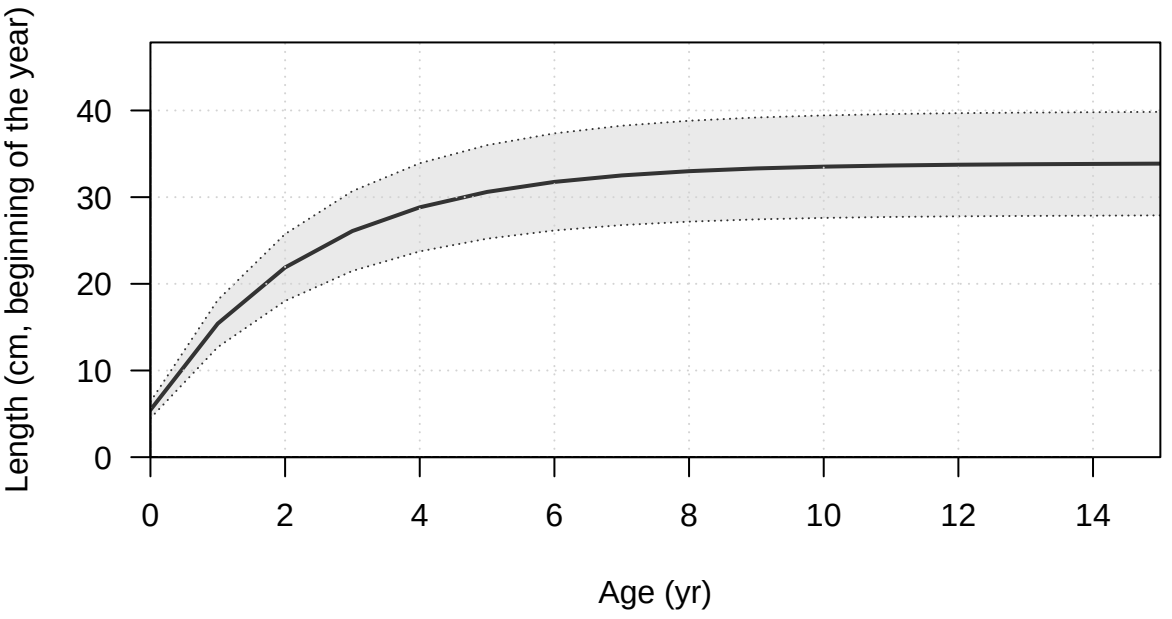
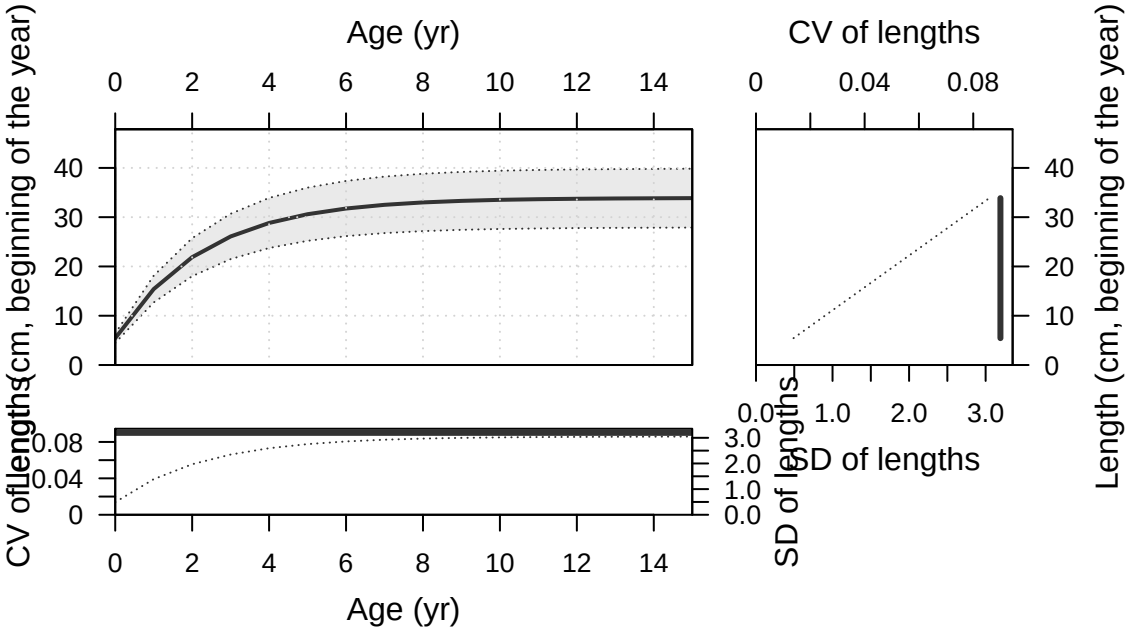
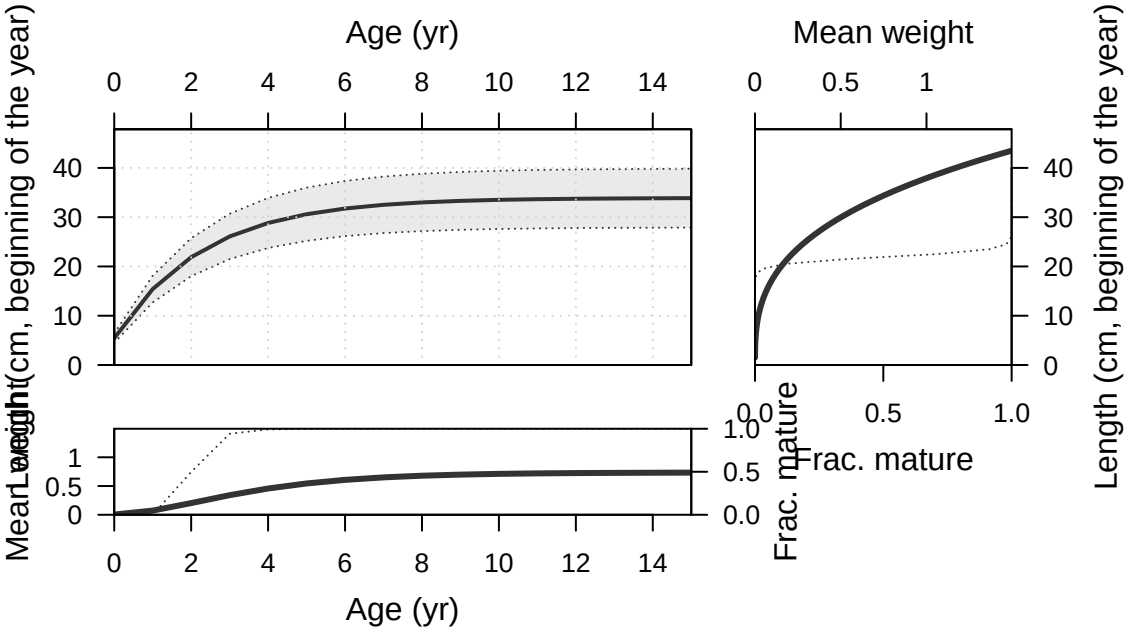
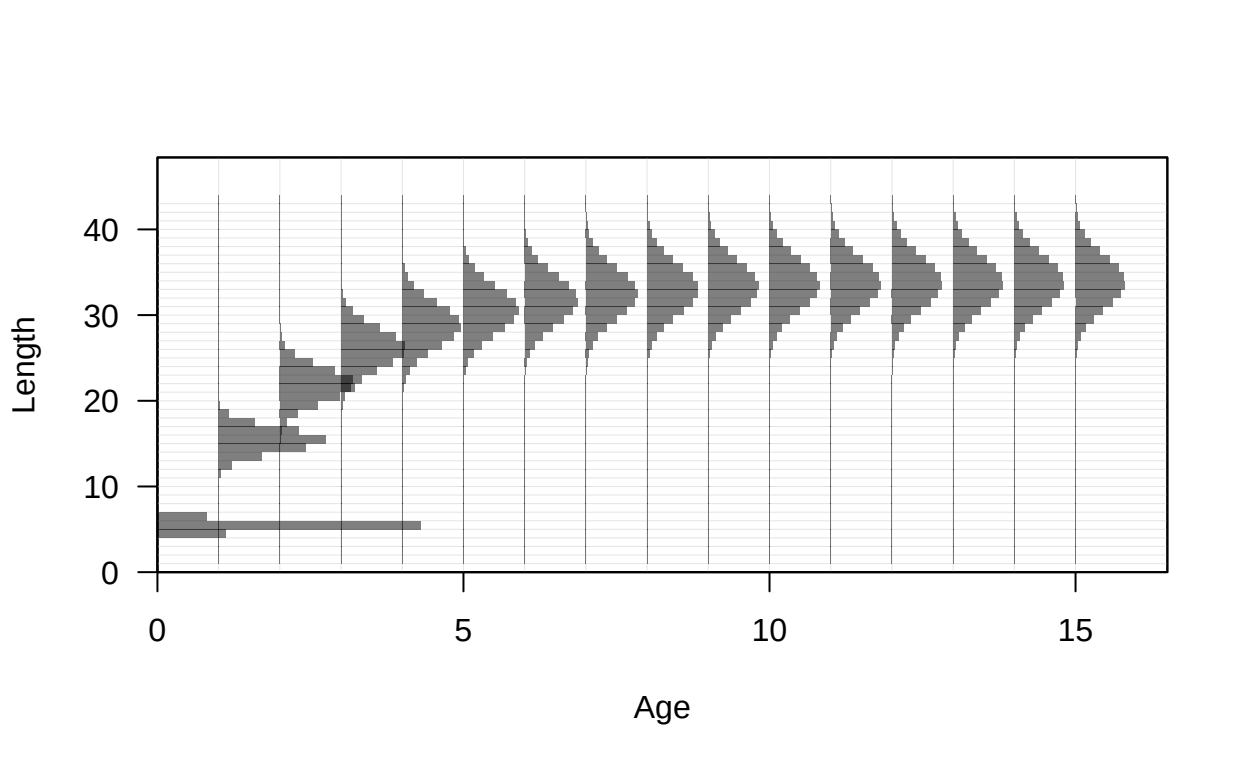
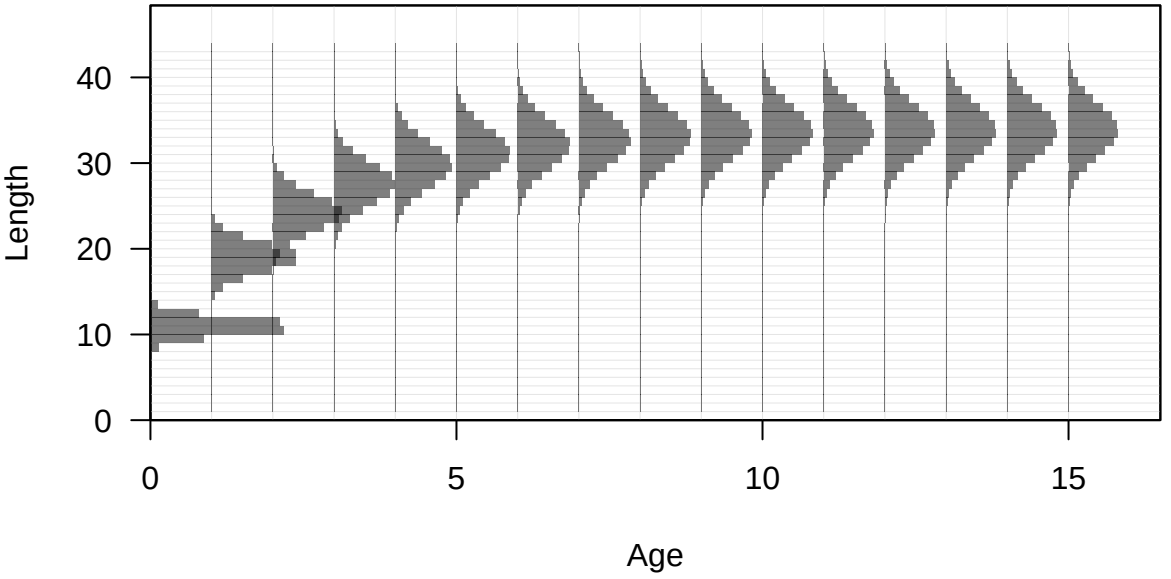
Plots created using the 'r4ss' package in R
Stock Synthesis version: 3.30.19.0
StartTime: Wed Aug 03 10:55:44 2022
Data_File: data.ss
Control_File: control.ss

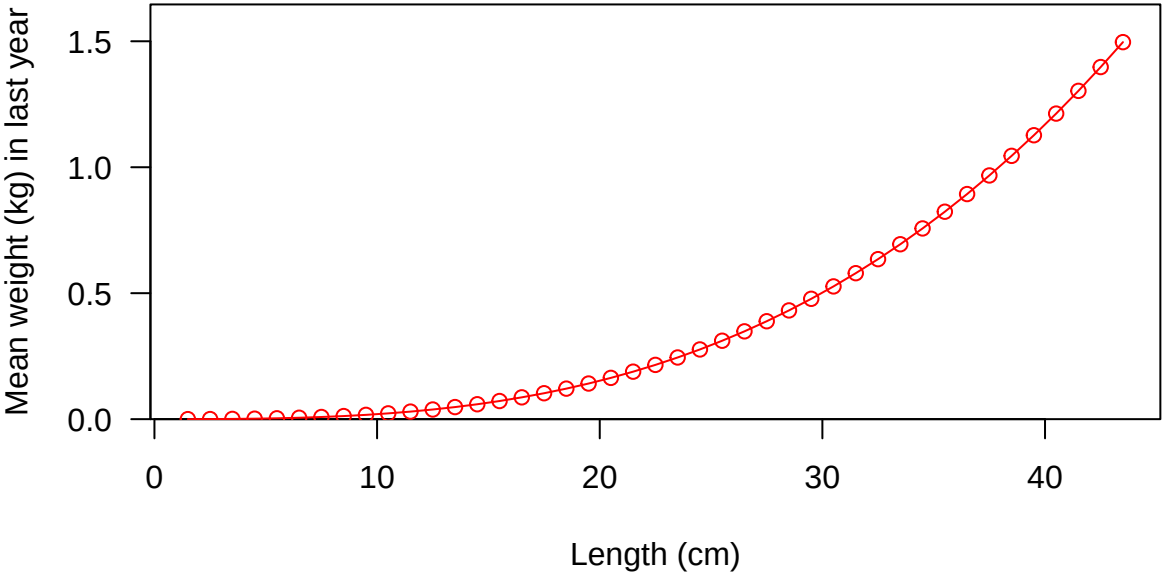

Length (cm, beginning of the year)
0
10
20
30
40
0
2
4
6
8
10
12
14
Age (yr)

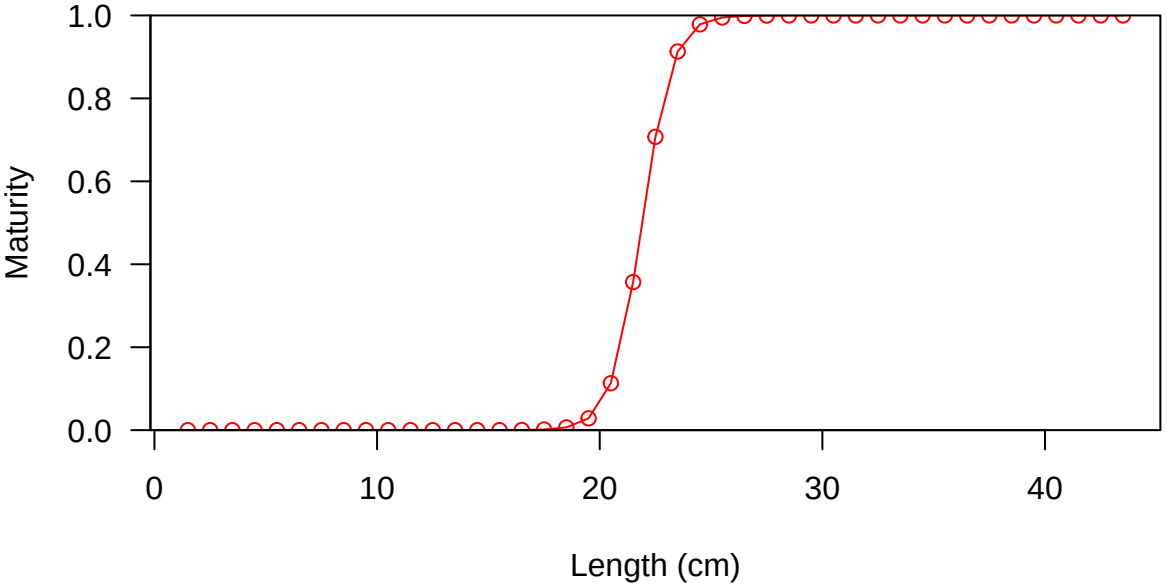

Age (yr)
0
2
4
6
8
10
12
14
Length (cm, beginning of the year)
0
10
20
30
40
CV of lengths
0
0.04
0.08
SD of lengths
0.0
1.0
2.0
3.0

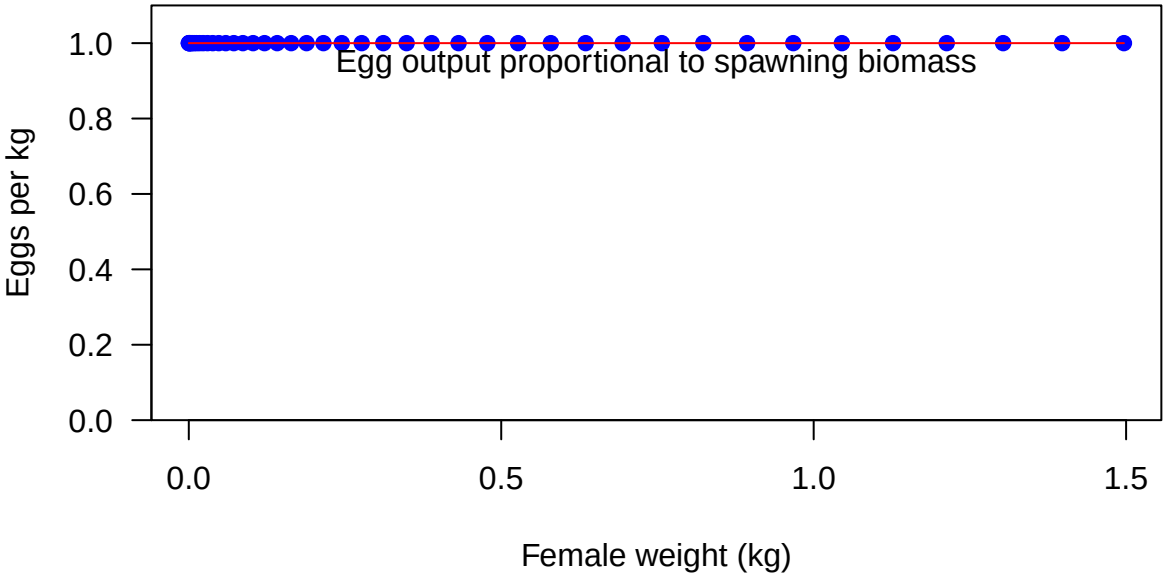

Age (yr)
Mean weight
Length (cm, beginning of the year)
Mean weight
Frac. mature
Age (yr)
0
2
4
6
8
10
12
14
0.5
1
20
30
40
0.0

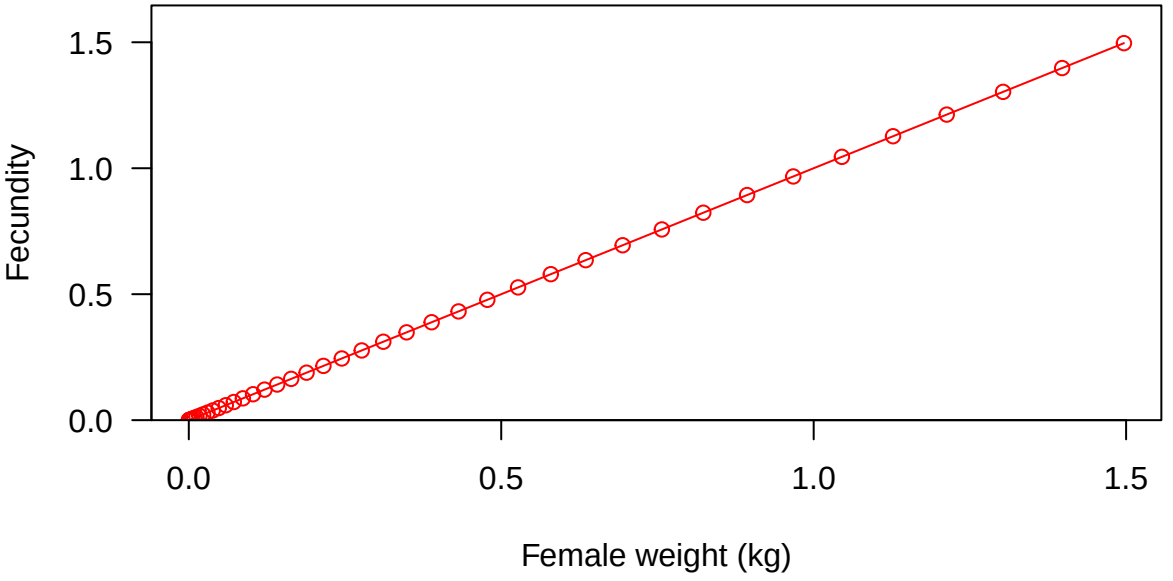

Length
0
10
20
30
40
0
5
10
15
Age

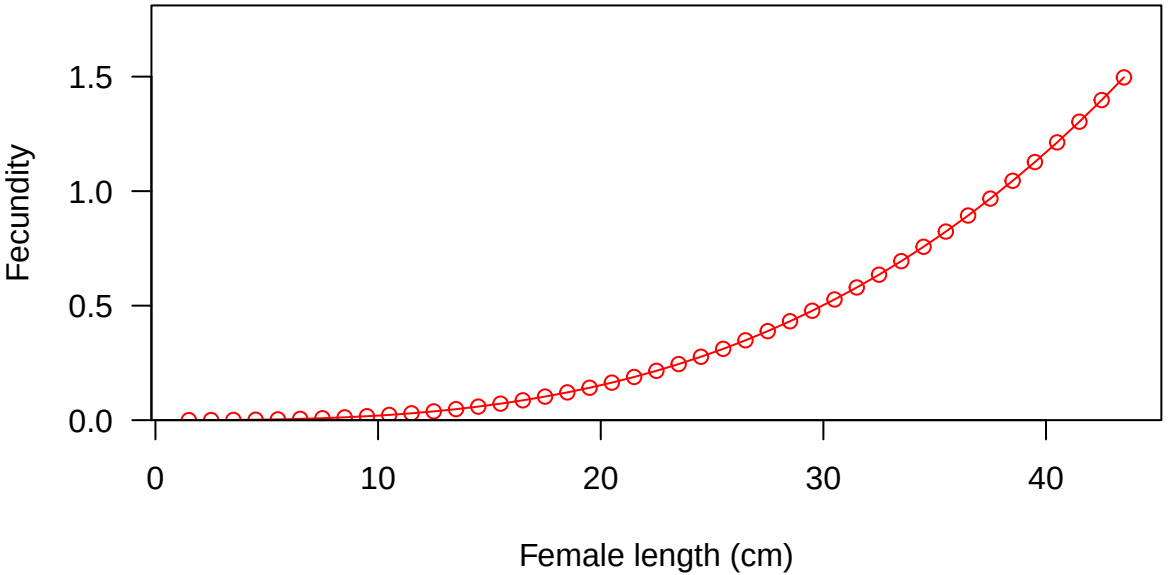

Length
0
10
20
30
40
0
5
10
15
Age

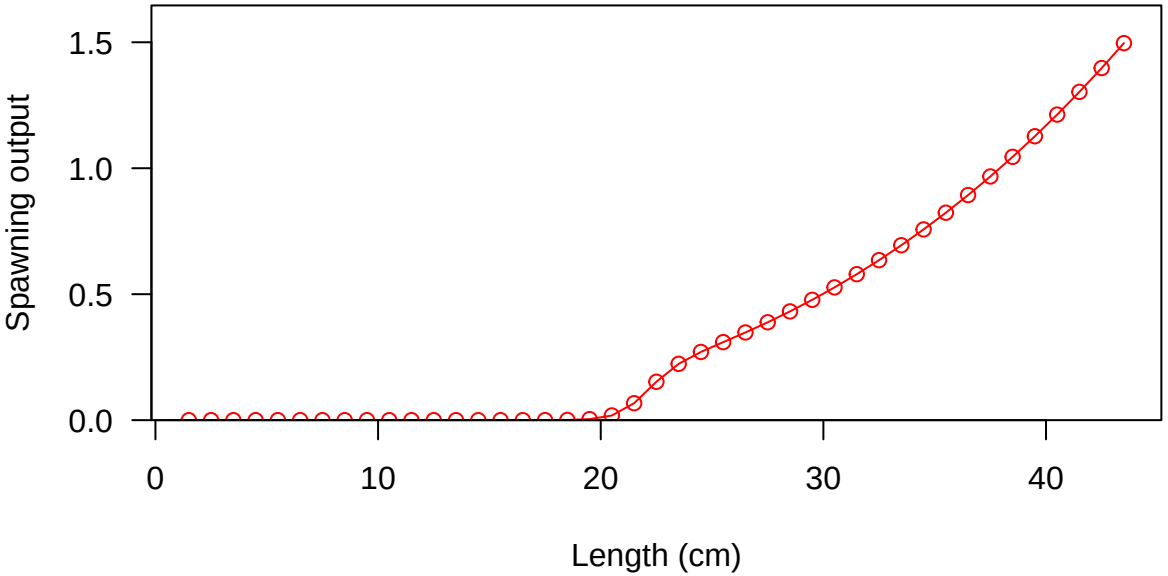

Mean weight (kg) in last year
1.5
1.0
0.5
0.0
0
10
20
30
40
Length (cm)

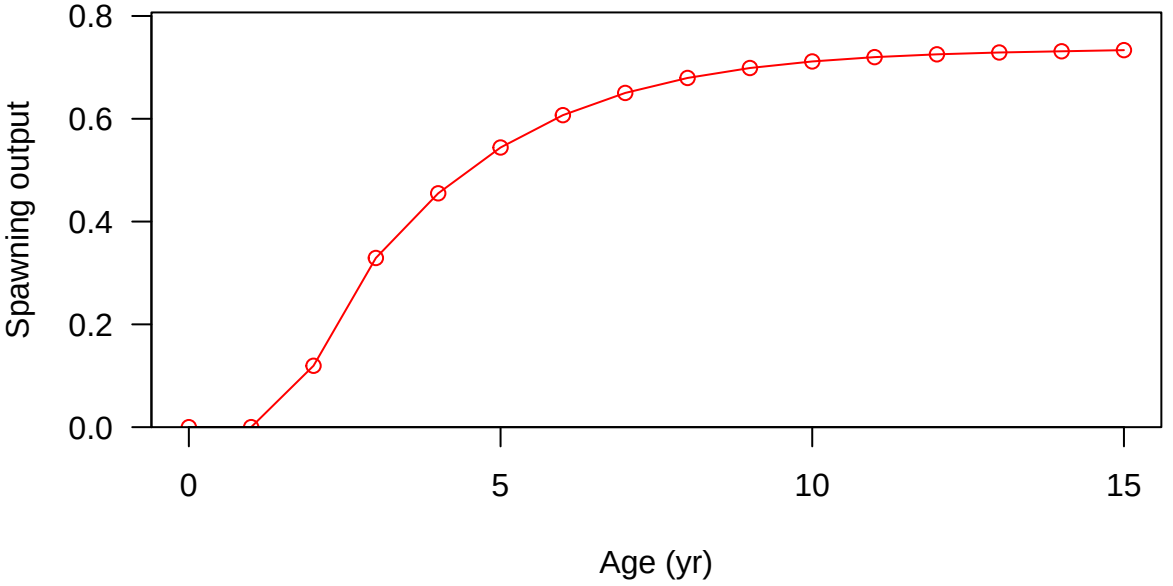

1.0
0.8
0.6
0.4
0.2
0.0
Maturity
0
10
20
30
40
Length (cm)

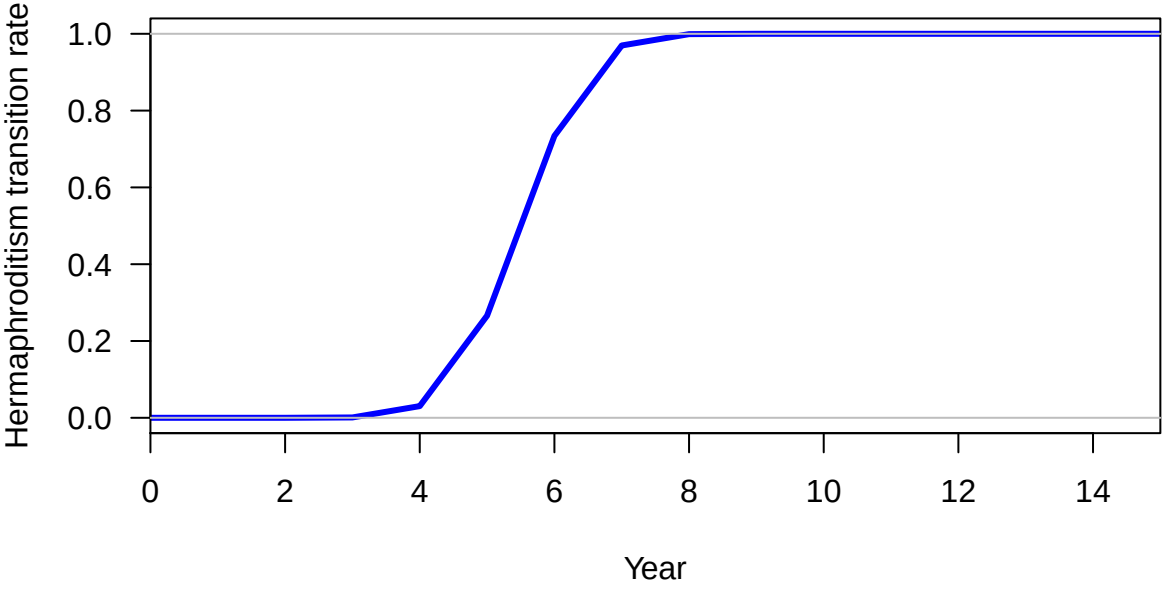

Egg output proportional to spawning biomass
Eggs per kg
1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.5
1.0
1.5
Female weight (kg)

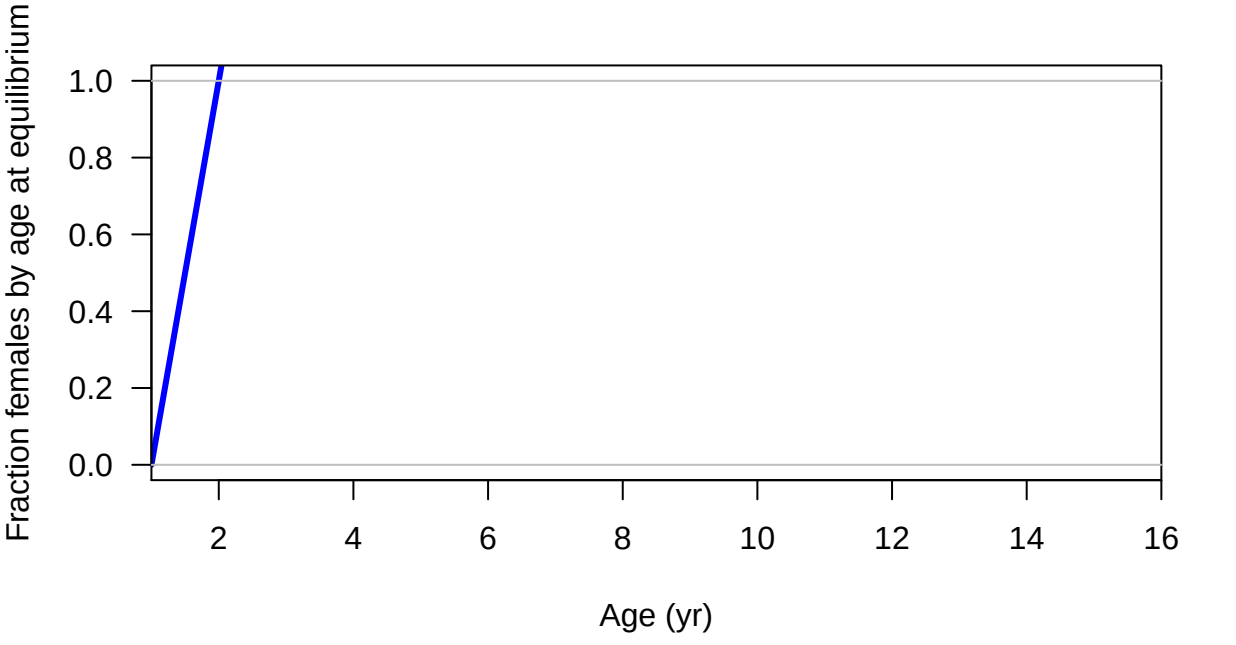

Fecundity
0.0
0.5
1.0
1.5
0.0
0.5
1.0
1.5
Female weight (kg)

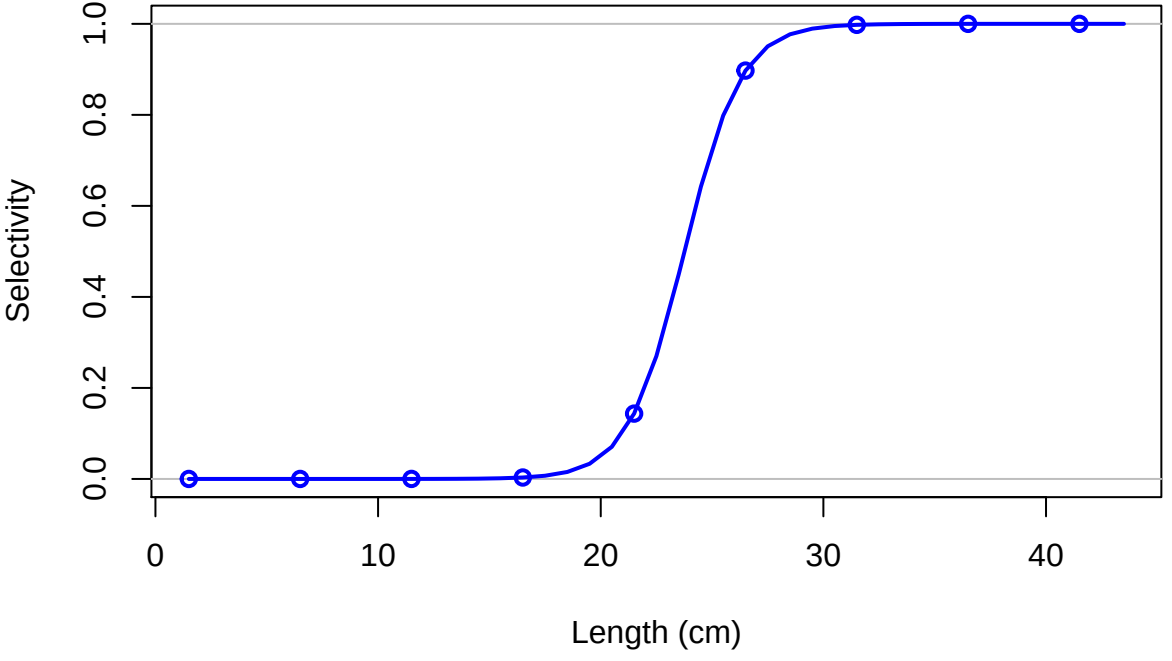

Fecundity
0.0
0.5
1.0
1.5
0
10
20
30
40
Female length (cm)

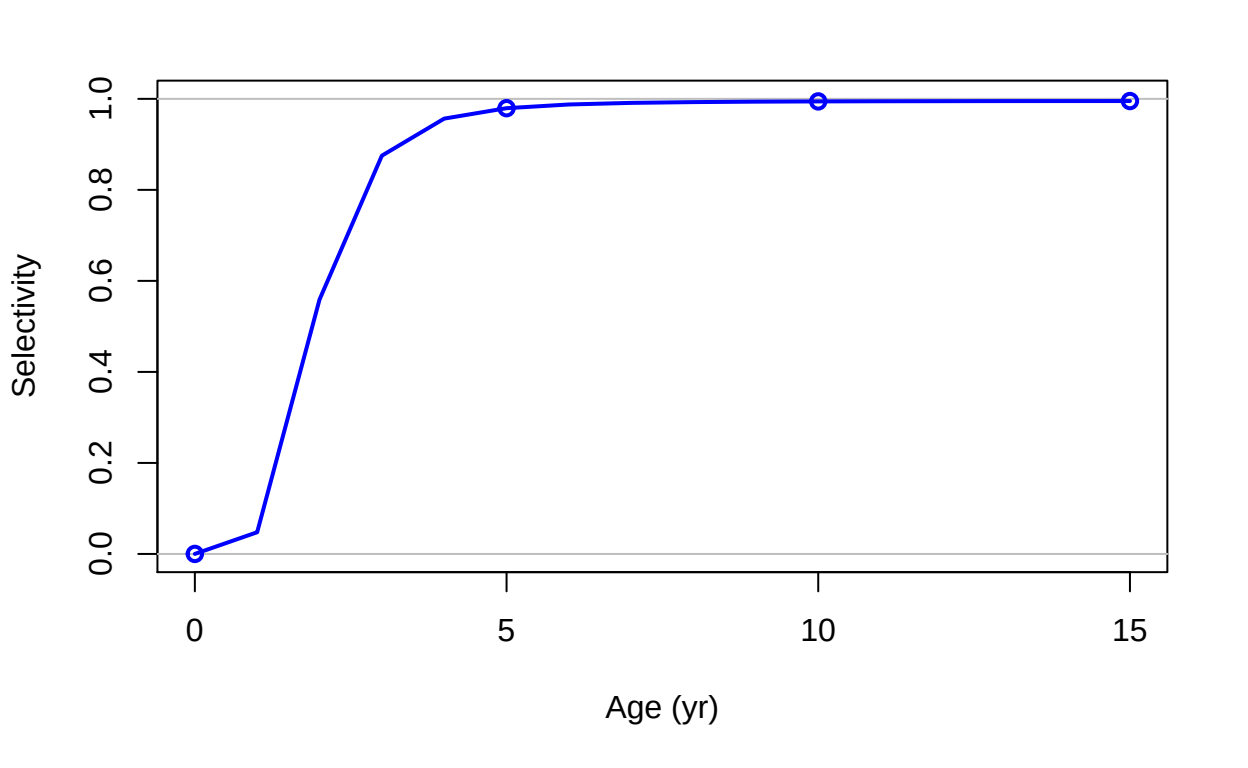

Spawning output
1.5
1.0
0.5
0.0
0
10
20
30
40
Length (cm)

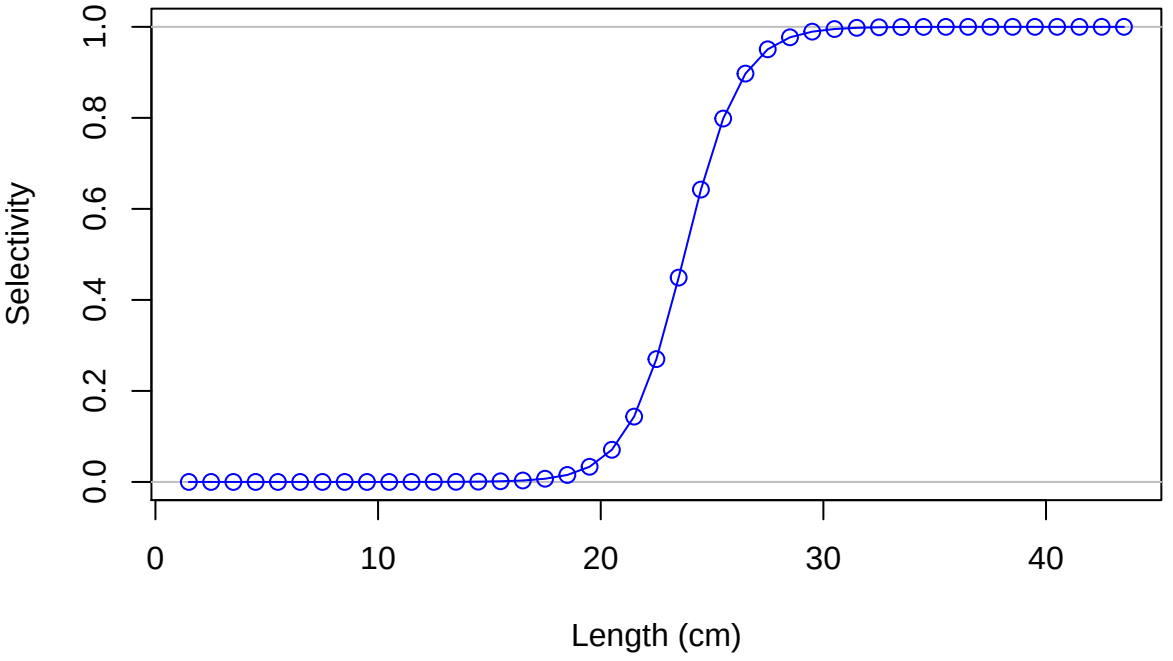

0.8
0.6
0.4
0.2
0.0
Spawning output
0
5
10
15
Age (yr)

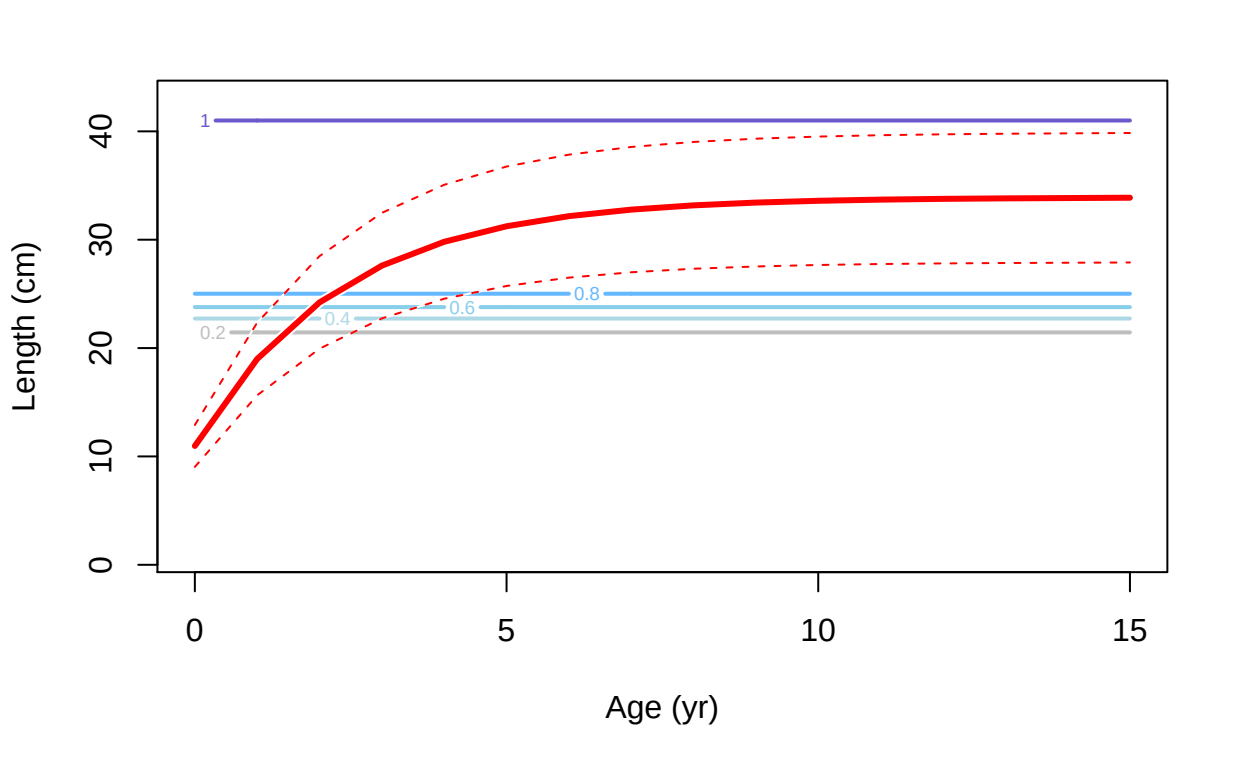

Hermaphroditism transition rate
1.0
0.8
0.6
0.4
0.2
0.0
0
2
4
6
8
10
12
14
Year

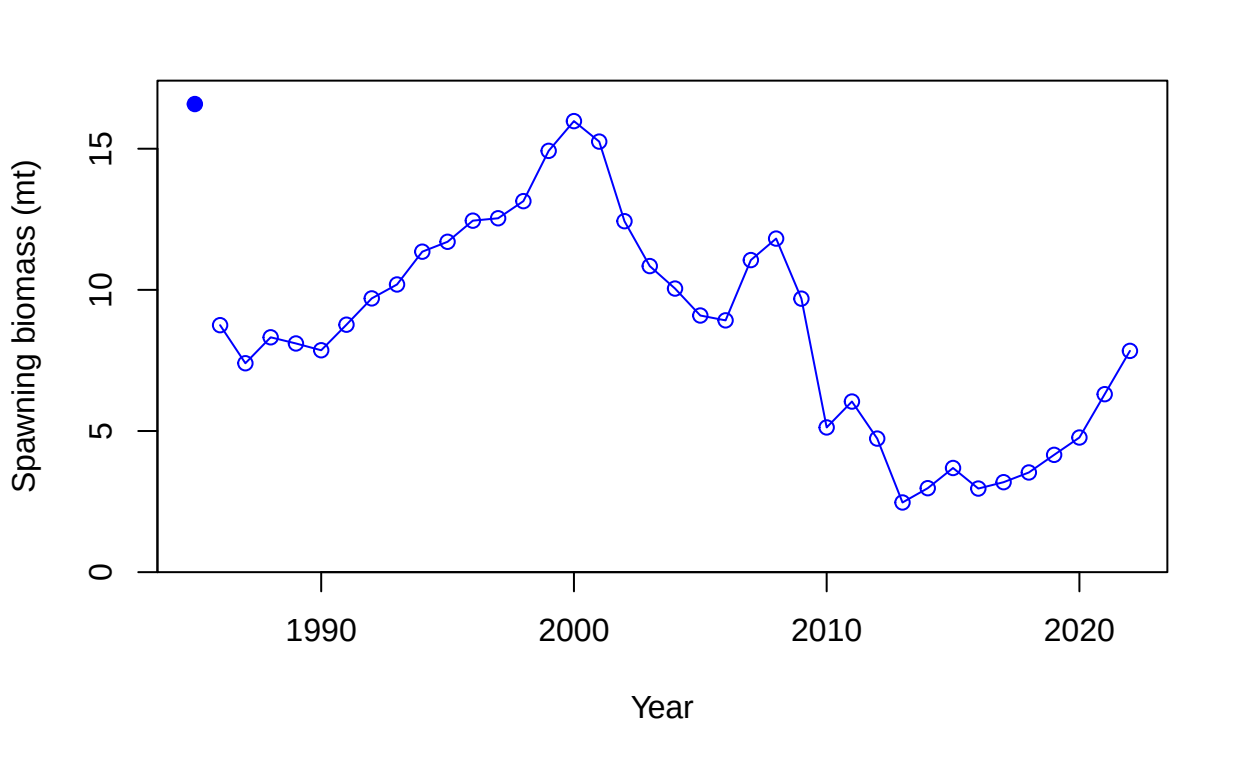

Fraction females by age at equilibrium
1.0
0.8
0.6
0.4
0.2
0.0
2
4
6
8
10
12
14
16
Age (yr)

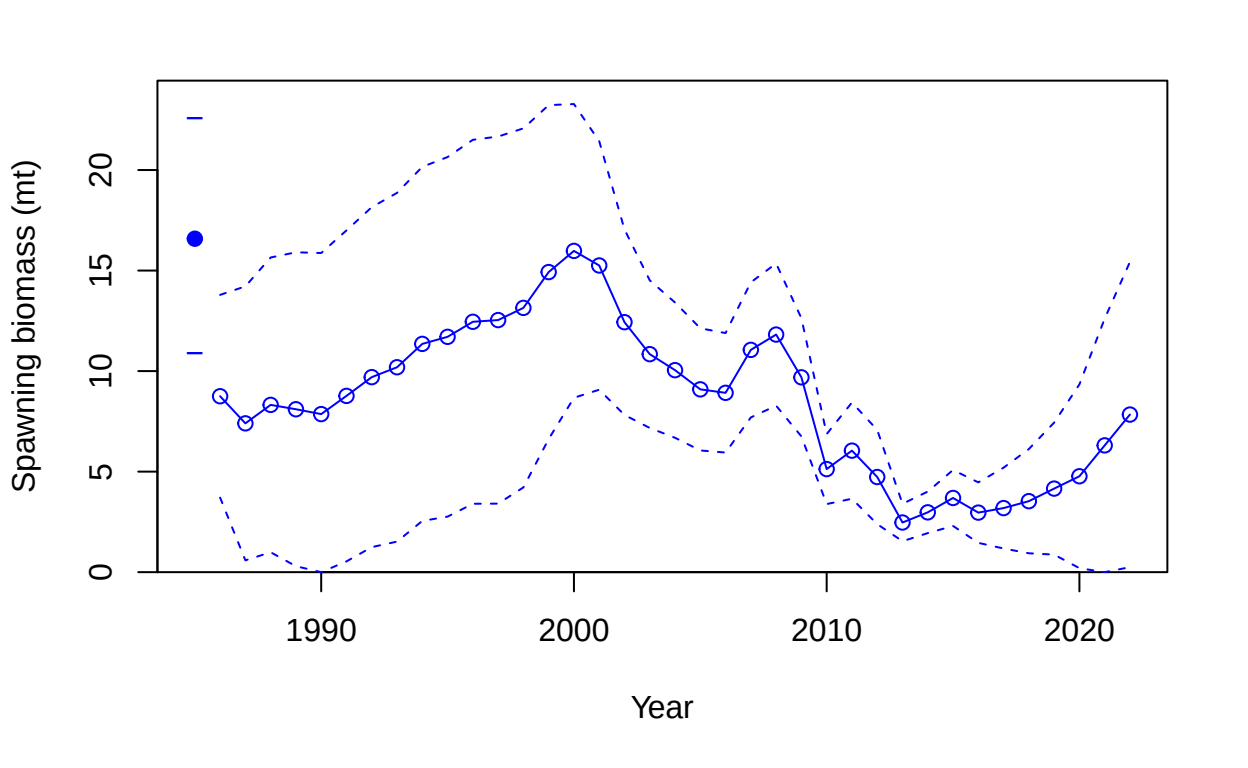

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
10
20
30
40
Length (cm)

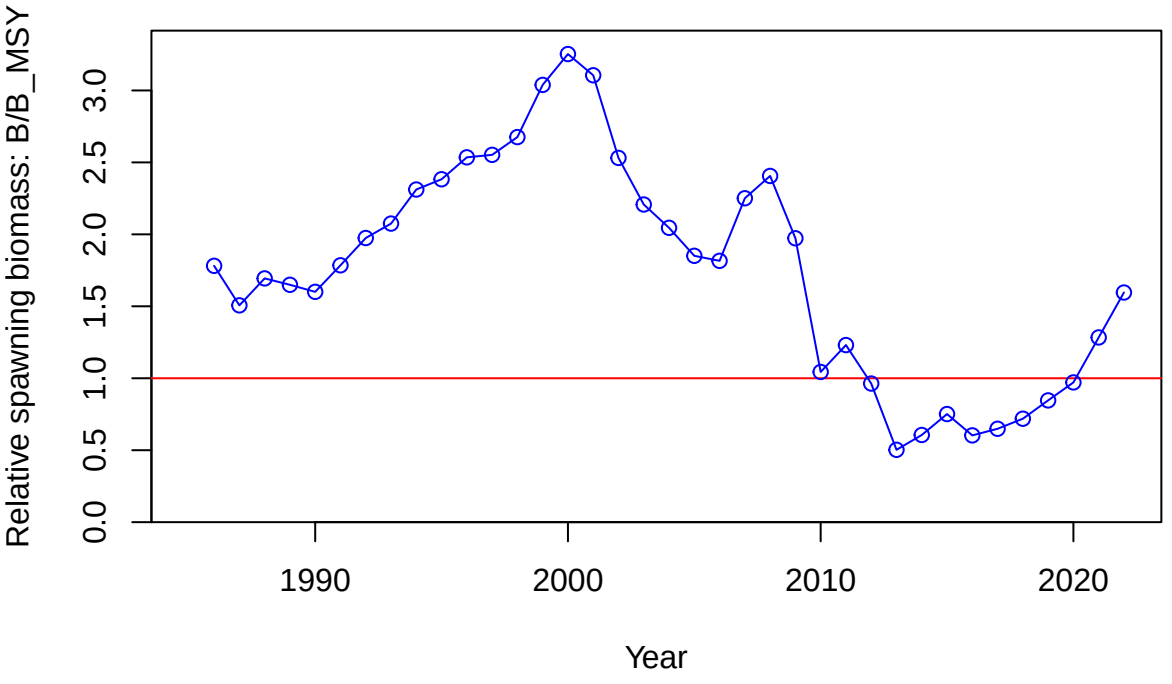

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
5
10
15
Age (yr)

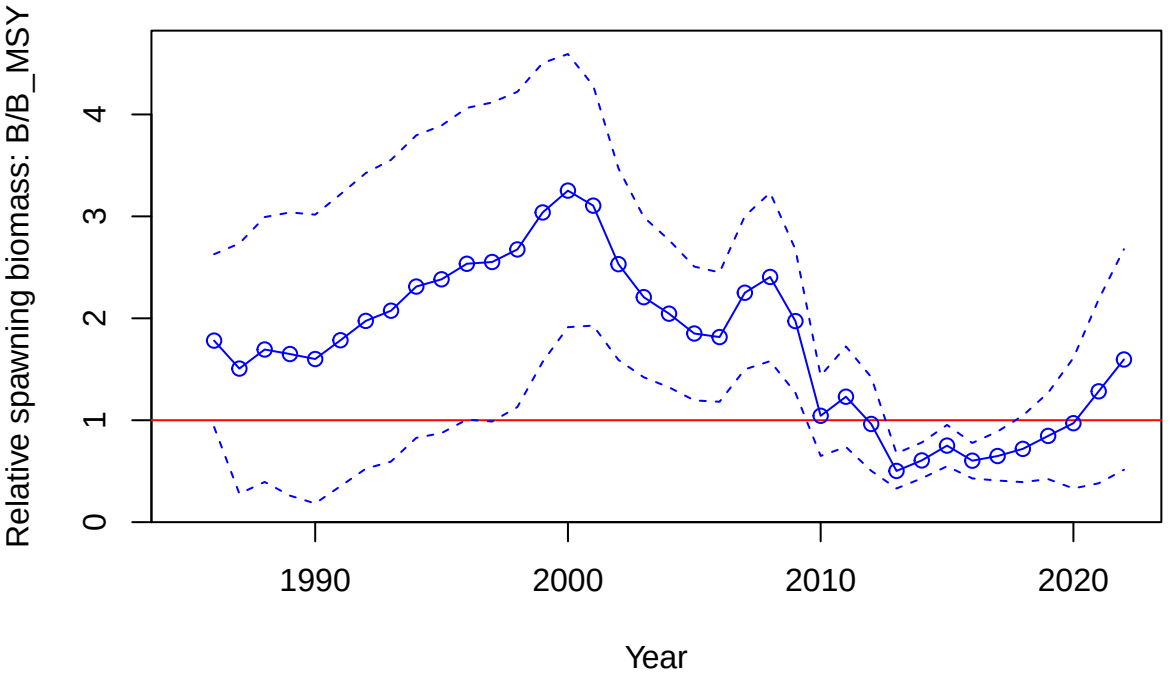

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
10
20
30
40
Length (cm)

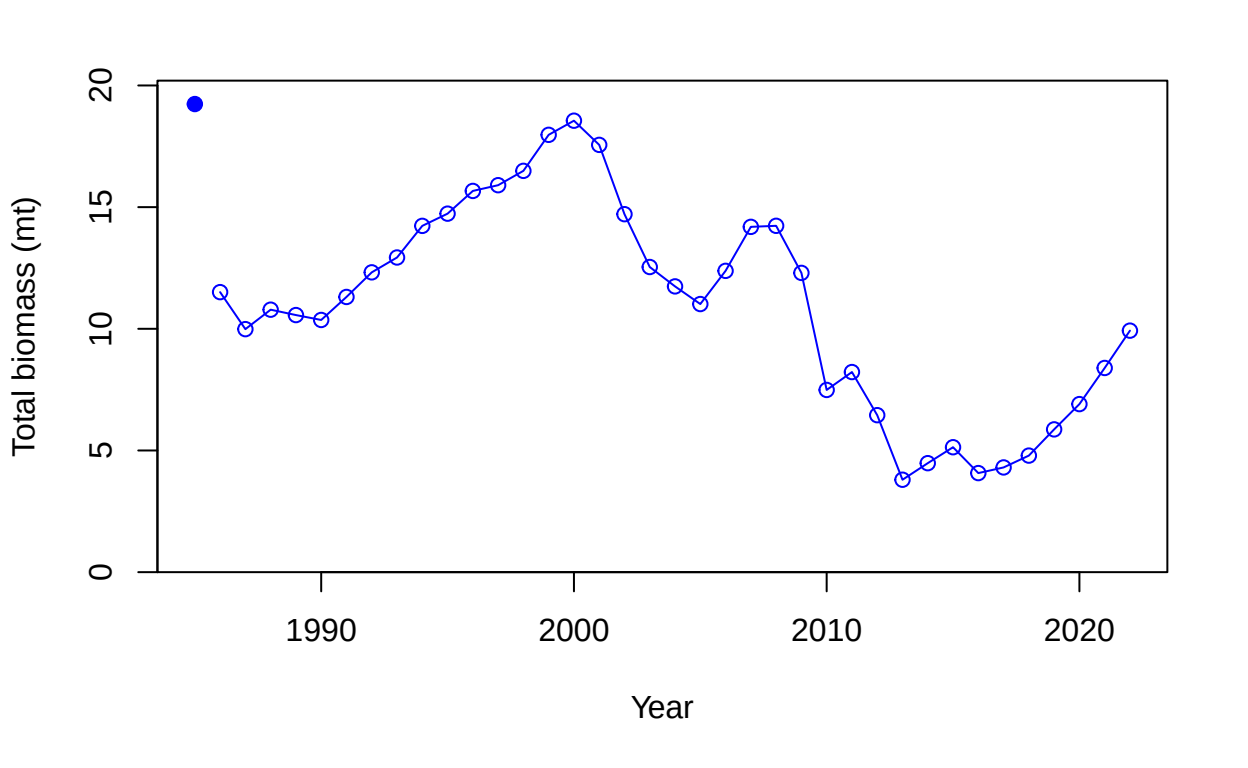

Length (cm)
0
10
20
30
40
1
0.8
0.6
0.4
0.2
0
5
10
15
Age (yr)

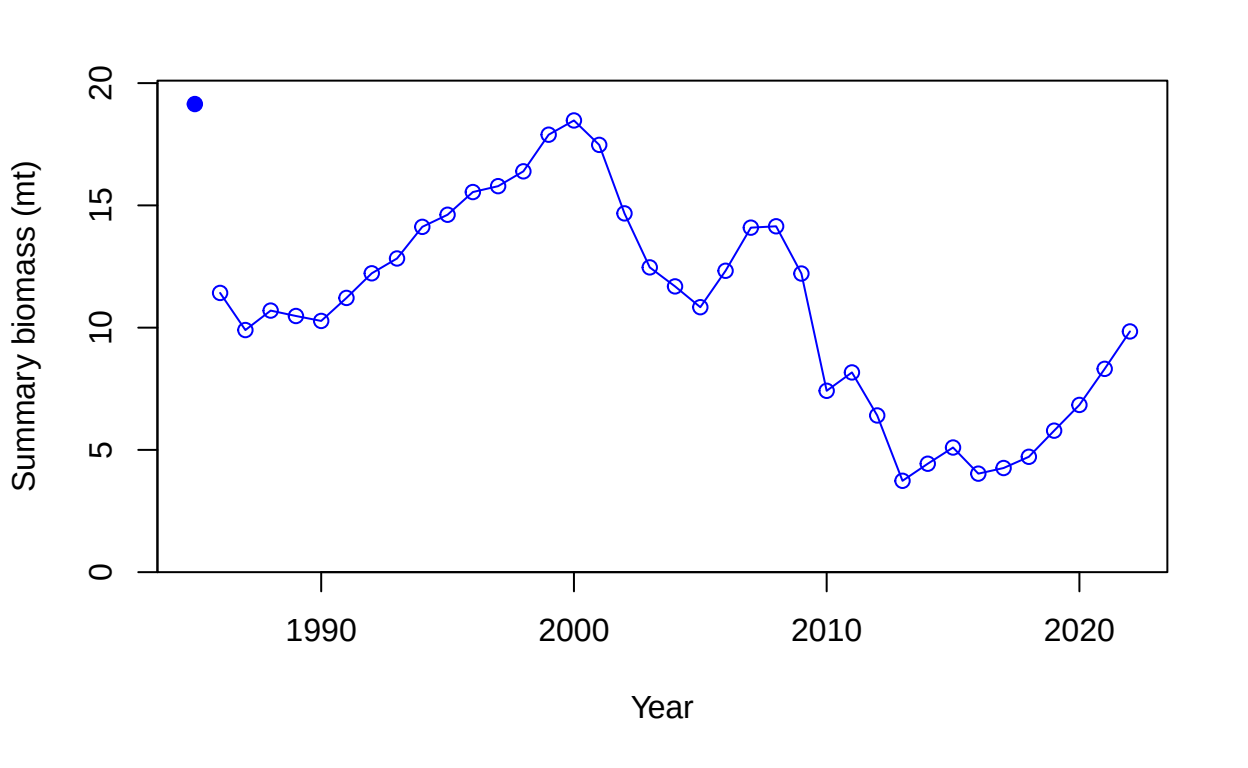

Spawning biomass (mt)
0
5
10
15
1990
2000
2010
2020
Year

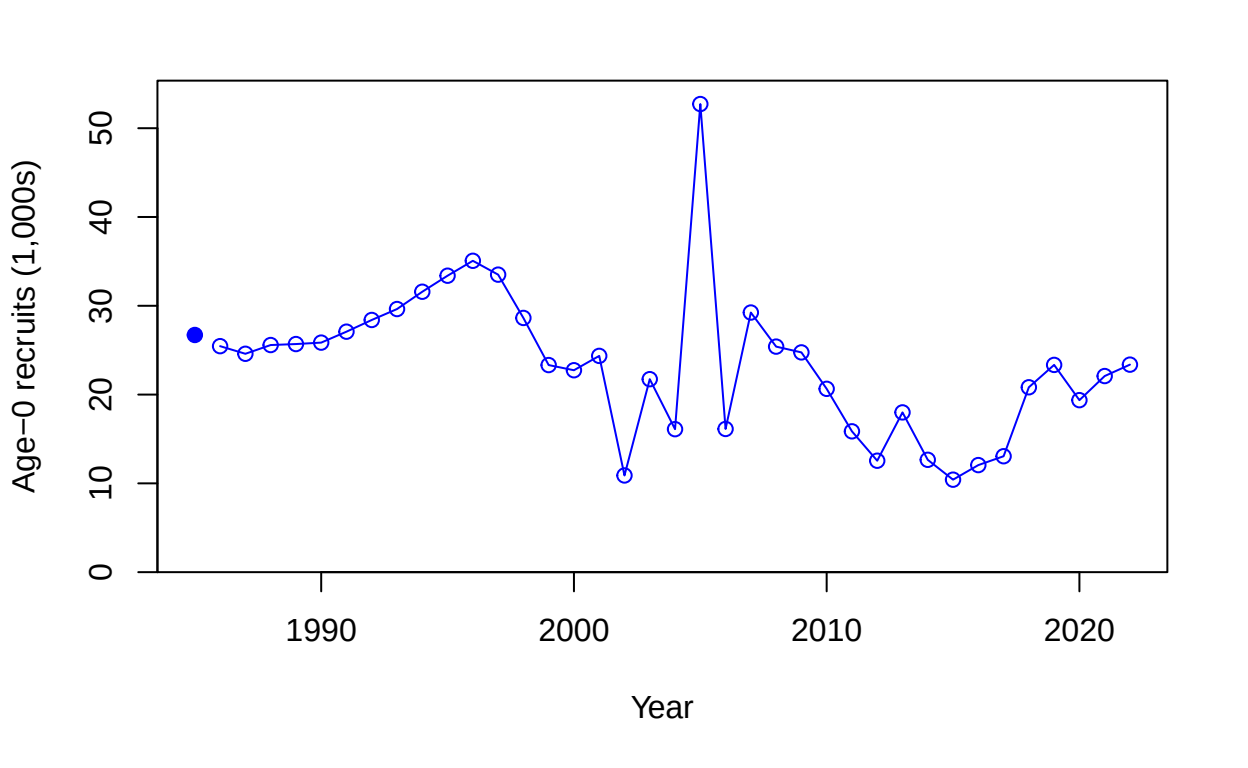

Spawning biomass (mt)
0
5
10
15
20
1990
2000
2010
2020
Year

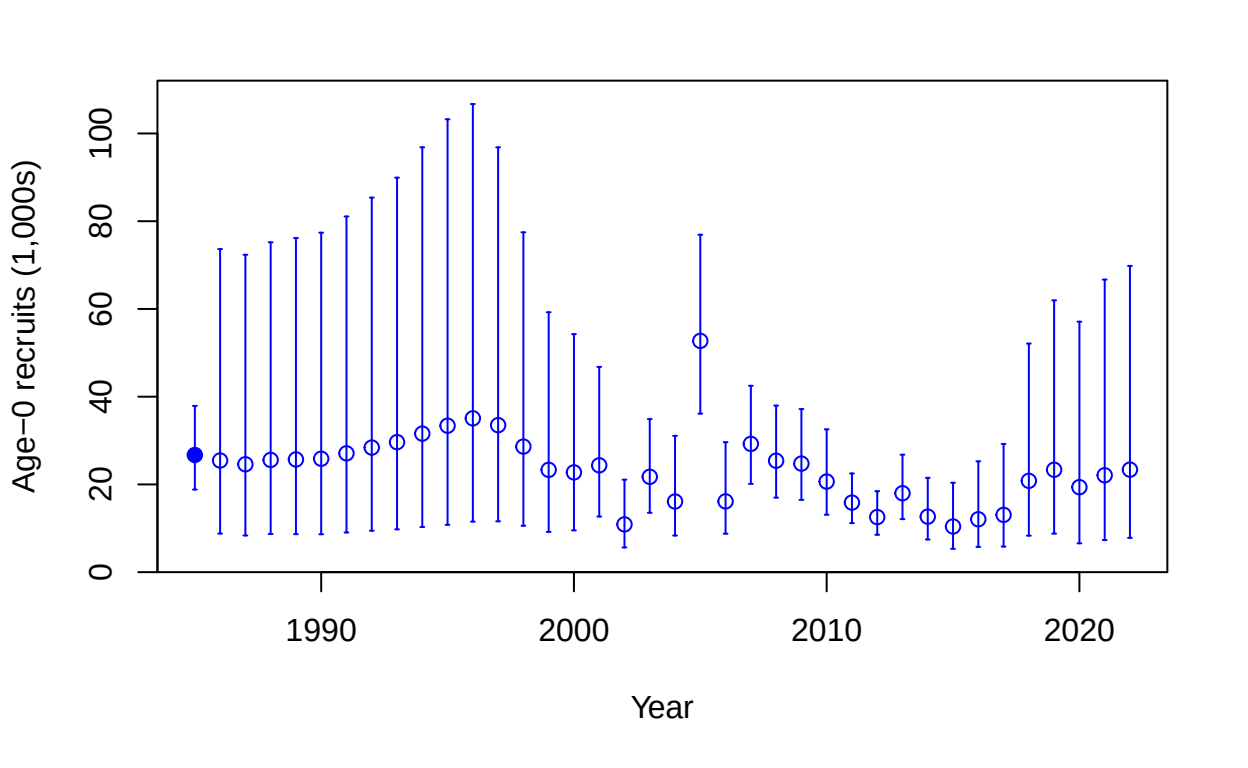

Relative spawning biomass: B/B_MSY
0.0
0.5
1.0
1.5
2.0
2.5
3.0
1990
2000
2010
2020
Year

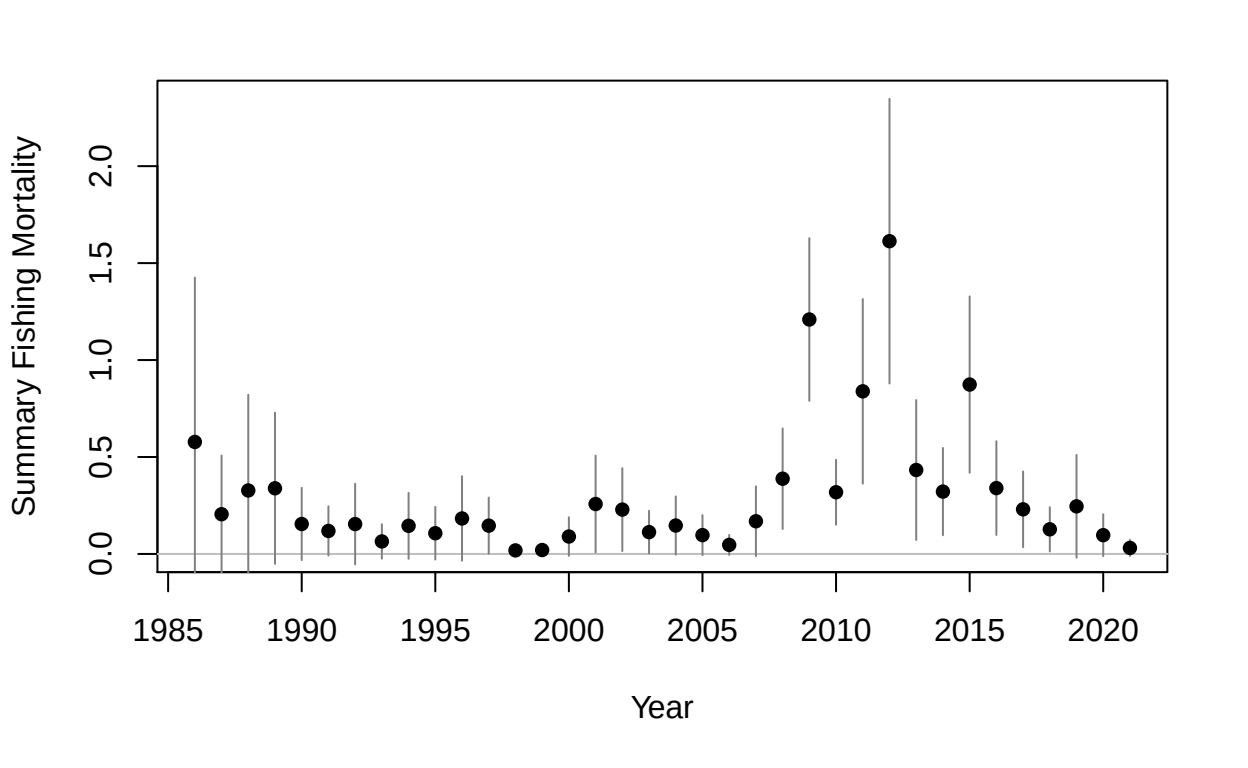

Relative spawning biomass: B/B_MSY
0
1
2
3
4
1990
2000
2010
2020
Year

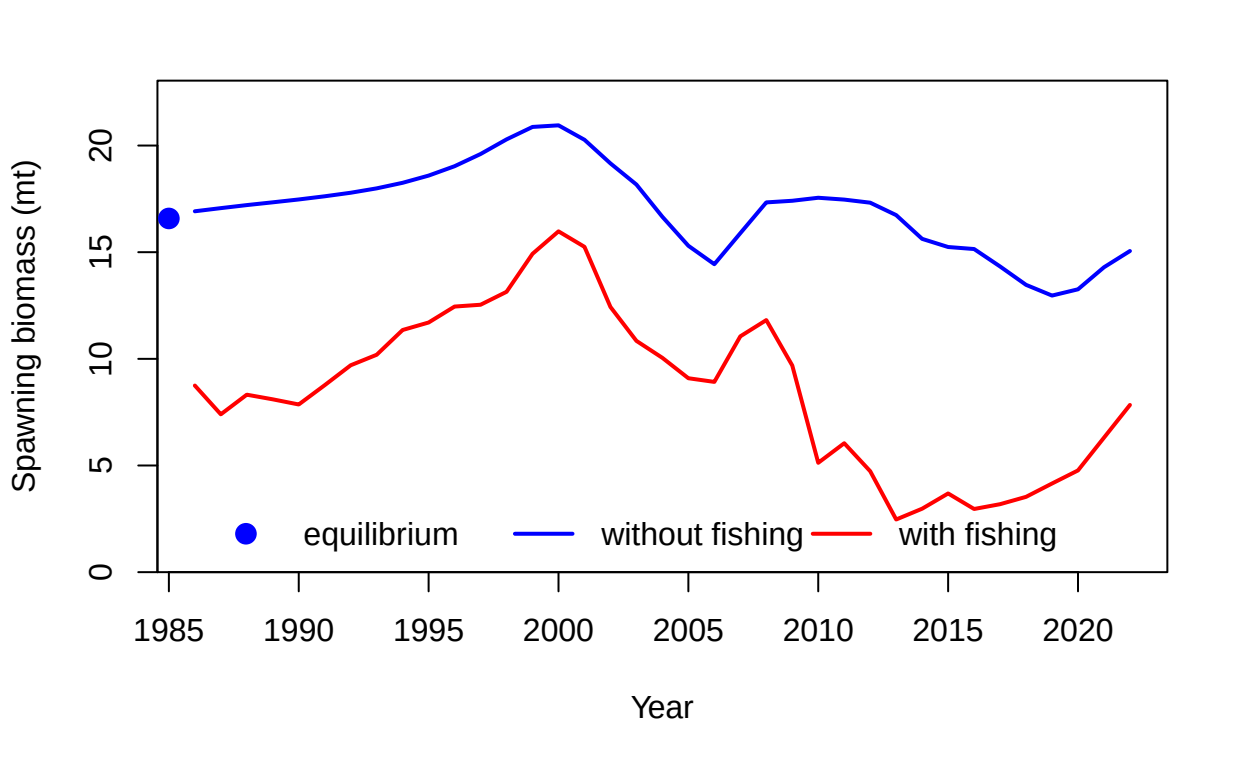

Total biomass (mt)
0
5
10
15
20
1990
2000
2010
2020
Year

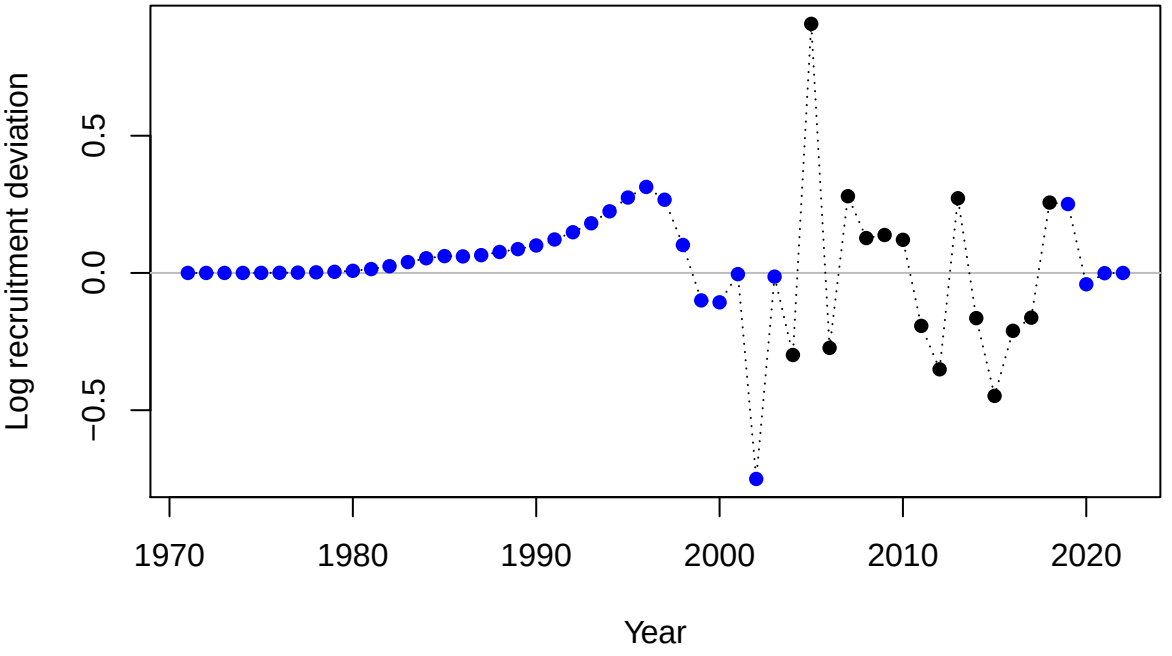

Summary biomass (mt)
0
5
10
15
20
1990
2000
2010
2020
Year

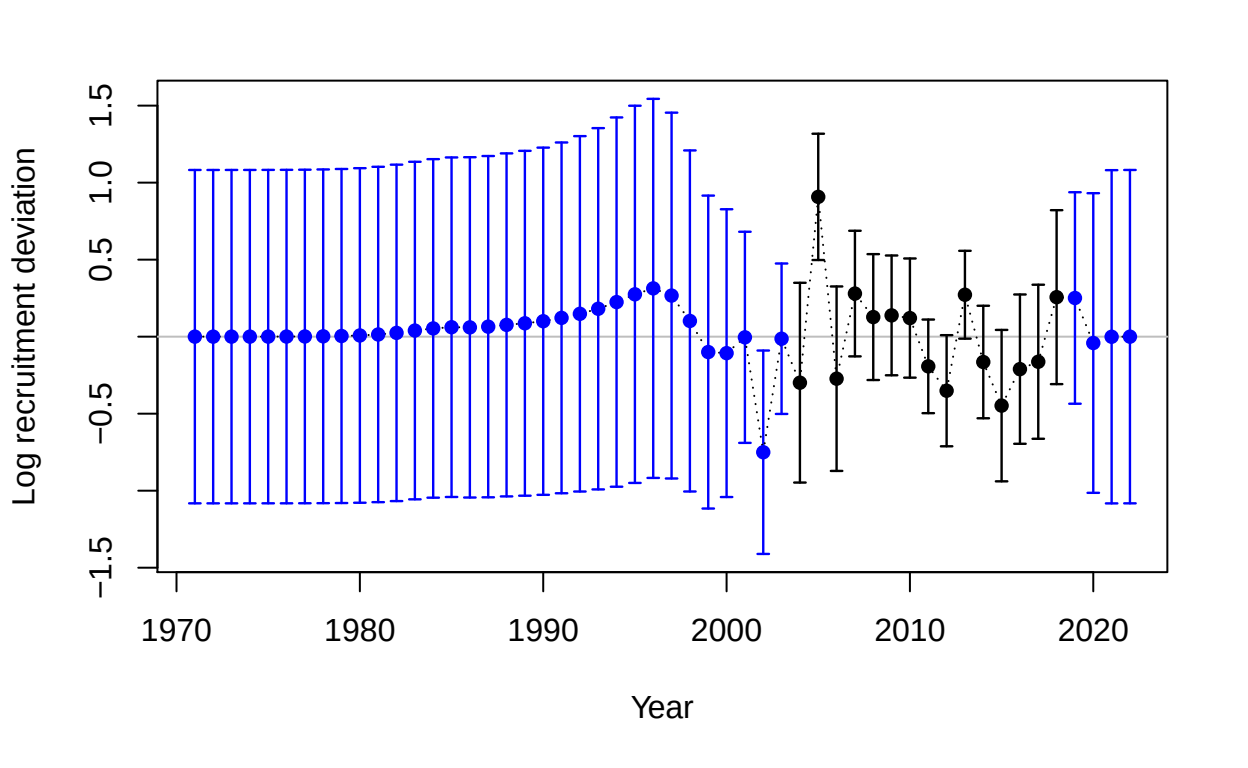

Age−0 recruits (1,000s)
0
10
20
30
40
50
1990
2000
2010
2020
Year

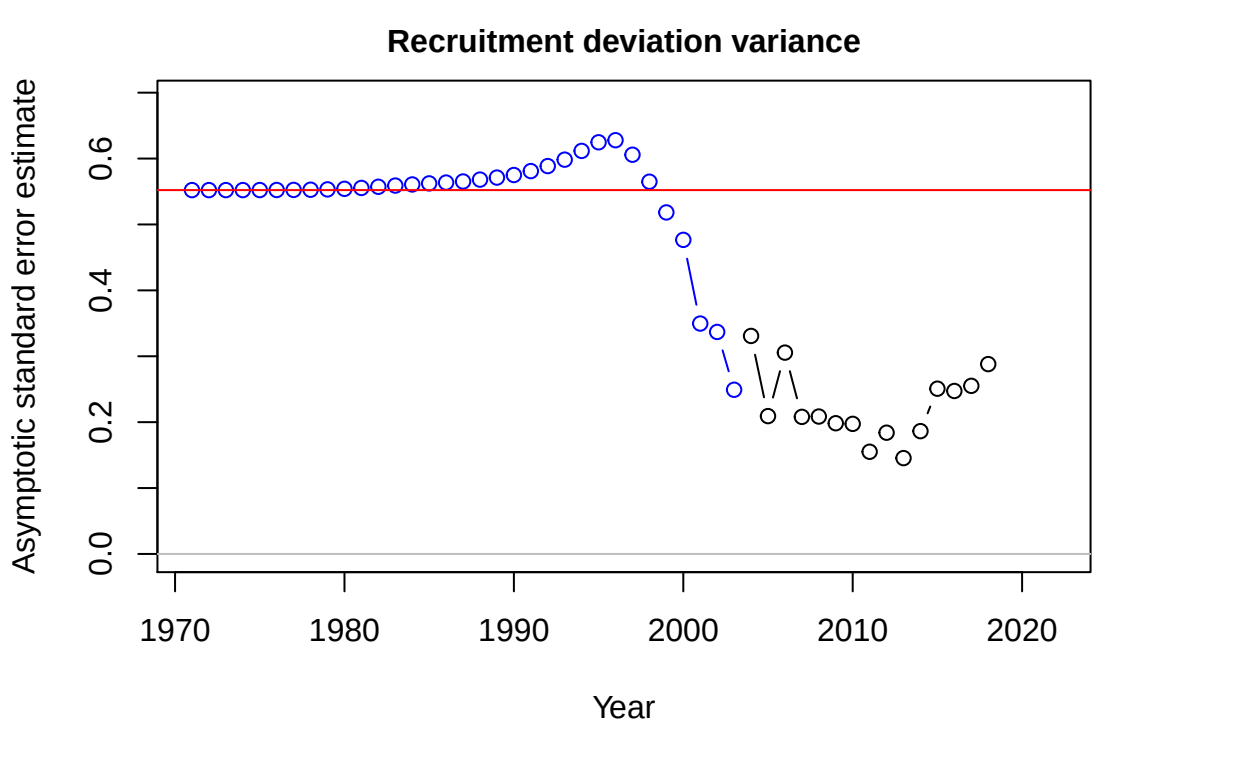

Age−0 recruits (1,000s)
0
20
40
60
80
100
1990
2000
2010
2020
Year

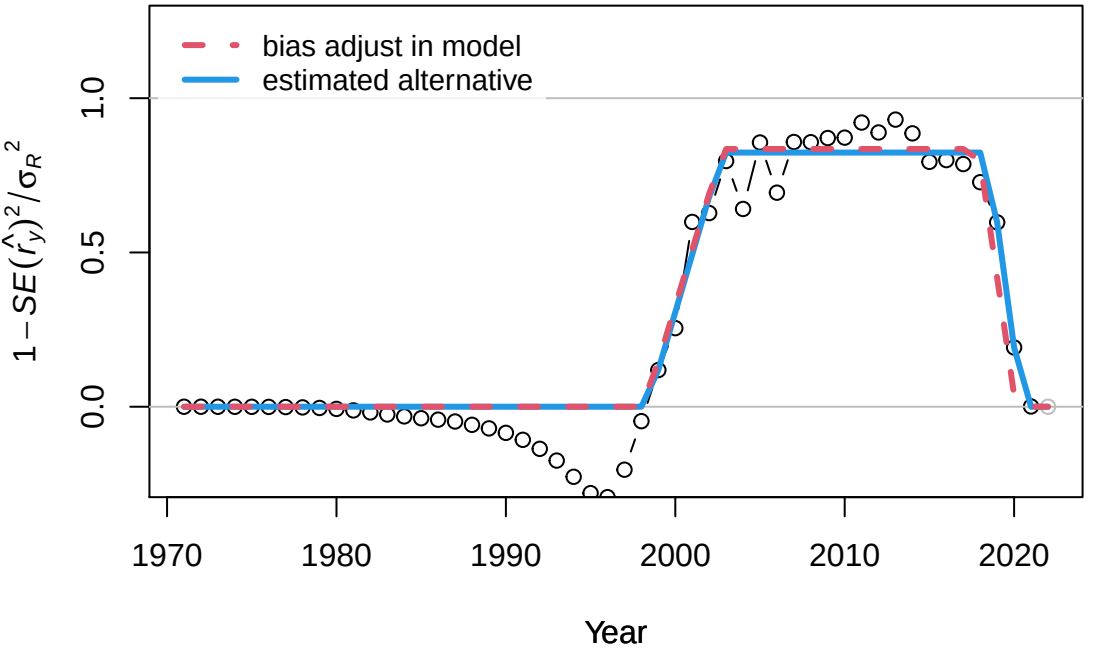

Summary Fishing Mortality
0.0
0.5
1.0
1.5
2.0
1985
1990
1995
2000
2005
2010
2015
2020
Year

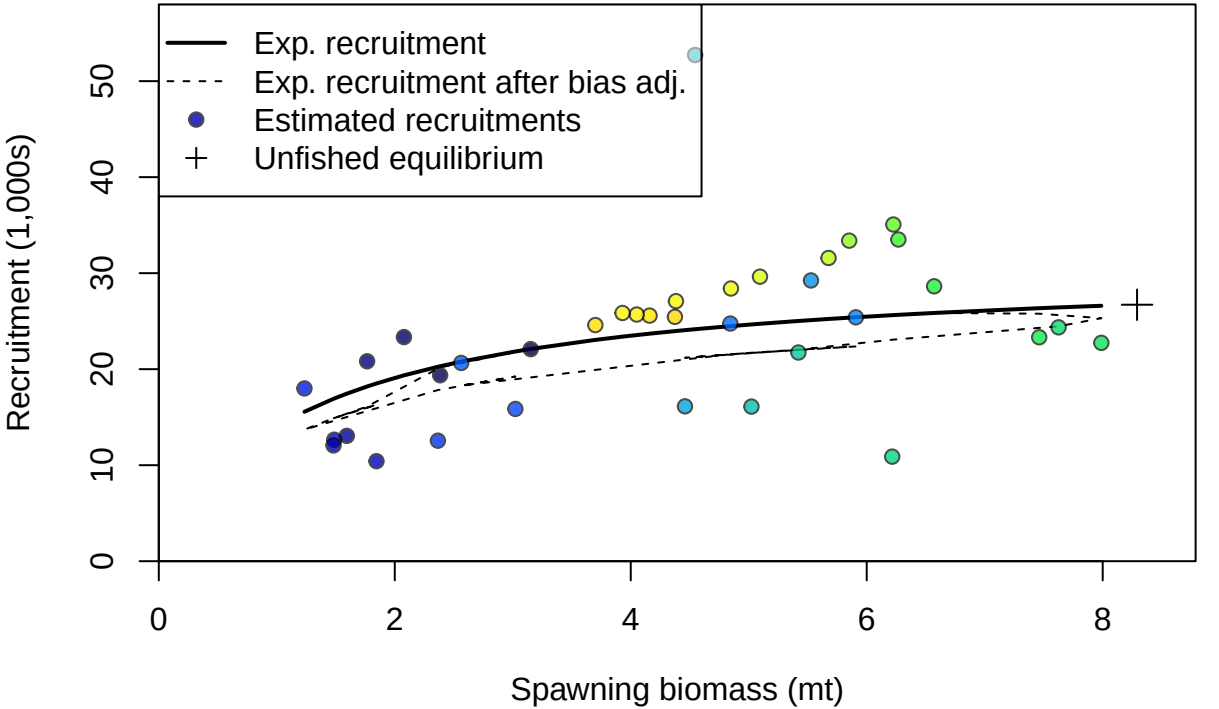

Spawning biomass (mt)
0
5
10
15
20
1985
1990
1995
2000
2005
2010
2015
2020
Year
equilibrium
without fishing
with fishing

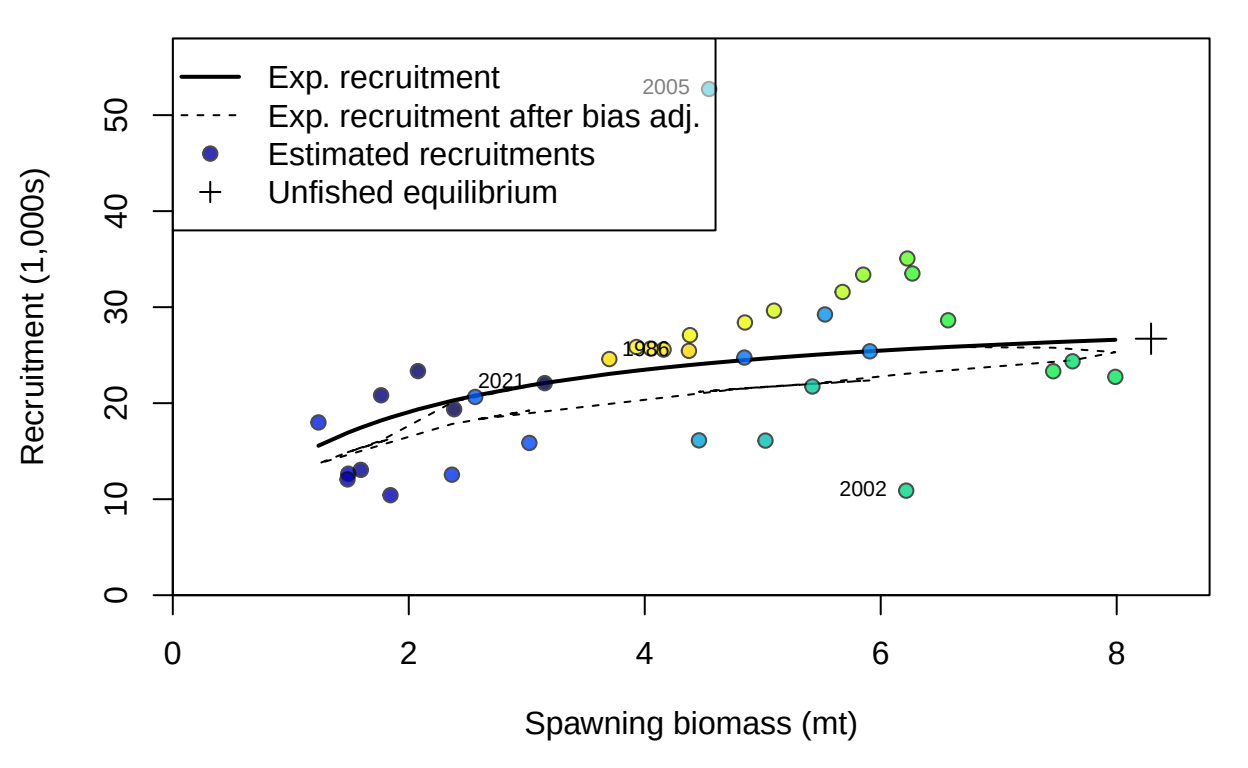

Log recruitment deviation
0.5
0.0
−0.5
1970
1980
1990
2000
2010
2020
Year

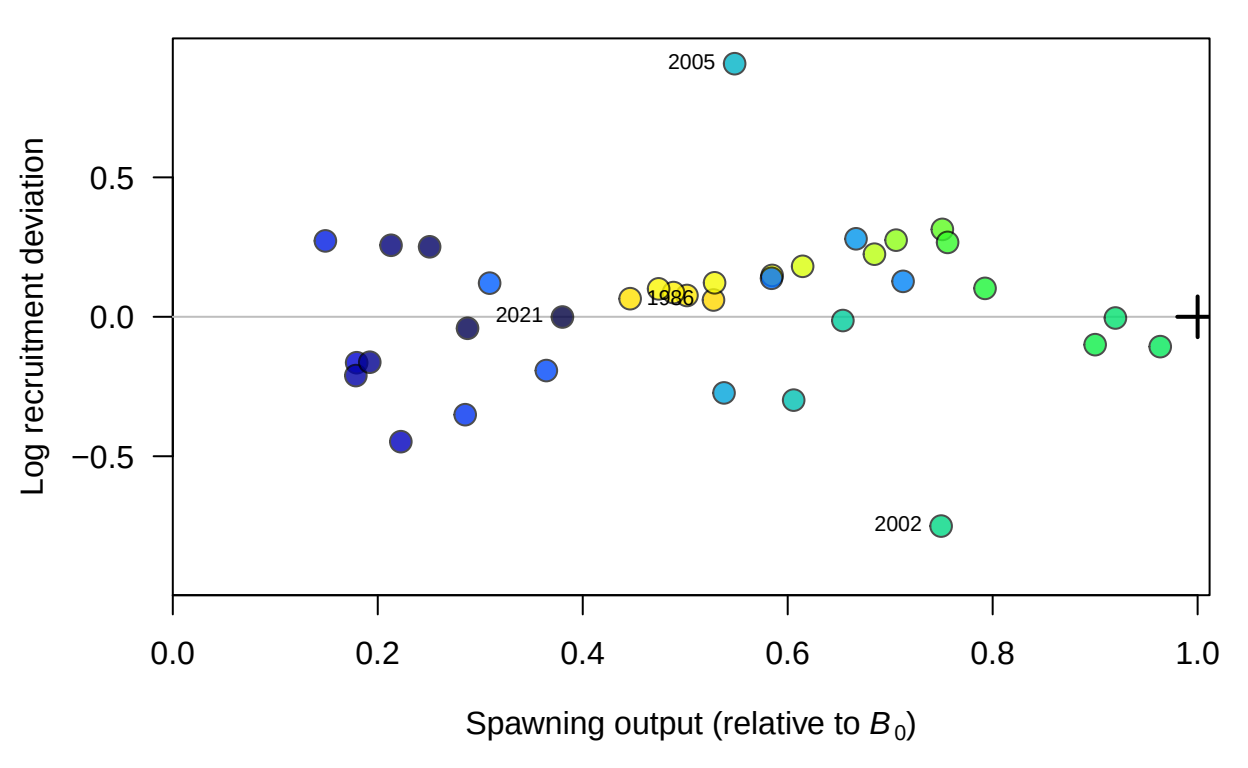

Log recruitment deviation
1.5
1.0
0.5
−0.5
−1.5
1970
1980
1990
2000
2010
2020
Year

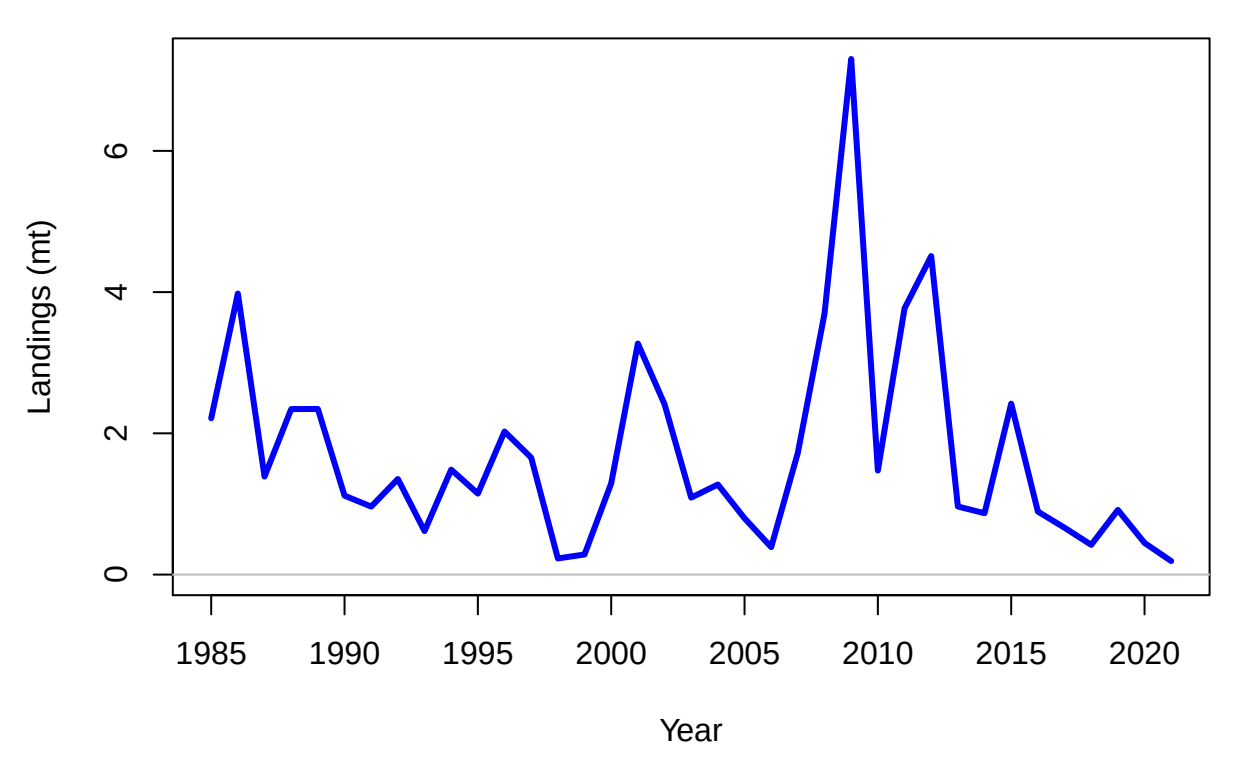

Recruitment deviation variance
Asymptotic standard error estimate
0.0
0.2
0.4
0.6
1970
1980
1990
2000
2010
2020
Year

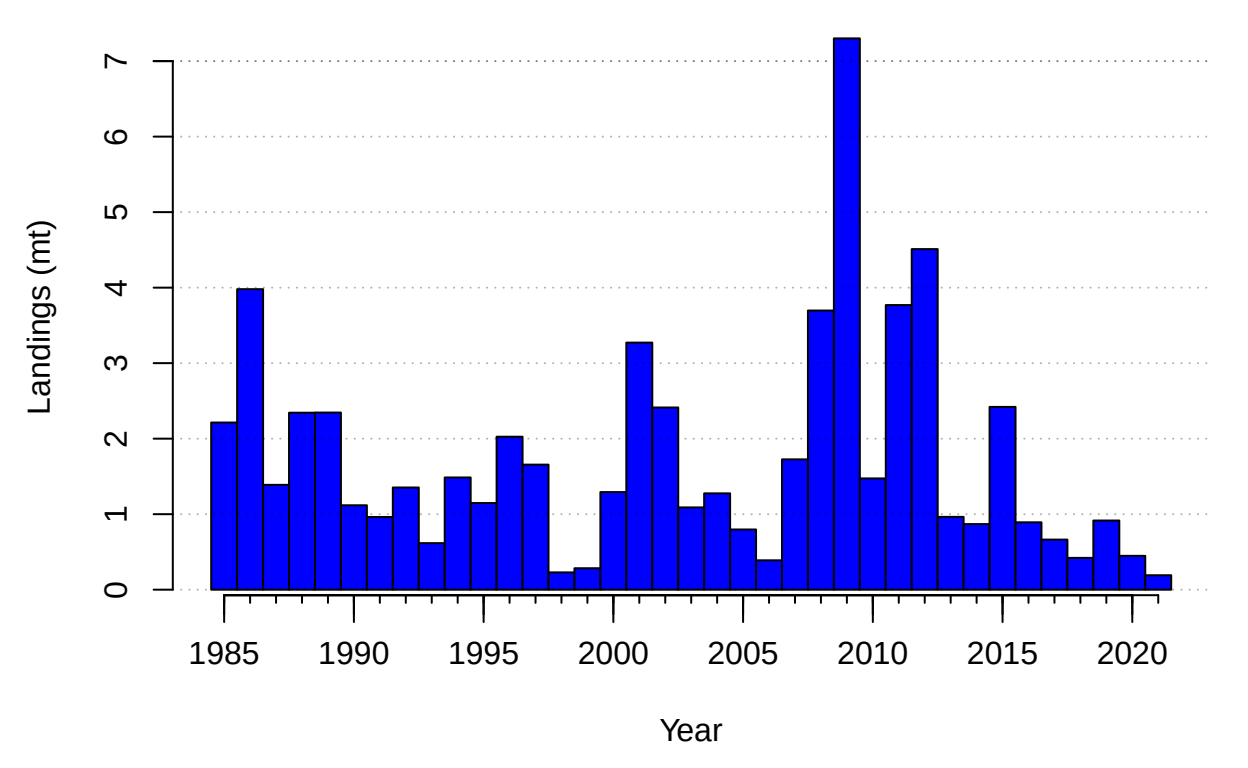

bias adjust in model
estimated alternative
1 − SE(r̂y)²/σR²
0.0
0.5
1.0
1970
1980
1990
2000
2010
2020
Year

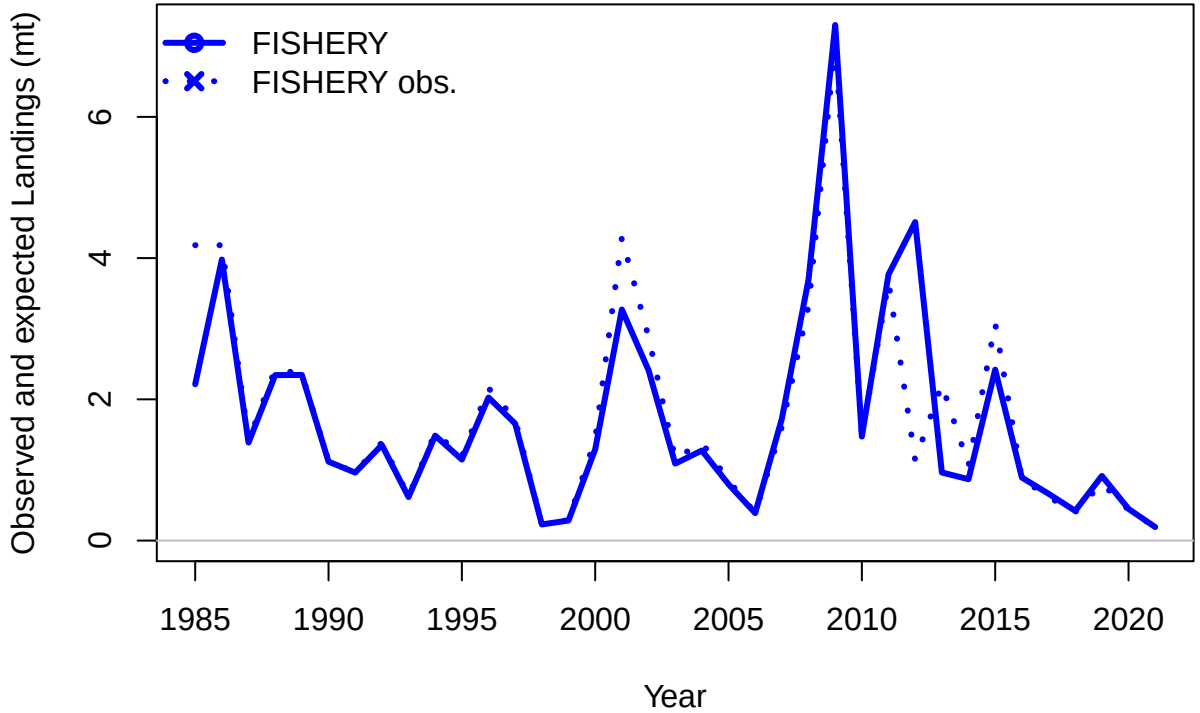

Exp. recruitment
Exp. recruitment after bias adj.
Estimated recruitments
Unfished equilibrium
Recruitment (1,000s)
0
10
20
30
40
50
0
2
4
6
8
Spawning biomass (mt)

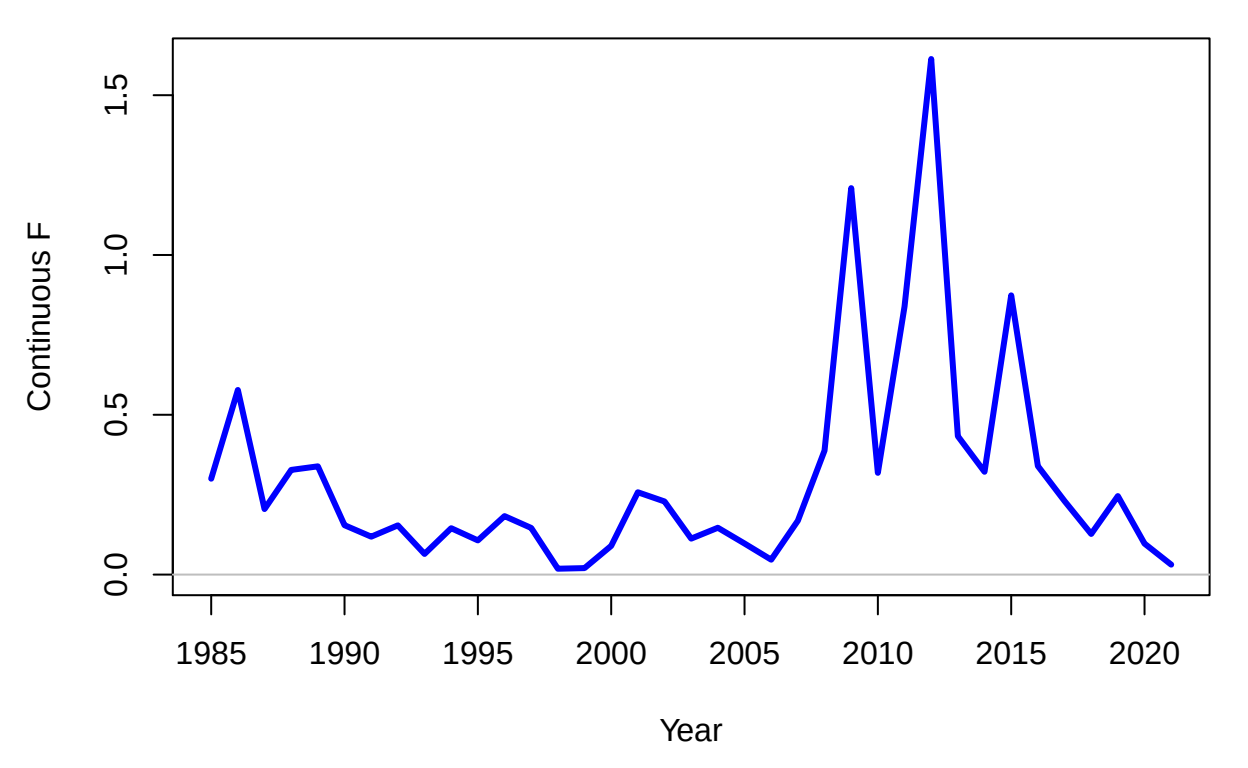

Exp. recruitment
Exp. recruitment after bias adj.
Estimated recruitments
Unfished equilibrium
2005
1986
2021
2002
Recruitment (1,000s)
0
10
20
30
40
50
0
2
4
6
8
Spawning biomass (mt)

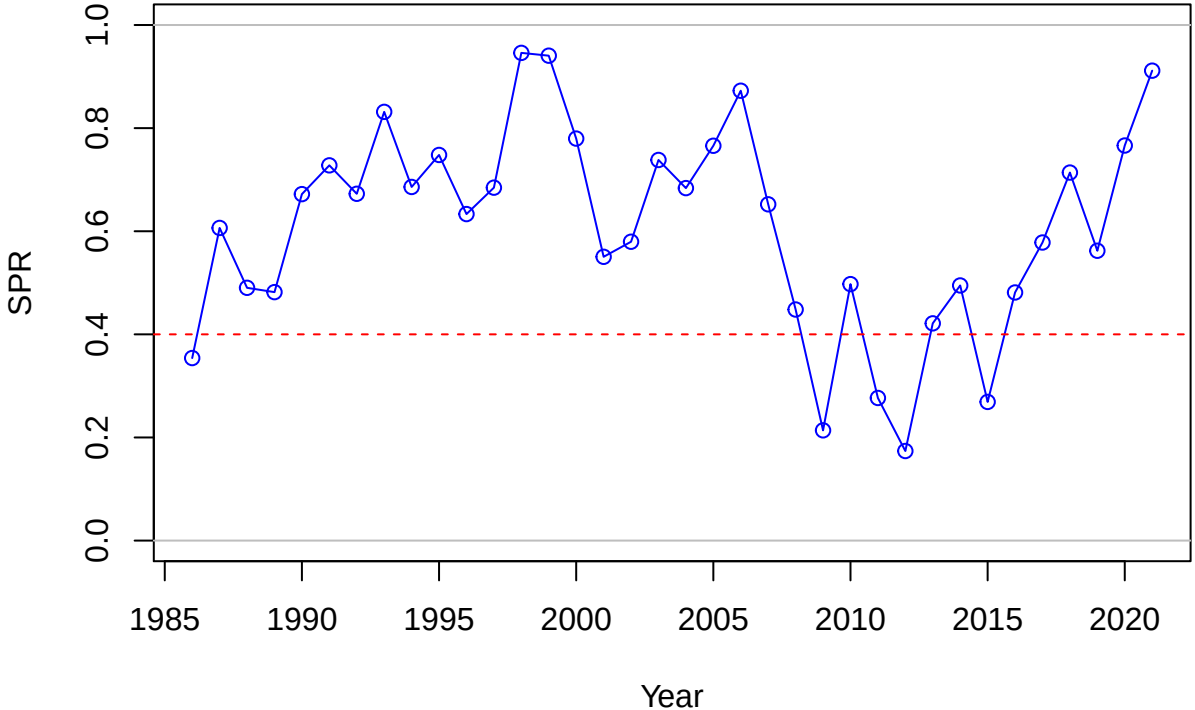

2005
2021
1986
2002
0.5
0.0
−0.5
0.0
0.2
0.4
0.6
0.8
1.0
Log recruitment deviation
Spawning output (relative to B_0)

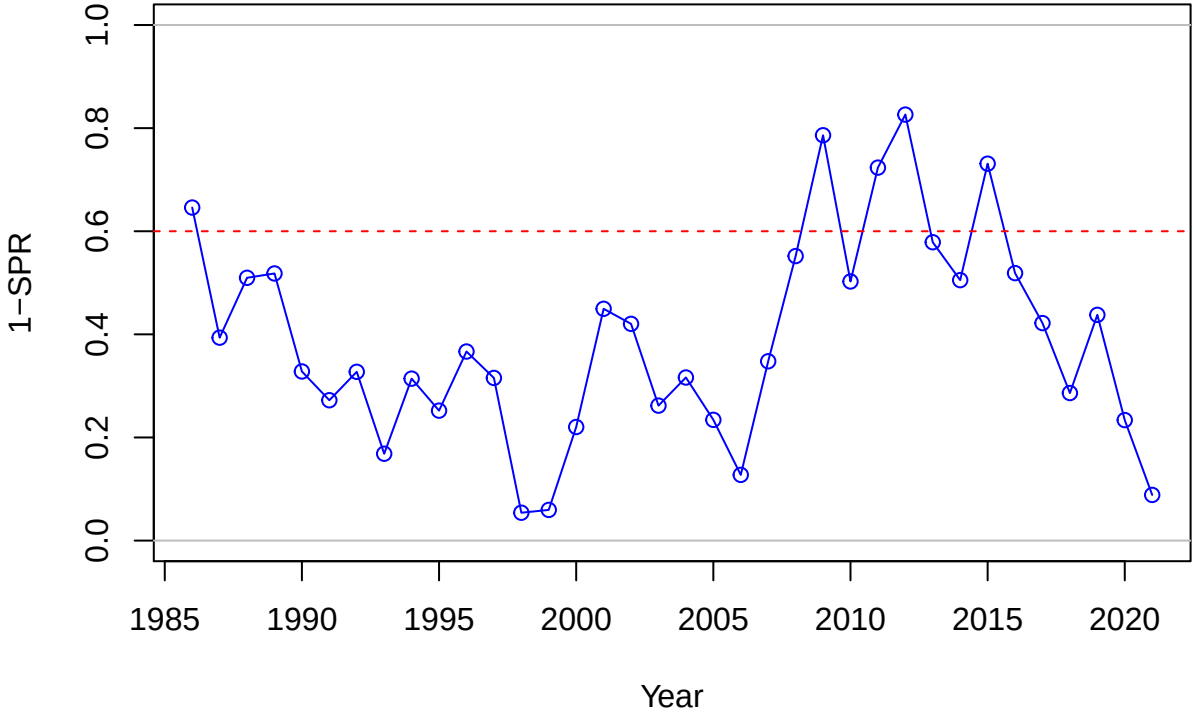

Landings (mt)
0
2
4
6
1985
1990
1995
2000
2005
2010
2015
2020
Year

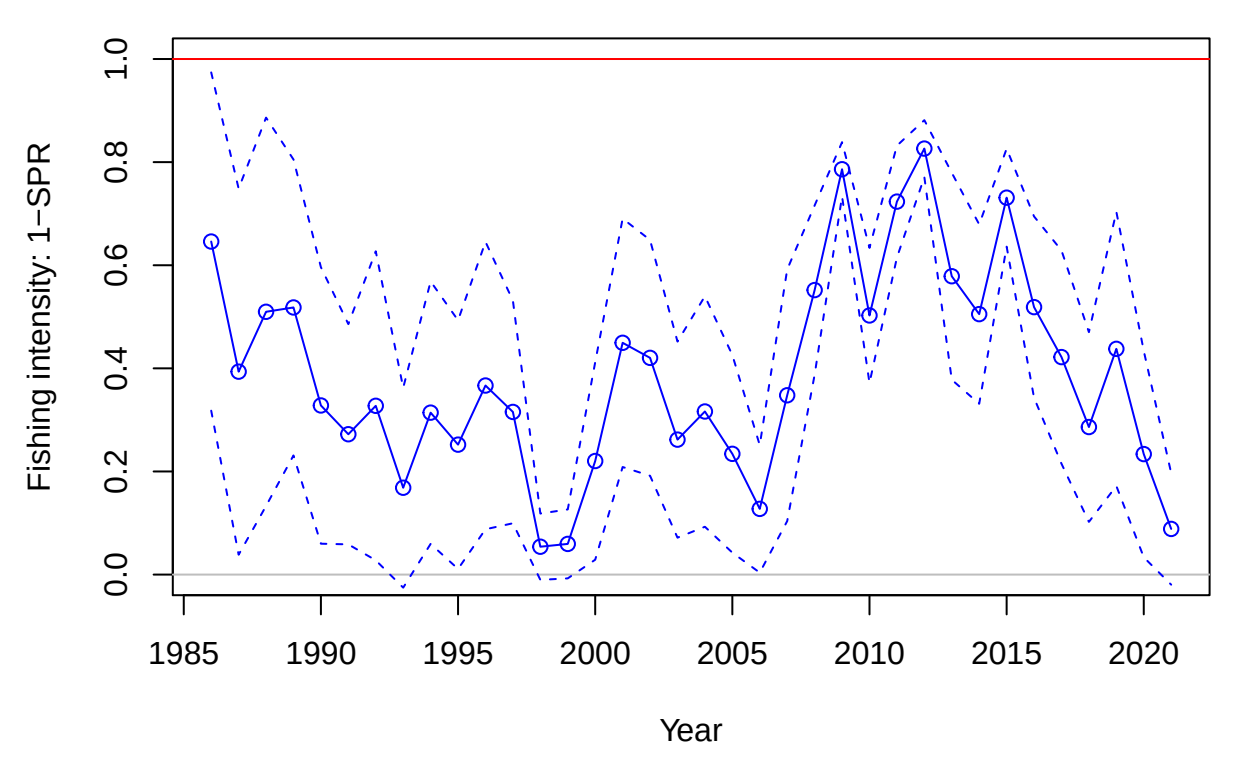

Landings (mt)
0
1
2
3
4
5
6
7
1985
1990
1995
2000
2005
2010
2015
2020
Year

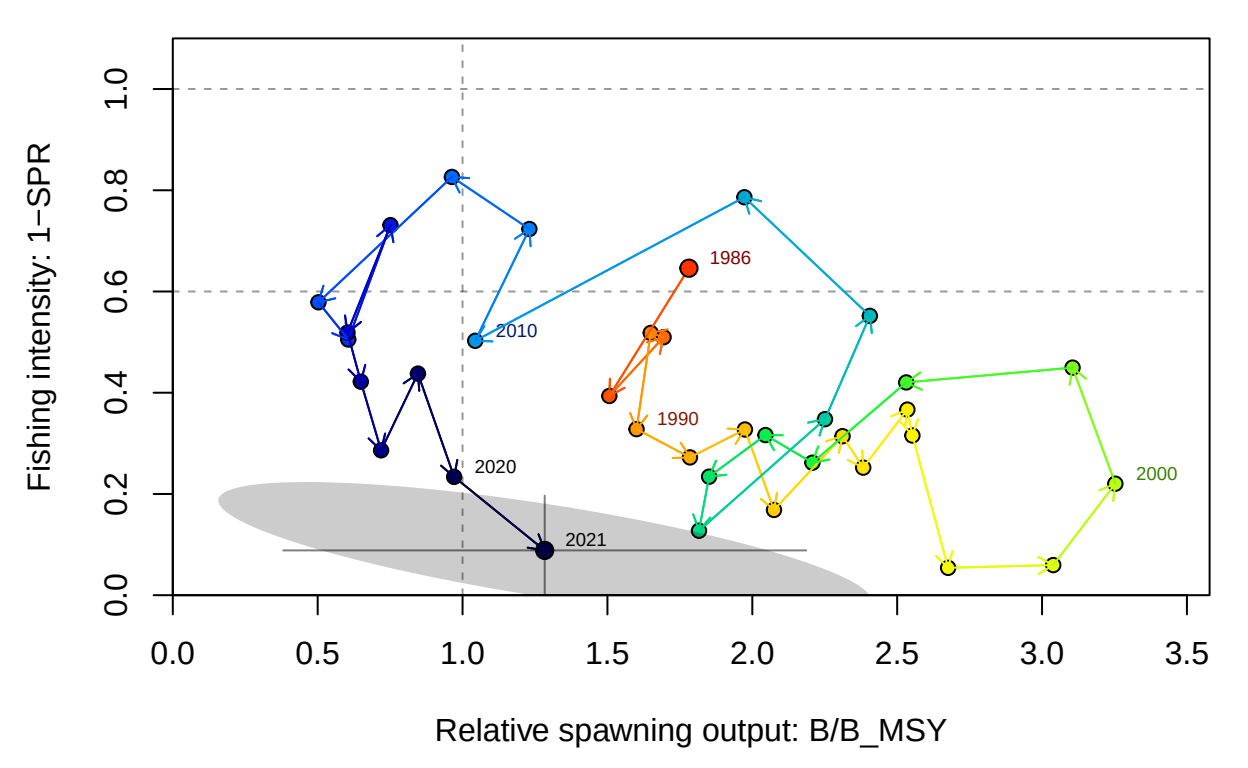

FISHERY
FISHERY obs.
Observed and expected Landings (mt)
0
2
4
6
1985
1990
1995
2000
2005
2010
2015
2020
Year

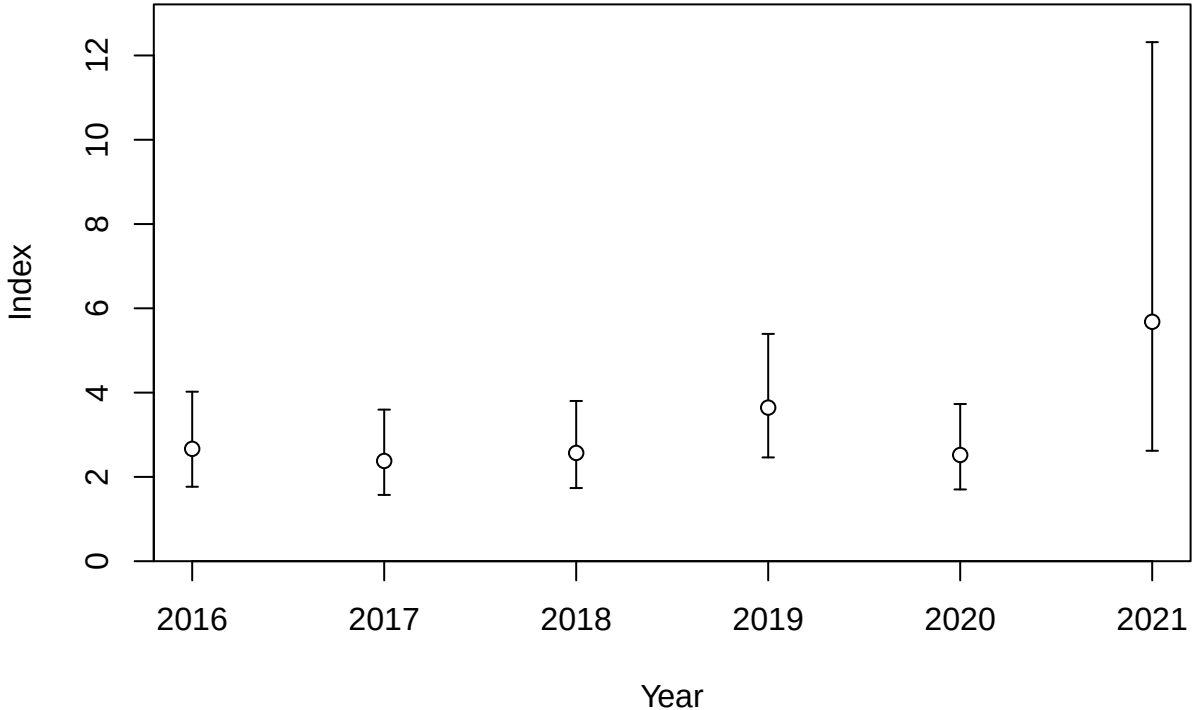

Continuous F
0.0
0.5
1.0
1.5
1985
1990
1995
2000
2005
2010
2015
2020
Year

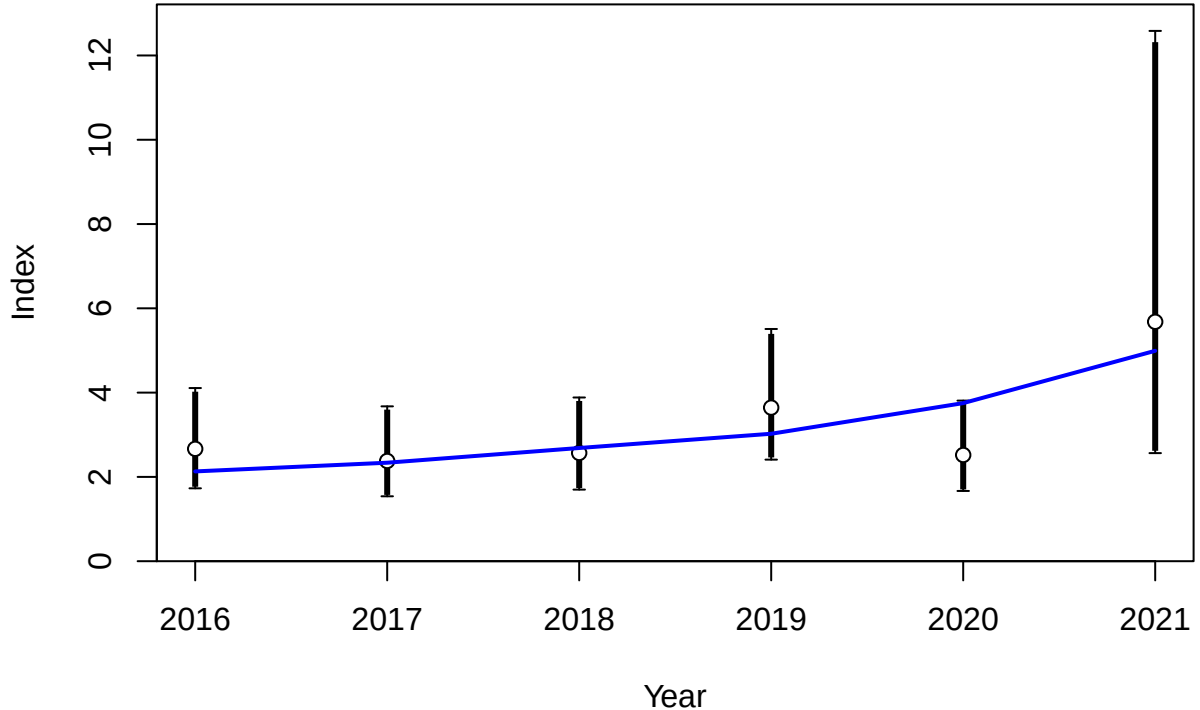

SPR
0.0
0.2
0.4
0.6
0.8
1.0
1985
1990
1995
2000
2005
2010
2015
2020
Year

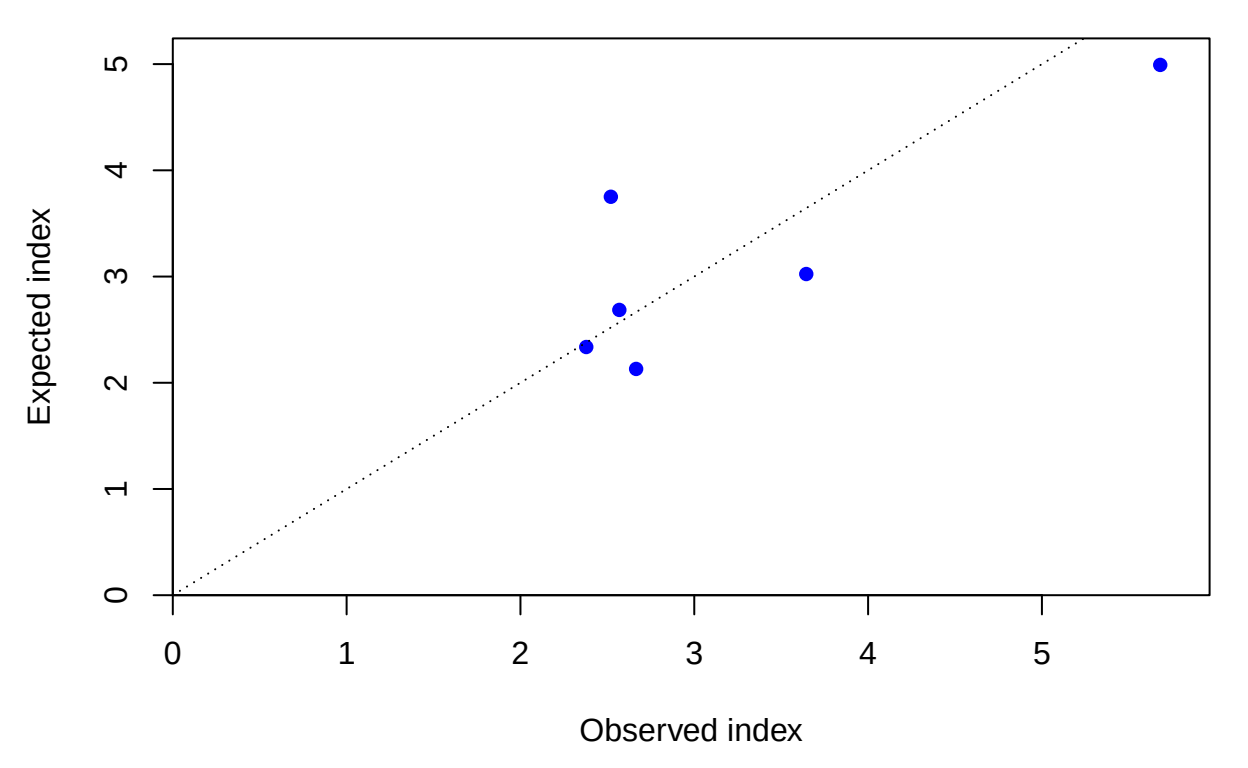

1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
1985
1990
1995
2000
2005
2010
2015
2020
Year

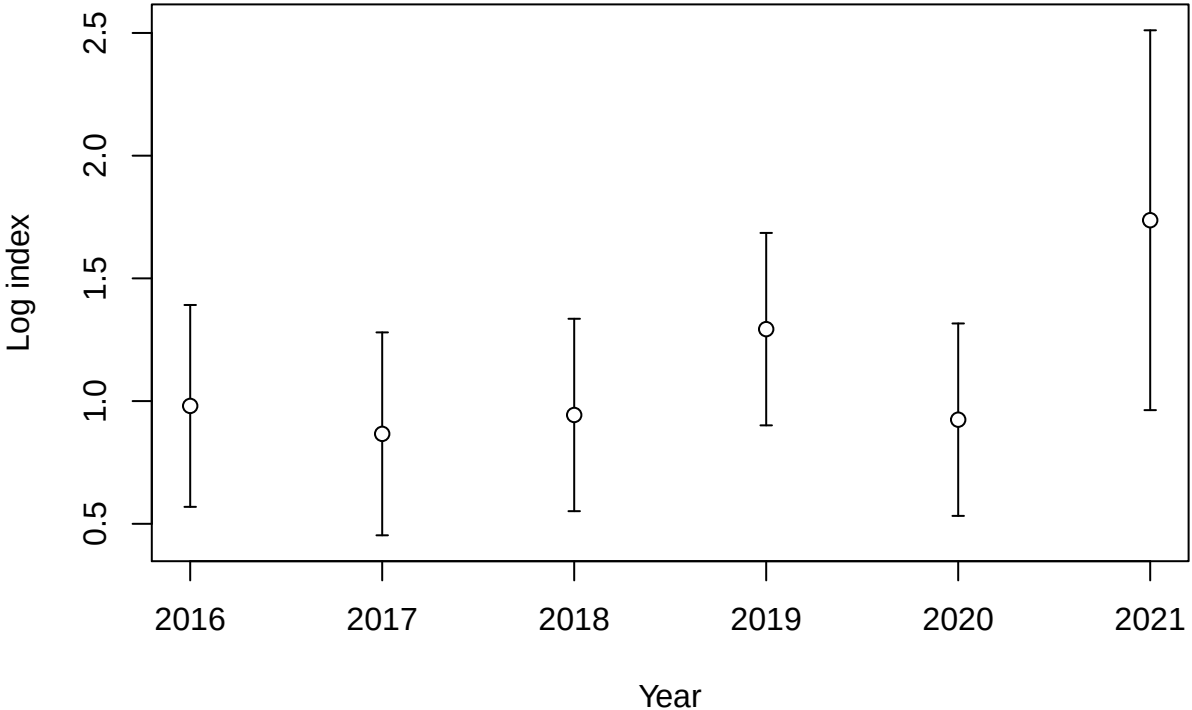

Fishing intensity: 1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
1985
1990
1995
2000
2005
2010
2015
2020
Year

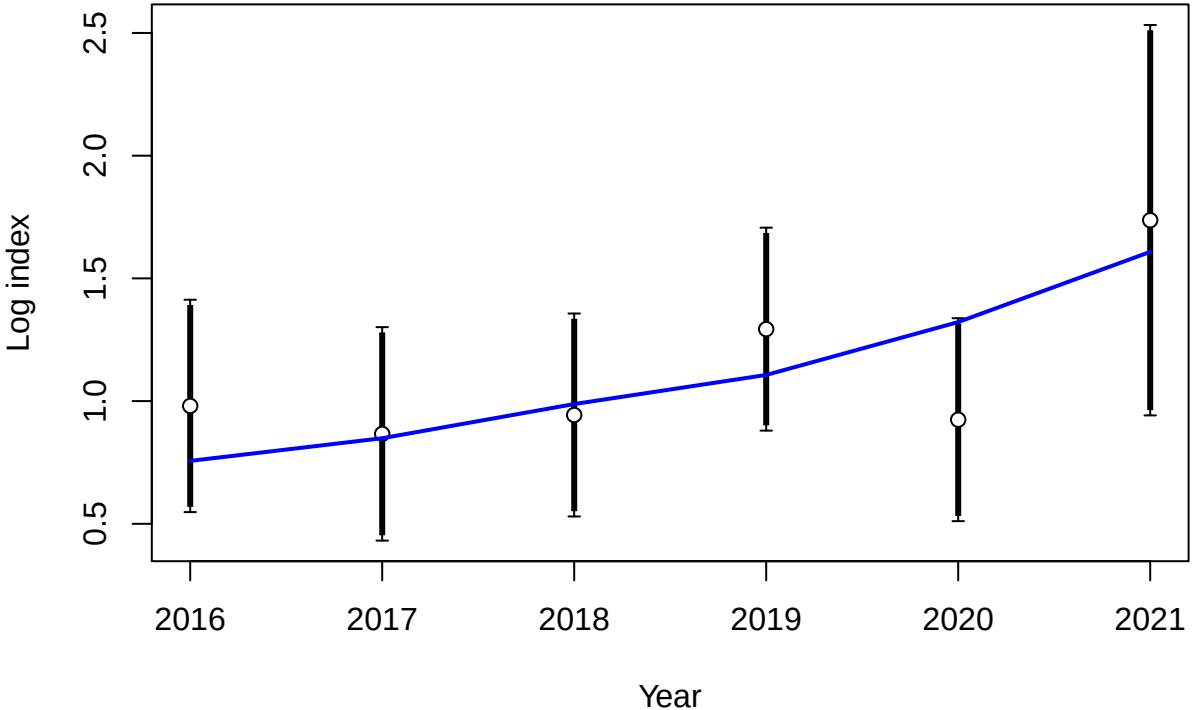

Fishing intensity: 1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
Relative spawning output: B/B_MSY
1986
2010
1990
2000
2020
2021

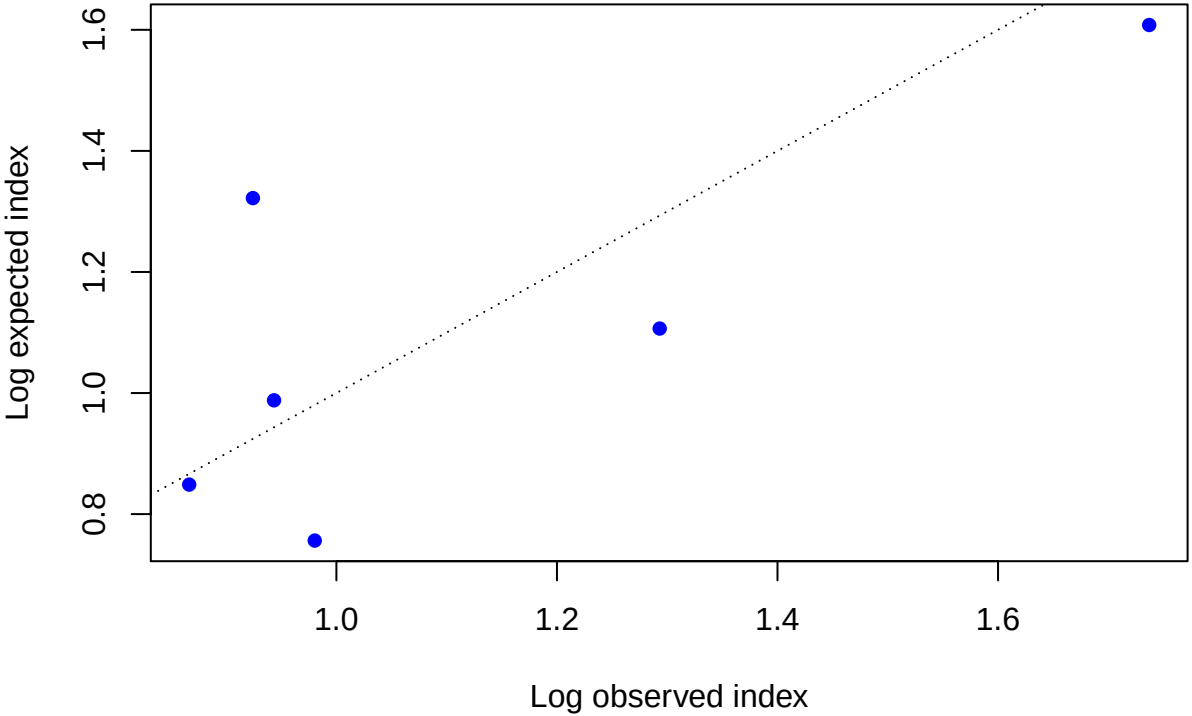

Index
0
2
4
6
8
10
12
2016
2017
2018
2019
2020
2021
Year

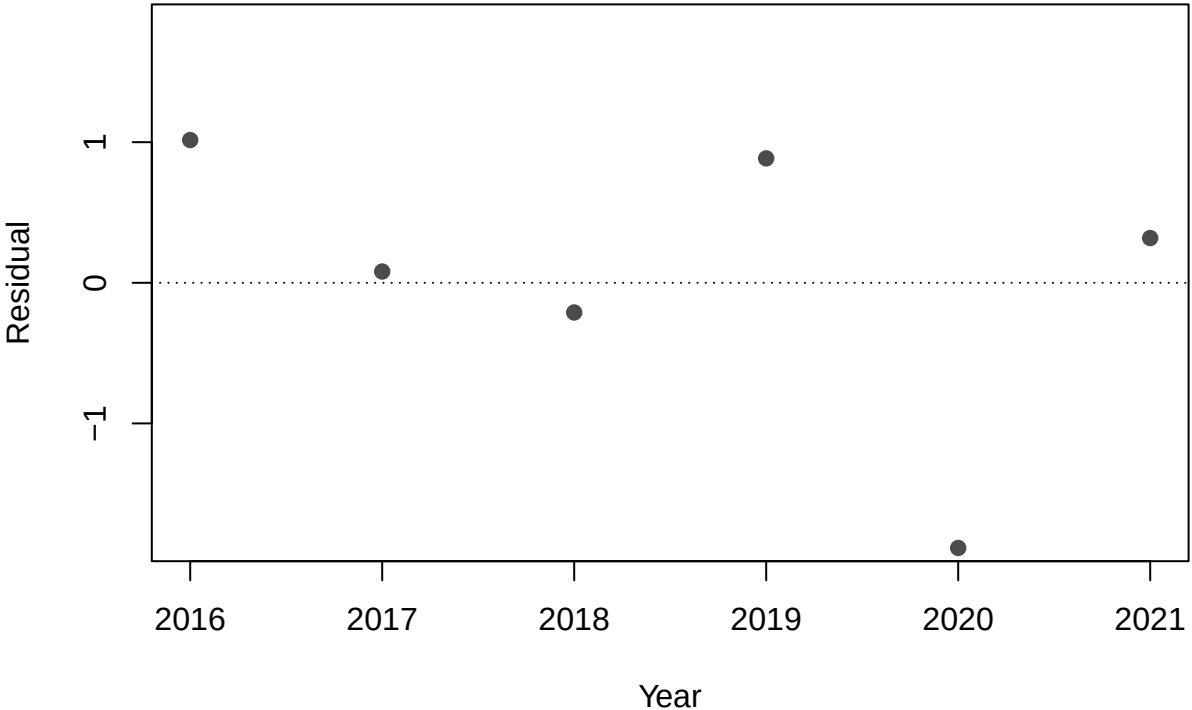

Index
0
2
4
6
8
10
12
2016
2017
2018
2019
2020
2021
Year

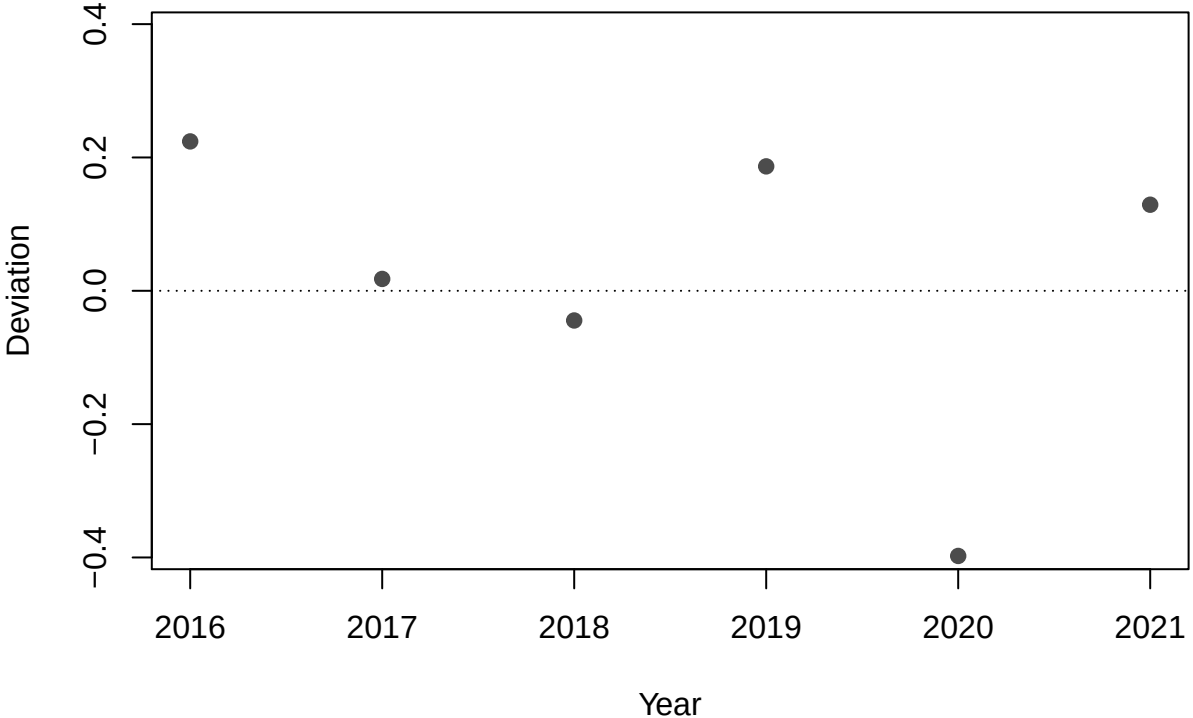

Expected index
Observed index
0
1
2
3
4
5

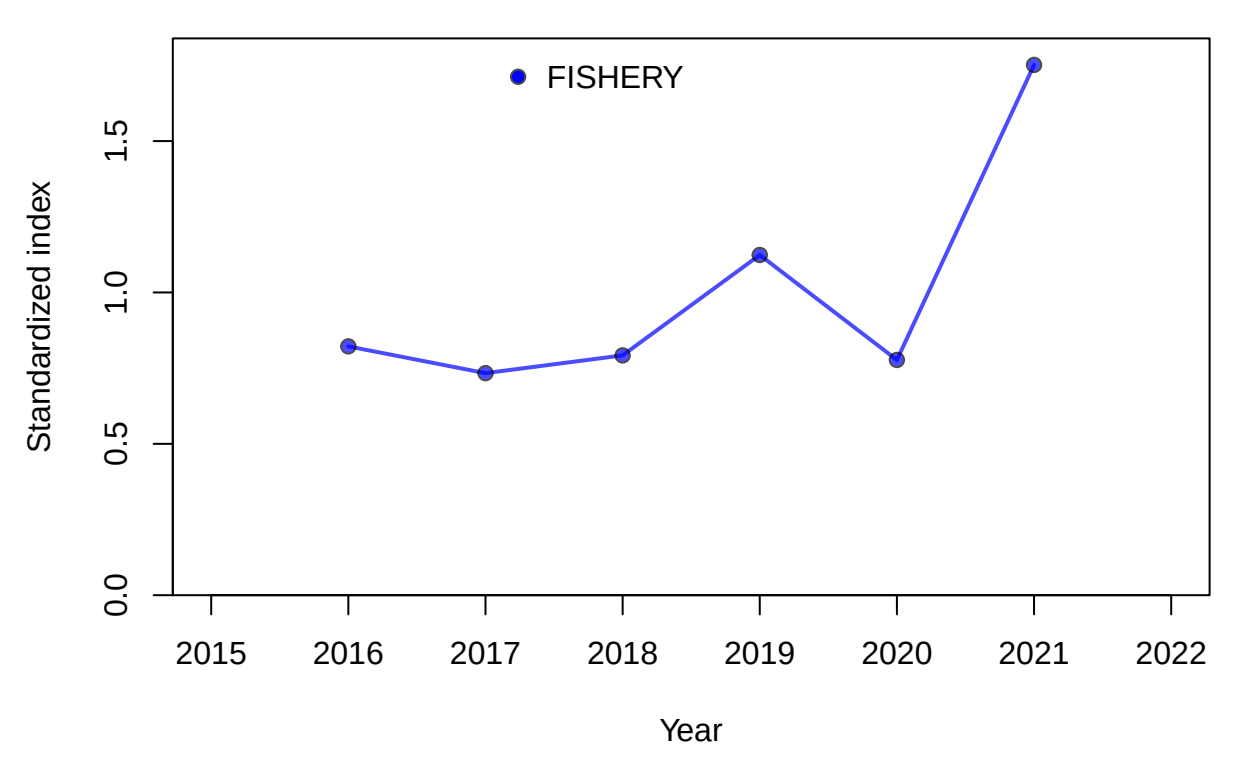

Log index
0.5
1.0
1.5
2.0
2.5
2016
2017
2018
2019
2020
2021
Year

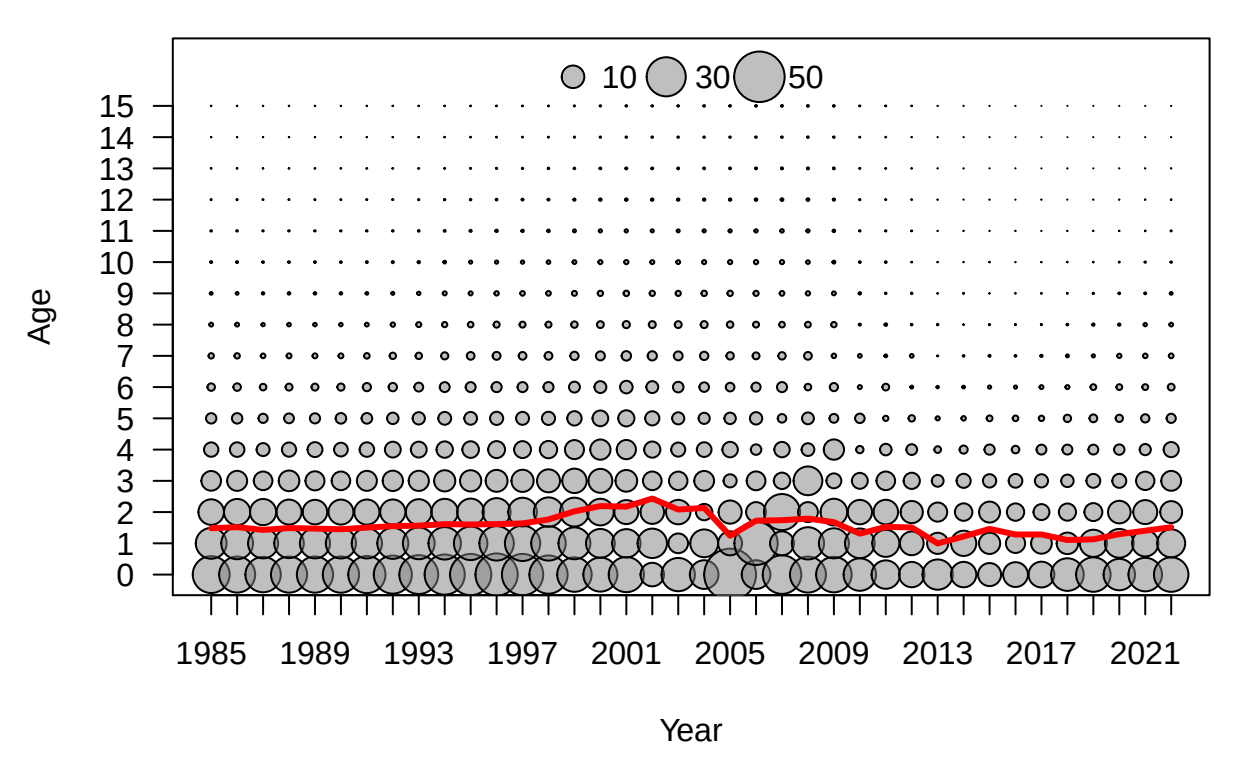

Log index
0.5
1.0
1.5
2.0
2.5
2016
2017
2018
2019
2020
2021
Year

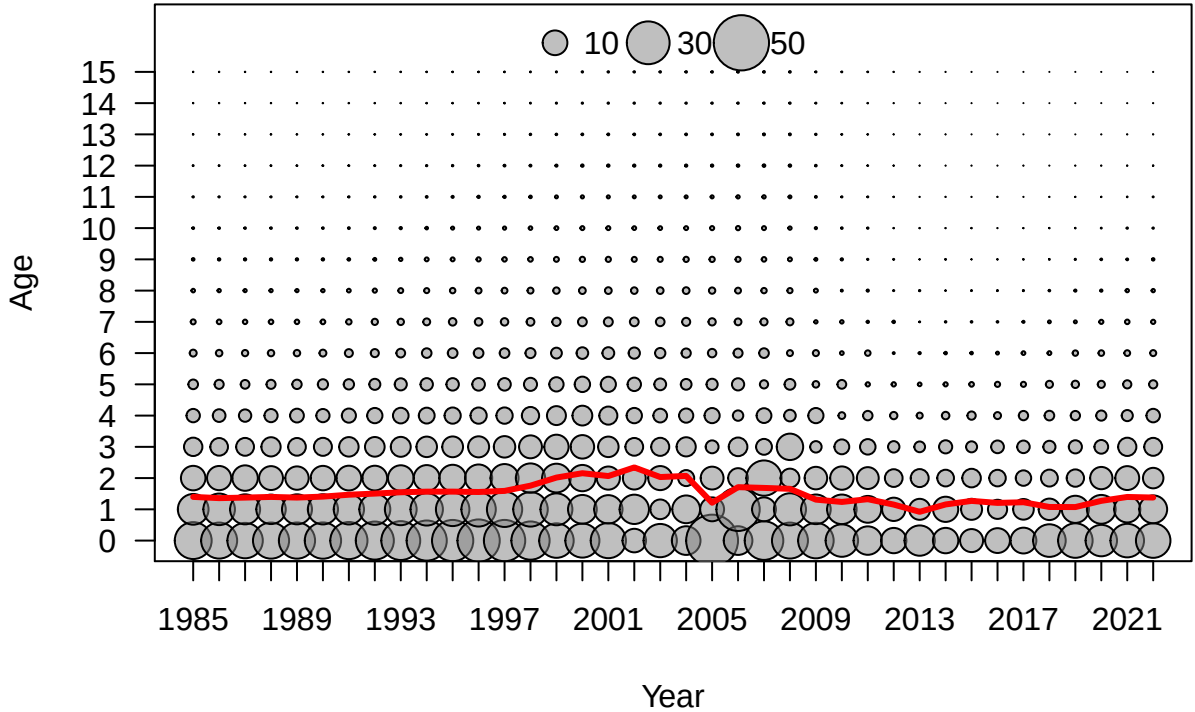

Log expected index
0.8
1.0
1.2
1.4
1.6
1.0
1.2
1.4
1.6
Log observed index

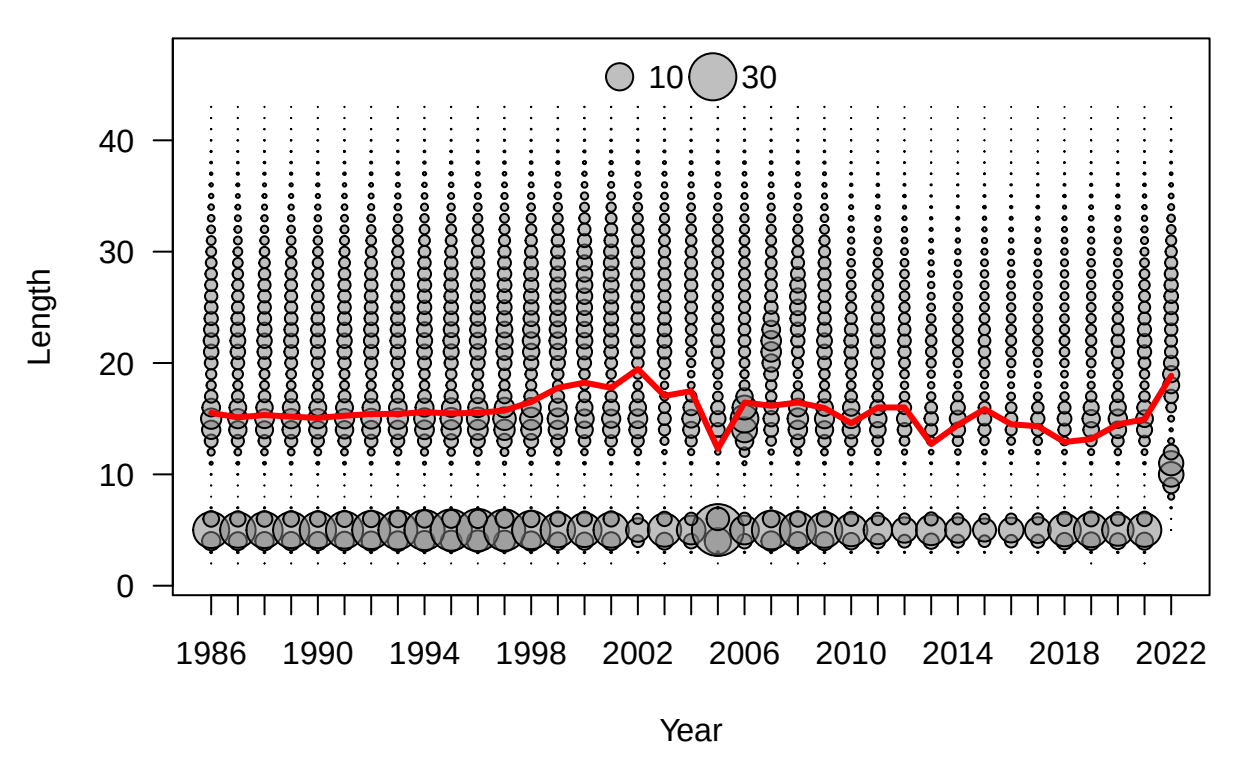

Residual
1
0
−1
2016
2017
2018
2019
2020
2021
Year

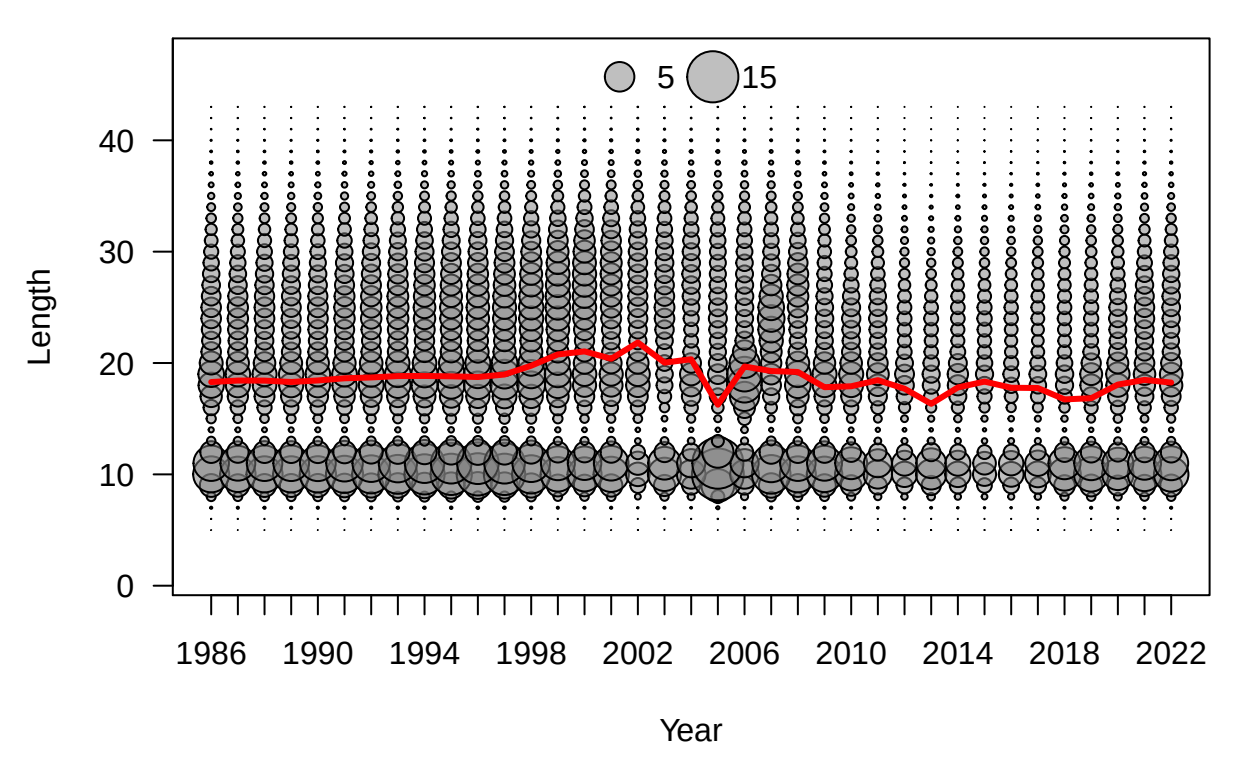

Deviation
0.4
0.2
0.0
−0.2
−0.4
2016
2017
2018
2019
2020
2021
Year

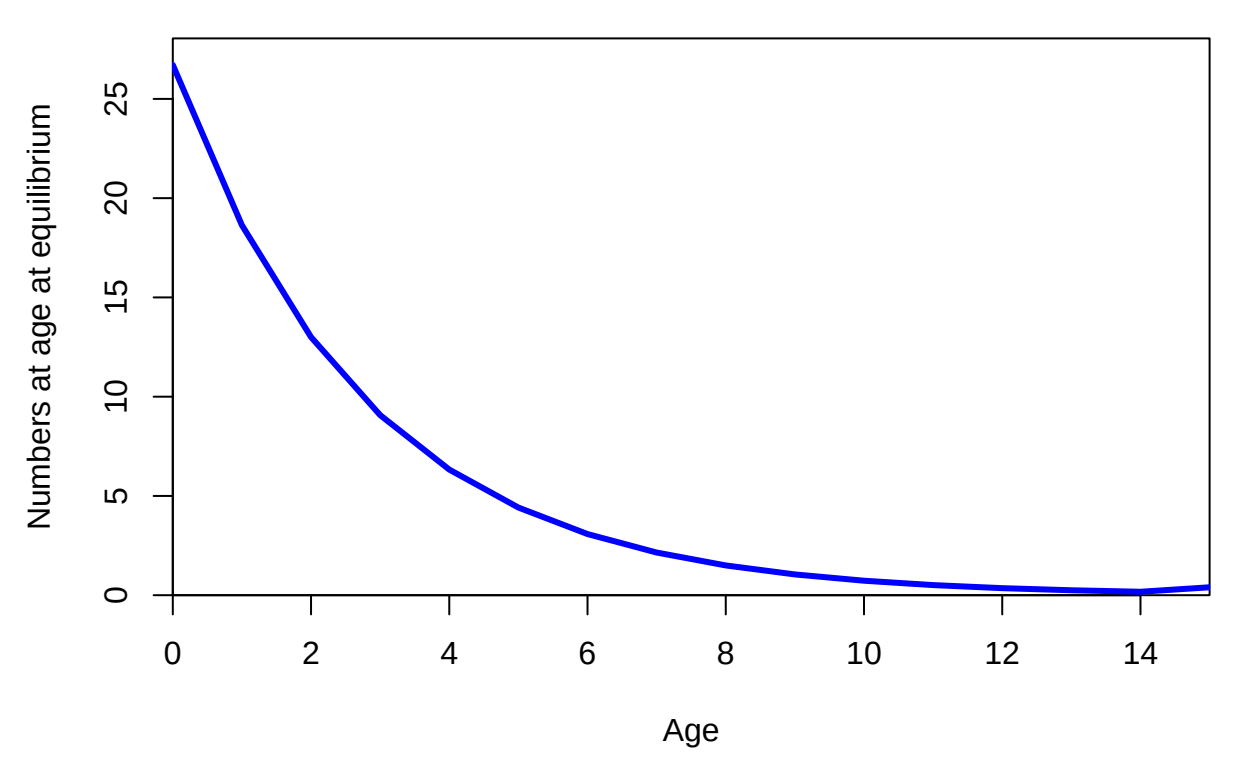

FISHERY
Standardized index
0.0
0.5
1.0
1.5
2015
2016
2017
2018
2019
2020
2021
2022
Year

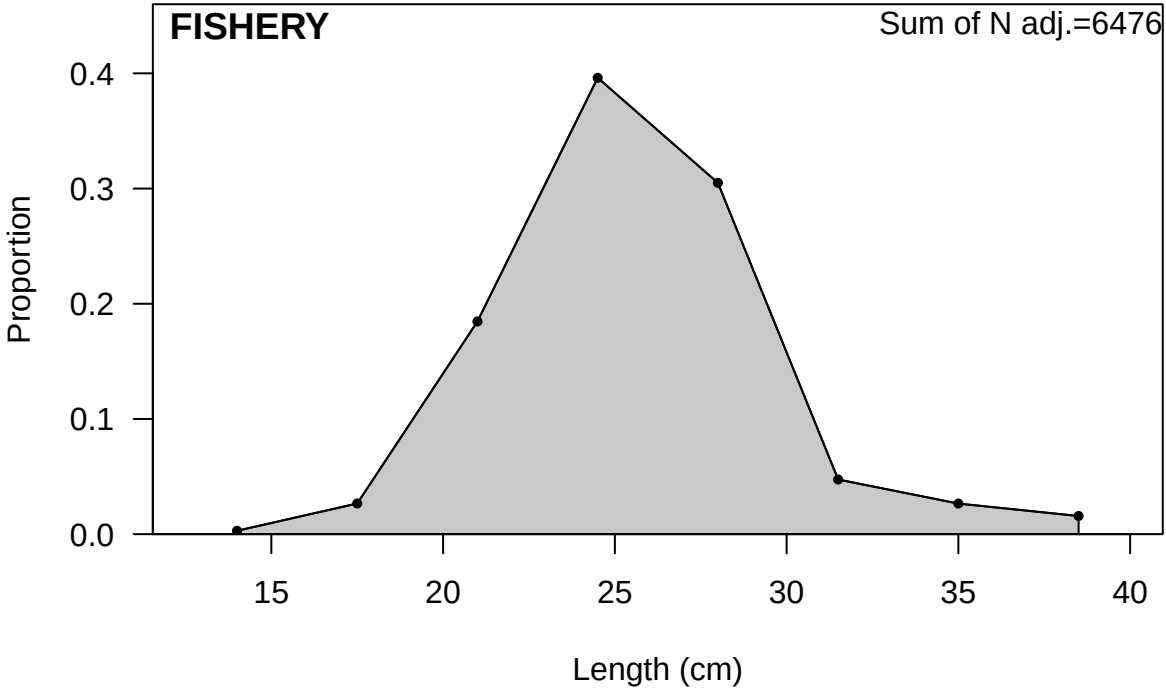

10
30
50
Age
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
1985
1989
1993
1997
2001
2005
2009
2013
2017
2021
Year

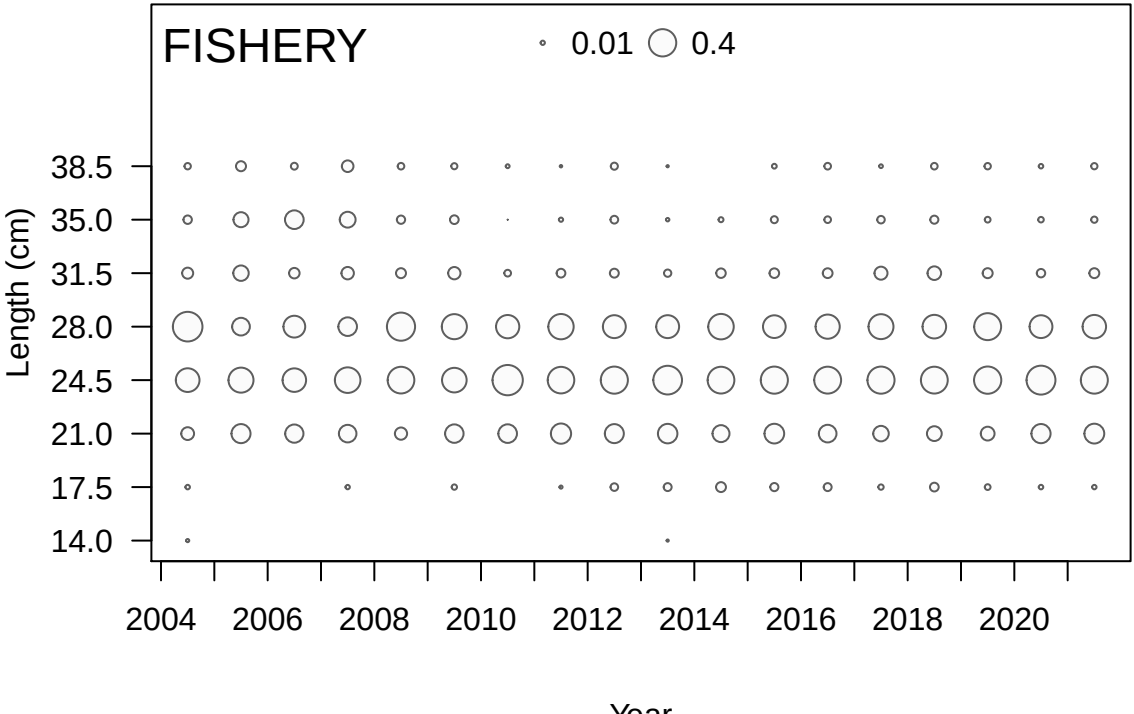

10
30
50
Age
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
1985
1989
1993
1997
2001
2005
2009
2013
2017
2021
Year

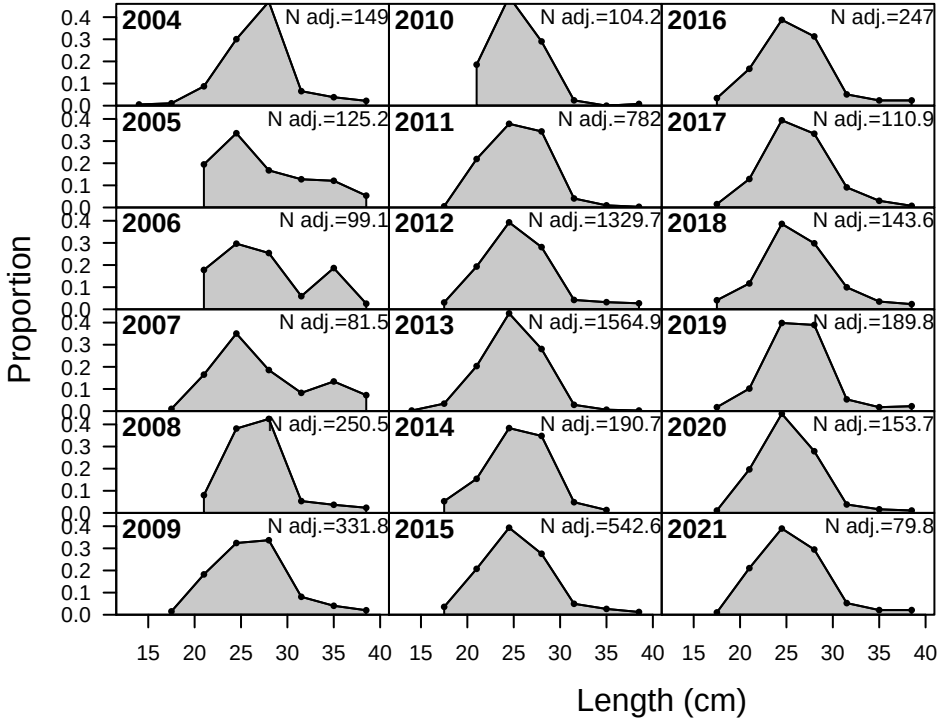

10
30
Length
0
10
20
30
40
1986
1990
1994
1998
2002
2006
2010
2014
2018
2022
Year

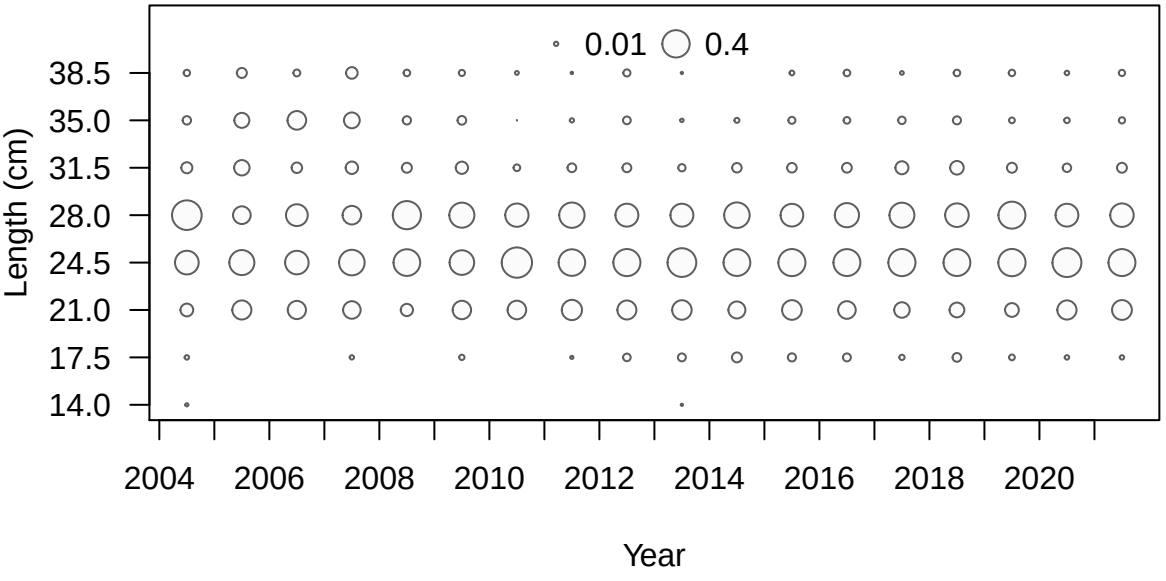

5
15
Length
0
10
20
30
40
1986
1990
1994
1998
2002
2006
2010
2014
2018
2022
Year

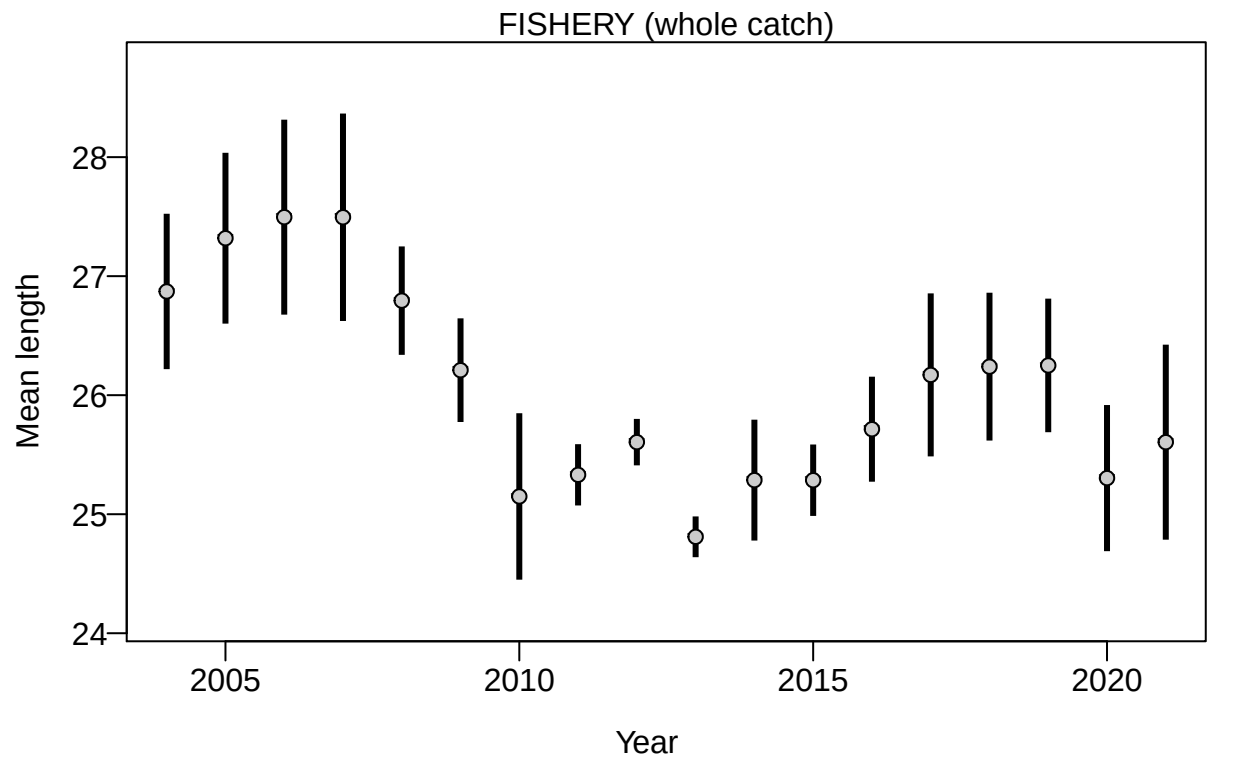

Numbers at age at equilibrium
0
5
10
15
20
25
0
2
4
6
8
10
12
14
Age

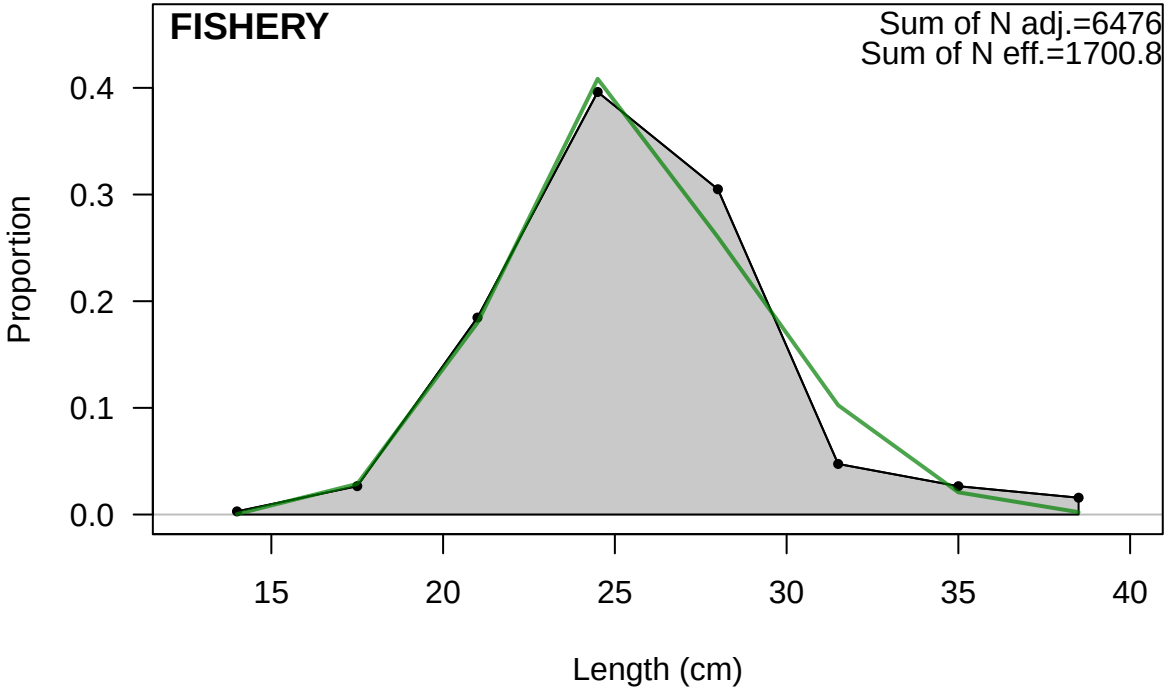

FISHERY
Sum of N adj.=6476
Proportion
0.0
0.1
0.2
0.3
0.4
15
20
25
30
35
40
Length (cm)

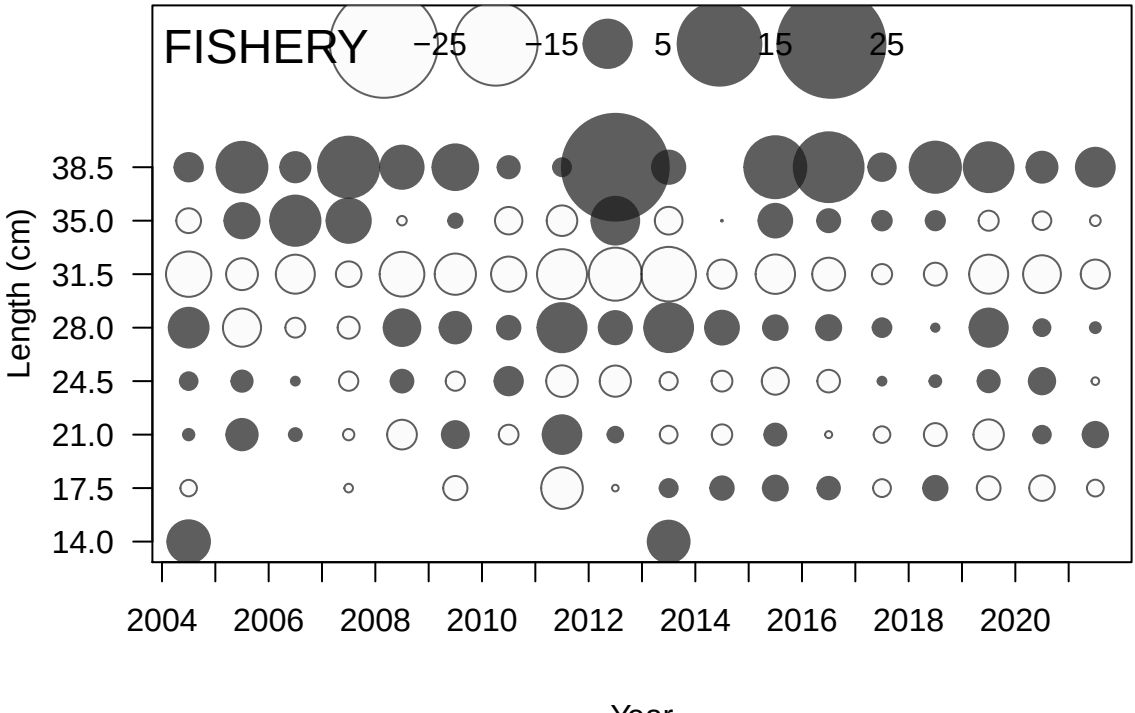

FISHERY
0.01
0.4
38.5
35.0
31.5
28.0
24.5
21.0
17.5
14.0
Length (cm)
2004
2006
2008
2010
2012
2014
2016
2018
2020
Year

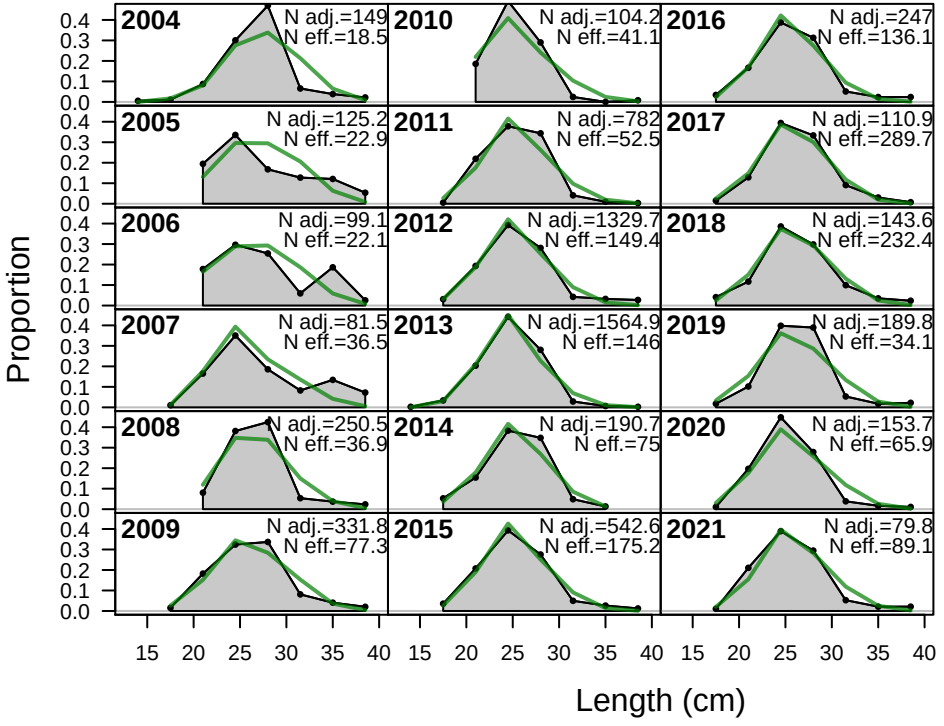

2004
N adj.=149
2010
N adj.=104.2
2016
N adj.=247
2005
N adj.=125.2
2011
N adj.=782
2017
N adj.=110.9
2006
N adj.=99.1
2012
N adj.=1329.7
2018
N adj.=143.6
2007
N adj.=81.5
2013
N adj.=1564.9
2019
N adj.=189.8
2008
N adj.=250.5
2014
N adj.=190.7
2020
N adj.=153.7
2009
N adj.=331.8
2015
N adj.=542.6
2021
N adj.=79.8
Proportion
0.0
0.1
0.2
0.3
0.4
15
20
25
30
35
40
Length (cm)

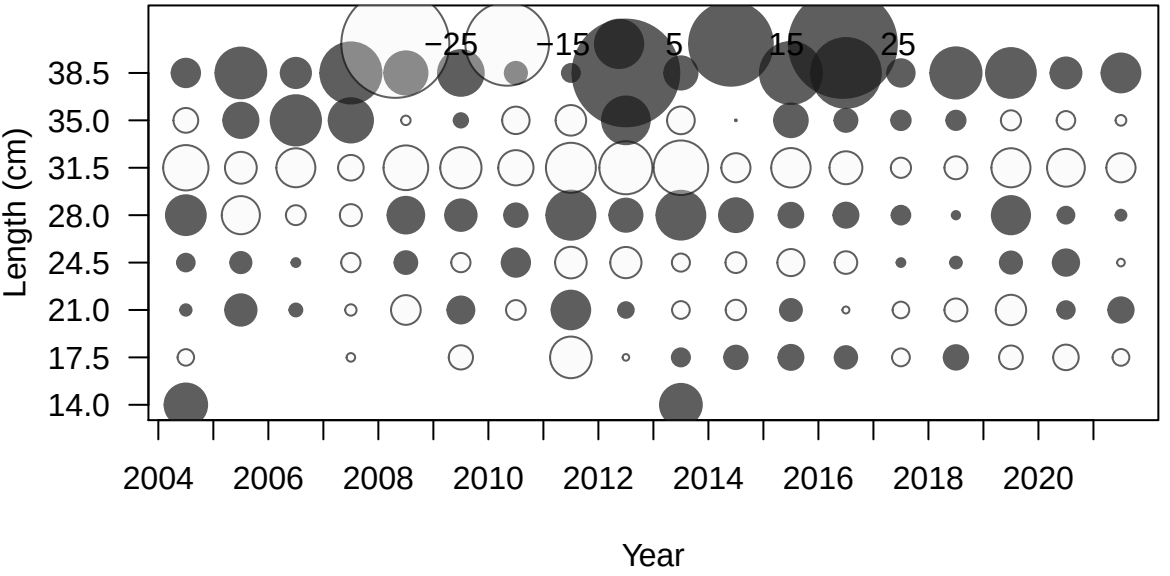

0.01
0.4
38.5
35.0
31.5
28.0
24.5
21.0
17.5
14.0
Length (cm)
2004
2006
2008
2010
2012
2014
2016
2018
2020
Year

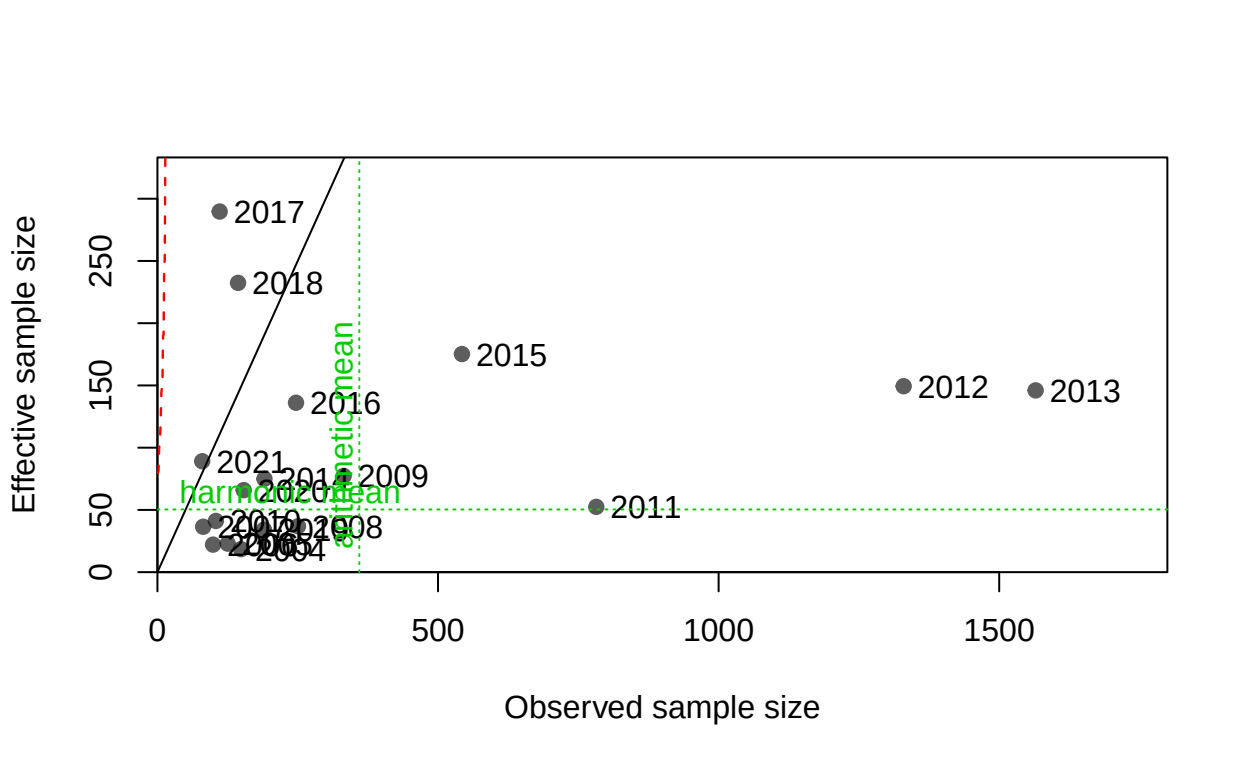

FISHERY (whole catch)
Mean length
28
27
26
25
24
2005
2010
2015
2020
Year

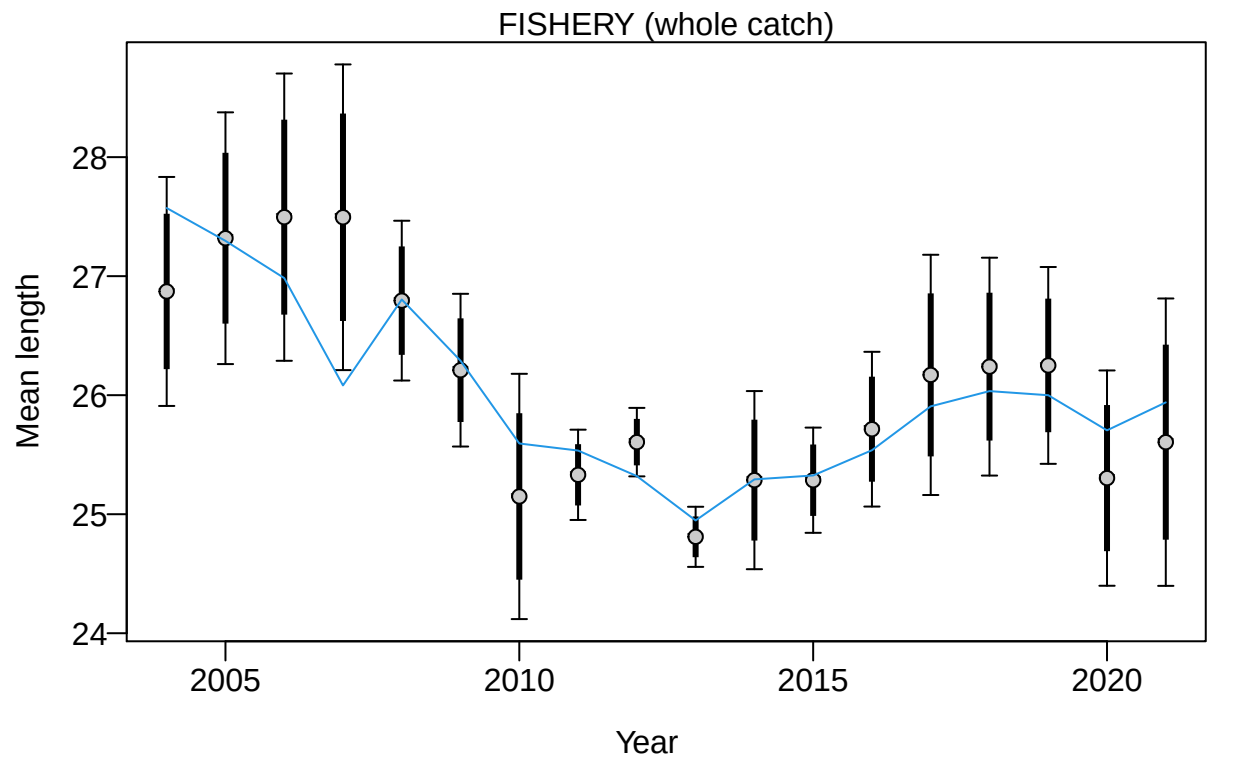

FISHERY
Sum of N adj.=6476
Sum of N eff.=1700.8
Proportion
0.0
0.1
0.2
0.3
0.4
15
20
25
30
35
40
Length (cm)

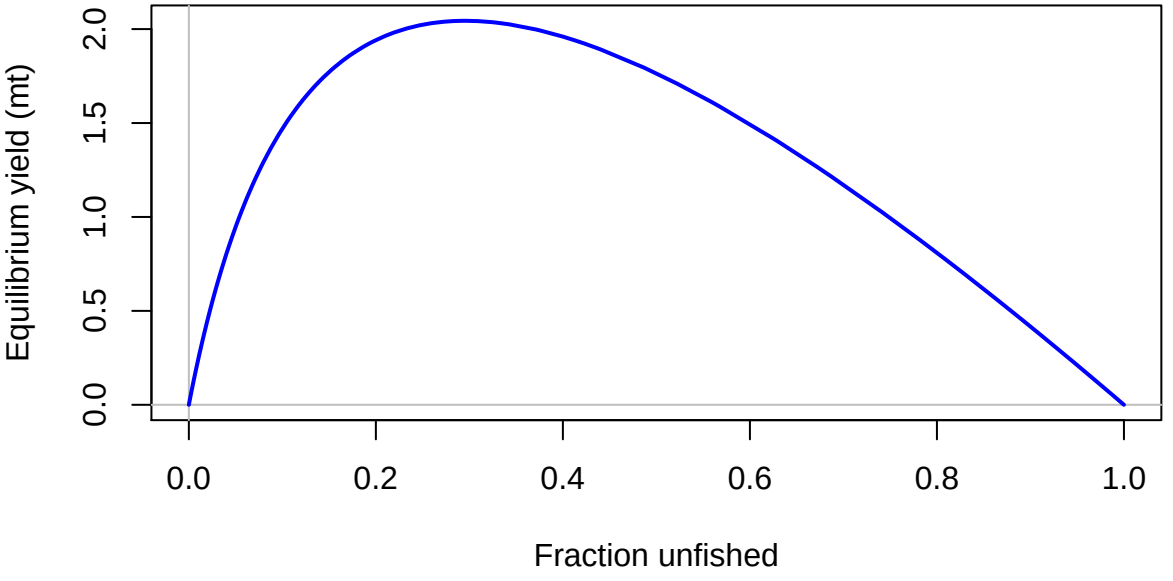

FISHERY
−25
−15
5
15
25
Length (cm)
38.5
35.0
31.5
28.0
24.5
21.0
17.5
14.0
2004
2006
2008
2010
2012
2014
2016
2018
2020
Year

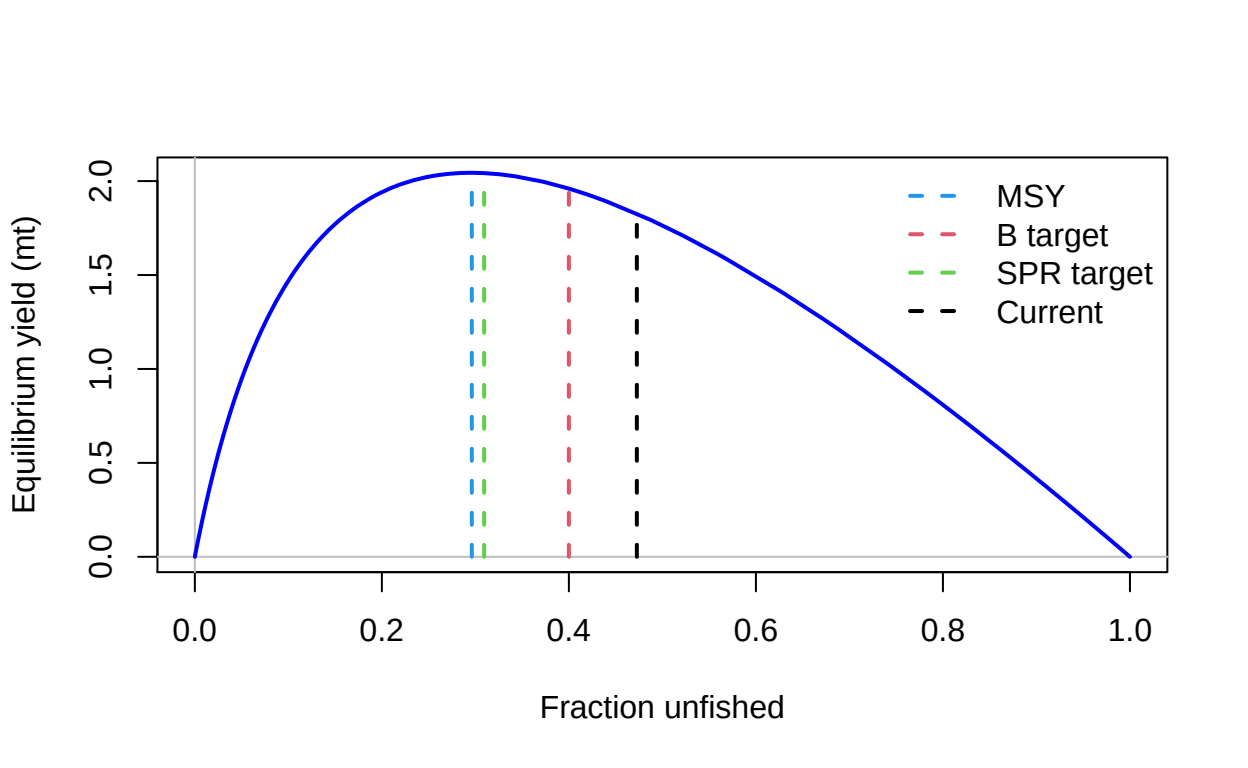

2004
N adj.=149
N eff.=18.5
2010
N adj.=104.2
N eff.=41.1
2016
N adj.=247
N eff.=136.1
2005
N adj.=125.2
N eff.=22.9
2011
N adj.=782
N eff.=52.5
2017
N adj.=110.9
N eff.=289.7
2006
N adj.=99.1
N eff.=22.1
2012
N adj.=1329.7
N eff.=149.4
2018
N adj.=143.6
N eff.=232.4
2007
N adj.=81.5
N eff.=36.5
2013
N adj.=1564.9
N eff.=146
2019
N adj.=189.8
N eff.=34.1
2008
N adj.=250.5
N eff.=36.9
2014
N adj.=190.7
N eff.=75
2020
N adj.=153.7
N eff.=65.9
2009
N adj.=331.8
N eff.=77.3
2015
N adj.=542.6
N eff.=175.2
2021
N adj.=79.8
N eff.=89.1
Proportion
0.0
0.1
0.2
0.3
0.4
15
20
25
30
35
40
Length (cm)

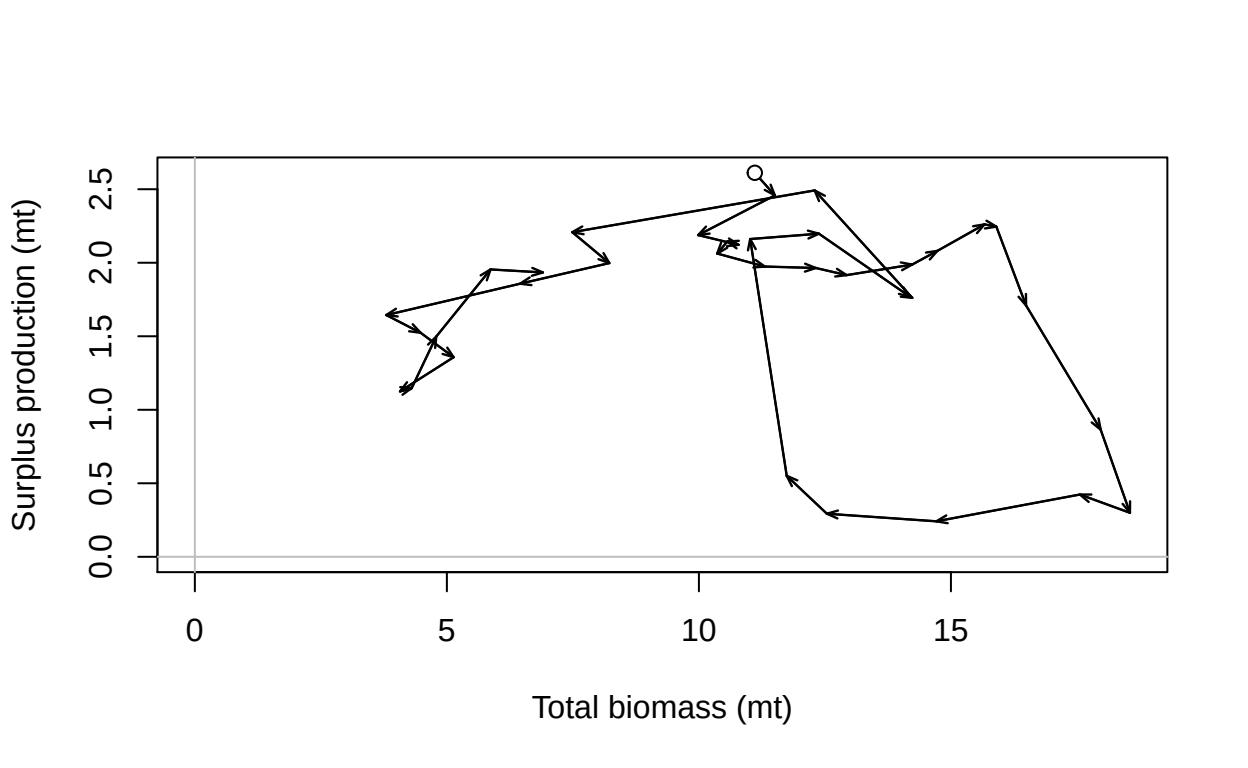

−25
−15
5
15
25
38.5
35.0
31.5
28.0
24.5
21.0
17.5
14.0
Length (cm)
2004
2006
2008
2010
2012
2014
2016
2018
2020
Year

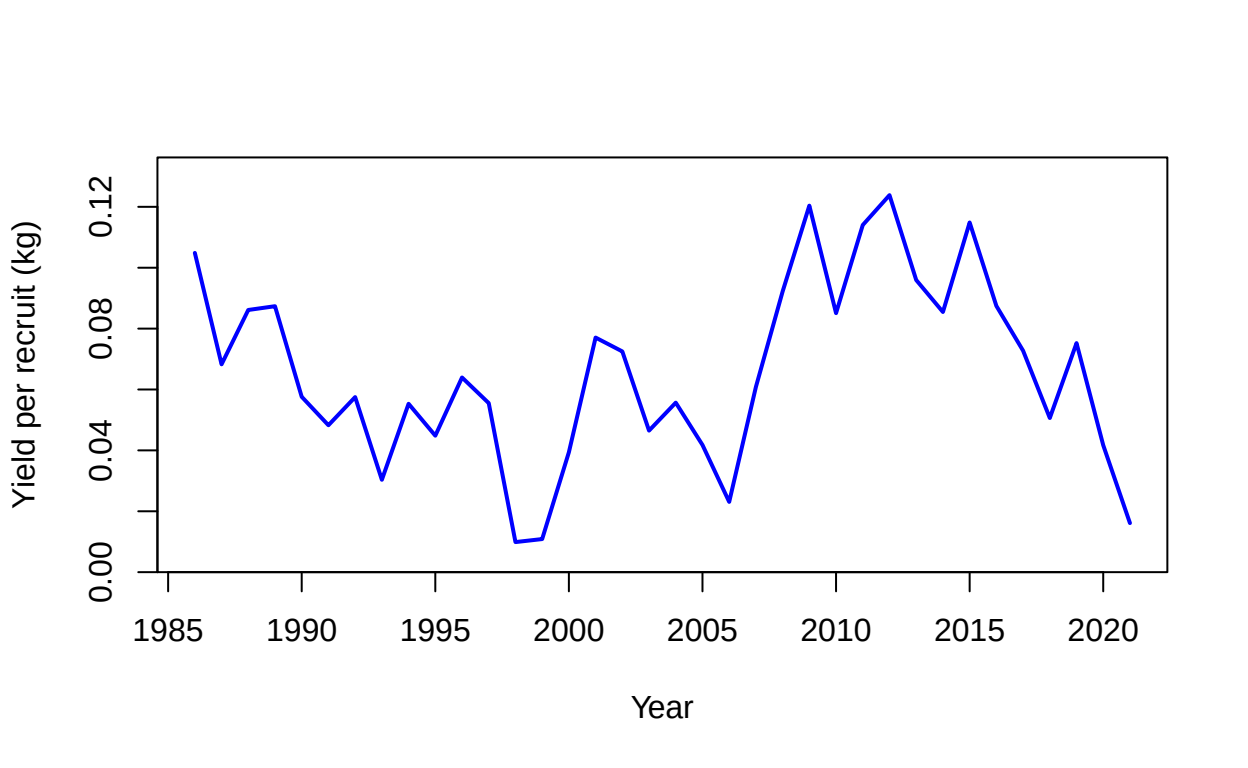

Effective sample size
0
50
150
250
0
500
1000
1500
Observed sample size
2017
2018
2015
2012
2013
2016
2021
2009
2011
2008
2004
harmonic mean
arithetic mean

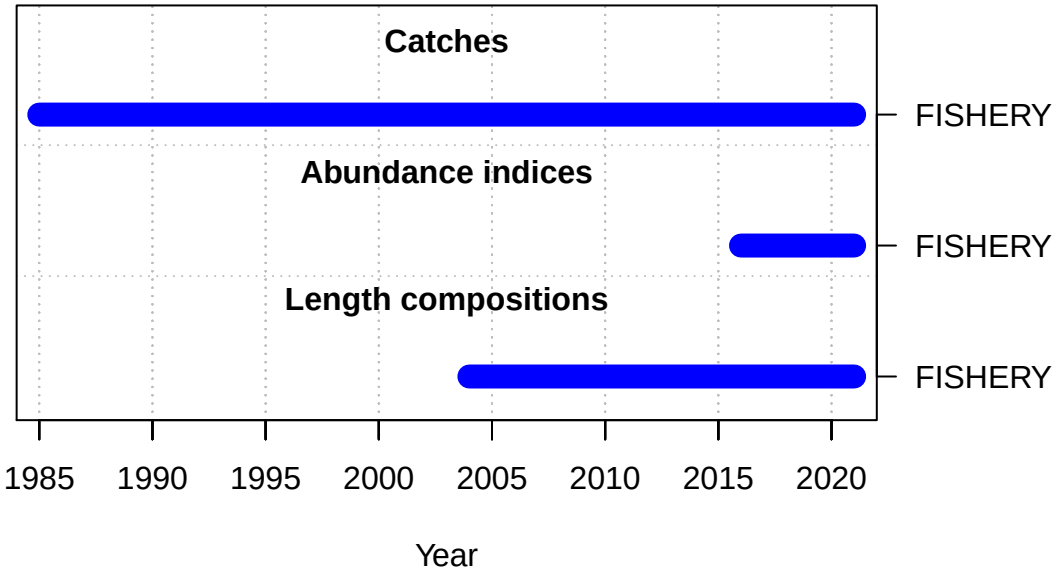

FISHERY (whole catch)
Mean length
28
27
26
25
24
2005
2010
2015
2020
Year

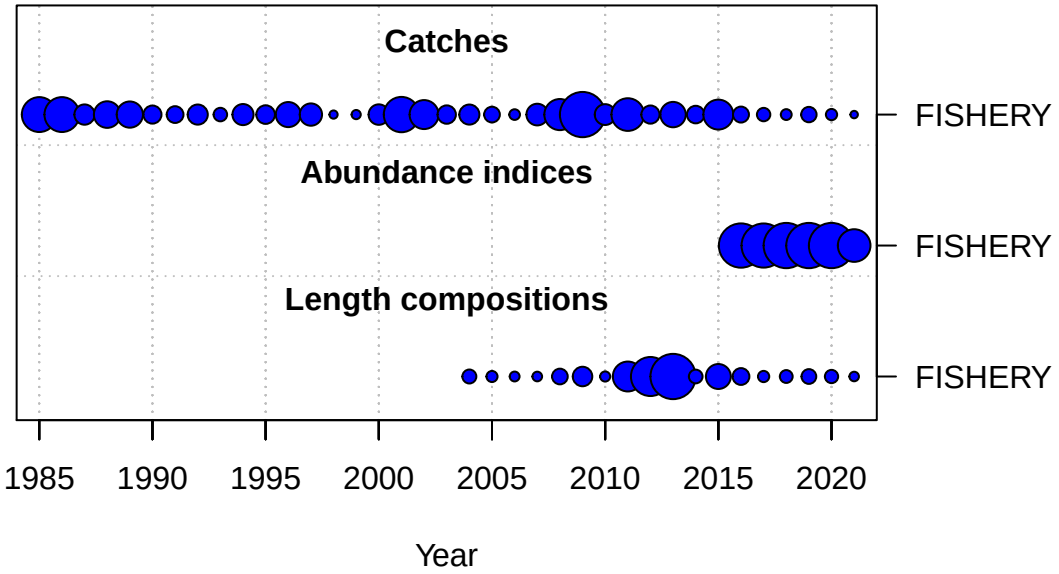

Equilibrium yield (mt)
0.0
0.5
1.0
1.5
2.0
0.0
0.2
0.4
0.6
0.8
1.0
Fraction unfished

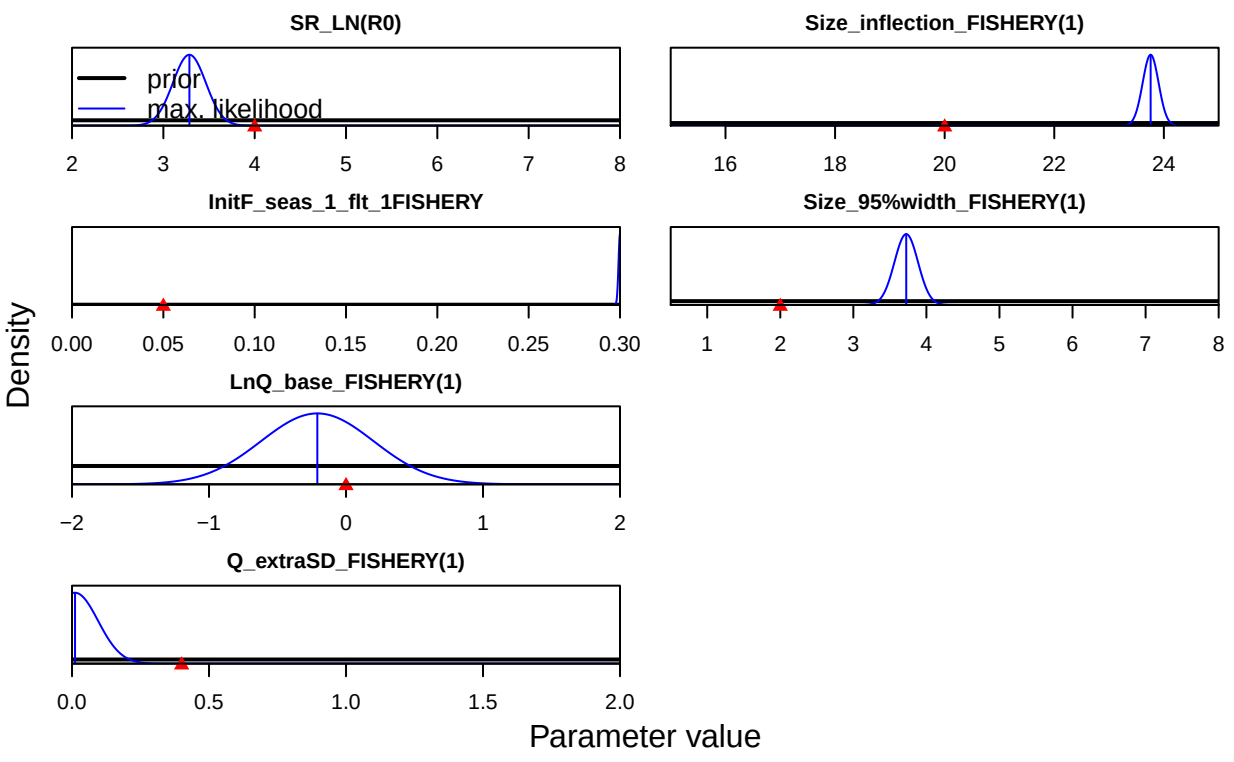

Equilibrium yield (mt)
0.0
0.5
1.0
1.5
2.0
0.0
0.2
0.4
0.6
0.8
1.0
Fraction unfished
MSY
B target
SPR target
Current


Surplus production (mt)
0.0
0.5
1.0
1.5
2.0
2.5
0
5
10
15
Total biomass (mt)


Yield per recruit (kg)
0.00
0.04
0.08
0.12
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
3
4
5
6
7
8
Size_inflection_FISHERY(1)
16
18
20
22
24
InitF_seas_1_flt_1FISHERY
0.00
0.05
0.10
0.15
0.20
0.25
0.30
Size_95%width_FISHERY(1)
1
2
3
4
5
6
7
8
LnQ_base_FISHERY(1)
−2
−1
0
1
2
Q_extraSD_FISHERY(1)
0.0
0.5
1.0
1.5
2.0
Density
Parameter value