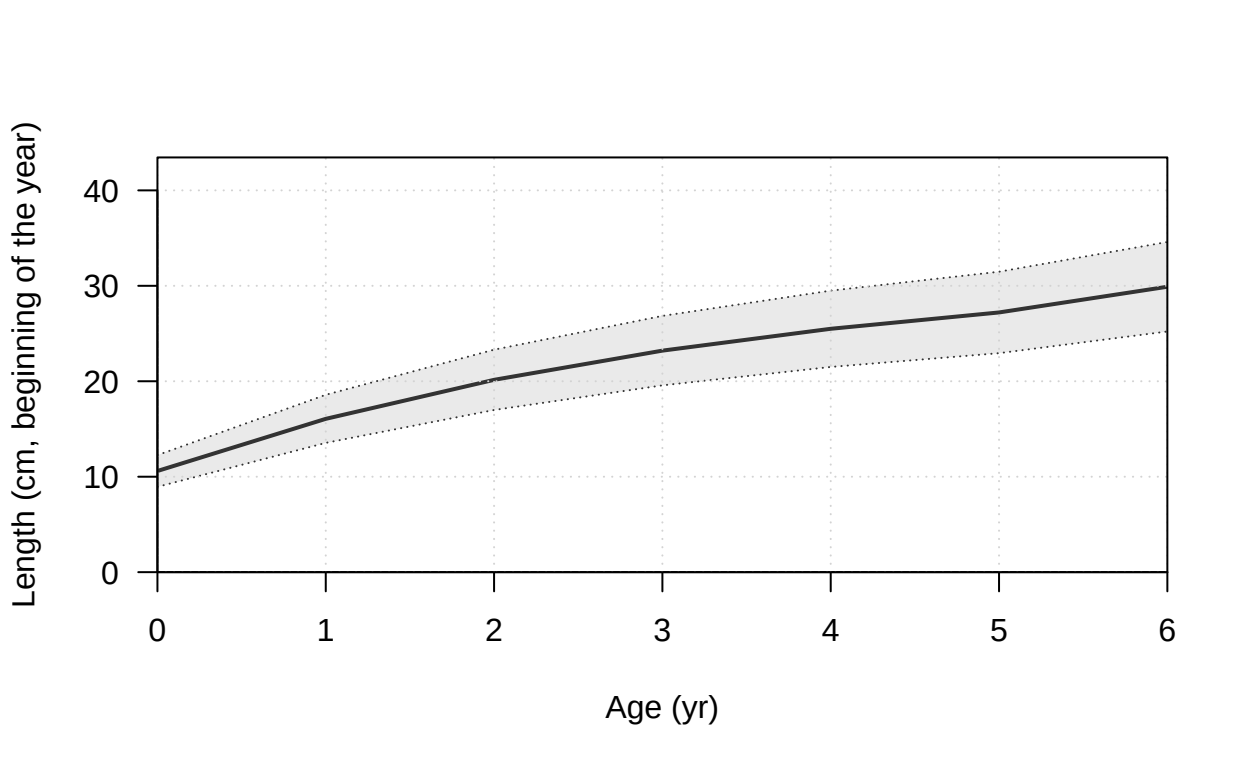
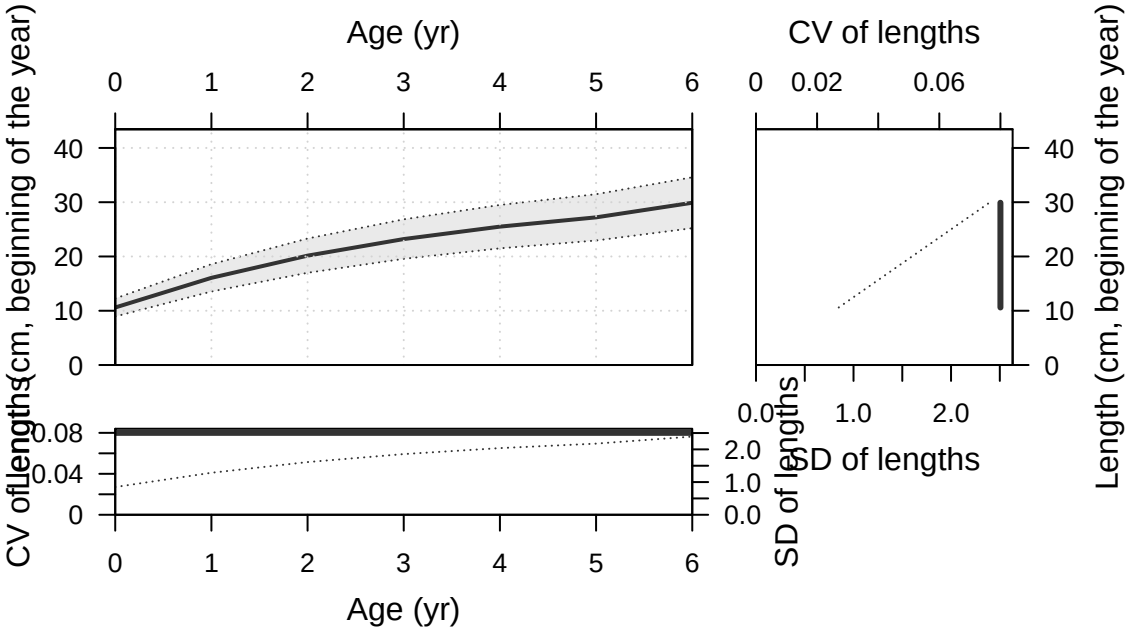
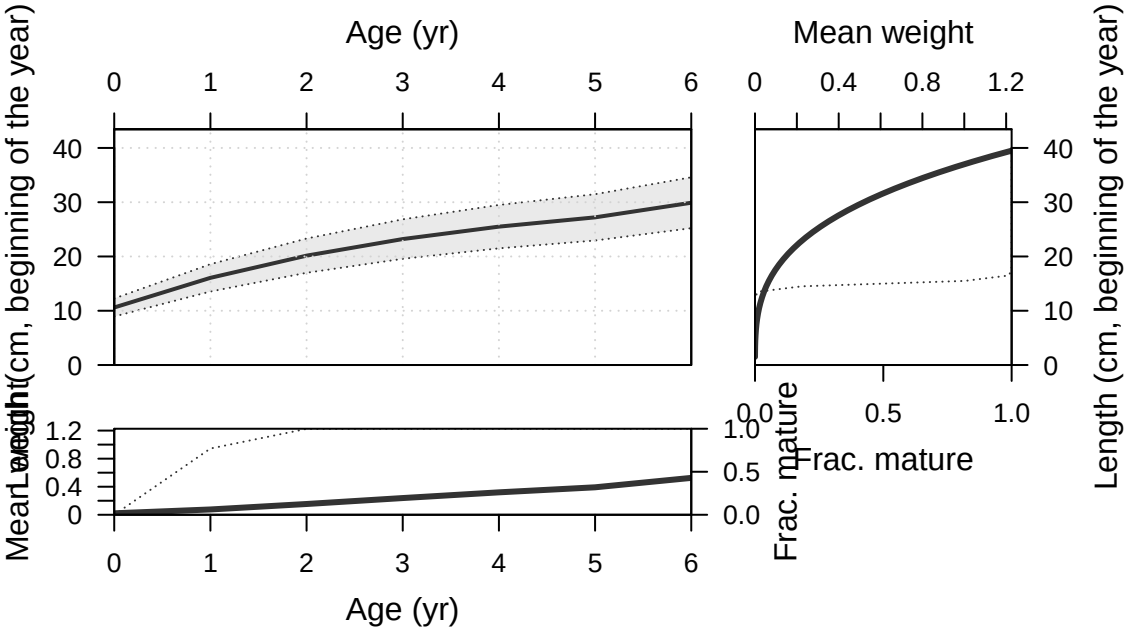
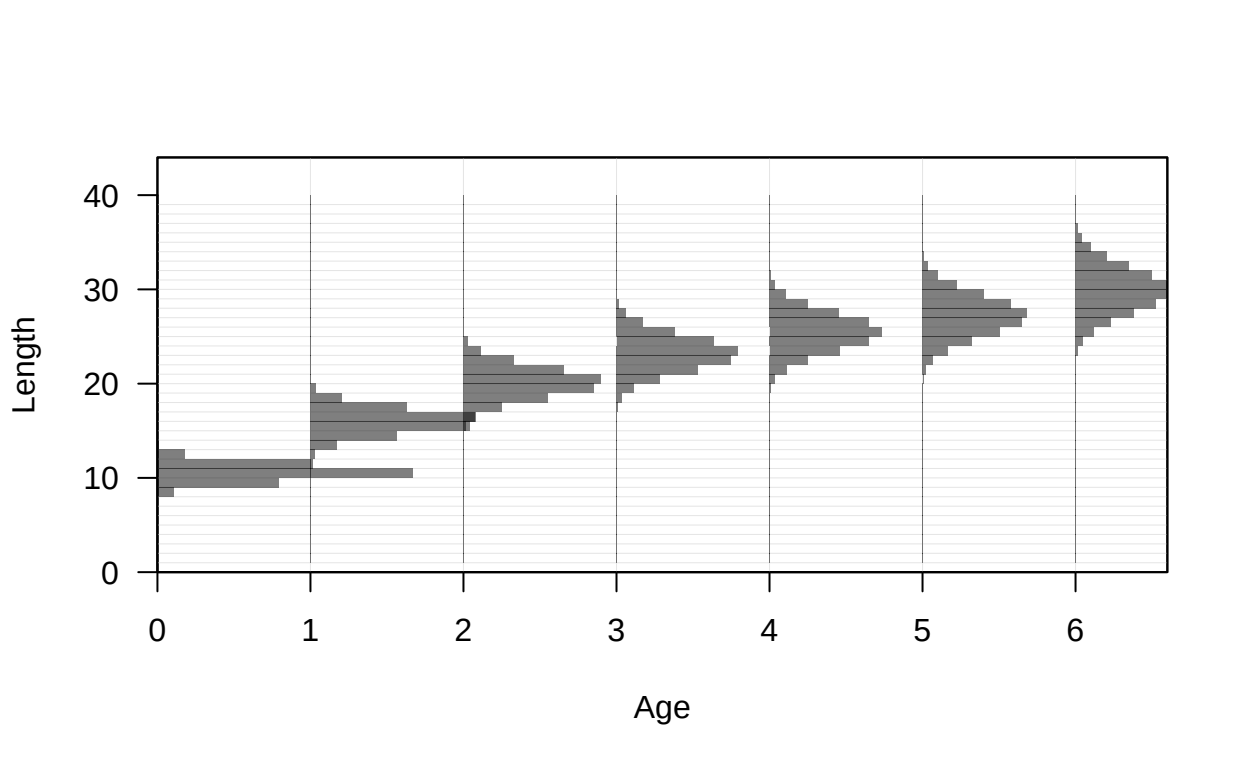
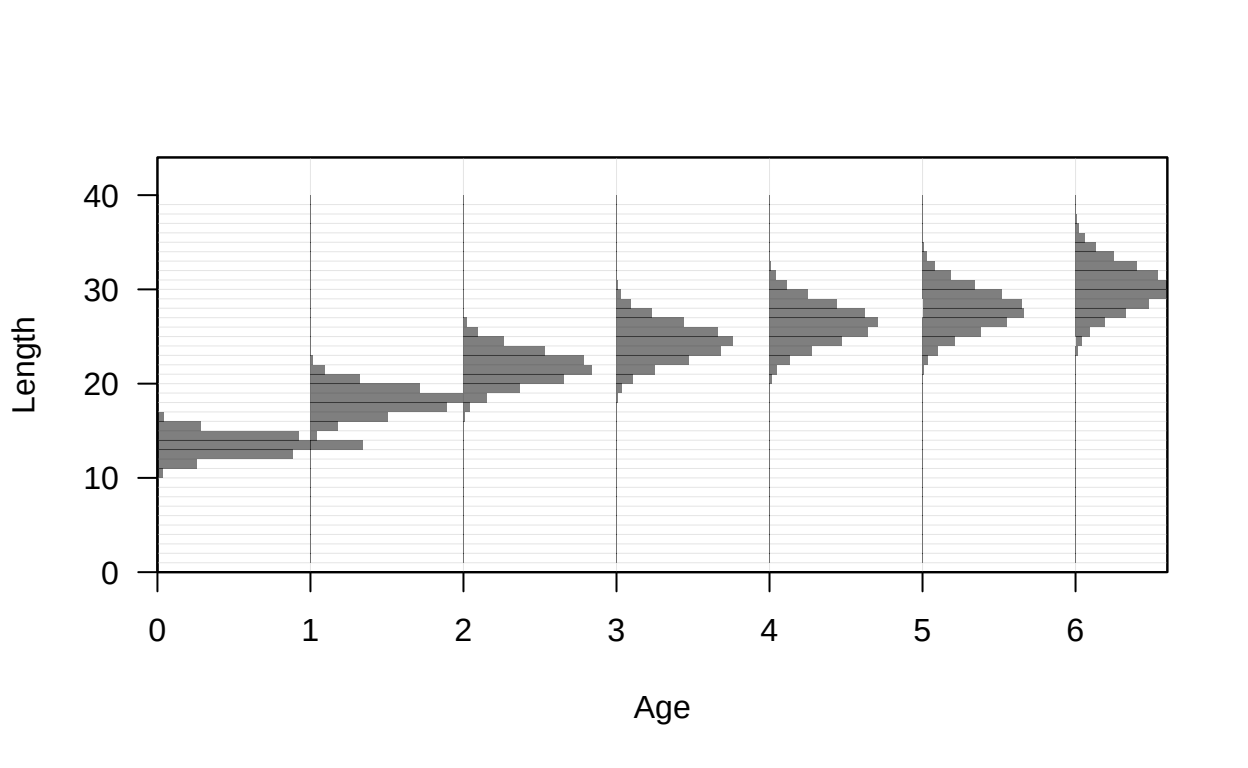
Plots created using the 'r4ss' package in R
Stock Synthesis version: 3.30.19.0
StartTime: Fri Jul 15 17:10:37 2022
Data_File: data.ss
Control_File: control.ss

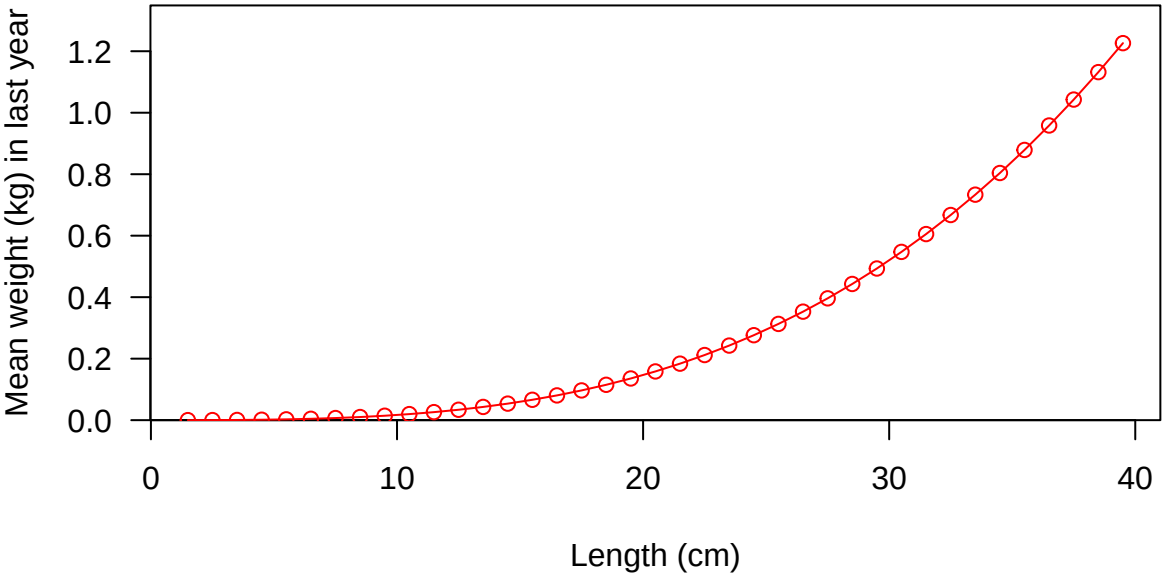

Length (cm, beginning of the year)
0
10
20
30
40
0
1
2
3
4
5
6
Age (yr)

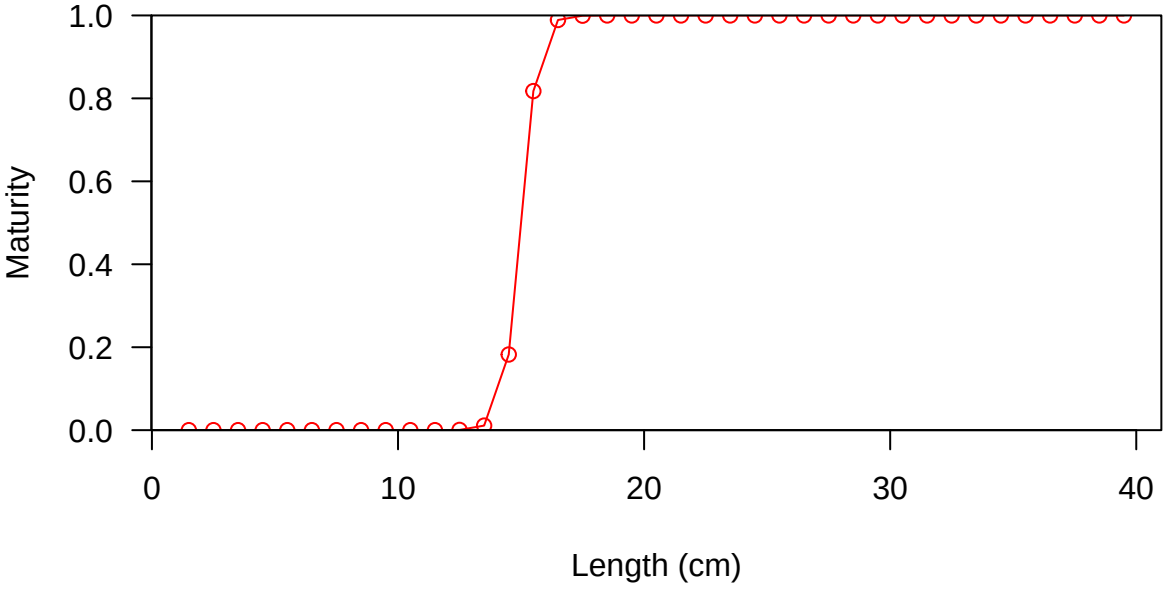

Age (yr)
0
1
2
3
4
5
6
Length (cm, beginning of the year)
0
10
20
30
40
CV of lengths
0.02
0.06
SD of lengths
0.0
1.0
2.0
0.04
0.08

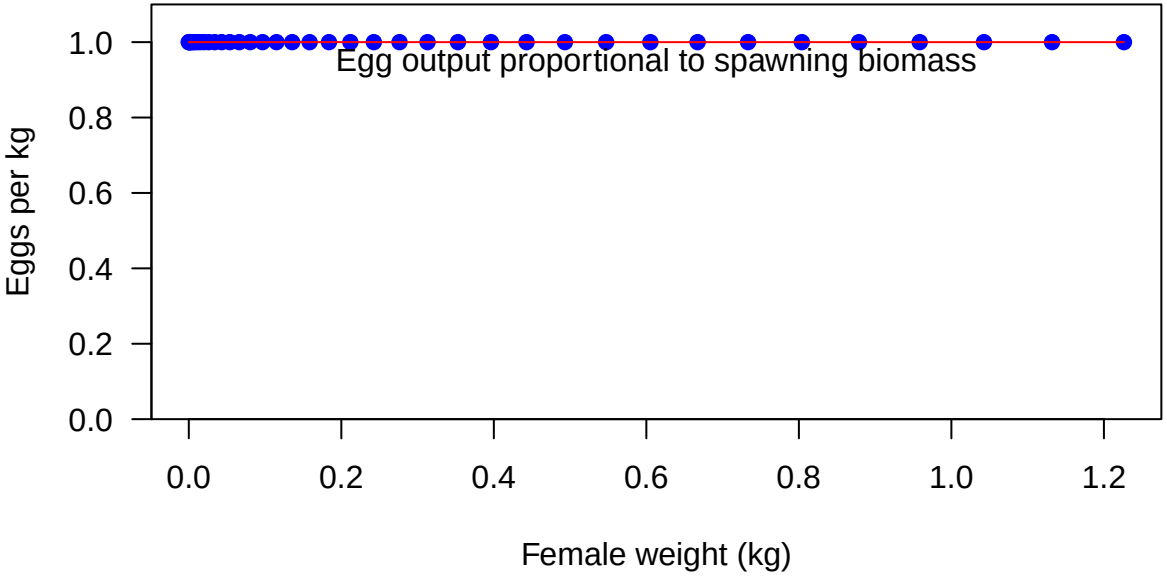

Age (yr)
Mean weight
Length (cm, beginning of the year)
Mean weight
Frac. mature
Age (yr)

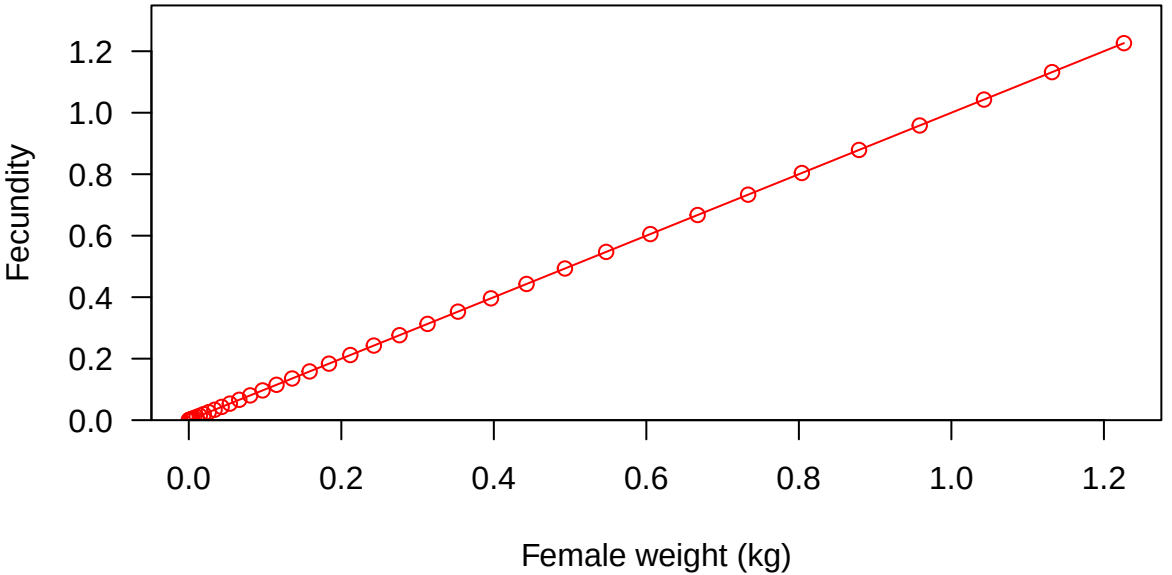

Length
40
30
20
10
0
0
1
2
3
4
5
6
Age

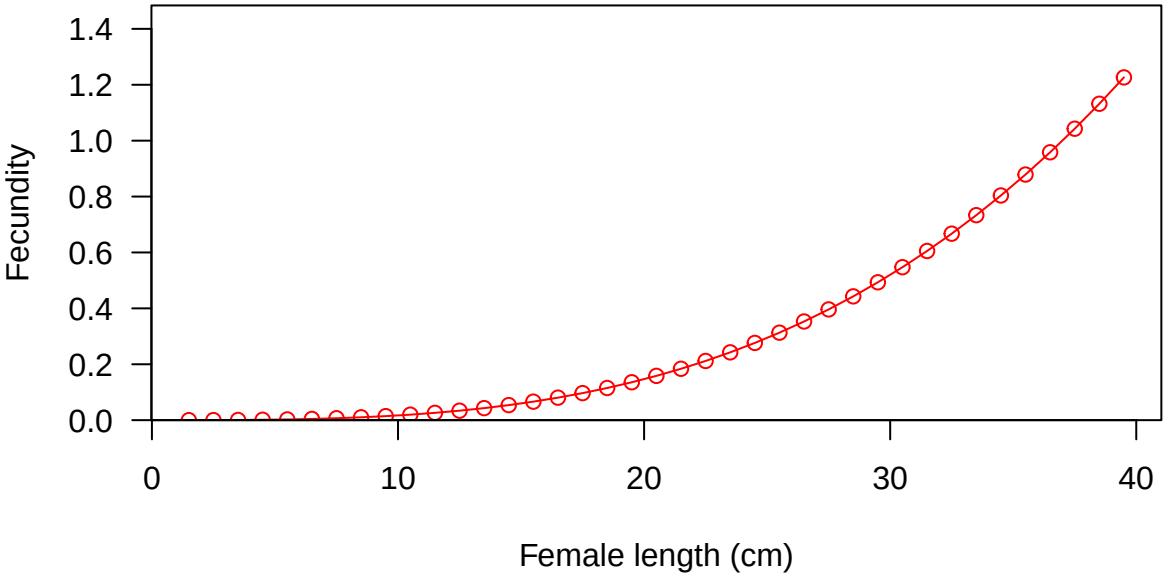

Length
0
10
20
30
40
0
1
2
3
4
5
6
Age

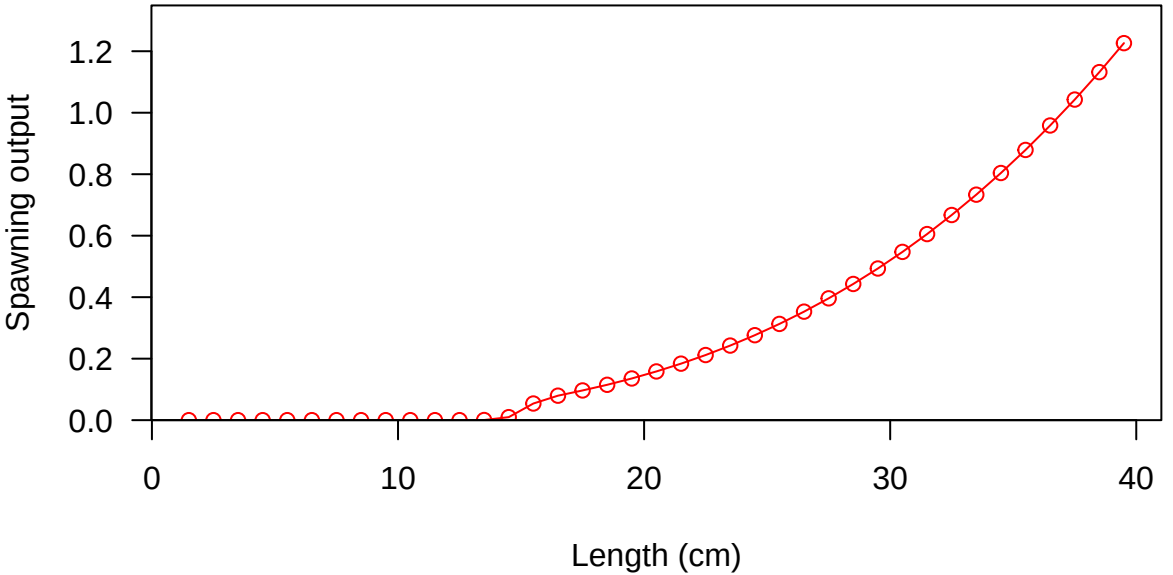

Mean weight (kg) in last year
0.0
0.2
0.4
0.6
0.8
1.0
1.2
0
10
20
30
40
Length (cm)

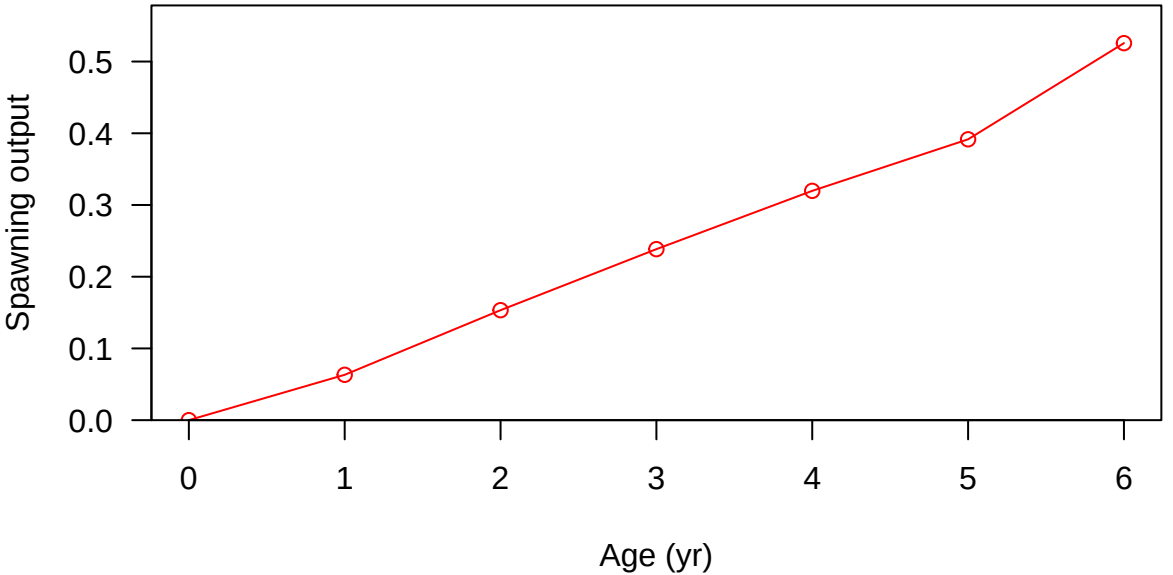

1.0
0.8
0.6
0.4
0.2
0.0
Maturity
0
10
20
30
40
Length (cm)

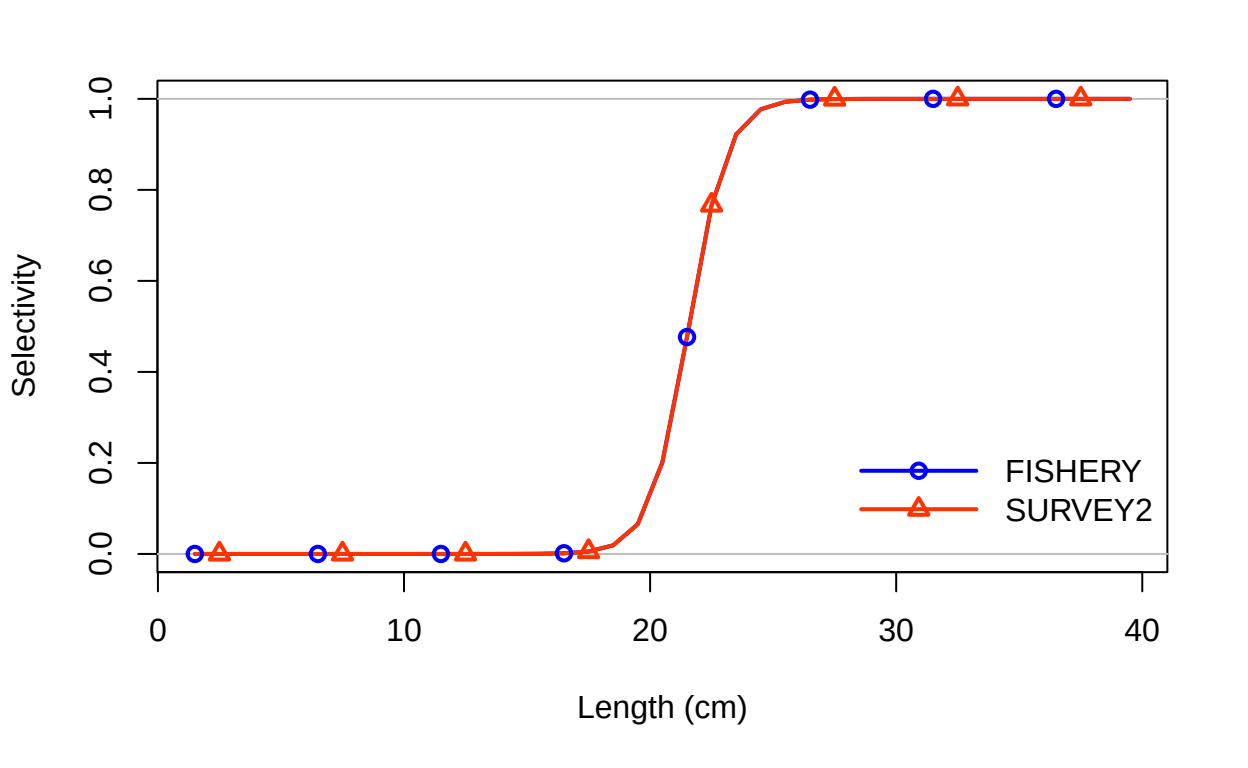

Egg output proportional to spawning biomass
Eggs per kg
0.0
0.2
0.4
0.6
0.8
1.0
0.0
0.2
0.4
0.6
0.8
1.0
1.2
Female weight (kg)

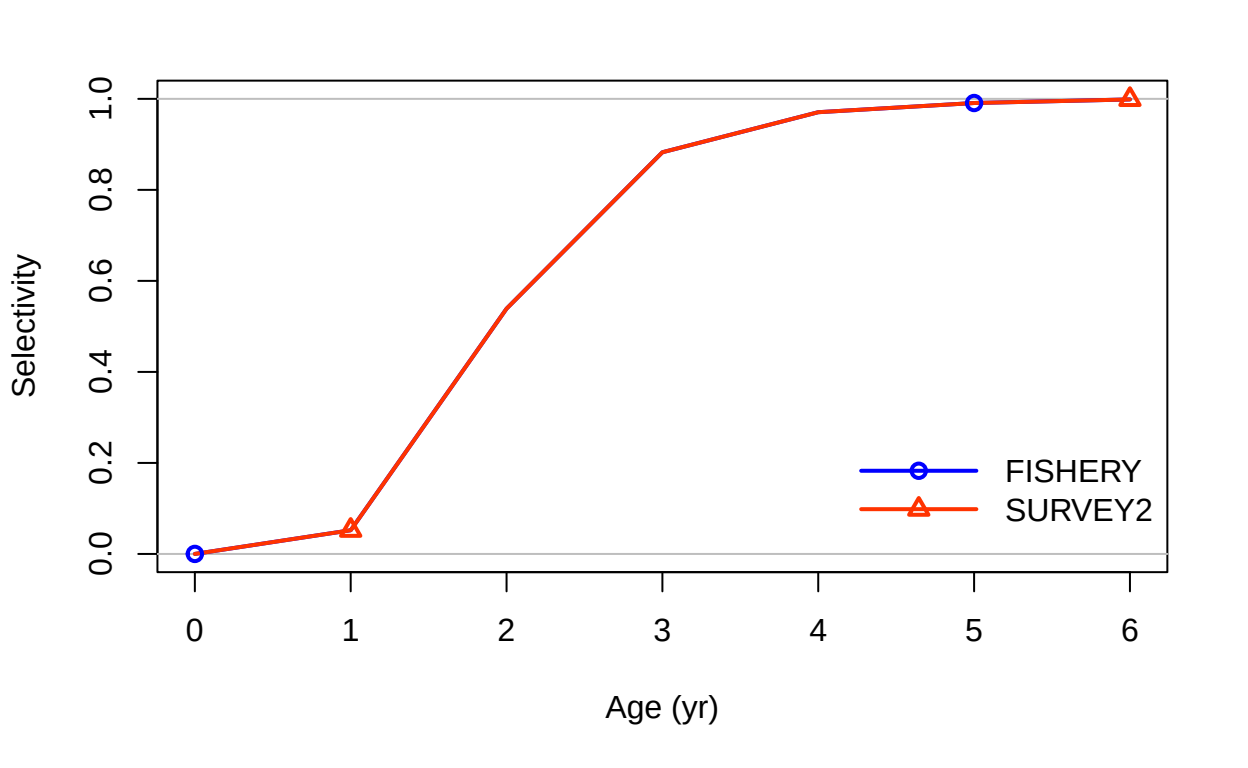

Fecundity
0.0
0.2
0.4
0.6
0.8
1.0
1.2
0.0
0.2
0.4
0.6
0.8
1.0
1.2
Female weight (kg)

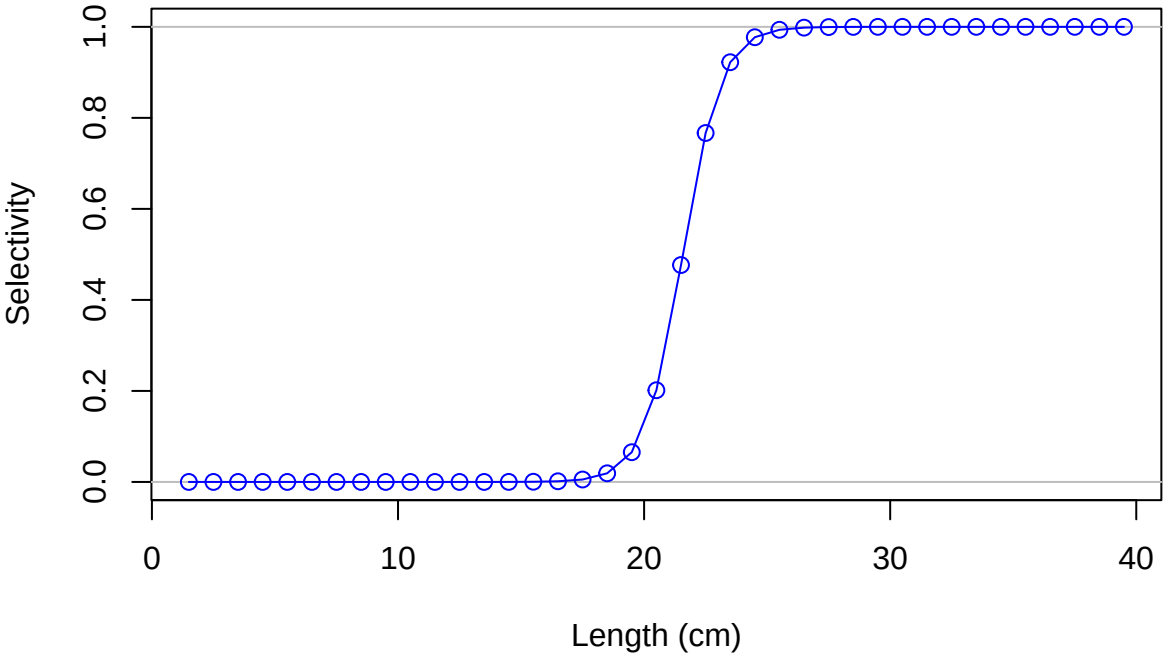

Fecundity
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0
10
20
30
40
Female length (cm)

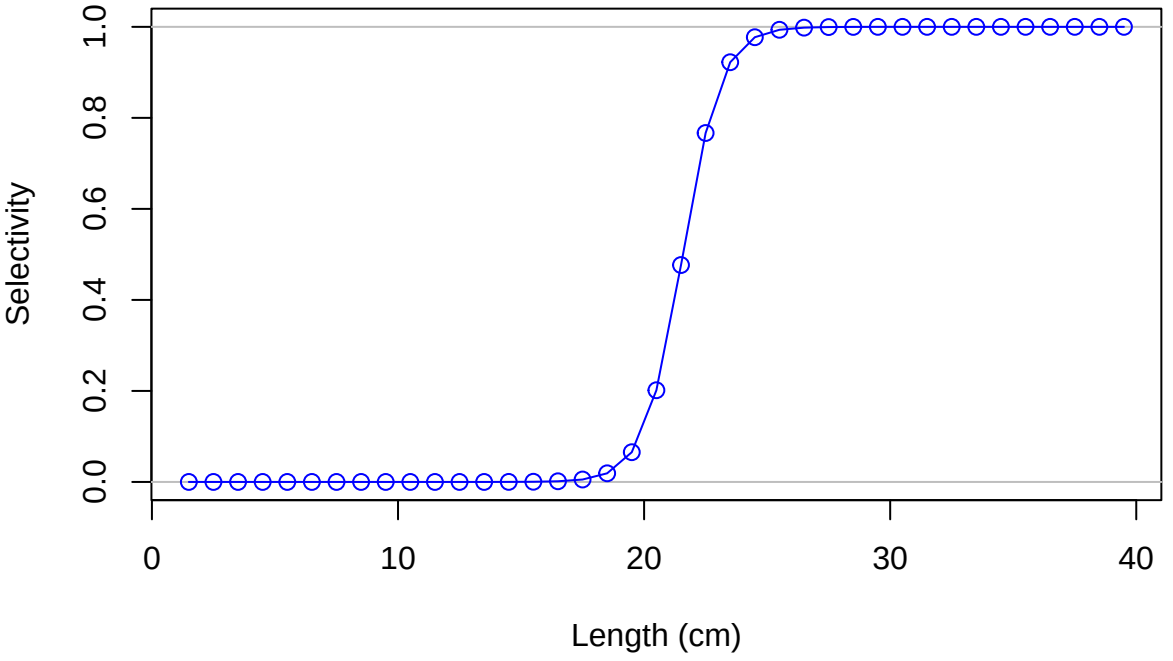

Spawning output
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0
10
20
30
40
Length (cm)

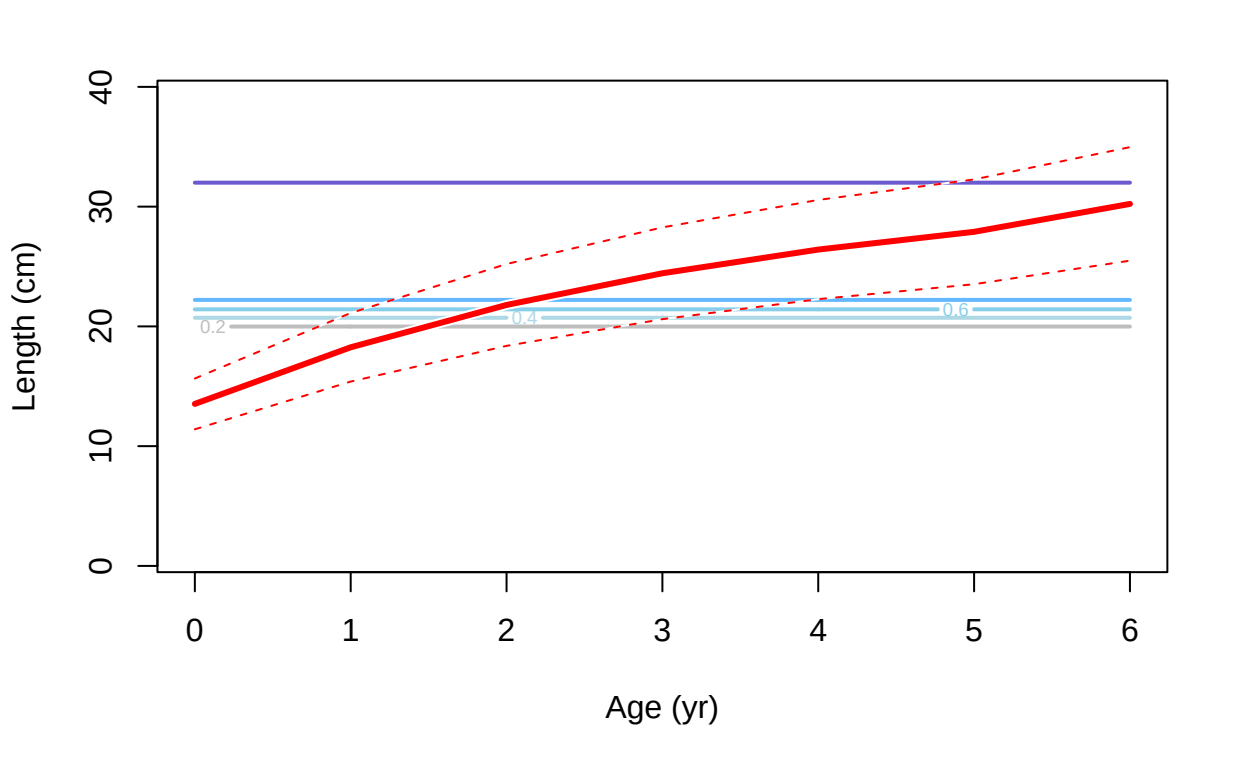

Spawning output
0.0
0.1
0.2
0.3
0.4
0.5
0
1
2
3
4
5
6
Age (yr)

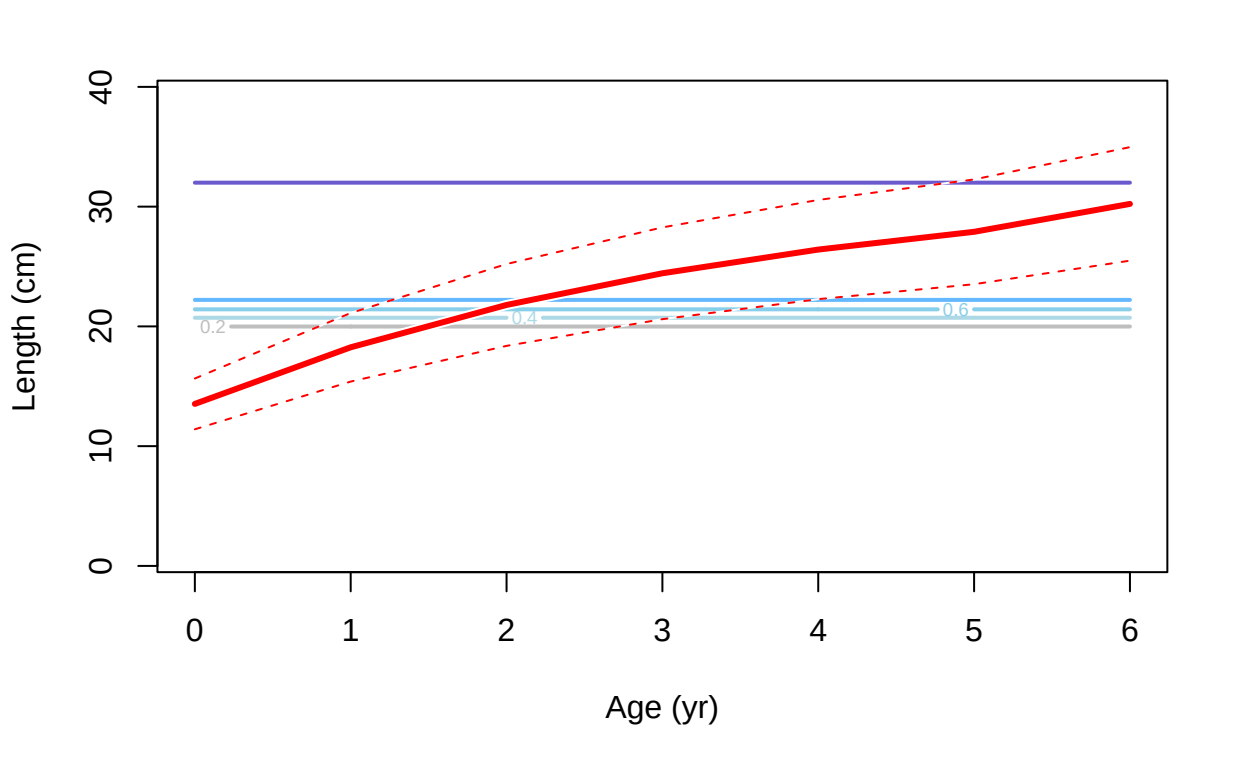

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
10
20
30
40
Length (cm)
FISHERY
SURVEY2

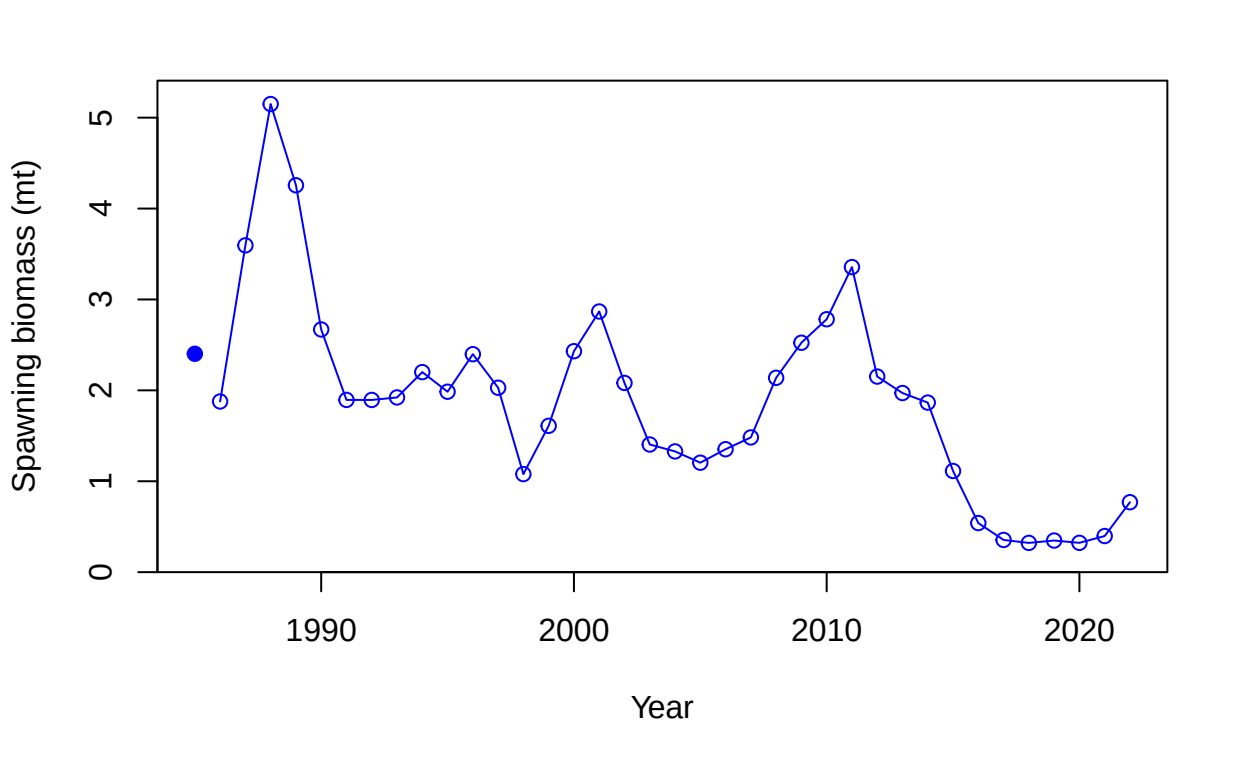

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
1
2
3
4
5
6
Age (yr)
FISHERY
SURVEY2

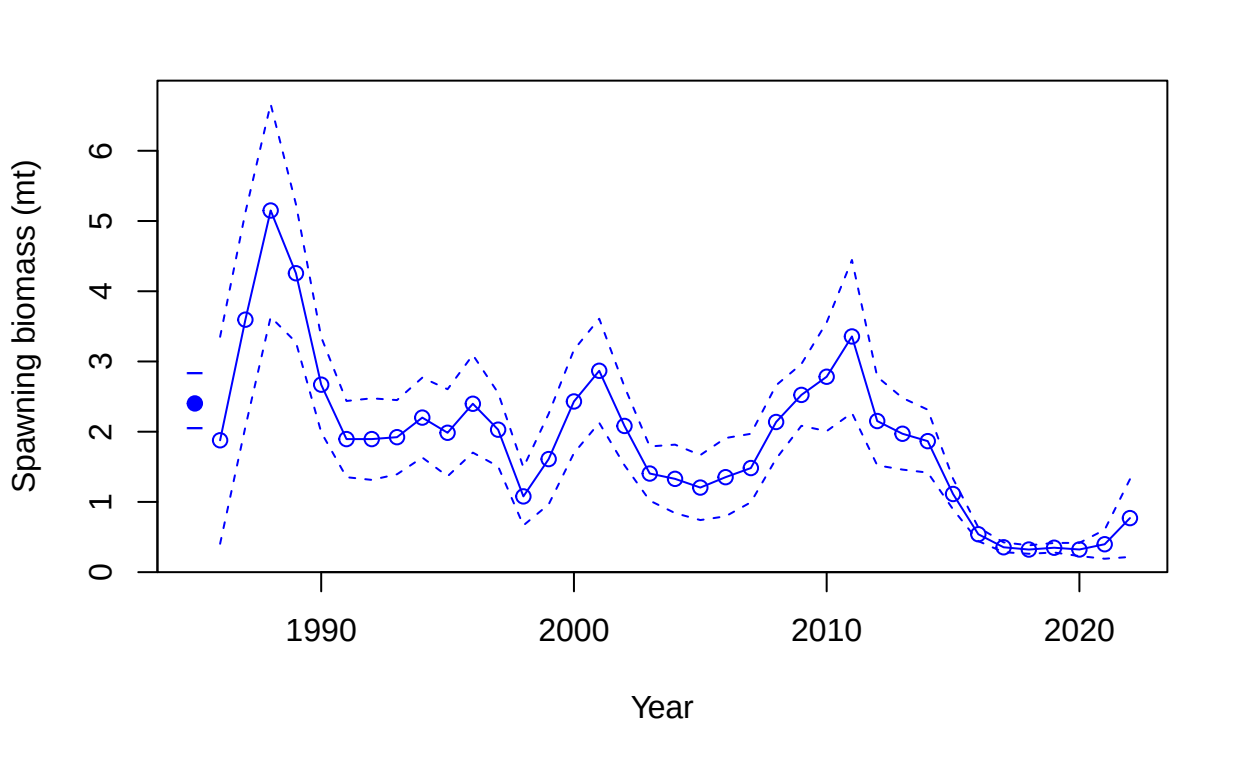

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
10
20
30
40
Length (cm)

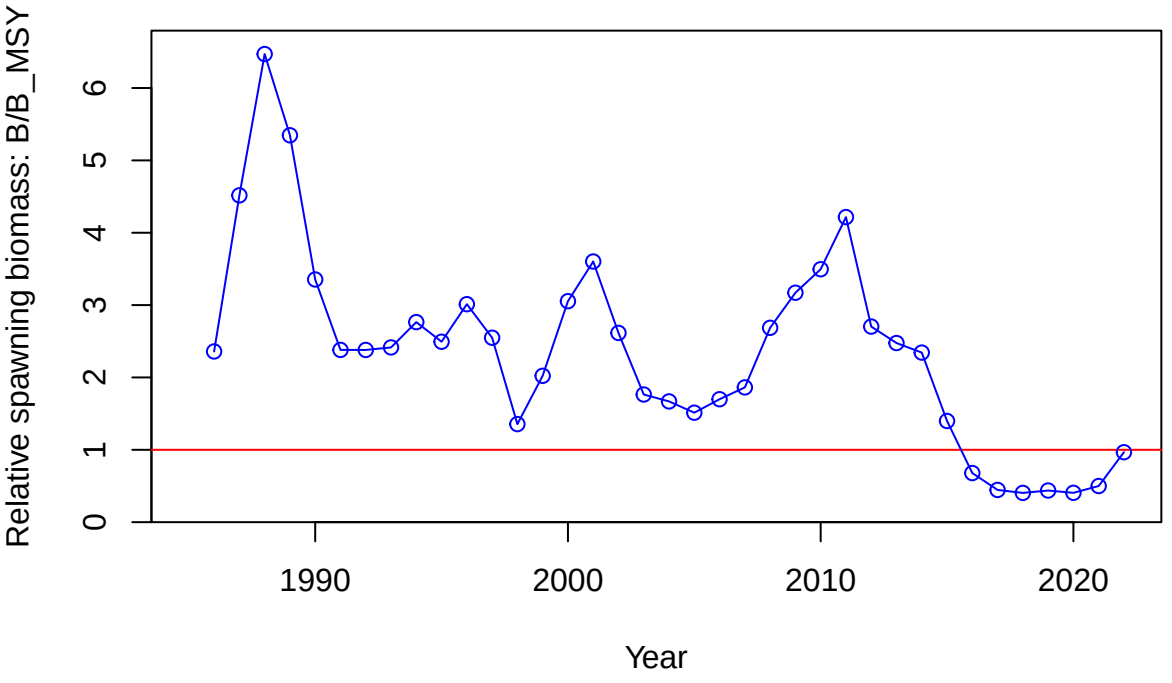

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
10
20
30
40
Length (cm)

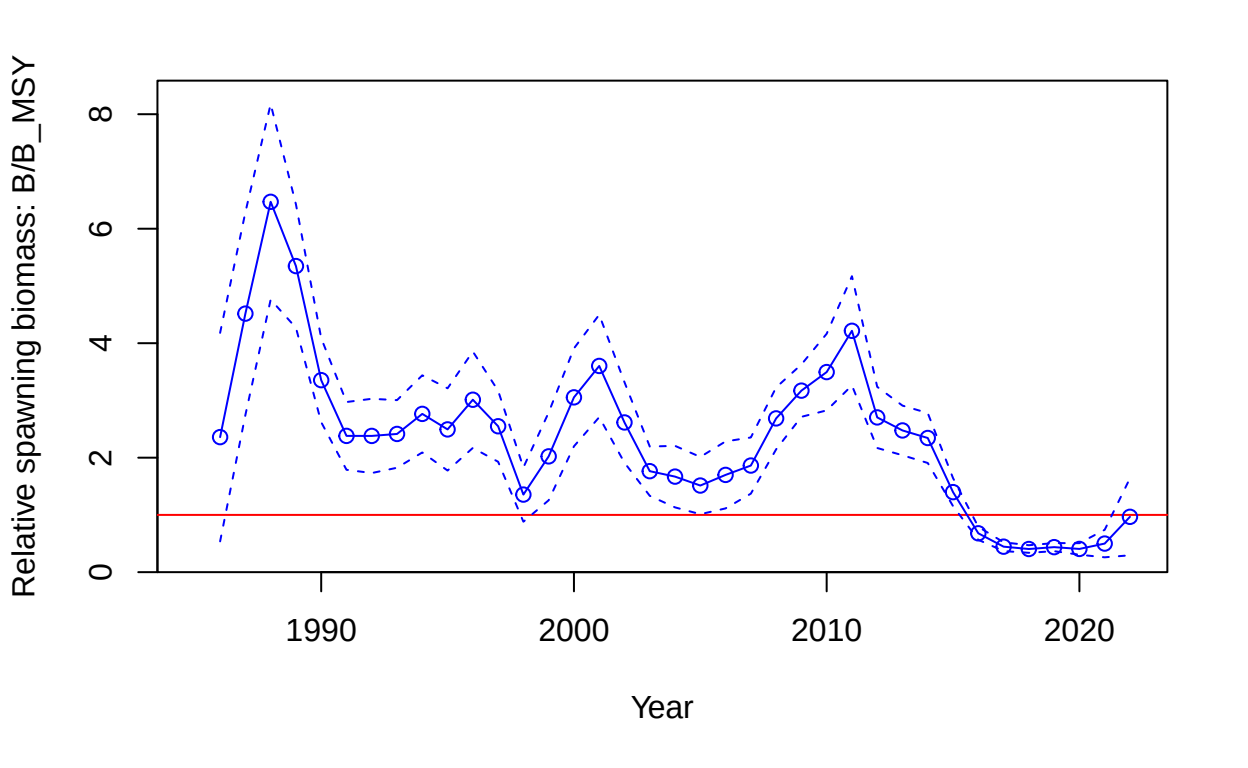

Length (cm)
0
10
20
30
40
0
1
2
3
4
5
6
Age (yr)
0.2
0.4
0.6

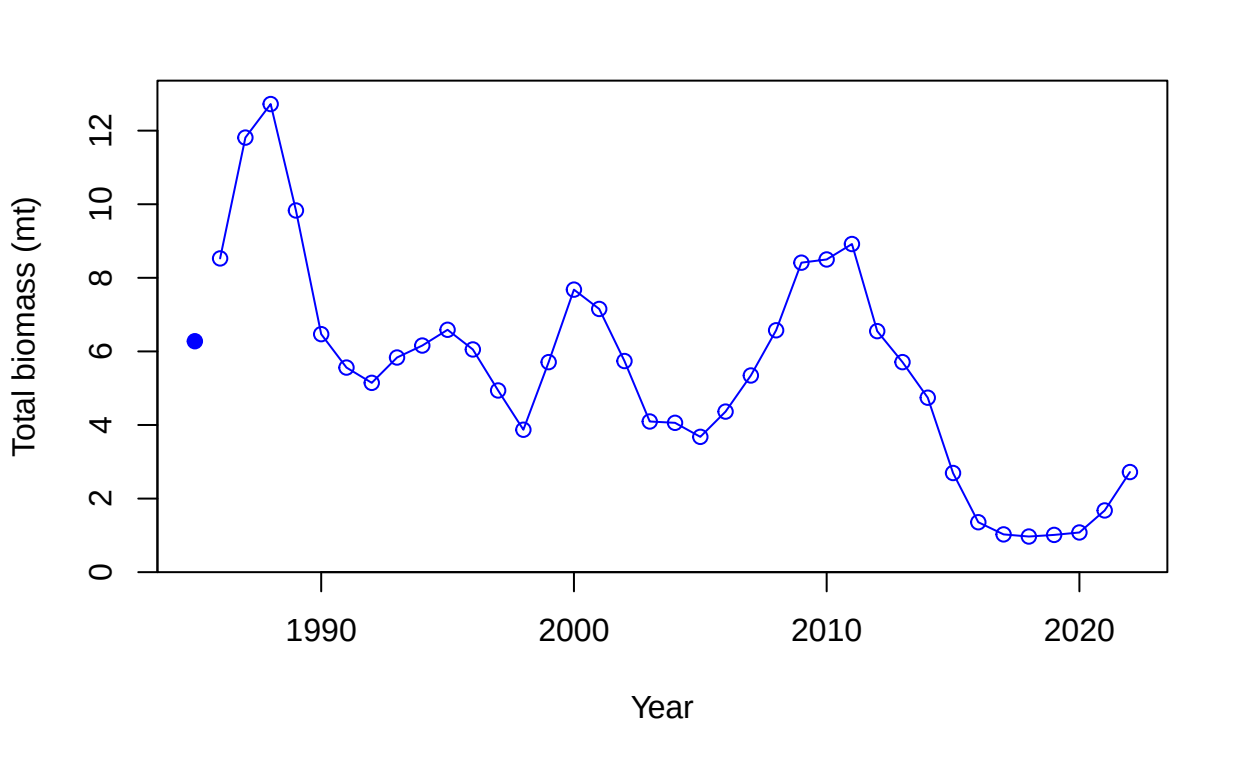

Length (cm)
0
10
20
30
40
0
1
2
3
4
5
6
Age (yr)
0.2
0.4
0.6

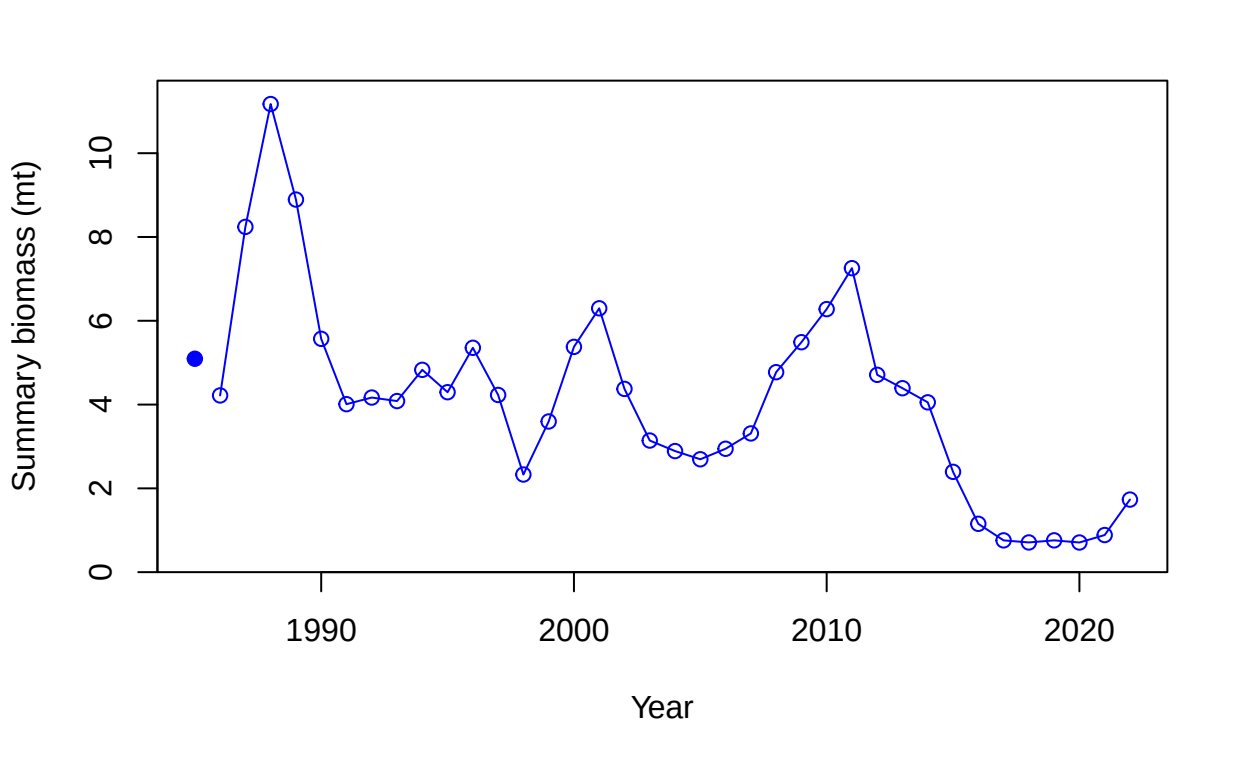

Spawning biomass (mt)
0
1
2
3
4
5
1990
2000
2010
2020
Year

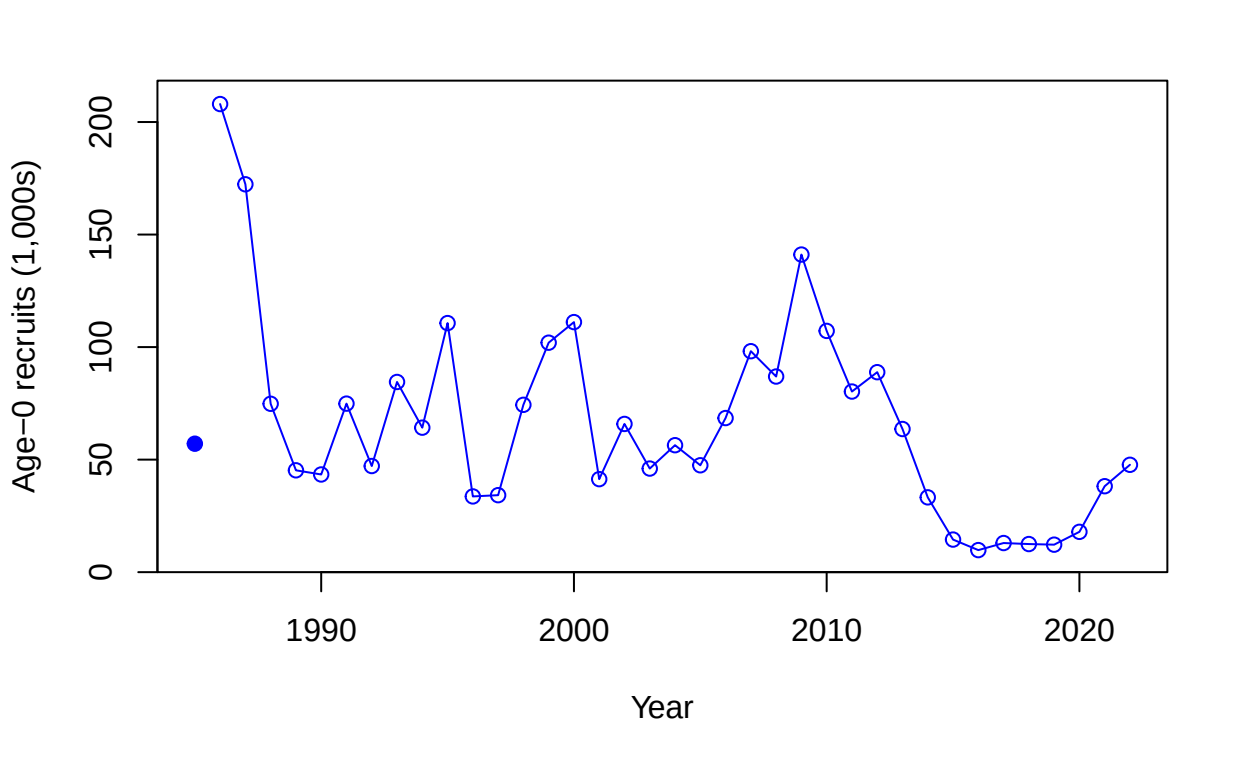

Spawning biomass (mt)
0
1
2
3
4
5
6
1990
2000
2010
2020
Year

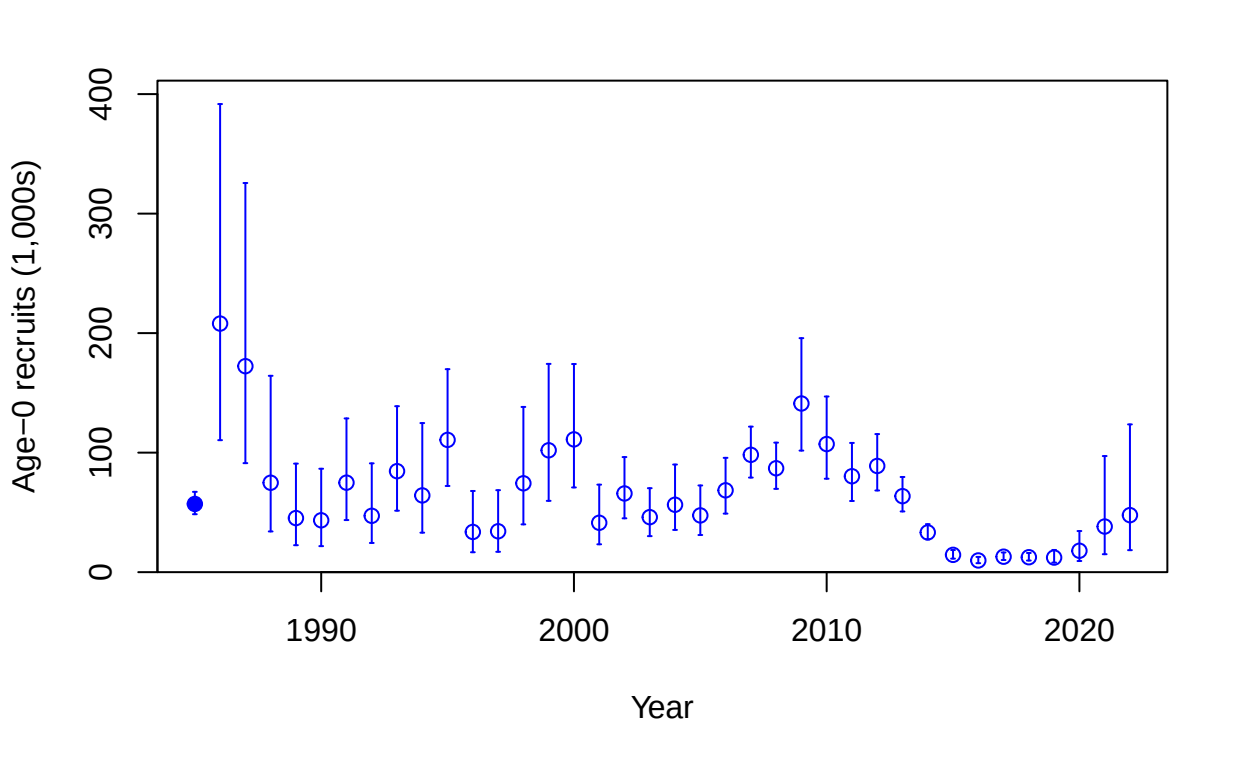

Relative spawning biomass: B/B_MSY
0
1
2
3
4
5
6
1990
2000
2010
2020
Year

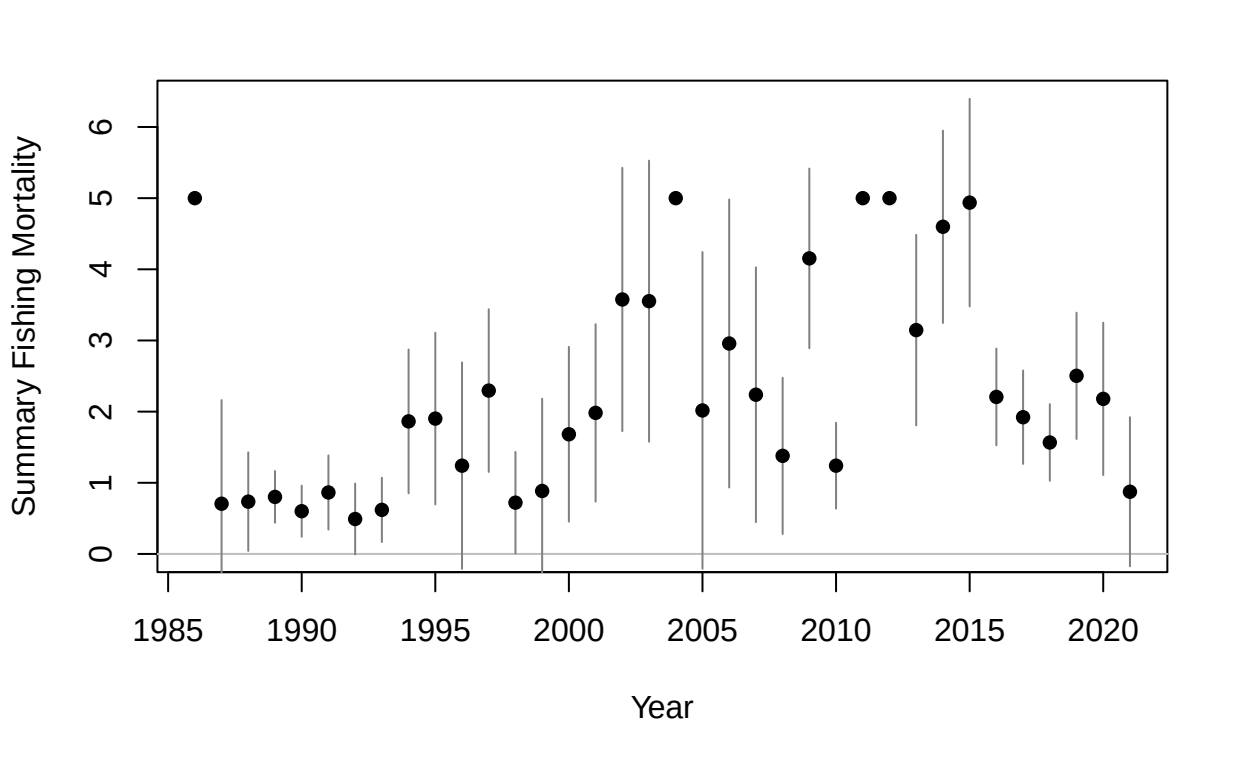

Relative spawning biomass: B/B_MSY
0
2
4
6
8
1990
2000
2010
2020
Year

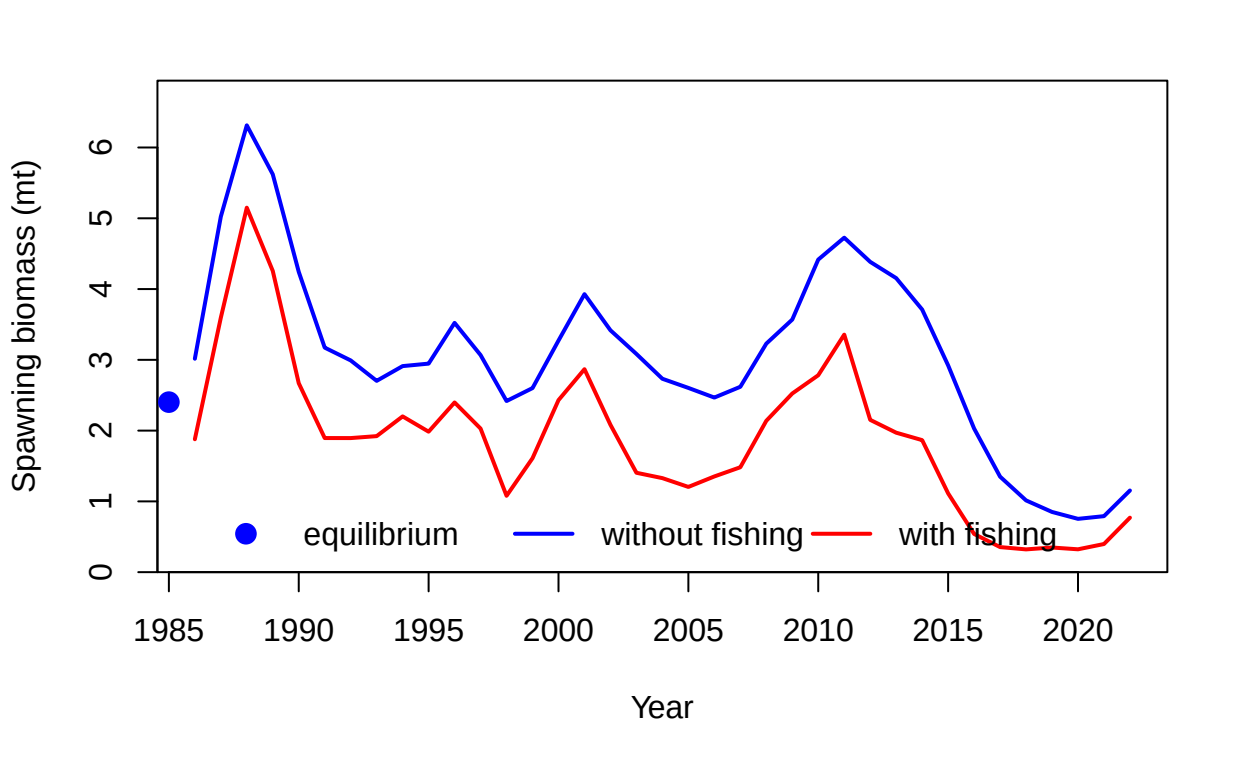

Total biomass (mt)
0
2
4
6
8
10
12
1990
2000
2010
2020
Year

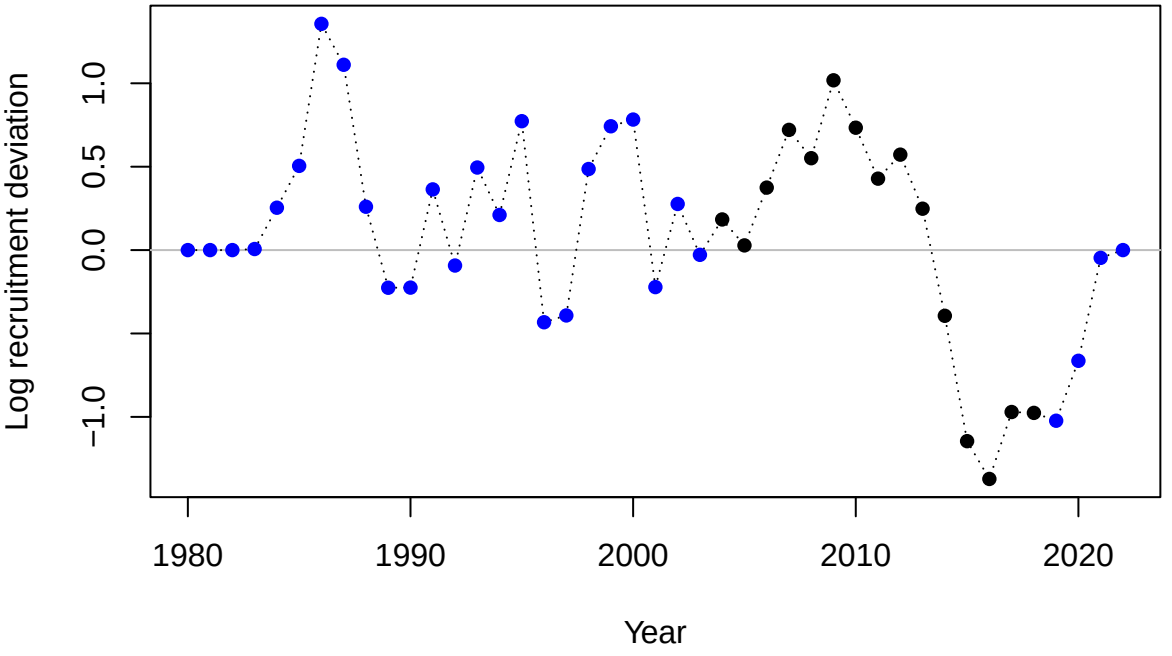

Summary biomass (mt)
0
2
4
6
8
10
1990
2000
2010
2020
Year

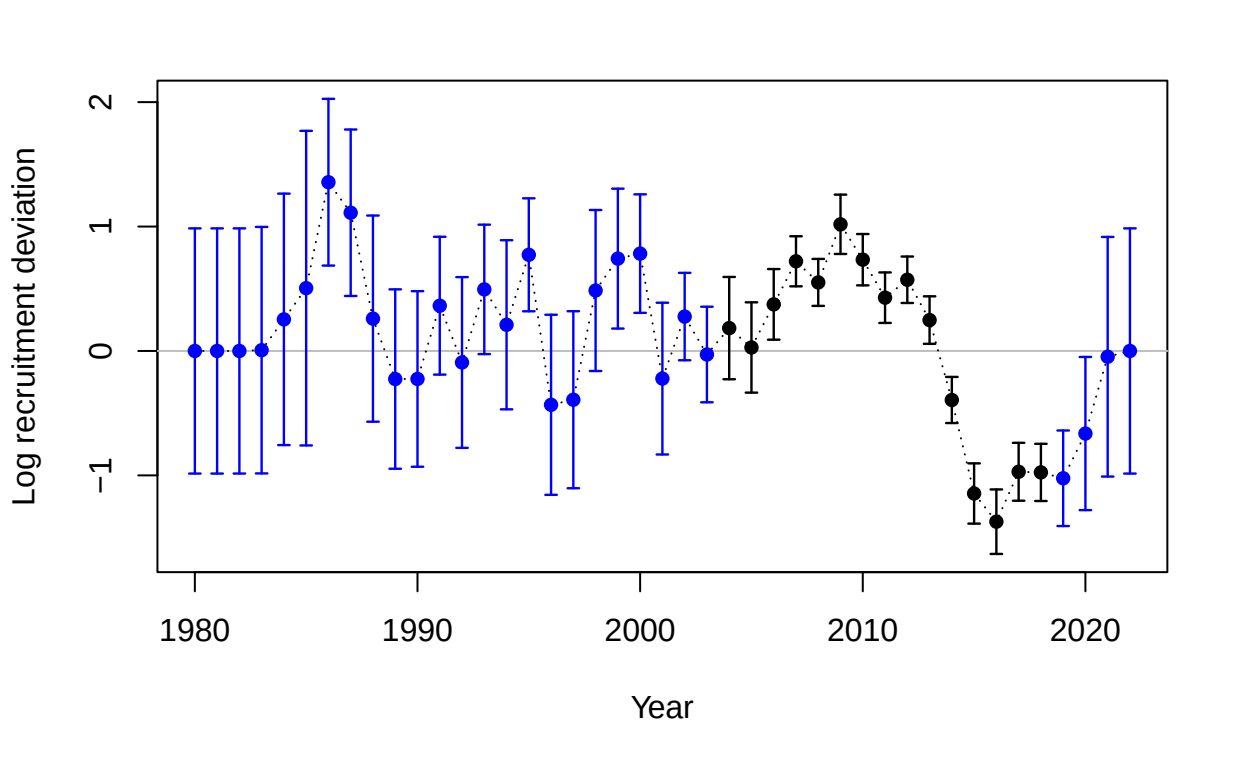

Age−0 recruits (1,000s)
0
50
100
150
200
1990
2000
2010
2020
Year

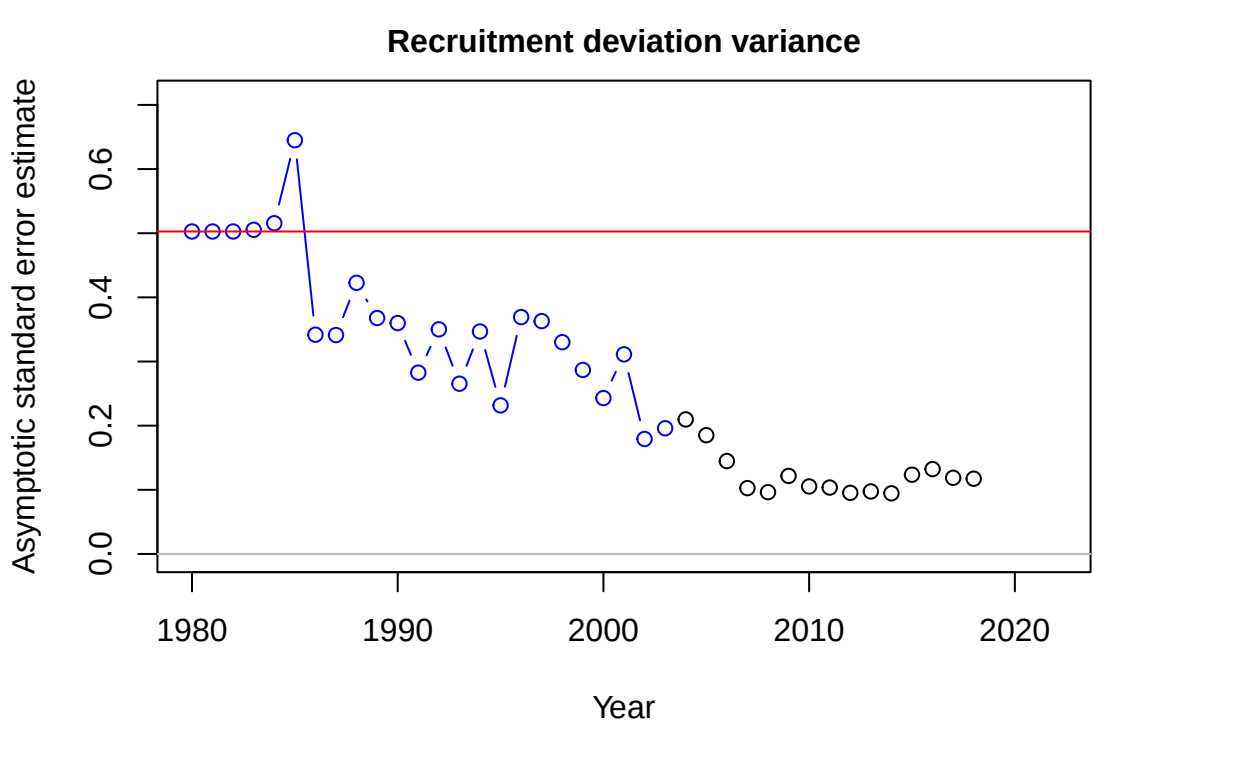

Age−0 recruits (1,000s)
0
100
200
300
400
1990
2000
2010
2020
Year

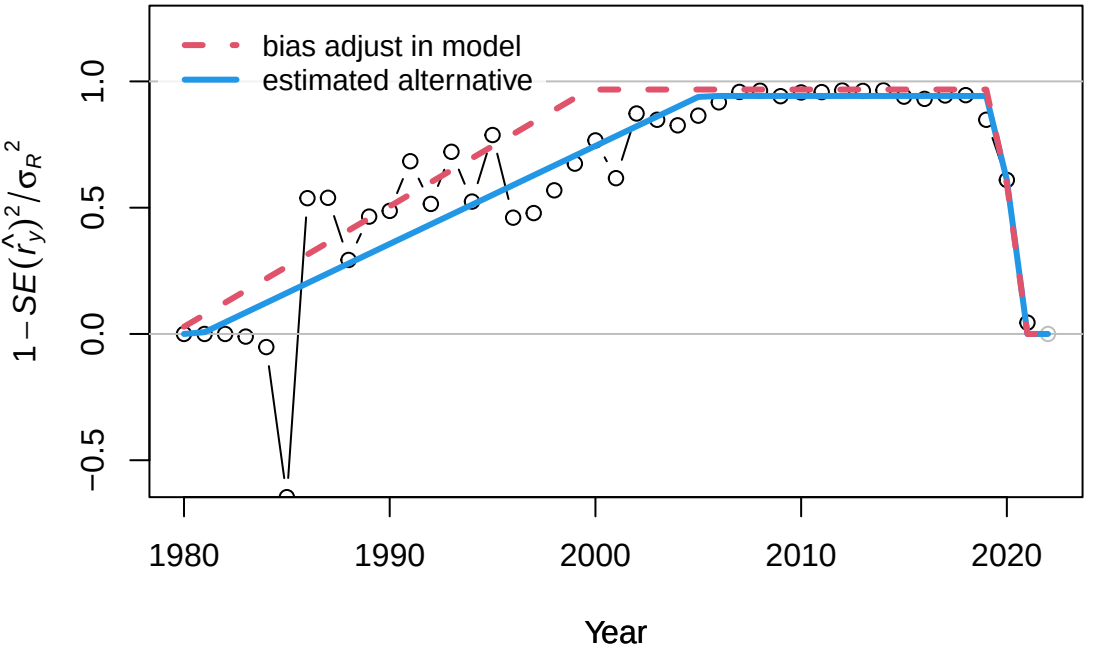

Summary Fishing Mortality
0
1
2
3
4
5
6
1985
1990
1995
2000
2005
2010
2015
2020
Year

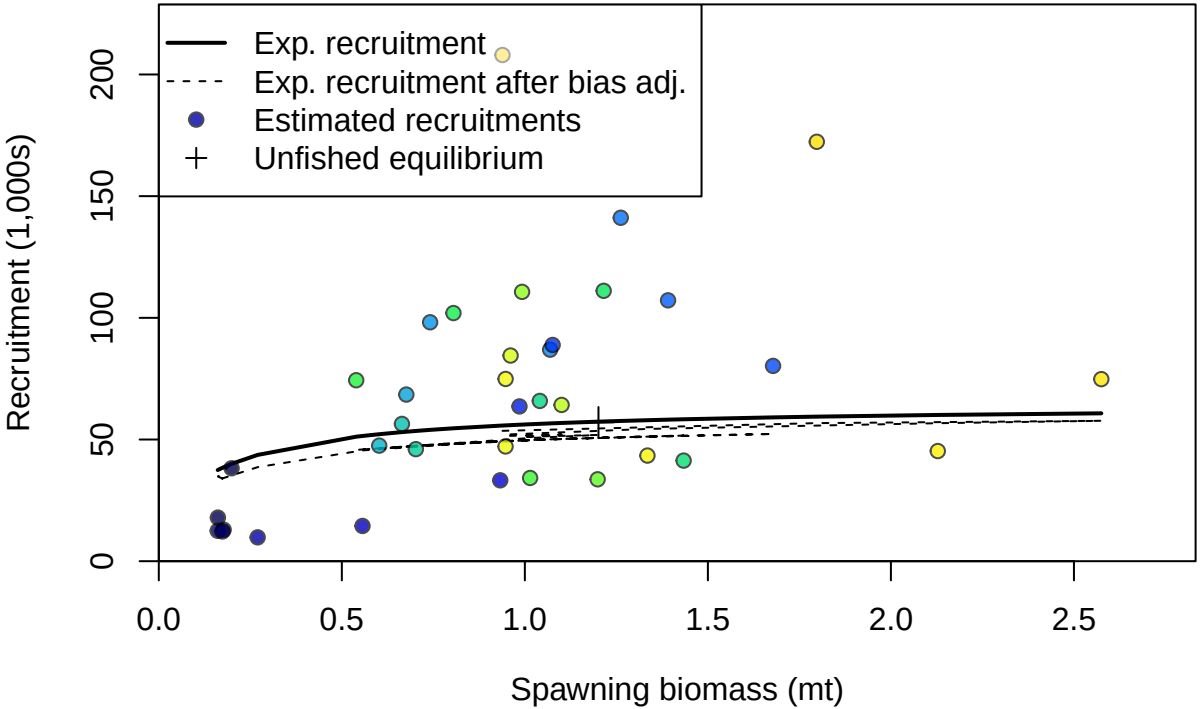

Spawning biomass (mt)
0
1
2
3
4
5
6
1985
1990
1995
2000
2005
2010
2015
2020
Year
equilibrium
without fishing
with fishing

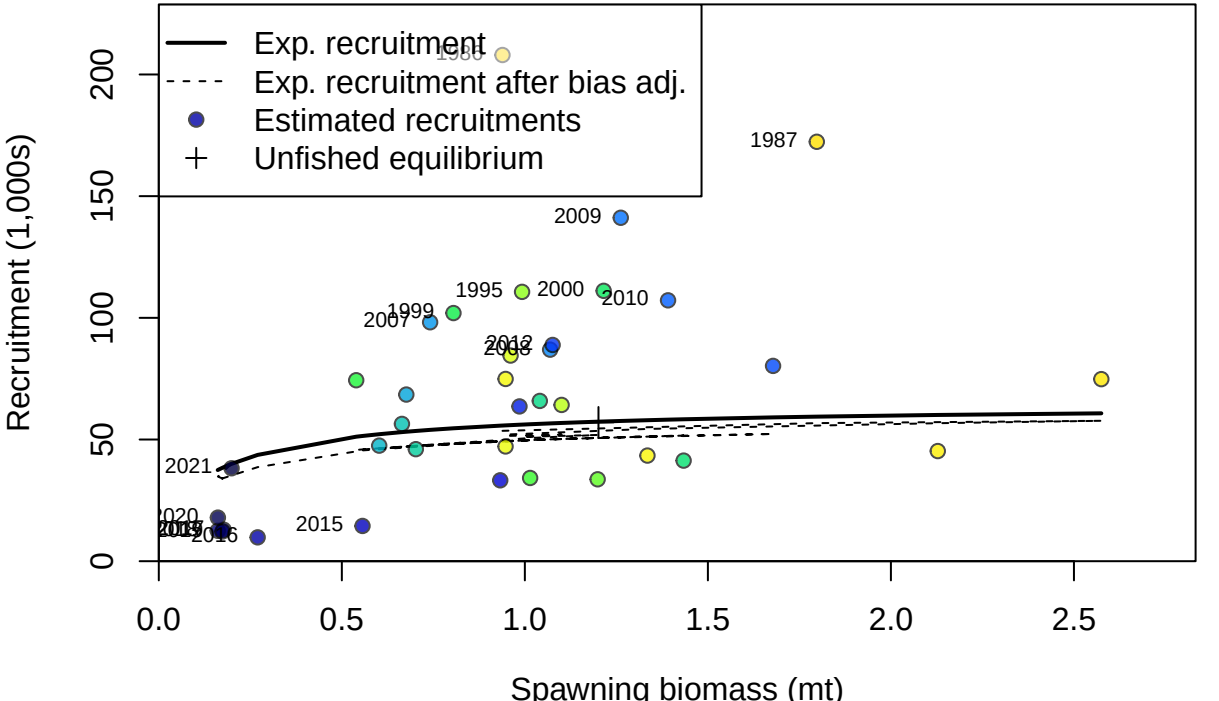

Log recruitment deviation
1.0
0.5
0.0
−1.0
1980
1990
2000
2010
2020
Year

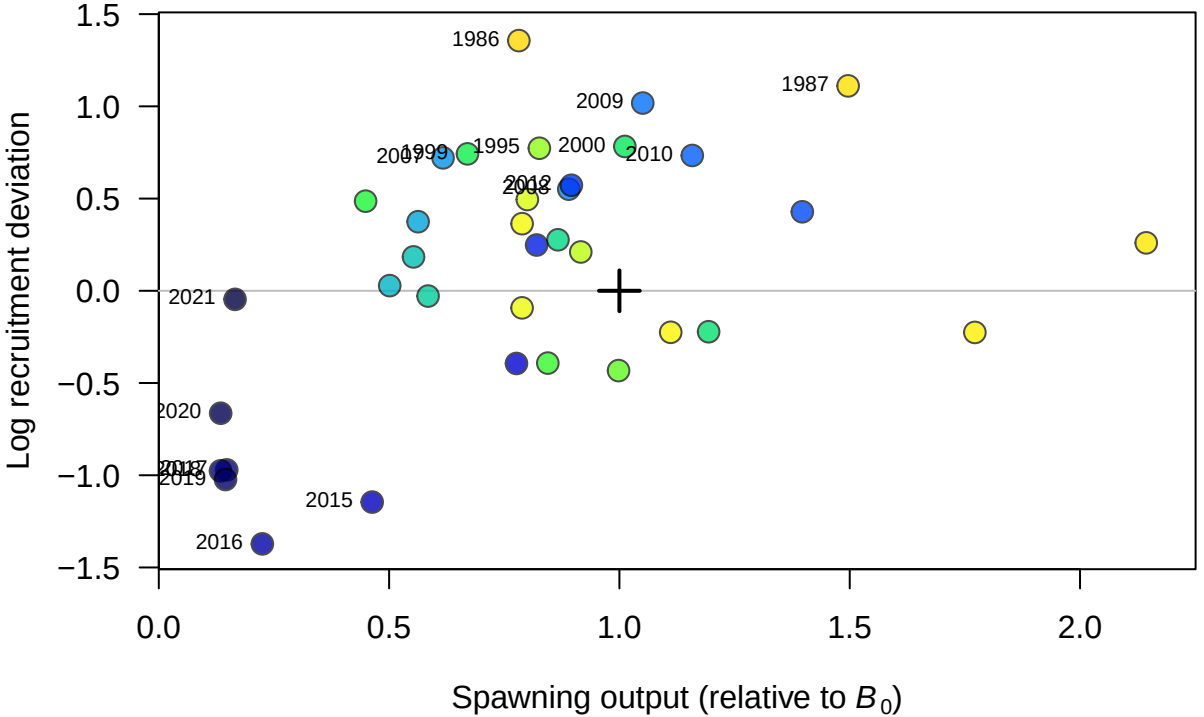

Log recruitment deviation
2
1
0
−1
1980
1990
2000
2010
2020
Year

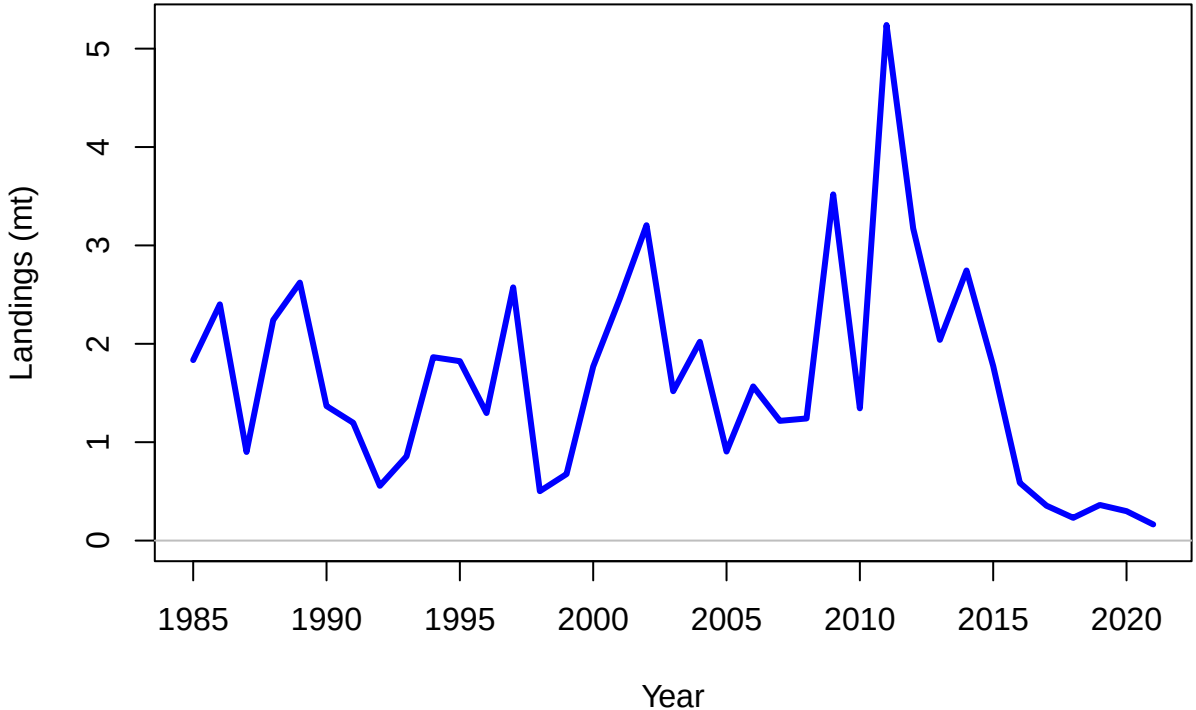

Recruitment deviation variance
Asymptotic standard error estimate
0.0
0.2
0.4
0.6
1980
1990
2000
2010
2020
Year

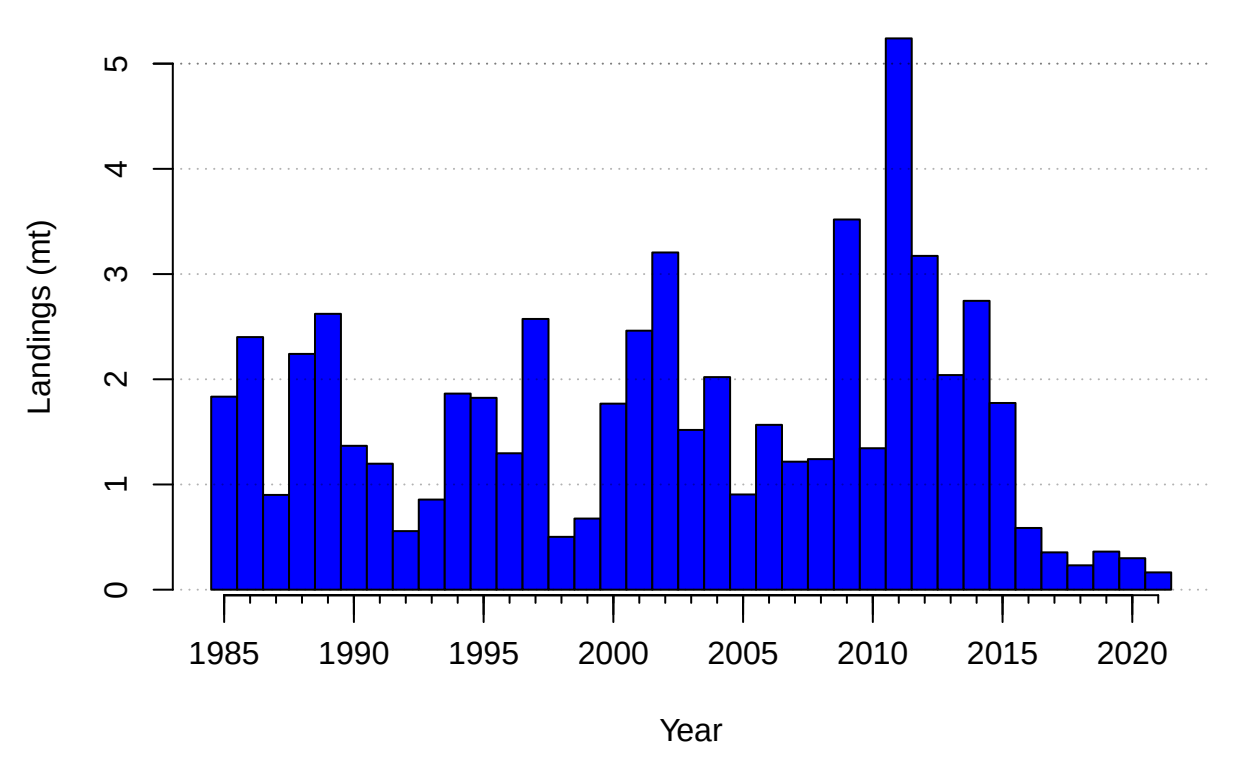

bias adjust in model
estimated alternative
1 − SE(r̂_y)²/σ_R²
1.0
0.5
0.0
−0.5
1980
1990
2000
2010
2020
Year

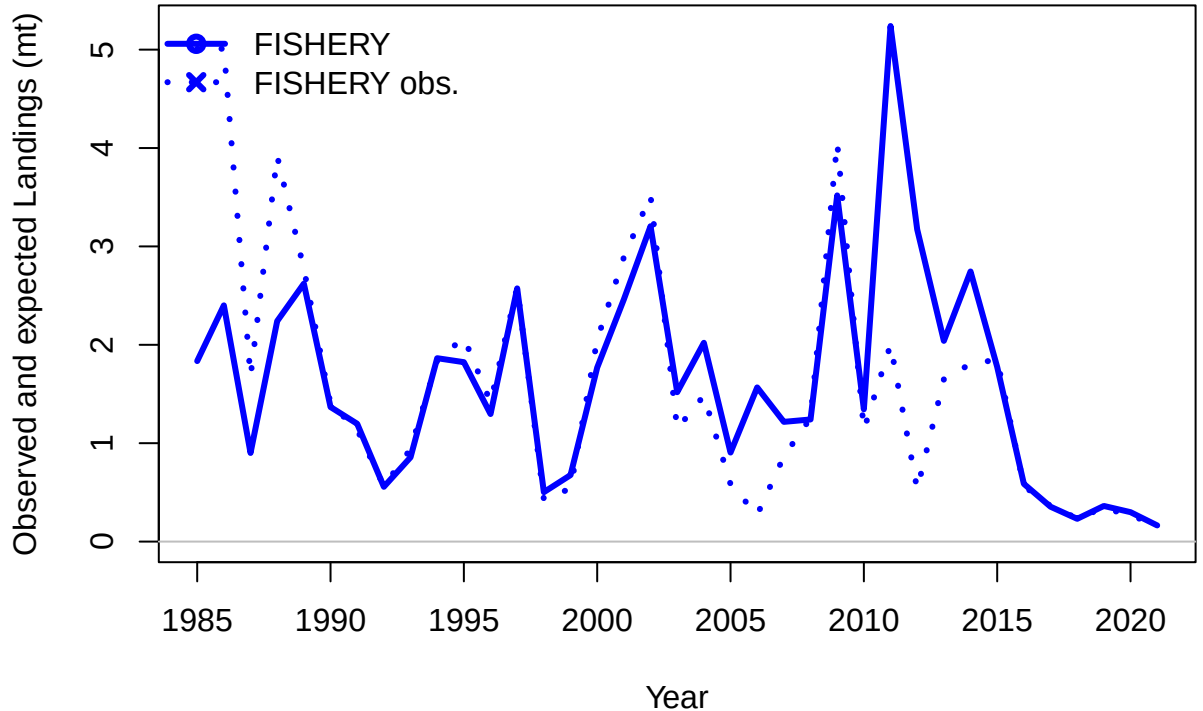

Exp. recruitment
Exp. recruitment after bias adj.
Estimated recruitments
Unfished equilibrium
Recruitment (1,000s)
0
50
100
150
200
0.0
0.5
1.0
1.5
2.0
2.5
Spawning biomass (mt)

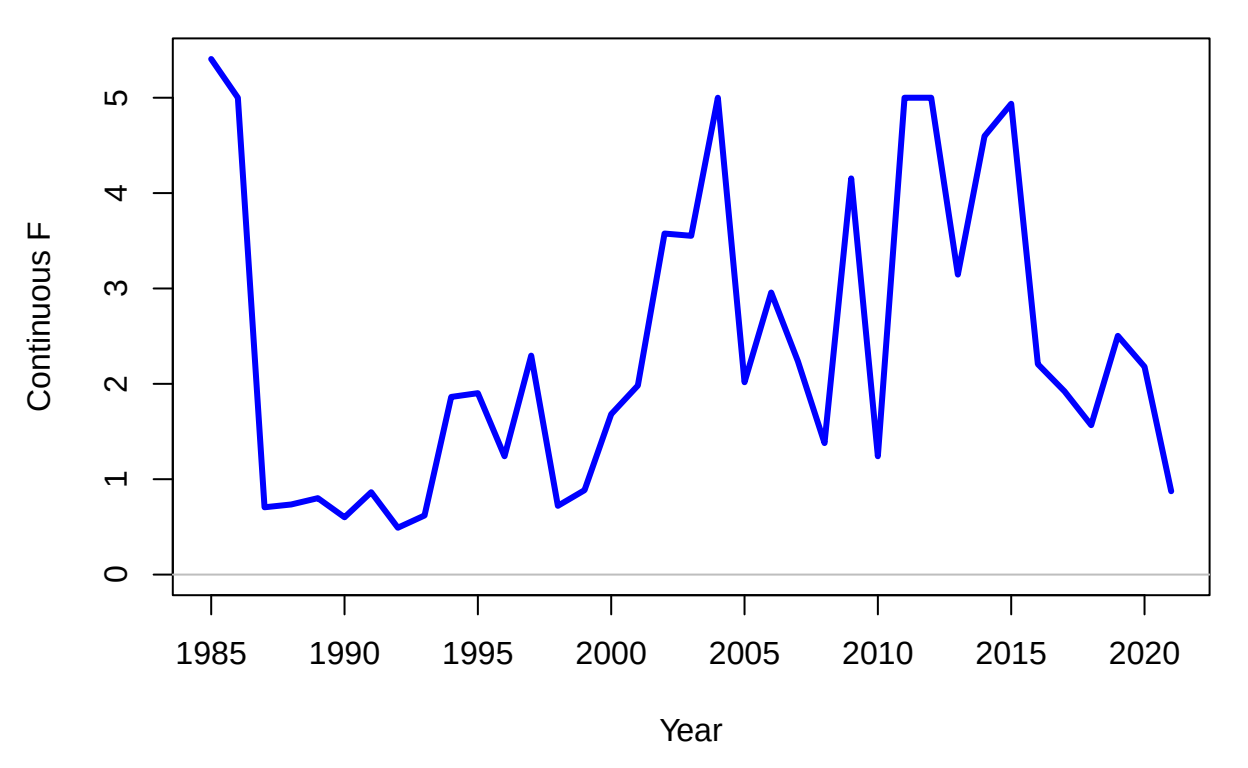

Exp. recruitment
Exp. recruitment after bias adj.
Estimated recruitments
Unfished equilibrium
Recruitment (1,000s)
Spawning biomass (mt)
0
50
100
150
200
0.0
0.5
1.0
1.5
2.0
2.5
1987
2009
1995
2000
2010
1999
2007
2012
2021
2015

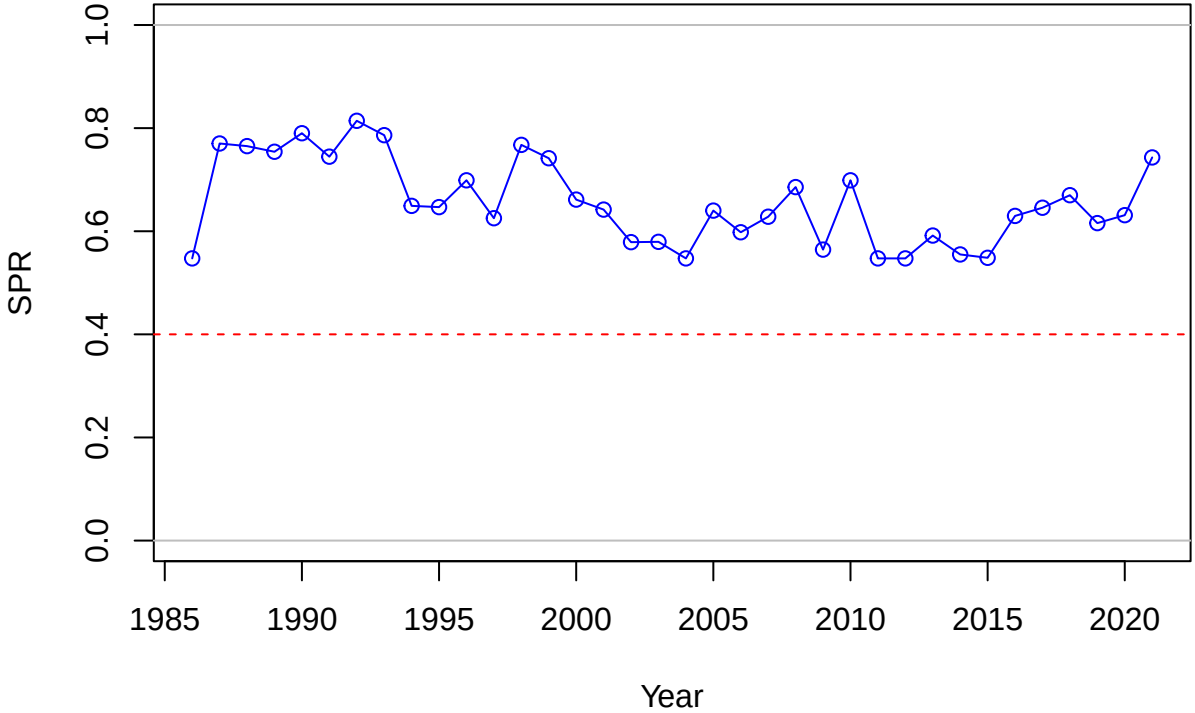

1.5
1.0
0.5
0.0
−0.5
−1.0
−1.5
Log recruitment deviation
1986
1987
2009
2007
1999
1995
2000
2010
2021
2020
2019
2015
2016
0.0
0.5
1.0
1.5
2.0
Spawning output (relative to B_0)

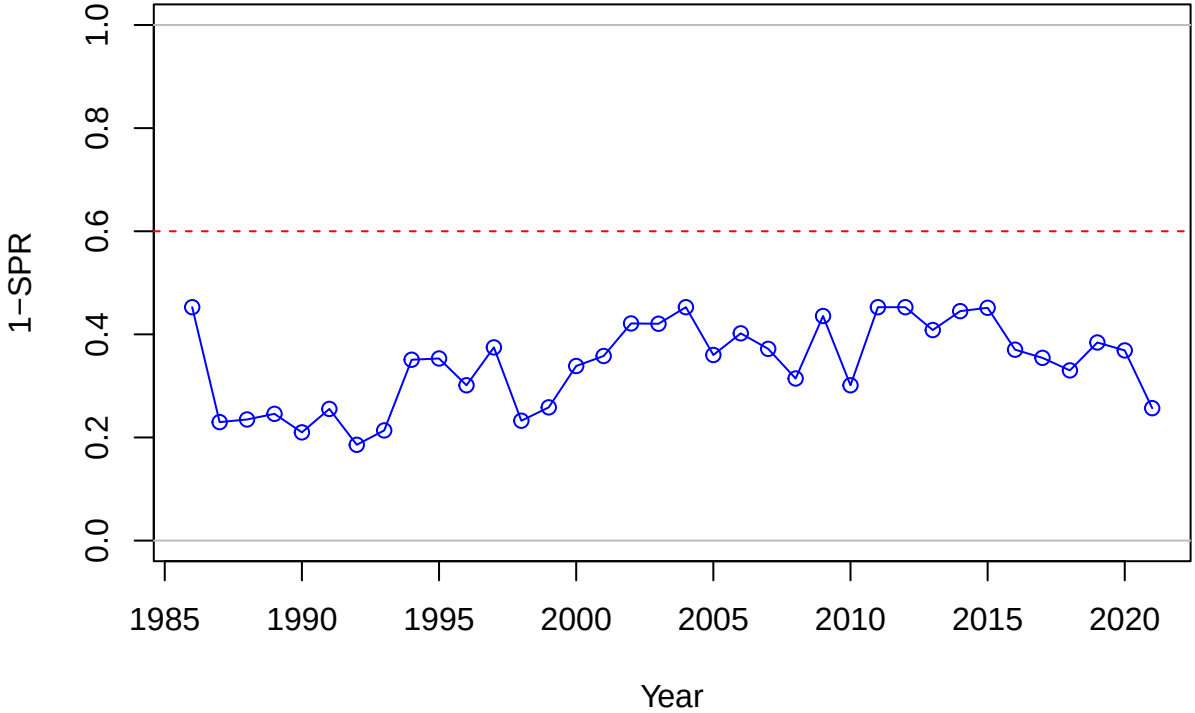

Landings (mt)
0
1
2
3
4
5
1985
1990
1995
2000
2005
2010
2015
2020
Year

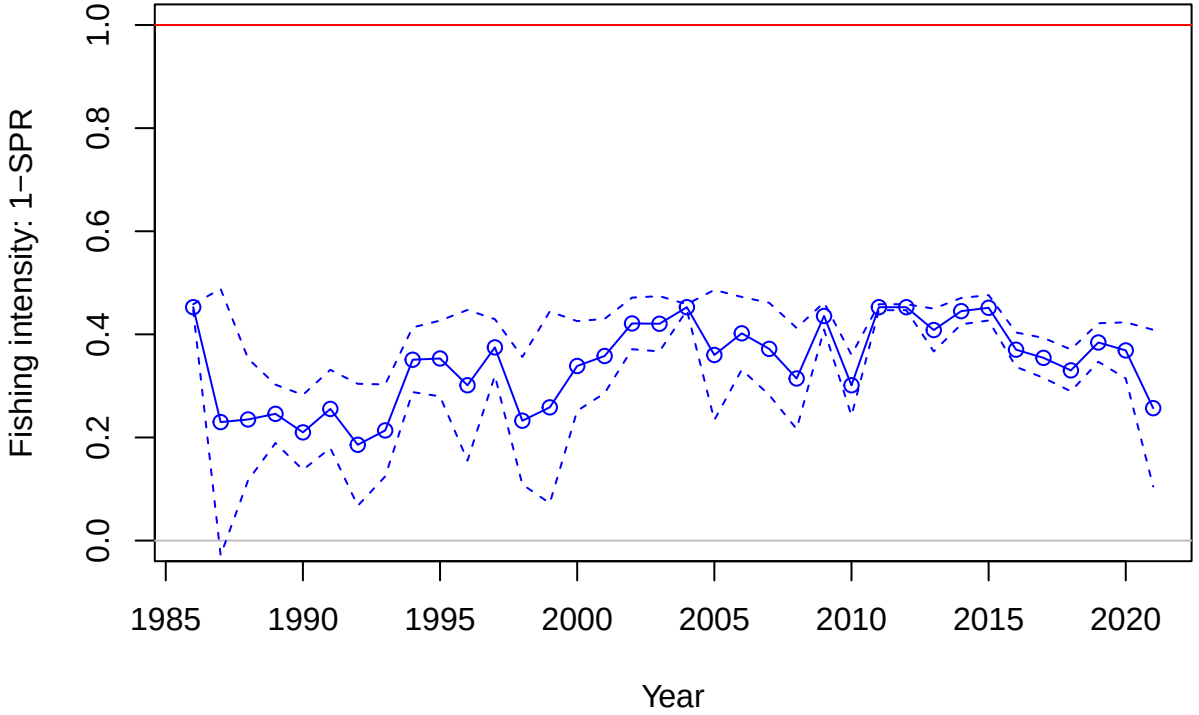

Landings (mt)
0
1
2
3
4
5
1985
1990
1995
2000
2005
2010
2015
2020
Year

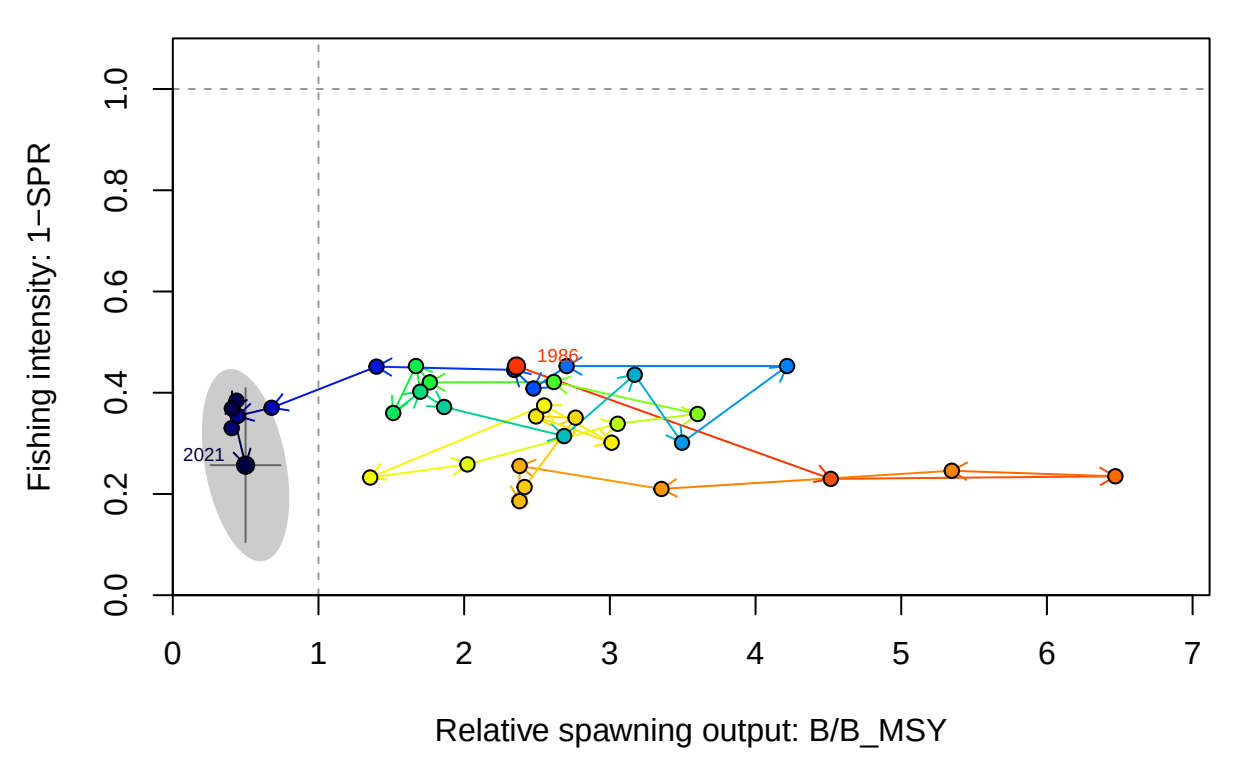

FISHERY
FISHERY obs.
Observed and expected Landings (mt)
0
1
2
3
4
5
1985
1990
1995
2000
2005
2010
2015
2020
Year

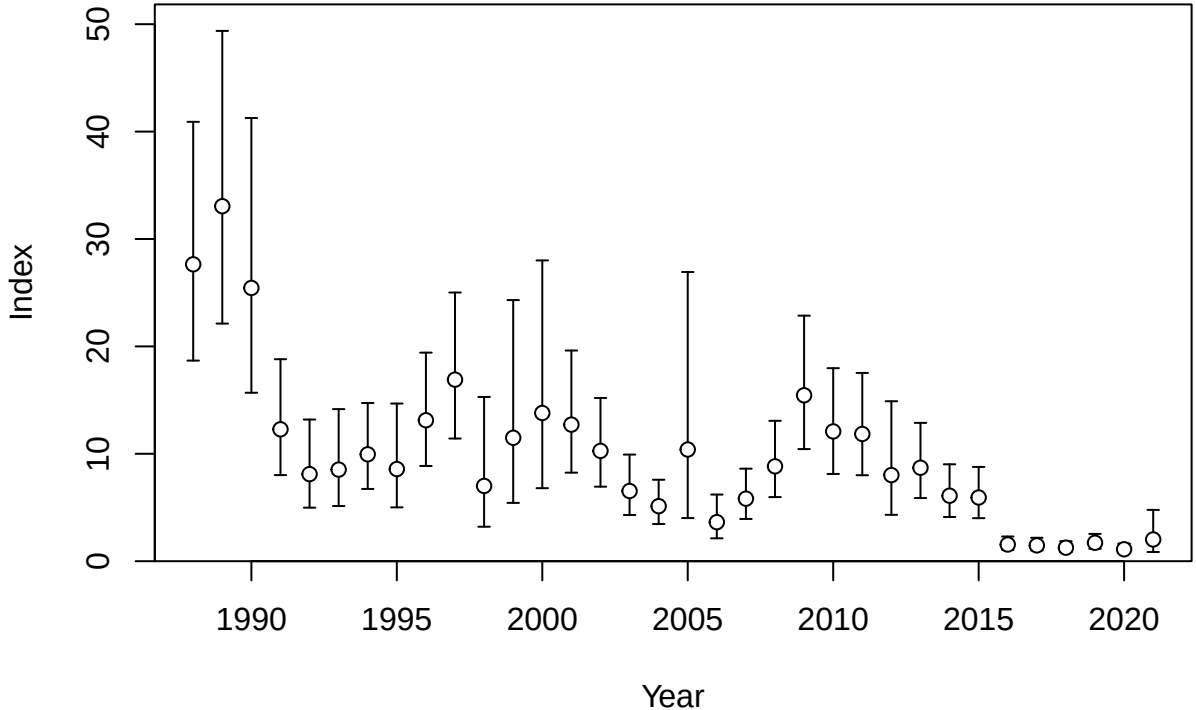

Continuous F
0
1
2
3
4
5
1985
1990
1995
2000
2005
2010
2015
2020
Year

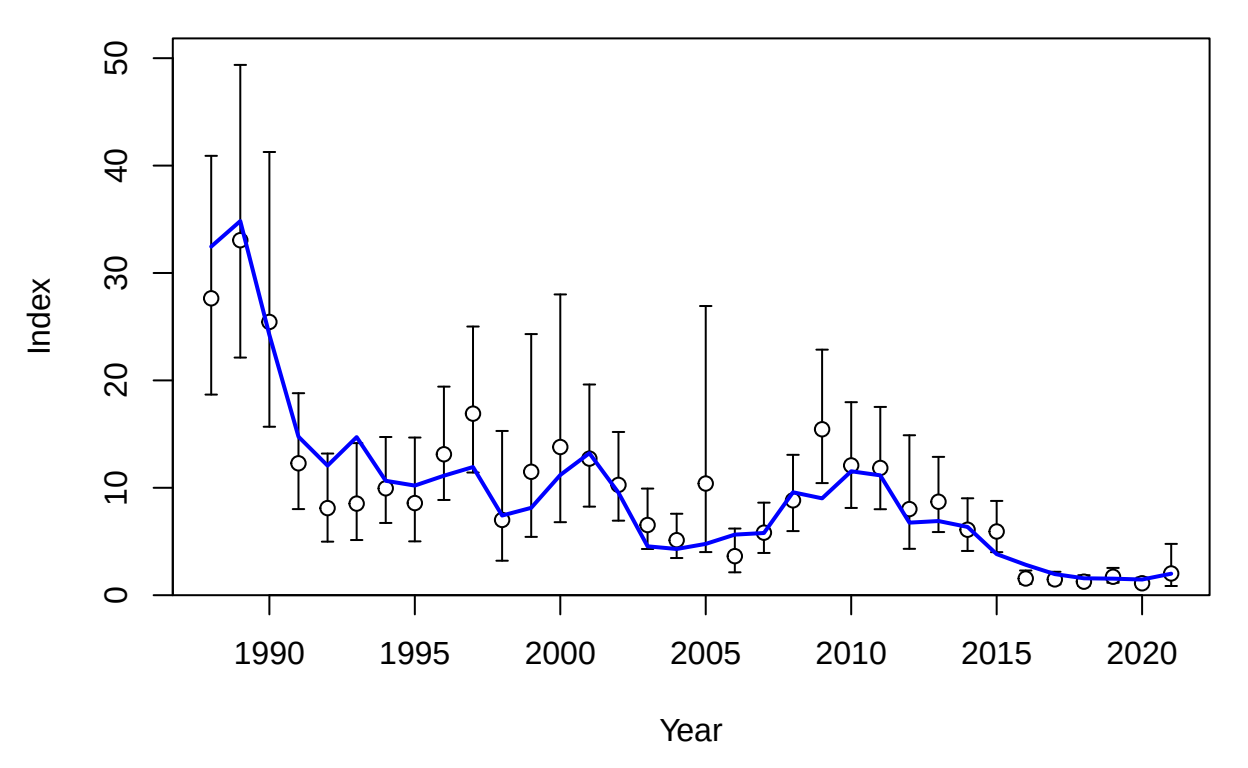

SPR
0.0
0.2
0.4
0.6
0.8
1.0
1985
1990
1995
2000
2005
2010
2015
2020
Year

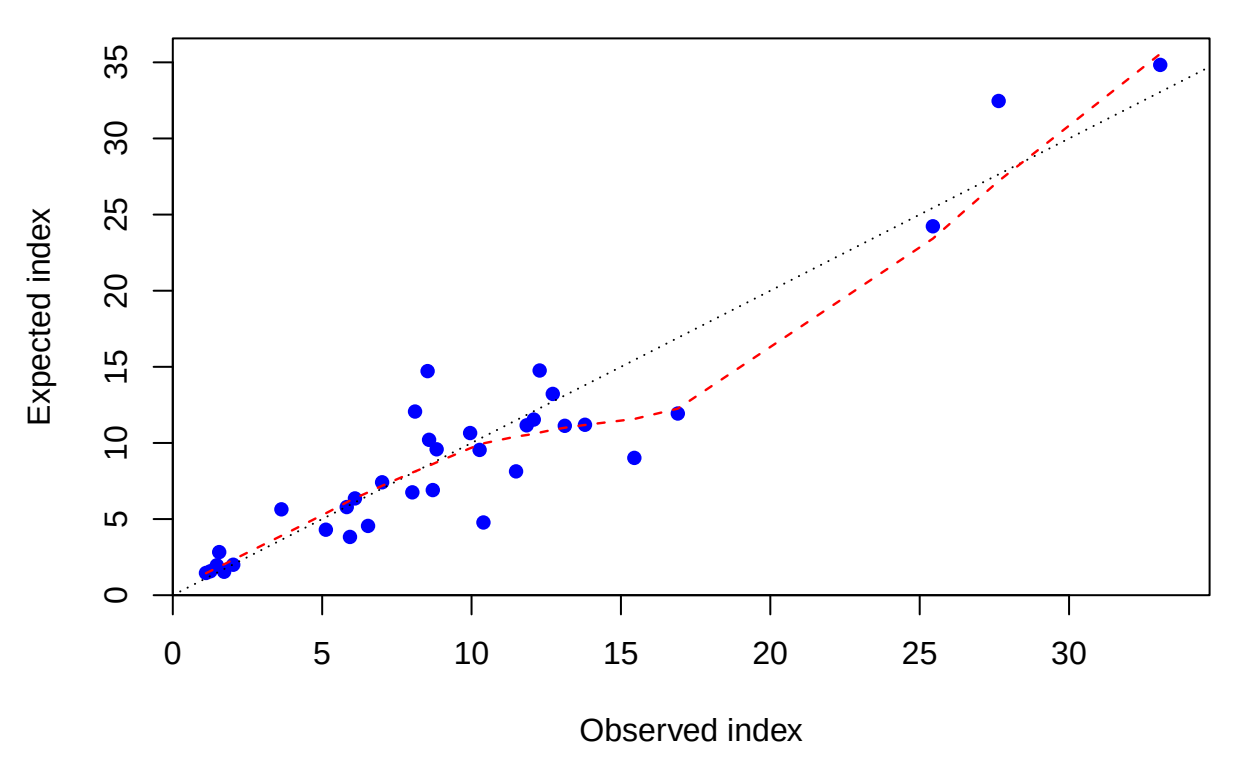

1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
1985
1990
1995
2000
2005
2010
2015
2020
Year

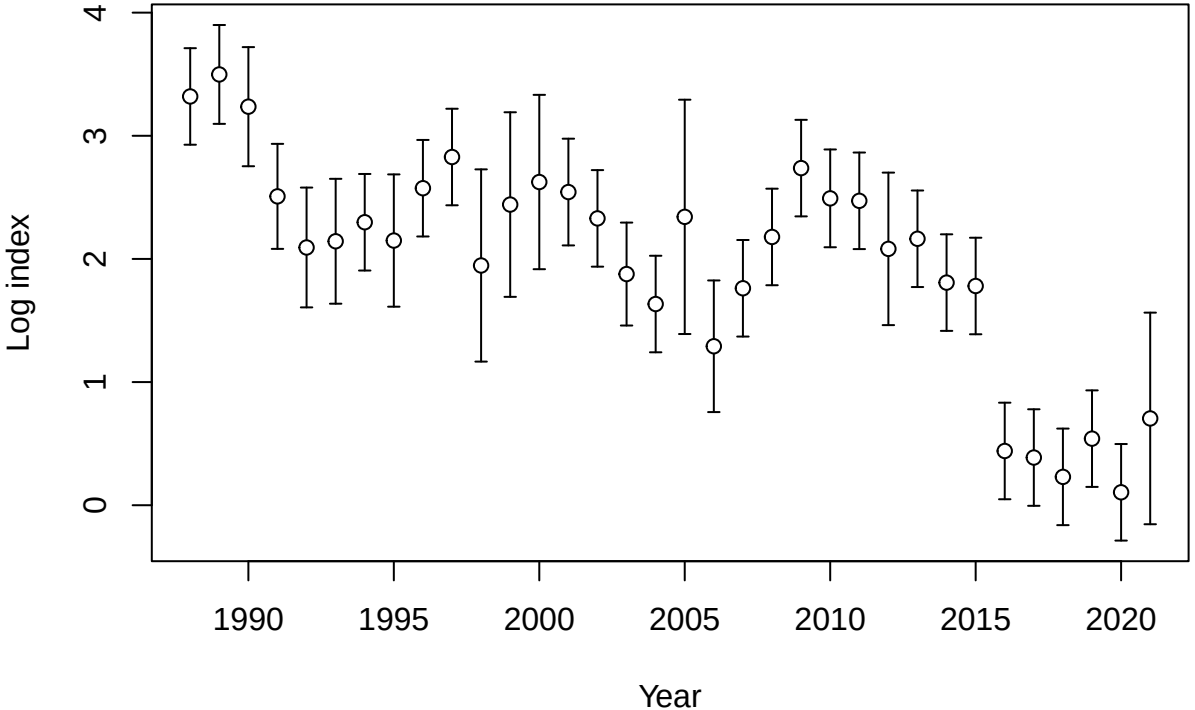

Fishing intensity: 1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
1985
1990
1995
2000
2005
2010
2015
2020
Year

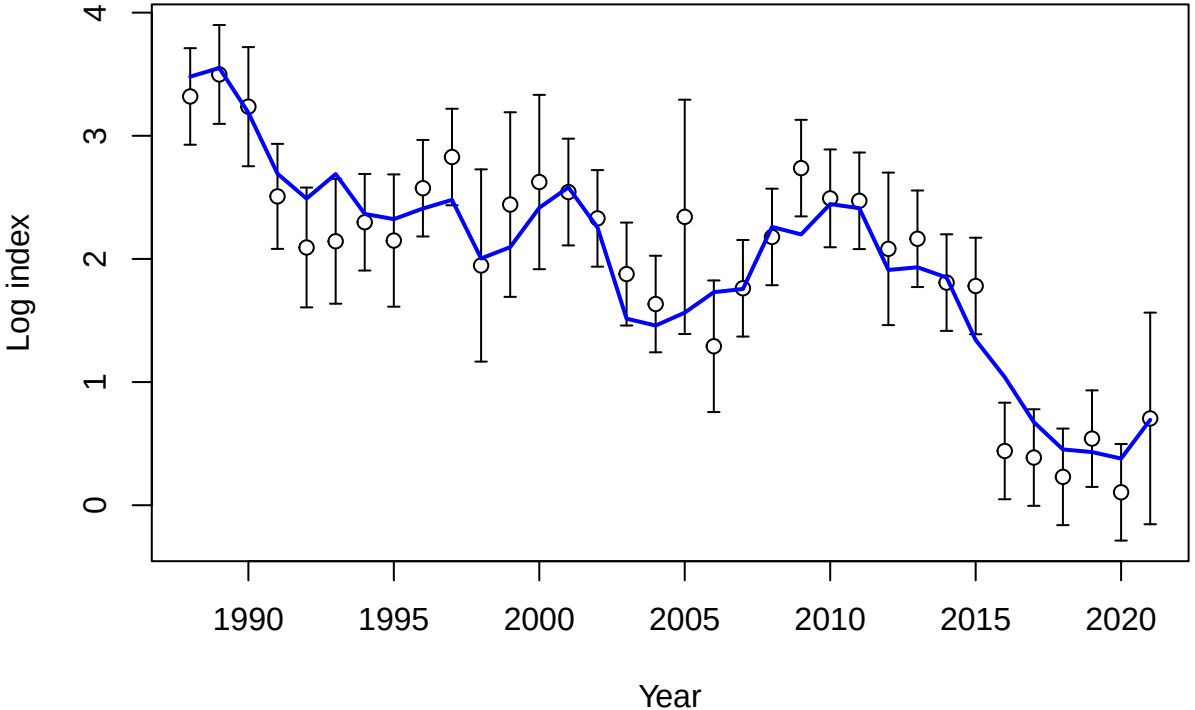

Fishing intensity: 1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
0
1
2
3
4
5
6
7
Relative spawning output: B/B_MSY
1986
2021

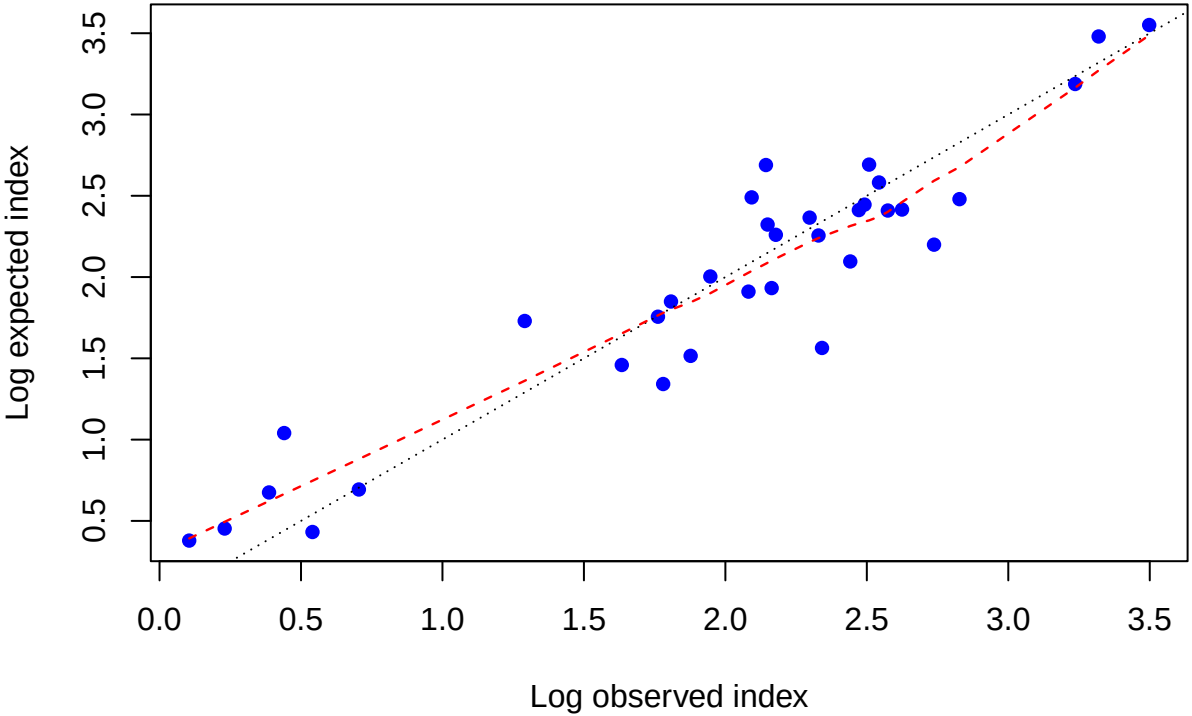

Index
0
10
20
30
40
50
1990
1995
2000
2005
2010
2015
2020
Year

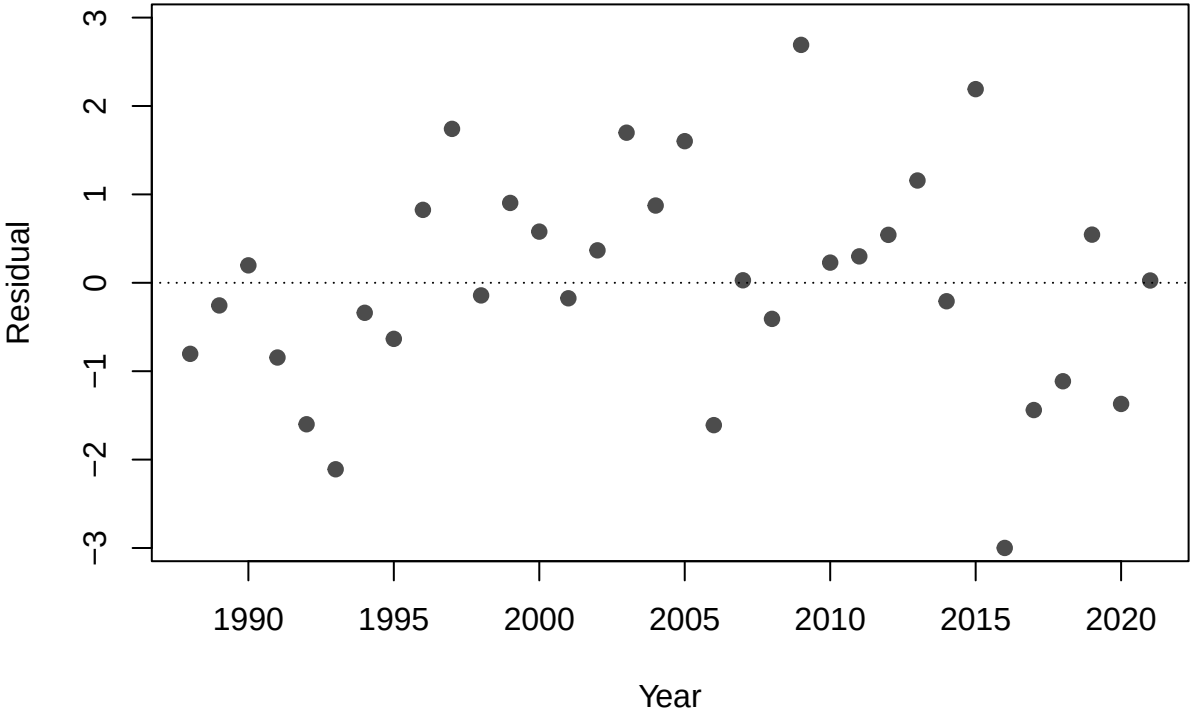

Index
0
10
20
30
40
50
1990
1995
2000
2005
2010
2015
2020
Year

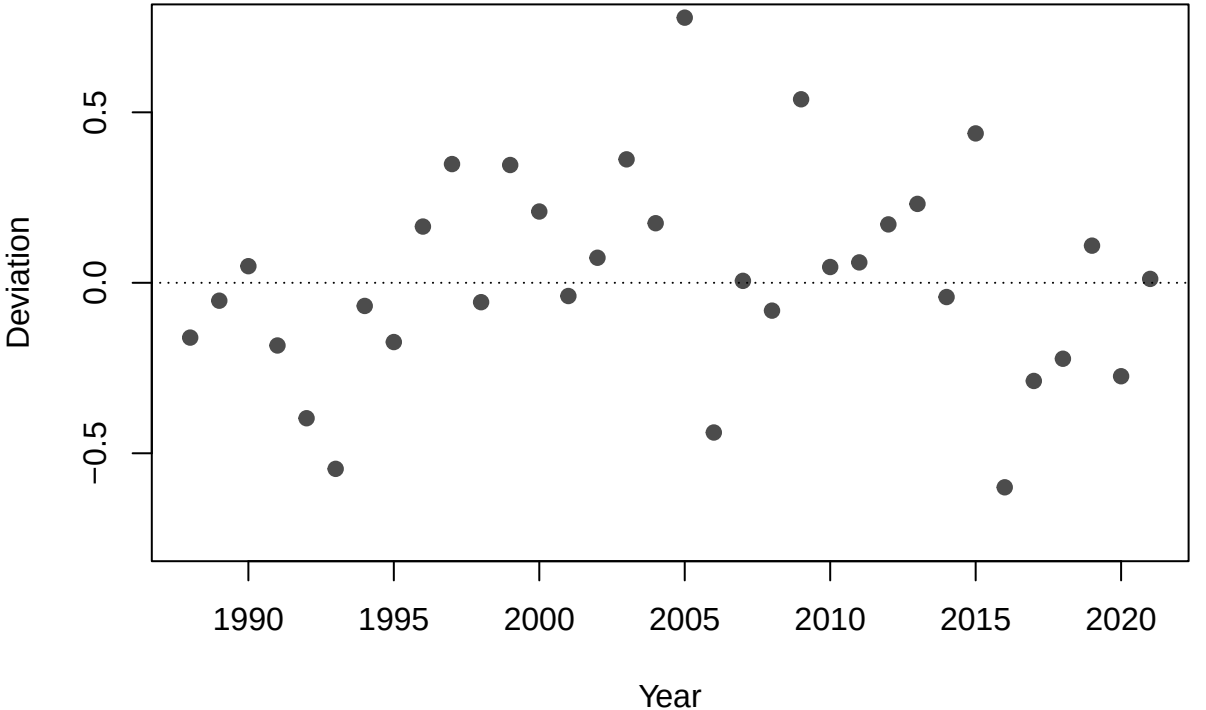

Expected index
Observed index
0
5
10
15
20
25
30
35

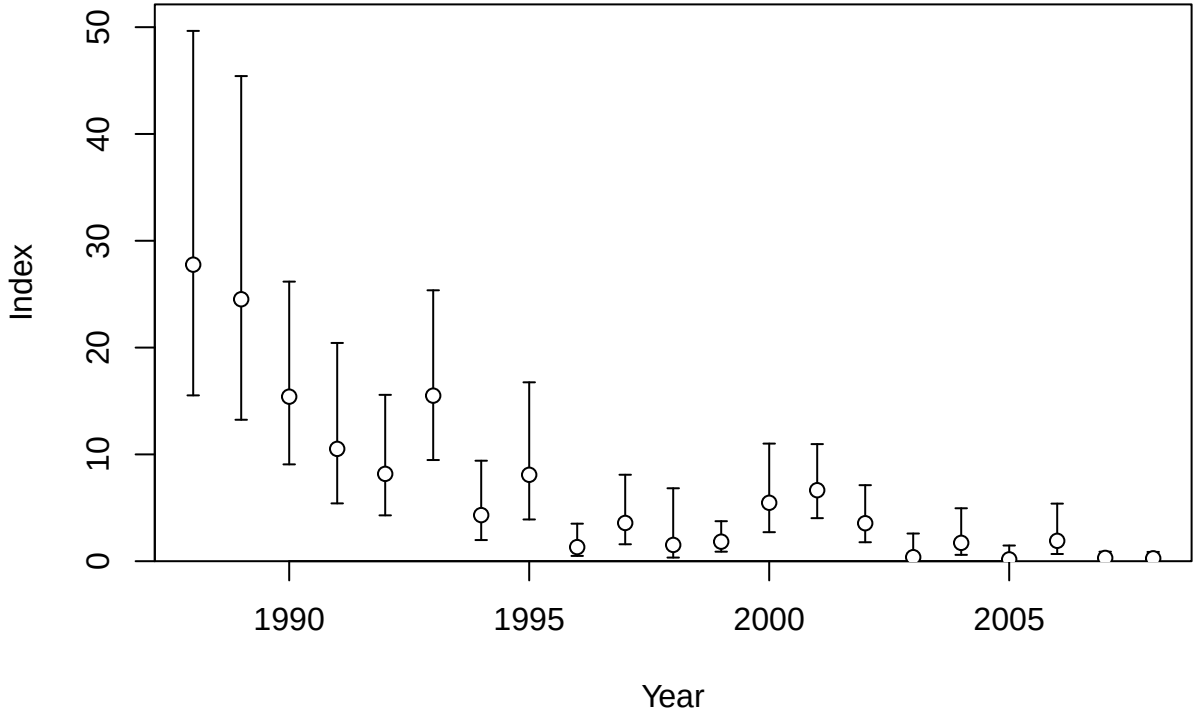

Log index
0
1
2
3
4
1990
1995
2000
2005
2010
2015
2020
Year

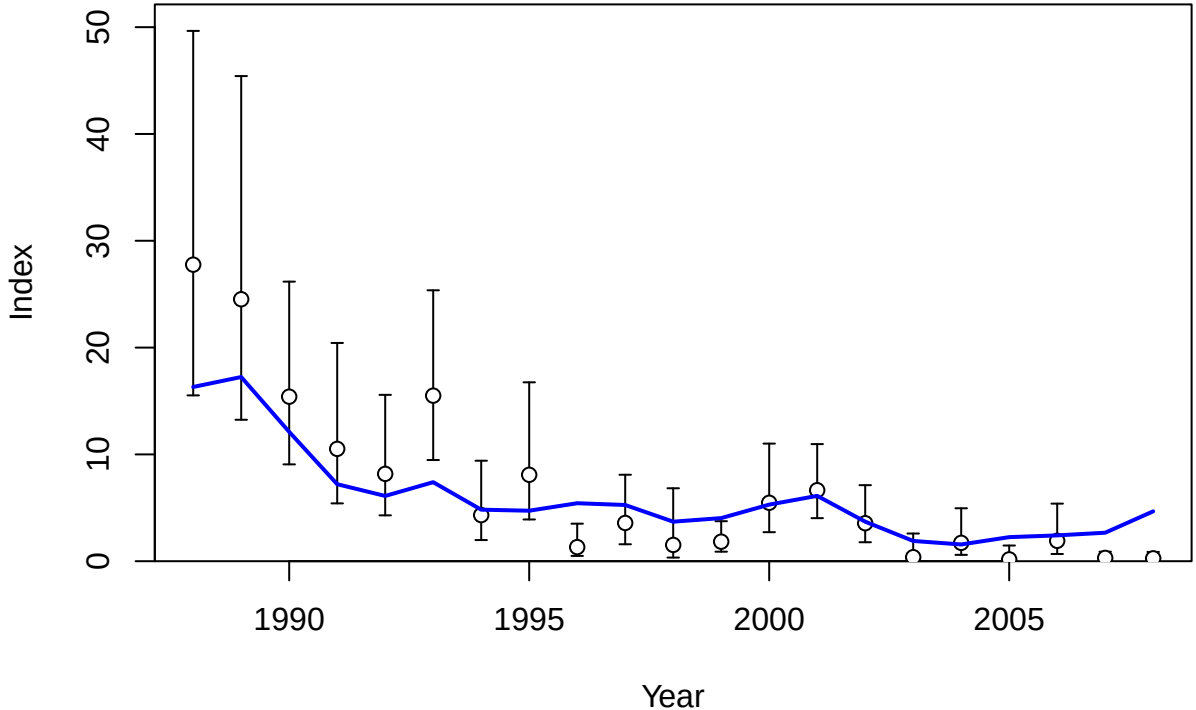

Log index
0
1
2
3
4
1990
1995
2000
2005
2010
2015
2020
Year

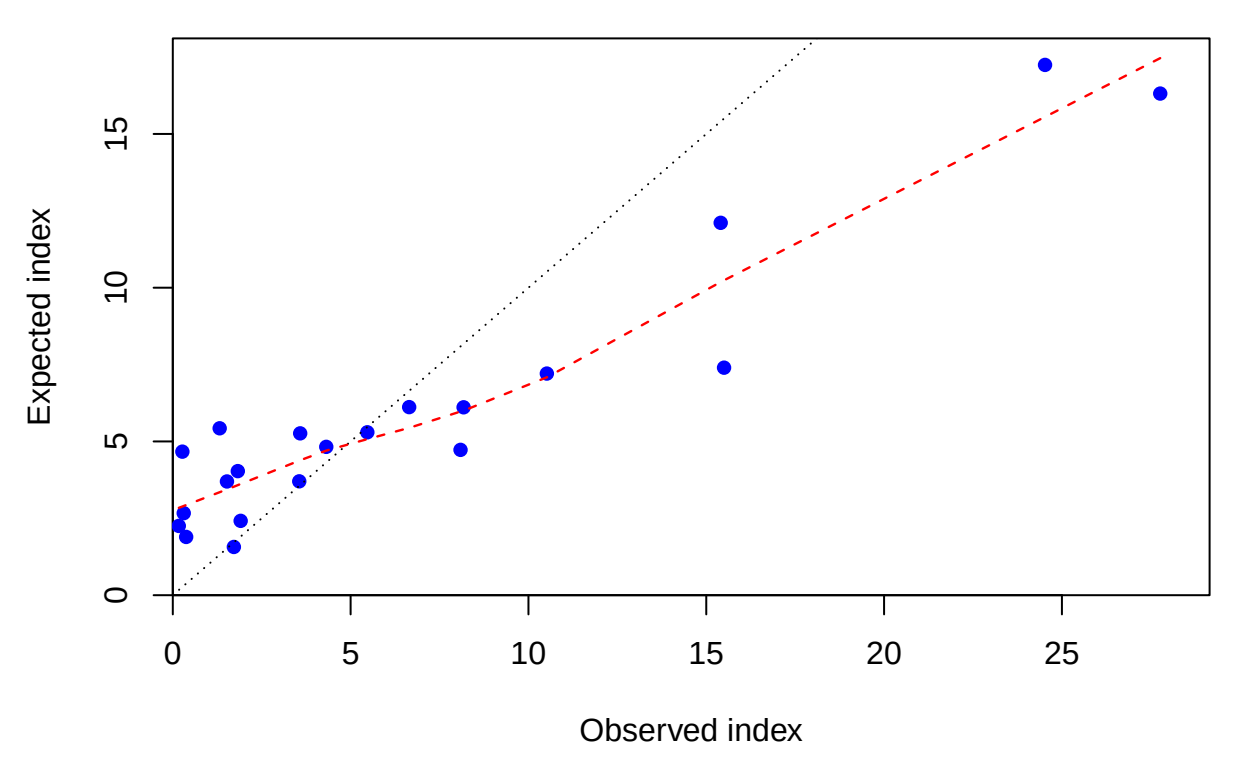

Log expected index
0.5
1.0
1.5
2.0
2.5
3.0
3.5
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
Log observed index

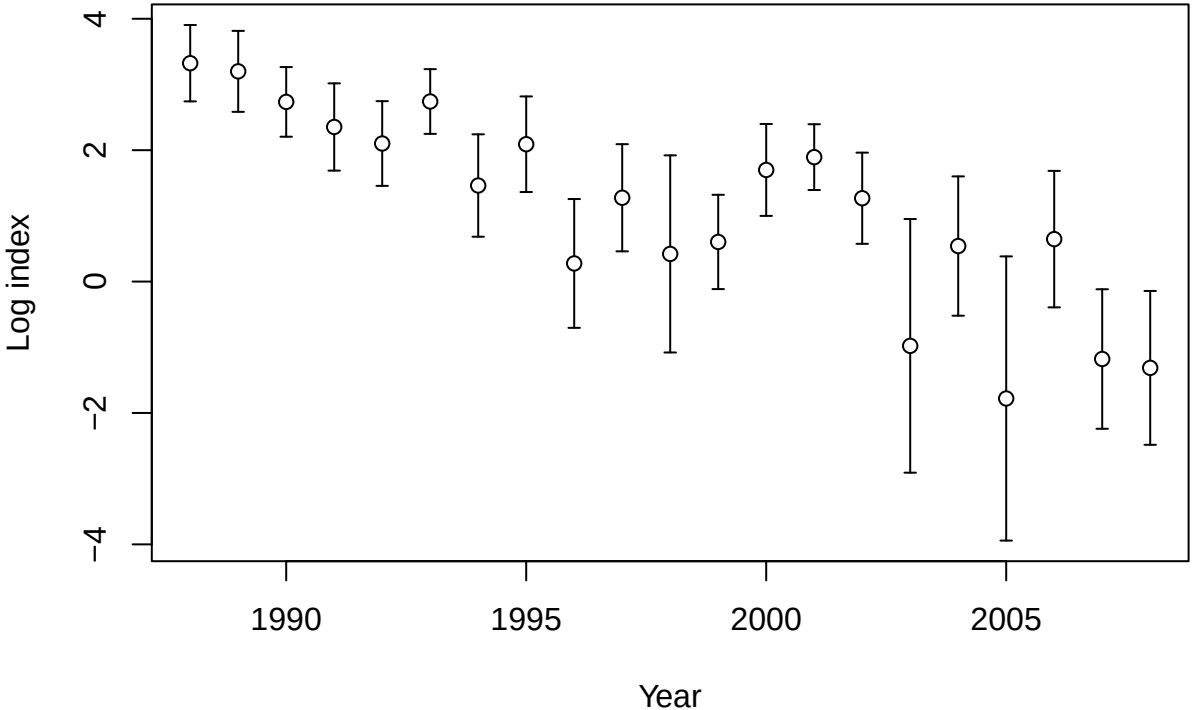

Residual
3
2
1
0
−1
−2
−3
1990
1995
2000
2005
2010
2015
2020
Year

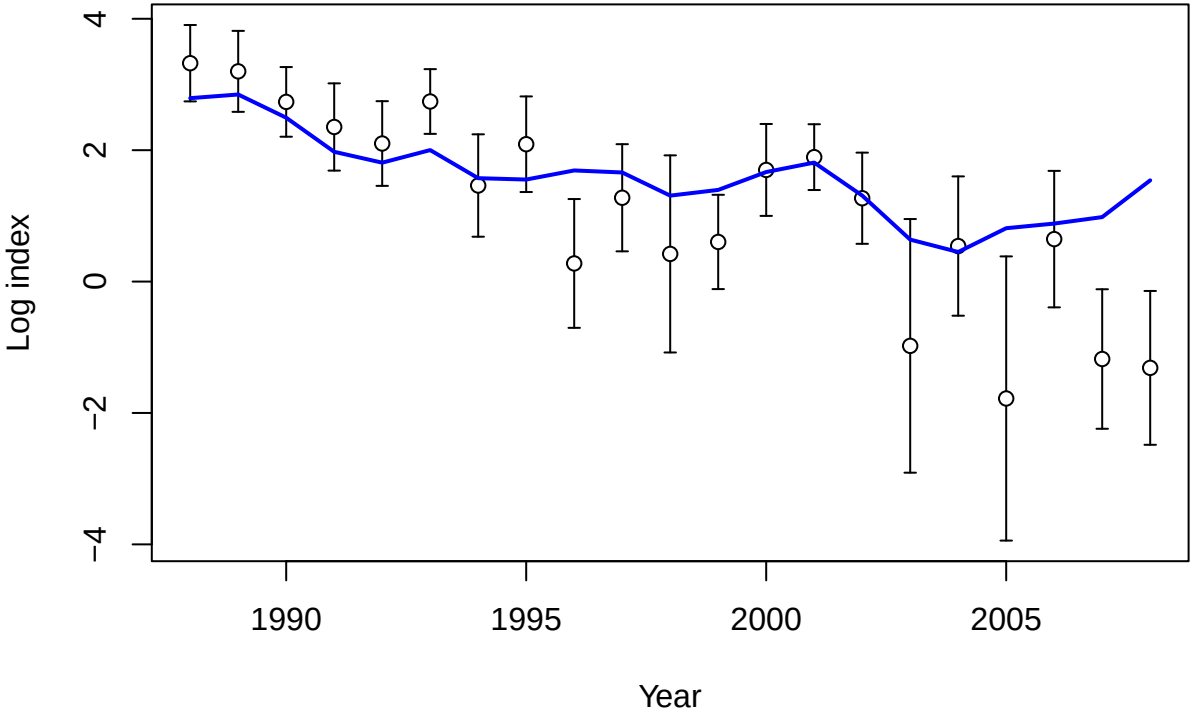

Deviation
0.5
0.0
−0.5
1990
1995
2000
2005
2010
2015
2020
Year

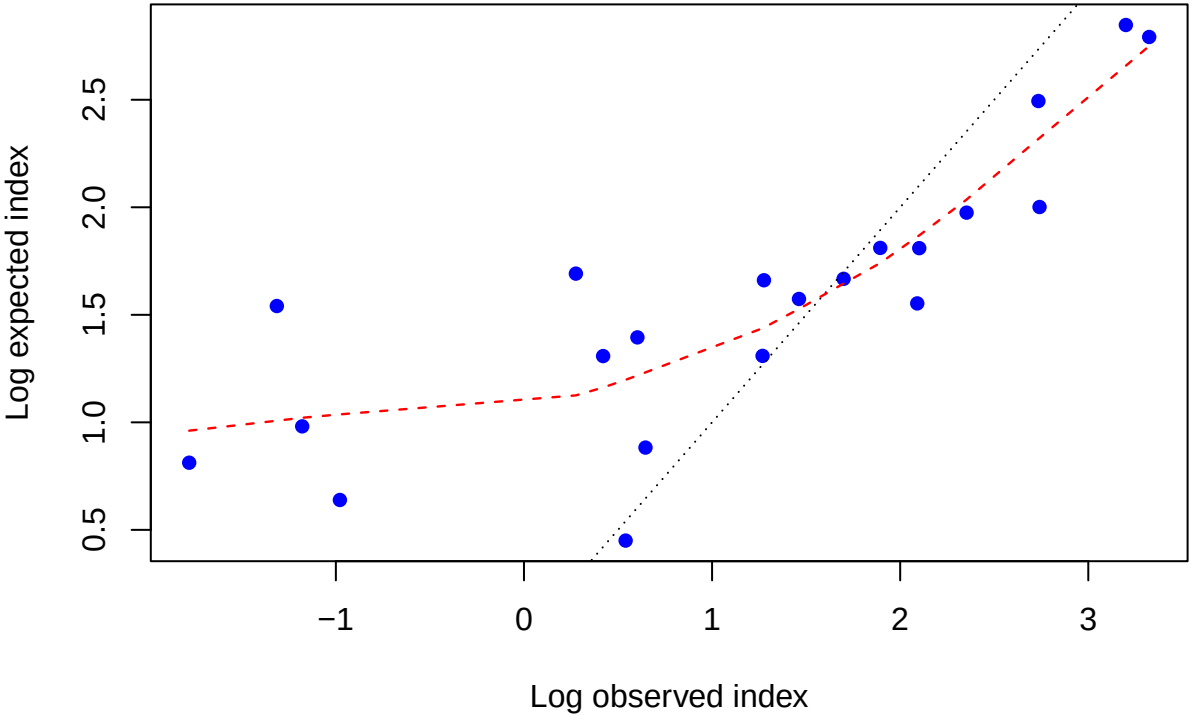

Index
0
10
20
30
40
50
1990
1995
2000
2005
Year

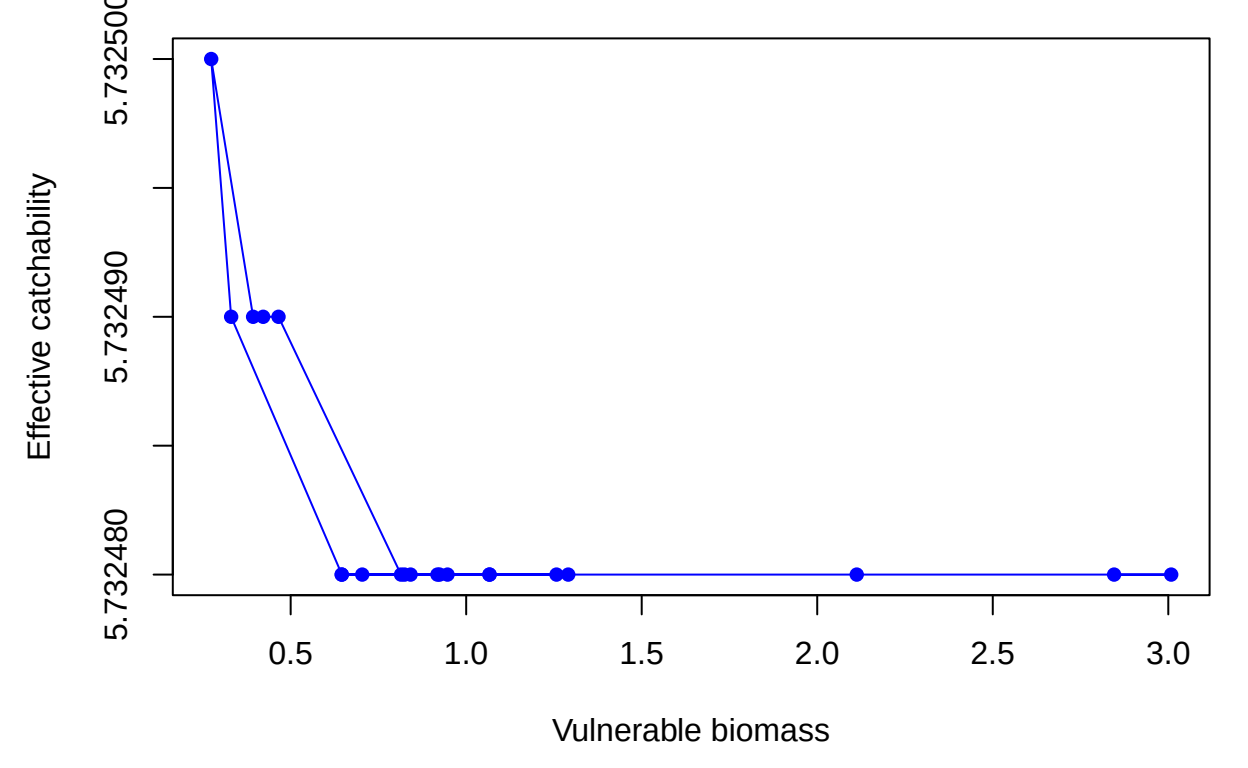

Index
0
10
20
30
40
50
1990
1995
2000
2005
Year

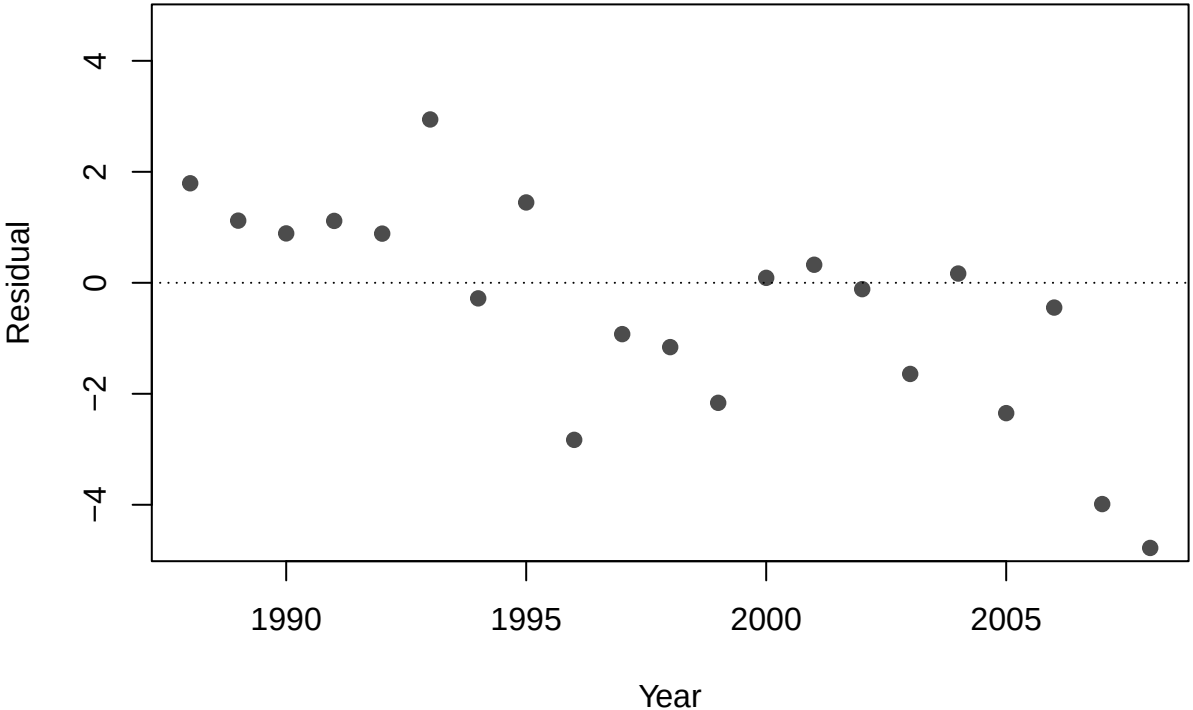

Expected index
Observed index
0
5
10
15
20
25
0
5
10
15

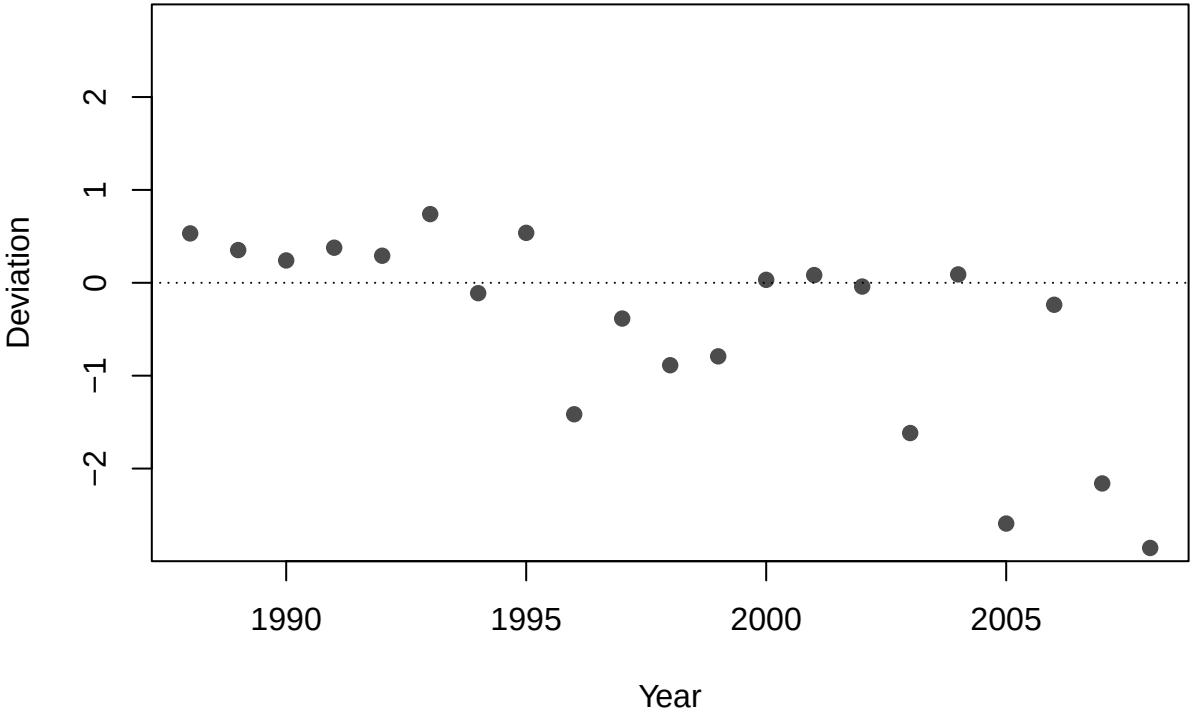

Log index
4
2
0
−2
−4
1990
1995
2000
2005
Year

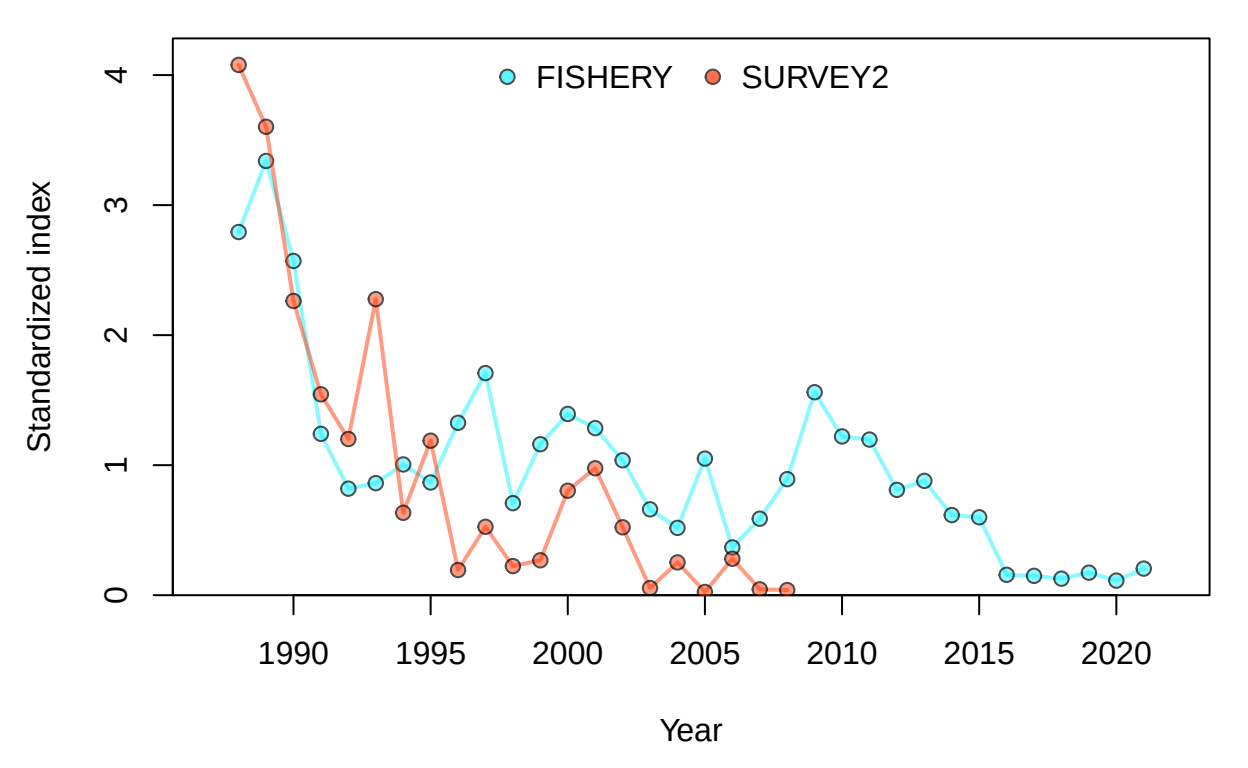

Log index
4
2
0
−2
−4
1990
1995
2000
2005
Year

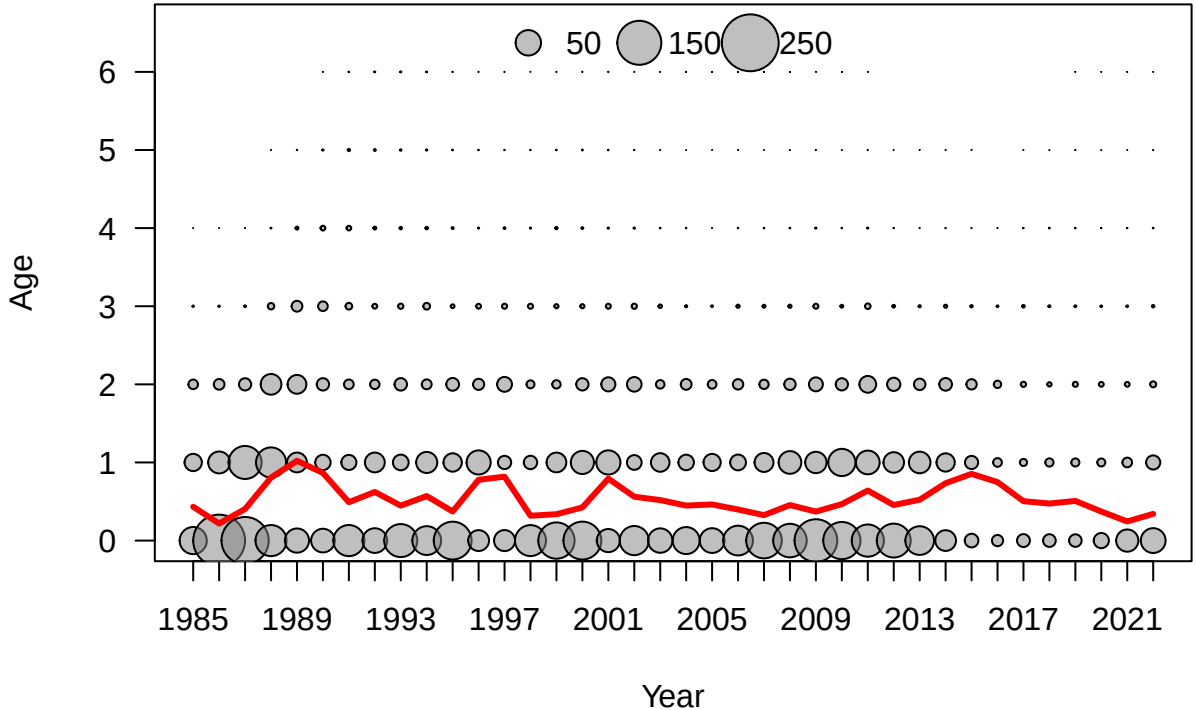

Log expected index
0.5
1.0
1.5
2.0
2.5
−1
0
1
2
3
Log observed index

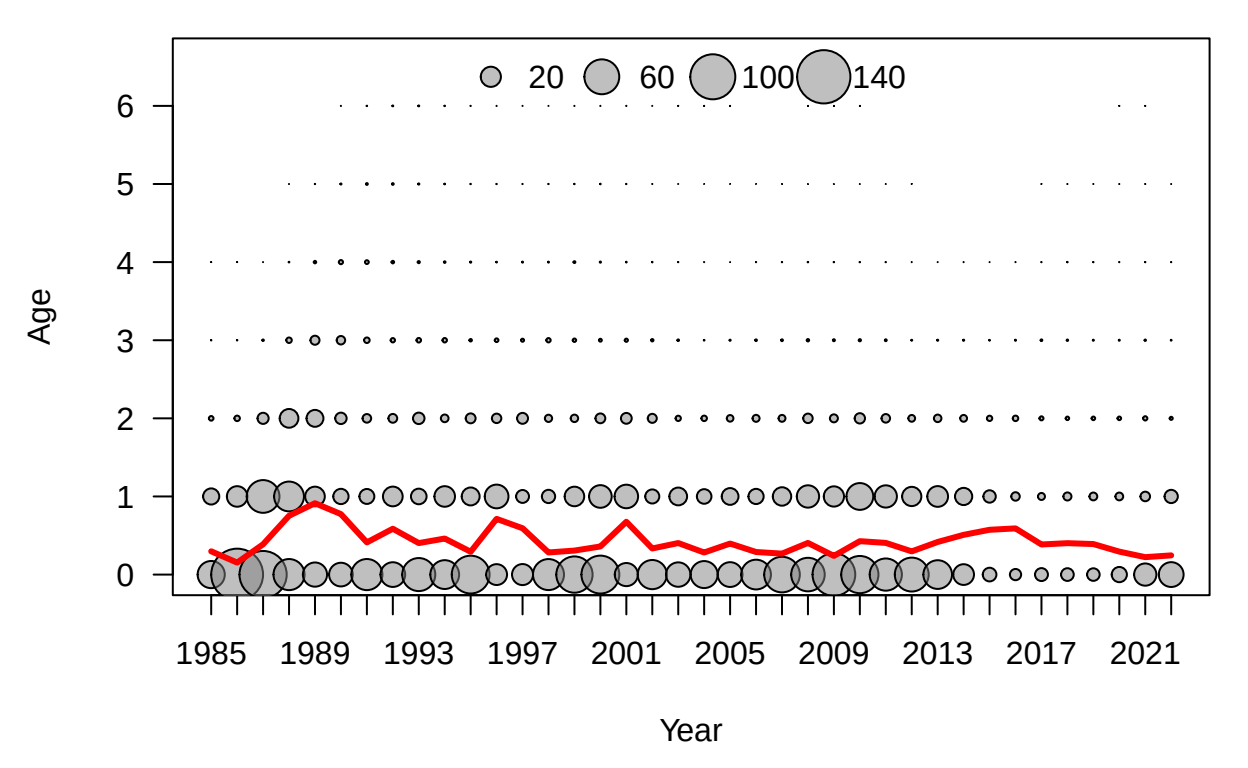

Effective catchability
5.732500
5.732490
5.732480
0.5
1.0
1.5
2.0
2.5
3.0
Vulnerable biomass

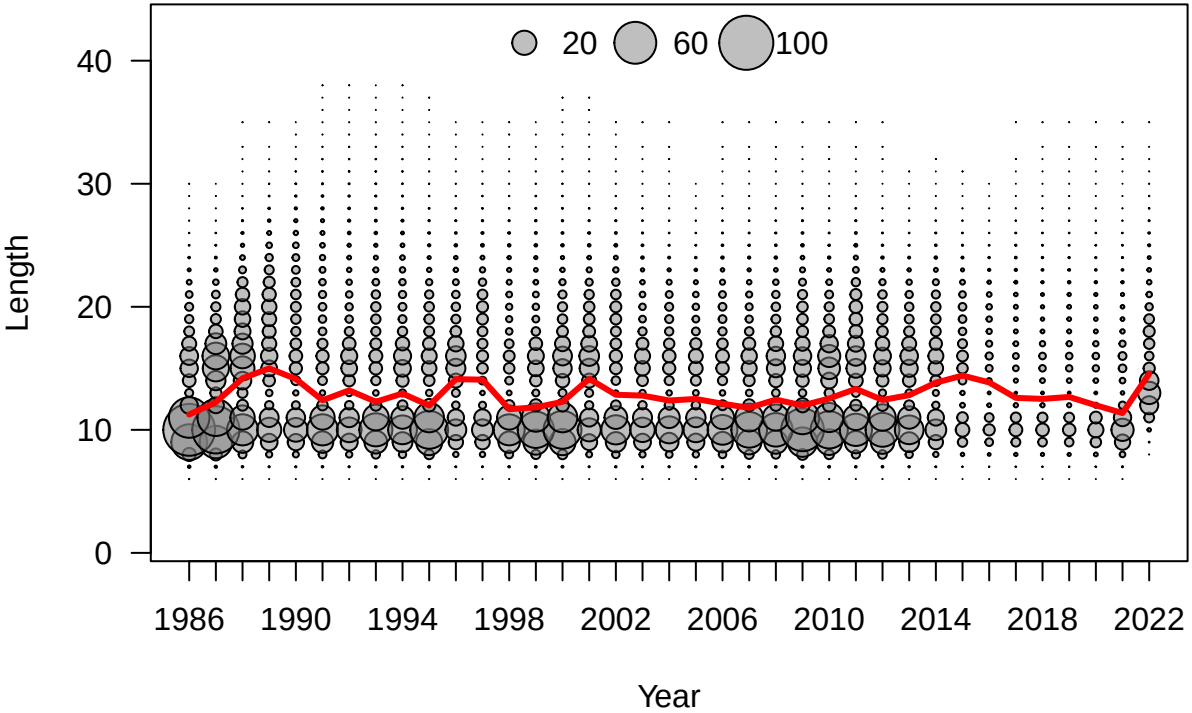

Residual
4
2
0
−2
−4
1990
1995
2000
2005
Year

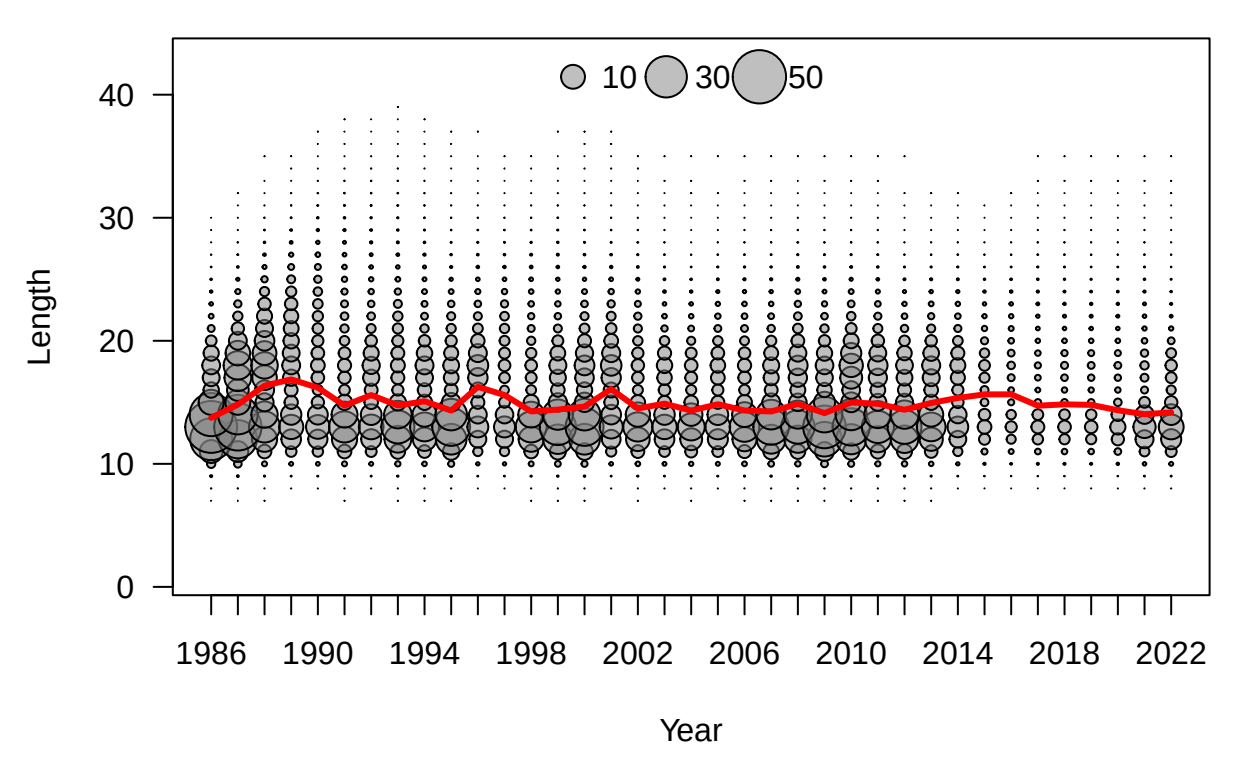

Deviation
2
1
0
−1
−2
1990
1995
2000
2005
Year

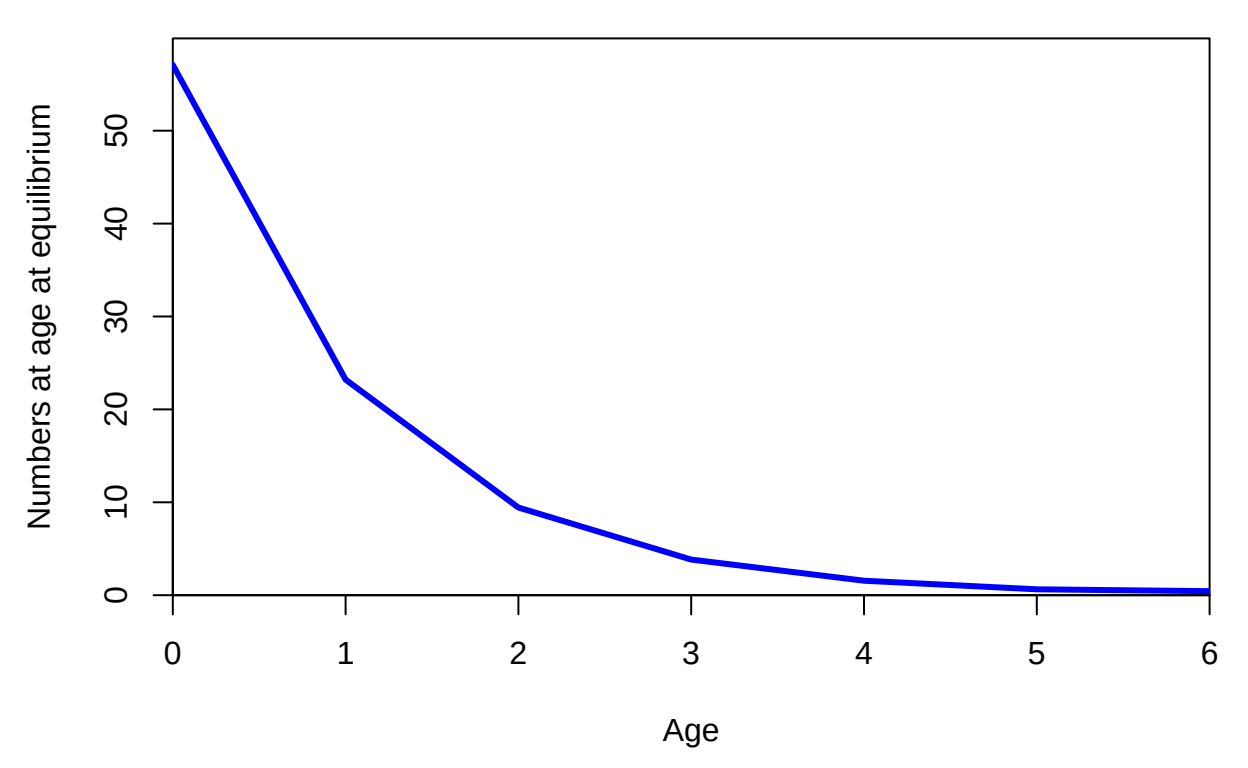

FISHERY
SURVEY2
Standardized index
Year
0
1
2
3
4
1990
1995
2000
2005
2010
2015
2020

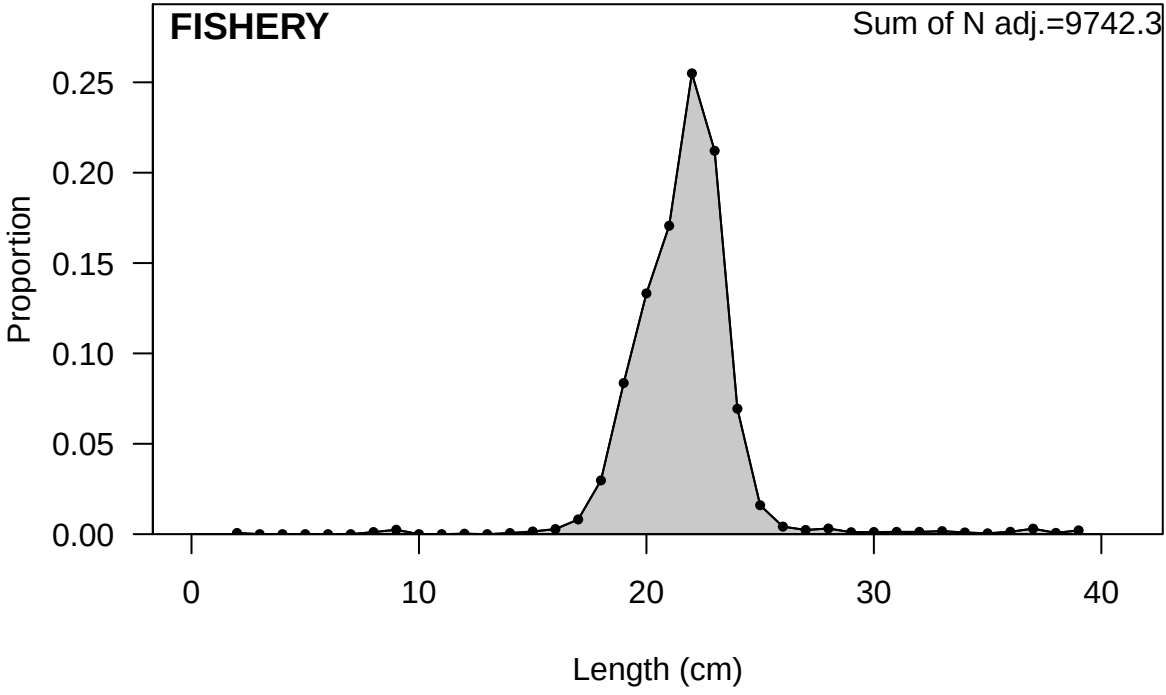

50
150
250
Age
0
1
2
3
4
5
6
1985
1989
1993
1997
2001
2005
2009
2013
2017
2021
Year

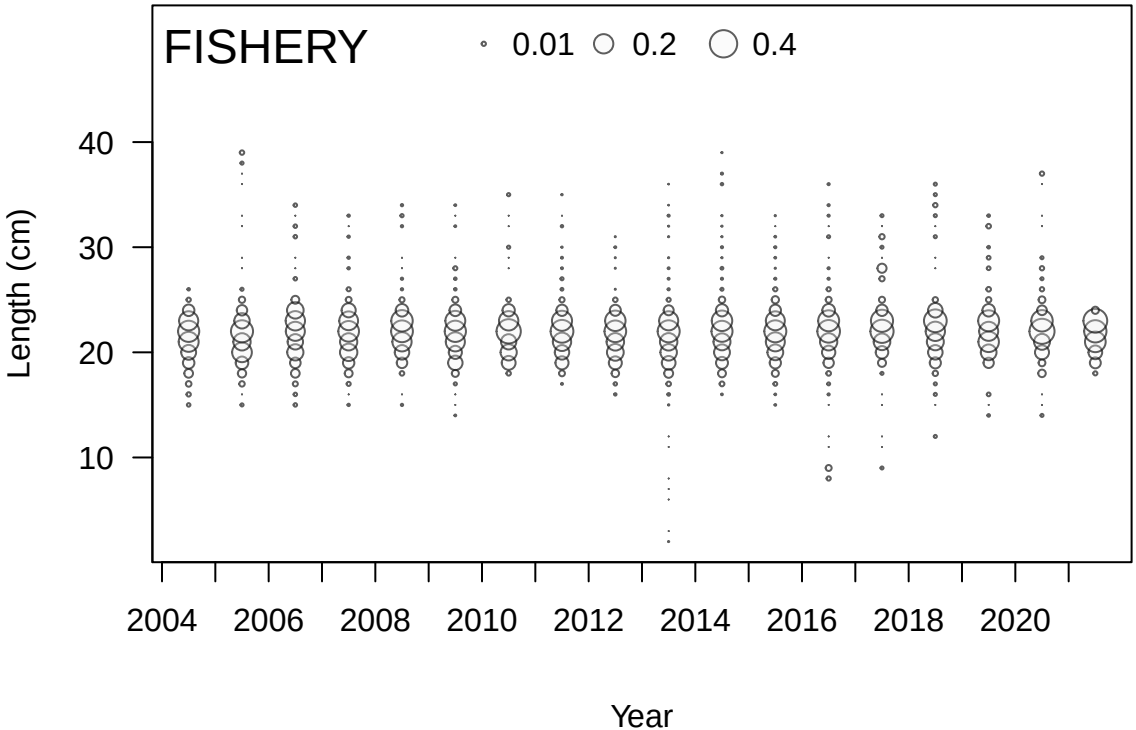

20
60
100
140
Age
0
1
2
3
4
5
6
1985
1989
1993
1997
2001
2005
2009
2013
2017
2021
Year

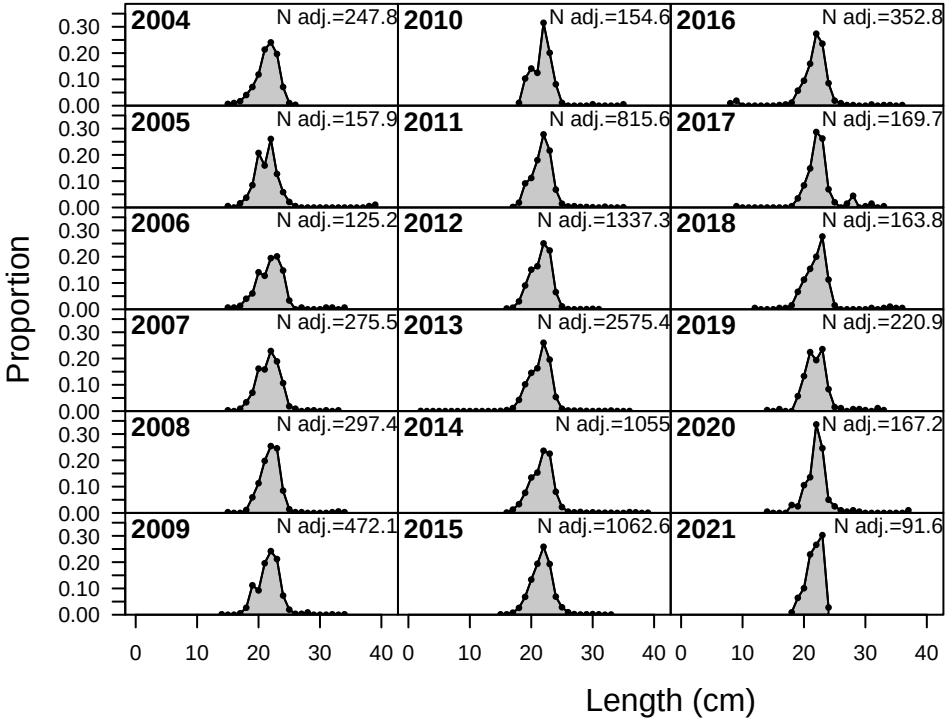

20
60
100
Length
0
10
20
30
40
1986
1990
1994
1998
2002
2006
2010
2014
2018
2022
Year

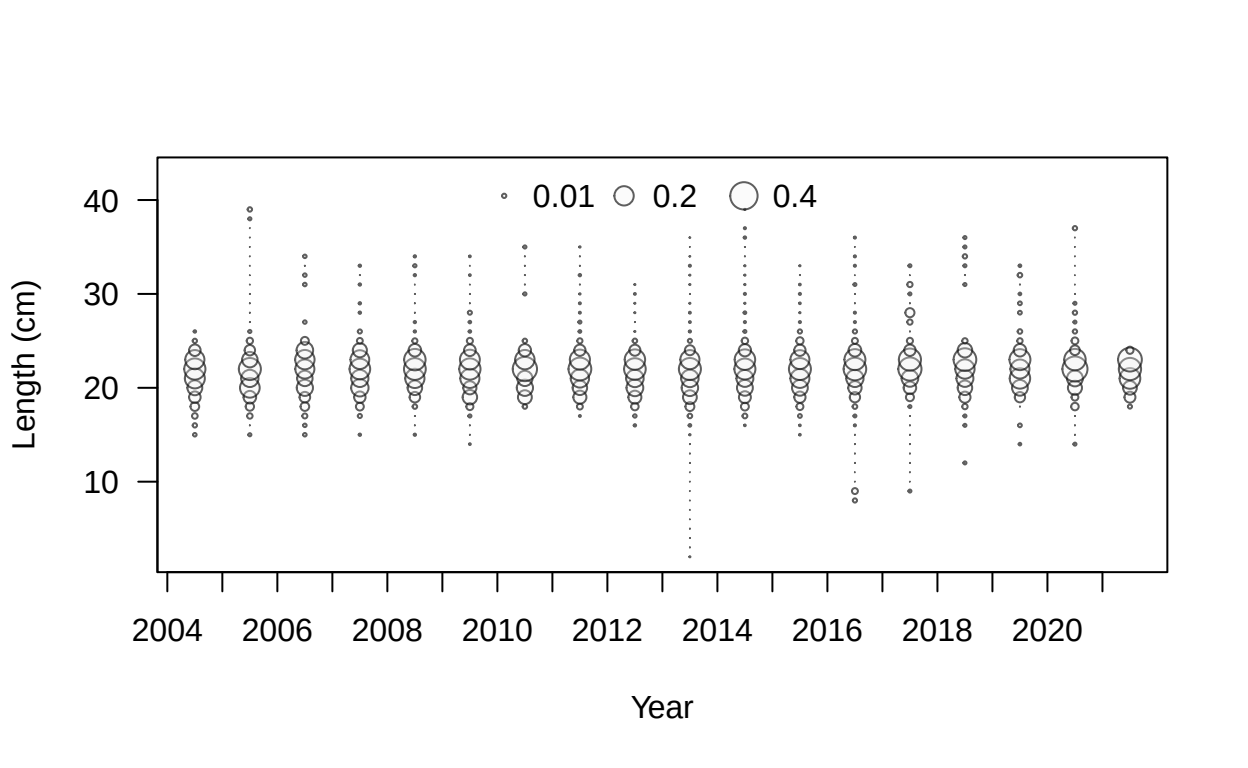

10
30
50
Length
0
10
20
30
40
1986
1990
1994
1998
2002
2006
2010
2014
2018
2022
Year

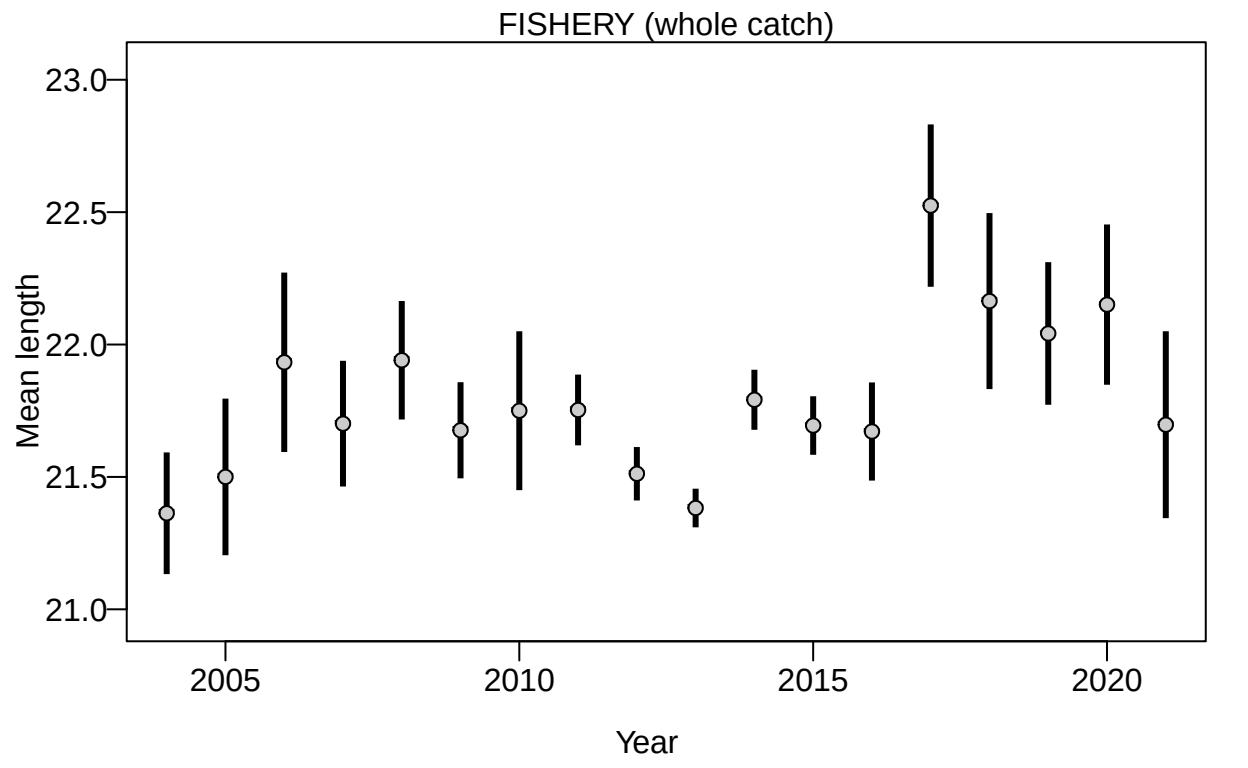

Numbers at age at equilibrium
0
10
20
30
40
50
0
1
2
3
4
5
6
Age

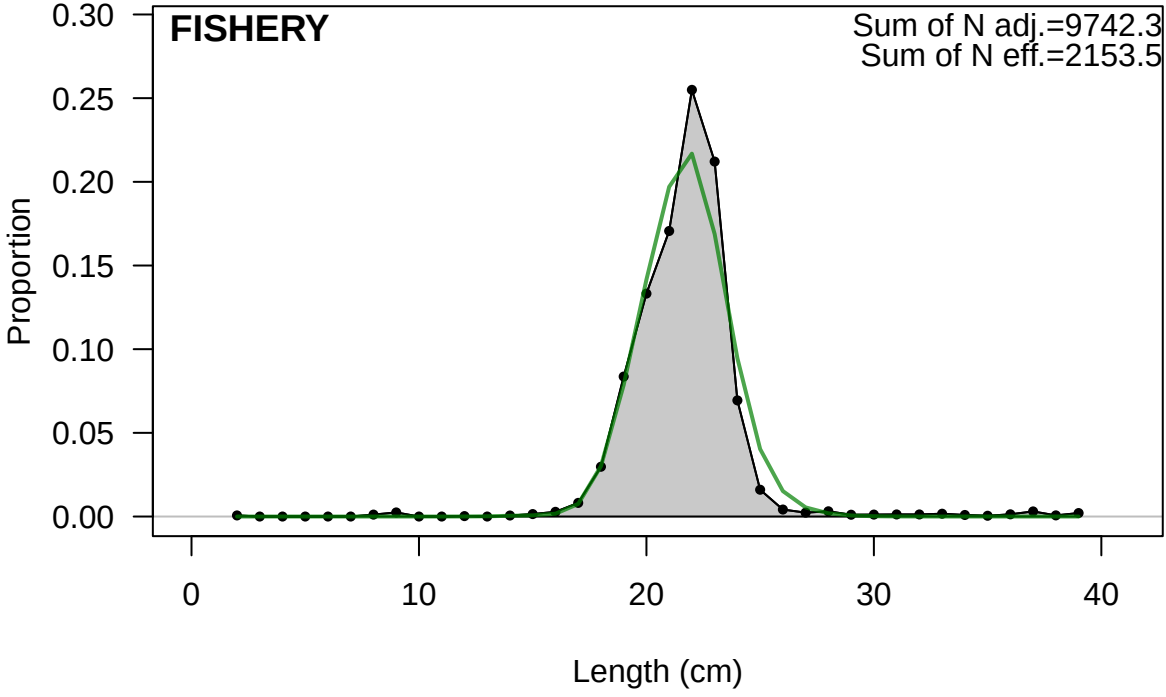

FISHERY
Sum of N adj.=9742.3
Proportion
0.25
0.20
0.15
0.10
0.05
0.00
0
10
20
30
40
Length (cm)

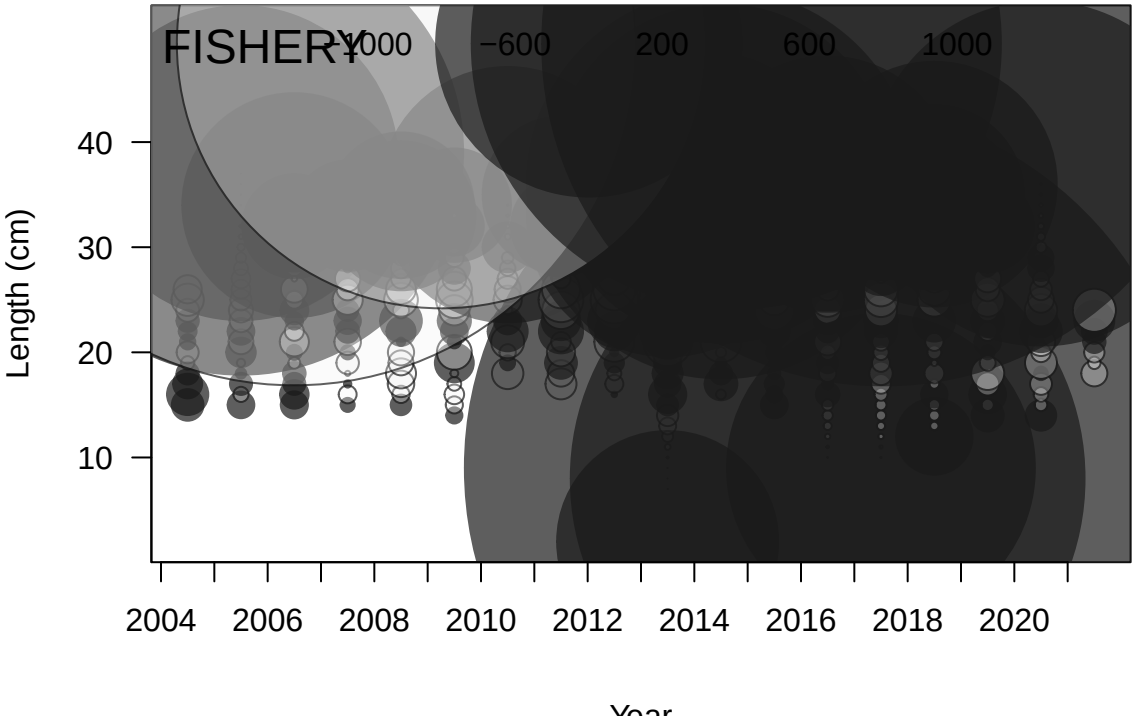

FISHERY
0.01
0.2
0.4
Length (cm)
40
30
20
10
2004
2006
2008
2010
2012
2014
2016
2018
2020
Year

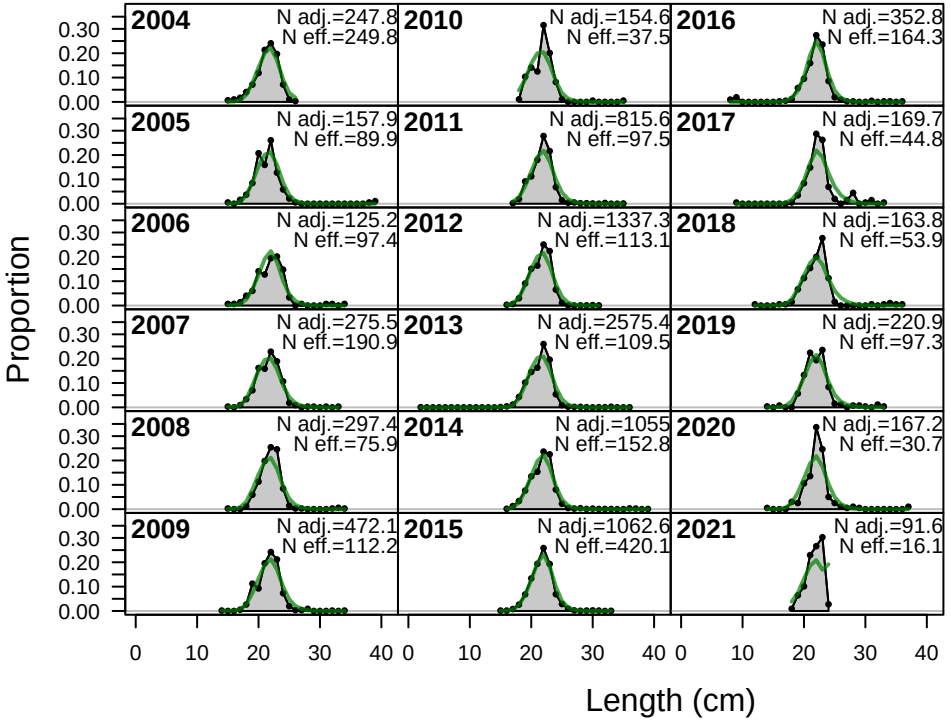

2004
N adj.=247.8
2010
N adj.=154.6
2016
N adj.=352.8
2005
N adj.=157.9
2011
N adj.=815.6
2017
N adj.=169.7
2006
N adj.=125.2
2012
N adj.=1337.3
2018
N adj.=163.8
2007
N adj.=275.5
2013
N adj.=2575.4
2019
N adj.=220.9
2008
N adj.=297.4
2014
N adj.=1055
2020
N adj.=167.2
2009
N adj.=472.1
2015
N adj.=1062.6
2021
N adj.=91.6
Proportion
0.00
0.10
0.20
0.30
0
10
20
30
40
Length (cm)

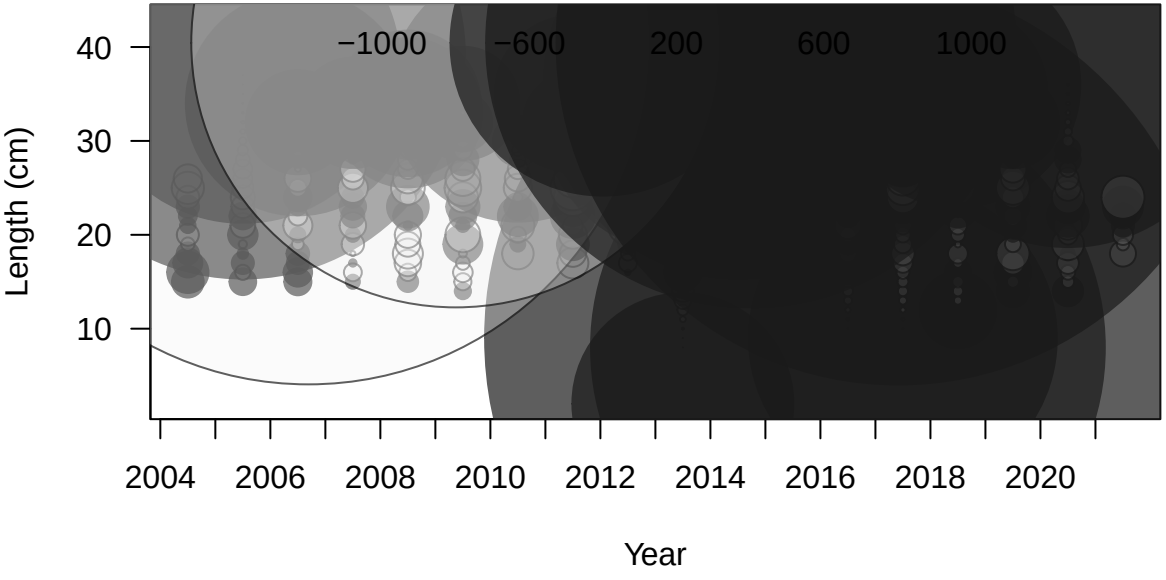

0.01
0.2
0.4
40
30
20
10
Length (cm)
2004
2006
2008
2010
2012
2014
2016
2018
2020
Year

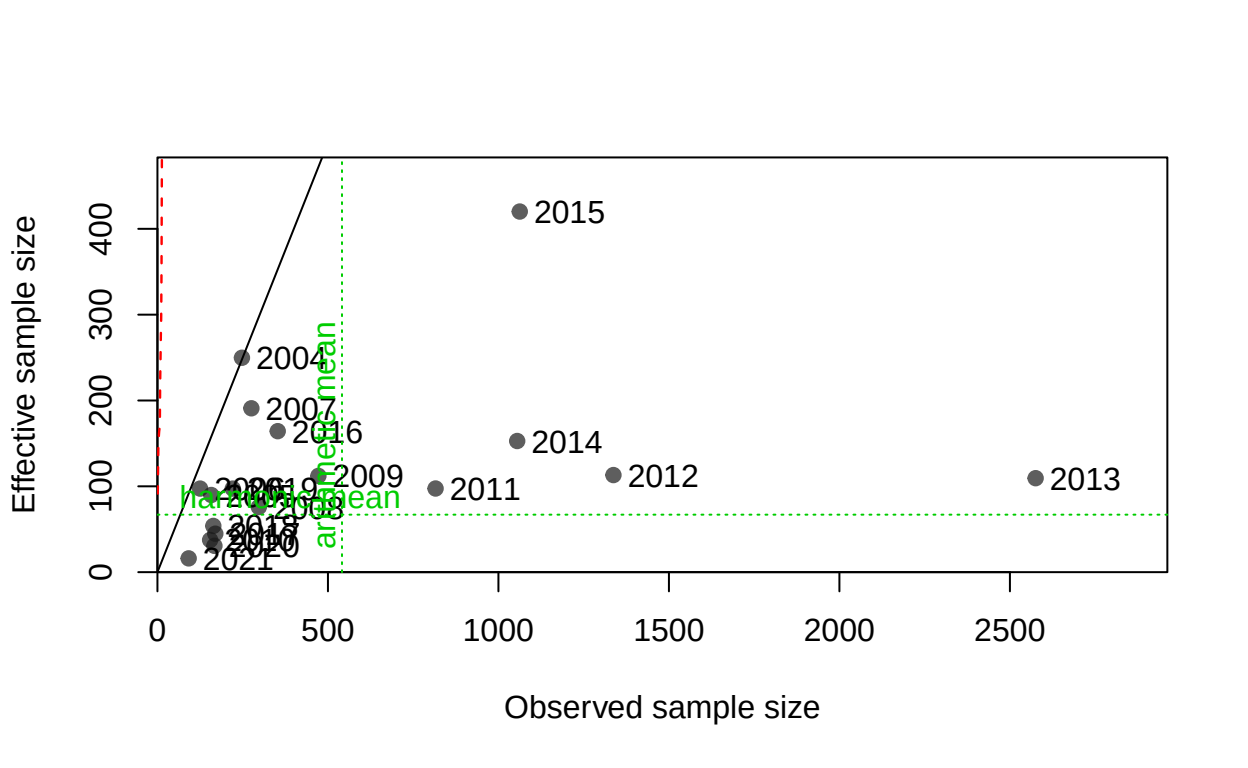

FISHERY (whole catch)
23.0
22.5
22.0
21.5
21.0
Mean length
2005
2010
2015
2020
Year

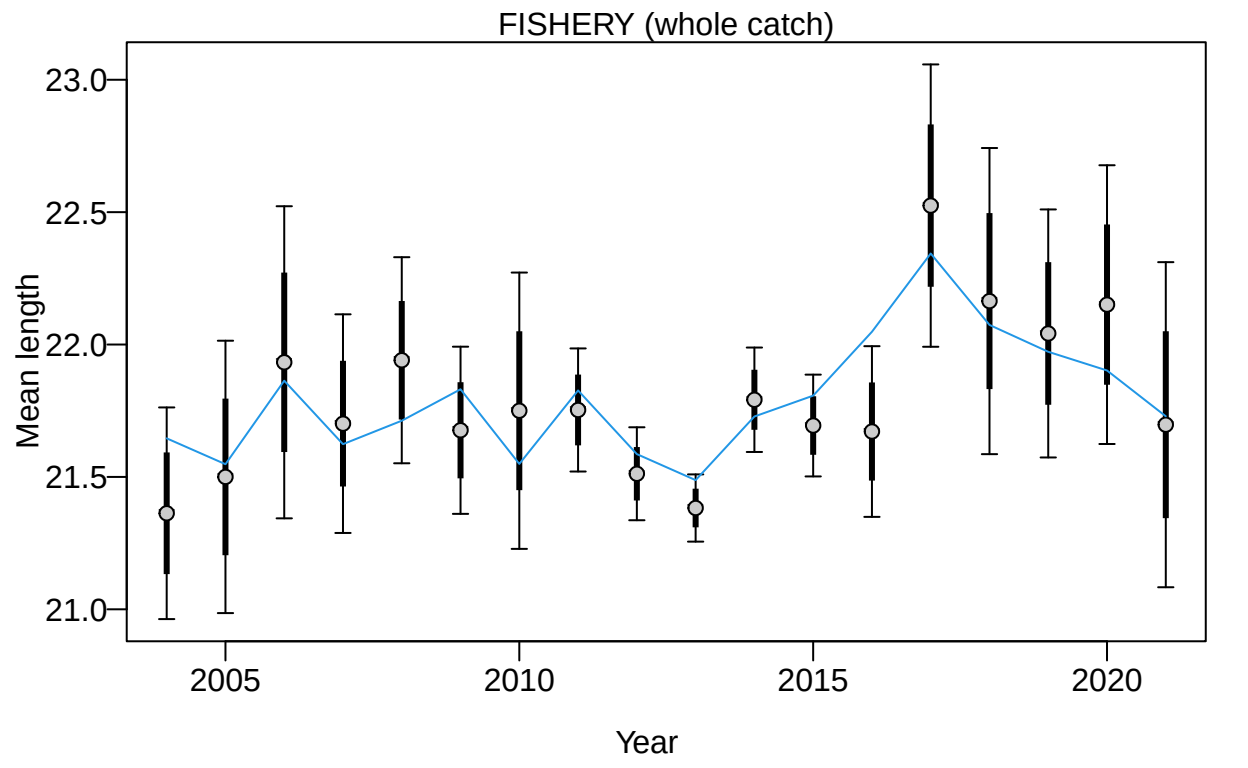

FISHERY
Sum of N adj.=9742.3
Sum of N eff.=2153.5
Proportion
0.30
0.25
0.20
0.15
0.10
0.05
0.00
0
10
20
30
40
Length (cm)

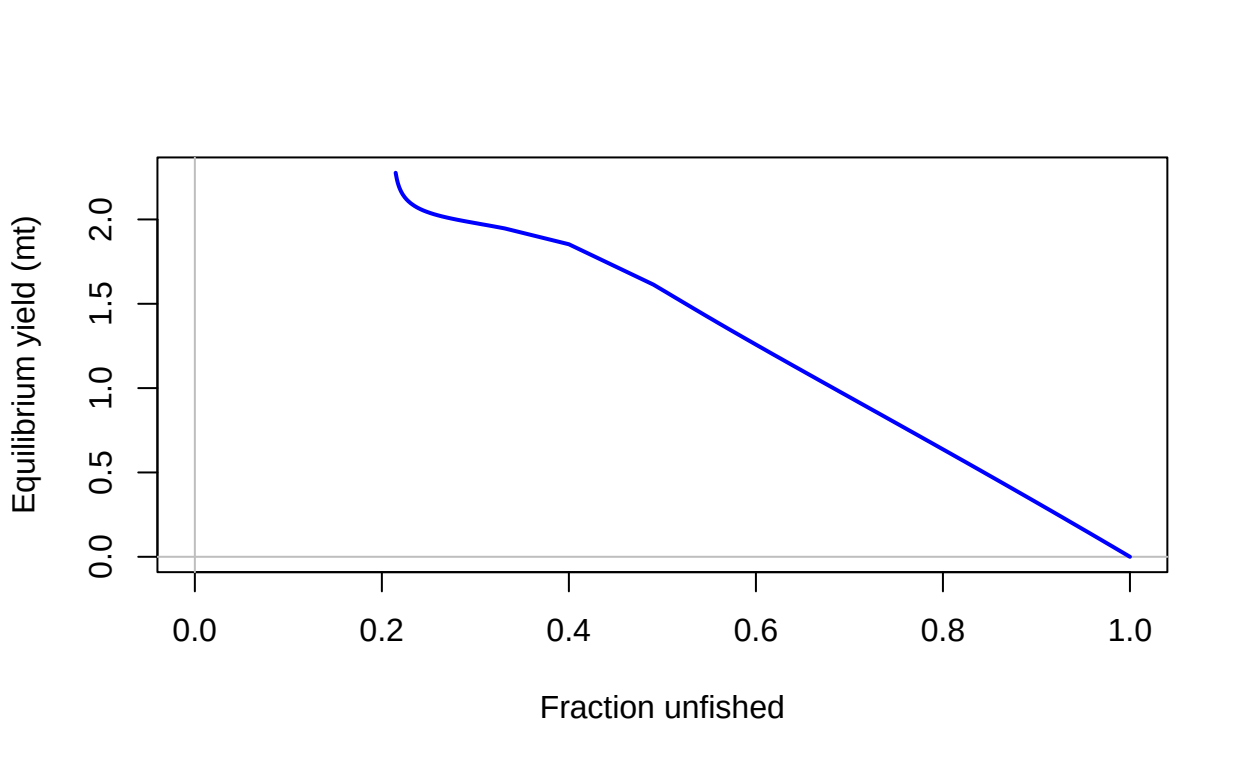

FISHERY
−1000
−600
200
600
1000
40
30
20
10
Length (cm)
2004
2006
2008
2010
2012
2014
2016
2018
2020
Year

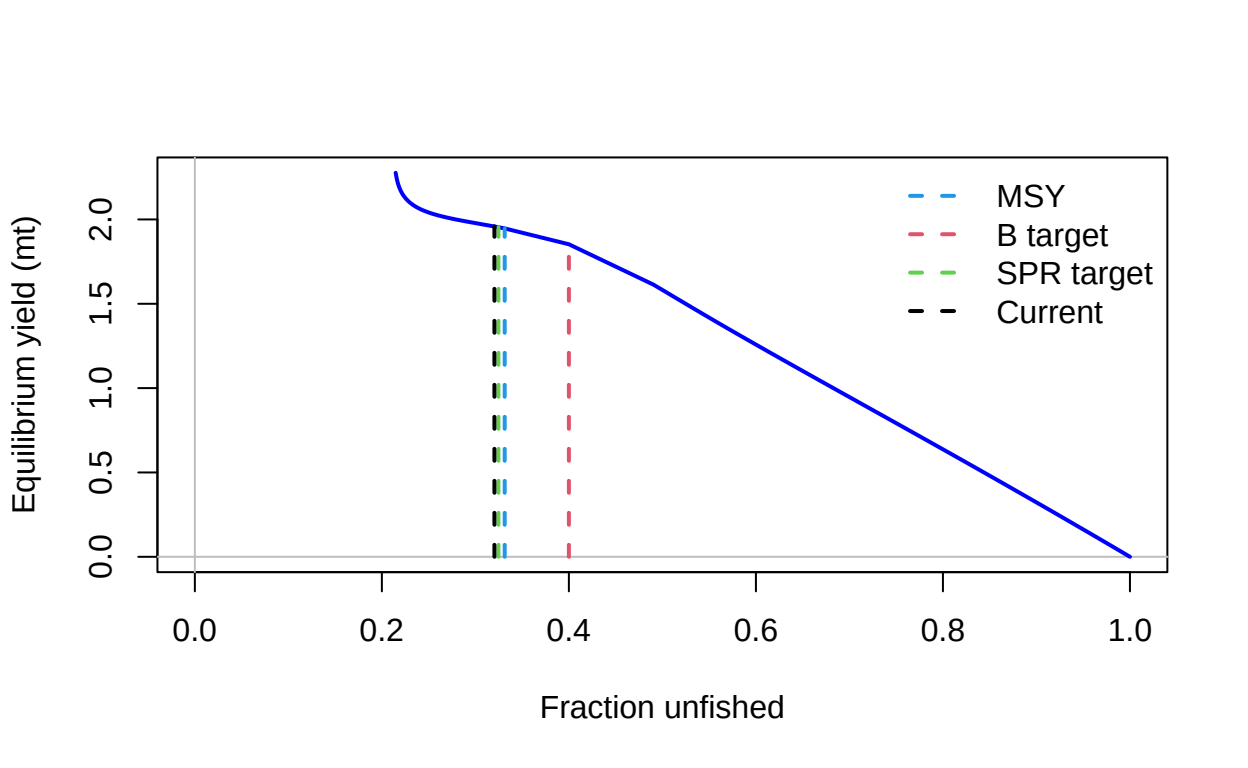

2004
N adj.=247.8
N eff.=249.8
2010
N adj.=154.6
N eff.=37.5
2016
N adj.=352.8
N eff.=164.3
2005
N adj.=157.9
N eff.=89.9
2011
N adj.=815.6
N eff.=97.5
2017
N adj.=169.7
N eff.=44.8
2006
N adj.=125.2
N eff.=97.4
2012
N adj.=1337.3
N eff.=113.1
2018
N adj.=163.8
N eff.=53.9
2007
N adj.=275.5
N eff.=190.9
2013
N adj.=2575.4
N eff.=109.5
2019
N adj.=220.9
N eff.=97.3
2008
N adj.=297.4
N eff.=75.9
2014
N adj.=1055
N eff.=152.8
2020
N adj.=167.2
N eff.=30.7
2009
N adj.=472.1
N eff.=112.2
2015
N adj.=1062.6
N eff.=420.1
2021
N adj.=91.6
N eff.=16.1
Proportion
0.00
0.10
0.20
0.30
0
10
20
30
40
Length (cm)

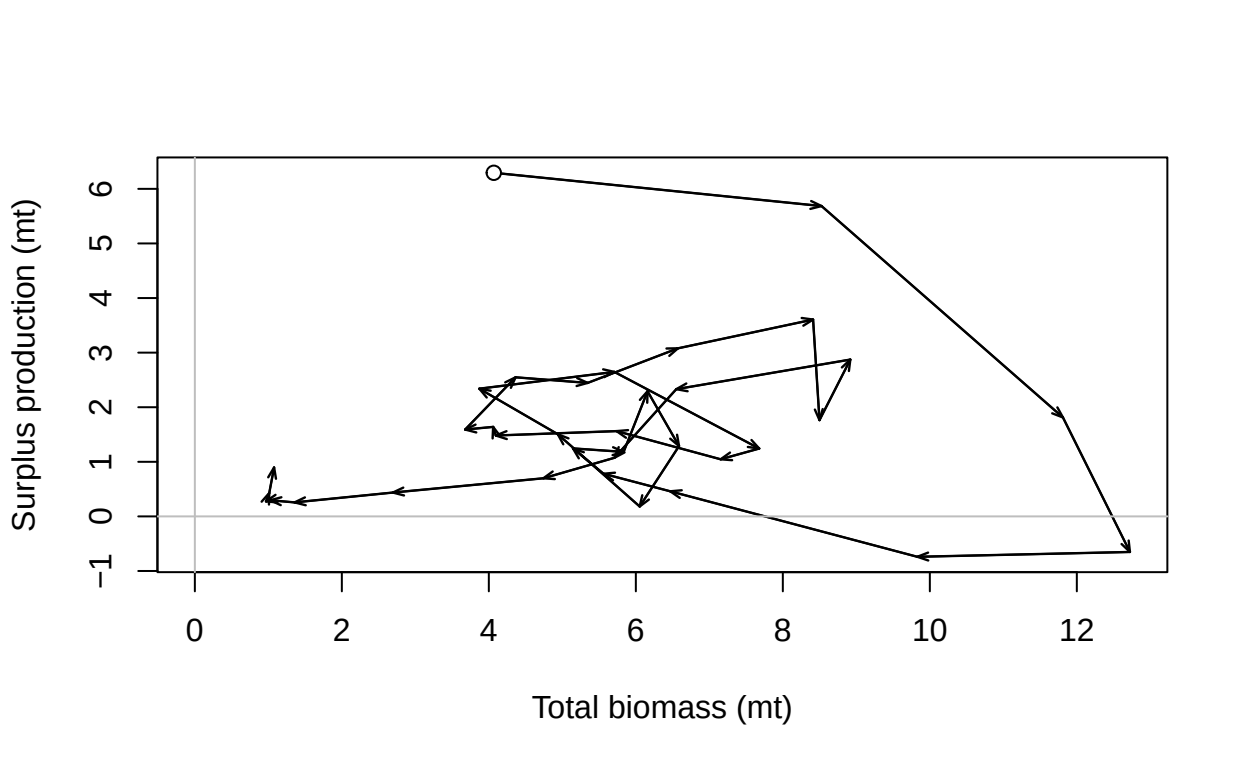

−1000
−600
200
600
1000
40
30
20
10
Length (cm)
2004
2006
2008
2010
2012
2014
2016
2018
2020
Year

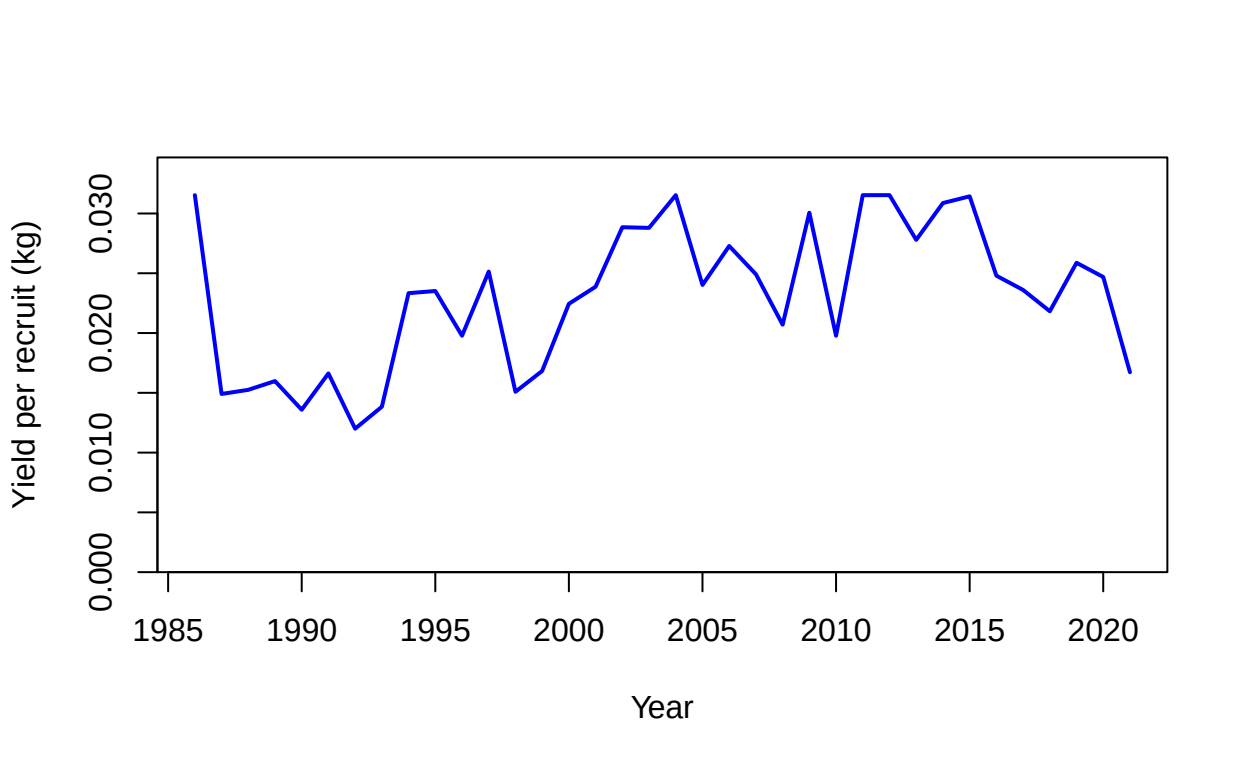

Effective sample size
0
100
200
300
400
0
500
1000
1500
2000
2500
Observed sample size
2015
2004
2007
2016
2014
2009
2012
2013
2011
harmonic mean
arithmetic mean
2021

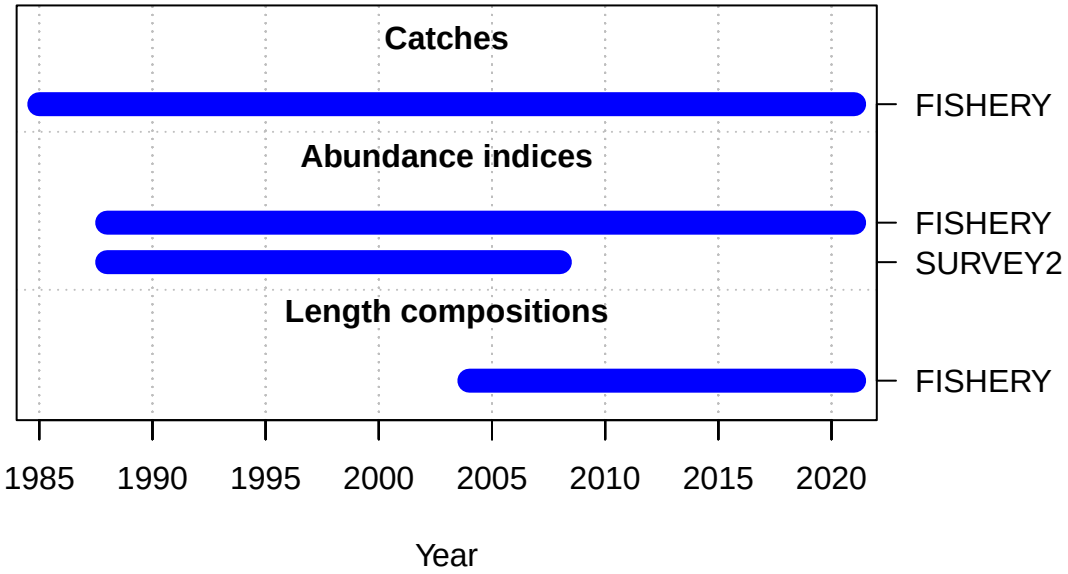

FISHERY (whole catch)
23.0
22.5
22.0
21.5
21.0
Mean length
2005
2010
2015
2020
Year

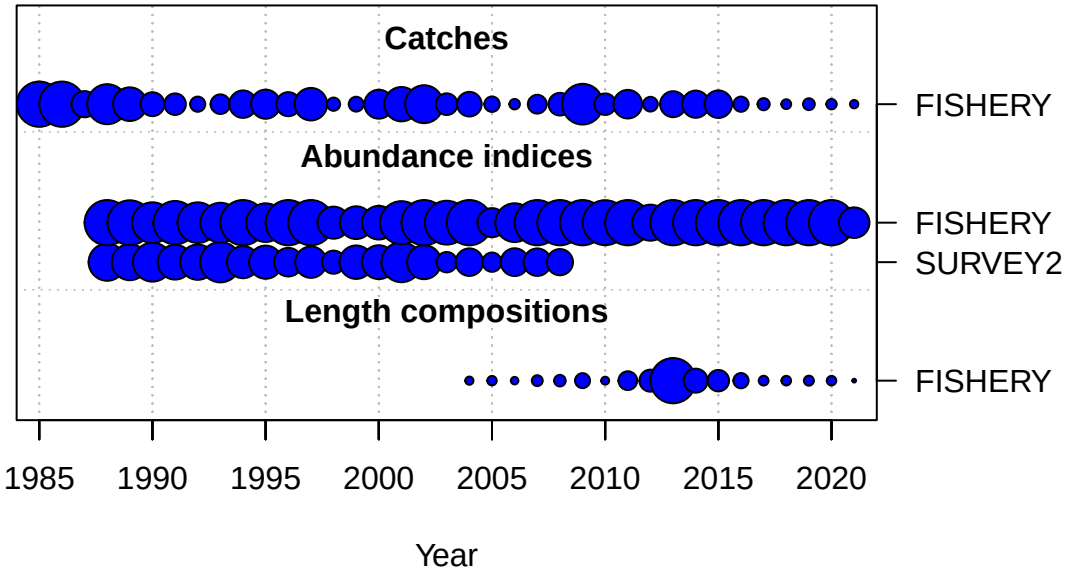

Equilibrium yield (mt)
0.0
0.5
1.0
1.5
2.0
0.0
0.2
0.4
0.6
0.8
1.0
Fraction unfished

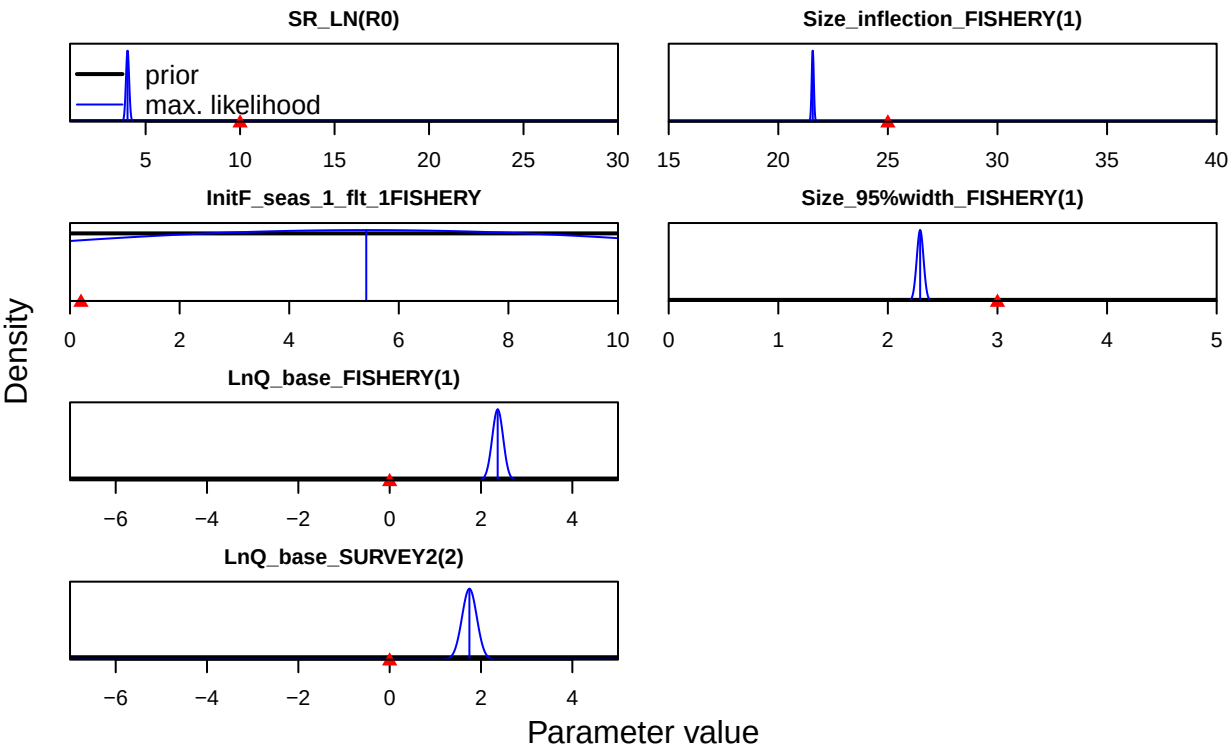

MSY
B target
SPR target
Current
Equilibrium yield (mt)
0.0
0.5
1.0
1.5
2.0
0.0
0.2
0.4
0.6
0.8
1.0
Fraction unfished


Surplus production (mt)
−1
0
1
2
3
4
5
6
0
2
4
6
8
10
12
Total biomass (mt)


Yield per recruit (kg)
0.000
0.010
0.020
0.030
1985
1990
1995
2000
2005
2010
2015
2020
Year


Catches
FISHERY
Abundance indices
FISHERY
SURVEY2
Length compositions
FISHERY
1985
1990
1995
2000
2005
2010
2015
2020
Year


Catches
FISHERY
Abundance indices
FISHERY
SURVEY2
Length compositions
FISHERY
1985
1990
1995
2000
2005
2010
2015
2020
Year


SR_LN(R0)
prior
max. likelihood
5
10
15
20
25
30
Size_inflection_FISHERY(1)
15
20
25
30
35
40
InitF_seas_1_flt_1FISHERY
0
2
4
6
8
10
Size_95%width_FISHERY(1)
0
1
2
3
4
5
LnQ_base_FISHERY(1)
−6
−4
−2
0
2
4
LnQ_base_SURVEY2(2)
−6
−4
−2
0
2
4
Density
Parameter value