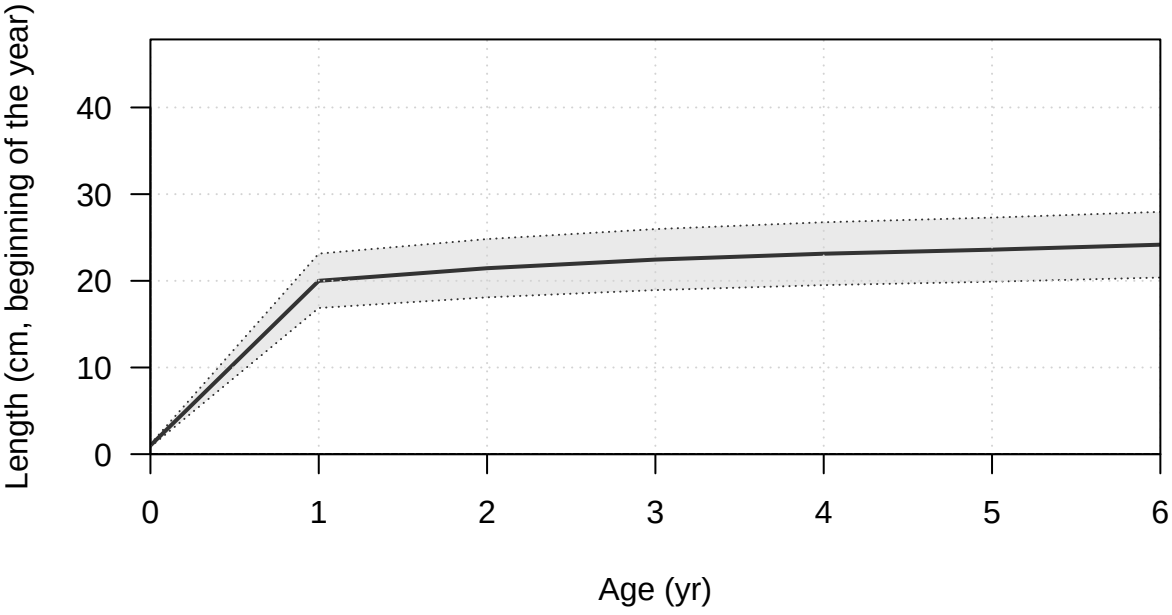
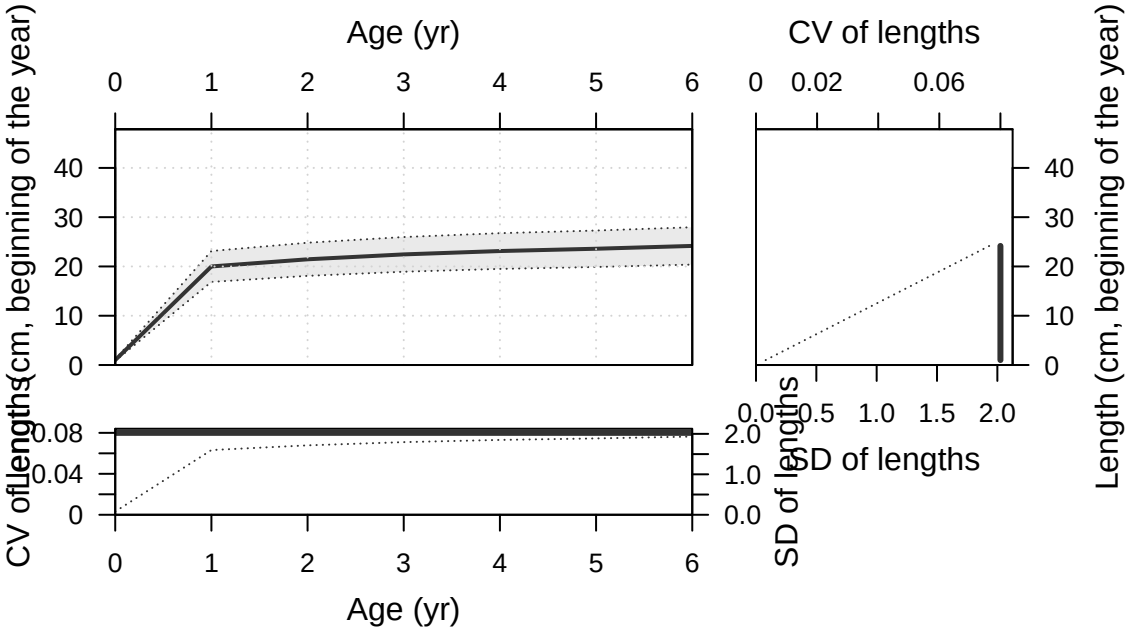
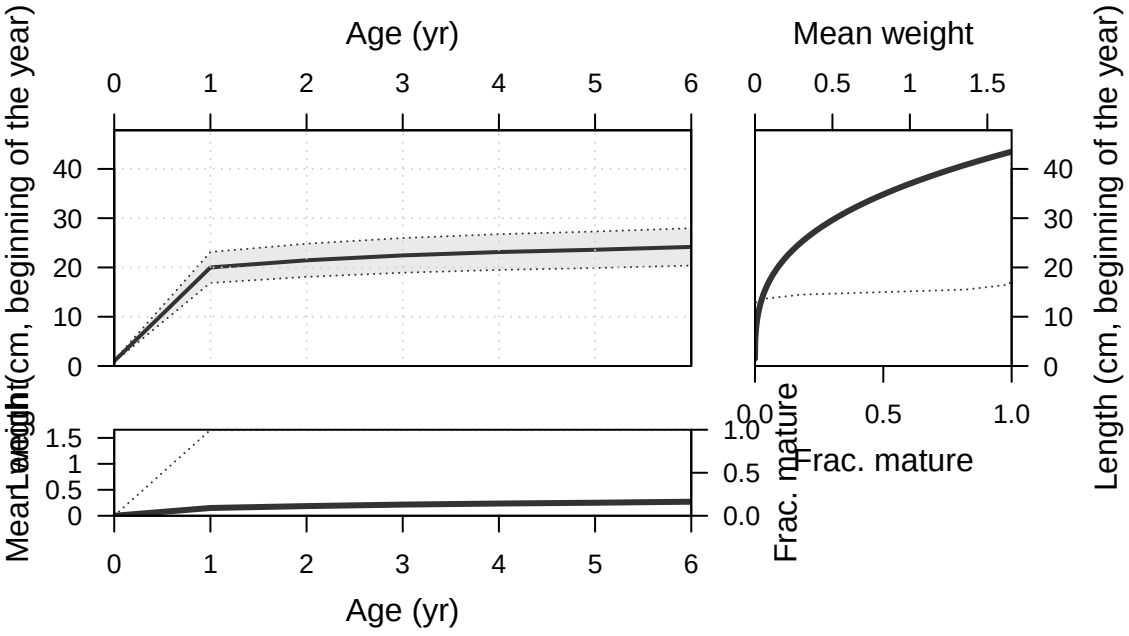
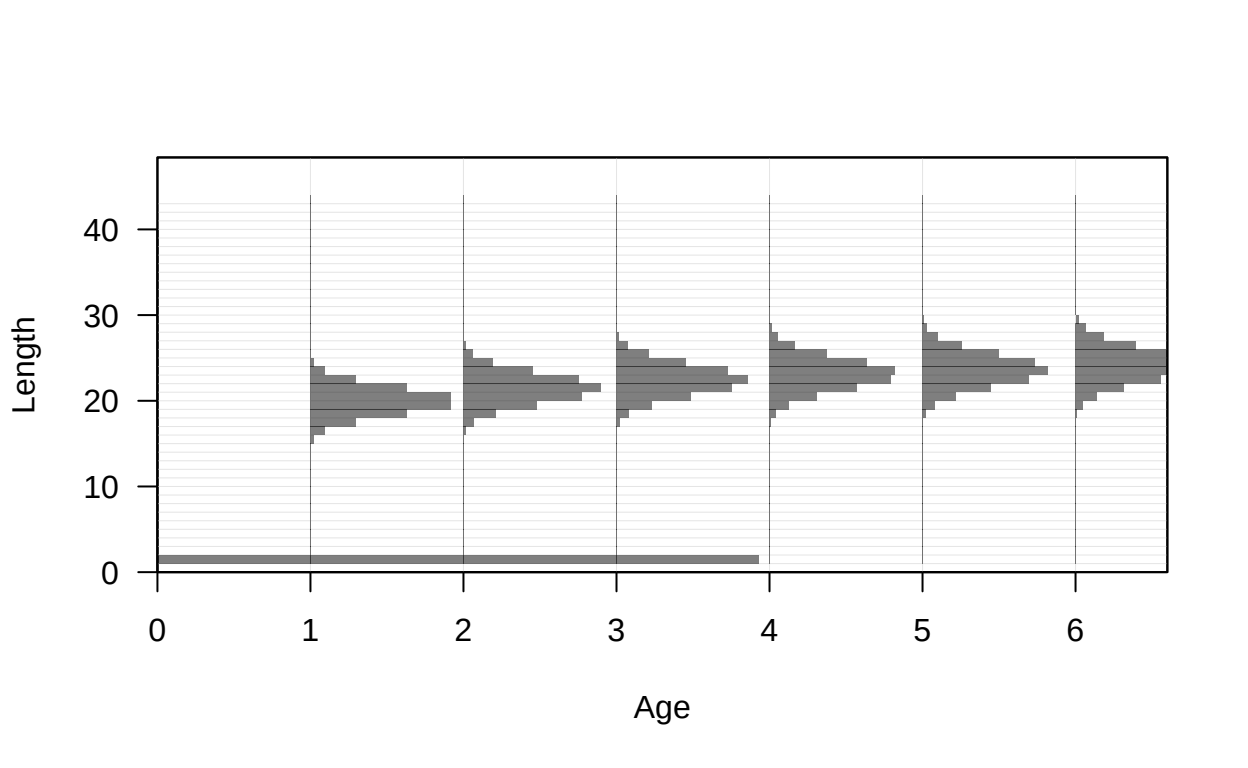
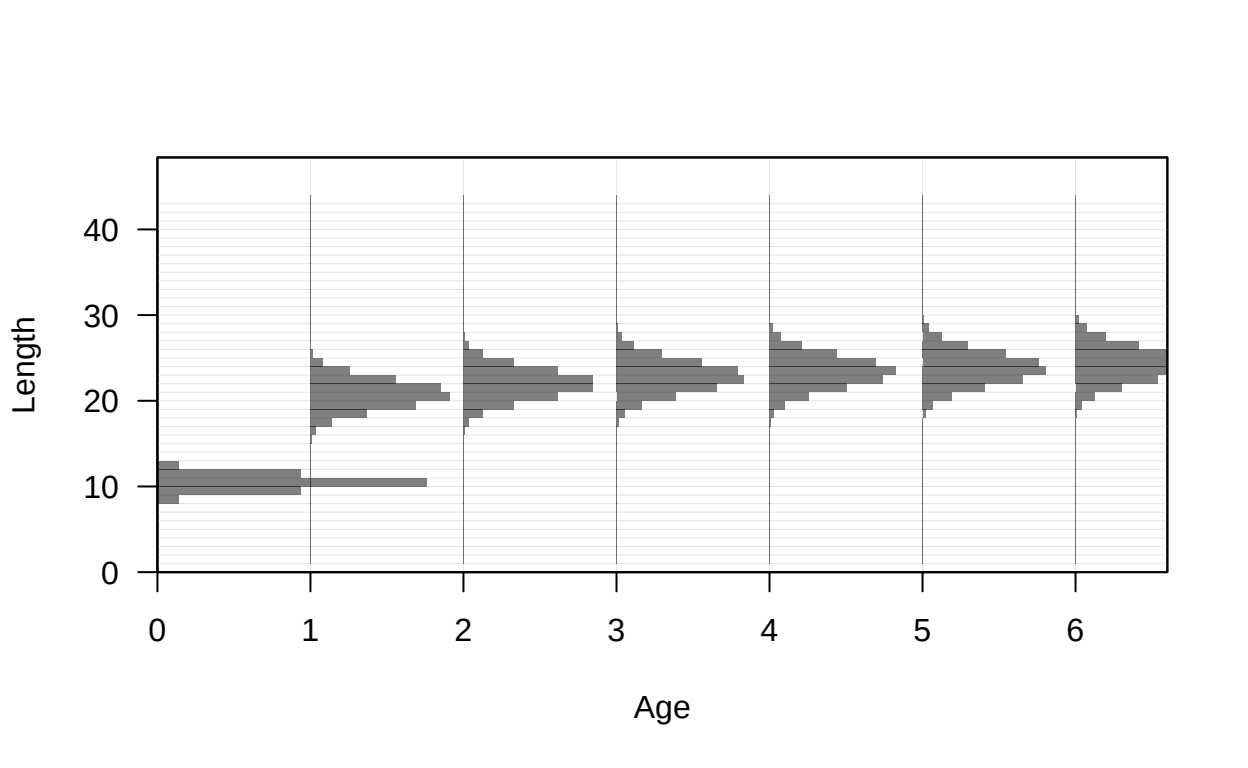
Plots created using the 'r4ss' package in R
Stock Synthesis version: 3.30.19.0
StartTime: Wed Jul 27 16:15:09 2022
Data_File: data.ss
Control_File: control.ss

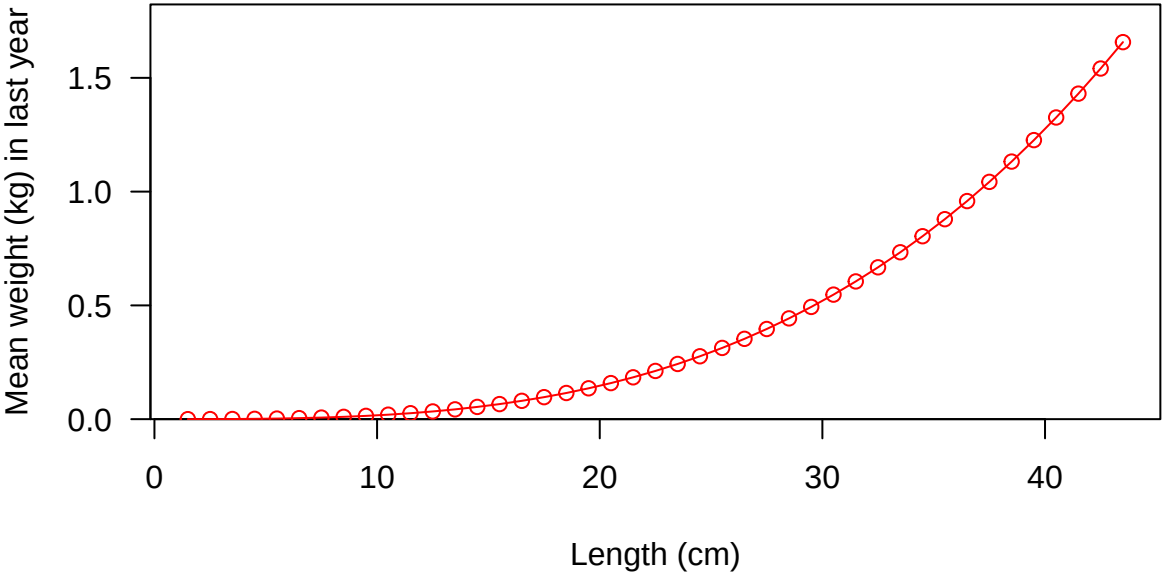

Length (cm, beginning of the year)
0
10
20
30
40
0
1
2
3
4
5
6
Age (yr)

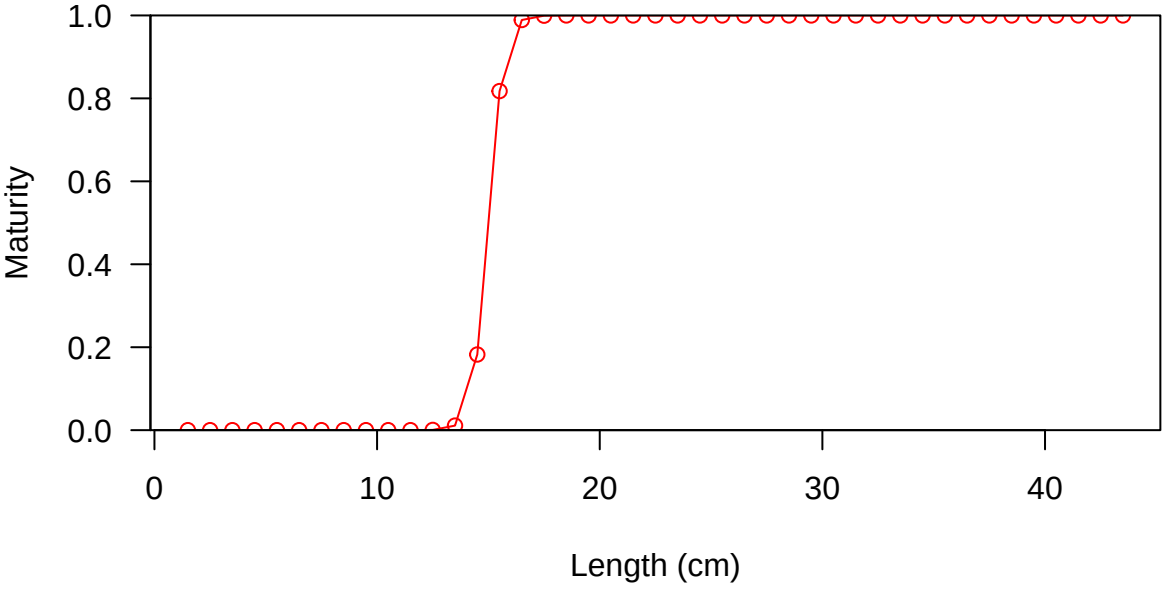

Age (yr)
0
1
2
3
4
5
6
Length (cm, beginning of the year)
0
10
20
30
40
CV of lengths
0
0.02
0.06
SD of lengths
0.0
0.5
1.0
1.5
2.0
CV of lengths
0
0.04
0.08
SD of lengths
0.0
1.0
2.0
Age (yr)

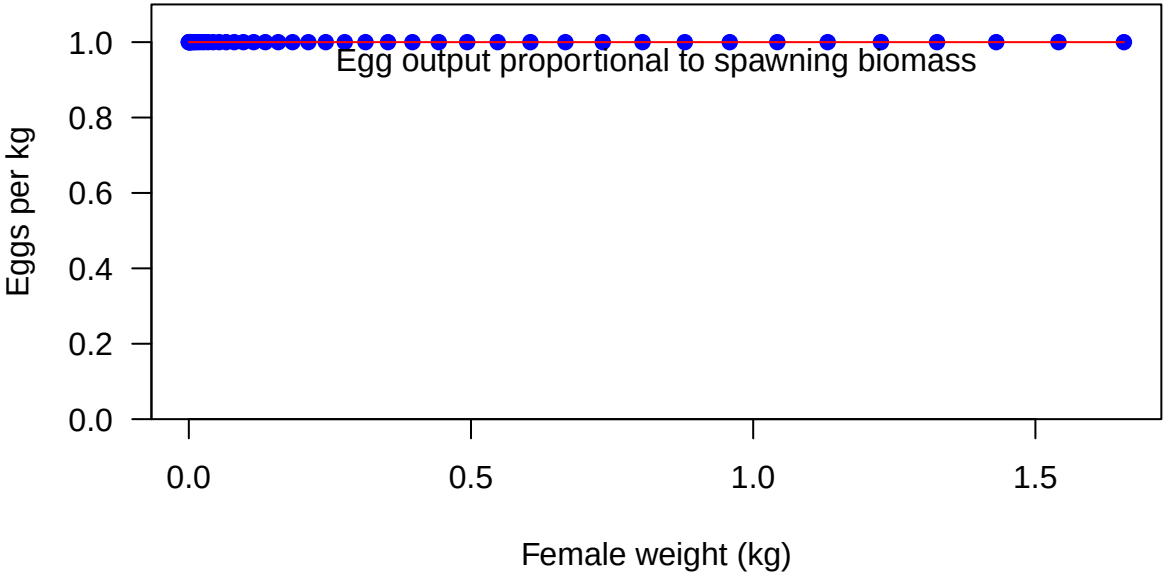

Age (yr)
Mean weight
Length (cm, beginning of the year)
Mean weight
Frac. mature
Age (yr)
Frac. mature
Length (cm, beginning of the year)

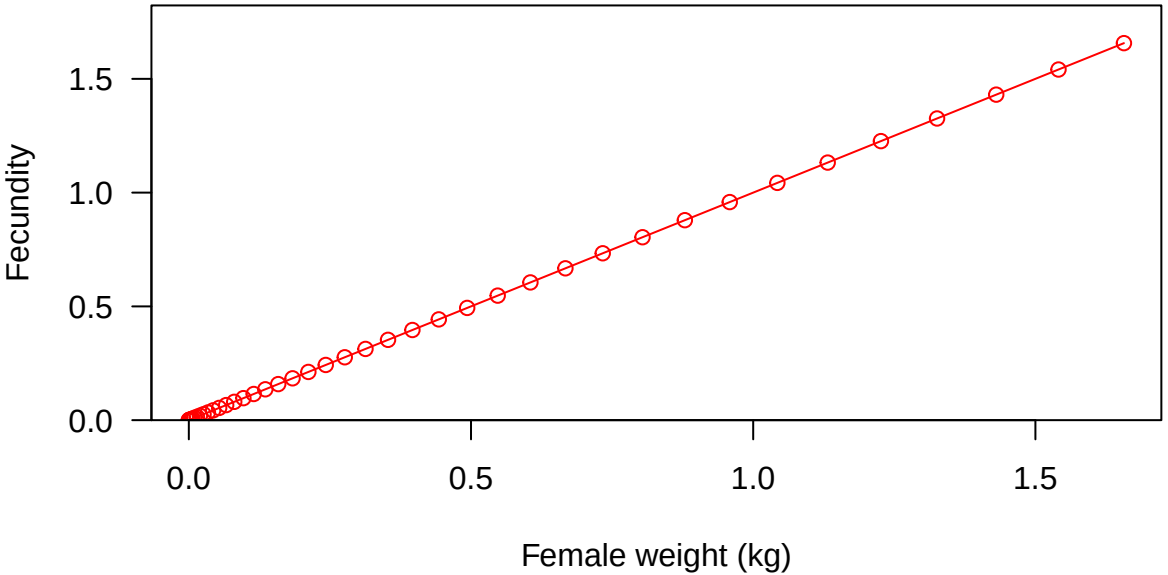

Length
0
10
20
30
40
0
1
2
3
4
5
6
Age

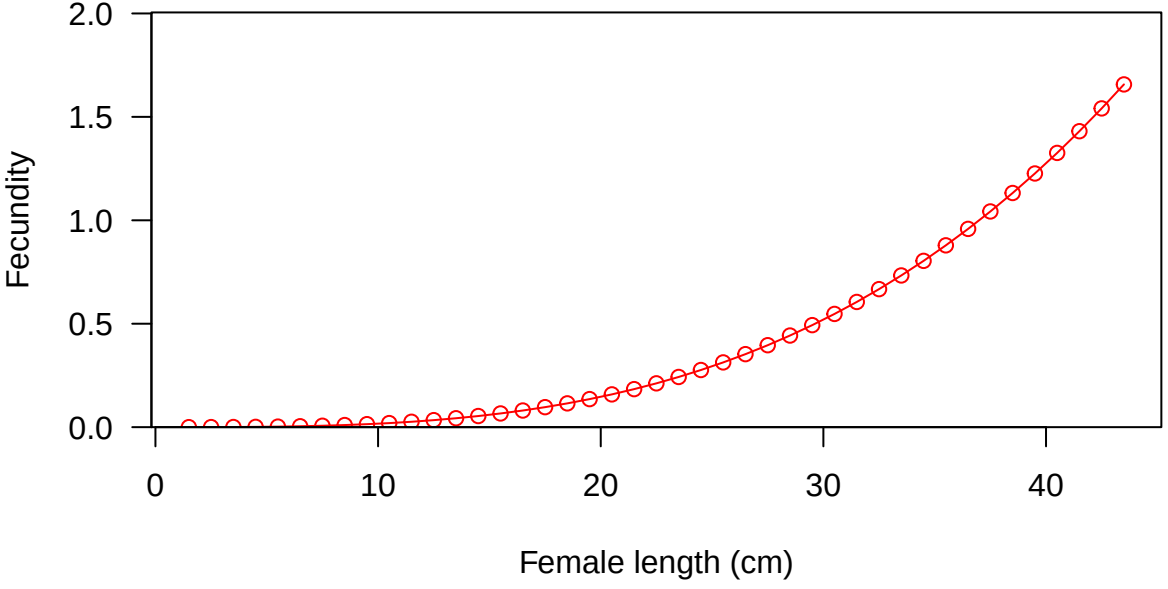

Length
0
10
20
30
40
0
1
2
3
4
5
6
Age

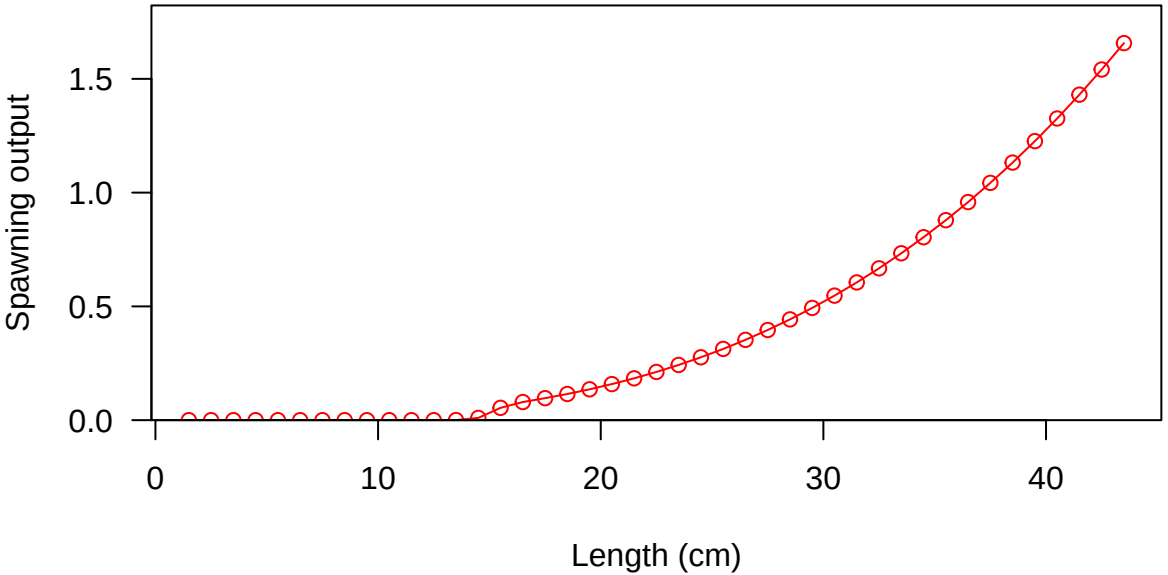

Mean weight (kg) in last year
0.0
0.5
1.0
1.5
0
10
20
30
40
Length (cm)

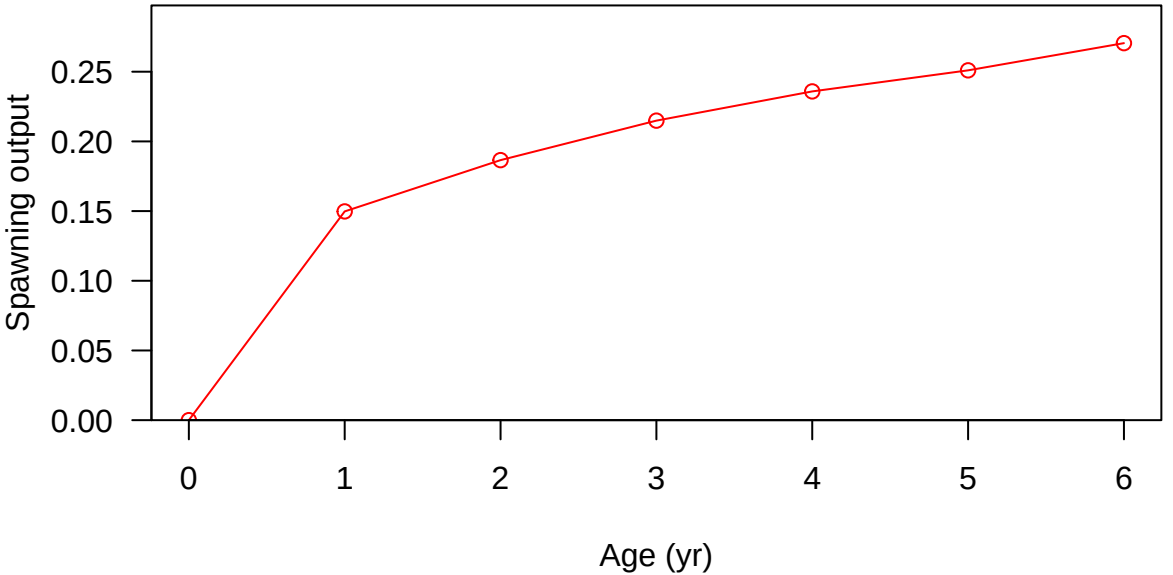

1.0
0.8
0.6
0.4
0.2
0.0
Maturity
0
10
20
30
40
Length (cm)

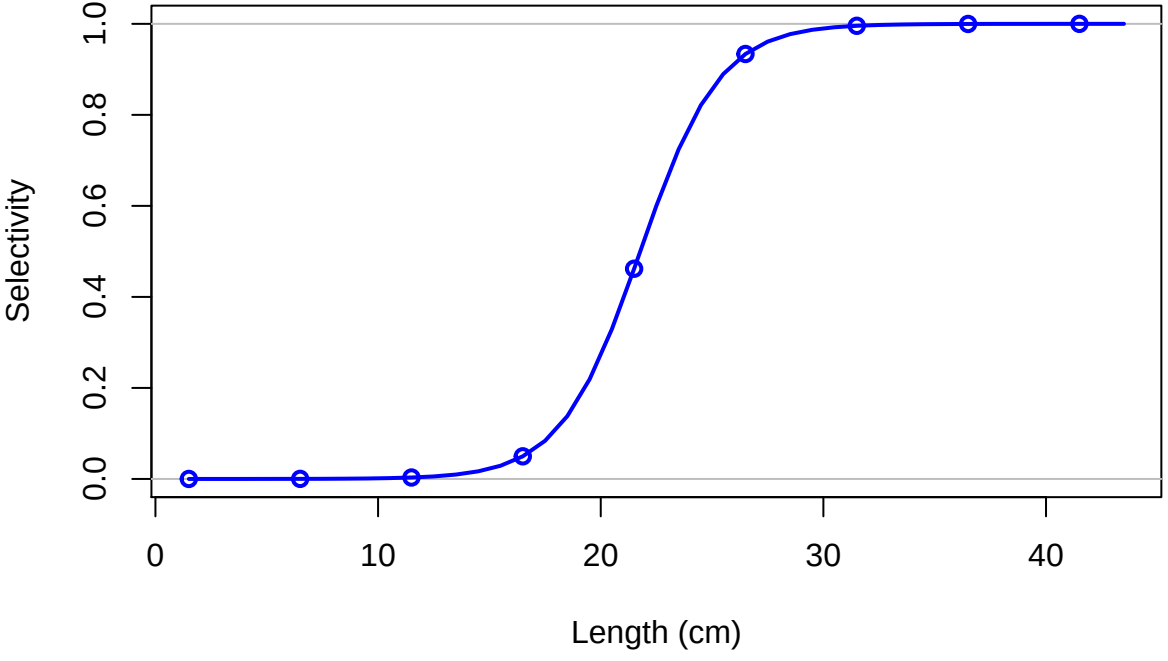

Egg output proportional to spawning biomass
Eggs per kg
1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.5
1.0
1.5
Female weight (kg)

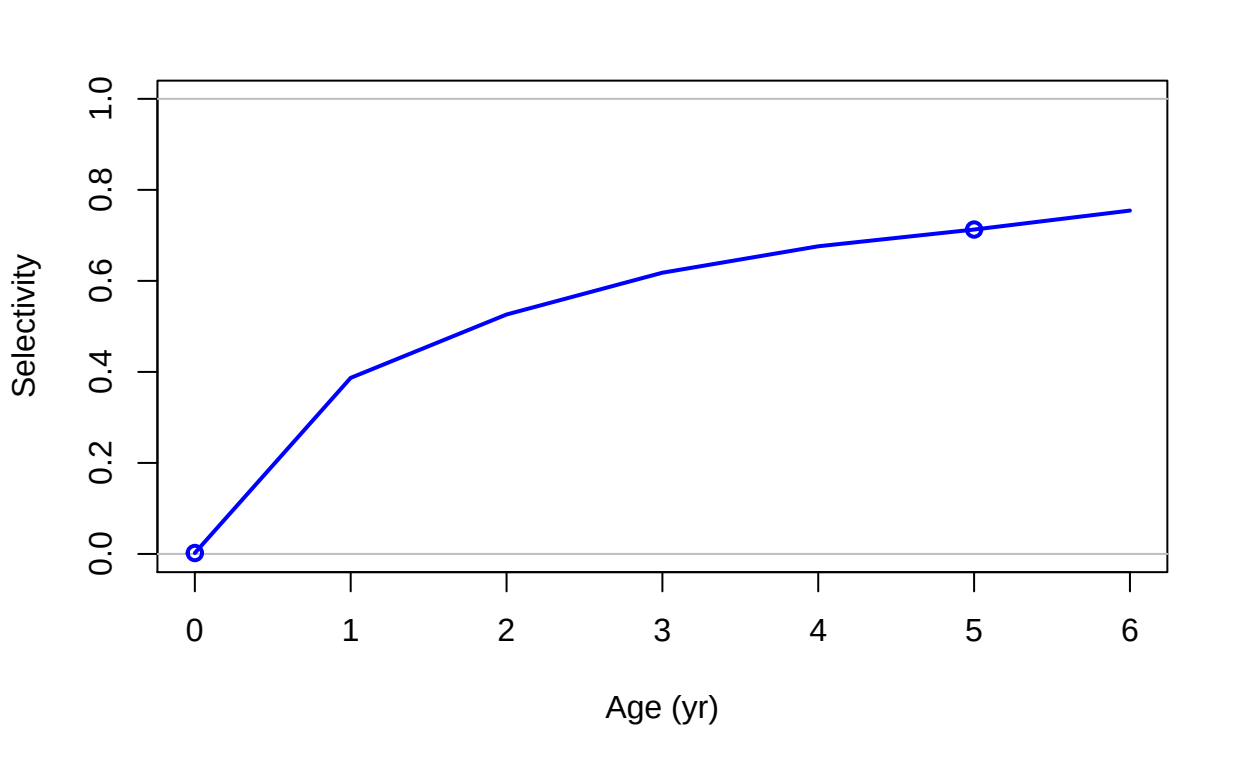

Fecundity
0.0
0.5
1.0
1.5
0.0
0.5
1.0
1.5
Female weight (kg)

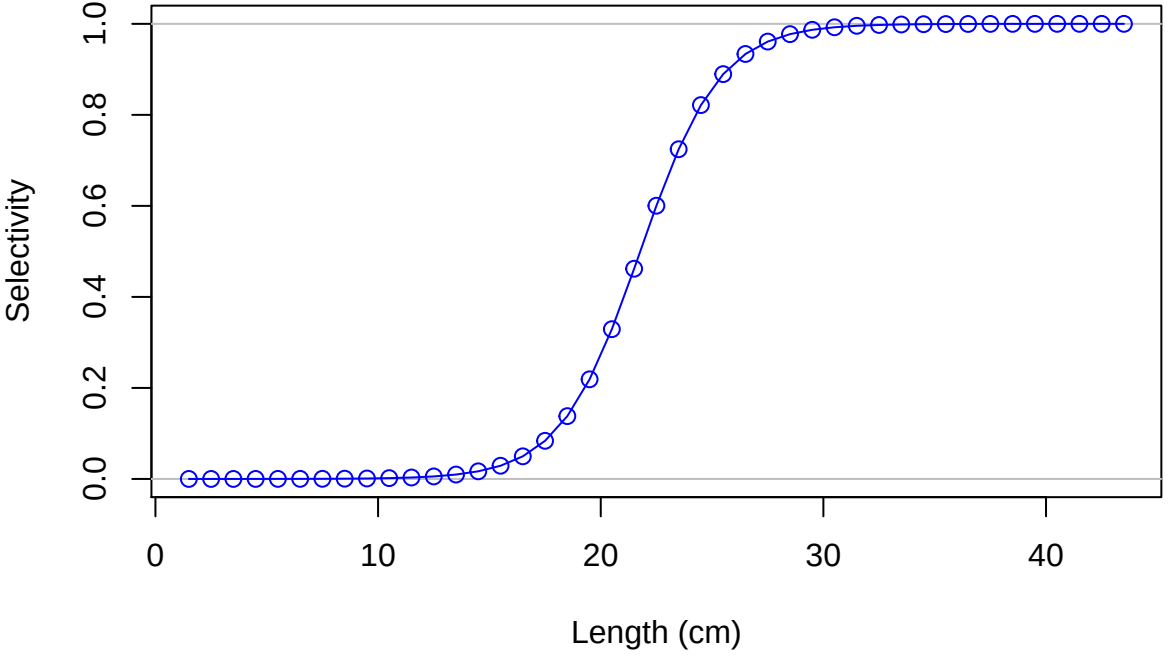

2.0
1.5
1.0
0.5
0.0
Fecundity
0
10
20
30
40
Female length (cm)

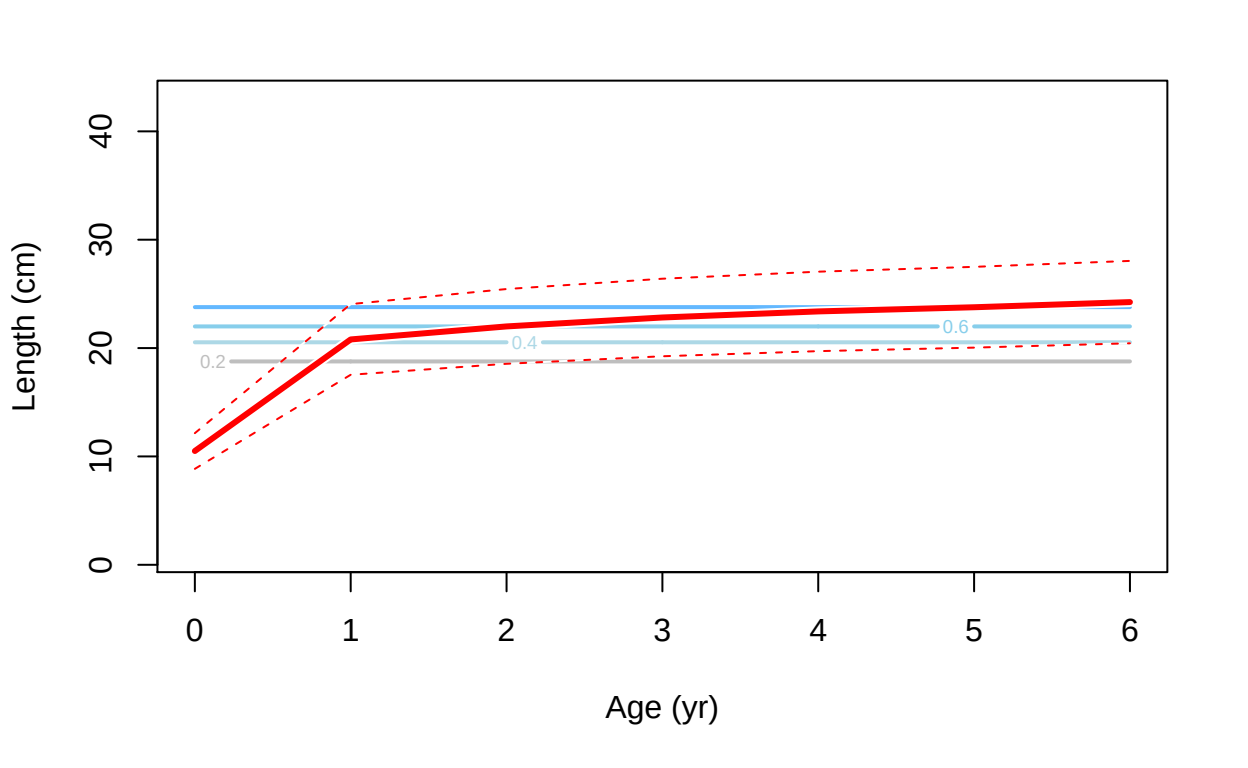

Spawning output
0.0
0.5
1.0
1.5
0
10
20
30
40
Length (cm)

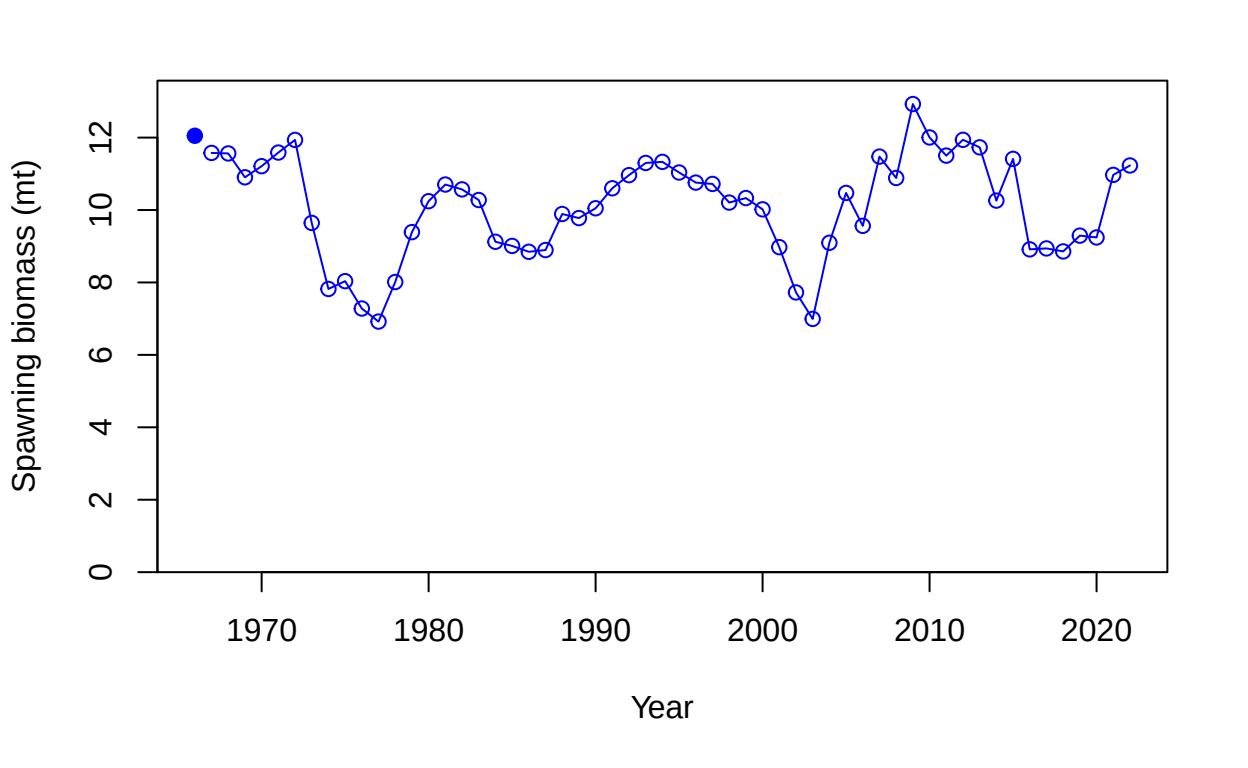

Spawning output
0.00
0.05
0.10
0.15
0.20
0.25
0
1
2
3
4
5
6
Age (yr)

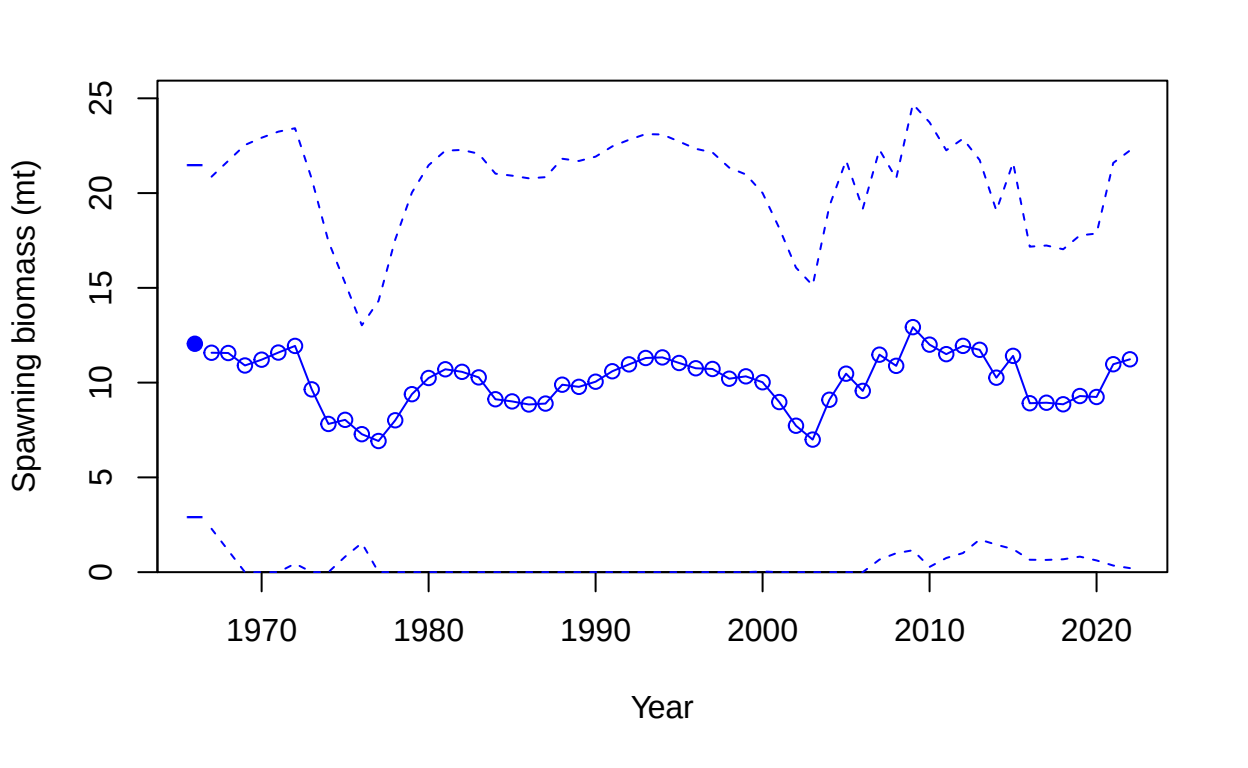

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
10
20
30
40
Length (cm)

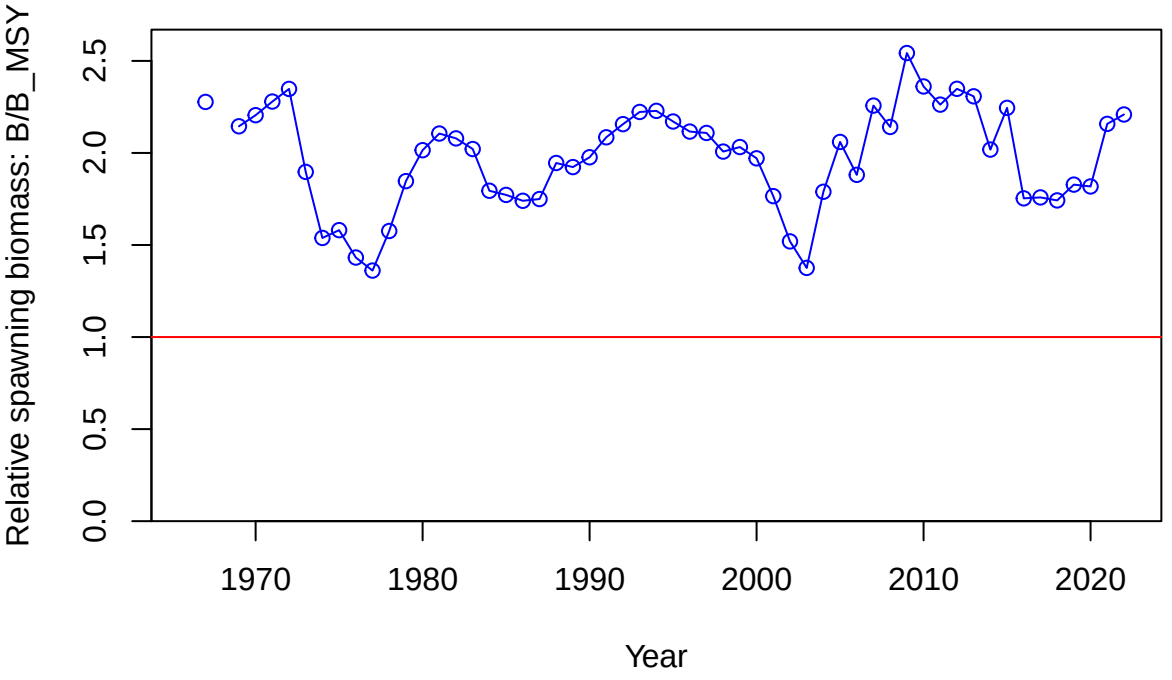

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
1
2
3
4
5
6
Age (yr)

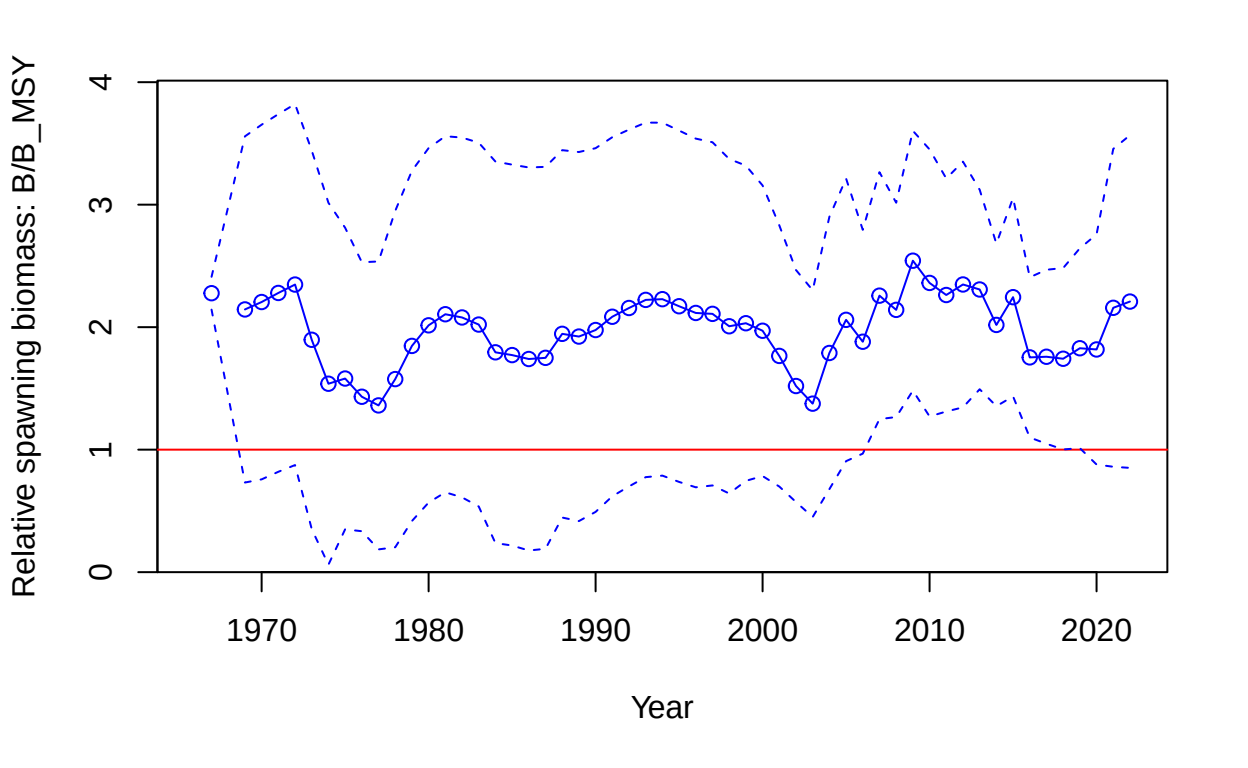

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
10
20
30
40
Length (cm)

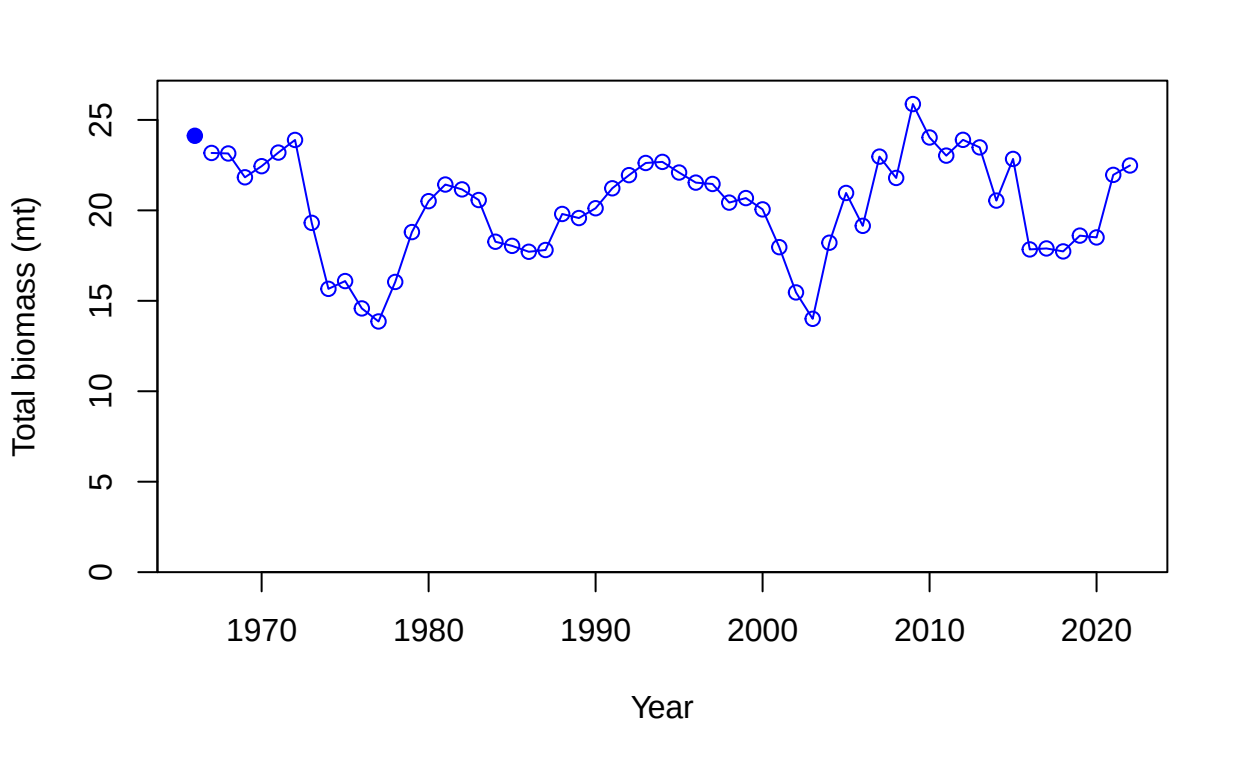

Length (cm)
0
10
20
30
40
0
1
2
3
4
5
6
Age (yr)
0.2
0.4
0.6

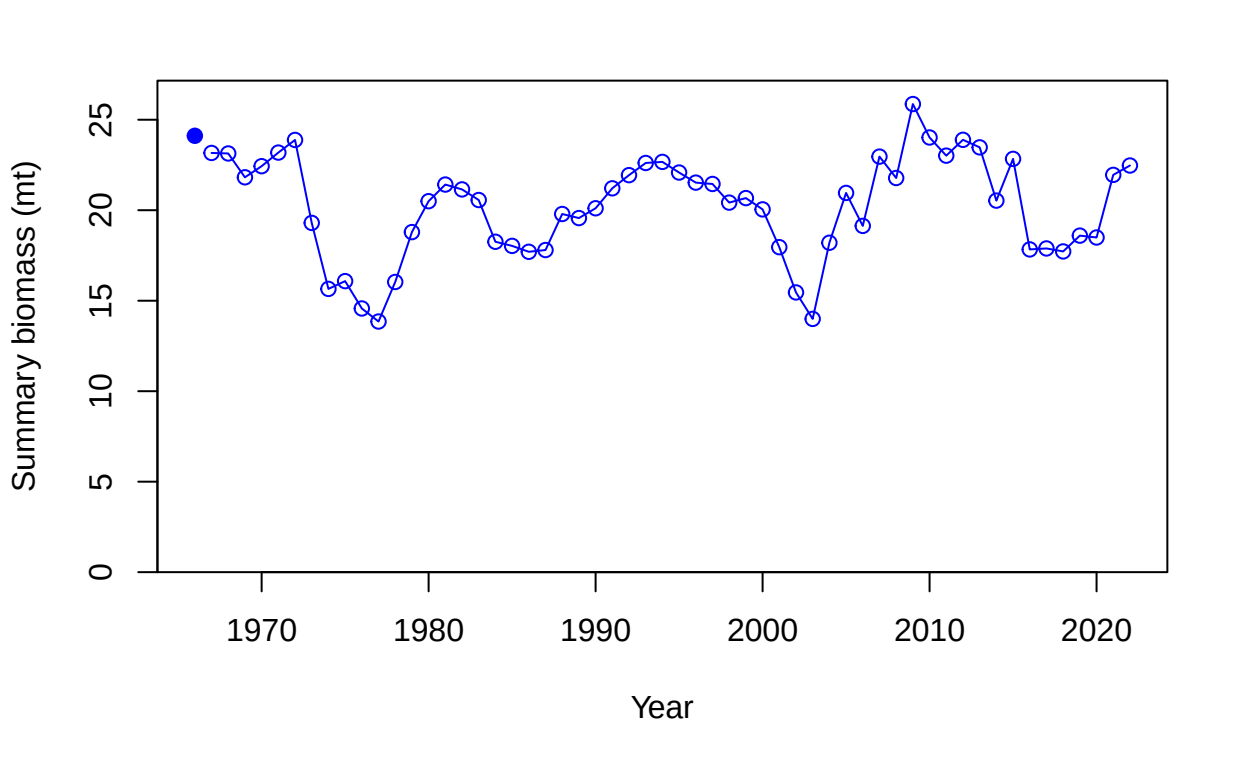

Spawning biomass (mt)
0
2
4
6
8
10
12
1970
1980
1990
2000
2010
2020
Year

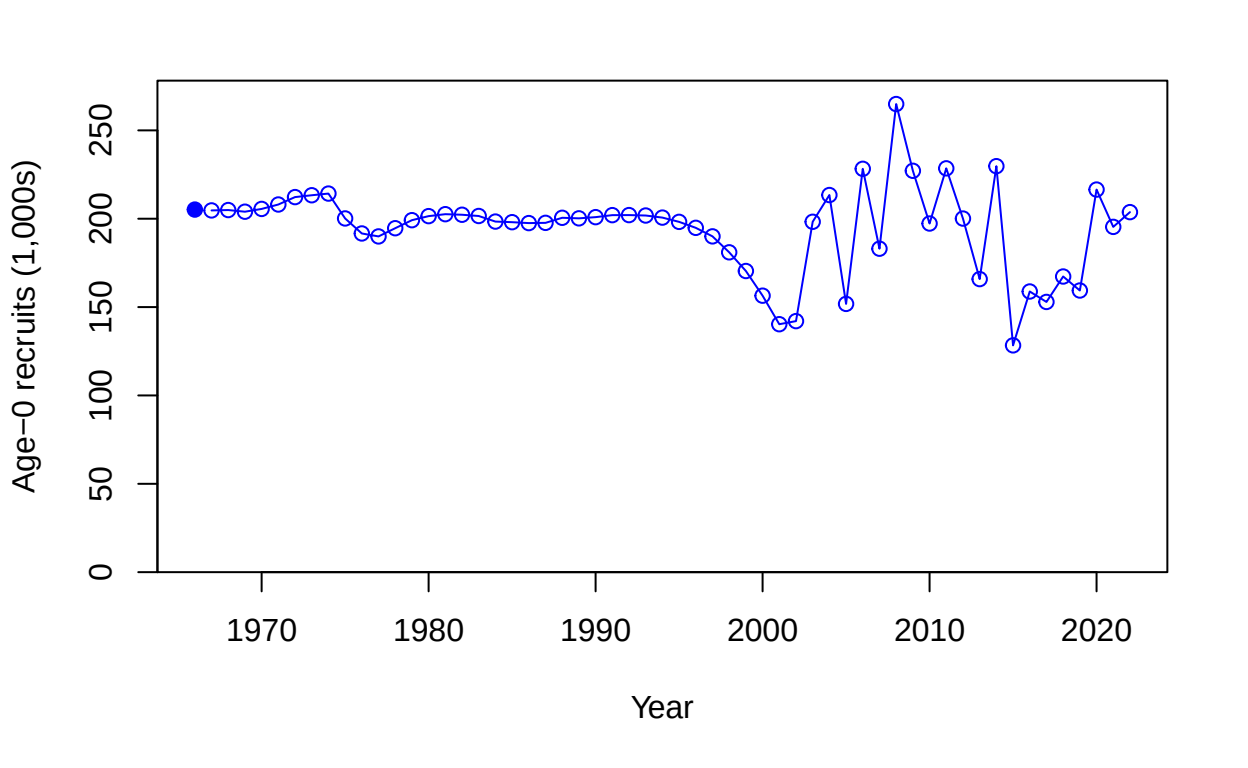

Spawning biomass (mt)
0
5
10
15
20
25
1970
1980
1990
2000
2010
2020
Year

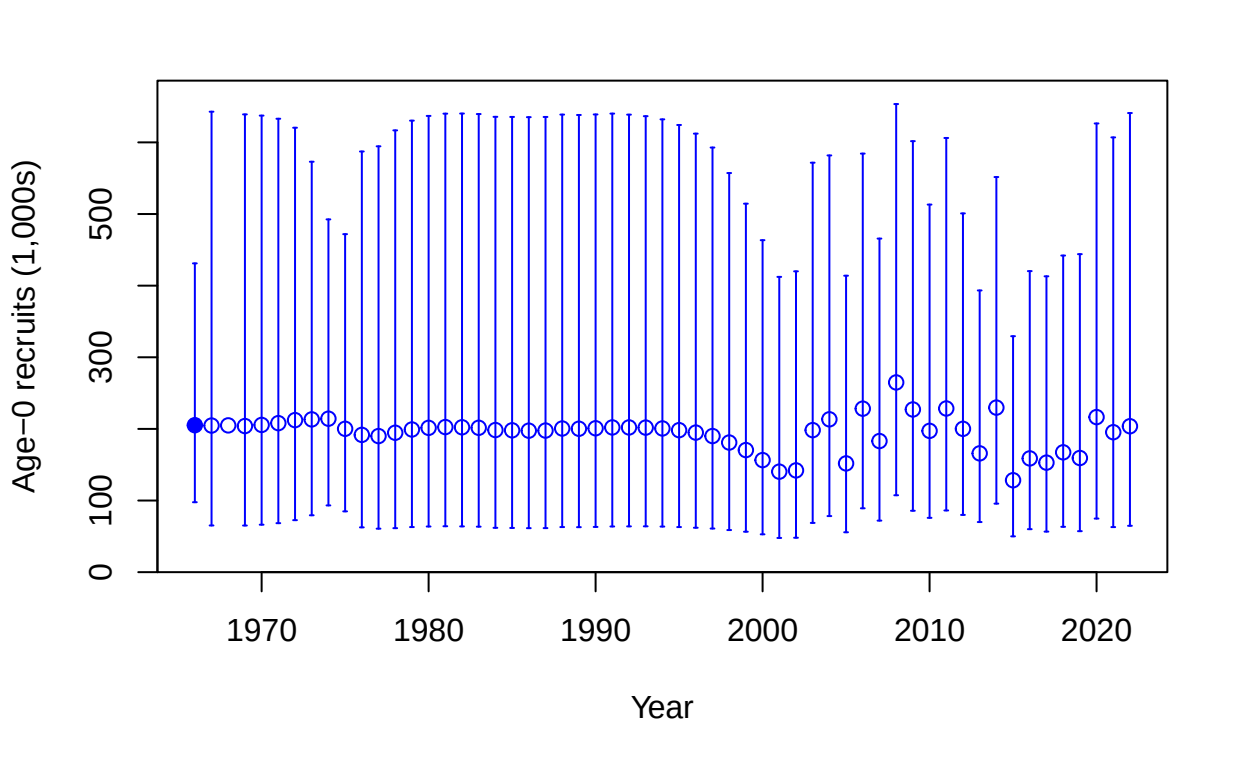

Relative spawning biomass: B/B_MSY
0.0
0.5
1.0
1.5
2.0
2.5
1970
1980
1990
2000
2010
2020
Year

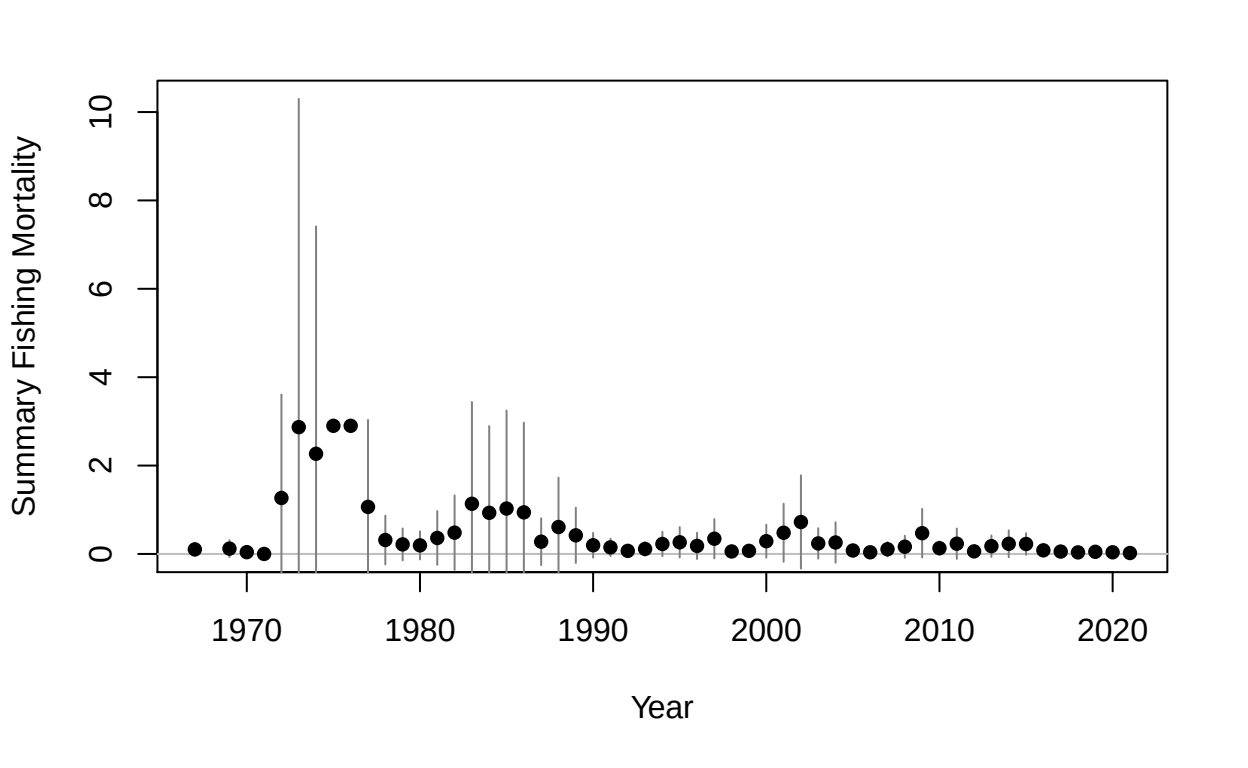

Relative spawning biomass: B/B_MSY
0
1
2
3
4
1970
1980
1990
2000
2010
2020
Year

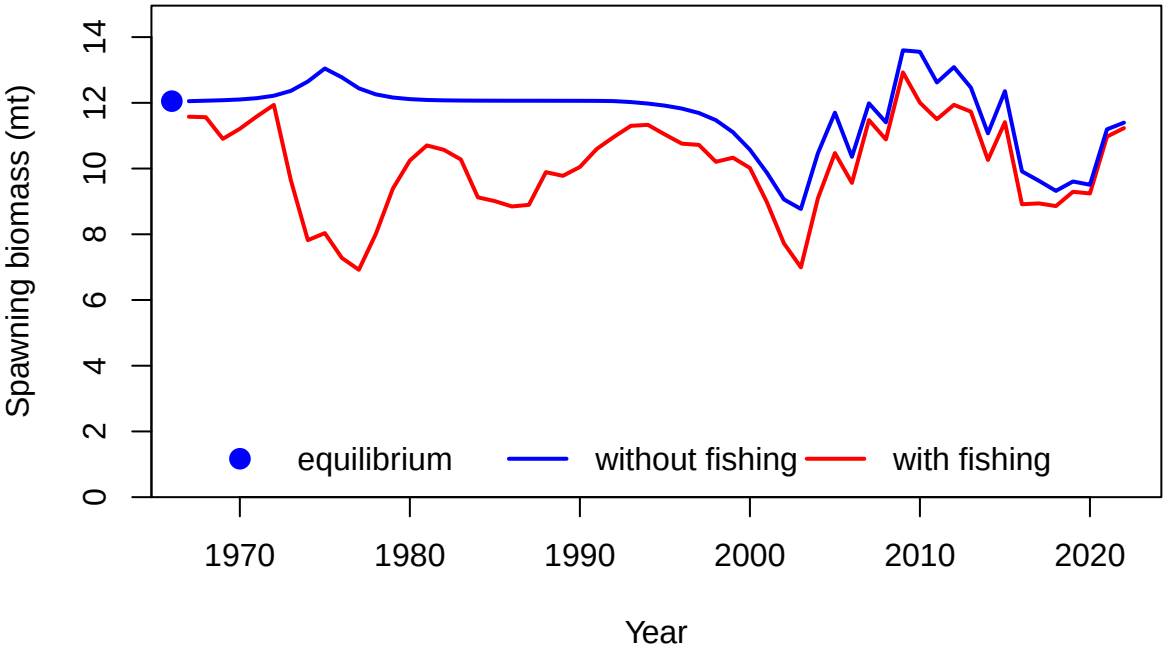

Total biomass (mt)
0
5
10
15
20
25
1970
1980
1990
2000
2010
2020
Year

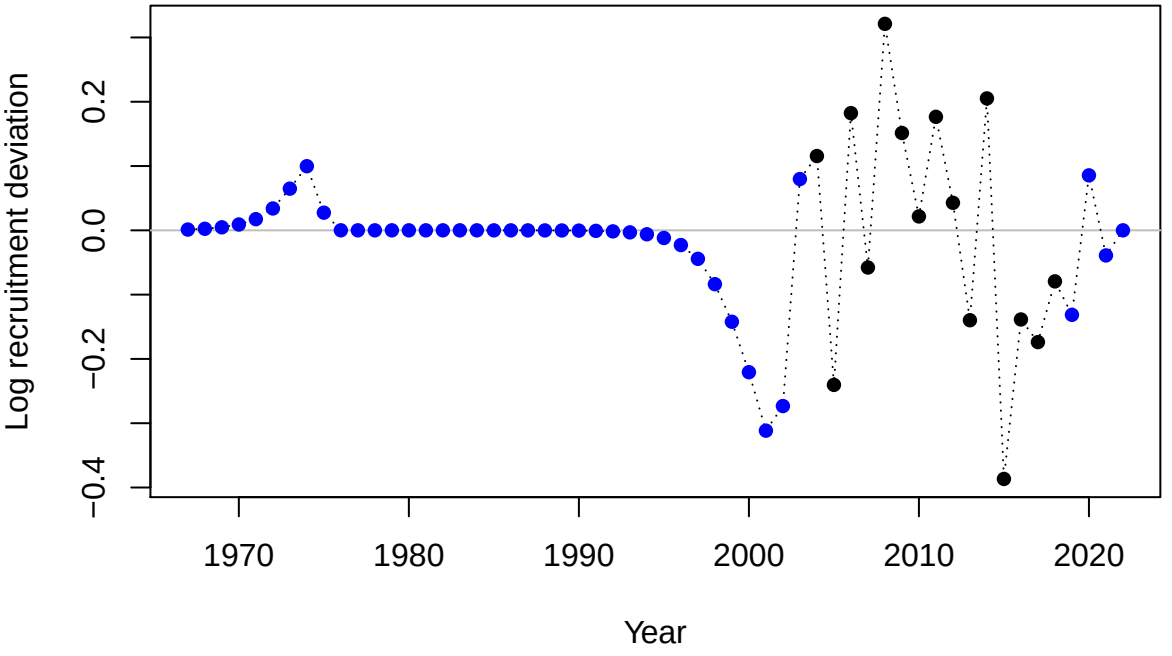

Summary biomass (mt)
0
5
10
15
20
25
1970
1980
1990
2000
2010
2020
Year

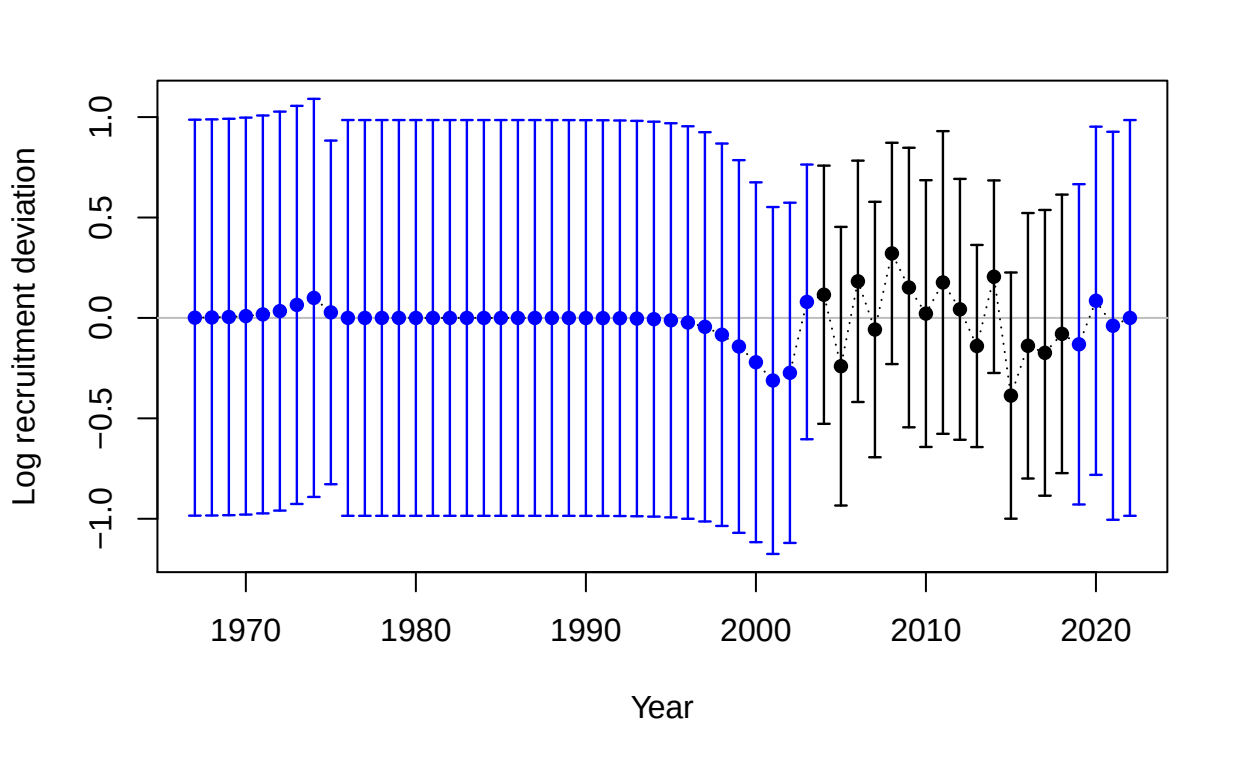

Age−0 recruits (1,000s)
0
50
100
150
200
250
1970
1980
1990
2000
2010
2020
Year

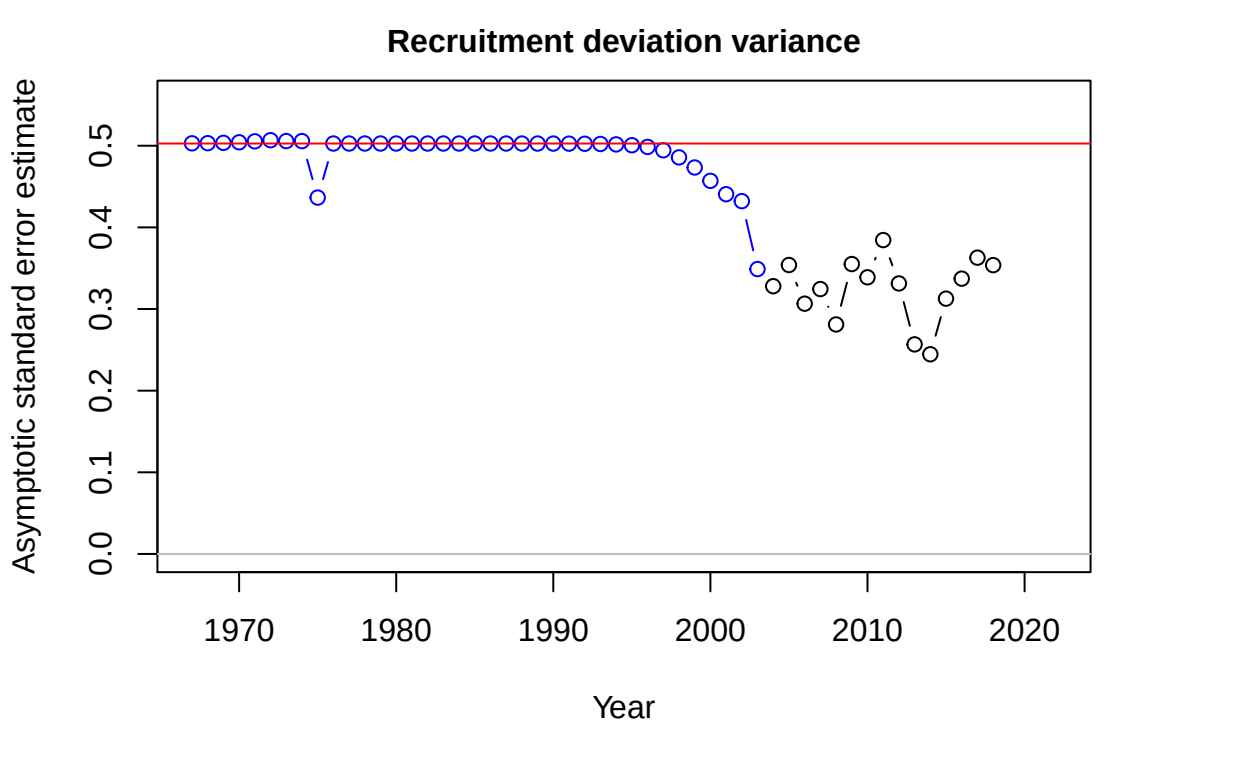

Age−0 recruits (1,000s)
0
100
300
500
1970
1980
1990
2000
2010
2020
Year

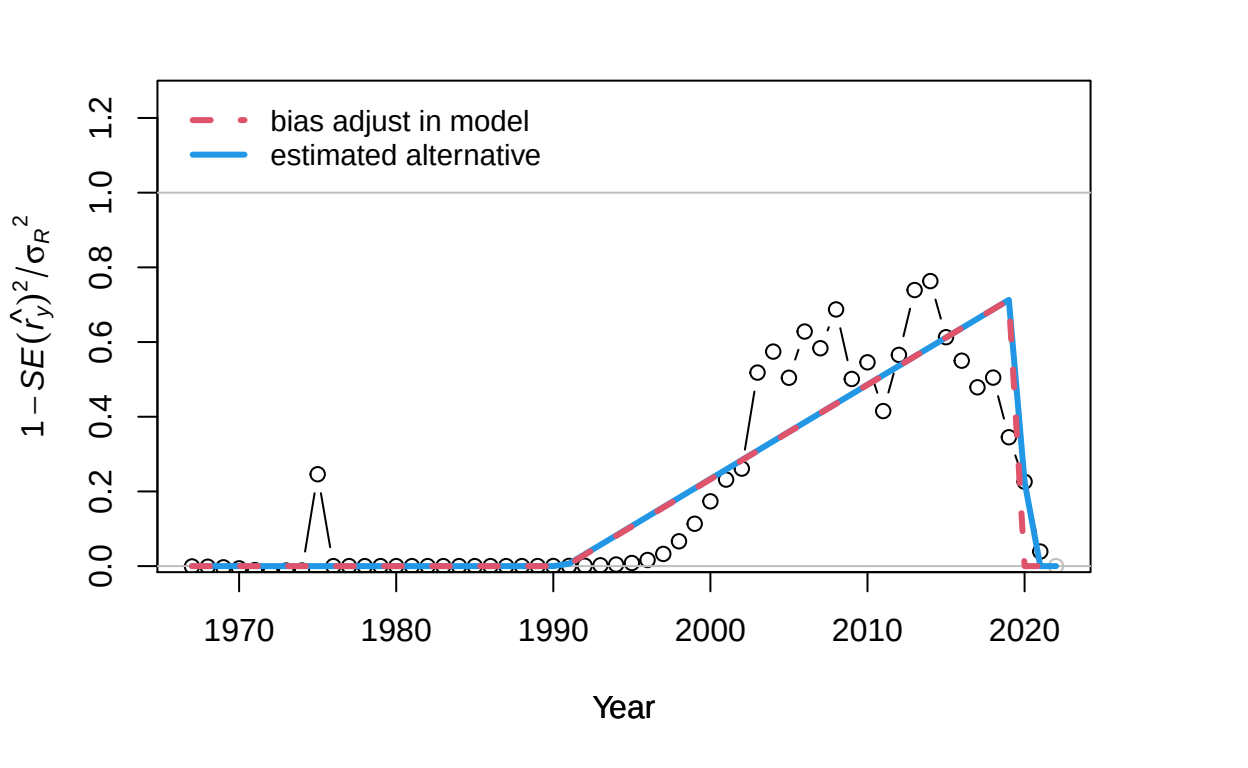

Summary Fishing Mortality
0
2
4
6
8
10
1970
1980
1990
2000
2010
2020
Year

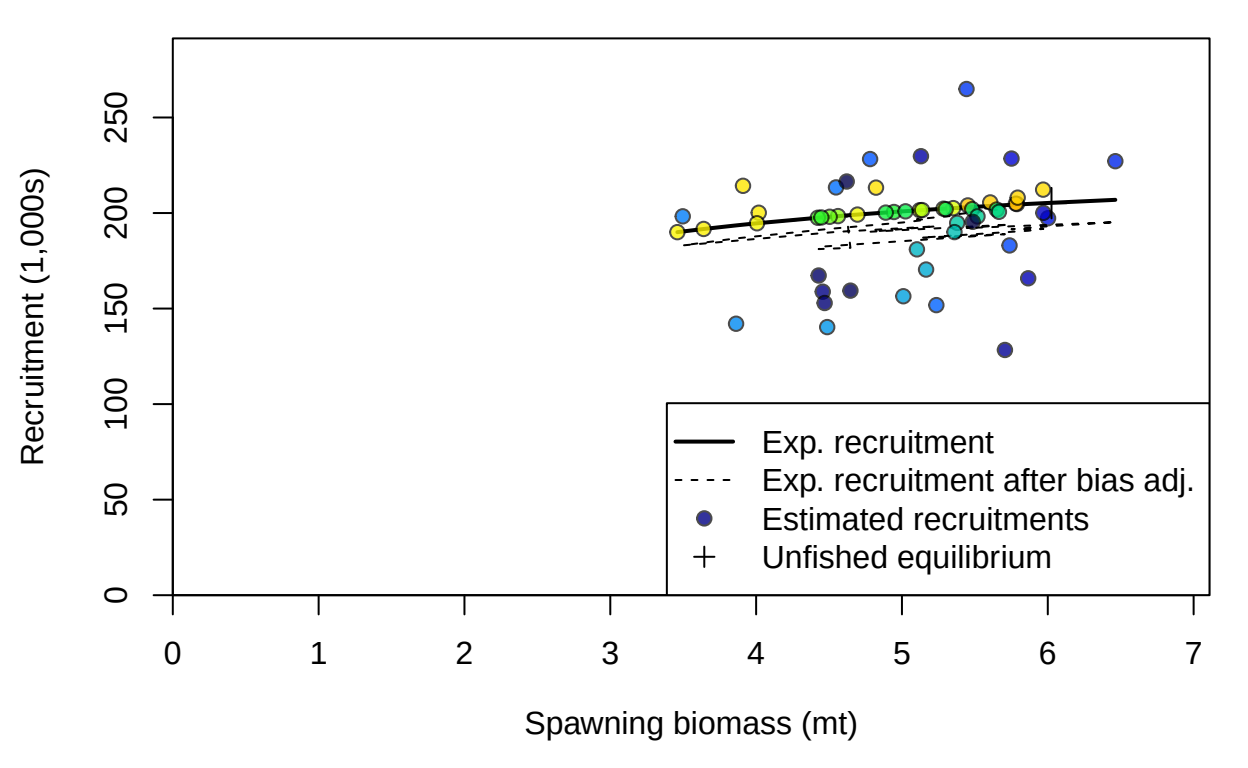

Spawning biomass (mt)
0
2
4
6
8
10
12
14
1970
1980
1990
2000
2010
2020
Year
equilibrium
without fishing
with fishing

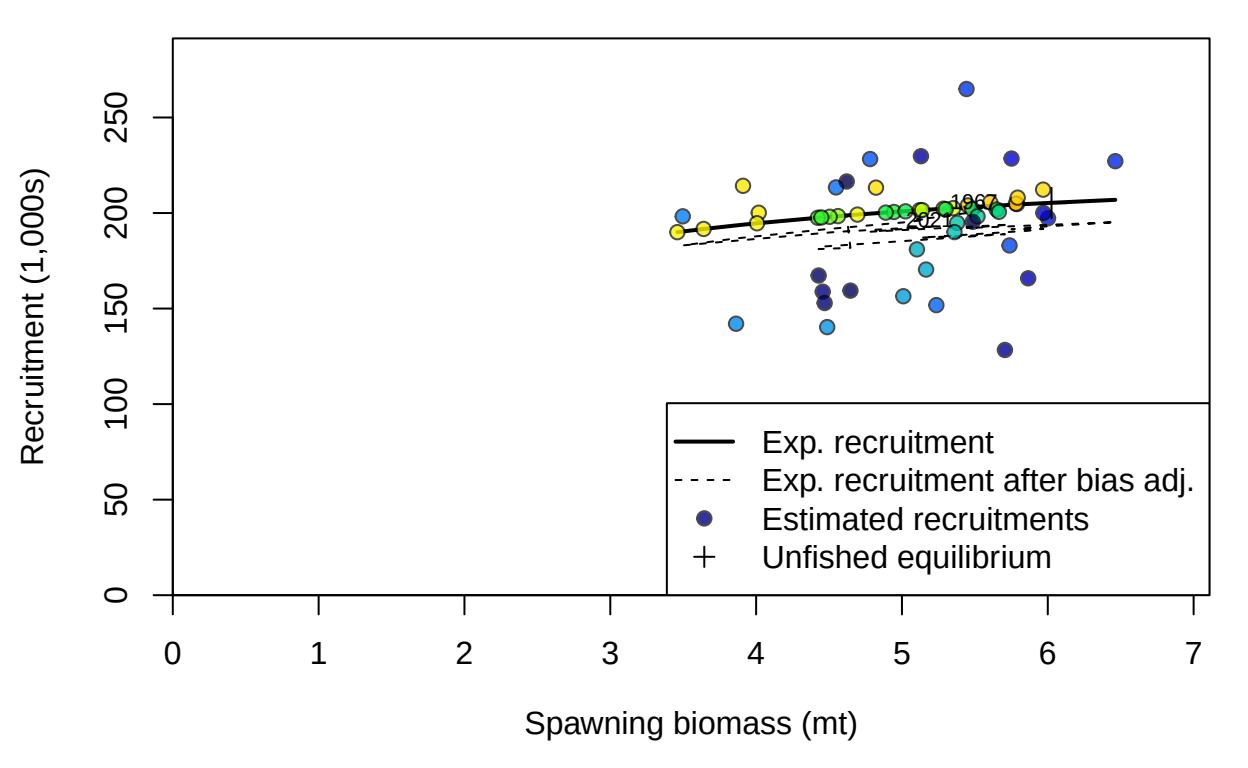

Log recruitment deviation
0.2
0.0
−0.2
−0.4
1970
1980
1990
2000
2010
2020
Year

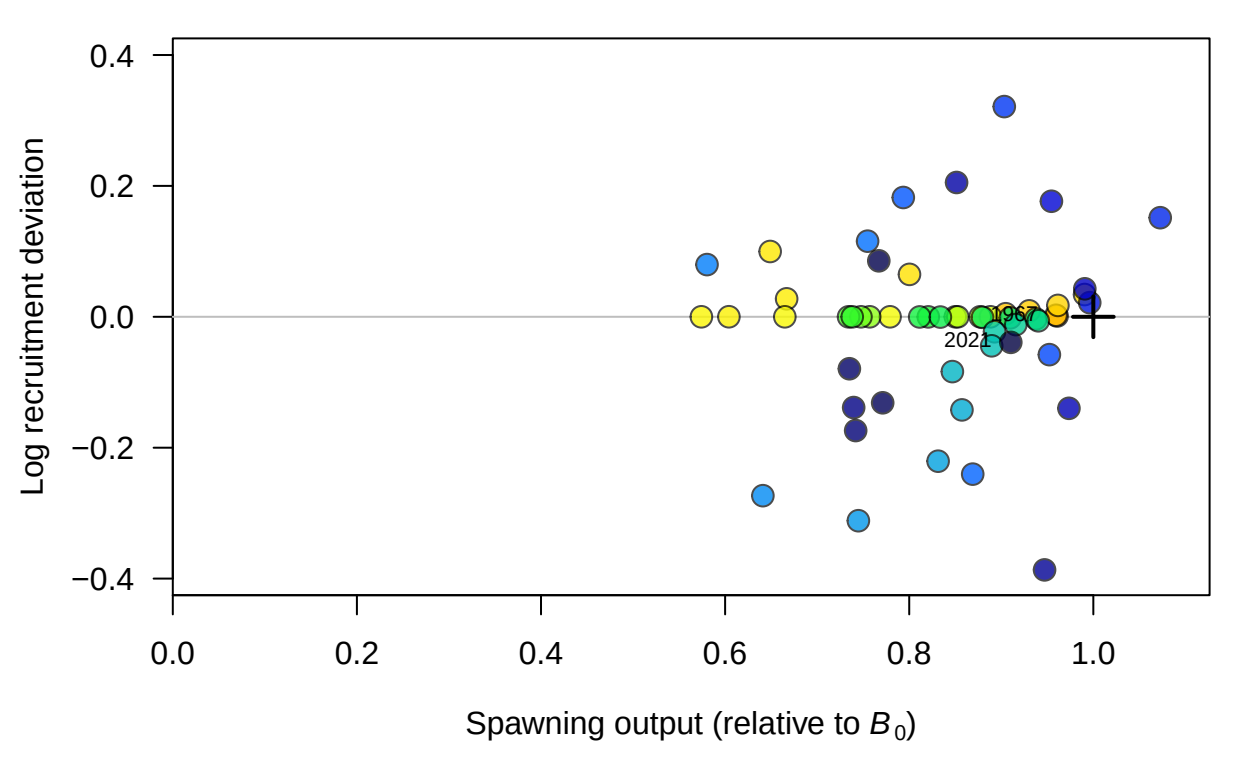

Log recruitment deviation
1.0
0.5
0.0
−0.5
−1.0
1970
1980
1990
2000
2010
2020
Year

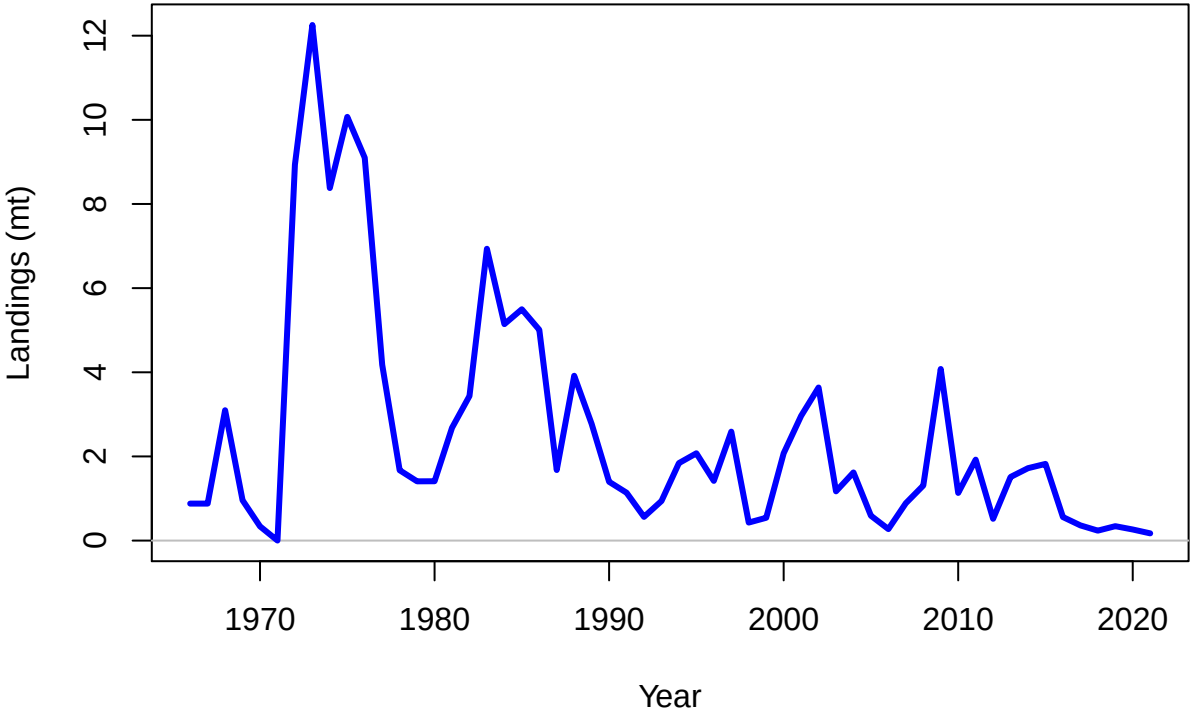

Recruitment deviation variance
Asymptotic standard error estimate
0.0
0.1
0.2
0.3
0.4
0.5
1970
1980
1990
2000
2010
2020
Year

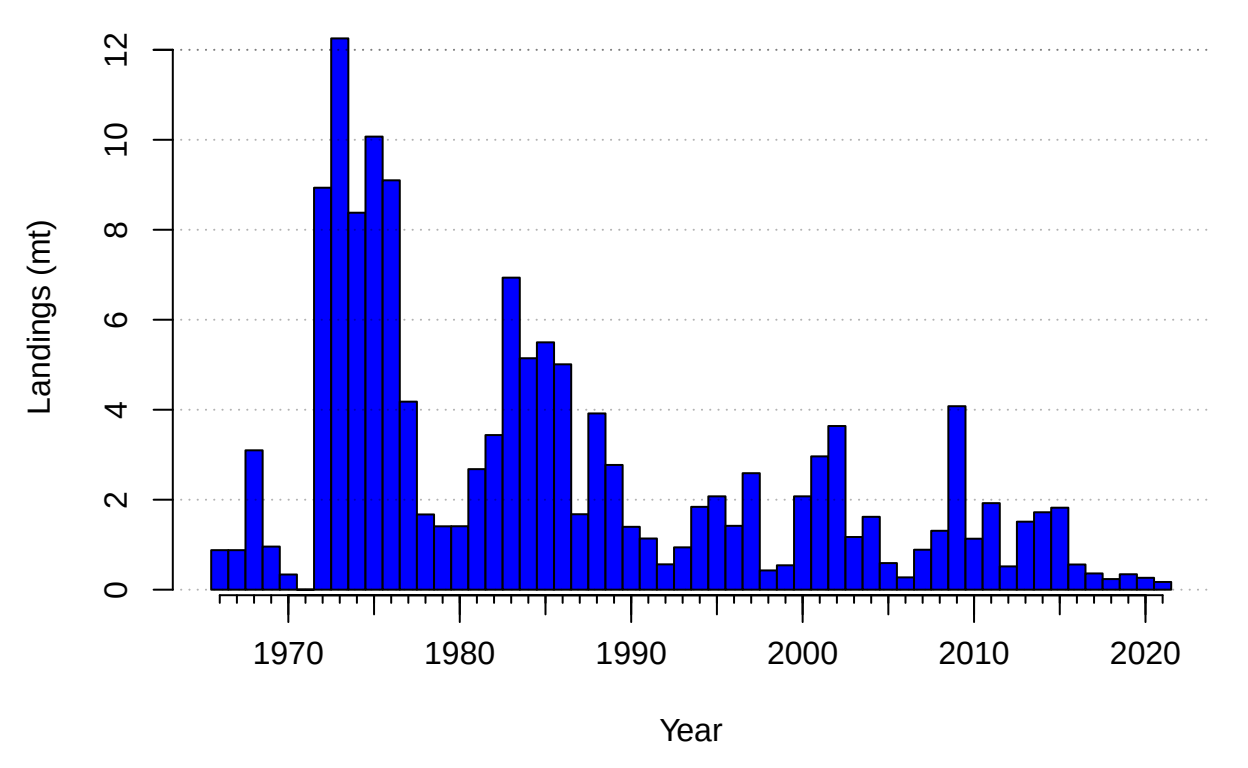

bias adjust in model
estimated alternative
$1-SE(\hat{r_y})^2/\sigma_R{}^2$
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1970
1980
1990
2000
2010
2020
Year

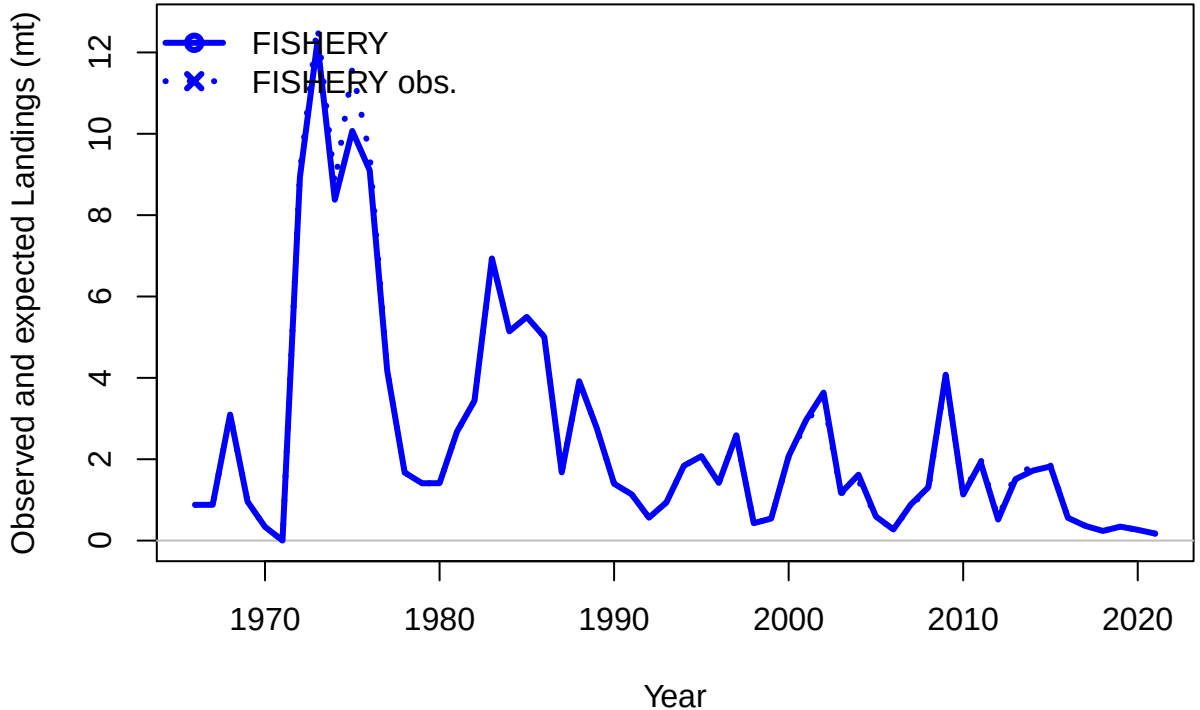

Recruitment (1,000s)
0
50
100
150
200
250
0
1
2
3
4
5
6
7
Spawning biomass (mt)
Exp. recruitment
Exp. recruitment after bias adj.
Estimated recruitments
Unfished equilibrium

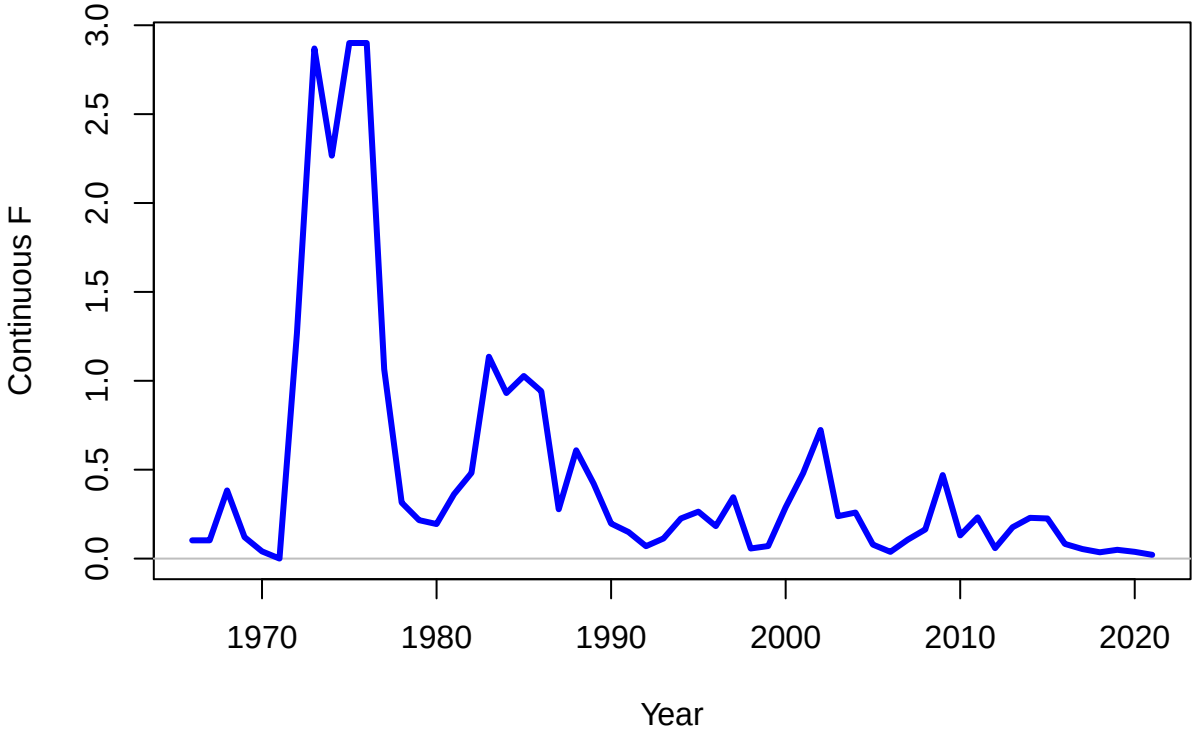

Recruitment (1,000s)
0
50
100
150
200
250
0
1
2
3
4
5
6
7
Spawning biomass (mt)
1967
1982
Exp. recruitment
Exp. recruitment after bias adj.
Estimated recruitments
Unfished equilibrium

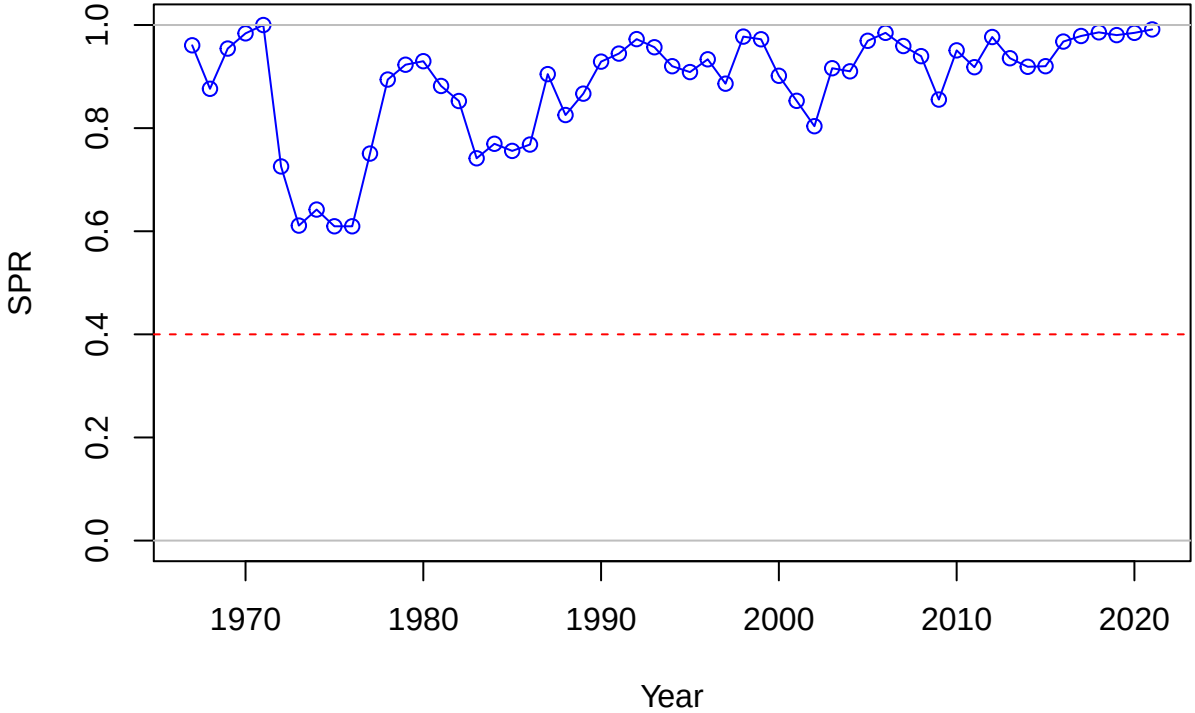

0.4
0.2
0.0
−0.2
−0.4
Log recruitment deviation
0.0
0.2
0.4
0.6
0.8
1.0
Spawning output (relative to B_0)
1967
2021

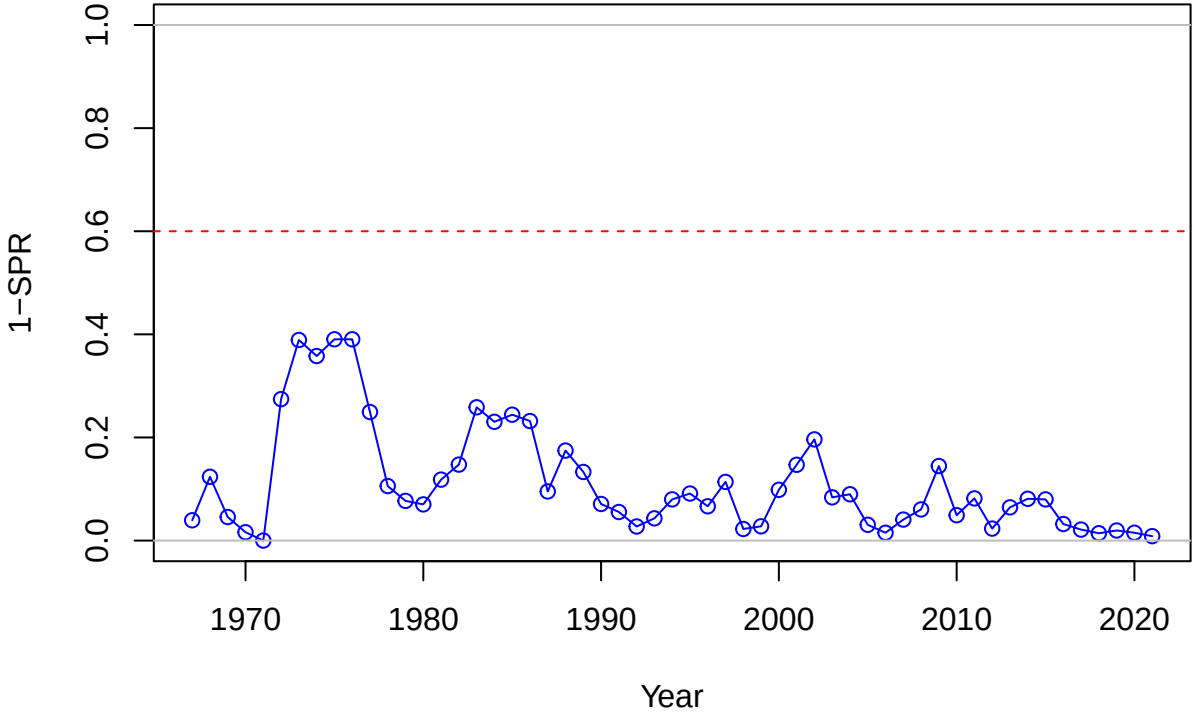

Landings (mt)
0
2
4
6
8
10
12
1970
1980
1990
2000
2010
2020
Year

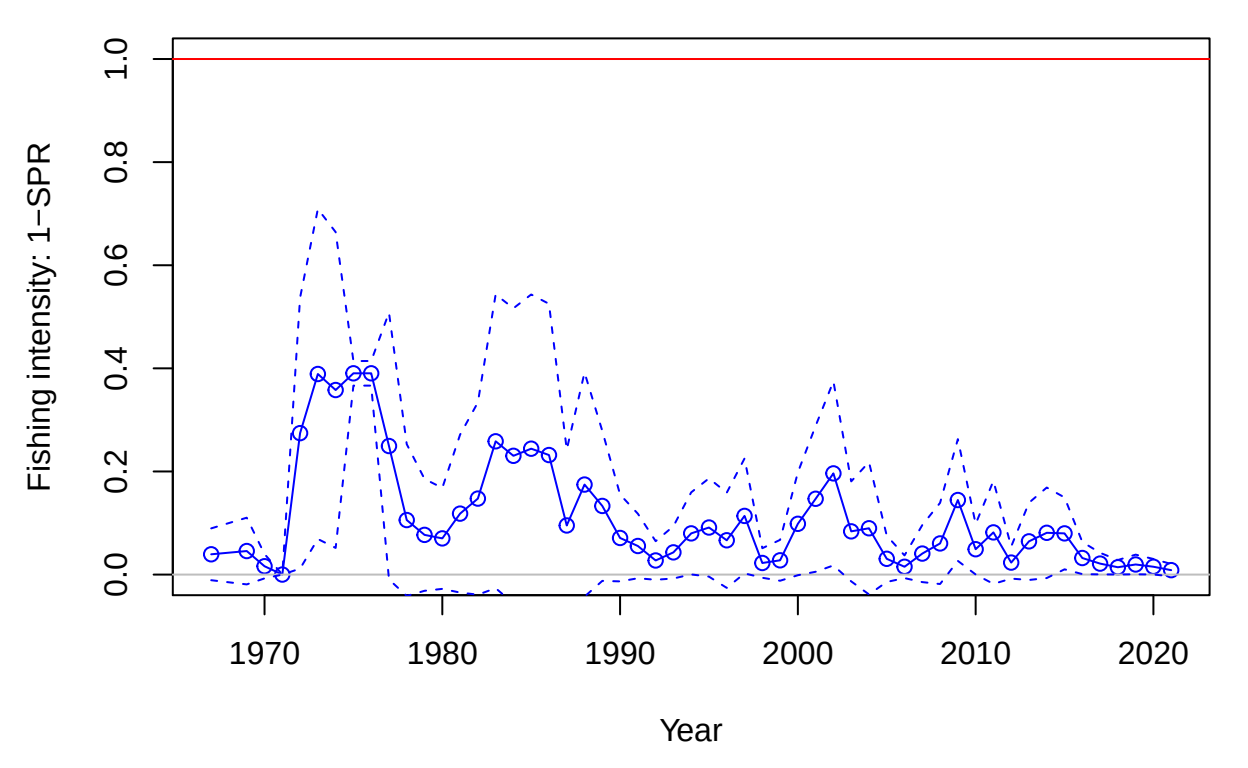

Landings (mt)
0
2
4
6
8
10
12
1970
1980
1990
2000
2010
2020
Year

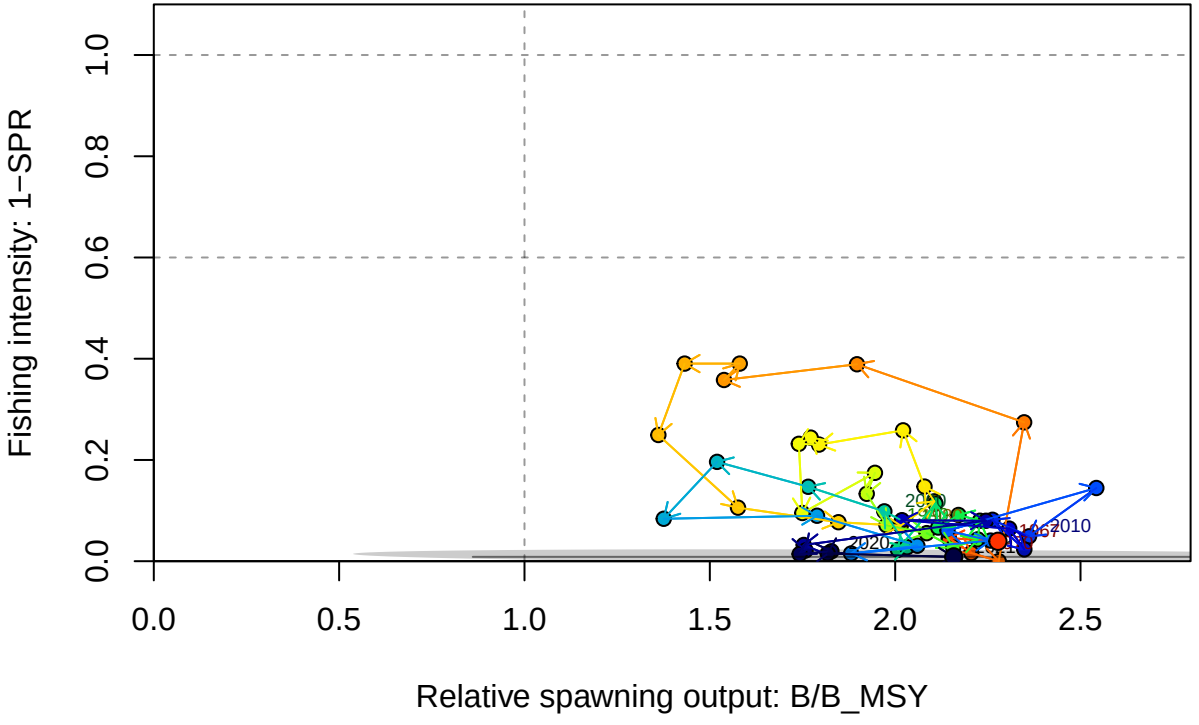

FISHERY
FISHERY obs.
Observed and expected Landings (mt)
0
2
4
6
8
10
12
1970
1980
1990
2000
2010
2020
Year

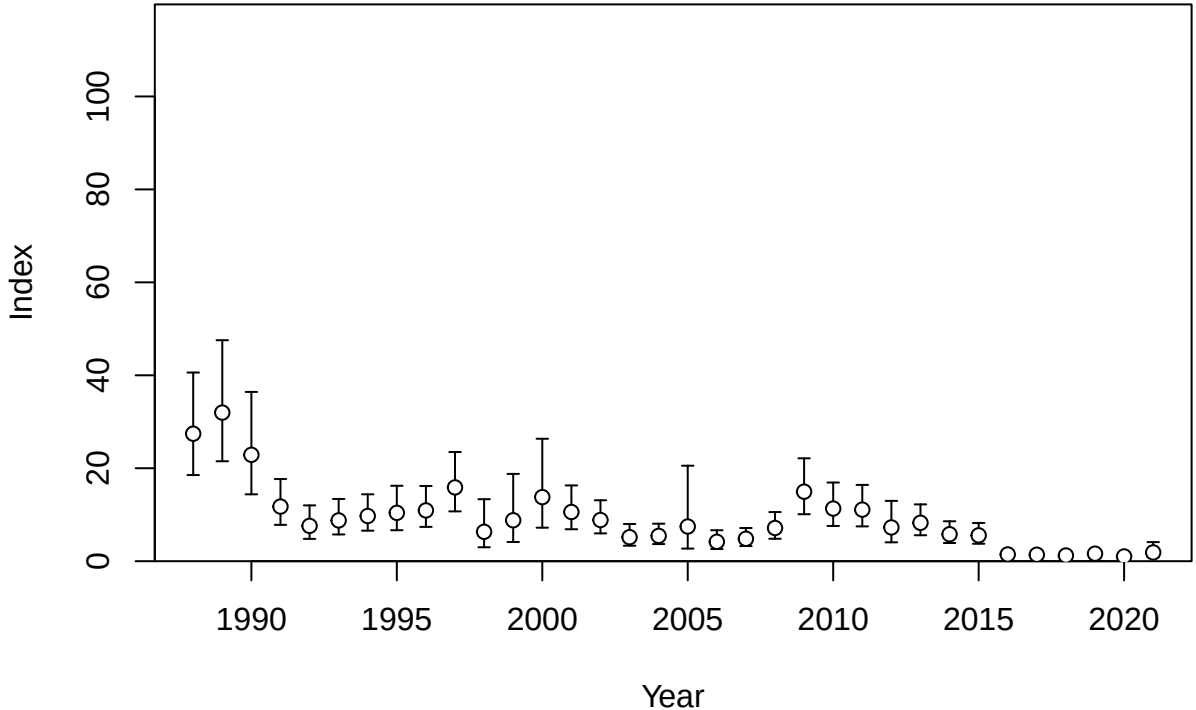

Continuous F
0.0
0.5
1.0
1.5
2.0
2.5
3.0
1970
1980
1990
2000
2010
2020
Year

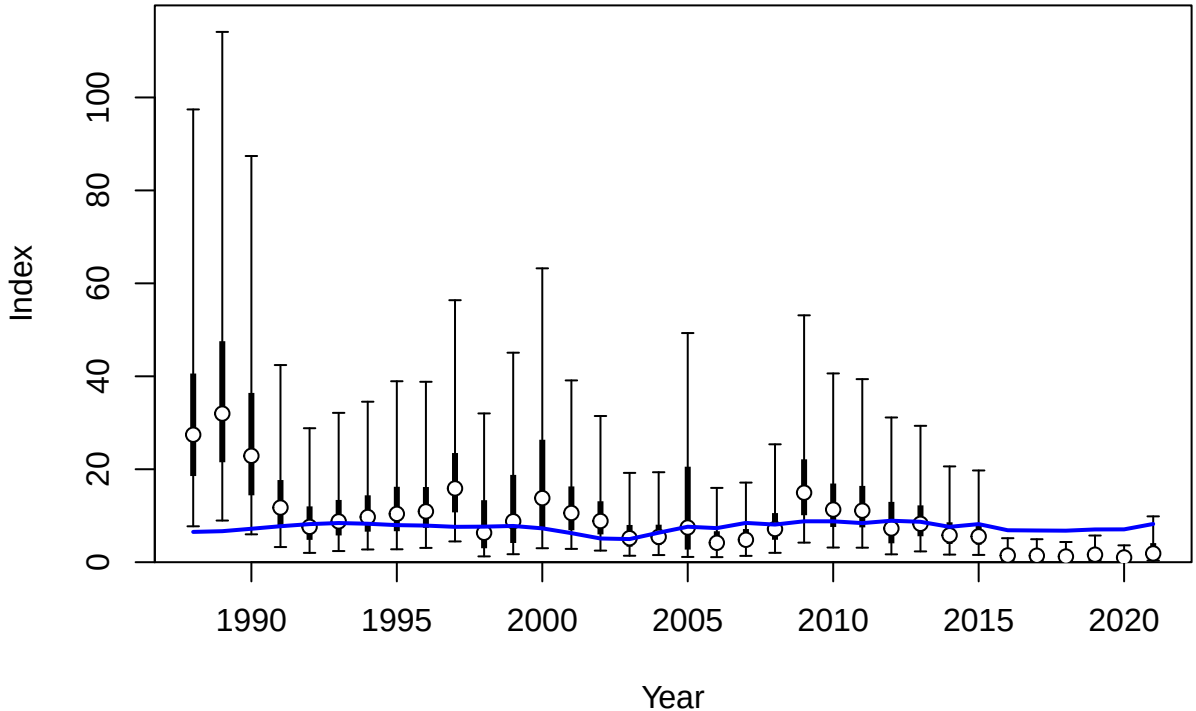

SPR
0.0
0.2
0.4
0.6
0.8
1.0
1970
1980
1990
2000
2010
2020
Year

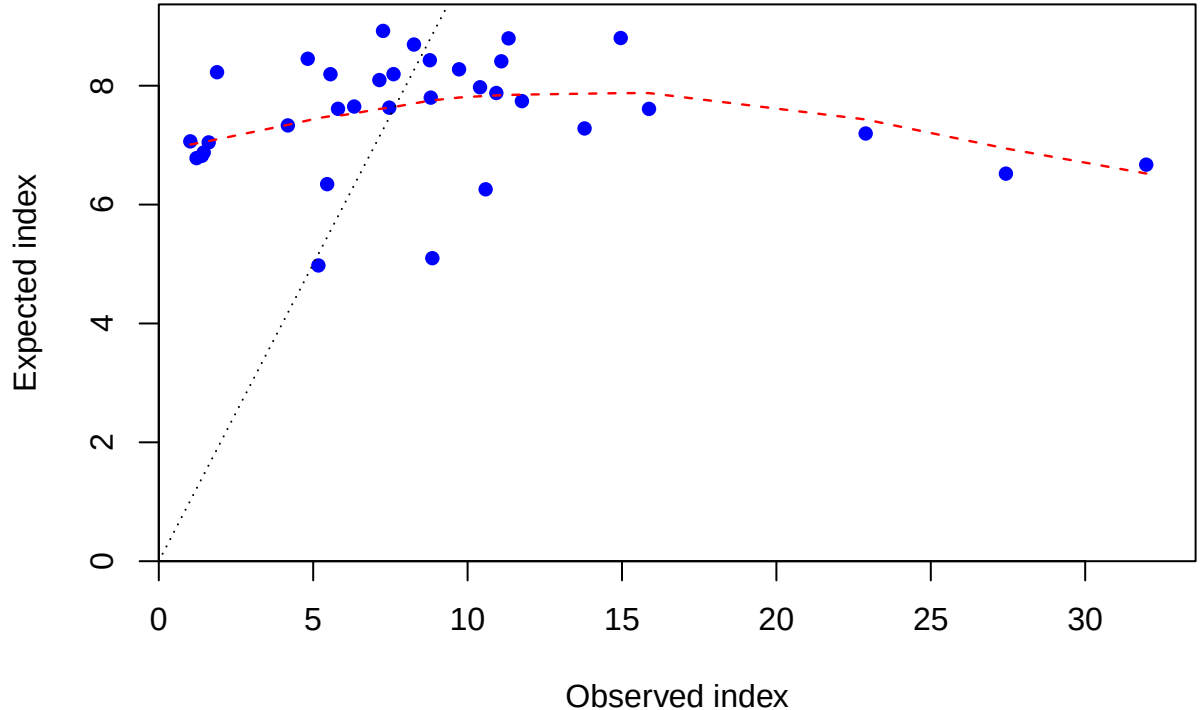

1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
1970
1980
1990
2000
2010
2020
Year

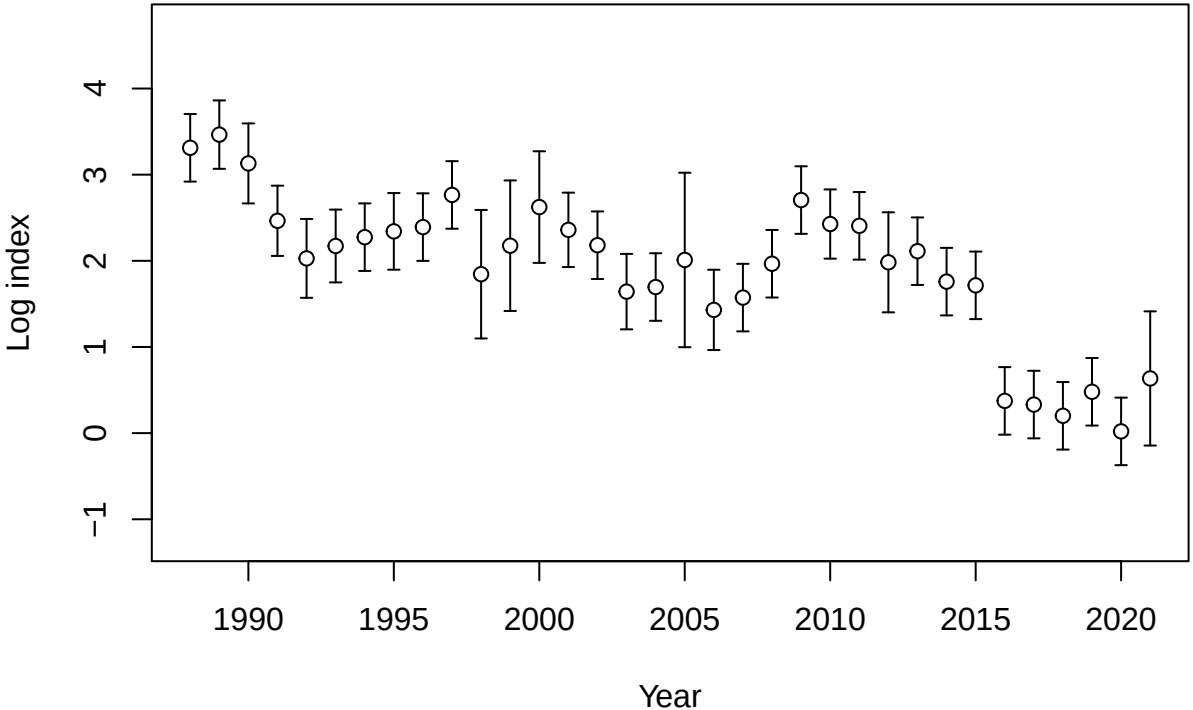

Fishing intensity: 1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
1970
1980
1990
2000
2010
2020
Year

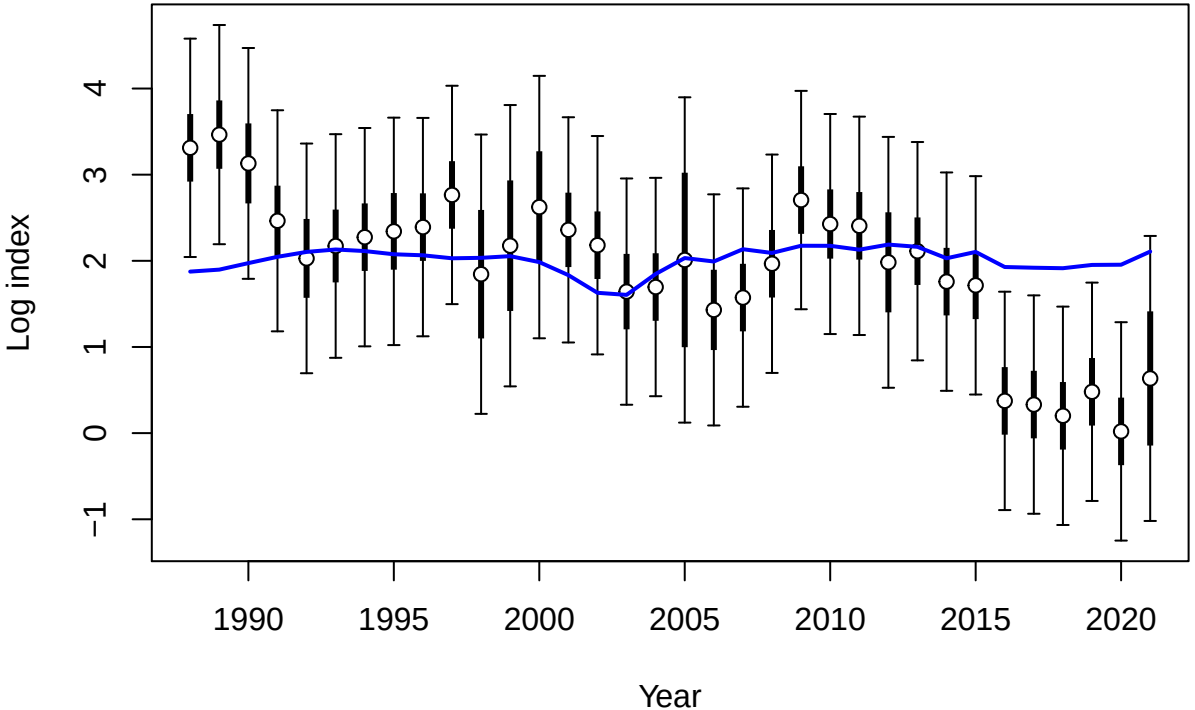

Fishing intensity: 1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
0.0
0.5
1.0
1.5
2.0
2.5
Relative spawning output: B/B_MSY
2010
2020

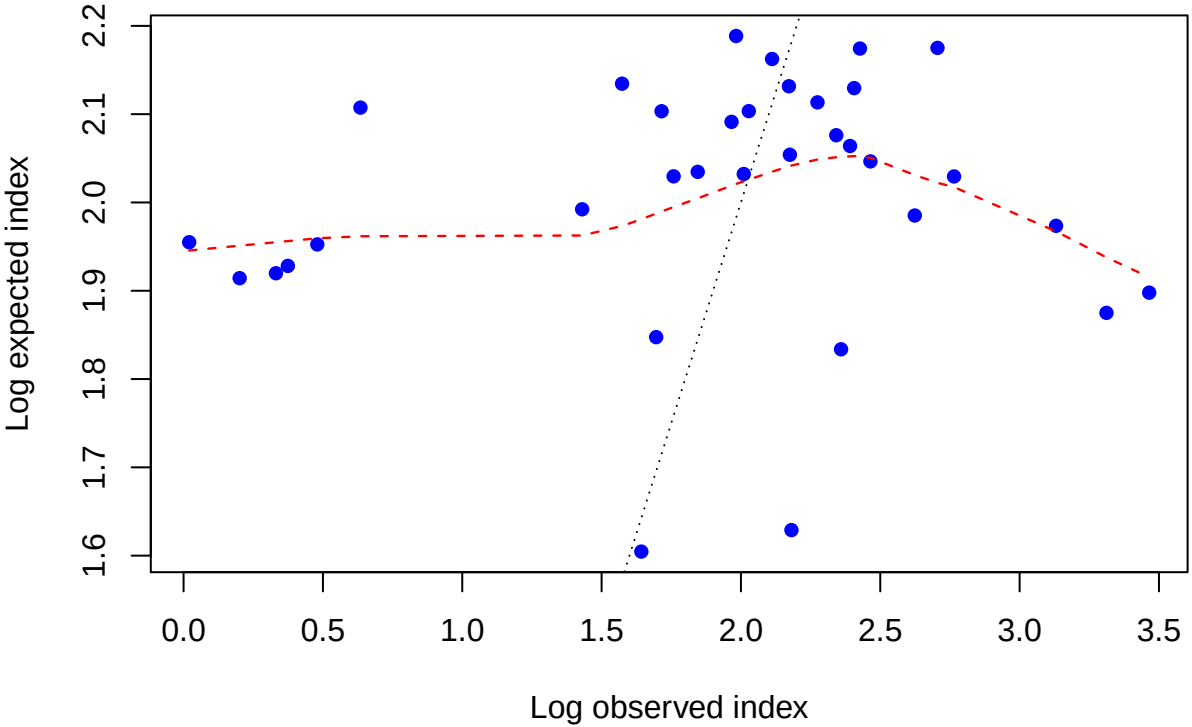

Index
0
20
40
60
80
100
1990
1995
2000
2005
2010
2015
2020
Year

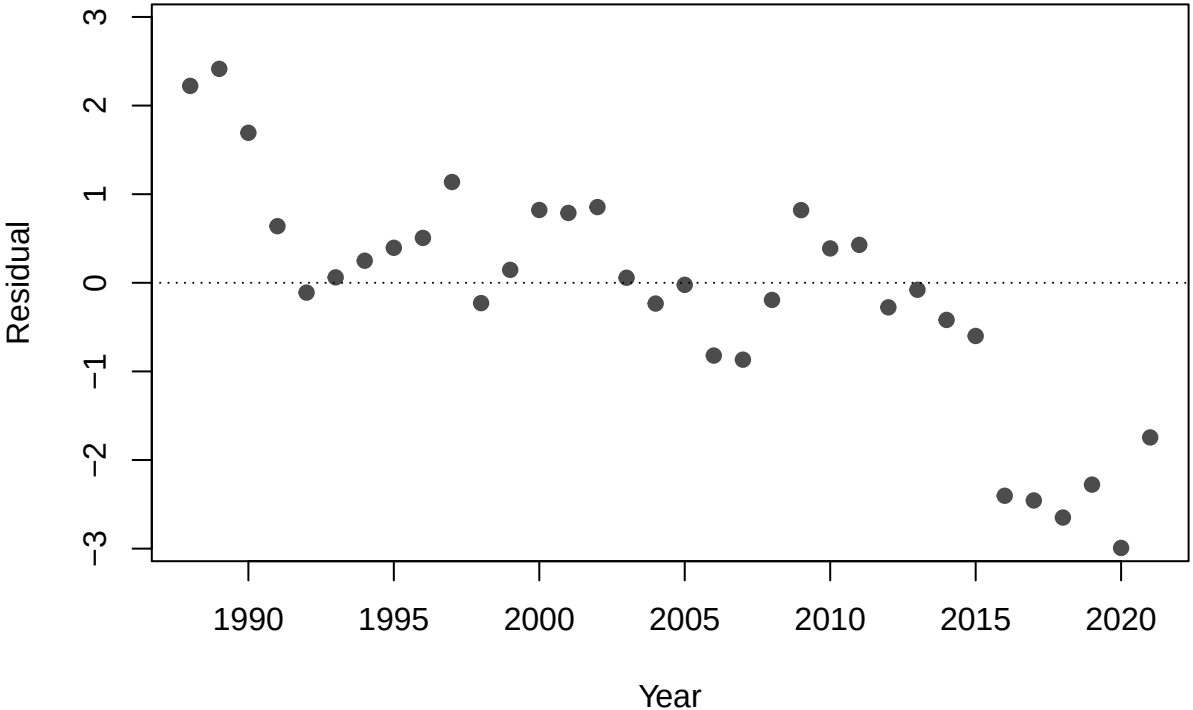

Index
0
20
40
60
80
100
1990
1995
2000
2005
2010
2015
2020
Year

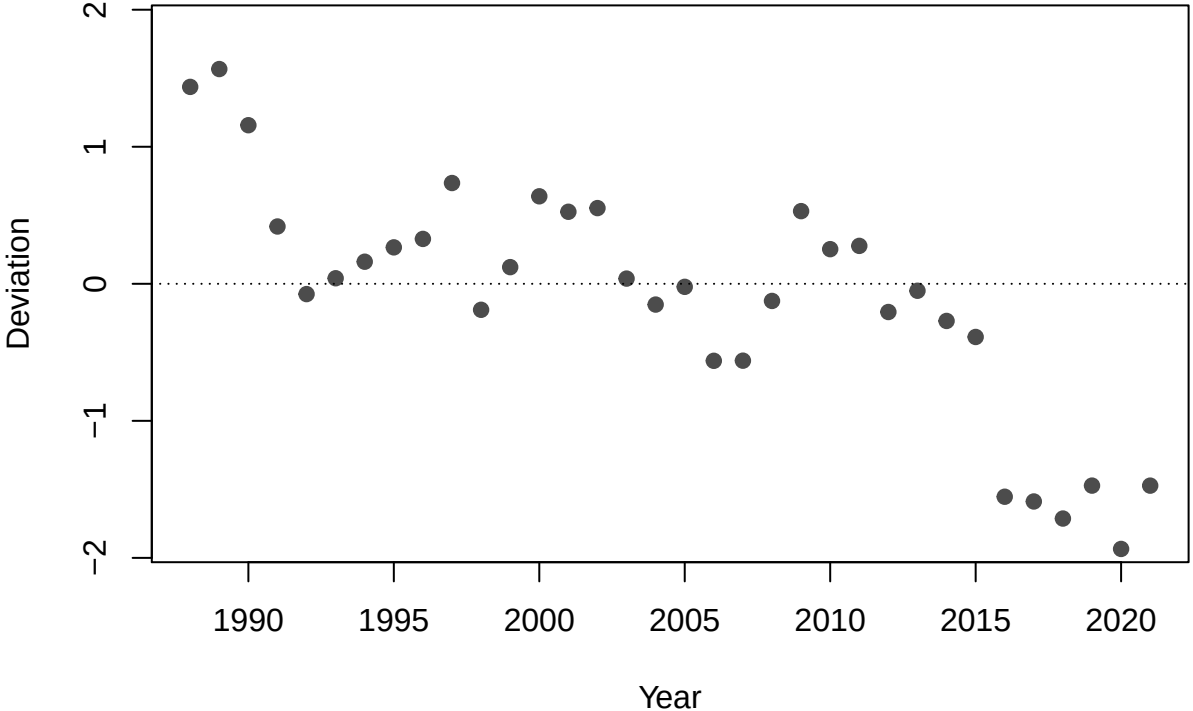

Expected index
0
2
4
6
8
0
5
10
15
20
25
30
Observed index

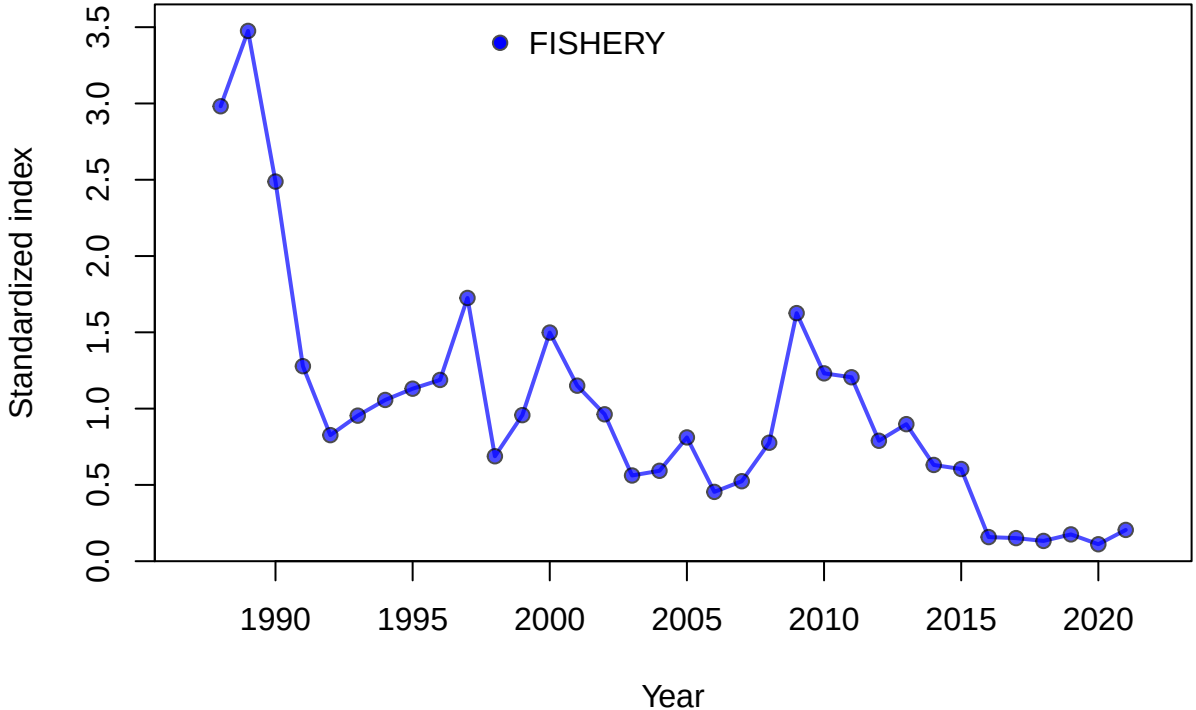

Log index
−1
0
1
2
3
4
1990
1995
2000
2005
2010
2015
2020
Year

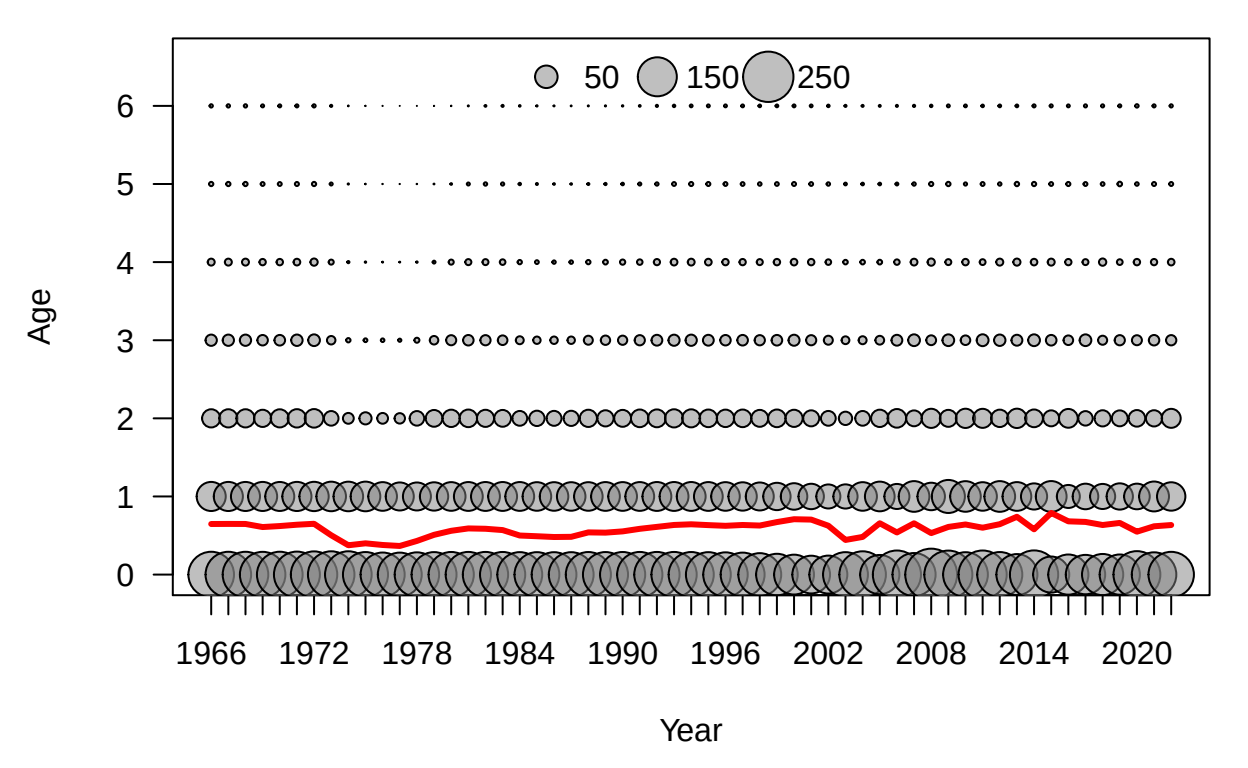

Log index
−1
0
1
2
3
4
1990
1995
2000
2005
2010
2015
2020
Year

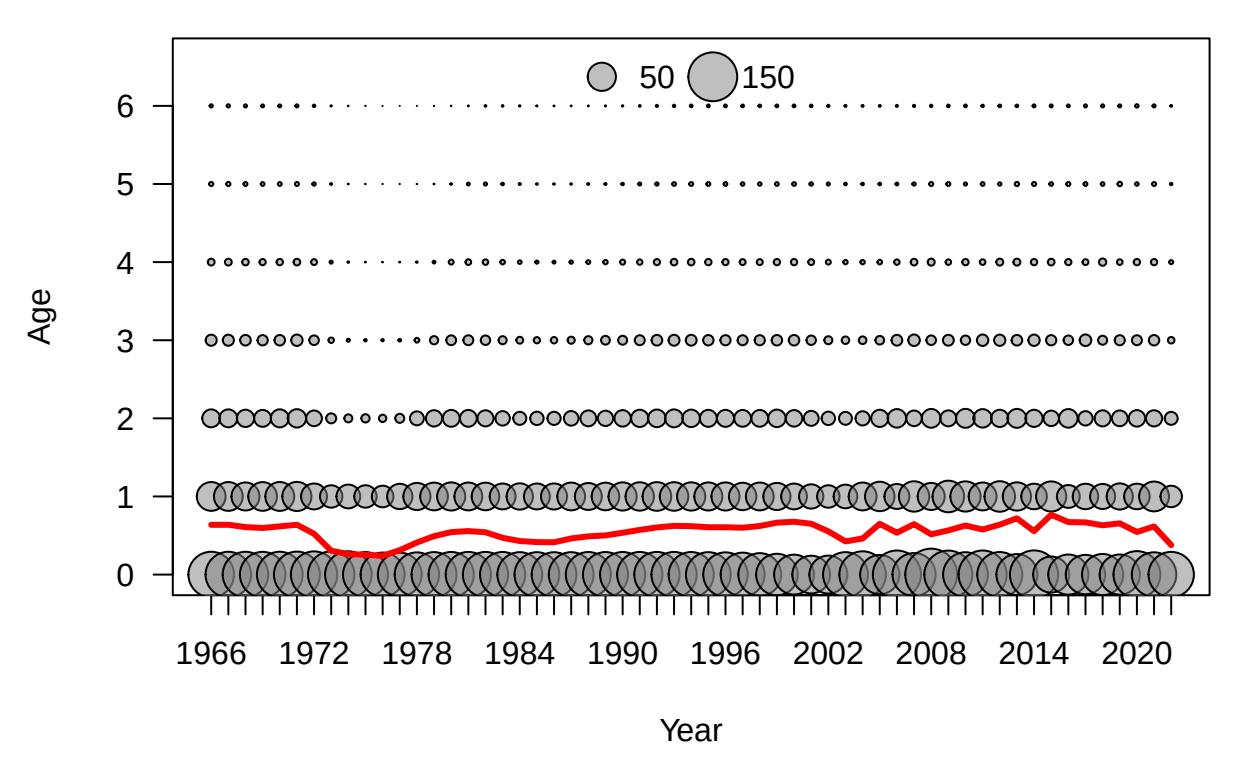

Log expected index
Log observed index
1.6
1.7
1.8
1.9
2.0
2.1
2.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5

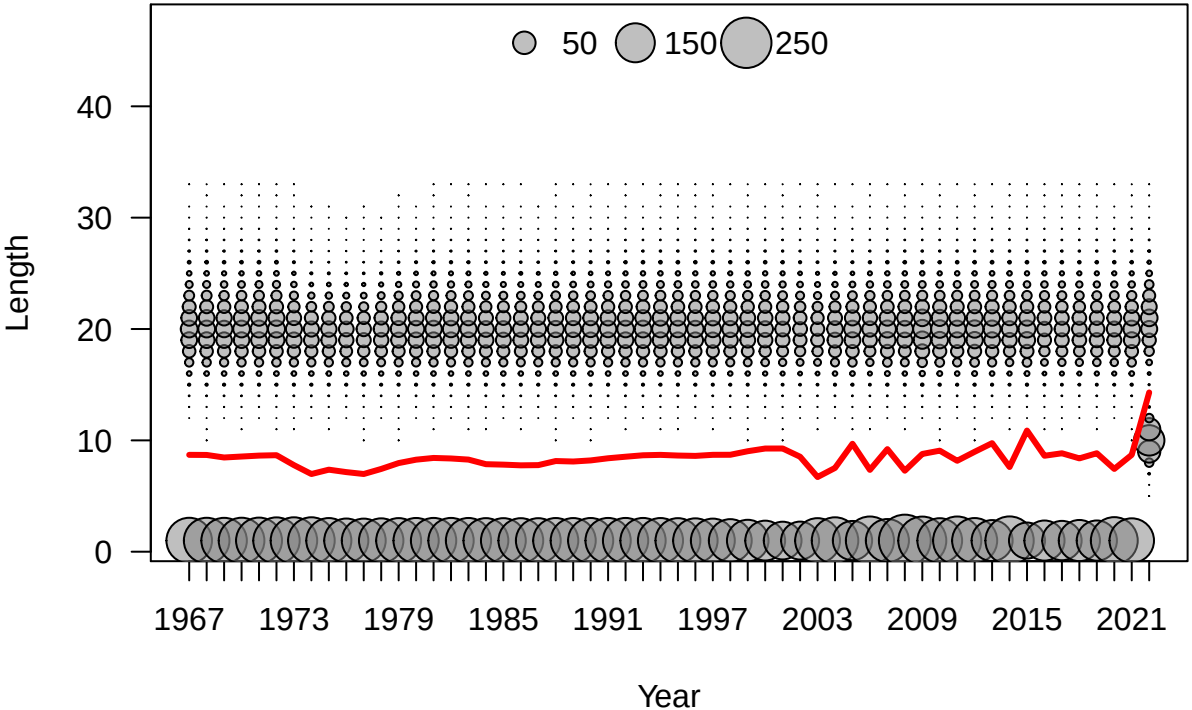

Residual
3
2
1
0
−1
−2
−3
1990
1995
2000
2005
2010
2015
2020
Year

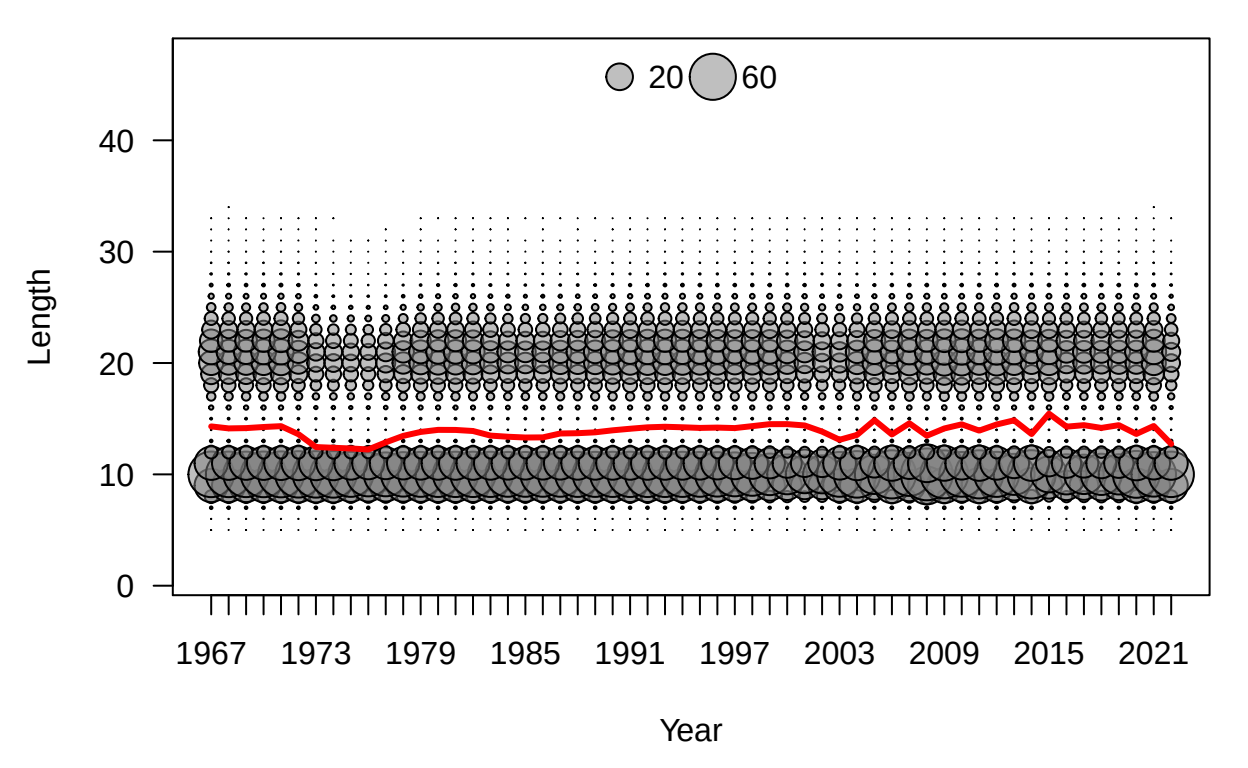

Deviation
2
1
0
−1
−2
1990
1995
2000
2005
2010
2015
2020
Year

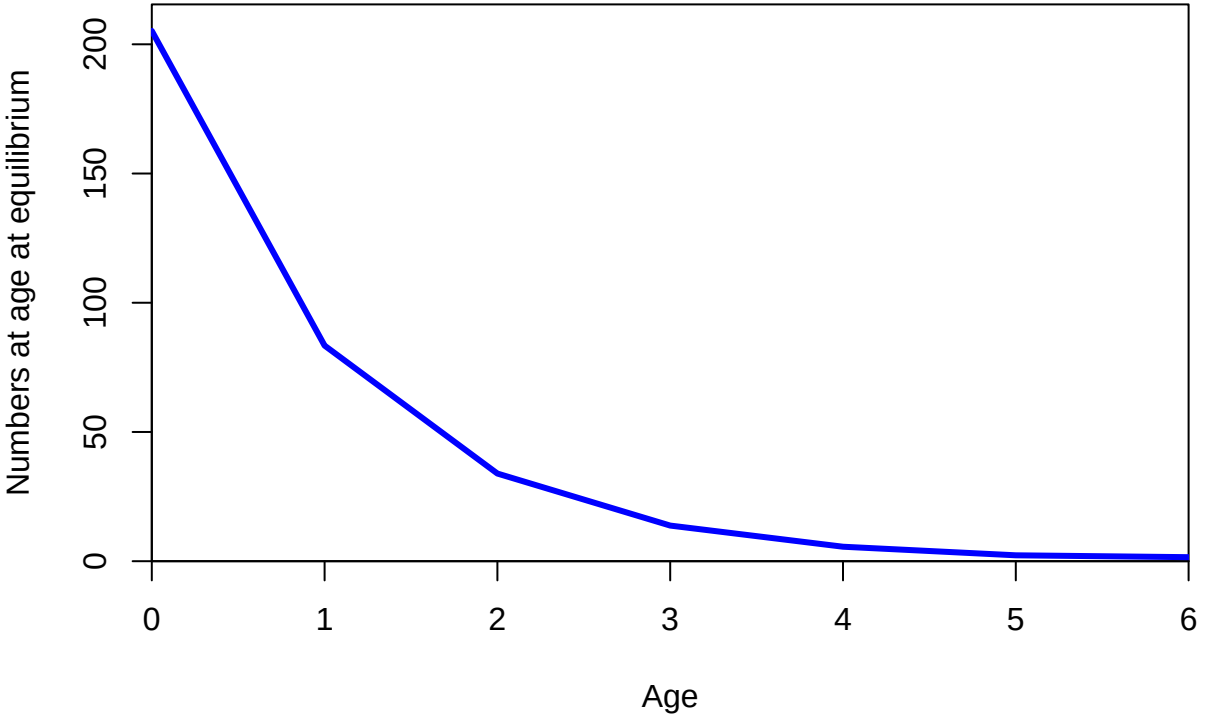

FISHERY
Standardized index
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1990
1995
2000
2005
2010
2015
2020
Year

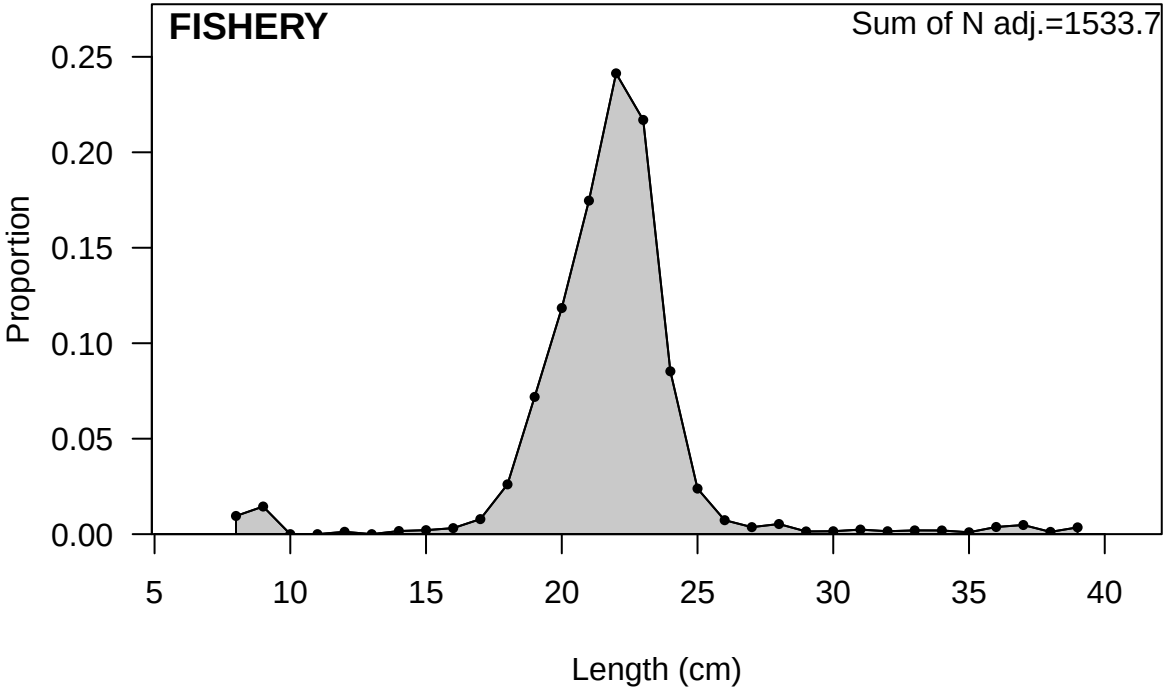

50
150
250
Age
0
1
2
3
4
5
6
1966
1972
1978
1984
1990
1996
2002
2008
2014
2020
Year

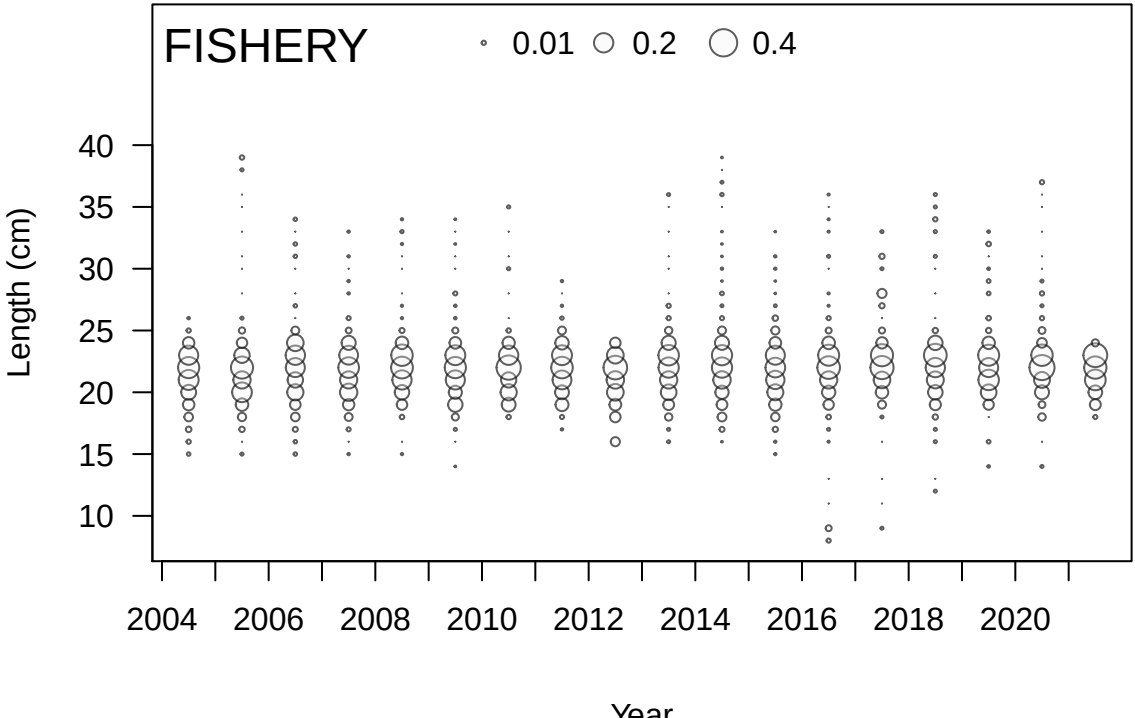

50
150
Age
0
1
2
3
4
5
6
1966
1972
1978
1984
1990
1996
2002
2008
2014
2020
Year

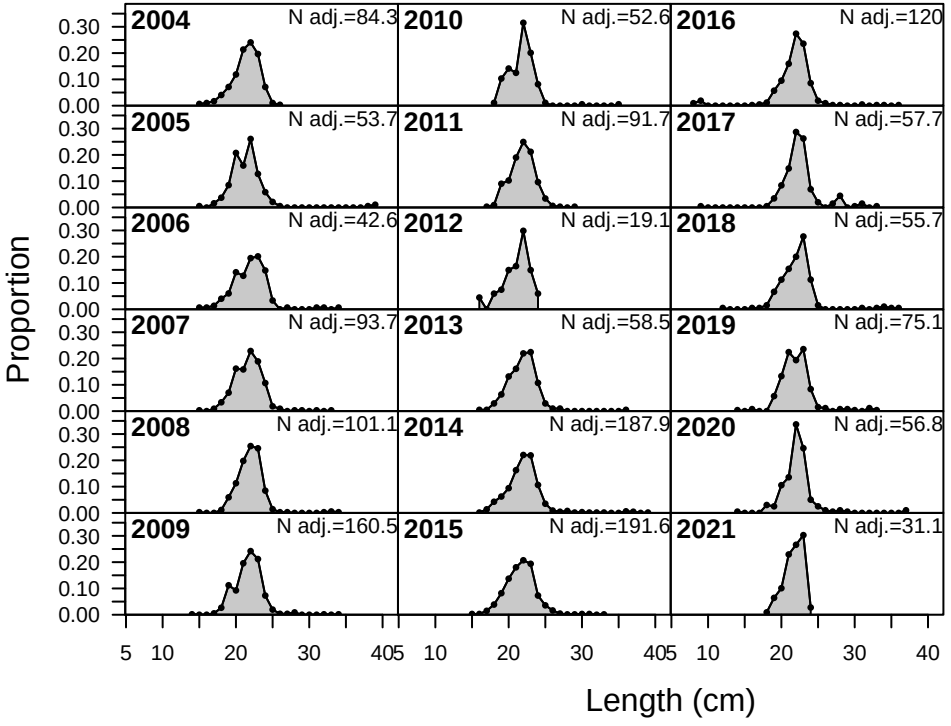

50
150
250
Length
0
10
20
30
40
1967
1973
1979
1985
1991
1997
2003
2009
2015
2021
Year

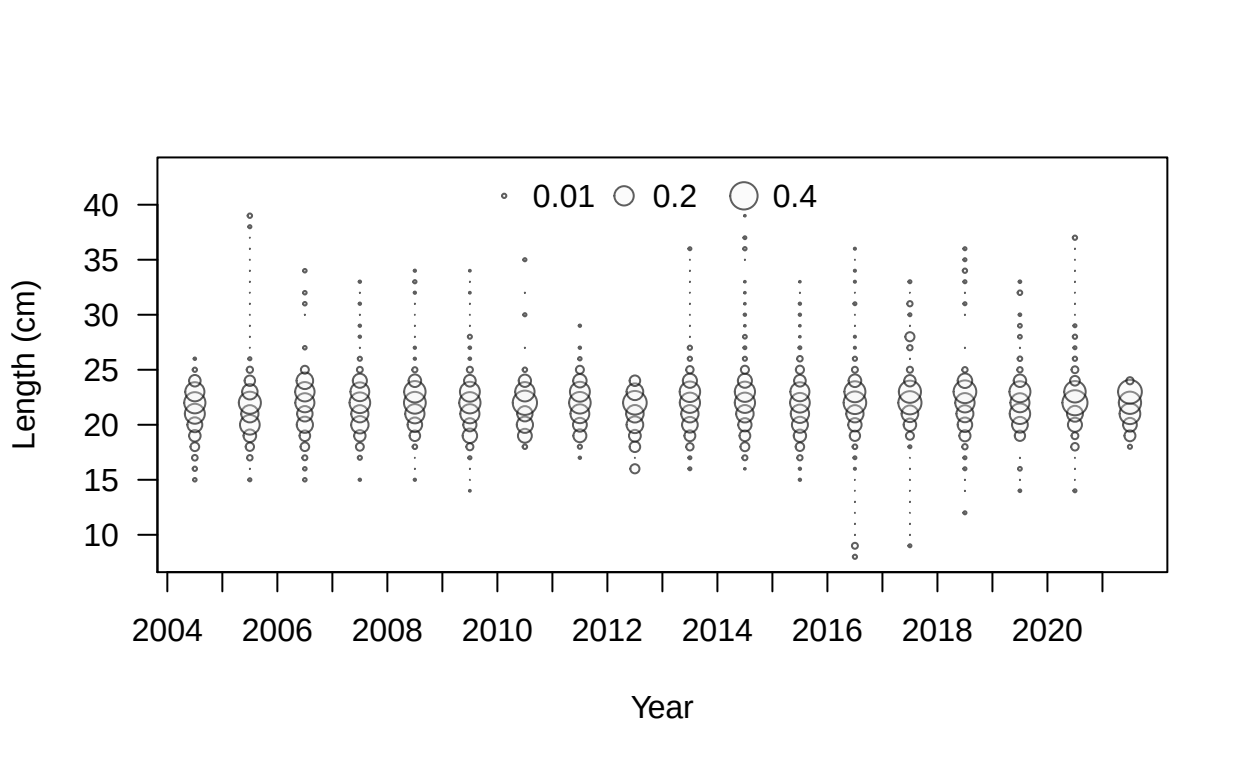

20
60
40
30
20
10
0
Length
1967
1973
1979
1985
1991
1997
2003
2009
2015
2021
Year

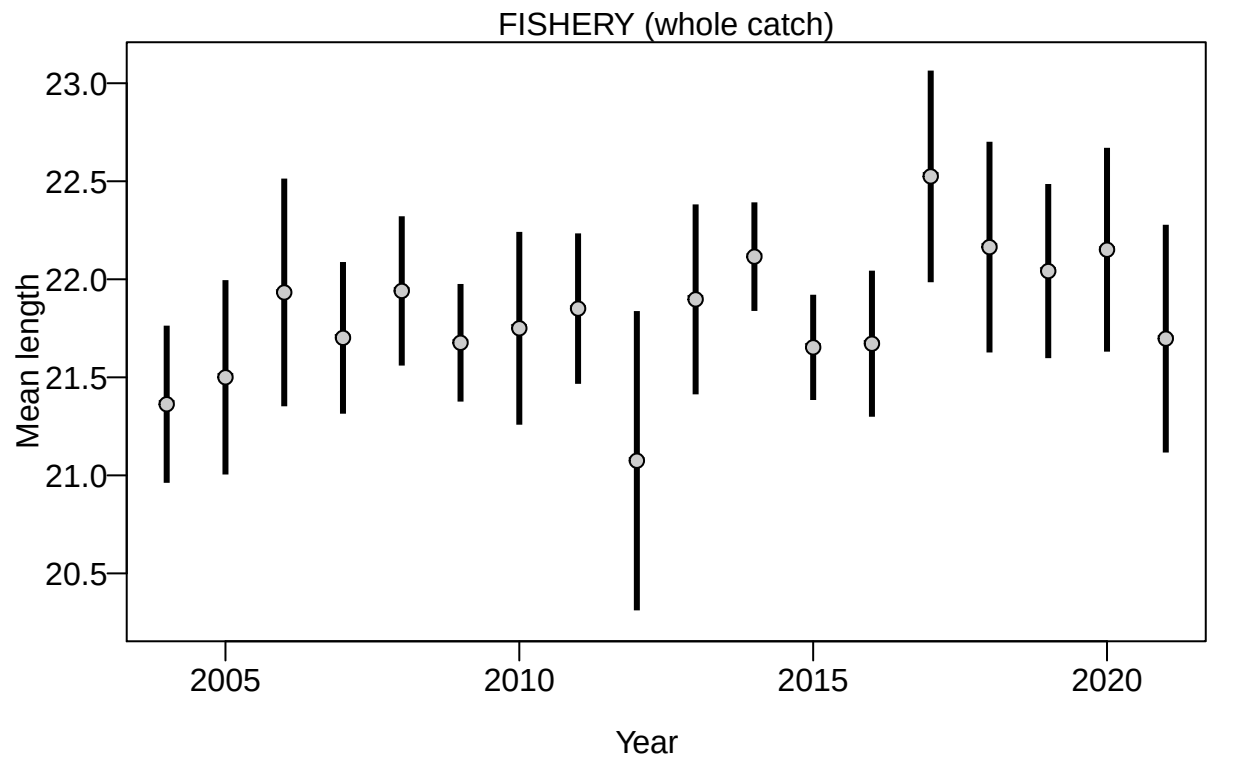

Numbers at age at equilibrium
0
50
100
150
200
0
1
2
3
4
5
6
Age

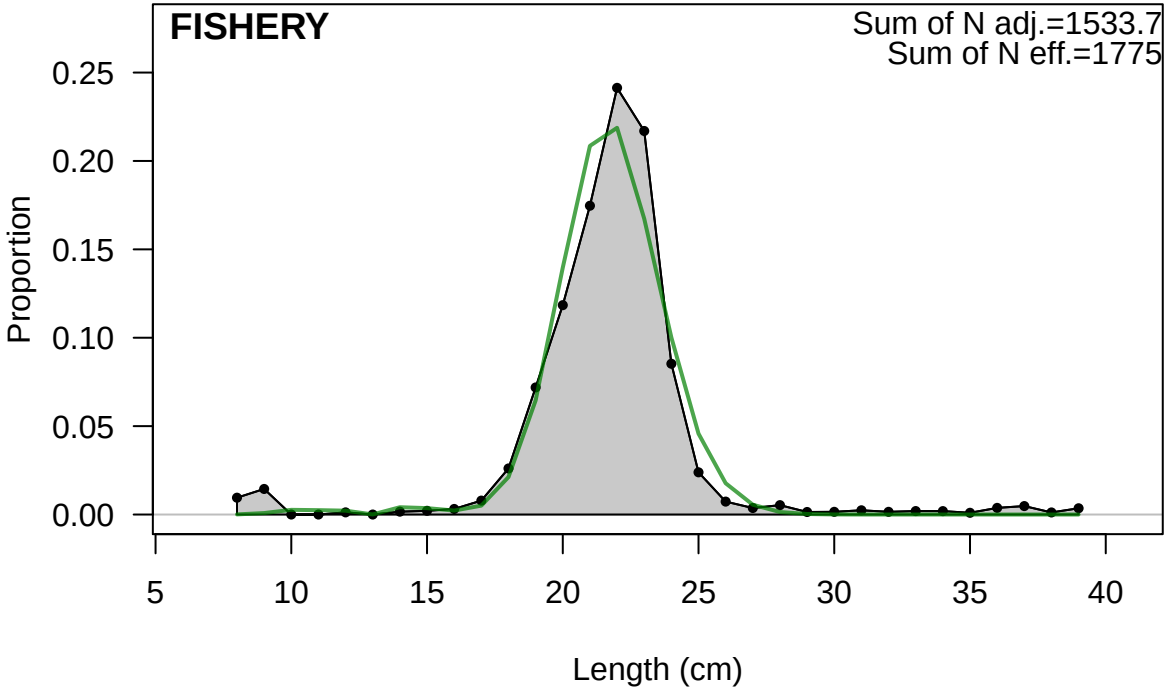

FISHERY
Sum of N adj.=1533.7
Proportion
0.25
0.20
0.15
0.10
0.05
0.00
5
10
15
20
25
30
35
40
Length (cm)

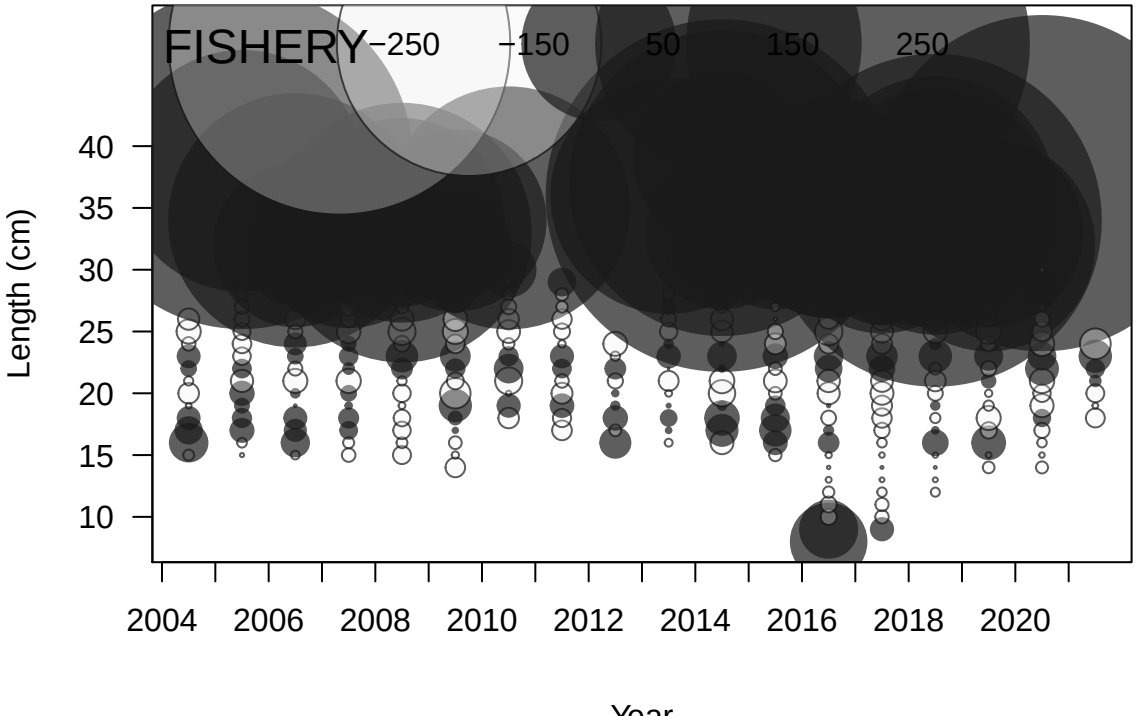

FISHERY
0.01
0.2
0.4
Length (cm)
40
35
30
25
20
15
10
2004
2006
2008
2010
2012
2014
2016
2018
2020
Year

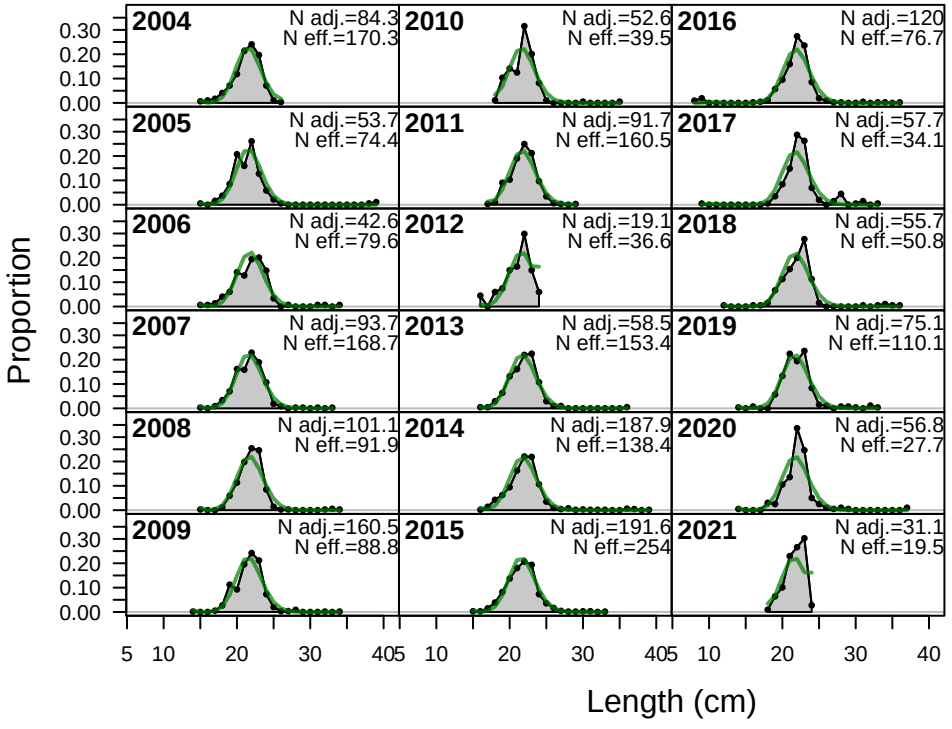

2004
N adj.=84.3
2010
N adj.=52.6
2016
N adj.=120
2005
N adj.=53.7
2011
N adj.=91.7
2017
N adj.=57.7
2006
N adj.=42.6
2012
N adj.=19.1
2018
N adj.=55.7
2007
N adj.=93.7
2013
N adj.=58.5
2019
N adj.=75.1
2008
N adj.=101.1
2014
N adj.=187.9
2020
N adj.=56.8
2009
N adj.=160.5
2015
N adj.=191.6
2021
N adj.=31.1
Proportion
0.00
0.10
0.20
0.30
5
10
20
30
40
Length (cm)

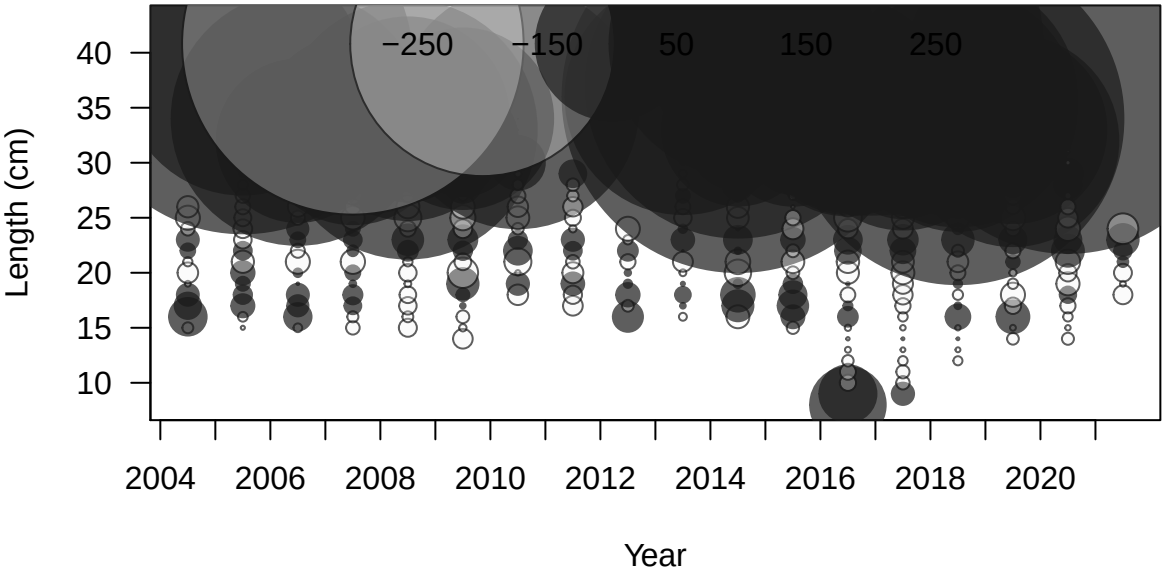

0.01
0.2
0.4
Length (cm)
40
35
30
25
20
15
10
2004
2006
2008
2010
2012
2014
2016
2018
2020
Year

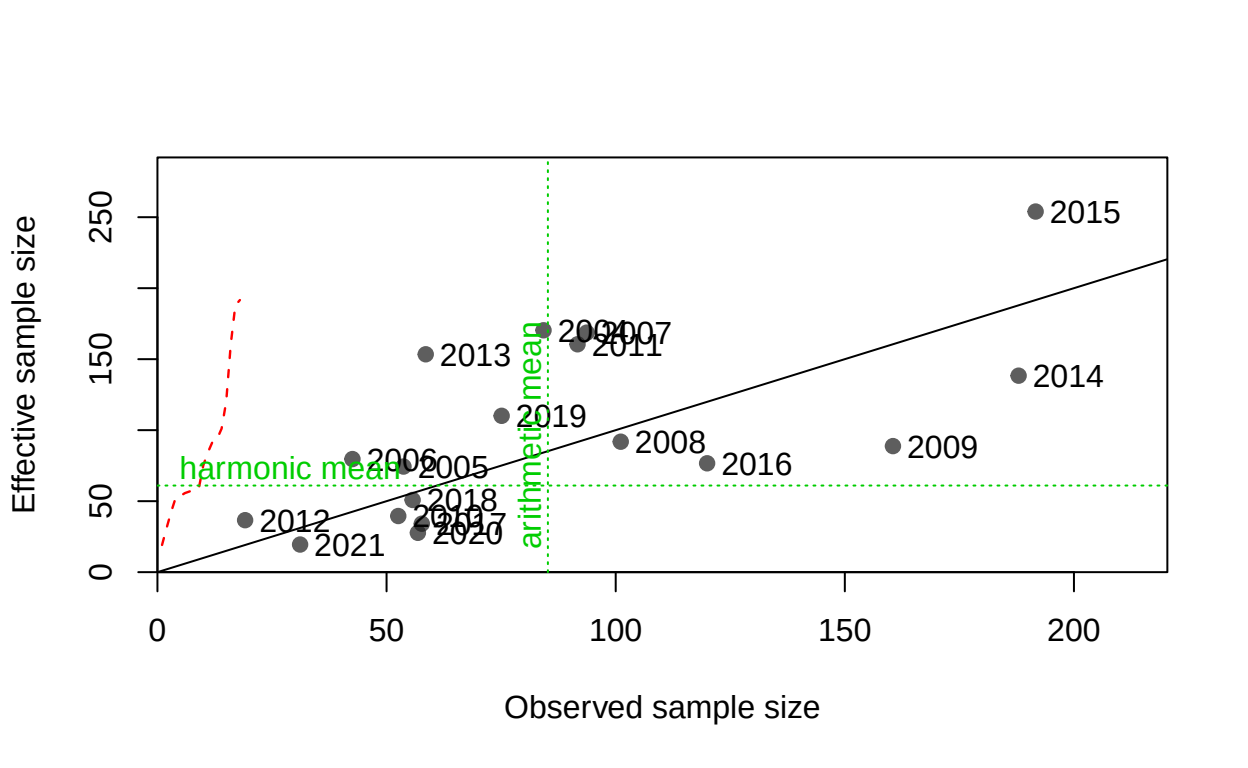

FISHERY (whole catch)
Mean length
23.0
22.5
22.0
21.5
21.0
20.5
2005
2010
2015
2020
Year

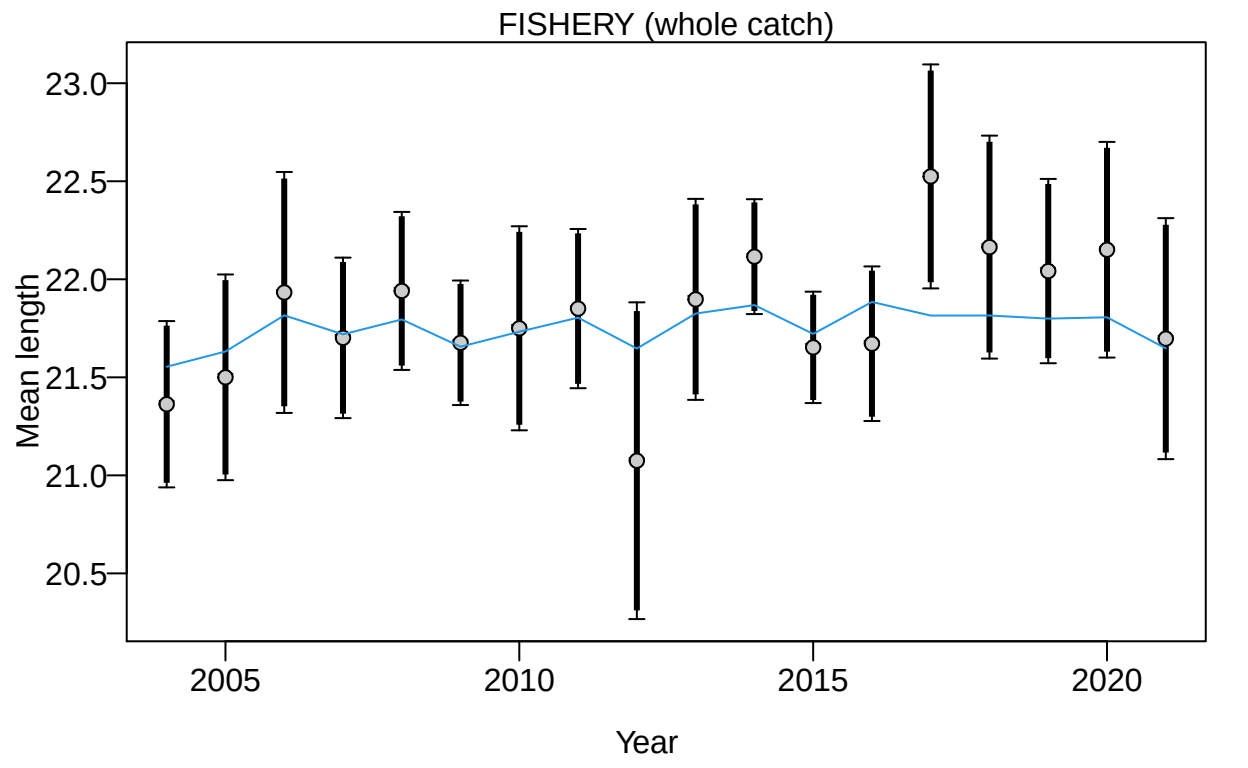

FISHERY
Sum of N adj.=1533.7
Sum of N eff.=1775
Proportion
0.25
0.20
0.15
0.10
0.05
0.00
5
10
15
20
25
30
35
40
Length (cm)

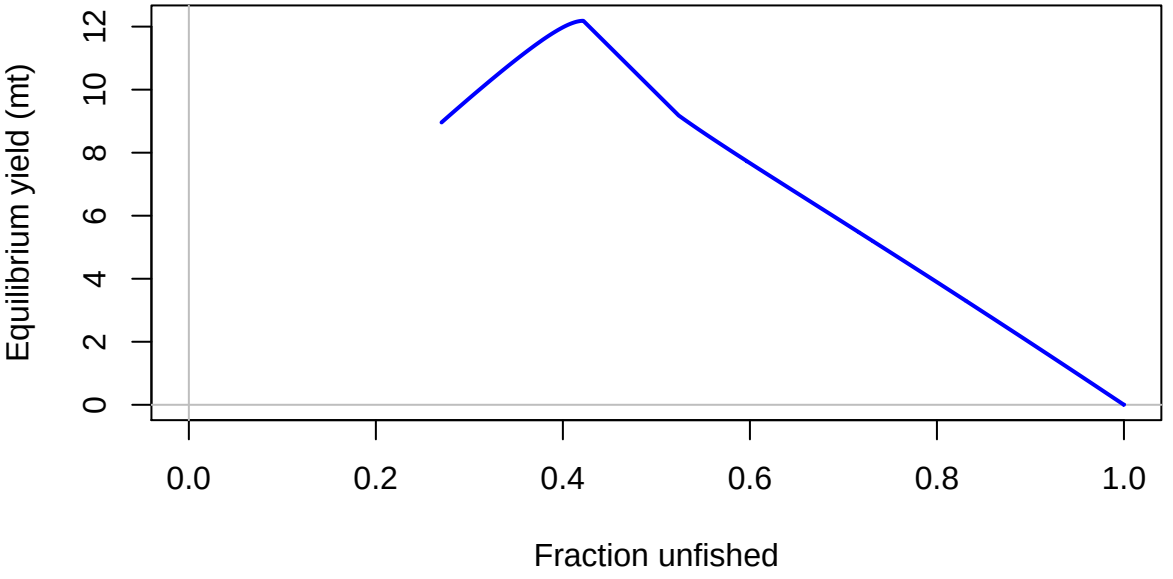

FISHERY
−250
−150
50
150
250
40
35
30
25
20
15
10
Length (cm)
2004
2006
2008
2010
2012
2014
2016
2018
2020
Year

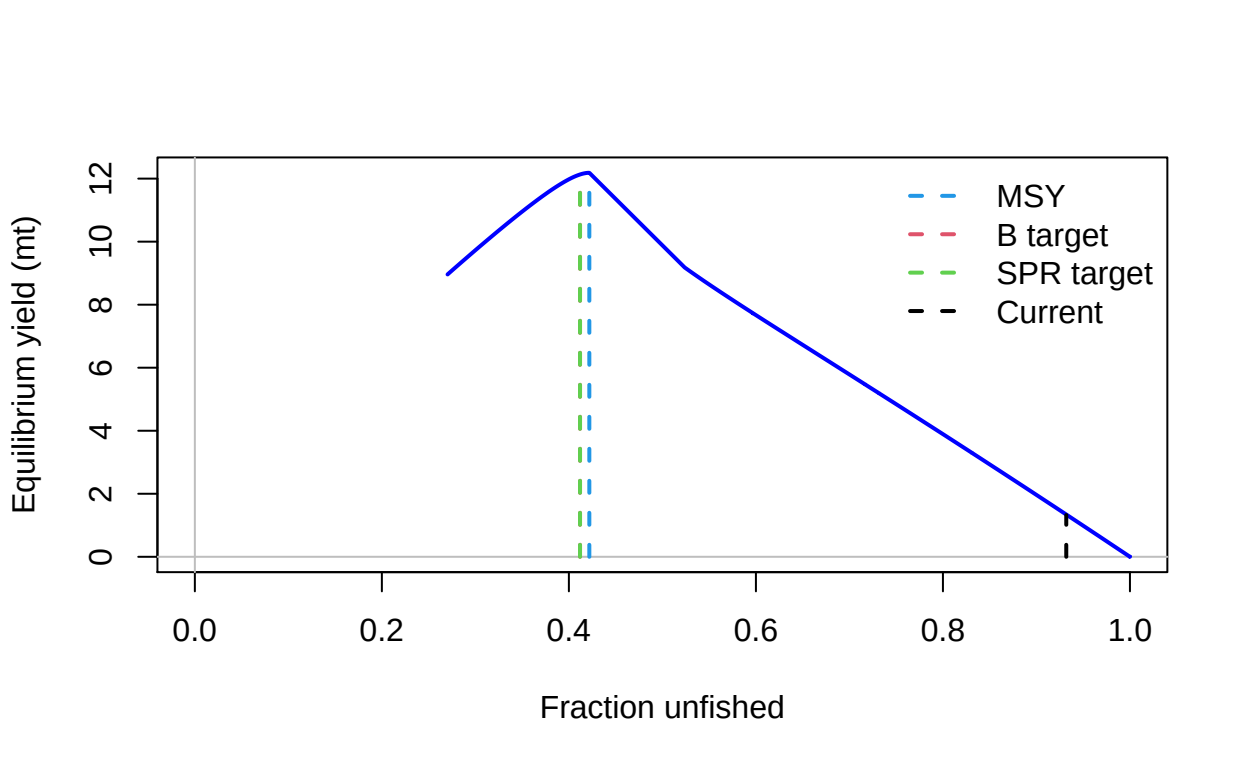

2004
N adj.=84.3
N eff.=170.3
2010
N adj.=52.6
N eff.=39.5
2016
N adj.=120
N eff.=76.7
2005
N adj.=53.7
N eff.=74.4
2011
N adj.=91.7
N eff.=160.5
2017
N adj.=57.7
N eff.=34.1
2006
N adj.=42.6
N eff.=79.6
2012
N adj.=19.1
N eff.=36.6
2018
N adj.=55.7
N eff.=50.8
2007
N adj.=93.7
N eff.=168.7
2013
N adj.=58.5
N eff.=153.4
2019
N adj.=75.1
N eff.=110.1
2008
N adj.=101.1
N eff.=91.9
2014
N adj.=187.9
N eff.=138.4
2020
N adj.=56.8
N eff.=27.7
2009
N adj.=160.5
N eff.=88.8
2015
N adj.=191.6
N eff.=254
2021
N adj.=31.1
N eff.=19.5
Proportion
0.00
0.10
0.20
0.30
5
10
20
30
40
Length (cm)

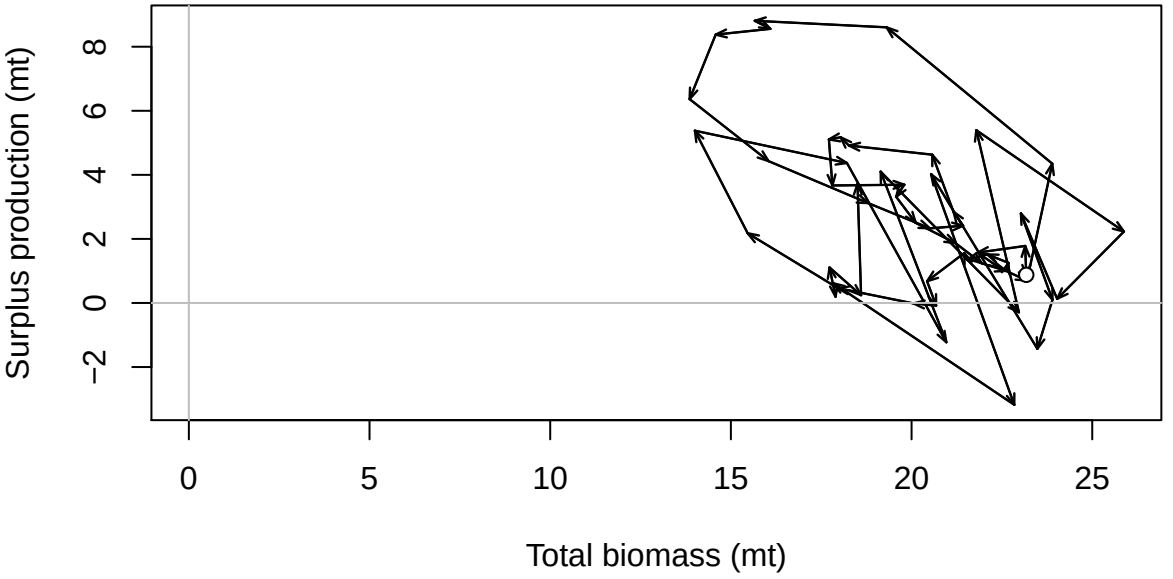

−250
−150
50
150
250
40
35
30
25
20
15
10
Length (cm)
2004
2006
2008
2010
2012
2014
2016
2018
2020
Year

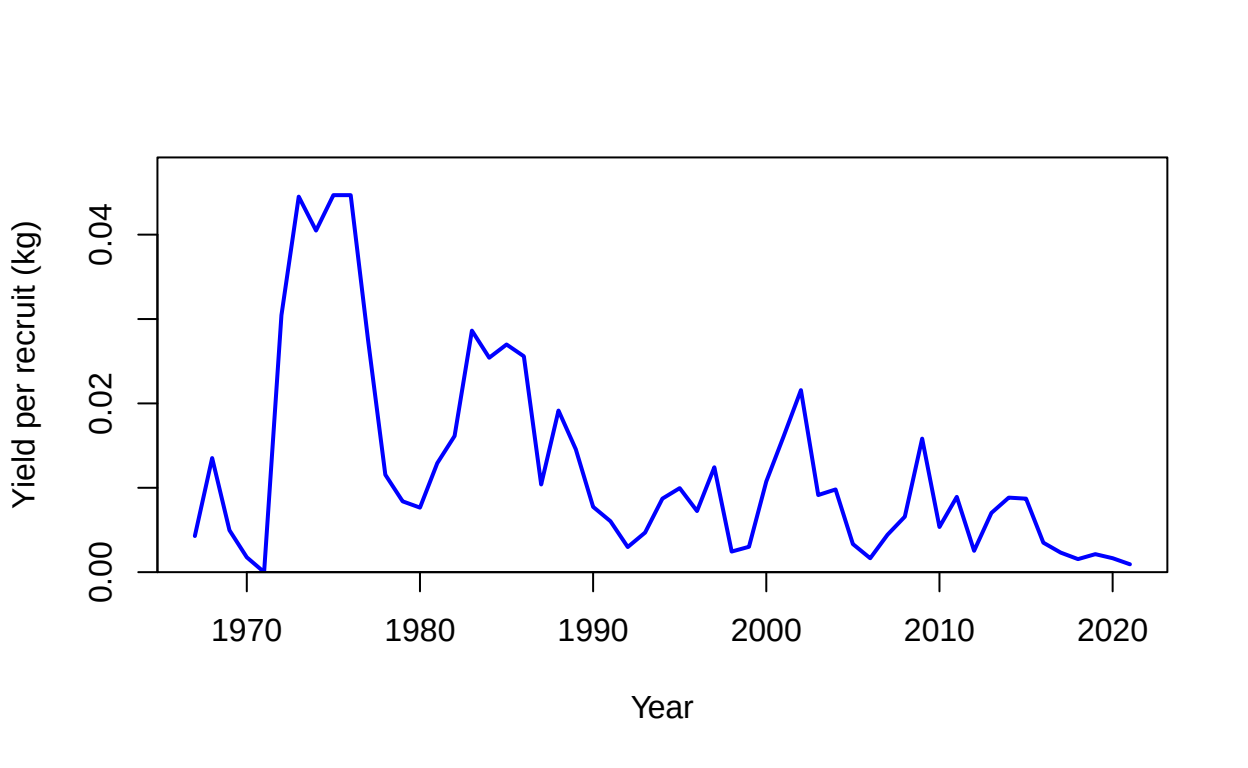

Effective sample size
Observed sample size
0
50
150
250
0
50
100
150
200
2015
2014
2013
2004
2007
2011
2019
2008
2009
2016
2006
2005
2018
2012
2017
2020
2021
harmonic mean
arithmetic mean

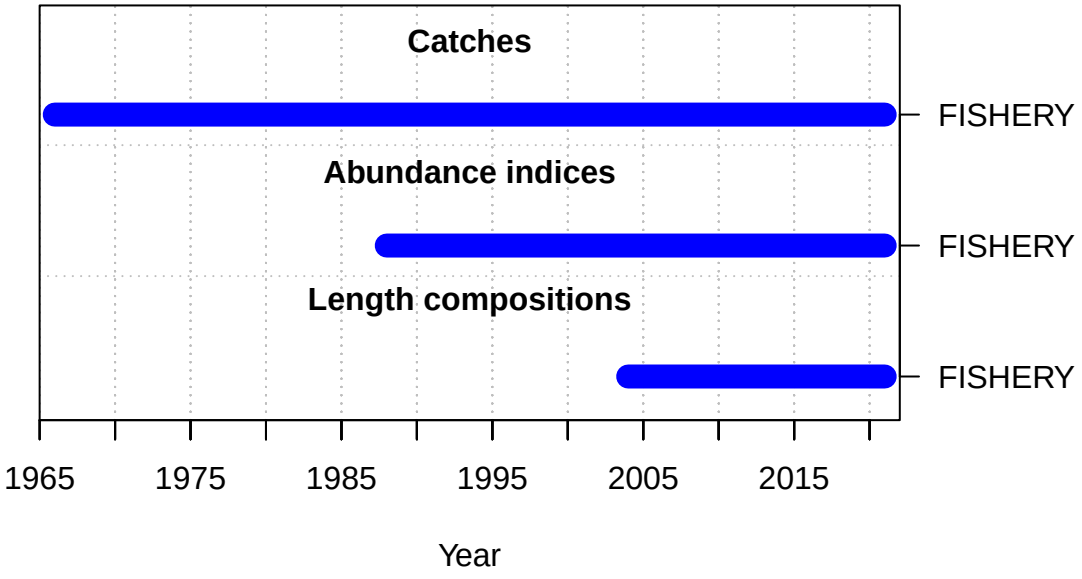

FISHERY (whole catch)
Mean length
23.0
22.5
22.0
21.5
21.0
20.5
2005
2010
2015
2020
Year

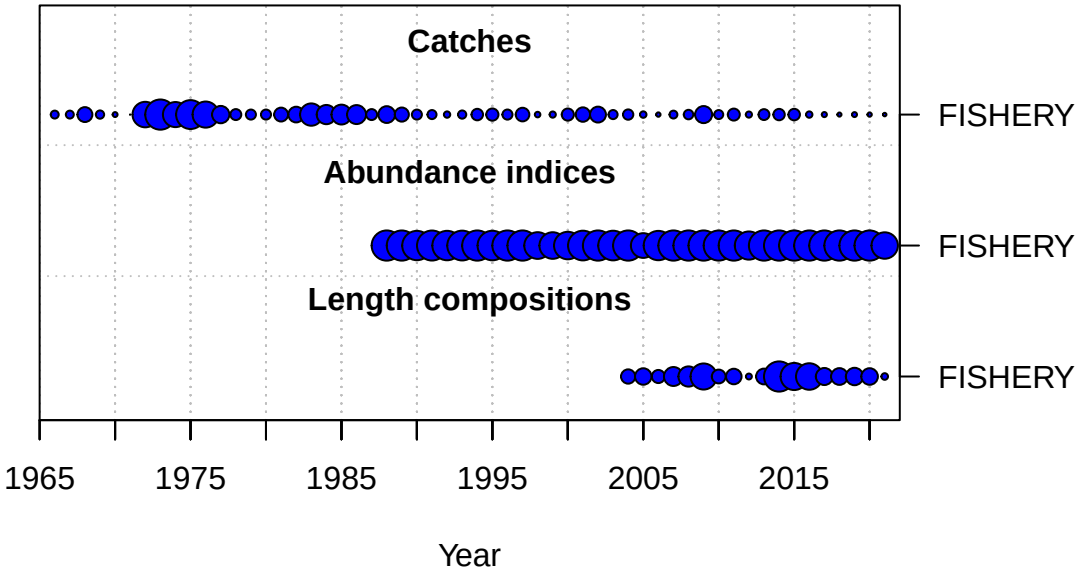

Equilibrium yield (mt)
0
2
4
6
8
10
12
0.0
0.2
0.4
0.6
0.8
1.0
Fraction unfished

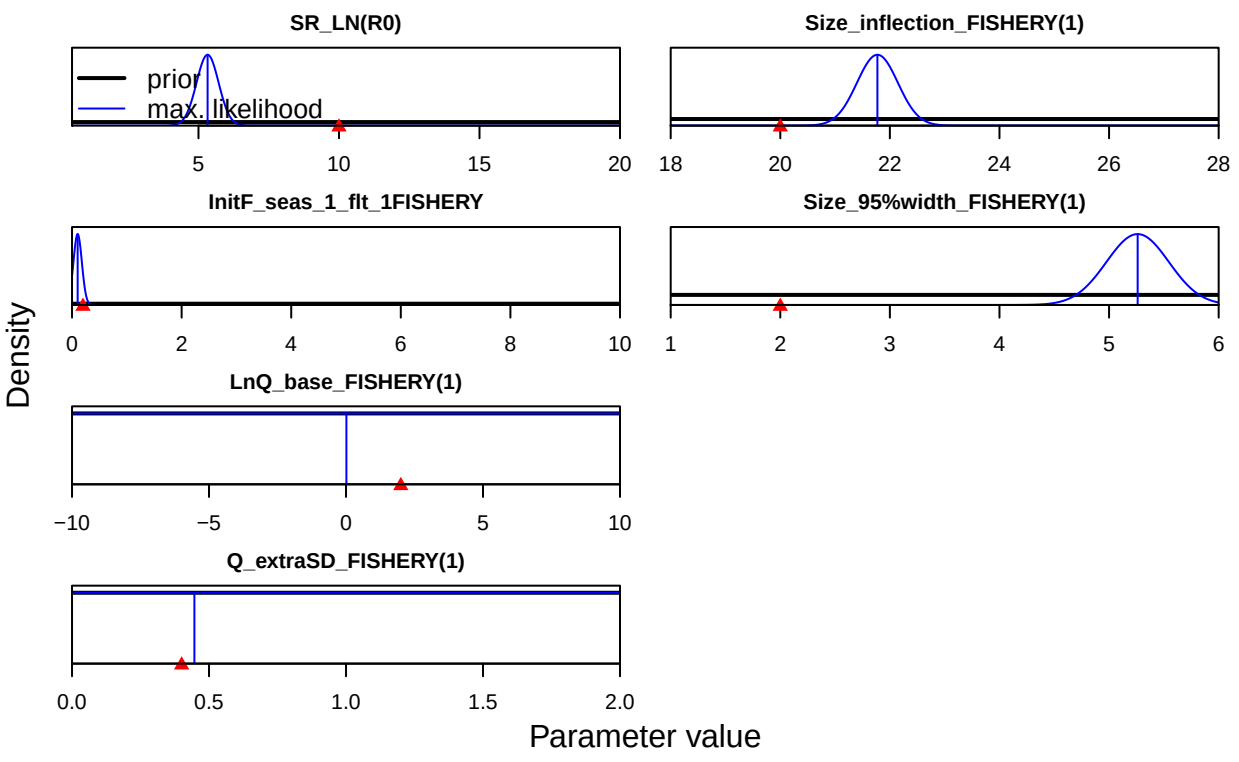

Equilibrium yield (mt)
0
2
4
6
8
10
12
0.0
0.2
0.4
0.6
0.8
1.0
Fraction unfished
MSY
B target
SPR target
Current


Surplus production (mt)
−2
0
2
4
6
8
0
5
10
15
20
25
Total biomass (mt)


Yield per recruit (kg)
0.00
0.02
0.04
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
5
10
15
20
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
2
3
4
5
6
LnQ_base_FISHERY(1)
−10
−5
0
5
10
Q_extraSD_FISHERY(1)
0.0
0.5
1.0
1.5
2.0
Density
Parameter value