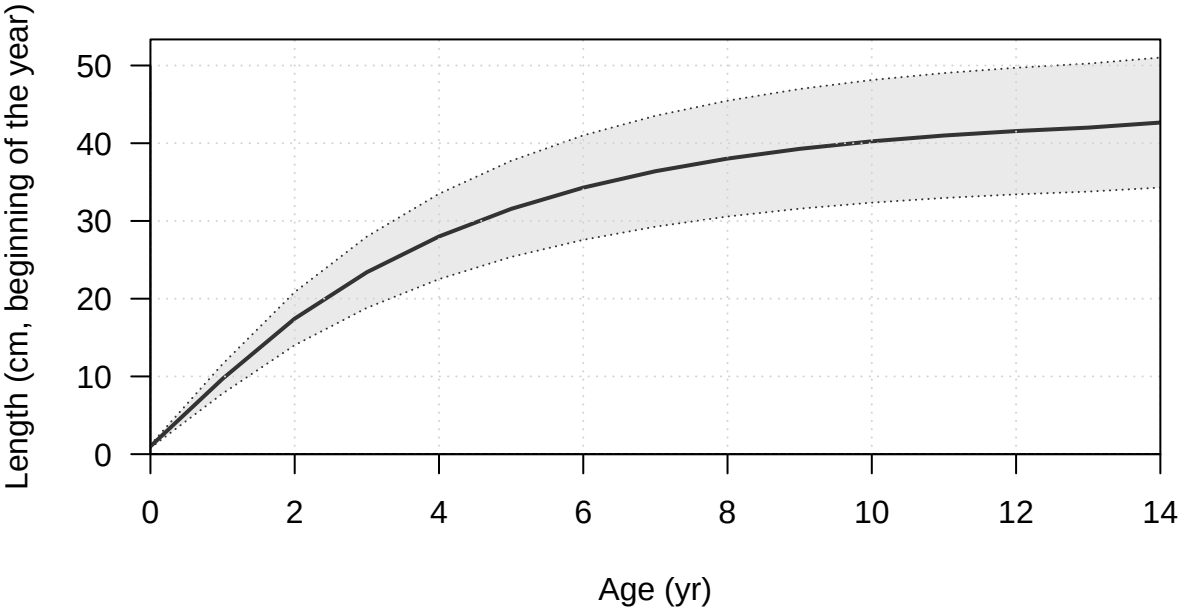
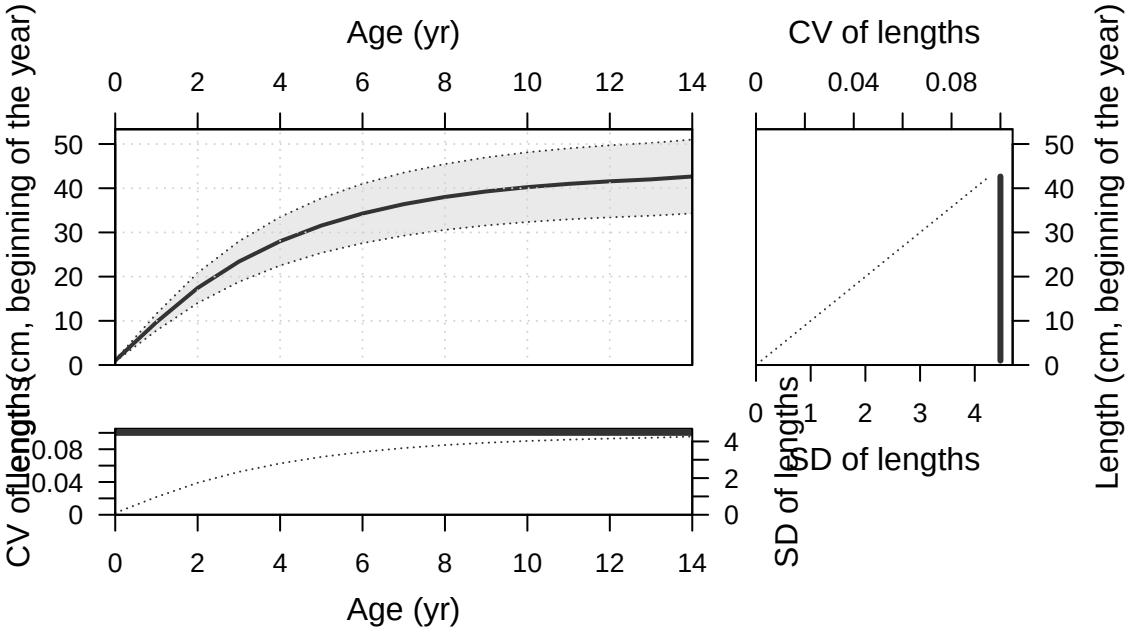
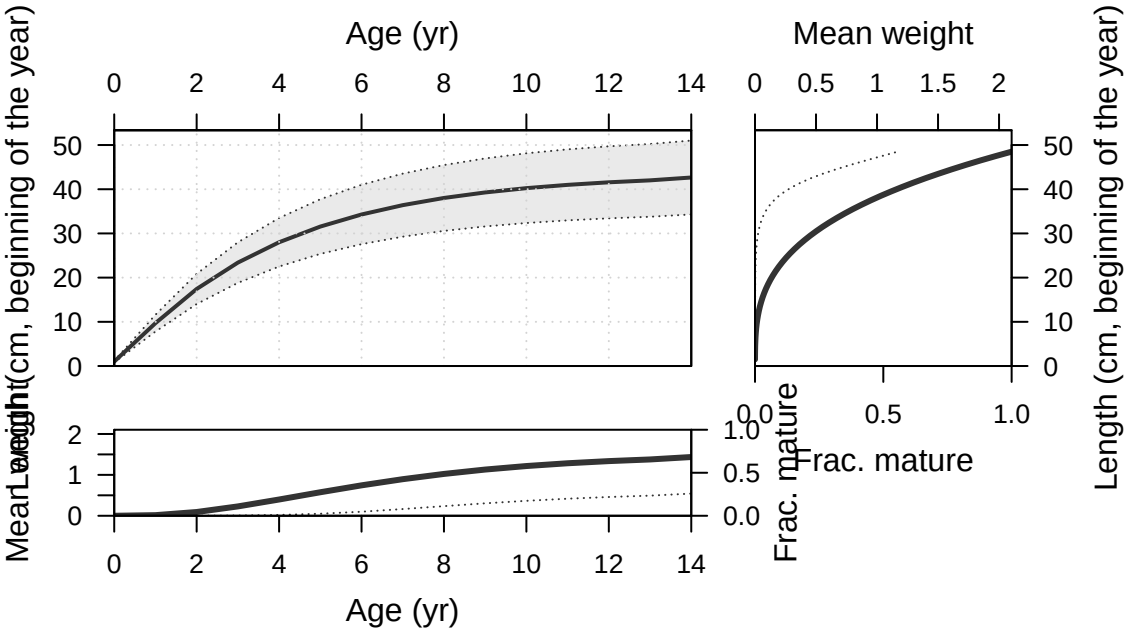
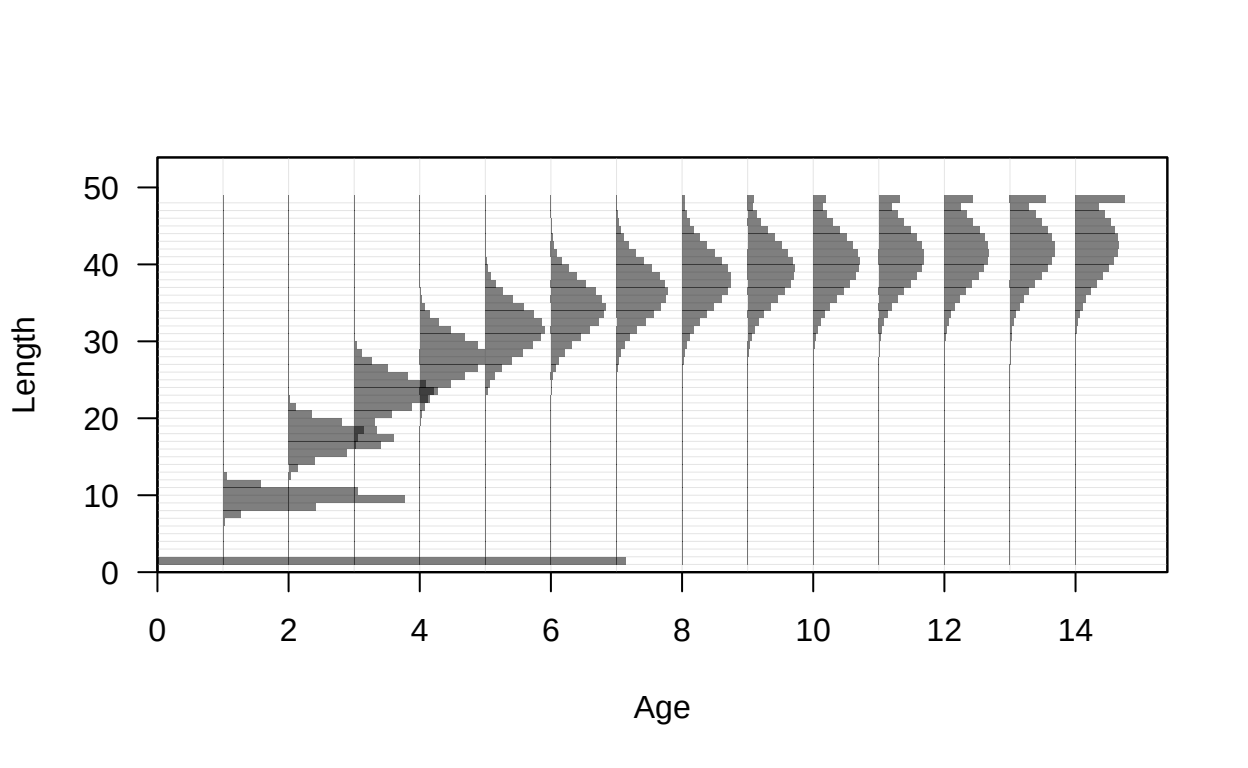
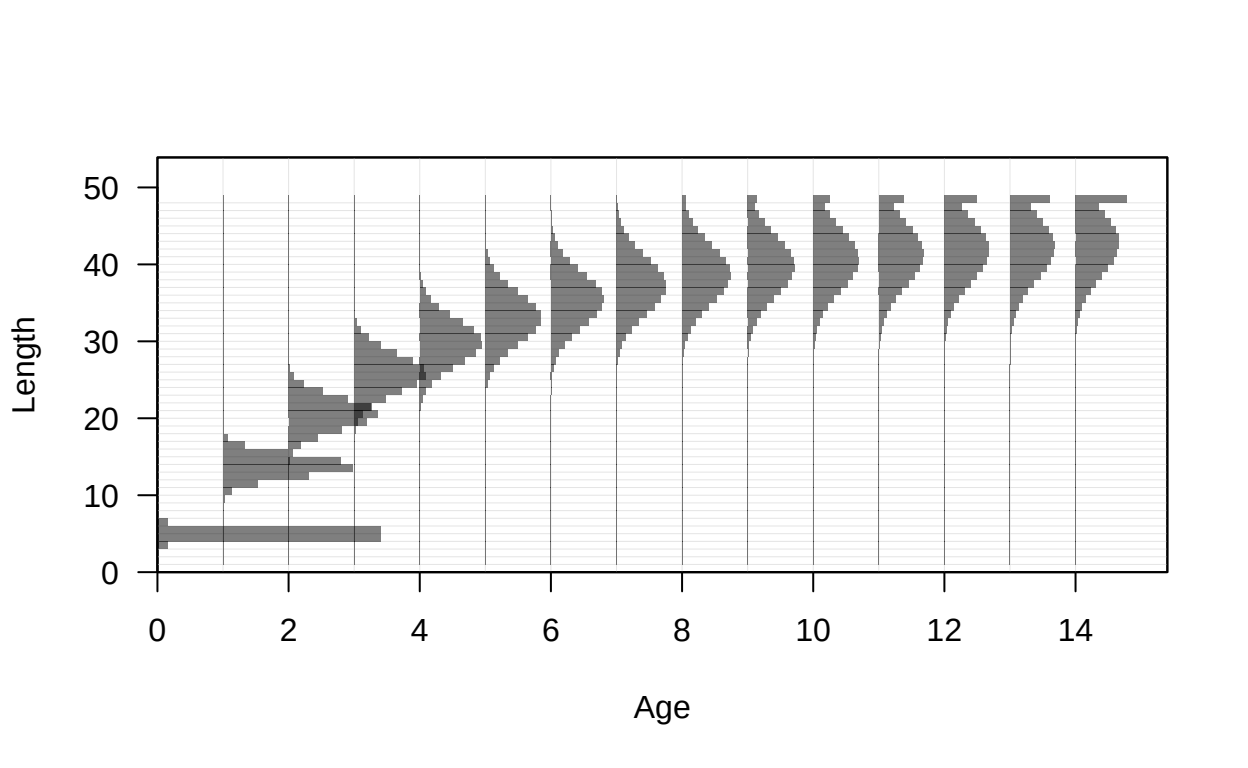
Plots created using the 'r4ss' package in R
Stock Synthesis version: 3.30.19.0
StartTime: Wed Jul 13 14:25:19 2022
Data_File: data.ss
Control_File: control.ss

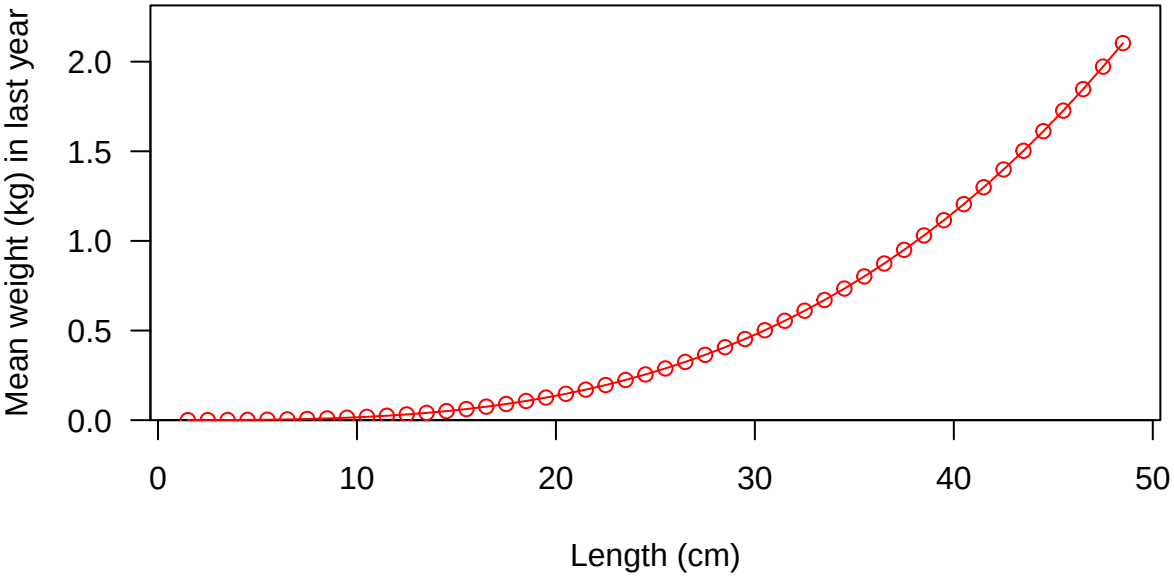

Length (cm, beginning of the year)
0
10
20
30
40
50
0
2
4
6
8
10
12
14
Age (yr)

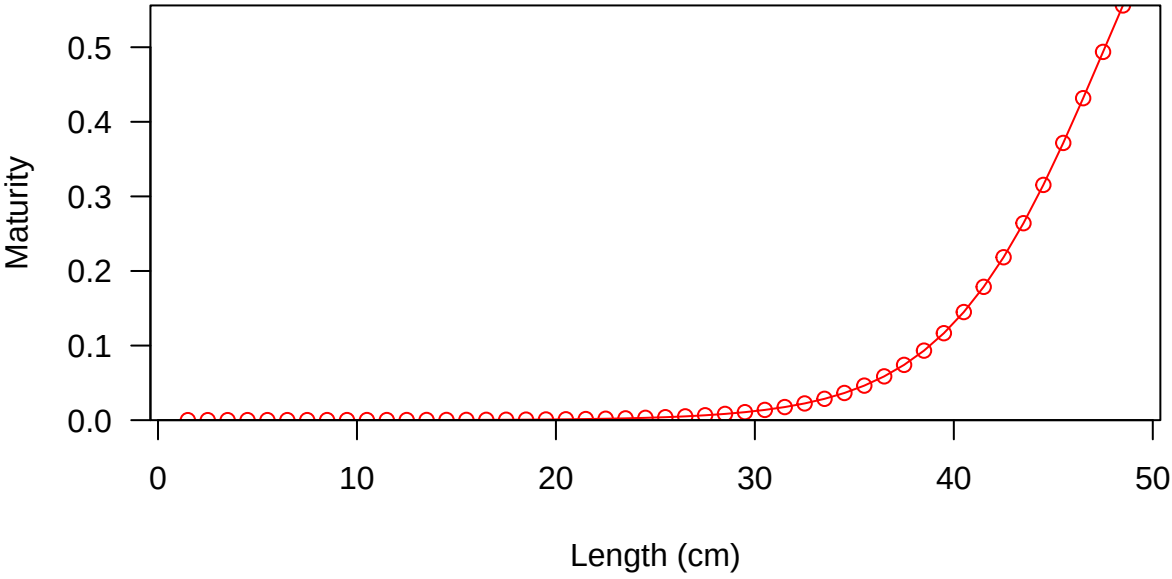

Age (yr)
0
2
4
6
8
10
12
14
Length (cm, beginning of the year)
0
10
20
30
40
50
CV of lengths
0
0.04
0.08
SD of lengths
0
1
2
3
4
Age (yr)

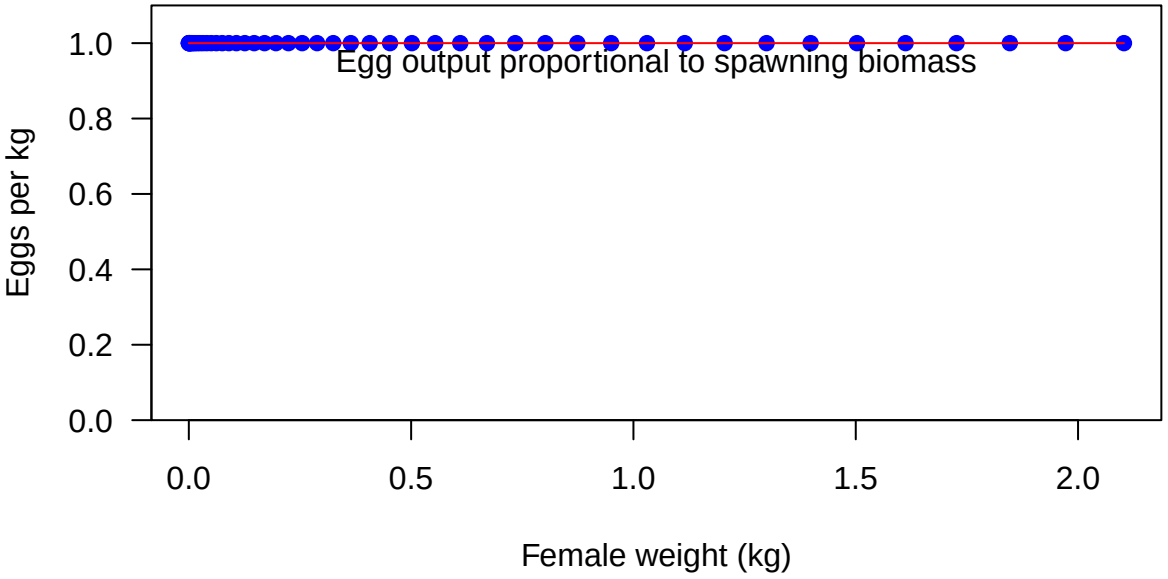

Age (yr)
Mean weight
Length (cm, beginning of the year)
Mean weight
Frac. mature
Age (yr)
Frac. mature
Length (cm, beginning of the year)

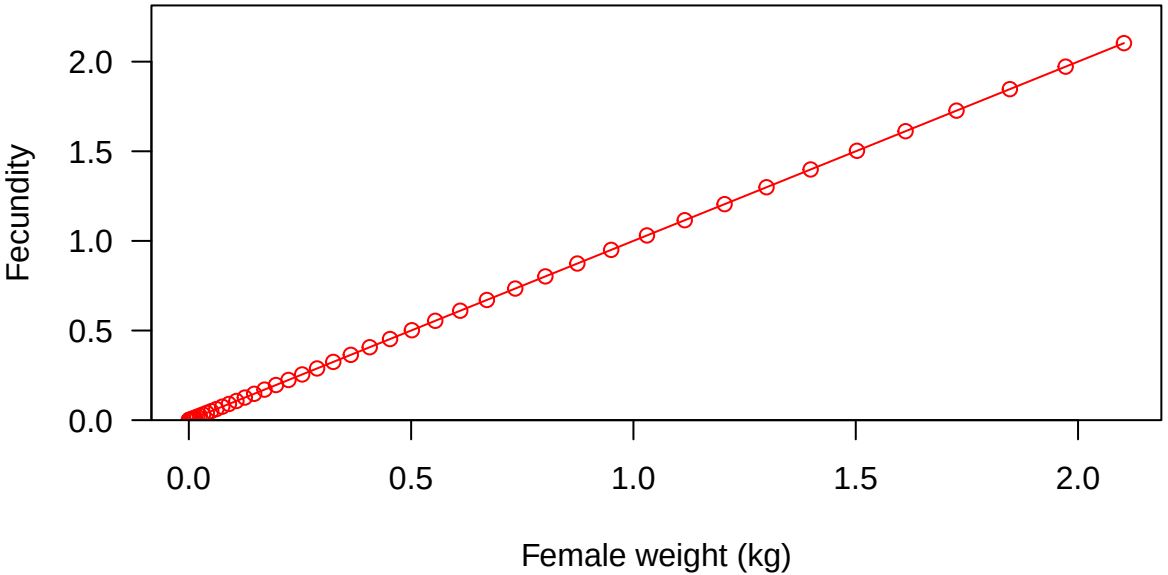

Length
50
40
30
20
10
0
0
2
4
6
8
10
12
14
Age

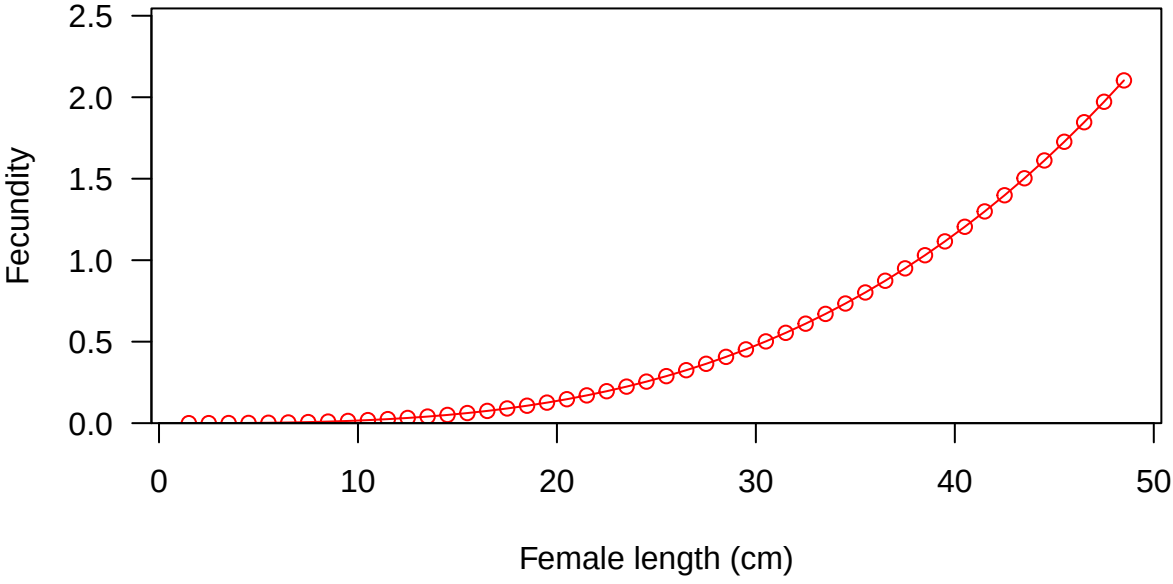

Length
50
40
30
20
10
0
0
2
4
6
8
10
12
14
Age

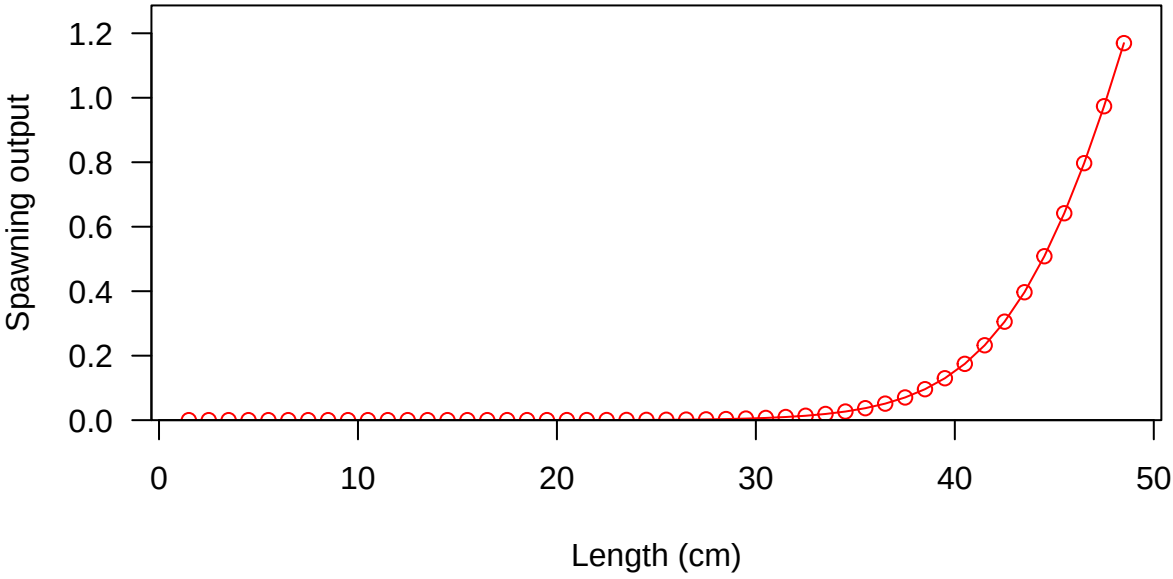

Mean weight (kg) in last year
0.0
0.5
1.0
1.5
2.0
0
10
20
30
40
50
Length (cm)

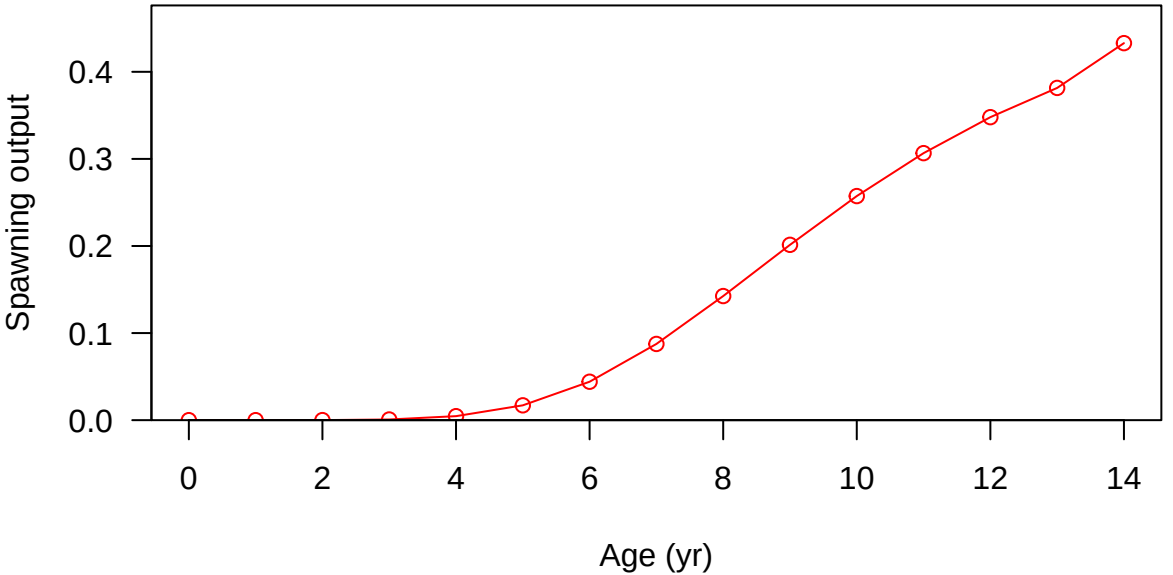

Maturity
0.0
0.1
0.2
0.3
0.4
0.5
0
10
20
30
40
50
Length (cm)

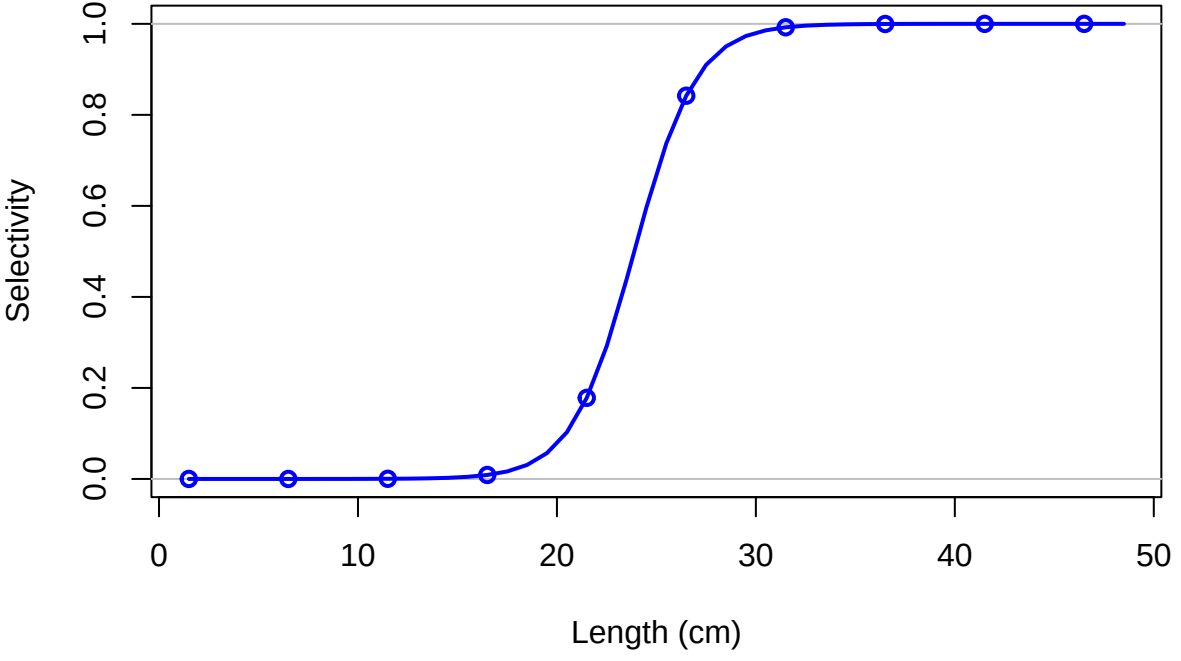

Egg output proportional to spawning biomass
Eggs per kg
1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.5
1.0
1.5
2.0
Female weight (kg)

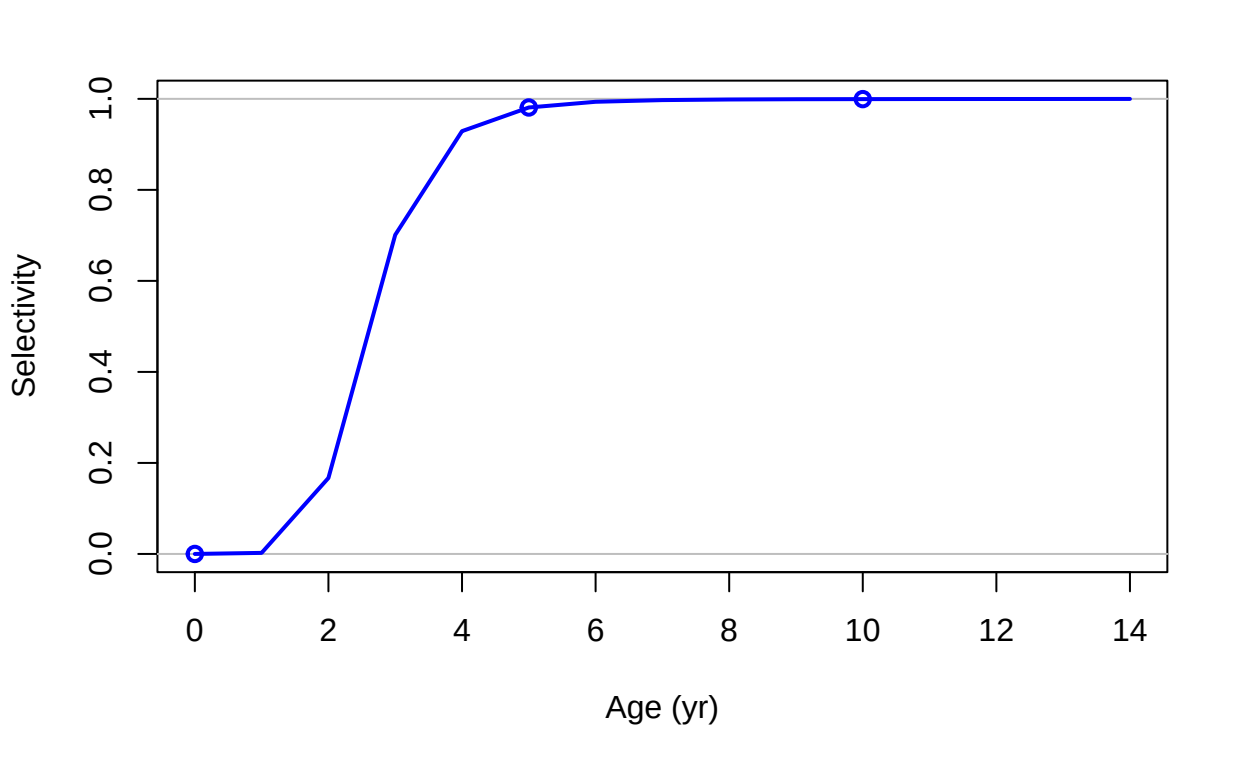

Fecundity
0.0
0.5
1.0
1.5
2.0
0.0
0.5
1.0
1.5
2.0
Female weight (kg)

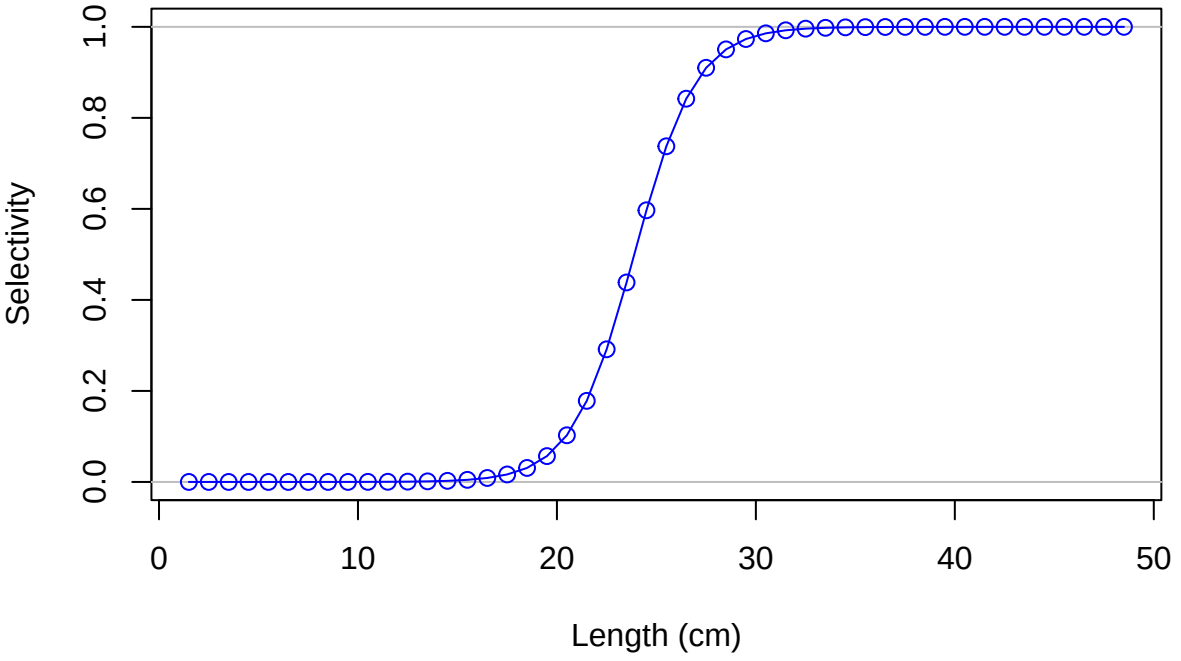

Fecundity
2.5
2.0
1.5
1.0
0.5
0.0
0
10
20
30
40
50
Female length (cm)

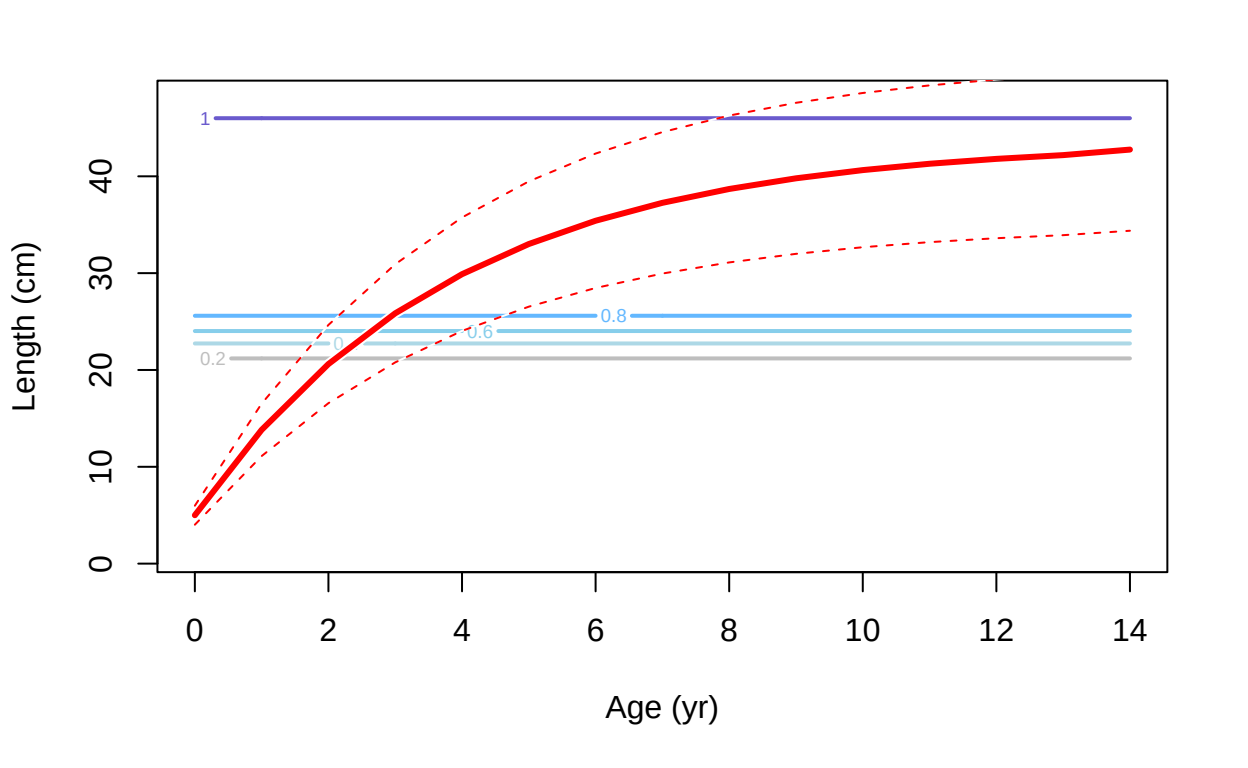

Spawning output
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0
10
20
30
40
50
Length (cm)

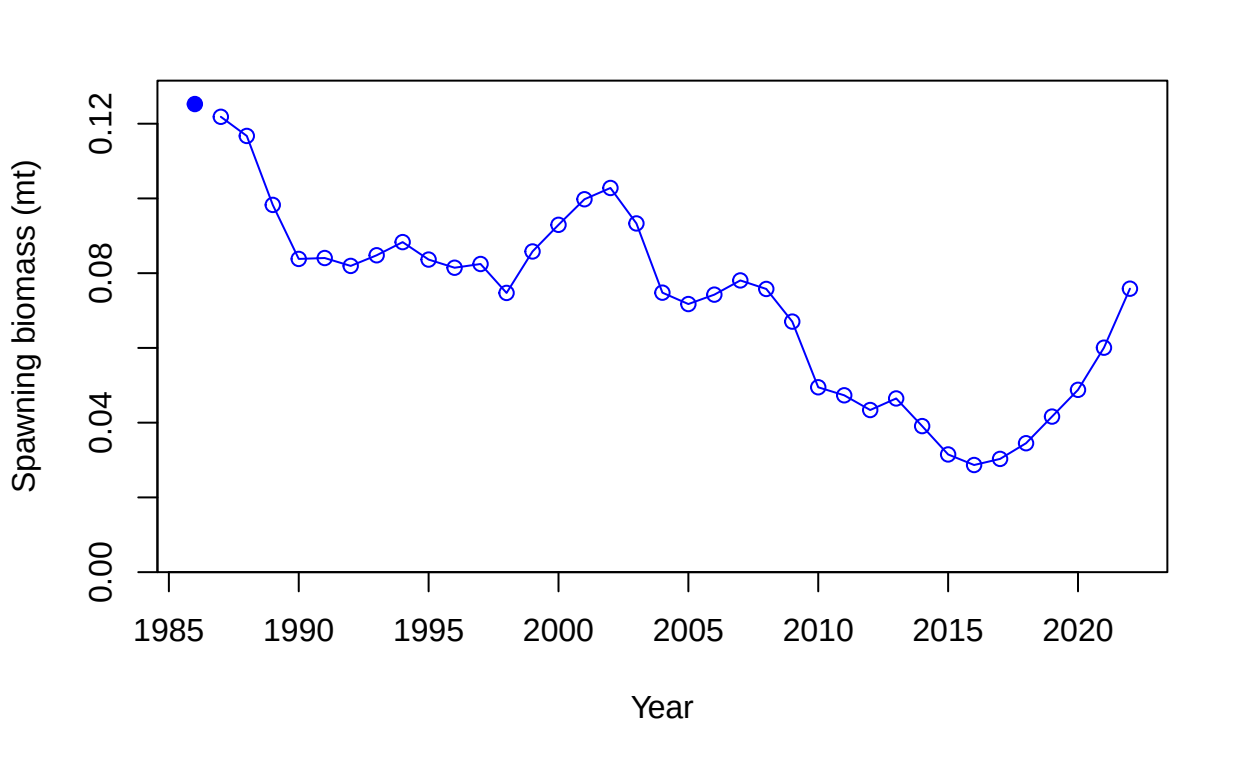

Spawning output
0.0
0.1
0.2
0.3
0.4
0
2
4
6
8
10
12
14
Age (yr)

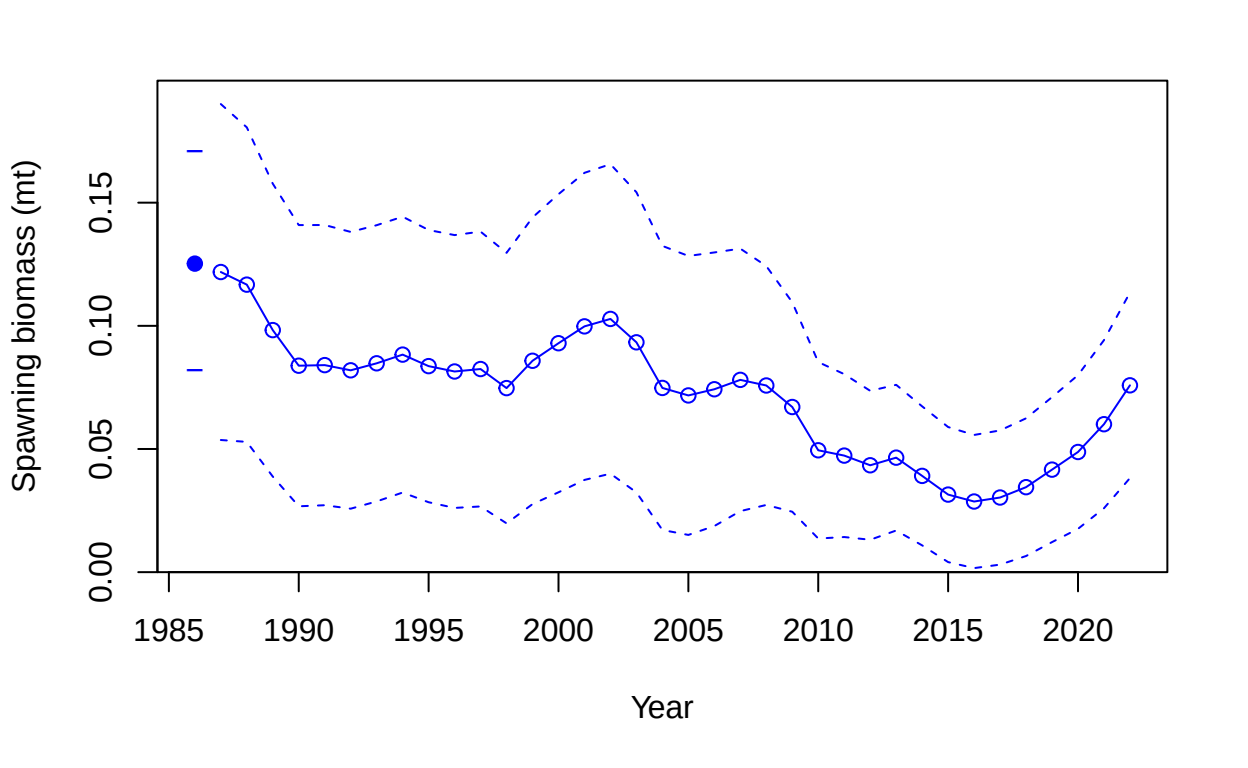

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
10
20
30
40
50
Length (cm)

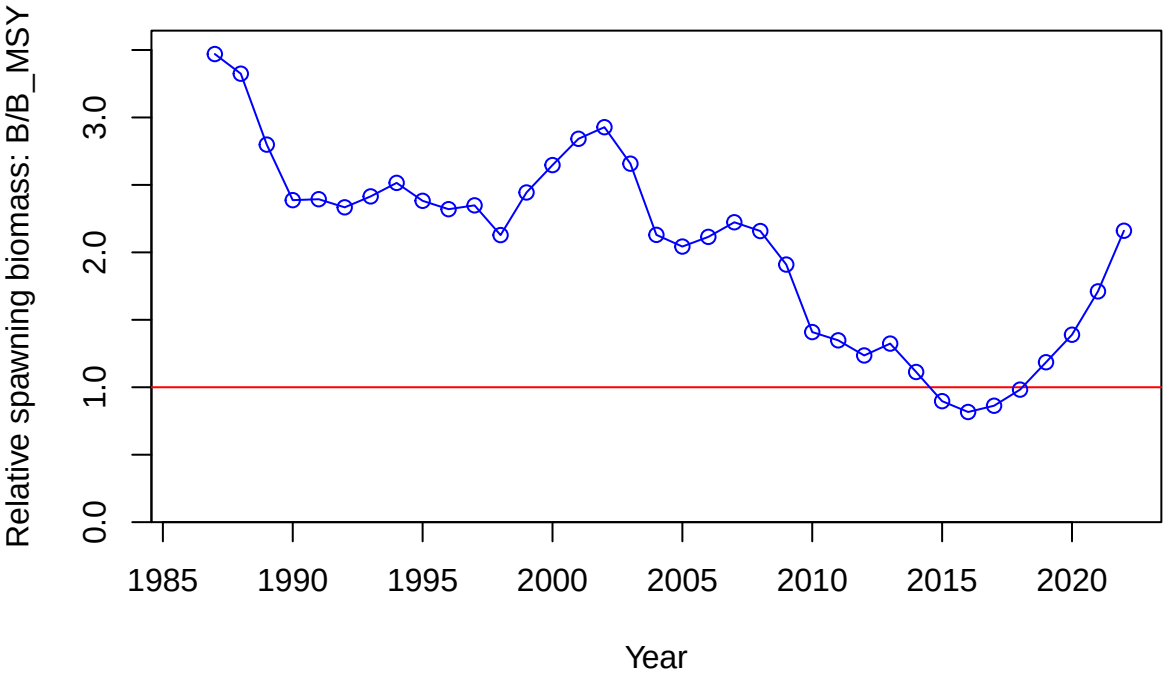

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
2
4
6
8
10
12
14
Age (yr)

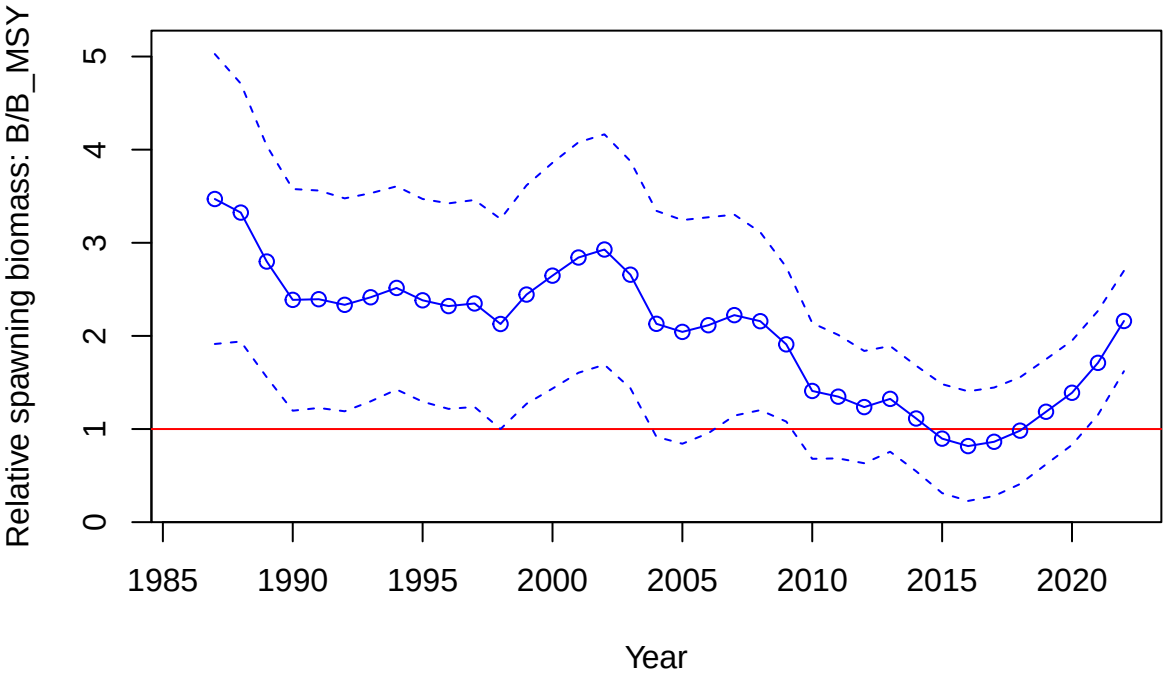

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
10
20
30
40
50
Length (cm)

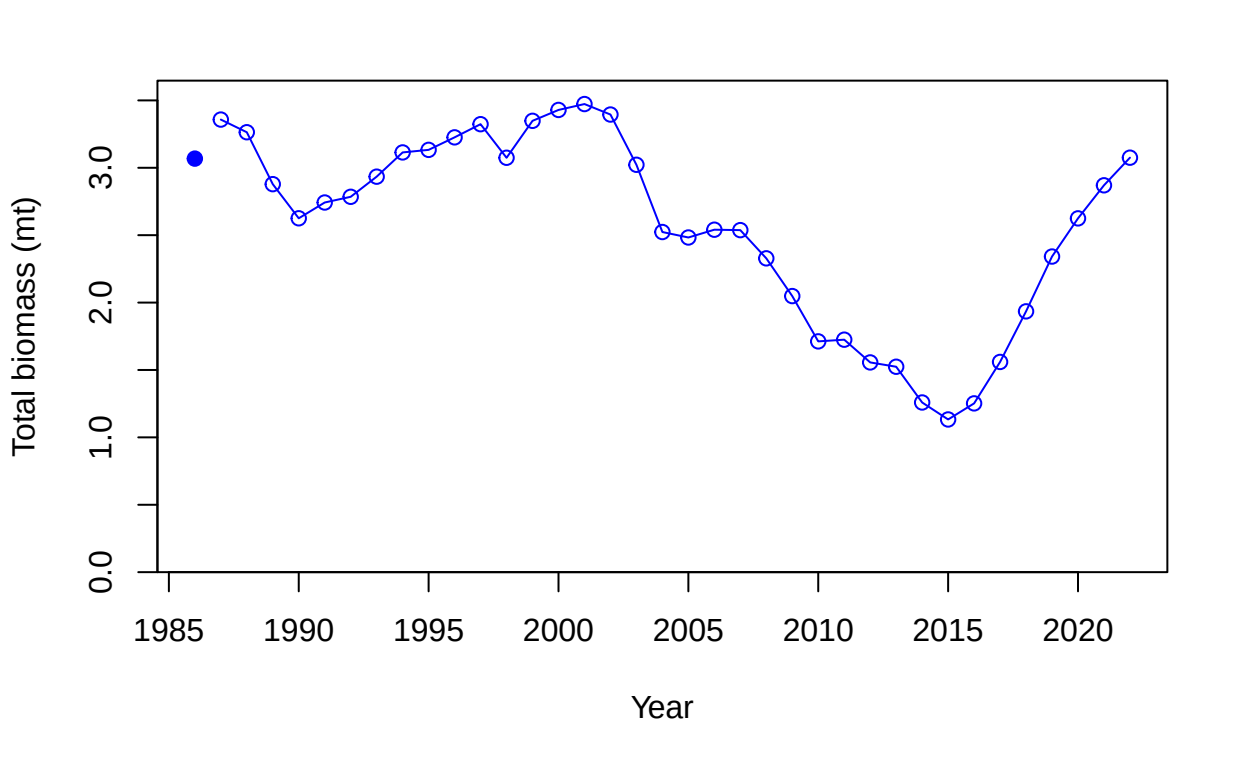

Length (cm)
0
10
20
30
40
Age (yr)
0
2
4
6
8
10
12
14
1
0.8
0.6
0
0.2

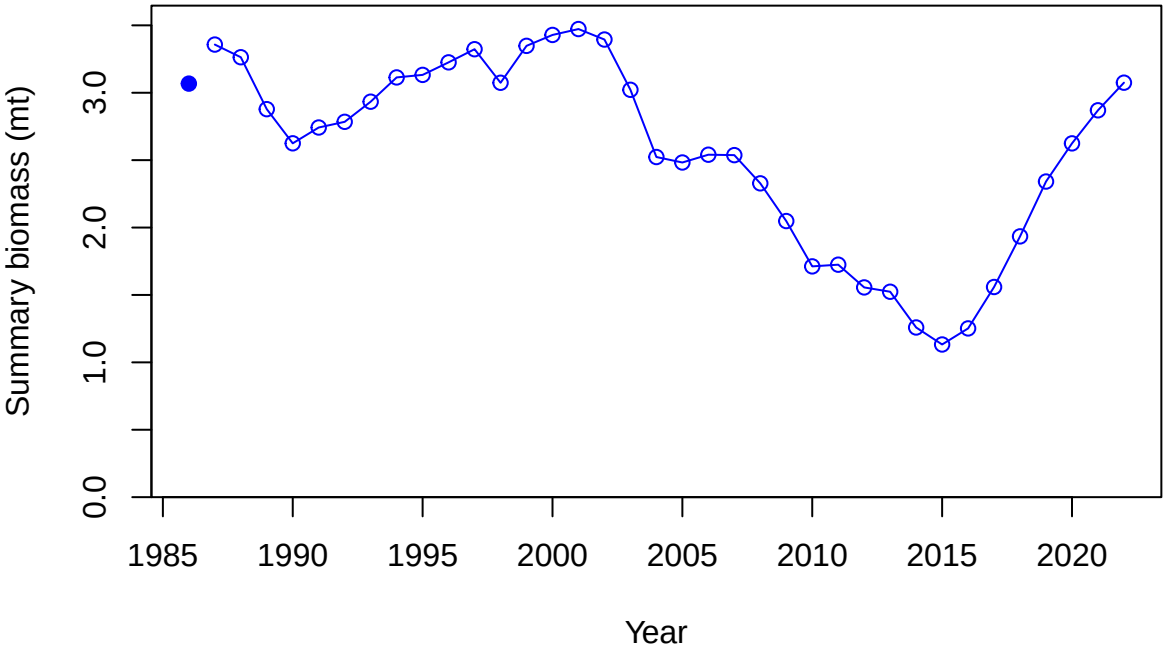

Spawning biomass (mt)
0.00
0.04
0.08
0.12
1985
1990
1995
2000
2005
2010
2015
2020
Year

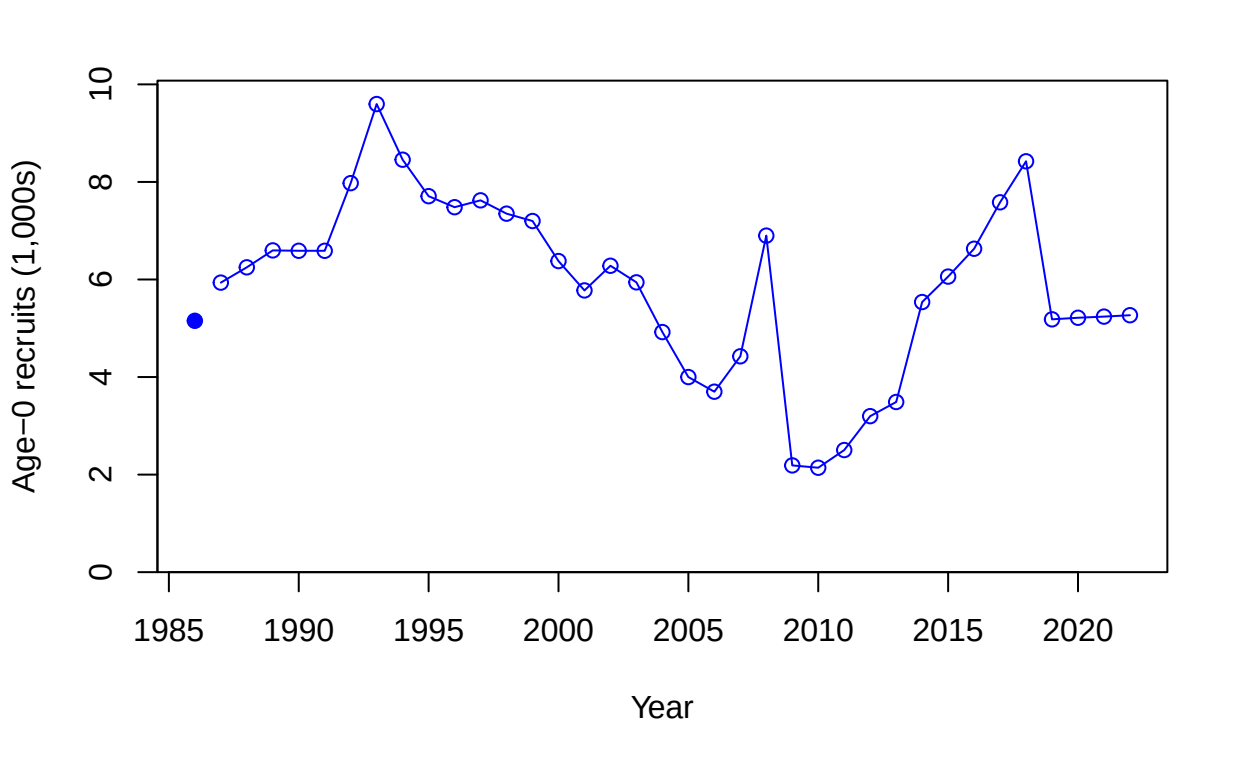

Spawning biomass (mt)
0.00
0.05
0.10
0.15
1985
1990
1995
2000
2005
2010
2015
2020
Year

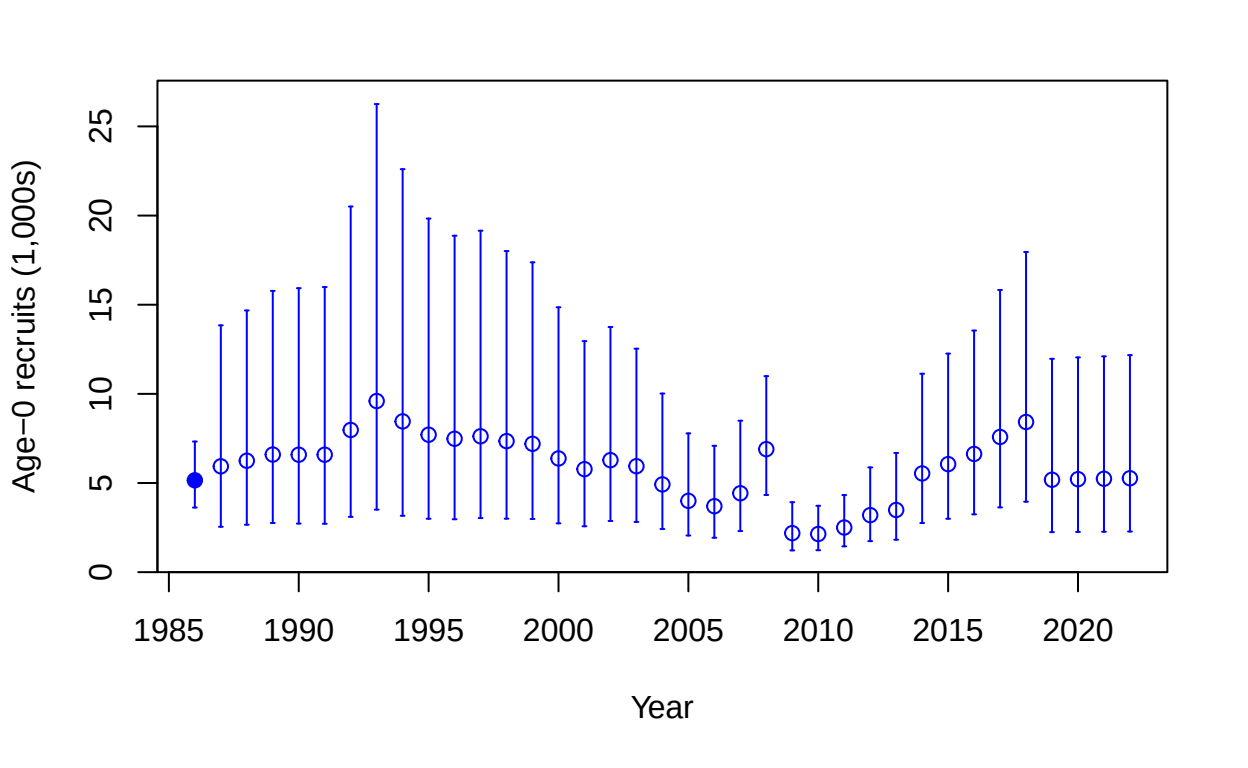

Relative spawning biomass: B/B_MSY
0.0
1.0
2.0
3.0
1985
1990
1995
2000
2005
2010
2015
2020
Year

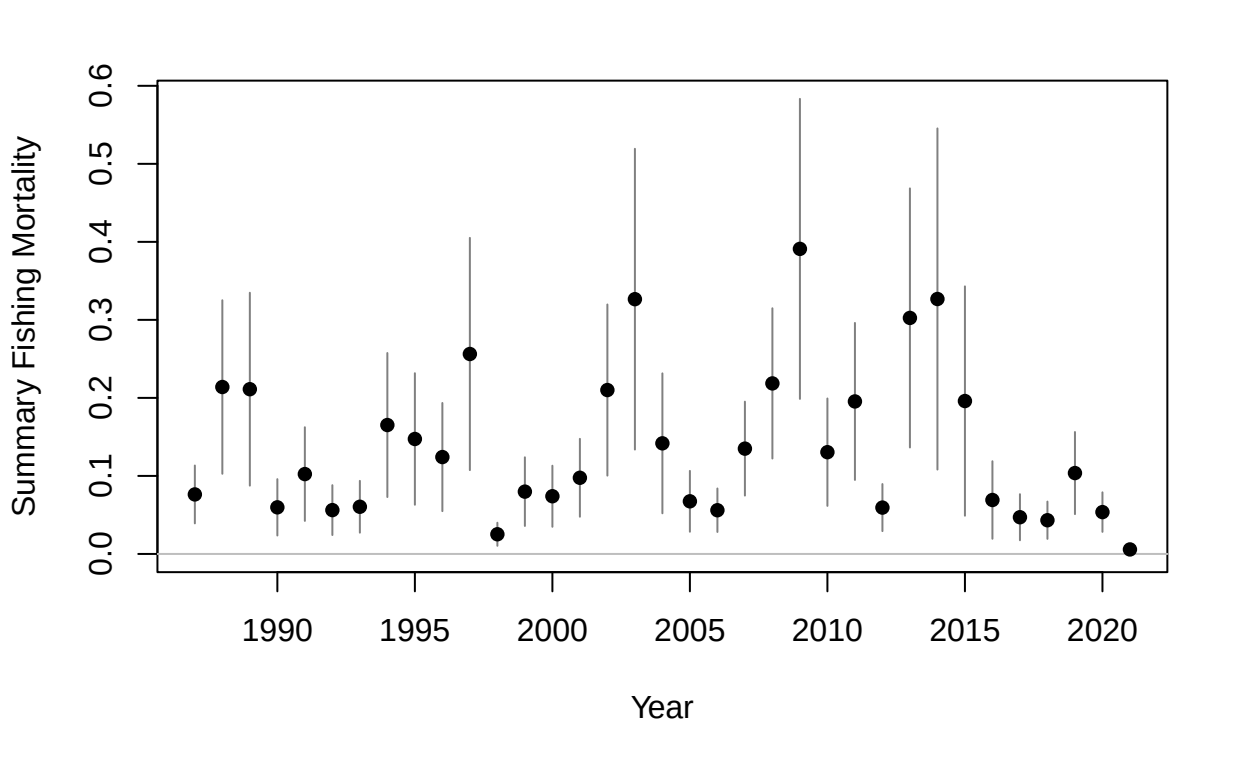

Relative spawning biomass: B/B_MSY
0
1
2
3
4
5
1985
1990
1995
2000
2005
2010
2015
2020
Year

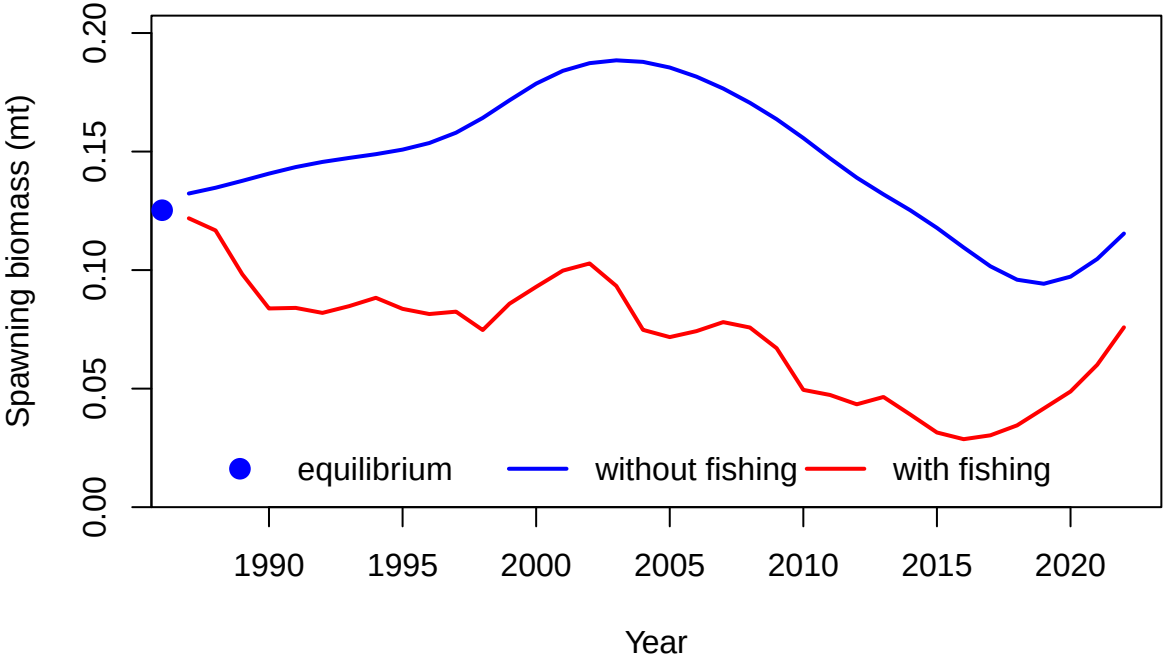

Total biomass (mt)
0.0
1.0
2.0
3.0
1985
1990
1995
2000
2005
2010
2015
2020
Year

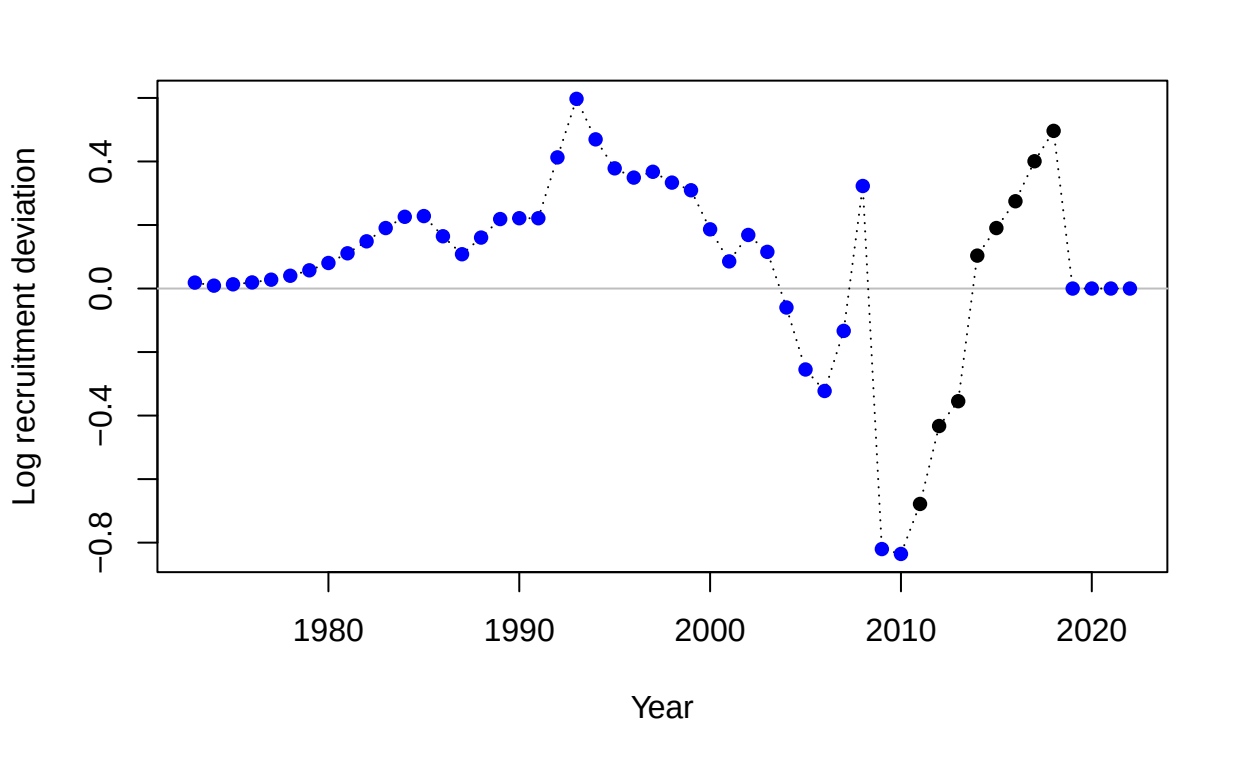

Summary biomass (mt)
0.0
1.0
2.0
3.0
1985
1990
1995
2000
2005
2010
2015
2020
Year

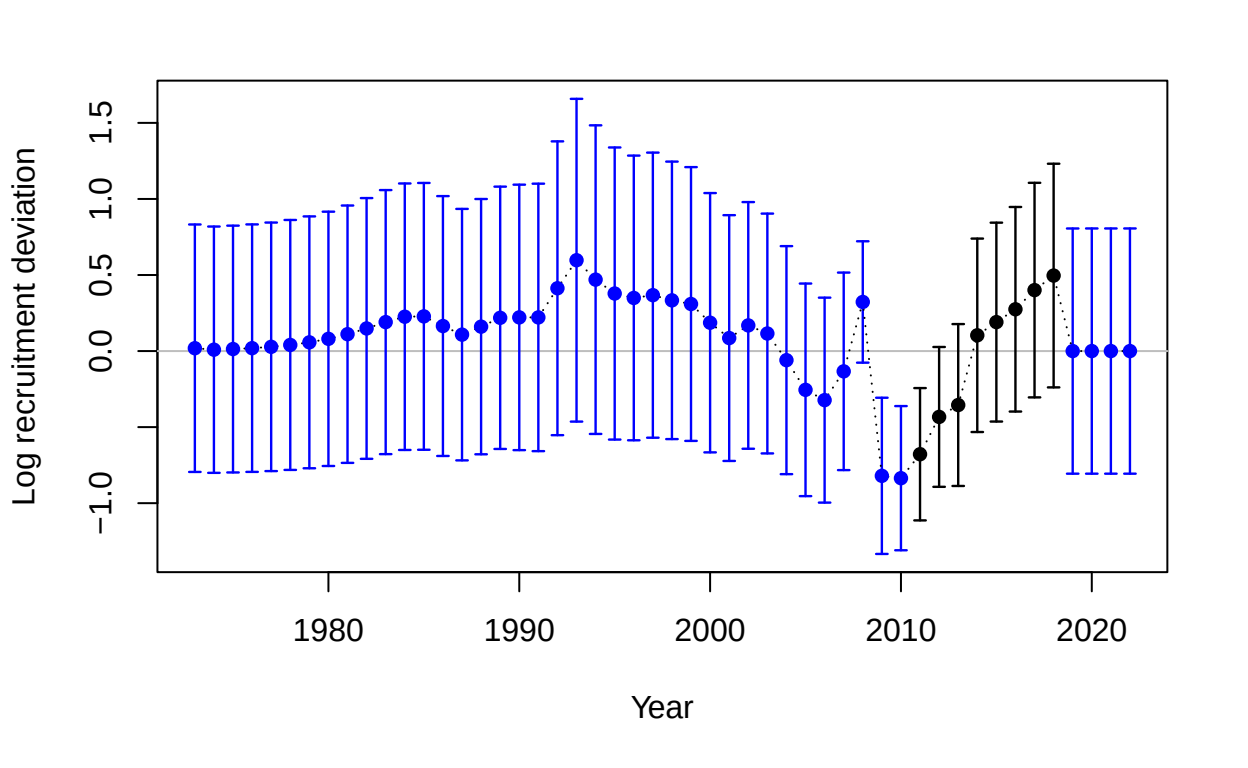

Age−0 recruits (1,000s)
0
2
4
6
8
10
1985
1990
1995
2000
2005
2010
2015
2020
Year

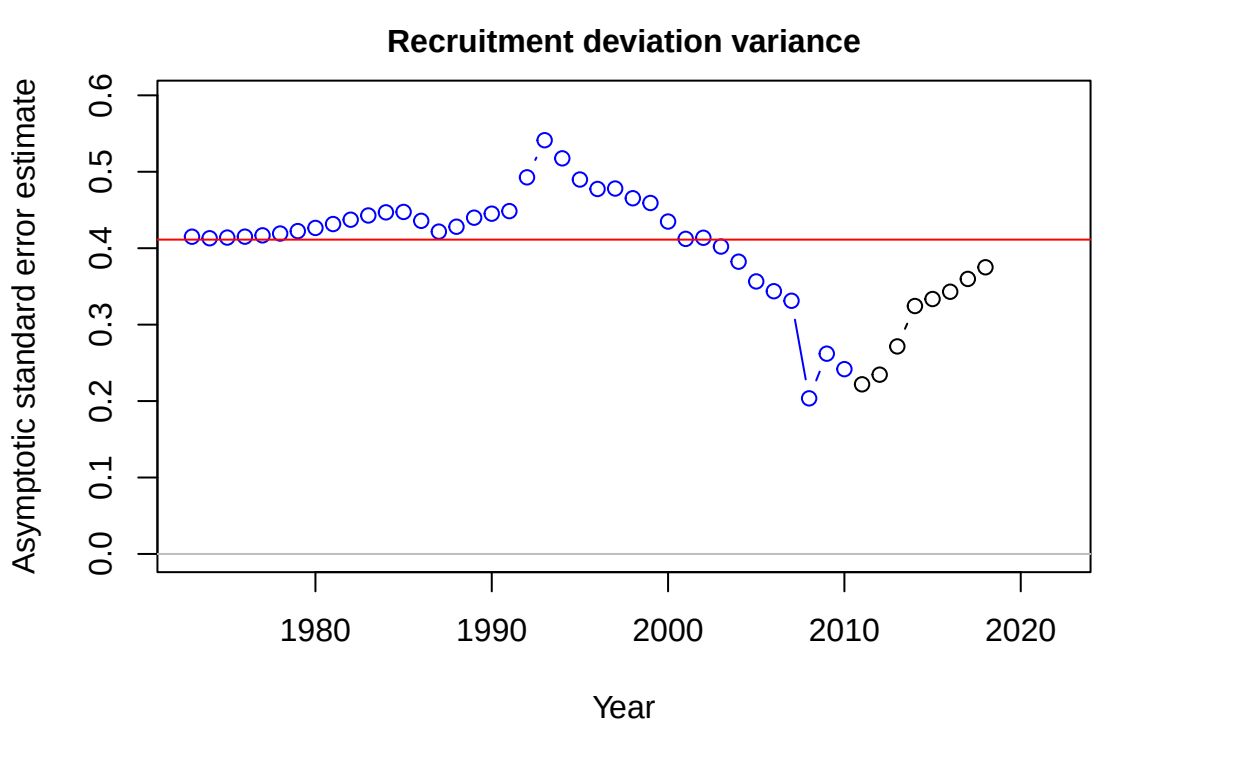

Age−0 recruits (1,000s)
0
5
10
15
20
25
1985
1990
1995
2000
2005
2010
2015
2020
Year

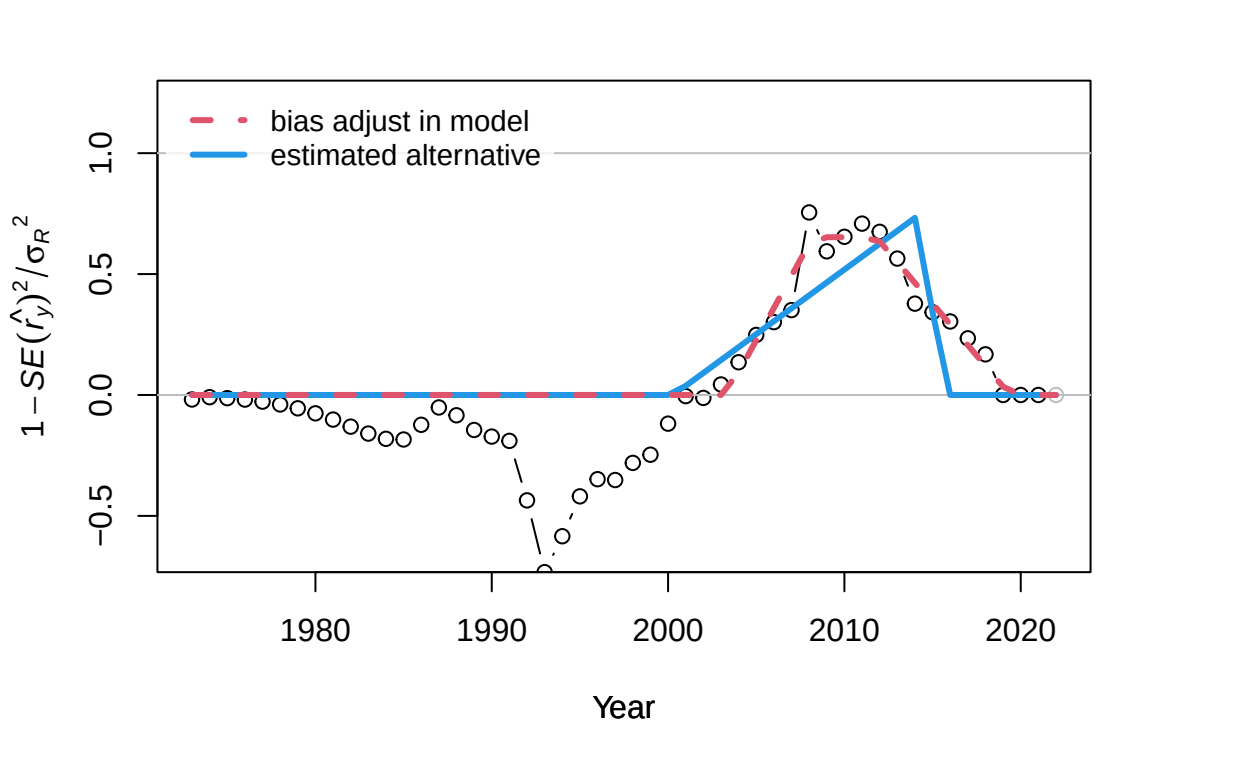

Summary Fishing Mortality
0.0
0.1
0.2
0.3
0.4
0.5
0.6
1990
1995
2000
2005
2010
2015
2020
Year

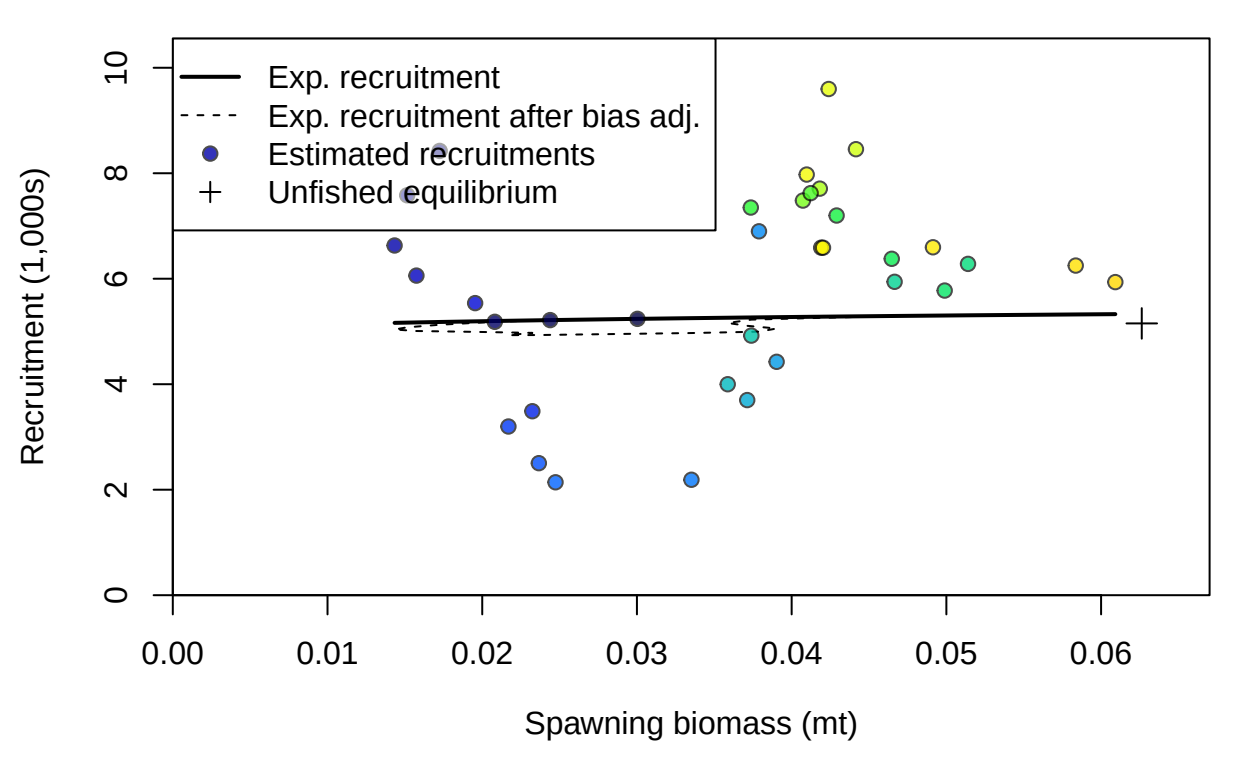

Spawning biomass (mt)
0.00
0.05
0.10
0.15
0.20
1990
1995
2000
2005
2010
2015
2020
Year
equilibrium
without fishing
with fishing

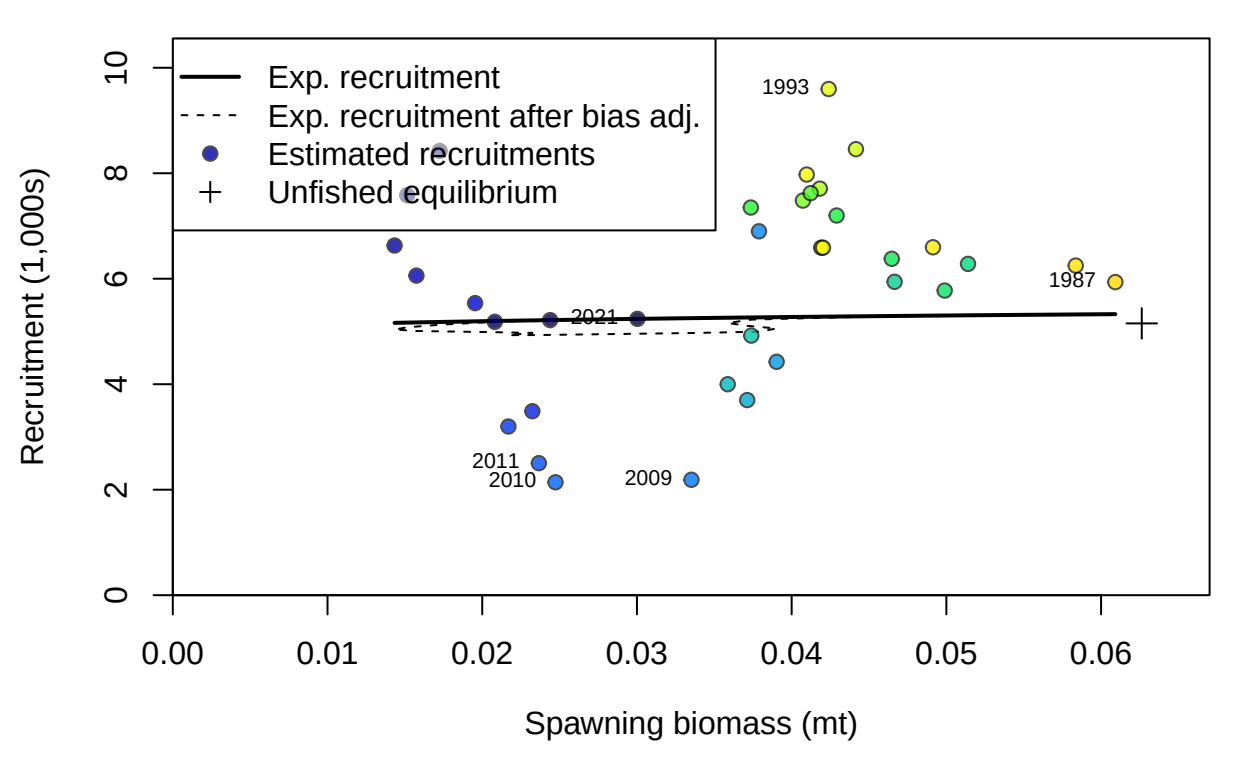

Log recruitment deviation
0.4
0.0
−0.4
−0.8
1980
1990
2000
2010
2020
Year

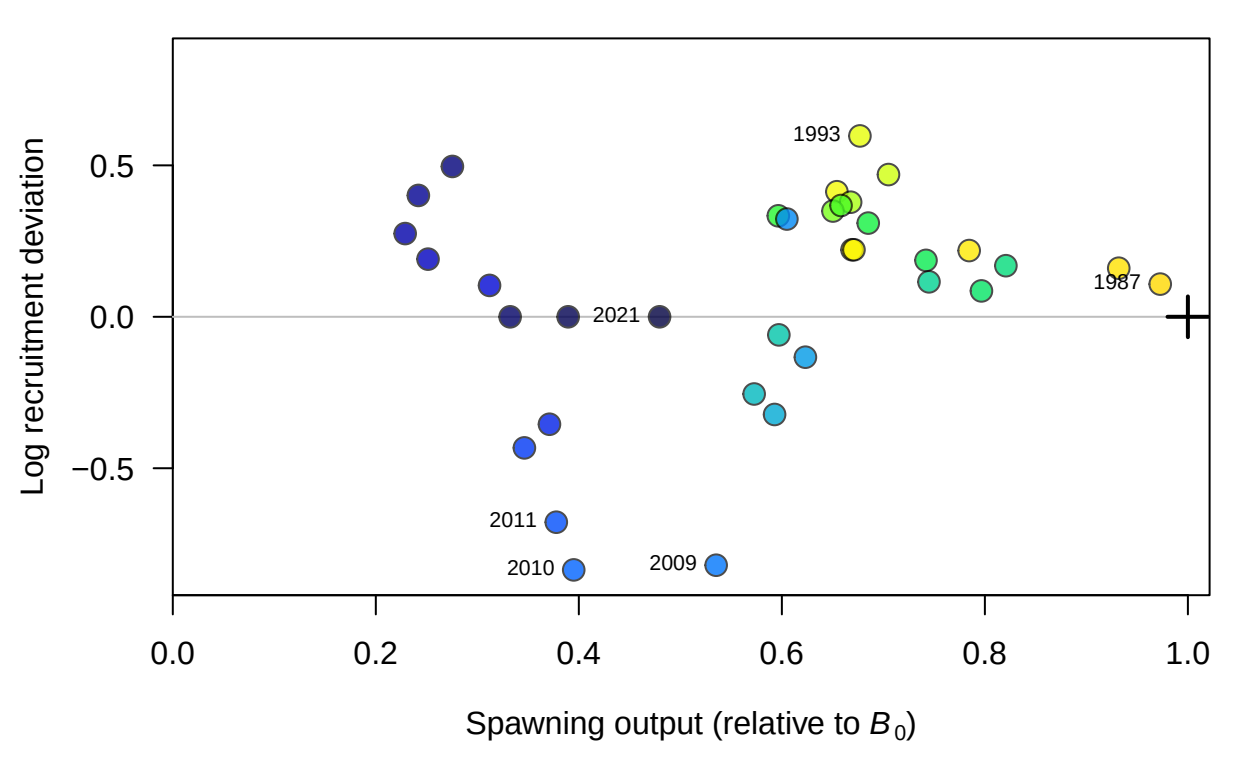

Log recruitment deviation
−1.0
0.0
0.5
1.0
1.5
1980
1990
2000
2010
2020
Year

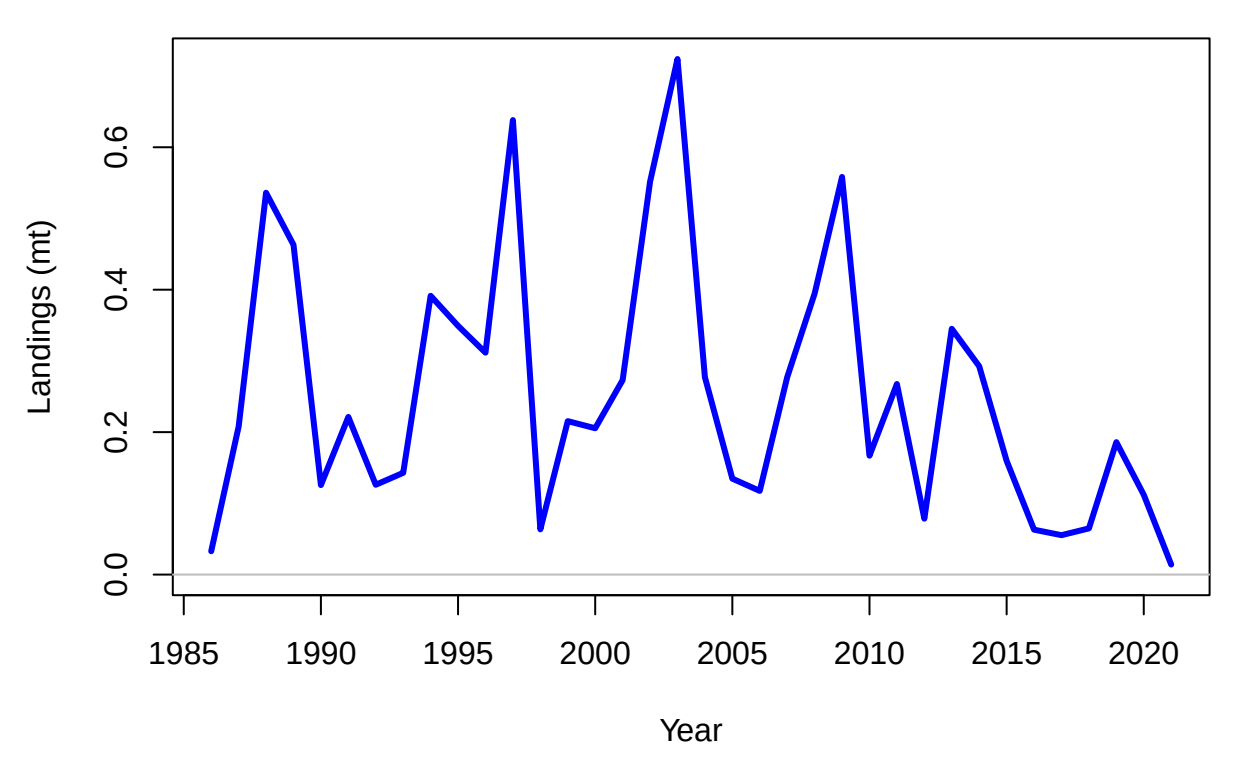

Recruitment deviation variance
Asymptotic standard error estimate
0.0
0.1
0.2
0.3
0.4
0.5
0.6
1980
1990
2000
2010
2020
Year

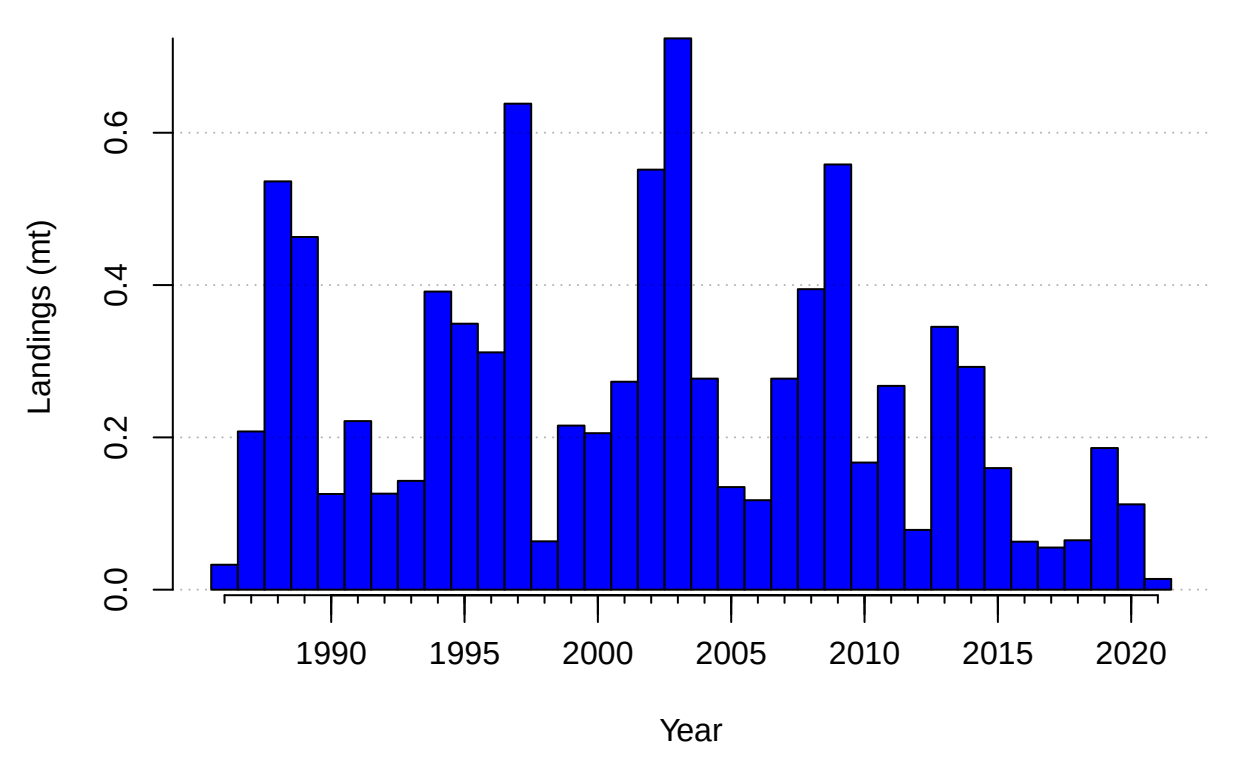

bias adjust in model
estimated alternative
$1 - SE(\hat{r_y})^2/\sigma_R^2$
1.0
0.5
0.0
−0.5
1980
1990
2000
2010
2020
Year

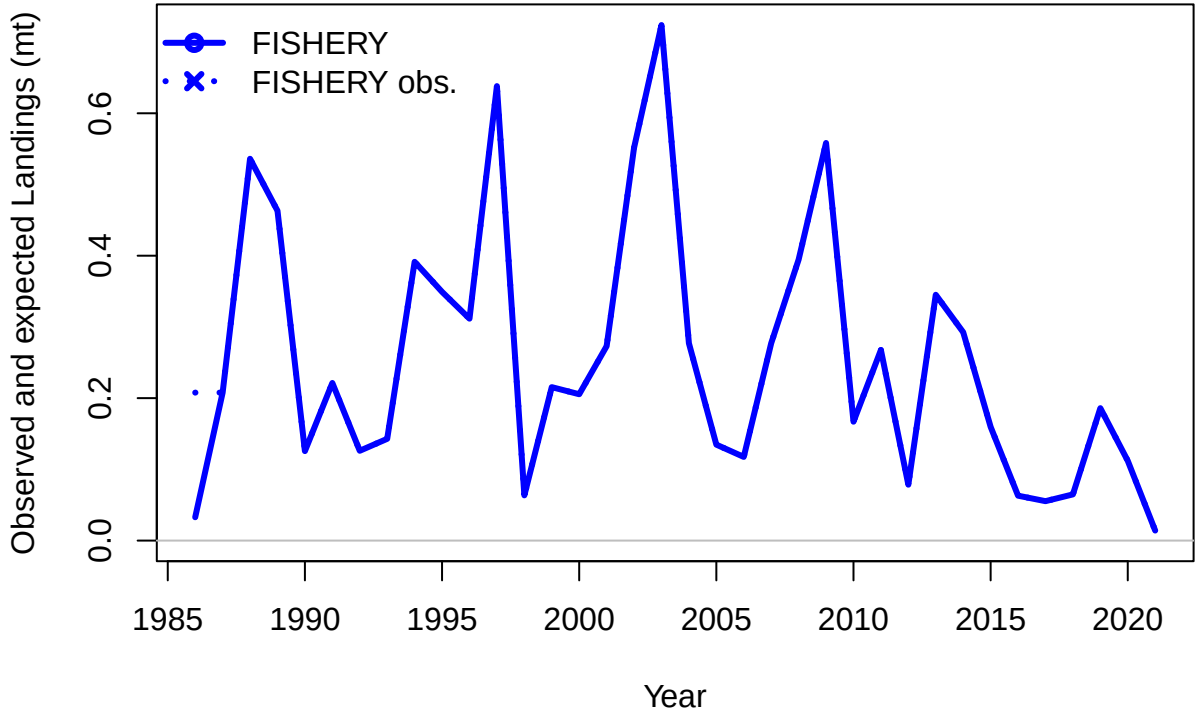

Exp. recruitment
Exp. recruitment after bias adj.
Estimated recruitments
Unfished equilibrium
Recruitment (1,000s)
0
2
4
6
8
10
0.00
0.01
0.02
0.03
0.04
0.05
0.06
Spawning biomass (mt)

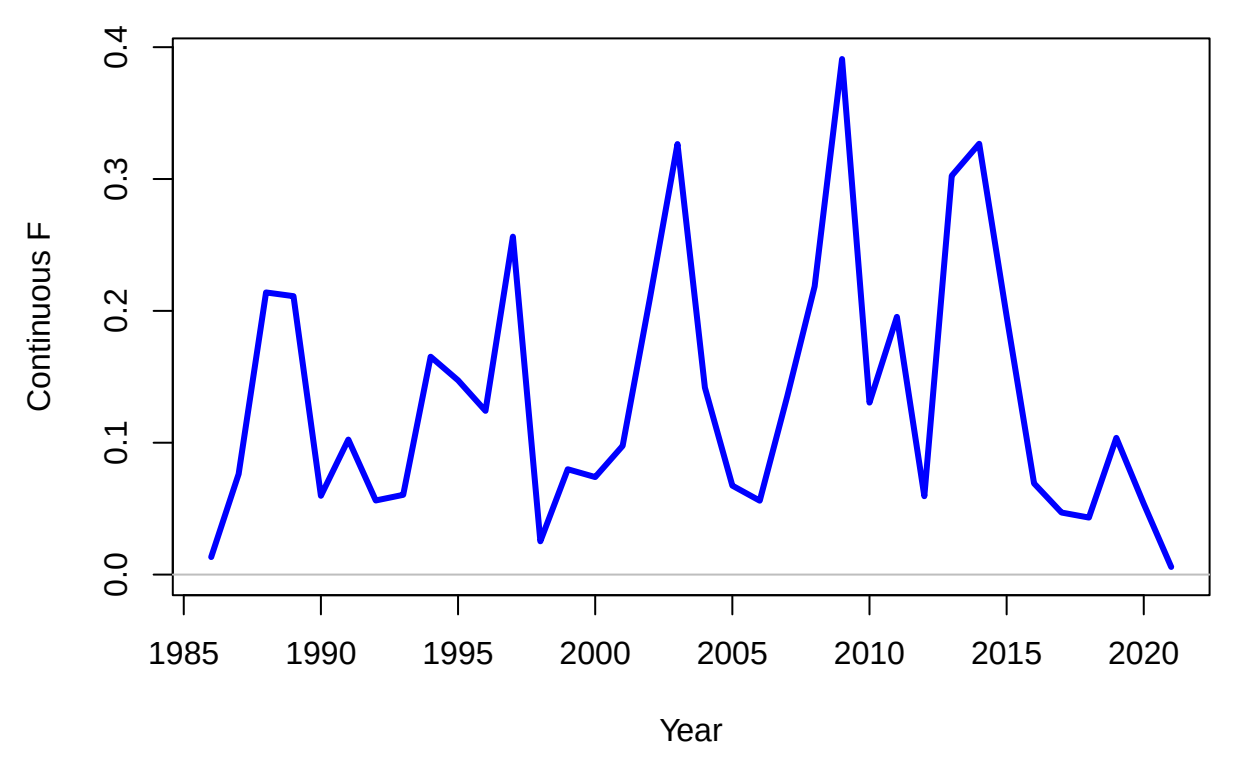

Exp. recruitment
Exp. recruitment after bias adj.
Estimated recruitments
Unfished equilibrium
1993
1987
2021
2011
2010
2009
Recruitment (1,000s)
Spawning biomass (mt)
0
2
4
6
8
10
0.00
0.01
0.02
0.03
0.04
0.05
0.06

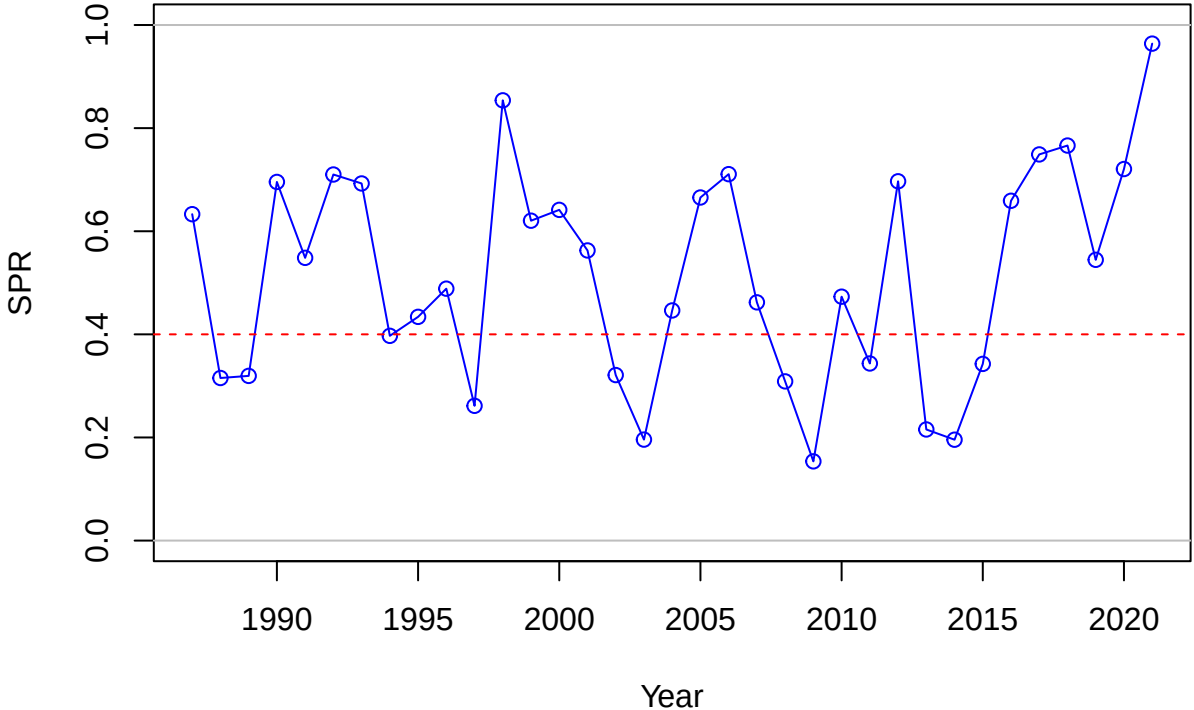

Log recruitment deviation
0.5
0.0
−0.5
1993
1987
2021
2011
2010
2009
0.0
0.2
0.4
0.6
0.8
1.0
Spawning output (relative to B_0)

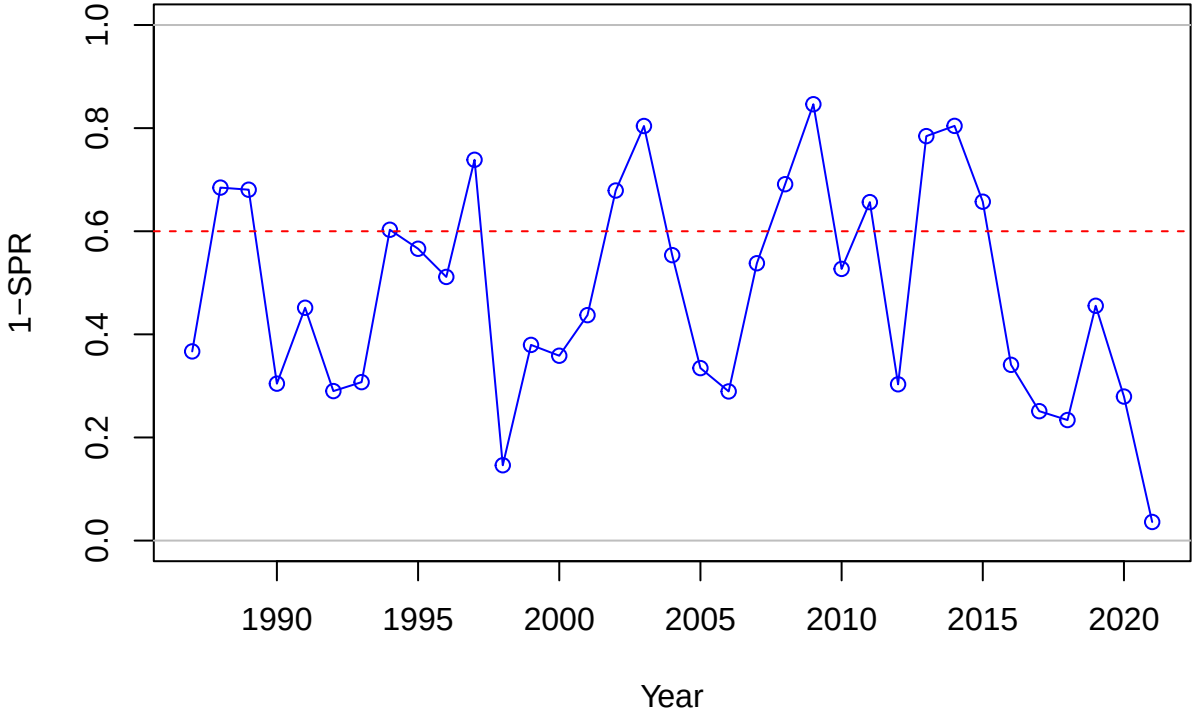

Landings (mt)
0.0
0.2
0.4
0.6
1985
1990
1995
2000
2005
2010
2015
2020
Year

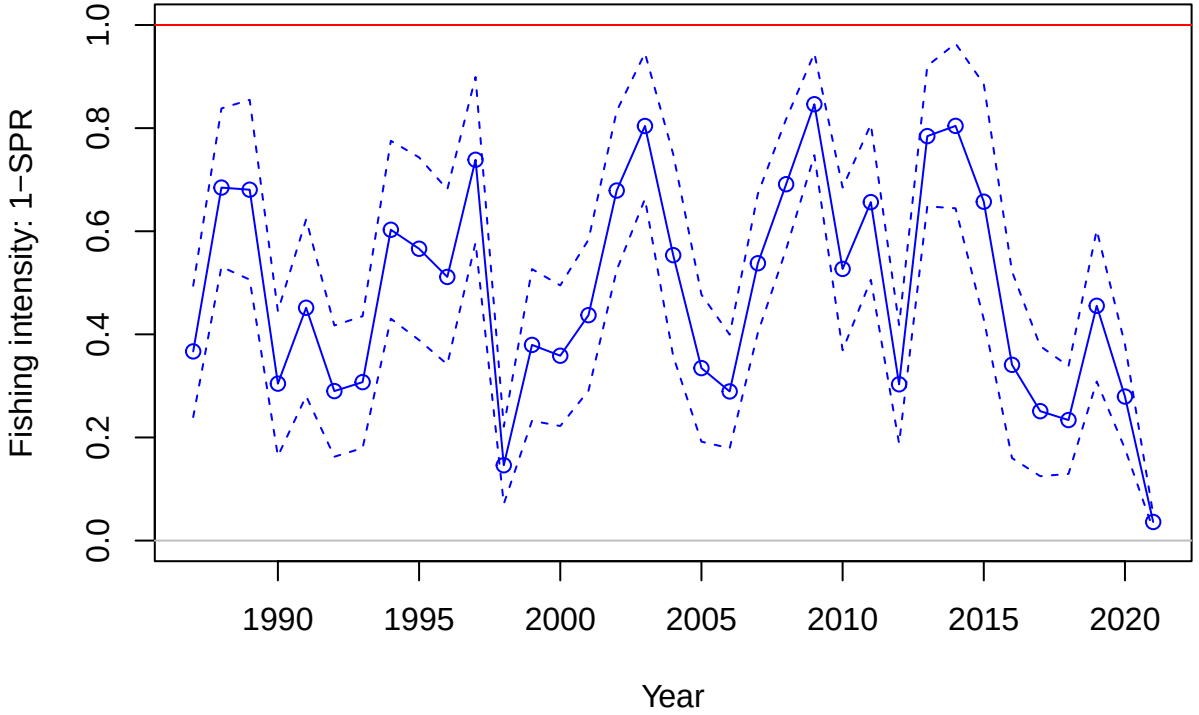

Landings (mt)
0.0
0.2
0.4
0.6
1990
1995
2000
2005
2010
2015
2020
Year

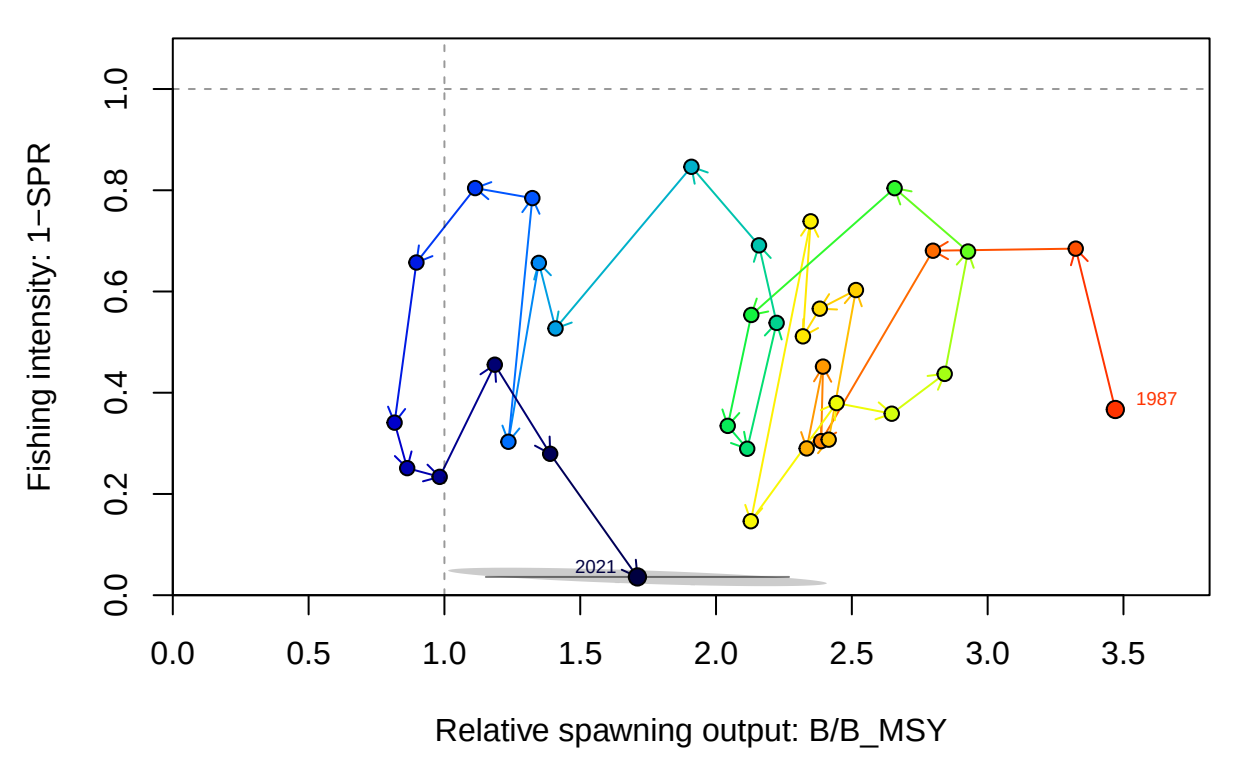

FISHERY
FISHERY obs.
Observed and expected Landings (mt)
0.0
0.2
0.4
0.6
1985
1990
1995
2000
2005
2010
2015
2020
Year

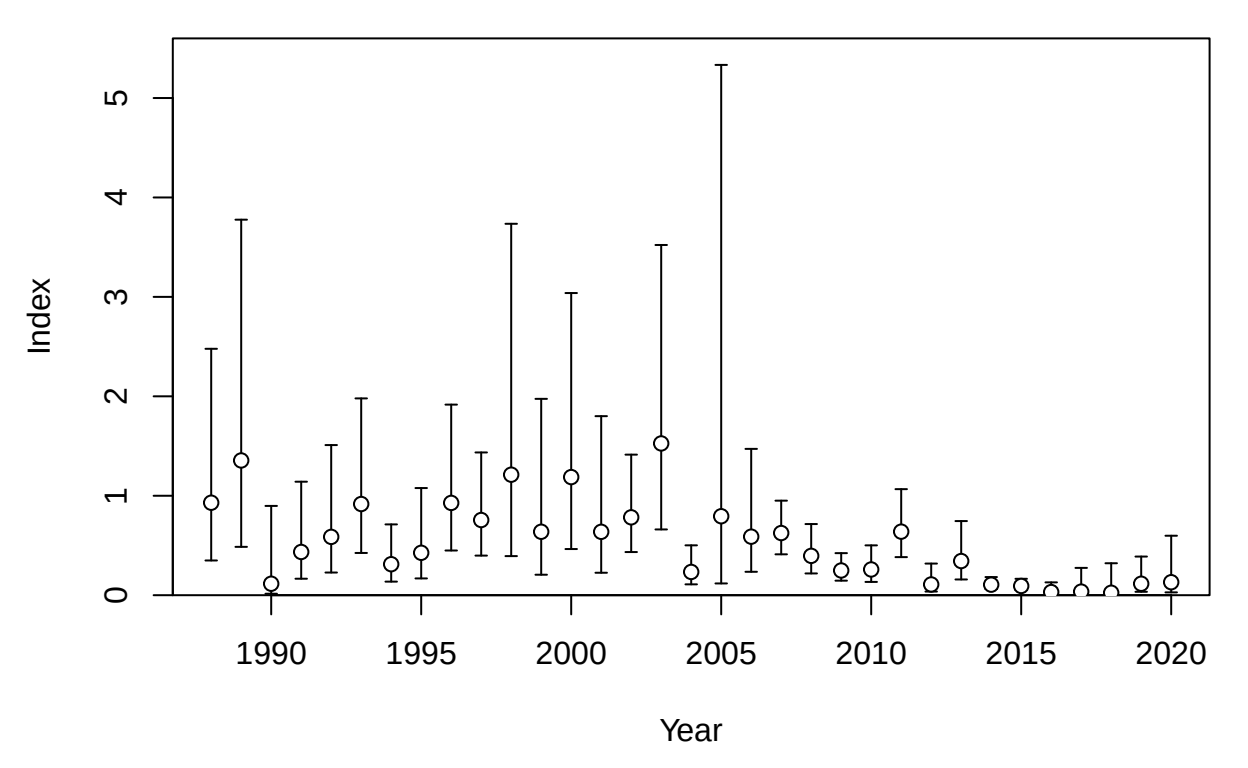

Continuous F
0.0
0.1
0.2
0.3
0.4
1985
1990
1995
2000
2005
2010
2015
2020
Year

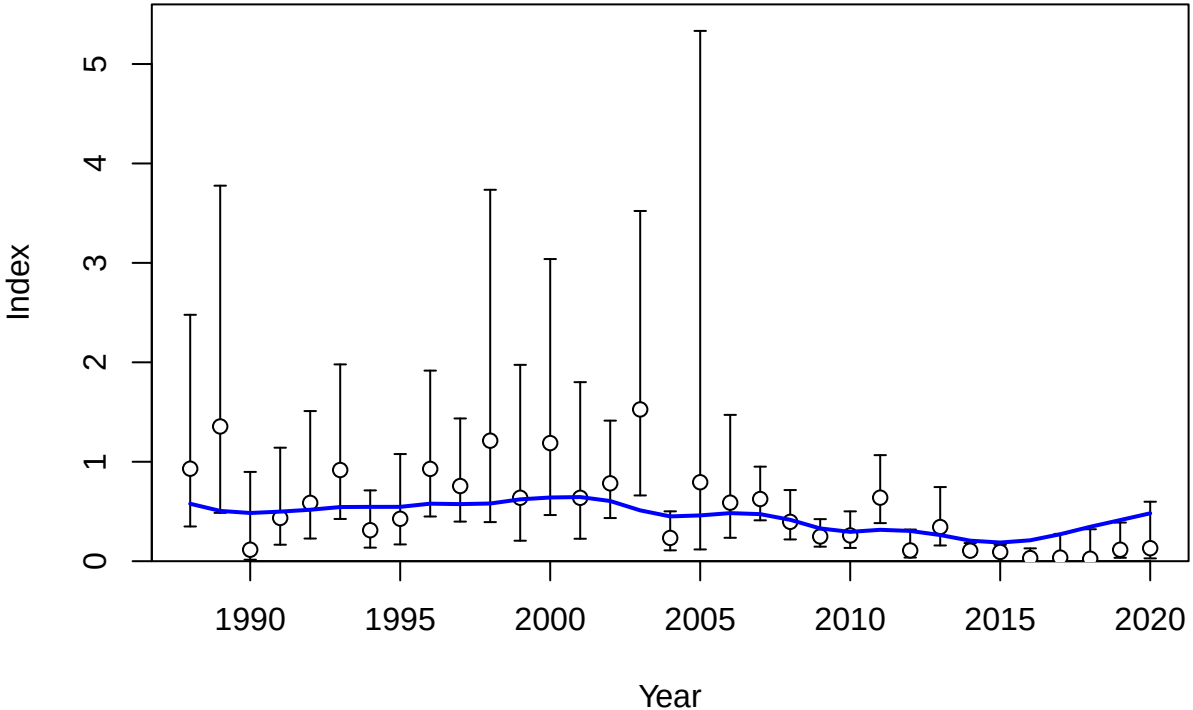

SPR
0.0
0.2
0.4
0.6
0.8
1.0
1990
1995
2000
2005
2010
2015
2020
Year

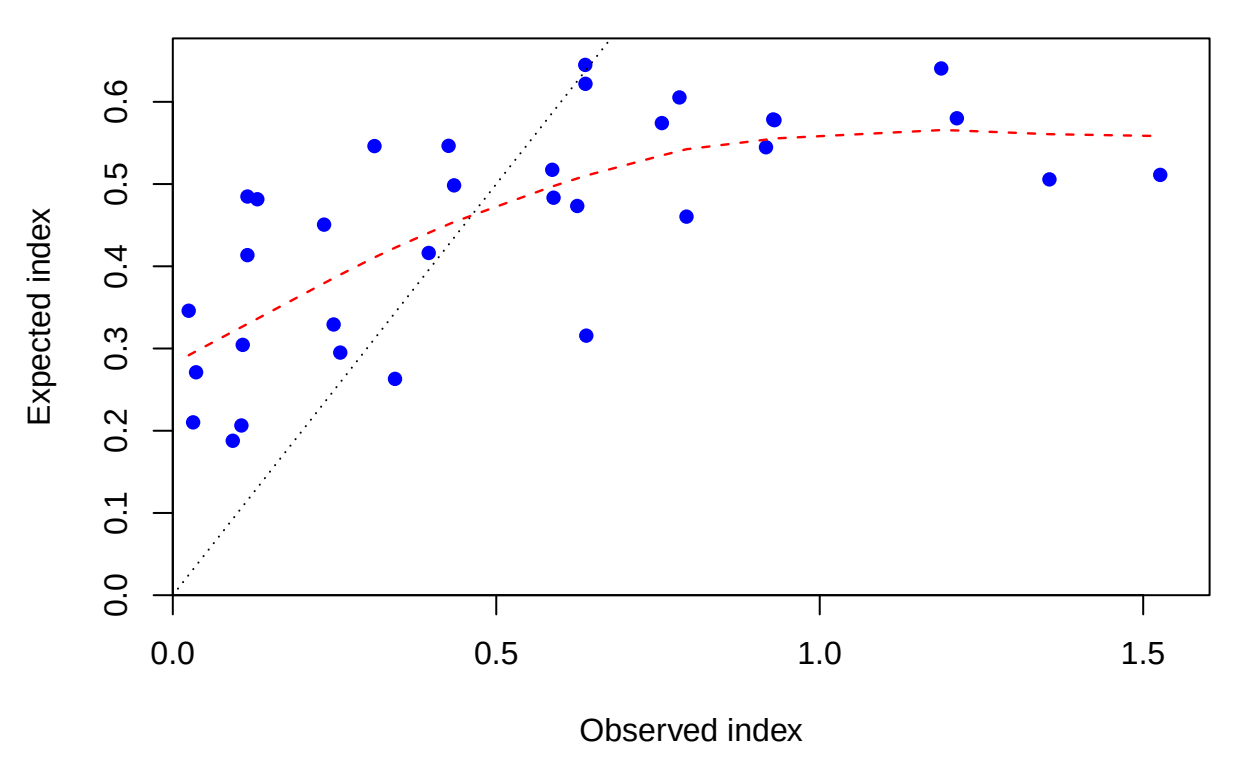

1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
1990
1995
2000
2005
2010
2015
2020
Year

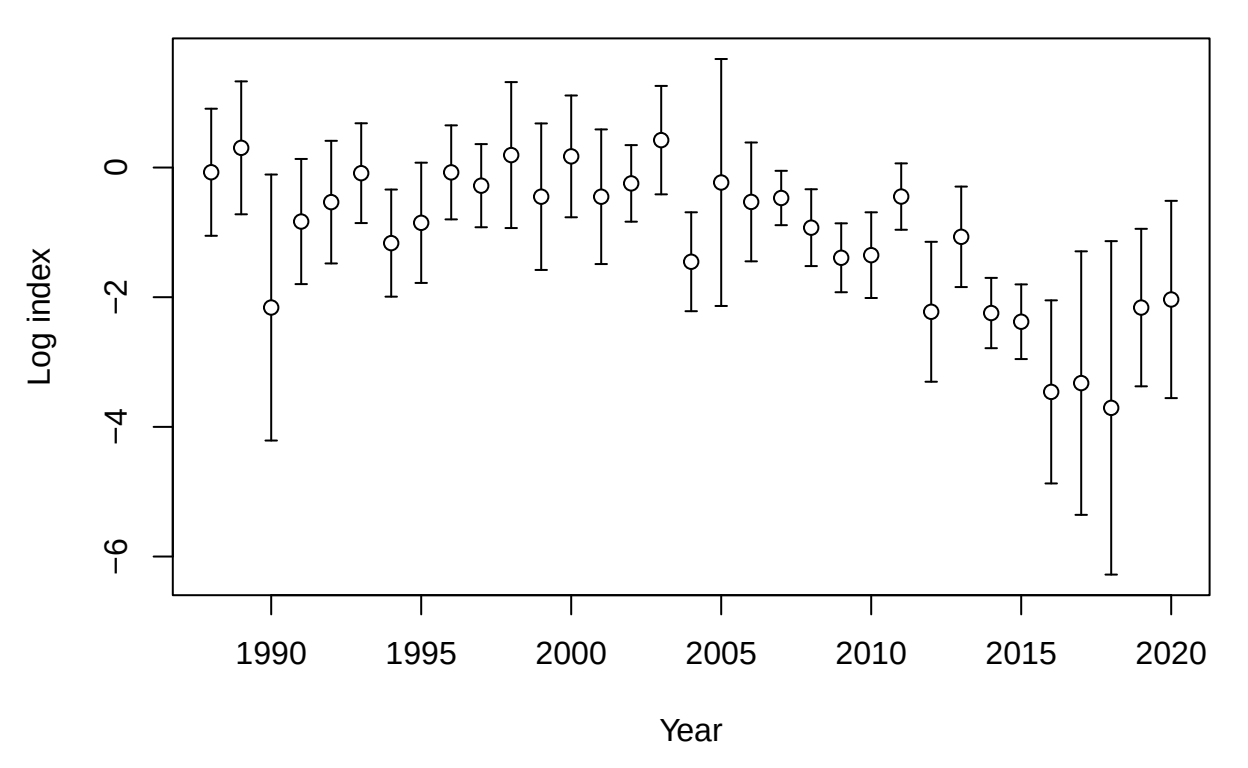

Fishing intensity: 1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
1990
1995
2000
2005
2010
2015
2020
Year

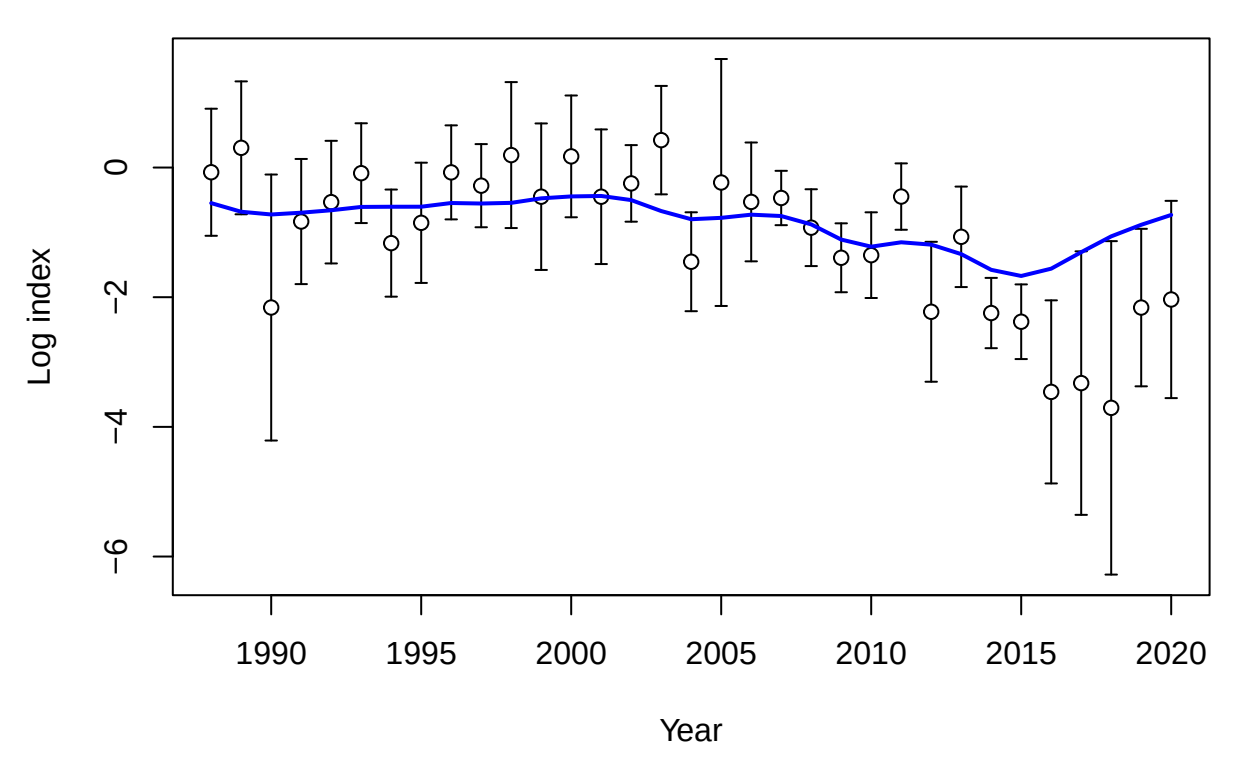

Fishing intensity: 1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
Relative spawning output: B/B_MSY
2021
1987

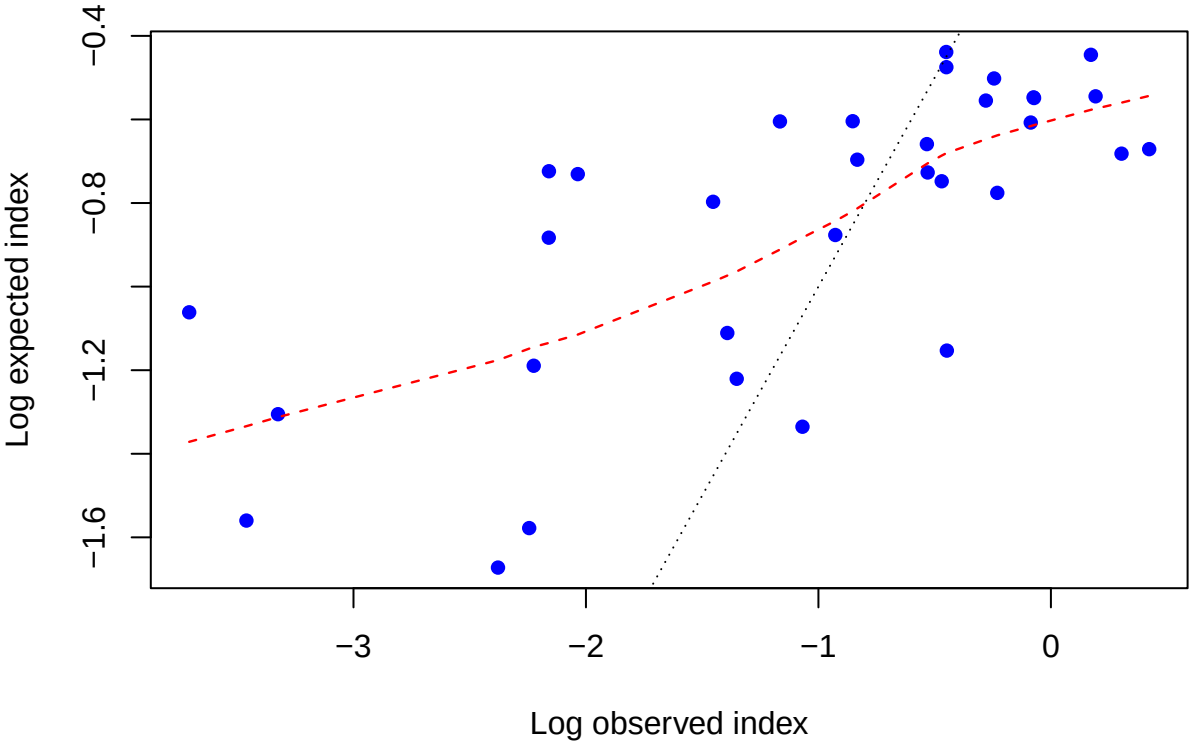

Index
0
1
2
3
4
5
1990
1995
2000
2005
2010
2015
2020
Year

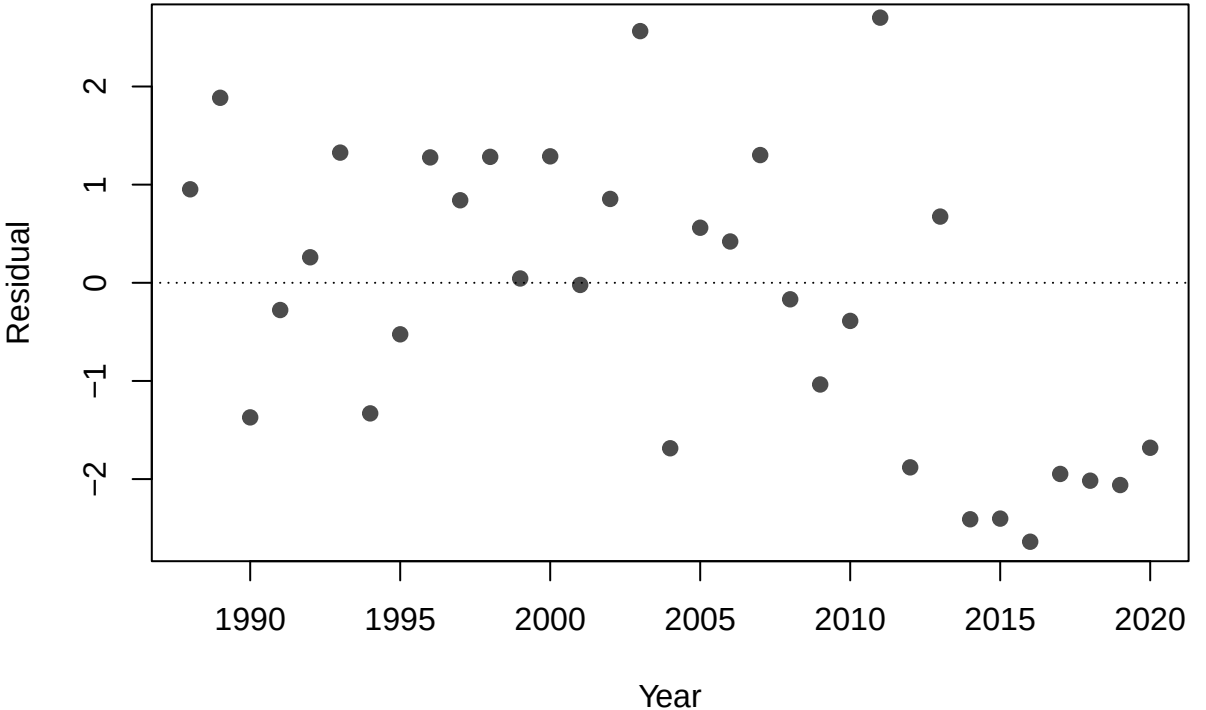

Index
0
1
2
3
4
5
1990
1995
2000
2005
2010
2015
2020
Year

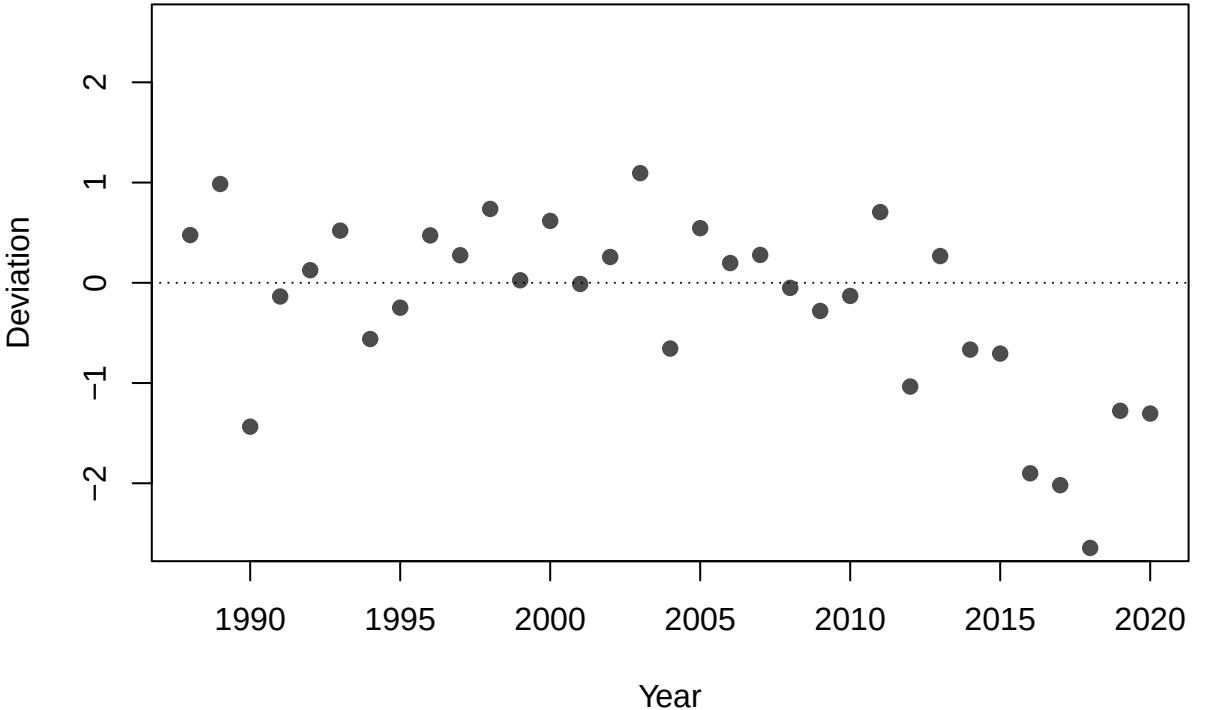

Expected index
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.0
0.5
1.0
1.5
Observed index

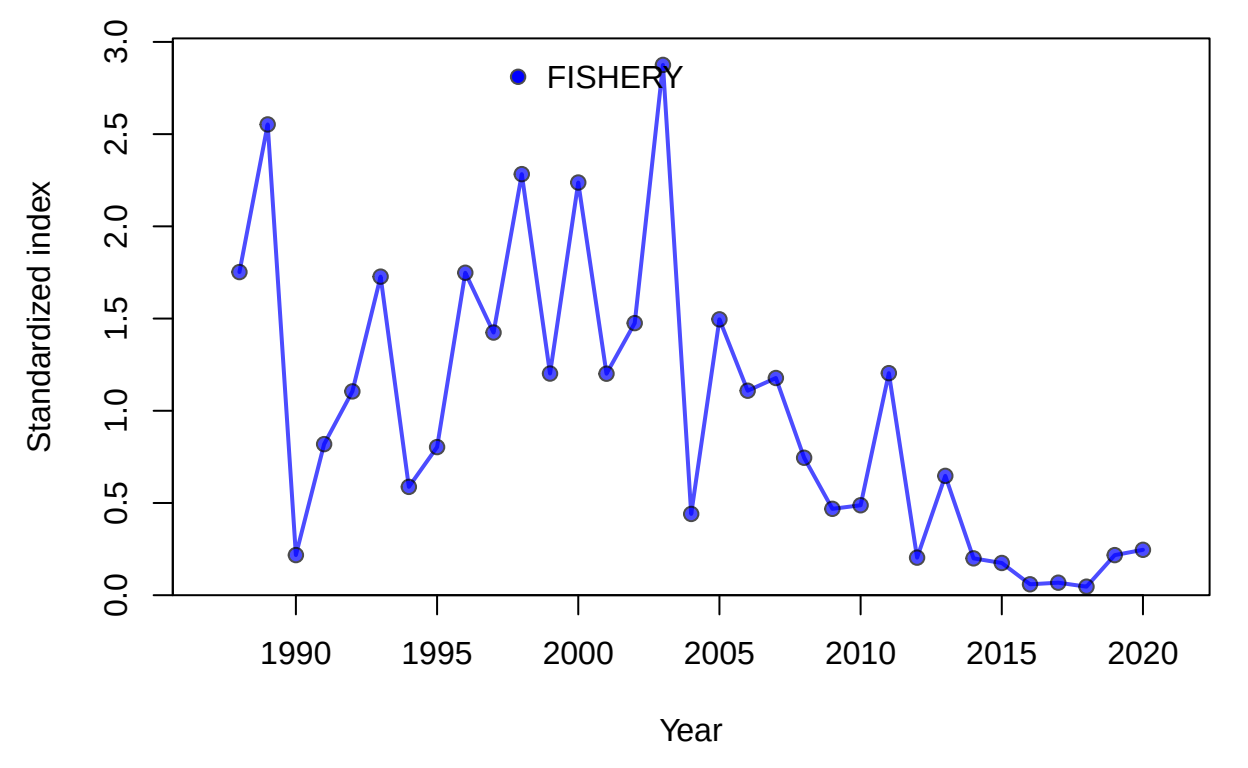

Log index
0
−2
−4
−6
1990
1995
2000
2005
2010
2015
2020
Year

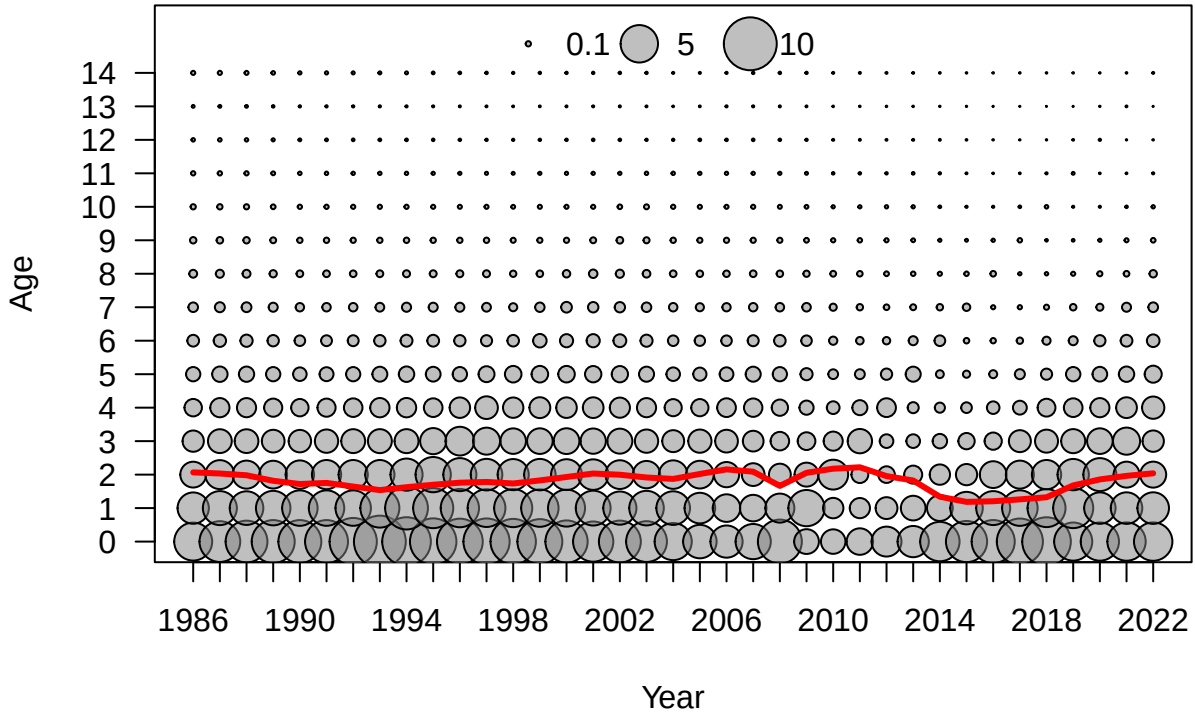

Log index
0
−2
−4
−6
1990
1995
2000
2005
2010
2015
2020
Year

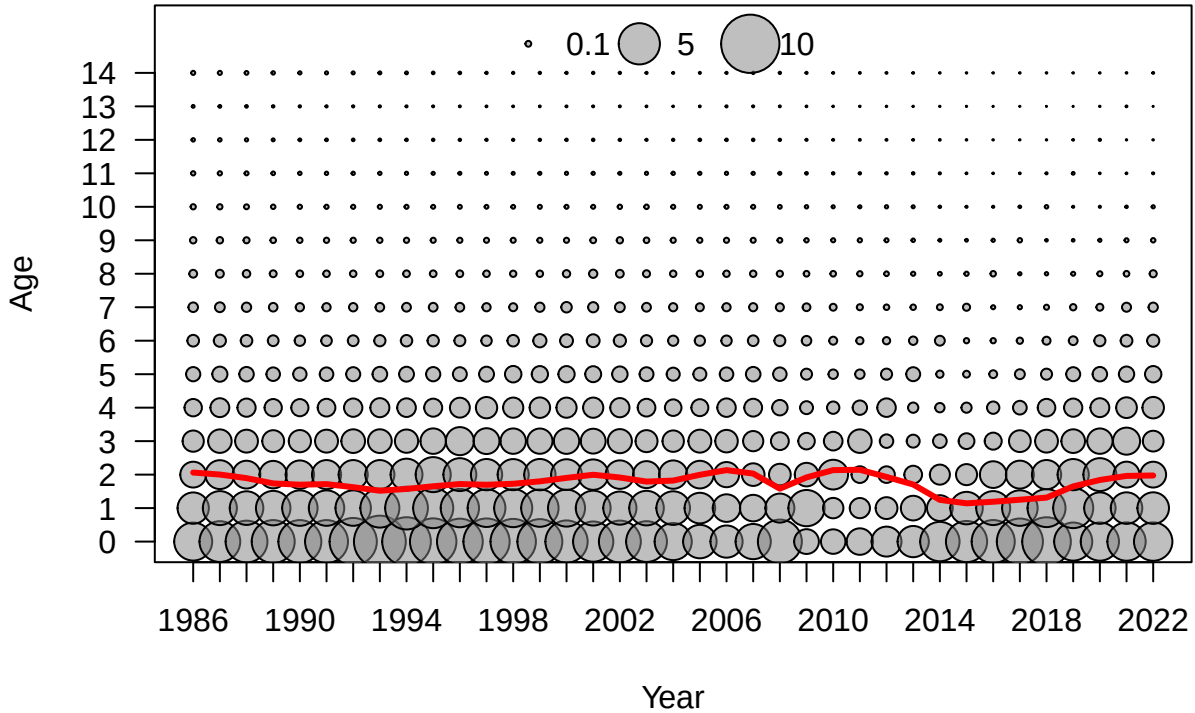

Log expected index
−0.4
−0.8
−1.2
−1.6
−3
−2
−1
0
Log observed index

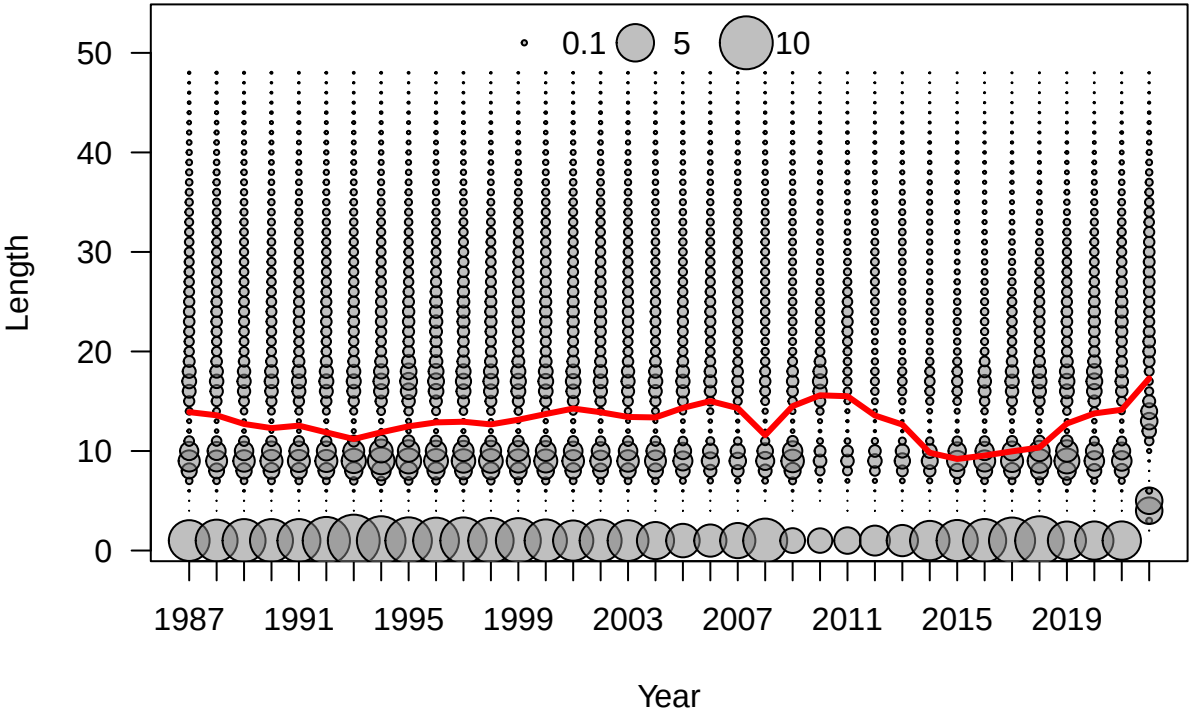

Residual
2
1
0
−1
−2
1990
1995
2000
2005
2010
2015
2020
Year

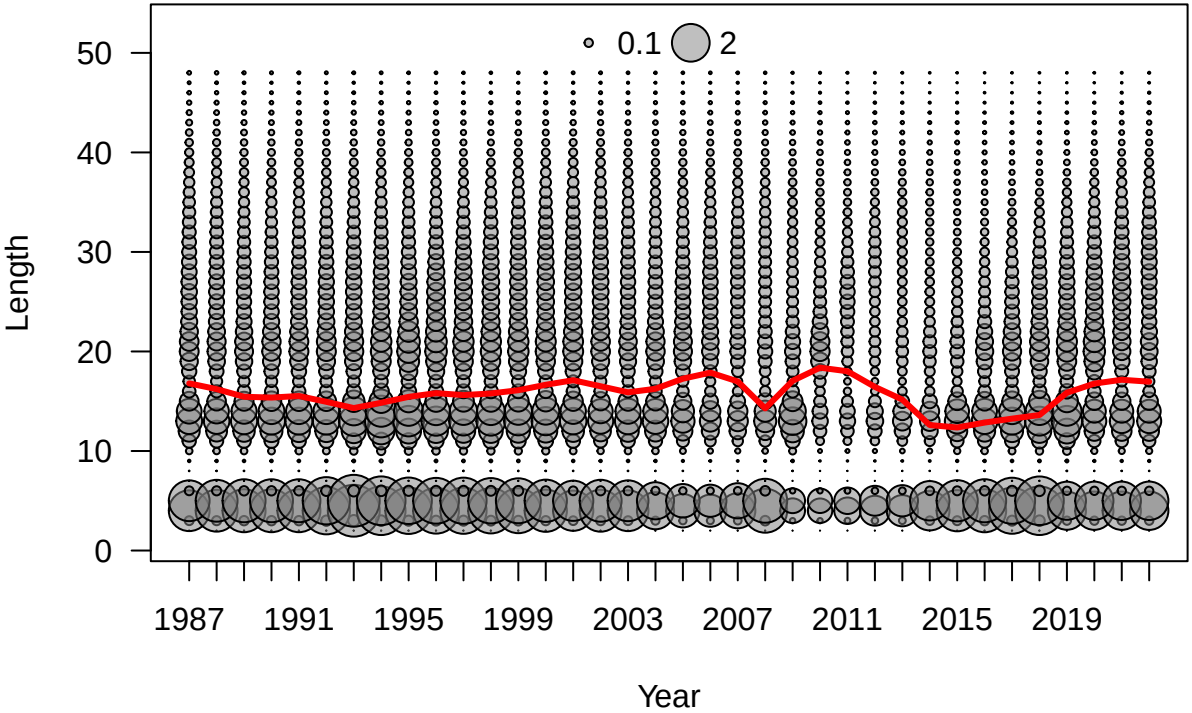

Deviation
2
1
0
−1
−2
1990
1995
2000
2005
2010
2015
2020
Year

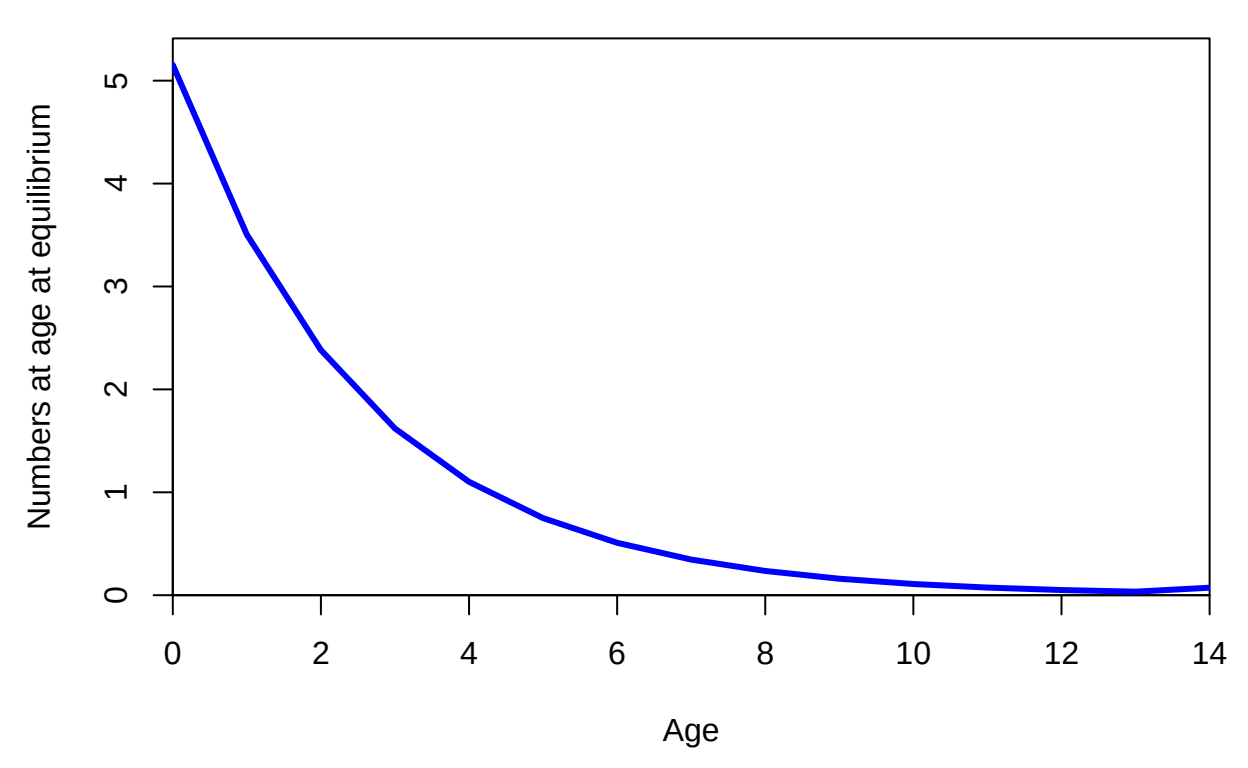

FISHERY
Standardized index
0.0
0.5
1.0
1.5
2.0
2.5
3.0
1990
1995
2000
2005
2010
2015
2020
Year

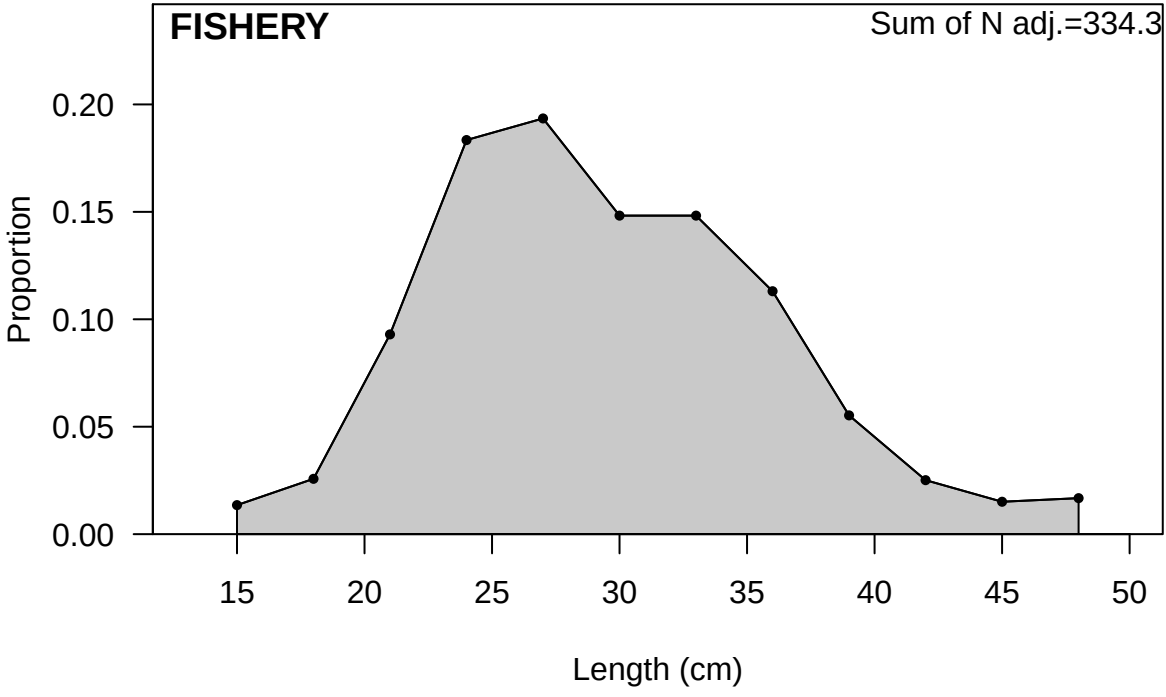

0.1
5
10
Age
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
1986
1990
1994
1998
2002
2006
2010
2014
2018
2022
Year

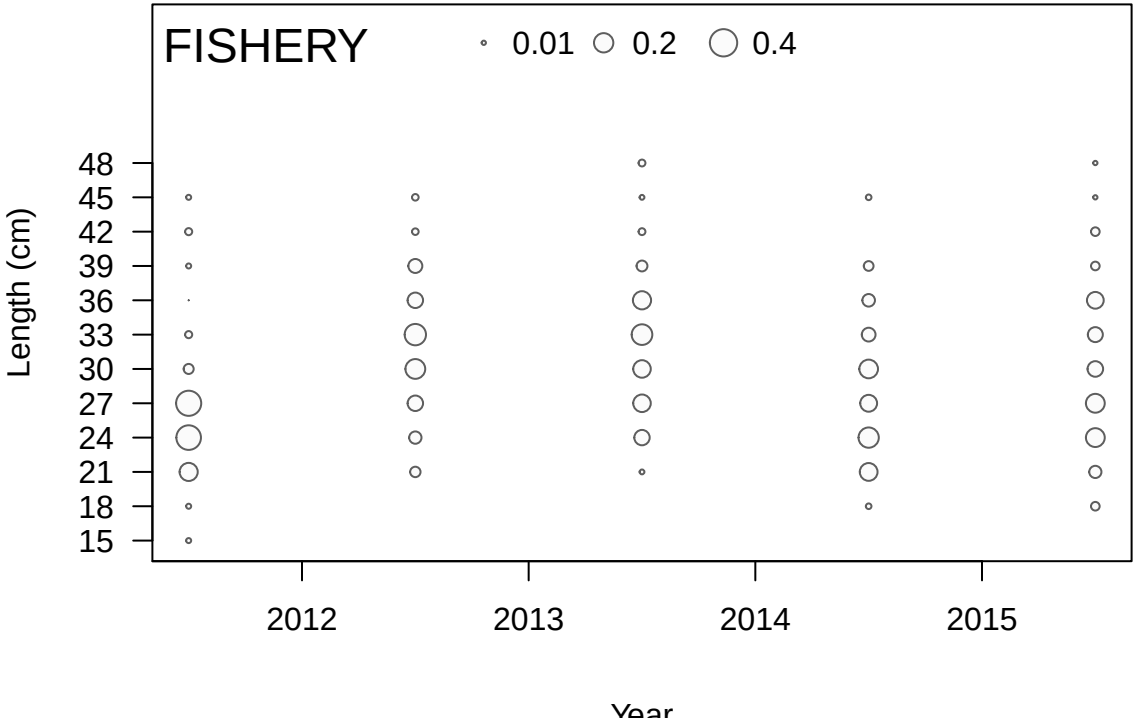

0.1
5
10
Age
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
1986
1990
1994
1998
2002
2006
2010
2014
2018
2022
Year

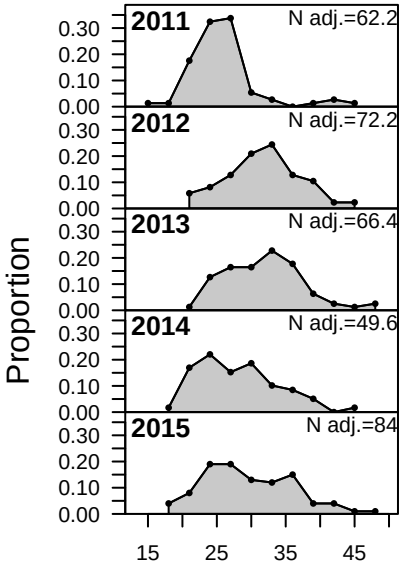

0.1
5
10
Length
0
10
20
30
40
50
1987
1991
1995
1999
2003
2007
2011
2015
2019
Year

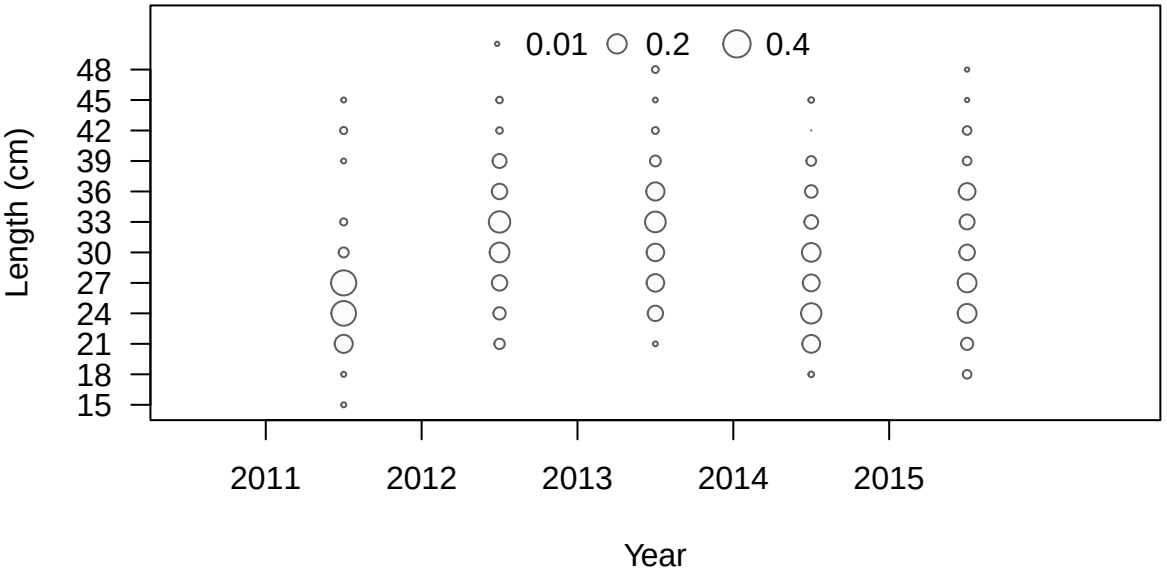

0.1
2
Length
0
10
20
30
40
50
1987
1991
1995
1999
2003
2007
2011
2015
2019
Year

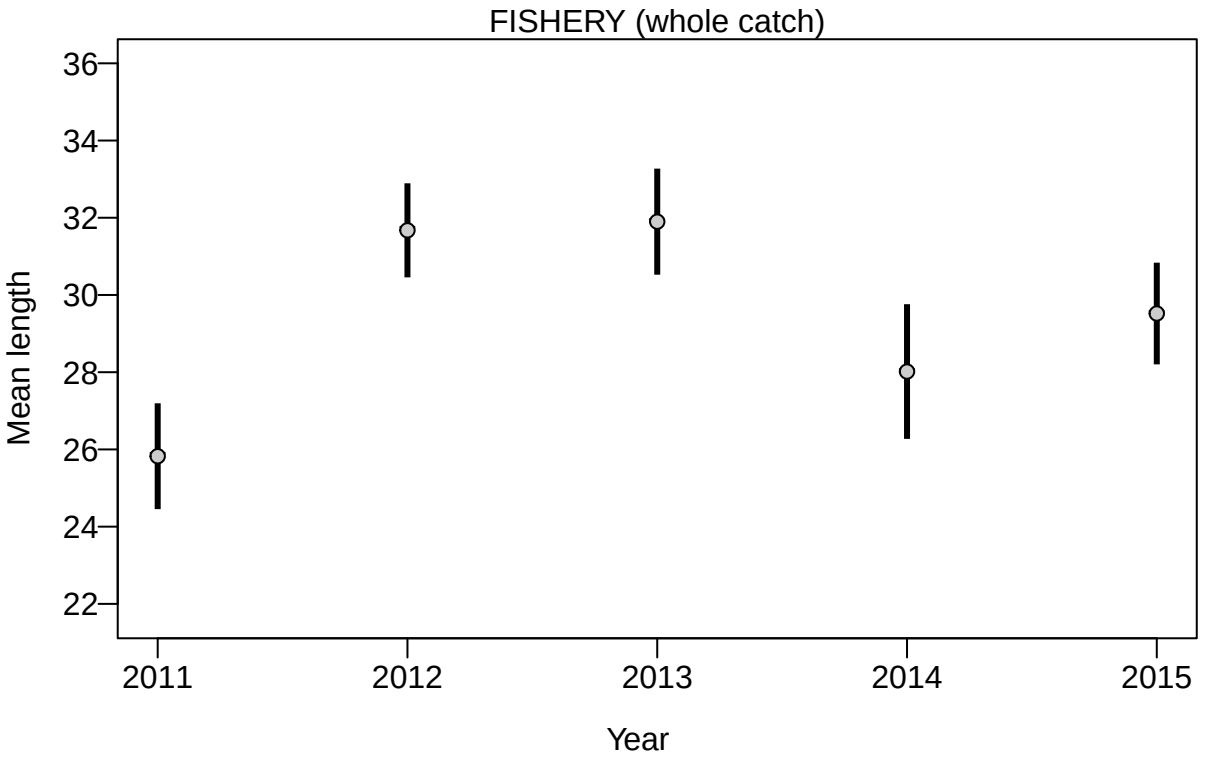

Numbers at age at equilibrium
0
1
2
3
4
5
0
2
4
6
8
10
12
14
Age

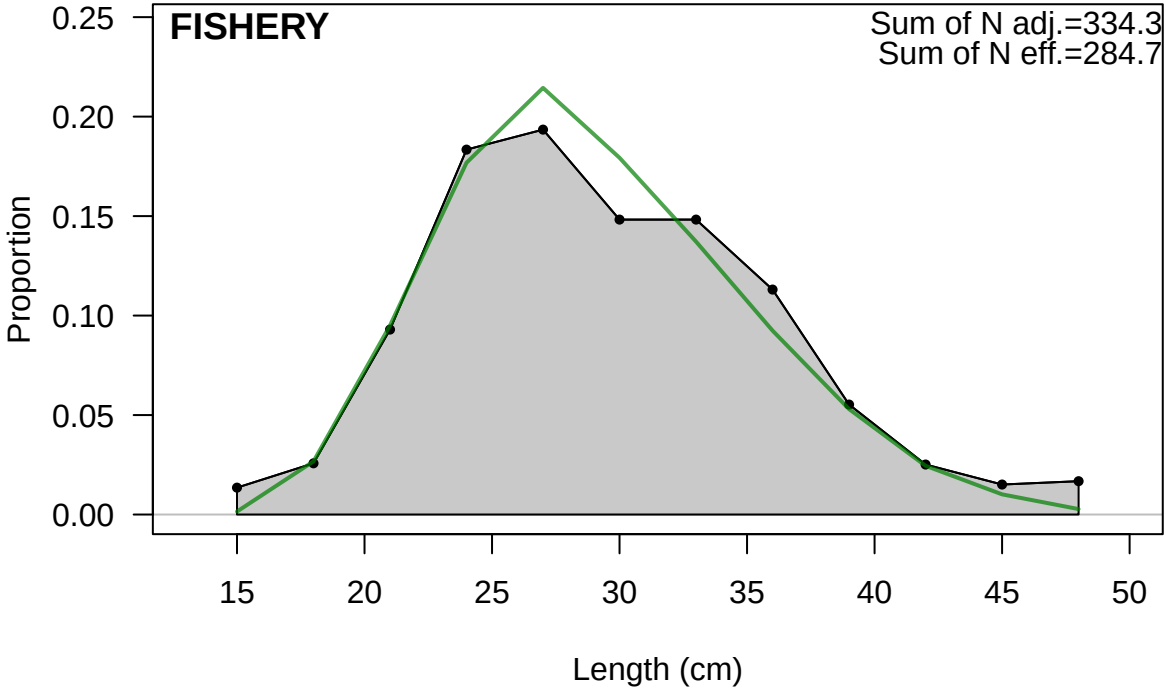

FISHERY
Sum of N adj.=334.3
Proportion
0.00
0.05
0.10
0.15
0.20
15
20
25
30
35
40
45
50
Length (cm)

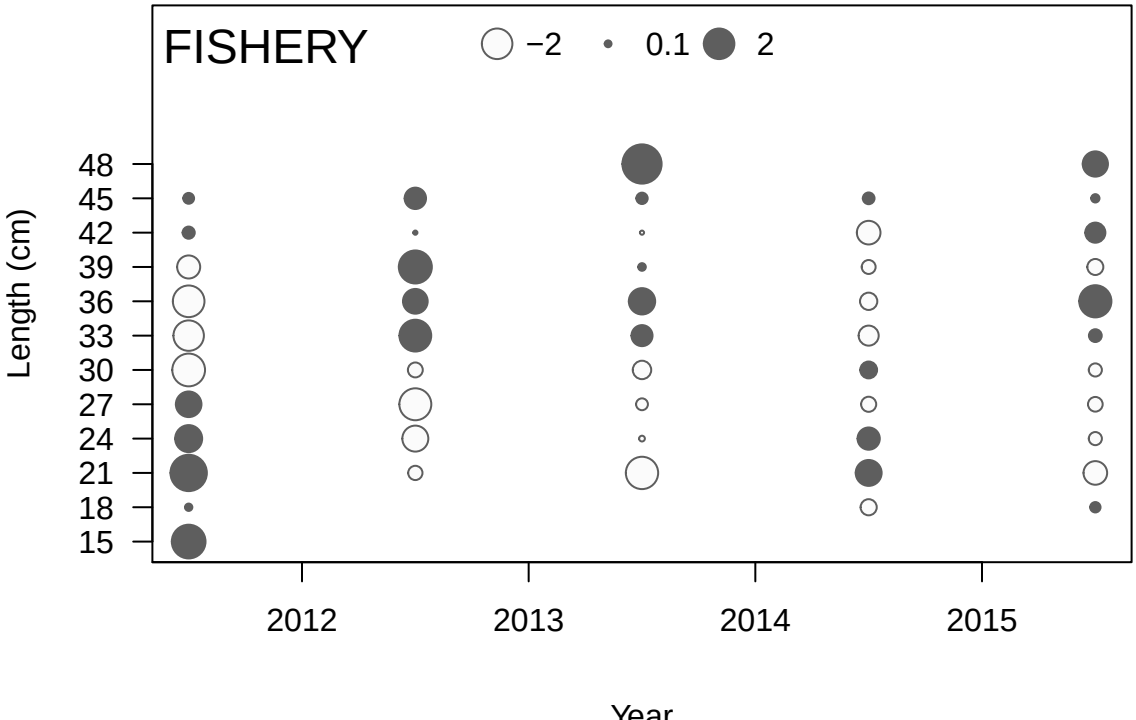

FISHERY
0.01
0.2
0.4
48
45
42
39
36
33
30
27
24
21
18
15
Length (cm)
2012
2013
2014
2015
Year

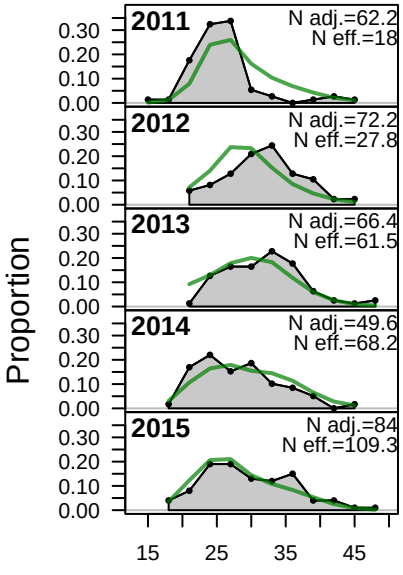

2011
N adj.=62.2
2012
N adj.=72.2
2013
N adj.=66.4
2014
N adj.=49.6
2015
N adj.=84
0.00
0.10
0.20
0.30
15
25
35
45
Proportion
Length (cm)

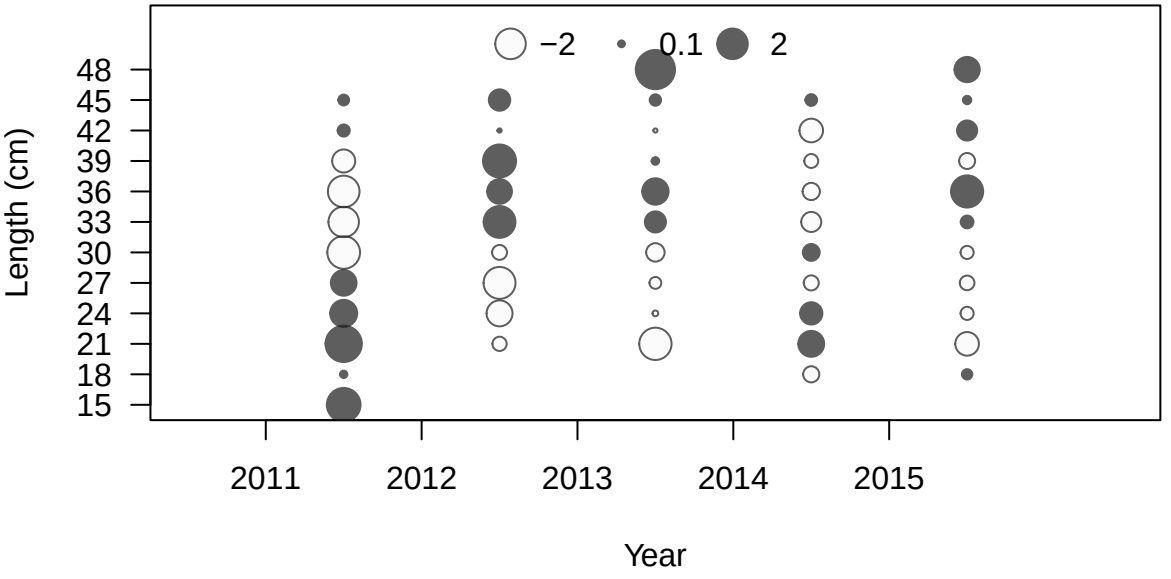

0.01
0.2
0.4
48
45
42
39
36
33
30
27
24
21
18
15
Length (cm)
2011
2012
2013
2014
2015
Year

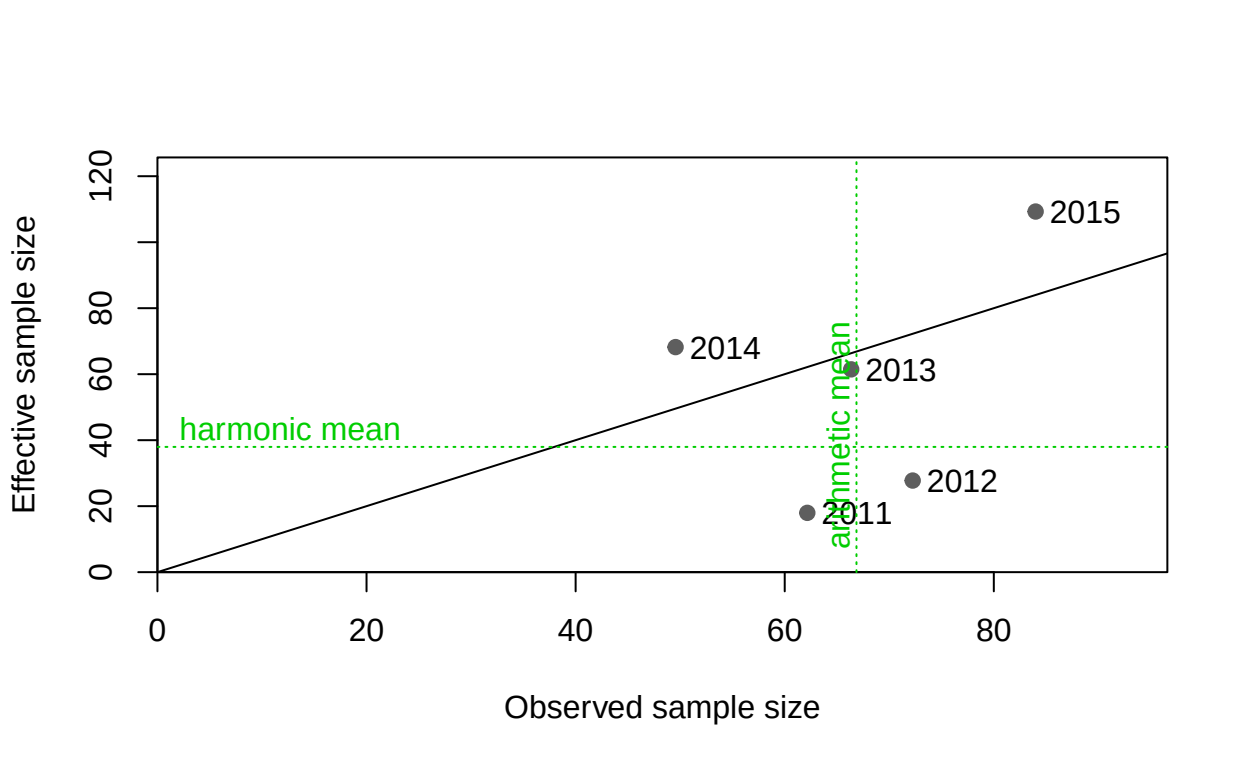

FISHERY (whole catch)
Mean length
36
34
32
30
28
26
24
22
2011
2012
2013
2014
2015
Year

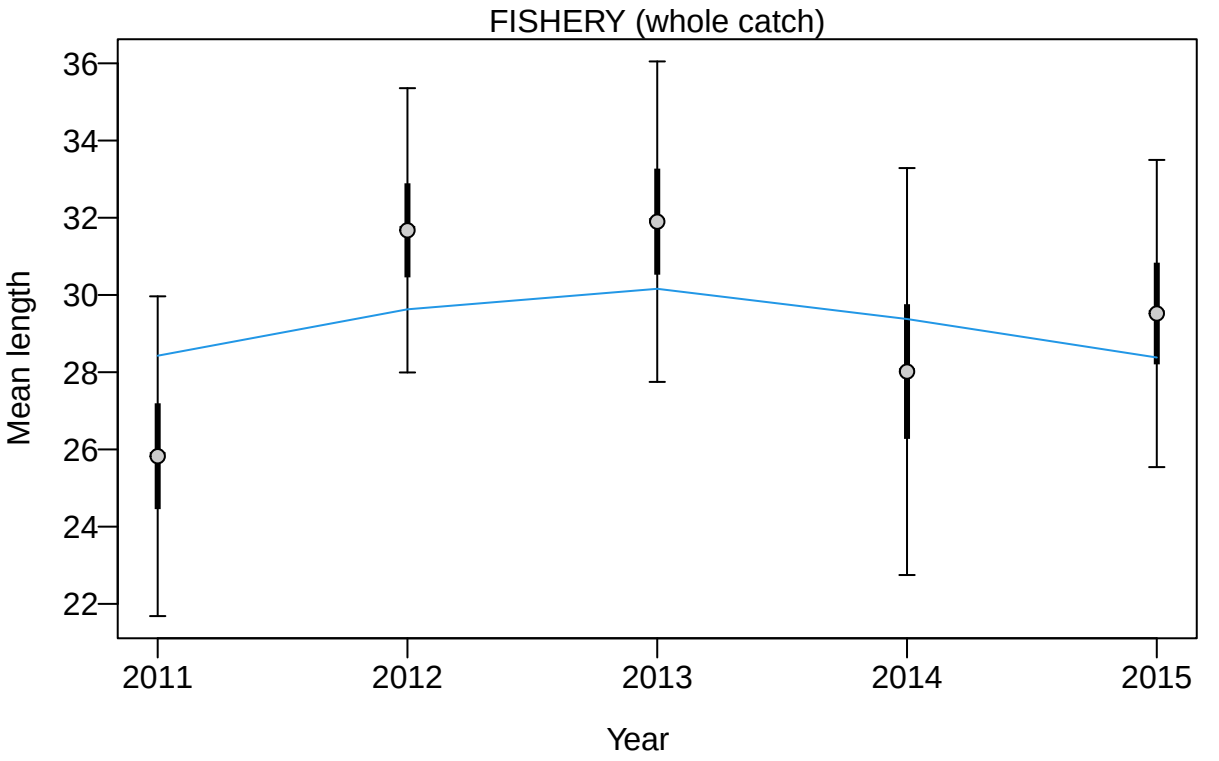

FISHERY
Sum of N adj.=334.3
Sum of N eff.=284.7
Proportion
0.25
0.20
0.15
0.10
0.05
0.00
15
20
25
30
35
40
45
50
Length (cm)

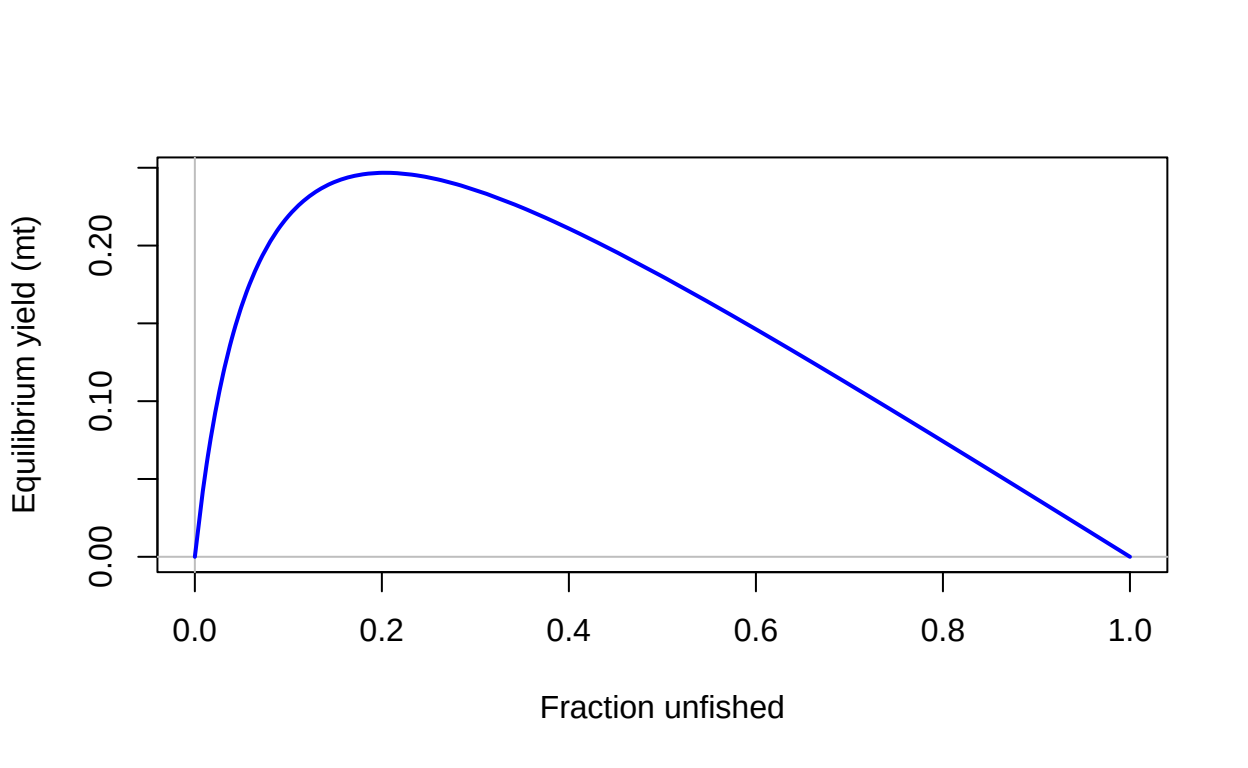

FISHERY
−2
0.1
2
Length (cm)
48
45
42
39
36
33
30
27
24
21
18
15
2012
2013
2014
2015
Year

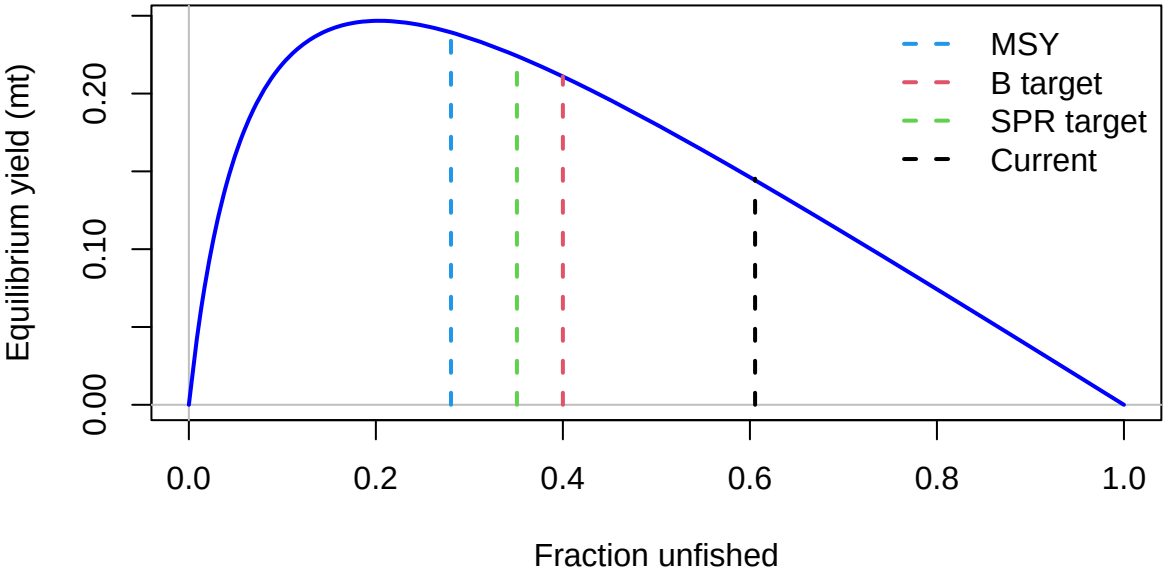

2011
N adj.=62.2
N eff.=18
2012
N adj.=72.2
N eff.=27.8
2013
N adj.=66.4
N eff.=61.5
2014
N adj.=49.6
N eff.=68.2
2015
N adj.=84
N eff.=109.3
0.00
0.10
0.20
0.30
15
25
35
45
Proportion
Length (cm)

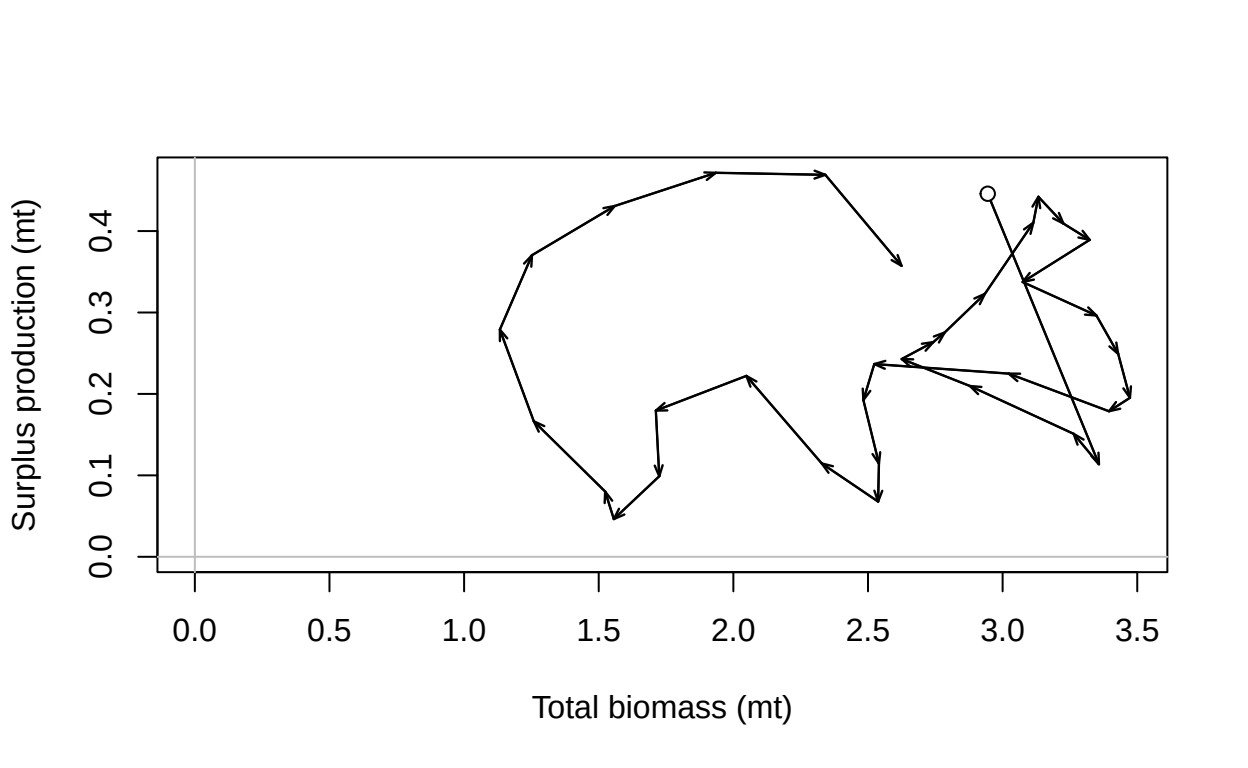

−2
0.1
2
48
45
42
39
36
33
30
27
24
21
18
15
Length (cm)
2011
2012
2013
2014
2015
Year

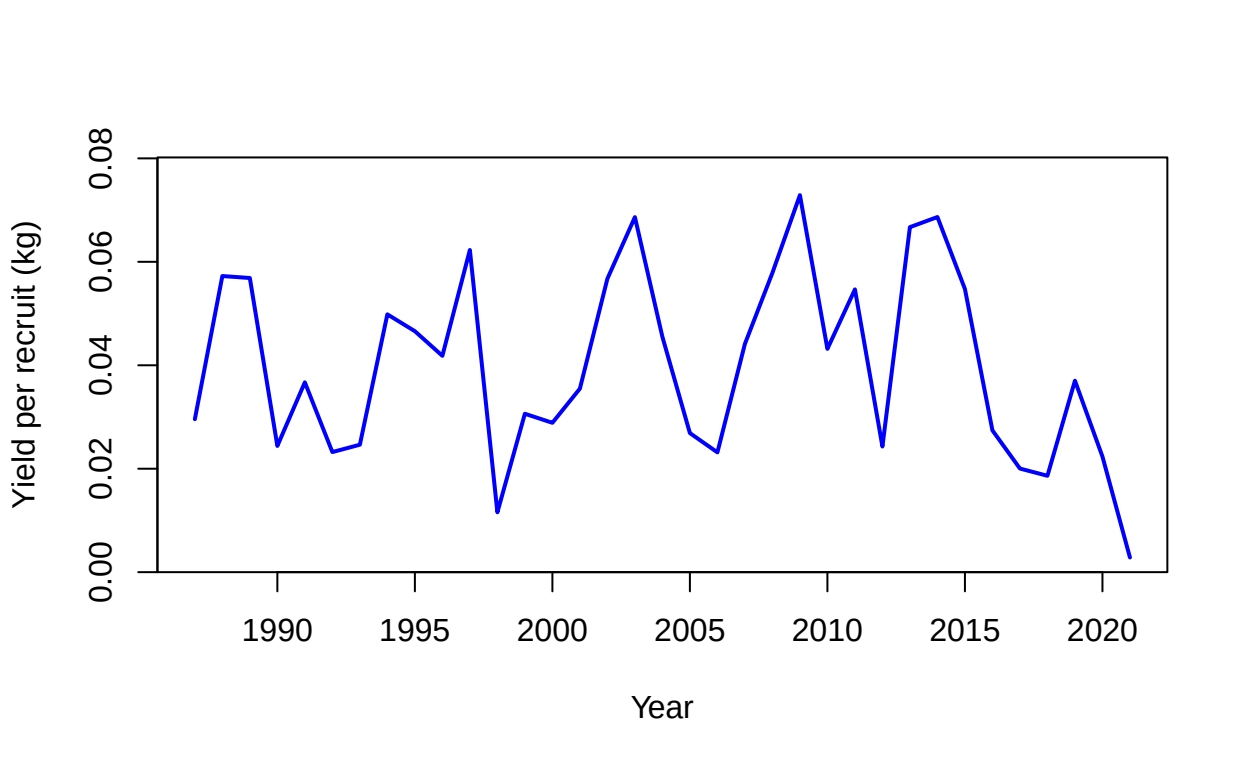

Effective sample size
0
20
40
60
80
120
0
20
40
60
80
Observed sample size
2015
2014
2013
2012
2011
harmonic mean
arithmetic mean

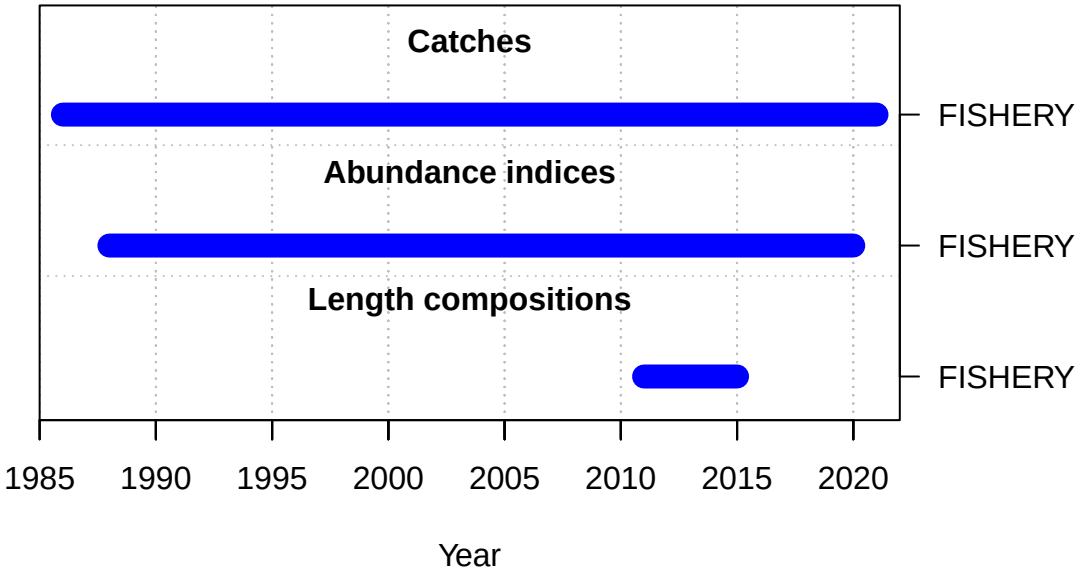

FISHERY (whole catch)
Mean length
36
34
32
30
28
26
24
22
2011
2012
2013
2014
2015
Year

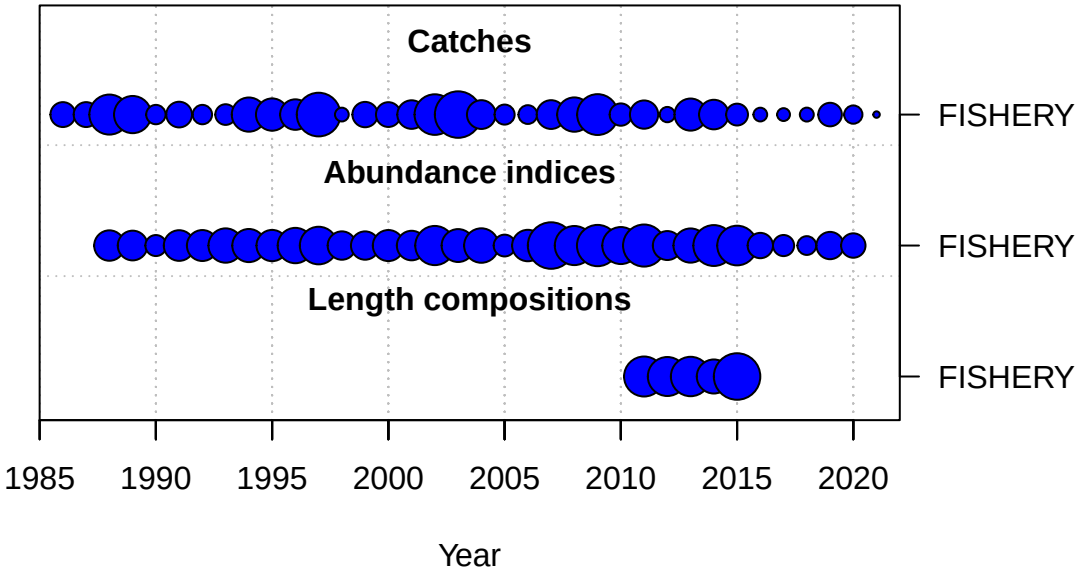

Equilibrium yield (mt)
0.00
0.10
0.20
0.0
0.2
0.4
0.6
0.8
1.0
Fraction unfished

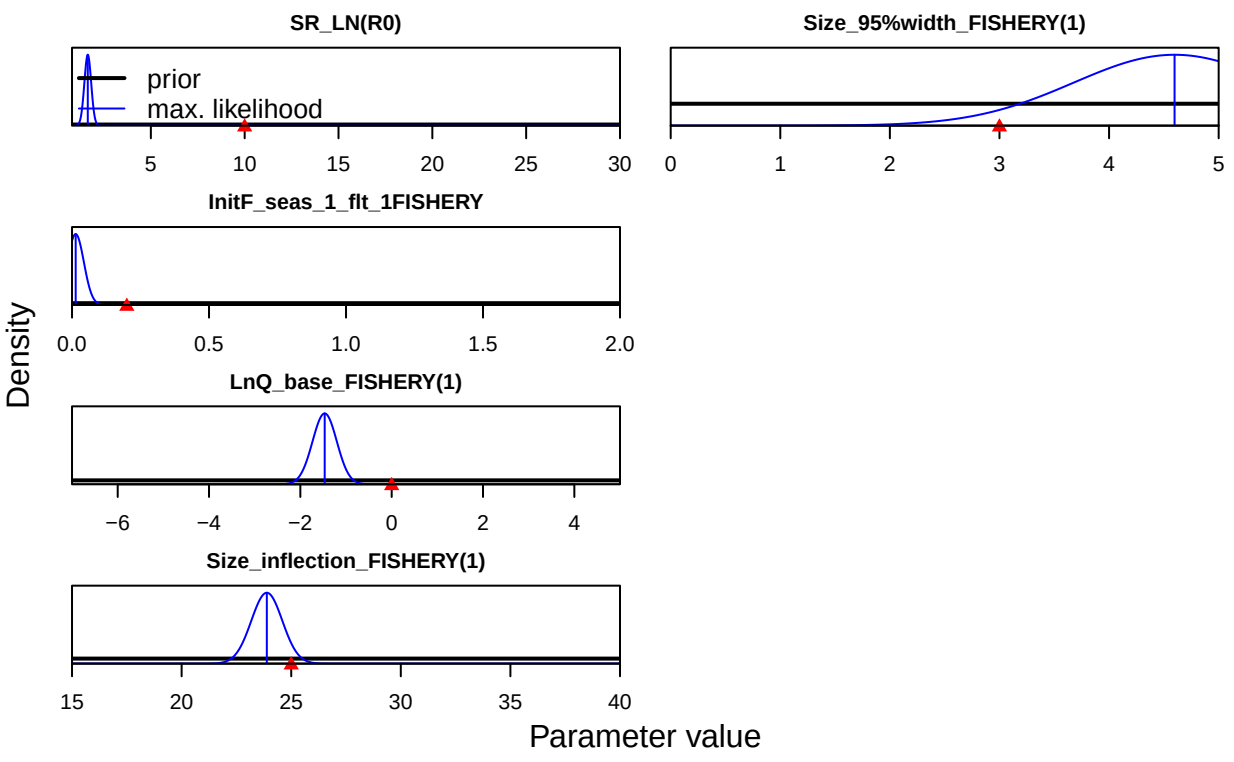

MSY
B target
SPR target
Current
Equilibrium yield (mt)
0.00
0.10
0.20
0.0
0.2
0.4
0.6
0.8
1.0
Fraction unfished


Surplus production (mt)
0.0
0.1
0.2
0.3
0.4
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
Total biomass (mt)


Yield per recruit (kg)
0.00
0.02
0.04
0.06
0.08
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
Size_95%width_FISHERY(1)
0
1
2
3
4
5
InitF_seas_1_flt_1FISHERY
0.0
0.5
1.0
1.5
2.0
LnQ_base_FISHERY(1)
−6
−4
−2
0
2
4
Size_inflection_FISHERY(1)
15
20
25
30
35
40
Density
Parameter value