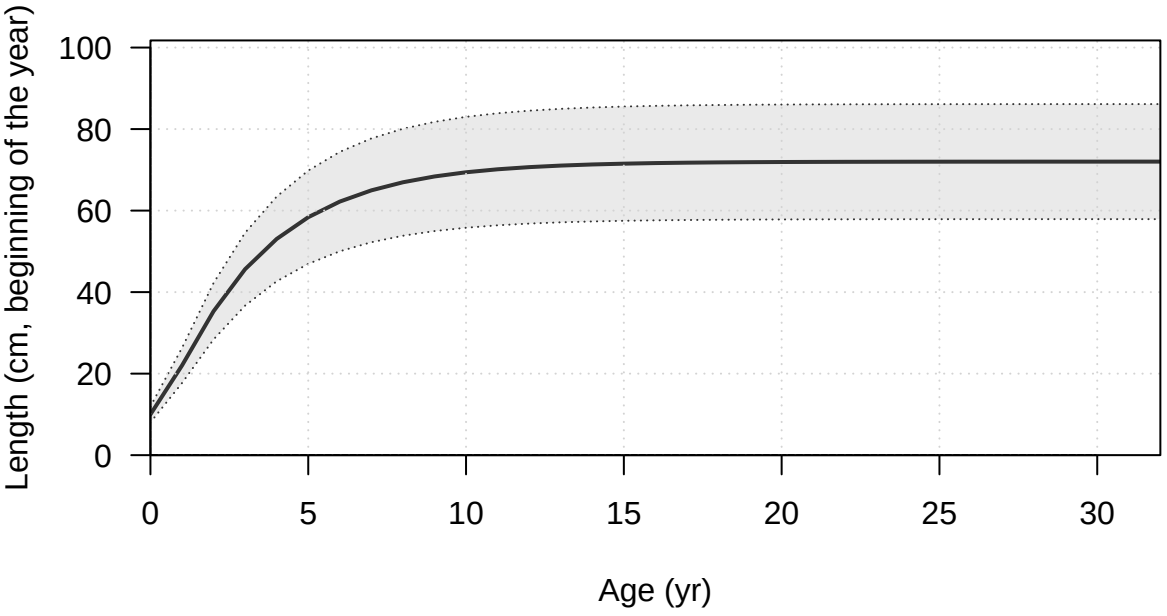
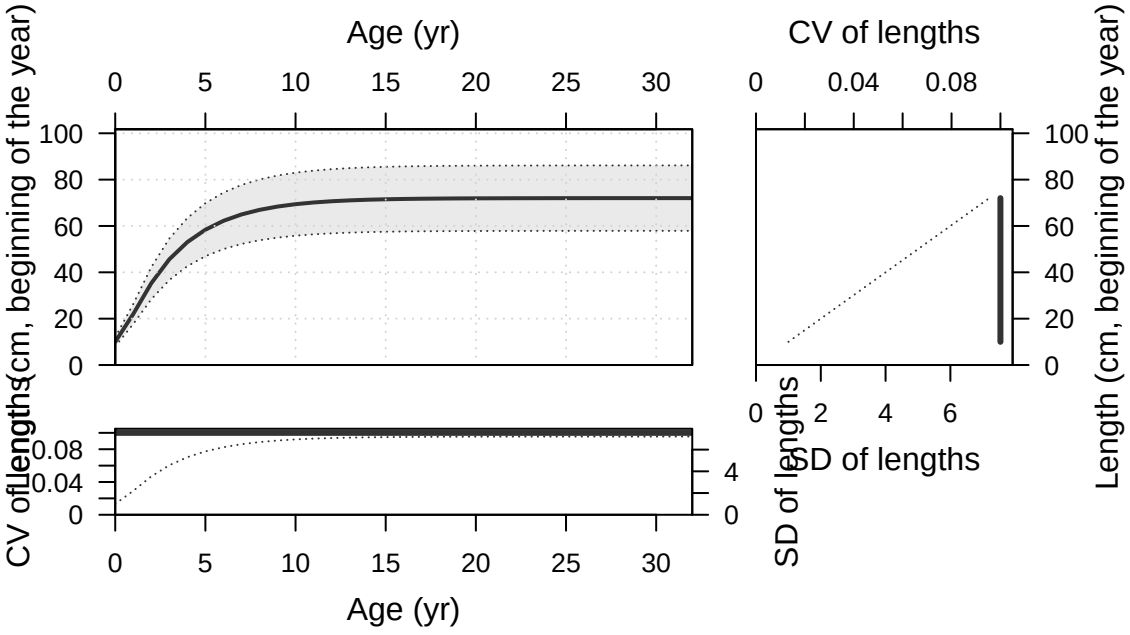
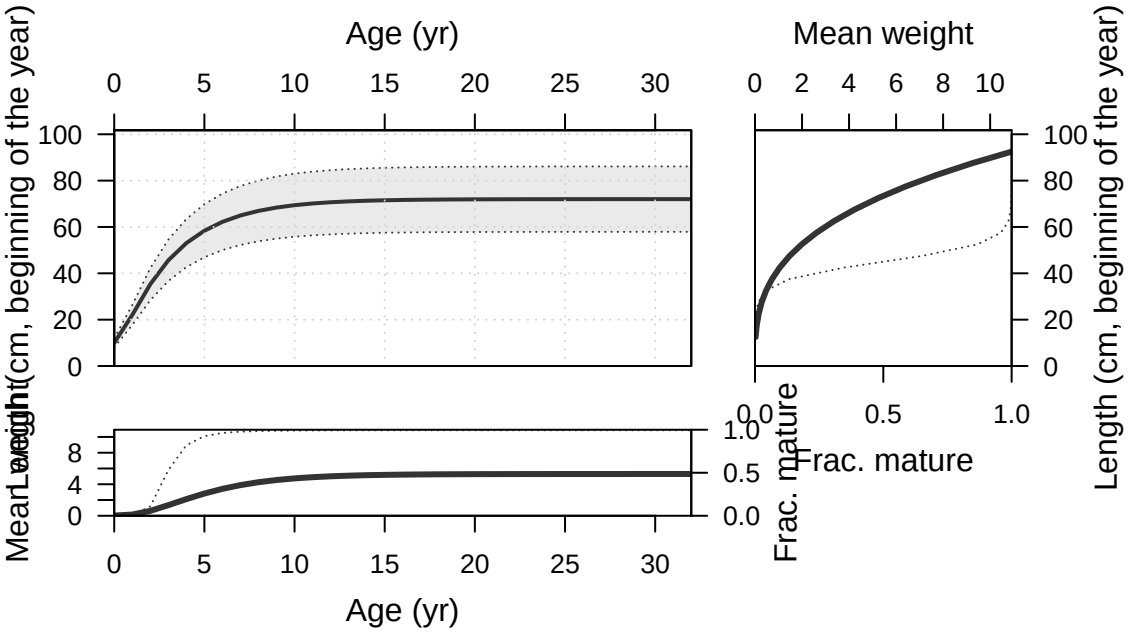
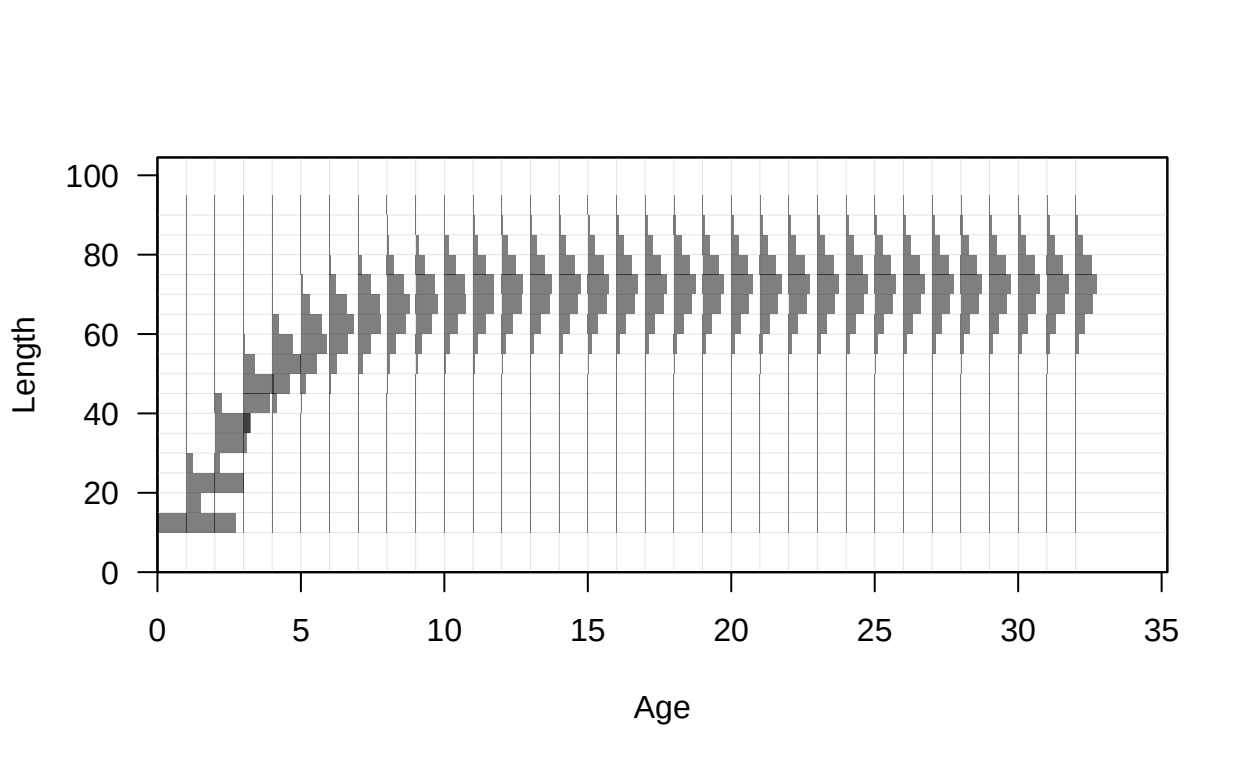
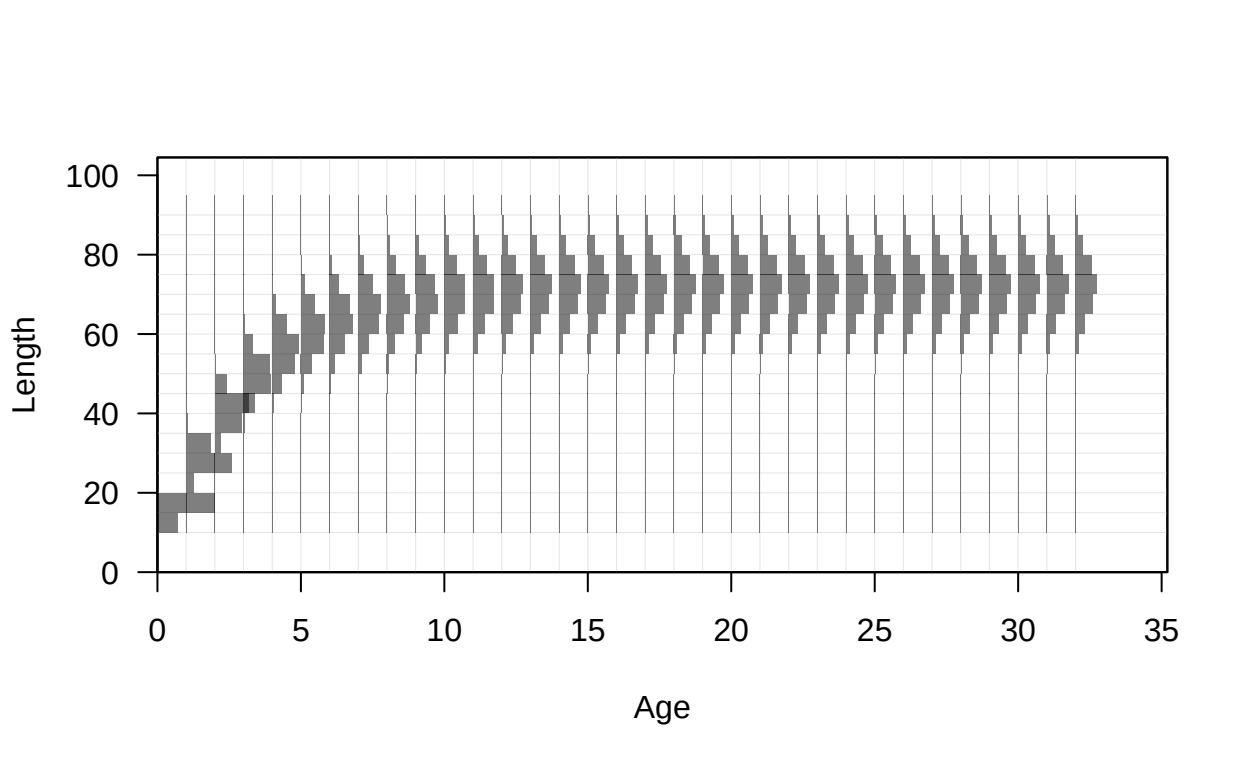
Plots created using the 'r4ss' package in R
Stock Synthesis version: 3.30.19.0
StartTime: Fri Jun 10 12:12:44 2022
Data_File: data.ss
Control_File: control.ss

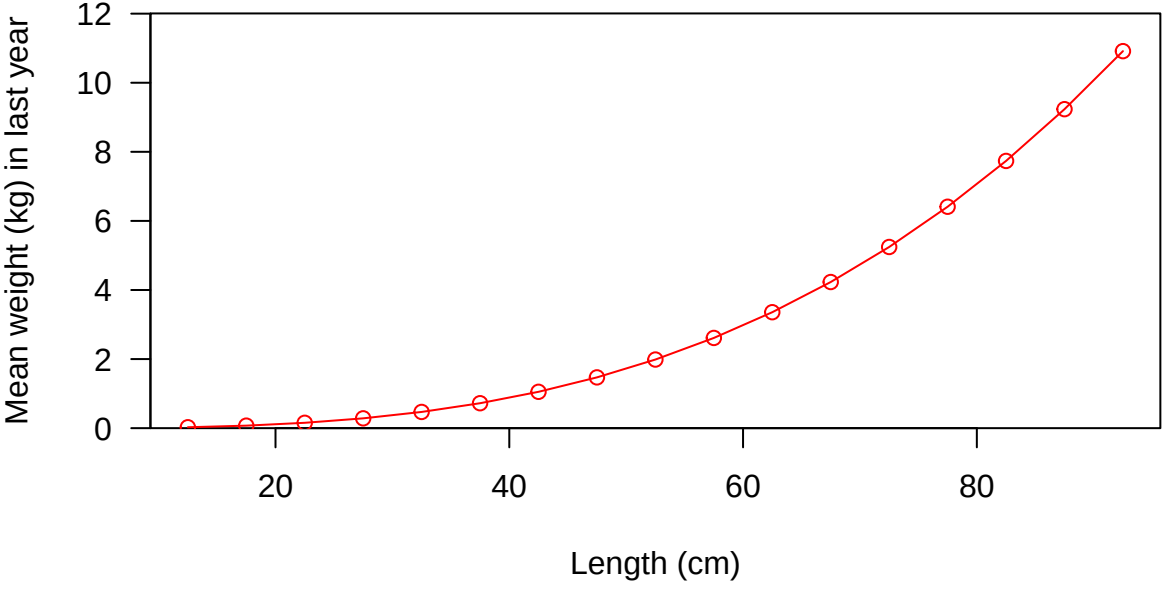

Length (cm, beginning of the year)
100
80
60
40
20
0
0
5
10
15
20
25
30
Age (yr)

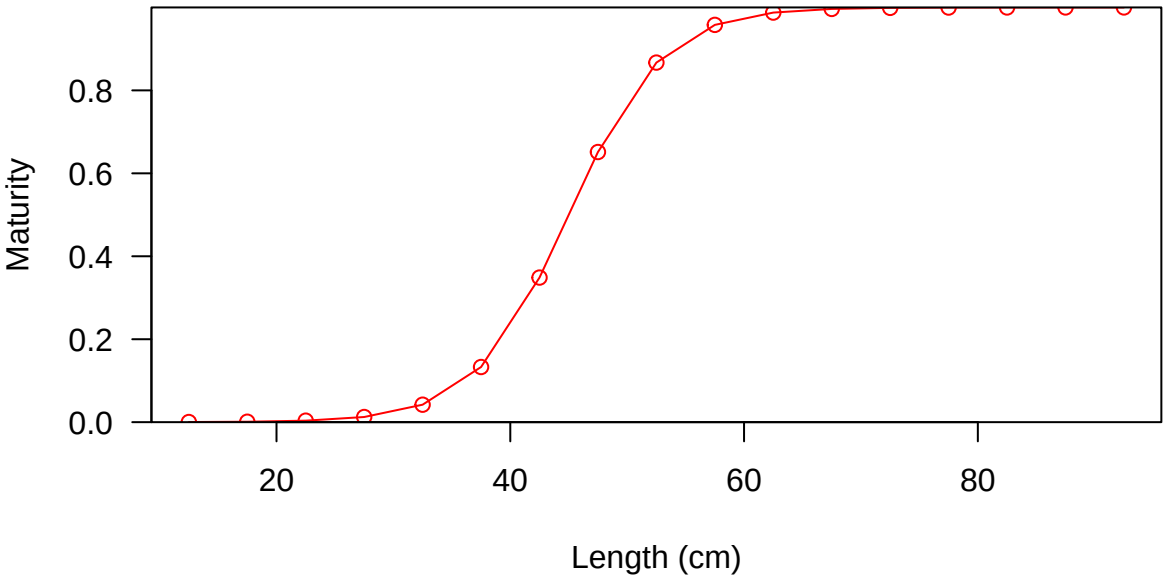

Age (yr)
0
5
10
15
20
25
30
100
80
60
40
20
0
Length (cm, beginning of the year)
CV of lengths
0.08
0.04
0
Age (yr)
CV of lengths
0
0.04
0.08
SD of lengths
0
2
4
6
4
0
Length (cm, beginning of the year)

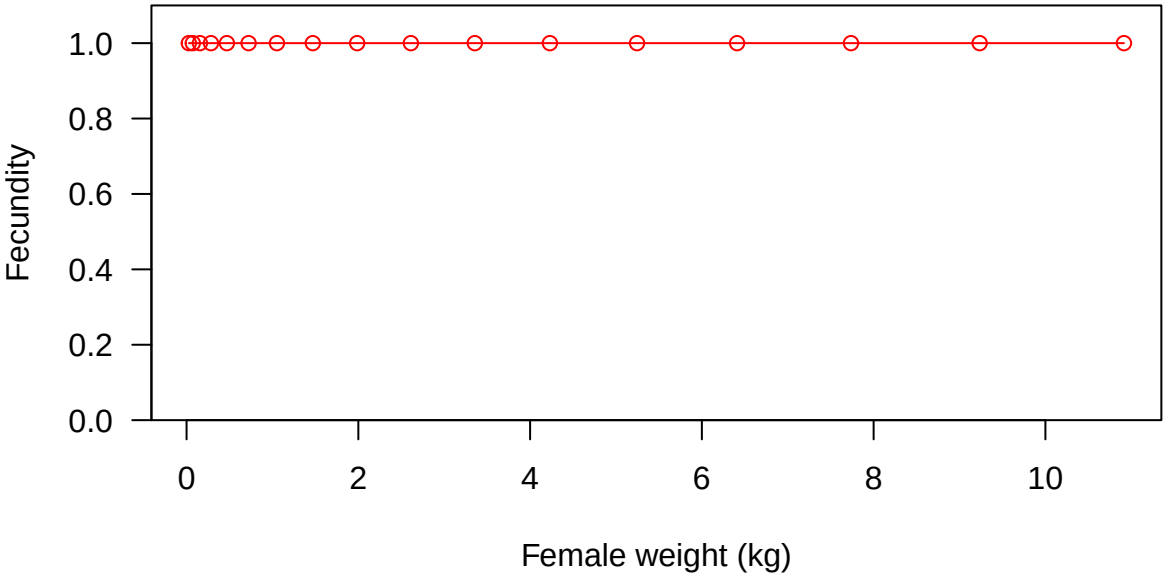

Age (yr)
Mean weight
Length (cm, beginning of the year)
Mean weight
Frac. mature
Age (yr)
Frac. mature
Length (cm, beginning of the year)

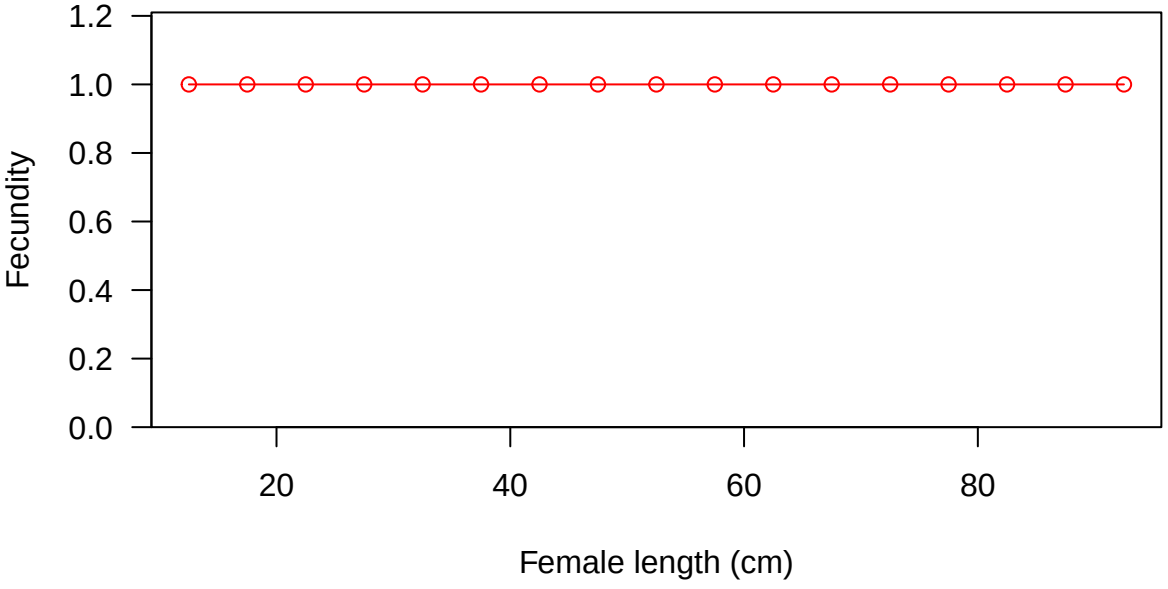

Length
Age
0
20
40
60
80
100
0
5
10
15
20
25
30
35

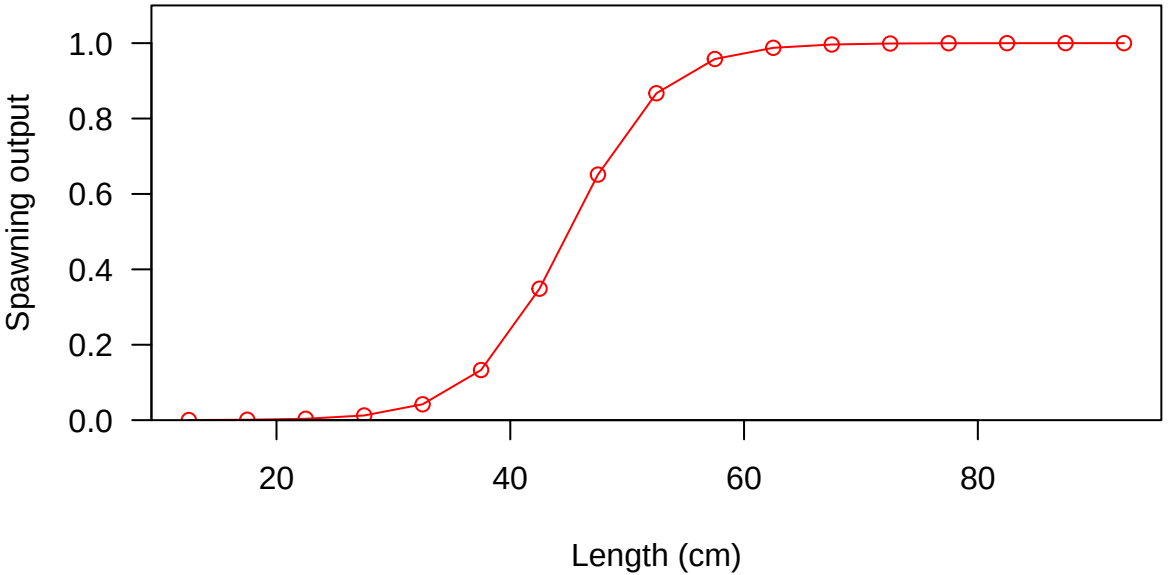

Length
Age
0
20
40
60
80
100
0
5
10
15
20
25
30
35

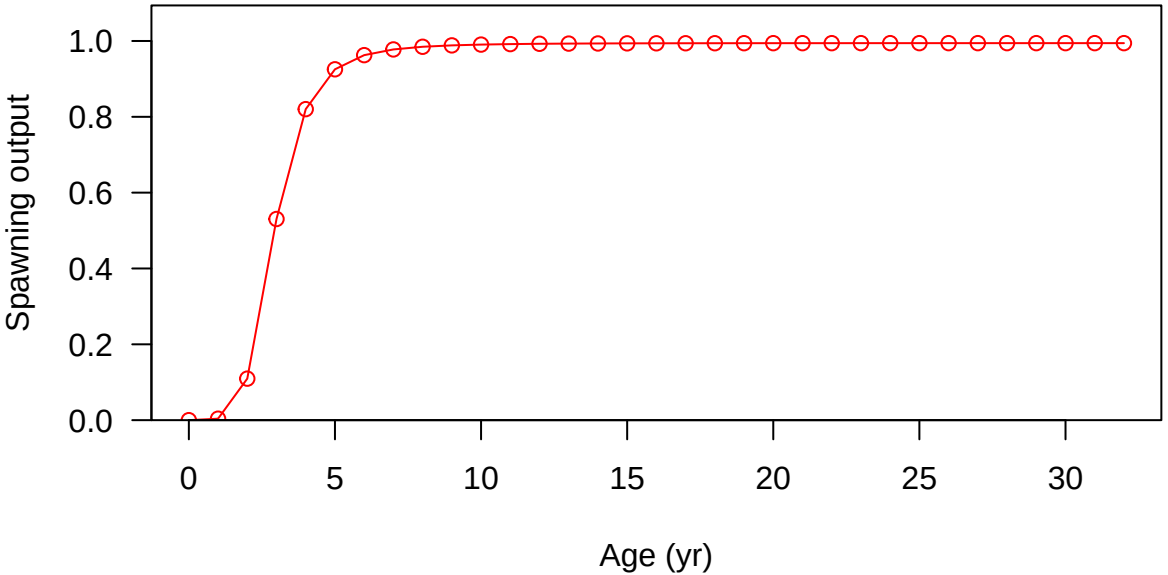

Mean weight (kg) in last year
0
2
4
6
8
10
12
20
40
60
80
Length (cm)

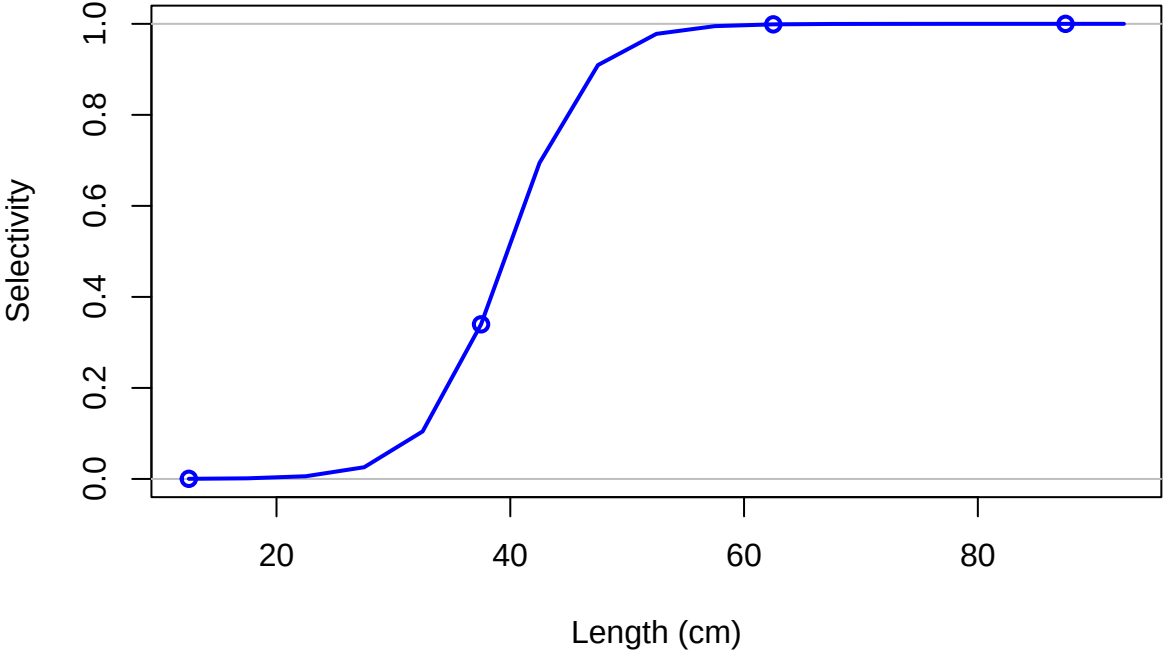

Maturity
0.0
0.2
0.4
0.6
0.8
20
40
60
80
Length (cm)

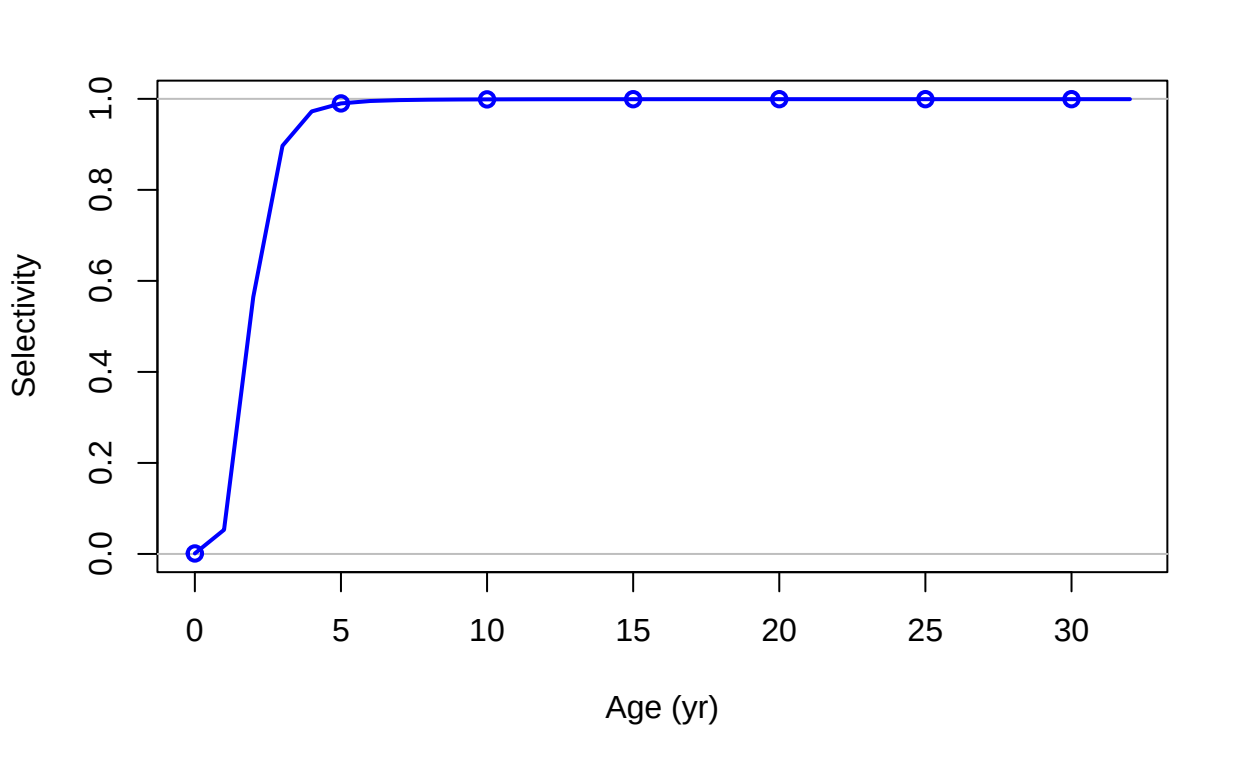

Fecundity
1.0
0.8
0.6
0.4
0.2
0.0
0
2
4
6
8
10
Female weight (kg)

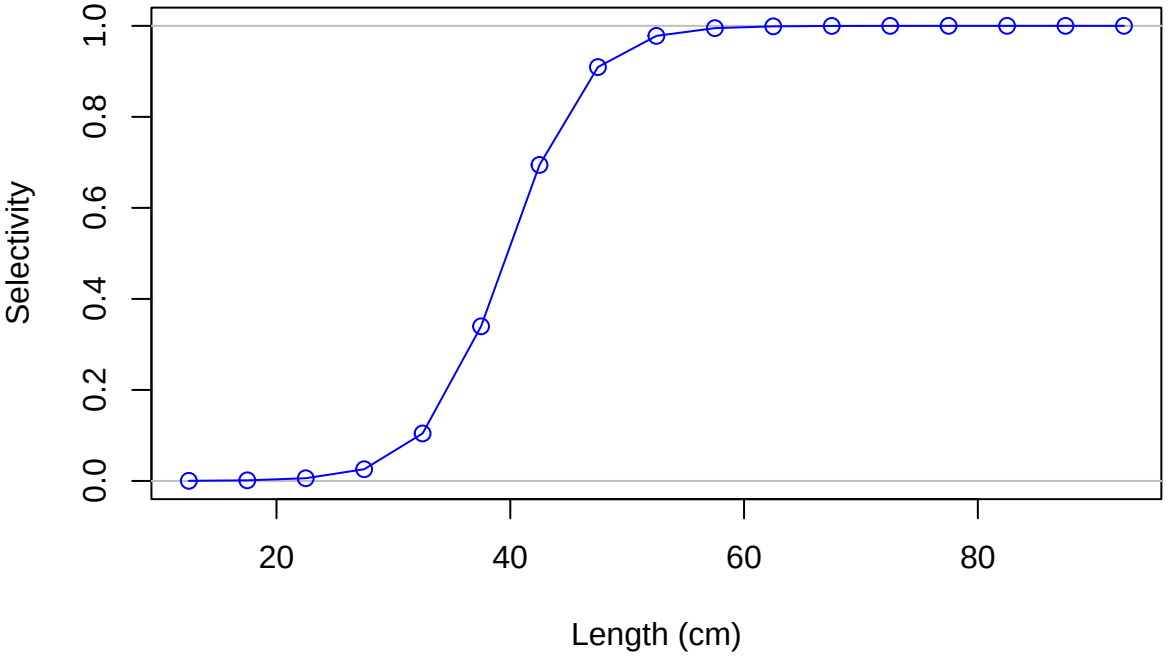

1.2
1.0
0.8
0.6
0.4
0.2
0.0
Fecundity
20
40
60
80
Female length (cm)

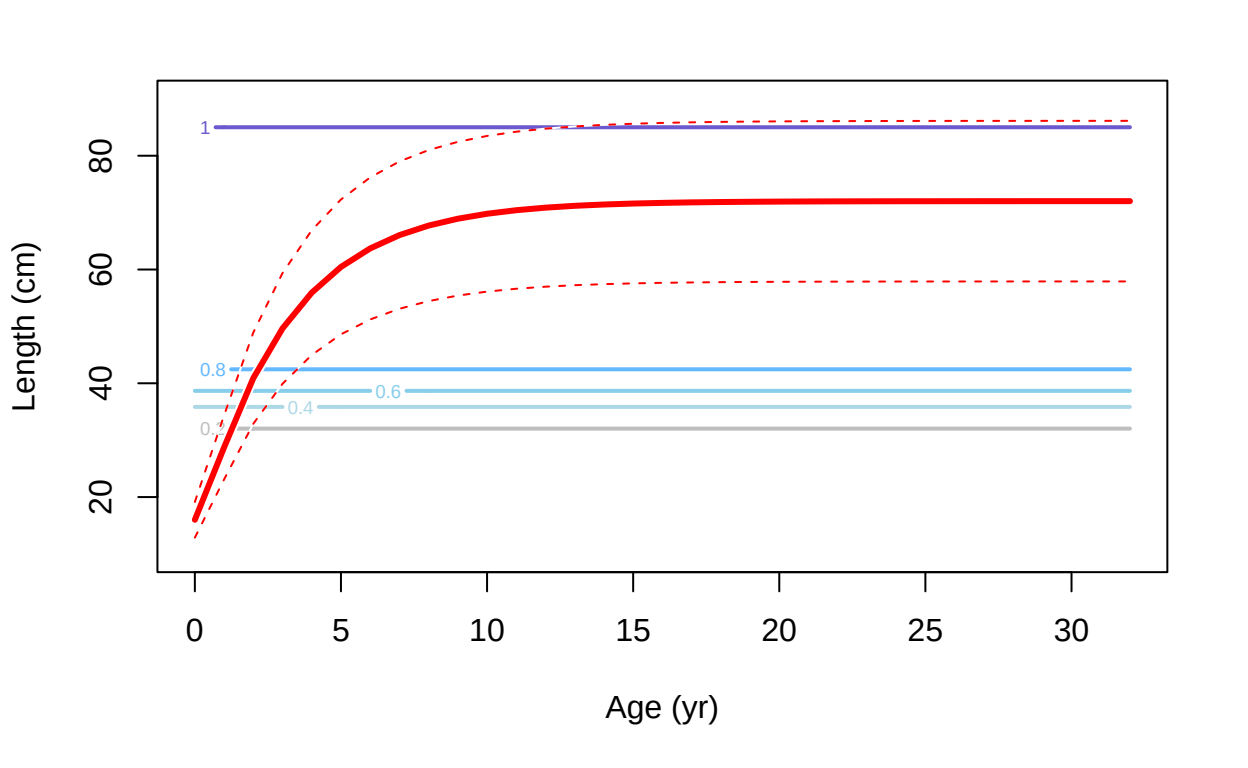

Spawning output
1.0
0.8
0.6
0.4
0.2
0.0
20
40
60
80
Length (cm)

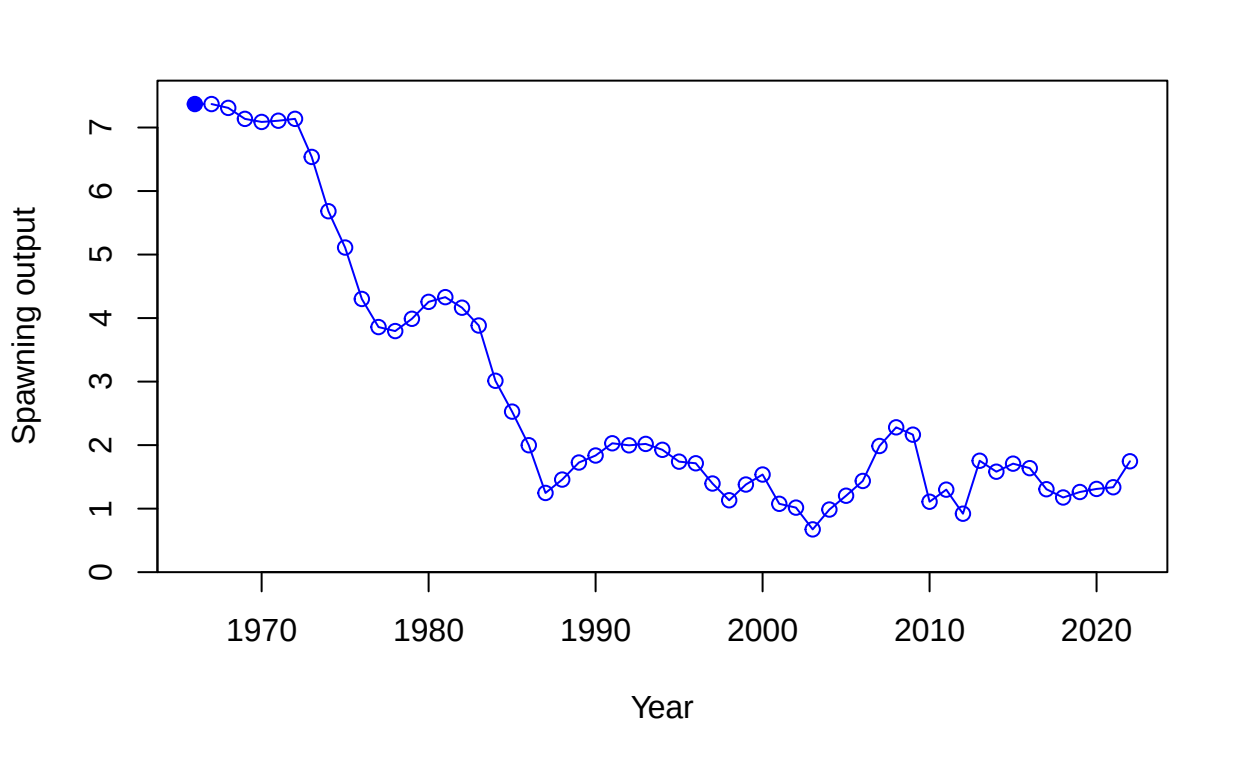

Spawning output
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30
Age (yr)

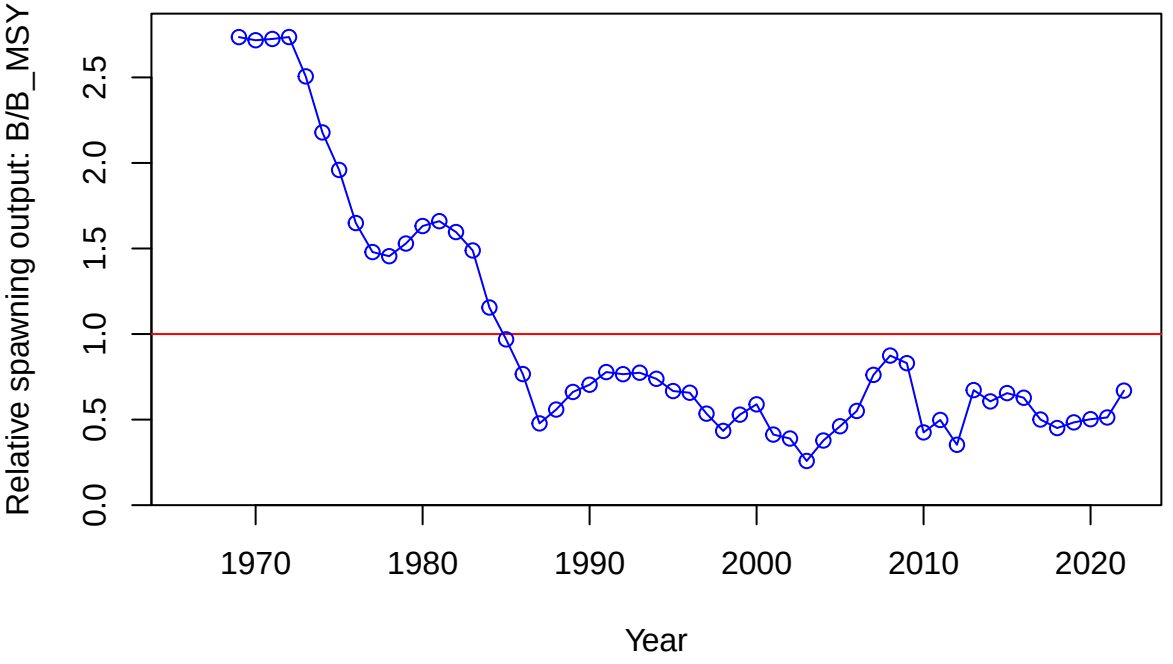

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
20
40
60
80
Length (cm)

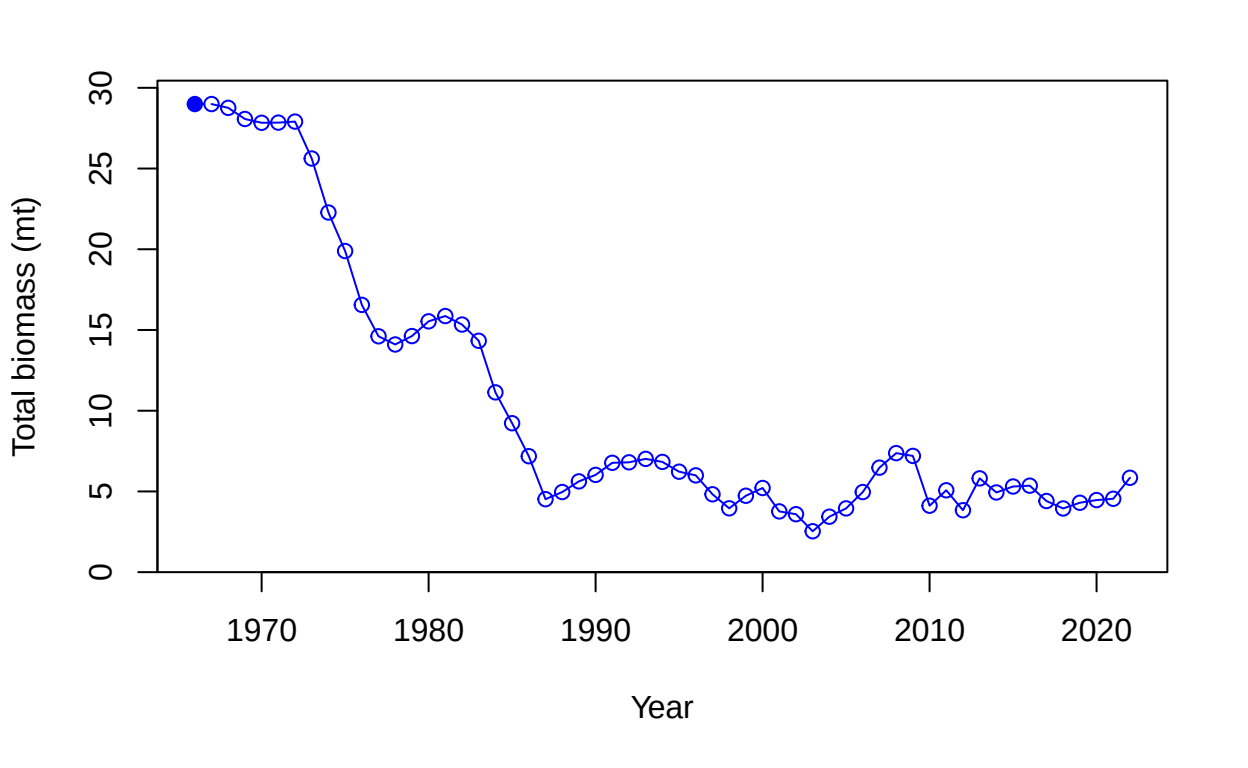

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
5
10
15
20
25
30
Age (yr)

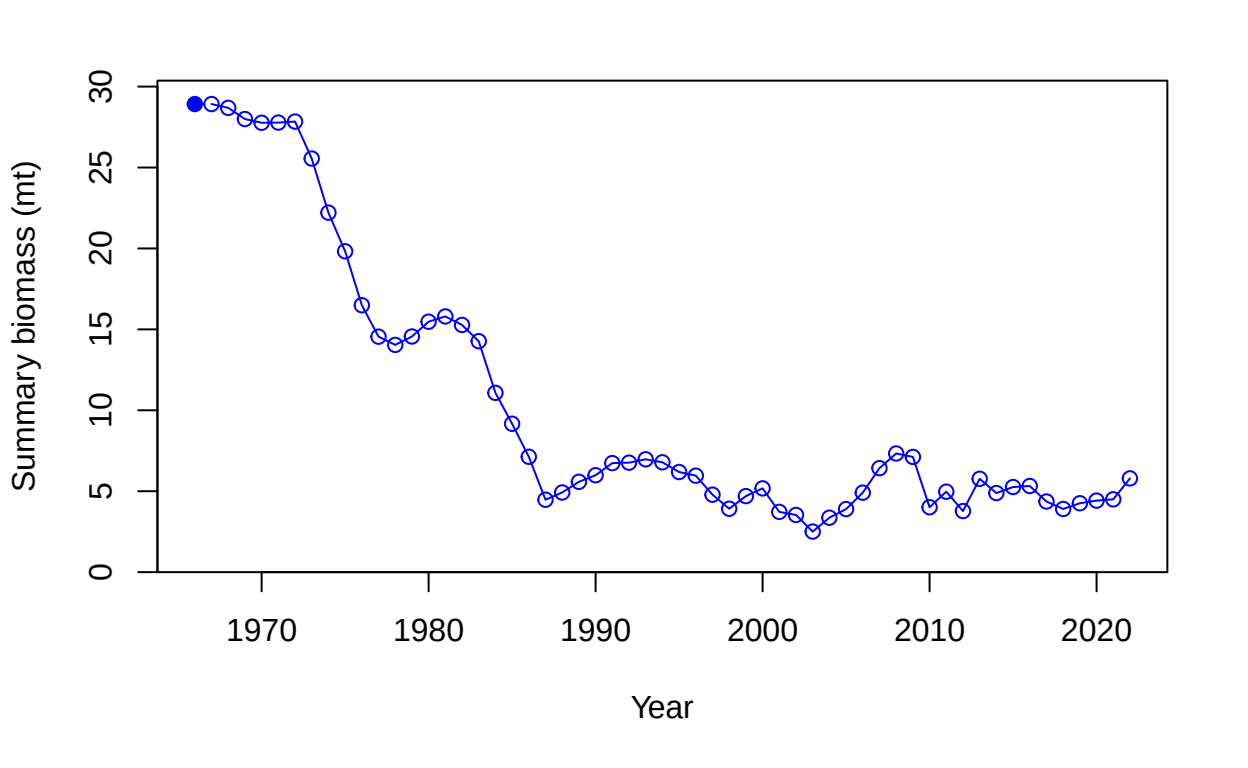

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
20
40
60
80
Length (cm)

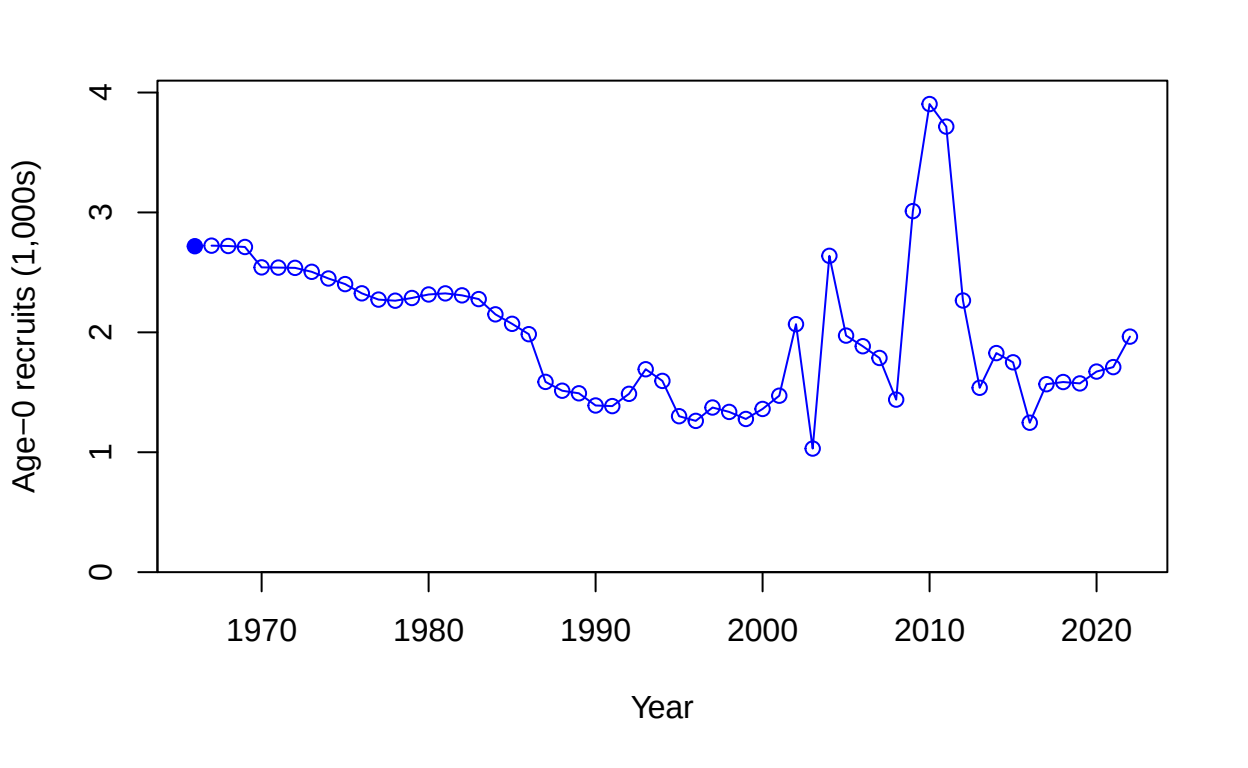

Length (cm)
20
40
60
80
0
5
10
15
20
25
30
Age (yr)
1
0.8
0.6
0.4
0.2

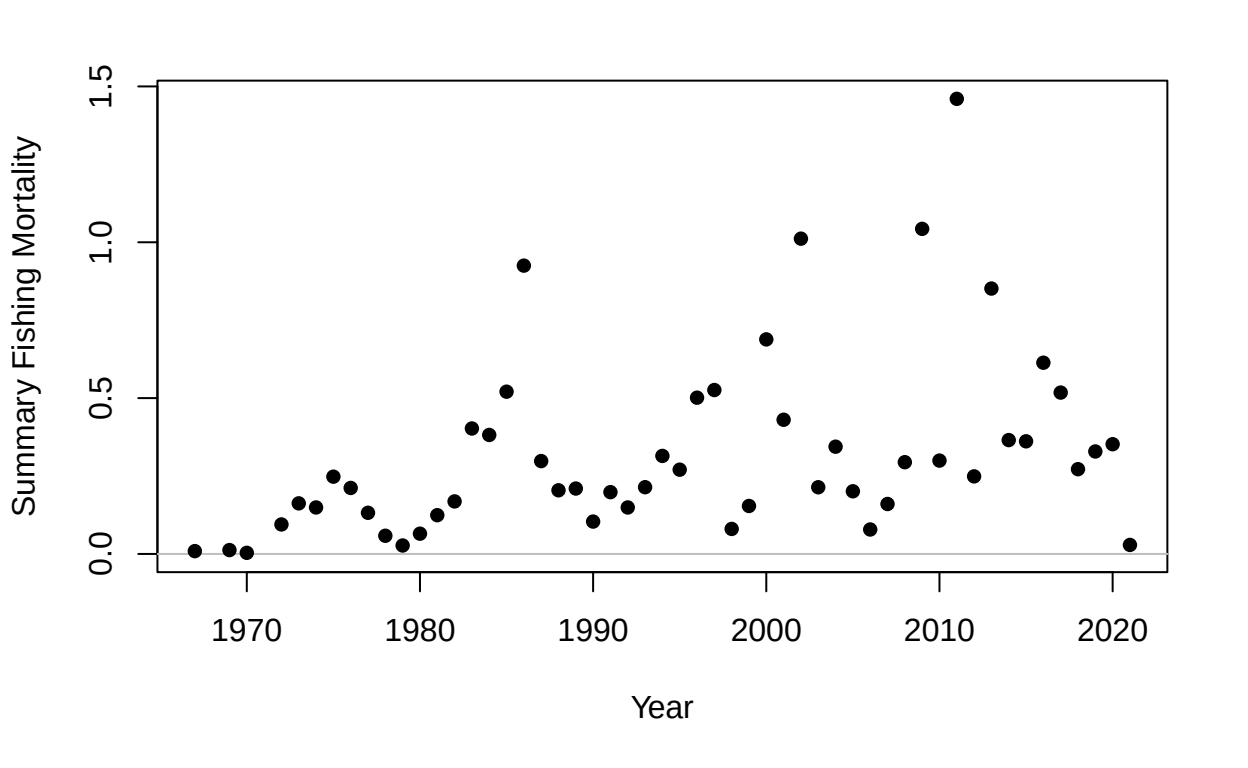

Spawning output
0
1
2
3
4
5
6
7
1970
1980
1990
2000
2010
2020
Year

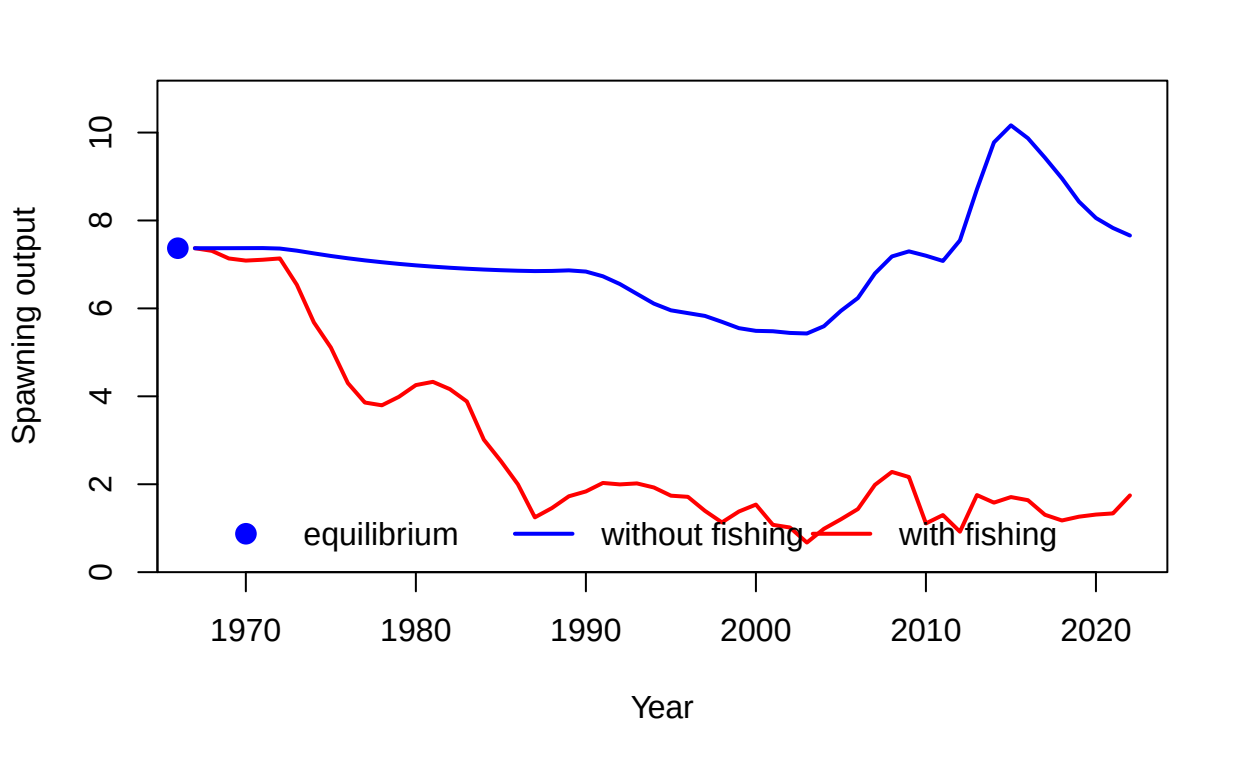

Relative spawning output: B/B_MSY
0.0
0.5
1.0
1.5
2.0
2.5
1970
1980
1990
2000
2010
2020
Year

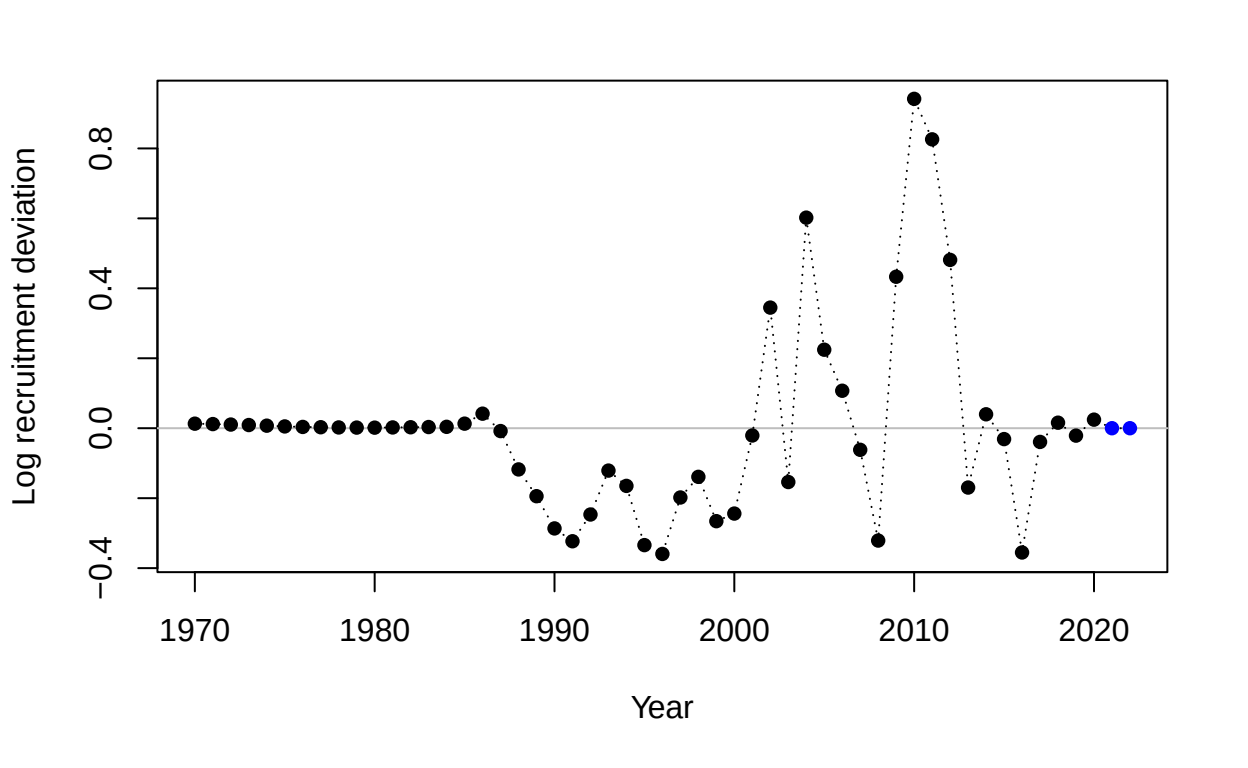

Total biomass (mt)
0
5
10
15
20
25
30
1970
1980
1990
2000
2010
2020
Year

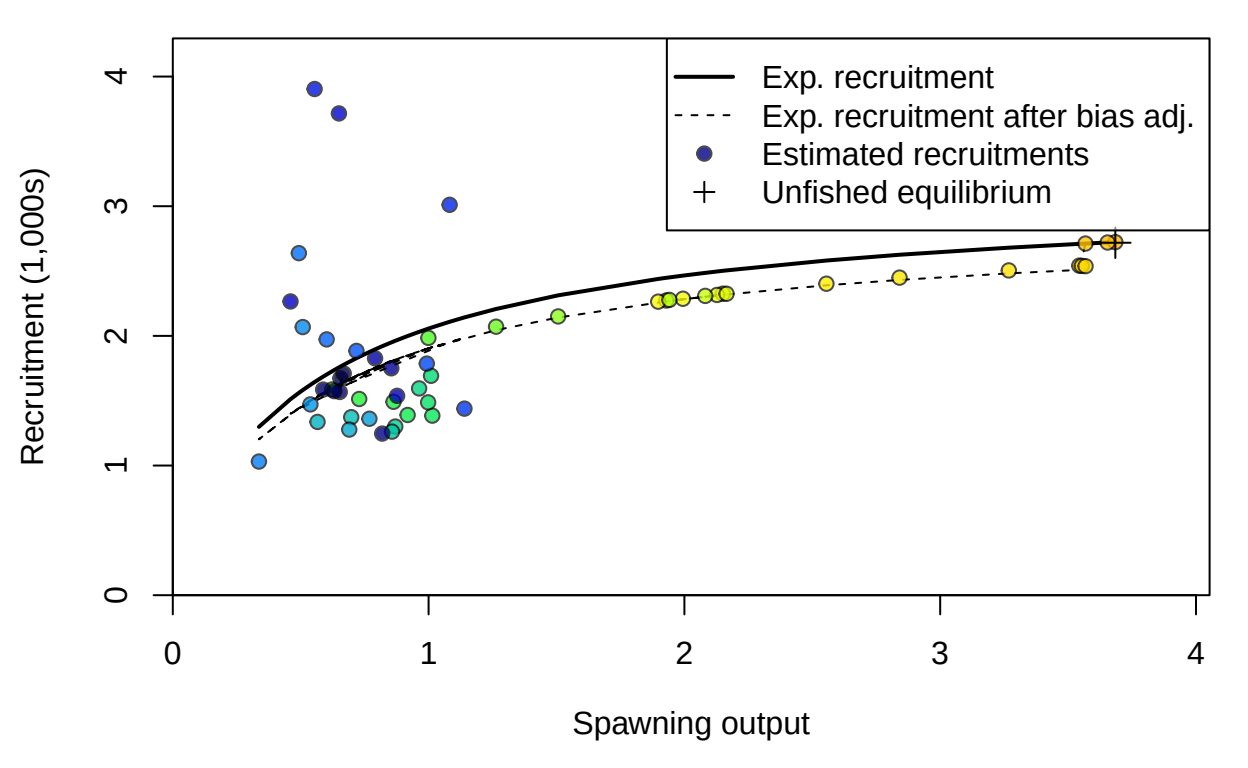

Summary biomass (mt)
0
5
10
15
20
25
30
1970
1980
1990
2000
2010
2020
Year

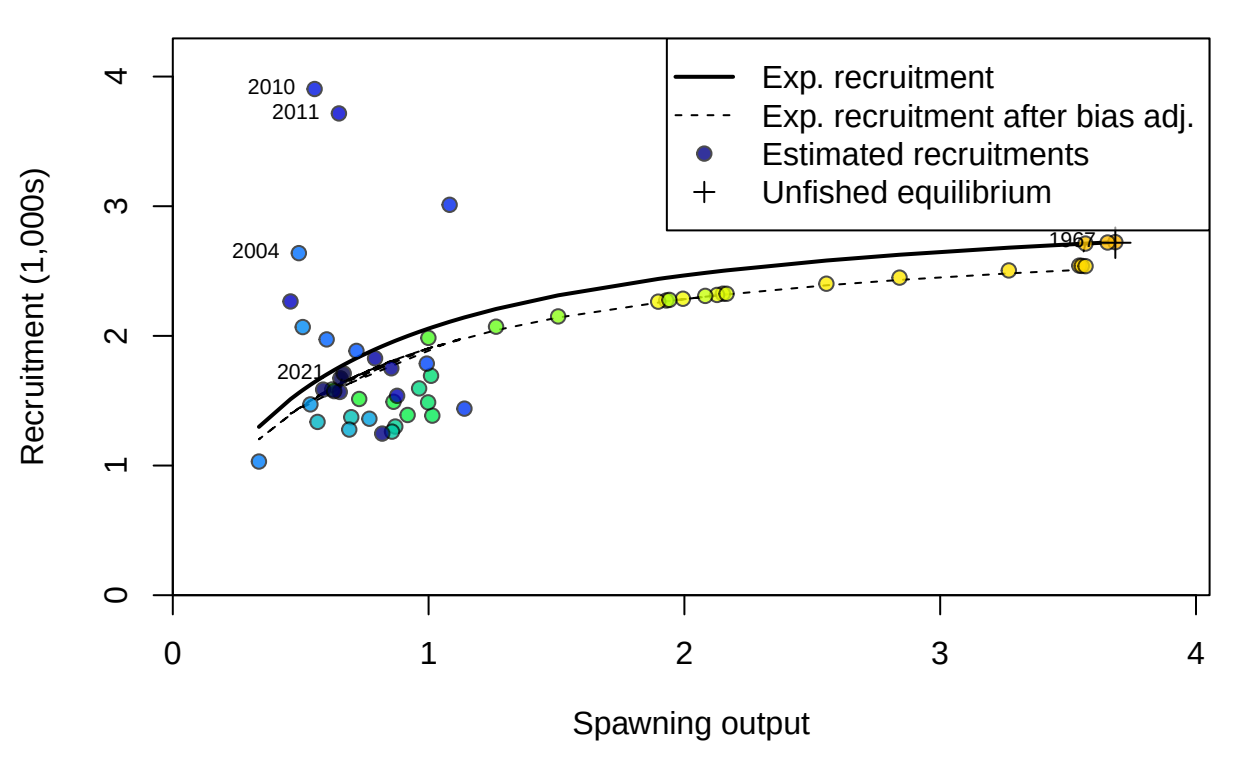

Age−0 recruits (1,000s)
0
1
2
3
4
1970
1980
1990
2000
2010
2020
Year

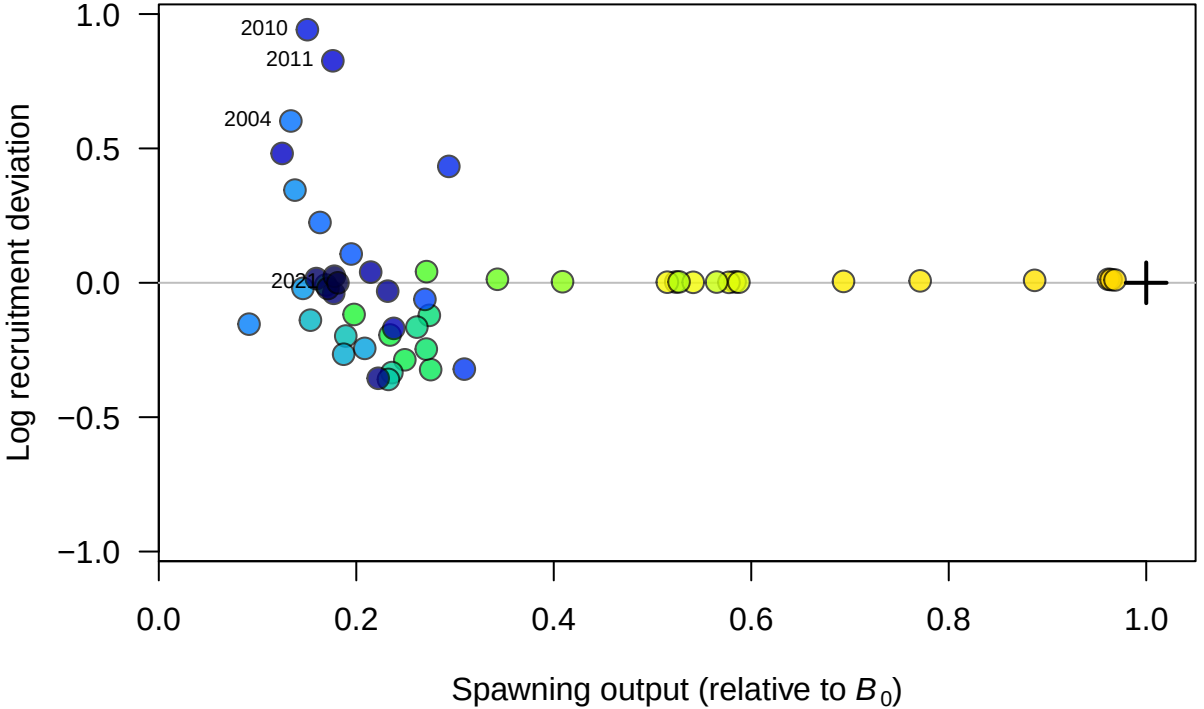

Summary Fishing Mortality
0.0
0.5
1.0
1.5
1970
1980
1990
2000
2010
2020
Year

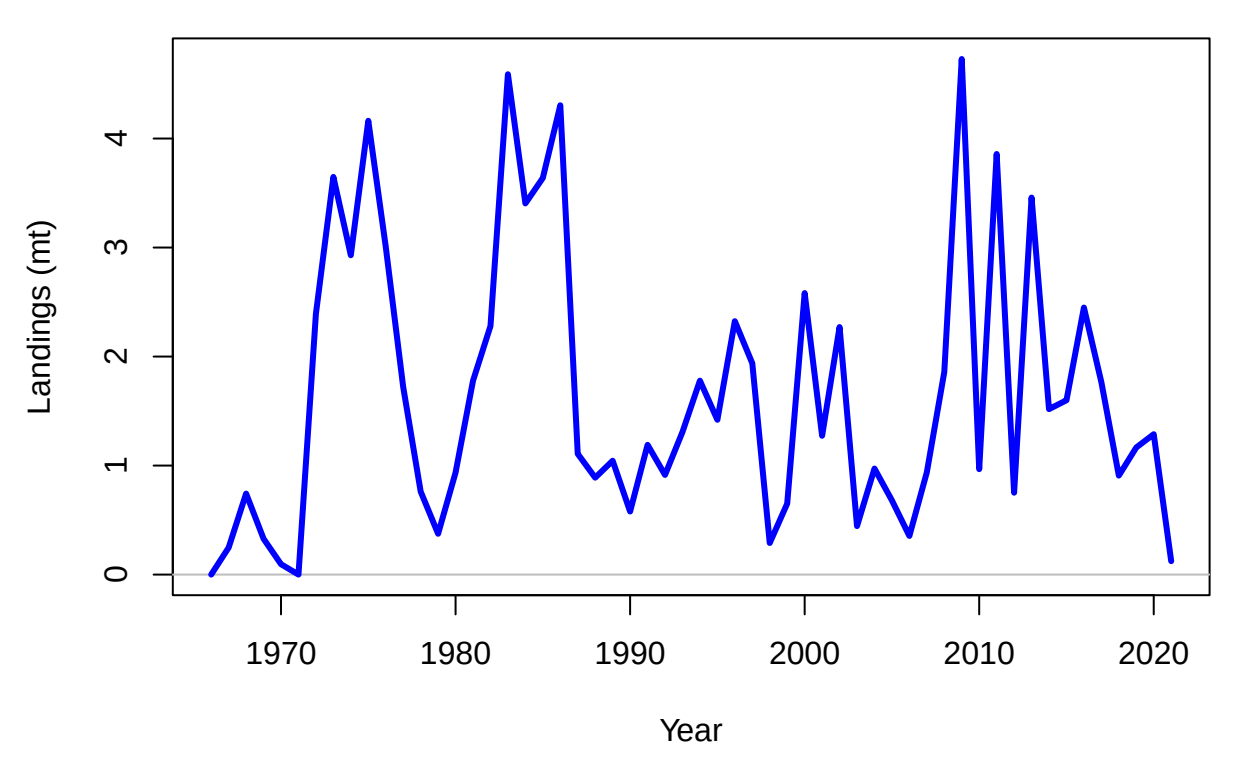

Spawning output
0
2
4
6
8
10
1970
1980
1990
2000
2010
2020
Year
equilibrium
without fishing
with fishing

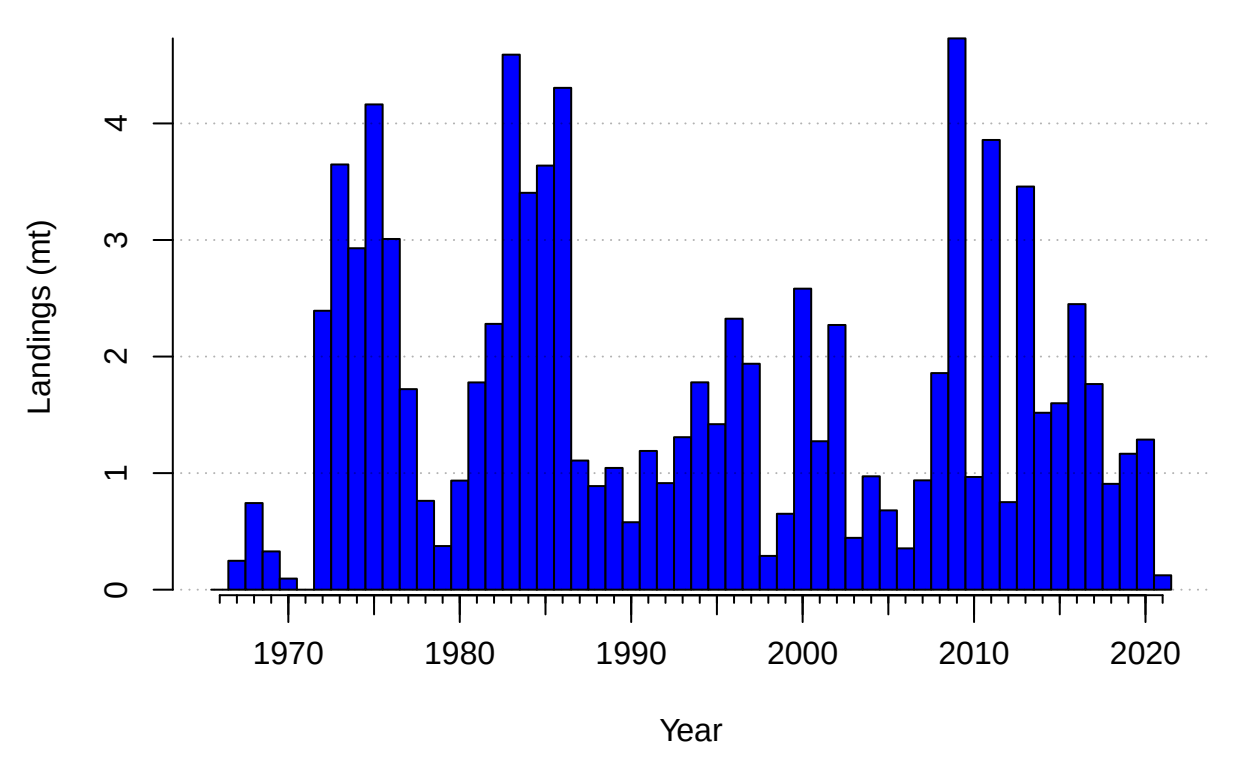

Log recruitment deviation
0.8
0.4
0.0
−0.4
1970
1980
1990
2000
2010
2020
Year

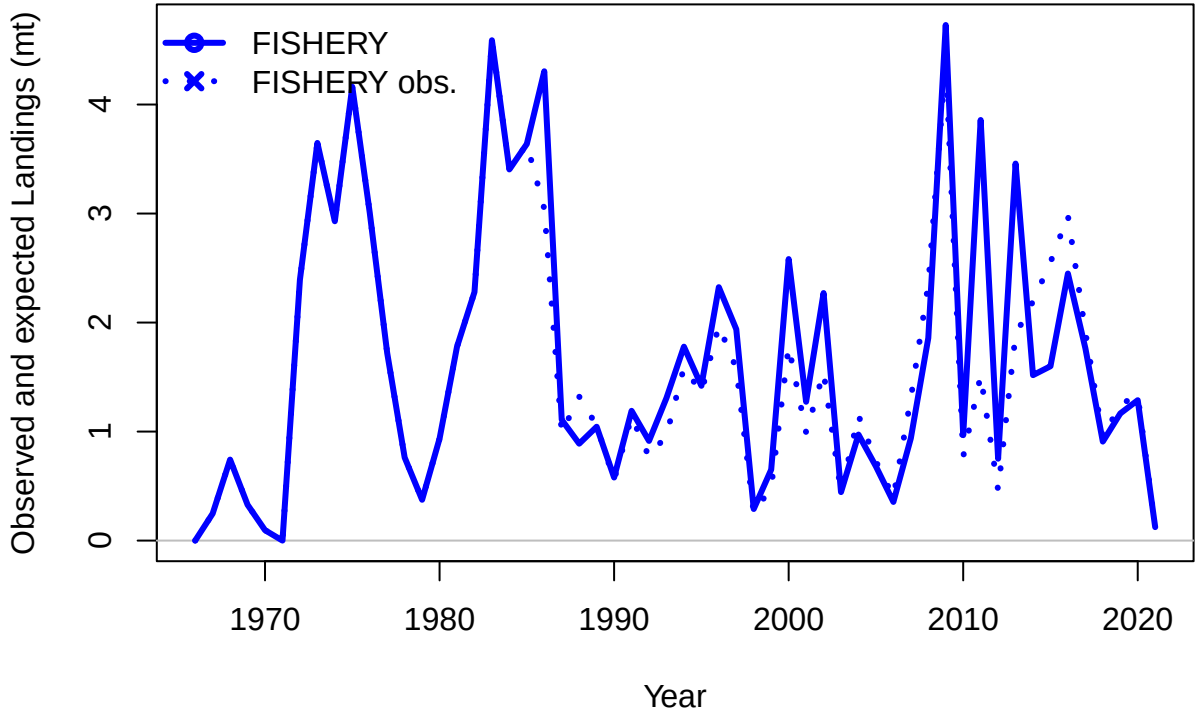

Exp. recruitment
Exp. recruitment after bias adj.
Estimated recruitments
Unfished equilibrium
Recruitment (1,000s)
Spawning output
0
1
2
3
4

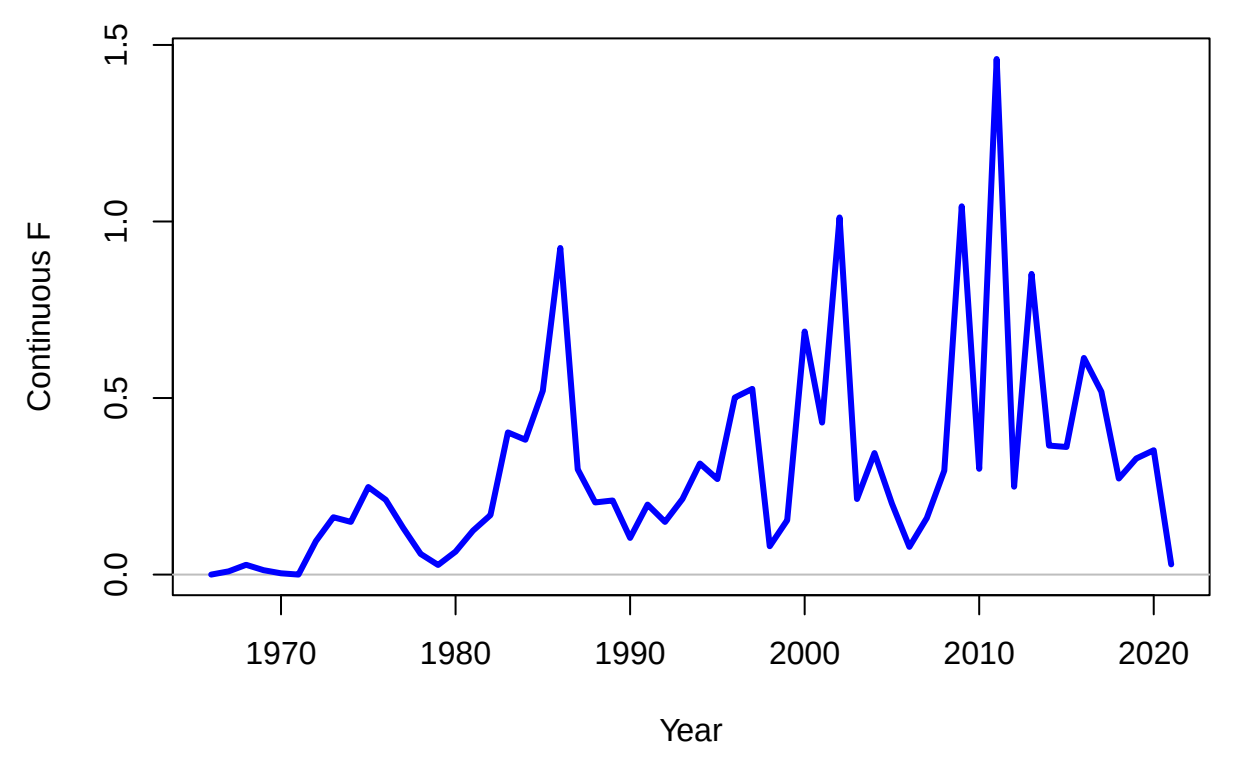

Exp. recruitment
Exp. recruitment after bias adj.
Estimated recruitments
Unfished equilibrium
2010
2011
2004
2021
1967
Recruitment (1,000s)
Spawning output
0
1
2
3
4

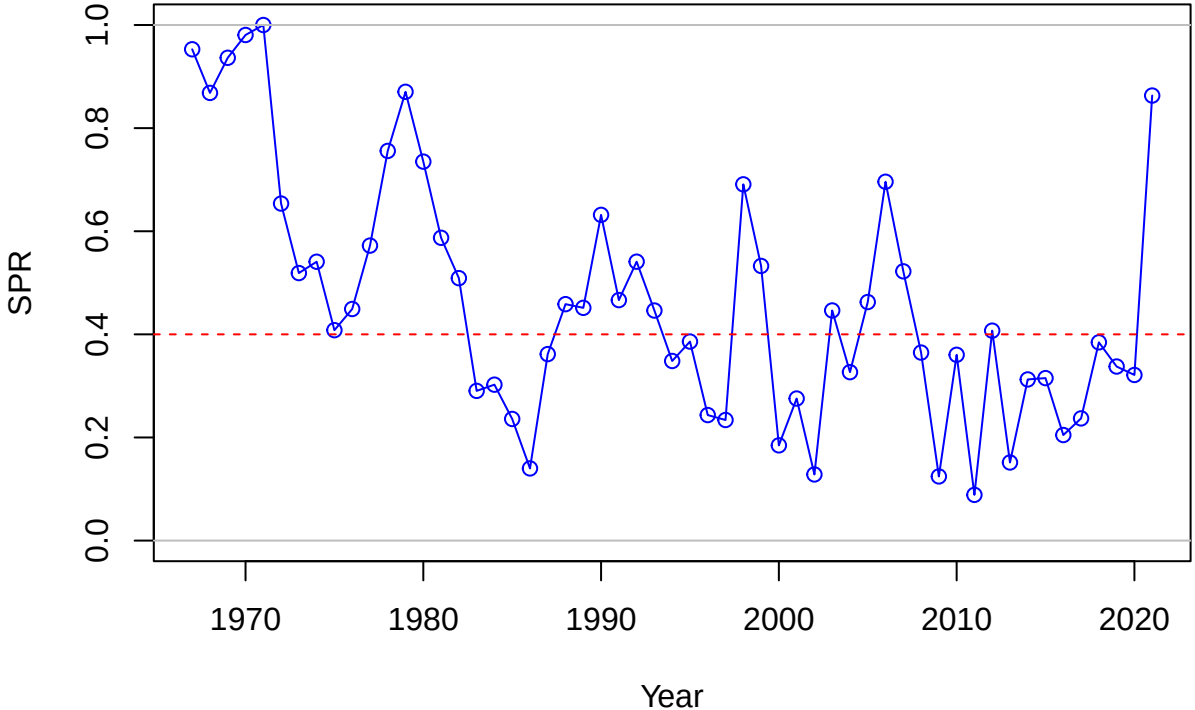

2010
2011
2004
2021
1.0
0.5
0.0
−0.5
−1.0
Log recruitment deviation
0.0
0.2
0.4
0.6
0.8
1.0
Spawning output (relative to B_0)

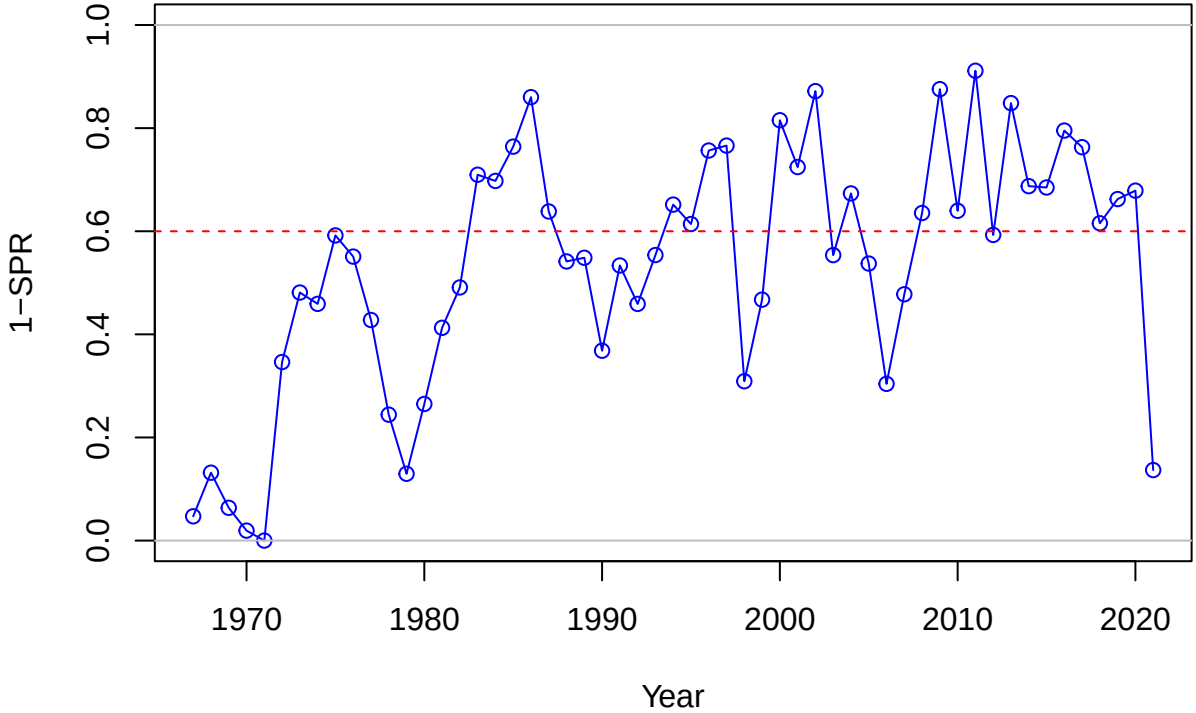

Landings (mt)
0
1
2
3
4
1970
1980
1990
2000
2010
2020
Year

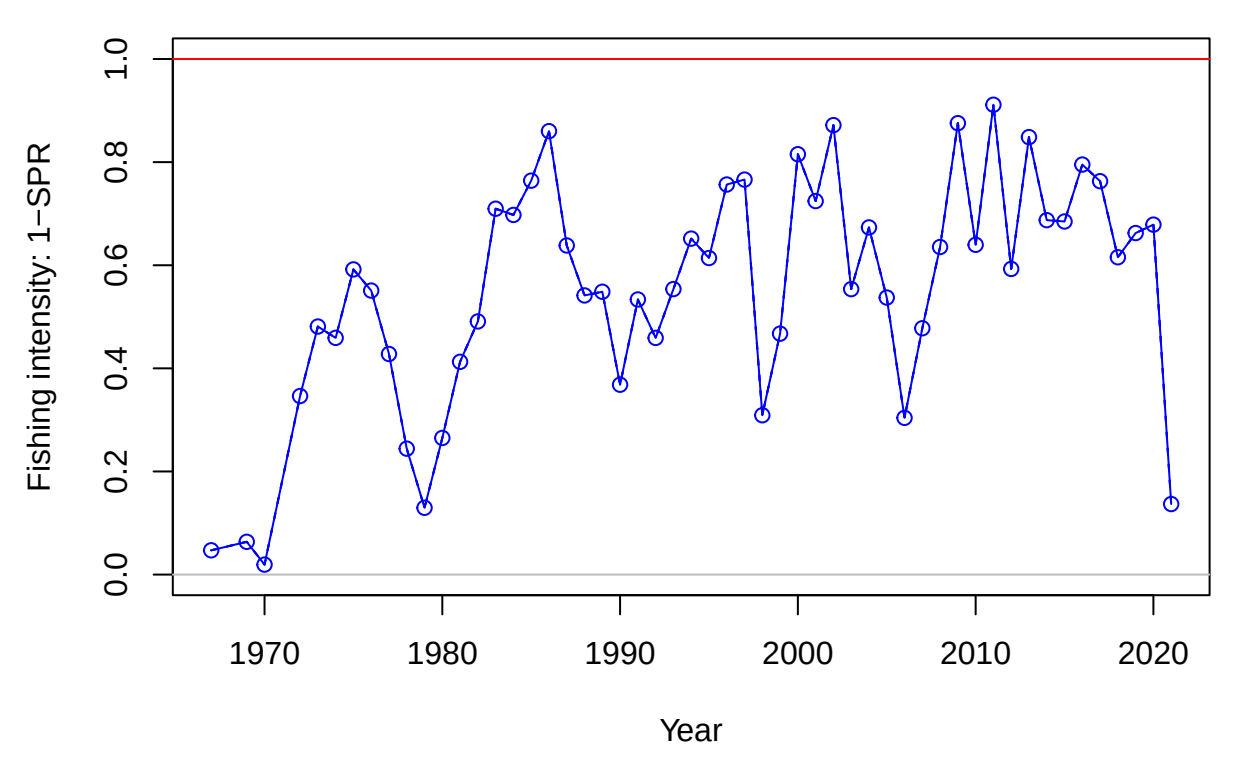

Landings (mt)
0
1
2
3
4
1970
1980
1990
2000
2010
2020
Year

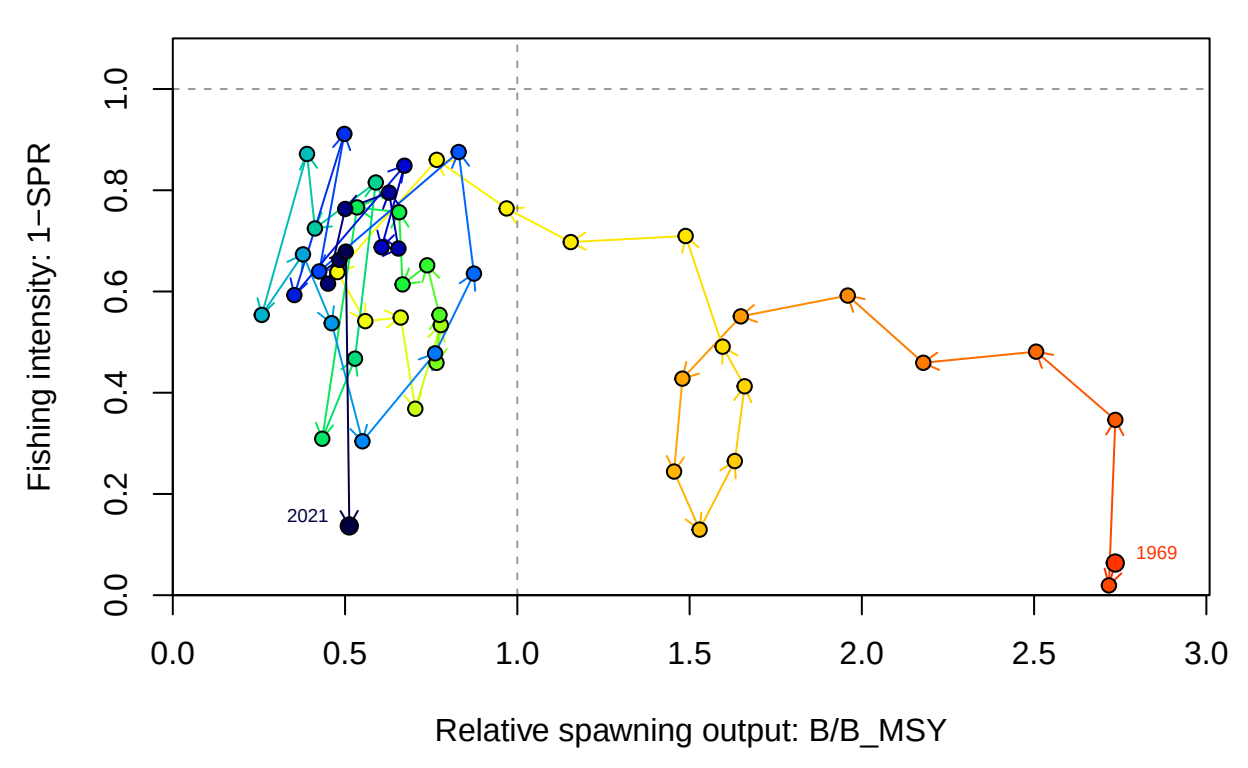

FISHERY
FISHERY obs.
Observed and expected Landings (mt)
0
1
2
3
4
1970
1980
1990
2000
2010
2020
Year

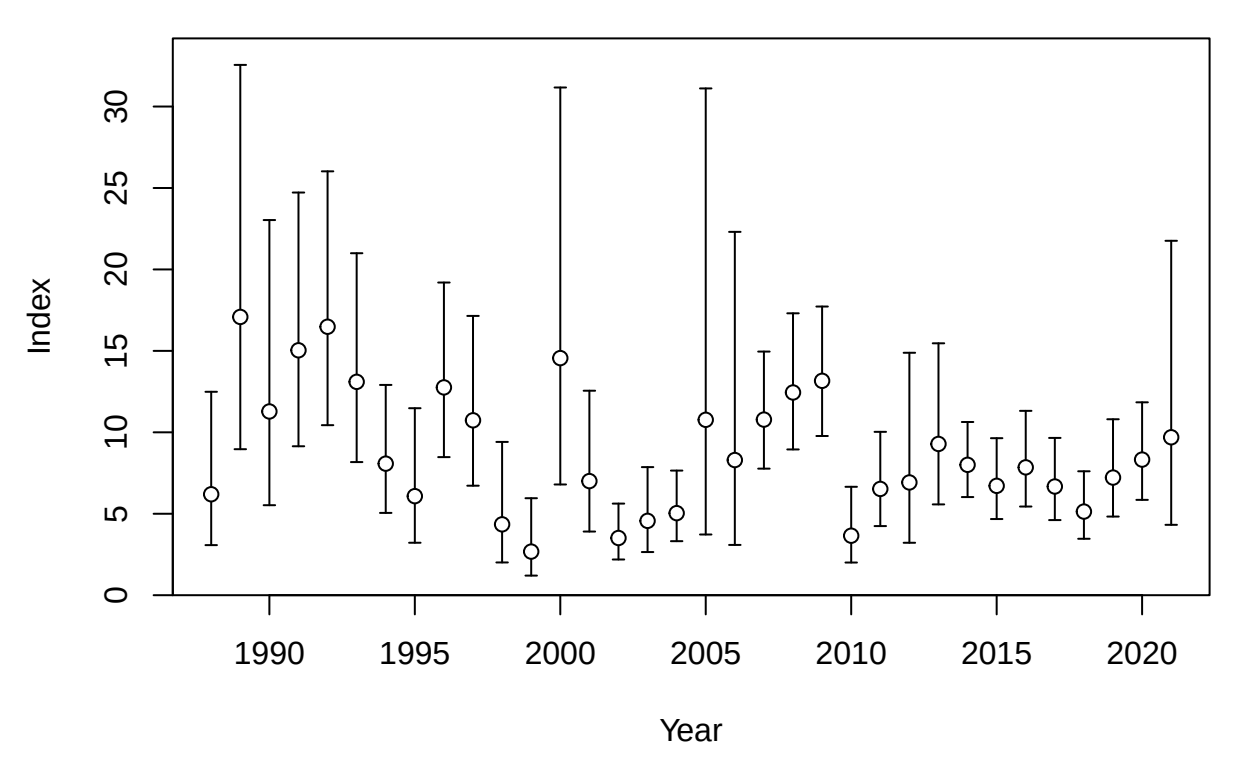

Continuous F
0.0
0.5
1.0
1.5
1970
1980
1990
2000
2010
2020
Year

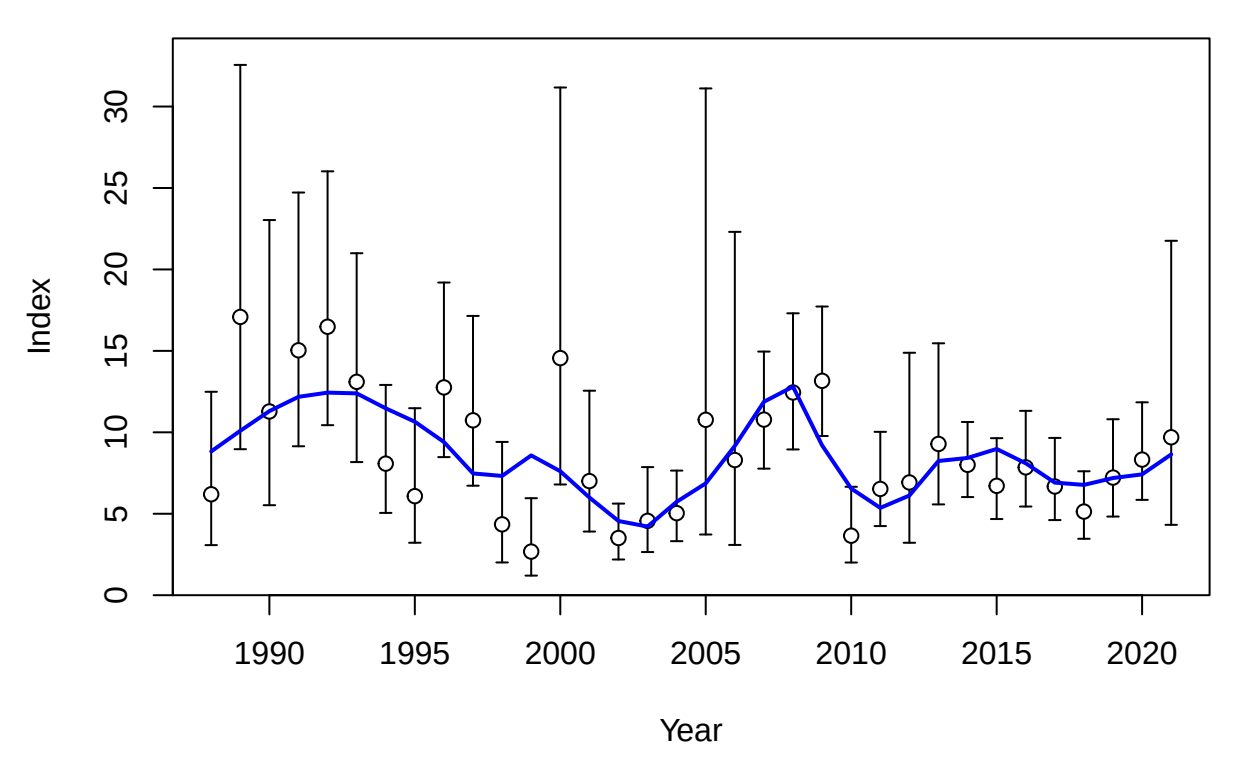

SPR
0.0
0.2
0.4
0.6
0.8
1.0
1970
1980
1990
2000
2010
2020
Year

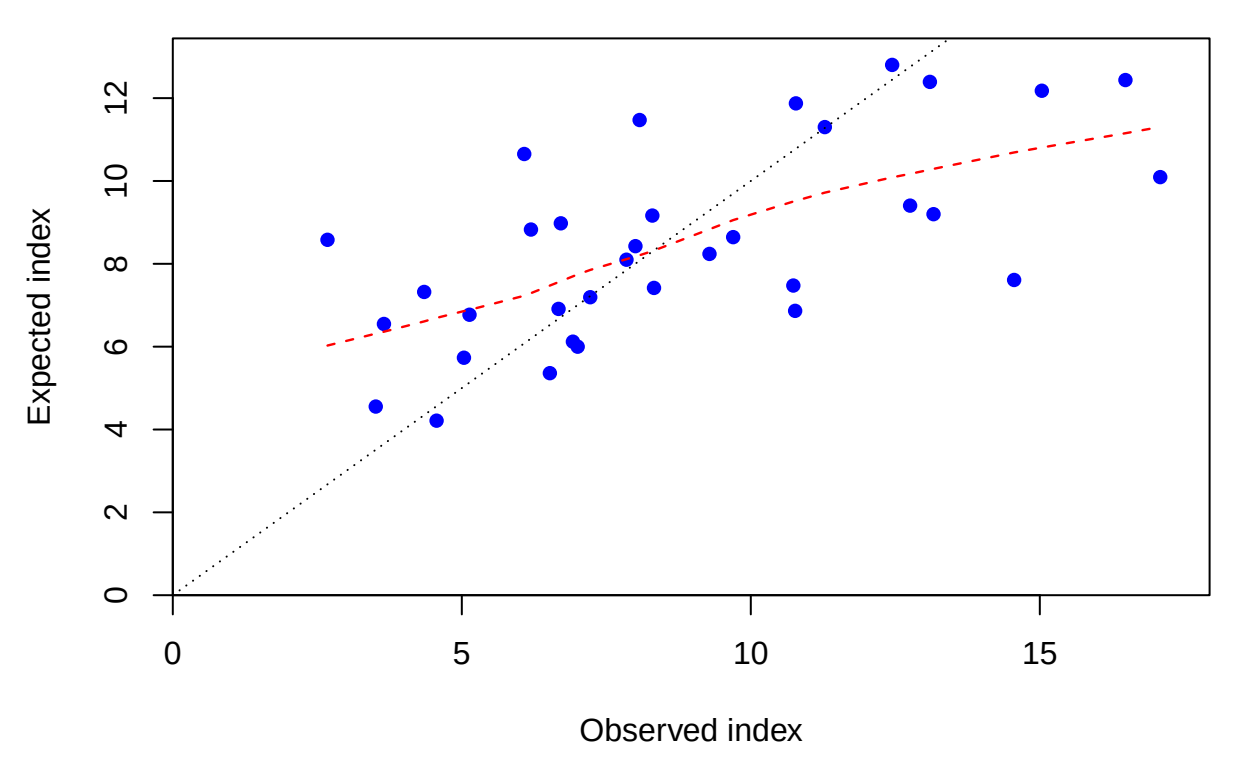

1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
1970
1980
1990
2000
2010
2020
Year

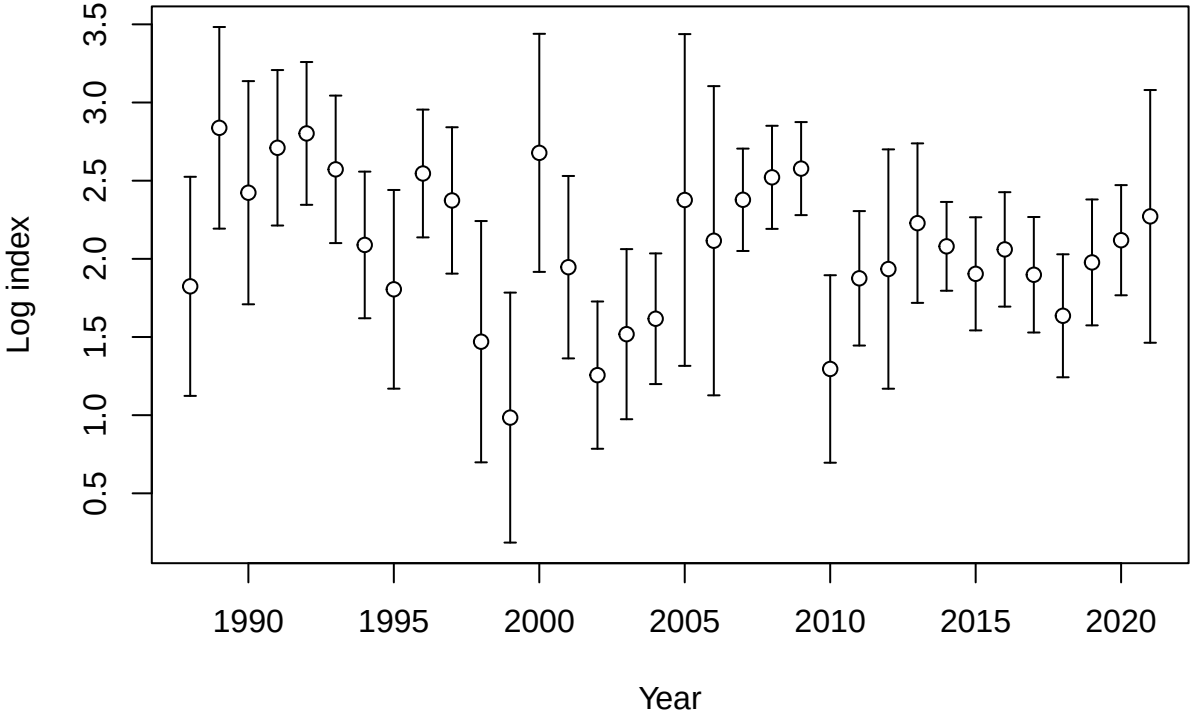

Fishing intensity: 1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
1970
1980
1990
2000
2010
2020
Year

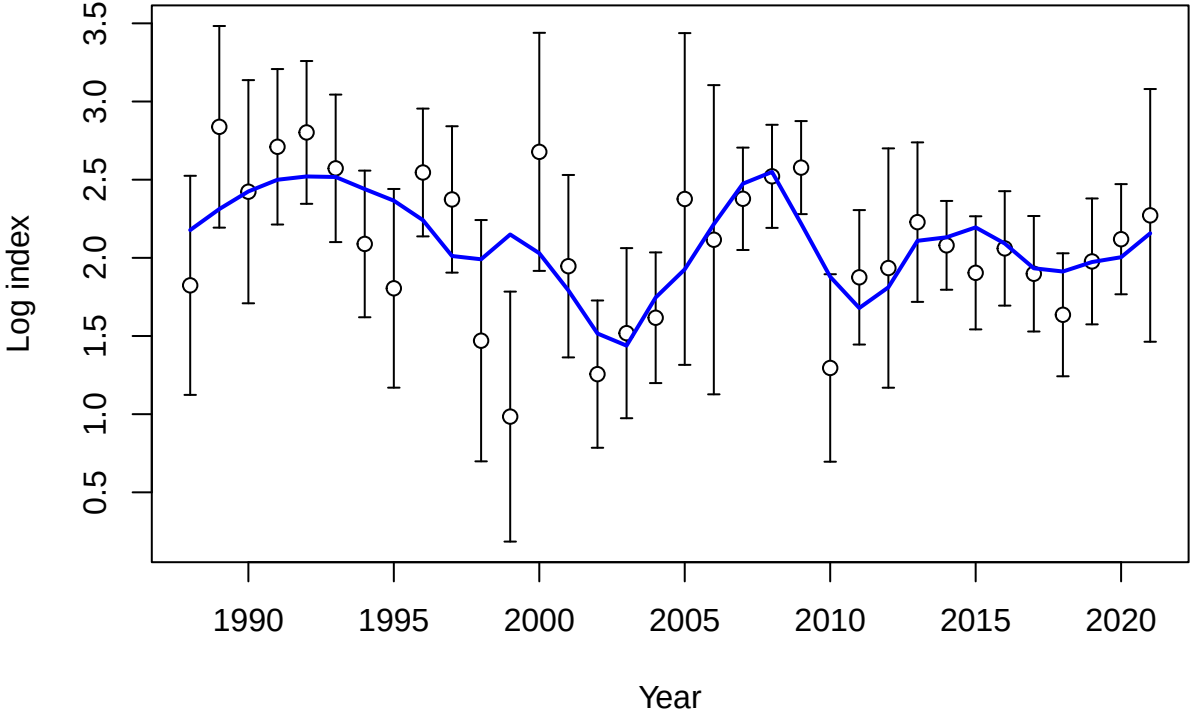

Fishing intensity: 1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
Relative spawning output: B/B_MSY
2021
1969

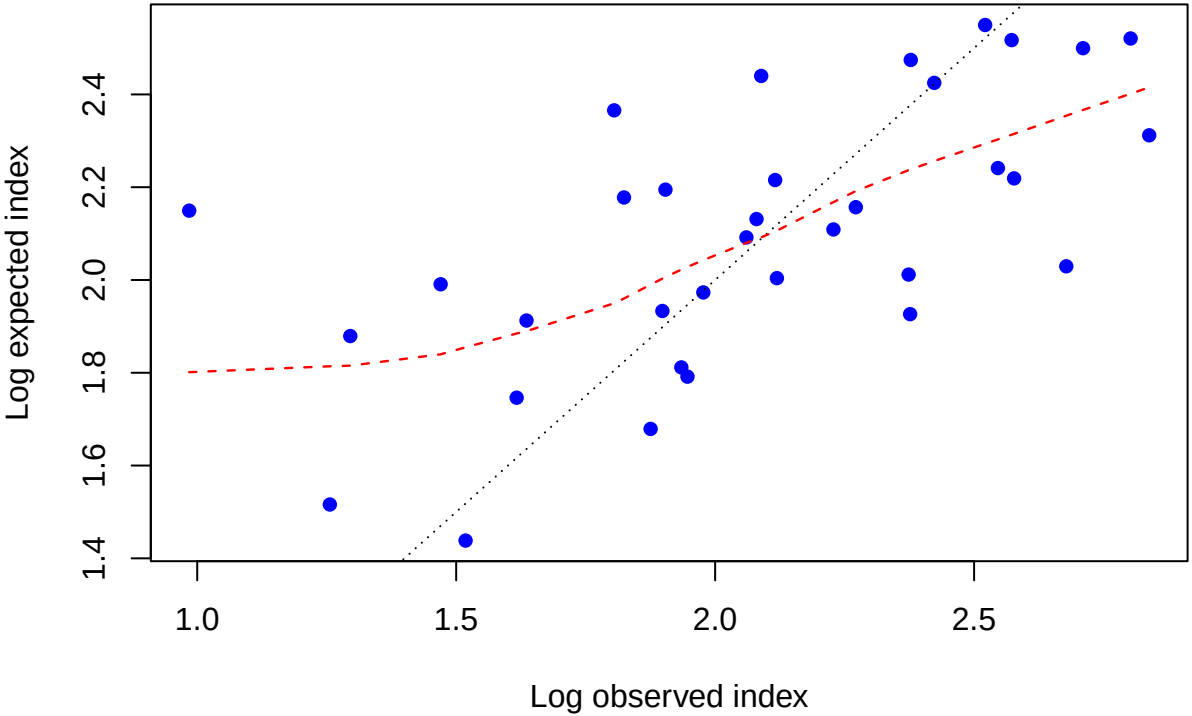

Index
0
5
10
15
20
25
30
1990
1995
2000
2005
2010
2015
2020
Year

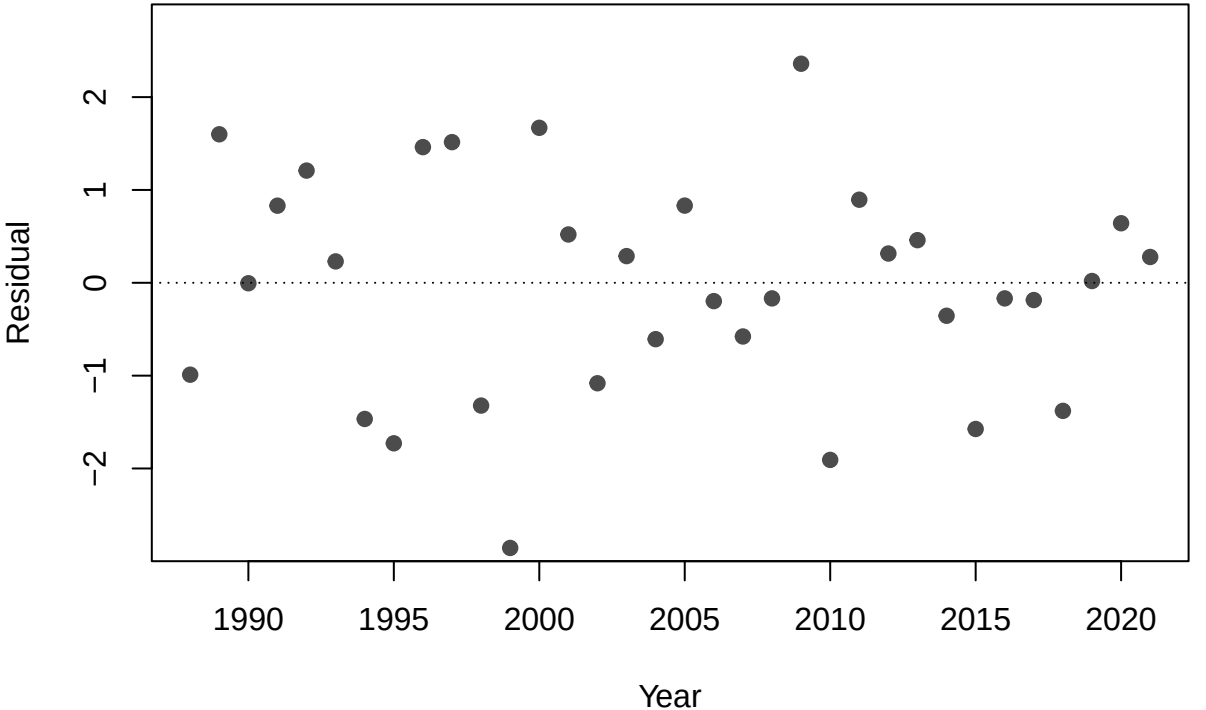

Index
0
5
10
15
20
25
30
1990
1995
2000
2005
2010
2015
2020
Year

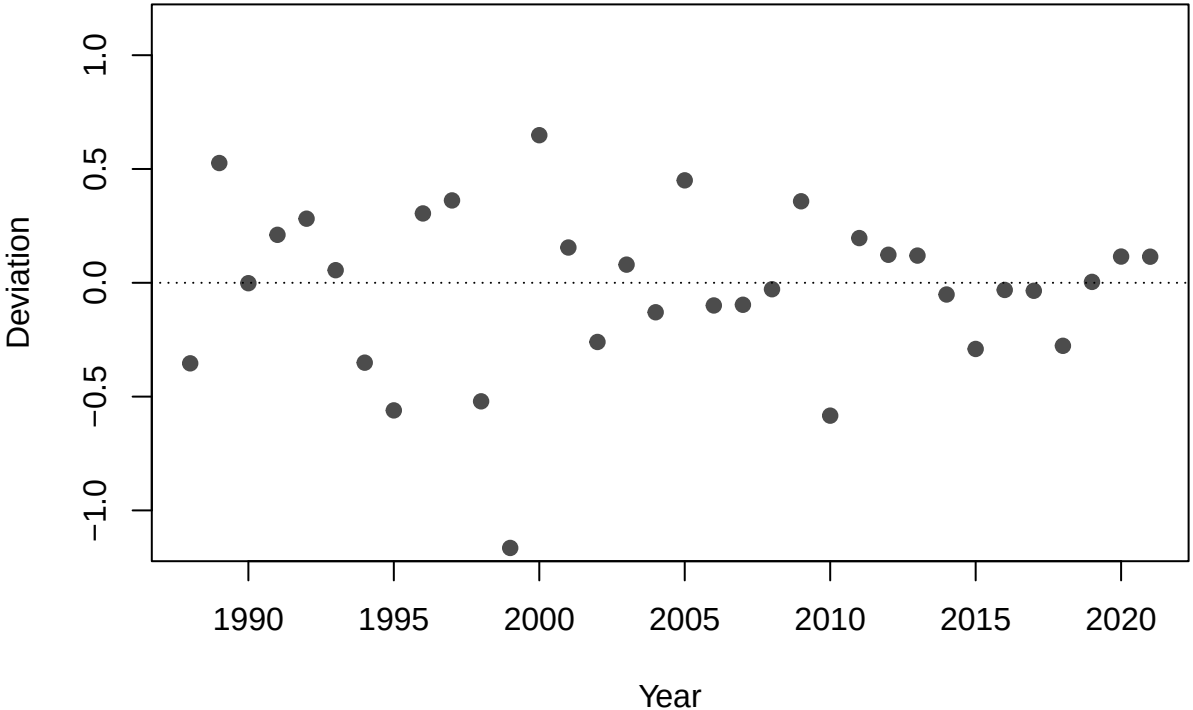

Expected index
0
2
4
6
8
10
12
0
5
10
15
Observed index

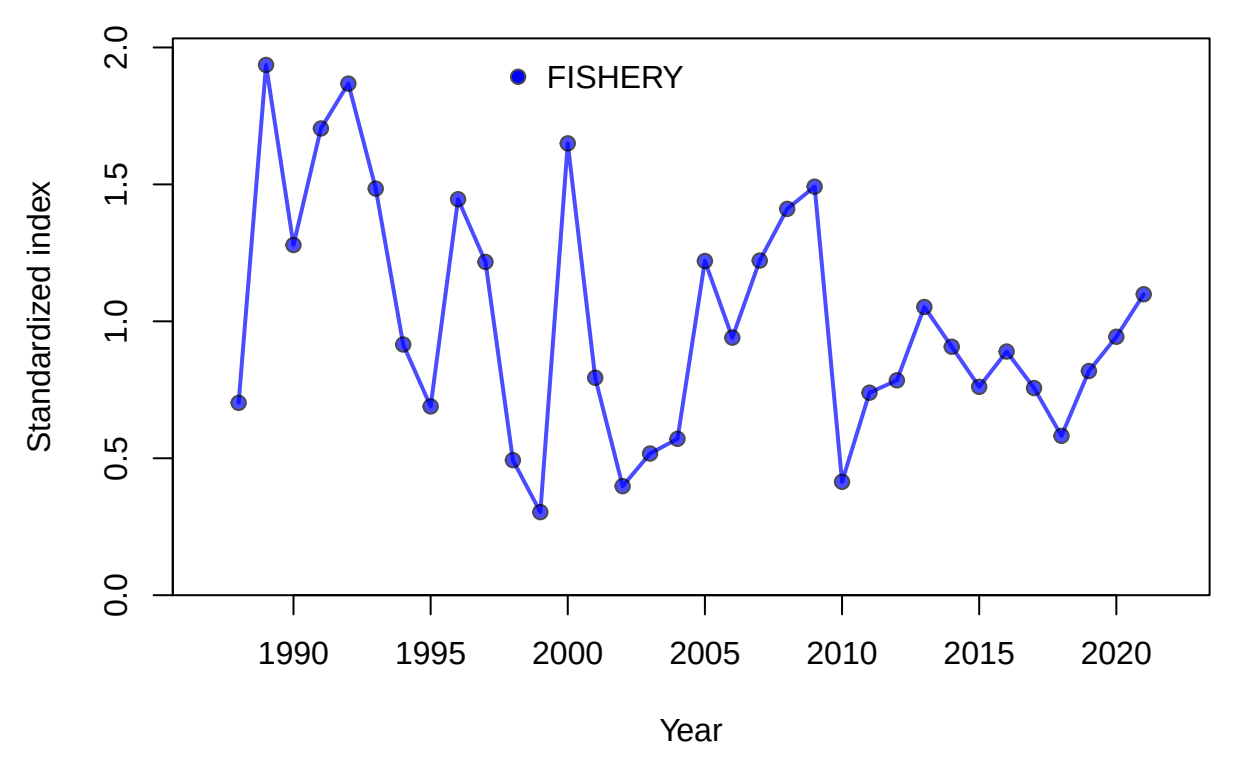

Log index
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1990
1995
2000
2005
2010
2015
2020
Year

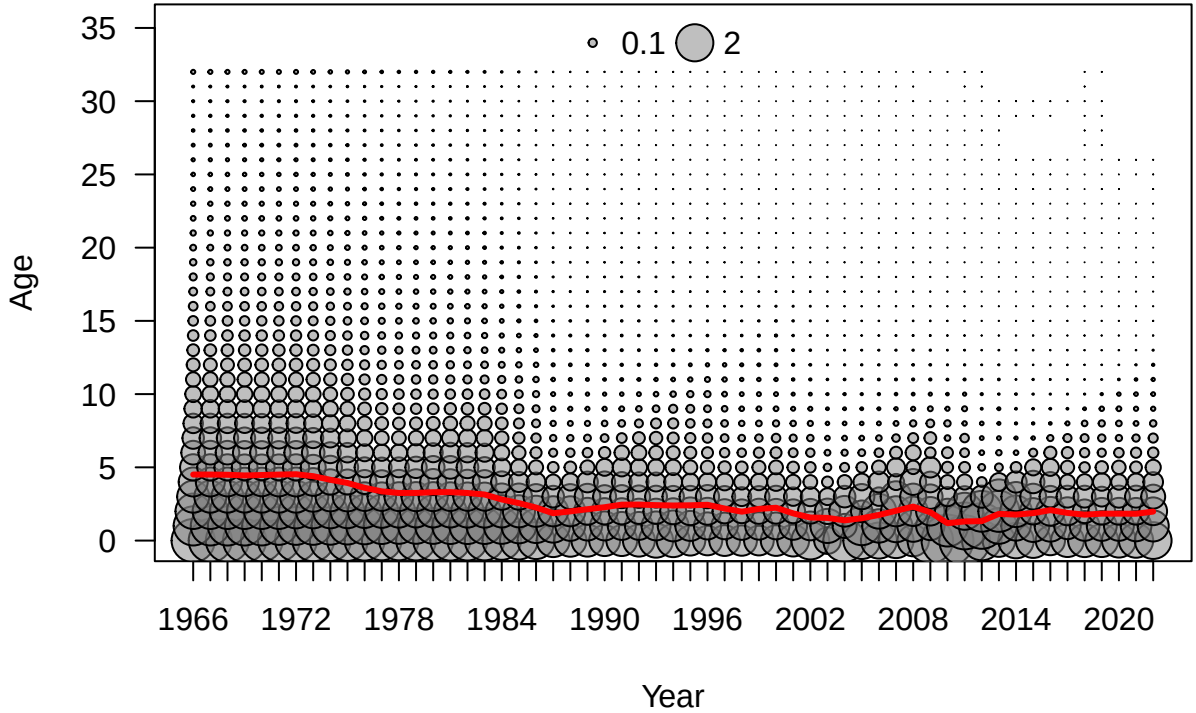

Log index
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1990
1995
2000
2005
2010
2015
2020
Year

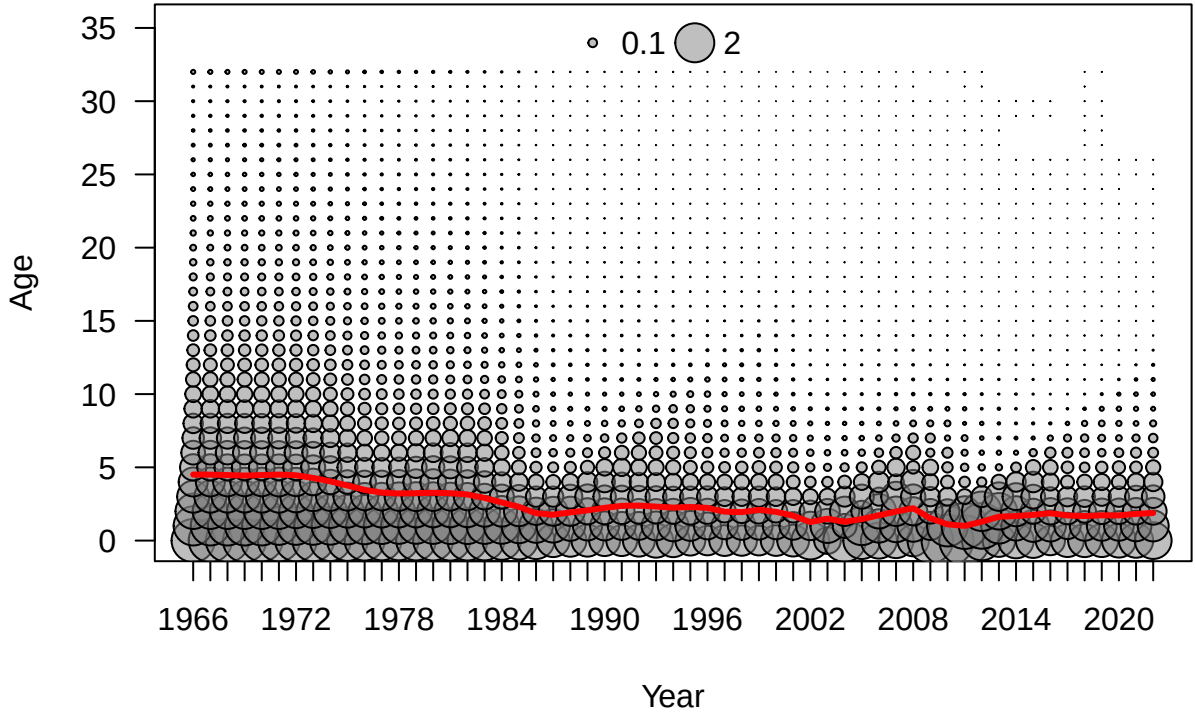

Log expected index
1.4
1.6
1.8
2.0
2.2
2.4
1.0
1.5
2.0
2.5
Log observed index

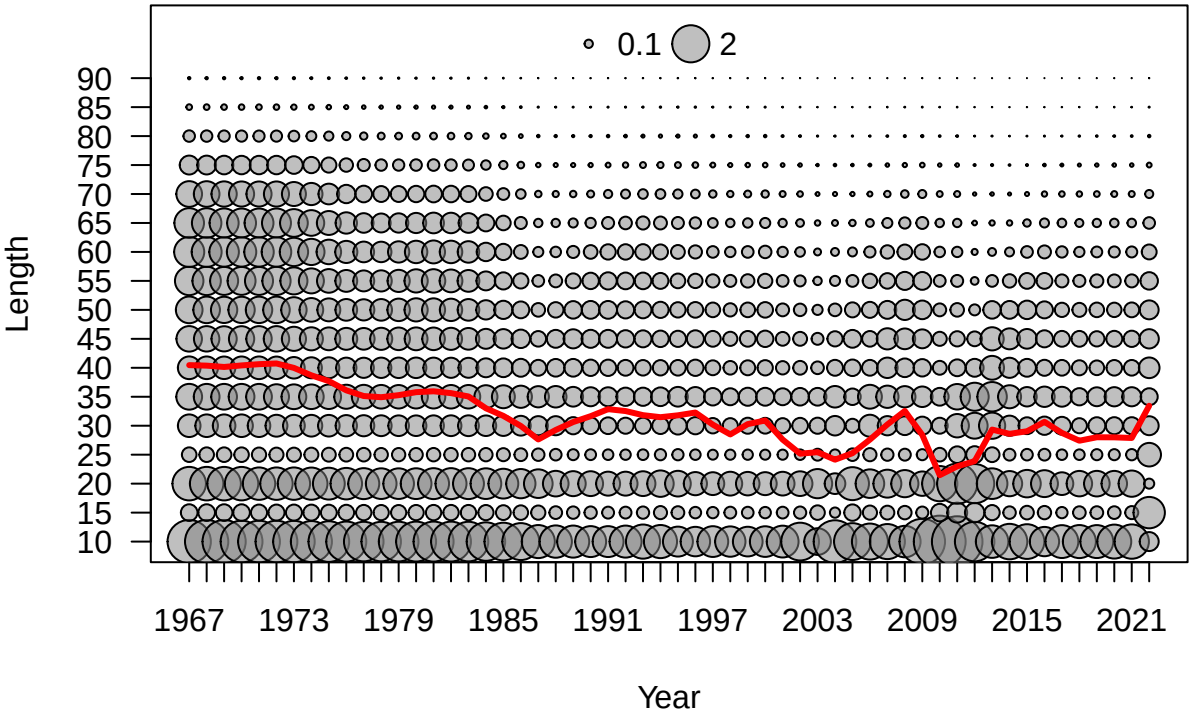

Residual
2
1
0
−1
−2
1990
1995
2000
2005
2010
2015
2020
Year

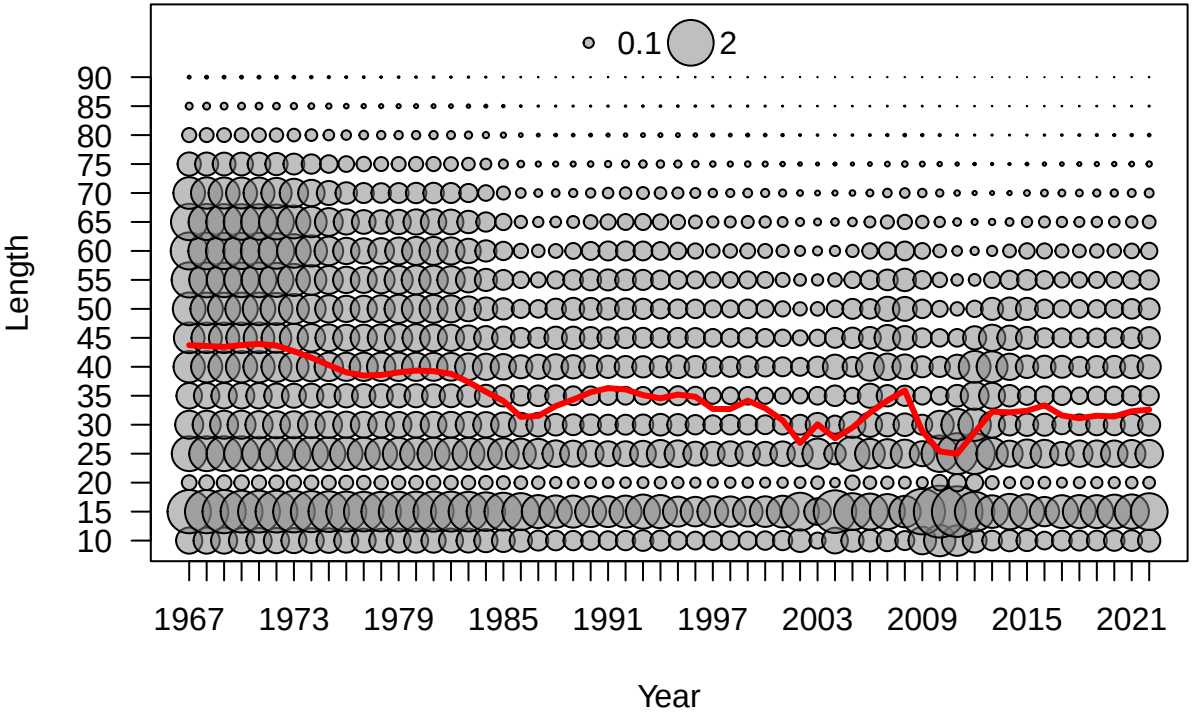

Deviation
1.0
0.5
0.0
−0.5
−1.0
1990
1995
2000
2005
2010
2015
2020
Year

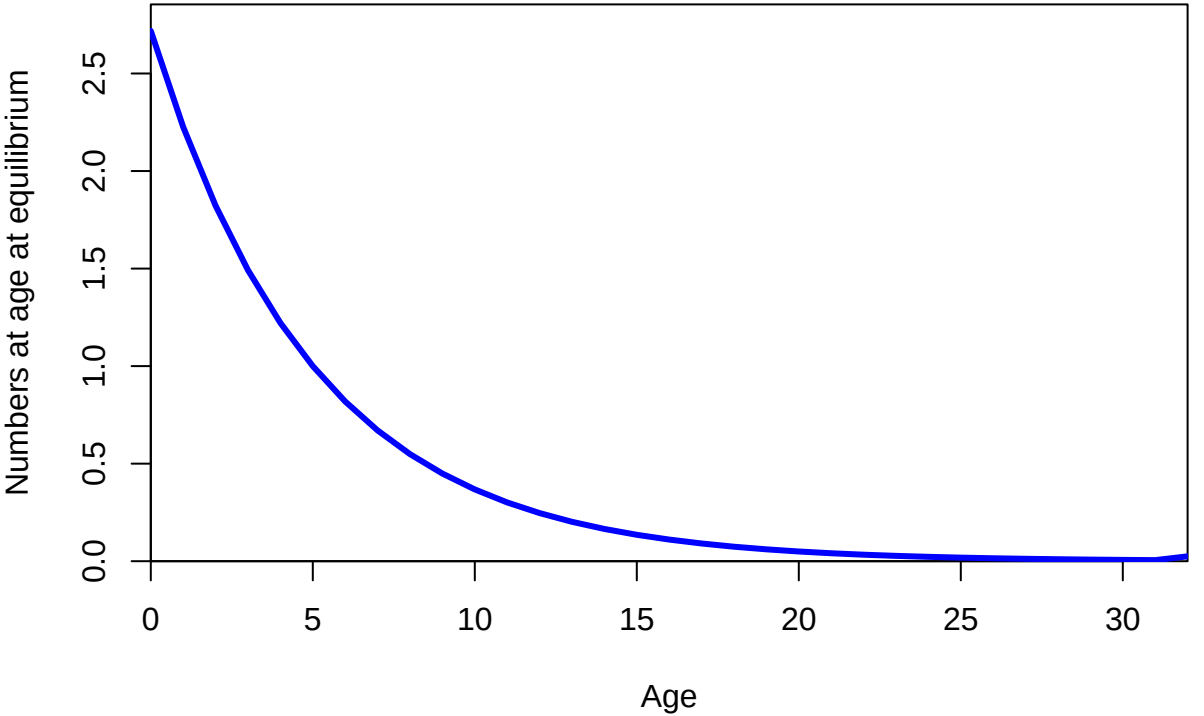

FISHERY
Standardized index
0.0
0.5
1.0
1.5
2.0
1990
1995
2000
2005
2010
2015
2020
Year

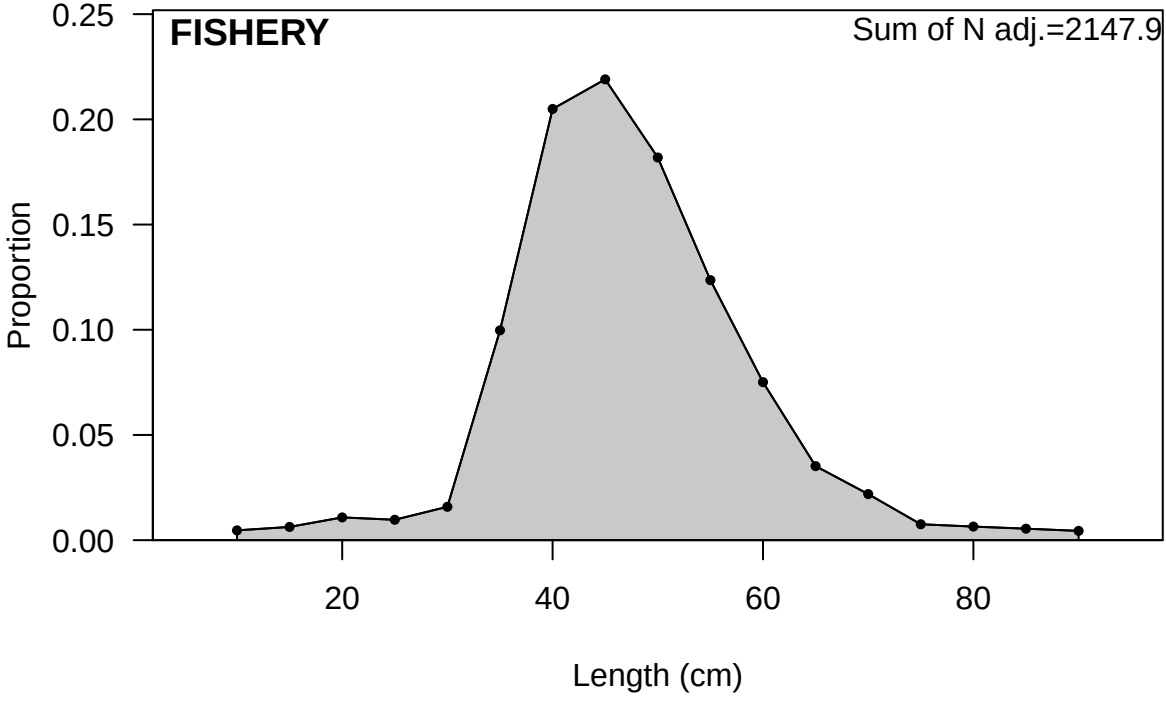

0.1
2
35
30
25
20
15
10
5
0
Age
1966
1972
1978
1984
1990
1996
2002
2008
2014
2020
Year

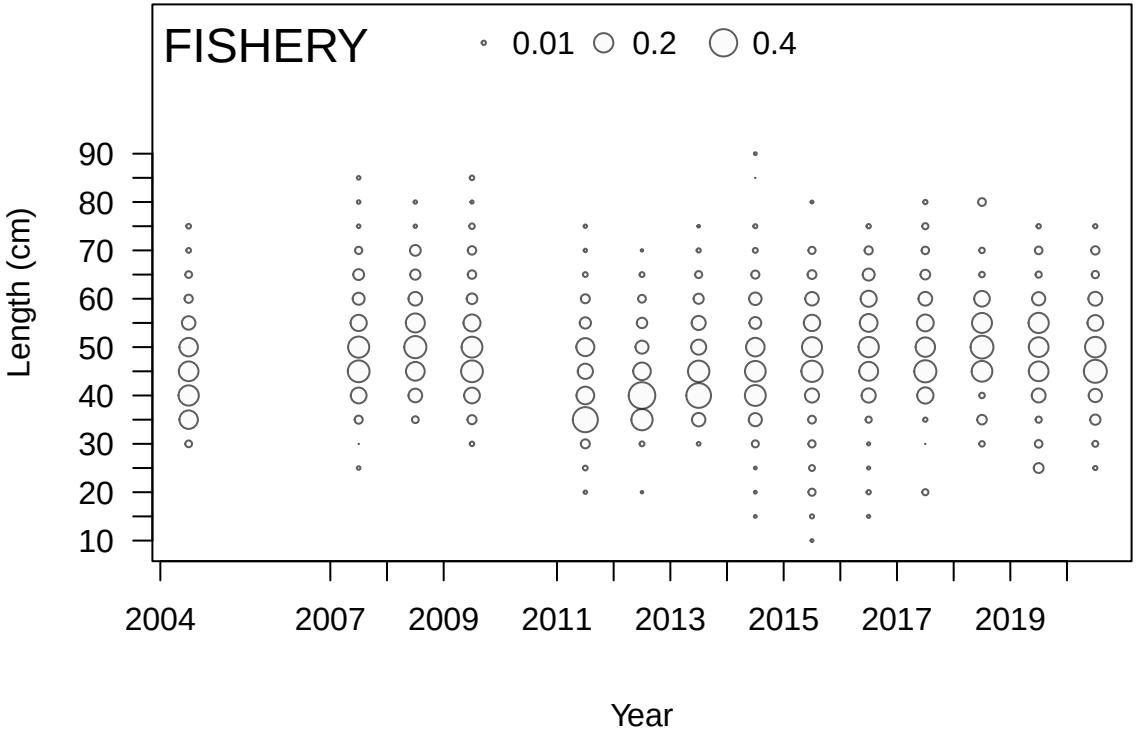

0.1
2
35
30
25
20
15
10
5
0
Age
1966
1972
1978
1984
1990
1996
2002
2008
2014
2020
Year

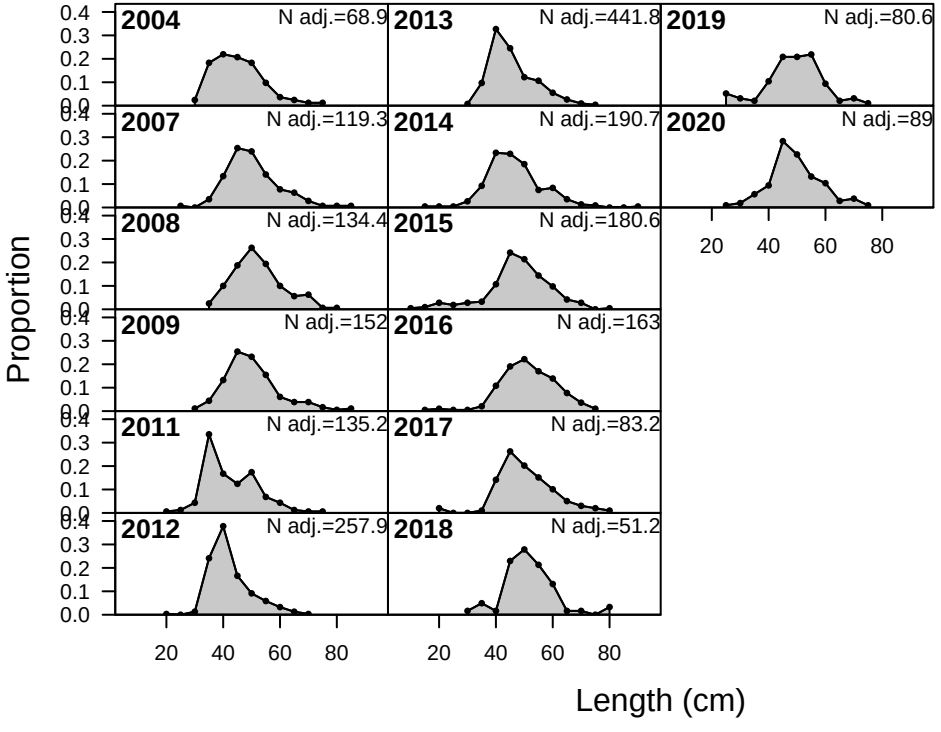

0.1
2
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
Length
1967
1973
1979
1985
1991
1997
2003
2009
2015
2021
Year

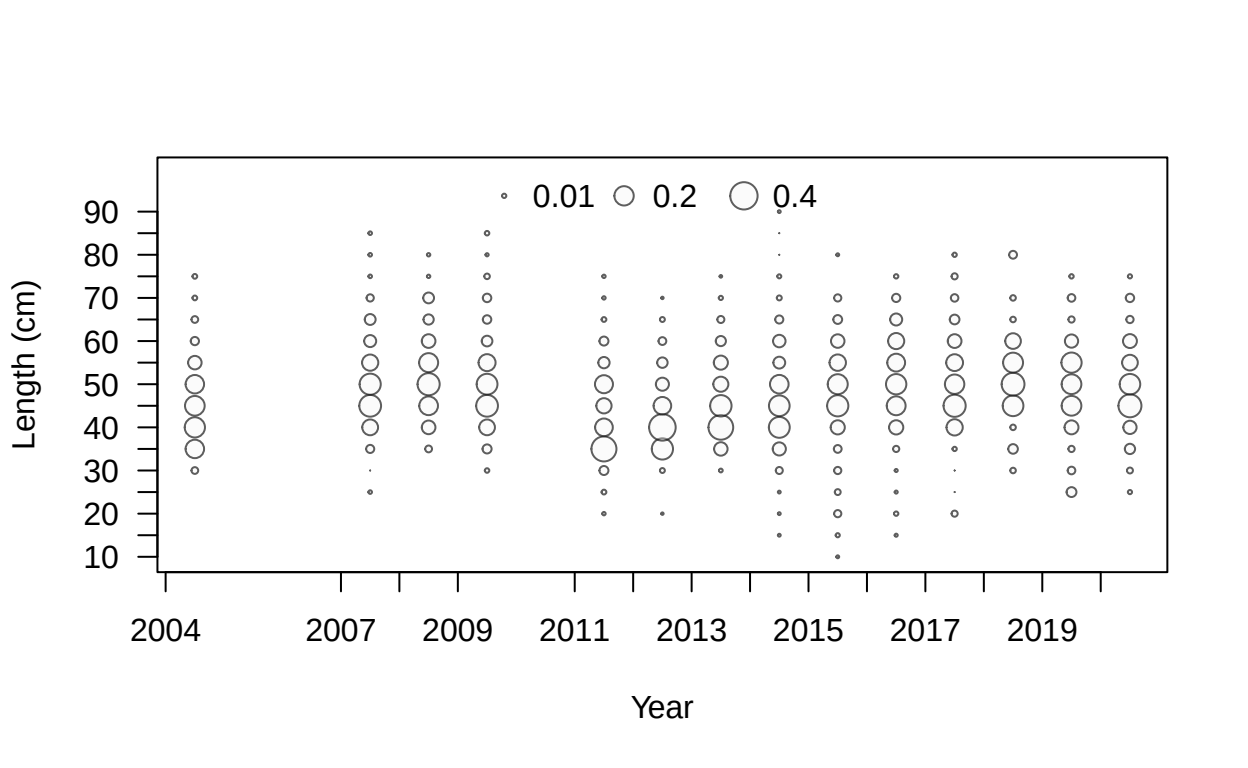

0.1
2
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
Length
1967
1973
1979
1985
1991
1997
2003
2009
2015
2021
Year

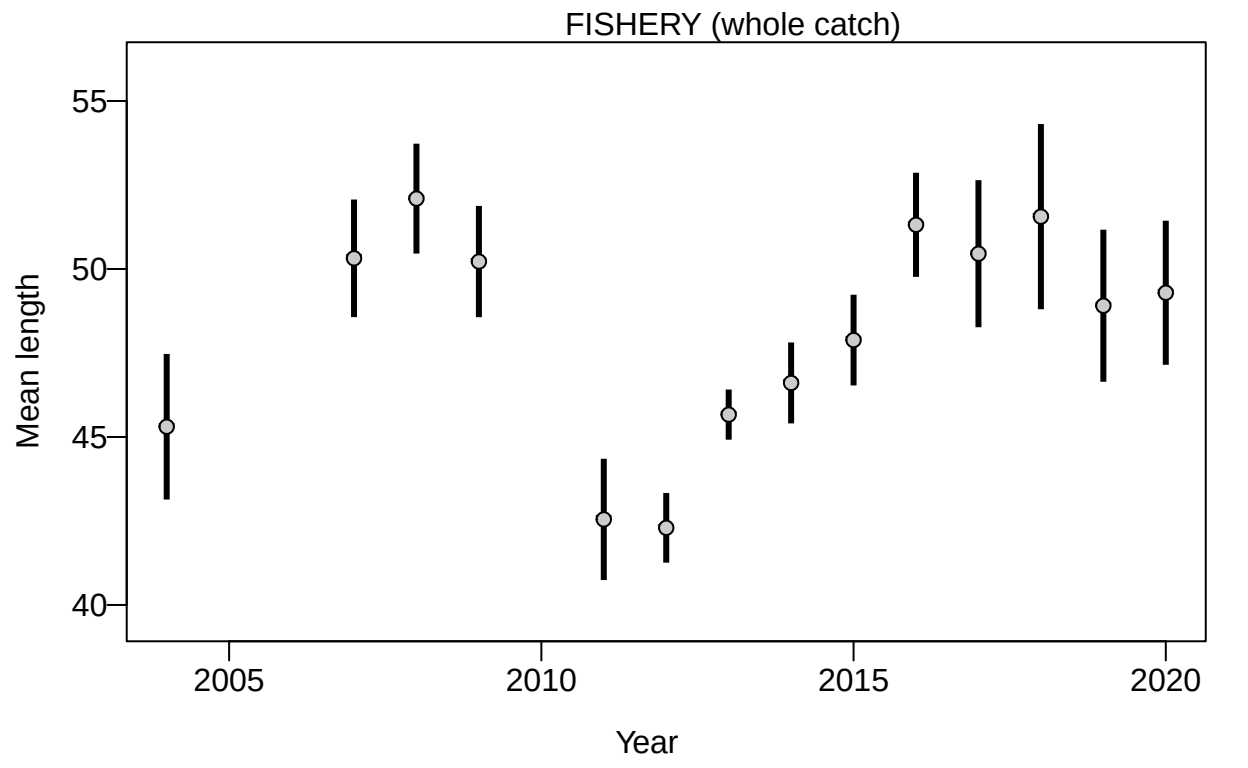

Numbers at age at equilibrium
0.0
0.5
1.0
1.5
2.0
2.5
0
5
10
15
20
25
30
Age

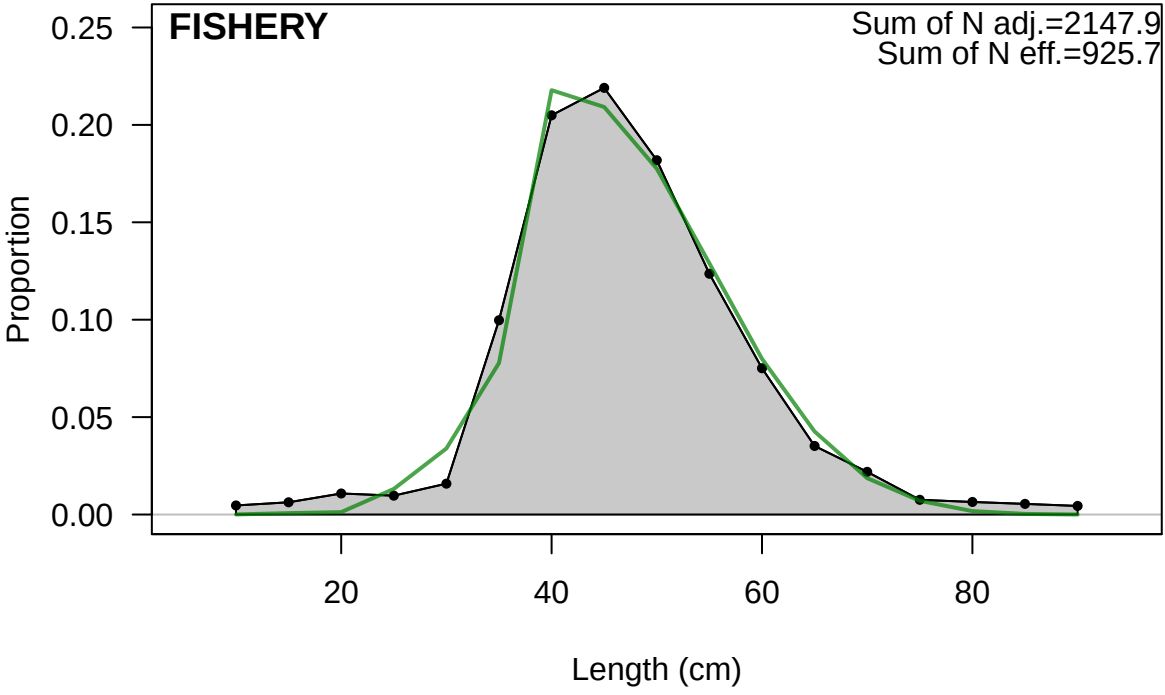

FISHERY
Sum of N adj.=2147.9
Proportion
0.25
0.20
0.15
0.10
0.05
0.00
20
40
60
80
Length (cm)

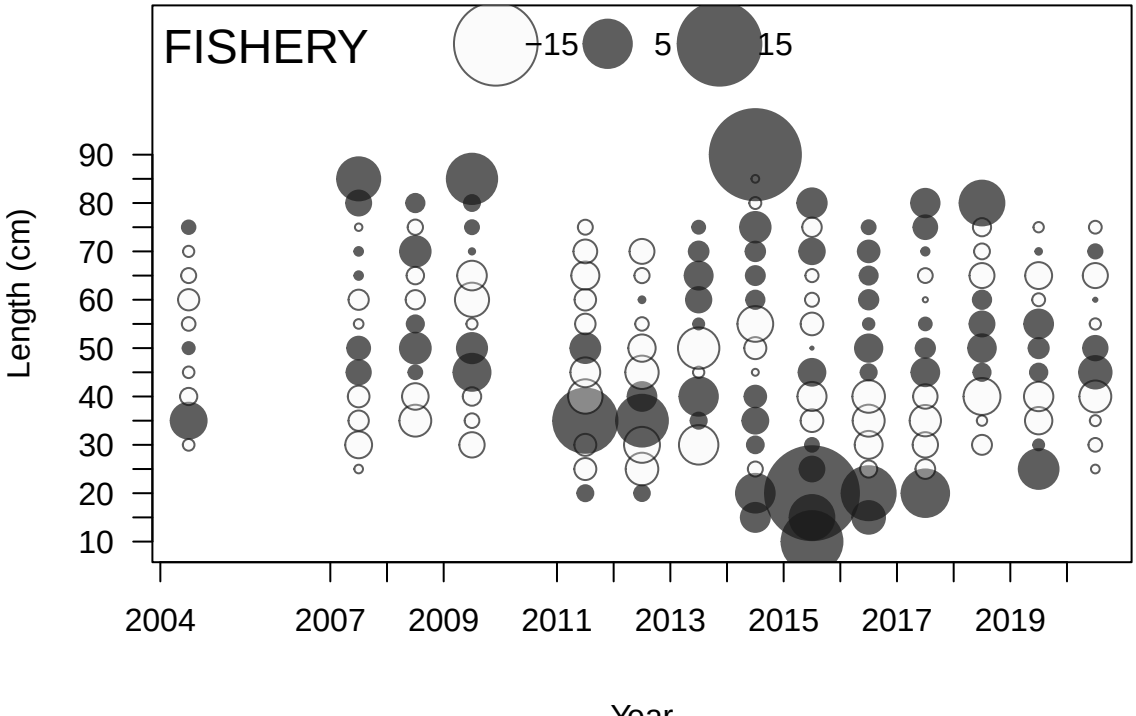

FISHERY
0.01
0.2
0.4
Length (cm)
90
80
70
60
50
40
30
20
10
2004
2007
2009
2011
2013
2015
2017
2019
Year

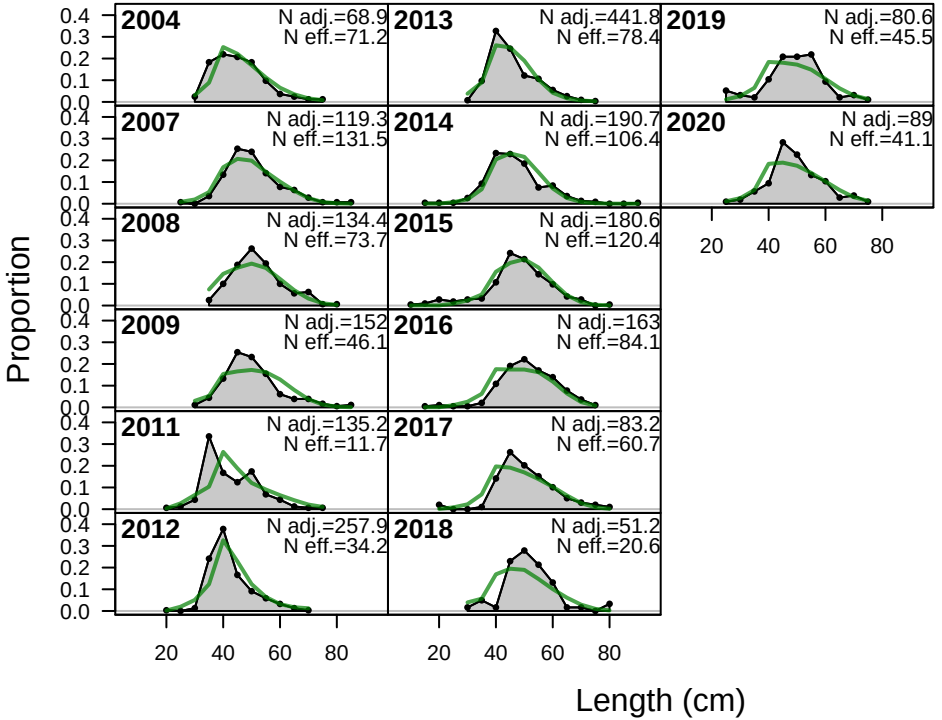

2004
N adj.=68.9
2013
N adj.=441.8
2019
N adj.=80.6
2007
N adj.=119.3
2014
N adj.=190.7
2020
N adj.=89
2008
N adj.=134.4
2015
N adj.=180.6
2009
N adj.=152
2016
N adj.=163
2011
N adj.=135.2
2017
N adj.=83.2
2012
N adj.=257.9
2018
N adj.=51.2
Proportion
Length (cm)

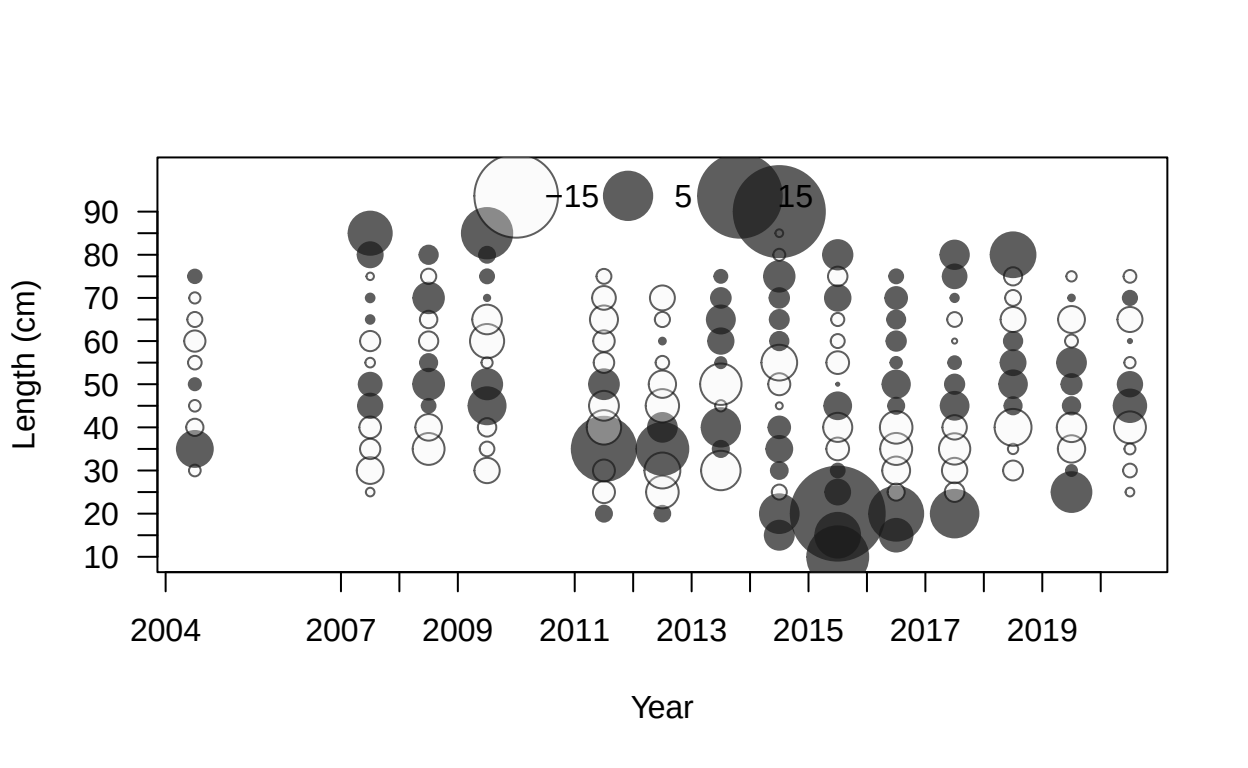

0.01
0.2
0.4
Length (cm)
90
80
70
60
50
40
30
20
10
2004
2007
2009
2011
2013
2015
2017
2019
Year

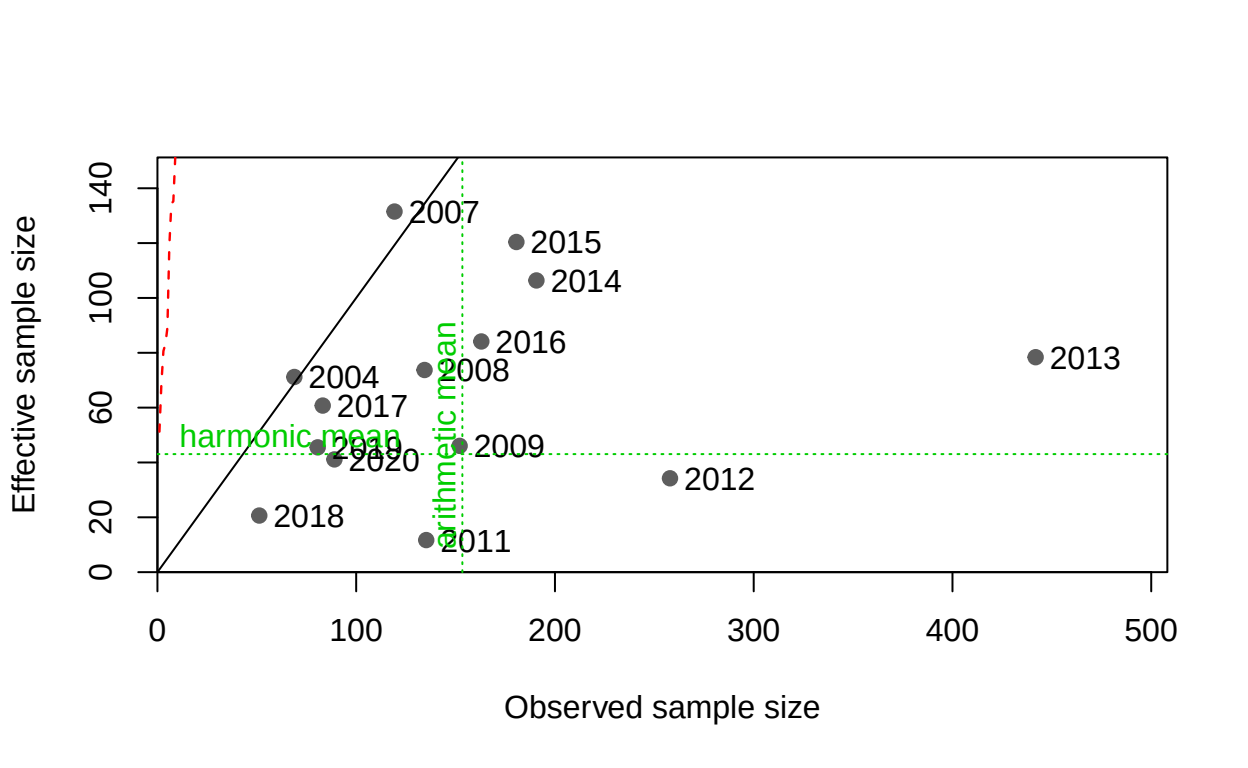

FISHERY (whole catch)
55
50
45
40
Mean length
2005
2010
2015
2020
Year

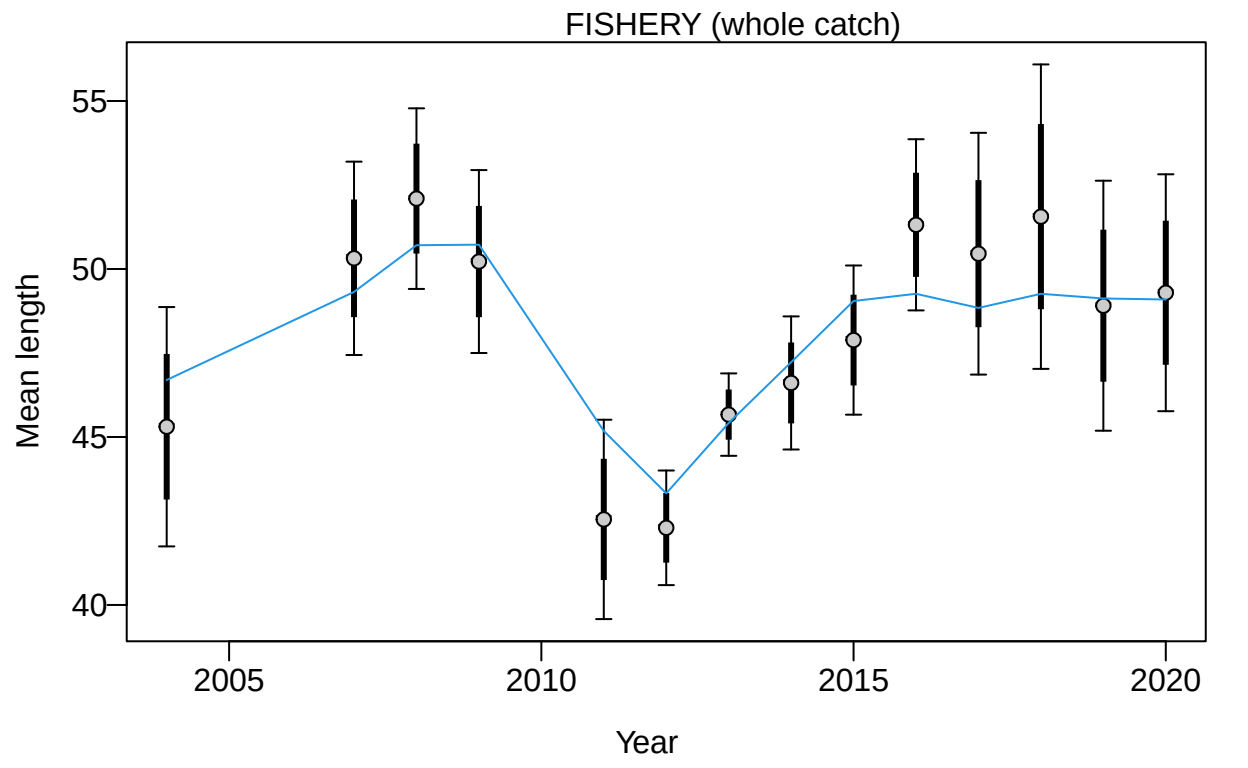

FISHERY
Sum of N adj.=2147.9
Sum of N eff.=925.7
Proportion
0.25
0.20
0.15
0.10
0.05
0.00
20
40
60
80
Length (cm)

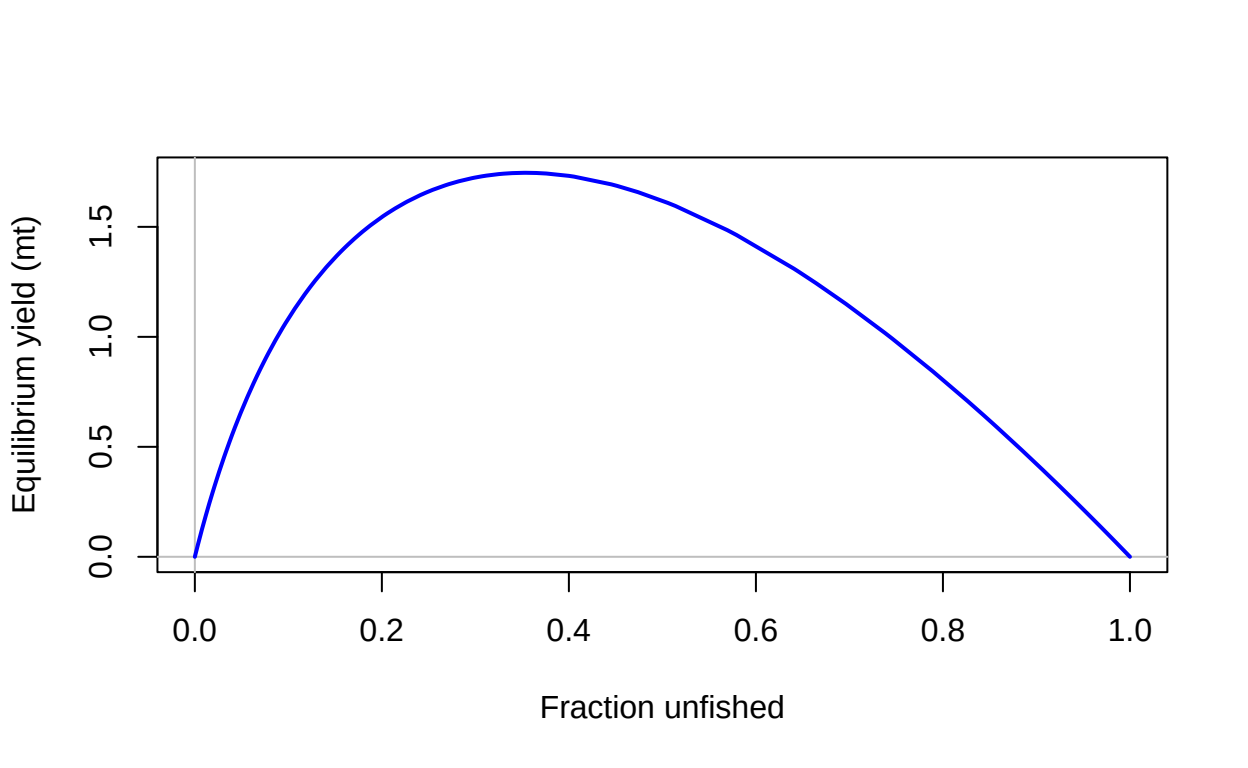

FISHERY
−15
5
15
Length (cm)
90
80
70
60
50
40
30
20
10
2004
2007
2009
2011
2013
2015
2017
2019
Year

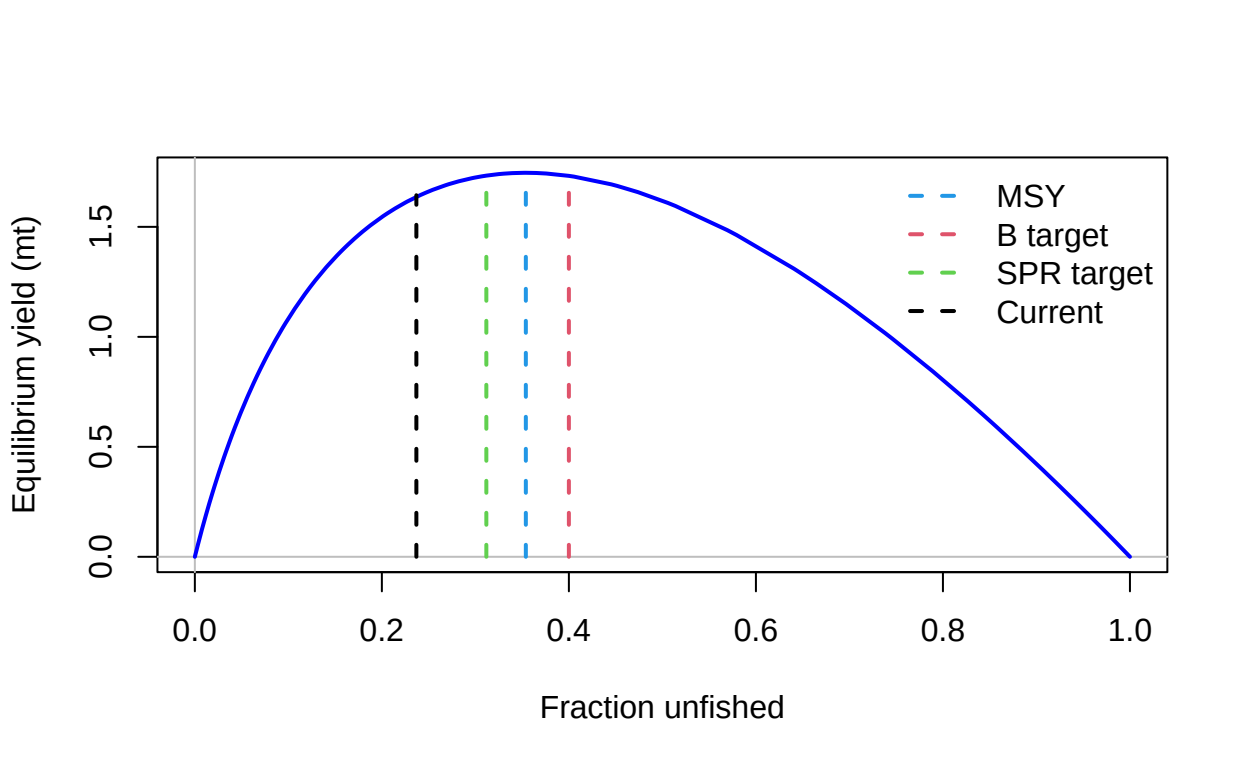

2004
N adj.=68.9
N eff.=71.2
2013
N adj.=441.8
N eff.=78.4
2019
N adj.=80.6
N eff.=45.5
2007
N adj.=119.3
N eff.=131.5
2014
N adj.=190.7
N eff.=106.4
2020
N adj.=89
N eff.=41.1
2008
N adj.=134.4
N eff.=73.7
2015
N adj.=180.6
N eff.=120.4
2009
N adj.=152
N eff.=46.1
2016
N adj.=163
N eff.=84.1
2011
N adj.=135.2
N eff.=11.7
2017
N adj.=83.2
N eff.=60.7
2012
N adj.=257.9
N eff.=34.2
2018
N adj.=51.2
N eff.=20.6
Proportion
0.0
0.1
0.2
0.3
0.4
20
40
60
80
Length (cm)

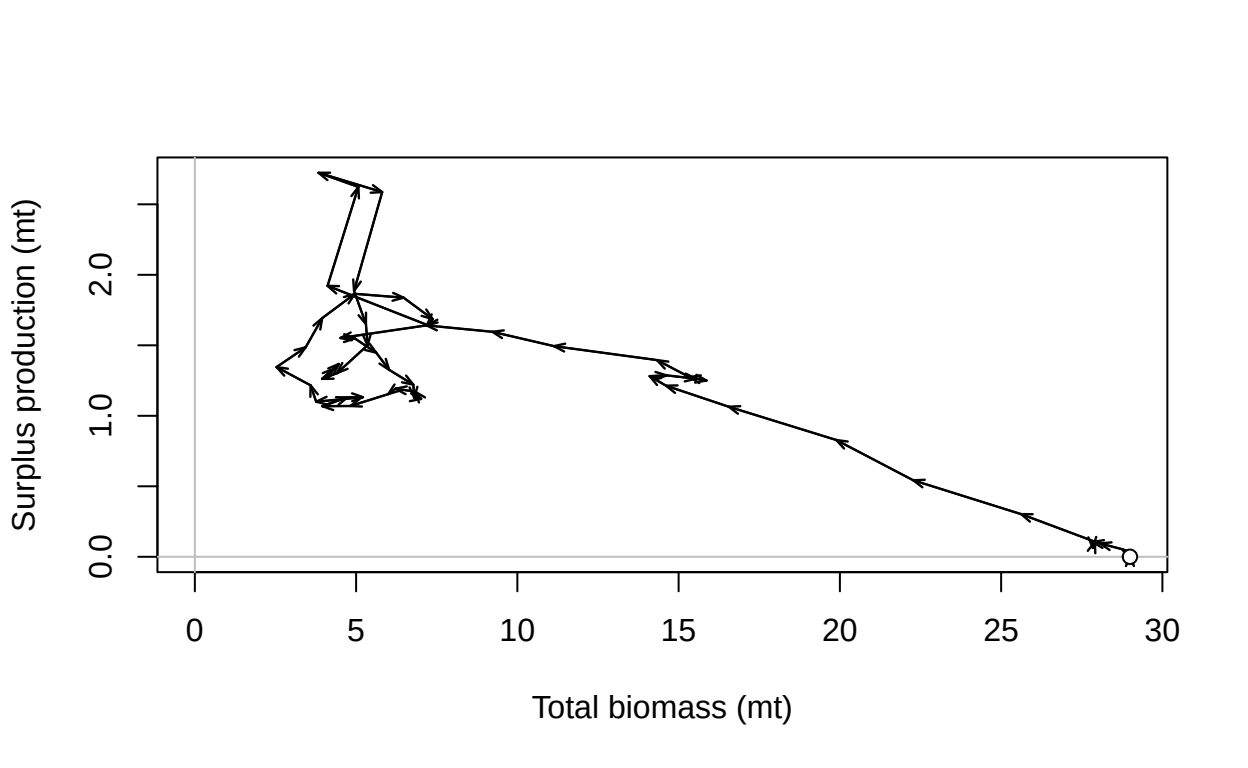

15
5
15
90
80
70
60
50
40
30
20
10
Length (cm)
2004
2007
2009
2011
2013
2015
2017
2019
Year

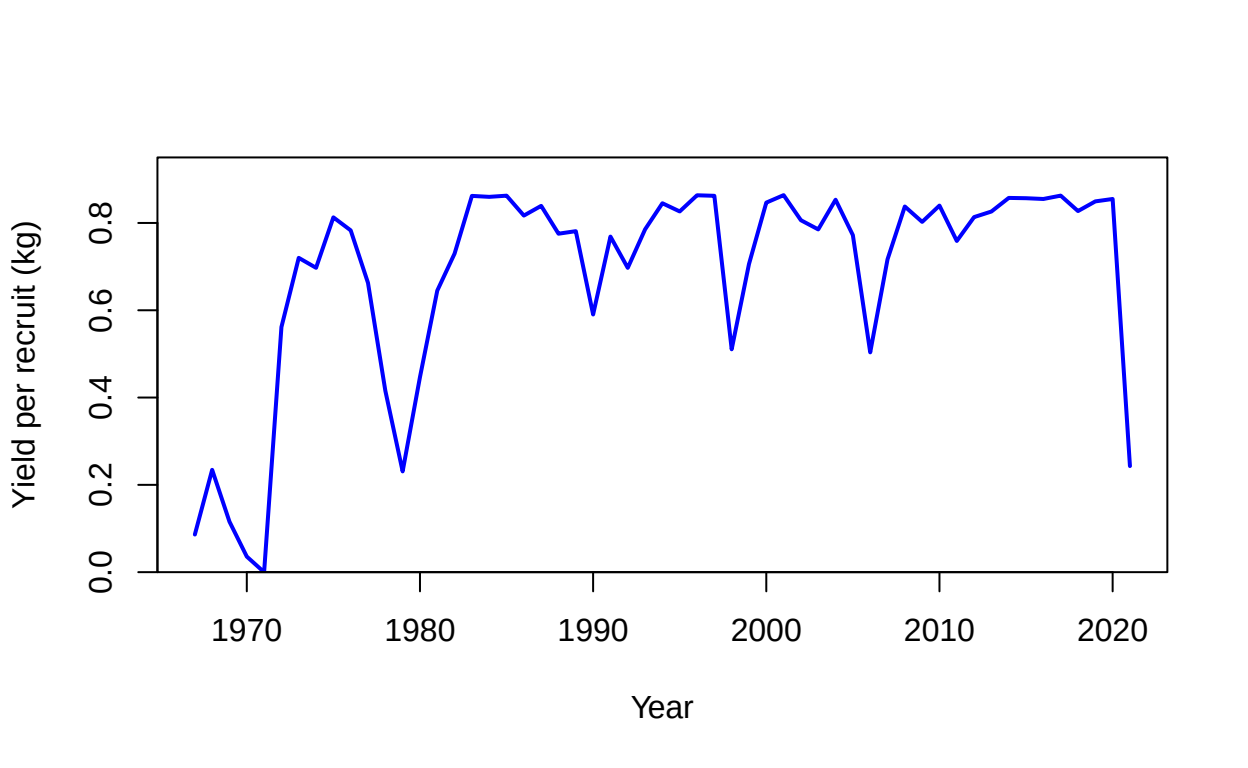

Effective sample size
0
20
60
100
140
Observed sample size
0
100
200
300
400
500
2007
2015
2014
2016
2013
2004
2008
2017
2019
2020
2009
2012
2018
2011
harmonic mean
arithmetic mean

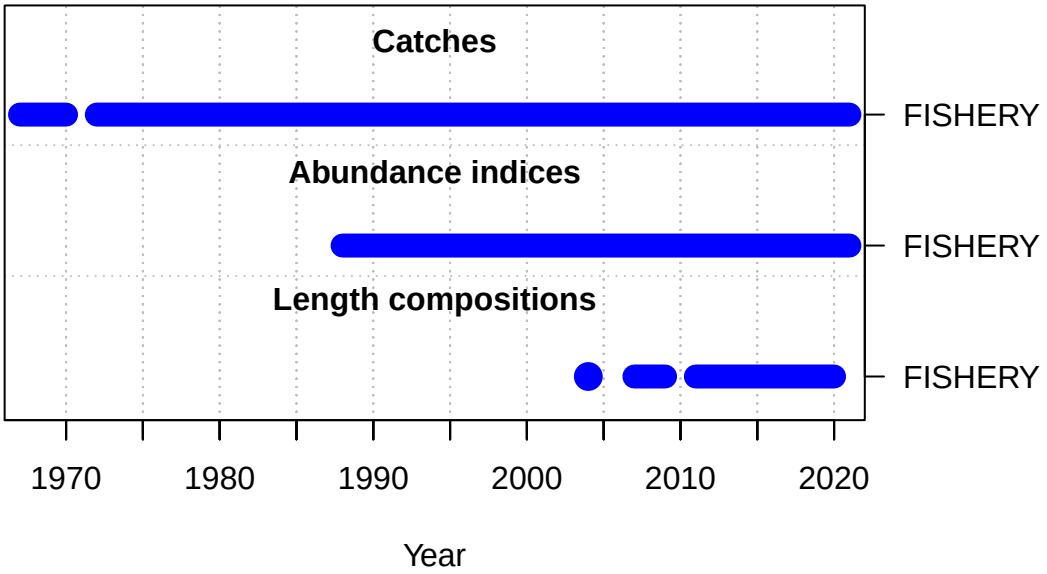

FISHERY (whole catch)
Mean length
55
50
45
40
2005
2010
2015
2020
Year

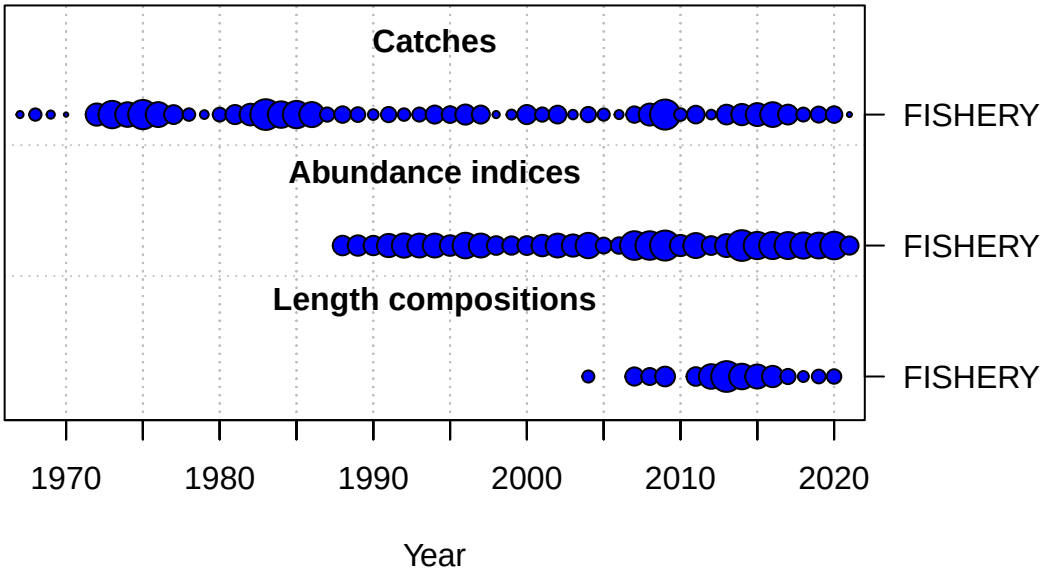

Equilibrium yield (mt)
0.0
0.5
1.0
1.5
0.0
0.2
0.4
0.6
0.8
1.0
Fraction unfished

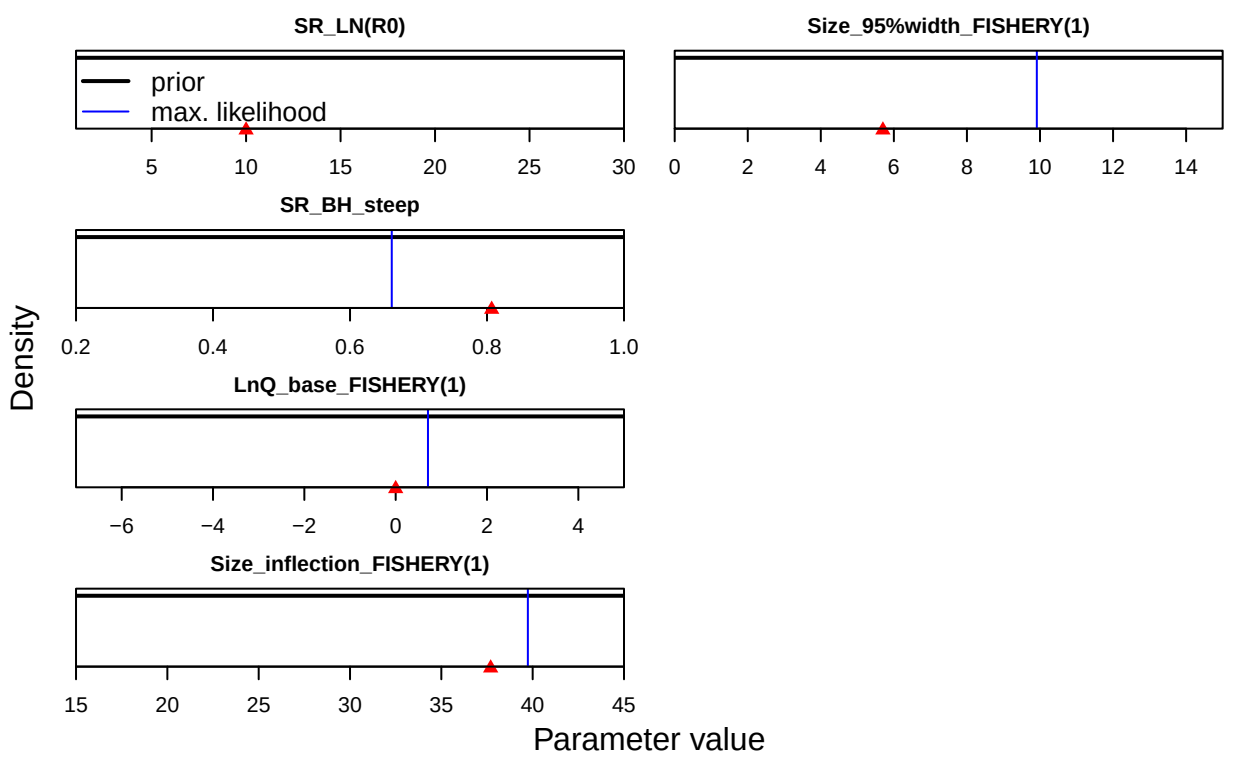

Equilibrium yield (mt)
0.0
0.5
1.0
1.5
0.0
0.2
0.4
0.6
0.8
1.0
Fraction unfished
MSY
B target
SPR target
Current


Surplus production (mt)
0.0
1.0
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
1970
1980
1990
2000
2010
2020
Year


Catches
FISHERY
Abundance indices
FISHERY
Length compositions
FISHERY
1970
1980
1990
2000
2010
2020
Year


Catches
FISHERY
Abundance indices
FISHERY
Length compositions
FISHERY
1970
1980
1990
2000
2010
2020
Year


SR_LN(R0)
prior
max. likelihood
5
10
15
20
25
30
Size_95%width_FISHERY(1)
0
2
4
6
8
10
12
14
SR_BH_steep
0.2
0.4
0.6
0.8
1.0
LnQ_base_FISHERY(1)
−6
−4
−2
0
2
4
Size_inflection_FISHERY(1)
15
20
25
30
35
40
45
Density
Parameter value