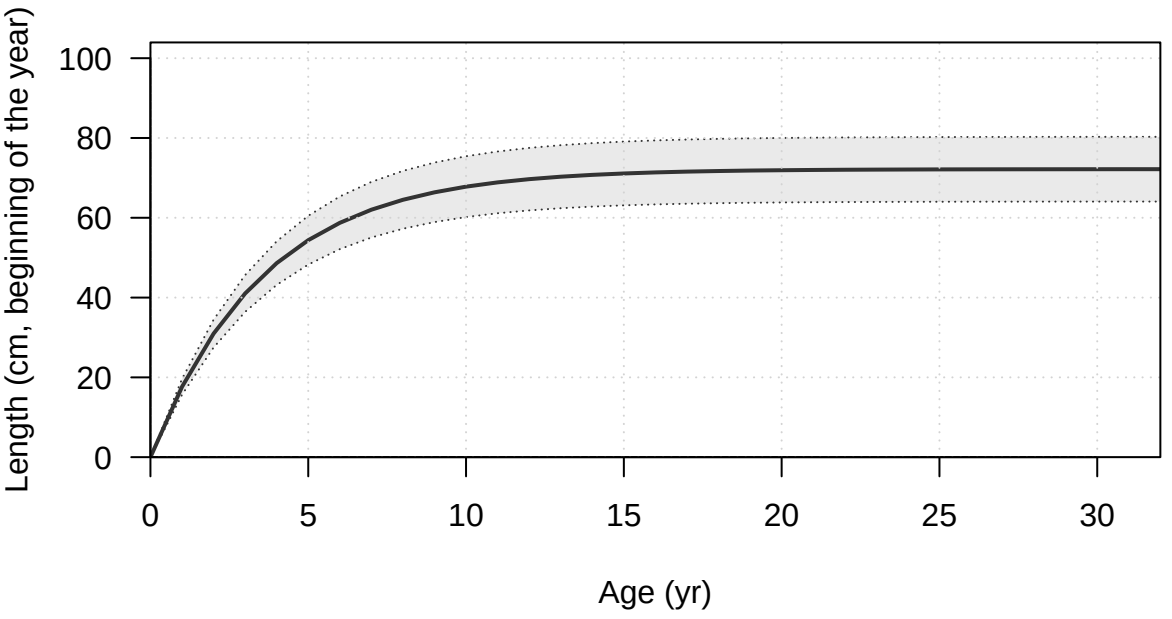
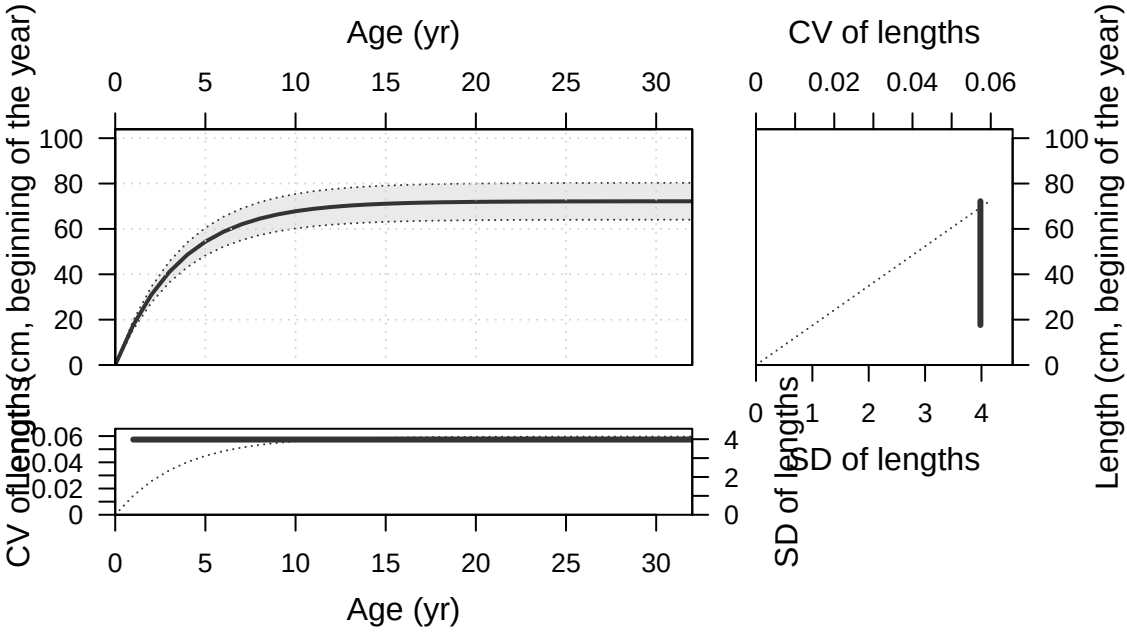
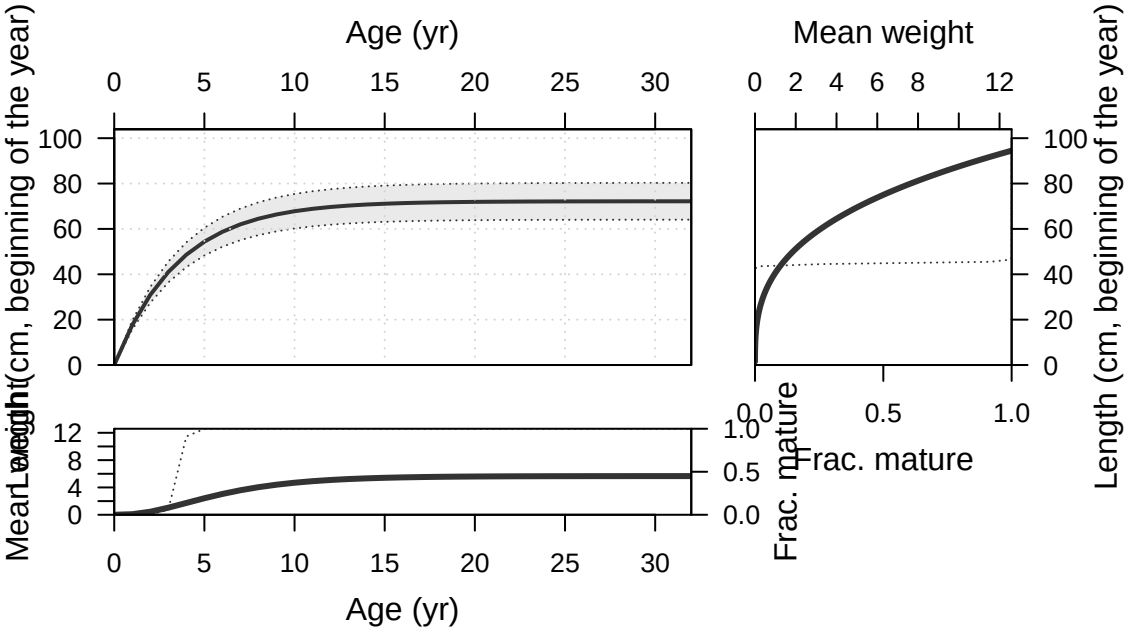
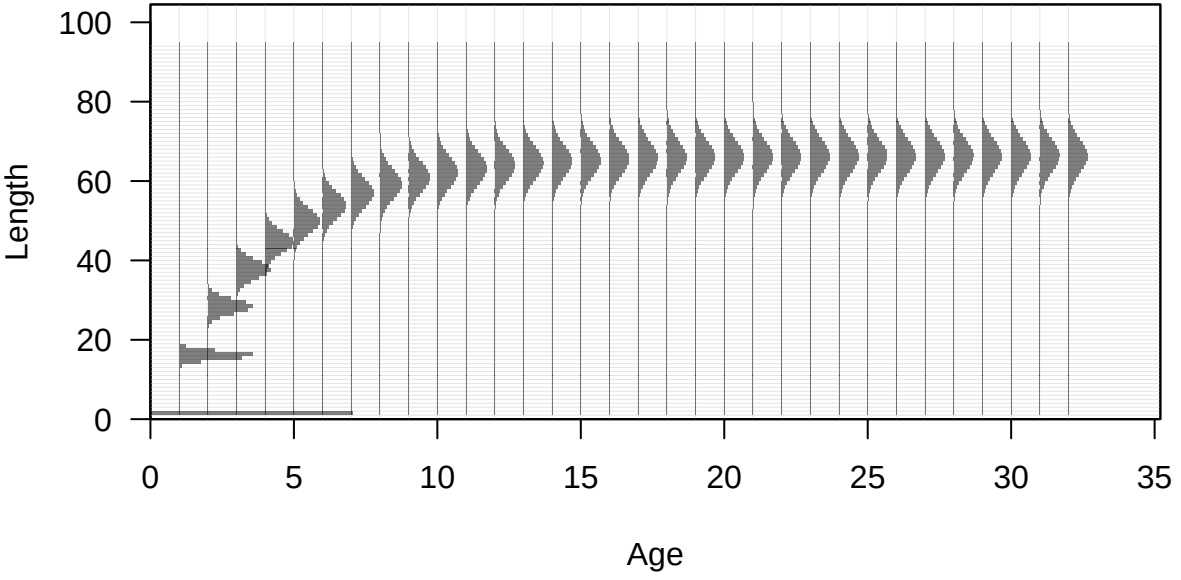
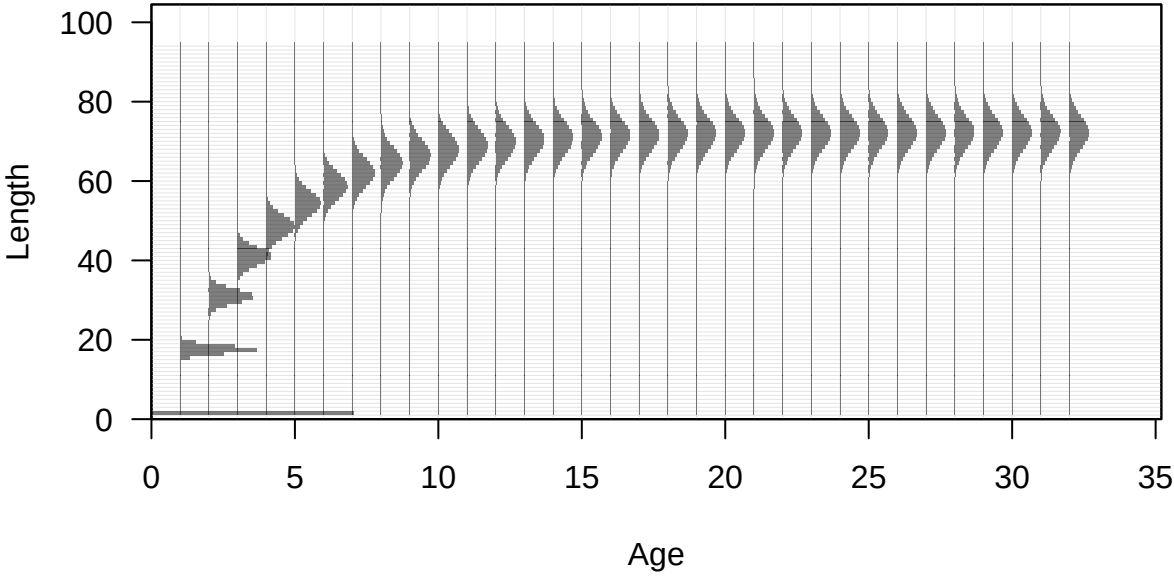
Plots created using the 'r4ss' package in R
Stock Synthesis version: 3.30.19.0
StartTime: Mon Aug 15 17:12:40 2022
Data_File: data.ss
Control_File: control.ss

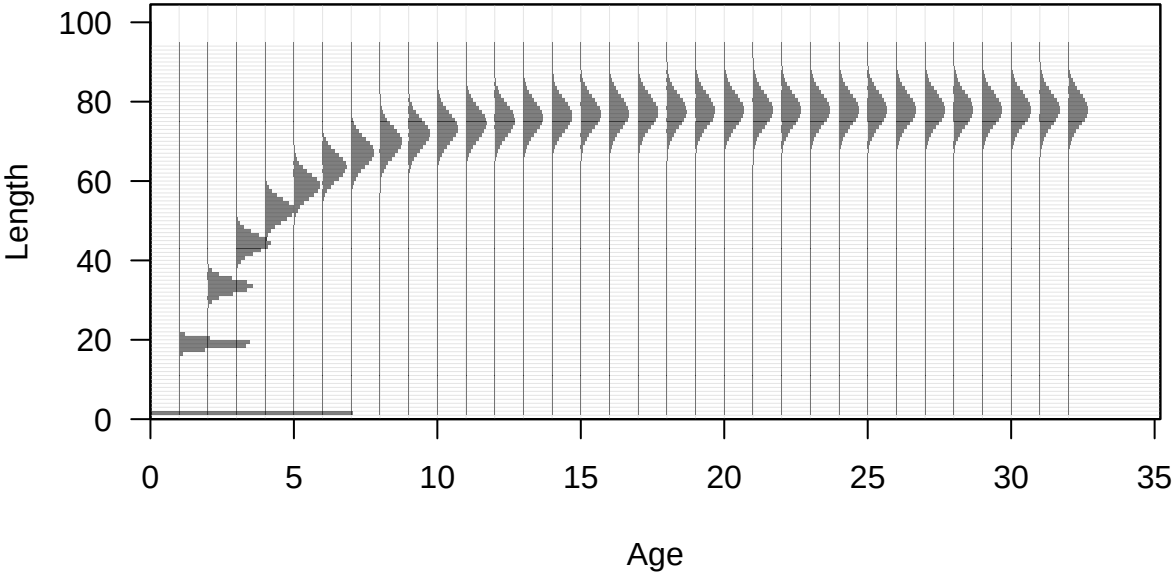

Length (cm, beginning of the year)
100
80
60
40
20
0
0
5
10
15
20
25
30
Age (yr)

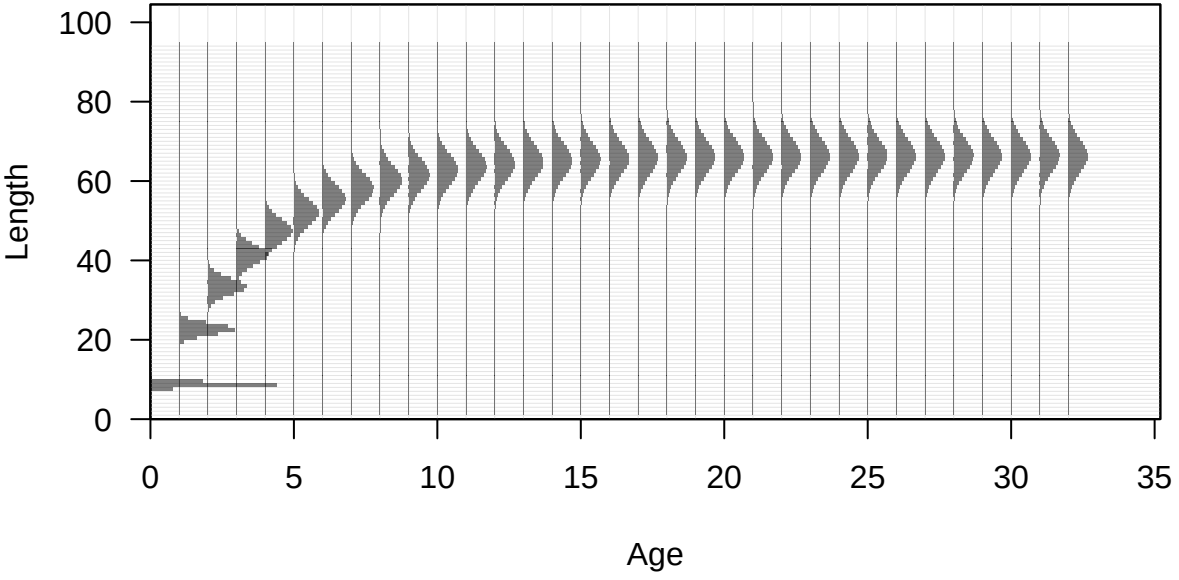

Age (yr)
0
5
10
15
20
25
30
100
80
60
40
20
0
Length (cm, beginning of the year)
CV of lengths
0.06
0.04
0.02
0
SD of lengths
4
2
0
Age (yr)
CV of lengths
0
0.02
0.04
0.06
0
1
2
3
4
SD of lengths
Length (cm, beginning of the year)

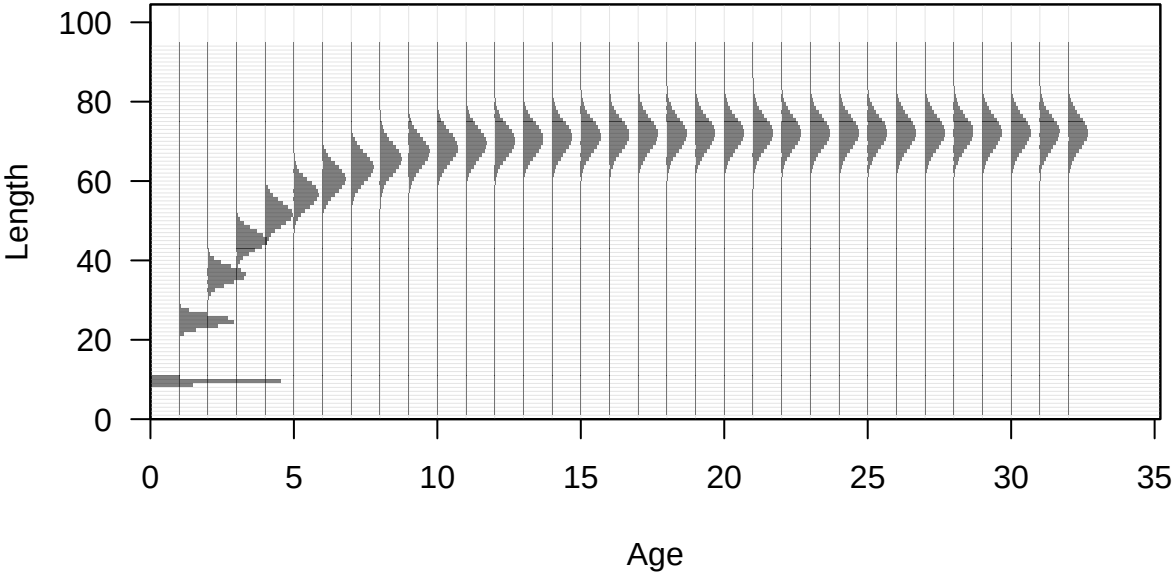

Age (yr)
Mean weight
Length (cm, beginning of the year)
Mean weight
Frac. mature
Age (yr)
Frac. mature
Length (cm, beginning of the year)

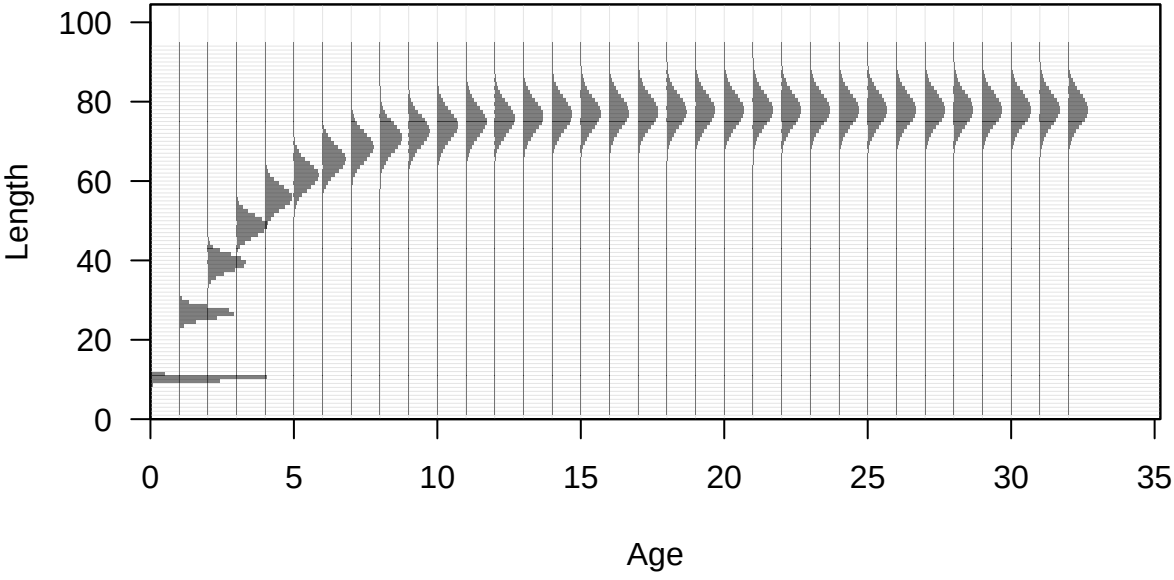

Length
100
80
60
40
20
0
0
5
10
15
20
25
30
35
Age

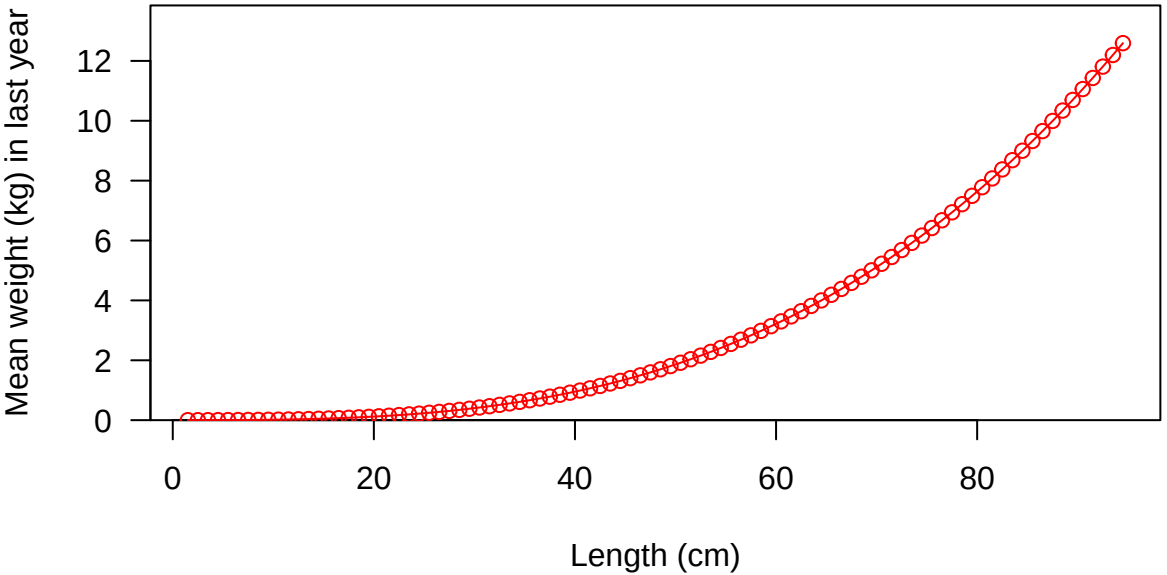

Length
100
80
60
40
20
0
0
5
10
15
20
25
30
35
Age

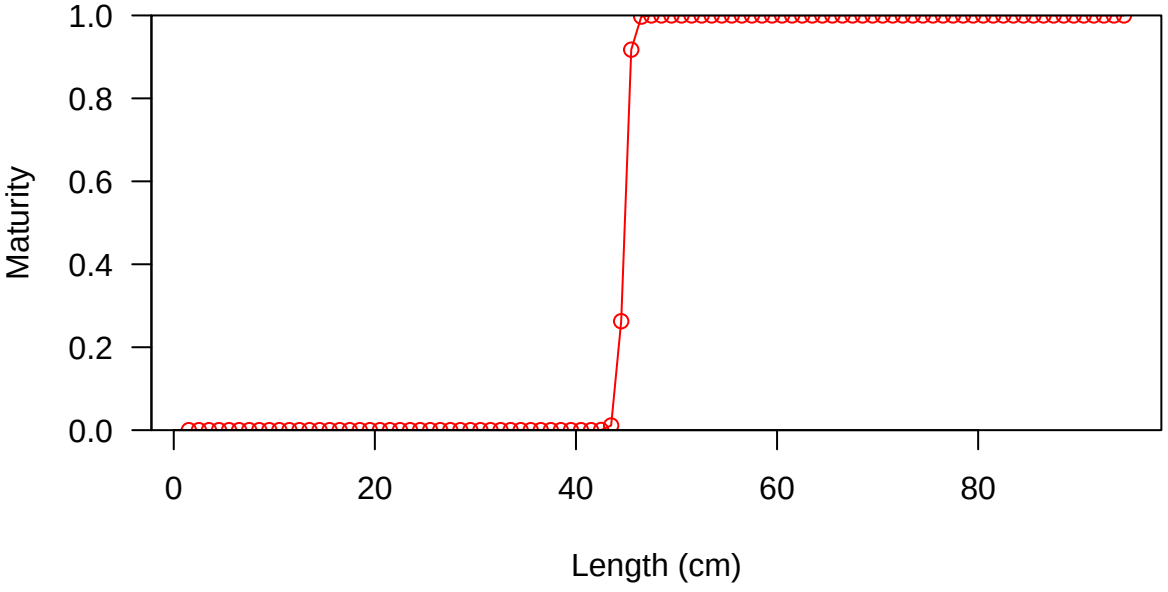

100
80
60
40
20
0
Length
0
5
10
15
20
25
30
35
Age

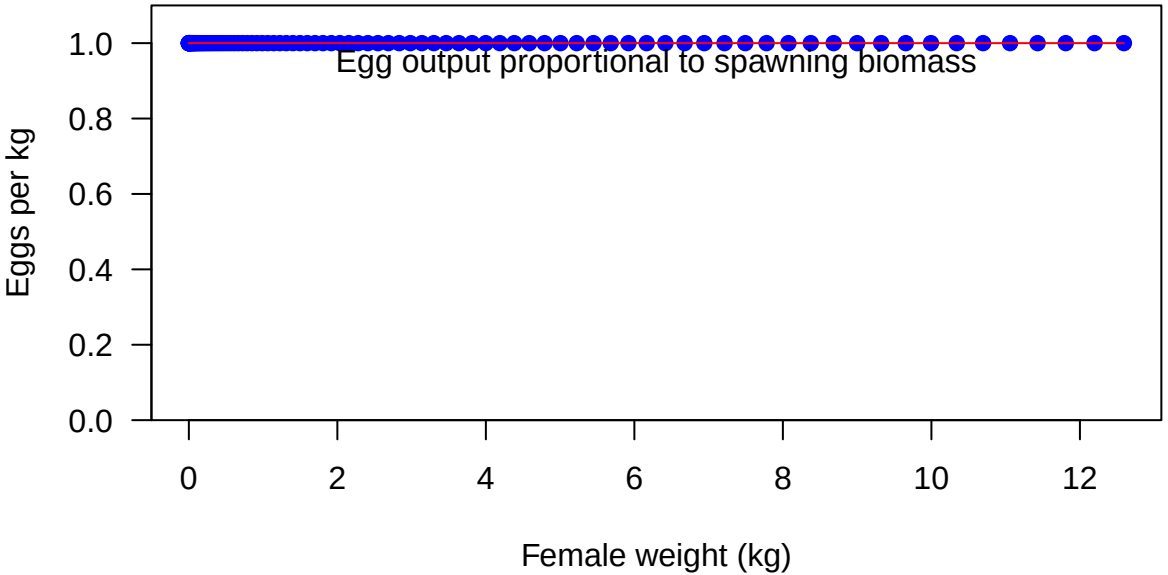

Length
100
80
60
40
20
0
0
5
10
15
20
25
30
35
Age

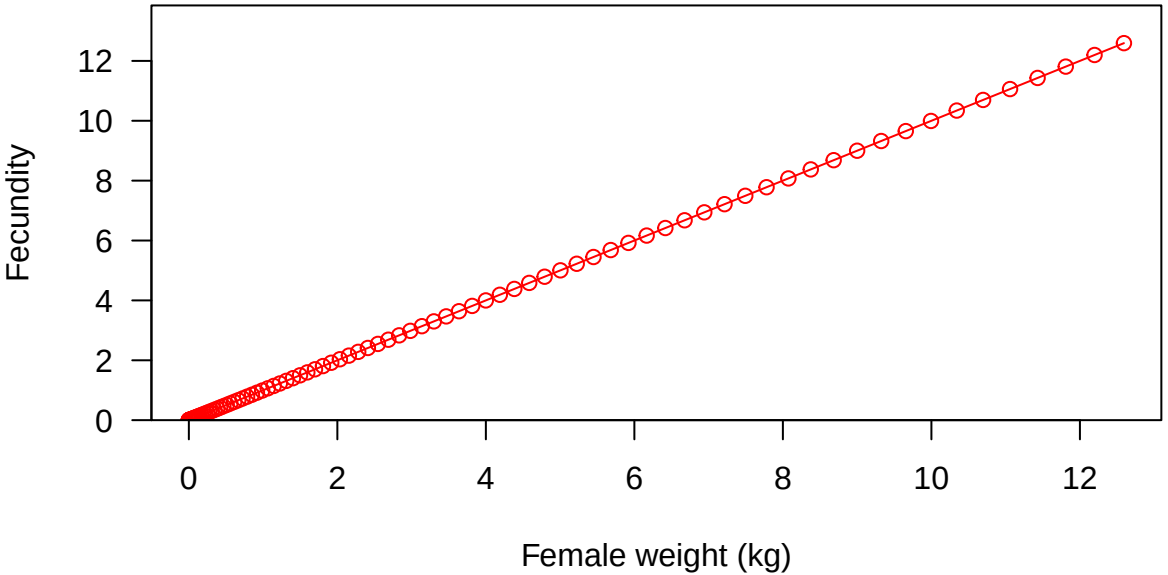

Length
100
80
60
40
20
0
0
5
10
15
20
25
30
35
Age

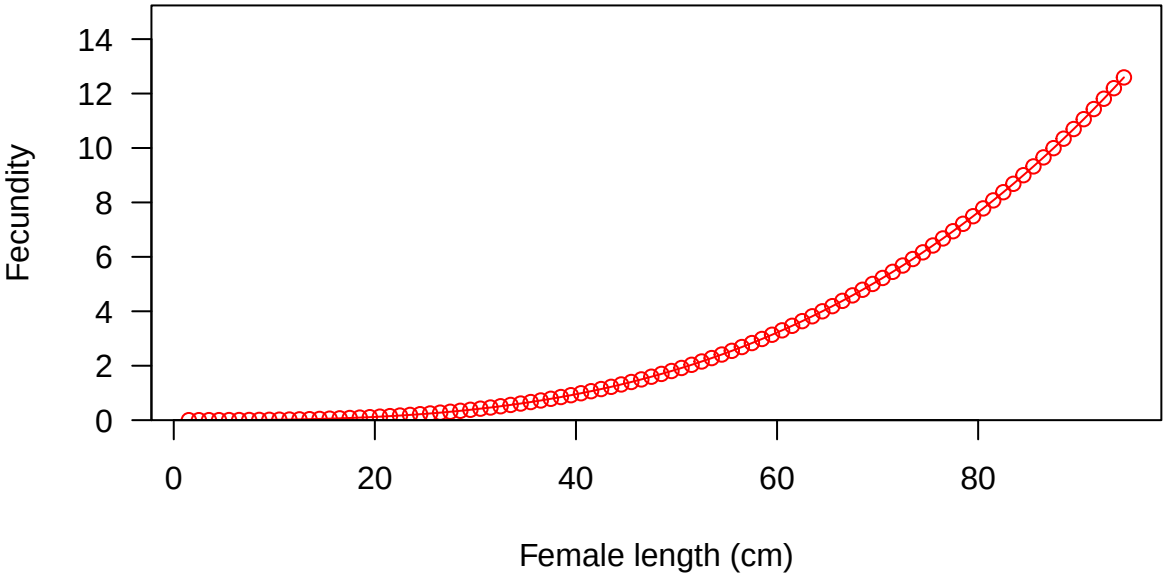

Length
100
80
60
40
20
0
0
5
10
15
20
25
30
35
Age

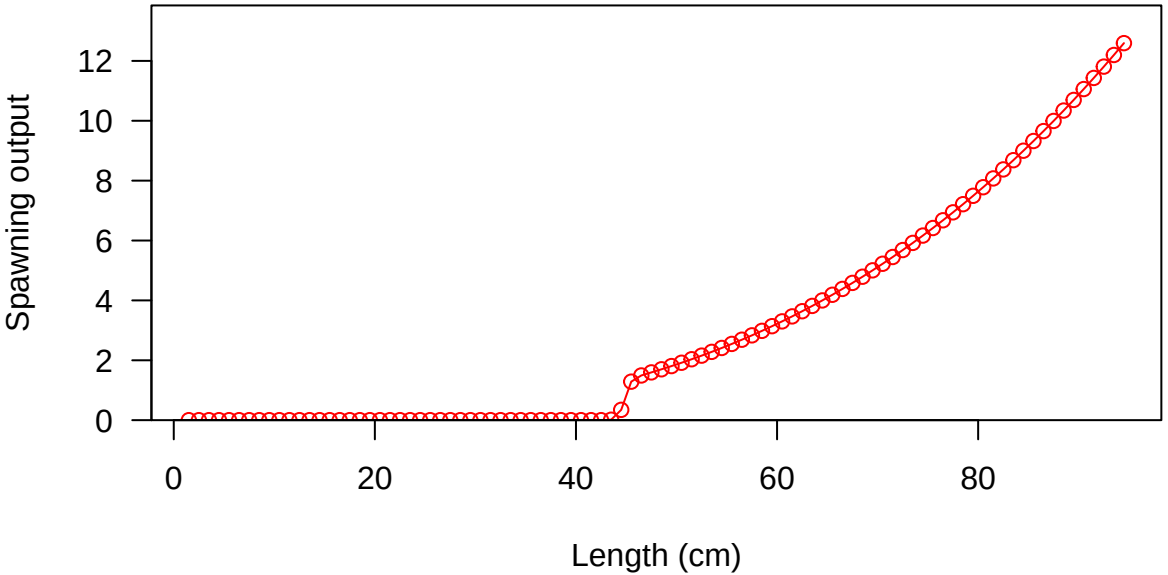

Mean weight (kg) in last year
0
2
4
6
8
10
12
0
20
40
60
80
Length (cm)

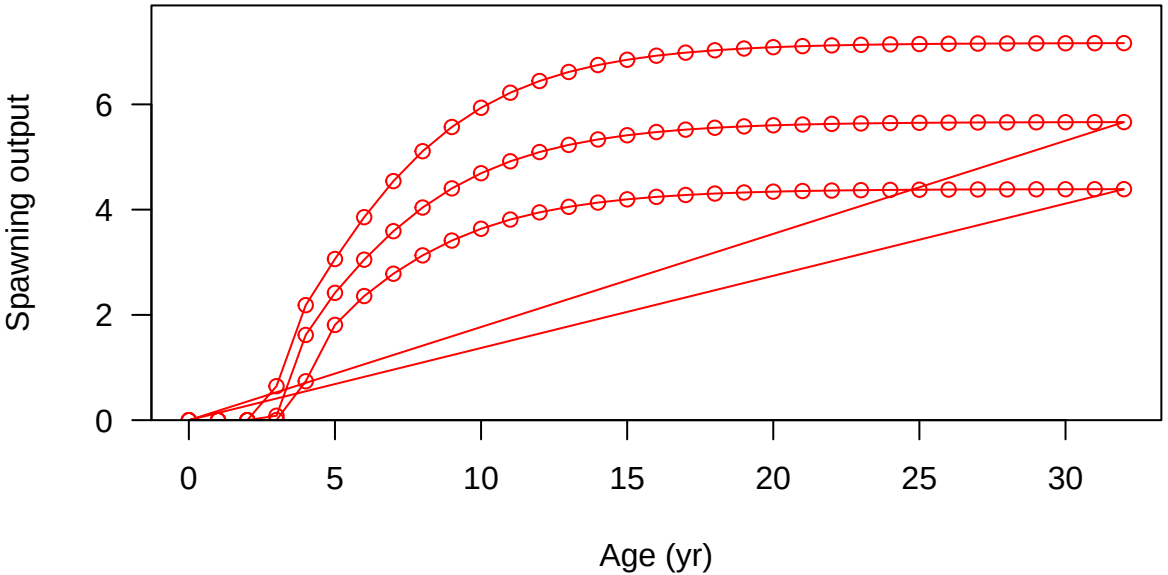

1.0
0.8
0.6
0.4
0.2
0.0
Maturity
0
20
40
60
80
Length (cm)

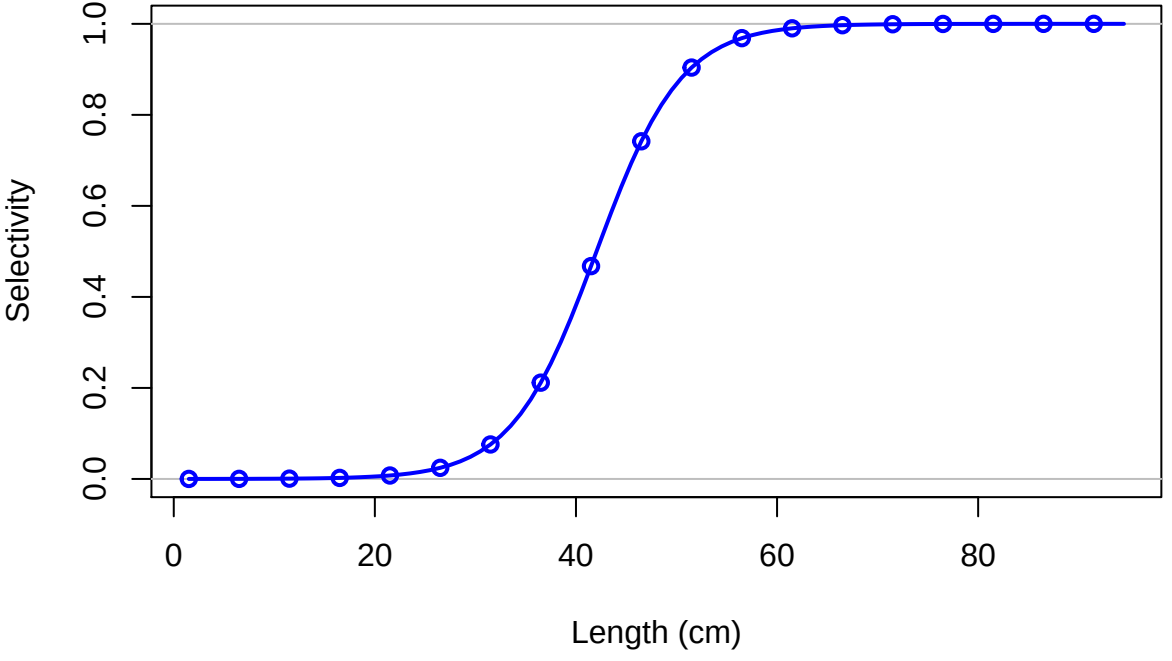

Egg output proportional to spawning biomass
Eggs per kg
1.0
0.8
0.6
0.4
0.2
0.0
0
2
4
6
8
10
12
Female weight (kg)

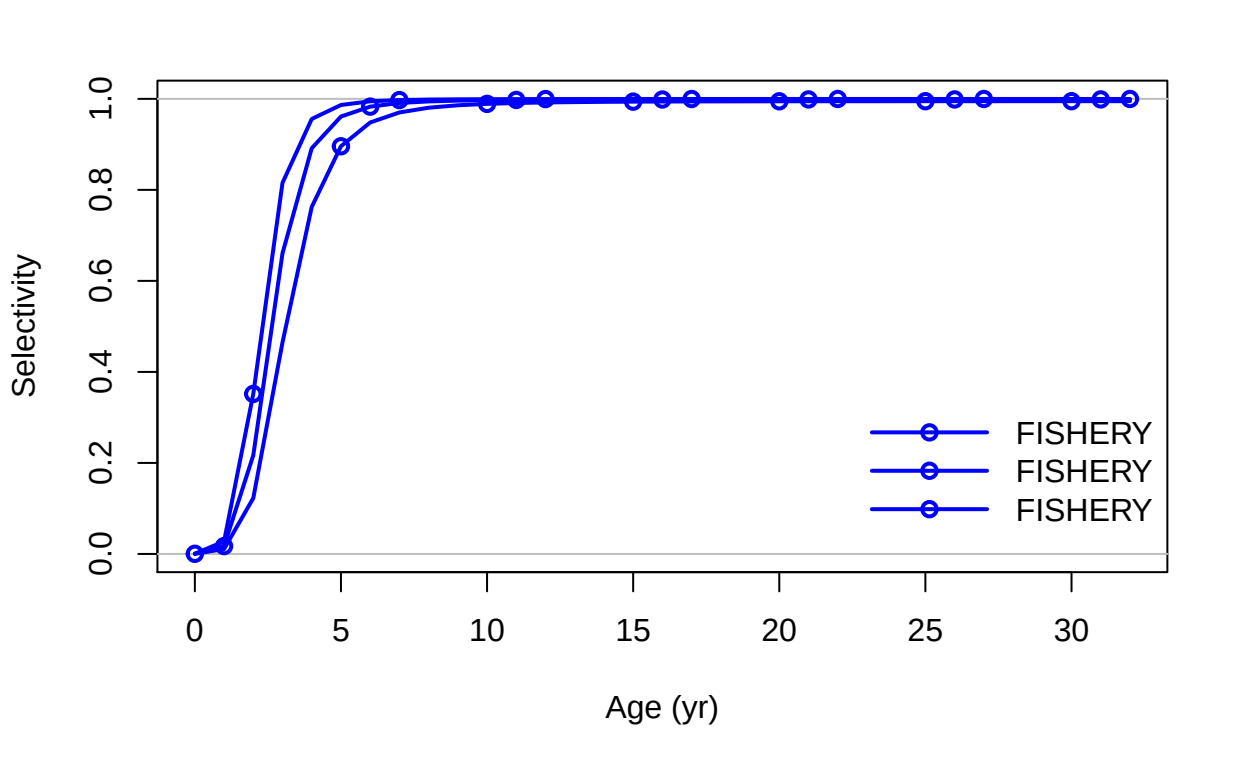

Fecundity
0
2
4
6
8
10
12
0
2
4
6
8
10
12
Female weight (kg)

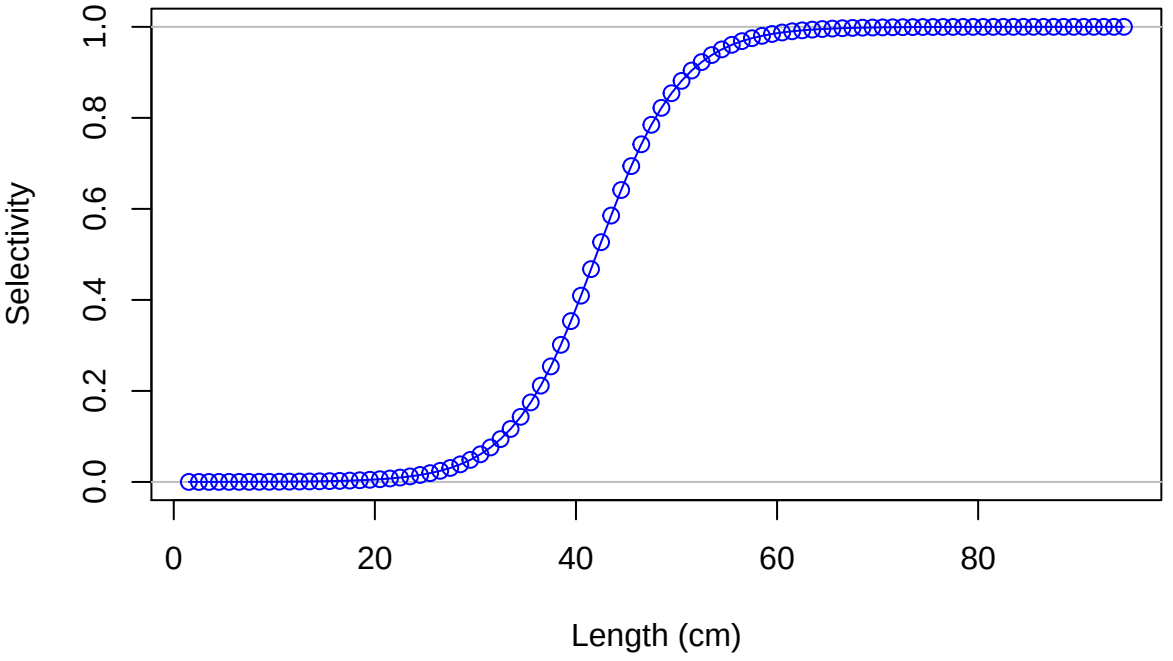

Fecundity
0
2
4
6
8
10
12
14
0
20
40
60
80
Female length (cm)

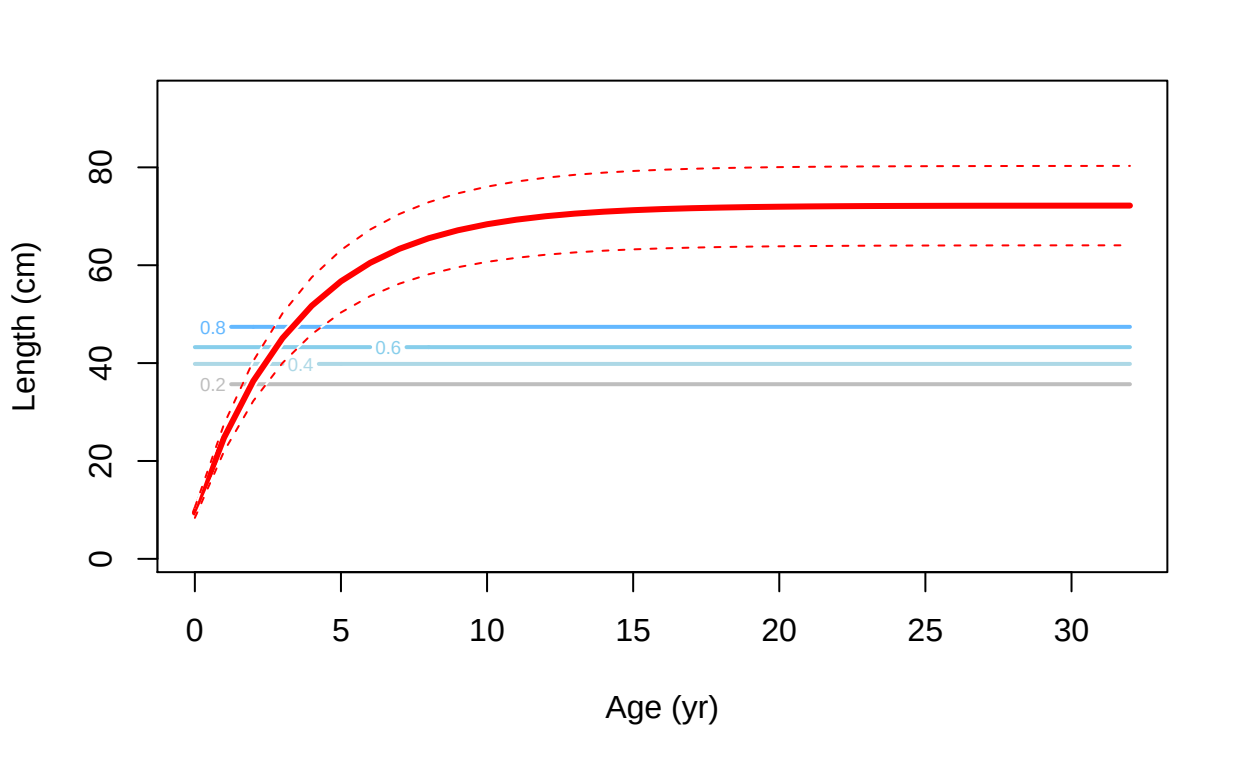

Spawning output
0
2
4
6
8
10
12
0
20
40
60
80
Length (cm)

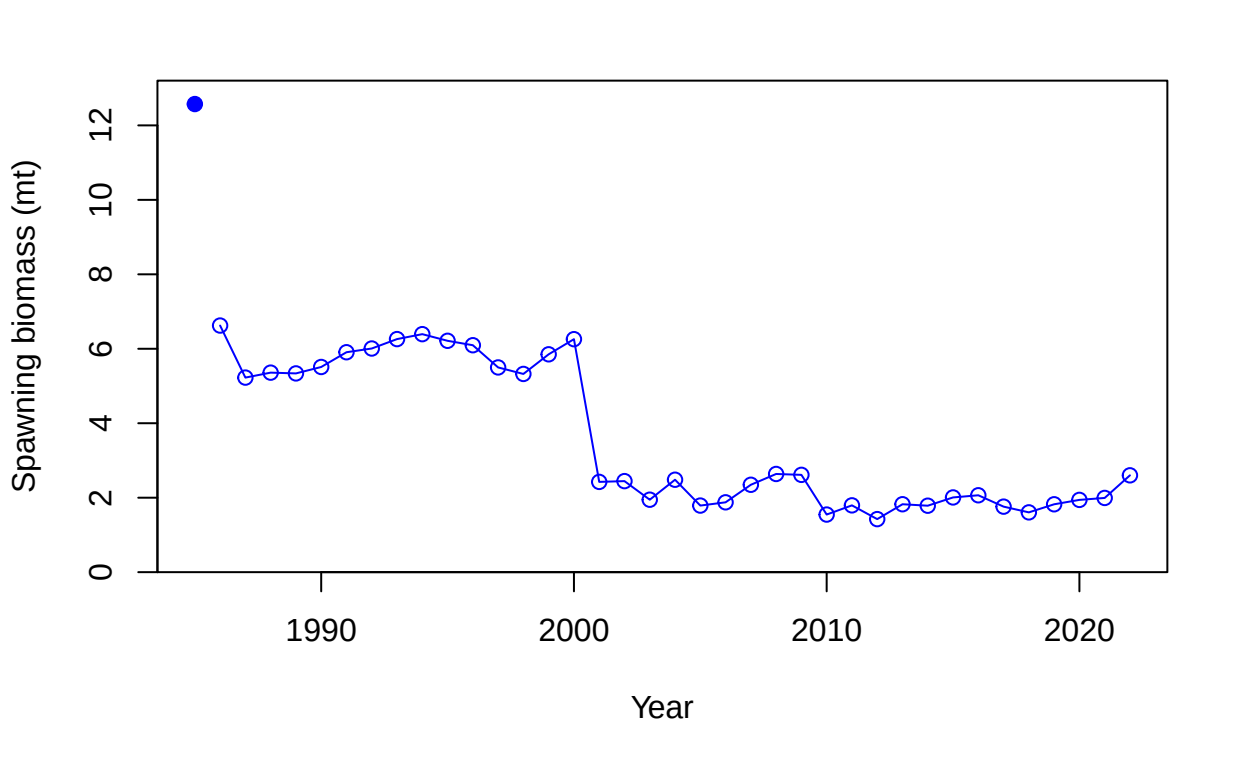

Spawning output
0
2
4
6
0
5
10
15
20
25
30
Age (yr)

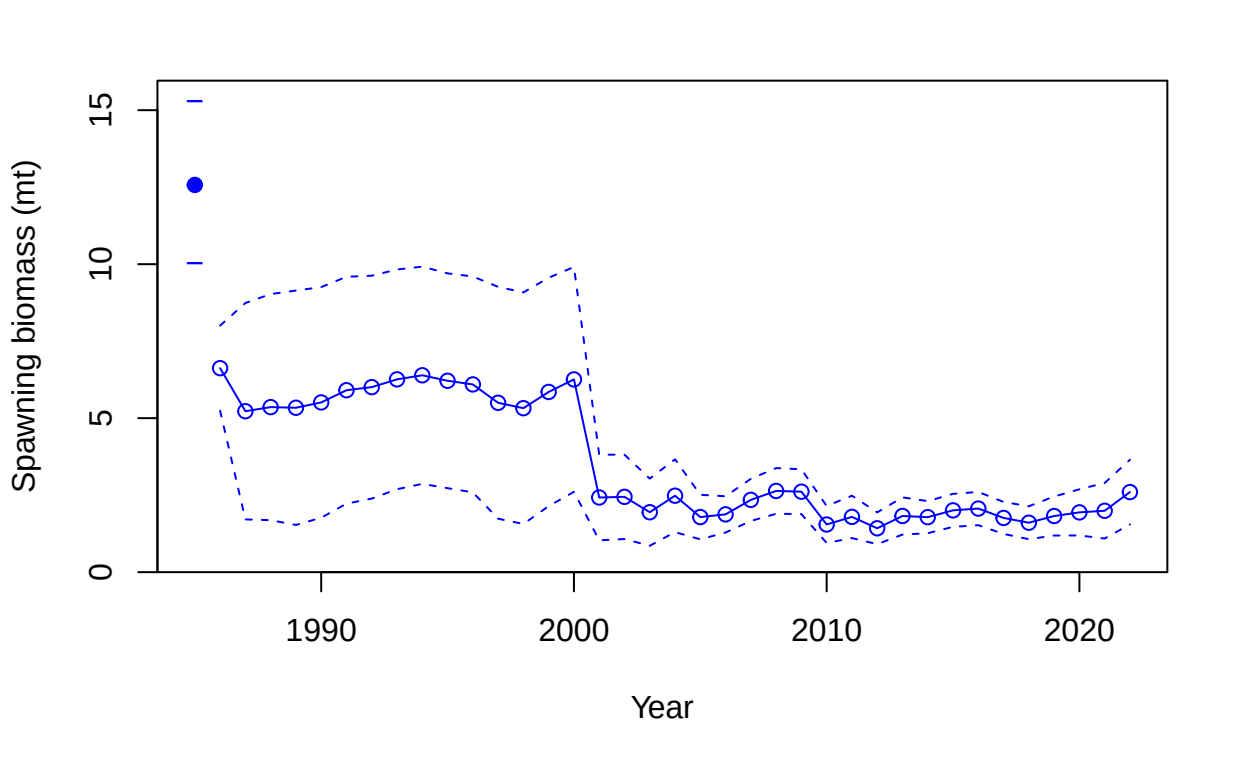

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
20
40
60
80
Length (cm)

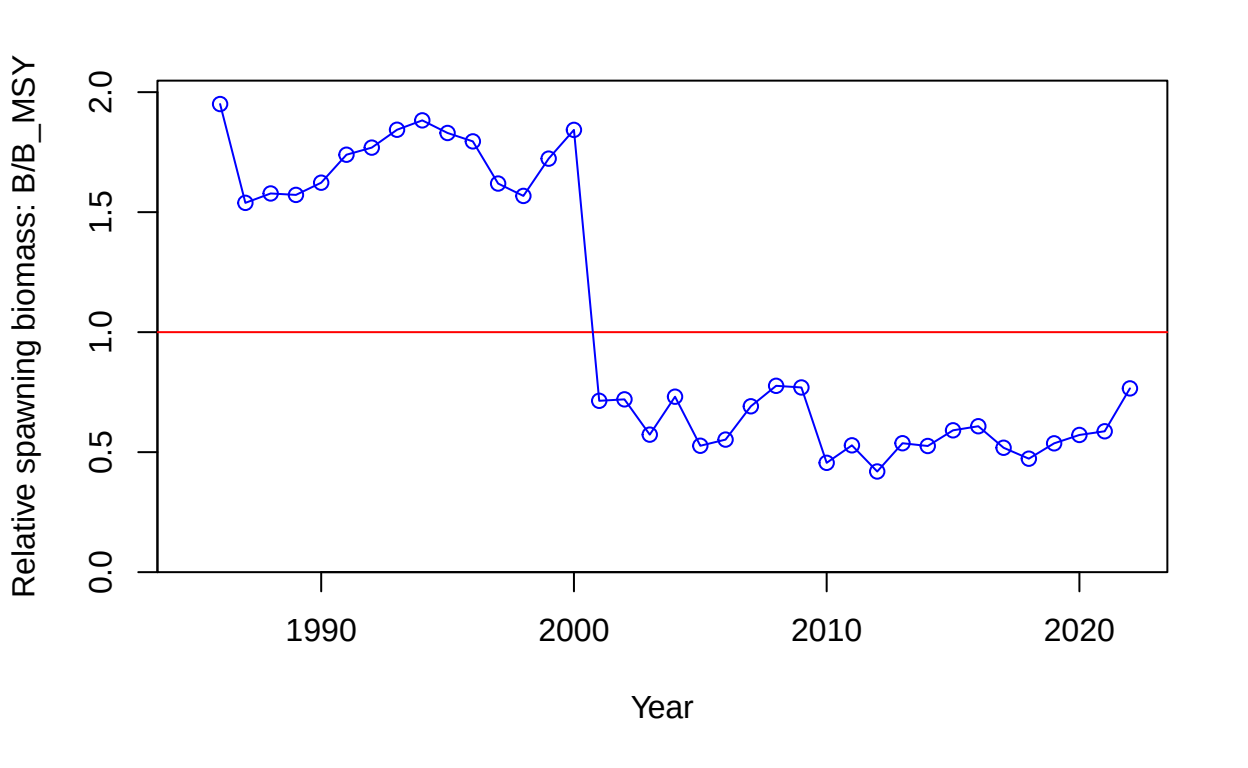

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
5
10
15
20
25
30
Age (yr)
FISHERY
FISHERY
FISHERY

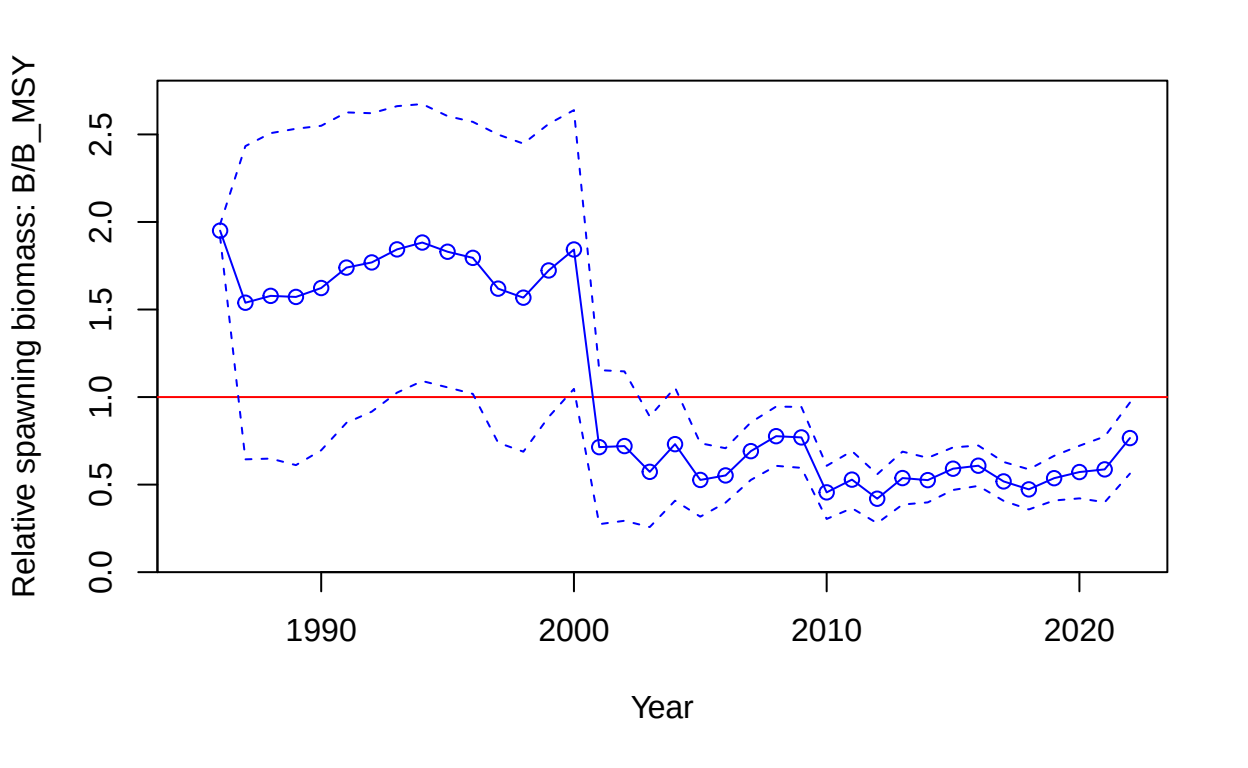

Selectivity
0.0
0.2
0.4
0.6
0.8
1.0
0
20
40
60
80
Length (cm)

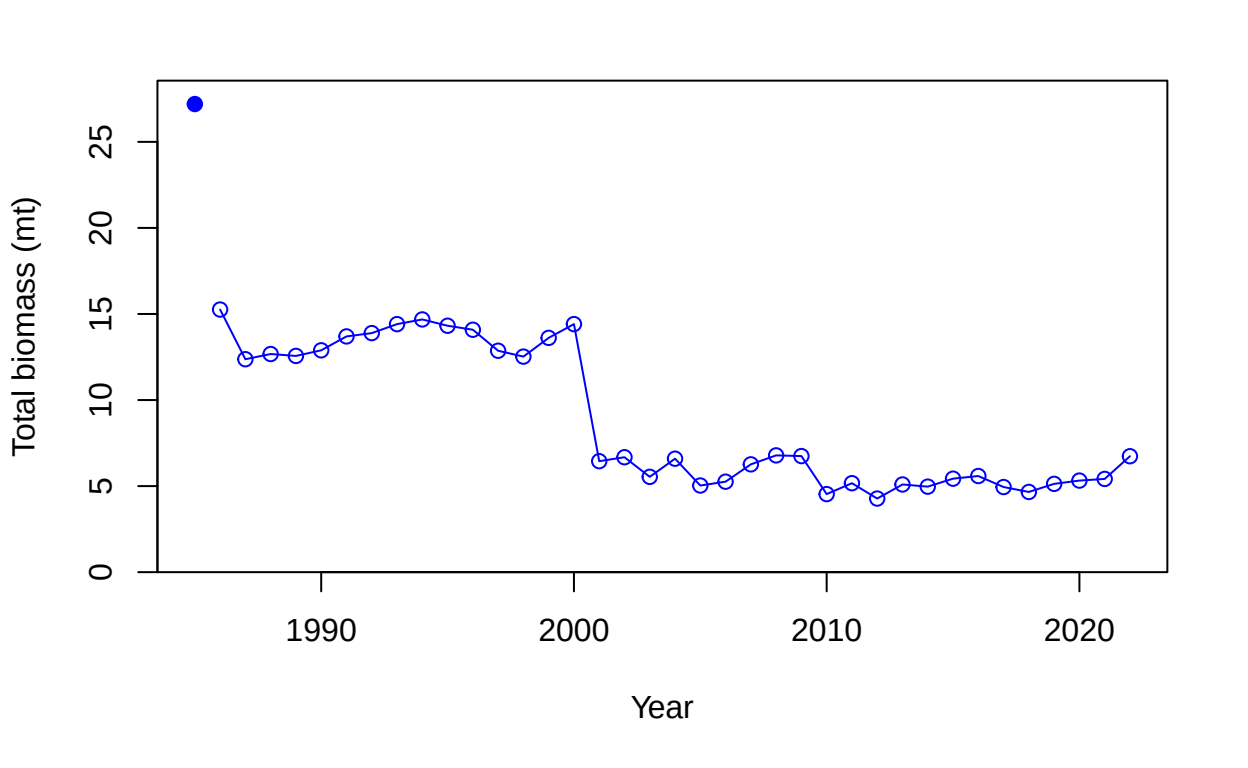

Length (cm)
0
20
40
60
80
0
5
10
15
20
25
30
Age (yr)
0.8
0.6
0.4
0.2

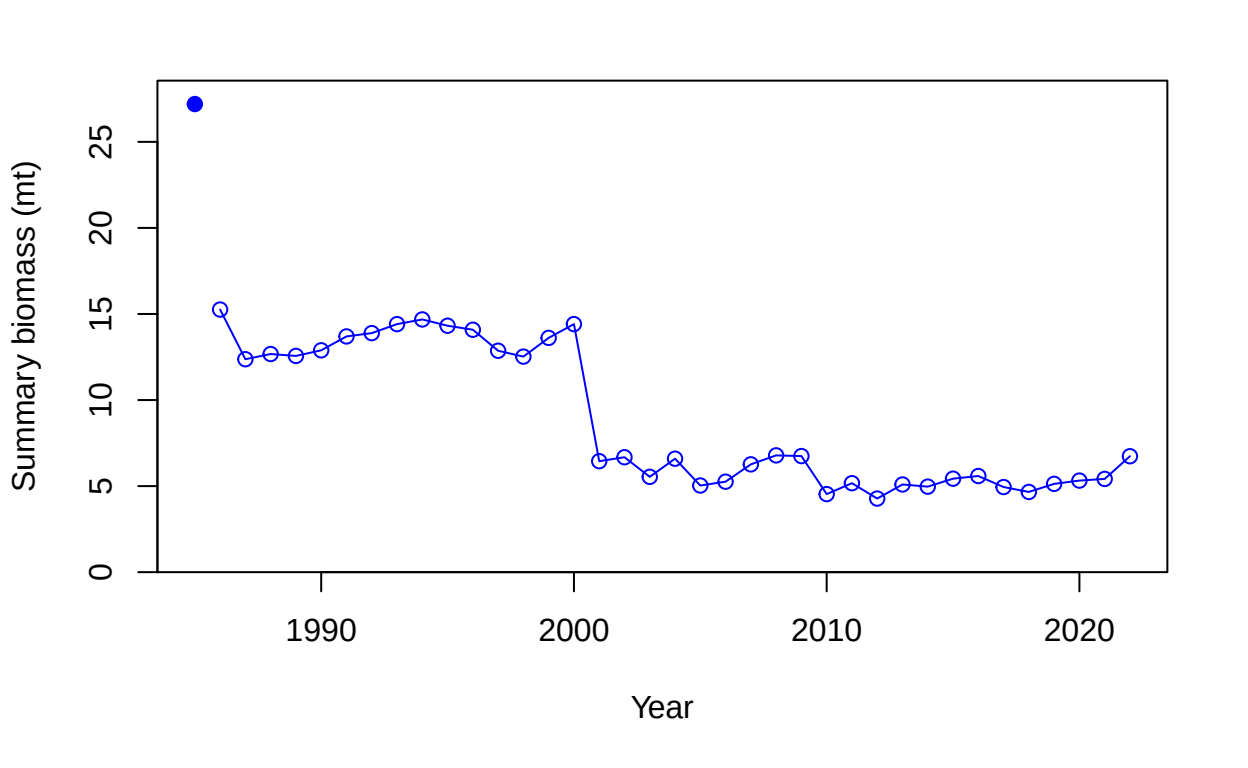

Spawning biomass (mt)
0
2
4
6
8
10
12
1990
2000
2010
2020
Year

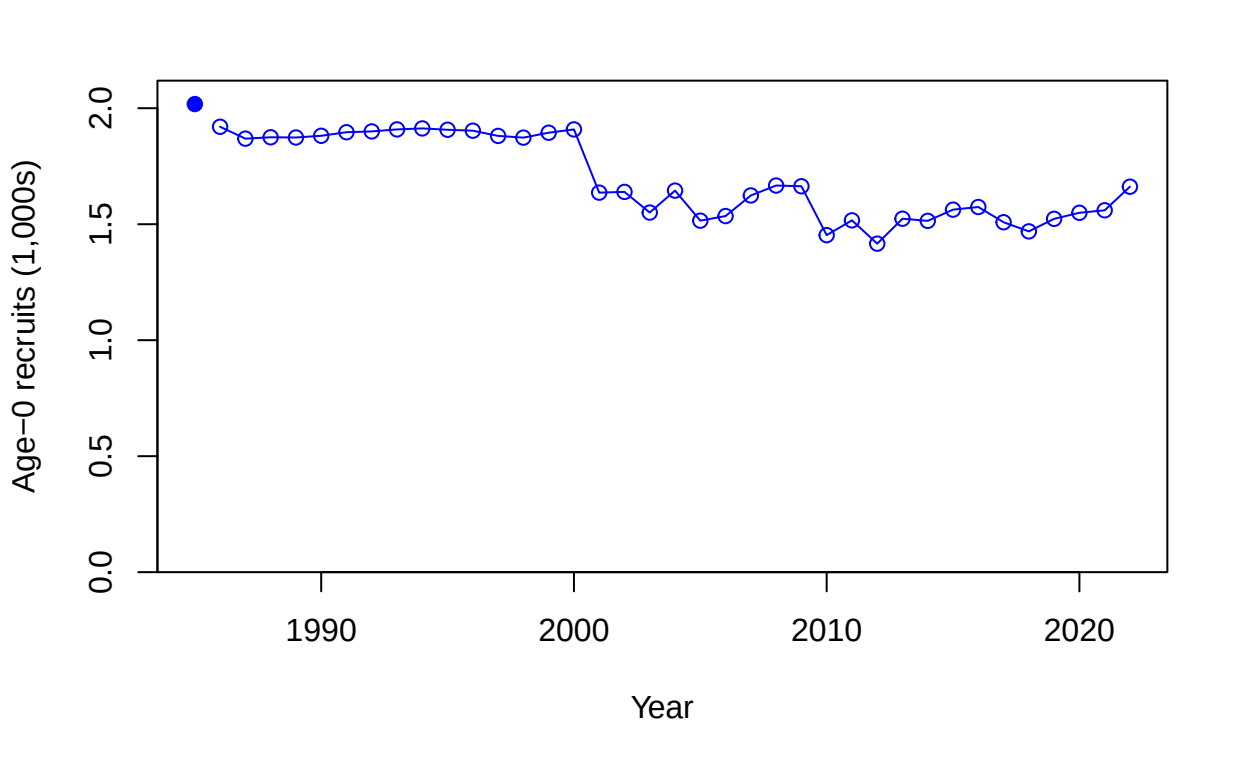

Spawning biomass (mt)
0
5
10
15
1990
2000
2010
2020
Year

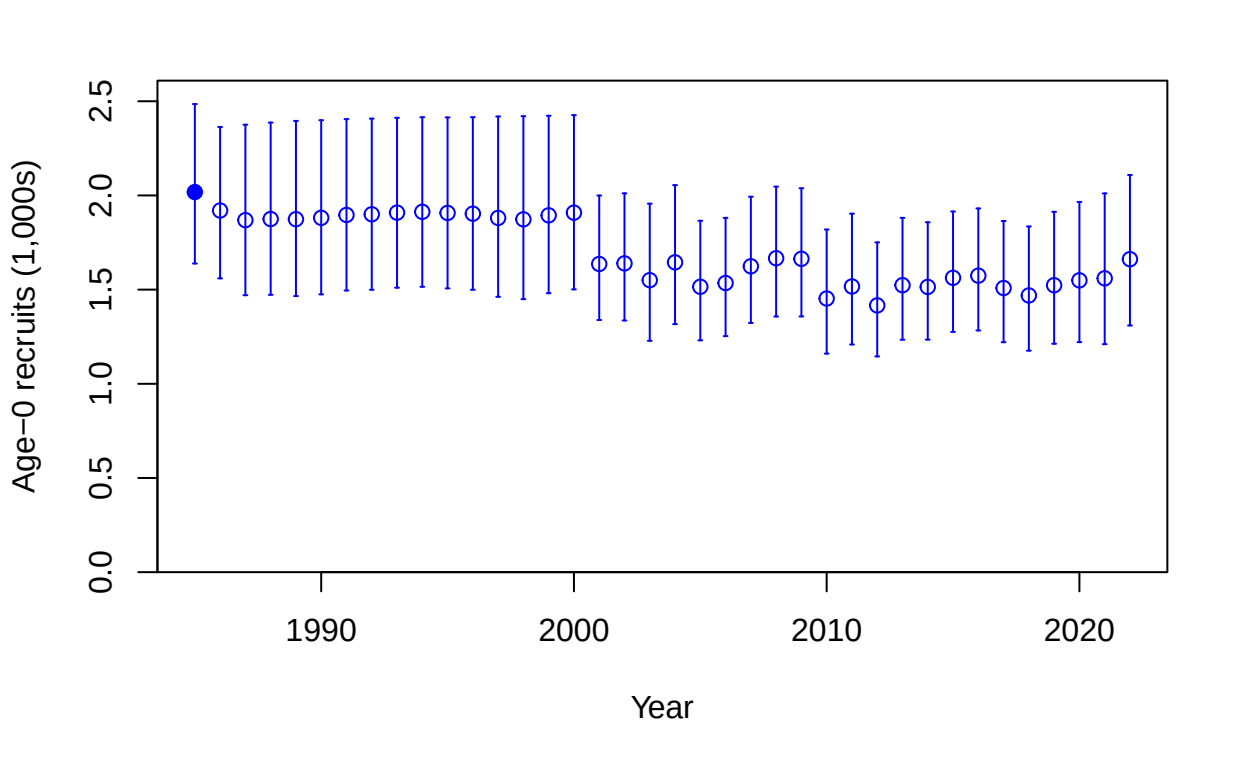

Relative spawning biomass: B/B_MSY
0.0
0.5
1.0
1.5
2.0
1990
2000
2010
2020
Year

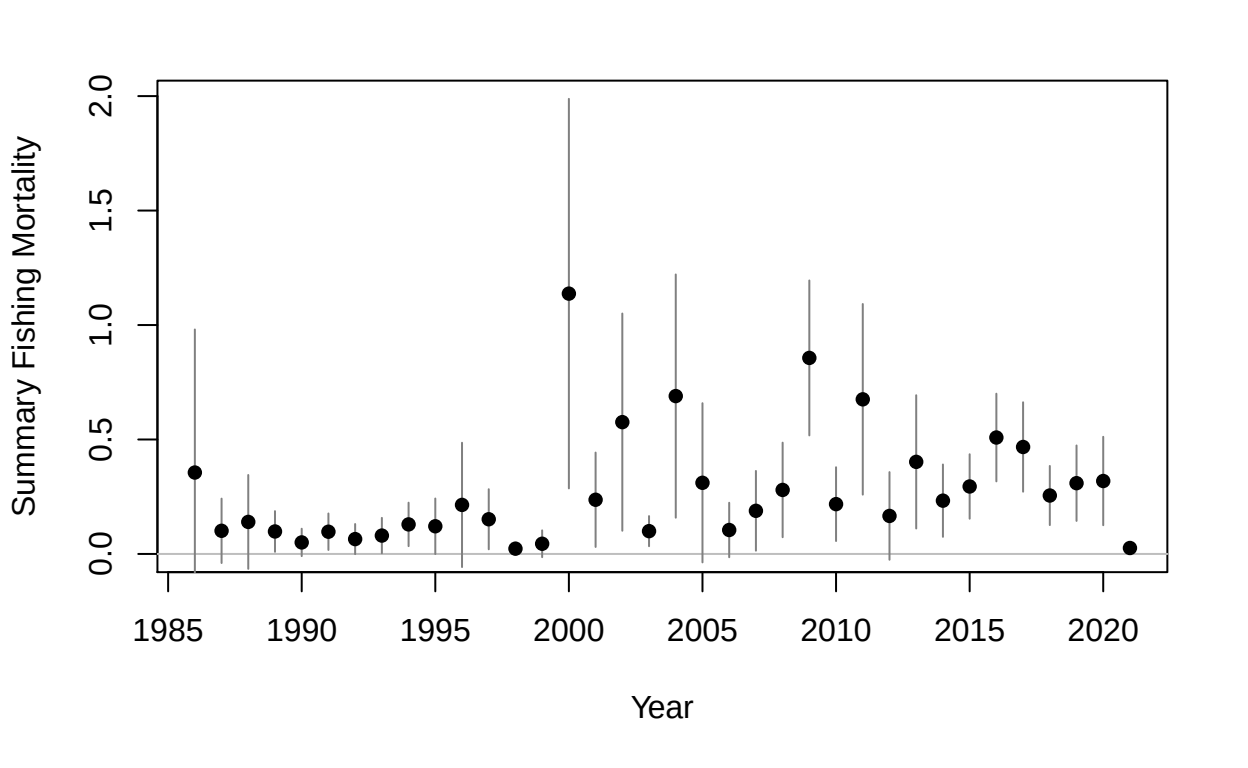

Relative spawning biomass: B/B_MSY
0.0
0.5
1.0
1.5
2.0
2.5
1990
2000
2010
2020
Year

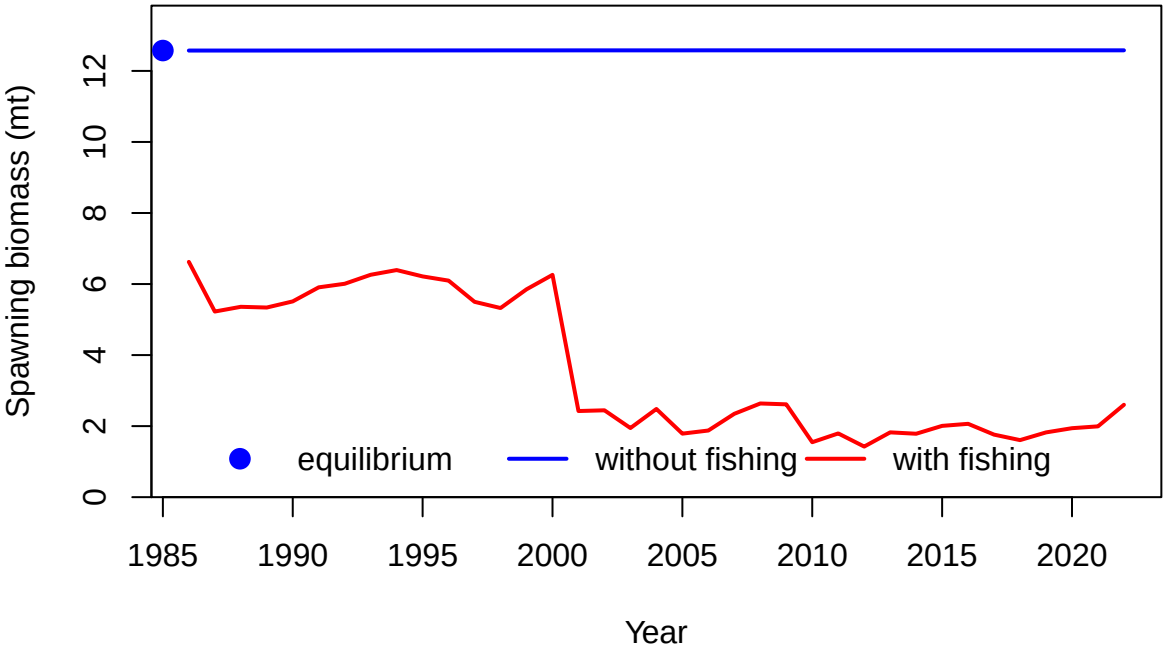

Total biomass (mt)
0
5
10
15
20
25
1990
2000
2010
2020
Year

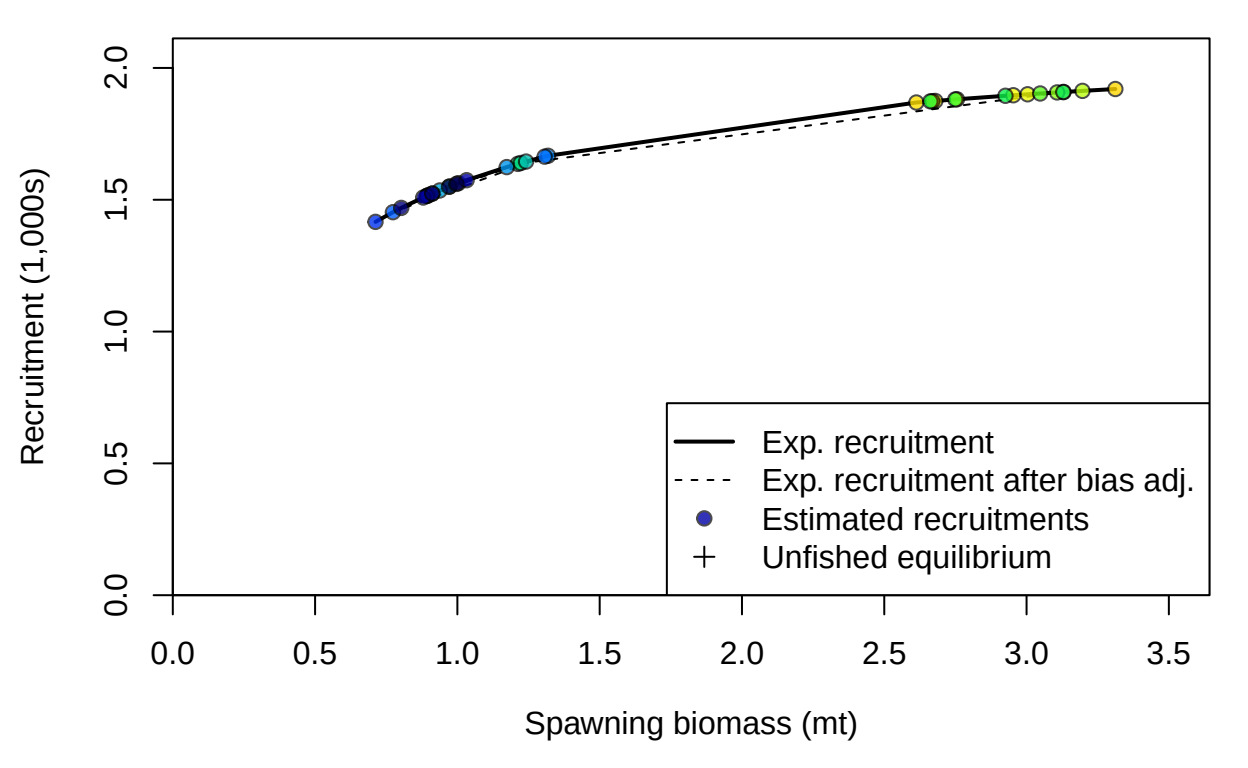

Summary biomass (mt)
0
5
10
15
20
25
1990
2000
2010
2020
Year

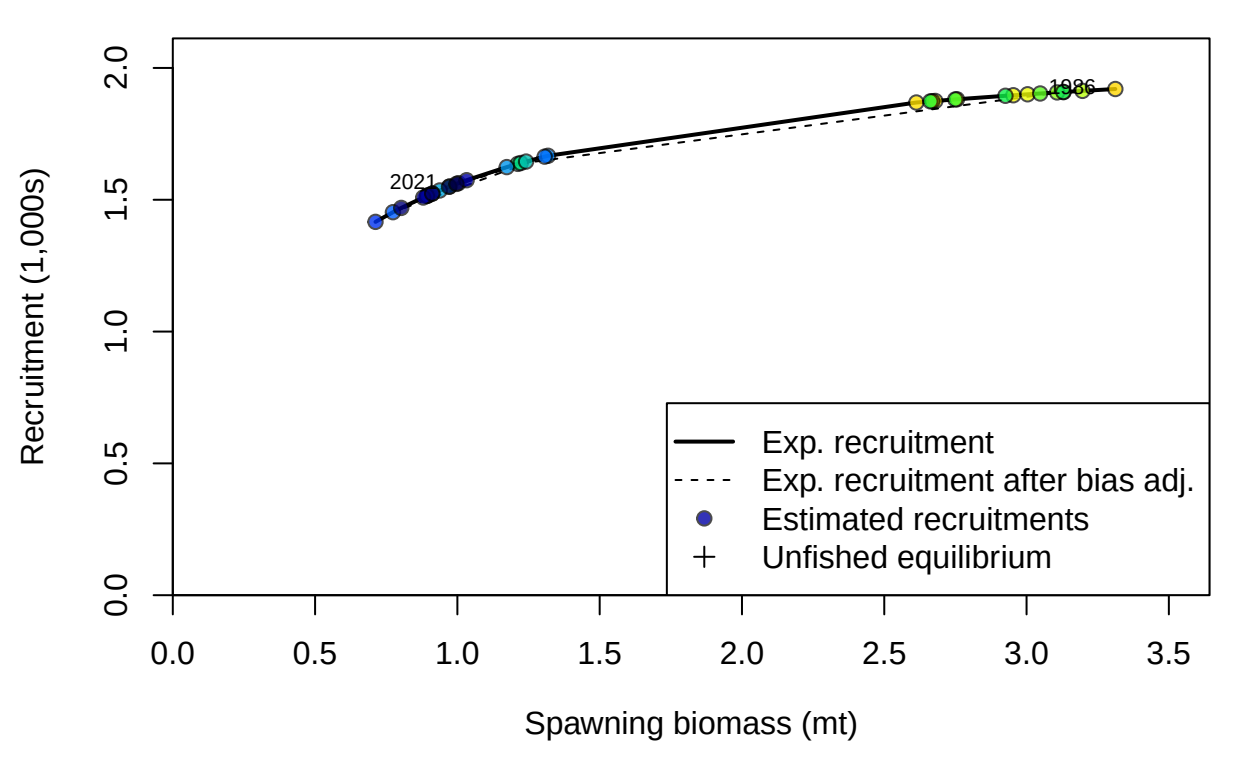

Age−0 recruits (1,000s)
0.0
0.5
1.0
1.5
2.0
1990
2000
2010
2020
Year

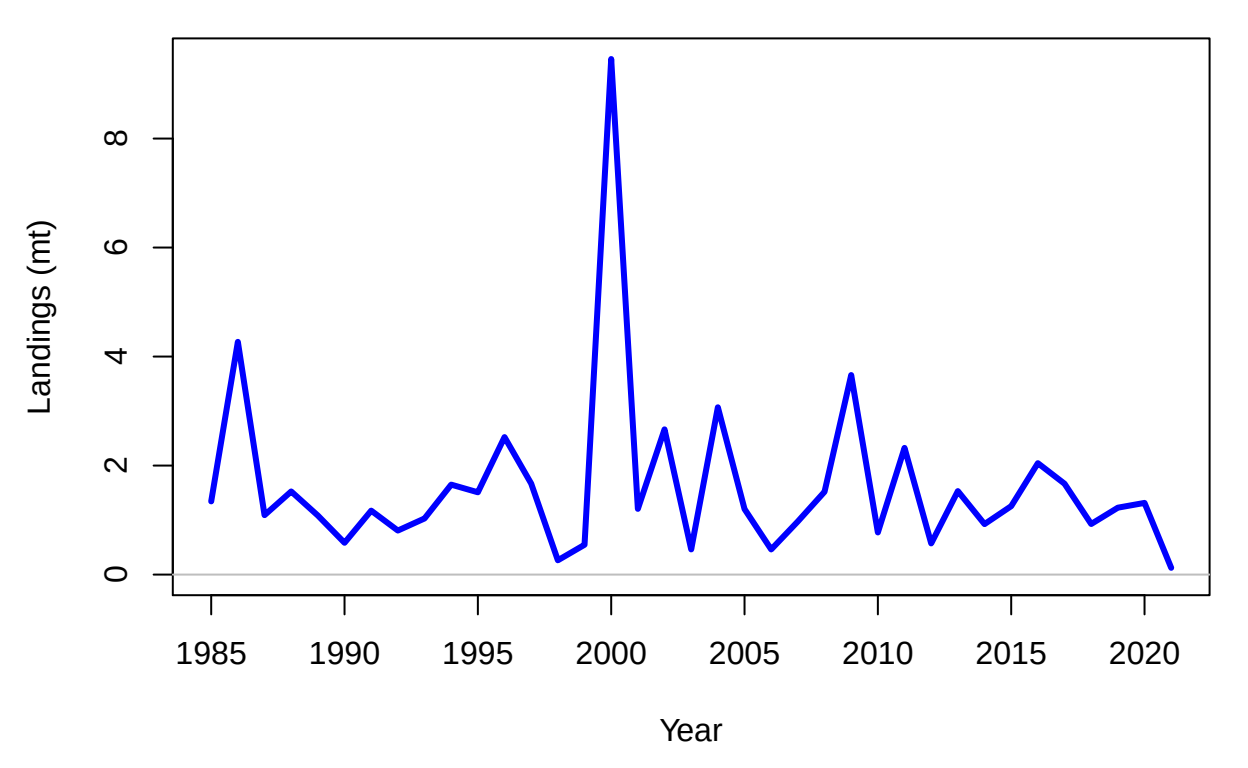

Age−0 recruits (1,000s)
0.0
0.5
1.0
1.5
2.0
2.5
1990
2000
2010
2020
Year

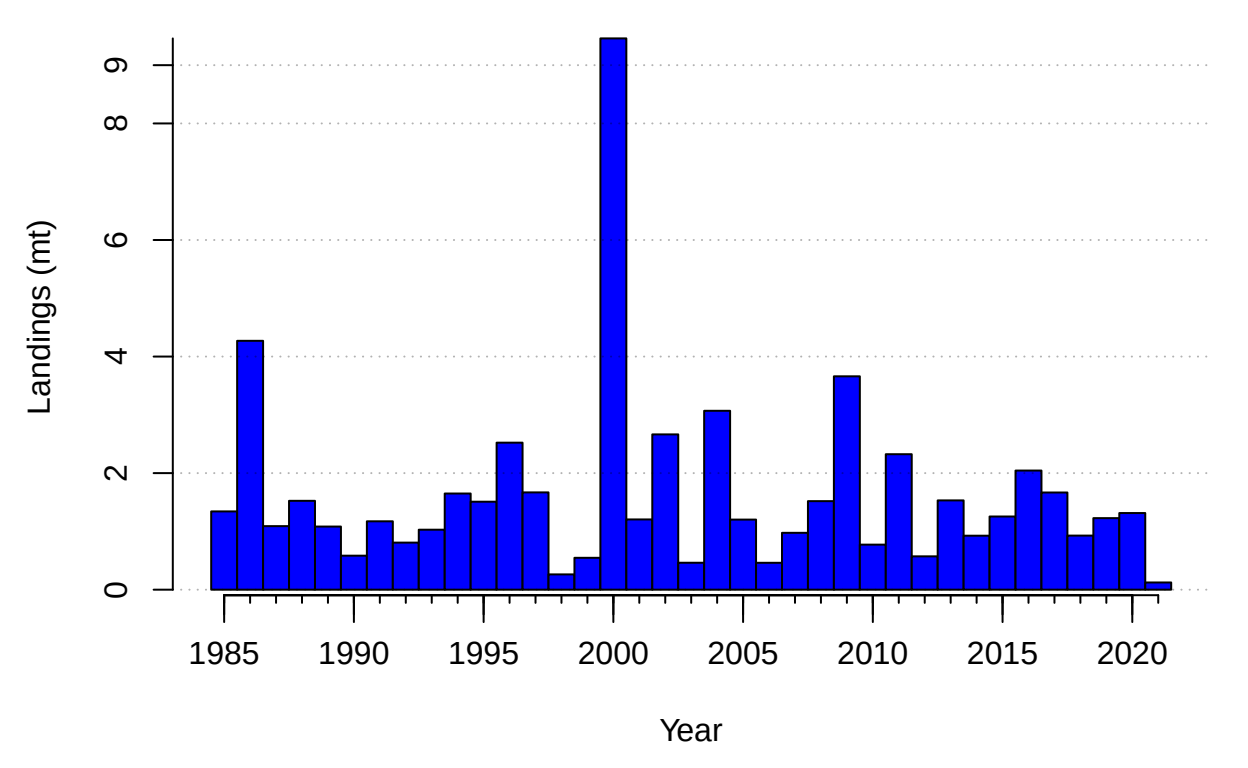

Summary Fishing Mortality
0.0
0.5
1.0
1.5
2.0
1985
1990
1995
2000
2005
2010
2015
2020
Year

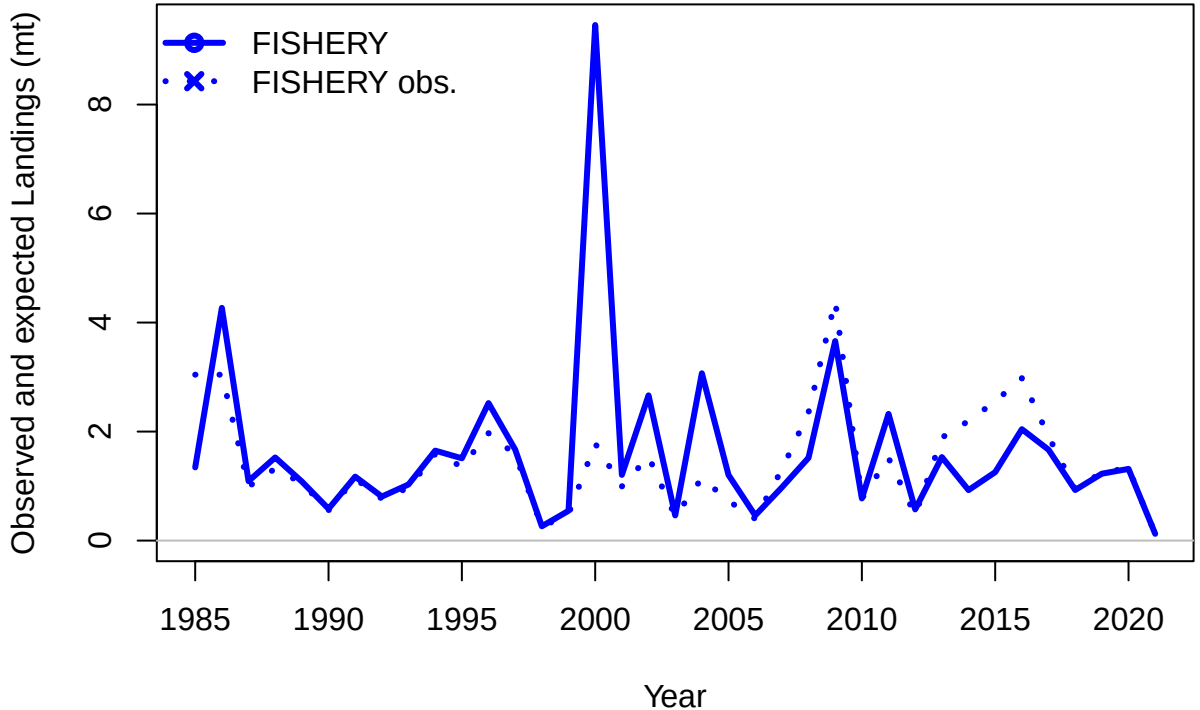

Spawning biomass (mt)
0
2
4
6
8
10
12
1985
1990
1995
2000
2005
2010
2015
2020
Year
equilibrium
without fishing
with fishing

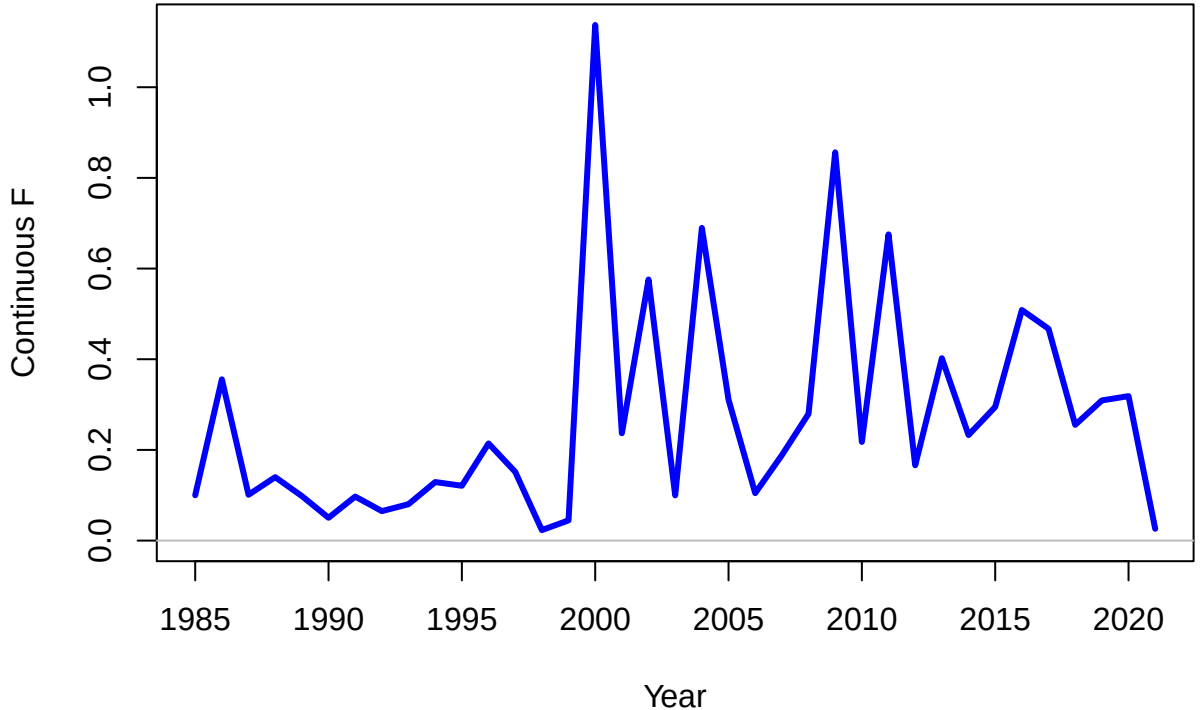

Recruitment (1,000s)
0.0
0.5
1.0
1.5
2.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
Spawning biomass (mt)
Exp. recruitment
Exp. recruitment after bias adj.
Estimated recruitments
Unfished equilibrium

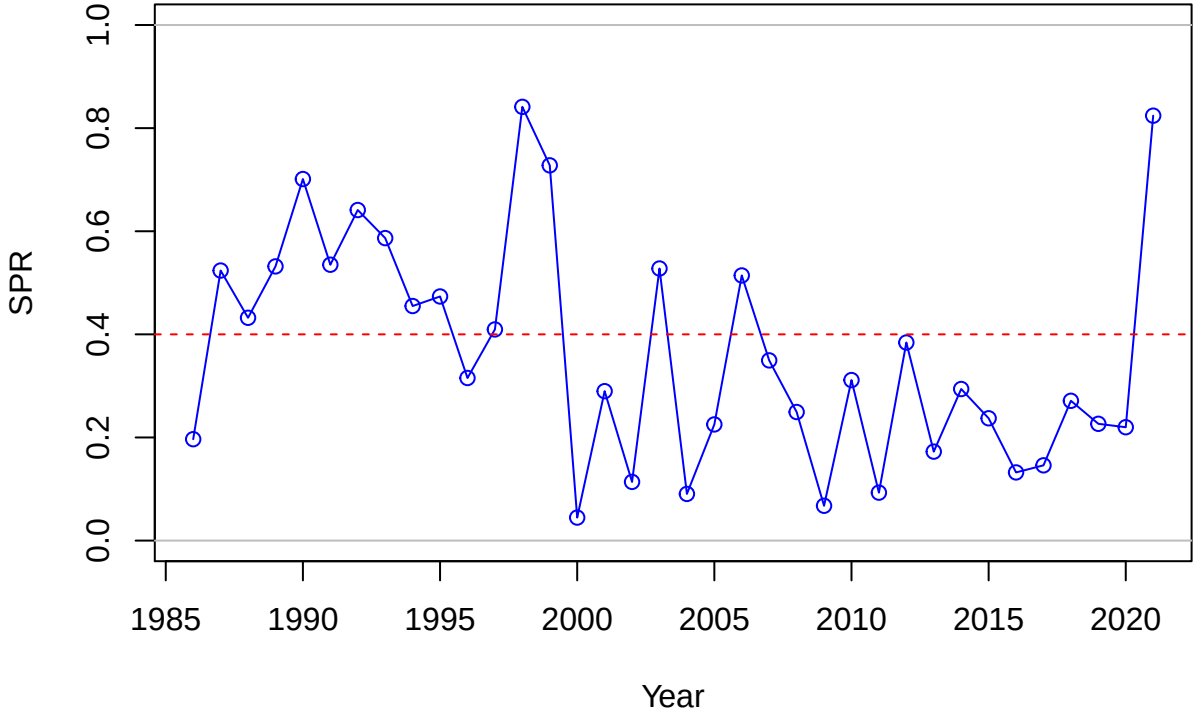

Recruitment (1,000s)
0.0
0.5
1.0
1.5
2.0
Spawning biomass (mt)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
2021
1986
Exp. recruitment
Exp. recruitment after bias adj.
Estimated recruitments
Unfished equilibrium

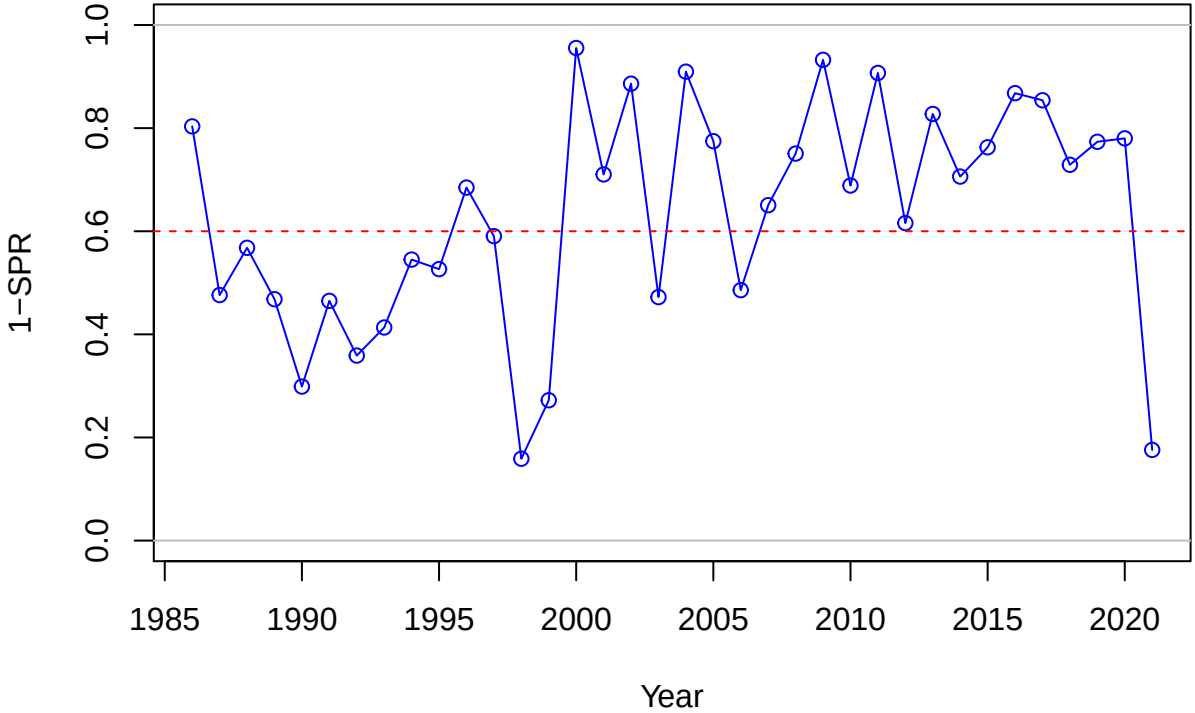

Landings (mt)
0
2
4
6
8
1985
1990
1995
2000
2005
2010
2015
2020
Year

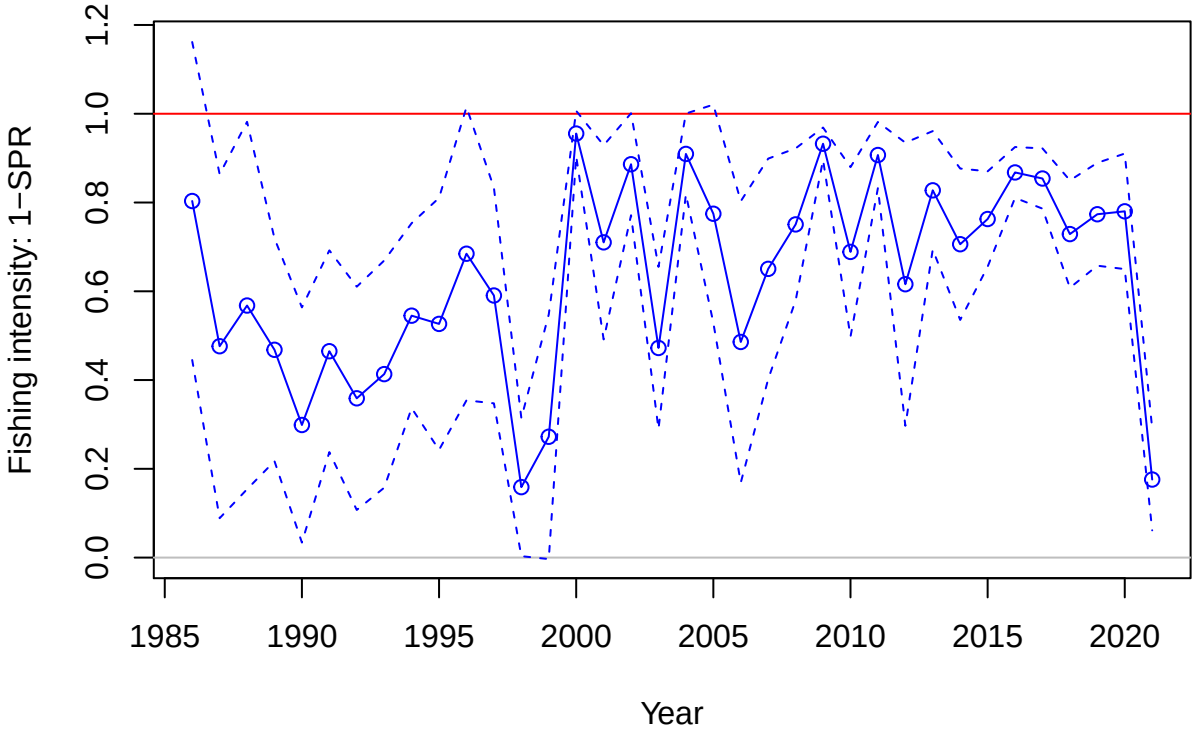

Landings (mt)
0
2
4
6
8
9
1985
1990
1995
2000
2005
2010
2015
2020
Year

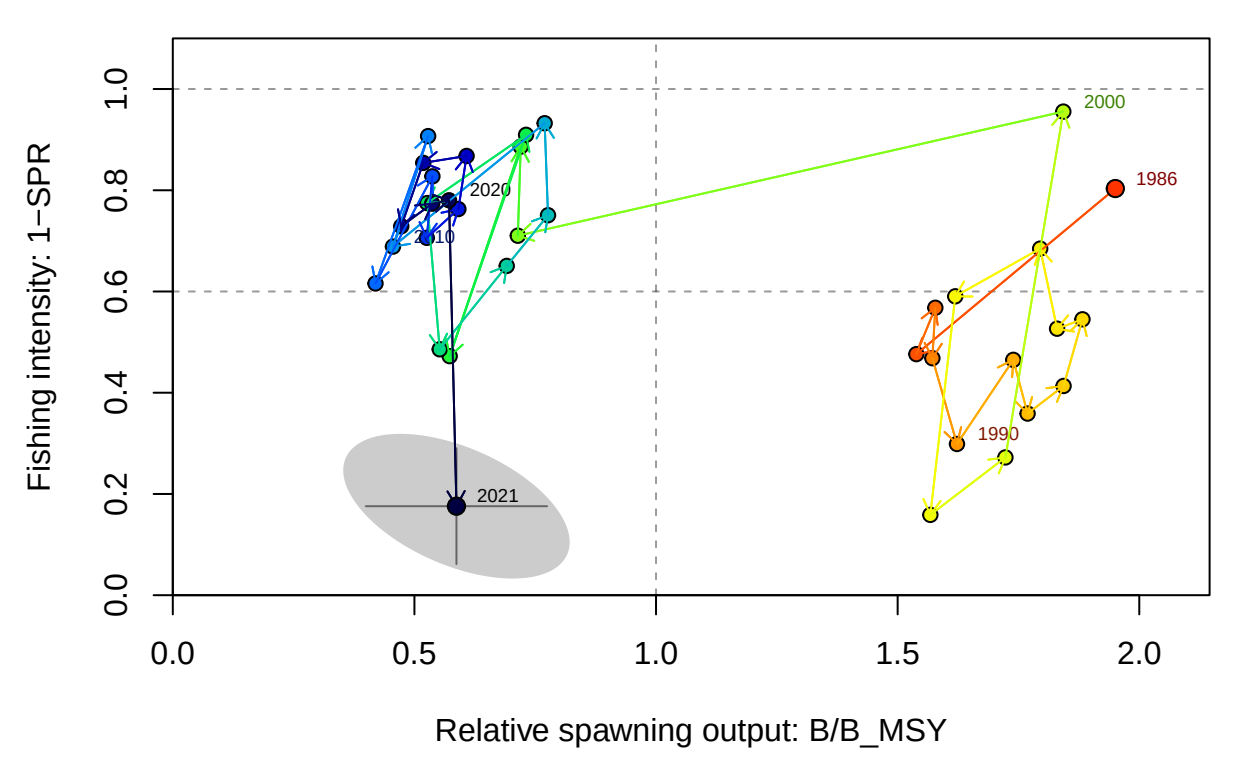

FISHERY
FISHERY obs.
Observed and expected Landings (mt)
0
2
4
6
8
1985
1990
1995
2000
2005
2010
2015
2020
Year

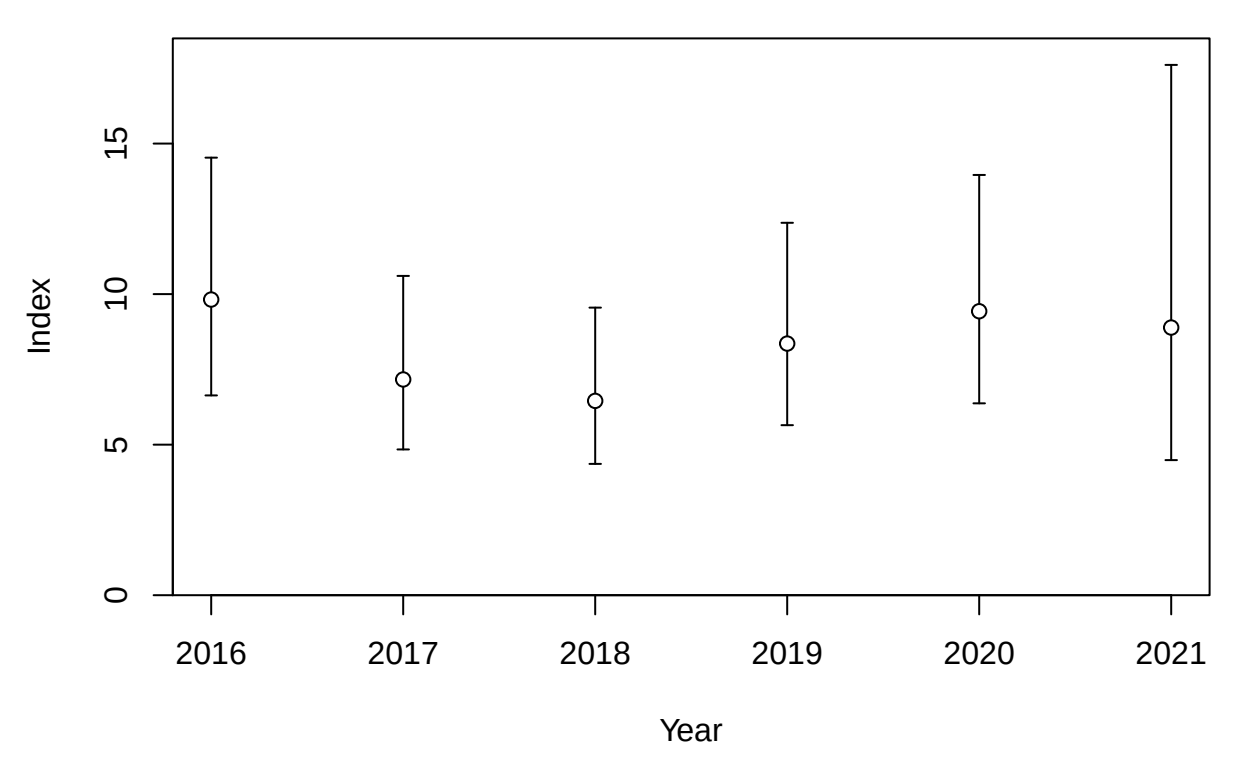

Continuous F
0.0
0.2
0.4
0.6
0.8
1.0
1985
1990
1995
2000
2005
2010
2015
2020
Year

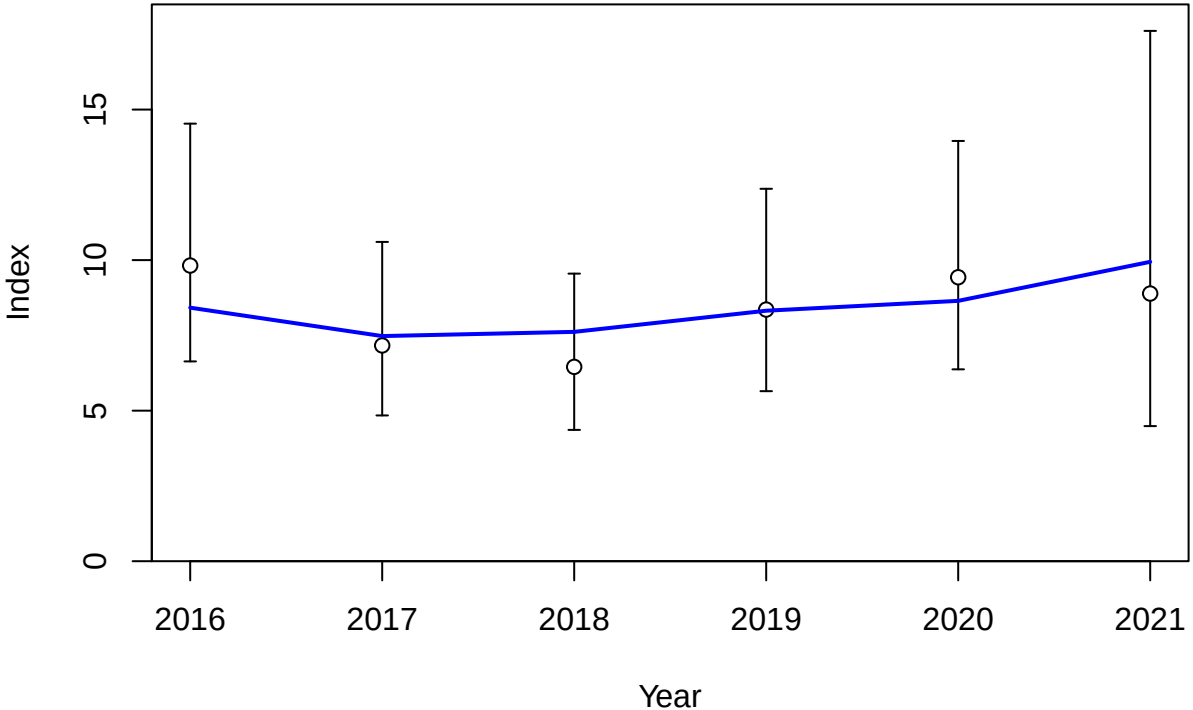

SPR
0.0
0.2
0.4
0.6
0.8
1.0
1985
1990
1995
2000
2005
2010
2015
2020
Year

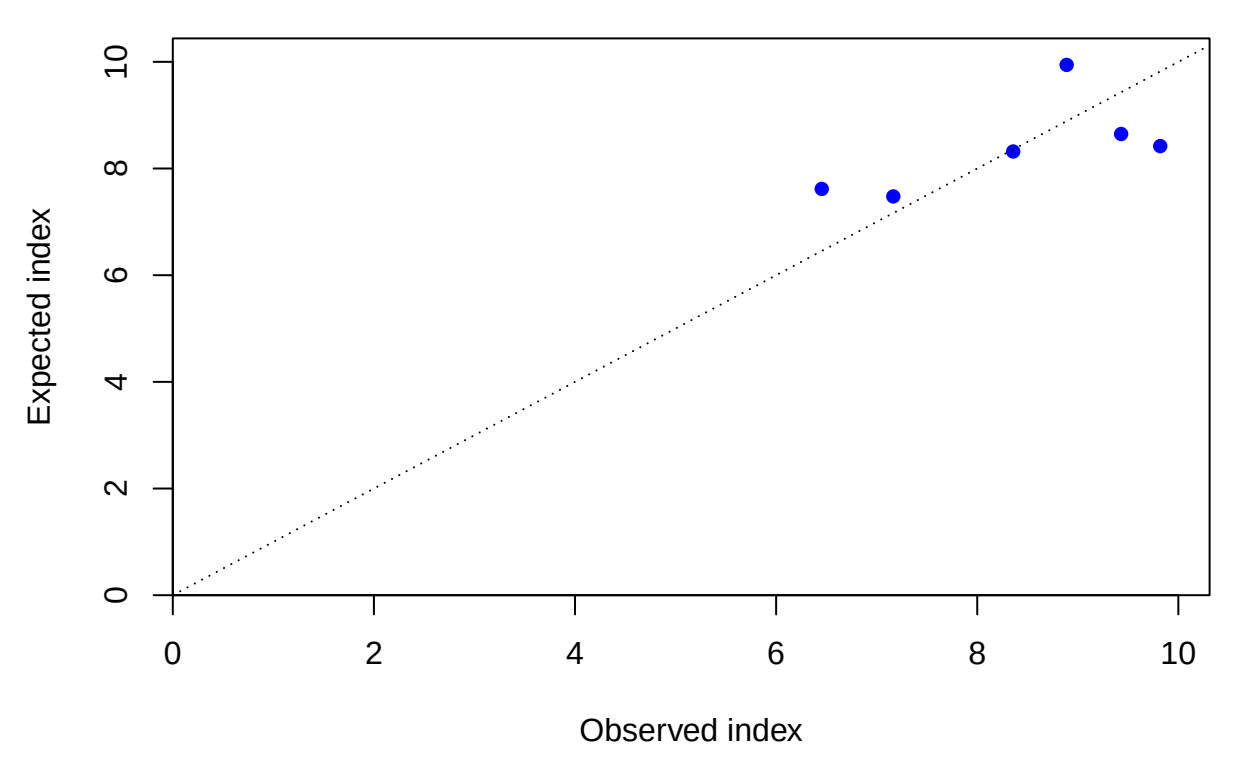

1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
1985
1990
1995
2000
2005
2010
2015
2020
Year

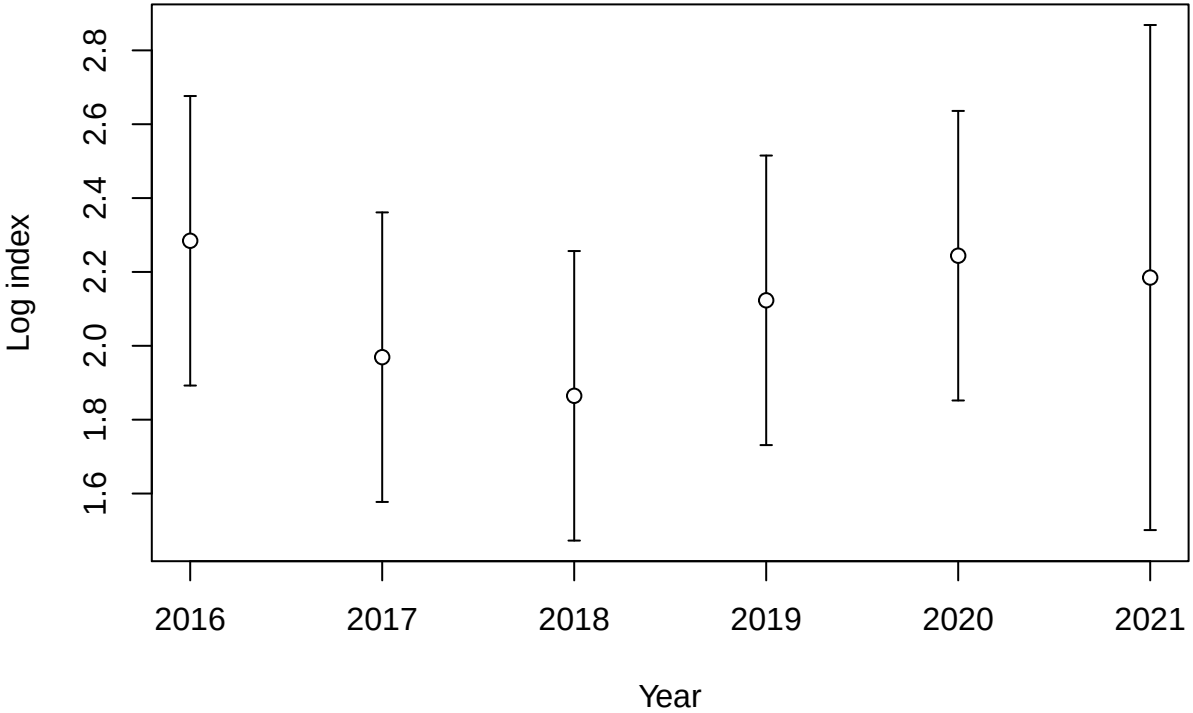

Fishing intensity: 1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1985
1990
1995
2000
2005
2010
2015
2020
Year

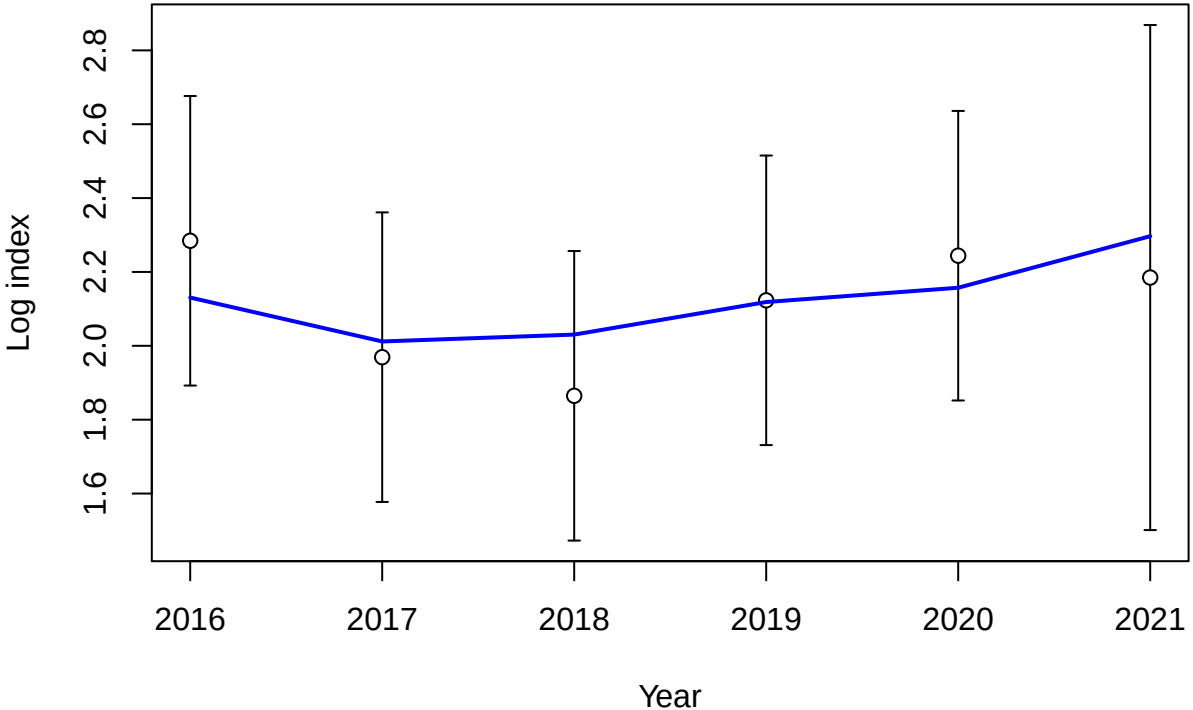

Fishing intensity: 1−SPR
0.0
0.2
0.4
0.6
0.8
1.0
0.0
0.5
1.0
1.5
2.0
Relative spawning output: B/B_MSY
2000
1986
2020
2010
1990
2021

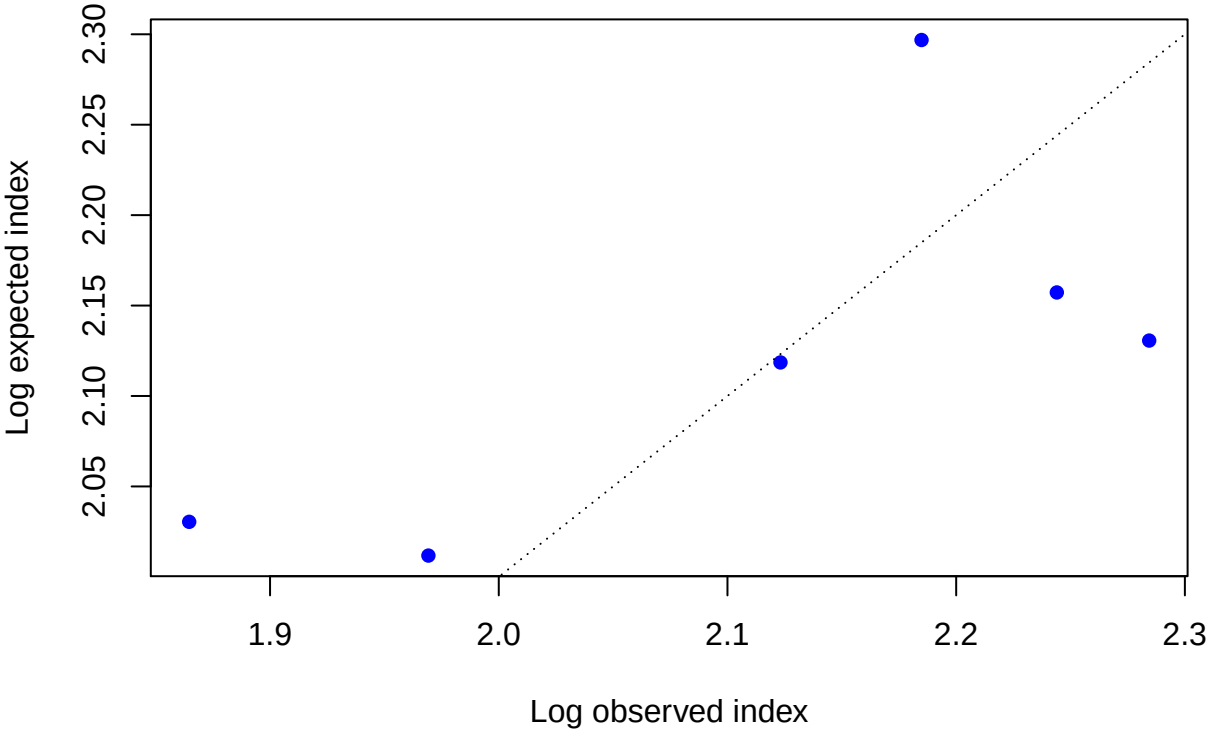

Index
0
5
10
15
2016
2017
2018
2019
2020
2021
Year

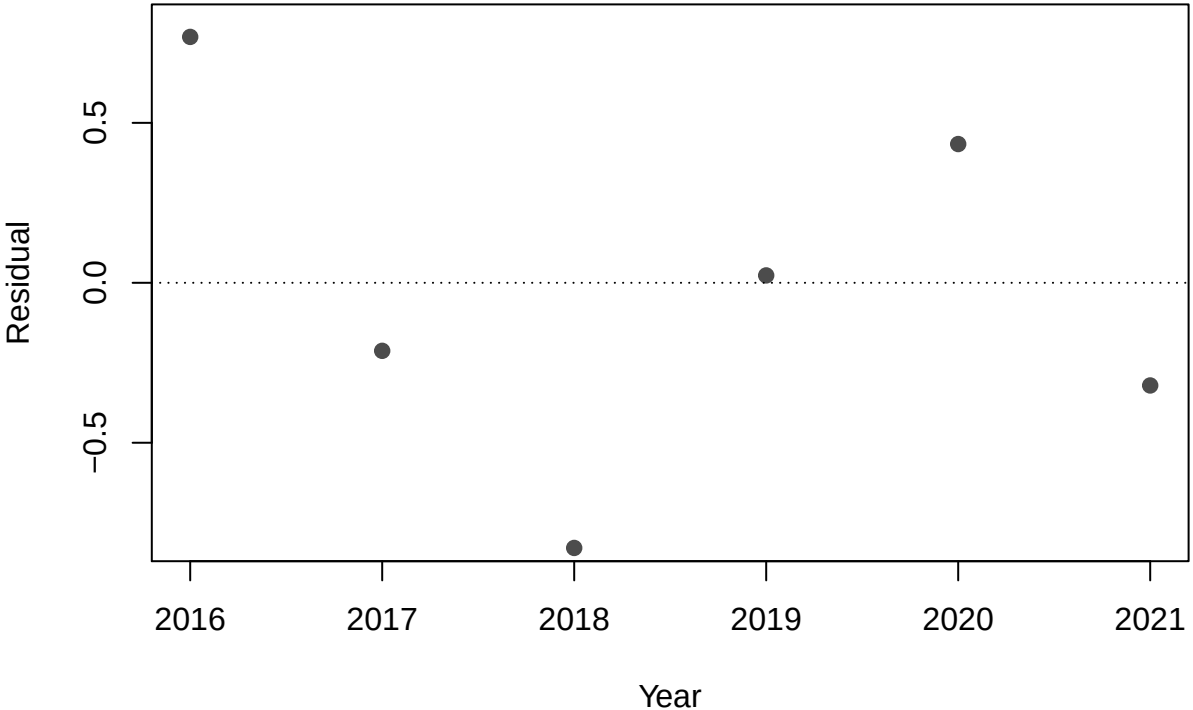

Index
0
5
10
15
2016
2017
2018
2019
2020
2021
Year

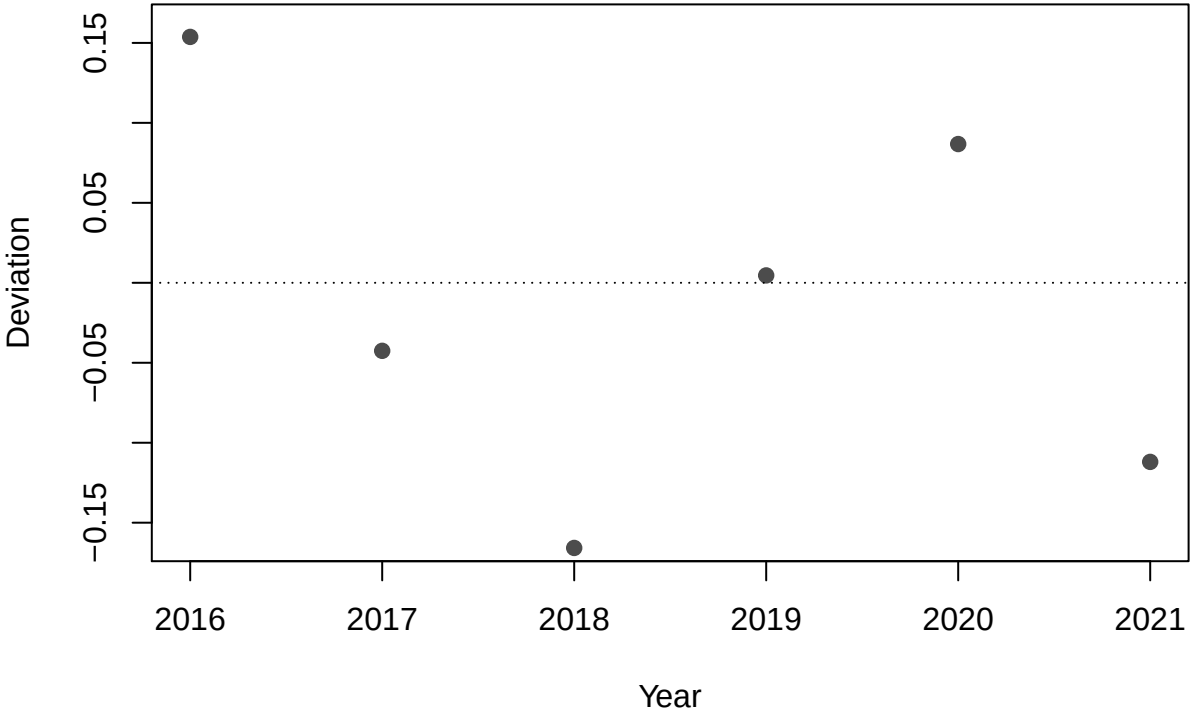

Expected index
Observed index
0
2
4
6
8
10

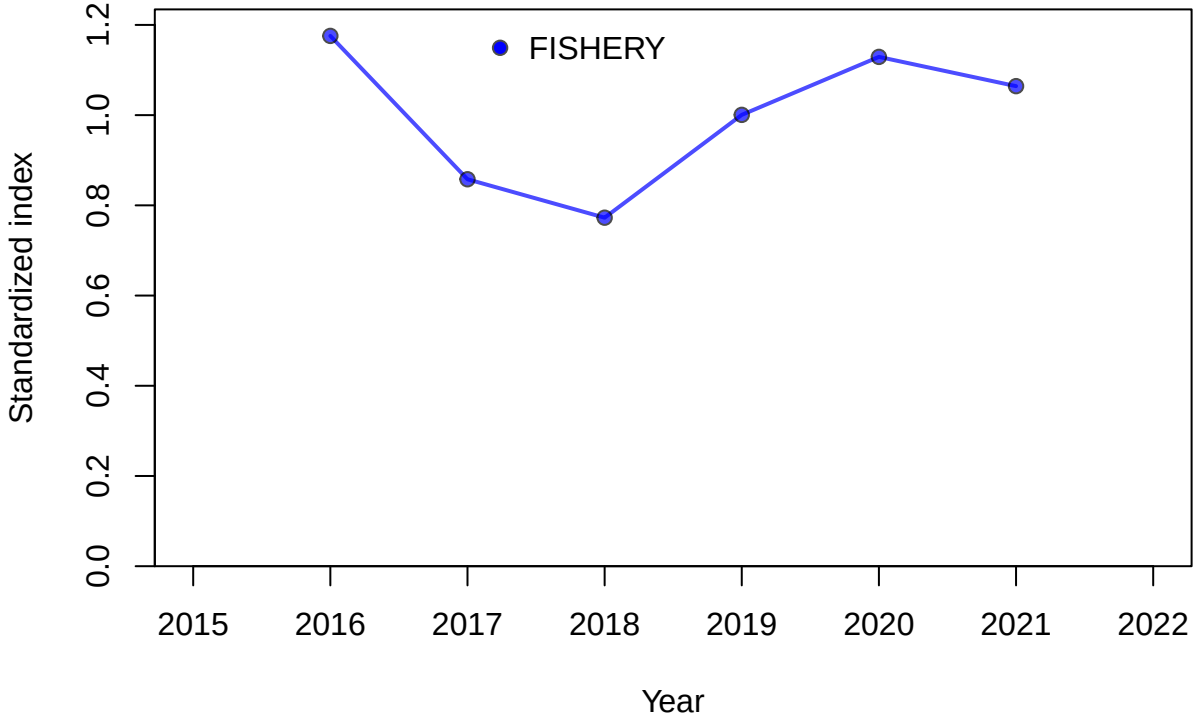

Log index
1.6
1.8
2.0
2.2
2.4
2.6
2.8
2016
2017
2018
2019
2020
2021
Year

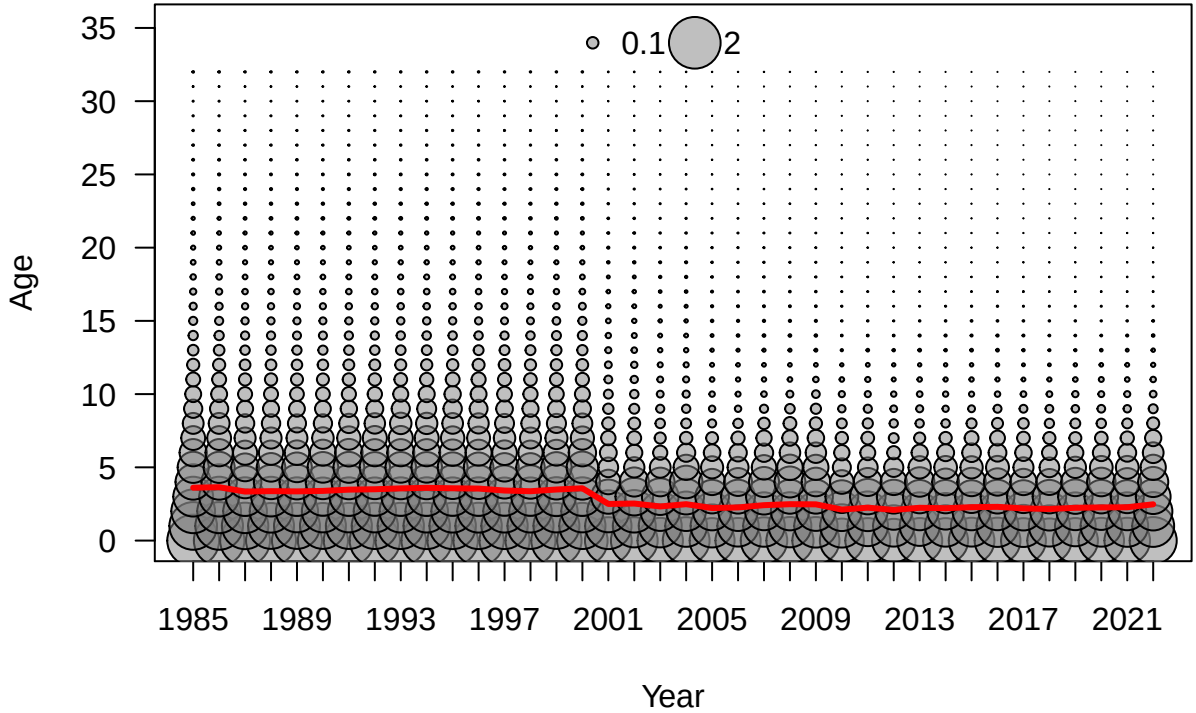

Log index
1.6
1.8
2.0
2.2
2.4
2.6
2.8
2016
2017
2018
2019
2020
2021
Year

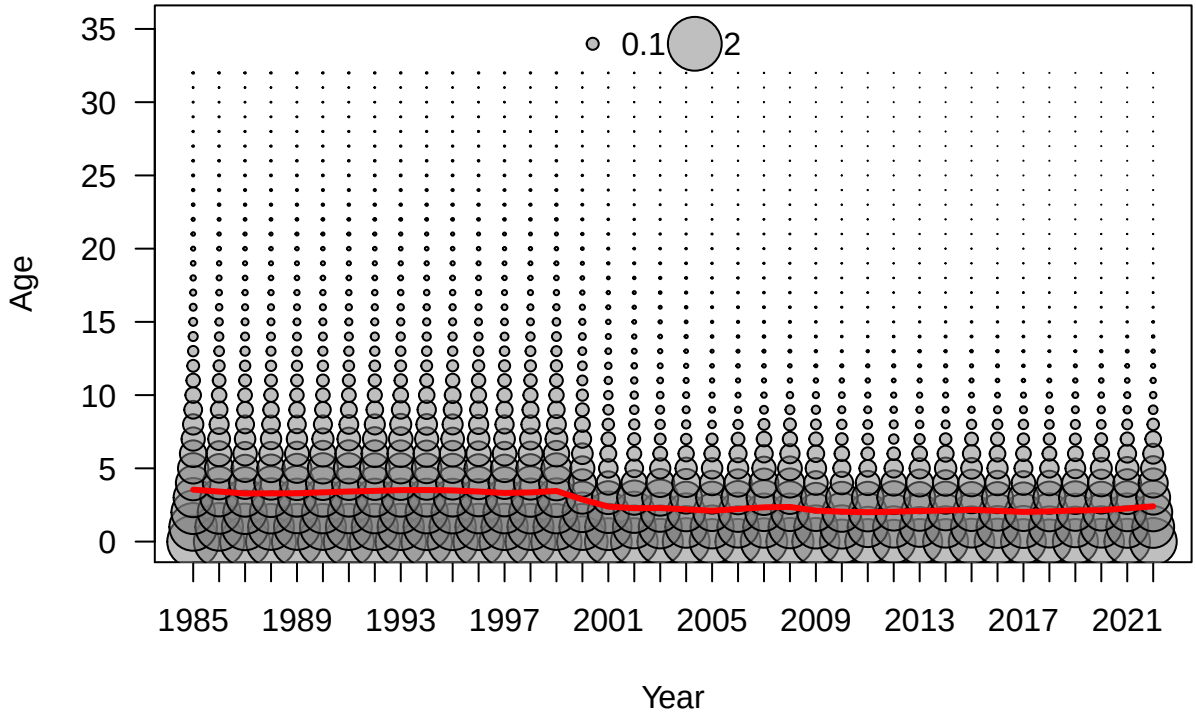

Log expected index
2.05
2.10
2.15
2.20
2.25
2.30
1.9
2.0
2.1
2.2
2.3
Log observed index

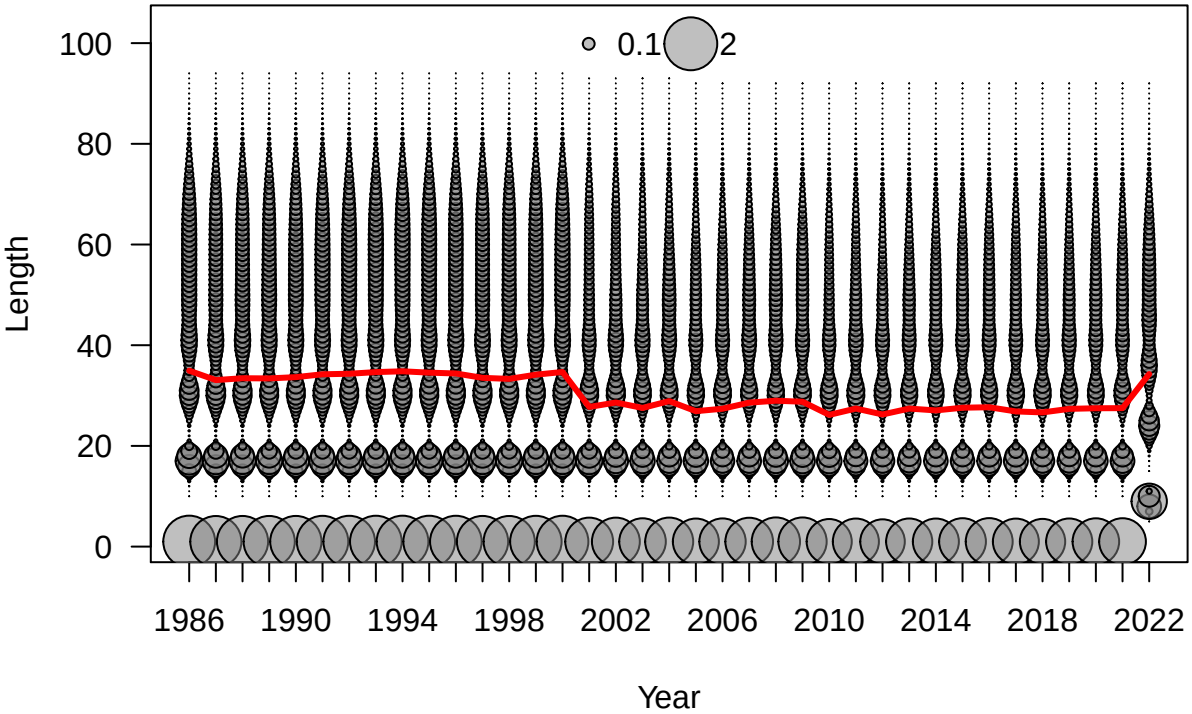

Residual
0.5
0.0
−0.5
2016
2017
2018
2019
2020
2021
Year

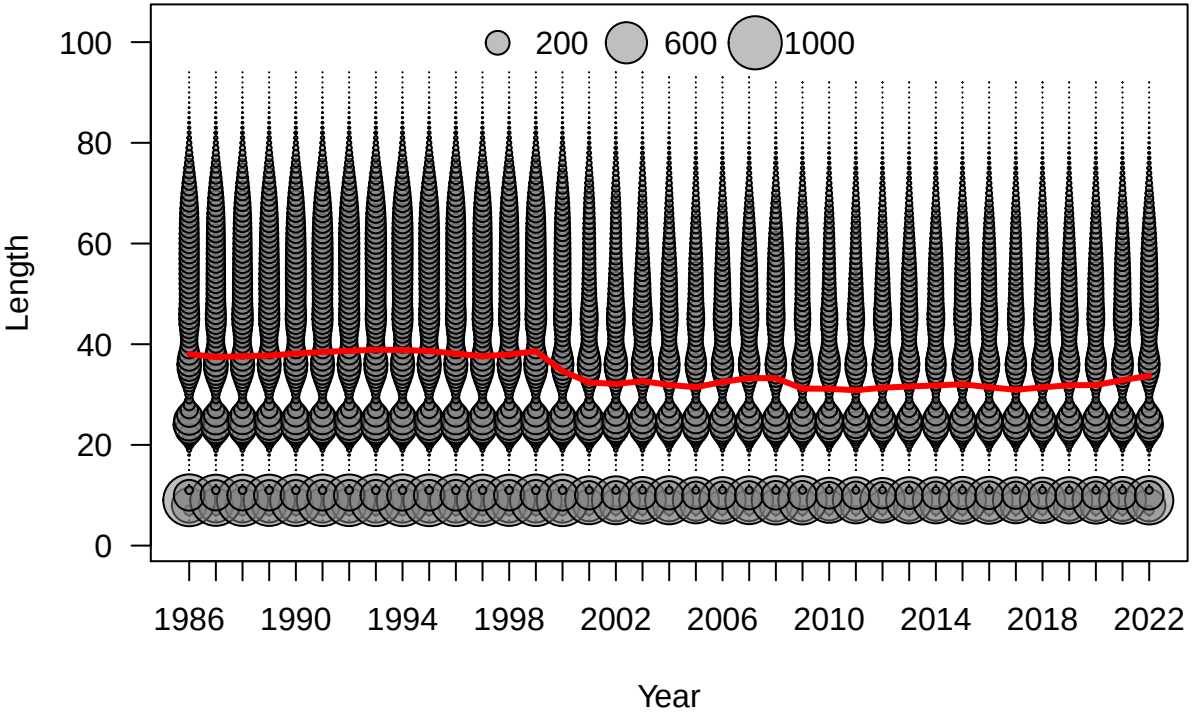

Deviation
0.15
0.05
−0.05
−0.15
2016
2017
2018
2019
2020
2021
Year

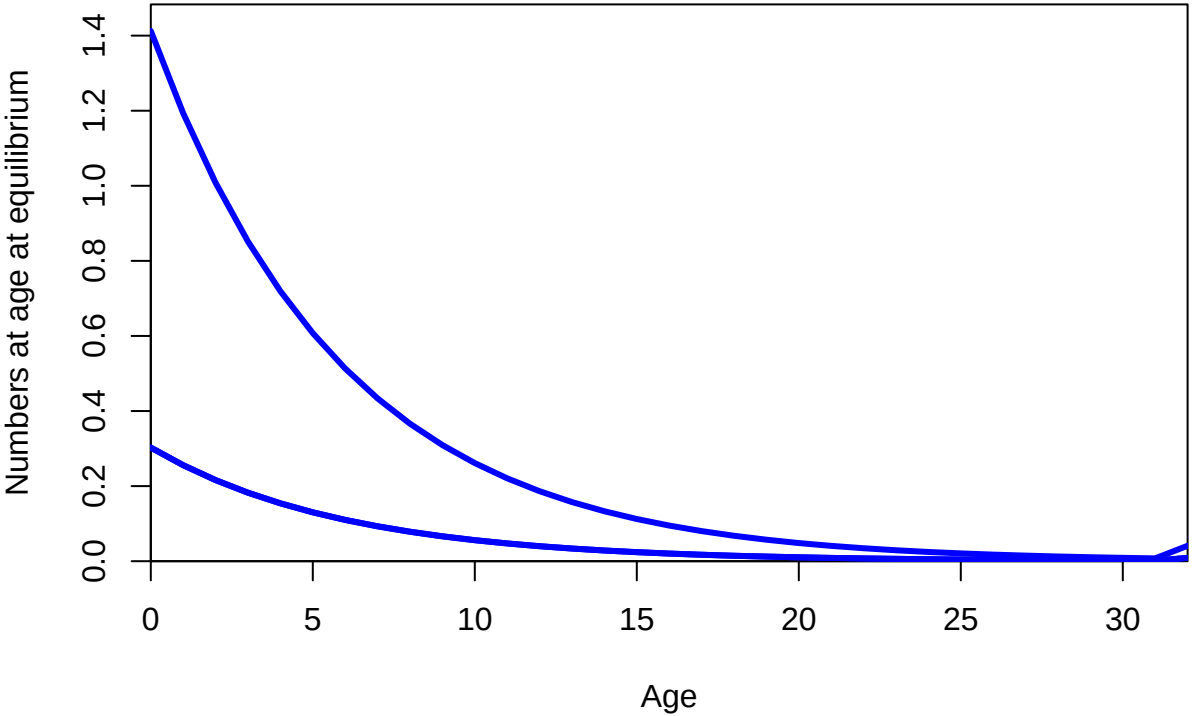

FISHERY
Standardized index
0.0
0.2
0.4
0.6
0.8
1.0
1.2
2015
2016
2017
2018
2019
2020
2021
2022
Year

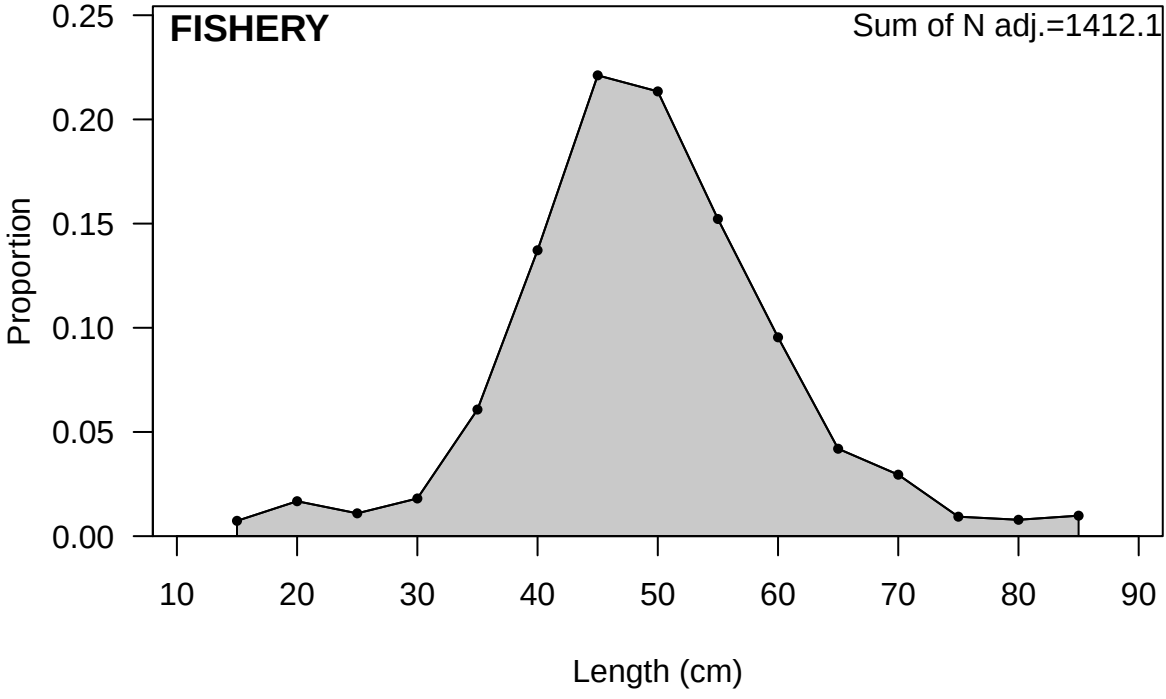

0.1
2
35
30
25
20
15
10
5
0
Age
1985
1989
1993
1997
2001
2005
2009
2013
2017
2021
Year

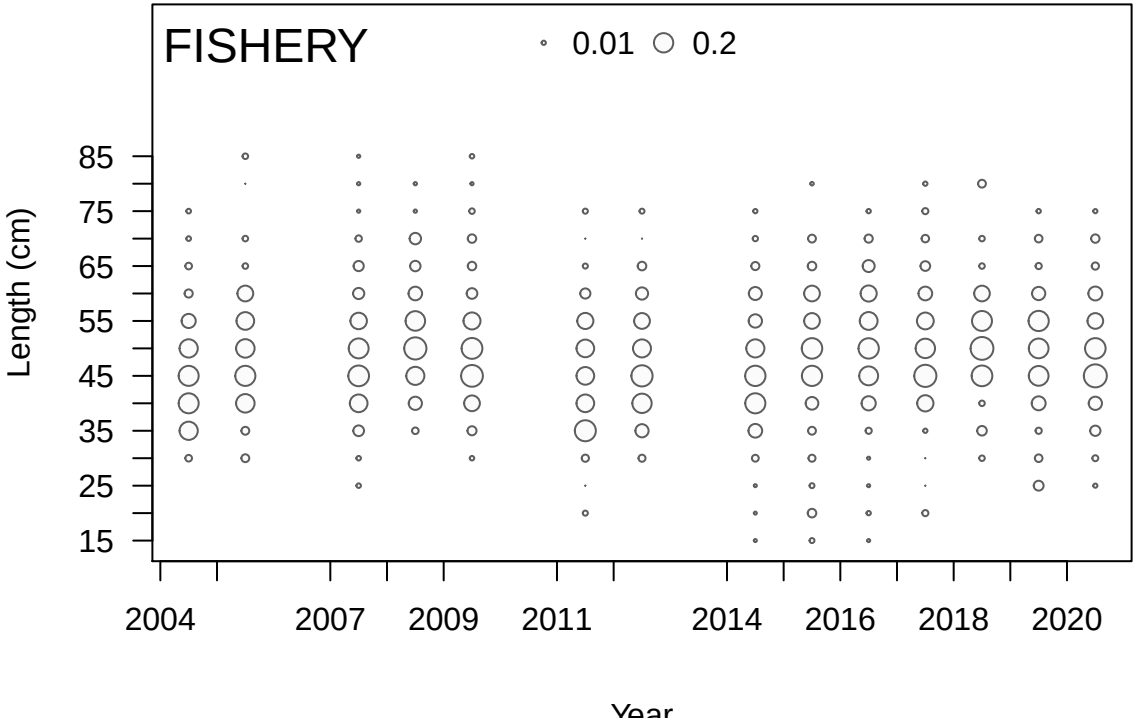

0.1
2
35
30
25
20
15
10
5
0
Age
1985
1989
1993
1997
2001
2005
2009
2013
2017
2021
Year

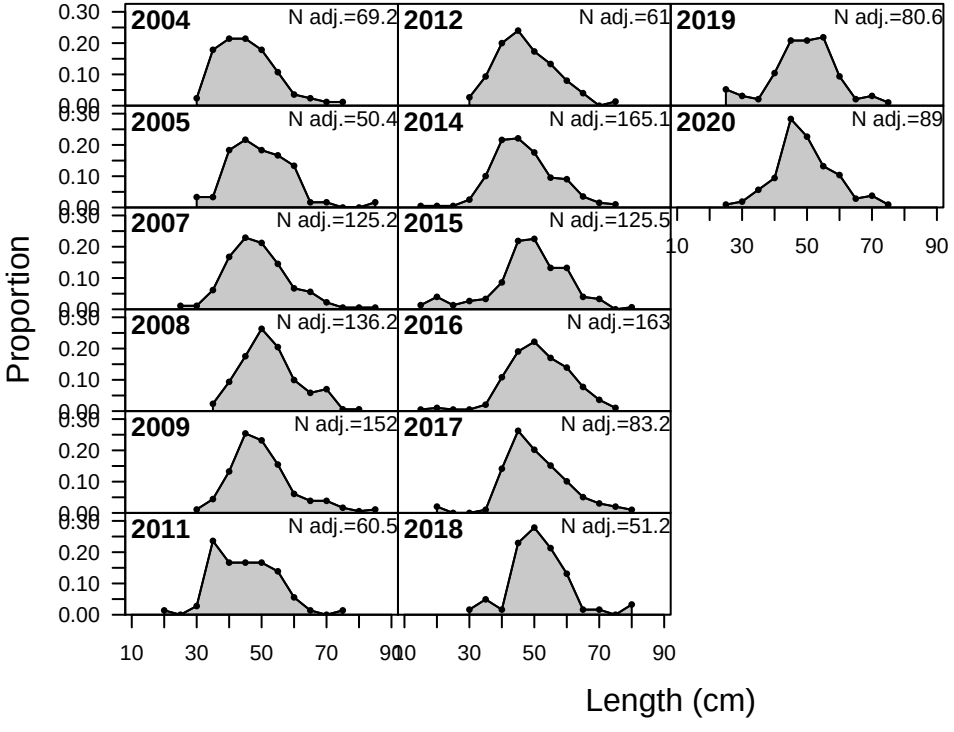

0.1
2
100
80
60
40
20
0
Length
1986
1990
1994
1998
2002
2006
2010
2014
2018
2022
Year

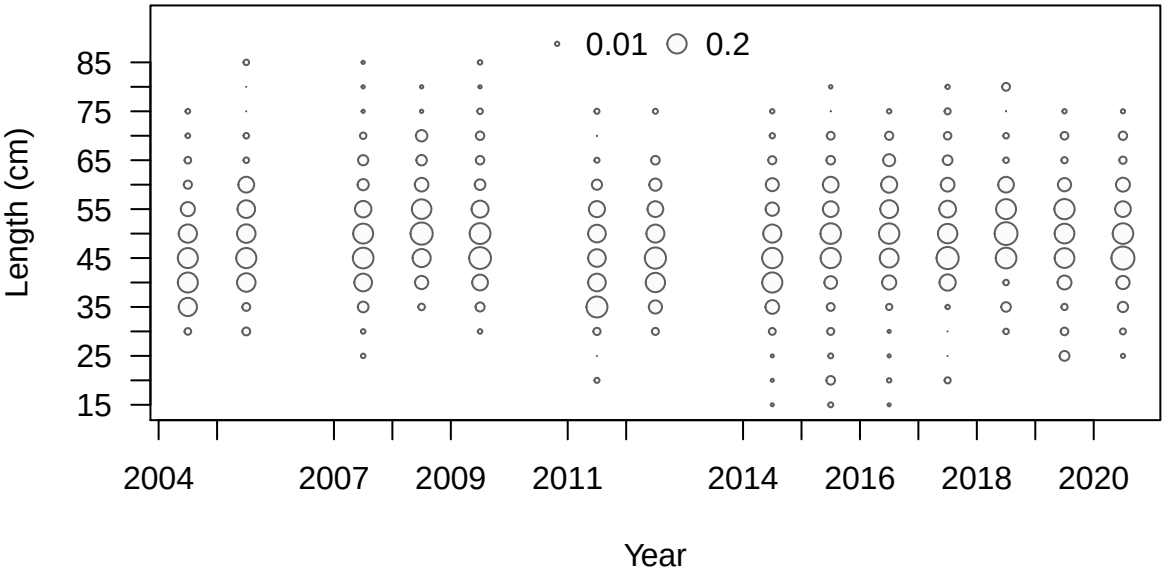

200
600
1000
100
80
60
40
20
0
Length
1986
1990
1994
1998
2002
2006
2010
2014
2018
2022
Year

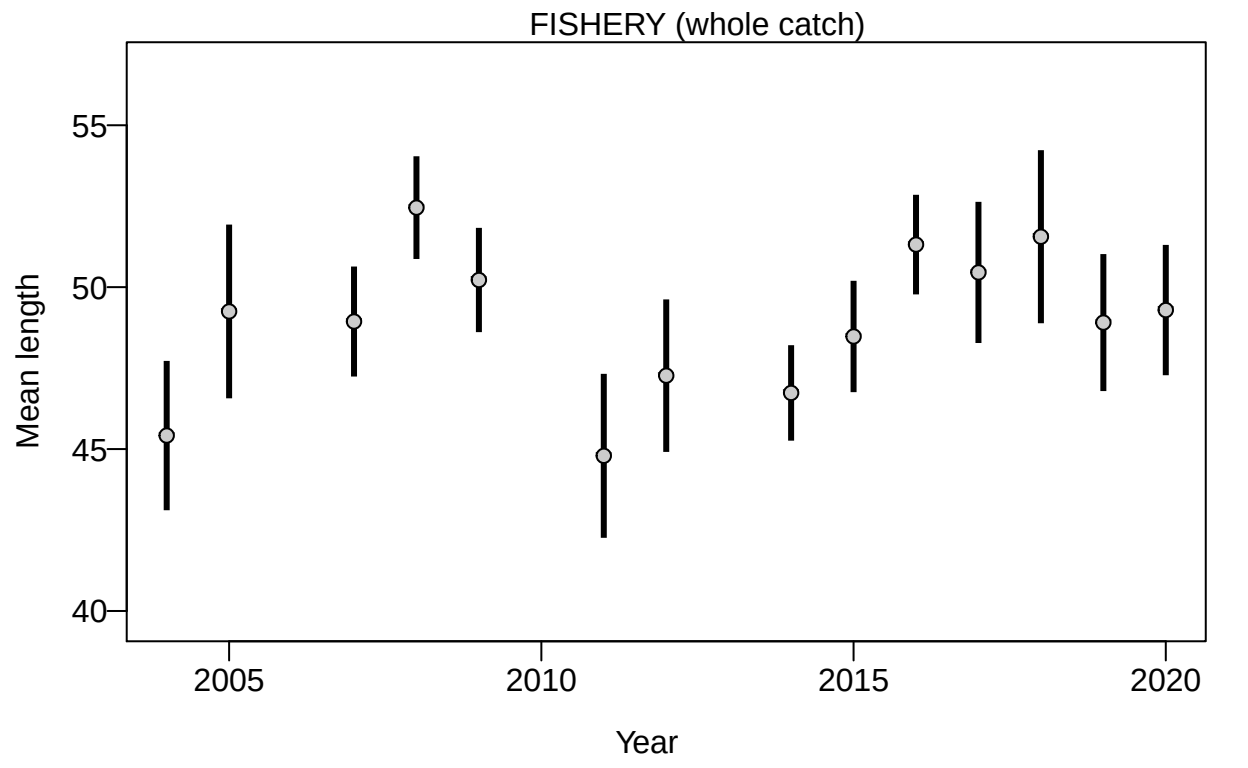

Numbers at age at equilibrium
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
0
5
10
15
20
25
30
Age

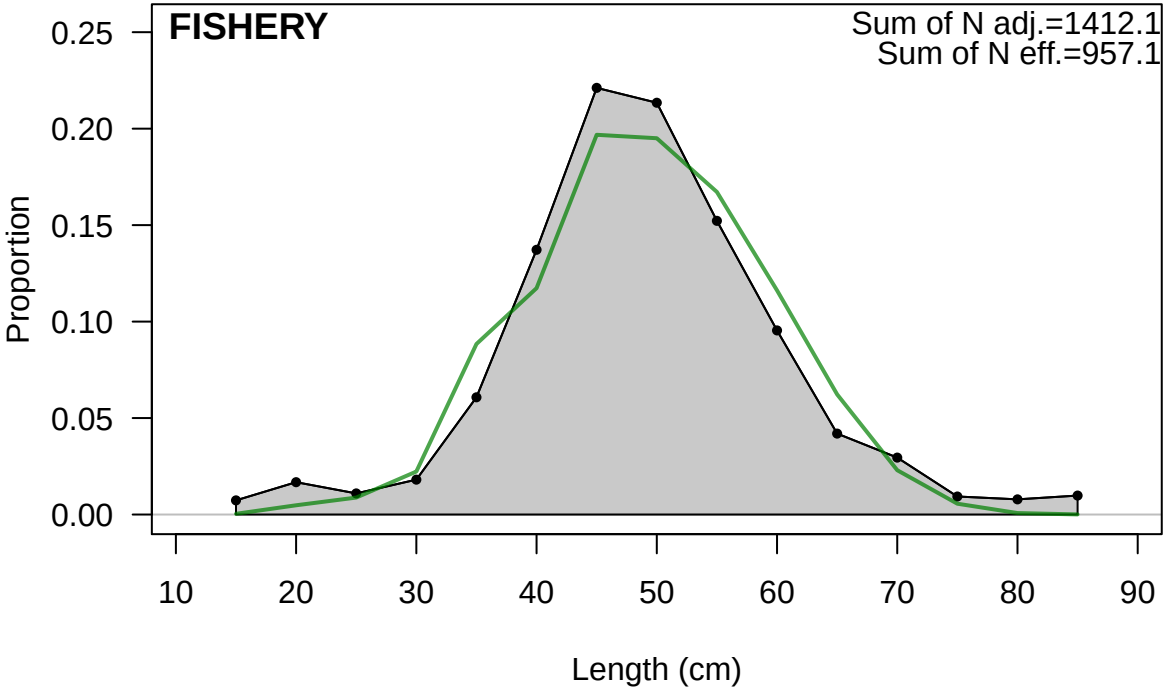

FISHERY
Sum of N adj.=1412.1
Proportion
0.25
0.20
0.15
0.10
0.05
0.00
10
20
30
40
50
60
70
80
90
Length (cm)

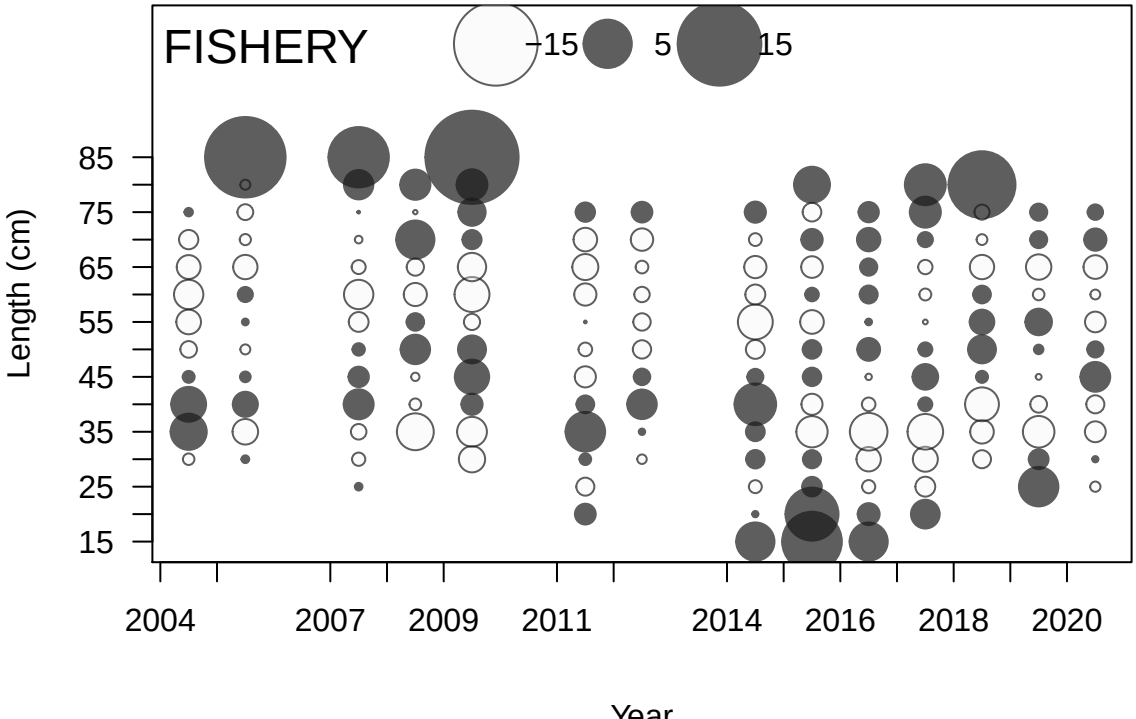

FISHERY
0.01
0.2
Length (cm)
85
75
65
55
45
35
25
15
2004
2007
2009
2011
2014
2016
2018
2020
Year

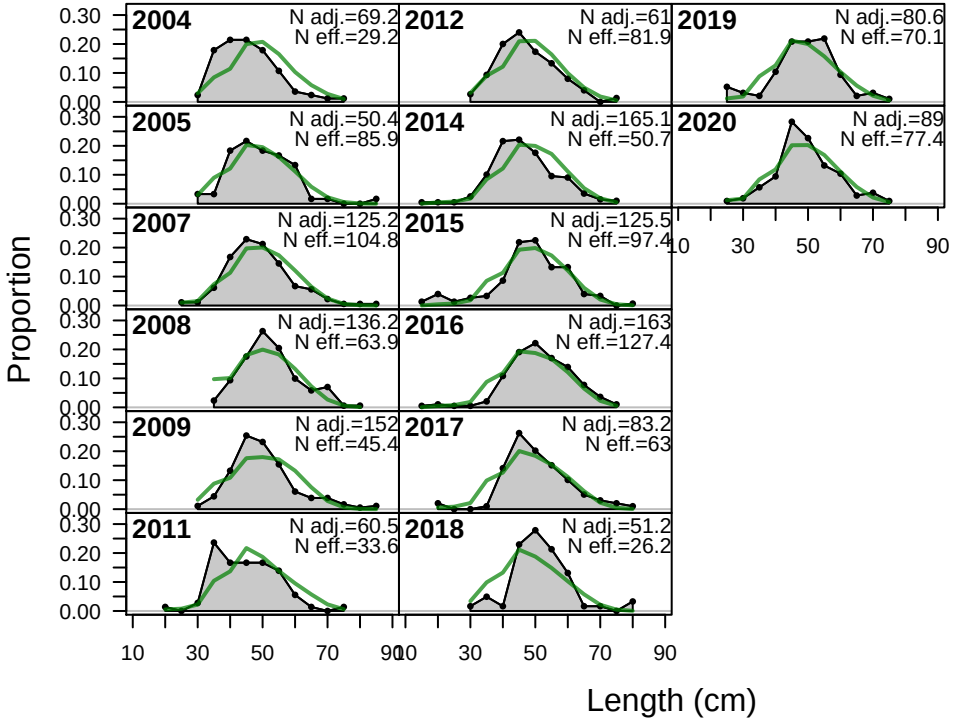

2004
N adj.=69.2
2012
N adj.=61
2019
N adj.=80.6
2005
N adj.=50.4
2014
N adj.=165.1
2020
N adj.=89
2007
N adj.=125.2
2015
N adj.=125.5
2008
N adj.=136.2
2016
N adj.=163
2009
N adj.=152
2017
N adj.=83.2
2011
N adj.=60.5
2018
N adj.=51.2
Proportion
0.00
0.10
0.20
0.30
10
30
50
70
90
Length (cm)

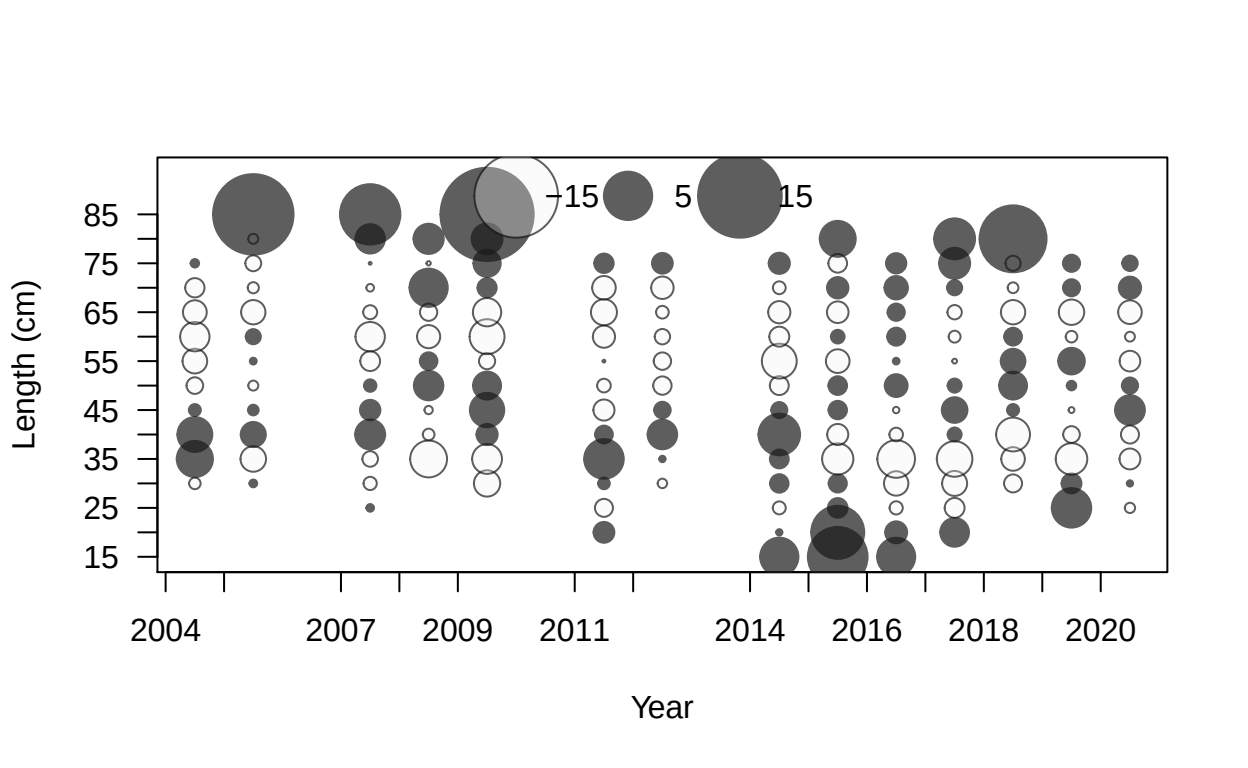

0.01
0.2
Length (cm)
85
75
65
55
45
35
25
15
2004
2007
2009
2011
2014
2016
2018
2020
Year

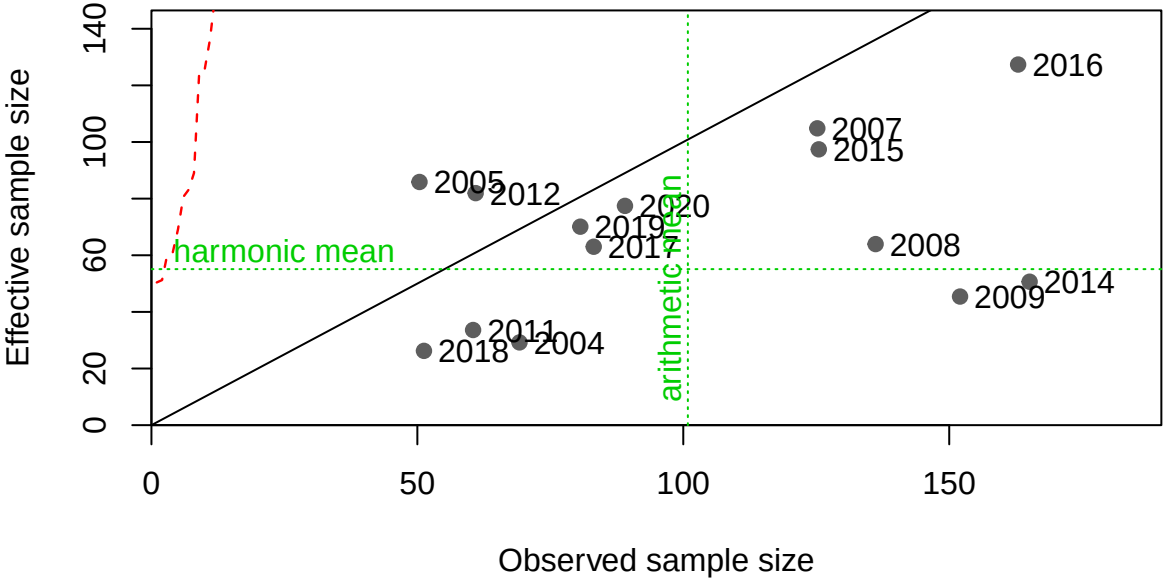

FISHERY (whole catch)
55
50
45
40
Mean length
2005
2010
2015
2020
Year

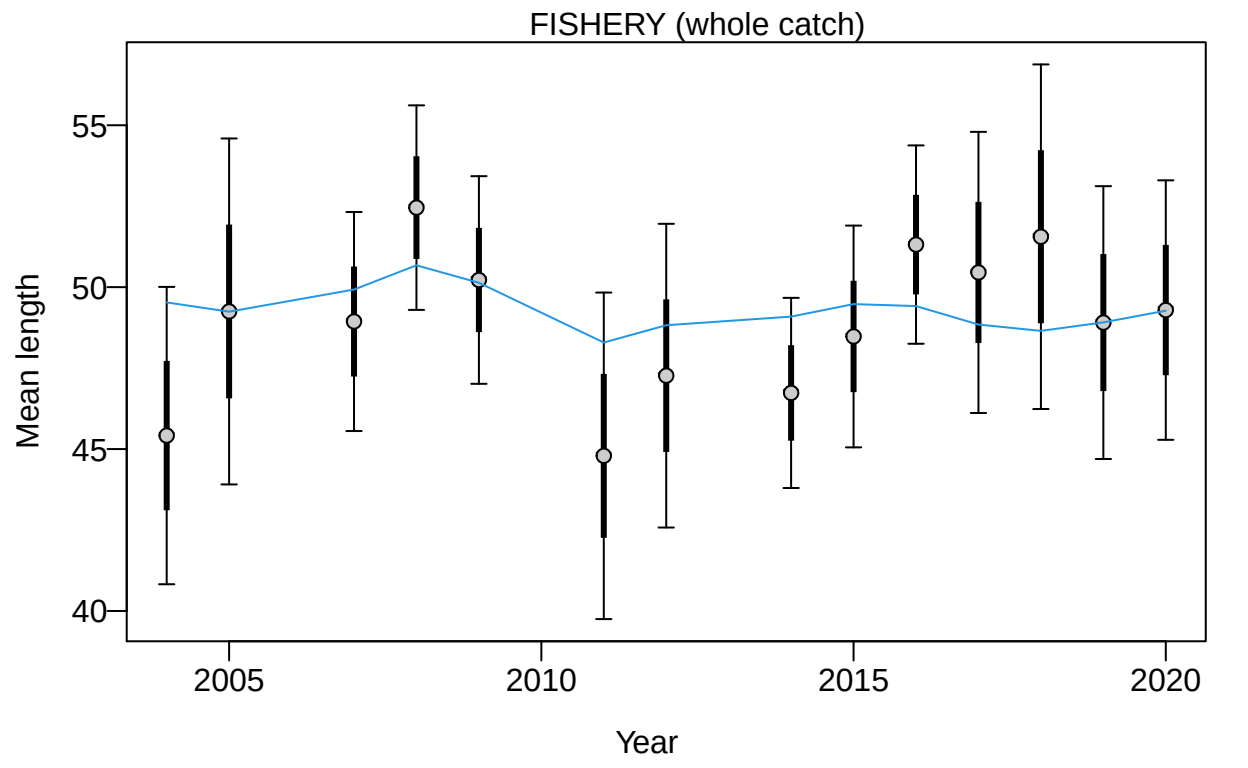

FISHERY
Sum of N adj.=1412.1
Sum of N eff.=957.1
Proportion
0.25
0.20
0.15
0.10
0.05
0.00
10
20
30
40
50
60
70
80
90
Length (cm)

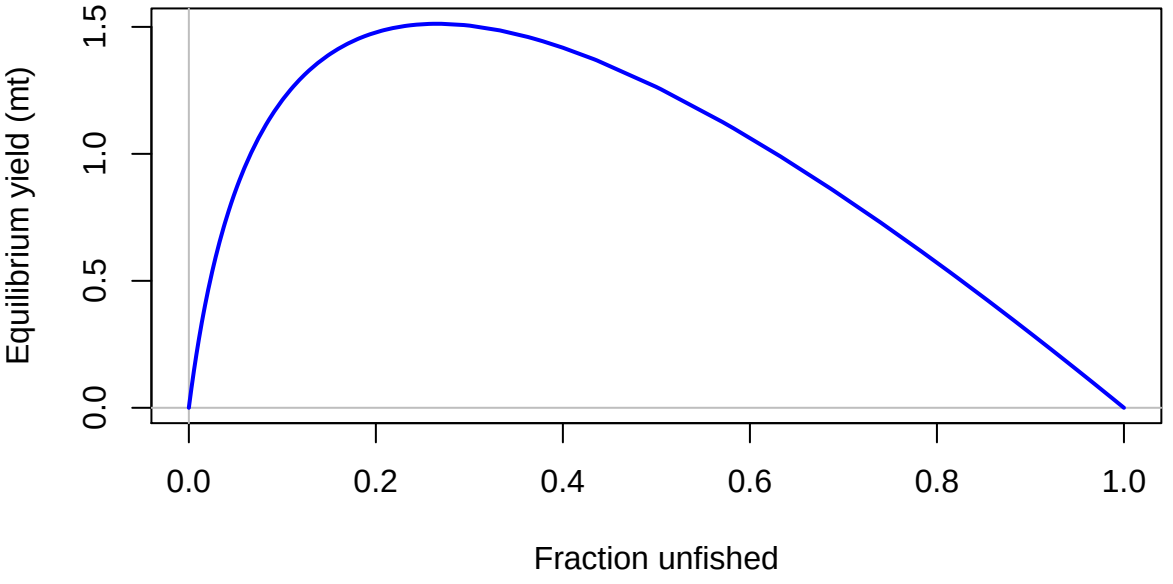

FISHERY
−15
5
15
Length (cm)
85
75
65
55
45
35
25
15
2004
2007
2009
2011
2014
2016
2018
2020
Year

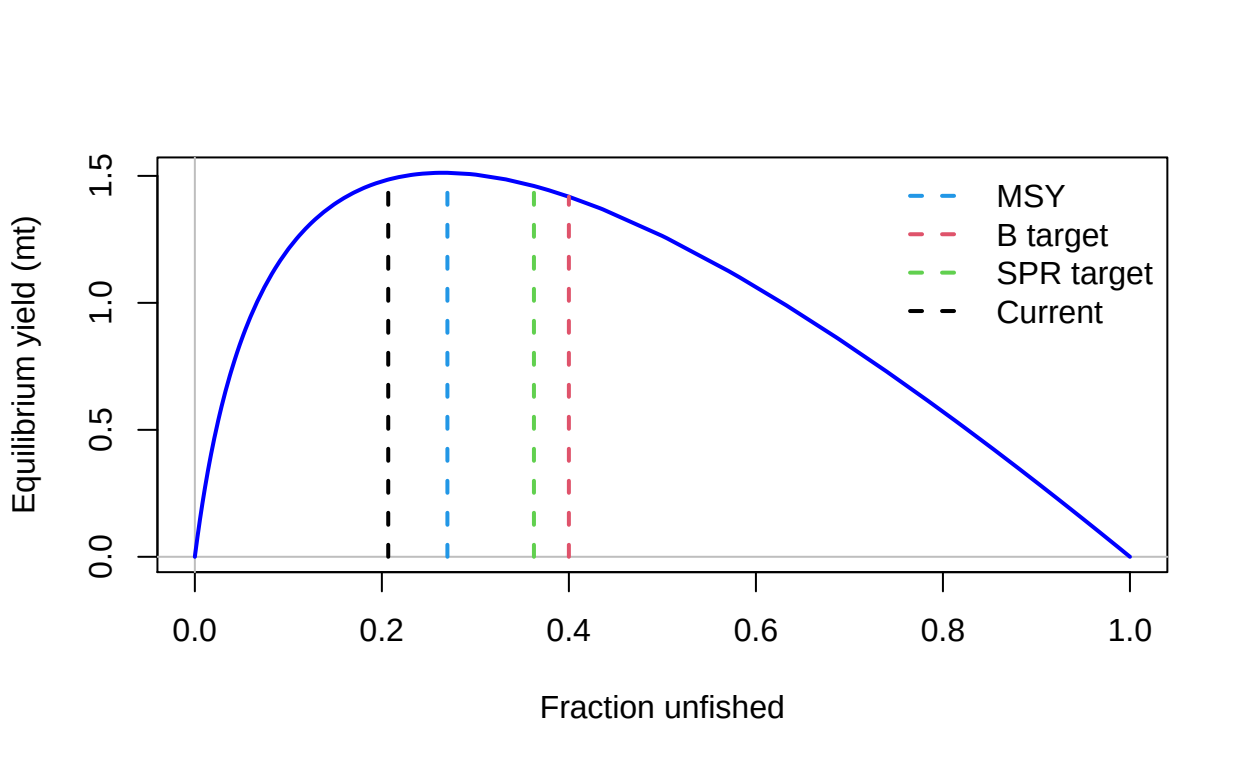

2004
N adj.=69.2
N eff.=29.2
2012
N adj.=61
N eff.=81.9
2019
N adj.=80.6
N eff.=70.1
2005
N adj.=50.4
N eff.=85.9
2014
N adj.=165.1
N eff.=50.7
2020
N adj.=89
N eff.=77.4
2007
N adj.=125.2
N eff.=104.8
2015
N adj.=125.5
N eff.=97.4
2008
N adj.=136.2
N eff.=63.9
2016
N adj.=163
N eff.=127.4
2009
N adj.=152
N eff.=45.4
2017
N adj.=83.2
N eff.=63
2011
N adj.=60.5
N eff.=33.6
2018
N adj.=51.2
N eff.=26.2
Proportion
0.00
0.10
0.20
0.30
10
30
50
70
90
Length (cm)

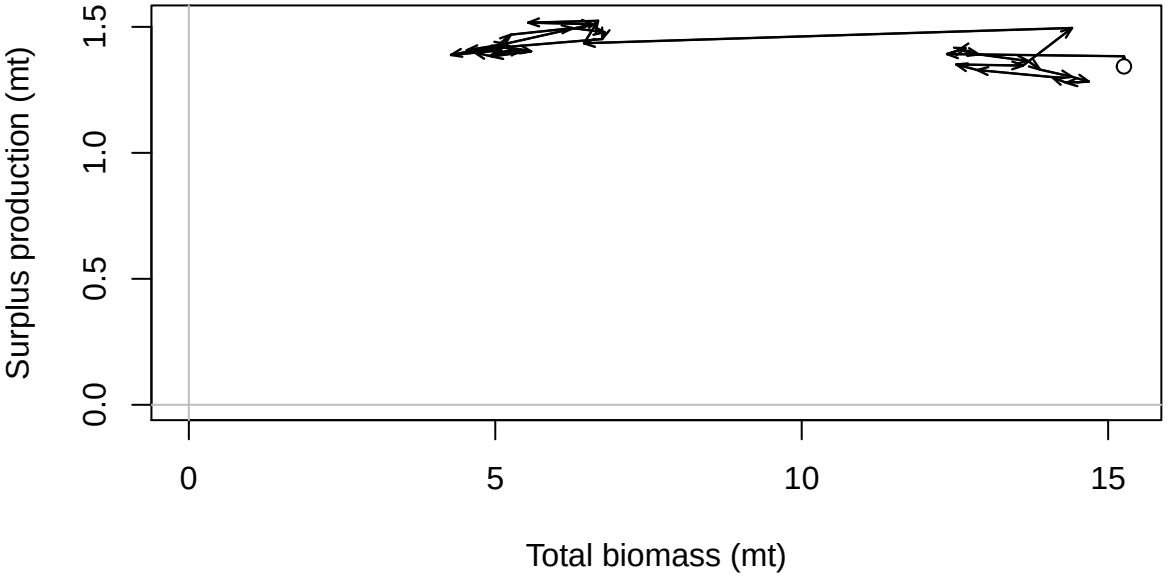

15
5
15
85
75
65
55
45
35
25
15
Length (cm)
2004
2007
2009
2011
2014
2016
2018
2020
Year

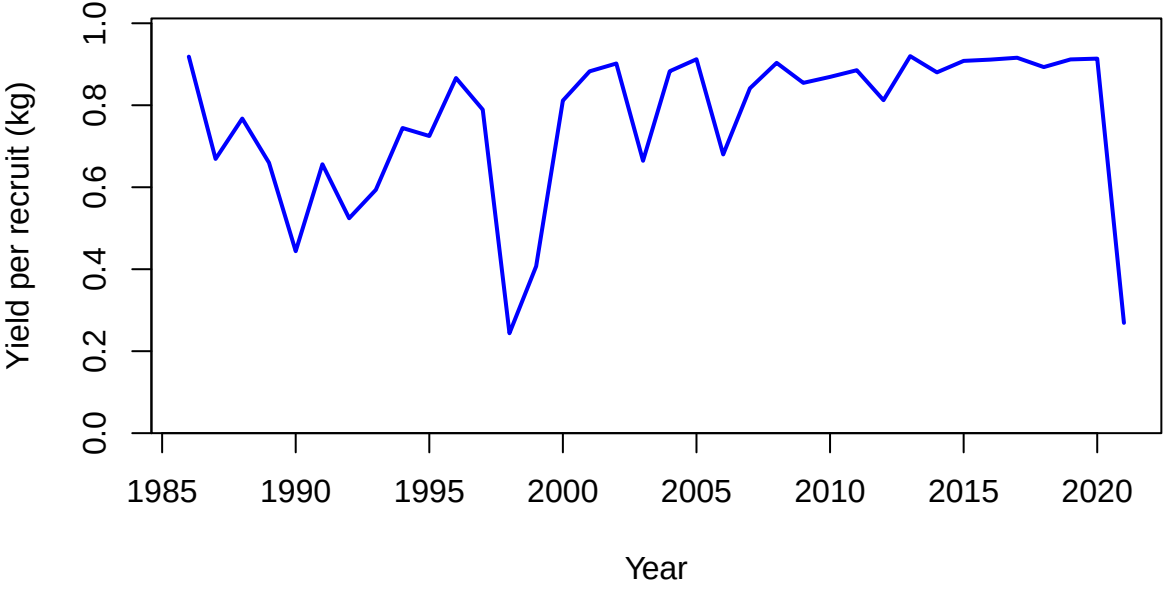

Effective sample size
0
20
60
100
140
0
50
100
150
Observed sample size
harmonic mean
arithmetic mean
2016
2007
2015
2005
2012
2020
2019
2017
2008
2014
2009
2011
2018
2004

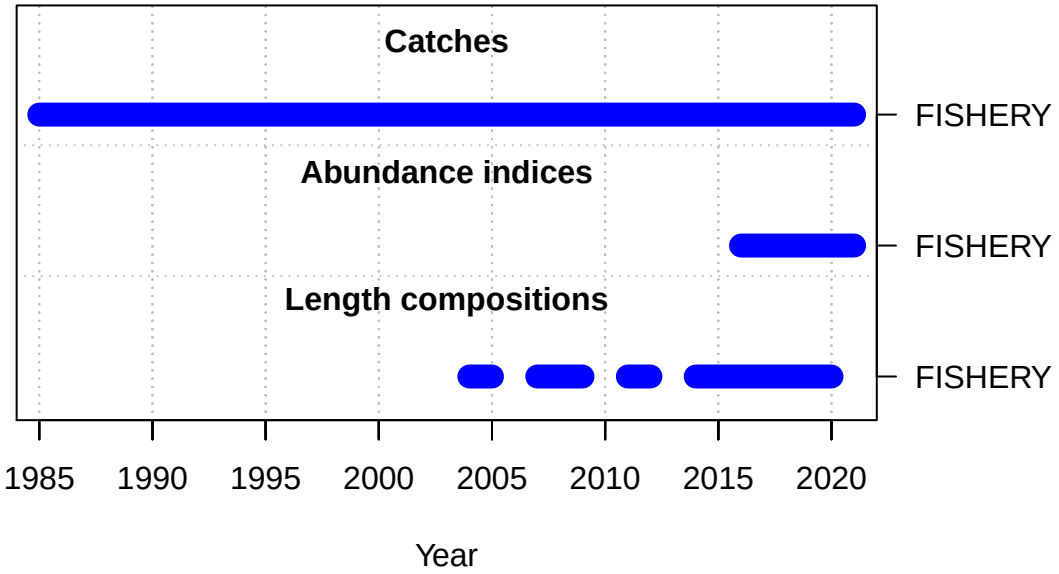

FISHERY (whole catch)
Mean length
55
50
45
40
2005
2010
2015
2020
Year

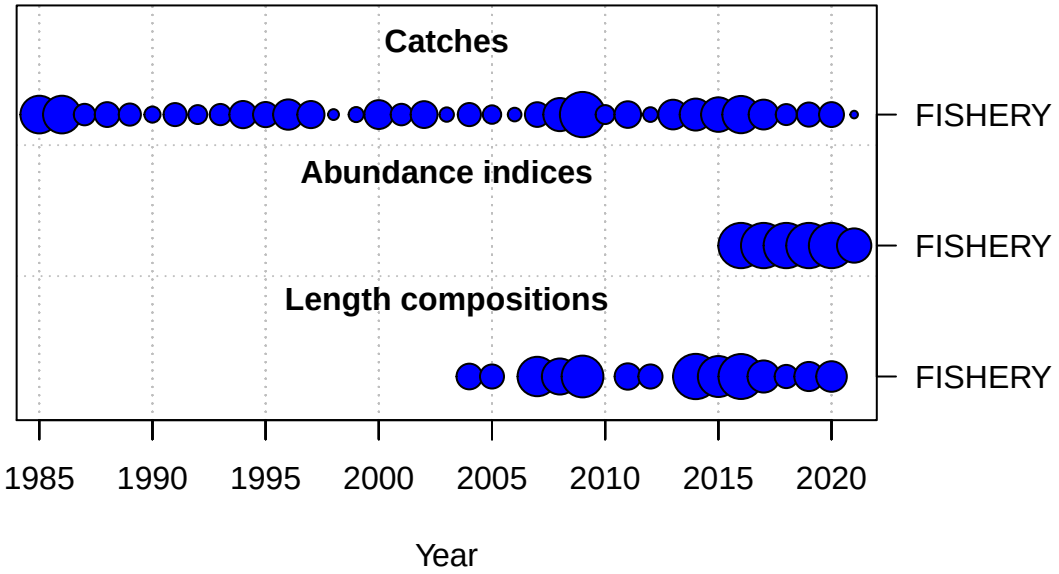

Equilibrium yield (mt)
0.0
0.5
1.0
1.5
0.0
0.2
0.4
0.6
0.8
1.0
Fraction unfished

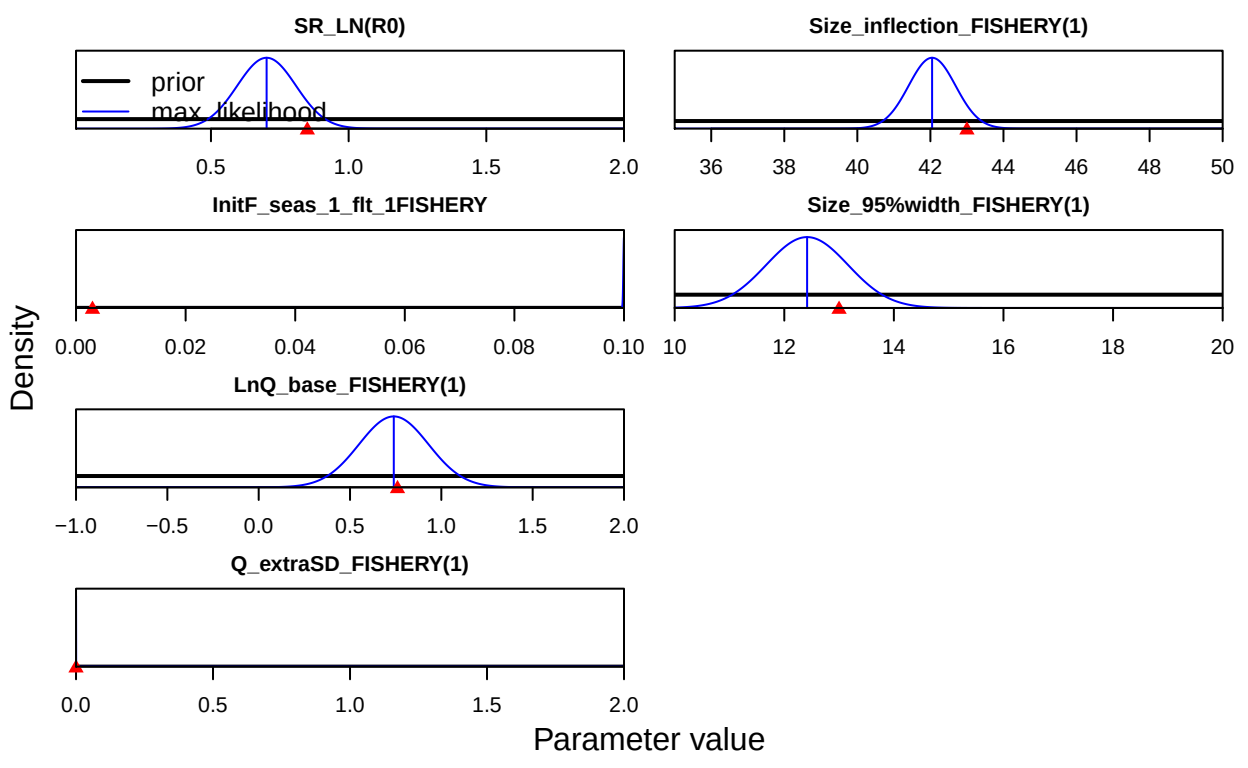

Equilibrium yield (mt)
0.0
0.5
1.0
1.5
0.0
0.2
0.4
0.6
0.8
1.0
Fraction unfished
MSY
B target
SPR target
Current


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


Yield per recruit (kg)
0.0
0.2
0.4
0.6
0.8
1.0
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
0.5
1.0
1.5
2.0
Size_inflection_FISHERY(1)
36
38
40
42
44
46
48
50
InitF_seas_1_flt_1FISHERY
0.00
0.02
0.04
0.06
0.08
0.10
Size_95%width_FISHERY(1)
10
12
14
16
18
20
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
Density
Parameter value