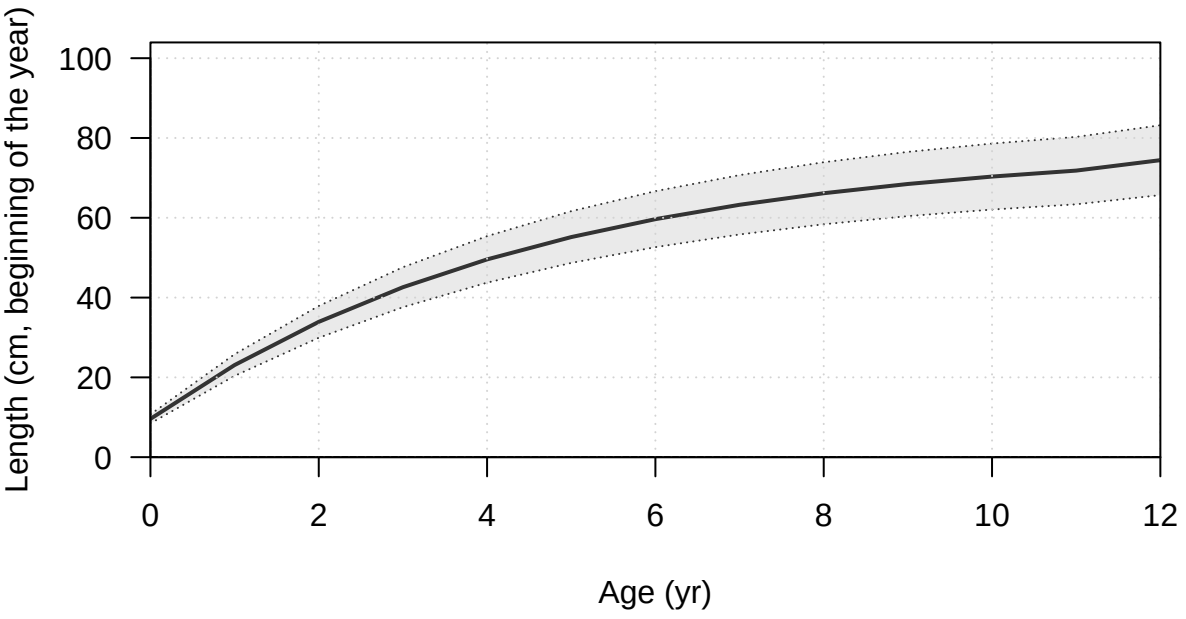
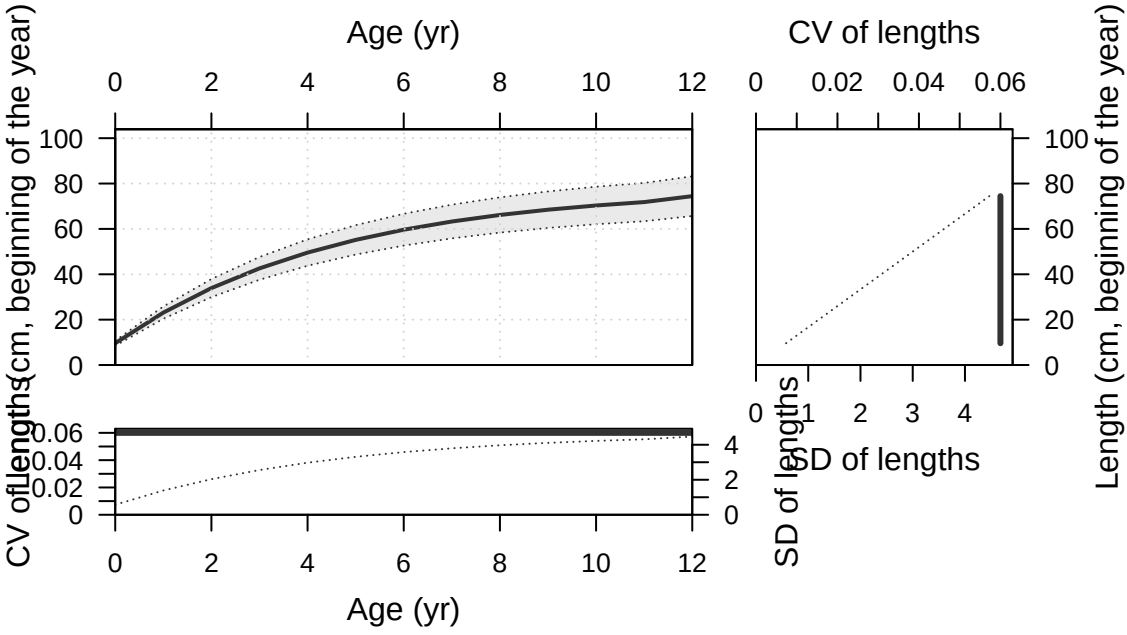
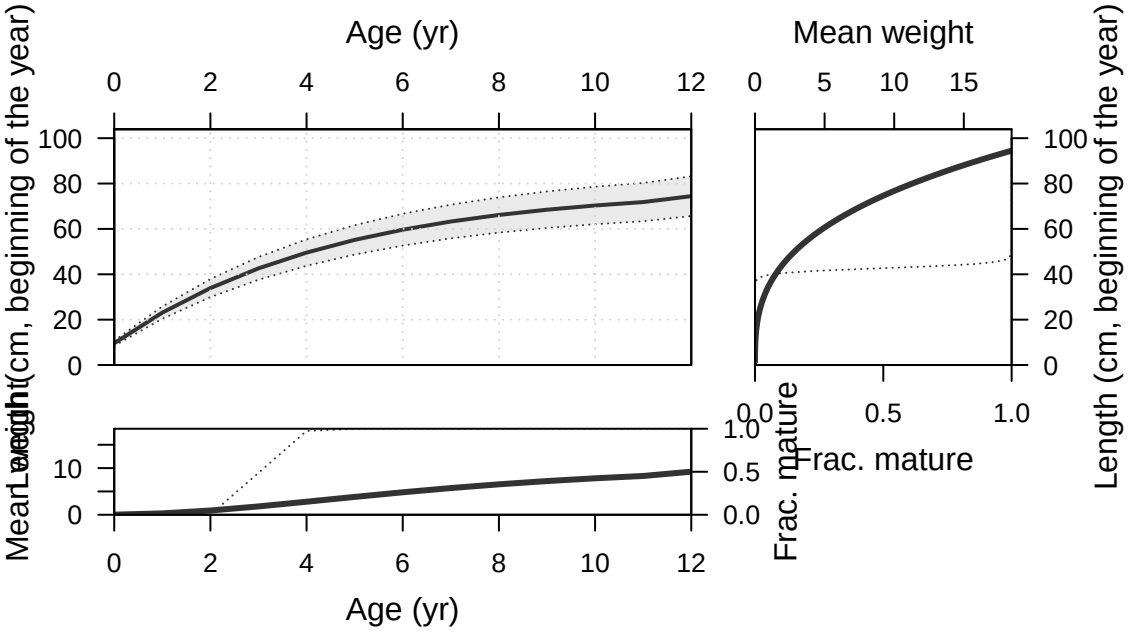
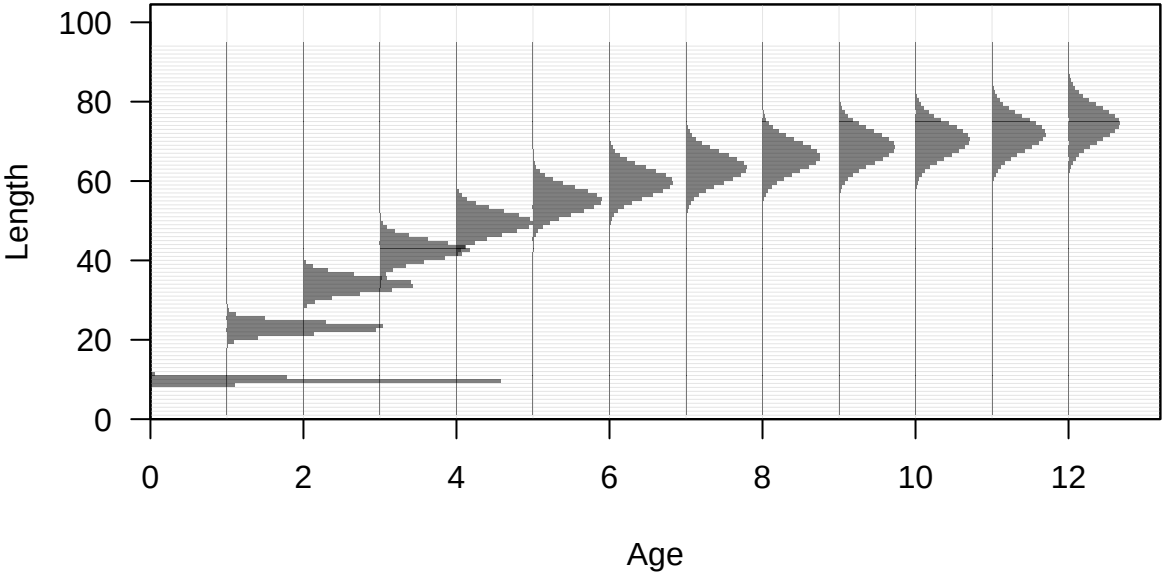
Plots created using the 'r4ss' package in R
Stock Synthesis version: 3.30.19.0
StartTime: Fri Jul 29 14:02:39 2022
Data_File: data.ss
Control_File: control.ss

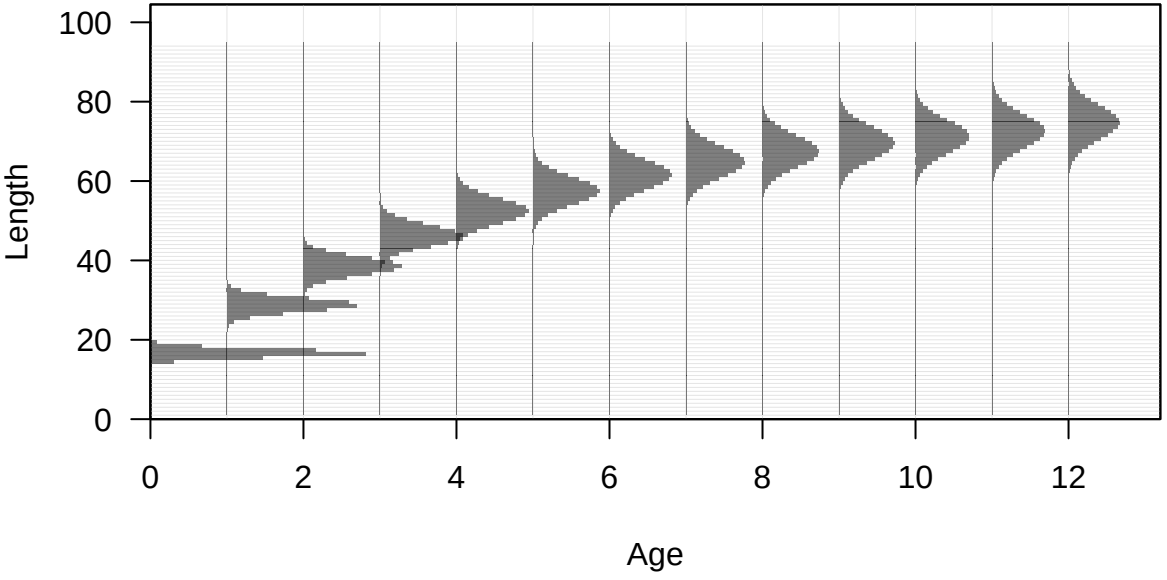

Length (cm, beginning of the year)
100
80
60
40
20
0
0
2
4
6
8
10
12
Age (yr)

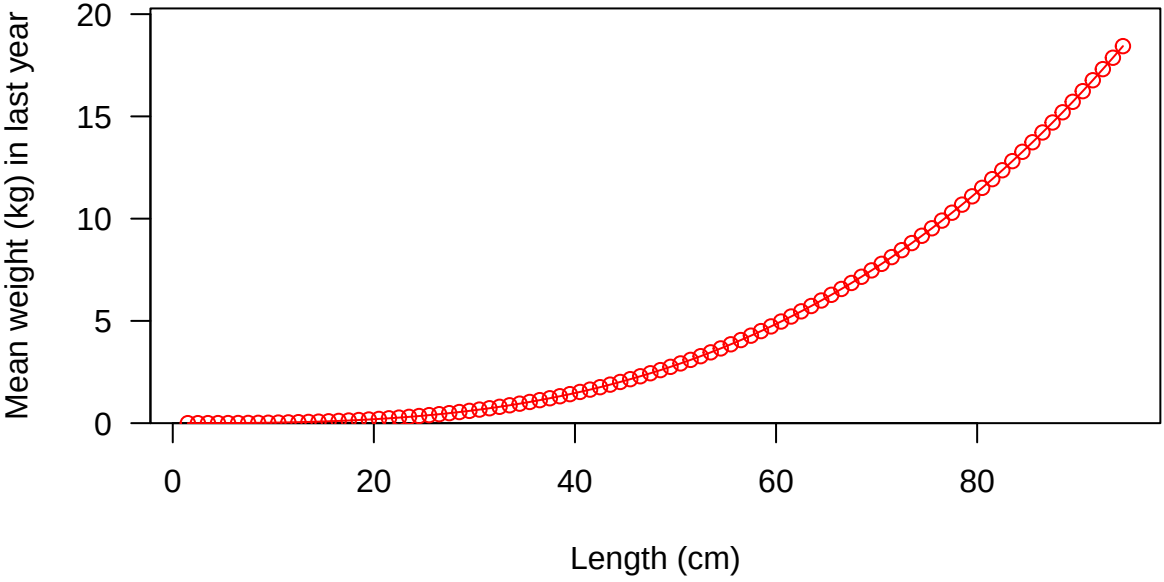


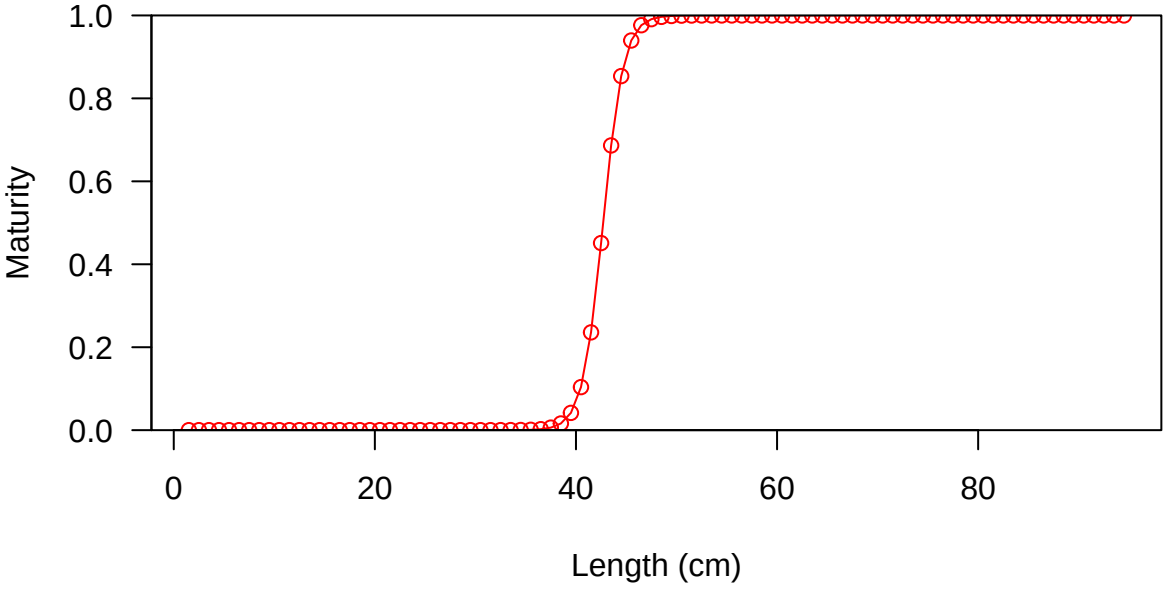
Age (yr)
0
2
4
6
8
10
12
CV of lengths
0
0.02
0.04
0.06
Length (cm, beginning of the year)
100
80
60
40
20
0
SD of lengths
0
1
2
3
4
CV of lengths
0.06
0.04
0.02
0
SD of lengths
4
2
0
Age (yr)

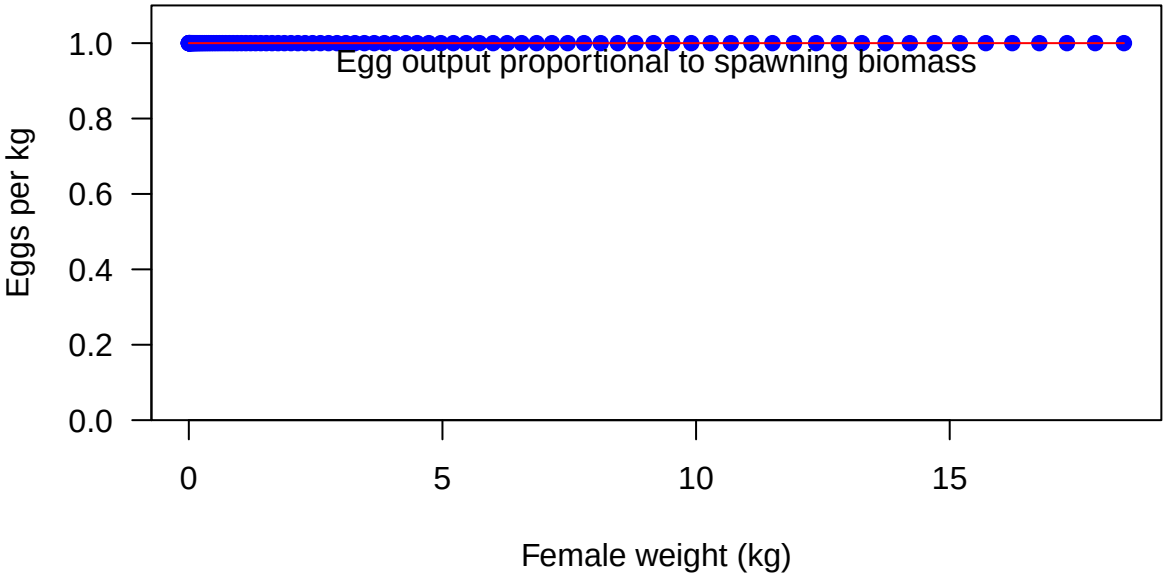

Age (yr)
0
2
4
6
8
10
12
Length (cm, beginning of the year)
100
80
60
40
20
0
Mean weight
0
5
10
15
Frac. mature
0.0
0.5
1.0
Age (yr)

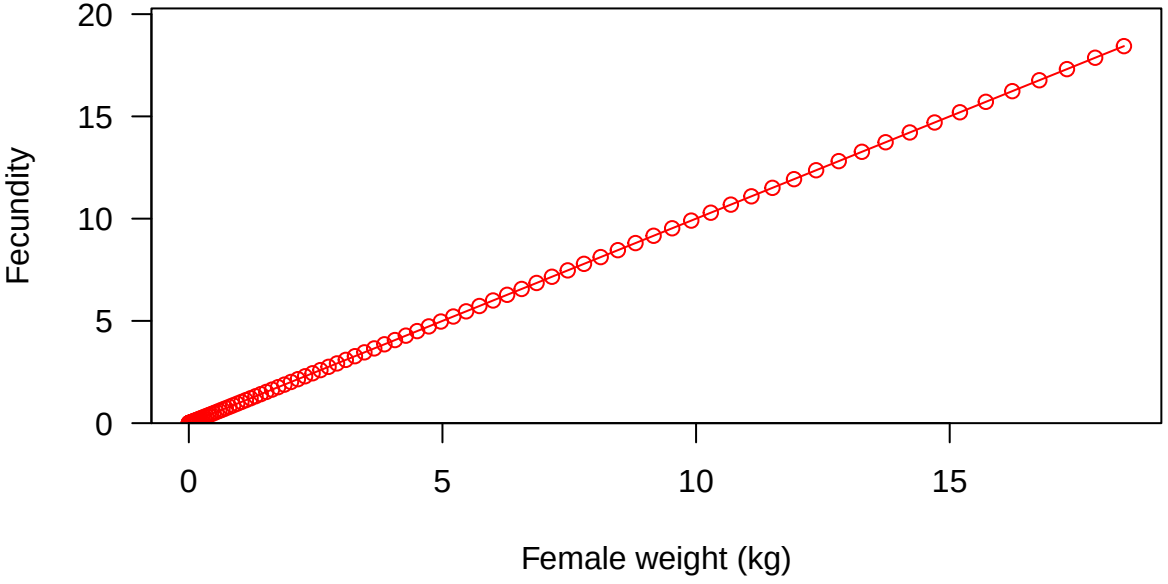

Length
100
80
60
40
20
0
0
2
4
6
8
10
12
Age

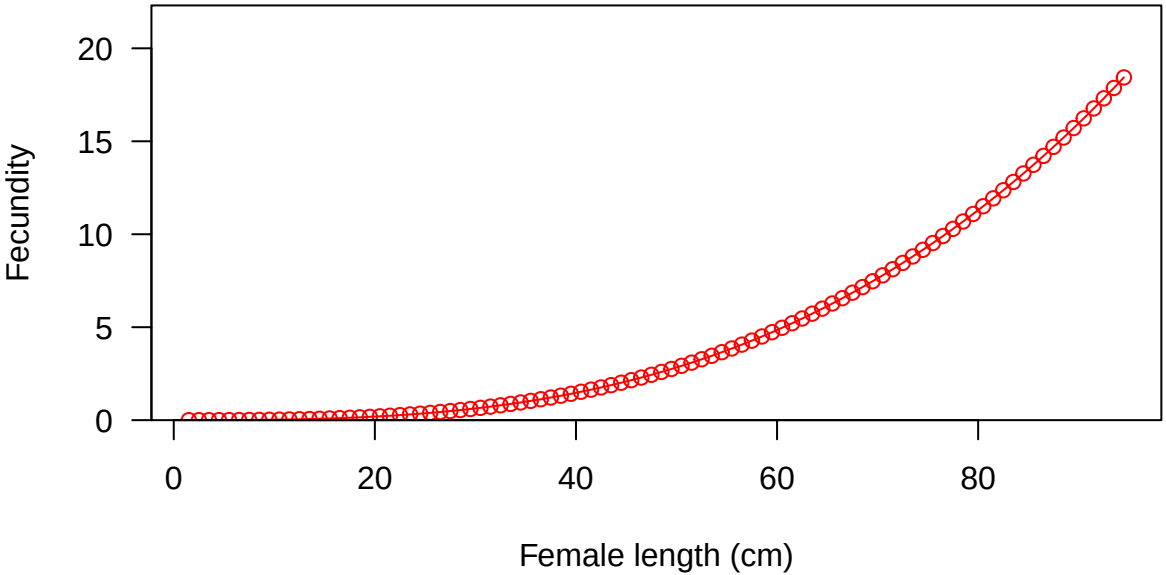

Length
100
80
60
40
20
0
0
2
4
6
8
10
12
Age

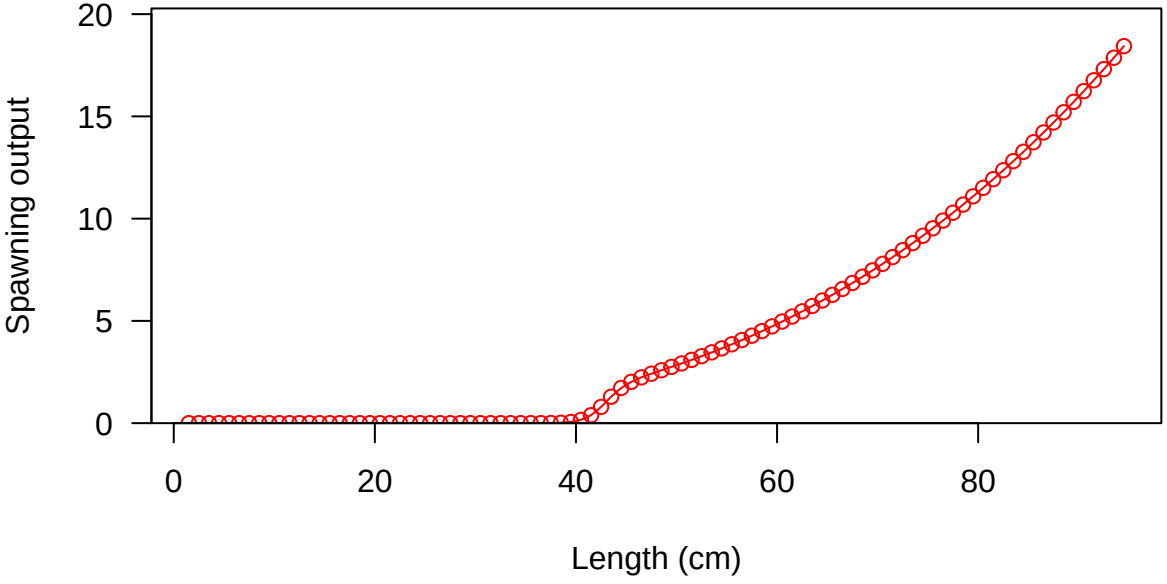

Mean weight (kg) in last year
20
15
10
5
0
0
20
40
60
80
Length (cm)

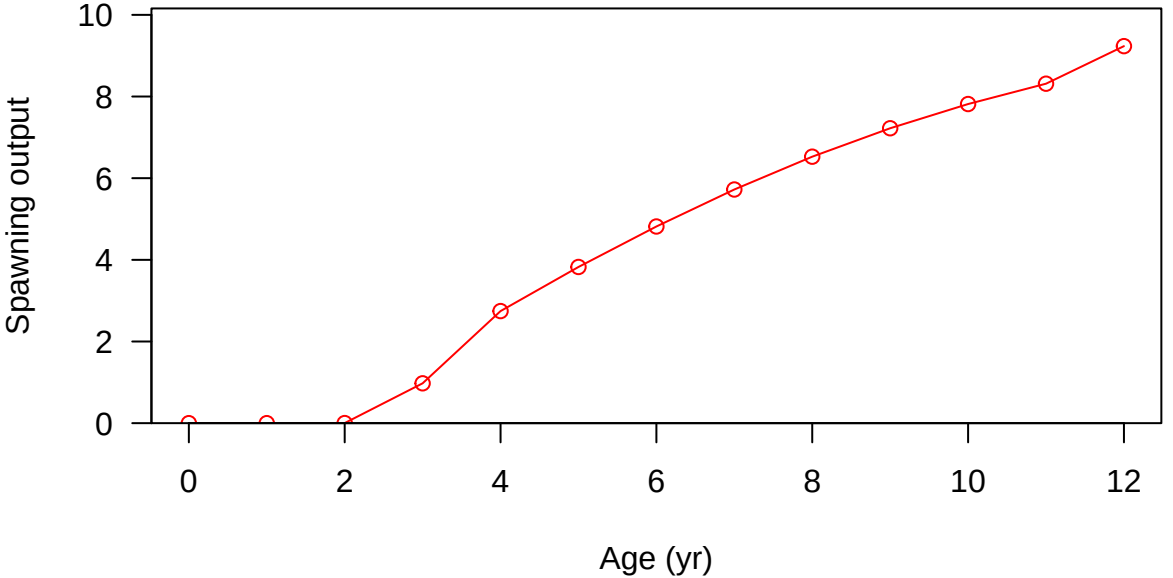

1.0
0.8
0.6
0.4
0.2
0.0
Maturity
0
20
40
60
80
Length (cm)

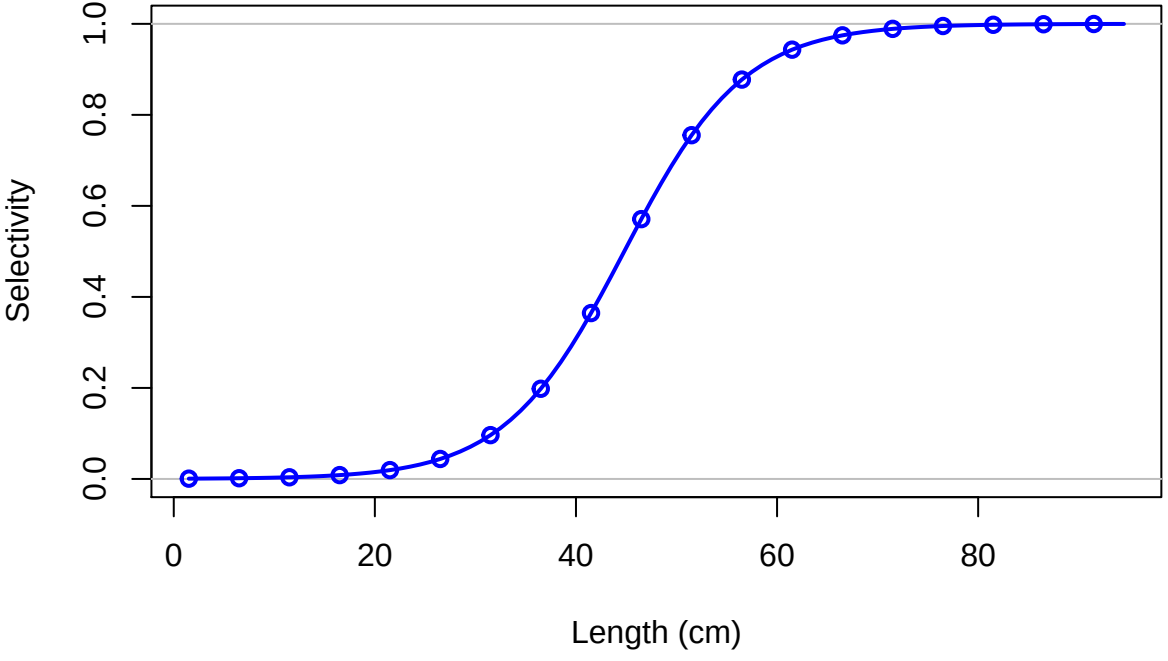

Egg output proportional to spawning biomass
Eggs per kg
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
Female weight (kg)

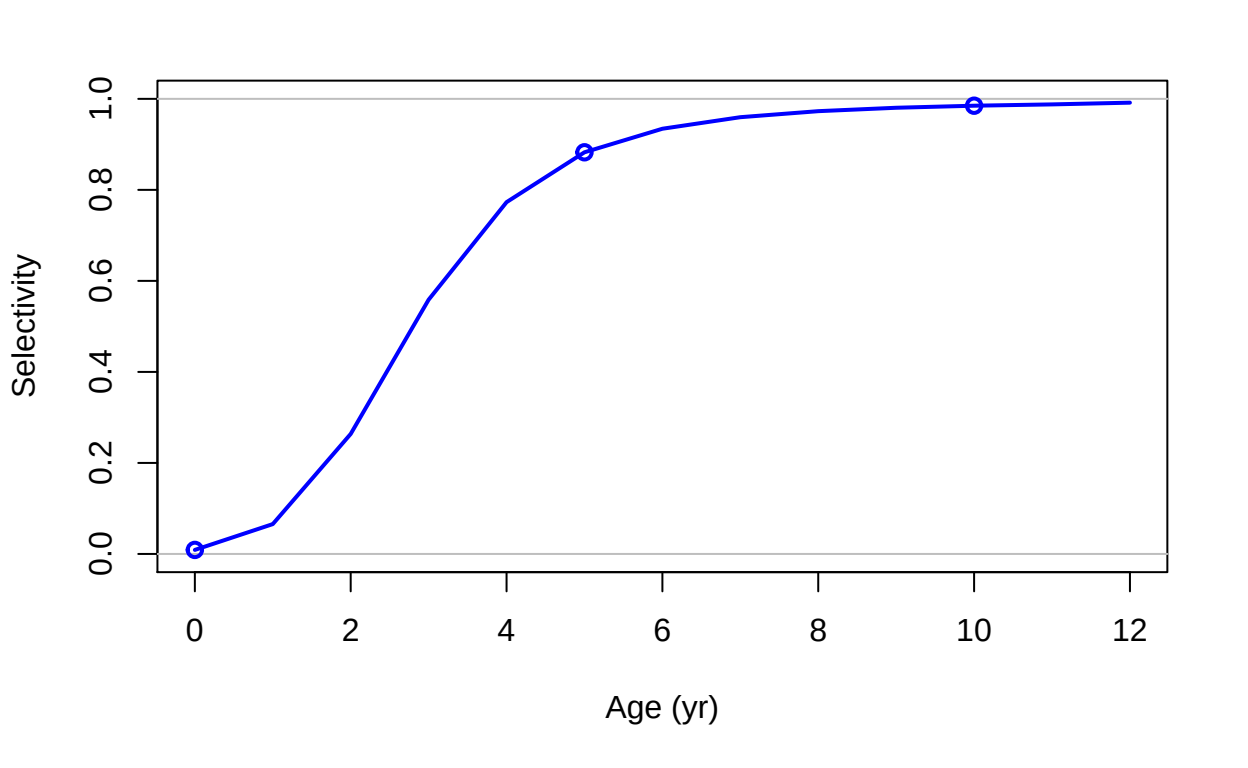

20
15
10
5
0
Fecundity
0
5
10
15
Female weight (kg)

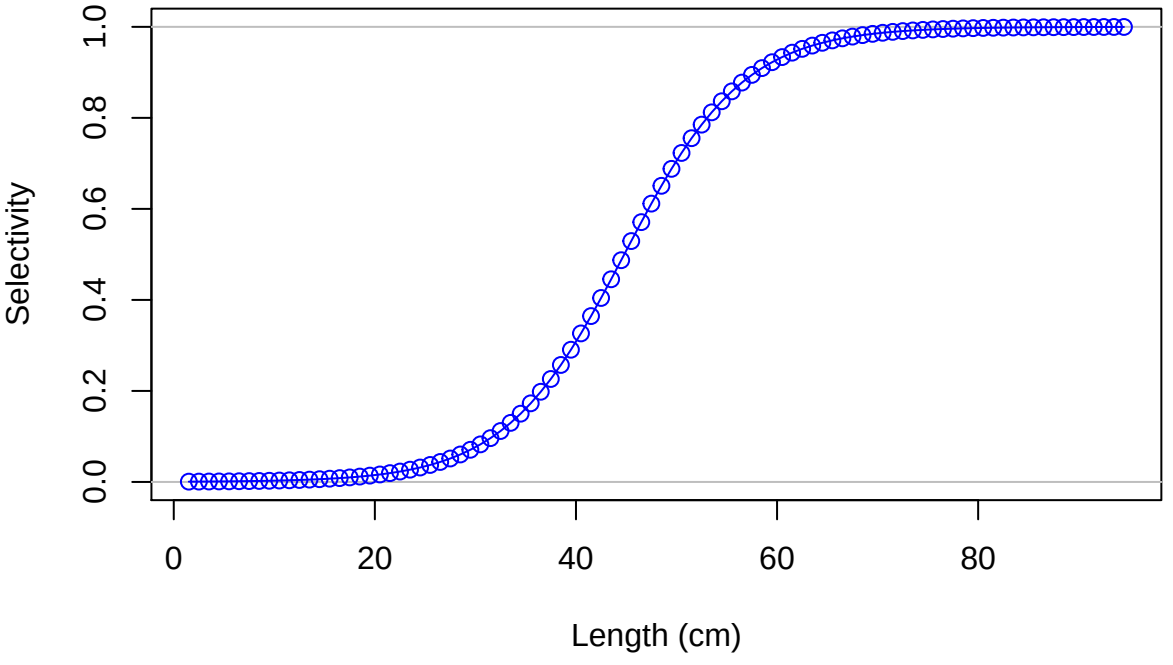

Fecundity
0
5
10
15
20
0
20
40
60
80
Female length (cm)

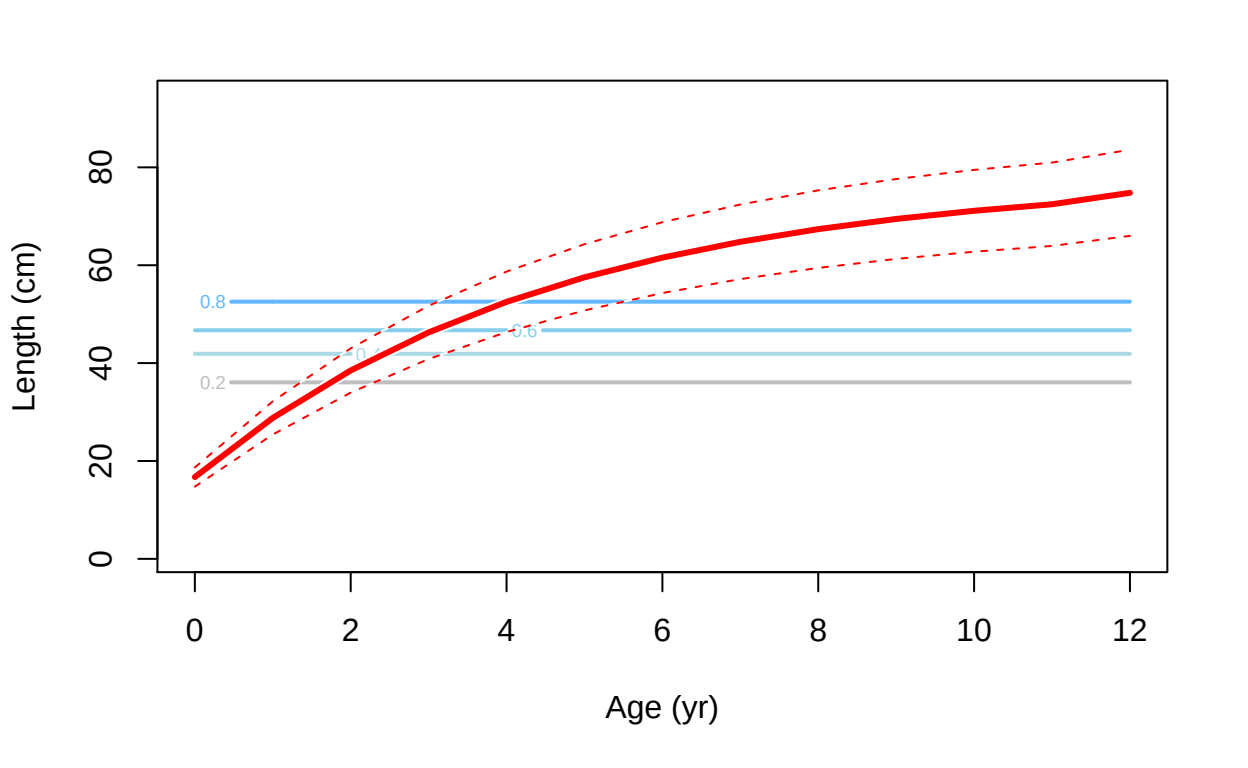

Spawning output
20
15
10
5
0
0
20
40
60
80
Length (cm)

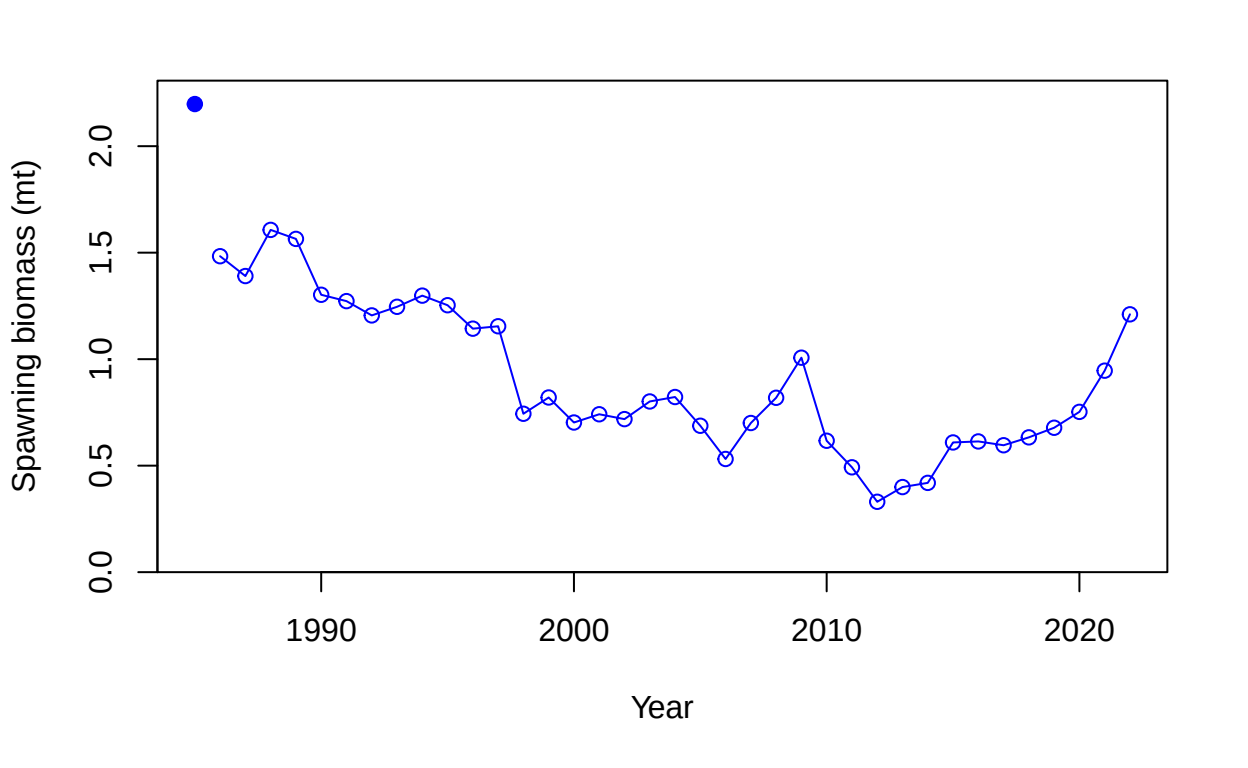

Spawning output
10
8
6
4
2
0
0
2
4
6
8
10
12
Age (yr)

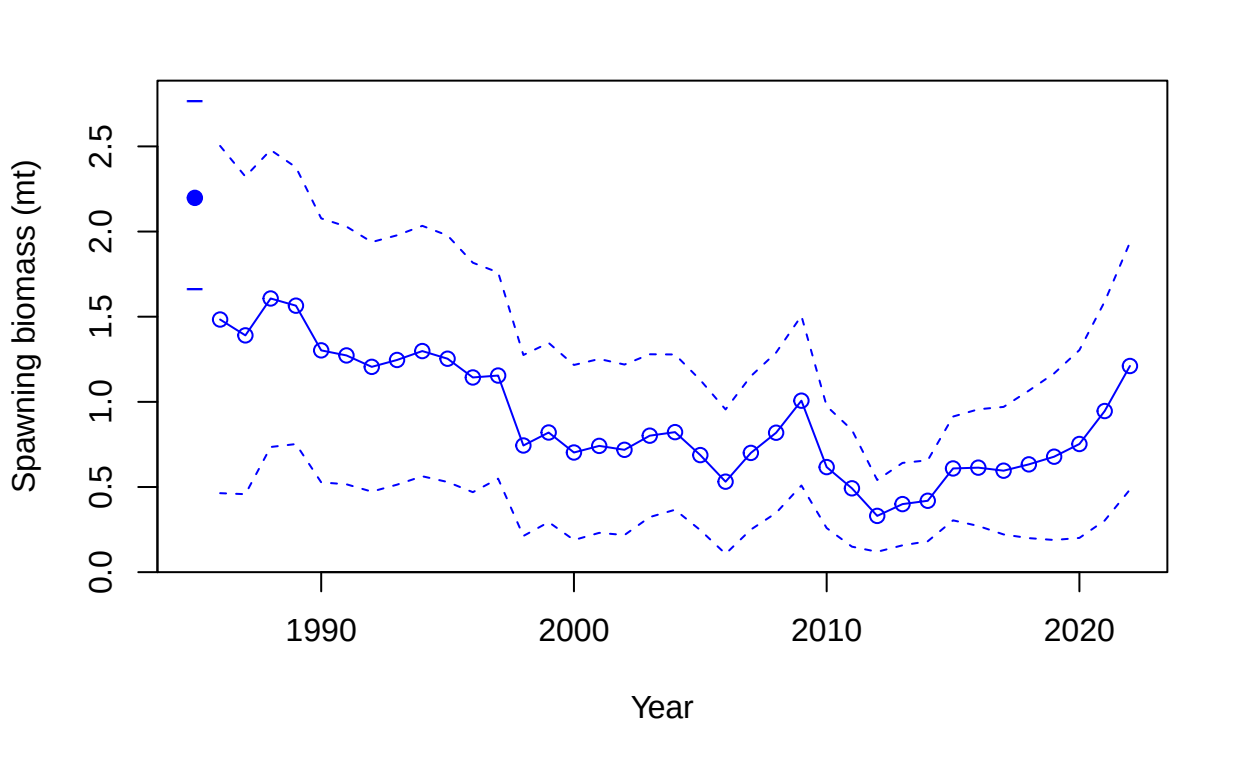

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
20
40
60
80
Length (cm)

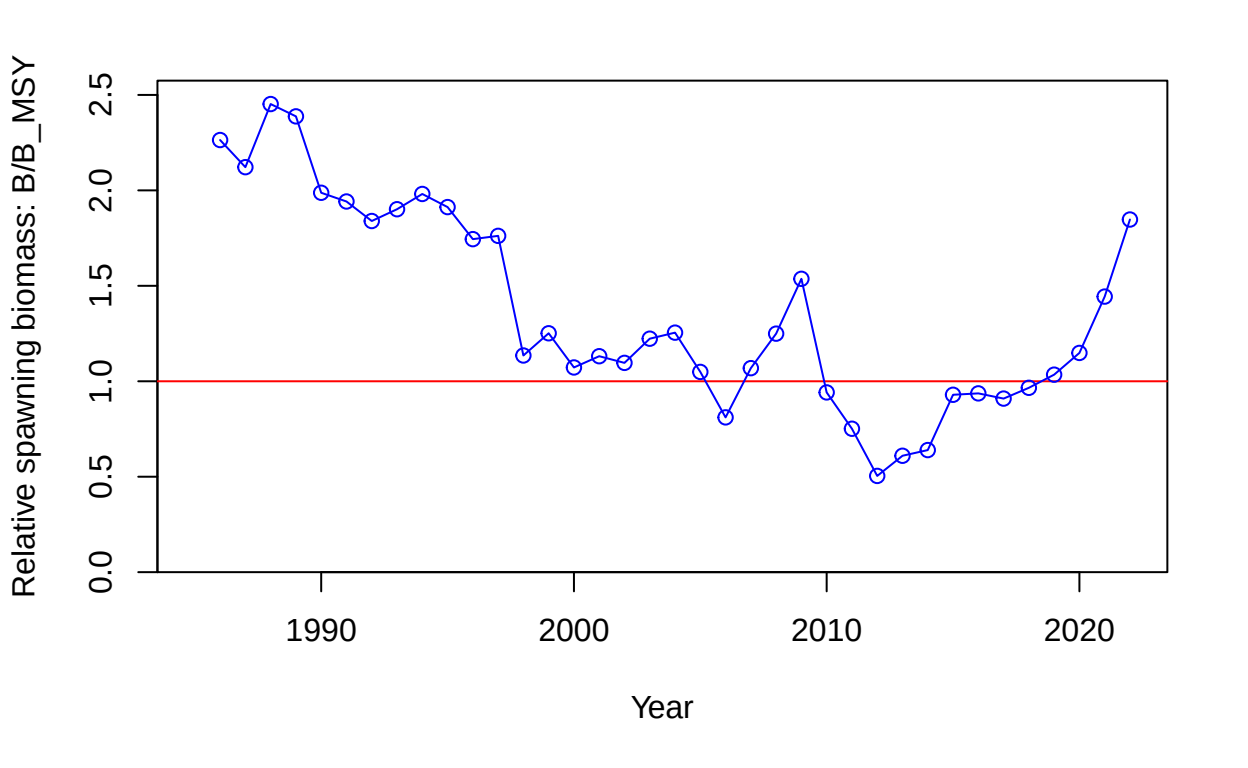

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
2
4
6
8
10
12
Age (yr)

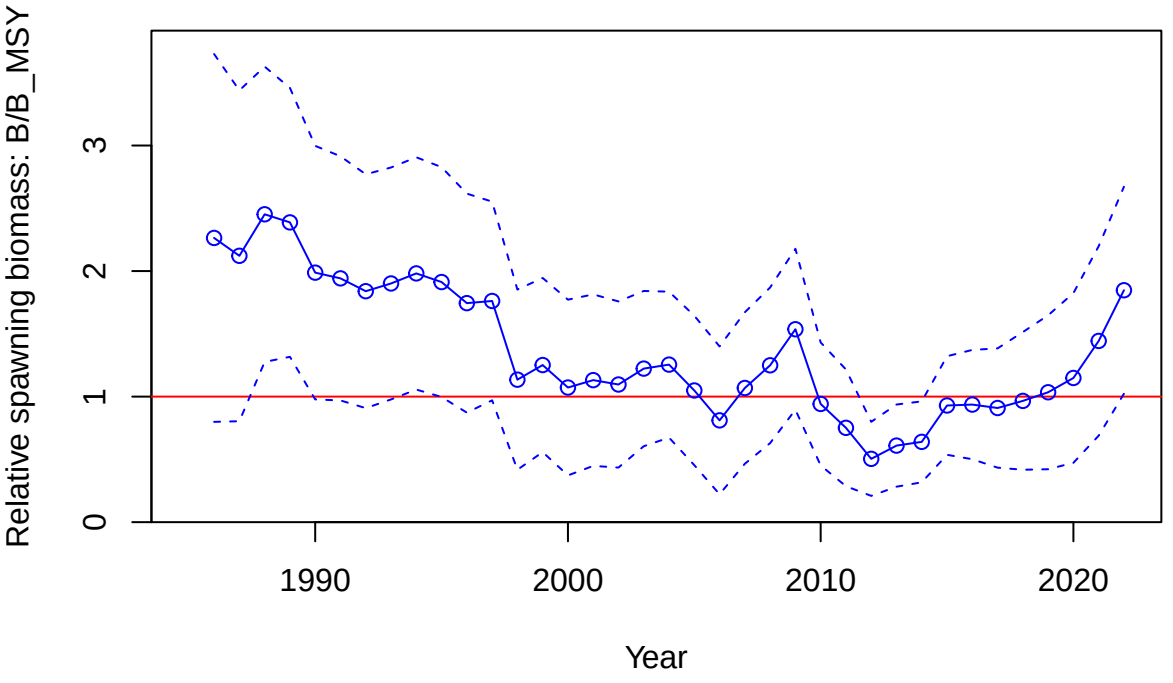

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
20
40
60
80
Length (cm)

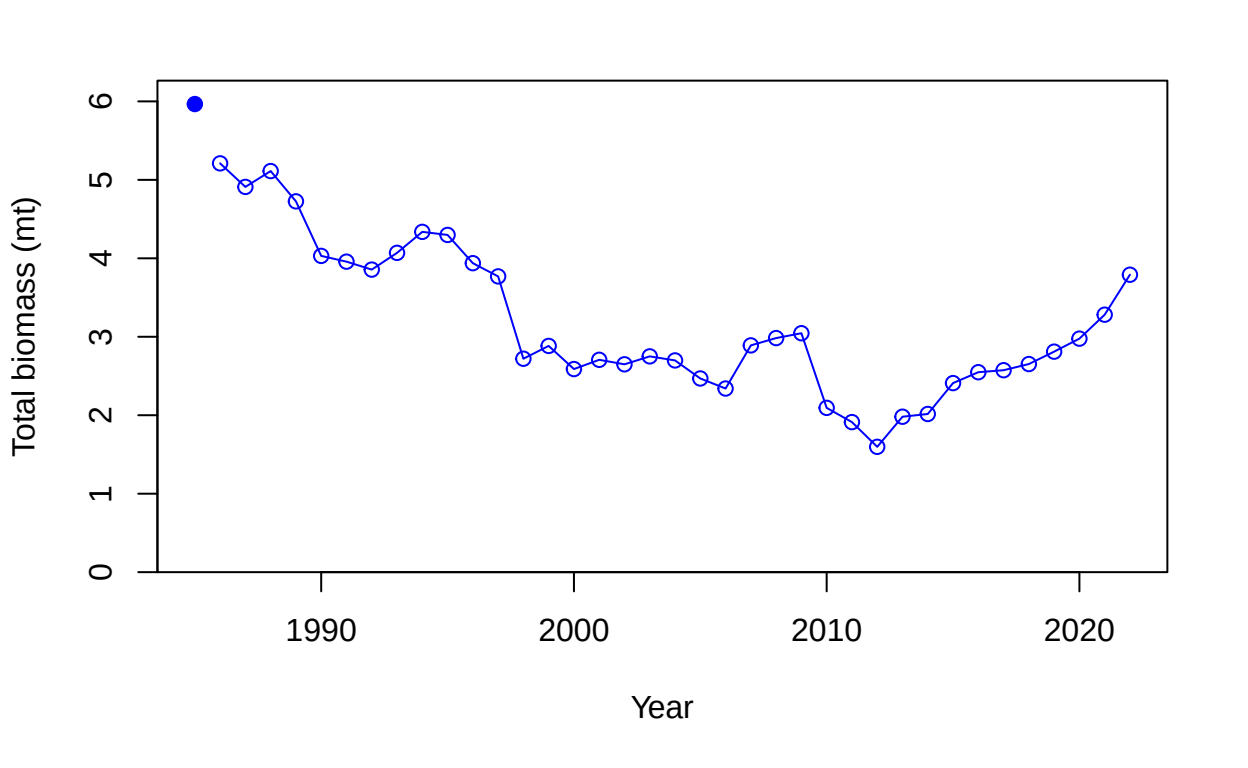

Length (cm)
0
20
40
60
80
0
2
4
6
8
10
12
Age (yr)
0.8
0.6
0.4
0.2

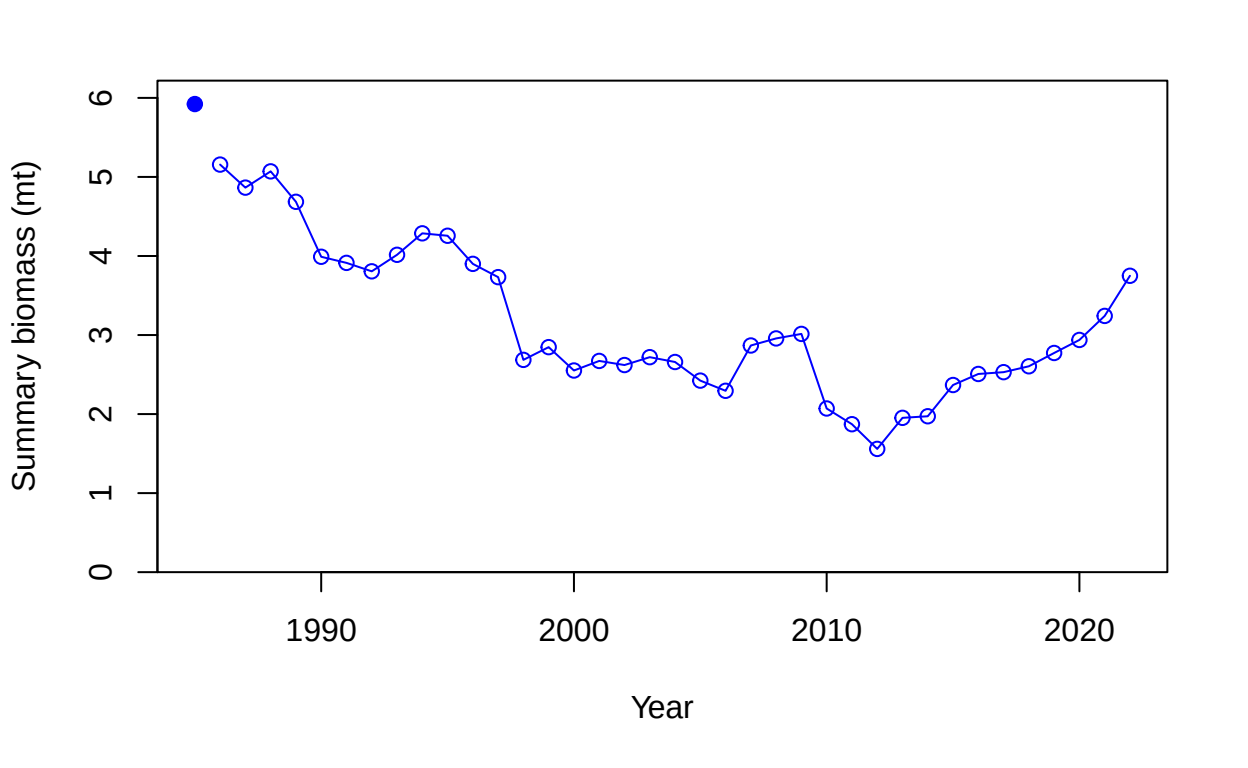

Spawning biomass (mt)
0.0
0.5
1.0
1.5
2.0
1990
2000
2010
2020
Year

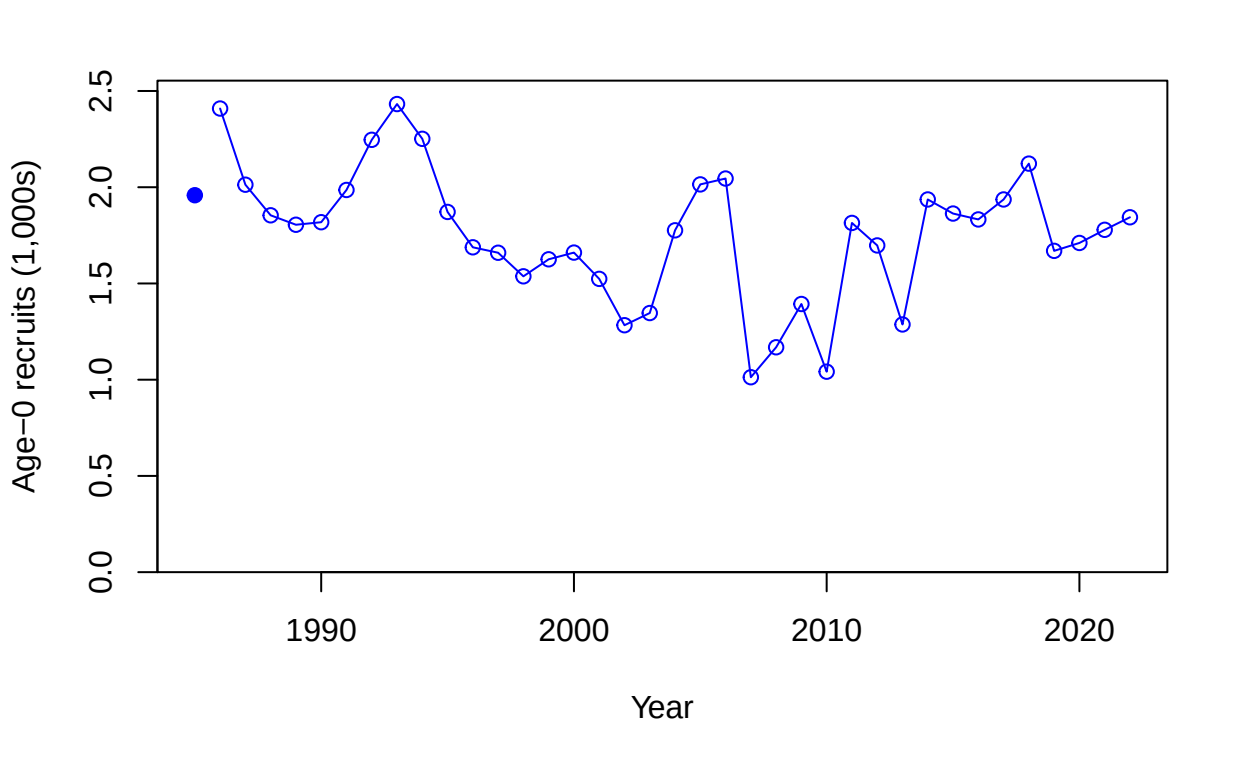

Spawning biomass (mt)
0.0
0.5
1.0
1.5
2.0
2.5
1990
2000
2010
2020
Year

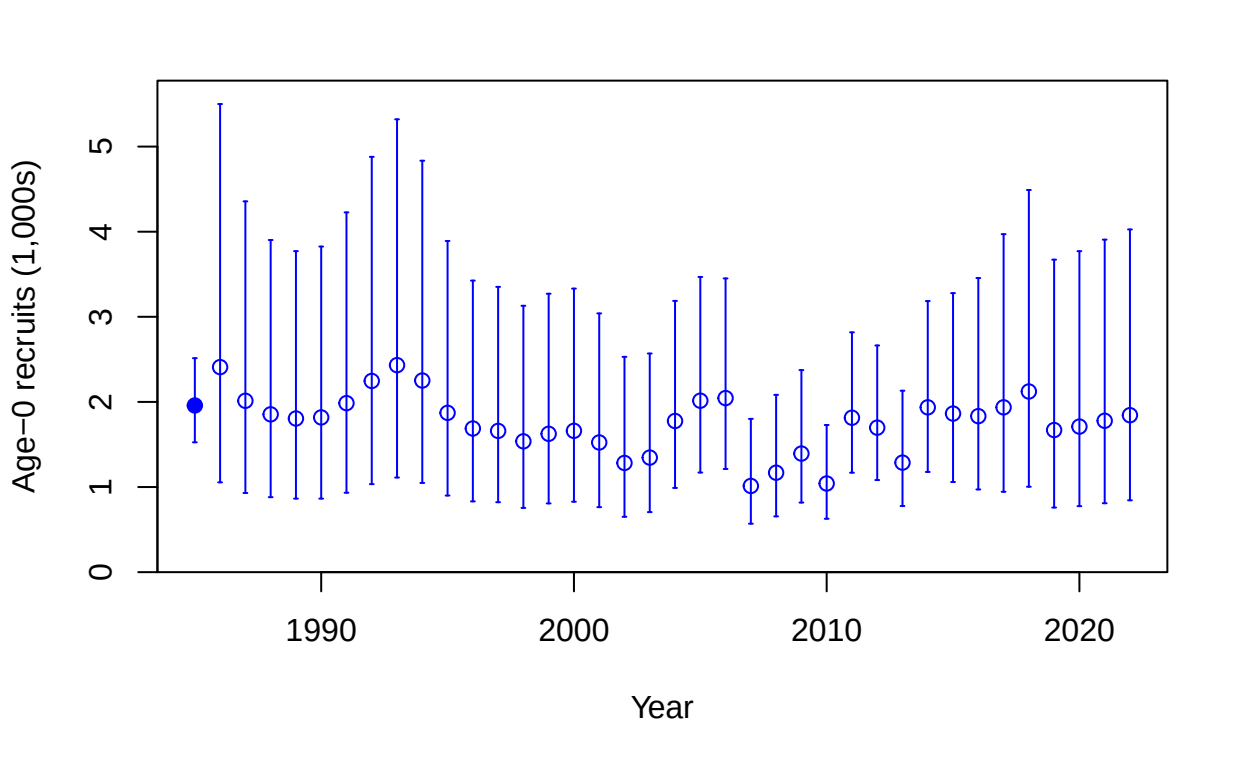

Relative spawning biomass: B/B_MSY
0.0
0.5
1.0
1.5
2.0
2.5
1990
2000
2010
2020
Year

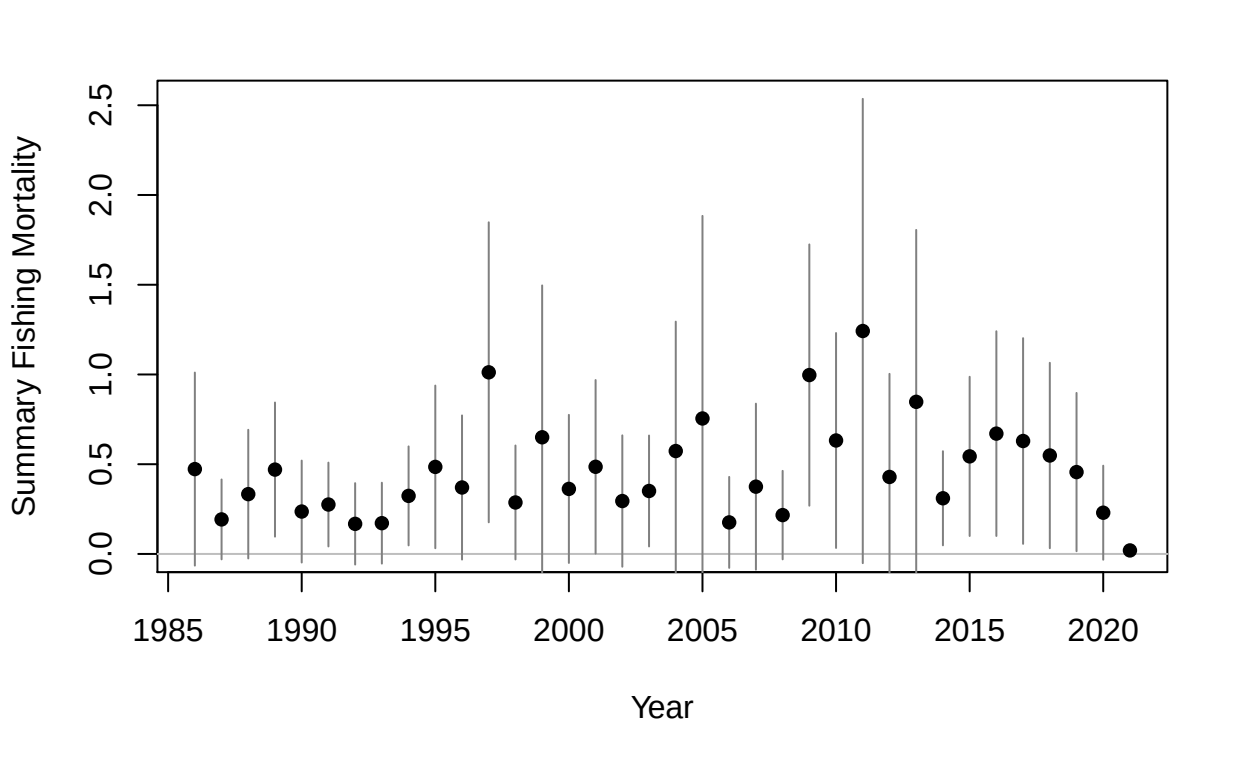

Relative spawning biomass: B/B_MSY
0
1
2
3
1990
2000
2010
2020
Year

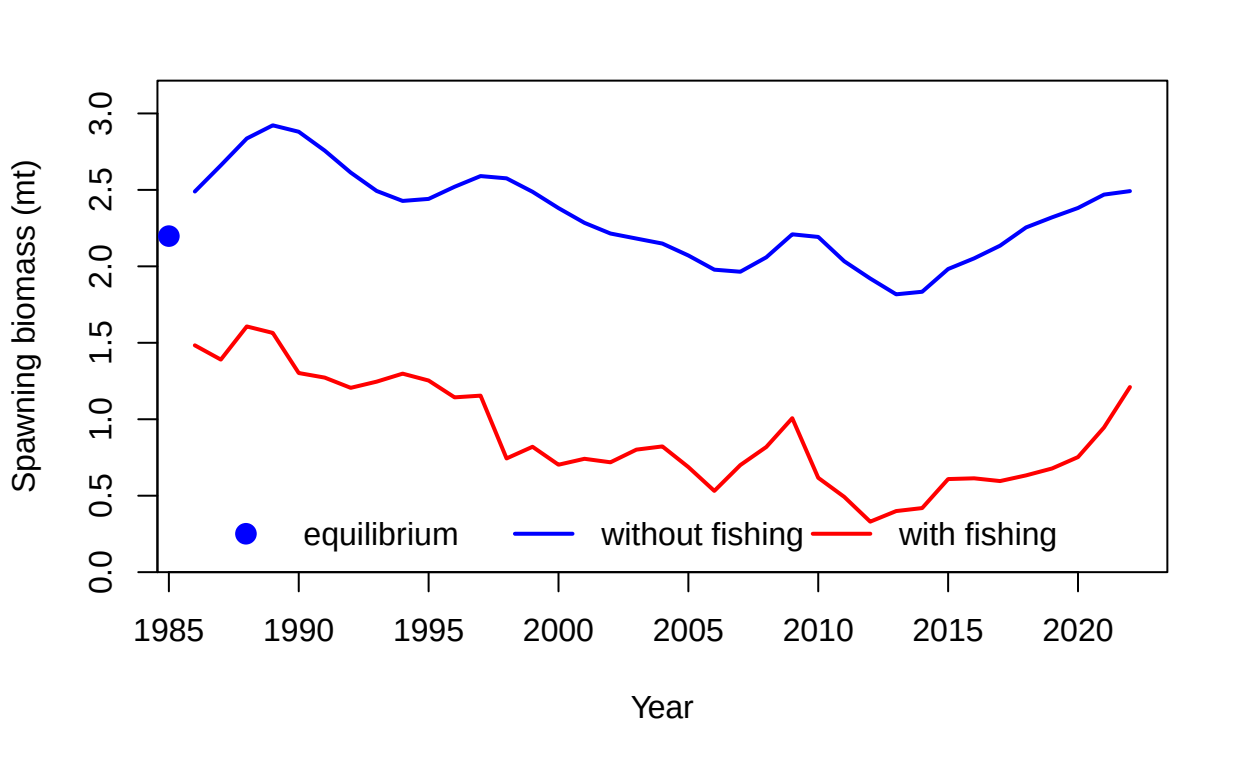

Total biomass (mt)
0
1
2
3
4
5
6
1990
2000
2010
2020
Year

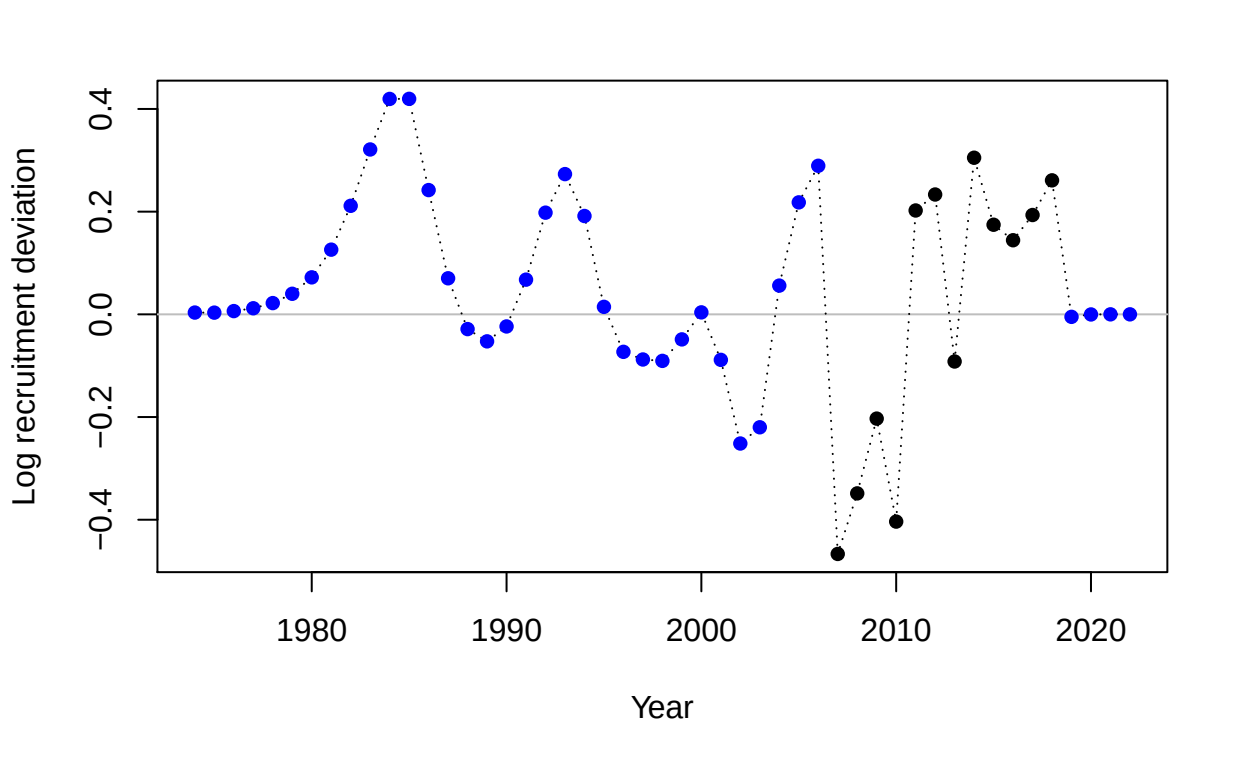

Summary biomass (mt)
0
1
2
3
4
5
6
1990
2000
2010
2020
Year

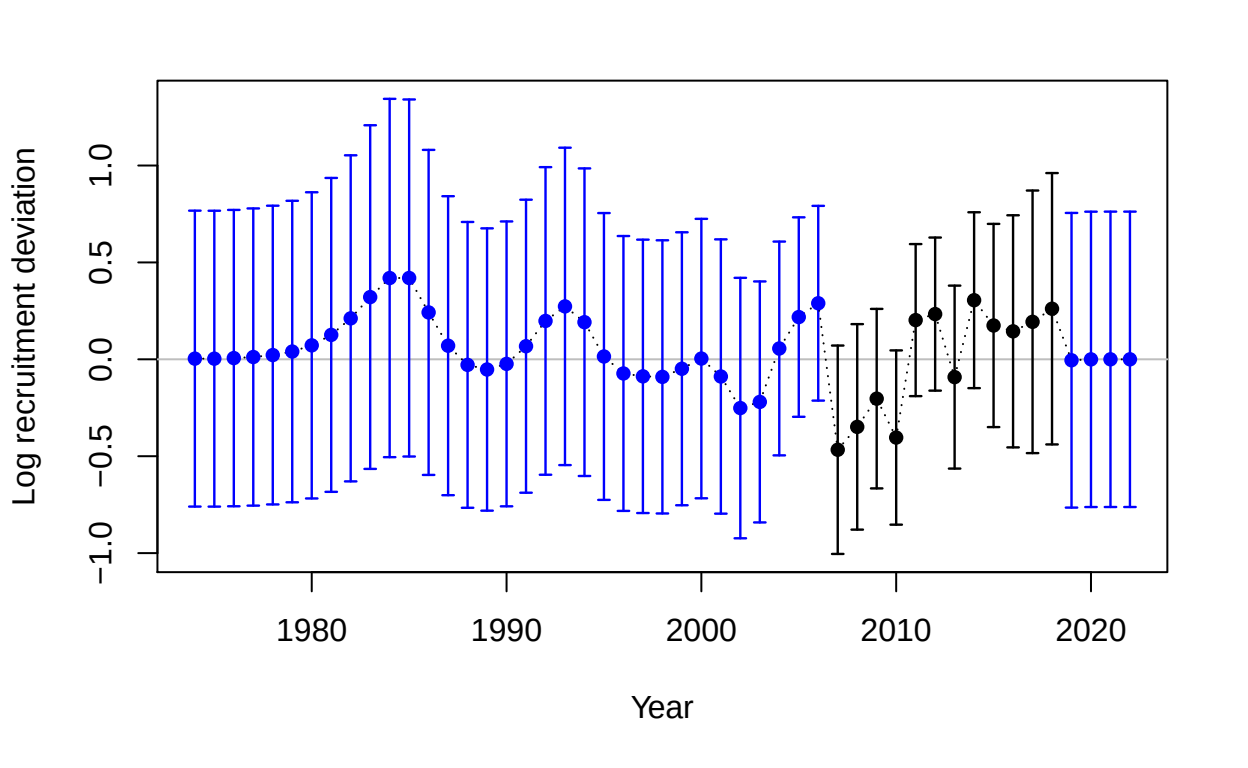

Age−0 recruits (1,000s)
0.0
0.5
1.0
1.5
2.0
2.5
1990
2000
2010
2020
Year

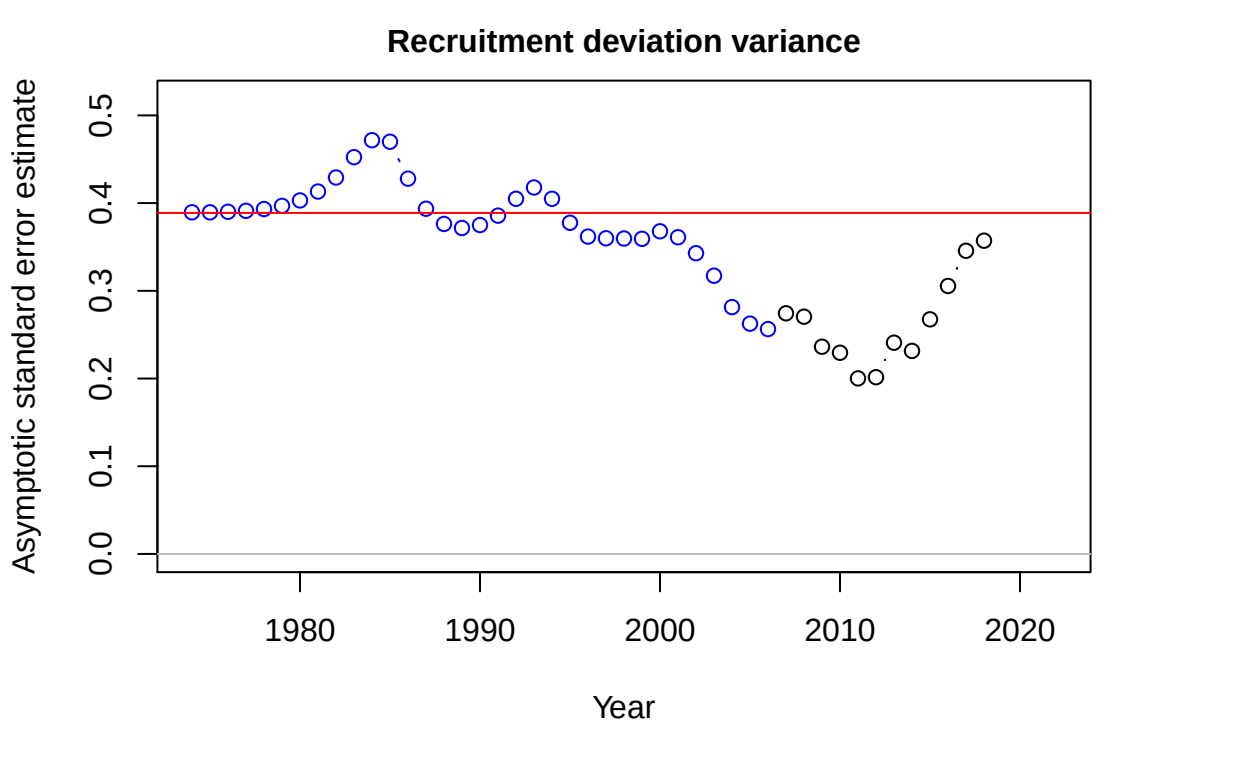

Age−0 recruits (1,000s)
0
1
2
3
4
5
1990
2000
2010
2020
Year

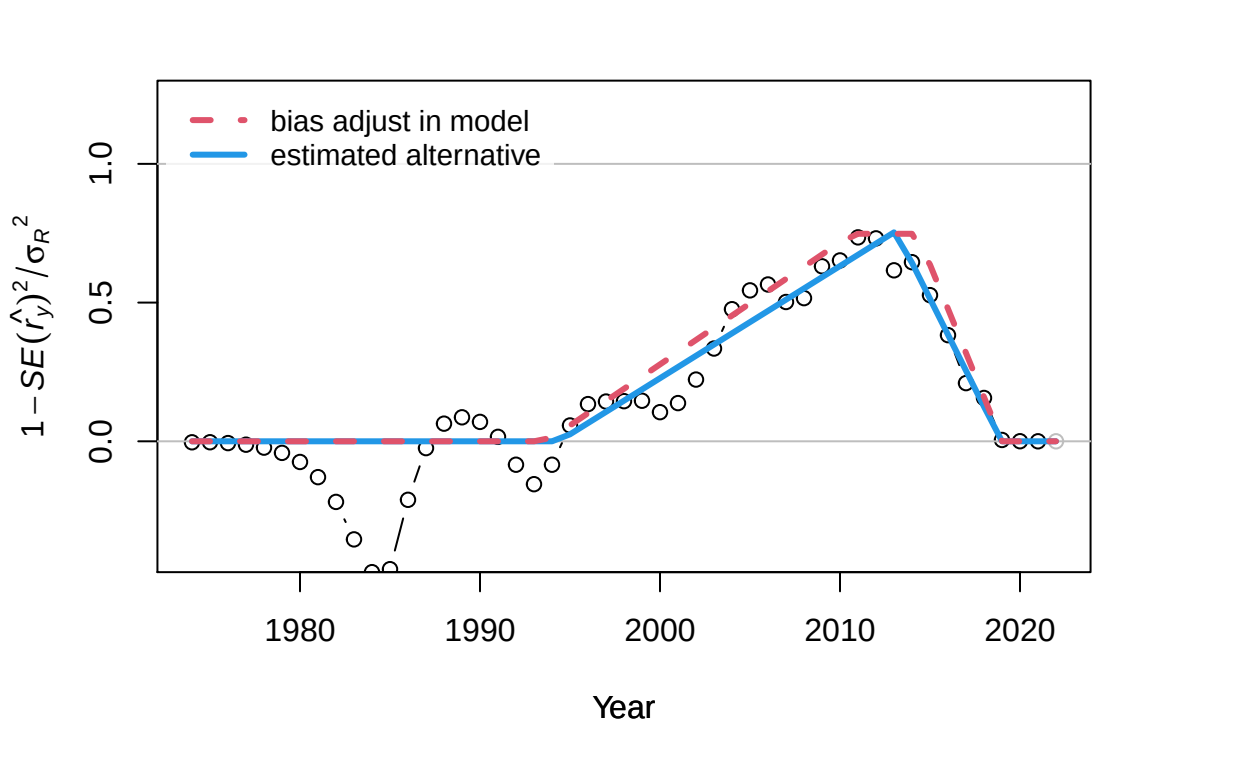

Summary Fishing Mortality
0.0
0.5
1.0
1.5
2.0
2.5
1985
1990
1995
2000
2005
2010
2015
2020
Year

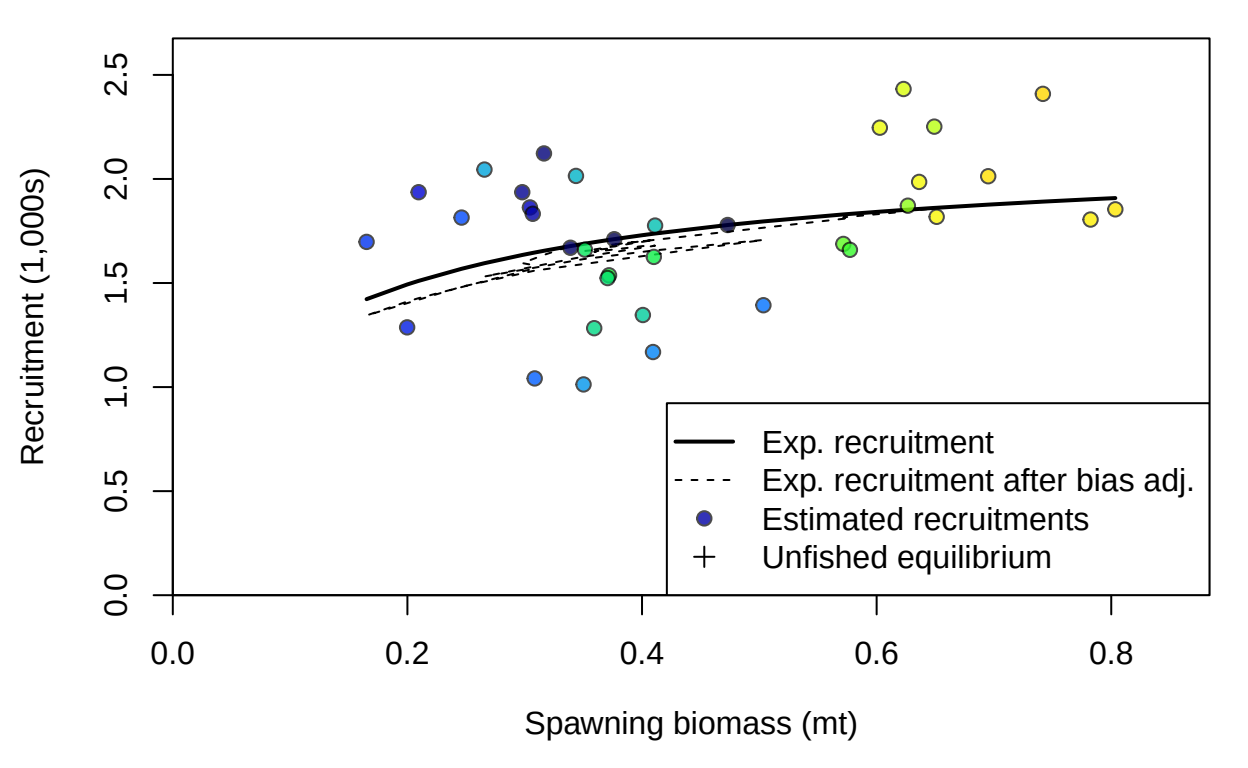

Spawning biomass (mt)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
1985
1990
1995
2000
2005
2010
2015
2020
Year
equilibrium
without fishing
with fishing

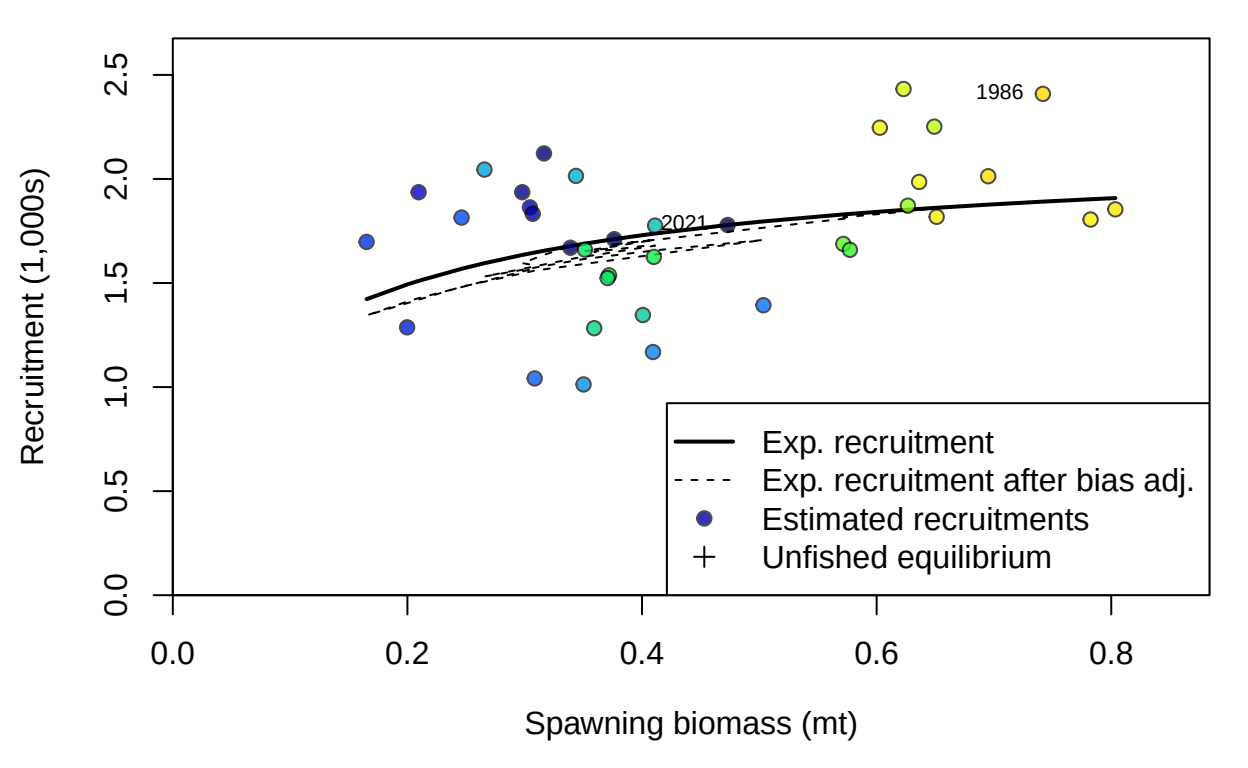

Log recruitment deviation
0.4
0.2
0.0
−0.2
−0.4
1980
1990
2000
2010
2020
Year

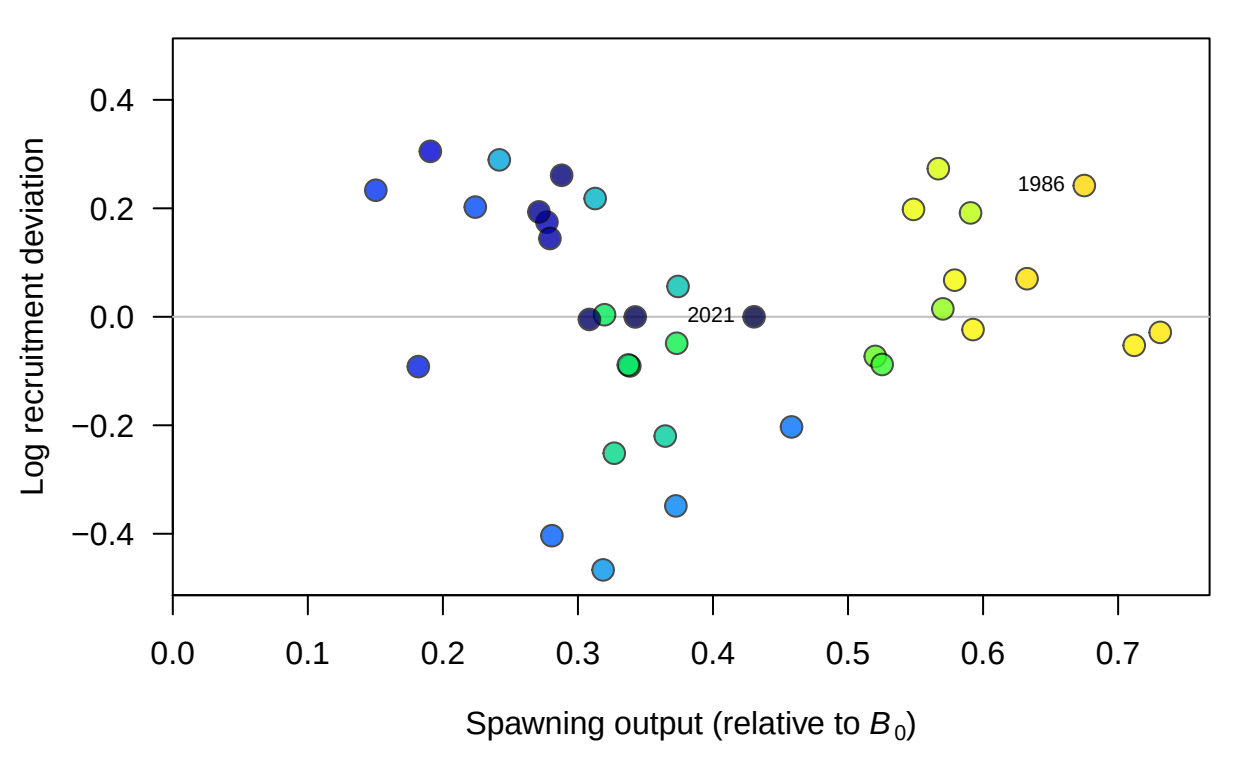

Log recruitment deviation
1.0
0.5
0.0
−0.5
−1.0
1980
1990
2000
2010
2020
Year

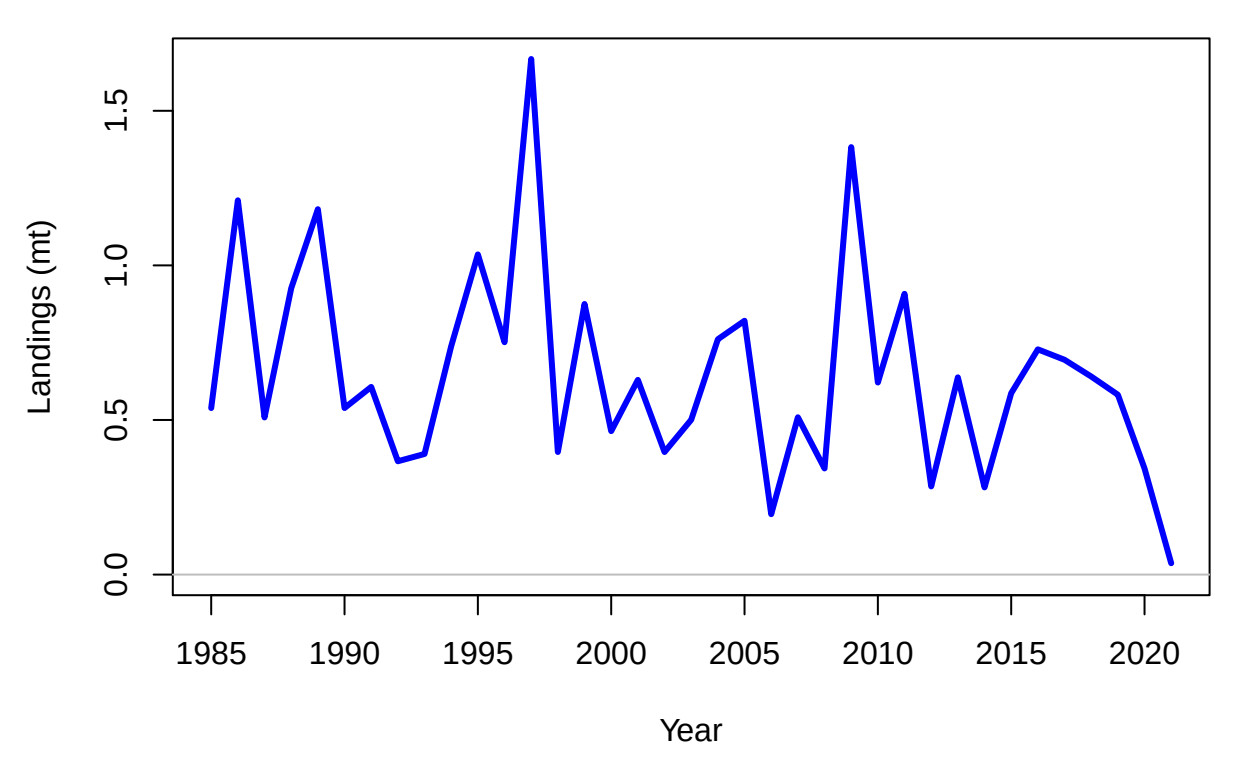

Recruitment deviation variance
Asymptotic standard error estimate
0.0
0.1
0.2
0.3
0.4
0.5
1980
1990
2000
2010
2020
Year

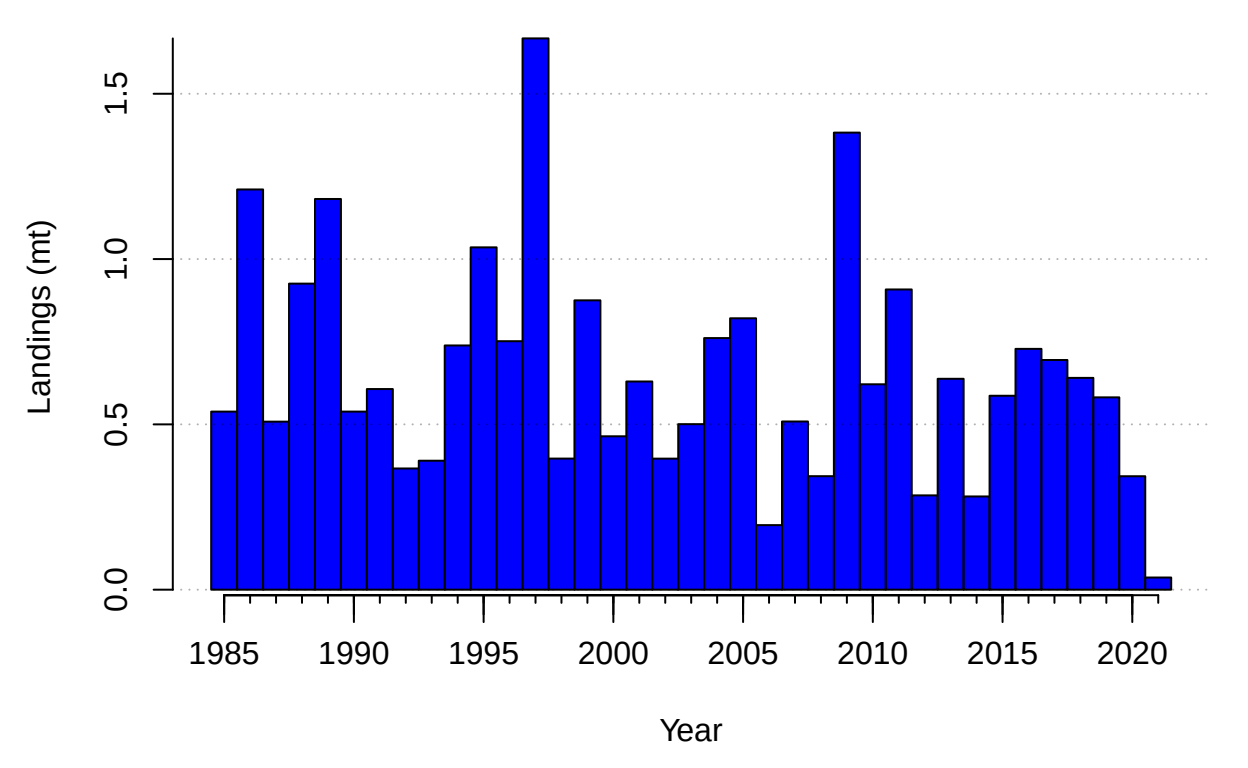

bias adjust in model
estimated alternative
$1 - SE(\hat{r_y})^2/\sigma_R^2$
1.0
0.5
0.0
1980
1990
2000
2010
2020
Year

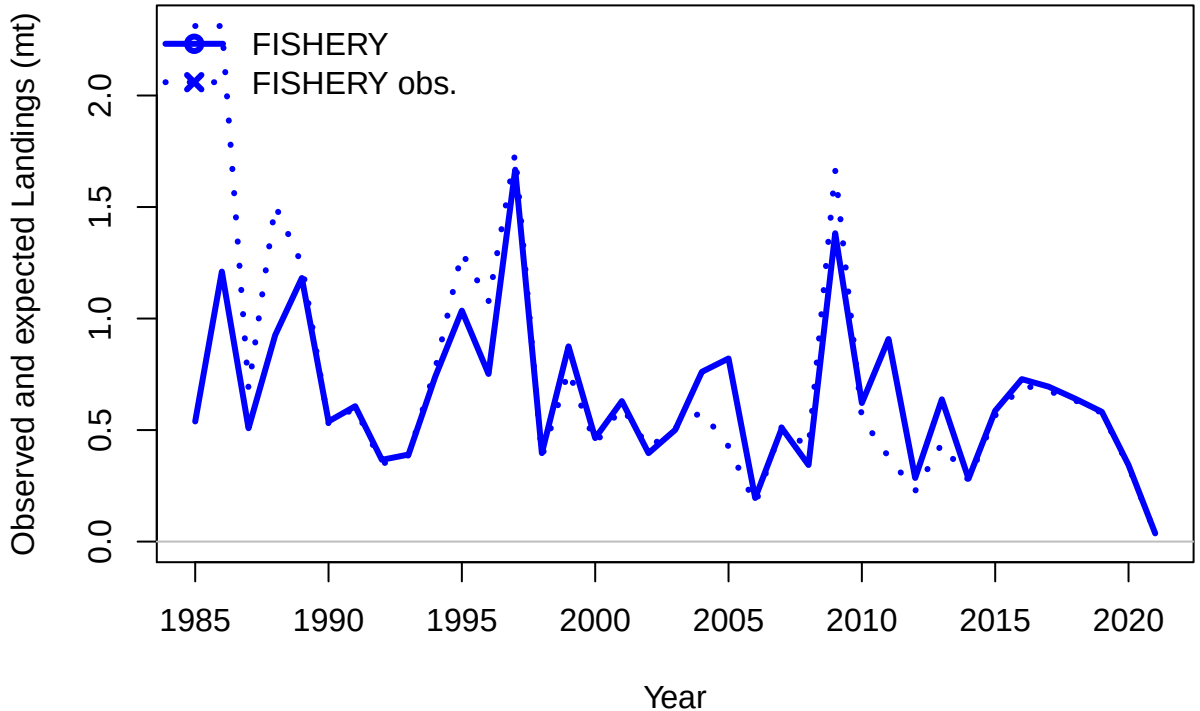

Recruitment (1,000s)
0.0
0.5
1.0
1.5
2.0
2.5
0.0
0.2
0.4
0.6
0.8
Spawning biomass (mt)
Exp. recruitment
Exp. recruitment after bias adj.
Estimated recruitments
Unfished equilibrium

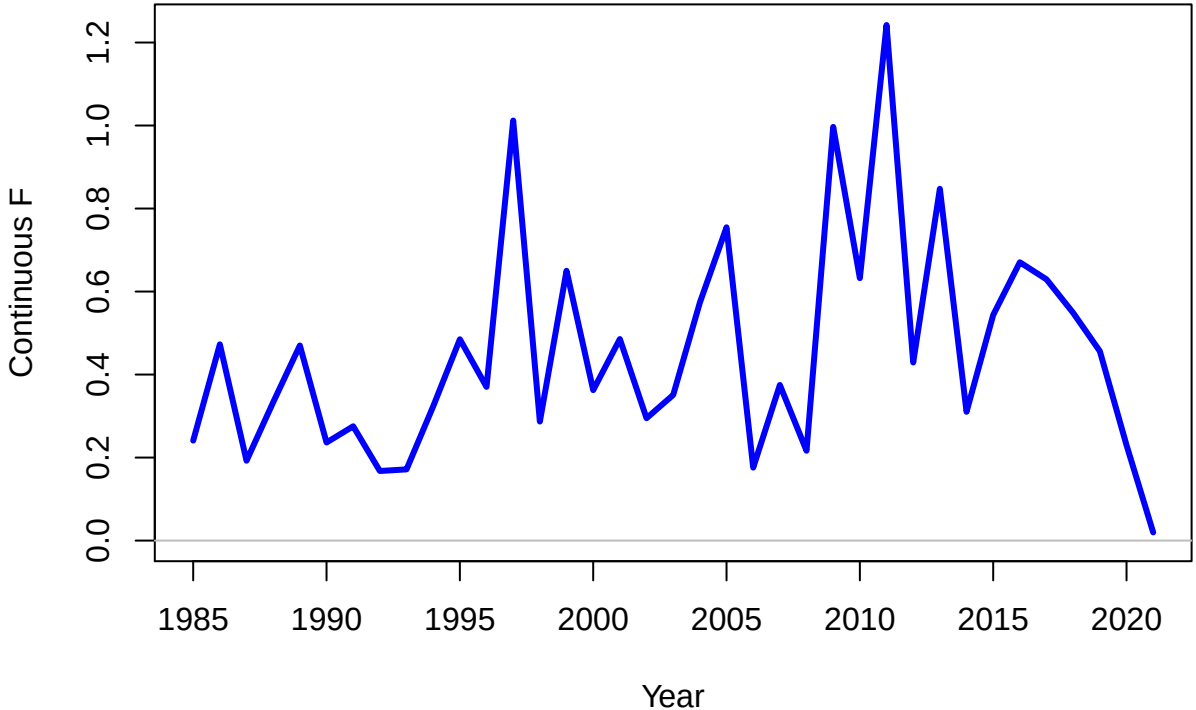

Recruitment (1,000s)
0.0
0.5
1.0
1.5
2.0
2.5
0.0
0.2
0.4
0.6
0.8
Spawning biomass (mt)
1986
2021
Exp. recruitment
Exp. recruitment after bias adj.
Estimated recruitments
Unfished equilibrium

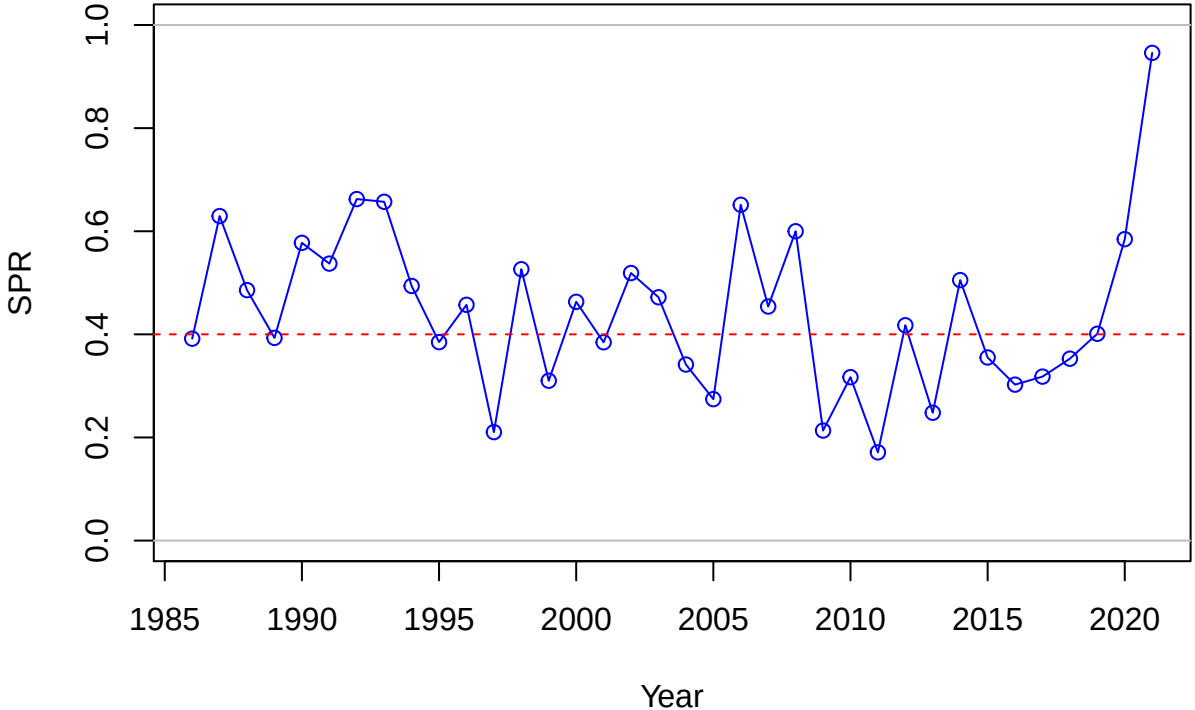

Log recruitment deviation
0.4
0.2
0.0
−0.2
−0.4
1986
2021
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
Spawning output (relative to B_0)

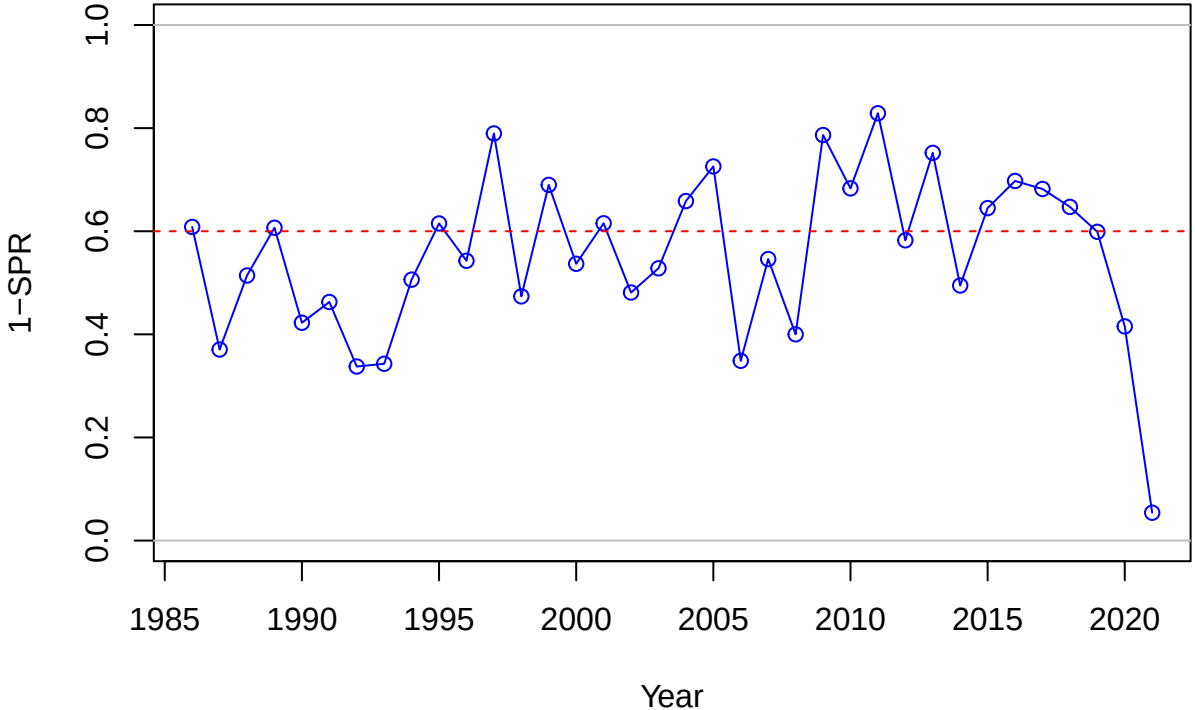

Landings (mt)
0.0
0.5
1.0
1.5
1985
1990
1995
2000
2005
2010
2015
2020
Year

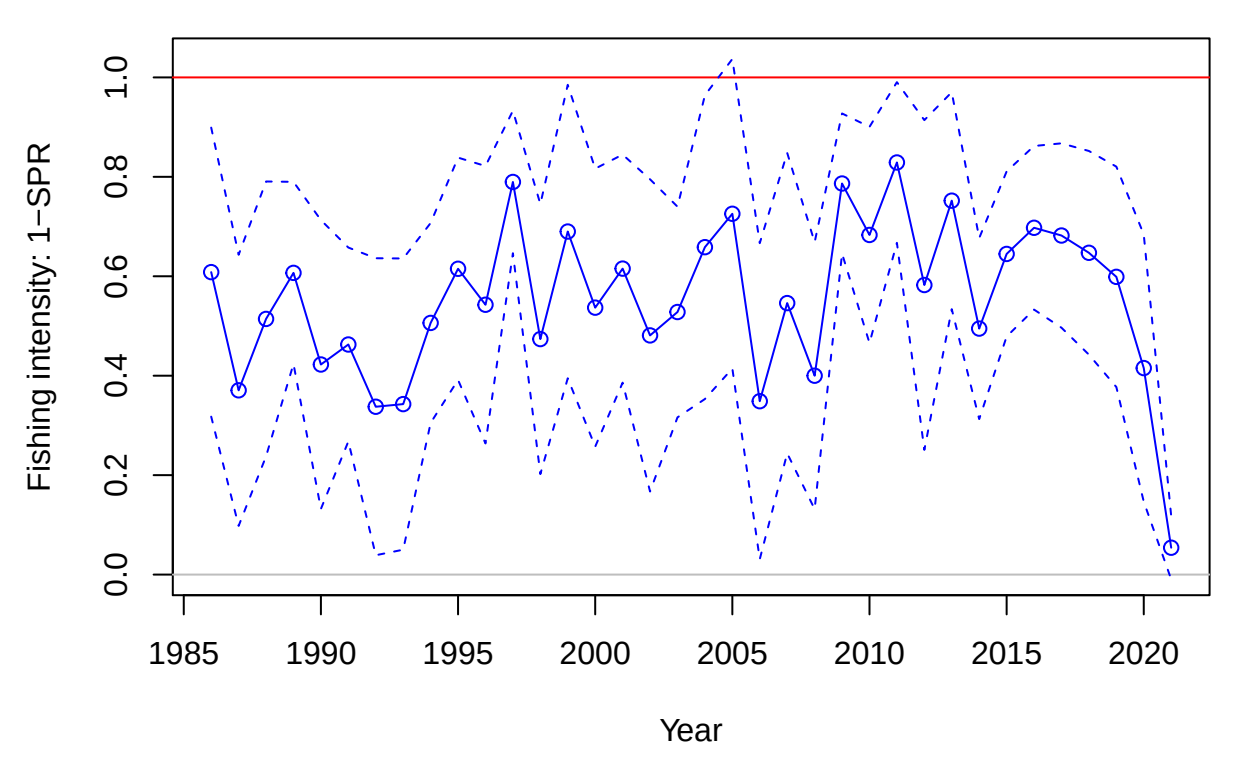

Landings (mt)
0.0
0.5
1.0
1.5
1985
1990
1995
2000
2005
2010
2015
2020
Year

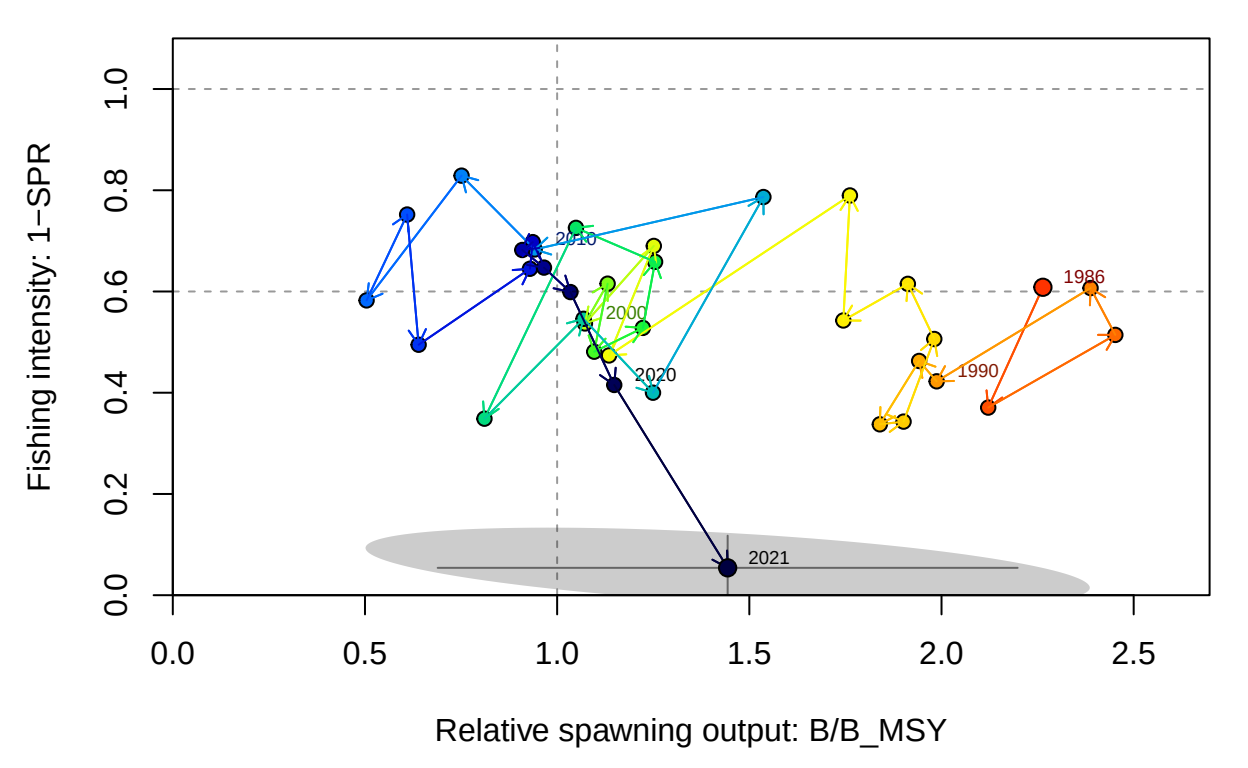

FISHERY
FISHERY obs.
Observed and expected Landings (mt)
0.0
0.5
1.0
1.5
2.0
1985
1990
1995
2000
2005
2010
2015
2020
Year

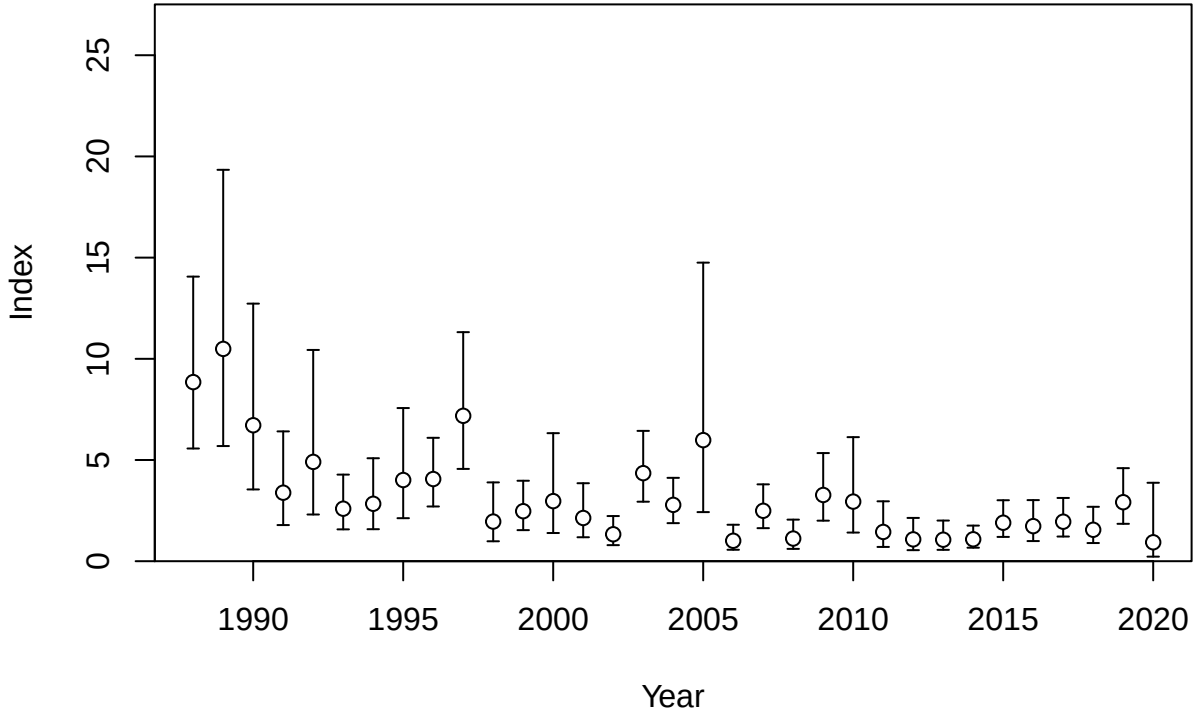

Continuous F
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1985
1990
1995
2000
2005
2010
2015
2020
Year

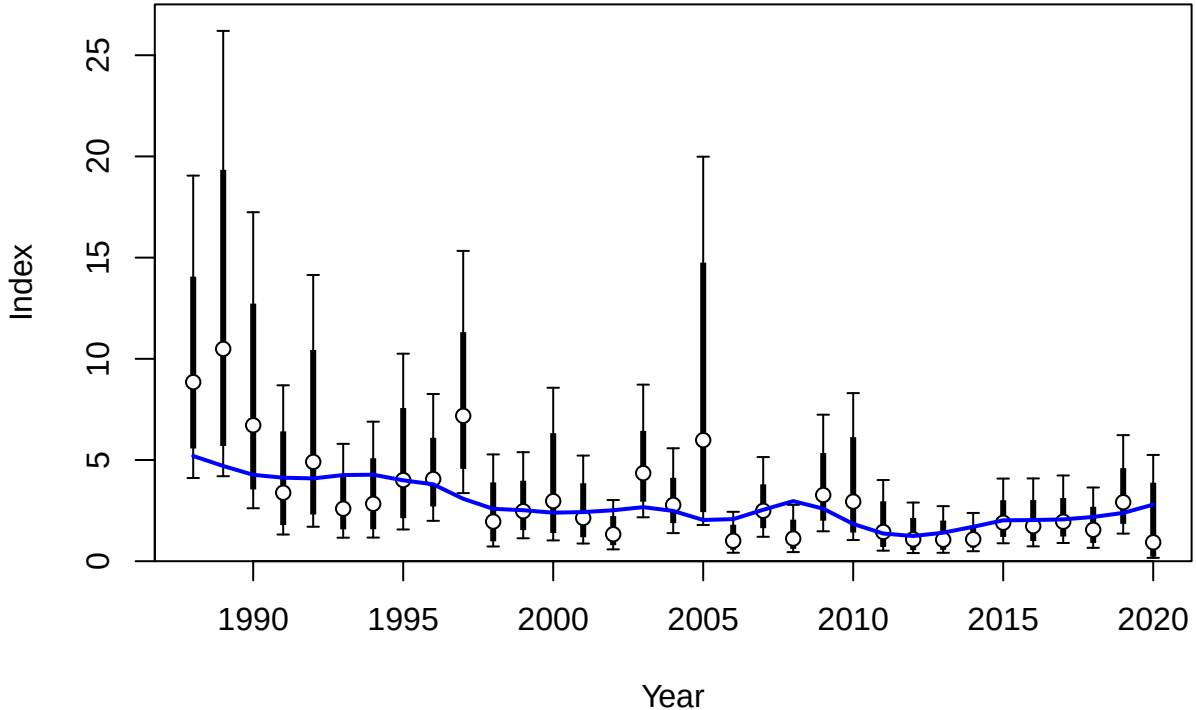

SPR
0.0
0.2
0.4
0.6
0.8
1.0
1985
1990
1995
2000
2005
2010
2015
2020
Year

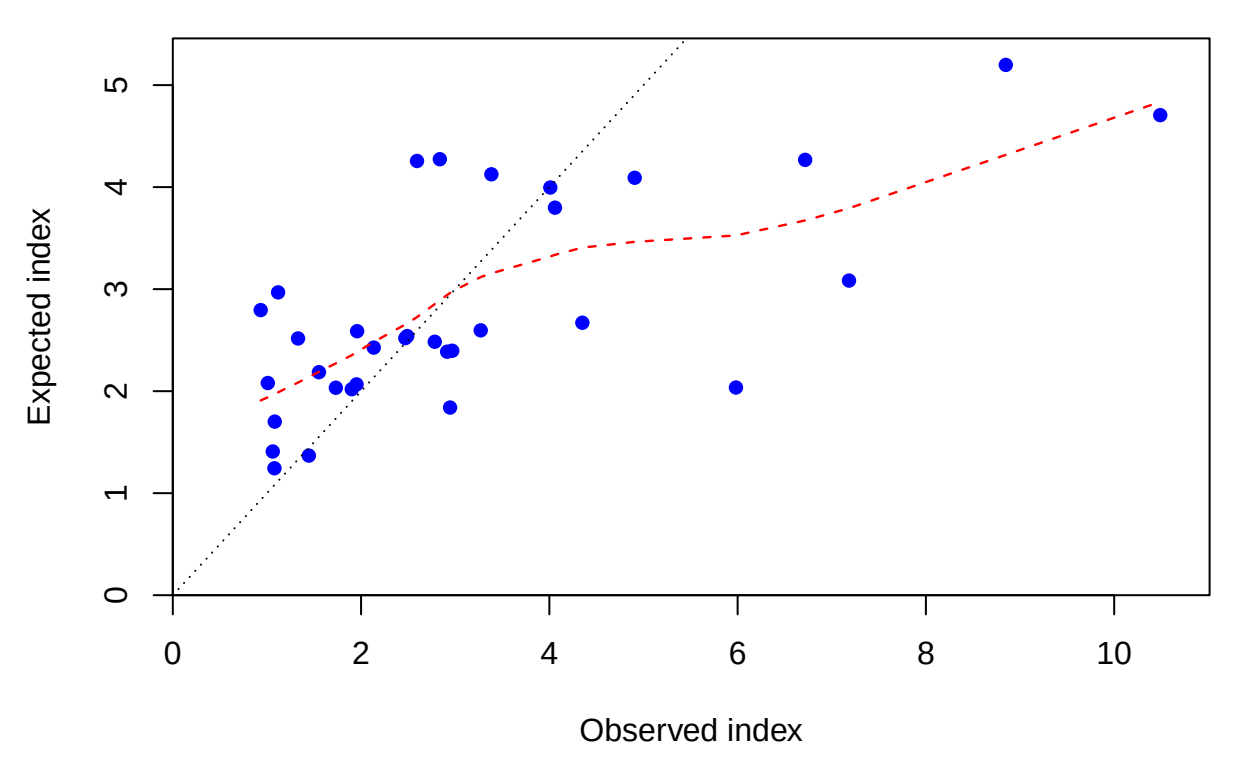

1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
1985
1990
1995
2000
2005
2010
2015
2020
Year

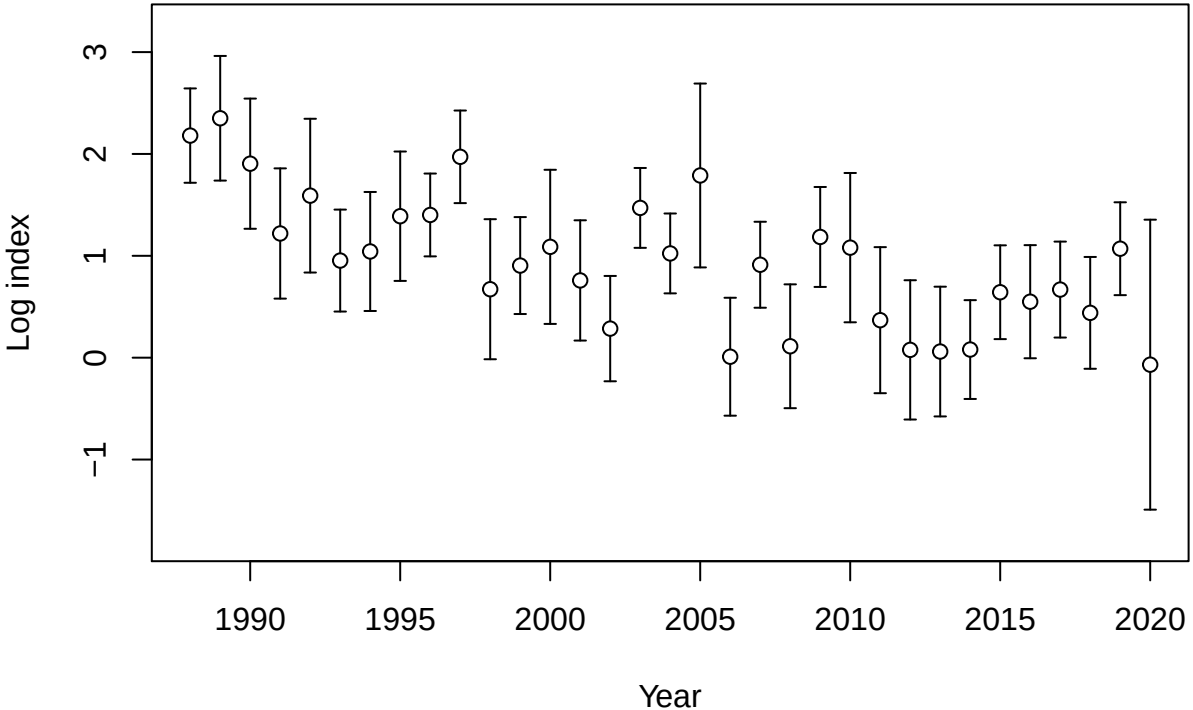

Fishing intensity: 1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
1985
1990
1995
2000
2005
2010
2015
2020
Year

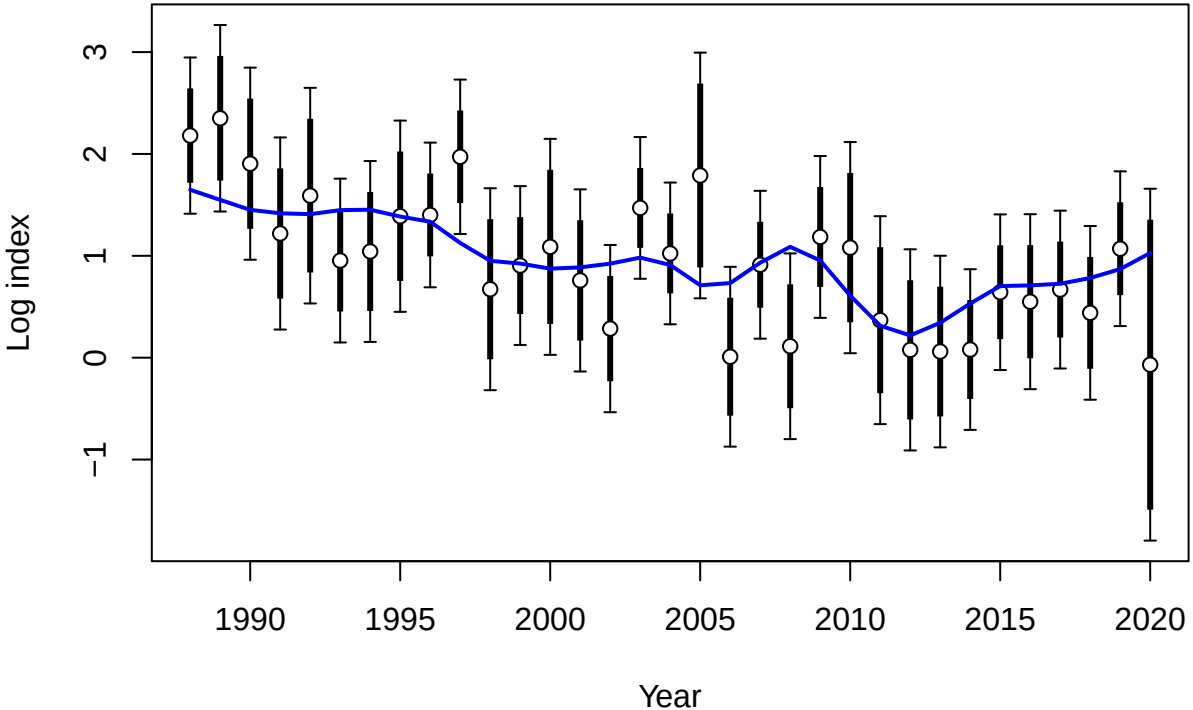

Fishing intensity: 1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
0.0
0.5
1.0
1.5
2.0
2.5
Relative spawning output: B/B_MSY
1986
1990
2000
2010
2020
2021

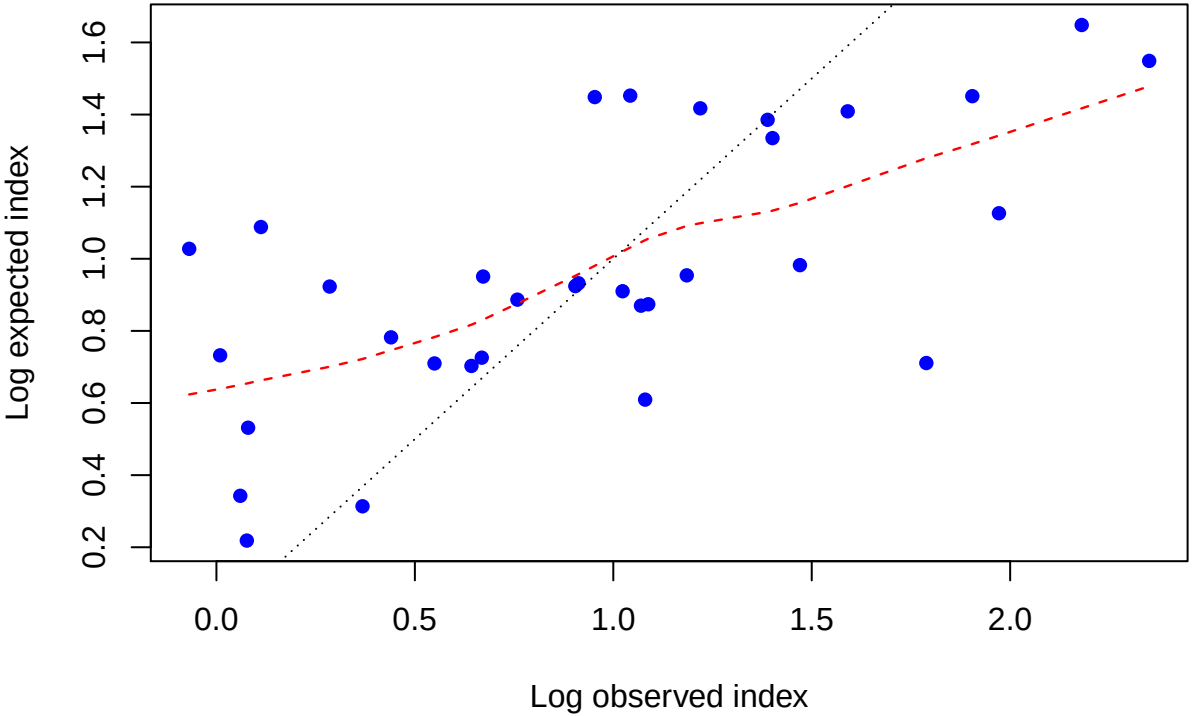

Index
0
5
10
15
20
25
1990
1995
2000
2005
2010
2015
2020
Year

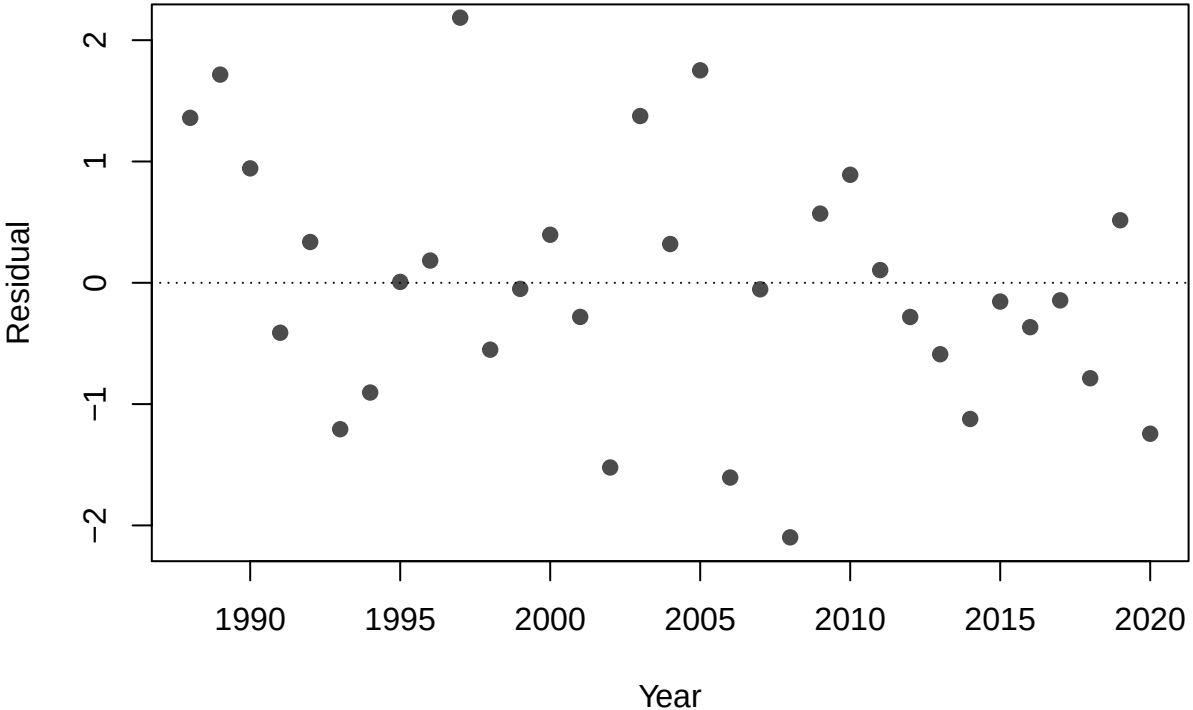

Index
0
5
10
15
20
25
1990
1995
2000
2005
2010
2015
2020
Year

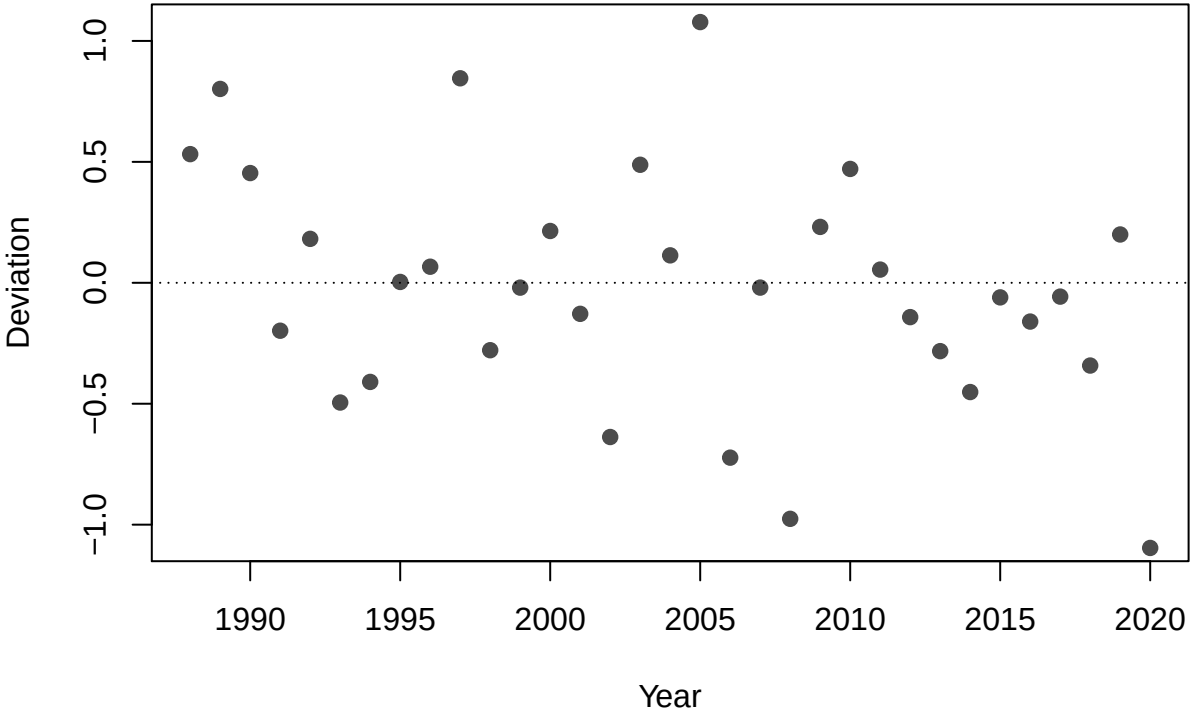

Expected index
Observed index
0
1
2
3
4
5
0
2
4
6
8
10

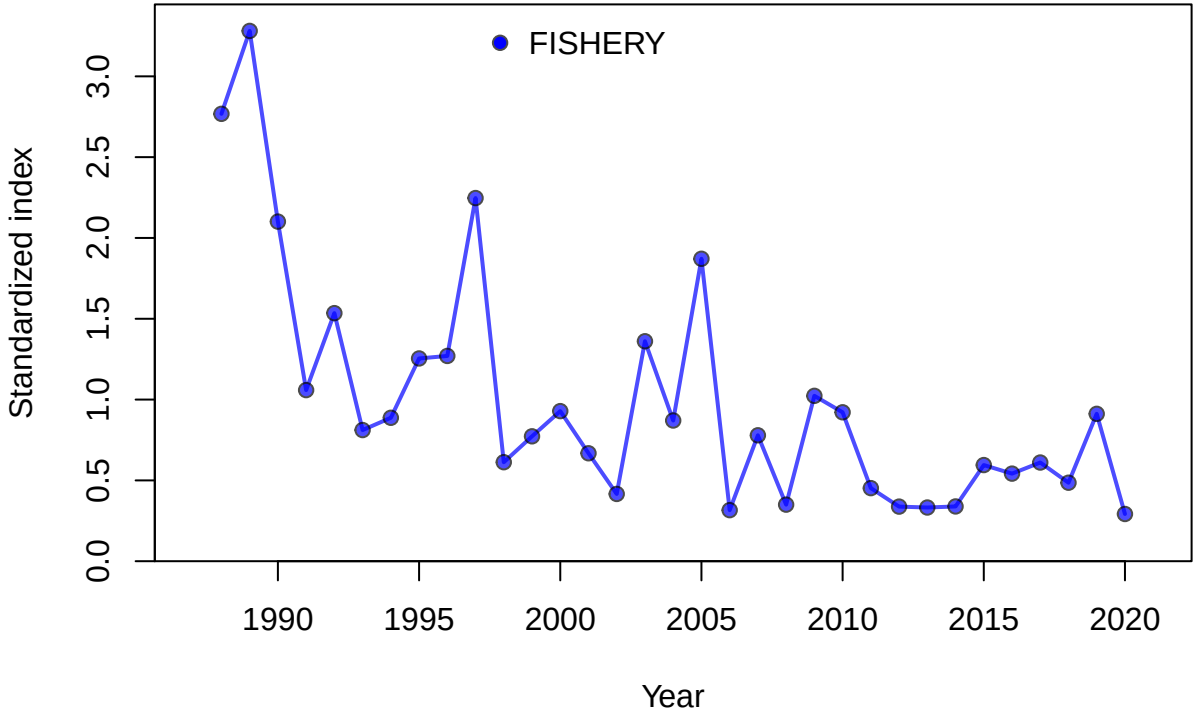

Log index
3
2
1
0
−1
1990
1995
2000
2005
2010
2015
2020
Year

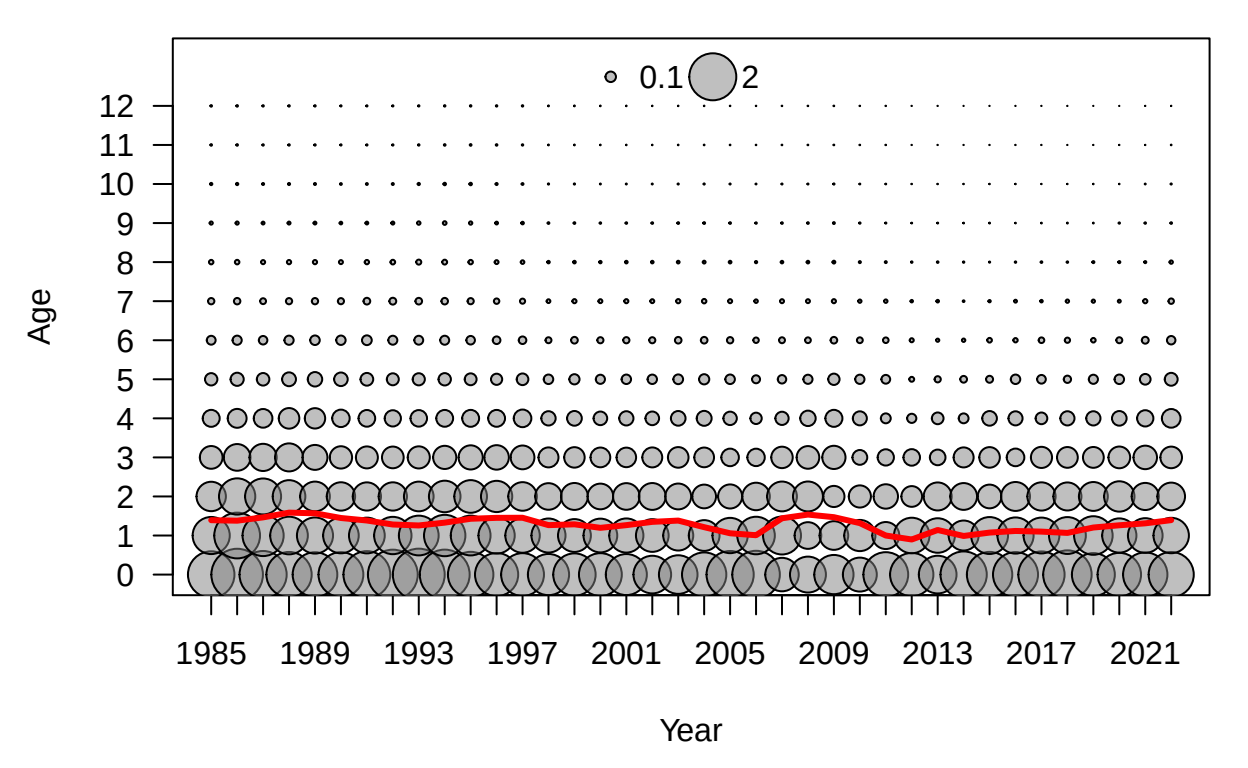

Log index
3
2
1
0
−1
1990
1995
2000
2005
2010
2015
2020
Year

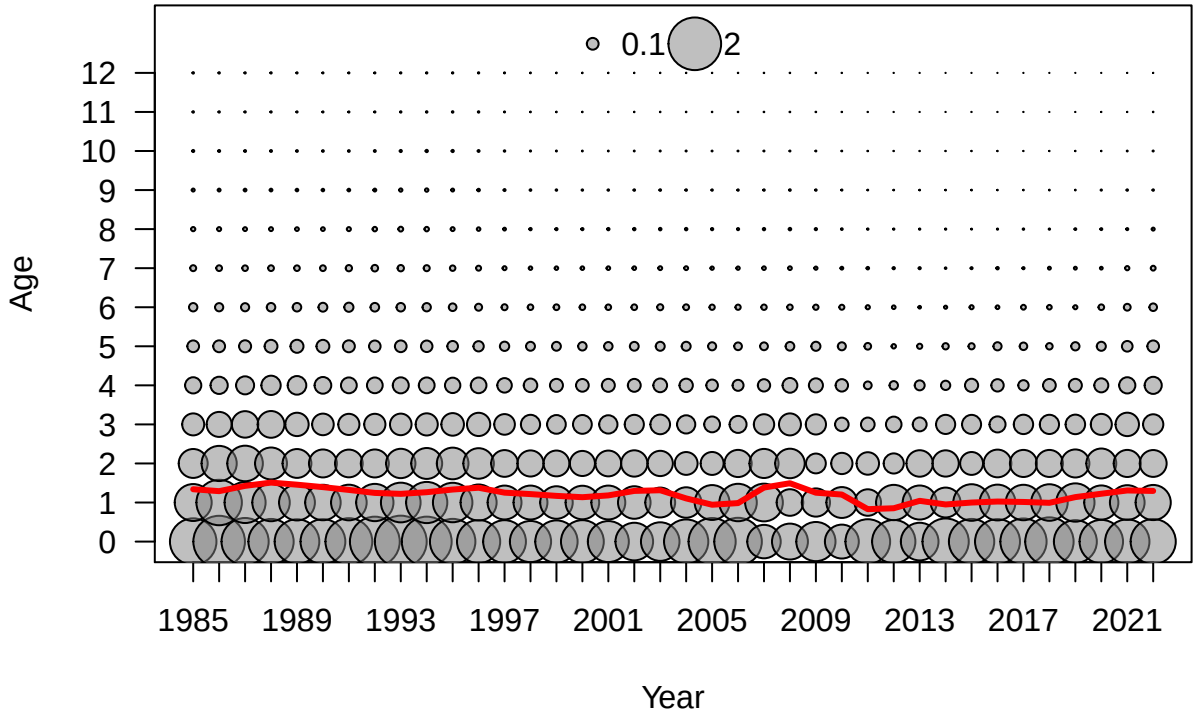

Log expected index
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
0.0
0.5
1.0
1.5
2.0
Log observed index

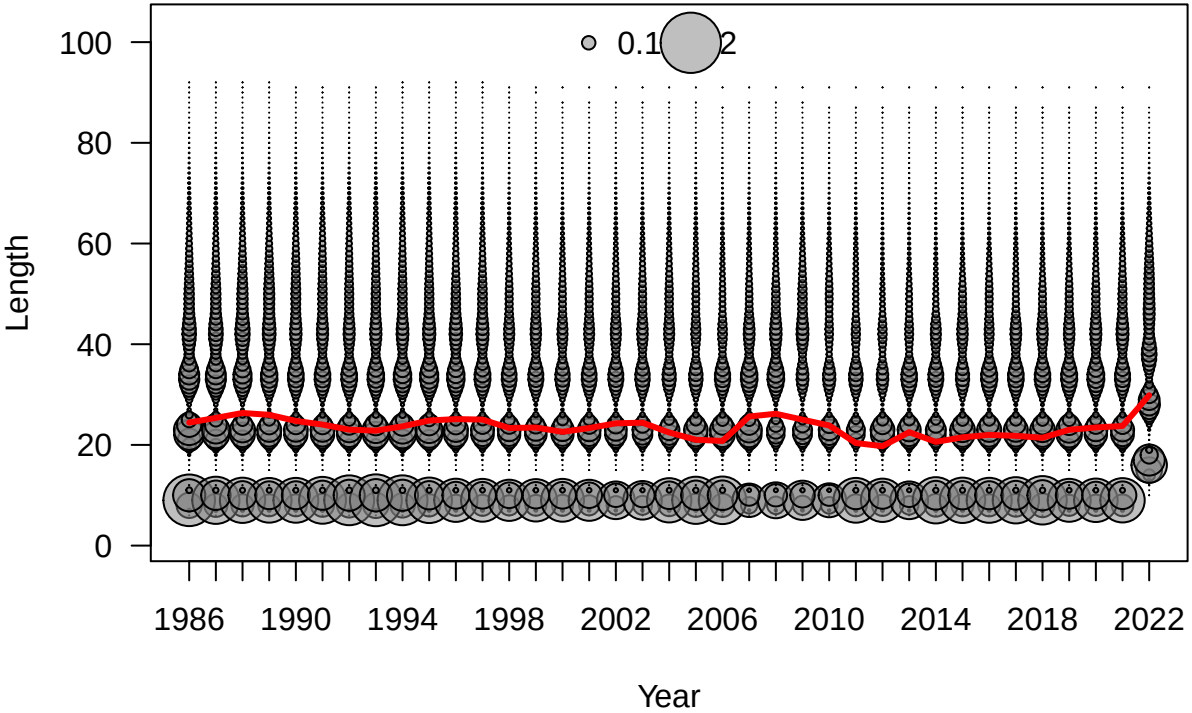

Residual
2
1
0
−1
−2
1990
1995
2000
2005
2010
2015
2020
Year

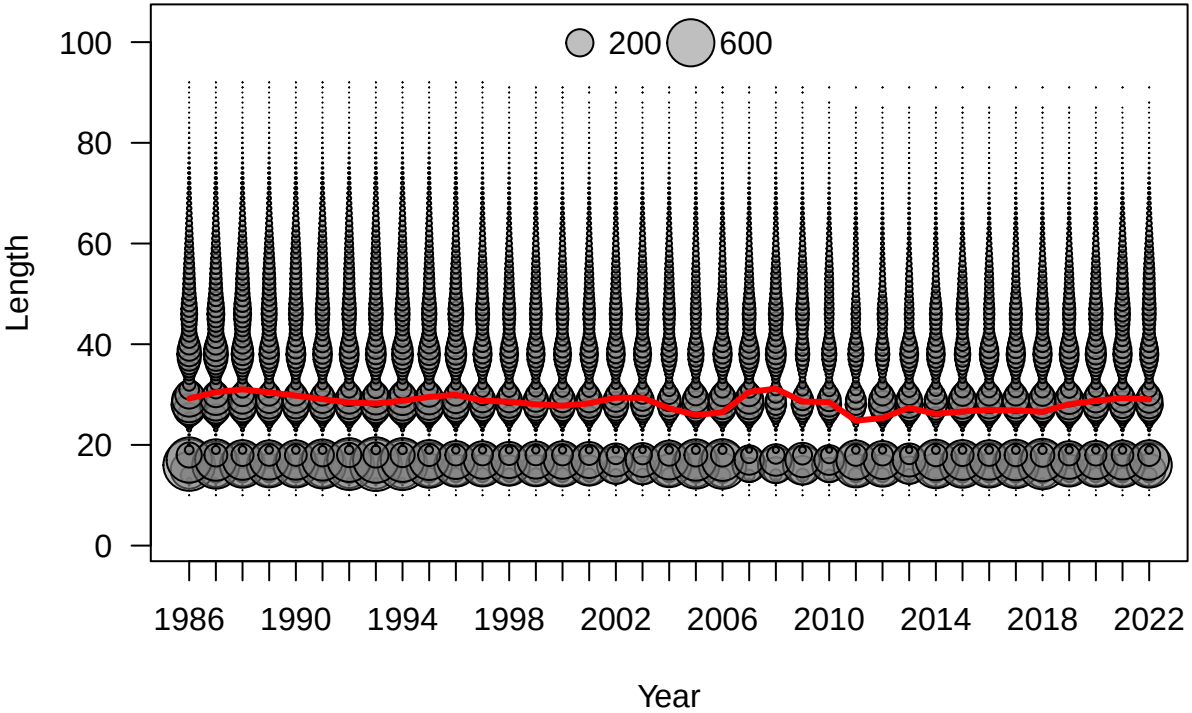

Deviation
1.0
0.5
0.0
−0.5
−1.0
1990
1995
2000
2005
2010
2015
2020
Year

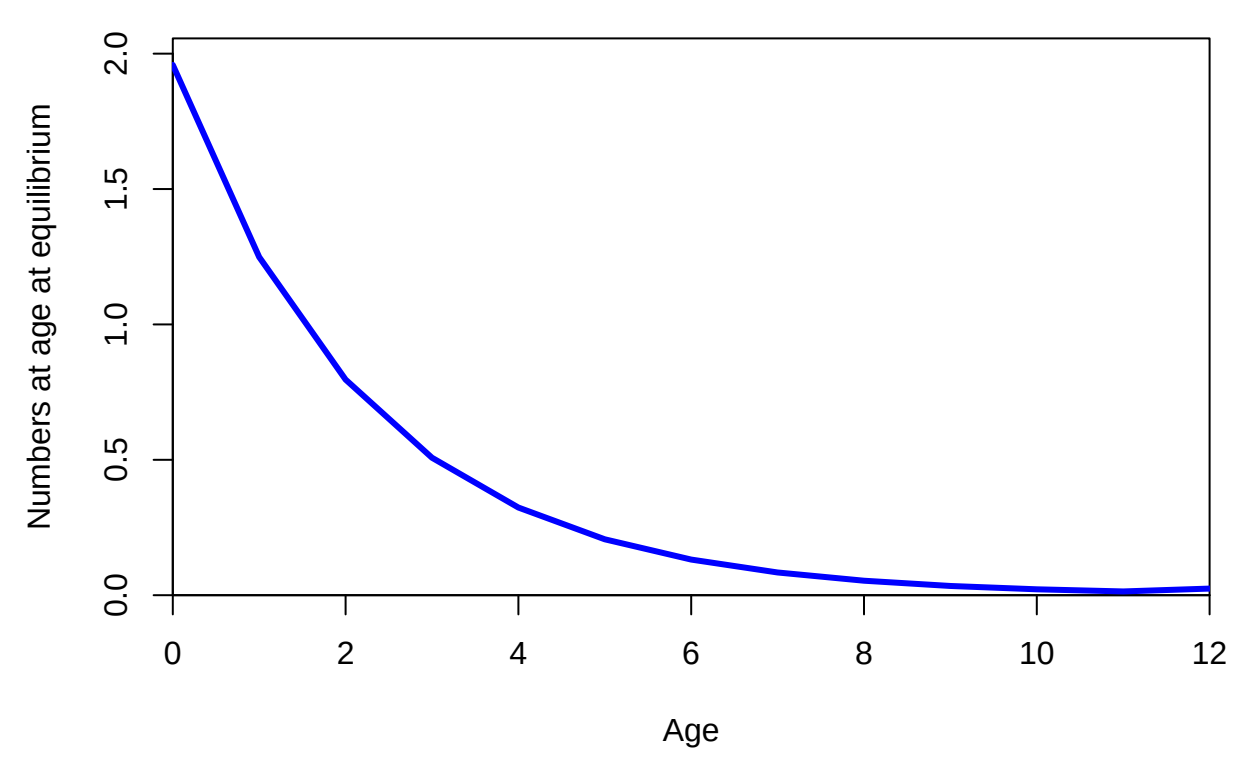

FISHERY
Standardized index
0.0
0.5
1.0
1.5
2.0
2.5
3.0
1990
1995
2000
2005
2010
2015
2020
Year

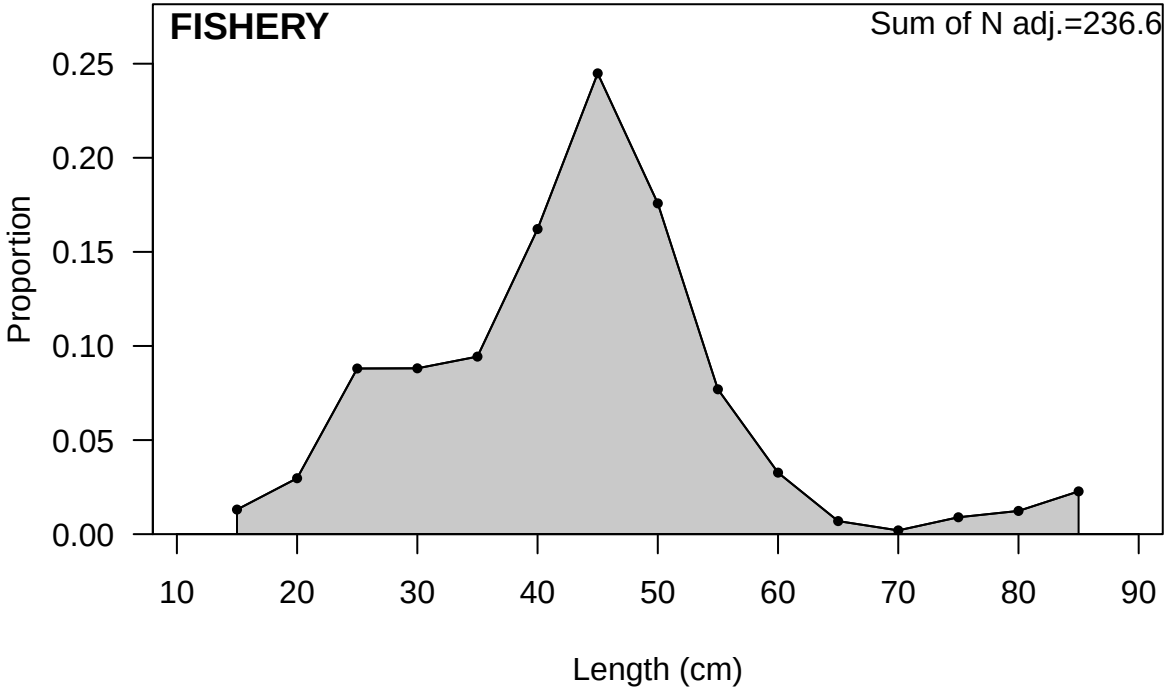

0.1
2
Age
12
11
10
9
8
7
6
5
4
3
2
1
0
1985
1989
1993
1997
2001
2005
2009
2013
2017
2021
Year

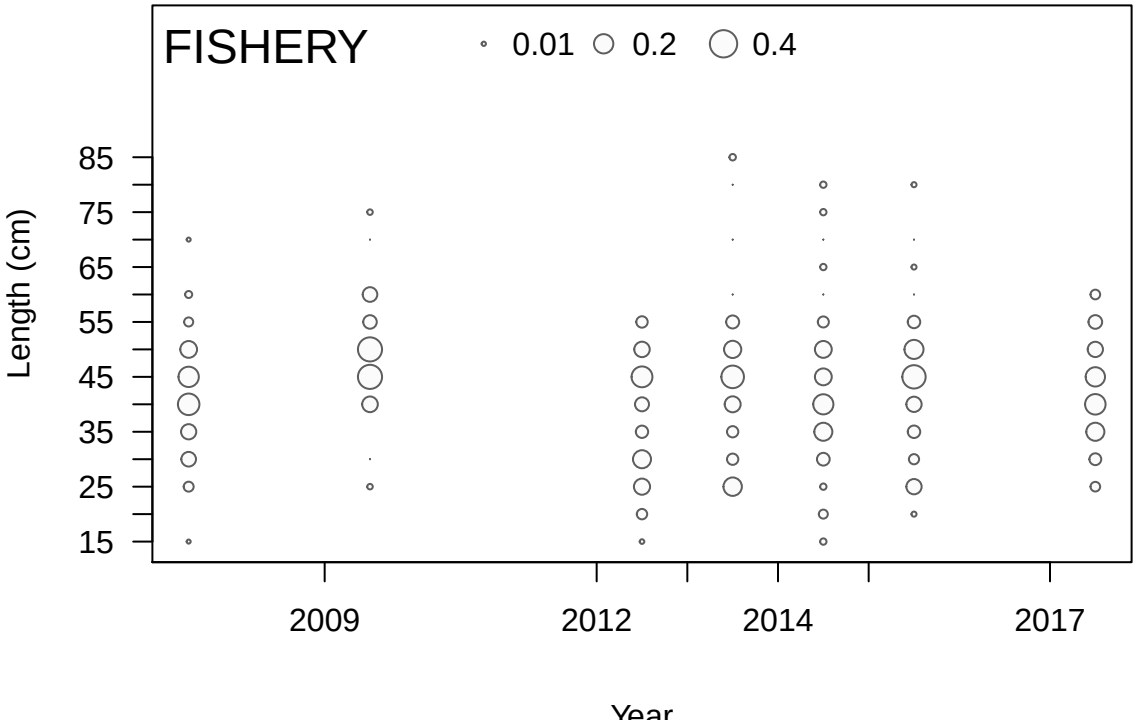

0.1
2
Age
12
11
10
9
8
7
6
5
4
3
2
1
0
1985
1989
1993
1997
2001
2005
2009
2013
2017
2021
Year

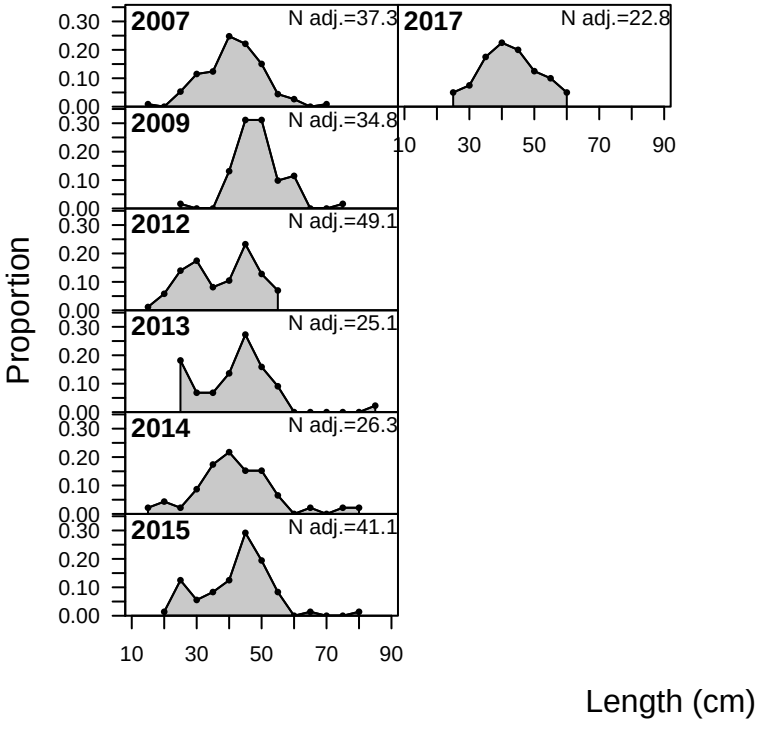

0.1
2
100
80
60
40
20
0
Length
1986
1990
1994
1998
2002
2006
2010
2014
2018
2022
Year

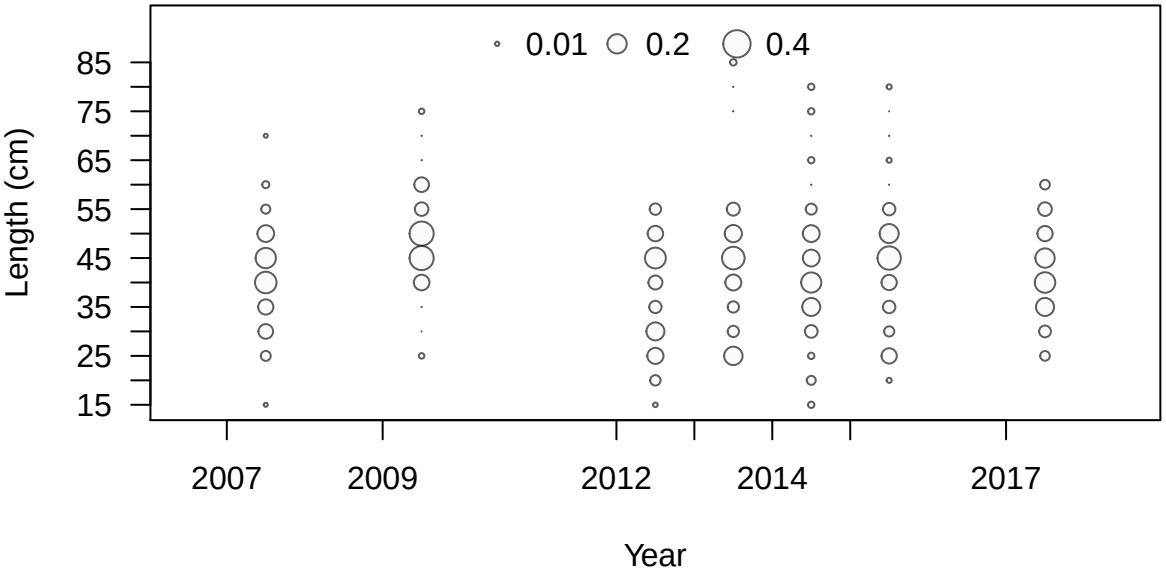

200
600
100
80
60
40
20
0
Length
1986
1990
1994
1998
2002
2006
2010
2014
2018
2022
Year

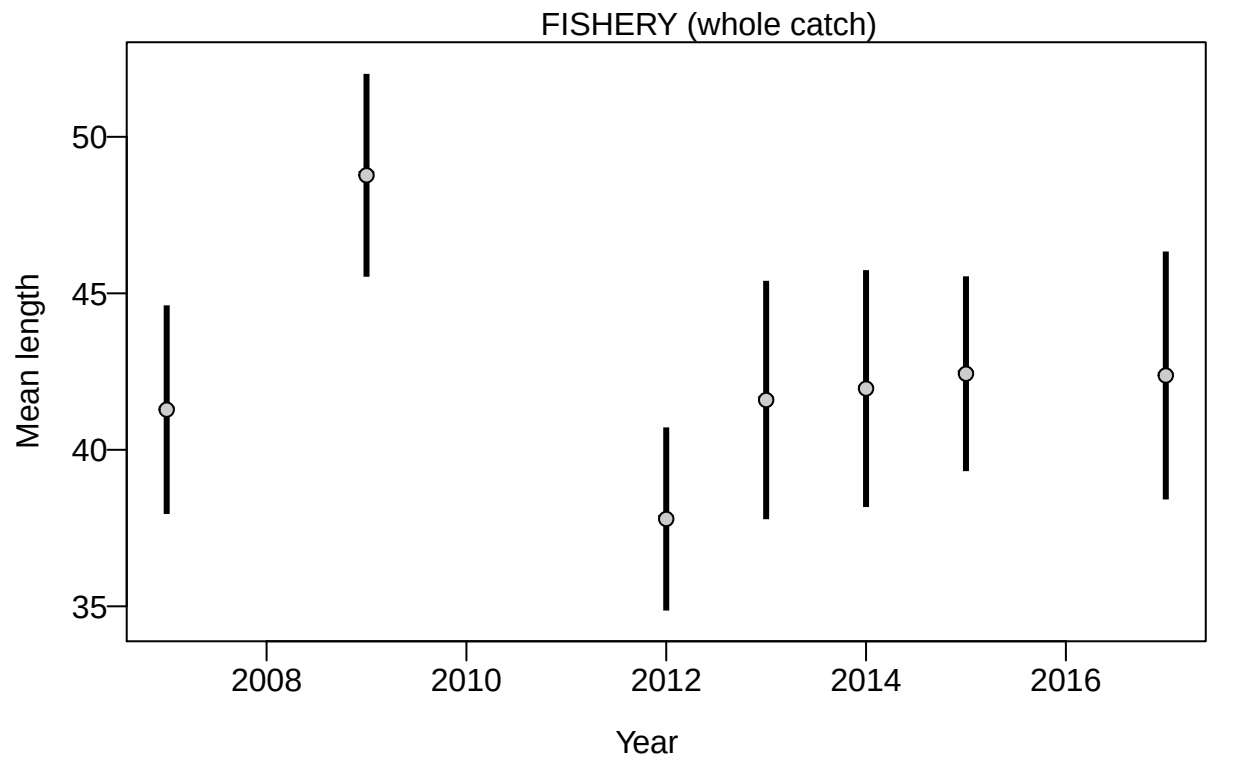

Numbers at age at equilibrium
0.0
0.5
1.0
1.5
2.0
0
2
4
6
8
10
12
Age

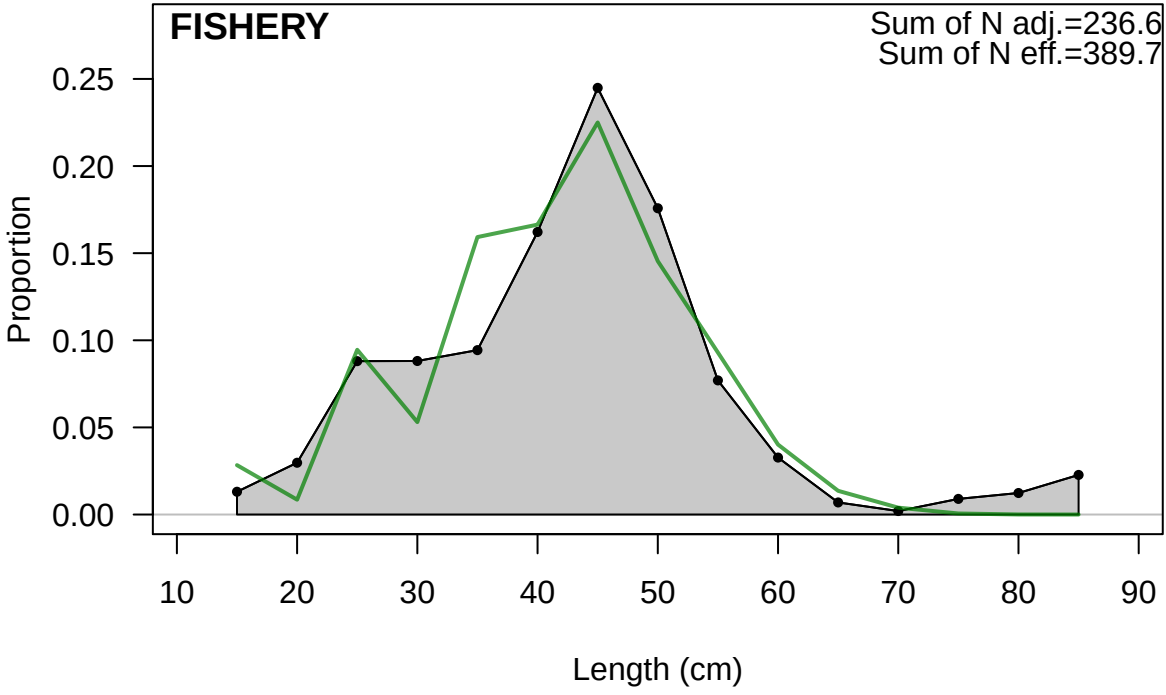

FISHERY
Sum of N adj.=236.6
Proportion
0.25
0.20
0.15
0.10
0.05
0.00
10
20
30
40
50
60
70
80
90
Length (cm)

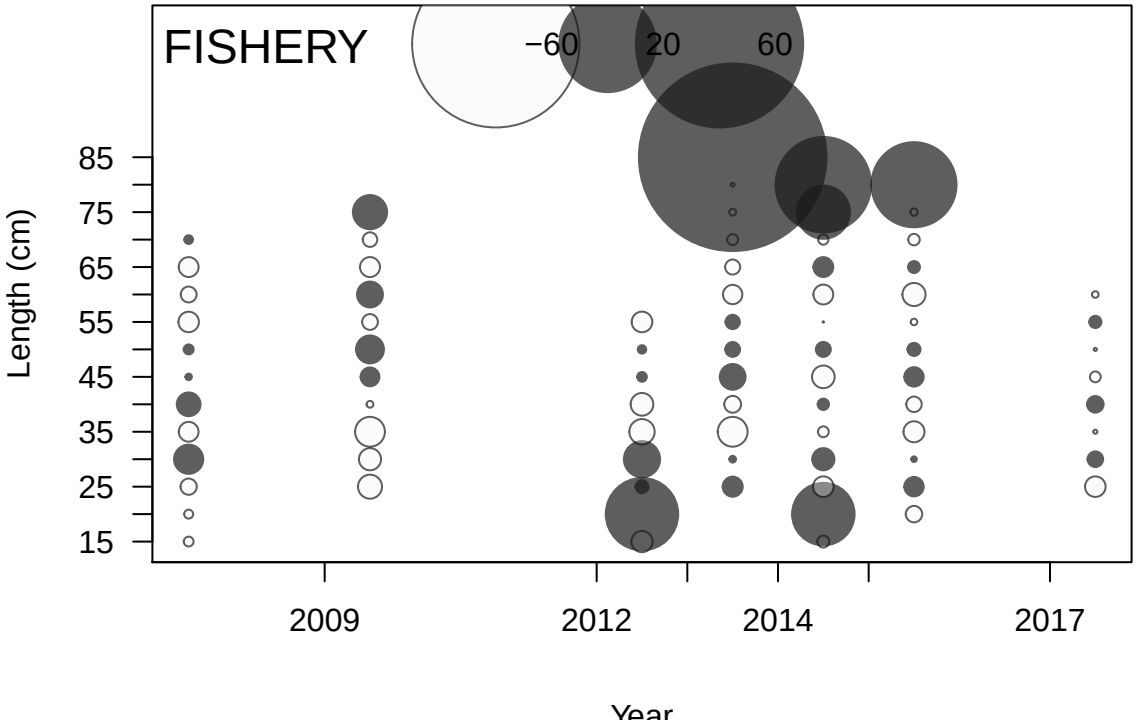

FISHERY
0.01
0.2
0.4
Length (cm)
85
75
65
55
45
35
25
15
2009
2012
2014
2017
Year

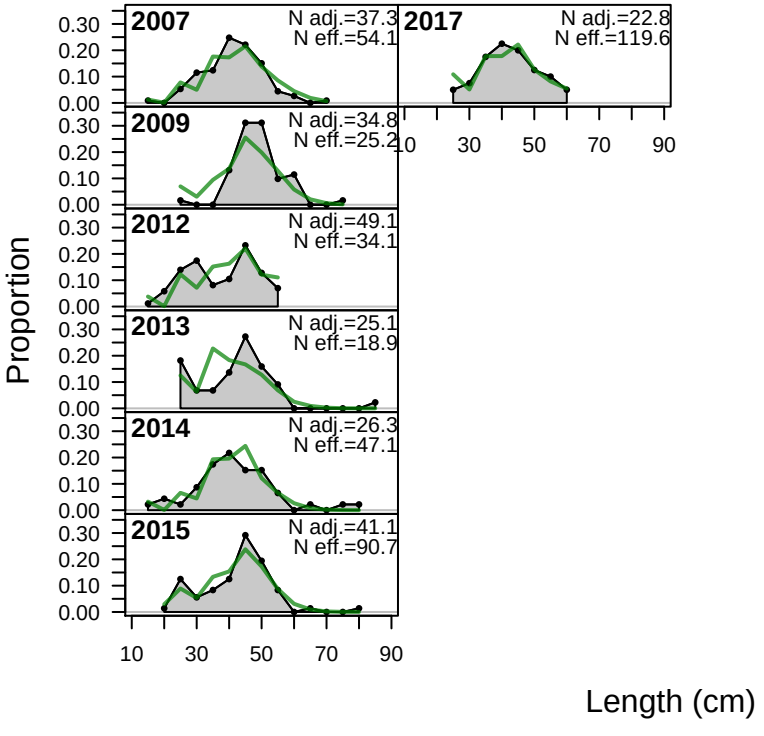

2007
N adj.=37.3
2017
N adj.=22.8
2009
N adj.=34.8
2012
N adj.=49.1
2013
N adj.=25.1
2014
N adj.=26.3
2015
N adj.=41.1
0.30
0.20
0.10
0.00
10
30
50
70
90
Proportion
Length (cm)

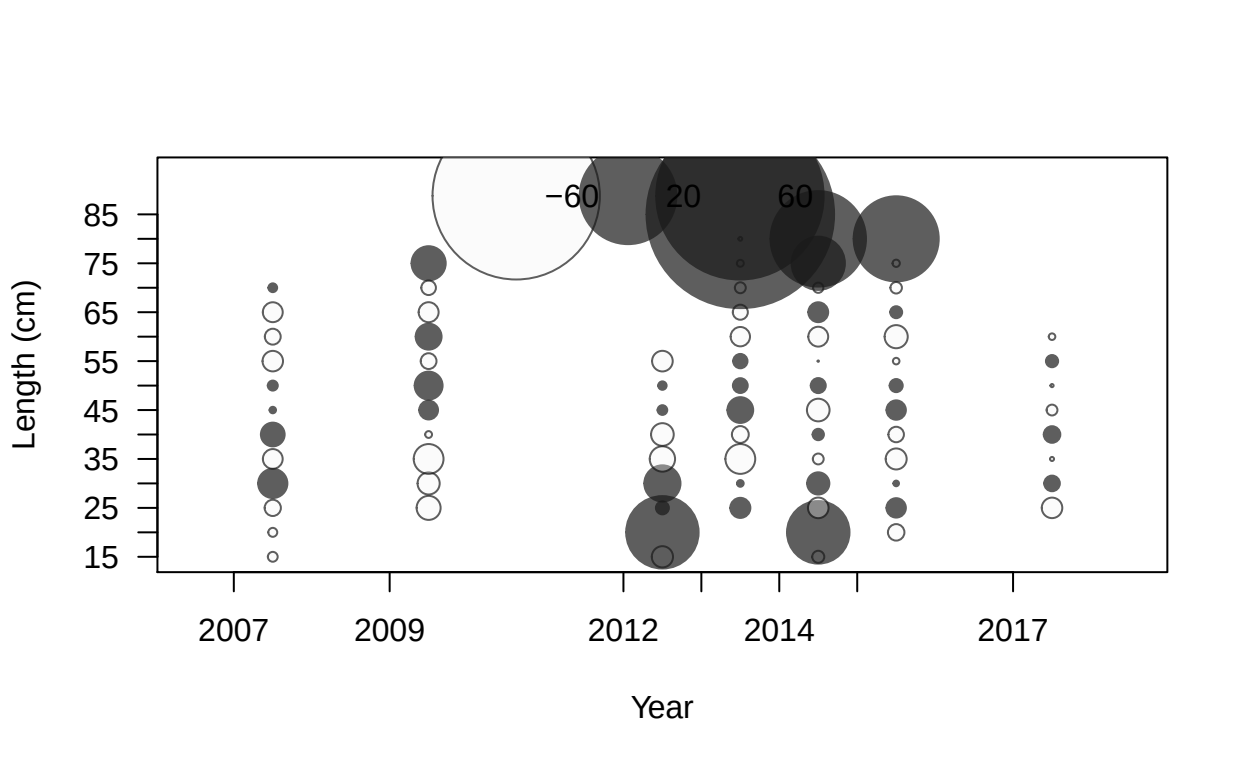

0.01
0.2
0.4
85
75
65
55
45
35
25
15
Length (cm)
2007
2009
2012
2014
2017
Year

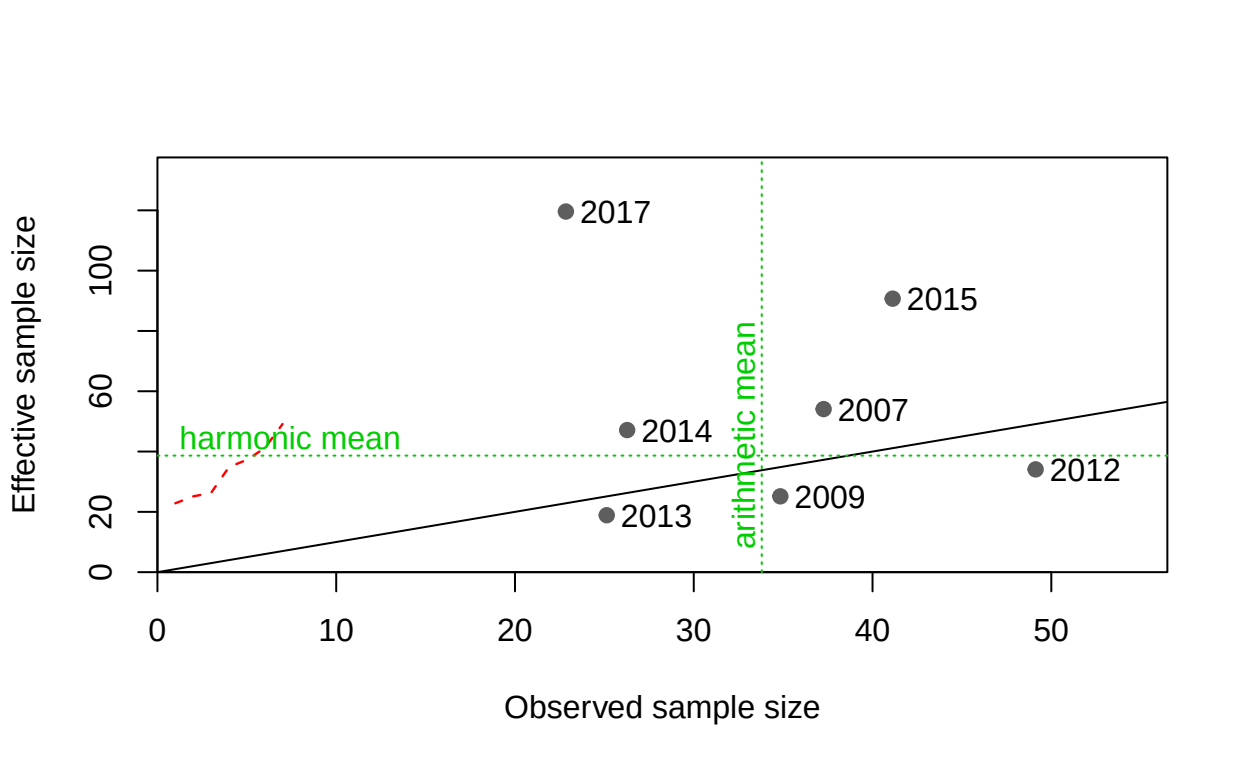

FISHERY (whole catch)
Mean length
50
45
40
35
2008
2010
2012
2014
2016
Year

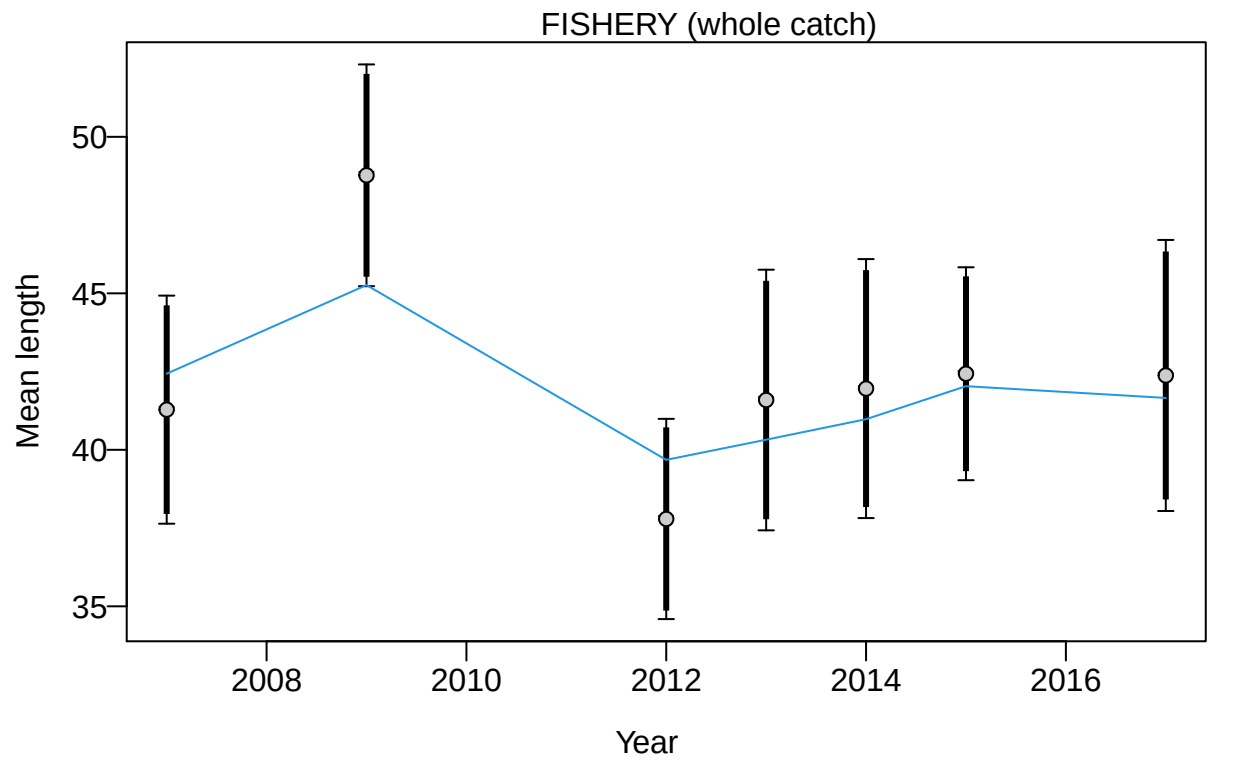

FISHERY
Sum of N adj.=236.6
Sum of N eff.=389.7
Proportion
0.25
0.20
0.15
0.10
0.05
0.00
10
20
30
40
50
60
70
80
90
Length (cm)

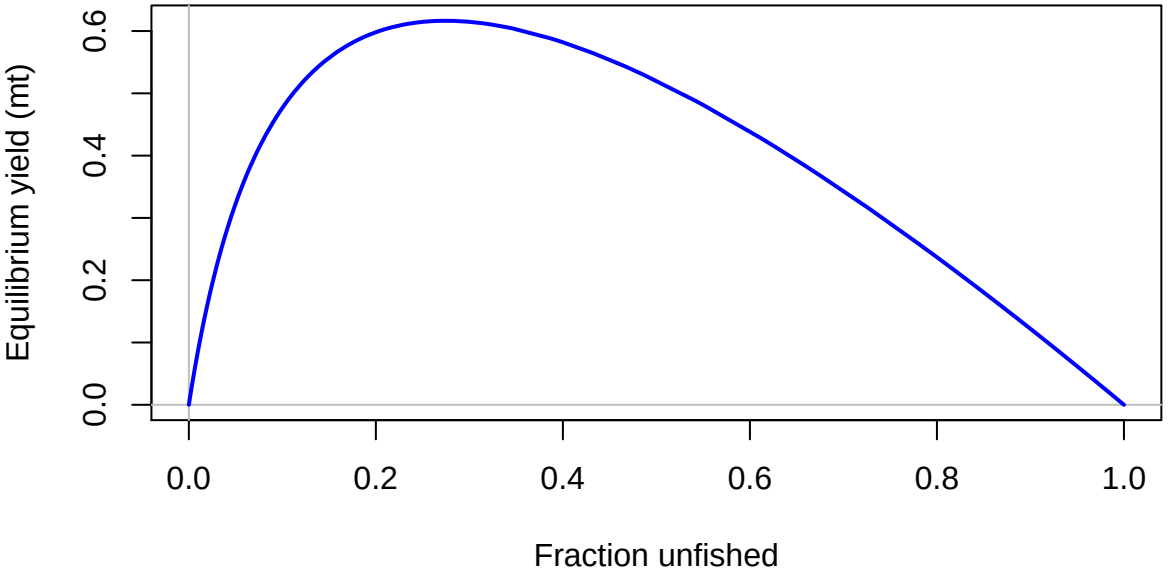

FISHERY
−60
20
60
Length (cm)
85
75
65
55
45
35
25
15
2009
2012
2014
2017
Year

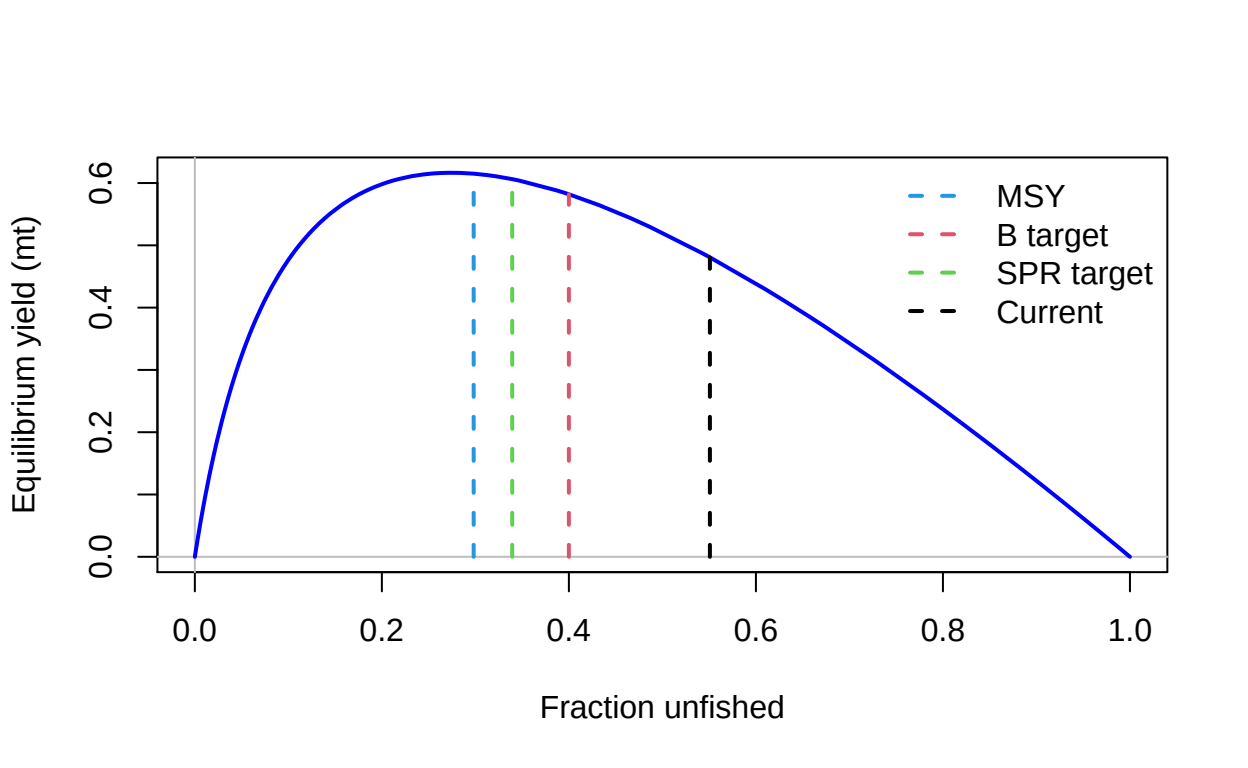

2007
N adj.=37.3
N eff.=54.1
2017
N adj.=22.8
N eff.=119.6
2009
N adj.=34.8
N eff.=25.2
2012
N adj.=49.1
N eff.=34.1
2013
N adj.=25.1
N eff.=18.9
2014
N adj.=26.3
N eff.=47.1
2015
N adj.=41.1
N eff.=90.7
Proportion
0.00
0.10
0.20
0.30
10
30
50
70
90
Length (cm)

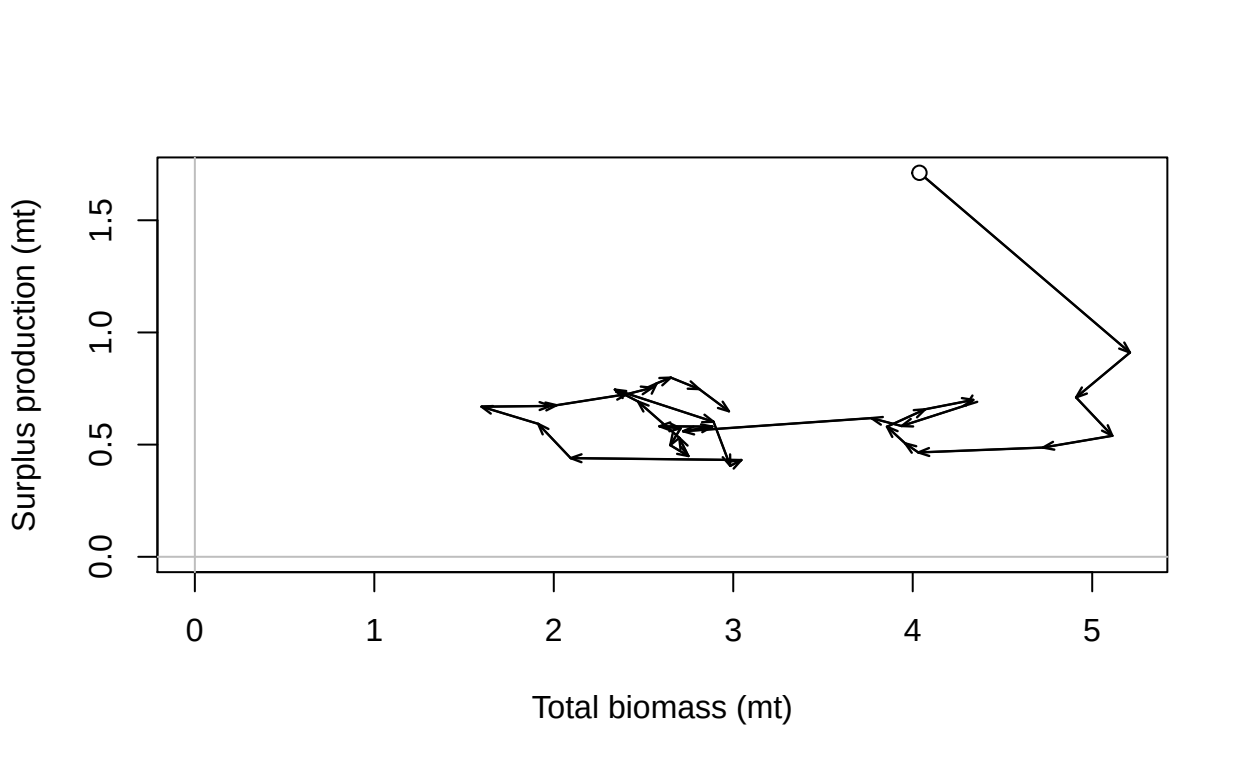

−60
20
60
85
75
65
55
45
35
25
15
Length (cm)
2007
2009
2012
2014
2017
Year

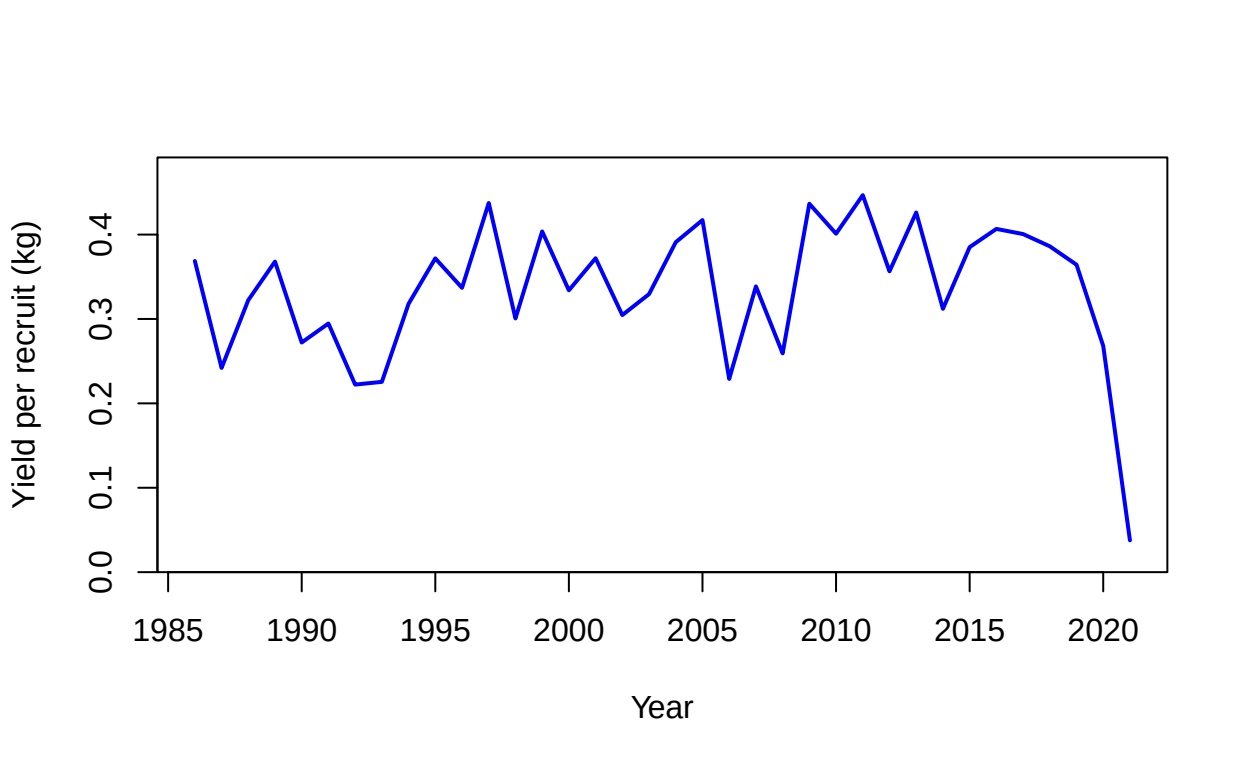

Effective sample size
0
20
60
100
0
10
20
30
40
50
Observed sample size
2017
2015
2007
2014
2012
2009
2013
harmonic mean
arithmetic mean

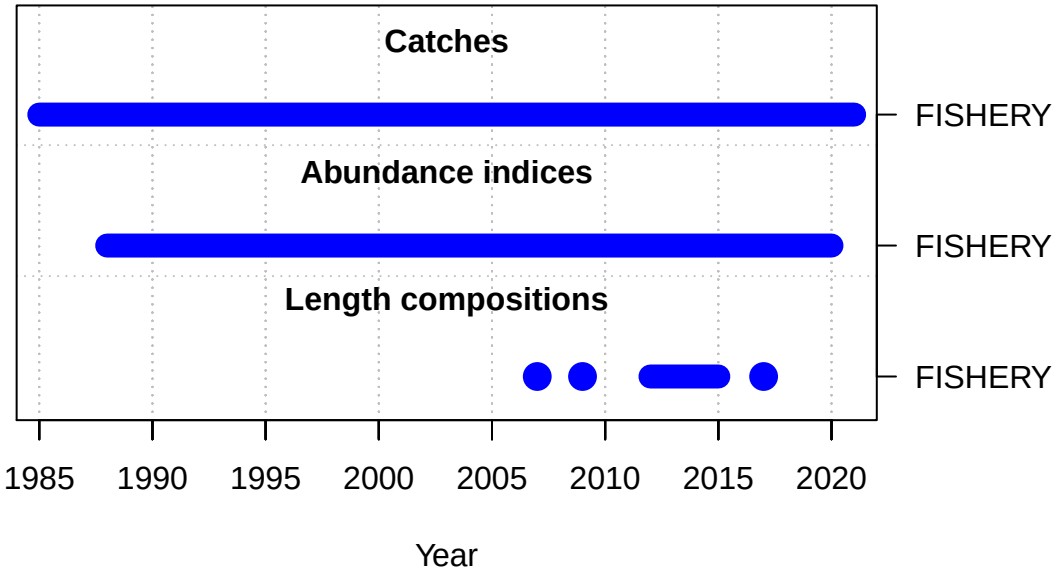

FISHERY (whole catch)
Mean length
50
45
40
35
2008
2010
2012
2014
2016
Year

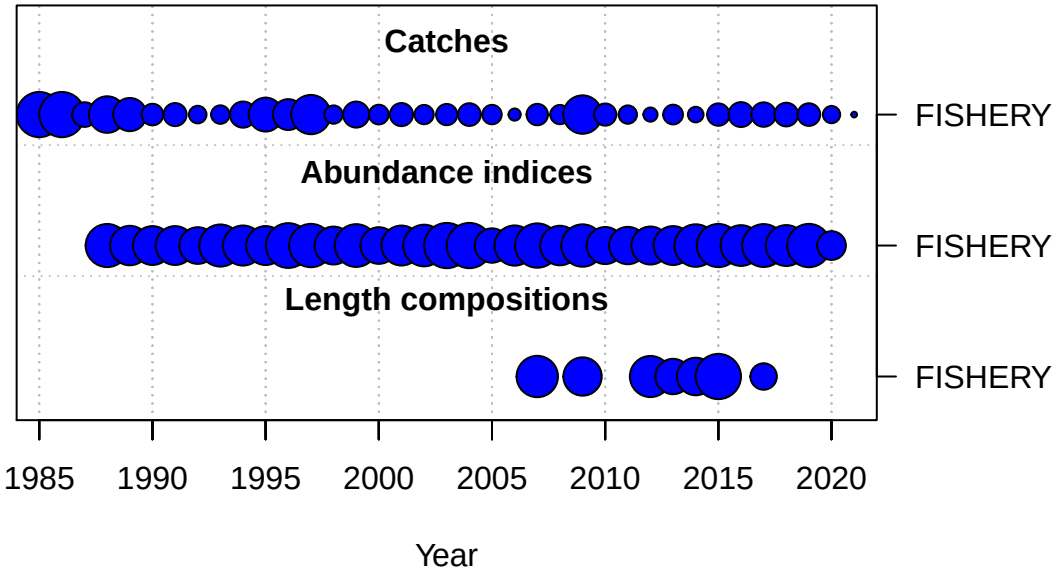

Equilibrium yield (mt)
0.0
0.2
0.4
0.6
0.0
0.2
0.4
0.6
0.8
1.0
Fraction unfished

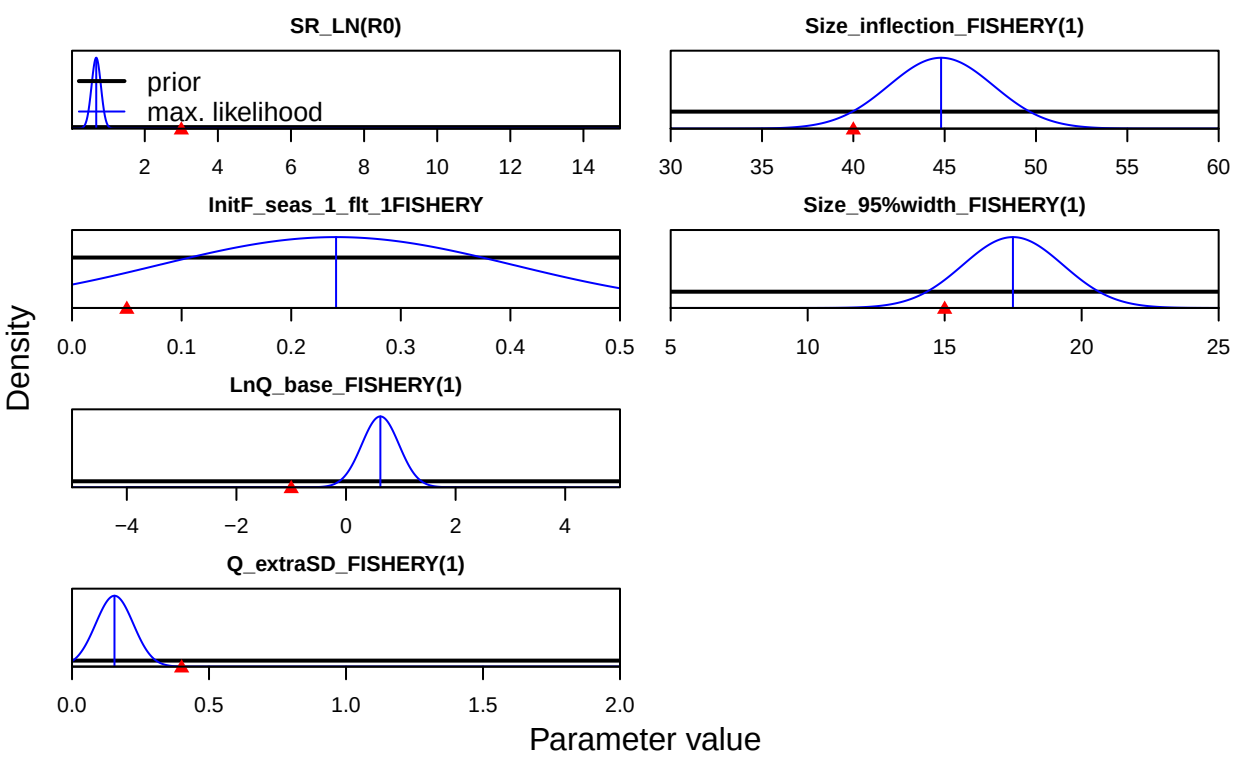

Equilibrium yield (mt)
0.0
0.2
0.4
0.6
0.0
0.2
0.4
0.6
0.8
1.0
Fraction unfished
MSY
B target
SPR target
Current


Surplus production (mt)
0.0
0.5
1.0
1.5
0
1
2
3
4
5
Total biomass (mt)


Yield per recruit (kg)
0.0
0.1
0.2
0.3
0.4
1985
1990
1995
2000
2005
2010
2015
2020
Year


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


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


SR_LN(R0)
prior
max. likelihood
2
4
6
8
10
12
14
Size_inflection_FISHERY(1)
30
35
40
45
50
55
60
InitF_seas_1_flt_1FISHERY
0.0
0.1
0.2
0.3
0.4
0.5
Size_95%width_FISHERY(1)
5
10
15
20
25
LnQ_base_FISHERY(1)
−4
−2
0
2
4
Q_extraSD_FISHERY(1)
0.0
0.5
1.0
1.5
2.0
Density
Parameter value