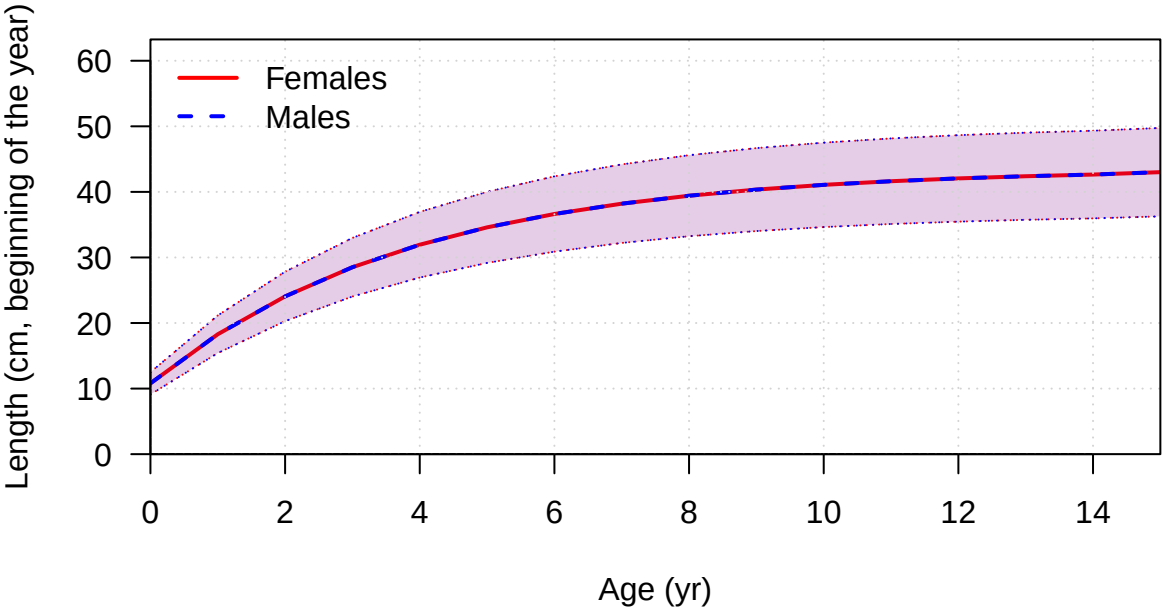
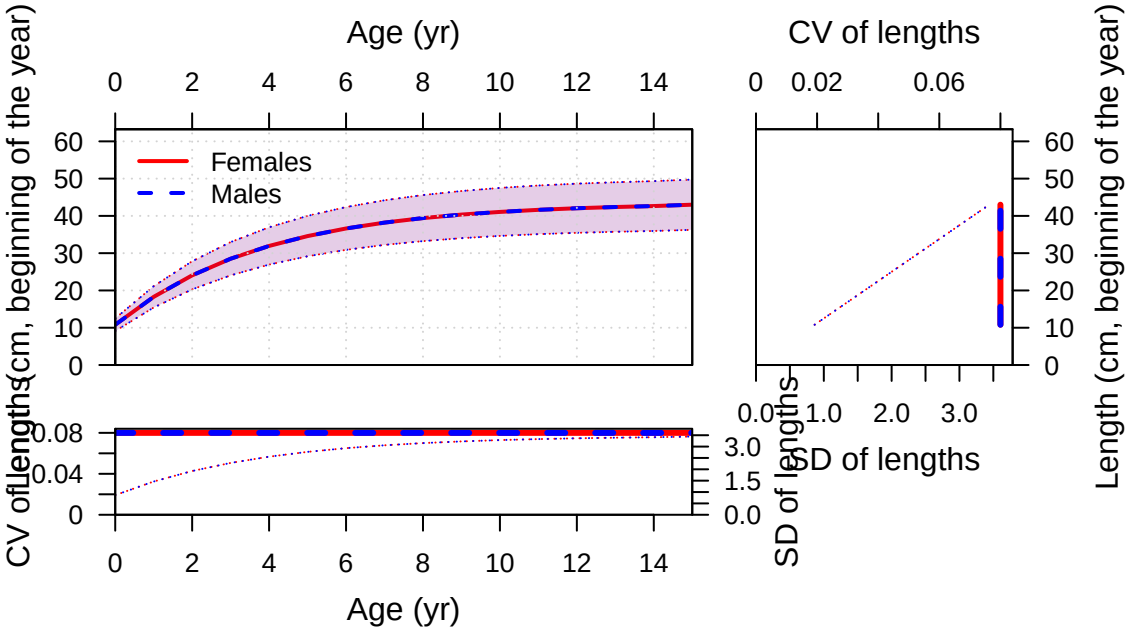
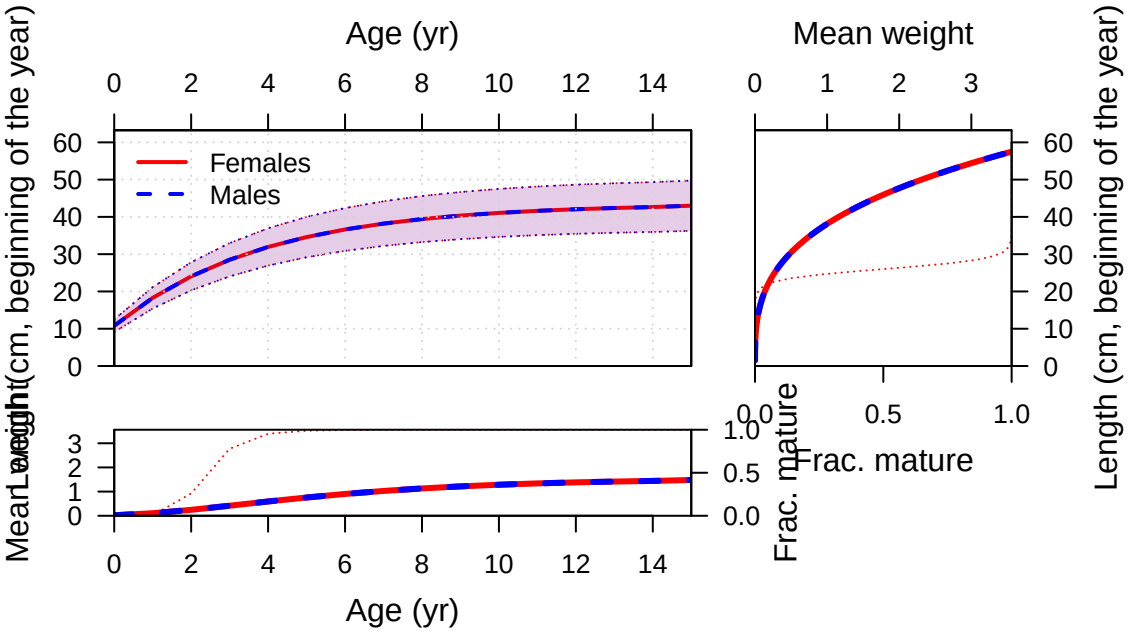
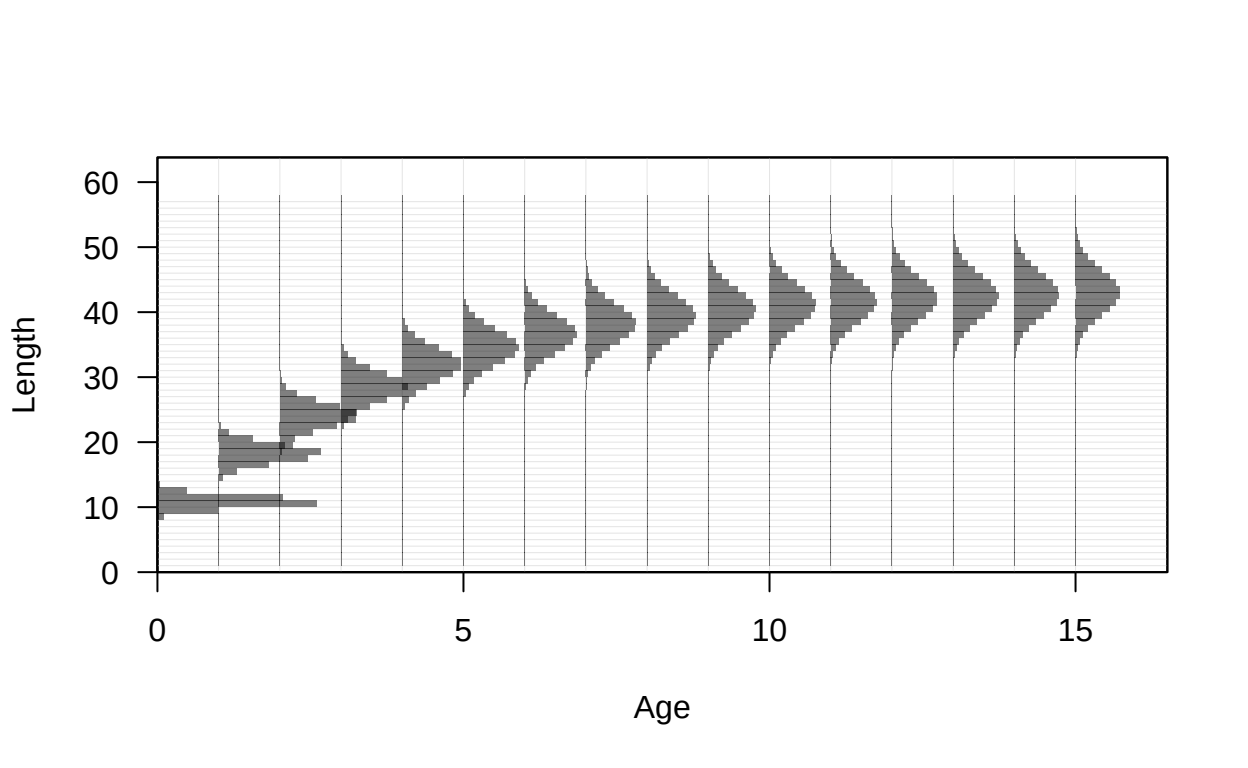
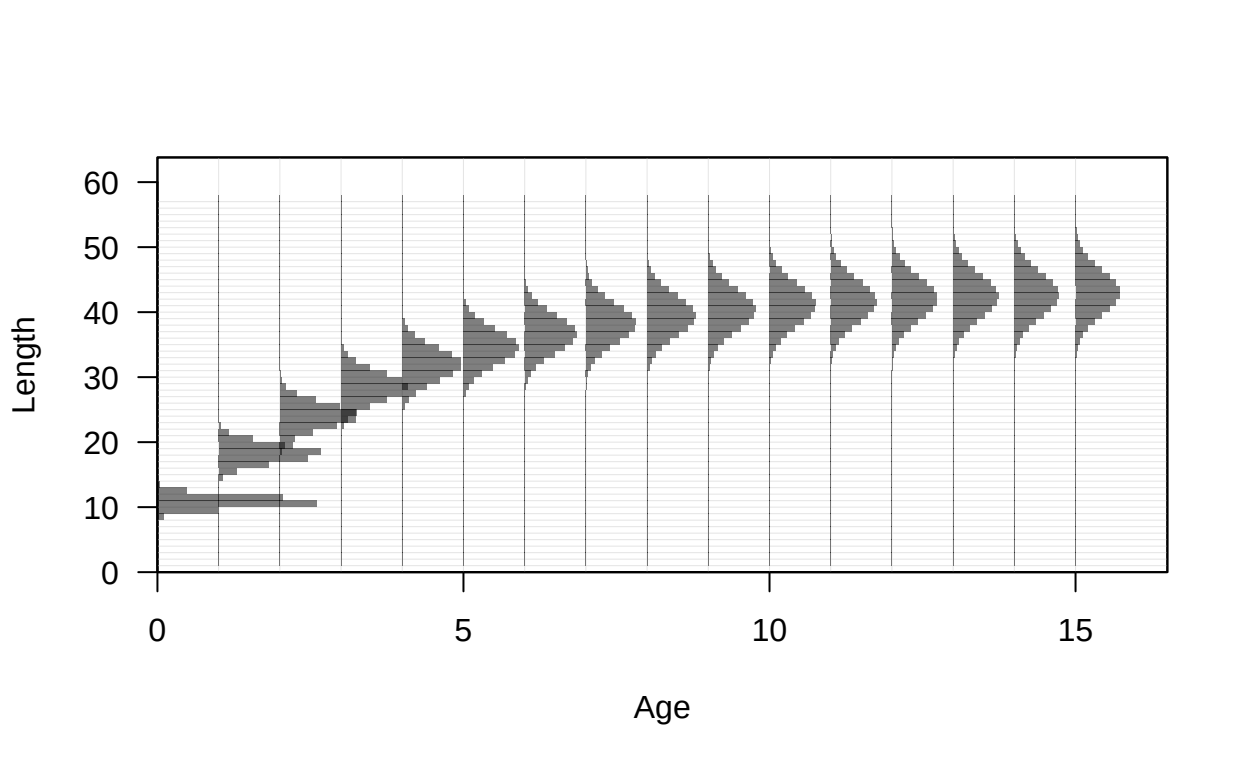
Plots created using the 'r4ss' package in R
Stock Synthesis version: 3.30.19.0
StartTime: Wed Aug 03 12:07:02 2022
Data_File: data.ss
Control_File: control.ss

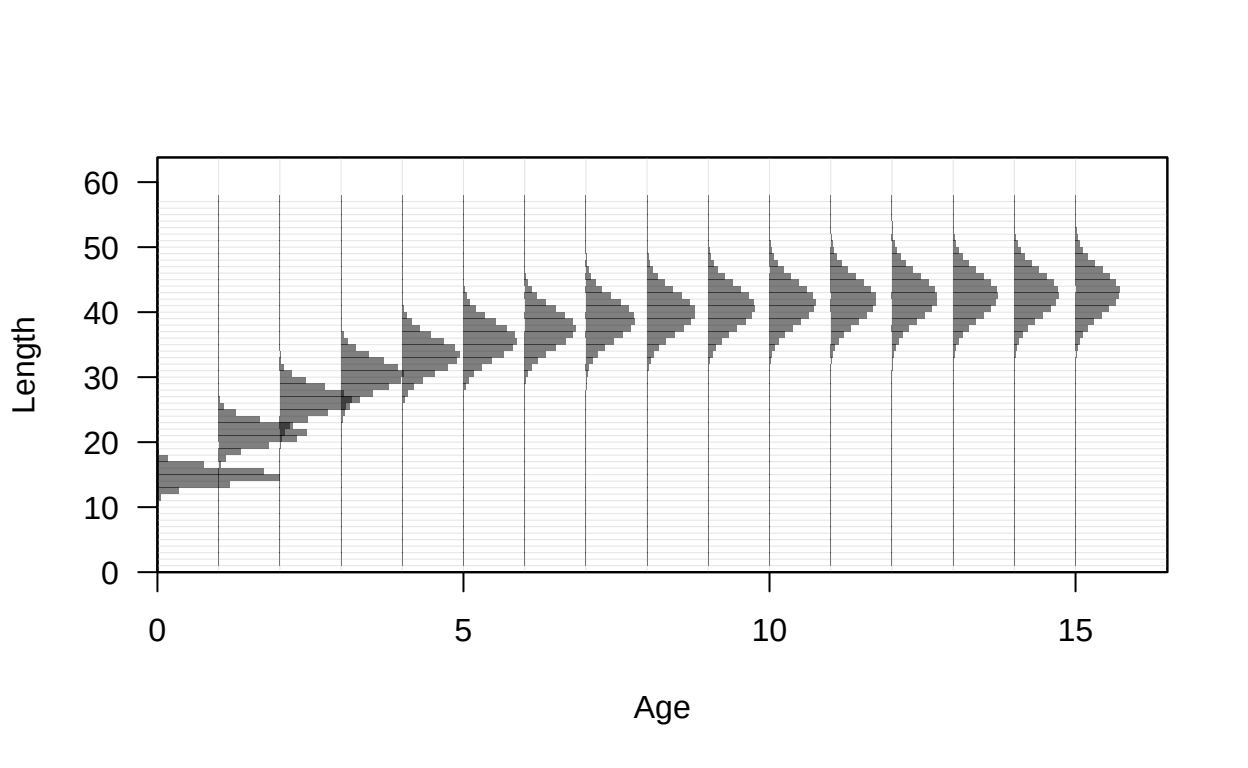

Females
Males
Length (cm, beginning of the year)
Age (yr)
0
10
20
30
40
50
60
0
2
4
6
8
10
12
14

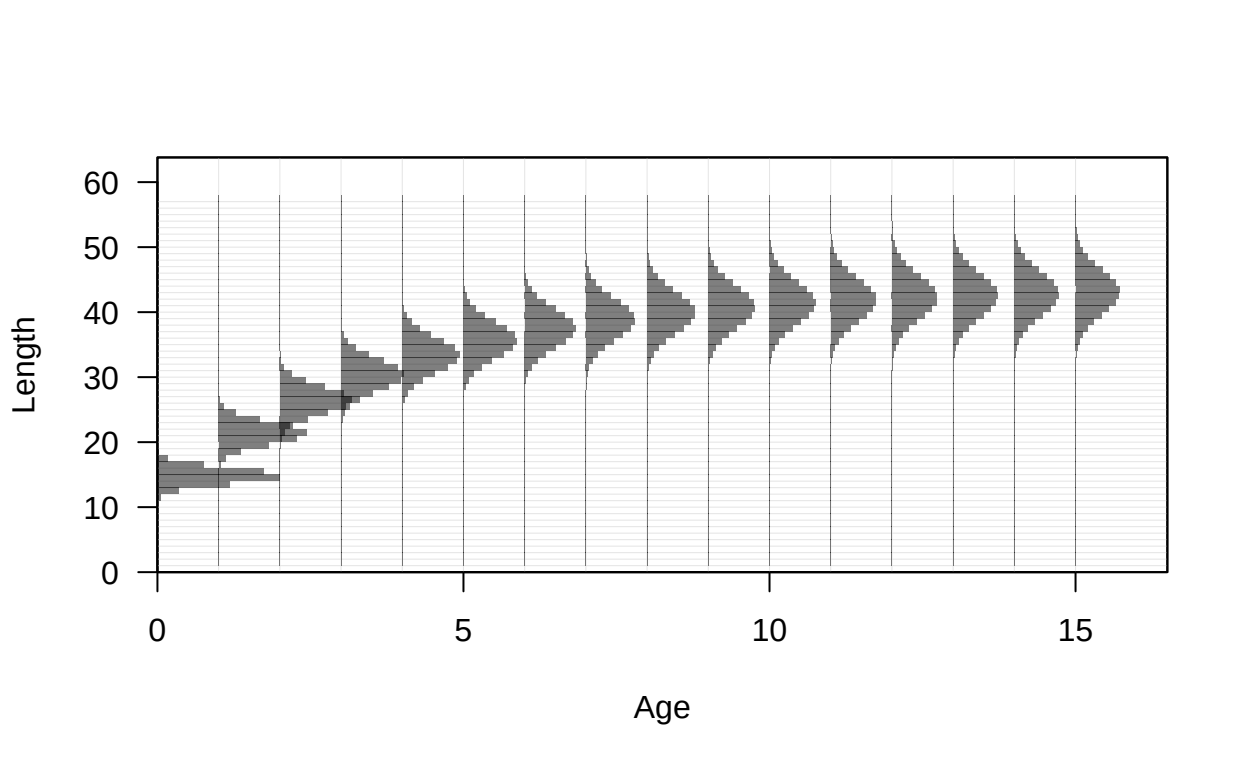

Age (yr)
0
2
4
6
8
10
12
14
Females
Males
Length (cm, beginning of the year)
60
50
40
30
20
10
0
CV of lengths
0
0.02
0.06
0.0
1.0
2.0
3.0
SD of lengths
CV of lengths
0.08
0.04
0
SD of lengths
3.0
1.5
0.0
Age (yr)

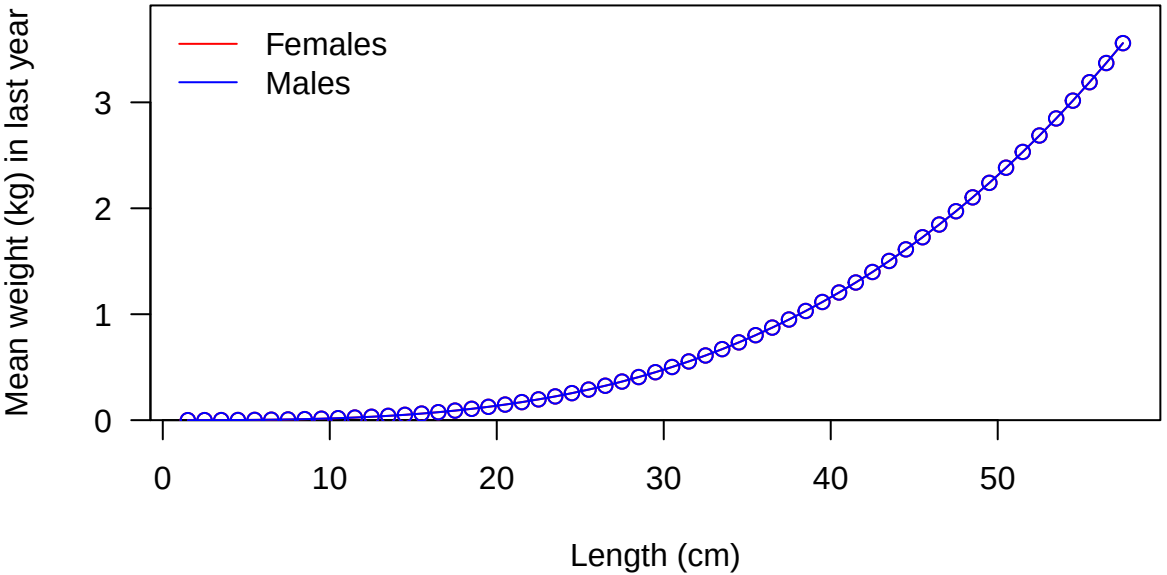

Age (yr)
Mean weight
Length (cm, beginning of the year)
Females
Males
Frac. mature
Age (yr)

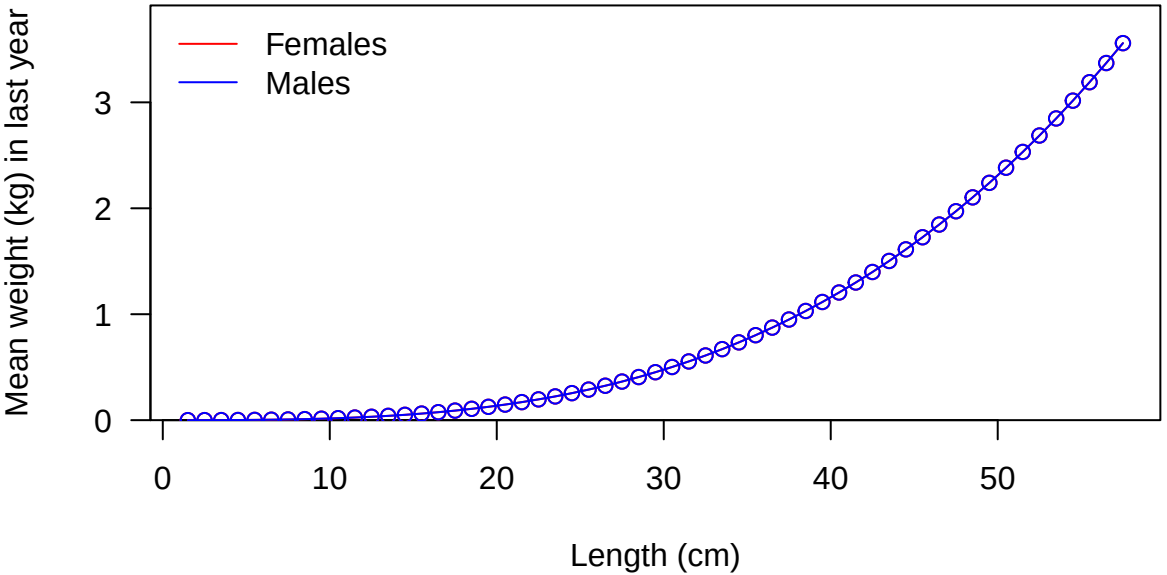

Length
60
50
40
30
20
10
0
0
5
10
15
Age

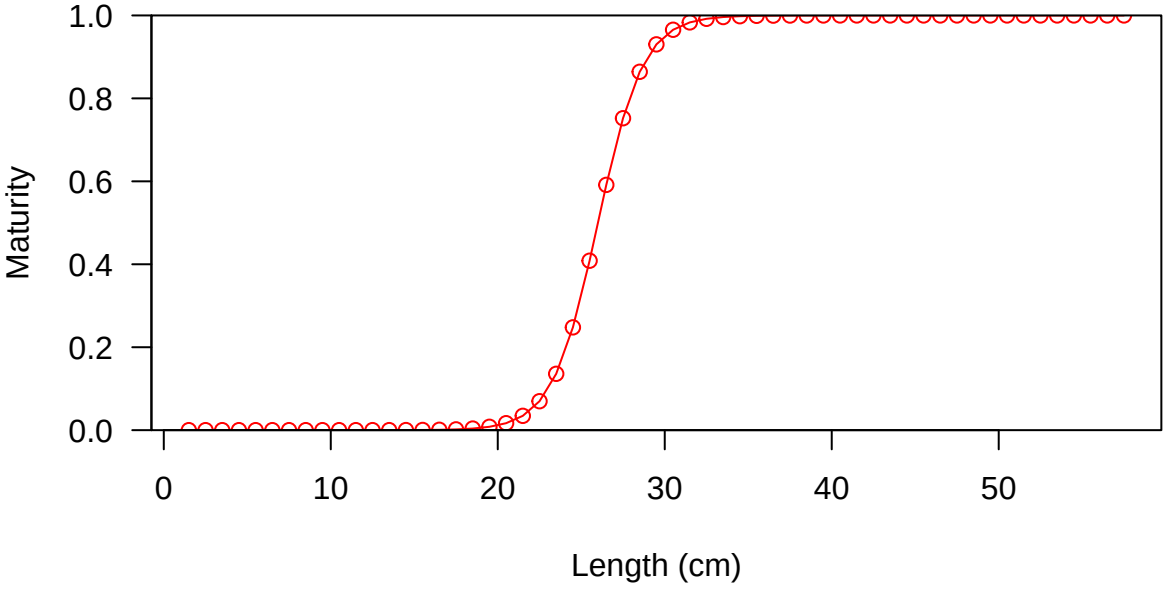

Length
60
50
40
30
20
10
0
0
5
10
15
Age

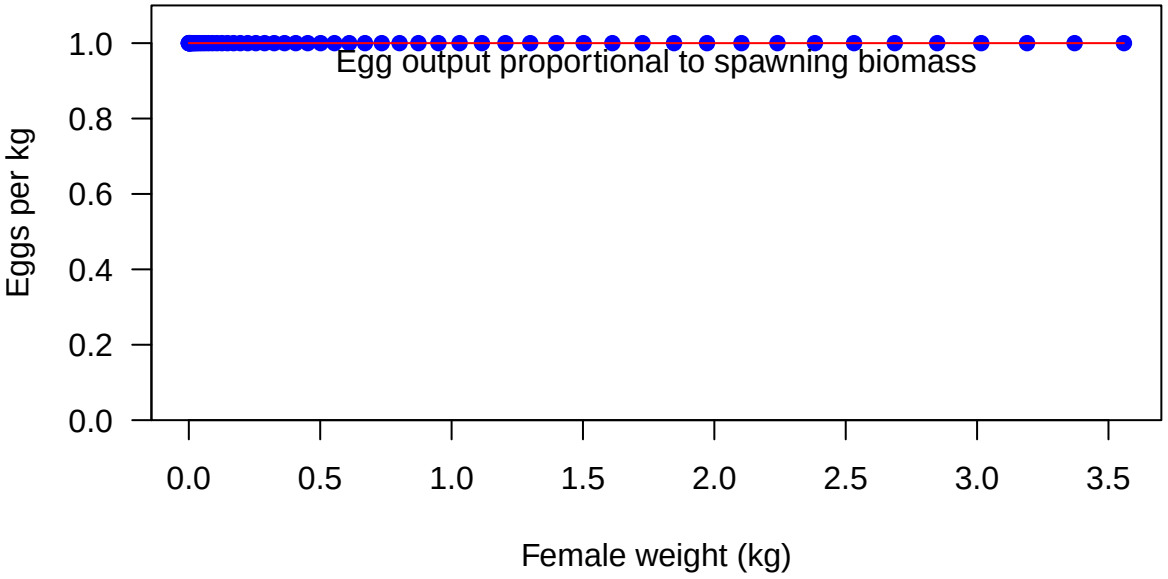

Length
60
50
40
30
20
10
0
0
5
10
15
Age

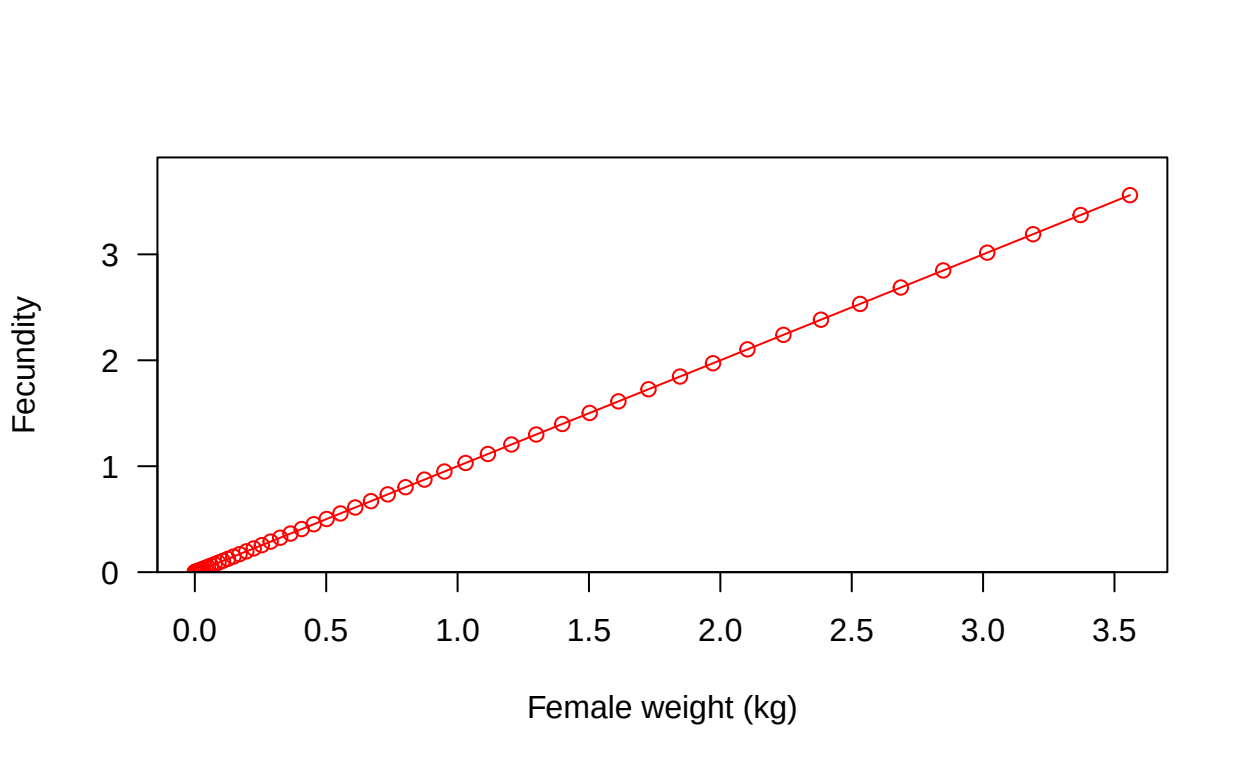

Length
60
50
40
30
20
10
0
0
5
10
15
Age

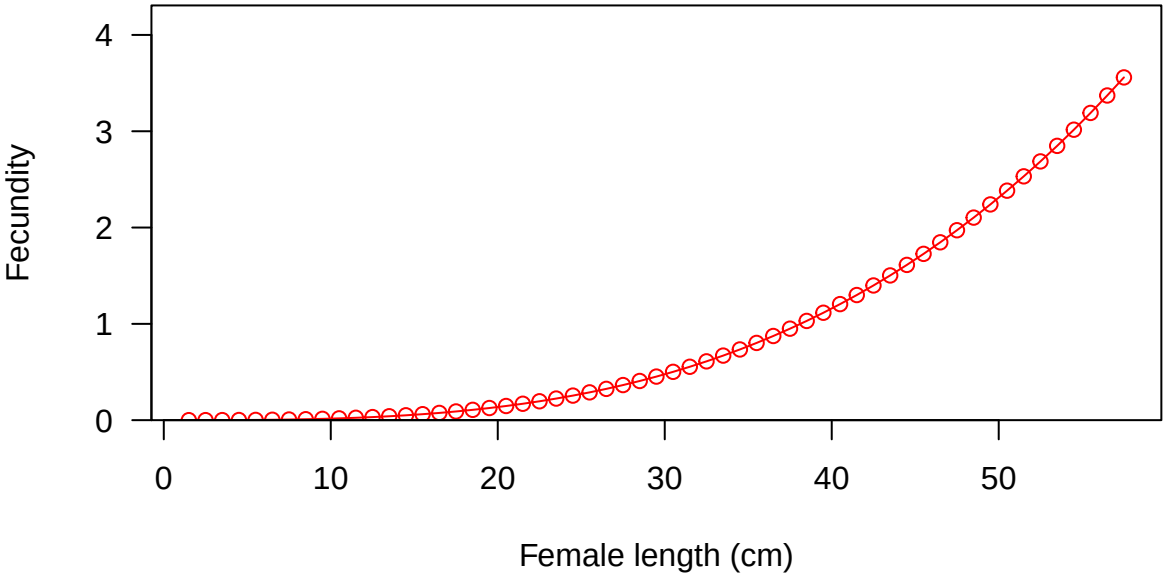

Females
Males
Mean weight (kg) in last year
0
1
2
3
0
10
20
30
40
50
Length (cm)

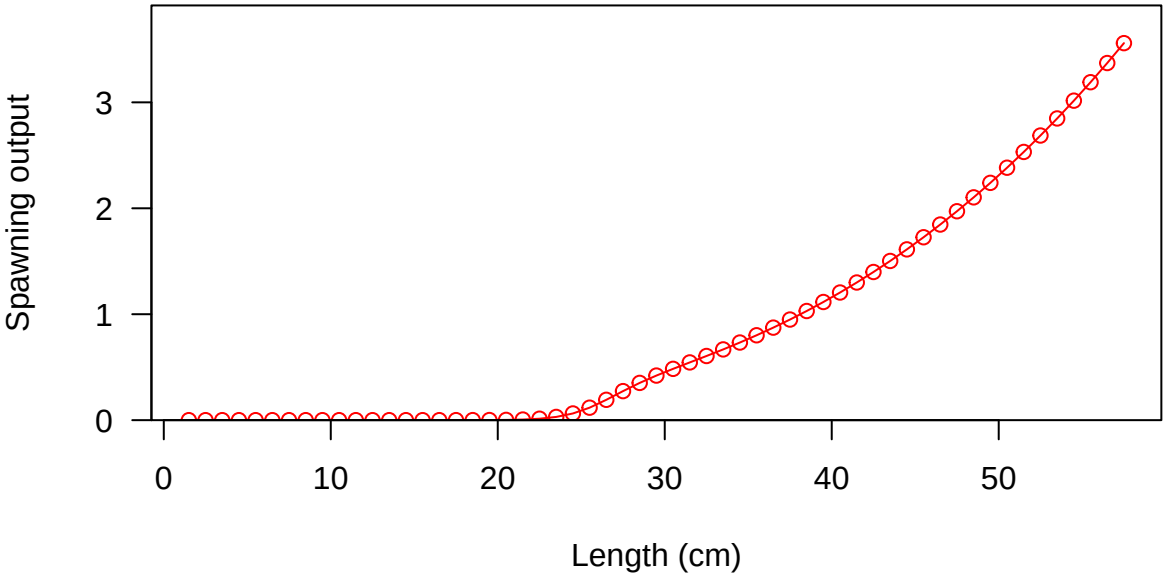

Females
Males
Mean weight (kg) in last year
0
1
2
3
0
10
20
30
40
50
Length (cm)

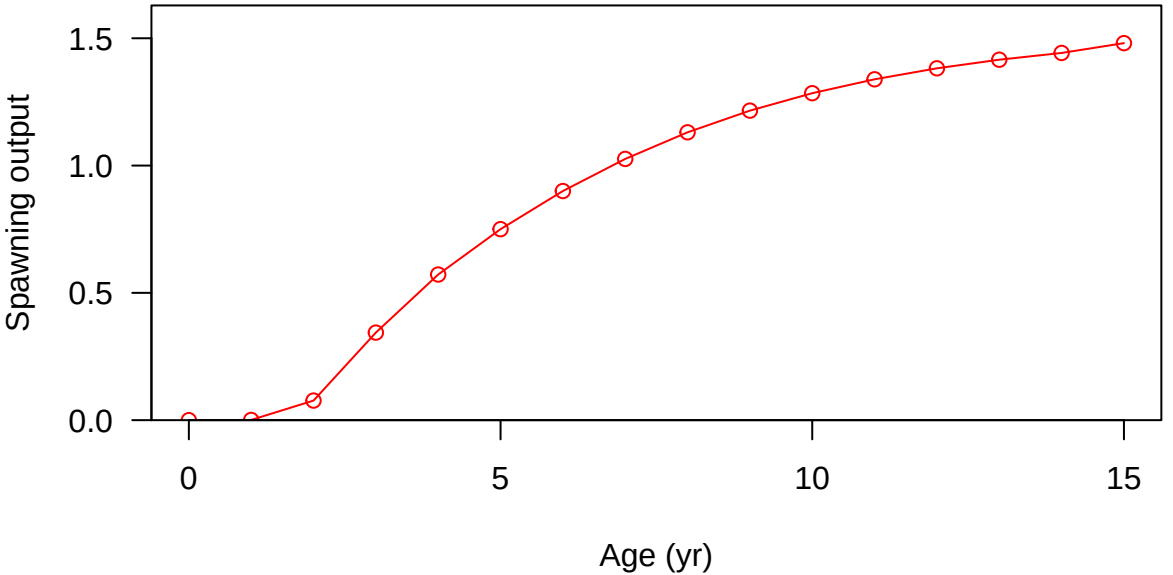

1.0
0.8
0.6
0.4
0.2
0.0
Maturity
0
10
20
30
40
50
Length (cm)

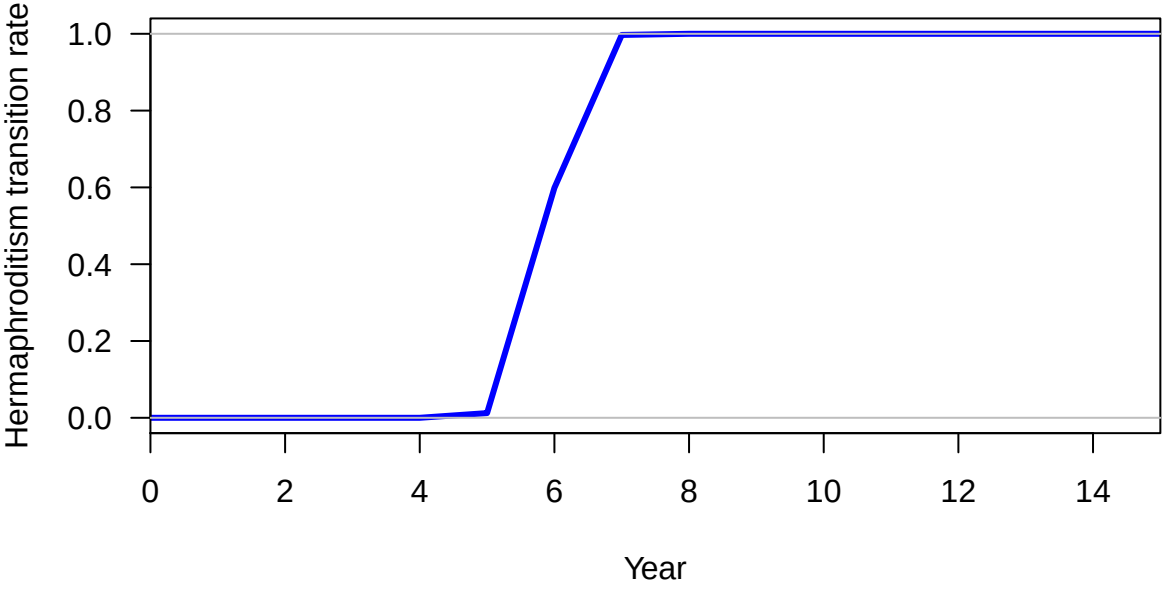

Egg output proportional to spawning biomass
Eggs per kg
1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
Female weight (kg)

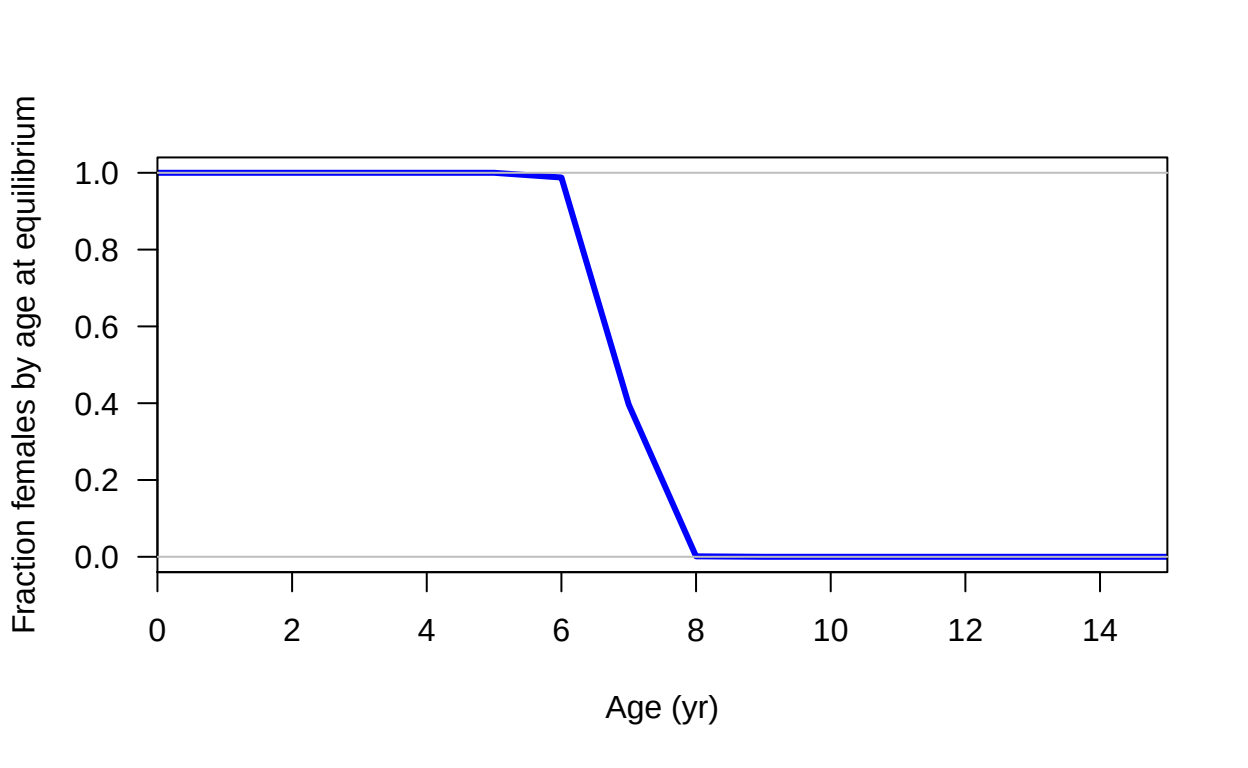

Fecundity
0
1
2
3
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
Female weight (kg)

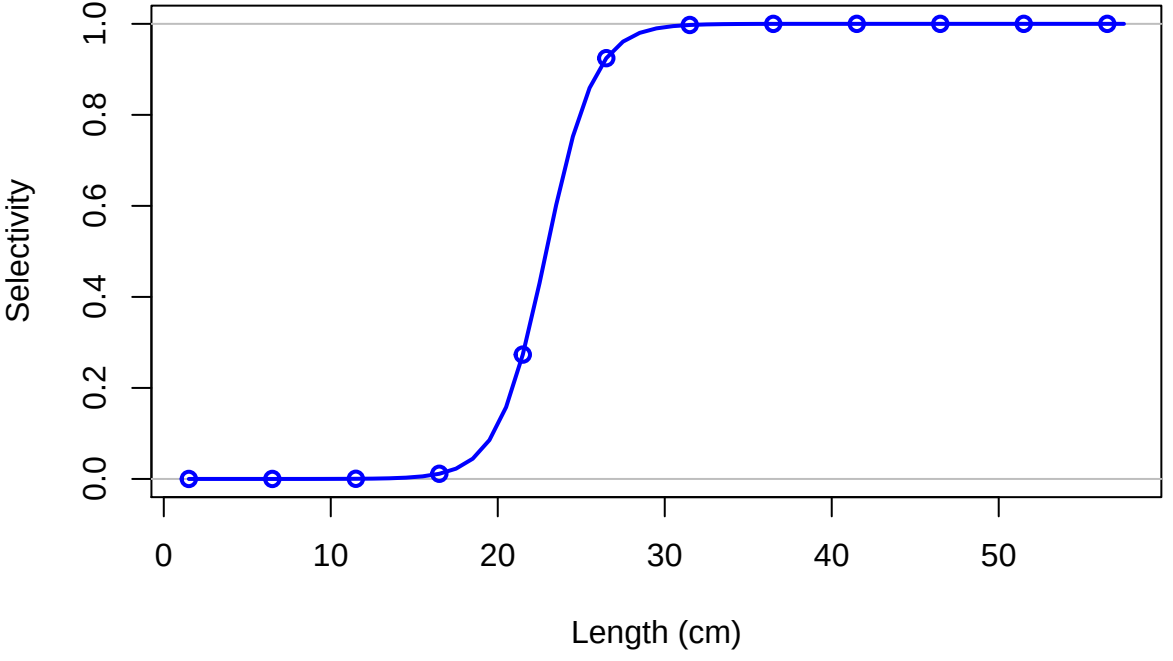

Fecundity
0
1
2
3
4
0
10
20
30
40
50
Female length (cm)

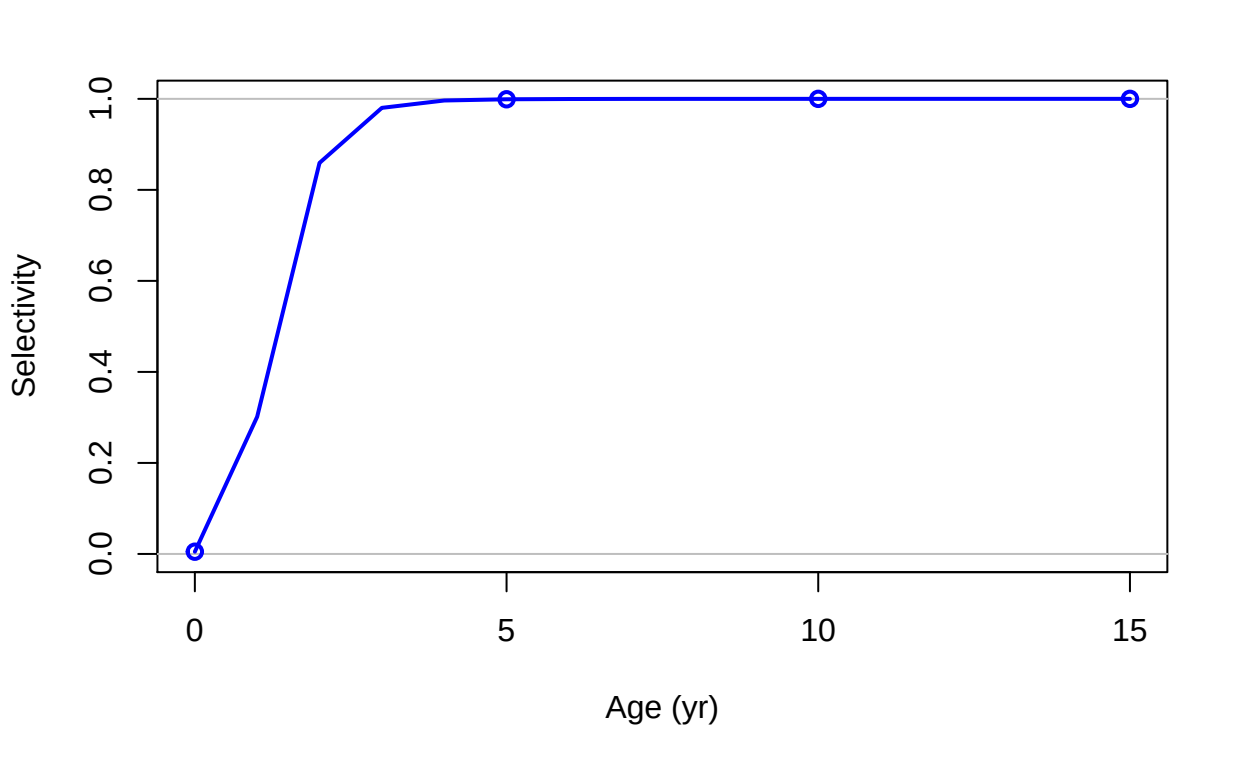

Spawning output
0
1
2
3
0
10
20
30
40
50
Length (cm)

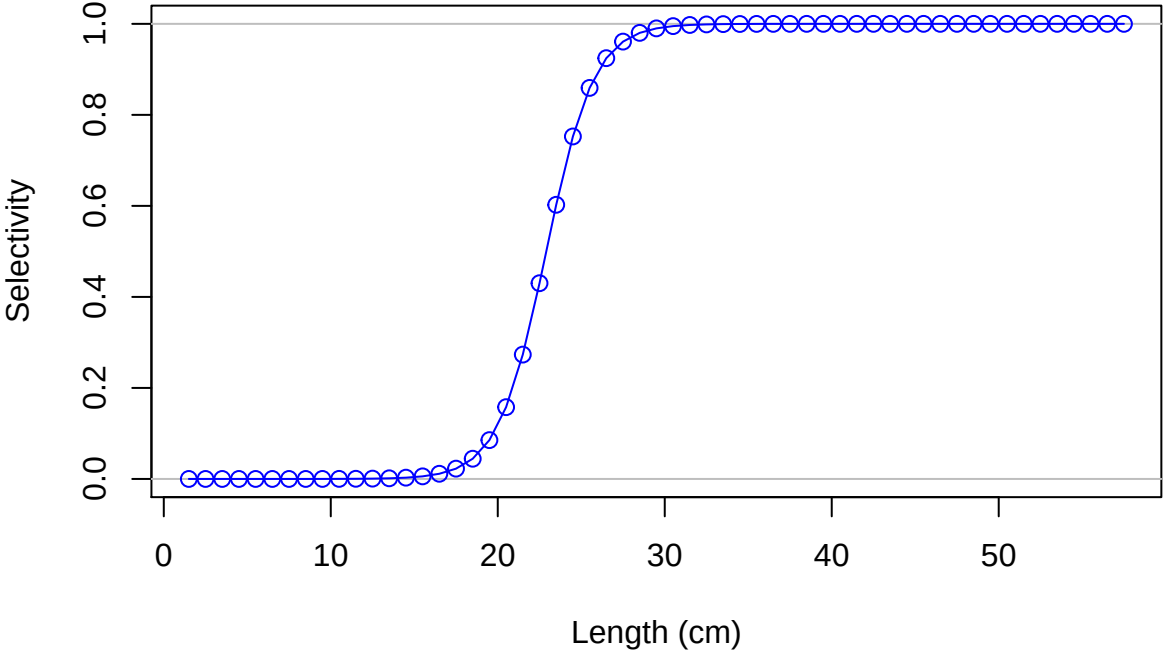

Spawning output
1.5
1.0
0.5
0.0
0
5
10
15
Age (yr)

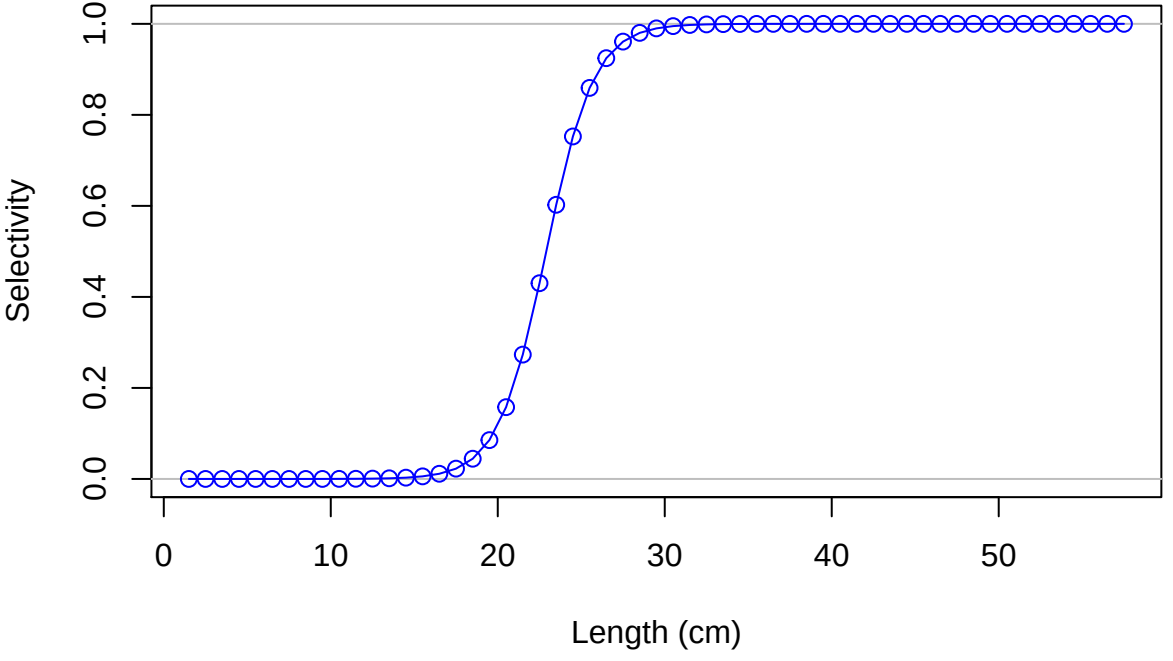

Hermaphroditism transition rate
1.0
0.8
0.6
0.4
0.2
0.0
0
2
4
6
8
10
12
14
Year

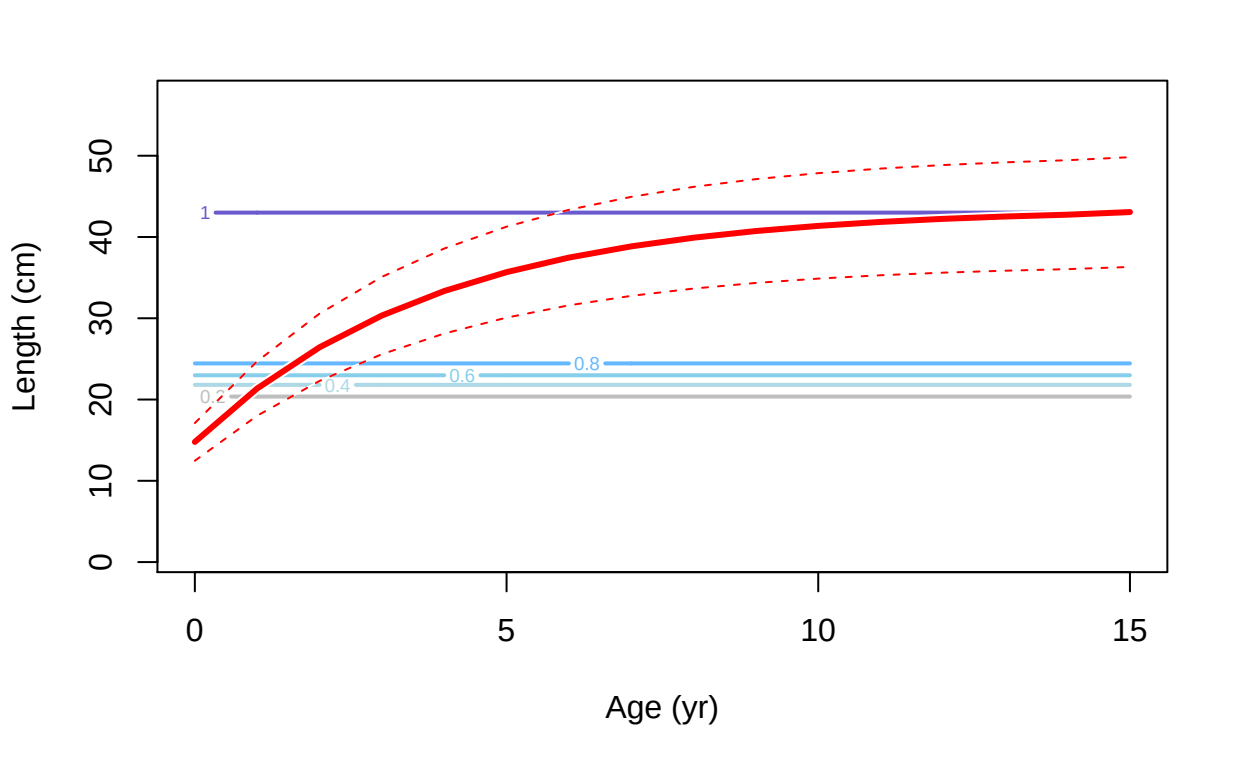

Fraction females by age at equilibrium
1.0
0.8
0.6
0.4
0.2
0.0
0
2
4
6
8
10
12
14
Age (yr)

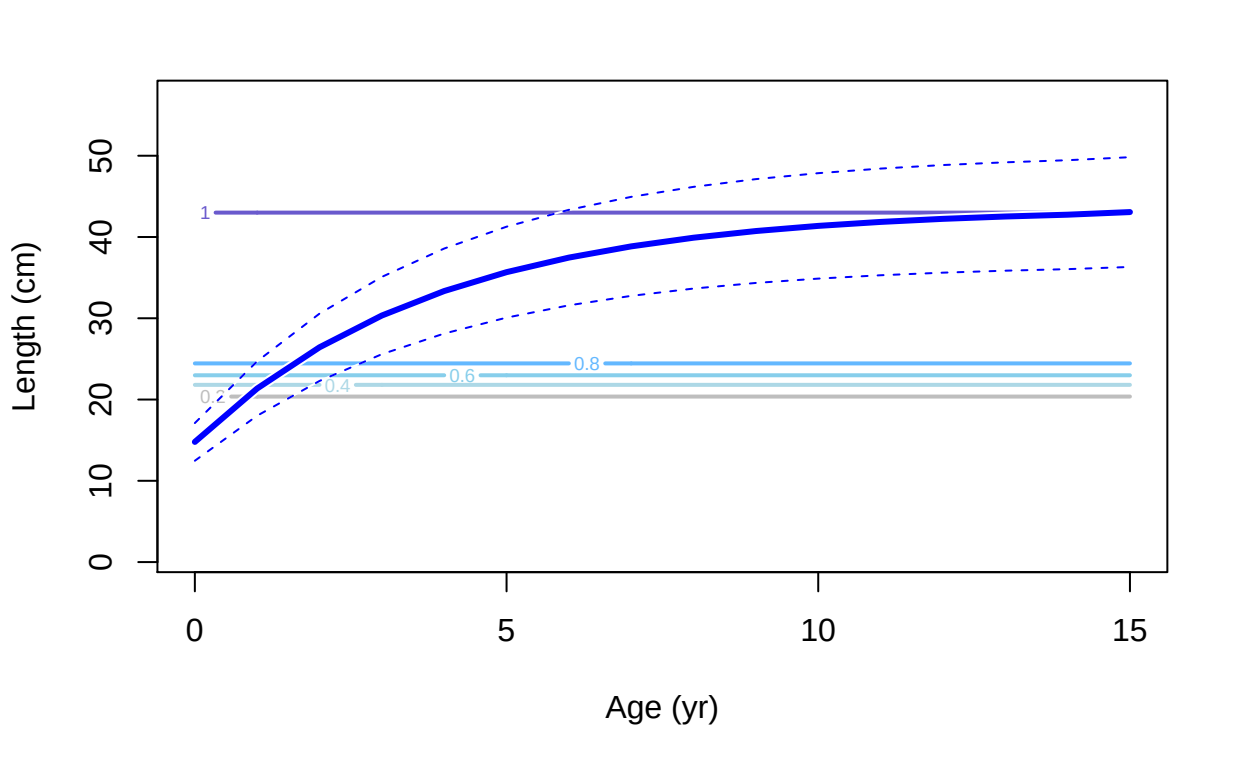

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
10
20
30
40
50
Length (cm)

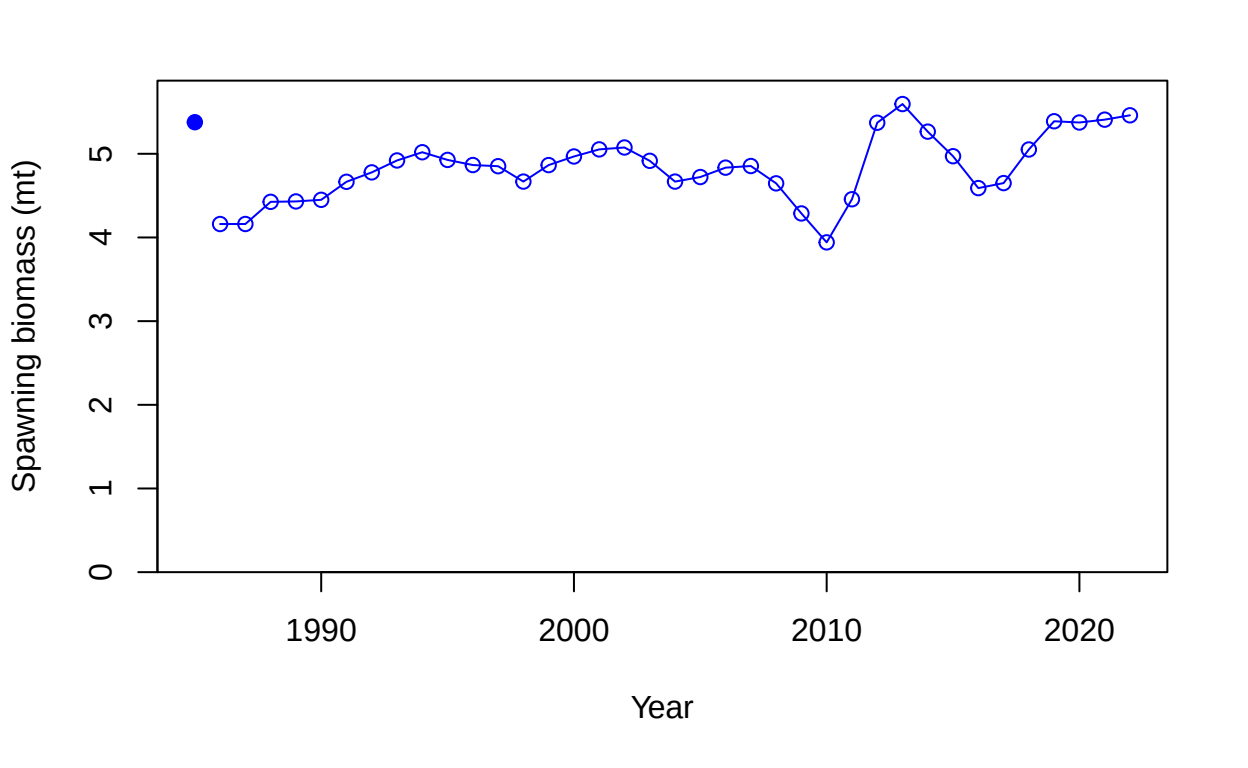

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
5
10
15
Age (yr)

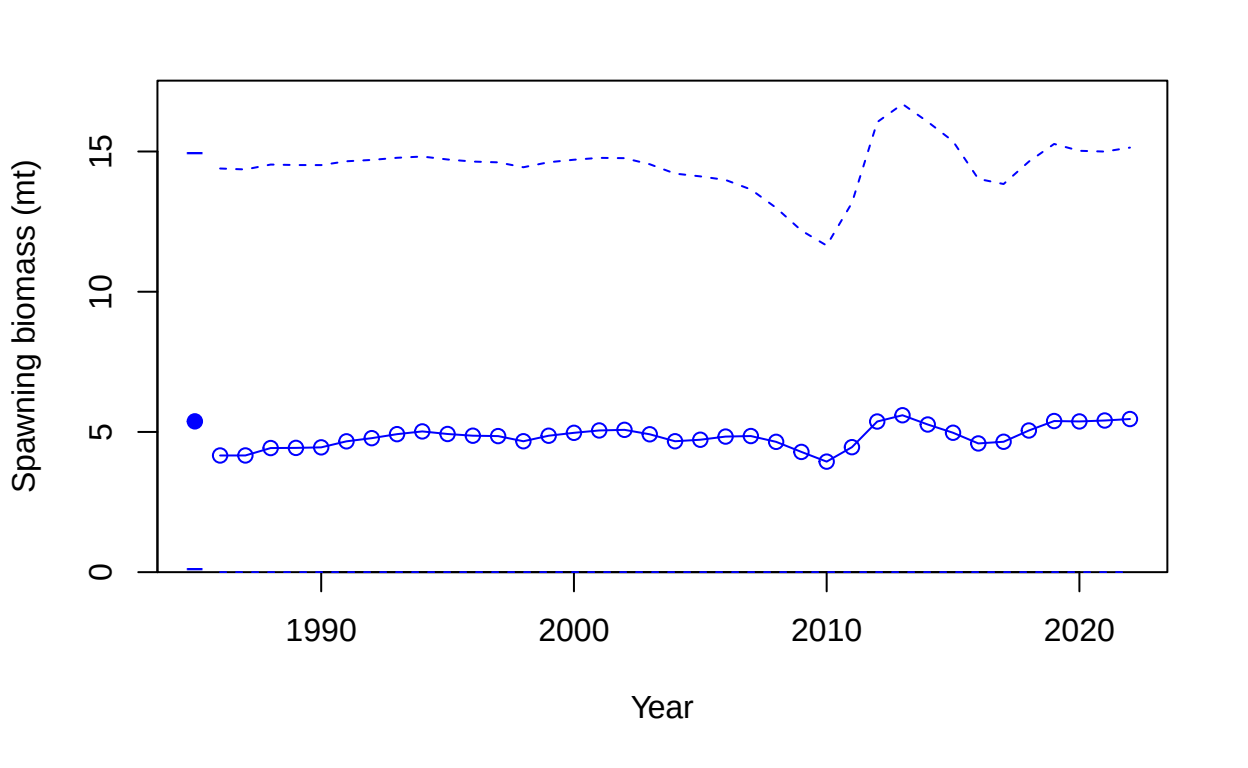

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
10
20
30
40
50
Length (cm)

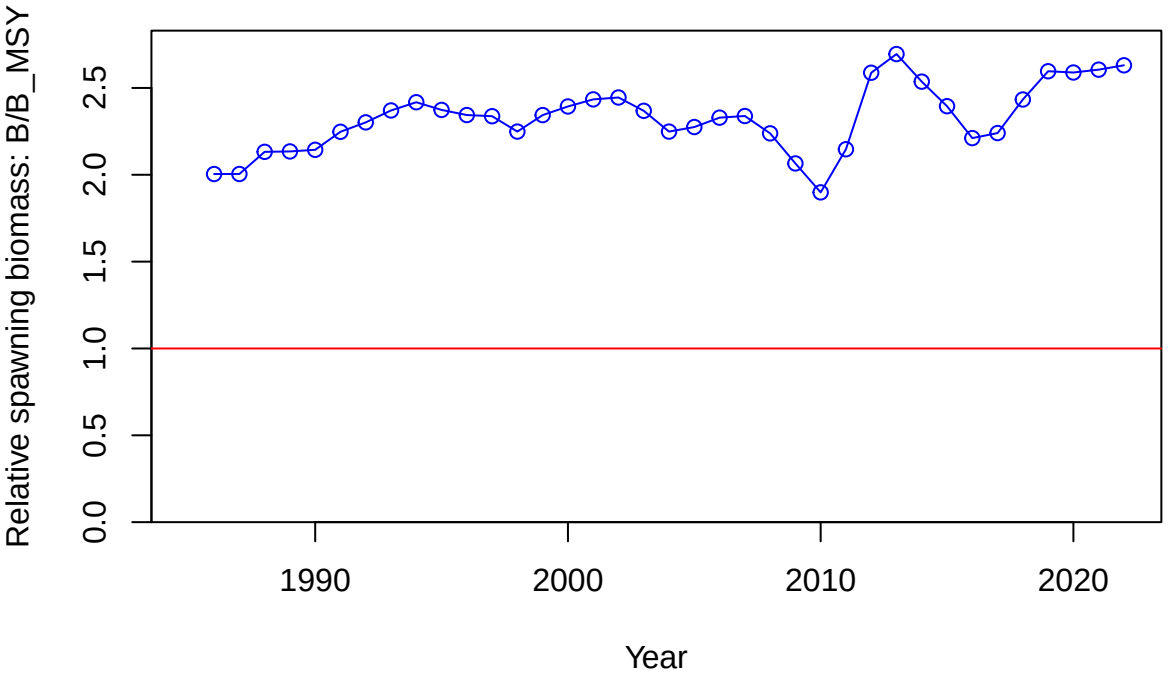

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
10
20
30
40
50
Length (cm)

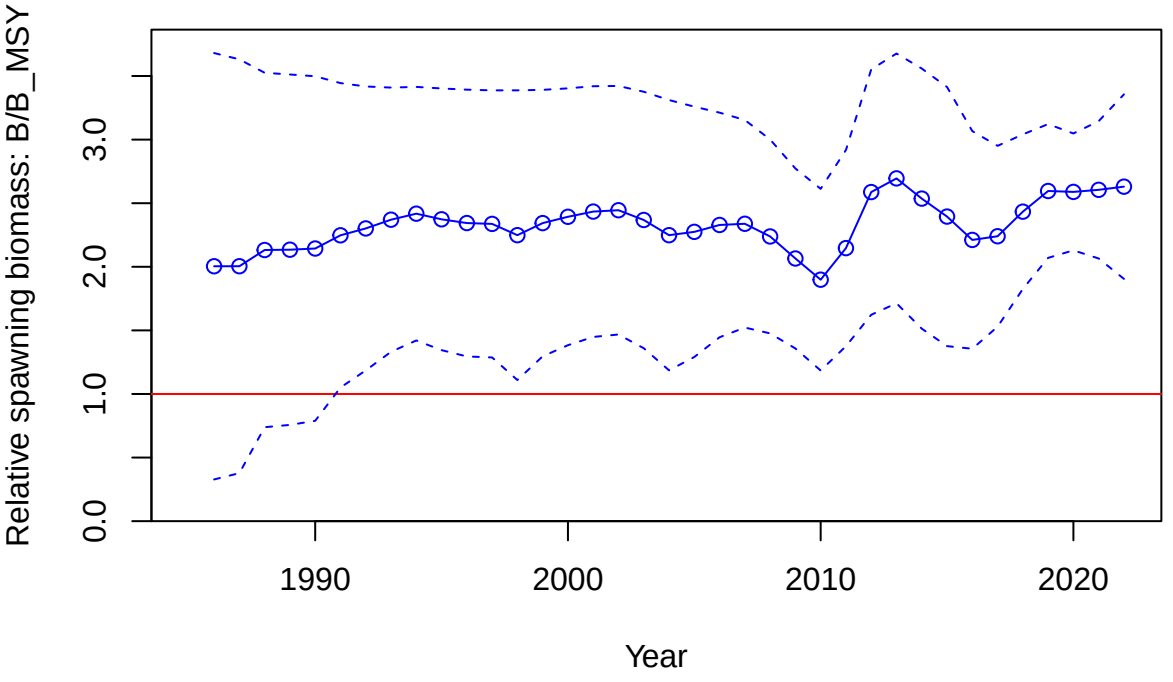

Length (cm)
0
10
20
30
40
50
0
5
10
15
Age (yr)
1
0.8
0.6
0.4
0.2

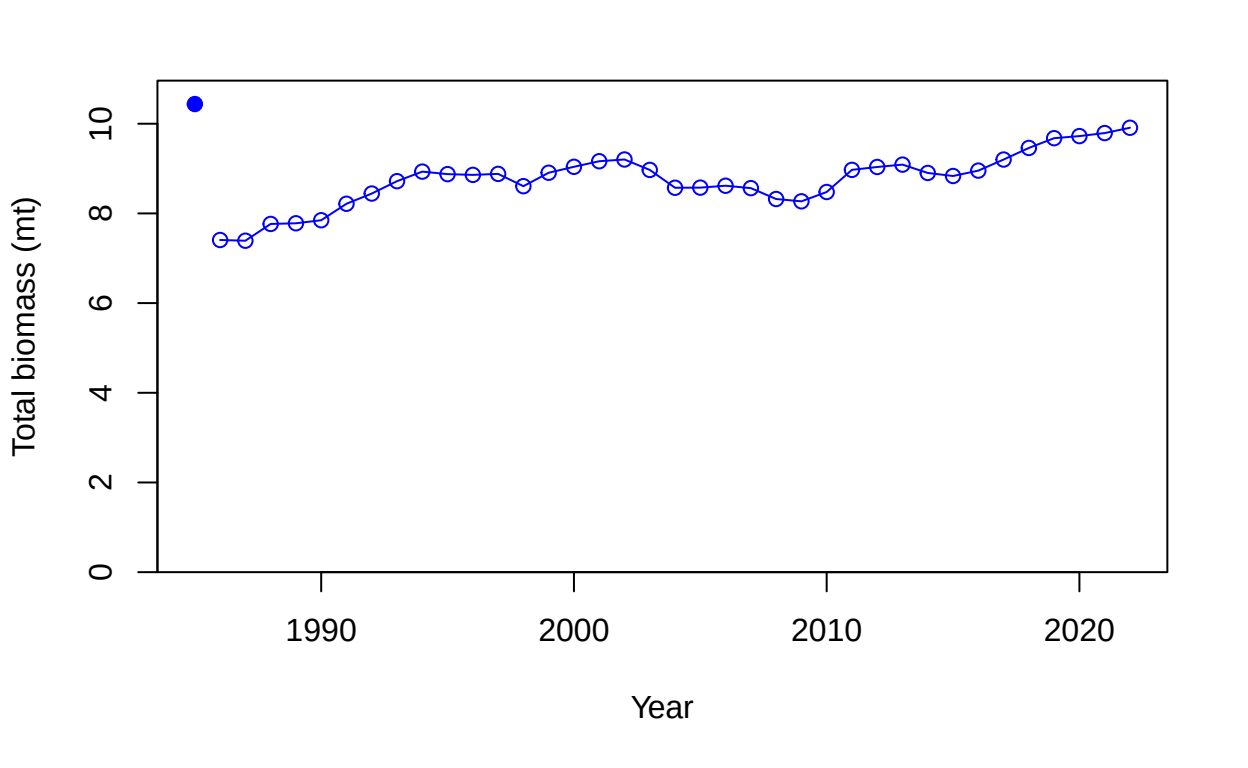

Length (cm)
0
10
20
30
40
50
0
5
10
15
Age (yr)
1
0.8
0.6
0.4
0.2

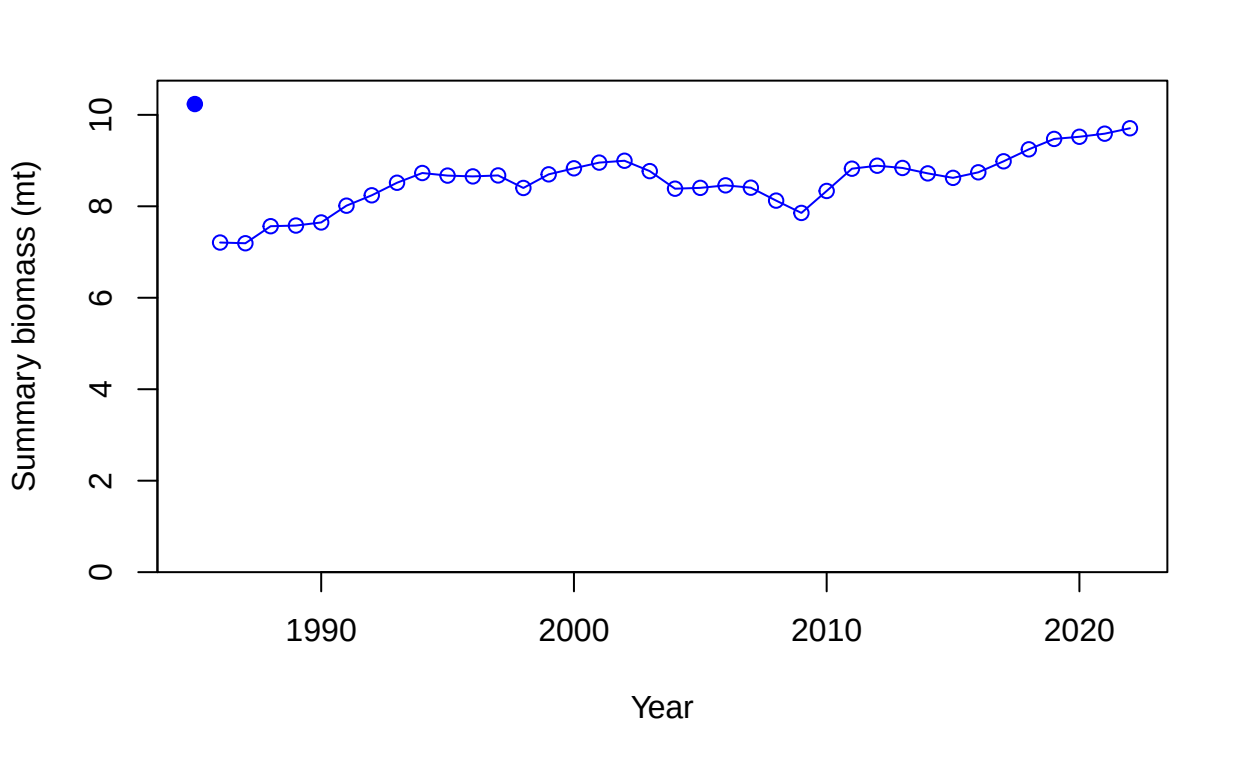

Spawning biomass (mt)
0
1
2
3
4
5
1990
2000
2010
2020
Year

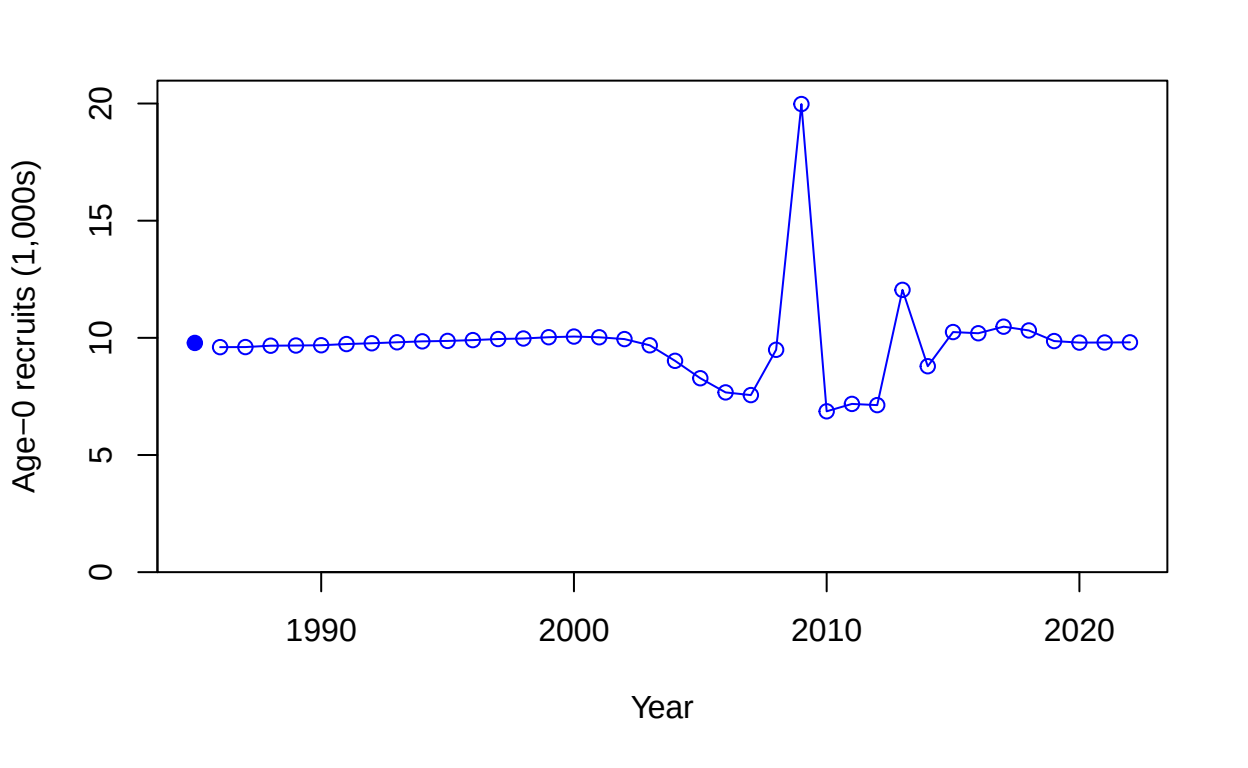

Spawning biomass (mt)
0
5
10
15
1990
2000
2010
2020
Year

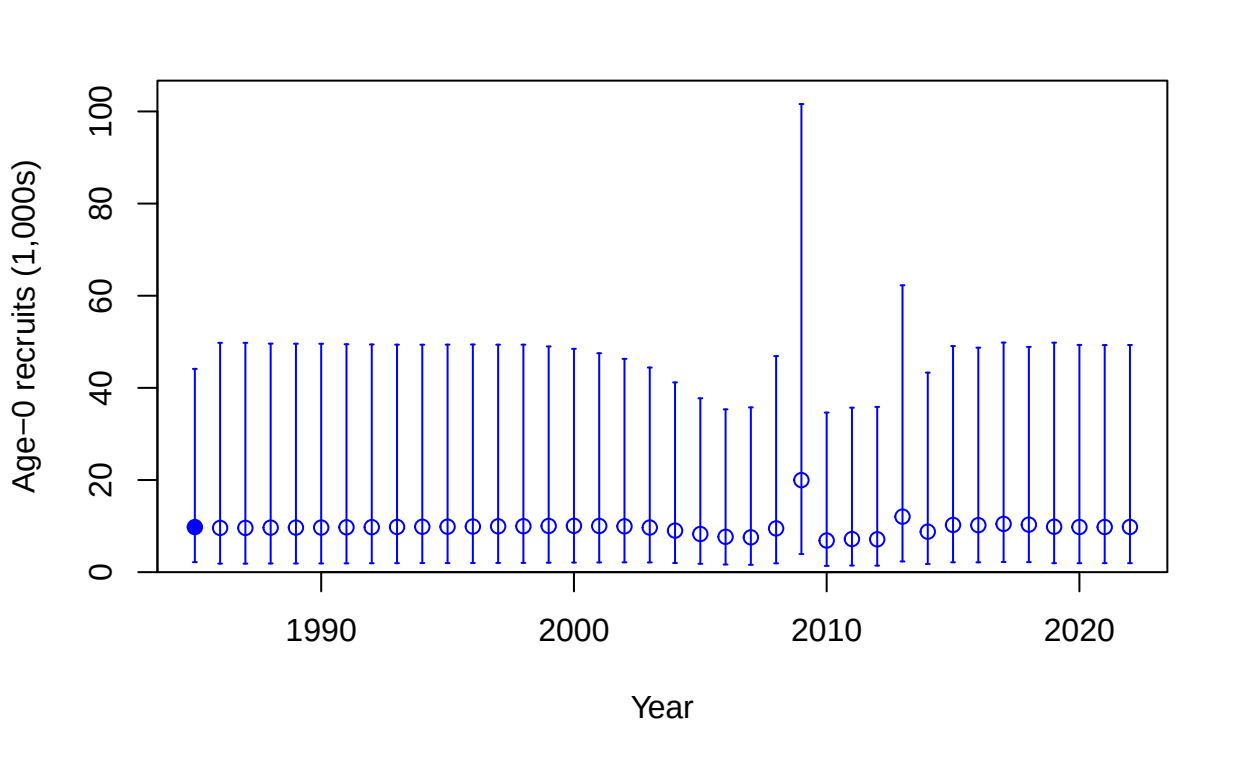

Relative spawning biomass: B/B_MSY
0.0
0.5
1.0
1.5
2.0
2.5
1990
2000
2010
2020
Year

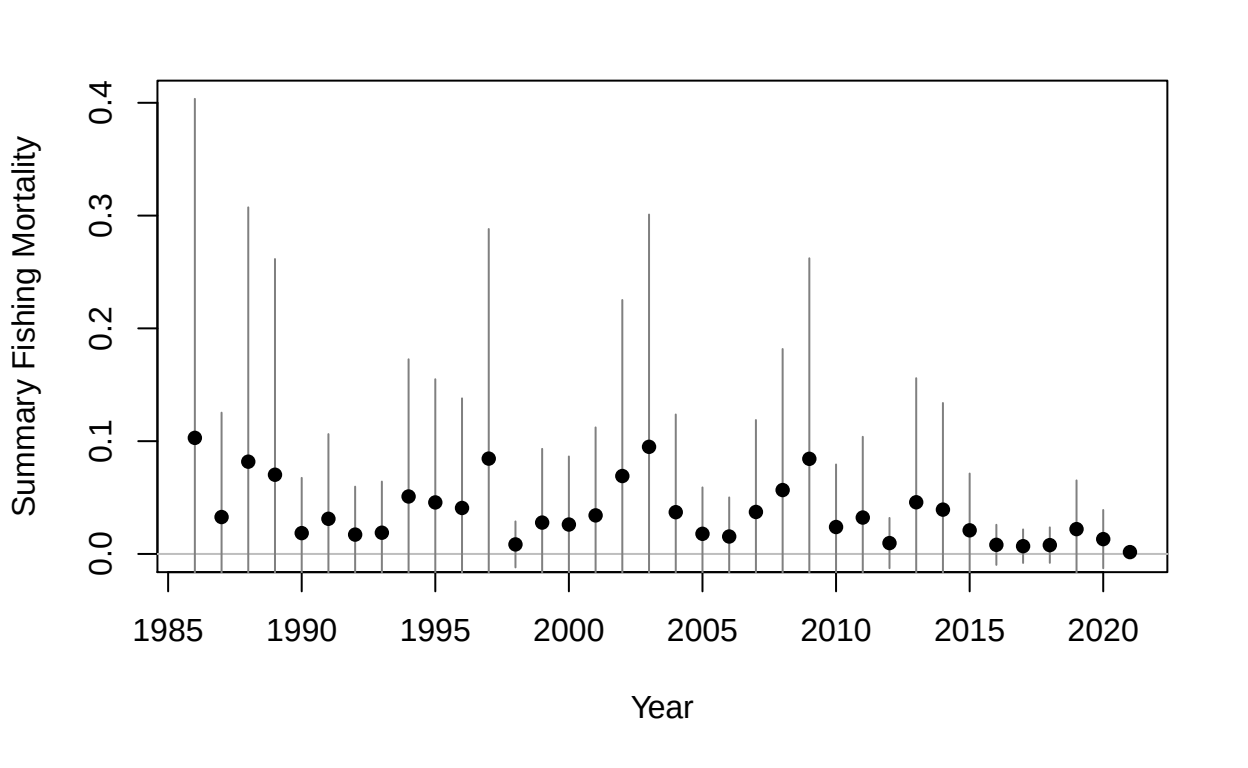

Relative spawning biomass: B/B_MSY
0.0
1.0
2.0
3.0
1990
2000
2010
2020
Year

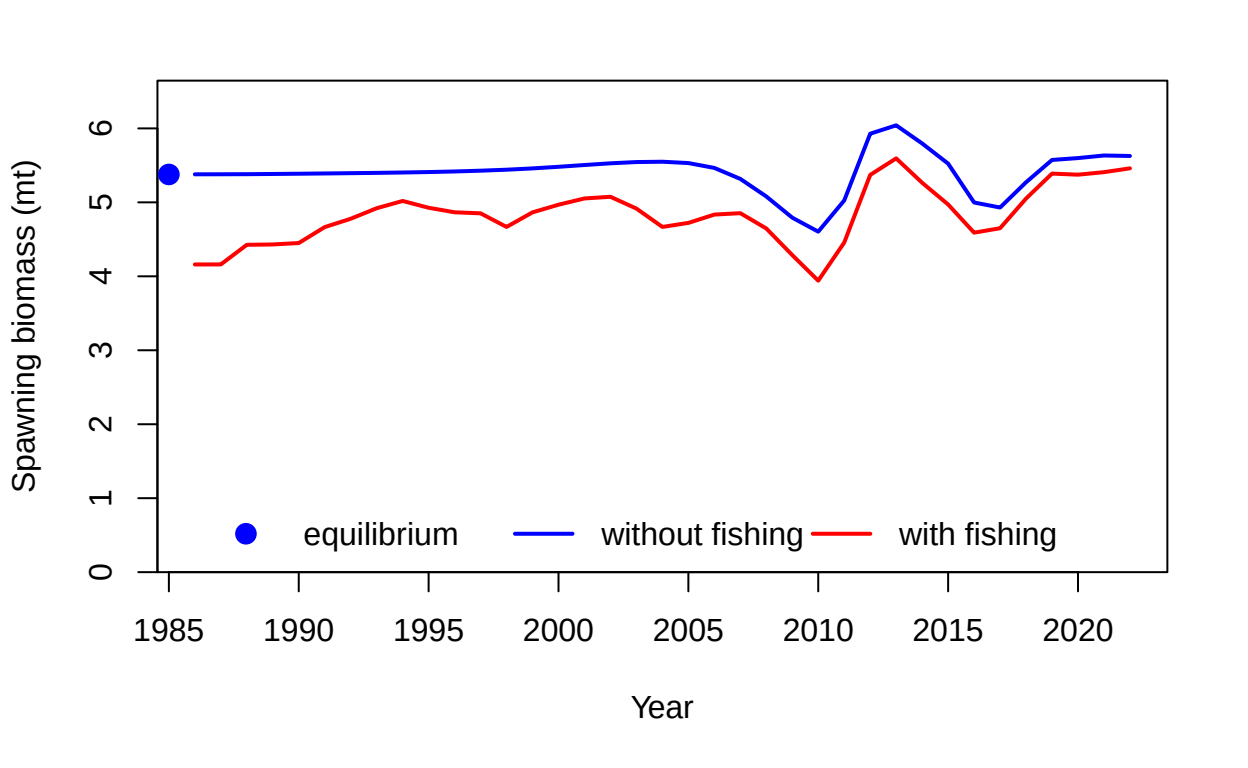

Total biomass (mt)
0
2
4
6
8
10
1990
2000
2010
2020
Year

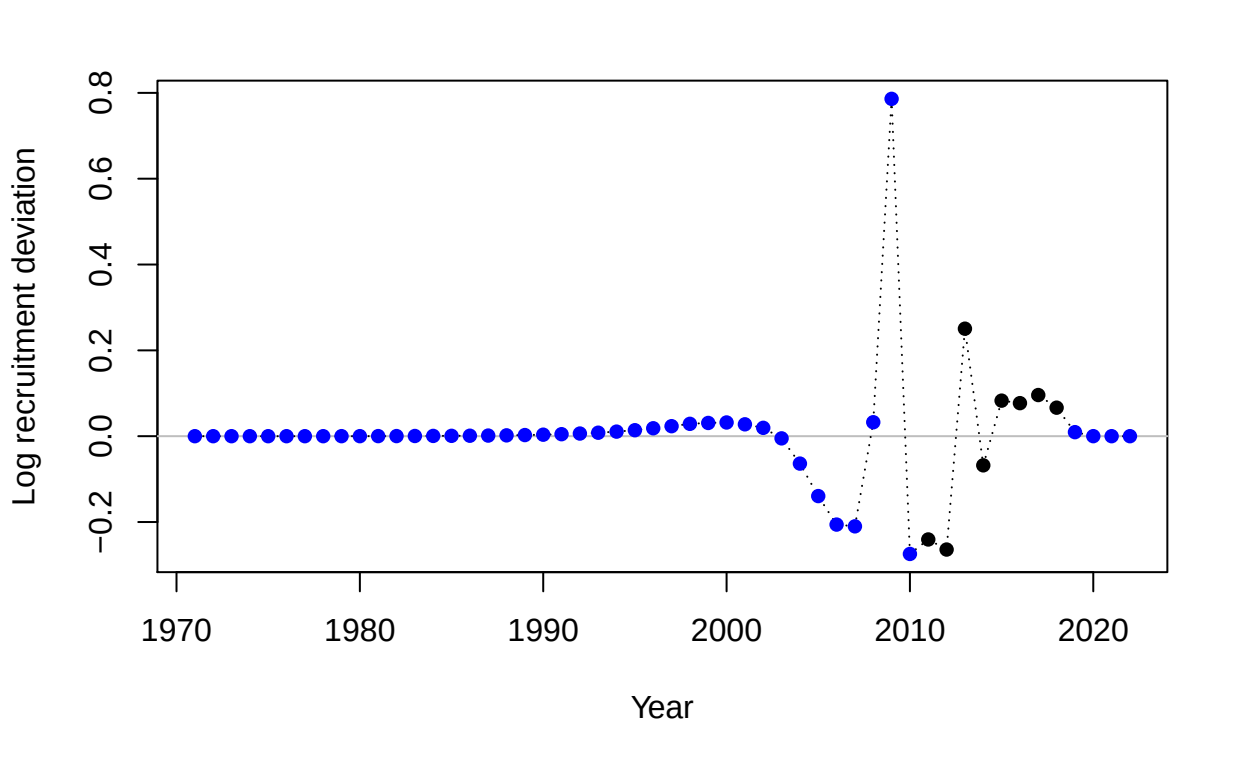

Summary biomass (mt)
0
2
4
6
8
10
1990
2000
2010
2020
Year

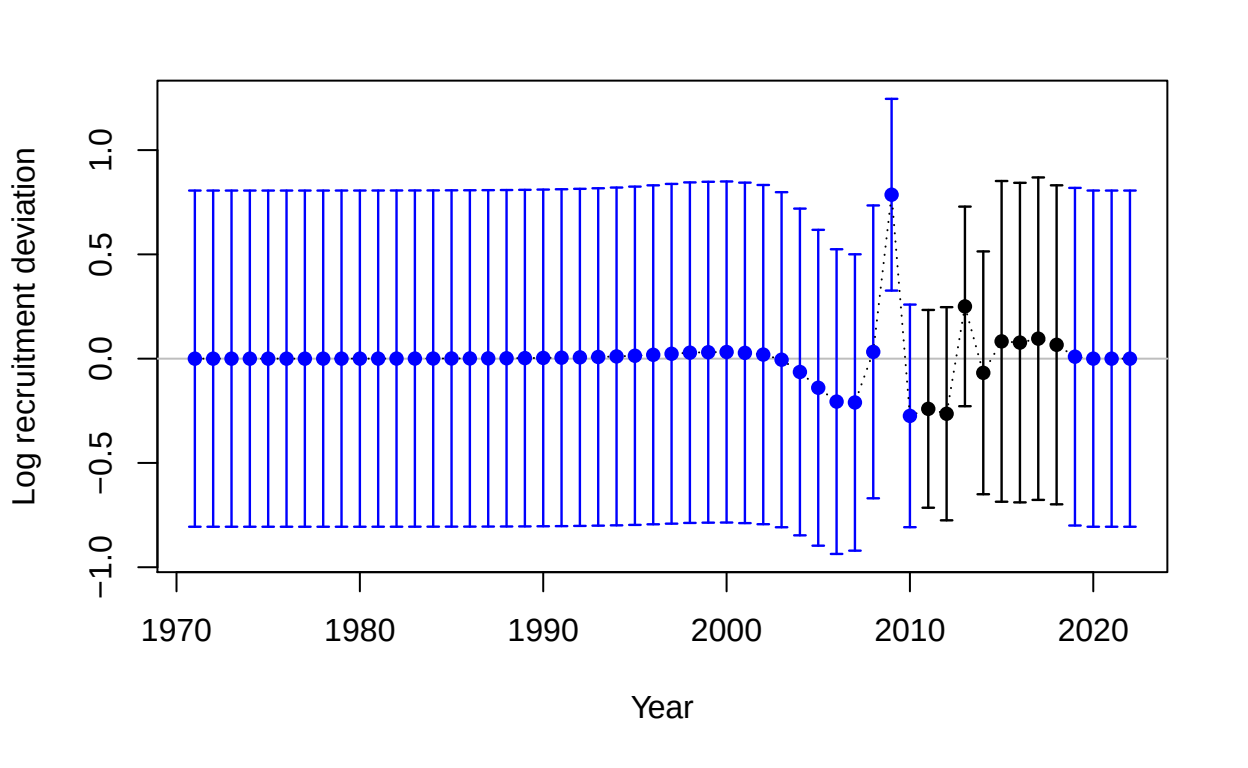

Age−0 recruits (1,000s)
0
5
10
15
20
1990
2000
2010
2020
Year

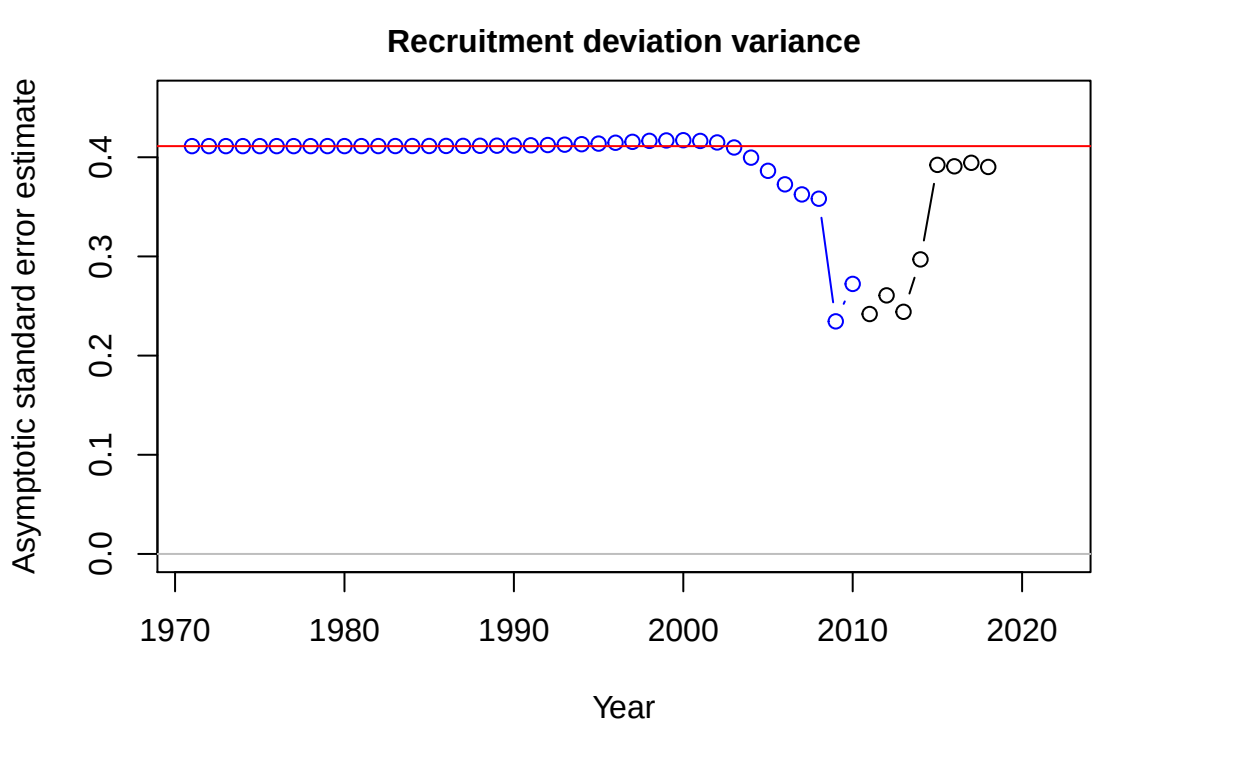

Age−0 recruits (1,000s)
0
20
40
60
80
100
1990
2000
2010
2020
Year

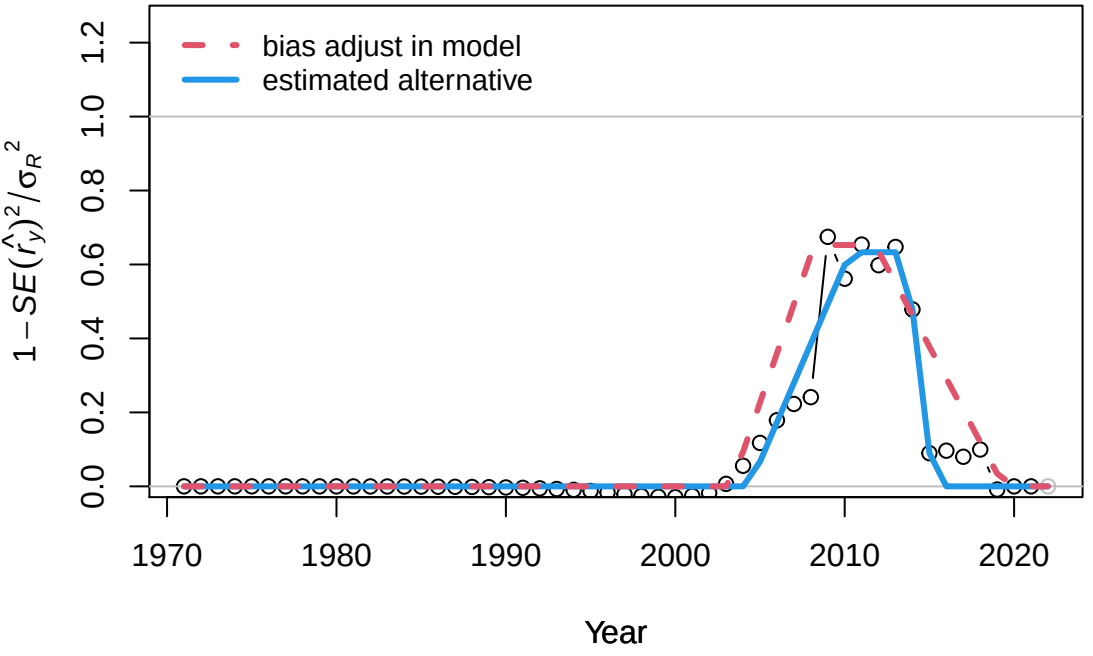

Summary Fishing Mortality
0.0
0.1
0.2
0.3
0.4
1985
1990
1995
2000
2005
2010
2015
2020
Year

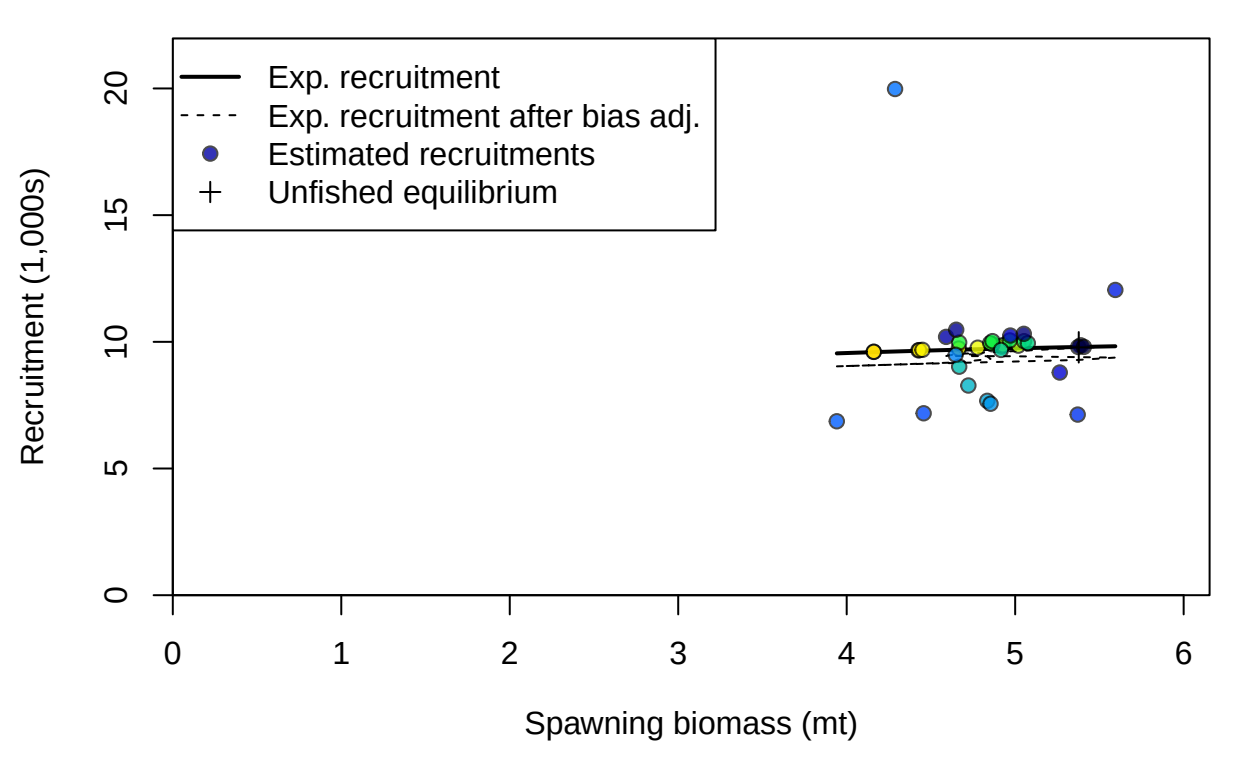

Spawning biomass (mt)
0
1
2
3
4
5
6
equilibrium
without fishing
with fishing
1985
1990
1995
2000
2005
2010
2015
2020
Year

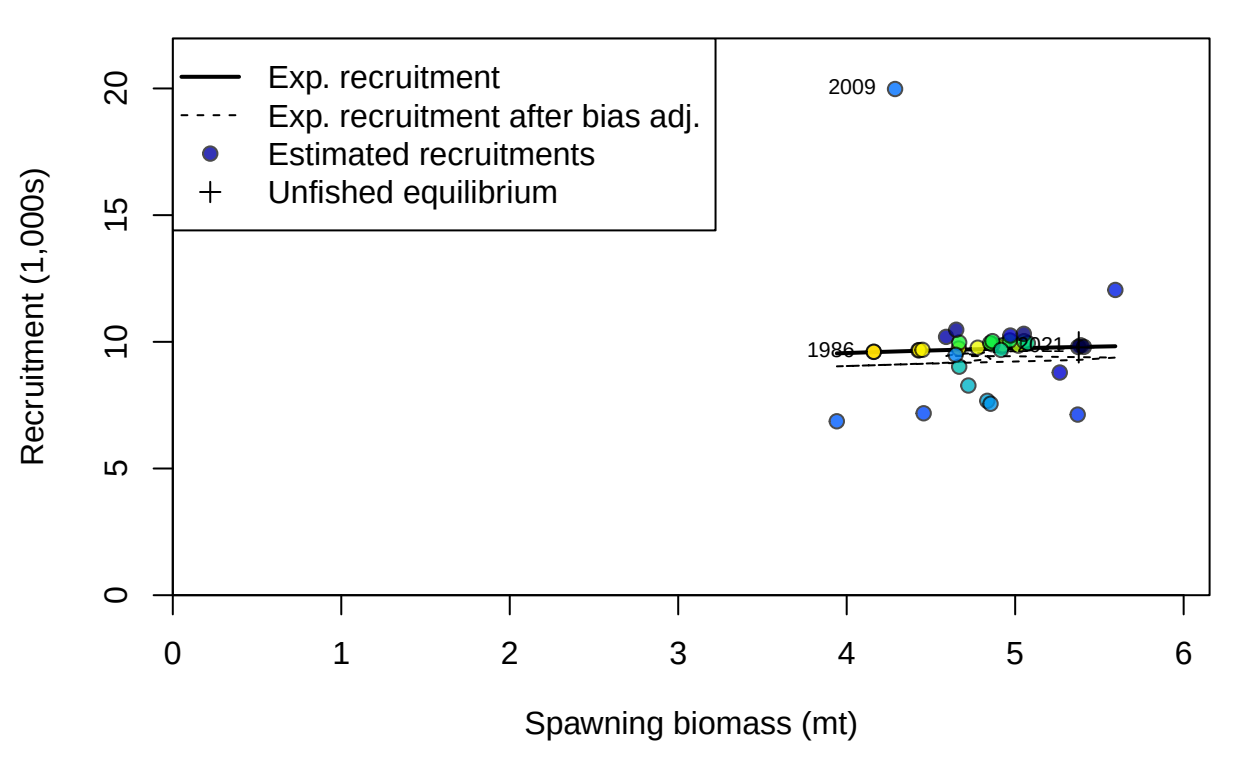

Log recruitment deviation
−0.2
0.0
0.2
0.4
0.6
0.8
1970
1980
1990
2000
2010
2020
Year

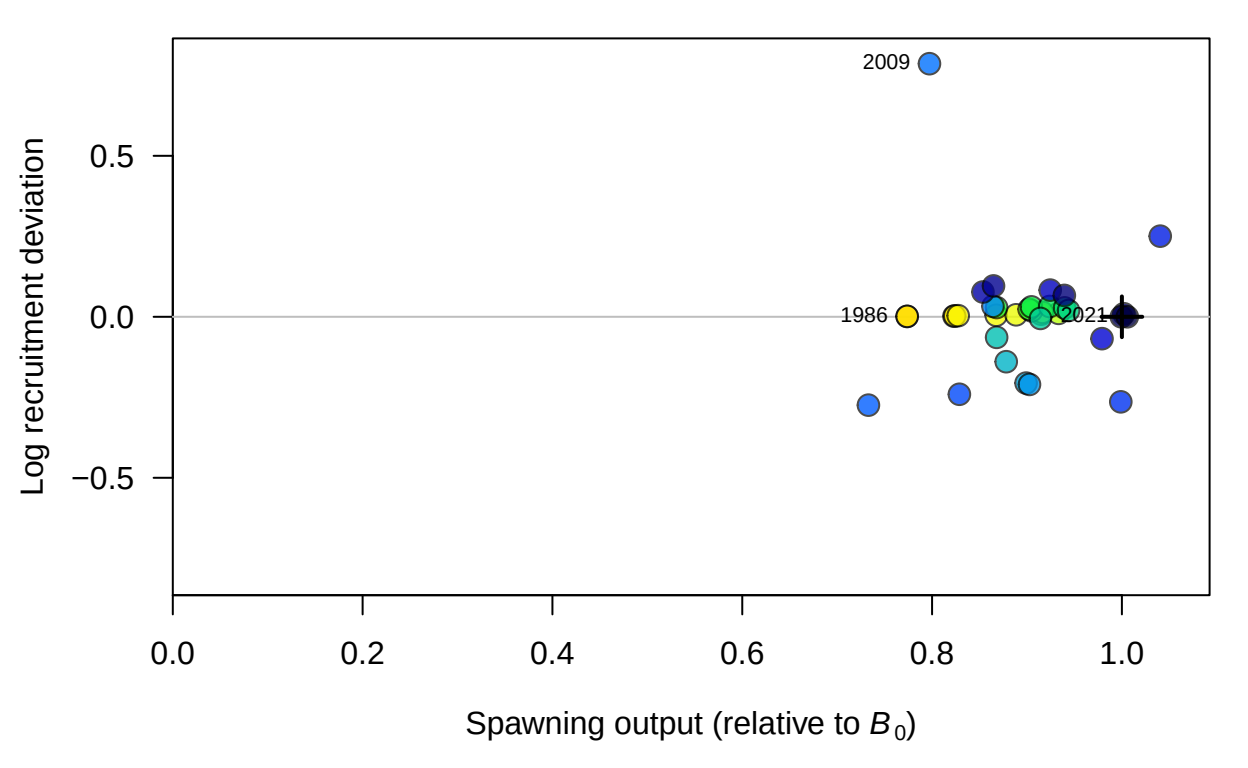

Log recruitment deviation
1.0
0.5
0.0
−0.5
−1.0
1970
1980
1990
2000
2010
2020
Year

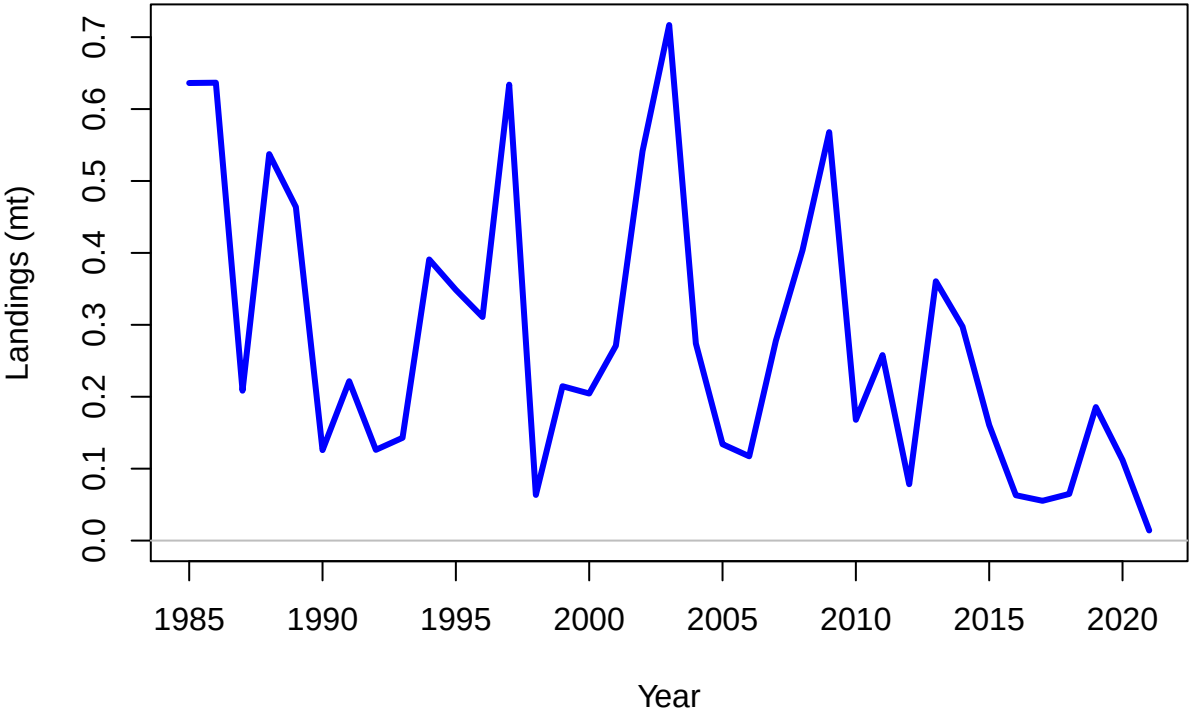

Recruitment deviation variance
Asymptotic standard error estimate
0.0
0.1
0.2
0.3
0.4
1970
1980
1990
2000
2010
2020
Year

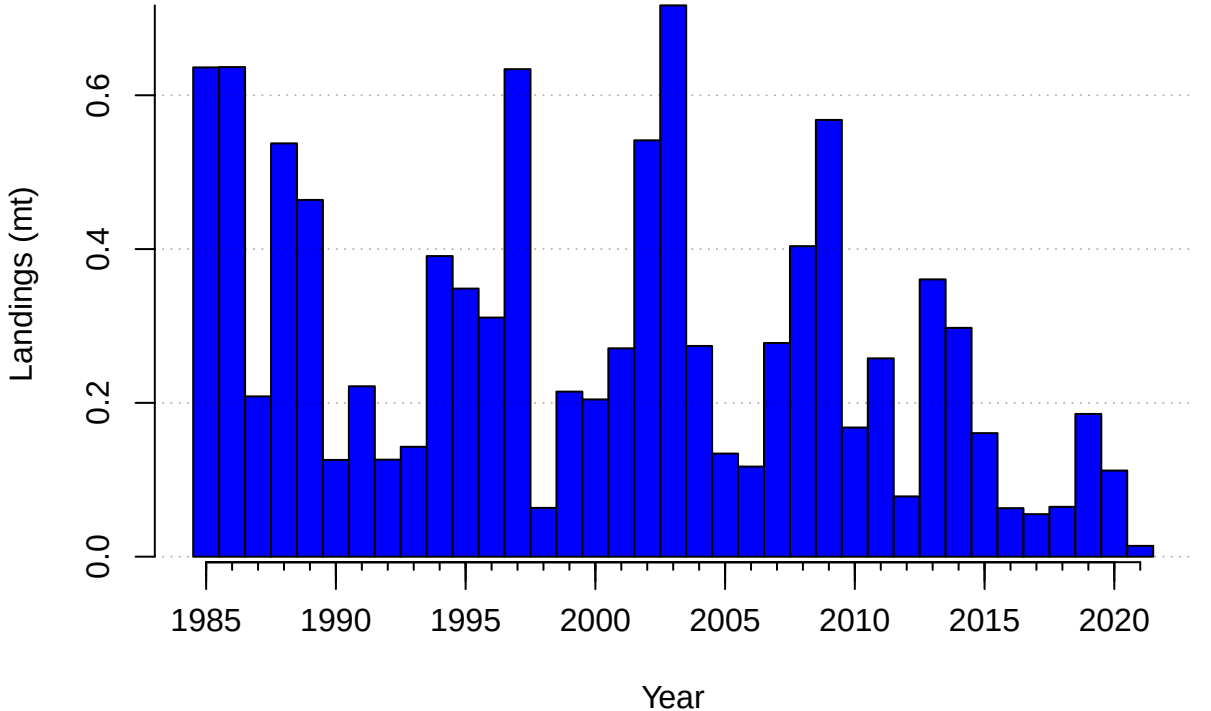

bias adjust in model
estimated alternative
$1-SE(\hat{r}_y)^2/\sigma_R{}^2$
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1970
1980
1990
2000
2010
2020
Year

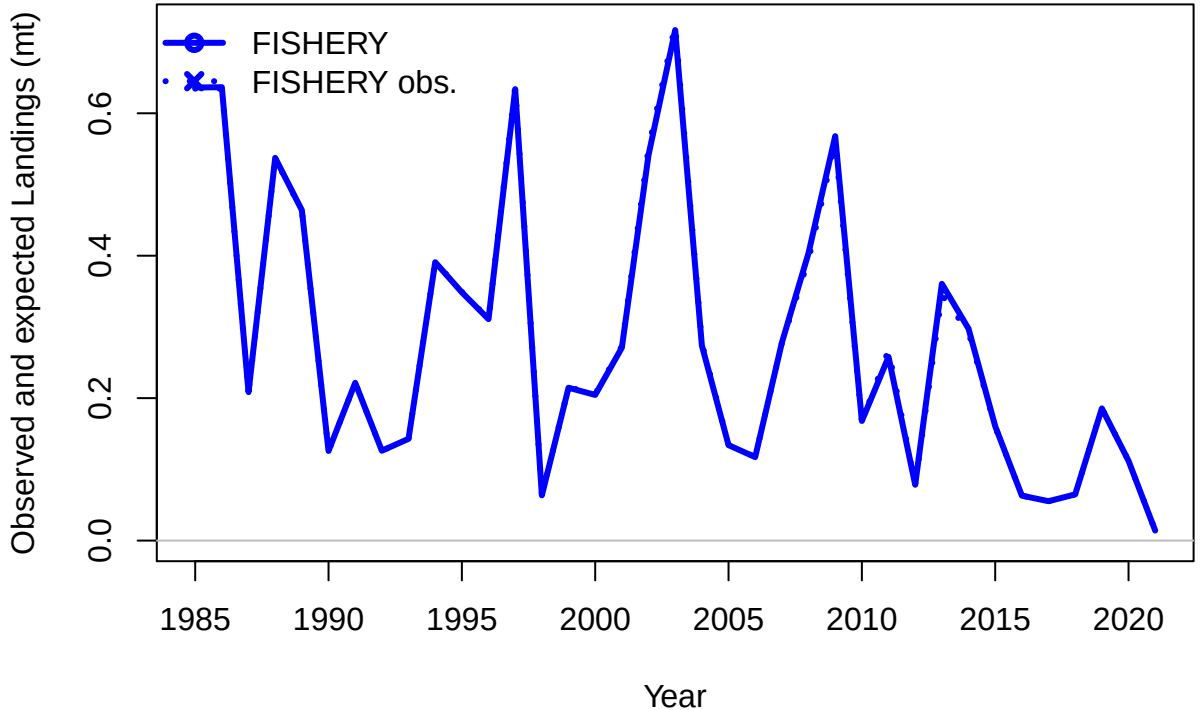

Exp. recruitment
Exp. recruitment after bias adj.
Estimated recruitments
Unfished equilibrium
Recruitment (1,000s)
0
5
10
15
20
0
1
2
3
4
5
6
Spawning biomass (mt)

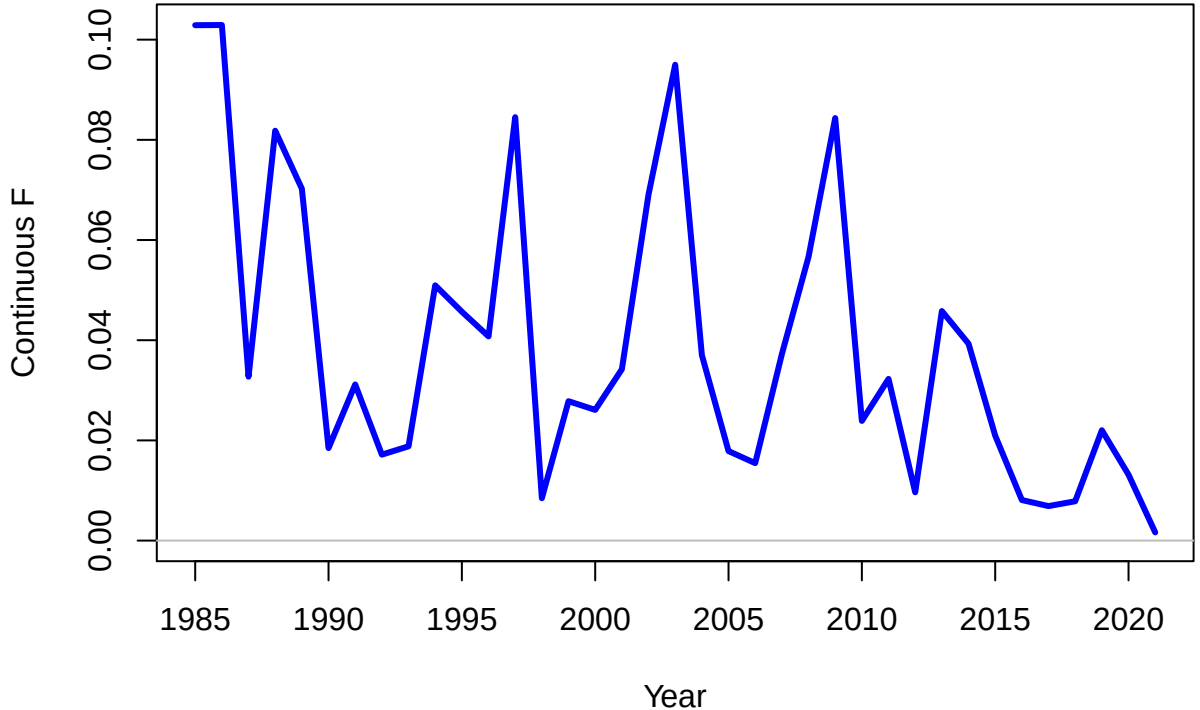

Exp. recruitment
Exp. recruitment after bias adj.
Estimated recruitments
Unfished equilibrium
2009
1986
2021
Recruitment (1,000s)
0
5
10
15
20
0
1
2
3
4
5
6
Spawning biomass (mt)

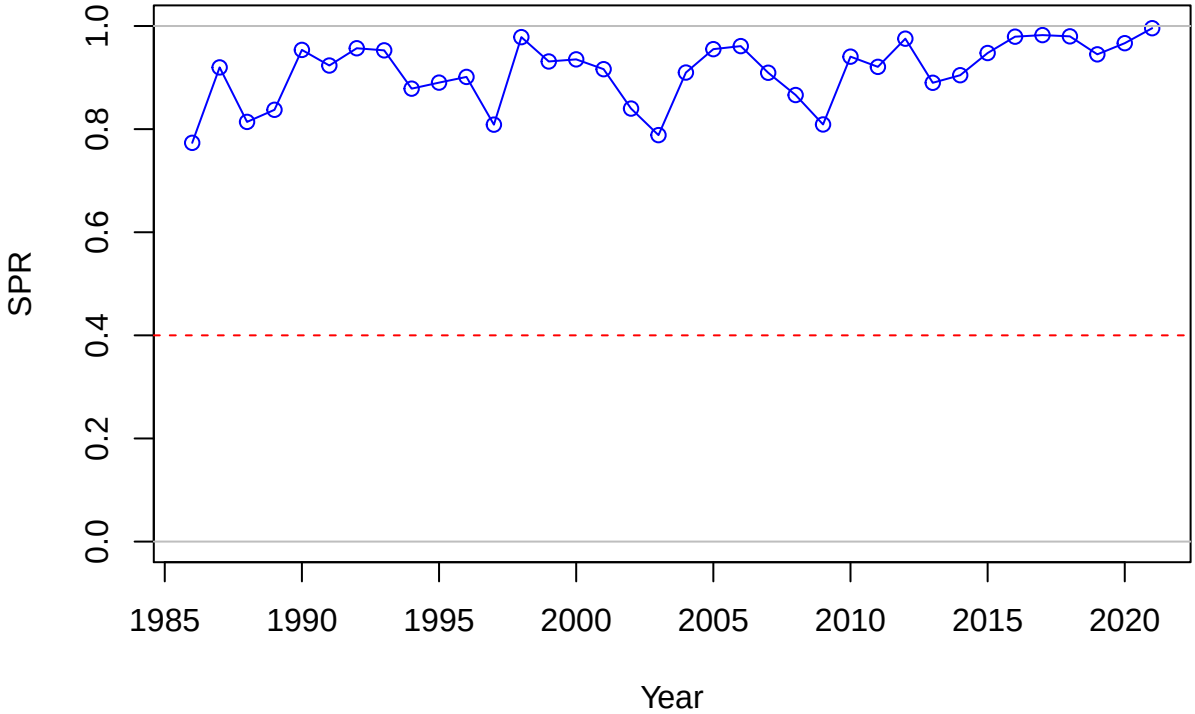

2009
1986
2021
0.5
0.0
−0.5
Log recruitment deviation
0.0
0.2
0.4
0.6
0.8
1.0
Spawning output (relative to B_0)

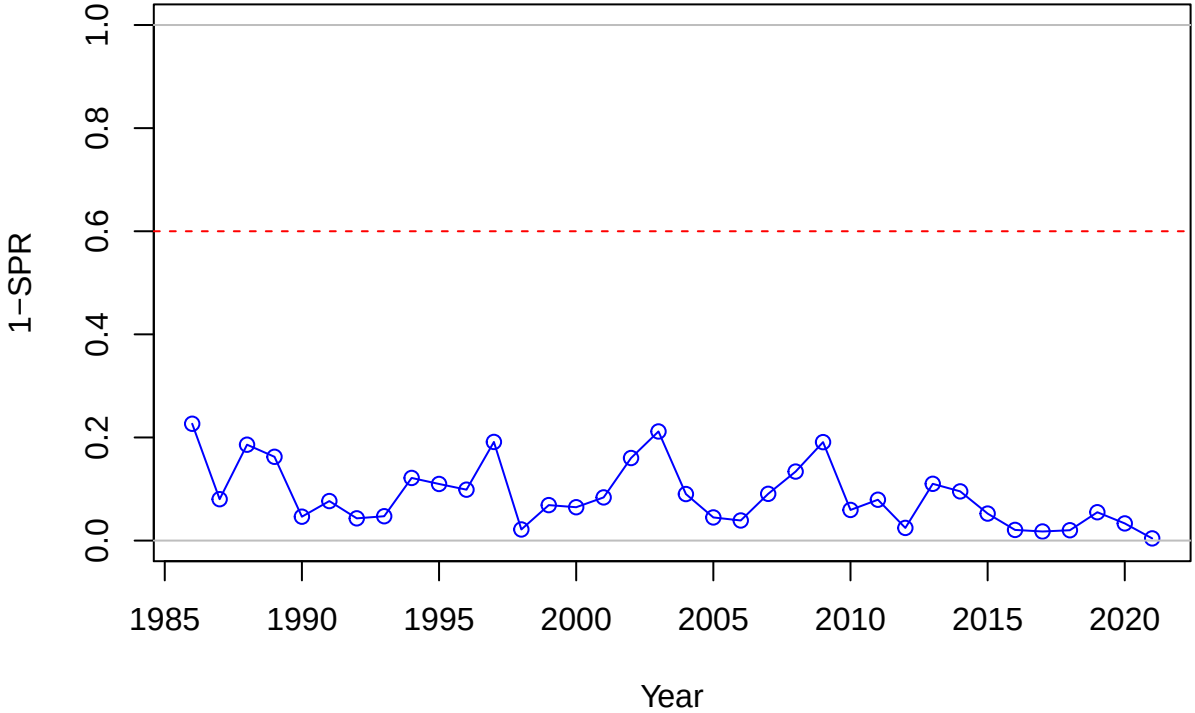

Landings (mt)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
1985
1990
1995
2000
2005
2010
2015
2020
Year

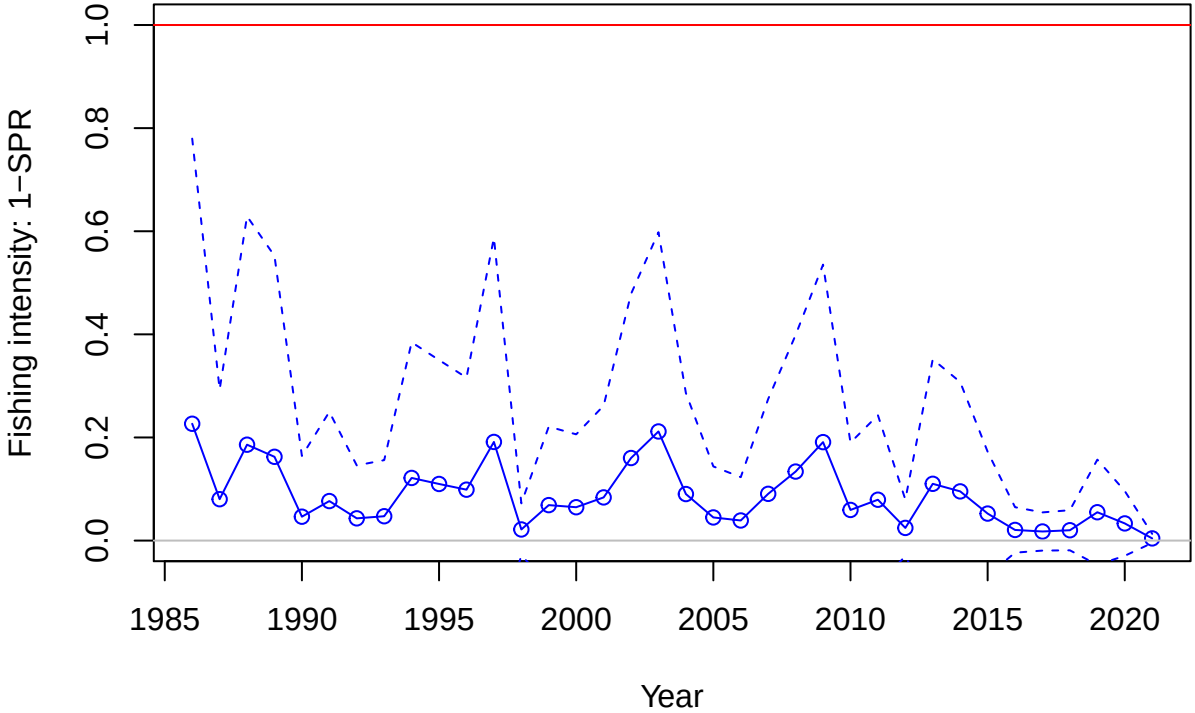

Landings (mt)
0.0
0.2
0.4
0.6
1985
1990
1995
2000
2005
2010
2015
2020
Year

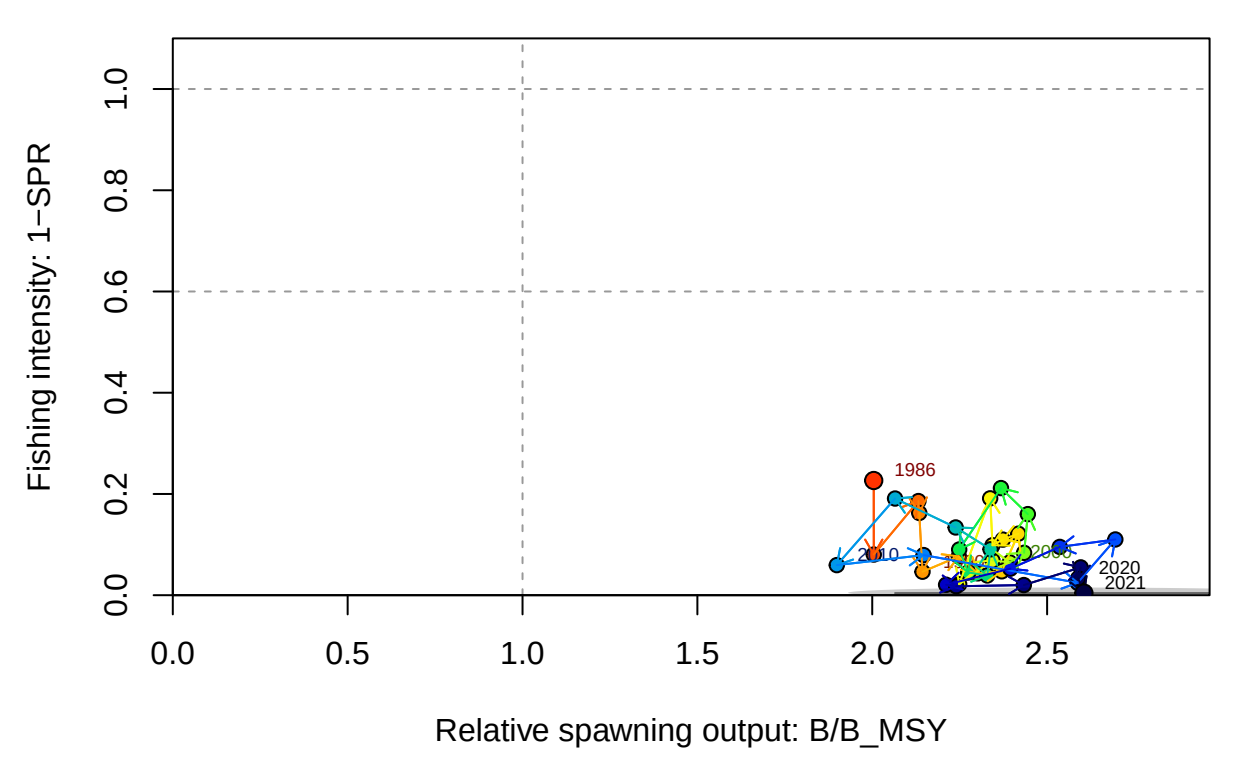

FISHERY
FISHERY obs.
Observed and expected Landings (mt)
0.0
0.2
0.4
0.6
1985
1990
1995
2000
2005
2010
2015
2020
Year

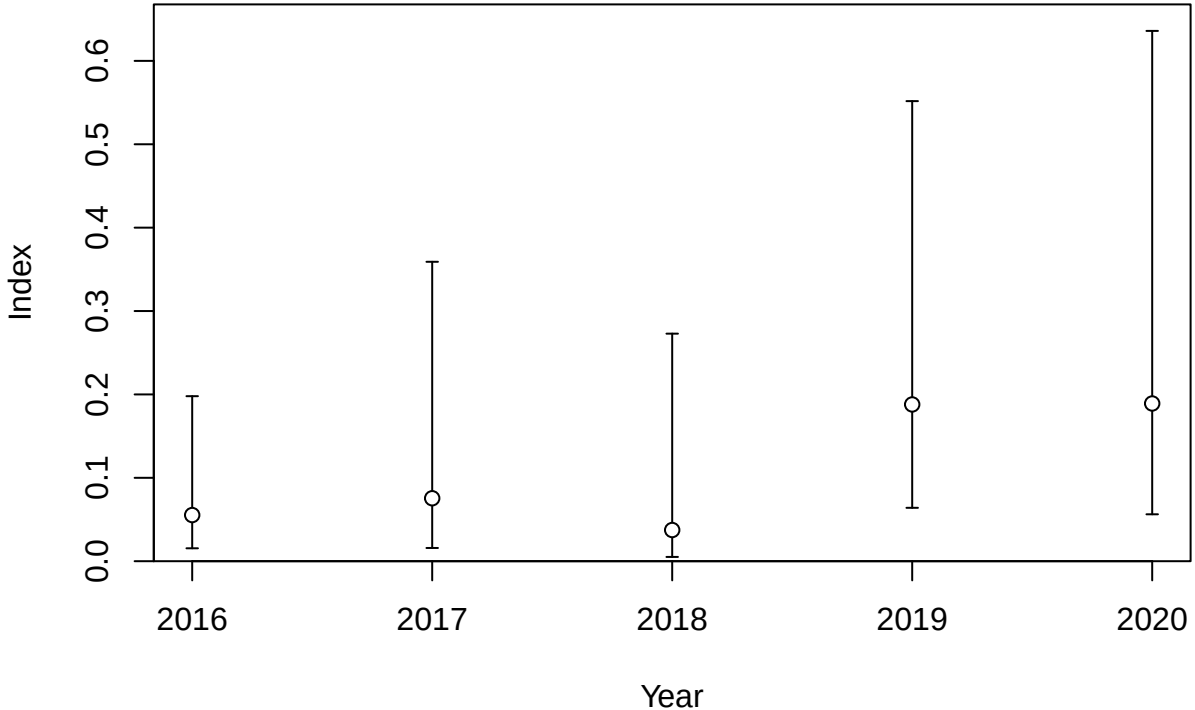

Continuous F
0.00
0.02
0.04
0.06
0.08
0.10
1985
1990
1995
2000
2005
2010
2015
2020
Year

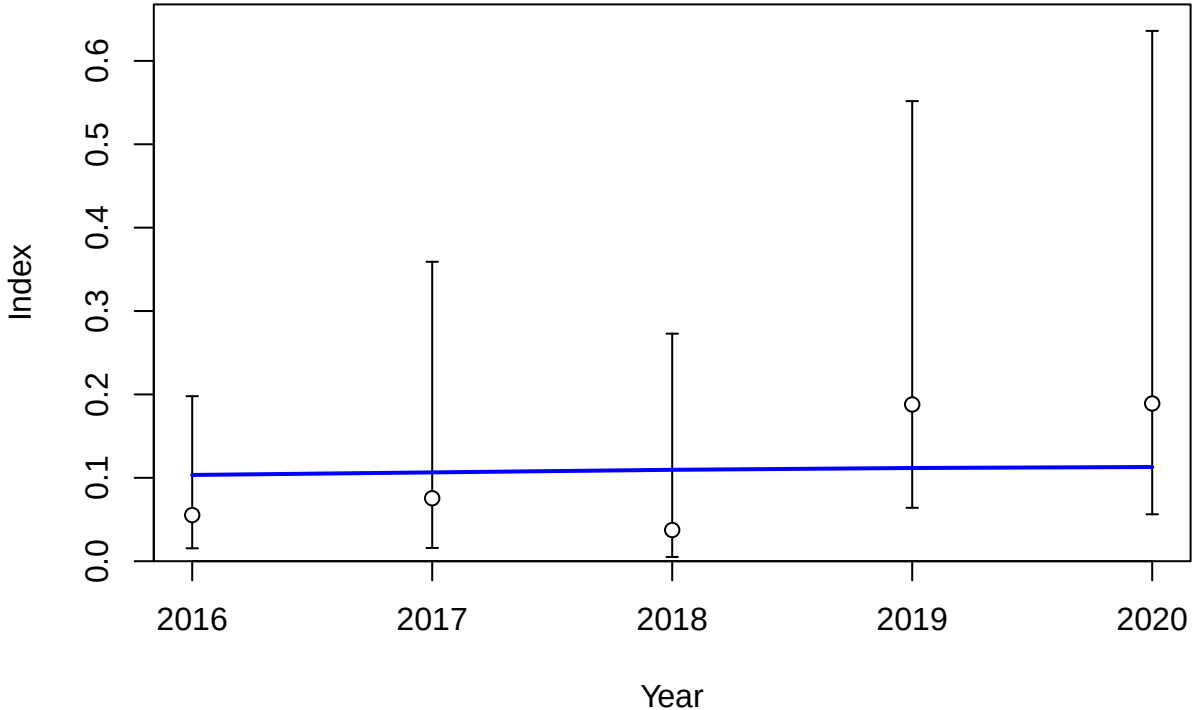

SPR
0.0
0.2
0.4
0.6
0.8
1.0
1985
1990
1995
2000
2005
2010
2015
2020
Year

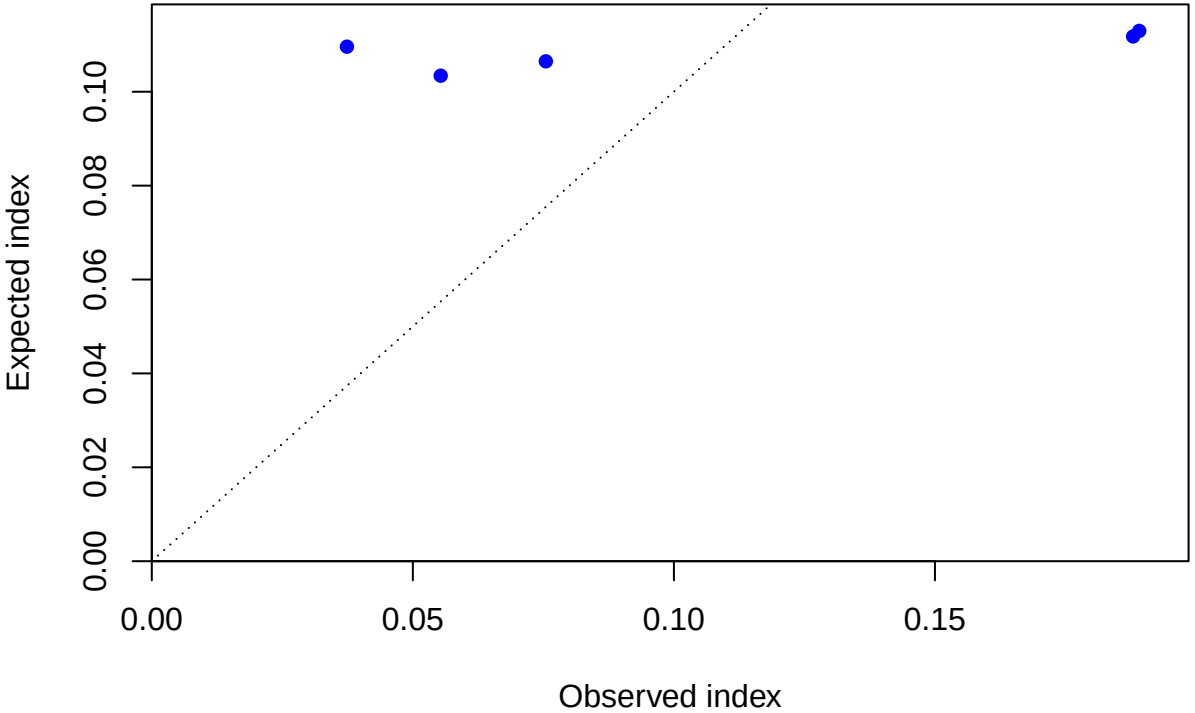

1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
1985
1990
1995
2000
2005
2010
2015
2020
Year

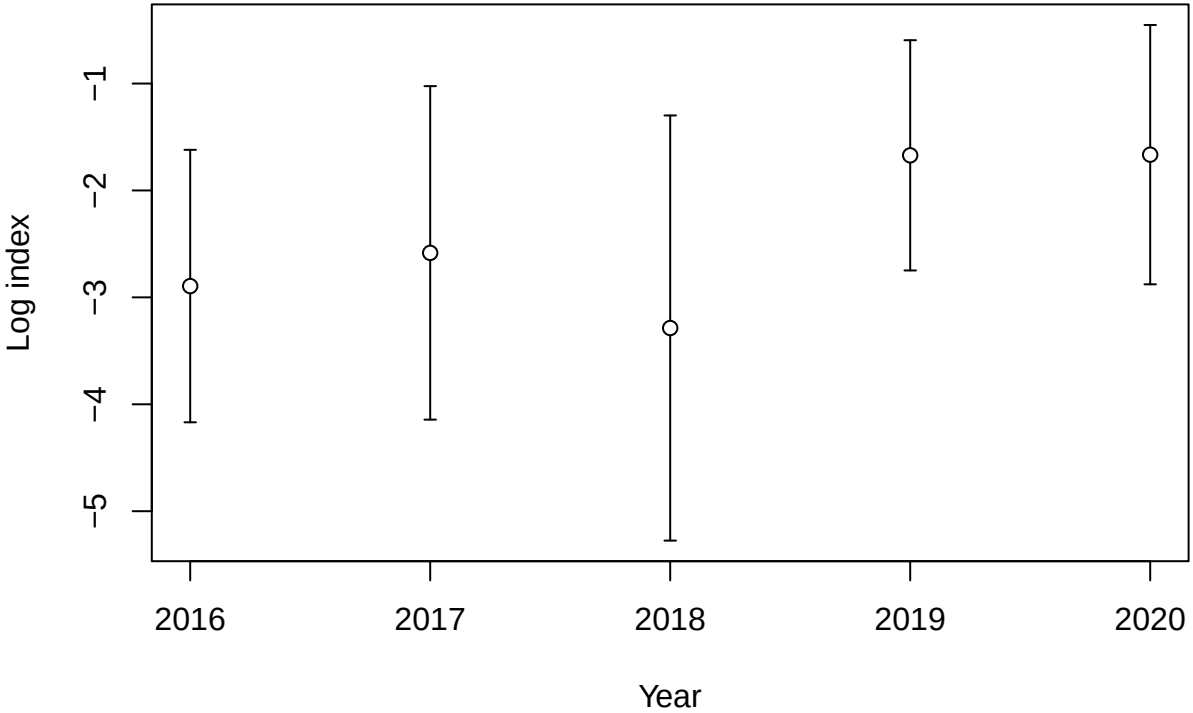

Fishing intensity: 1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
1985
1990
1995
2000
2005
2010
2015
2020
Year

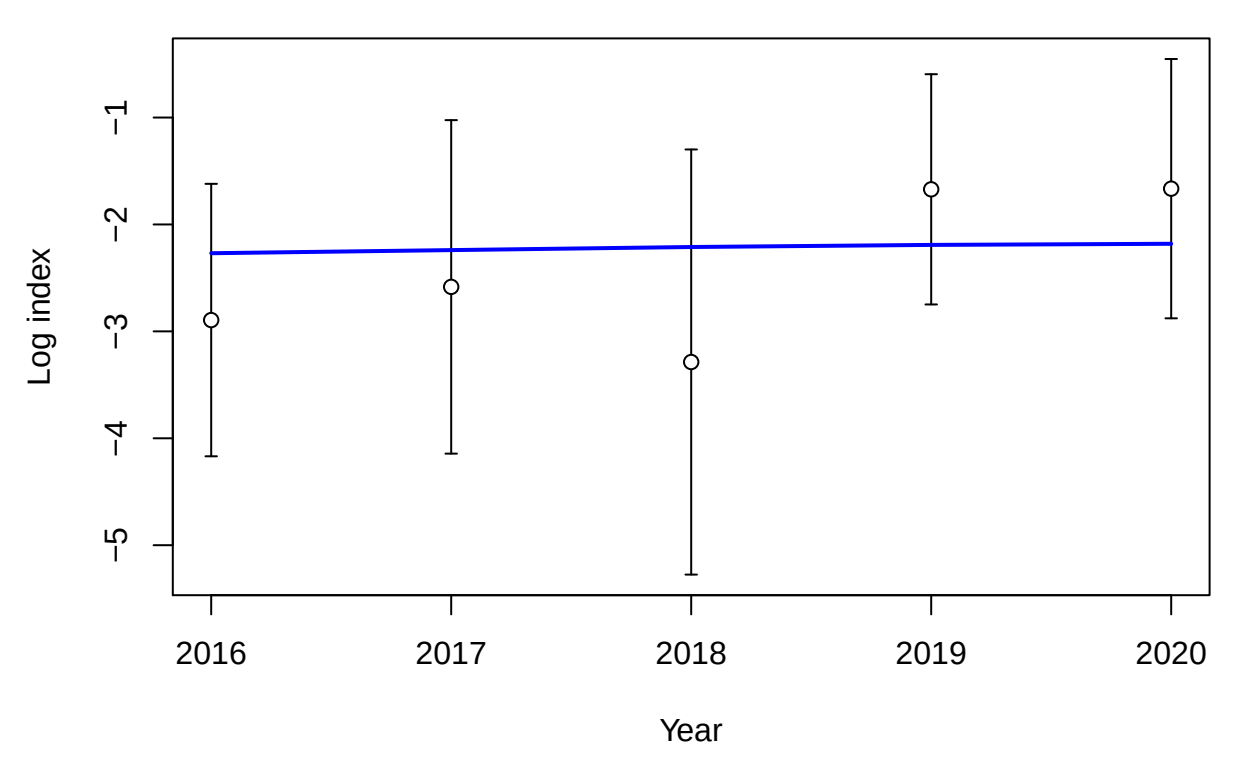

Fishing intensity: 1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
0.0
0.5
1.0
1.5
2.0
2.5
Relative spawning output: B/B_MSY
1986
2010
2020
2021

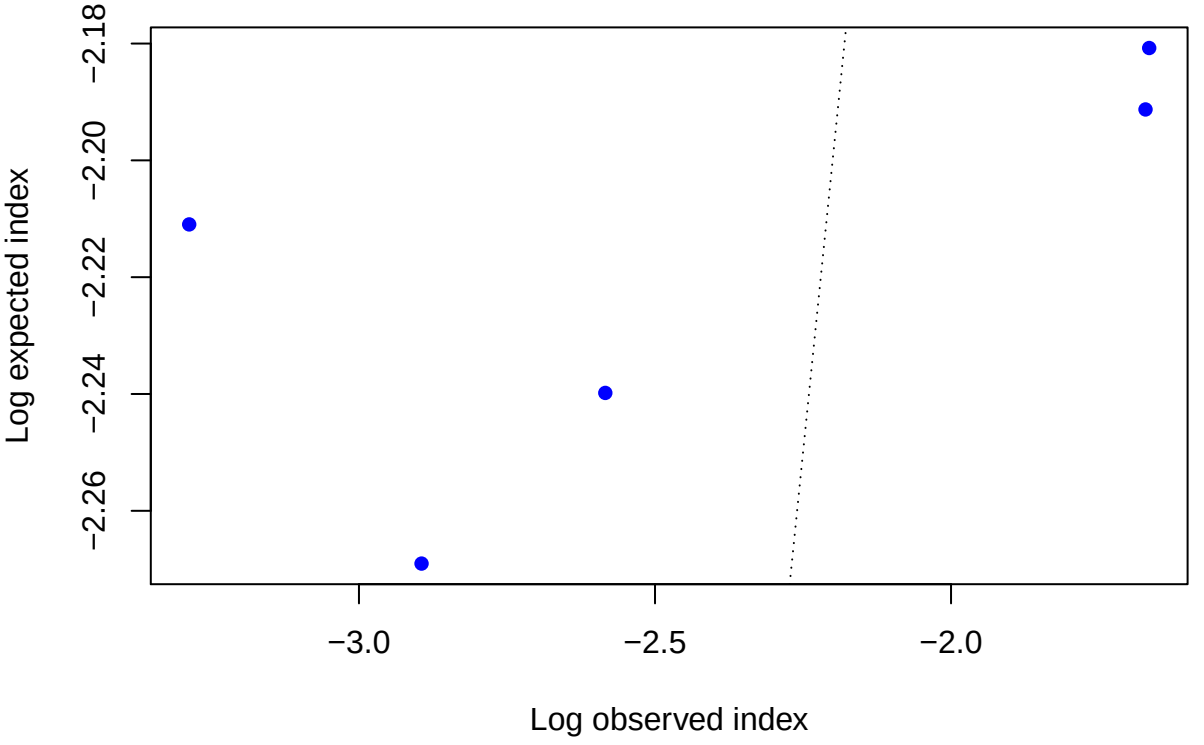

Index
0.0
0.1
0.2
0.3
0.4
0.5
0.6
2016
2017
2018
2019
2020
Year

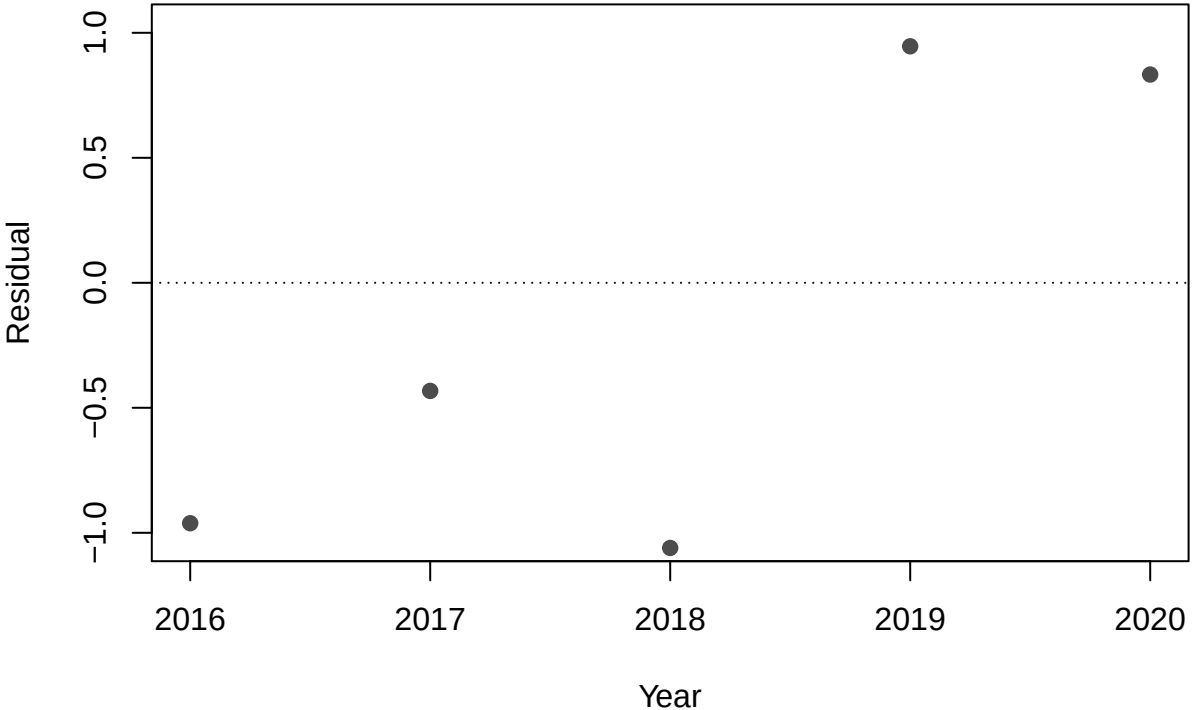

Index
0.0
0.1
0.2
0.3
0.4
0.5
0.6
2016
2017
2018
2019
2020
Year

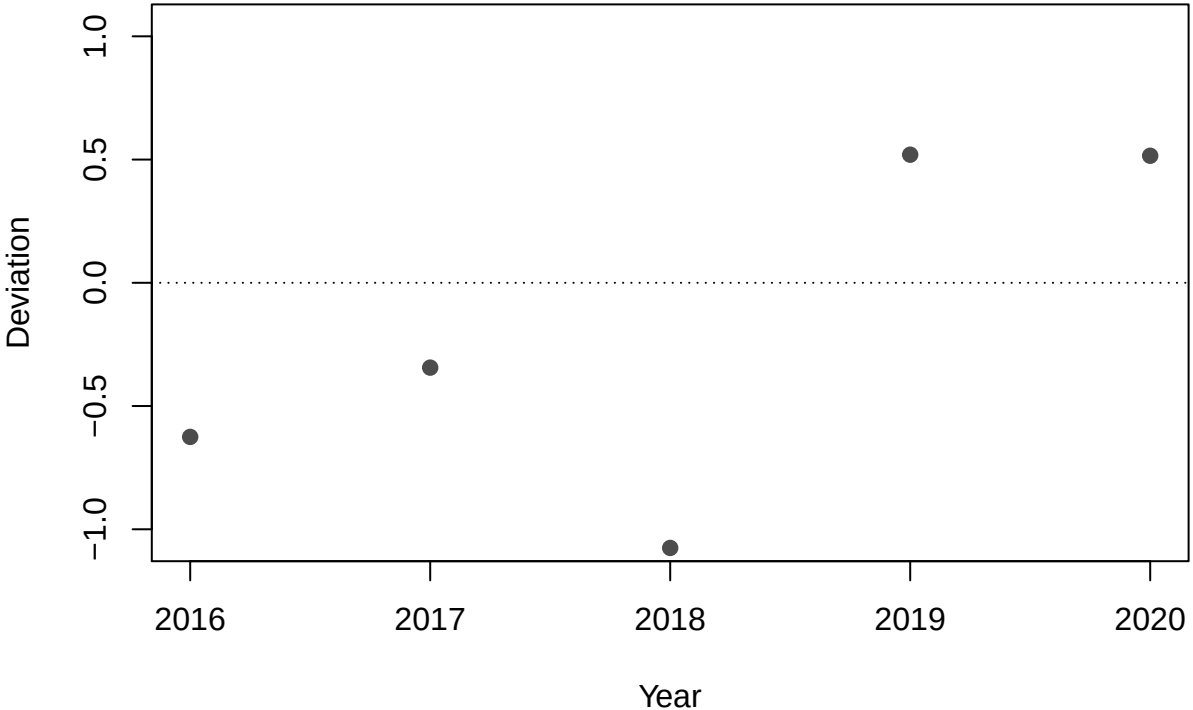

Expected index
0.00
0.02
0.04
0.06
0.08
0.10
0.00
0.05
0.10
0.15
Observed index

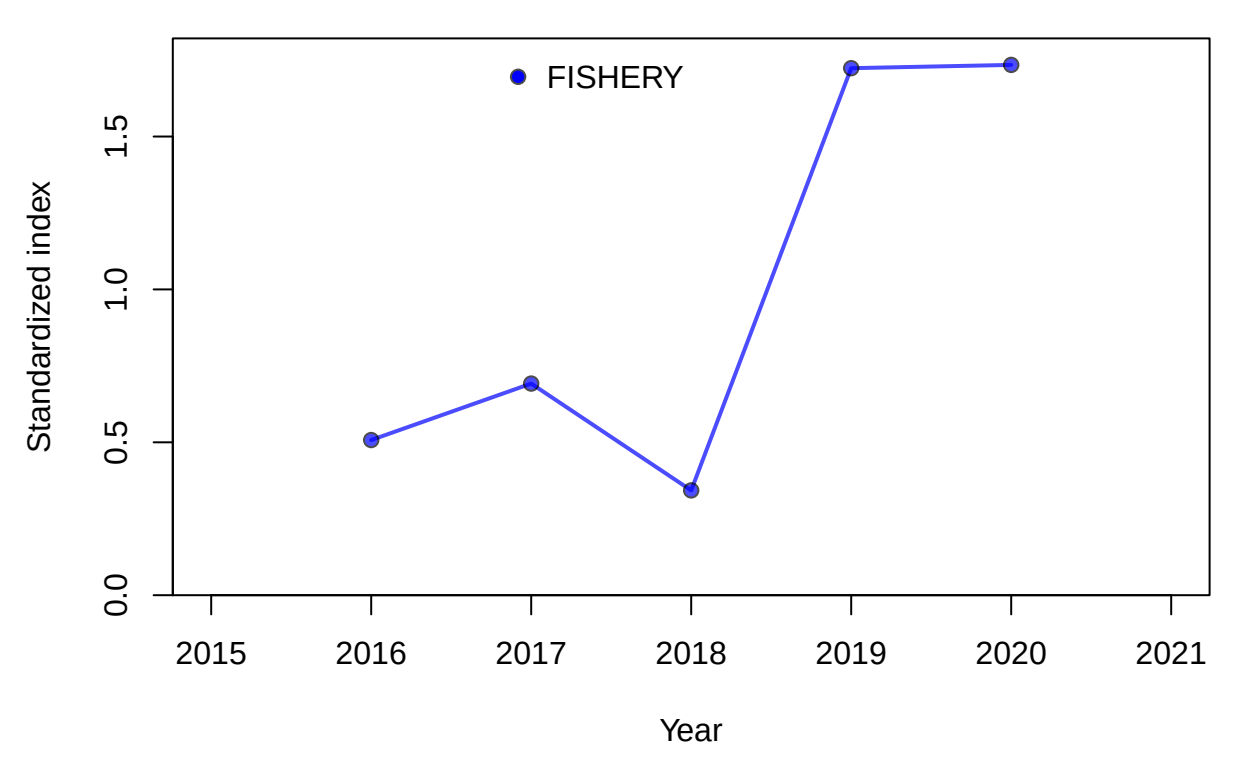

Log index
−1
−2
−3
−4
−5
2016
2017
2018
2019
2020
Year

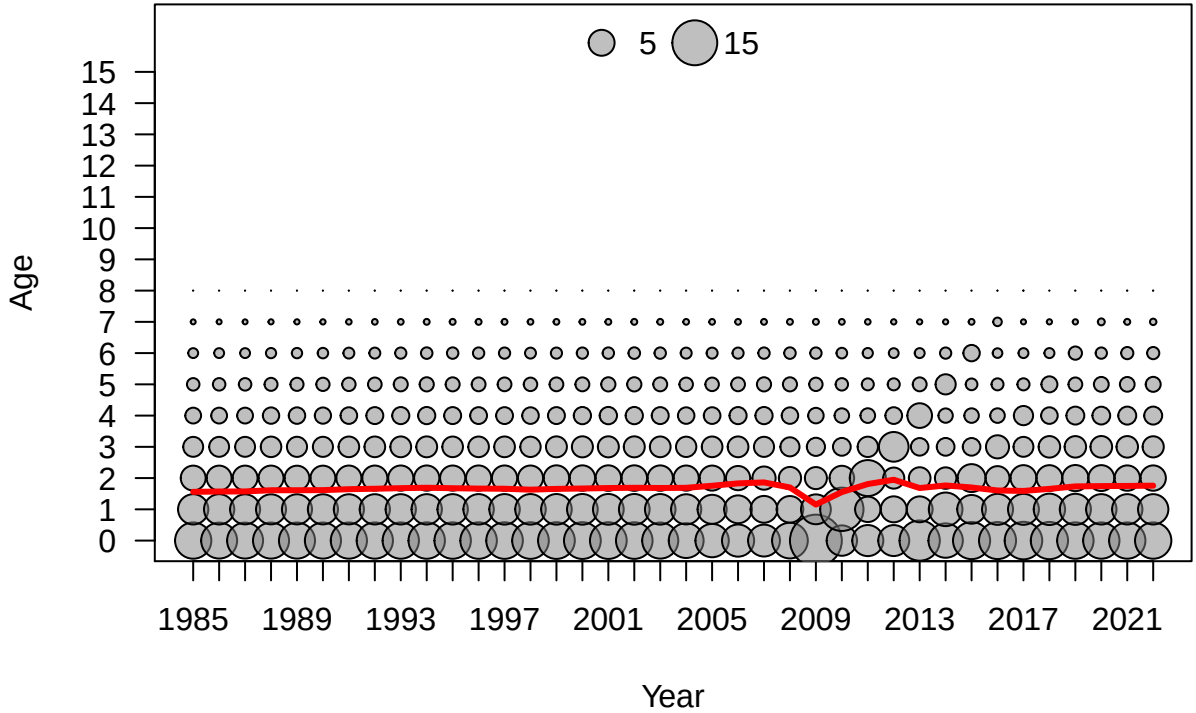

Log index
−1
−2
−3
−4
−5
2016
2017
2018
2019
2020
Year

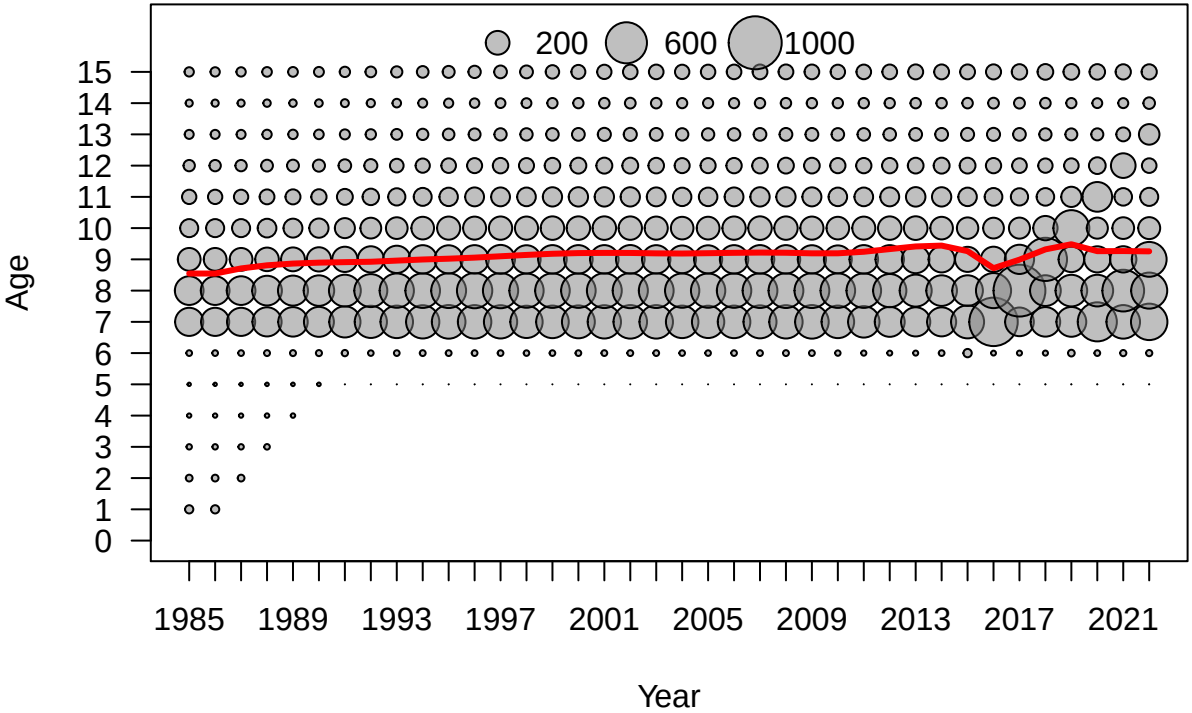

Log expected index
−2.18
−2.20
−2.22
−2.24
−2.26
−3.0
−2.5
−2.0
Log observed index

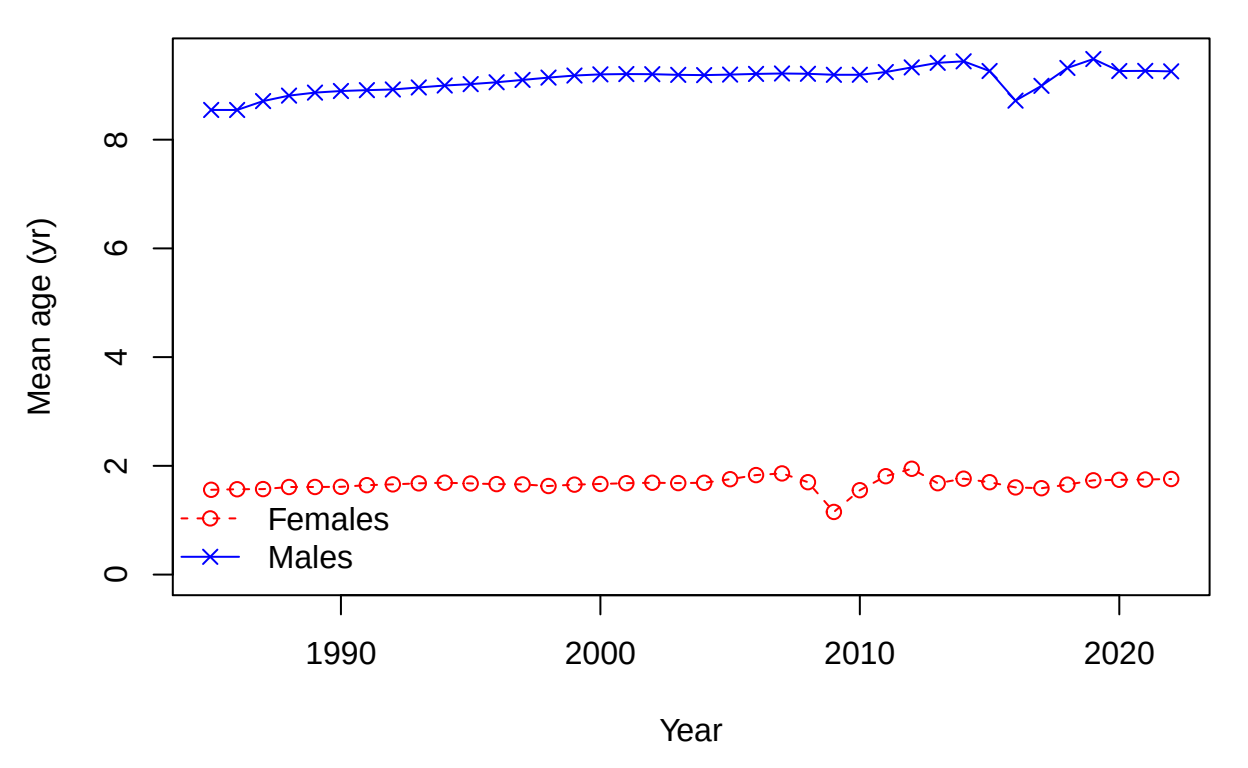

Residual
1.0
0.5
0.0
−0.5
−1.0
2016
2017
2018
2019
2020
Year

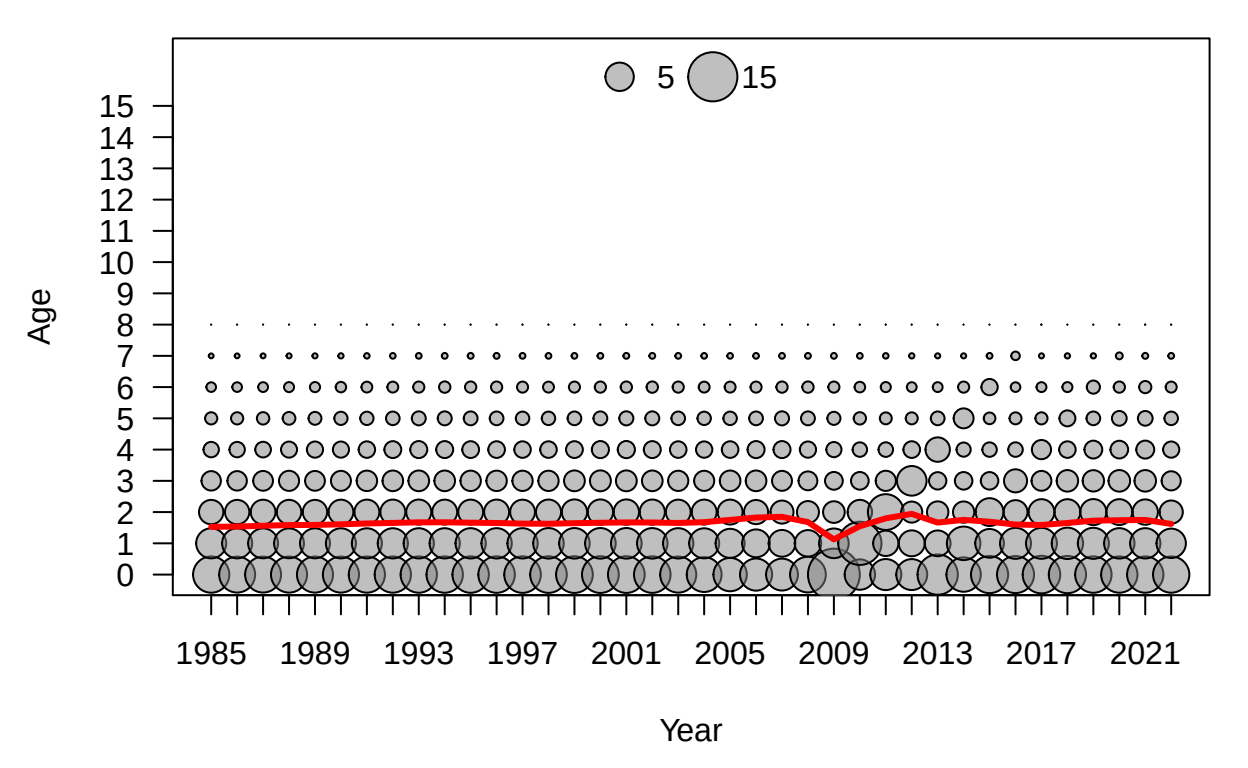

Deviation
1.0
0.5
0.0
−0.5
−1.0
2016
2017
2018
2019
2020
Year

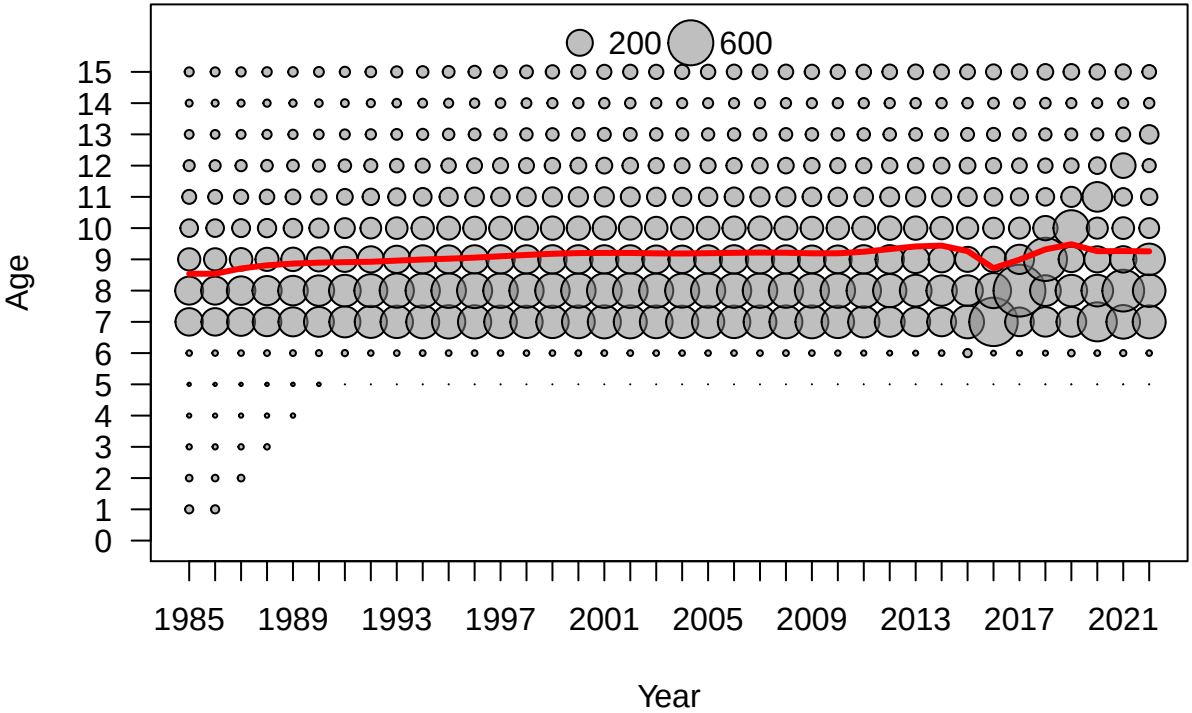

FISHERY
Standardized index
0.0
0.5
1.0
1.5
2015
2016
2017
2018
2019
2020
2021
Year

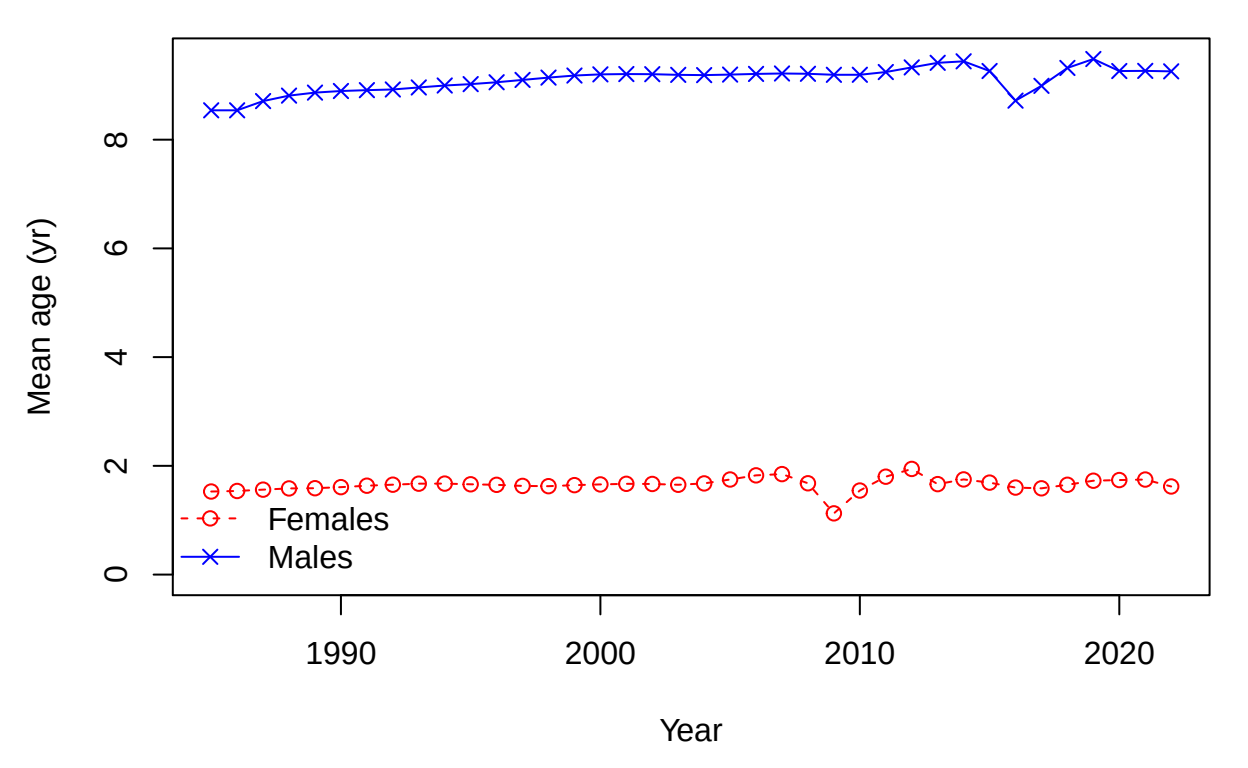

5
15
Age
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
1985
1989
1993
1997
2001
2005
2009
2013
2017
2021
Year

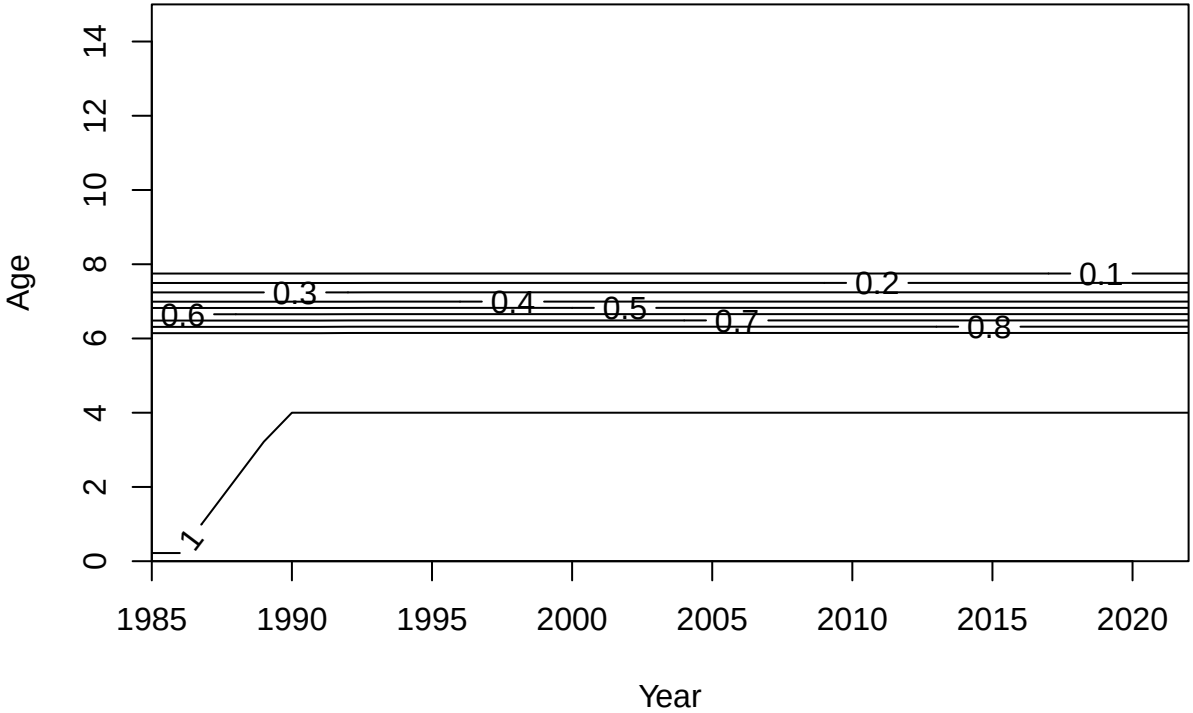

200
600
1000
Age
Year
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
1985
1989
1993
1997
2001
2005
2009
2013
2017
2021

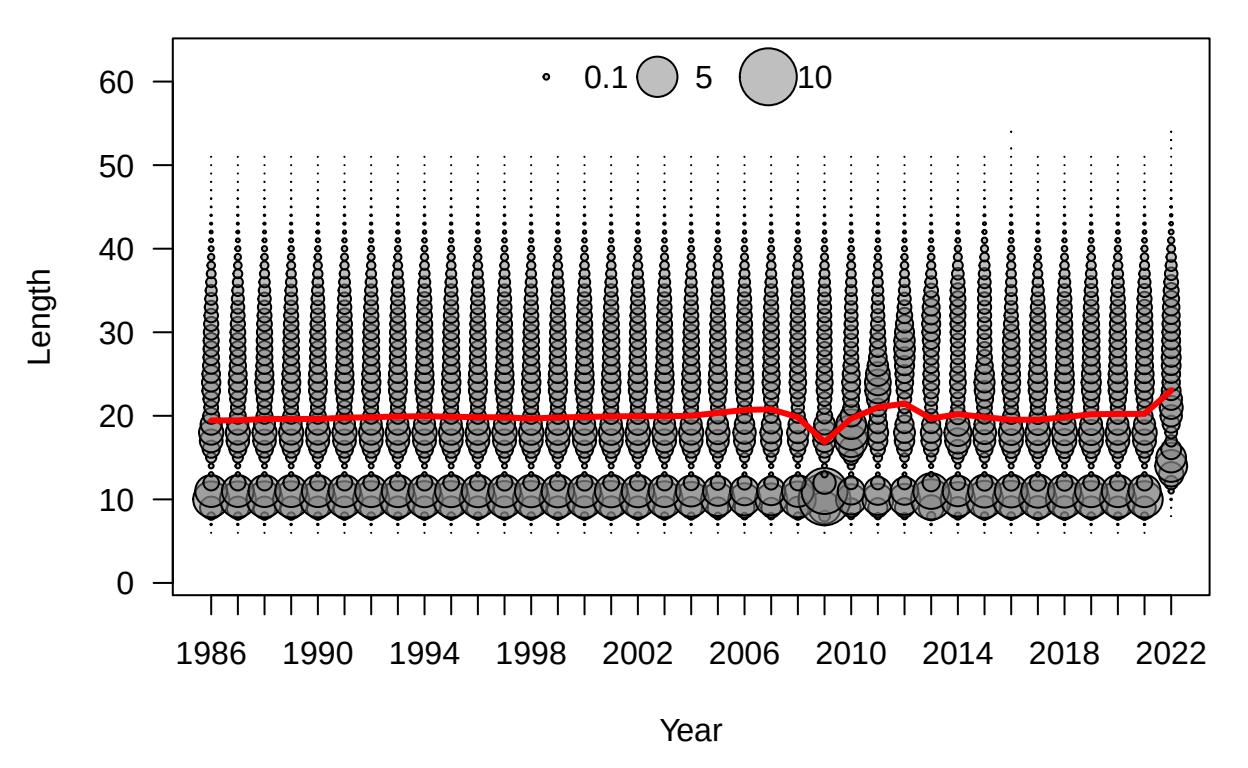

Mean age (yr)
0
2
4
6
8
1990
2000
2010
2020
Year
Females
Males

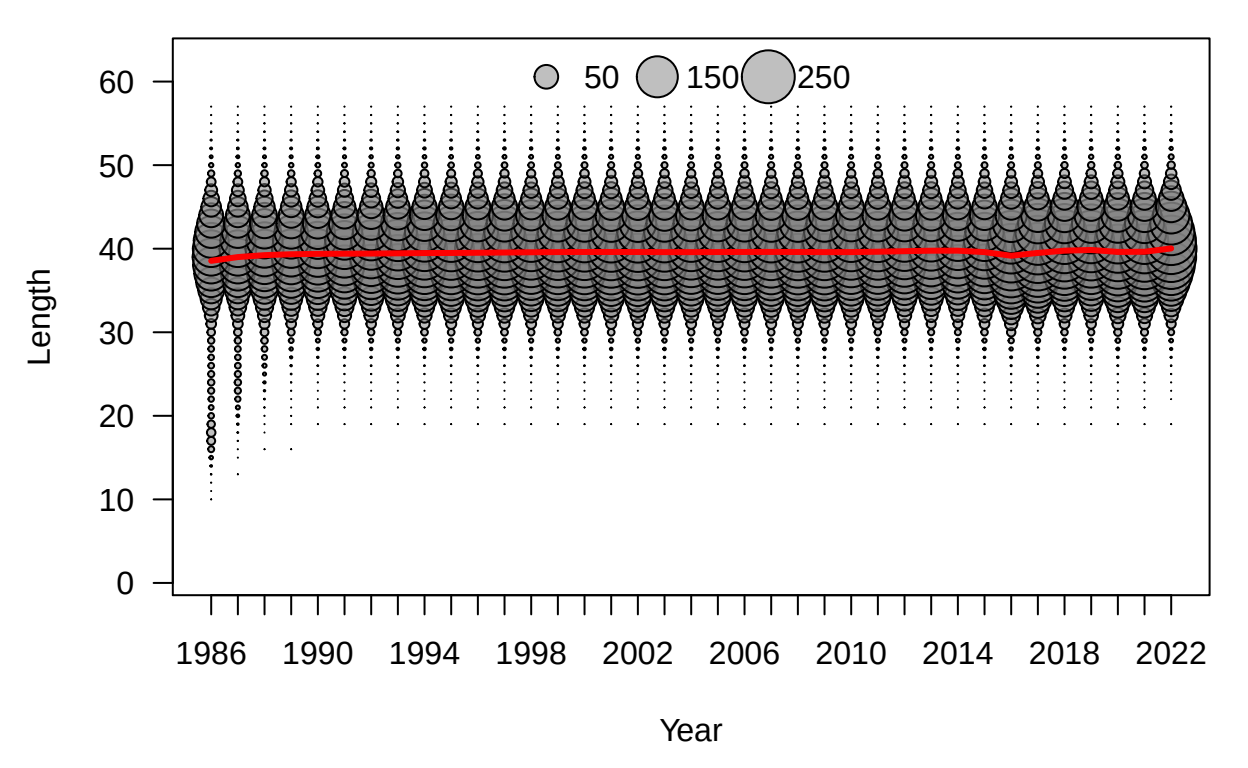

5
15
Age
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
1985
1989
1993
1997
2001
2005
2009
2013
2017
2021
Year

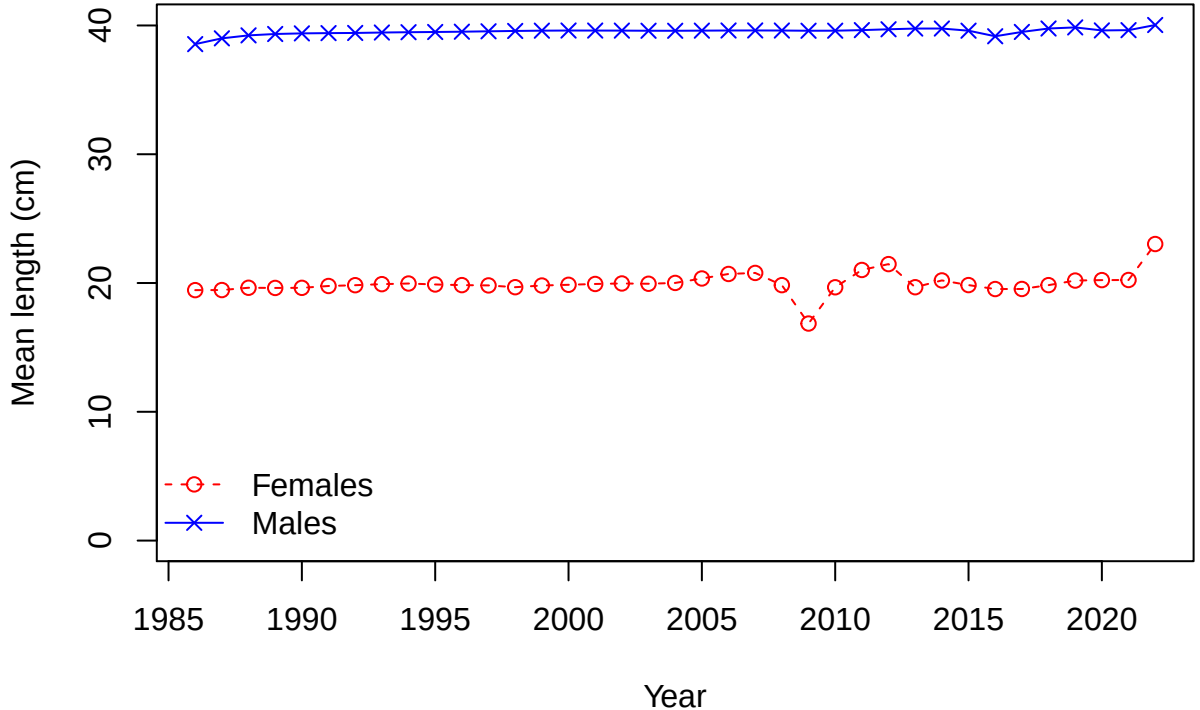

200
600
Age
Year
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
1985
1989
1993
1997
2001
2005
2009
2013
2017
2021

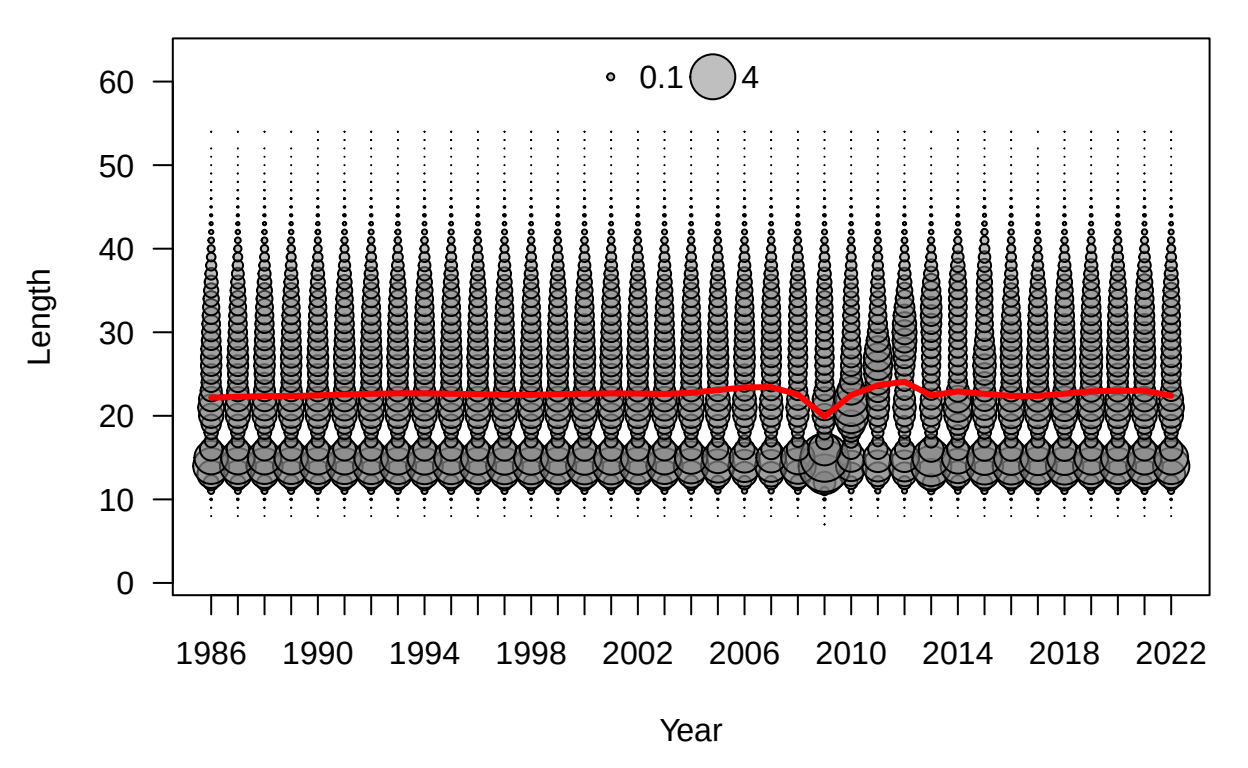

Mean age (yr)
0
2
4
6
8
1990
2000
2010
2020
Year
Females
Males

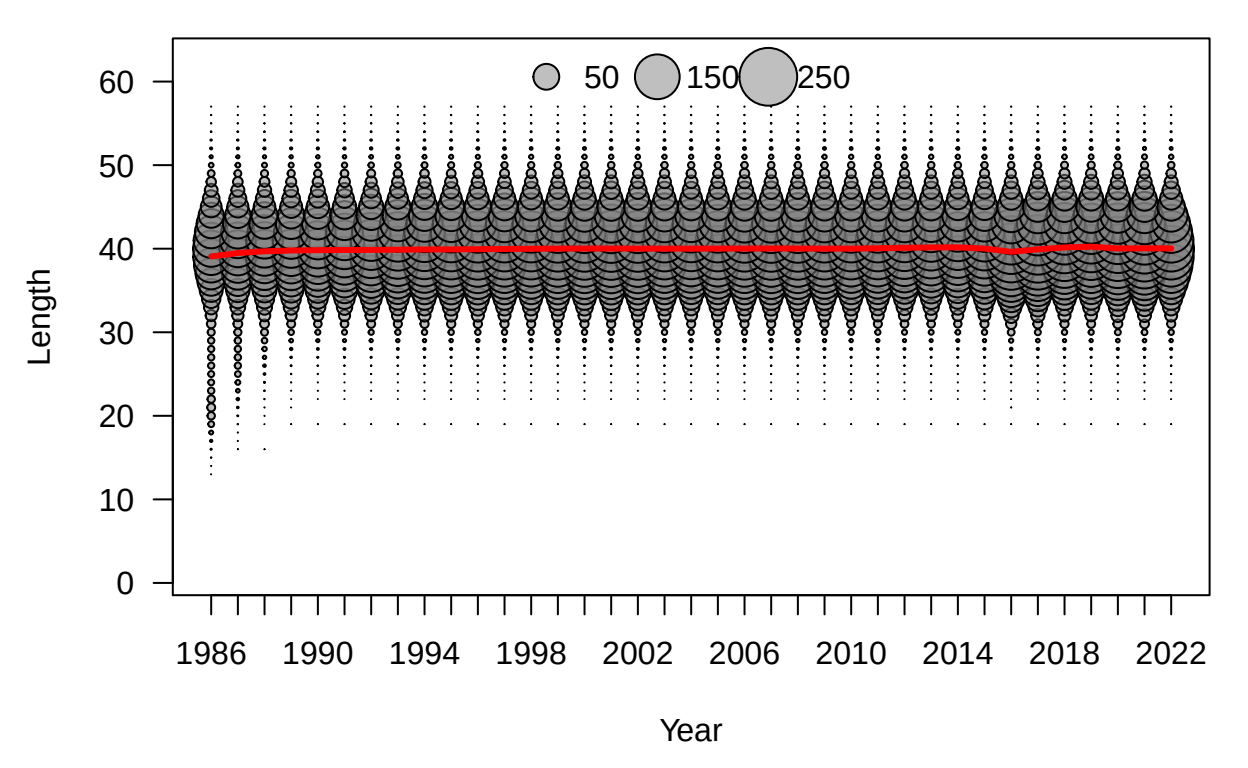

Age
0
2
4
6
8
10
12
14
1985
1990
1995
2000
2005
2010
2015
2020
Year
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
1

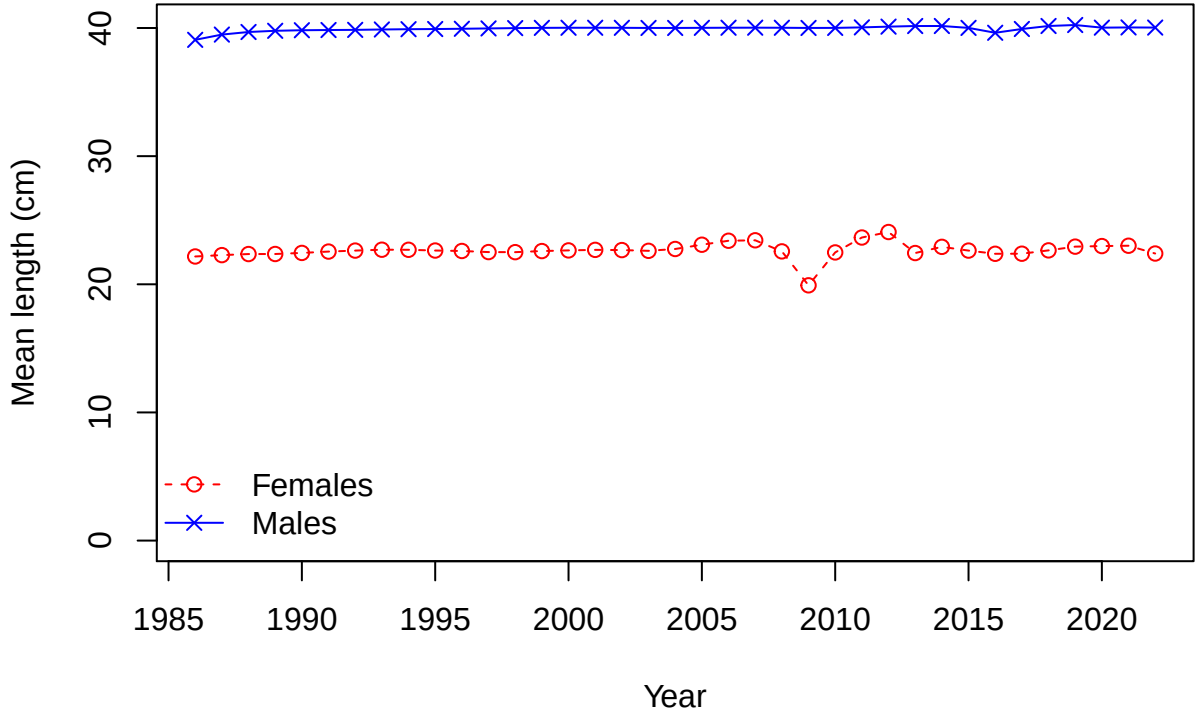

0.1
5
10
Length
0
10
20
30
40
50
60
1986
1990
1994
1998
2002
2006
2010
2014
2018
2022
Year

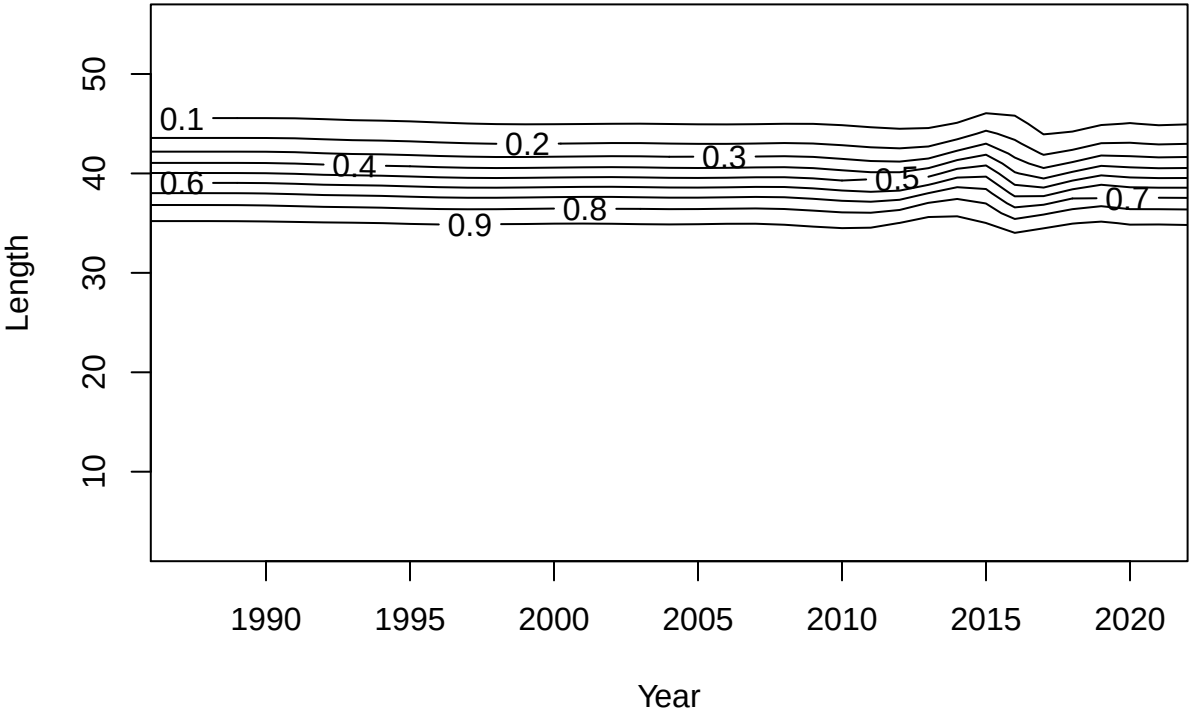

50
150
250
Length
0
10
20
30
40
50
60
1986
1990
1994
1998
2002
2006
2010
2014
2018
2022
Year

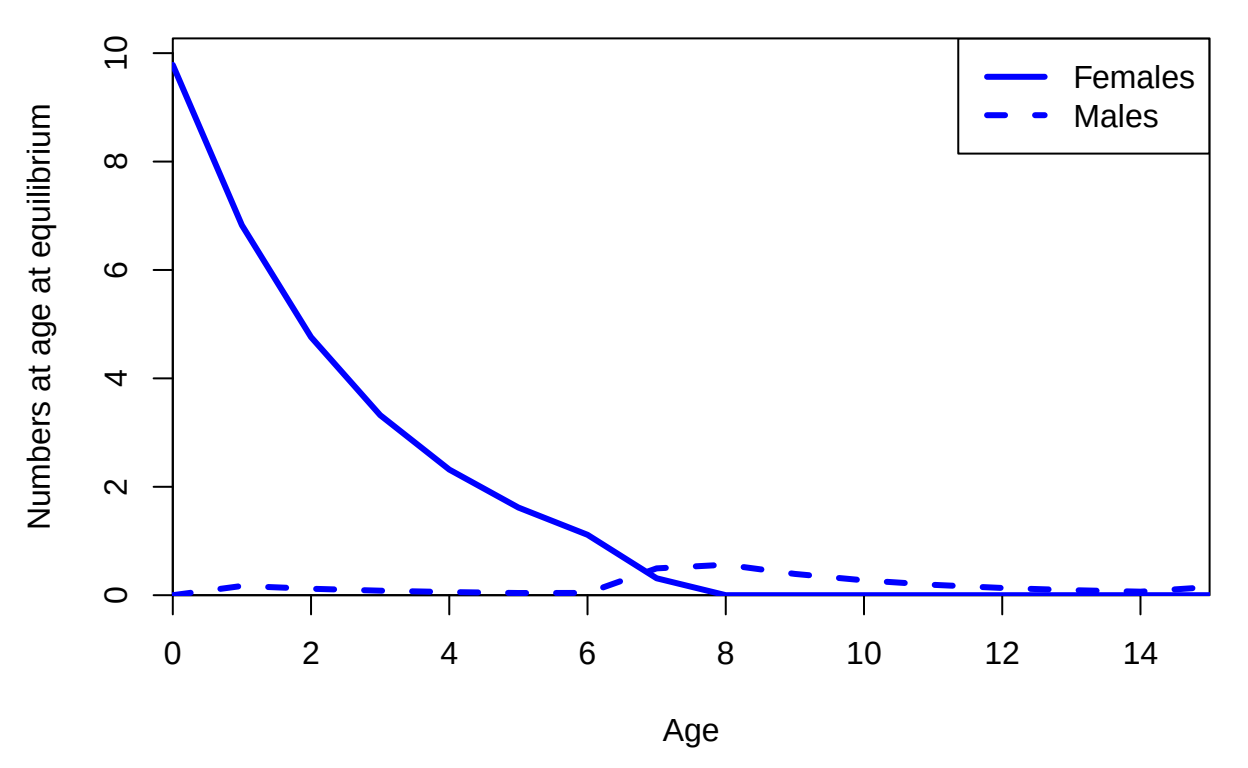

Mean length (cm)
0
10
20
30
40
1985
1990
1995
2000
2005
2010
2015
2020
Year
Females
Males

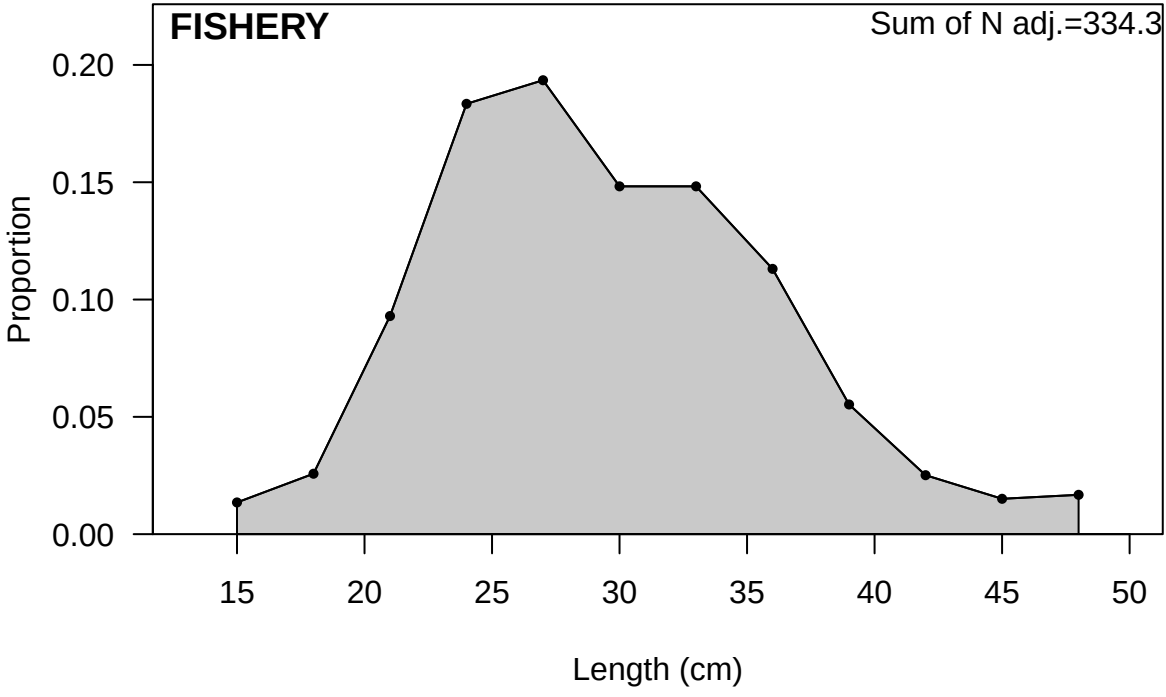

0.1
4
Length
0
10
20
30
40
50
60
1986
1990
1994
1998
2002
2006
2010
2014
2018
2022
Year

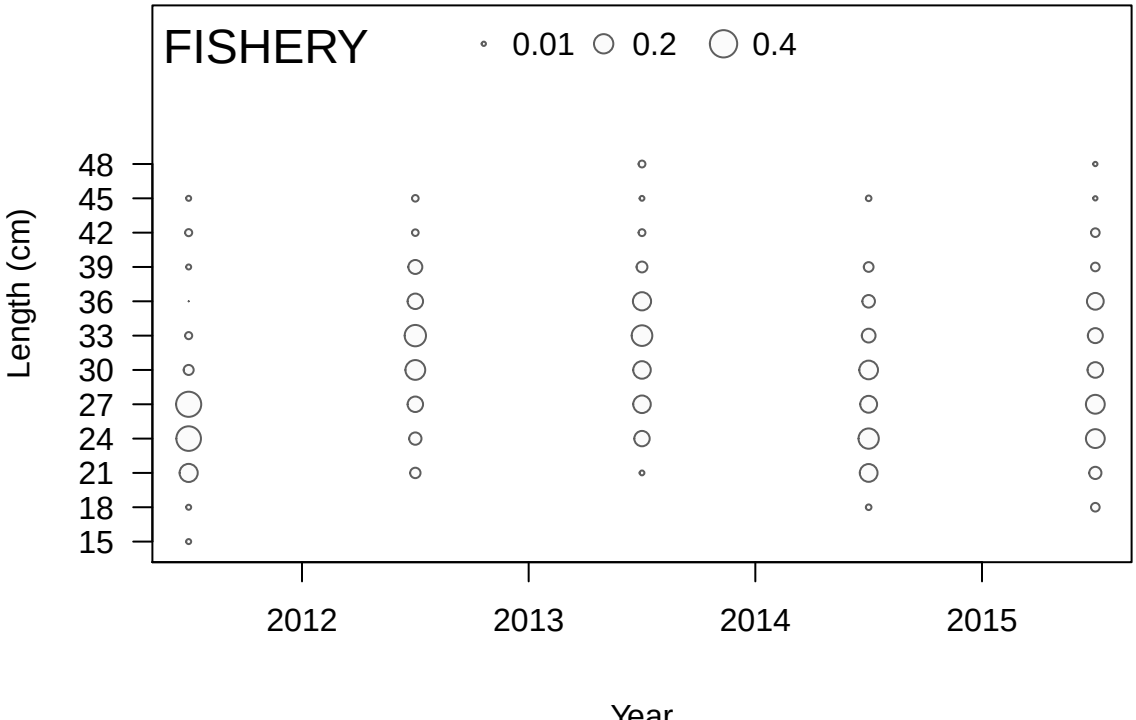

50
150
250
Length
Year
0
10
20
30
40
50
60
1986
1990
1994
1998
2002
2006
2010
2014
2018
2022

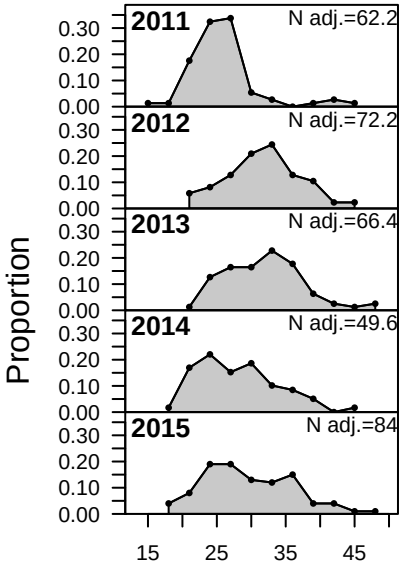

Mean length (cm)
0
10
20
30
40
1985
1990
1995
2000
2005
2010
2015
2020
Year
Females
Males

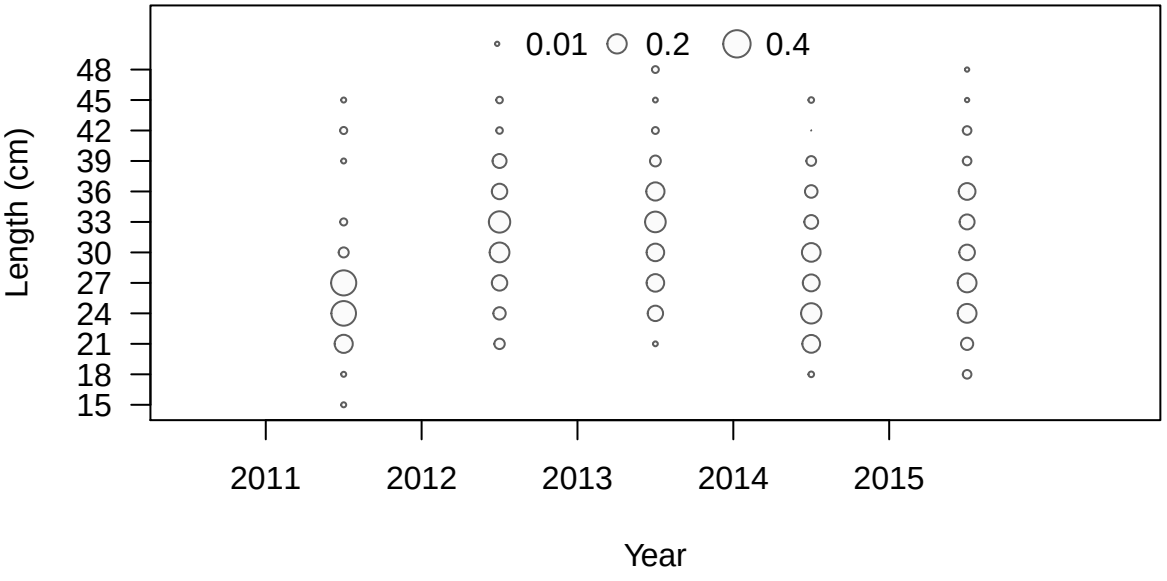

0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
Length
10
20
30
40
50
1990
1995
2000
2005
2010
2015
2020
Year

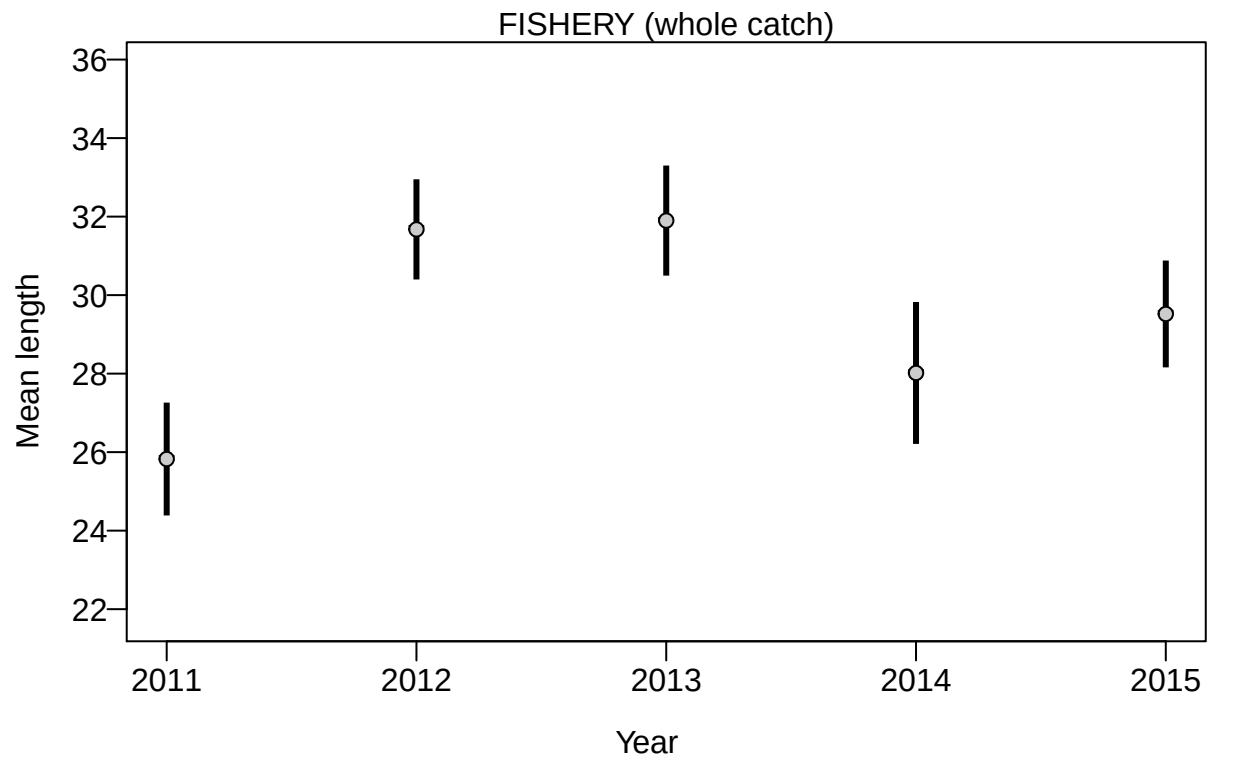

Numbers at age at equilibrium
0
2
4
6
8
10
0
2
4
6
8
10
12
14
Age
Females
Males

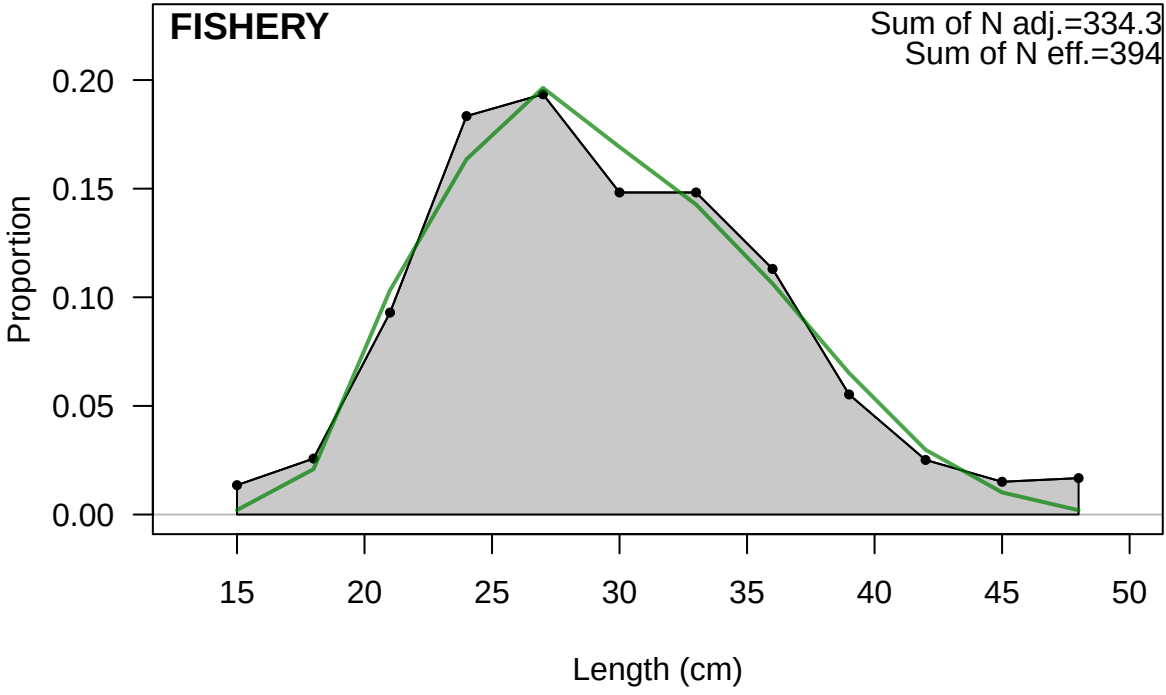

FISHERY
Sum of N adj.=334.3
Proportion
0.00
0.05
0.10
0.15
0.20
15
20
25
30
35
40
45
50
Length (cm)

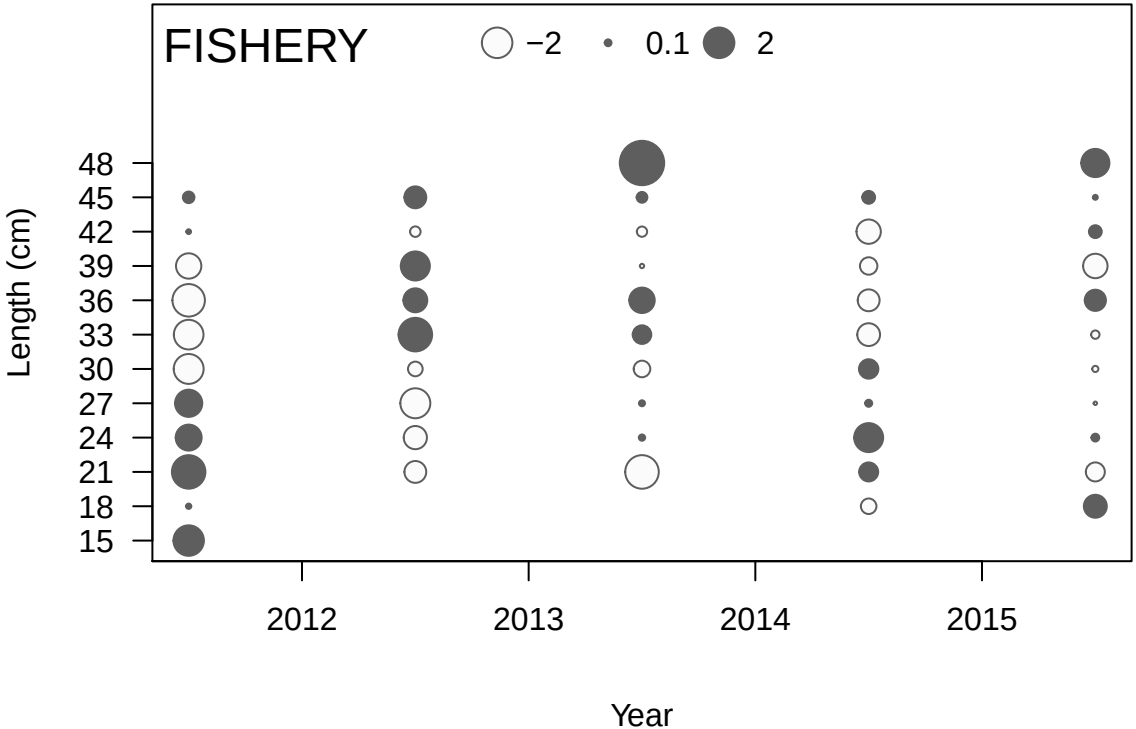

FISHERY
0.01
0.2
0.4
Length (cm)
48
45
42
39
36
33
30
27
24
21
18
15
2012
2013
2014
2015
Year

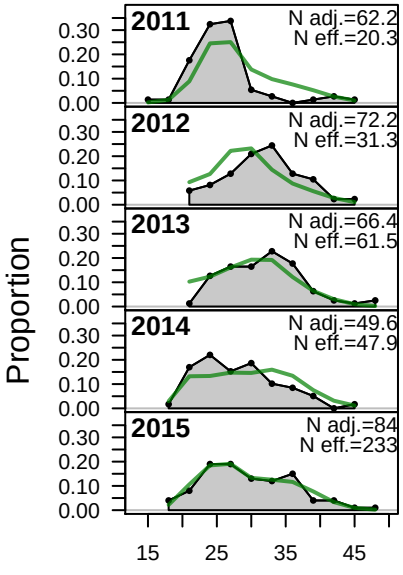

2011
N adj.=62.2
2012
N adj.=72.2
2013
N adj.=66.4
2014
N adj.=49.6
2015
N adj.=84
0.00
0.10
0.20
0.30
15
25
35
45
Proportion
Length (cm)

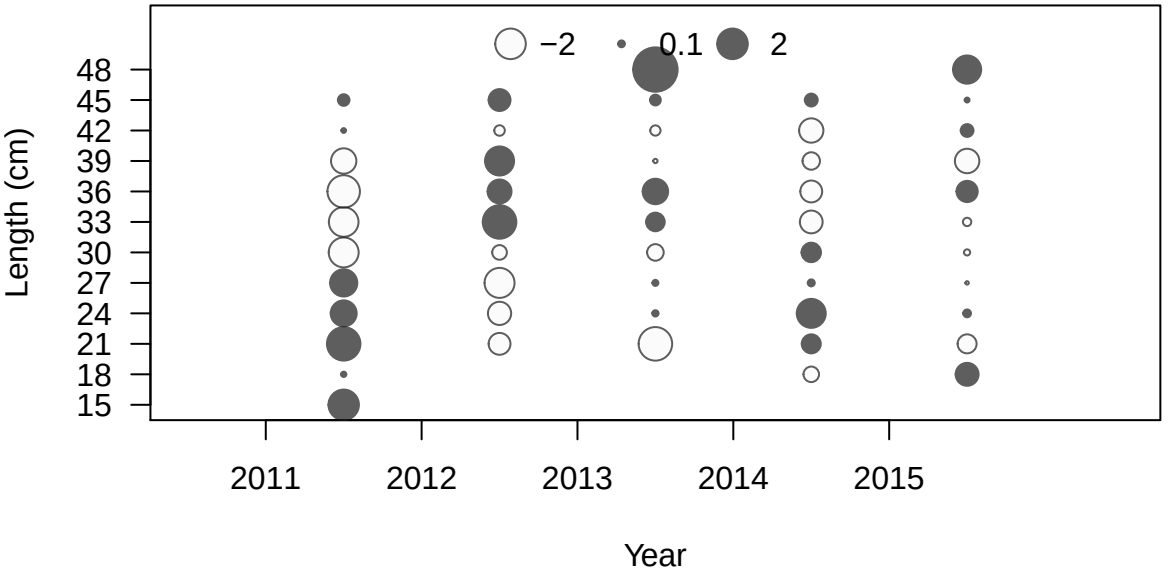

0.01
0.2
0.4
48
45
42
39
36
33
30
27
24
21
18
15
Length (cm)
2011
2012
2013
2014
2015
Year

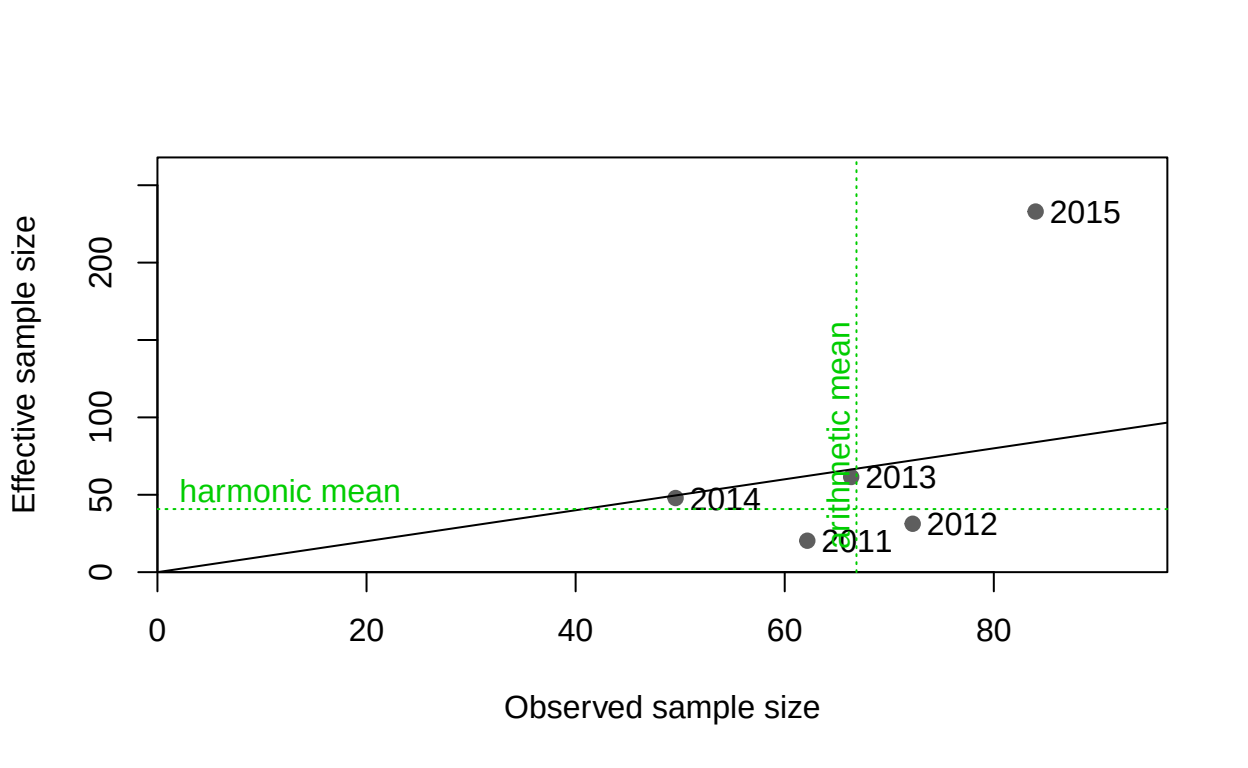

FISHERY (whole catch)
36
34
32
30
28
26
24
22
Mean length
2011
2012
2013
2014
2015
Year

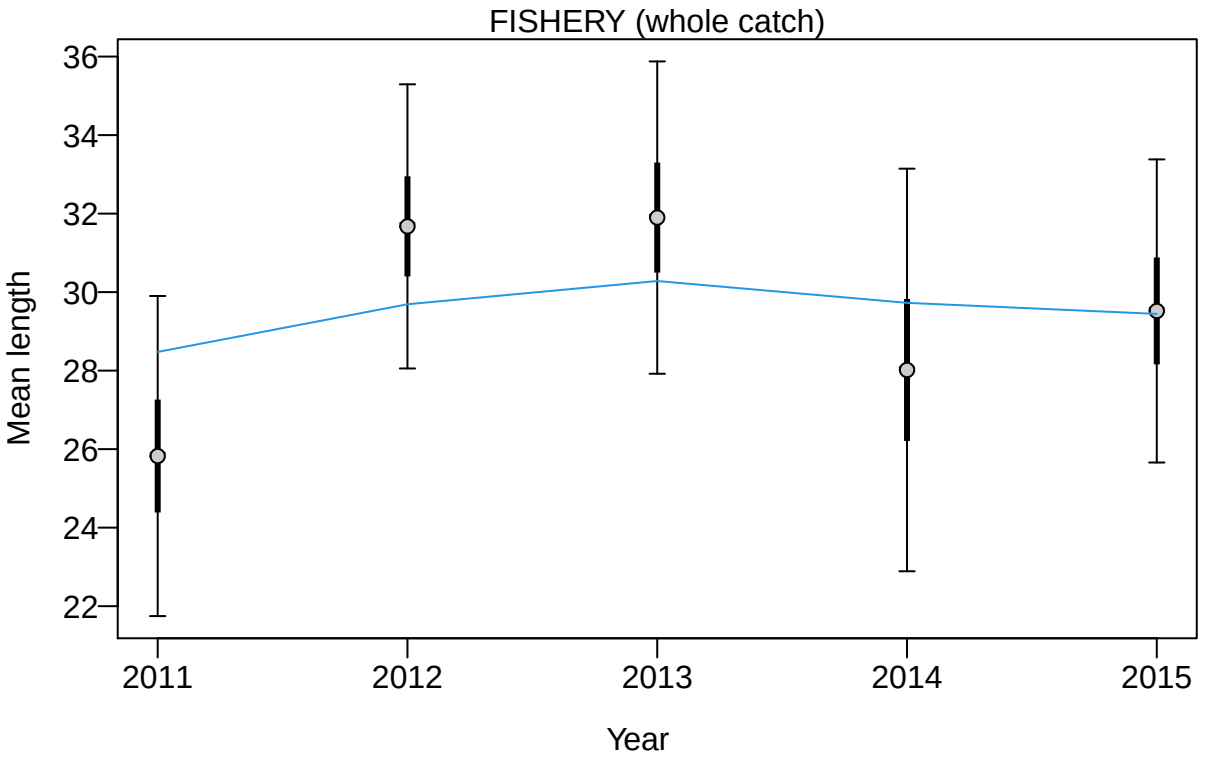

FISHERY
Sum of N adj.=334.3
Sum of N eff.=394
Proportion
0.00
0.05
0.10
0.15
0.20
15
20
25
30
35
40
45
50
Length (cm)

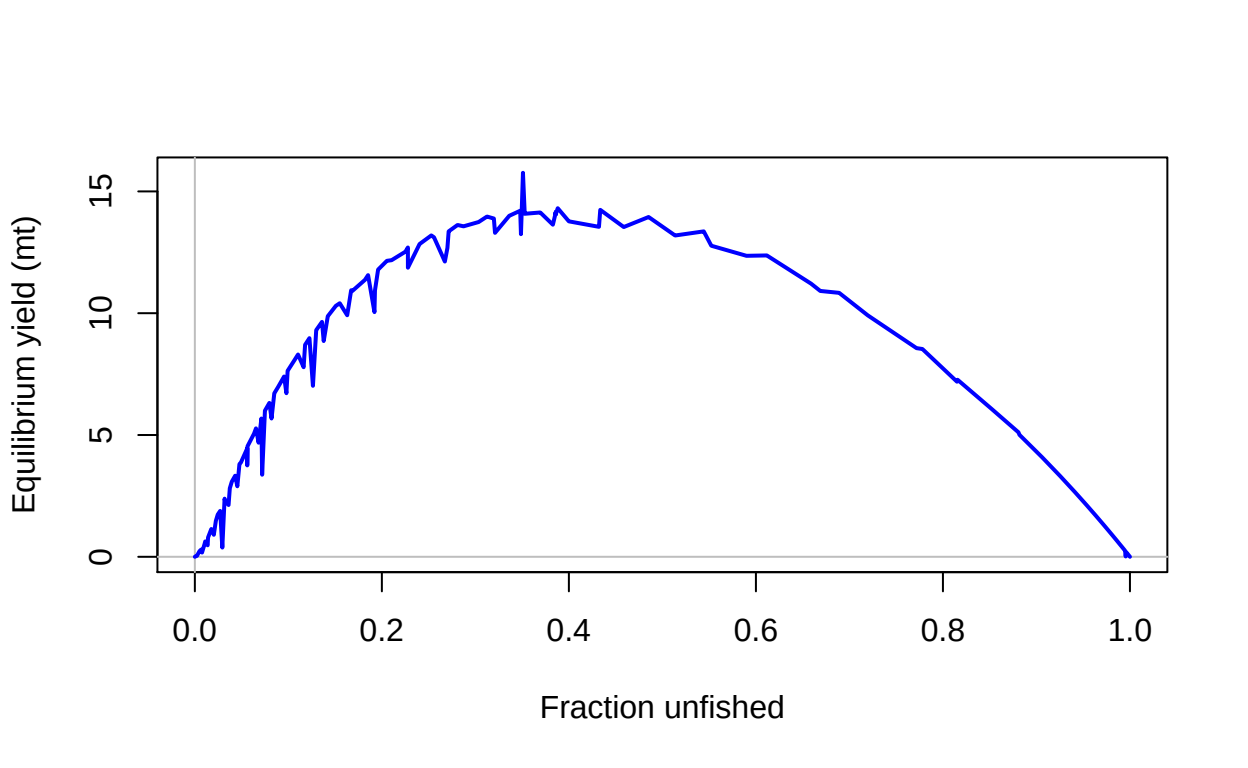

FISHERY
−2
0.1
2
Length (cm)
48
45
42
39
36
33
30
27
24
21
18
15
2012
2013
2014
2015
Year

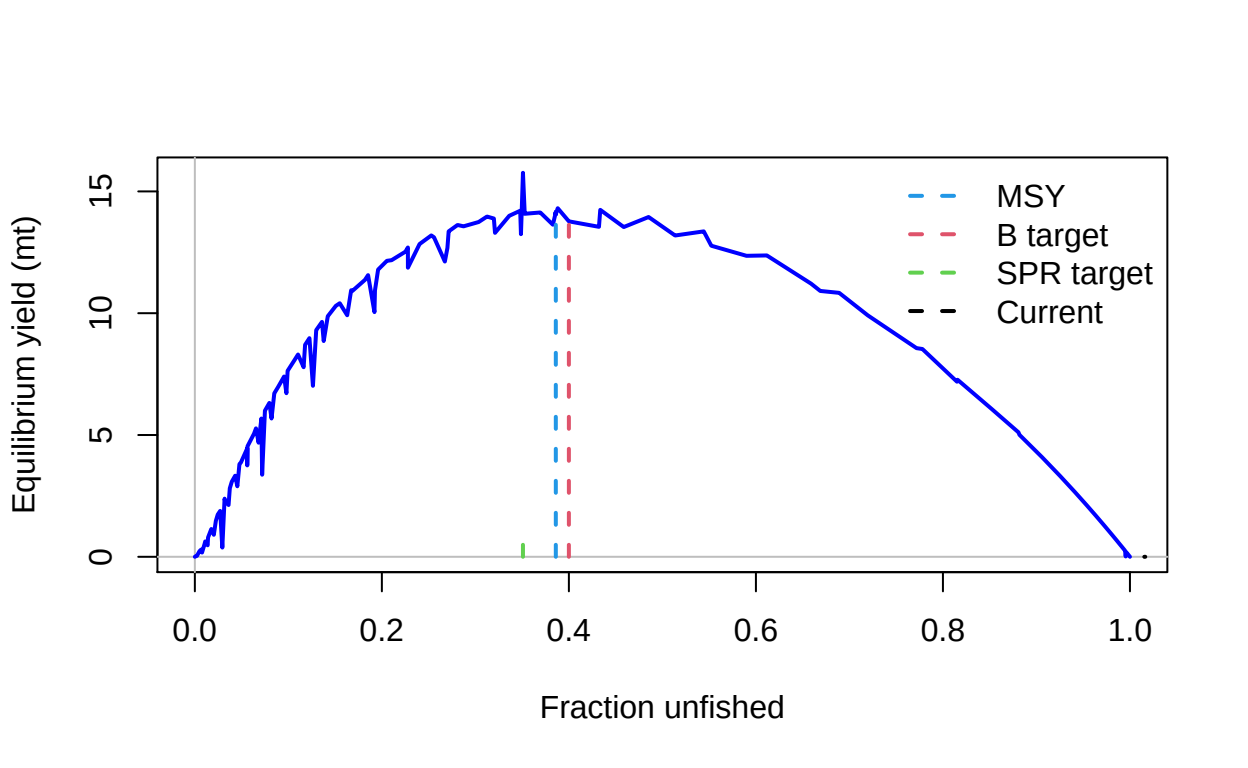

2011
N adj.=62.2
N eff.=20.3
2012
N adj.=72.2
N eff.=31.3
2013
N adj.=66.4
N eff.=61.5
2014
N adj.=49.6
N eff.=47.9
2015
N adj.=84
N eff.=233
0.00
0.10
0.20
0.30
15
25
35
45
Proportion
Length (cm)

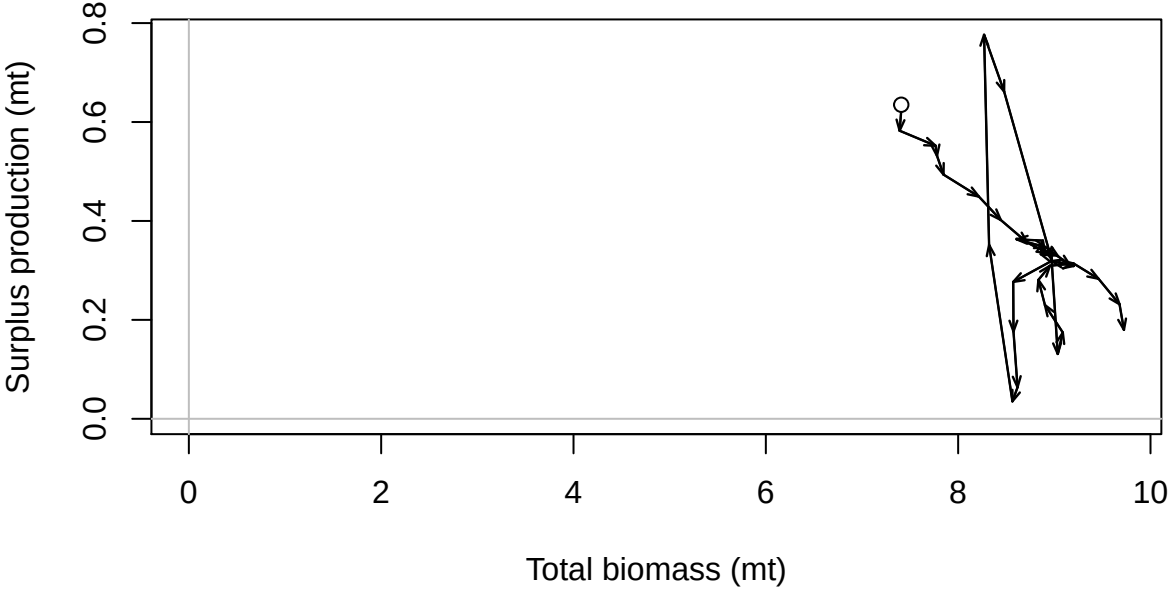

−2
0.1
2
48
45
42
39
36
33
30
27
24
21
18
15
Length (cm)
2011
2012
2013
2014
2015
Year

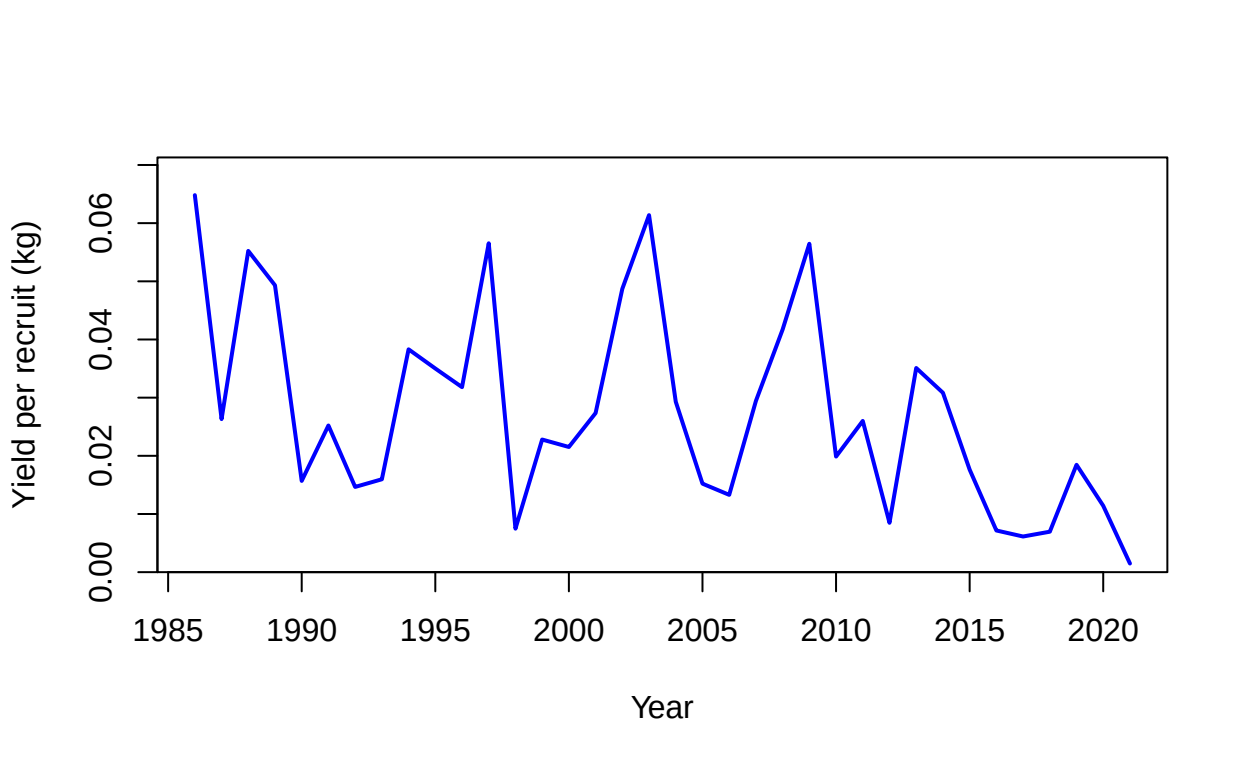

Effective sample size
0
50
100
200
0
20
40
60
80
Observed sample size
harmonic mean
arithmetic mean
2015
2013
2014
2012
2011

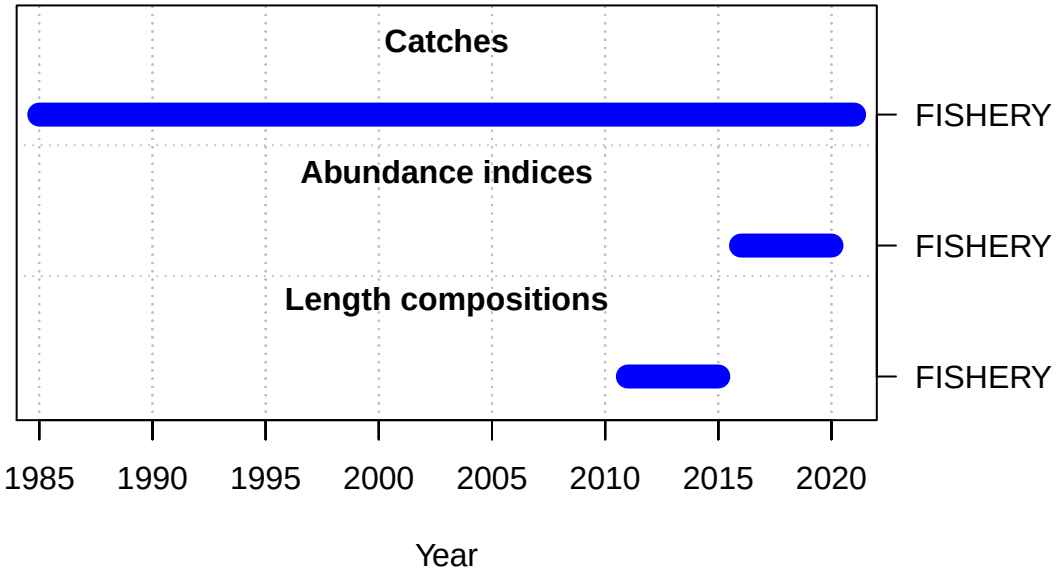

FISHERY (whole catch)
Mean length
36
34
32
30
28
26
24
22
2011
2012
2013
2014
2015
Year

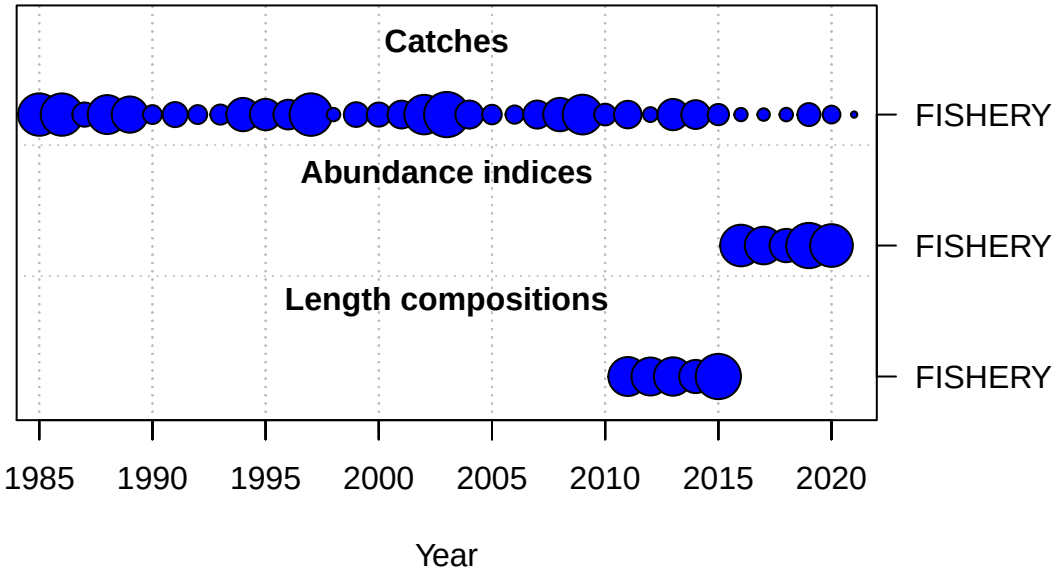

Equilibrium yield (mt)
0
5
10
15
0.0
0.2
0.4
0.6
0.8
1.0
Fraction unfished

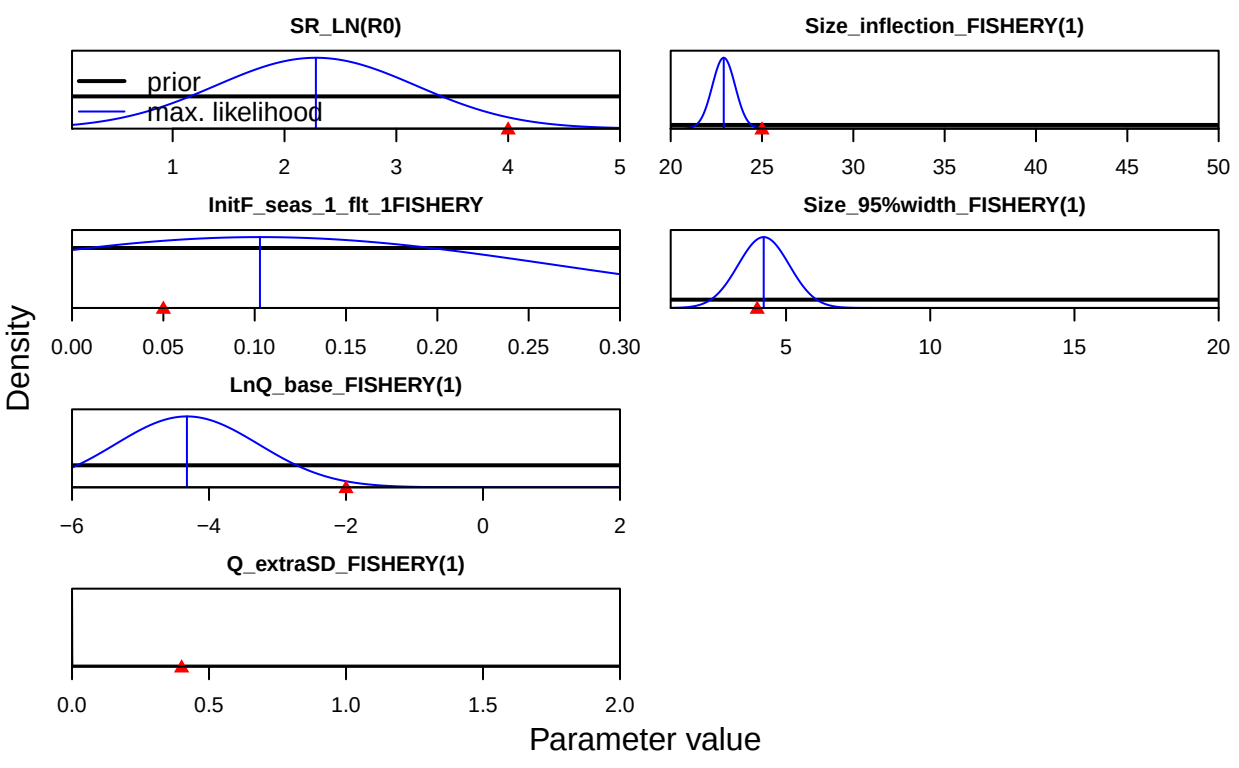

Equilibrium yield (mt)
0
5
10
15
0.0
0.2
0.4
0.6
0.8
1.0
Fraction unfished
MSY
B target
SPR target
Current


Surplus production (mt)
0.0
0.2
0.4
0.6
0.8
0
2
4
6
8
10
Total biomass (mt)


Yield per recruit (kg)
0.00
0.02
0.04
0.06
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
1
2
3
4
5
Size_inflection_FISHERY(1)
20
25
30
35
40
45
50
InitF_seas_1_flt_1FISHERY
0.00
0.05
0.10
0.15
0.20
0.25
0.30
Size_95%width_FISHERY(1)
5
10
15
20
LnQ_base_FISHERY(1)
−6
−4
−2
0
2
Q_extraSD_FISHERY(1)
0.0
0.5
1.0
1.5
2.0
Density
Parameter value