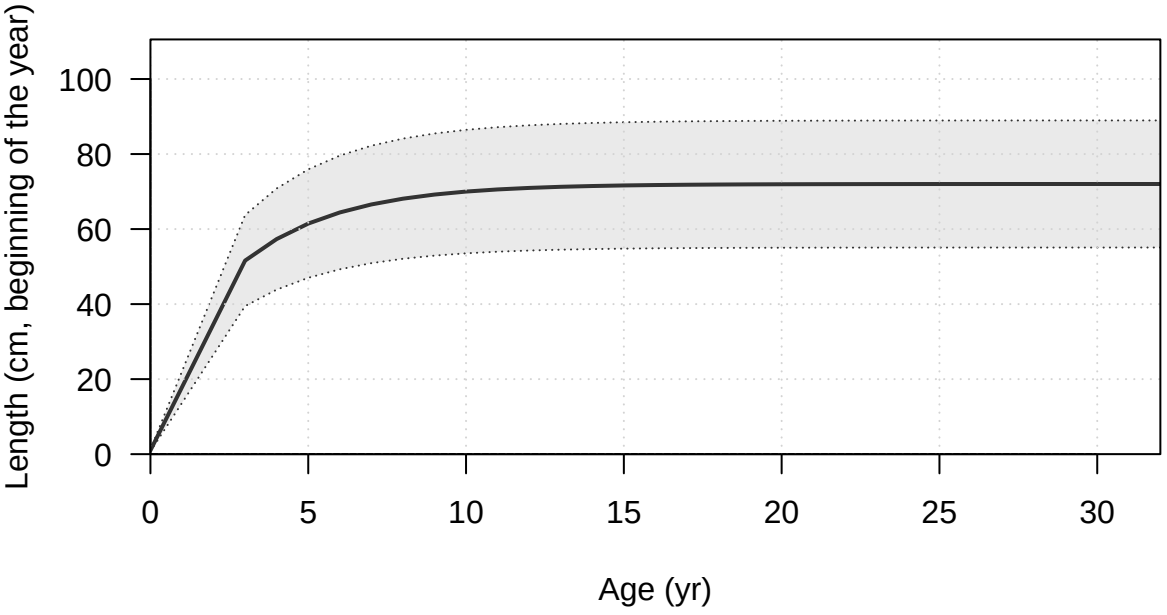
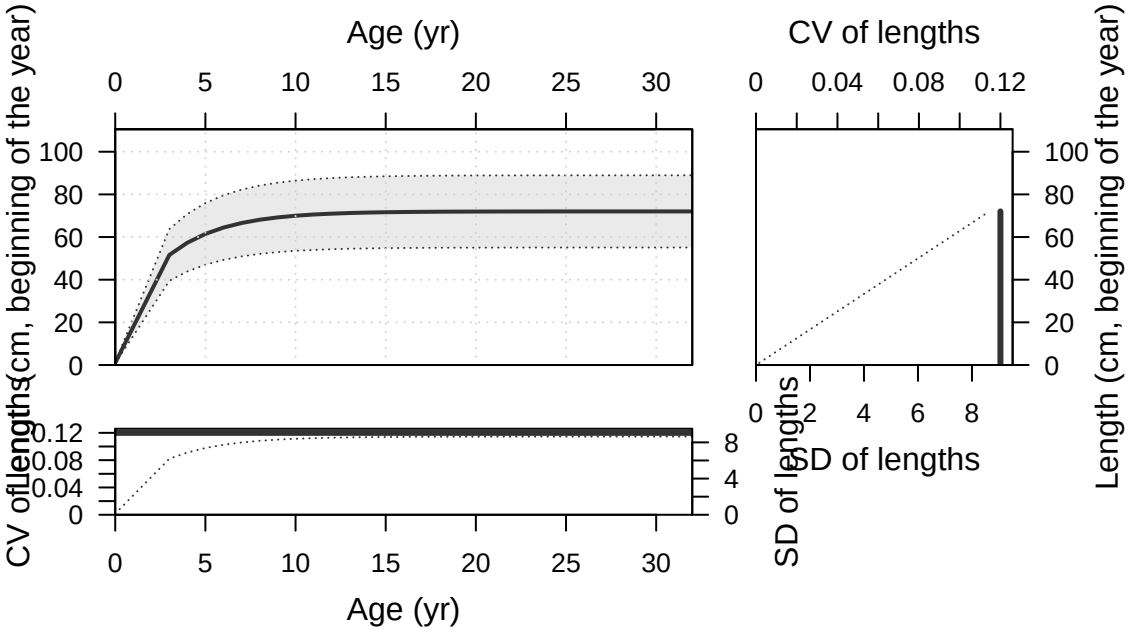
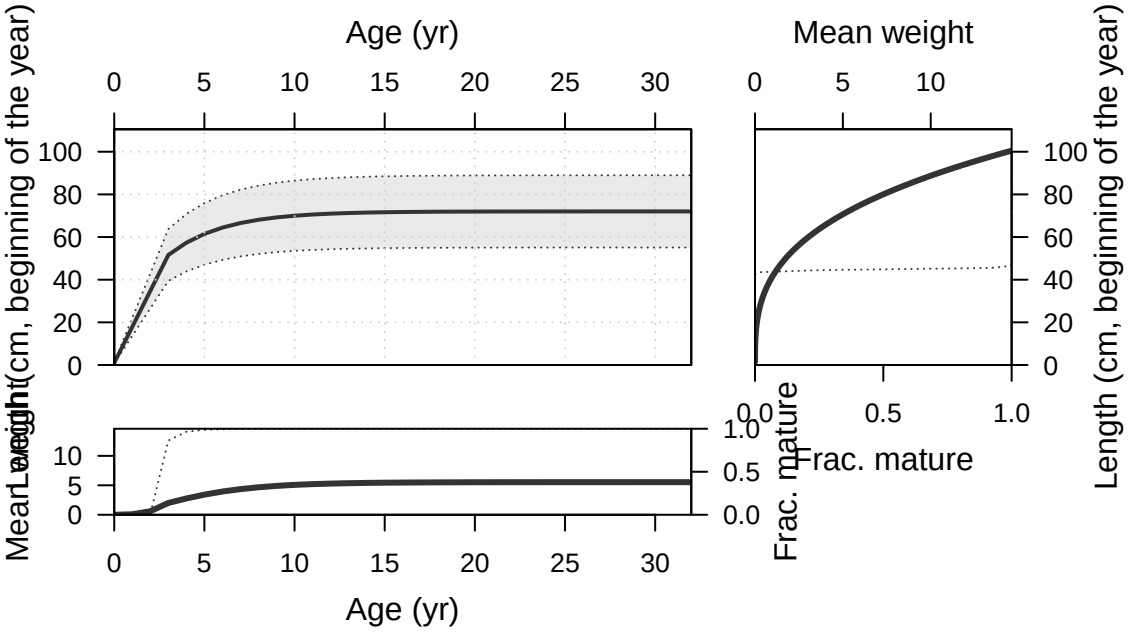
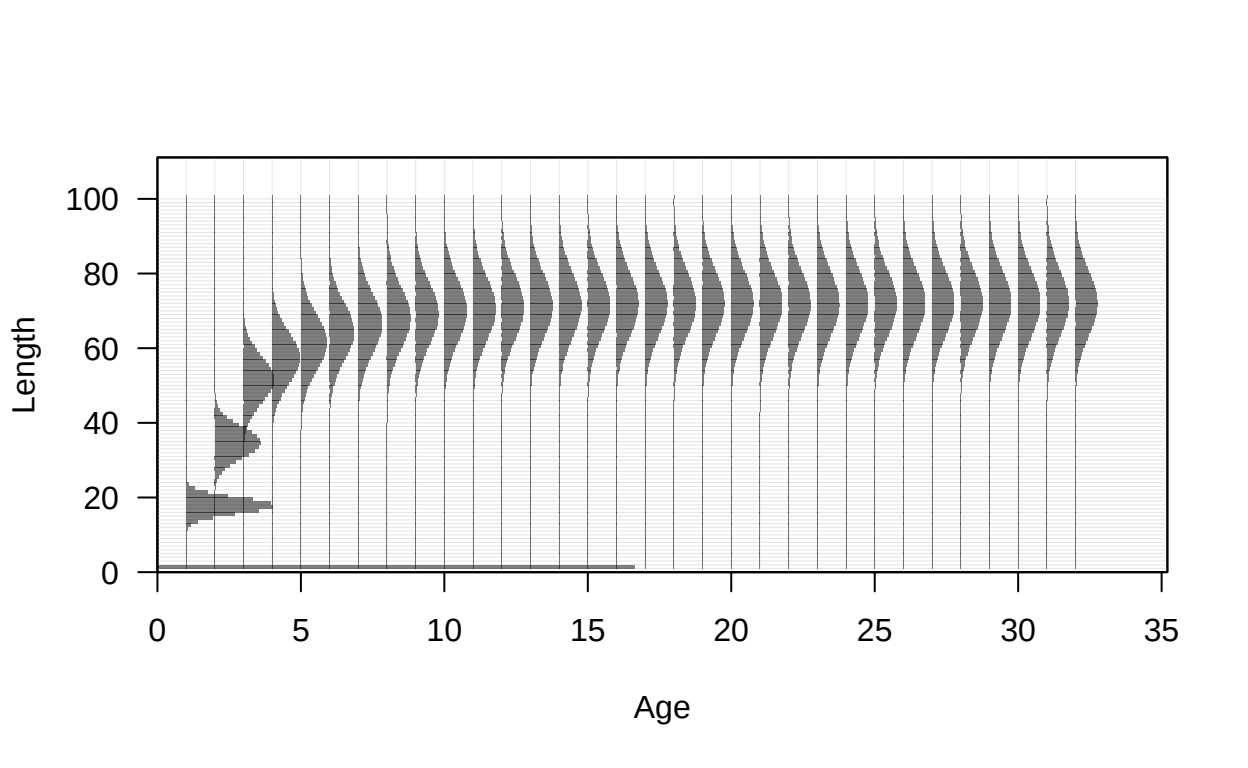
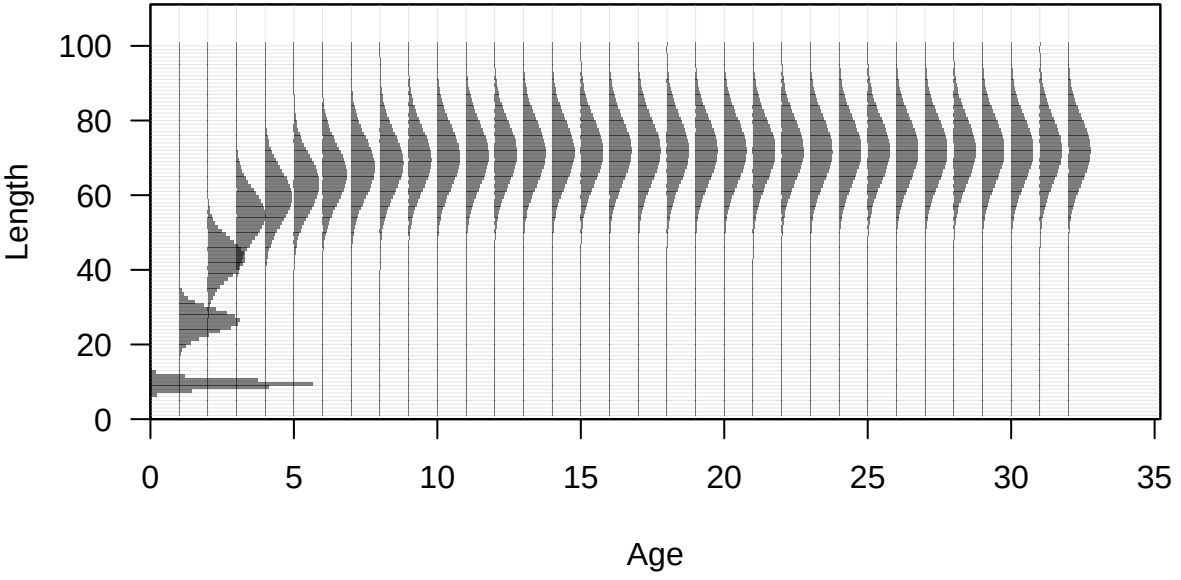
Plots created using the 'r4ss' package in R
Stock Synthesis version: 3.30.19.0
StartTime: Fri Jun 17 12:26:04 2022
Data_File: data.ss
Control_File: control.ss

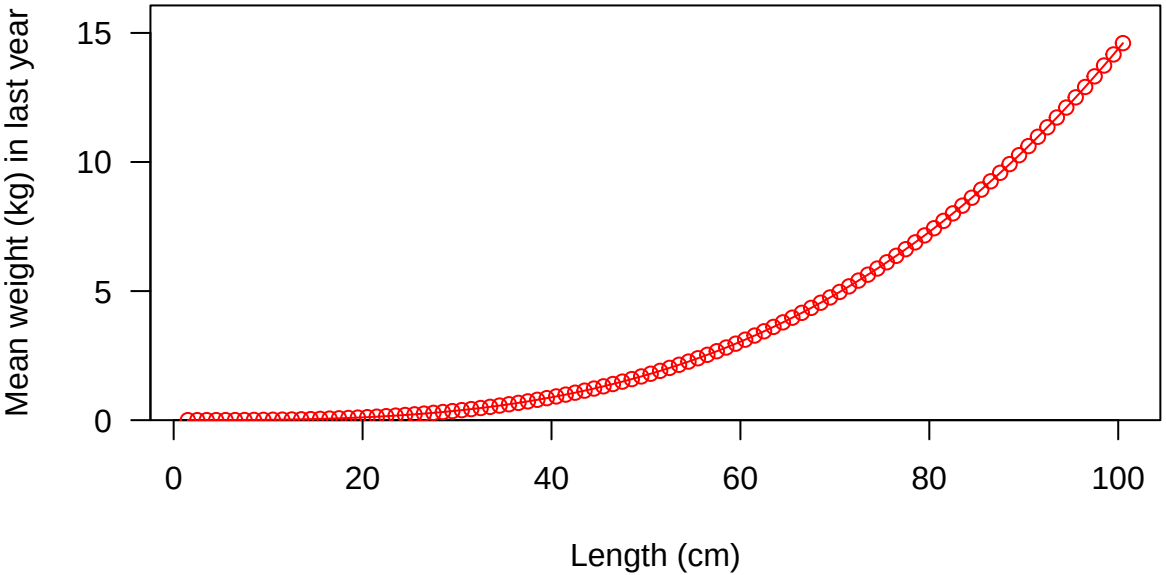

Length (cm, beginning of the year)
100
80
60
40
20
0
0
5
10
15
20
25
30
Age (yr)

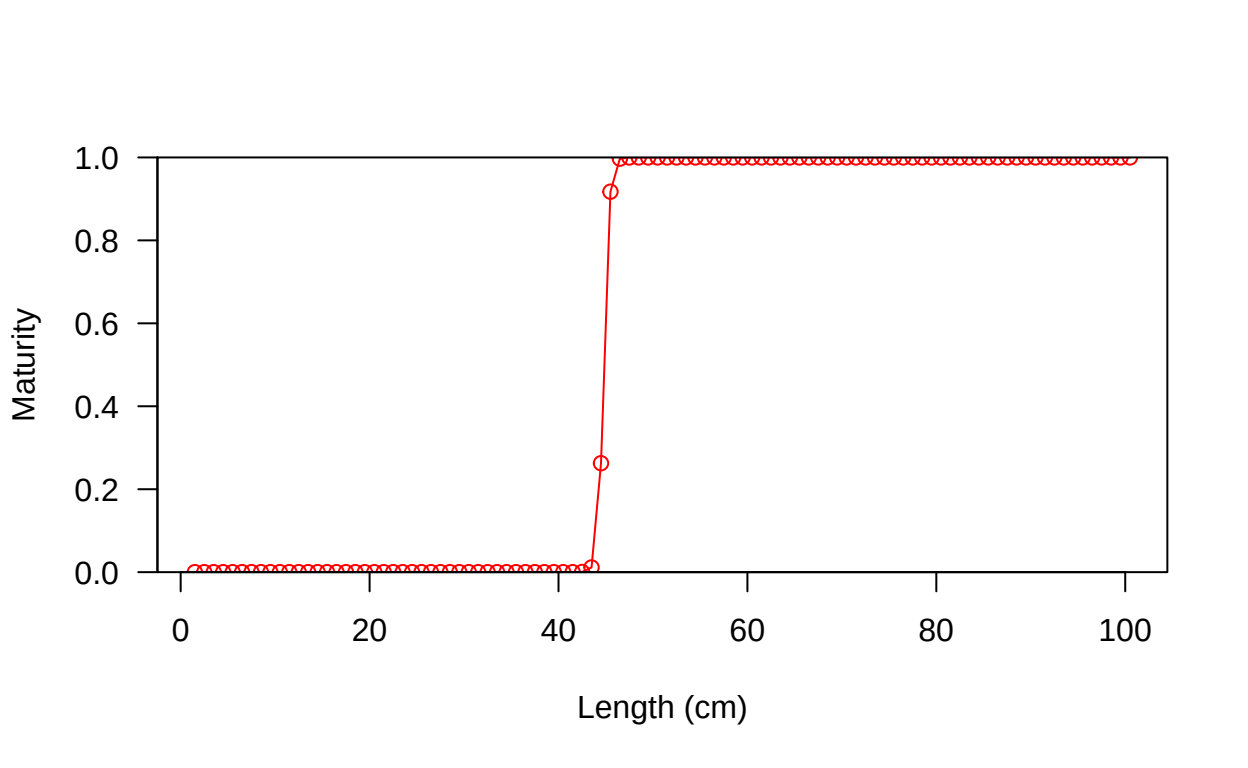

Age (yr)
0
5
10
15
20
25
30
Length (cm, beginning of the year)
0
20
40
60
80
100
CV of lengths
0
0.04
0.08
0.12
SD of lengths
0
2
4
6
8

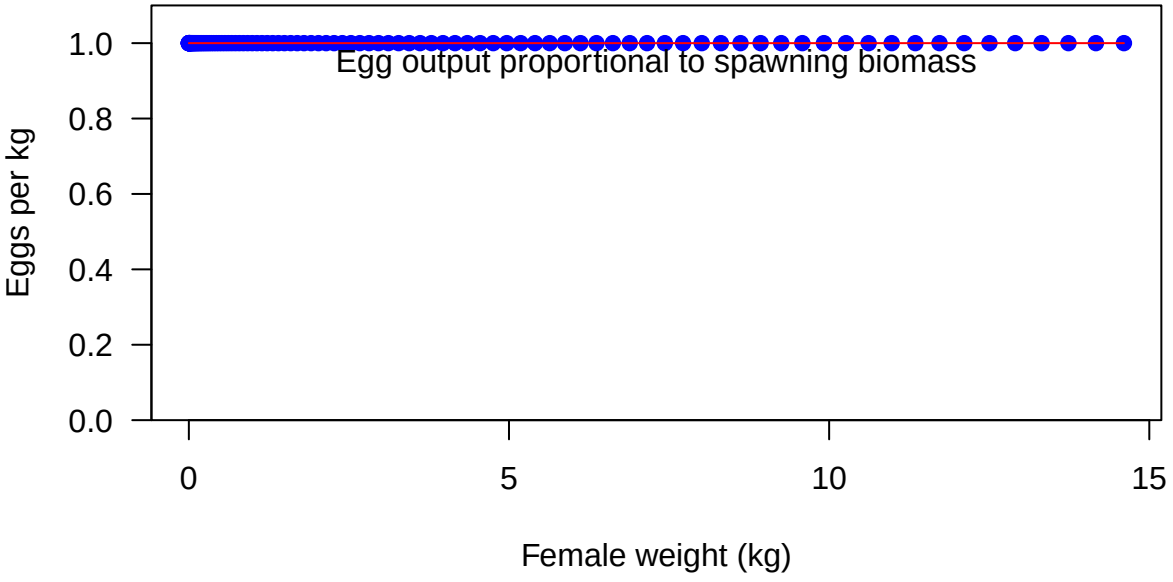

Age (yr)
Mean weight
Length (cm, beginning of the year)
Mean weight
Frac. mature
Age (yr)
Frac. mature
Length (cm, beginning of the year)

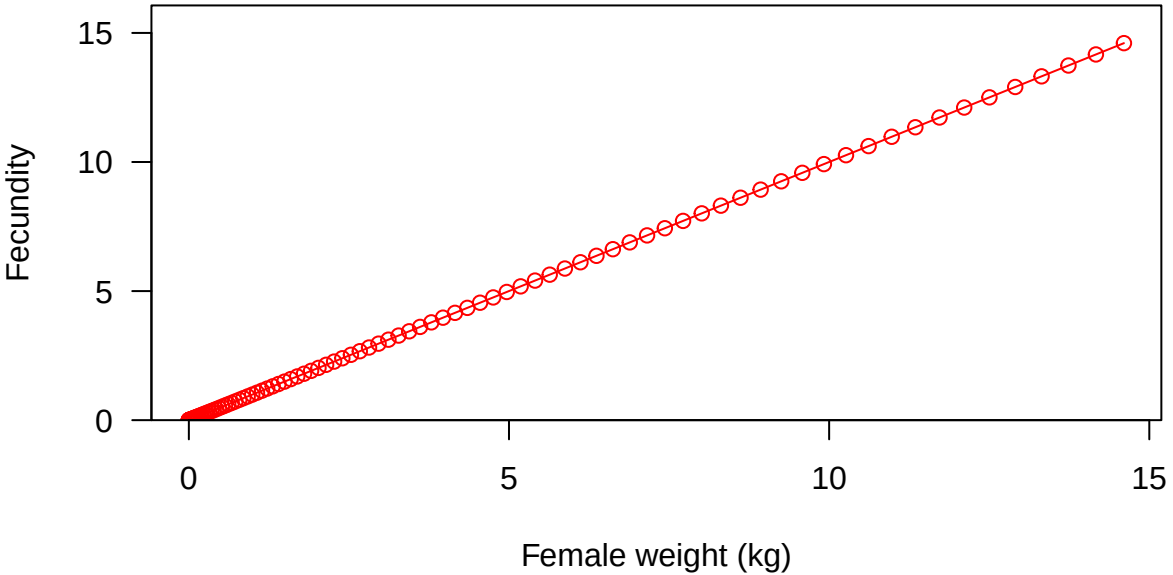

Length
100
80
60
40
20
0
0
5
10
15
20
25
30
35
Age

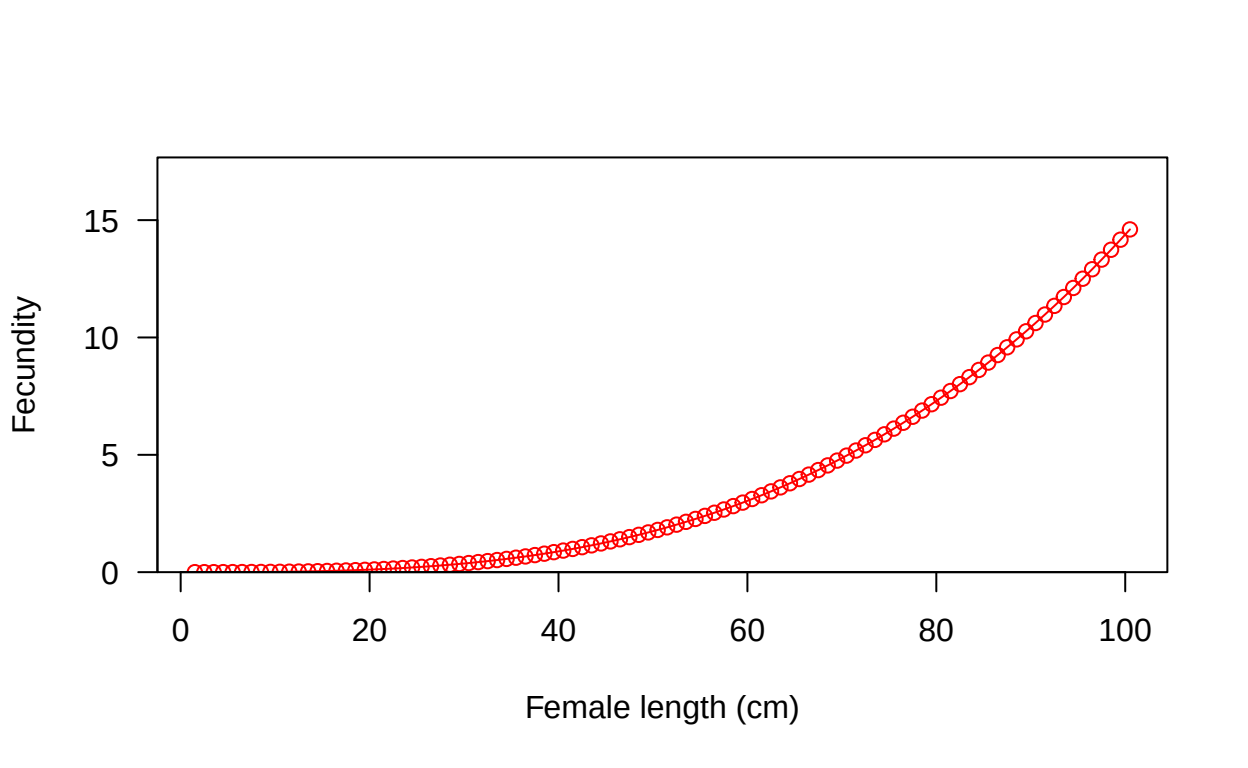

Length
100
80
60
40
20
0
0
5
10
15
20
25
30
35
Age

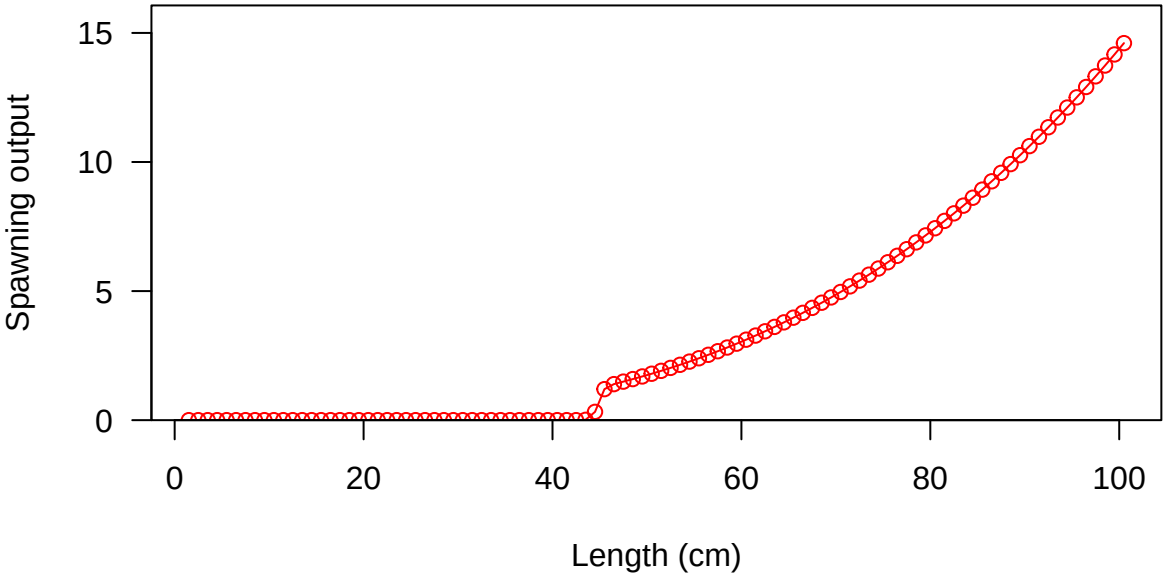

Mean weight (kg) in last year
15
10
5
0
0
20
40
60
80
100
Length (cm)

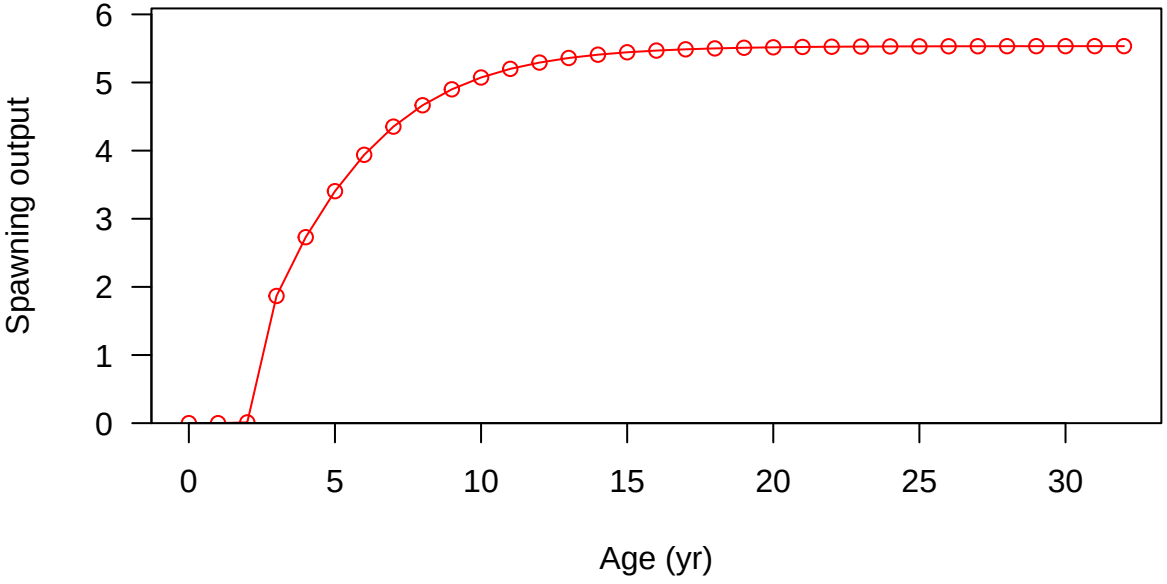

1.0
0.8
0.6
0.4
0.2
0.0
Maturity
0
20
40
60
80
100
Length (cm)

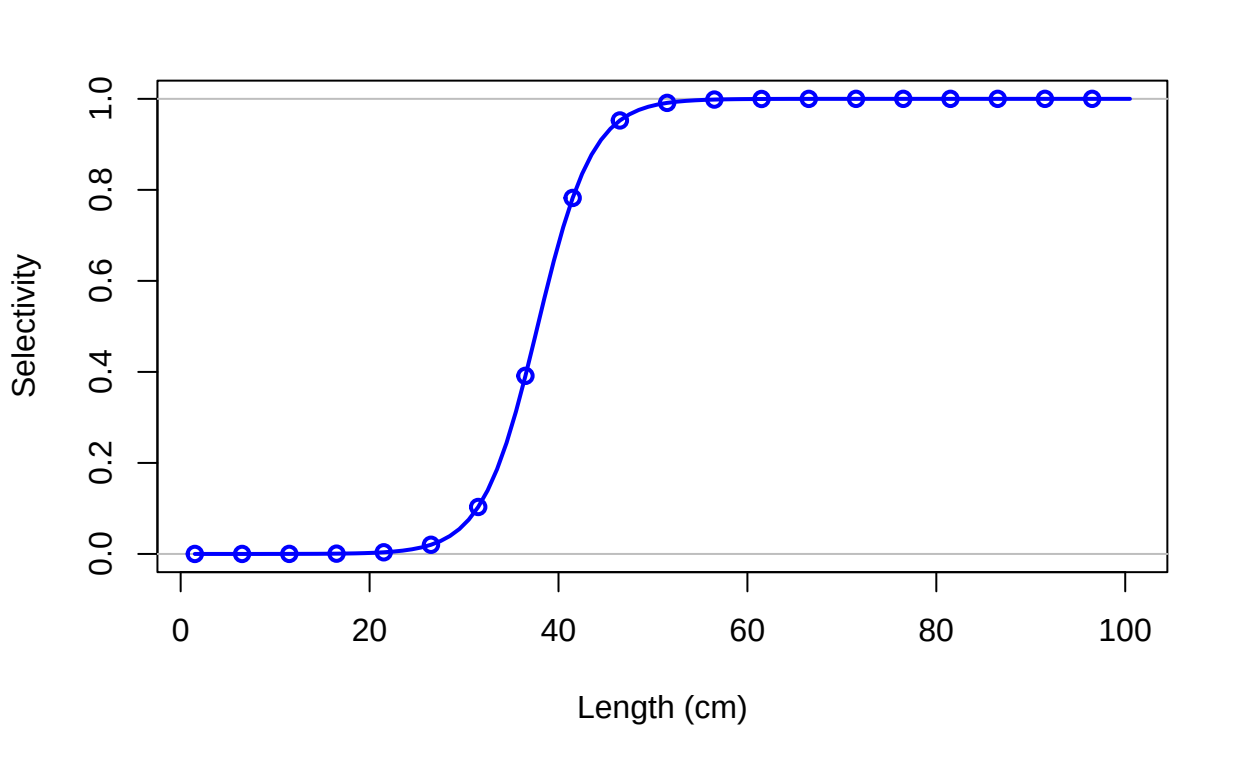

Egg output proportional to spawning biomass
Eggs per kg
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
Female weight (kg)

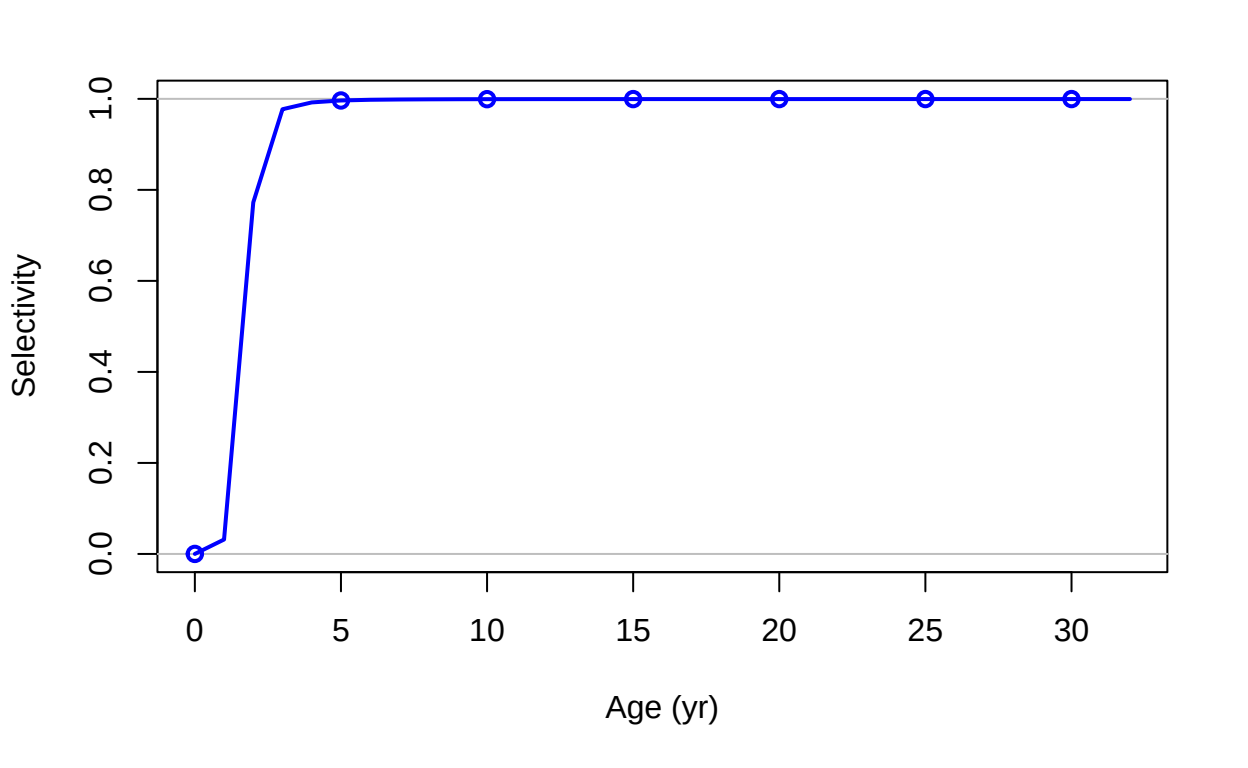

15
10
5
0
Fecundity
0
5
10
15
Female weight (kg)

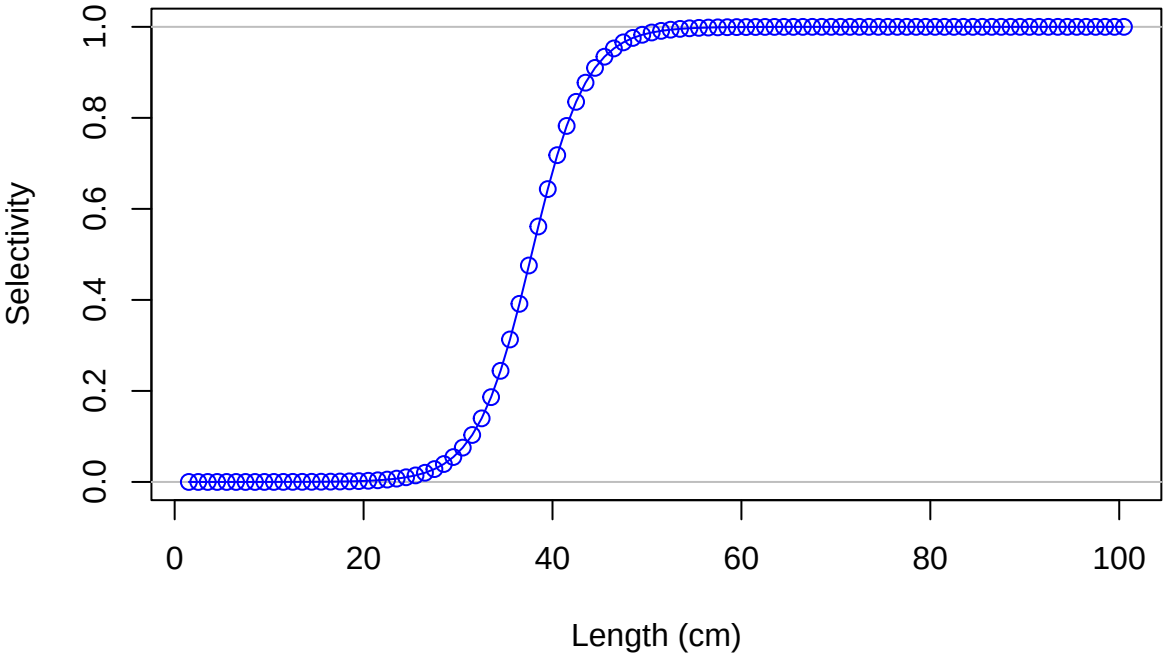

Fecundity
15
10
5
0
0
20
40
60
80
100
Female length (cm)

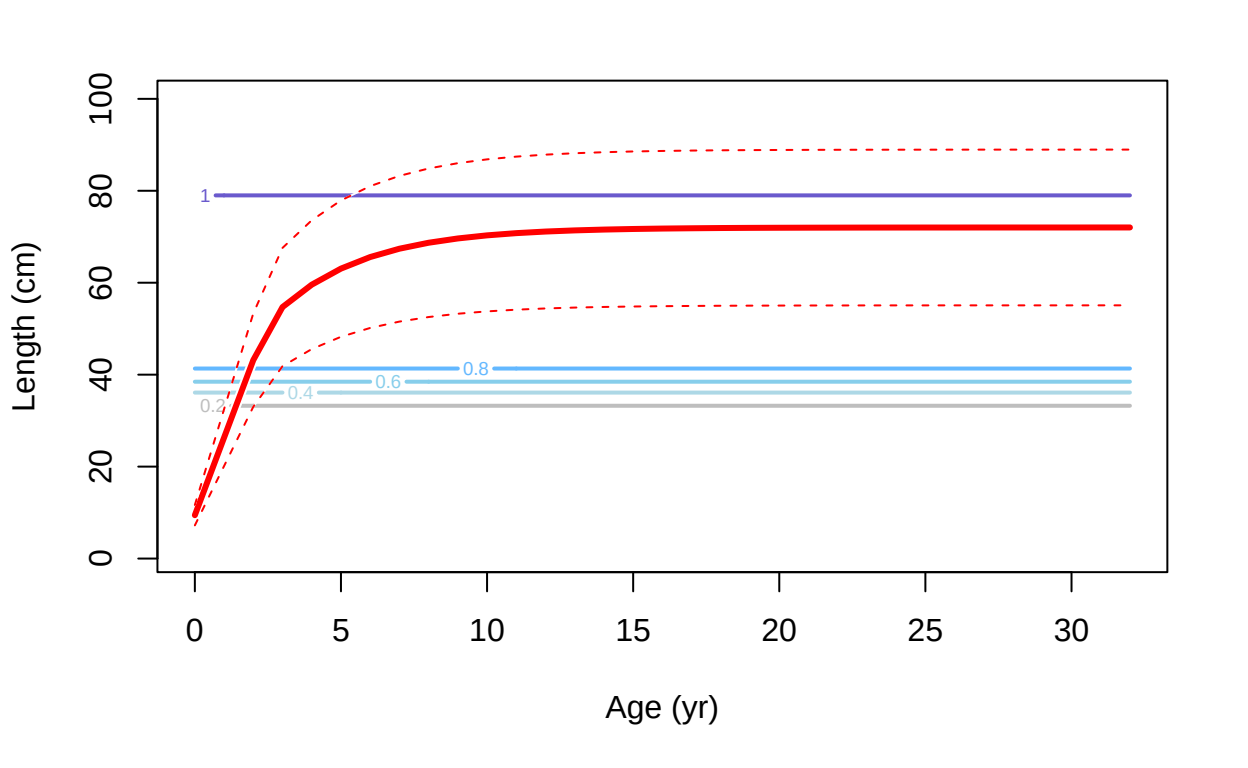

Spawning output
15
10
5
0
0
20
40
60
80
100
Length (cm)

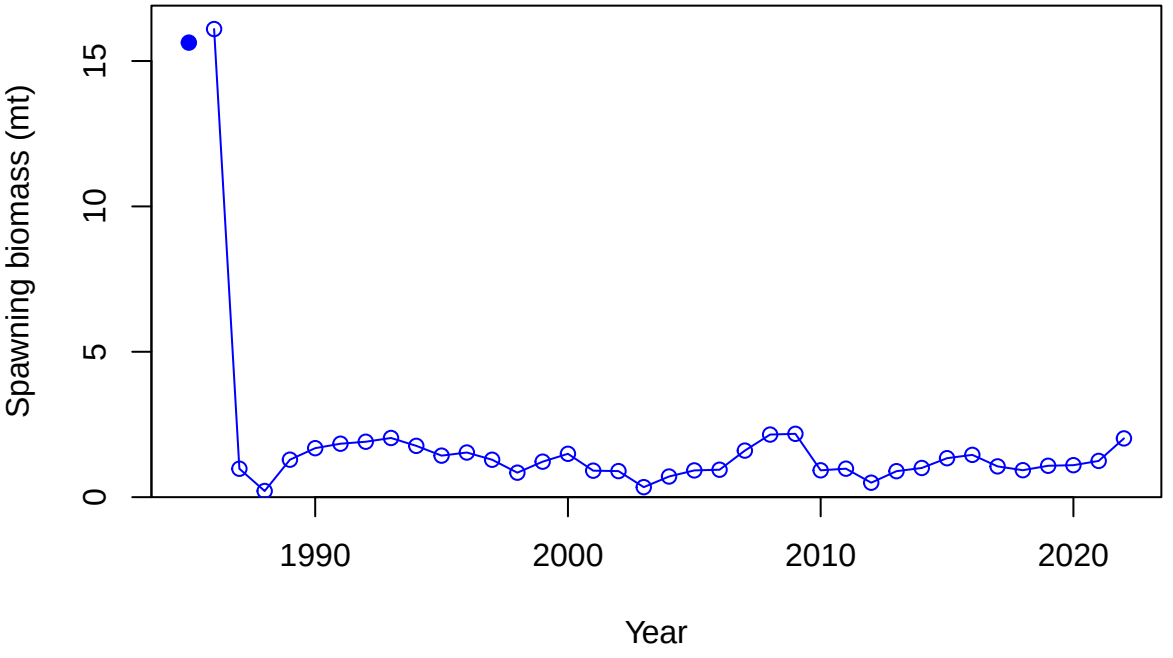

Spawning output
0
1
2
3
4
5
6
0
5
10
15
20
25
30
Age (yr)

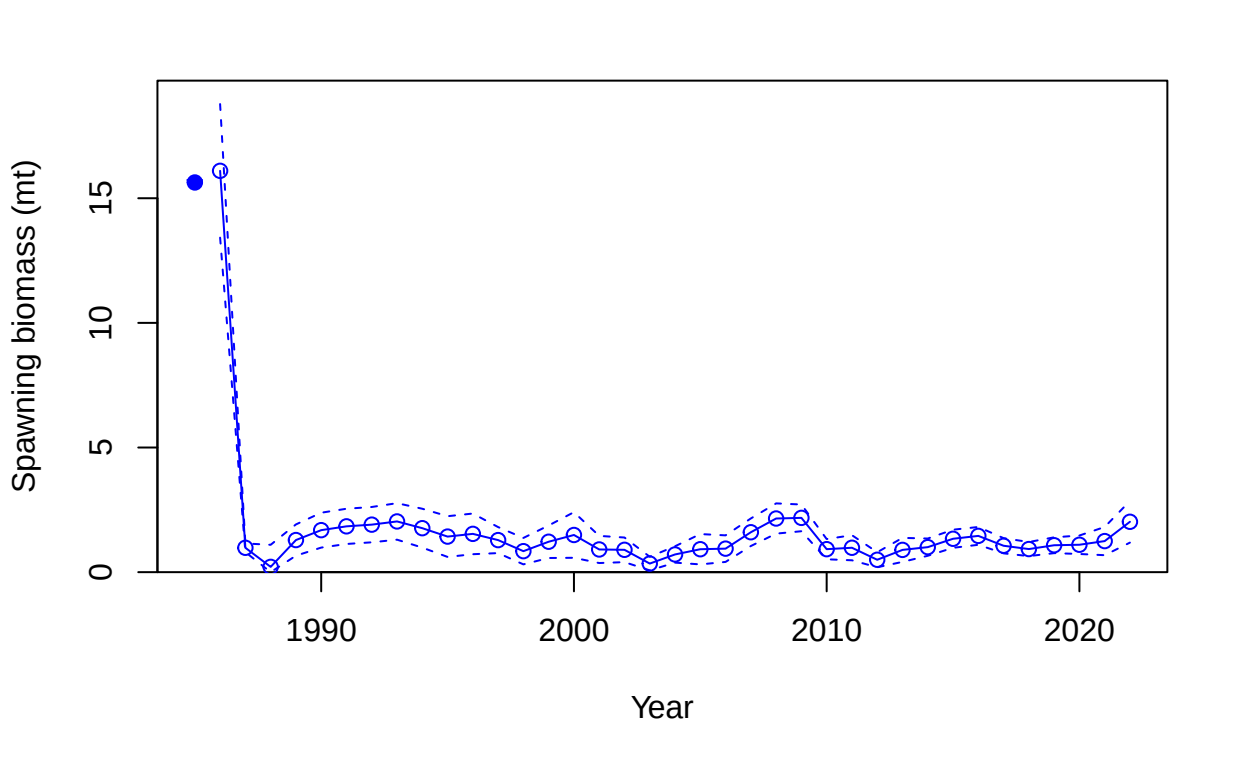

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
20
40
60
80
100
Length (cm)

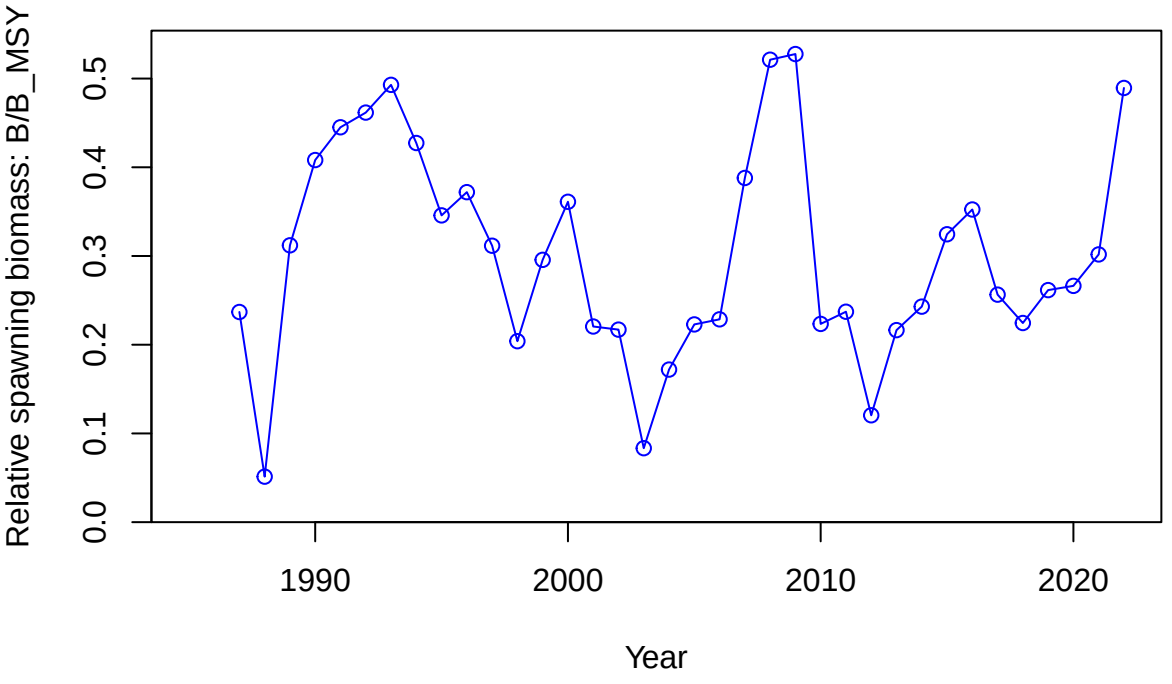

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
5
10
15
20
25
30
Age (yr)

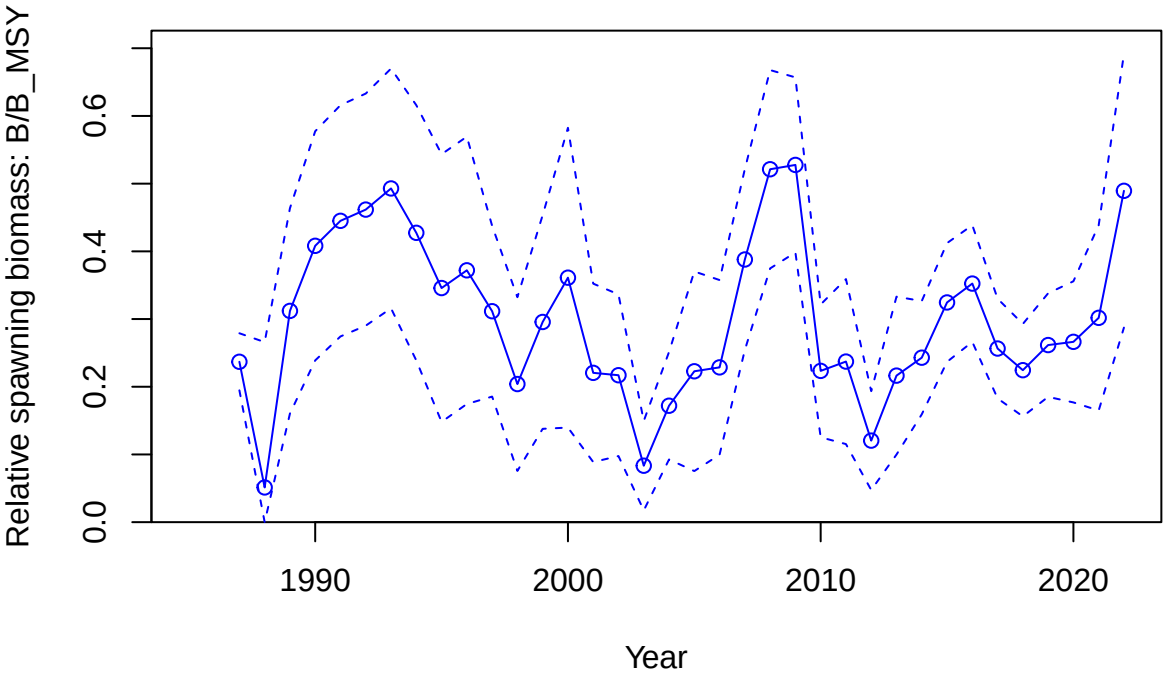

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
20
40
60
80
100
Length (cm)

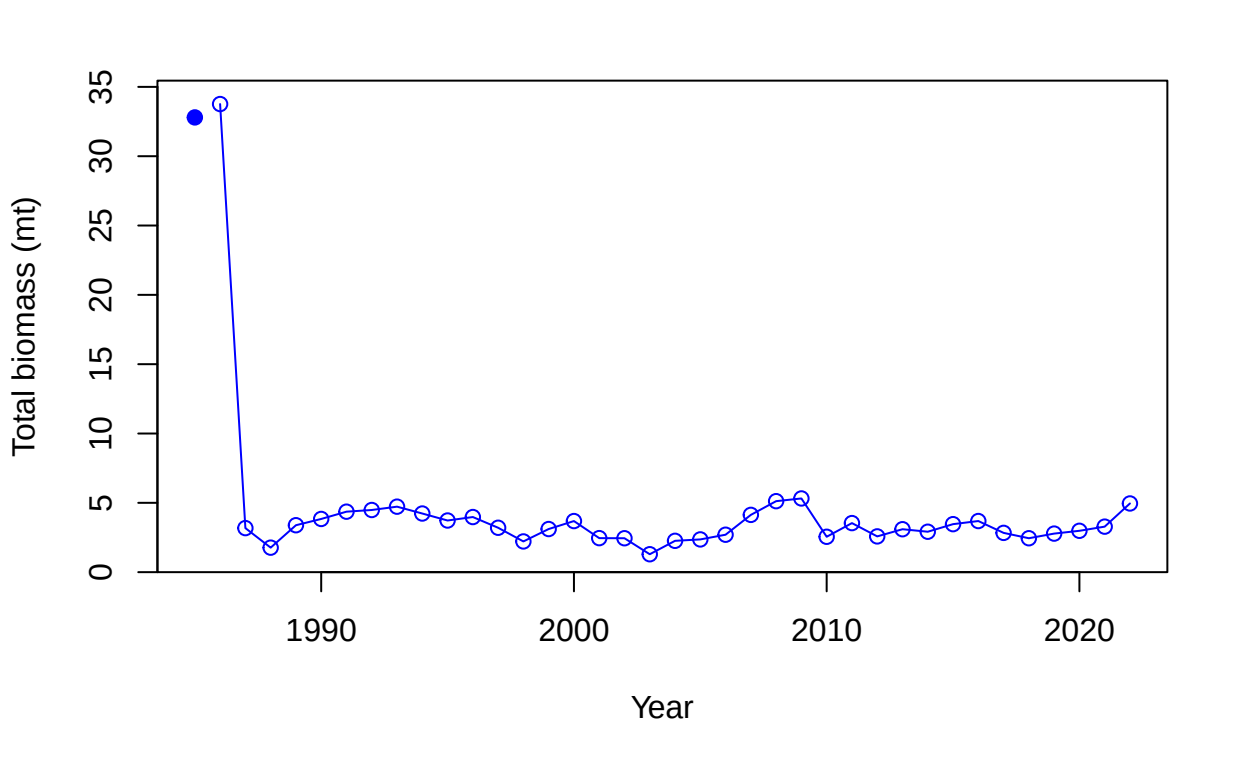

Length (cm)
0
20
40
60
80
100
0
5
10
15
20
25
30
Age (yr)
1
0.8
0.6
0.4
0.2

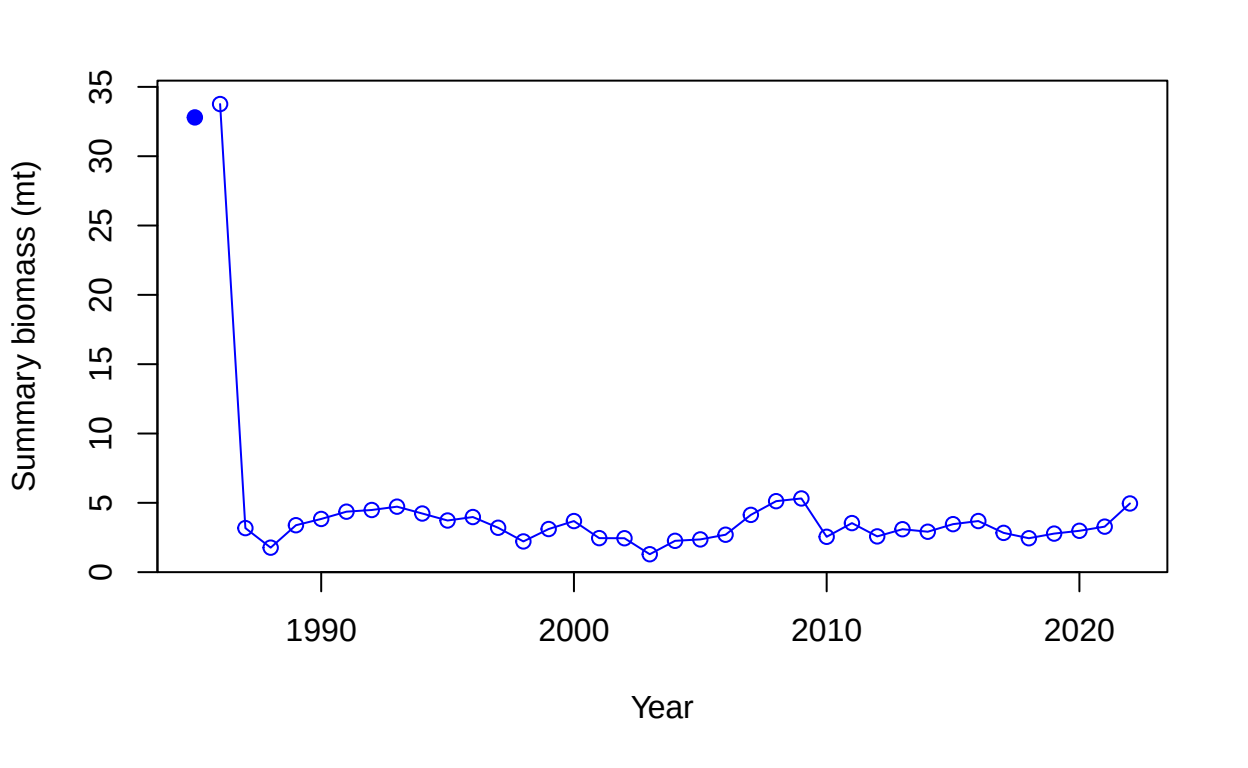

Spawning biomass (mt)
0
5
10
15
1990
2000
2010
2020
Year

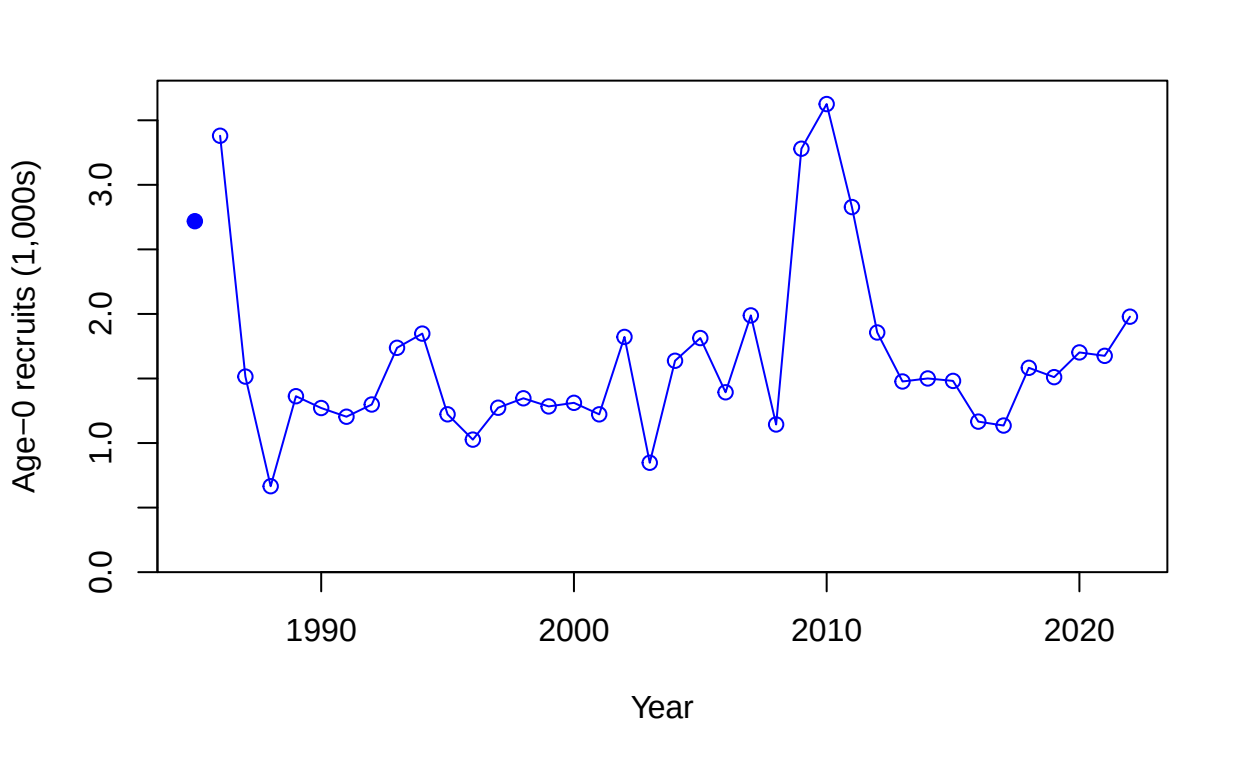

Spawning biomass (mt)
0
5
10
15
1990
2000
2010
2020
Year

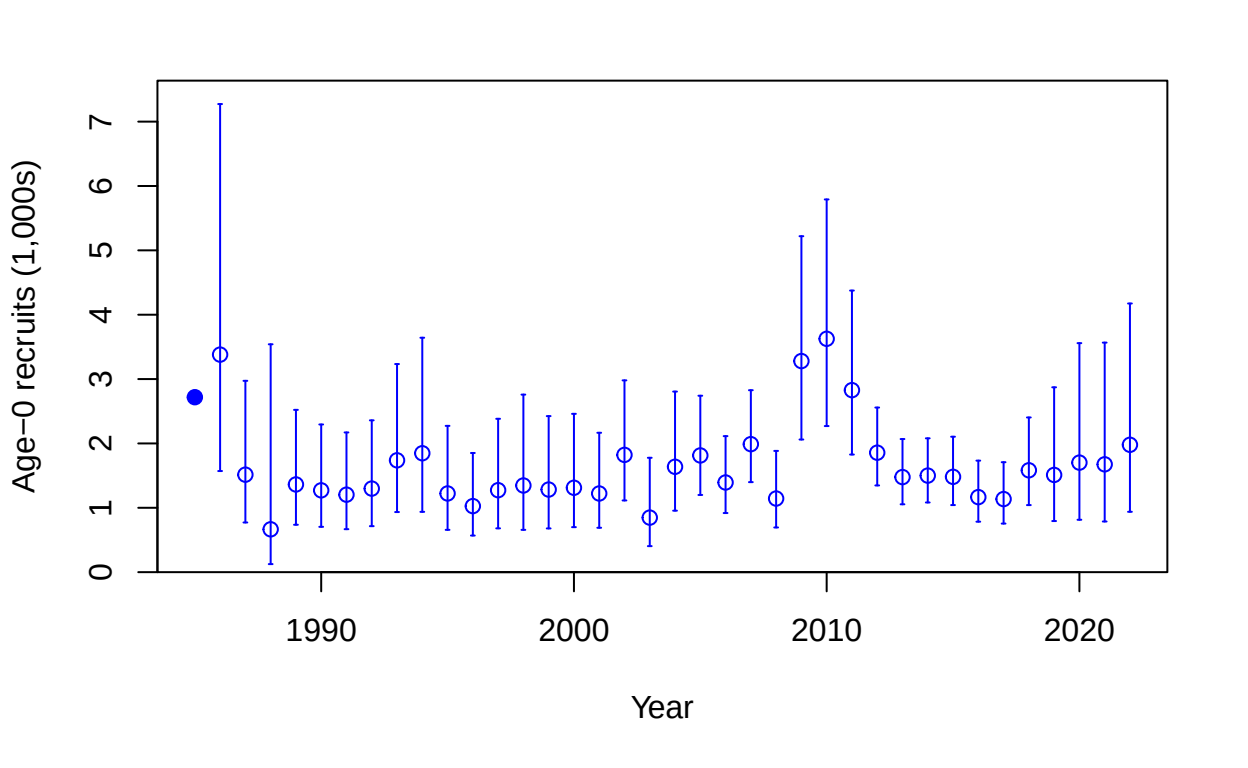

Relative spawning biomass: B/B_MSY
0.0
0.1
0.2
0.3
0.4
0.5
1990
2000
2010
2020
Year

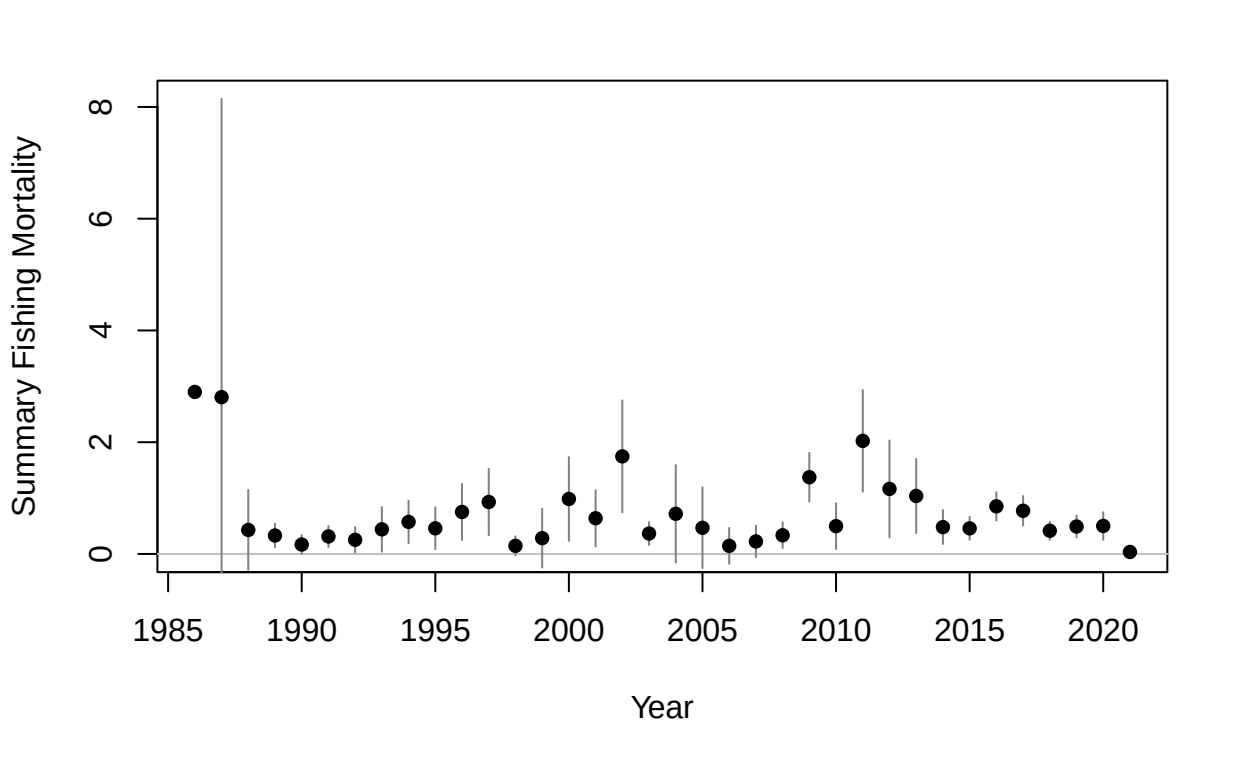

Relative spawning biomass: B/B_MSY
0.0
0.2
0.4
0.6
1990
2000
2010
2020
Year

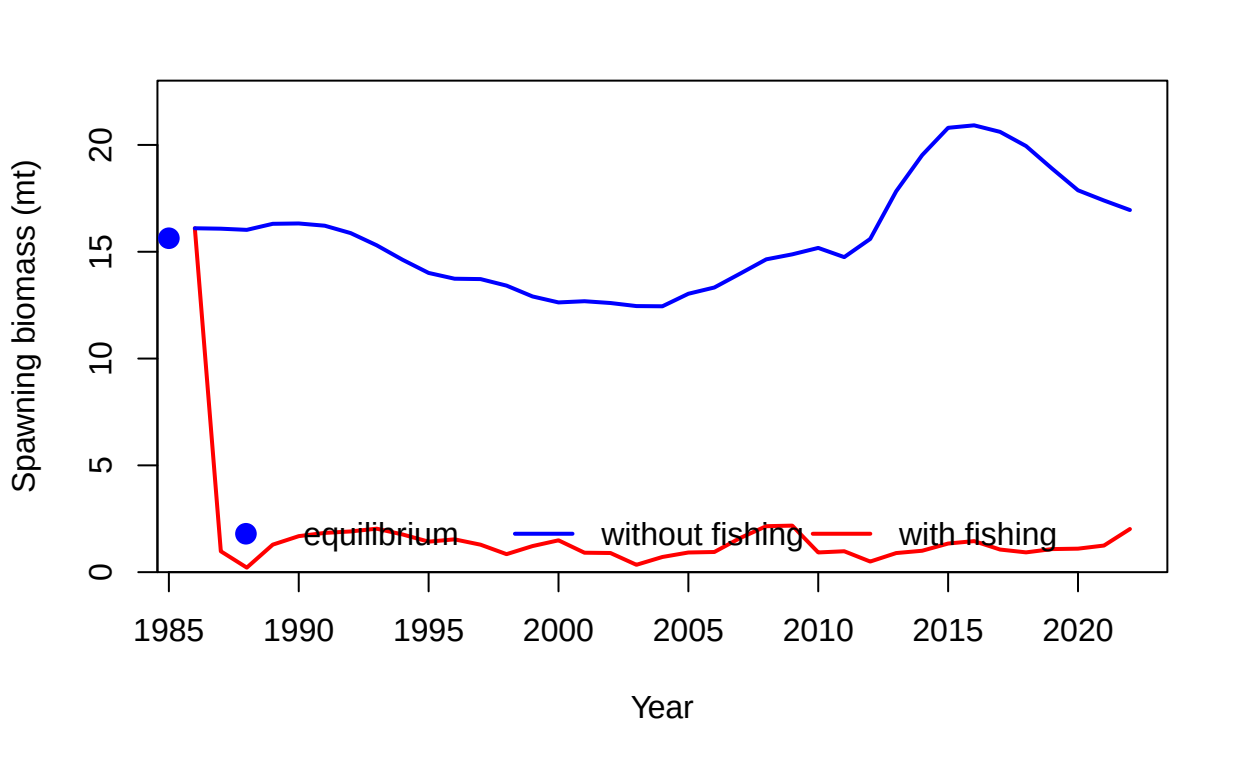

Total biomass (mt)
0
5
10
15
20
25
30
35
1990
2000
2010
2020
Year

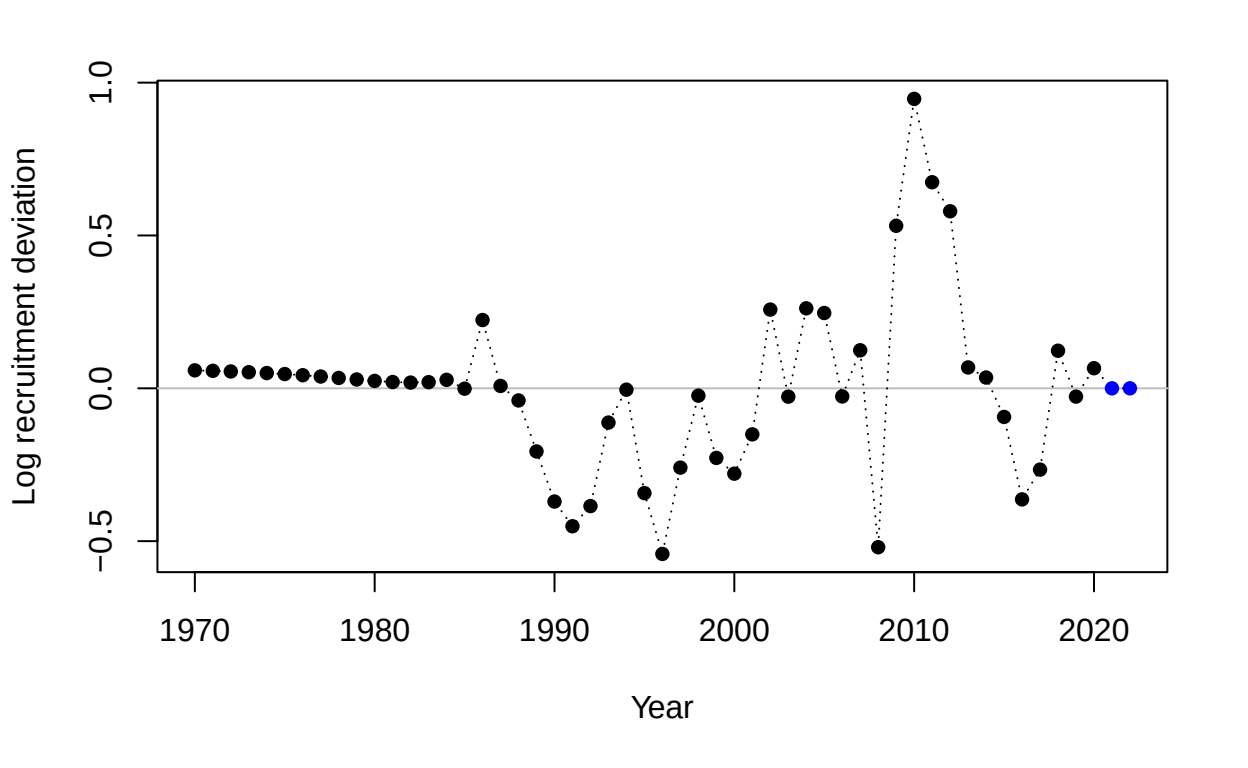

Summary biomass (mt)
0
5
10
15
20
25
30
35
1990
2000
2010
2020
Year

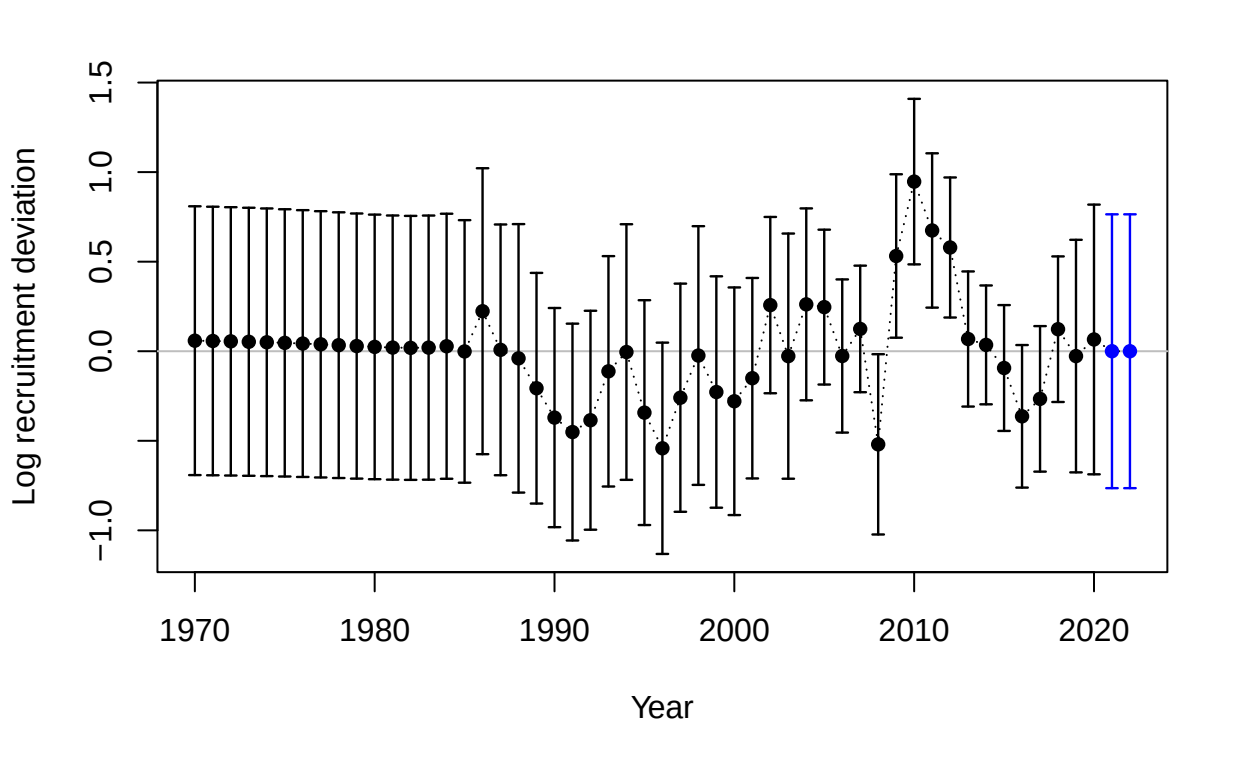

Age−0 recruits (1,000s)
0.0
1.0
2.0
3.0
1990
2000
2010
2020
Year

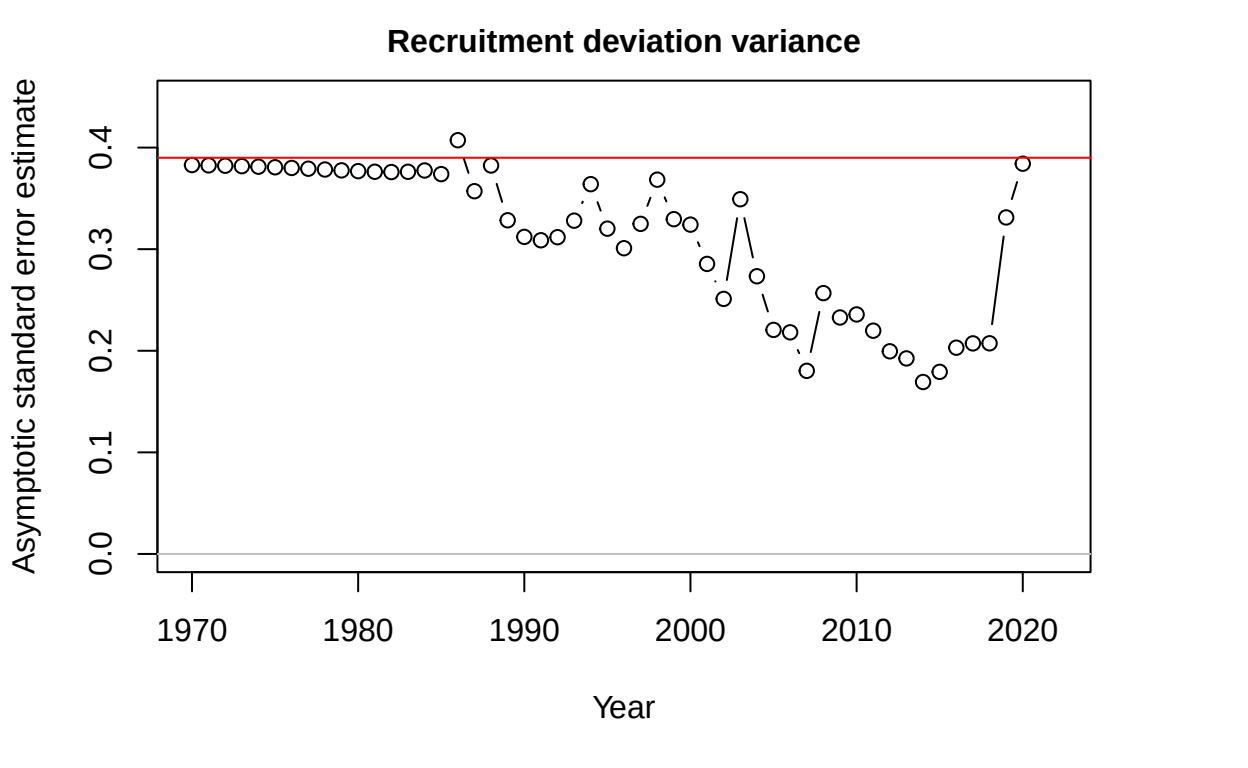

Age−0 recruits (1,000s)
0
1
2
3
4
5
6
7
1990
2000
2010
2020
Year

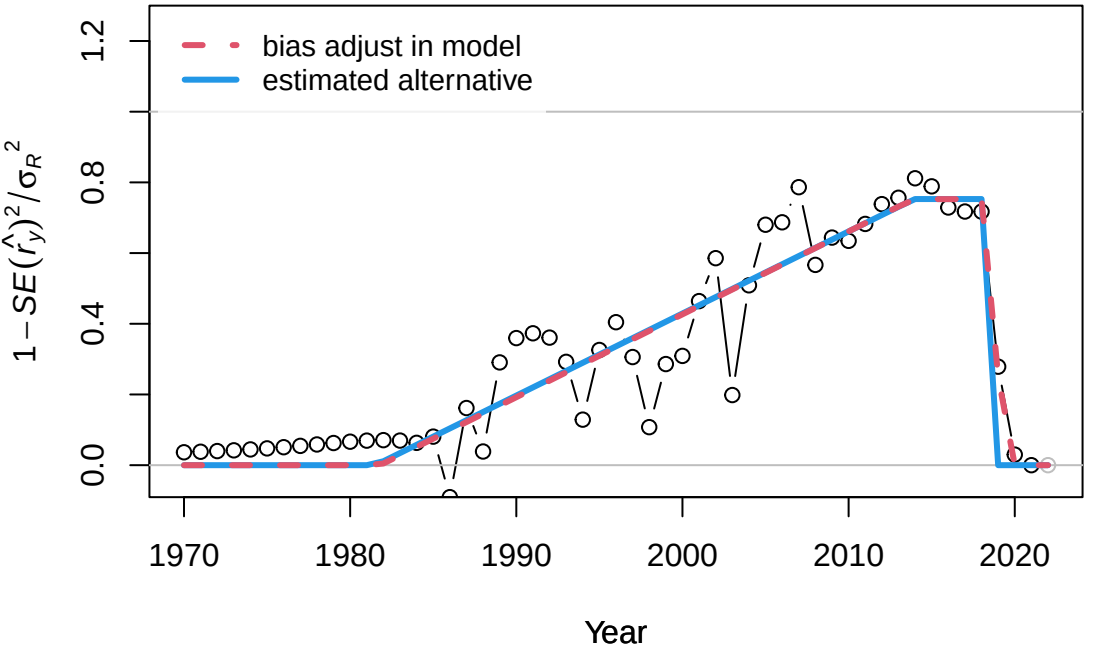

Summary Fishing Mortality
0
2
4
6
8
1985
1990
1995
2000
2005
2010
2015
2020
Year

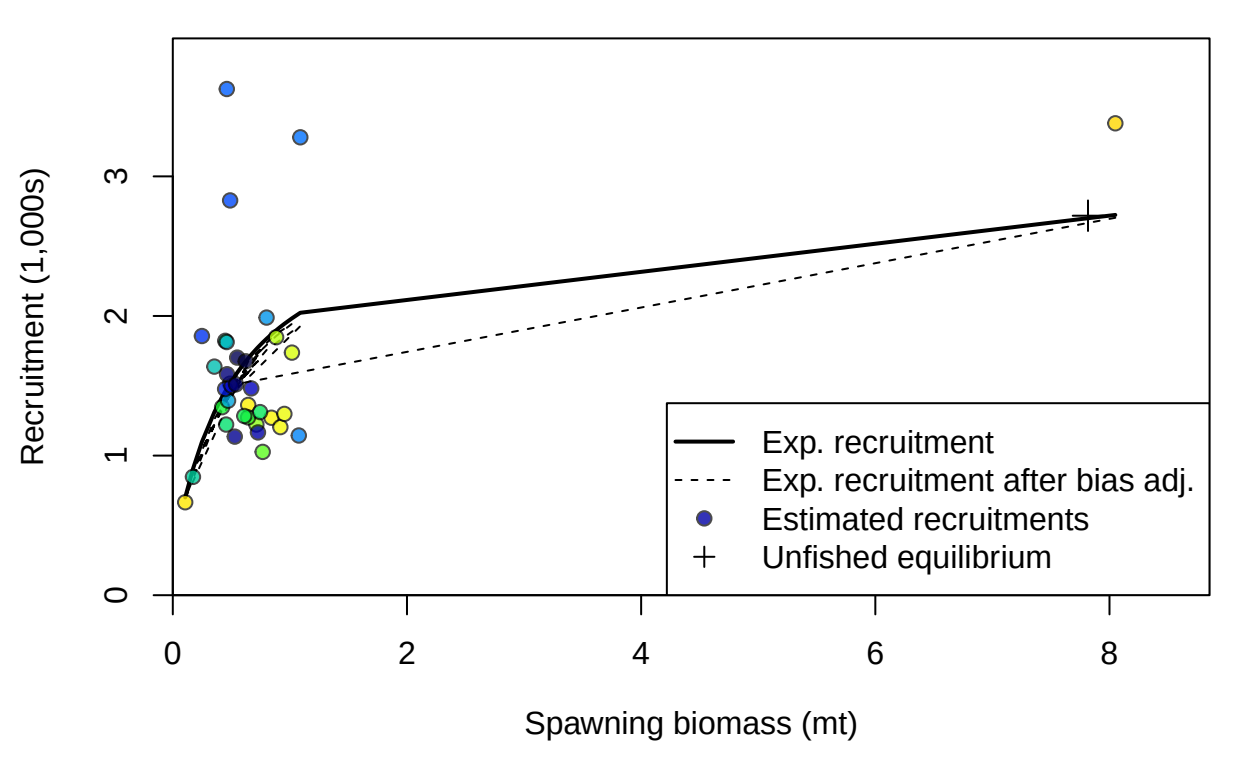

Spawning biomass (mt)
0
5
10
15
20
1985
1990
1995
2000
2005
2010
2015
2020
Year
equilibrium
without fishing
with fishing

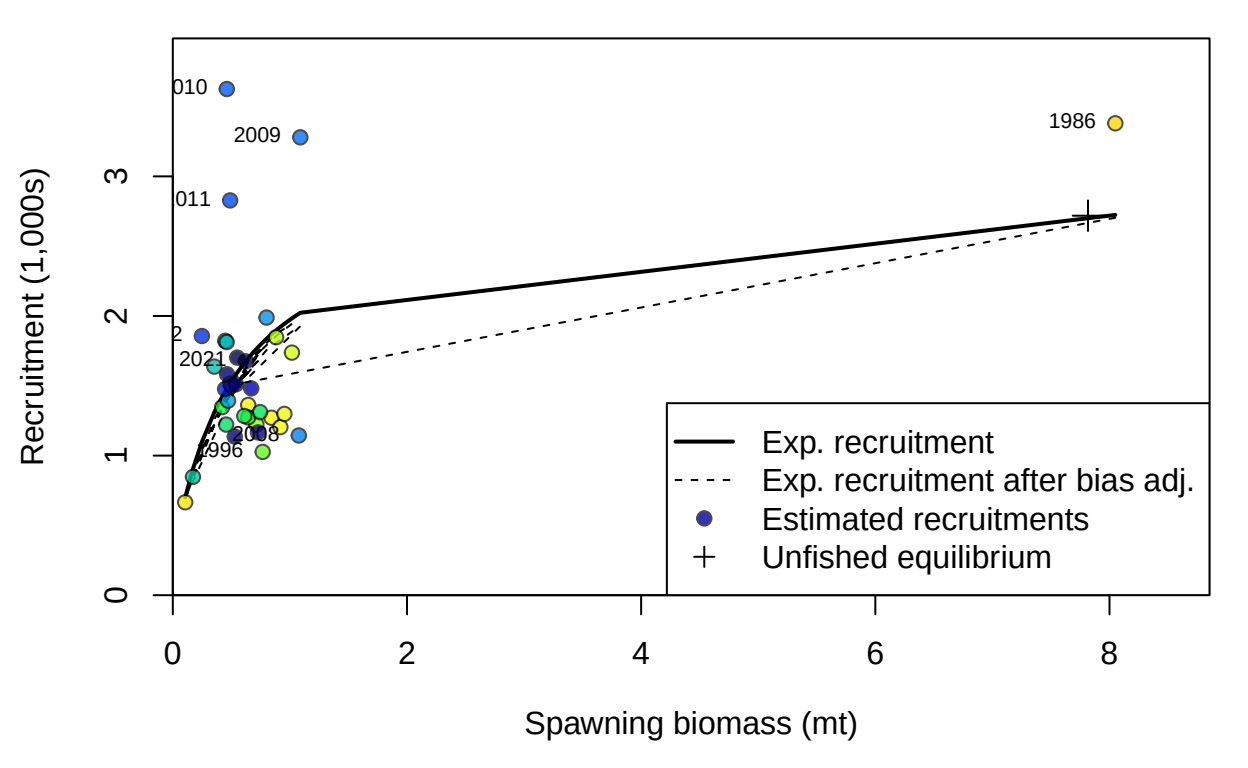

Log recruitment deviation
1.0
0.5
0.0
−0.5
1970
1980
1990
2000
2010
2020
Year

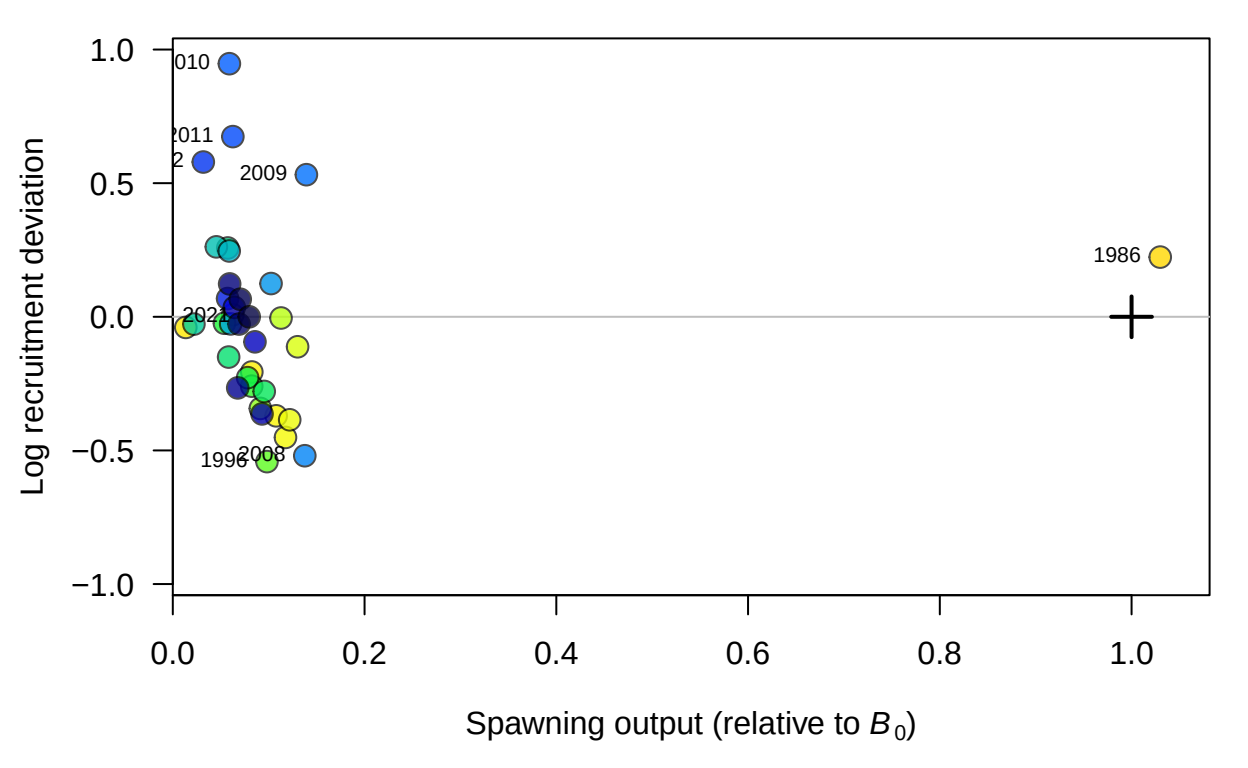

Log recruitment deviation
1.5
1.0
0.5
0.0
−1.0
1970
1980
1990
2000
2010
2020
Year

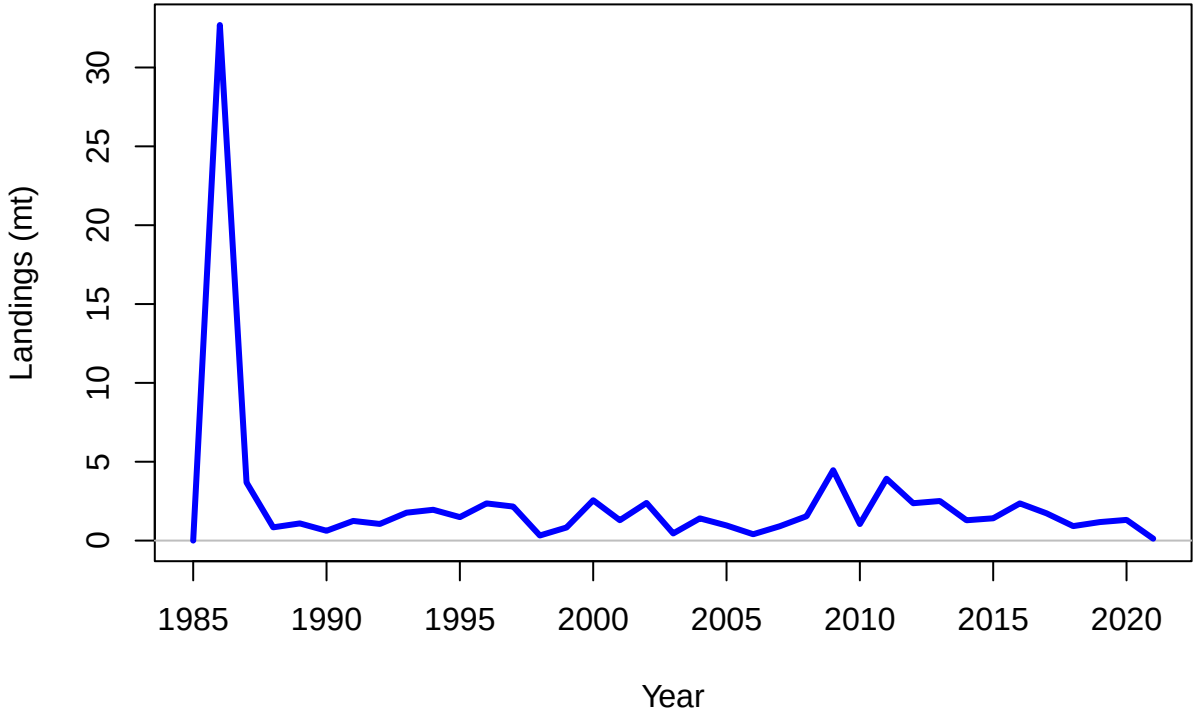

Recruitment deviation variance
Asymptotic standard error estimate
0.0
0.1
0.2
0.3
0.4
1970
1980
1990
2000
2010
2020
Year

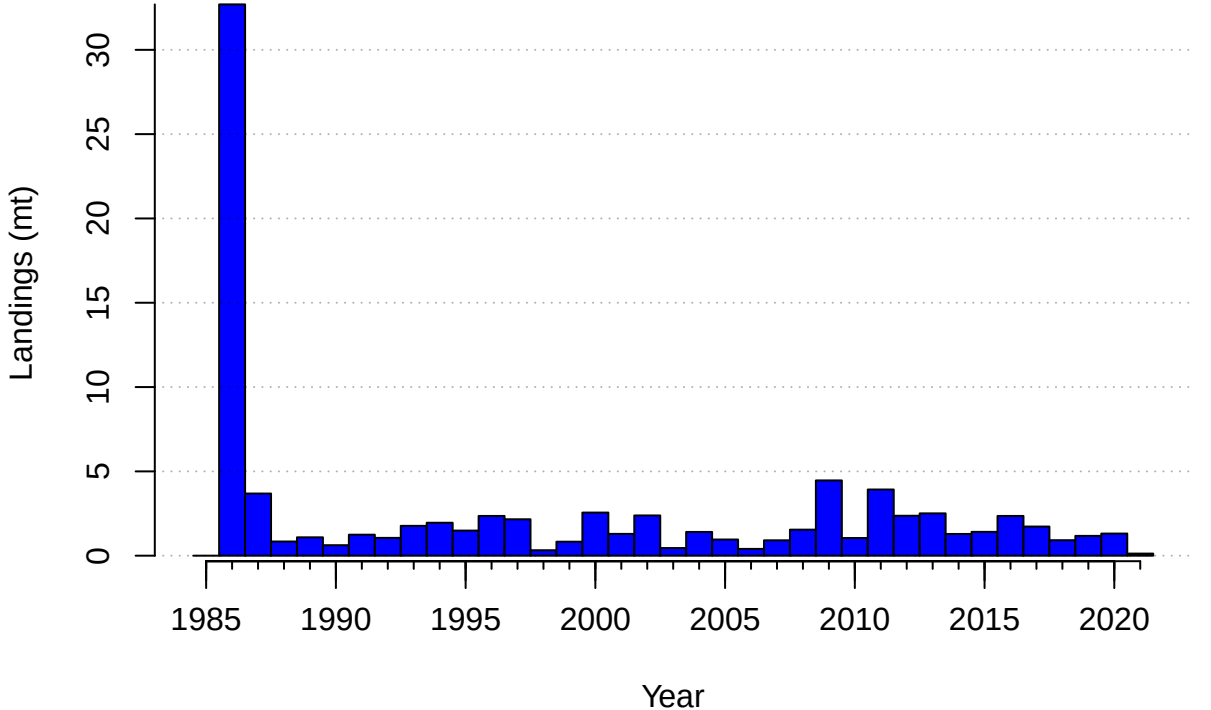

bias adjust in model
estimated alternative
$1 - SE(\hat{r}_y)^2/\sigma_R^2$
0.0
0.4
0.8
1.2
1970
1980
1990
2000
2010
2020
Year

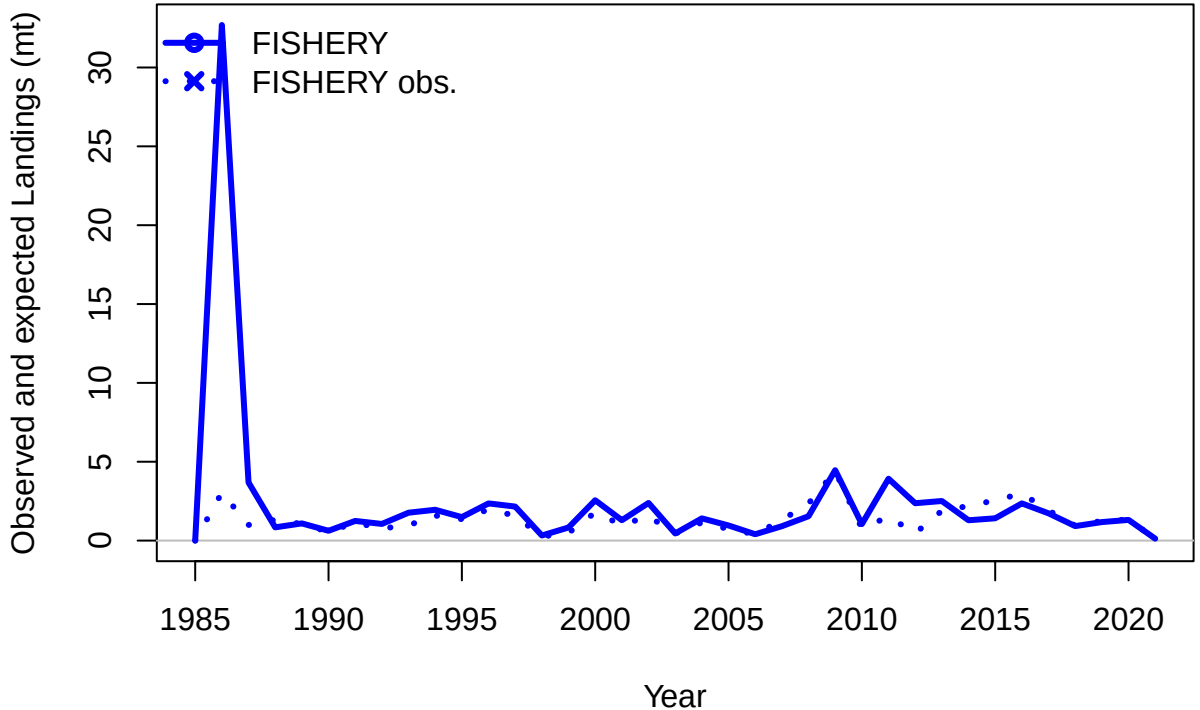

Recruitment (1,000s)
0
1
2
3
0
2
4
6
8
Spawning biomass (mt)
Exp. recruitment
Exp. recruitment after bias adj.
Estimated recruitments
Unfished equilibrium

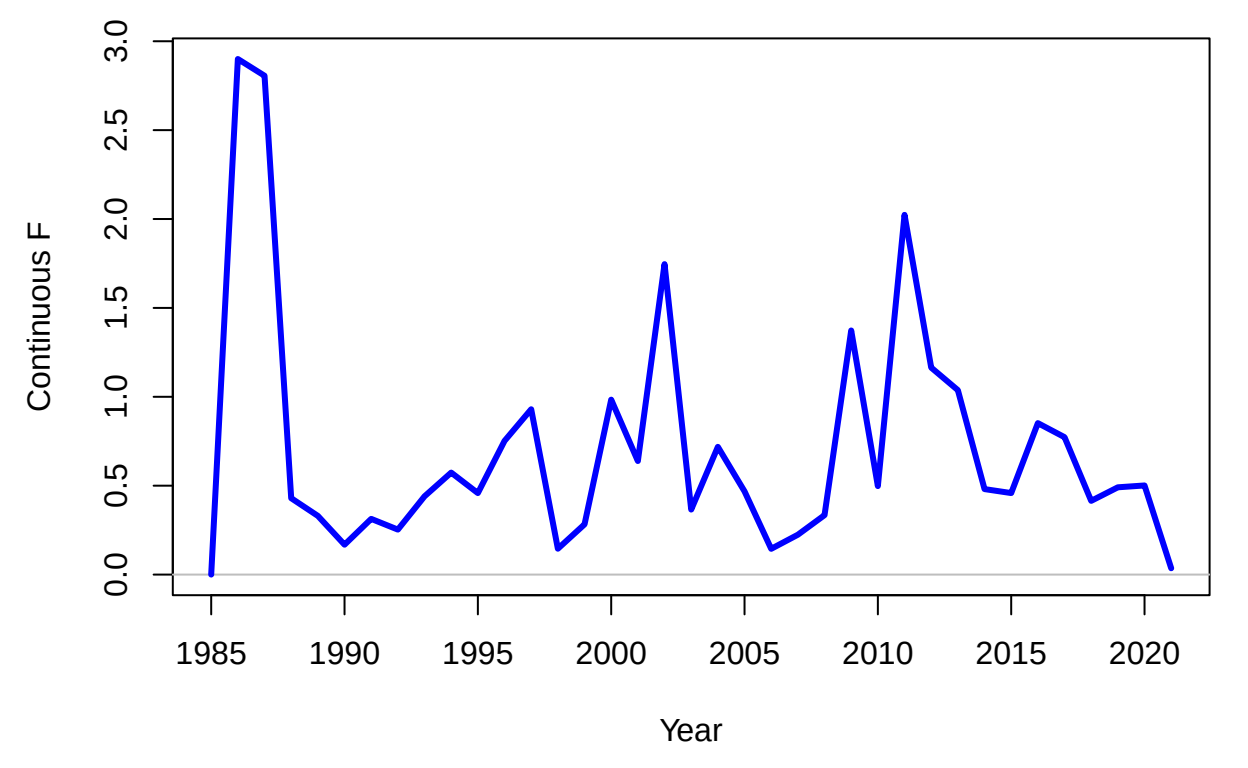

Recruitment (1,000s)
Spawning biomass (mt)
0
1
2
3
0
2
4
6
8
010
2009
011
1986
2021
2008
1996
Exp. recruitment
Exp. recruitment after bias adj.
Estimated recruitments
Unfished equilibrium

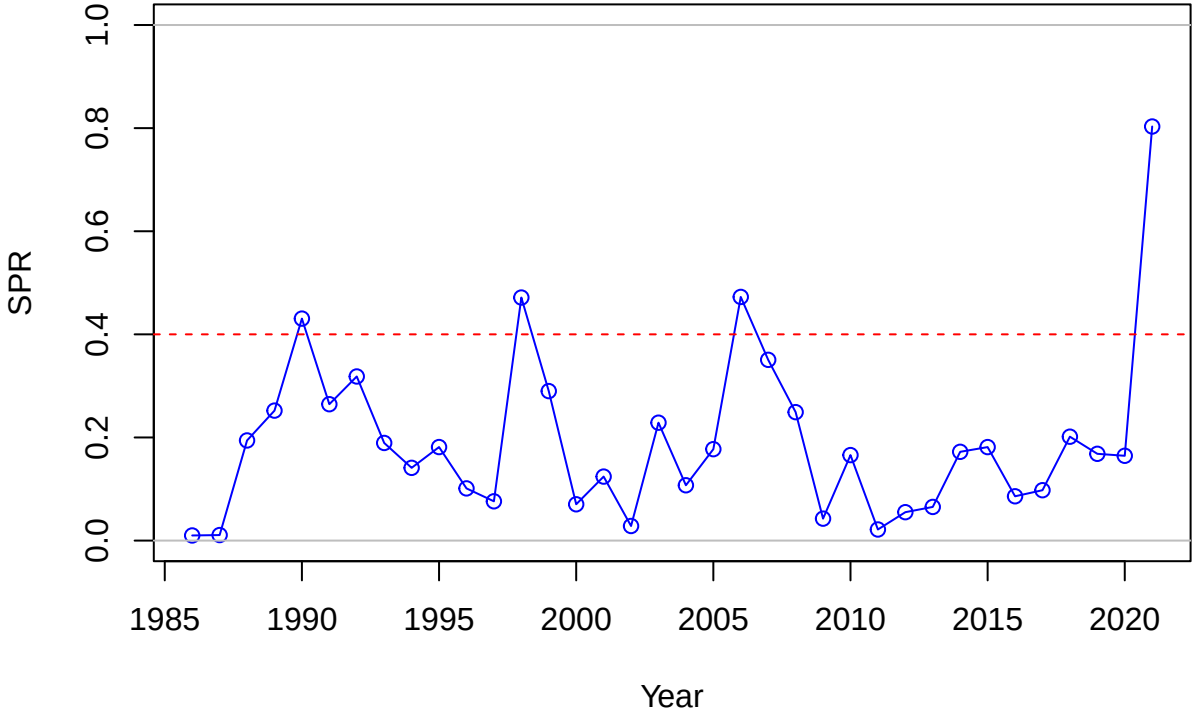

1.0
0.5
0.0
−0.5
−1.0
Log recruitment deviation
0.0
0.2
0.4
0.6
0.8
1.0
Spawning output (relative to B_0)
010
2011
2
2009
1986
2021
1998
2008

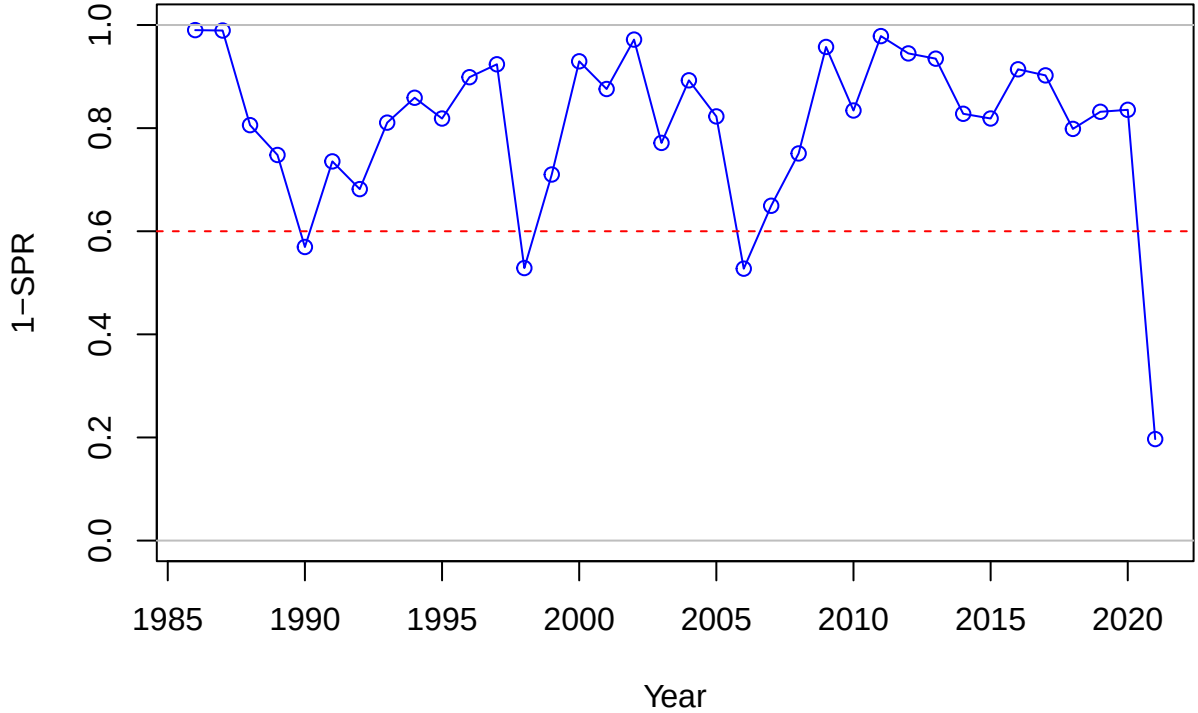

Landings (mt)
0
5
10
15
20
25
30
1985
1990
1995
2000
2005
2010
2015
2020
Year

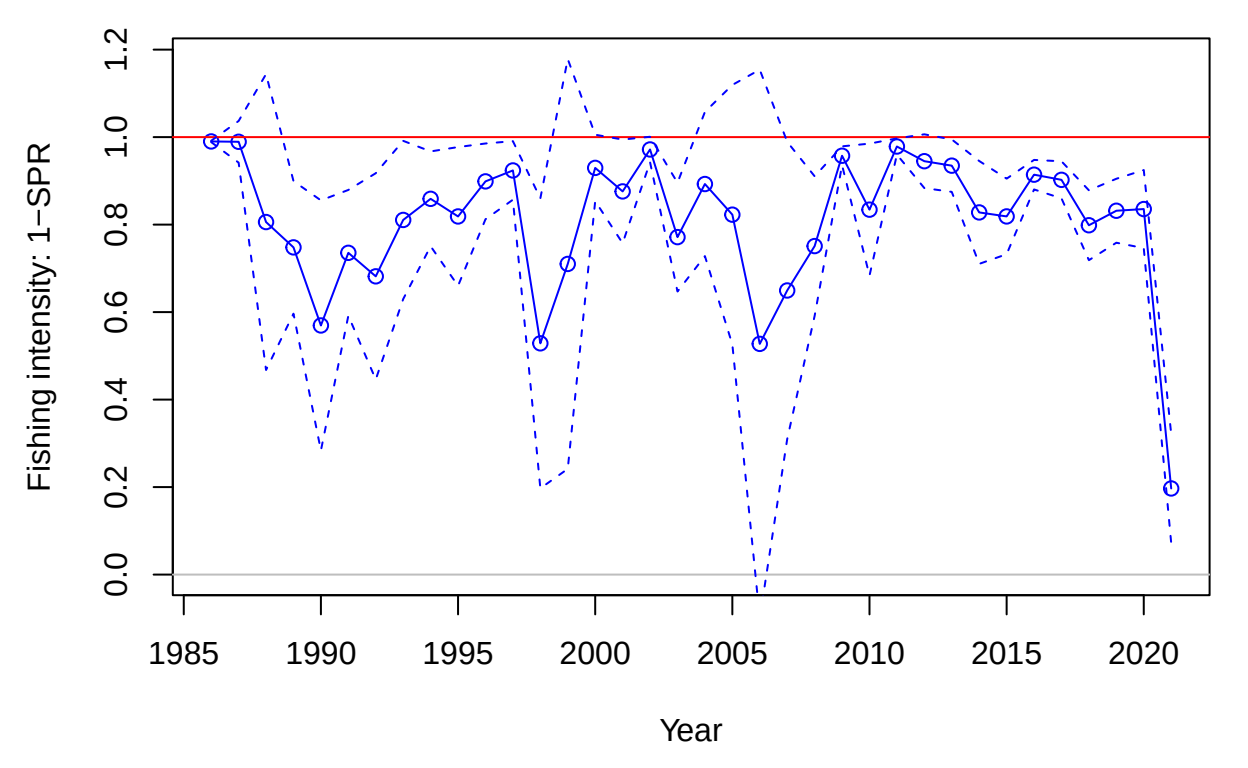

Landings (mt)
0
5
10
15
20
25
30
1985
1990
1995
2000
2005
2010
2015
2020
Year

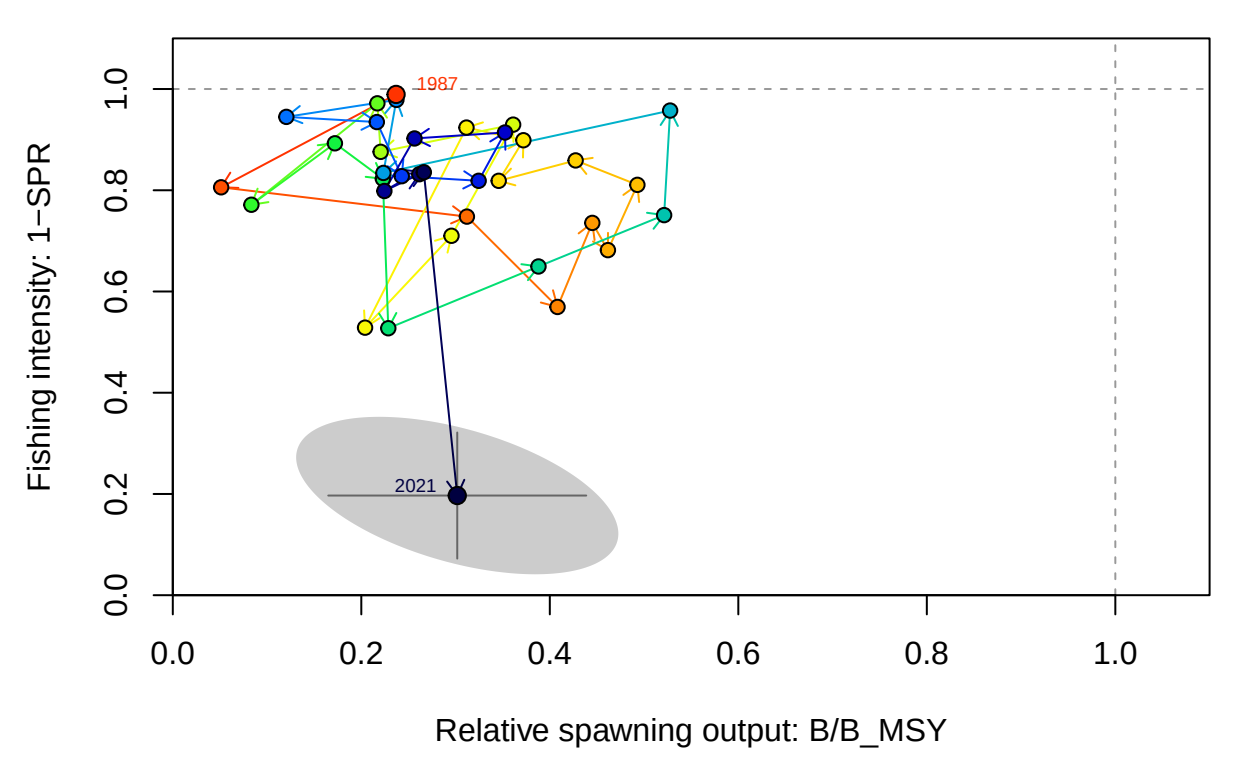

FISHERY
FISHERY obs.
Observed and expected Landings (mt)
0
5
10
15
20
25
30
1985
1990
1995
2000
2005
2010
2015
2020
Year

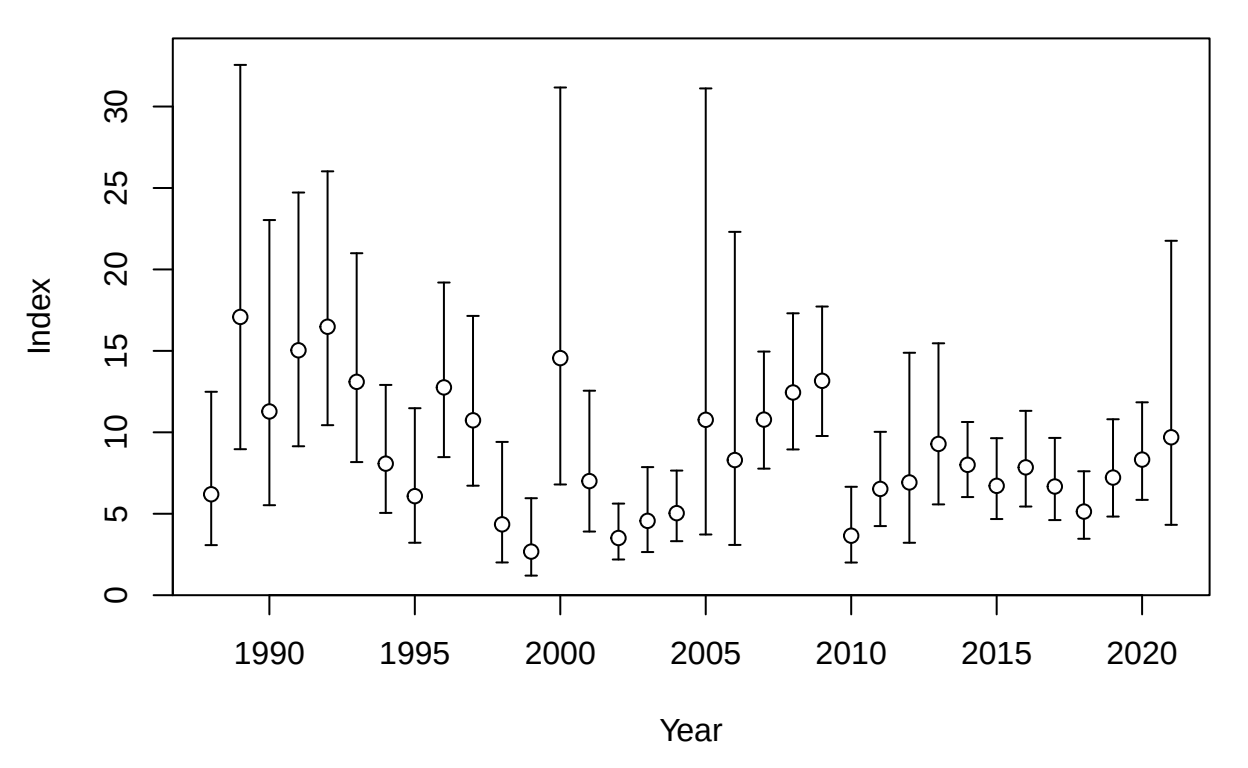

Continuous F
0.0
0.5
1.0
1.5
2.0
2.5
3.0
1985
1990
1995
2000
2005
2010
2015
2020
Year

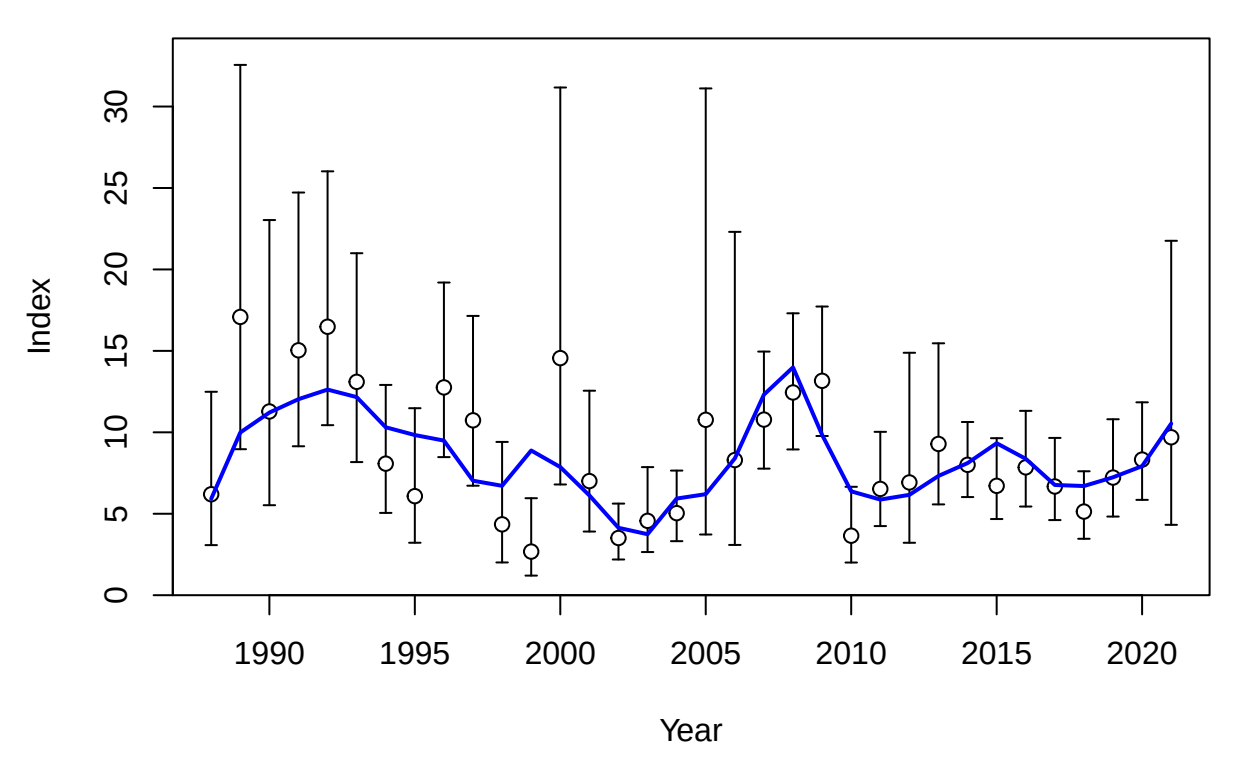

SPR
0.0
0.2
0.4
0.6
0.8
1.0
1985
1990
1995
2000
2005
2010
2015
2020
Year

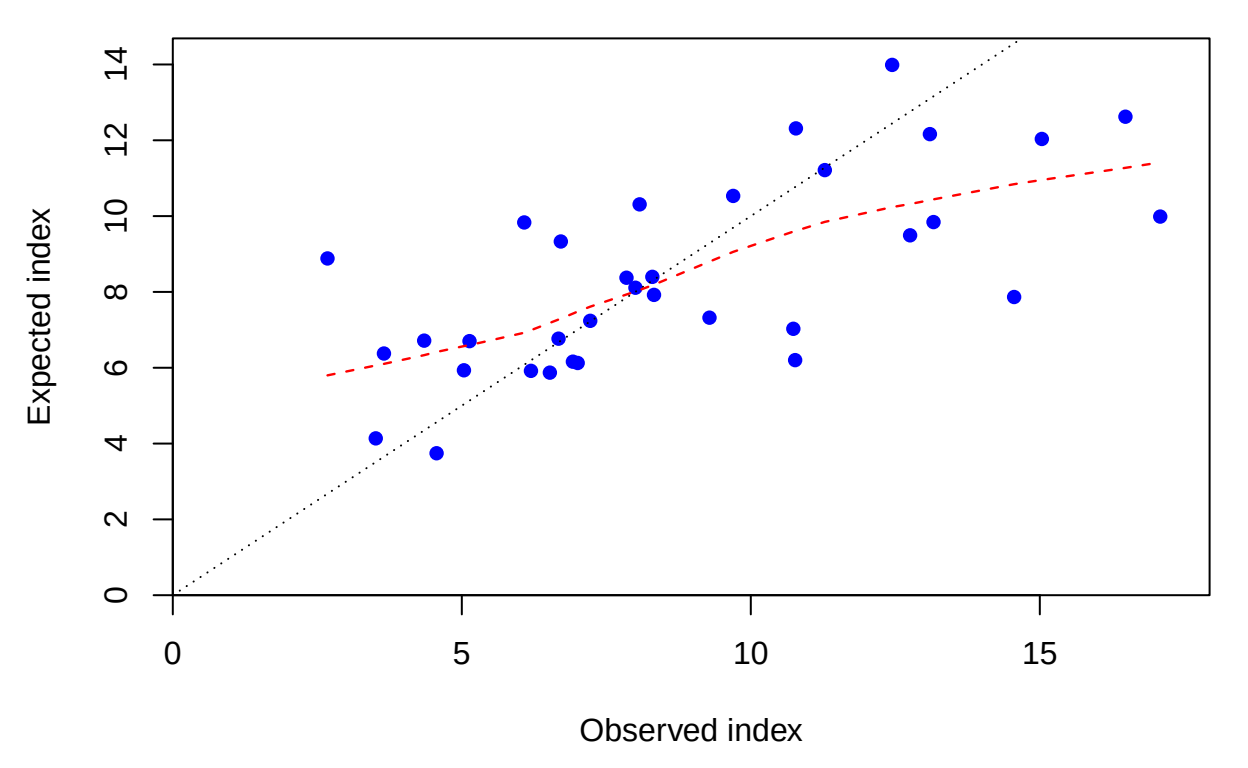

1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
1985
1990
1995
2000
2005
2010
2015
2020
Year

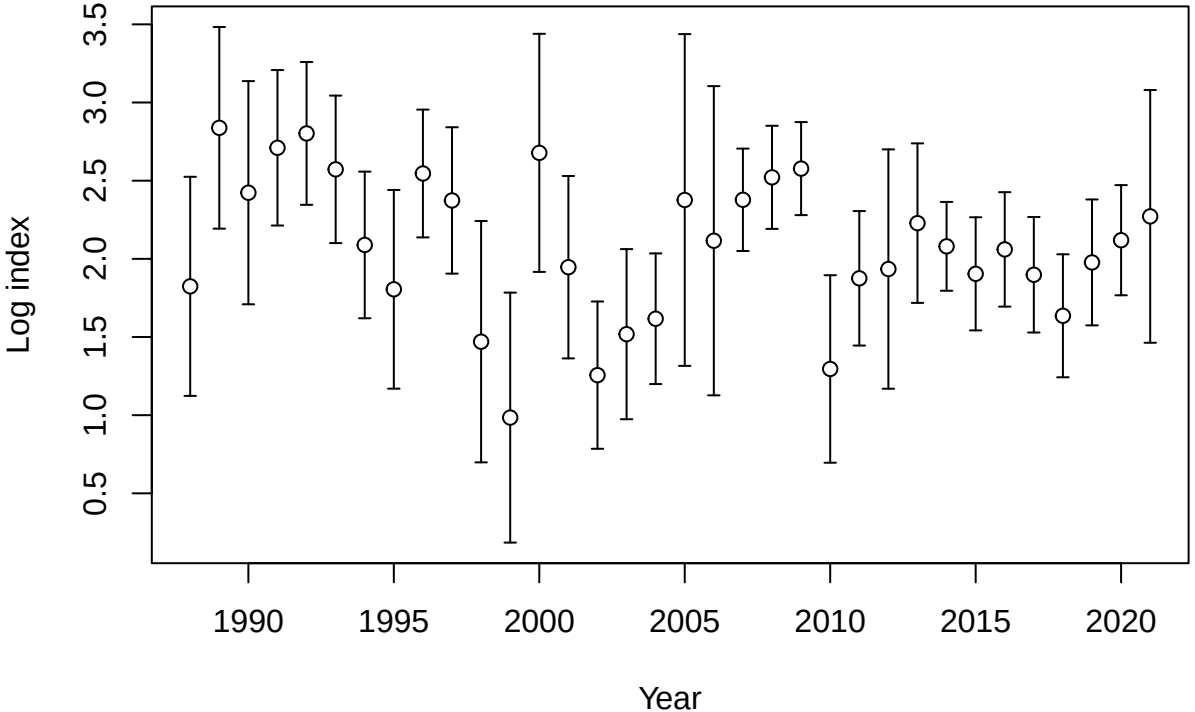

Fishing intensity: 1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1985
1990
1995
2000
2005
2010
2015
2020
Year

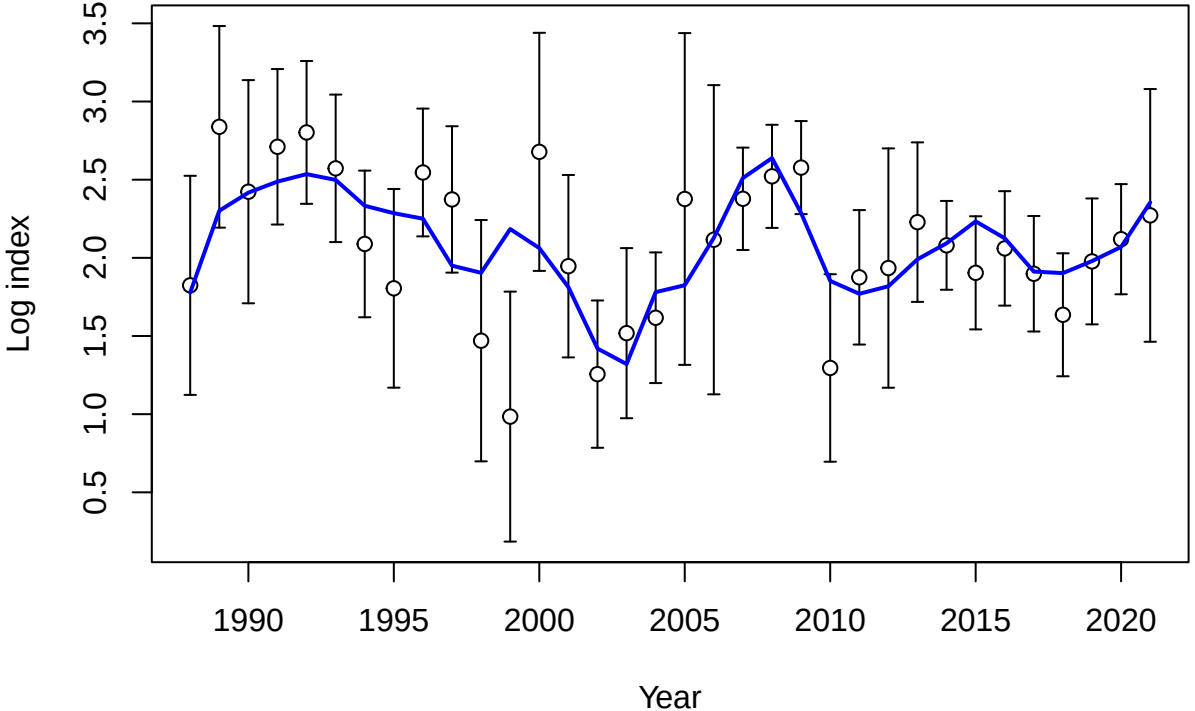

1987
2021
Fishing intensity: 1−SPR
Relative spawning output: B/B_MSY
0.0
0.2
0.4
0.6
0.8
1.0

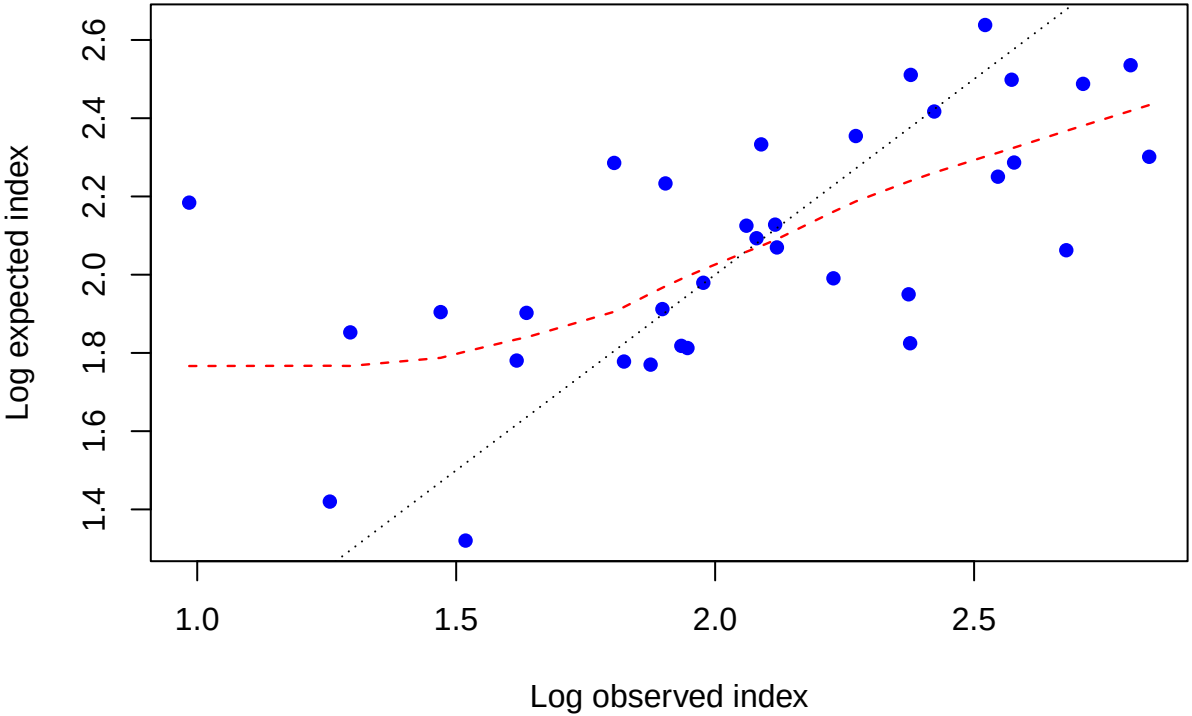

Index
0
5
10
15
20
25
30
1990
1995
2000
2005
2010
2015
2020
Year

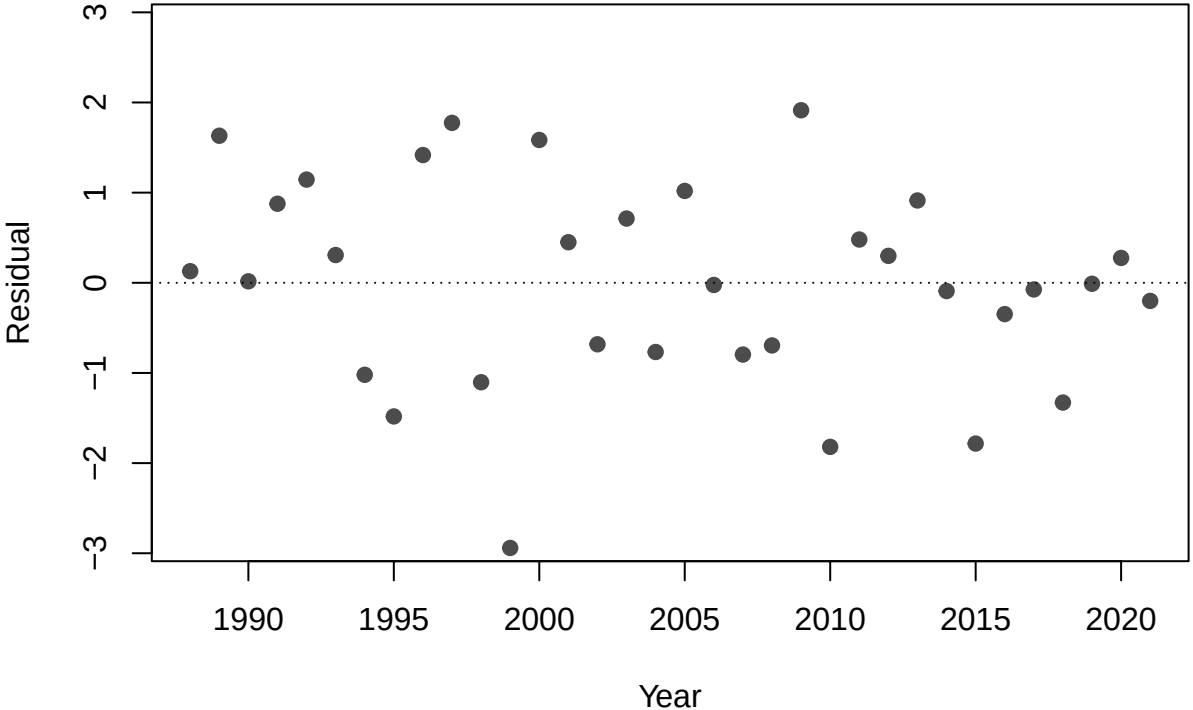

Index
0
5
10
15
20
25
30
1990
1995
2000
2005
2010
2015
2020
Year

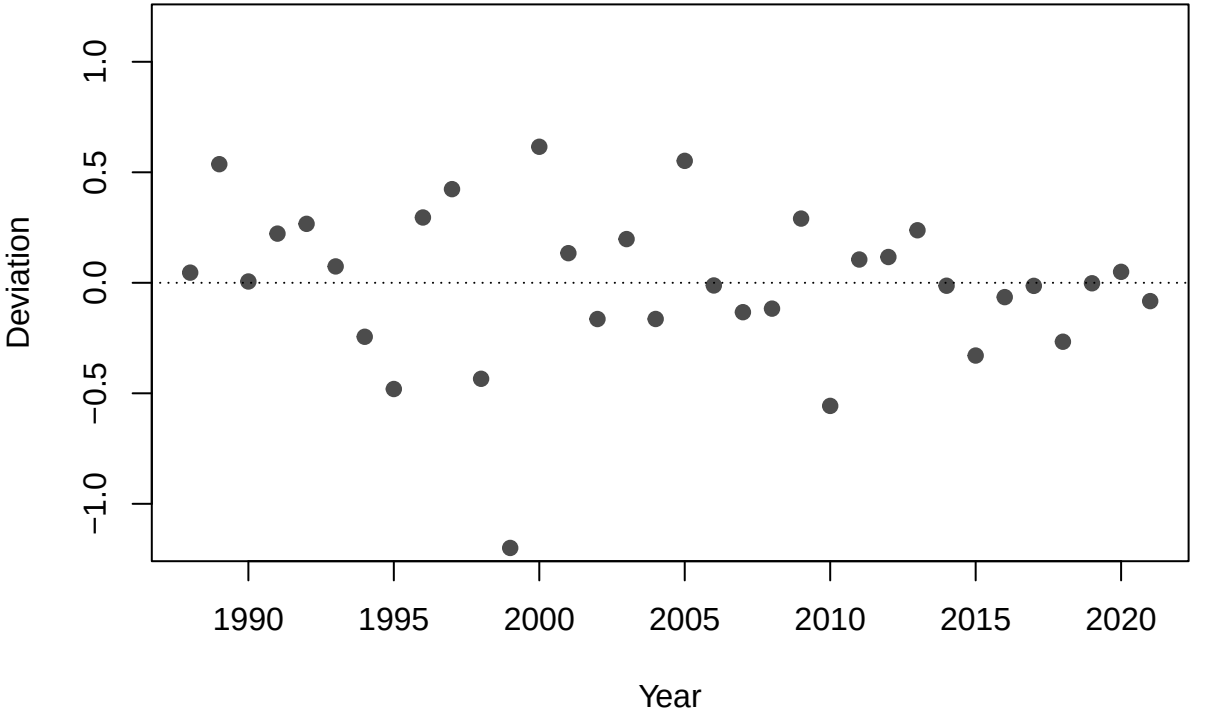

Expected index
0
2
4
6
8
10
12
14
0
5
10
15
Observed index

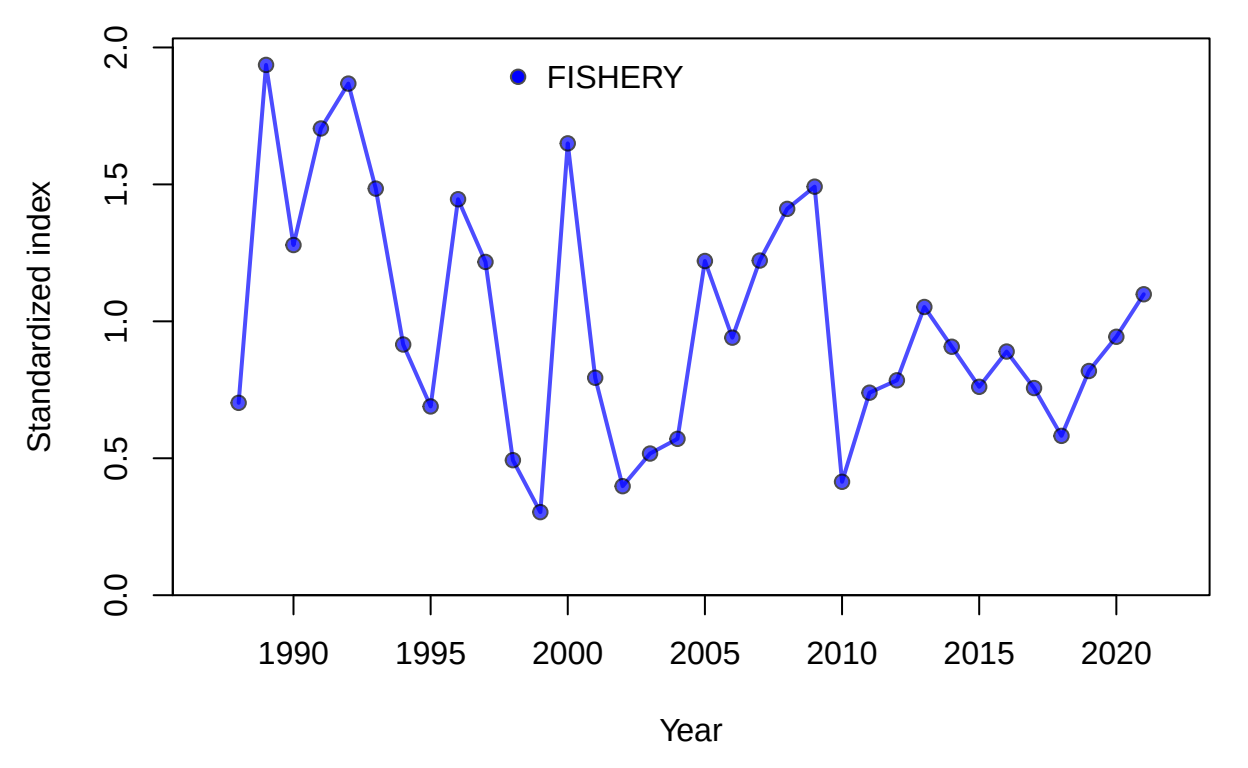

Log index
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1990
1995
2000
2005
2010
2015
2020
Year

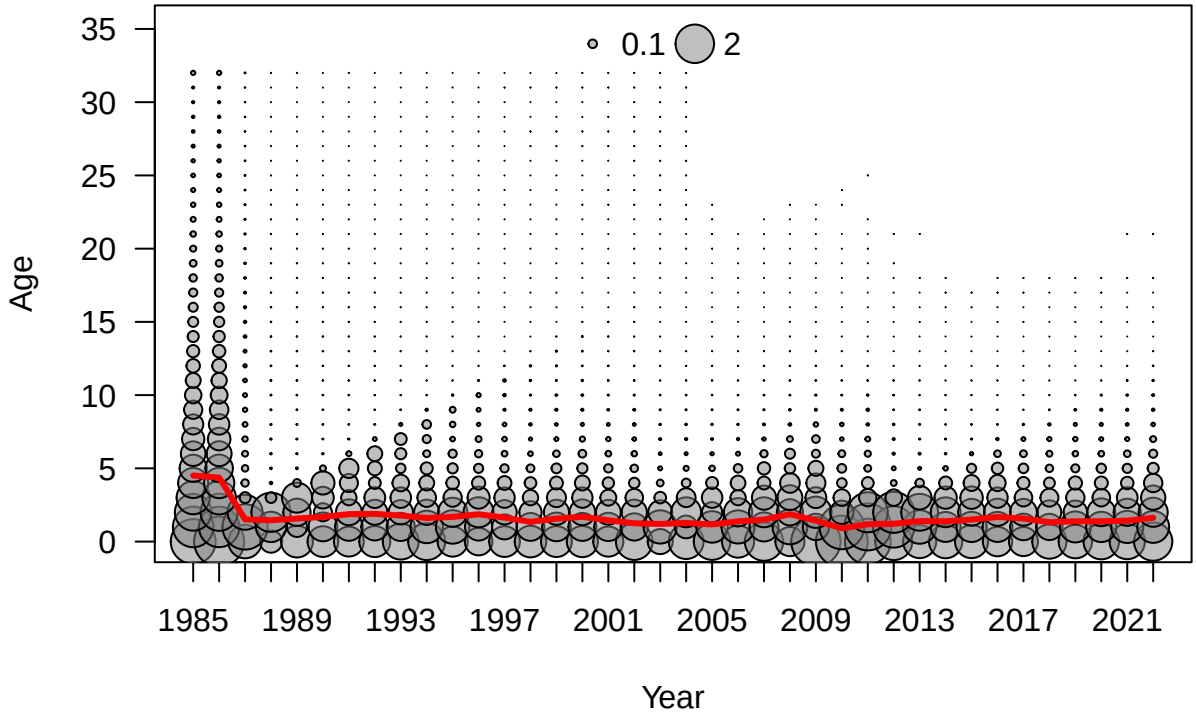

Log index
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1990
1995
2000
2005
2010
2015
2020
Year

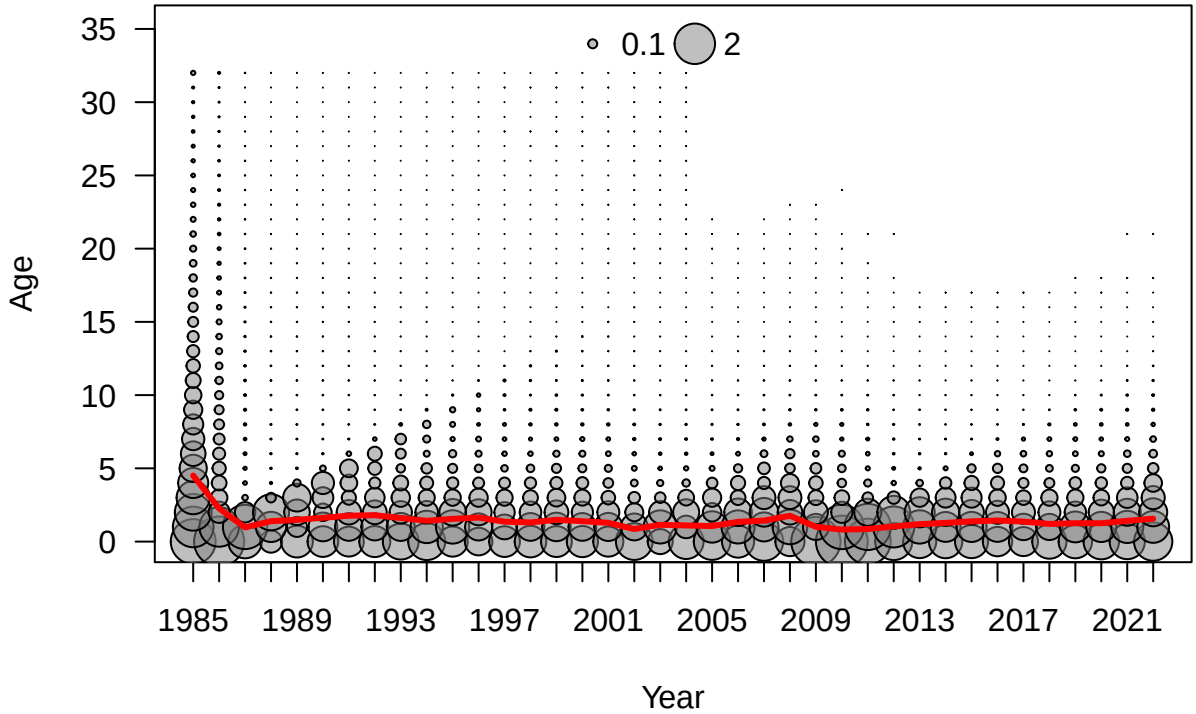

Log expected index
1.4
1.6
1.8
2.0
2.2
2.4
2.6
1.0
1.5
2.0
2.5
Log observed index

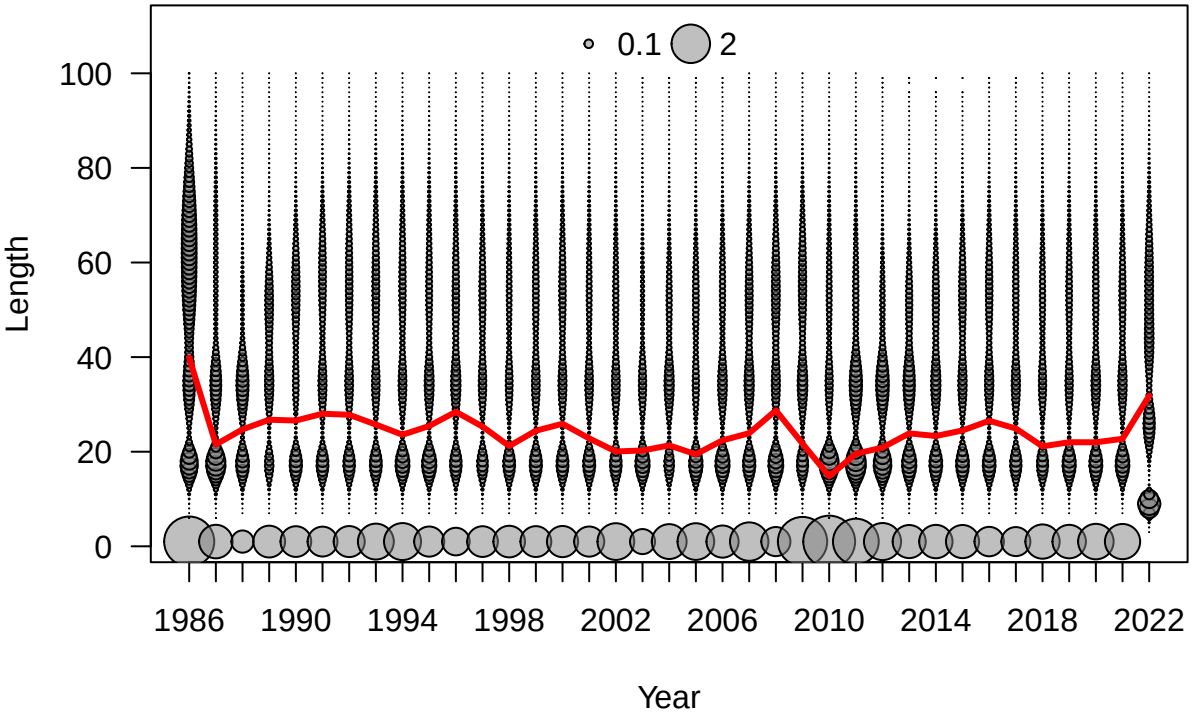

Residual
3
2
1
0
−1
−2
−3
1990
1995
2000
2005
2010
2015
2020
Year

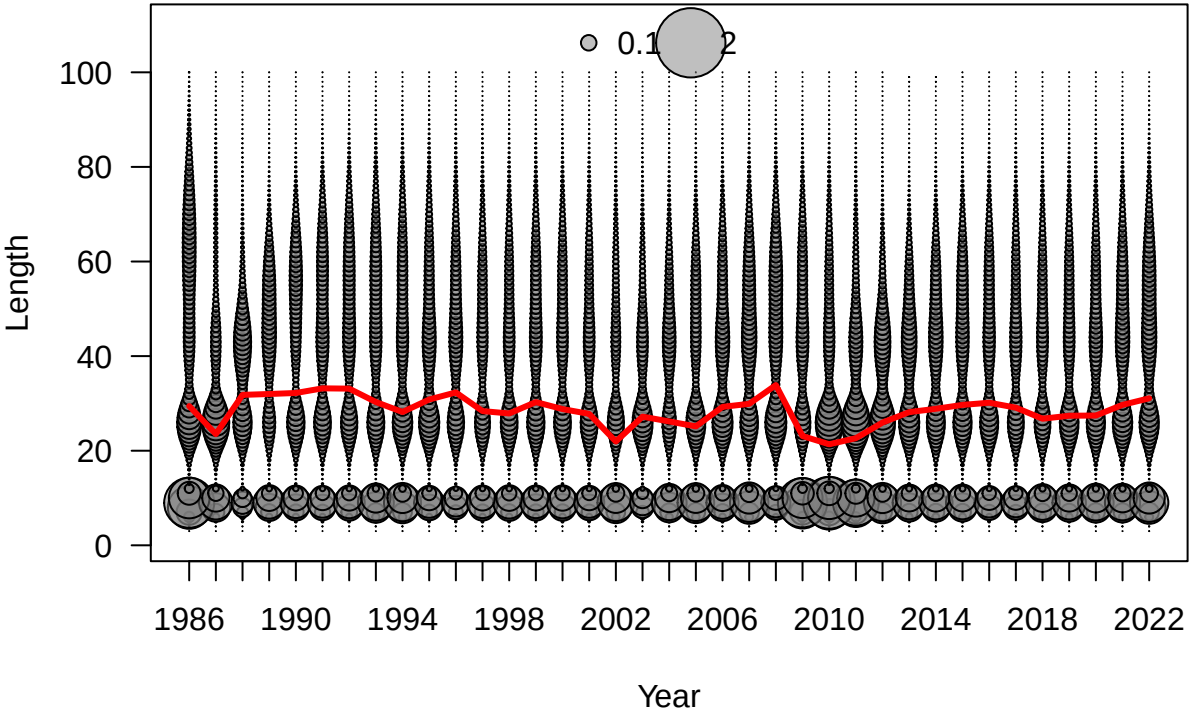

Deviation
1.0
0.5
0.0
−0.5
−1.0
1990
1995
2000
2005
2010
2015
2020
Year

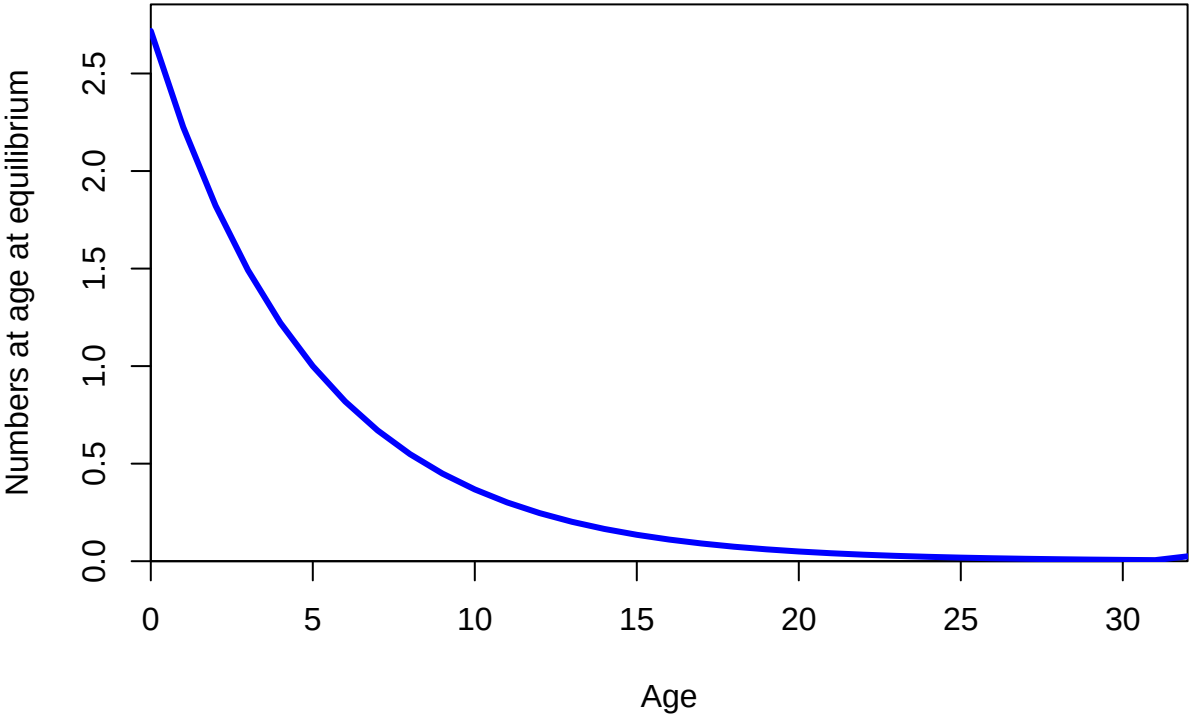

FISHERY
Standardized index
0.0
0.5
1.0
1.5
2.0
1990
1995
2000
2005
2010
2015
2020
Year

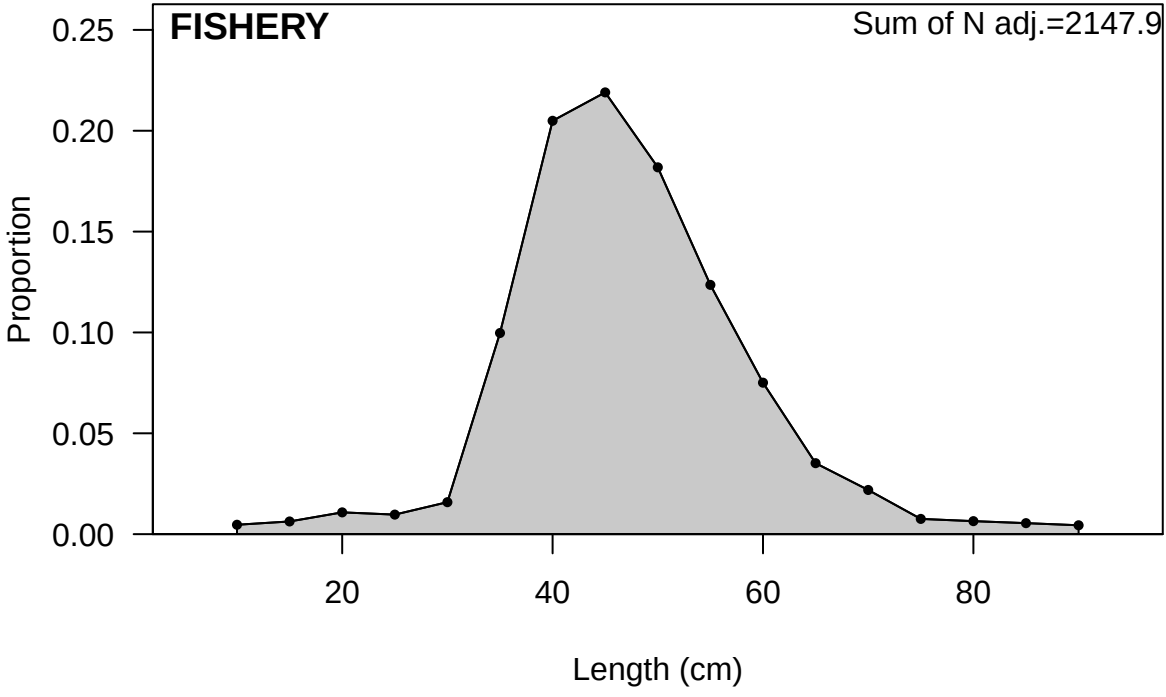

0.1
2
Age
Year
0
5
10
15
20
25
30
35
1985
1989
1993
1997
2001
2005
2009
2013
2017
2021

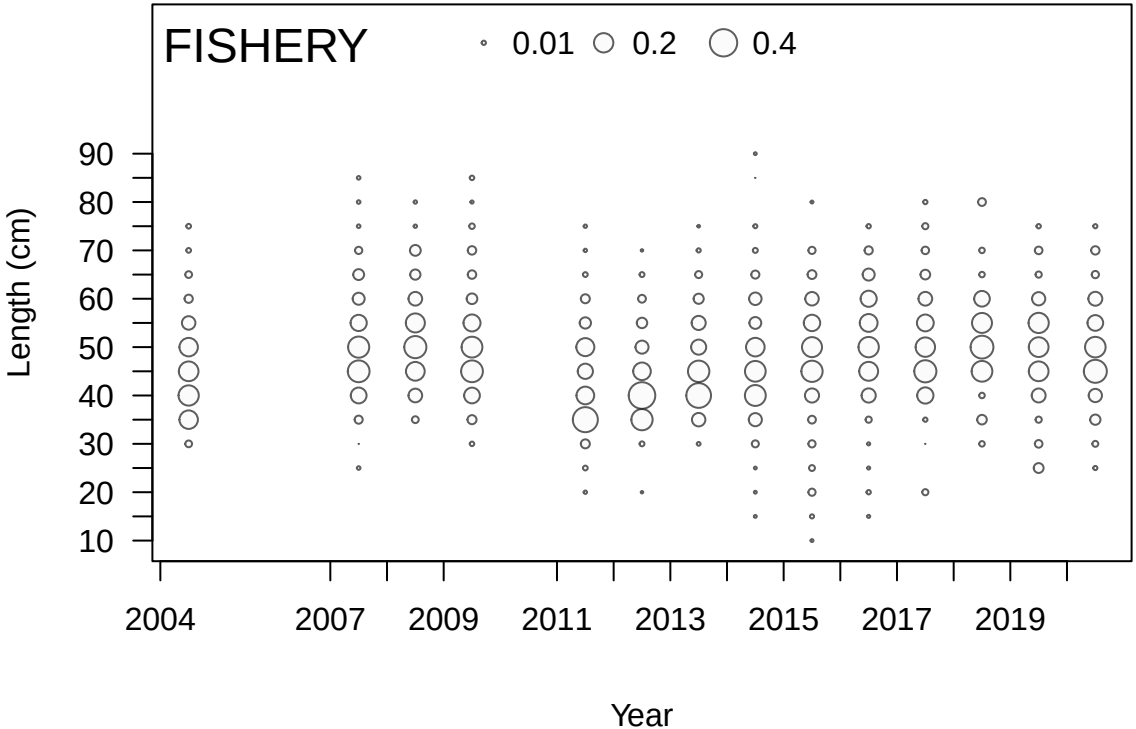

0.1
2
Age
Year
0
5
10
15
20
25
30
35
1985
1989
1993
1997
2001
2005
2009
2013
2017
2021

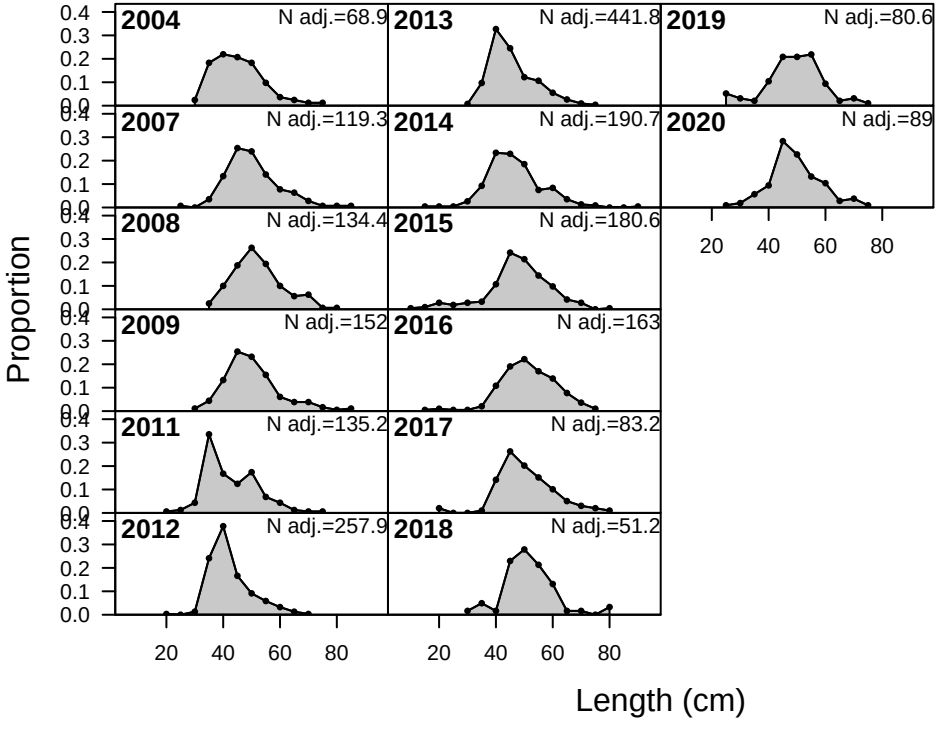

0.1
2
100
80
60
40
20
0
Length
1986
1990
1994
1998
2002
2006
2010
2014
2018
2022
Year

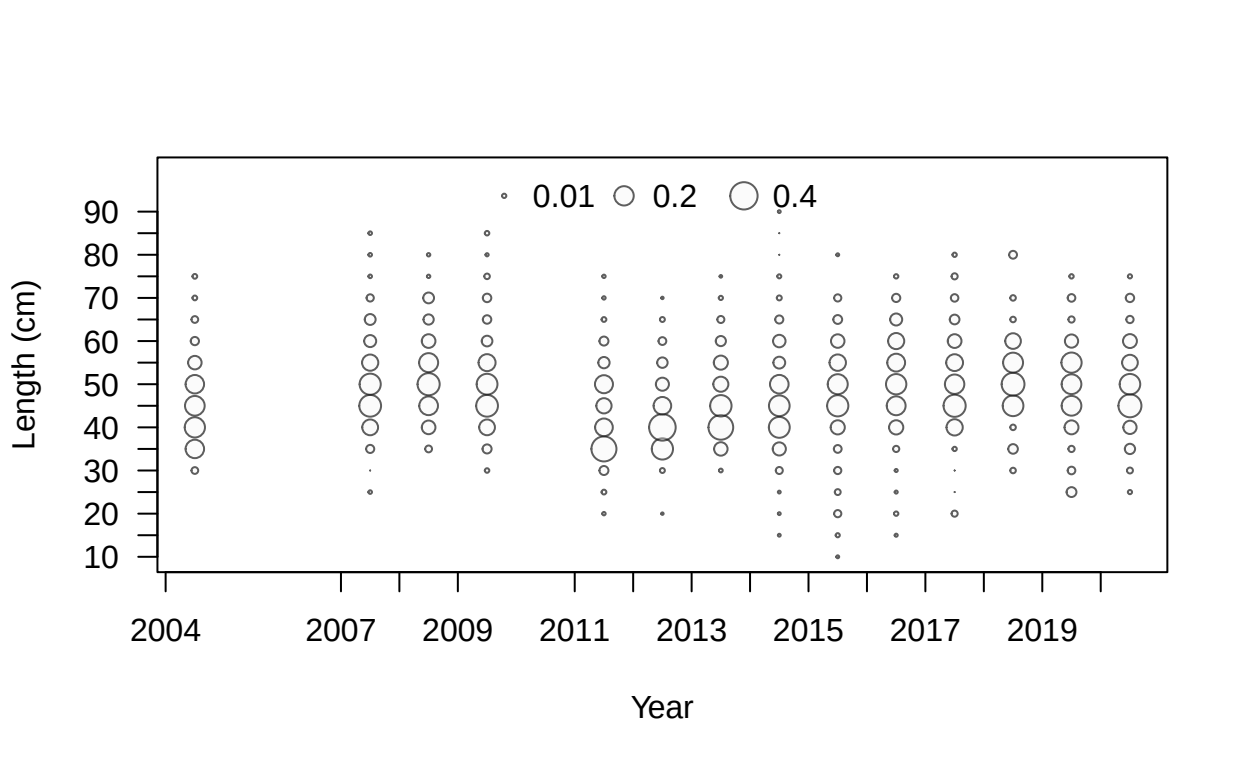

0.1
2
100
80
60
40
20
0
Length
1986
1990
1994
1998
2002
2006
2010
2014
2018
2022
Year

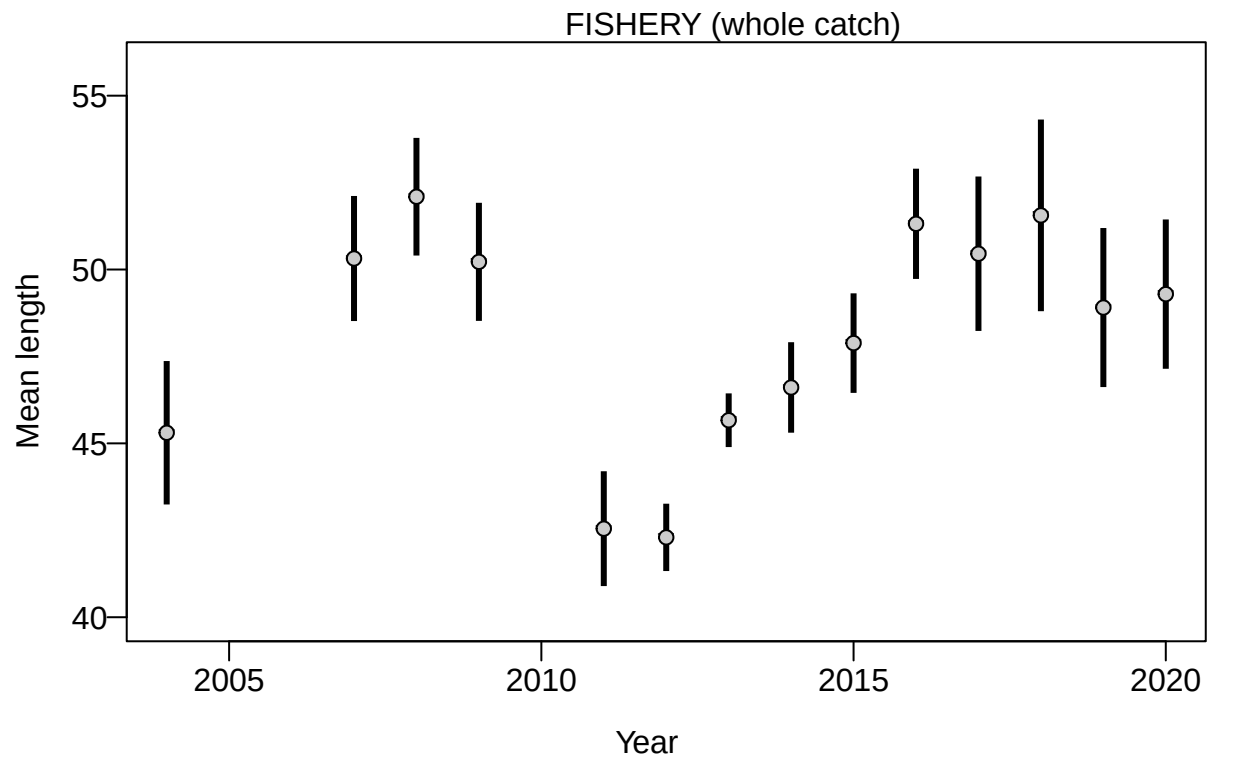

Numbers at age at equilibrium
0.0
0.5
1.0
1.5
2.0
2.5
0
5
10
15
20
25
30
Age

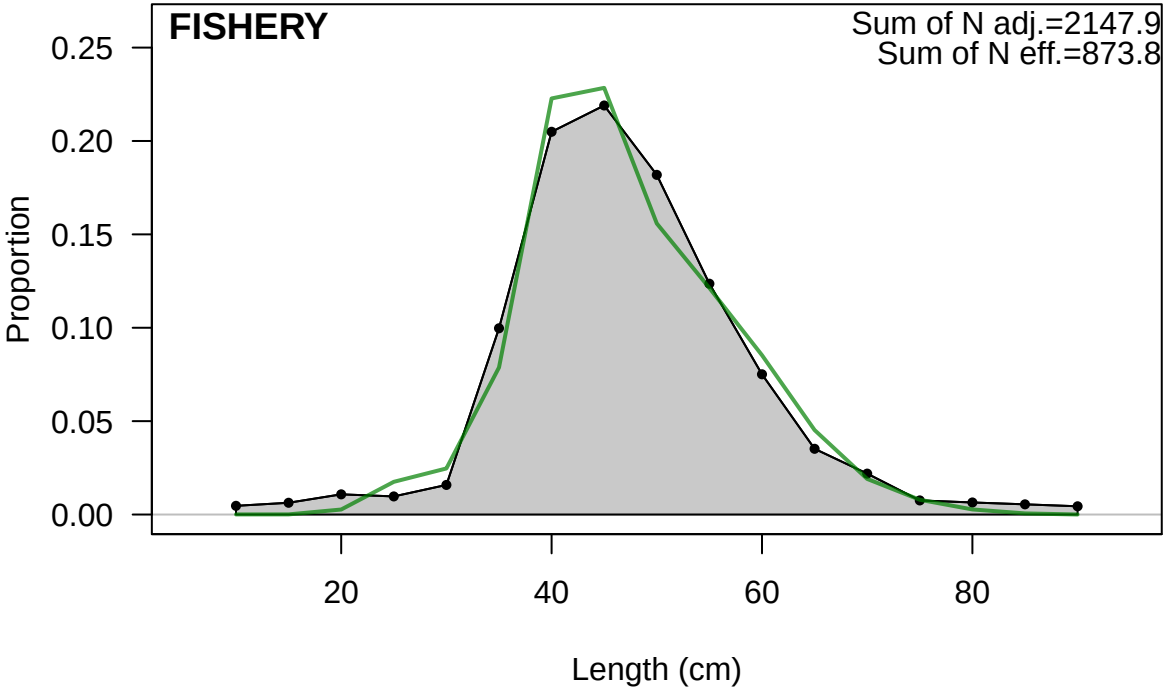

FISHERY
Sum of N adj.=2147.9
0.25
0.20
0.15
0.10
0.05
0.00
Proportion
20
40
60
80
Length (cm)

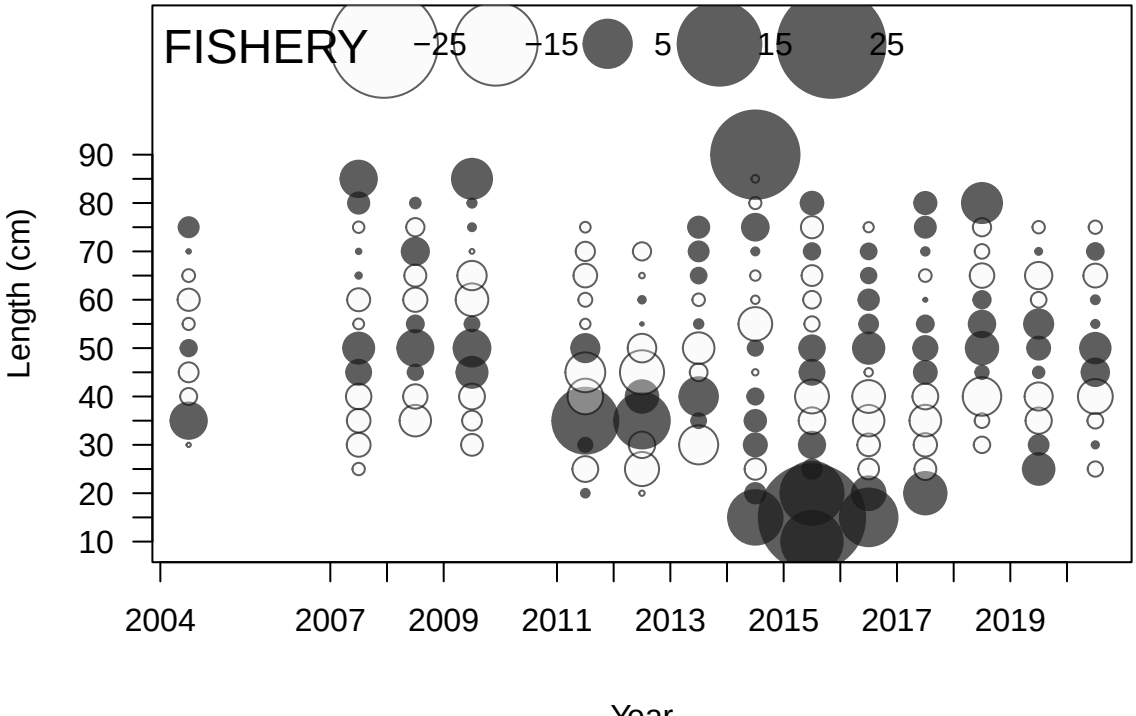

FISHERY
0.01
0.2
0.4
Length (cm)
90
80
70
60
50
40
30
20
10
2004
2007
2009
2011
2013
2015
2017
2019
Year

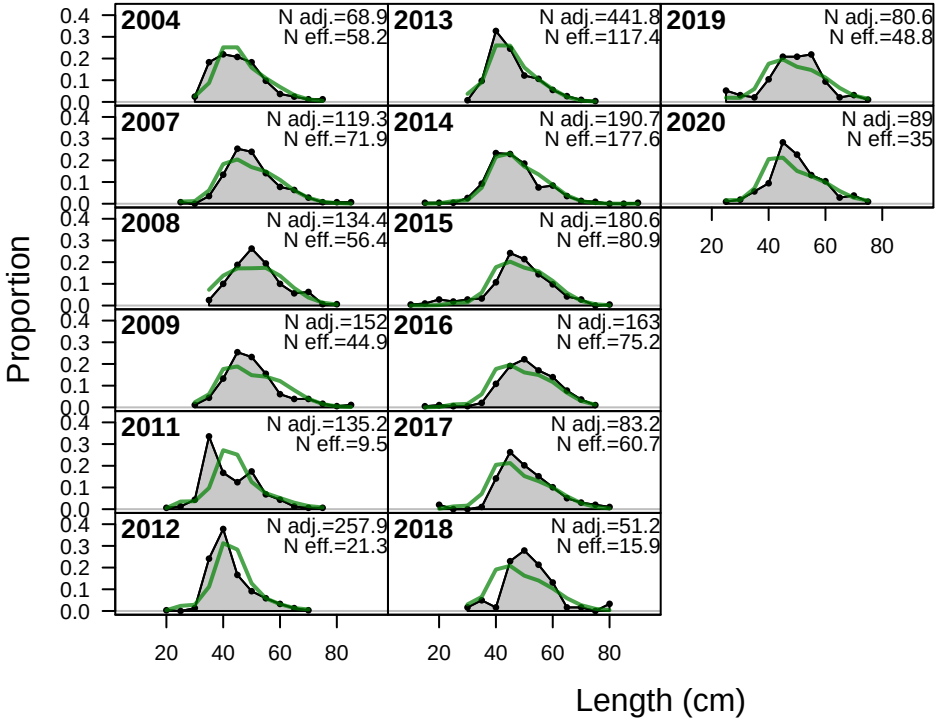

2004
N adj.=68.9
2013
N adj.=441.8
2019
N adj.=80.6
2007
N adj.=119.3
2014
N adj.=190.7
2020
N adj.=89
2008
N adj.=134.4
2015
N adj.=180.6
2009
N adj.=152
2016
N adj.=163
2011
N adj.=135.2
2017
N adj.=83.2
2012
N adj.=257.9
2018
N adj.=51.2
Proportion
Length (cm)

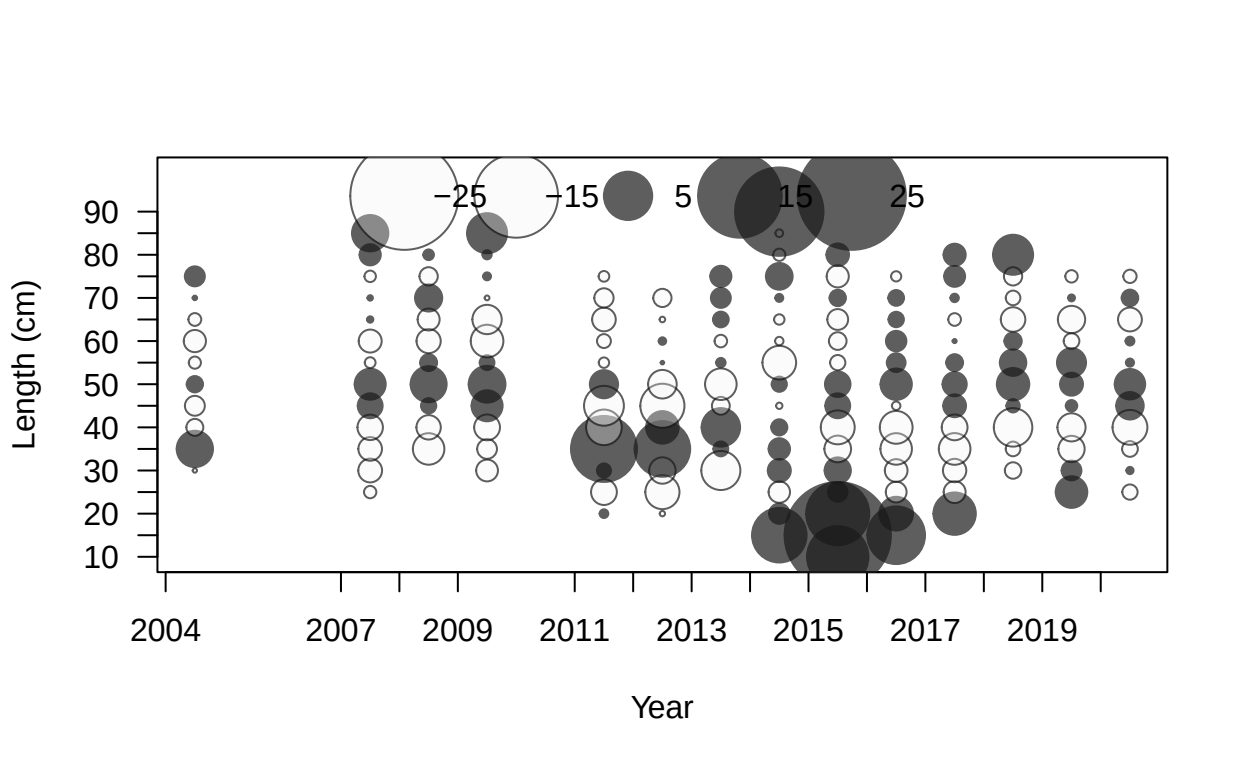

0.01
0.2
0.4
Length (cm)
90
80
70
60
50
40
30
20
10
2004
2007
2009
2011
2013
2015
2017
2019
Year

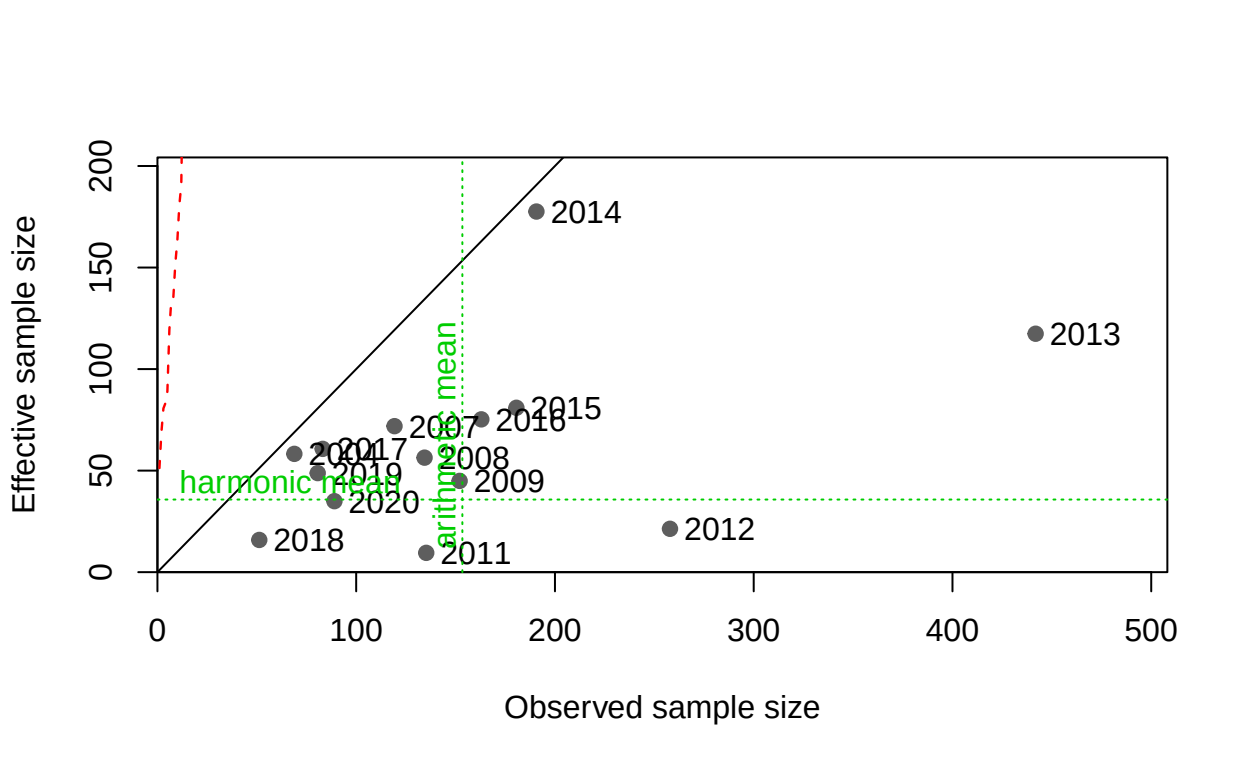

FISHERY (whole catch)
55
50
45
40
Mean length
2005
2010
2015
2020
Year

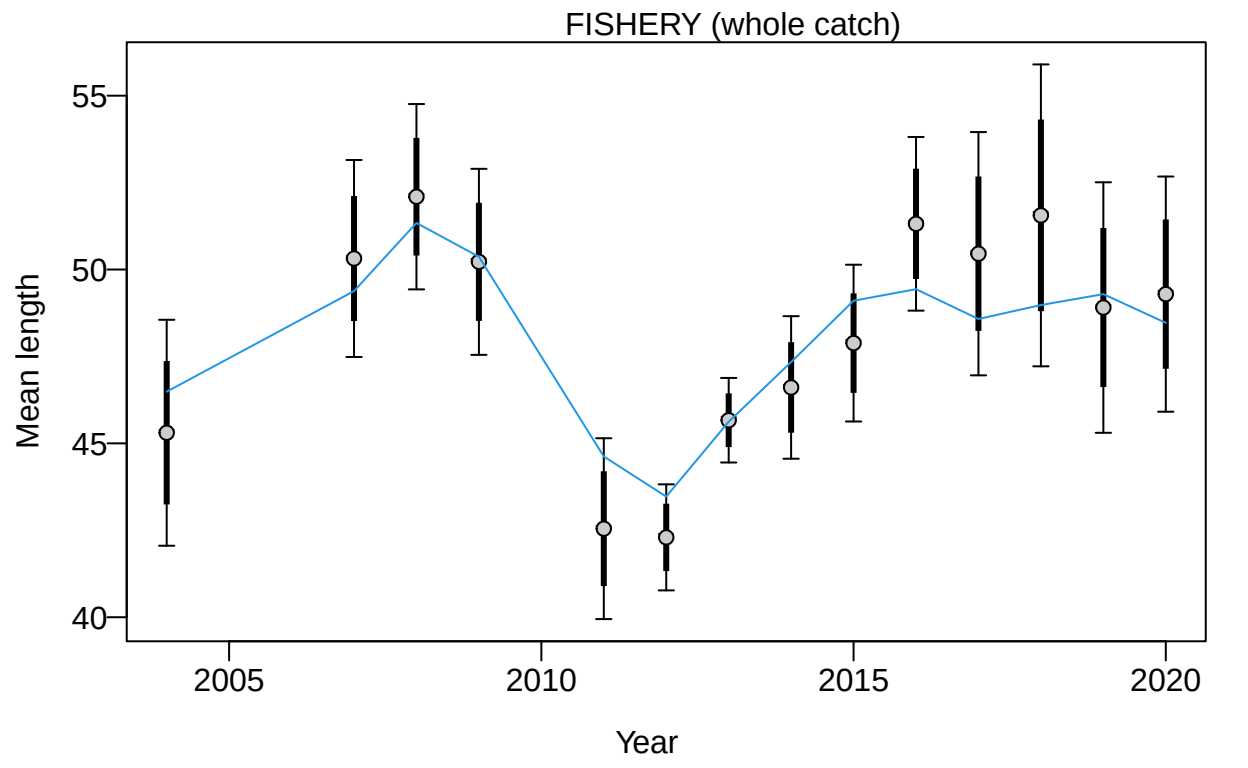

FISHERY
Sum of N adj.=2147.9
Sum of N eff.=873.8
Proportion
0.25
0.20
0.15
0.10
0.05
0.00
20
40
60
80
Length (cm)

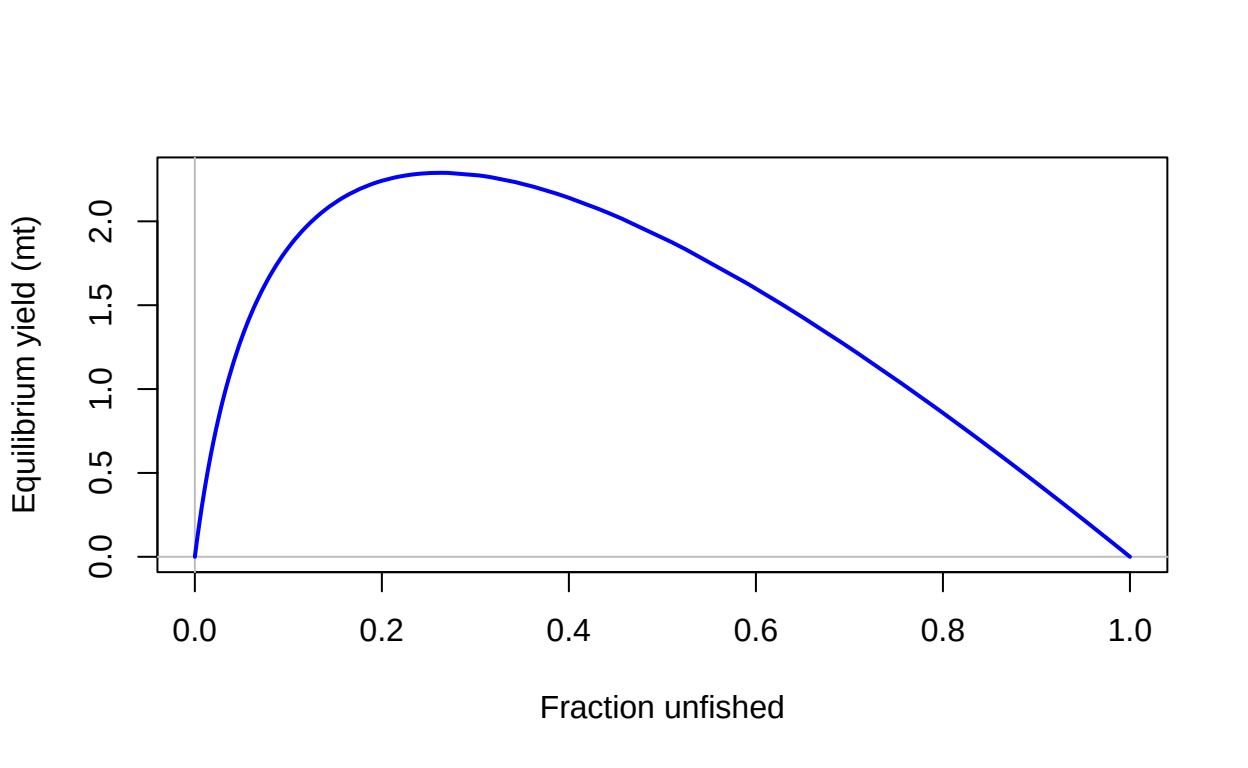

FISHERY
−25
−15
5
15
25
Length (cm)
90
80
70
60
50
40
30
20
10
2004
2007
2009
2011
2013
2015
2017
2019
Year

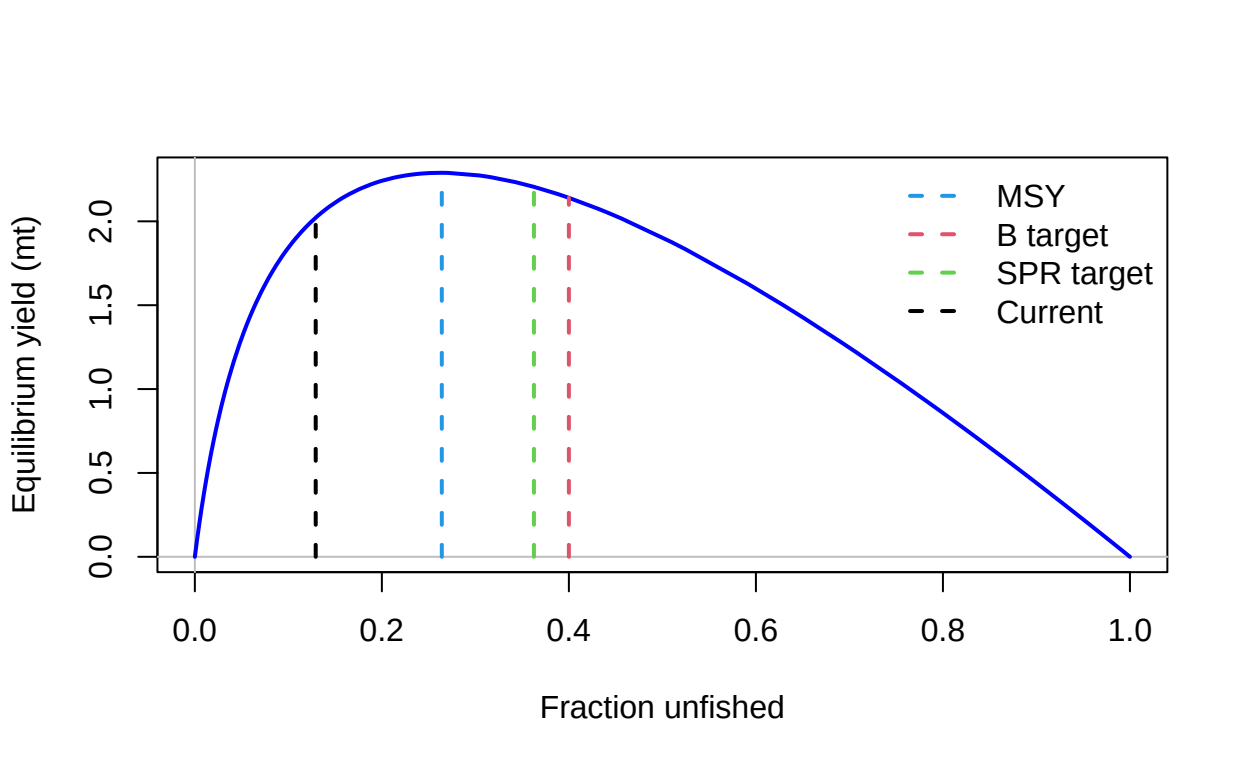

2004
N adj.=68.9
N eff.=58.2
2013
N adj.=441.8
N eff.=117.4
2019
N adj.=80.6
N eff.=48.8
2007
N adj.=119.3
N eff.=71.9
2014
N adj.=190.7
N eff.=177.6
2020
N adj.=89
N eff.=35
2008
N adj.=134.4
N eff.=56.4
2015
N adj.=180.6
N eff.=80.9
2009
N adj.=152
N eff.=44.9
2016
N adj.=163
N eff.=75.2
2011
N adj.=135.2
N eff.=9.5
2017
N adj.=83.2
N eff.=60.7
2012
N adj.=257.9
N eff.=21.3
2018
N adj.=51.2
N eff.=15.9
Proportion
0.0
0.1
0.2
0.3
0.4
20
40
60
80
Length (cm)

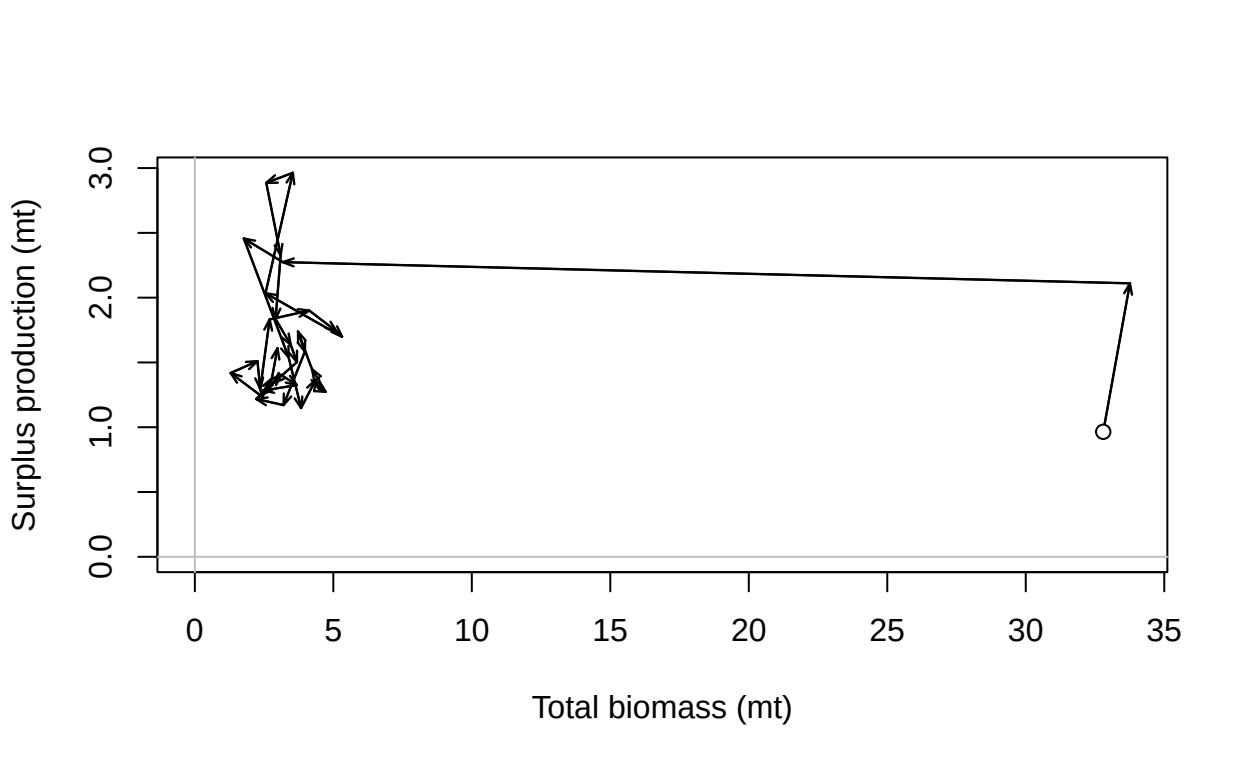

−25
−15
5
15
25
90
80
70
60
50
40
30
20
10
Length (cm)
2004
2007
2009
2011
2013
2015
2017
2019
Year

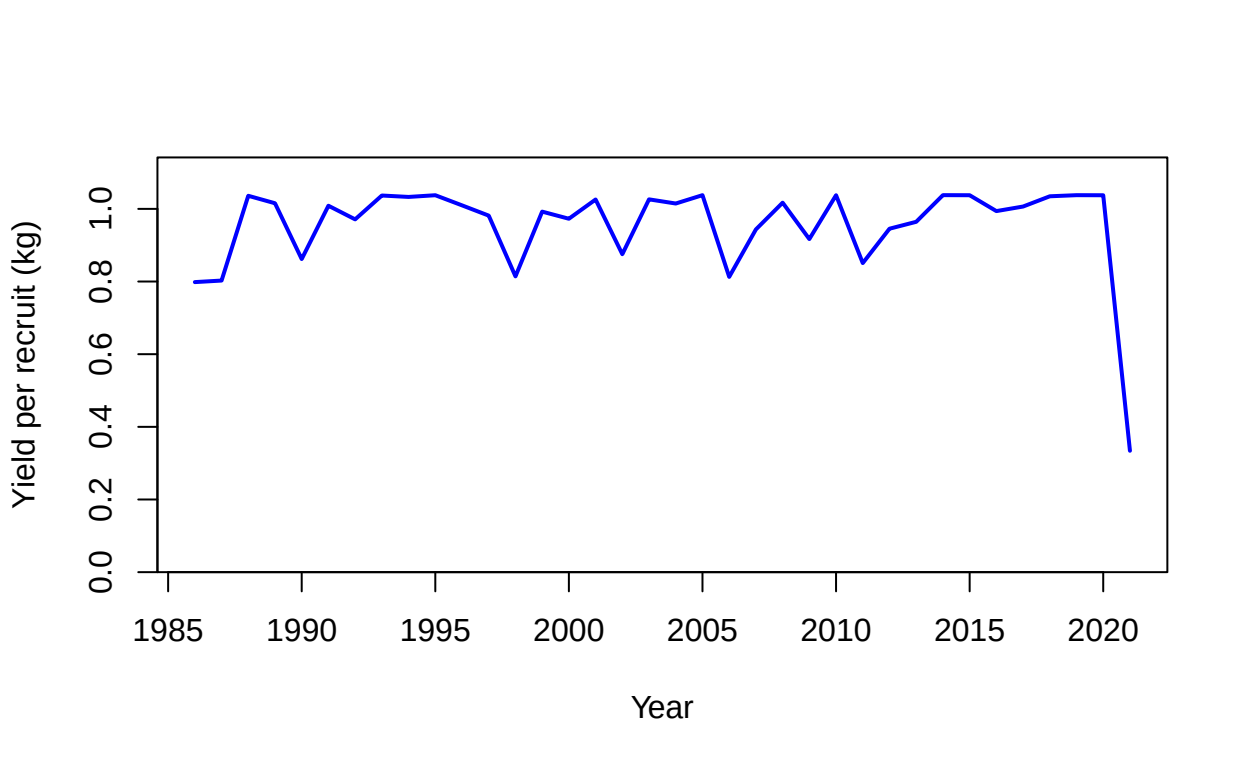

Effective sample size
Observed sample size
0
50
100
150
200
0
100
200
300
400
500
2014
2013
2015
2016
2007
2017
2004
2019
2008
2009
2020
2018
2012
2011
harmonic mean
arithmetic mean

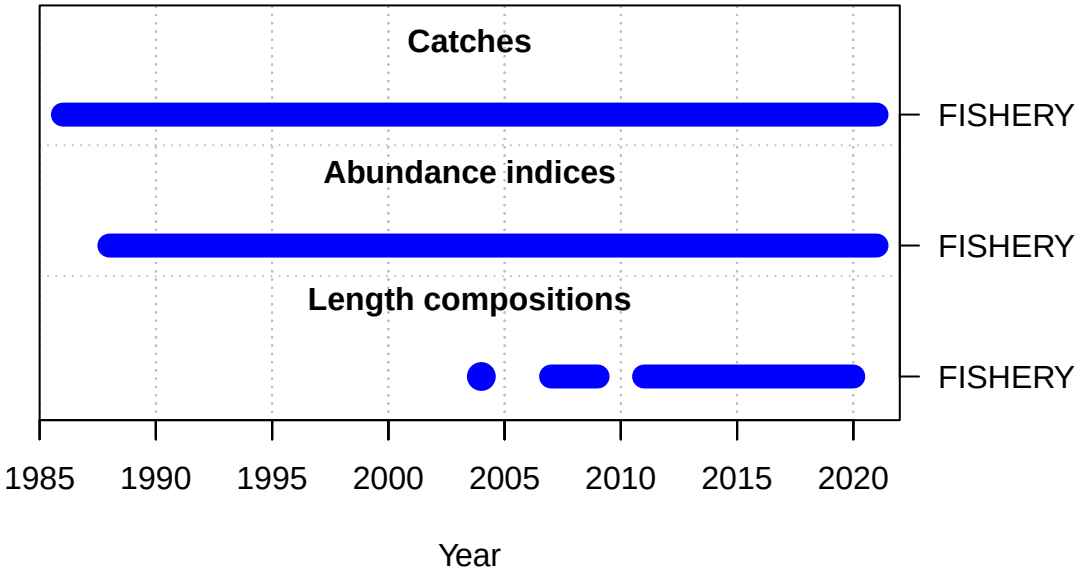

FISHERY (whole catch)
Mean length
55
50
45
40
2005
2010
2015
2020
Year

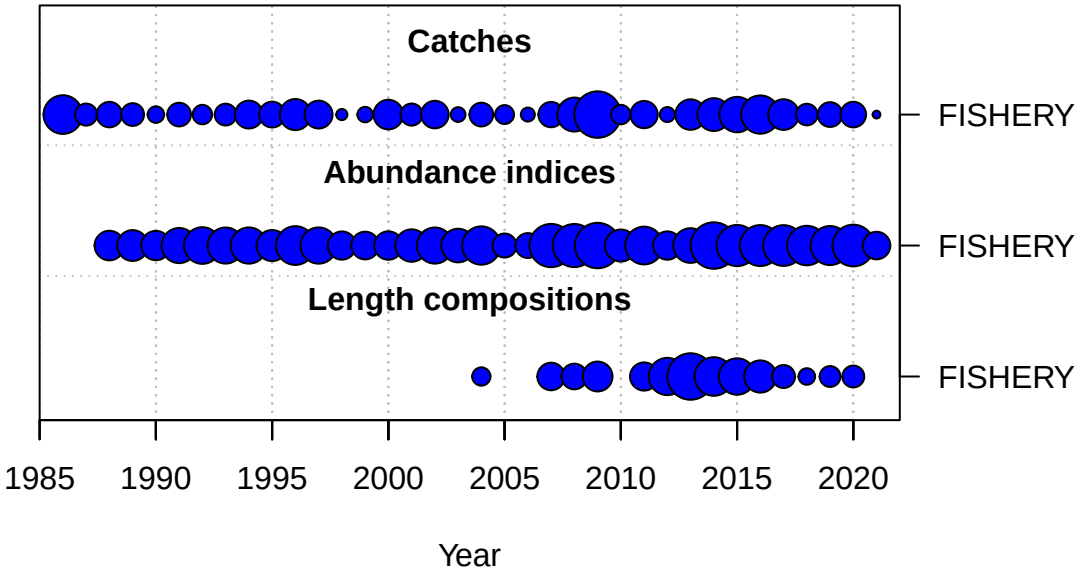

Equilibrium yield (mt)
0.0
0.5
1.0
1.5
2.0
0.0
0.2
0.4
0.6
0.8
1.0
Fraction unfished

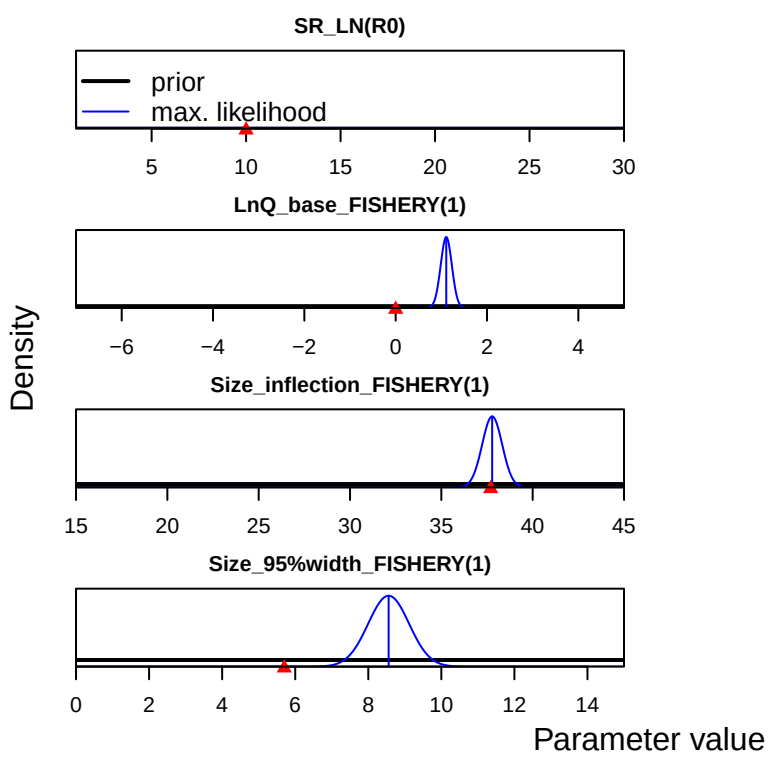

Equilibrium yield (mt)
0.0
0.5
1.0
1.5
2.0
0.0
0.2
0.4
0.6
0.8
1.0
Fraction unfished
MSY
B target
SPR target
Current


Surplus production (mt)
0.0
1.0
2.0
3.0
0
5
10
15
20
25
30
35
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