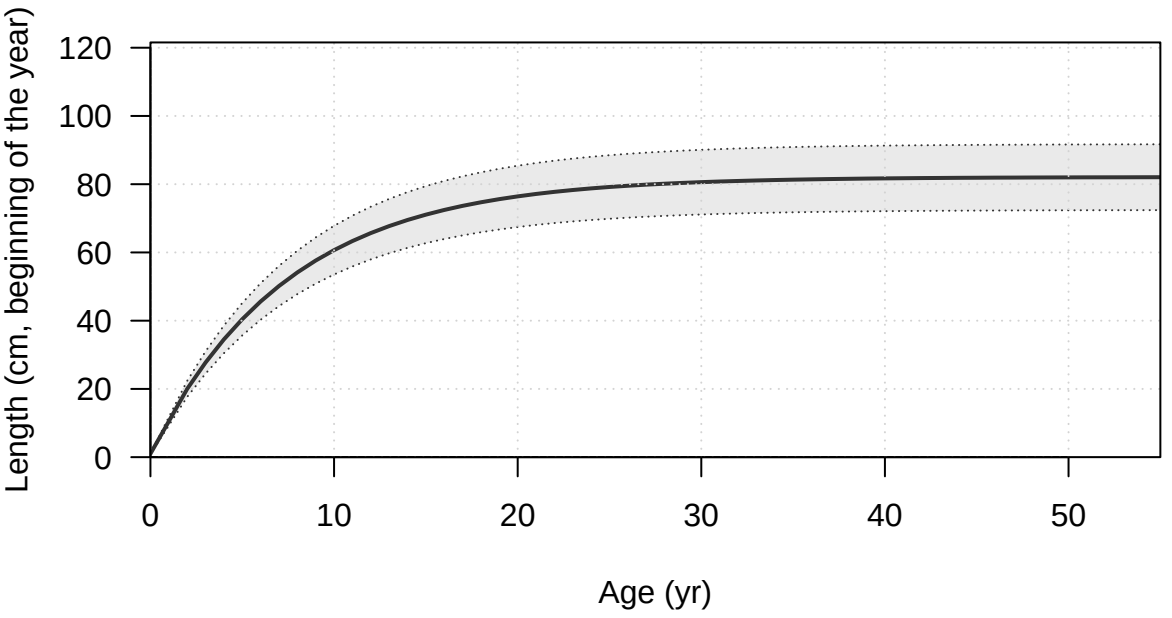
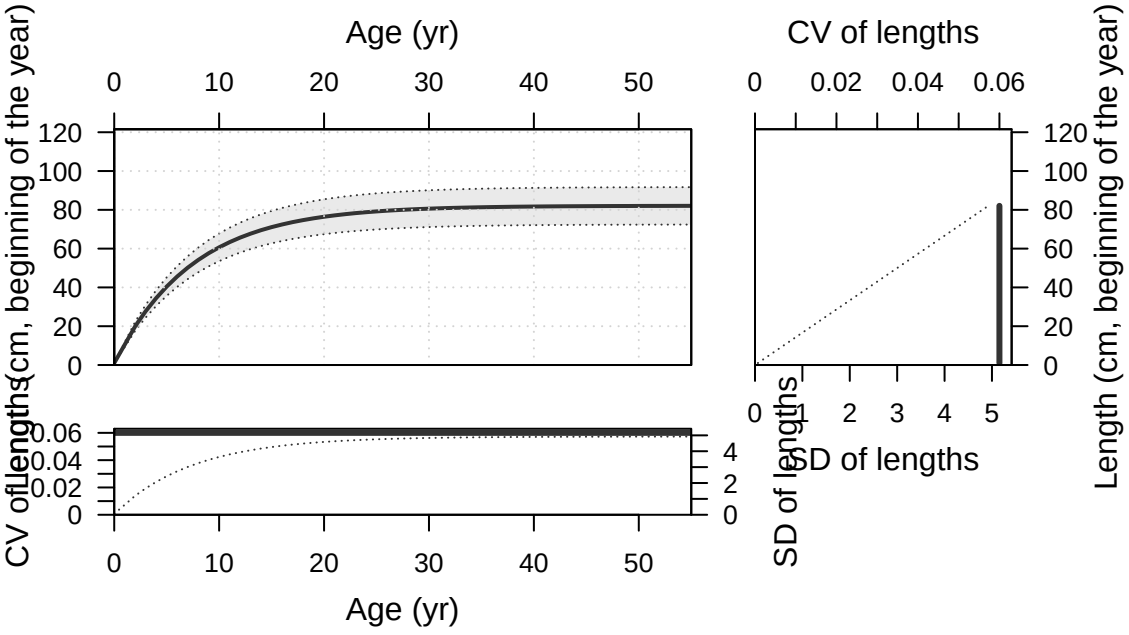
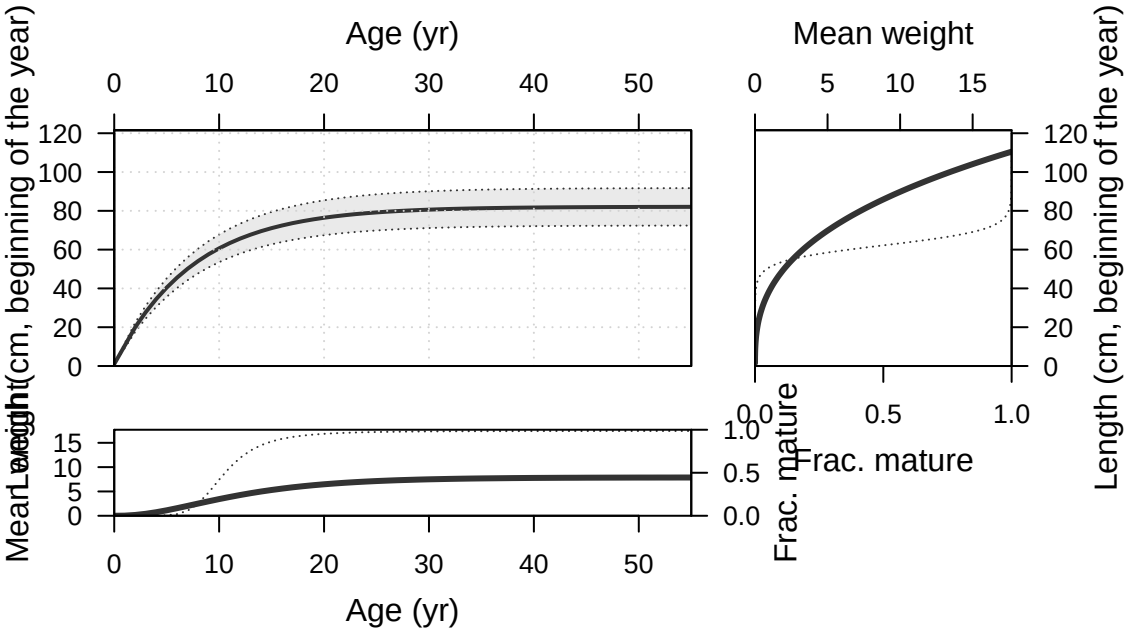
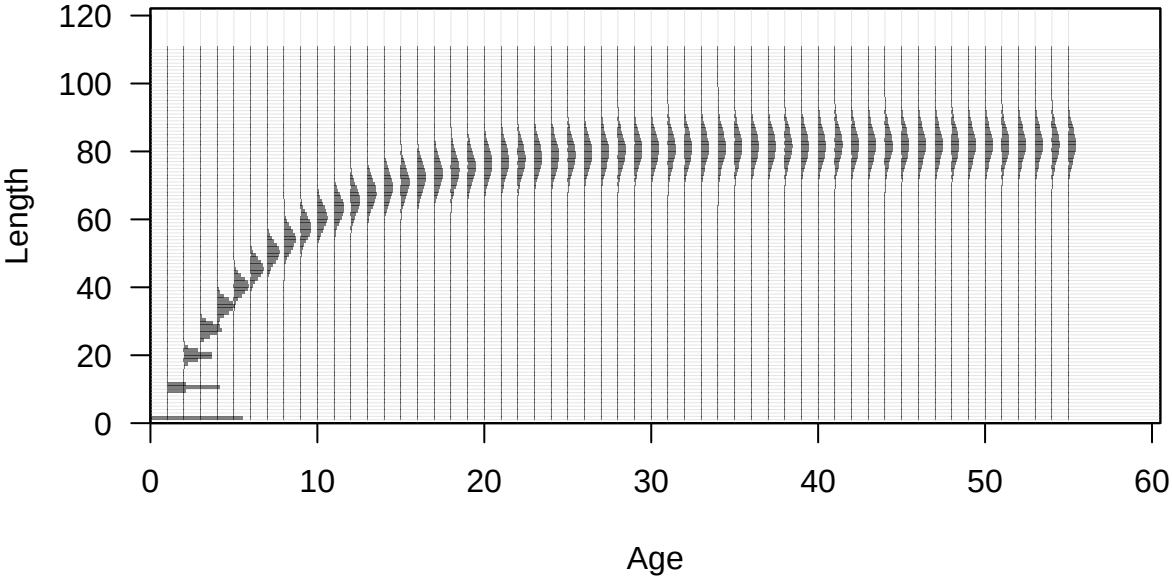
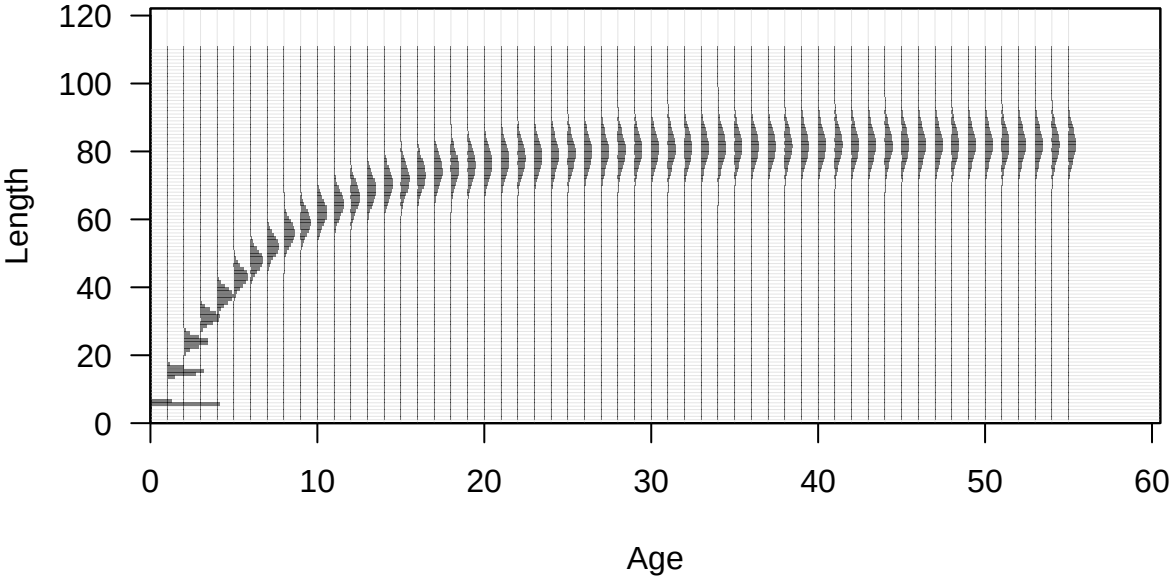
Plots created using the 'r4ss' package in R
Stock Synthesis version: 3.30.19.0
StartTime: Mon Jul 18 13:12:59 2022
Data_File: data.ss
Control_File: control.ss

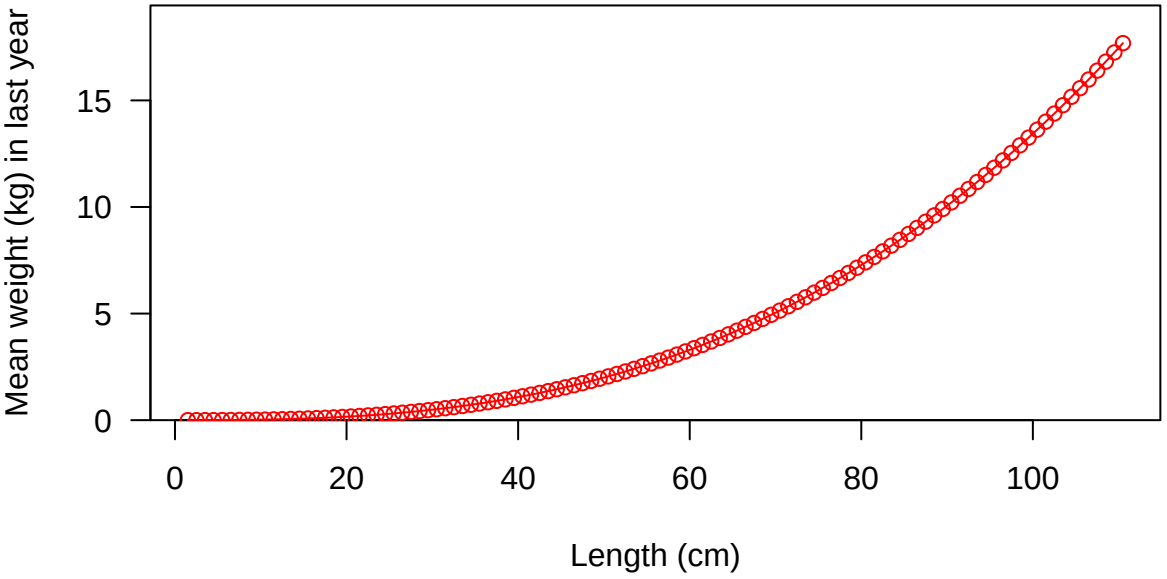

Length (cm, beginning of the year)
120
100
80
60
40
20
0
0
10
20
30
40
50
Age (yr)

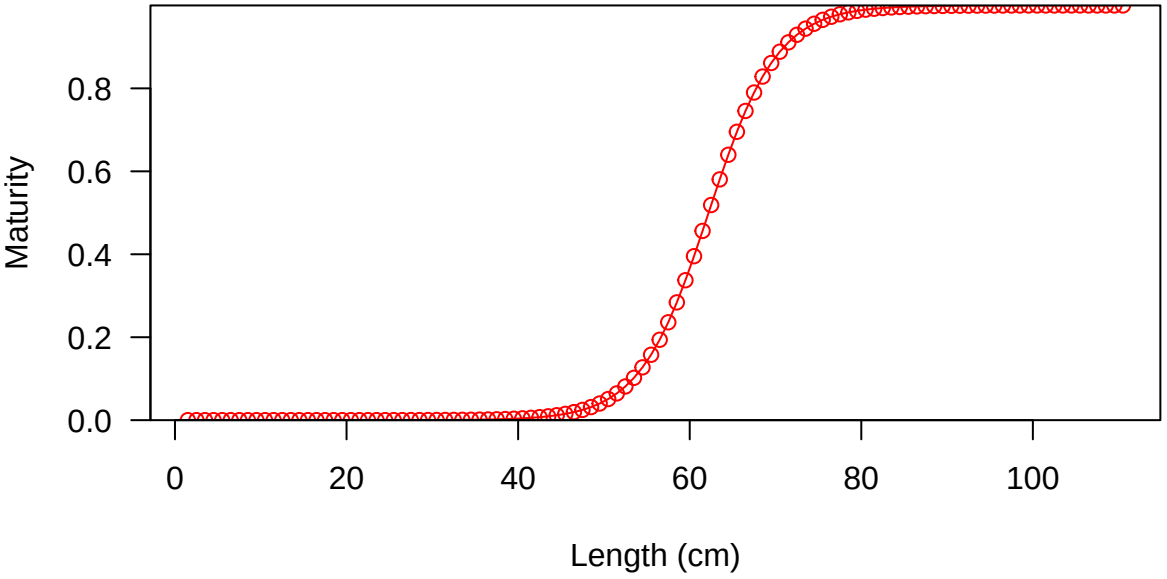

Age (yr)
0
10
20
30
40
50
120
100
80
60
40
20
0
Length (cm, beginning of the year)
CV of lengths
0.06
0.04
0.02
0
SD of lengths
4
2
0
Age (yr)
CV of lengths
0
0.02
0.04
0.06
0
1
2
3
4
5
SD of lengths
Length (cm, beginning of the year)

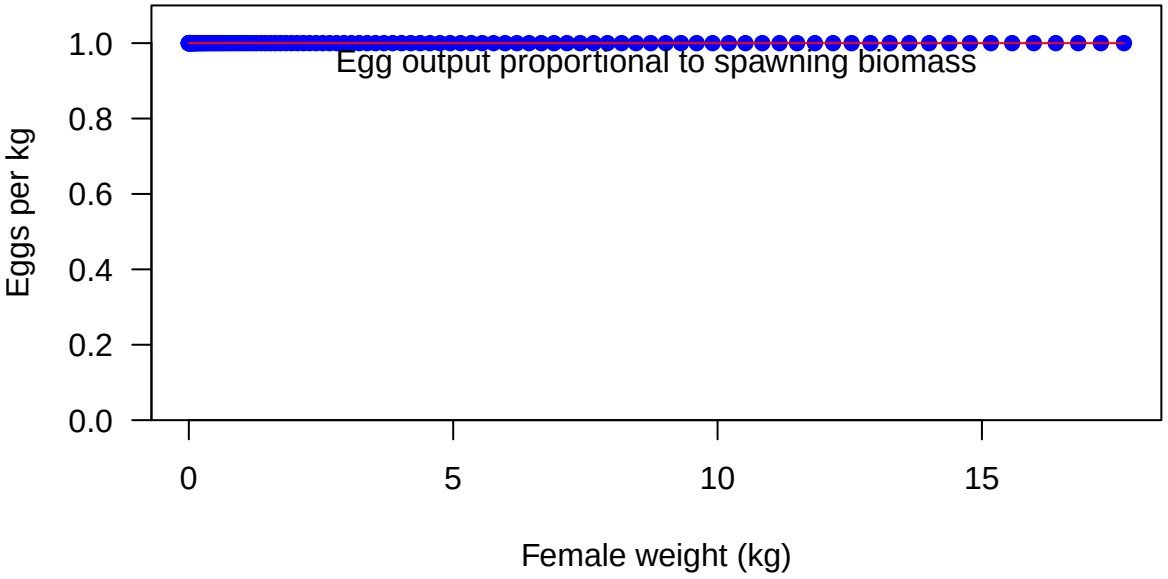

Age (yr)
Mean weight
Length (cm, beginning of the year)
Mean weight
Age (yr)
Frac. mature
Frac. mature
Length (cm, beginning of the year)

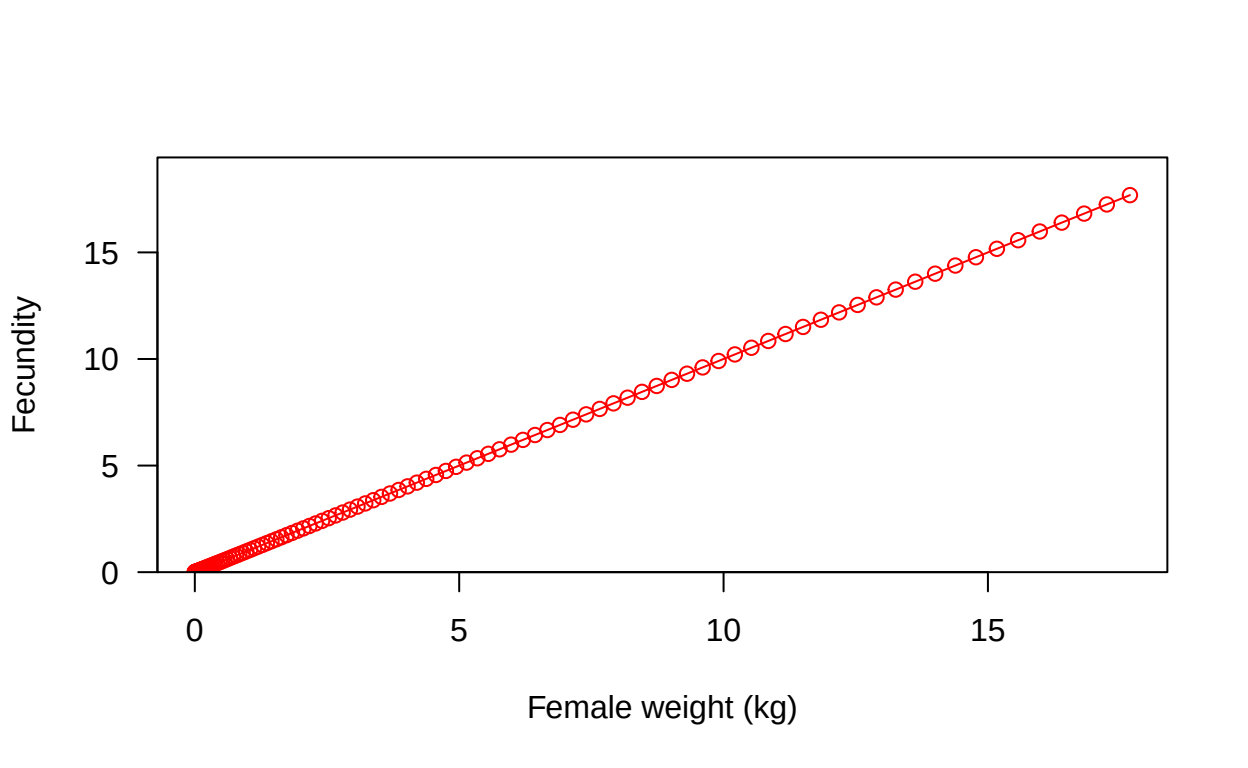

120
100
80
60
40
20
0
Length
0
10
20
30
40
50
60
Age

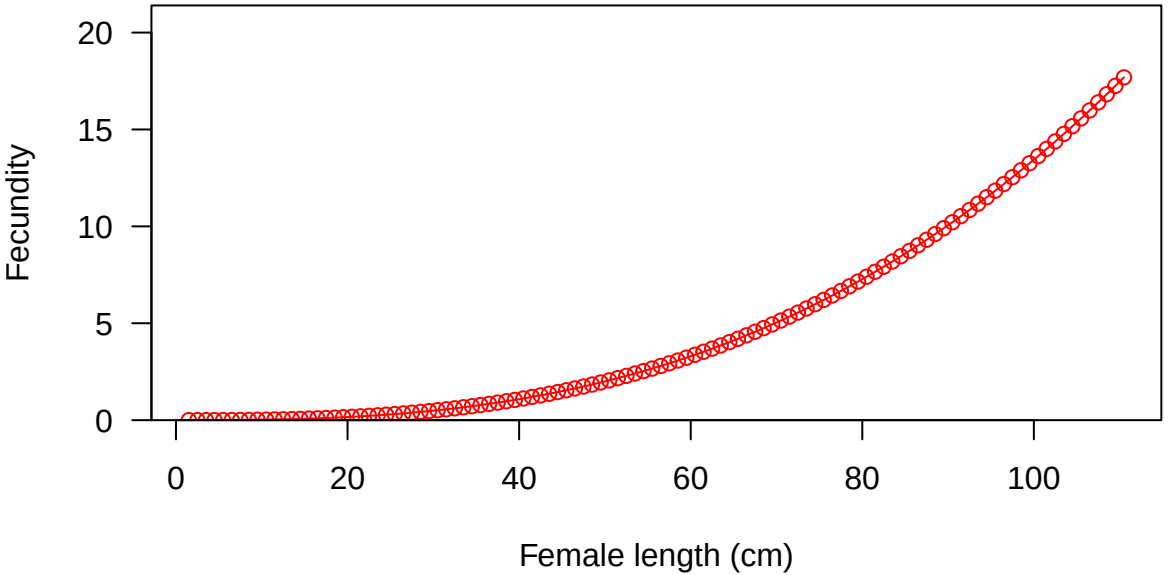

120
100
80
60
40
20
0
Length
0
10
20
30
40
50
60
Age

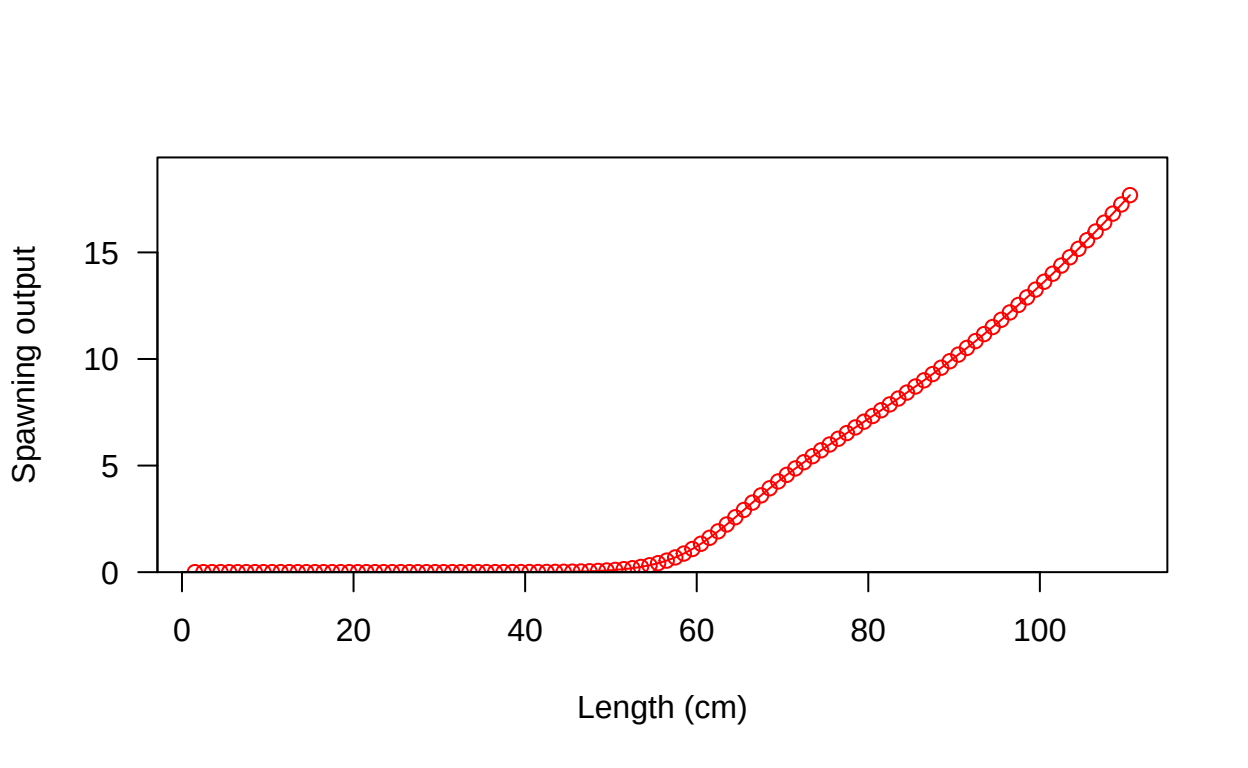

Mean weight (kg) in last year
0
5
10
15
0
20
40
60
80
100
Length (cm)

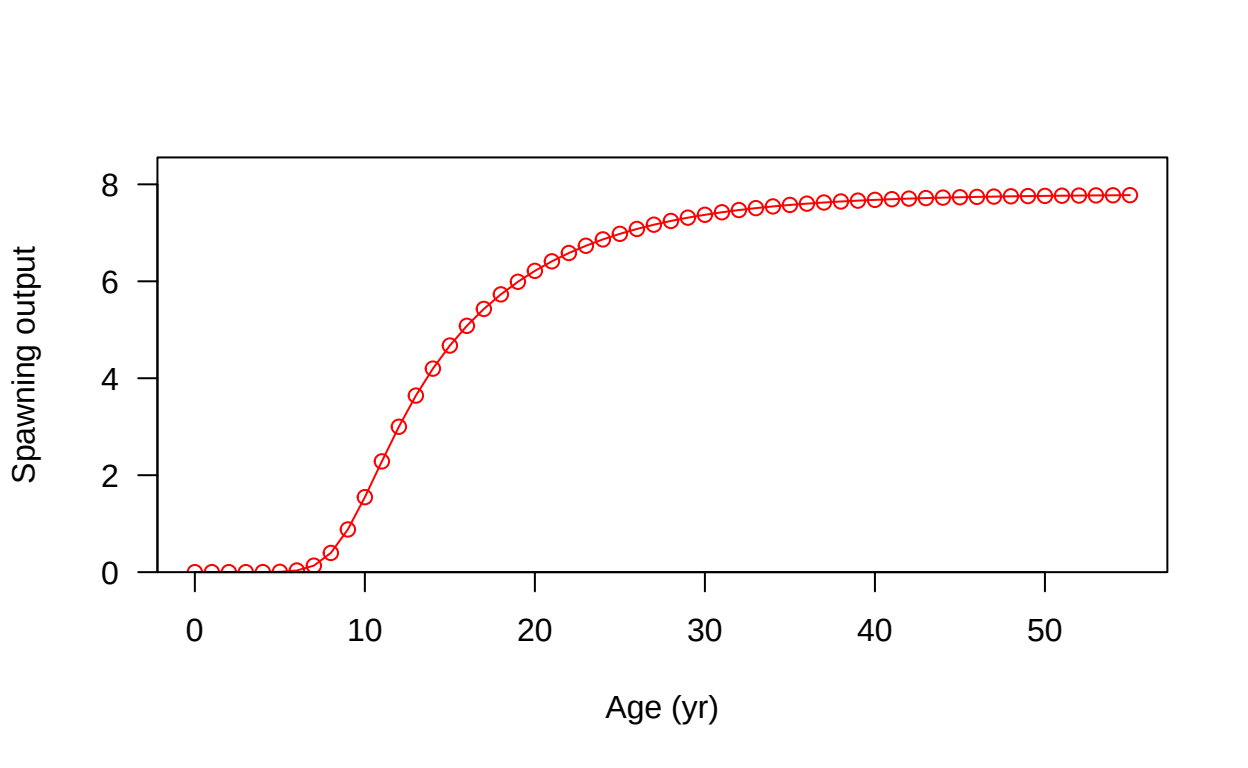

Maturity
0.0
0.2
0.4
0.6
0.8
0
20
40
60
80
100
Length (cm)

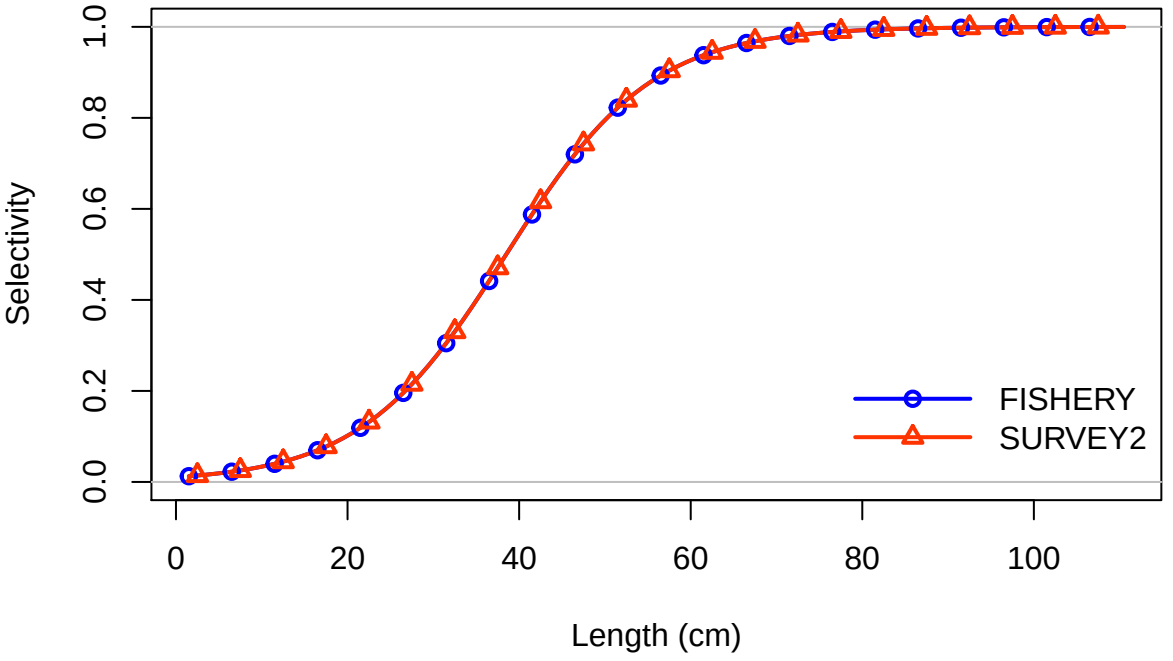

Egg output proportional to spawning biomass
Eggs per kg
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
Female weight (kg)

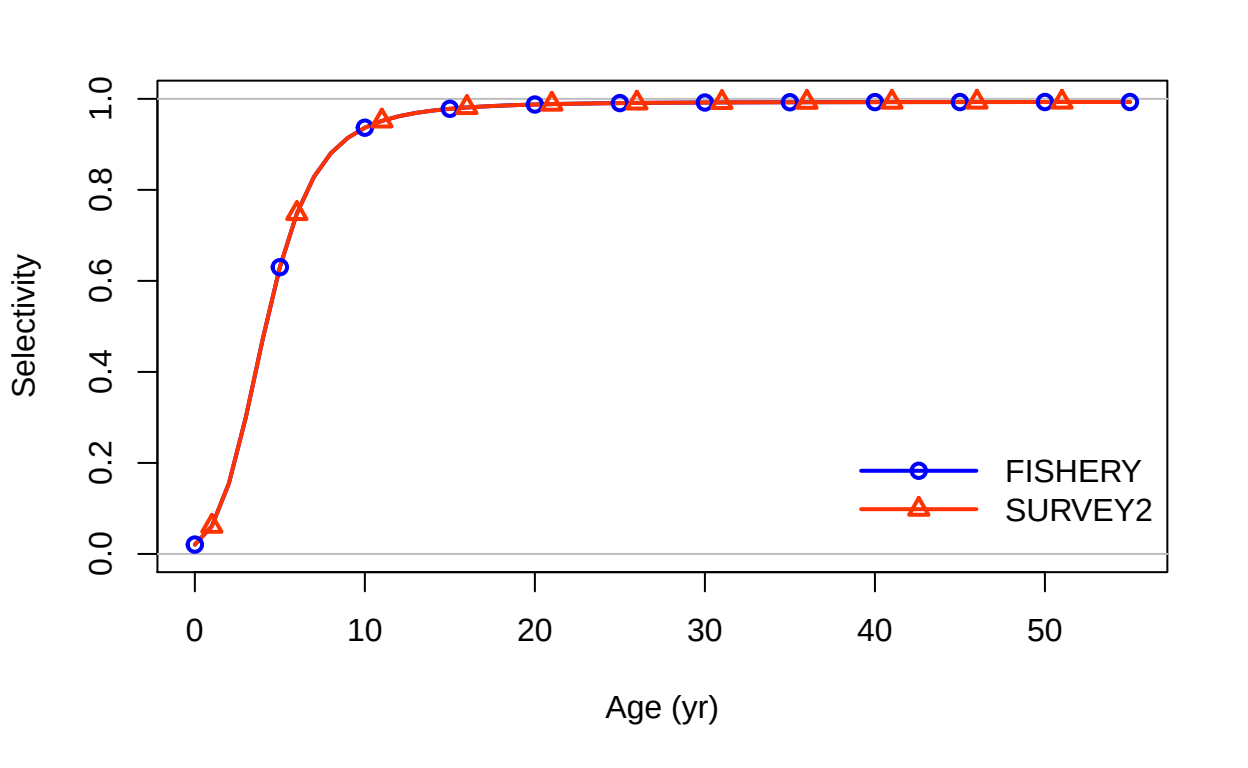

Fecundity
0
5
10
15
0
5
10
15
Female weight (kg)

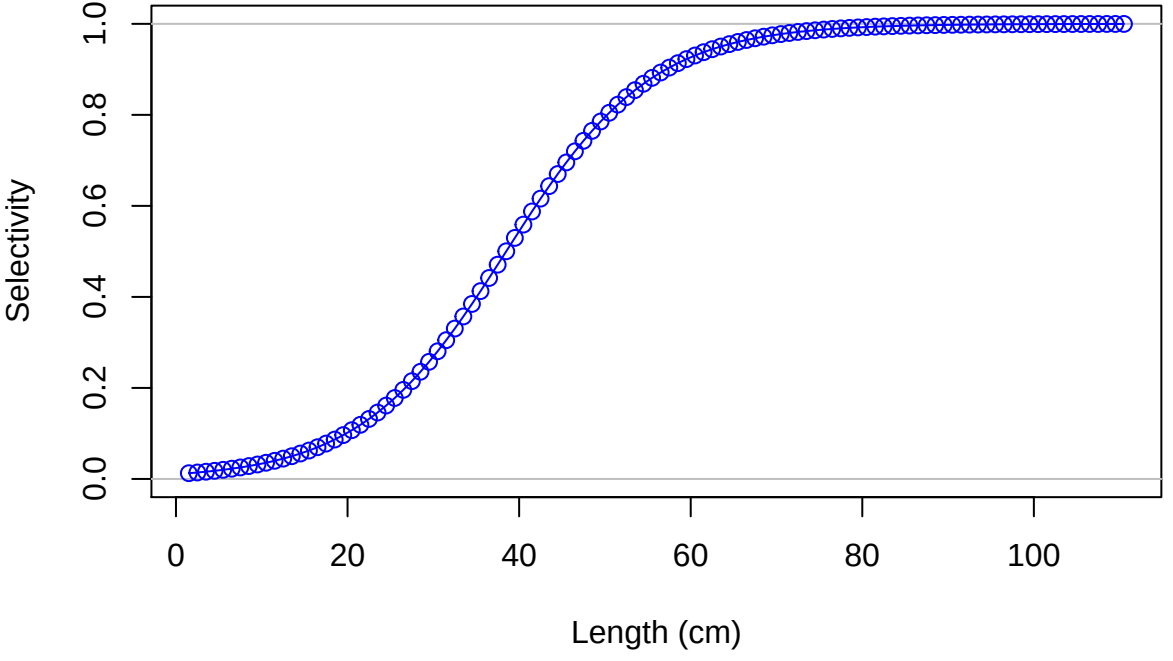

Fecundity
0
5
10
15
20
0
20
40
60
80
100
Female length (cm)

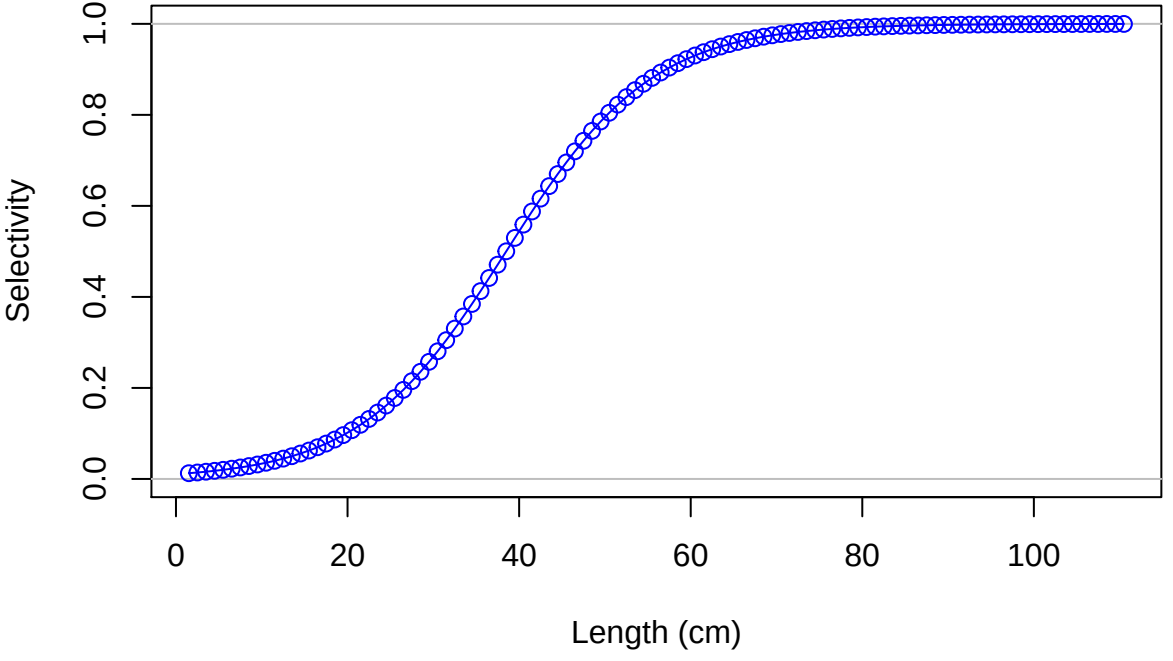

Spawning output
0
5
10
15
0
20
40
60
80
100
Length (cm)

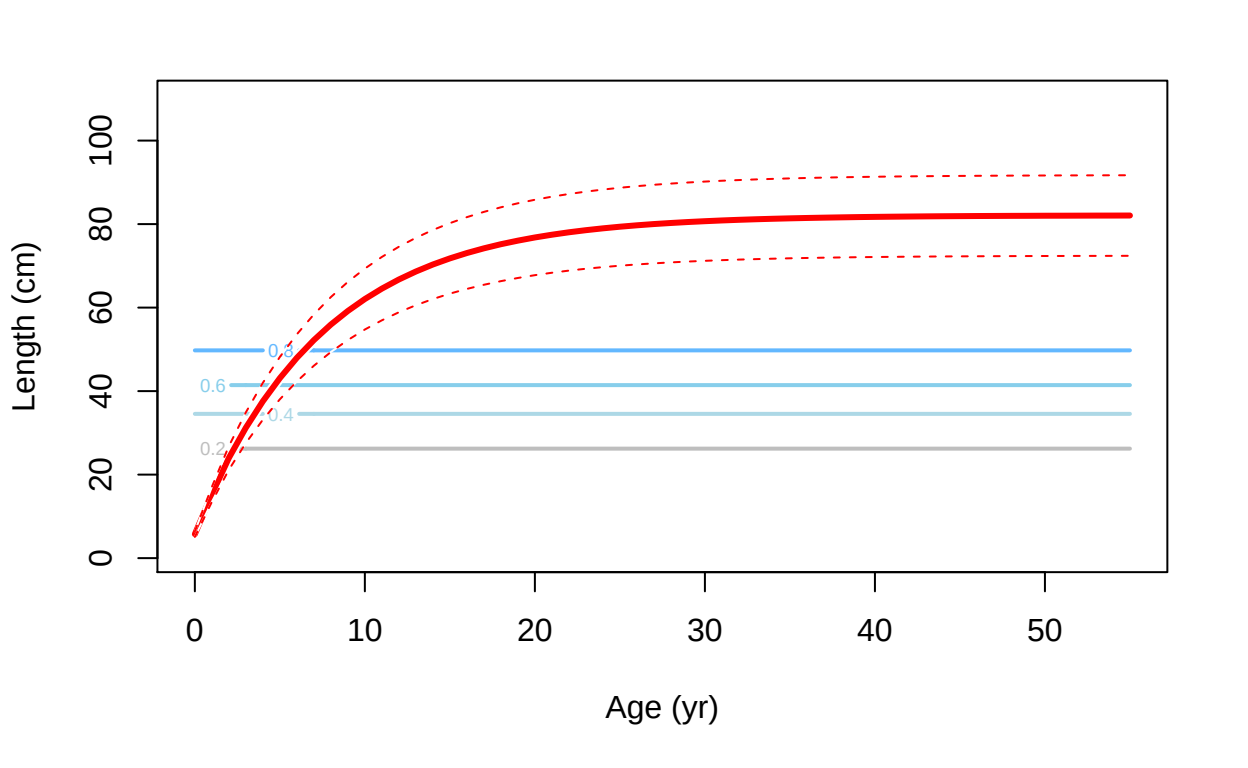

Spawning output
0
2
4
6
8
0
10
20
30
40
50
Age (yr)

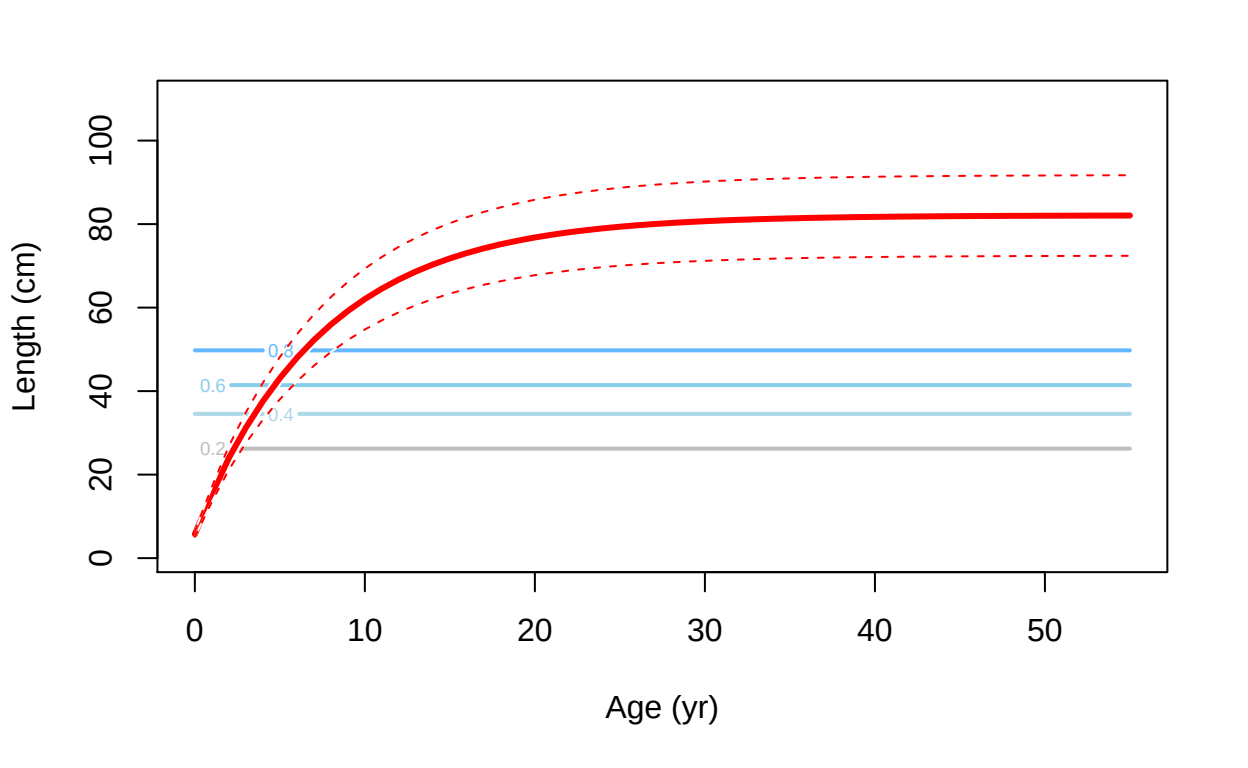

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
20
40
60
80
100
Length (cm)
FISHERY
SURVEY2

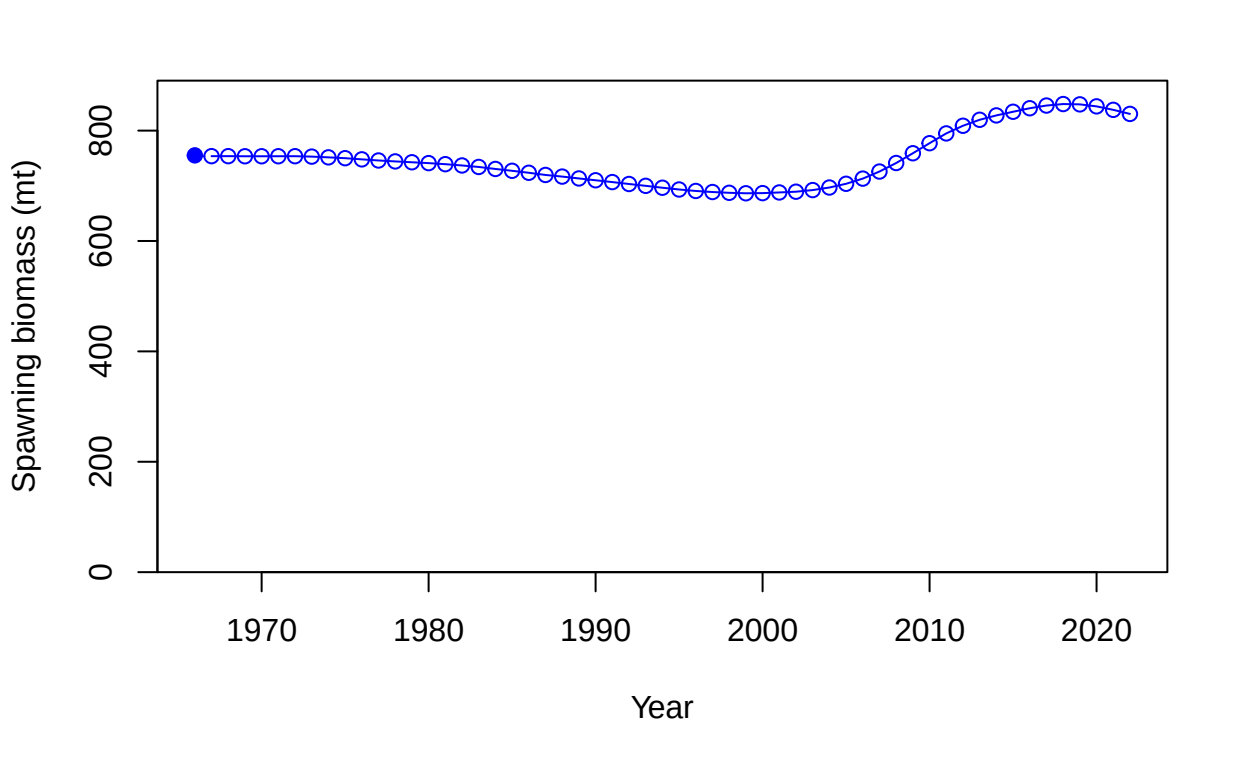

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
10
20
30
40
50
Age (yr)
FISHERY
SURVEY2

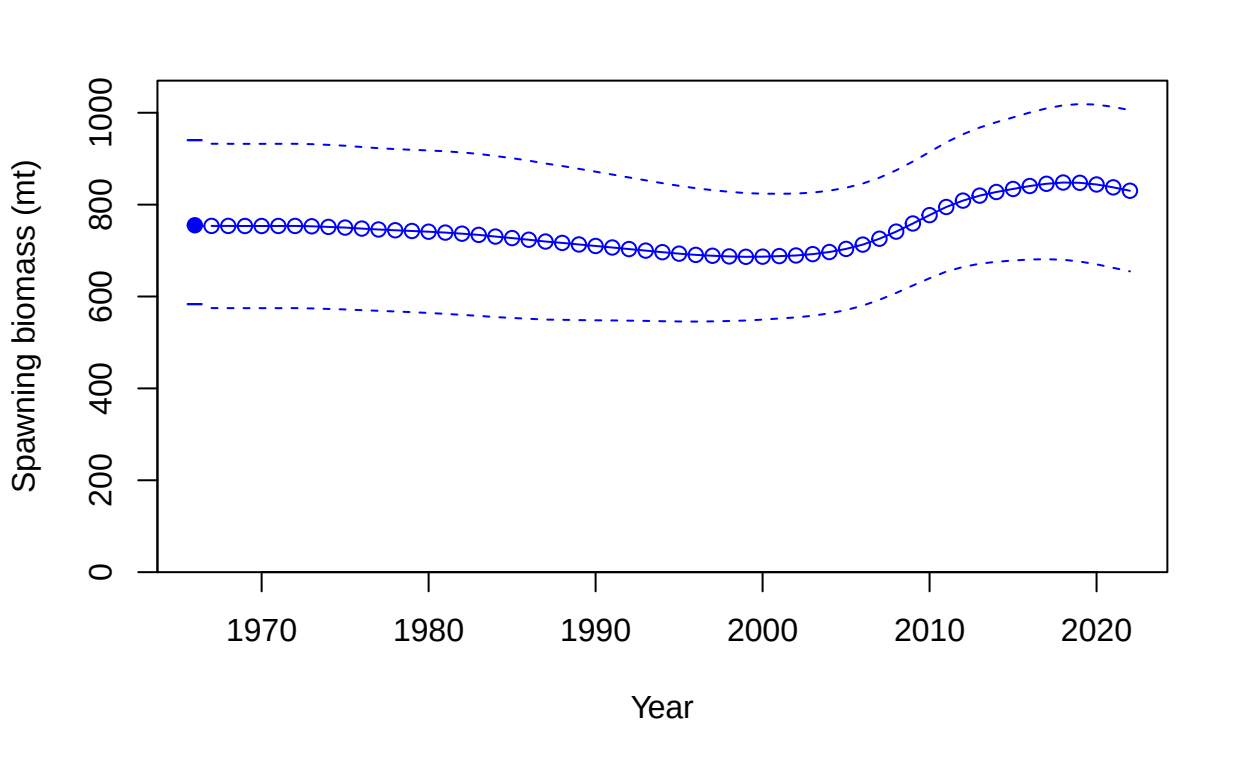

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
20
40
60
80
100
Length (cm)

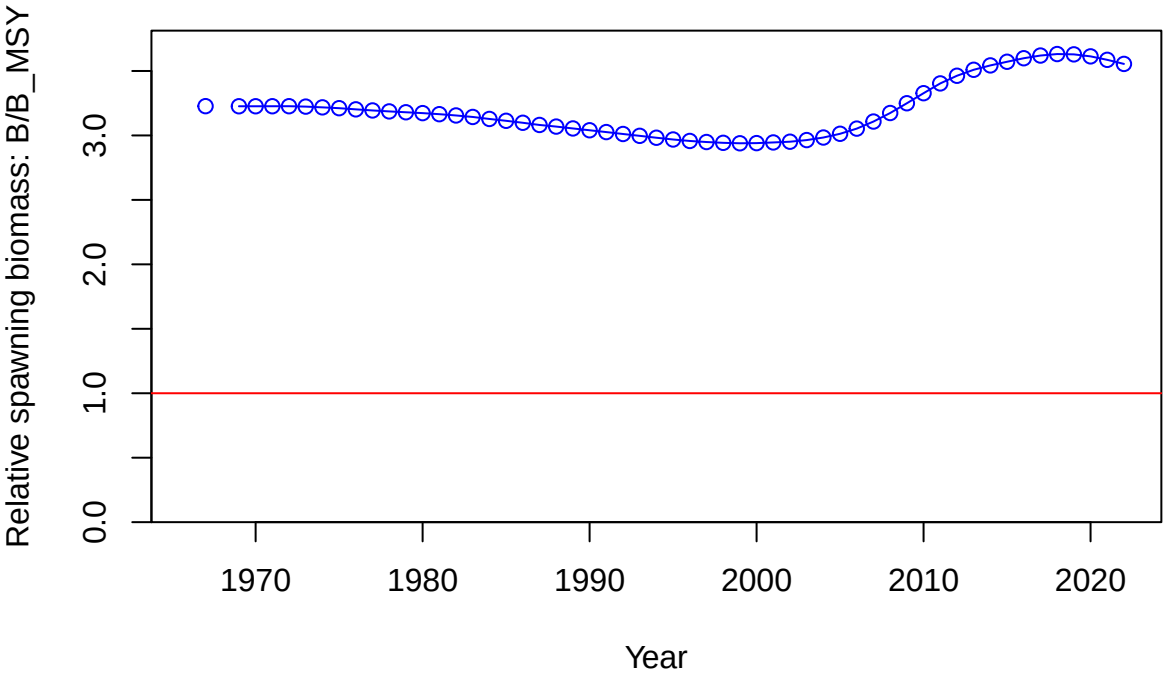

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
20
40
60
80
100
Length (cm)

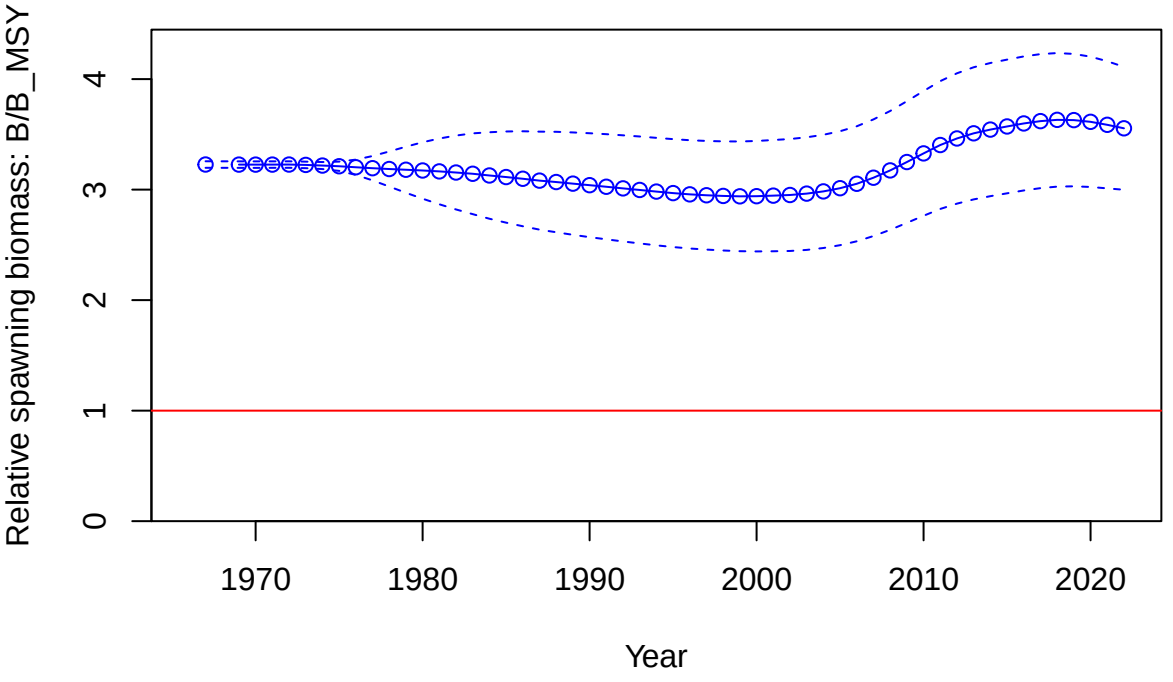

Length (cm)
0
20
40
60
80
100
0
10
20
30
40
50
Age (yr)
0.8
0.6
0.4
0.2

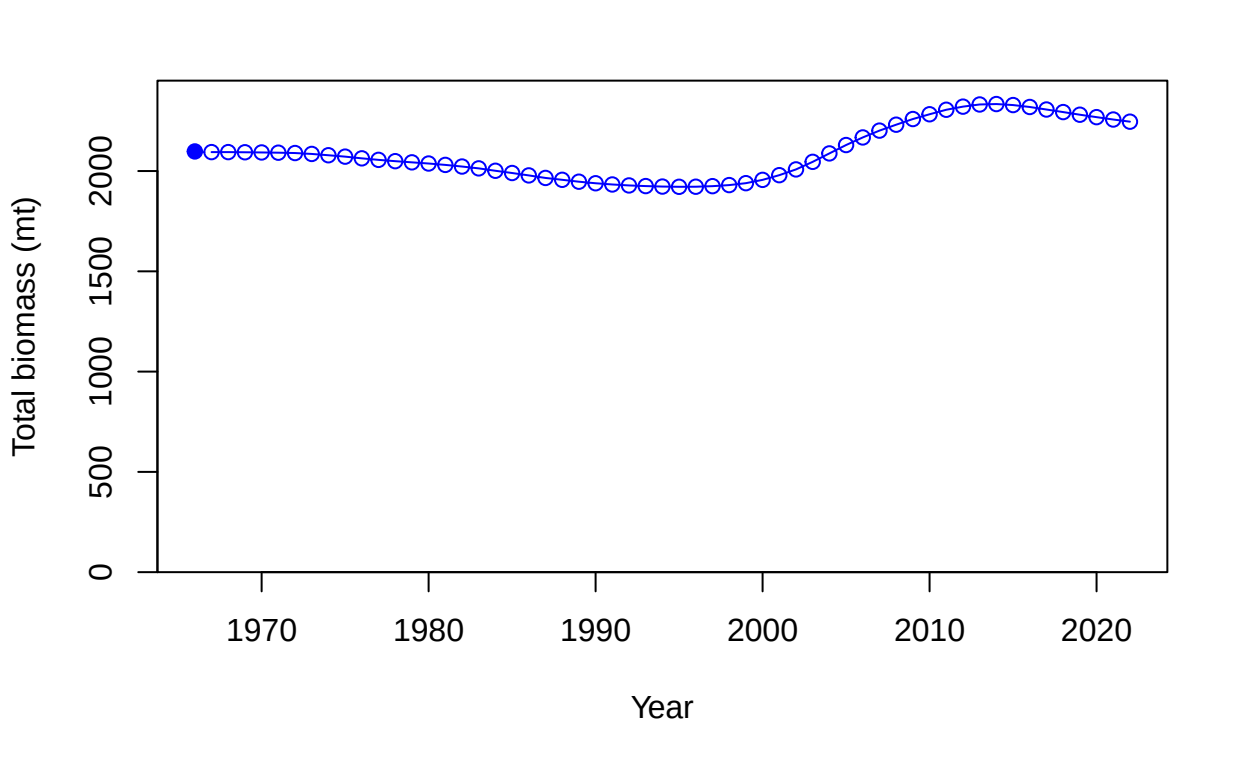

Length (cm)
0
20
40
60
80
100
0
10
20
30
40
50
Age (yr)
0.8
0.6
0.4
0.2

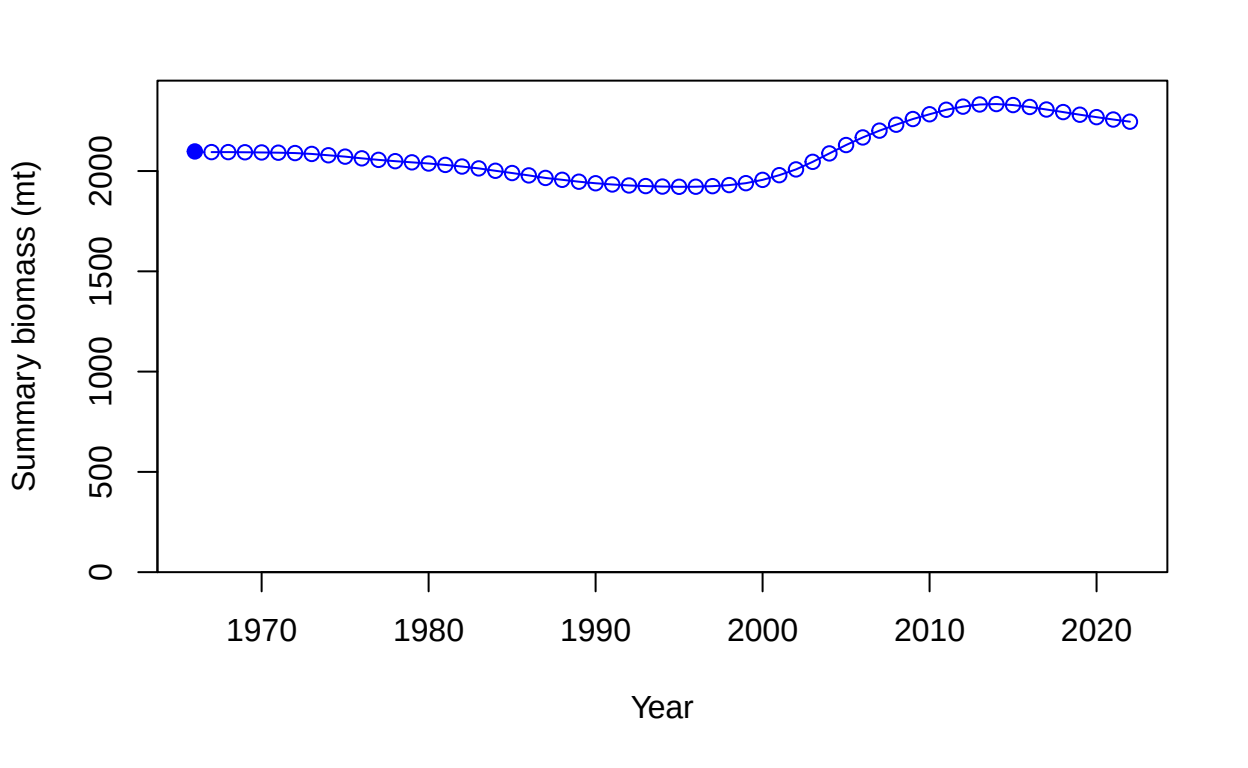

Spawning biomass (mt)
0
200
400
600
800
1970
1980
1990
2000
2010
2020
Year

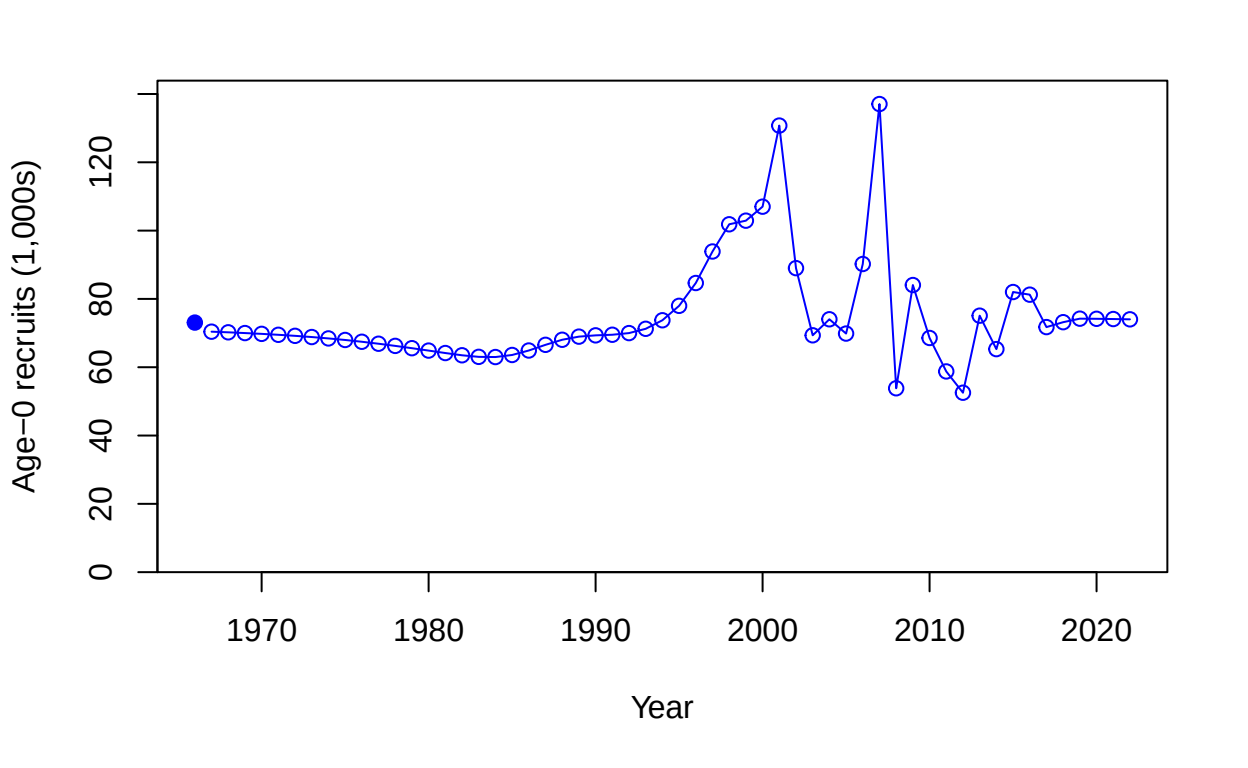

Spawning biomass (mt)
0
200
400
600
800
1000
1970
1980
1990
2000
2010
2020
Year

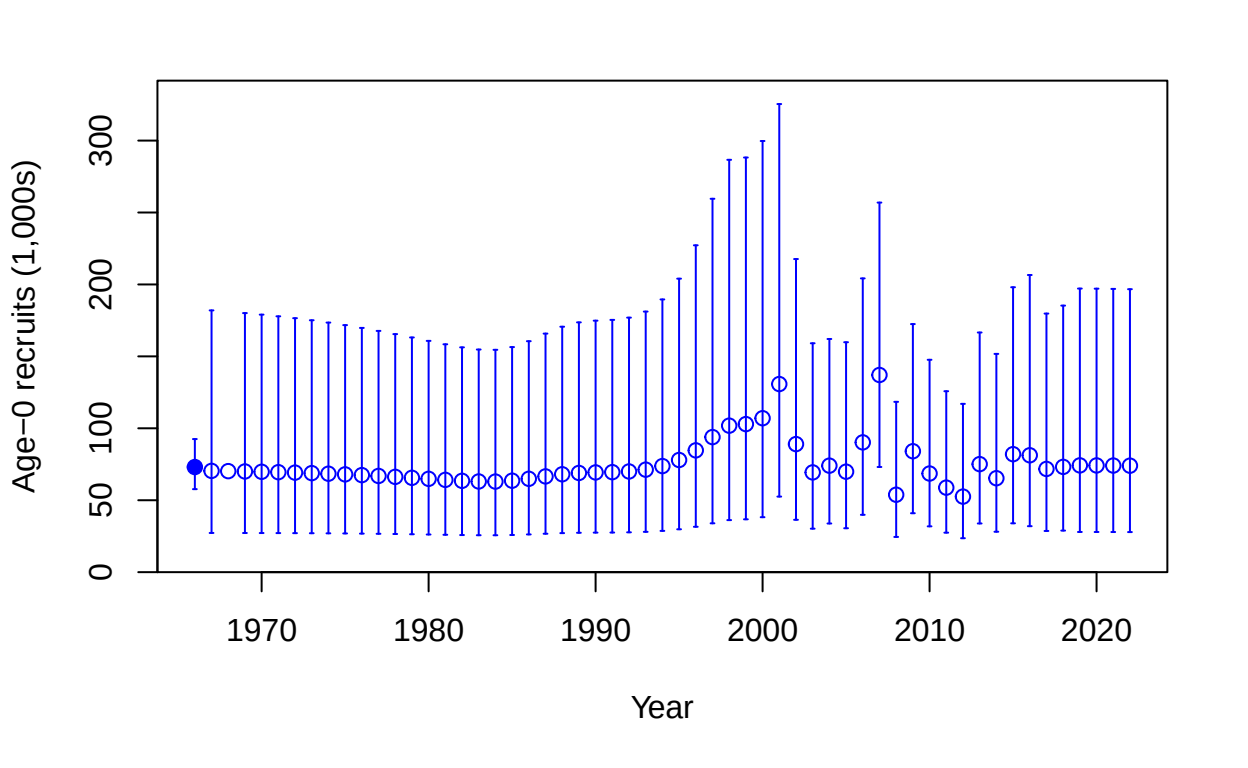

Relative spawning biomass: B/B_MSY
0.0
1.0
2.0
3.0
1970
1980
1990
2000
2010
2020
Year

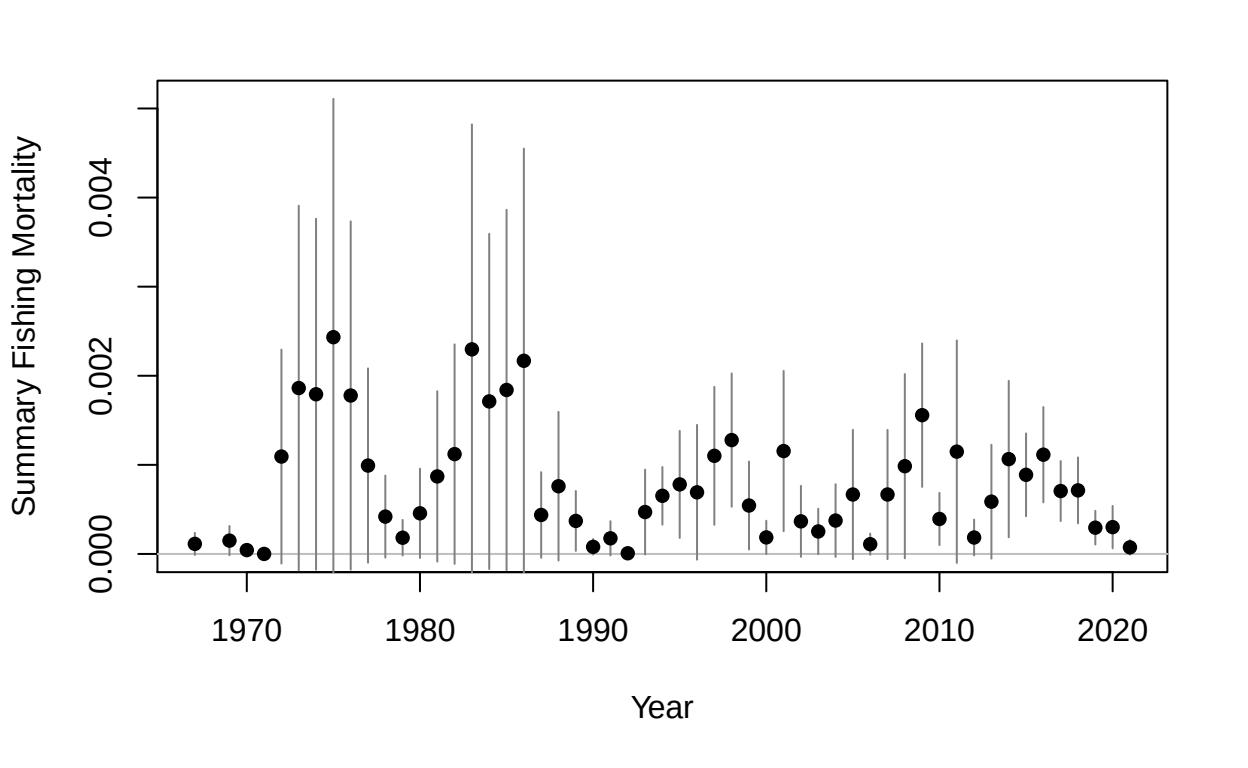

Relative spawning biomass: B/B_MSY
0
1
2
3
4
1970
1980
1990
2000
2010
2020
Year

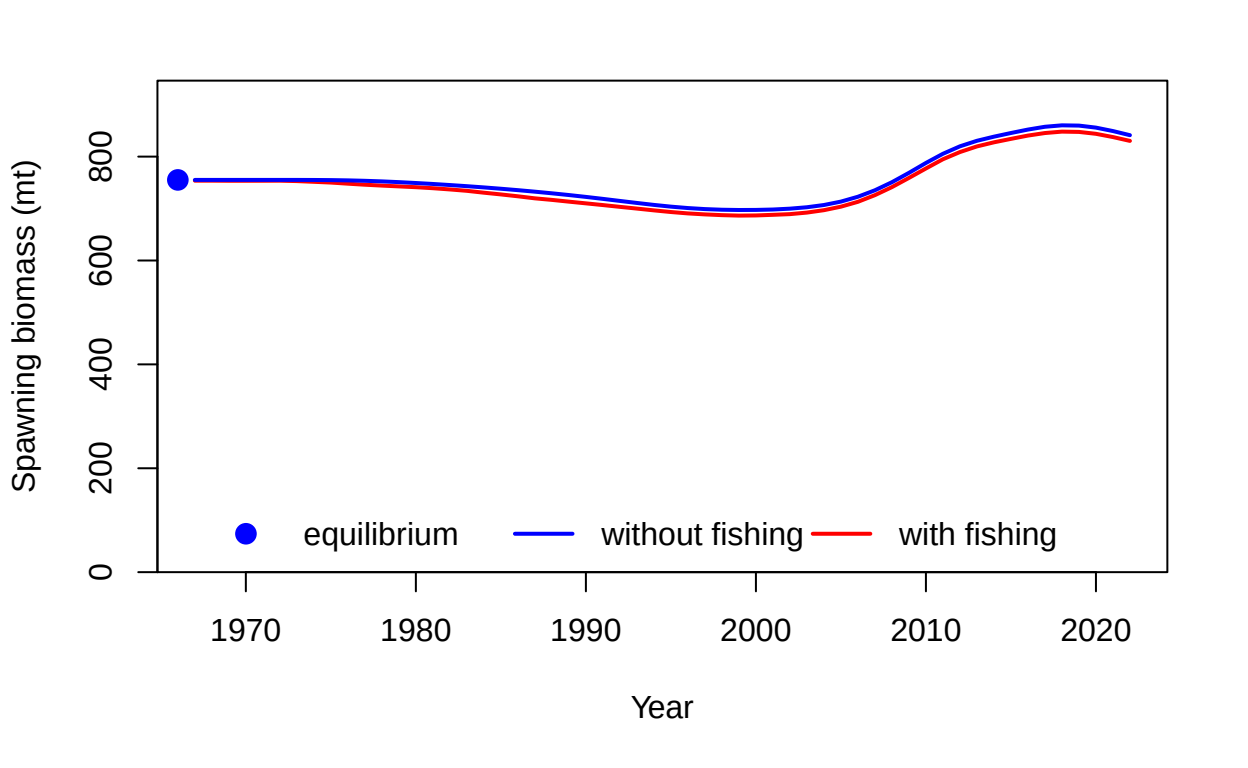

Total biomass (mt)
0
500
1000
1500
2000
1970
1980
1990
2000
2010
2020
Year

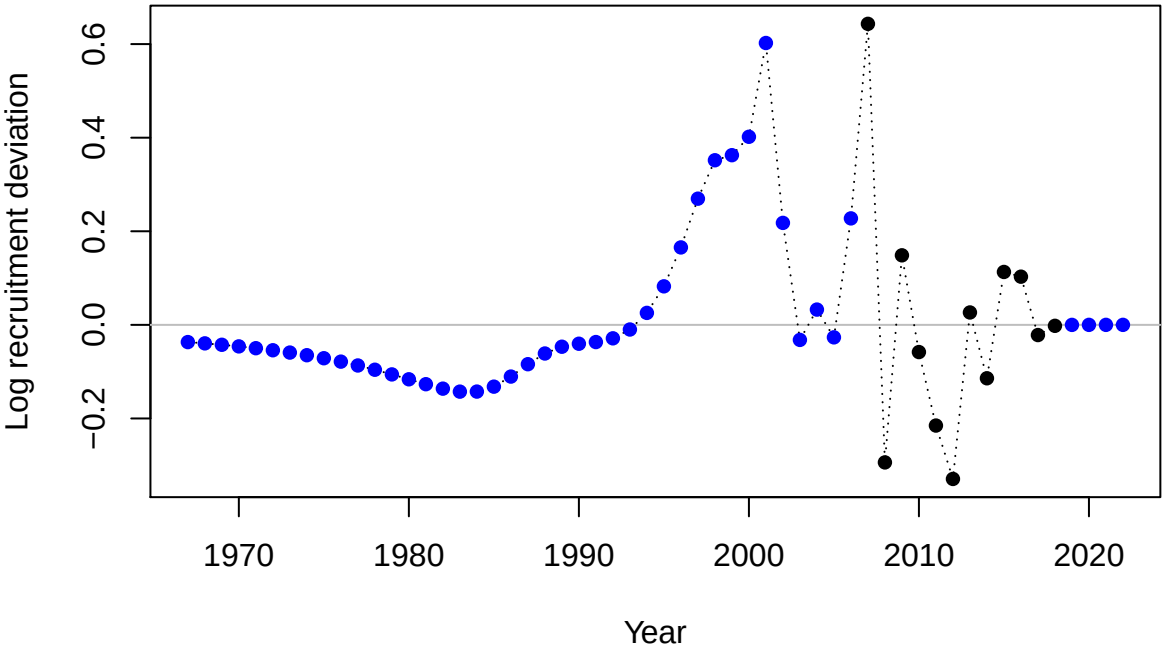

Summary biomass (mt)
0
500
1000
1500
2000
1970
1980
1990
2000
2010
2020
Year

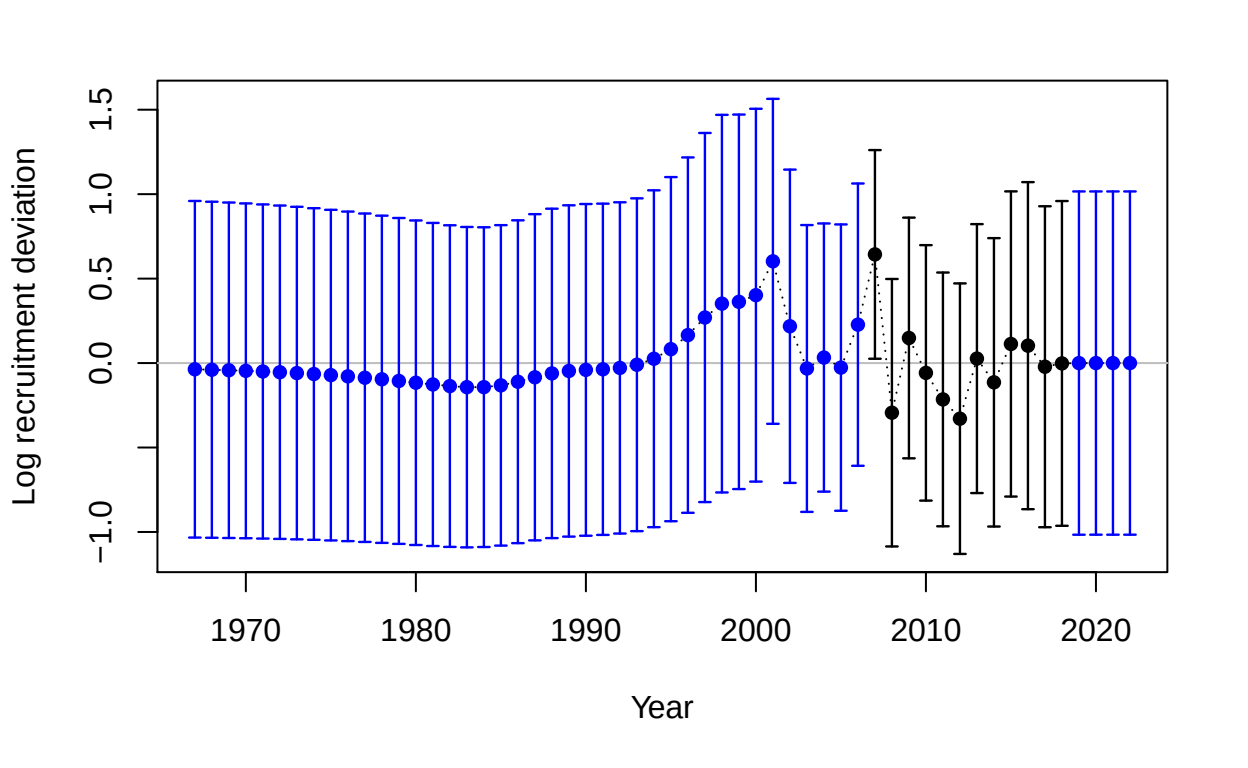

Age−0 recruits (1,000s)
0
20
40
60
80
120
1970
1980
1990
2000
2010
2020
Year

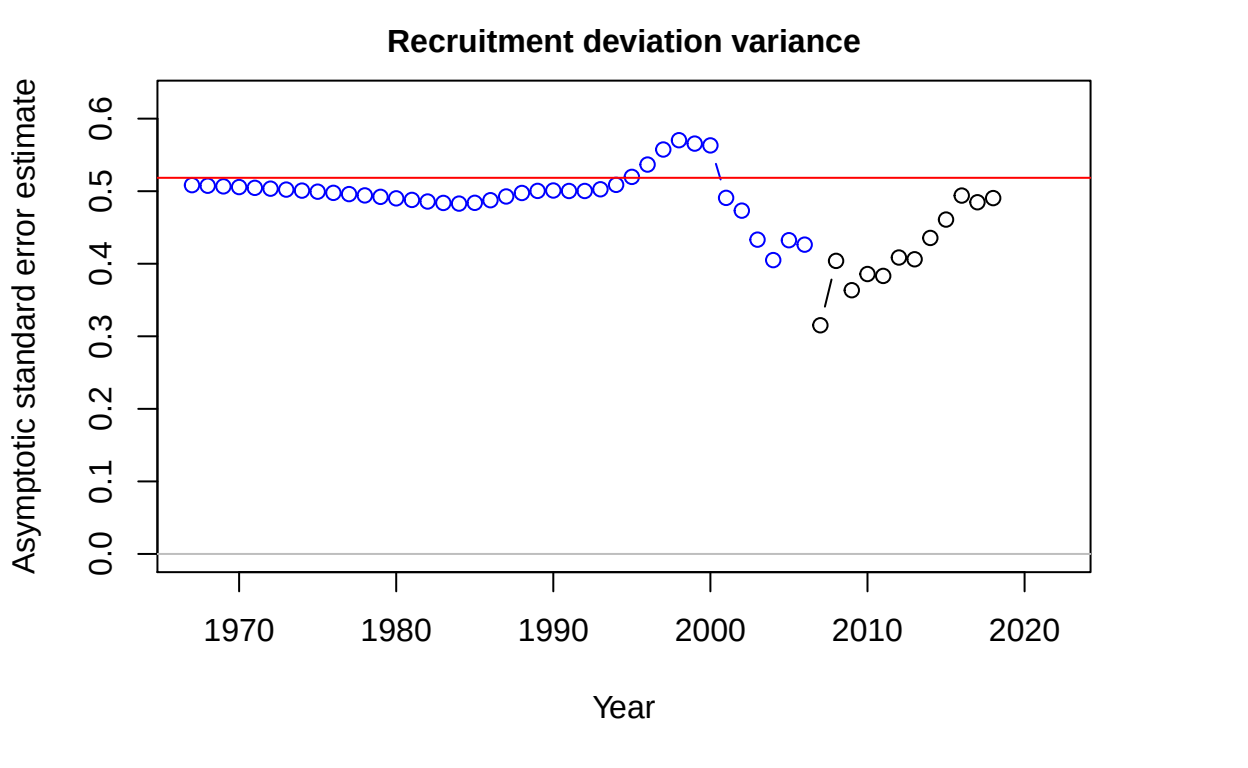

Age−0 recruits (1,000s)
0
50
100
200
300
1970
1980
1990
2000
2010
2020
Year

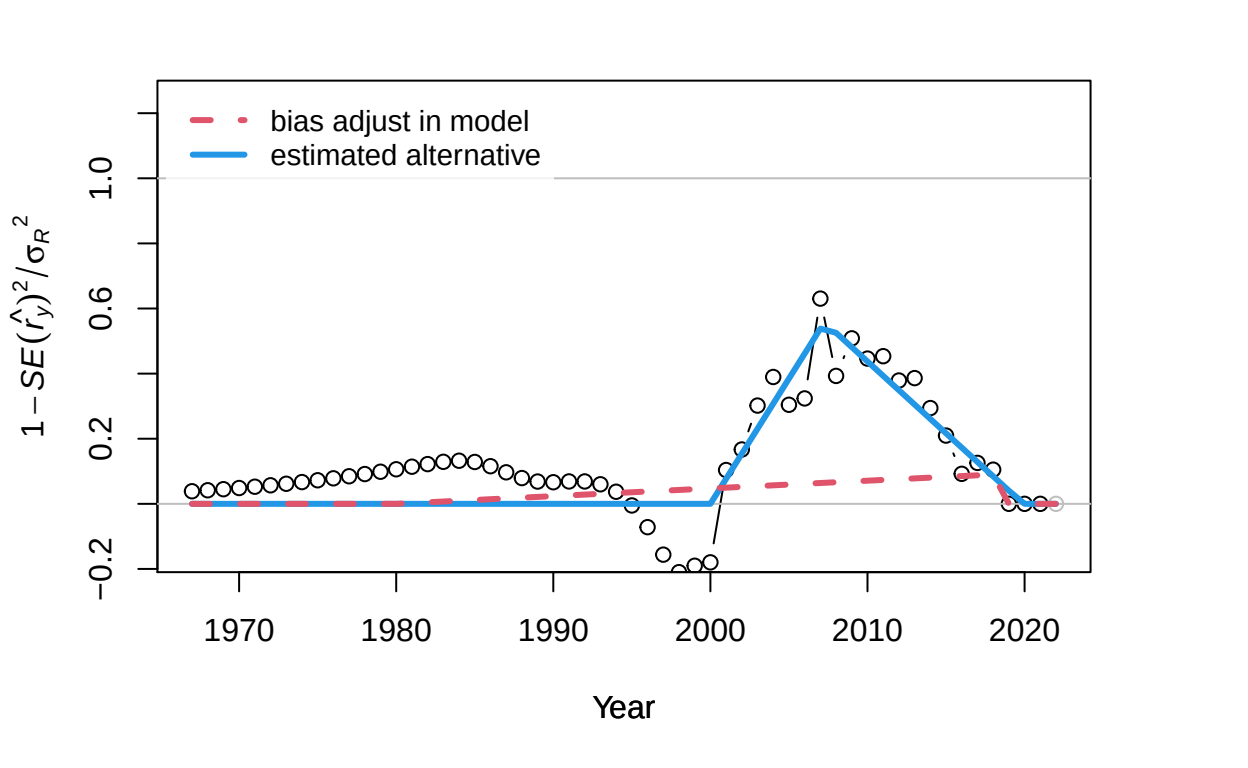

Summary Fishing Mortality
0.000
0.002
0.004
1970
1980
1990
2000
2010
2020
Year

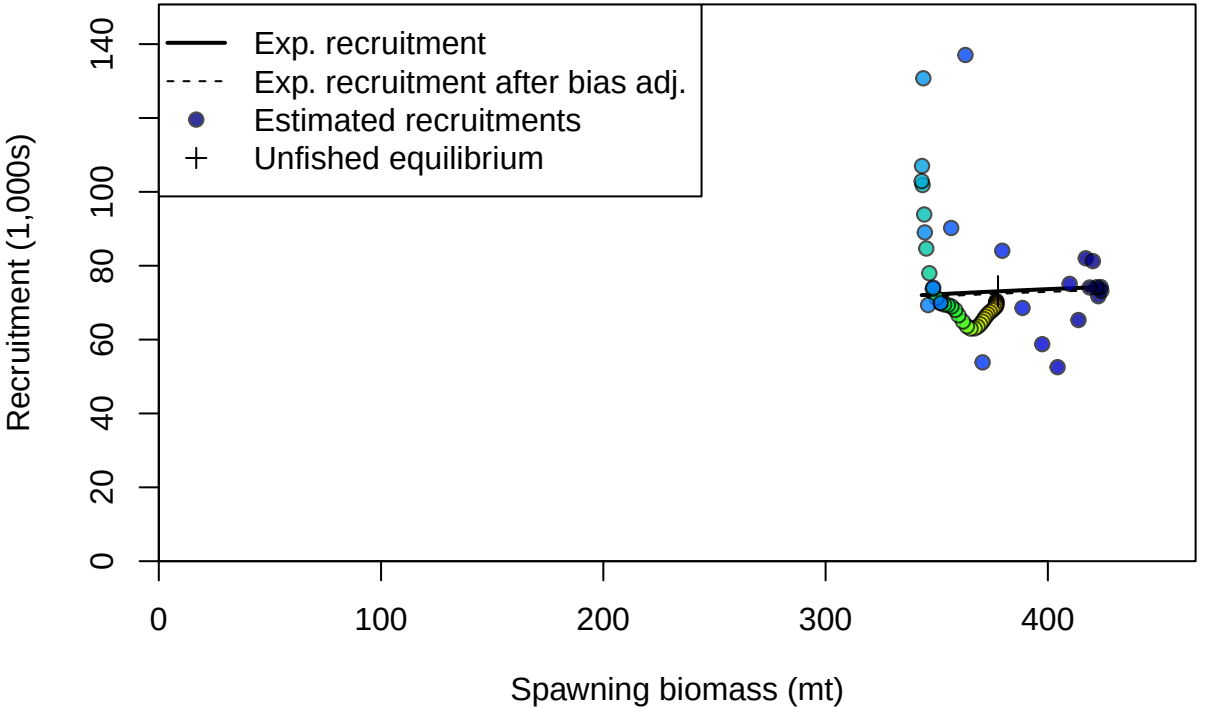

Spawning biomass (mt)
0
200
400
600
800
1970
1980
1990
2000
2010
2020
Year
equilibrium
without fishing
with fishing

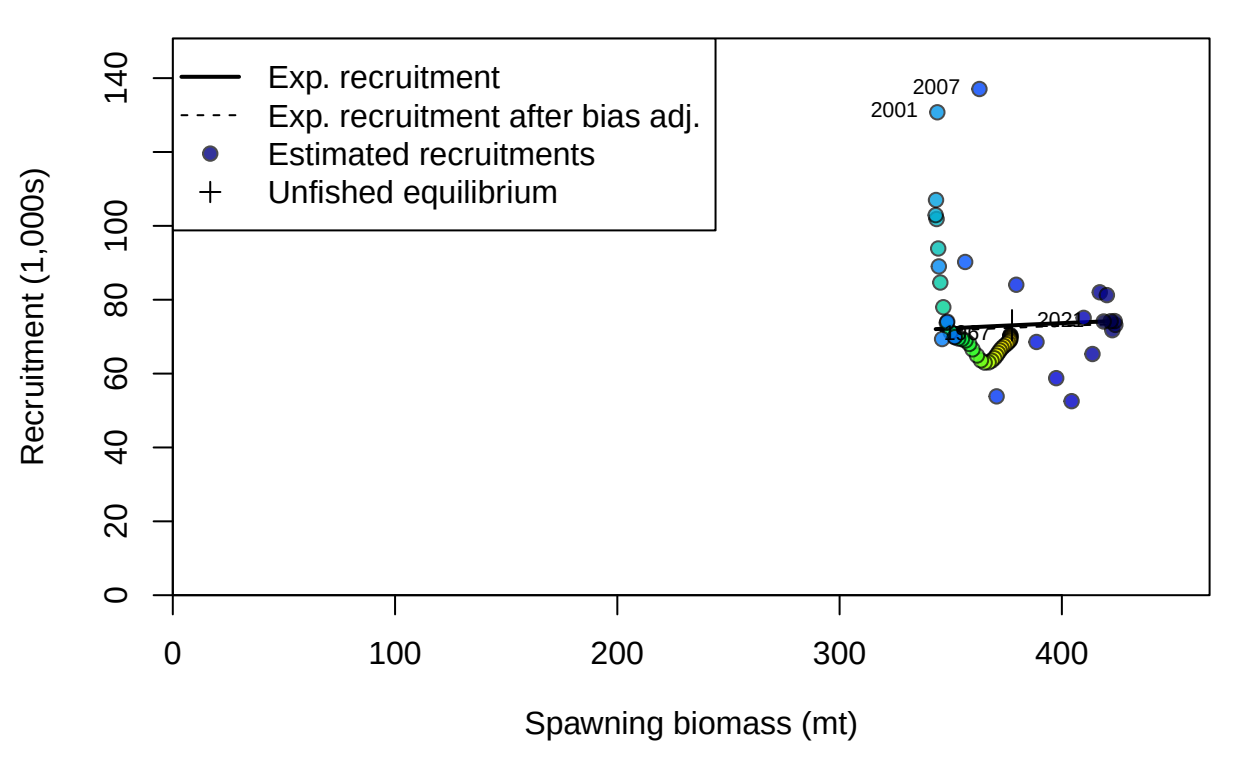

Log recruitment deviation
−0.2
0.0
0.2
0.4
0.6
1970
1980
1990
2000
2010
2020
Year

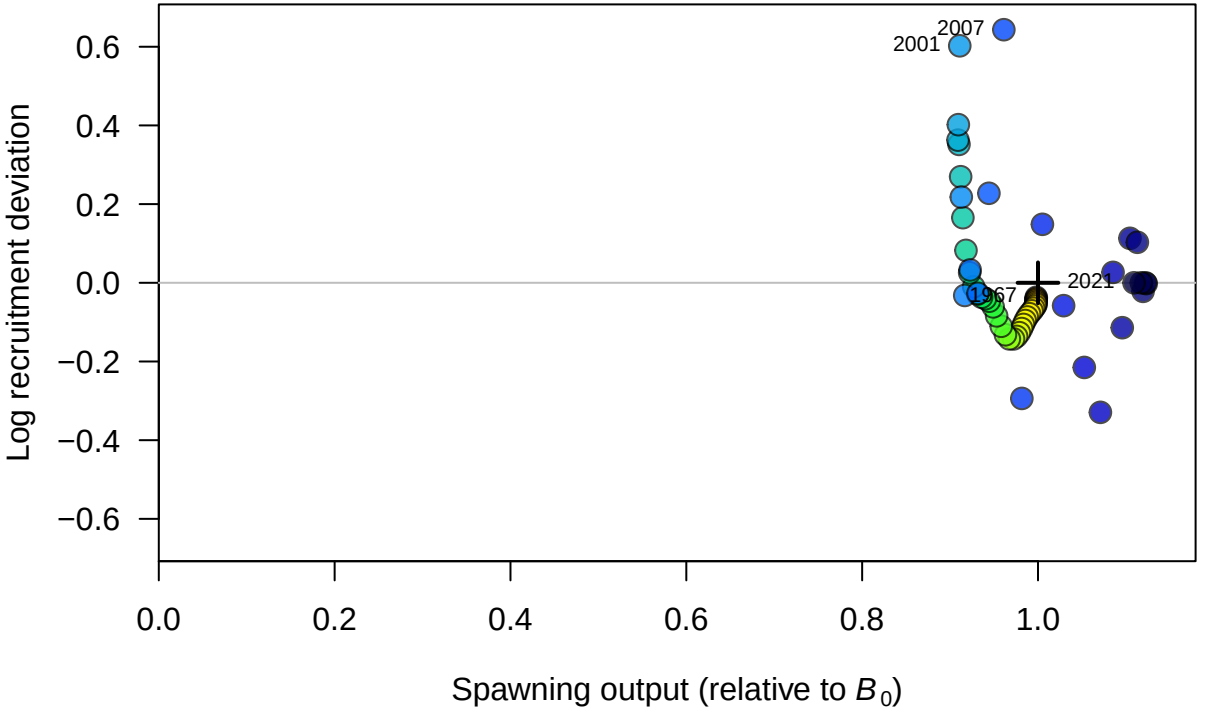

Log recruitment deviation
1.5
1.0
0.5
0.0
−1.0
1970
1980
1990
2000
2010
2020
Year

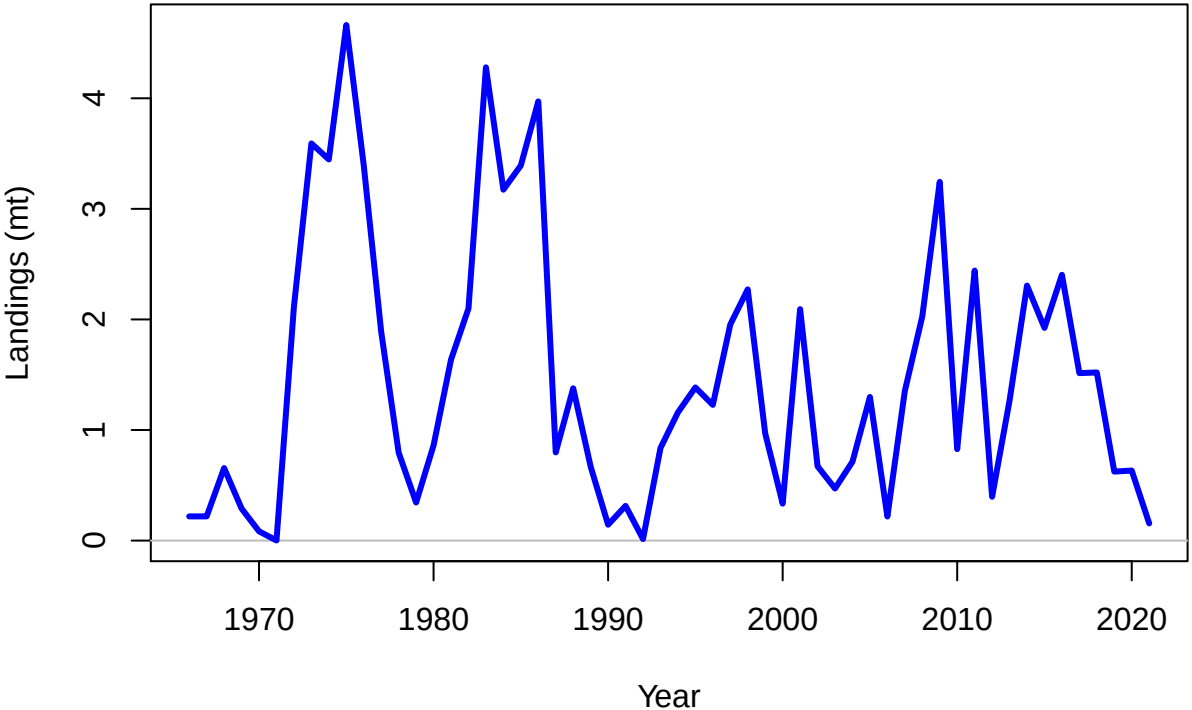

Recruitment deviation variance
Asymptotic standard error estimate
0.0
0.1
0.2
0.3
0.4
0.5
0.6
1970
1980
1990
2000
2010
2020
Year

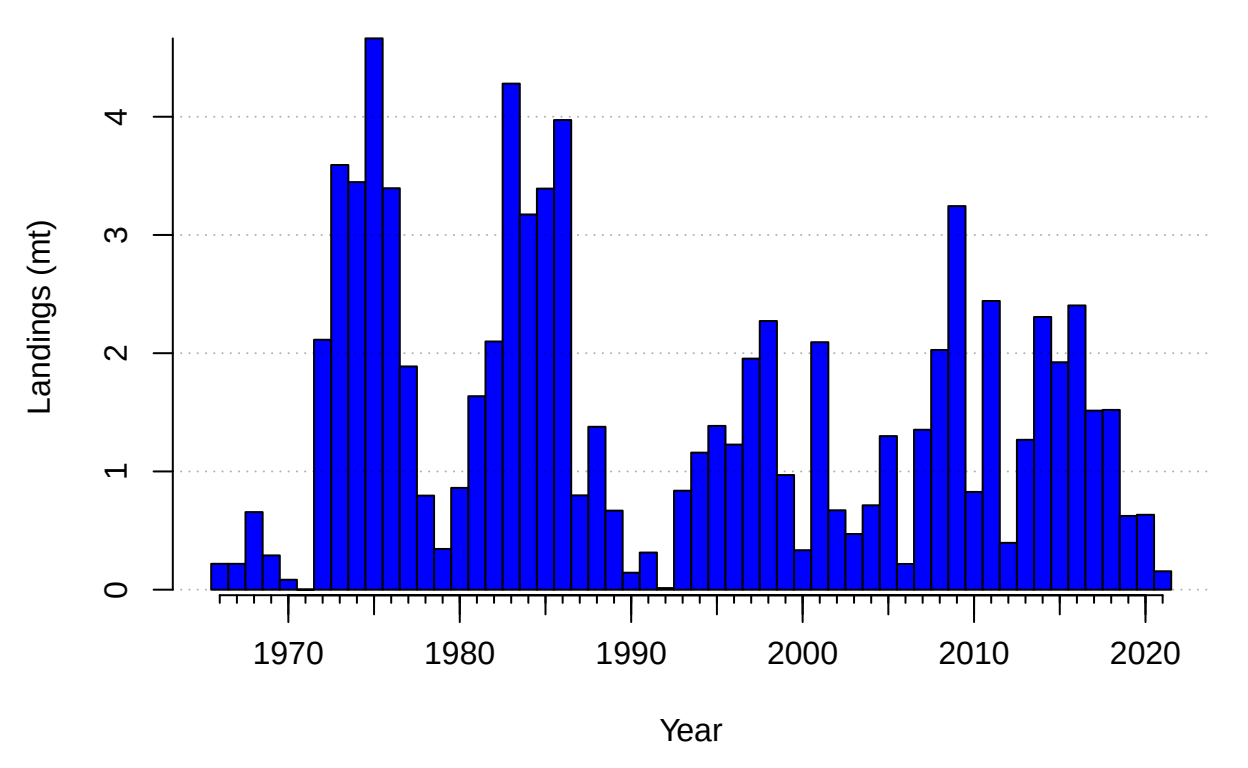

bias adjust in model
estimated alternative
$1 - SE(\hat{r}_y)^2/\sigma_R^2$
1.0
0.6
0.2
−0.2
1970
1980
1990
2000
2010
2020
Year

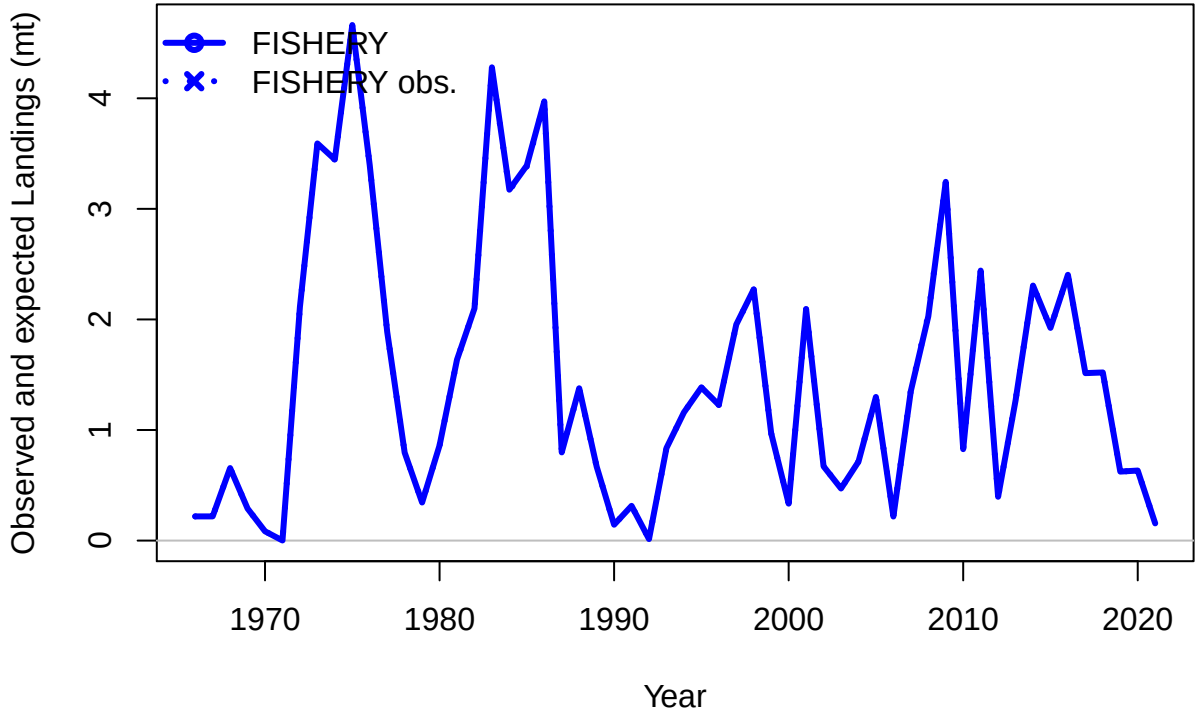

Exp. recruitment
Exp. recruitment after bias adj.
Estimated recruitments
Unfished equilibrium
Recruitment (1,000s)
0
20
40
60
80
100
140
0
100
200
300
400
Spawning biomass (mt)

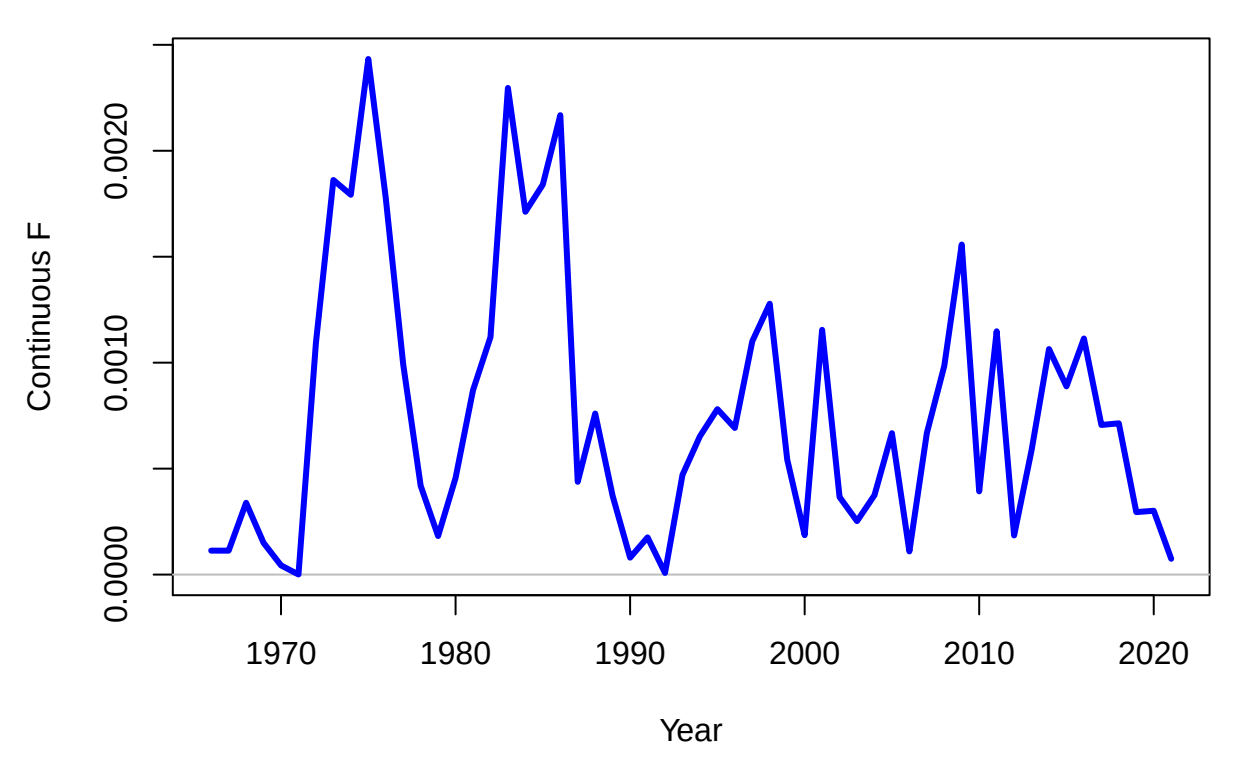

Exp. recruitment
Exp. recruitment after bias adj.
Estimated recruitments
Unfished equilibrium
2007
2001
2021
1967
Recruitment (1,000s)
0
20
40
60
80
100
140
0
100
200
300
400
Spawning biomass (mt)

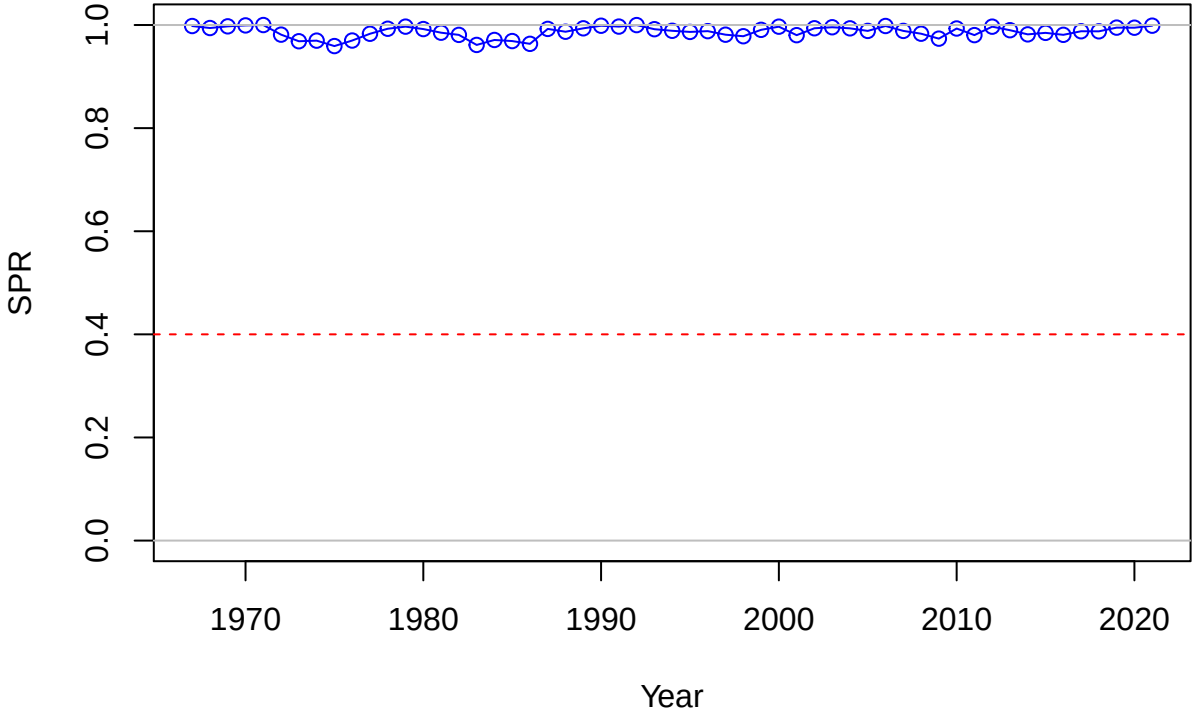

2007
2001
1967
2021
0.6
0.4
0.2
0.0
−0.2
−0.4
−0.6
Log recruitment deviation
0.0
0.2
0.4
0.6
0.8
1.0
Spawning output (relative to B_0)

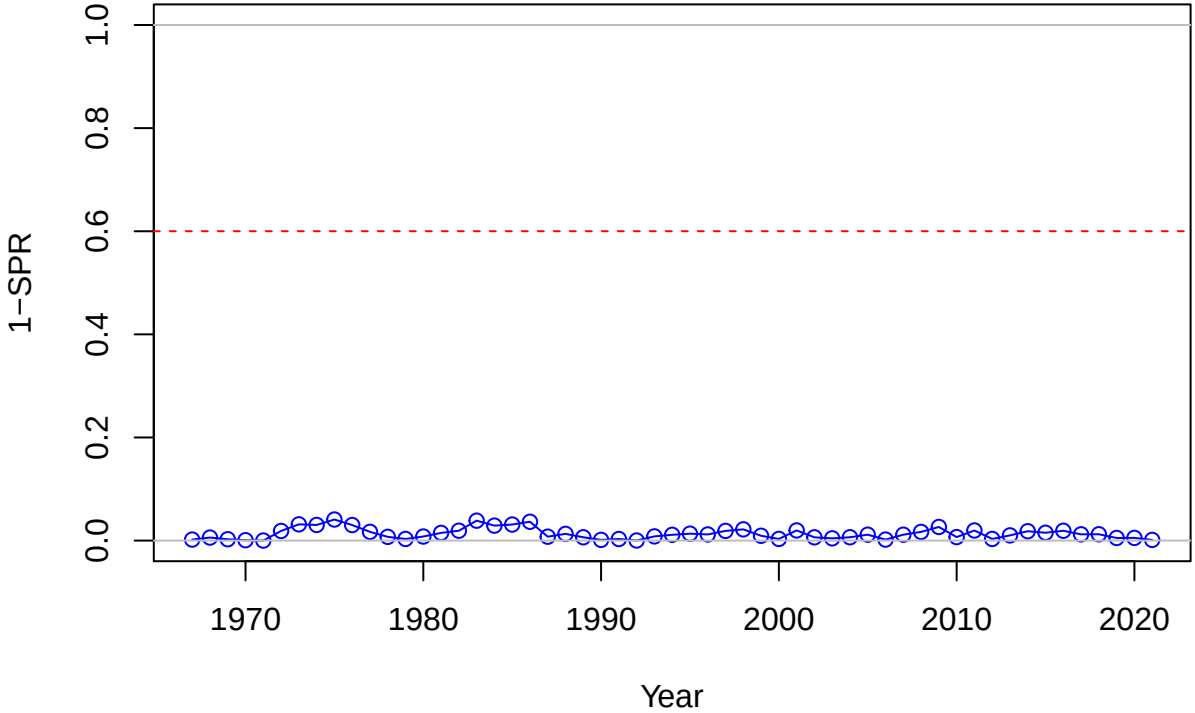

Landings (mt)
0
1
2
3
4
1970
1980
1990
2000
2010
2020
Year

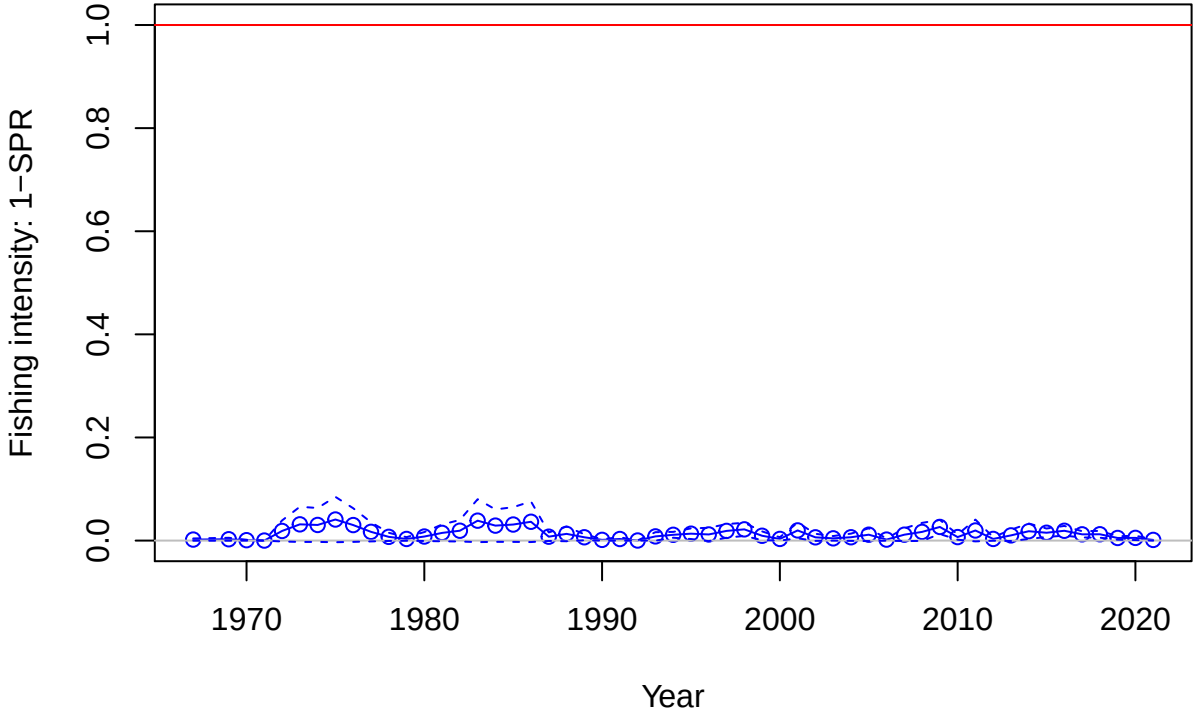

Landings (mt)
0
1
2
3
4
1970
1980
1990
2000
2010
2020
Year

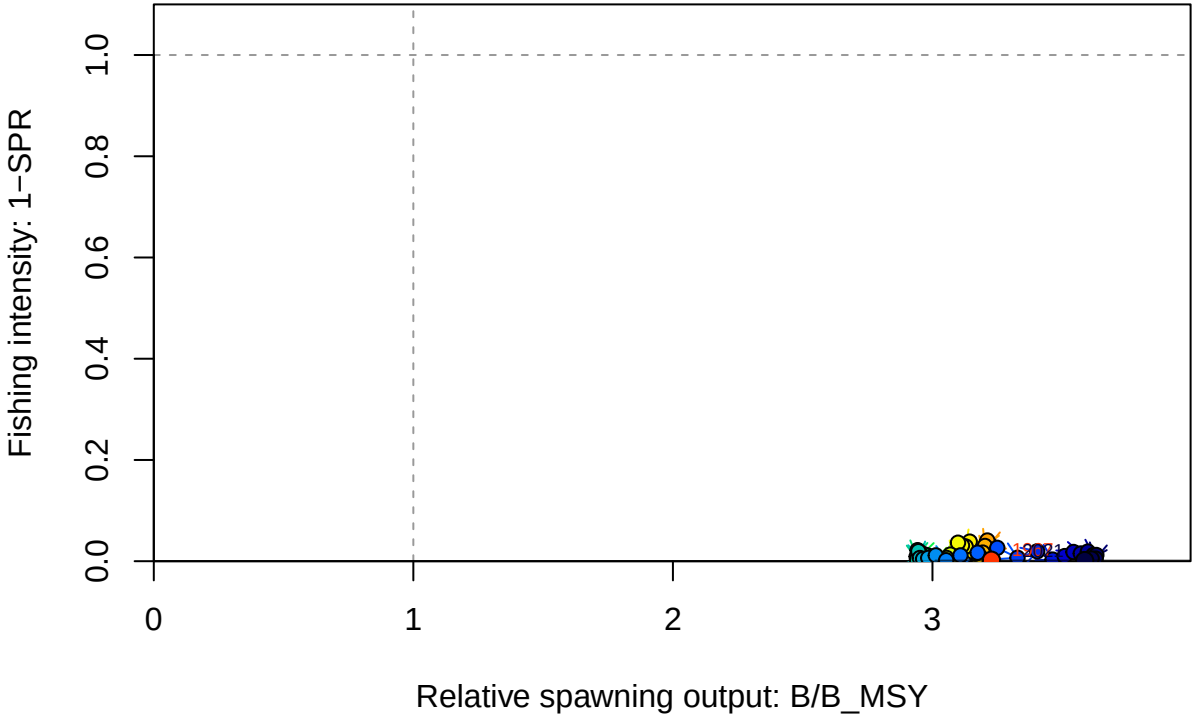

FISHERY
FISHERY obs.
Observed and expected Landings (mt)
0
1
2
3
4
1970
1980
1990
2000
2010
2020
Year

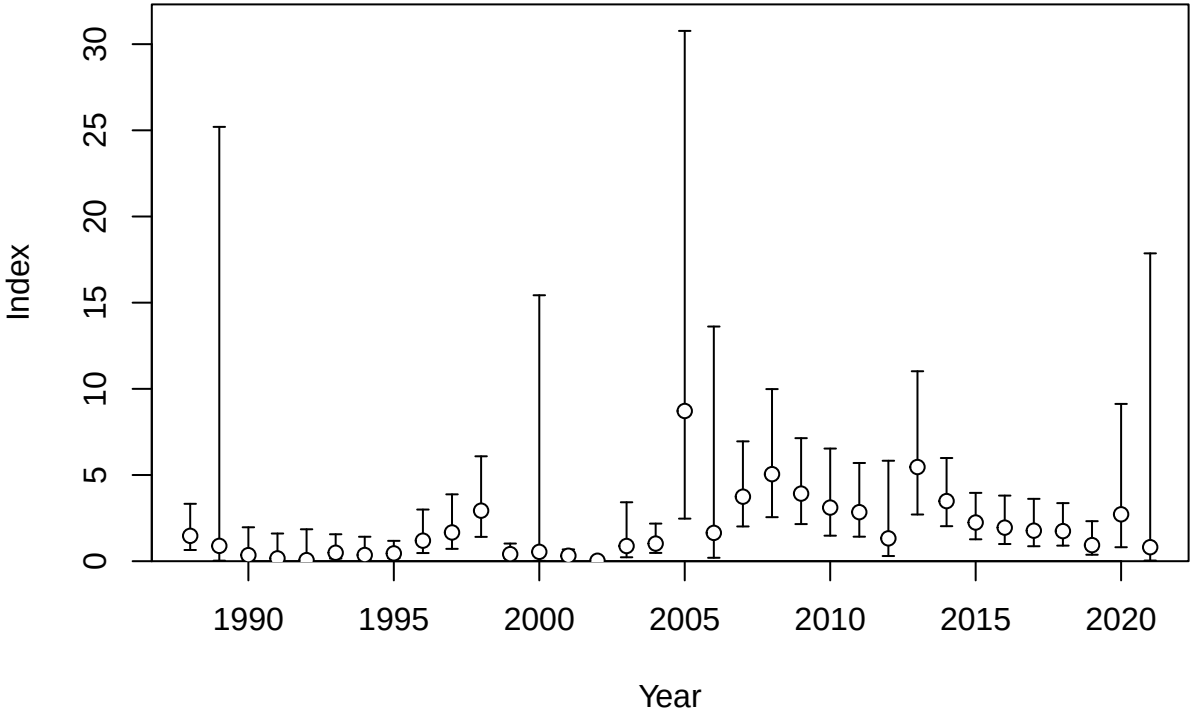

Continuous F
0.0000
0.0010
0.0020
1970
1980
1990
2000
2010
2020
Year

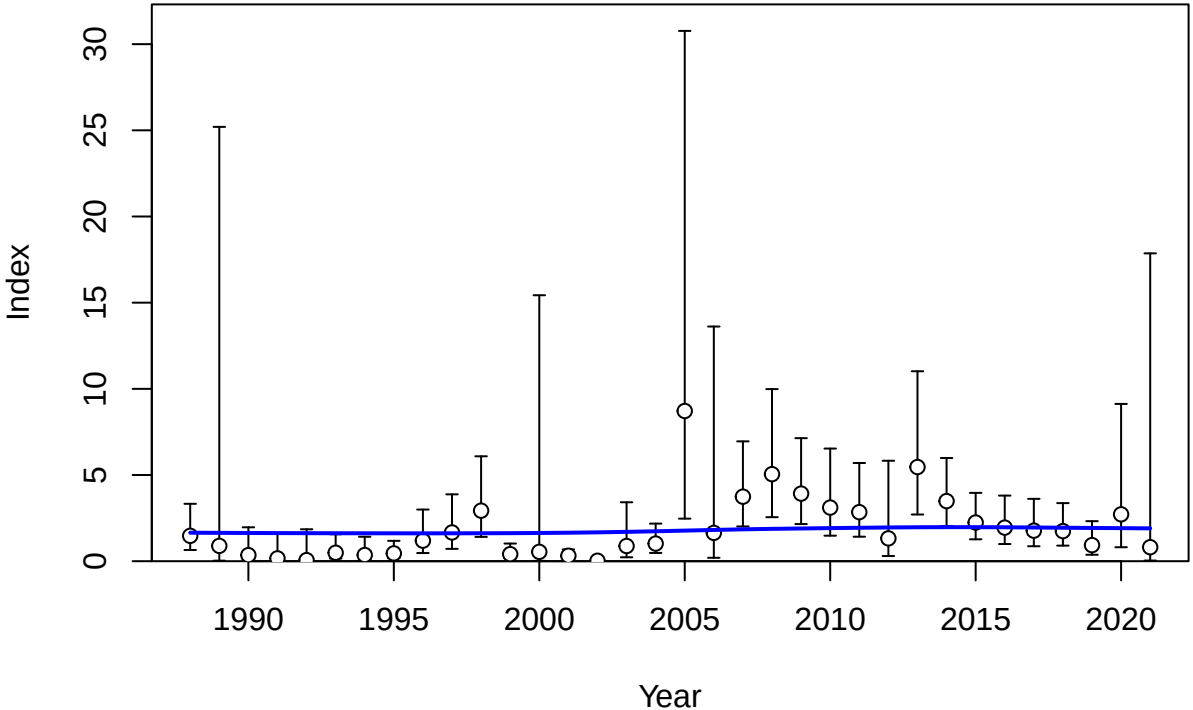

SPR
0.0
0.2
0.4
0.6
0.8
1.0
1970
1980
1990
2000
2010
2020
Year

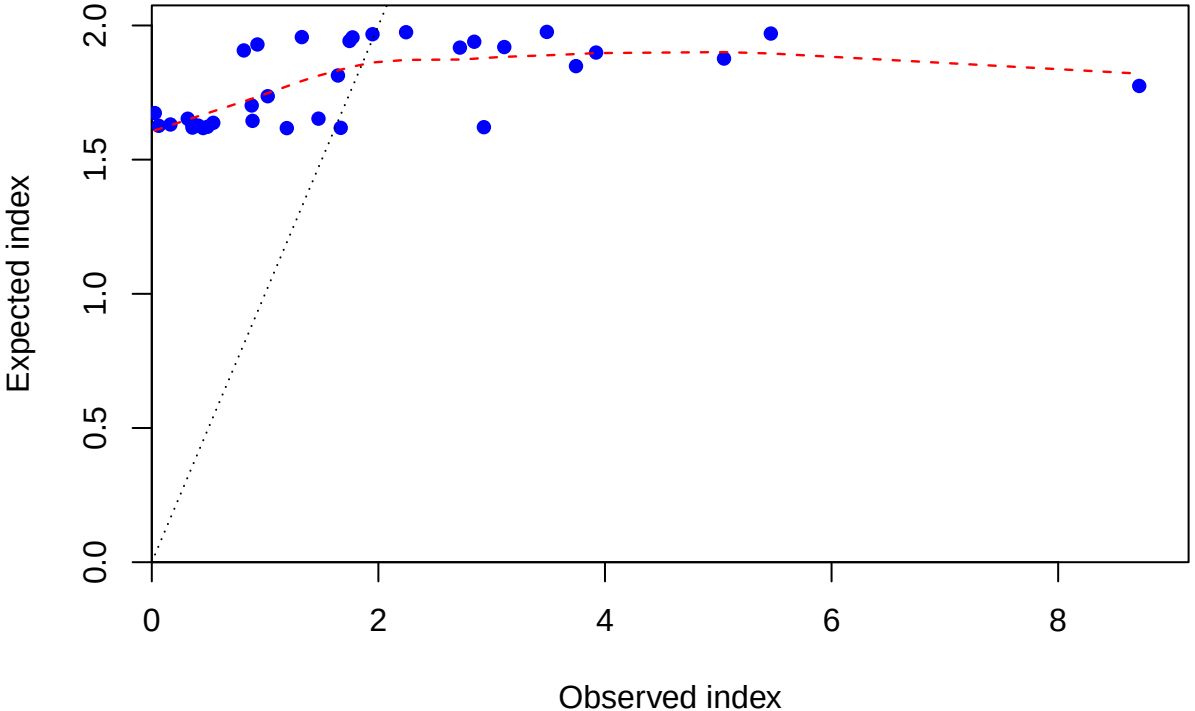

1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
1970
1980
1990
2000
2010
2020
Year

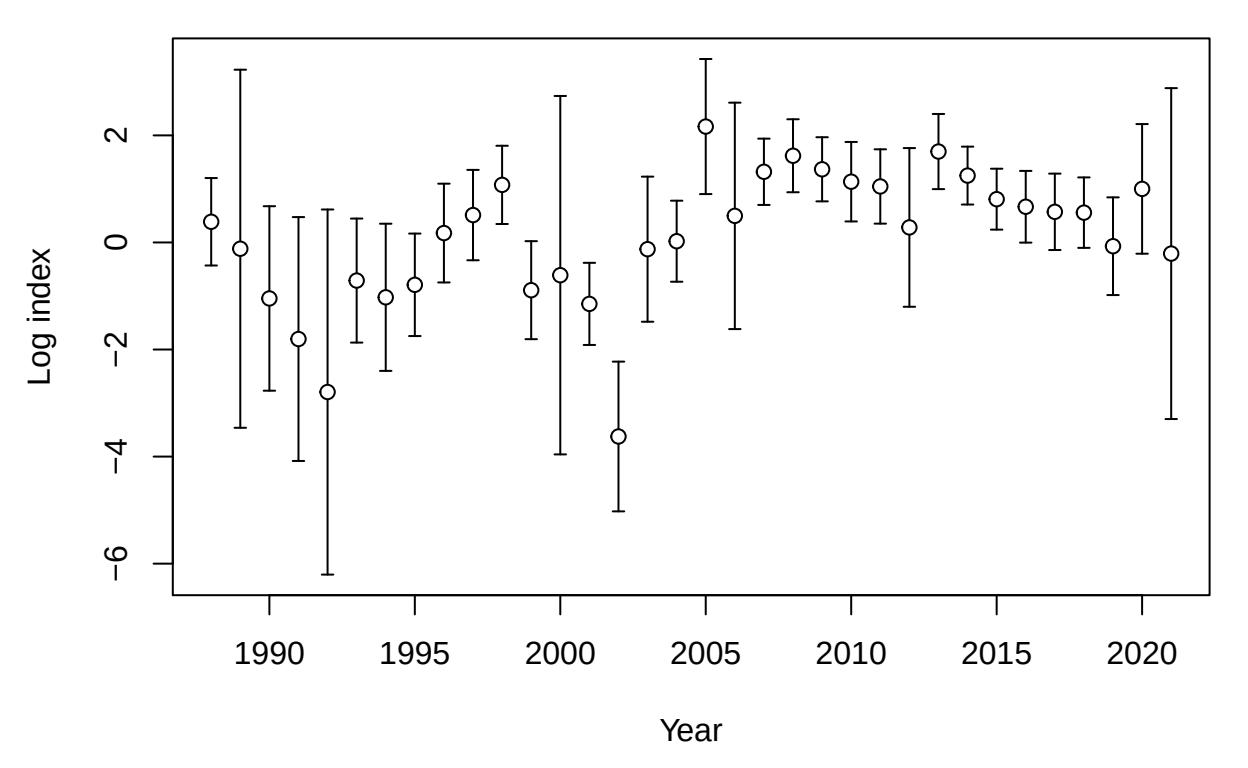

Fishing intensity: 1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
1970
1980
1990
2000
2010
2020
Year

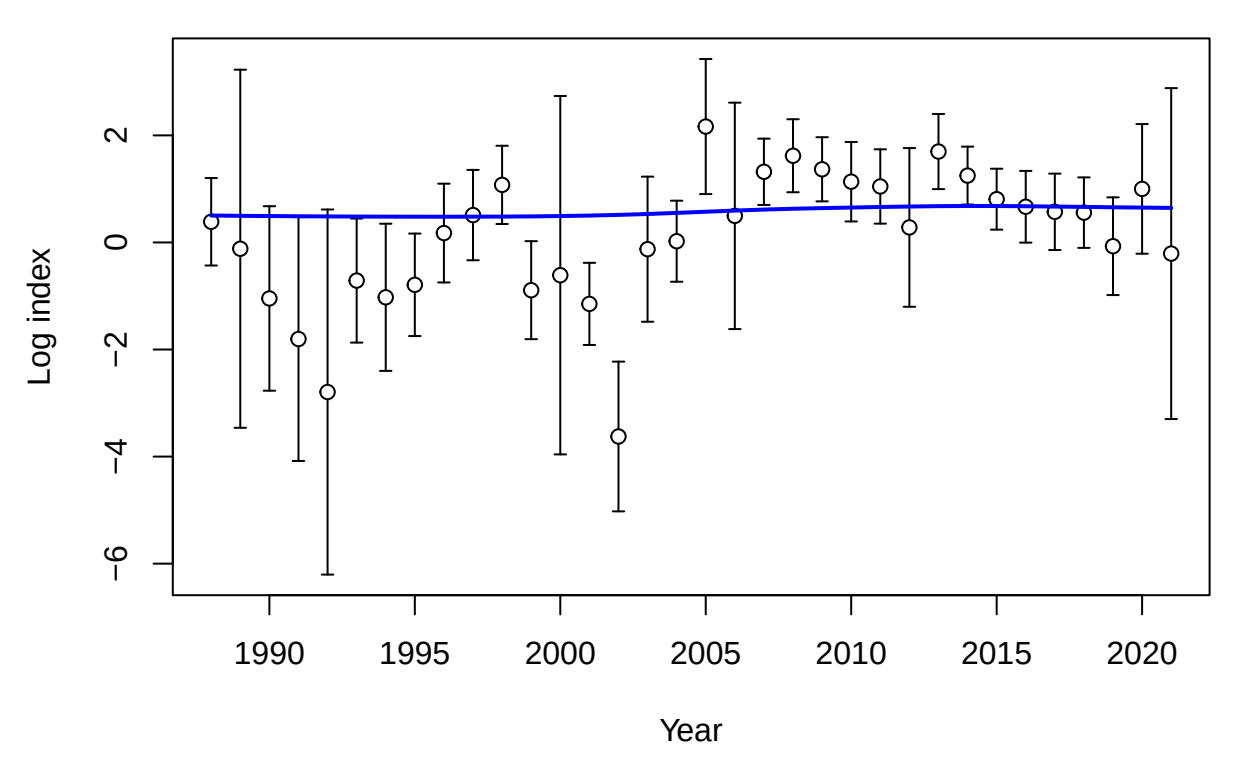

Fishing intensity: 1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
0
1
2
3
Relative spawning output: B/B_MSY

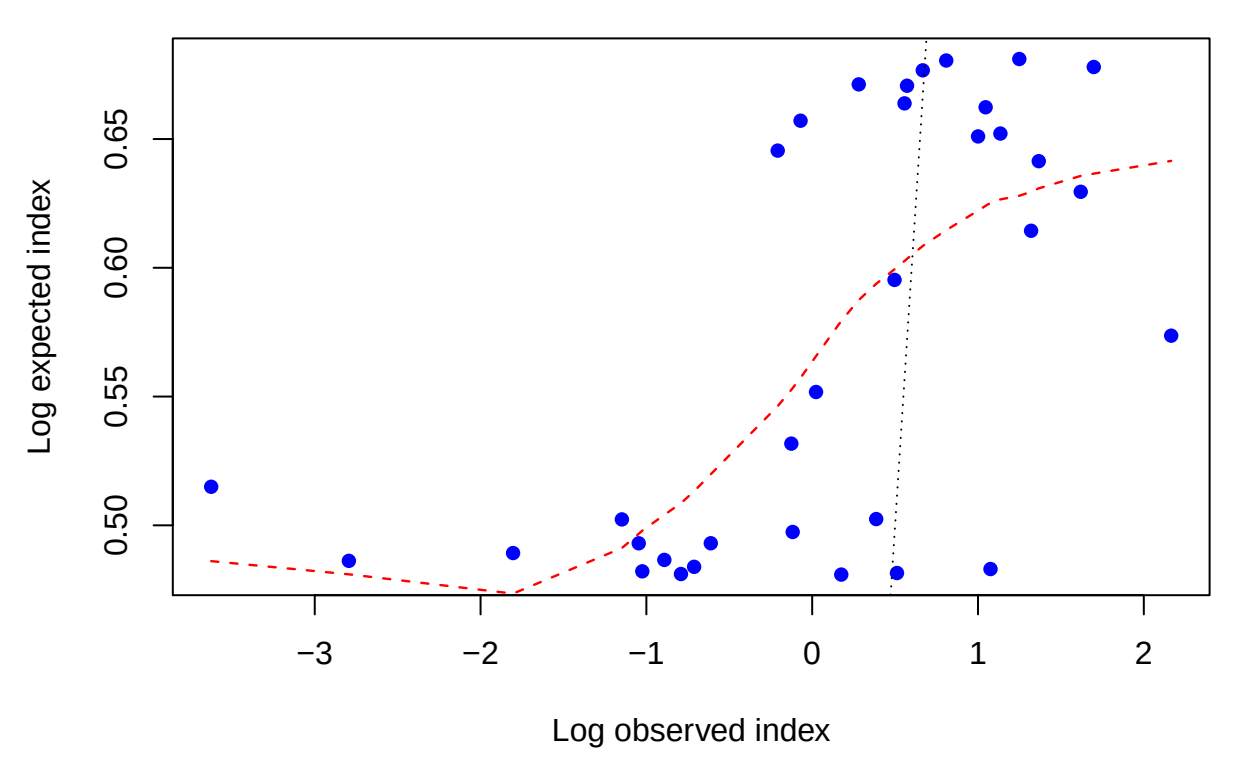

Index
0
5
10
15
20
25
30
1990
1995
2000
2005
2010
2015
2020
Year

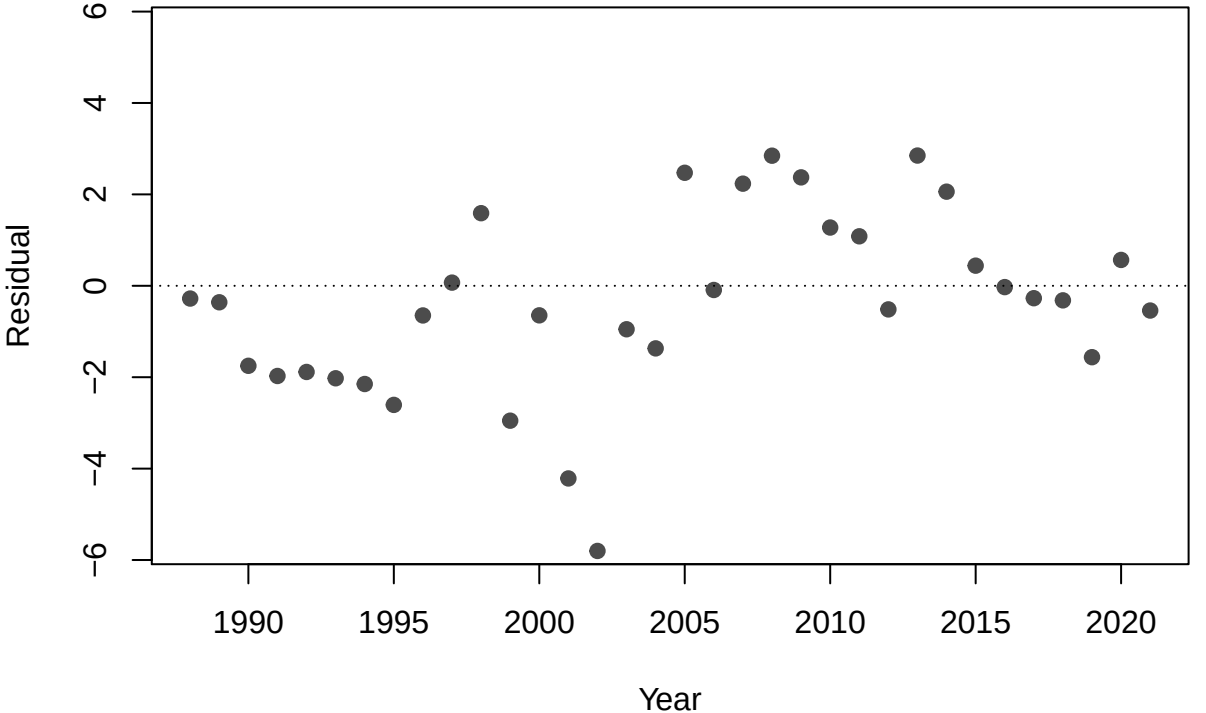

Index
0
5
10
15
20
25
30
1990
1995
2000
2005
2010
2015
2020
Year

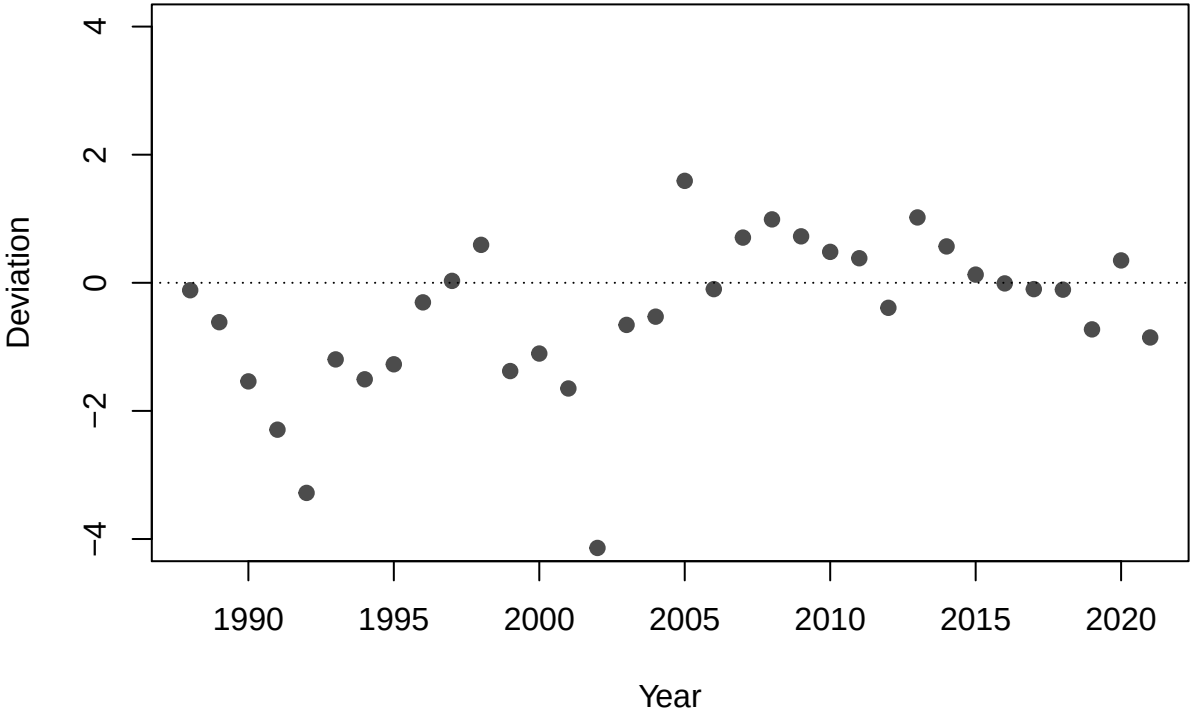

Expected index
0.0
0.5
1.0
1.5
2.0
0
2
4
6
8
Observed index

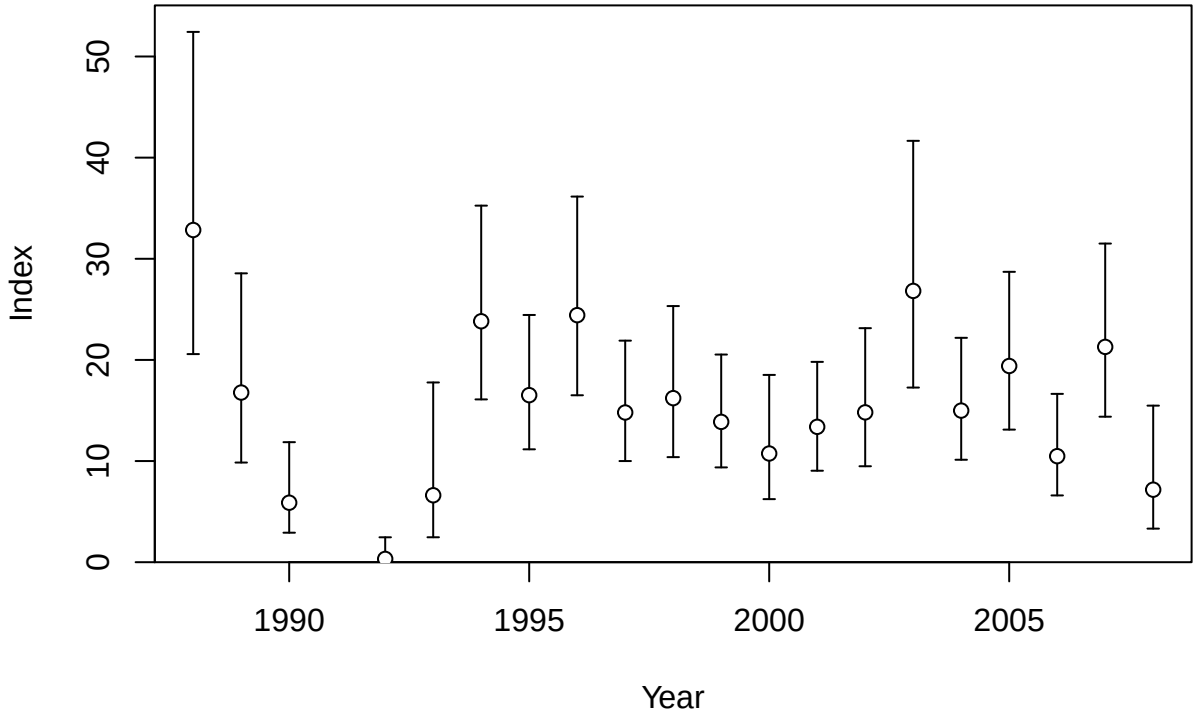

Log index
2
0
−2
−4
−6
1990
1995
2000
2005
2010
2015
2020
Year

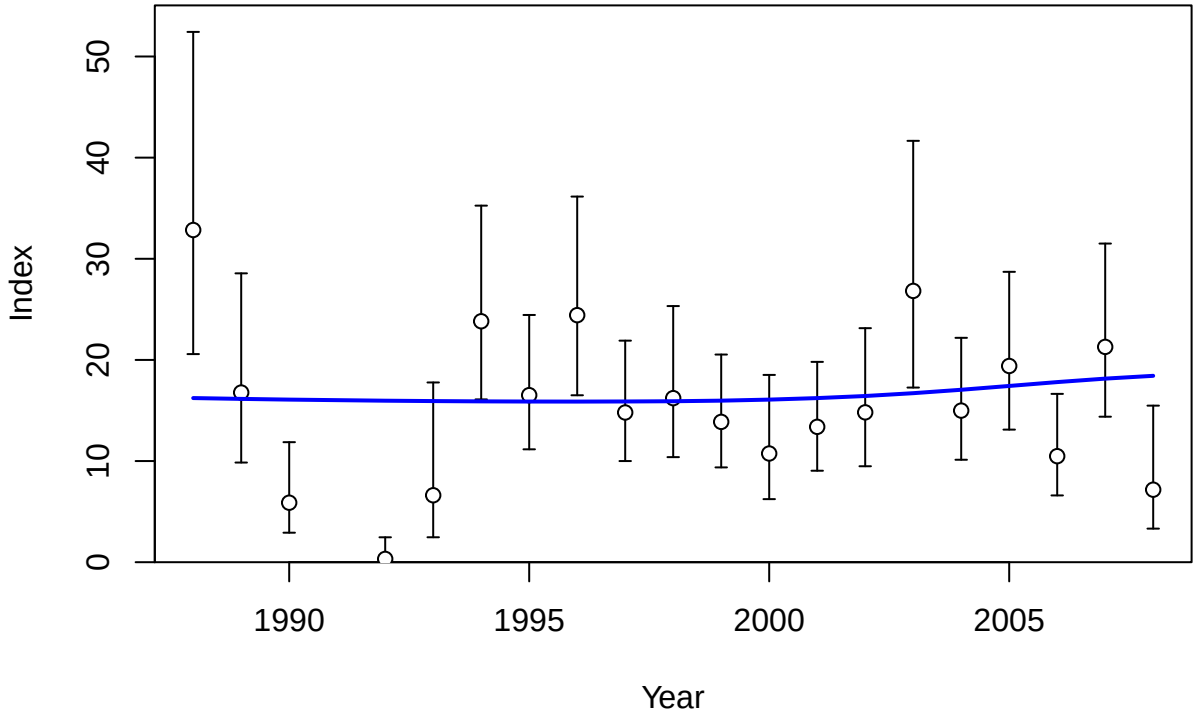

Log index
2
0
−2
−4
−6
1990
1995
2000
2005
2010
2015
2020
Year

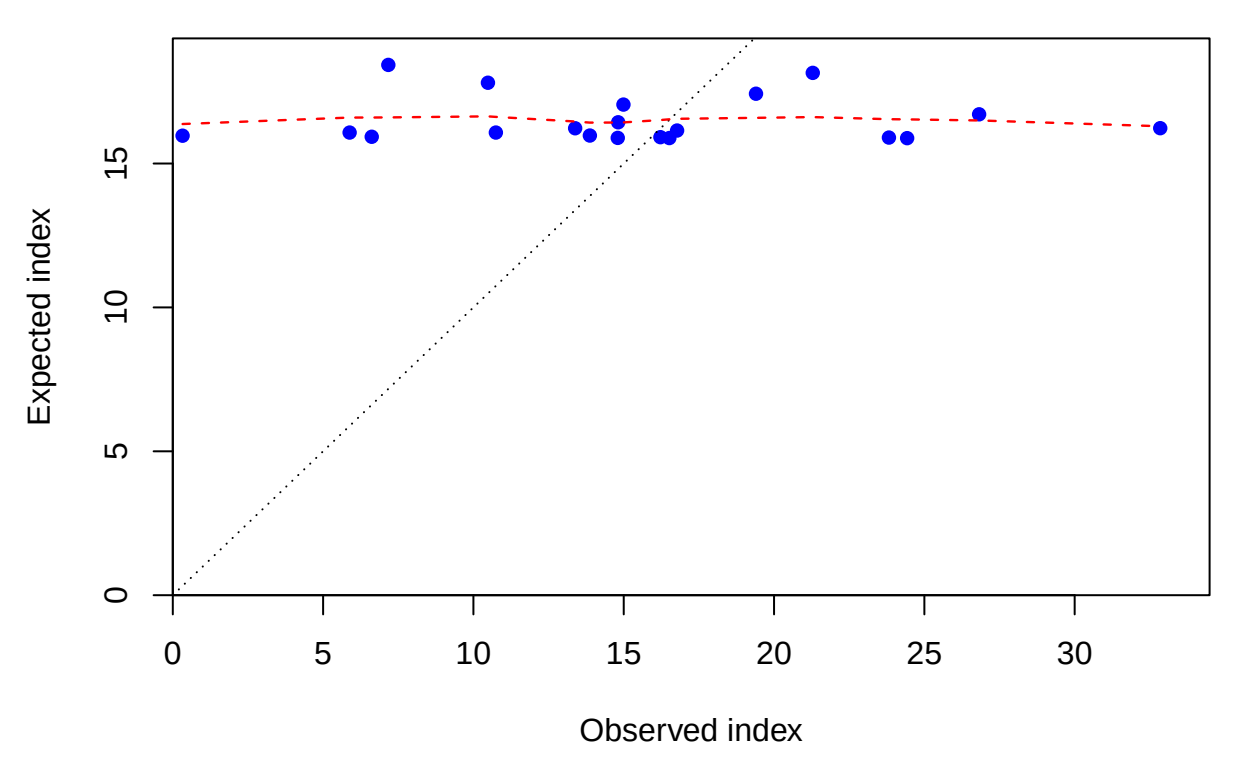

Log expected index
0.50
0.55
0.60
0.65
−3
−2
−1
0
1
2
Log observed index

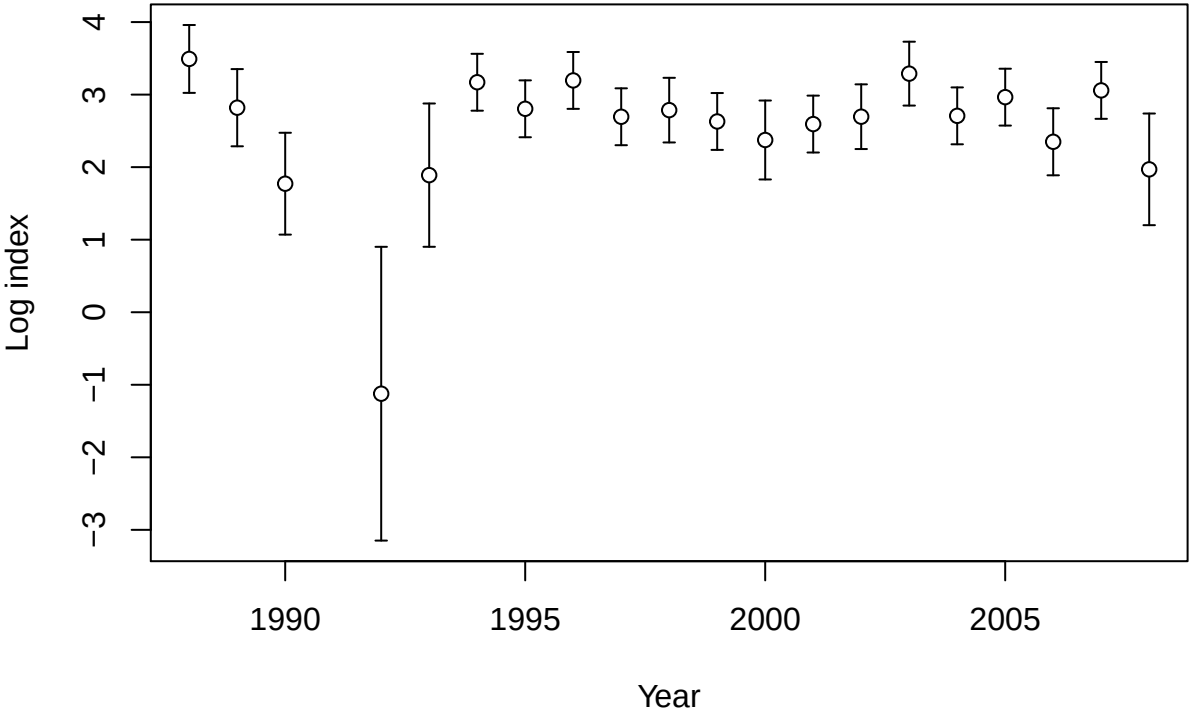

Residual
6
4
2
0
−2
−4
−6
1990
1995
2000
2005
2010
2015
2020
Year

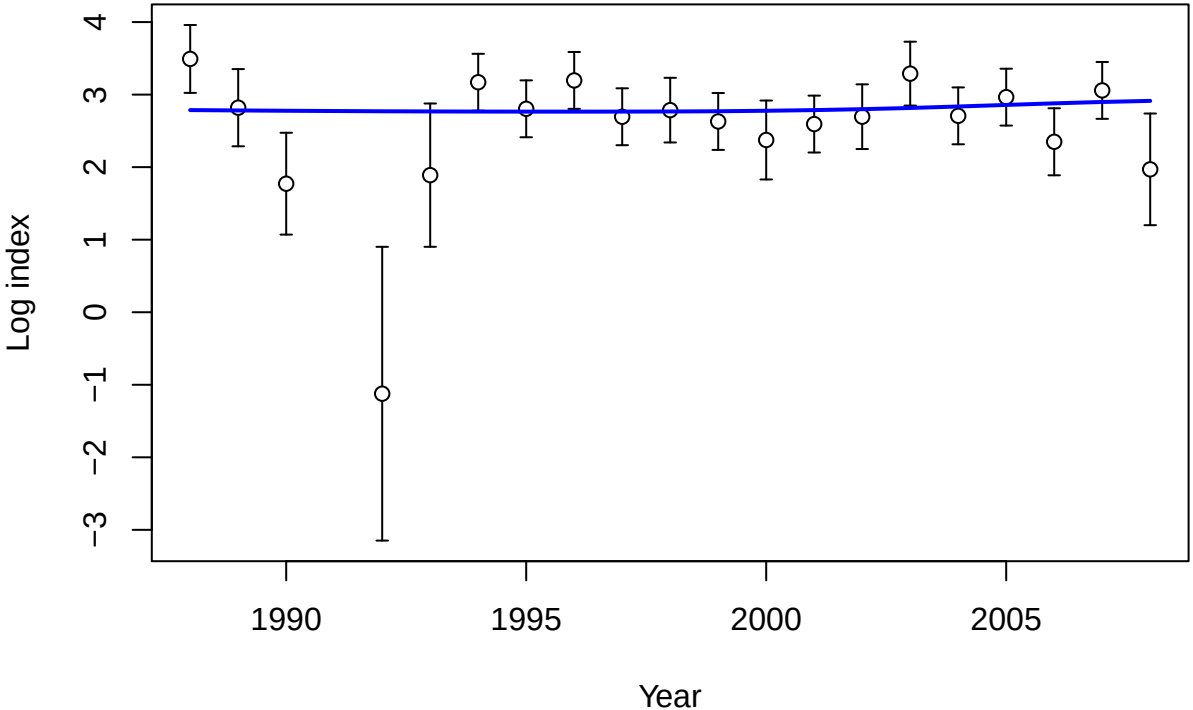

Deviation
4
2
0
−2
−4
1990
1995
2000
2005
2010
2015
2020
Year

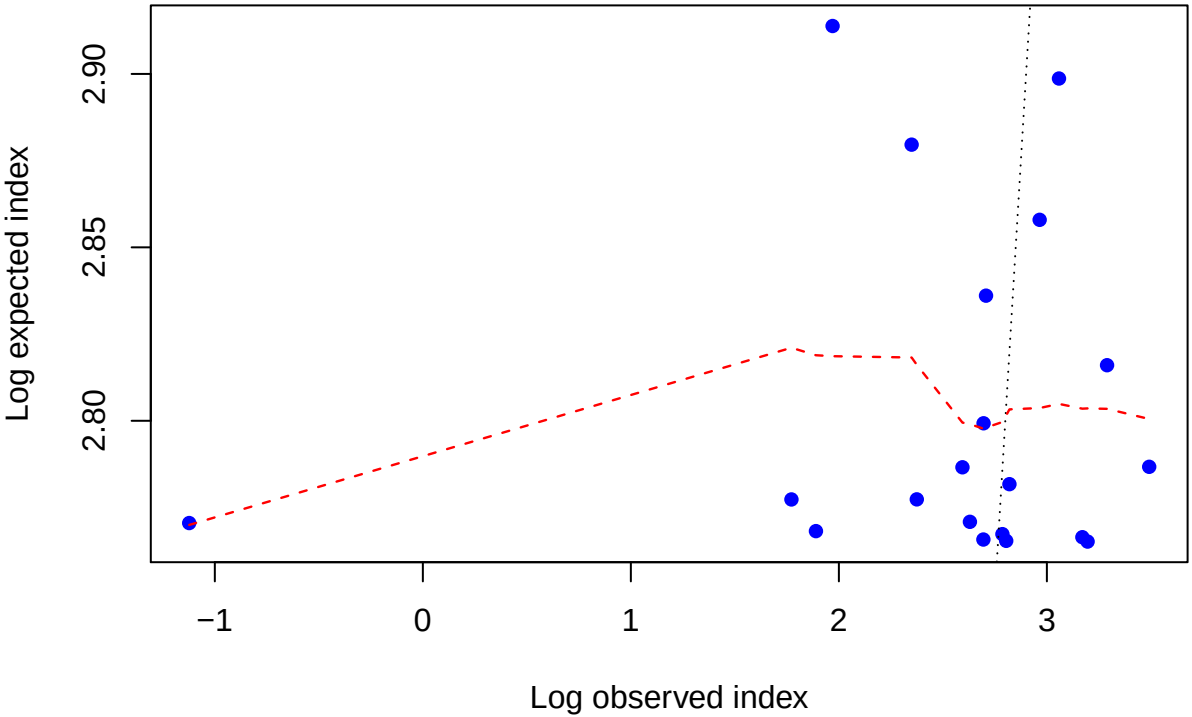

Index
0
10
20
30
40
50
1990
1995
2000
2005
Year

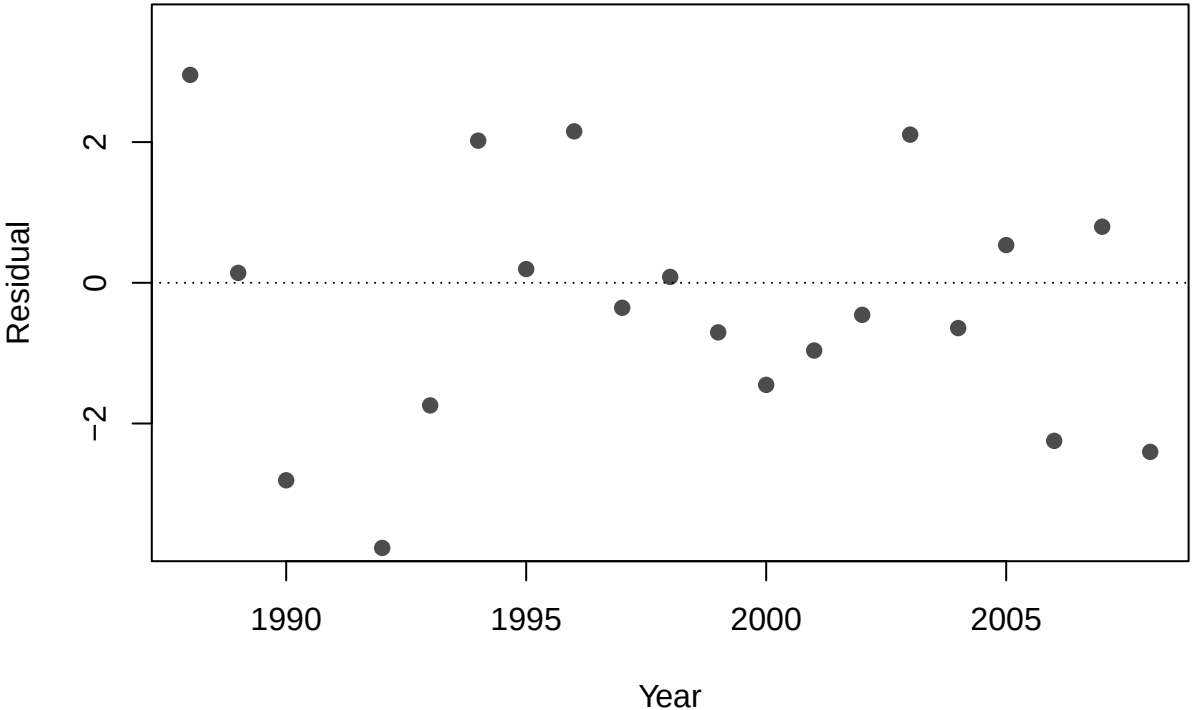

Index
0
10
20
30
40
50
1990
1995
2000
2005
Year

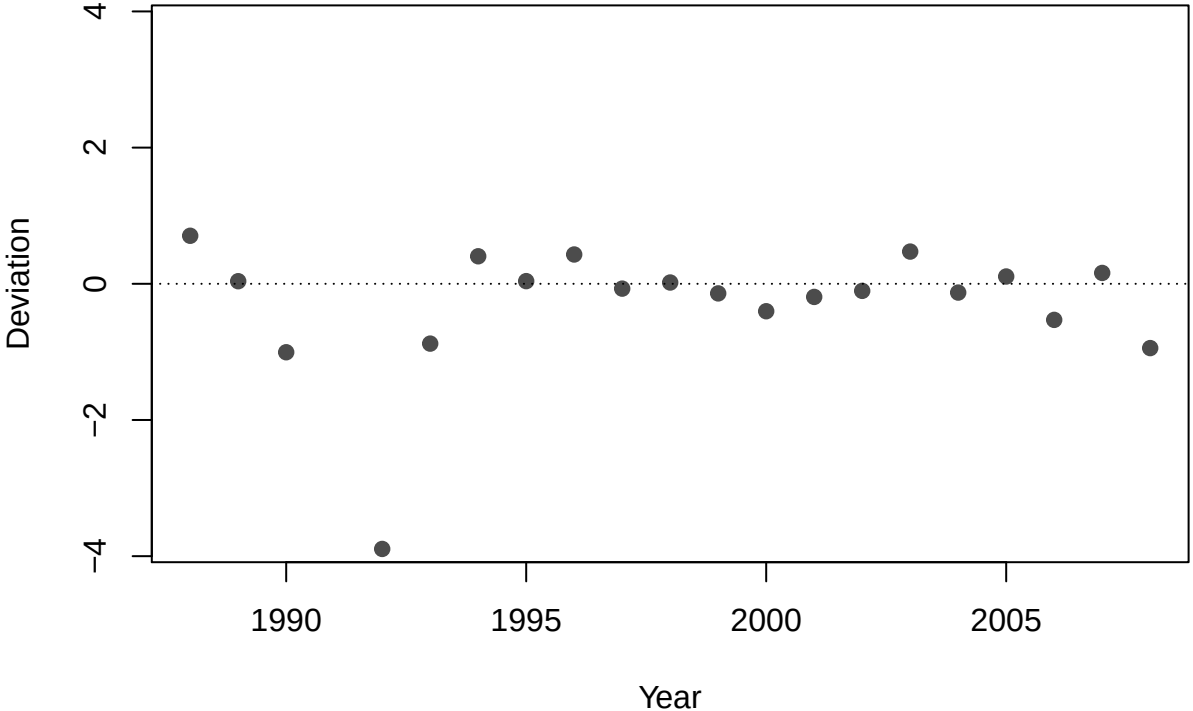

Expected index
0
5
10
15
0
5
10
15
20
25
30
Observed index

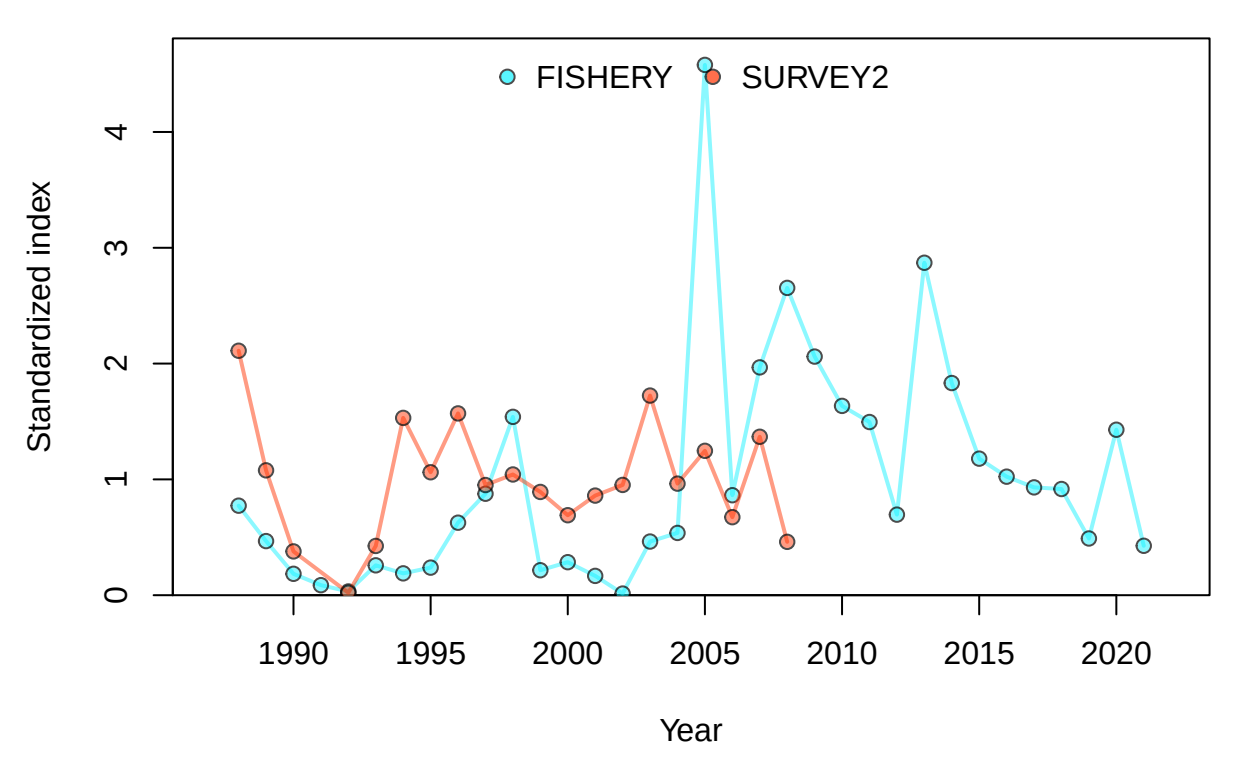

Log index
4
3
2
1
0
−1
−2
−3
1990
1995
2000
2005
Year

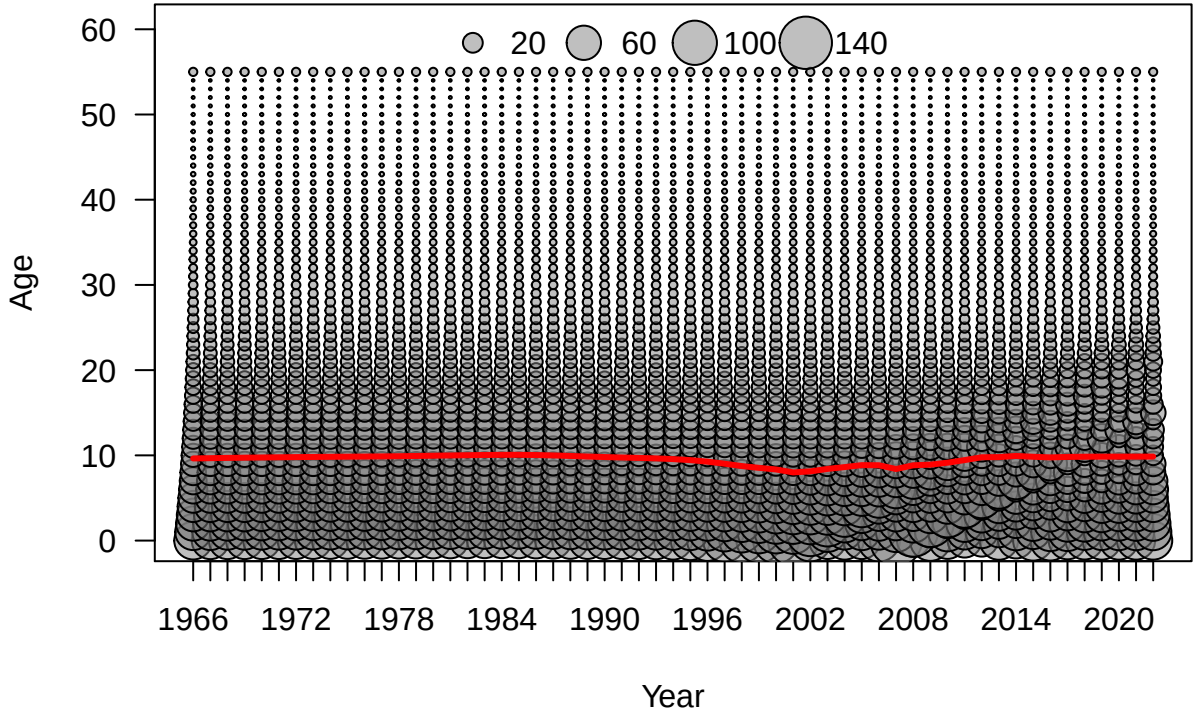

Log index
4
3
2
1
0
−1
−2
−3
1990
1995
2000
2005
Year

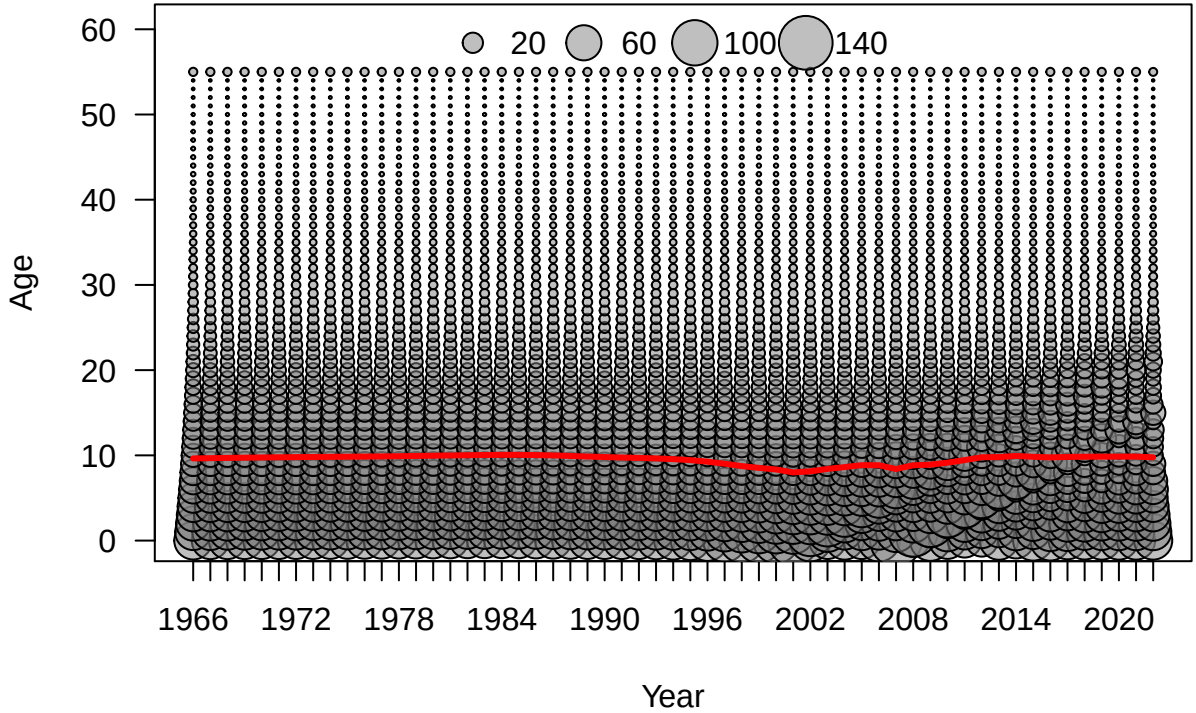

Log expected index
2.80
2.85
2.90
−1
0
1
2
3
Log observed index

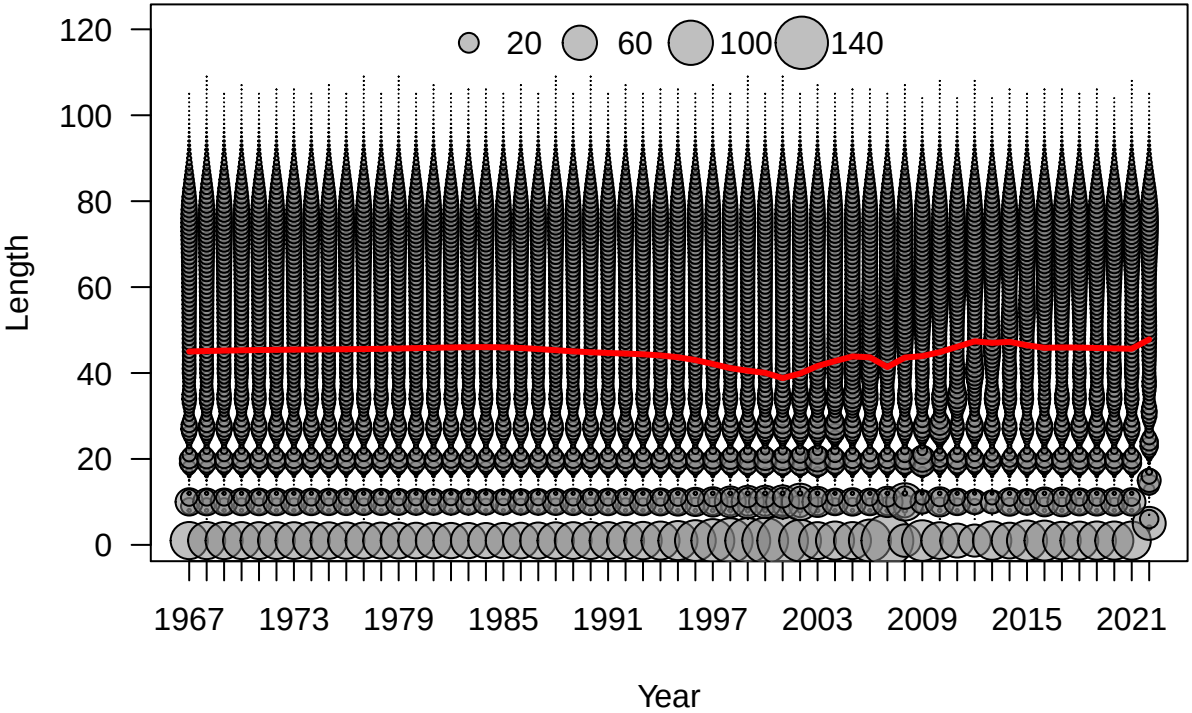

Residual
2
0
−2
1990
1995
2000
2005
Year

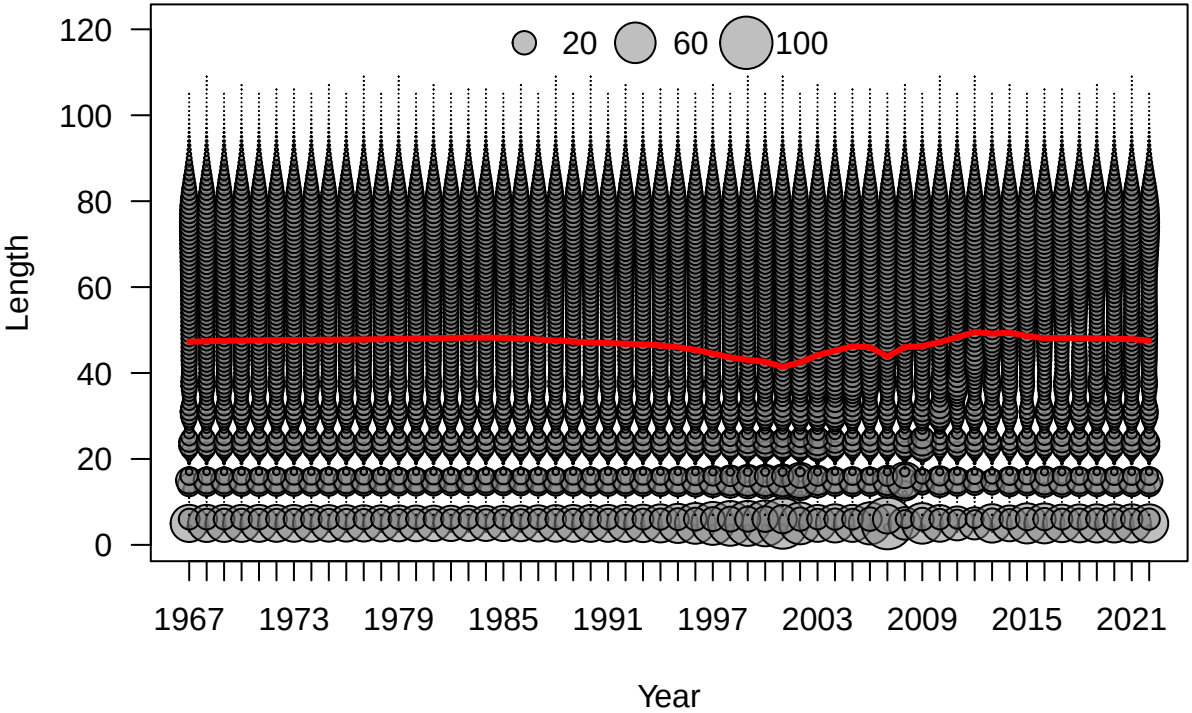

Deviation
4
2
0
−2
−4
1990
1995
2000
2005
Year

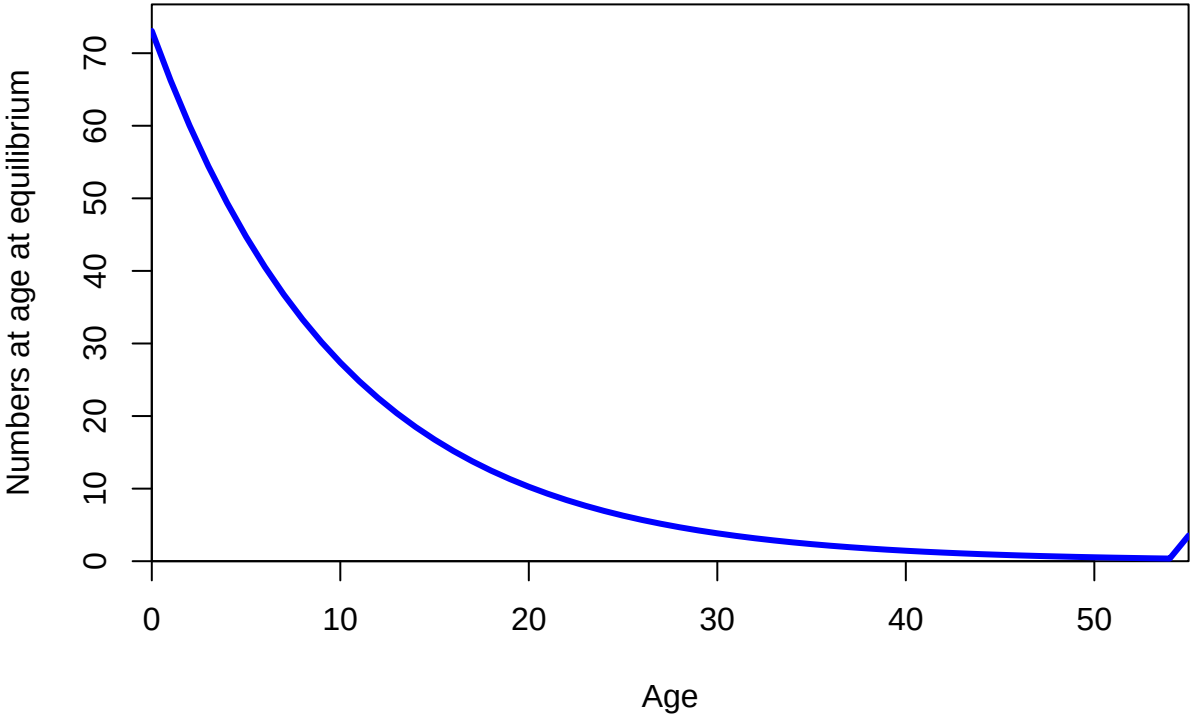

FISHERY
SURVEY2
Standardized index
0
1
2
3
4
1990
1995
2000
2005
2010
2015
2020
Year

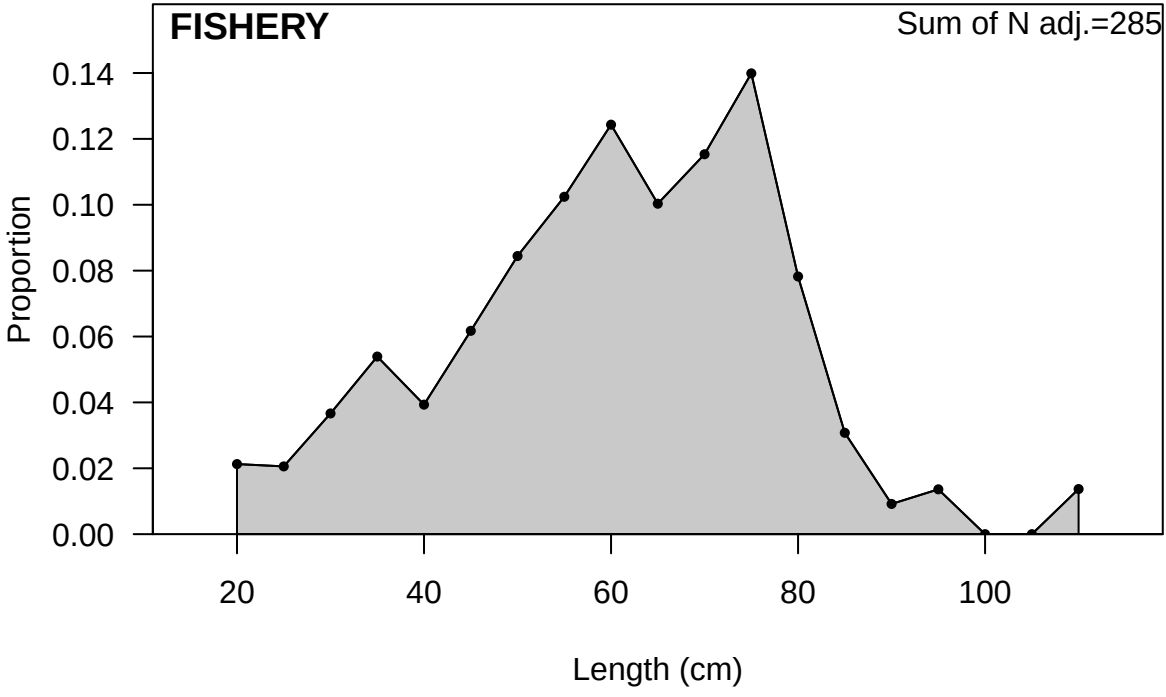

20
60
100
140
Age
Year
0
10
20
30
40
50
60
1966
1972
1978
1984
1990
1996
2002
2008
2014
2020

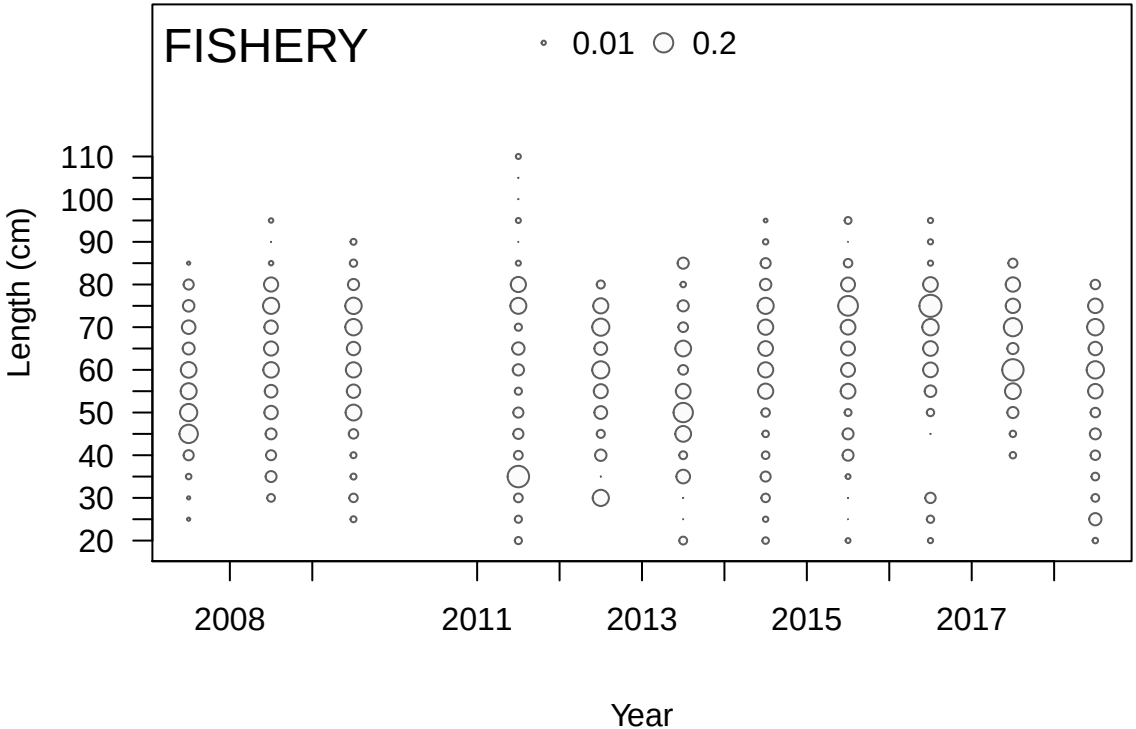

20
60
100
140
Age
Year
0
10
20
30
40
50
60
1966
1972
1978
1984
1990
1996
2002
2008
2014
2020

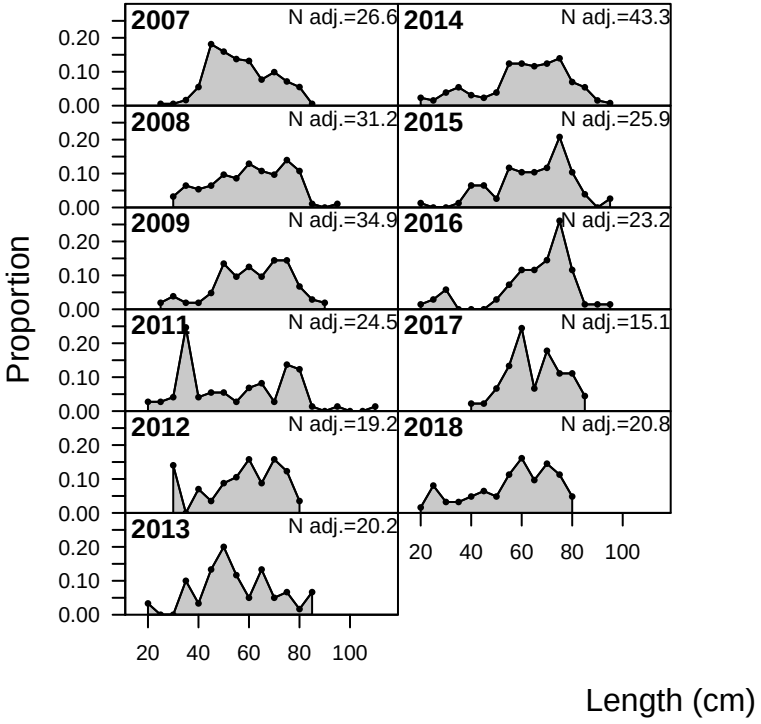

20
60
100
140
120
100
80
60
40
20
0
Length
1967
1973
1979
1985
1991
1997
2003
2009
2015
2021
Year

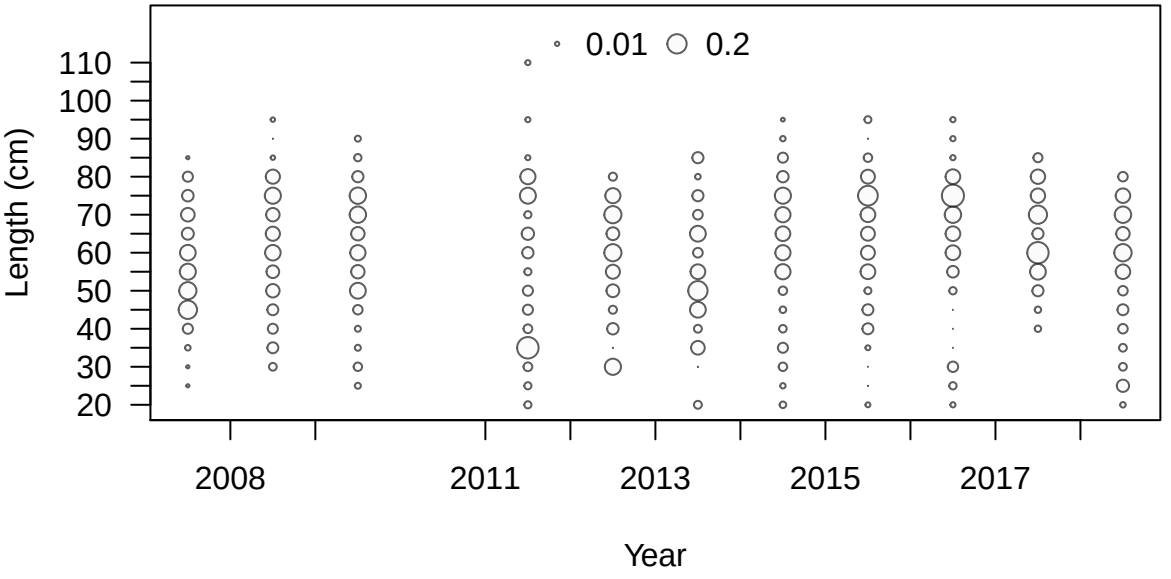

20
60
100
120
100
80
60
40
20
0
Length
1967
1973
1979
1985
1991
1997
2003
2009
2015
2021
Year

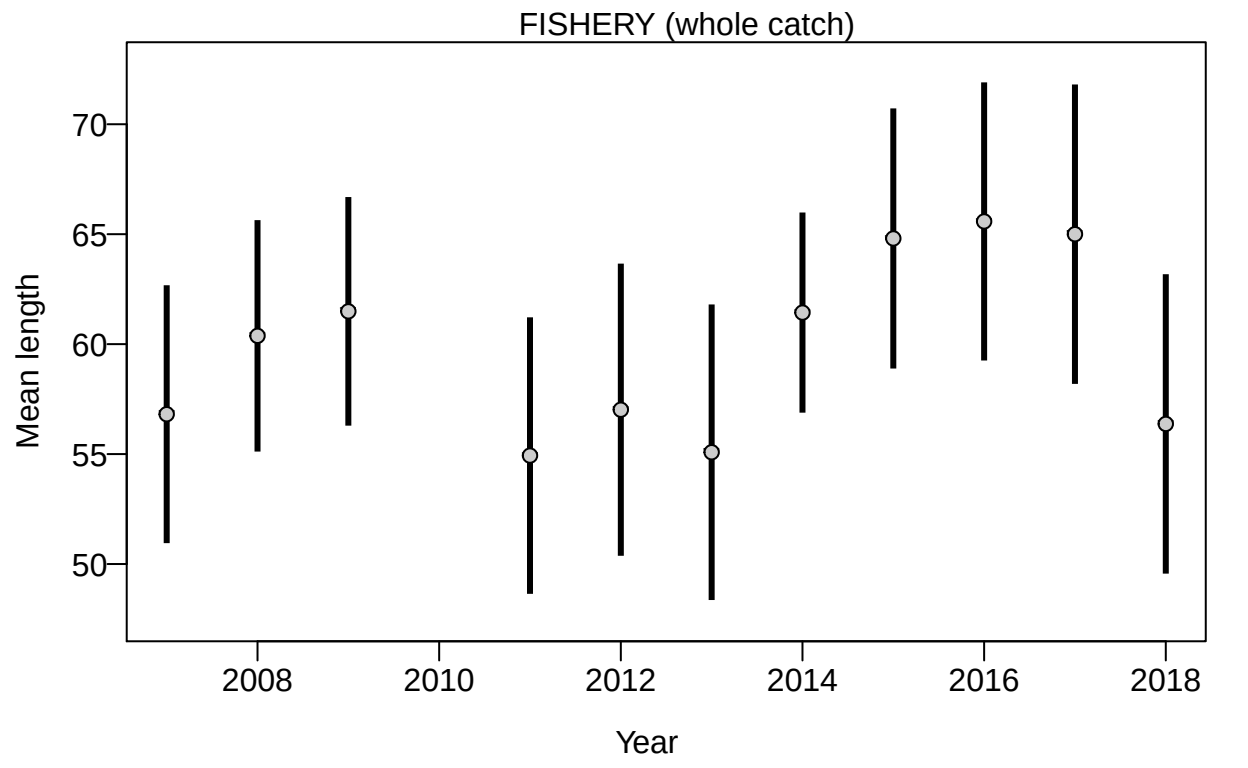

Numbers at age at equilibrium
0
10
20
30
40
50
60
70
0
10
20
30
40
50
Age

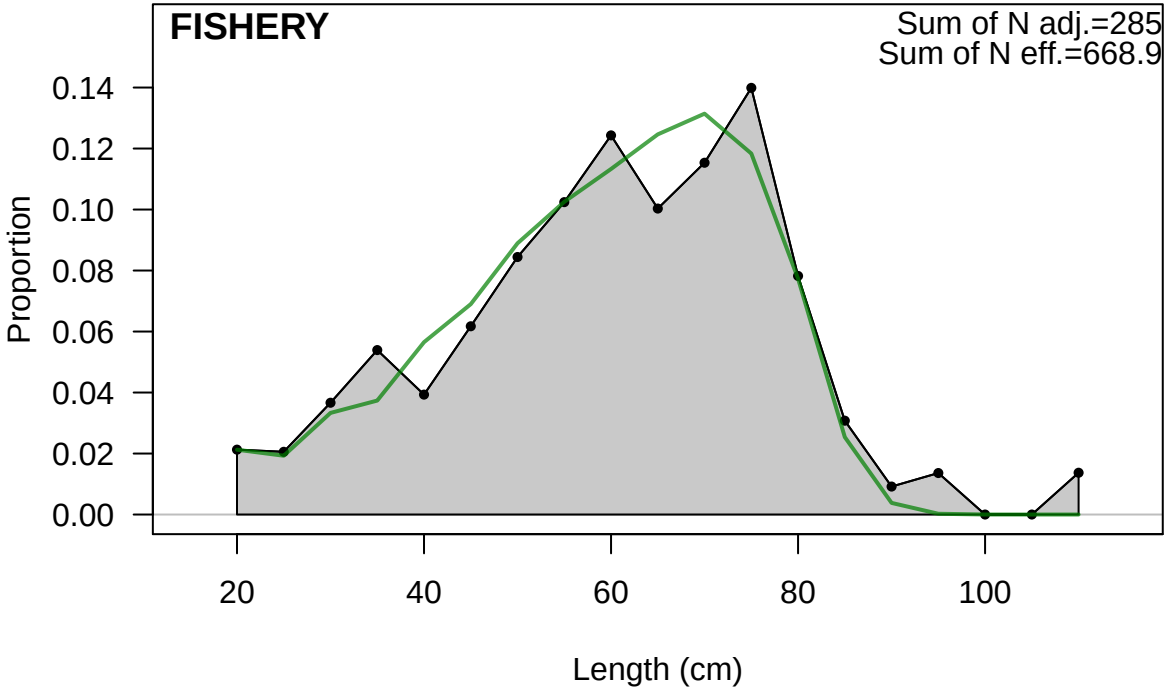

FISHERY
Sum of N adj.=285
Proportion
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
20
40
60
80
100
Length (cm)

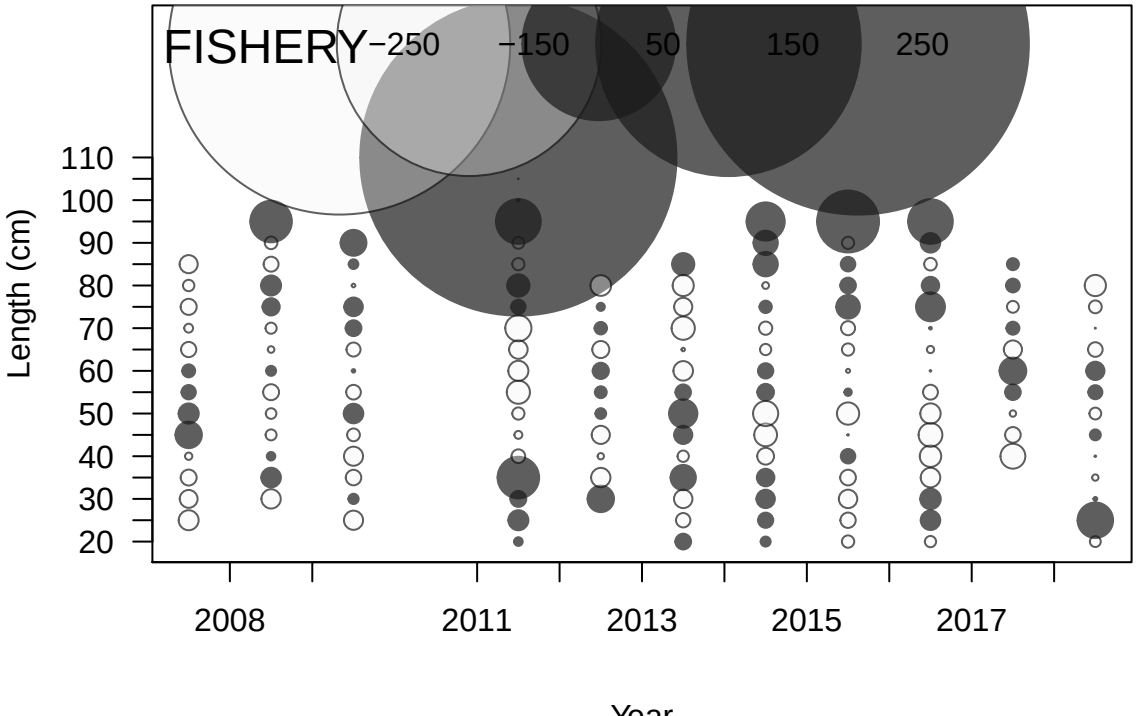

FISHERY
0.01
0.2
Length (cm)
110
100
90
80
70
60
50
40
30
20
2008
2011
2013
2015
2017
Year

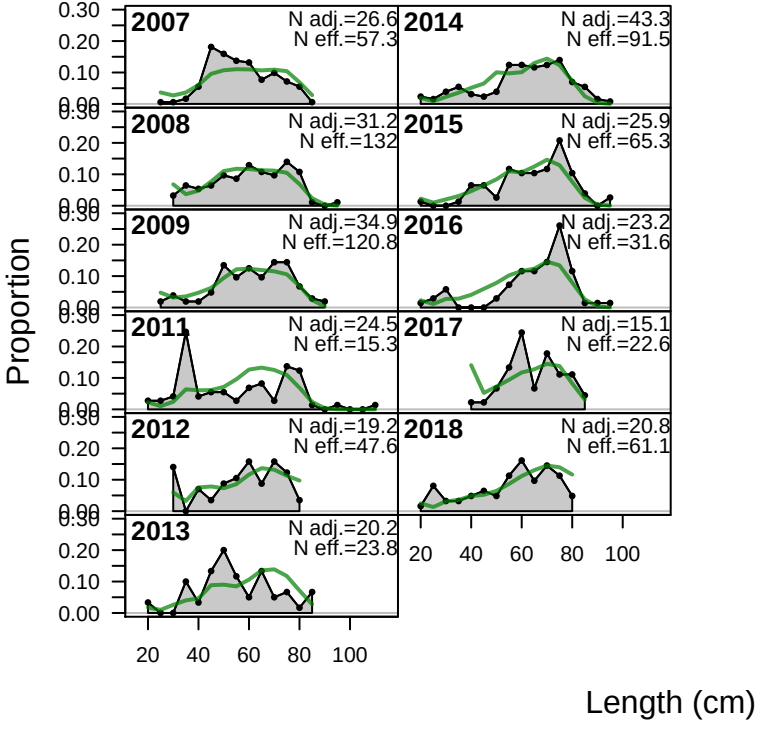

2007
N adj.=26.6
2014
N adj.=43.3
2008
N adj.=31.2
2015
N adj.=25.9
2009
N adj.=34.9
2016
N adj.=23.2
2011
N adj.=24.5
2017
N adj.=15.1
2012
N adj.=19.2
2018
N adj.=20.8
2013
N adj.=20.2
0.00
0.10
0.20
20
40
60
80
100
Proportion
Length (cm)

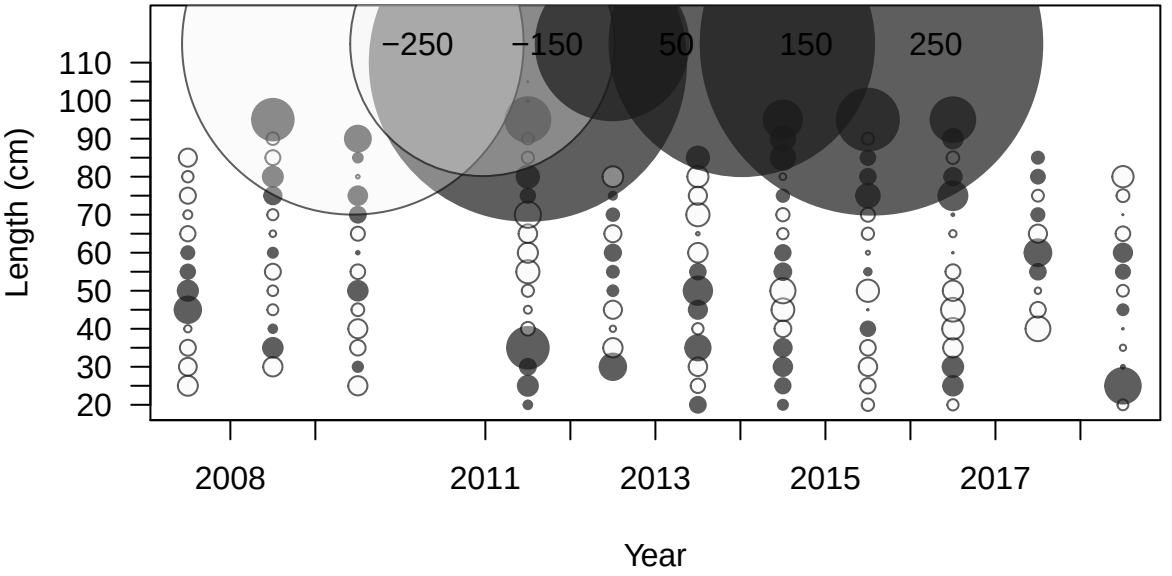

0.01
0.2
Length (cm)
110
100
90
80
70
60
50
40
30
20
2008
2011
2013
2015
2017
Year

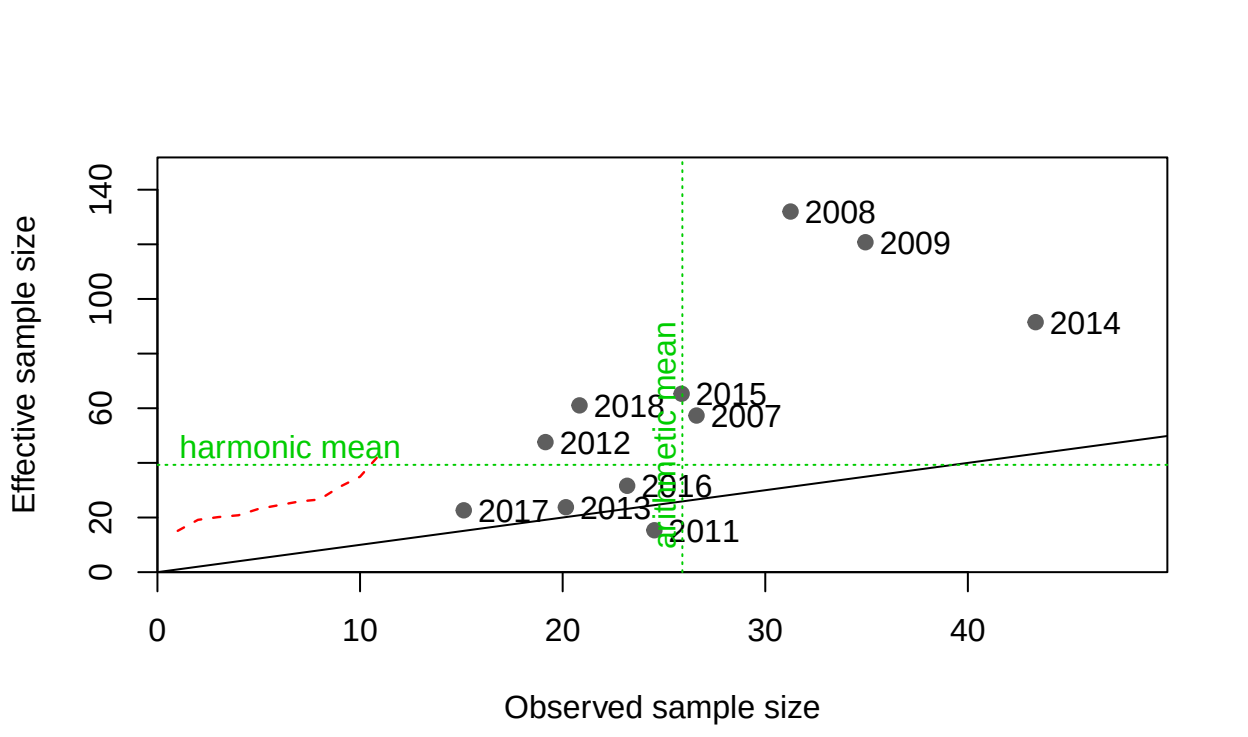

FISHERY (whole catch)
Mean length
70
65
60
55
50
2008
2010
2012
2014
2016
2018
Year

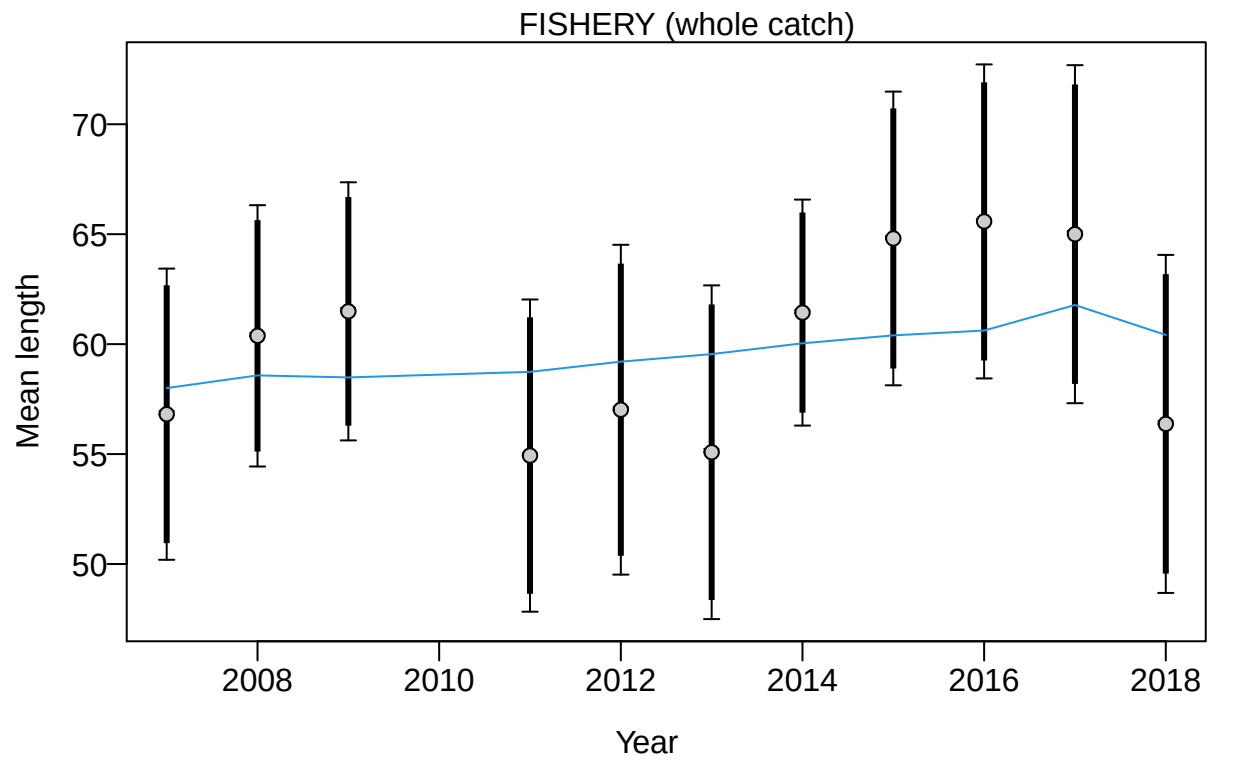

FISHERY
Sum of N adj.=285
Sum of N eff.=668.9
Proportion
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
20
40
60
80
100
Length (cm)

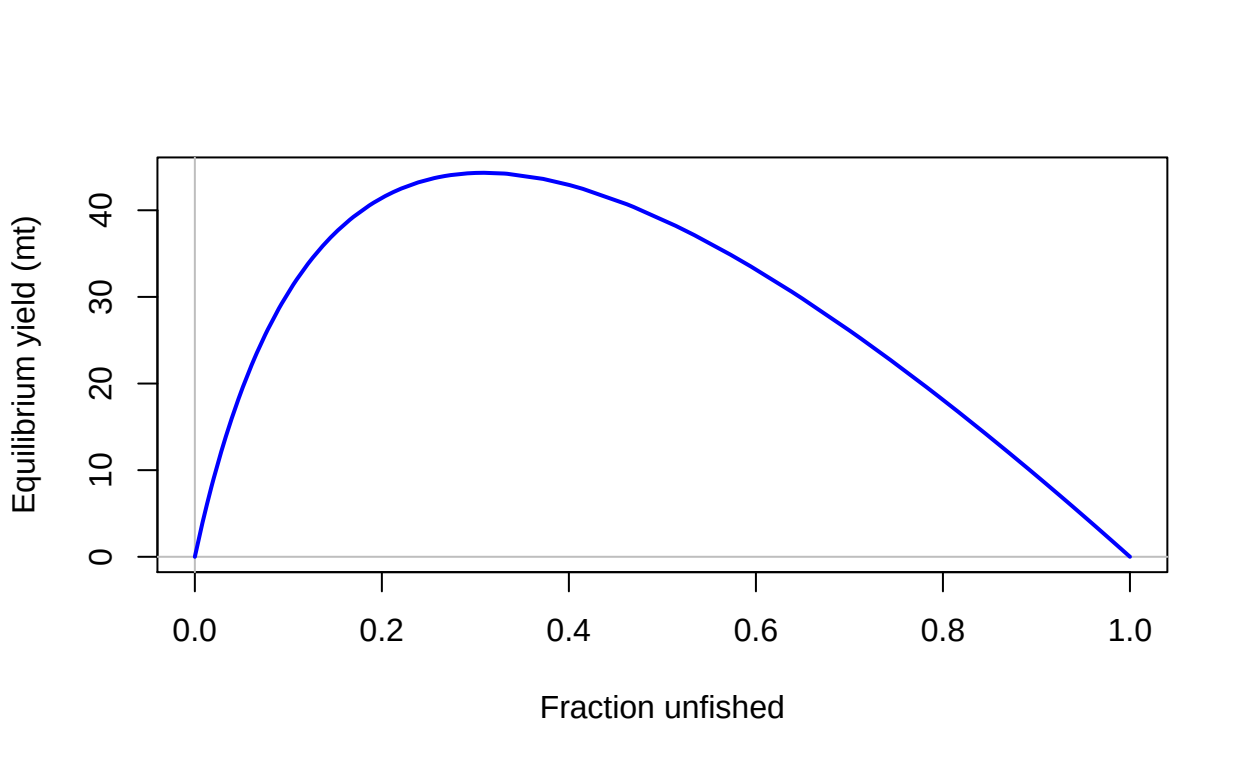

FISHERY
−250
−150
50
150
250
Length (cm)
110
100
90
80
70
60
50
40
30
20
2008
2011
2013
2015
2017
Year

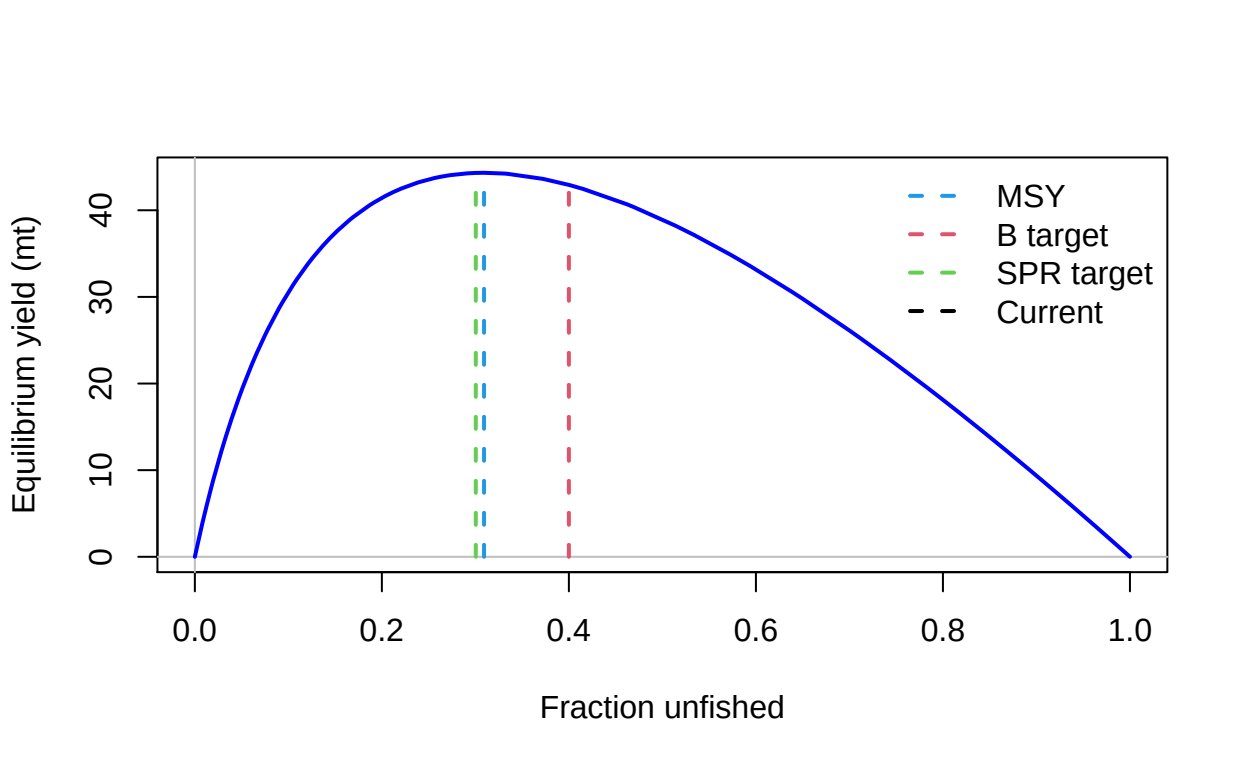

2007
N adj.=26.6
N eff.=57.3
2014
N adj.=43.3
N eff.=91.5
2008
N adj.=31.2
N eff.=132
2015
N adj.=25.9
N eff.=65.3
2009
N adj.=34.9
N eff.=120.8
2016
N adj.=23.2
N eff.=31.6
2011
N adj.=24.5
N eff.=15.3
2017
N adj.=15.1
N eff.=22.6
2012
N adj.=19.2
N eff.=47.6
2018
N adj.=20.8
N eff.=61.1
2013
N adj.=20.2
N eff.=23.8
0.30
0.20
0.10
0.00
20
40
60
80
100
Proportion
Length (cm)

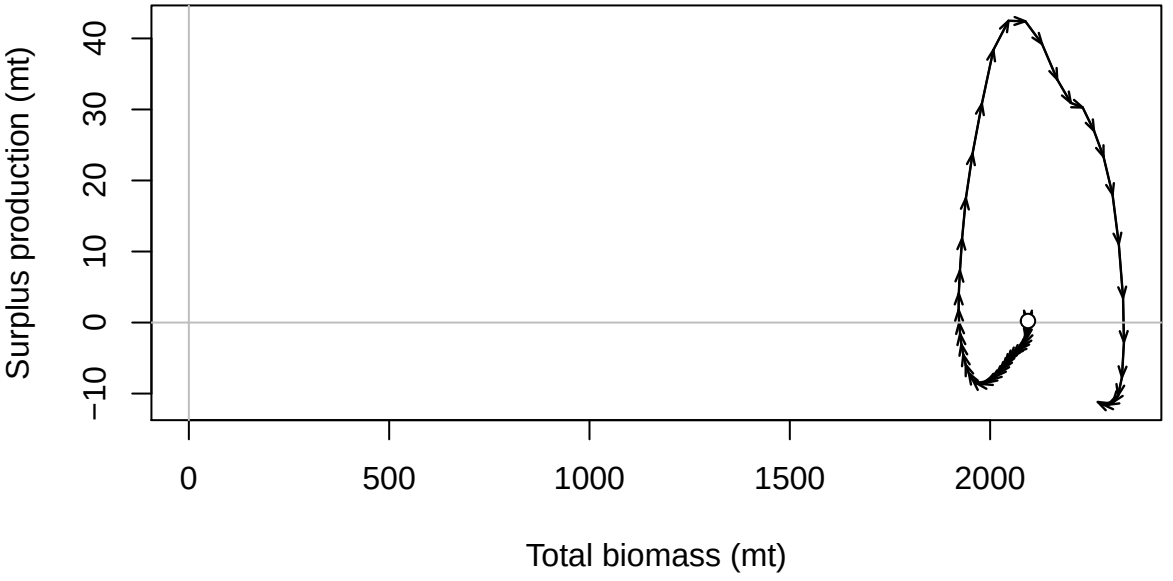

−250
−150
50
150
250
110
100
90
80
70
60
50
40
30
20
Length (cm)
2008
2011
2013
2015
2017
Year

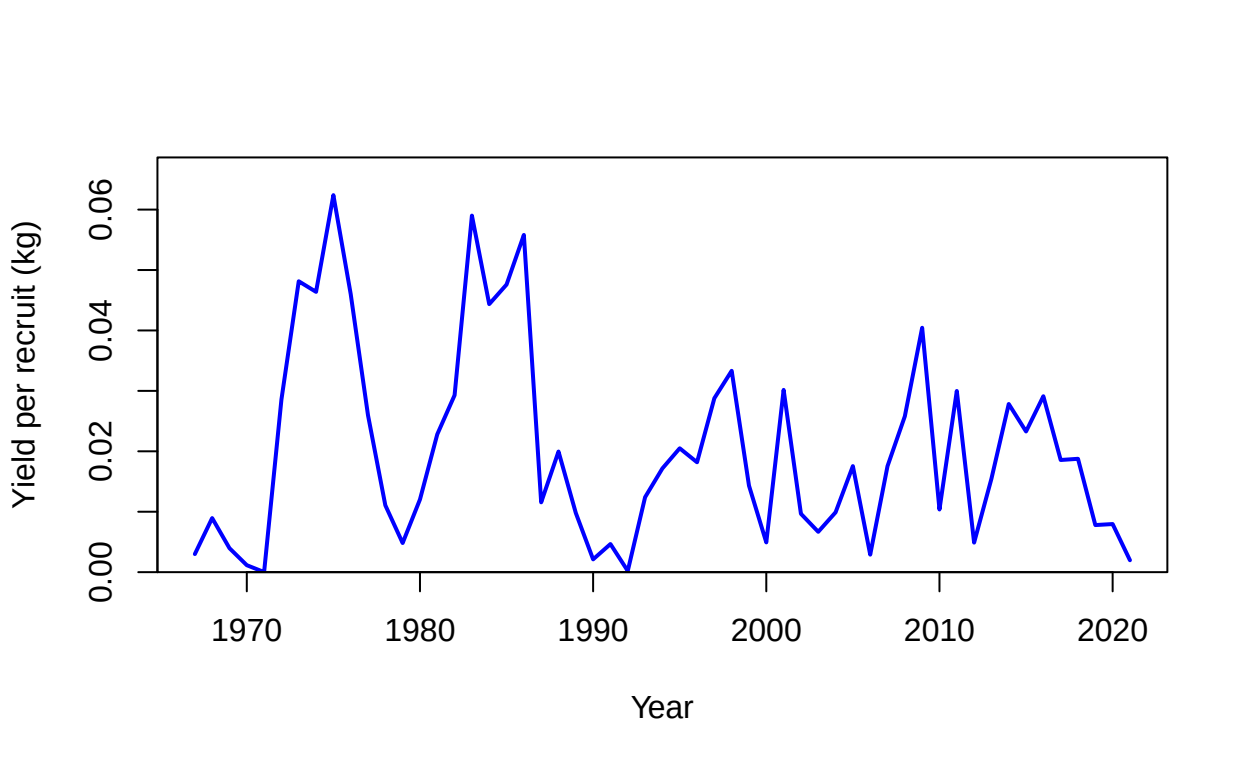

Effective sample size
0
20
60
100
140
0
10
20
30
40
Observed sample size
harmonic mean
arithmetic mean
2008
2009
2014
2015
2018
2007
2012
2016
2017
2013
2011

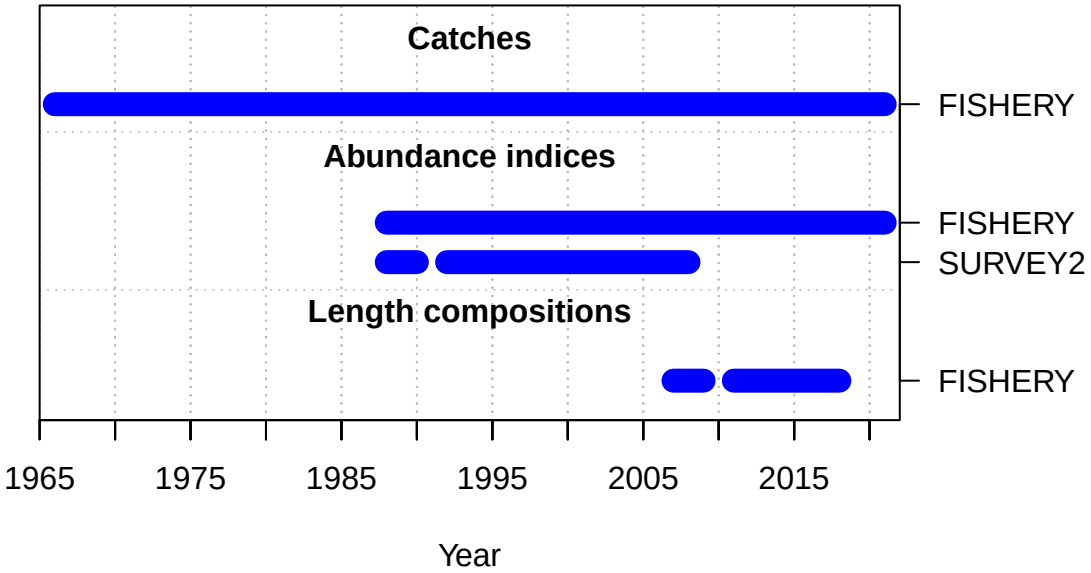

FISHERY (whole catch)
Mean length
70
65
60
55
50
2008
2010
2012
2014
2016
2018
Year

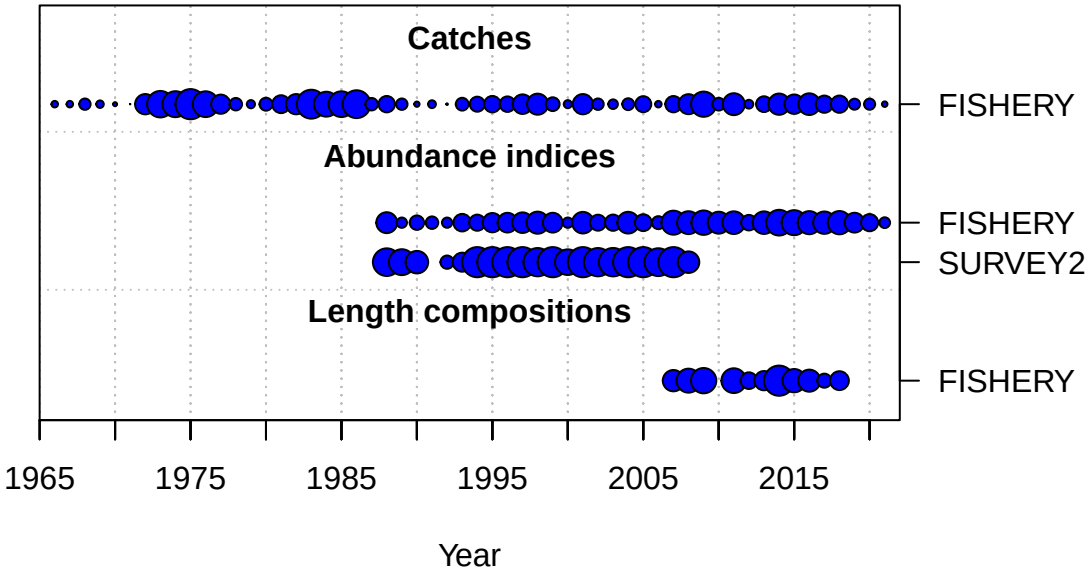

Equilibrium yield (mt)
0
10
20
30
40
0.0
0.2
0.4
0.6
0.8
1.0
Fraction unfished

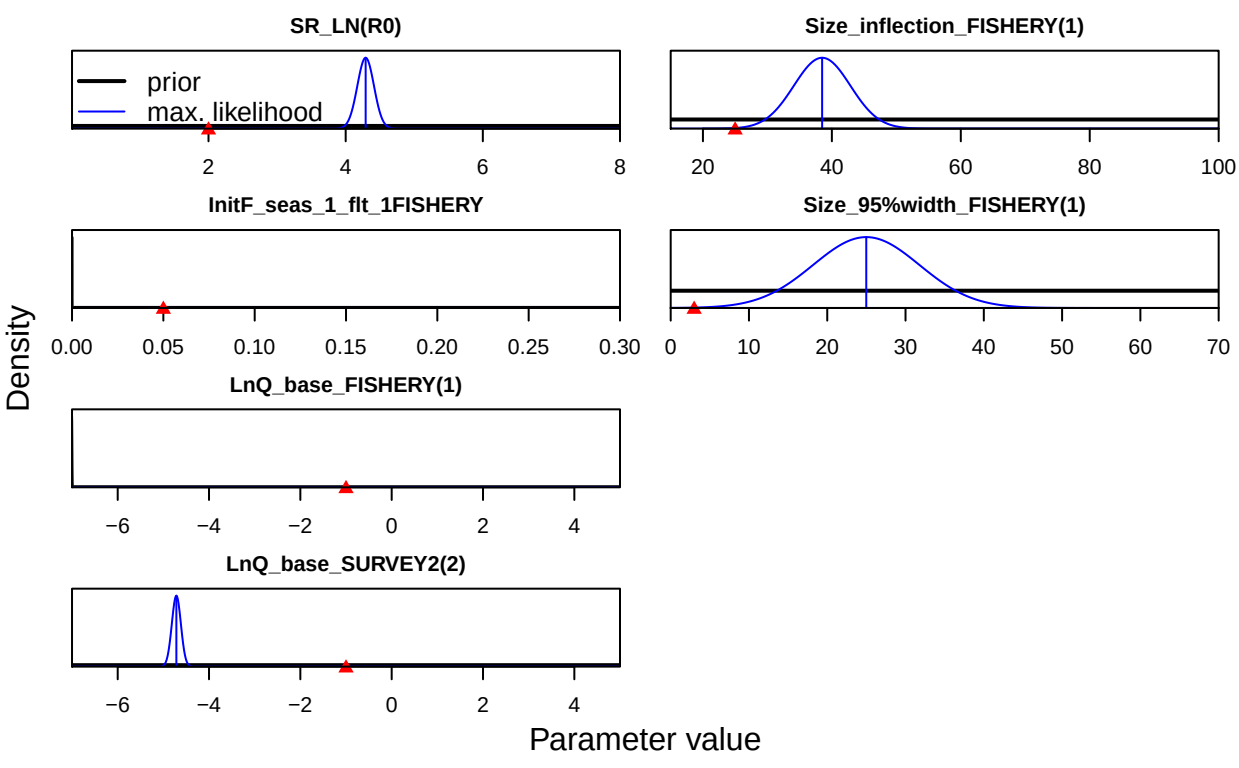

Equilibrium yield (mt)
0
10
20
30
40
0.0
0.2
0.4
0.6
0.8
1.0
Fraction unfished
MSY
B target
SPR target
Current


Surplus production (mt)
−10
0
10
20
30
40
0
500
1000
1500
2000
Total biomass (mt)


Yield per recruit (kg)
0.00
0.02
0.04
0.06
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
2
4
6
8
Size_inflection_FISHERY(1)
20
40
60
80
100
InitF_seas_1_flt_1FISHERY
0.00
0.05
0.10
0.15
0.20
0.25
0.30
Size_95%width_FISHERY(1)
0
10
20
30
40
50
60
70
LnQ_base_FISHERY(1)
−6
−4
−2
0
2
4
LnQ_base_SURVEY2(2)
−6
−4
−2
0
2
4
Density
Parameter value