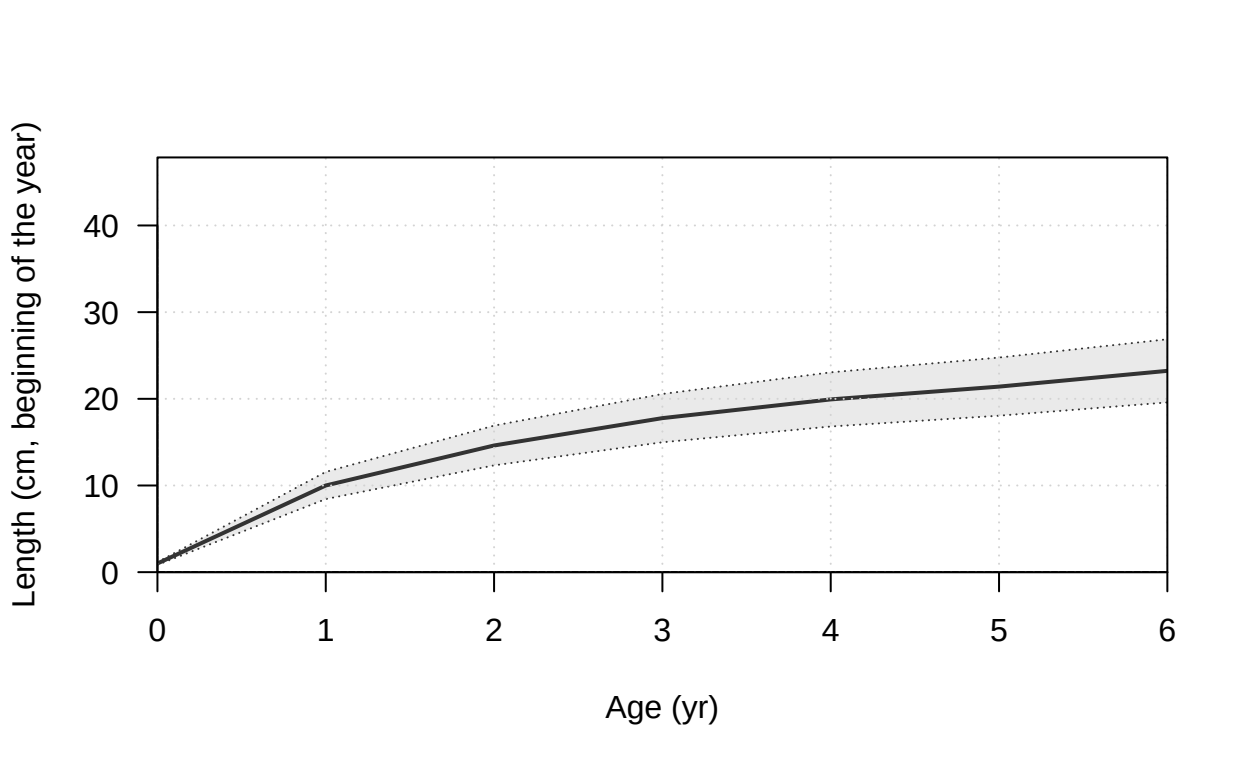
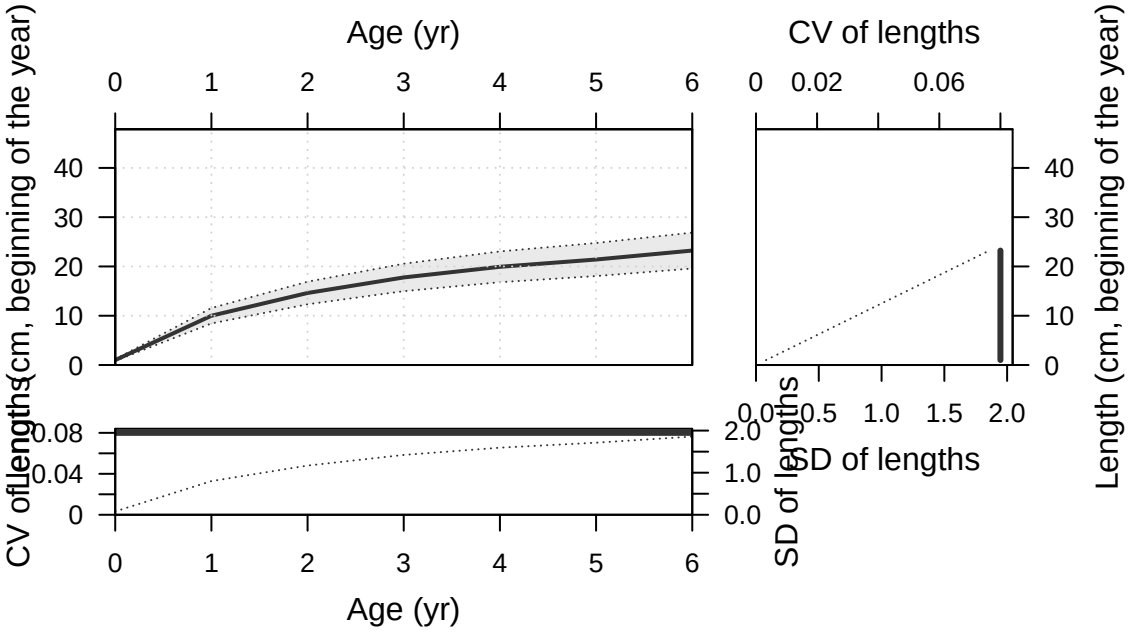
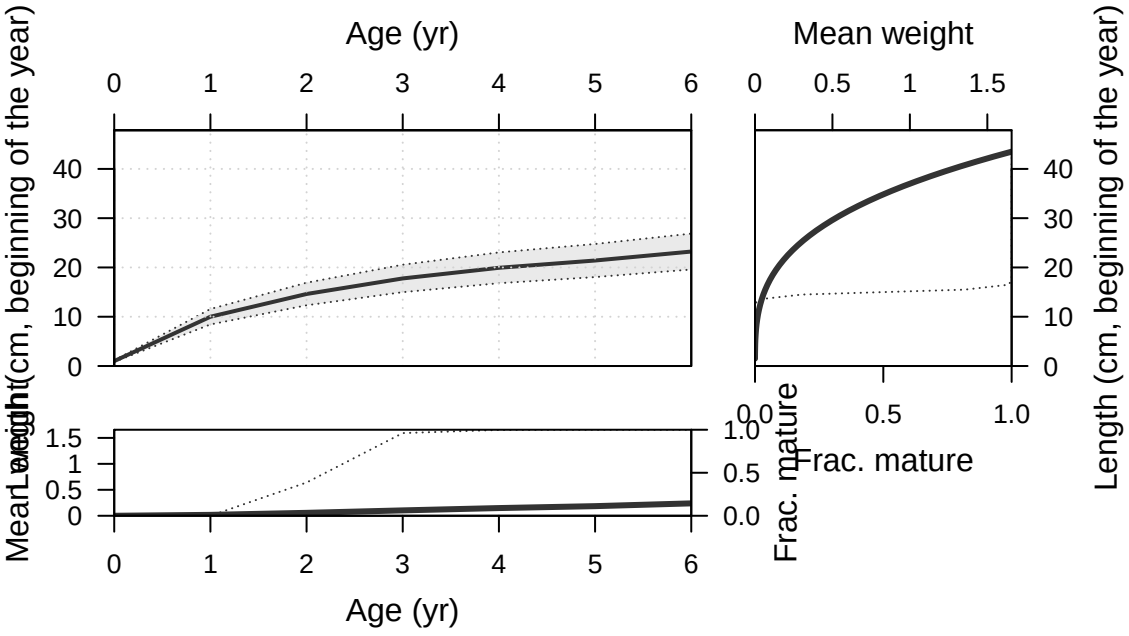
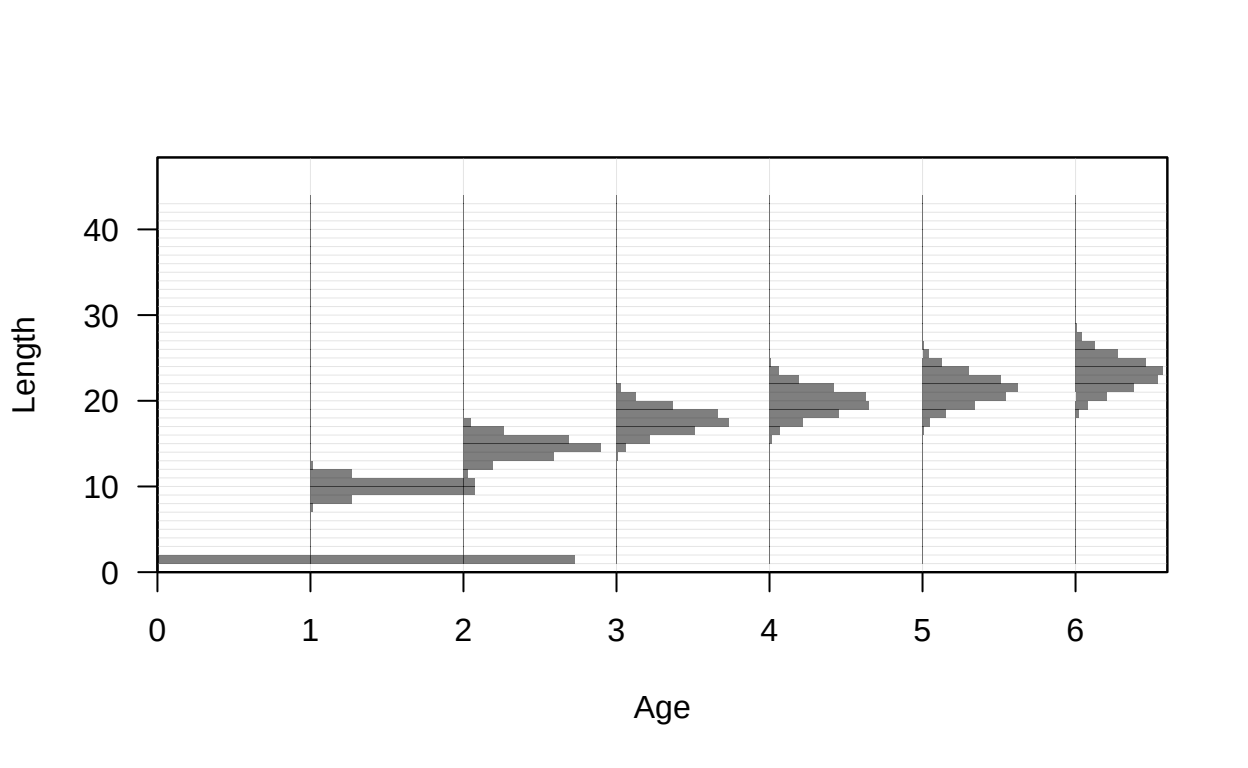
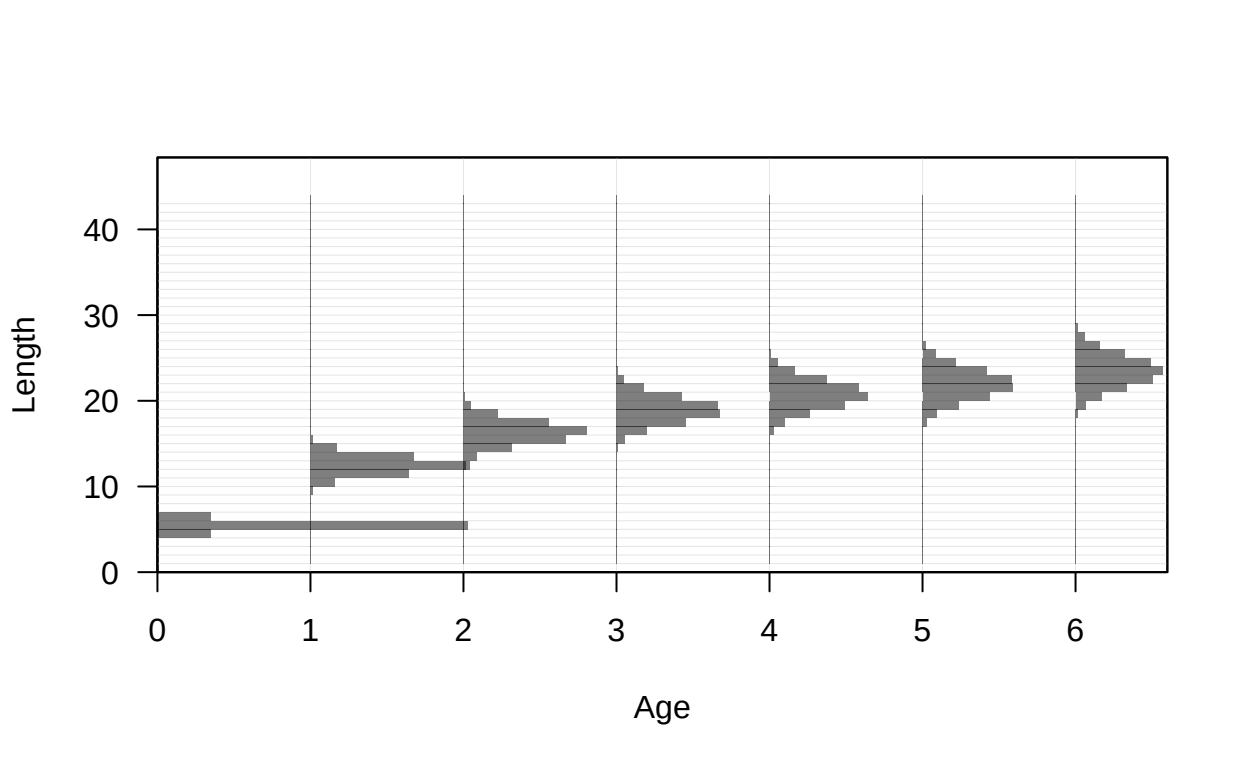
Plots created using the 'r4ss' package in R
Stock Synthesis version: 3.30.19.0
StartTime: Sat Jul 23 09:17:32 2022
Data_File: data.ss
Control_File: control.ss

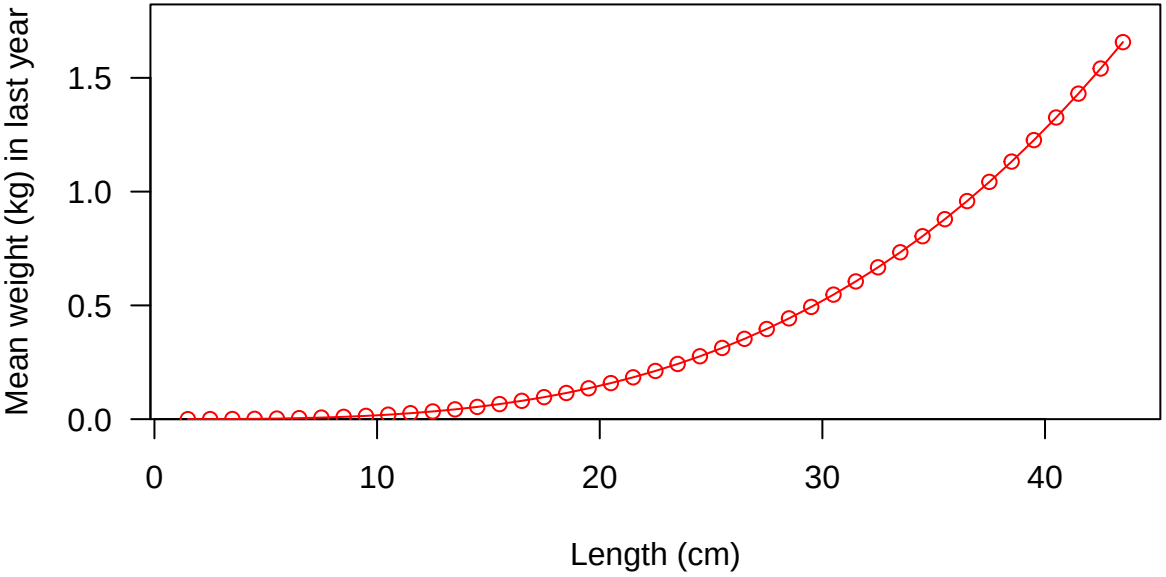

Length (cm, beginning of the year)
0
10
20
30
40
0
1
2
3
4
5
6
Age (yr)

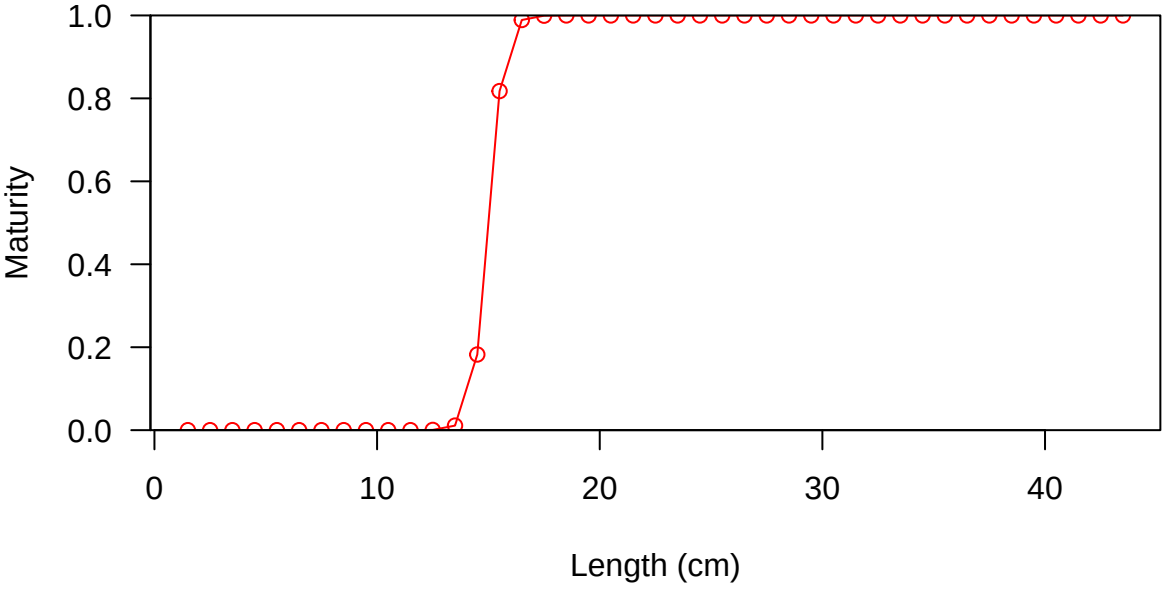

Age (yr)
0
1
2
3
4
5
6
CV of lengths
0
0.02
0.06
Length (cm, beginning of the year)
10
20
30
40
0.0
0.5
1.0
1.5
2.0
SD of lengths
CV of lengths
0.08
0.04
0

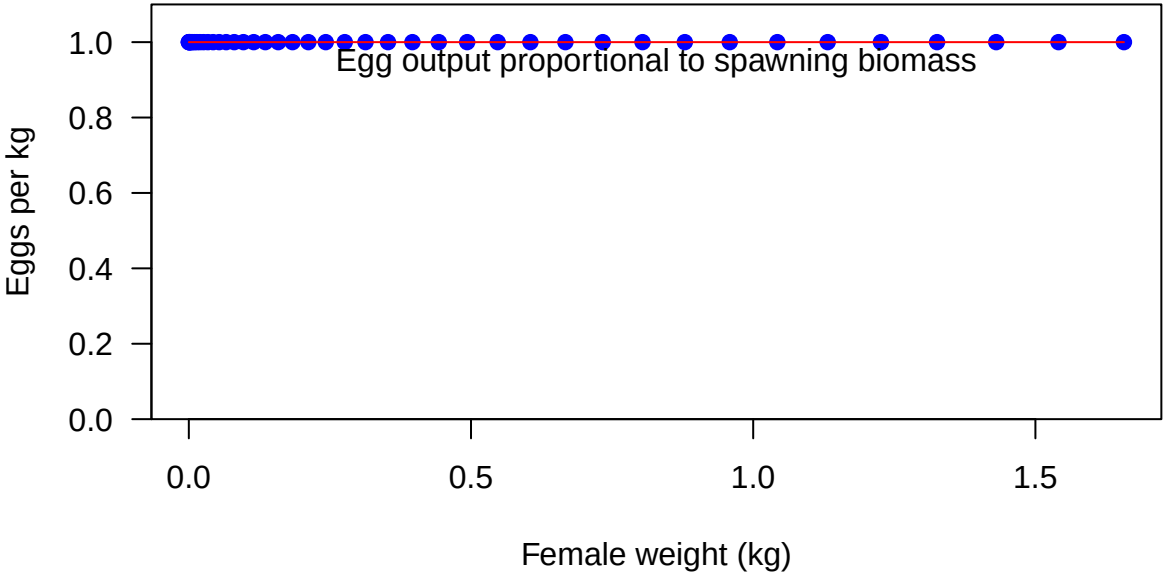

Age (yr)
Mean weight
Length (cm, beginning of the year)
Mean weight
Frac. mature
Age (yr)
Frac. mature
Length (cm, beginning of the year)

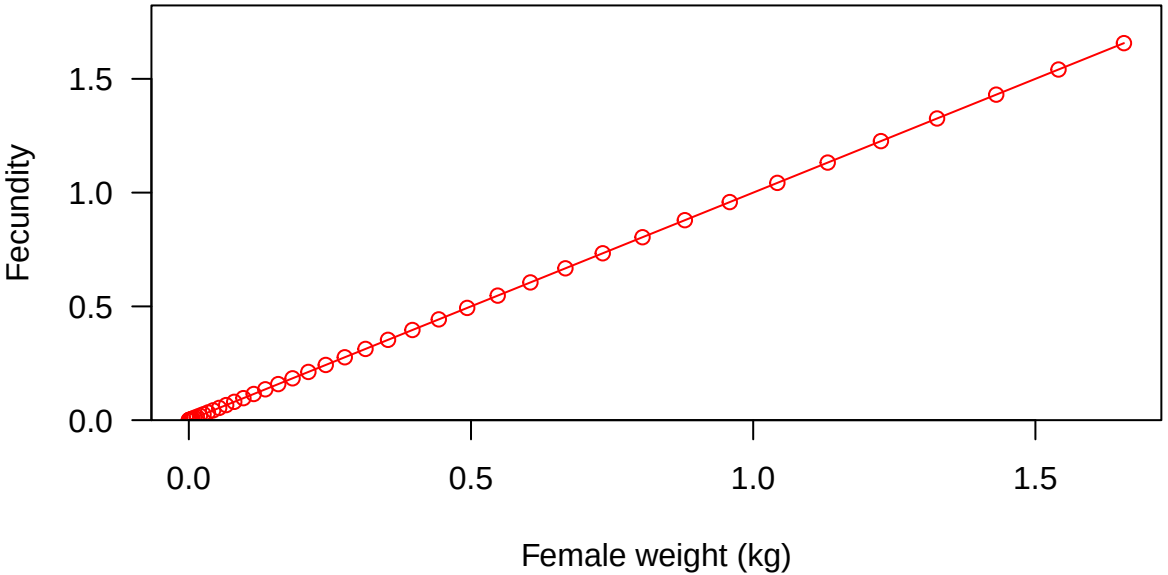

Length
0
10
20
30
40
0
1
2
3
4
5
6
Age

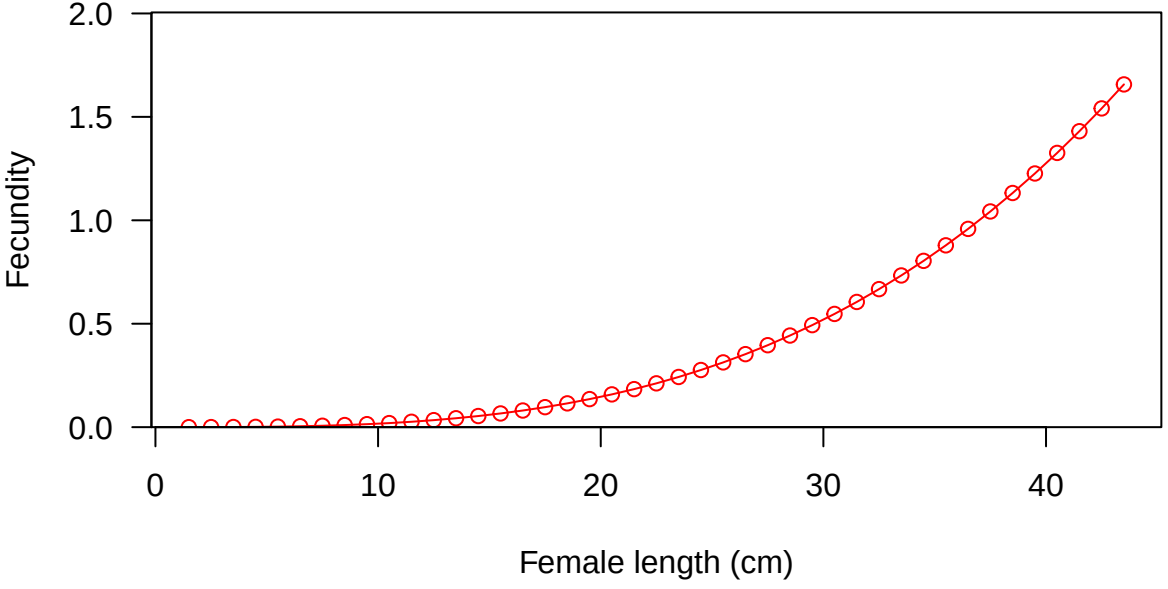

Length
0
10
20
30
40
0
1
2
3
4
5
6
Age

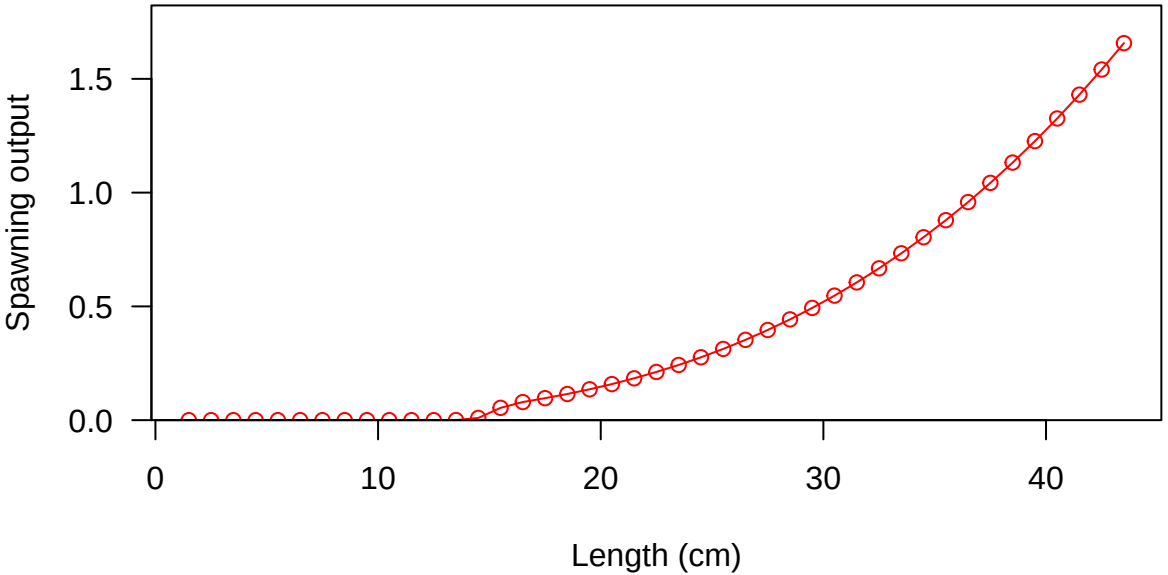

Mean weight (kg) in last year
0.0
0.5
1.0
1.5
0
10
20
30
40
Length (cm)

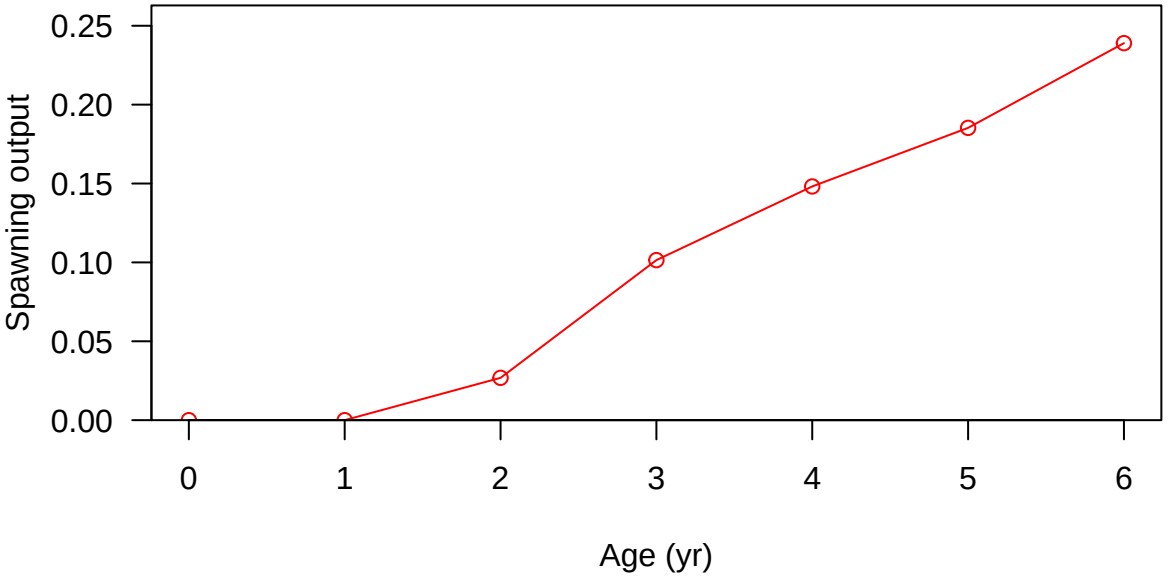

1.0
0.8
0.6
0.4
0.2
0.0
Maturity
0
10
20
30
40
Length (cm)

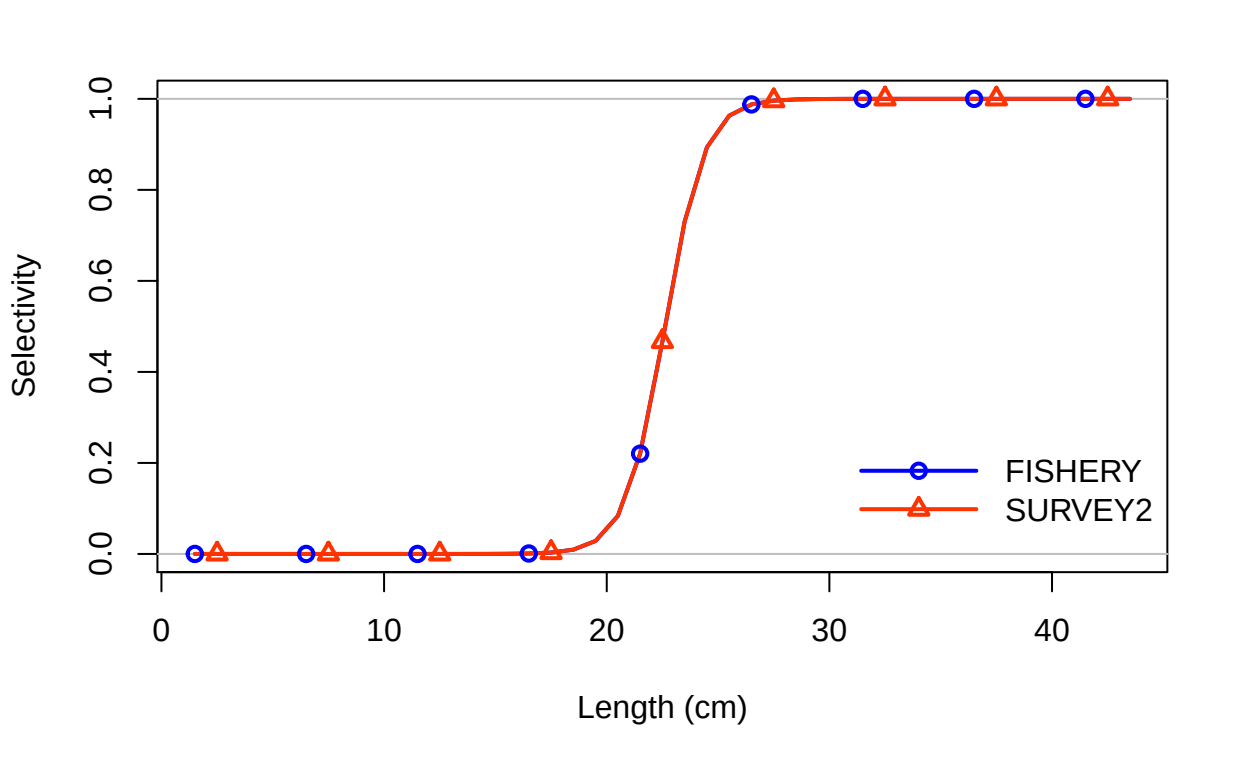

Egg output proportional to spawning biomass
Eggs per kg
1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.5
1.0
1.5
Female weight (kg)

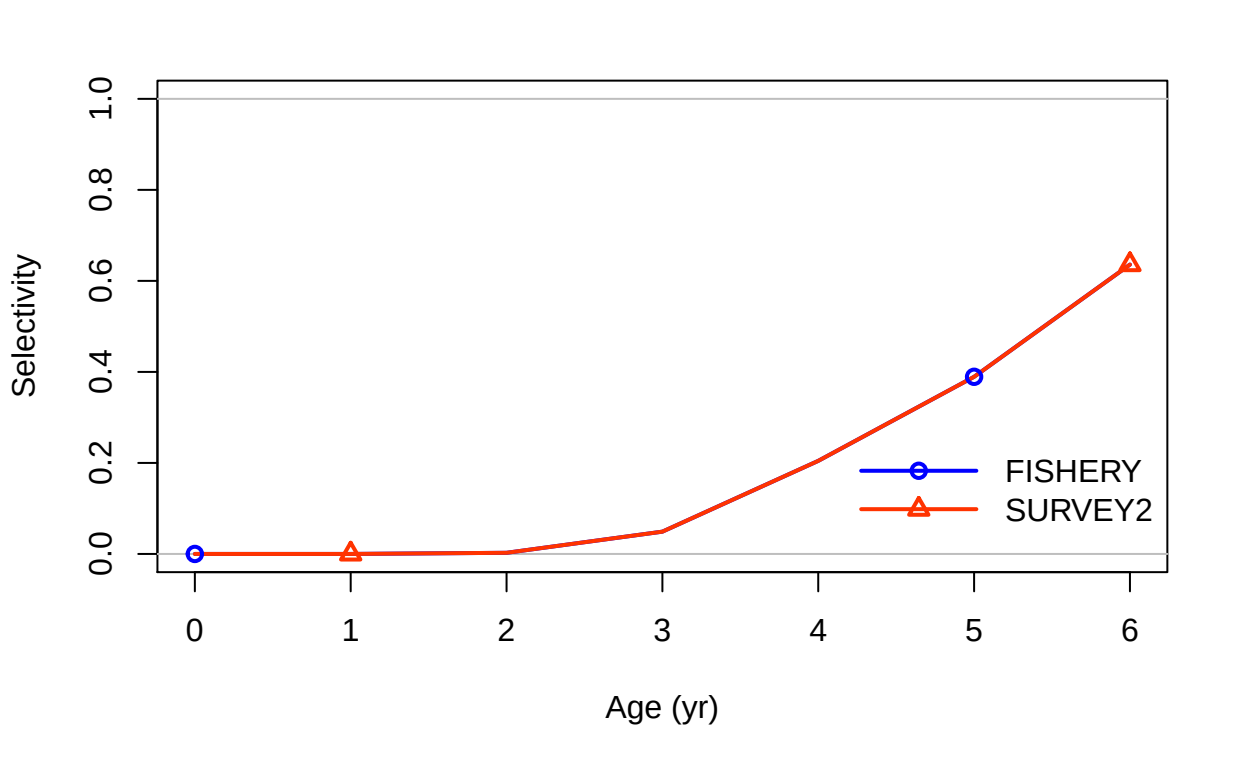

Fecundity
0.0
0.5
1.0
1.5
0.0
0.5
1.0
1.5
Female weight (kg)

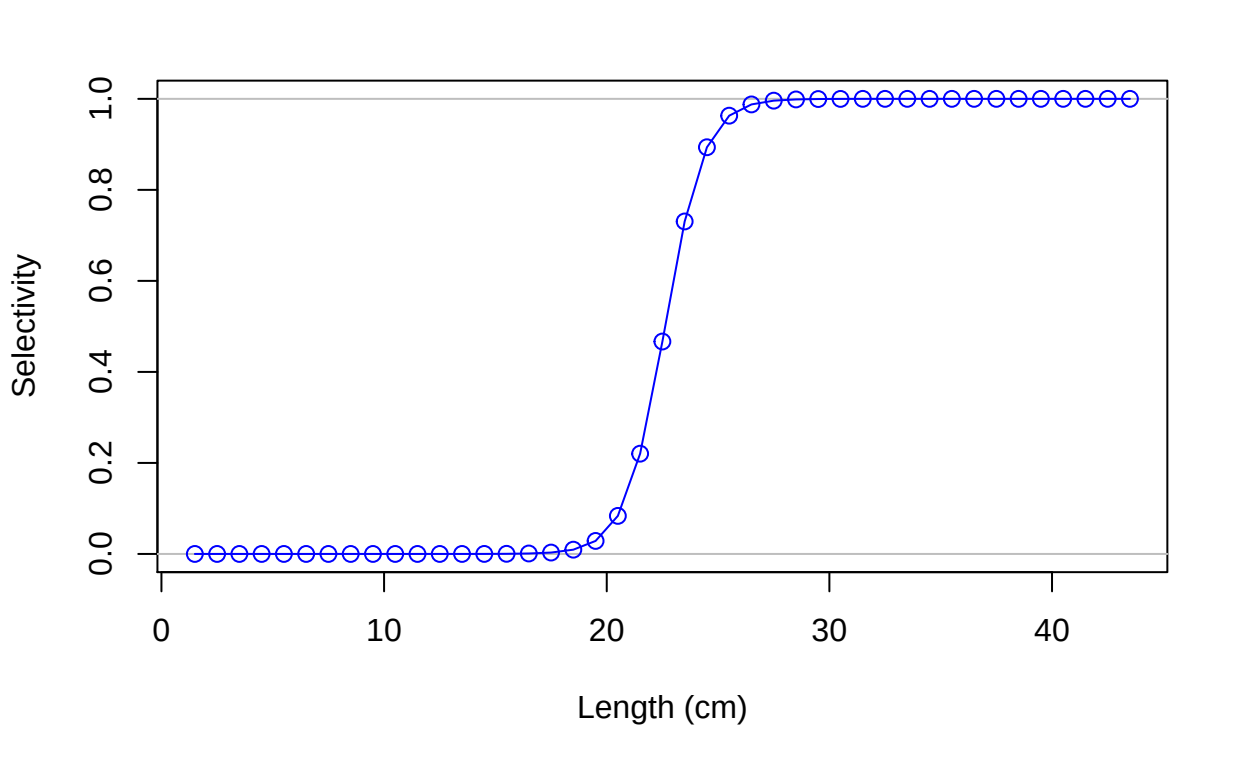

2.0
1.5
1.0
0.5
0.0
Fecundity
0
10
20
30
40
Female length (cm)

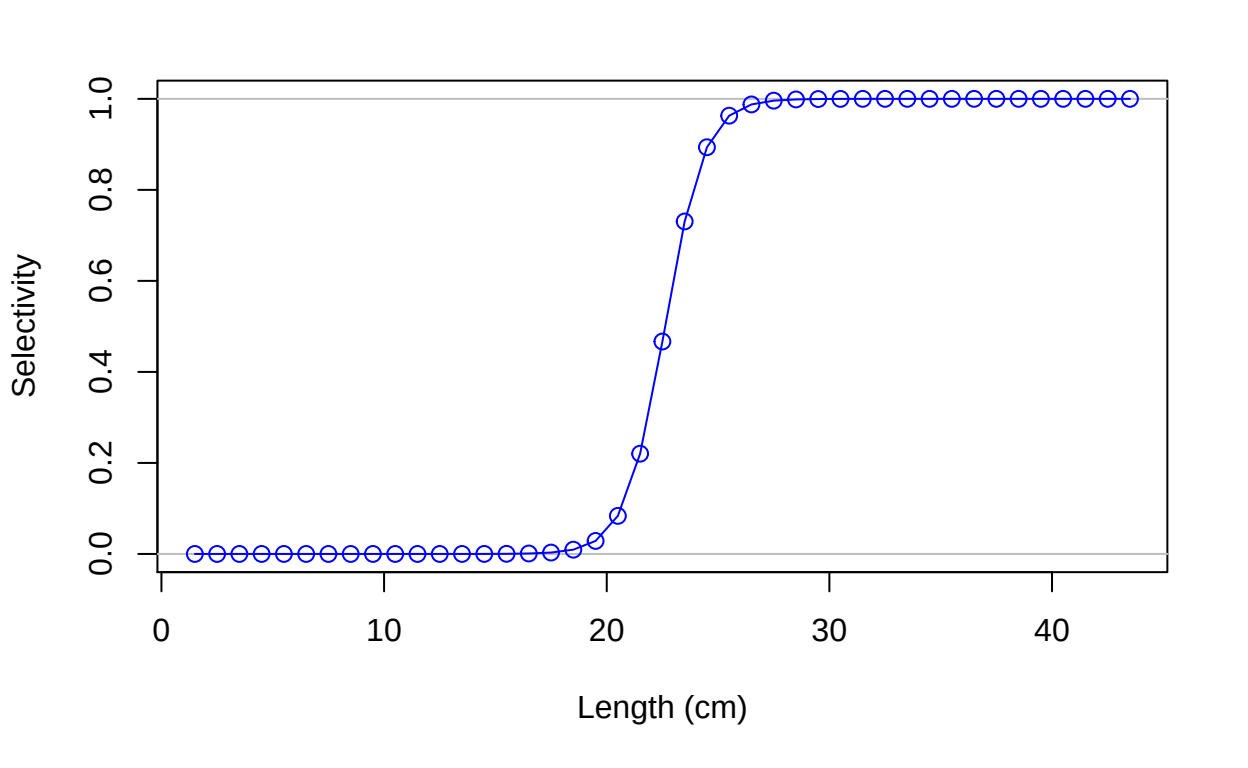

Spawning output
0.0
0.5
1.0
1.5
0
10
20
30
40
Length (cm)

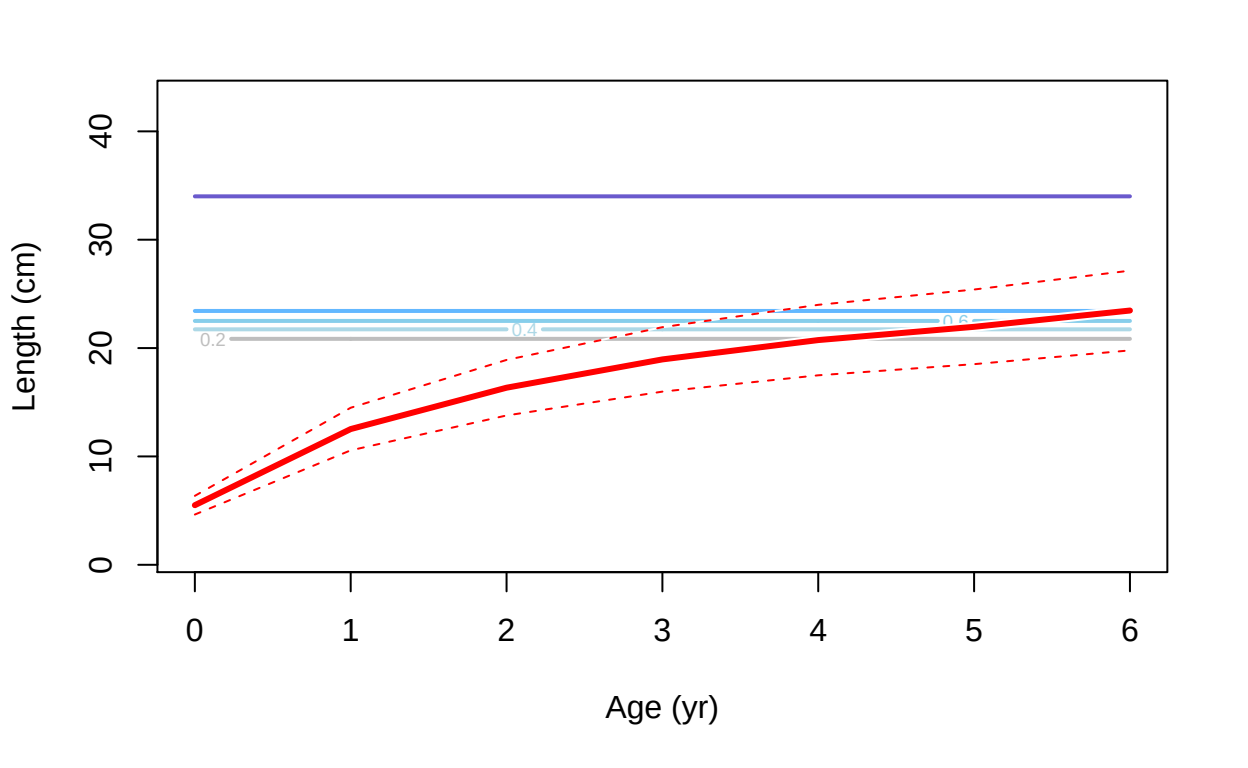

0.25
0.20
0.15
0.10
0.05
0.00
Spawning output
0
1
2
3
4
5
6
Age (yr)

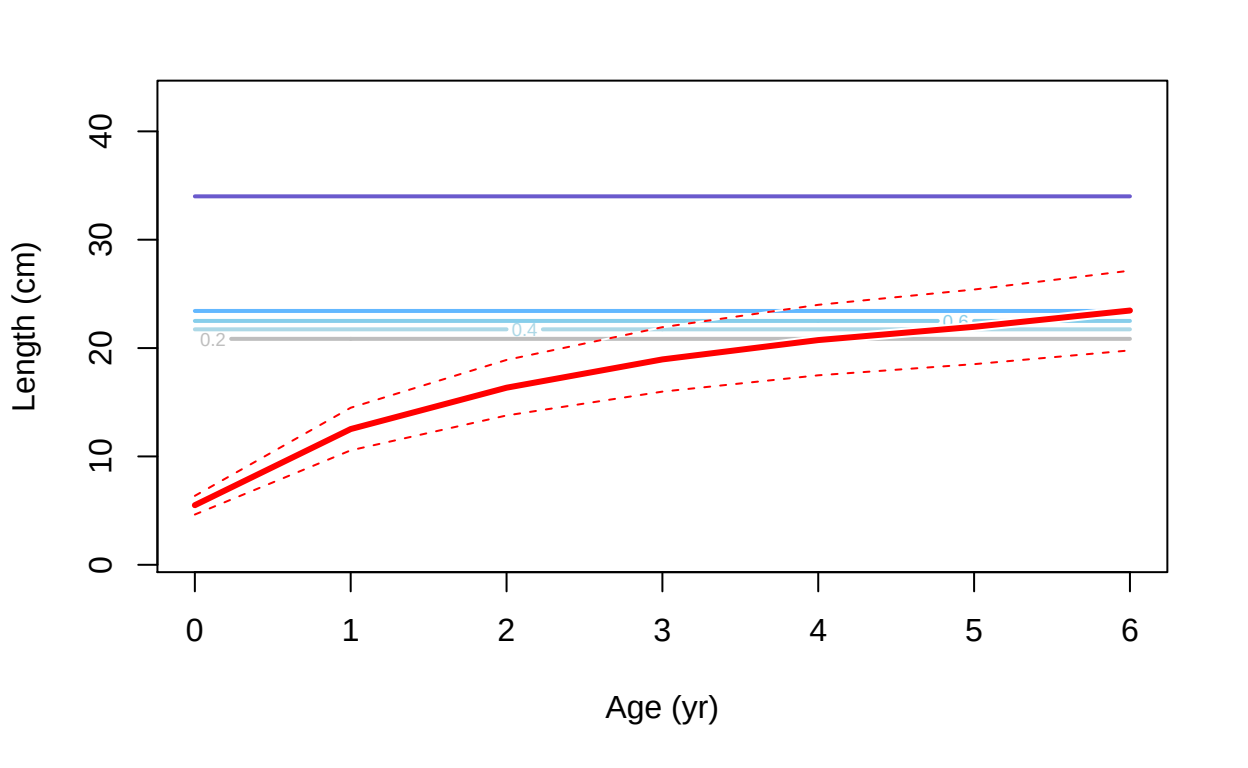

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
10
20
30
40
Length (cm)
FISHERY
SURVEY2

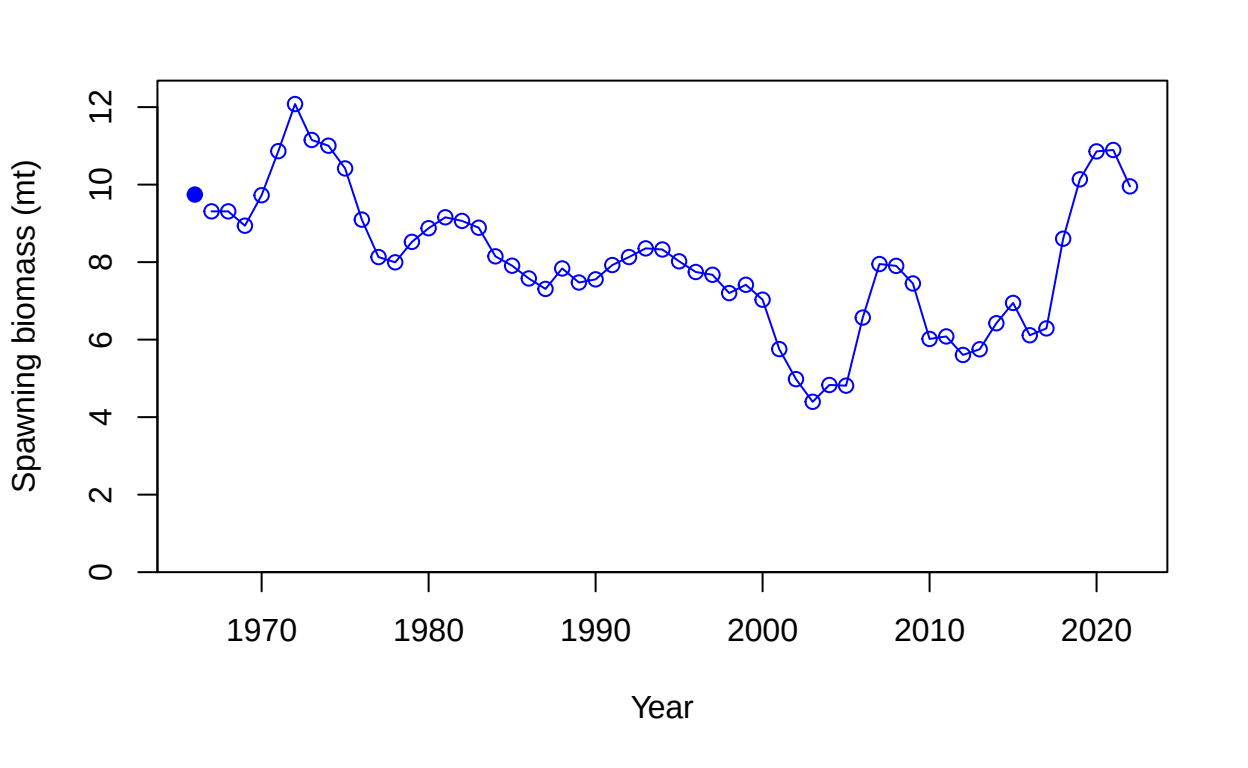

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
1
2
3
4
5
6
Age (yr)
FISHERY
SURVEY2

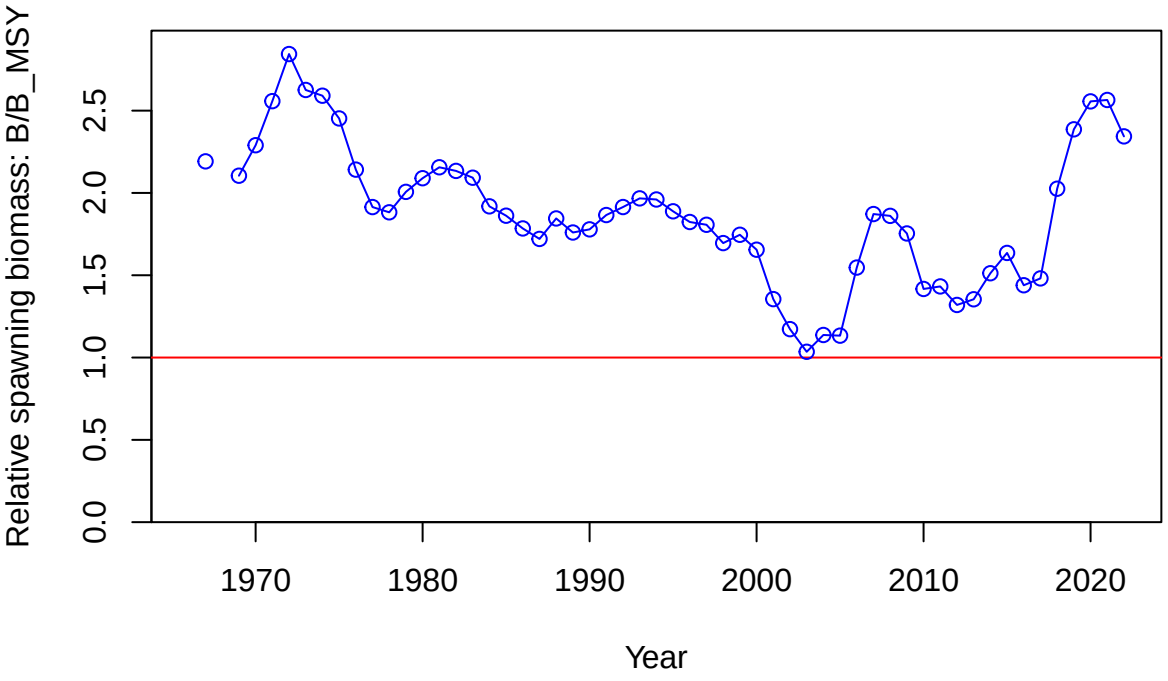

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
10
20
30
40
Length (cm)

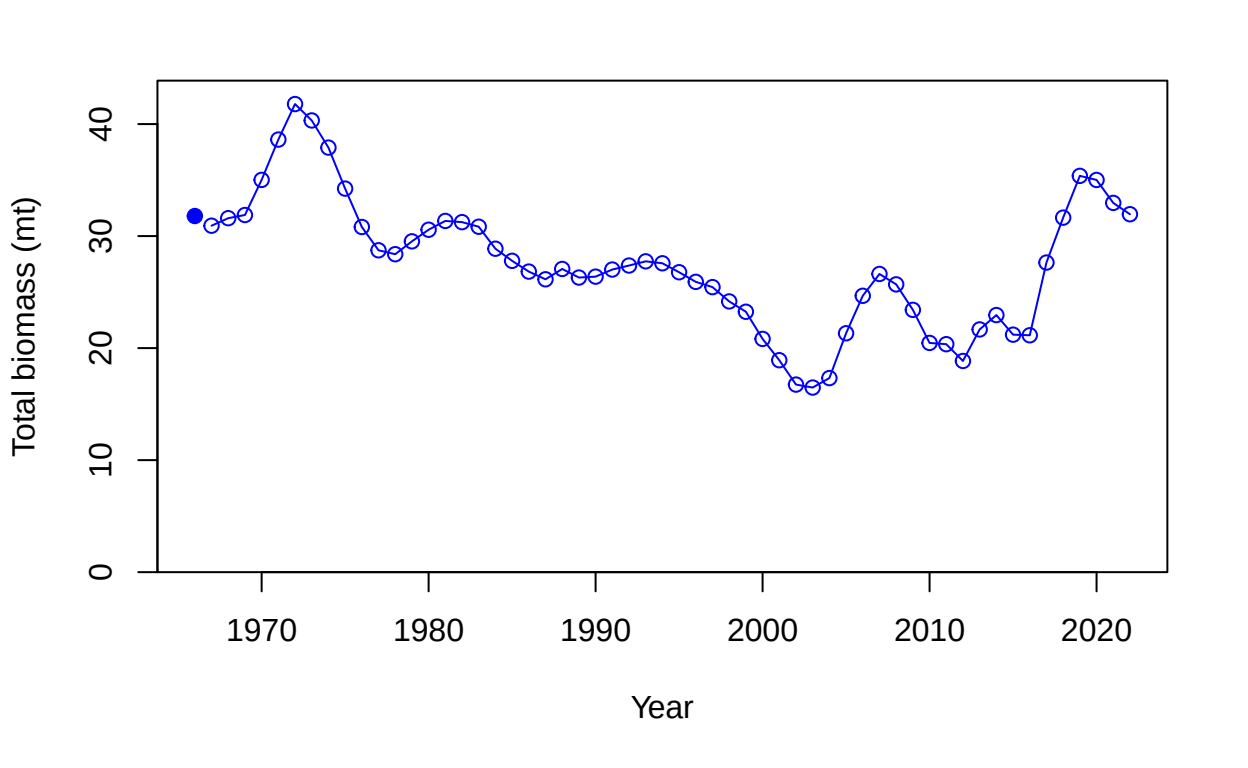

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
10
20
30
40
Length (cm)

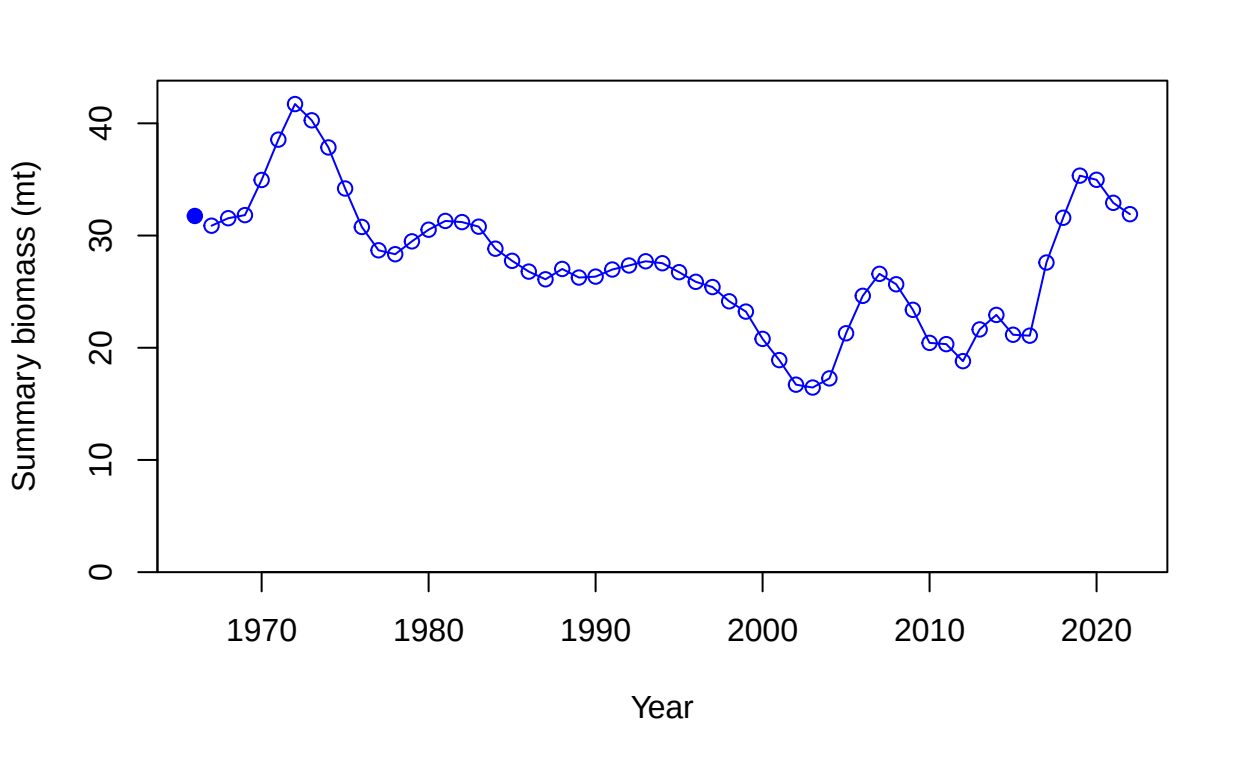

Length (cm)
0
10
20
30
40
0.2
0.4
0.6
0
1
2
3
4
5
6
Age (yr)

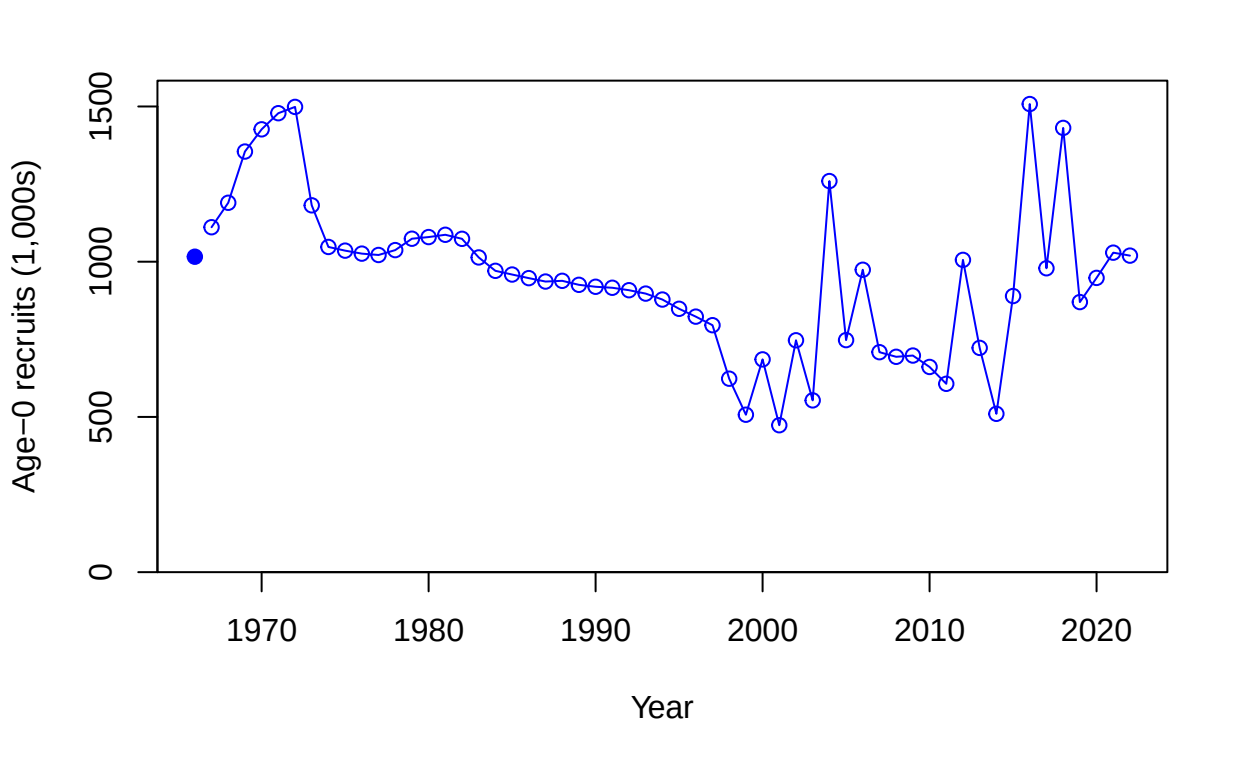

Length (cm)
0
10
20
30
40
0.2
0.4
0.6
0
1
2
3
4
5
6
Age (yr)

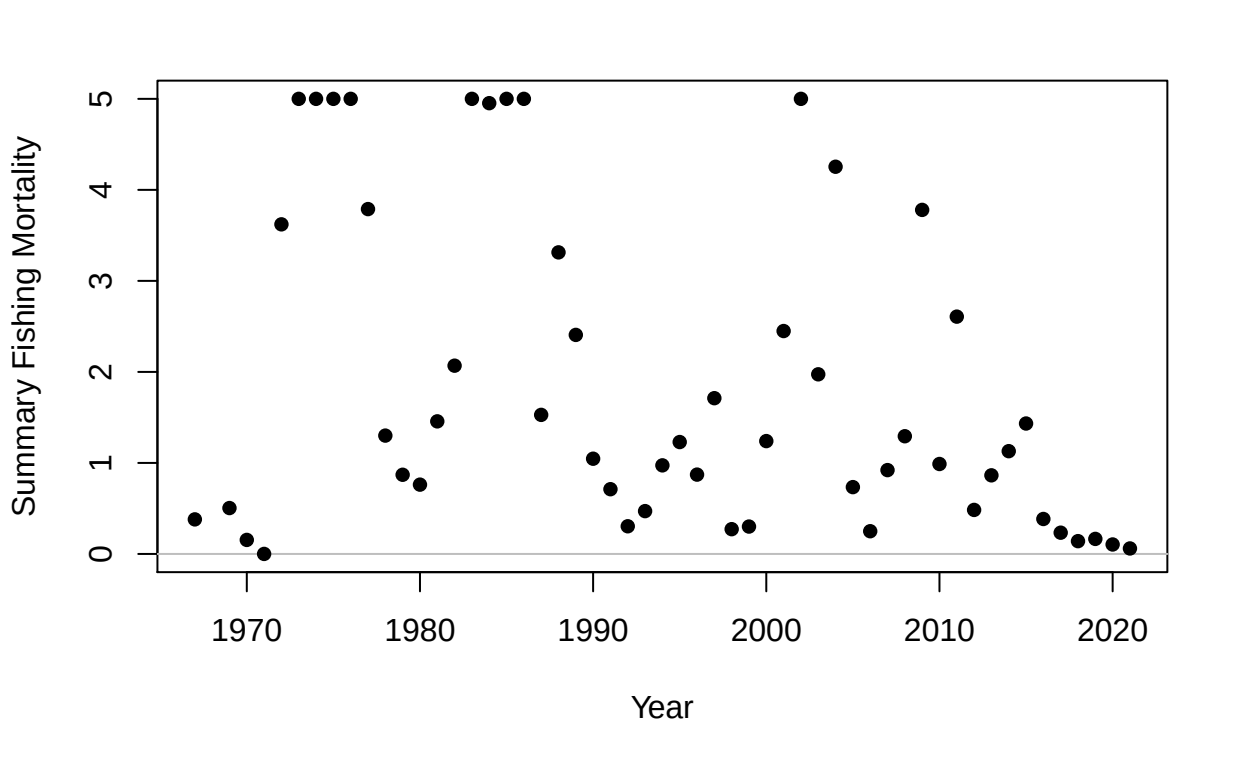

Spawning biomass (mt)
0
2
4
6
8
10
12
1970
1980
1990
2000
2010
2020
Year

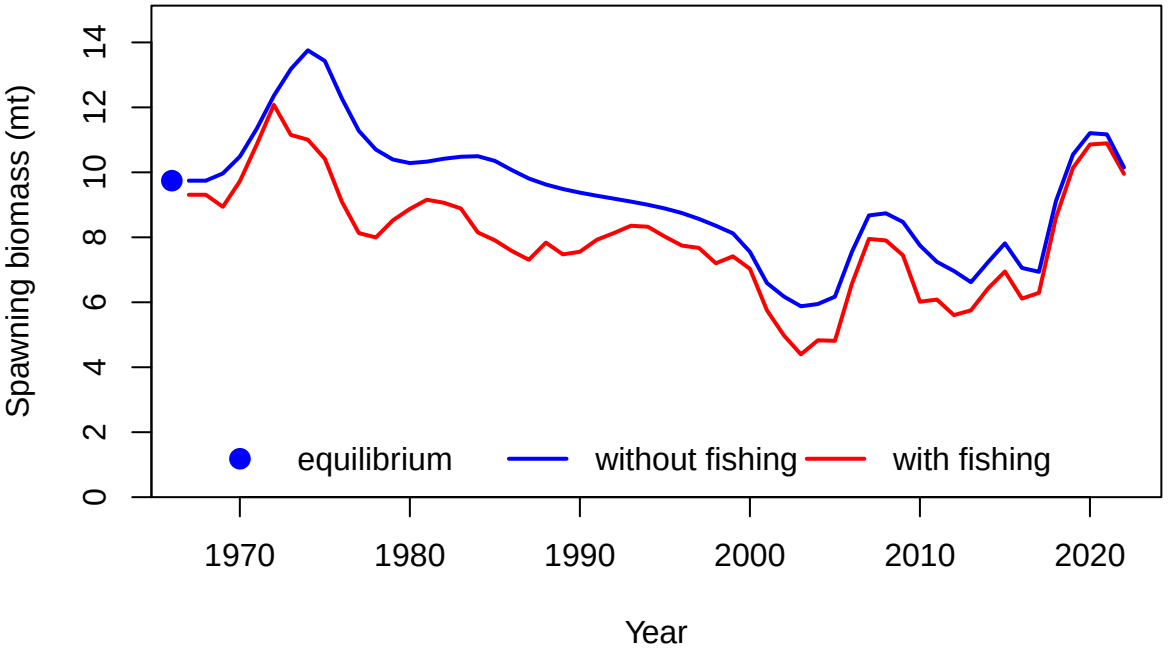

Relative spawning biomass: B/B_MSY
0.0
0.5
1.0
1.5
2.0
2.5
1970
1980
1990
2000
2010
2020
Year

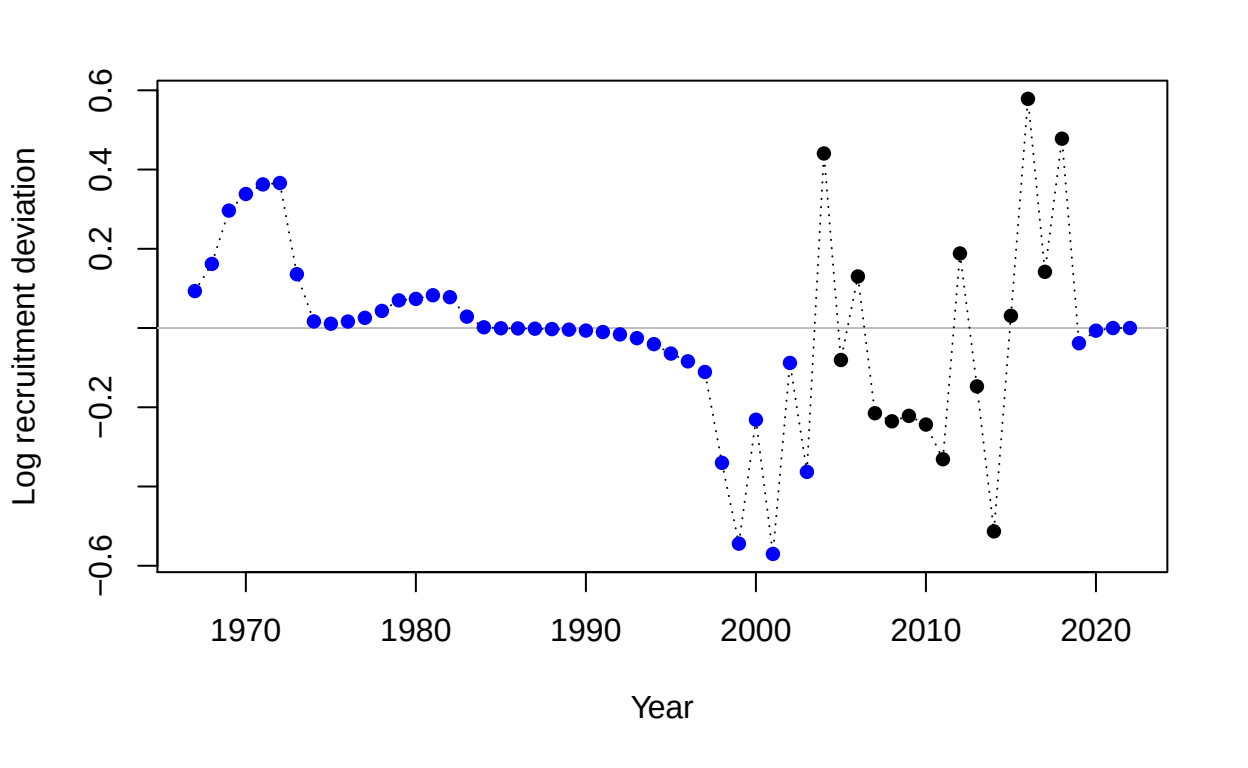

Total biomass (mt)
0
10
20
30
40
1970
1980
1990
2000
2010
2020
Year

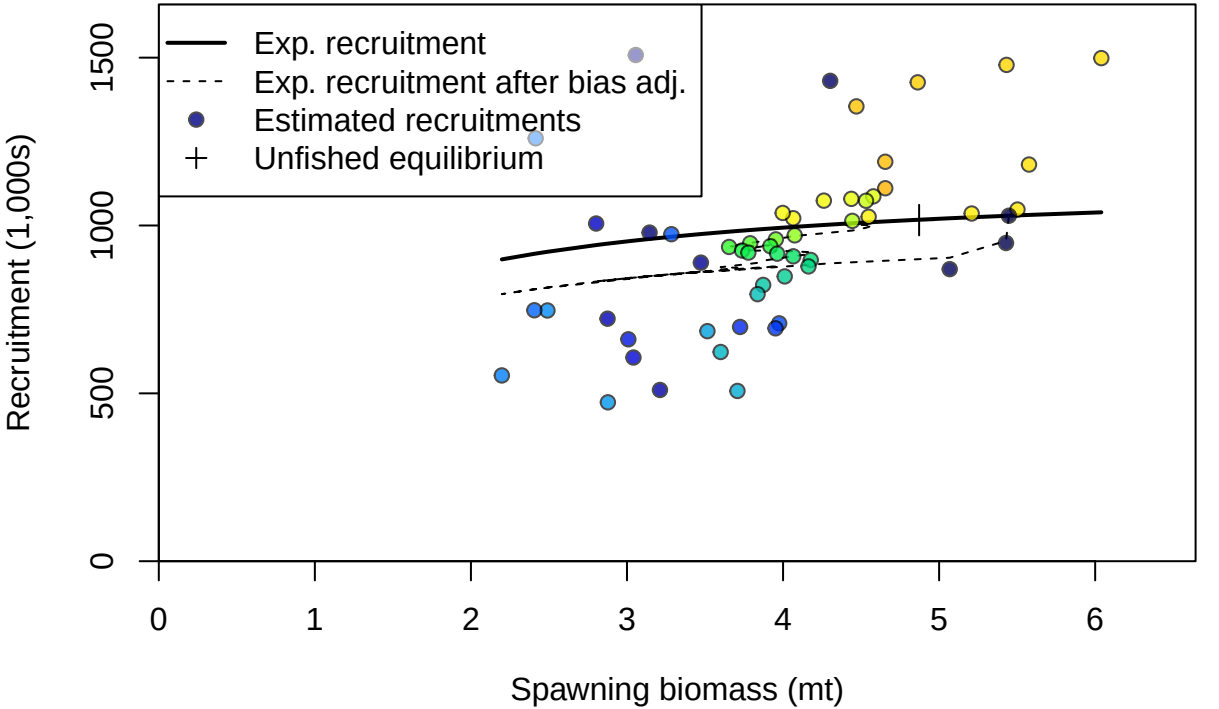

Summary biomass (mt)
0
10
20
30
40
1970
1980
1990
2000
2010
2020
Year

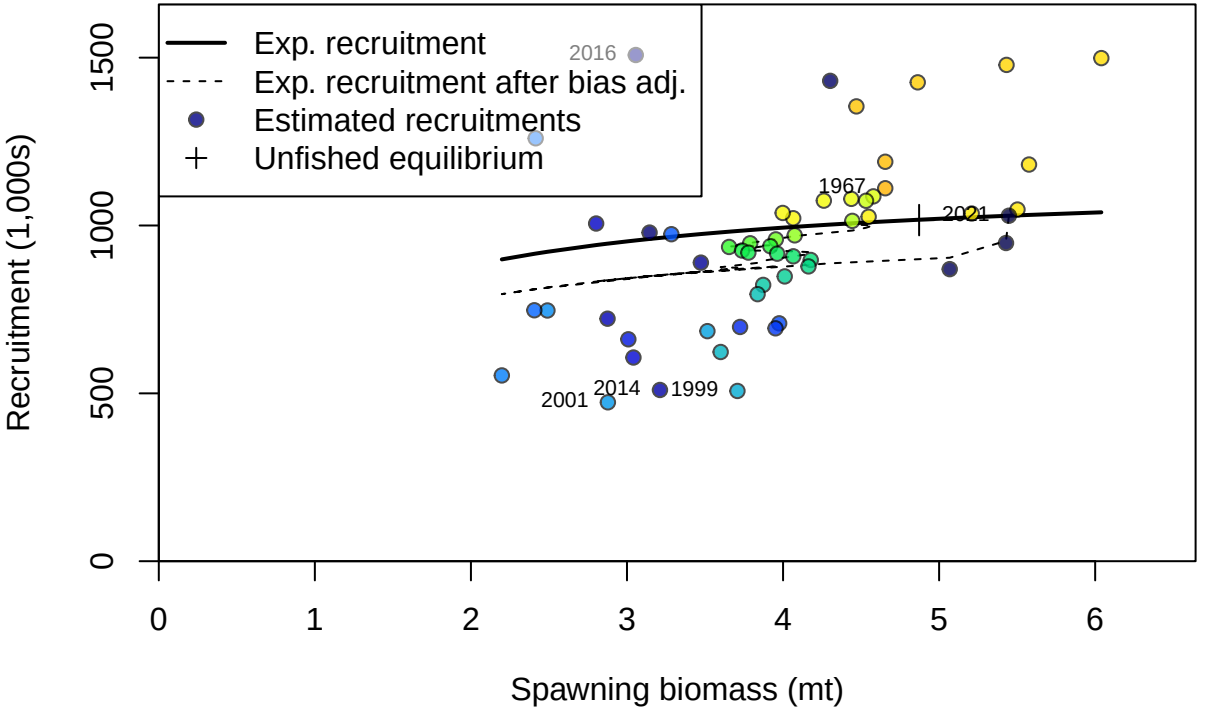

Age−0 recruits (1,000s)
0
500
1000
1500
1970
1980
1990
2000
2010
2020
Year

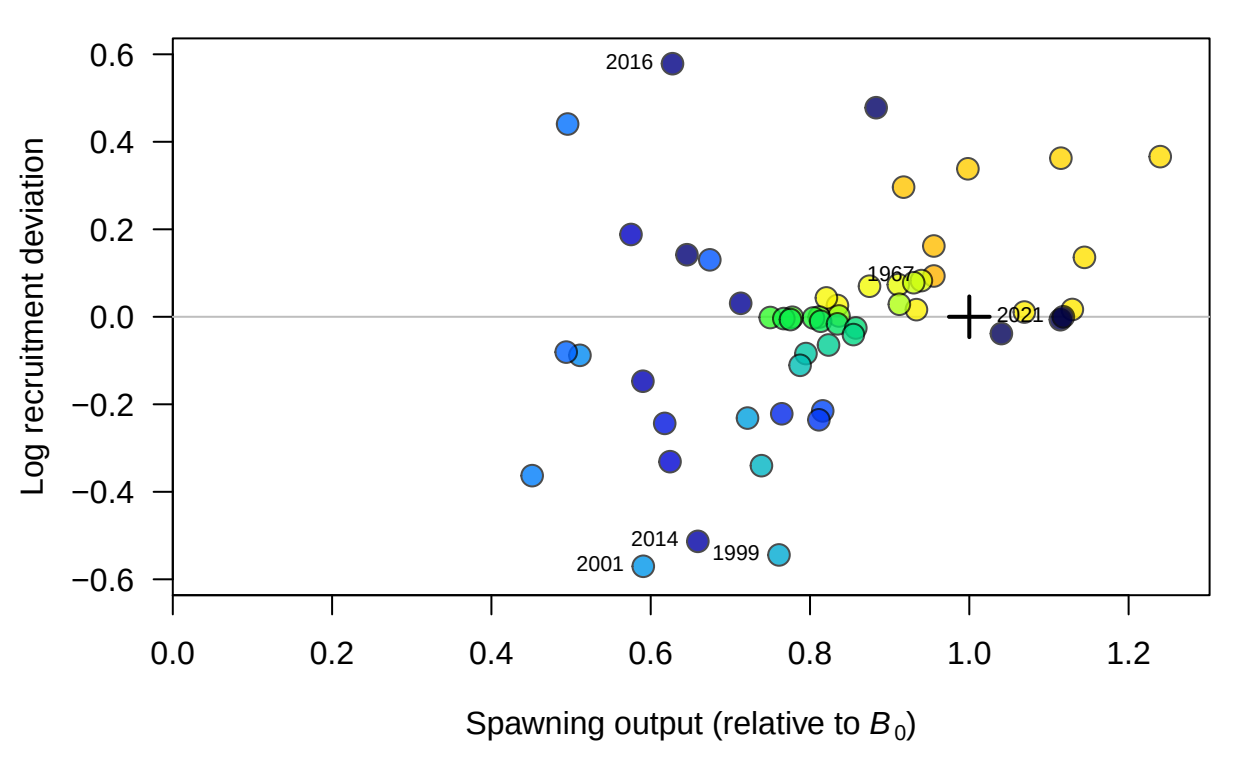

Summary Fishing Mortality
0
1
2
3
4
5
1970
1980
1990
2000
2010
2020
Year

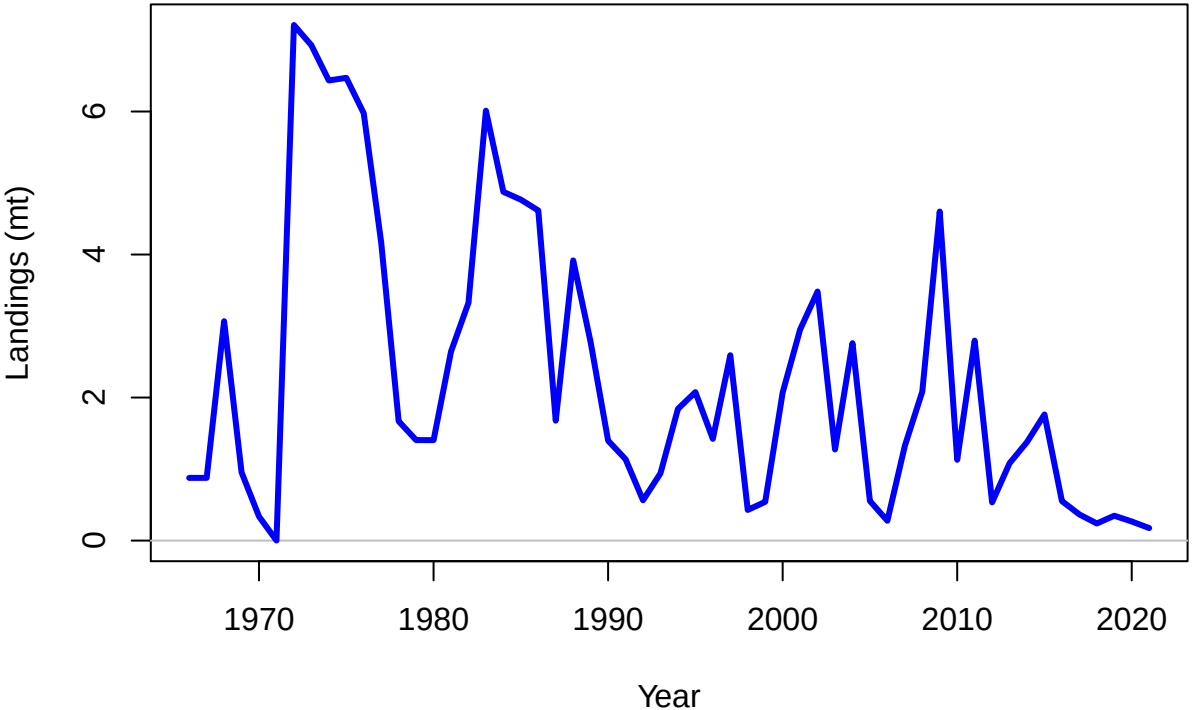

Spawning biomass (mt)
0
2
4
6
8
10
12
14
1970
1980
1990
2000
2010
2020
Year
equilibrium
without fishing
with fishing

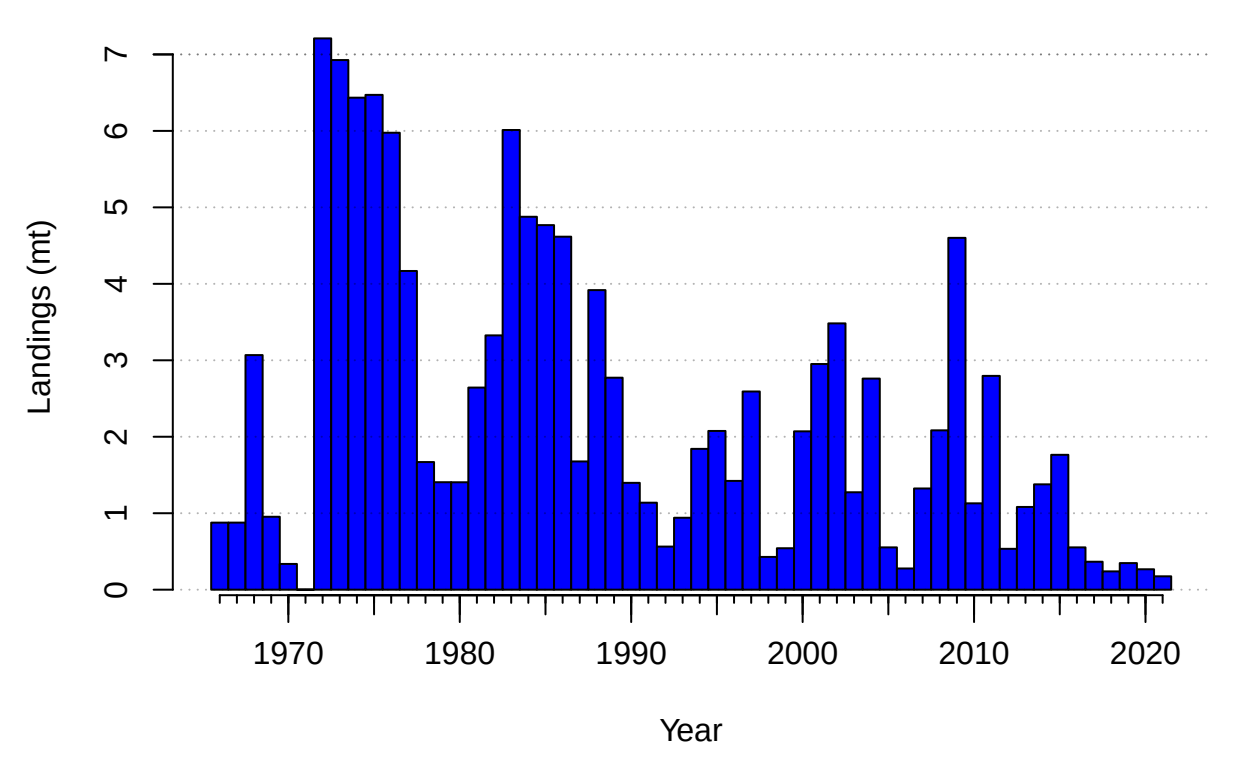

Log recruitment deviation
0.6
0.4
0.2
−0.2
−0.6
1970
1980
1990
2000
2010
2020
Year

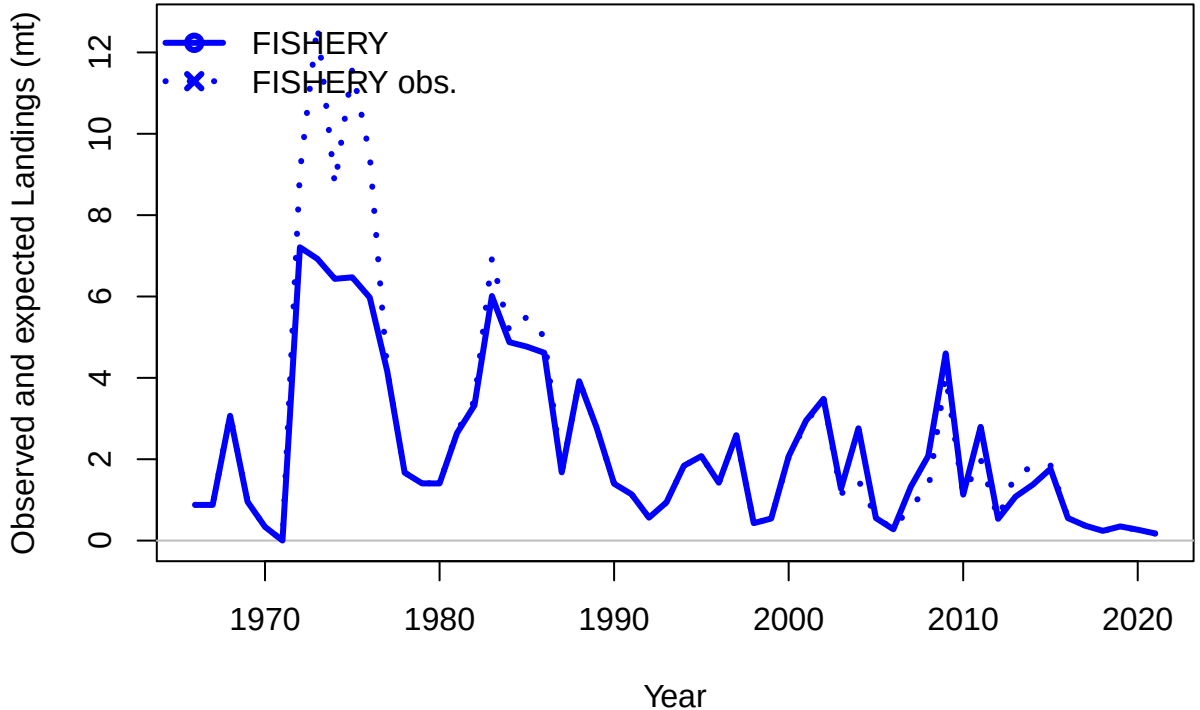

Exp. recruitment
Exp. recruitment after bias adj.
Estimated recruitments
Unfished equilibrium
Recruitment (1,000s)
0
500
1000
1500
0
1
2
3
4
5
6
Spawning biomass (mt)

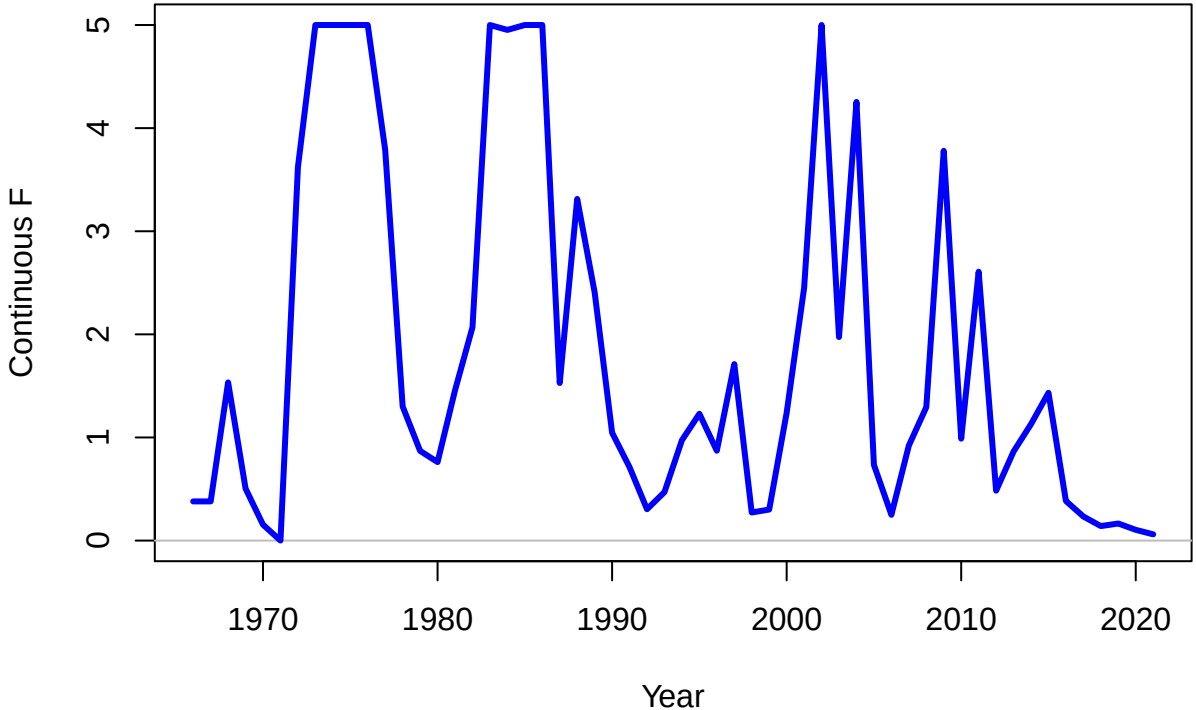

Exp. recruitment
Exp. recruitment after bias adj.
Estimated recruitments
Unfished equilibrium
Recruitment (1,000s)
0
500
1000
1500
0
1
2
3
4
5
6
Spawning biomass (mt)
2016
1967
2021
2001
2014
1999

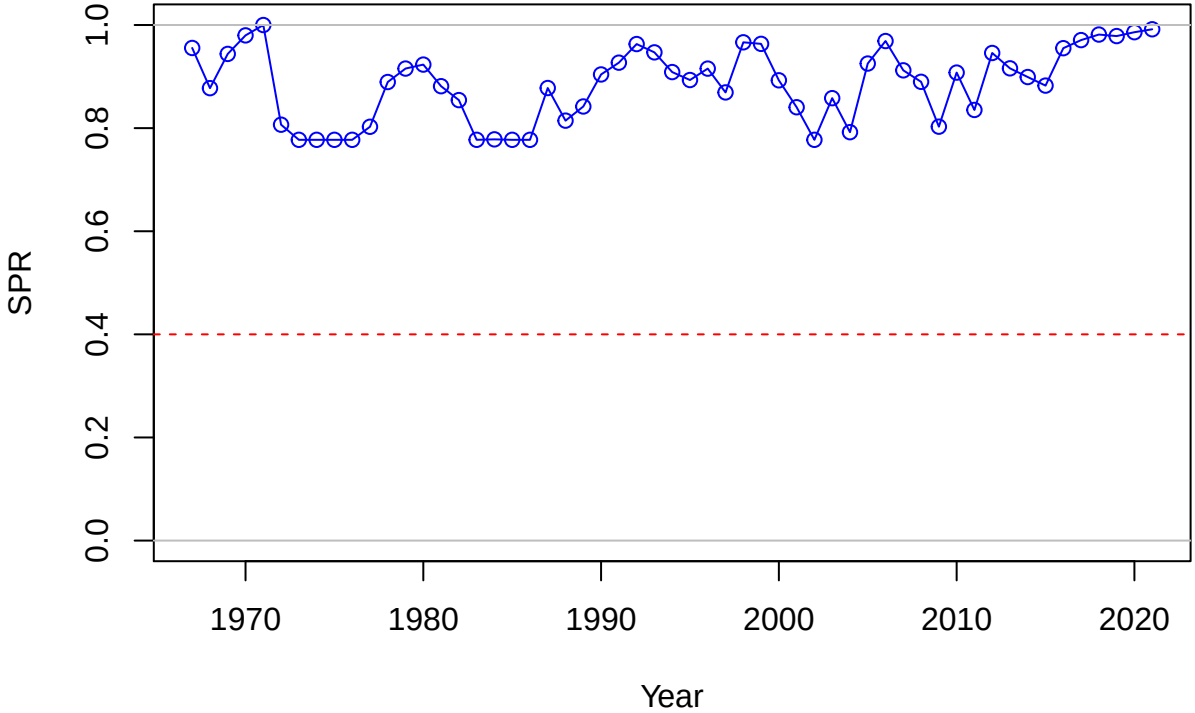

Log recruitment deviation
0.6
0.4
0.2
0.0
−0.2
−0.4
−0.6
2016
1967
2021
2014
1999
2001
0.0
0.2
0.4
0.6
0.8
1.0
1.2
Spawning output (relative to B_0)

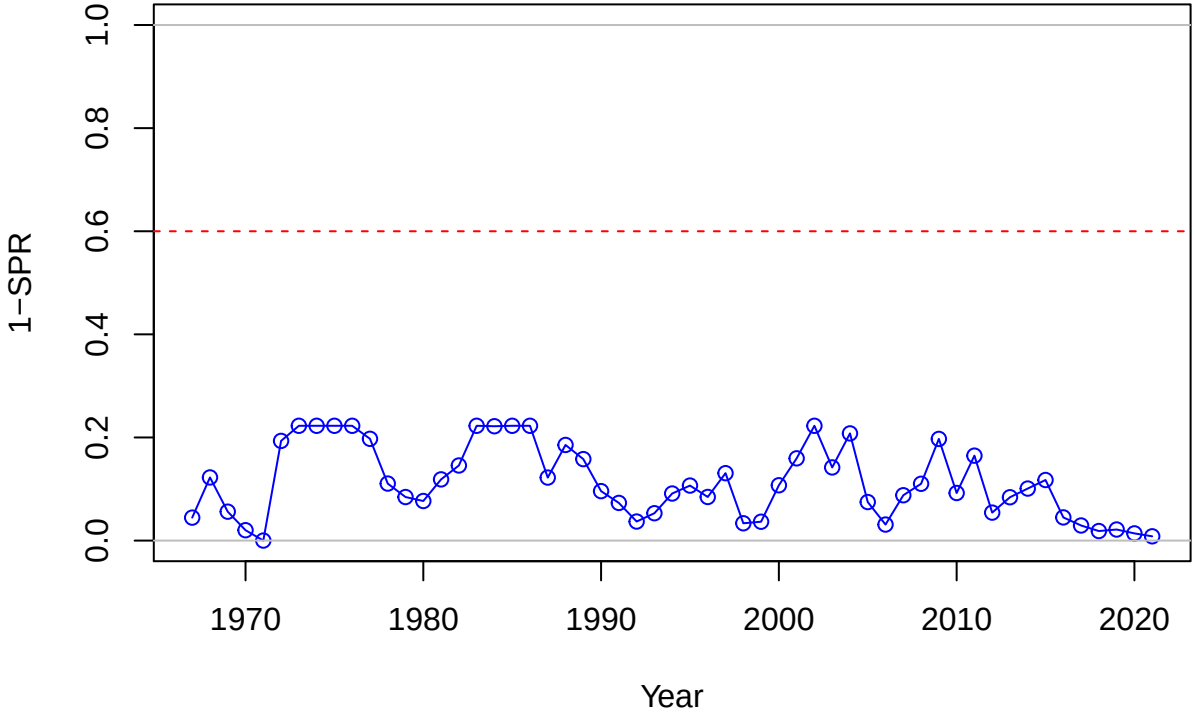

Landings (mt)
0
2
4
6
1970
1980
1990
2000
2010
2020
Year

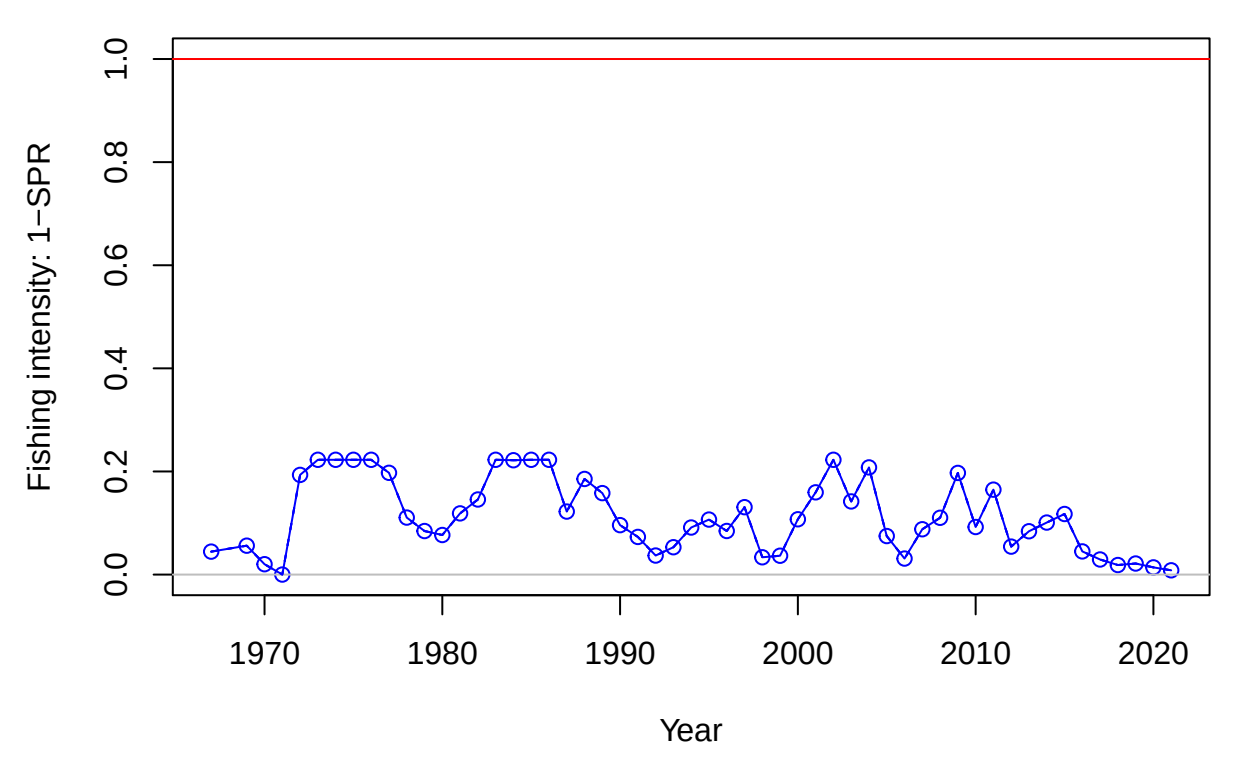

Landings (mt)
0
1
2
3
4
5
6
7
1970
1980
1990
2000
2010
2020
Year

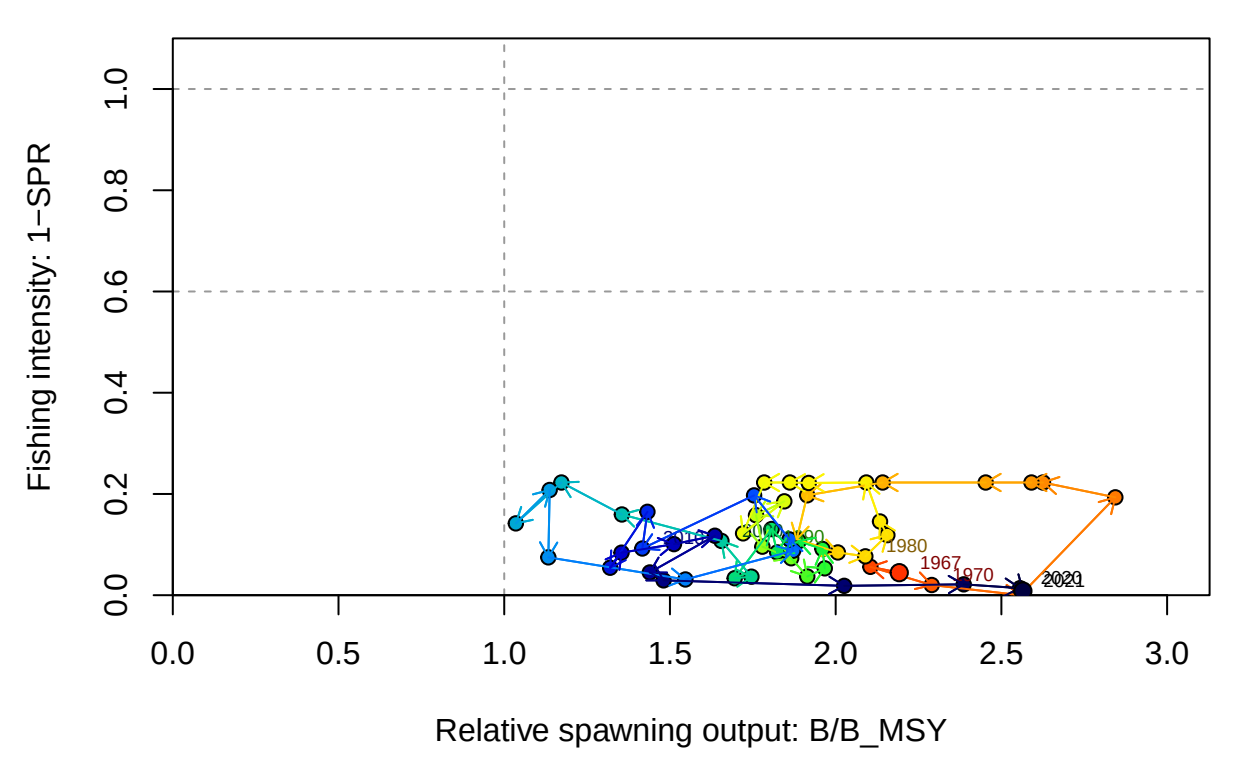

FISHERY
FISHERY obs.
Observed and expected Landings (mt)
0
2
4
6
8
10
12
1970
1980
1990
2000
2010
2020
Year

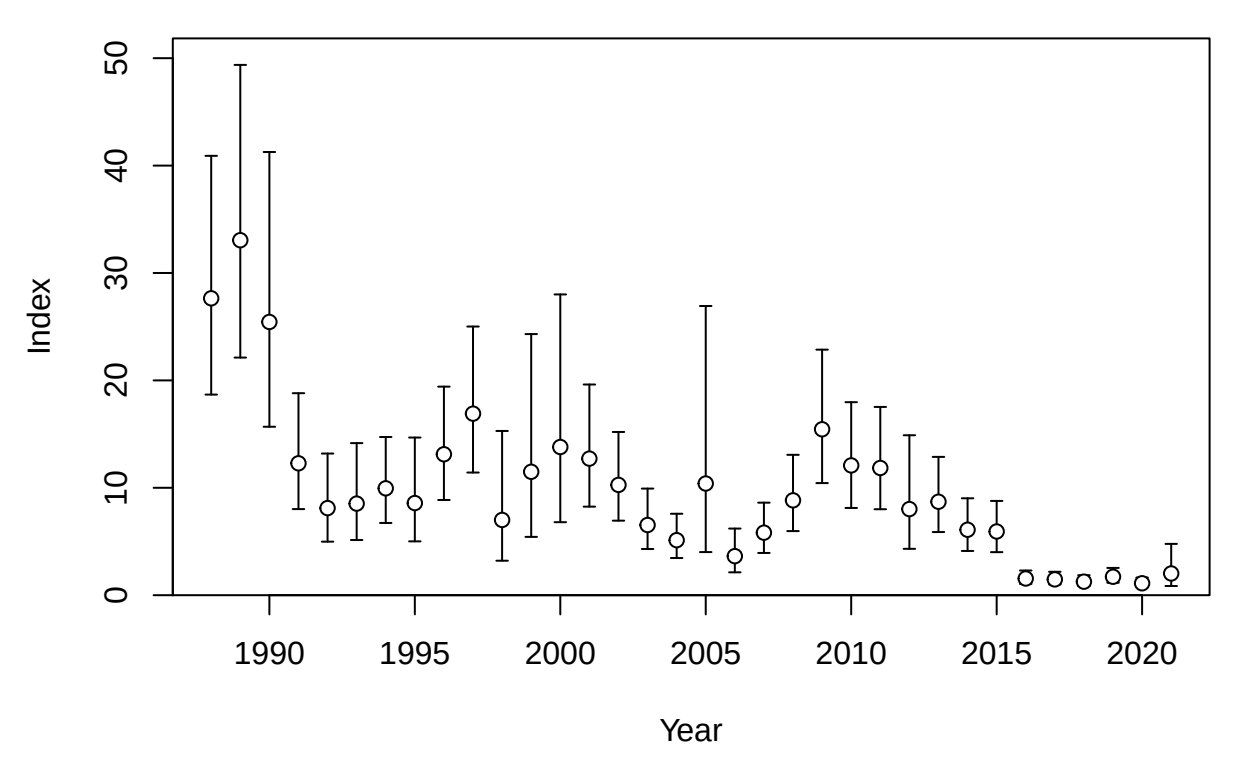

Continuous F
0
1
2
3
4
5
1970
1980
1990
2000
2010
2020
Year

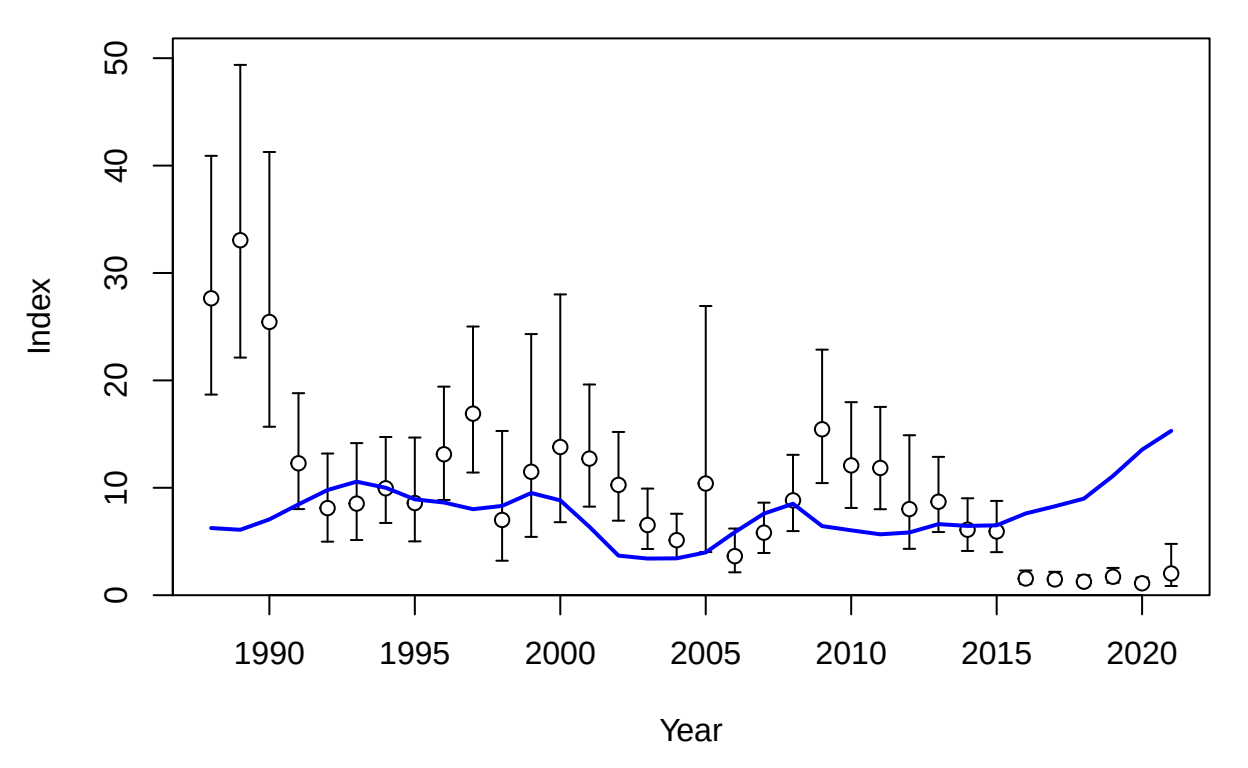

SPR
0.0
0.2
0.4
0.6
0.8
1.0
1970
1980
1990
2000
2010
2020
Year

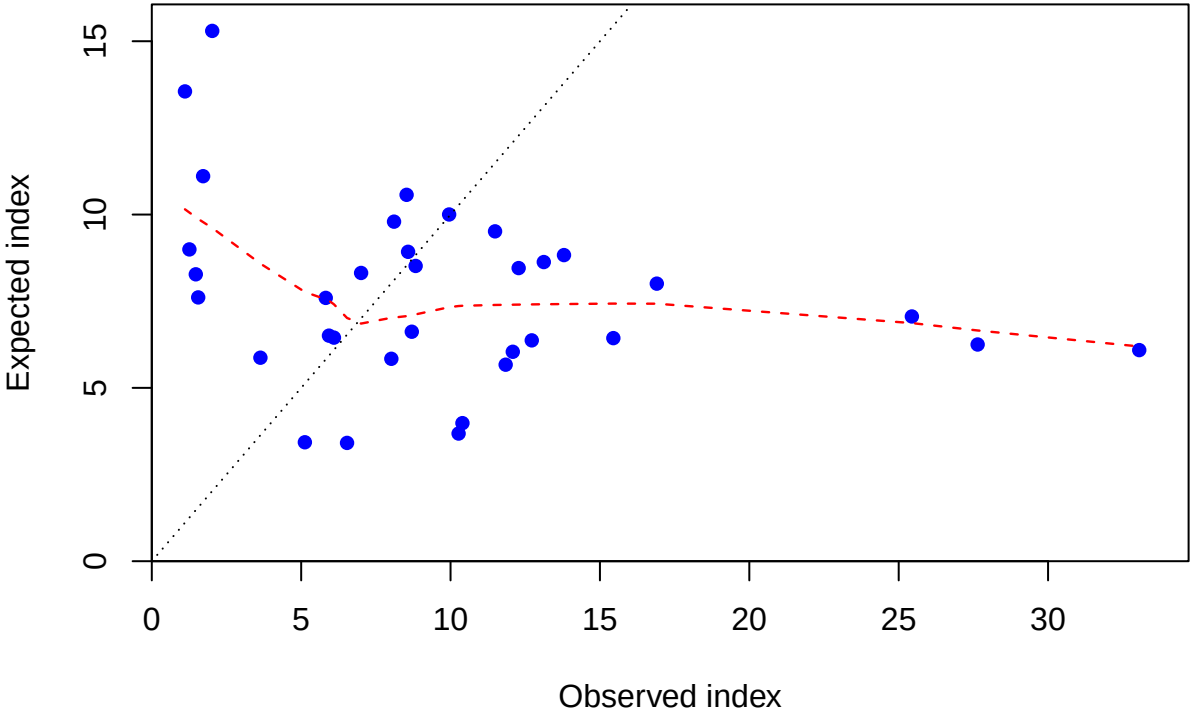

1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
1970
1980
1990
2000
2010
2020
Year

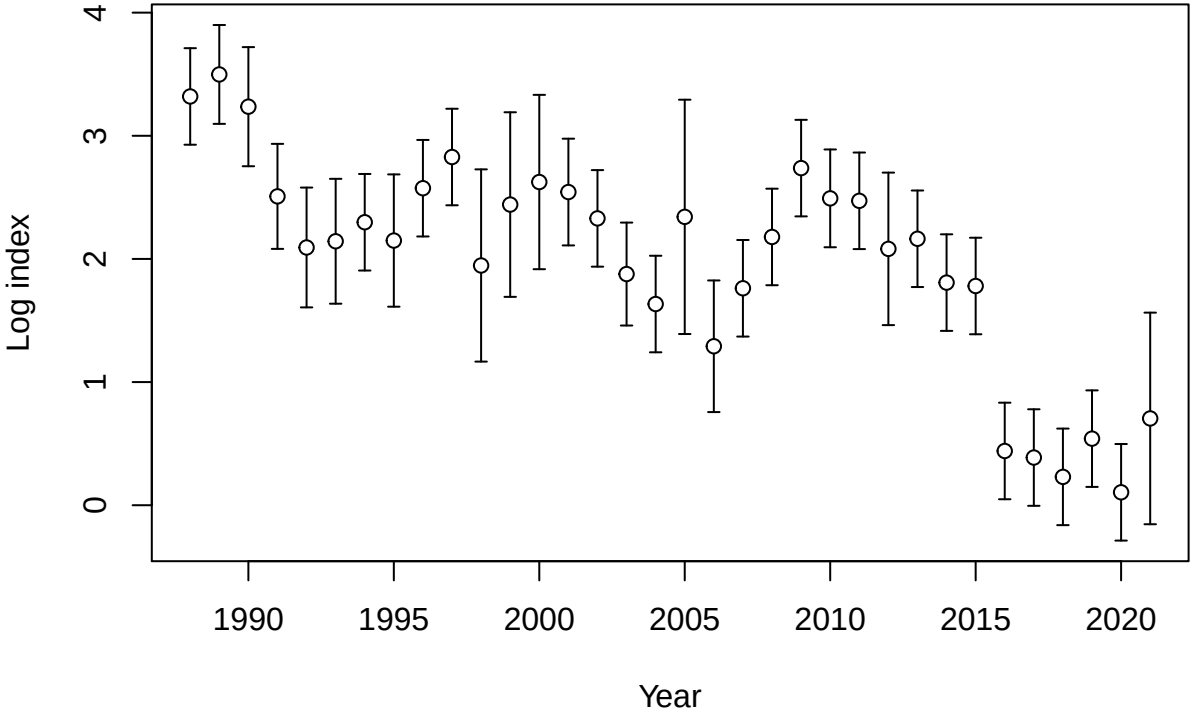

Fishing intensity: 1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
1970
1980
1990
2000
2010
2020
Year

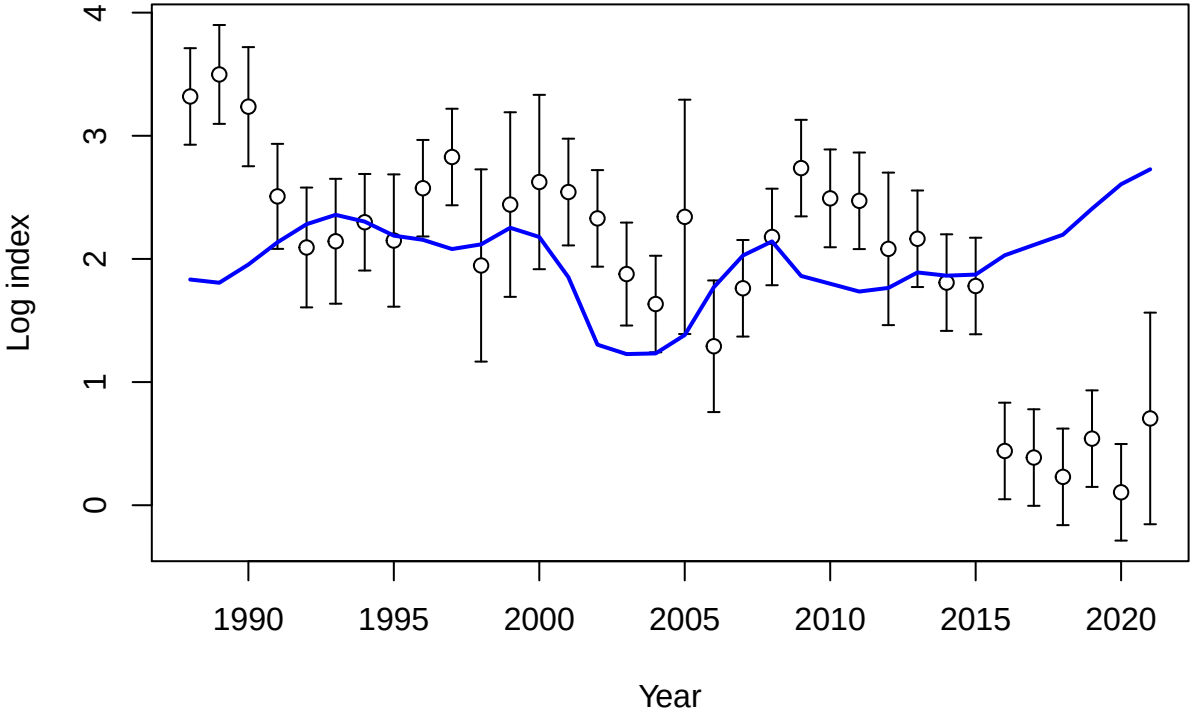

Fishing intensity: 1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
Relative spawning output: B/B_MSY
1980
1967
1970
2020
2021

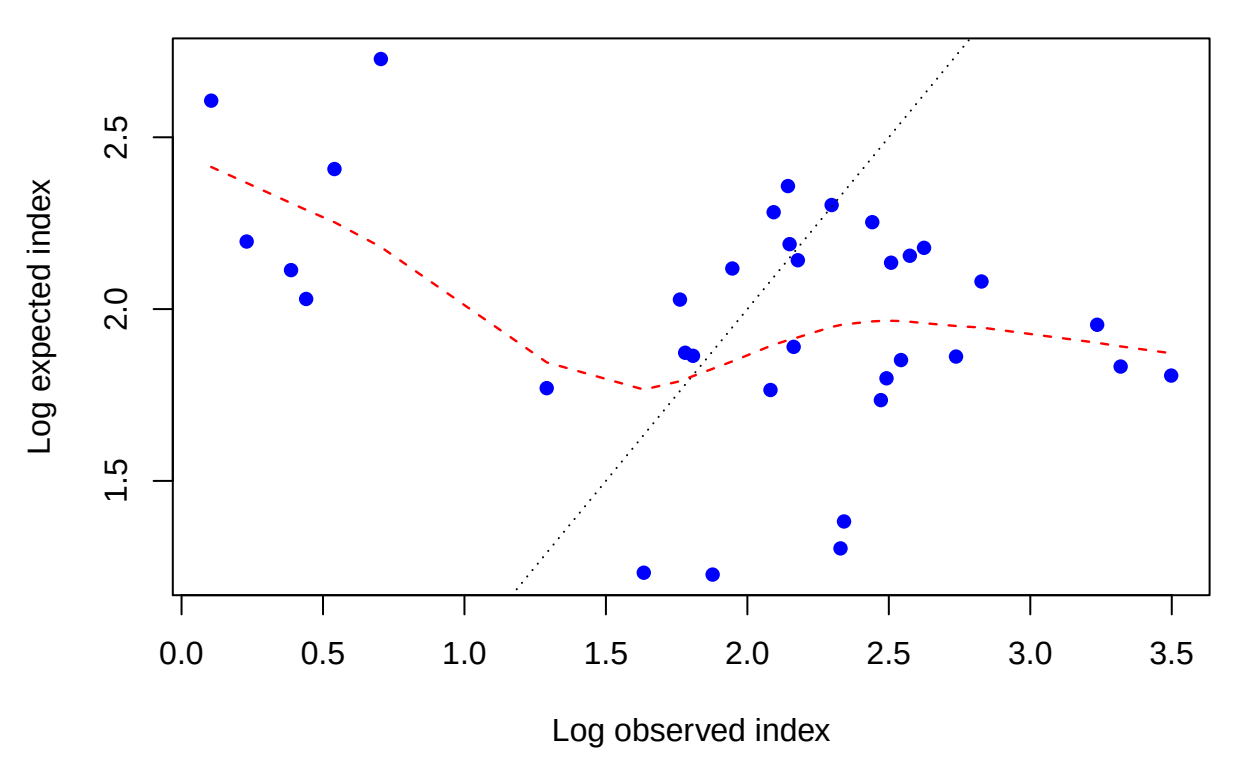

Index
0
10
20
30
40
50
1990
1995
2000
2005
2010
2015
2020
Year

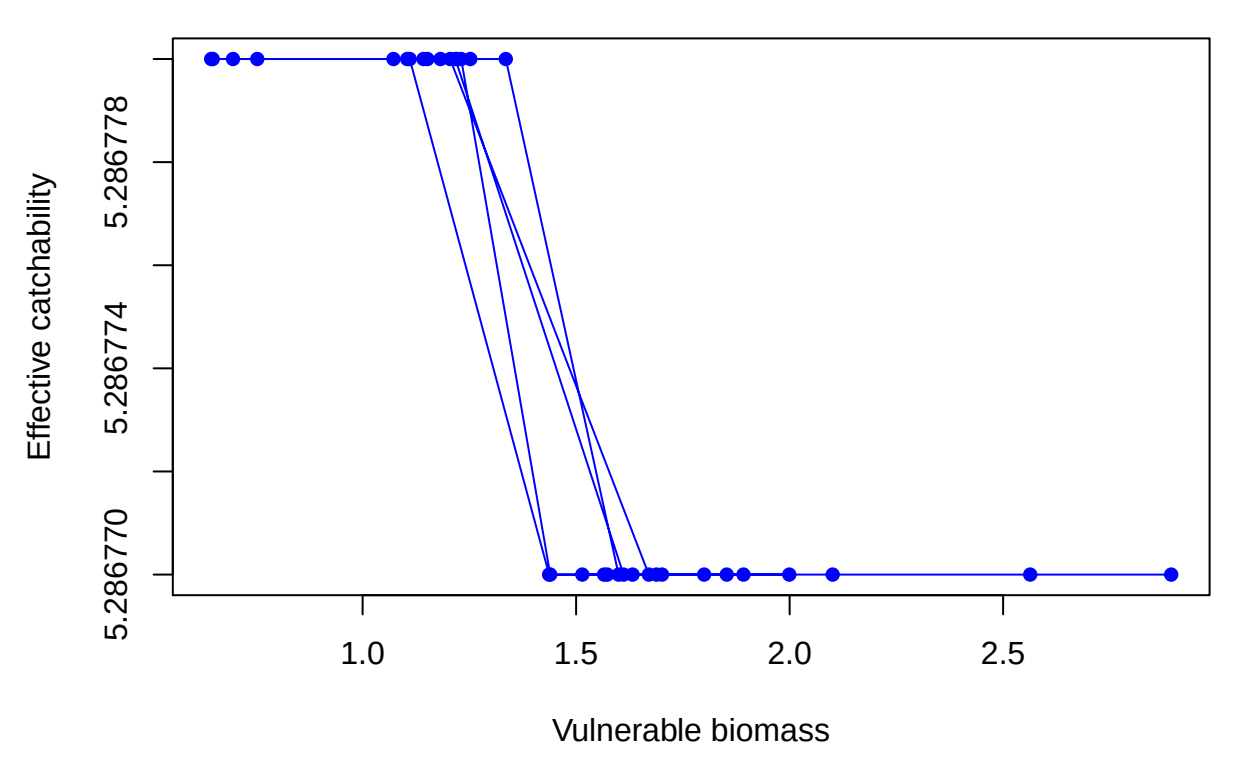

Index
0
10
20
30
40
50
1990
1995
2000
2005
2010
2015
2020
Year

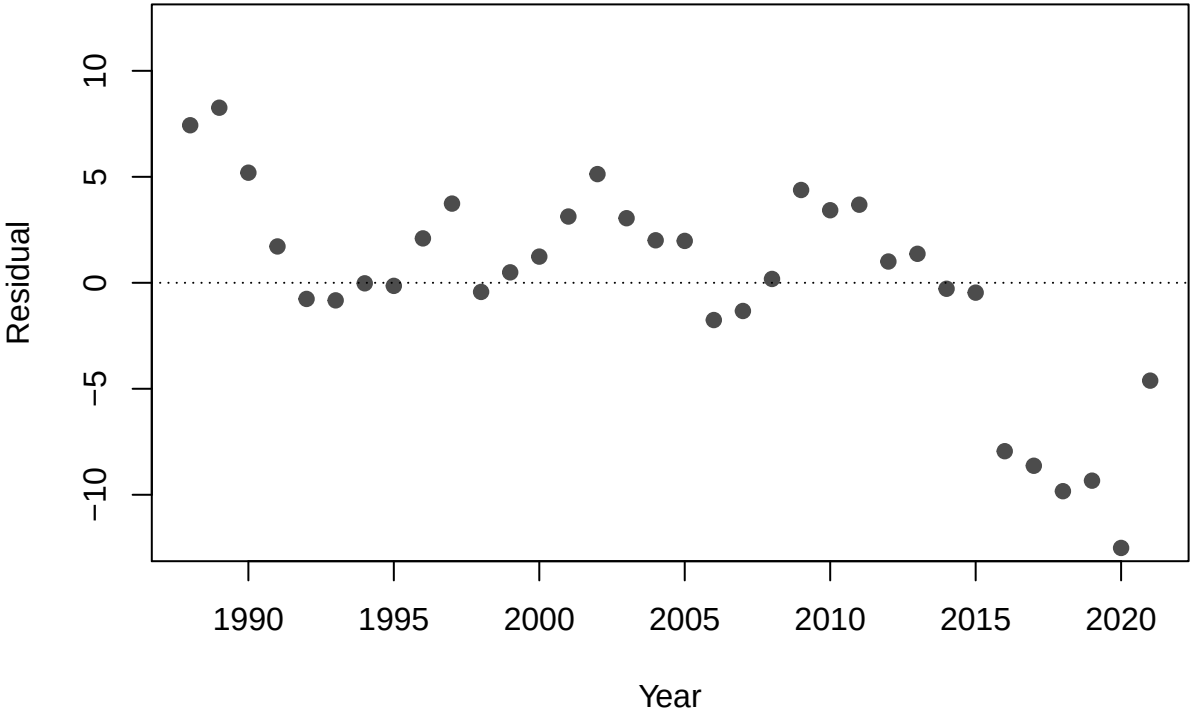

Expected index
0
5
10
15
0
5
10
15
20
25
30
Observed index

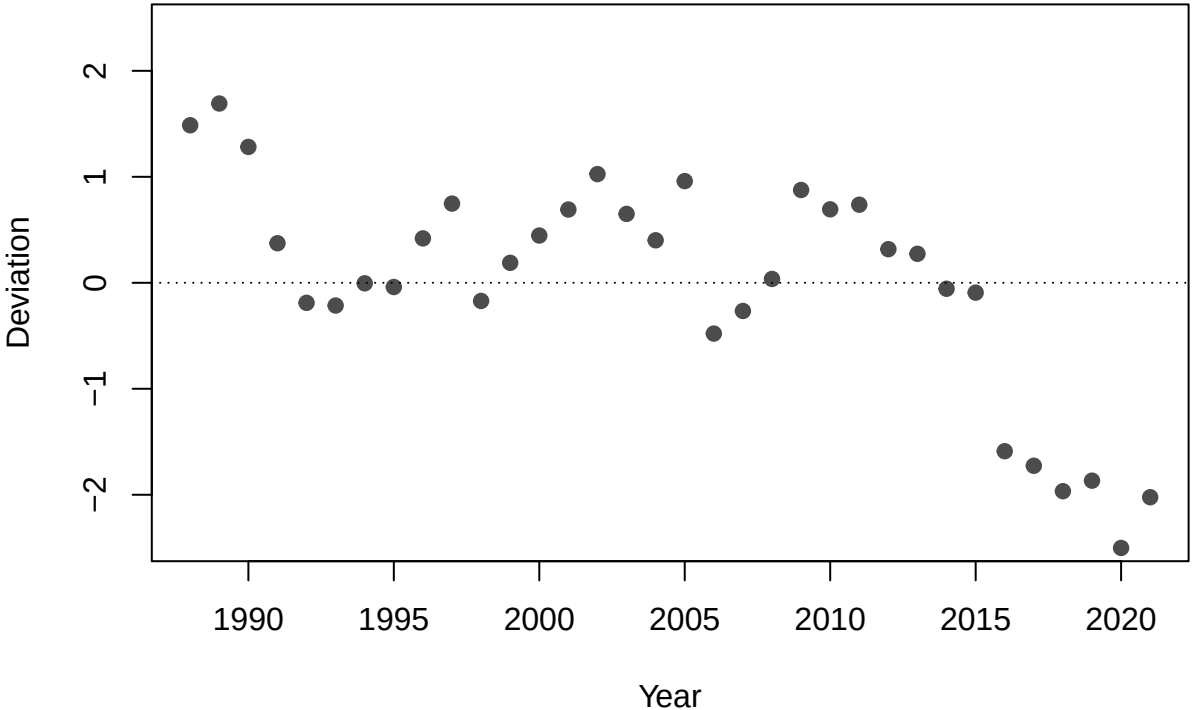

Log index
0
1
2
3
4
1990
1995
2000
2005
2010
2015
2020
Year

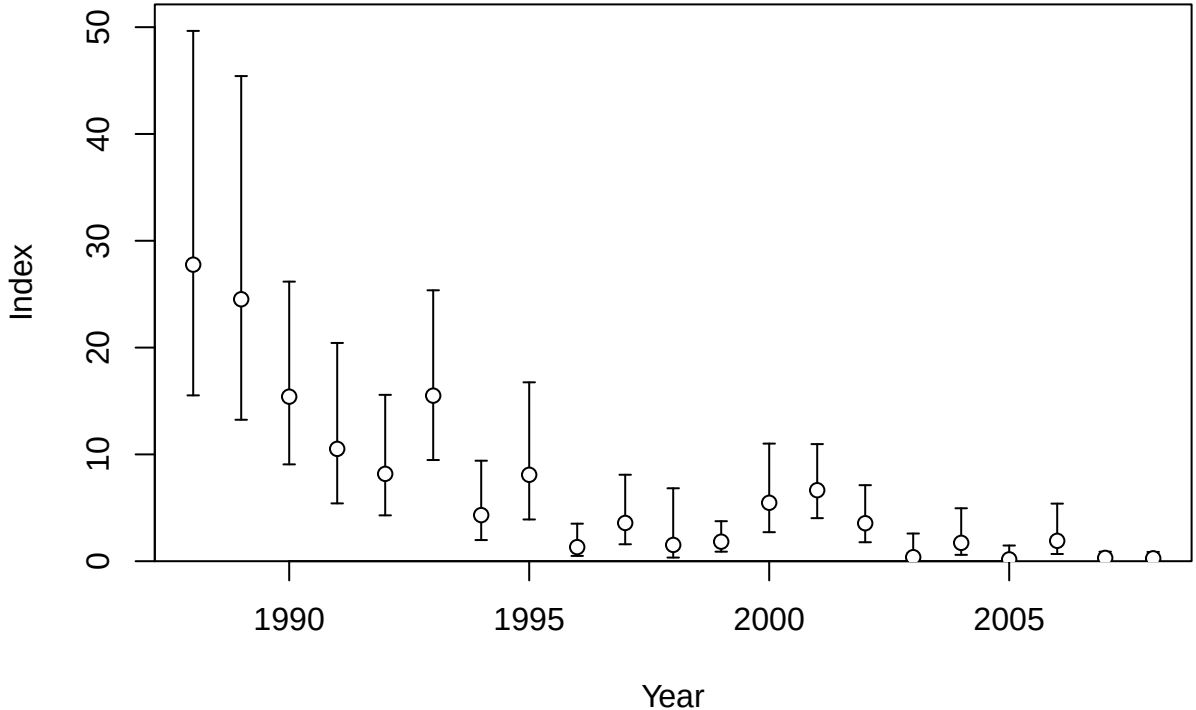

Log index
0
1
2
3
4
1990
1995
2000
2005
2010
2015
2020
Year

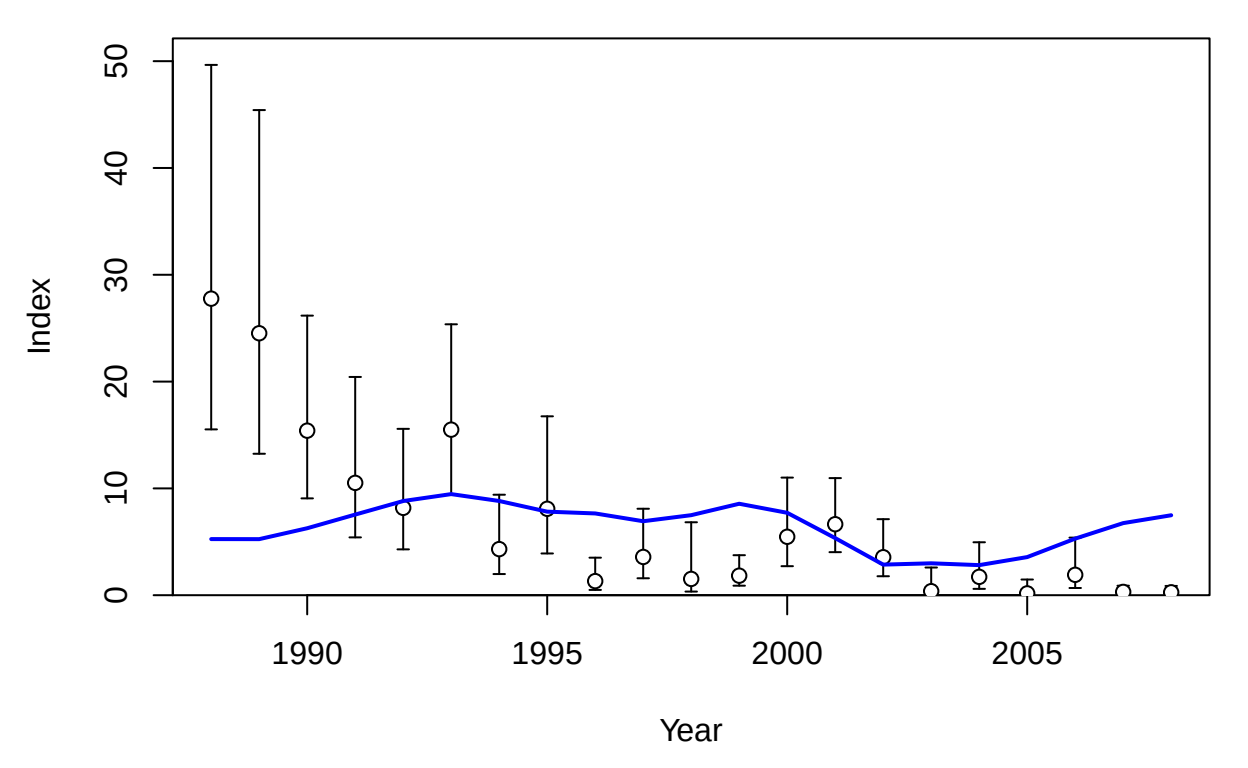

Log expected index
2.5
2.0
1.5
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
Log observed index

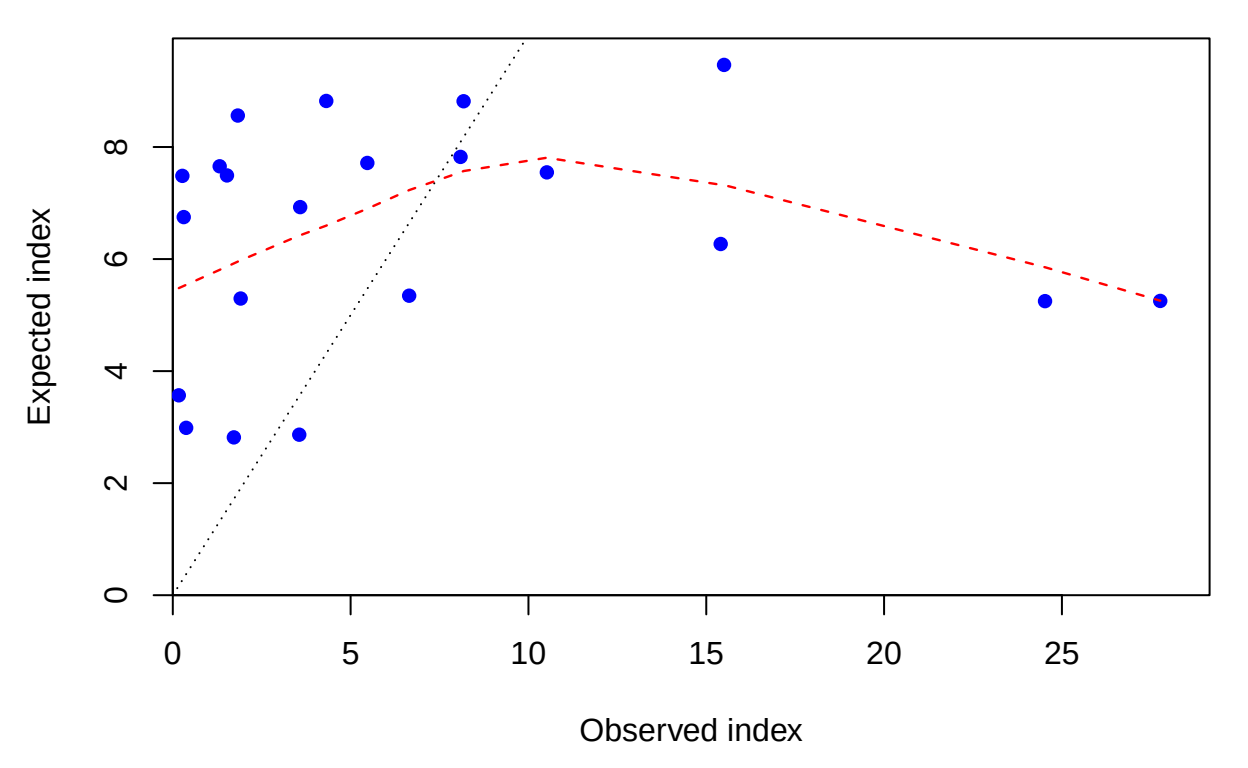

Effective catchability
5.286770
5.286774
5.286778
1.0
1.5
2.0
2.5
Vulnerable biomass

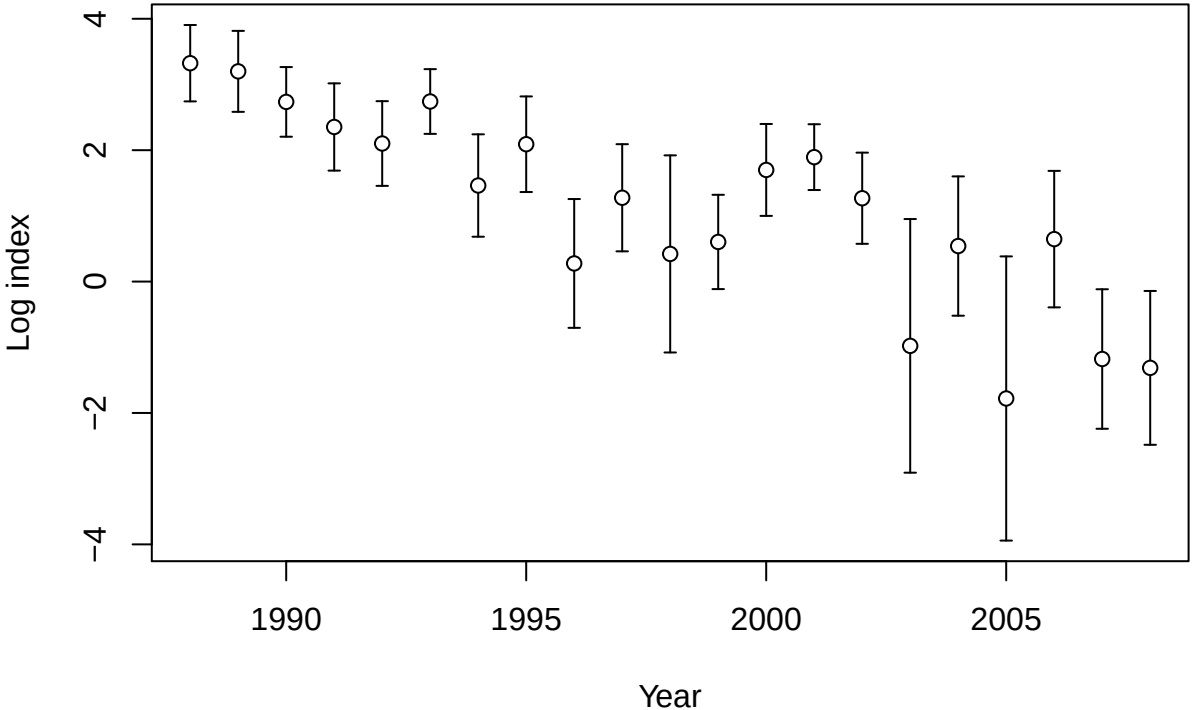

Residual
10
5
0
−5
−10
1990
1995
2000
2005
2010
2015
2020
Year

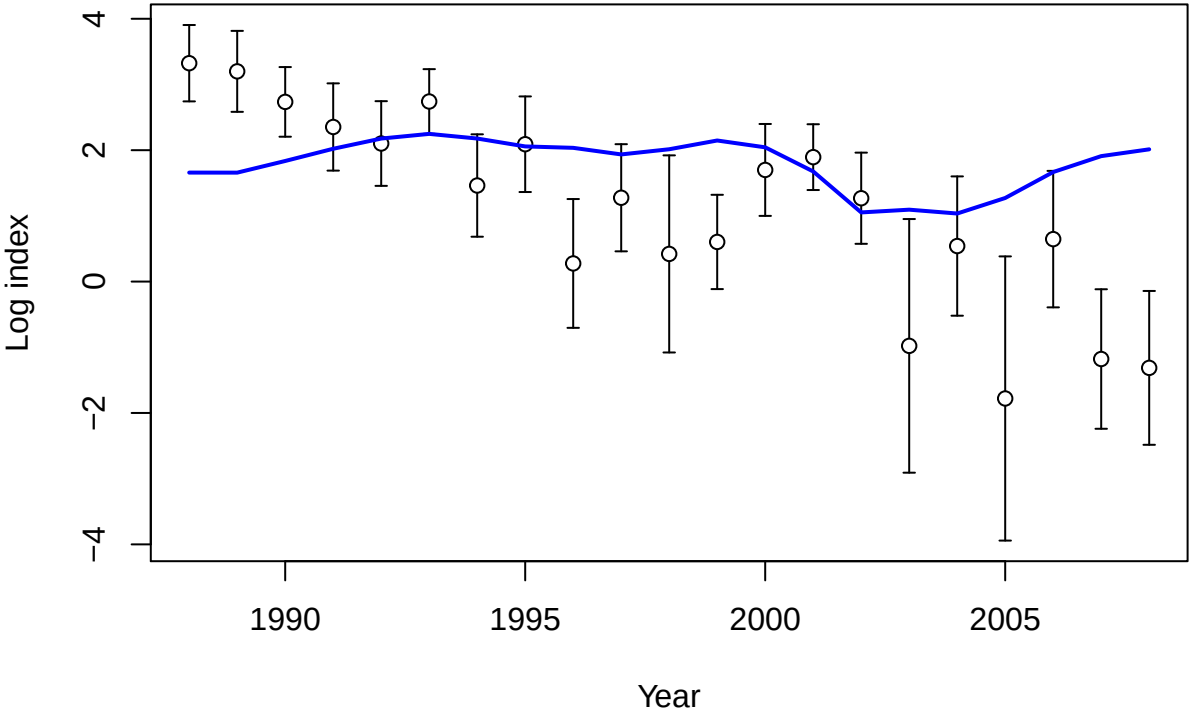

Deviation
2
1
0
−1
−2
1990
1995
2000
2005
2010
2015
2020
Year

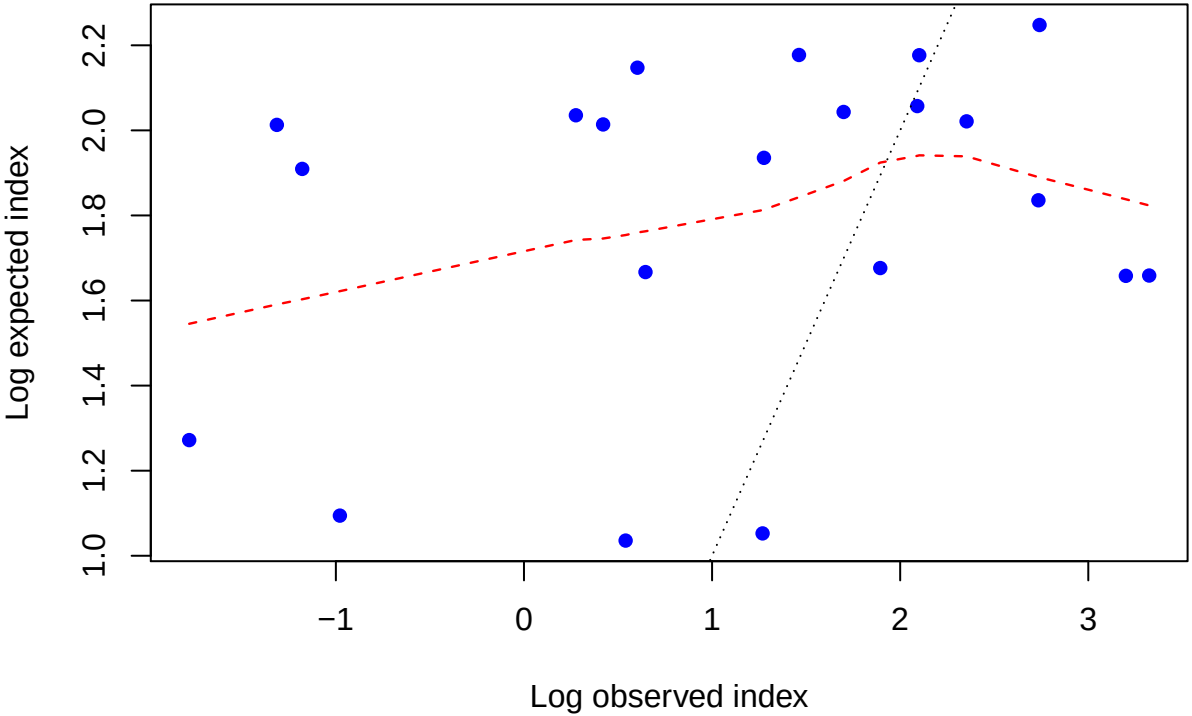

Index
0
10
20
30
40
50
1990
1995
2000
2005
Year

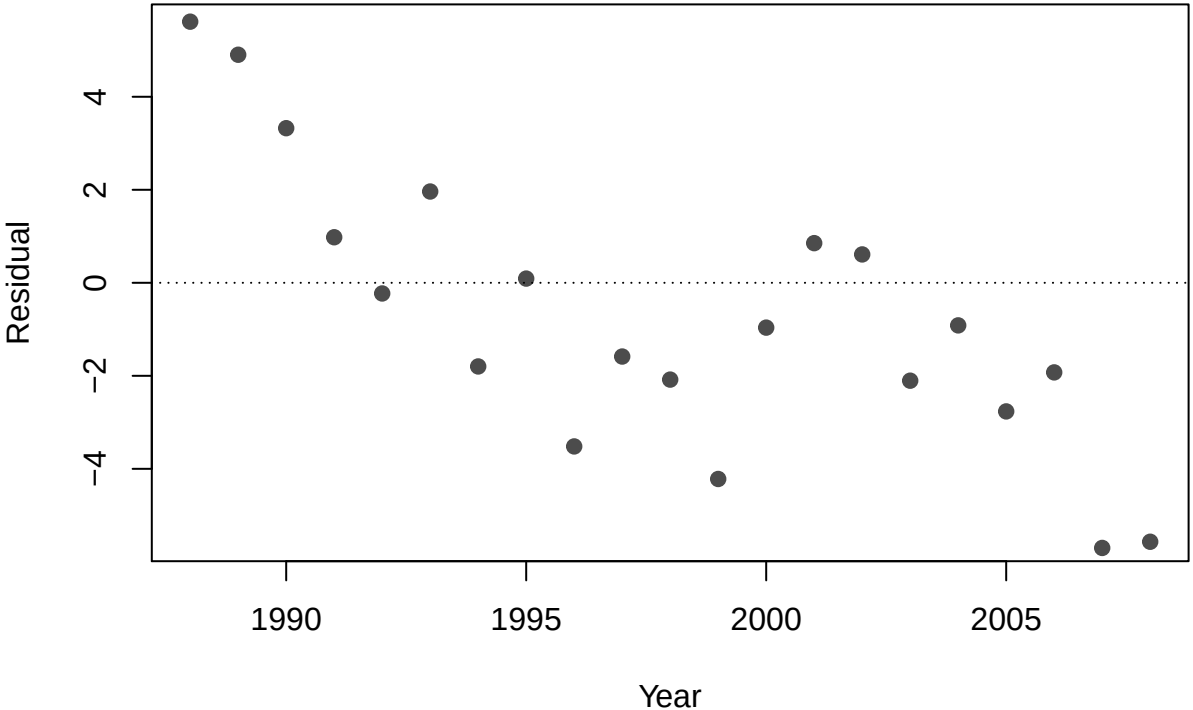

Index
0
10
20
30
40
50
1990
1995
2000
2005
Year

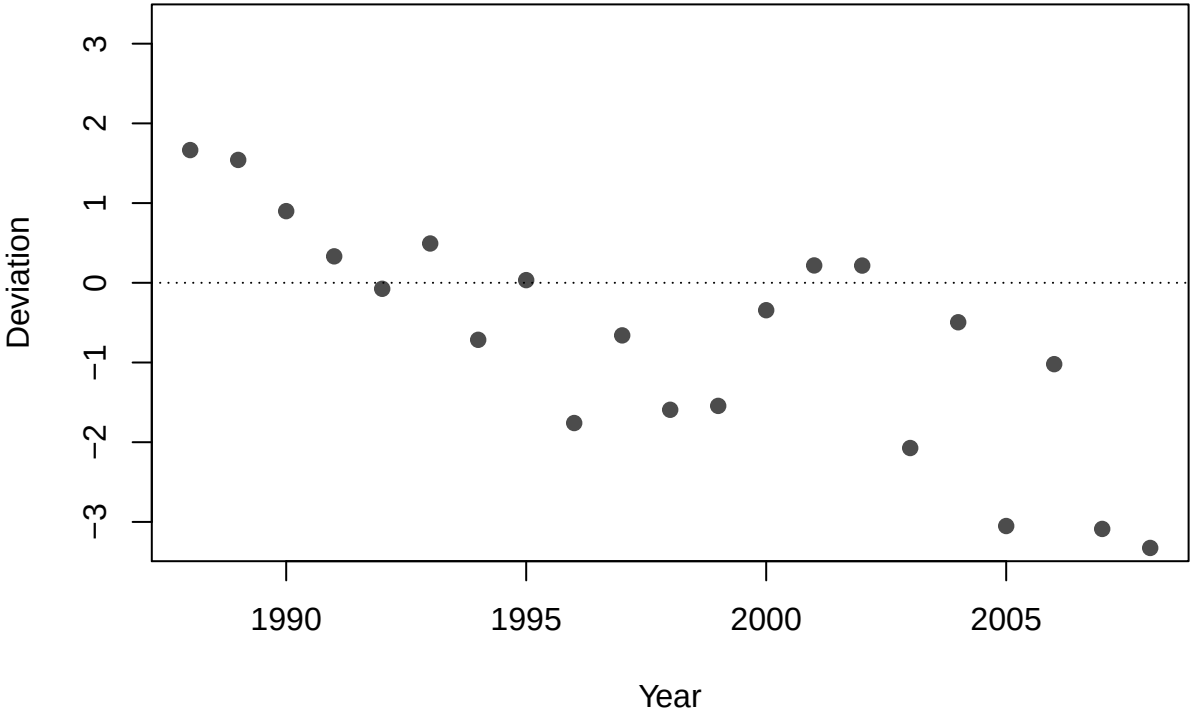

Expected index
0
2
4
6
8
0
5
10
15
20
25
Observed index

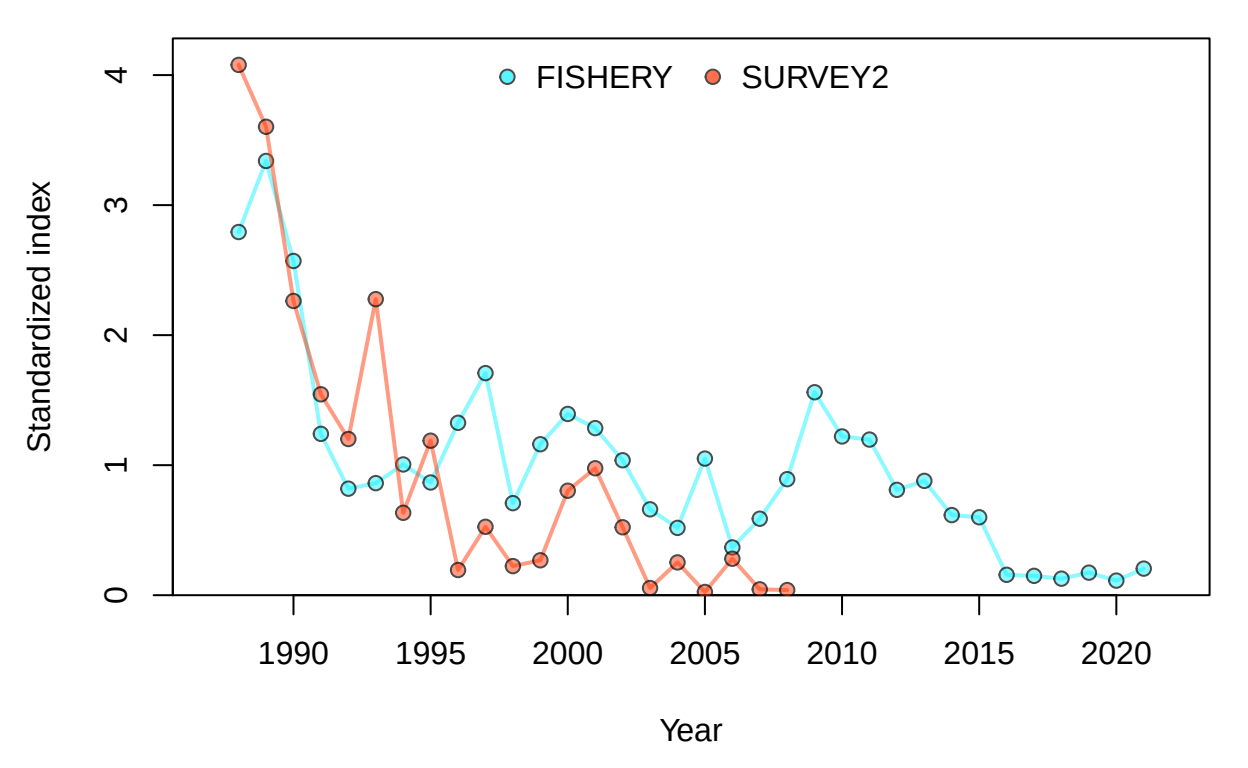

Log index
4
2
0
−2
−4
1990
1995
2000
2005
Year

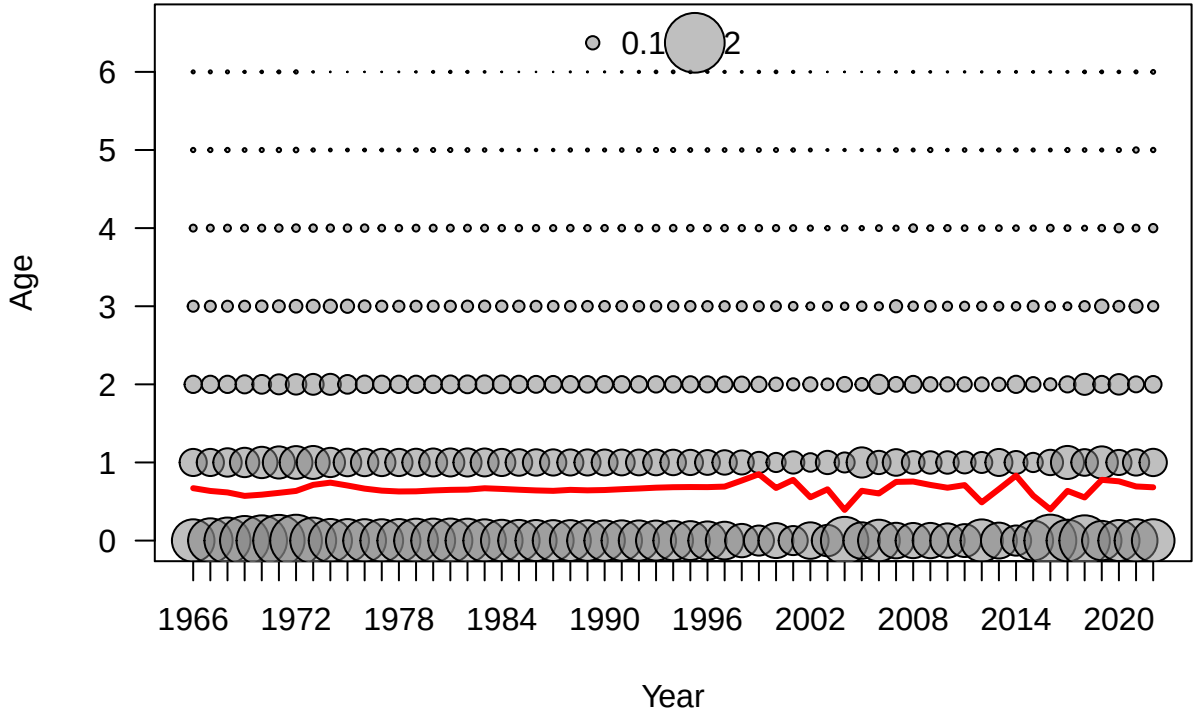

Log index
4
2
0
−2
−4
1990
1995
2000
2005
Year

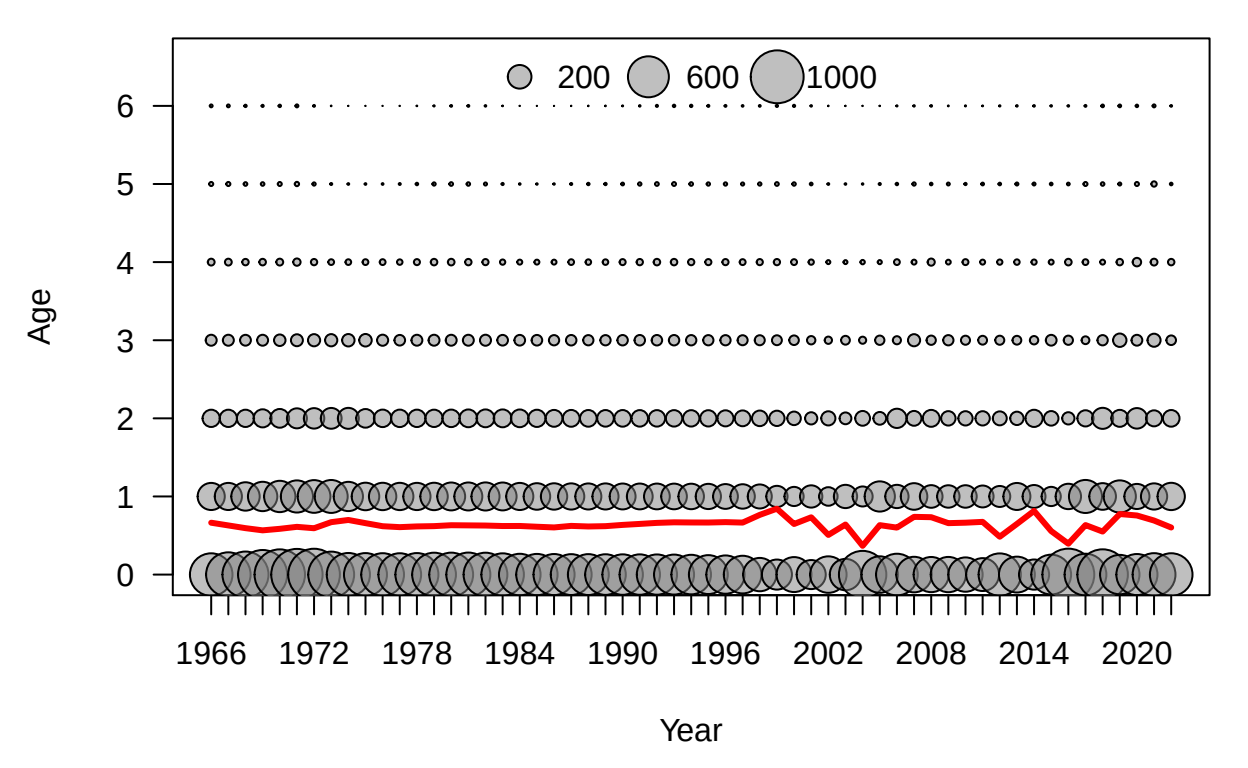

Log expected index
1.0
1.2
1.4
1.6
1.8
2.0
2.2
−1
0
1
2
3
Log observed index

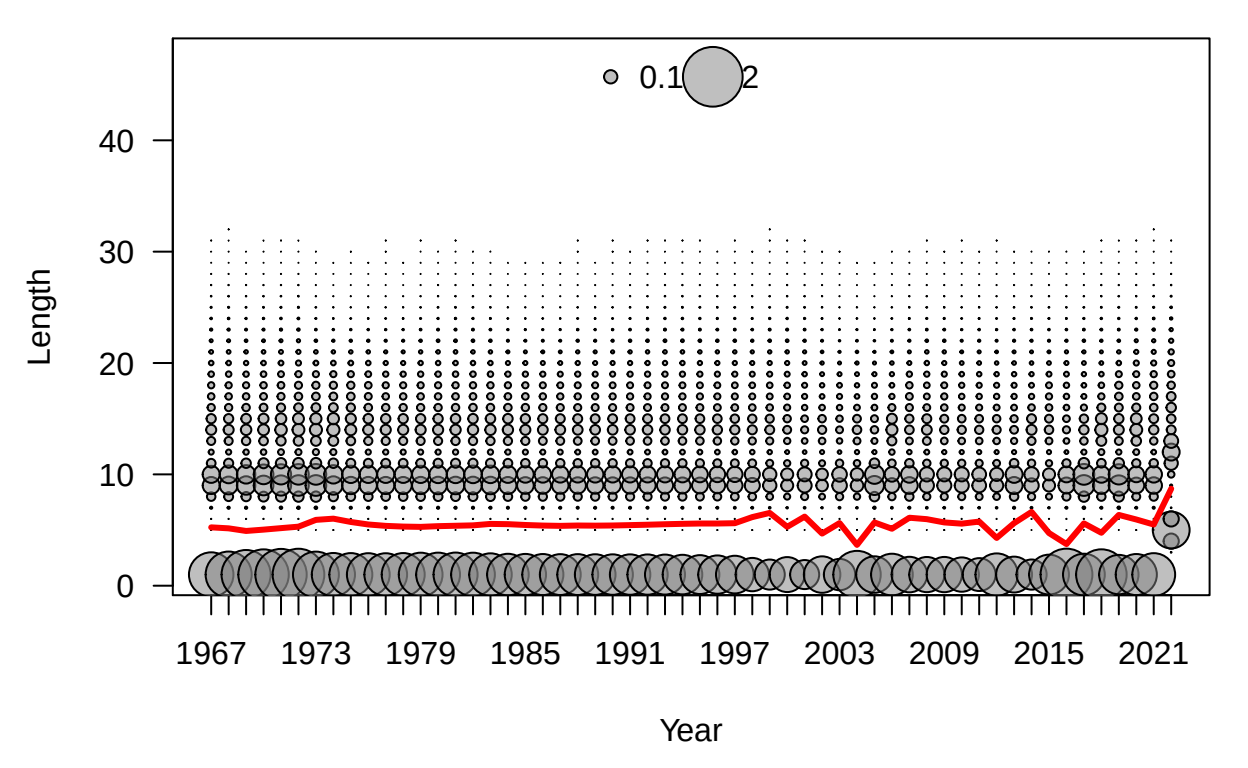

Residual
4
2
0
−2
−4
1990
1995
2000
2005
Year

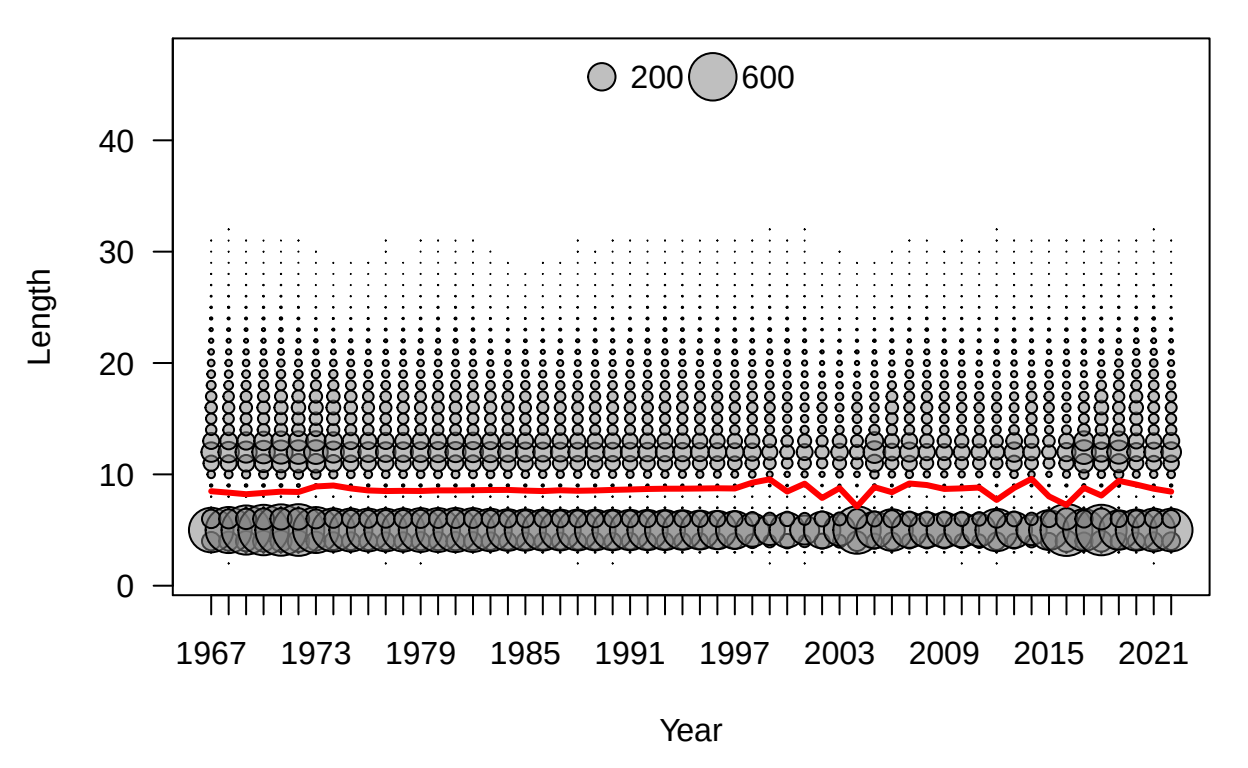

Deviation
3
2
1
0
−1
−2
−3
1990
1995
2000
2005
Year

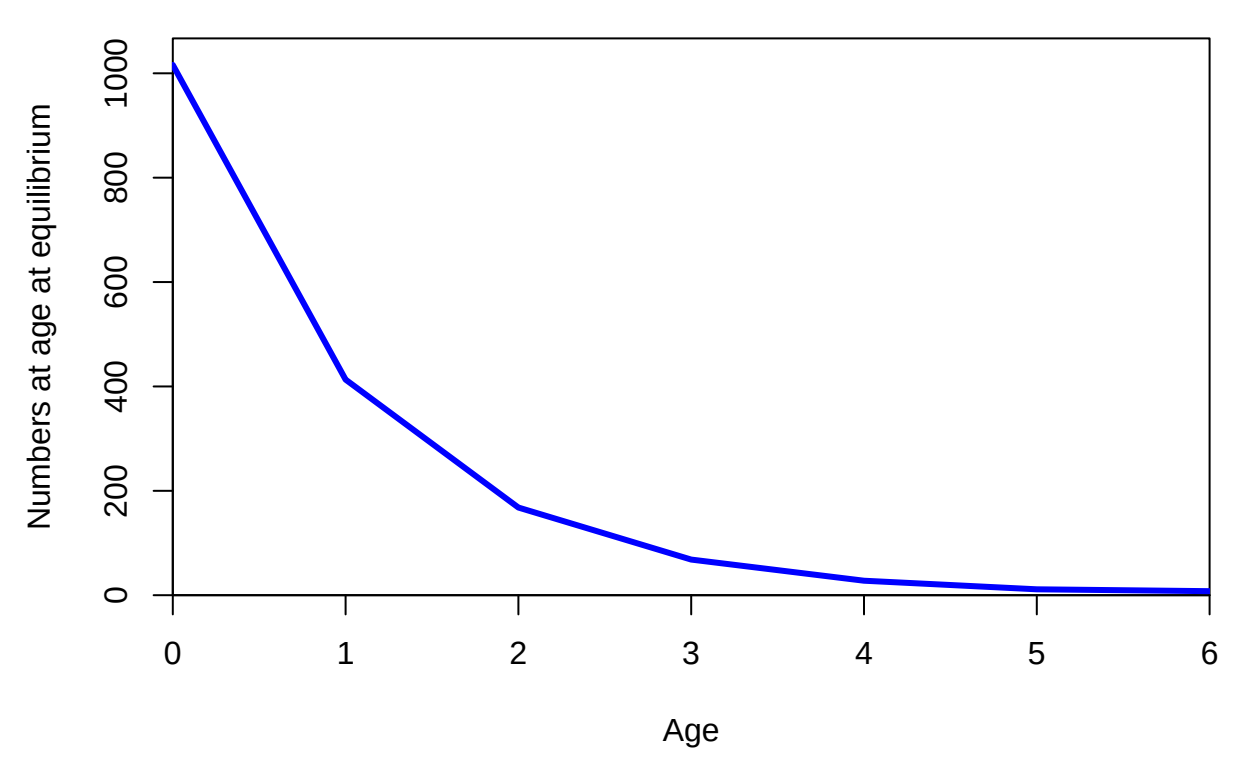

FISHERY
SURVEY2
Standardized index
Year
0
1
2
3
4
1990
1995
2000
2005
2010
2015
2020

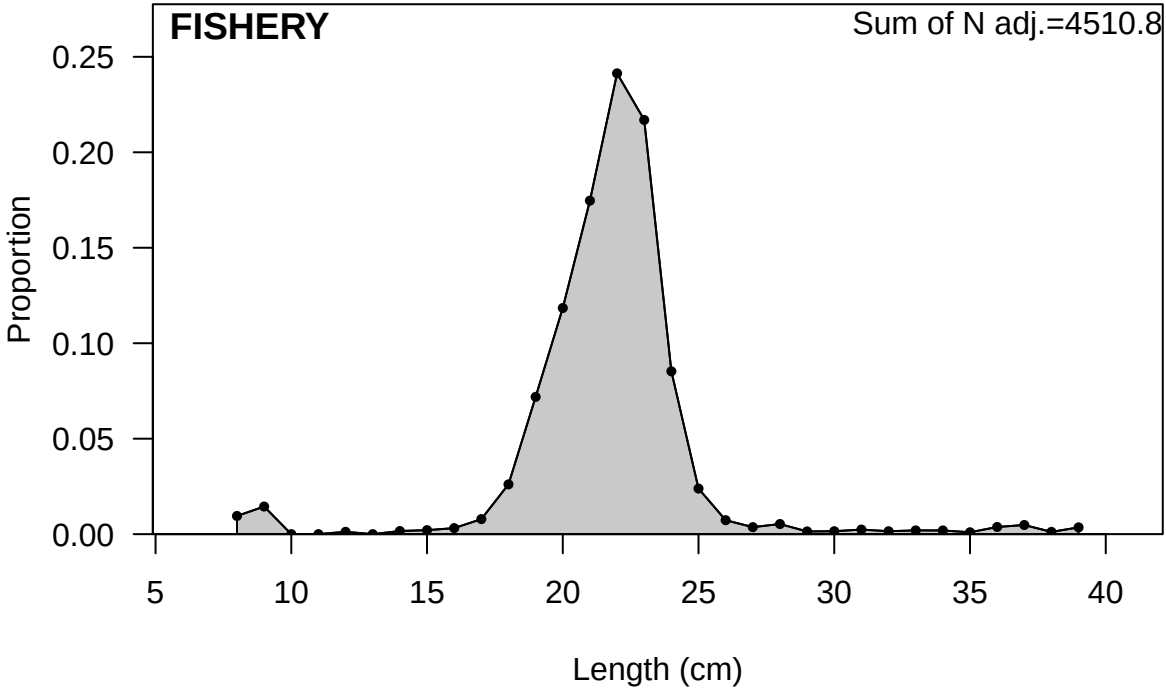

0.1
2
Age
Year
0
1
2
3
4
5
6
1966
1972
1978
1984
1990
1996
2002
2008
2014
2020

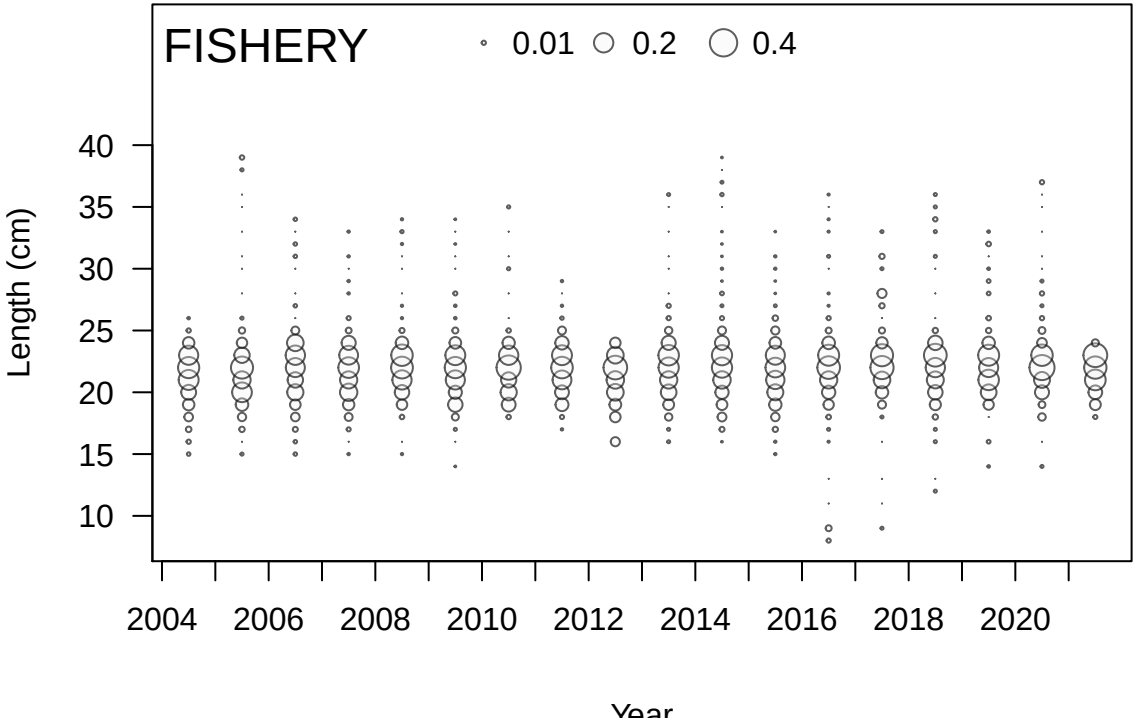

200
600
1000
Age
0
1
2
3
4
5
6
1966
1972
1978
1984
1990
1996
2002
2008
2014
2020
Year

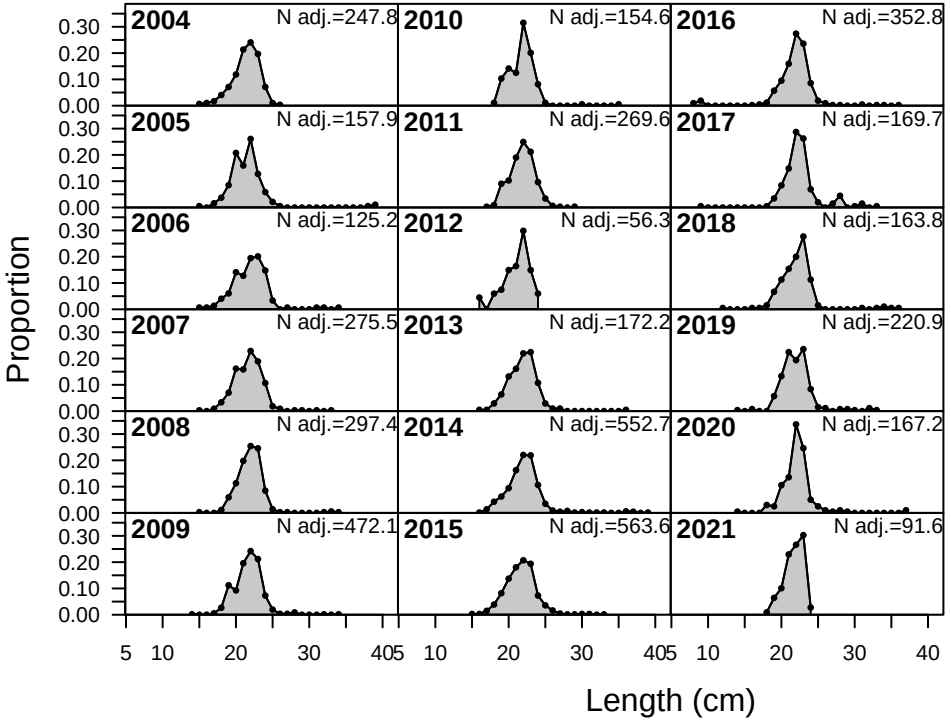

0.1
2
40
30
20
10
0
Length
1967
1973
1979
1985
1991
1997
2003
2009
2015
2021
Year

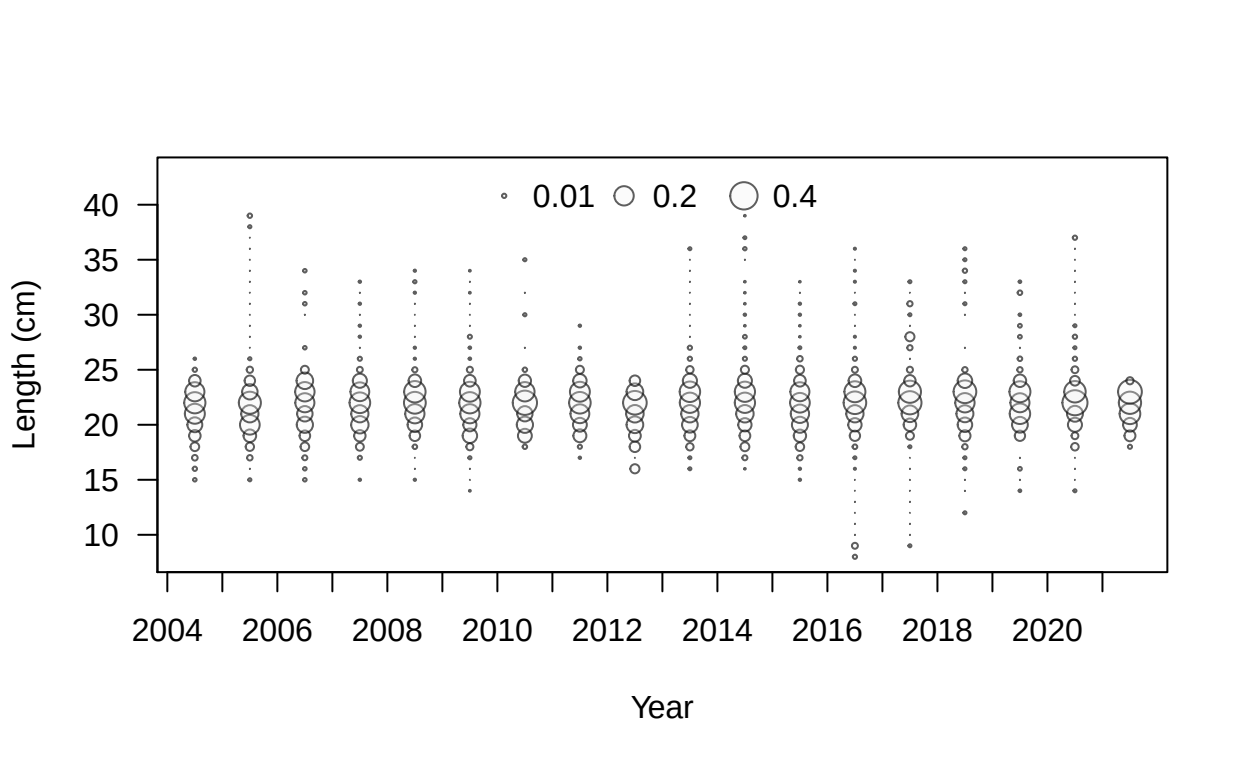

200
600
Length
0
10
20
30
40
1967
1973
1979
1985
1991
1997
2003
2009
2015
2021
Year

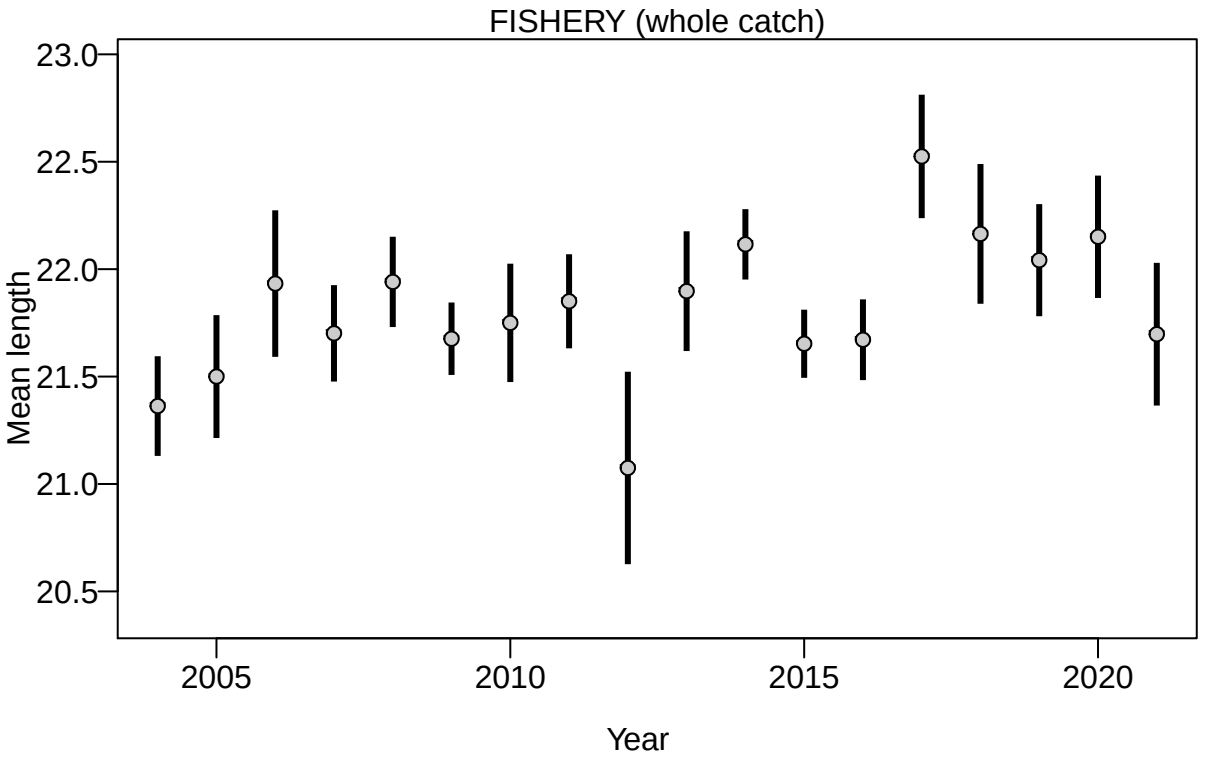

Numbers at age at equilibrium
0
200
400
600
800
1000
0
1
2
3
4
5
6
Age

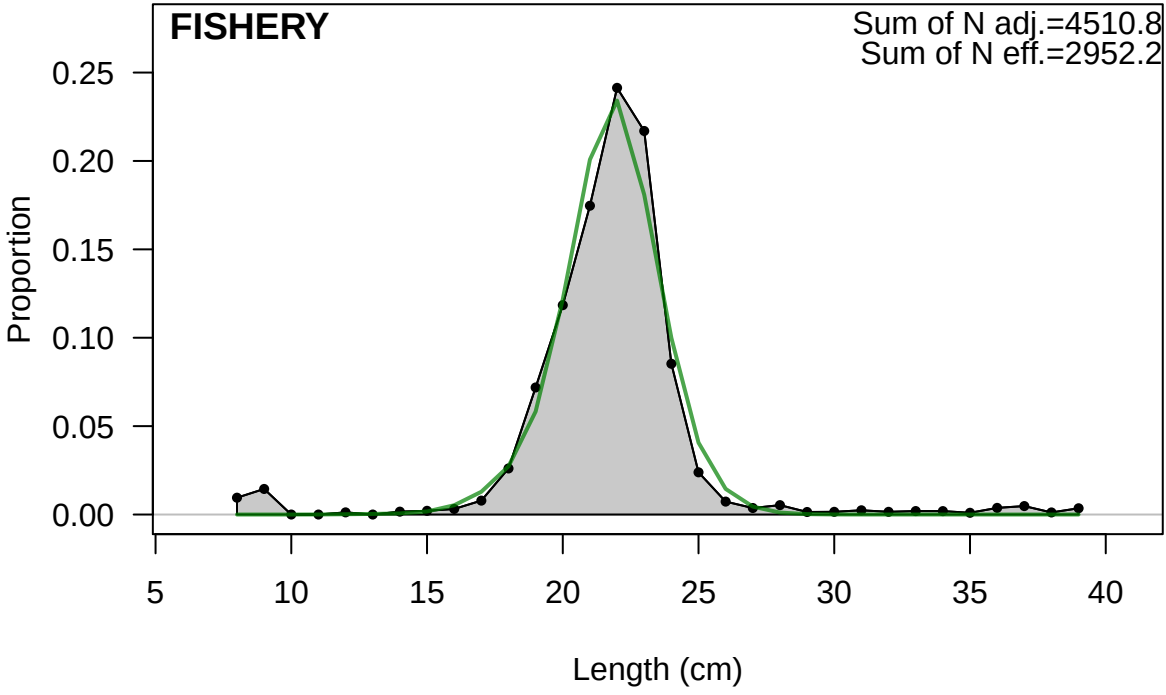

FISHERY
Sum of N adj.=4510.8
Proportion
0.25
0.20
0.15
0.10
0.05
0.00
5
10
15
20
25
30
35
40
Length (cm)

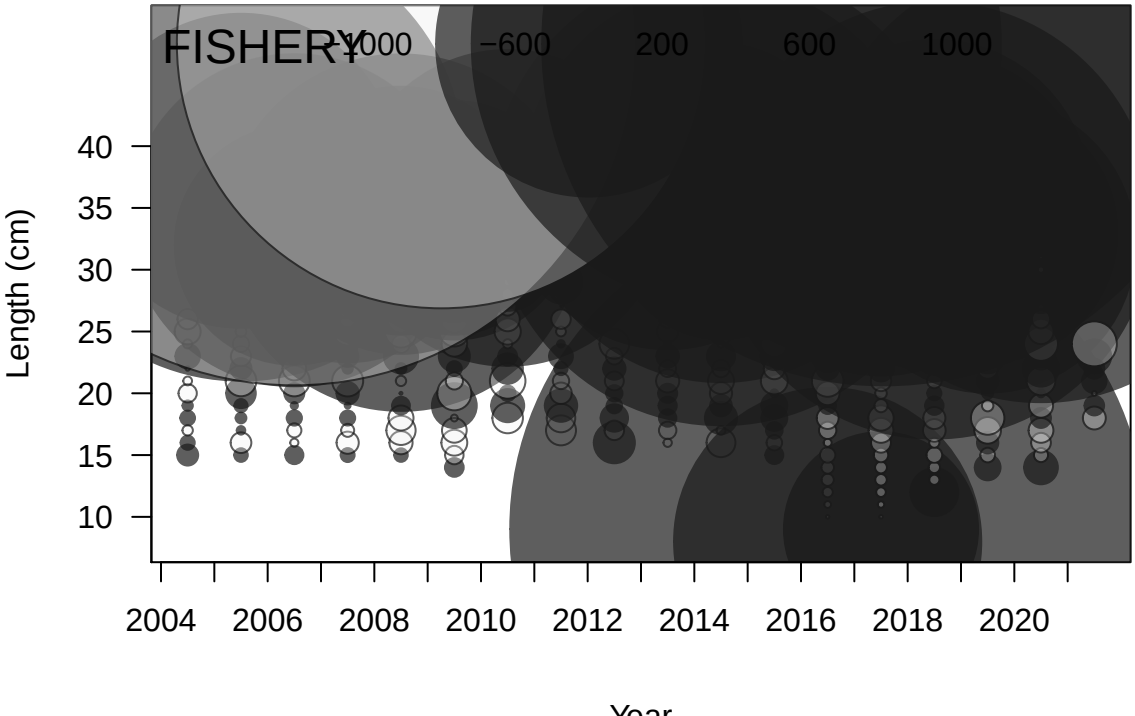

FISHERY
0.01
0.2
0.4
Length (cm)
40
35
30
25
20
15
10
2004
2006
2008
2010
2012
2014
2016
2018
2020
Year

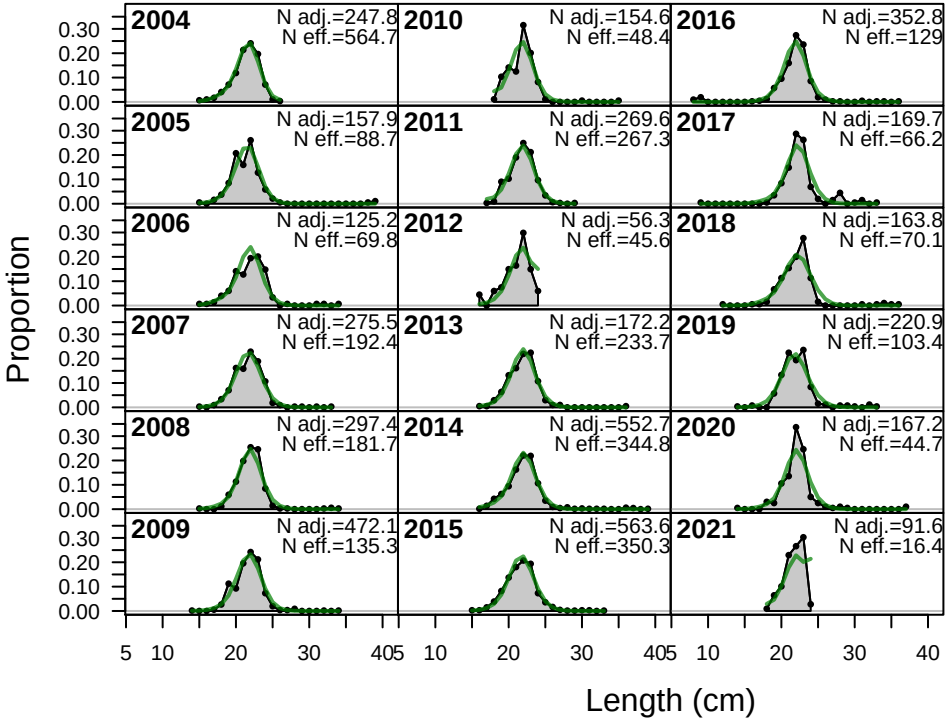

2004
N adj.=247.8
2010
N adj.=154.6
2016
N adj.=352.8
2005
N adj.=157.9
2011
N adj.=269.6
2017
N adj.=169.7
2006
N adj.=125.2
2012
N adj.=56.3
2018
N adj.=163.8
2007
N adj.=275.5
2013
N adj.=172.2
2019
N adj.=220.9
2008
N adj.=297.4
2014
N adj.=552.7
2020
N adj.=167.2
2009
N adj.=472.1
2015
N adj.=563.6
2021
N adj.=91.6
Proportion
0.00
0.10
0.20
0.30
5
10
20
30
40
Length (cm)

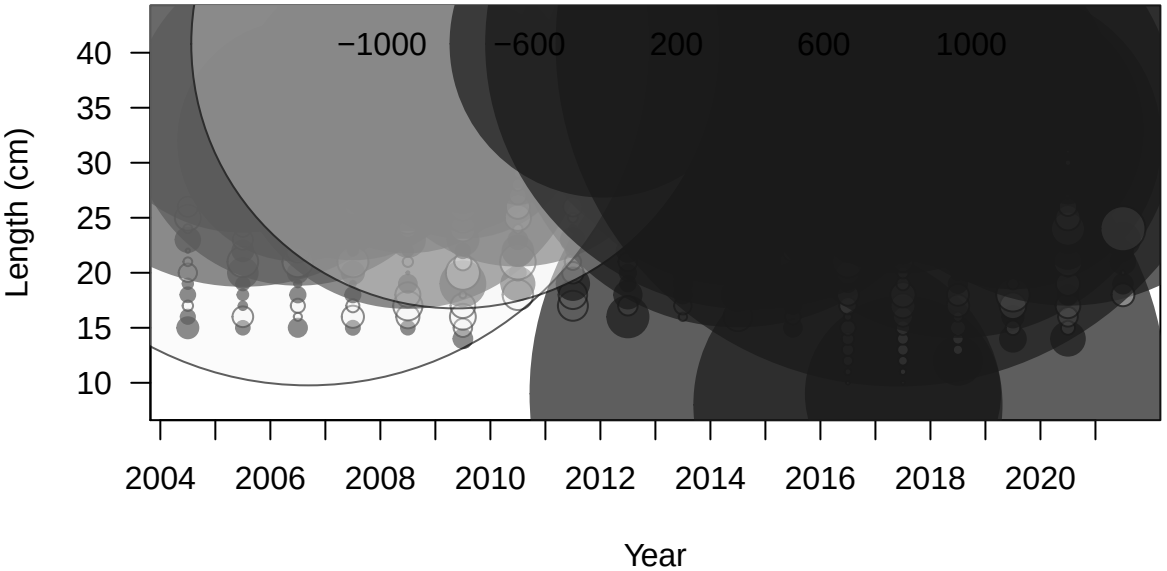

0.01
0.2
0.4
Length (cm)
40
35
30
25
20
15
10
2004
2006
2008
2010
2012
2014
2016
2018
2020
Year

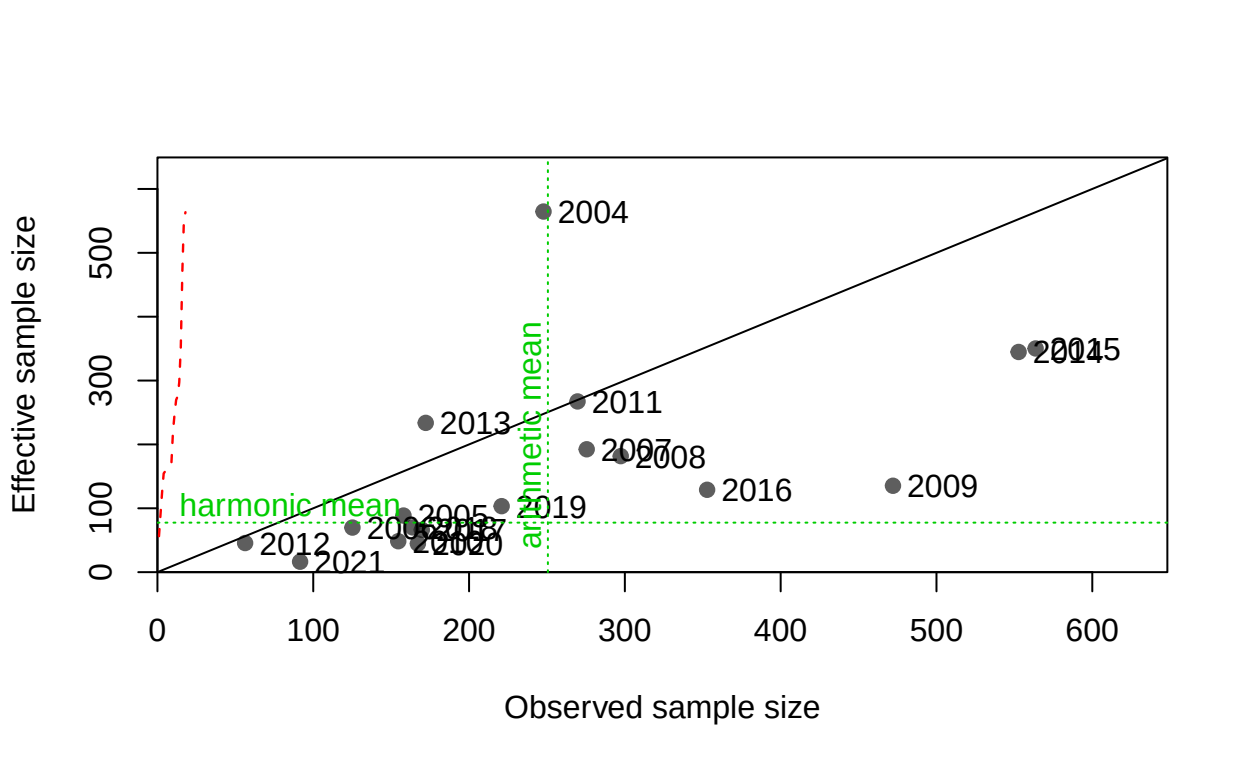

FISHERY (whole catch)
23.0
22.5
22.0
21.5
21.0
20.5
Mean length
2005
2010
2015
2020
Year

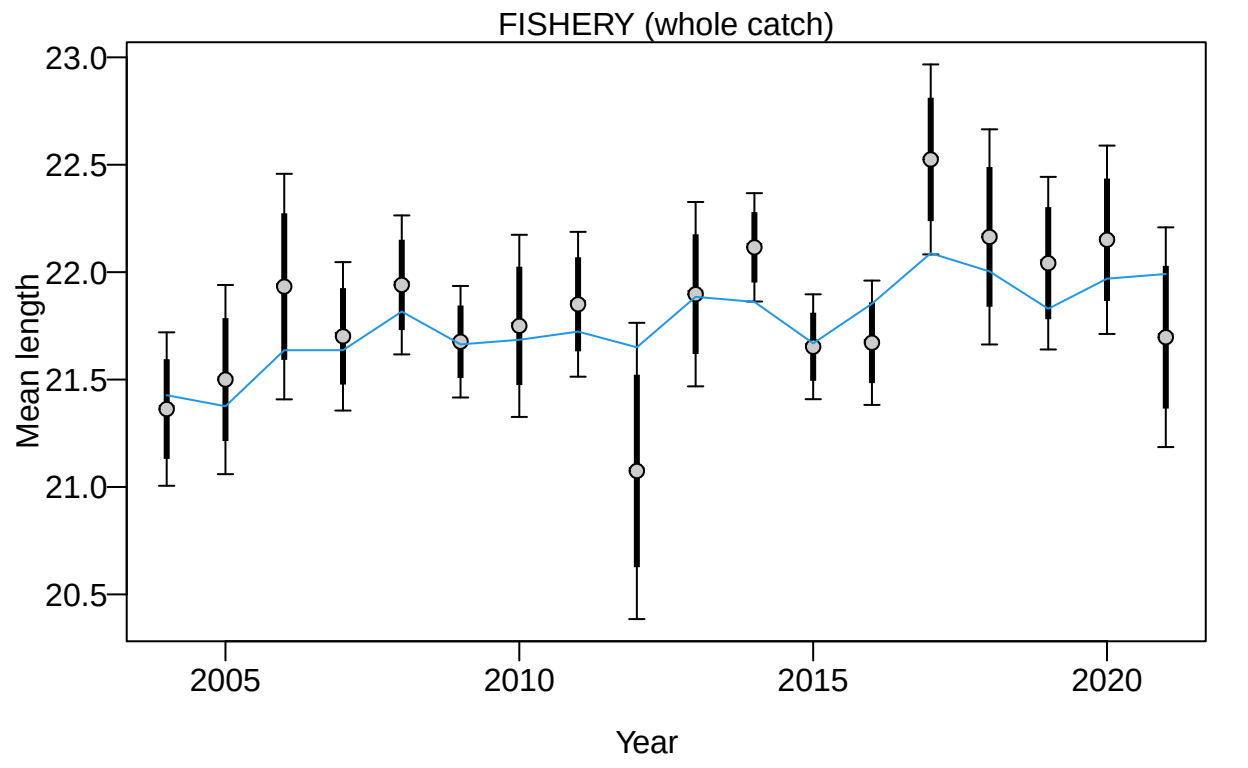

FISHERY
Sum of N adj.=4510.8
Sum of N eff.=2952.2
Proportion
0.25
0.20
0.15
0.10
0.05
0.00
5
10
15
20
25
30
35
40
Length (cm)

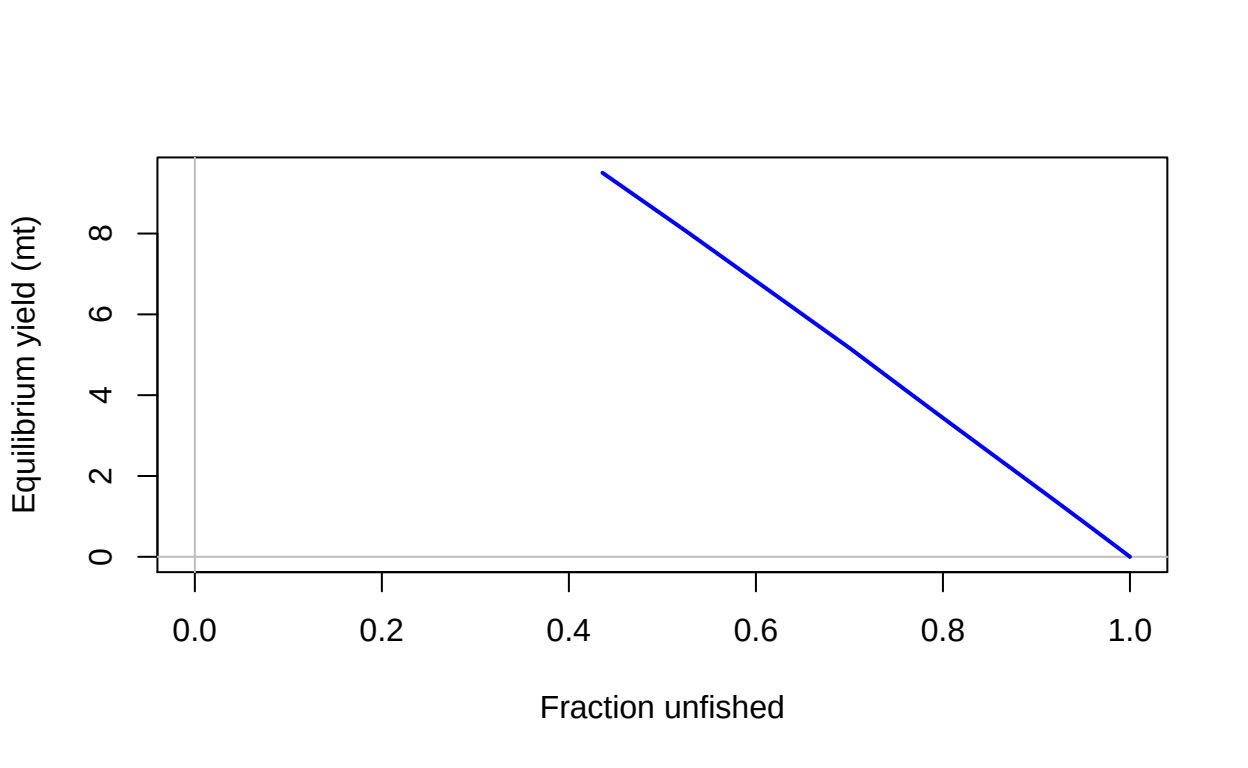

FISHERY
−1000
−600
200
600
1000
40
35
30
25
20
15
10
Length (cm)
2004
2006
2008
2010
2012
2014
2016
2018
2020
Year

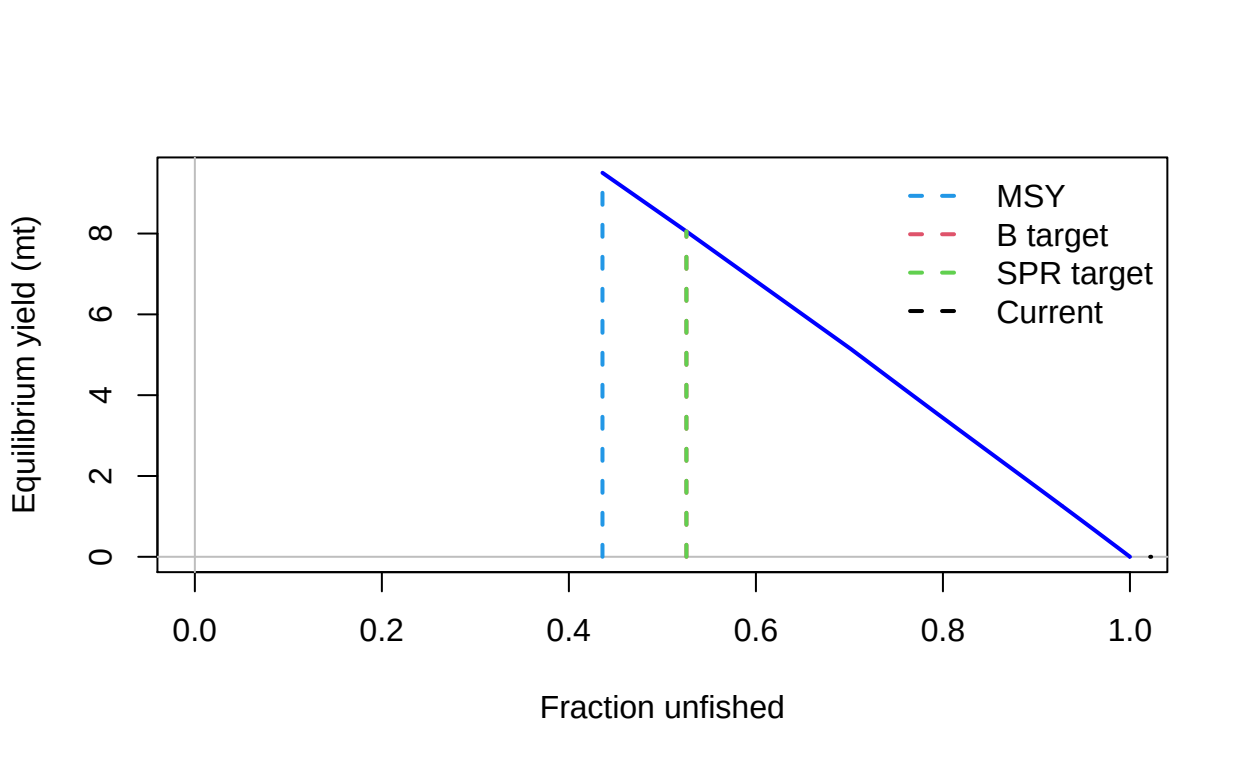

2004
N adj.=247.8
N eff.=564.7
2010
N adj.=154.6
N eff.=48.4
2016
N adj.=352.8
N eff.=129
2005
N adj.=157.9
N eff.=88.7
2011
N adj.=269.6
N eff.=267.3
2017
N adj.=169.7
N eff.=66.2
2006
N adj.=125.2
N eff.=69.8
2012
N adj.=56.3
N eff.=45.6
2018
N adj.=163.8
N eff.=70.1
2007
N adj.=275.5
N eff.=192.4
2013
N adj.=172.2
N eff.=233.7
2019
N adj.=220.9
N eff.=103.4
2008
N adj.=297.4
N eff.=181.7
2014
N adj.=552.7
N eff.=344.8
2020
N adj.=167.2
N eff.=44.7
2009
N adj.=472.1
N eff.=135.3
2015
N adj.=563.6
N eff.=350.3
2021
N adj.=91.6
N eff.=16.4
Proportion
0.00
0.10
0.20
0.30
5
10
20
30
40
Length (cm)

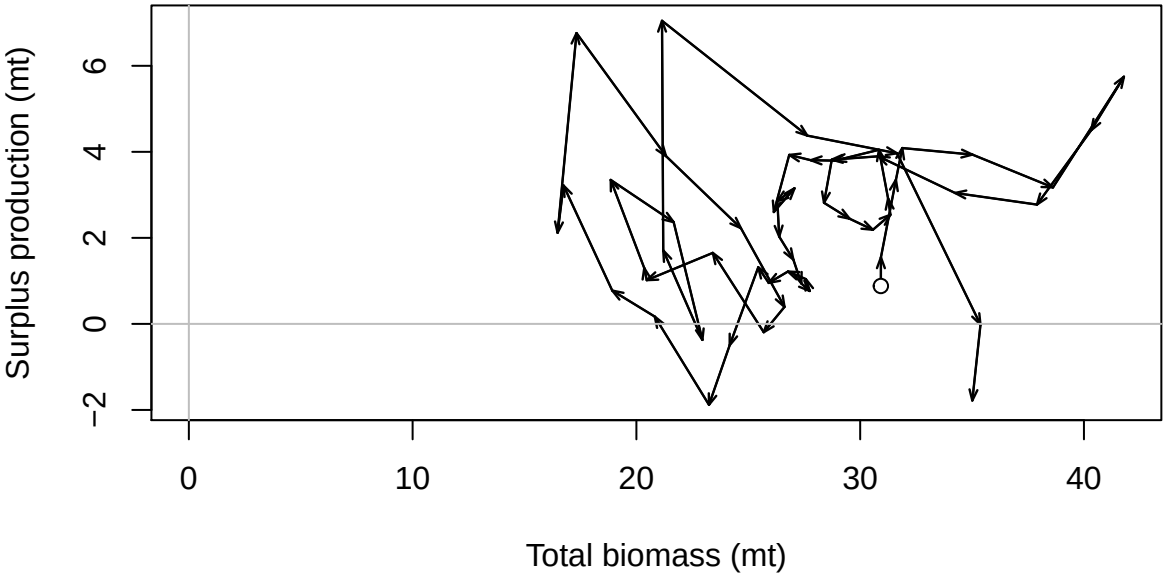

−1000
−600
200
600
1000
40
35
30
25
20
15
10
Length (cm)
2004
2006
2008
2010
2012
2014
2016
2018
2020
Year

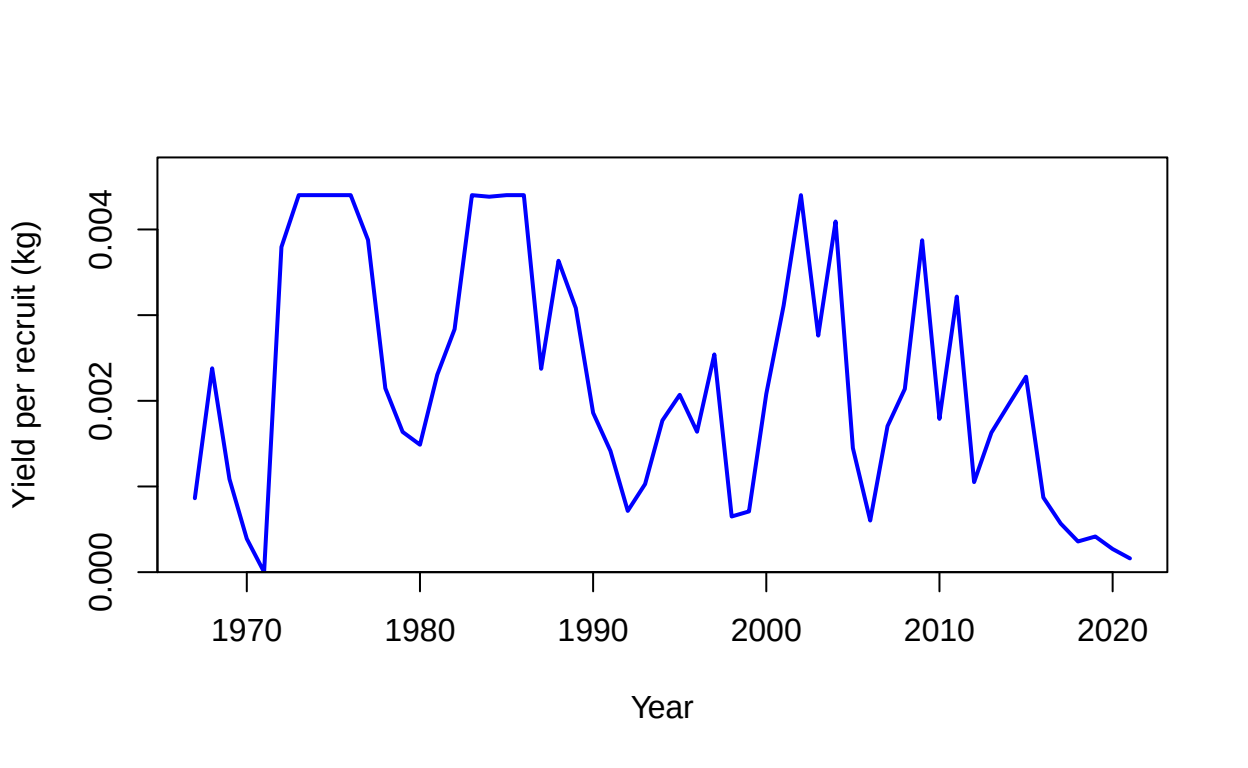

Effective sample size
0
100
300
500
0
100
200
300
400
500
600
Observed sample size
harmonic mean
arithmetic mean
2004
2011
2013
2007
2008
2016
2009
2019
2012
2021

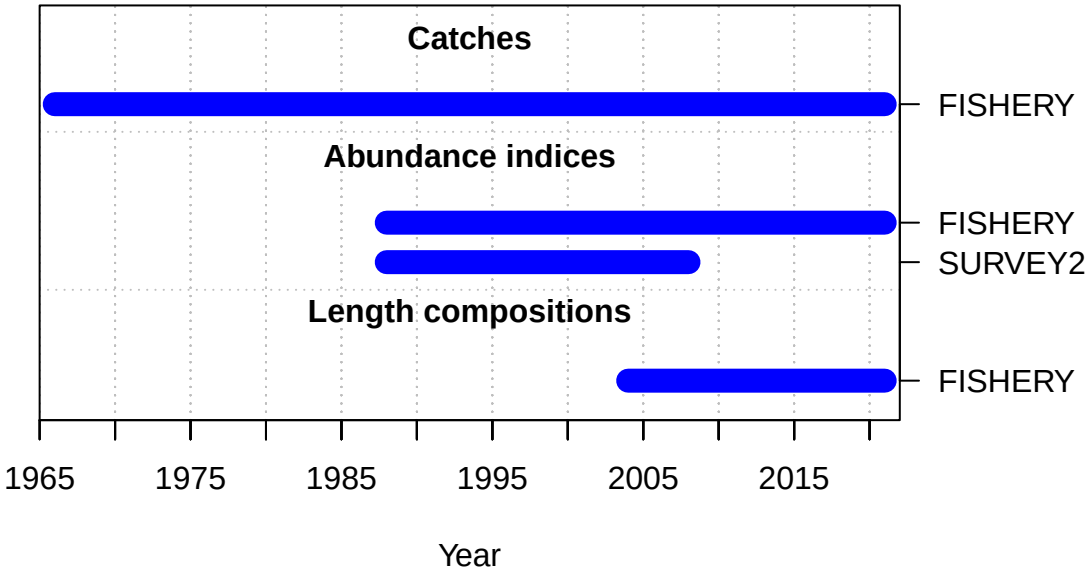

FISHERY (whole catch)
23.0
22.5
22.0
21.5
21.0
20.5
Mean length
2005
2010
2015
2020
Year

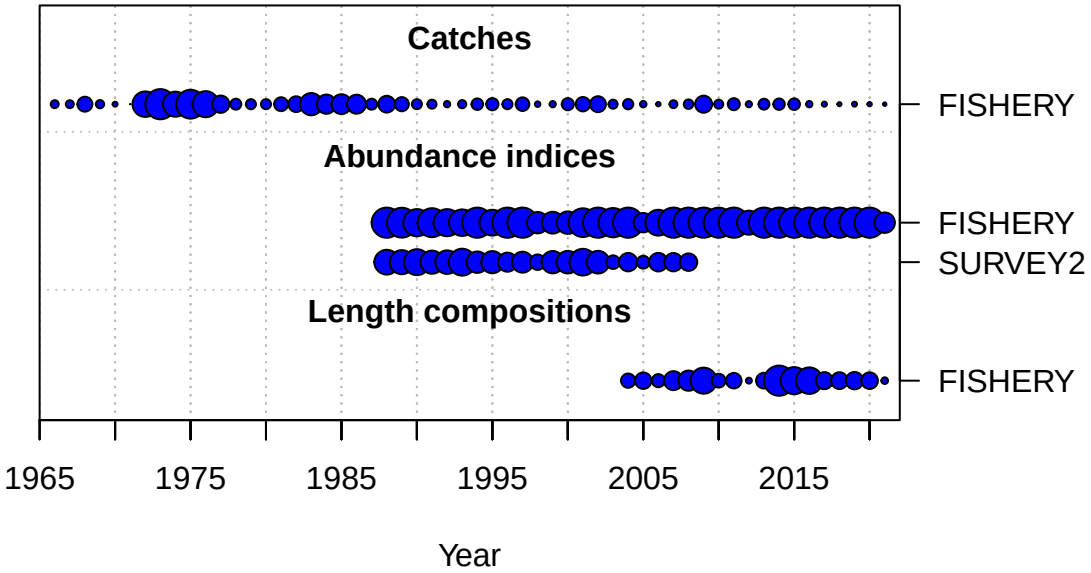

Equilibrium yield (mt)
0
2
4
6
8
0.0
0.2
0.4
0.6
0.8
1.0
Fraction unfished

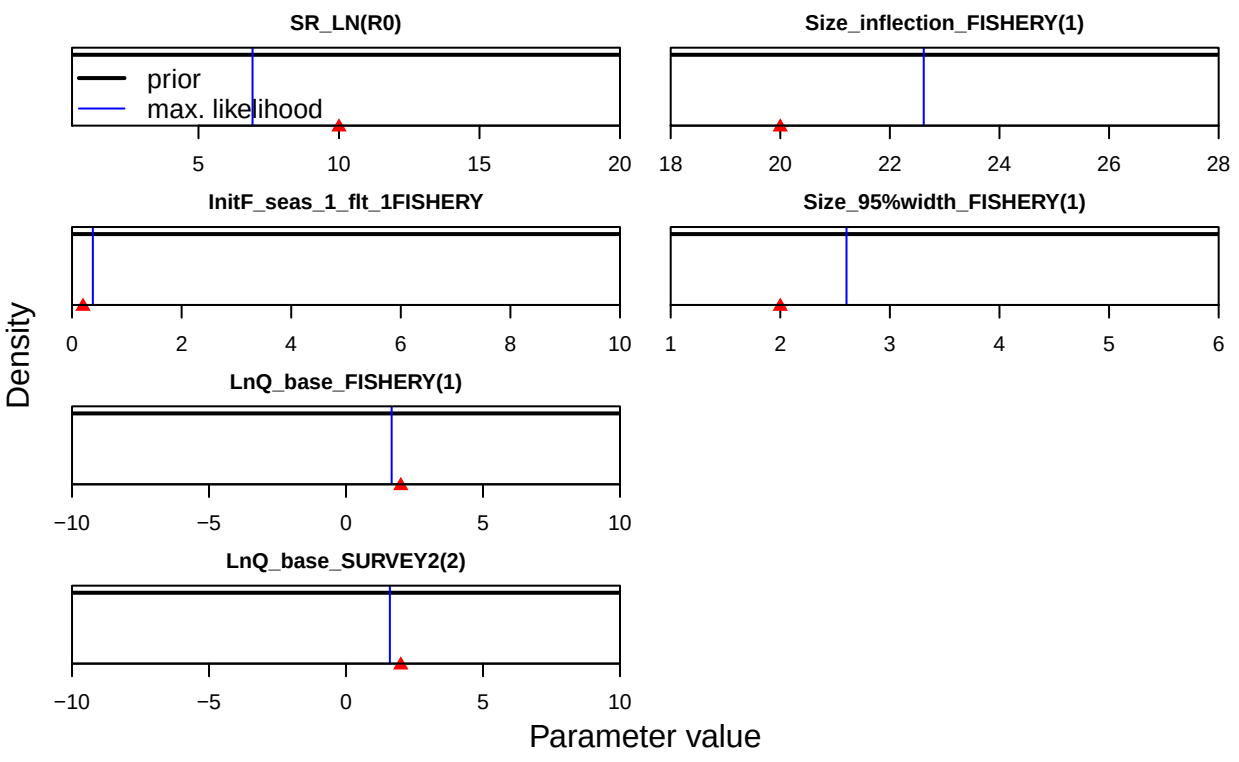

Equilibrium yield (mt)
0
2
4
6
8
0.0
0.2
0.4
0.6
0.8
1.0
Fraction unfished
MSY
B target
SPR target
Current


Surplus production (mt)
−2
0
2
4
6
0
10
20
30
40
Total biomass (mt)


Yield per recruit (kg)
0.000
0.002
0.004
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
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
LnQ_base_SURVEY2(2)
−10
−5
0
5
10
Density
Parameter value