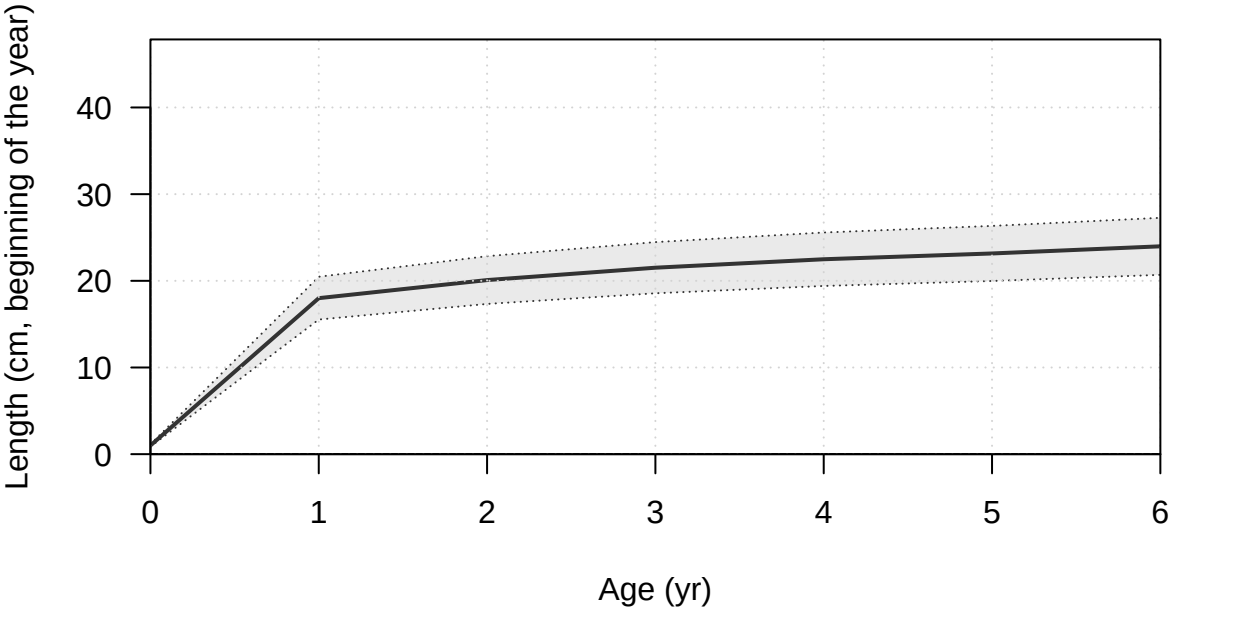
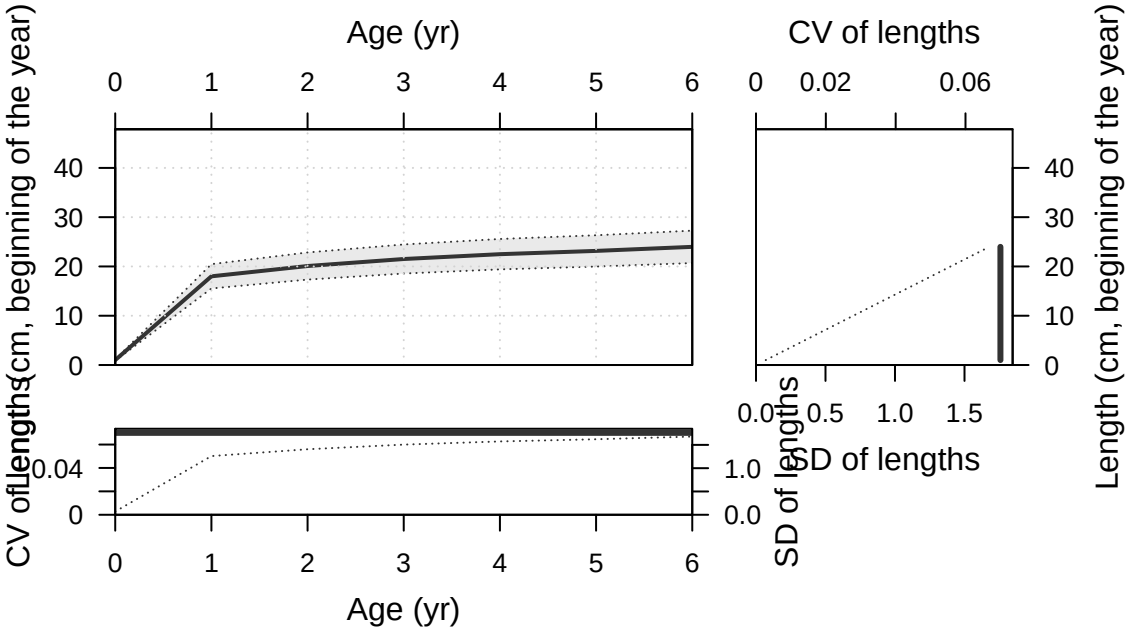
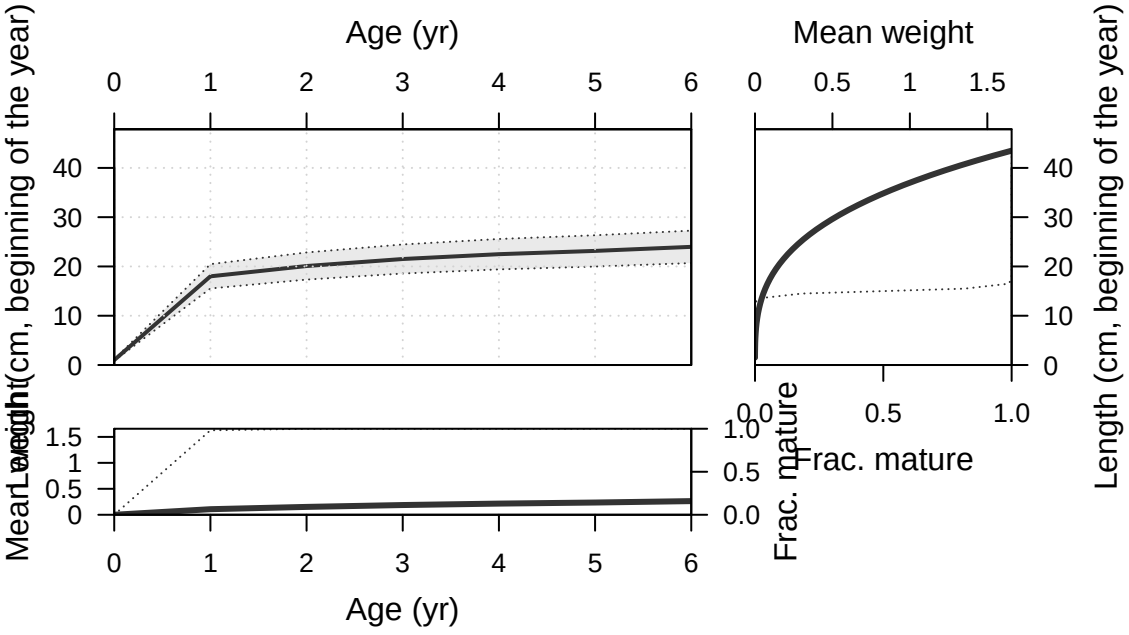
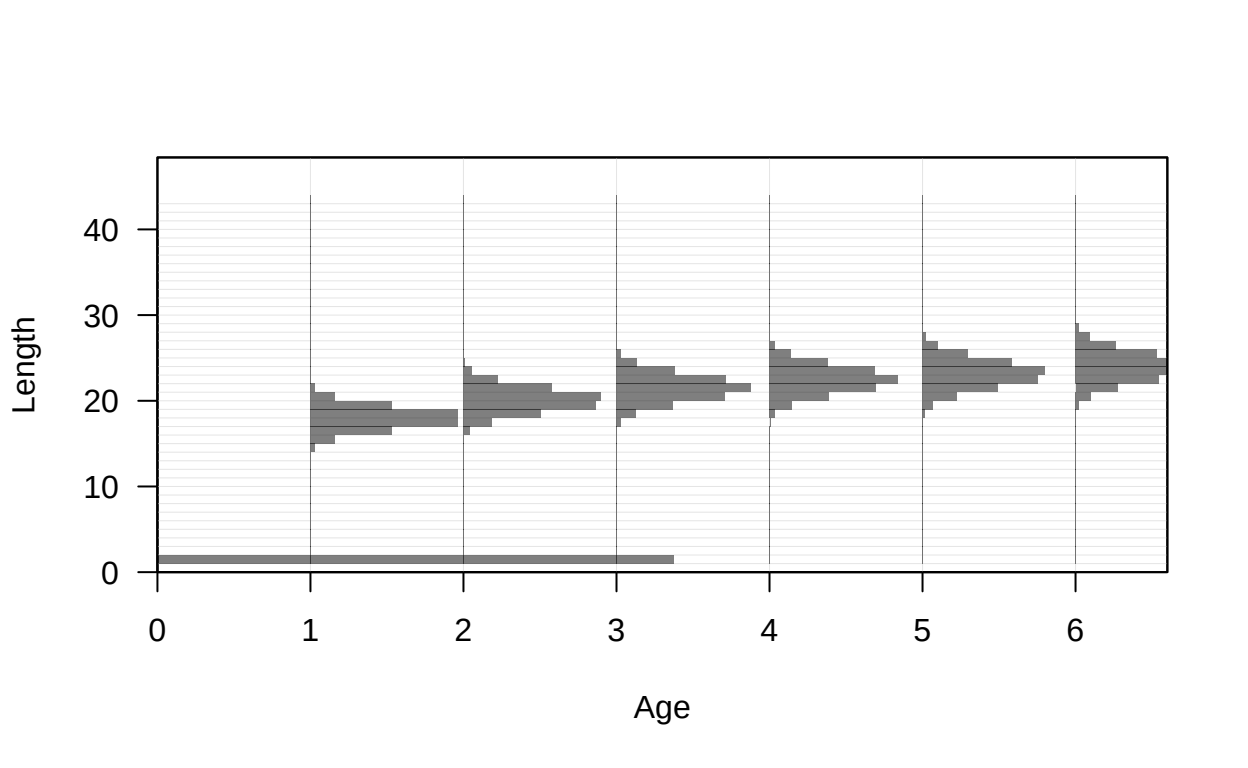
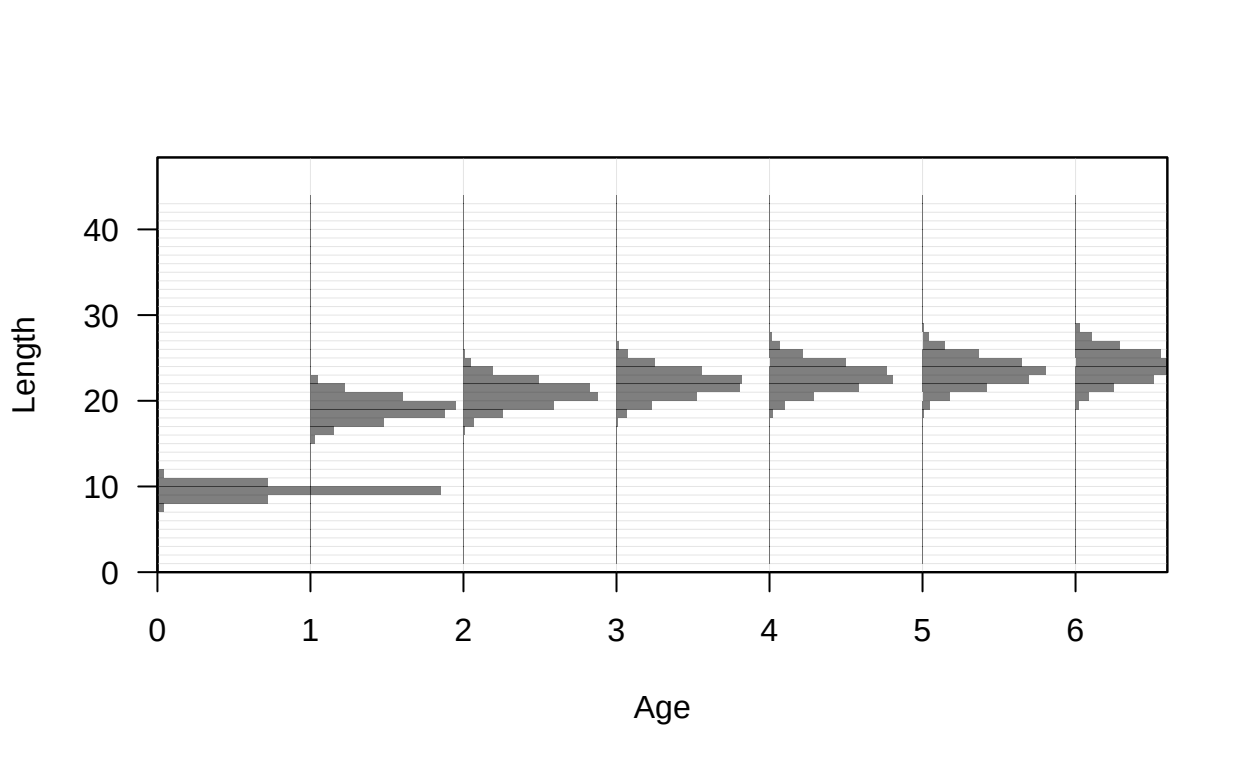
Plots created using the 'r4ss' package in R
Stock Synthesis version: 3.30.19.0
StartTime: Sat Jul 23 09:14:08 2022
Data_File: data.ss
Control_File: control.ss

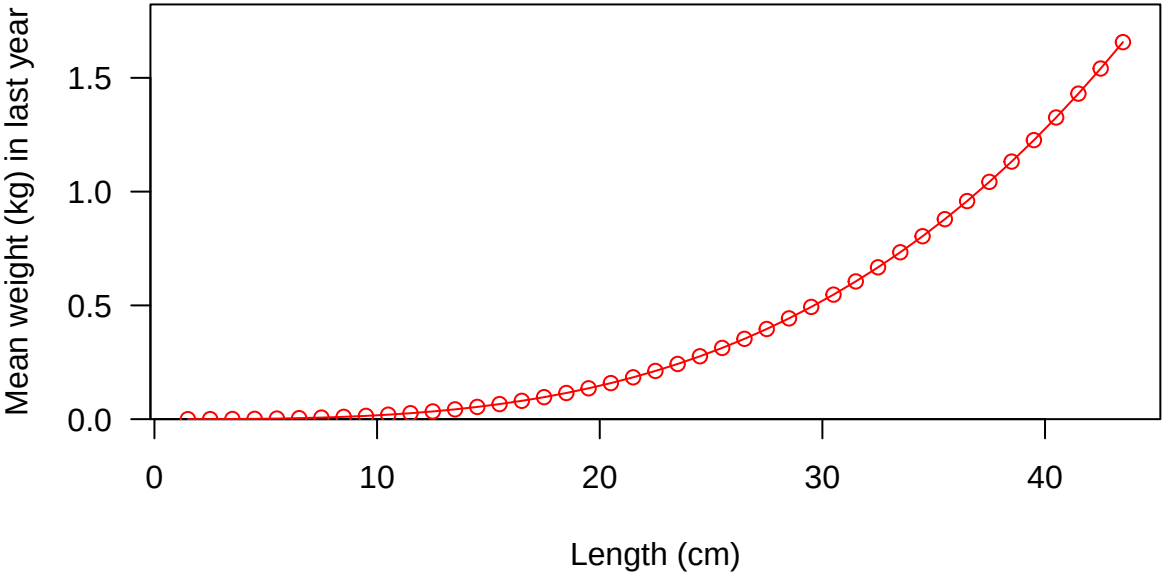

Length (cm, beginning of the year)
0
10
20
30
40
0
1
2
3
4
5
6
Age (yr)

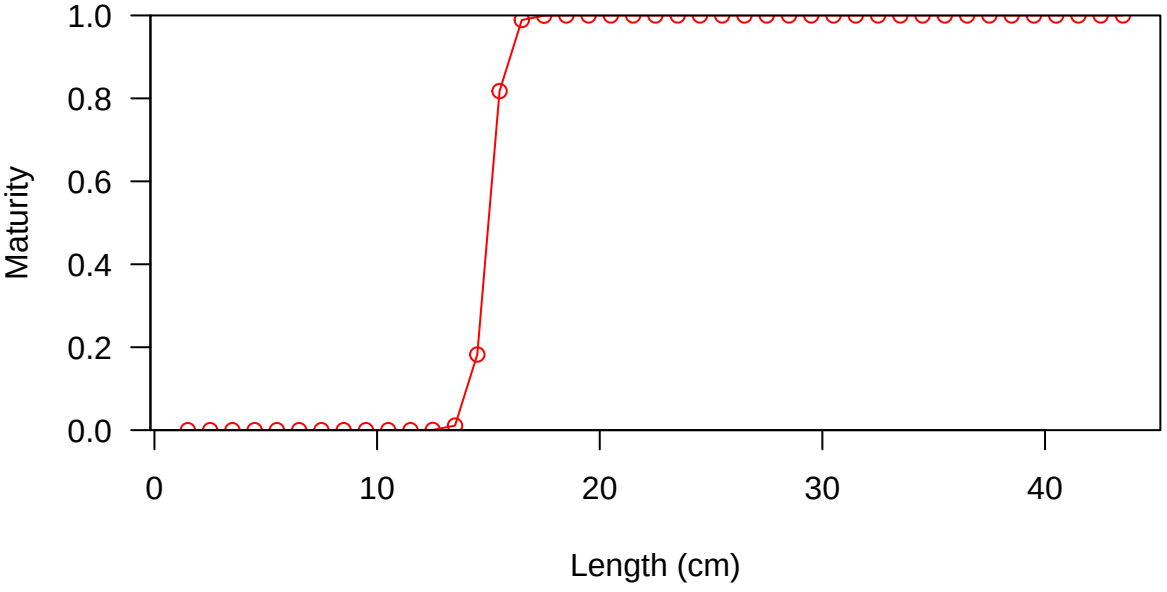

Age (yr)
0
1
2
3
4
5
6
Length (cm, beginning of the year)
0
10
20
30
40
CV of lengths
0
0.02
0.06
SD of lengths
0.0
0.5
1.0
1.5
CV of lengths
0
0.04
SD of lengths
0.0
1.0
Age (yr)

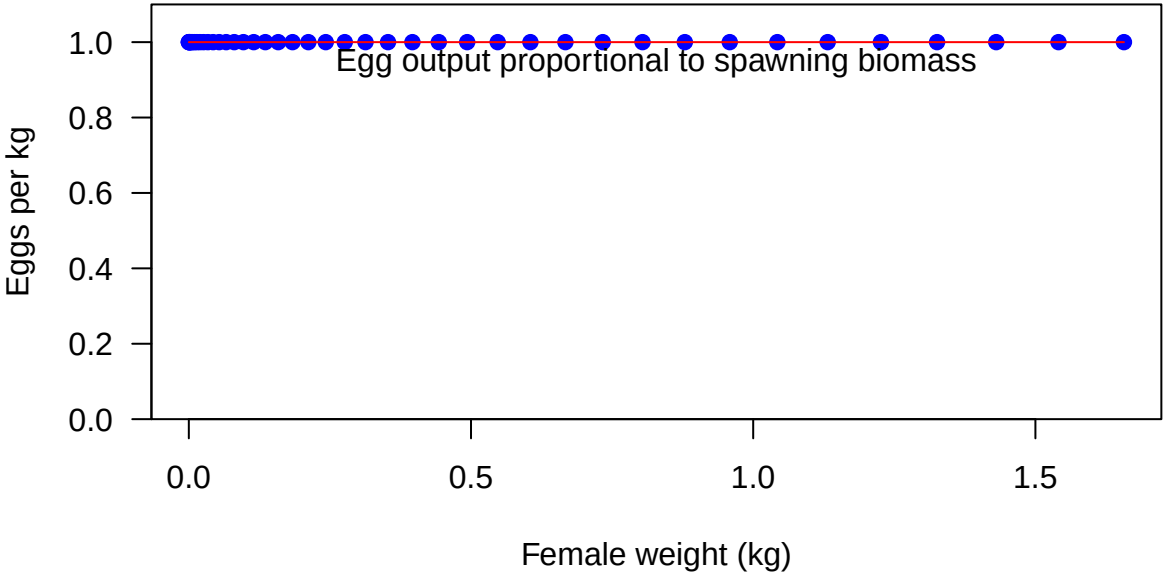

Age (yr)
0
1
2
3
4
5
6
Length (cm, beginning of the year)
40
30
20
10
0
Mean weight
0
0.5
1
1.5
Frac. mature
0.0
0.5
1.0
Mean weight
1.5
1
0.5
0
Age (yr)

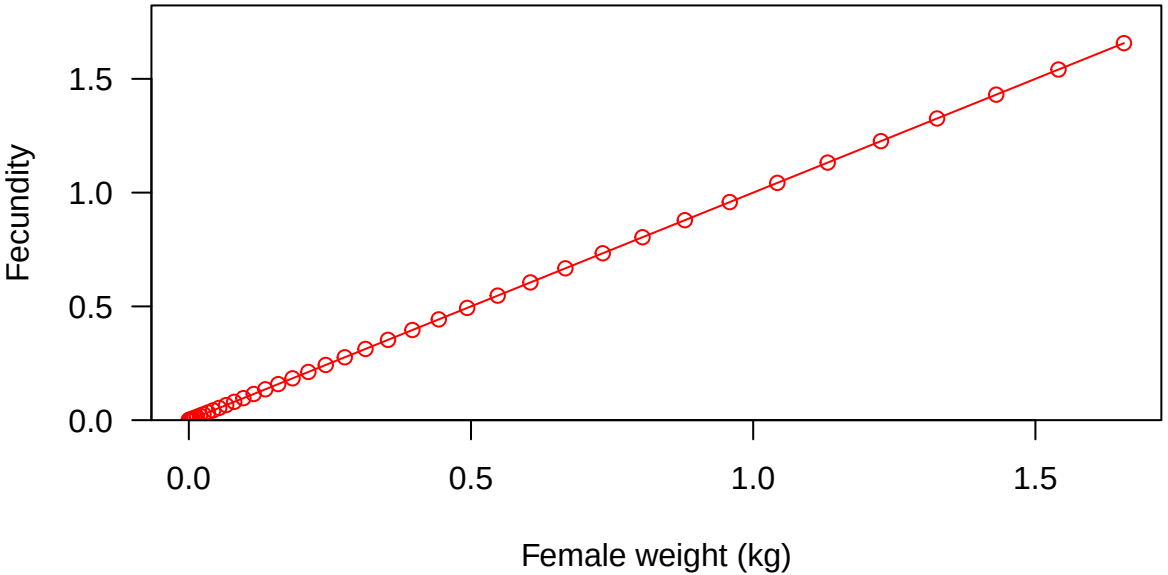

Length
0
10
20
30
40
0
1
2
3
4
5
6
Age

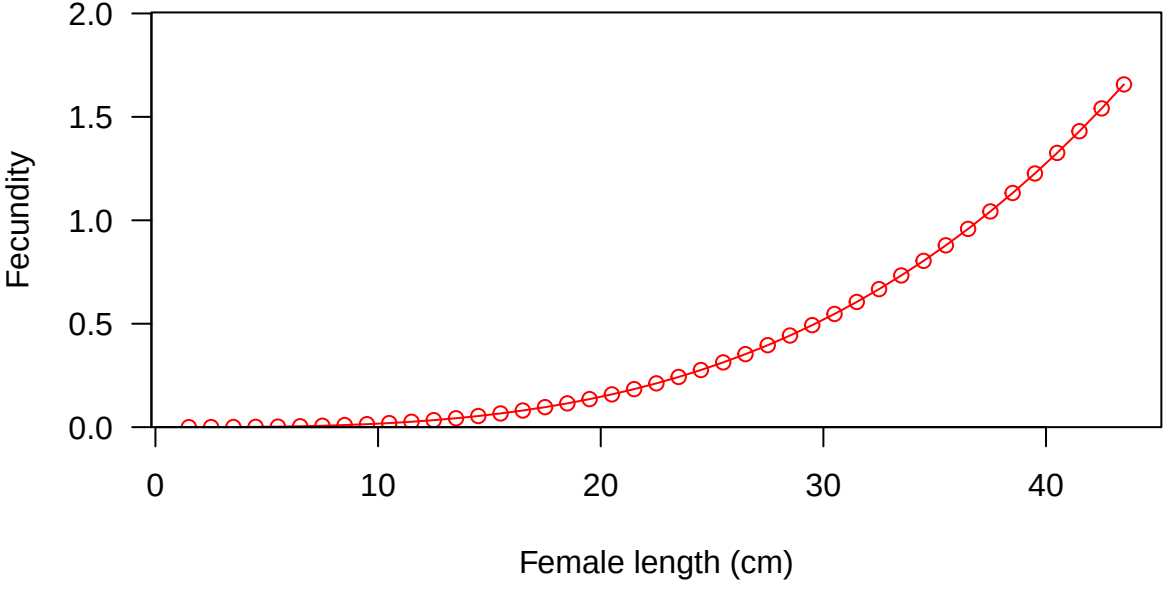

Length
0
10
20
30
40
0
1
2
3
4
5
6
Age

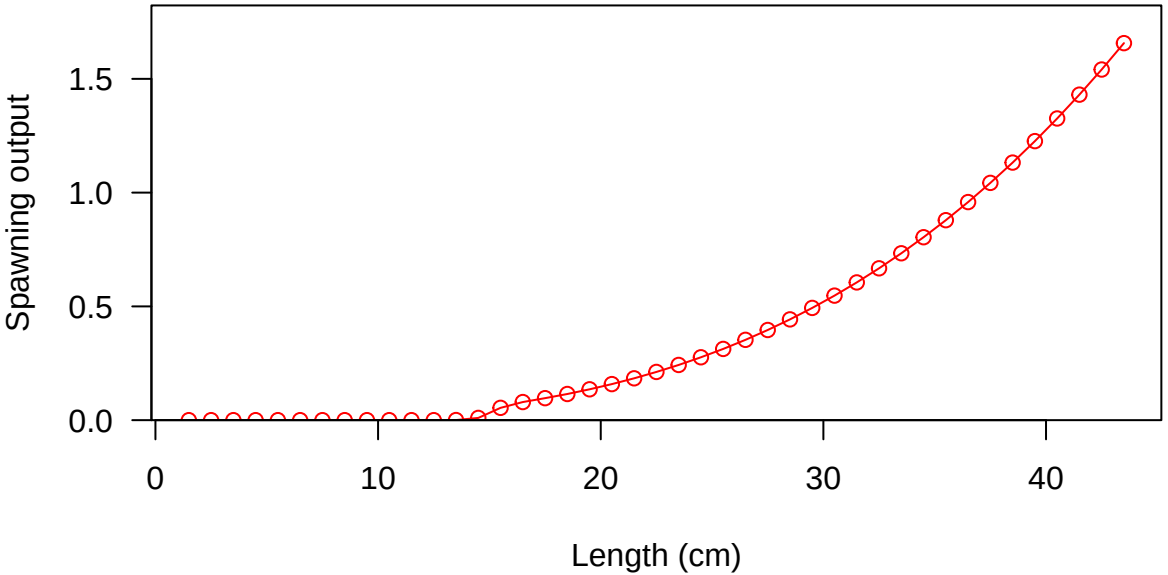

Mean weight (kg) in last year
0.0
0.5
1.0
1.5
0
10
20
30
40
Length (cm)

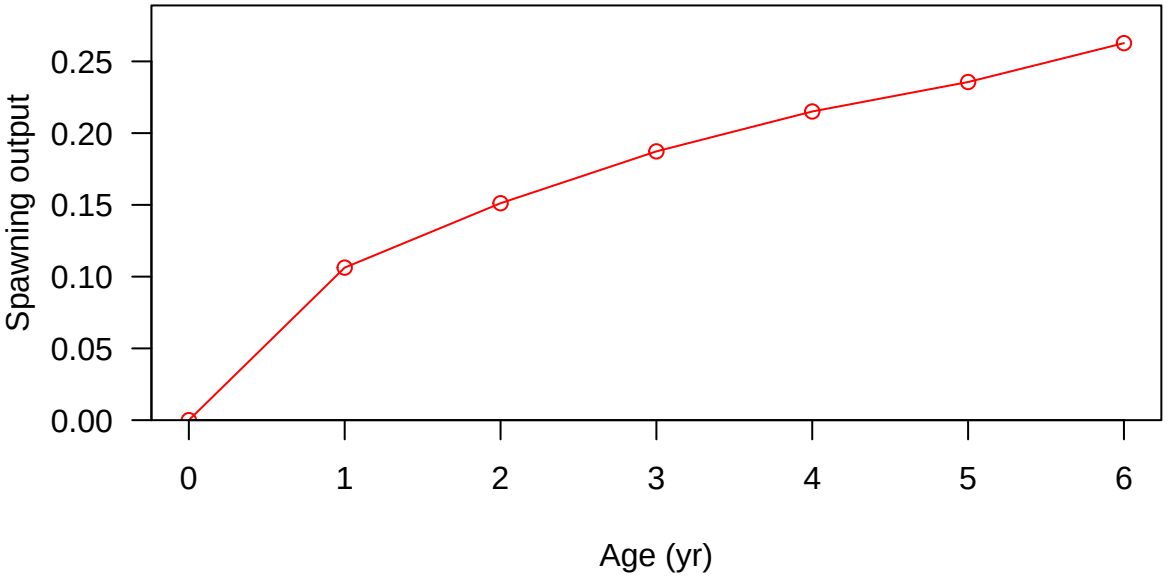

1.0
0.8
0.6
0.4
0.2
0.0
Maturity
0
10
20
30
40
Length (cm)

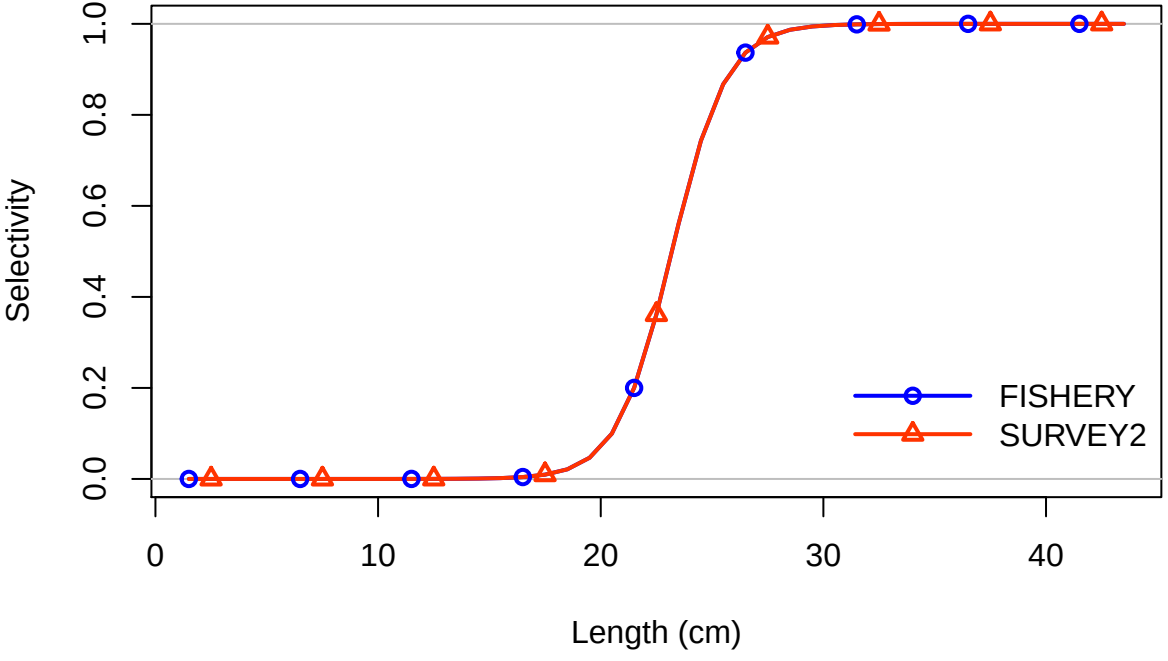

Egg output proportional to spawning biomass
Eggs per kg
1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.5
1.0
1.5
Female weight (kg)

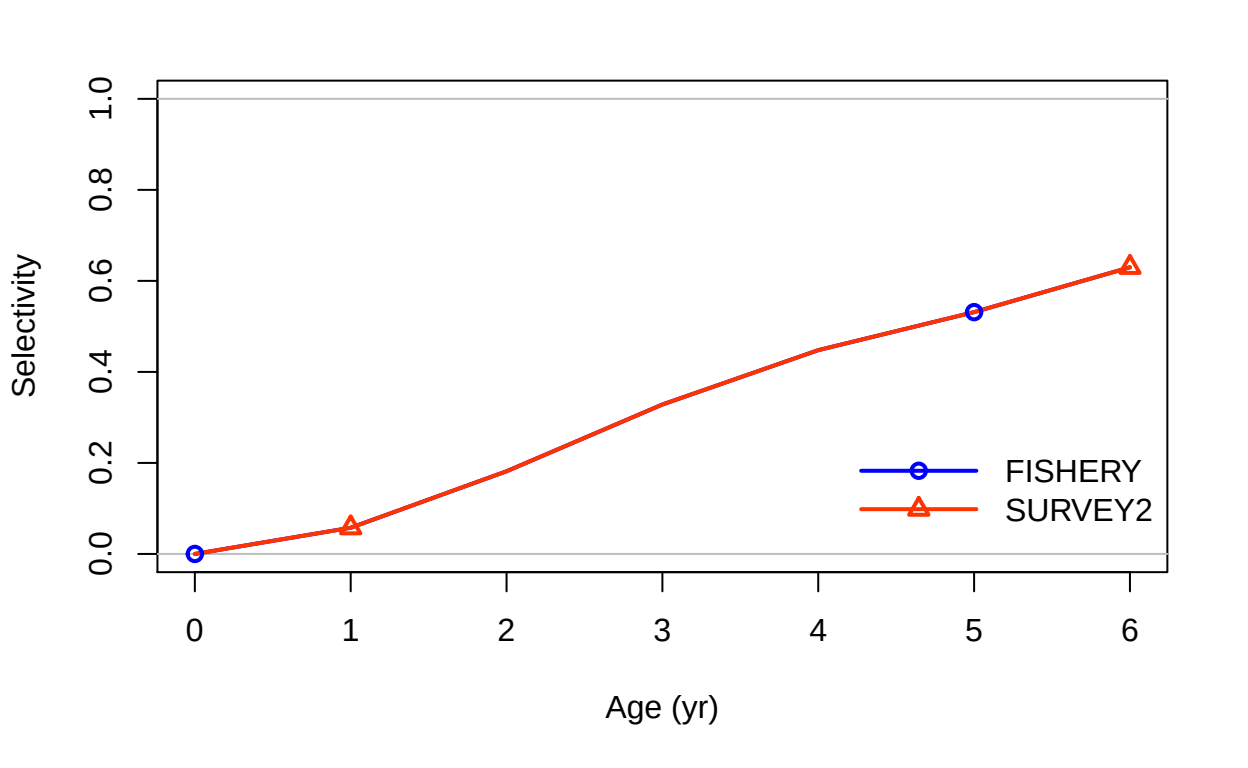

Fecundity
0.0
0.5
1.0
1.5
0.0
0.5
1.0
1.5
Female weight (kg)

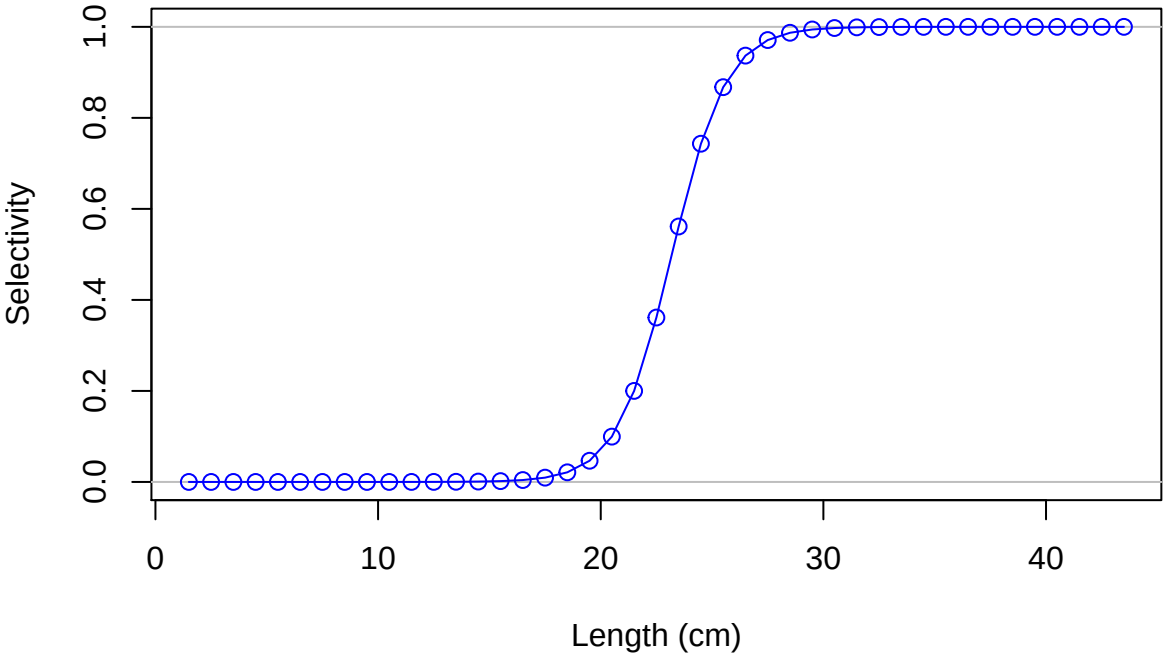

2.0
1.5
1.0
0.5
0.0
Fecundity
0
10
20
30
40
Female length (cm)

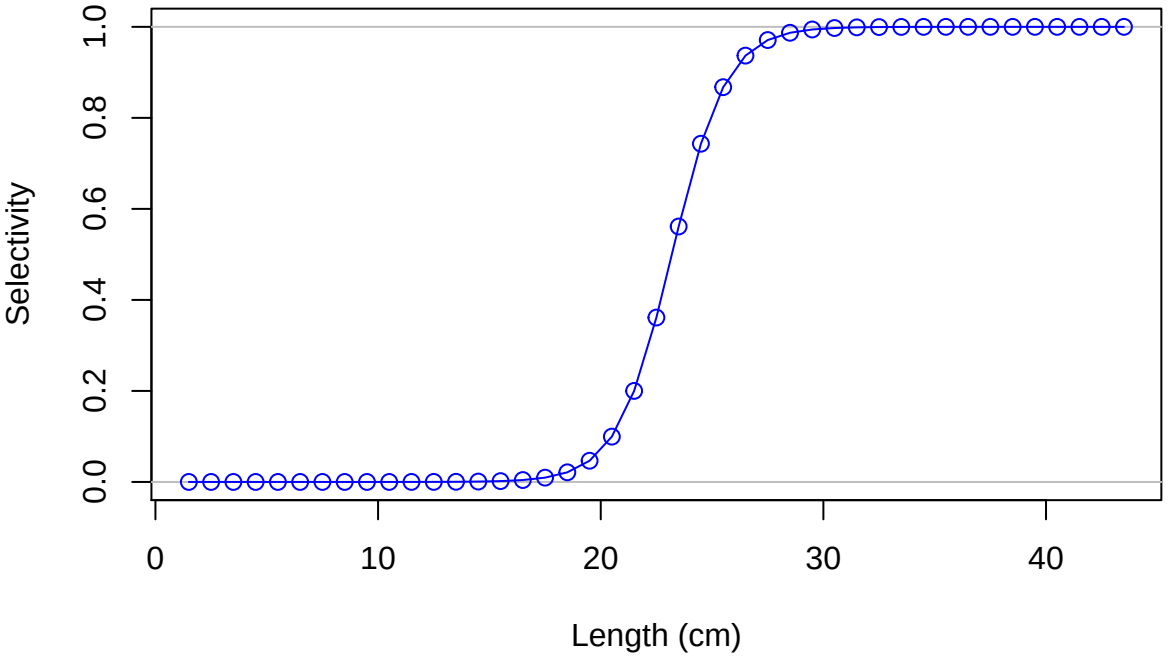

Spawning output
0.0
0.5
1.0
1.5
0
10
20
30
40
Length (cm)

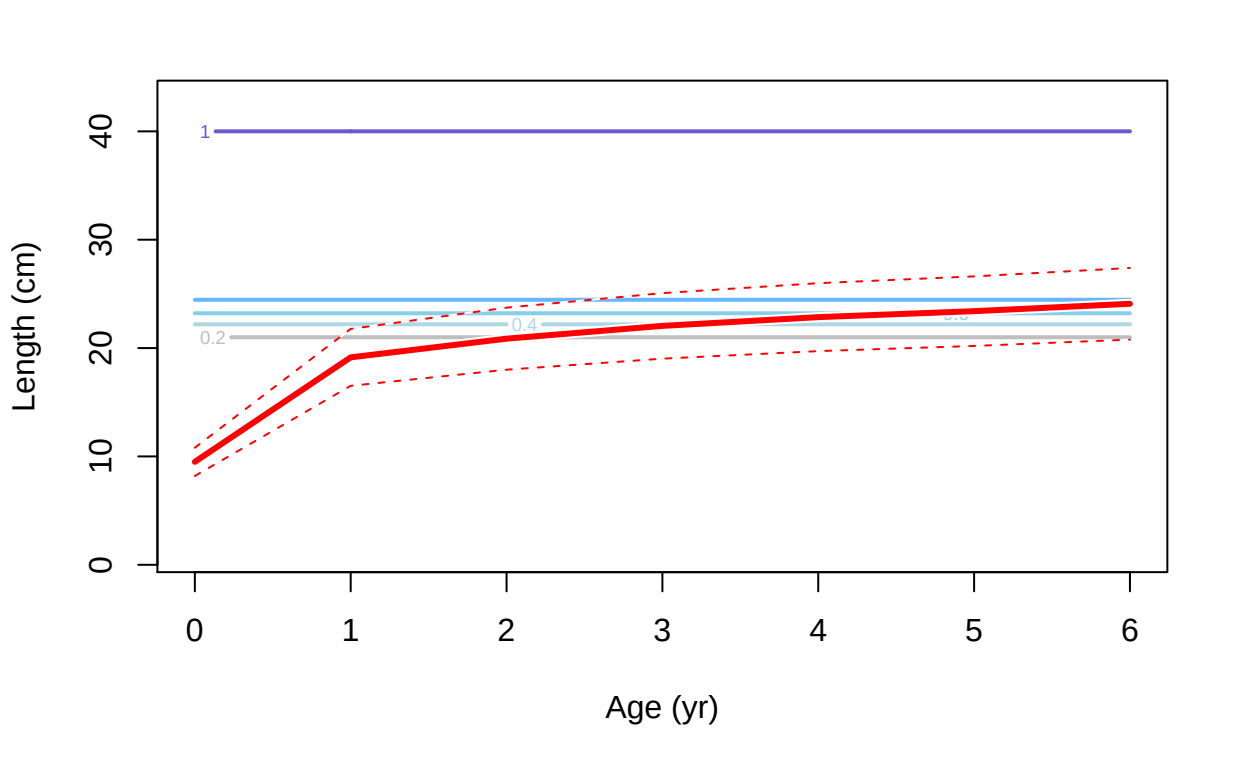

Spawning output
0.00
0.05
0.10
0.15
0.20
0.25
0
1
2
3
4
5
6
Age (yr)

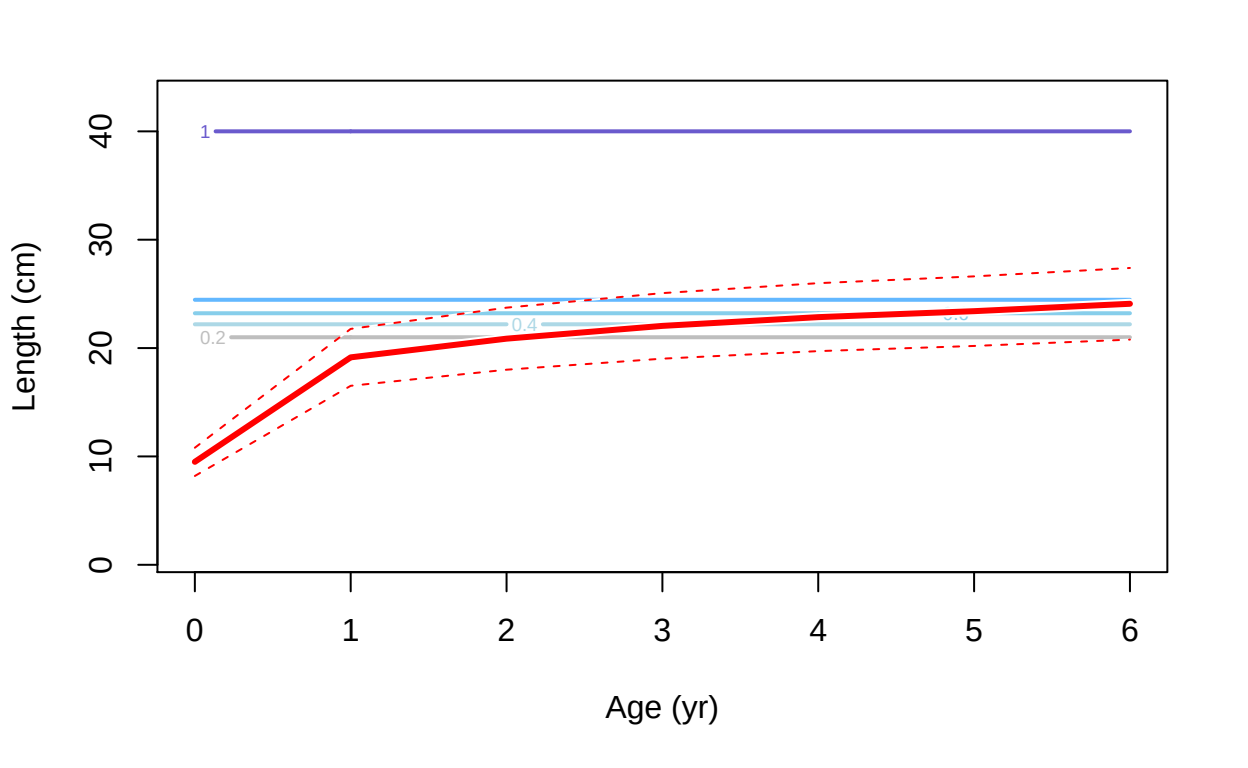

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
10
20
30
40
Length (cm)
FISHERY
SURVEY2

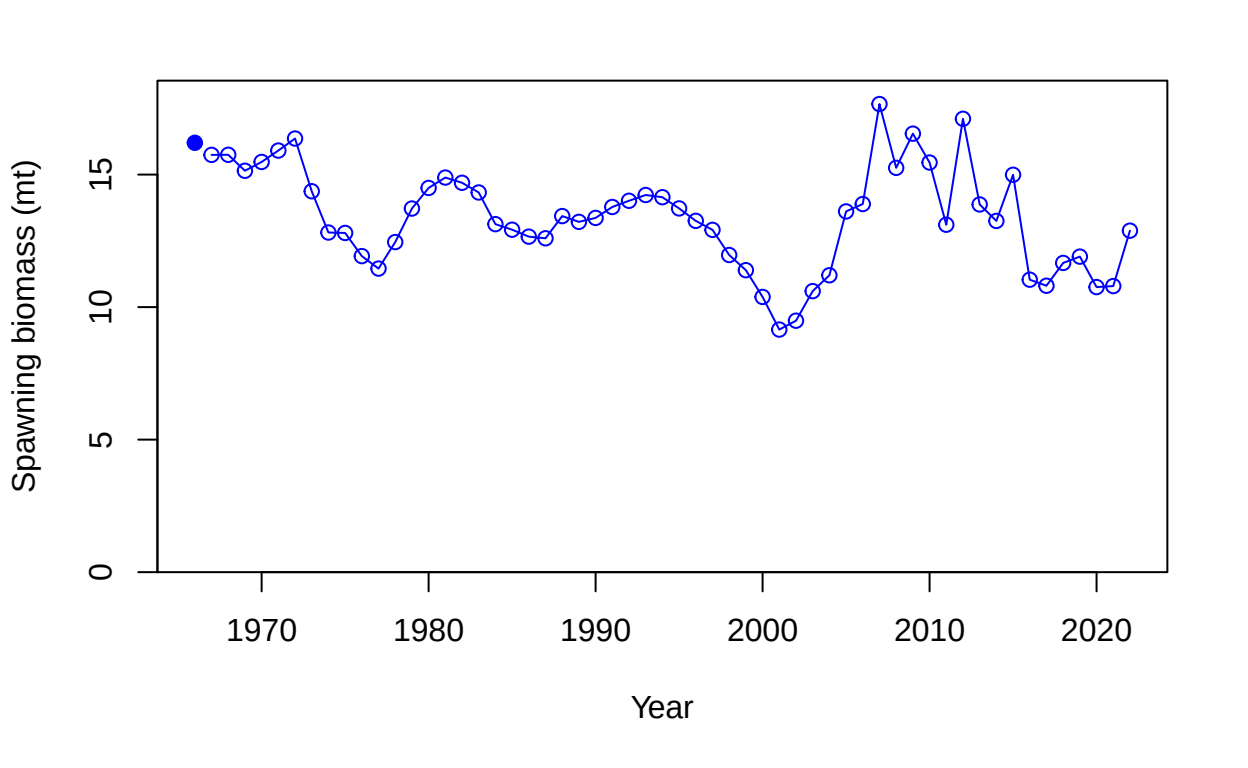

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
1
2
3
4
5
6
Age (yr)
FISHERY
SURVEY2

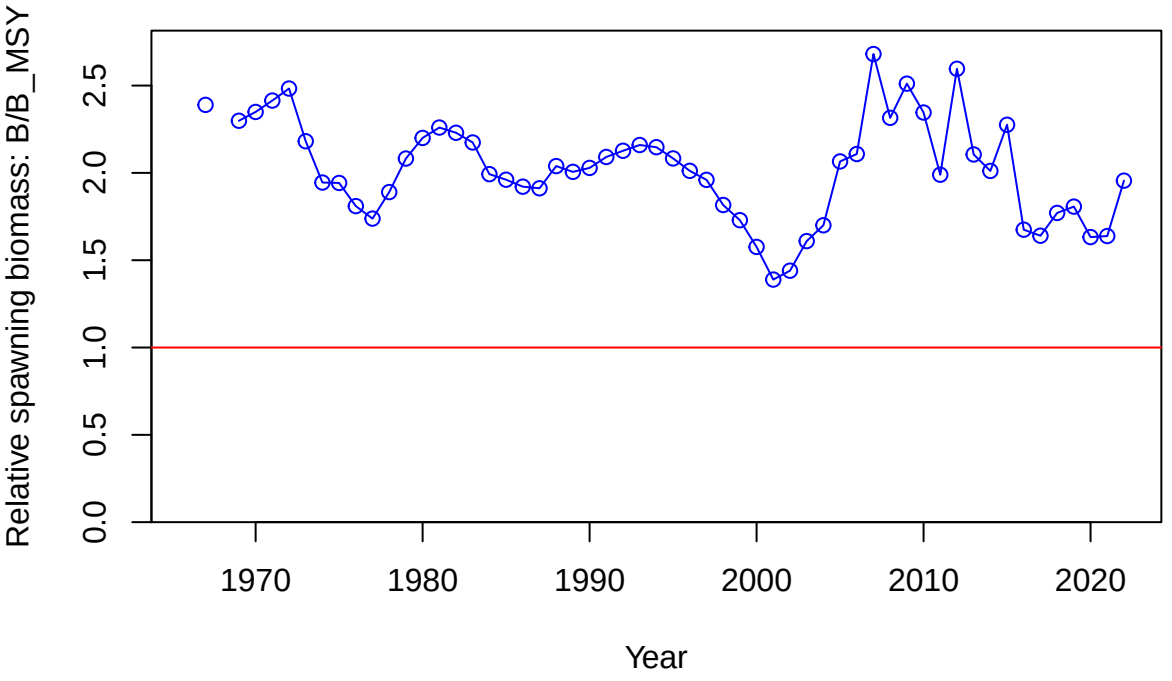

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
10
20
30
40
Length (cm)

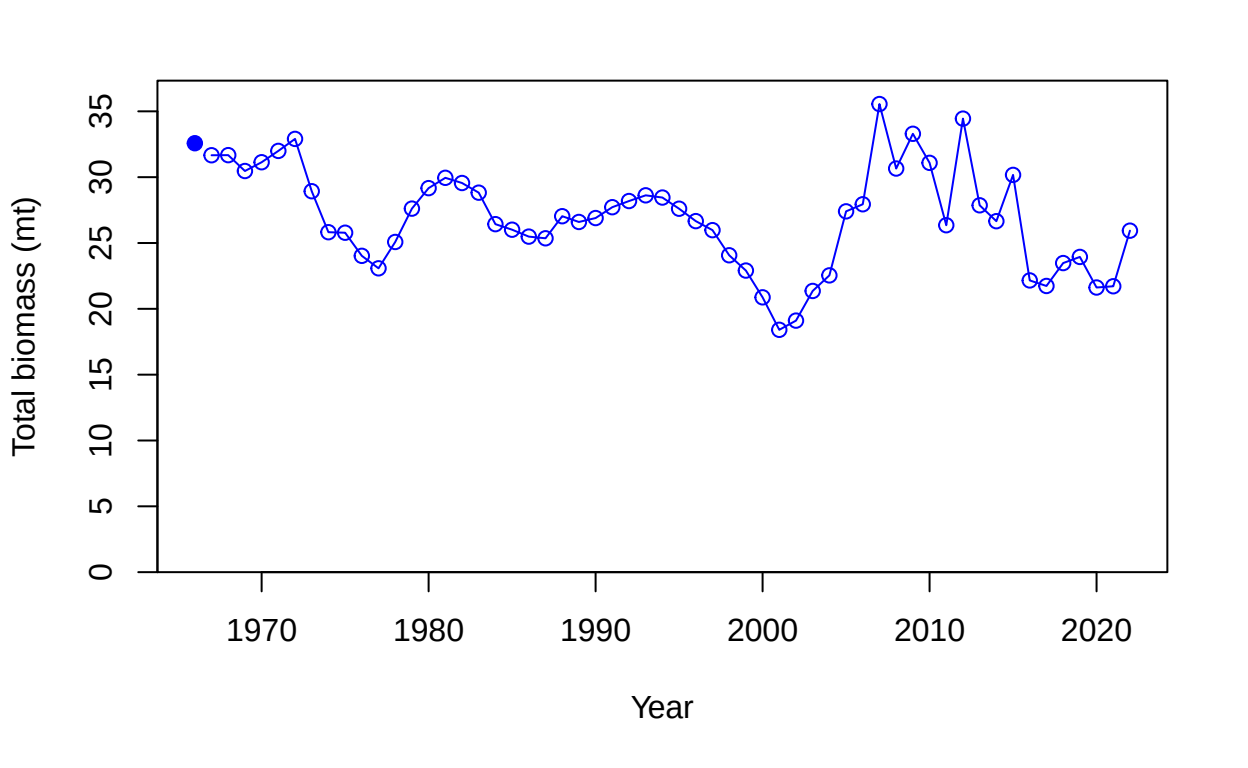

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
10
20
30
40
Length (cm)

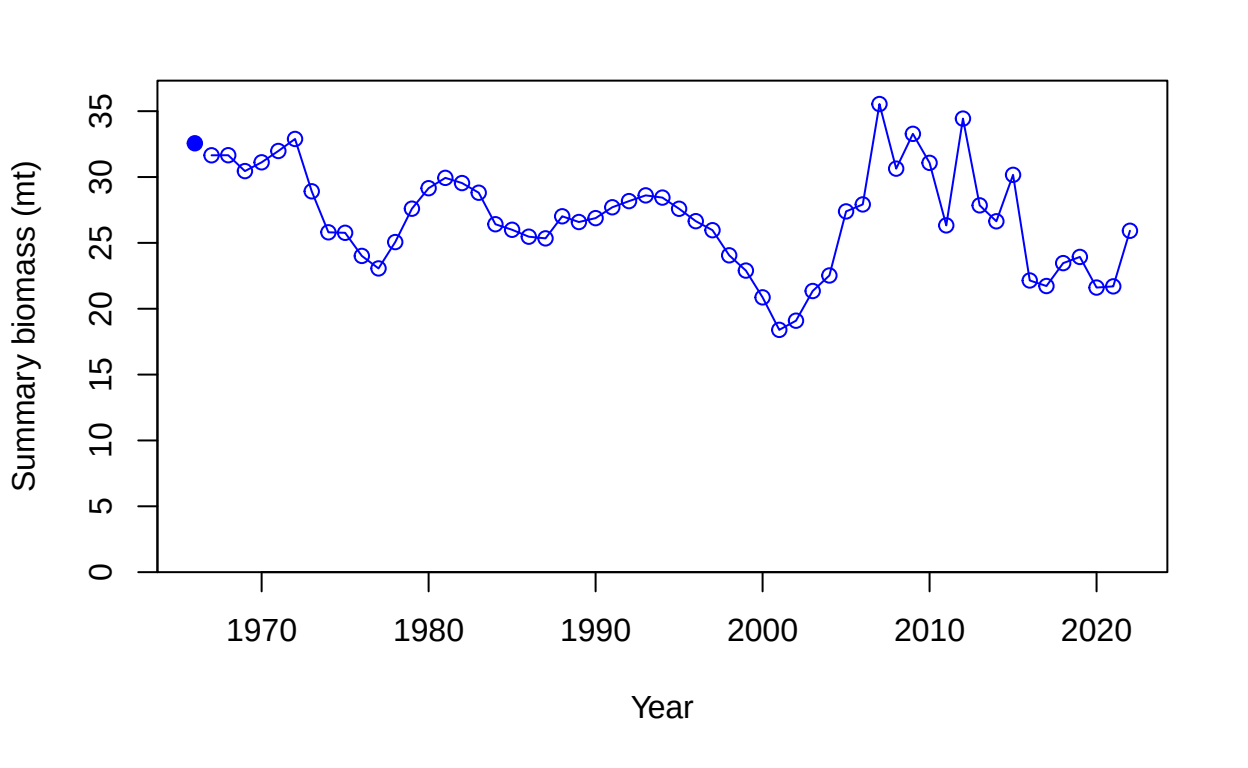

Length (cm)
0
10
20
30
40
1
0.2
0.4
0
1
2
3
4
5
6
Age (yr)

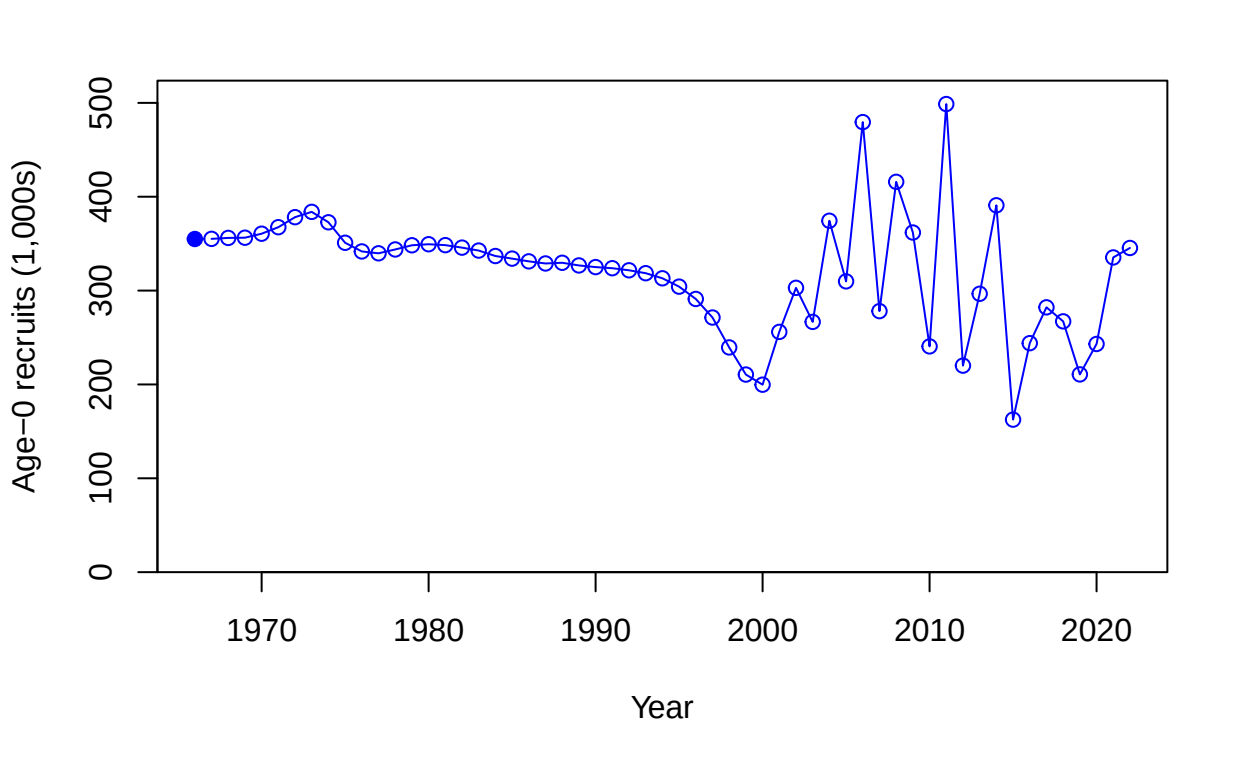

Length (cm)
0
10
20
30
40
1
0.2
0.4
0
1
2
3
4
5
6
Age (yr)

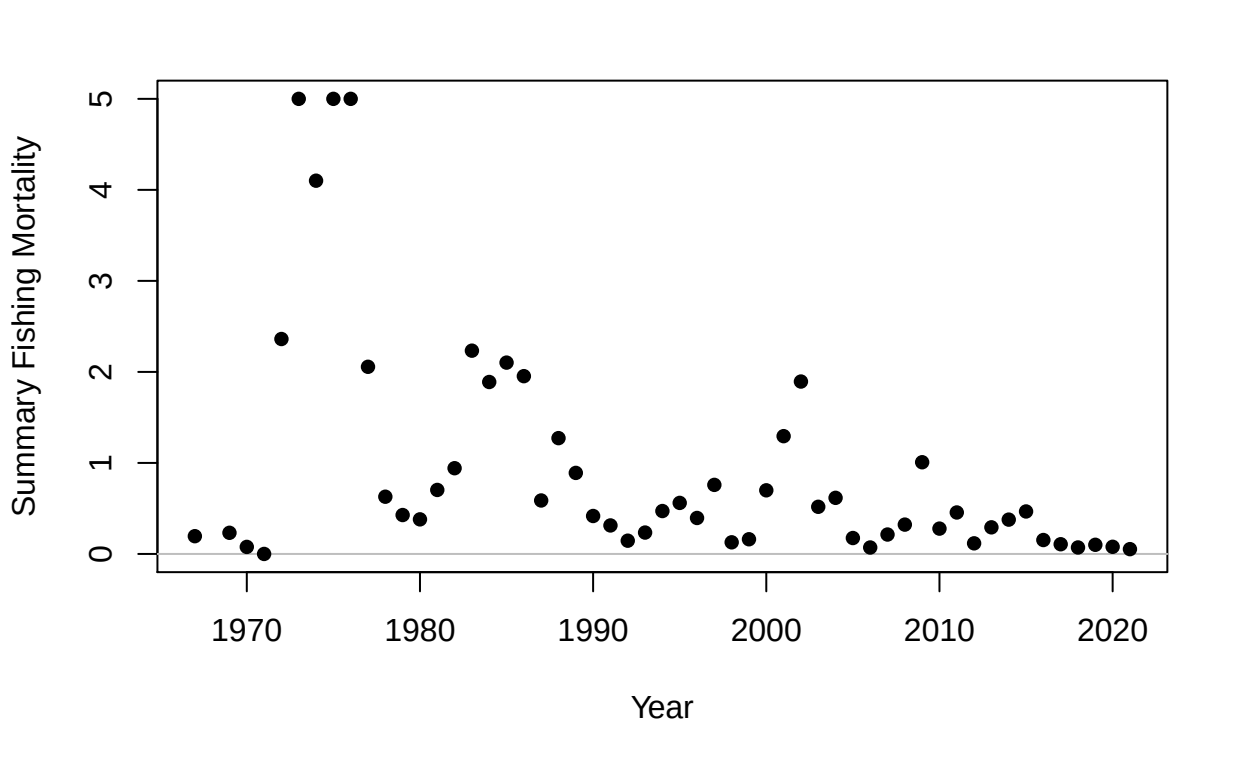

Spawning biomass (mt)
0
5
10
15
1970
1980
1990
2000
2010
2020
Year

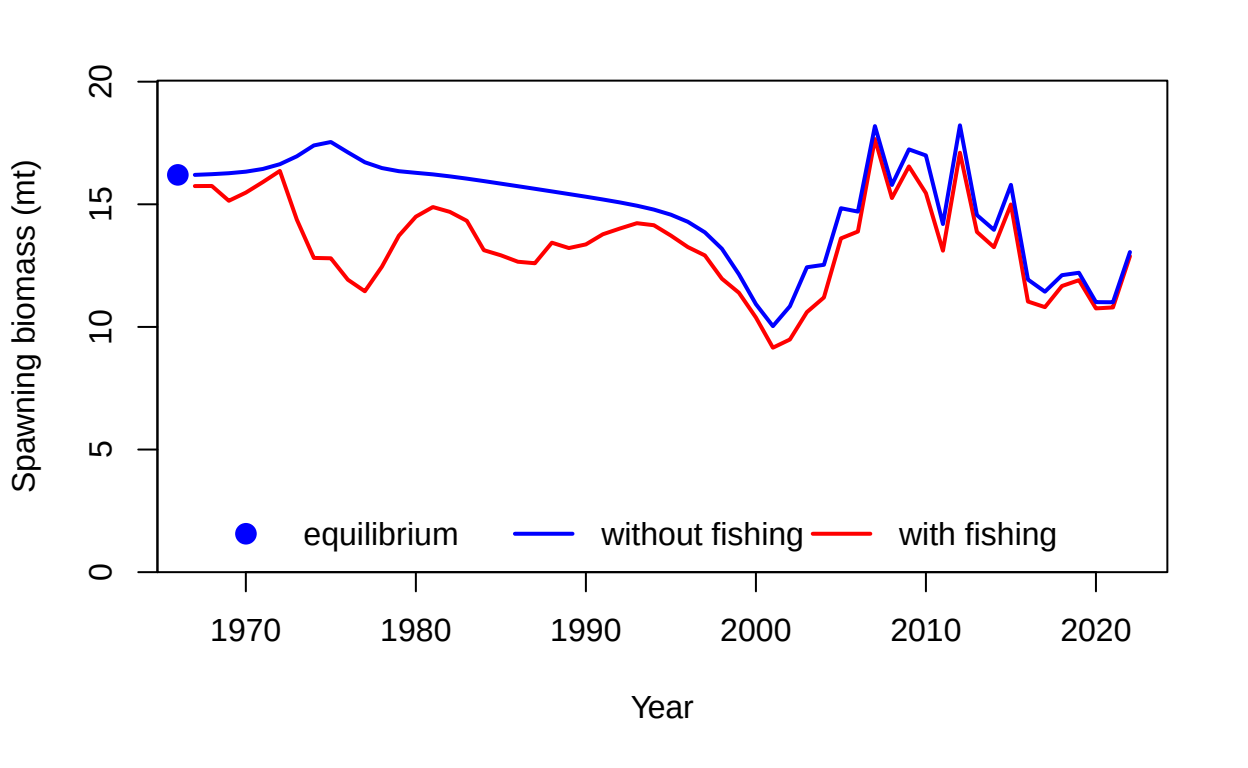

Relative spawning biomass: B/B_MSY
0.0
0.5
1.0
1.5
2.0
2.5
1970
1980
1990
2000
2010
2020
Year

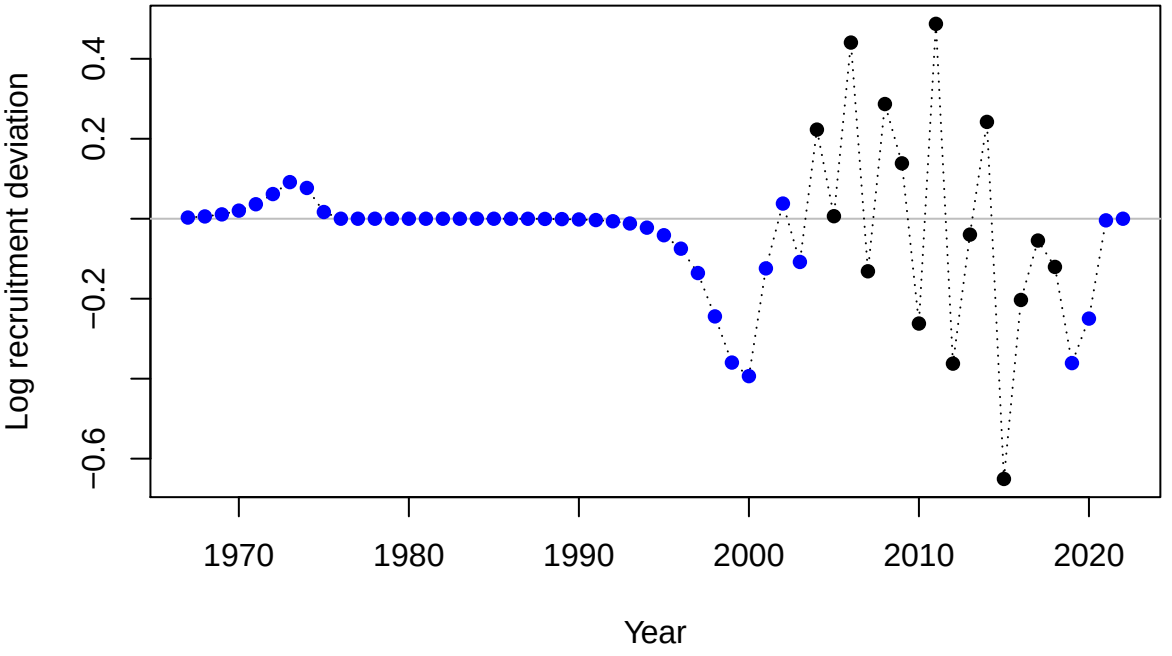

Total biomass (mt)
0
5
10
15
20
25
30
35
1970
1980
1990
2000
2010
2020
Year

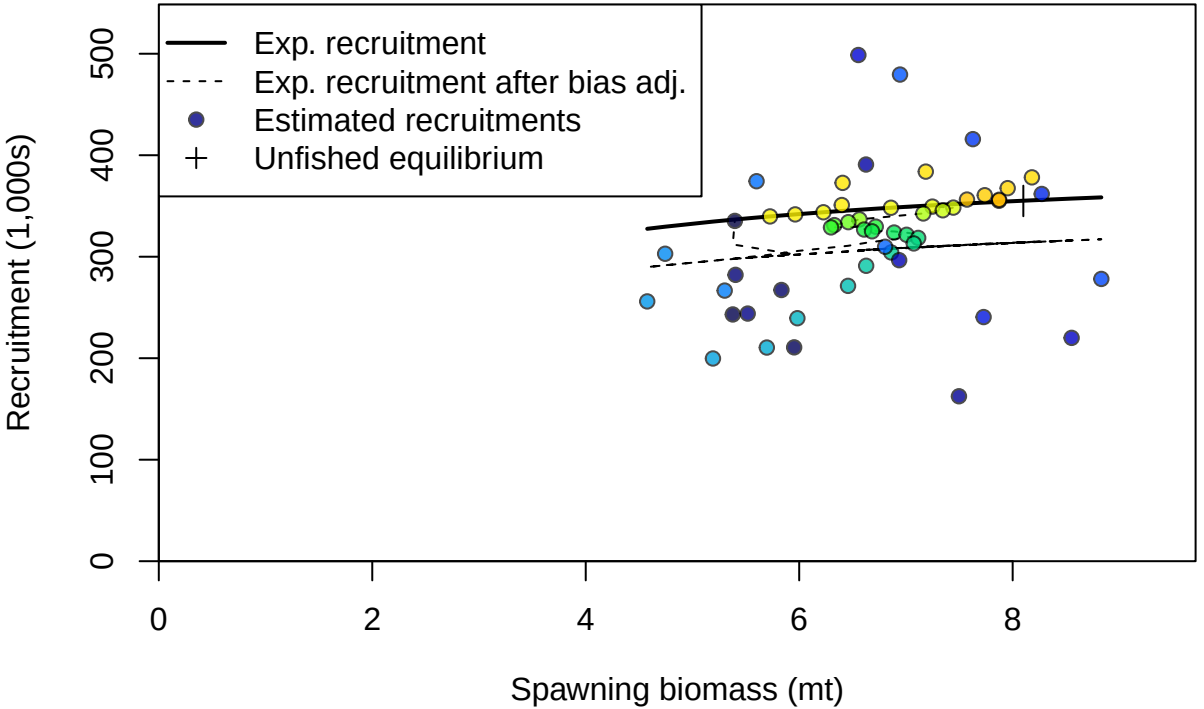

Summary biomass (mt)
0
5
10
15
20
25
30
35
1970
1980
1990
2000
2010
2020
Year

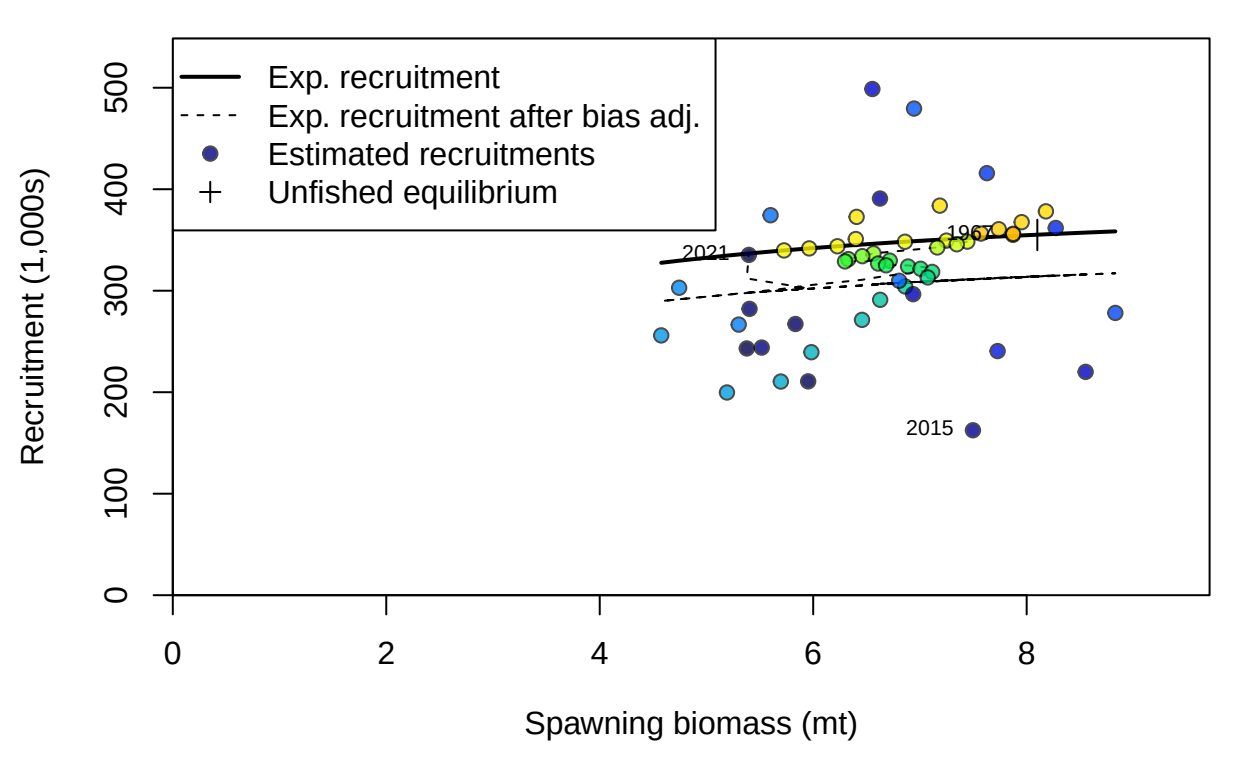

Age−0 recruits (1,000s)
0
100
200
300
400
500
1970
1980
1990
2000
2010
2020
Year

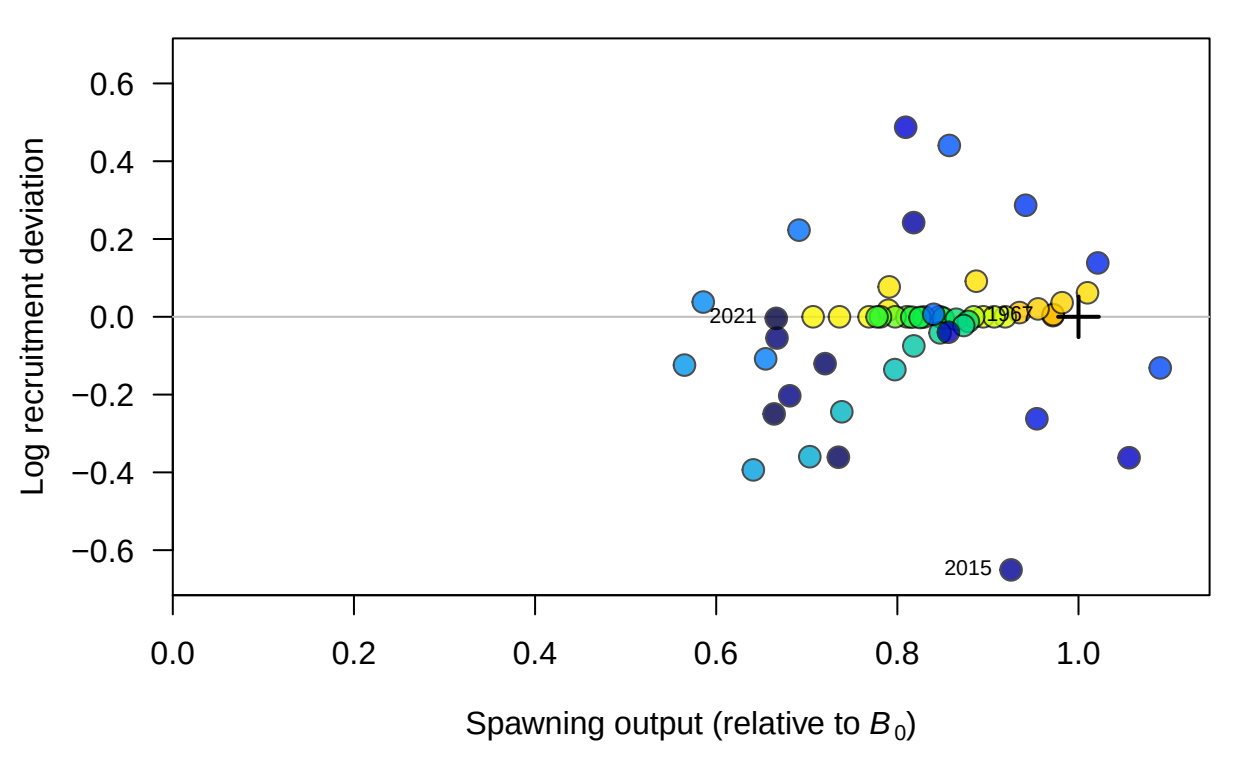

Summary Fishing Mortality
0
1
2
3
4
5
1970
1980
1990
2000
2010
2020
Year

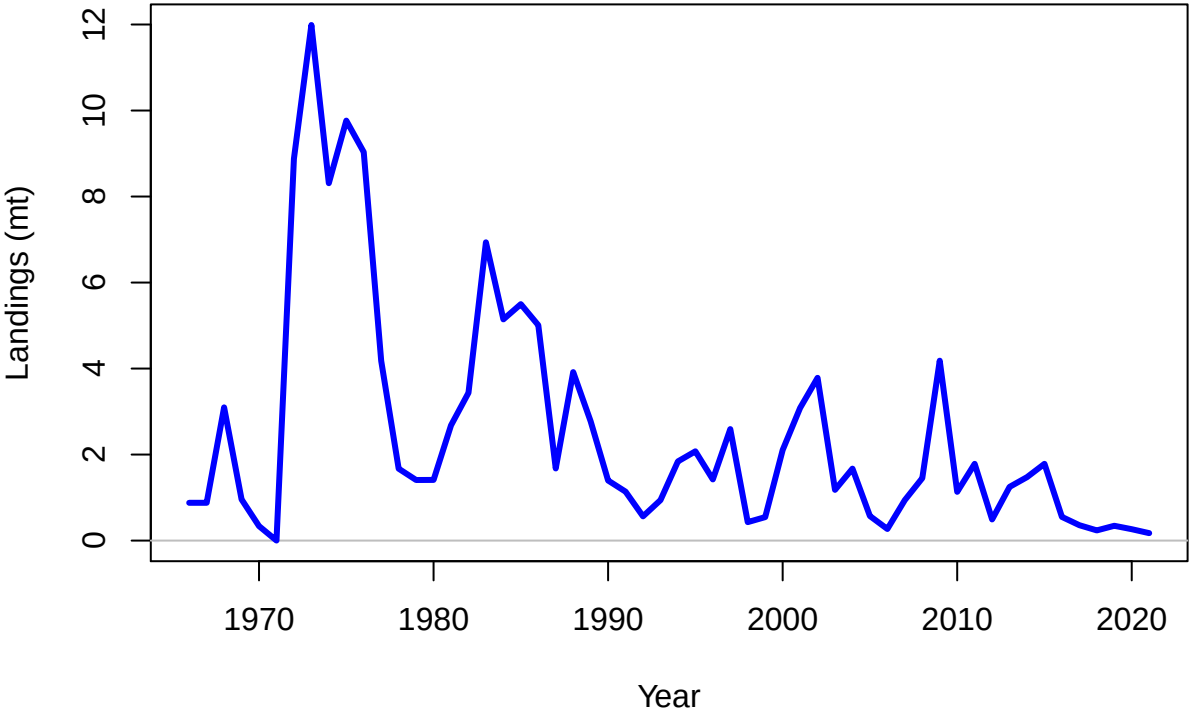

Spawning biomass (mt)
0
5
10
15
20
1970
1980
1990
2000
2010
2020
Year
equilibrium
without fishing
with fishing

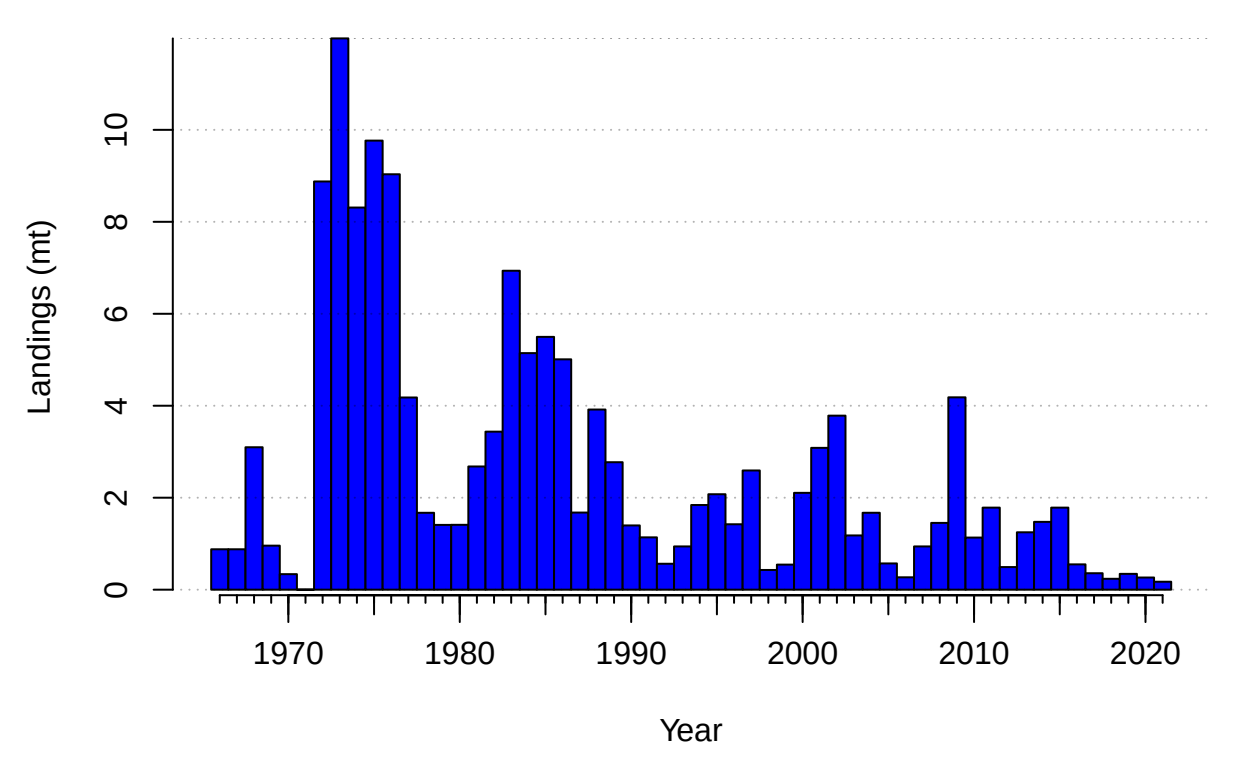

Log recruitment deviation
0.4
0.2
−0.2
−0.6
1970
1980
1990
2000
2010
2020
Year

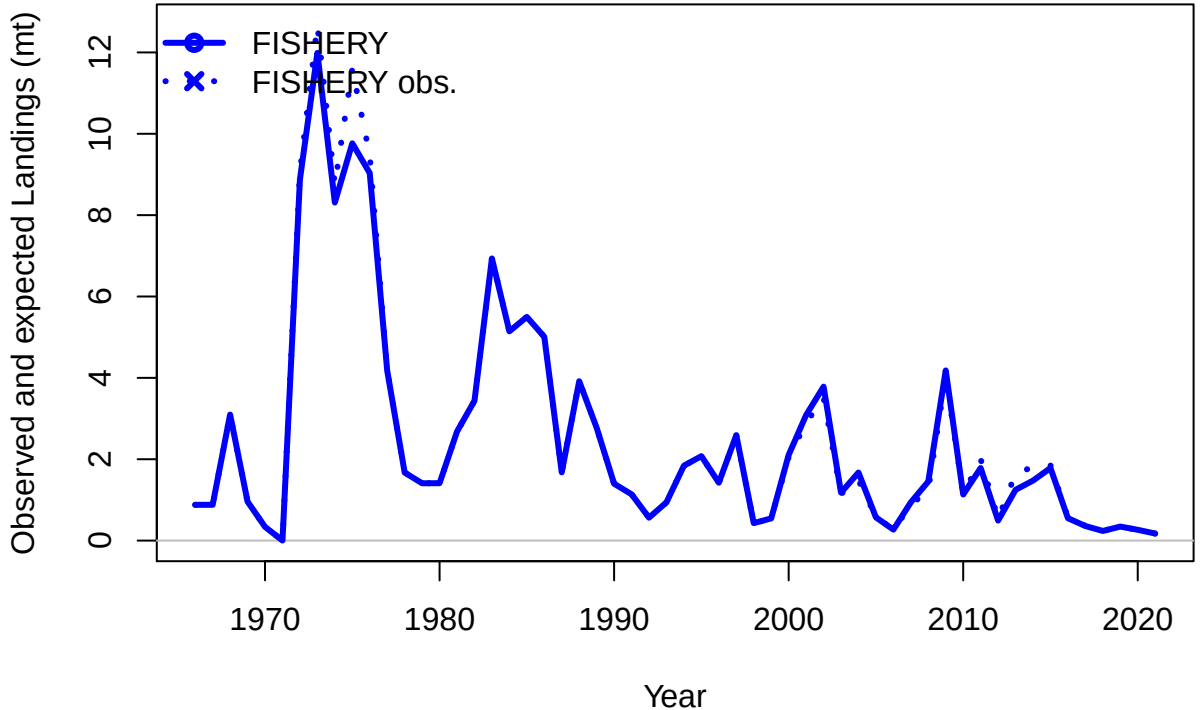

Exp. recruitment
Exp. recruitment after bias adj.
Estimated recruitments
Unfished equilibrium
Recruitment (1,000s)
0
100
200
300
400
500
0
2
4
6
8
Spawning biomass (mt)

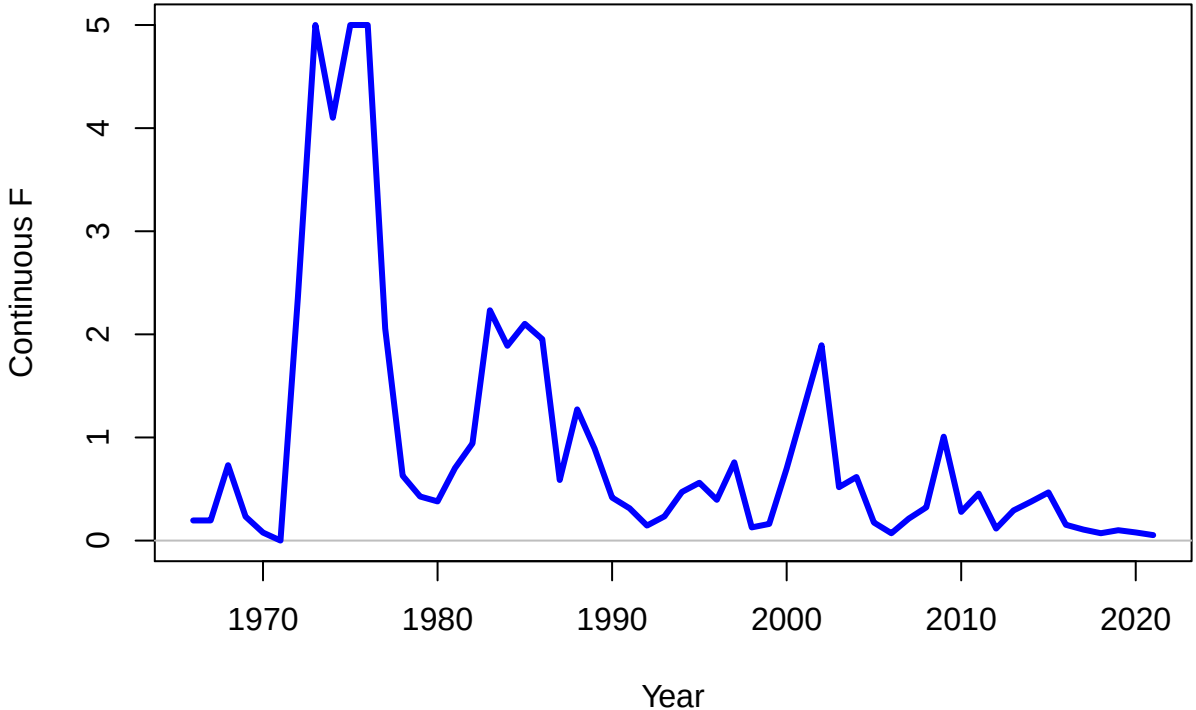

Exp. recruitment
Exp. recruitment after bias adj.
Estimated recruitments
Unfished equilibrium
Recruitment (1,000s)
0
100
200
300
400
500
0
2
4
6
8
Spawning biomass (mt)
2021
1967
2015

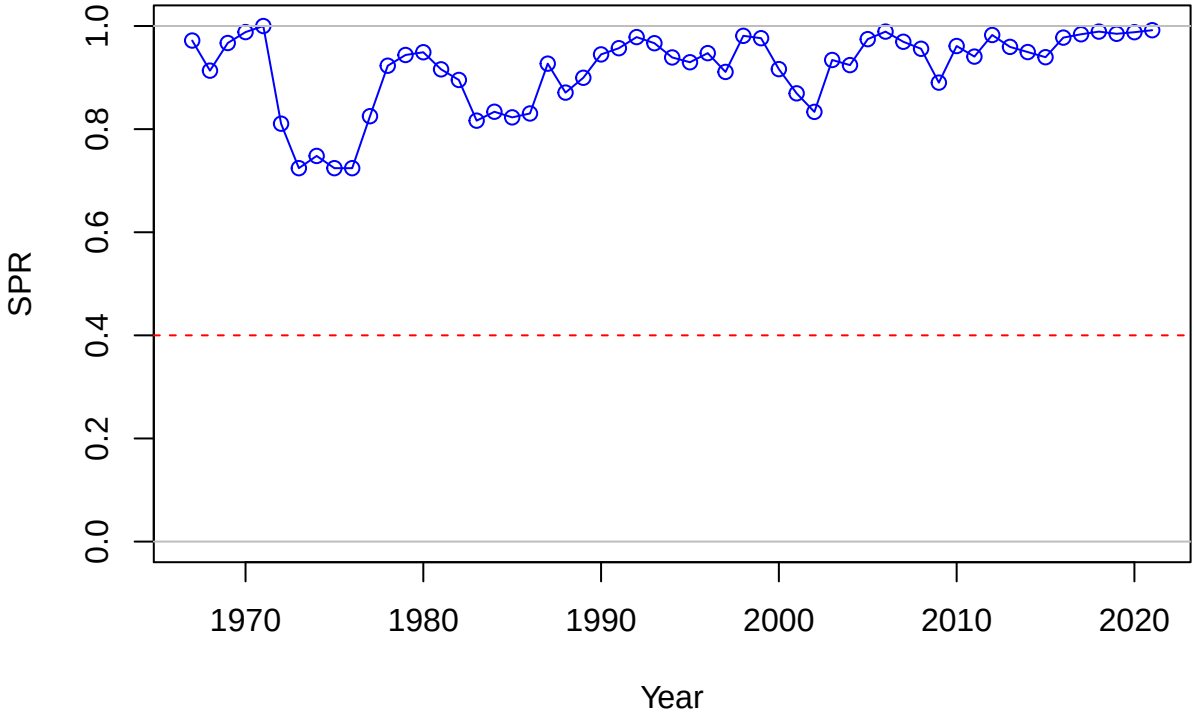

Log recruitment deviation
0.6
0.4
0.2
0.0
−0.2
−0.4
−0.6
2021
1967
2015
0.0
0.2
0.4
0.6
0.8
1.0
Spawning output (relative to B_0)

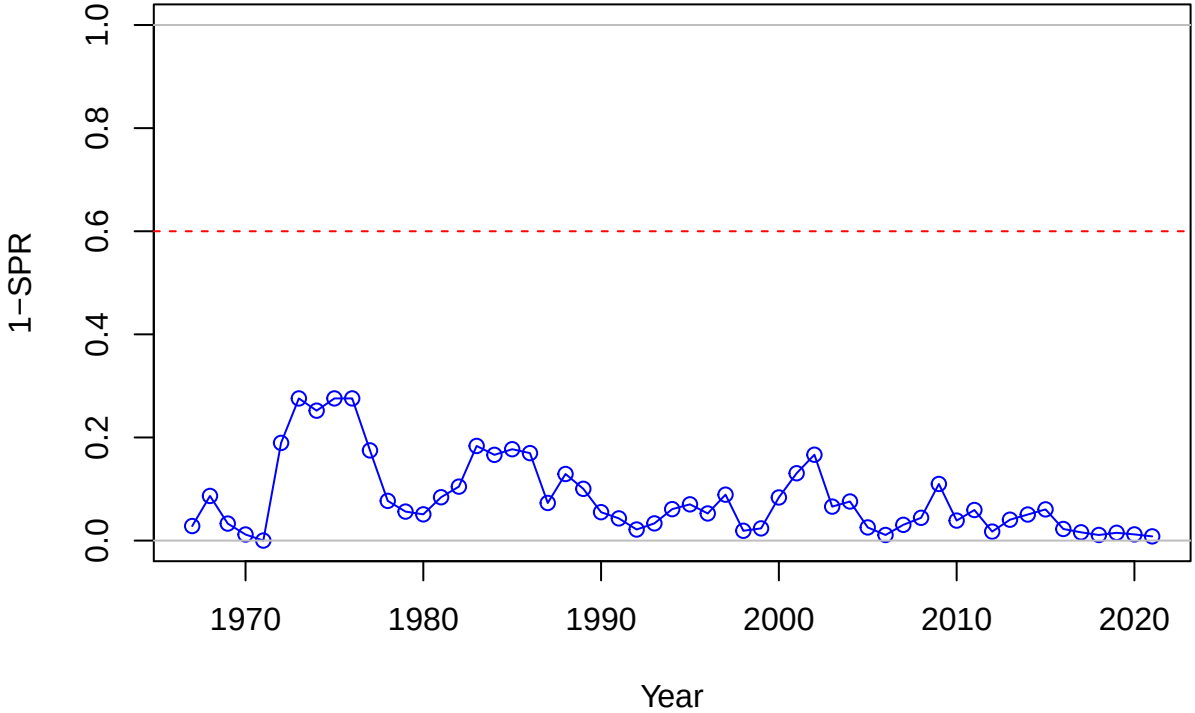

Landings (mt)
0
2
4
6
8
10
12
1970
1980
1990
2000
2010
2020
Year

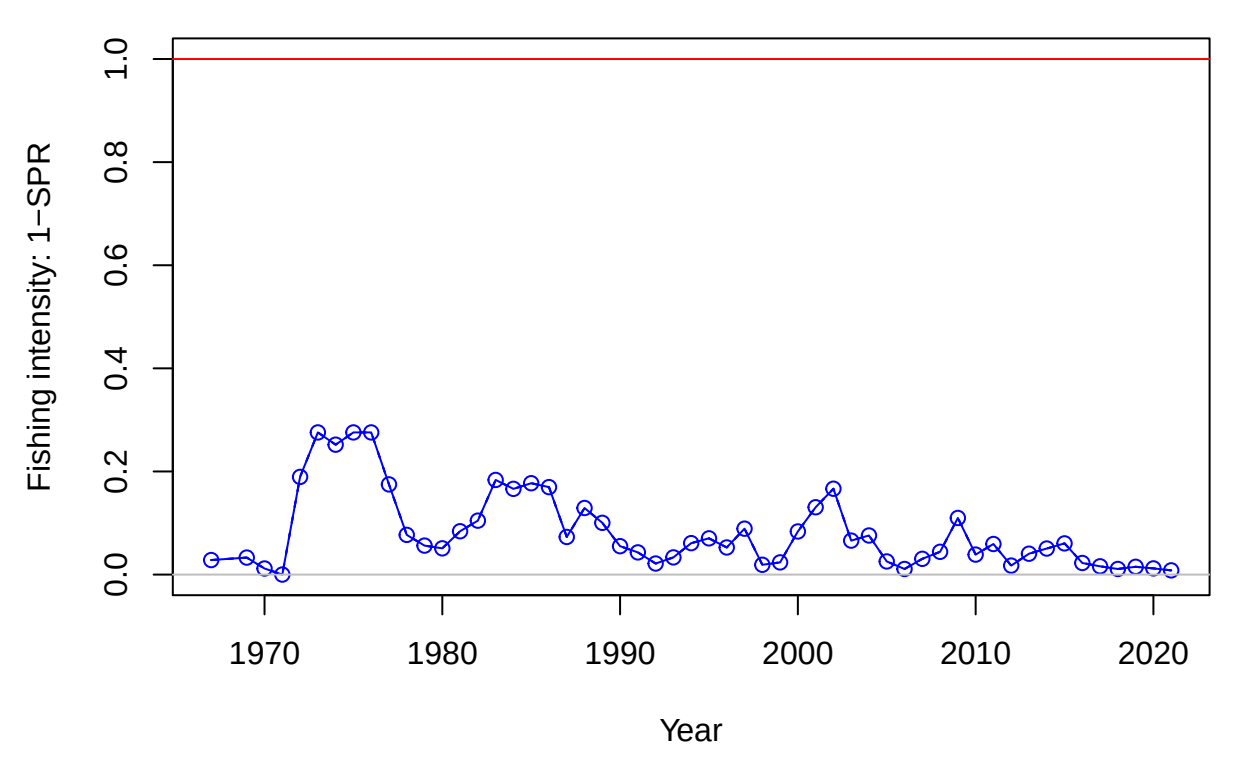

Landings (mt)
0
2
4
6
8
10
1970
1980
1990
2000
2010
2020
Year

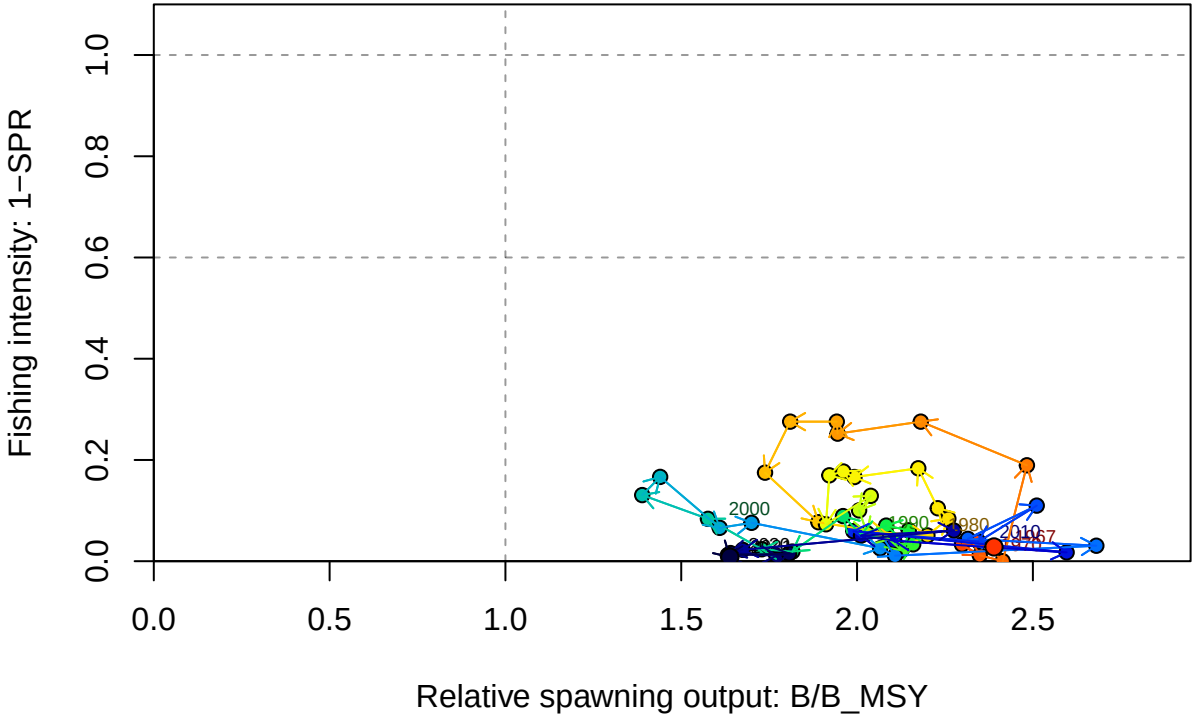

FISHERY
FISHERY obs.
Observed and expected Landings (mt)
0
2
4
6
8
10
12
1970
1980
1990
2000
2010
2020
Year

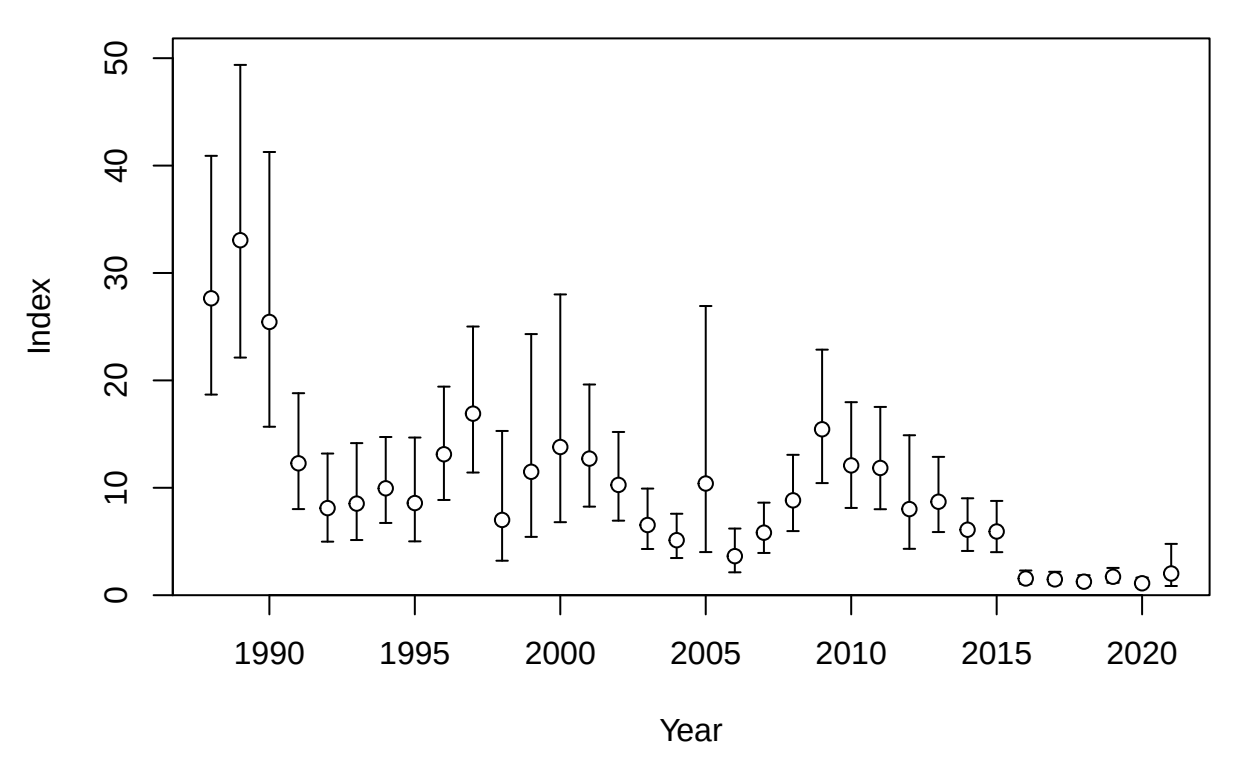

Continuous F
0
1
2
3
4
5
1970
1980
1990
2000
2010
2020
Year

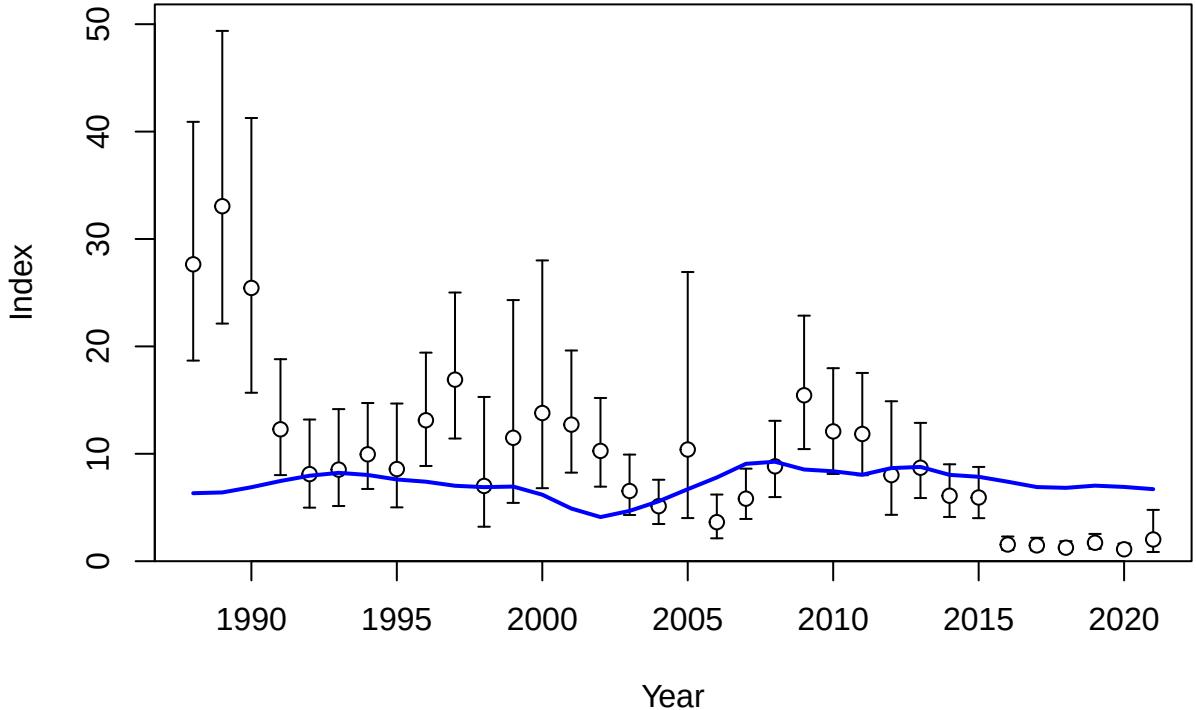

SPR
0.0
0.2
0.4
0.6
0.8
1.0
1970
1980
1990
2000
2010
2020
Year

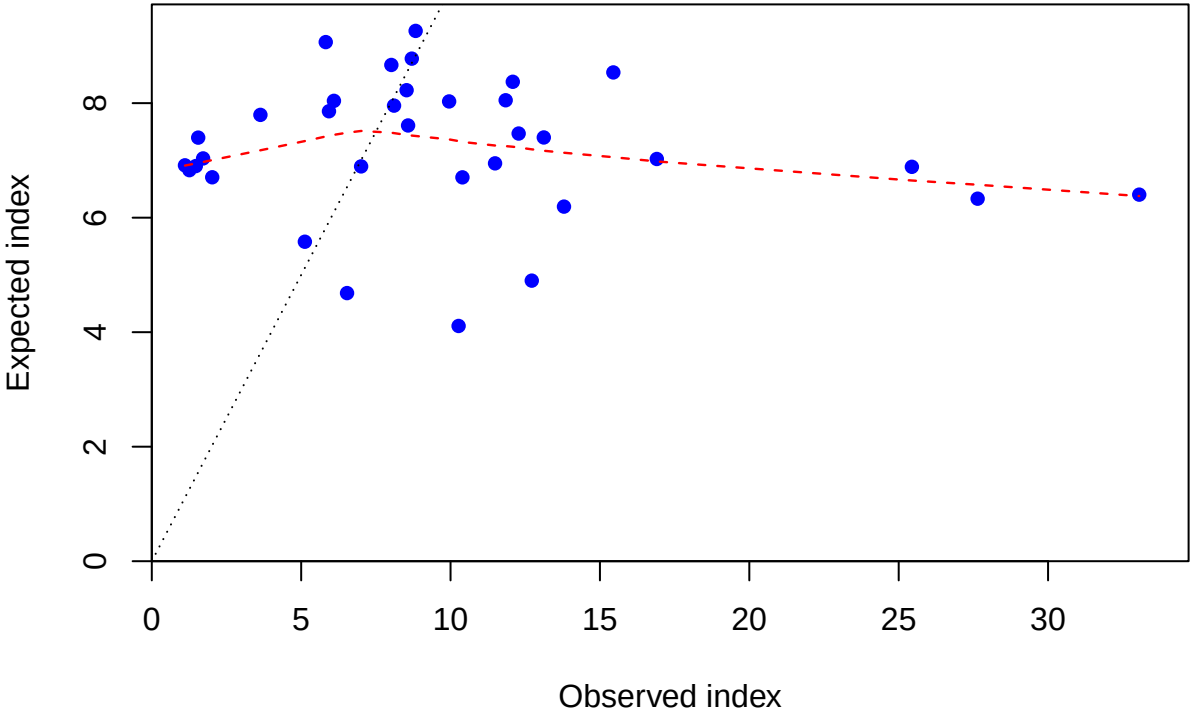

1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
1970
1980
1990
2000
2010
2020
Year

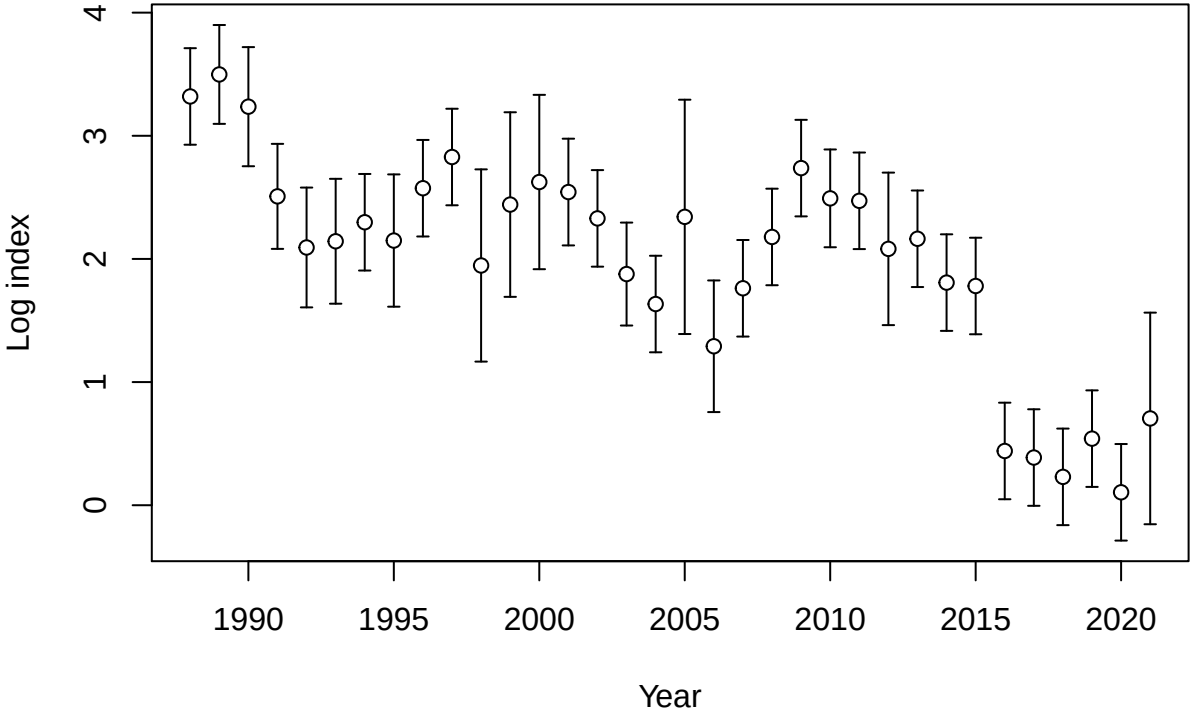

Fishing intensity: 1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
1970
1980
1990
2000
2010
2020
Year

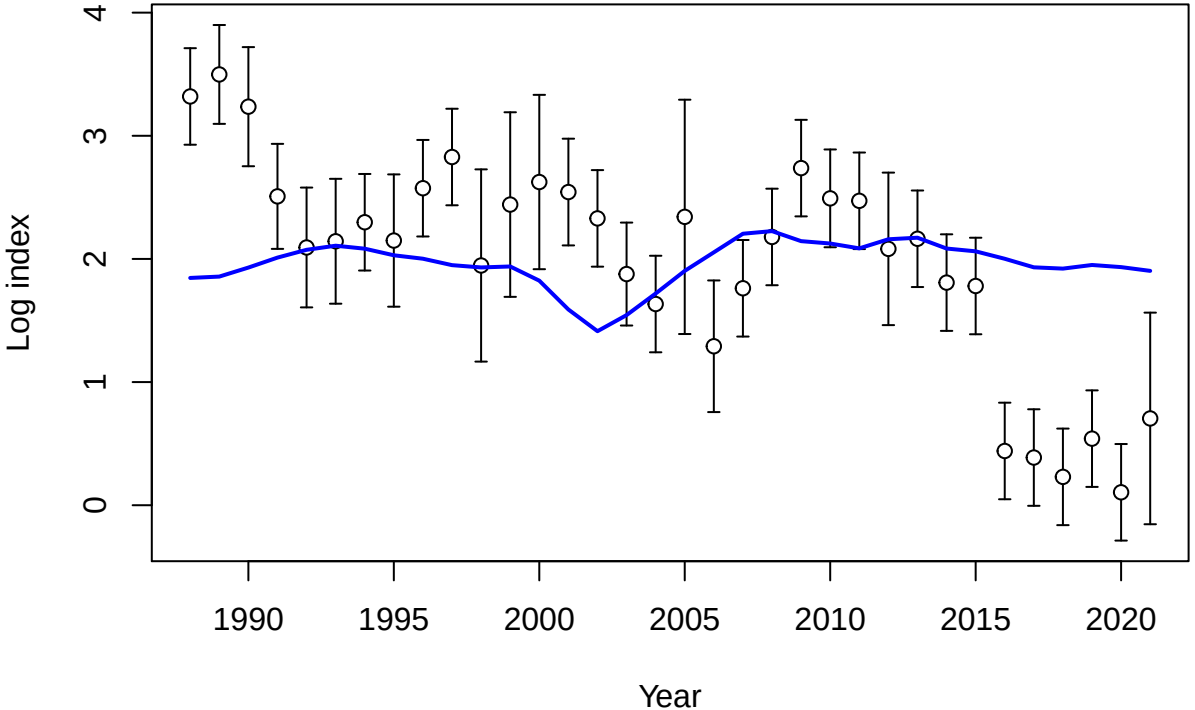

Fishing intensity: 1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
0.0
0.5
1.0
1.5
2.0
2.5
Relative spawning output: B/B_MSY
2000
1990
1980

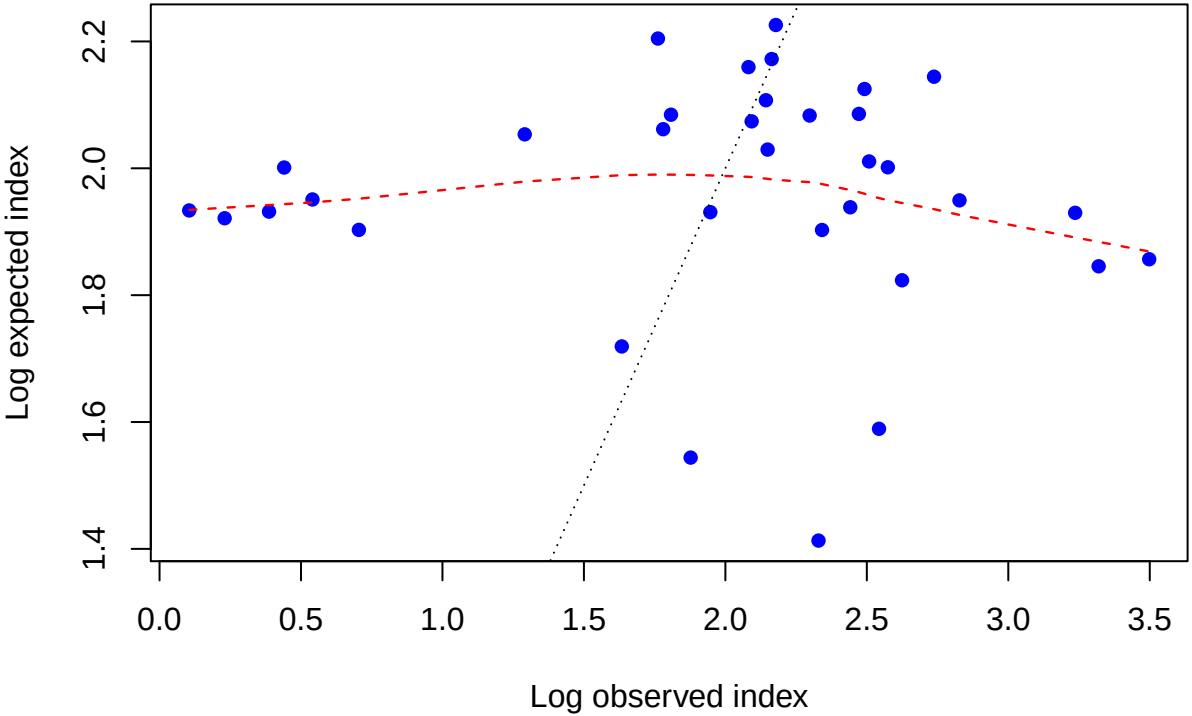

Index
0
10
20
30
40
50
1990
1995
2000
2005
2010
2015
2020
Year

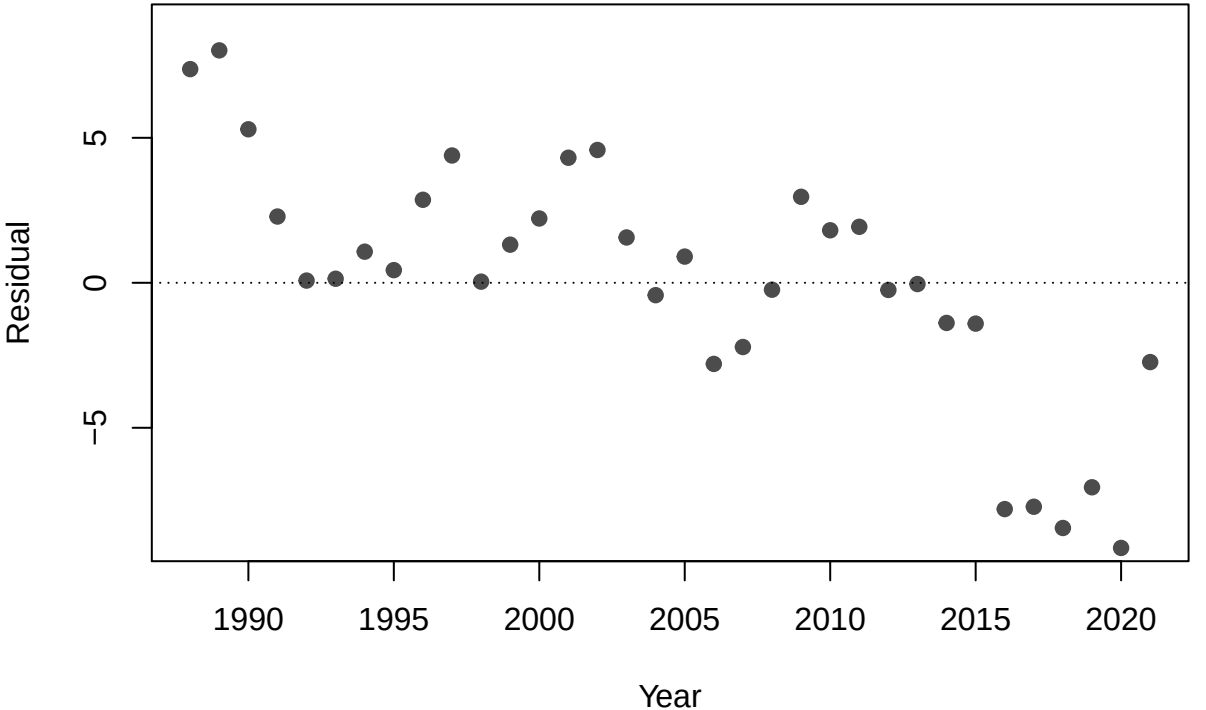

Index
0
10
20
30
40
50
1990
1995
2000
2005
2010
2015
2020
Year

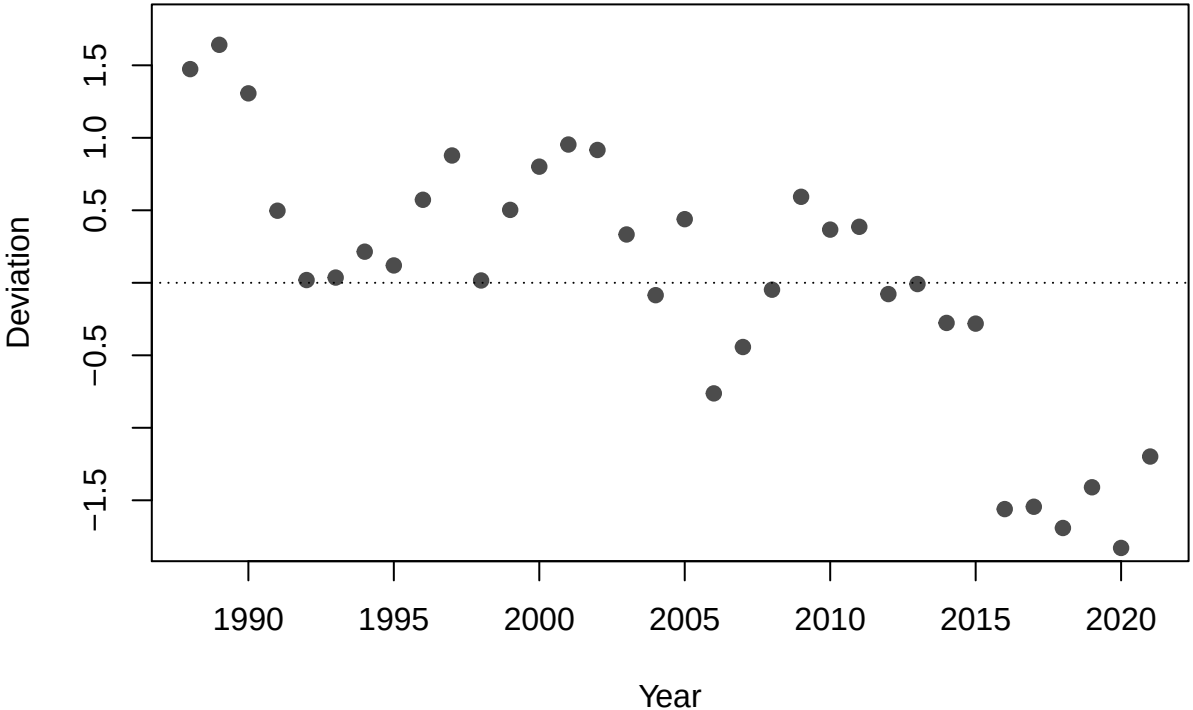

Expected index
0
2
4
6
8
0
5
10
15
20
25
30
Observed index

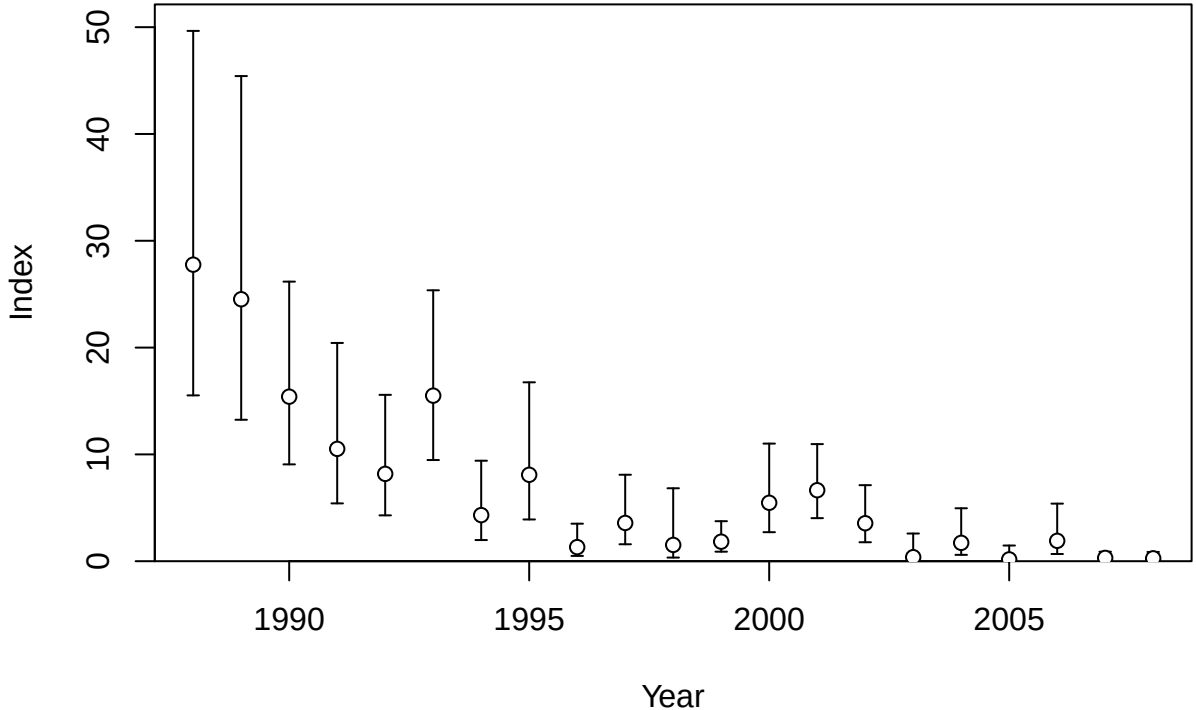

Log index
0
1
2
3
4
1990
1995
2000
2005
2010
2015
2020
Year

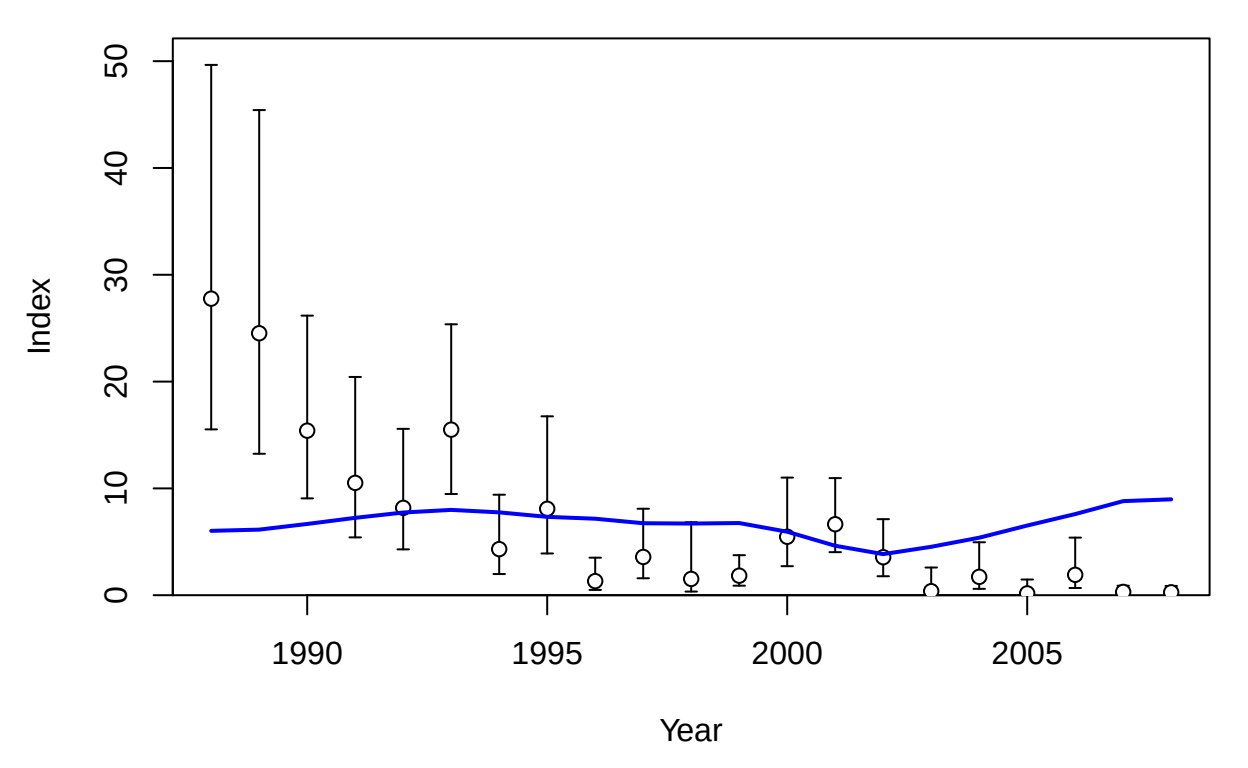

Log index
0
1
2
3
4
1990
1995
2000
2005
2010
2015
2020
Year

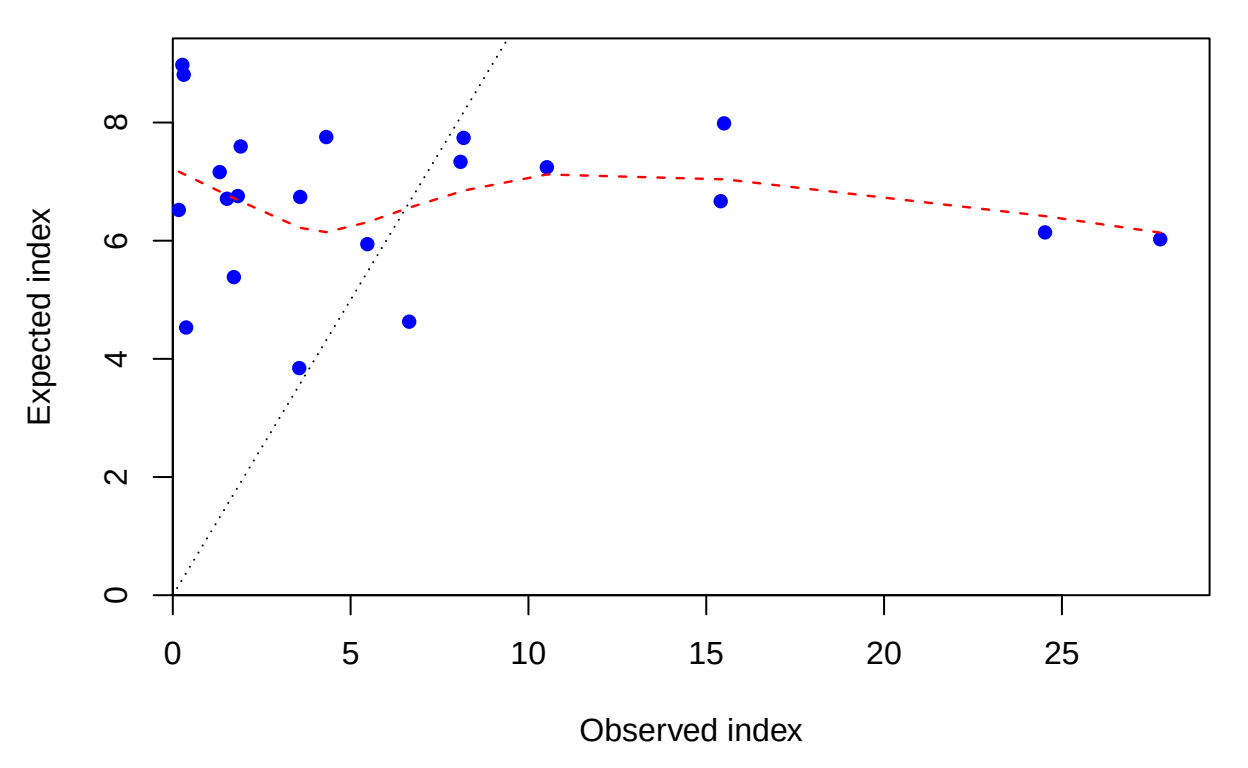

Log expected index
2.2
2.0
1.8
1.6
1.4
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
Log observed index

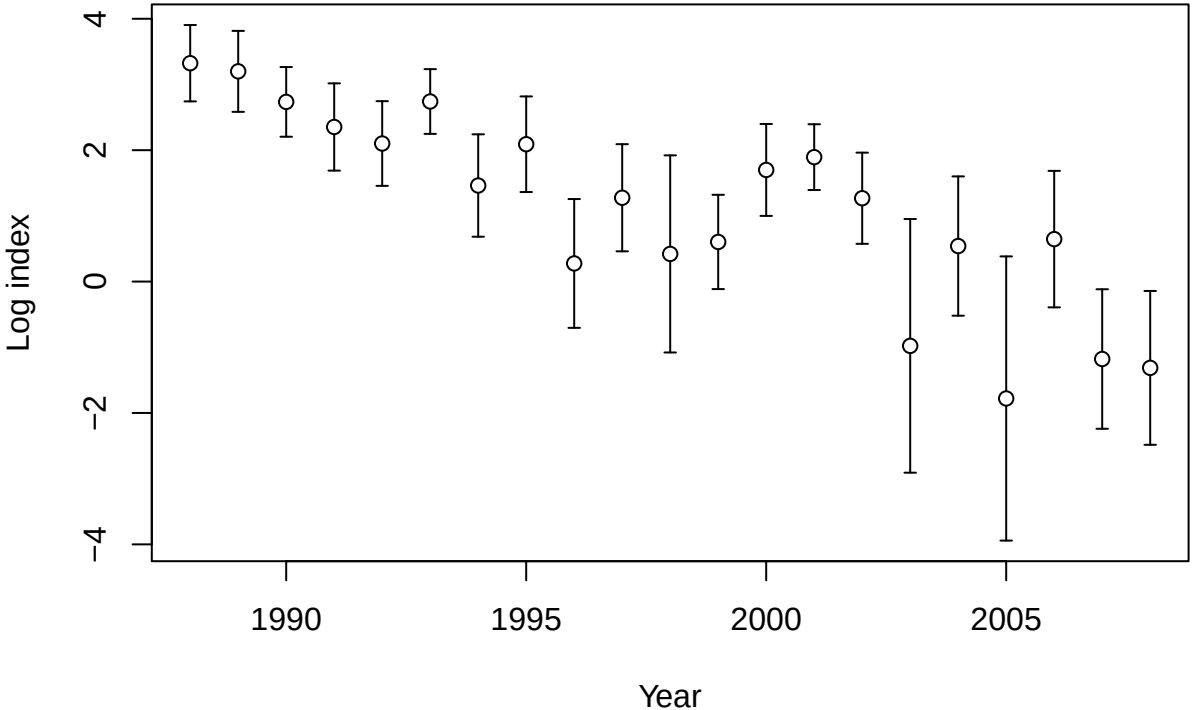

Residual
5
0
−5
1990
1995
2000
2005
2010
2015
2020
Year

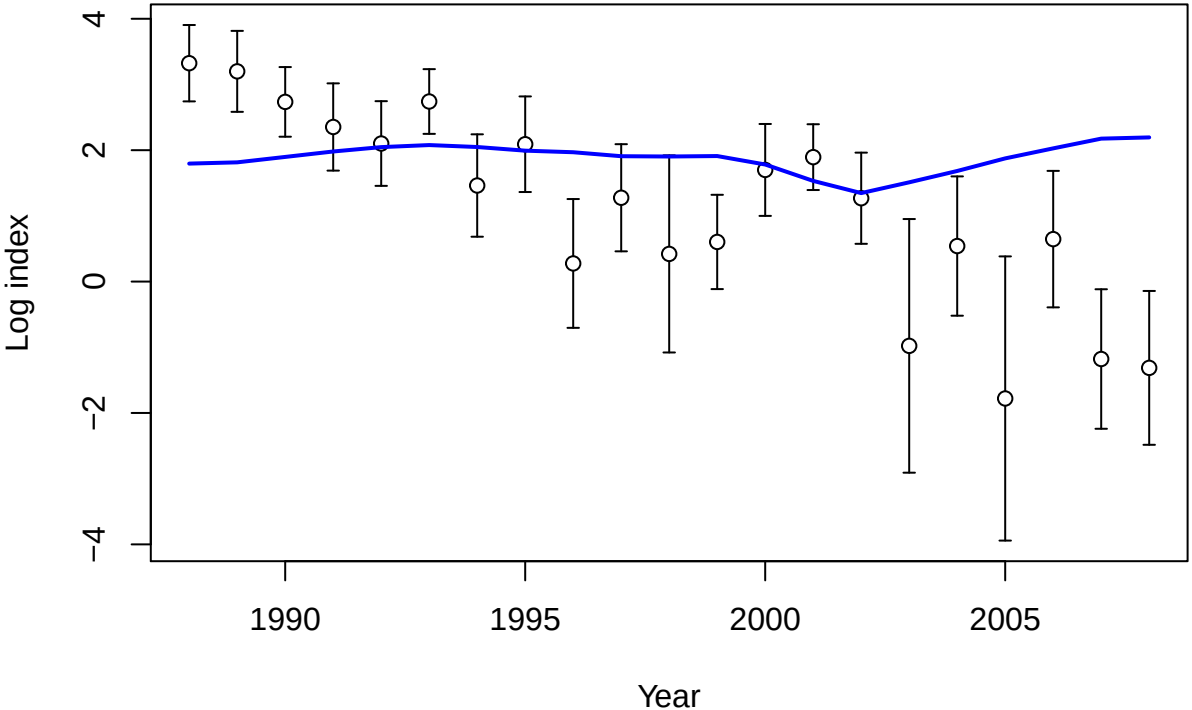

Deviation
1.5
1.0
0.5
−0.5
−1.5
1990
1995
2000
2005
2010
2015
2020
Year

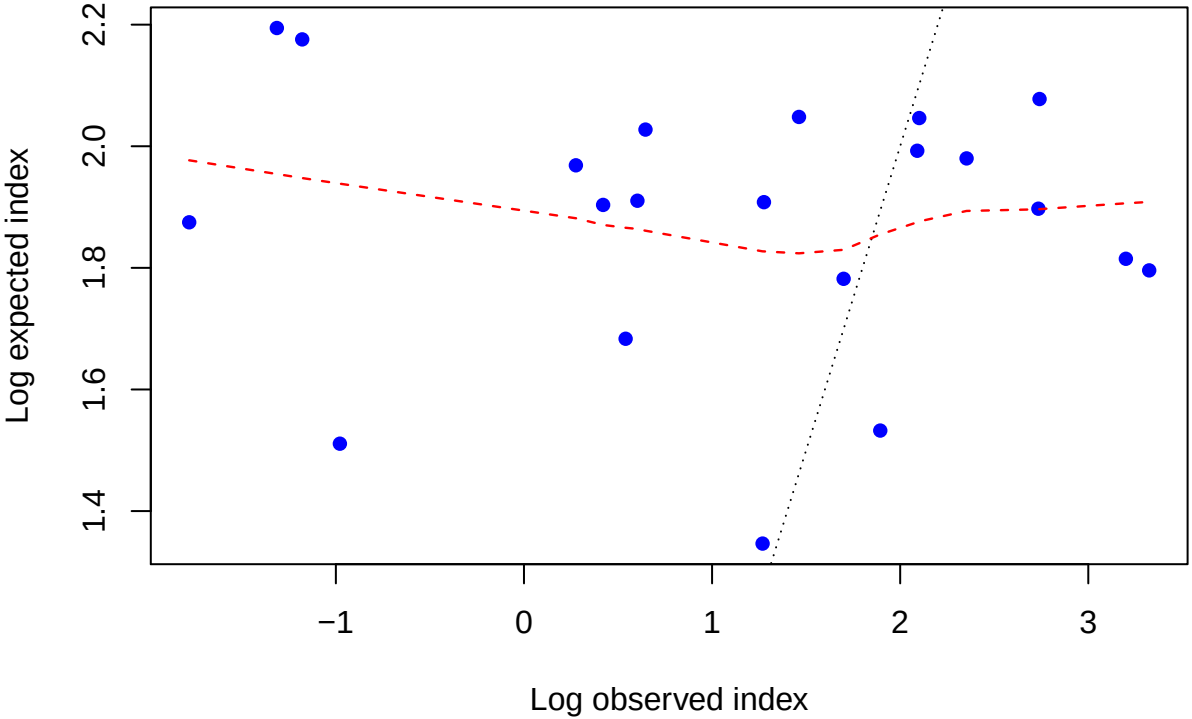

Index
0
10
20
30
40
50
1990
1995
2000
2005
Year

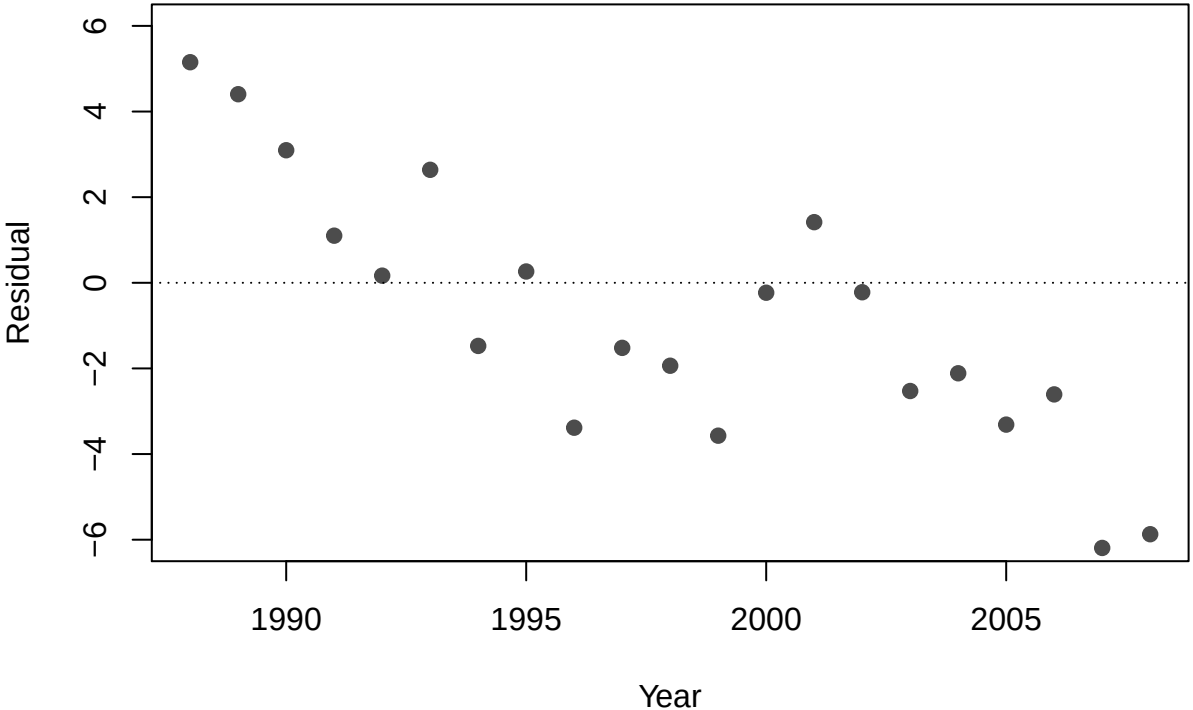

Index
0
10
20
30
40
50
1990
1995
2000
2005
Year

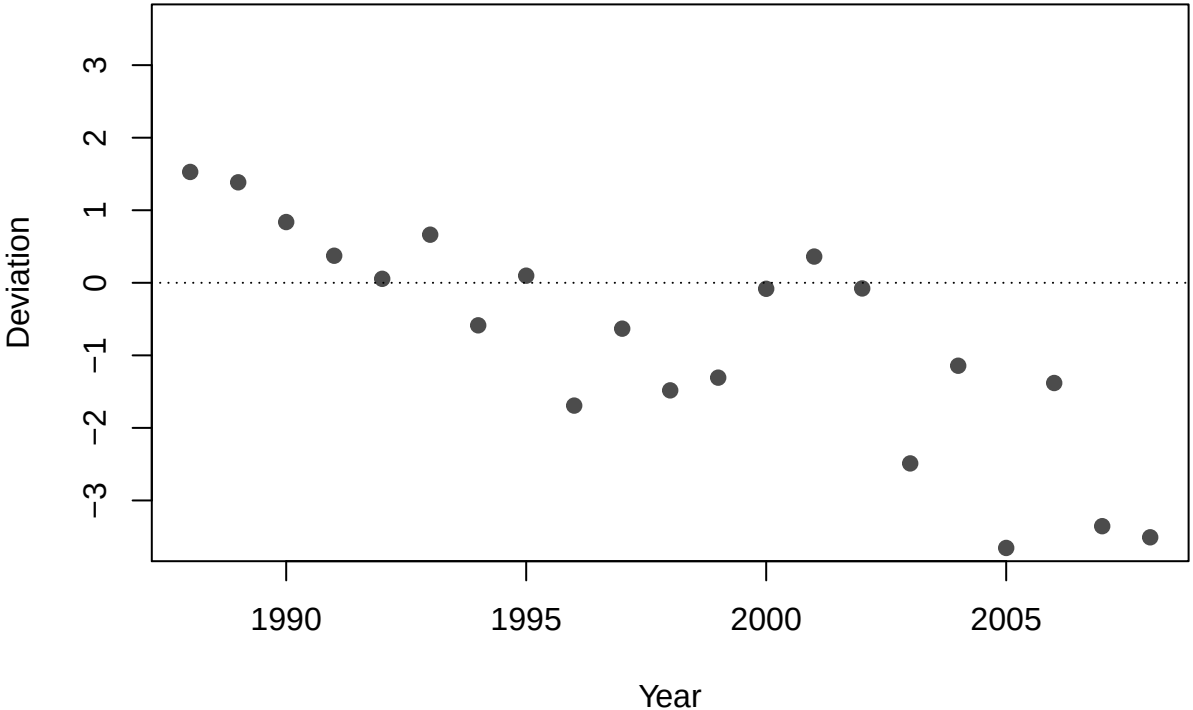

Expected index
0
2
4
6
8
0
5
10
15
20
25
Observed index

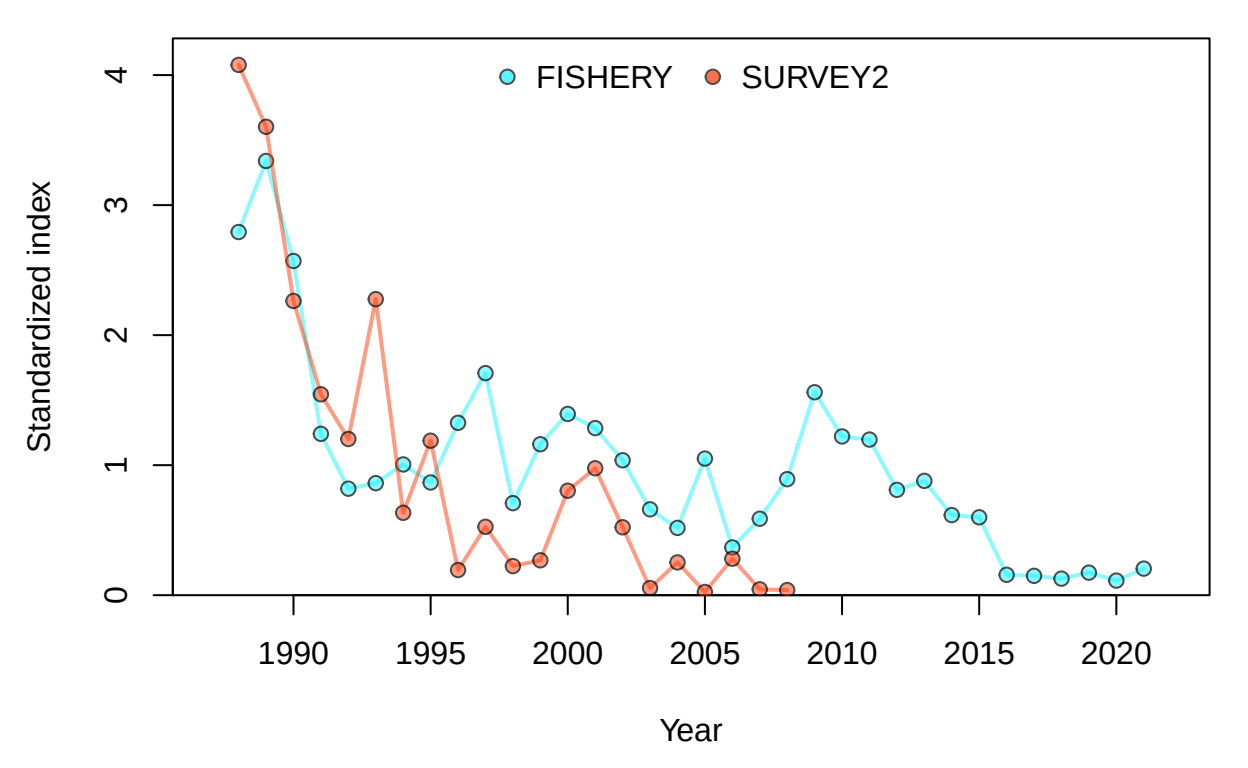

Log index
4
2
0
−2
−4
1990
1995
2000
2005
Year

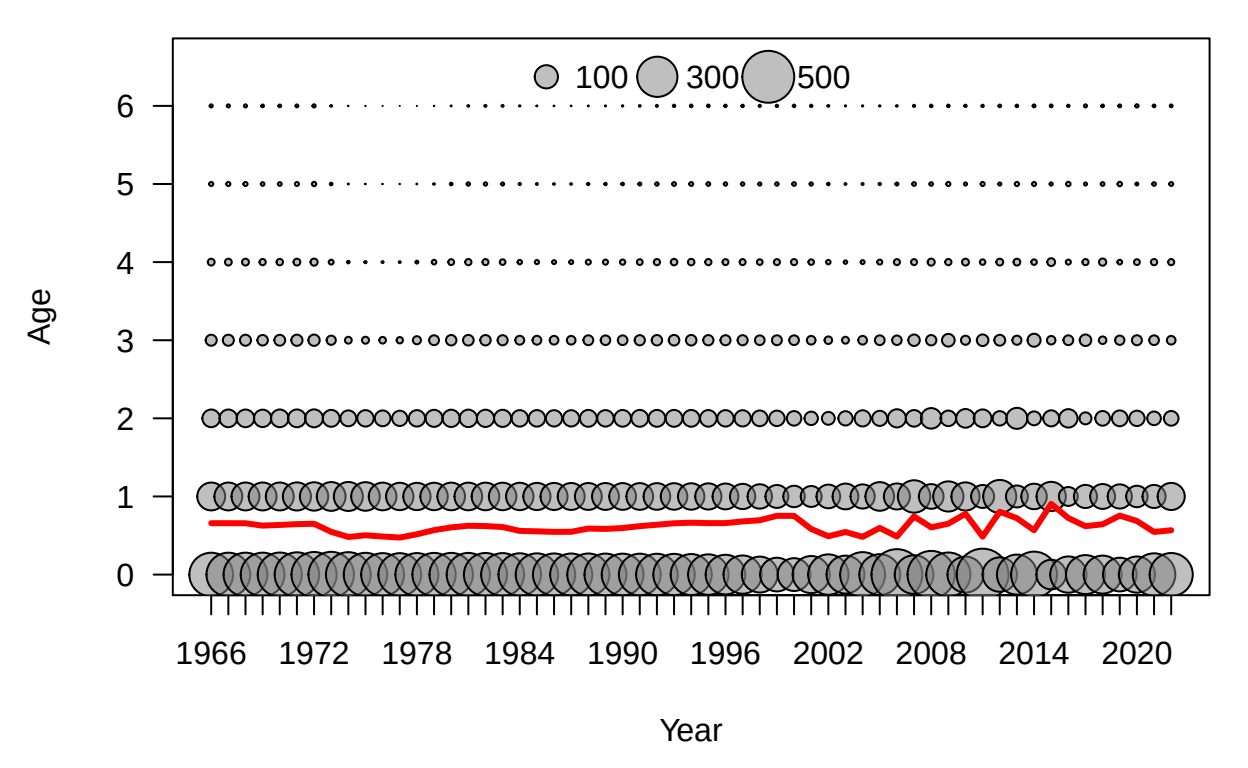

Log index
4
2
0
−2
−4
1990
1995
2000
2005
Year

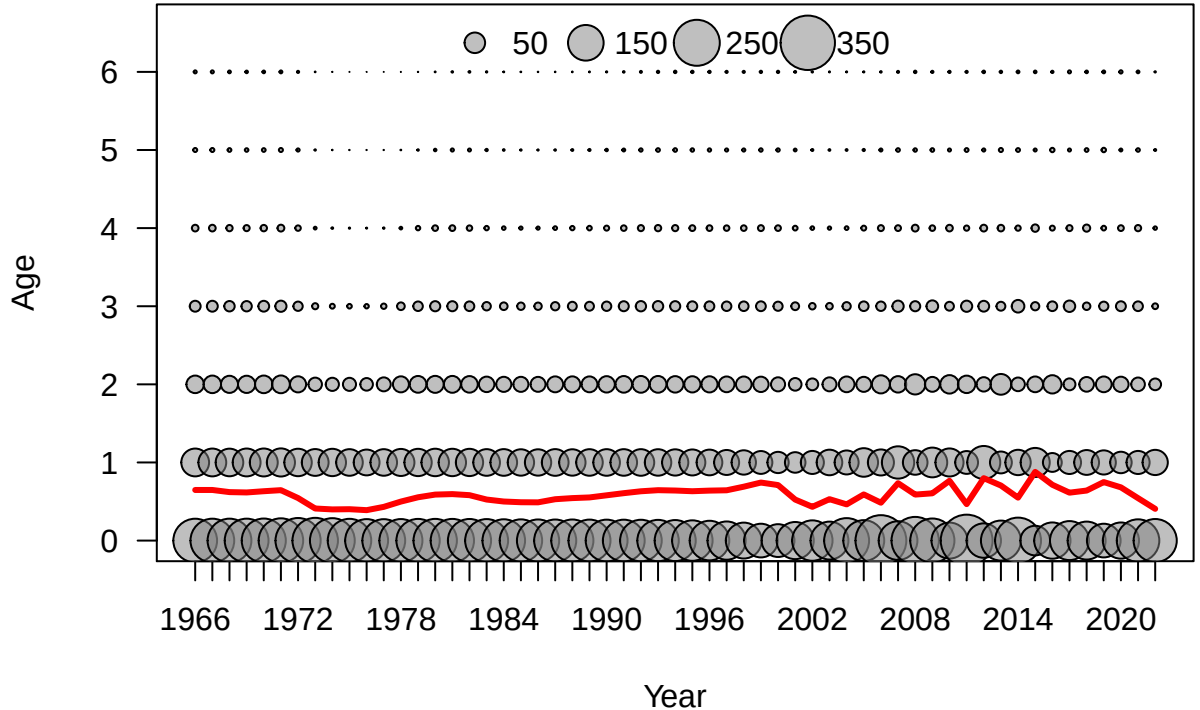

Log expected index
2.2
2.0
1.8
1.6
1.4
−1
0
1
2
3
Log observed index

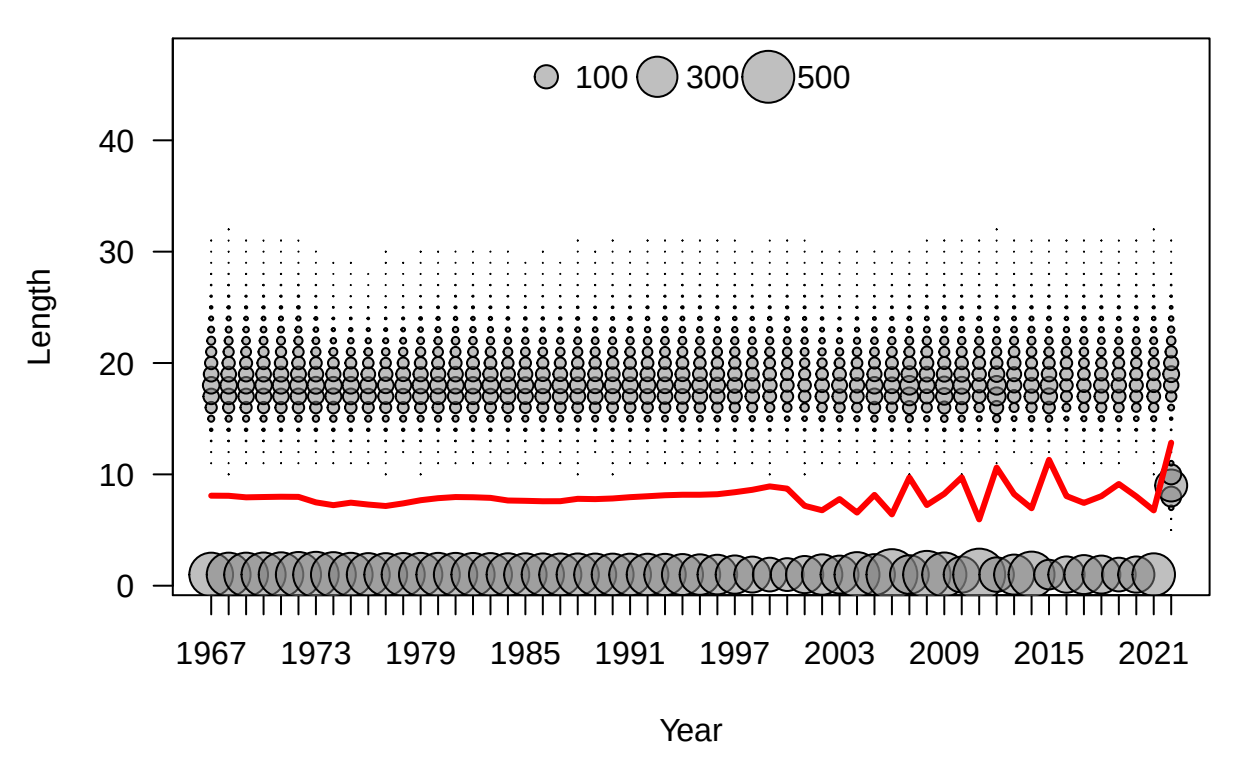

Residual
6
4
2
0
−2
−4
−6
1990
1995
2000
2005
Year

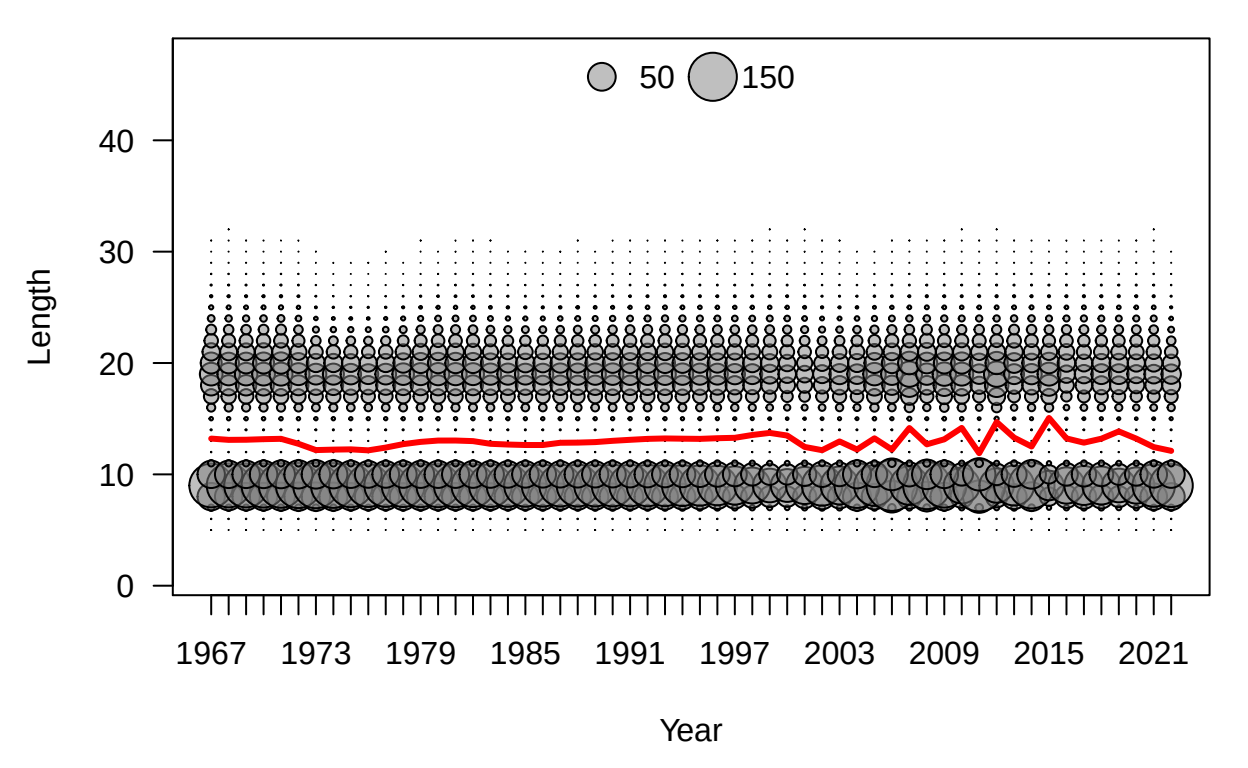

Deviation
3
2
1
0
−1
−2
−3
1990
1995
2000
2005
Year

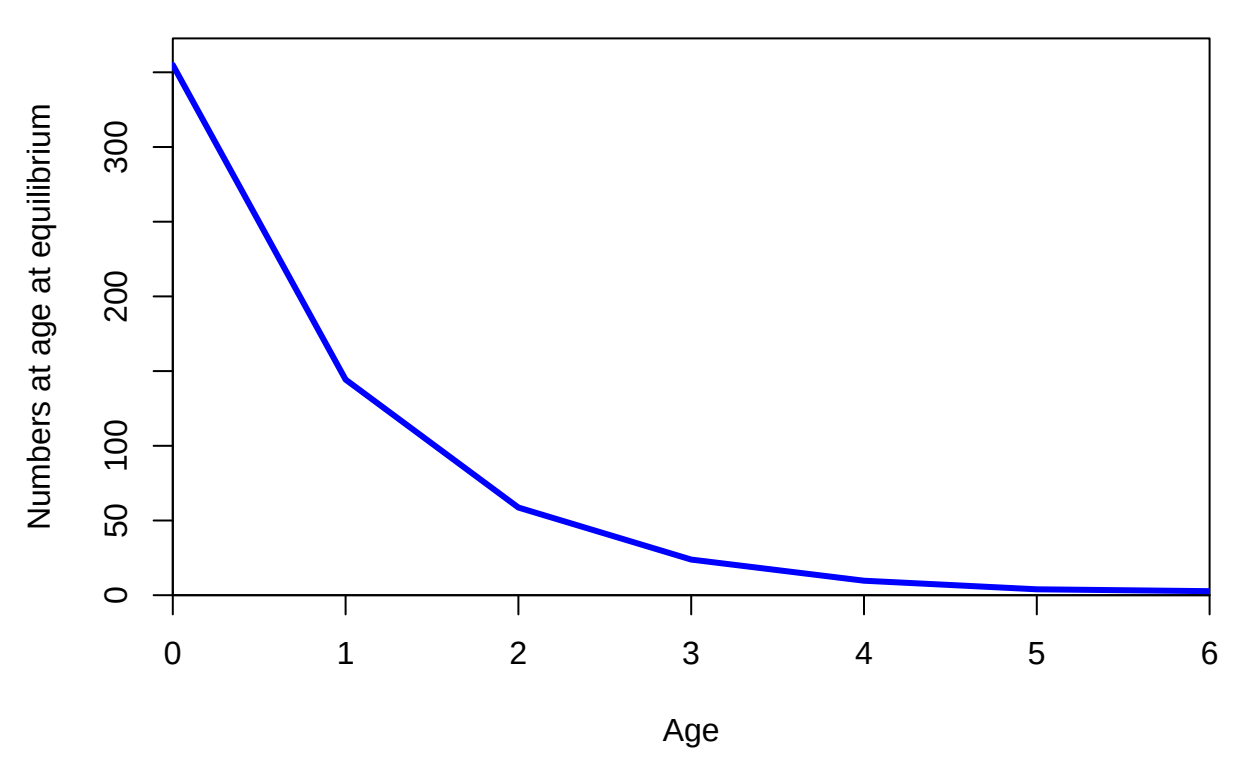

FISHERY
SURVEY2
Standardized index
Year
0
1
2
3
4
1990
1995
2000
2005
2010
2015
2020

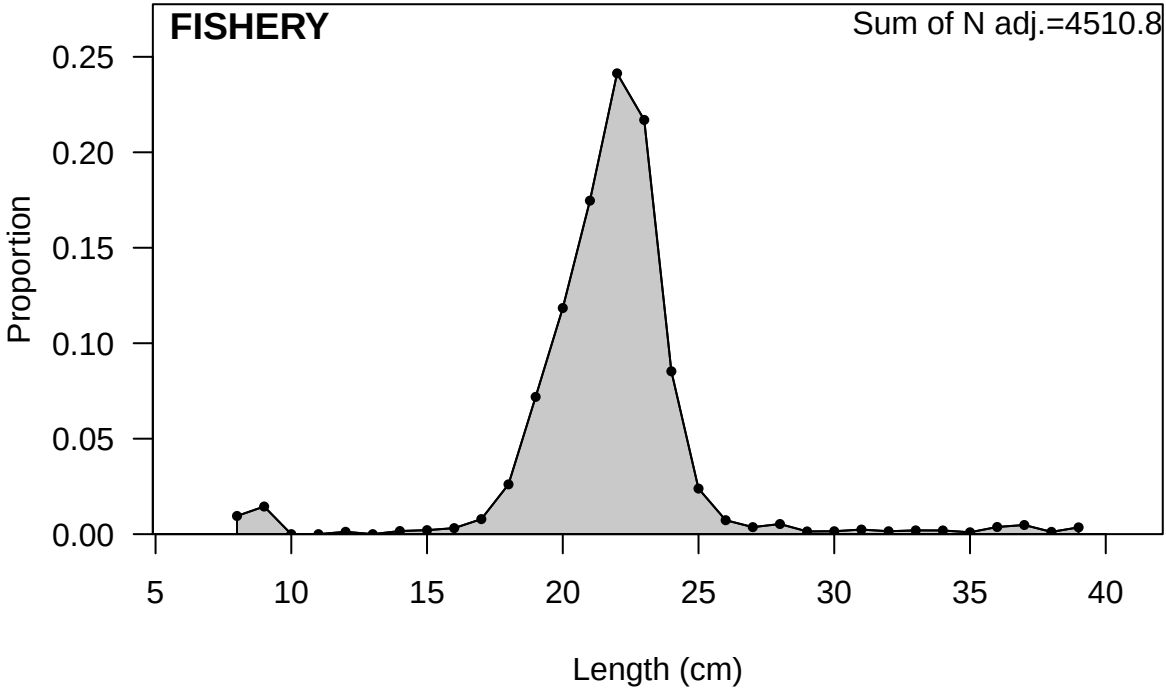

100
300
500
Age
0
1
2
3
4
5
6
1966
1972
1978
1984
1990
1996
2002
2008
2014
2020
Year

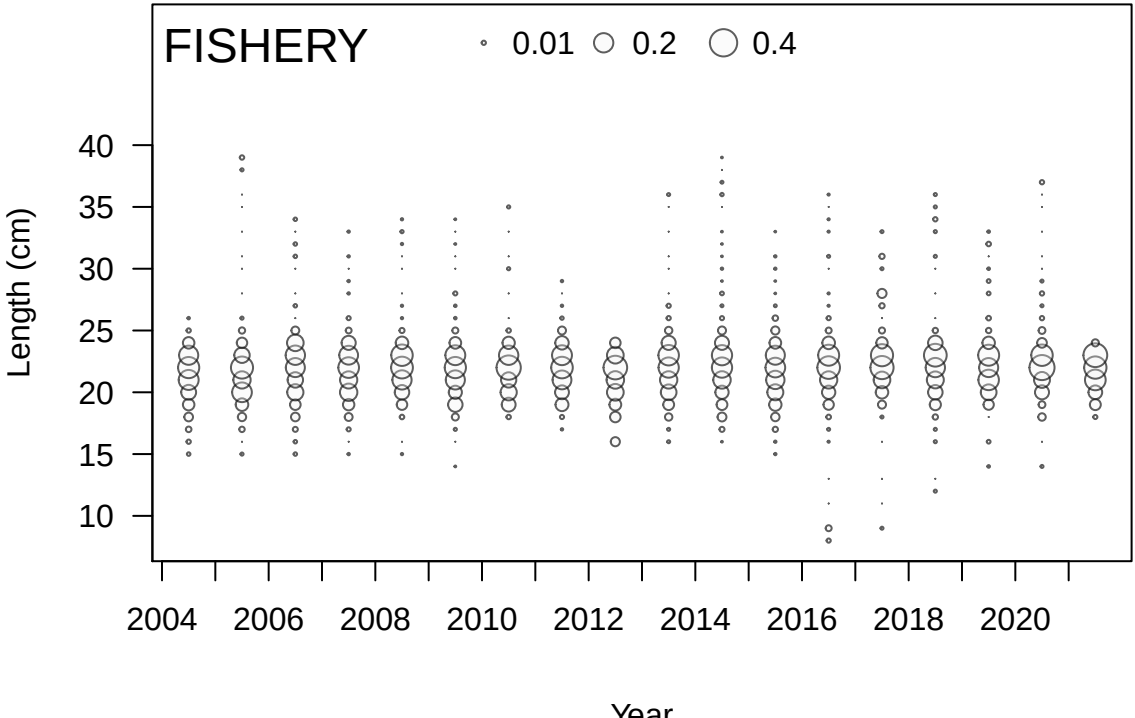

50
150
250
350
Age
0
1
2
3
4
5
6
1966
1972
1978
1984
1990
1996
2002
2008
2014
2020
Year

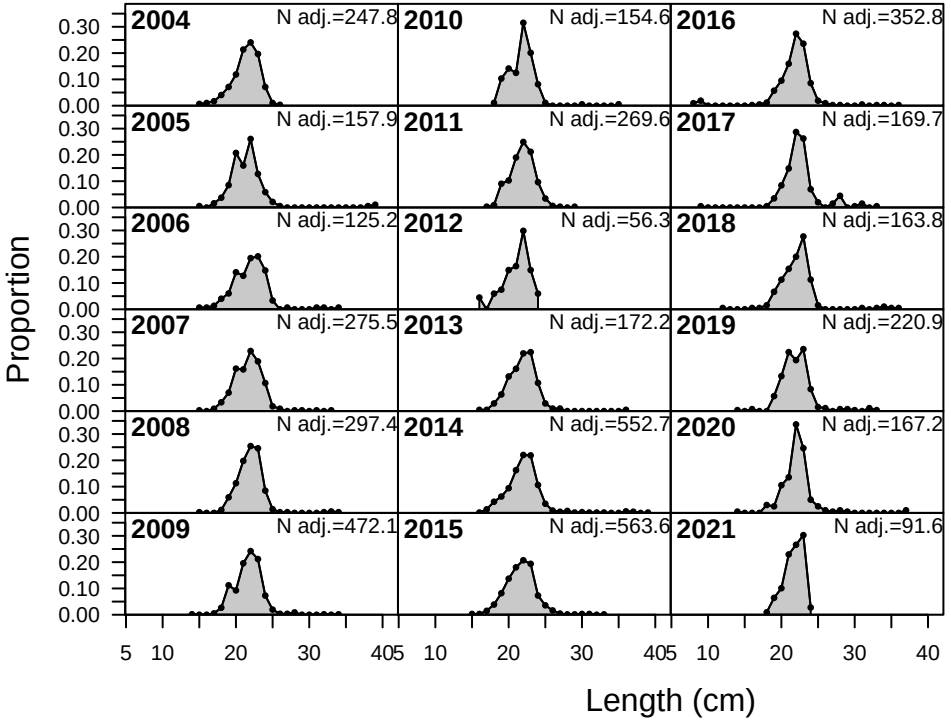

100
300
500
40
30
20
10
0
Length
1967
1973
1979
1985
1991
1997
2003
2009
2015
2021
Year

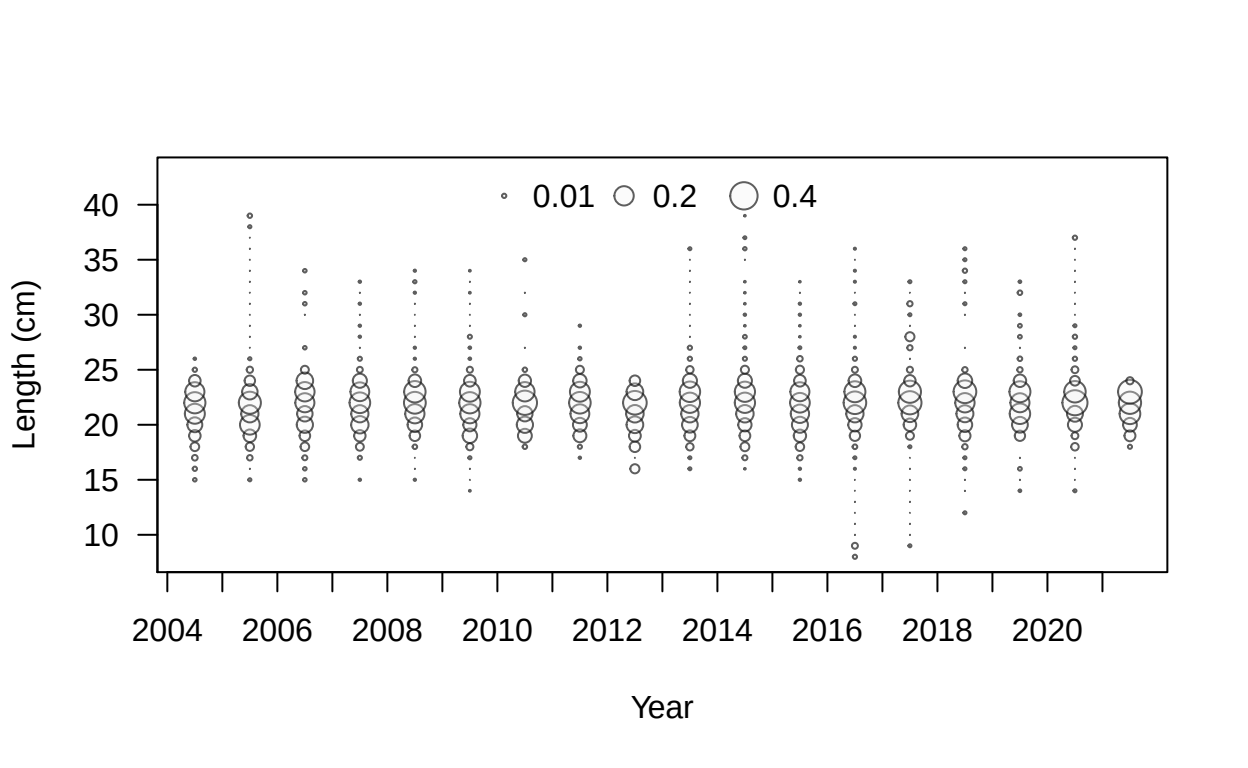

50
150
40
30
20
10
0
Length
1967
1973
1979
1985
1991
1997
2003
2009
2015
2021
Year

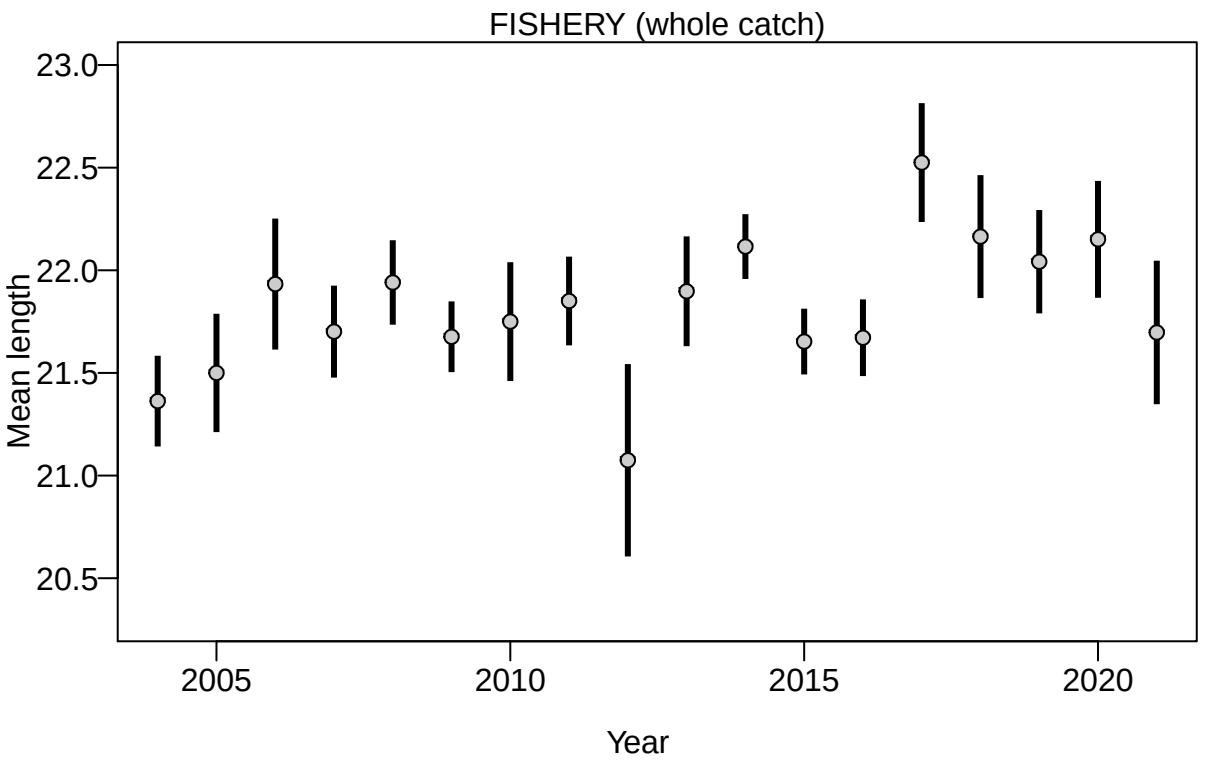

Numbers at age at equilibrium
0
50
100
200
300
0
1
2
3
4
5
6
Age

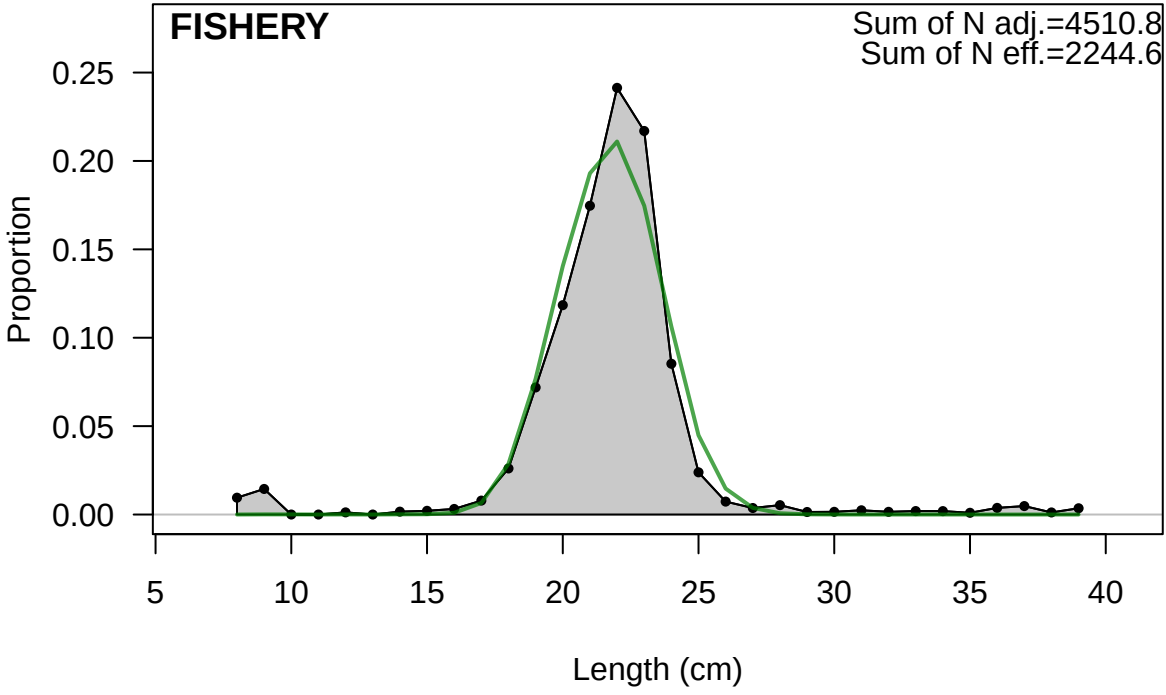

FISHERY
Sum of N adj.=4510.8
Proportion
0.25
0.20
0.15
0.10
0.05
0.00
5
10
15
20
25
30
35
40
Length (cm)

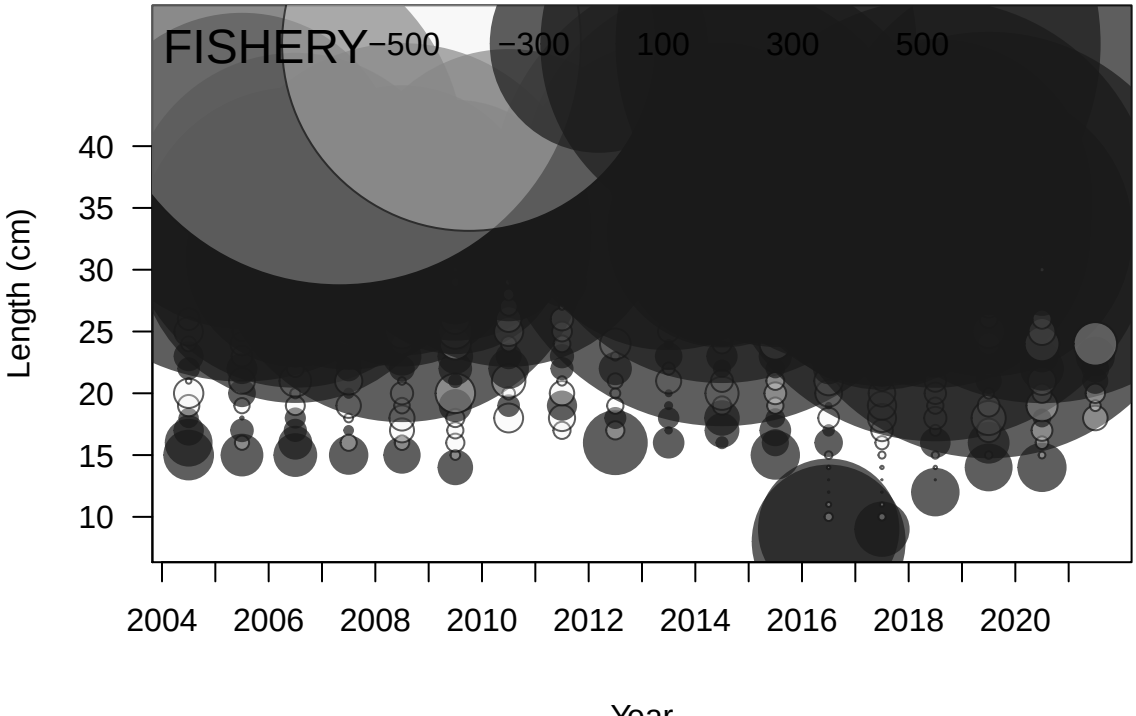

FISHERY
0.01
0.2
0.4
Length (cm)
40
35
30
25
20
15
10
2004
2006
2008
2010
2012
2014
2016
2018
2020
Year

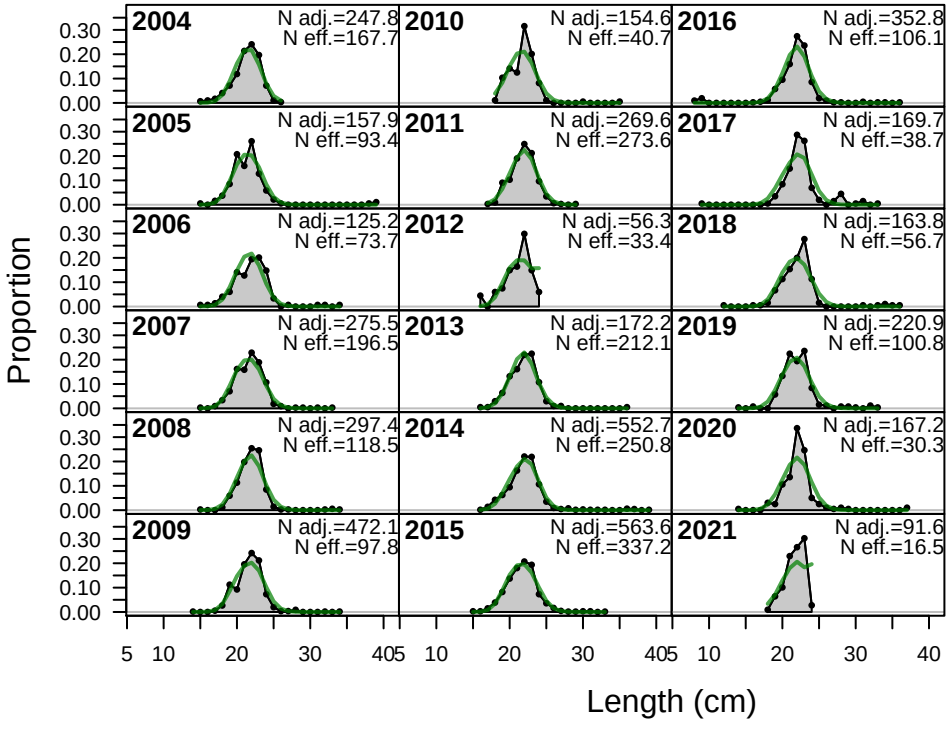

2004
N adj.=247.8
2010
N adj.=154.6
2016
N adj.=352.8
2005
N adj.=157.9
2011
N adj.=269.6
2017
N adj.=169.7
2006
N adj.=125.2
2012
N adj.=56.3
2018
N adj.=163.8
2007
N adj.=275.5
2013
N adj.=172.2
2019
N adj.=220.9
2008
N adj.=297.4
2014
N adj.=552.7
2020
N adj.=167.2
2009
N adj.=472.1
2015
N adj.=563.6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

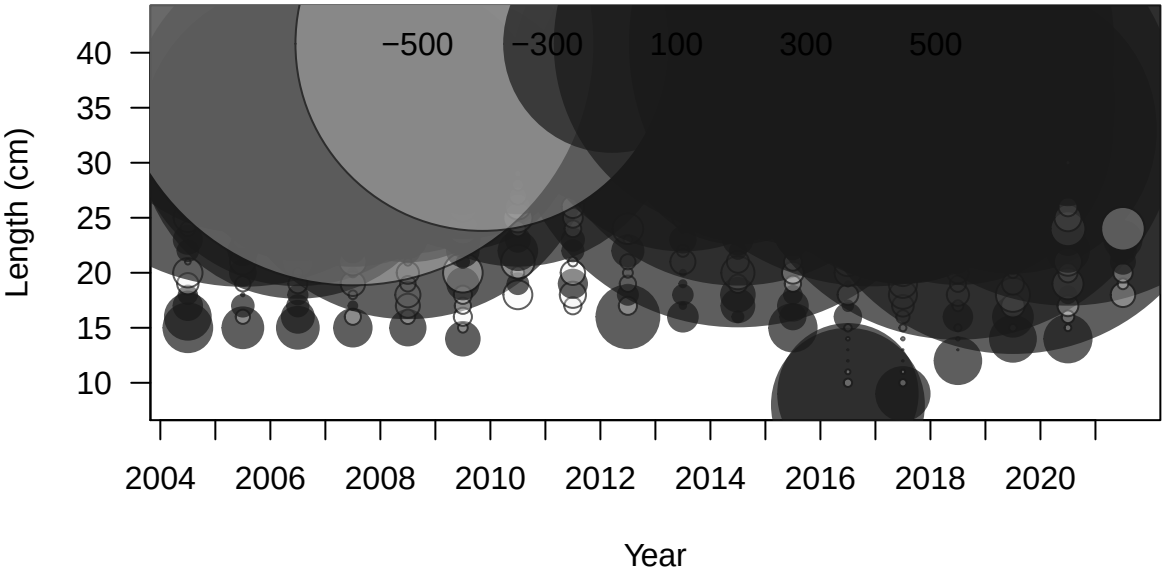

0.01
0.2
0.4
Length (cm)
40
35
30
25
20
15
10
2004
2006
2008
2010
2012
2014
2016
2018
2020
Year

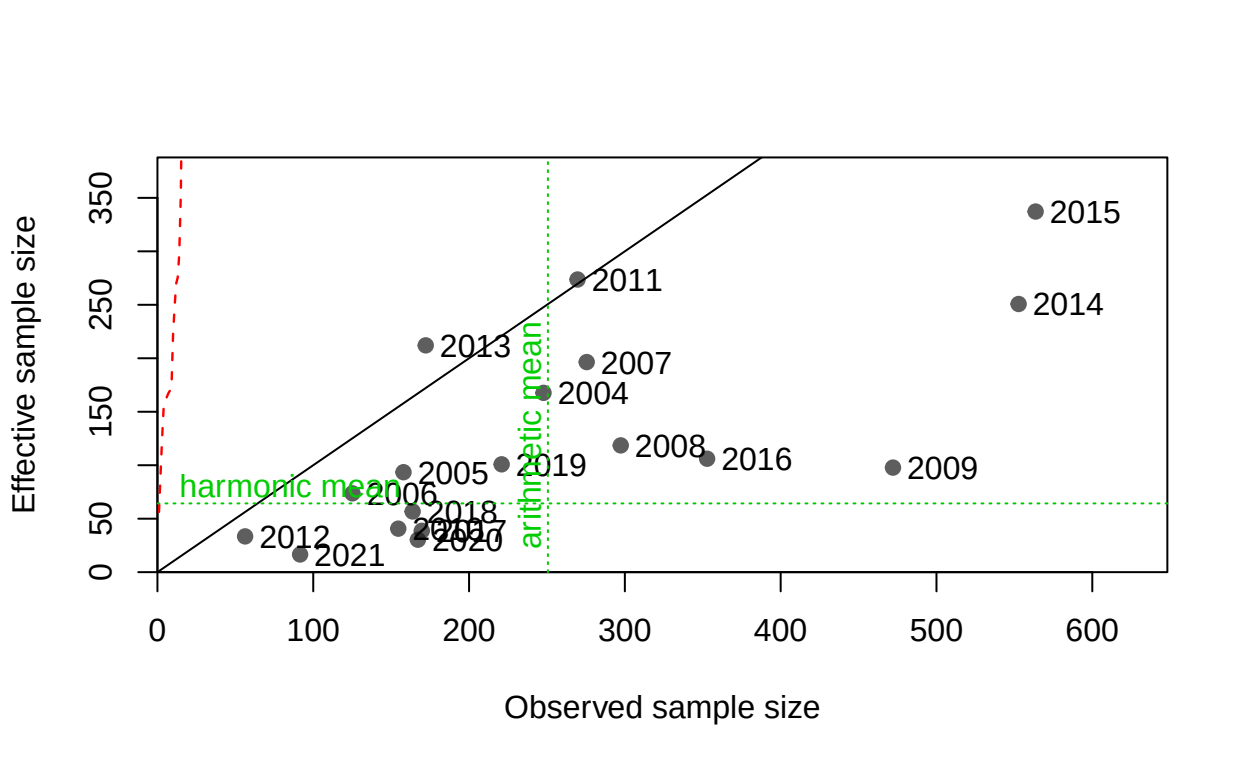

FISHERY (whole catch)
23.0
22.5
22.0
21.5
21.0
20.5
Mean length
2005
2010
2015
2020
Year

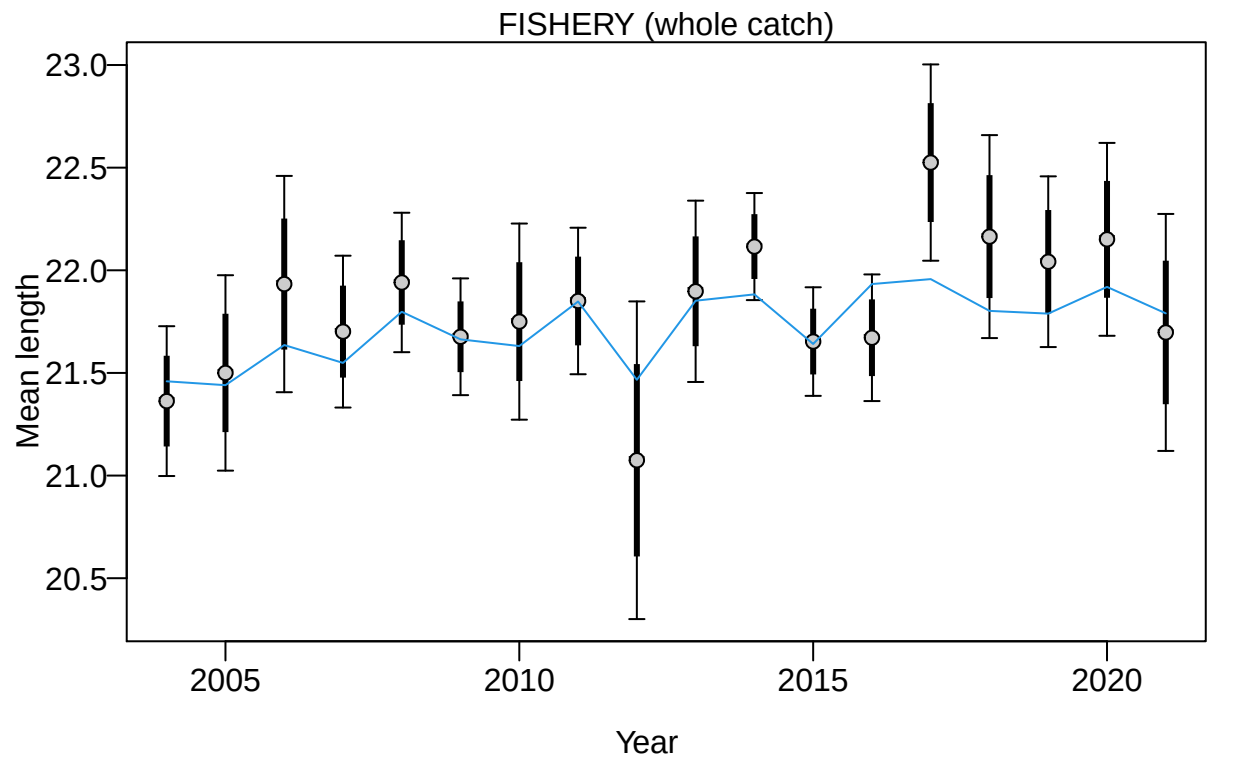

FISHERY
Sum of N adj.=4510.8
Sum of N eff.=2244.6
Proportion
0.25
0.20
0.15
0.10
0.05
0.00
5
10
15
20
25
30
35
40
Length (cm)

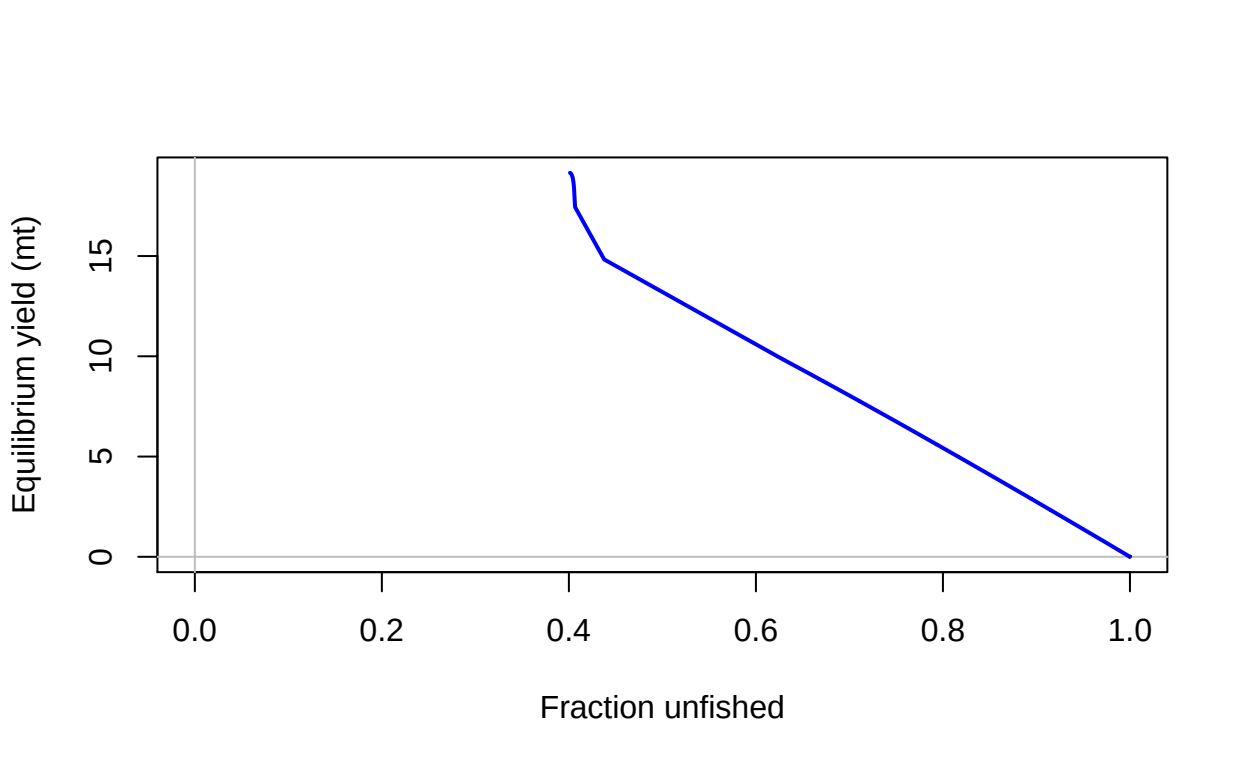

FISHERY
−500
−300
100
300
500
40
35
30
25
20
15
10
Length (cm)
2004
2006
2008
2010
2012
2014
2016
2018
2020
Year

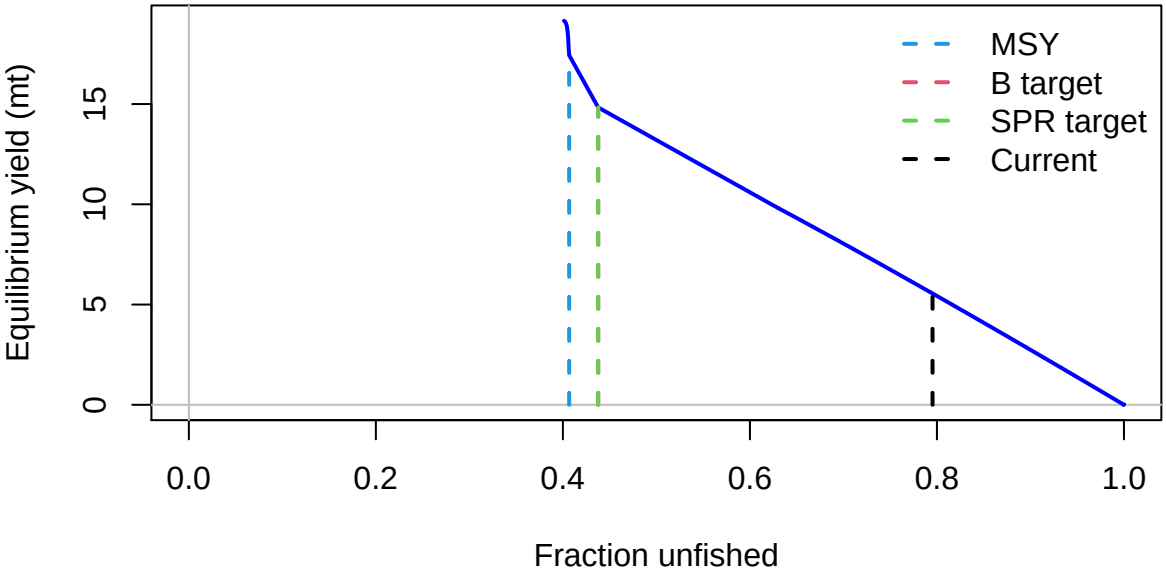

2004
N adj.=247.8
N eff.=167.7
2010
N adj.=154.6
N eff.=40.7
2016
N adj.=352.8
N eff.=106.1
2005
N adj.=157.9
N eff.=93.4
2011
N adj.=269.6
N eff.=273.6
2017
N adj.=169.7
N eff.=38.7
2006
N adj.=125.2
N eff.=73.7
2012
N adj.=56.3
N eff.=33.4
2018
N adj.=163.8
N eff.=56.7
2007
N adj.=275.5
N eff.=196.5
2013
N adj.=172.2
N eff.=212.1
2019
N adj.=220.9
N eff.=100.8
2008
N adj.=297.4
N eff.=118.5
2014
N adj.=552.7
N eff.=250.8
2020
N adj.=167.2
N eff.=30.3
2009
N adj.=472.1
N eff.=97.8
2015
N adj.=563.6
N eff.=337.2
2021
N adj.=91.6
N eff.=16.5
Proportion
0.00
0.10
0.20
0.30
5
10
20
30
40
Length (cm)

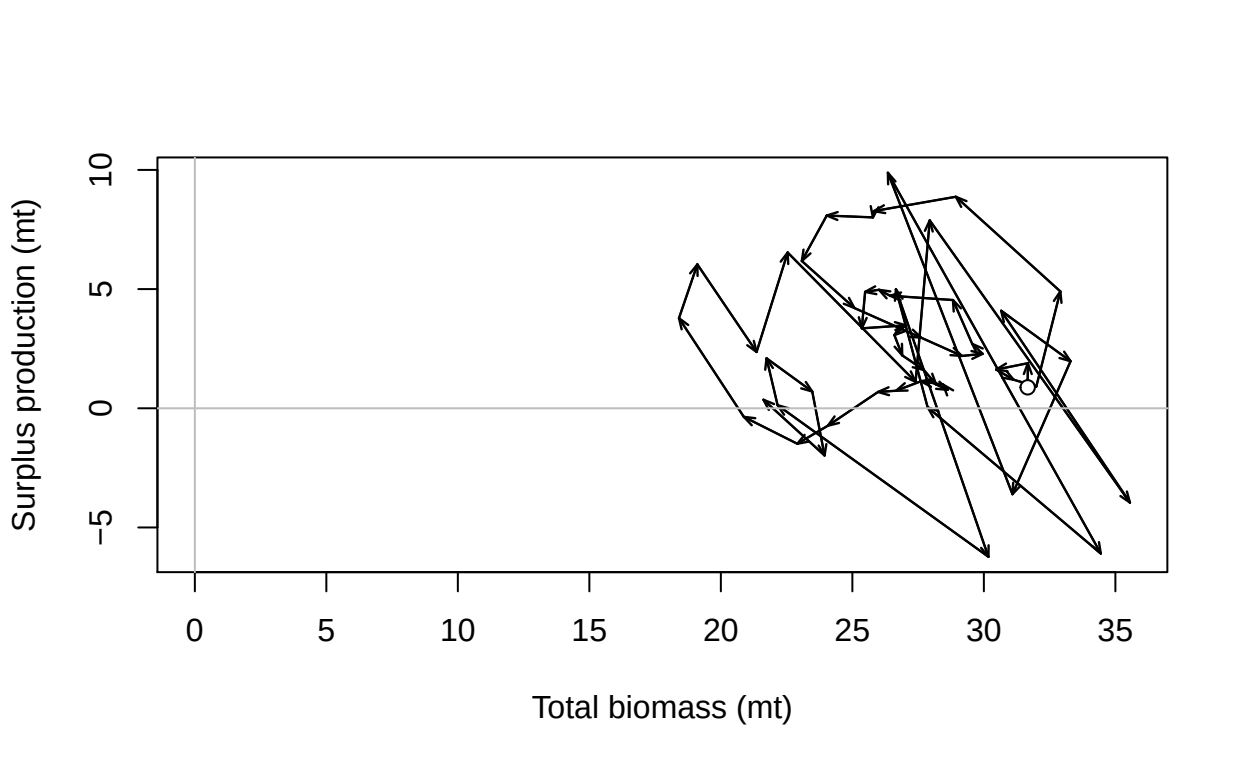

−500
−300
100
300
500
40
35
30
25
20
15
10
Length (cm)
2004
2006
2008
2010
2012
2014
2016
2018
2020
Year

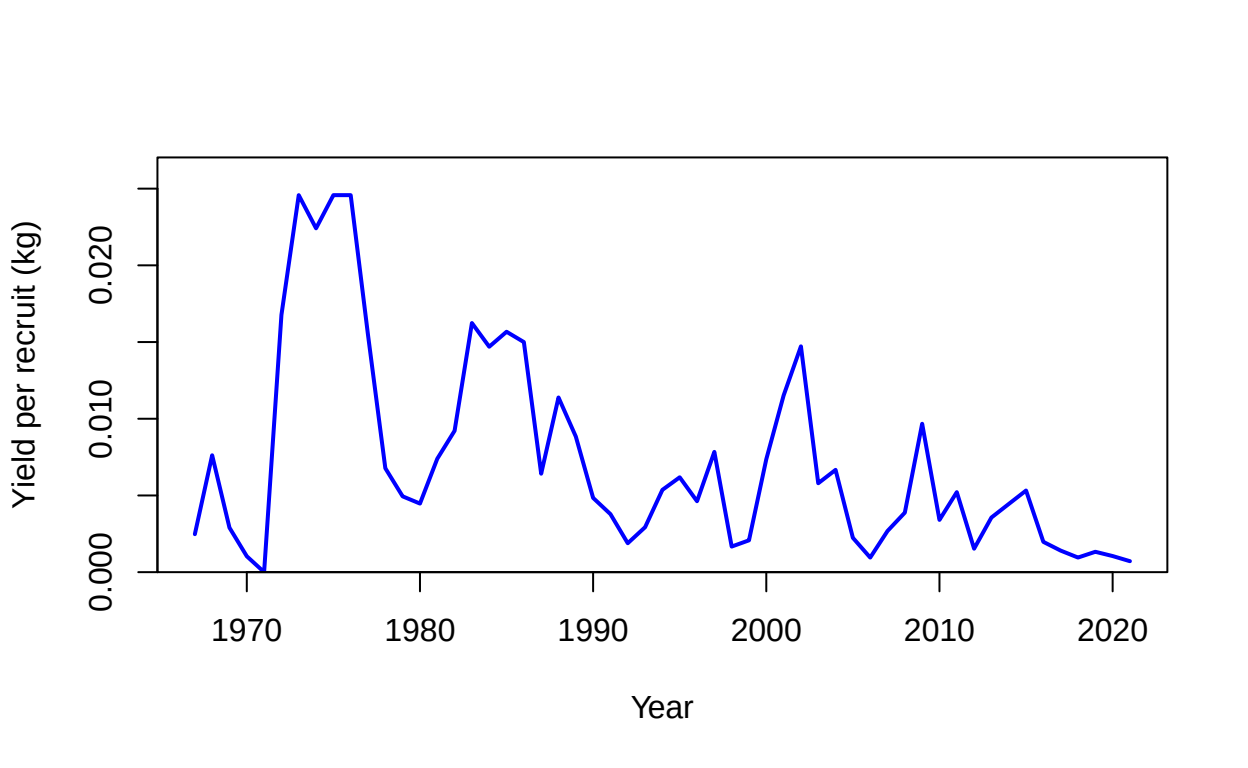

Effective sample size
Observed sample size
0
50
150
250
350
0
100
200
300
400
500
600
2015
2011
2014
2013
2007
2004
2008
2016
2009
2005
2019
harmonic mean
2006
2018
2012
2021
2020
arithmetic mean

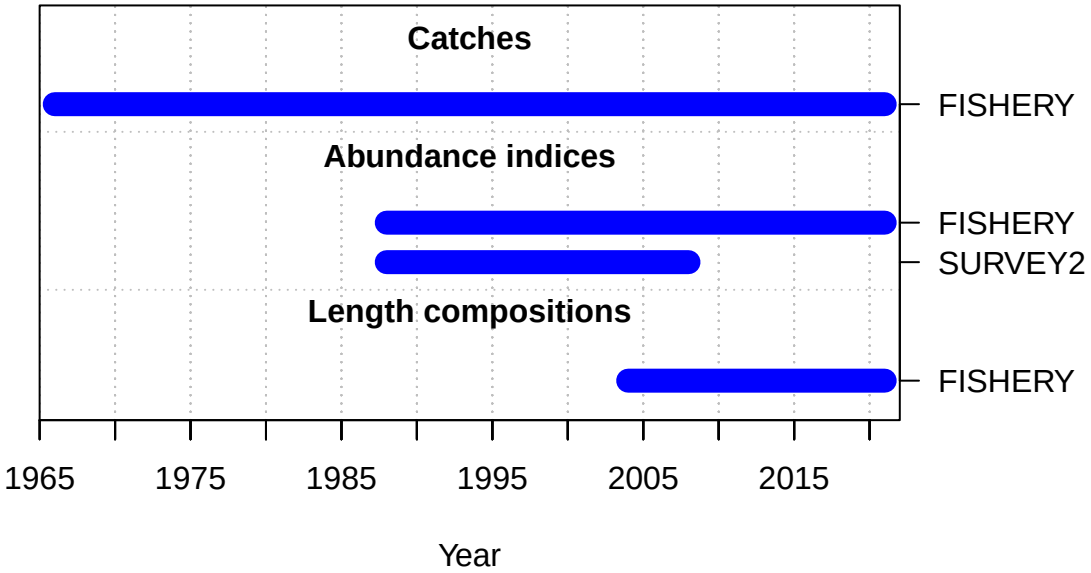

FISHERY (whole catch)
23.0
22.5
22.0
21.5
21.0
20.5
Mean length
2005
2010
2015
2020
Year

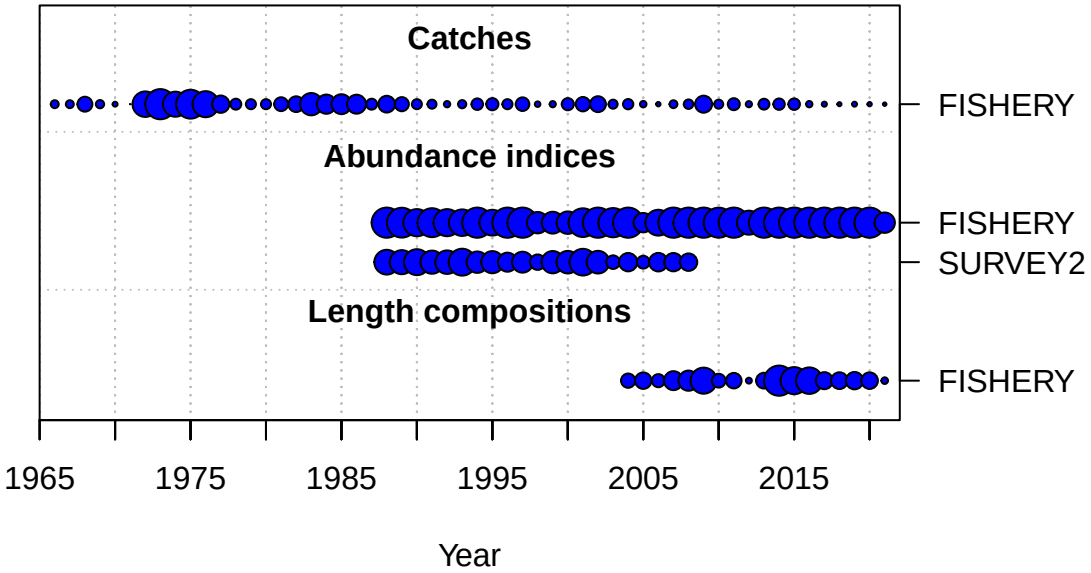

Equilibrium yield (mt)
0
5
10
15
0.0
0.2
0.4
0.6
0.8
1.0
Fraction unfished

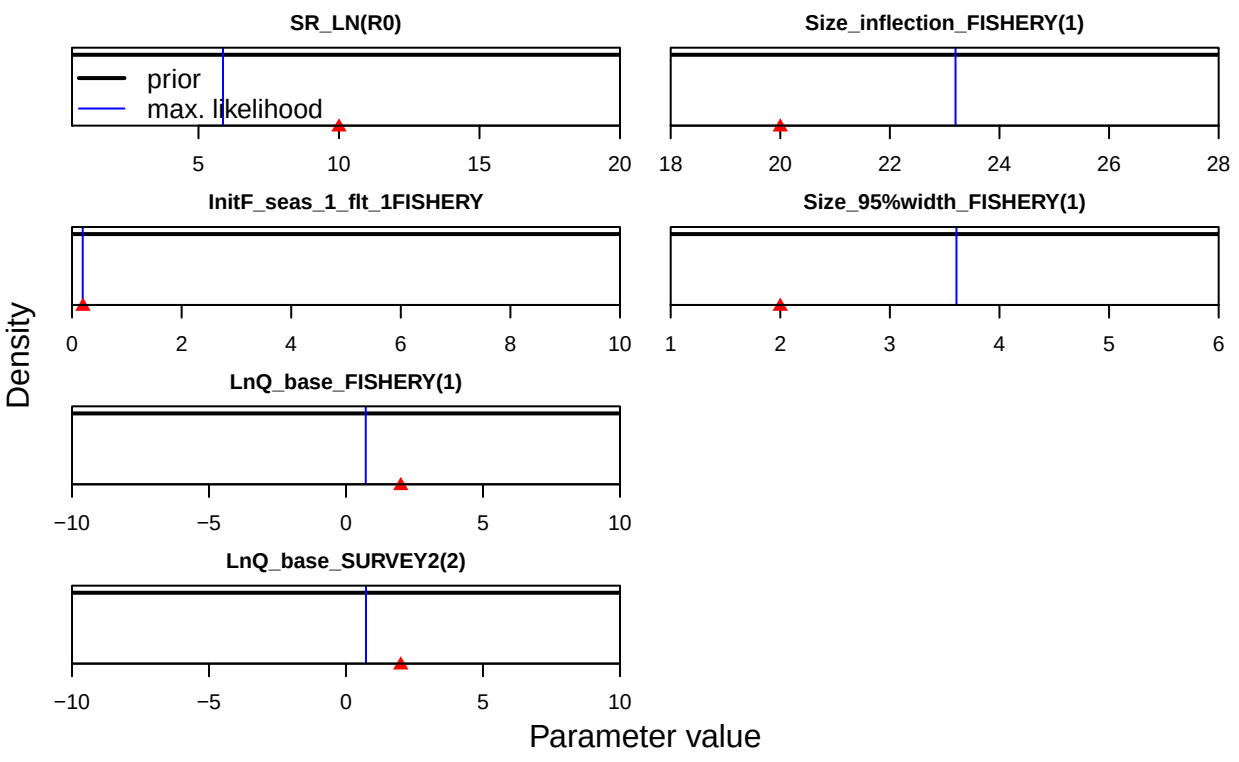

MSY
B target
SPR target
Current
Equilibrium yield (mt)
0
5
10
15
0.0
0.2
0.4
0.6
0.8
1.0
Fraction unfished


Surplus production (mt)
10
5
0
−5
0
5
10
15
20
25
30
35
Total biomass (mt)


Yield per recruit (kg)
0.000
0.010
0.020
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