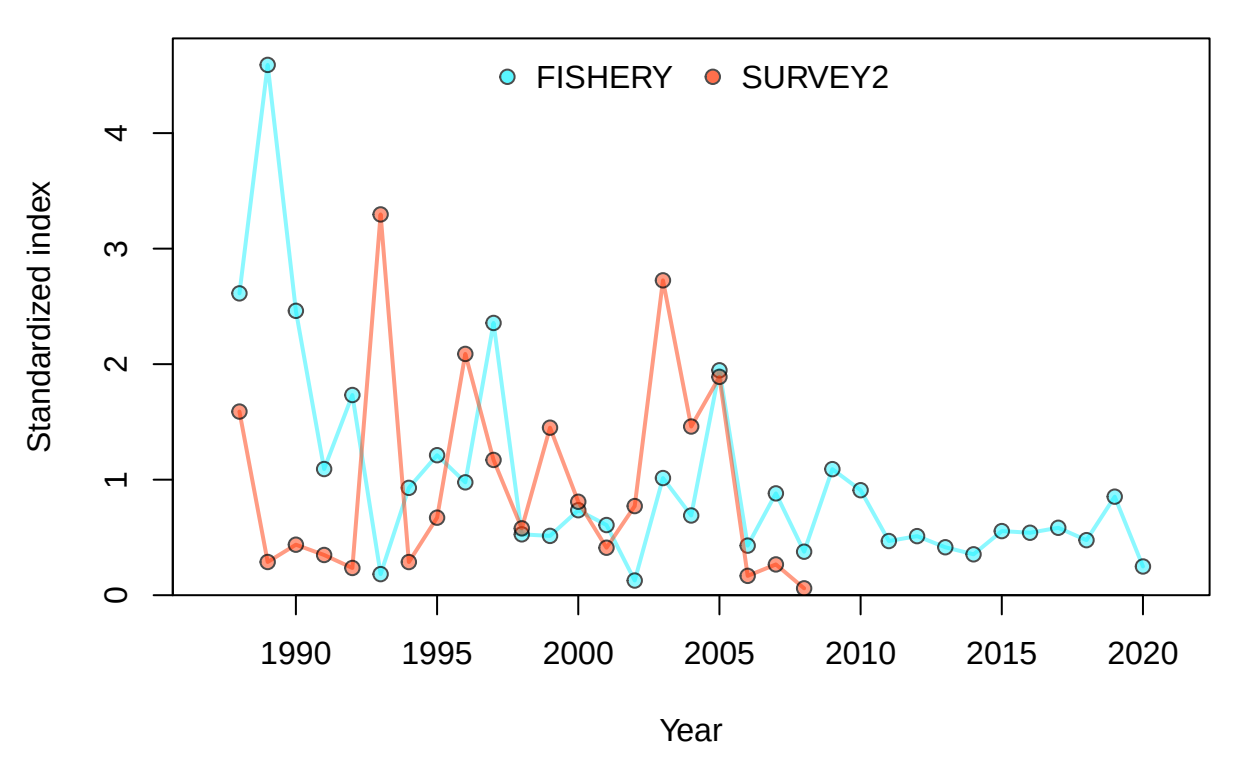

Log index
3
2
1
0
−1
−2
−3
−4
1990
1995
2000
2005
Year

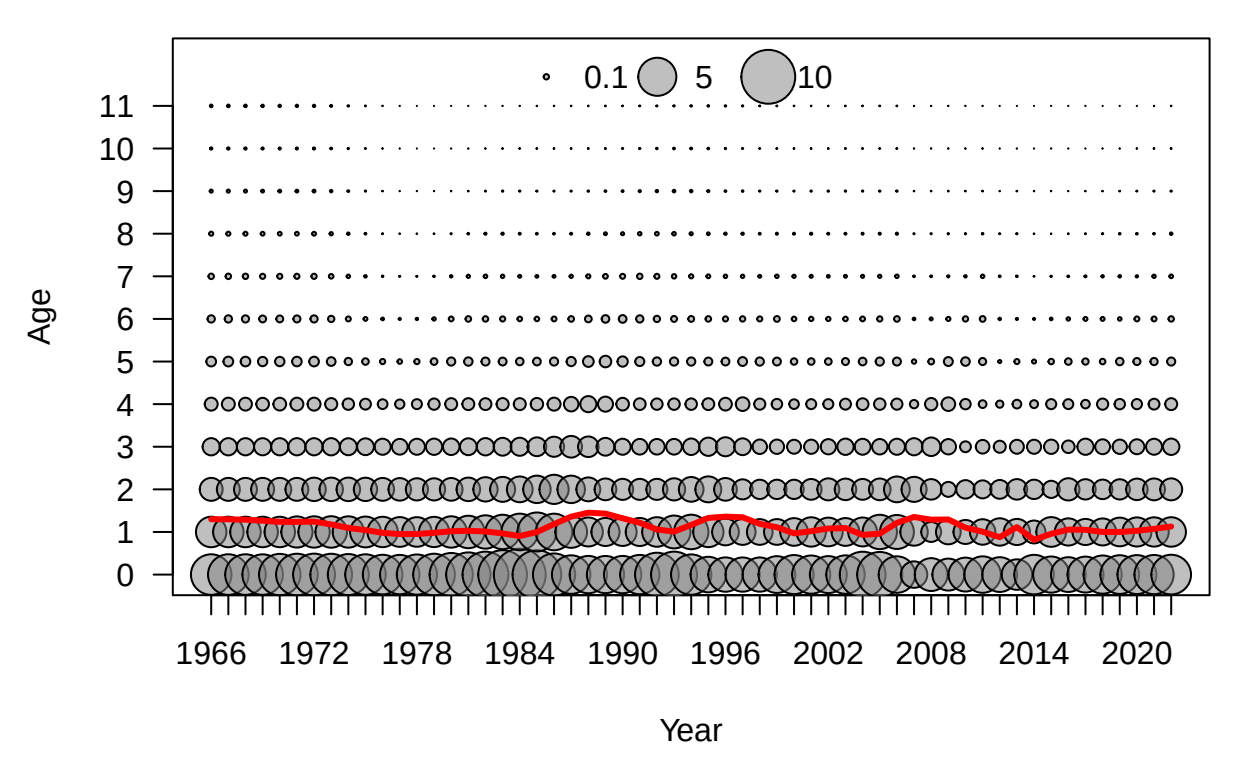

Log index
3
2
1
0
−1
−2
−3
−4
1990
1995
2000
2005
Year

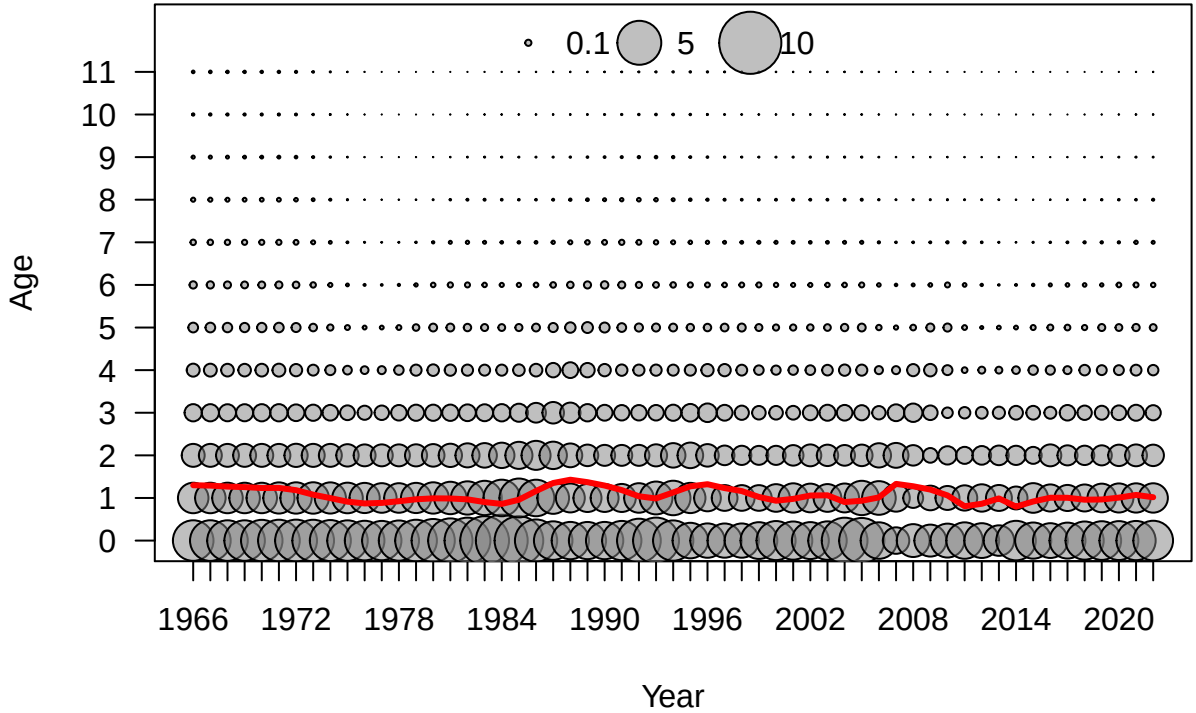

Log expected index
0.2
0.4
0.6
0.8
1.0
1.2
−2
−1
0
1
2
Log observed index

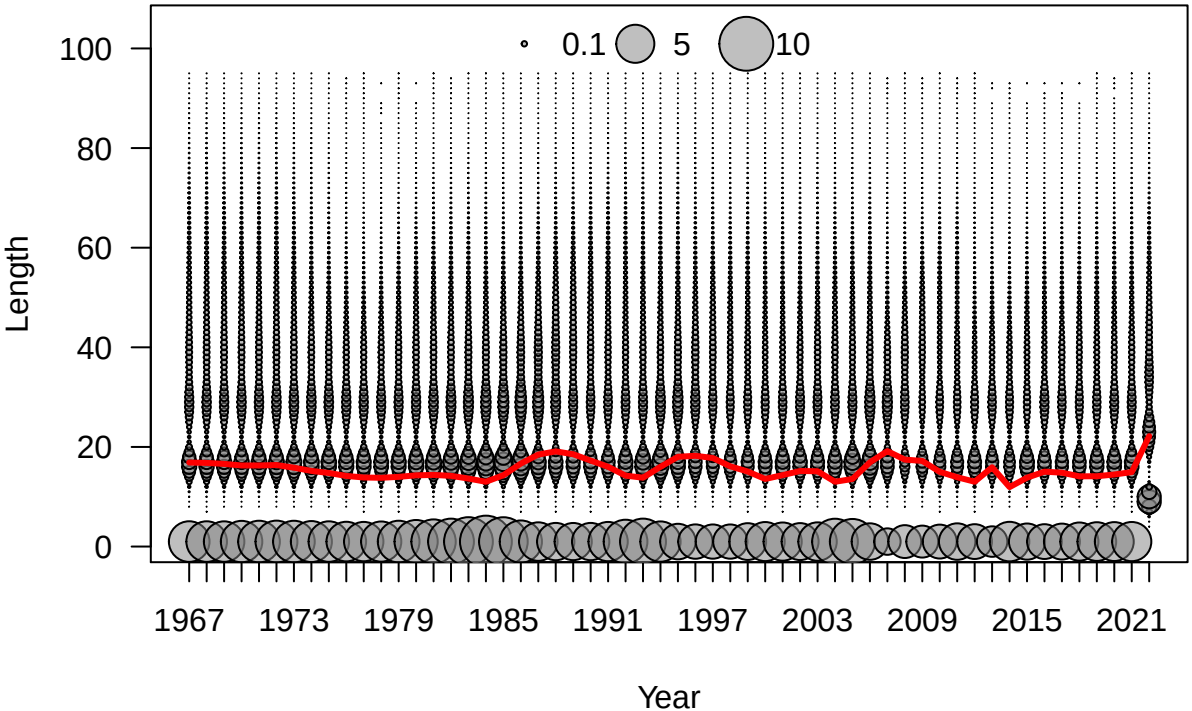

Residual
2
1
0
−1
−2
1990
1995
2000
2005
Year

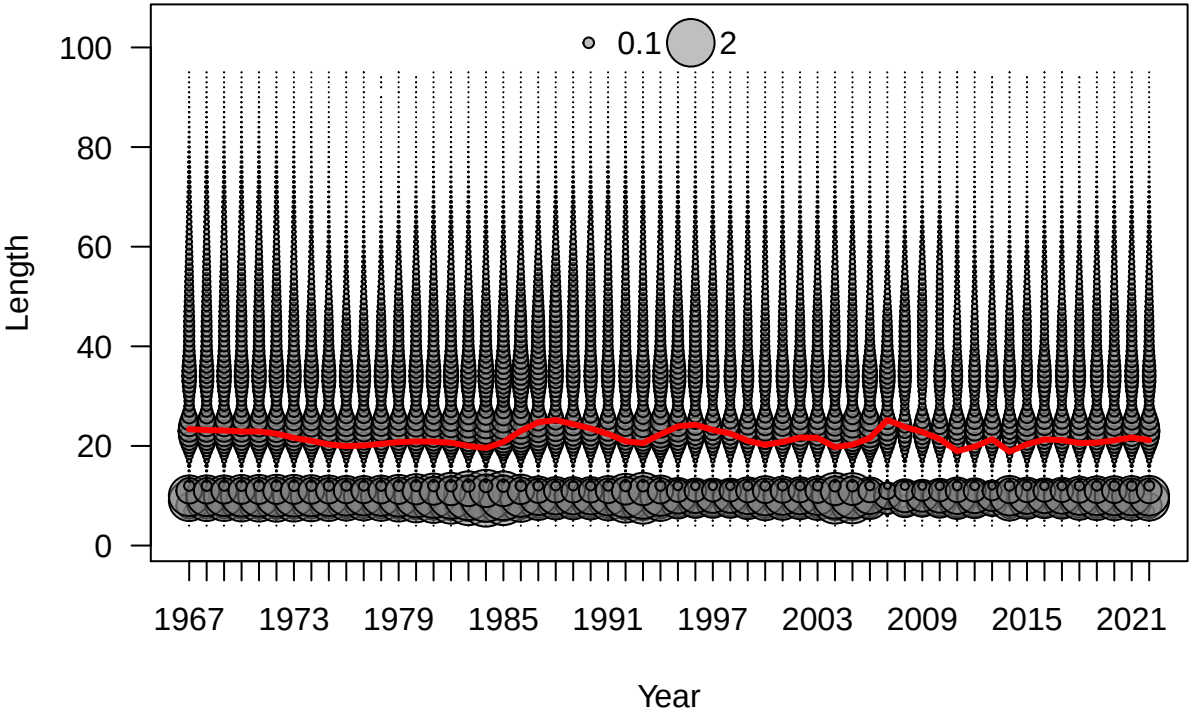

Deviation
2
1
0
−1
−2
1990
1995
2000
2005
Year

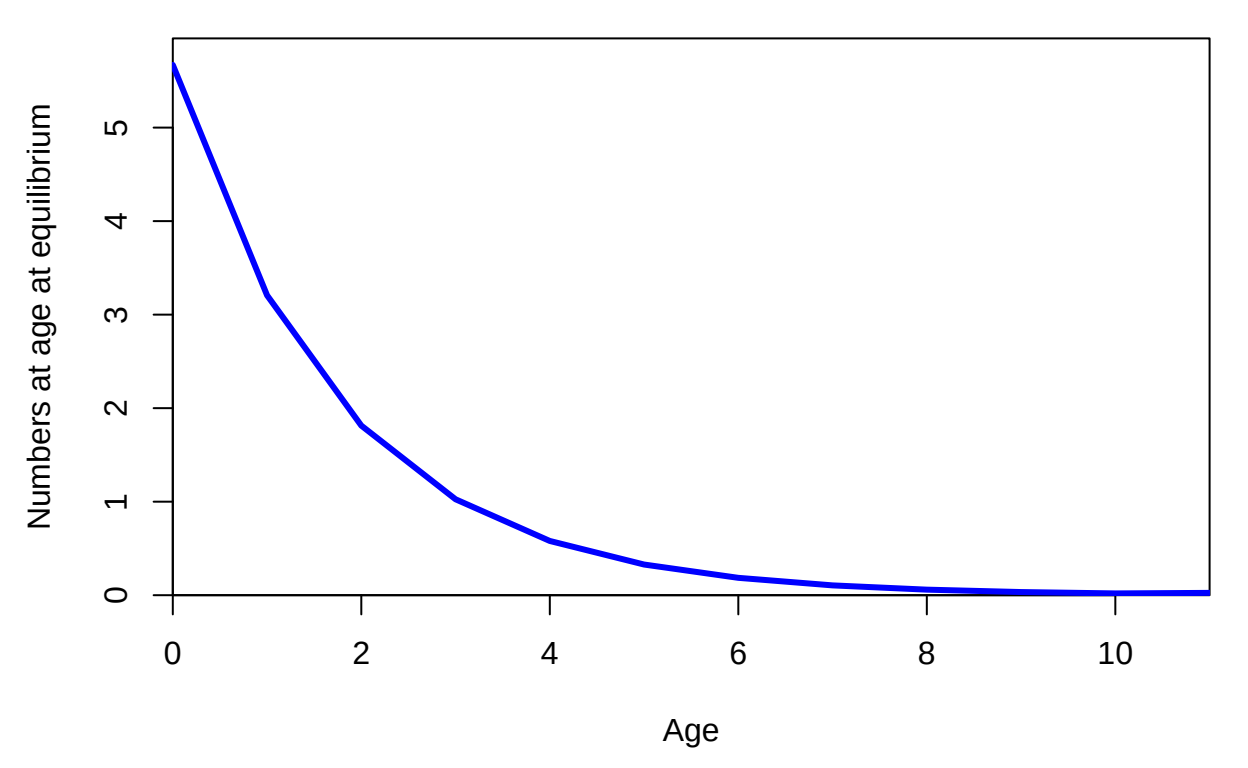

FISHERY
SURVEY2
Standardized index
0
1
2
3
4
1990
1995
2000
2005
2010
2015
2020
Year

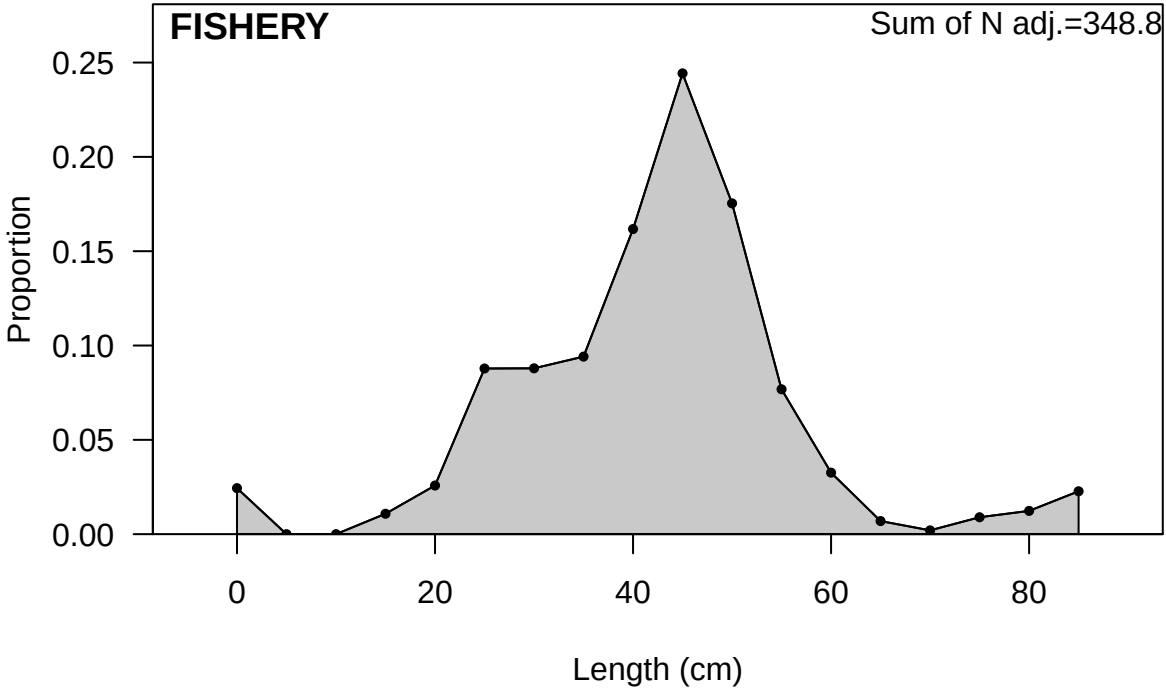

0.1
5
10
Age
11
10
9
8
7
6
5
4
3
2
1
0
1966
1972
1978
1984
1990
1996
2002
2008
2014
2020
Year

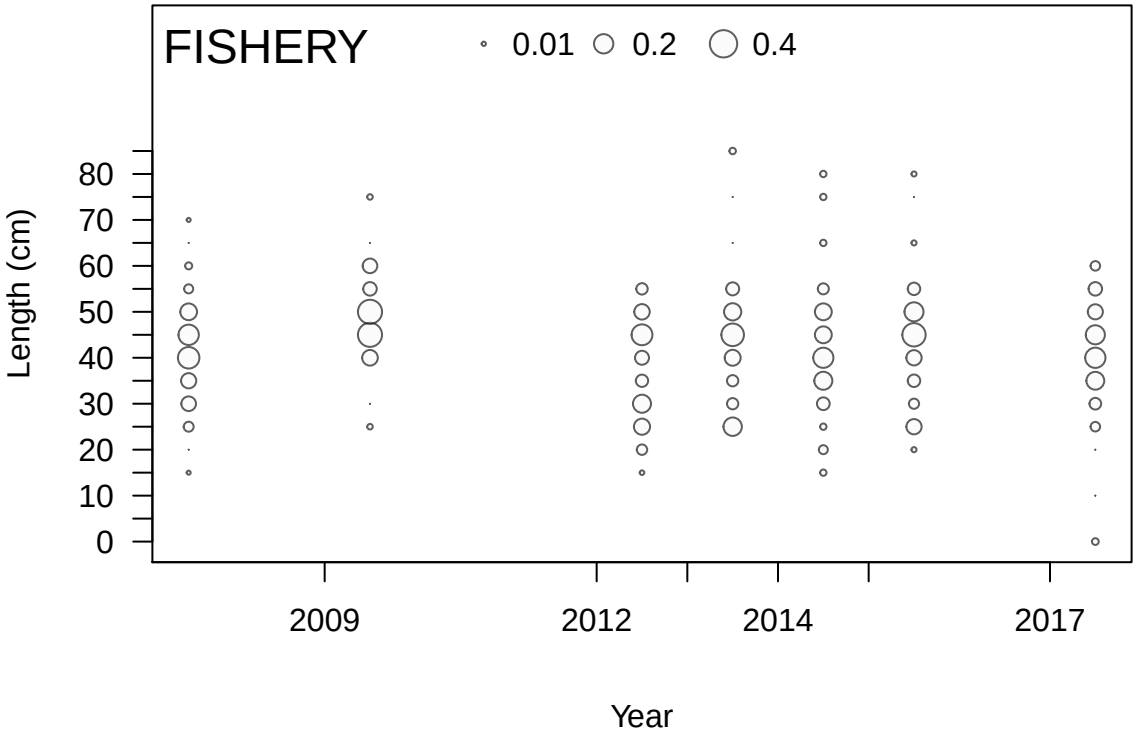

0.1
5
10
Age
11
10
9
8
7
6
5
4
3
2
1
0
1966
1972
1978
1984
1990
1996
2002
2008
2014
2020
Year

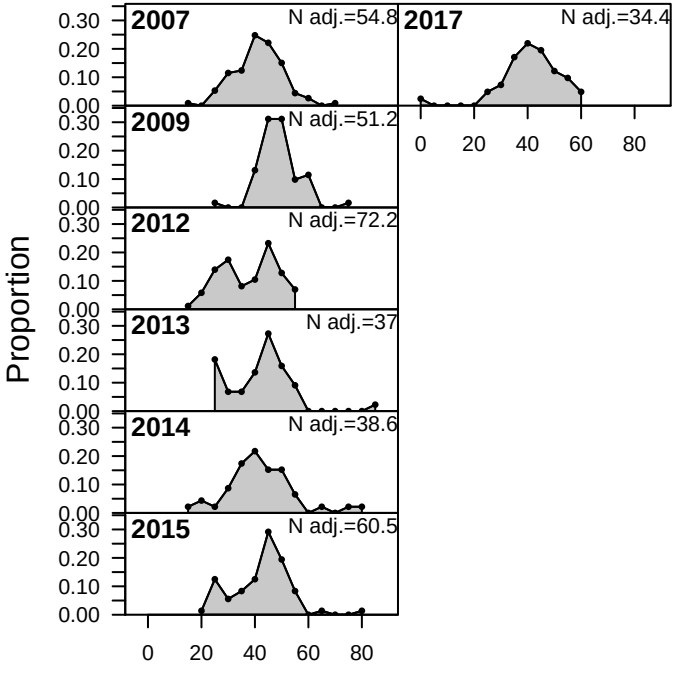

0.1
5
10
100
80
60
40
20
0
Length
1967
1973
1979
1985
1991
1997
2003
2009
2015
2021
Year

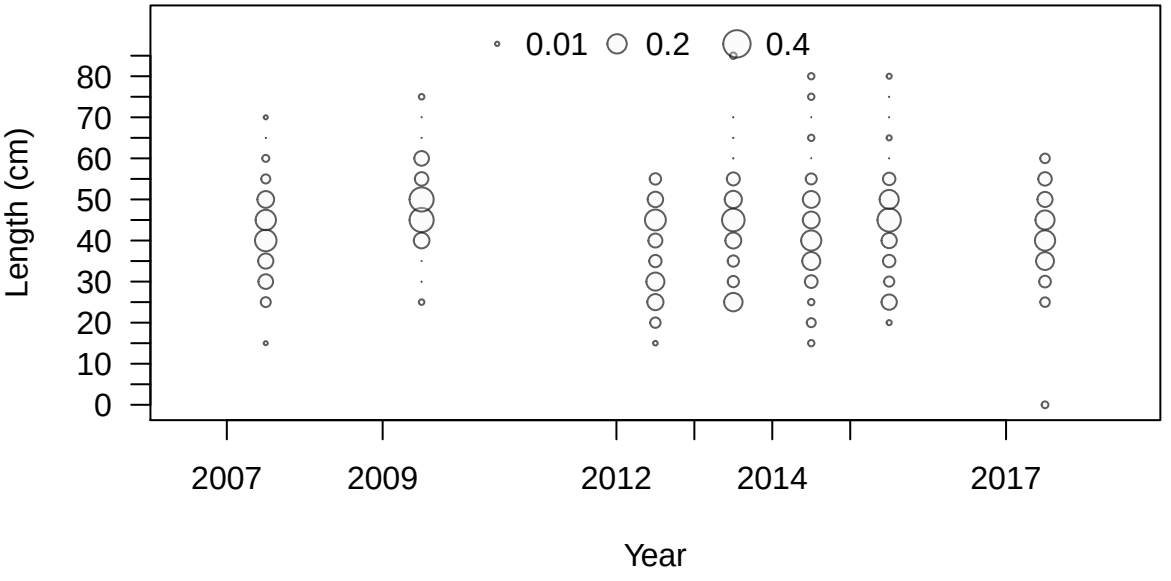

0.1
2
100
80
60
40
20
0
Length
1967
1973
1979
1985
1991
1997
2003
2009
2015
2021
Year

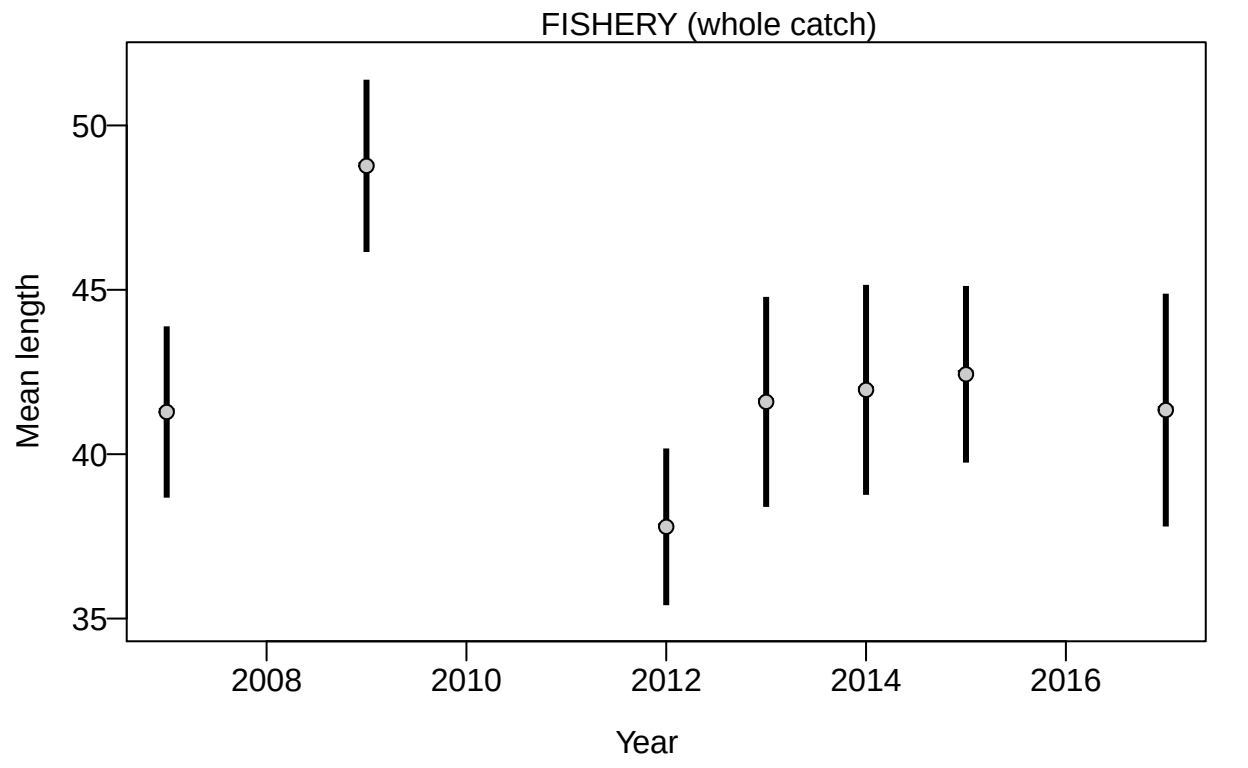

Numbers at age at equilibrium
0
1
2
3
4
5
0
2
4
6
8
10
Age

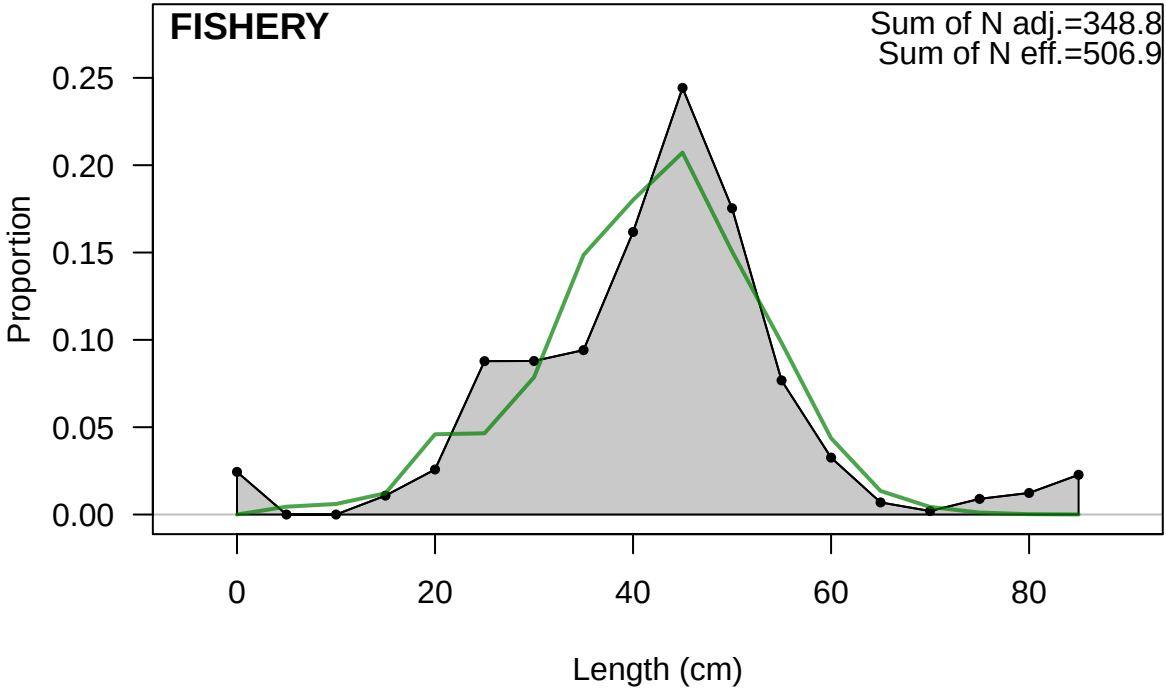

FISHERY
Sum of N adj.=348.8
Proportion
0.25
0.20
0.15
0.10
0.05
0.00
0
20
40
60
80
Length (cm)

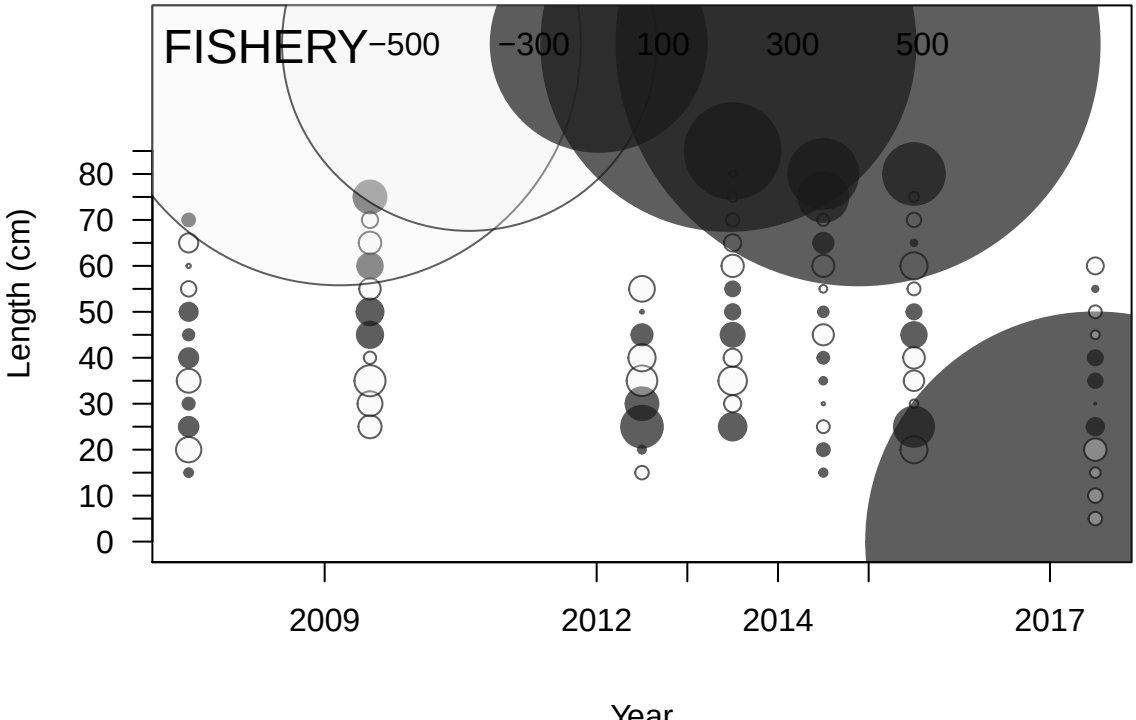

FISHERY
0.01
0.2
0.4
Length (cm)
0
10
20
30
40
50
60
70
80
2009
2012
2014
2017
Year

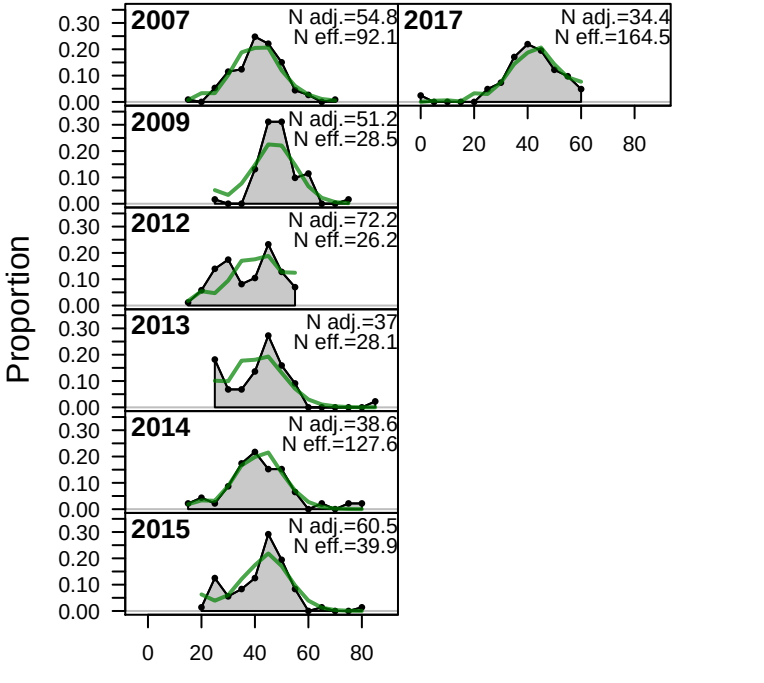

2007
N adj.=54.8
2017
N adj.=34.4
2009
N adj.=51.2
2012
N adj.=72.2
2013
N adj.=37
2014
N adj.=38.6
2015
N adj.=60.5
0.30
0.20
0.10
0.00
0
20
40
60
80
Proportion
Length (cm)

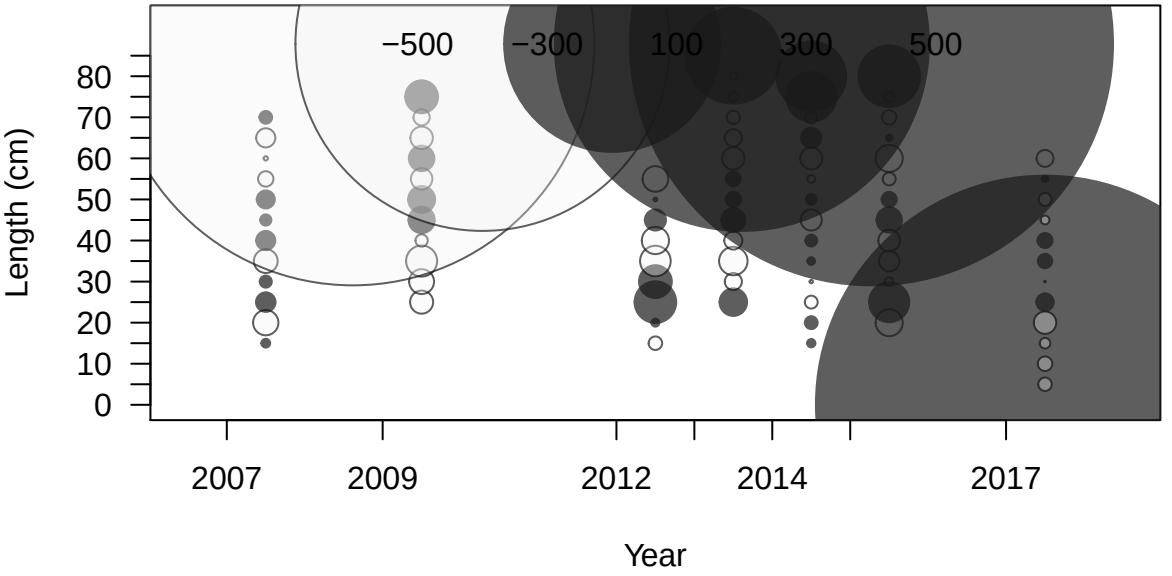

0.01
0.2
0.4
Length (cm)
0
10
20
30
40
50
60
70
80
2007
2009
2012
2014
2017
Year

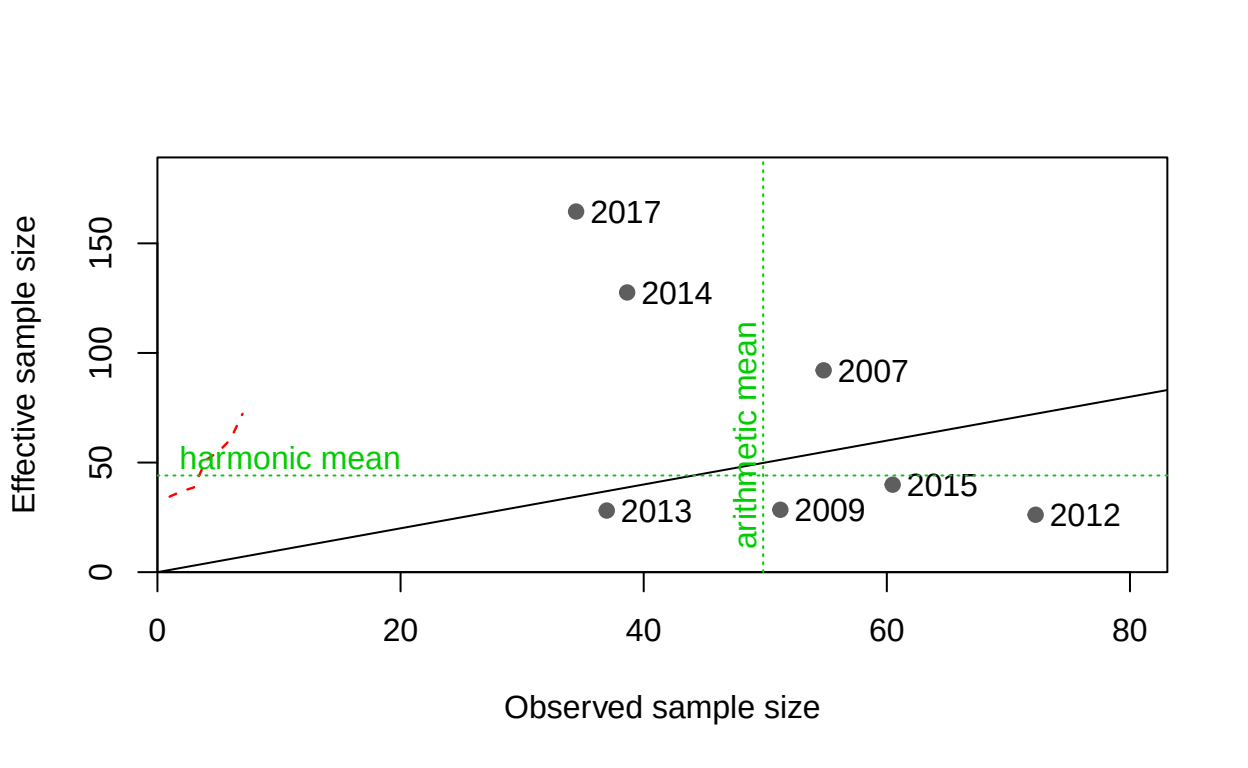

FISHERY (whole catch)
Mean length
50
45
40
35
2008
2010
2012
2014
2016
Year

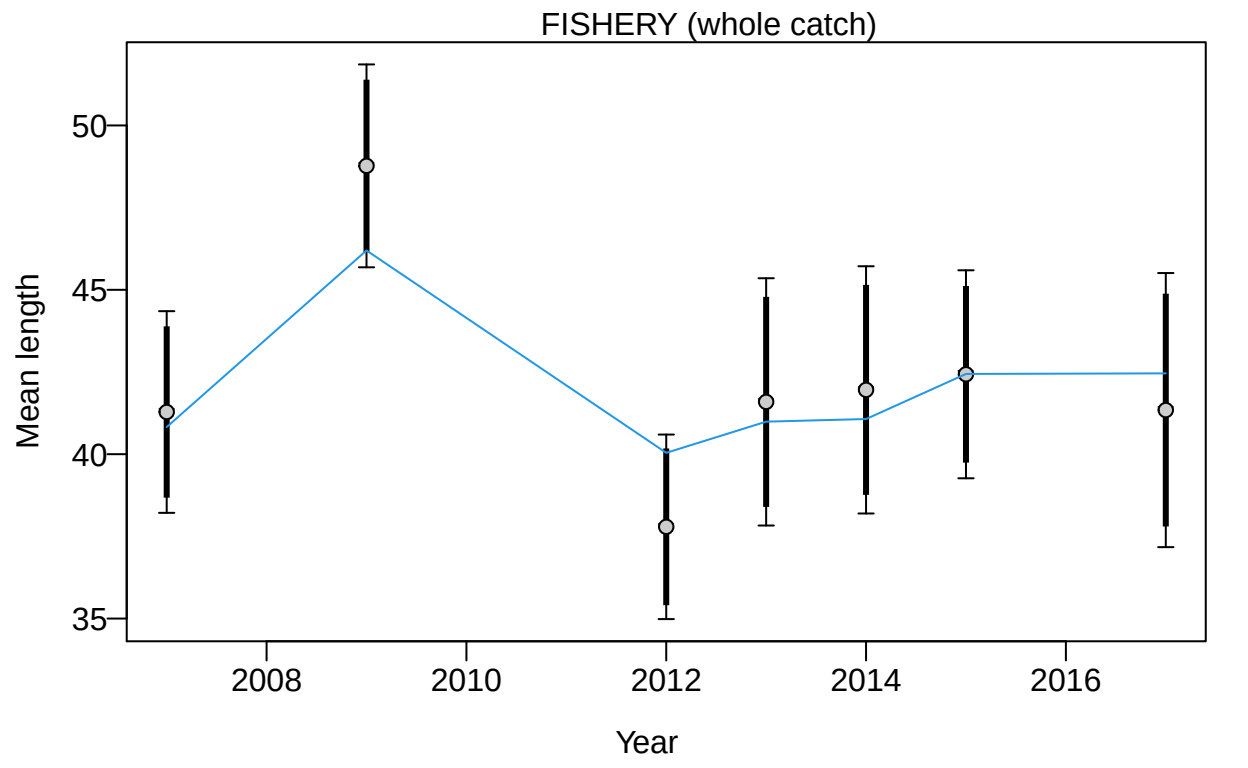

FISHERY
Sum of N adj.=348.8
Sum of N eff.=506.9
Proportion
0.25
0.20
0.15
0.10
0.05
0.00
0
20
40
60
80
Length (cm)

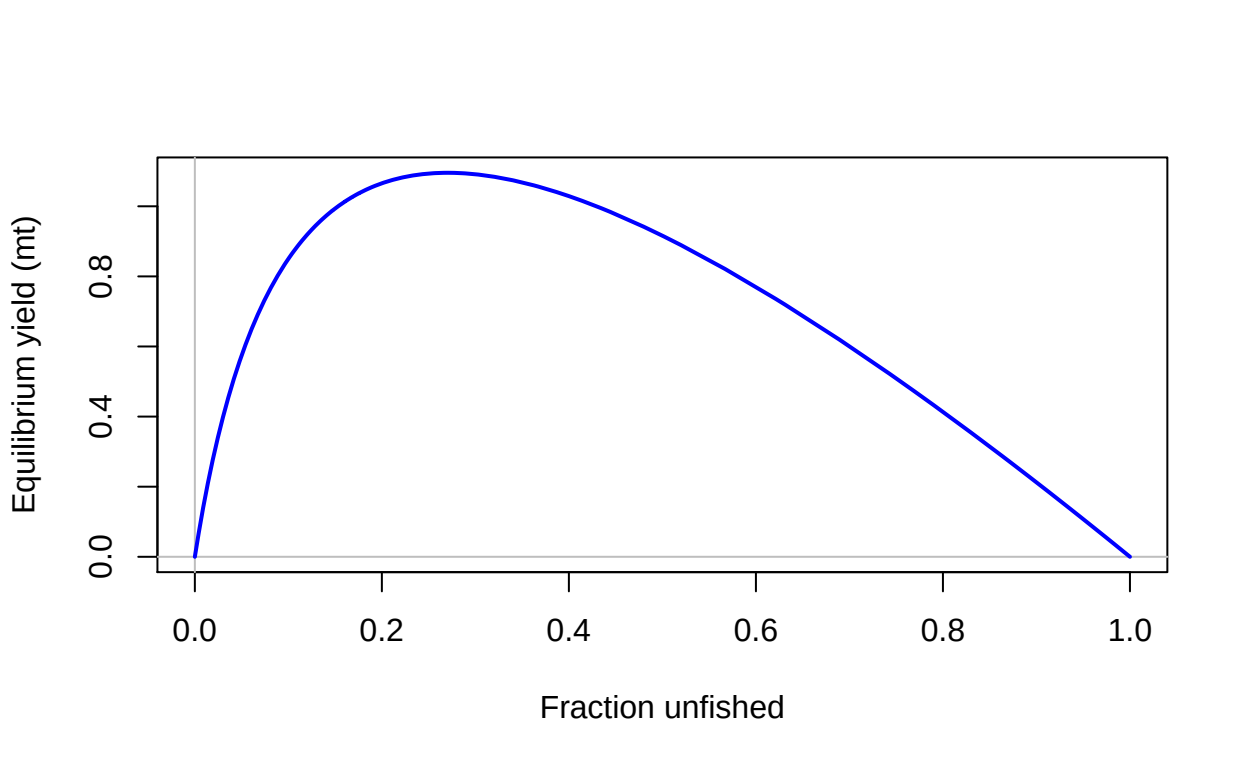

FISHERY
−500
−300
100
300
500
Length (cm)
0
10
20
30
40
50
60
70
80
2009
2012
2014
2017
Year

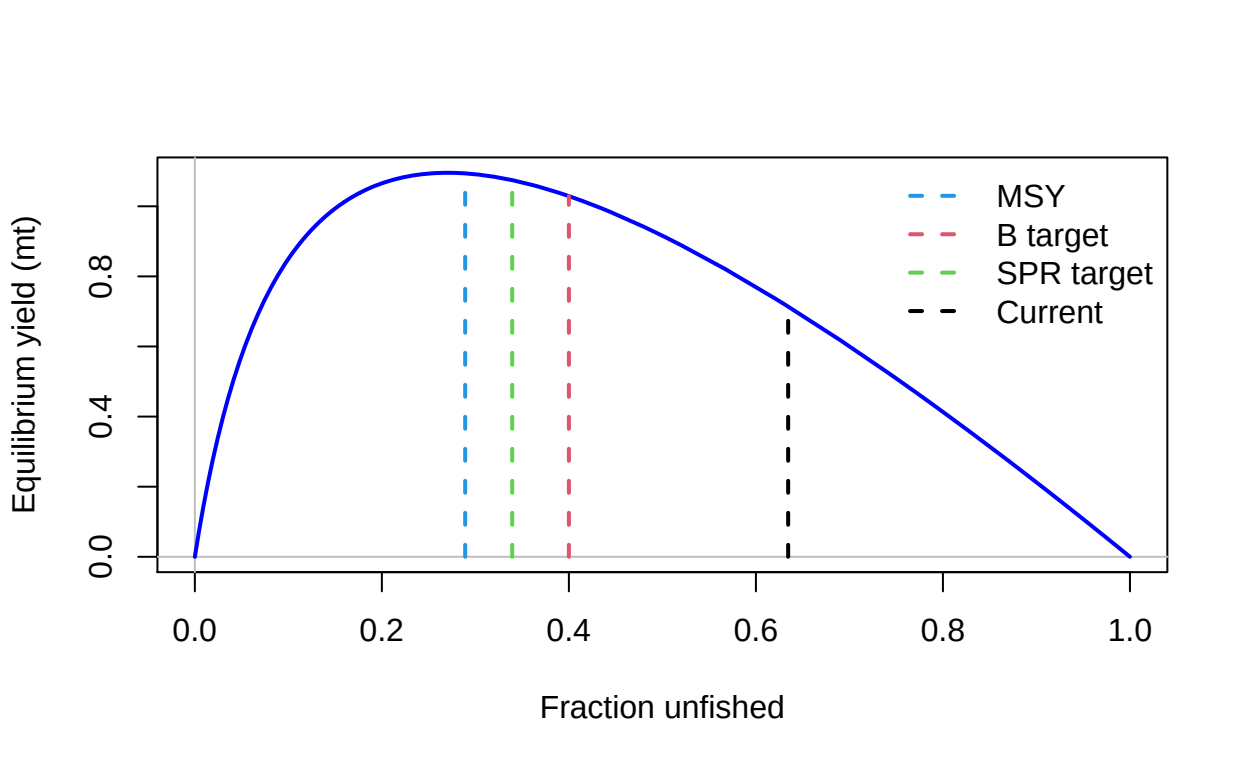

2007
N adj.=54.8
N eff.=92.1
2017
N adj.=34.4
N eff.=164.5
2009
N adj.=51.2
N eff.=28.5
2012
N adj.=72.2
N eff.=26.2
2013
N adj.=37
N eff.=28.1
2014
N adj.=38.6
N eff.=127.6
2015
N adj.=60.5
N eff.=39.9
Proportion
0.00
0.10
0.20
0.30
0
20
40
60
80
Length (cm)

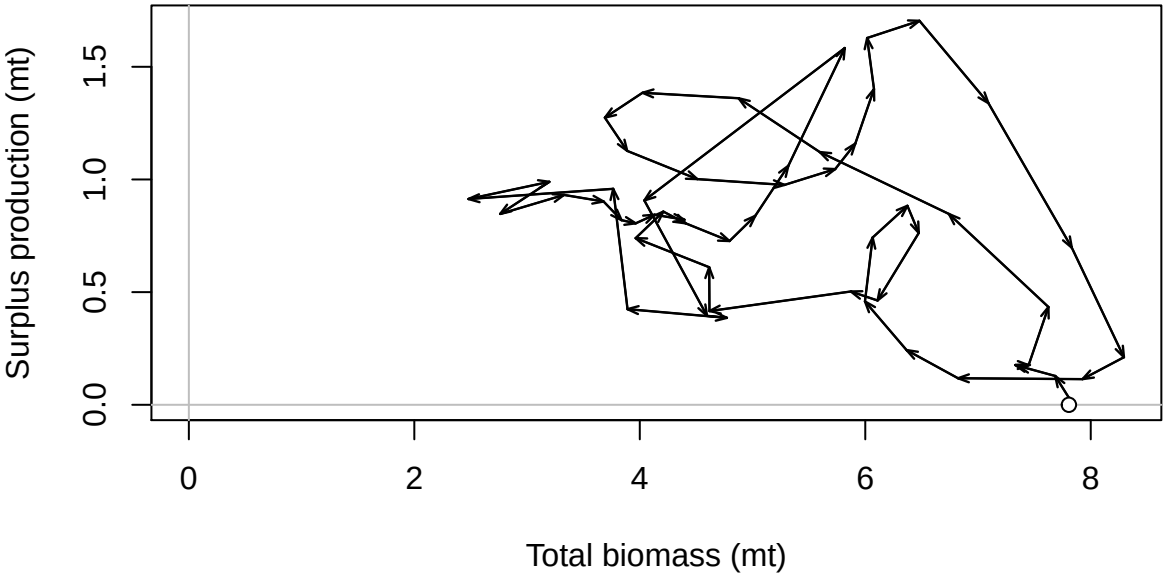

−500
−300
100
300
500
Length (cm)
0
10
20
30
40
50
60
70
80
2007
2009
2012
2014
2017
Year

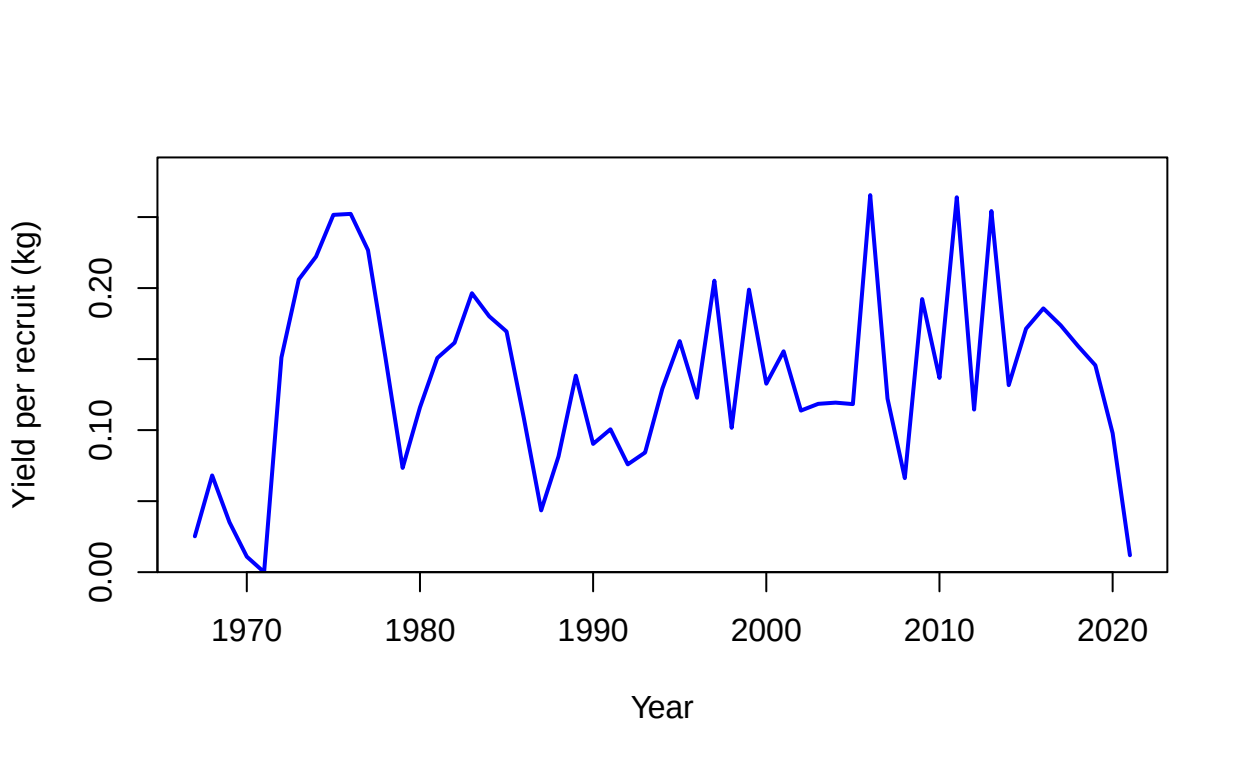

Effective sample size
0
50
100
150
0
20
40
60
80
Observed sample size
2017
2014
2007
2015
2013
2009
2012
harmonic mean
arithmetic mean

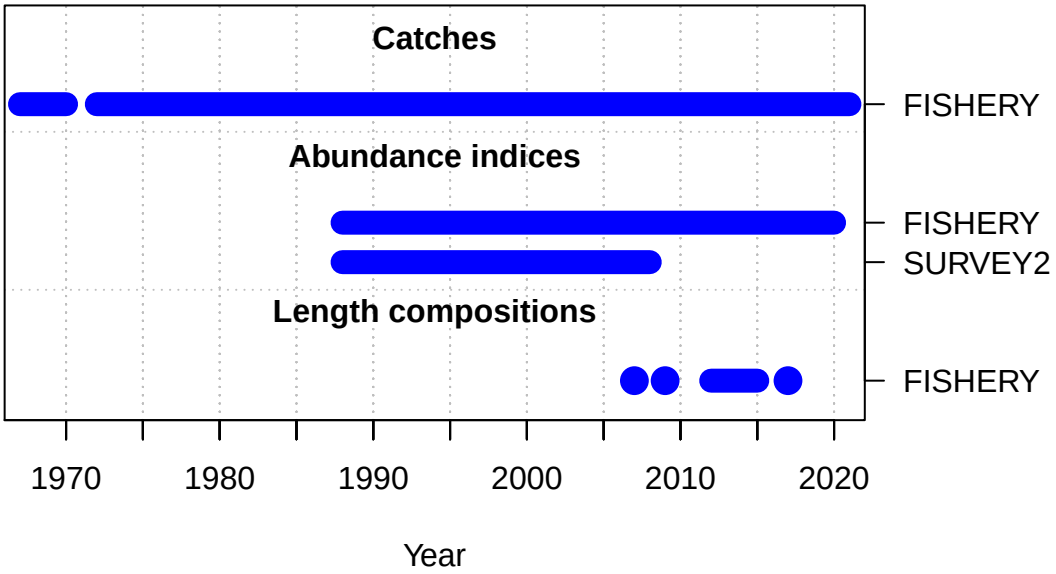

FISHERY (whole catch)
Mean length
50
45
40
35
2008
2010
2012
2014
2016
Year

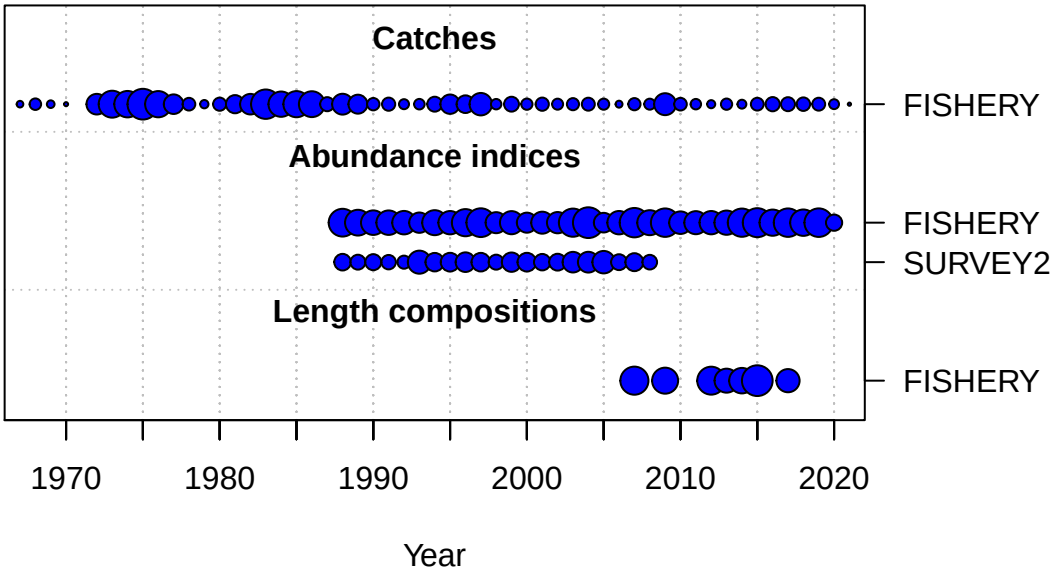

Equilibrium yield (mt)
0.0
0.4
0.8
0.0
0.2
0.4
0.6
0.8
1.0
Fraction unfished


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


Surplus production (mt)
0.0
0.5
1.0
1.5
0
2
4
6
8
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
SURVEY2
Length compositions
FISHERY
1970
1980
1990
2000
2010
2020
Year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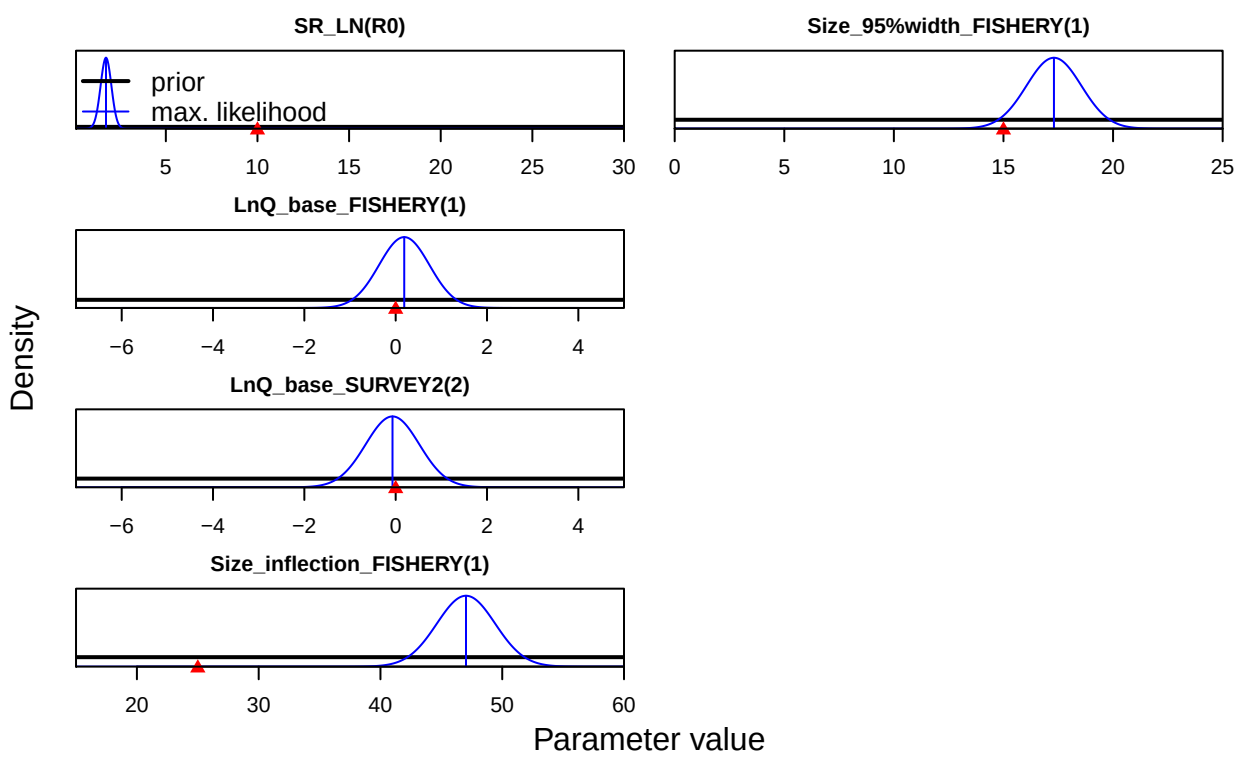
SR_LN(R0)
prior
max. likelihood
5
10
15
20
25
30
Size_95%width_FISHERY(1)
0
5
10
15
20
25
LnQ_base_FISHERY(1)
−6
−4
−2
0
2
4
LnQ_base_SURVEY2(2)
−6
−4
−2
0
2
4
Size_inflection_FISHERY(1)
20
30
40
50
60
Density
Parameter value