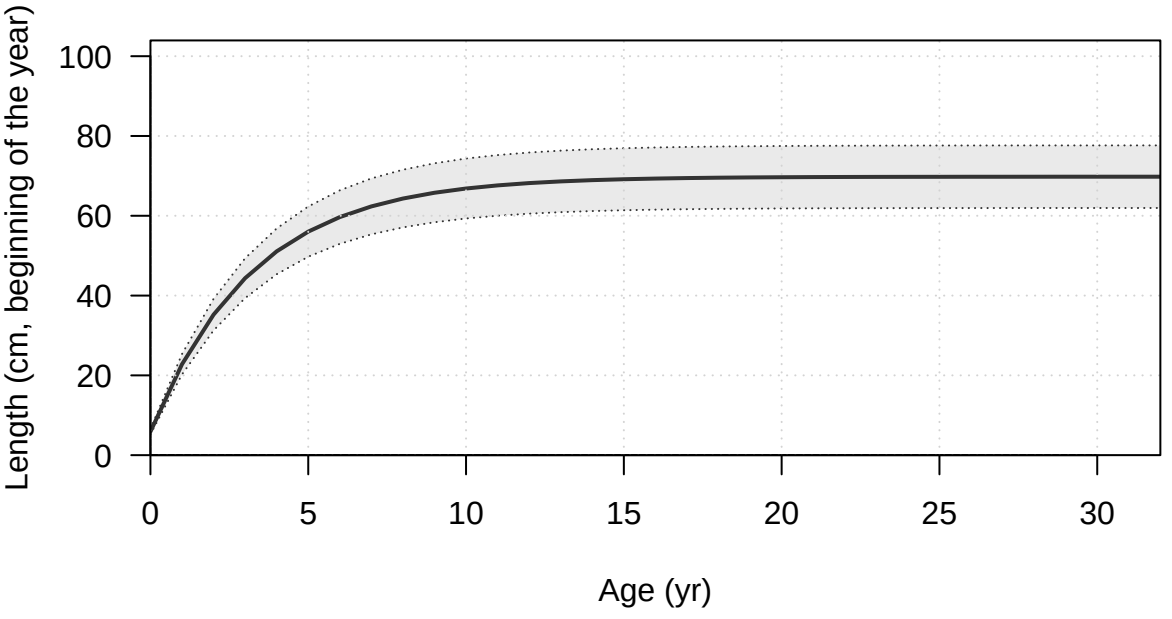
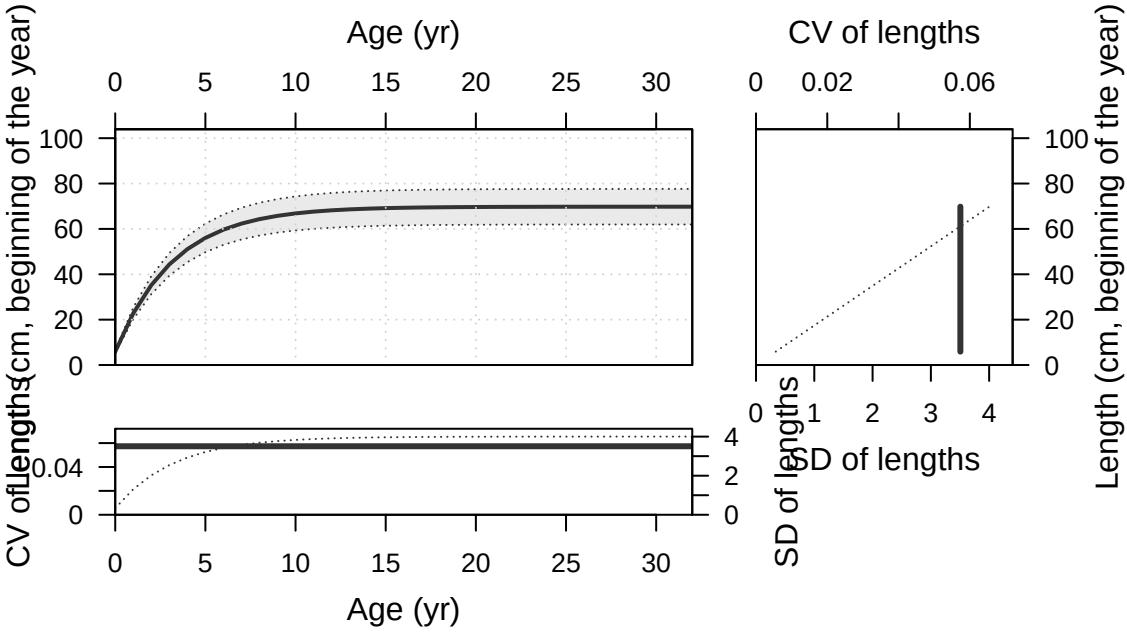
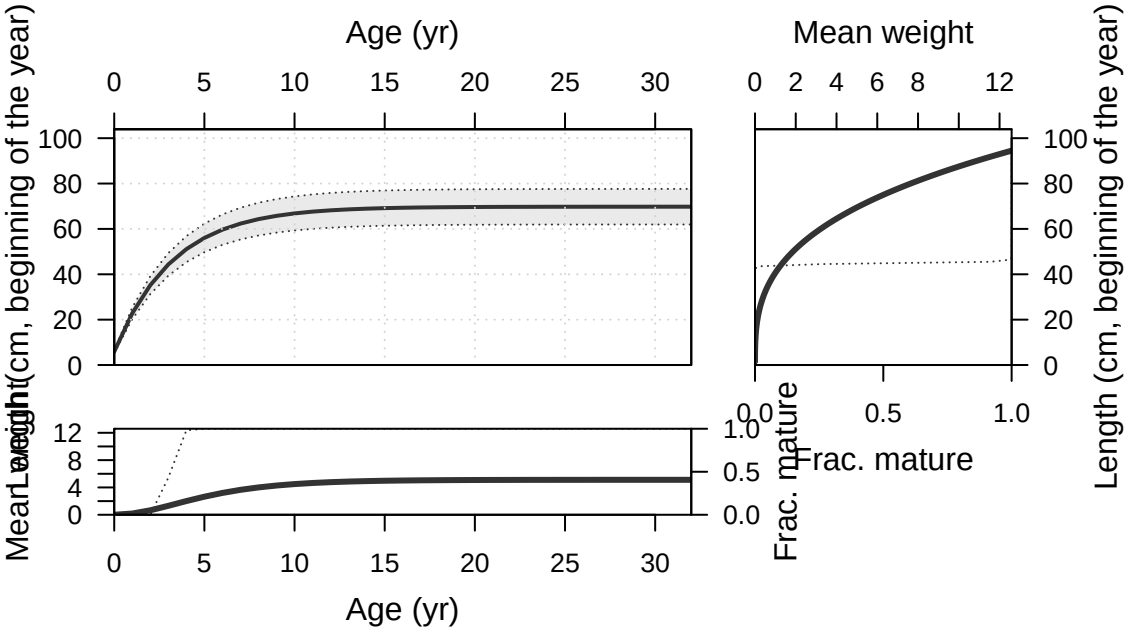
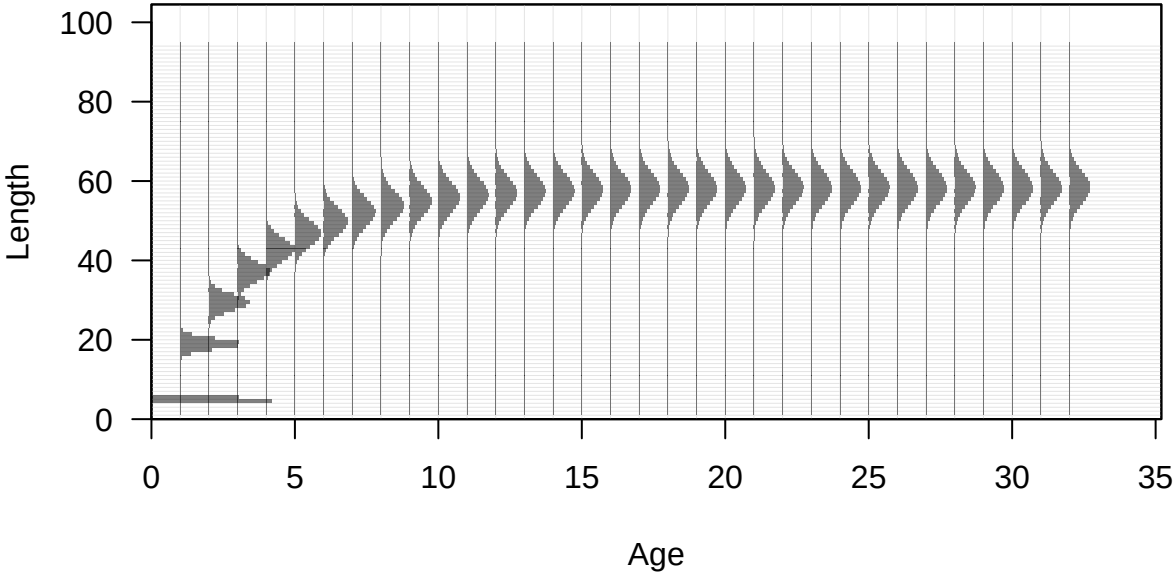
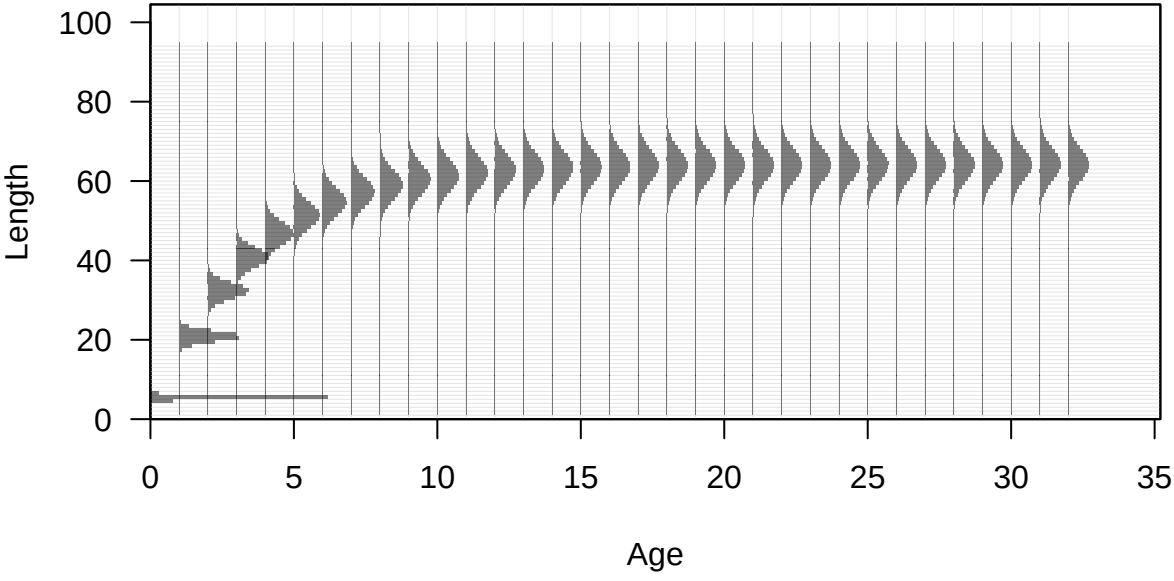
Plots created using the 'r4ss' package in R
Stock Synthesis version: 3.30.19.0
StartTime: Wed Aug 10 16:01:33 2022
Data_File: data.ss
Control_File: control.ss

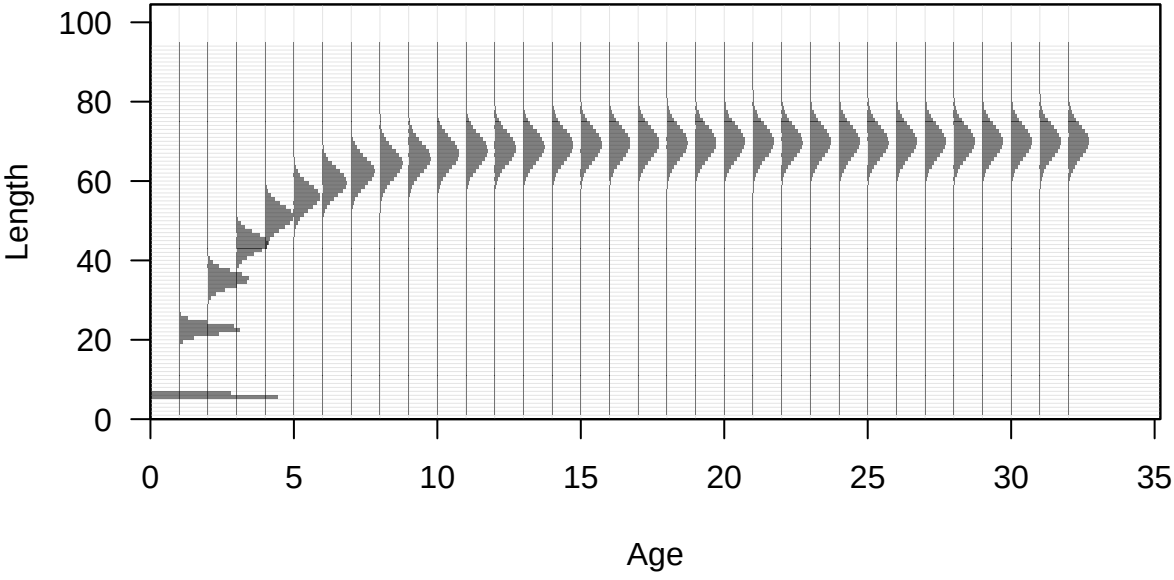

Length (cm, beginning of the year)
100
80
60
40
20
0
0
5
10
15
20
25
30
Age (yr)

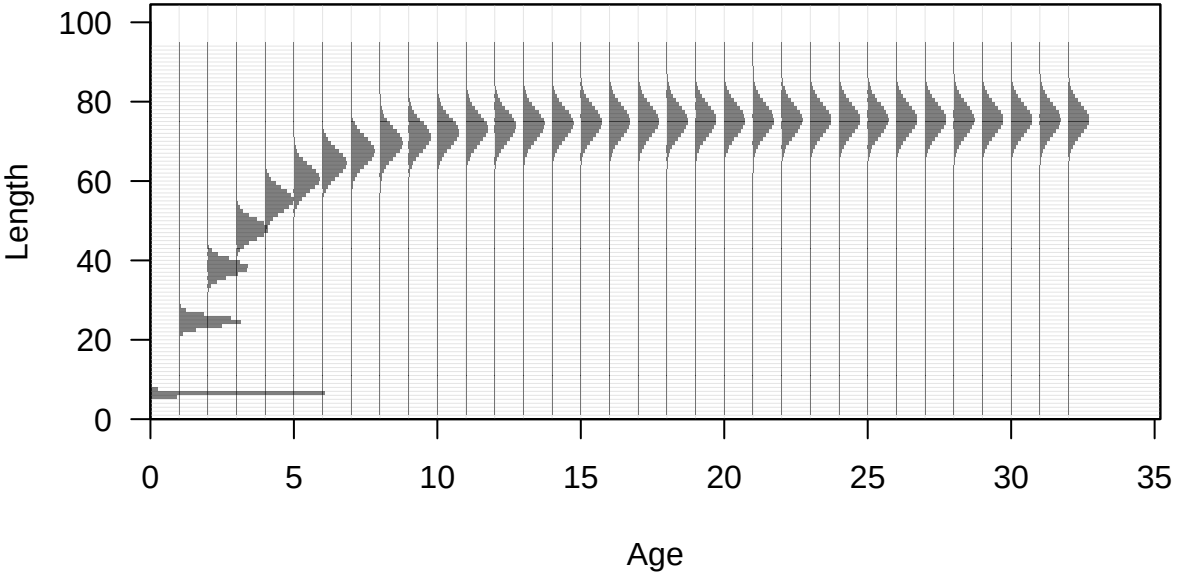

Age (yr)
0
5
10
15
20
25
30
100
80
60
40
20
0
Length (cm, beginning of the year)
CV of lengths
0.04
0
4
2
0
SD of lengths
Age (yr)
CV of lengths
0
0.02
0.06
0
1
2
3
4
SD of lengths
Length (cm, beginning of the year)

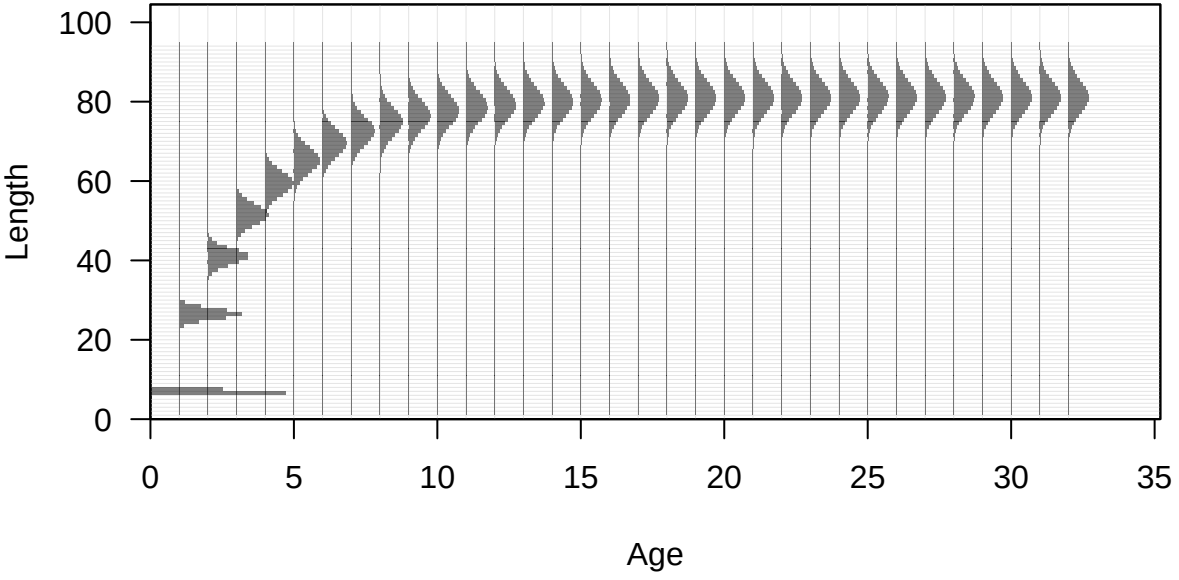

Age (yr)
Mean weight
Length (cm, beginning of the year)
Mean weight
Age (yr)
Frac. mature
Frac. mature
Length (cm, beginning of the year)

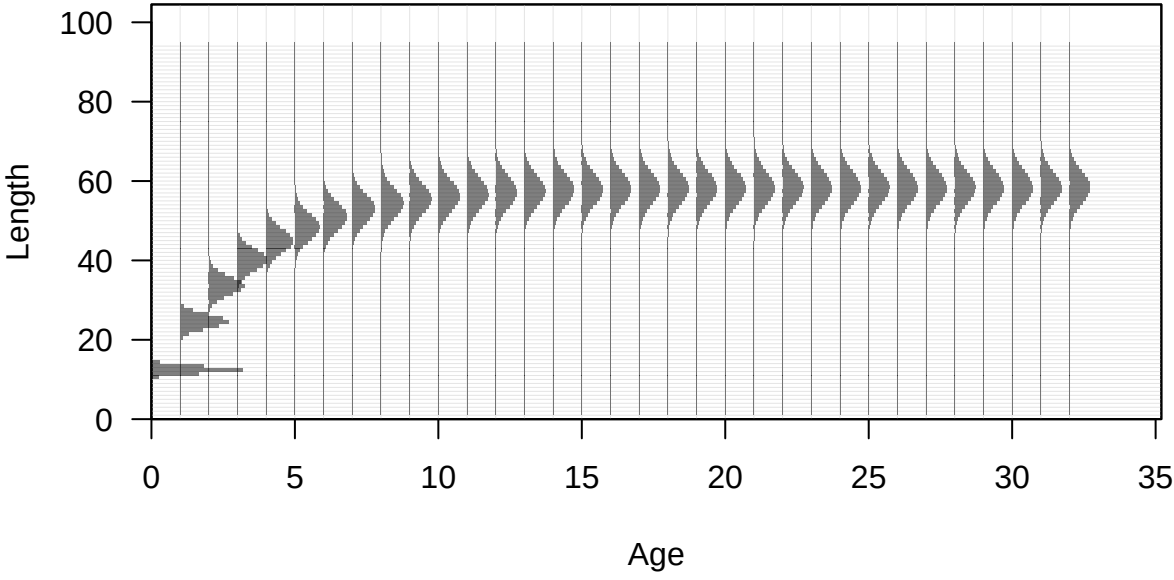

Length
100
80
60
40
20
0
0
5
10
15
20
25
30
35
Age

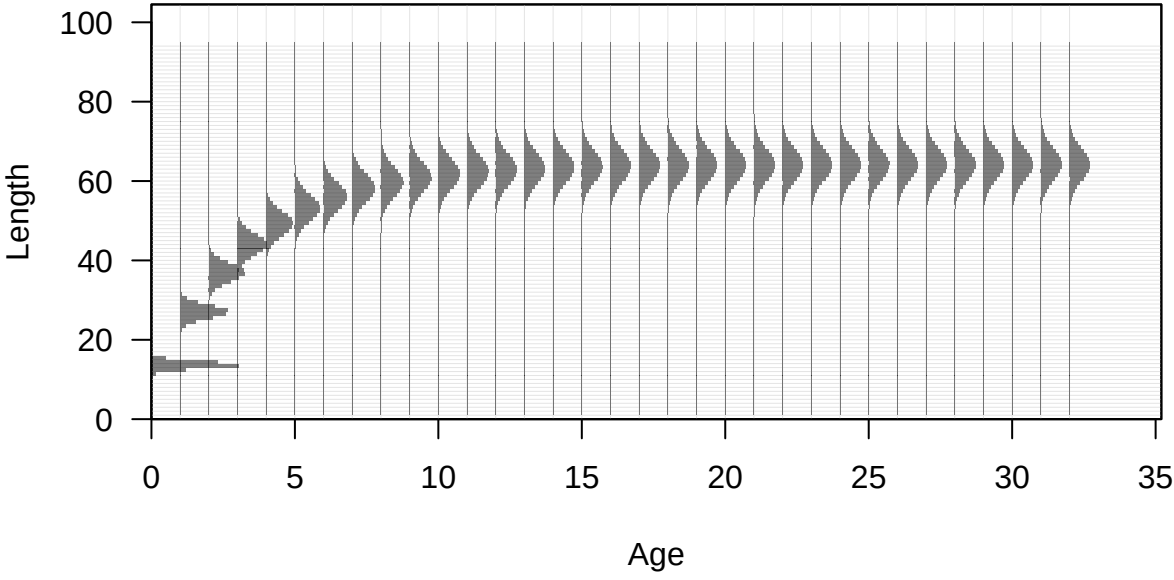

Length
100
80
60
40
20
0
0
5
10
15
20
25
30
35
Age

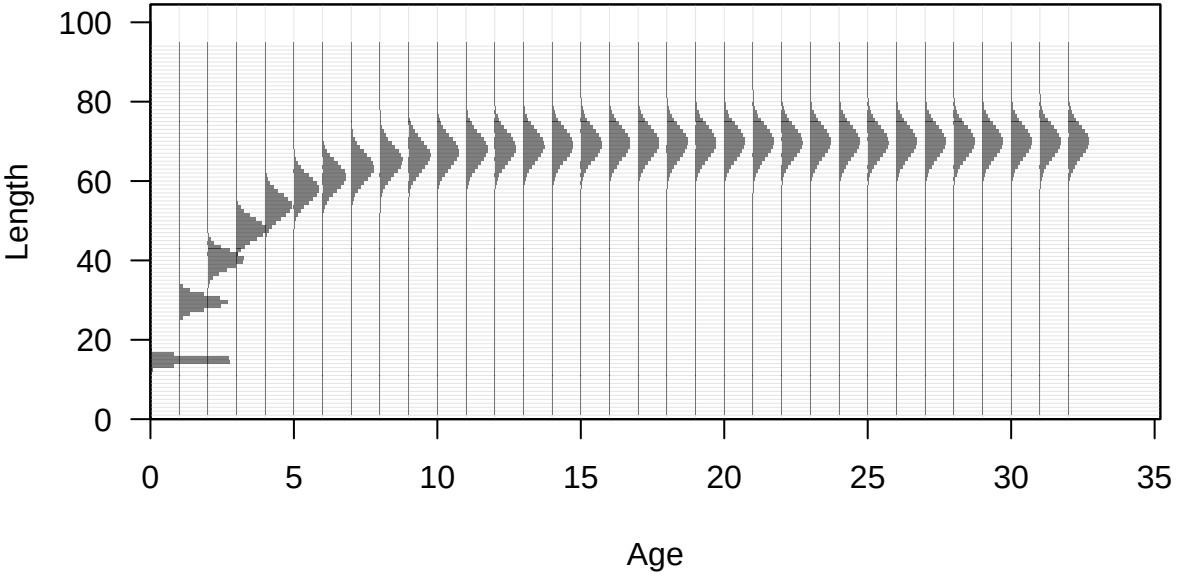

Length
100
80
60
40
20
0
0
5
10
15
20
25
30
35
Age

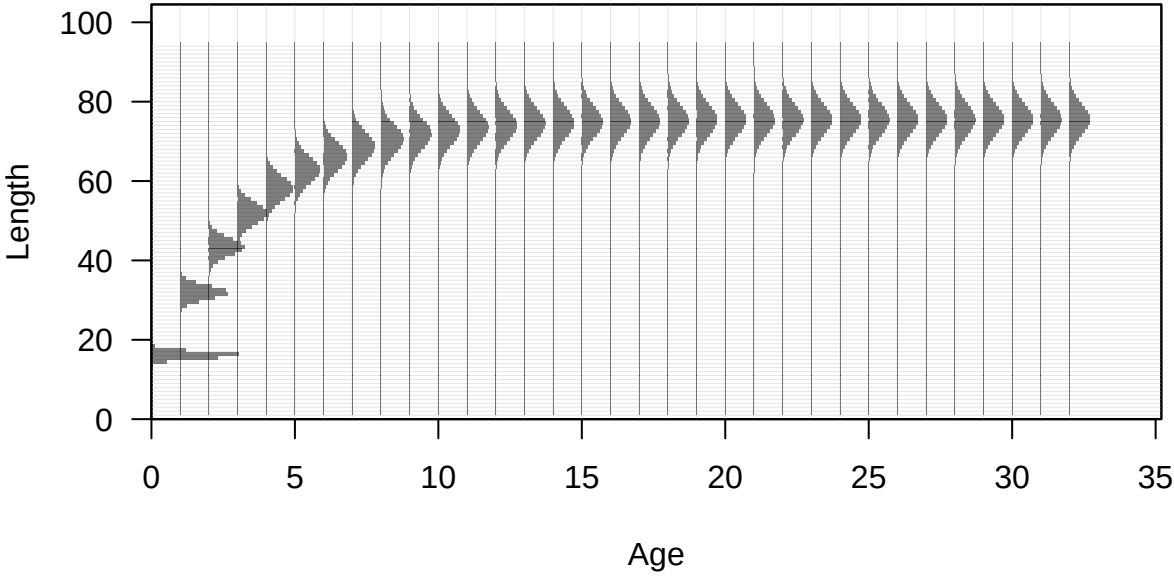

Length
100
80
60
40
20
0
0
5
10
15
20
25
30
35
Age

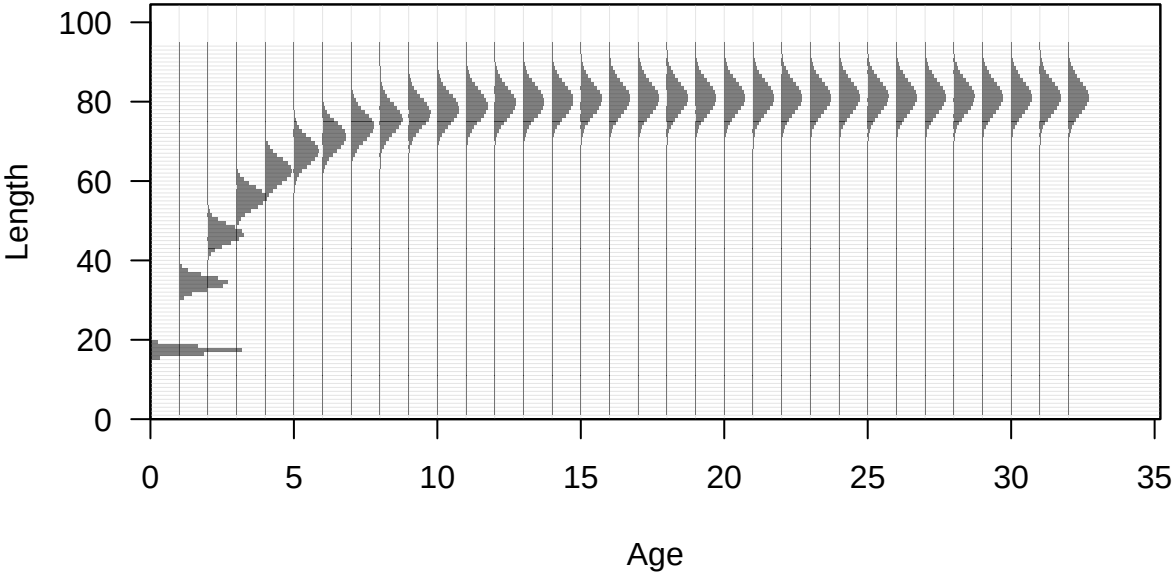

100
80
60
40
20
0
Length
0
5
10
15
20
25
30
35
Age

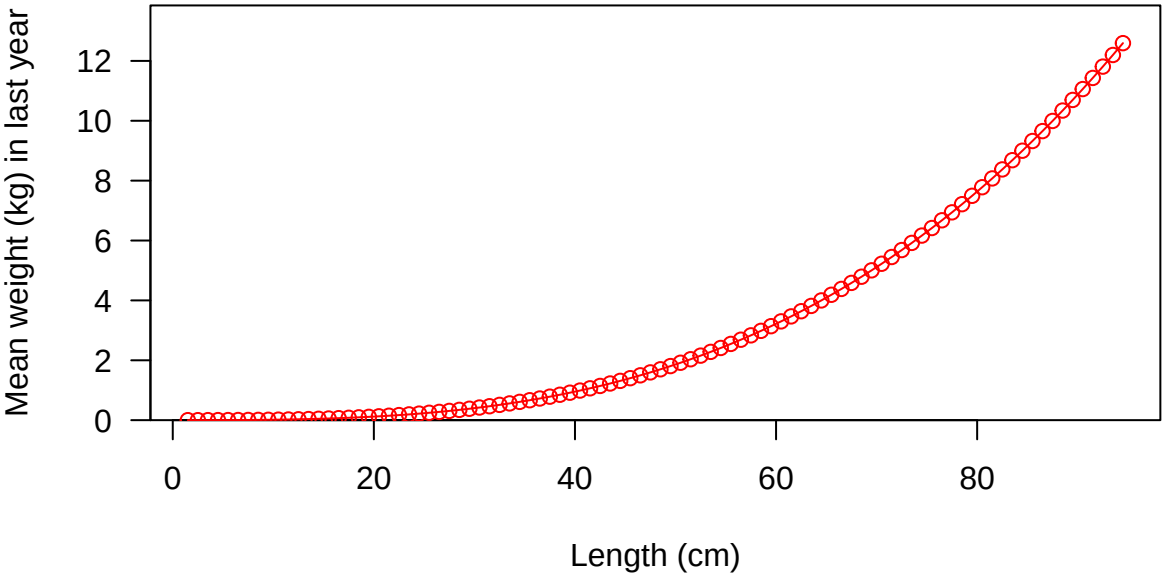

100
80
60
40
20
0
Length
0
5
10
15
20
25
30
35
Age

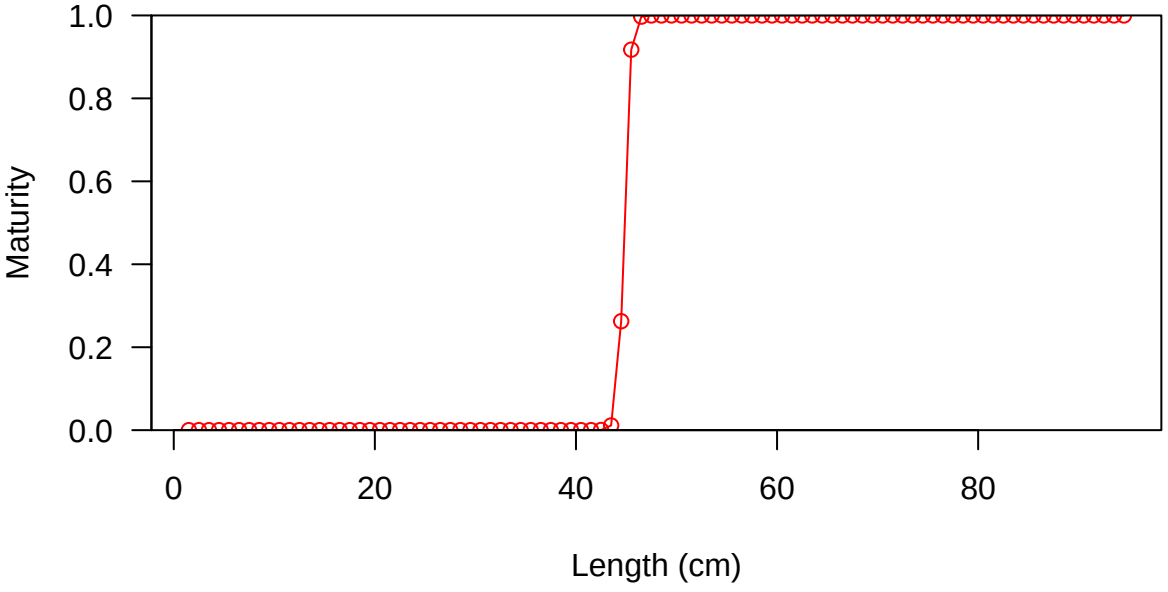

Length
100
80
60
40
20
0
0
5
10
15
20
25
30
35
Age

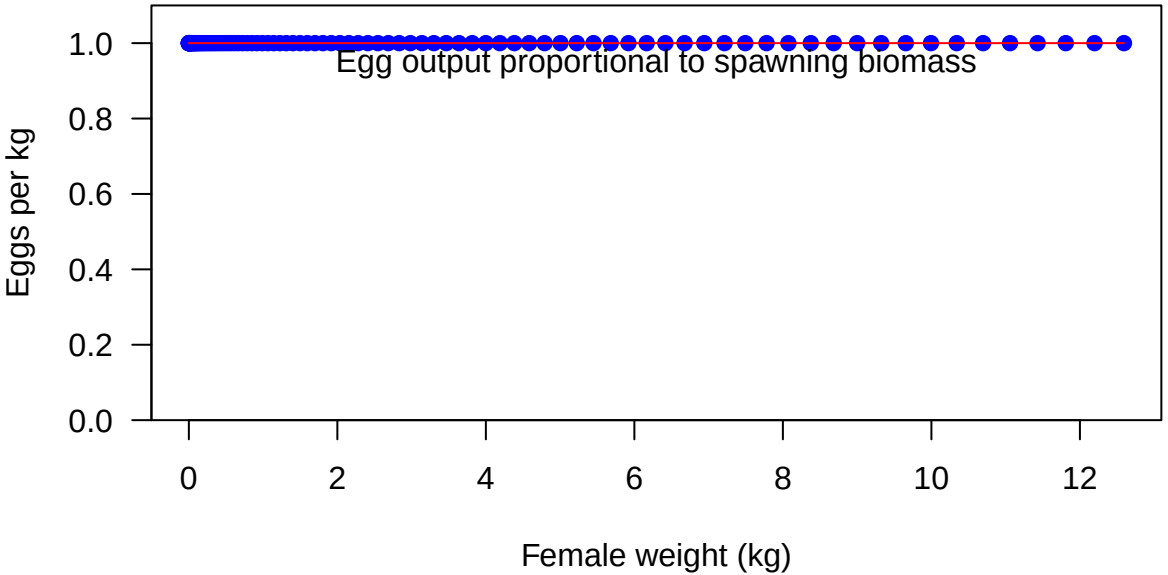

Length
100
80
60
40
20
0
0
5
10
15
20
25
30
35
Age

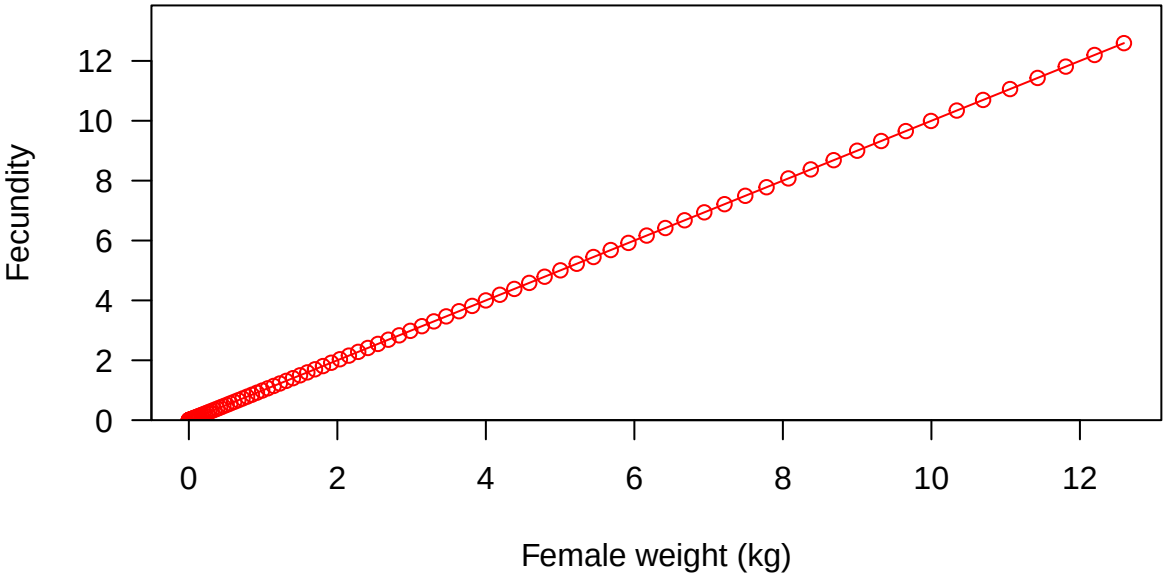

Length
100
80
60
40
20
0
0
5
10
15
20
25
30
35
Age

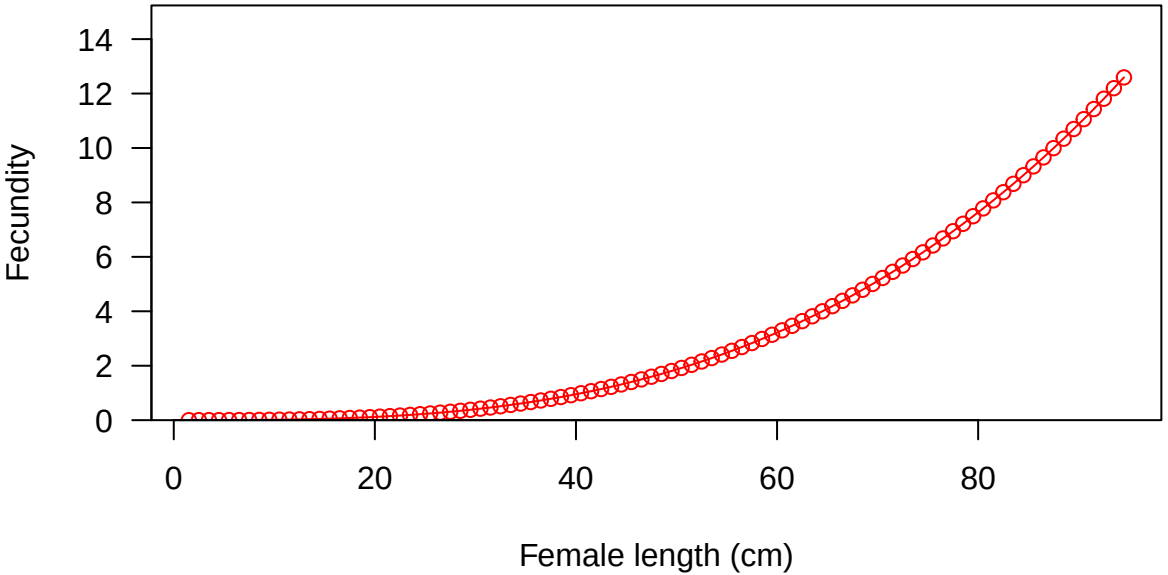

Length
100
80
60
40
20
0
0
5
10
15
20
25
30
35
Age

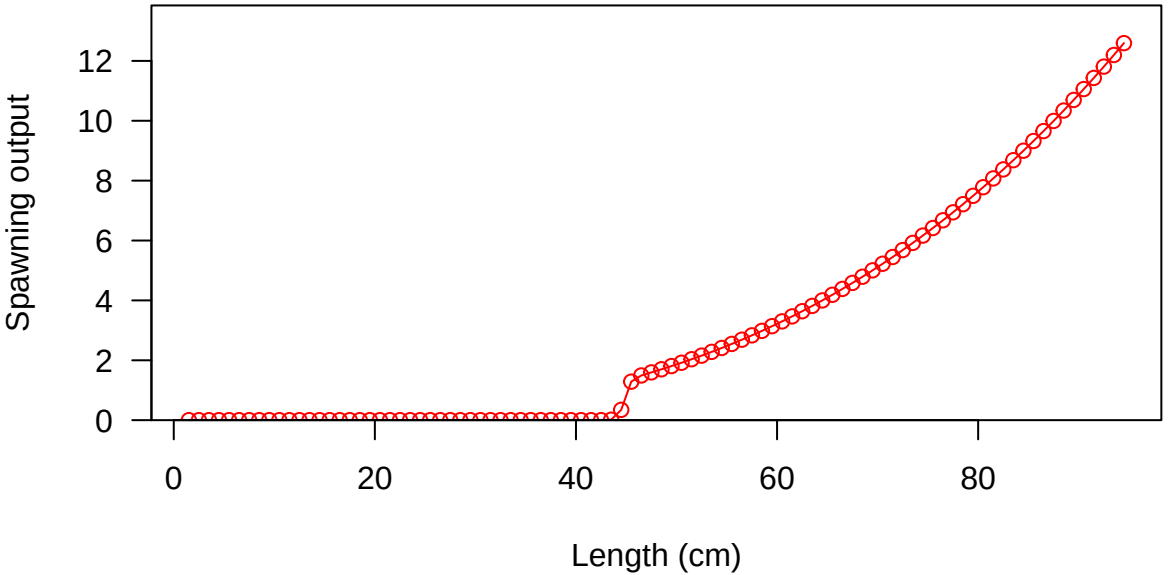

Mean weight (kg) in last year
0
2
4
6
8
10
12
0
20
40
60
80
Length (cm)

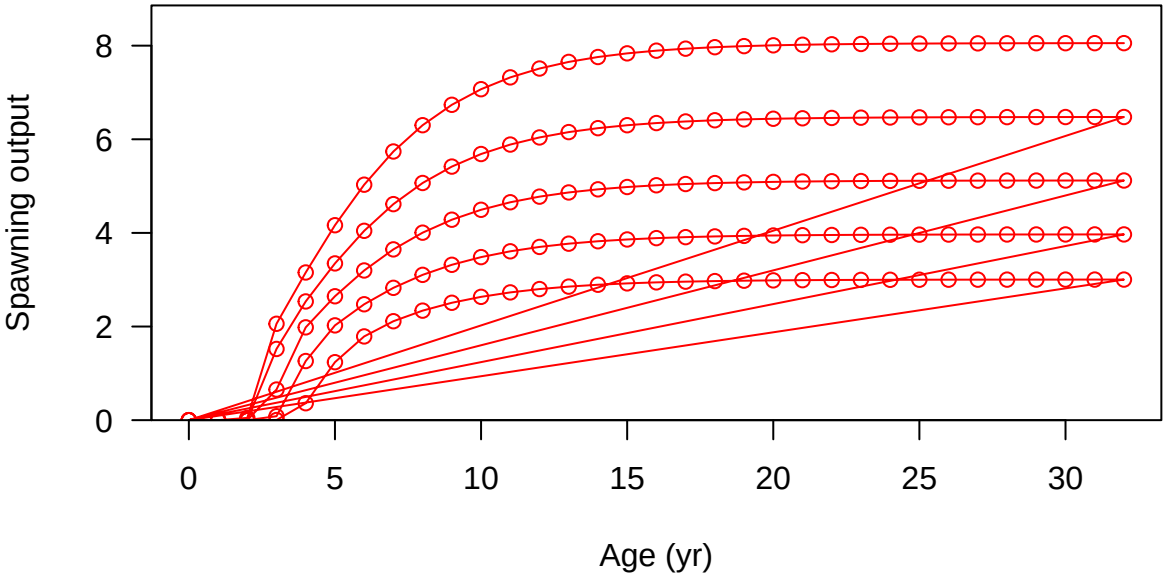

1.0
0.8
0.6
0.4
0.2
0.0
Maturity
0
20
40
60
80
Length (cm)

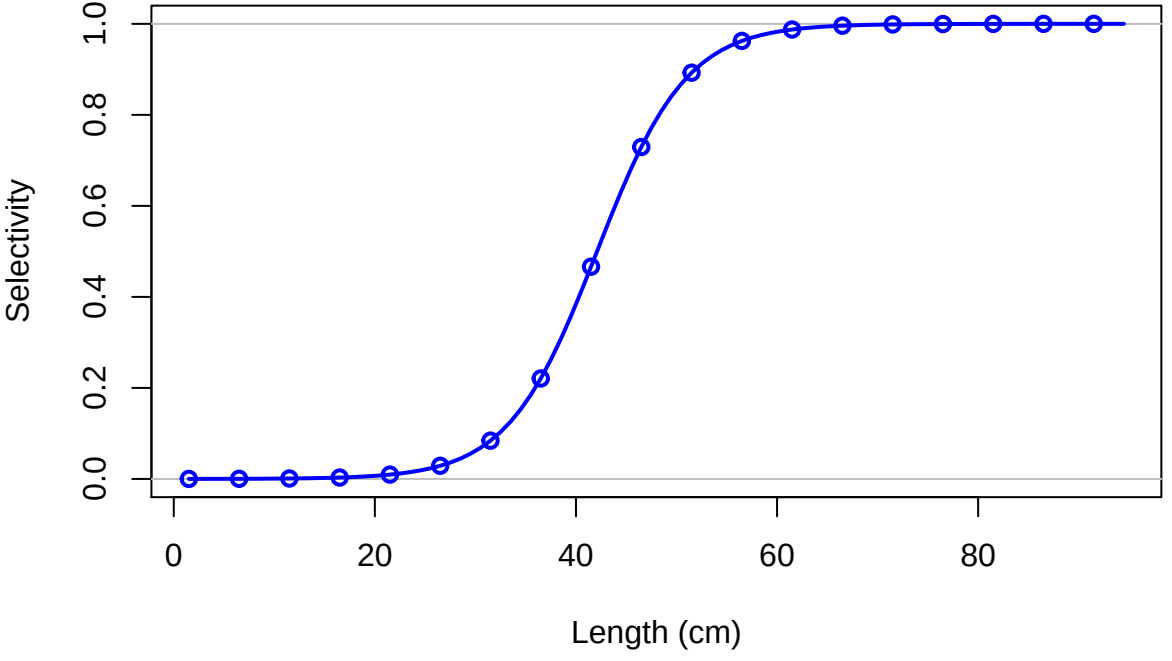

Egg output proportional to spawning biomass
Eggs per kg
1.0
0.8
0.6
0.4
0.2
0.0
0
2
4
6
8
10
12
Female weight (kg)

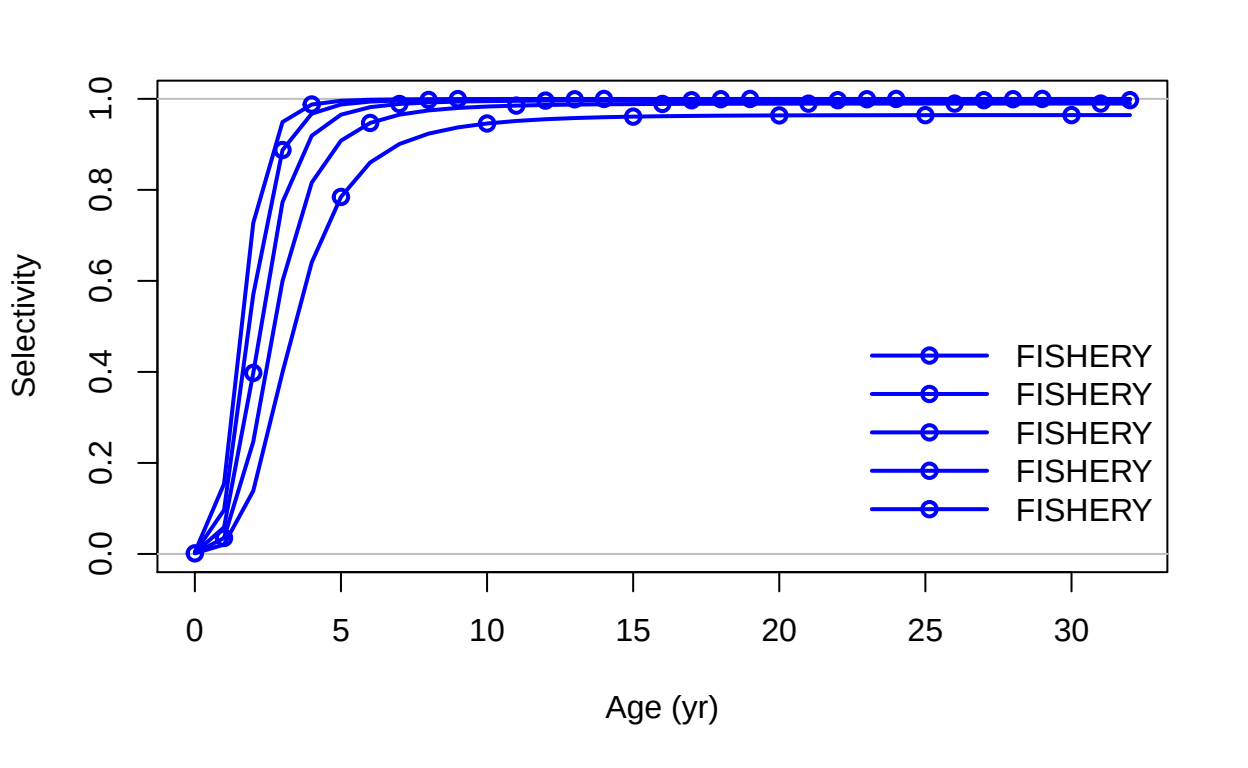

Fecundity
0
2
4
6
8
10
12
0
2
4
6
8
10
12
Female weight (kg)

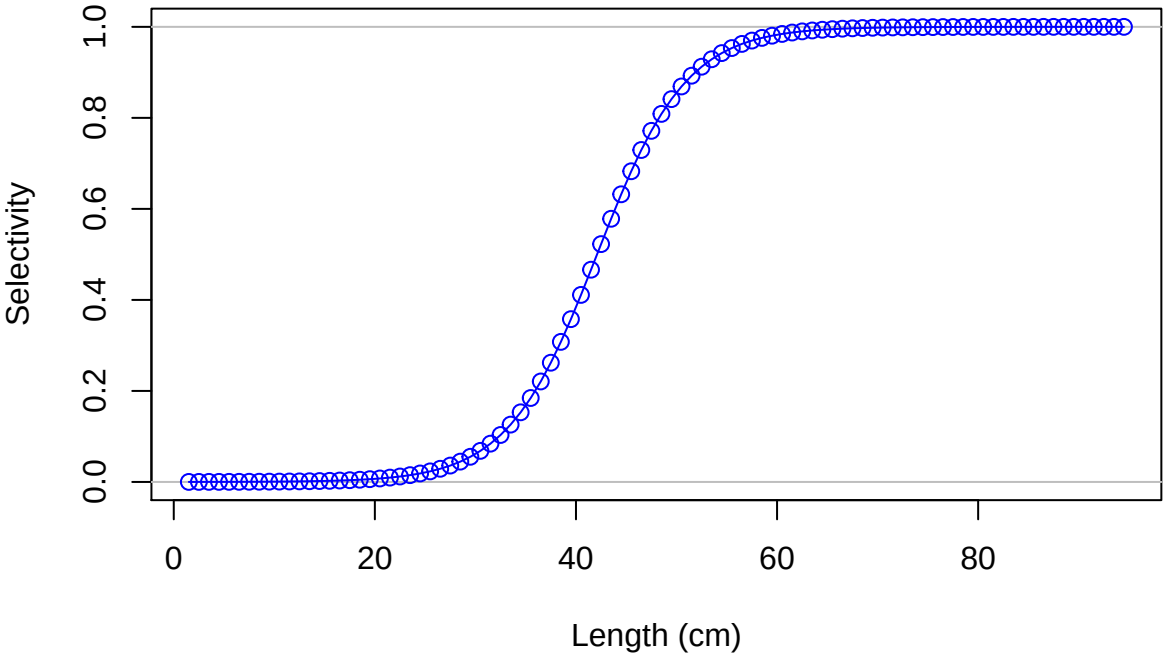

Fecundity
0
2
4
6
8
10
12
14
0
20
40
60
80
Female length (cm)

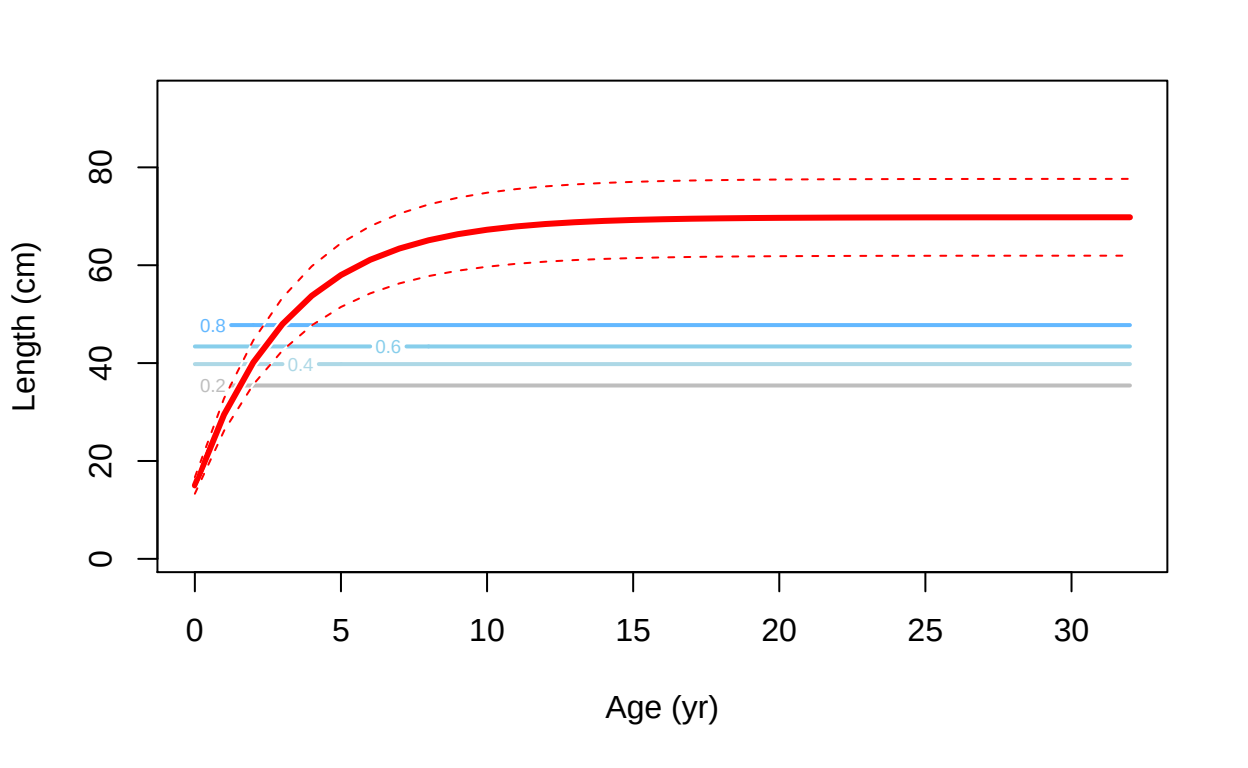

Spawning output
0
2
4
6
8
10
12
0
20
40
60
80
Length (cm)

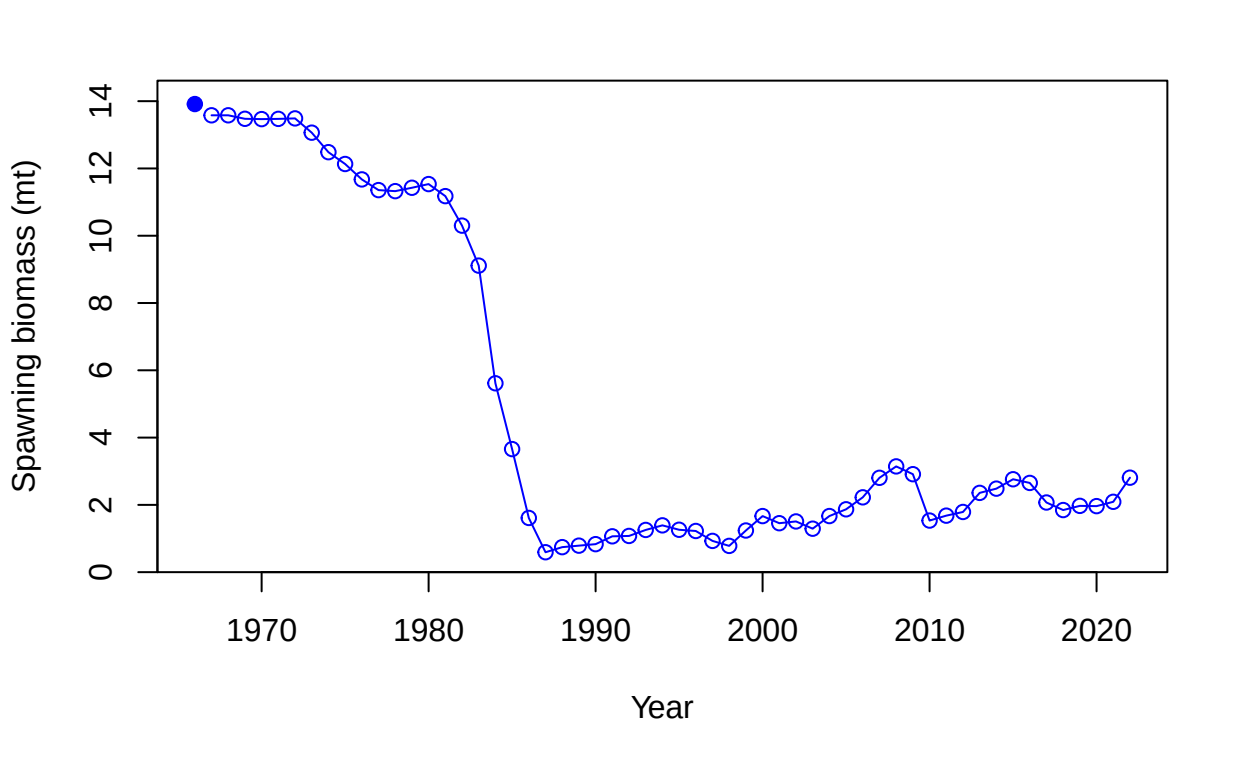

Spawning output
0
2
4
6
8
0
5
10
15
20
25
30
Age (yr)

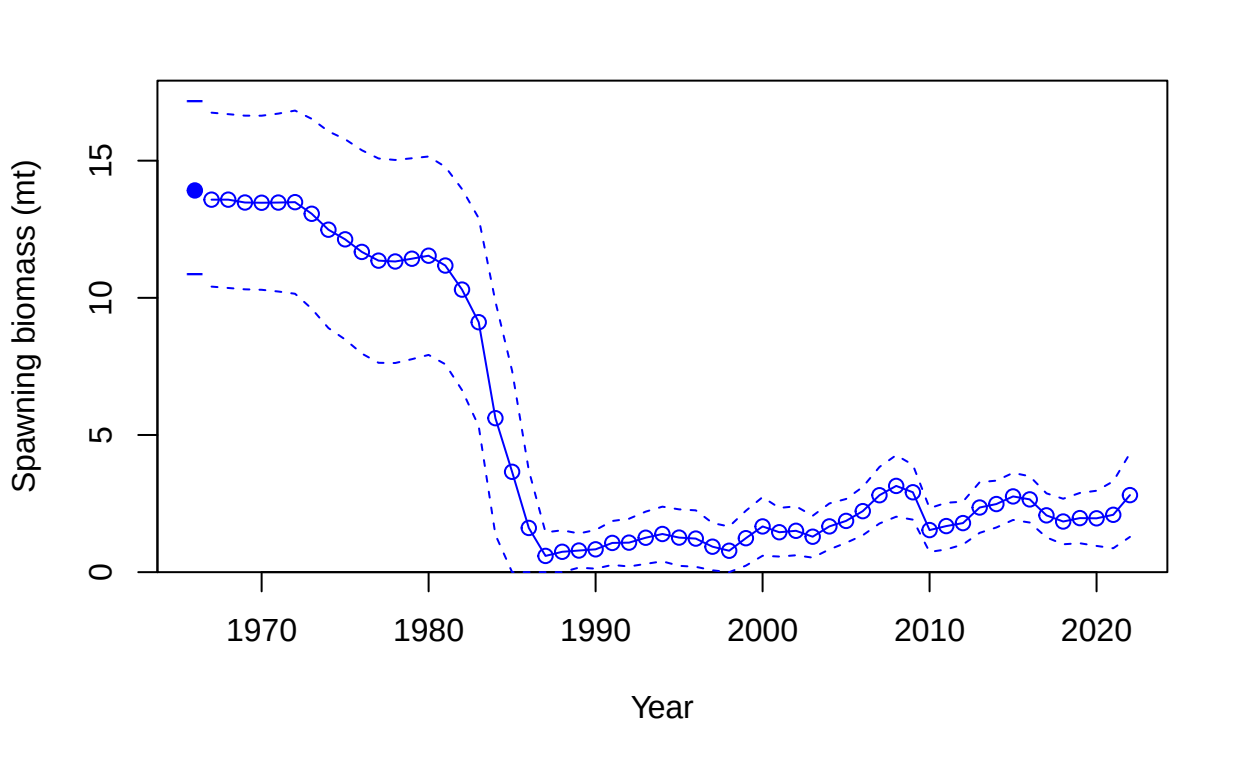

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
20
40
60
80
Length (cm)

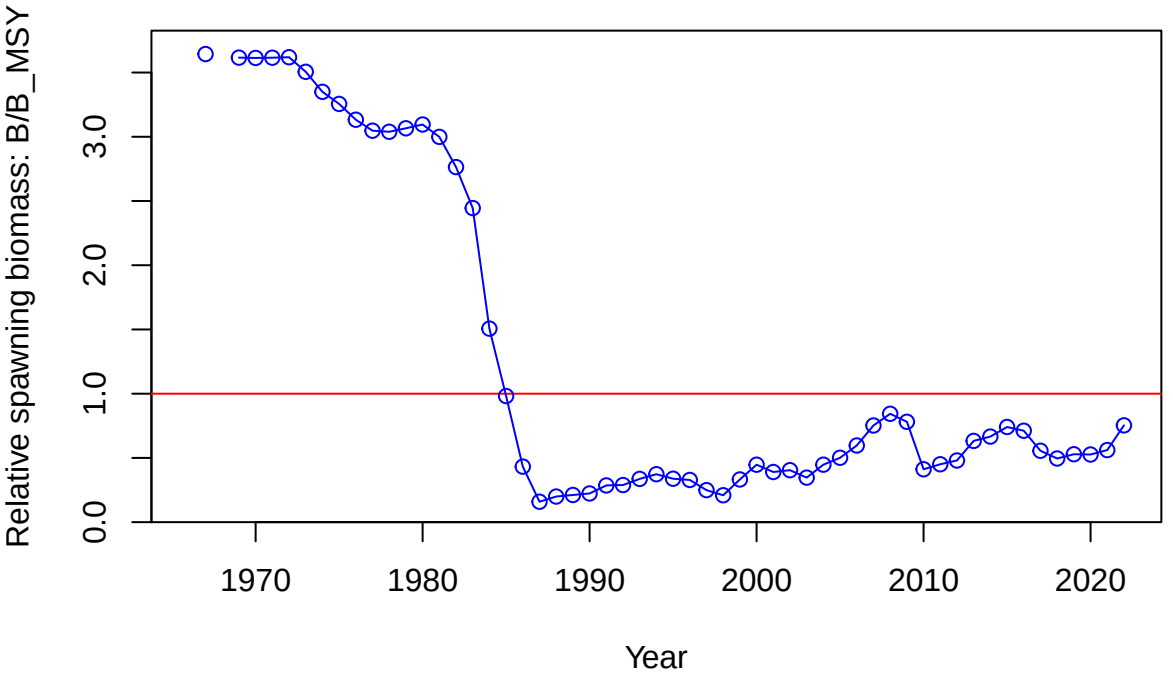

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
5
10
15
20
25
30
Age (yr)
FISHERY
FISHERY
FISHERY
FISHERY
FISHERY

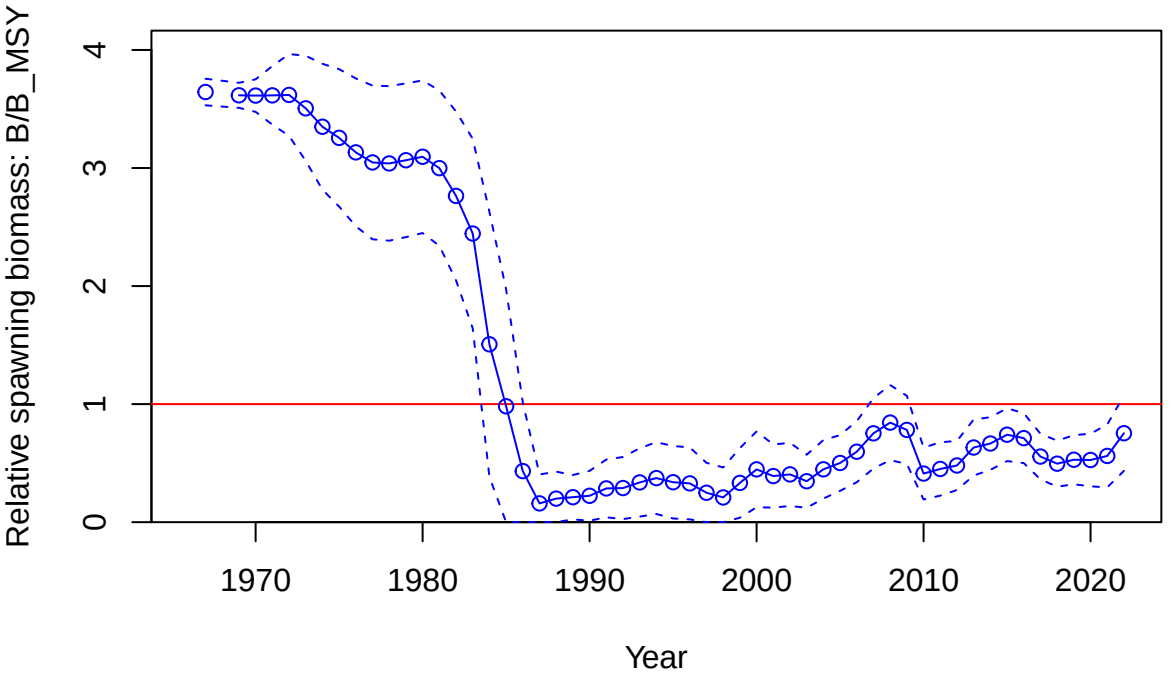

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
20
40
60
80
Length (cm)

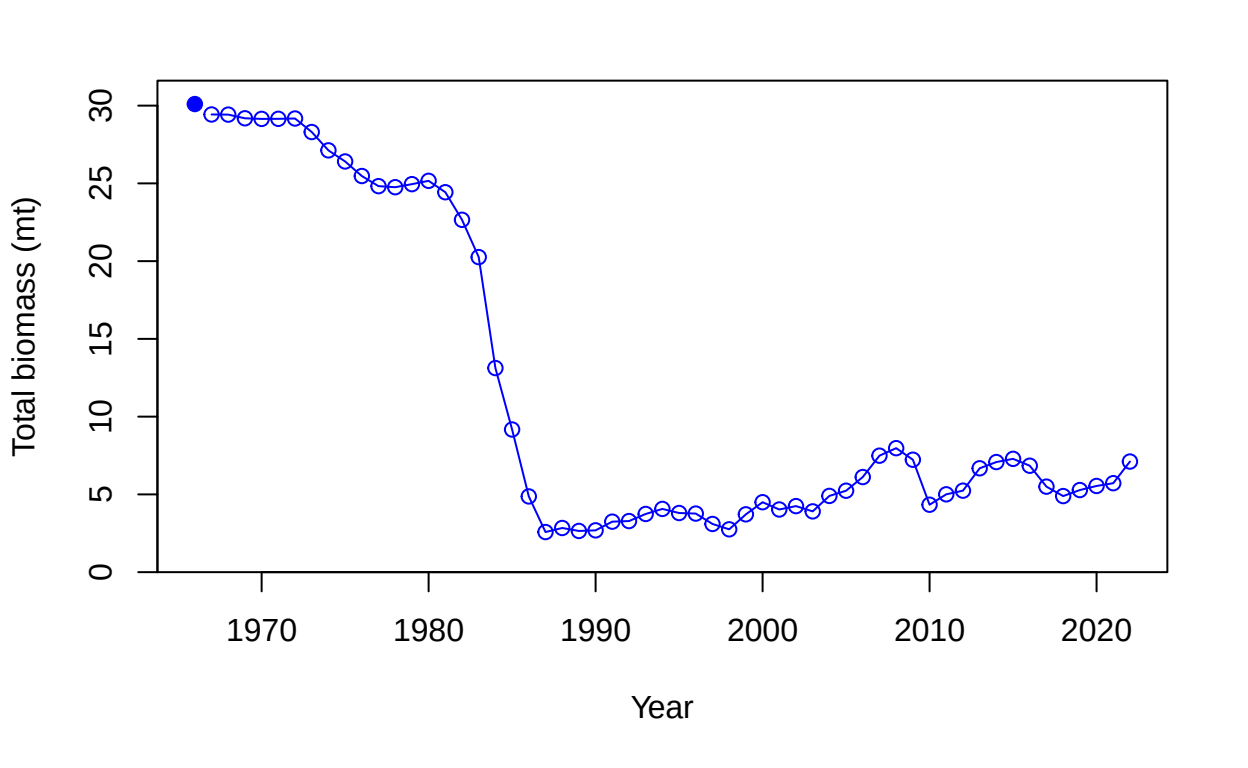

Length (cm)
0
20
40
60
80
0
5
10
15
20
25
30
Age (yr)
0.8
0.6
0.4
0.2

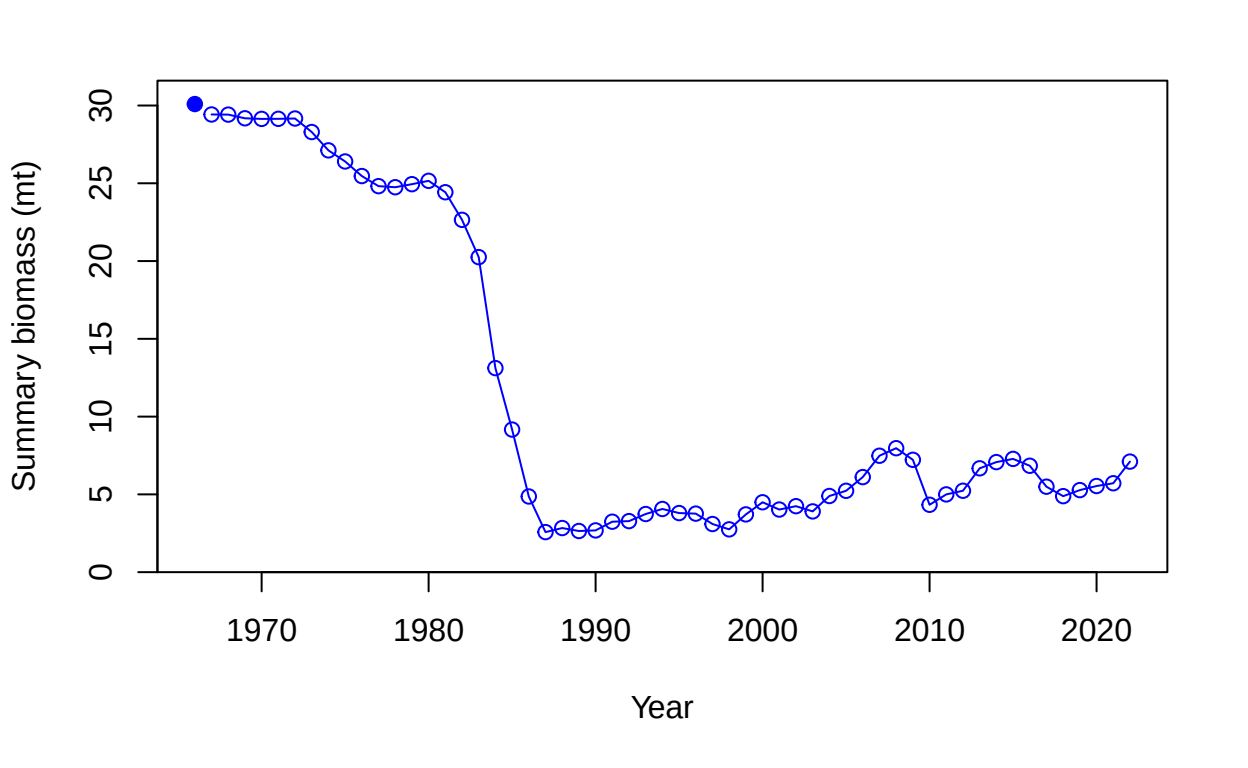

Spawning biomass (mt)
0
2
4
6
8
10
12
14
1970
1980
1990
2000
2010
2020
Year

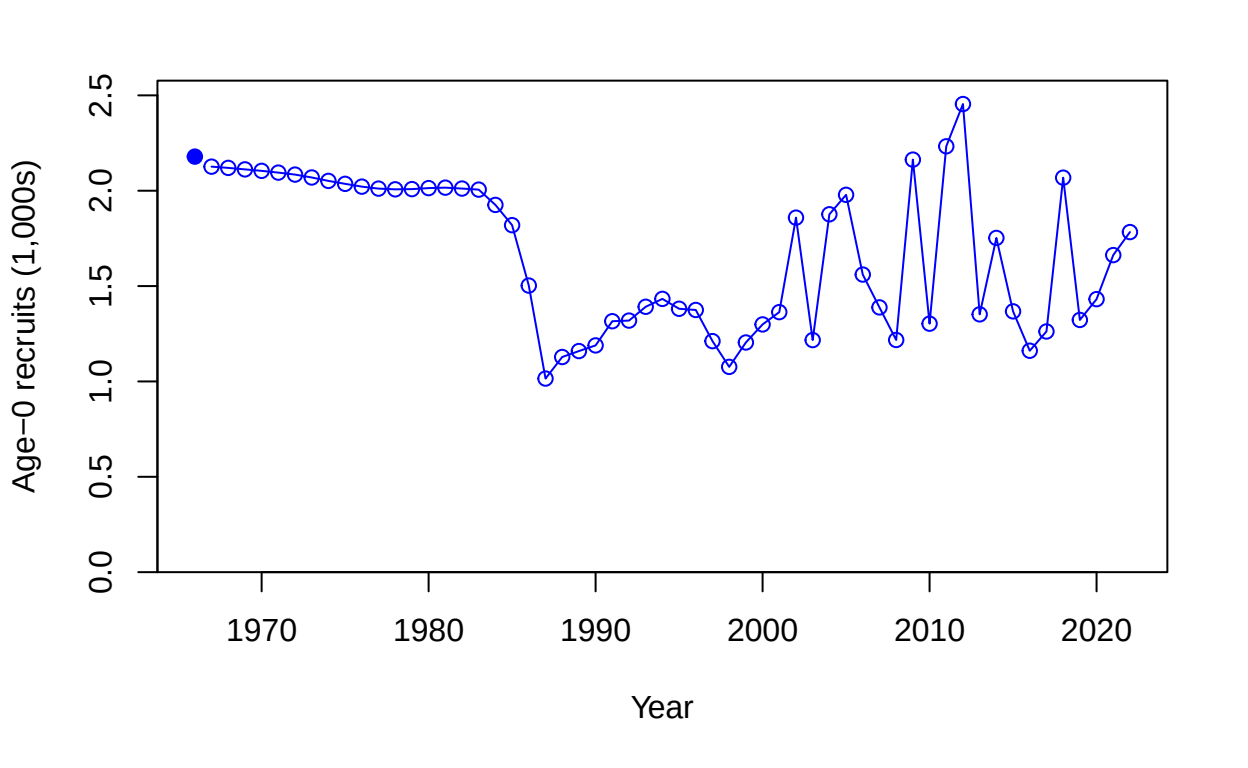

Spawning biomass (mt)
0
5
10
15
1970
1980
1990
2000
2010
2020
Year

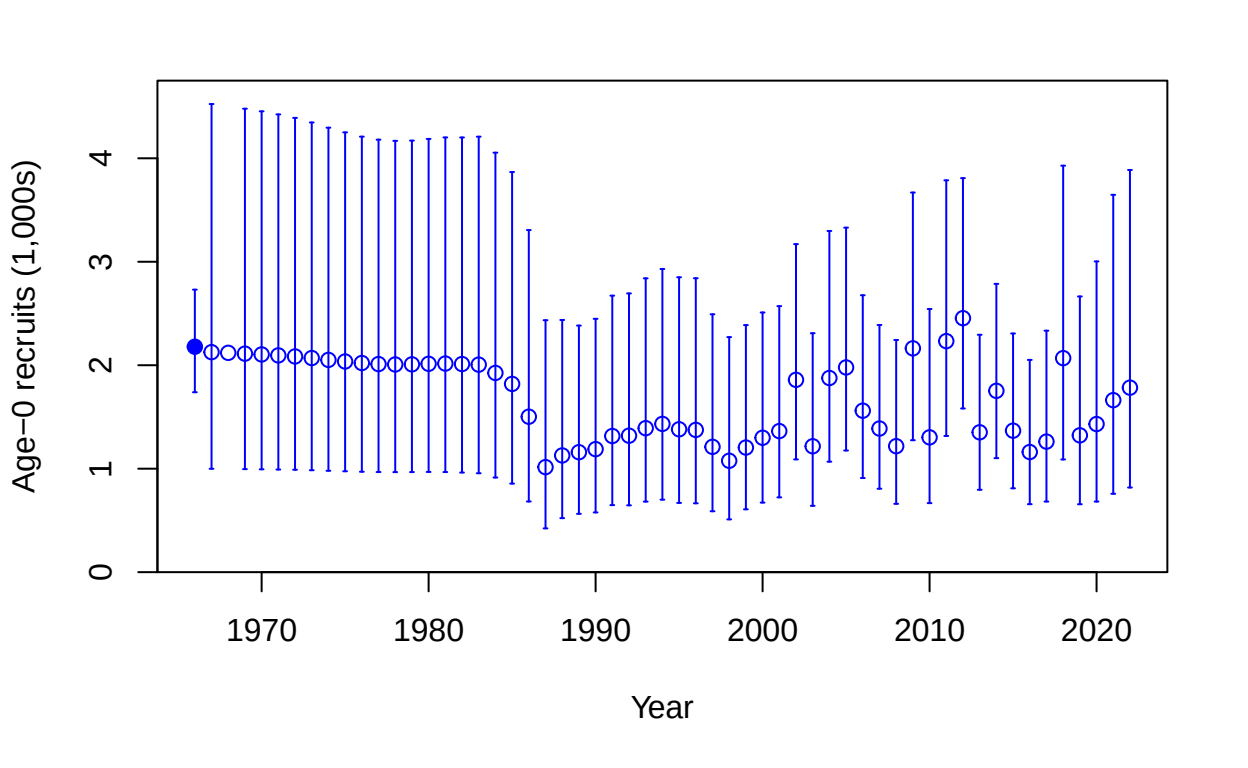

Relative spawning biomass: B/B_MSY
0.0
1.0
2.0
3.0
1970
1980
1990
2000
2010
2020
Year

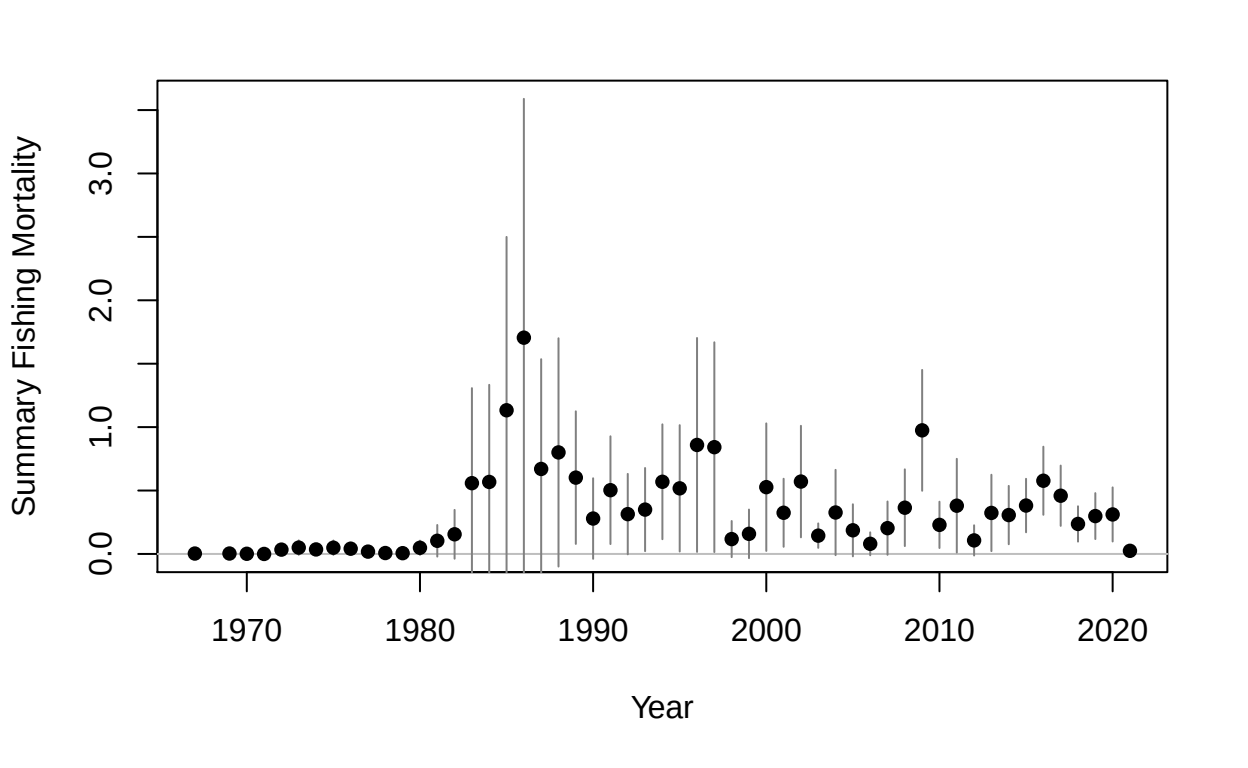

Relative spawning biomass: B/B_MSY
0
1
2
3
4
1970
1980
1990
2000
2010
2020
Year

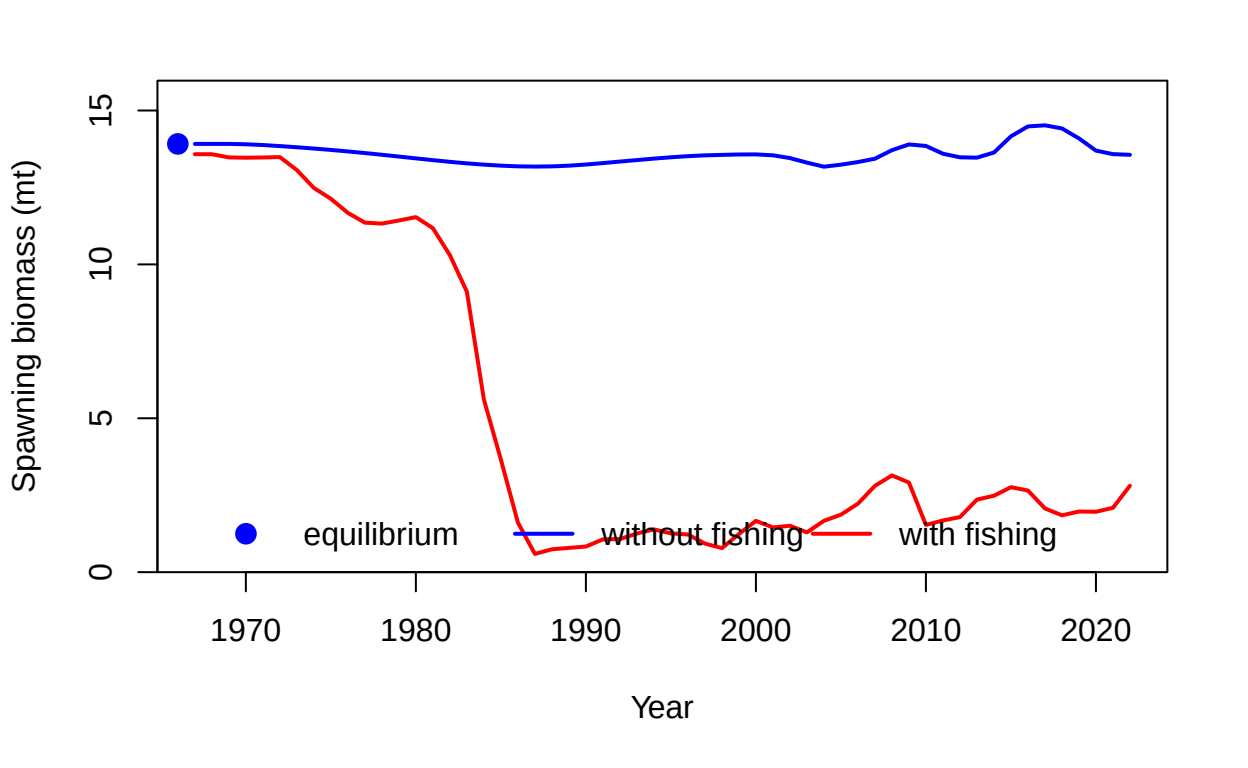

Total biomass (mt)
0
5
10
15
20
25
30
1970
1980
1990
2000
2010
2020
Year

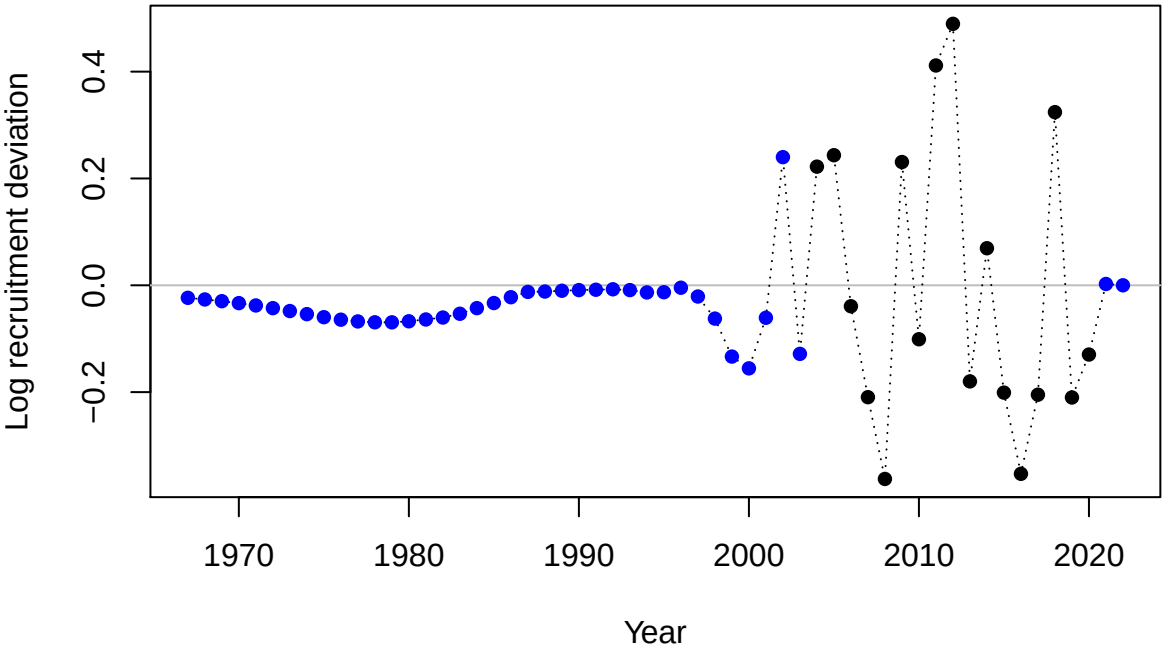

Summary biomass (mt)
0
5
10
15
20
25
30
1970
1980
1990
2000
2010
2020
Year

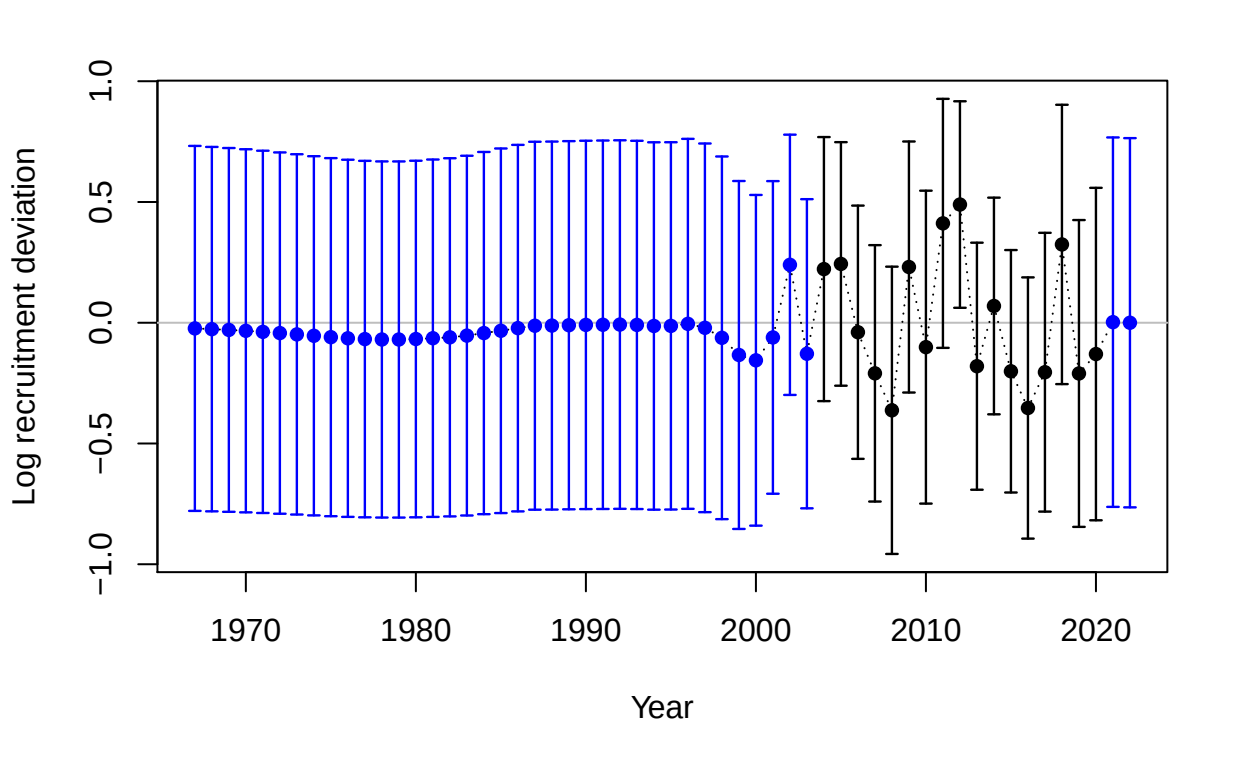

Age−0 recruits (1,000s)
0.0
0.5
1.0
1.5
2.0
2.5
1970
1980
1990
2000
2010
2020
Year

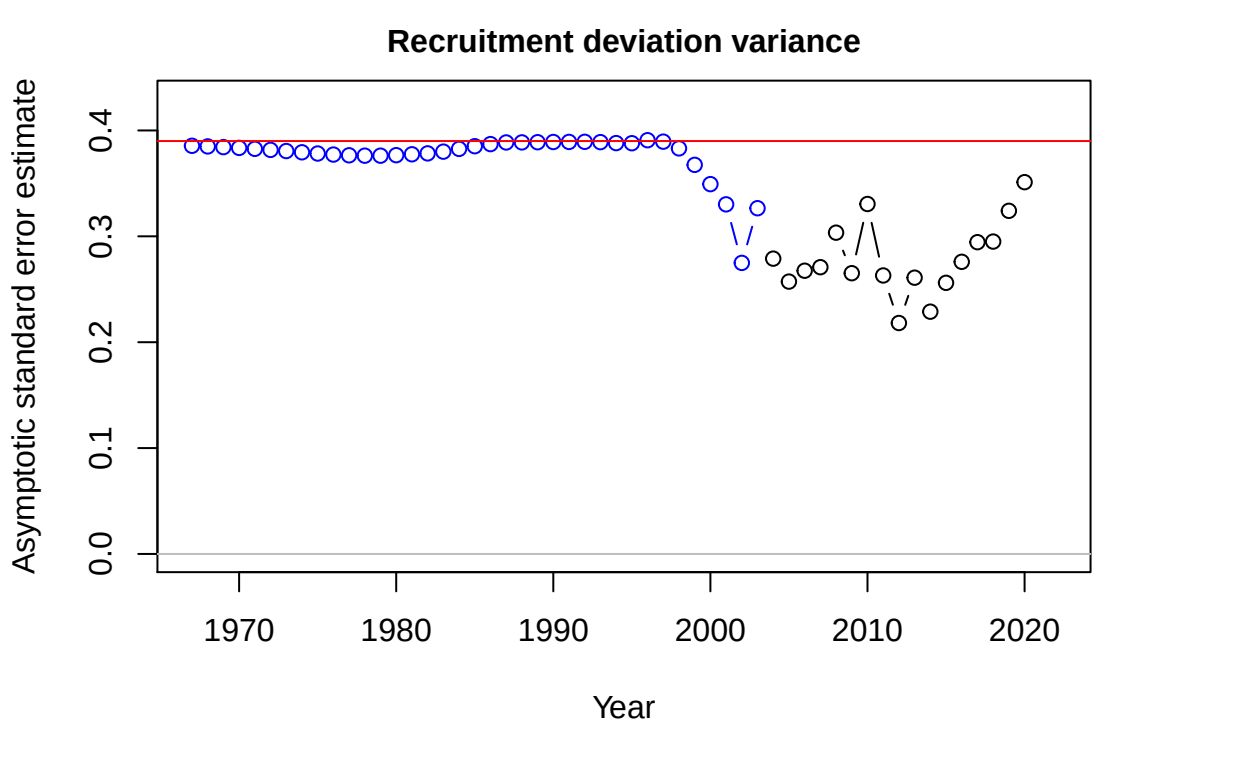

Age−0 recruits (1,000s)
0
1
2
3
4
1970
1980
1990
2000
2010
2020
Year

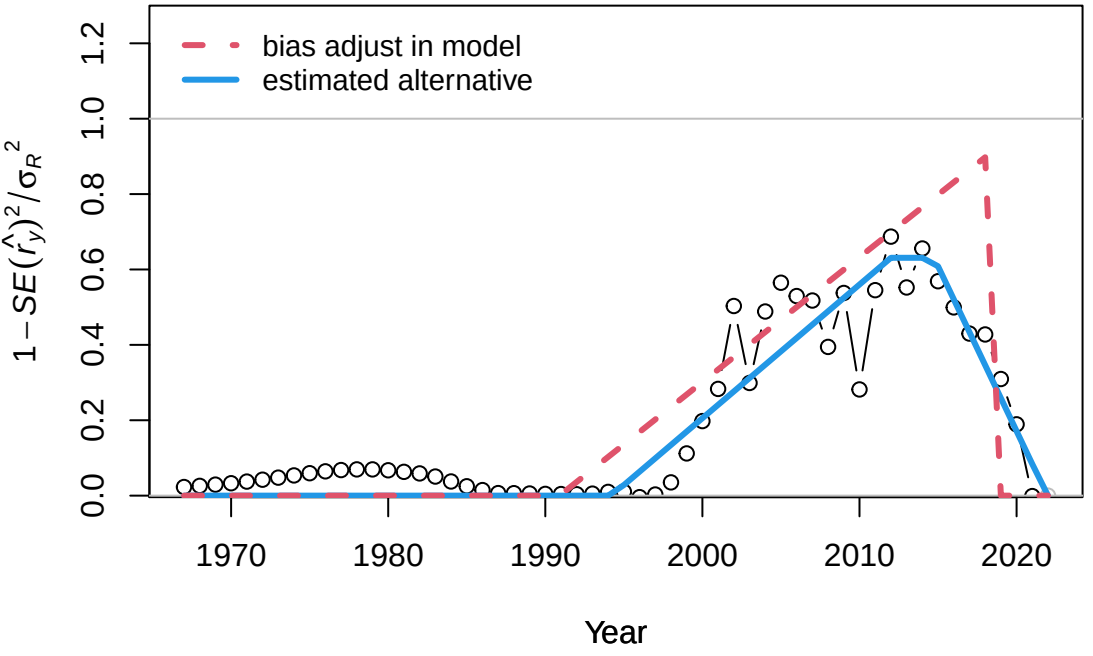

Summary Fishing Mortality
0.0
1.0
2.0
3.0
1970
1980
1990
2000
2010
2020
Year

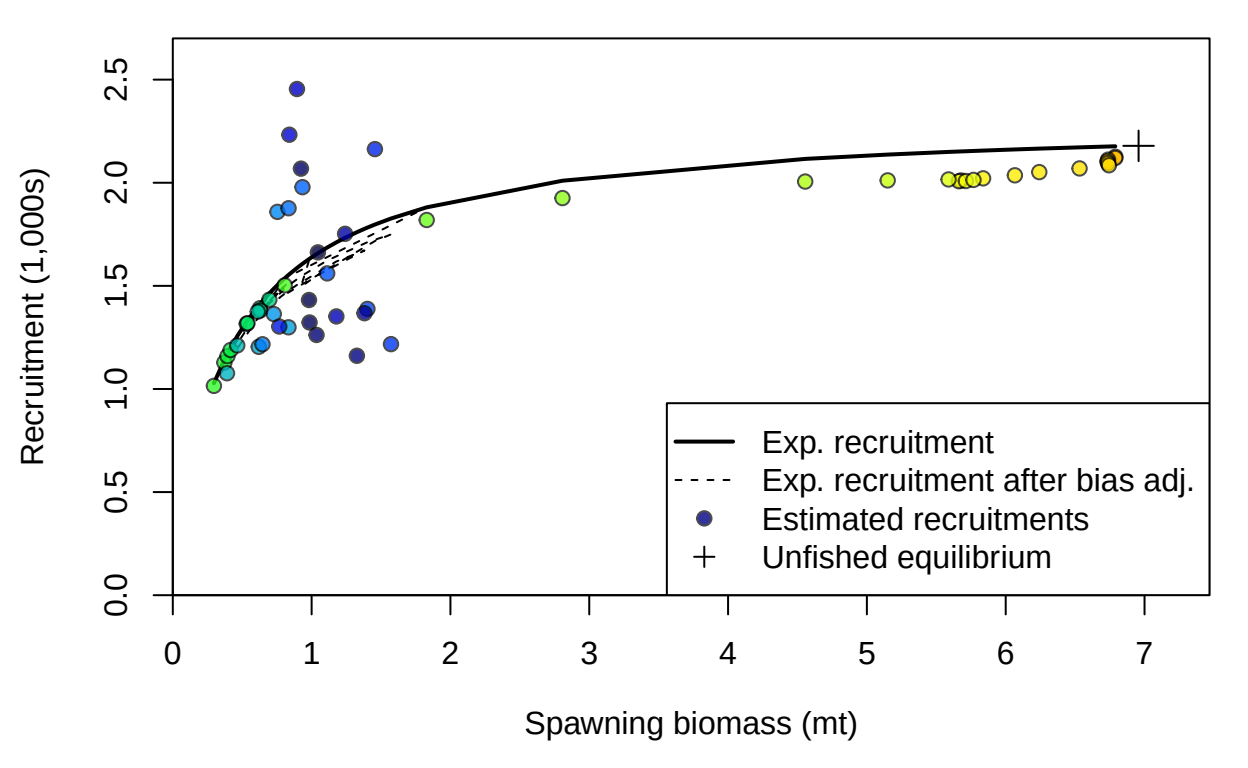

Spawning biomass (mt)
0
5
10
15
1970
1980
1990
2000
2010
2020
Year
equilibrium
without fishing
with fishing

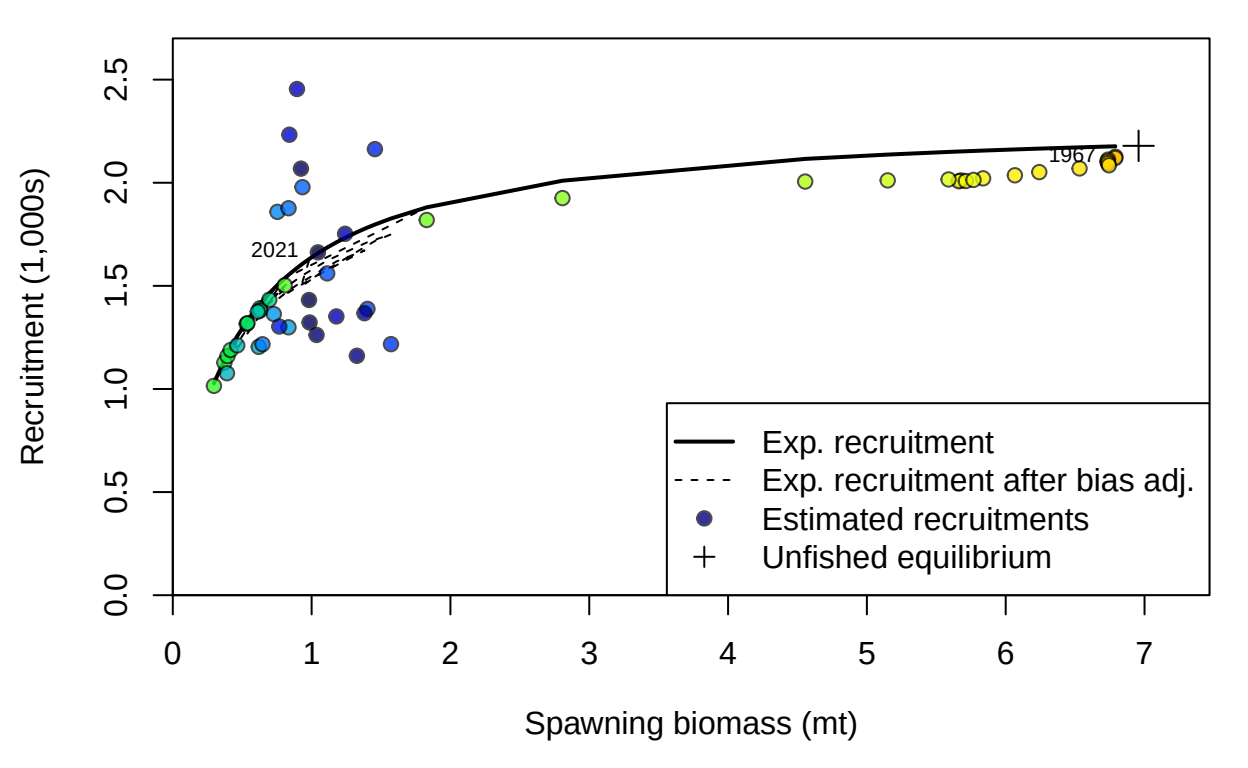

Log recruitment deviation
−0.2
0.0
0.2
0.4
1970
1980
1990
2000
2010
2020
Year

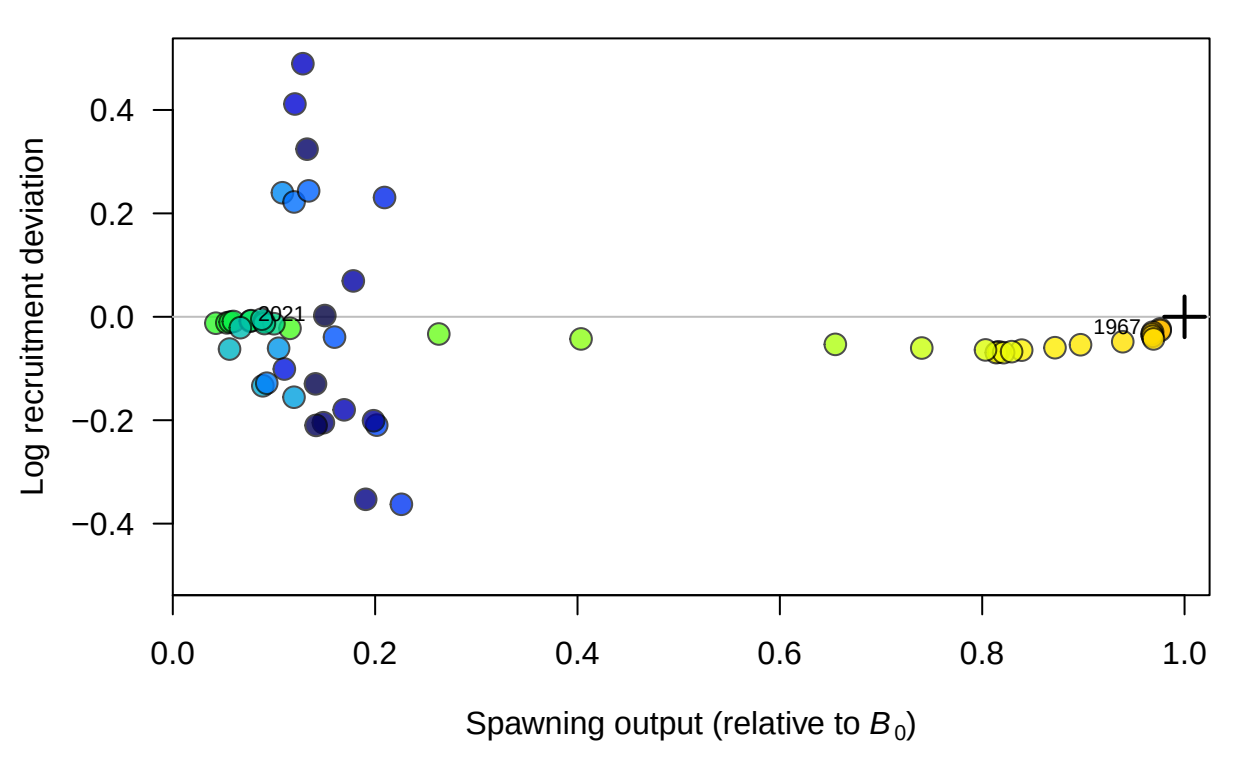

Log recruitment deviation
1.0
0.5
0.0
−0.5
−1.0
1970
1980
1990
2000
2010
2020
Year

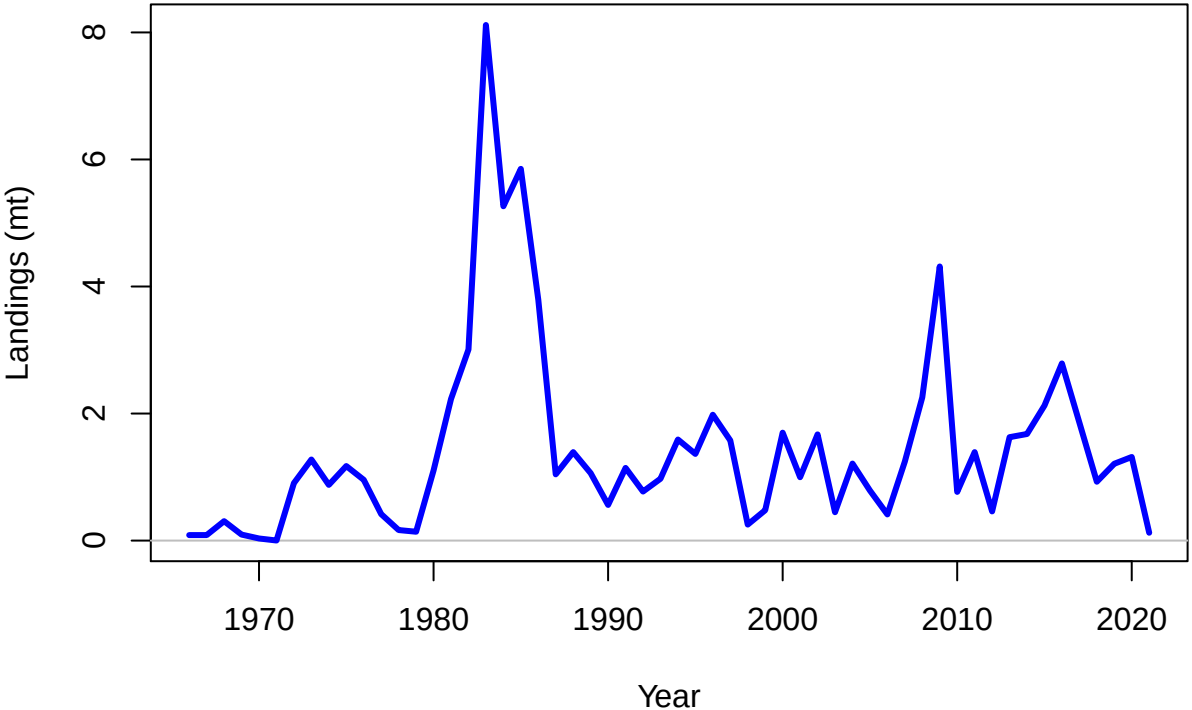

Recruitment deviation variance
Asymptotic standard error estimate
0.0
0.1
0.2
0.3
0.4
1970
1980
1990
2000
2010
2020
Year

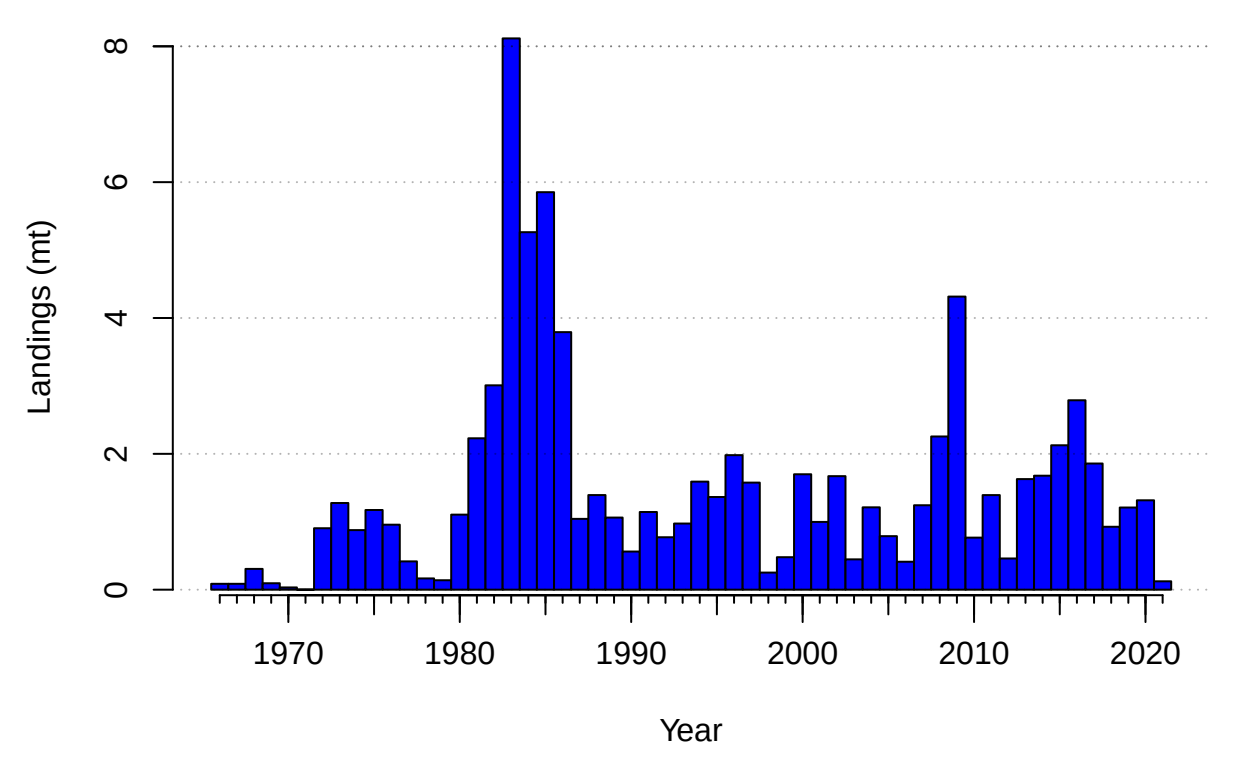

bias adjust in model
estimated alternative
$1-SE(\hat{r}_y)^2/\sigma_R{}^2$
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1970
1980
1990
2000
2010
2020
Year

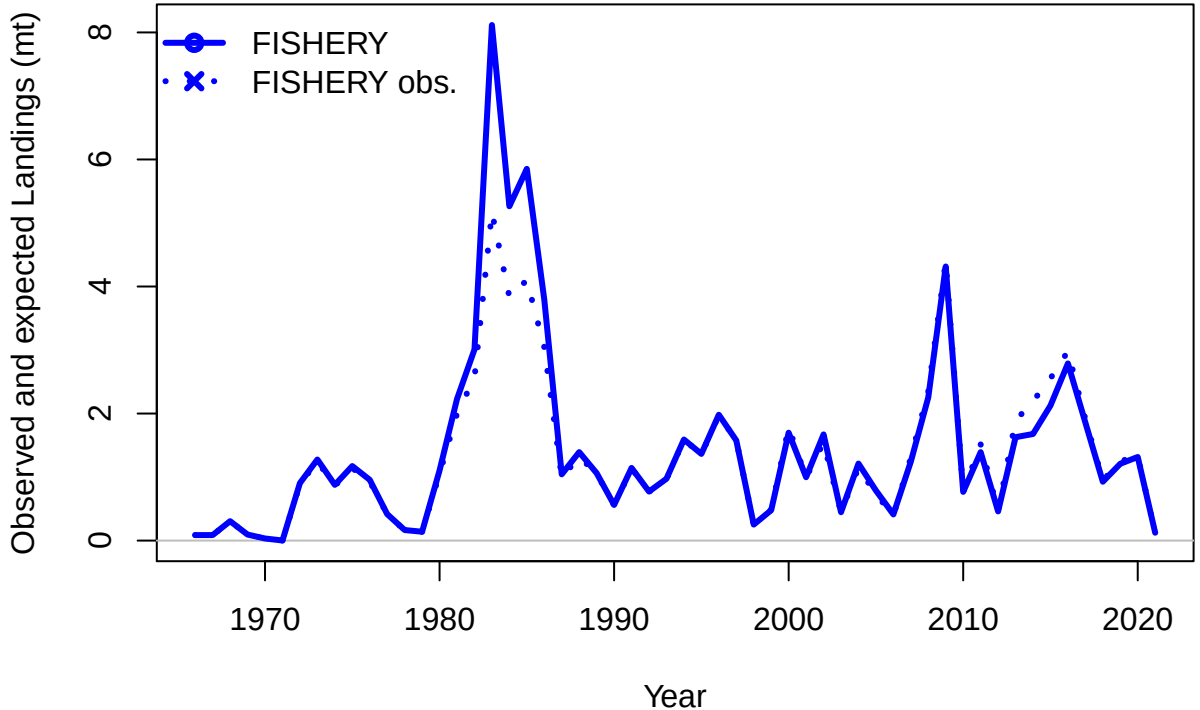

Recruitment (1,000s)
0.0
0.5
1.0
1.5
2.0
2.5
0
1
2
3
4
5
6
7
Spawning biomass (mt)
Exp. recruitment
Exp. recruitment after bias adj.
Estimated recruitments
Unfished equilibrium

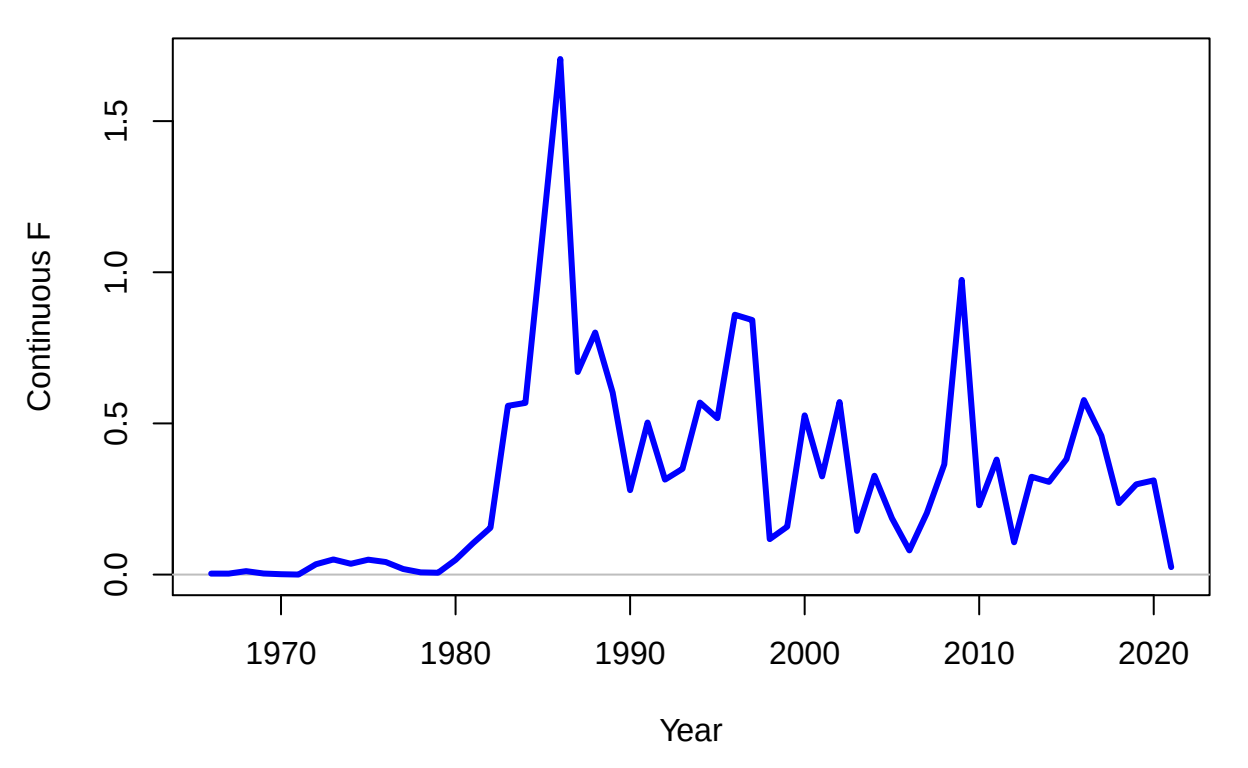

Recruitment (1,000s)
0.0
0.5
1.0
1.5
2.0
2.5
0
1
2
3
4
5
6
7
Spawning biomass (mt)
2021
1967
Exp. recruitment
Exp. recruitment after bias adj.
Estimated recruitments
Unfished equilibrium

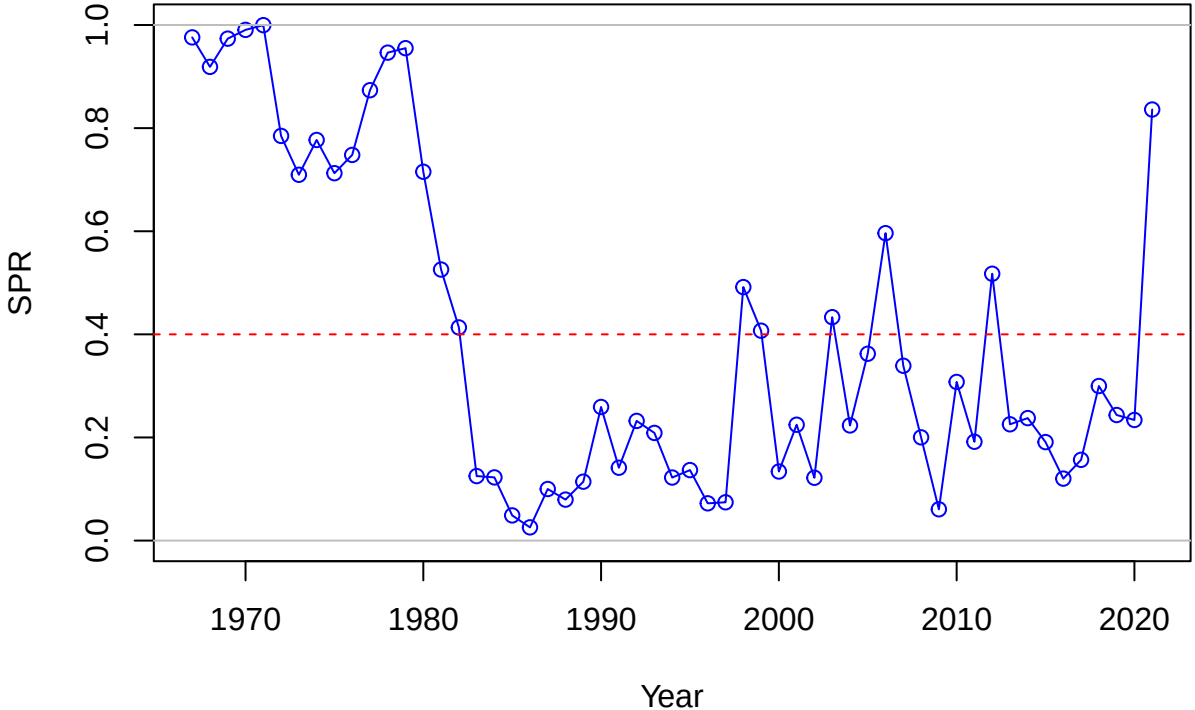

Log recruitment deviation
0.4
0.2
0.0
−0.2
−0.4
2021
1967
0.0
0.2
0.4
0.6
0.8
1.0
Spawning output (relative to B_0)

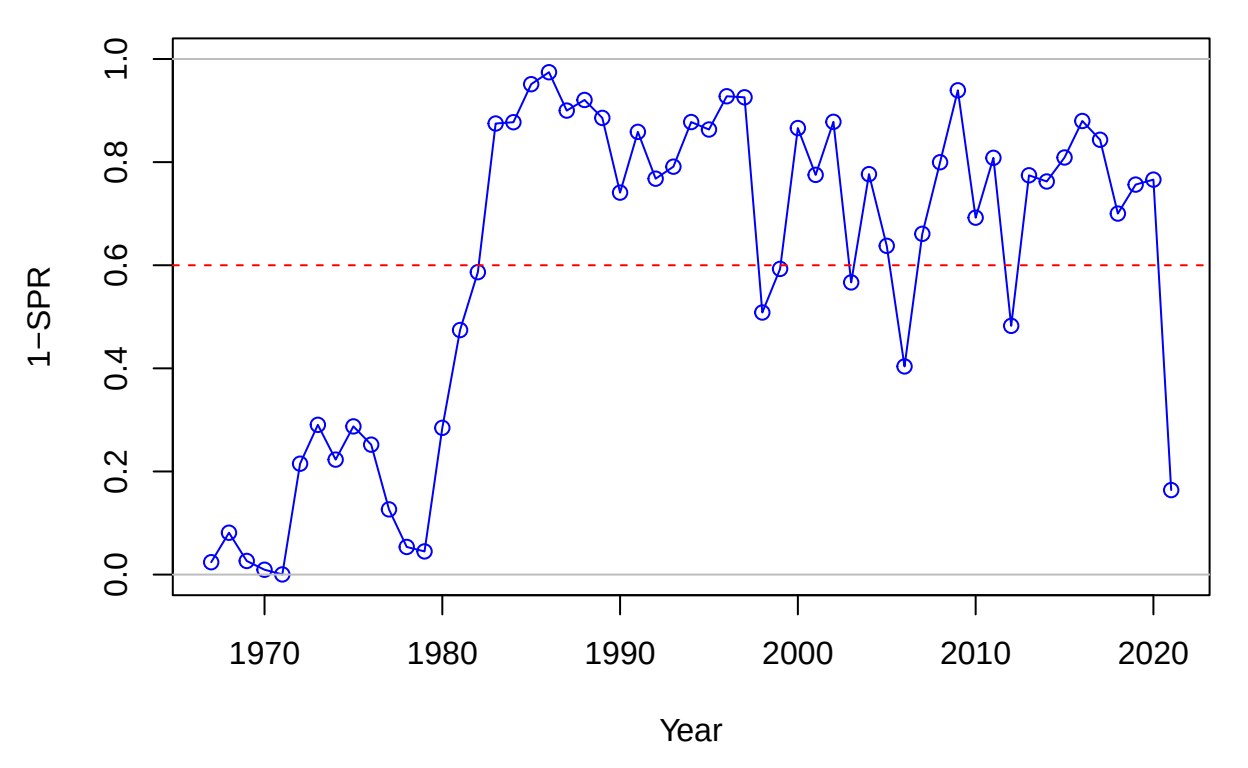

Landings (mt)
0
2
4
6
8
1970
1980
1990
2000
2010
2020
Year

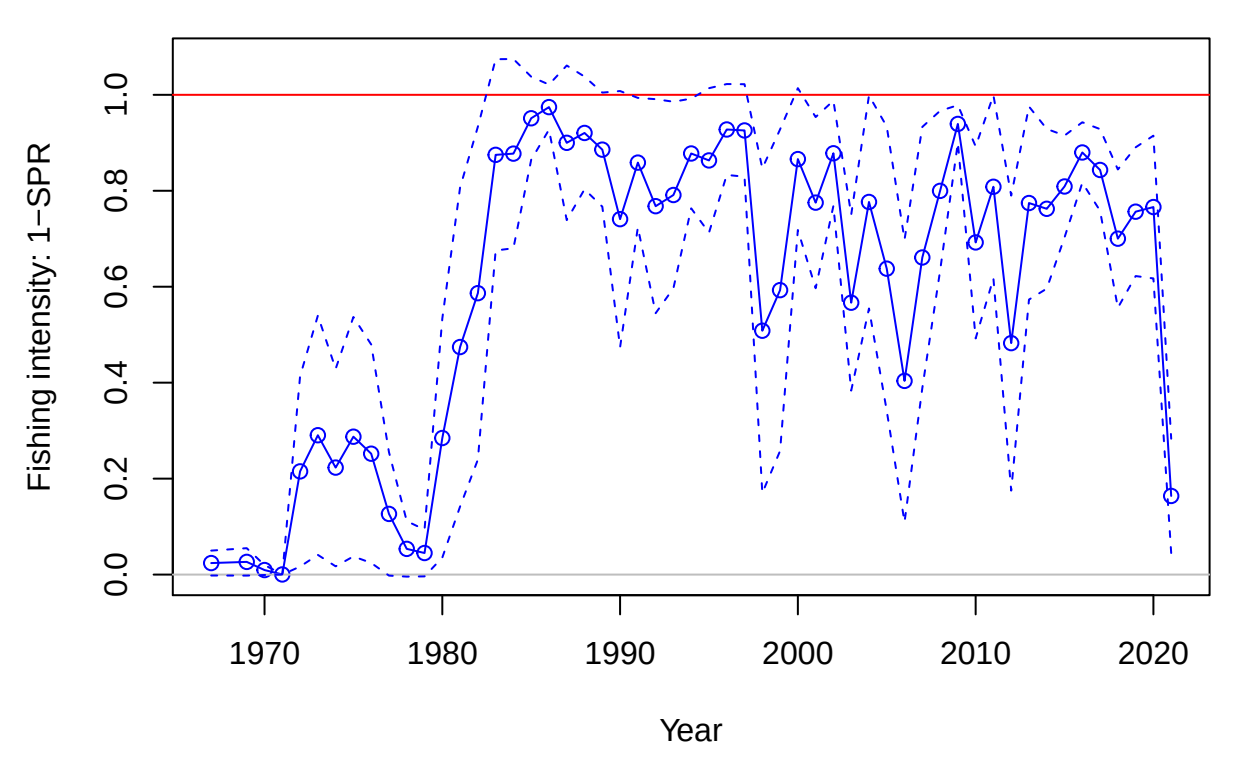

Landings (mt)
0
2
4
6
8
1970
1980
1990
2000
2010
2020
Year

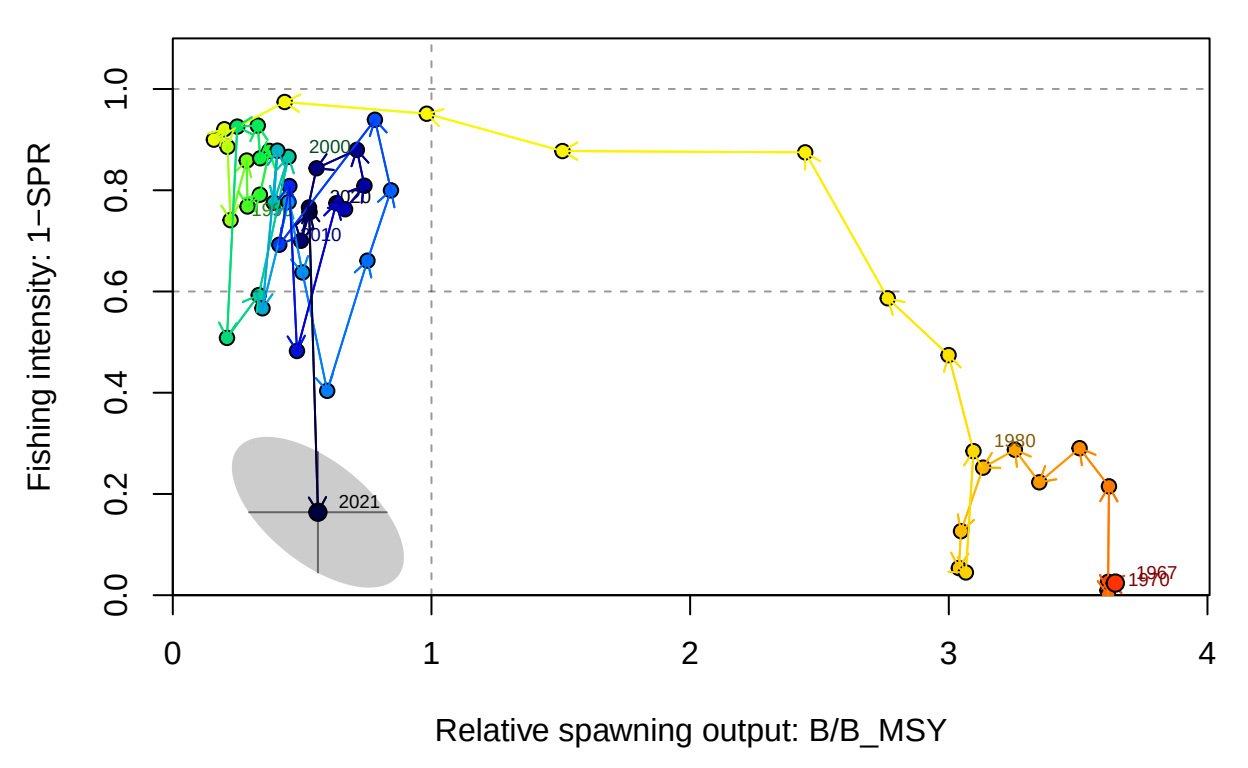

FISHERY
FISHERY obs.
Observed and expected Landings (mt)
0
2
4
6
8
1970
1980
1990
2000
2010
2020
Year

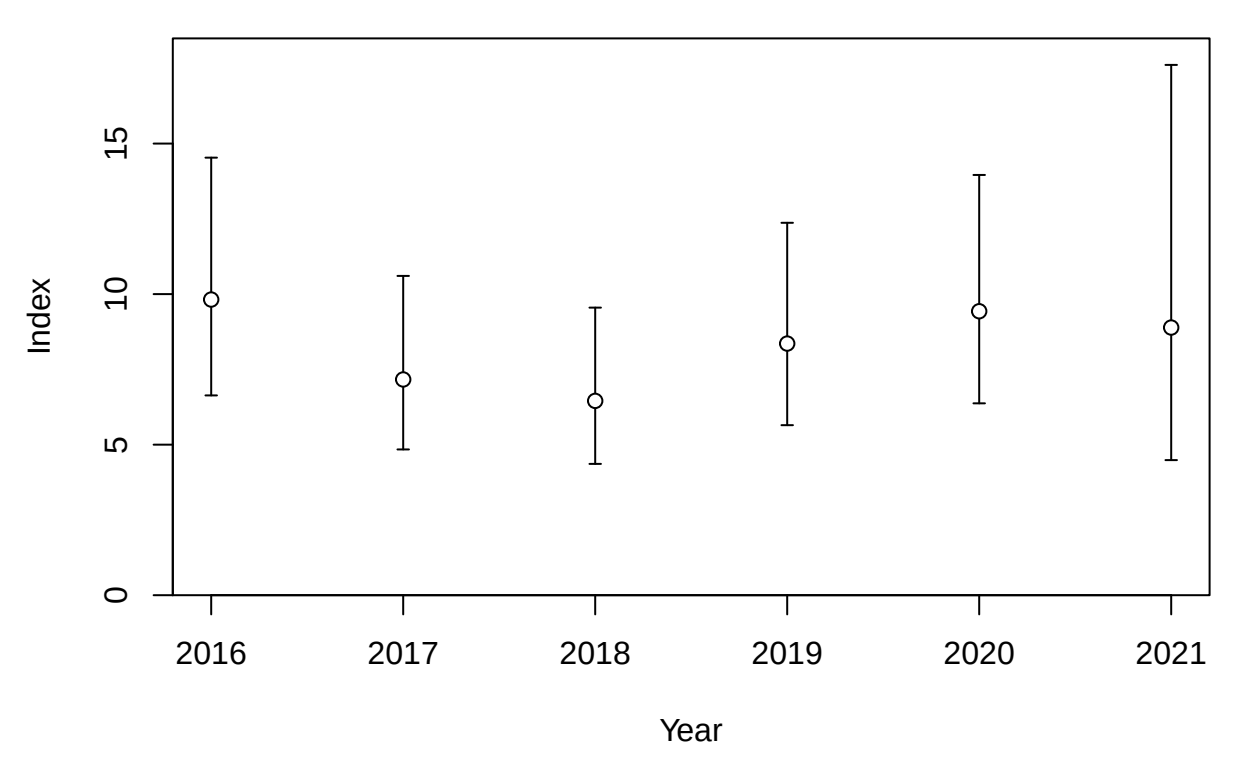

Continuous F
0.0
0.5
1.0
1.5
1970
1980
1990
2000
2010
2020
Year

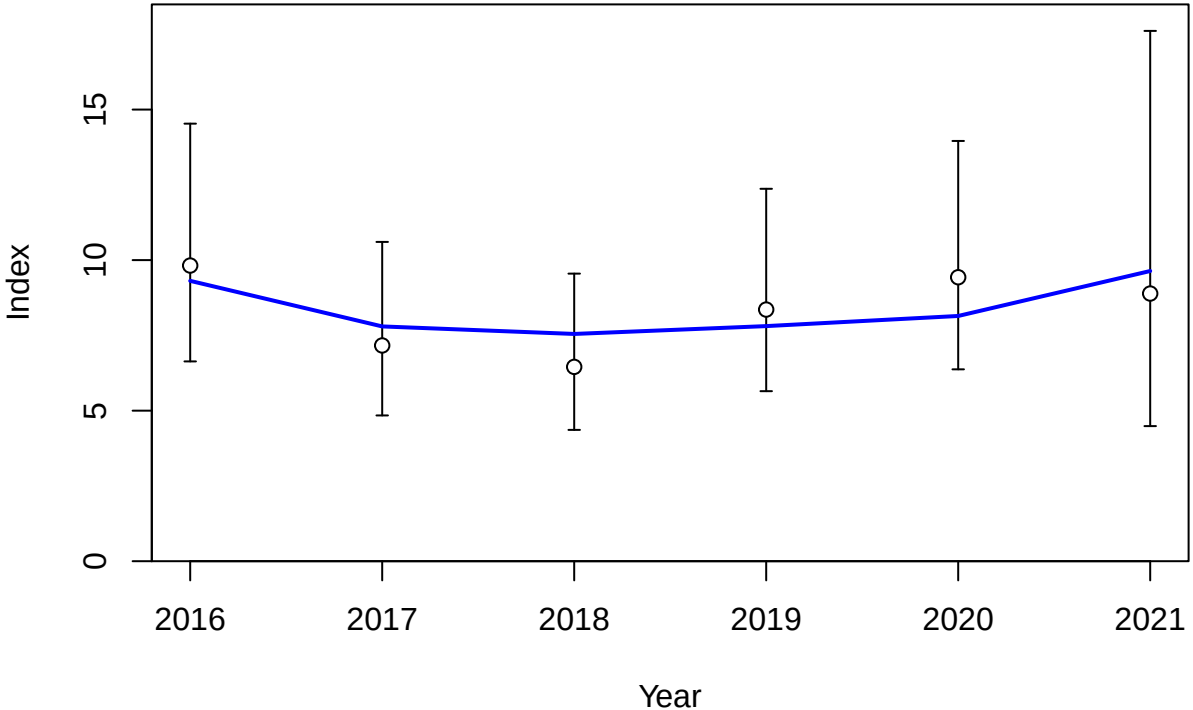

SPR
0.0
0.2
0.4
0.6
0.8
1.0
1970
1980
1990
2000
2010
2020
Year

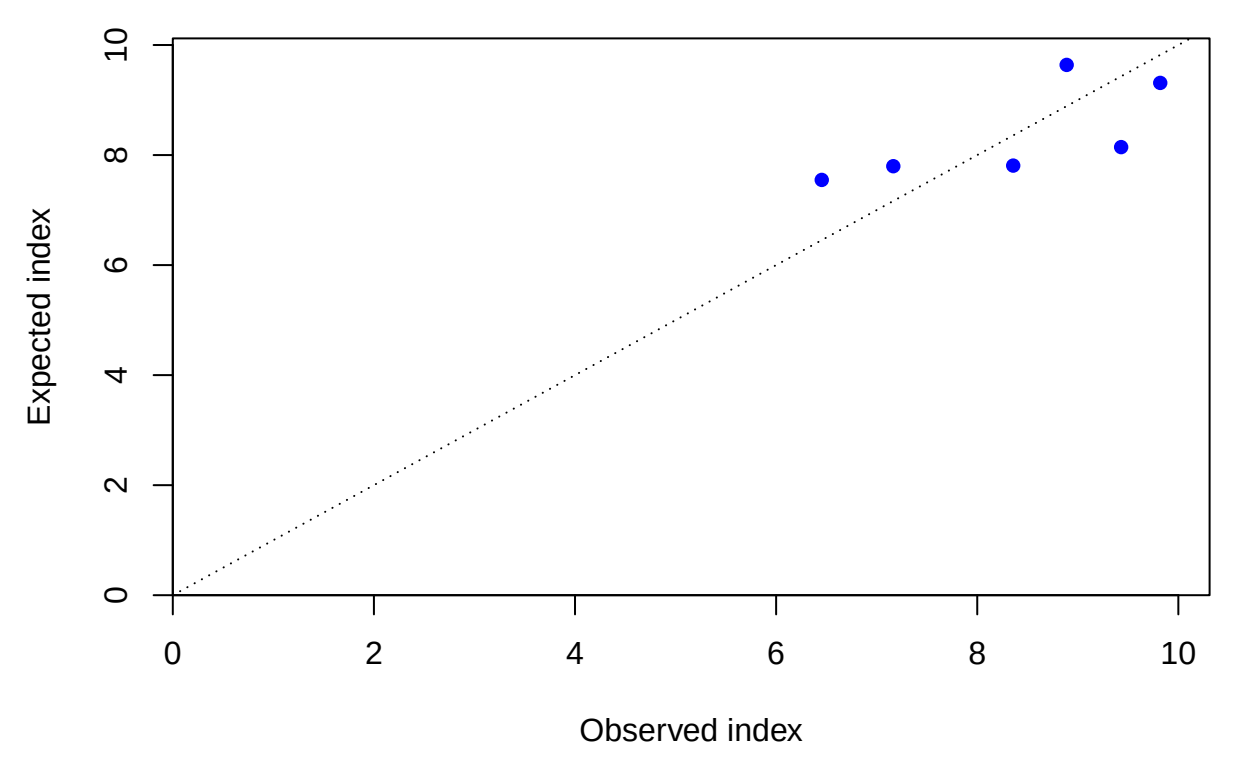

1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
1970
1980
1990
2000
2010
2020
Year

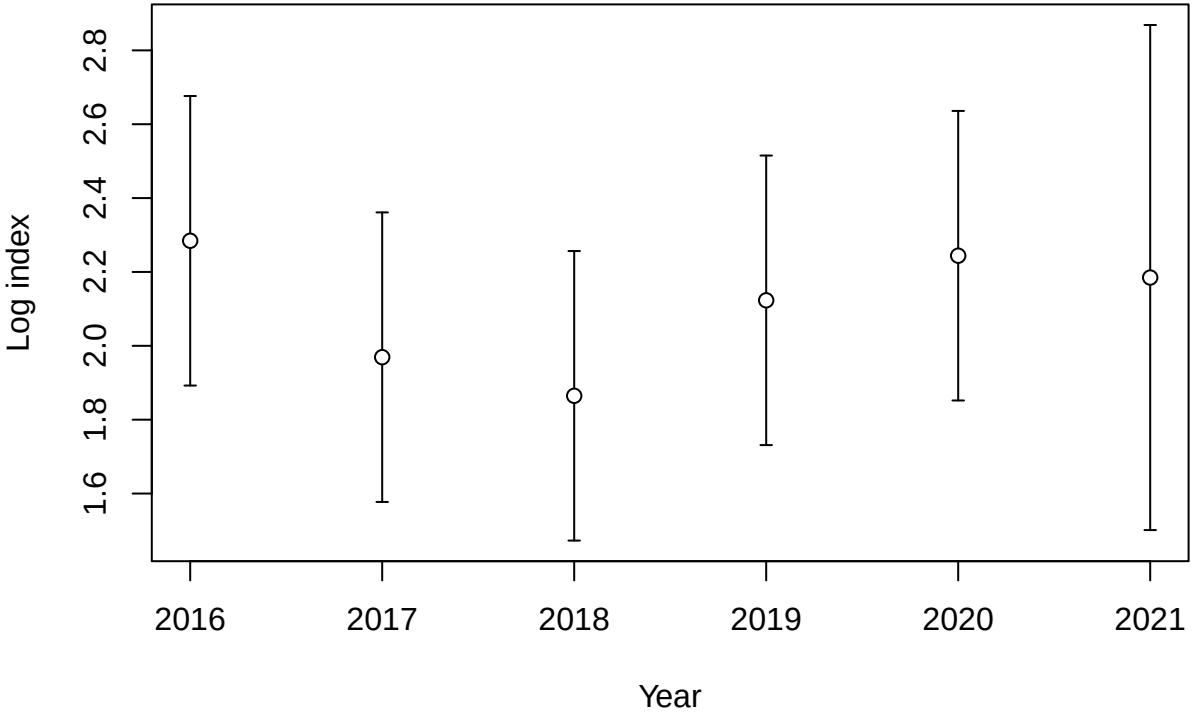

Fishing intensity: 1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
1970
1980
1990
2000
2010
2020
Year

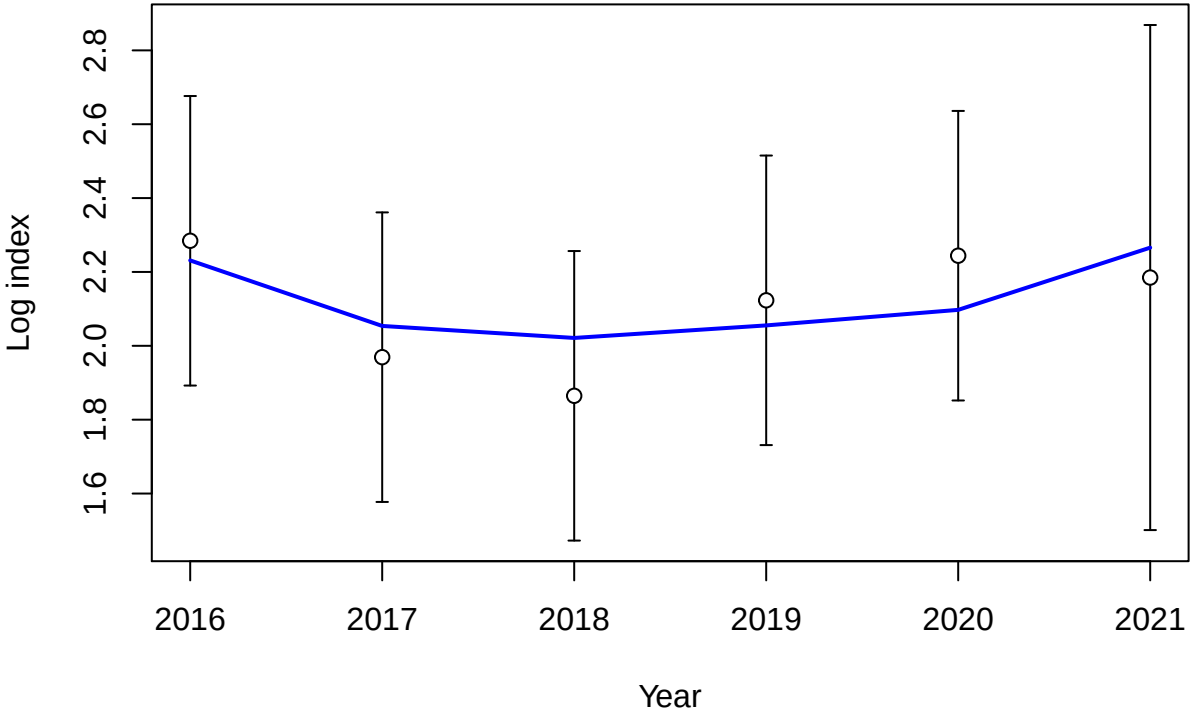

Fishing intensity: 1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
0
1
2
3
4
Relative spawning output: B/B_MSY
2000
2020
2010
2021
1980
1967
1970

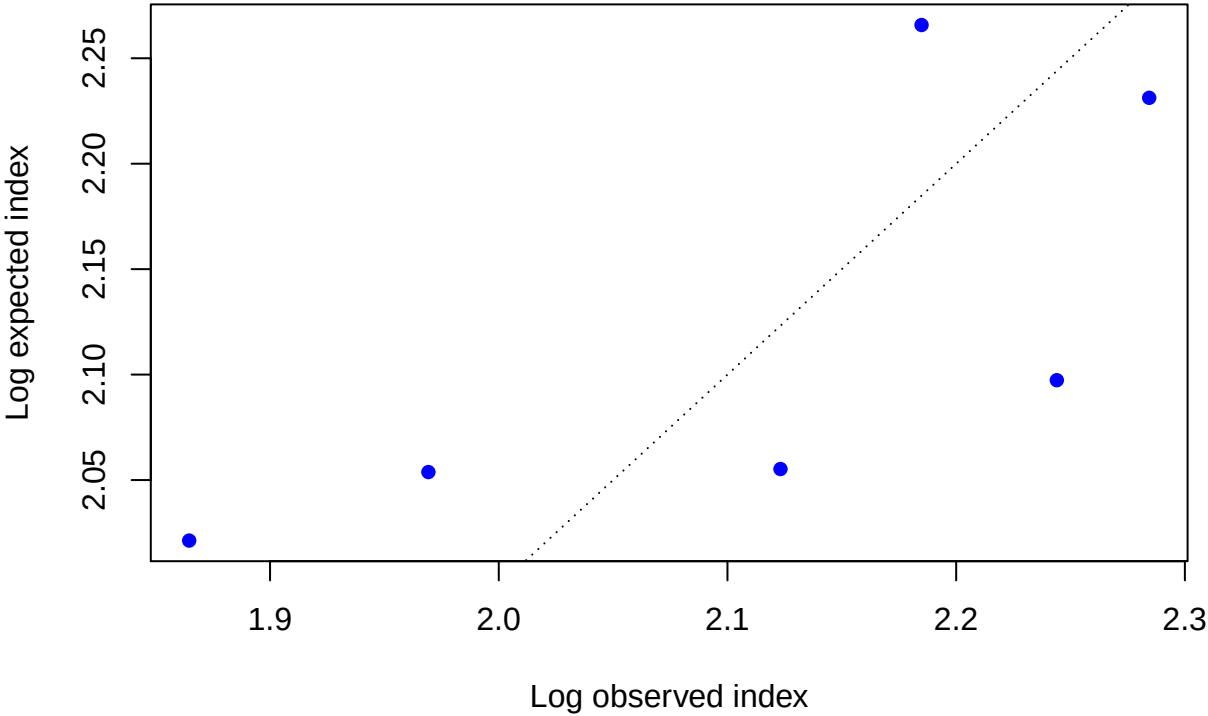

Index
0
5
10
15
2016
2017
2018
2019
2020
2021
Year

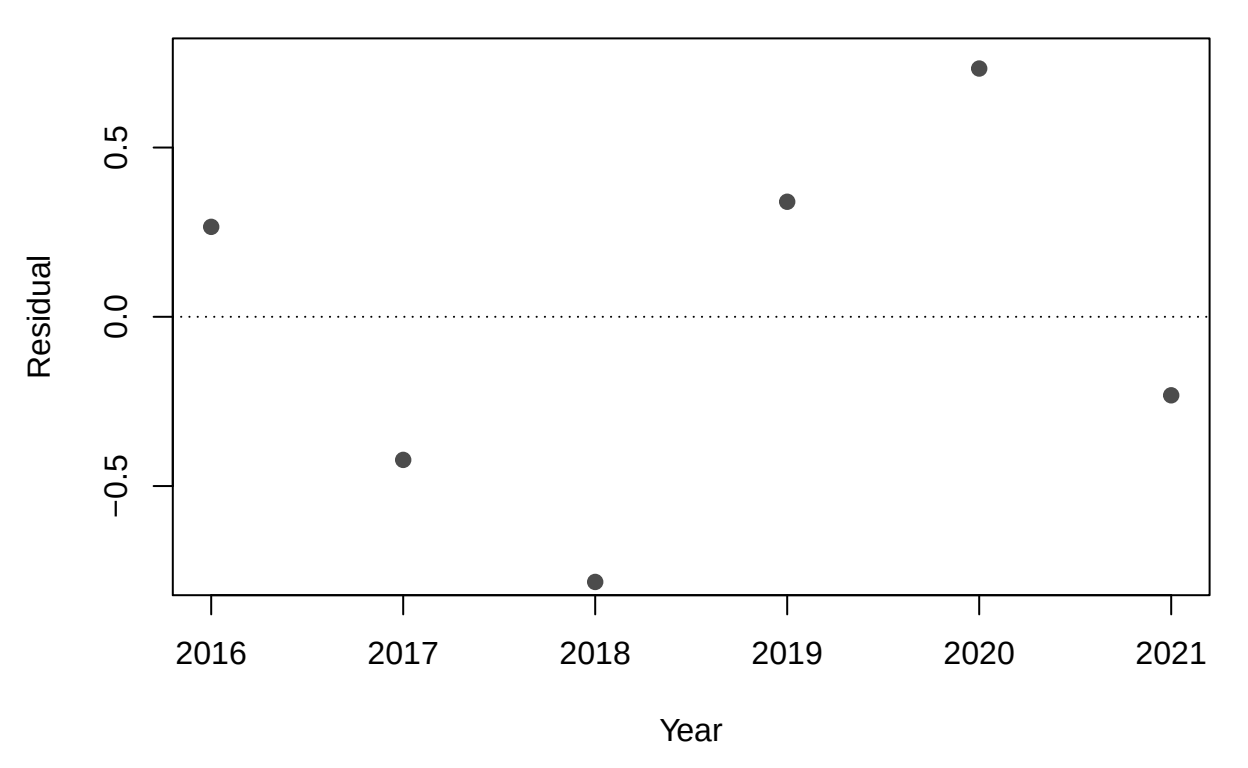

Index
0
5
10
15
2016
2017
2018
2019
2020
2021
Year

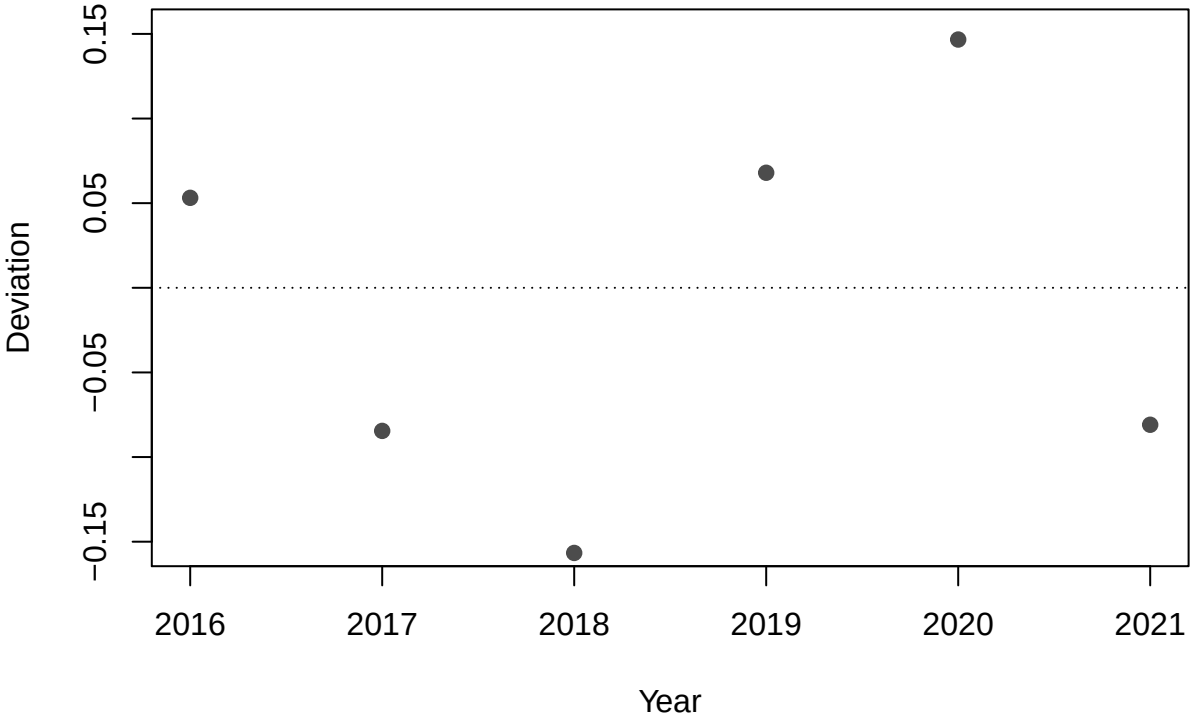

Expected index
Observed index
0
2
4
6
8
10

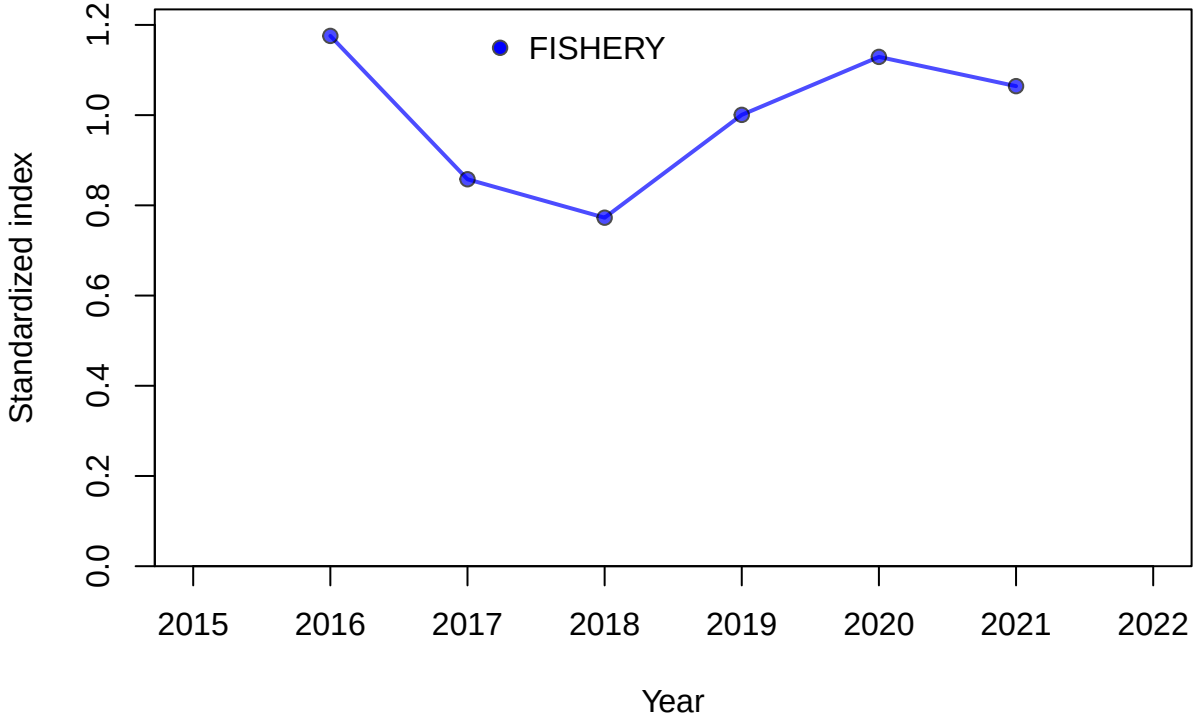

Log index
1.6
1.8
2.0
2.2
2.4
2.6
2.8
2016
2017
2018
2019
2020
2021
Year

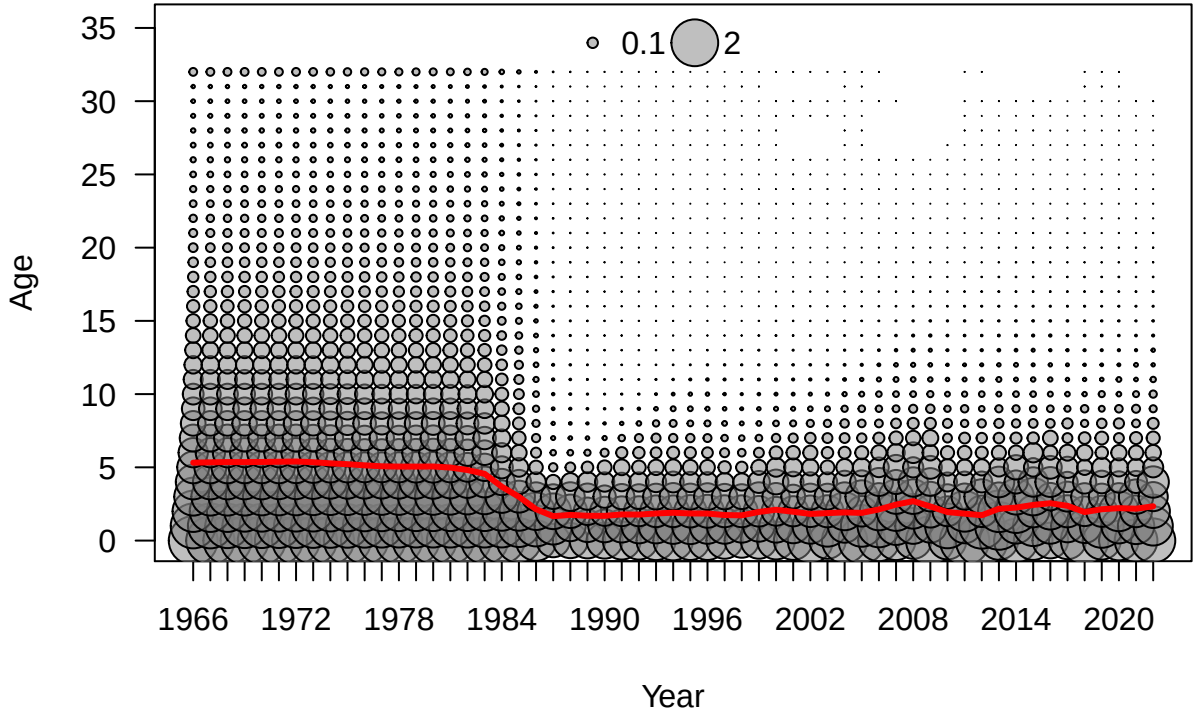

Log index
1.6
1.8
2.0
2.2
2.4
2.6
2.8
2016
2017
2018
2019
2020
2021
Year

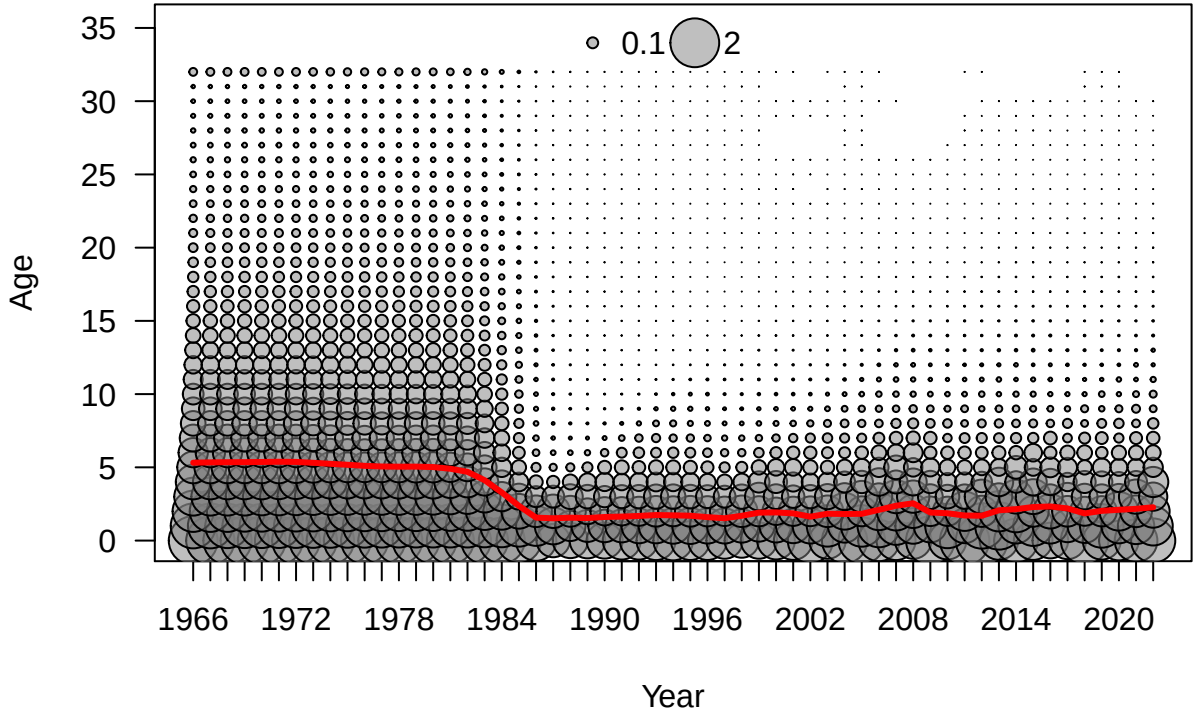

Log expected index
2.05
2.10
2.15
2.20
2.25
1.9
2.0
2.1
2.2
2.3
Log observed index

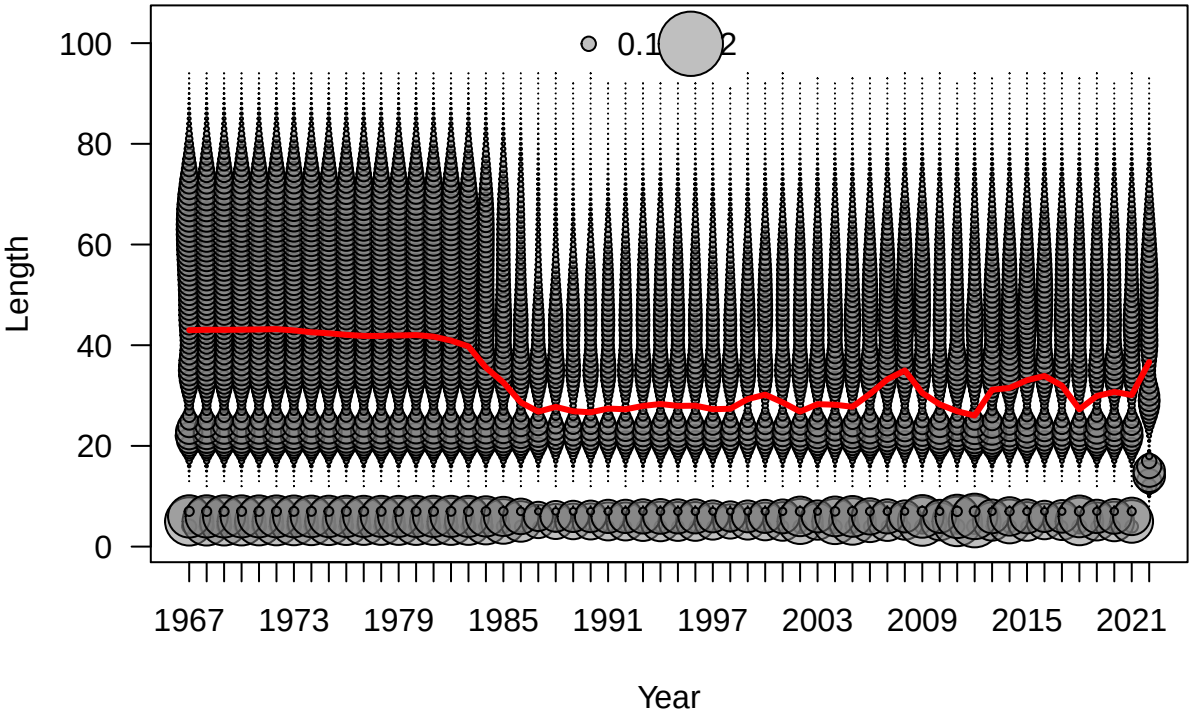

Residual
0.5
0.0
−0.5
2016
2017
2018
2019
2020
2021
Year

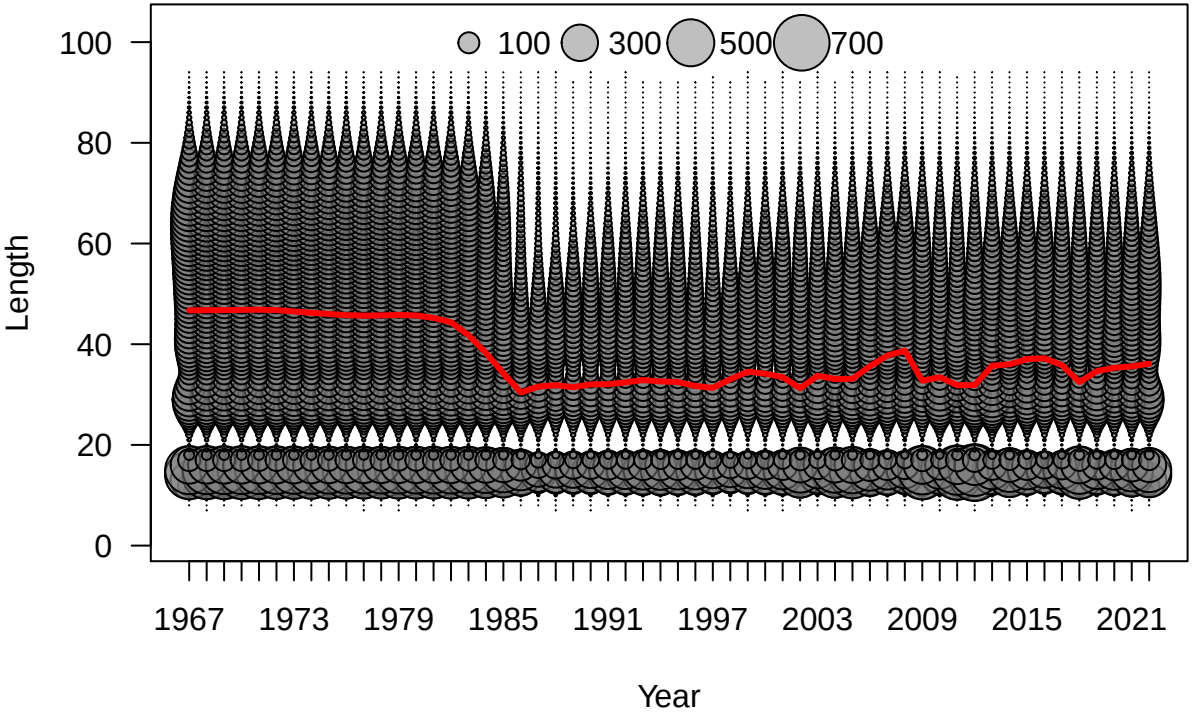

Deviation
0.15
0.05
−0.05
−0.15
2016
2017
2018
2019
2020
2021
Year

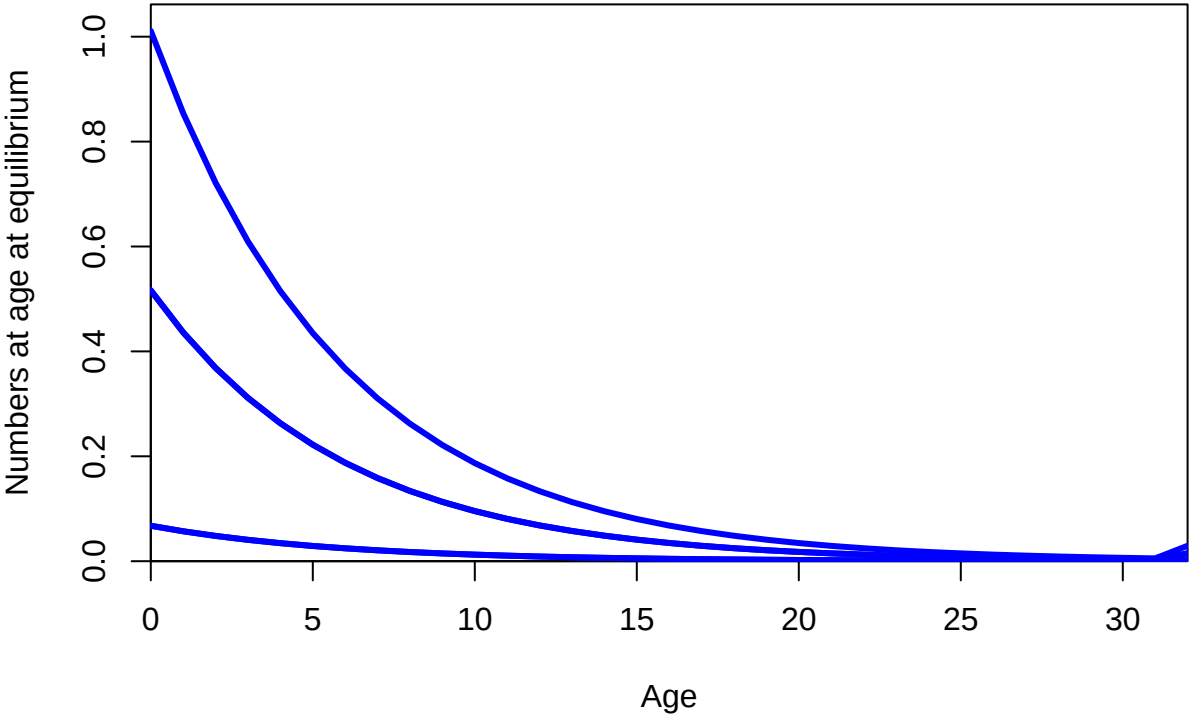

FISHERY
Standardized index
0.0
0.2
0.4
0.6
0.8
1.0
1.2
2015
2016
2017
2018
2019
2020
2021
2022
Year

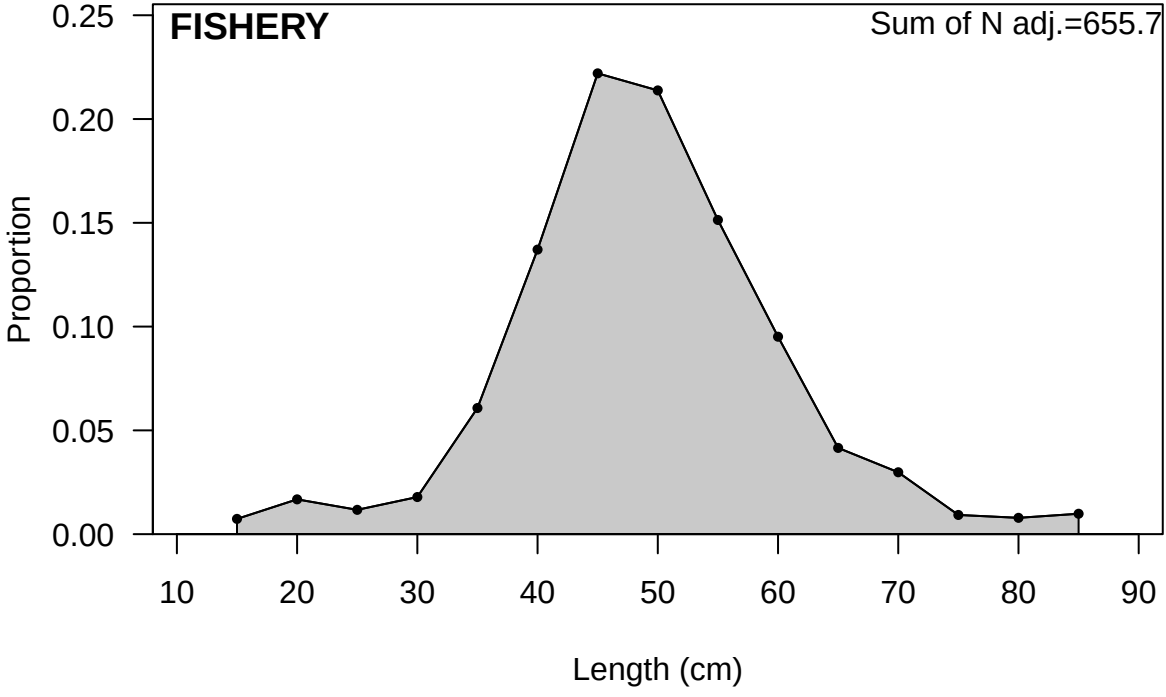

0.1
2
35
30
25
20
15
10
5
0
Age
1966
1972
1978
1984
1990
1996
2002
2008
2014
2020
Year

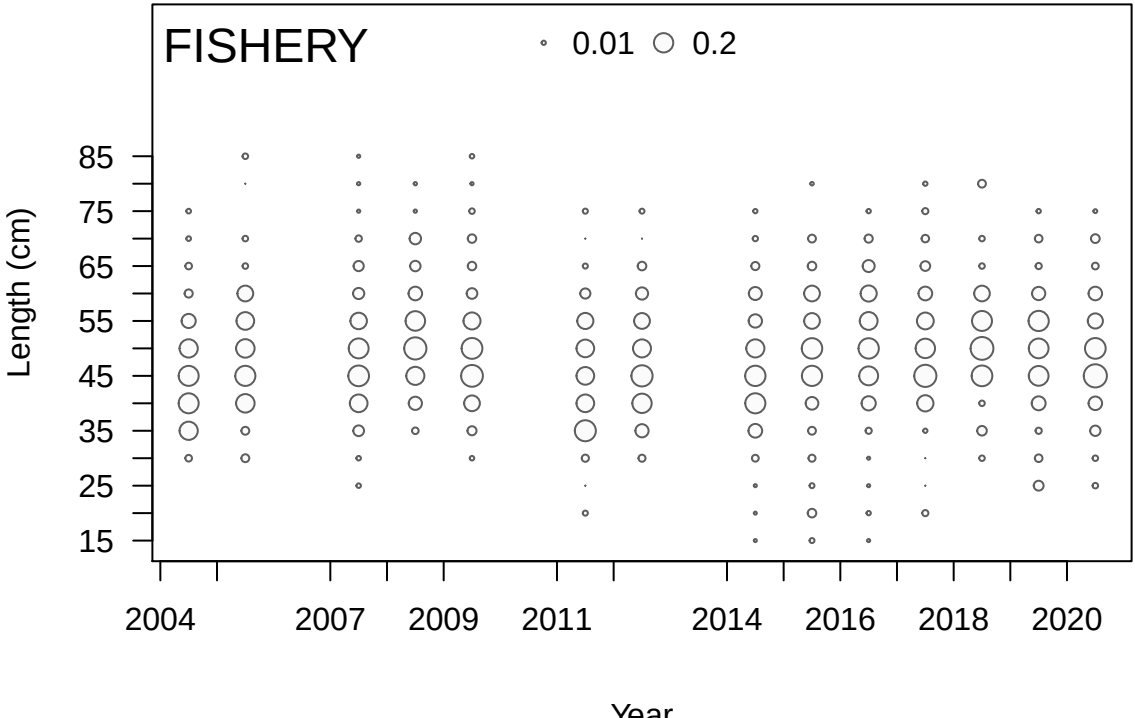

0.1
2
35
30
25
20
15
10
5
0
Age
1966
1972
1978
1984
1990
1996
2002
2008
2014
2020
Year

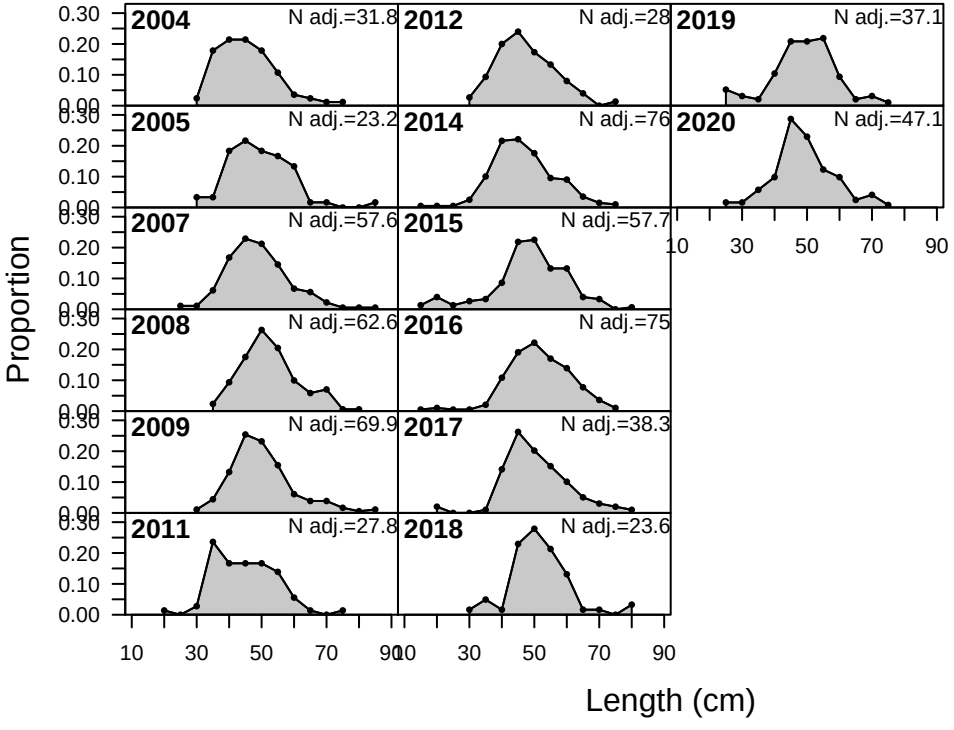

0.1
2
100
80
60
40
20
0
Length
1967
1973
1979
1985
1991
1997
2003
2009
2015
2021
Year

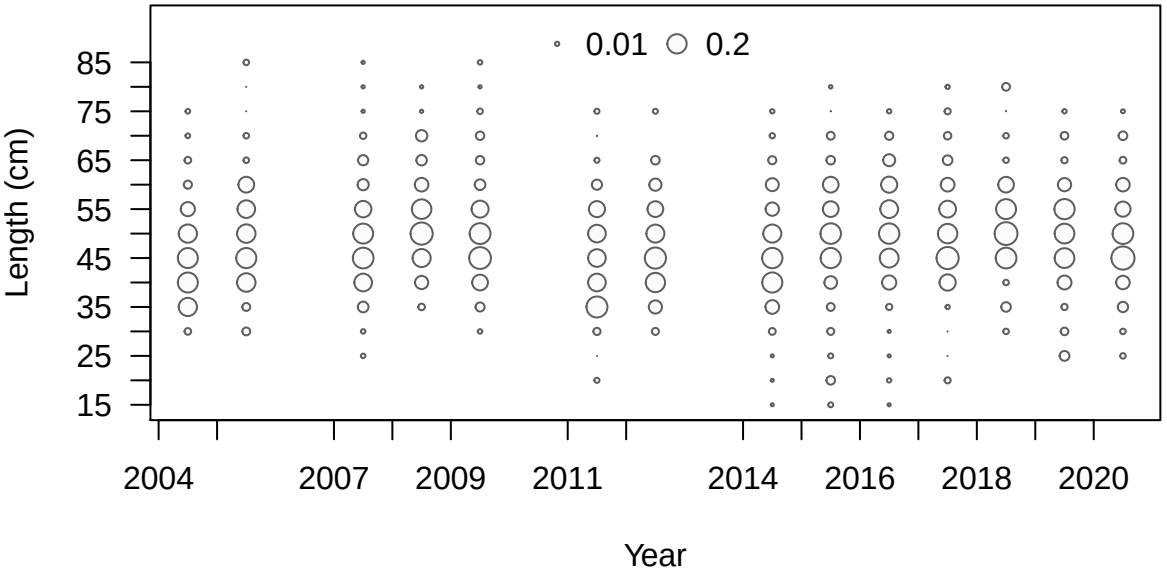

100
300
500
700
Length
0
20
40
60
80
100
1967
1973
1979
1985
1991
1997
2003
2009
2015
2021
Year

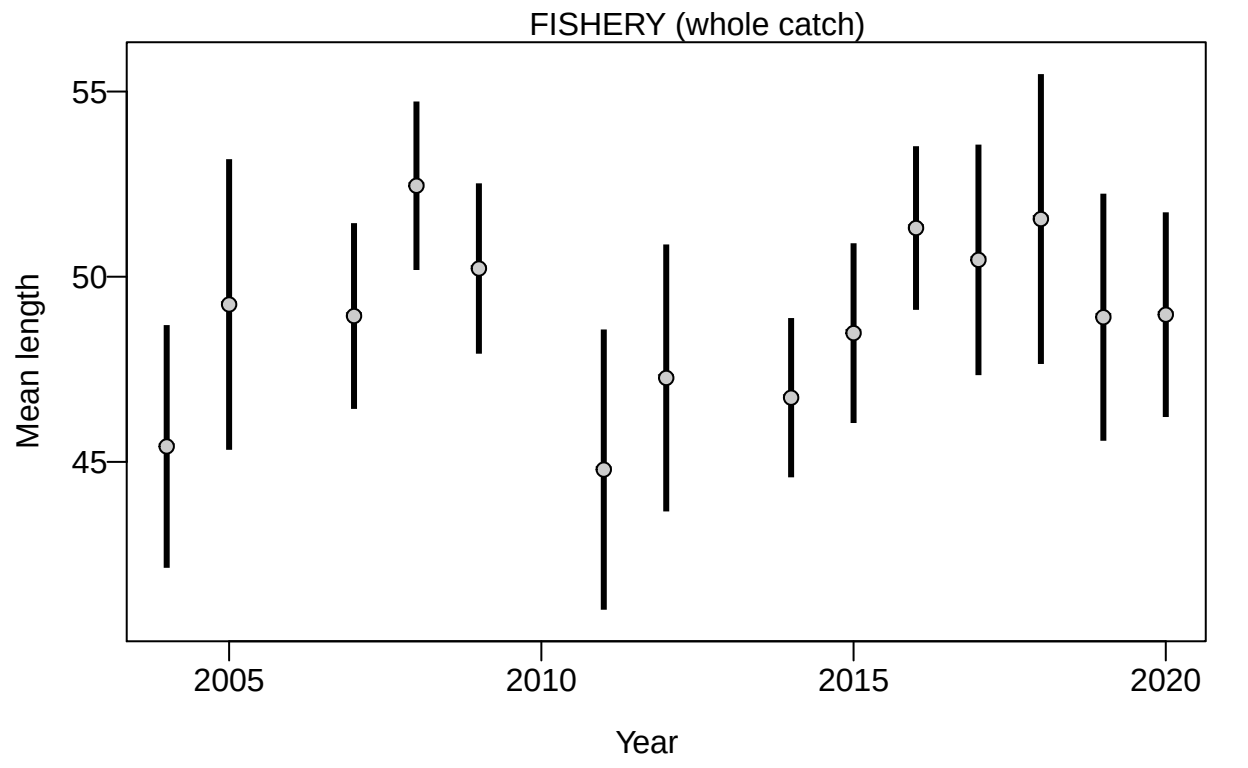

Numbers at age at equilibrium
0.0
0.2
0.4
0.6
0.8
1.0
0
5
10
15
20
25
30
Age

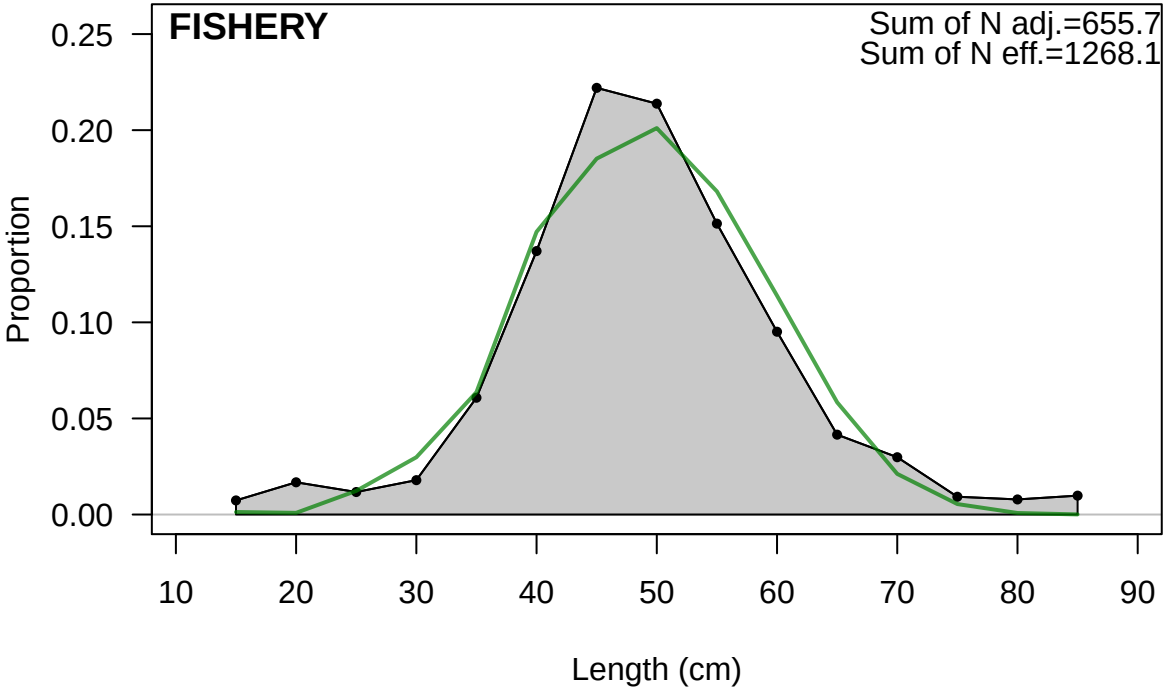

FISHERY
Sum of N adj.=655.7
Proportion
0.25
0.20
0.15
0.10
0.05
0.00
10
20
30
40
50
60
70
80
90
Length (cm)

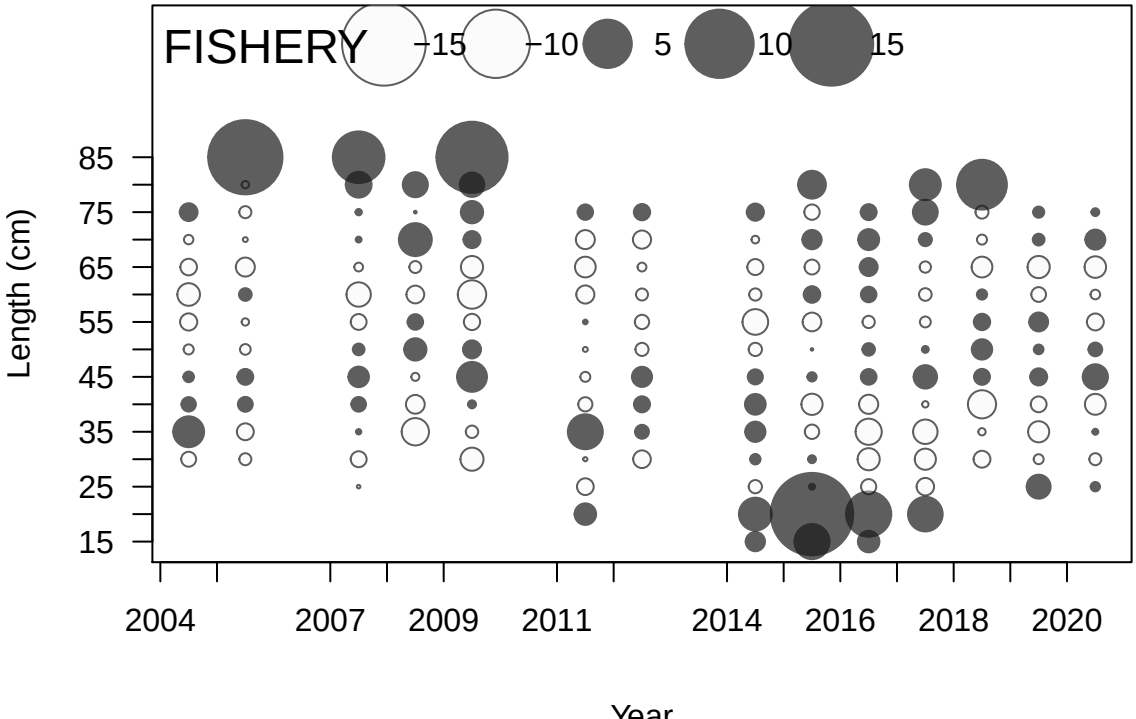

FISHERY
0.01
0.2
Length (cm)
85
75
65
55
45
35
25
15
2004
2007
2009
2011
2014
2016
2018
2020
Year

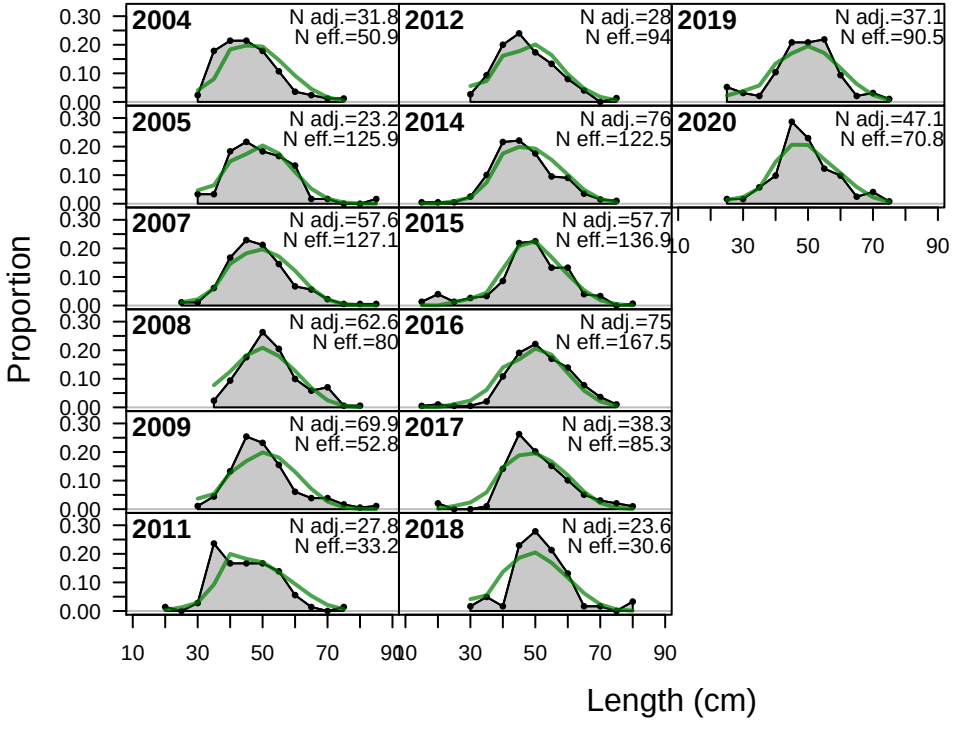

2004
N adj.=31.8
2012
N adj.=28
2019
N adj.=37.1
2005
N adj.=23.2
2014
N adj.=76
2020
N adj.=47.1
2007
N adj.=57.6
2015
N adj.=57.7
2008
N adj.=62.6
2016
N adj.=75
2009
N adj.=69.9
2017
N adj.=38.3
2011
N adj.=27.8
2018
N adj.=23.6
Proportion
0.00
0.10
0.20
0.30
10
30
50
70
90
Length (cm)

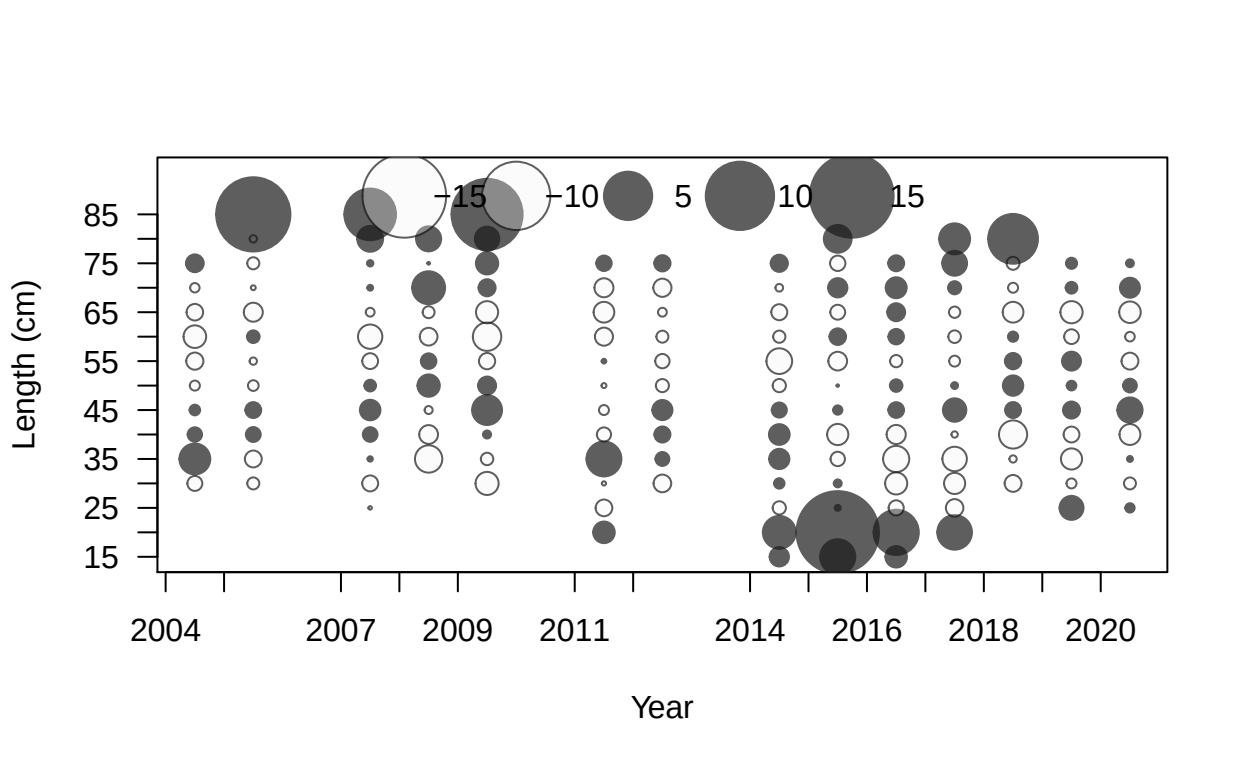

0.01
0.2
Length (cm)
85
75
65
55
45
35
25
15
2004
2007
2009
2011
2014
2016
2018
2020
Year

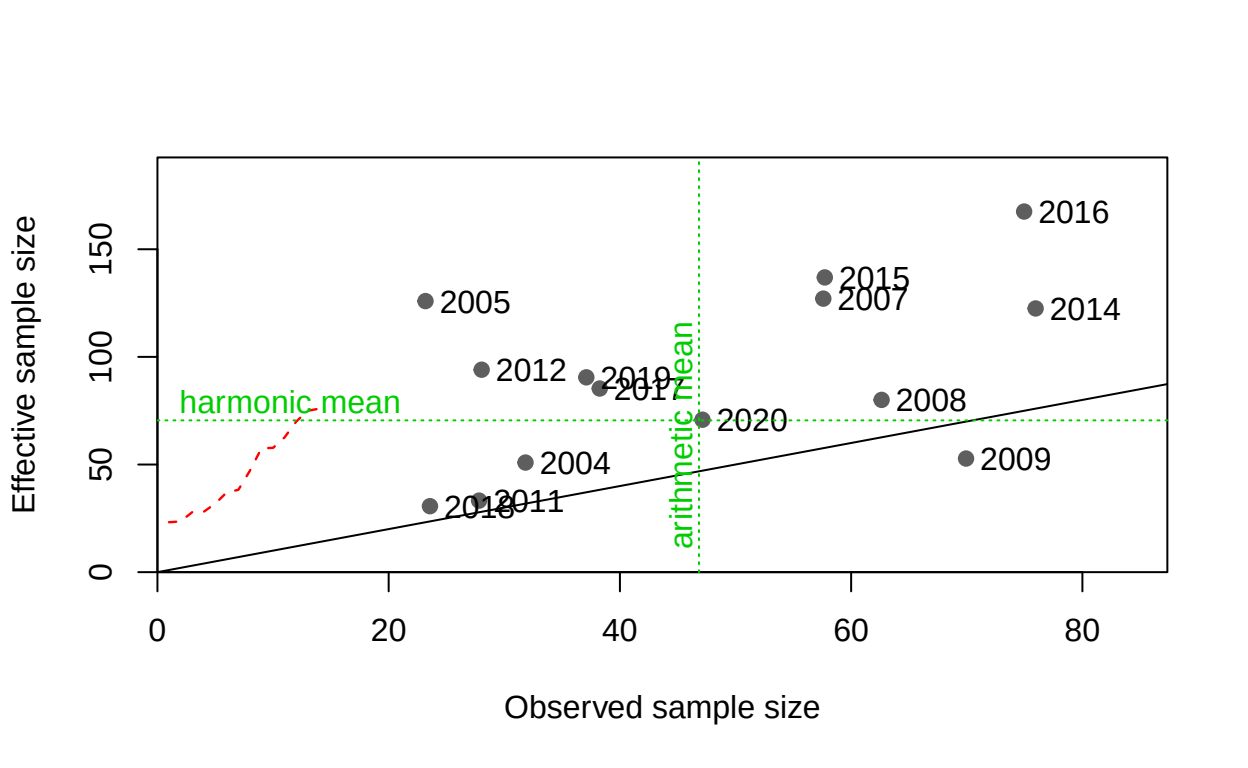

FISHERY (whole catch)
55
50
45
Mean length
2005
2010
2015
2020
Year

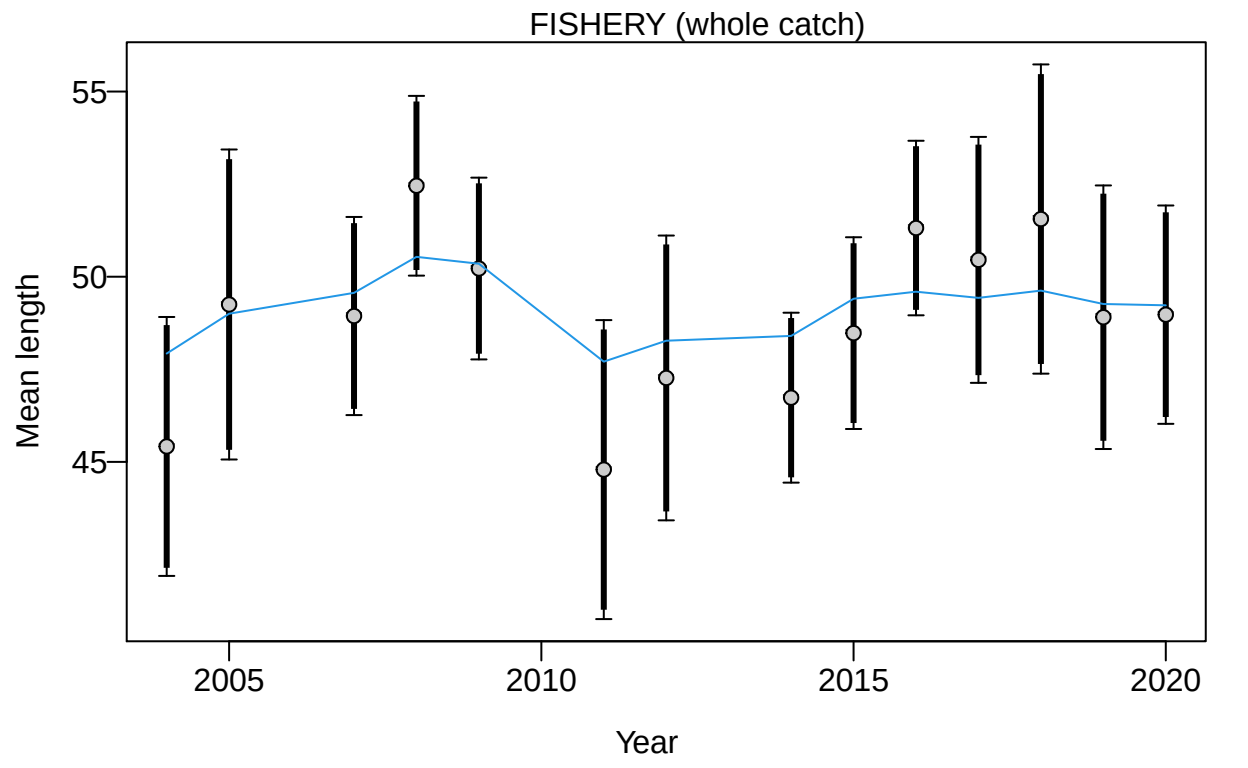

FISHERY
Sum of N adj.=655.7
Sum of N eff.=1268.1
Proportion
0.25
0.20
0.15
0.10
0.05
0.00
10
20
30
40
50
60
70
80
90
Length (cm)

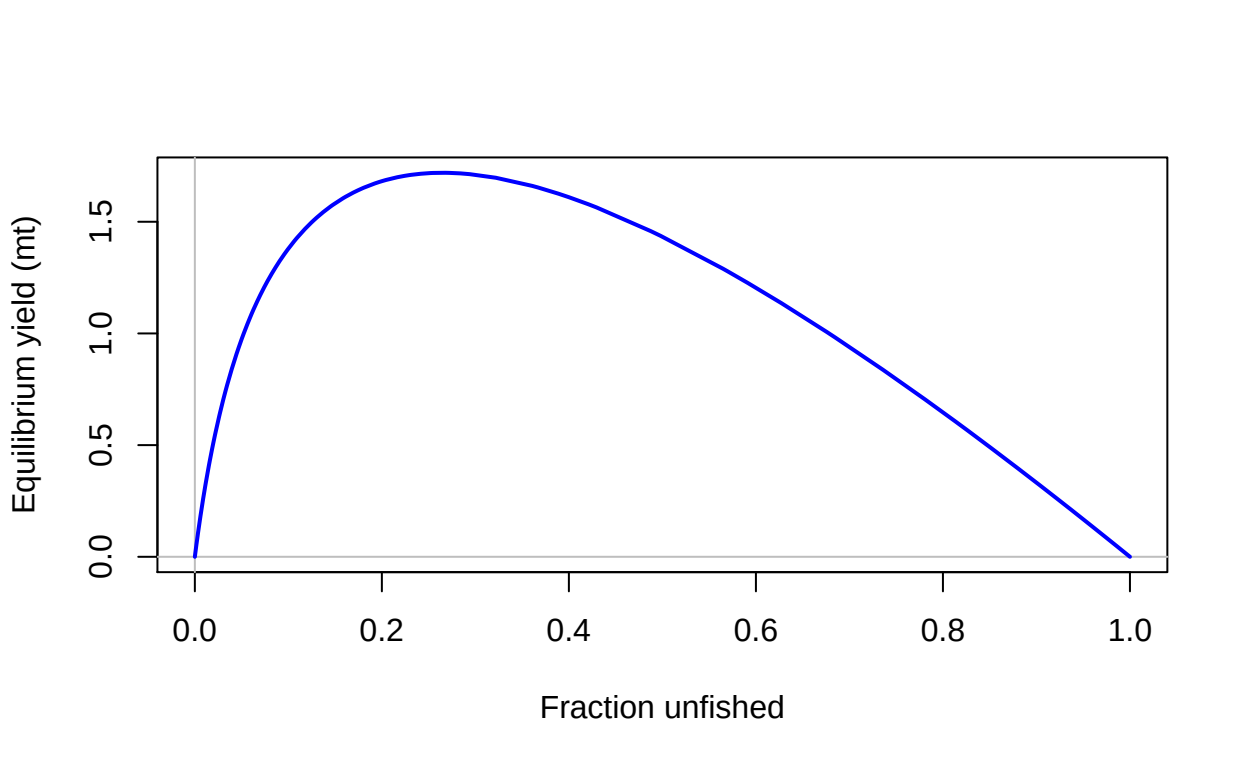

FISHERY
15
10
5
10
15
Length (cm)
85
75
65
55
45
35
25
15
2004
2007
2009
2011
2014
2016
2018
2020
Year

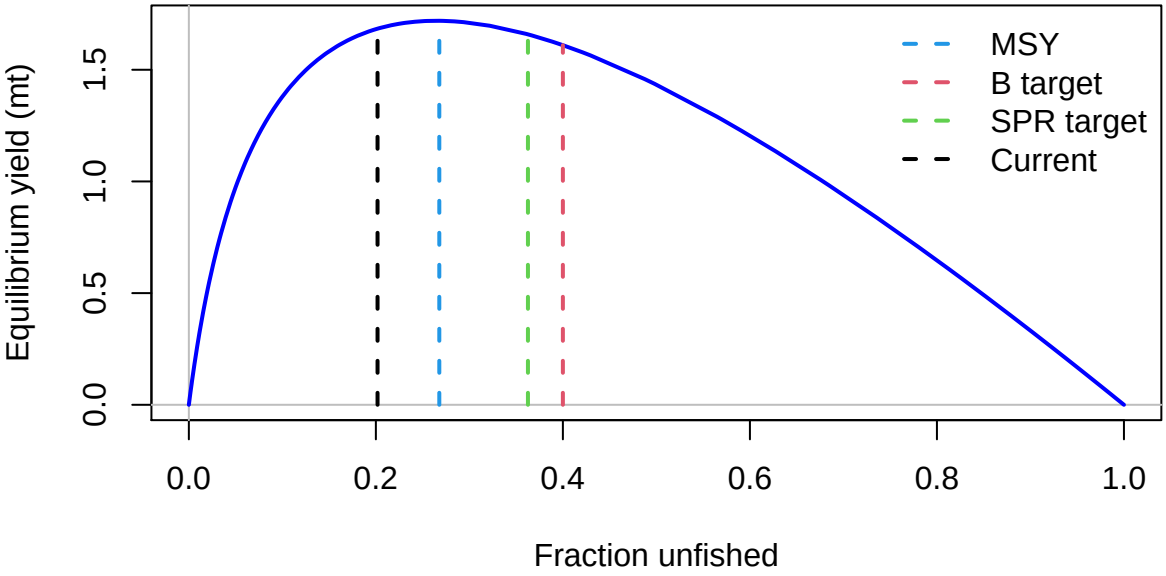

2004
N adj.=31.8
N eff.=50.9
2012
N adj.=28
N eff.=94
2019
N adj.=37.1
N eff.=90.5
2005
N adj.=23.2
N eff.=125.9
2014
N adj.=76
N eff.=122.5
2020
N adj.=47.1
N eff.=70.8
2007
N adj.=57.6
N eff.=127.1
2015
N adj.=57.7
N eff.=136.9
2008
N adj.=62.6
N eff.=80
2016
N adj.=75
N eff.=167.5
2009
N adj.=69.9
N eff.=52.8
2017
N adj.=38.3
N eff.=85.3
2011
N adj.=27.8
N eff.=33.2
2018
N adj.=23.6
N eff.=30.6
Proportion
0.00
0.10
0.20
0.30
10
30
50
70
90
Length (cm)

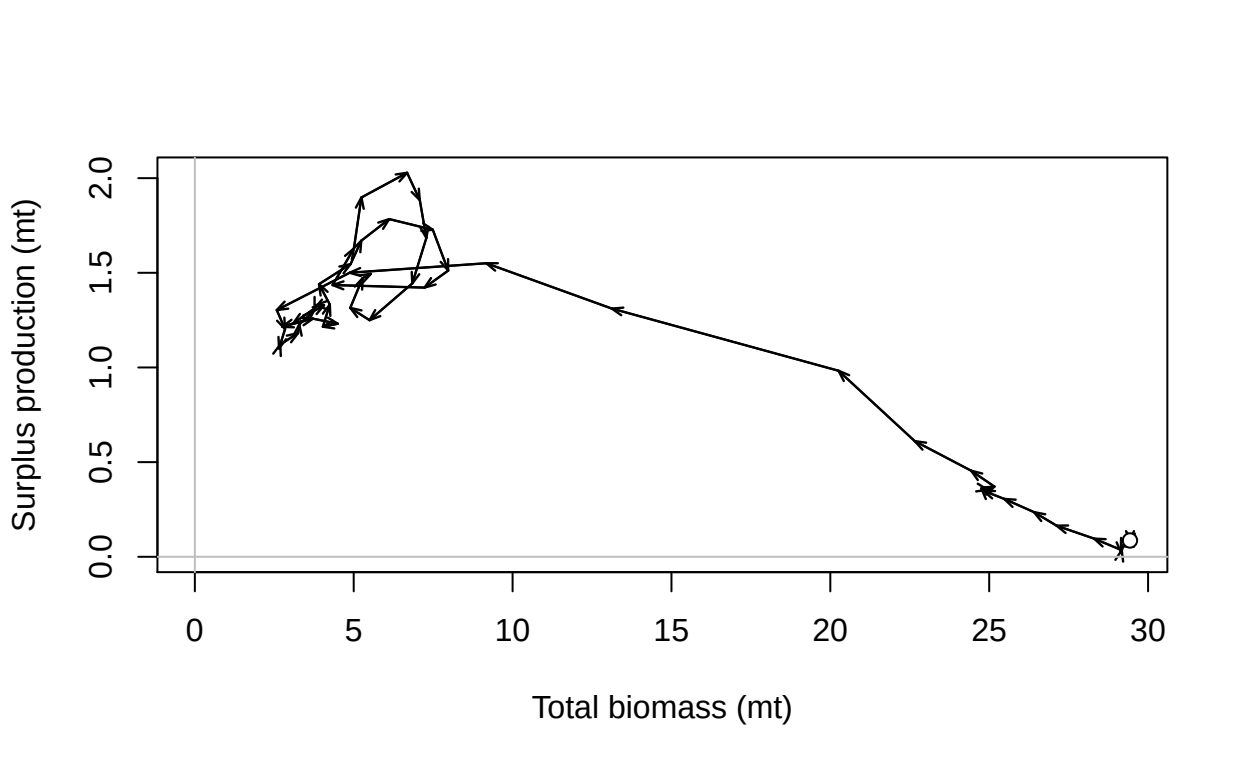

15
10
5
10
15
85
75
65
55
45
35
25
15
Length (cm)
2004
2007
2009
2011
2014
2016
2018
2020
Year

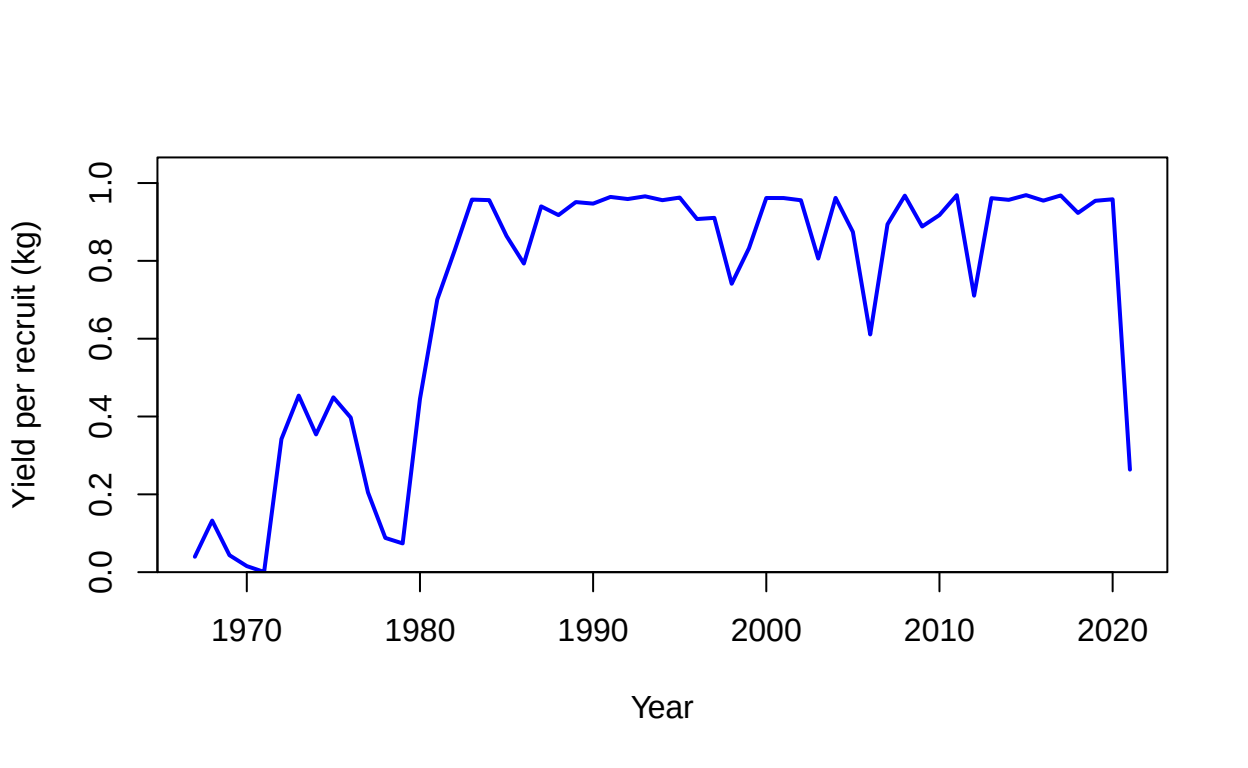

Effective sample size
0
50
100
150
0
20
40
60
80
Observed sample size
harmonic mean
arithmetic mean
2016
2015
2007
2014
2005
2012
2010
2017
2008
2020
2004
2009
2018
2011

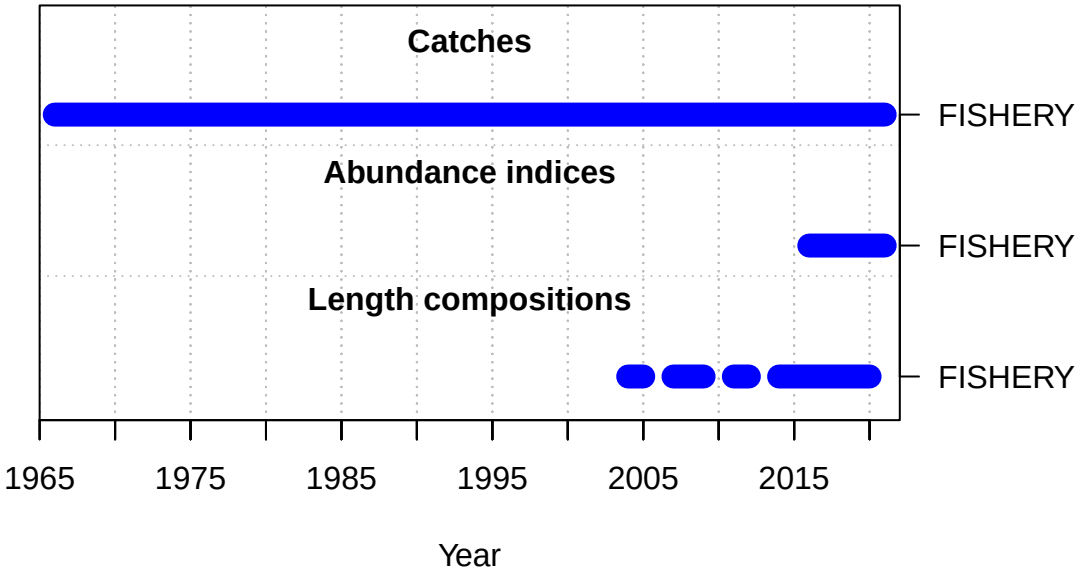

FISHERY (whole catch)
55
50
45
Mean length
2005
2010
2015
2020
Year

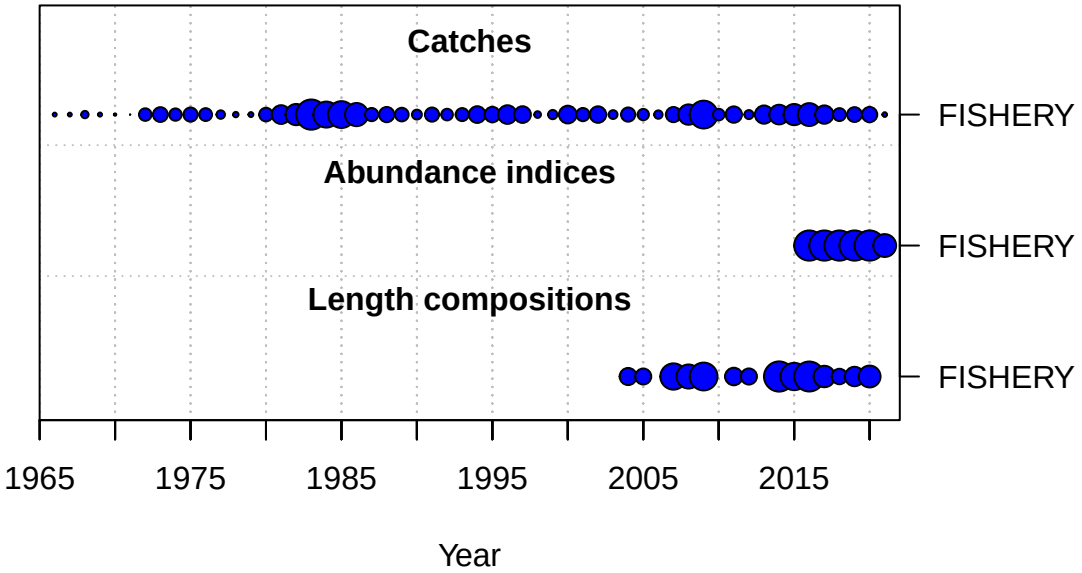

Equilibrium yield (mt)
0.0
0.5
1.0
1.5
0.0
0.2
0.4
0.6
0.8
1.0
Fraction unfished

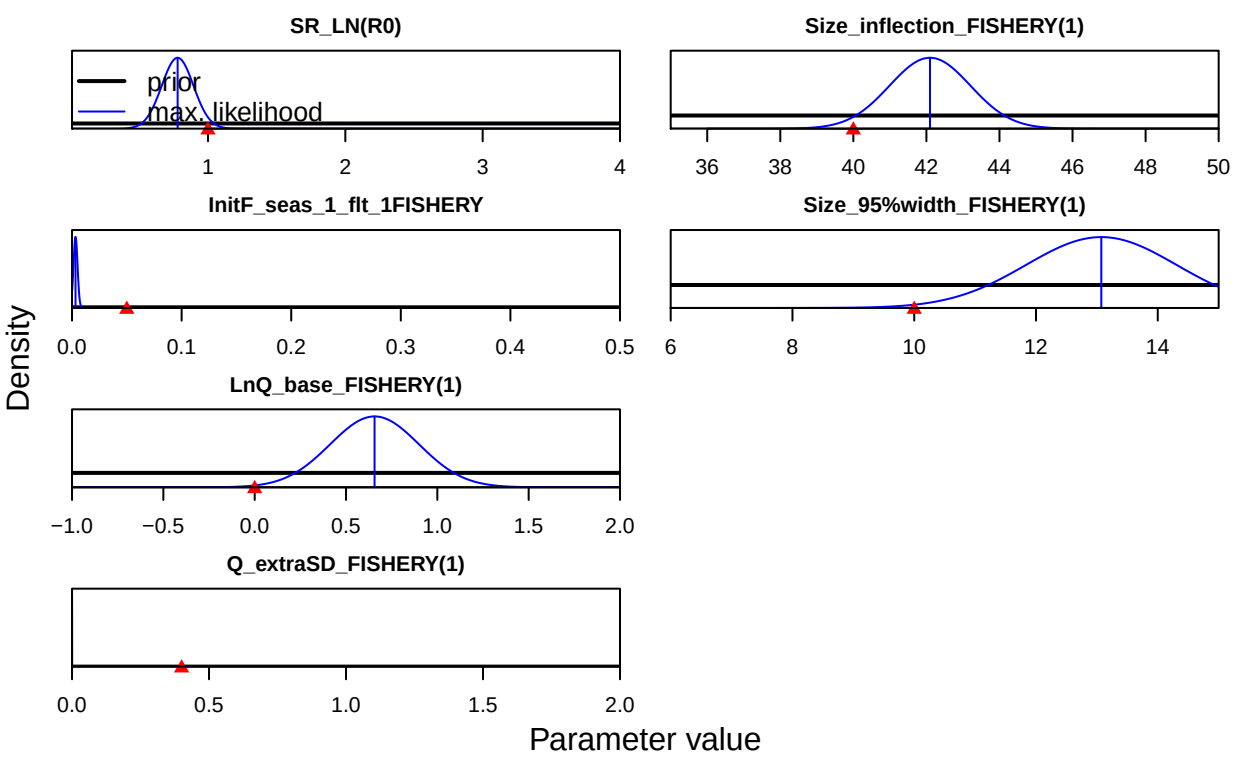

Equilibrium yield (mt)
0.0
0.5
1.0
1.5
0.0
0.2
0.4
0.6
0.8
1.0
Fraction unfished
MSY
B target
SPR target
Current


Surplus production (mt)
0.0
0.5
1.0
1.5
2.0
0
5
10
15
20
25
30
Total biomass (mt)


Yield per recruit (kg)
0.0
0.2
0.4
0.6
0.8
1.0
1970
1980
1990
2000
2010
2020
Year


Catches
FISHERY
Abundance indices
FISHERY
Length compositions
FISHERY
1965
1975
1985
1995
2005
2015
Year


Catches
FISHERY
Abundance indices
FISHERY
Length compositions
FISHERY
1965
1975
1985
1995
2005
2015
Year


SR_LN(R0)
prior
max. likelihood
1
2
3
4
Size_inflection_FISHERY(1)
36
38
40
42
44
46
48
50
InitF_seas_1_flt_1FISHERY
0.0
0.1
0.2
0.3
0.4
0.5
Size_95%width_FISHERY(1)
6
8
10
12
14
Density
LnQ_base_FISHERY(1)
−1.0
−0.5
0.0
0.5
1.0
1.5
2.0
Q_extraSD_FISHERY(1)
0.0
0.5
1.0
1.5
2.0
Parameter value