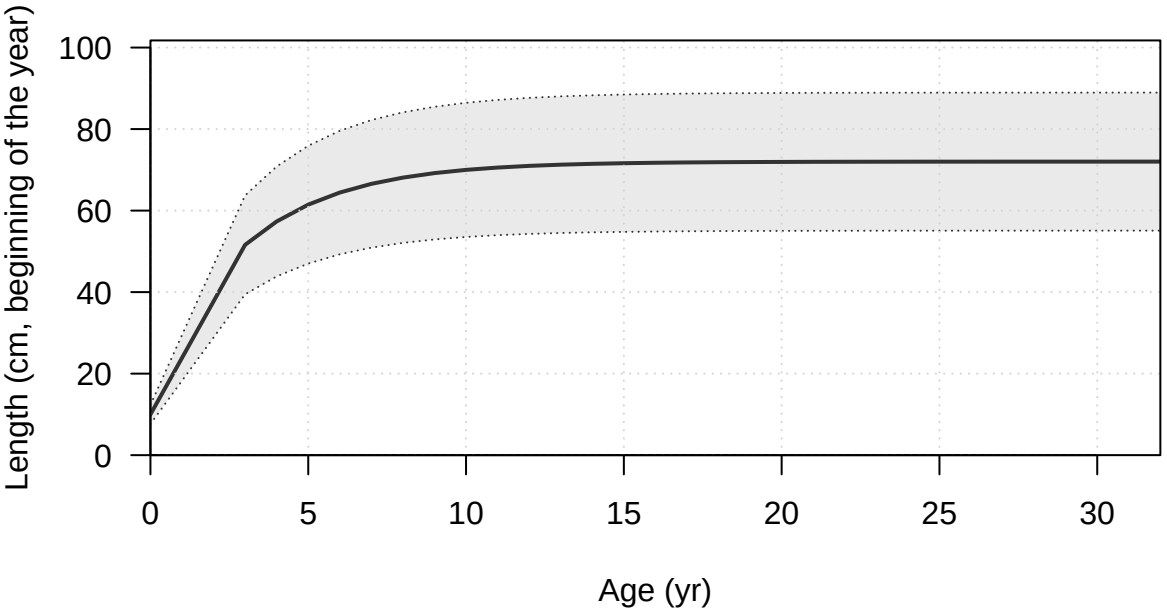
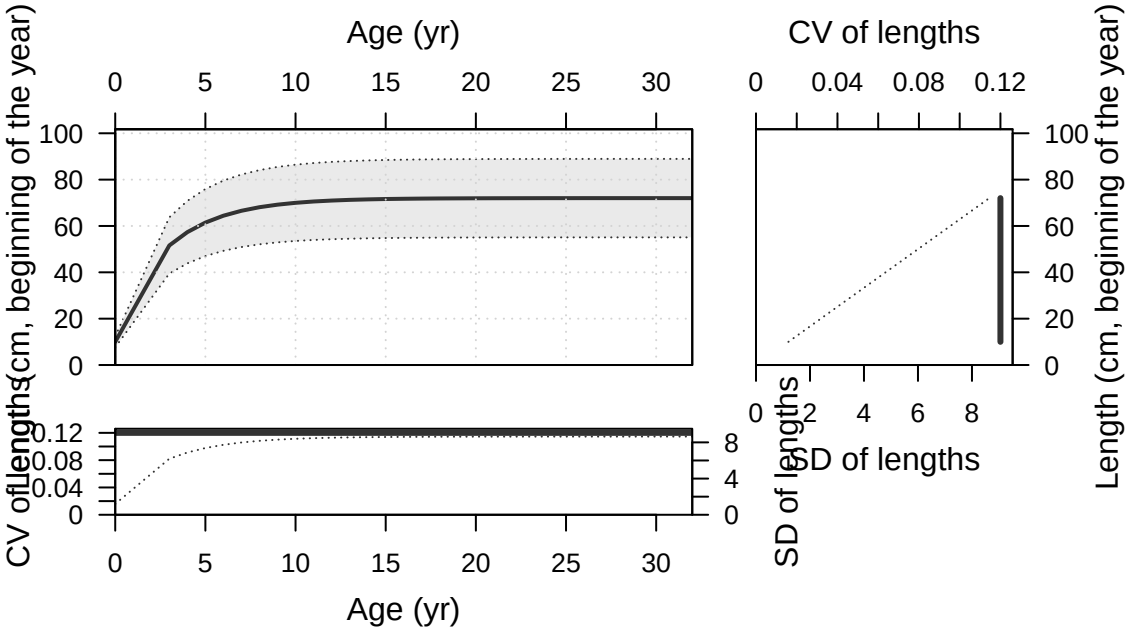
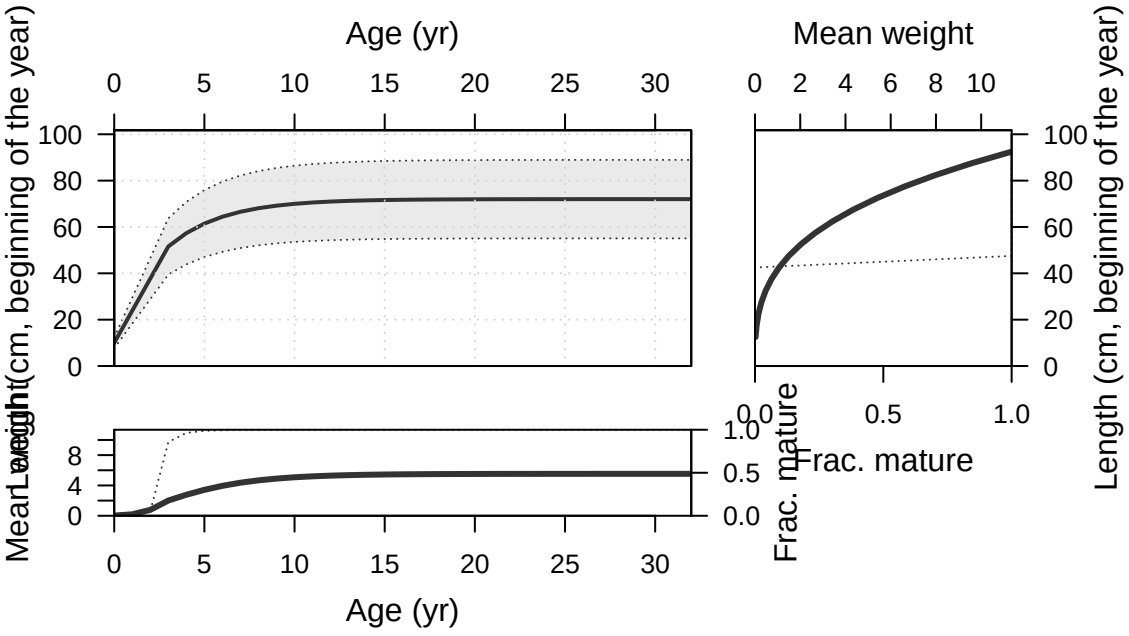
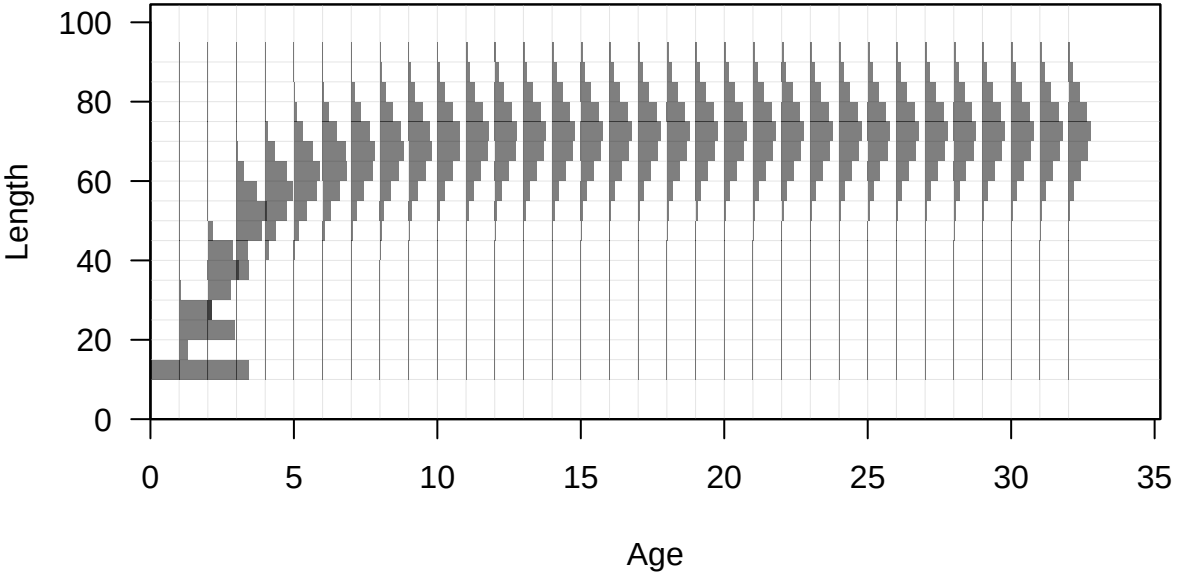
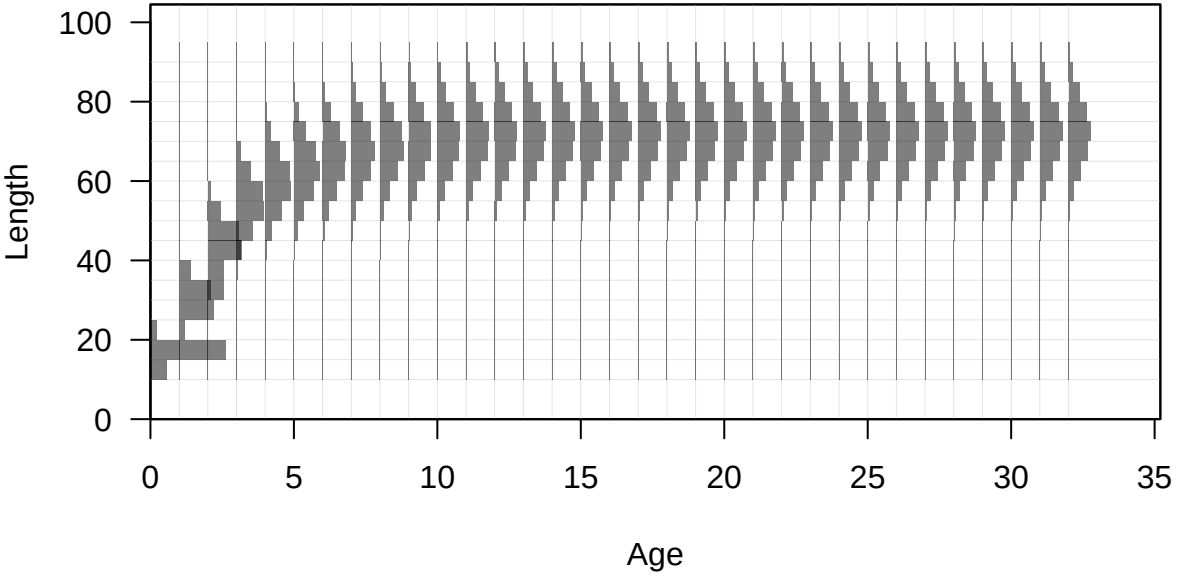
Plots created using the 'r4ss' package in R
Stock Synthesis version: 3.30.19.0
StartTime: Thu Jun 16 15:55:29 2022
Data_File: data.ss
Control_File: control.ss

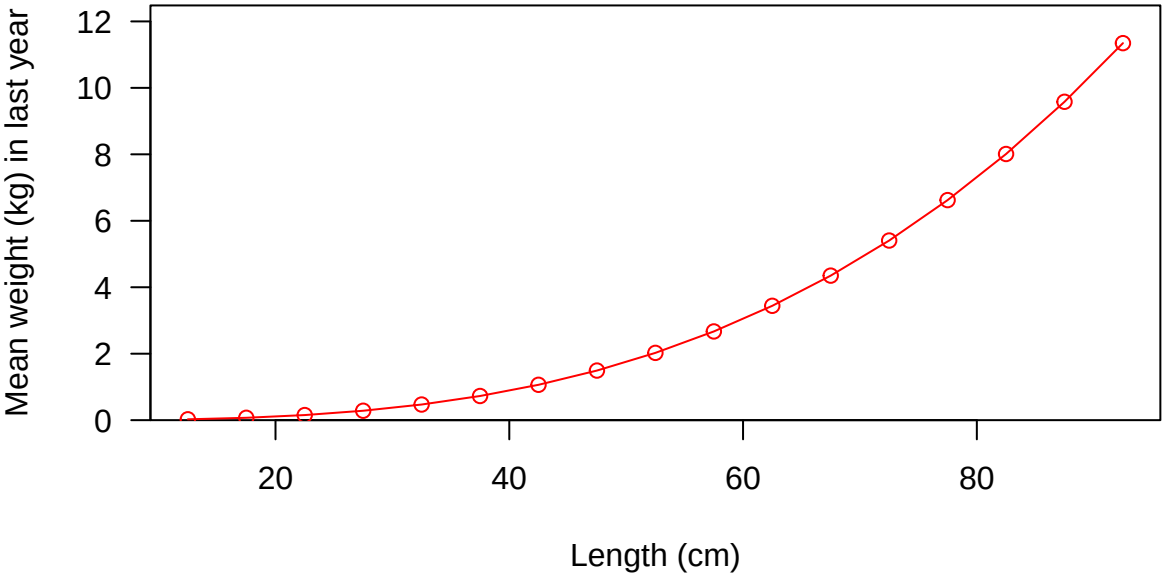

Length (cm, beginning of the year)
100
80
60
40
20
0
0
5
10
15
20
25
30
Age (yr)

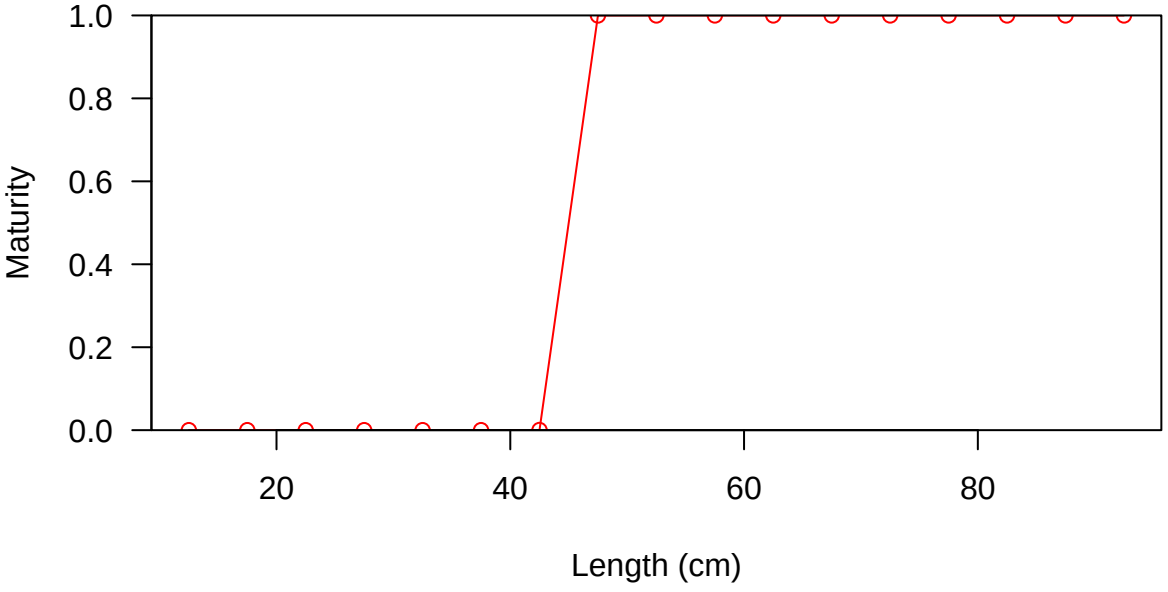

Age (yr)
0
5
10
15
20
25
30
100
80
60
40
20
0
Length (cm, beginning of the year)
CV of lengths
0.12
0.08
0.04
0
8
4
0
SD of lengths
Age (yr)
CV of lengths
0
0.04
0.08
0.12
0
2
4
6
8
SD of lengths
Length (cm, beginning of the year)

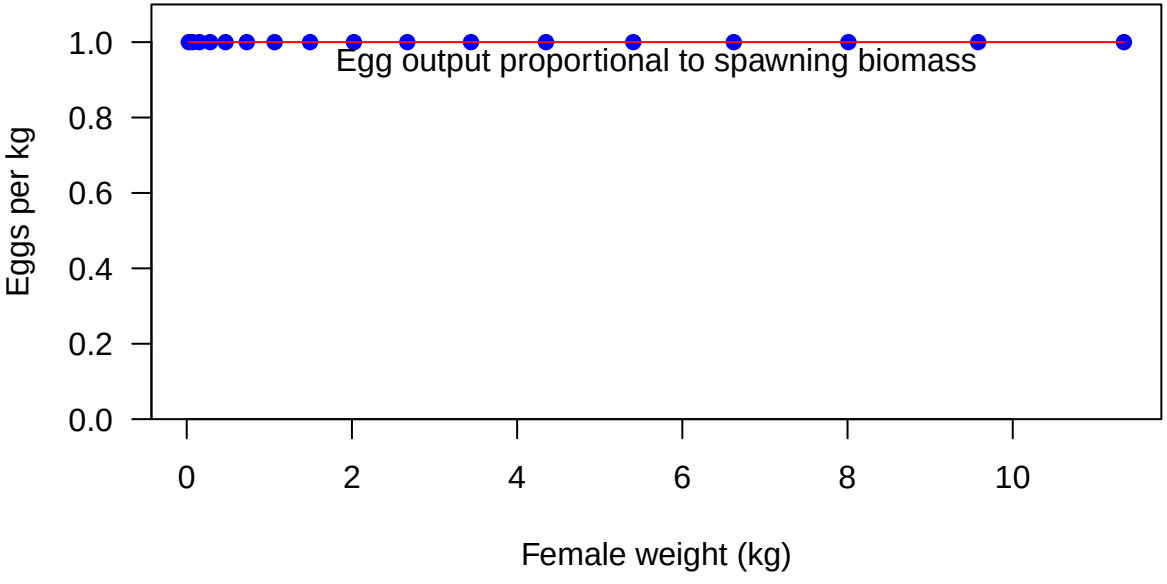

Age (yr)
Mean weight
Length (cm, beginning of the year)
Mean weight
Age (yr)
Frac. mature
Frac. mature
Length (cm, beginning of the year)

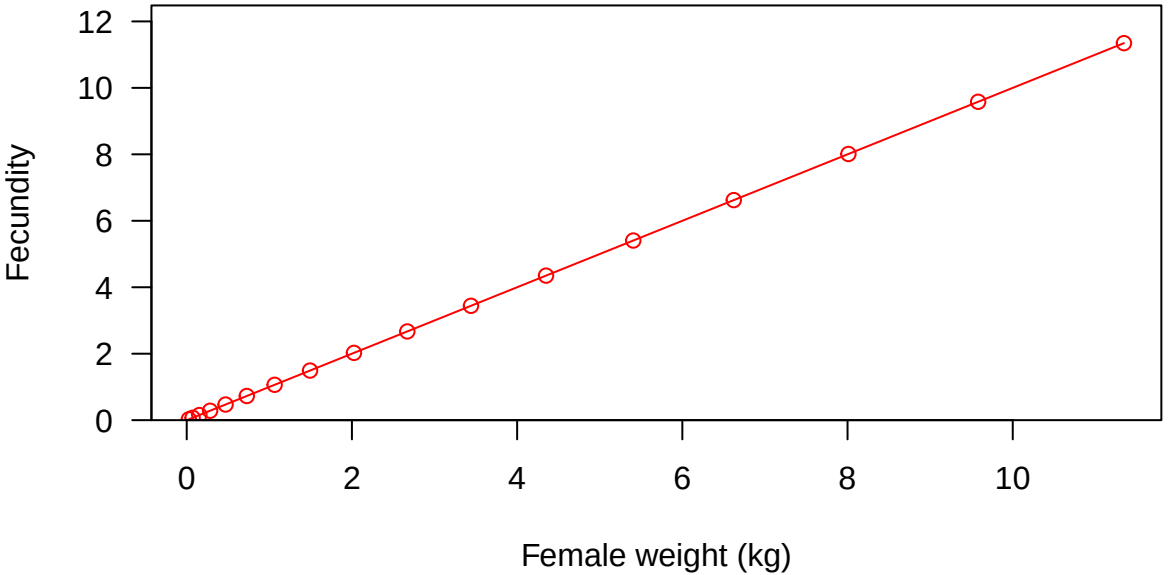

Length
100
80
60
40
20
0
0
5
10
15
20
25
30
35
Age

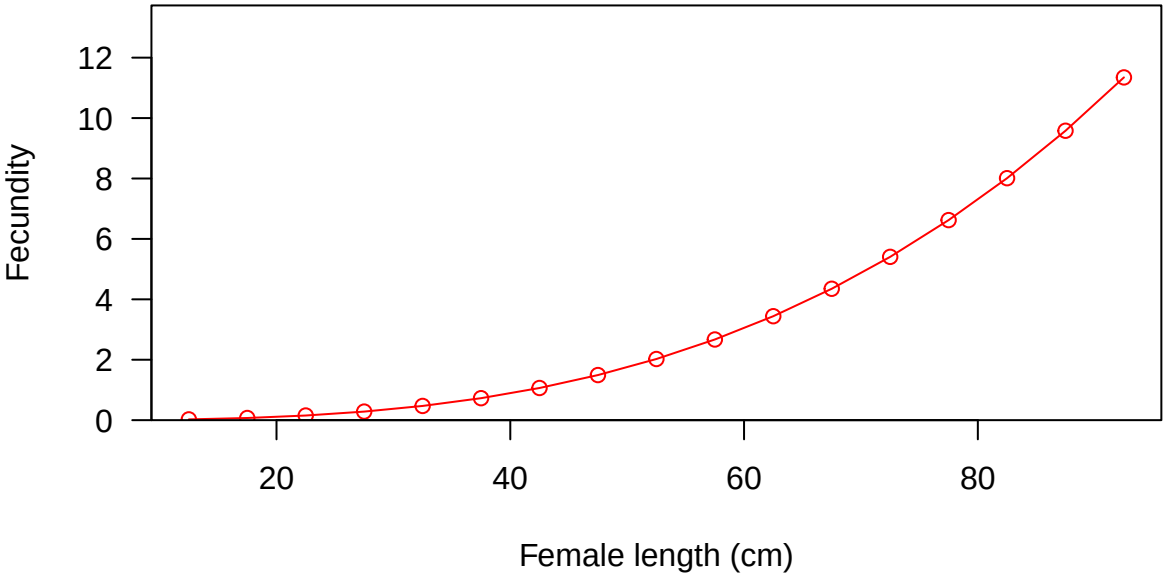

Length
100
80
60
40
20
0
0
5
10
15
20
25
30
35
Age

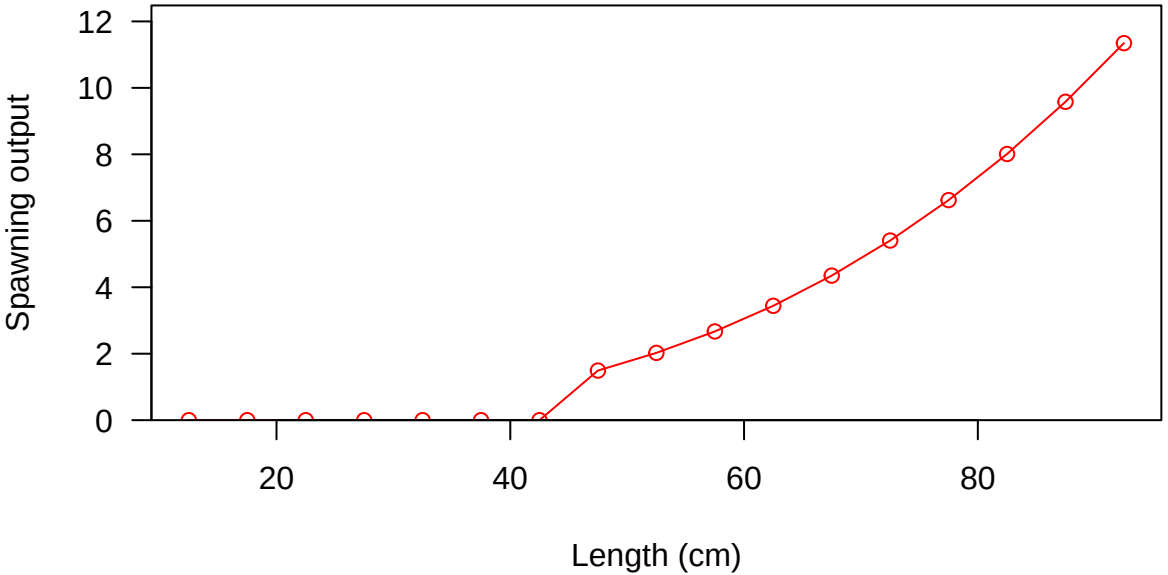

Mean weight (kg) in last year
0
2
4
6
8
10
12
20
40
60
80
Length (cm)

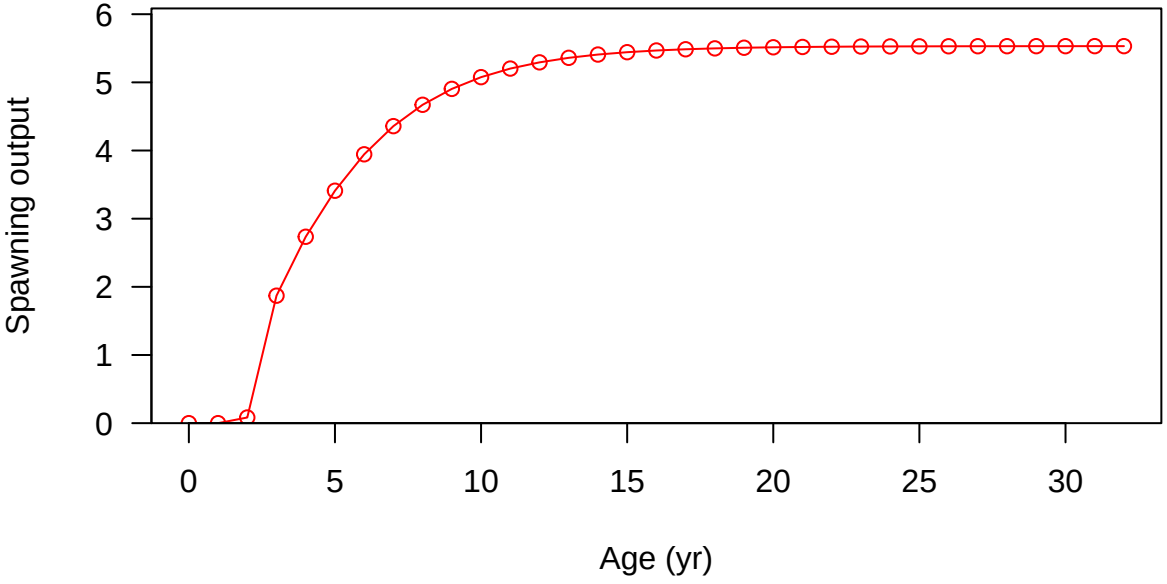

1.0
0.8
0.6
0.4
0.2
0.0
Maturity
20
40
60
80
Length (cm)

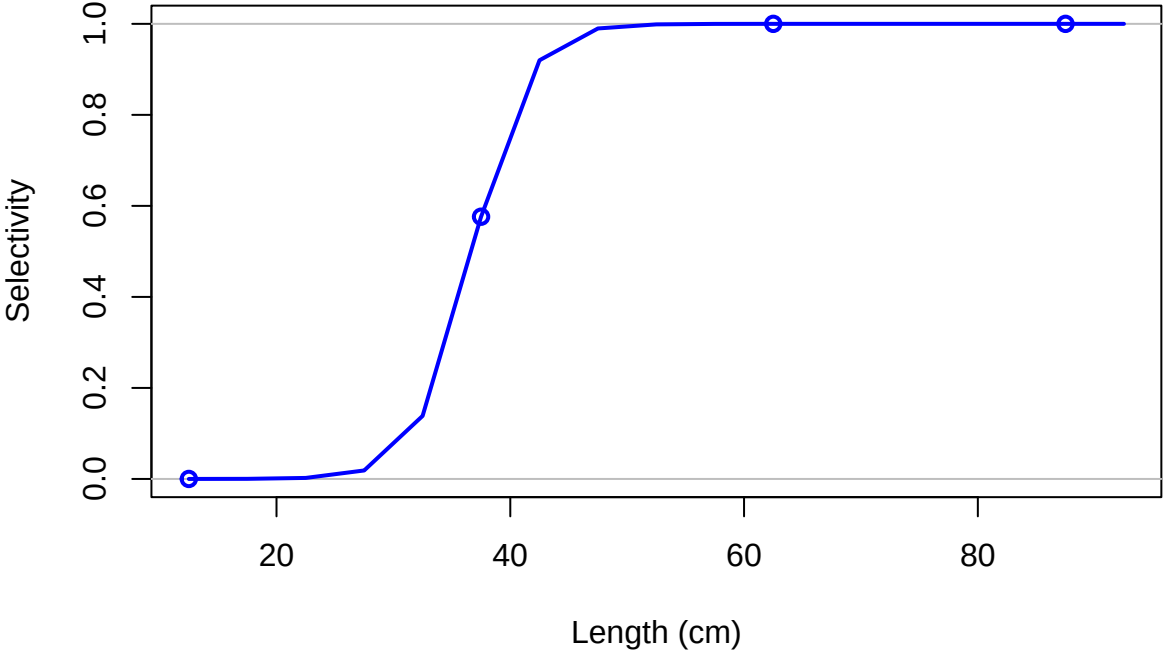

Egg output proportional to spawning biomass
Eggs per kg
1.0
0.8
0.6
0.4
0.2
0.0
0
2
4
6
8
10
Female weight (kg)

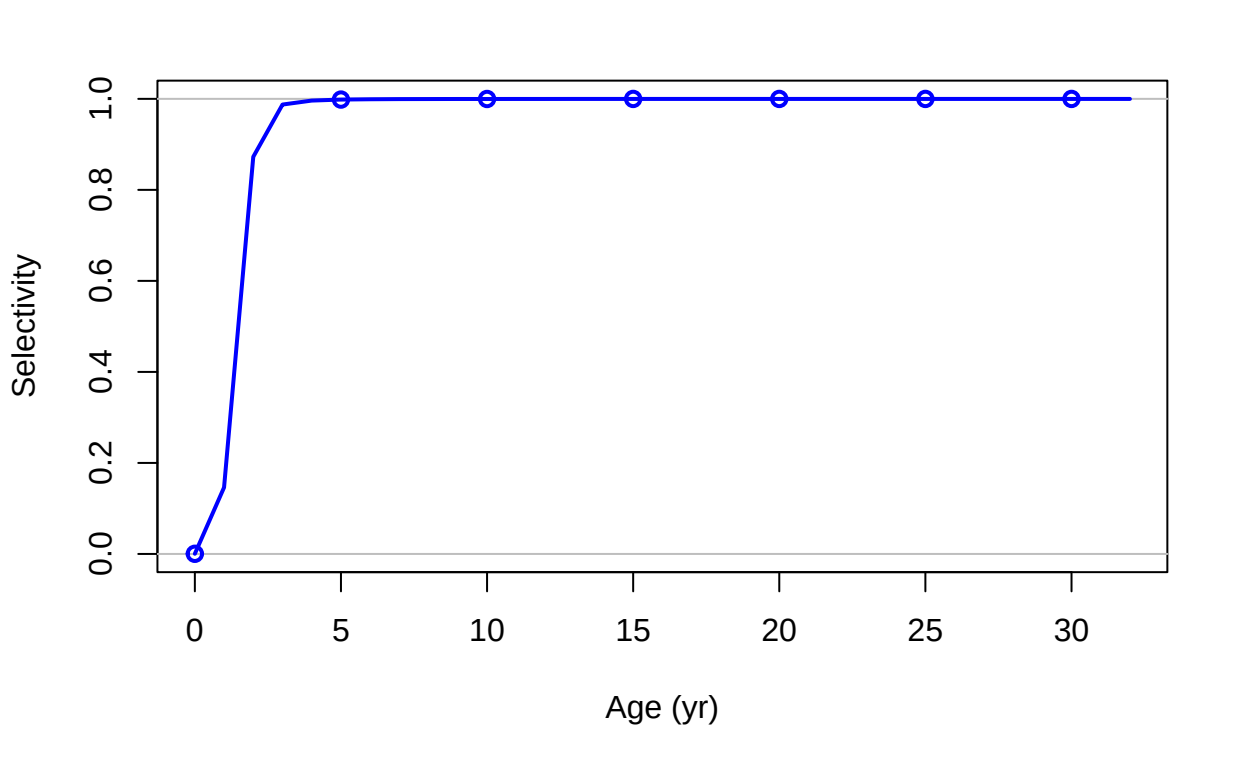

Fecundity
0
2
4
6
8
10
12
0
2
4
6
8
10
Female weight (kg)

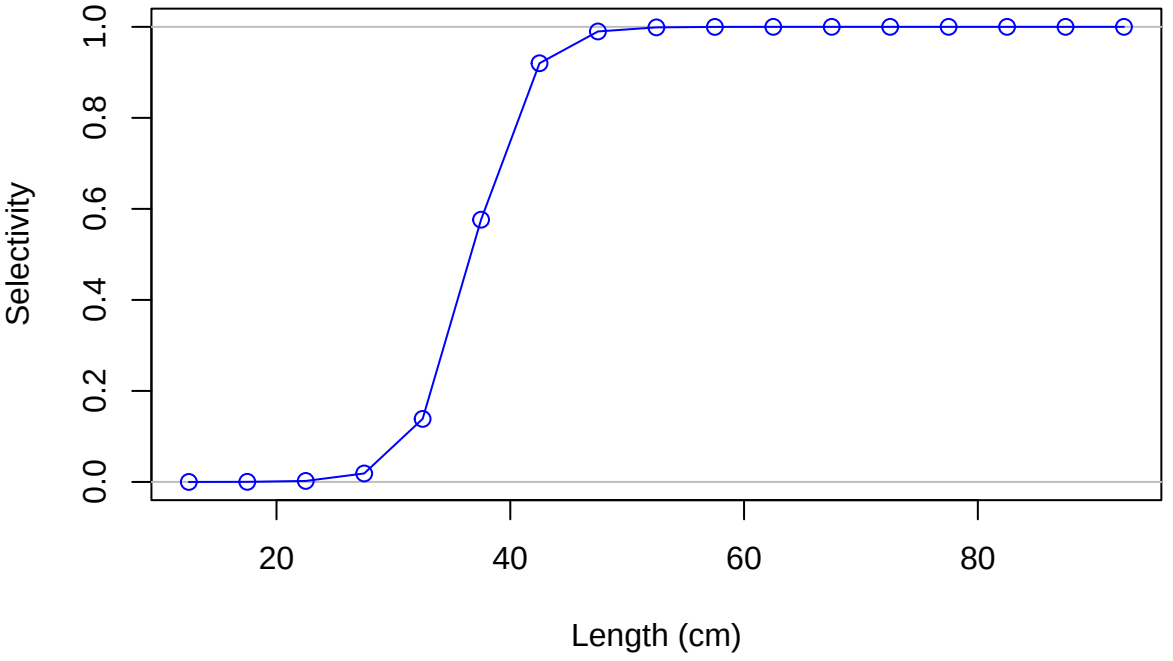

Fecundity
0
2
4
6
8
10
12
20
40
60
80
Female length (cm)

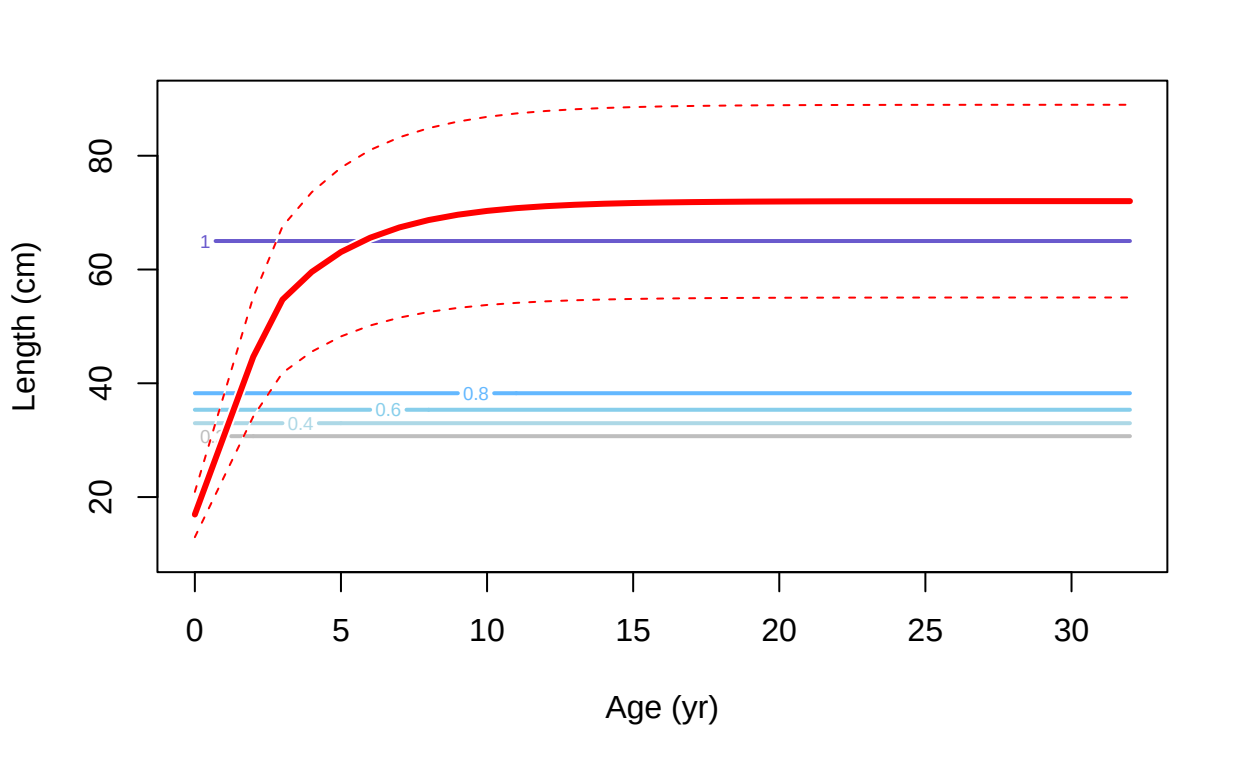

Spawning output
0
2
4
6
8
10
12
20
40
60
80
Length (cm)

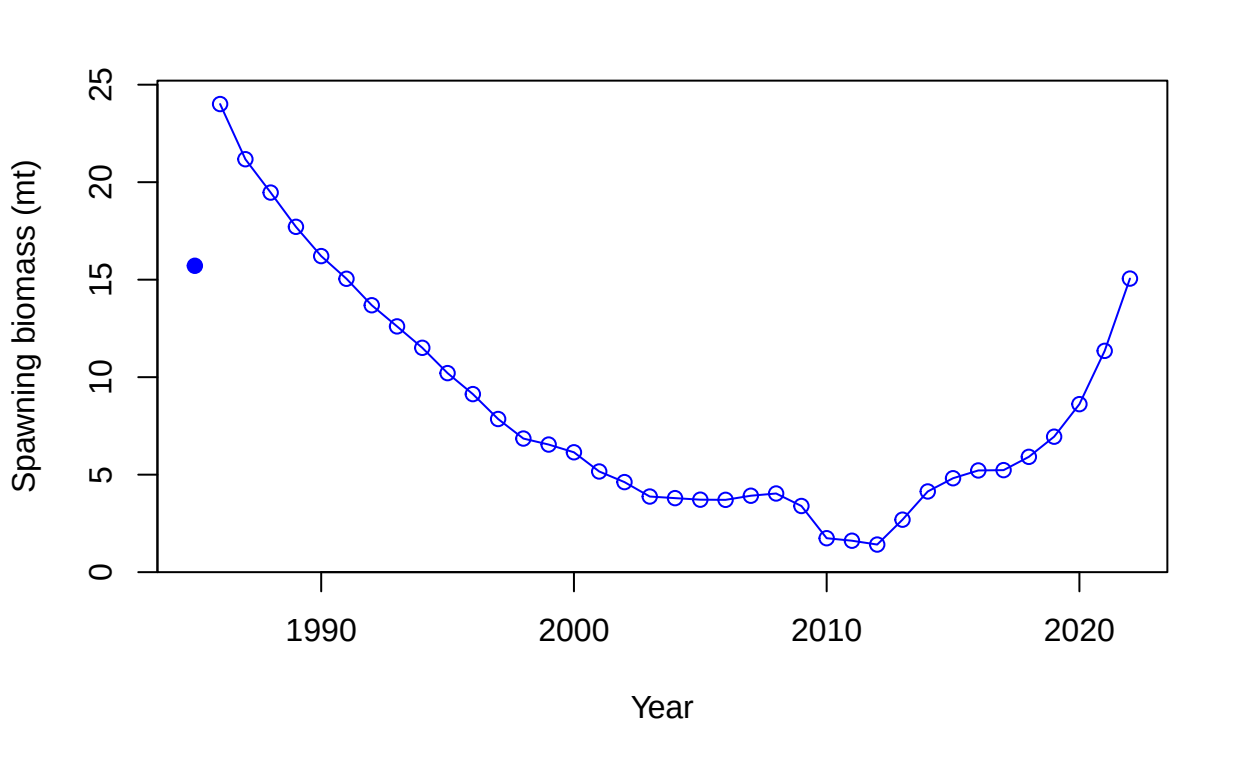

Spawning output
0
1
2
3
4
5
6
0
5
10
15
20
25
30
Age (yr)

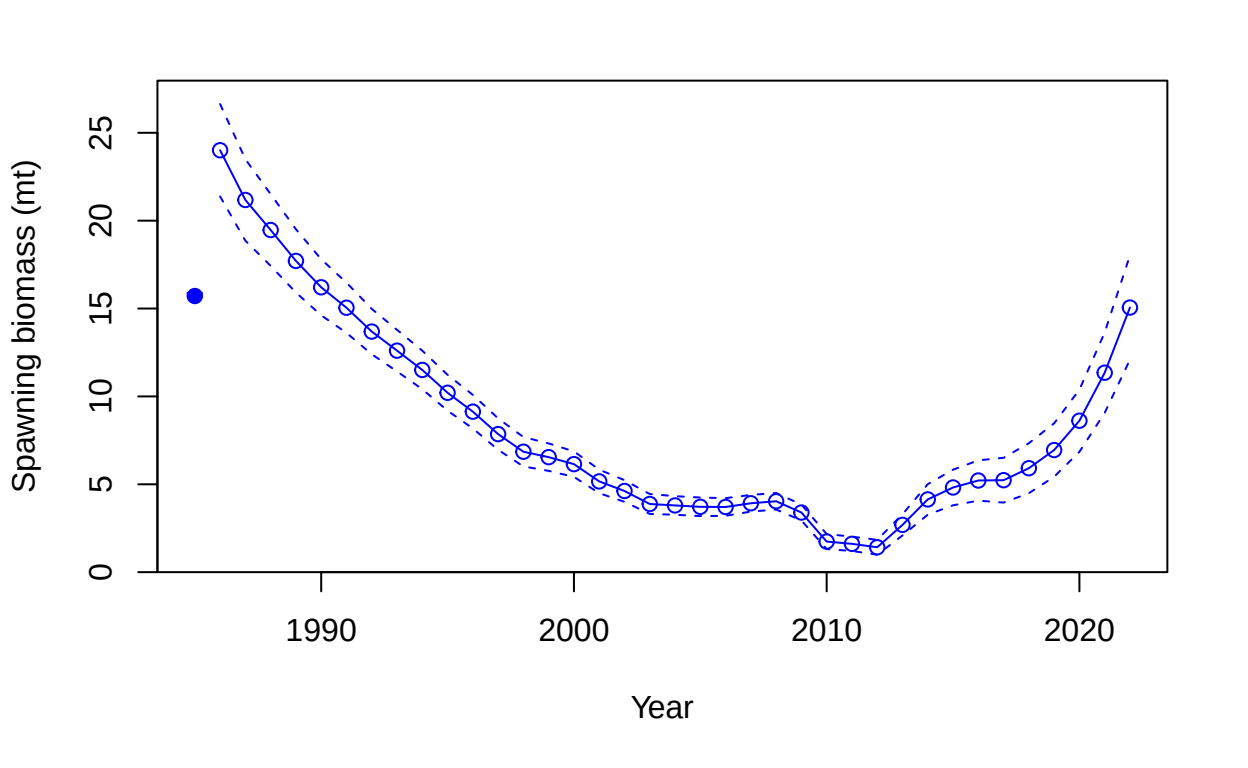

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
20
40
60
80
Length (cm)

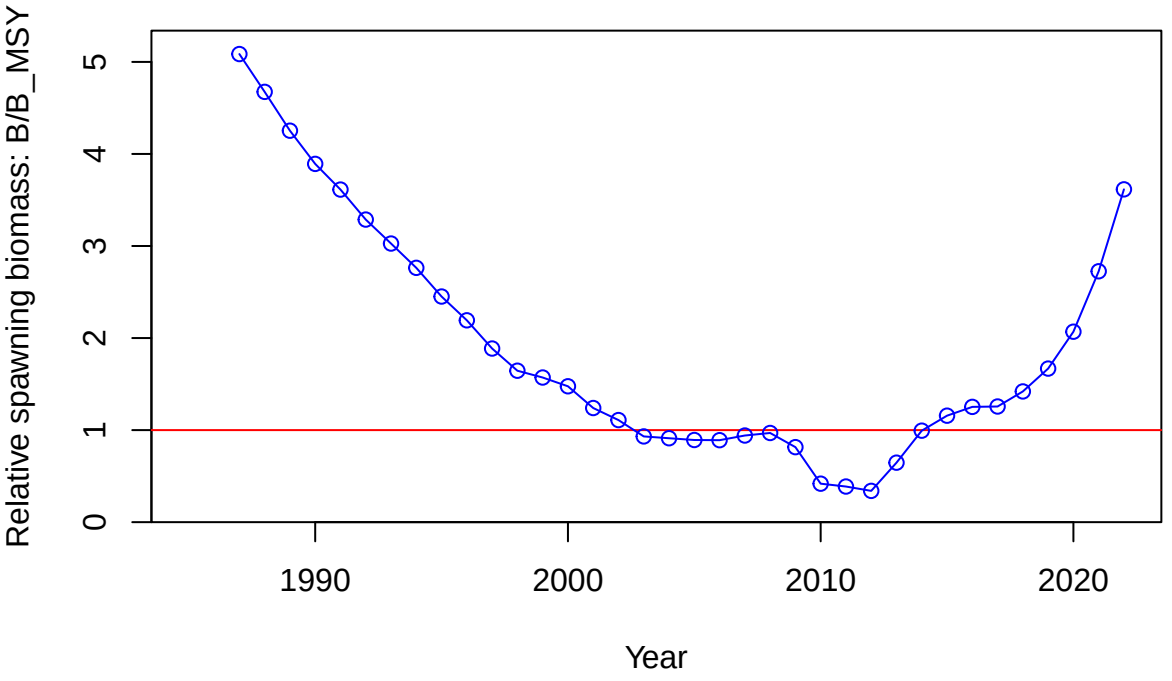

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
5
10
15
20
25
30
Age (yr)

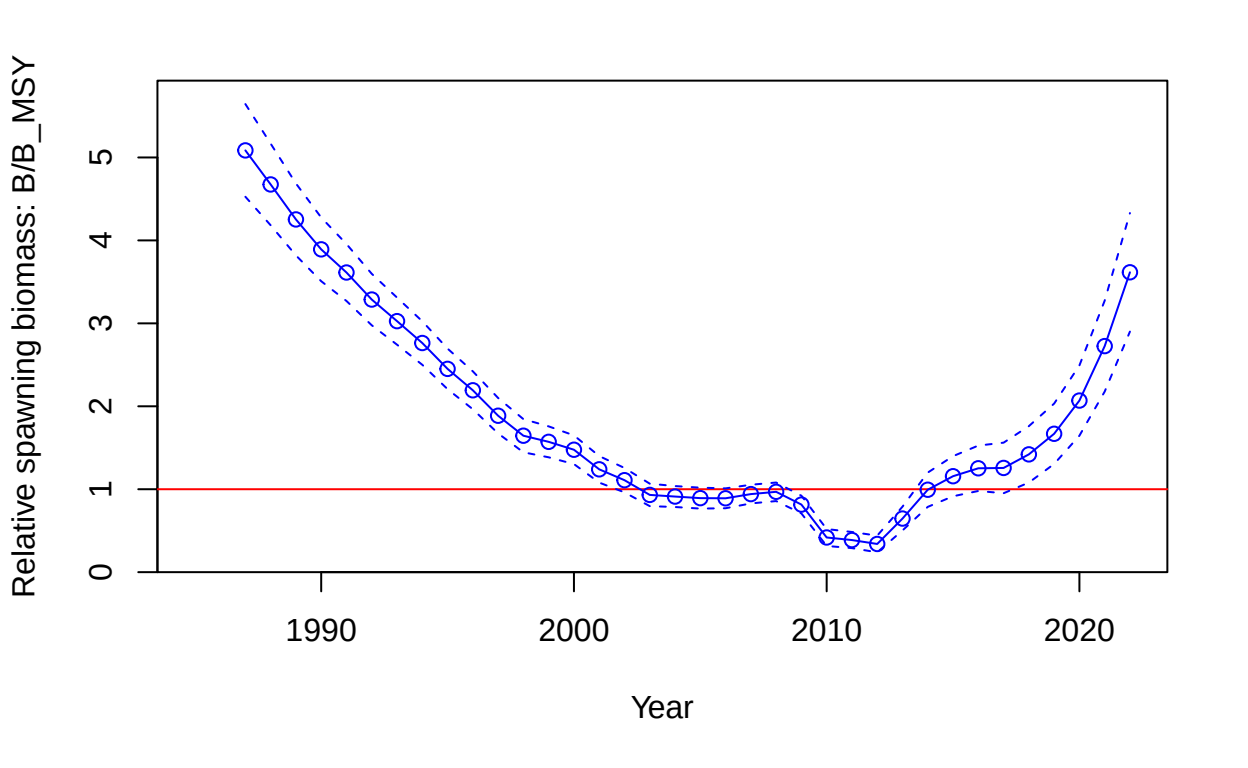

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
20
40
60
80
Length (cm)

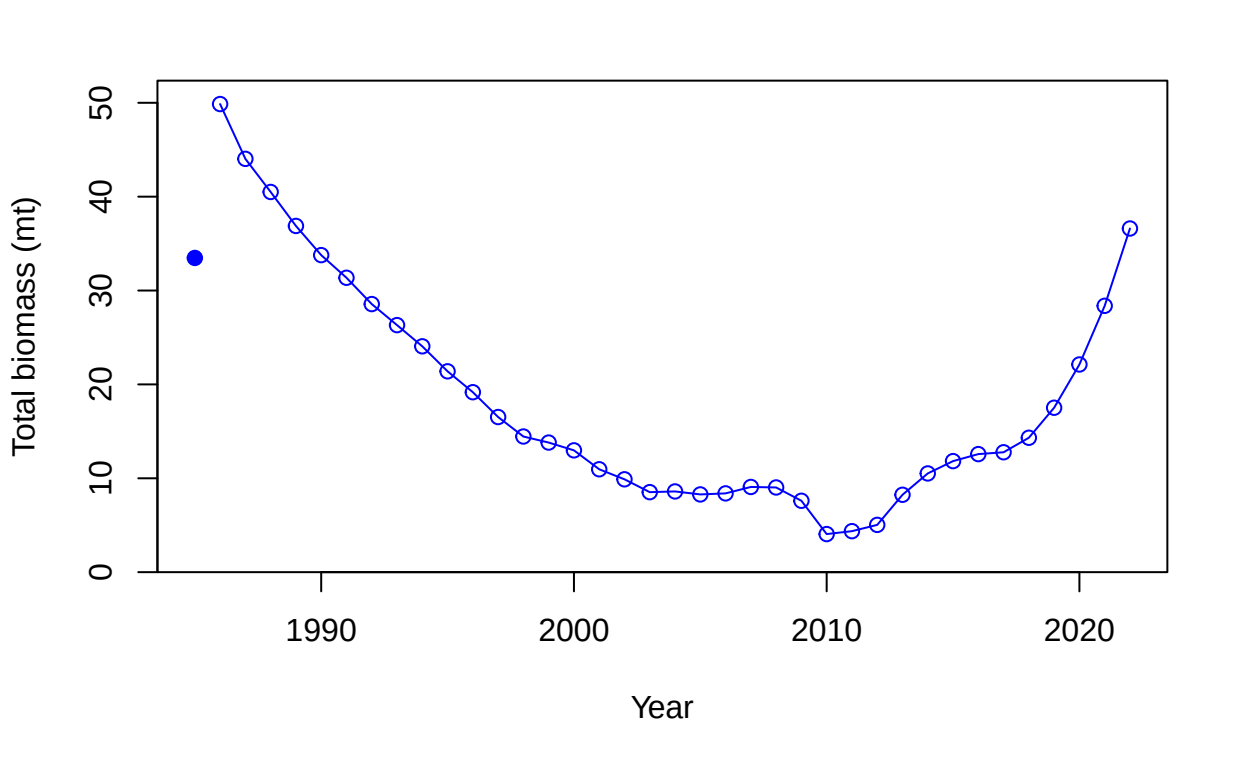

Length (cm)
20
40
60
80
0
5
10
15
20
25
30
Age (yr)
1
0.8
0.6
0.4
0

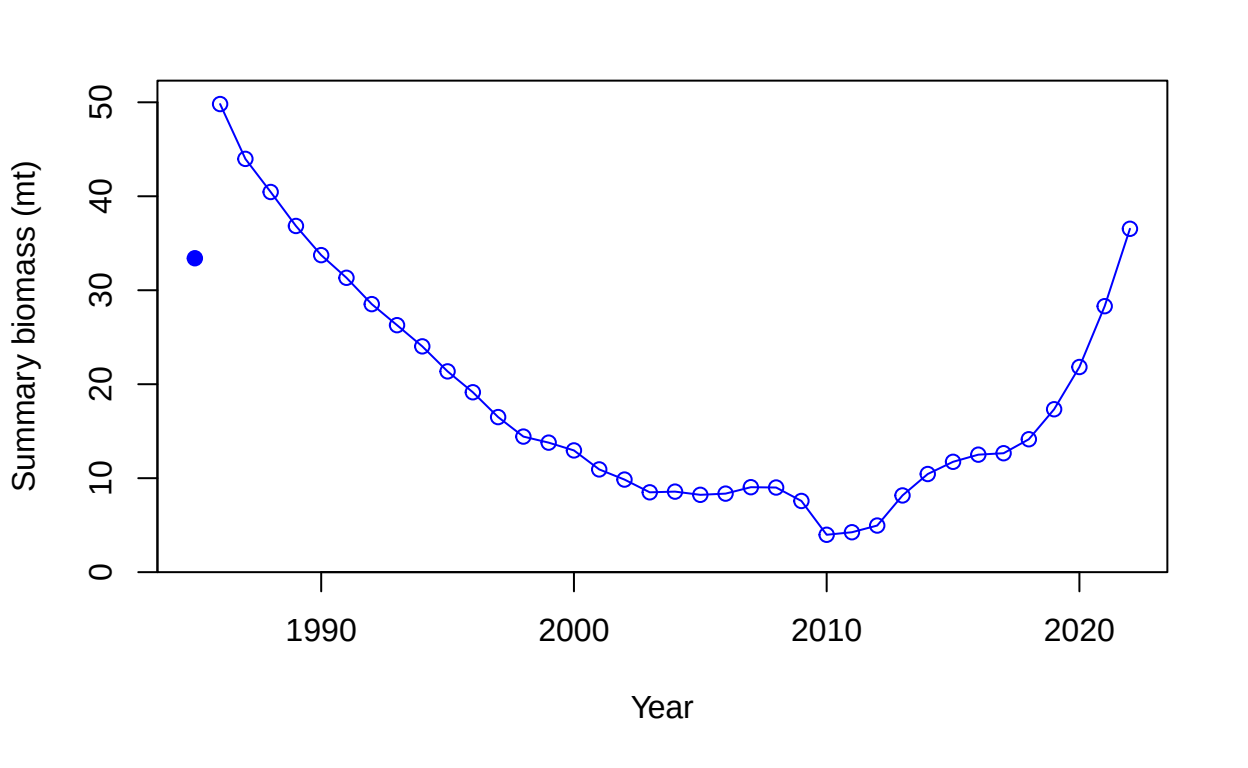

Spawning biomass (mt)
0
5
10
15
20
25
1990
2000
2010
2020
Year

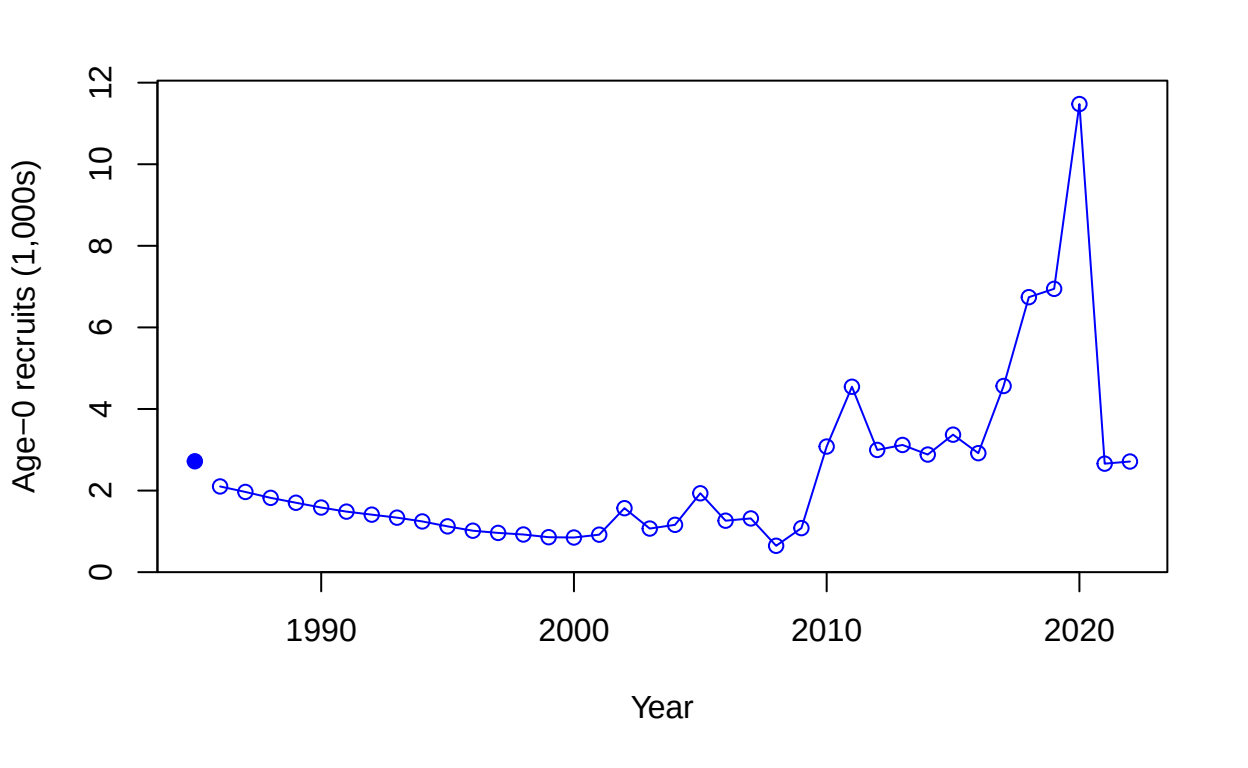

Spawning biomass (mt)
0
5
10
15
20
25
1990
2000
2010
2020
Year

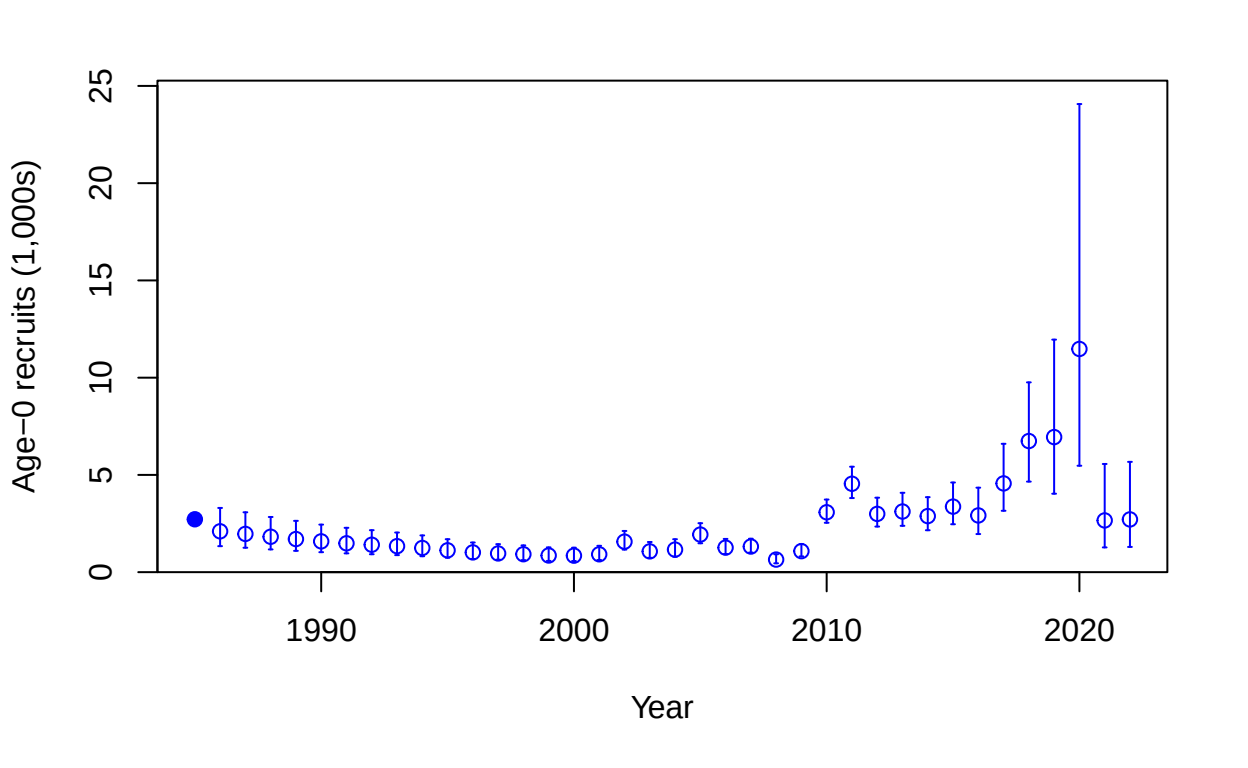

Relative spawning biomass: B/B_MSY
0
1
2
3
4
5
1990
2000
2010
2020
Year

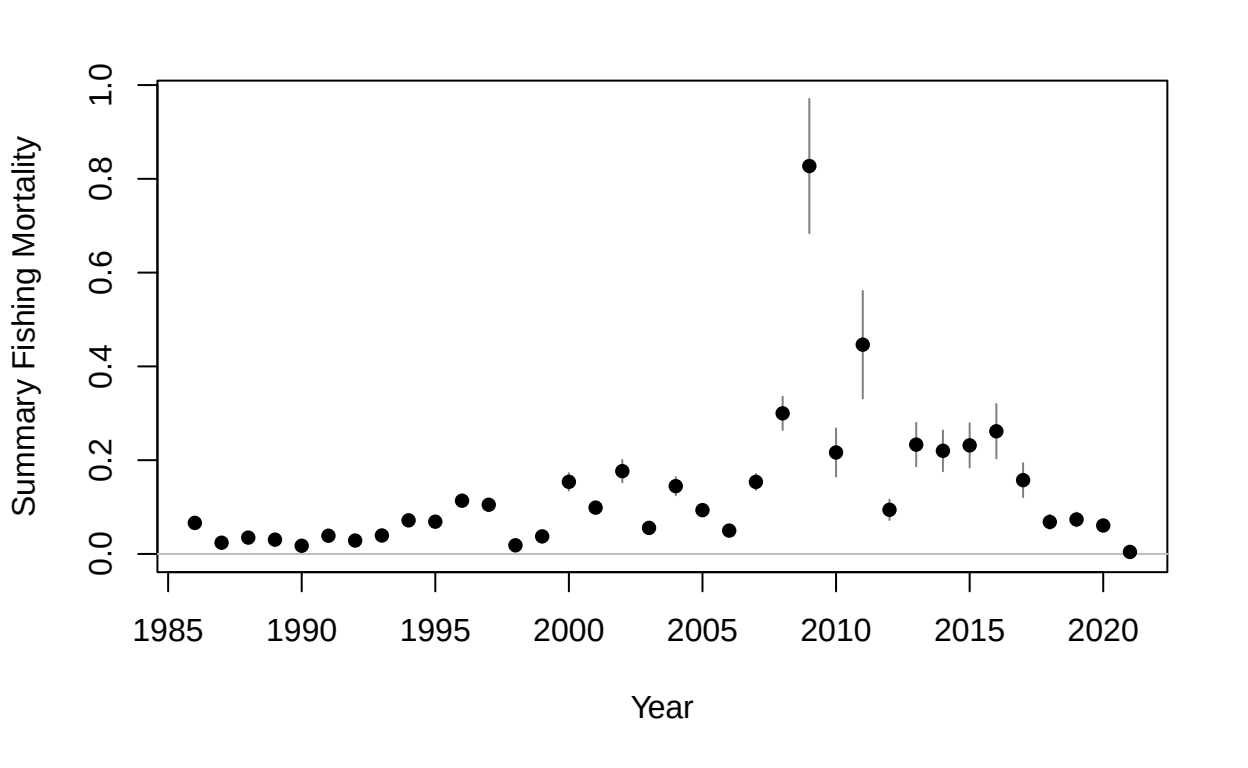

Relative spawning biomass: B/B_MSY
0
1
2
3
4
5
1990
2000
2010
2020
Year

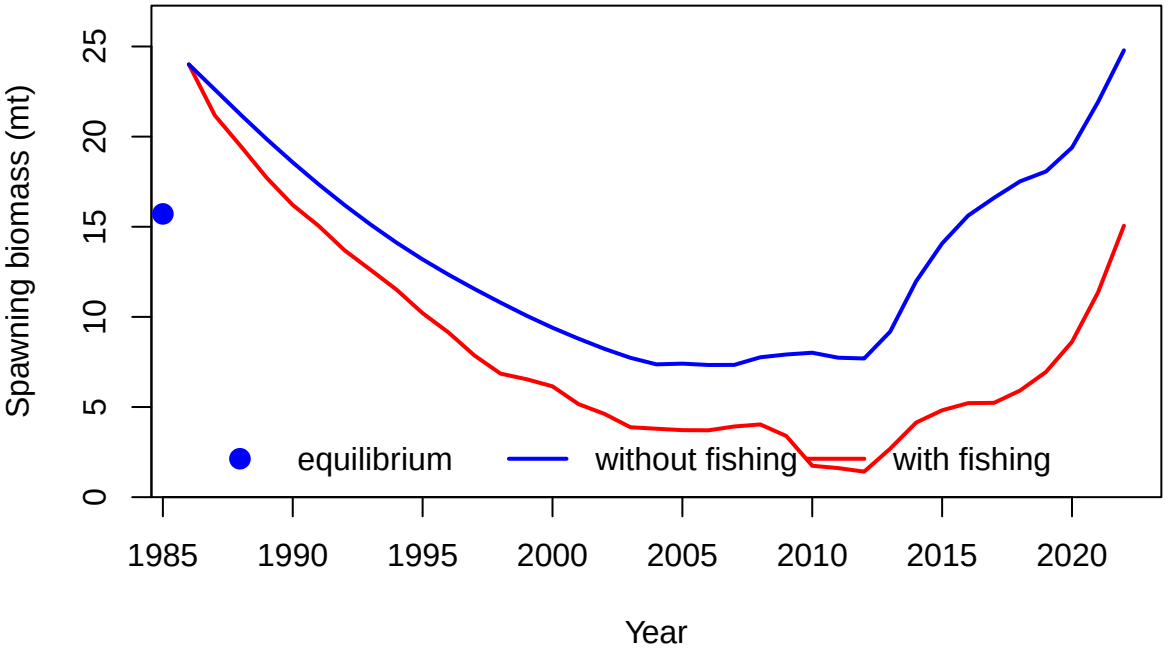

Total biomass (mt)
0
10
20
30
40
50
1990
2000
2010
2020
Year

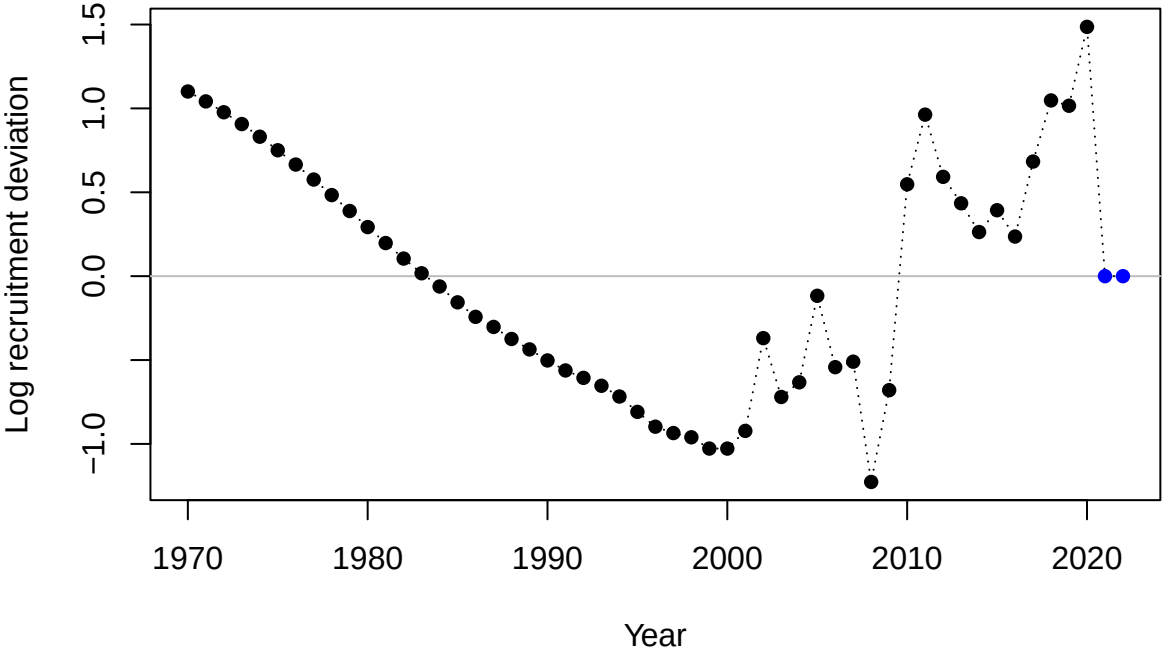

Summary biomass (mt)
0
10
20
30
40
50
1990
2000
2010
2020
Year

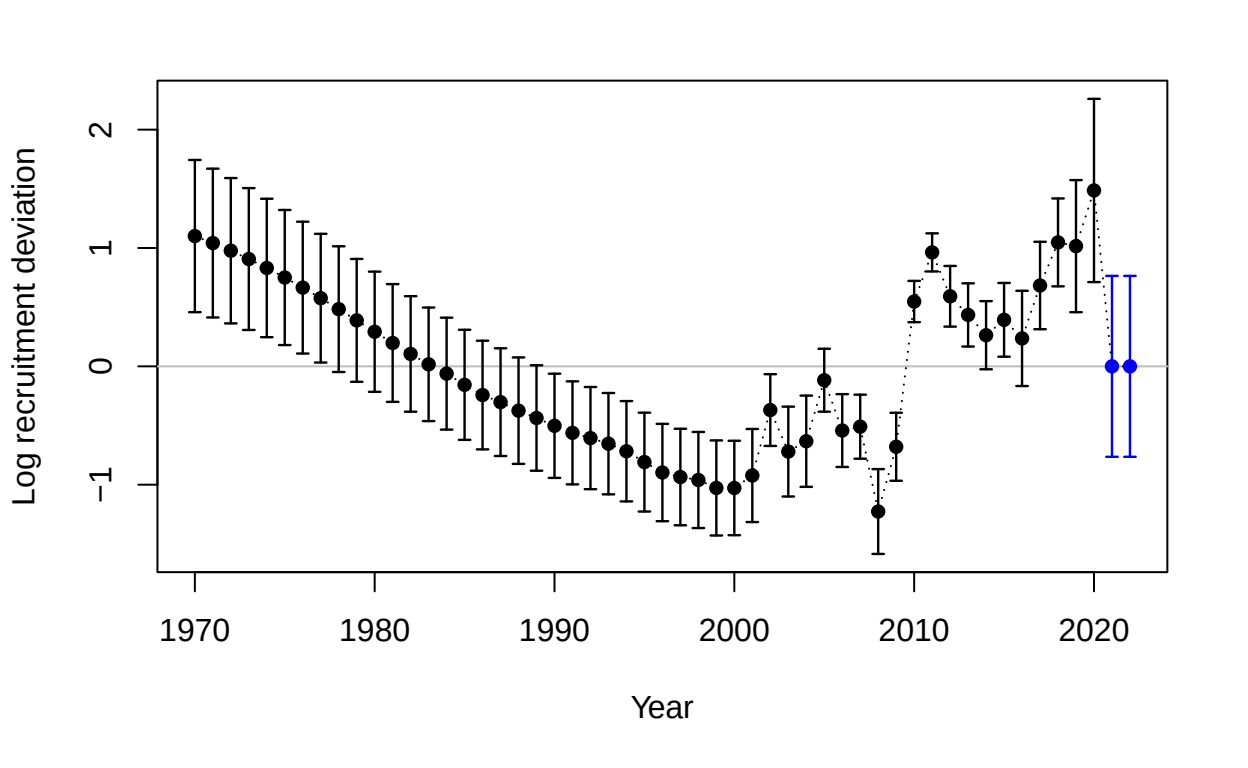

Age−0 recruits (1,000s)
0
2
4
6
8
10
12
1990
2000
2010
2020
Year

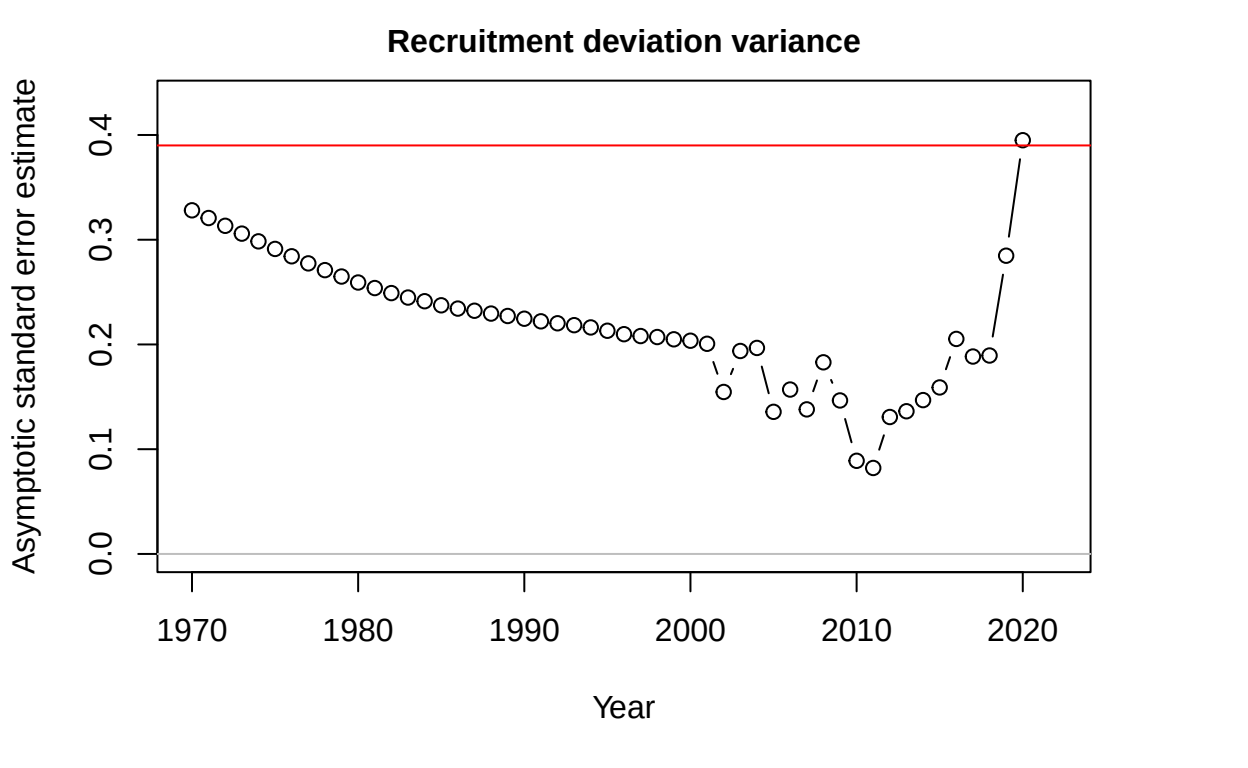

Age−0 recruits (1,000s)
0
5
10
15
20
25
1990
2000
2010
2020
Year

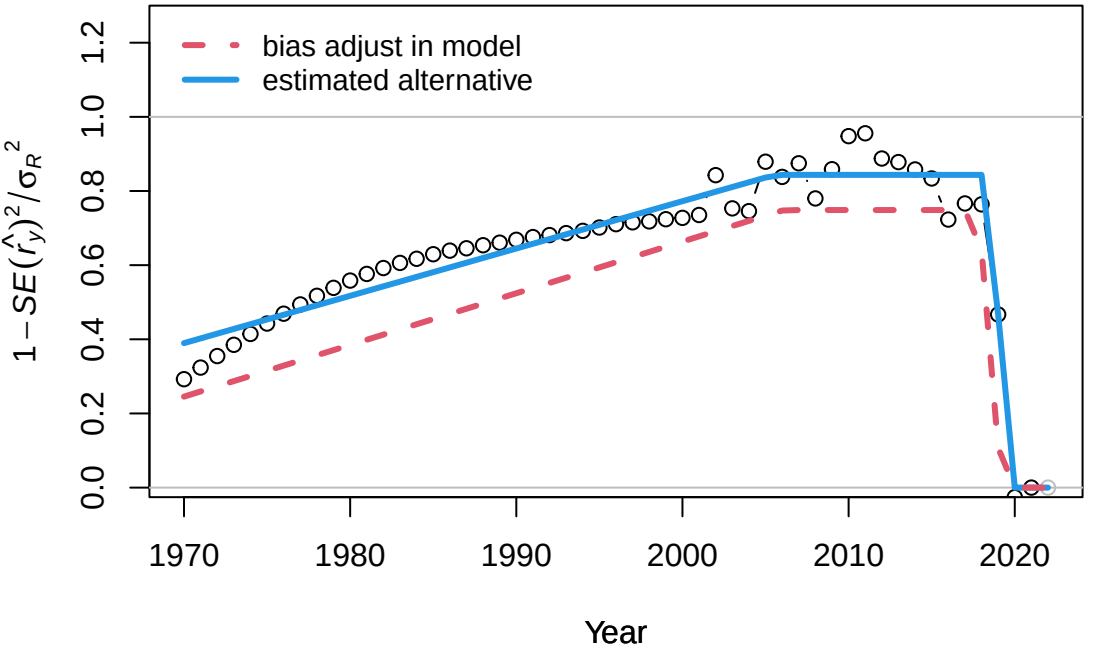

Summary Fishing Mortality
0.0
0.2
0.4
0.6
0.8
1.0
1985
1990
1995
2000
2005
2010
2015
2020
Year

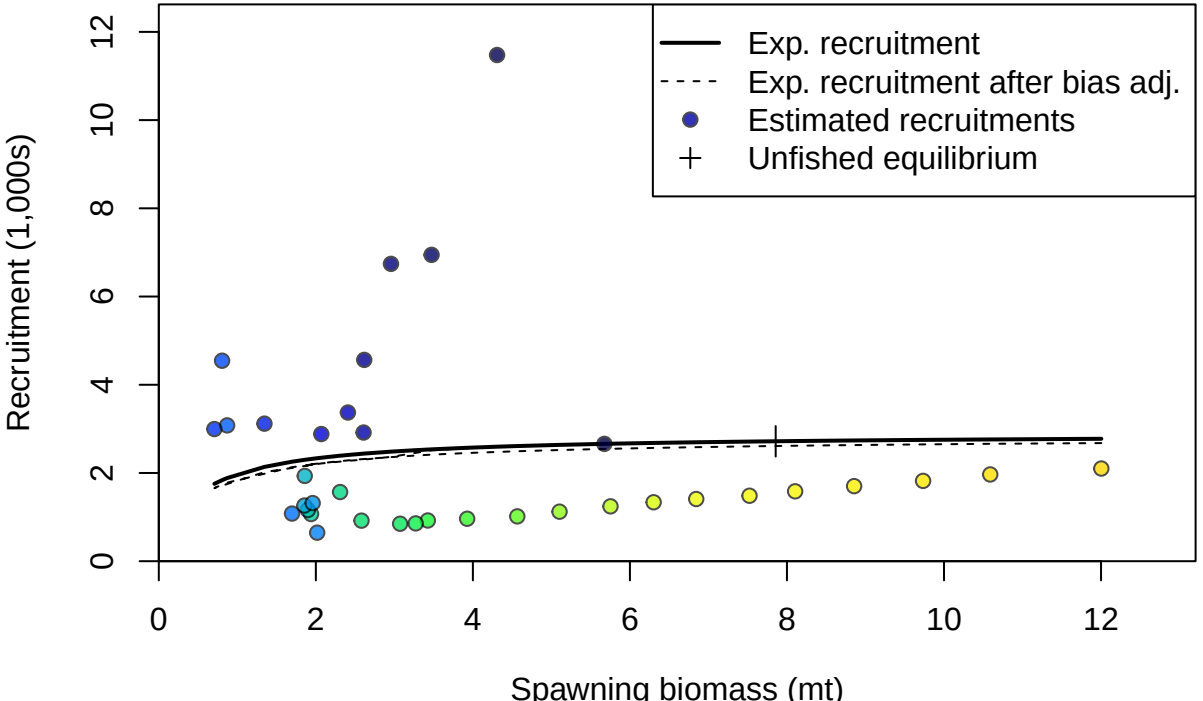

Spawning biomass (mt)
0
5
10
15
20
25
1985
1990
1995
2000
2005
2010
2015
2020
Year
equilibrium
without fishing
with fishing

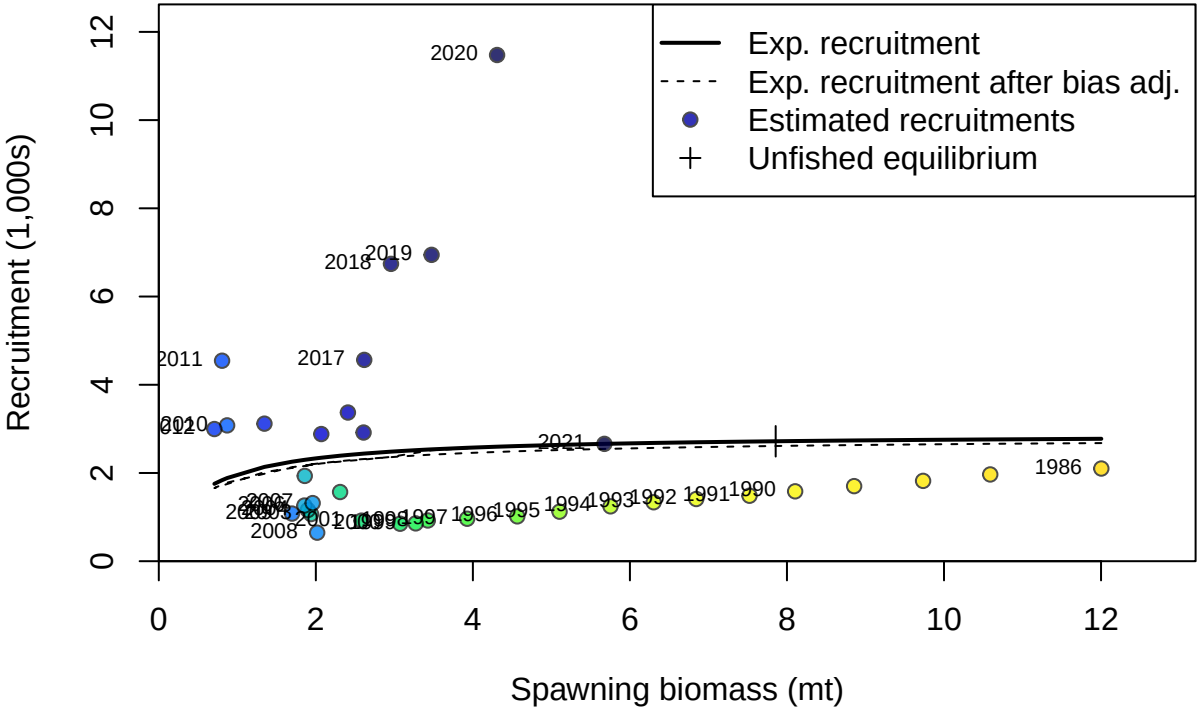

Log recruitment deviation
1.5
1.0
0.5
0.0
−1.0
1970
1980
1990
2000
2010
2020
Year

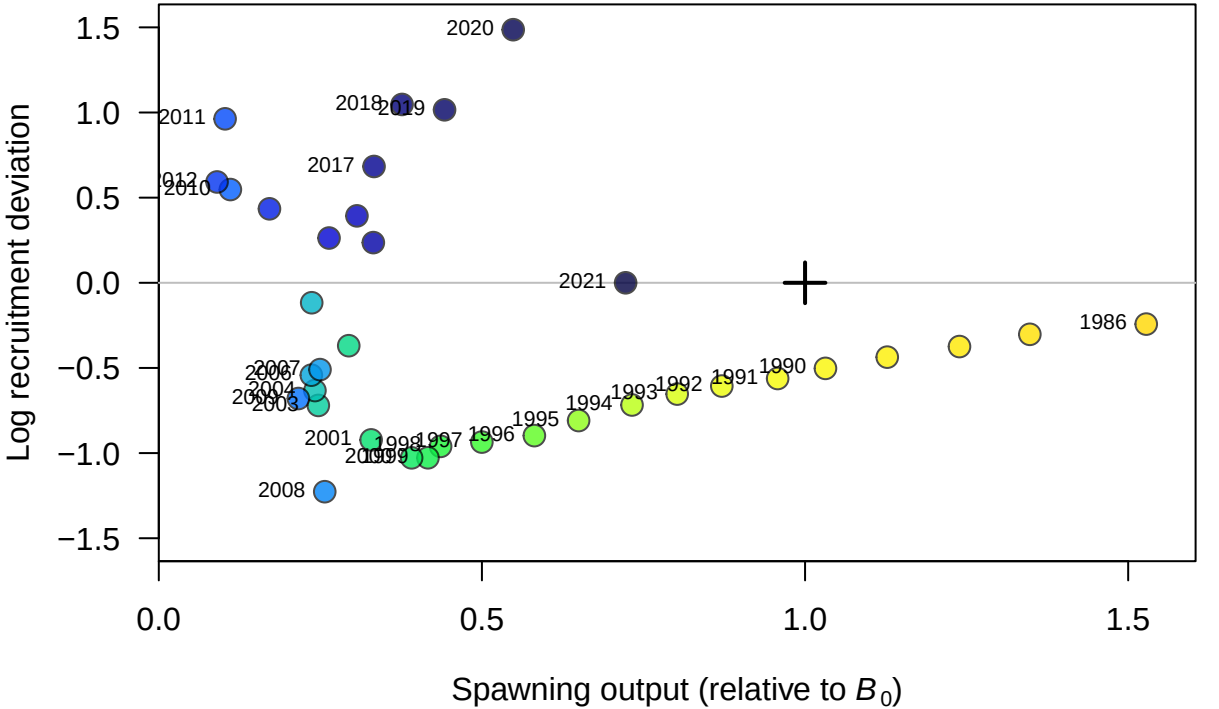

Log recruitment deviation
2
1
0
−1
1970
1980
1990
2000
2010
2020
Year

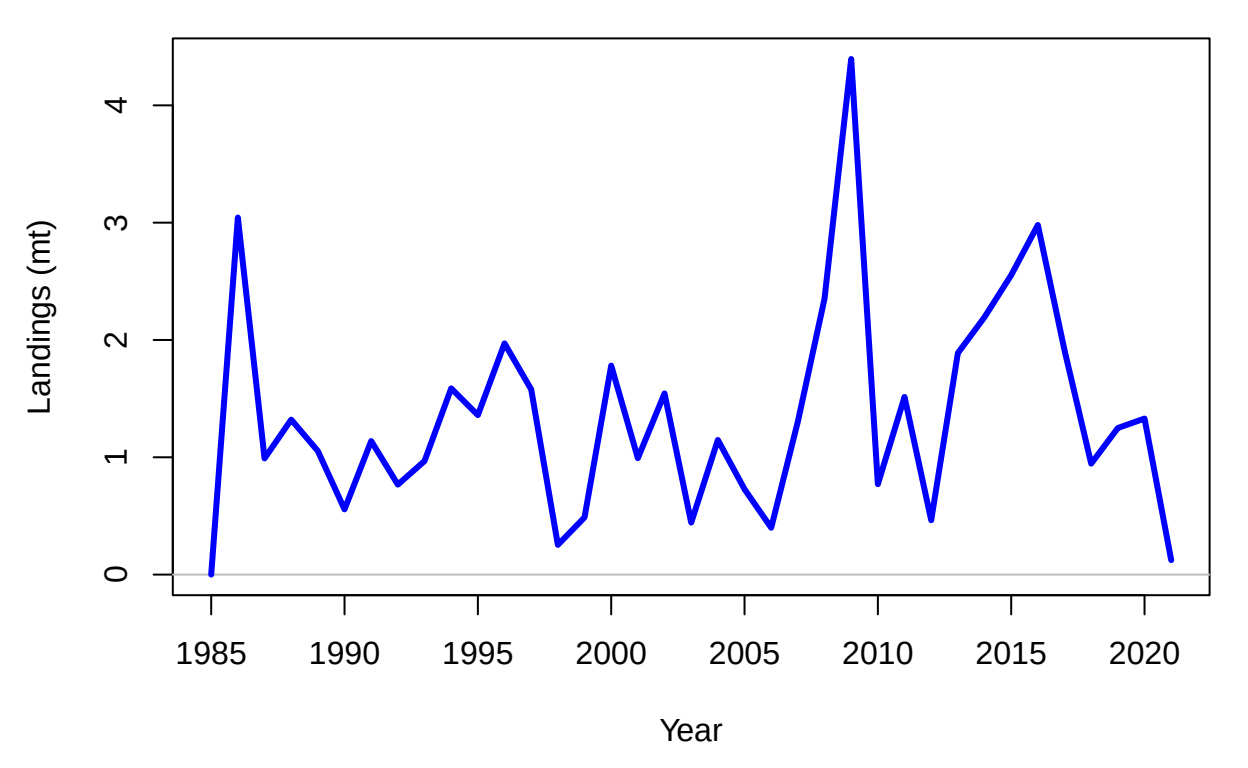

Recruitment deviation variance
Asymptotic standard error estimate
0.0
0.1
0.2
0.3
0.4
1970
1980
1990
2000
2010
2020
Year

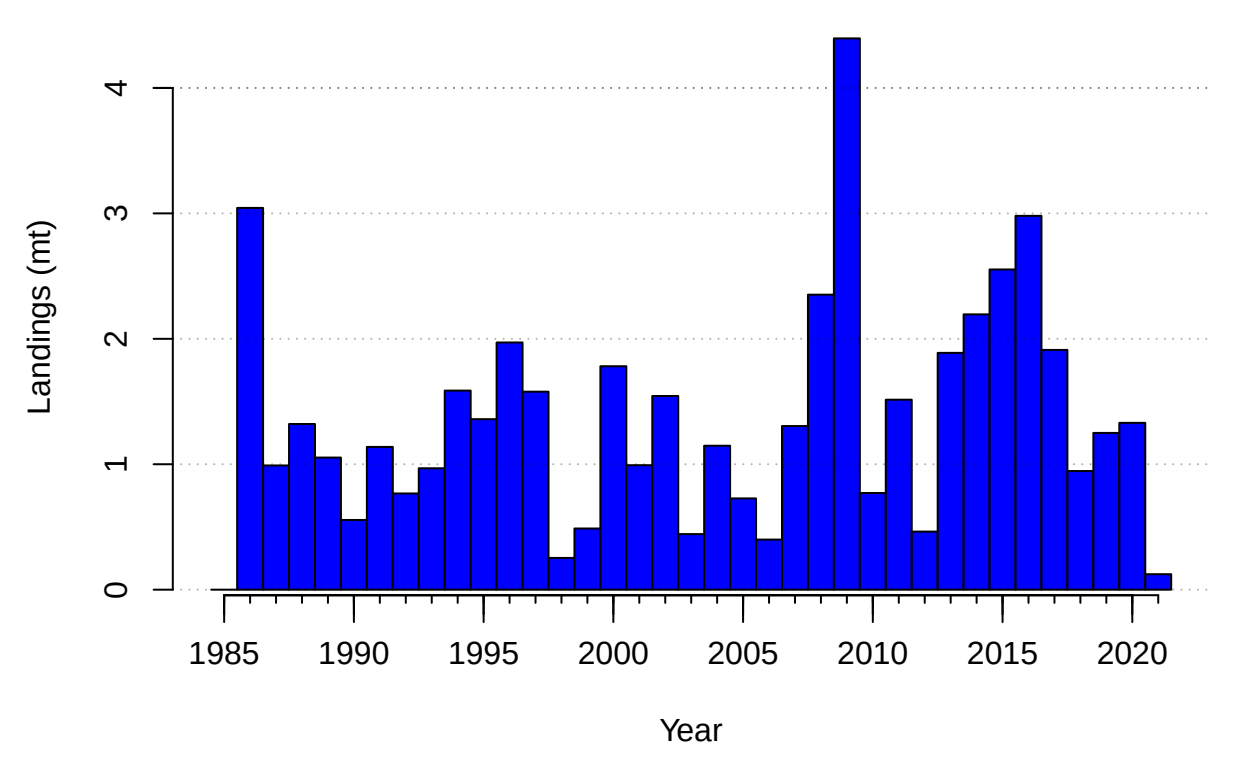

bias adjust in model
estimated alternative
$1-SE(\hat{r}_y)^2/\sigma_R{}^2$
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1970
1980
1990
2000
2010
2020
Year

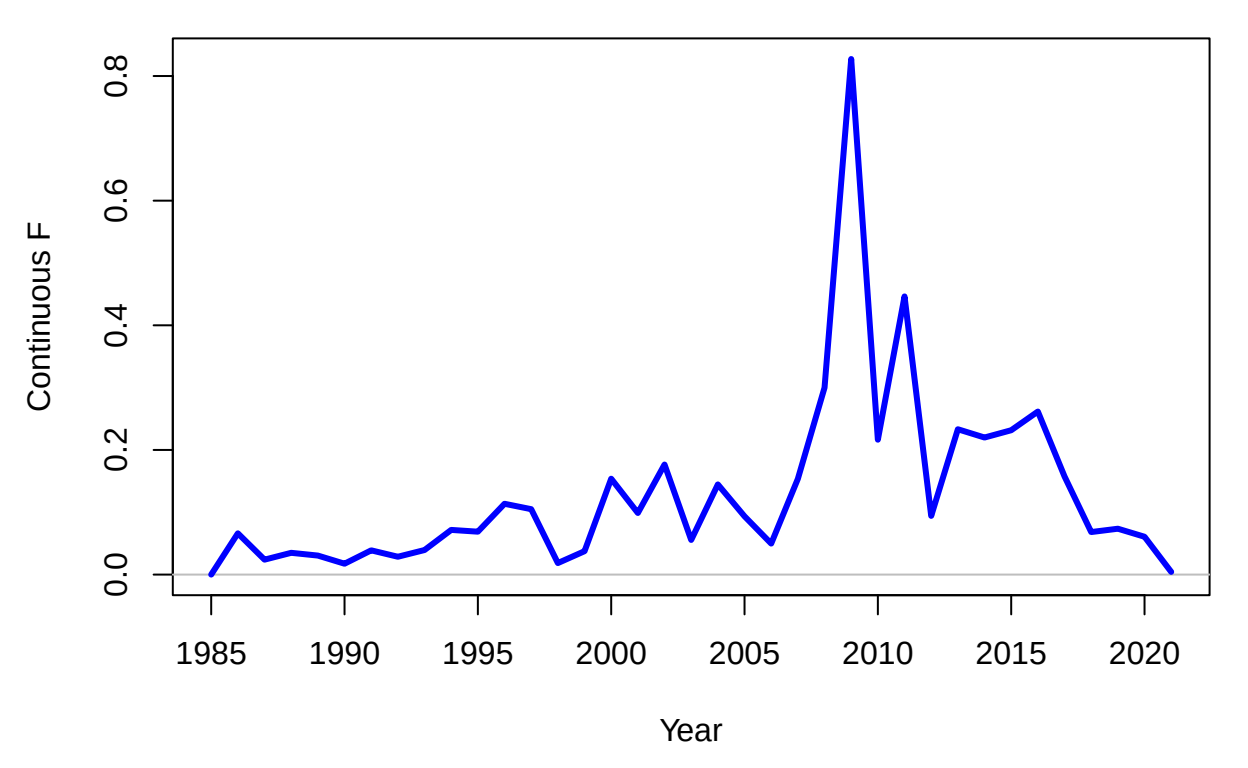

Exp. recruitment
Exp. recruitment after bias adj.
Estimated recruitments
Unfished equilibrium
Recruitment (1,000s)
0
2
4
6
8
10
12
Spawning biomass (mt)
0
2
4
6
8
10
12

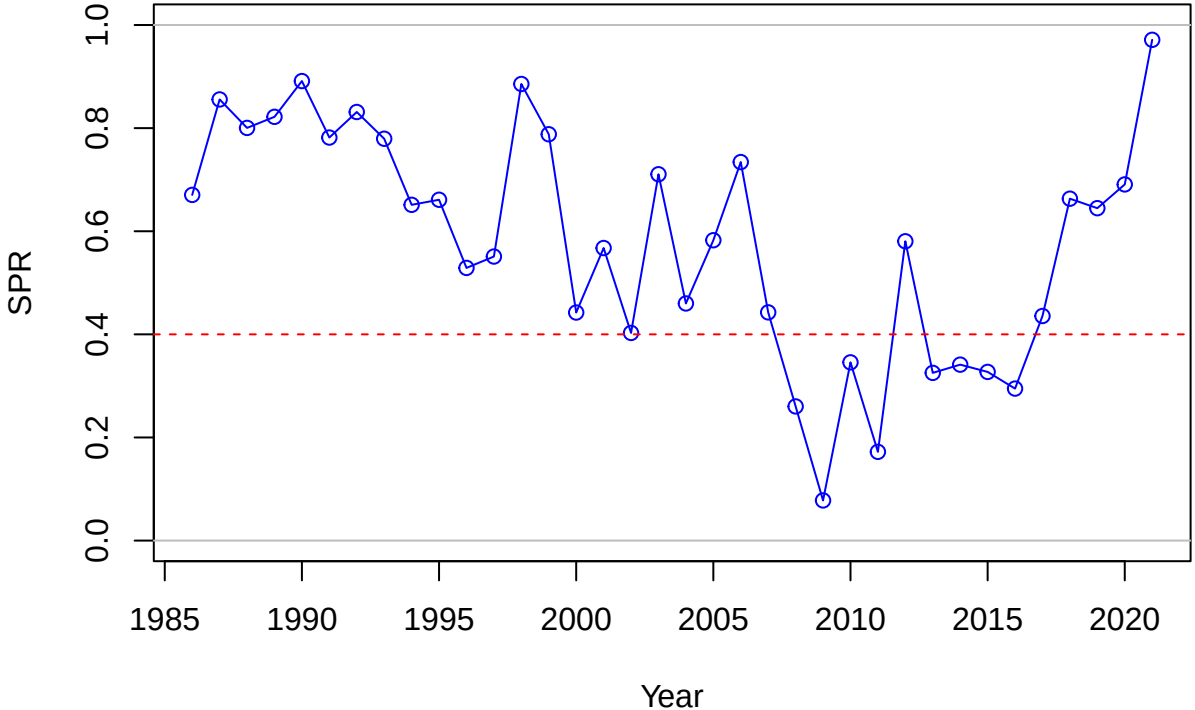

Exp. recruitment
Exp. recruitment after bias adj.
Estimated recruitments
Unfished equilibrium
Recruitment (1,000s)
Spawning biomass (mt)
0
2
4
6
8
10
12
2020
2019
2018
2011
2017
2021
1986
1990
1991
1992
1993
1994
1995
1996
1997
2008

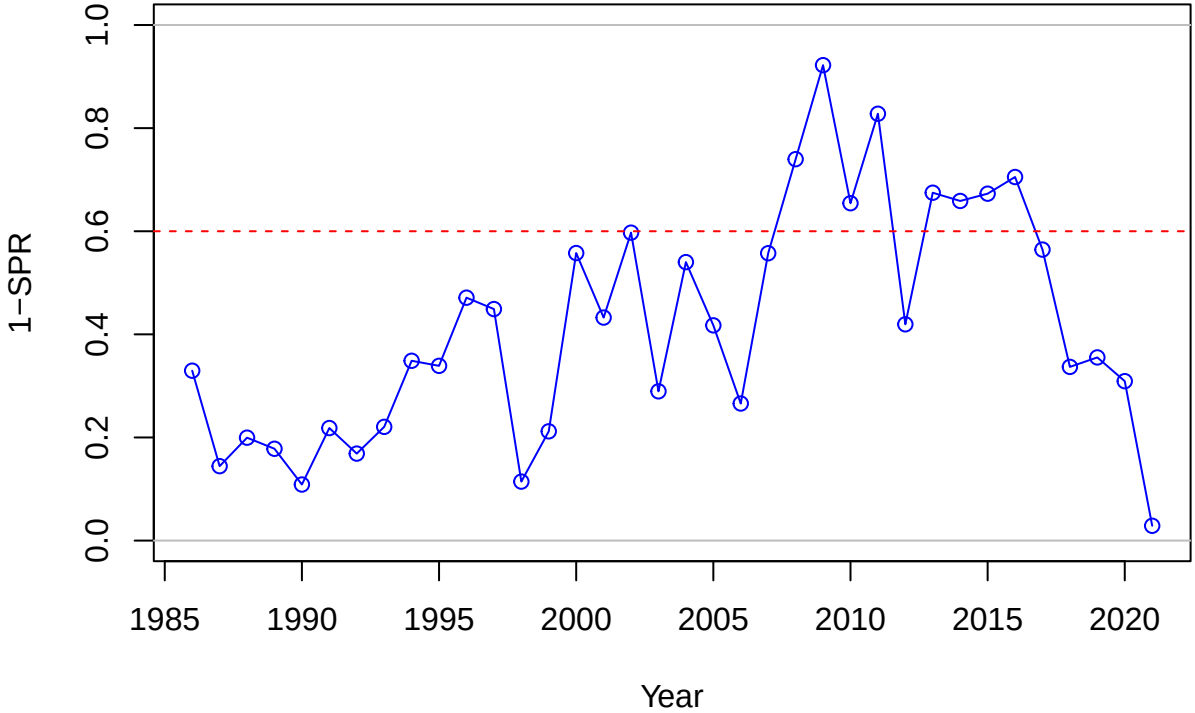

Log recruitment deviation
Spawning output (relative to B_0)
1.5
1.0
0.5
0.0
−0.5
−1.0
−1.5
0.0
0.5
1.0
1.5
2020
2018
2019
2011
2017
2010
2021
1986
1990
1991
1992
1993
1994
1995
1996
1997
2001
2008

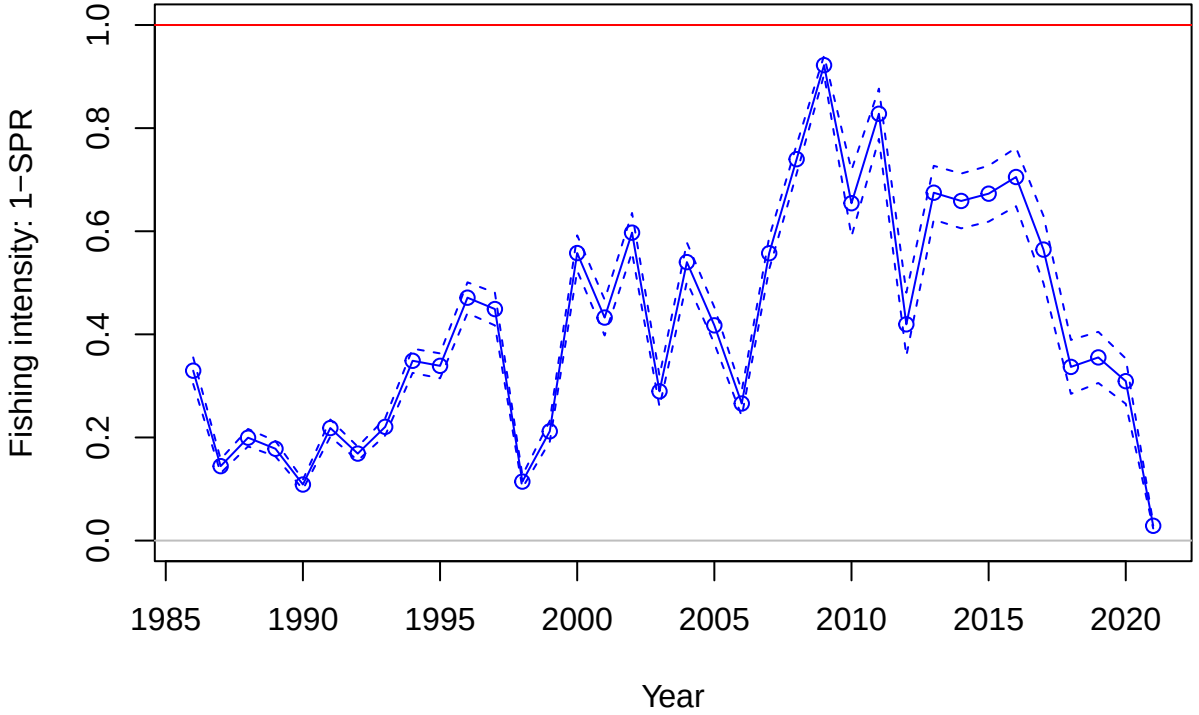

Landings (mt)
0
1
2
3
4
1985
1990
1995
2000
2005
2010
2015
2020
Year

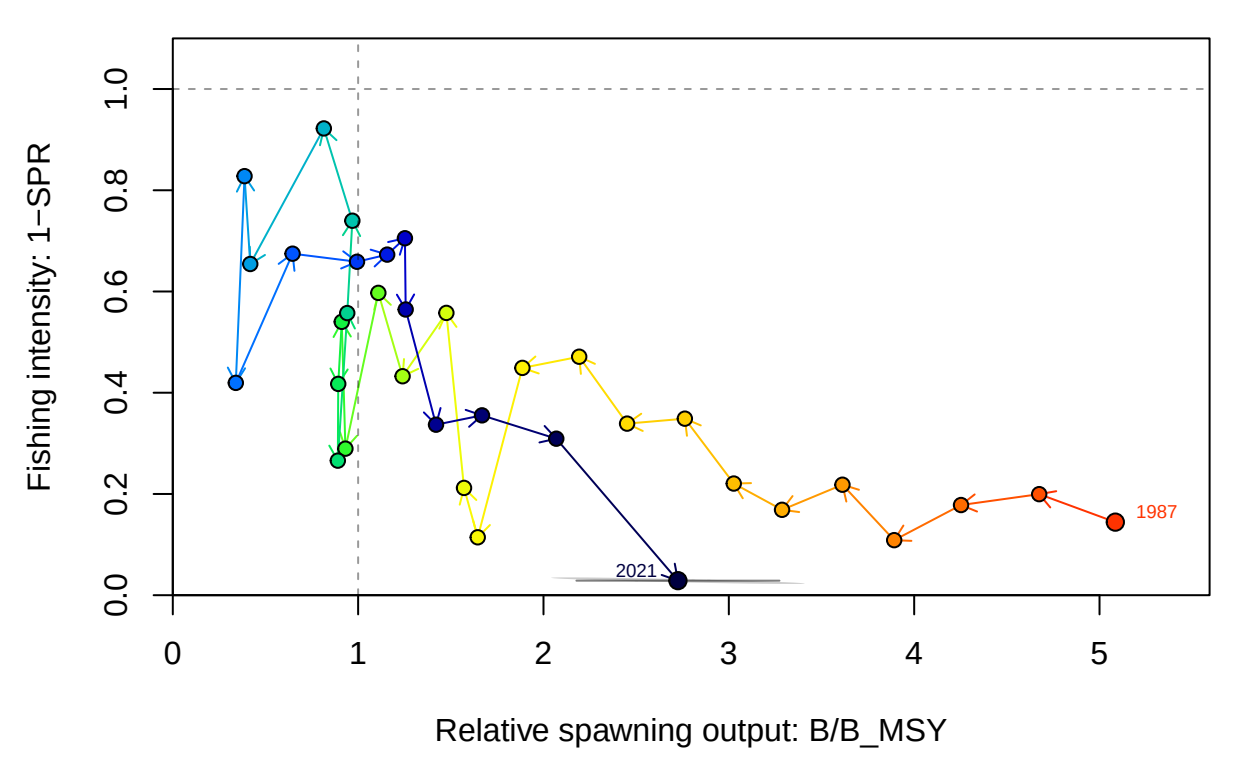

Landings (mt)
0
1
2
3
4
1985
1990
1995
2000
2005
2010
2015
2020
Year

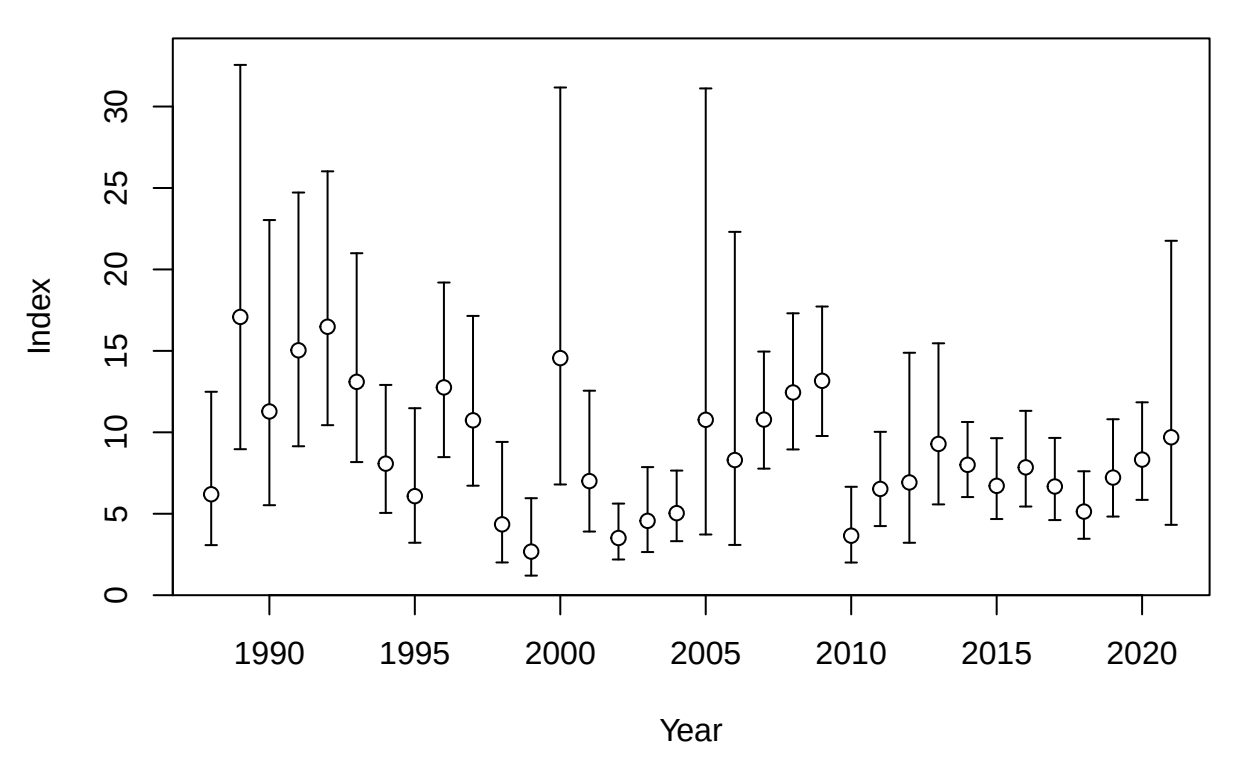

Continuous F
0.0
0.2
0.4
0.6
0.8
1985
1990
1995
2000
2005
2010
2015
2020
Year

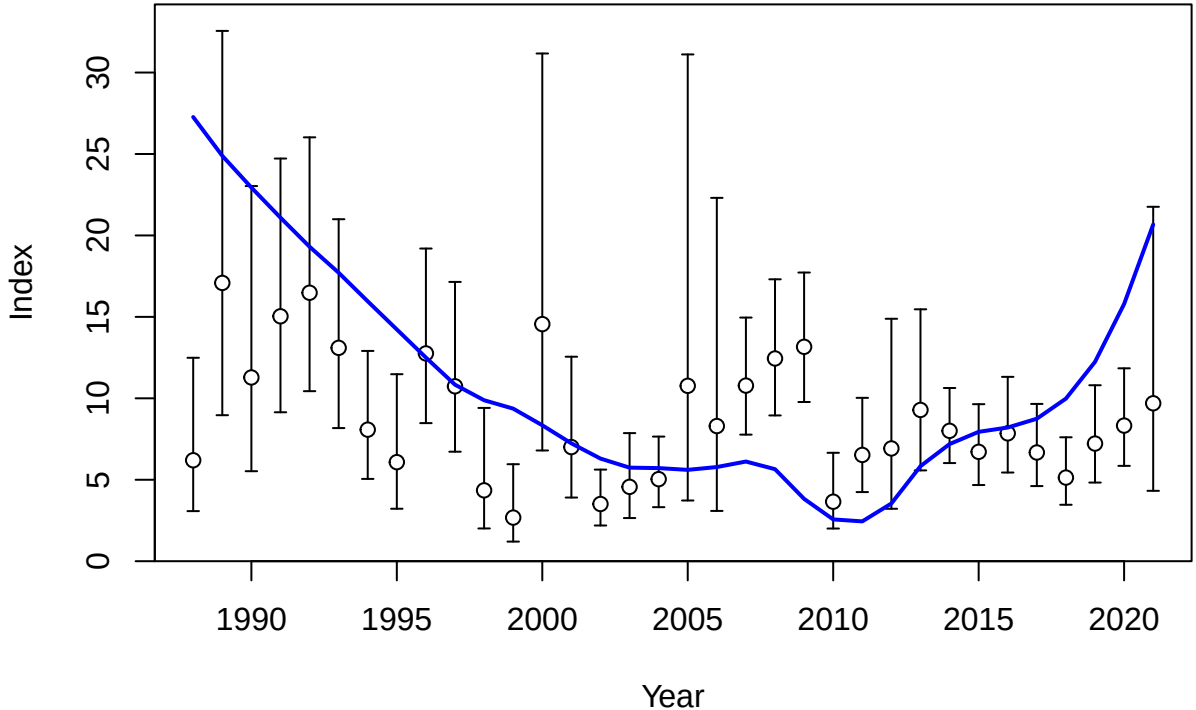

SPR
0.0
0.2
0.4
0.6
0.8
1.0
1985
1990
1995
2000
2005
2010
2015
2020
Year

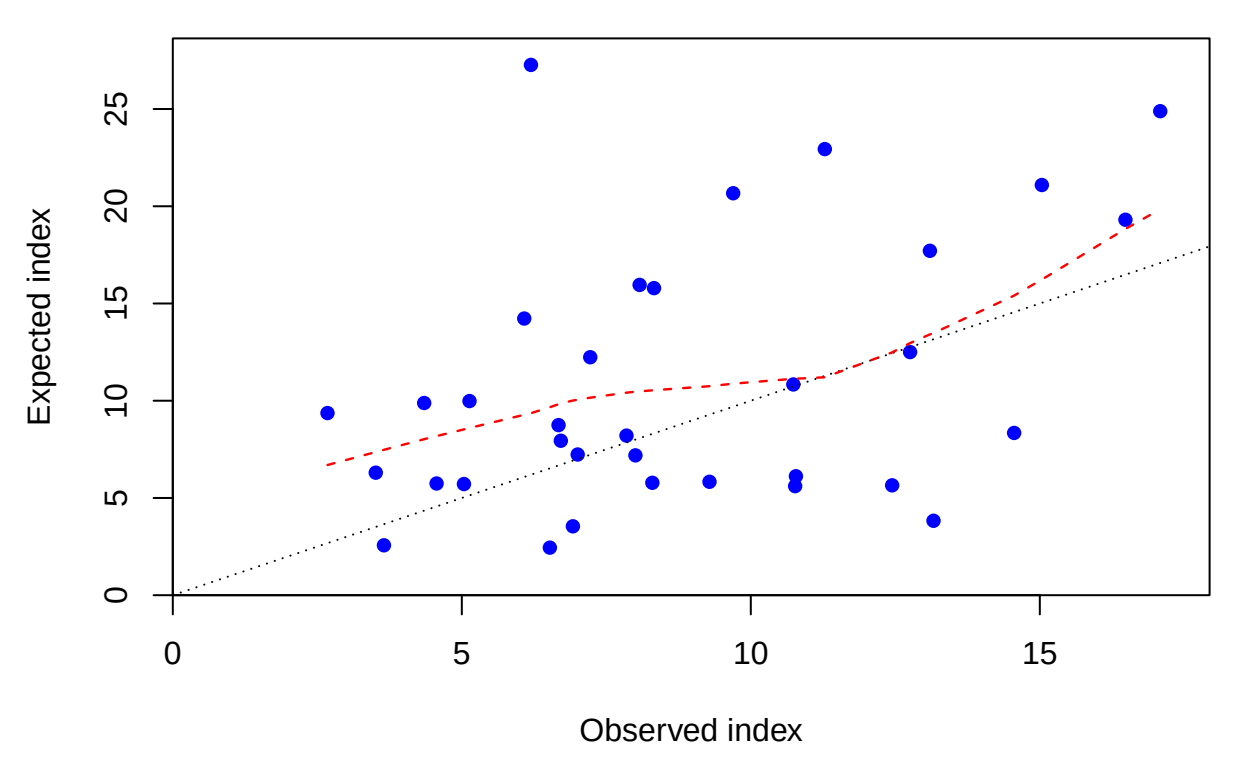

1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
1985
1990
1995
2000
2005
2010
2015
2020
Year

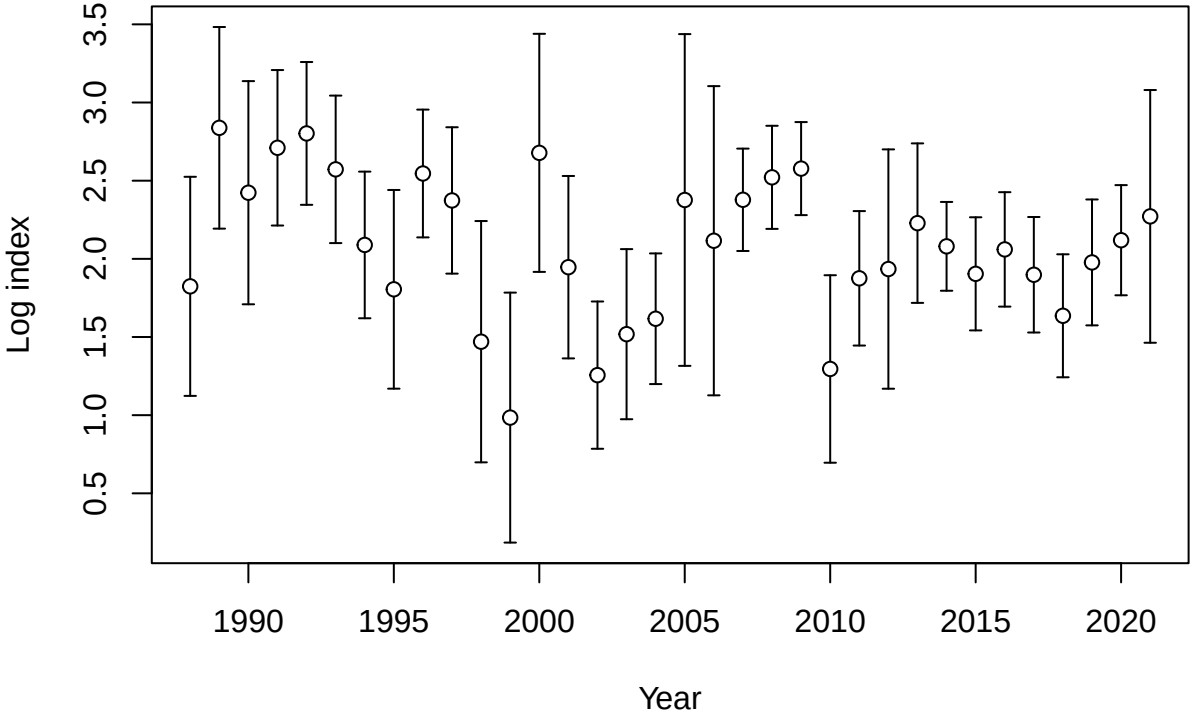

Fishing intensity: 1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
1985
1990
1995
2000
2005
2010
2015
2020
Year

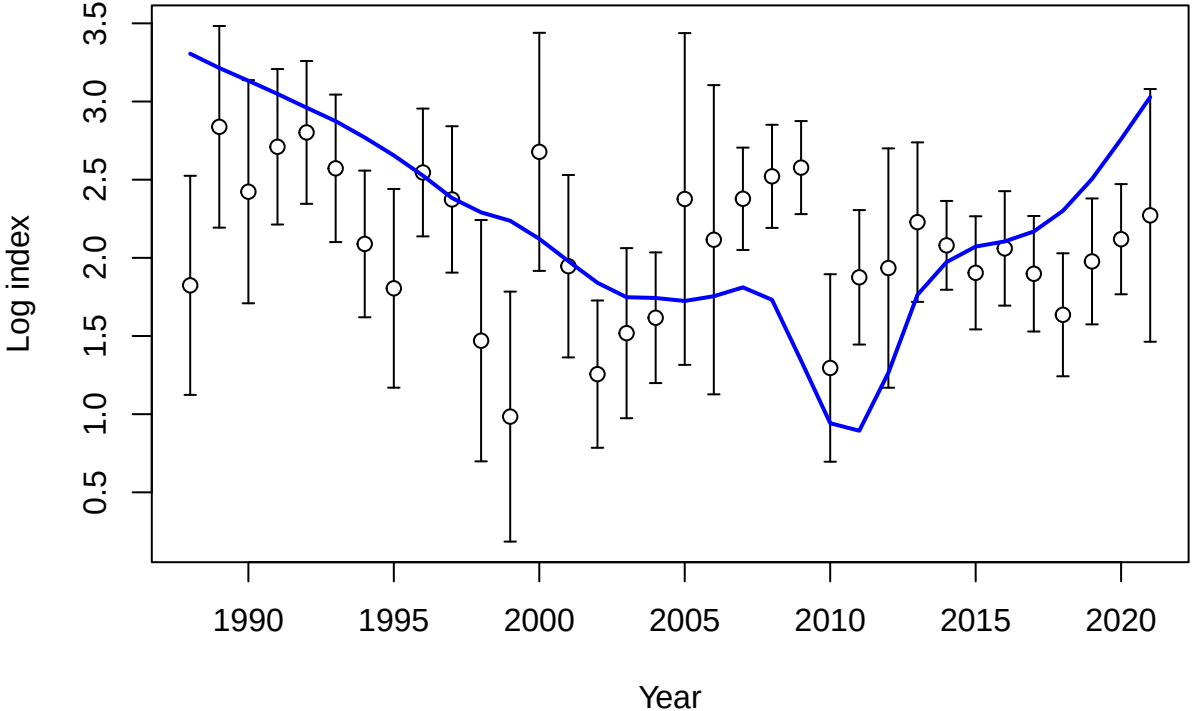

Fishing intensity: 1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
0
1
2
3
4
5
Relative spawning output: B/B_MSY
1987
2021

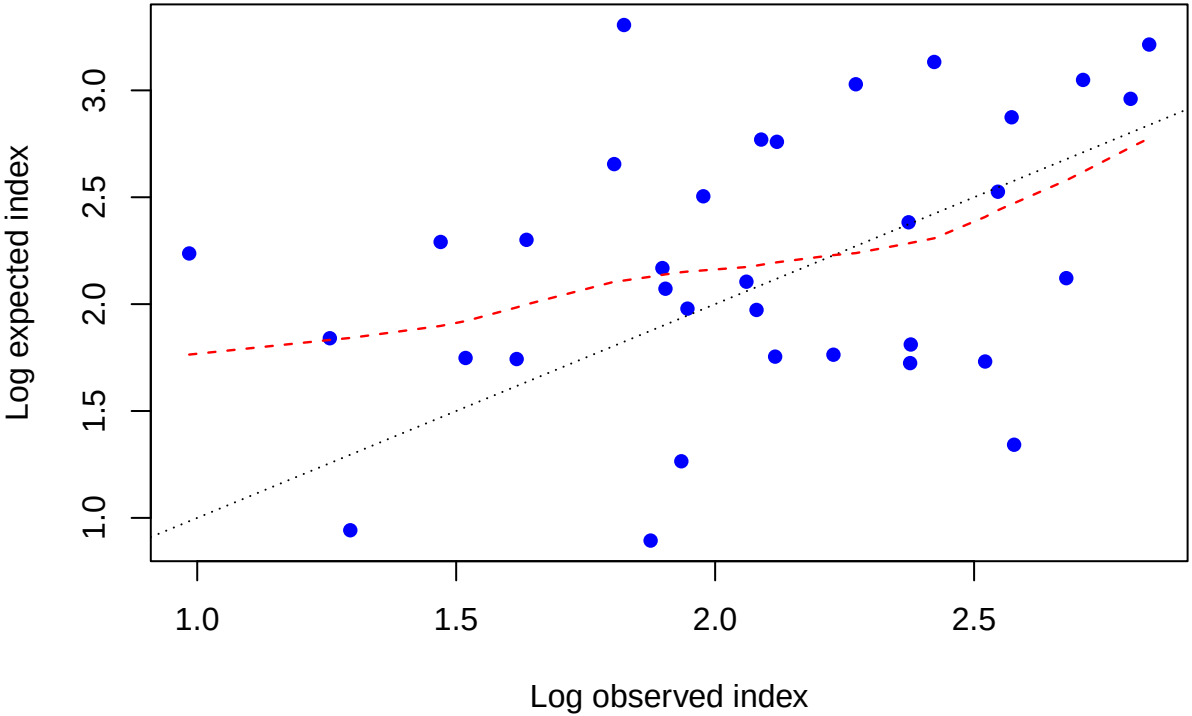

Index
0
5
10
15
20
25
30
1990
1995
2000
2005
2010
2015
2020
Year

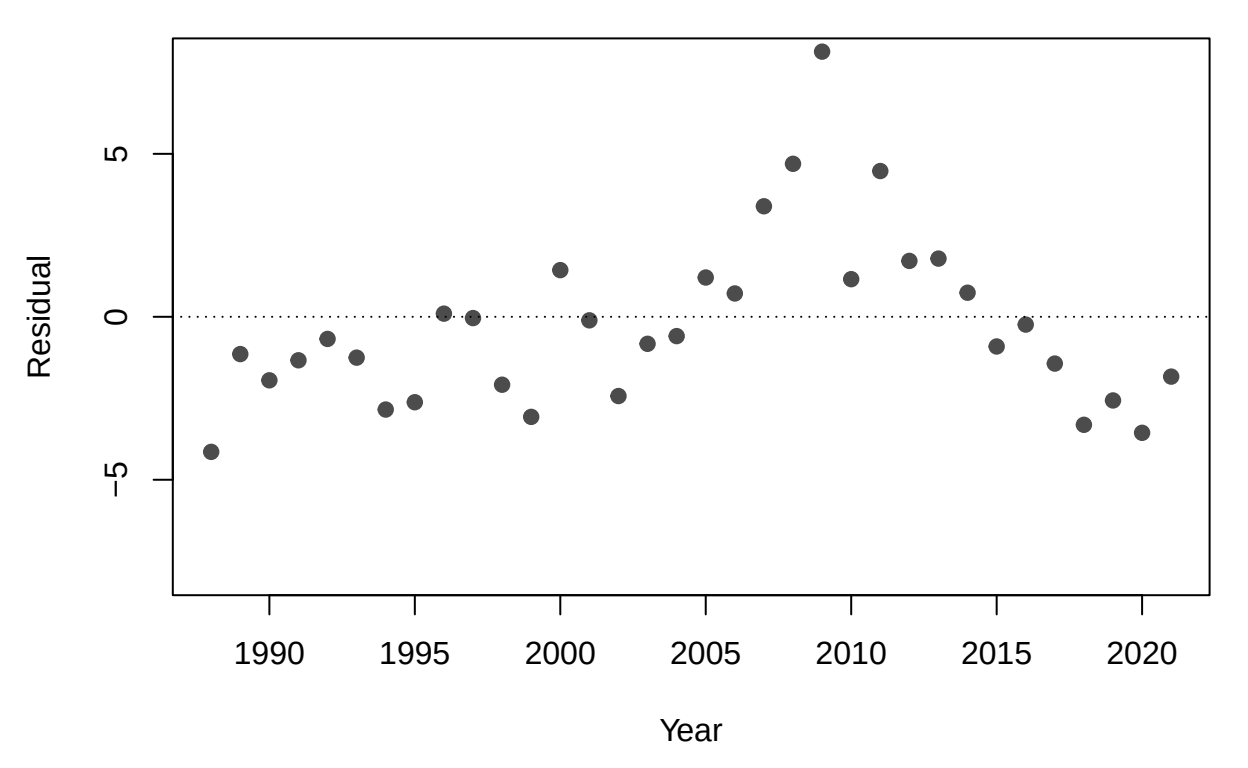

Index
0
5
10
15
20
25
30
1990
1995
2000
2005
2010
2015
2020
Year

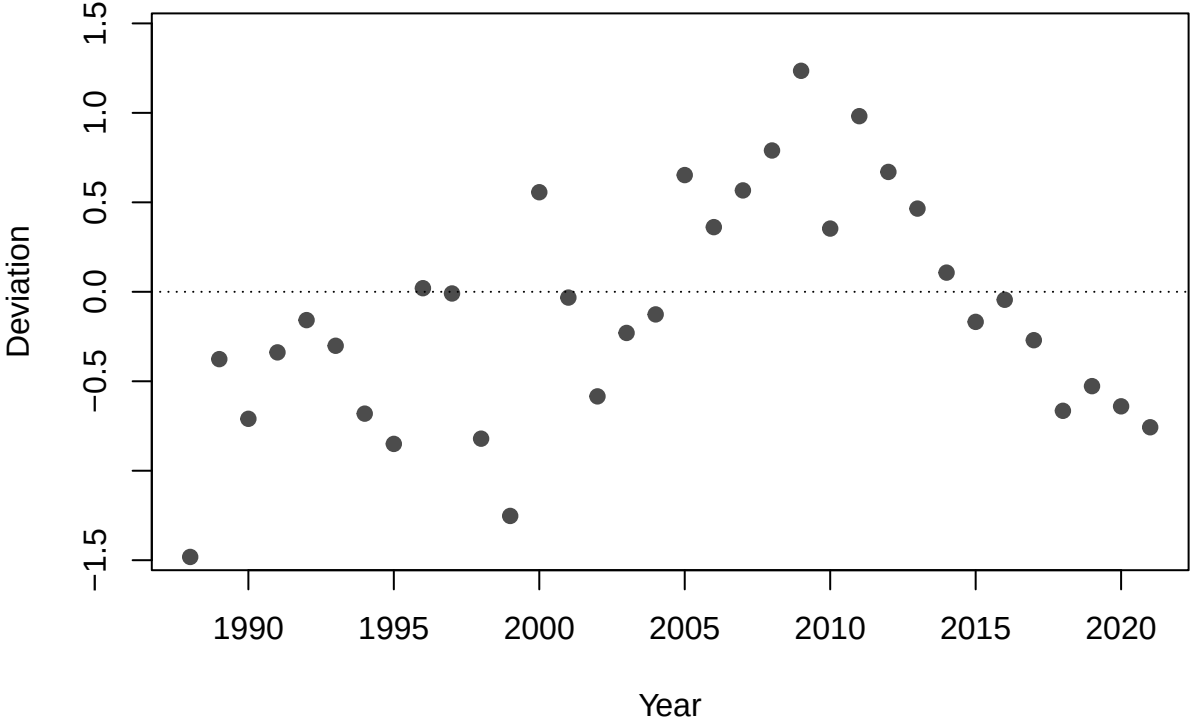

Expected index
0
5
10
15
20
25
0
5
10
15
Observed index

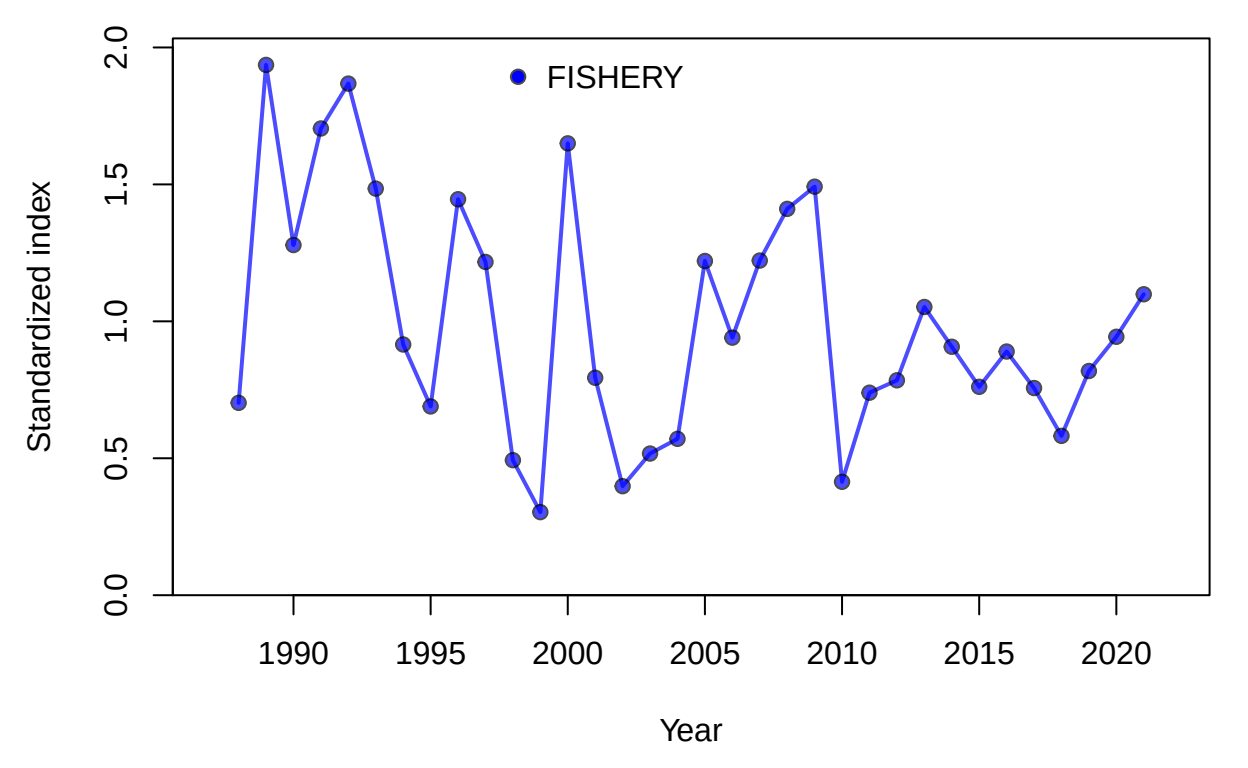

Log index
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1990
1995
2000
2005
2010
2015
2020
Year

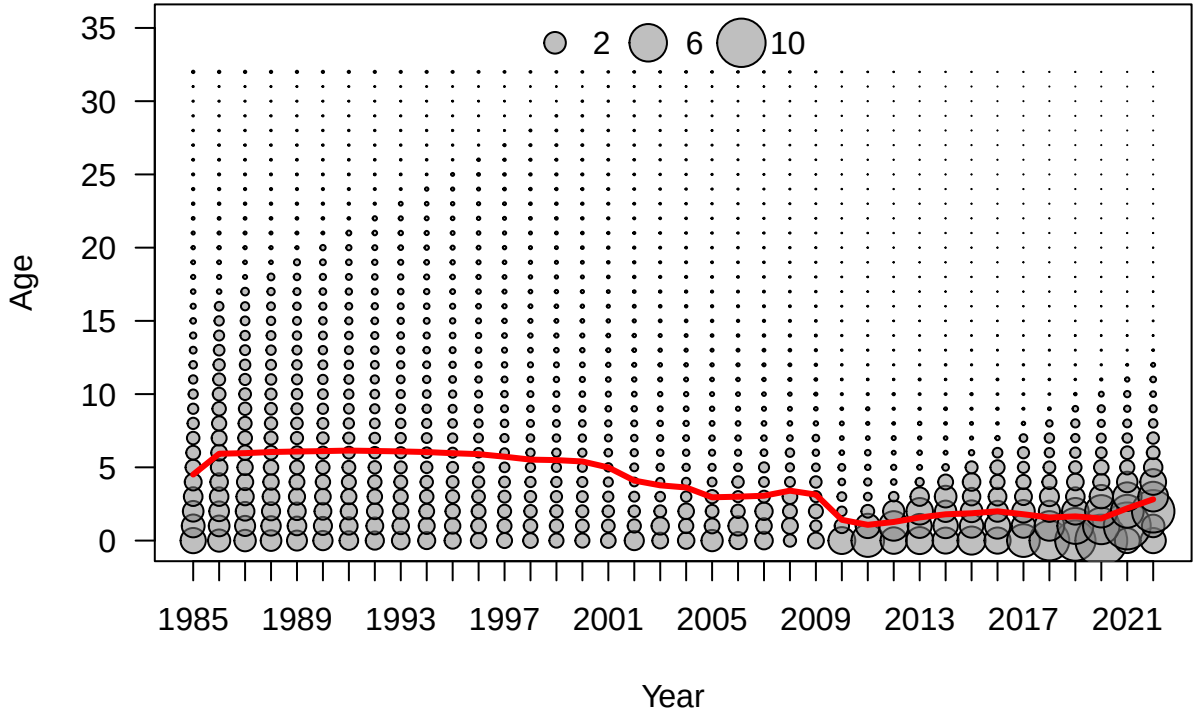

Log index
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1990
1995
2000
2005
2010
2015
2020
Year

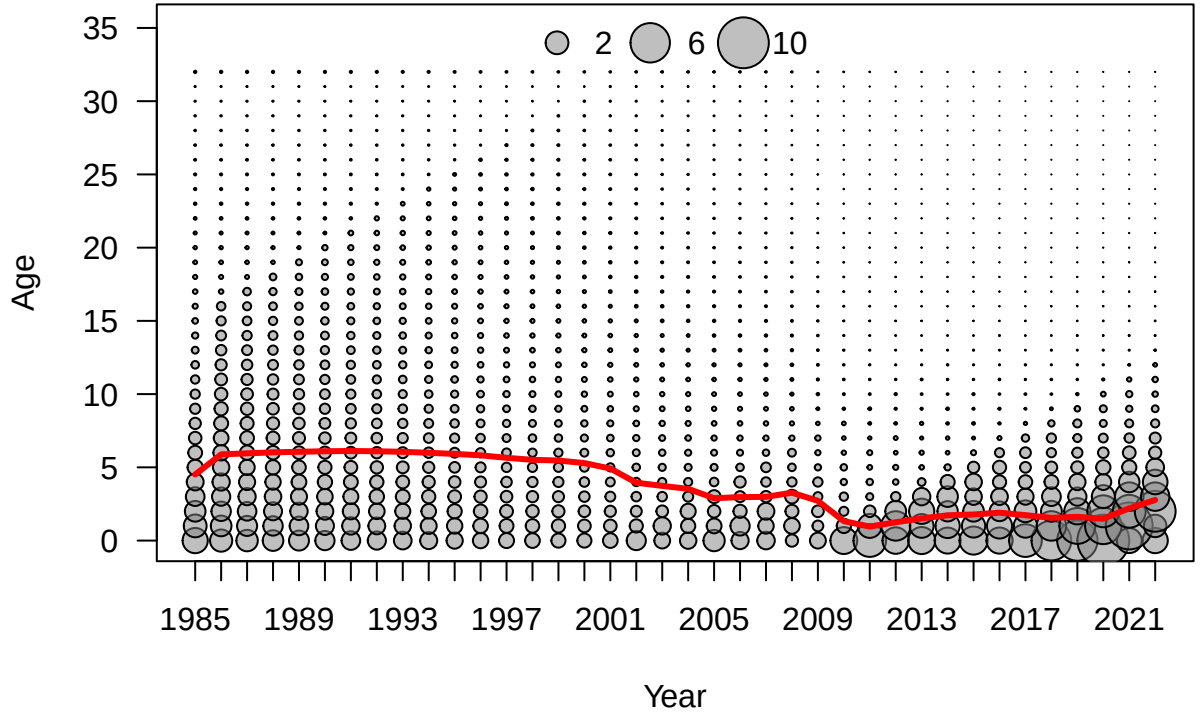

Log expected index
1.0
1.5
2.0
2.5
3.0
Log observed index
1.0
1.5
2.0
2.5

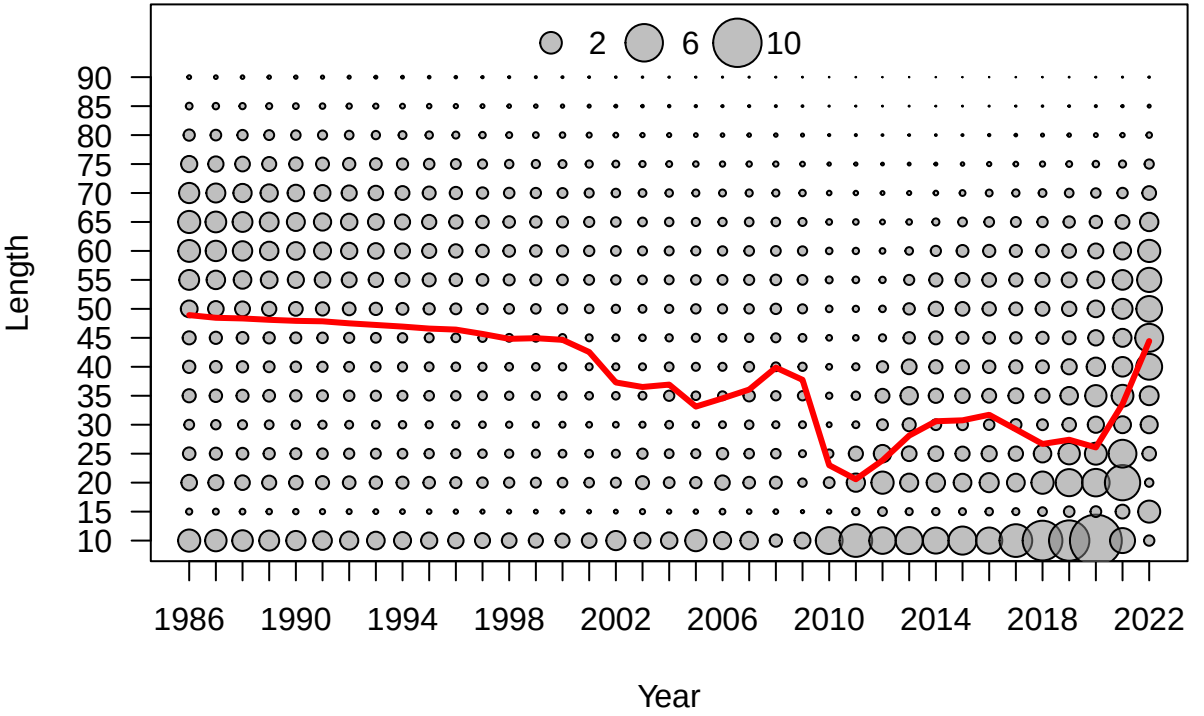

Residual
5
0
−5
1990
1995
2000
2005
2010
2015
2020
Year

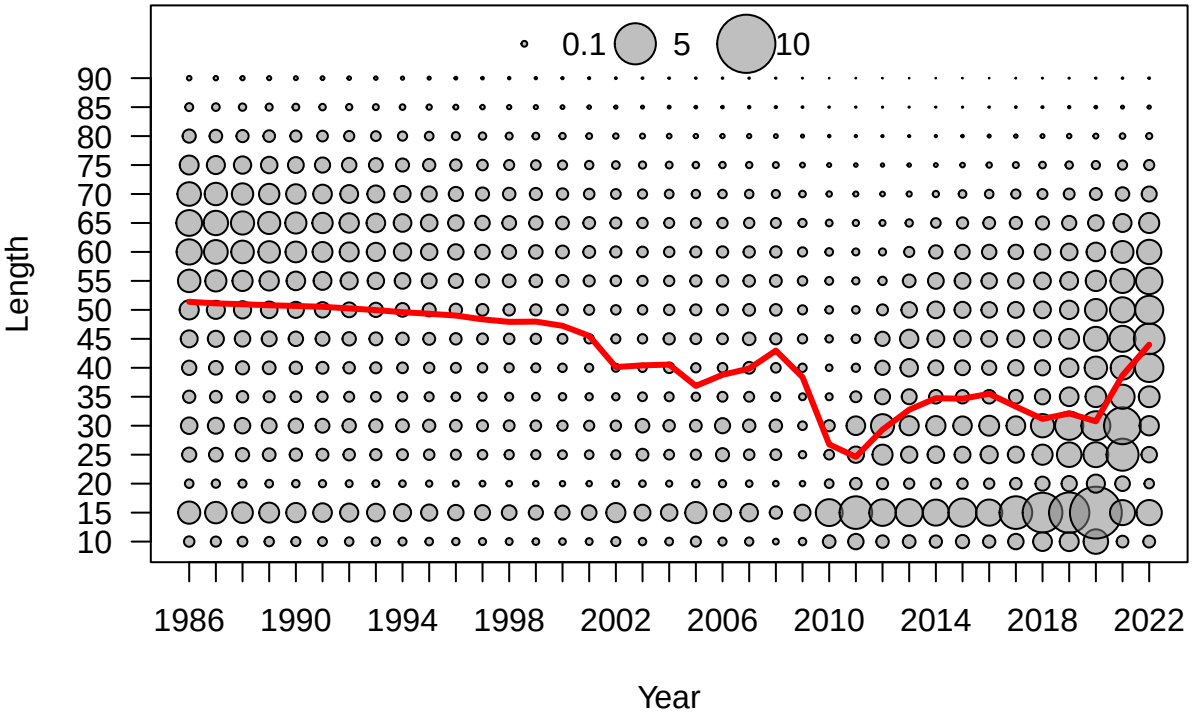

Deviation
1.5
1.0
0.5
0.0
−0.5
−1.5
1990
1995
2000
2005
2010
2015
2020
Year

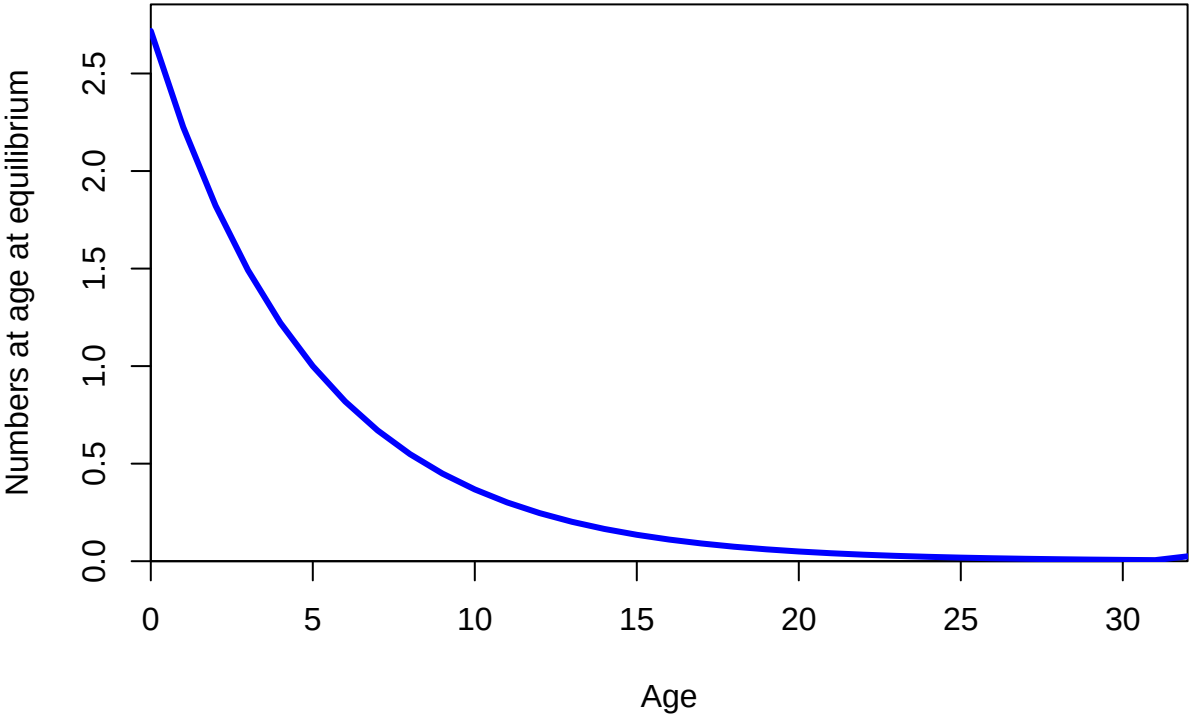

FISHERY
Standardized index
0.0
0.5
1.0
1.5
2.0
1990
1995
2000
2005
2010
2015
2020
Year

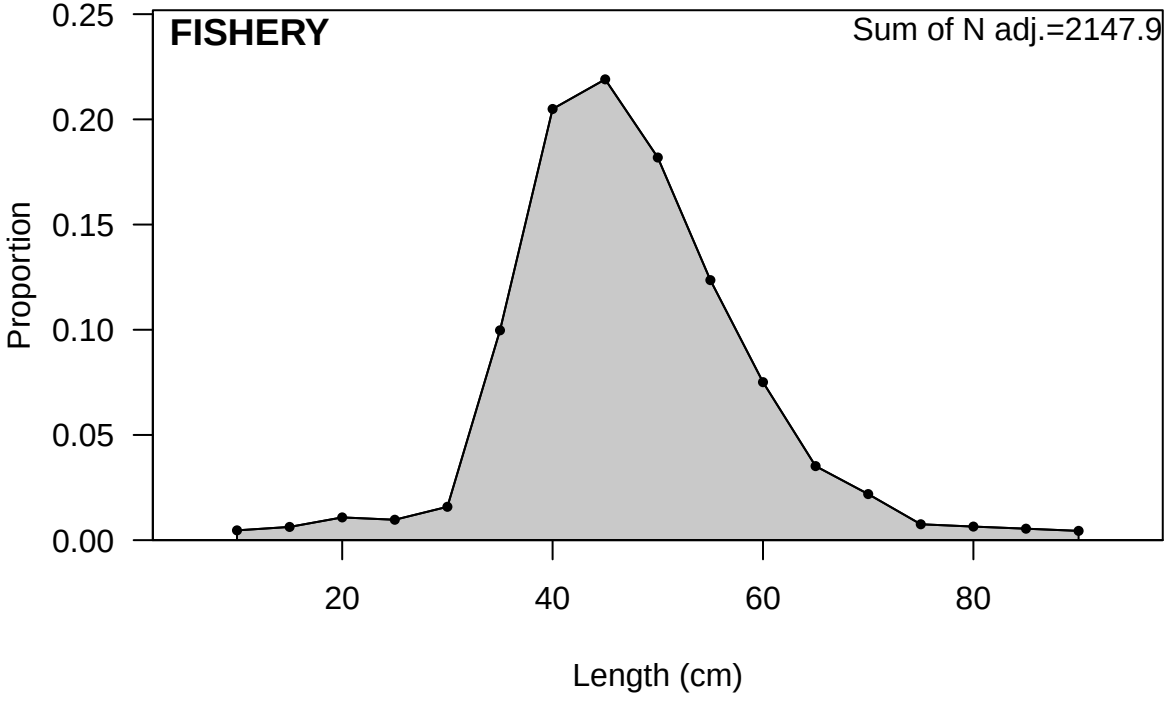

2
6
10
Age
0
5
10
15
20
25
30
35
1985
1989
1993
1997
2001
2005
2009
2013
2017
2021
Year

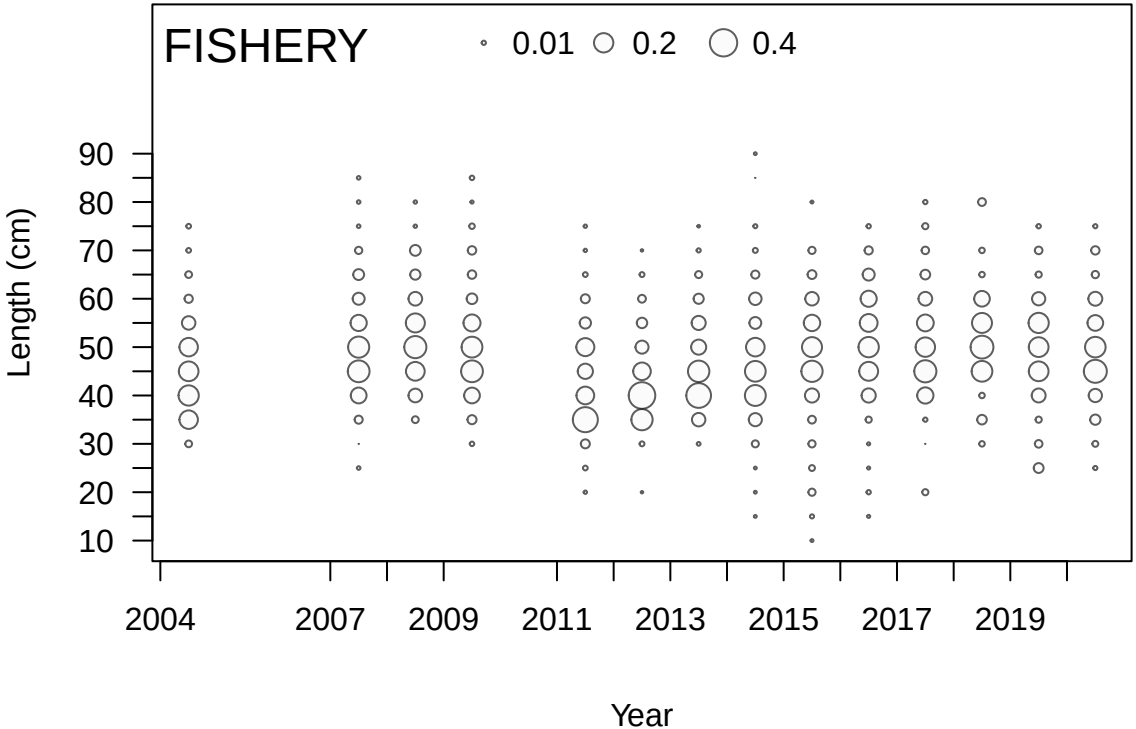

2
6
10
Age
0
5
10
15
20
25
30
35
1985
1989
1993
1997
2001
2005
2009
2013
2017
2021
Year

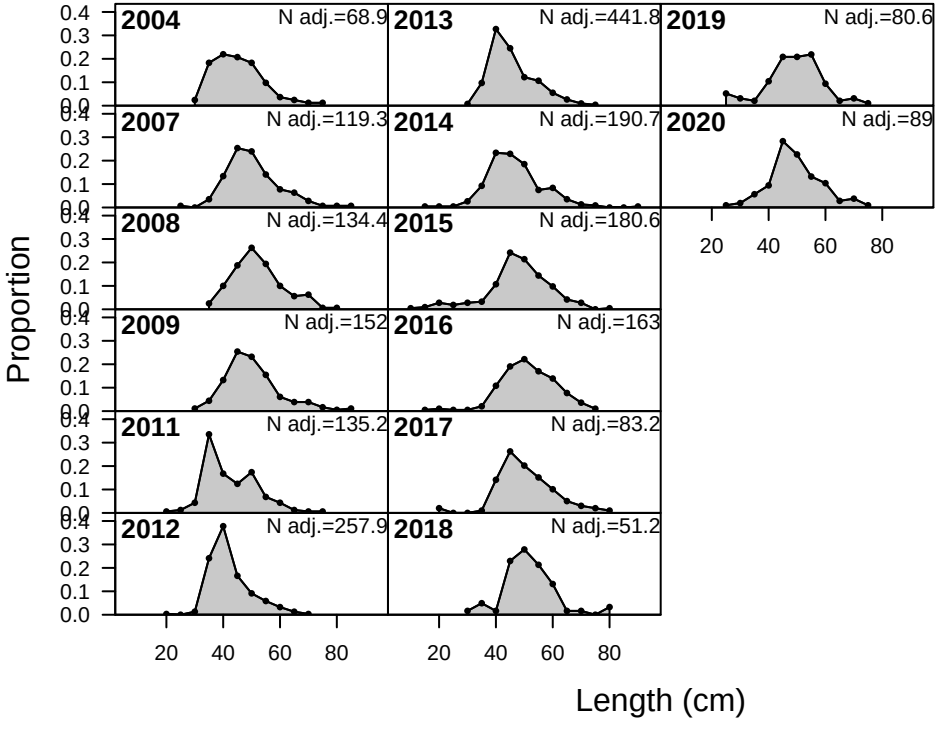

2
6
10
Length
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
1986
1990
1994
1998
2002
2006
2010
2014
2018
2022
Year

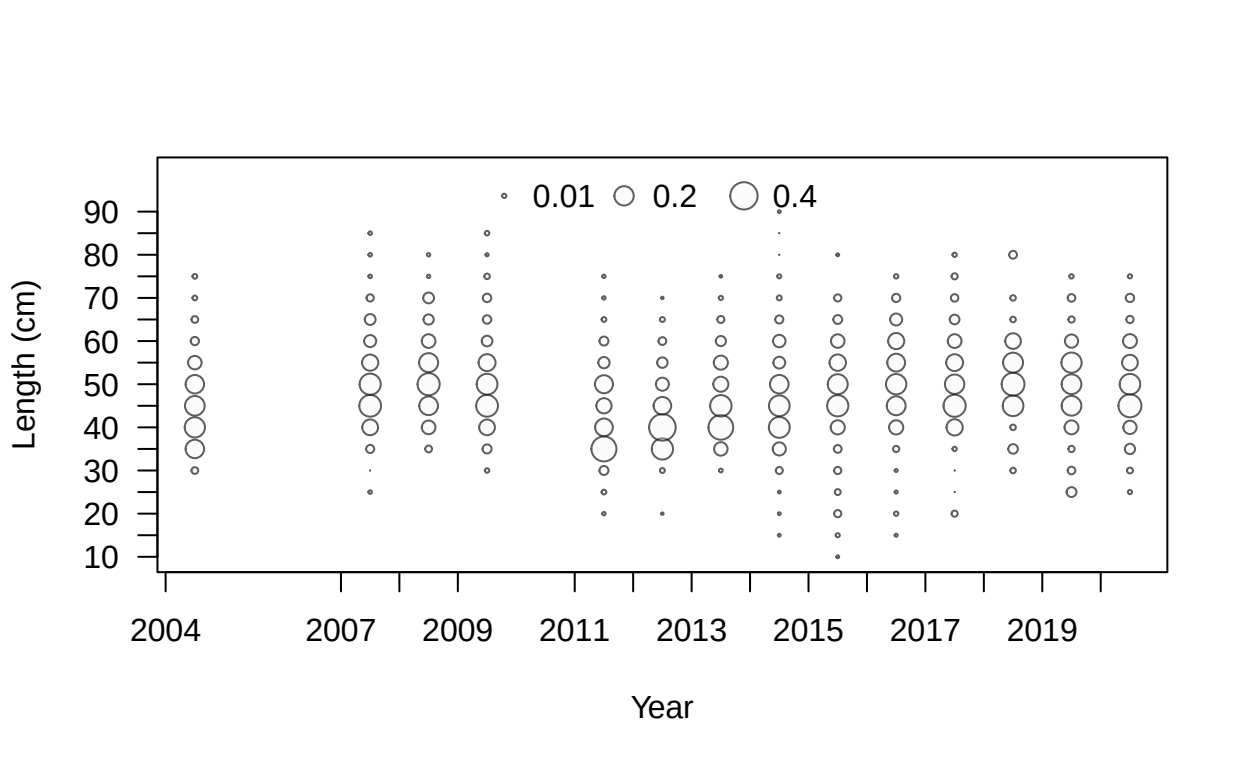

0.1
5
10
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
Length
1986
1990
1994
1998
2002
2006
2010
2014
2018
2022
Year

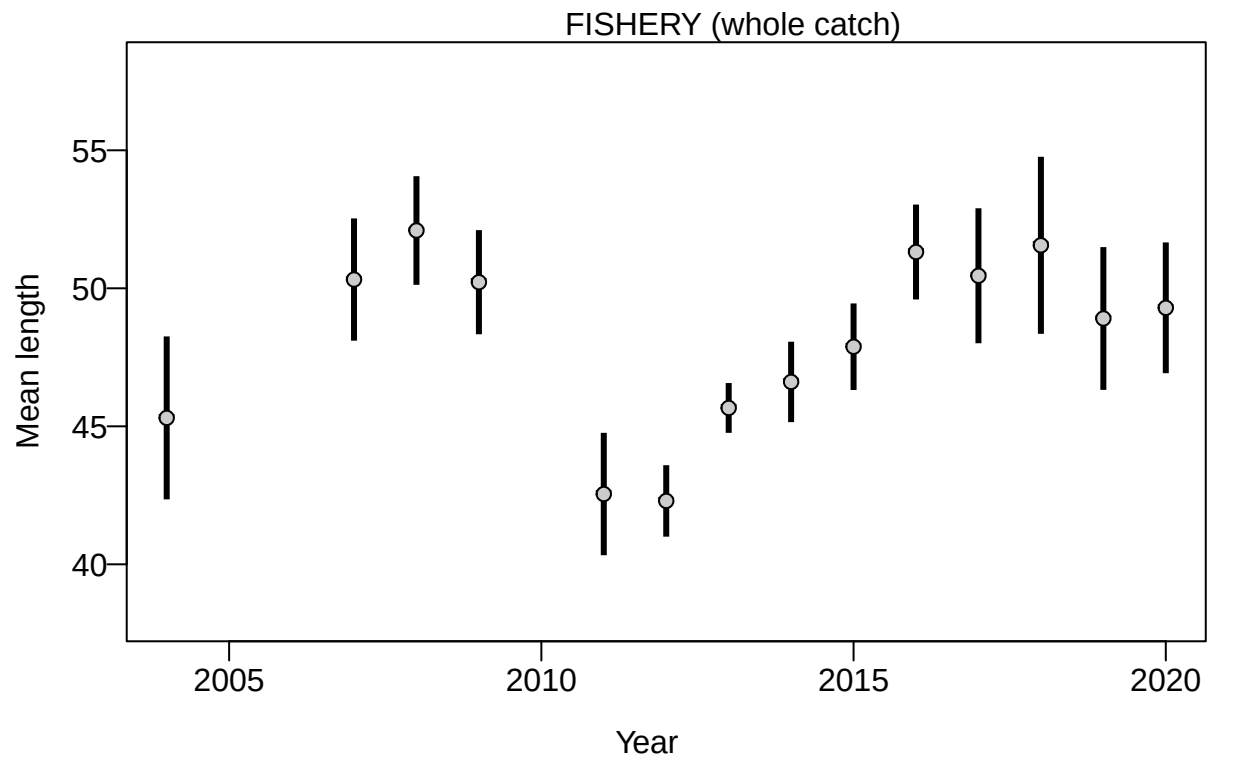

Numbers at age at equilibrium
0.0
0.5
1.0
1.5
2.0
2.5
0
5
10
15
20
25
30
Age

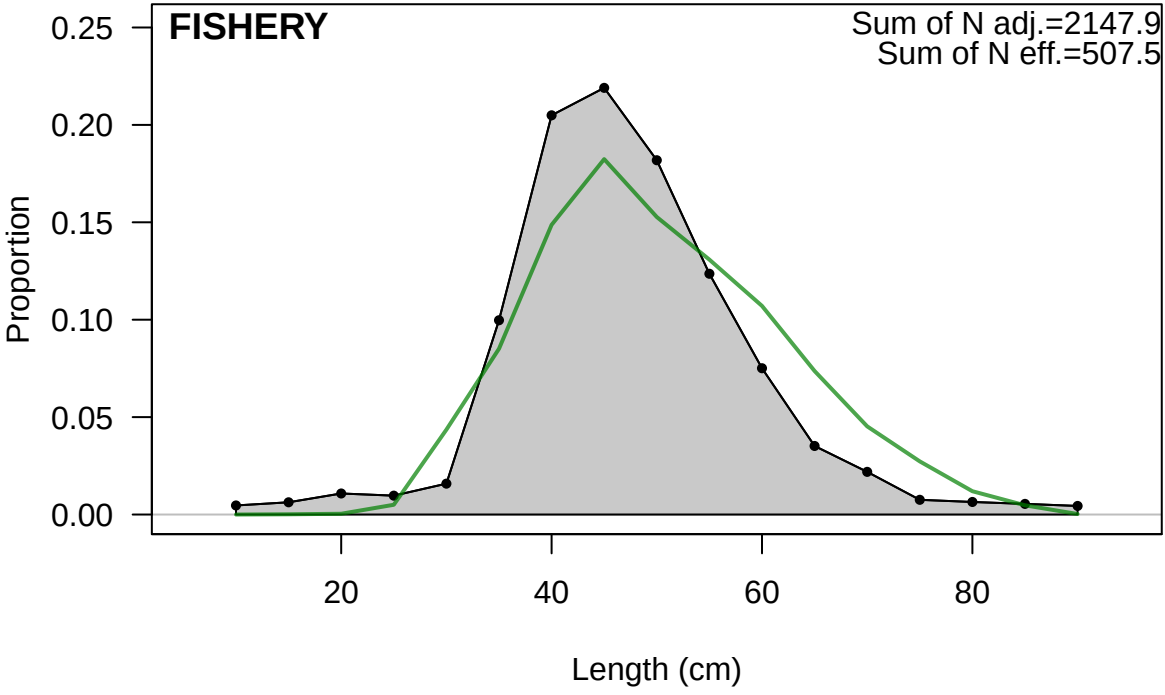

FISHERY
Sum of N adj.=2147.9
Proportion
0.25
0.20
0.15
0.10
0.05
0.00
20
40
60
80
Length (cm)

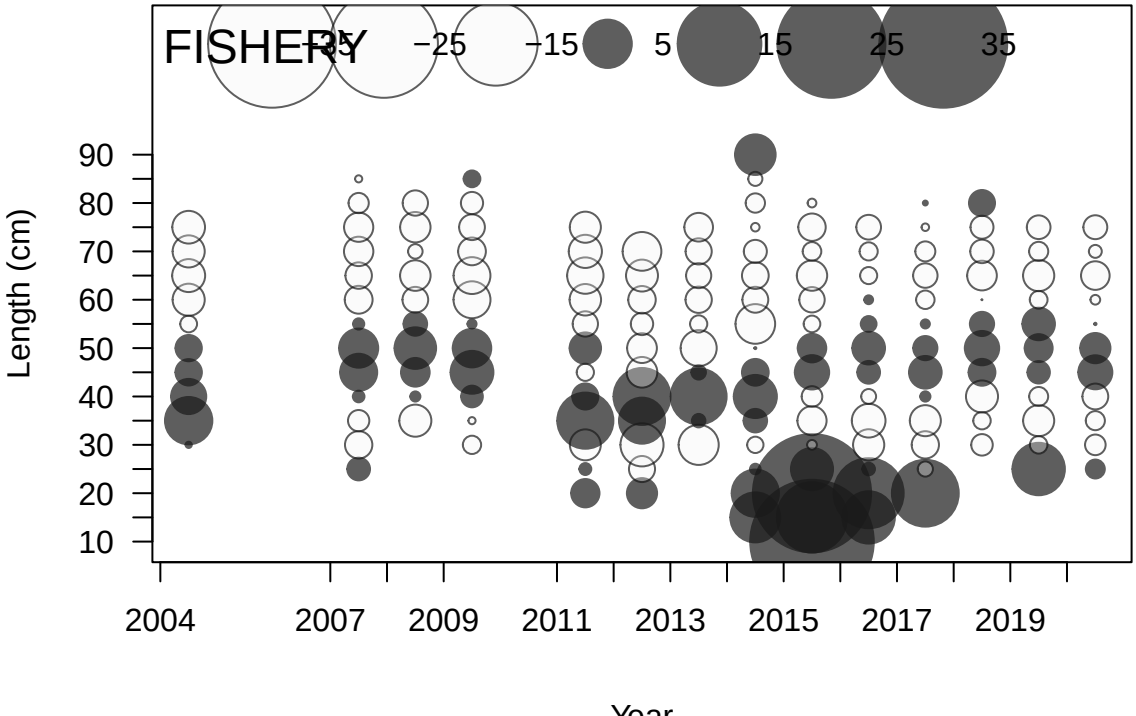

FISHERY
0.01
0.2
0.4
Length (cm)
90
80
70
60
50
40
30
20
10
2004
2007
2009
2011
2013
2015
2017
2019
Year

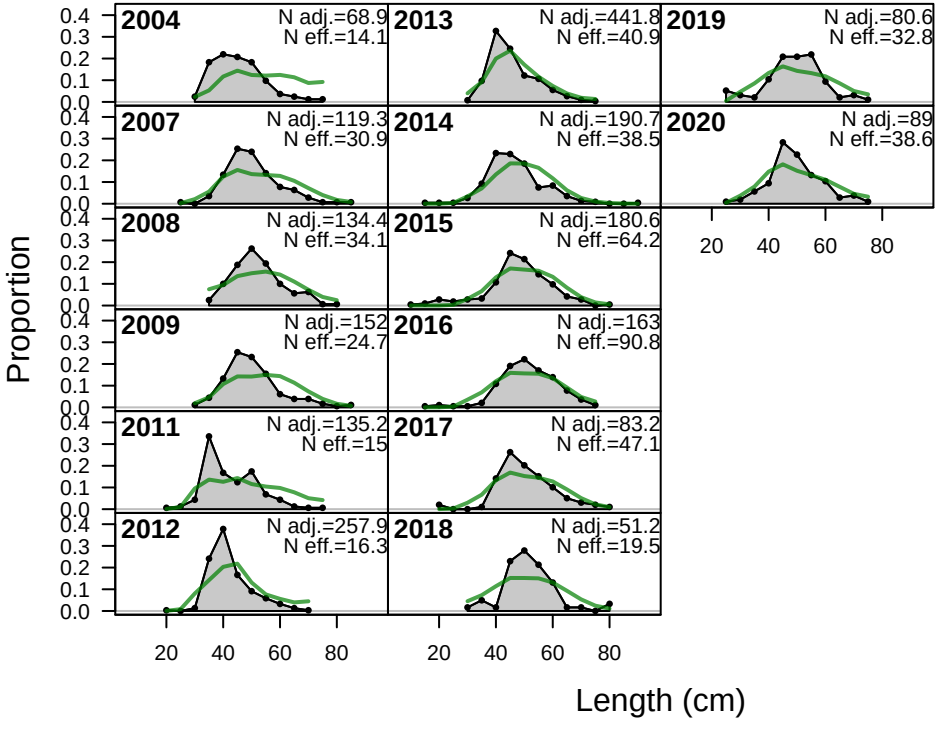

2004
N adj.=68.9
2013
N adj.=441.8
2019
N adj.=80.6
2007
N adj.=119.3
2014
N adj.=190.7
2020
N adj.=89
2008
N adj.=134.4
2015
N adj.=180.6
2009
N adj.=152
2016
N adj.=163
2011
N adj.=135.2
2017
N adj.=83.2
2012
N adj.=257.9
2018
N adj.=51.2
Proportion
Length (cm)

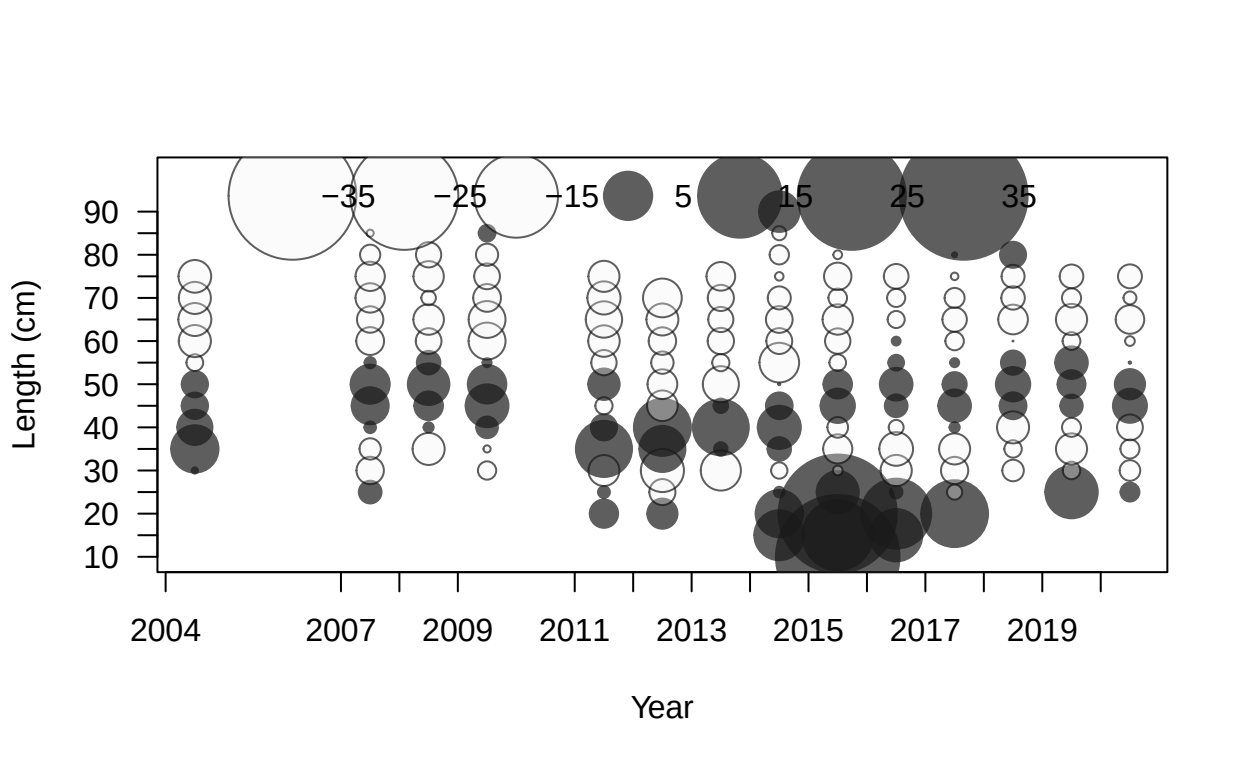

0.01
0.2
0.4
Length (cm)
90
80
70
60
50
40
30
20
10
2004
2007
2009
2011
2013
2015
2017
2019
Year

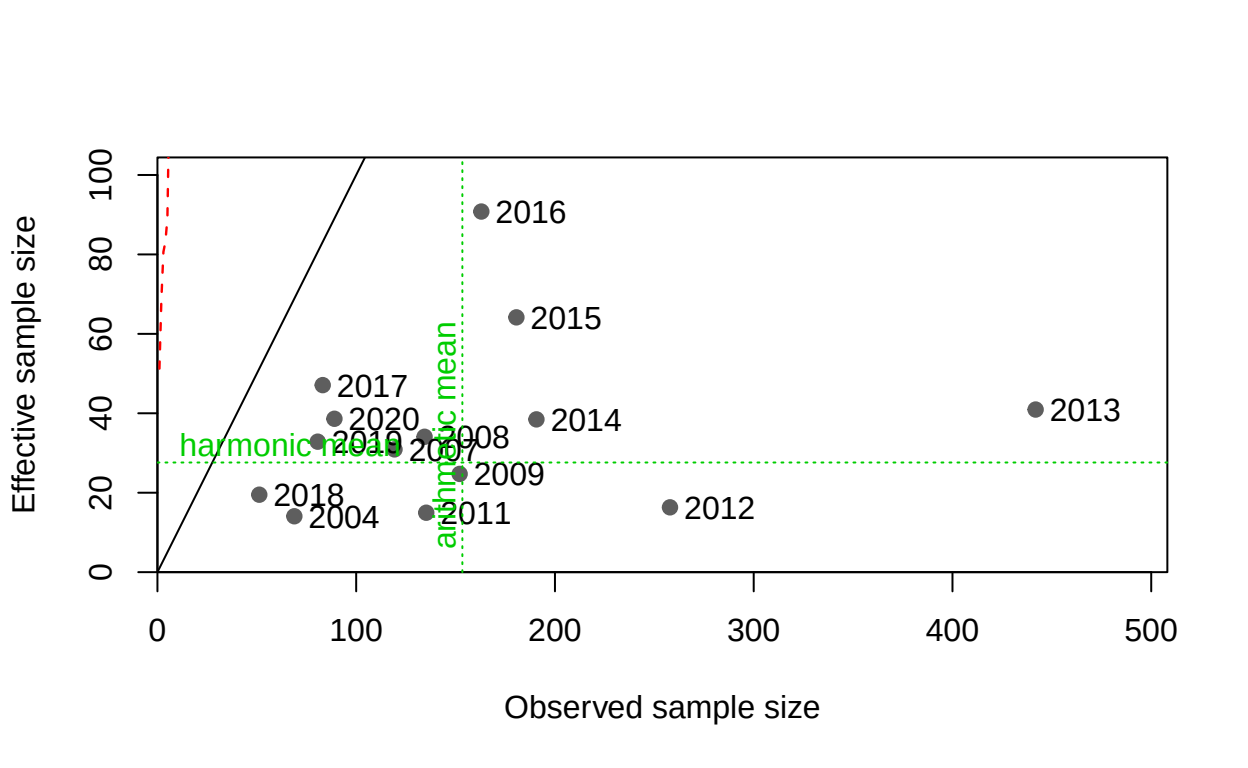

FISHERY (whole catch)
55
50
45
40
Mean length
2005
2010
2015
2020
Year

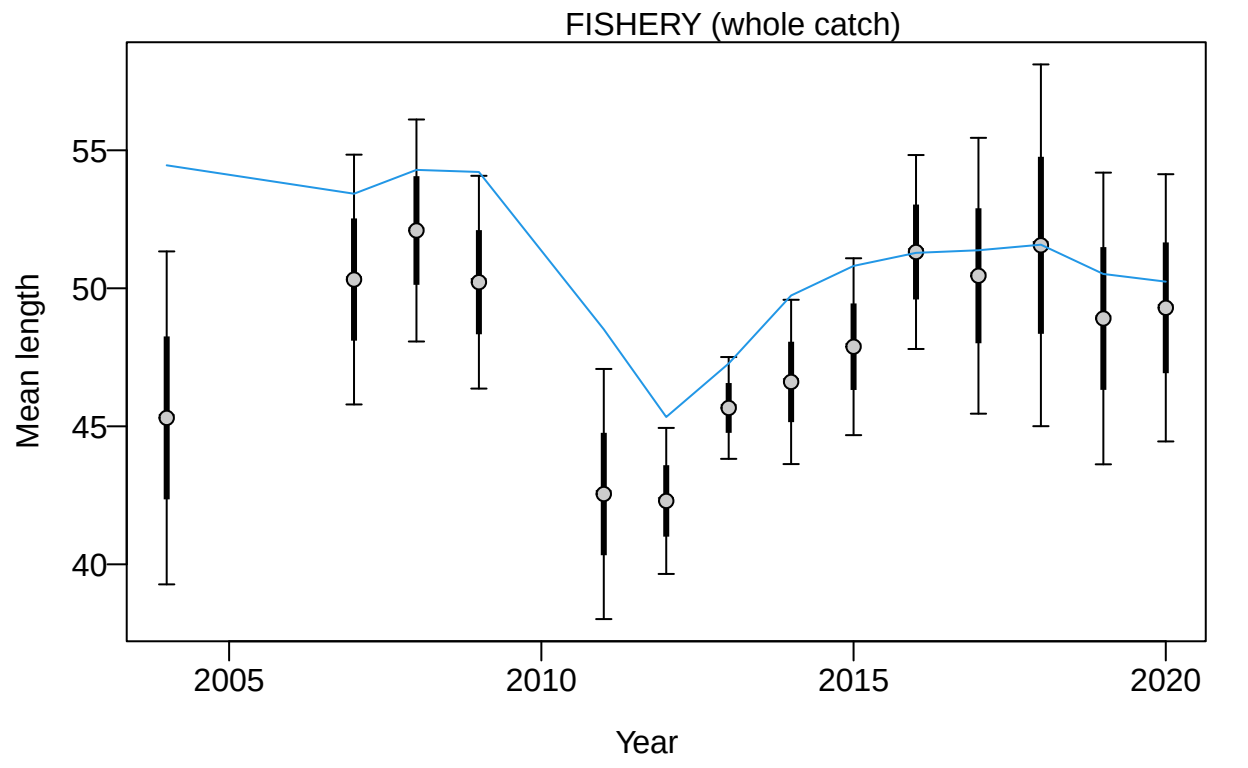

FISHERY
Sum of N adj.=2147.9
Sum of N eff.=507.5
Proportion
0.25
0.20
0.15
0.10
0.05
0.00
20
40
60
80
Length (cm)

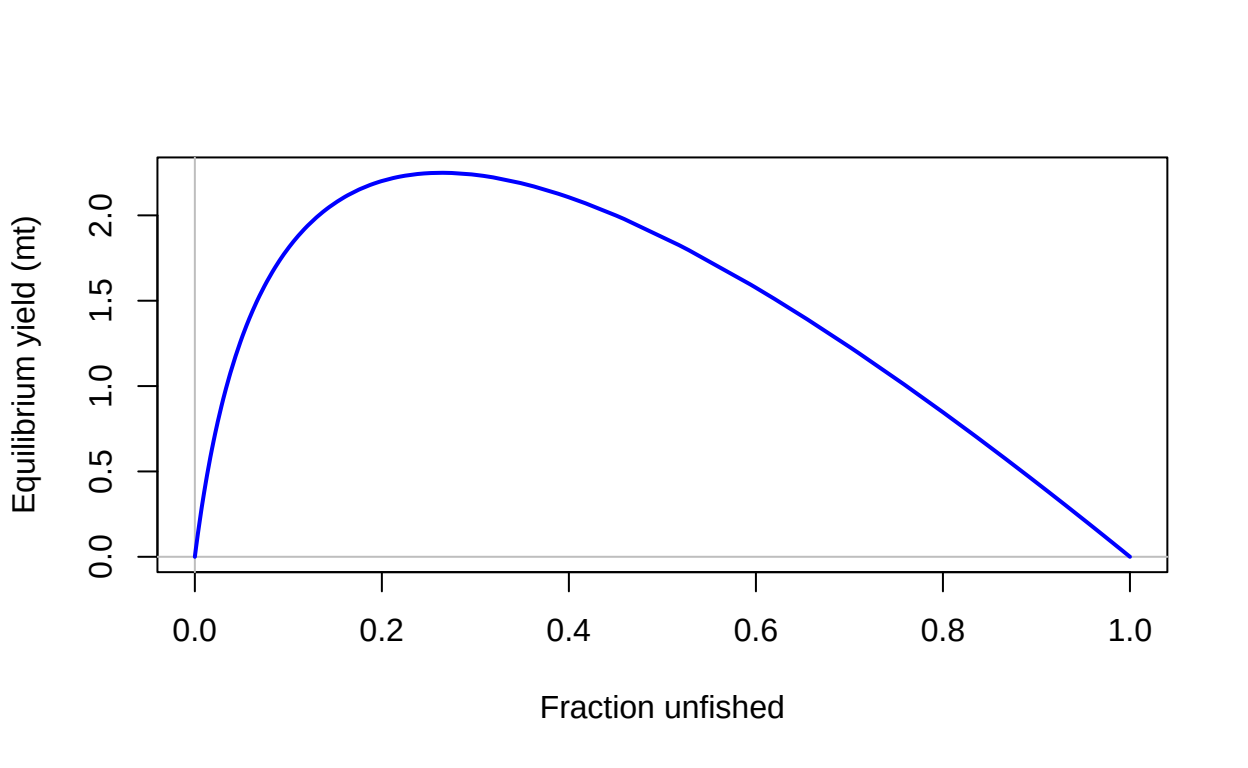

FISHERY
−35
−25
−15
5
15
25
35
Length (cm)
90
80
70
60
50
40
30
20
10
2004
2007
2009
2011
2013
2015
2017
2019
Year

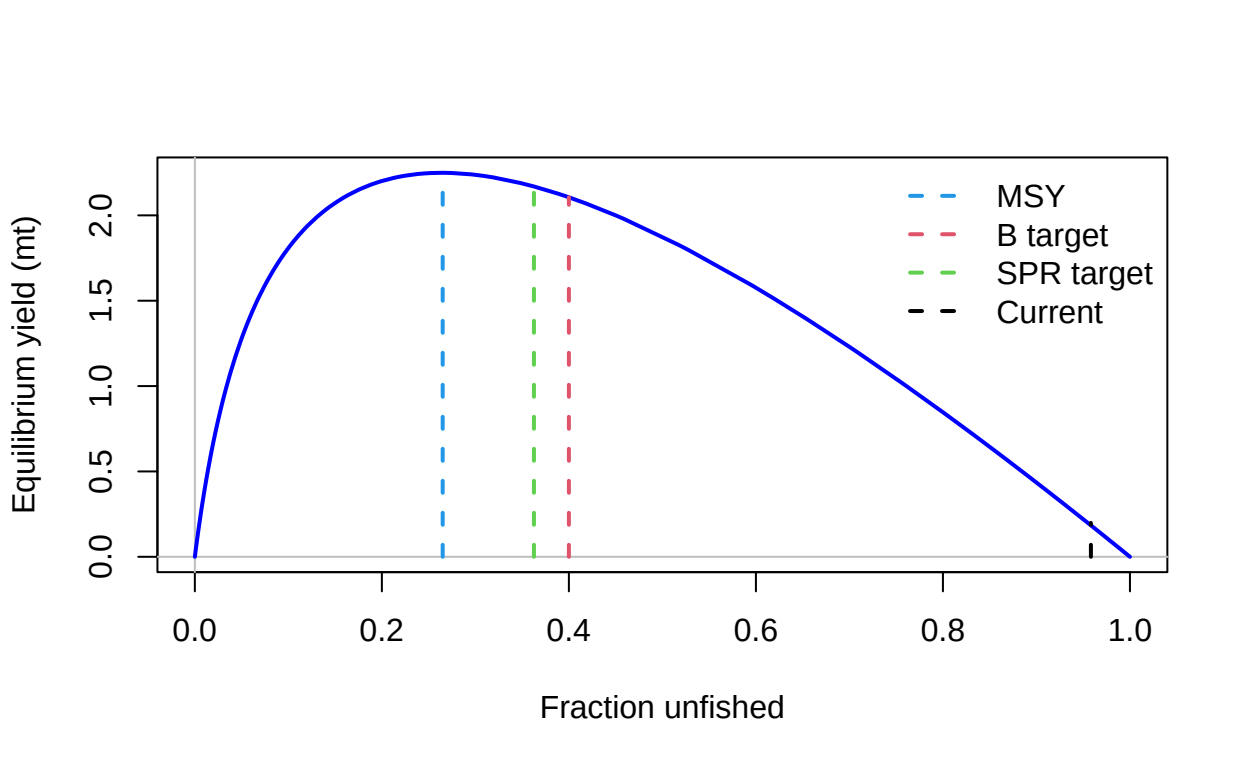

2004
N adj.=68.9
N eff.=14.1
2013
N adj.=441.8
N eff.=40.9
2019
N adj.=80.6
N eff.=32.8
2007
N adj.=119.3
N eff.=30.9
2014
N adj.=190.7
N eff.=38.5
2020
N adj.=89
N eff.=38.6
2008
N adj.=134.4
N eff.=34.1
2015
N adj.=180.6
N eff.=64.2
2009
N adj.=152
N eff.=24.7
2016
N adj.=163
N eff.=90.8
2011
N adj.=135.2
N eff.=15
2017
N adj.=83.2
N eff.=47.1
2012
N adj.=257.9
N eff.=16.3
2018
N adj.=51.2
N eff.=19.5
Proportion
0.0
0.1
0.2
0.3
0.4
20
40
60
80
Length (cm)

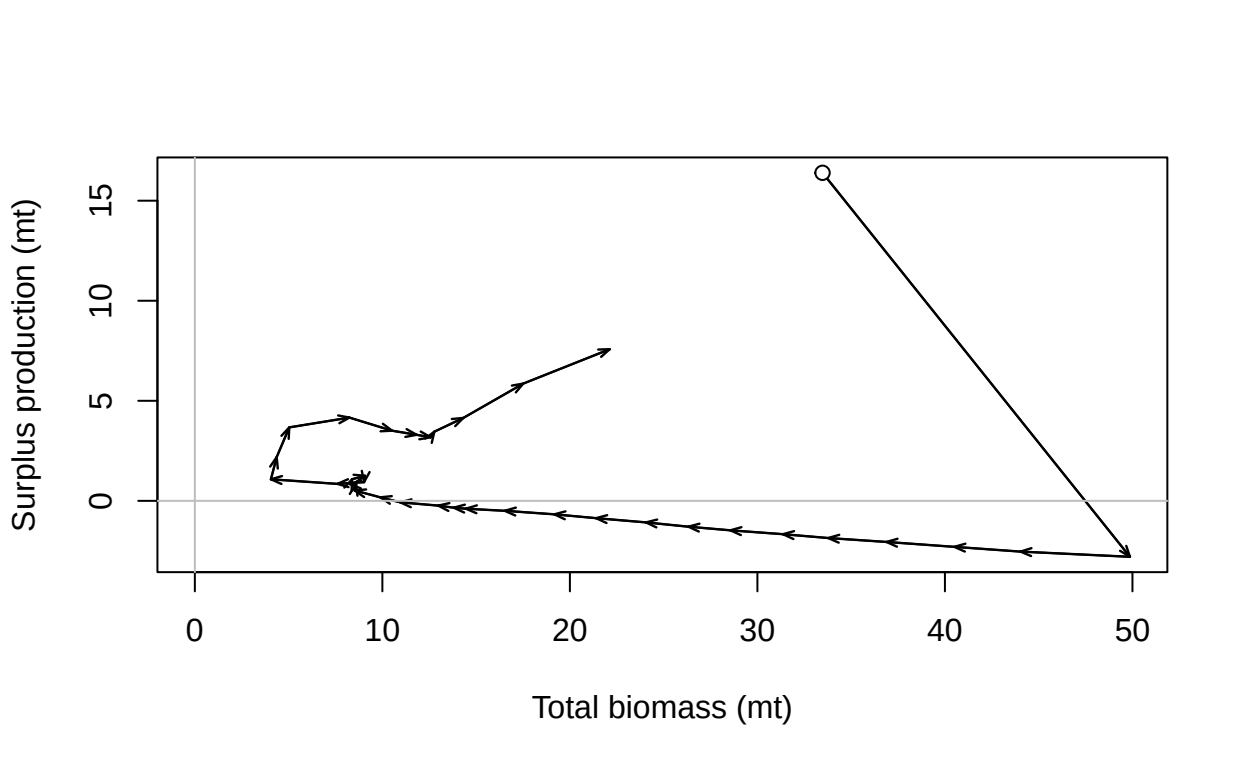

−35
−25
−15
5
15
25
35
90
80
70
60
50
40
30
20
10
Length (cm)
2004
2007
2009
2011
2013
2015
2017
2019
Year

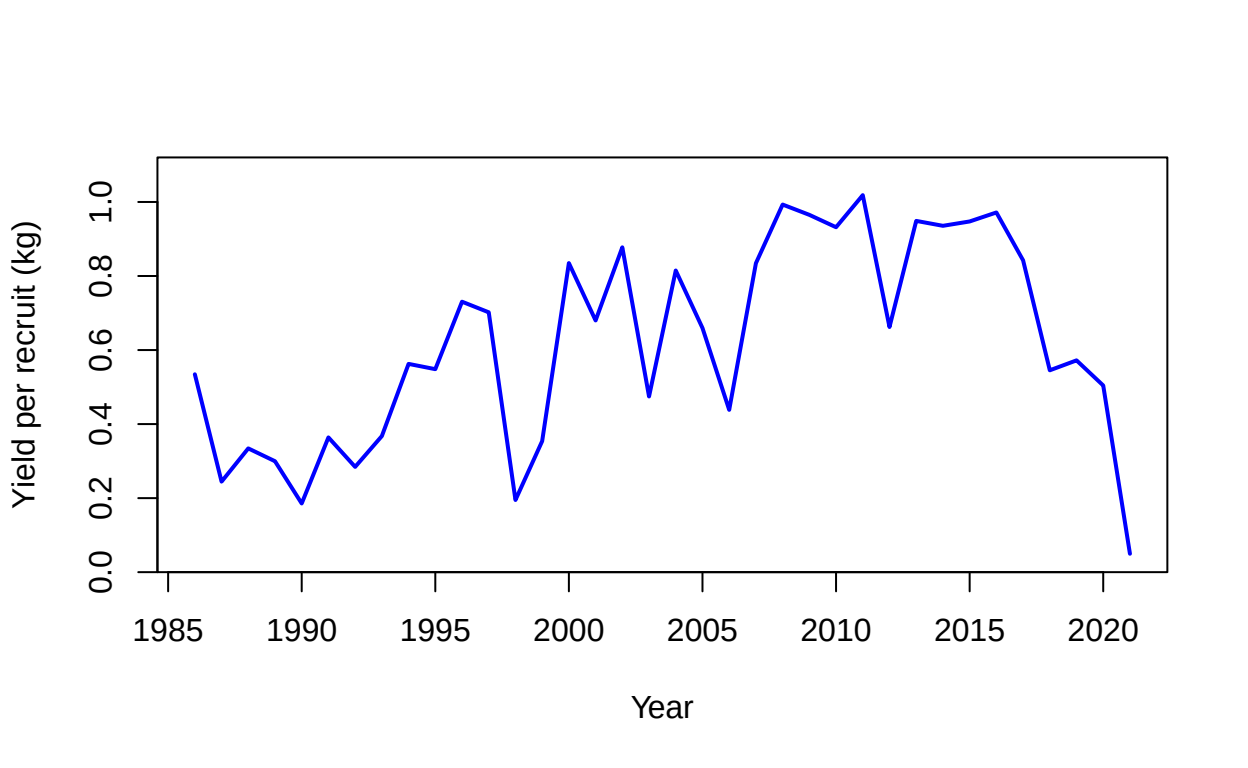

Effective sample size
Observed sample size
0
20
40
60
80
100
0
100
200
300
400
500
2016
2015
2017
2020
2019
2008
2007
2014
2013
2009
2018
2004
2011
2012
harmonic mean
arithmetic mean

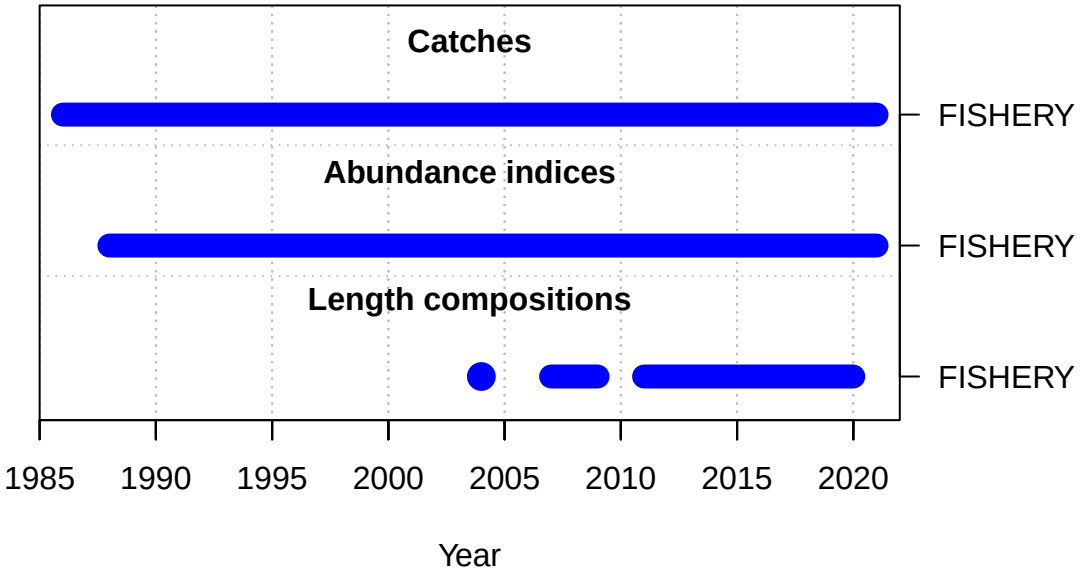

FISHERY (whole catch)
Mean length
55
50
45
40
2005
2010
2015
2020
Year

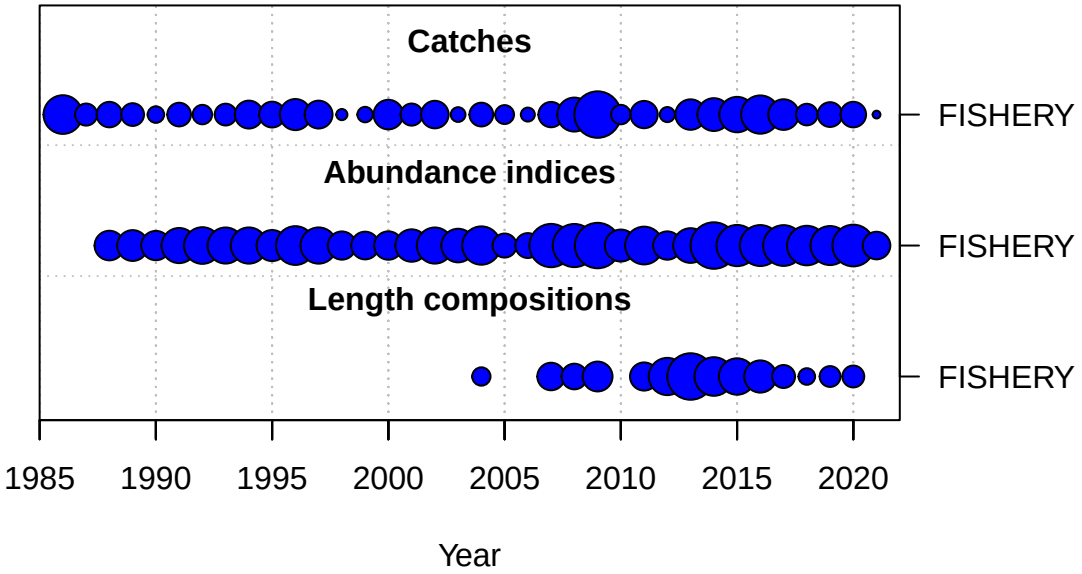

Equilibrium yield (mt)
0.0
0.5
1.0
1.5
2.0
0.0
0.2
0.4
0.6
0.8
1.0
Fraction unfished

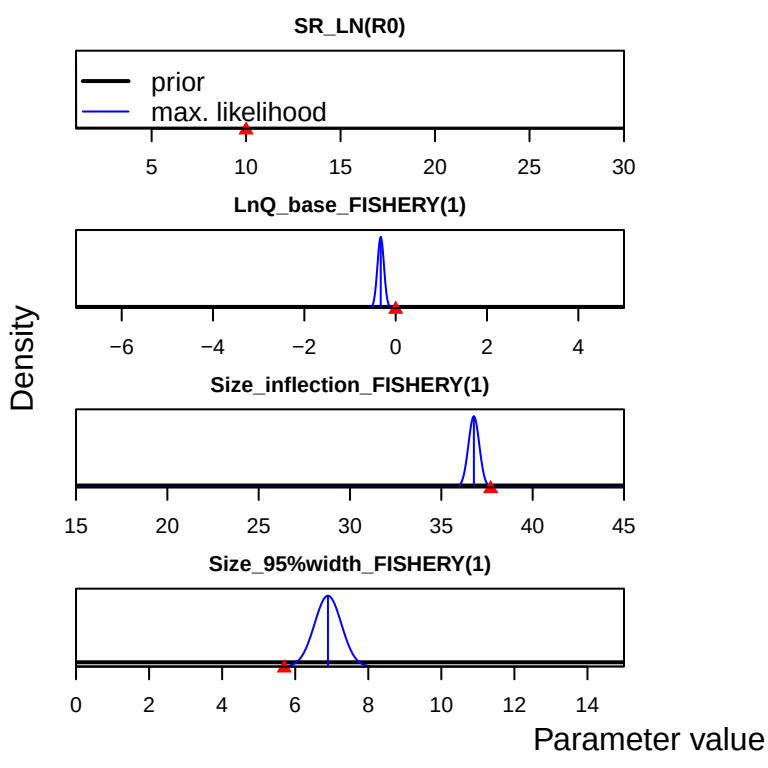

Equilibrium yield (mt)
0.0
0.5
1.0
1.5
2.0
0.0
0.2
0.4
0.6
0.8
1.0
Fraction unfished
MSY
B target
SPR target
Current


Surplus production (mt)
0
5
10
15
0
10
20
30
40
50
Total biomass (mt)


Yield per recruit (kg)
0.0
0.2
0.4
0.6
0.8
1.0
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
5
10
15
20
25
30
LnQ_base_FISHERY(1)
−6
−4
−2
0
2
4
Size_inflection_FISHERY(1)
15
20
25
30
35
40
45
Size_95%width_FISHERY(1)
0
2
4
6
8
10
12
14
Density
Parameter value