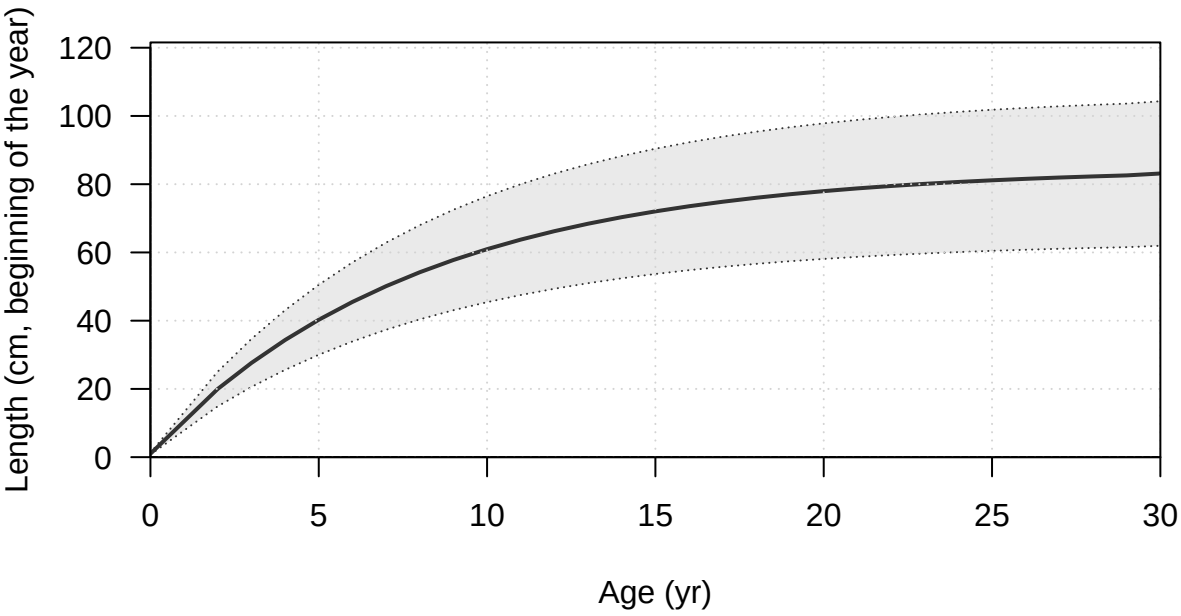
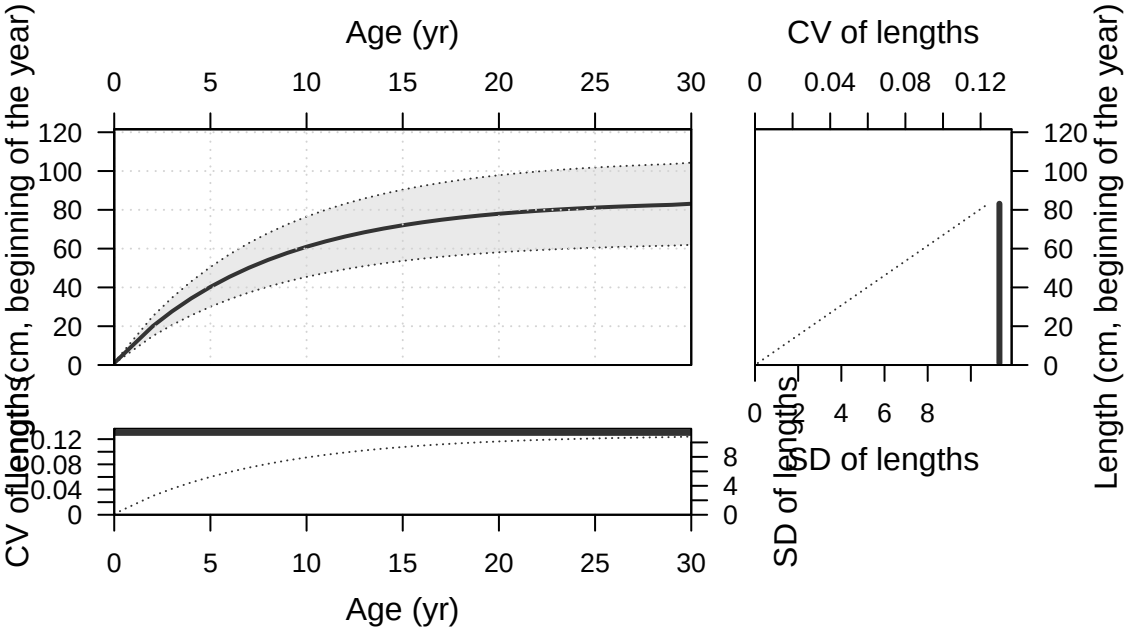
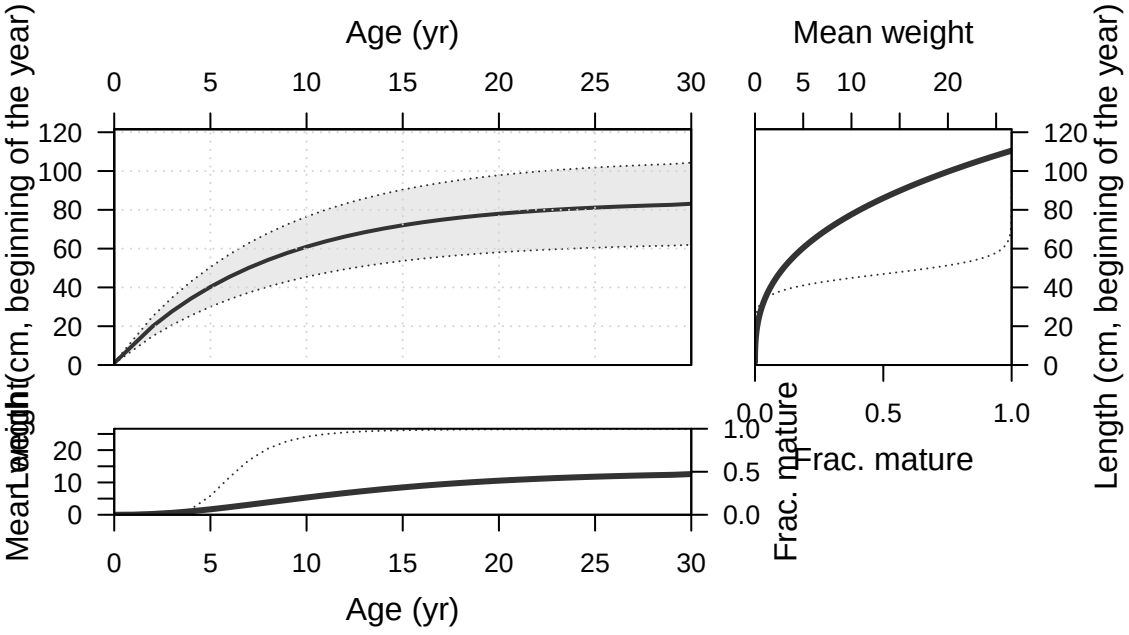
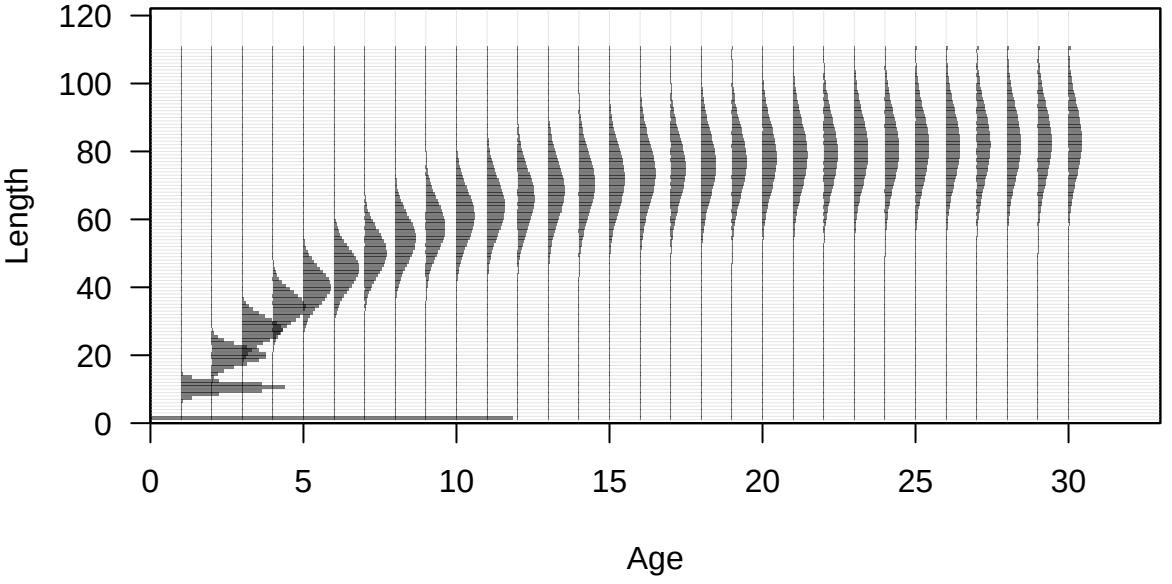
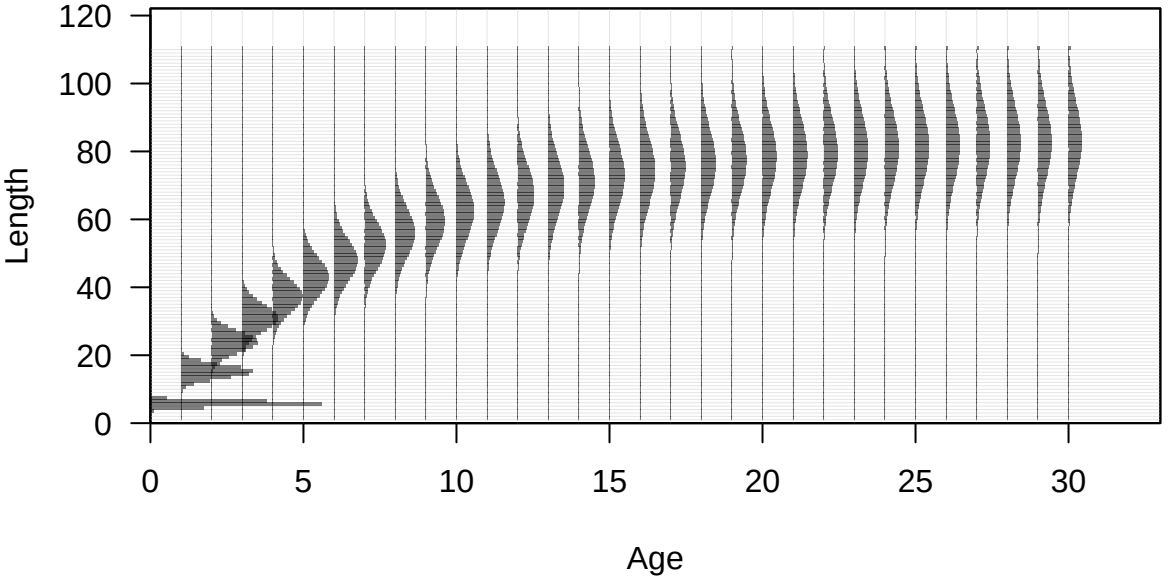
Plots created using the 'r4ss' package in R
Stock Synthesis version: 3.30.19.0
StartTime: Fri Jul 01 13:15:16 2022
Data_File: data.ss
Control_File: control.ss

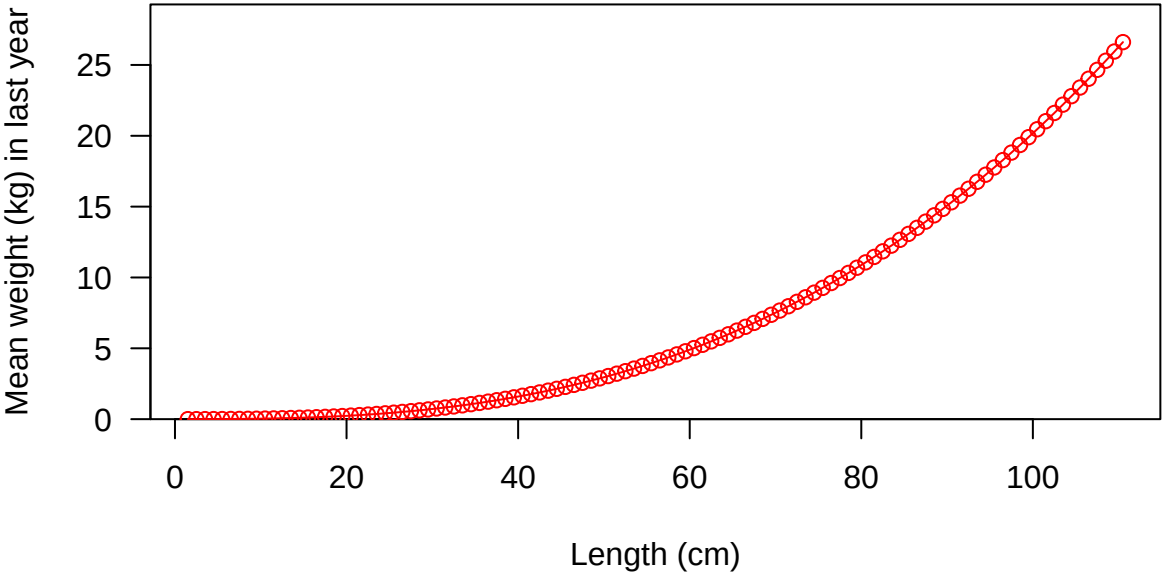

Length (cm, beginning of the year)
120
100
80
60
40
20
0
0
5
10
15
20
25
30
Age (yr)

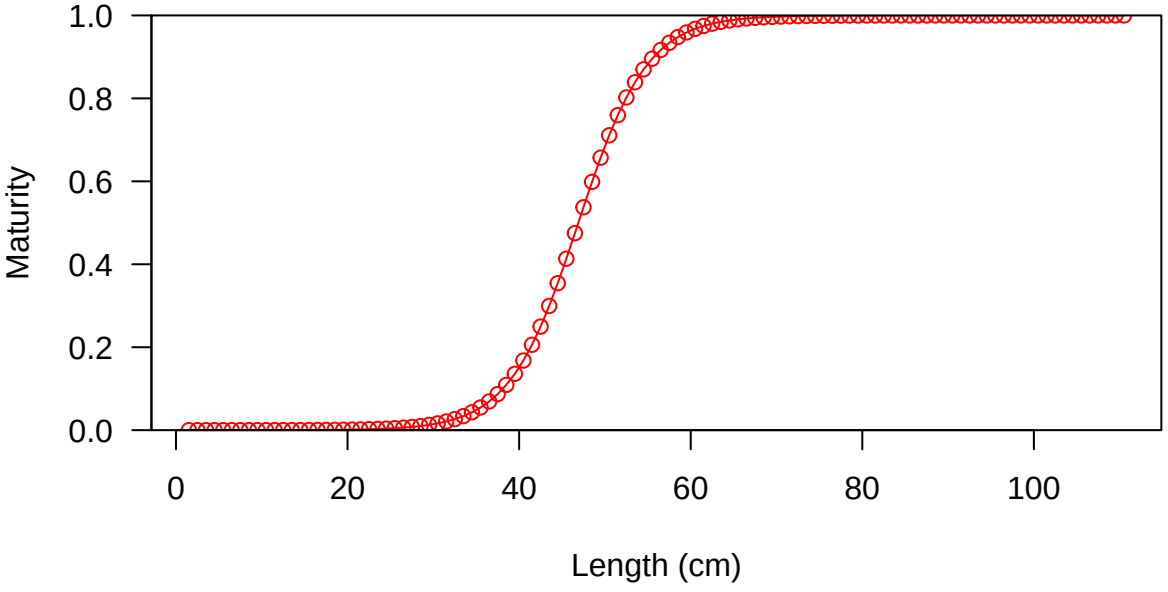

Age (yr)
0
5
10
15
20
25
30
Length (cm, beginning of the year)
120
100
80
60
40
20
0
CV of lengths
0.12
0.08
0.04
0
SD of lengths
8
4
0
CV of lengths
0
0.04
0.08
0.12
SD of lengths
0
2
4
6
8
Length (cm, beginning of the year)

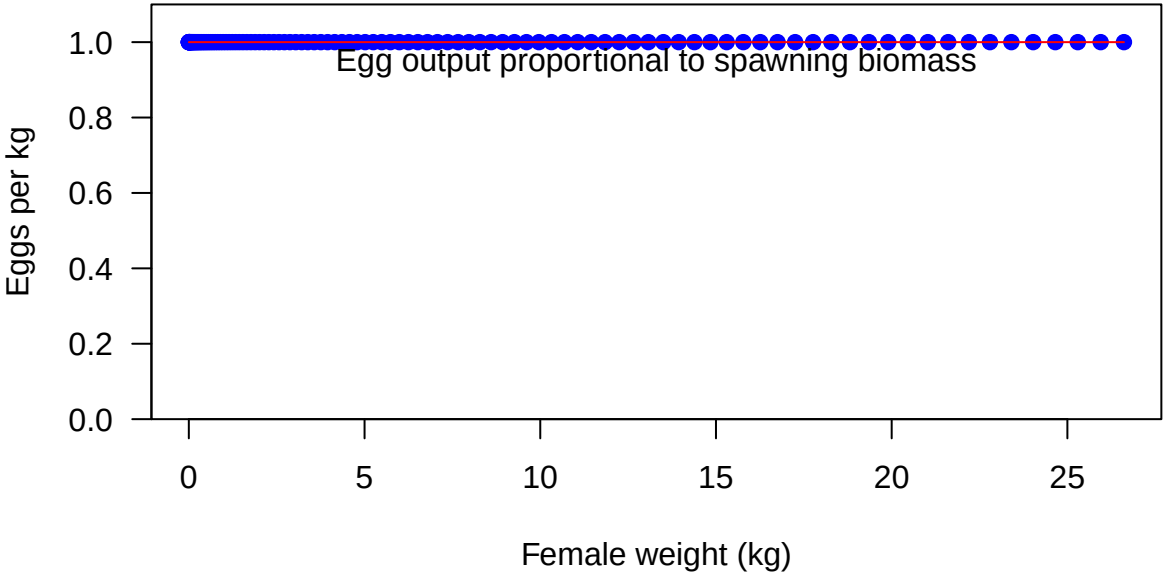

Age (yr)
Mean weight
Length (cm, beginning of the year)
Mean weight
Frac. mature
Age (yr)
Frac. mature
Length (cm, beginning of the year)

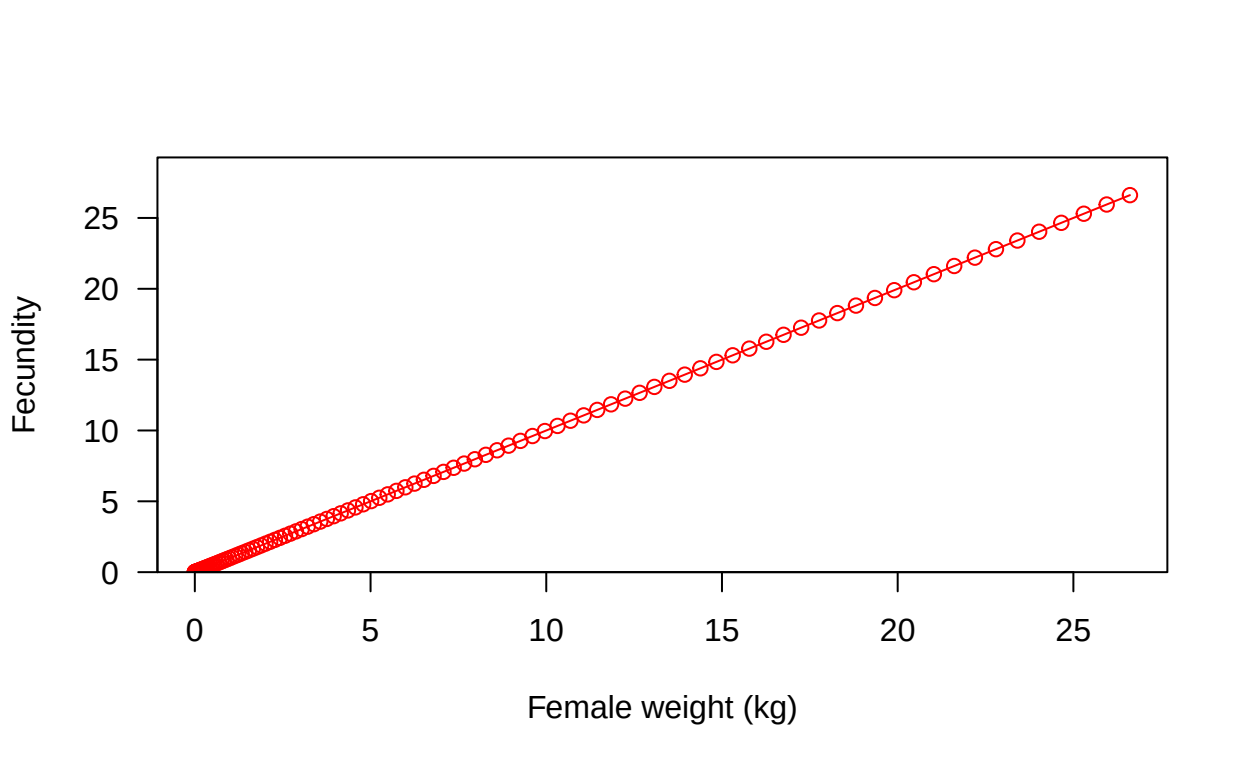

120
100
80
60
40
20
0
Length
0
5
10
15
20
25
30
Age

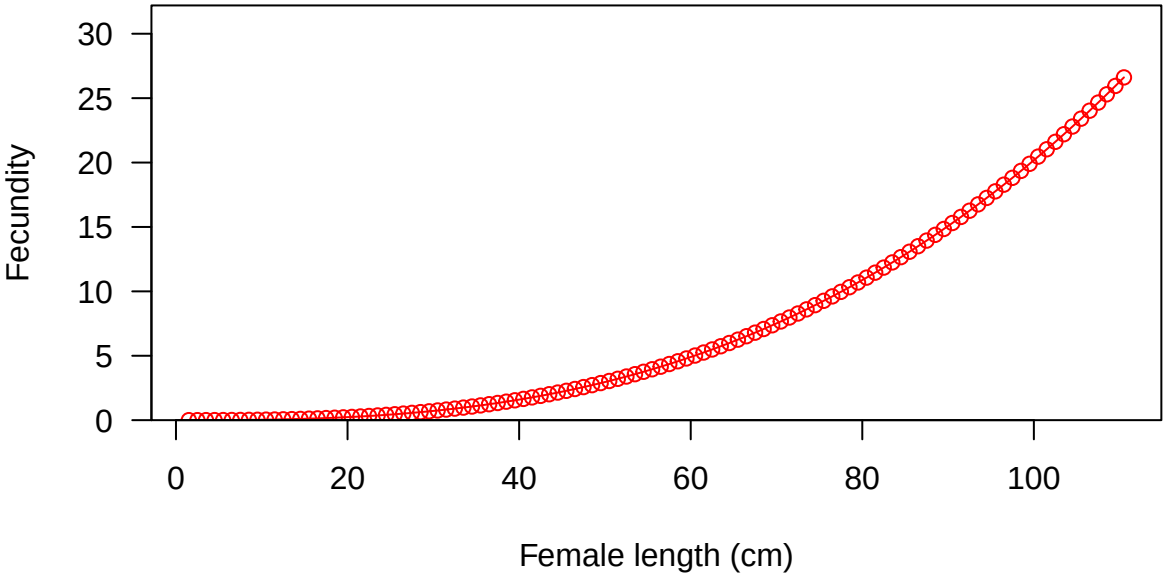

120
100
80
60
40
20
0
Length
0
5
10
15
20
25
30
Age

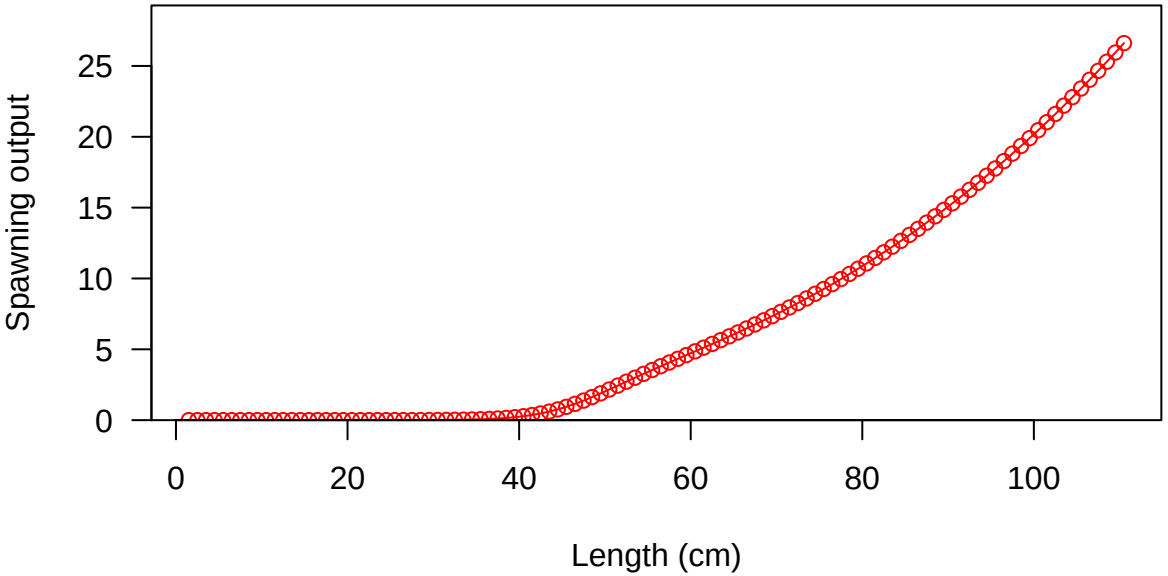

Mean weight (kg) in last year
0
5
10
15
20
25
0
20
40
60
80
100
Length (cm)

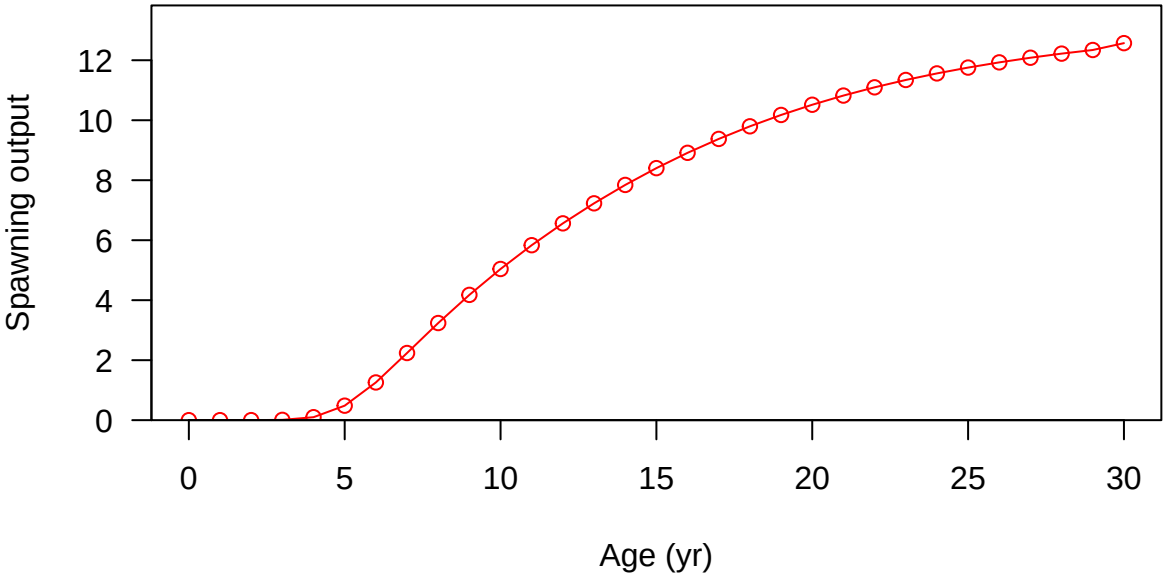

1.0
0.8
0.6
0.4
0.2
0.0
Maturity
0
20
40
60
80
100
Length (cm)

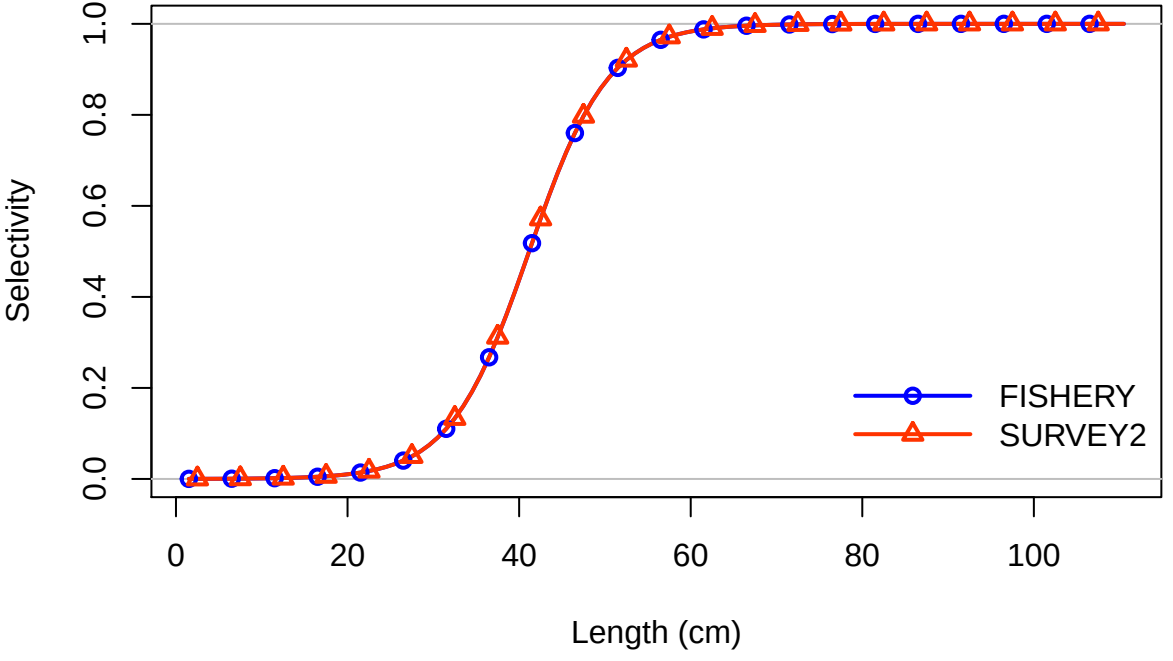

Egg output proportional to spawning biomass
Eggs per kg
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
Female weight (kg)

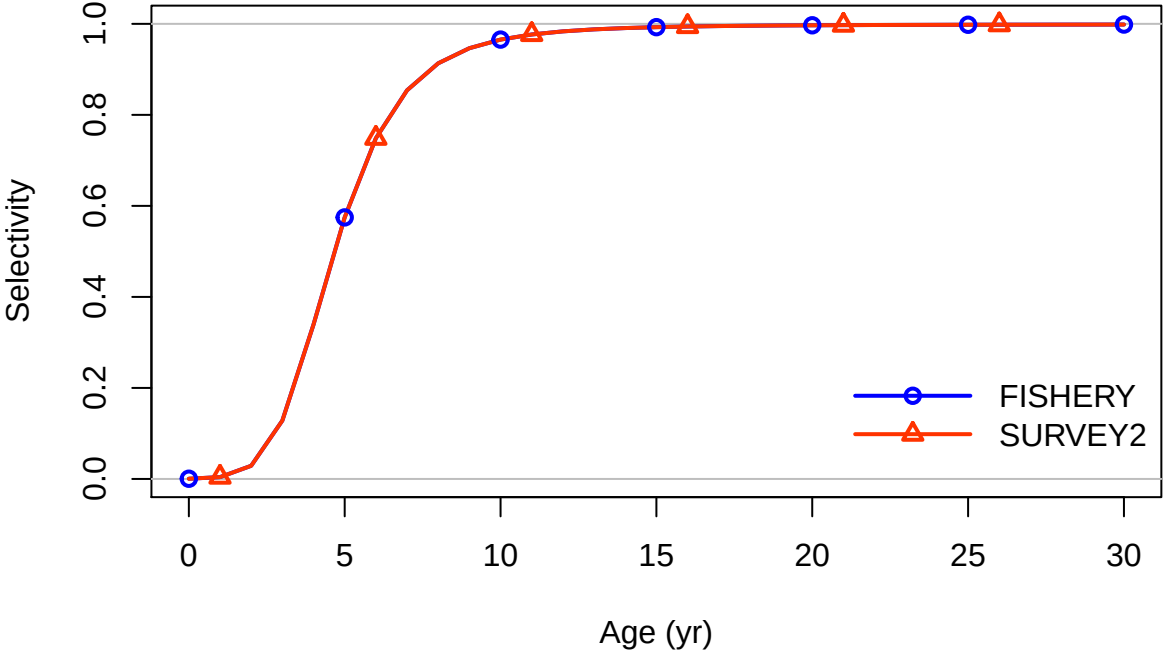

Fecundity
0
5
10
15
20
25
0
5
10
15
20
25
Female weight (kg)

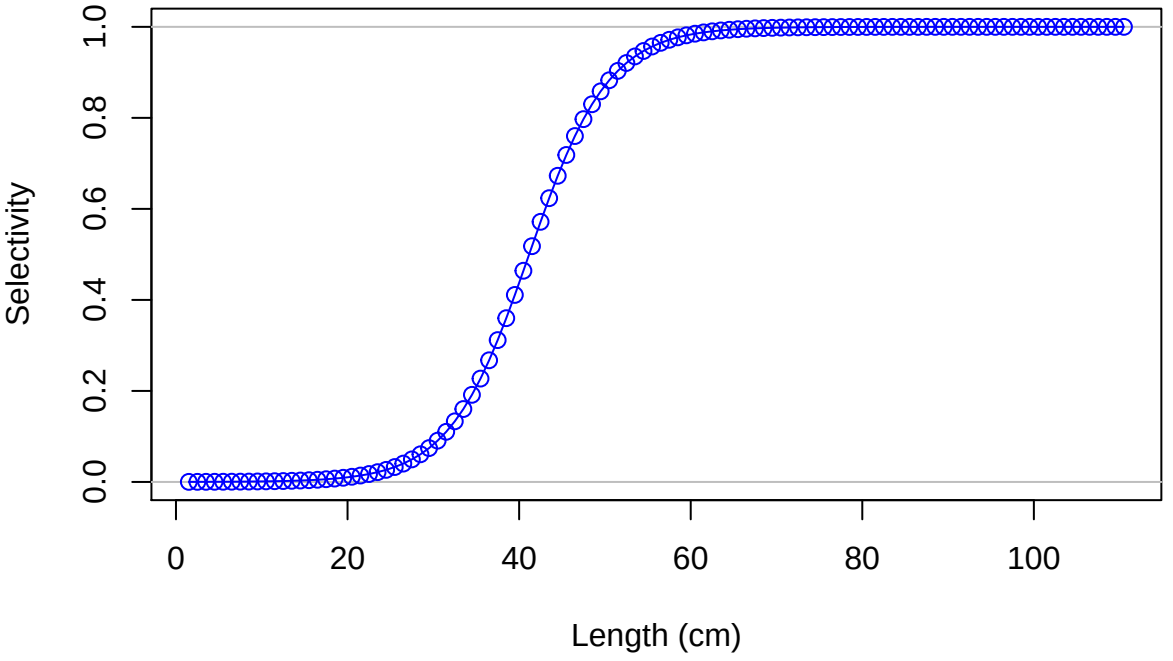

Fecundity
0
5
10
15
20
25
30
0
20
40
60
80
100
Female length (cm)

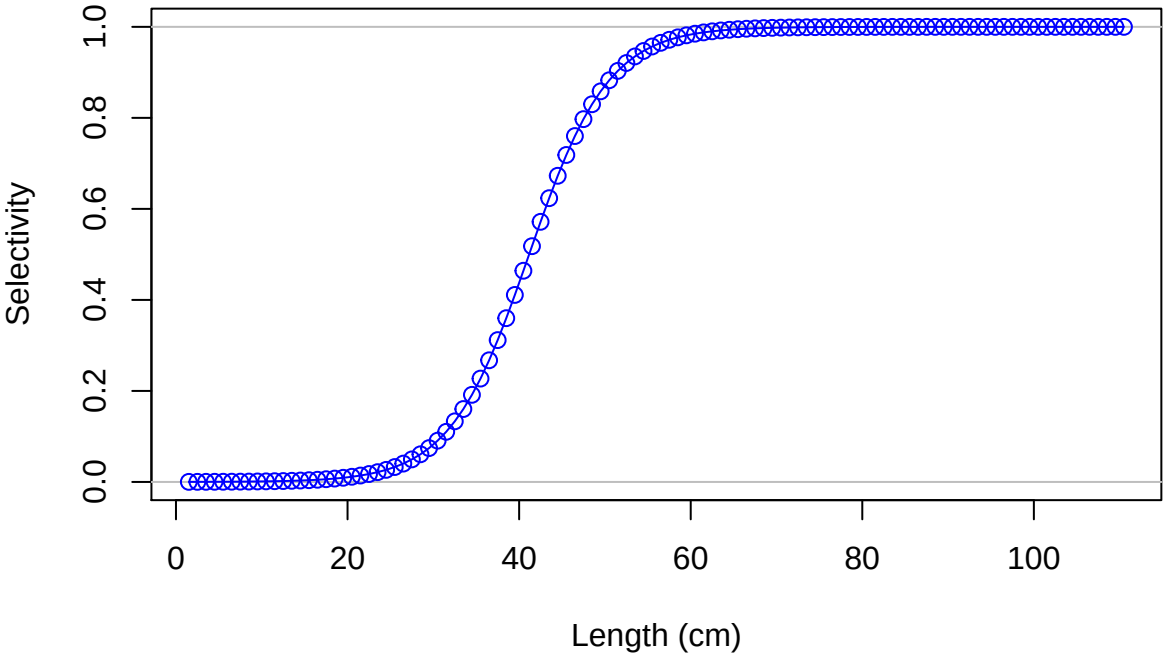

Spawning output
0
5
10
15
20
25
0
20
40
60
80
100
Length (cm)

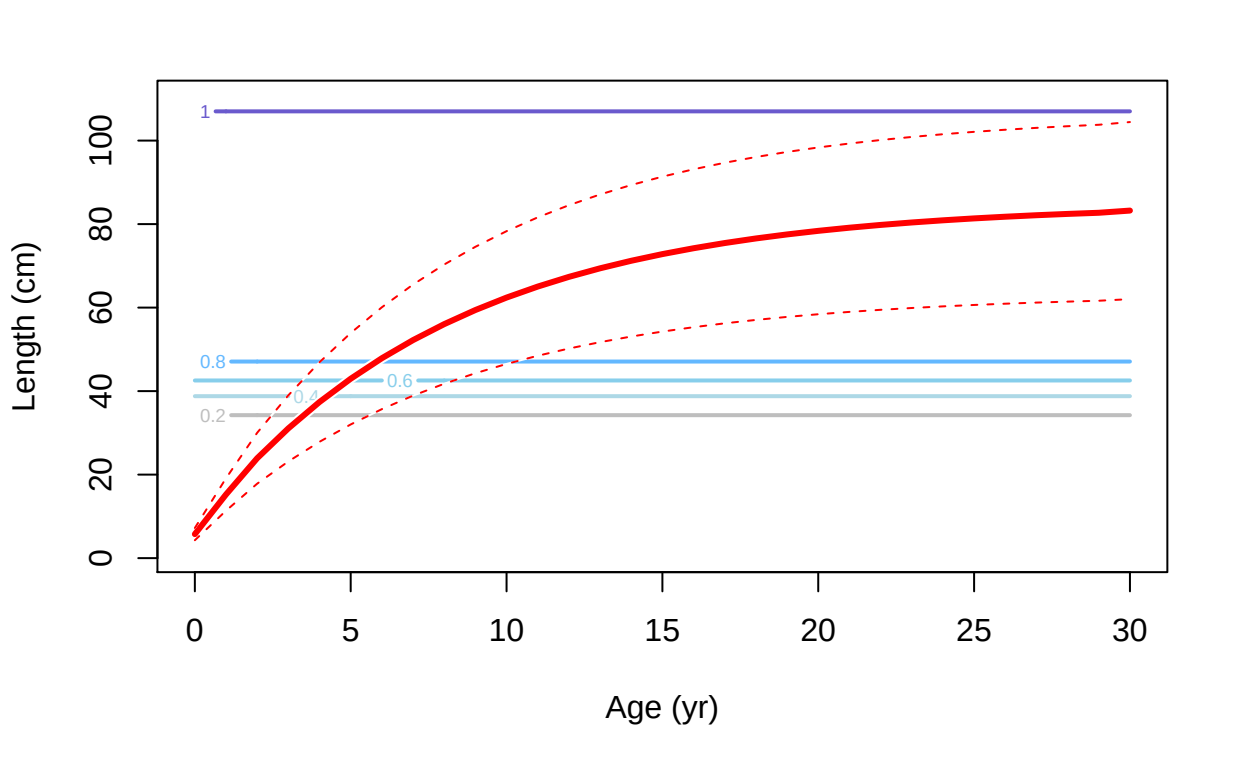

Spawning output
0
2
4
6
8
10
12
0
5
10
15
20
25
30
Age (yr)

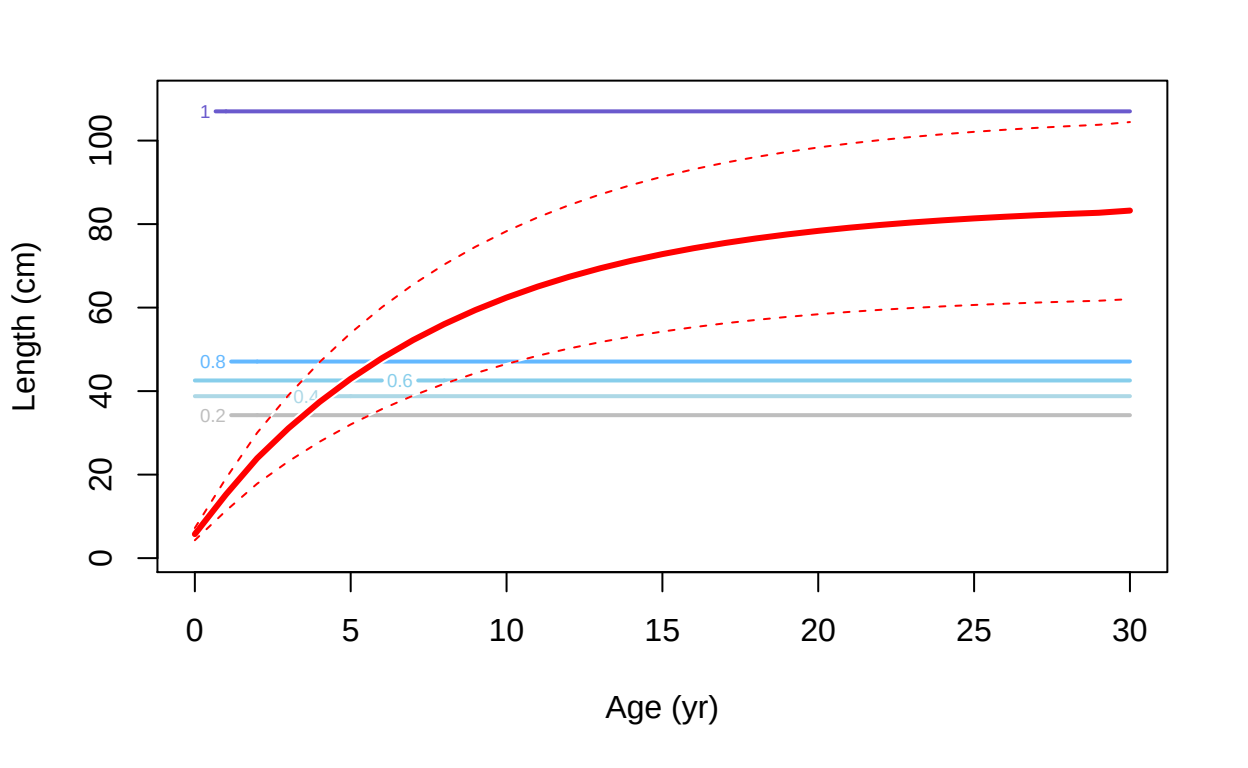

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
20
40
60
80
100
Length (cm)
FISHERY
SURVEY2

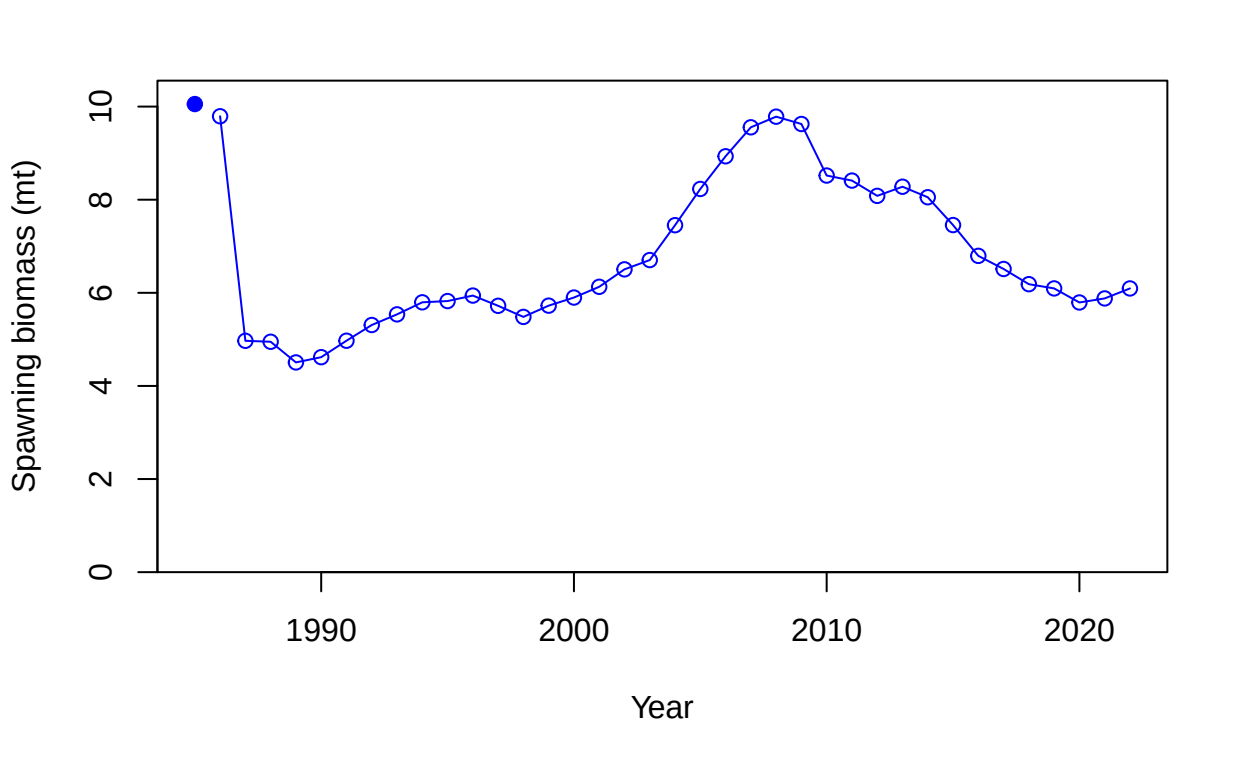

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
5
10
15
20
25
30
Age (yr)
FISHERY
SURVEY2

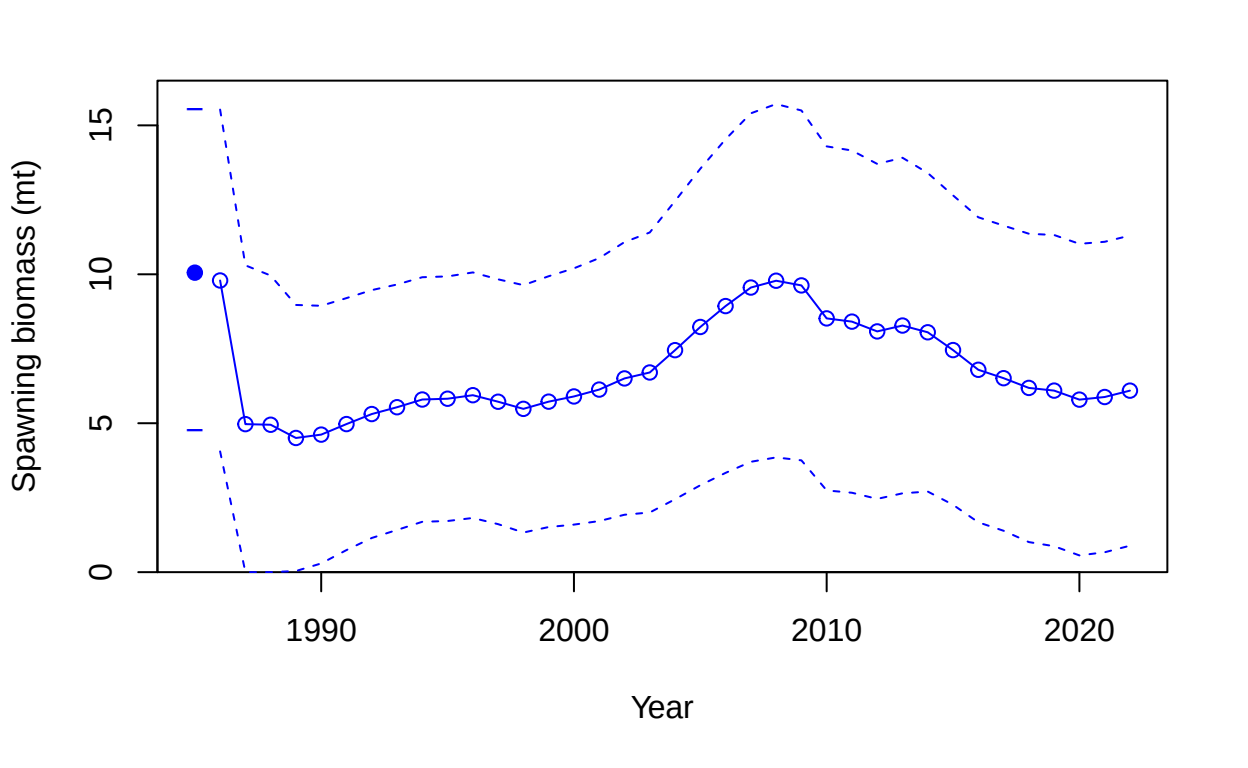

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
20
40
60
80
100
Length (cm)

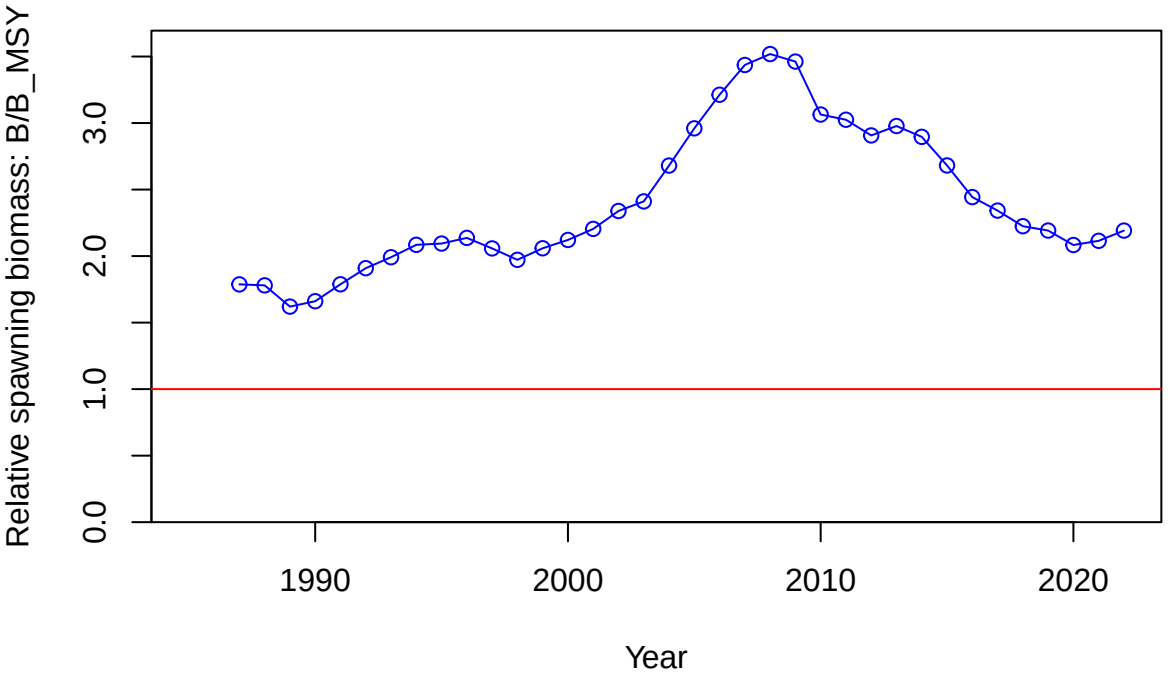

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
20
40
60
80
100
Length (cm)

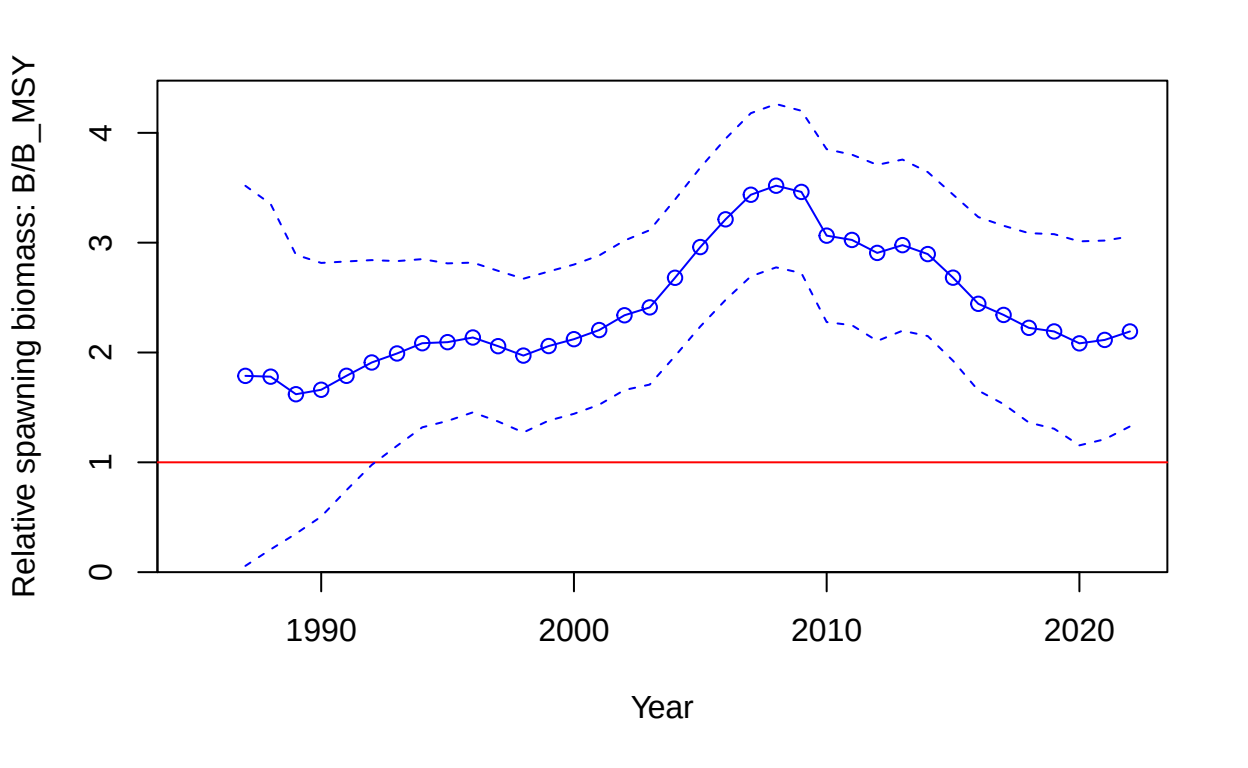

Length (cm)
0
20
40
60
80
100
1
0.8
0.6
0.4
0.2
0
5
10
15
20
25
30
Age (yr)

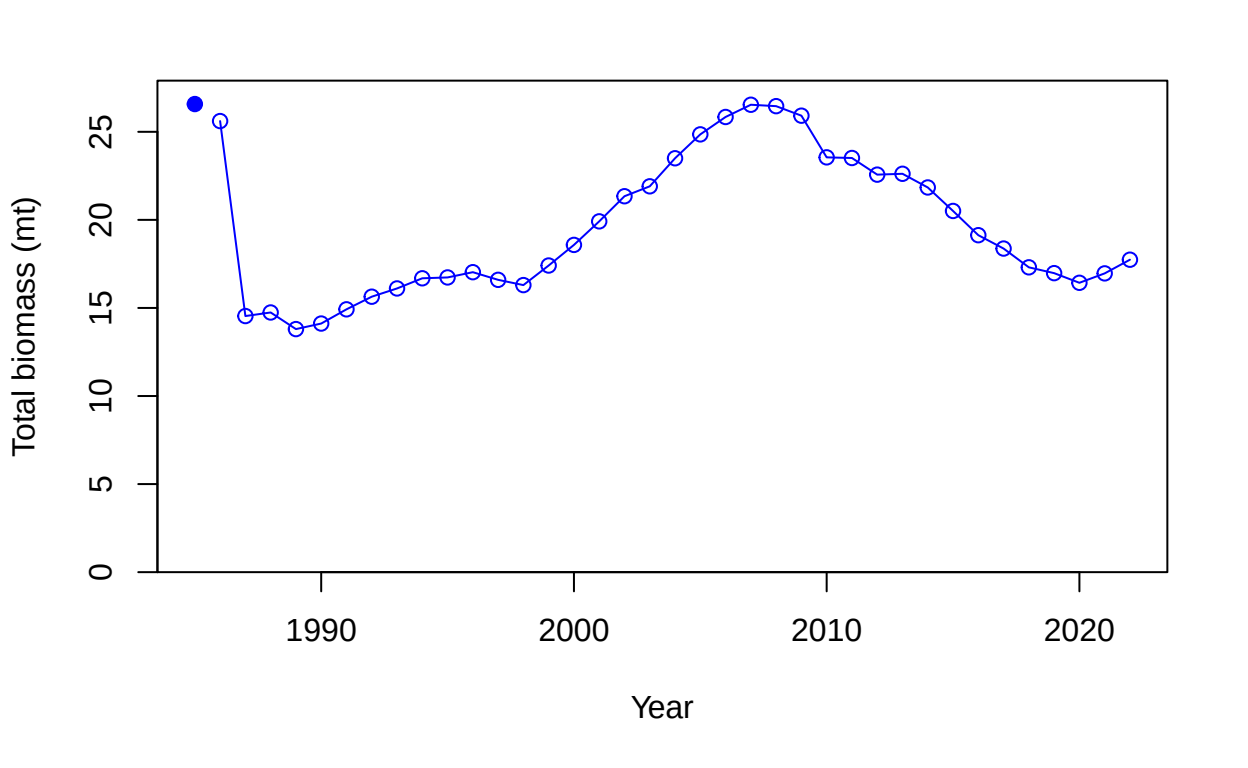

Length (cm)
0
20
40
60
80
100
1
0.8
0.6
0.4
0.2
0
5
10
15
20
25
30
Age (yr)

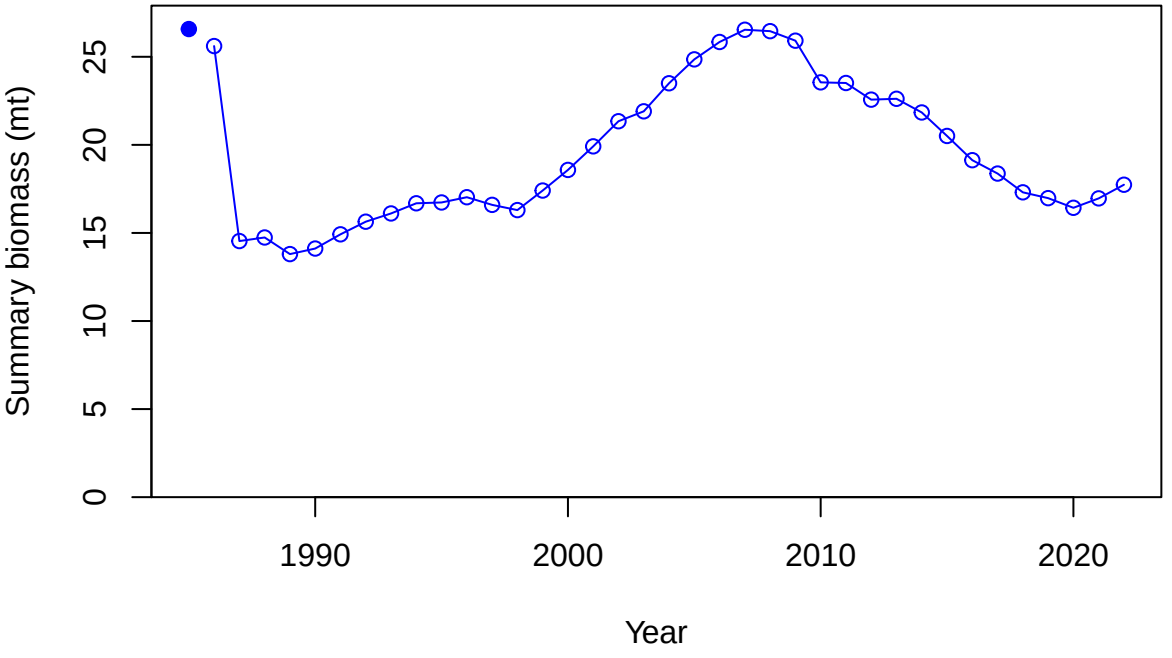

Spawning biomass (mt)
0
2
4
6
8
10
1990
2000
2010
2020
Year

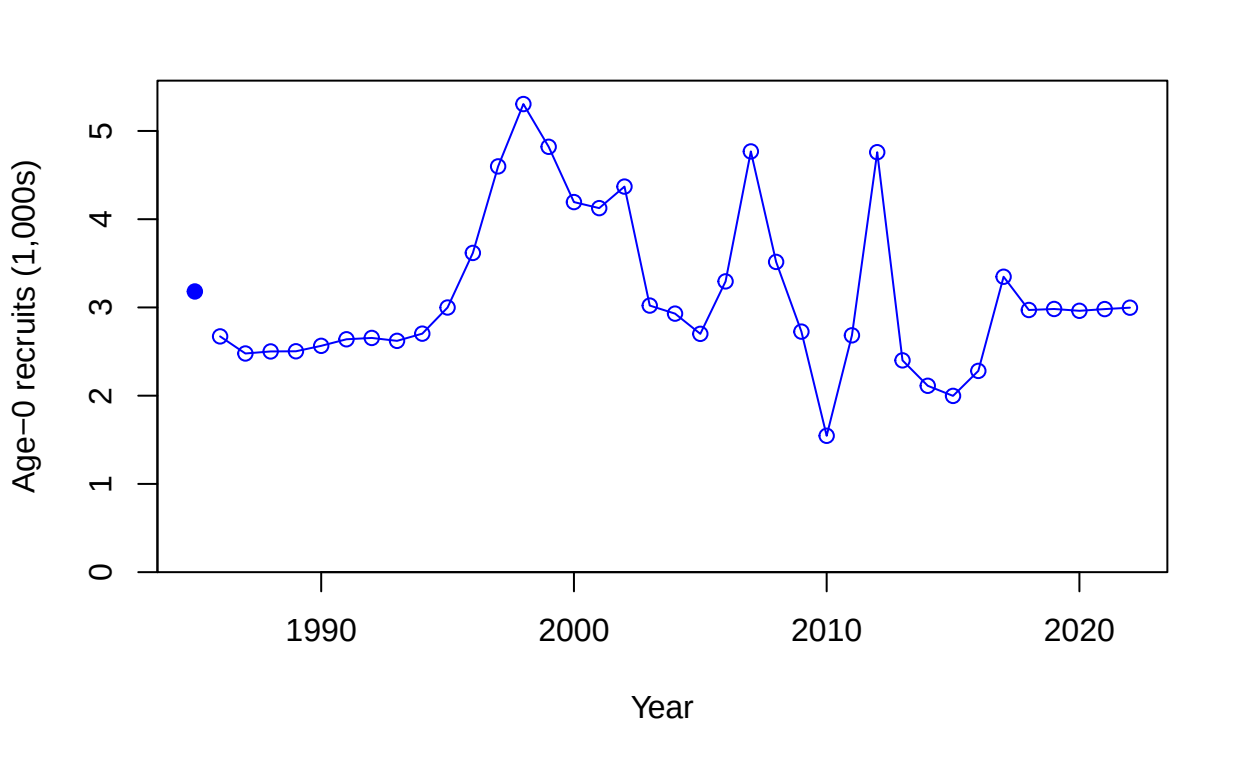

Spawning biomass (mt)
0
5
10
15
1990
2000
2010
2020
Year

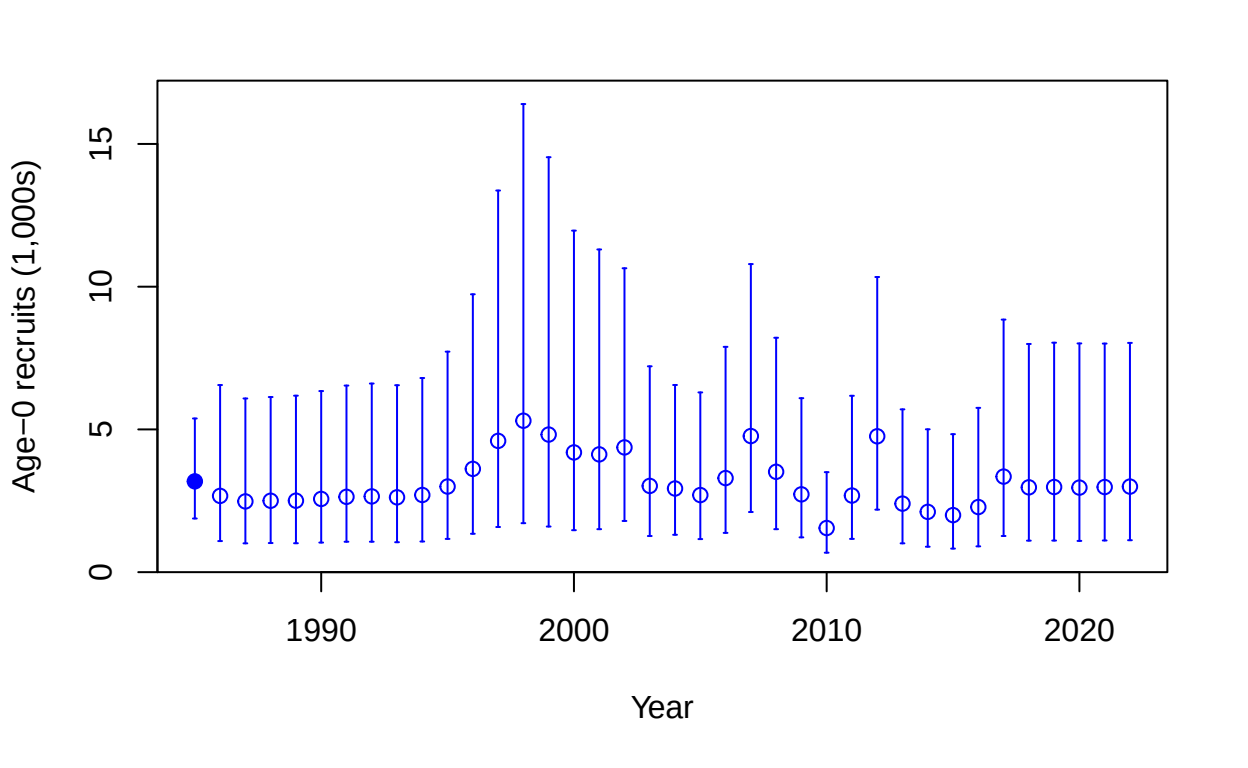

Relative spawning biomass: B/B_MSY
0.0
1.0
2.0
3.0
1990
2000
2010
2020
Year

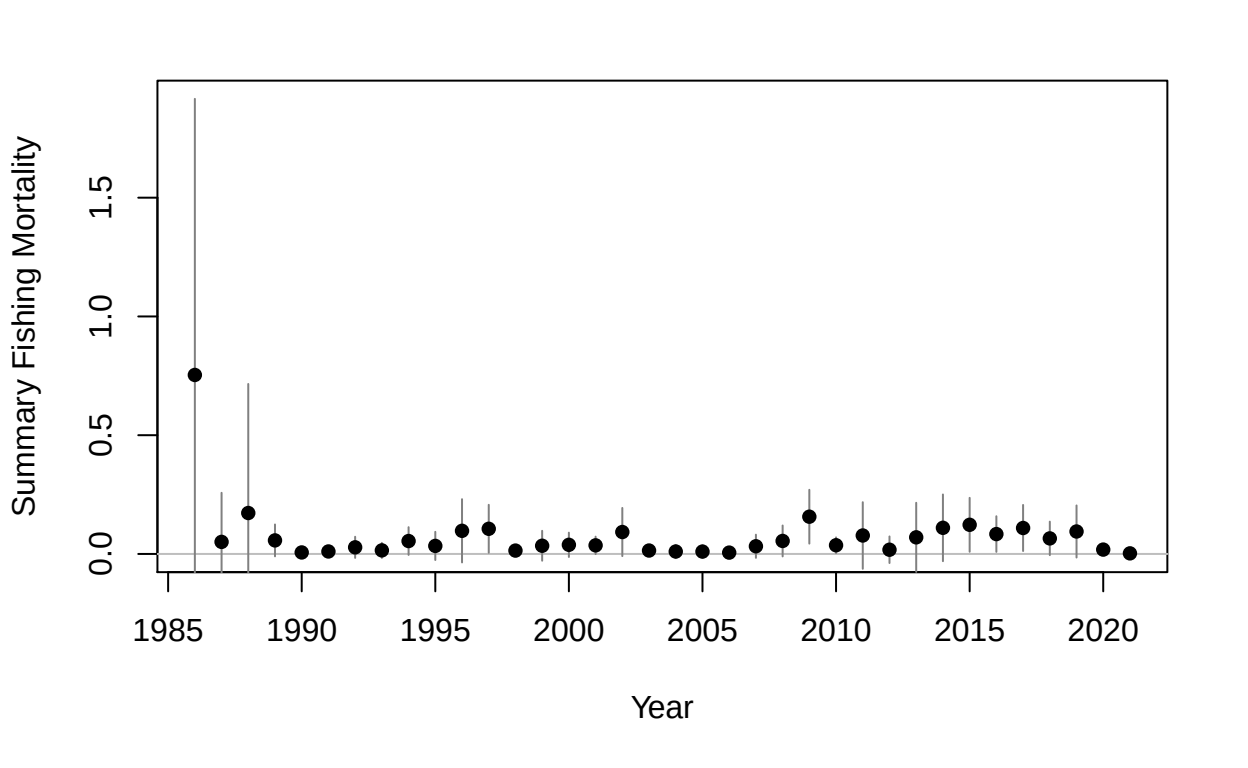

Relative spawning biomass: B/B_MSY
0
1
2
3
4
1990
2000
2010
2020
Year

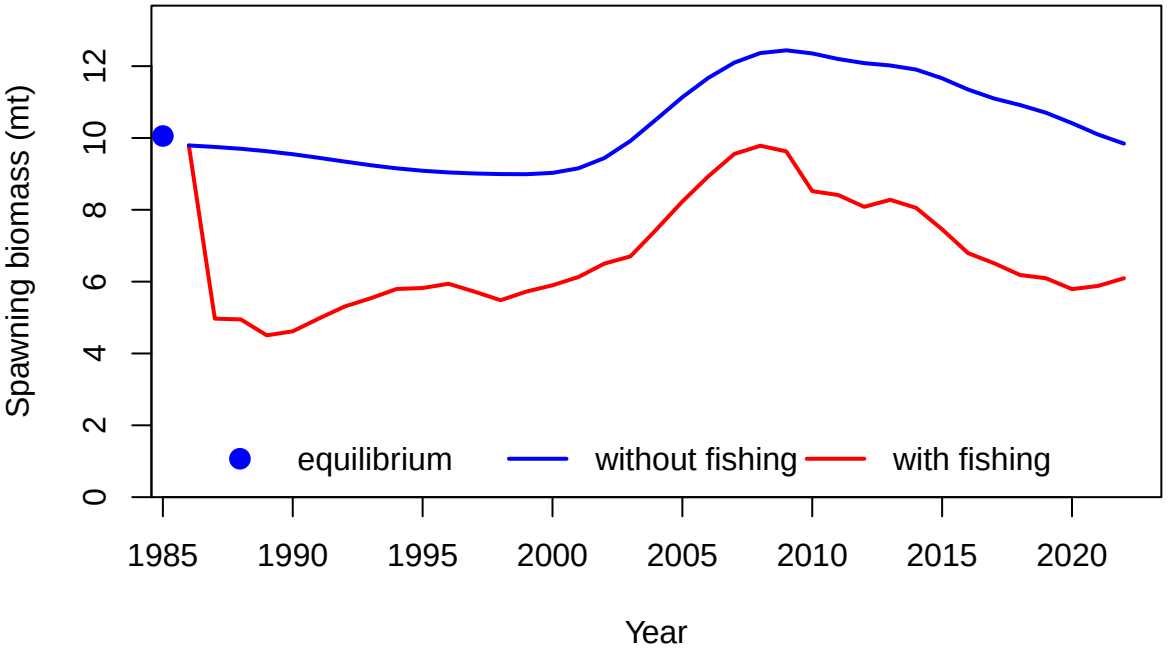

Total biomass (mt)
0
5
10
15
20
25
1990
2000
2010
2020
Year

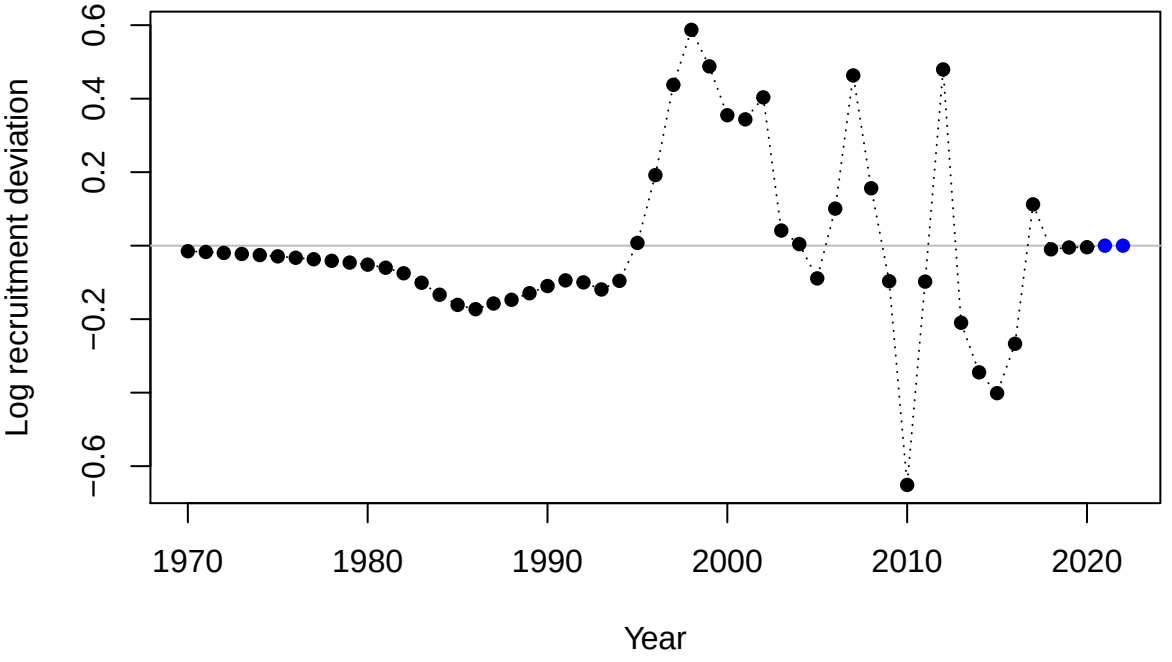

Summary biomass (mt)
0
5
10
15
20
25
1990
2000
2010
2020
Year

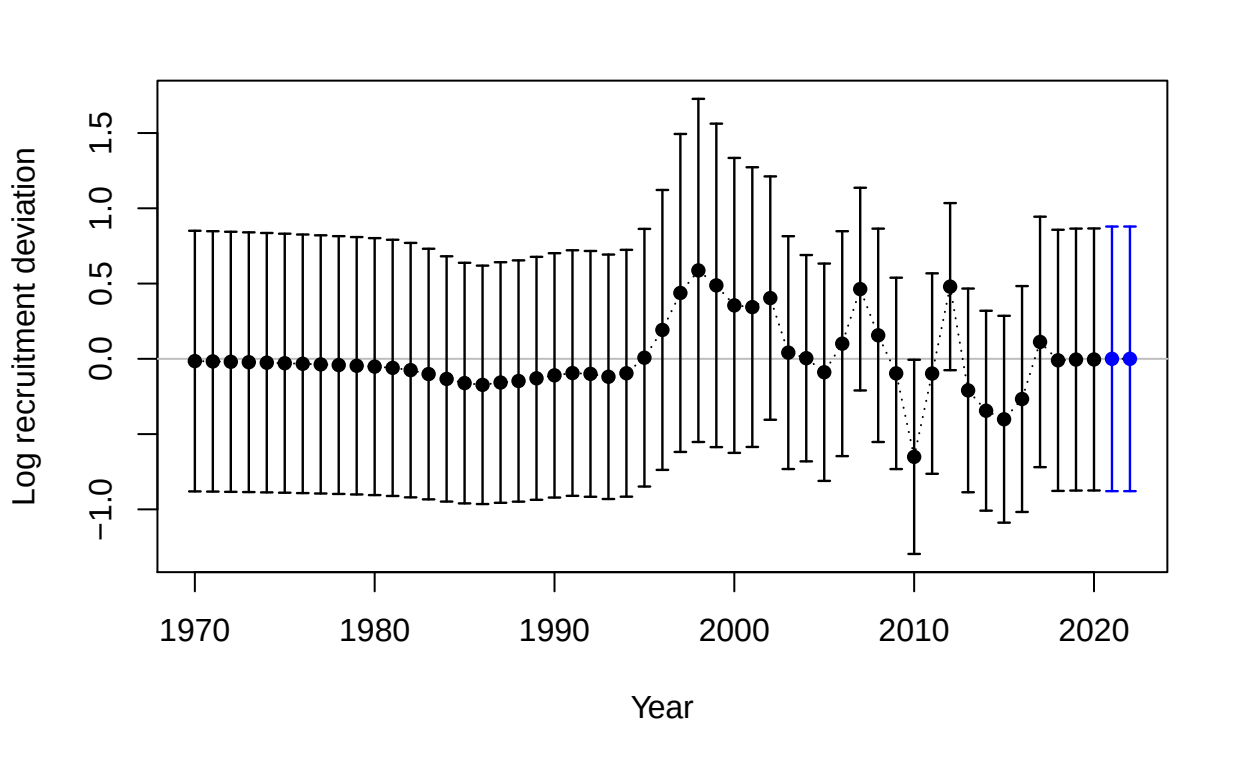

Age−0 recruits (1,000s)
0
1
2
3
4
5
1990
2000
2010
2020
Year

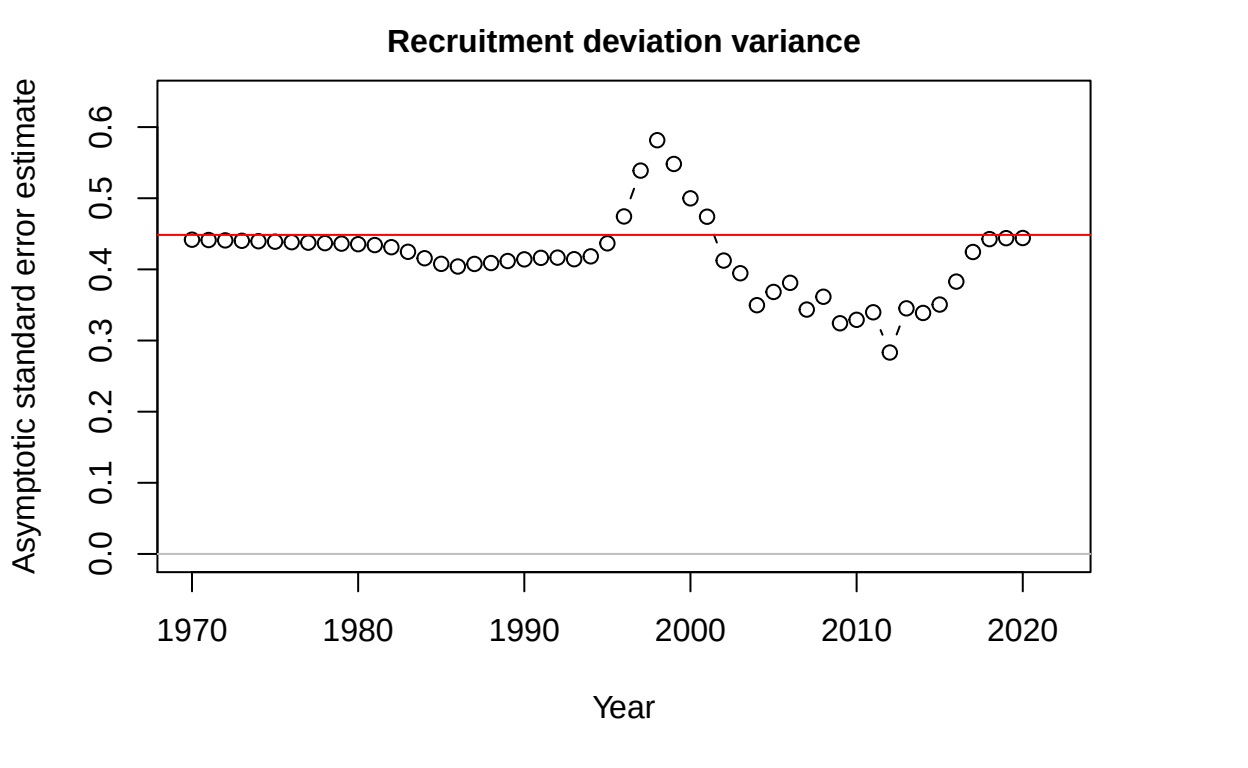

Age−0 recruits (1,000s)
0
5
10
15
1990
2000
2010
2020
Year

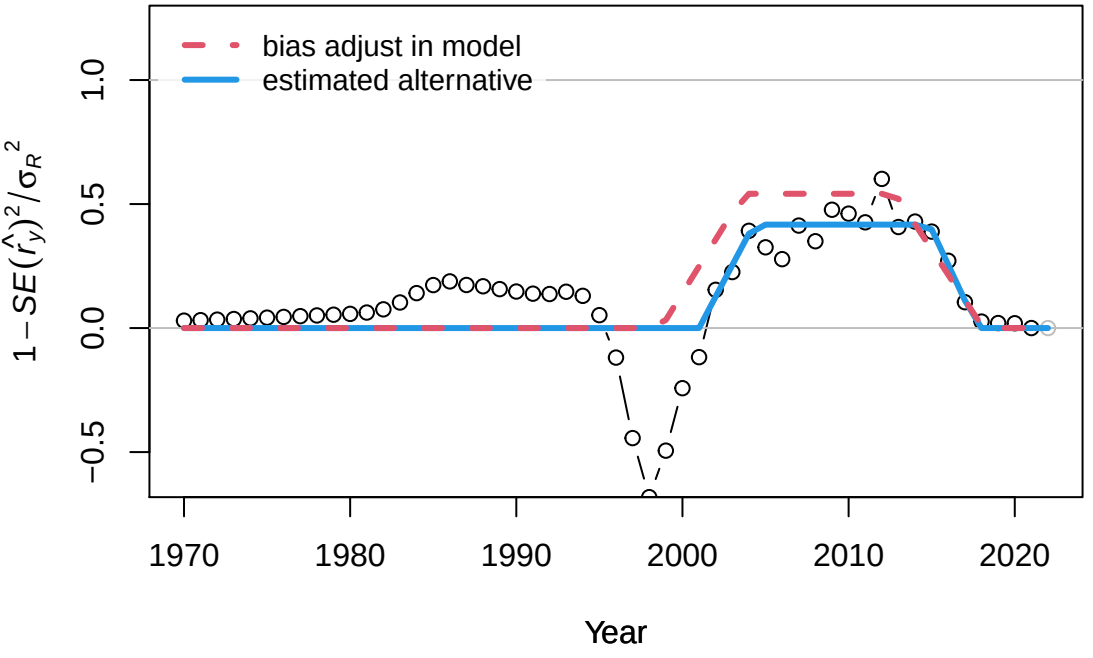

Summary Fishing Mortality
0.0
0.5
1.0
1.5
1985
1990
1995
2000
2005
2010
2015
2020
Year

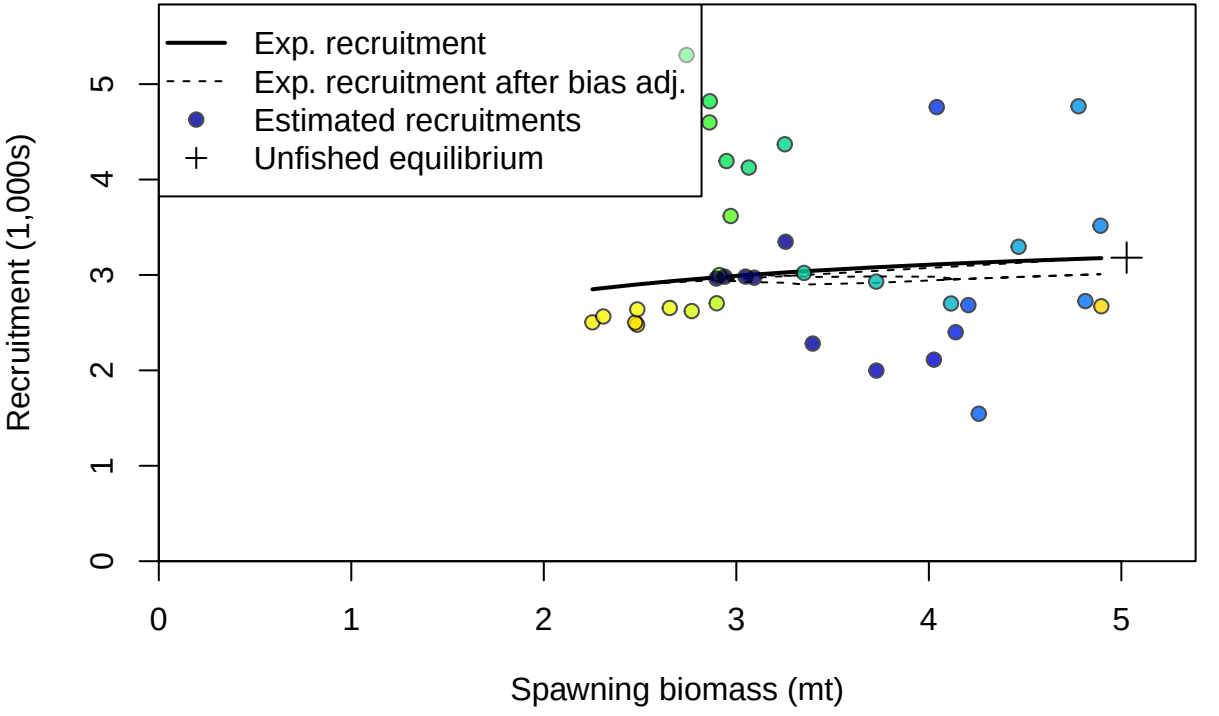

Spawning biomass (mt)
0
2
4
6
8
10
12
1985
1990
1995
2000
2005
2010
2015
2020
Year
equilibrium
without fishing
with fishing

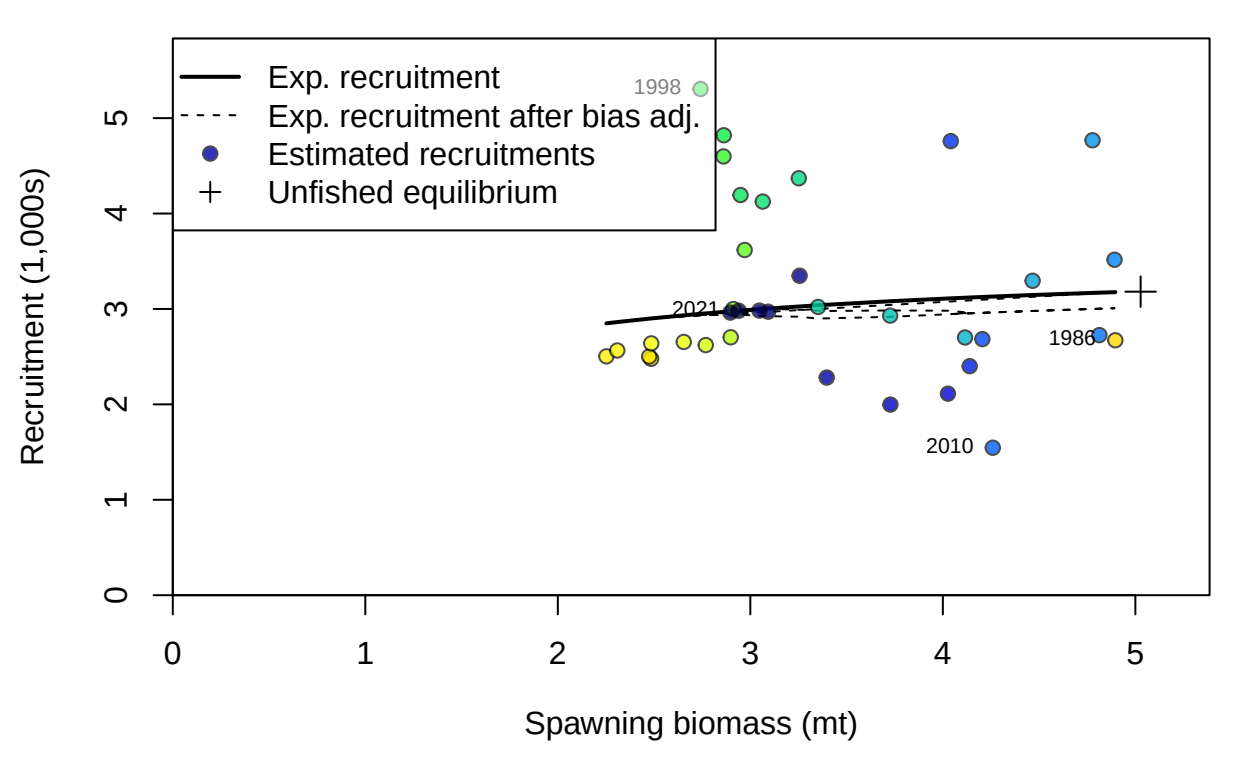

Log recruitment deviation
0.6
0.4
0.2
−0.2
−0.6
1970
1980
1990
2000
2010
2020
Year

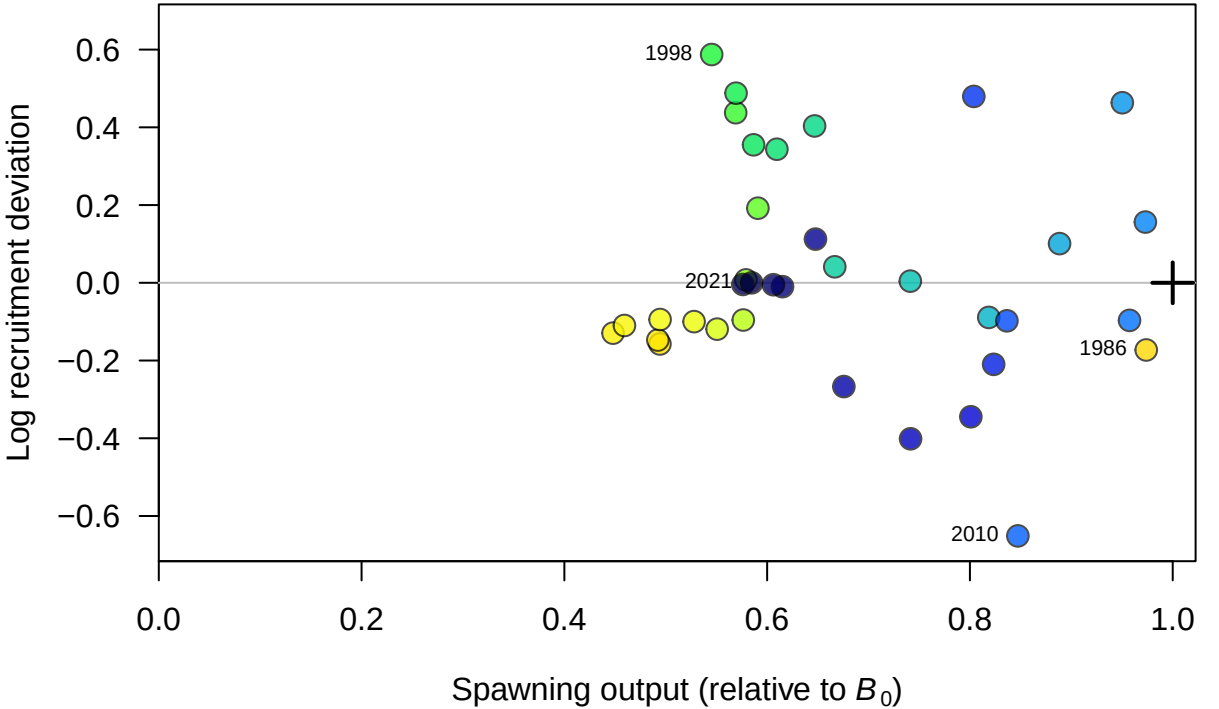

Log recruitment deviation
−1.0
0.0
0.5
1.0
1.5
1970
1980
1990
2000
2010
2020
Year

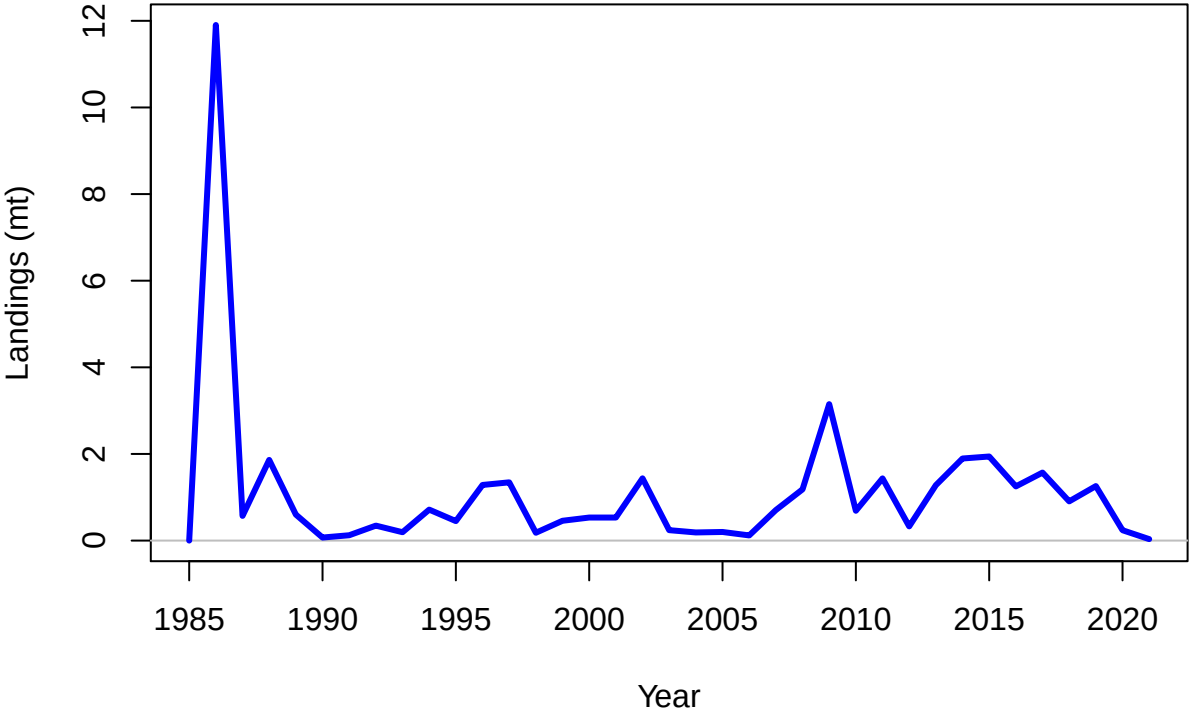

Recruitment deviation variance
Asymptotic standard error estimate
0.0
0.1
0.2
0.3
0.4
0.5
0.6
1970
1980
1990
2000
2010
2020
Year

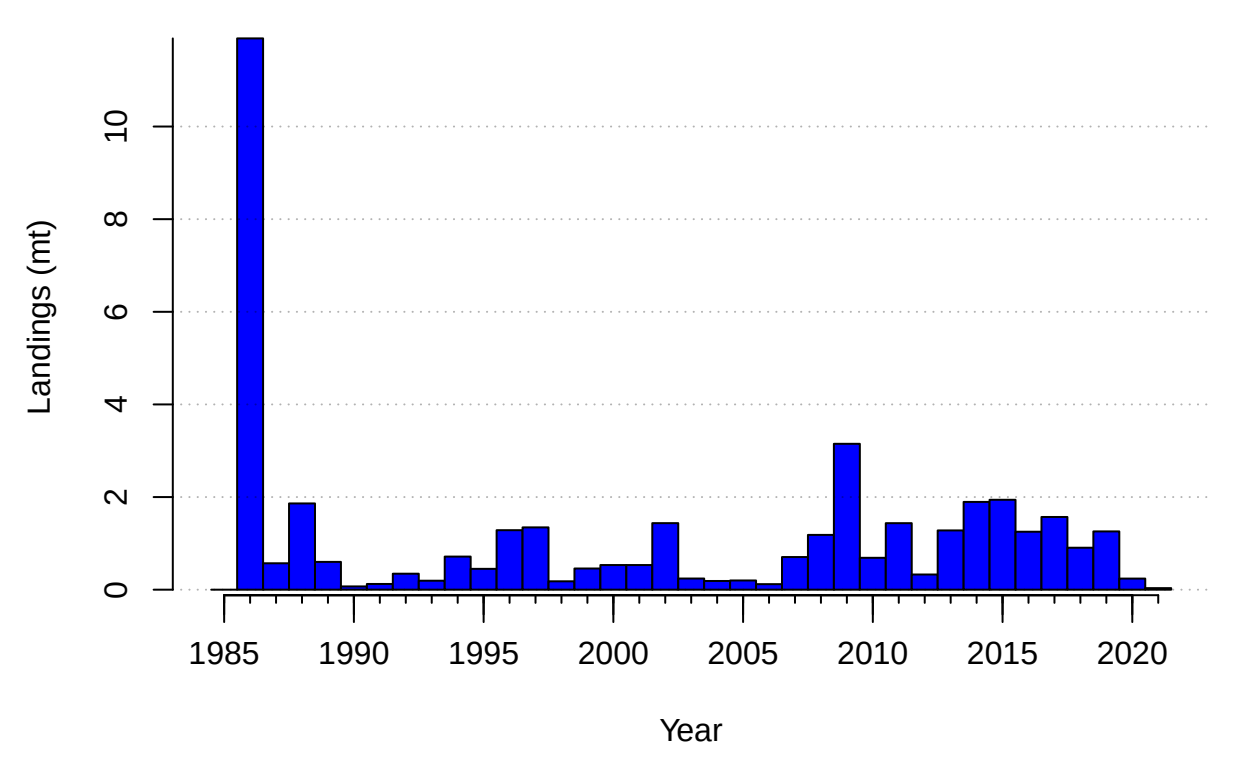

bias adjust in model
estimated alternative
1.0
0.5
0.0
−0.5
$1-SE(\hat{r}_y)^2/\sigma_R^2$
1970
1980
1990
2000
2010
2020
Year

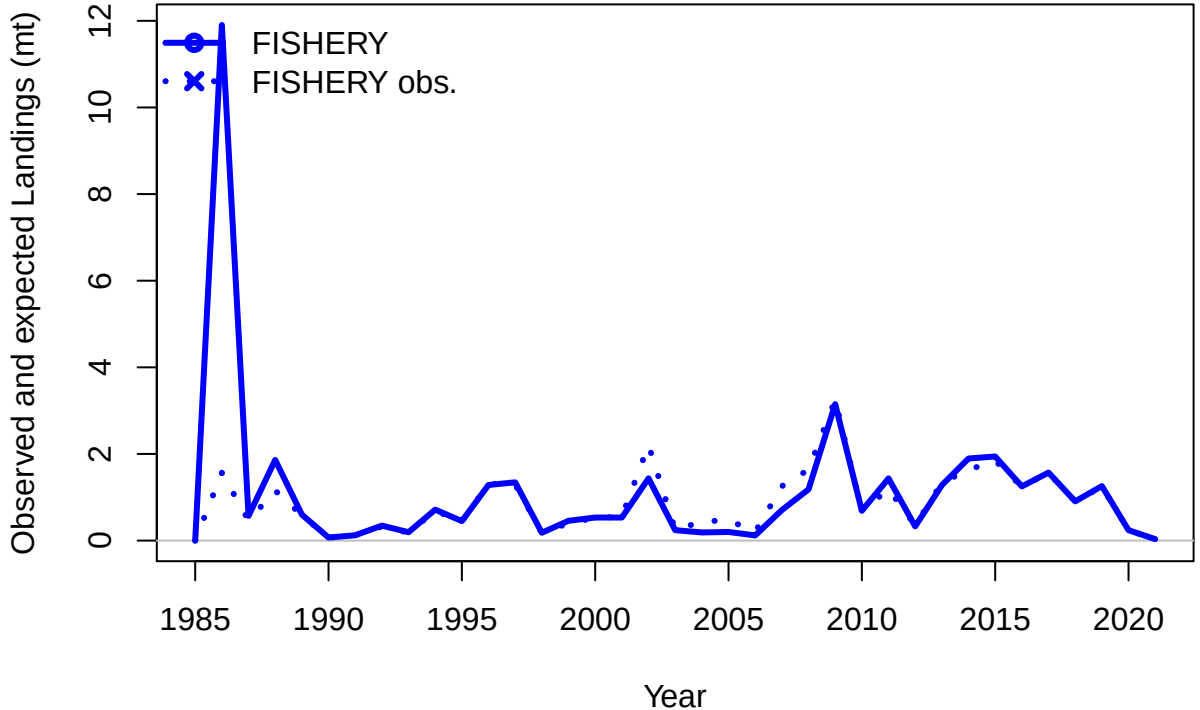

Exp. recruitment
Exp. recruitment after bias adj.
Estimated recruitments
Unfished equilibrium
Recruitment (1,000s)
0
1
2
3
4
5
Spawning biomass (mt)
0
1
2
3
4
5

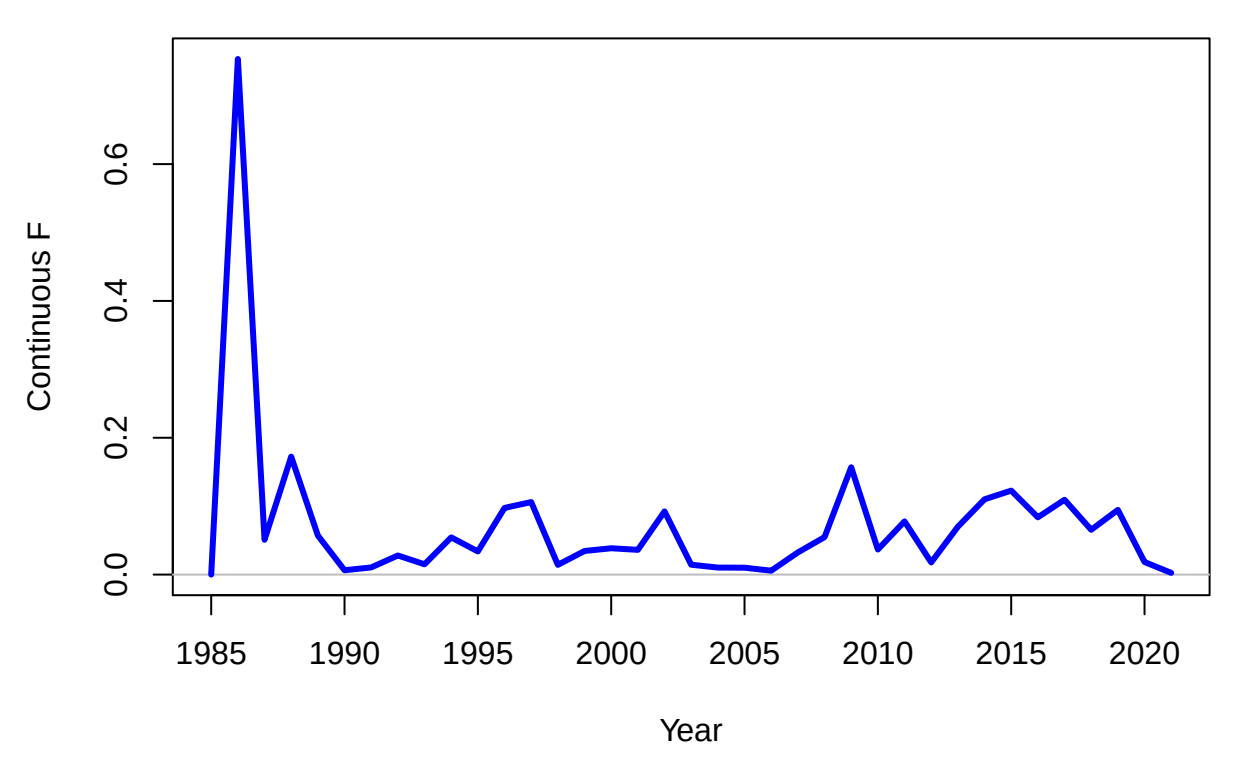

Exp. recruitment
Exp. recruitment after bias adj.
Estimated recruitments
Unfished equilibrium
1998
2021
1986
2010
Recruitment (1,000s)
Spawning biomass (mt)
0
1
2
3
4
5

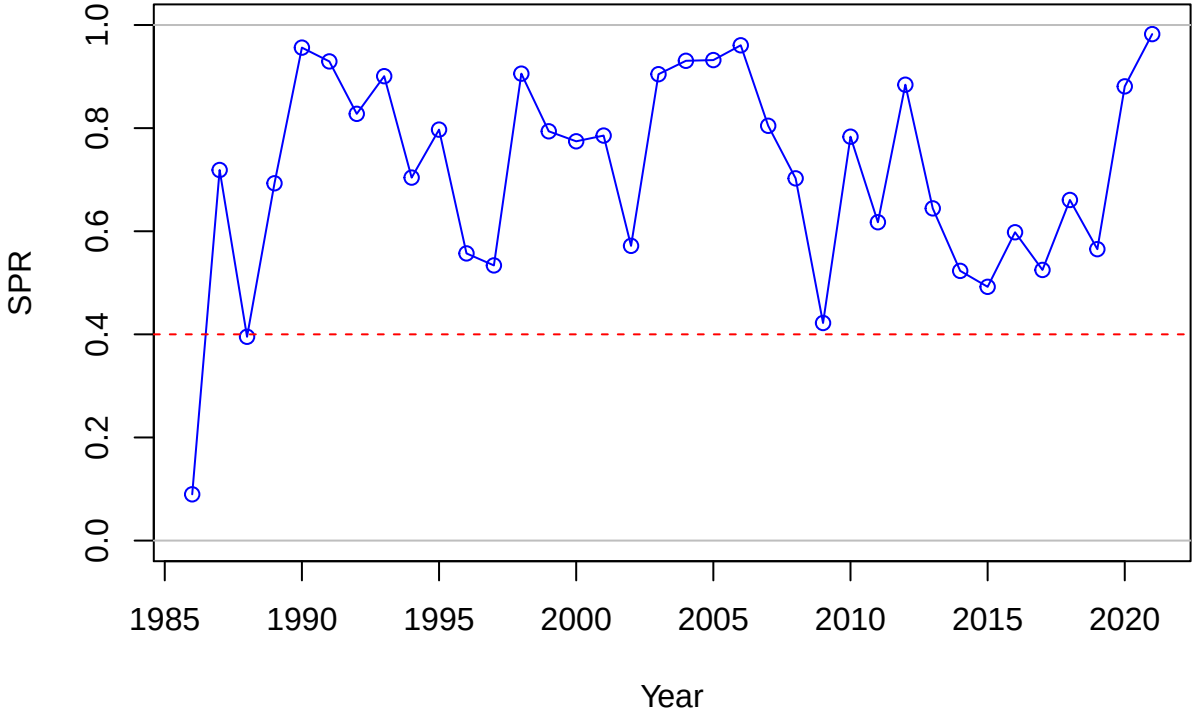

1998
2021
1986
2010
0.6
0.4
0.2
0.0
−0.2
−0.4
−0.6
Log recruitment deviation
0.0
0.2
0.4
0.6
0.8
1.0
Spawning output (relative to B_0)

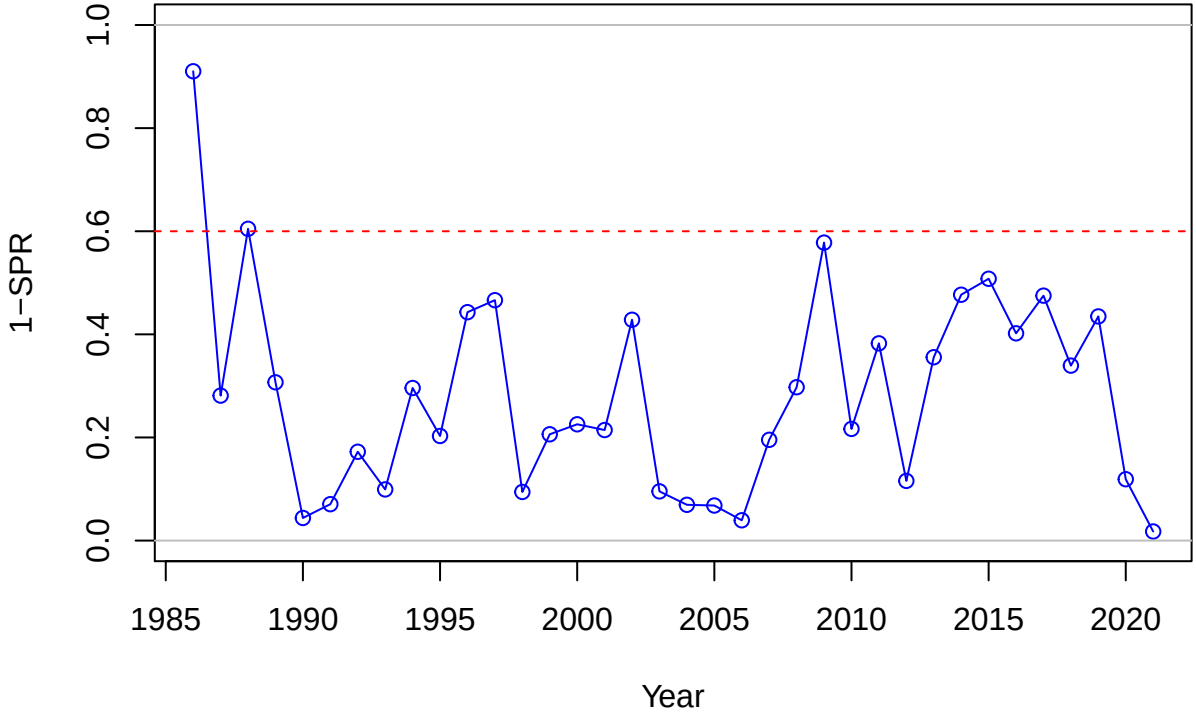

Landings (mt)
0
2
4
6
8
10
12
1985
1990
1995
2000
2005
2010
2015
2020
Year

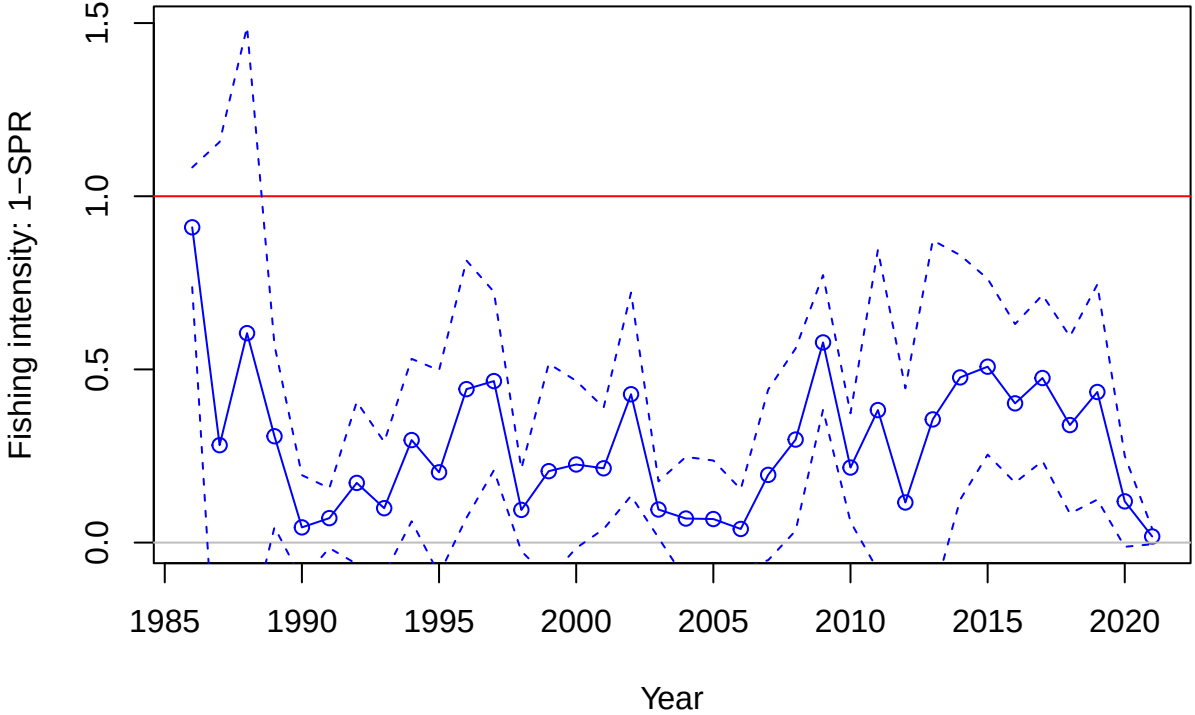

Landings (mt)
0
2
4
6
8
10
1985
1990
1995
2000
2005
2010
2015
2020
Year

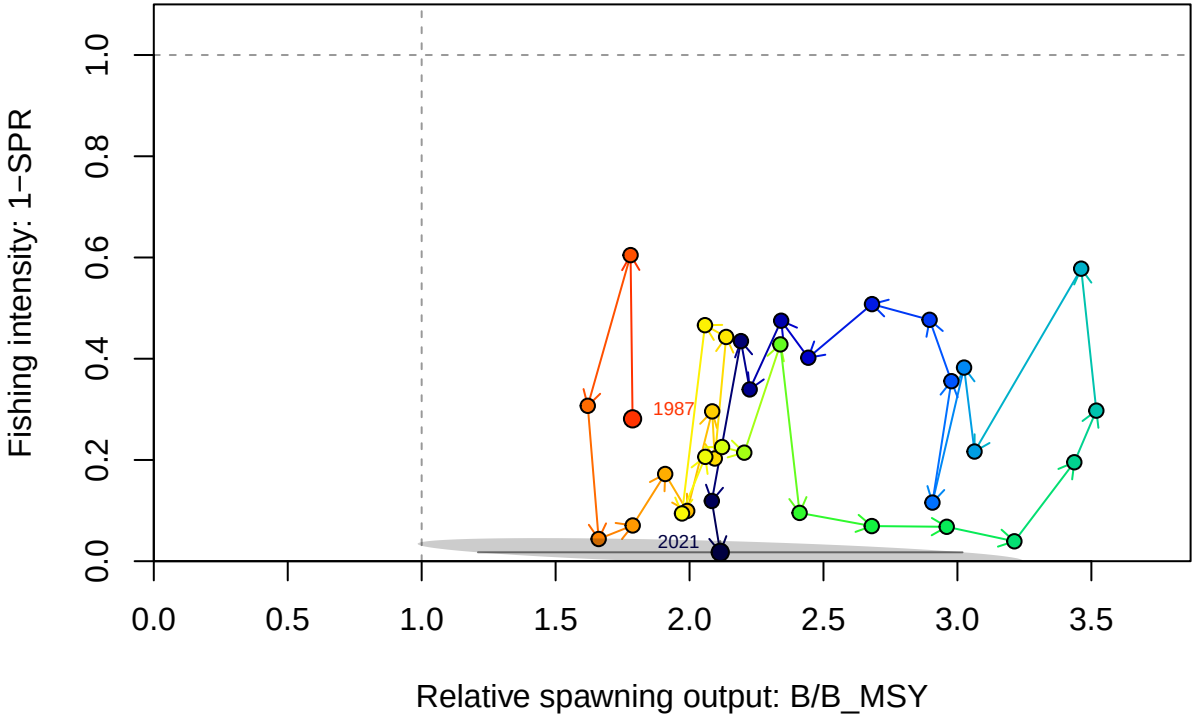

FISHERY
FISHERY obs.
Observed and expected Landings (mt)
0
2
4
6
8
10
12
1985
1990
1995
2000
2005
2010
2015
2020
Year

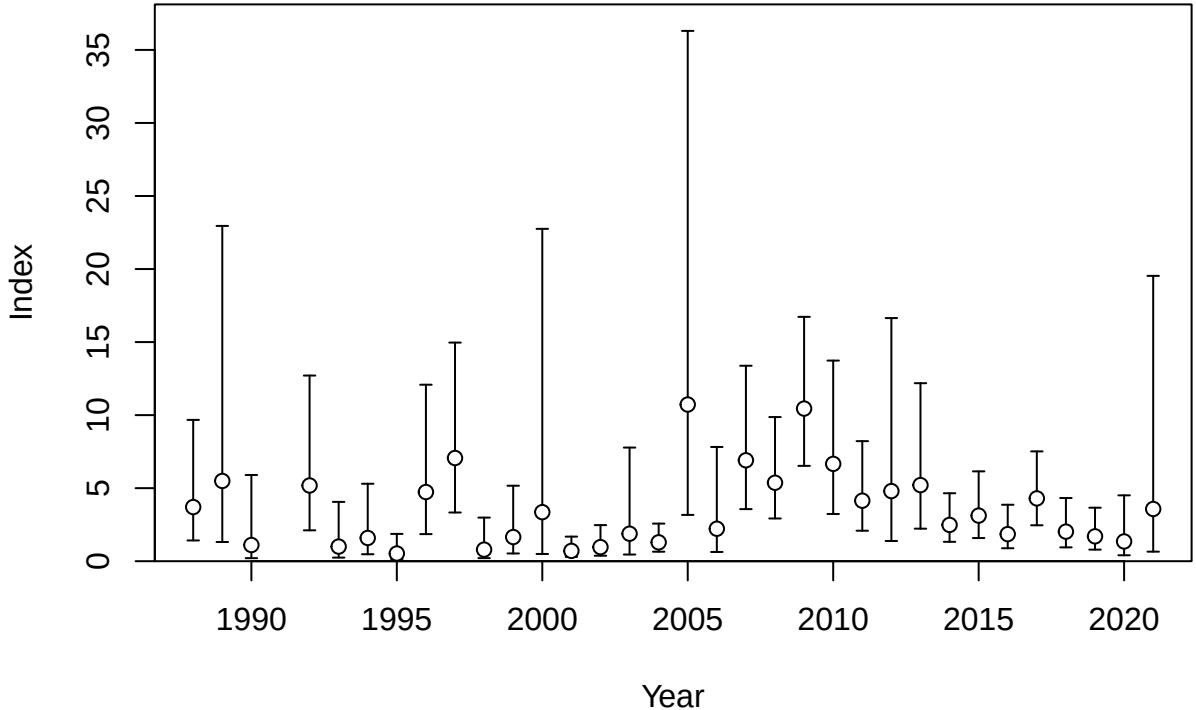

Continuous F
0.0
0.2
0.4
0.6
1985
1990
1995
2000
2005
2010
2015
2020
Year

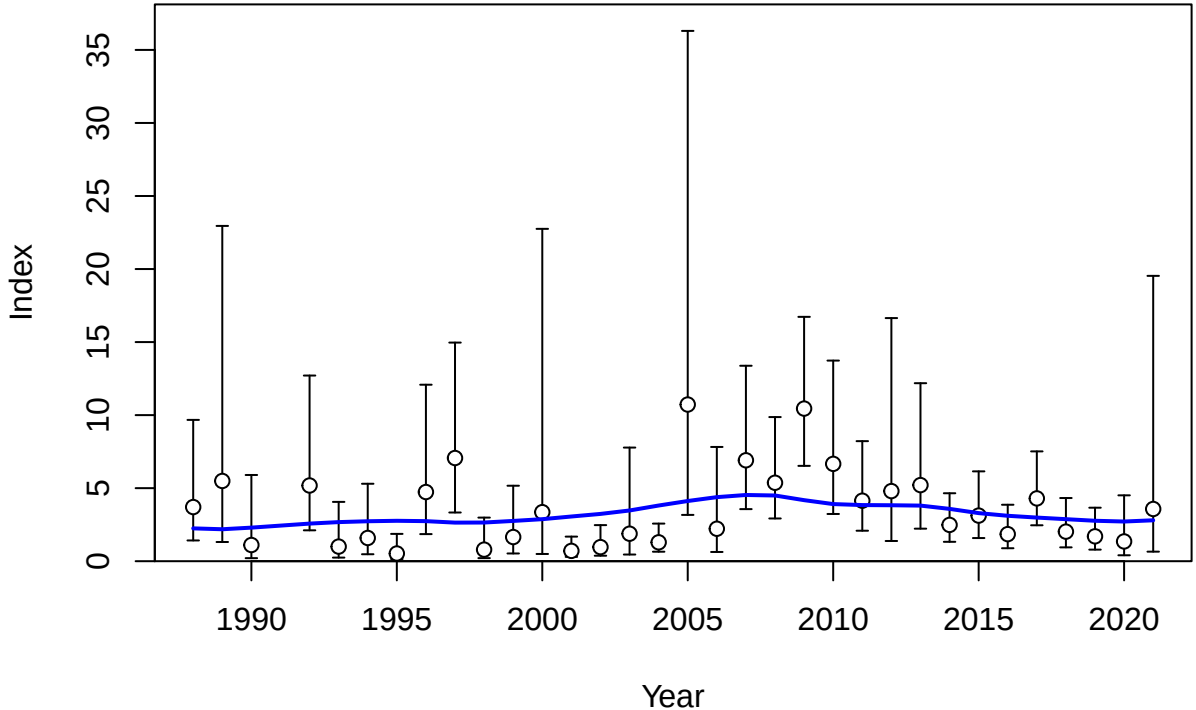

SPR
0.0
0.2
0.4
0.6
0.8
1.0
1985
1990
1995
2000
2005
2010
2015
2020
Year

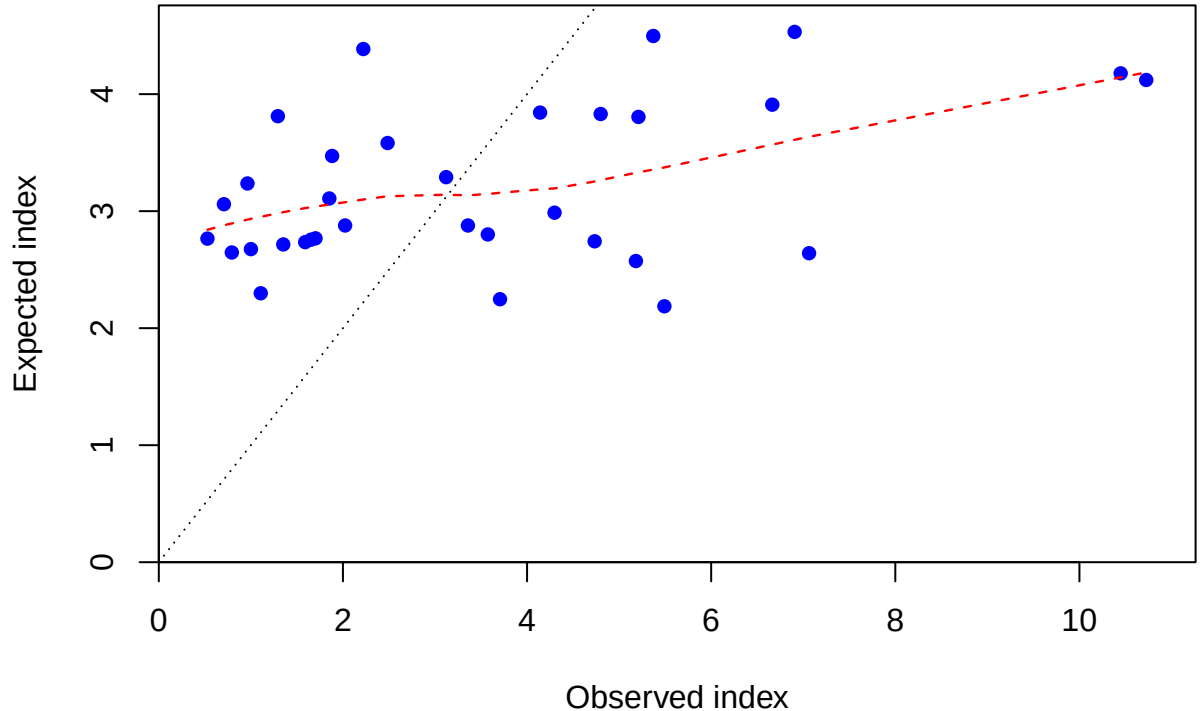

1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
1985
1990
1995
2000
2005
2010
2015
2020
Year

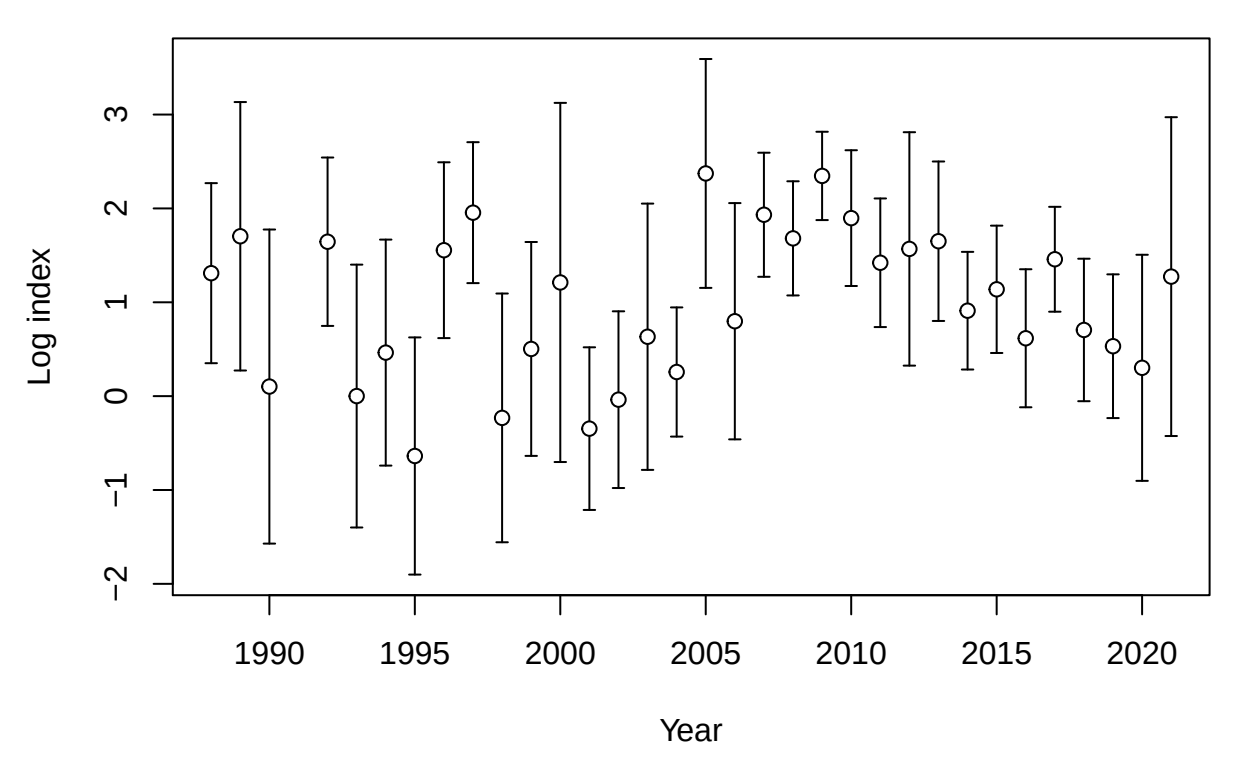

Fishing intensity: 1−SPR
0.0
0.5
1.0
1.5
1985
1990
1995
2000
2005
2010
2015
2020
Year

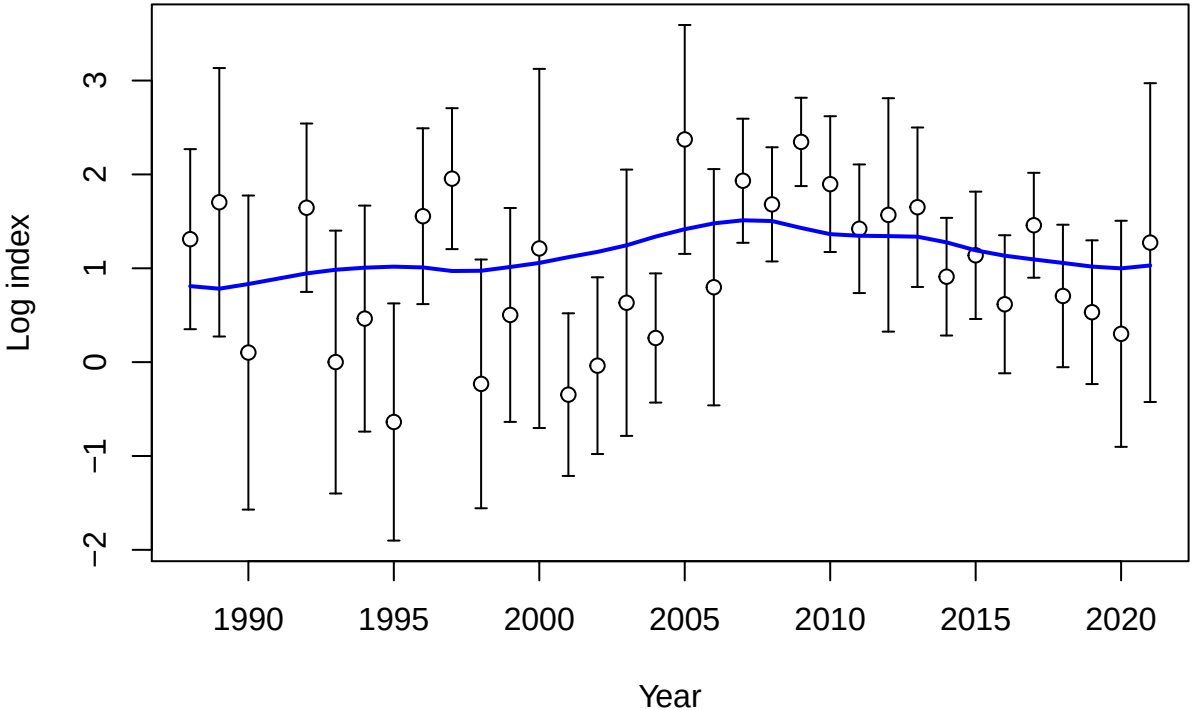

Fishing intensity: 1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
Relative spawning output: B/B_MSY
1987
2021

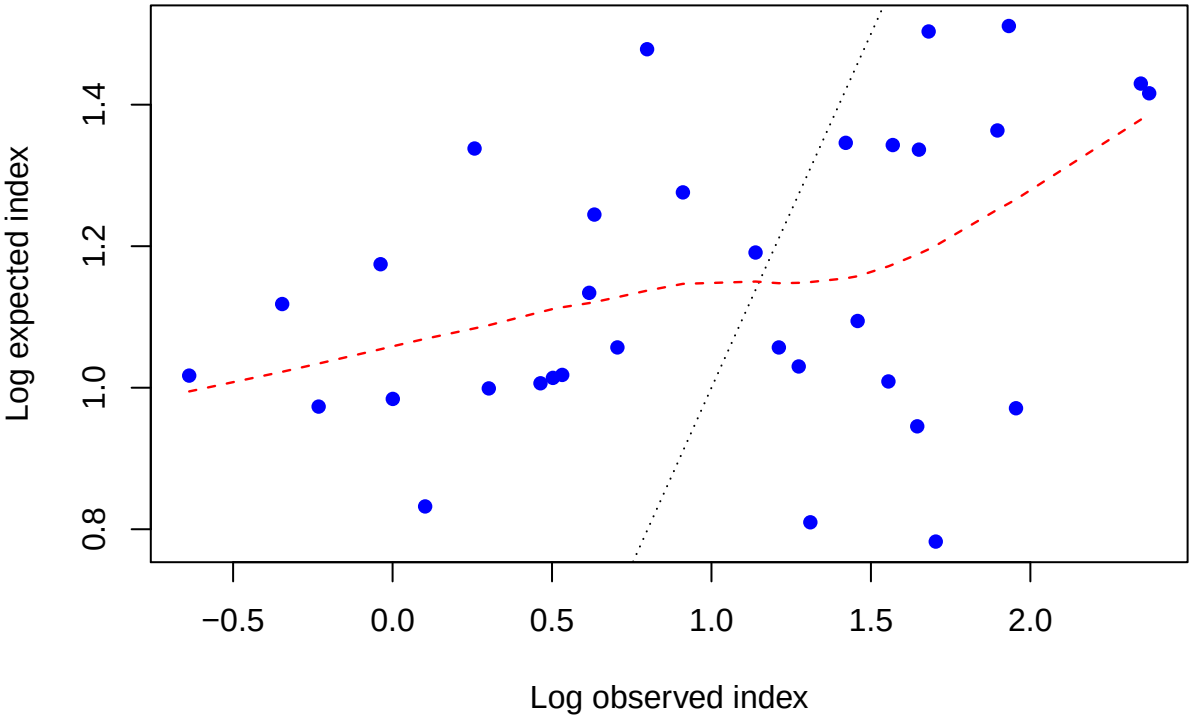

Index
0
5
10
15
20
25
30
35
1990
1995
2000
2005
2010
2015
2020
Year

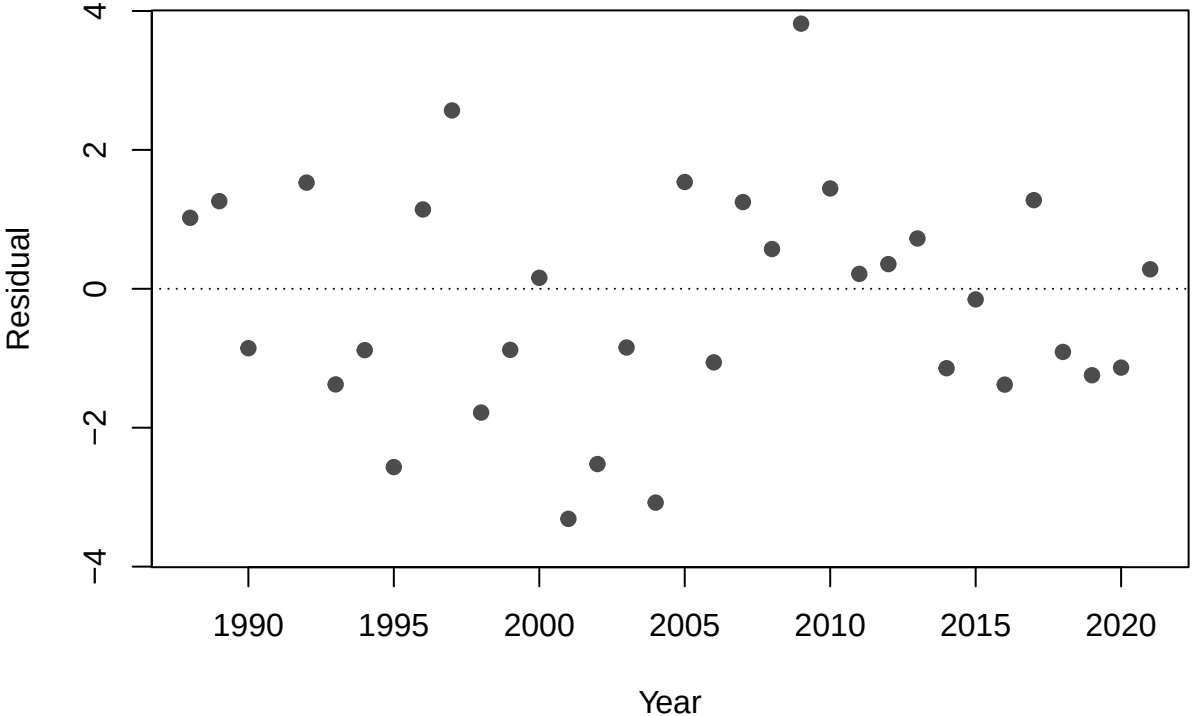

Index
0
5
10
15
20
25
30
35
1990
1995
2000
2005
2010
2015
2020
Year

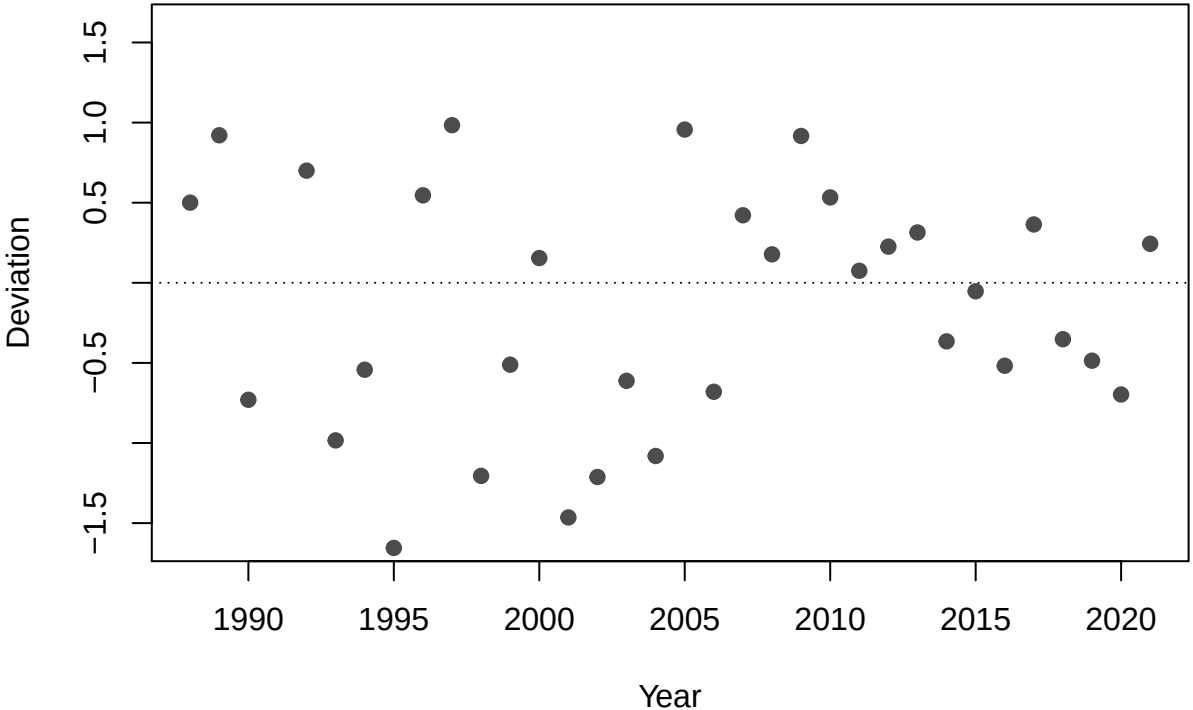

Expected index
0
1
2
3
4
0
2
4
6
8
10
Observed index

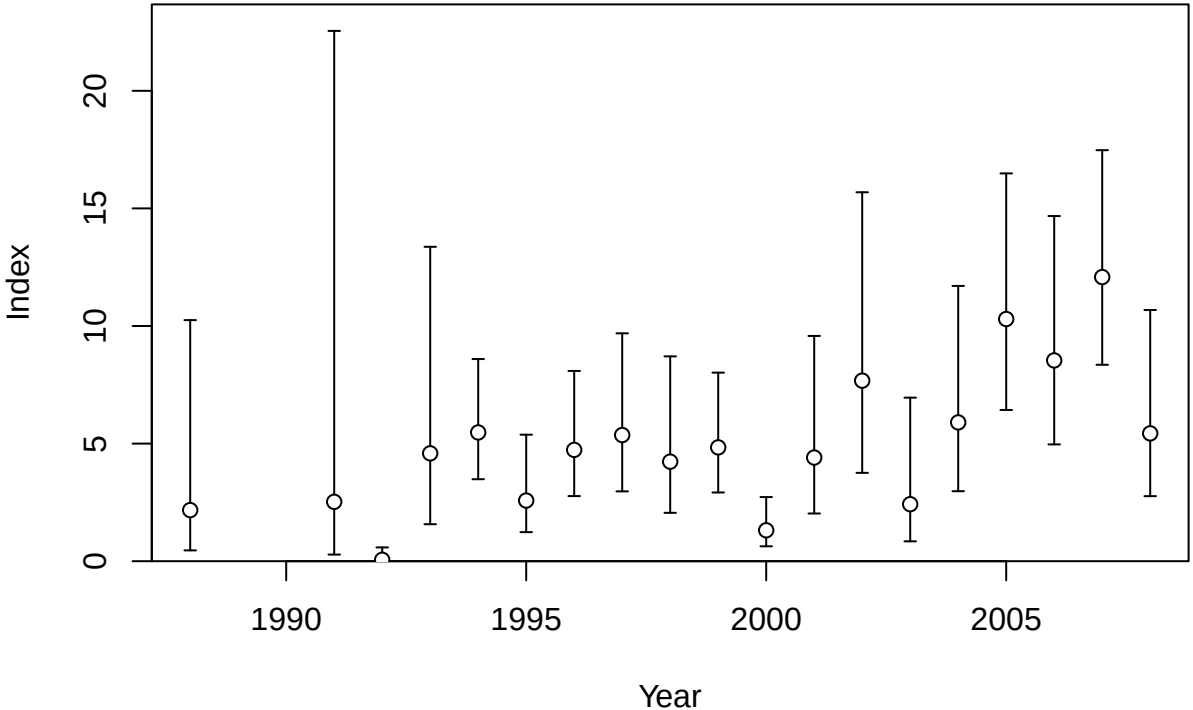

Log index
3
2
1
0
−1
−2
1990
1995
2000
2005
2010
2015
2020
Year

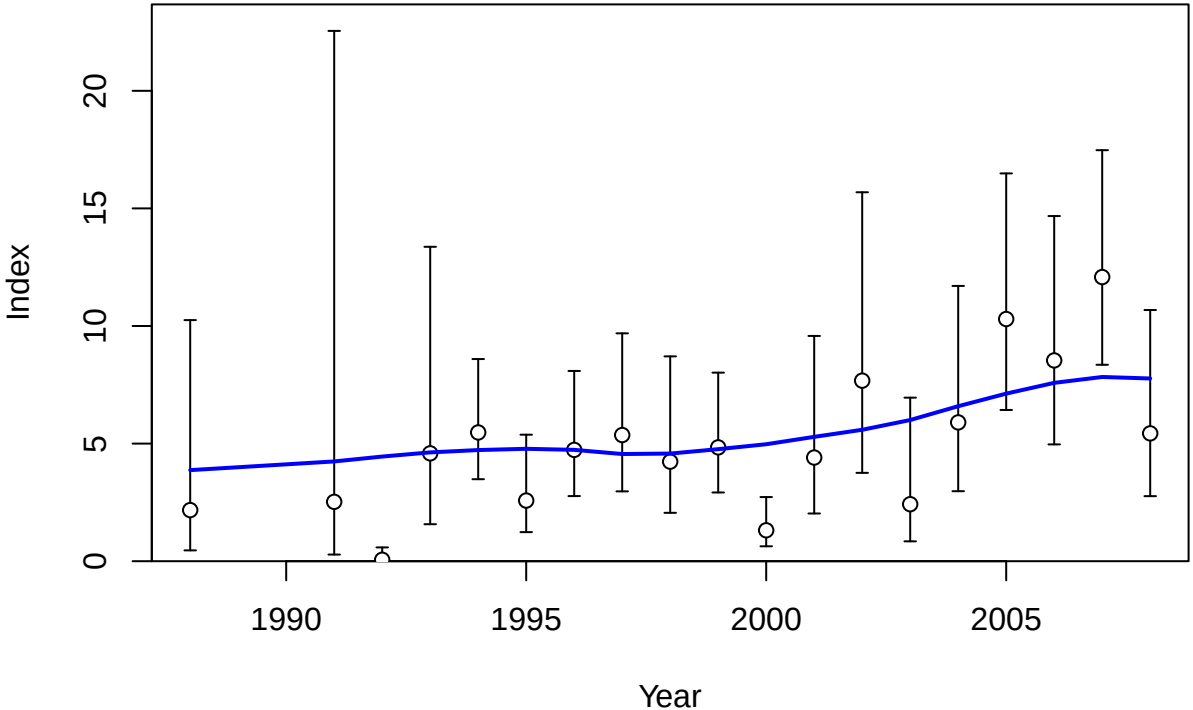

Log index
3
2
1
0
−1
−2
1990
1995
2000
2005
2010
2015
2020
Year

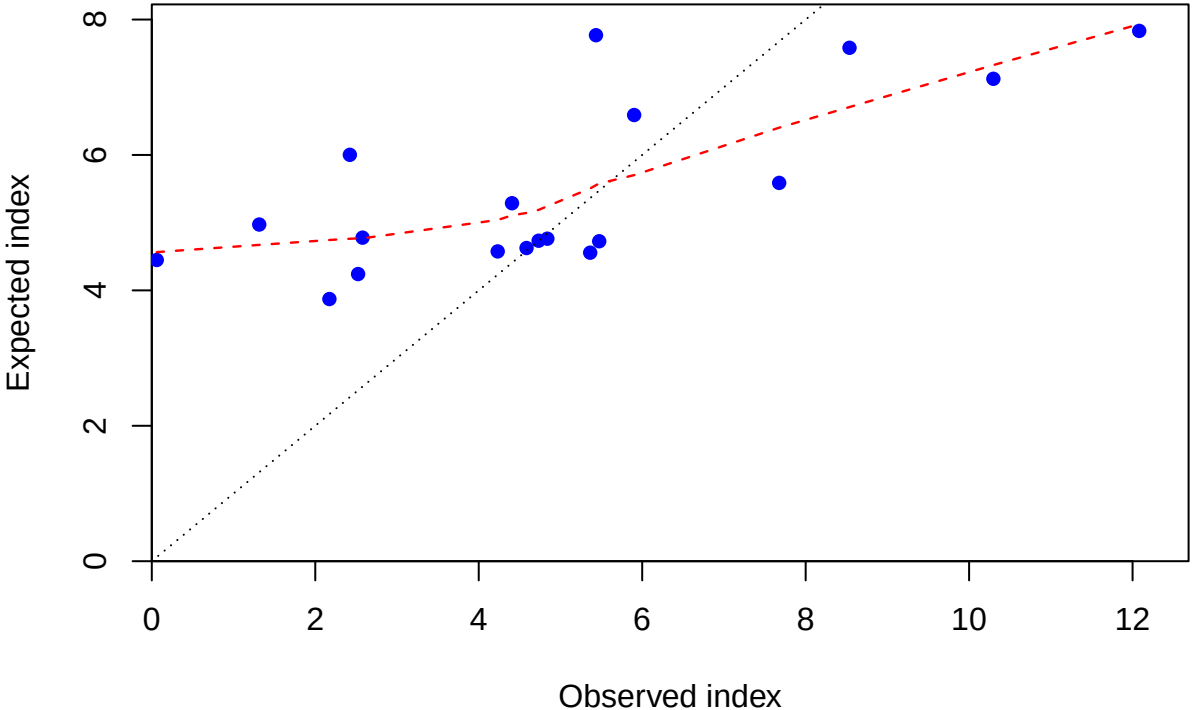

Log expected index
0.8
1.0
1.2
1.4
−0.5
0.0
0.5
1.0
1.5
2.0
Log observed index

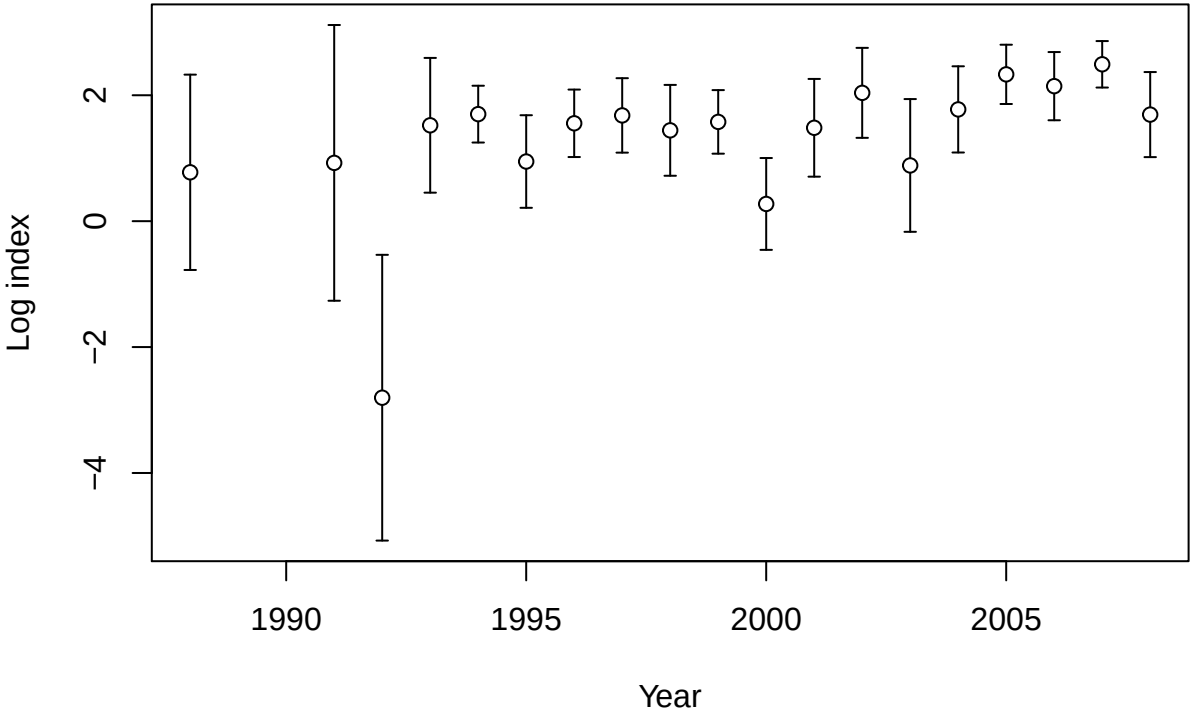

Residual
4
2
0
−2
−4
1990
1995
2000
2005
2010
2015
2020
Year

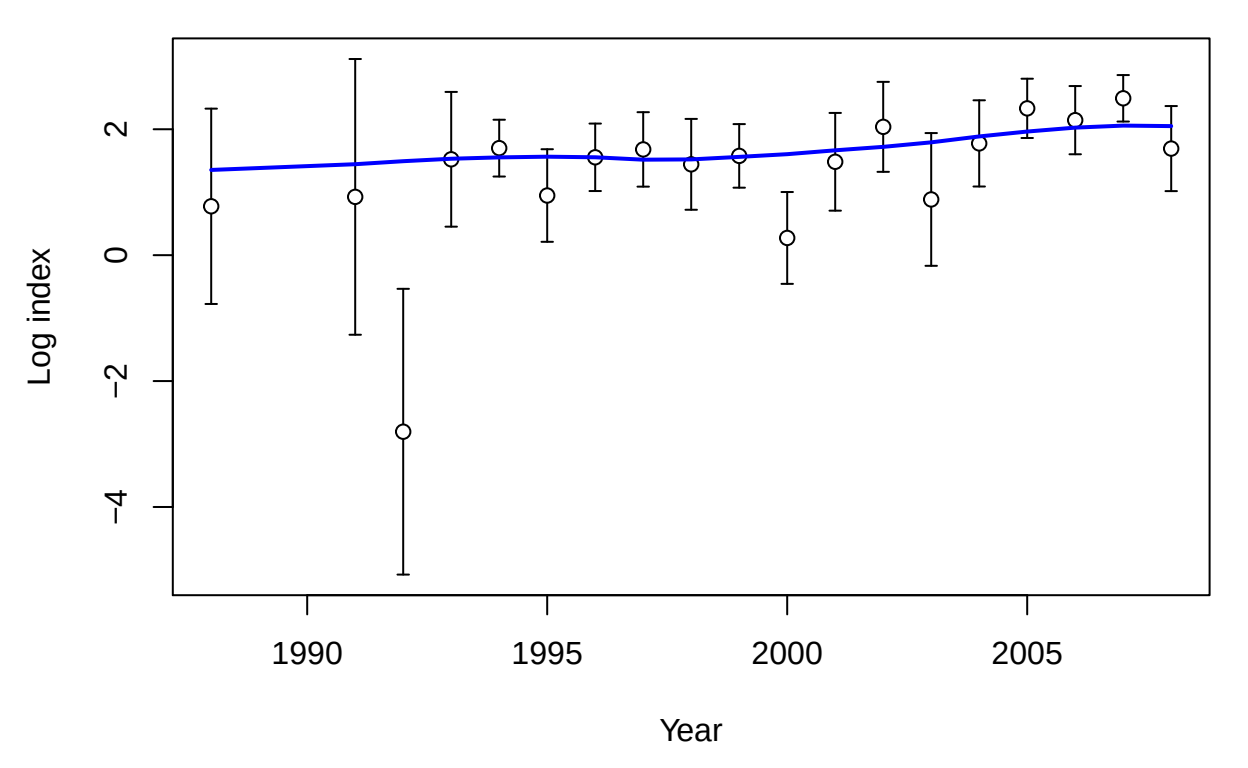

Deviation
1.5
1.0
0.5
−0.5
−1.5
1990
1995
2000
2005
2010
2015
2020
Year

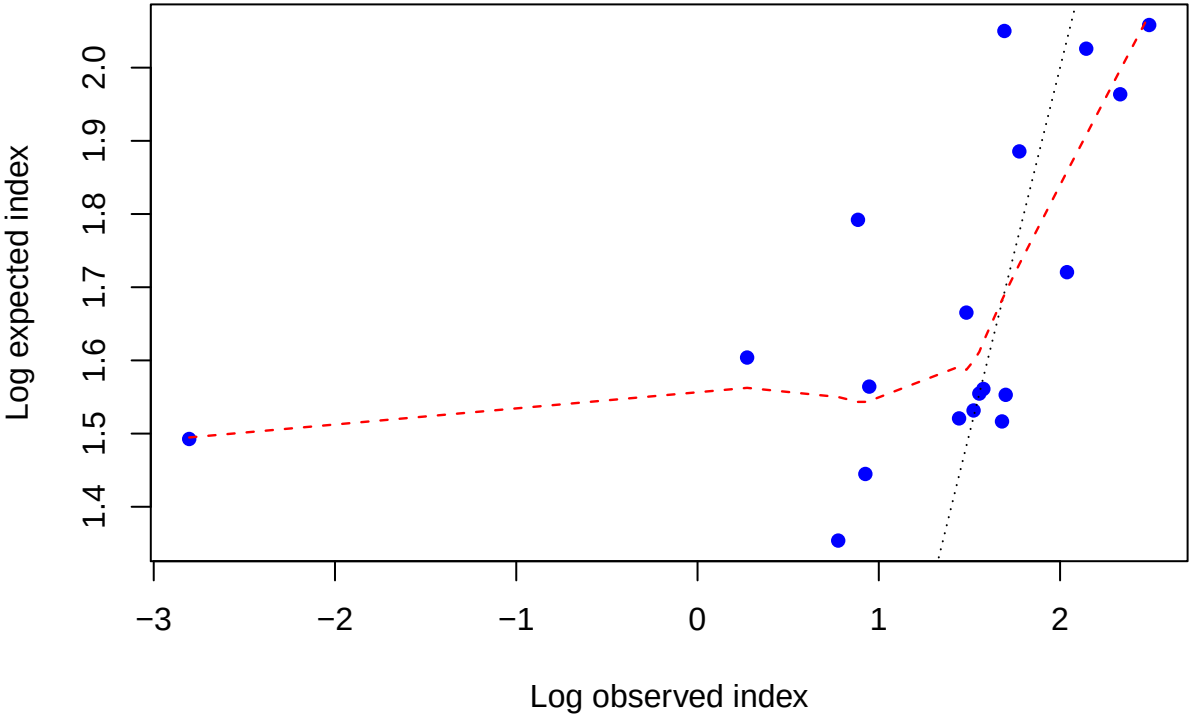

Index
0
5
10
15
20
1990
1995
2000
2005
Year

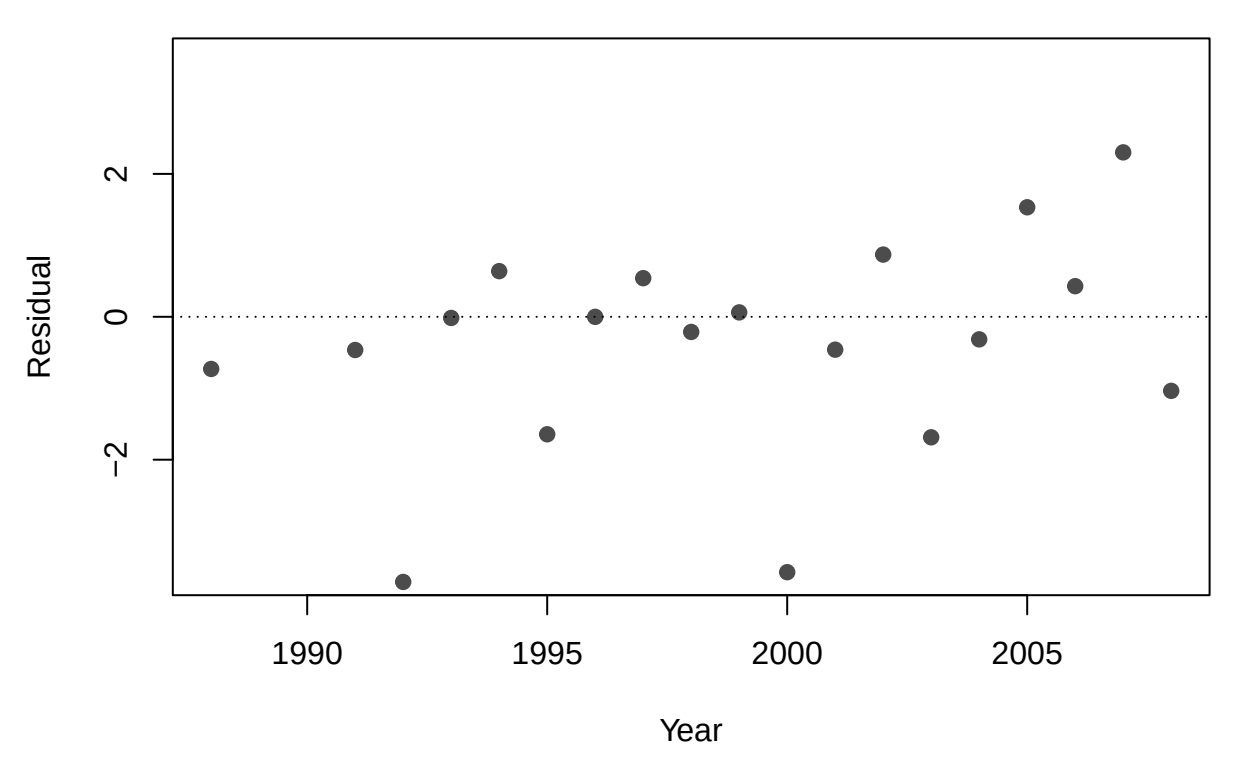

Index
0
5
10
15
20
1990
1995
2000
2005
Year

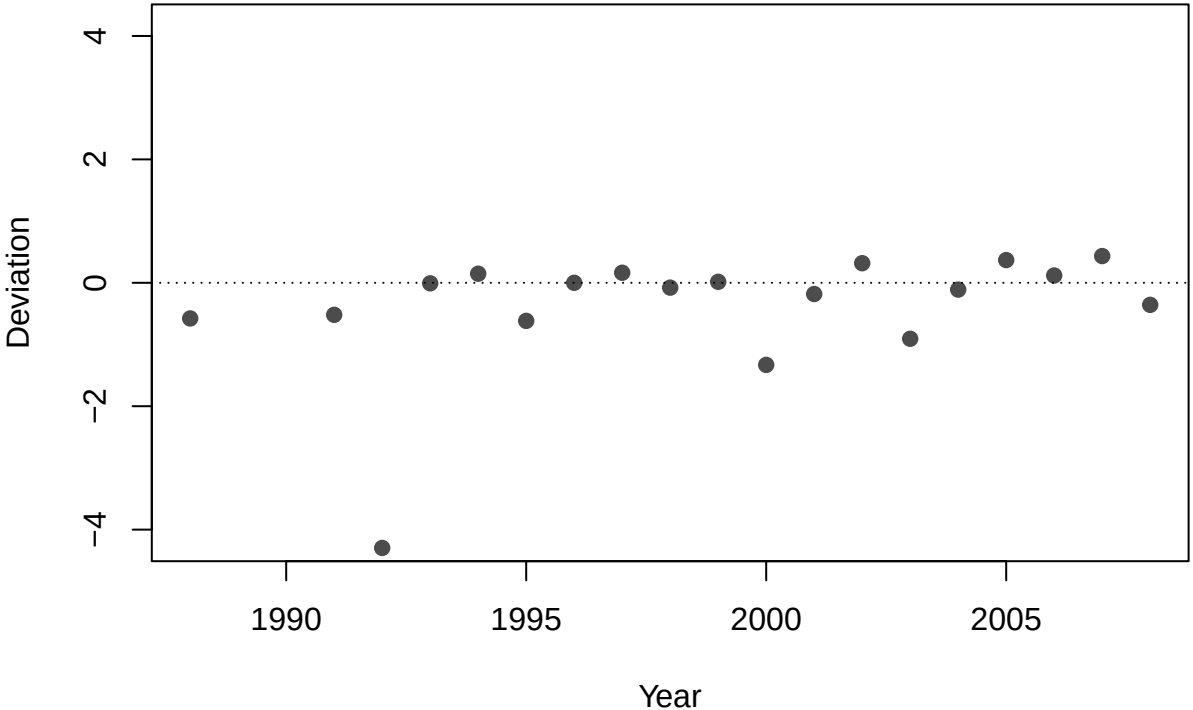

Expected index
Observed index
0
2
4
6
8
0
2
4
6
8
10
12

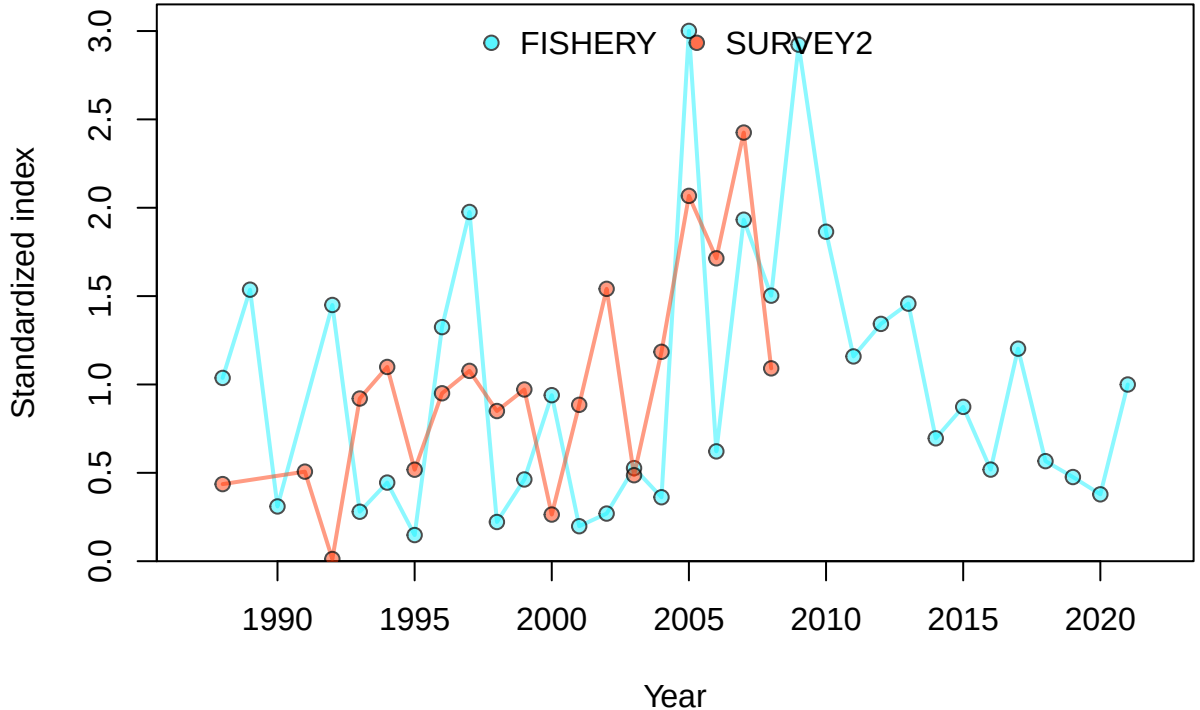

Log index
2
0
−2
−4
1990
1995
2000
2005
Year

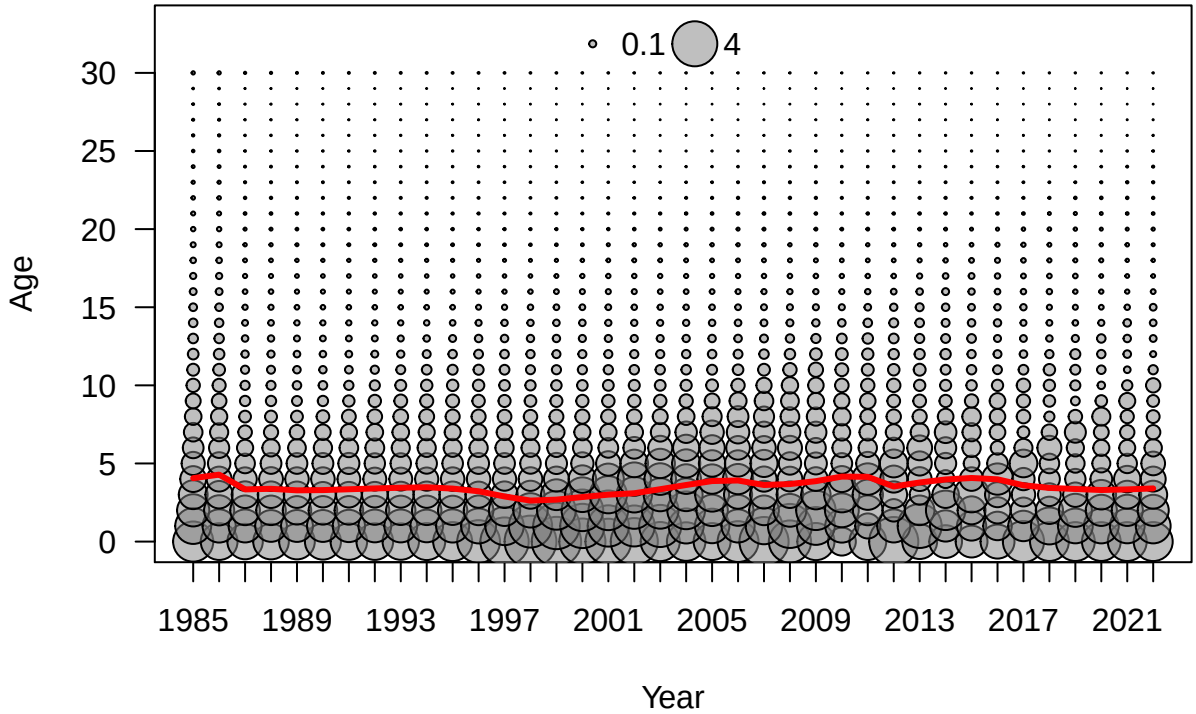

Log index
2
0
−2
−4
1990
1995
2000
2005
Year

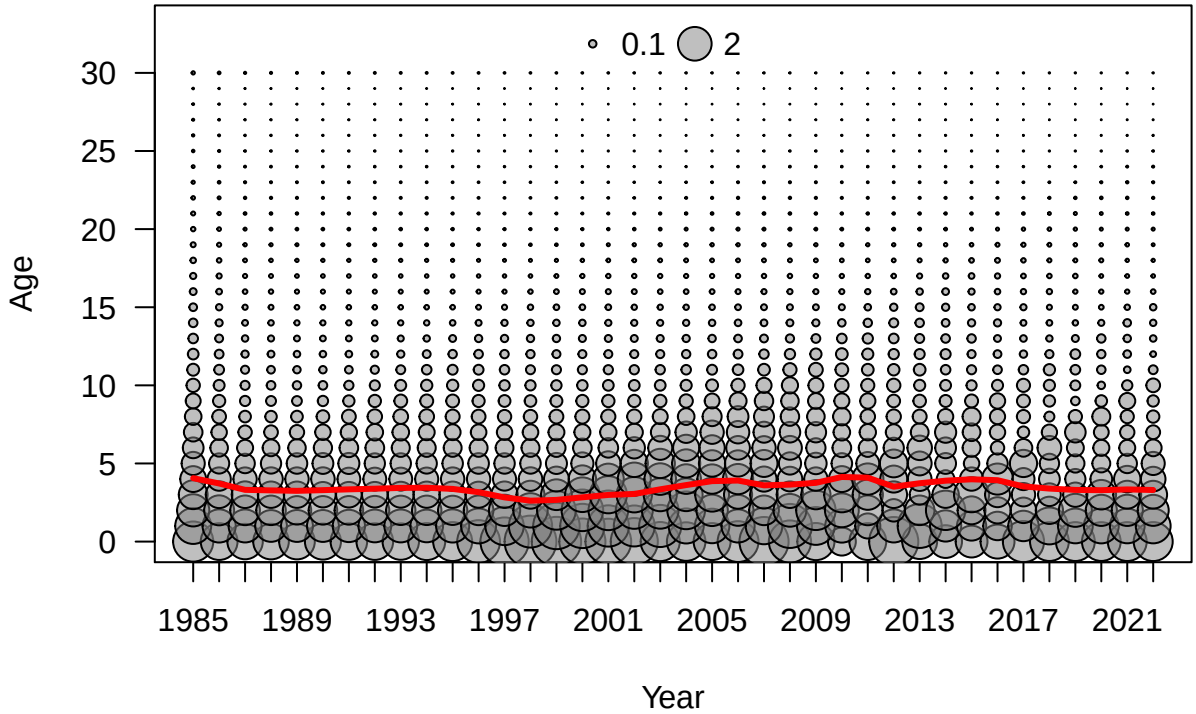

Log expected index
1.4
1.5
1.6
1.7
1.8
1.9
2.0
−3
−2
−1
0
1
2
Log observed index

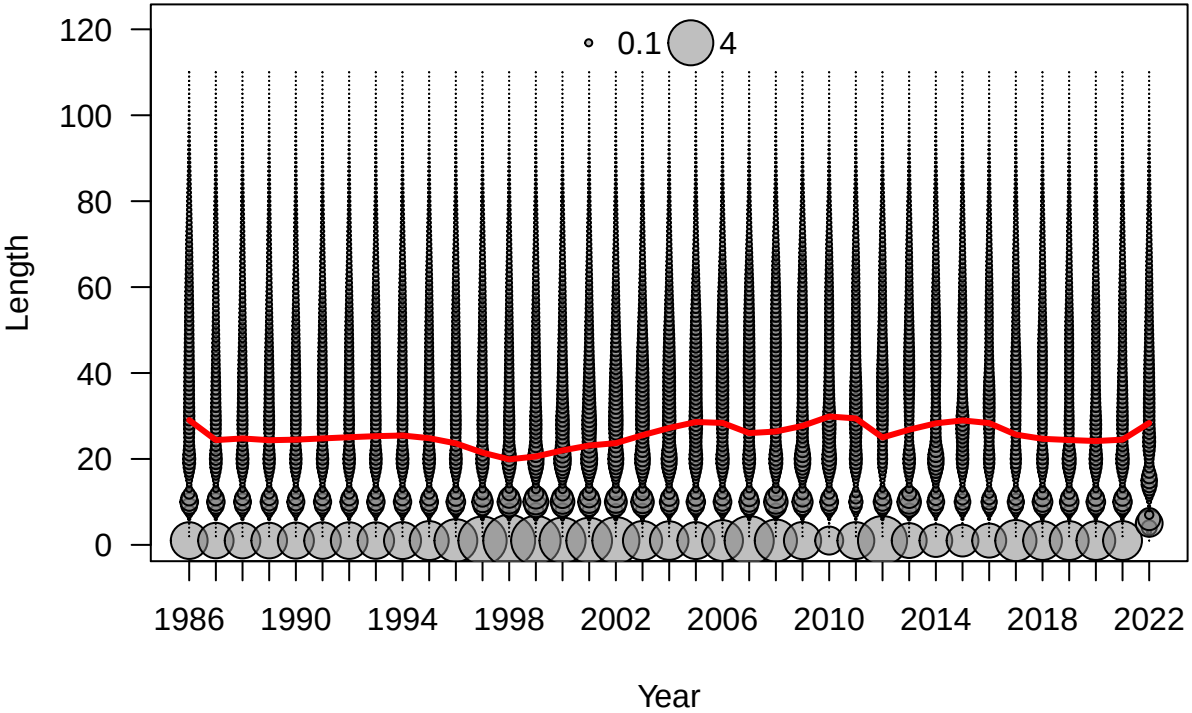

Residual
2
0
−2
1990
1995
2000
2005
Year

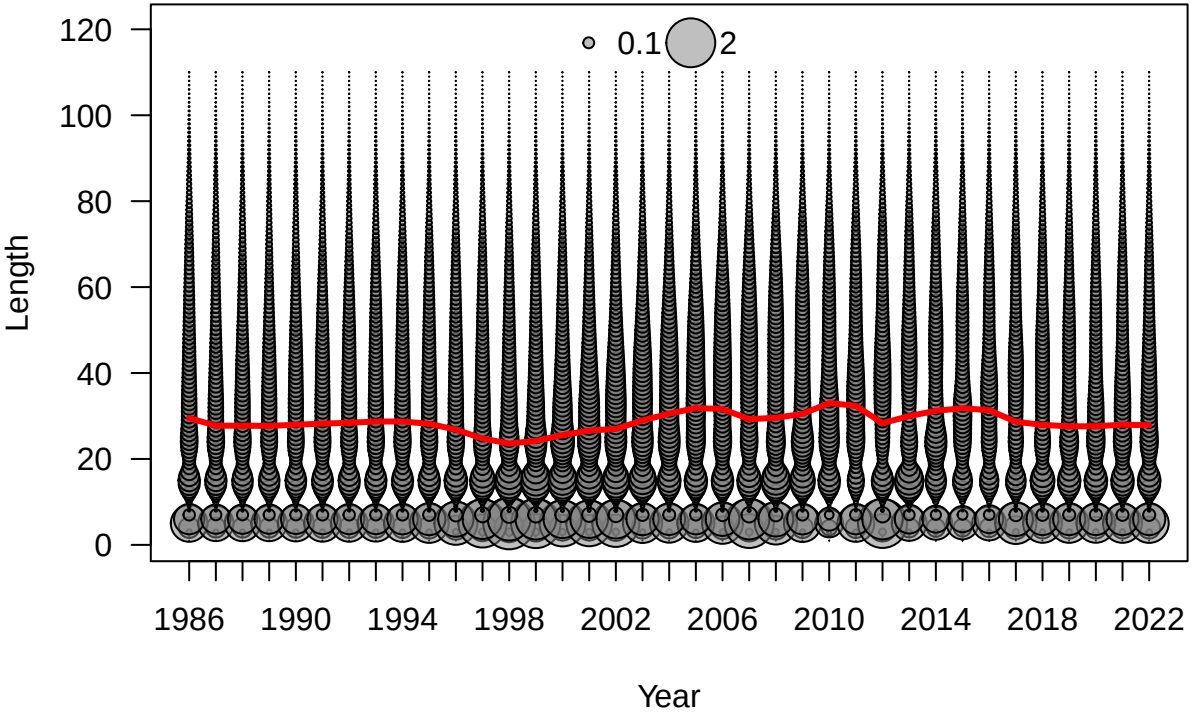

Deviation
4
2
0
−2
−4
1990
1995
2000
2005
Year

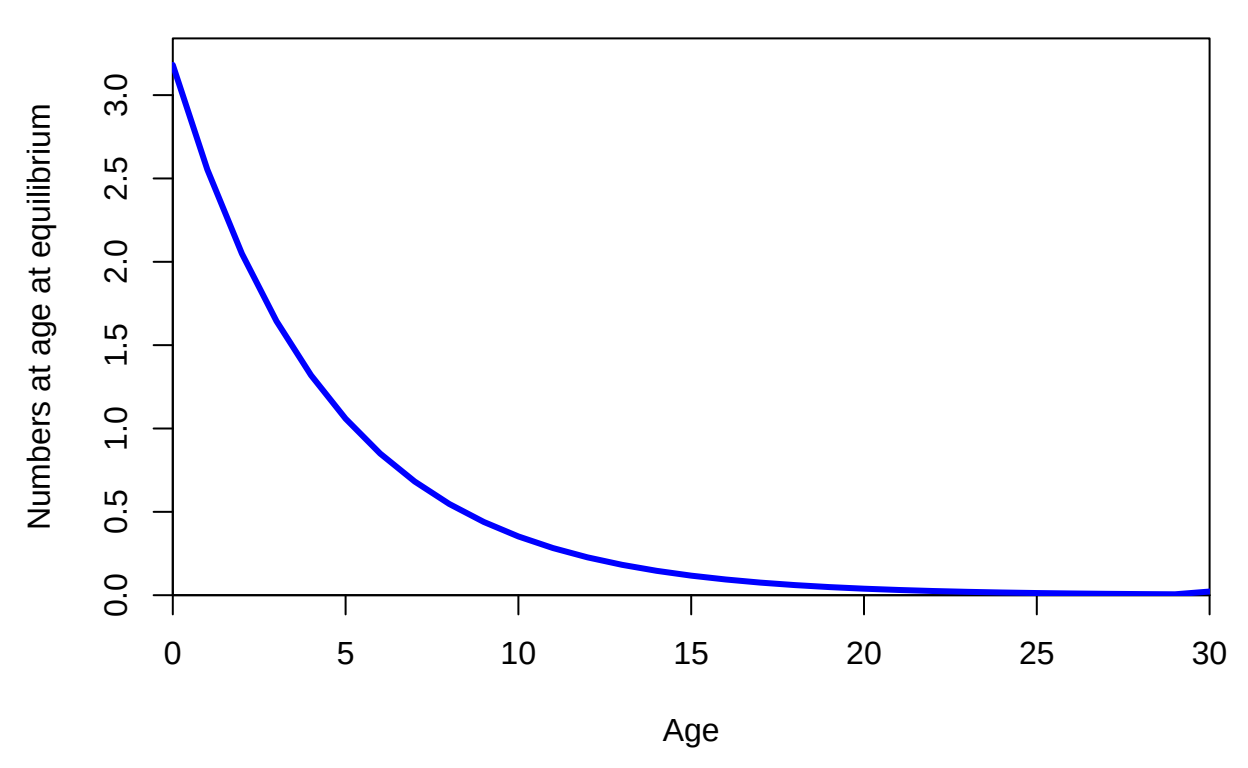

FISHERY
SURVEY2
Standardized index
0.0
0.5
1.0
1.5
2.0
2.5
3.0
1990
1995
2000
2005
2010
2015
2020
Year

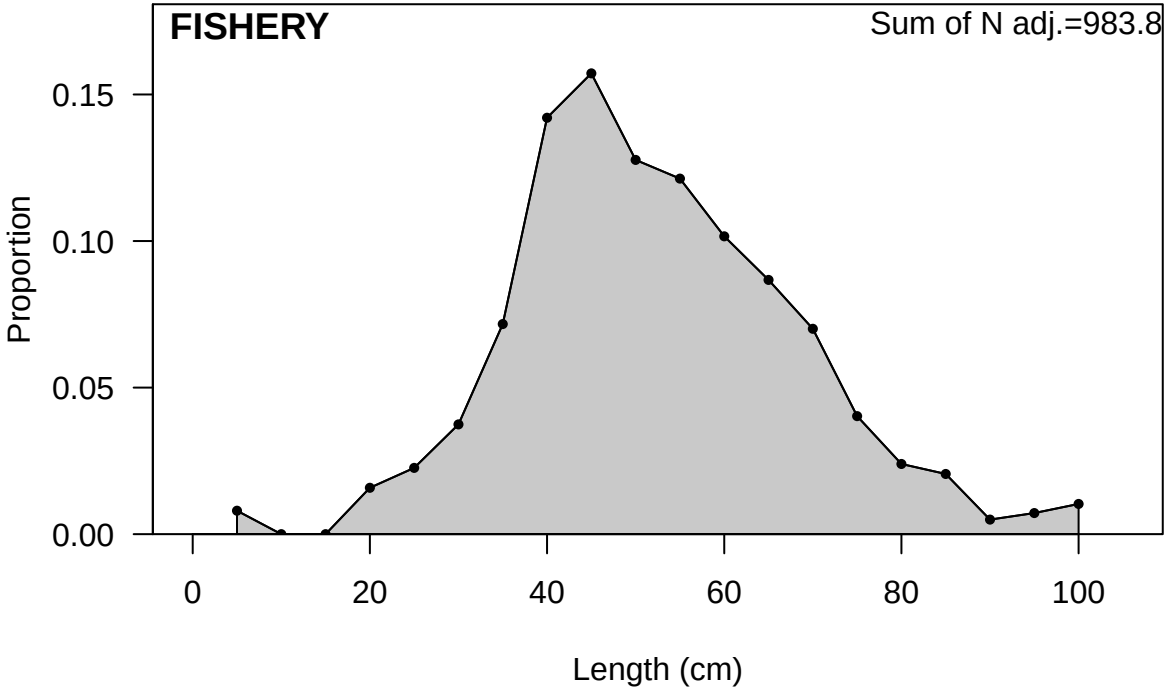

0.1
4
30
25
20
15
10
5
0
Age
1985
1989
1993
1997
2001
2005
2009
2013
2017
2021
Year

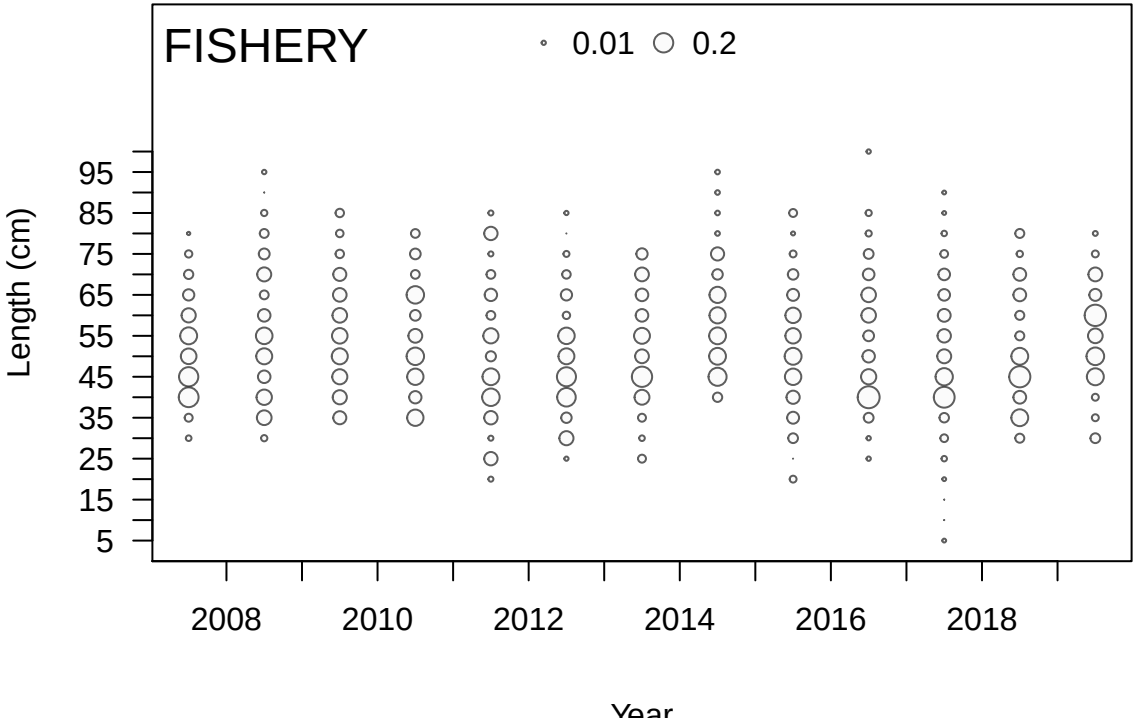

0.1
2
30
25
20
15
10
5
0
Age
1985
1989
1993
1997
2001
2005
2009
2013
2017
2021
Year

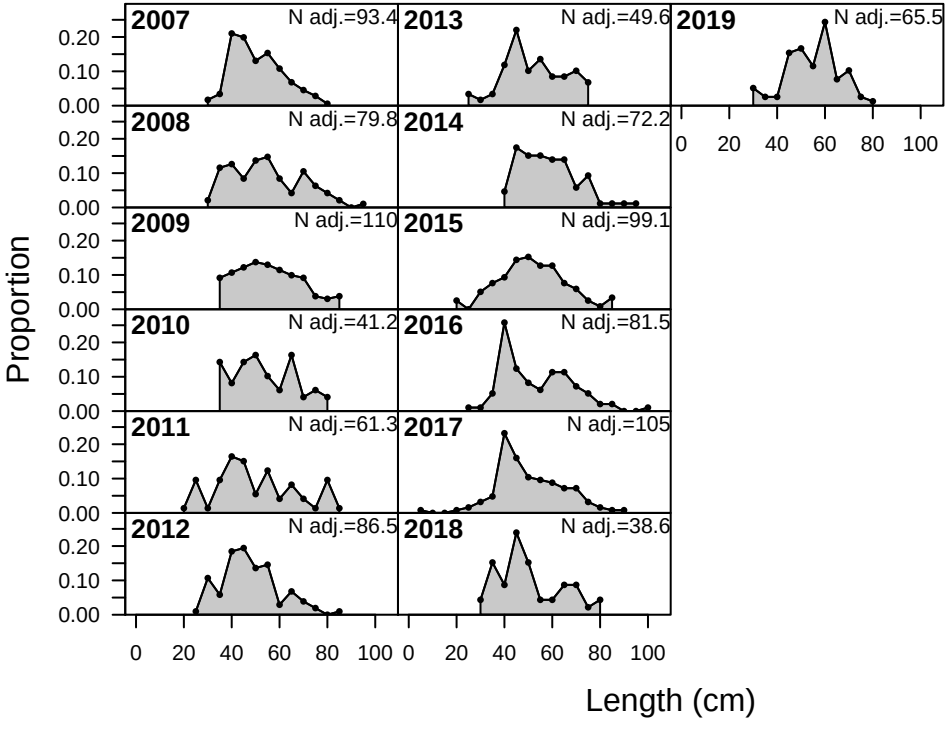

0.1
4
120
100
80
60
40
20
0
Length
1986
1990
1994
1998
2002
2006
2010
2014
2018
2022
Year

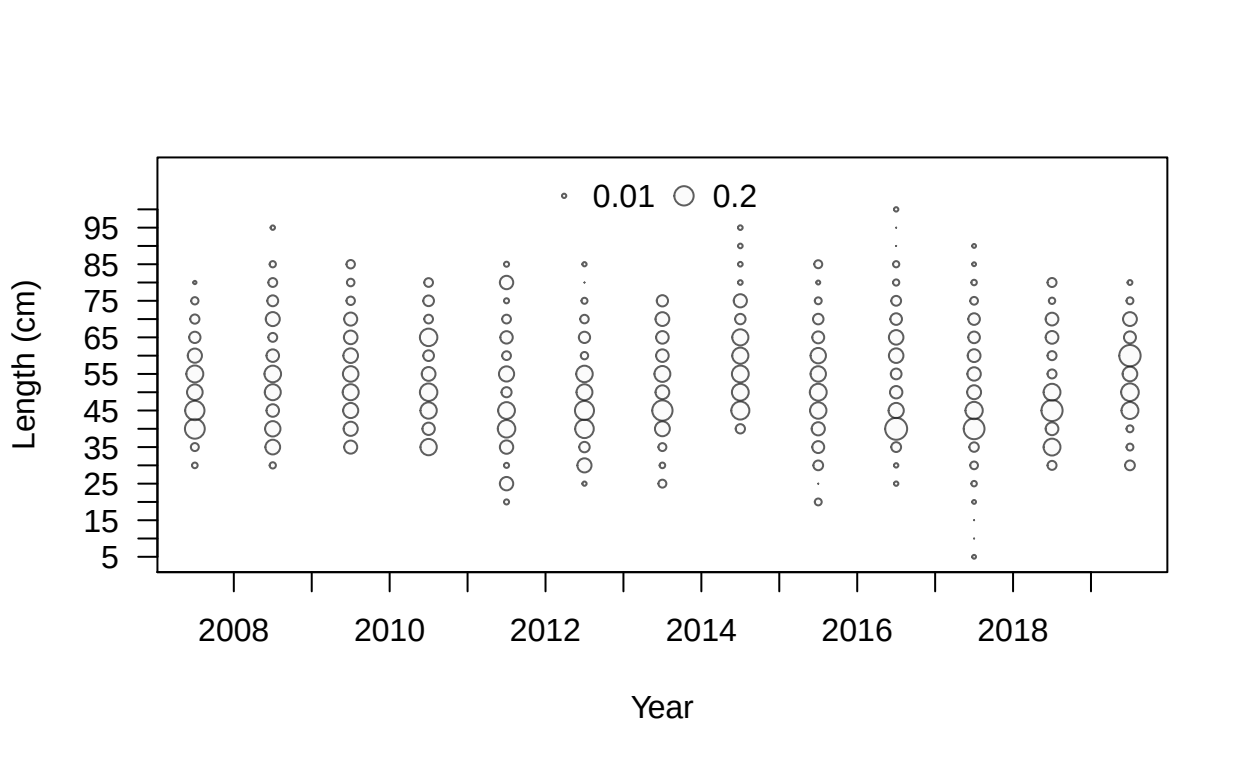

0.1
2
120
100
80
60
40
20
0
Length
1986
1990
1994
1998
2002
2006
2010
2014
2018
2022
Year

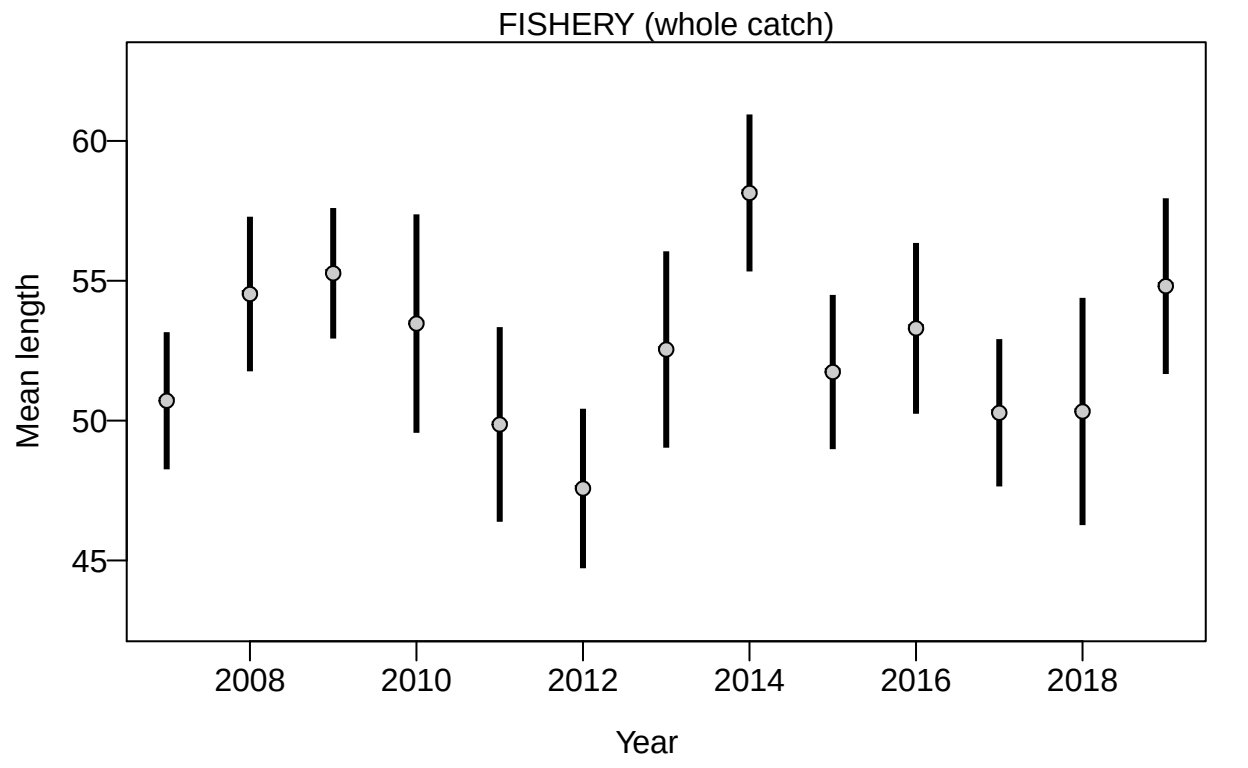

Numbers at age at equilibrium
0.0
0.5
1.0
1.5
2.0
2.5
3.0
0
5
10
15
20
25
30
Age

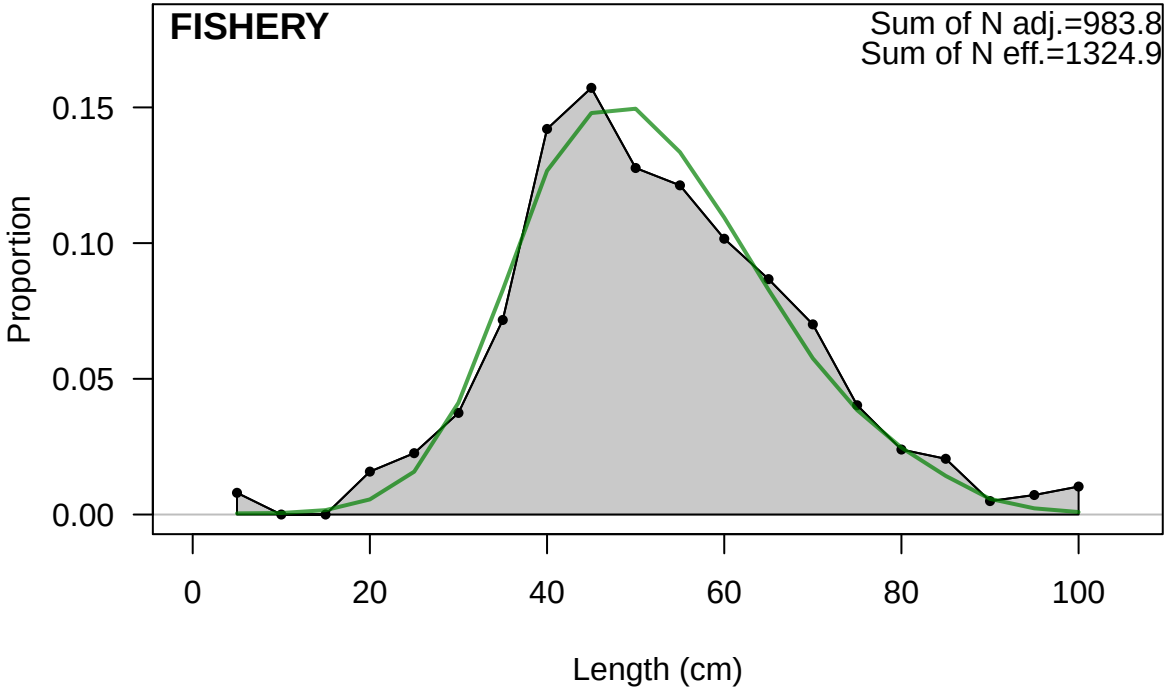

FISHERY
Sum of N adj.=983.8
Proportion
0.00
0.05
0.10
0.15
0
20
40
60
80
100
Length (cm)

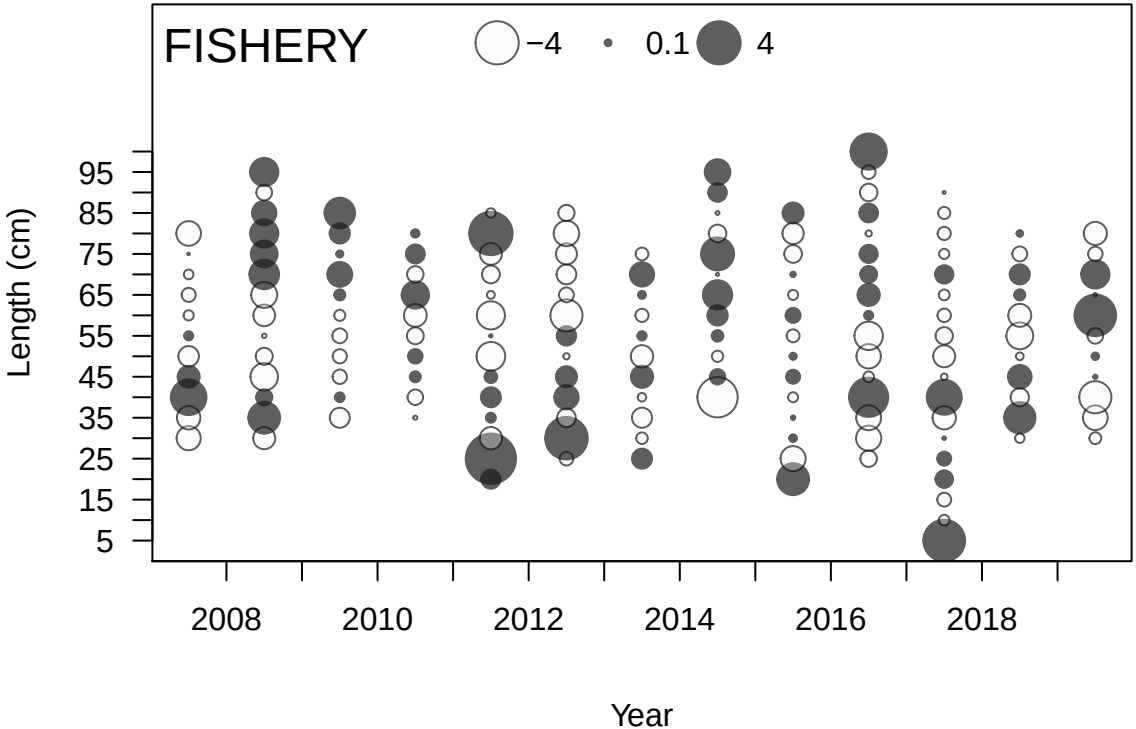

FISHERY
0.01
0.2
Length (cm)
95
85
75
65
55
45
35
25
15
5
2008
2010
2012
2014
2016
2018
Year

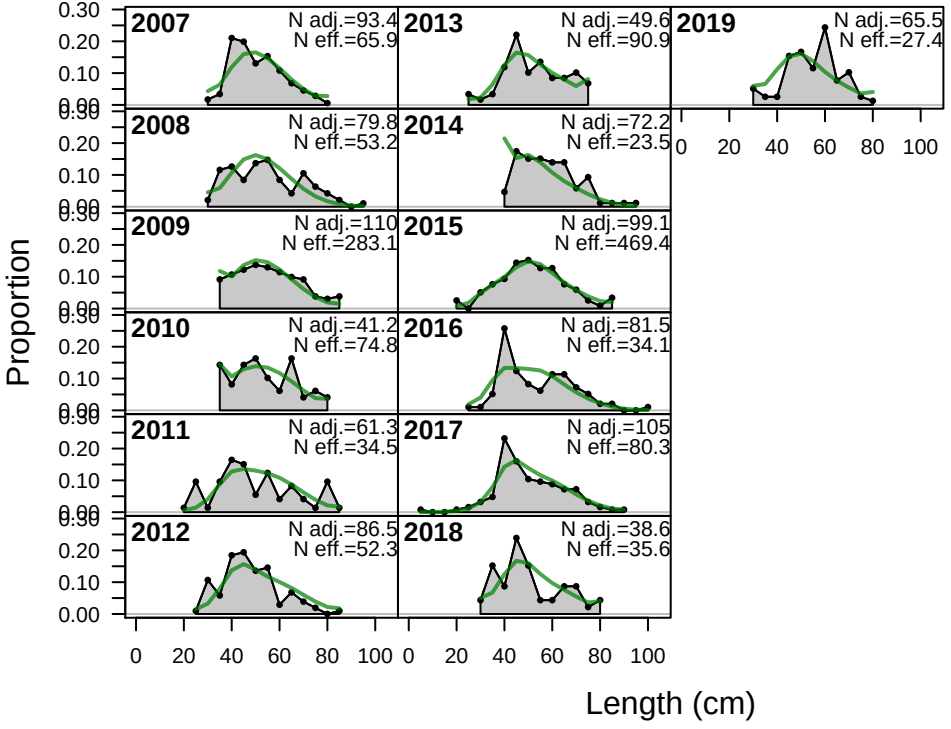

2007
N adj.=93.4
2013
N adj.=49.6
2019
N adj.=65.5
2008
N adj.=79.8
2014
N adj.=72.2
2009
N adj.=110
2015
N adj.=99.1
2010
N adj.=41.2
2016
N adj.=81.5
2011
N adj.=61.3
2017
N adj.=105
2012
N adj.=86.5
2018
N adj.=38.6
Proportion
0.00
0.10
0.20
0
20
40
60
80
100
Length (cm)

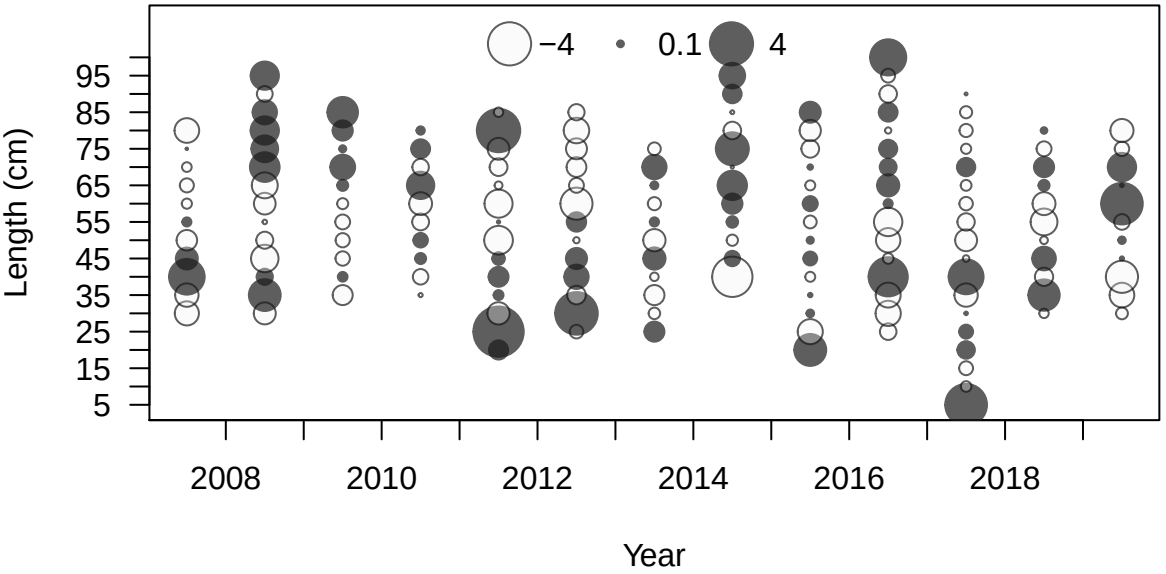

0.01
0.2
Length (cm)
95
85
75
65
55
45
35
25
15
5
2008
2010
2012
2014
2016
2018
Year

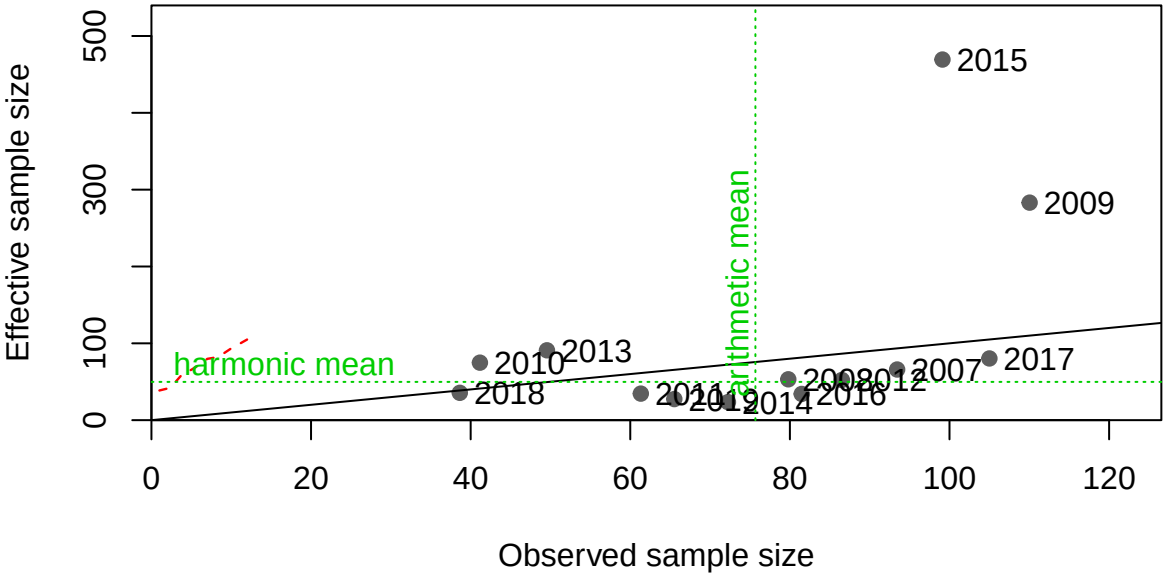

FISHERY (whole catch)
Mean length
60
55
50
45
2008
2010
2012
2014
2016
2018
Year


FISHERY
Sum of N adj.=983.8
Sum of N eff.=1324.9
Proportion
0.00
0.05
0.10
0.15
0
20
40
60
80
100
Length (cm)

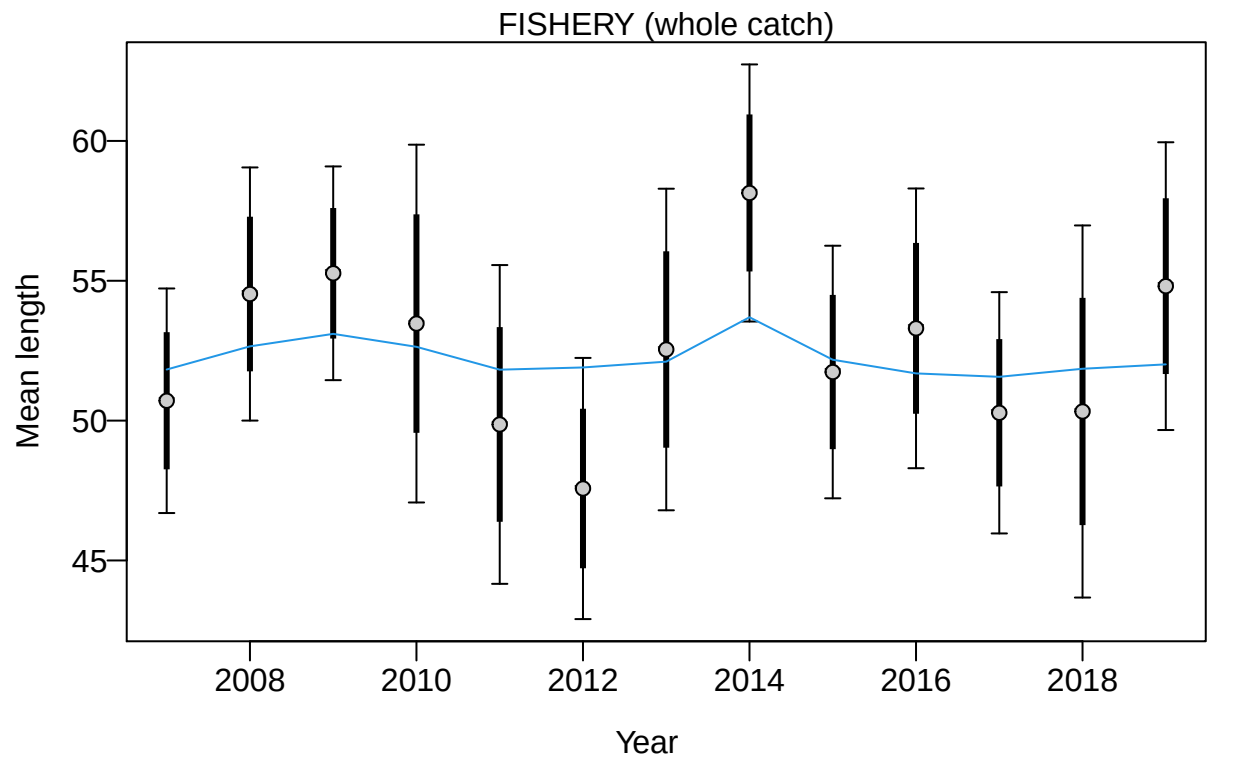

FISHERY
−4
0.1
4
Length (cm)
95
85
75
65
55
45
35
25
15
5
2008
2010
2012
2014
2016
2018
Year

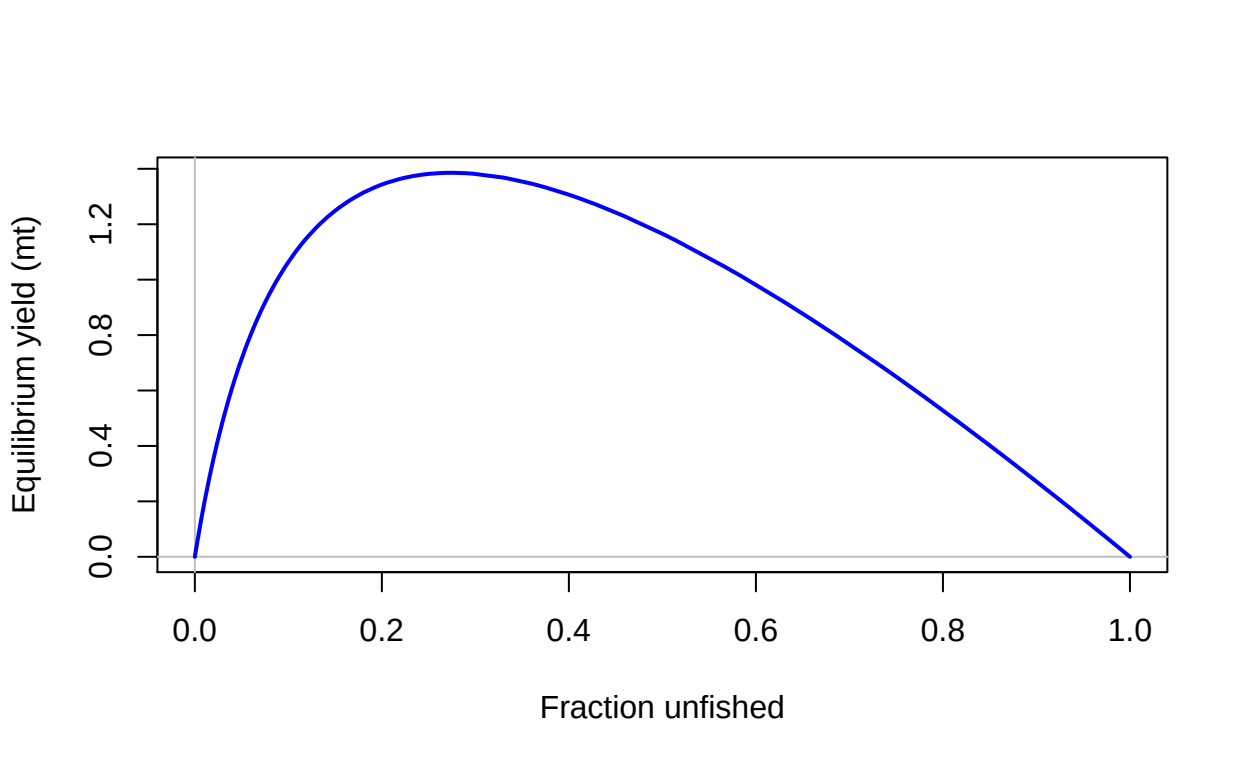

2007
N adj.=93.4
N eff.=65.9
2013
N adj.=49.6
N eff.=90.9
2019
N adj.=65.5
N eff.=27.4
2008
N adj.=79.8
N eff.=53.2
2014
N adj.=72.2
N eff.=23.5
2009
N adj.=110
N eff.=283.1
2015
N adj.=99.1
N eff.=469.4
2010
N adj.=41.2
N eff.=74.8
2016
N adj.=81.5
N eff.=34.1
2011
N adj.=61.3
N eff.=34.5
2017
N adj.=105
N eff.=80.3
2012
N adj.=86.5
N eff.=52.3
2018
N adj.=38.6
N eff.=35.6
Proportion
0.00
0.10
0.20
0.30
0
20
40
60
80
100
Length (cm)

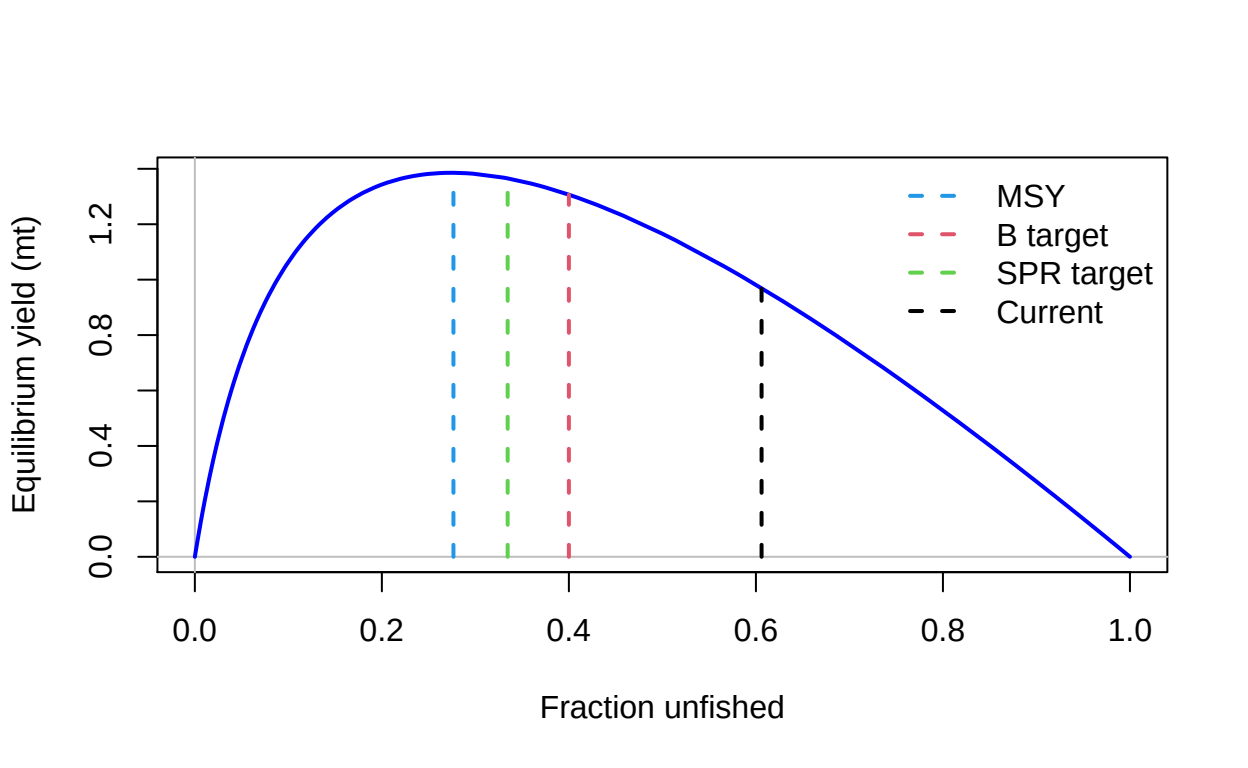

−4
0.1
4
95
85
75
65
55
45
35
25
15
5
Length (cm)
2008
2010
2012
2014
2016
2018
Year

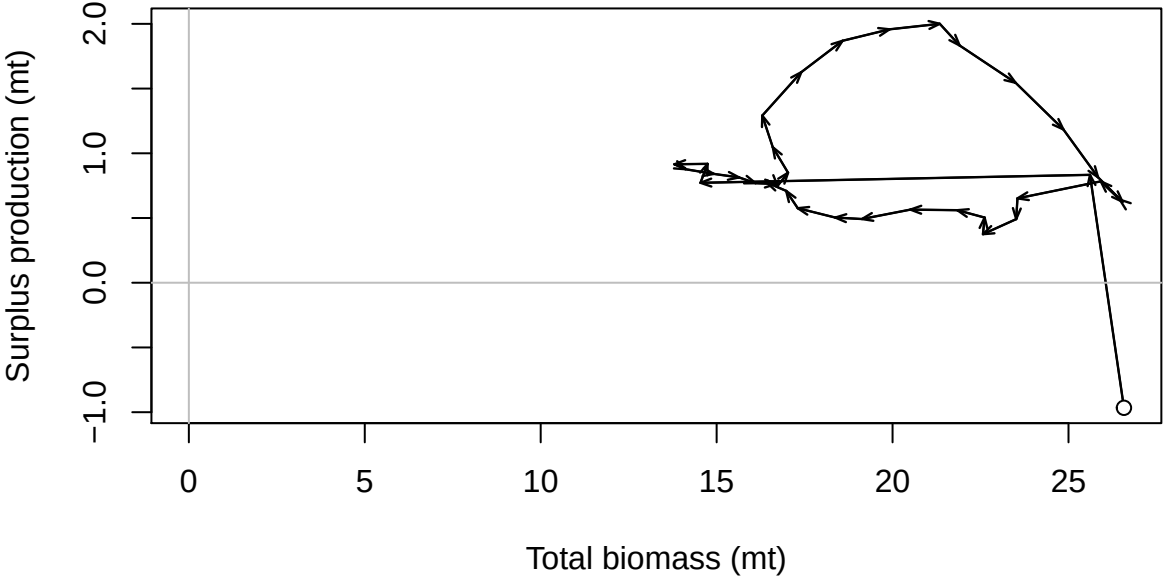


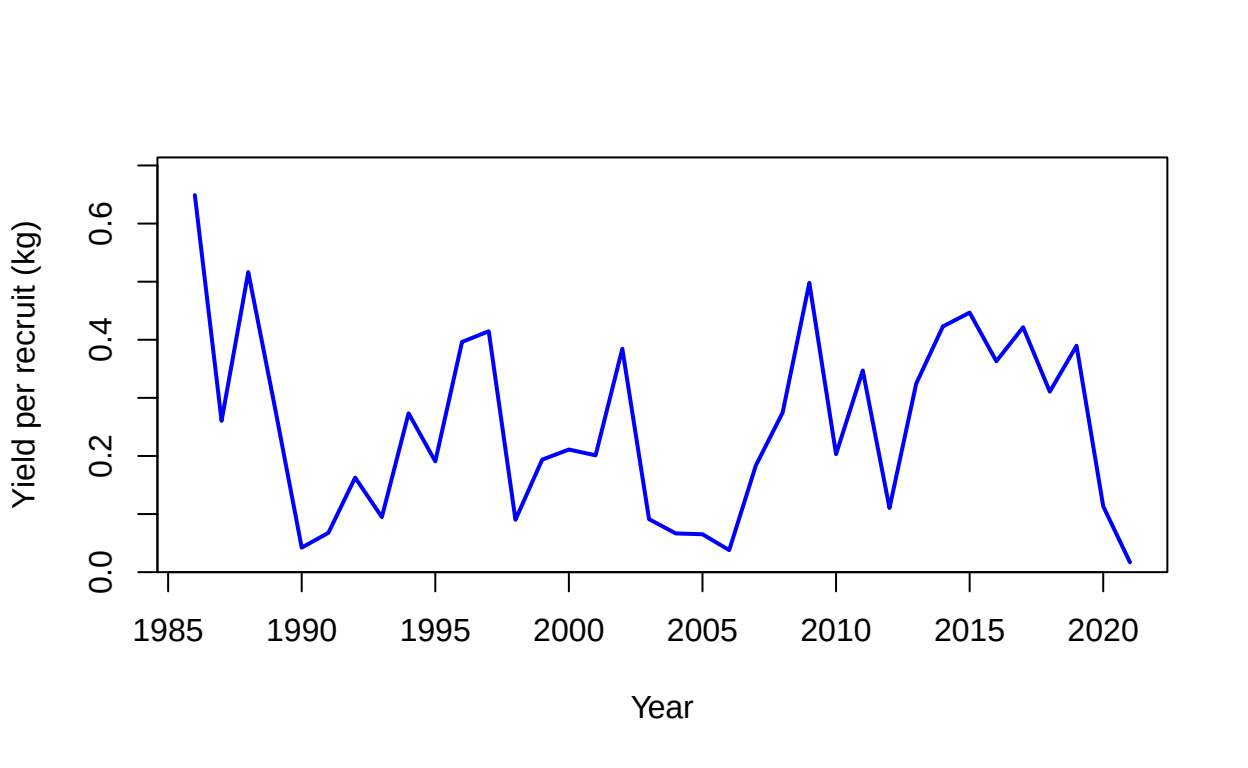
Effective sample size
Observed sample size
harmonic mean
arithmetic mean
2015
2009
2013
2010
2018
2011
2012
2014
2016
2008
2012
2007
2017
0
100
300
500
0
20
40
60
80
100
120

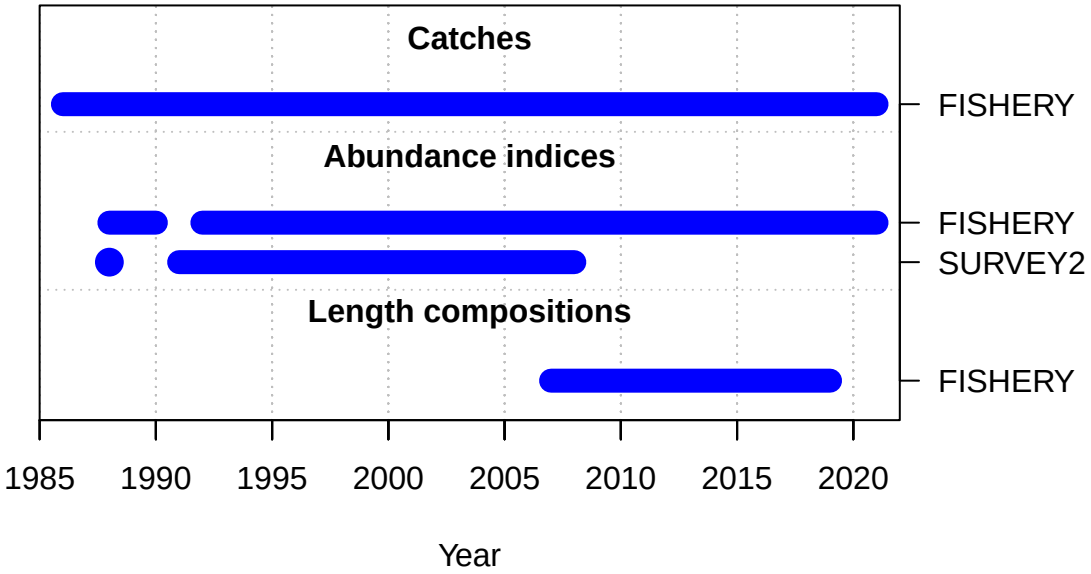

FISHERY (whole catch)
Mean length
60
55
50
45
2008
2010
2012
2014
2016
2018
Year

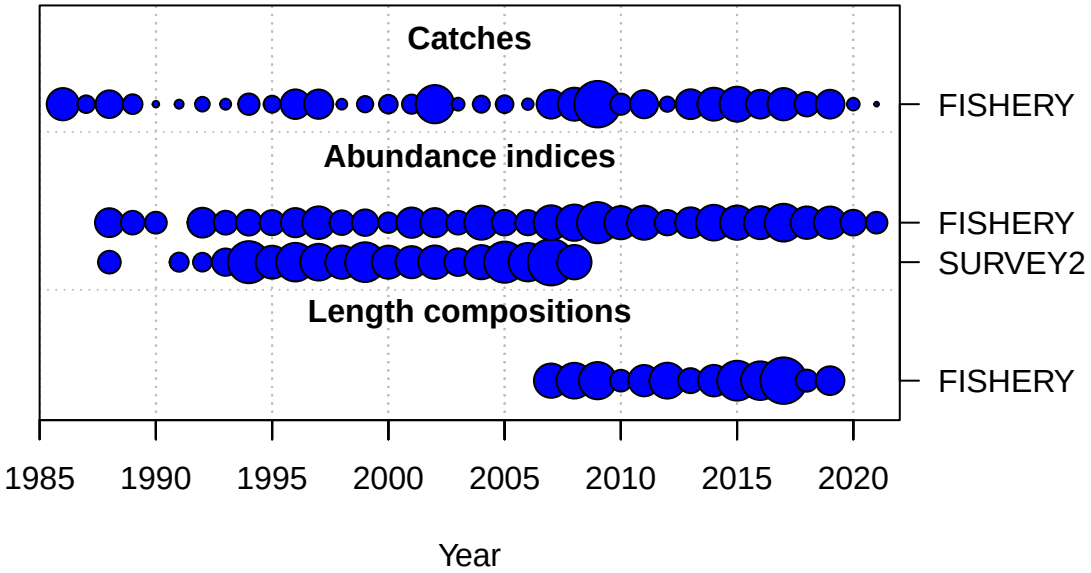

Equilibrium yield (mt)
0.0
0.4
0.8
1.2
0.0
0.2
0.4
0.6
0.8
1.0
Fraction unfished

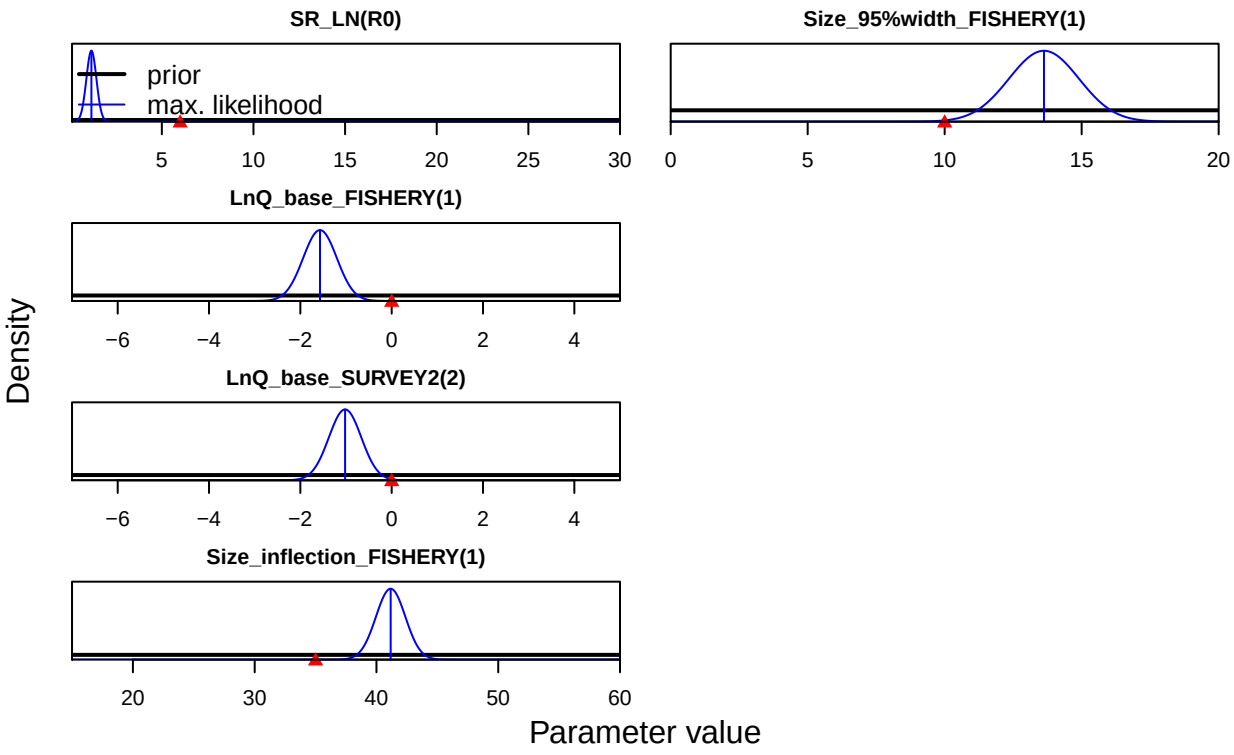

Equilibrium yield (mt)
0.0
0.4
0.8
1.2
0.0
0.2
0.4
0.6
0.8
1.0
Fraction unfished
MSY
B target
SPR target
Current


Surplus production (mt)
2.0
1.0
0.0
−1.0
0
5
10
15
20
25
Total biomass (mt)


Yield per recruit (kg)
0.0
0.2
0.4
0.6
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_95%width_FISHERY(1)
0
5
10
15
20
LnQ_base_FISHERY(1)
−6
−4
−2
0
2
4
LnQ_base_SURVEY2(2)
−6
−4
−2
0
2
4
Size_inflection_FISHERY(1)
20
30
40
50
60
Density
Parameter value