

Supplementary Material for `Estimating stock status from relative abundance and resilience'

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This Supplement contains:

Appendix 1 with application of AMSY to 24 simulated stocks, without filters, pages 2-27

Appendix 2 with application of AMSY to 24 simulated stocks, with filters, pages 28-53

Appendix 3 with application of AMSY to 38 data-poor stocks, pages 54-168

Adriatic Sea	55 - 63
Aegean Sea	64 - 81
Cyprus	82 - 87
North Sea	88 - 135
Baltic Sea	136 - 147
Northwest Atlantic	148 - 153
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Results of analysis of simulated data without filters with AMSY_68v.R
29 October 2019

Table 1. Comparison of estimated and “true” parameter values (r , k_q , F/F_{msy} and B/B_{msy}) for 24 simulated stocks. The target value for estimated relative to true value is one. The approximate lower confidence range as fraction of the estimated central value $[(est-cl)/est]$ is an indication of the uncertainty about the estimate. Column 2 shows the median across the 24 simulated stocks. Columns 3 and 4 show the range that includes 95% of the estimated values. Note that this run of AMSY did not filter the potential r - k pairs, thus making the estimates of r and k_q fully depended on and basically equal to the prior ranges for r and k_q , as is evident in the graphs displayed below. Source: AMSYResSimNoFilOctober292019_4.xls

	Median	2.5 th percentile	97.5 th percentile
r : est/true	0.72	0.62	0.97
r : (est-1cl)/est	0.55	0.36	0.68
k_q : est /true	1.08	0.82	1.42
k_q : (est-1cl)/est	0.24	0.19	0.43
F/F_{msy} : est/true	1.45	0.96	5.41
F/F_{msy} : (est-1cl)/est	1.42	0.64	5.41
B/B_{msy} : est/true	0.94	0.81	1.19
B/B_{msy} : (est-1cl)/est	0.44	0.44	0.45

Settings for analysis in R-code:

```
#-----
# Required settings, File names
#-----
id_file    <- "SimCPUE_ID_8.csv"

#-----
# General settings for the analysis -----
#-----
smooth.cpue   <- T
filter        <- FALSE
cor.rk         <- -0.607
sigma.r        <- c(0.05,0.07,0.1,0.15)
sigma.cpue     <- 0.3
n.p            <- 50000
n.trial        <- 30
min.viable     <- 20
max.viable     <- 20000
creep.graph    <- F
do.plots       <- T
write.output   <- T
kobe.plot      <- F
save.plots     <- F
close.plots    <- F
retros         <- F
```

Generic legend for the subsequent graphs:

Panel (a) shows the time series of CPUE data as bold curve, a smoothed version of CPUE as thin dotted line, the prior range for kq as vertical blue line, and the corresponding upper and lower bounds of the relative B_{msy} range as dotted horizontal lines.

Panel (b) shows the $r-kq$ prior space in log scale with a cloud of gray points representing the multivariate log-normal distribution of r and kq corresponding to a correlation of -0.607 , derived from full Schaefer models applied to 140 real stocks. The dotted rectangle indicates the prior ranges for r and kq and includes 85% of the gray dots. The red cross indicates the estimated central $r-kq$ pair and the approximate 95% confidence limits. The blue circle indicates the “true” $r-kq$ pair used in the simulation.

Panel (c) is a zoom-in on the viable $r-kq$ pairs, with the red cross indicating the estimated central $r-kq$ pair and its approximate 95% confidence limits and the blue circle indicating the “true” $r-kq$ pair used in the simulation.

Panel (d) shows the time series of catch predicted by AMSY as bold curve relative to MSY, indicated by the dashed horizontal line. The dotted curves indicate the approximate 95% confidence limits. The blue curve shows the “true” catch used in the simulations.

Panel (e) shows the predicted time series of F over F_{msy} as bold curve with dotted curves indicating the approximate 95% confidence limits. The dashed horizontal line indicates F_{msy} .

Panel (f) shows the predicted time series of B over B_{msy} as bold curve with dotted curves indicating the approximate 95% confidence limits. The dashed horizontal line indicates B_{msy} , the dotted lines indicate the approximate 95% confidence limits of B_{msy} , and the dashed red line indicates half of B_{msy} . The blue curve shows the “true” biomass used in the simulations relative to the “true” value of B_{msy} , indicated by a blue dashed line.

File SimCPUE_ID_8.csv read successfully

AMSY Analysis, Tue Oct 29 17:49:52 2019

Stock HH_H, , Simulated data

CPUE data for years 1950 - 1999, CPUE range 656 - 789, smooth = TRUE

Prior for r = High, NA - NA

Used prior range for r = 0.6 - 1.5

Prior for 1950 stock status = More than half, NA - NA

Used 1950 prior B/B0 range = 0.5 - 0.85, prior B/Bmsy = 1 - 1.7

Used prior range for kq = 832 - 1415 [original range = 832 - 1415]

Comment: True r=1.0, true kq=1000, true MSYq=250

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
Viable r-kq pairs = 20010

Results:

viable r-kq pairs = 20010

median kq = 1088, 825 - 1424

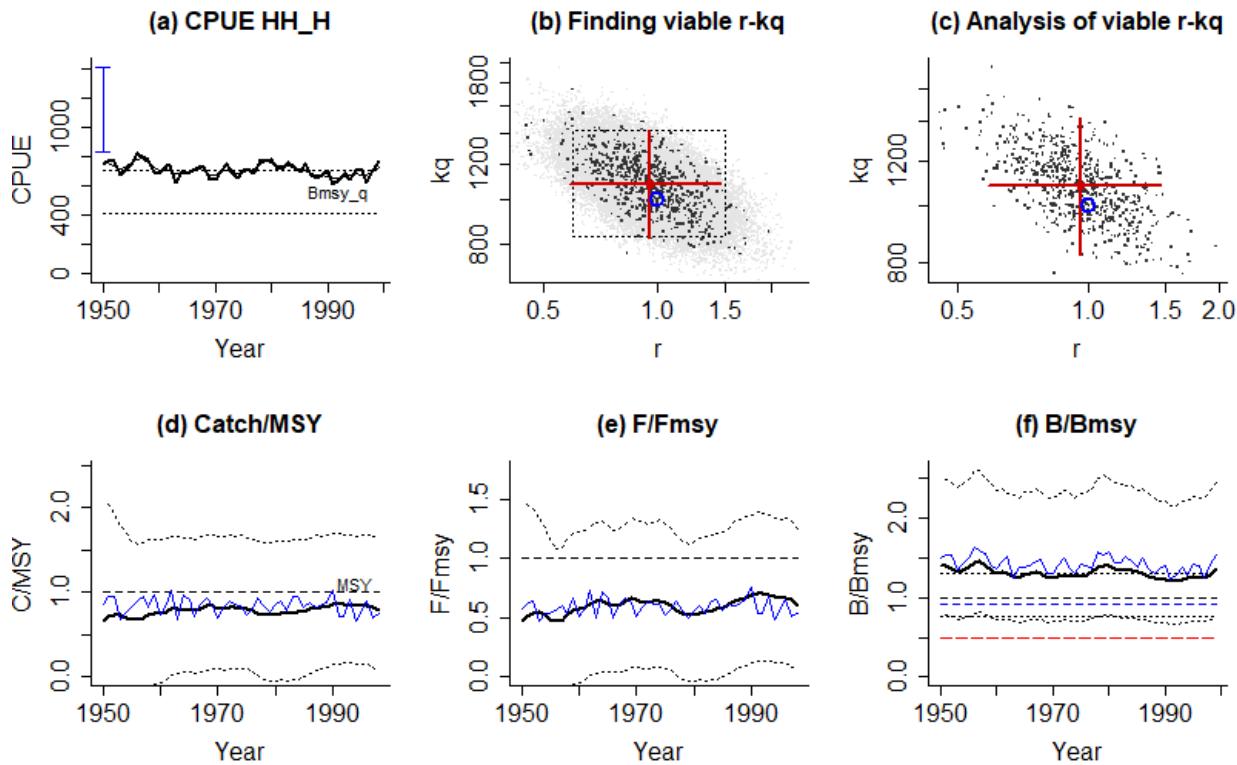
median MSYq = 260, 178 - 374

r (4 MSYq/kq) = 0.955, 0.588 - 1.47

Fmsy (r/2) = 0.478, 0.294 - 0.734

F/Fmsy = 0.602, 0.0529 - 1.25 (1998), true: 0.539

B/Bmsy = 1.36, 0.753 - 2.46 (1999), true: 1.54

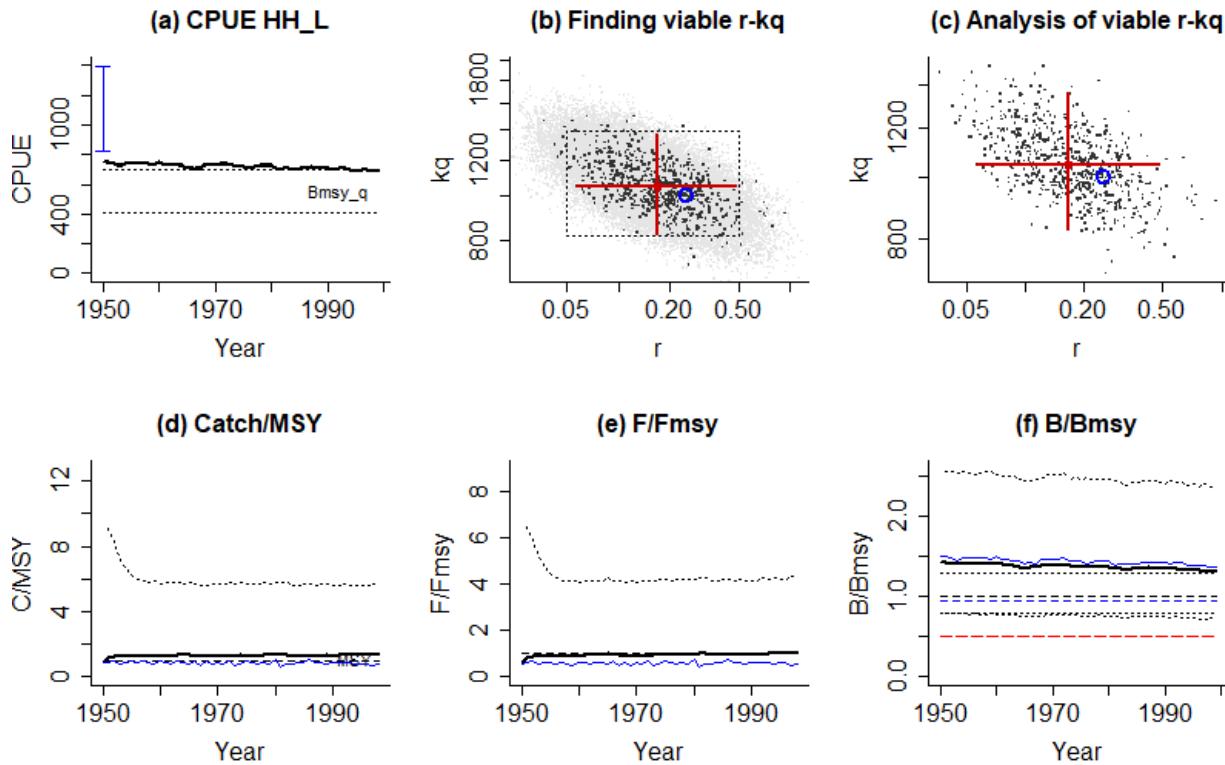


Stock HH_LL, , Simulated data
 CPUE data for years 1950 - 1999, CPUE range 691 - 747, smooth = TRUE
 Prior for r = Low, NA - NA
 Used prior range for r = 0.05 - 0.5
 Prior for 1950 stock status = More than half, NA - NA
 Used 1950 prior B/B0 range = 0.5 - 0.85, prior B/Bmsy = 1 - 1.7
 Used prior range for kq = 820 - 1394 [original range = 820 - 1394]
 Comment: True r=0.25, true kq=1000, true MSYq=62.5

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
 Viable r-kq pairs = 20010

Results:

viable r-kq pairs	= 20010
median kq	= 1050, 827 - 1366
median MSYq	= 43.7, 16.9 - 110
r (4 MSYq/kq)	= 0.167, 0.0564 - 0.484
Fmsy (r/2)	= 0.0833, 0.0282 - 0.242
F/Fmsy	= 1.03, -1.49 - 4.26 (1998), true: 0.577
B/Bmsy	= 1.32, 0.737 - 2.37 (1999), true: 1.38

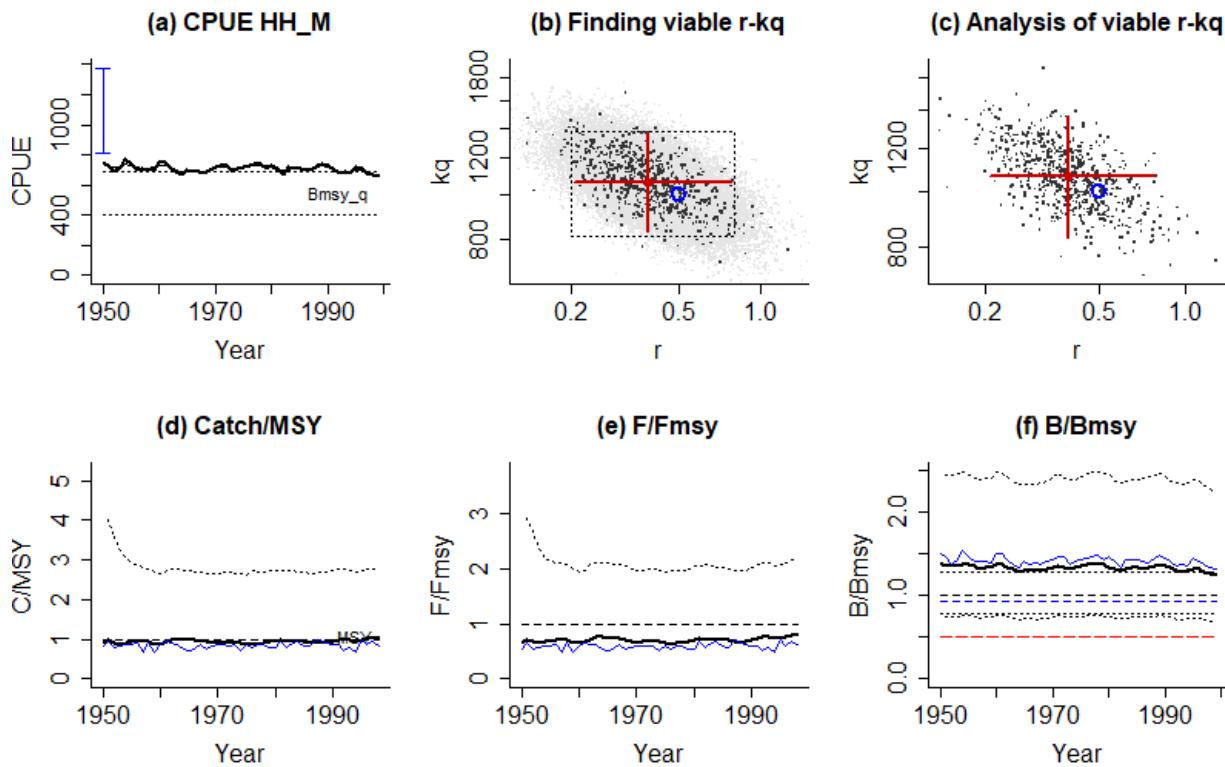


Stock HH_M, , Simulated data
 CPUE data for years 1950 - 1999, CPUE range 665 - 737, smooth = TRUE
 Prior for r = Medium, NA - NA
 Used prior range for r = 0.2 - 0.8
 Prior for 1950 stock status = More than half, NA - NA
 Used 1950 prior B/B0 range = 0.5 - 0.85, prior B/Bmsy = 1 - 1.7
 Used prior range for kq = 809 - 1375 [original range = 809 - 1375]
 Comment: True r=0.5, true kq=1000, true MSYq=125, true q=0.001

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
 Viable r-kq pairs = 20010

Results:

viable r-kq pairs	= 20010
median kq	= 1066, 830 - 1365
median MSYq	= 103, 60.6 - 177
r (4 MSYq/kq)	= 0.387, 0.206 - 0.779
Fmsy (r/2)	= 0.193, 0.103 - 0.389
F/Fmsy	= 0.819, -0.303 - 2.18 (1998), true: 0.623
B/Bmsy	= 1.24, 0.691 - 2.22 (1999), true: 1.32

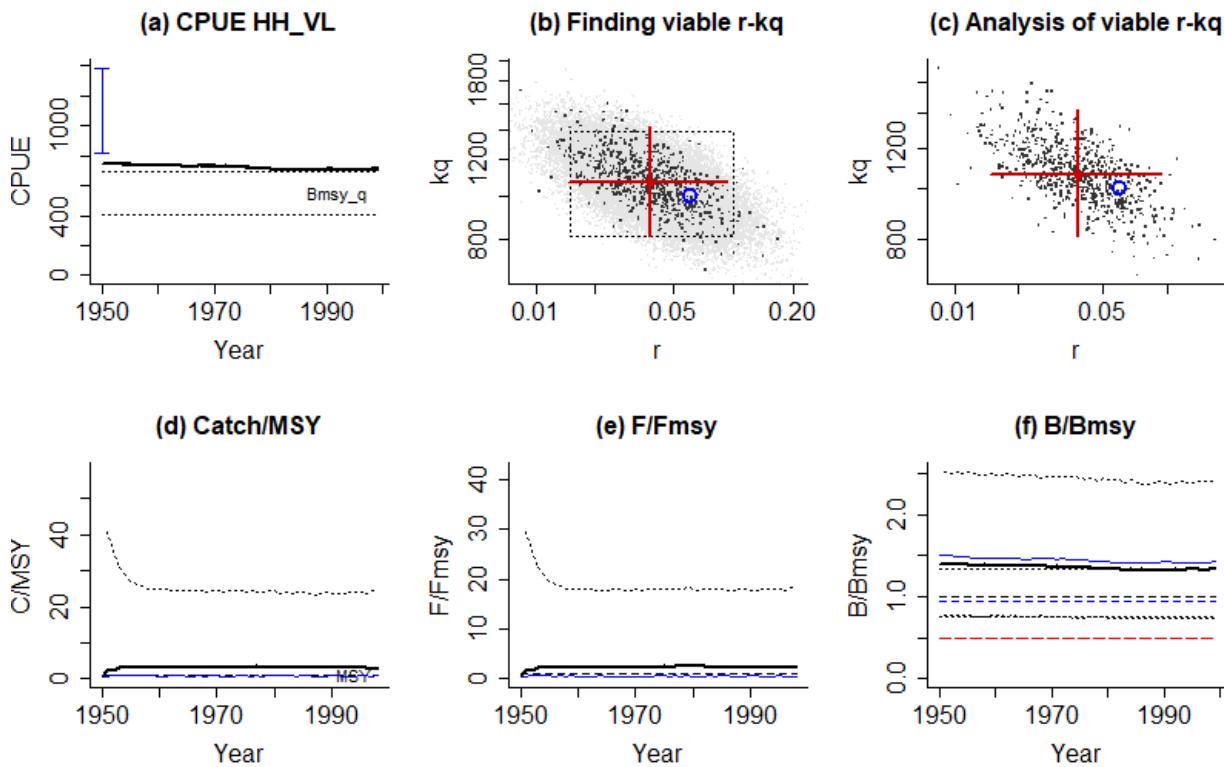


Stock HH_VL, , simulated data
 CPUE data for years 1950 - 1999, CPUE range 708 - 742, smooth = TRUE
 Prior for r = Very low, NA - NA
 Used prior range for r = 0.015 - 0.1
 Prior for 1950 stock status = More than half, NA - NA
 Used 1950 prior B/B0 range = 0.5 - 0.85, prior B/Bmsy = 1 - 1.7
 Used prior range for kq = 814 - 1385 [original range = 814 - 1385]
 Comment: True r=0.06, true kq=1000, true MSYq=15

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
 Viable r-kq pairs = 20010

Results:

viable r-kq pairs	= 20010
median kq	= 1066, 814 - 1417
median MSYq	= 10.2, 4.51 - 21.7
r (4 MSYq/kq)	= 0.0381, 0.0148 - 0.0936
Fmsy (r/2)	= 0.0191, 0.0074 - 0.0468
F/Fmsy	= 2.31, -8.75 - 18 (1998), true: 0.612
B/Bmsy	= 1.33, 0.737 - 2.4 (1999), true: 1.42

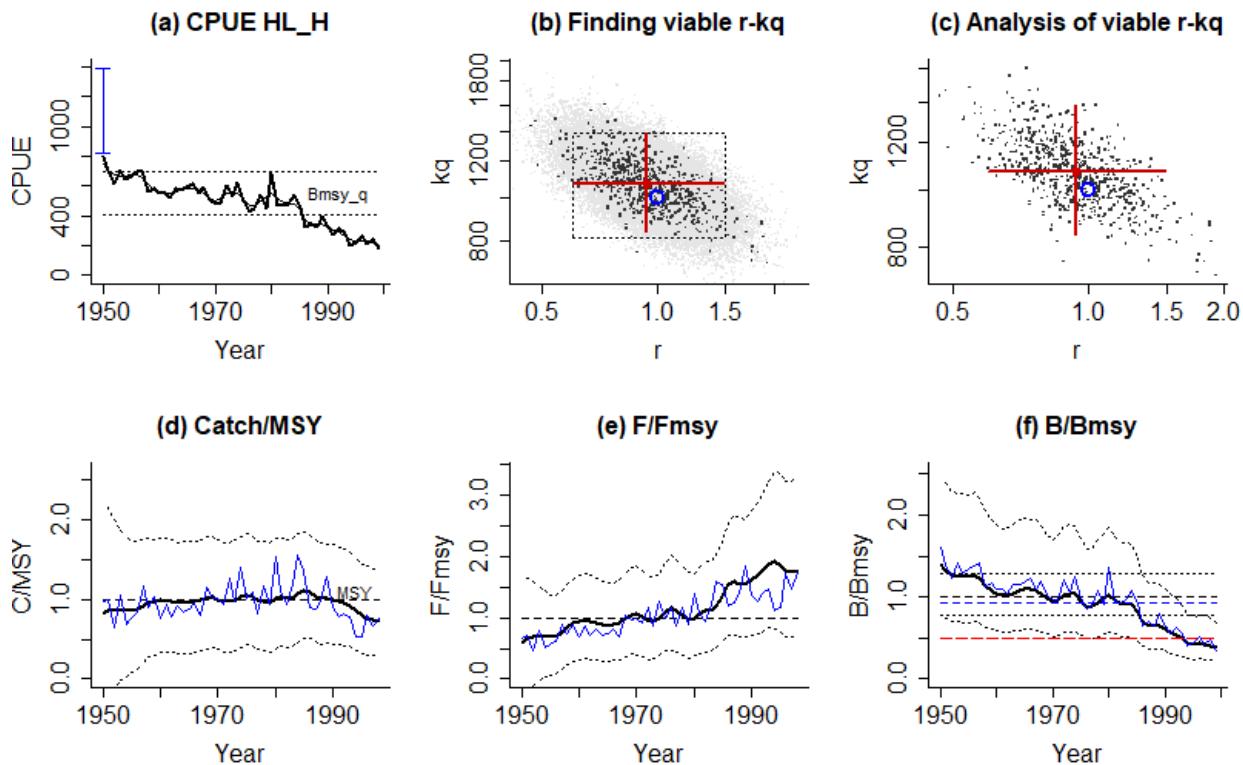


Stock HL_H, , Simulated data
 CPUE data for years 1950 - 1999, CPUE range 204 - 745, smooth = TRUE
 Prior for r = High, NA - NA
 Used prior range for r = 0.6 - 1.5
 Prior for 1950 stock status = More than half, NA - NA
 Used 1950 prior B/B0 range = 0.5 - 0.85, prior B/Bmsy = 1 - 1.7
 Used prior range for kq = 818 - 1390 [original range = 818 - 1390]
 Comment: True r=1.0, true kq=1000, true MSYq=250

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
 Viable r-kq pairs = 20010

Results:

viable r-kq pairs	= 20010
median kq	= 1070, 838 - 1387
median MSYq	= 251, 175 - 359
r (4 MSYq/kq)	= 0.938, 0.599 - 1.49
Fmsy (r/2)	= 0.469, 0.3 - 0.743
F/Fmsy	= 1.77, 0.687 - 3.32 (1998), true: 1.75
B/Bmsy	= 0.382, 0.212 - 0.691 (1999), true: 0.36

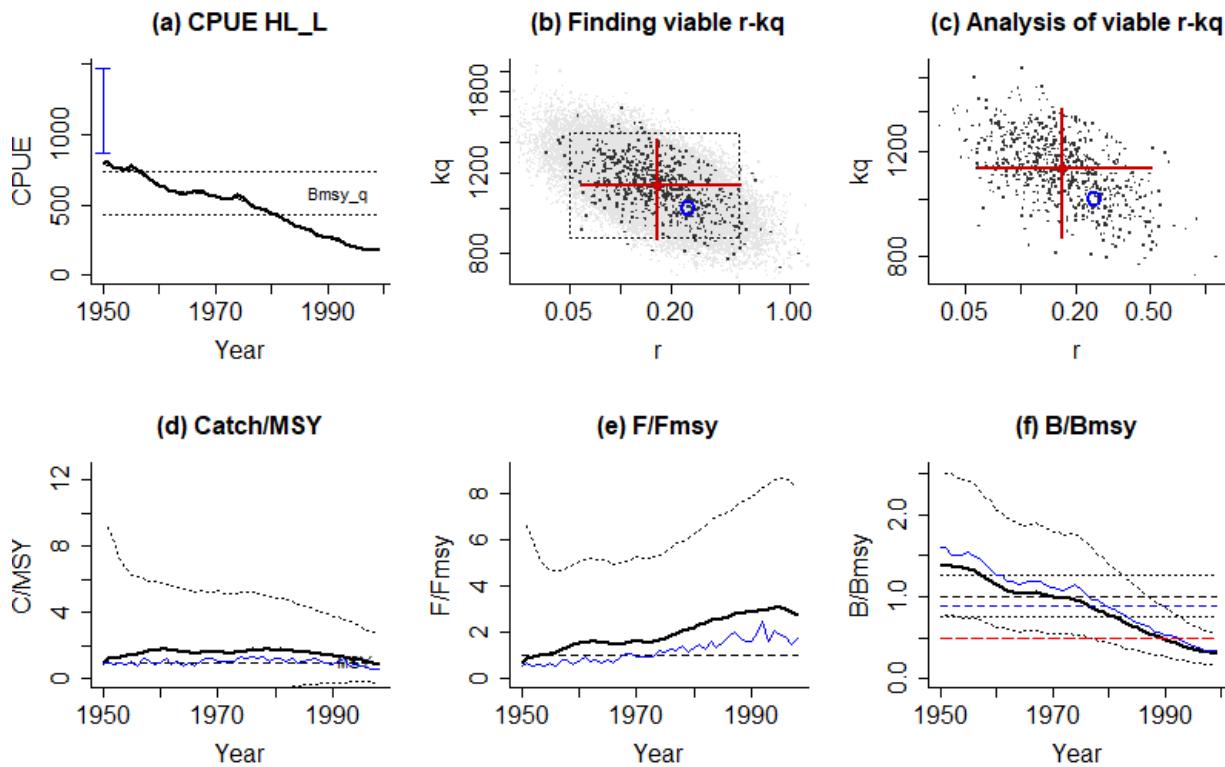


Stock HL_L, , Simulated data
 CPUE data for years 1950 - 1999, CPUE range 177 - 787, smooth = TRUE
 Prior for r = Low, NA - NA
 Used prior range for r = 0.05 - 0.5
 Prior for 1950 stock status = More than half, NA - NA
 Used 1950 prior B/B0 range = 0.5 - 0.85, prior B/Bmsy = 1 - 1.7
 Used prior range for kq = 864 - 1469 [original range = 864 - 1469]
 Comment: True r=0.25, true kq=1000, true MSYq=62.5

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
 Viable r-kq pairs = 20010

Results:

viable r-kq pairs	= 20010
median kq	= 1125, 859 - 1417
median MSYq	= 46.7, 16.6 - 122
r (4 MSYq/kq)	= 0.166, 0.0582 - 0.516
Fmsy (r/2)	= 0.083, 0.0291 - 0.258
F/Fmsy	= 2.75, -0.728 - 8.3 (1998), true: 1.79
B/Bmsy	= 0.314, 0.175 - 0.57 (1999), true: 0.36

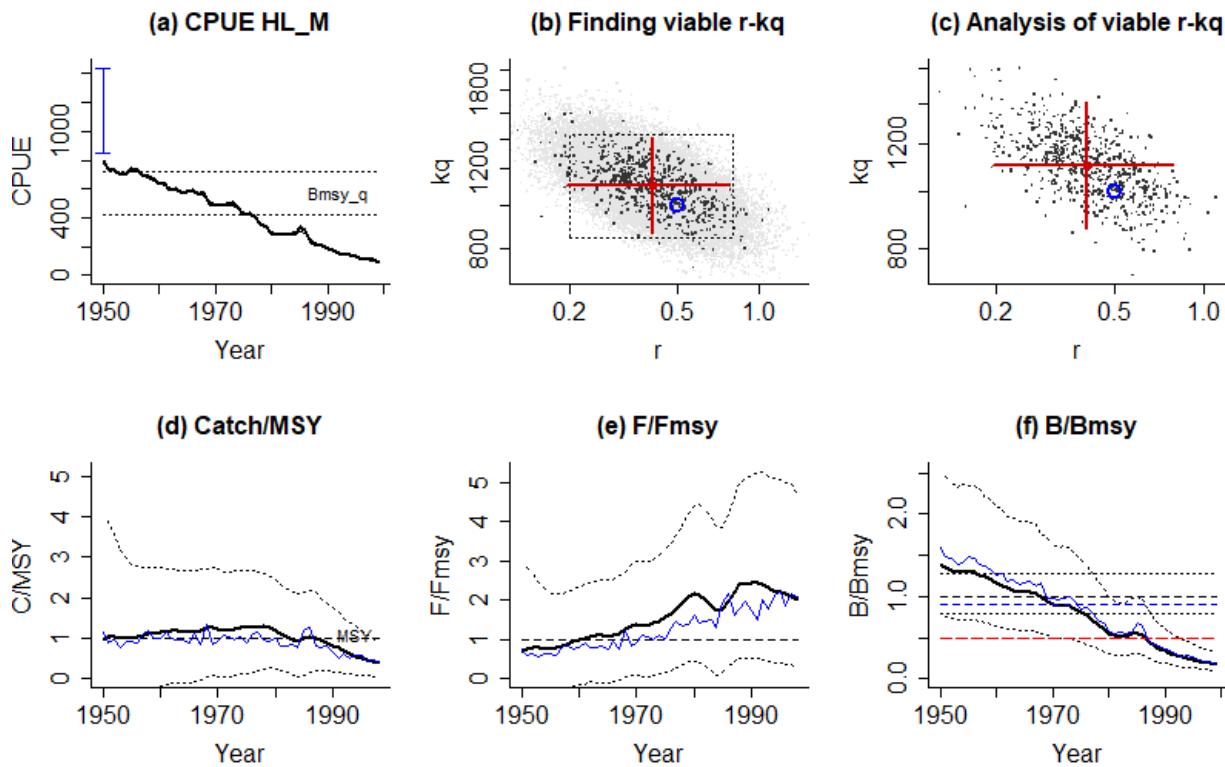


Stock HL_M, , Simulated data
 CPUE data for years 1950 - 1999, CPUE range 101 - 770, smooth = TRUE
 Prior for r = Medium, NA - NA
 Used prior range for r = 0.2 - 0.8
 Prior for 1950 stock status = More than half, NA - NA
 Used 1950 prior B/B0 range = 0.5 - 0.85, prior B/Bmsy = 1 - 1.7
 Used prior range for kq = 845 - 1437 [original range = 845 - 1437]
 Comment: True r=0.5, true kq=1000, true MSYq=125, true q=0.001

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
 Viable r-kq pairs = 20010

Results:

viable r-kq pairs	= 20010
median kq	= 1104, 865 - 1406
median MSYq	= 112, 60.5 - 195
r (4 MSYq/kq)	= 0.404, 0.196 - 0.787
Fmsy (r/2)	= 0.202, 0.0978 - 0.394
F/Fmsy	= 2, 0.262 - 4.69 (1998), true: 2.09
B/Bmsy	= 0.183, 0.101 - 0.332 (1999), true: 0.18

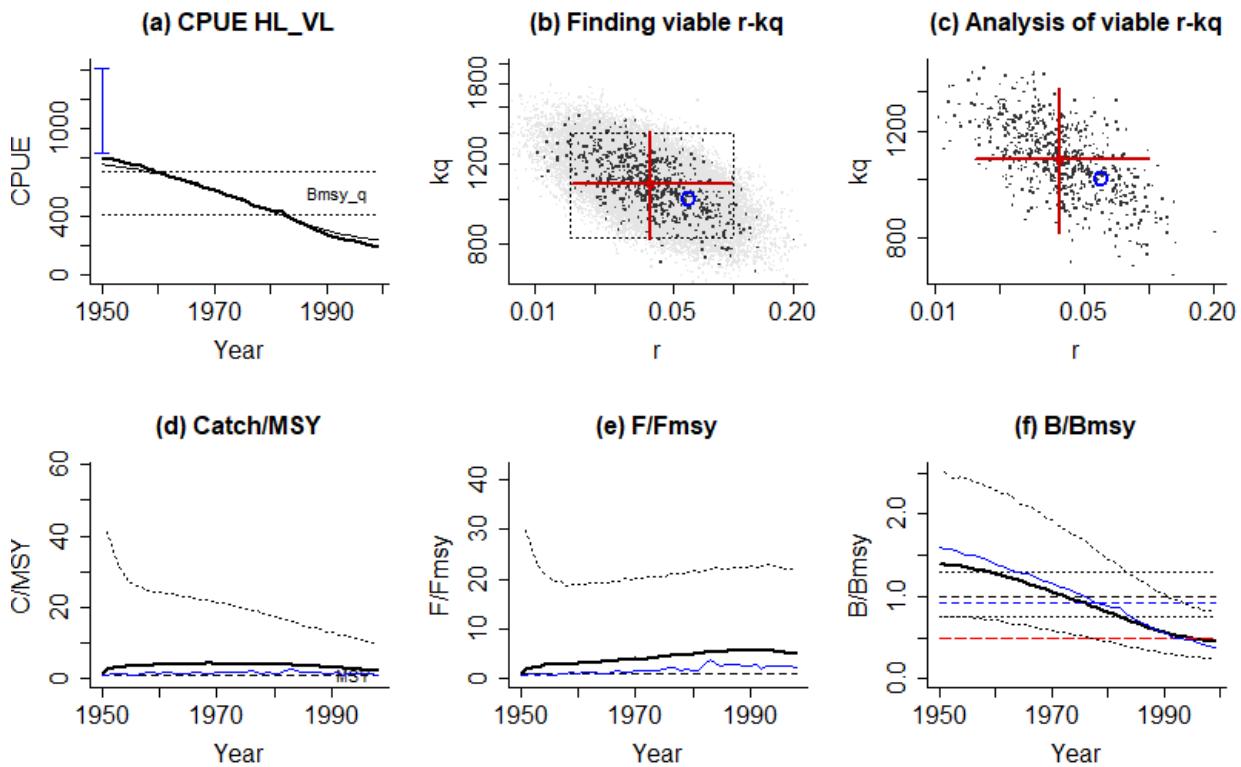


Stock HL_VL, , simulated data
 CPUE data for years 1950 - 1999, CPUE range 244 - 754, smooth = TRUE
 Prior for r = Very low, NA - NA
 Used prior range for r = 0.015 - 0.1
 Prior for 1950 stock status = More than half, NA - NA
 Used 1950 prior B/B0 range = 0.5 - 0.85, prior B/Bmsy = 1 - 1.7
 Used prior range for kq = 828 - 1407 [original range = 828 - 1407]
 Comment: True r=0.06, true kq=1000, true MSYq=15

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
 Viable r-kq pairs = 20010

Results:

viable r-kq pairs	= 20010
median kq	= 1083, 817 - 1413
median MSYq	= 10.3, 4.71 - 23.6
r (4 MSYq/kq)	= 0.038, 0.0153 - 0.0987
Fmsy (r/2)	= 0.019, 0.00767 - 0.0493
F/Fmsy	= 5.12, -6.94 - 21.8 (1998), true: 2.41
B/Bmsy	= 0.45, 0.249 - 0.811 (1999), true: 0.38

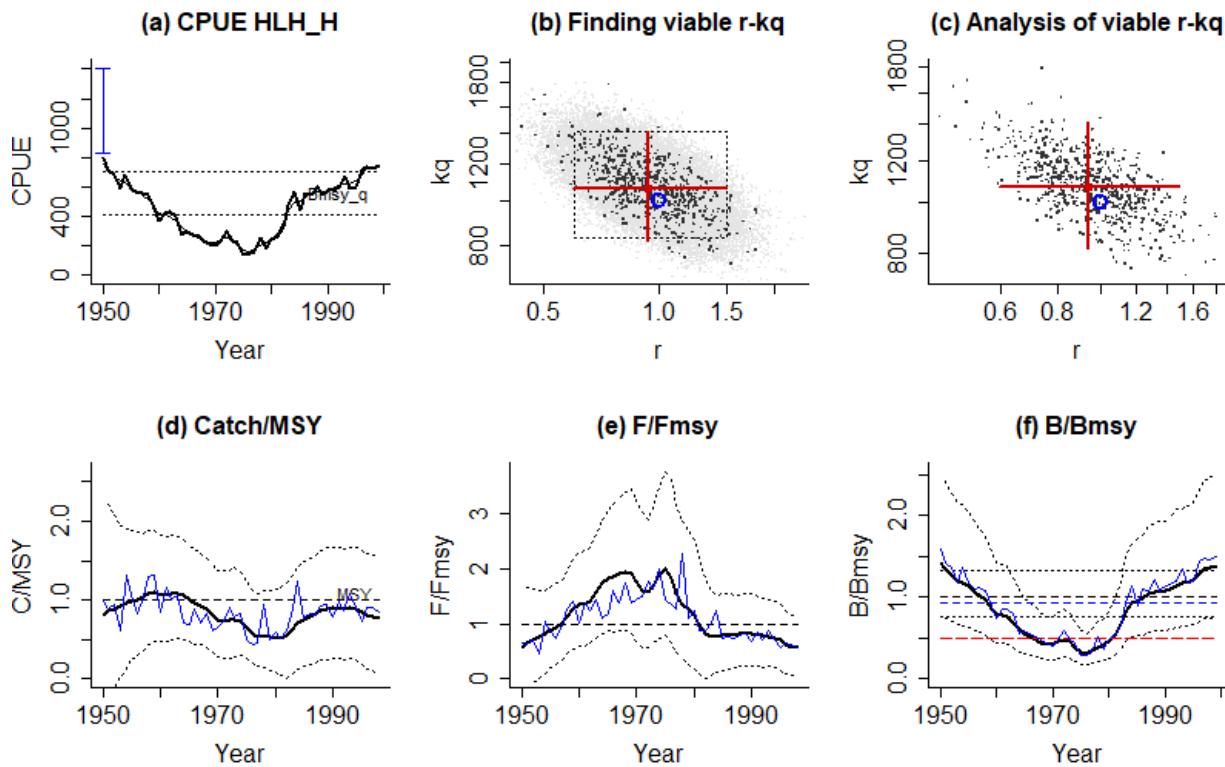


Stock HLH_H, , simulated data
 CPUE data for years 1950 - 1999, CPUE range 165 - 753, smooth = TRUE
 Prior for r = High, NA - NA
 Used prior range for r = 0.6 - 1.5
 Prior for 1950 stock status = More than half, NA - NA
 Used 1950 prior B/B0 range = 0.5 - 0.85, prior B/Bmsy = 1 - 1.7
 Used prior range for kq = 827 - 1405 [original range = 827 - 1405]
 Comment: True r=1.0, true kq=1000, true MSYq=250

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
 Viable r-kq pairs = 20010

Results:

viable r-kq pairs	= 20010
median kq	= 1065, 819 - 1408
median MSYq	= 250, 179 - 363
r (4 MSYq/kq)	= 0.941, 0.594 - 1.5
Fmsy (r/2)	= 0.47, 0.297 - 0.75
F/Fmsy	= 0.564, 0.0348 - 1.16 (1998), true: 0.577
B/Bmsy	= 1.38, 0.776 - 2.5 (1999), true: 1.5

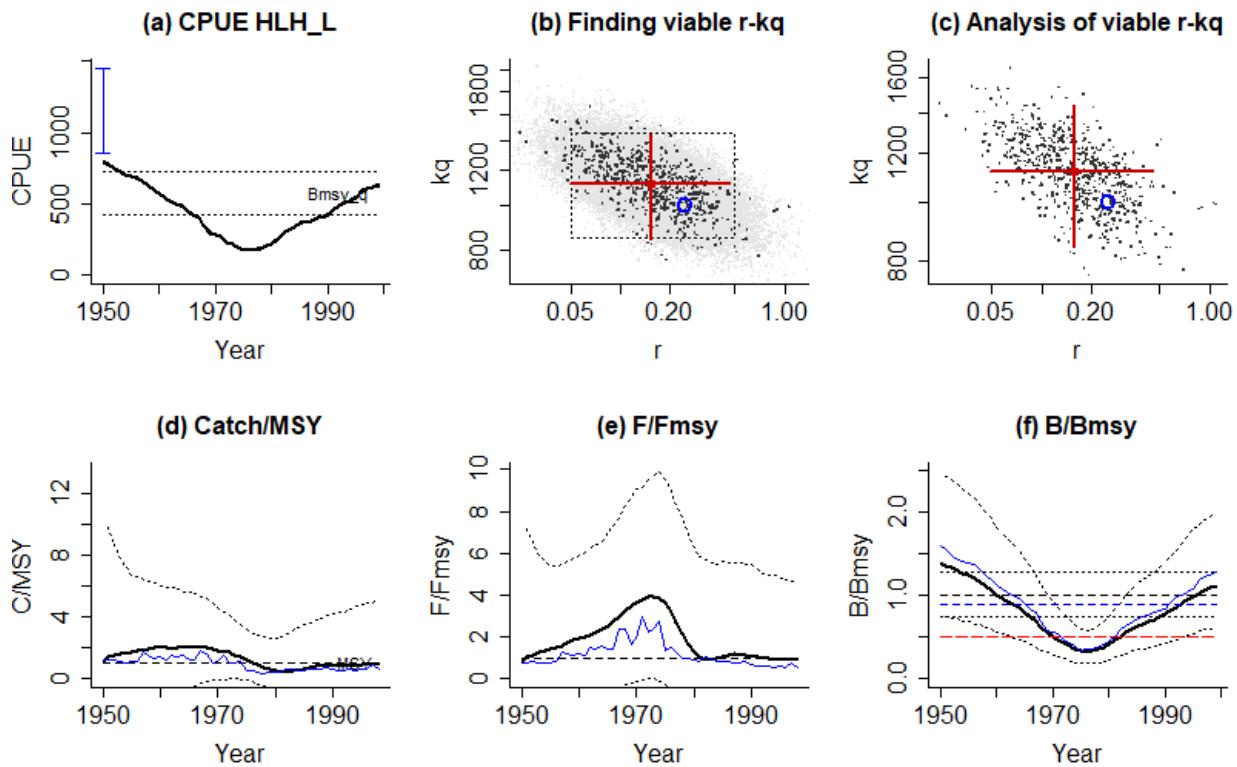


Stock HLH_L, , simulated data
 CPUE data for years 1950 - 1999, CPUE range 186 - 777, smooth = TRUE
 Prior for r = Low, NA - NA
 Used prior range for r = 0.05 - 0.5
 Prior for 1950 stock status = More than half, NA - NA
 Used 1950 prior B/B₀ range = 0.5 - 0.85, prior B/B_{MSY} = 1 - 1.7
 Used prior range for kq = 852 - 1449 [original range = 852 - 1449]
 Comment: True r=0.25, true kq=1000, true MSYq=62.5

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
 Viable r-kq pairs = 20010

Results:

viable r-kq pairs	= 20010
median kq	= 1121, 842 - 1441
median MSYq	= 43.5, 15.8 - 115
r (4 MSYq/kq)	= 0.155, 0.0489 - 0.464
F _{MSY} (r/2)	= 0.0777, 0.0245 - 0.232
F/F _{MSY}	= 0.961, -1.83 - 4.72 (1998), true: 0.546
B/B _{MSY}	= 1.11, 0.62 - 2 (1999), true: 1.28

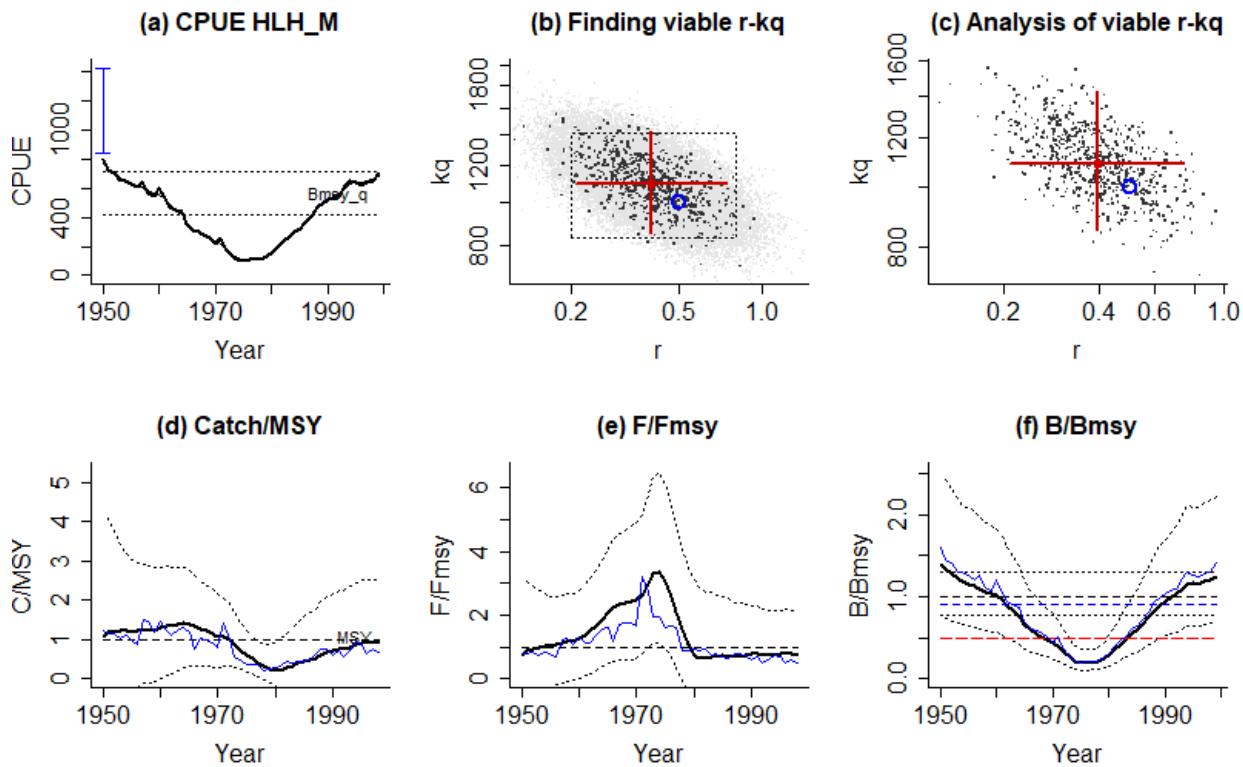


Stock HLH_M, , simulated data
 CPUE data for years 1950 - 1999, CPUE range 108 - 760, smooth = TRUE
 Prior for r = Medium, NA - NA
 Used prior range for r = 0.2 - 0.8
 Prior for 1950 stock status = More than half, NA - NA
 Used 1950 prior B/B0 range = 0.5 - 0.85, prior B/Bmsy = 1 - 1.7
 Used prior range for kq = 835 - 1419 [original range = 835 - 1419]
 Comment: True r=0.5, true kq=1000, true MSYq=125, true q=0.001

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
 Viable r-kq pairs = 20010

Results:

viable r-kq pairs	= 20010
median kq	= 1091, 854 - 1429
median MSYq	= 108, 63.9 - 185
r (4 MSYq/kq)	= 0.395, 0.209 - 0.747
Fmsy (r/2)	= 0.197, 0.104 - 0.373
F/Fmsy	= 0.755, -0.353 - 2.09 (1998), true: 0.522
B/Bmsy	= 1.25, 0.688 - 2.22 (1999), true: 1.4

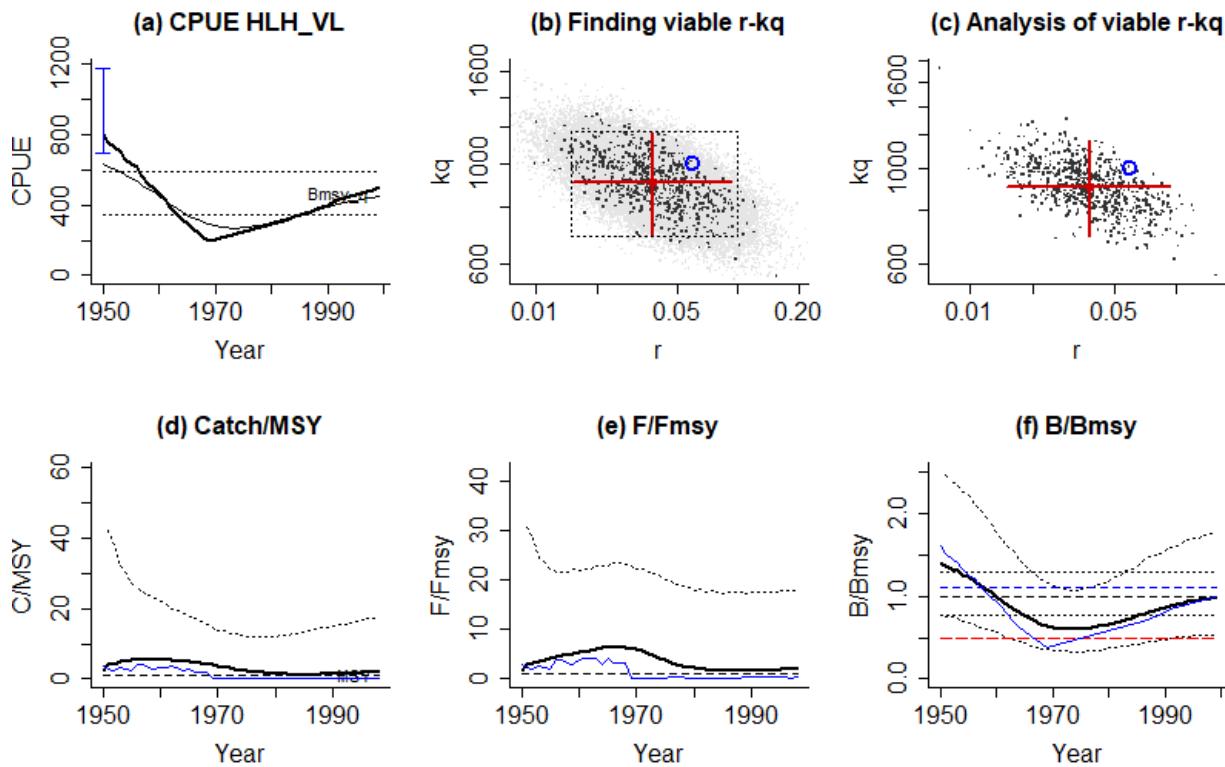


Stock HLH_VL, , Simulated data
 CPUE data for years 1950 - 1999, CPUE range 270 - 631, smooth = TRUE
 Prior for r = Very low, NA - NA
 Used prior range for r = 0.015 - 0.1
 Prior for 1950 stock status = More than half, NA - NA
 Used 1950 prior B/B_0 range = 0.5 - 0.85, prior B/B_{msy} = 1 - 1.7
 Used prior range for kq = 692 - 1176 [original range = 692 - 1176]
 Comment: True $r=0.06$, true $kq=1000$, true MSYq=15

Monte Carlo filtering of r - kq space with 50000 points and 30 error patterns.
 Viable r - kq pairs = 20010

Results:

viable r - kq pairs	= 20010
median kq	= 905, 697 - 1166
median MSYq	= 8.61, 3.84 - 18.6
r (4 MSYq/ kq)	= 0.0381, 0.015 - 0.0933
F/F_{msy} ($r/2$)	= 0.019, 0.00752 - 0.0466
F/F_{msy}	= 2.04, -9.09 - 17.9 (1998), true: 0.377
B/B_{msy}	= 0.987, 0.548 - 1.79 (1999), true: 1

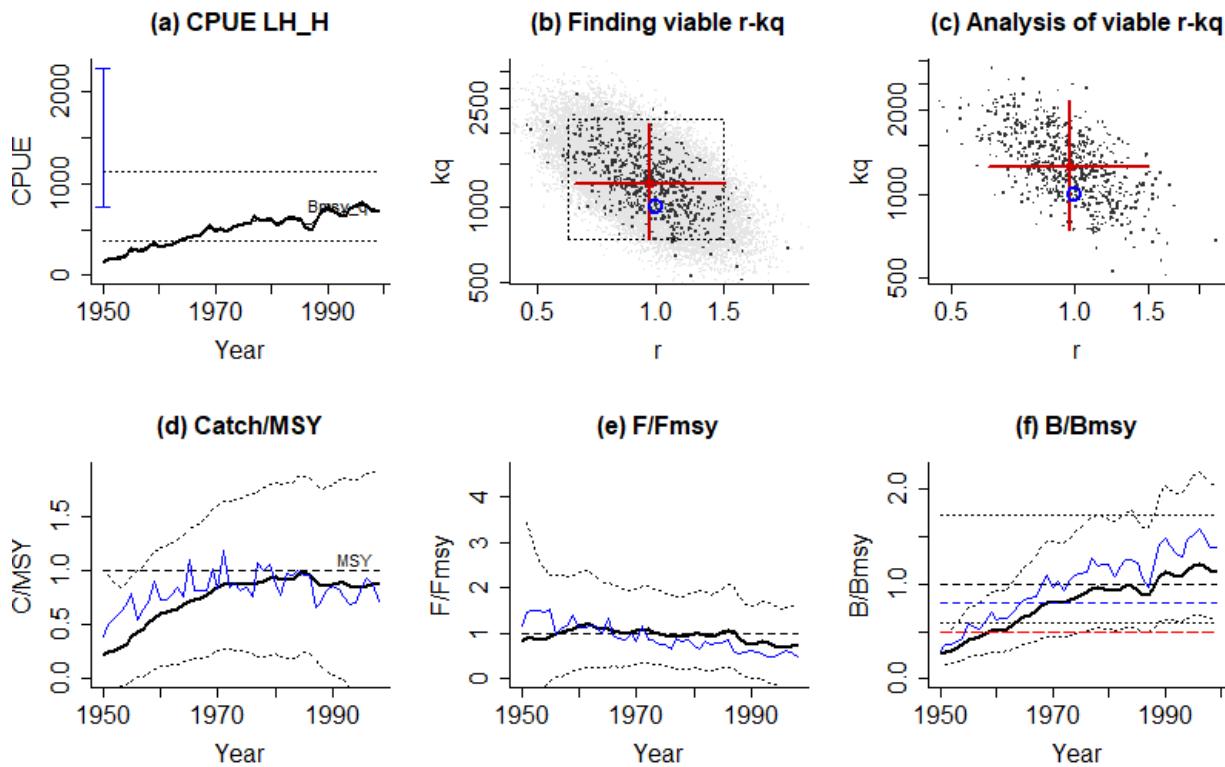


Stock LH_H, , Simulated data
 CPUE data for years 1950 - 1999, CPUE range 164 - 761, smooth = TRUE
 Prior for r = High, NA - NA
 Used prior range for r = 0.6 - 1.5
 Prior for 1950 stock status = Very small, NA - NA
 Used 1950 prior B/B0 range = 0.01 - 0.2, prior B/Bmsy = 0.02 - 0.4
 Used prior range for kq = 749 - 2248 [original range = 149 - 2981]
 Comment: True r=1.0, true kq=1000, true MSYq=250

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
 Viable r-kq pairs = 20010

Results:

viable r-kq pairs	= 20010
median kq	= 1253, 747 - 2162
median MSYq	= 304, 187 - 487
r (4 MSYq/kq)	= 0.971, 0.617 - 1.51
Fmsy (r/2)	= 0.485, 0.309 - 0.756
F/Fmsy	= 0.771, -0.199 - 1.66 (1998), true: 0.5
B/Bmsy	= 1.12, 0.619 - 2.02 (1999), true: 1.4

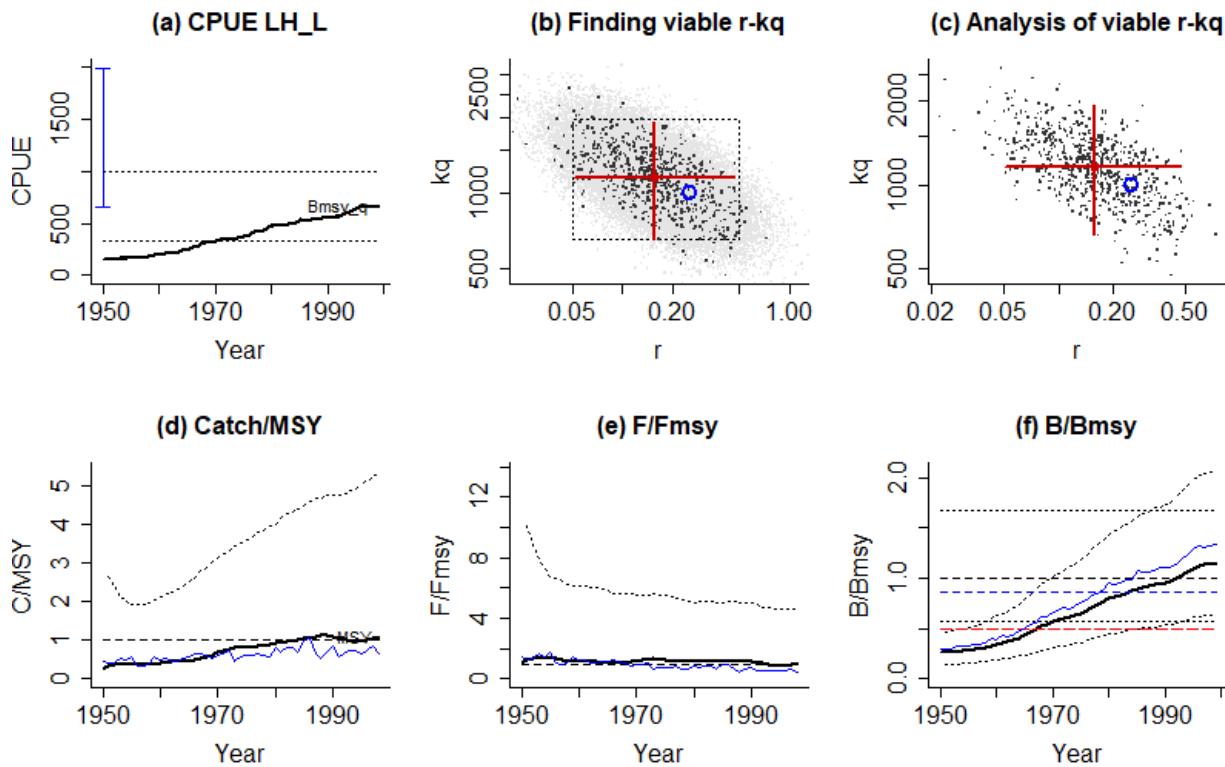


Stock LH_LL, , Simulated data
 CPUE data for years 1950 - 1999, CPUE range 152 - 663, smooth = TRUE
 Prior for r = Low, NA - NA
 Used prior range for r = 0.05 - 0.5
 Prior for 1950 stock status = Very small, NA - NA
 Used 1950 prior B/B0 range = 0.01 - 0.2, prior B/Bmsy = 0.02 - 0.4
 Used prior range for kq = 661 - 1982 [original range = 138 - 2750]
 Comment: True r=0.25, true kq=1000, true MSYq=62.5

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
 Viable r-kq pairs = 20010

Results:

viable r-kq pairs	= 20010
median kq	= 1157, 658 - 1926
median MSYq	= 45.1, 17.1 - 110
r (4 MSYq/kq)	= 0.156, 0.0513 - 0.464
Fmsy (r/2)	= 0.078, 0.0257 - 0.232
F/Fmsy	= 0.943, -1.84 - 4.71 (1998), true: 0.484
B/Bmsy	= 1.15, 0.638 - 2.06 (1999), true: 1.34

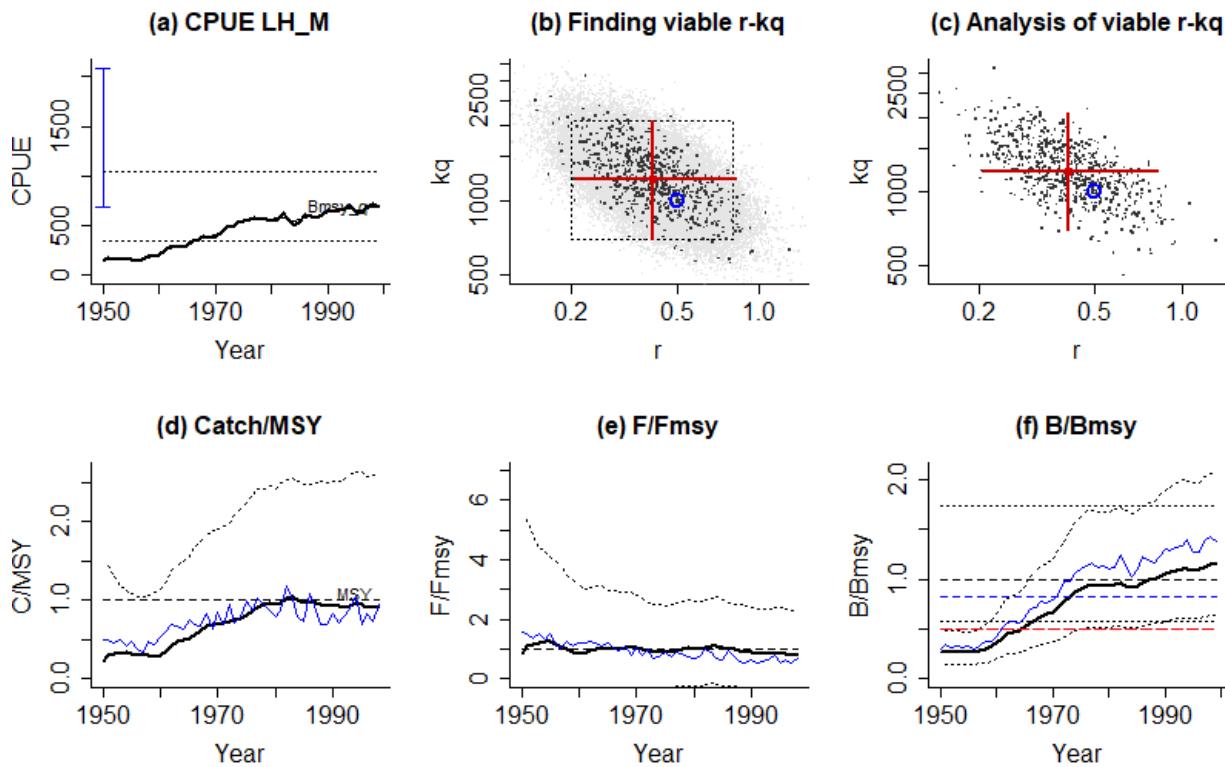


Stock LH_M, , Simulated data
 CPUE data for years 1950 - 1999, CPUE range 159 - 697, smooth = TRUE
 Prior for r = Medium, NA - NA
 Used prior range for r = 0.2 - 0.8
 Prior for 1950 stock status = Very small, NA - NA
 Used 1950 prior B/B0 range = 0.01 - 0.2, prior B/Bmsy = 0.02 - 0.4
 Used prior range for kq = 695 - 2086 [original range = 144 - 2886]
 Comment: True r=0.5, true kq=1000, true MSYq=125, true q=0.001

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
 Viable r-kq pairs = 20010

Results:

viable r-kq pairs	= 20010
median kq	= 1208, 699 - 2090
median MSYq	= 122, 71.7 - 203
r (4 MSYq/kq)	= 0.405, 0.206 - 0.823
Fmsy (r/2)	= 0.203, 0.103 - 0.412
F/Fmsy	= 0.794, -0.445 - 2.29 (1998), true: 0.679
B/Bmsy	= 1.16, 0.639 - 2.08 (1999), true: 1.38

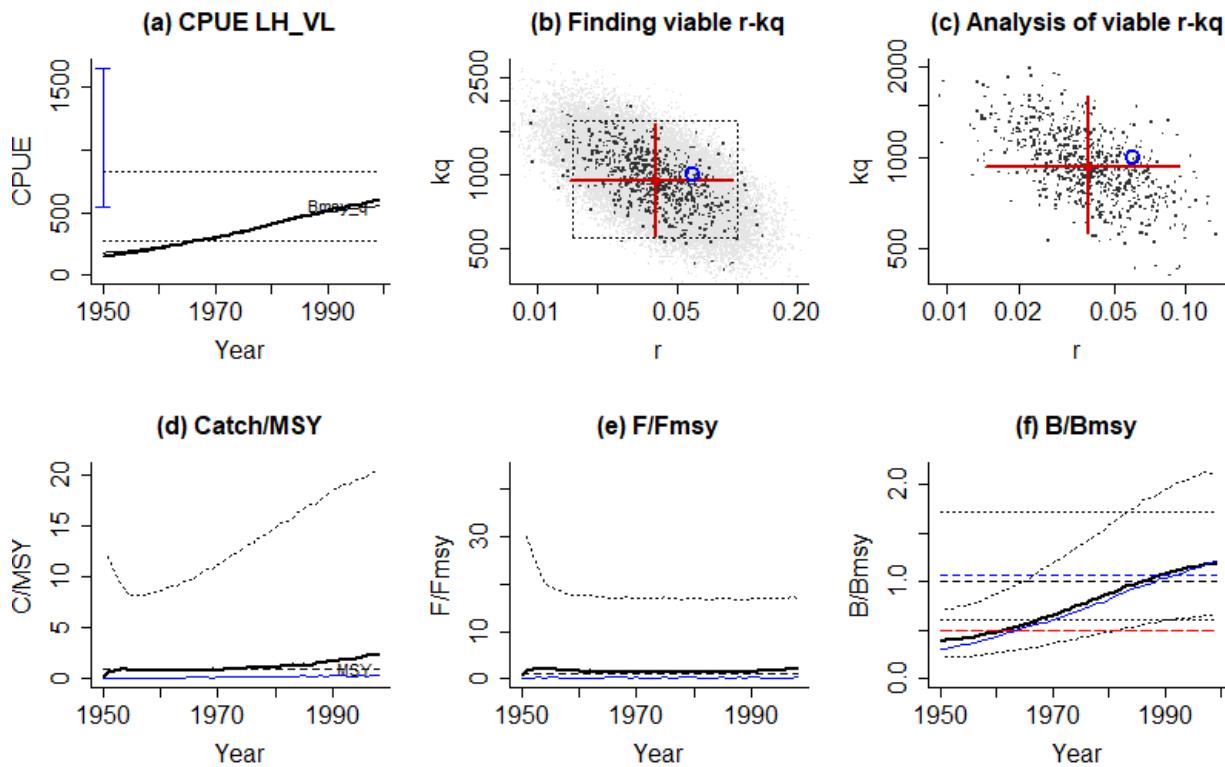


Stock LH_VL, , simulated data
 CPUE data for years 1950 - 1999, CPUE range 182 - 555, smooth = TRUE
 Prior for r = Very low, NA - NA
 Used prior range for r = 0.015 - 0.1
 Prior for 1950 stock status = Very small, NA - NA
 Used 1950 prior B/B_0 range = 0.01 - 0.2, prior B/B_{msy} = 0.02 - 0.4
 Used prior range for kq = 551 - 1654 [original range = 165 - 3305]
 Comment: True $r=0.06$, true $kq=1000$, true MSYq=15

Monte Carlo filtering of r - kq space with 50000 points and 30 error patterns.
 Viable r - kq pairs = 20010

Results:

viable r - kq pairs	= 20010
median kq	= 936, 563 - 1606
median MSYq	= 9.12, 4.39 - 19.1
r (4 MSYq/ kq)	= 0.039, 0.0144 - 0.0948
F/F_{msy} ($r/2$)	= 0.0195, 0.00722 - 0.0474
F/F_{msy}	= 1.96, -8.57 - 17.2 (1998), true: 0.362
B/B_{msy}	= 1.18, 0.659 - 2.13 (1999), true: 1.2

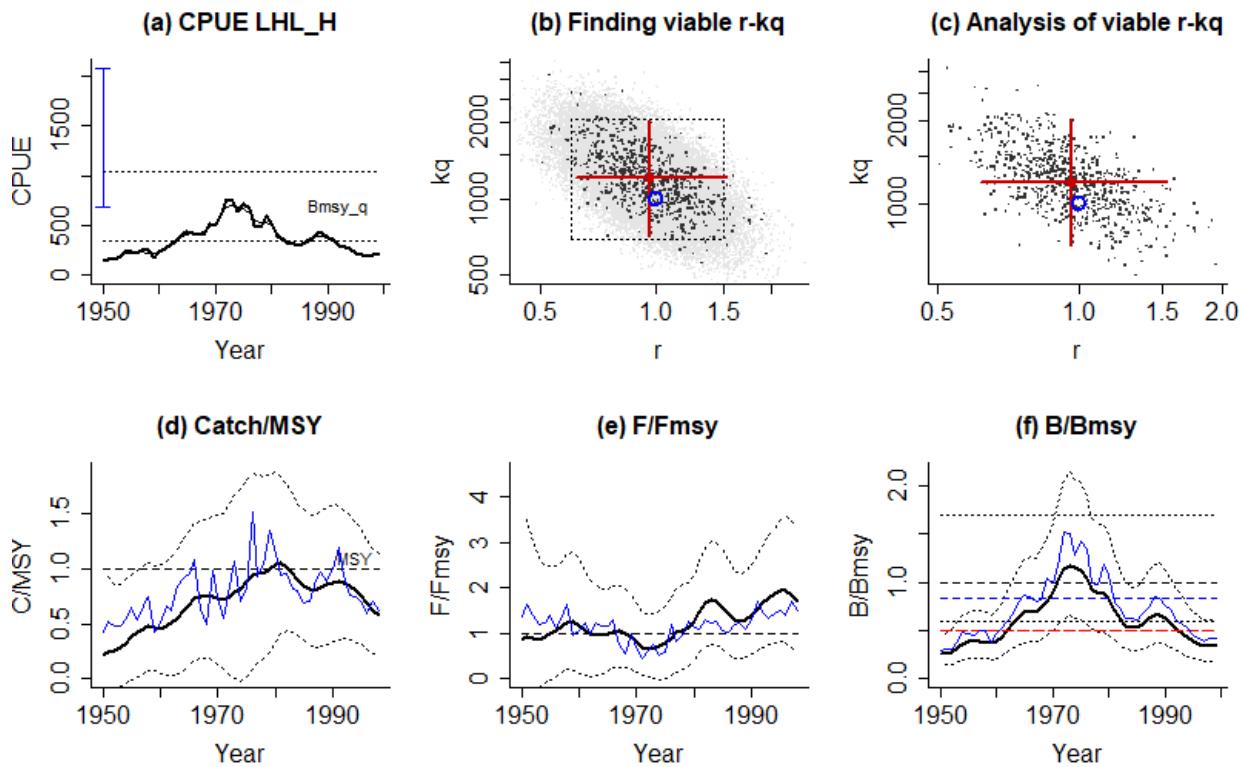


Stock LHL_H, , simulated data
 CPUE data for years 1950 - 1999, CPUE range 155 - 708, smooth = TRUE
 Prior for r = High, NA - NA
 Used prior range for r = 0.6 - 1.5
 Prior for 1950 stock status = Very small, NA - NA
 Used 1950 prior B/B0 range = 0.01 - 0.2, prior B/Bmsy = 0.02 - 0.4
 Used prior range for kq = 693 - 2079 [original range = 140 - 2807]
 Comment: True r=1.0, true kq=1000, true MSYq=250

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
 Viable r-kq pairs = 20010

Results:

viable r-kq pairs	= 20010
median kq	= 1207, 711 - 2038
median MSYq	= 290, 190 - 442
r (4 MSYq/kq)	= 0.961, 0.62 - 1.53
Fmsy (r/2)	= 0.48, 0.31 - 0.765
F/Fmsy	= 1.71, 0.595 - 3.33 (1998), true: 1.5
B/Bmsy	= 0.345, 0.192 - 0.622 (1999), true: 0.42

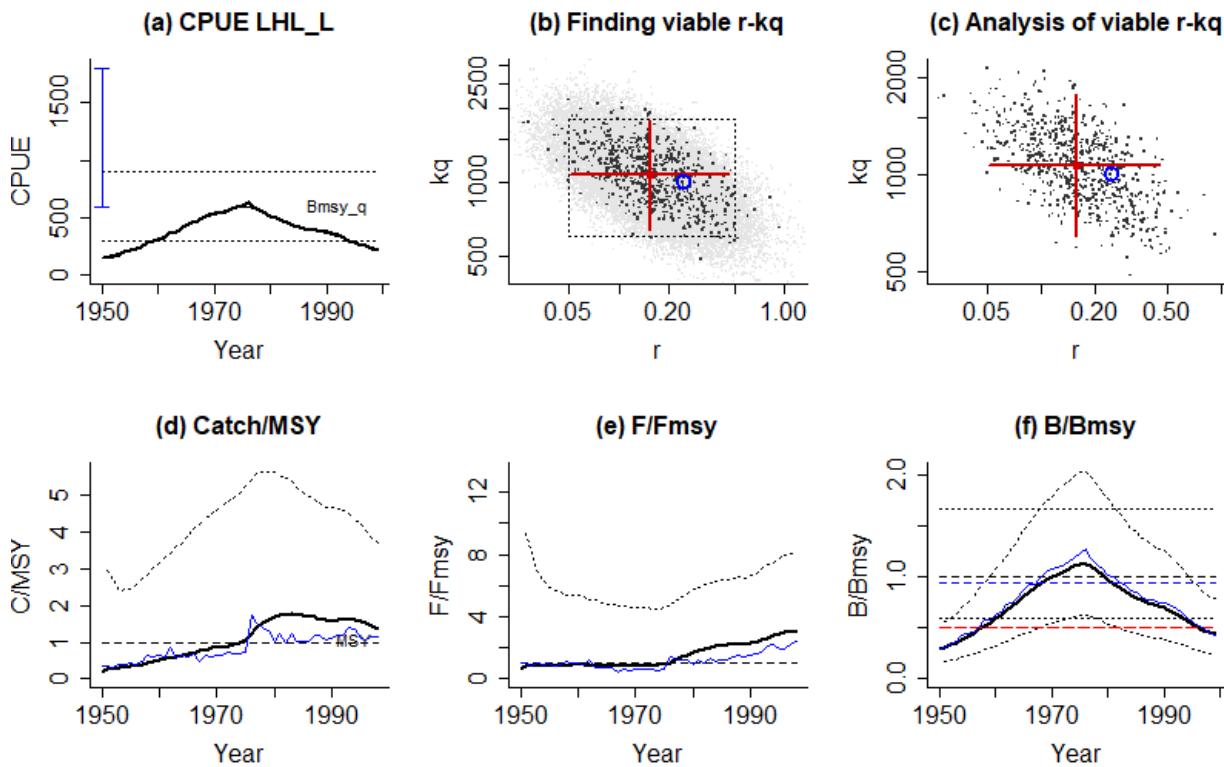


Stock LHL_L, , simulated data
 CPUE data for years 1950 - 1999, CPUE range 160 - 602, smooth = TRUE
 Prior for r = Low, NA - NA
 Used prior range for r = 0.05 - 0.5
 Prior for 1950 stock status = Very small, NA - NA
 Used 1950 prior B/B0 range = 0.01 - 0.2, prior B/Bmsy = 0.02 - 0.4
 Used prior range for kq = 600 - 1801 [original range = 145 - 2909]
 Comment: True r=0.25, true kq=1000, true MSYq=62.5

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
 Viable r-kq pairs = 20010

Results:

viable r-kq pairs	= 20010
median kq	= 1065, 639 - 1787
median MSYq	= 41.5, 17.1 - 105
r (4 MSYq/kq)	= 0.156, 0.0514 - 0.461
Fmsy (r/2)	= 0.0779, 0.0257 - 0.23
F/Fmsy	= 2.99, -0.641 - 8.15 (1998), true: 2.38
B/Bmsy	= 0.439, 0.245 - 0.79 (1999), true: 0.42

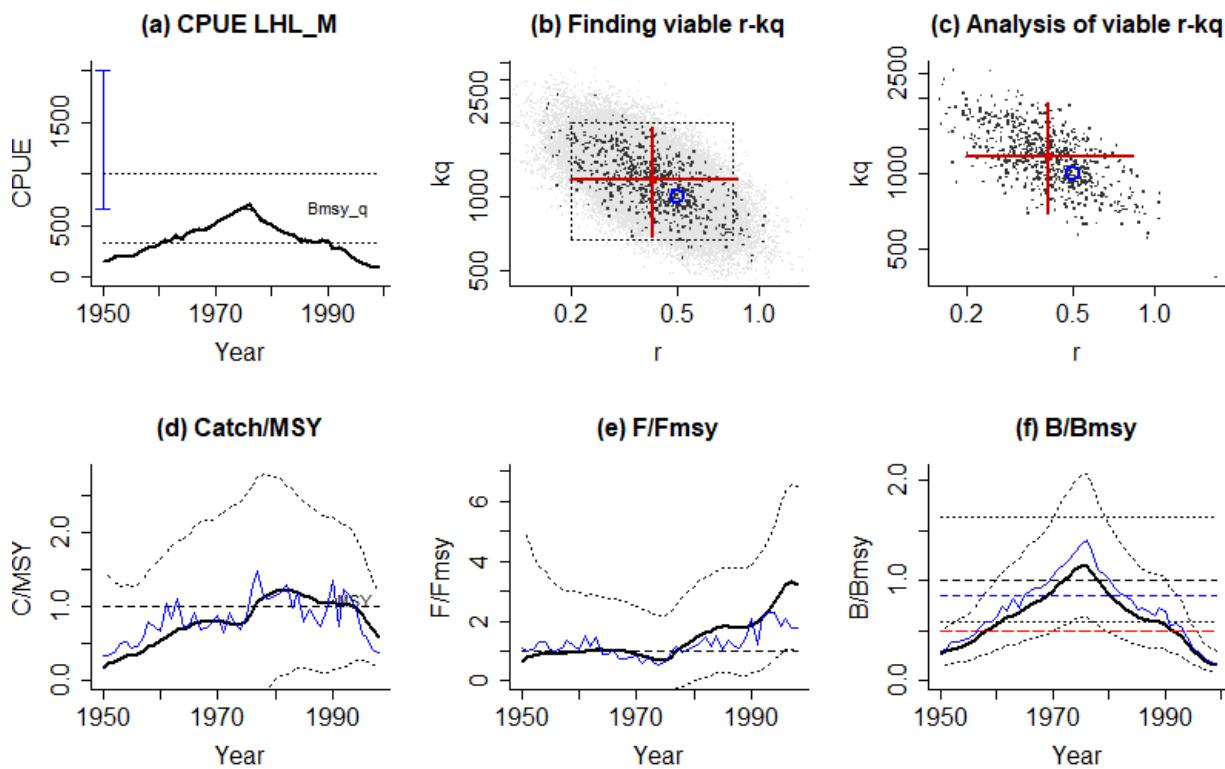


Stock LHL_M, , simulated data
 CPUE data for years 1950 - 1999, CPUE range 96.7 - 669, smooth = TRUE
 Prior for r = Medium, NA - NA
 Used prior range for r = 0.2 - 0.8
 Prior for 1950 stock status = Very small, NA - NA
 Used 1950 prior B/B0 range = 0.01 - 0.2, prior B/Bmsy = 0.02 - 0.4
 Used prior range for kq = 668 - 2005 [original range = 144 - 2875]
 Comment: True r=0.5, true kq=1000, true MSYq=125, true q=0.001

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
 Viable r-kq pairs = 20010

Results:

viable r-kq pairs	= 20010
median kq	= 1164, 693 - 1908
median MSYq	= 117, 64.1 - 196
r (4 MSYq/kq)	= 0.401, 0.196 - 0.831
Fmsy (r/2)	= 0.2, 0.098 - 0.415
F/Fmsy	= 3.22, 1.01 - 6.48 (1998), true: 1.77
B/Bmsy	= 0.166, 0.0911 - 0.295 (1999), true: 0.18

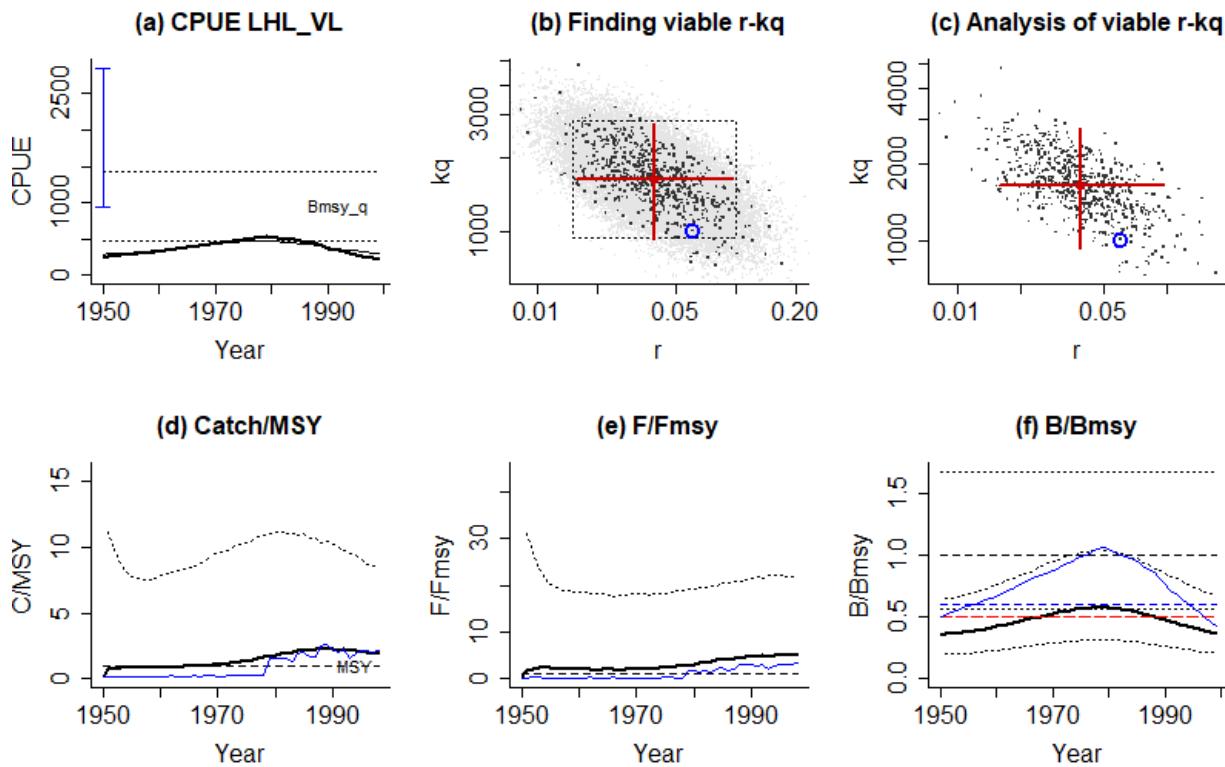


Stock LHL_VL, , Simulated data
 CPUE data for years 1950 - 1999, CPUE range 293 - 475, smooth = TRUE
 Prior for r = Very low, NA - NA
 Used prior range for r = 0.015 - 0.1
 Prior for 1950 stock status = Very small, NA - NA
 Used 1950 prior B/B0 range = 0.01 - 0.2, prior B/Bmsy = 0.02 - 0.4
 Used prior range for kq = 949 - 2848 [original range = 266 - 5322]
 Comment: True r=0.06, true kq=1000, true MSYq=15

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
 Viable r-kq pairs = 20010

Results:

viable r-kq pairs	= 20010
median kq	= 1647, 936 - 2756
median MSYq	= 15.9, 7.37 - 32.8
r (4 MSYq/kq)	= 0.0386, 0.0157 - 0.0965
Fmsy (r/2)	= 0.0193, 0.00785 - 0.0483
F/Fmsy	= 4.95, -7.03 - 22.1 (1998), true: 3.4
B/Bmsy	= 0.373, 0.207 - 0.668 (1999), true: 0.42

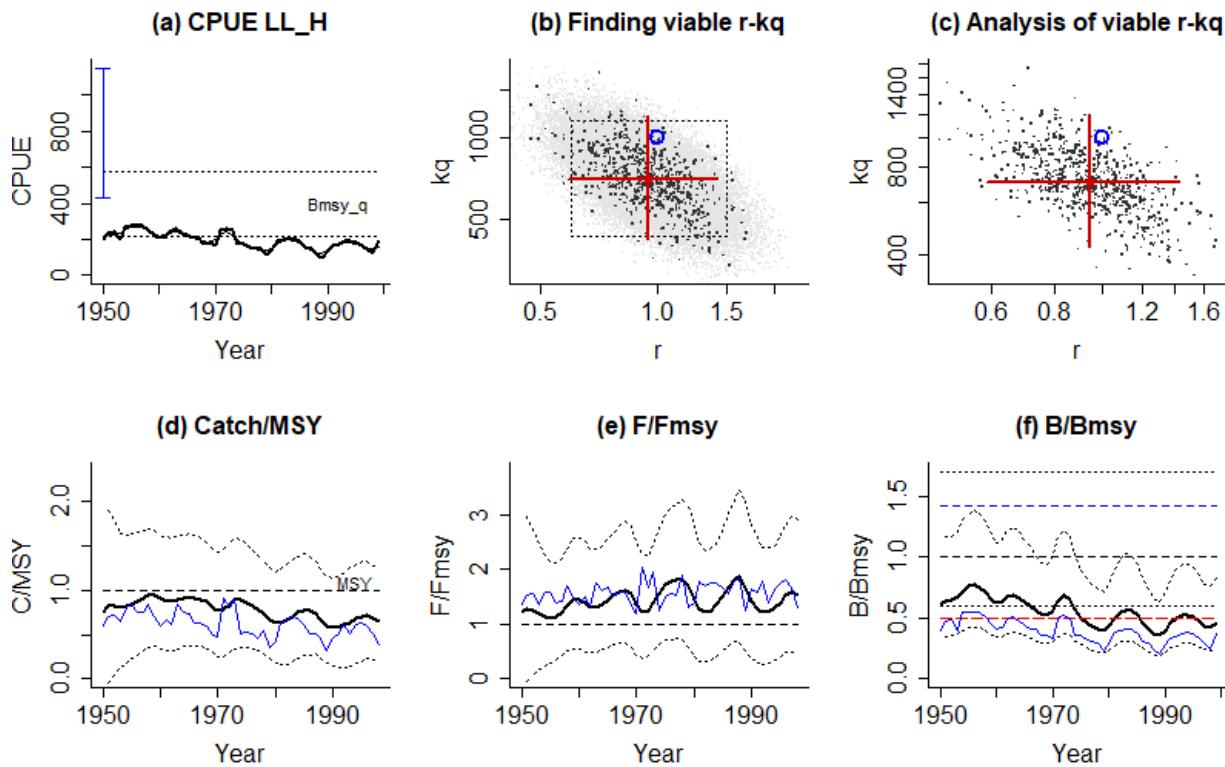


Stock LL_H, , Simulated data
 CPUE data for years 1950 - 1999, CPUE range 125 - 272, smooth = TRUE
 Prior for r = High, NA - NA
 Used prior range for r = 0.6 - 1.5
 Prior for 1950 stock status = Small, NA - NA
 Used 1950 prior B/B0 range = 0.15 - 0.4, prior B/Bmsy = 0.3 - 0.8
 Used prior range for kq = 431 - 1149 [original range = 431 - 1149]
 Comment: True r=1.0, true kq=1000, true MSYq=250

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
 Viable r-kq pairs = 20010

Results:

viable r-kq pairs	= 20010
median kq	= 704, 421 - 1196
median MSYq	= 166, 110 - 255
r (4 MSYq/kq)	= 0.944, 0.585 - 1.42
Fmsy (r/2)	= 0.472, 0.293 - 0.712
F/Fmsy	= 1.53, 0.439 - 2.91 (1998), true: 1.31
B/Bmsy	= 0.455, 0.255 - 0.821 (1999), true: 0.38

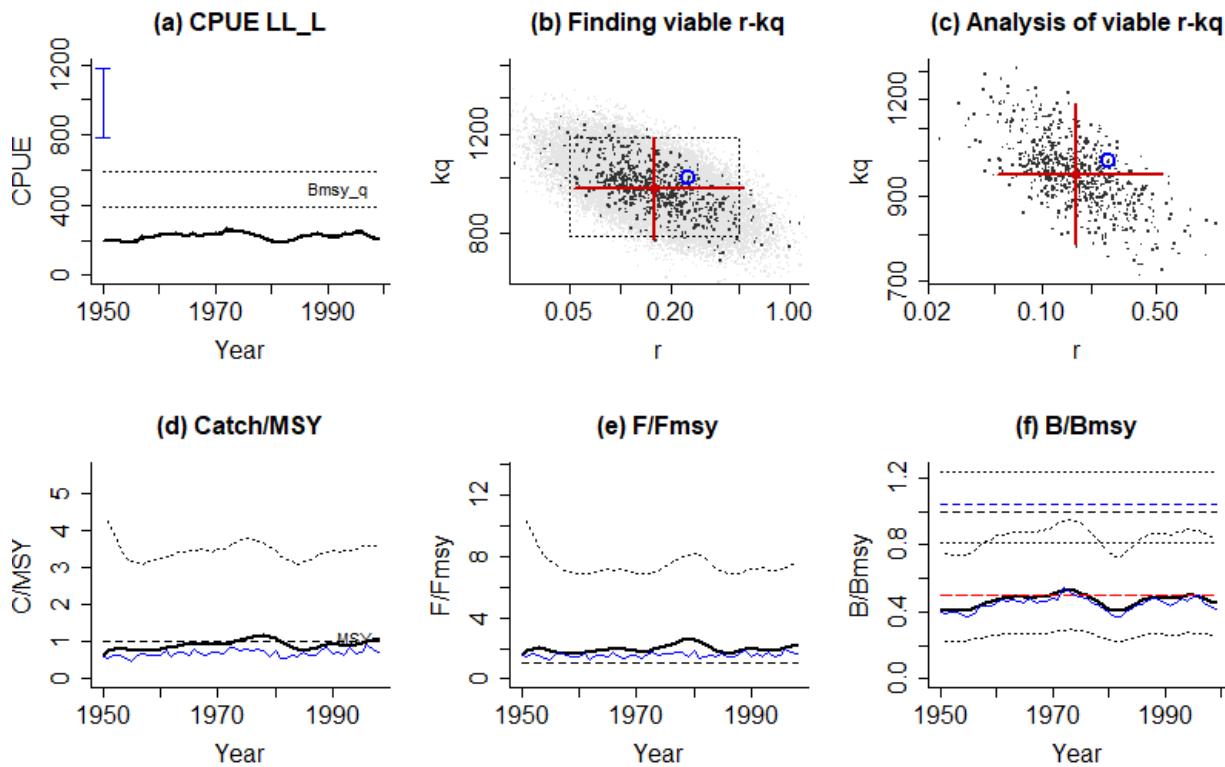


Stock LL_L, , Simulated data
 CPUE data for years 1950 - 1999, CPUE range 195 - 254, smooth = TRUE
 Prior for r = Low, NA - NA
 Used prior range for r = 0.05 - 0.5
 Prior for 1950 stock status = Small, NA - NA
 Used 1950 prior B/B0 range = 0.15 - 0.4, prior B/Bmsy = 0.3 - 0.8
 Used prior range for kq = 787 - 1180 [original range = 393 - 1049]
 Comment: True r=0.25, true kq=1000, true MSYq=62.5

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
 Viable r-kq pairs = 20010

Results:

viable r-kq pairs	= 20010
median kq	= 958, 779 - 1184
median MSYq	= 38.1, 13.8 - 108
r (4 MSYq/kq)	= 0.159, 0.0533 - 0.54
Fmsy (r/2)	= 0.0796, 0.0266 - 0.27
F/Fmsy	= 2.25, -1.21 - 7.65 (1998), true: 1.64
B/Bmsy	= 0.456, 0.253 - 0.829 (1999), true: 0.42

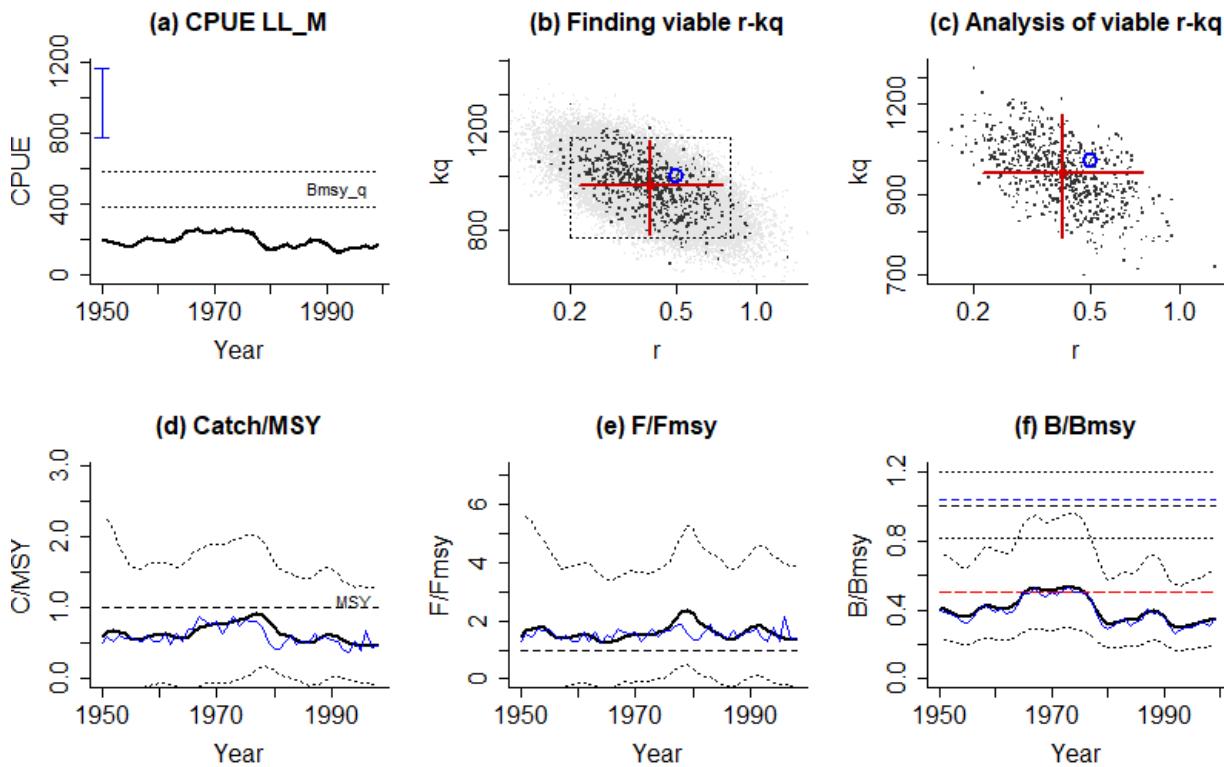


Stock LL_M, Simulated data
 CPUE data for years 1950 - 1999, CPUE range 144 - 257, smooth = TRUE
 Prior for r = Medium, NA - NA
 Used prior range for r = 0.2 - 0.8
 Prior for 1950 stock status = Small, NA - NA
 Used 1950 prior B/B0 range = 0.15 - 0.4, prior B/Bmsy = 0.3 - 0.8
 Used prior range for kq = 779 - 1168 [original range = 389 - 1038]
 Comment: True r=0.5, true kq=1000, true MSYq=125, true q=0.001

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
 Viable r-kq pairs = 20010

Results:

viable r-kq pairs	= 20010
median kq	= 964, 786 - 1155
median MSYq	= 96.6, 55 - 169
r (4 MSYq/kq)	= 0.401, 0.215 - 0.752
Fmsy (r/2)	= 0.2, 0.108 - 0.376
F/Fmsy	= 1.35, -0.23 - 3.87 (1998), true: 1.4
B/Bmsy	= 0.348, 0.192 - 0.627 (1999), true: 0.36

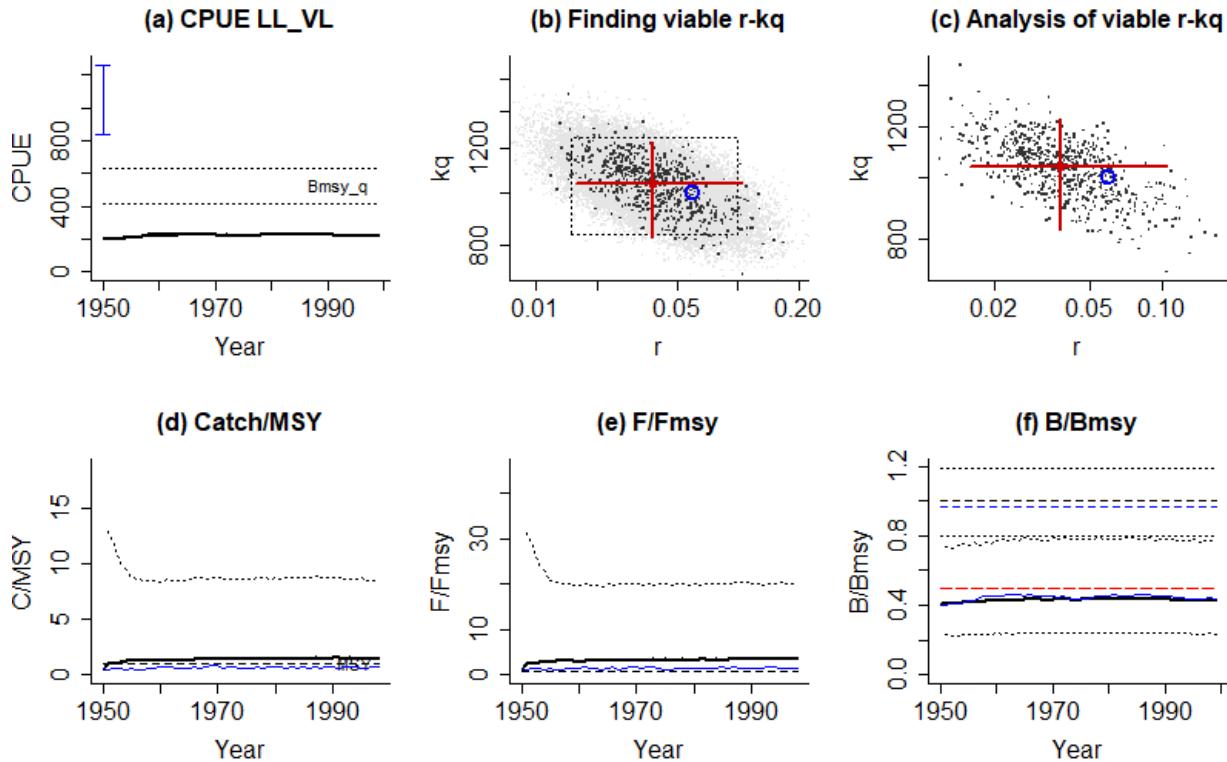


Stock LL_VL, , simulated data
 CPUE data for years 1950 - 1999, CPUE range 212 - 226, smooth = TRUE
 Prior for r = Very low, NA - NA
 Used prior range for r = 0.015 - 0.1
 Prior for 1950 stock status = Small, NA - NA
 Used 1950 prior B/B0 range = 0.15 - 0.4, prior B/Bmsy = 0.3 - 0.8
 Used prior range for kq = 840 - 1260 [original range = 420 - 1120]
 Comment: True r=0.06, true kq=1000, true MSYq=15

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
 Viable r-kq pairs = 20010

Results:

viable r-kq pairs	= 20010
median kq	= 1039, 829 - 1234
median MSYq	= 9.89, 4.6 - 24.4
r (4 MSYq/kq)	= 0.0381, 0.0157 - 0.106
Fmsy (r/2)	= 0.019, 0.00787 - 0.0528
F/Fmsy	= 3.38, -8.35 - 20.1 (1998), true: 1.66
B/Bmsy	= 0.426, 0.237 - 0.774 (1999), true: 0.44



Results of analysis of simulated data with filters with AMSY_68x.R
01 November 2019

Table 2. Comparison of estimated and “true” parameter values (r , kq , $F/Fmsy$ and $B/Bmsy$) for 24 simulated stocks. The target value for estimated relative to true value is one. The approximate lower confidence range as fraction of the estimated central value $[(est-cl)/est]$ is an indication of the uncertainty about the estimate. Column 2 shows the median across the 24 simulated stocks. Columns 3 and 4 show the range that includes 95% of the estimated values. Note that this run of AMSY applied several logical filters to the potential r - k pairs, thus making the estimates of r and kq less depended on the priors and basically reducing the cloud of viable r - kq pairs and moving it towards the “true” value within the original prior ranges for r and kq , as is evident in the graphs displayed below. Source: AMSYResSimFil_6.xls

	Median	2.5 th percentile	97.5 th percentile
r : est/true	1.04	0.89	1.51
r : (est-1cl)/est	0.36	0.29	0.47
kq : est /true	1.07	0.83	1.48
kq : (est-1cl)/est	0.18	0.15	0.34
$F/Fmsy$: est/true	1.19	0.79	4.14
$F/Fmsy$: (est-1cl)/est	0.89	0.60	3.53
$B/Bmsy$: est/true	0.93	0.79	1.17
$B/Bmsy$: (est-1cl)/est	0.44	0.43	0.45

Settings for analysis in the R-code:

```
#-----
# Required settings, File names
#-----
id_file  <- "SimCPUE_ID_8.csv"

#-----
# General settings for the analysis -----
#-----
smooth.cpue  <- T
filter        <- TRUE
cor.rk         <- -0.607
sigma.r        <- c(0.05,0.07,0.1,0.15)
sigma.cpue    <- 0.3
n.p           <- 50000
n.trial       <- 30
min.viable    <- 20
max.viable    <- 5000
creep.graph   <- F
do.plots      <- T
write.output  <- T
kobe.plot     <- F
save.plots    <- F
close.plots   <- F
retros        <- F
```

Generic legend for the subsequent graphs:

Panel (a) shows the time series of CPUE data as bold curve, a smoothed version of CPUE as thin dotted line, the prior range for k_q as vertical blue line, and the corresponding upper and lower bounds of the relative B_{MSY} range as dotted horizontal lines.

Panel (b) shows the r - k_q prior space in log scale with a cloud of gray points representing the multivariate log-normal distribution of r and k_q corresponding to a correlation of -0.607, derived from full Schaefer models applied to 140 real stocks. The dotted rectangle indicates the prior ranges for r and k_q and includes 85% of the gray dots. The red cross indicates the estimated central r - k_q pair and the approximate 95% confidence limits. The blue circle indicates the “true” r - k_q pair used in the simulation.

Panel (c) is a zoom-in on the viable r - k_q pairs, with the red cross indicating the estimated central r - k_q pair and its approximate 95% confidence limits and the blue circle indicating the “true” r - k_q pair used in the simulation.

Panel (d) shows the time series of catch predicted by AMSY as bold curve relative to MSY, indicated by the dashed horizontal line. The dotted curves indicate the approximate 95% confidence limits. The blue curve shows the “true” catch used in the simulations.

Panel (e) shows the predicted time series of F over F_{MSY} as bold curve with dotted curves indicating the approximate 95% confidence limits. The dashed horizontal line indicates F_{MSY} .

Panel (f) shows the predicted time series of B over B_{MSY} as bold curve with dotted curves indicating the approximate 95% confidence limits. The dashed horizontal line indicates B_{MSY} , the dotted lines indicate the approximate 95% confidence limits of B_{MSY} , and the dashed red line indicates half of B_{MSY} . The blue curve shows the “true” biomass used in the simulations relative to the “true” value of B_{MSY} , indicated by a blue dashed line.

```

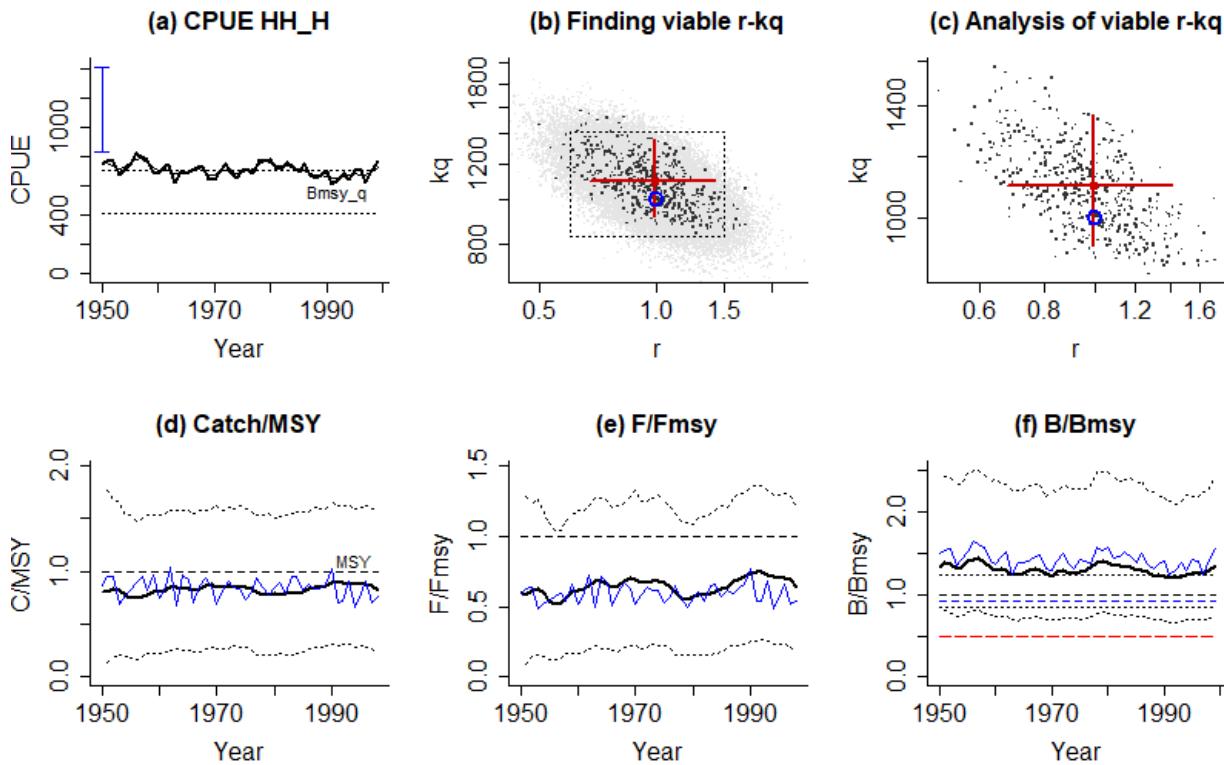
> source('D:/RF_Documents/AMSY/Review/SimFilt/AMSY_68x.R')
File SimCPUE_ID_8.csv read successfully
-----
AMSY Analysis, Fri Nov 01 14:03:00 2019
-----
Stock HH_H, , Simulated data
CPUE data for years 1950 - 1999, CPUE range 656 - 789, smooth = TRUE
Prior for r = High, NA - NA
Used prior range for r = 0.6 - 1.5
Prior for 1950 stock status = More than half, NA - NA
Used 1950 prior B/B0 range = 0.5 - 0.85, prior B/Bmsy = 1 - 1.7
Used prior range for kq = 832 - 1415 [original range = 832 - 1415]
Comment: True r=1.0, true kq=1000, true MSYq=250

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
Viable r-kq pairs = 5002

```

Results:

viable r-kq pairs	= 5002
median kq	= 1097, 918 - 1363
median MSYq	= 273, 198 - 362
r (4 MSYq/kq)	= 0.996, 0.677 - 1.42
Fmsy (r/2)	= 0.498, 0.339 - 0.708
F/Fmsy	= 0.631, 0.178 - 1.2 (1998), true: 0.536
B/Bmsy	= 1.35, 0.742 - 2.43 (1999), true: 1.54

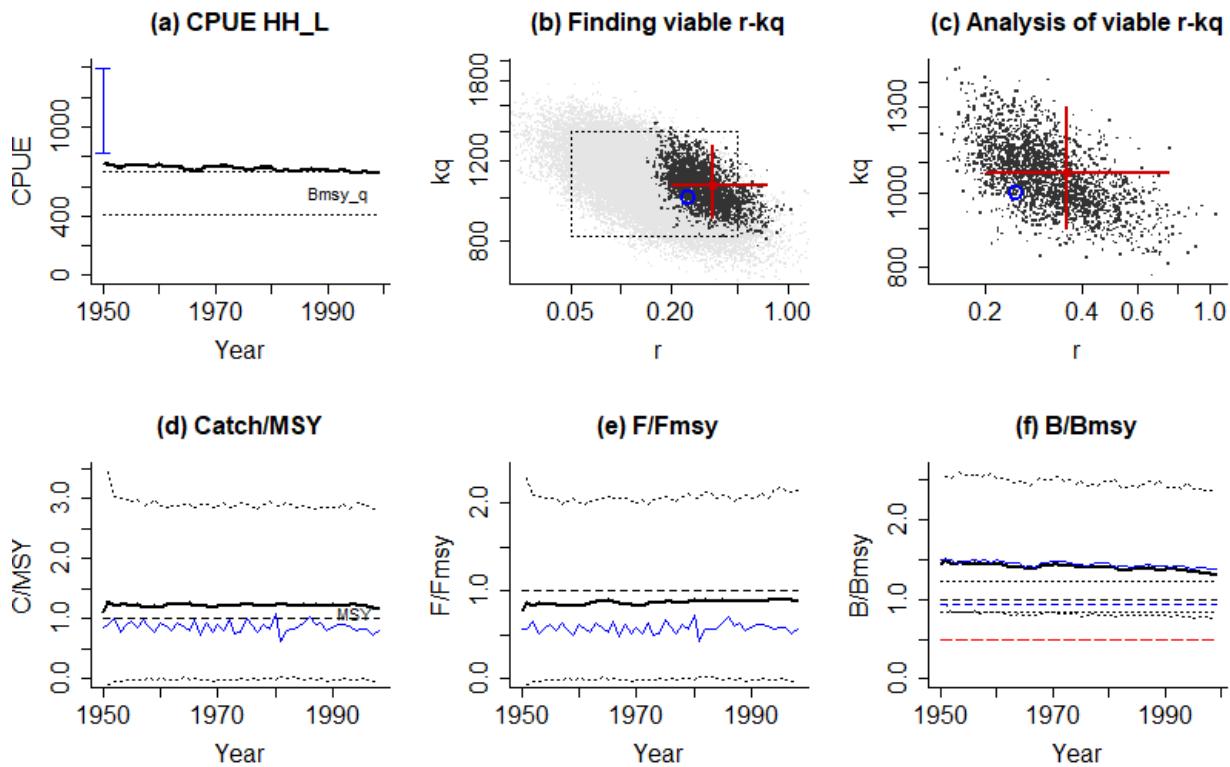


Stock HH_LL, , Simulated data
 CPUE data for years 1950 - 1999, CPUE range 691 - 747, smooth = TRUE
 Prior for r = Low, NA - NA
 Used prior range for r = 0.05 - 0.5
 Prior for 1950 stock status = More than half, NA - NA
 Used 1950 prior B/B0 range = 0.5 - 0.85, prior B/Bmsy = 1 - 1.7
 Used prior range for kq = 820 - 1394 [original range = 820 - 1394]
 Comment: True r=0.25, true kq=1000, true MSYq=62.5

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
 Viable r-kq pairs = 5003

Results:

viable r-kq pairs	= 5003
median kq	= 1062, 900 - 1298
median MSYq	= 95, 55.6 - 177
r (4 MSYq/kq)	= 0.358, 0.199 - 0.741
F _{msy} (r/2)	= 0.179, 0.0995 - 0.37
F/F _{msy}	= 0.889, -0.0313 - 2.15 (1998), true: 0.572
B/B _{msy}	= 1.31, 0.726 - 2.34 (1999), true: 1.38

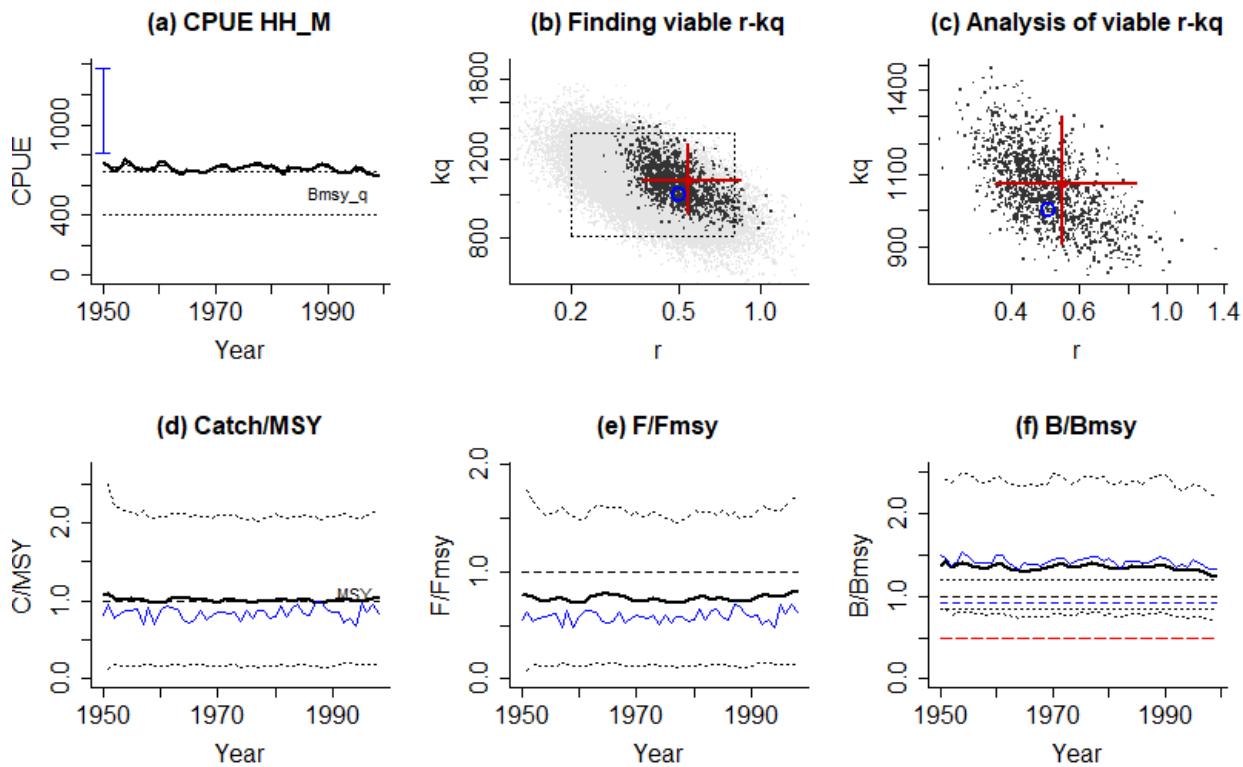


Stock HH_M, , Simulated data
 CPUE data for years 1950 - 1999, CPUE range 665 - 737, smooth = TRUE
 Prior for r = Medium, NA - NA
 Used prior range for r = 0.2 - 0.8
 Prior for 1950 stock status = More than half, NA - NA
 Used 1950 prior B/B0 range = 0.5 - 0.85, prior B/Bmsy = 1 - 1.7
 Used prior range for kq = 809 - 1375 [original range = 809 - 1375]
 Comment: True r=0.5, true kq=1000, true MSYq=125, true q=0.001

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
 Viable r-kq pairs = 5001

Results:

viable r-kq pairs	= 5001
median kq	= 1076, 909 - 1299
median MSYq	= 146, 103 - 213
r (4 MSYq/kq)	= 0.542, 0.364 - 0.838
Fmsy (r/2)	= 0.271, 0.182 - 0.419
F/Fmsy	= 0.817, 0.135 - 1.71 (1998), true: 0.621
B/Bmsy	= 1.24, 0.698 - 2.21 (1999), true: 1.32

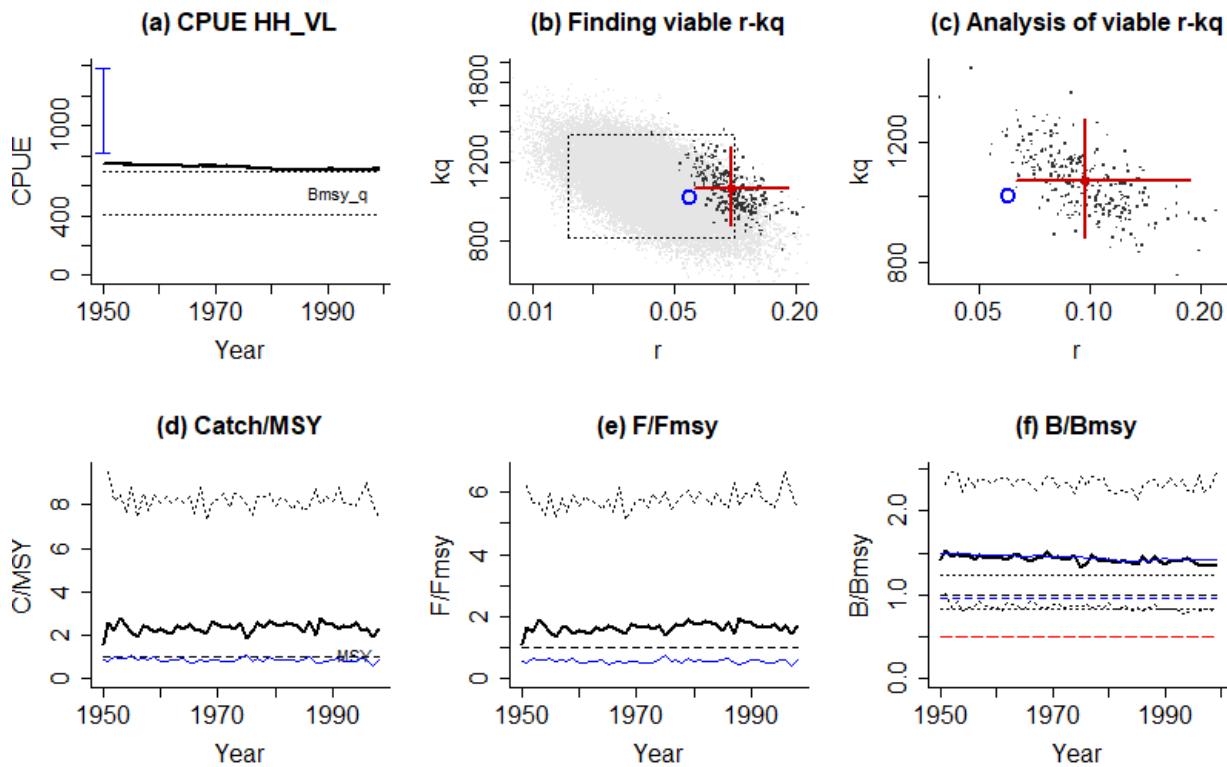


Stock HH_VL, , simulated data
 CPUE data for years 1950 - 1999, CPUE range 708 - 742, smooth = TRUE
 Prior for r = Very low, NA - NA
 Used prior range for r = 0.015 - 0.1
 Prior for 1950 stock status = More than half, NA - NA
 Used 1950 prior B/B0 range = 0.5 - 0.85, prior B/Bmsy = 1 - 1.7
 Used prior range for kq = 814 - 1385 [original range = 814 - 1385]
 Comment: True r=0.06, true kq=1000, true MSYq=15

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
 Viable r-kq pairs = 320

Results:

viable r-kq pairs	= 320
median kq	= 1050, 868 - 1296
median MSYq	= 25.4, 17.5 - 43.8
r (4 MSYq/kq)	= 0.0969, 0.0631 - 0.186
Fmsy (r/2)	= 0.0485, 0.0316 - 0.093
F/Fmsy	= 1.68, -1.47 - 5.46 (1998), true: 0.61
B/Bmsy	= 1.35, 0.752 - 2.46 (1999), true: 1.42

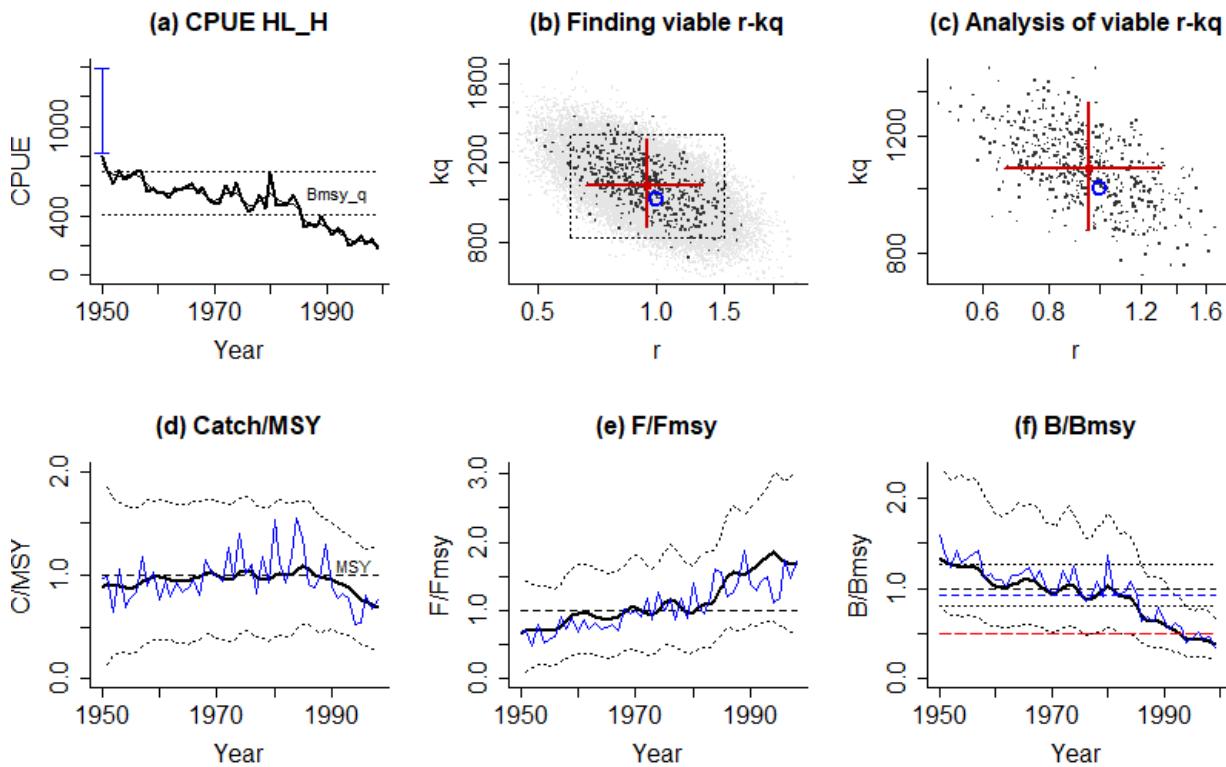


Stock HL_H, , Simulated data
 CPUE data for years 1950 - 1999, CPUE range 204 - 745, smooth = TRUE
 Prior for r = High, NA - NA
 Used prior range for r = 0.6 - 1.5
 Prior for 1950 stock status = More than half, NA - NA
 Used 1950 prior B/B0 range = 0.5 - 0.85, prior B/Bmsy = 1 - 1.7
 Used prior range for kq = 818 - 1390 [original range = 818 - 1390]
 Comment: True r=1.0, true kq=1000, true MSYq=250

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
 Viable r-kq pairs = 5015

Results:

viable r-kq pairs	= 5015
median kq	= 1073, 867 - 1353
median MSYq	= 256, 189 - 343
r (4 MSYq/kq)	= 0.953, 0.66 - 1.31
Fmsy (r/2)	= 0.477, 0.33 - 0.655
F/Fmsy	= 1.7, 0.706 - 3.03 (1998), true: 1.73
B/Bmsy	= 0.379, 0.21 - 0.675 (1999), true: 0.36



Stock HL_L, , Simulated data

CPUE data for years 1950 - 1999, CPUE range 177 - 787, smooth = TRUE

Prior for r = Low, NA - NA

Used prior range for r = 0.05 - 0.5

Prior for 1950 stock status = More than half, NA - NA

Used 1950 prior B/B0 range = 0.5 - 0.85, prior B/Bmsy = 1 - 1.7

Used prior range for kq = 864 - 1469 [original range = 864 - 1469]

Comment: True r=0.25, true kq=1000, true MSYq=62.5

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
Viable r-kq pairs = 5001

Results:

viable r-kq pairs = 5001

median kq = 1115, 935 - 1350

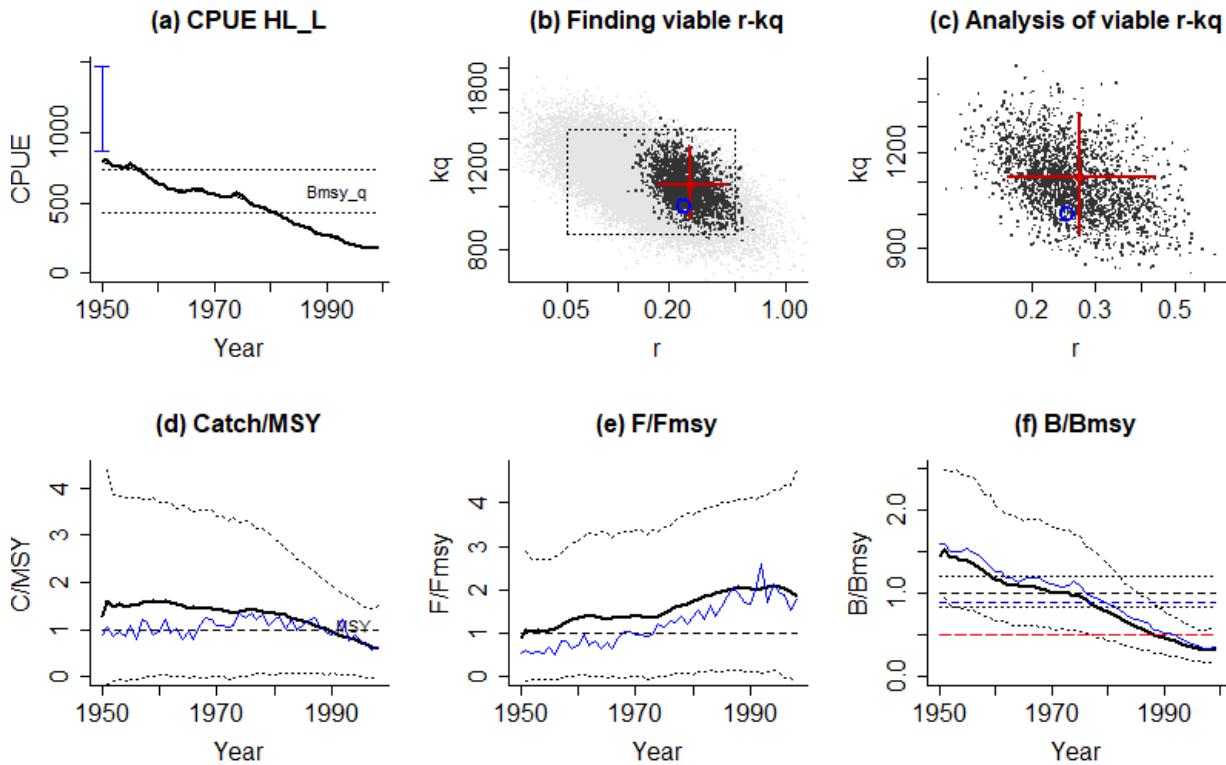
median MSYq = 75.4, 49.9 - 118

r (4 MSYq/kq) = 0.271, 0.172 - 0.438

Fmsy (r/2) = 0.135, 0.0859 - 0.219

F/Fmsy = 1.85, -0.141 - 4.76 (1998), true: 1.8

B/Bmsy = 0.32, 0.177 - 0.56 (1999), true: 0.36

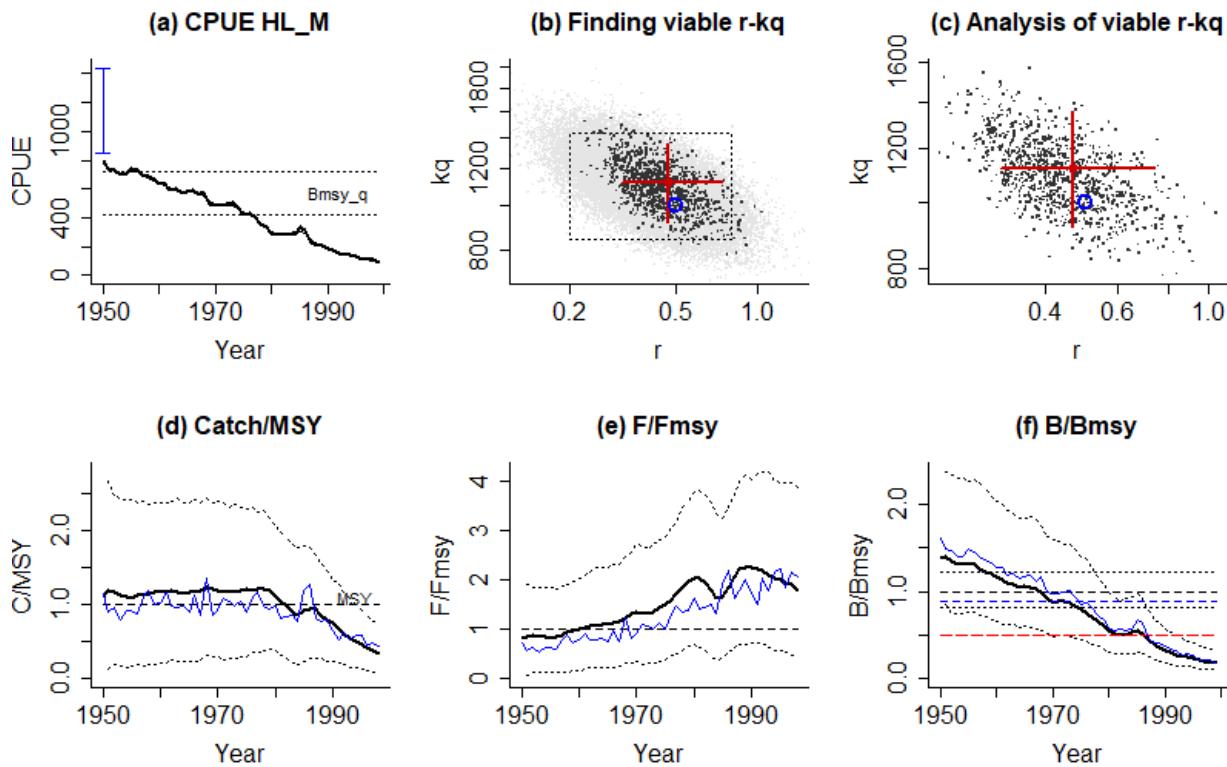


Stock HL_M, , Simulated data
 CPUE data for years 1950 - 1999, CPUE range 101 - 770, smooth = TRUE
 Prior for r = Medium, NA - NA
 Used prior range for r = 0.2 - 0.8
 Prior for 1950 stock status = More than half, NA - NA
 Used 1950 prior B/B0 range = 0.5 - 0.85, prior B/Bmsy = 1 - 1.7
 Used prior range for kq = 845 - 1437 [original range = 845 - 1437]
 Comment: True r=0.5, true kq=1000, true MSYq=125, true q=0.001

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
 Viable r-kq pairs = 5000

Results:

viable r-kq pairs	= 5000
median kq	= 1121, 920 - 1357
median MSYq	= 131, 90.1 - 195
r (4 MSYq/kq)	= 0.468, 0.311 - 0.743
Fmsy (r/2)	= 0.234, 0.155 - 0.371
F/Fmsy	= 1.8, 0.436 - 3.89 (1998), true: 2.07
B/Bmsy	= 0.179, 0.1 - 0.328 (1999), true: 0.18

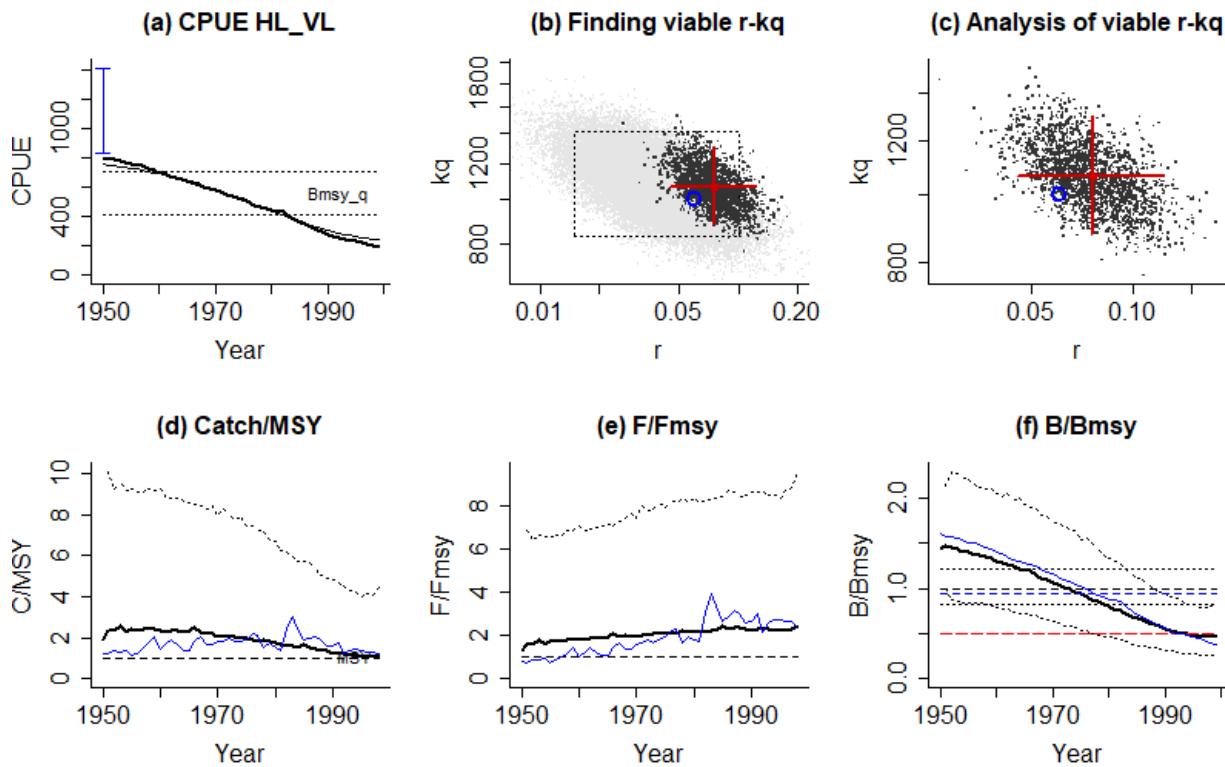


Stock HL_VL, , simulated data
 CPUE data for years 1950 - 1999, CPUE range 244 - 754, smooth = TRUE
 Prior for r = Very low, NA - NA
 Used prior range for r = 0.015 - 0.1
 Prior for 1950 stock status = More than half, NA - NA
 Used 1950 prior B/B0 range = 0.5 - 0.85, prior B/Bmsy = 1 - 1.7
 Used prior range for kq = 828 - 1407 [original range = 828 - 1407]
 Comment: True r=0.06, true kq=1000, true MSYq=15

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
 Viable r-kq pairs = 2549

Results:

viable r-kq pairs	= 2549
median kq	= 1067, 883 - 1299
median MSYq	= 20.3, 13.3 - 32.1
r (4 MSYq/kq)	= 0.076, 0.0453 - 0.124
Fmsy (r/2)	= 0.038, 0.0226 - 0.0618
F/Fmsy	= 2.46, -3.32 - 9.57 (1998), true: 2.4
B/Bmsy	= 0.46, 0.249 - 0.824 (1999), true: 0.38

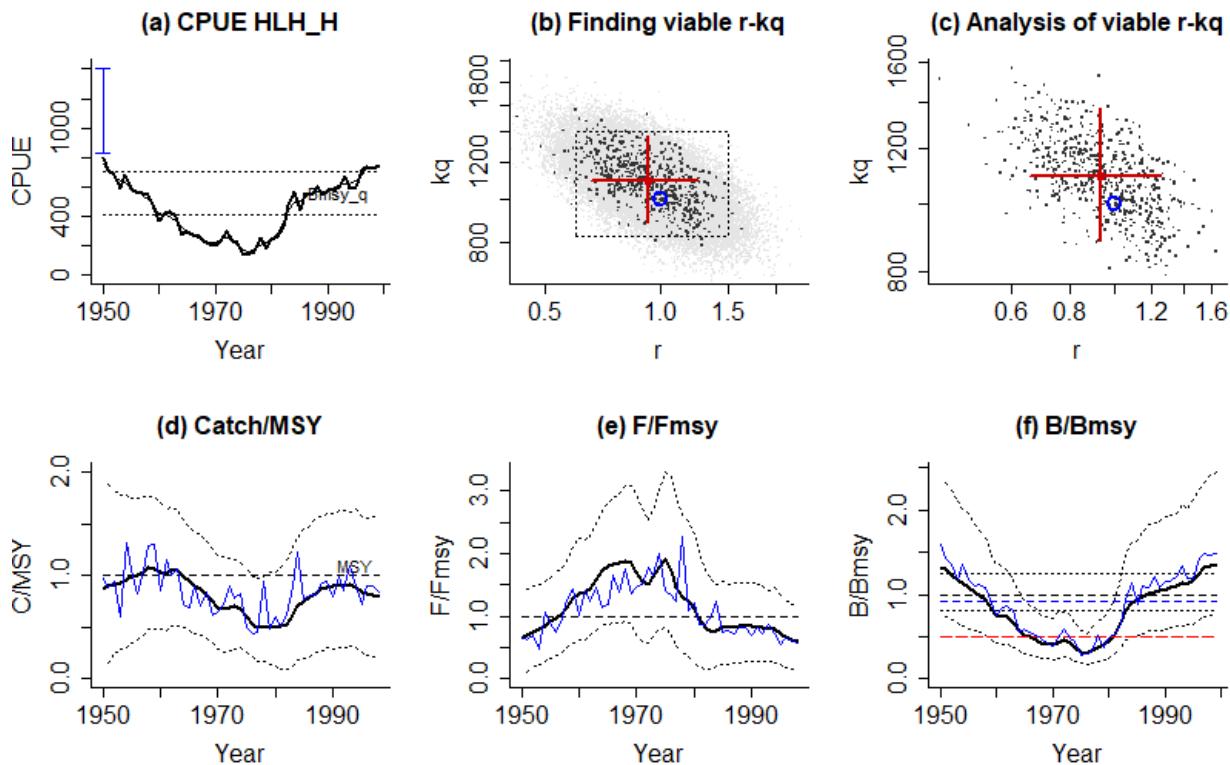


Stock HLH_H, , simulated data
 CPUE data for years 1950 - 1999, CPUE range 165 - 753, smooth = TRUE
 Prior for r = High, NA - NA
 Used prior range for r = 0.6 - 1.5
 Prior for 1950 stock status = More than half, NA - NA
 Used 1950 prior B/B0 range = 0.5 - 0.85, prior B/Bmsy = 1 - 1.7
 Used prior range for kq = 827 - 1405 [original range = 827 - 1405]
 Comment: True r=1.0, true kq=1000, true MSYq=250

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
 Viable r-kq pairs = 5004

Results:

viable r-kq pairs	= 5004
median kq	= 1096, 884 - 1372
median MSYq	= 256, 189 - 345
r (4 MSYq/kq)	= 0.933, 0.66 - 1.25
Fmsy (r/2)	= 0.467, 0.33 - 0.627
F/Fmsy	= 0.599, 0.141 - 1.18 (1998), true: 0.577
B/Bmsy	= 1.34, 0.753 - 2.45 (1999), true: 1.5

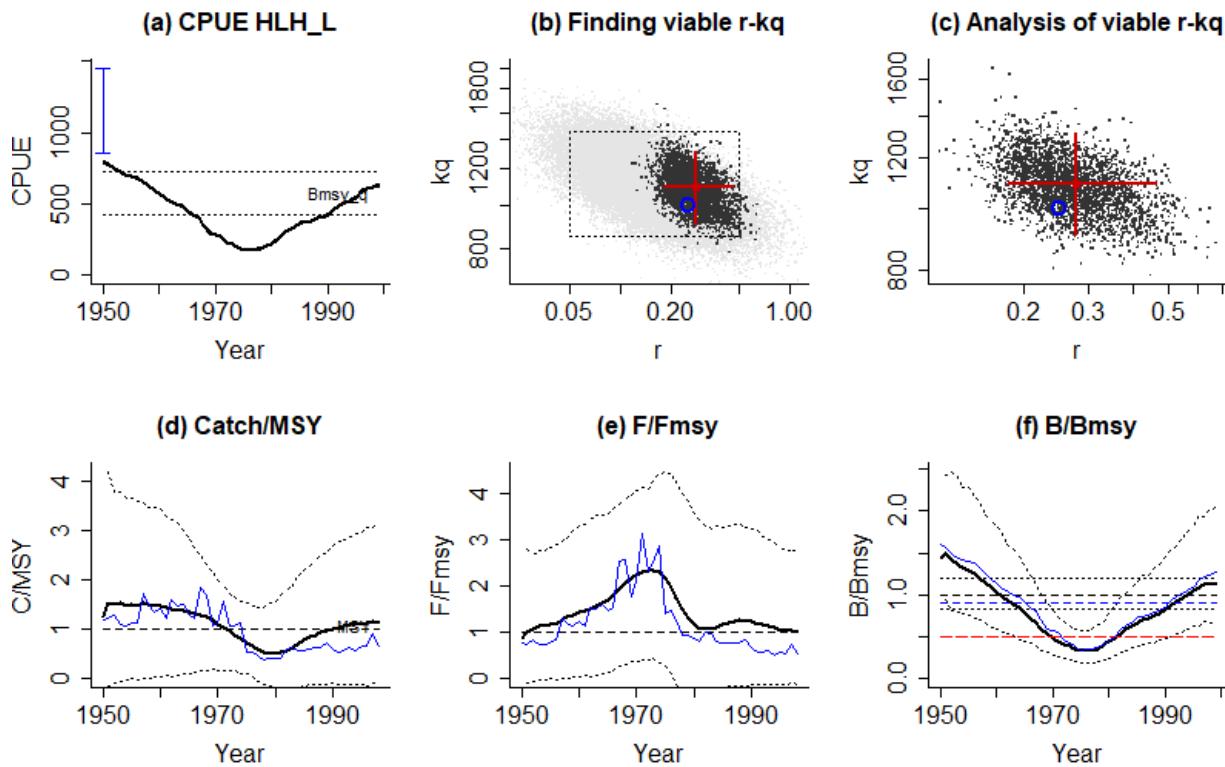


Stock HLH_L, , simulated data
 CPUE data for years 1950 - 1999, CPUE range 186 - 777, smooth = TRUE
 Prior for r = Low, NA - NA
 Used prior range for r = 0.05 - 0.5
 Prior for 1950 stock status = More than half, NA - NA
 Used 1950 prior B/B₀ range = 0.5 - 0.85, prior B/B_{msy} = 1 - 1.7
 Used prior range for kq = 852 - 1449 [original range = 852 - 1449]
 Comment: True r=0.25, true kq=1000, true MSYq=62.5

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
 Viable r-kq pairs = 5000

Results:

viable r-kq pairs	= 5000
median kq	= 1097, 911 - 1312
median MSYq	= 76.5, 50.4 - 120
r (4 MSYq/kq)	= 0.279, 0.18 - 0.462
F _{msy} (r/2)	= 0.139, 0.0899 - 0.231
F/F _{msy}	= 1, -0.12 - 2.82 (1998), true: 0.543
B/B _{msy}	= 1.13, 0.645 - 2.05 (1999), true: 1.28

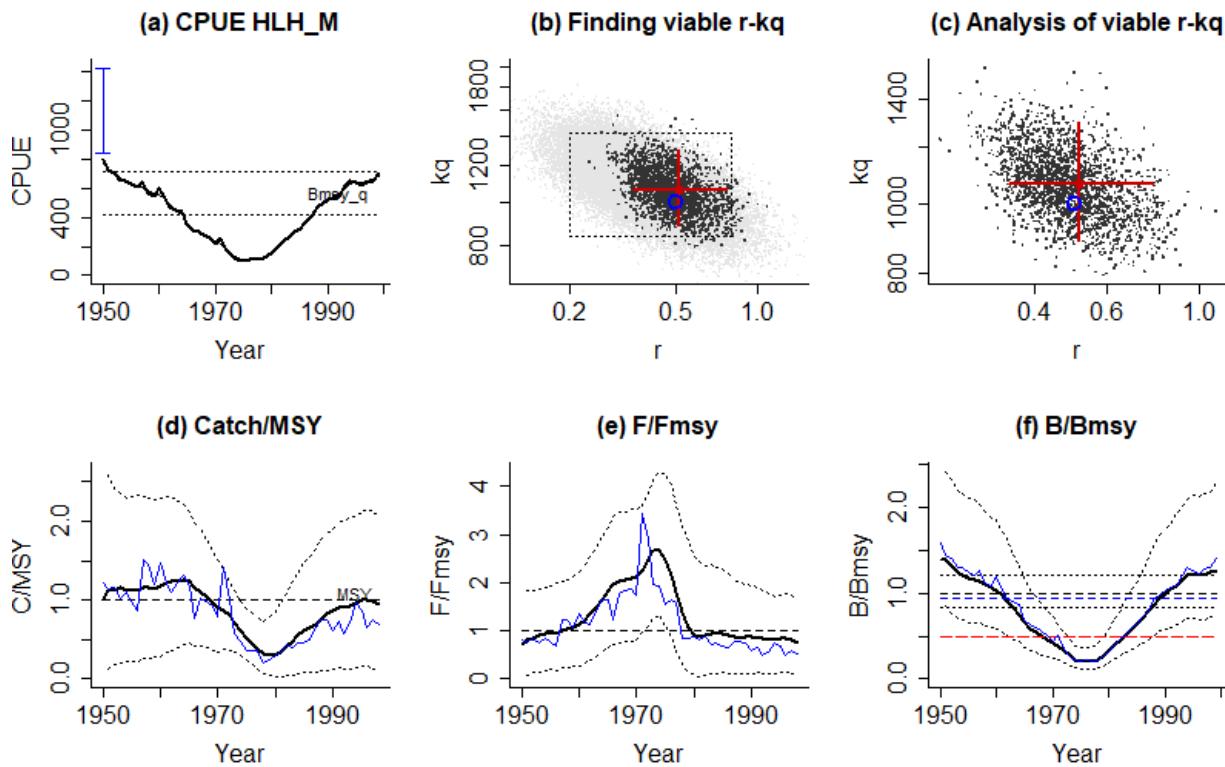


Stock HLH_M, , simulated data
 CPUE data for years 1950 - 1999, CPUE range 108 - 760, smooth = TRUE
 Prior for r = Medium, NA - NA
 Used prior range for r = 0.2 - 0.8
 Prior for 1950 stock status = More than half, NA - NA
 Used 1950 prior B/B0 range = 0.5 - 0.85, prior B/Bmsy = 1 - 1.7
 Used prior range for kq = 835 - 1419 [original range = 835 - 1419]
 Comment: True r=0.5, true kq=1000, true MSYq=125, true q=0.001

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
 Viable r-kq pairs = 5004

Results:

viable r-kq pairs	= 5004
median kq	= 1074, 885 - 1310
median MSYq	= 137, 95.6 - 193
r (4 MSYq/kq)	= 0.51, 0.342 - 0.747
Fmsy (r/2)	= 0.255, 0.171 - 0.373
F/Fmsy	= 0.765, 0.103 - 1.74 (1998), true: 0.515
B/Bmsy	= 1.26, 0.699 - 2.31 (1999), true: 1.4

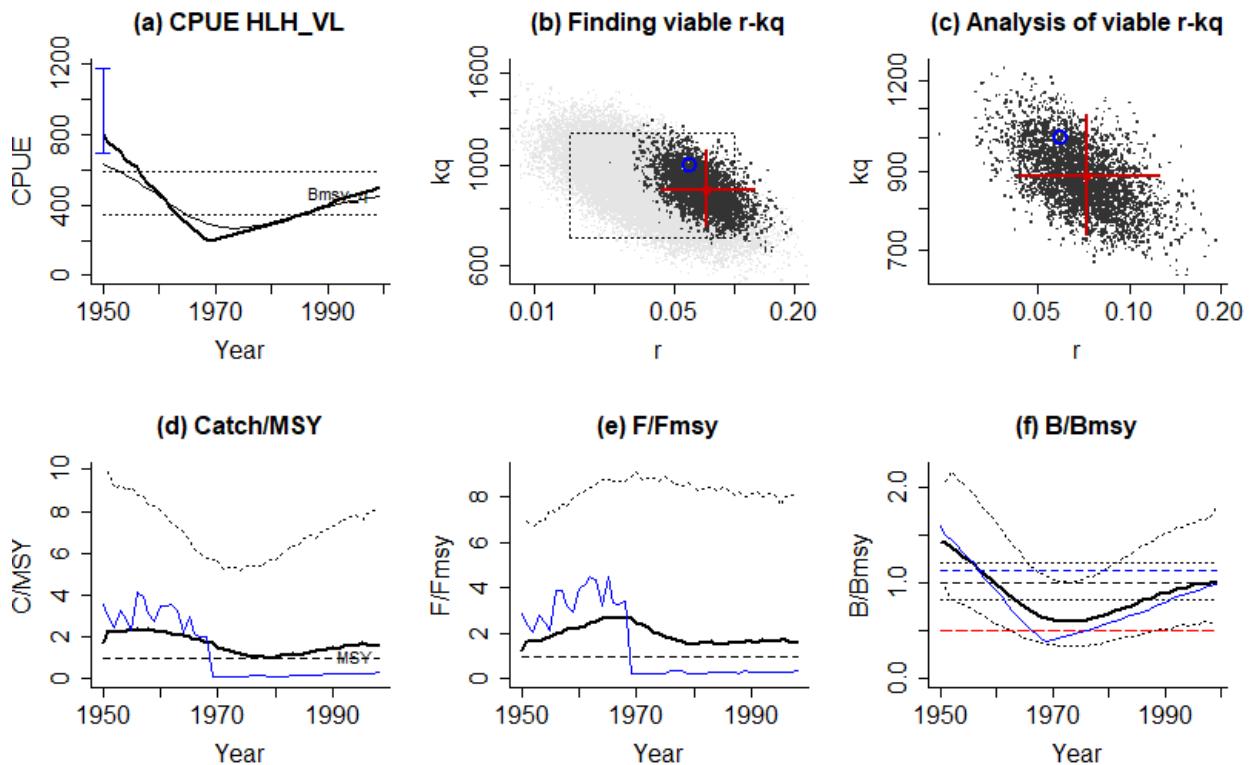


Stock HLH_VL, , Simulated data
 CPUE data for years 1950 - 1999, CPUE range 270 - 631, smooth = TRUE
 Prior for r = Very low, NA - NA
 Used prior range for r = 0.015 - 0.1
 Prior for 1950 stock status = More than half, NA - NA
 Used 1950 prior B/B_0 range = 0.5 - 0.85, prior B/B_{msy} = 1 - 1.7
 Used prior range for kq = 692 - 1176 [original range = 692 - 1176]
 Comment: True $r=0.06$, true $kq=1000$, true MSYq=15

Monte Carlo filtering of r - kq space with 50000 points and 30 error patterns.
 Viable r - kq pairs = 5000

Results:

viable r - kq pairs	= 5000
median kq	= 883, 735 - 1080
median MSYq	= 16, 10.2 - 26
r (4 MSYq/ kq)	= 0.0725, 0.043 - 0.125
F/F_{msy} ($r/2$)	= 0.0363, 0.0215 - 0.0623
F/F_{msy}	= 1.56, -2.76 - 8.15 (1998), true: 0.374
B/B_{msy}	= 1, 0.568 - 1.79 (1999), true: 1



Stock LH_H, , Simulated data

CPUE data for years 1950 - 1999, CPUE range 164 - 761, smooth = TRUE

Prior for r = High, NA - NA

Used prior range for r = 0.6 - 1.5

Prior for 1950 stock status = Very small, NA - NA

Used 1950 prior B/B0 range = 0.01 - 0.2, prior B/Bmsy = 0.02 - 0.4

Used prior range for kq = 749 - 2248 [original range = 149 - 2981]

Comment: True r=1.0, true kq=1000, true MSYq=250

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
Viable r-kq pairs = 5002

Results:

viable r-kq pairs = 5002

median kq = 1320, 891 - 2315

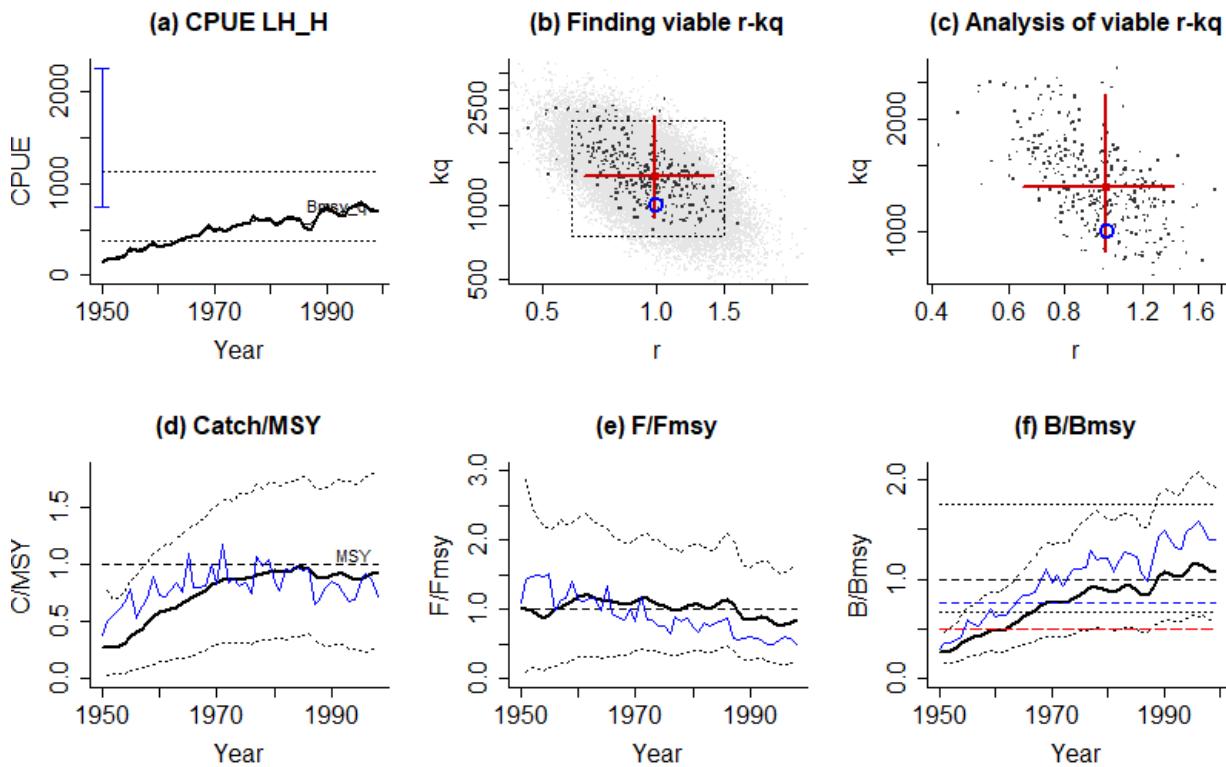
median MSYq = 327, 225 - 484

r (4 MSYq/kq) = 0.99, 0.642 - 1.41

Fmsy (r/2) = 0.495, 0.321 - 0.703

F/Fmsy = 0.854, 0.238 - 1.67 (1998), true: 0.5

B/Bmsy = 1.08, 0.597 - 1.91 (1999), true: 1.4

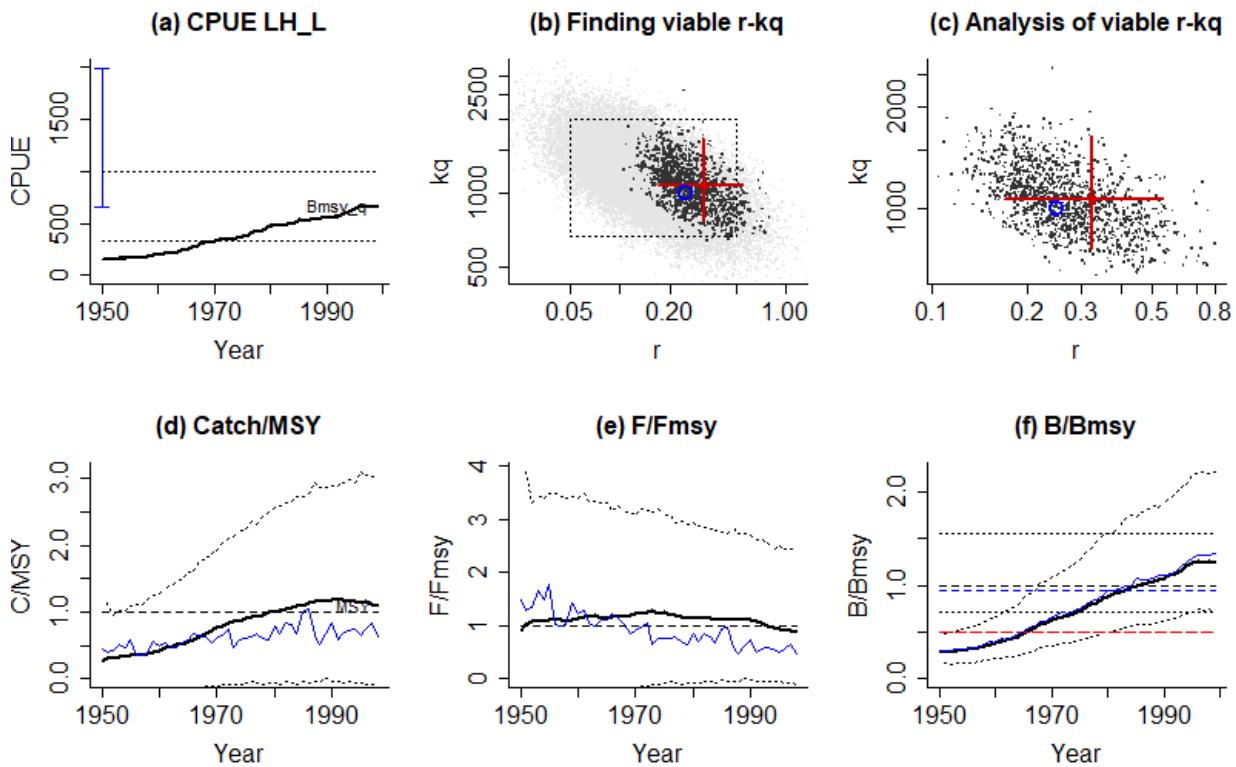


Stock LH_LL, , Simulated data
 CPUE data for years 1950 - 1999, CPUE range 152 - 663, smooth = TRUE
 Prior for r = Low, NA - NA
 Used prior range for r = 0.05 - 0.5
 Prior for 1950 stock status = Very small, NA - NA
 Used 1950 prior B/B0 range = 0.01 - 0.2, prior B/Bmsy = 0.02 - 0.4
 Used prior range for kq = 661 - 1982 [original range = 138 - 2750]
 Comment: True r=0.25, true kq=1000, true MSYq=62.5

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
 Viable r-kq pairs = 5001

Results:

viable r-kq pairs	= 5001
median kq	= 1068, 763 - 1649
median MSYq	= 85.9, 49 - 141
r (4 MSYq/kq)	= 0.322, 0.169 - 0.544
Fmsy (r/2)	= 0.161, 0.0845 - 0.272
F/Fmsy	= 0.876, -0.097 - 2.43 (1998), true: 0.48
B/Bmsy	= 1.23, 0.691 - 2.21 (1999), true: 1.34

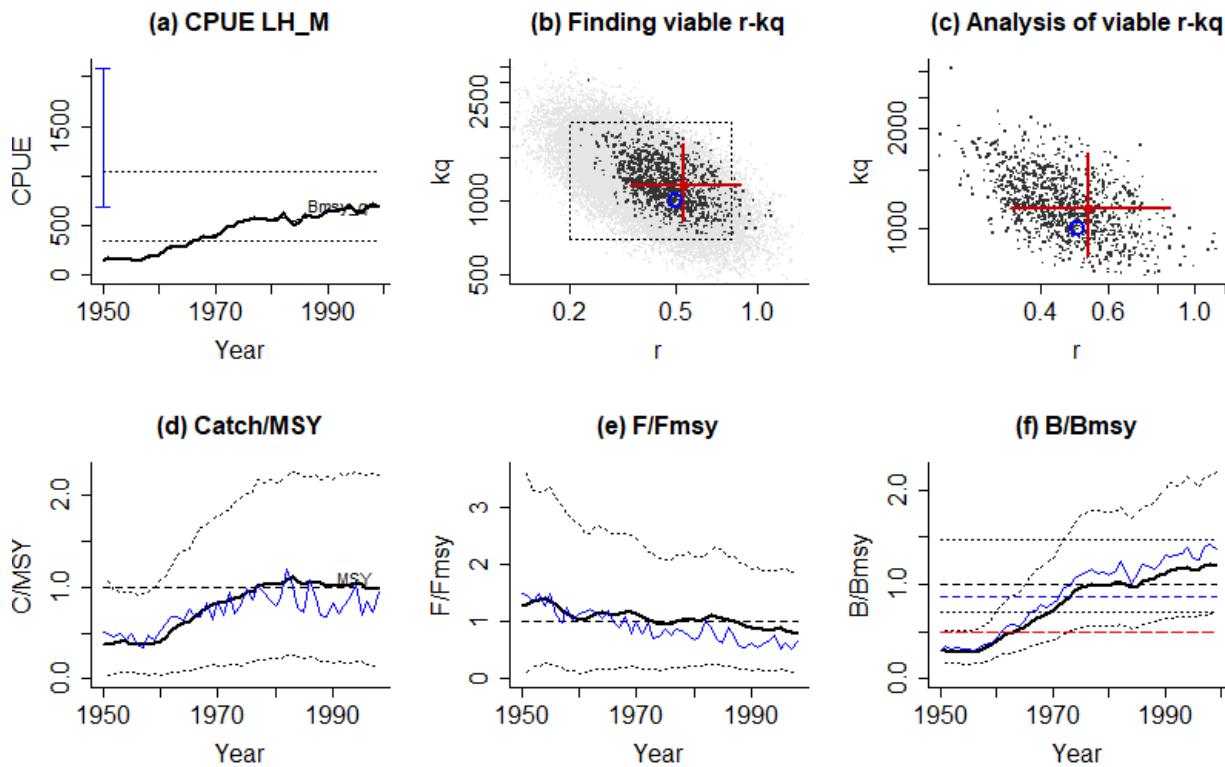


Stock LH_M, , Simulated data
 CPUE data for years 1950 - 1999, CPUE range 159 - 697, smooth = TRUE
 Prior for r = Medium, NA - NA
 Used prior range for r = 0.2 - 0.8
 Prior for 1950 stock status = Very small, NA - NA
 Used 1950 prior B/B0 range = 0.01 - 0.2, prior B/Bmsy = 0.02 - 0.4
 Used prior range for kq = 695 - 2086 [original range = 144 - 2886]
 Comment: True r=0.5, true kq=1000, true MSYq=125, true q=0.001

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
 Viable r-kq pairs = 5005

Results:

viable r-kq pairs	= 5005
median kq	= 1154, 826 - 1699
median MSYq	= 154, 99.9 - 244
r (4 MSYq/kq)	= 0.533, 0.334 - 0.865
Fmsy (r/2)	= 0.266, 0.167 - 0.433
F/Fmsy	= 0.807, 0.111 - 1.83 (1998), true: 0.672
B/Bmsy	= 1.2, 0.666 - 2.19 (1999), true: 1.38

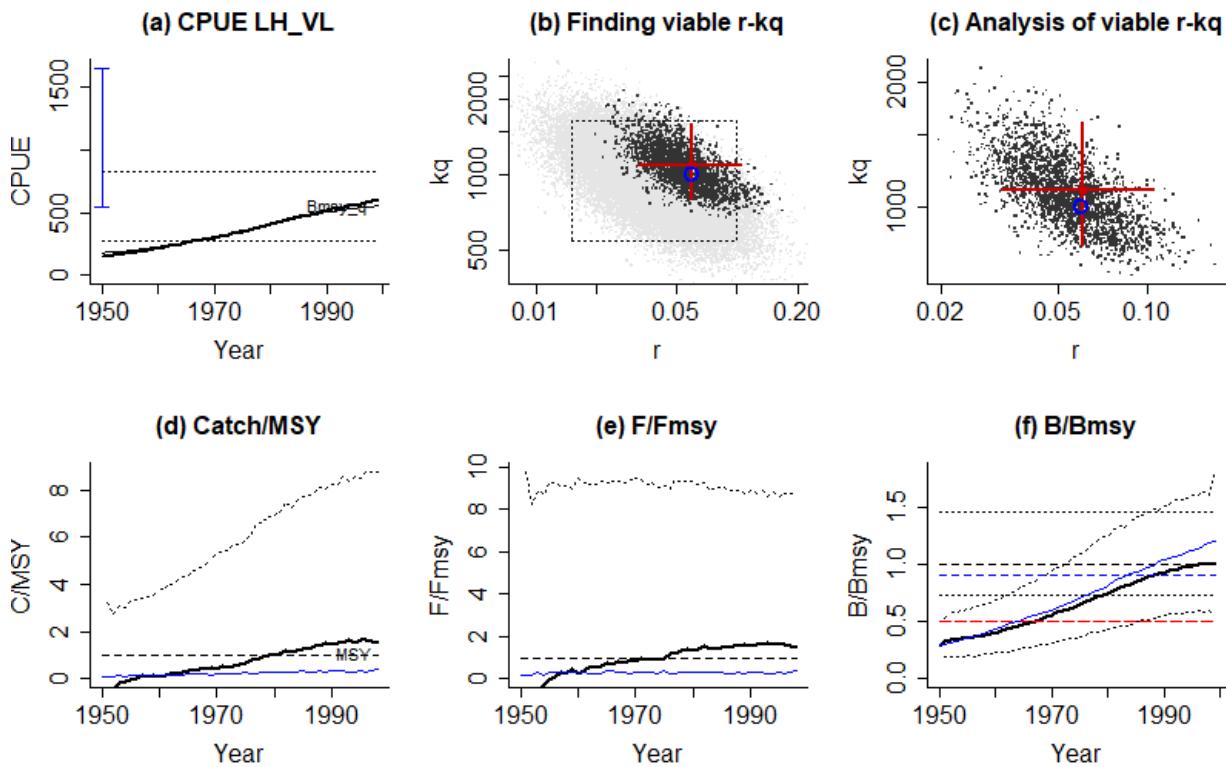


Stock LH_VL, , simulated data
 CPUE data for years 1950 - 1999, CPUE range 182 - 555, smooth = TRUE
 Prior for r = Very low, NA - NA
 Used prior range for r = 0.015 - 0.1
 Prior for 1950 stock status = Very small, NA - NA
 Used 1950 prior B/B_0 range = 0.01 - 0.2, prior B/B_{msy} = 0.02 - 0.4
 Used prior range for kq = 551 - 1654 [original range = 165 - 3305]
 Comment: True $r=0.06$, true $kq=1000$, true MSYq=15

Monte Carlo filtering of r - kq space with 50000 points and 30 error patterns.
 Viable r - kq pairs = 5003

Results:

viable r - kq pairs	= 5003
median kq	= 1097, 801 - 1604
median MSYq	= 16.5, 9.87 - 26.2
r (4 MSYq/ kq)	= 0.0601, 0.0321 - 0.105
F/F_{msy}	= 0.03, 0.0161 - 0.0524
F/F_{msy}	= 1.51, -3.51 - 8.75 (1998), true: 0.365
B/B_{msy}	= 1.02, 0.56 - 1.82 (1999), true: 1.2

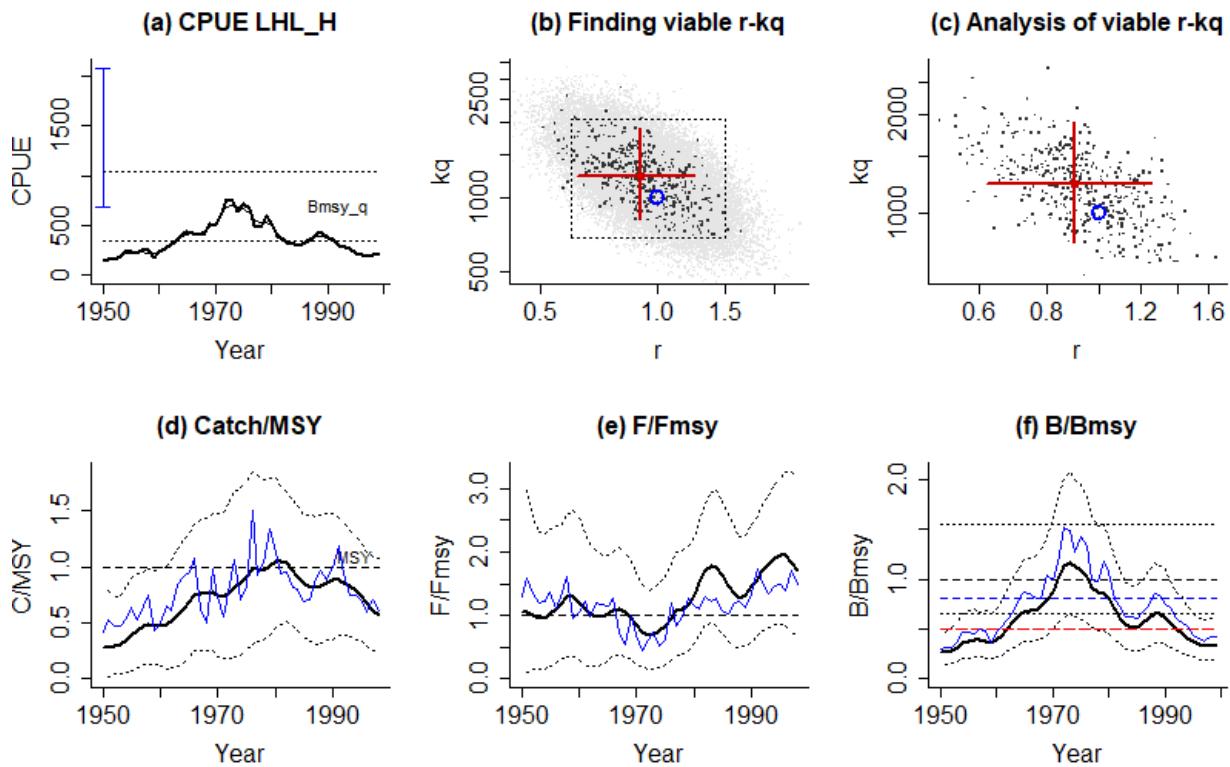


Stock LHL_H, , simulated data
 CPUE data for years 1950 - 1999, CPUE range 155 - 708, smooth = TRUE
 Prior for r = High, NA - NA
 Used prior range for r = 0.6 - 1.5
 Prior for 1950 stock status = Very small, NA - NA
 Used 1950 prior B/B0 range = 0.01 - 0.2, prior B/Bmsy = 0.02 - 0.4
 Used prior range for kq = 693 - 2079 [original range = 140 - 2807]
 Comment: True r=1.0, true kq=1000, true MSYq=250

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
 Viable r-kq pairs = 5000

Results:

viable r-kq pairs	= 5000
median kq	= 1224, 813 - 1901
median MSYq	= 276, 196 - 407
r (4 MSYq/kq)	= 0.903, 0.623 - 1.25
Fmsy (r/2)	= 0.451, 0.312 - 0.625
F/Fmsy	= 1.7, 0.666 - 3.19 (1998), true: 1.49
B/Bmsy	= 0.339, 0.188 - 0.621 (1999), true: 0.42

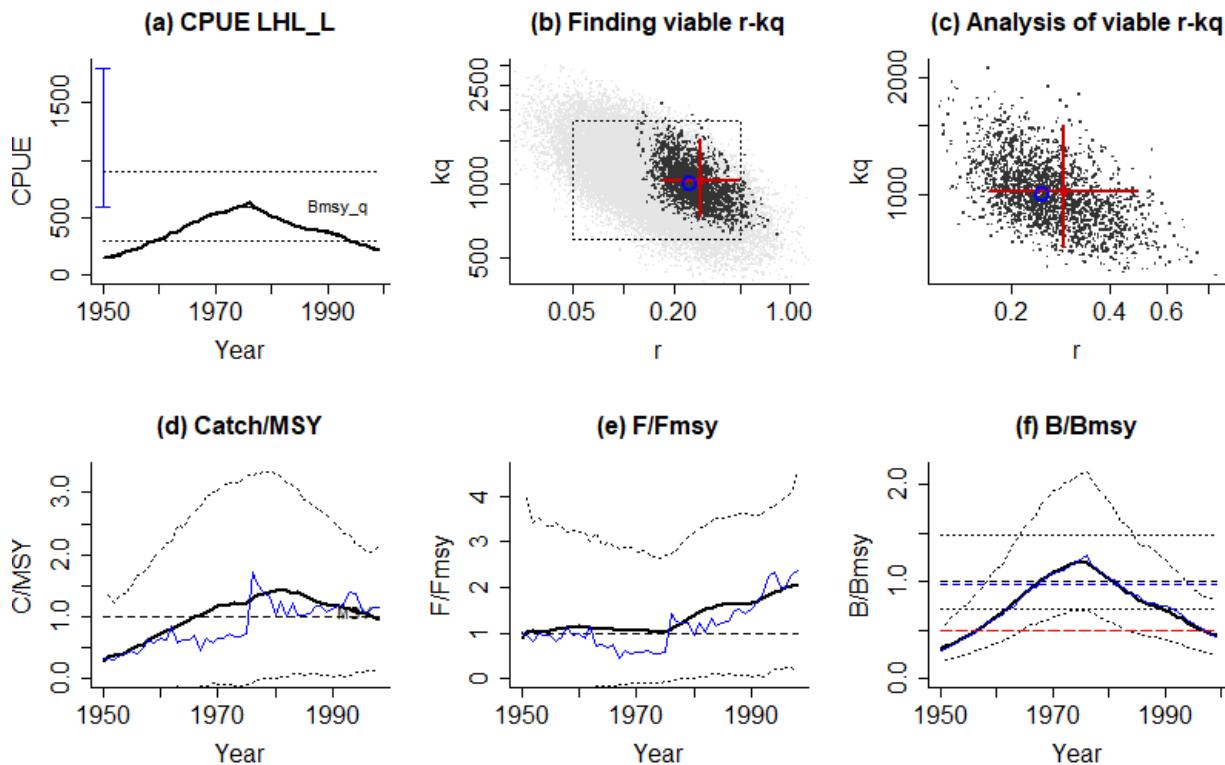


Stock LHL_L, , simulated data
 CPUE data for years 1950 - 1999, CPUE range 160 - 602, smooth = TRUE
 Prior for r = Low, NA - NA
 Used prior range for r = 0.05 - 0.5
 Prior for 1950 stock status = Very small, NA - NA
 Used 1950 prior B/B0 range = 0.01 - 0.2, prior B/Bmsy = 0.02 - 0.4
 Used prior range for kq = 600 - 1801 [original range = 145 - 2909]
 Comment: True r=0.25, true kq=1000, true MSYq=62.5

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
 Viable r-kq pairs = 5001

Results:

viable r-kq pairs	= 5001
median kq	= 1022, 738 - 1509
median MSYq	= 74, 45.4 - 120
r (4 MSYq/kq)	= 0.29, 0.171 - 0.489
Fmsy (r/2)	= 0.145, 0.0855 - 0.245
F/Fmsy	= 2.03, 0.161 - 4.53 (1998), true: 2.38
B/Bmsy	= 0.457, 0.251 - 0.811 (1999), true: 0.42

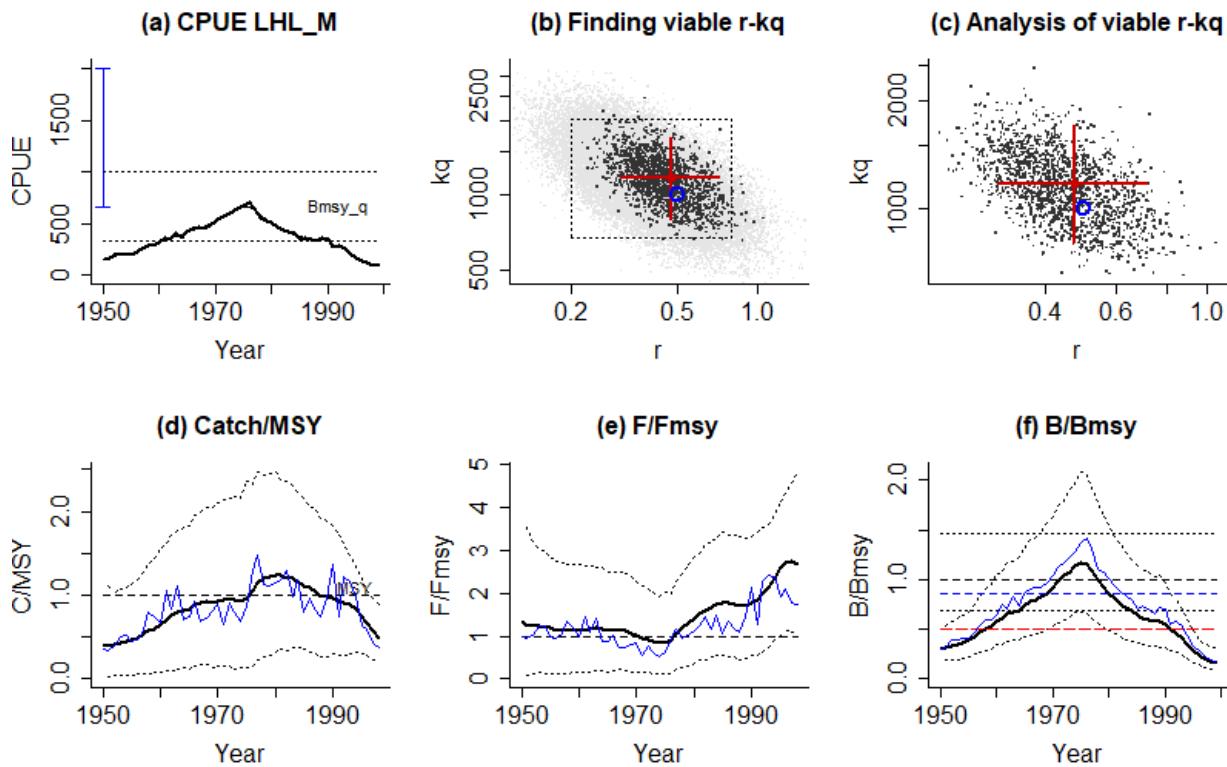


Stock LHL_M, , simulated data
 CPUE data for years 1950 - 1999, CPUE range 96.7 - 669, smooth = TRUE
 Prior for r = Medium, NA - NA
 Used prior range for r = 0.2 - 0.8
 Prior for 1950 stock status = Very small, NA - NA
 Used 1950 prior B/B0 range = 0.01 - 0.2, prior B/Bmsy = 0.02 - 0.4
 Used prior range for kq = 668 - 2005 [original range = 144 - 2875]
 Comment: True r=0.5, true kq=1000, true MSYq=125, true q=0.001

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
 Viable r-kq pairs = 5002

Results:

viable r-kq pairs	= 5002
median kq	= 1165, 803 - 1703
median MSYq	= 138, 90.2 - 211
r (4 MSYq/kq)	= 0.473, 0.307 - 0.714
Fmsy (r/2)	= 0.236, 0.153 - 0.357
F/Fmsy	= 2.66, 1.05 - 4.83 (1998), true: 1.74
B/Bmsy	= 0.165, 0.0921 - 0.302 (1999), true: 0.18

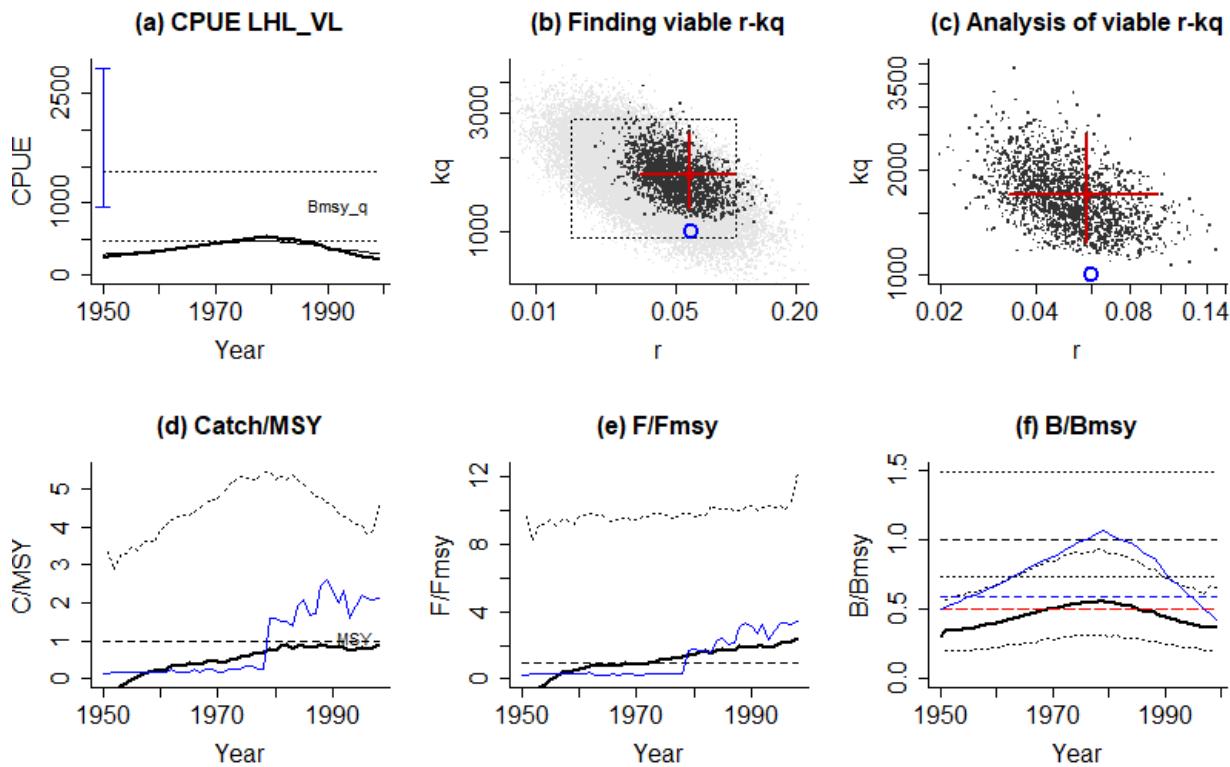


Stock LHL_VL, , Simulated data
 CPUE data for years 1950 - 1999, CPUE range 293 - 475, smooth = TRUE
 Prior for r = Very low, NA - NA
 Used prior range for r = 0.015 - 0.1
 Prior for 1950 stock status = Very small, NA - NA
 Used 1950 prior B/B0 range = 0.01 - 0.2, prior B/Bmsy = 0.02 - 0.4
 Used prior range for kq = 949 - 2848 [original range = 266 - 5322]
 Comment: True r=0.06, true kq=1000, true MSYq=15

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
 Viable r-kq pairs = 5001

Results:

viable r-kq pairs	= 5001
median kq	= 1687, 1238 - 2509
median MSYq	= 24.5, 14.2 - 40.1
r (4 MSYq/kq)	= 0.0581, 0.0326 - 0.0978
Fmsy (r/2)	= 0.0291, 0.0163 - 0.0489
F/Fmsy	= 2.42, -4.96 - 12.3 (1998), true: 3.41
B/Bmsy	= 0.366, 0.202 - 0.654 (1999), true: 0.42

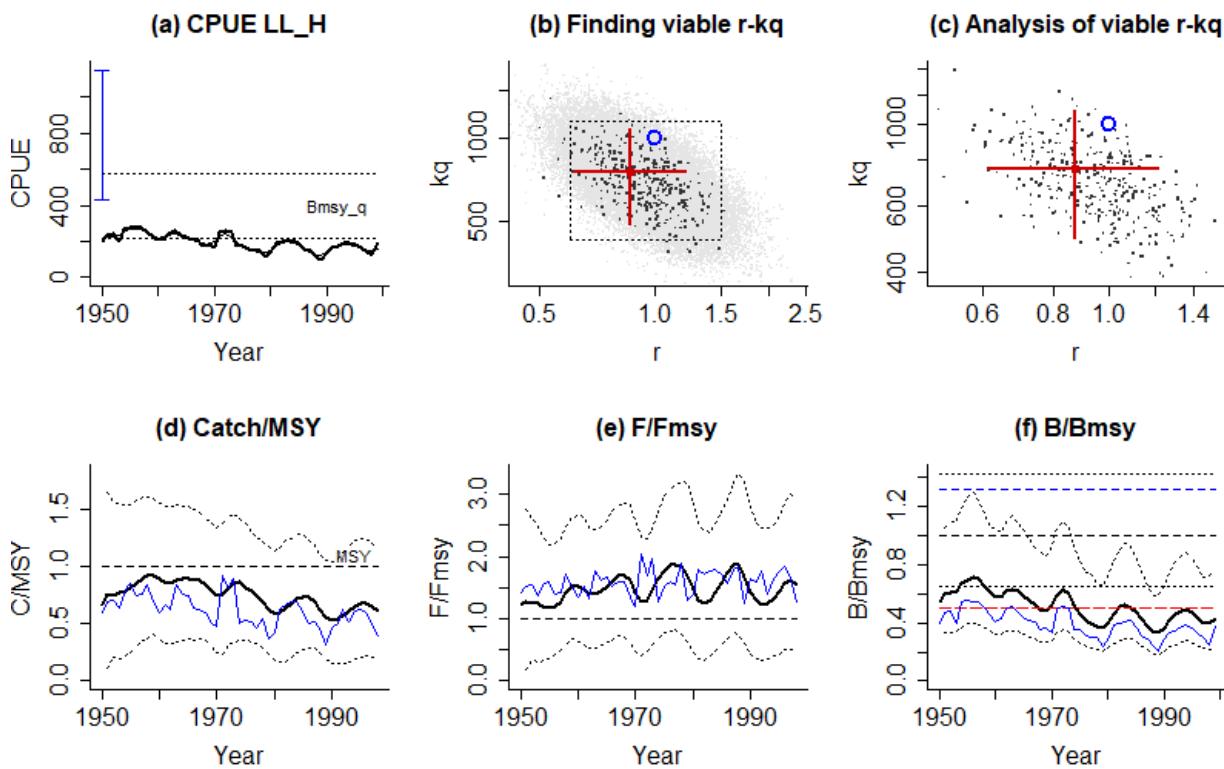


Stock LL_H, , Simulated data
 CPUE data for years 1950 - 1999, CPUE range 125 - 272, smooth = TRUE
 Prior for r = High, NA - NA
 Used prior range for r = 0.6 - 1.5
 Prior for 1950 stock status = Small, NA - NA
 Used 1950 prior B/B0 range = 0.15 - 0.4, prior B/Bmsy = 0.3 - 0.8
 Used prior range for kq = 431 - 1149 [original range = 431 - 1149]
 Comment: True r=1.0, true kq=1000, true MSYq=250

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
 Viable r-kq pairs = 5013

Results:

viable r-kq pairs	= 5013
median kq	= 759, 491 - 1084
median MSYq	= 165, 115 - 244
r (4 MSYq/kq)	= 0.869, 0.613 - 1.21
Fmsy (r/2)	= 0.434, 0.307 - 0.607
F/Fmsy	= 1.54, 0.472 - 2.91 (1998), true: 1.29
B/Bmsy	= 0.424, 0.242 - 0.769 (1999), true: 0.38

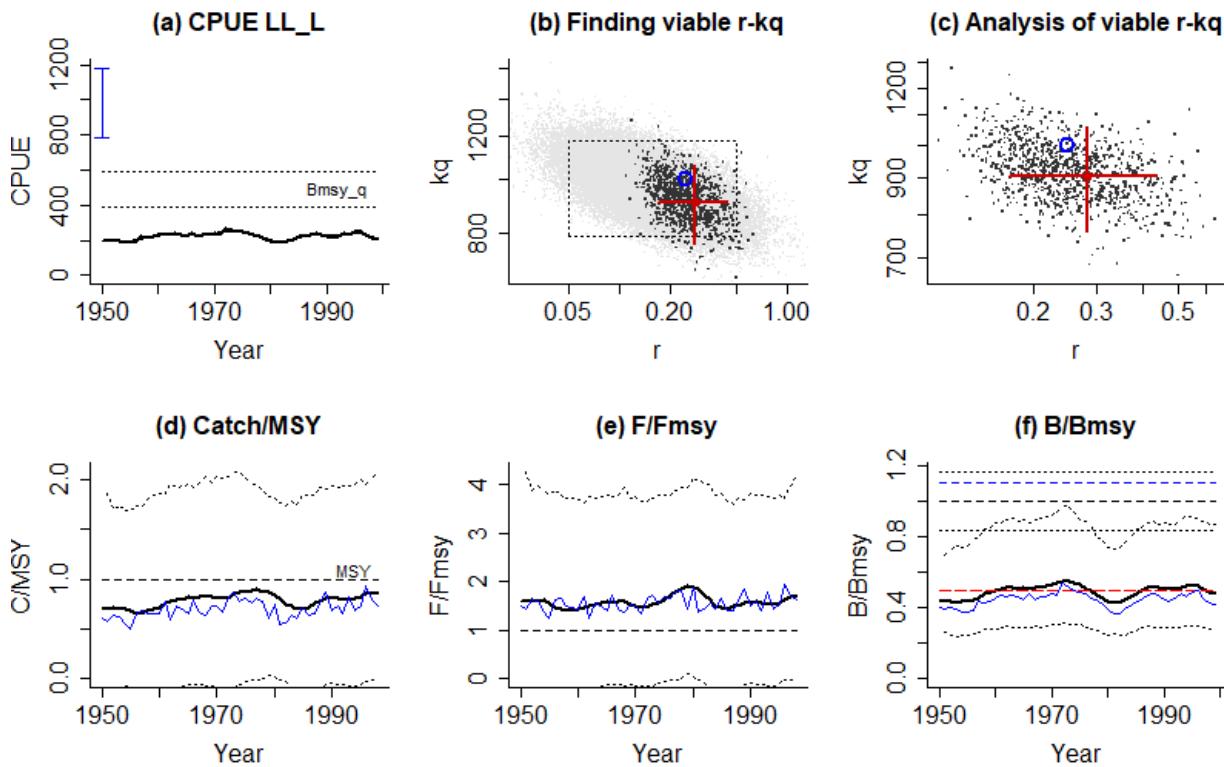


Stock LL_L, Simulated data
 CPUE data for years 1950 - 1999, CPUE range 195 - 254, smooth = TRUE
 Prior for r = Low, NA - NA
 Used prior range for r = 0.05 - 0.5
 Prior for 1950 stock status = Small, NA - NA
 Used 1950 prior B/B0 range = 0.15 - 0.4, prior B/Bmsy = 0.3 - 0.8
 Used prior range for kq = 787 - 1180 [original range = 393 - 1049]
 Comment: True r=0.25, true kq=1000, true MSYq=62.5

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
 Viable r-kq pairs = 5002

Results:

viable r-kq pairs	= 5002
median kq	= 906, 761 - 1060
median MSYq	= 63.7, 40.3 - 96.7
r (4 MSYq/kq)	= 0.282, 0.171 - 0.438
Fmsy (r/2)	= 0.141, 0.0857 - 0.219
F/Fmsy	= 1.73, -0.06 - 4.2 (1998), true: 1.65
B/Bmsy	= 0.481, 0.264 - 0.871 (1999), true: 0.42

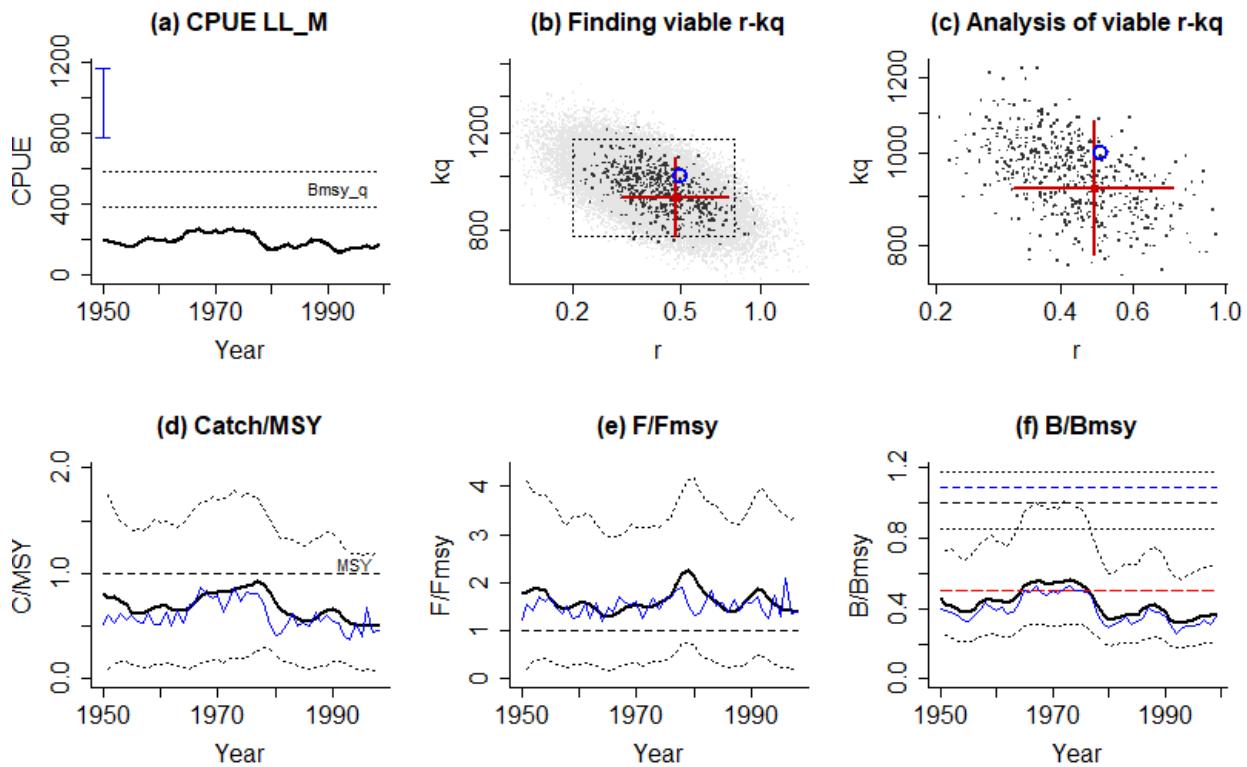


Stock LL_M, Simulated data
 CPUE data for years 1950 - 1999, CPUE range 144 - 257, smooth = TRUE
 Prior for r = Medium, NA - NA
 Used prior range for r = 0.2 - 0.8
 Prior for 1950 stock status = Small, NA - NA
 Used 1950 prior B/B0 range = 0.15 - 0.4, prior B/Bmsy = 0.3 - 0.8
 Used prior range for kq = 779 - 1168 [original range = 389 - 1038]
 Comment: True r=0.5, true kq=1000, true MSYq=125, true q=0.001

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
 Viable r-kq pairs = 5003

Results:

viable r-kq pairs	= 5003
median kq	= 919, 784 - 1081
median MSYq	= 111, 74 - 169
r (4 MSYq/kq)	= 0.483, 0.306 - 0.752
Fmsy (r/2)	= 0.241, 0.153 - 0.376
F/Fmsy	= 1.4, 0.217 - 3.41 (1998), true: 1.38
B/Bmsy	= 0.364, 0.203 - 0.65 (1999), true: 0.36

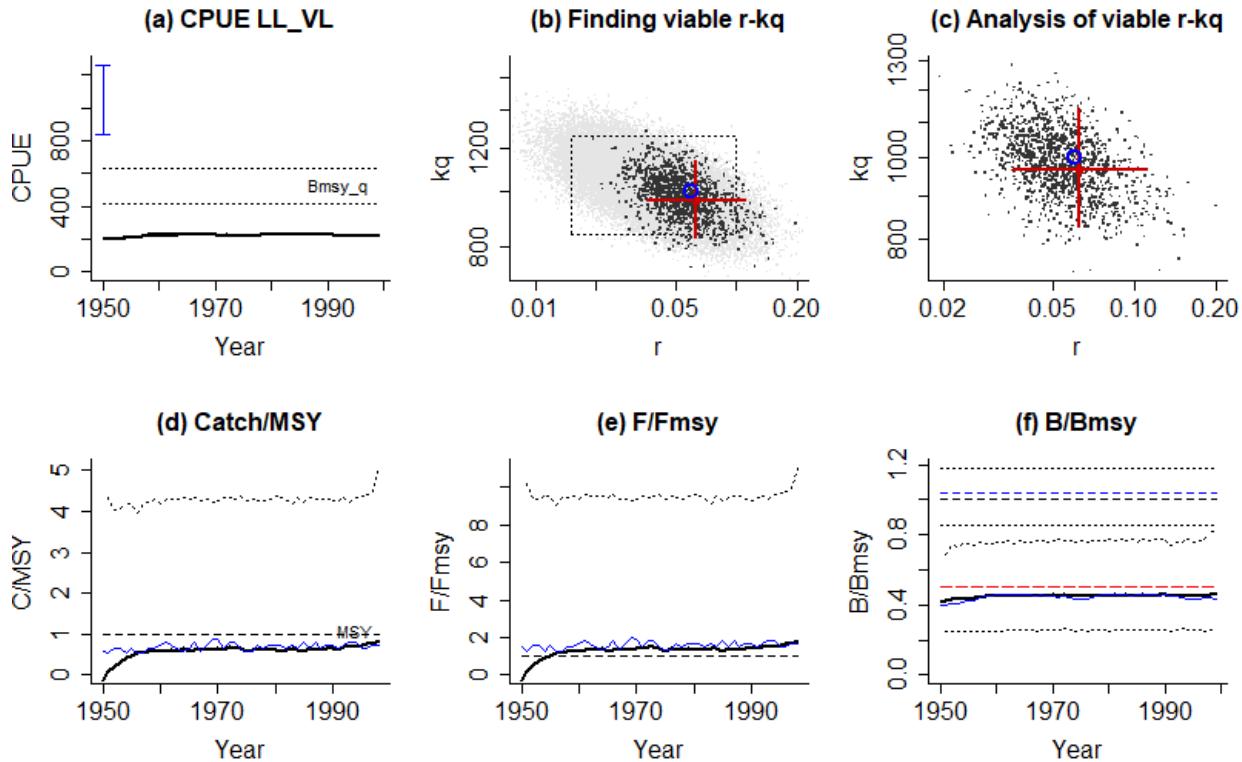


Stock LL_VL, , simulated data
 CPUE data for years 1950 - 1999, CPUE range 212 - 226, smooth = TRUE
 Prior for r = Very low, NA - NA
 Used prior range for r = 0.015 - 0.1
 Prior for 1950 stock status = Small, NA - NA
 Used 1950 prior B/B0 range = 0.15 - 0.4, prior B/Bmsy = 0.3 - 0.8
 Used prior range for kq = 840 - 1260 [original range = 420 - 1120]
 Comment: True r=0.06, true kq=1000, true MSYq=15

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
 Viable r-kq pairs = 5000

Results:

viable r-kq pairs	= 5000
median kq	= 967, 829 - 1141
median MSYq	= 15.2, 8.99 - 25.9
r (4 MSYq/kq)	= 0.063, 0.0356 - 0.111
Fmsy (r/2)	= 0.0315, 0.0178 - 0.0554
F/Fmsy	= 1.85, -5.19 - 11 (1998), true: 1.66
B/Bmsy	= 0.456, 0.255 - 0.84 (1999), true: 0.44



Appendix 3: Stocks and species for which AMSY provides the first assessment

This Appendix presents details of the first MSY-level stock assessments for 38 stocks comprising 35 species. For 23 species, these are the first assessments globally. For all stocks, length frequencies were analyzed with the LBB method (Froese et al. 2018, 2019) to obtain priors for relative stock size B/B_0 in a given year. These priors were then used in the analysis of CPUE data obtained from research surveys with the AMSY method presented in this study. R-code and data mentioned below are available as part of the Supplemental Material available at the link indicated on the first page of this document.

Length frequencies and CPUE in numbers by length and area for the Adriatic Sea and Cyprus were obtained from the Mediterranean and Black Sea data call - 2018, after explicit request to the DCF national correspondents. (<https://datacollection.jrc.ec.europa.eu/dc/medbs>)

Length frequencies and CPUE in kg/km² by area for the Aegean Sea were obtained from the MEDITS bottom trawl survey (MEDITS Working Group 2012).

Length frequencies and CPUE in kg/h by length and area for the North Sea were obtained from the GNSIntOT3 survey as standardized in Greenstreet & Moriarty (2018). The data were aggregated with R-code SMFS_kg2B_4.R.

Length frequencies and CPUE in numbers by length and area for the Baltic Sea were obtained from the BITS survey in DATRAS (https://datras.ices.dk/Data_products/Download/Download_Data_public.aspx), accessed in April 2019. The data were aggregated and transformed from numbers to weight with R-code Nh2kghAr_3.R.

Stocks are arranged alphabetically by regions and by stock acronyms with region.

References

- Froese, R., Winker, H., Coro, G., Demirel, N., Tsikliras, A.C., Dimarchopoulou, D., Scarcella, G., Probst, W.N., Dureuil, M. and D. Pauly. 2018. A new approach for estimating stock status from length frequency data. ICES Journal of Marine Science 75(6): 2004-2015.
- Froese, R., Winker, H., Coro, G., Demirel, N., Tsikliras, A.C., Dimarchopoulou, D., Scarcella, G., Probst, W.N., Dureuil, M. and D. Pauly. 2019. On the pile-up effect and priors for Linf and M/K: response to a comment by Hordyk et al. on “A new approach for estimating stock status from length frequency data”. ICES Journal of Marine Science, 76(2): 461–465.
- Greenstreet, S.P.R. and Moriarty, M. 2018. Manual for Version 3 of the Groundfish Survey Monitoring and Assessment Data Product. Scottish Government, Scottish Marine and Freshwater Science Report Vol 8, No 18, 77 p.
- MEDITS working group (2012). MEDITS. International bottom trawl survey in the Mediterranean. Instruction manual. Version 6. MEDITS-Handbook. Revision n.6, April 2012, MEDITS Working group. <https://archimer.ifremer.fr/doc/00117/22783/>

Adriatic Sea

LBB results for *Illlex coindetii*, stock Ille_coi_AD, 1996-2016
 Files:LBB4AMSY_ID_2.csv, Ille_coi_AD.csv

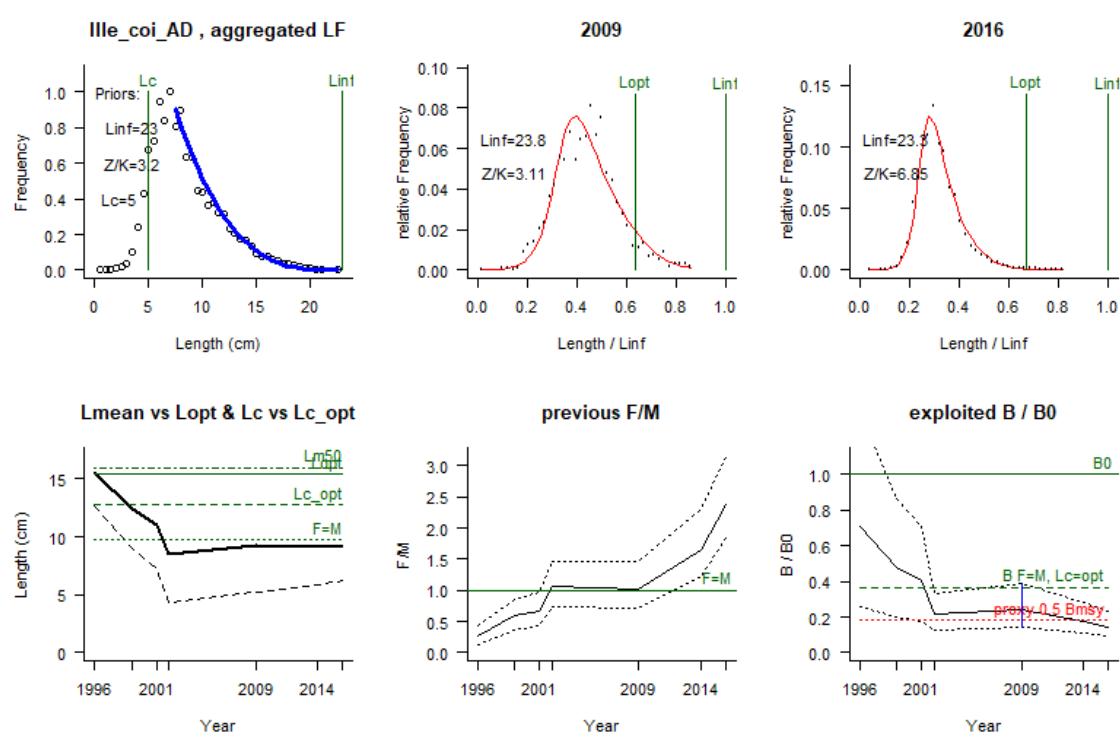
L_{inf} prior= 23, SD=0.23 cm (user-defined), $L_{max}=23.5$, median $L_{max}=20.5$
 Z/K prior = 3.2, SD=0.12, M/K prior=1.5, SD=0.15
 F/K prior = 1.71 (wide range with tau=4 in log-normal distribution)
 L_c prior = 5.1, SD=0.51 cm, alpha prior=42, SD=4.2, $L_{m50}=16$ cm

General reference points (median across years):

L_{inf} = 23.3 (22.8-23.6) cm
 L_{opt} = 15 cm, $L_{opt}/L_{inf}=0.66$
 L_c_{opt} = 13 cm, $L_c_{opt}/L_{inf}=0.55$, Lmean if $F=M$ 9.75 cm
 M/K = 1.52 (1.29-1.79)
 F/M = 0.92 (0.611-1.3), $F/K=1.49$ (1.12-1.79), $Z/K=3.14$ (2.95-3.36)
 B/B_0 = 0.26 (0.14-0.38), $B/B_0 F=M L_c=L_c_{opt} 0.37$
 Y/R' = 0.017 (0.011-0.033), $Y/R' F=M L_c=L_c_{opt} 0.045$

Estimates for 2016 (mean of last 3 years with data):

L_{c50} = 6.21 (6.1-6.33) cm, $L_c/L_{inf}=0.27$ (0.26-0.27)
 L_{c95} = 8.26, alpha=1.44 (1.38-1.49)
 L_{mean}/L_{opt} = 0.6, $L_c/L_c_{opt}=0.49$, $L_{95th}/L_{inf}=0.84$, Mature=0.34%
 F/M = 2.4 (1.8-3.2), $F/K=3.5$ (3.2-3.9), $Z/K=5.1$ (4.8-5.3)
 Y/R' = 0.015 (0.0091-0.024)
 B/B_0 = 0.15 (0.09-0.24), best LF fit year 2002=0.22 (0.13-0.33)
 B/B_{msy} = 0.4 (0.25-0.64), selected B/B_0 2009 = 0.24 (0.14-0.39)
 RF: removed years with chaotic LF; set L_{inf} to 23 cm between median 20.5 and max 23.5, instead of 24.6 suggested by aggregated data. Selected 2009 for AMSY prior because of reasonable fit, CL, not too low B/B_0 which makes predictions of k uncertain.



File FirstAss_ID_4.csv read successfully

AMSY Analysis, Fri Nov 01 16:34:11 2019

Stock **Ille_coi_AD**, *Illlex coindetii*, Shortfin squid

CPUE data for years 2001 - 2017, CPUE range 12.6 - 32.5, smooth = TRUE

Prior for r = Medium, 0.34 - 0.78

Used prior range for r = 0.319 - 0.833

Prior for 2009 stock status = Small, 0.14 - 0.39

Used 2009 prior B/B₀ range = 0.14 - 0.39, prior B/B_{msy} = 0.28 - 0.78

Used prior range for k_q = 33.5 - 93.3 [original range = 33.5 - 93.3]

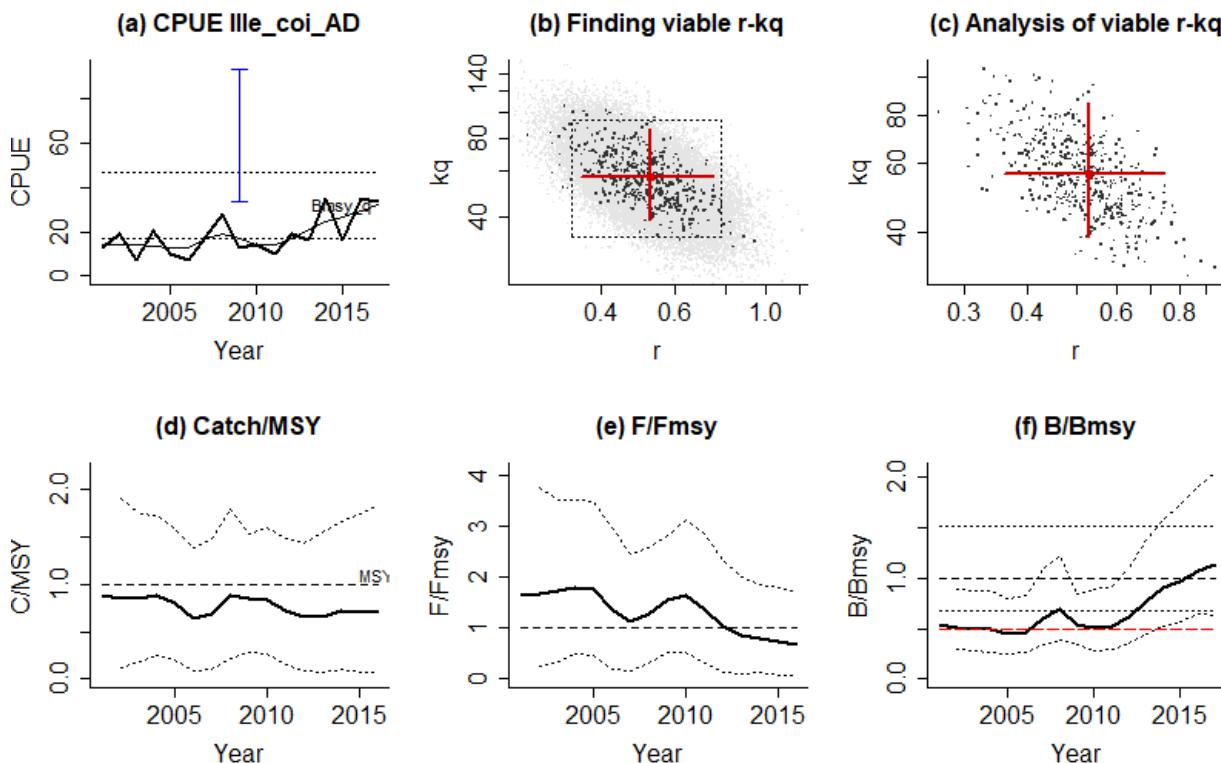
Comment: B/B₀ prior from LBB. RF: Initial low abundance of stock doubtful. Starting analysis in 2001. OK

Source:

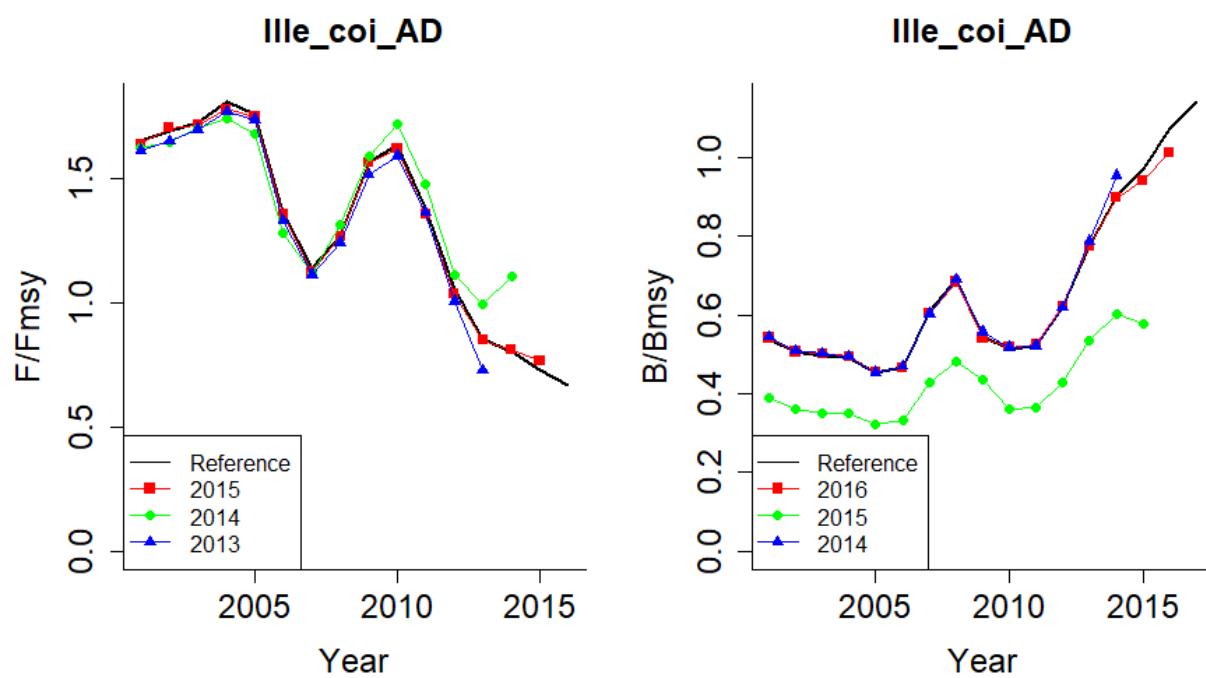
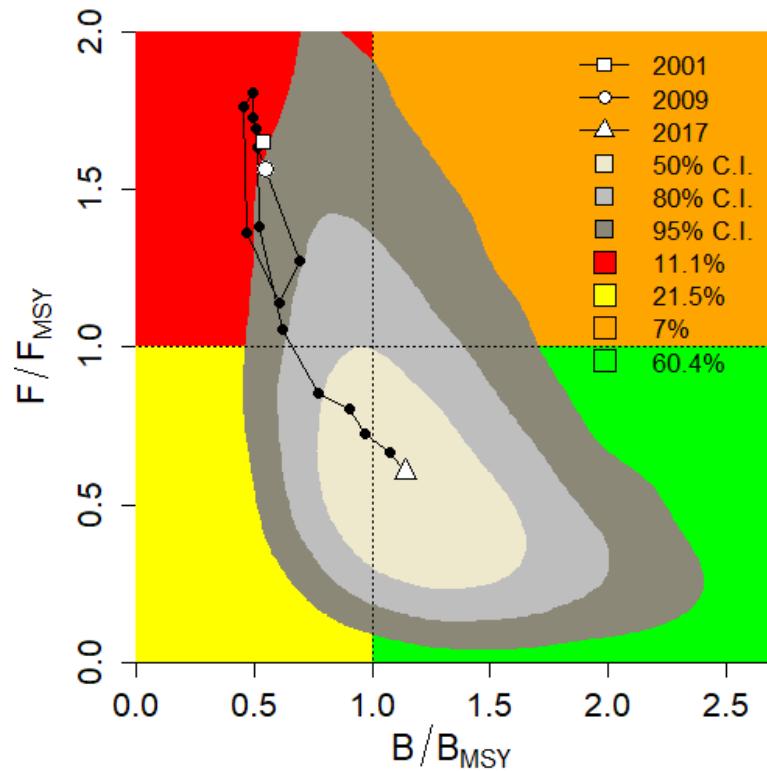
Monte Carlo filtering of r-k_q space with 50000 points and 30 error patterns.
Viable r-k_q pairs = 5003

Results:

viable r-k _q pairs	= 5003
median k _q	= 56.6, 38.8 - 85.9
median MSY _q	= 7.46, 5.2 - 11
r (4 MSY _q /k _q)	= 0.527, 0.359 - 0.745
F _{msy} (r/2)	= 0.264, 0.18 - 0.372
F/F _{msy}	= 0.665, 0.0673 - 1.71 (2016)
B/B _{msy}	= 1.14, 0.64 - 2.05 (2017)



AMSY Kobe and retrospective plots for *Ille_coi_AD*, *Illlex coindetti*



LBB results for *Micromesistius poutassou*, stock **Micr_pou_AD**, 1994-2001
 Files:LBB4AMSY_ID_2.csv, Micr_pou_AD.csv

L_{inf} prior= 40, SD=0.4 cm (user-defined), $L_{max}=44$, median $L_{max}=35$

Z/K prior = 2.5, SD=0.39, M/K prior=1.5, SD=0.15

F/K prior = 1.05 (wide range with $\tau=4$ in log-normal distribution)

L_c prior = 21.9, SD=2.2 cm, alpha prior=37.2, SD=3.7, $L_{m50}=18$ cm

General reference points (median across years):

L_{inf} = 40.3 (39.7-40.9) cm

L_{opt} = 27 cm, $L_{opt}/L_{inf}=0.66$

L_c_{opt} = 24 cm, $L_c_{opt}/L_{inf}=0.59$, Lmean if $F=M$ 26.2 cm

M/K = 1.52 (1.25-1.81)

F/M = 2.19 (1.67-2.82), $F/K=3.29$ (2.94-3.84), $Z/K=4.84$ (4.52-5.35)

B/B_0 = 0.19 (0.13-0.27), $B/B_0 F=M L_c=L_c_{opt} 0.37$

Y/R' = 0.038 (0.017-0.056)(reduced: $B/B_0 < 0.25$), $Y/R' F=M L_c=L_c_{opt} 0.045$

Estimates for 2001 (mean of last 3 years with data):

L_{c50} = 21.2 (21.1-21.3) cm, $L_c/L_{inf}=0.53$ (0.53-0.53)

L_{c95} = 23.4, alpha=1.31 (1.26-1.35)

$L_{mean}/L_{opt}=0.9$, $L_c/L_c_{opt}=0.88$, $L_{95th}/L_{inf}=0.82$, Mature=100%

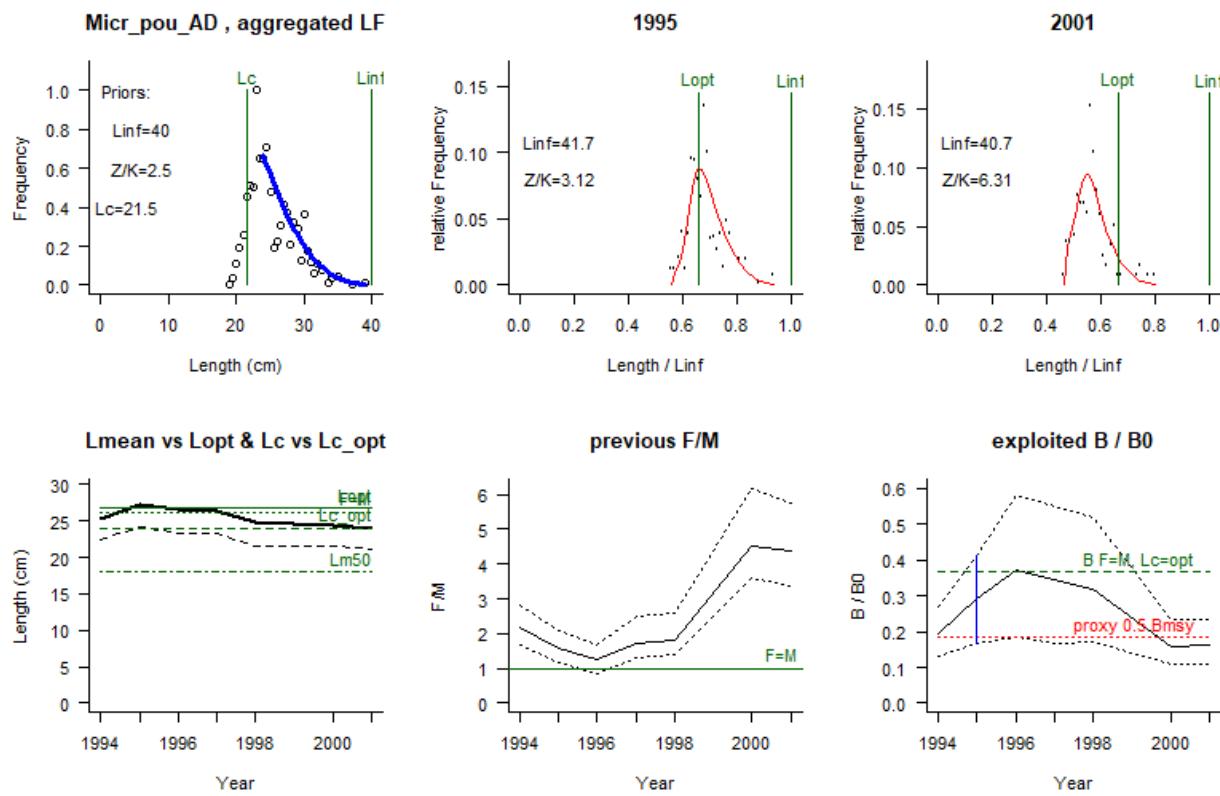
F/M = 4.4 (3.4-5.7), $F/K=6.3$ (5.5-7.1), $Z/K=7.7$ (7.1-8.5)

Y/R' = 0.027 (0.018-0.039)(reduced because $B/B_0 < 0.25$)

B/B_0 = 0.16 (0.11-0.23), best LF fit year 1996=0.37 (0.18-0.58)

B/B_{msy} = 0.44 (0.3-0.64), selected B/B_0 1995 = 0.29 (0.17-0.41)

RF: set L_{cut} to 18 cm to ignore distorting high catches of early juveniles; excluded years with unsuitable LFs; set L_{inf} to 40 cm, between median 36 and max 44; note that L_c is overestimated, but F of adults and thus B/B_0 seems reasonable. Selected 1995 for reasonable fit, CL, and B/B_0 .



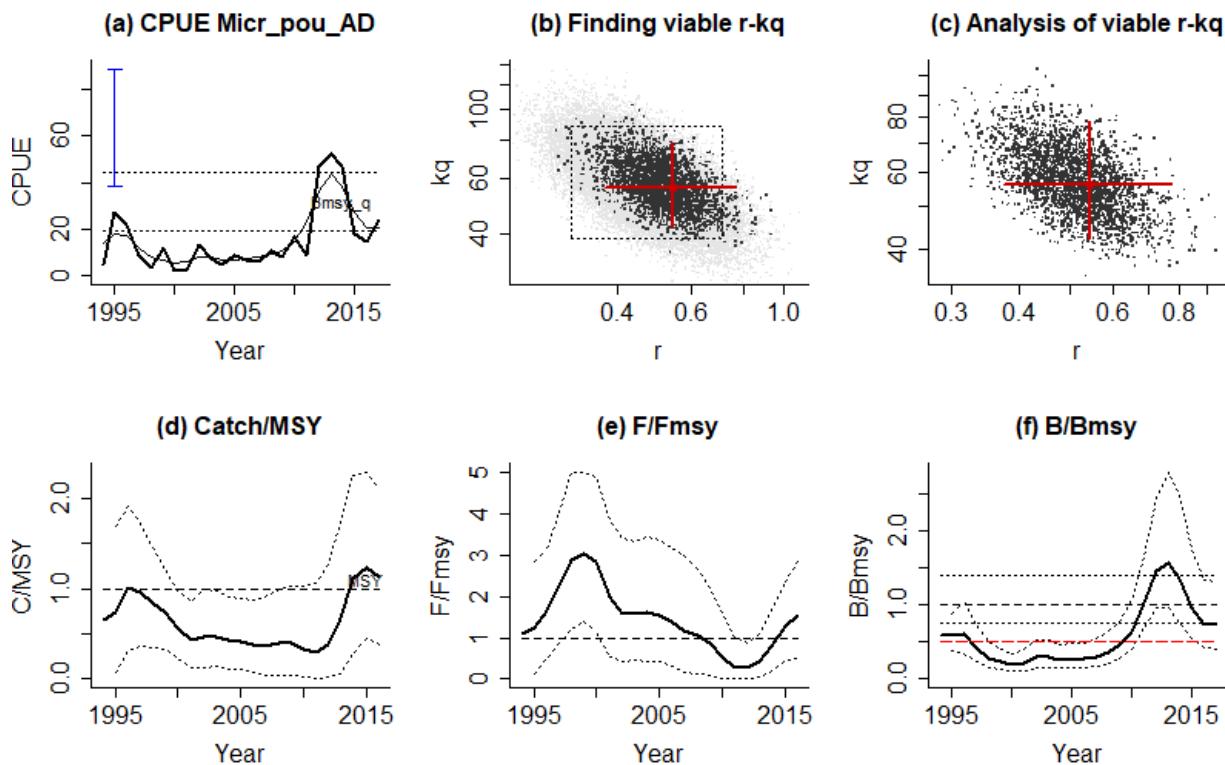
AMSY Analysis, Fri Nov 01 16:38:14 2019

Stock **Micr_pou_AD**, *Micromesistius poutassou*, Blue whiting
CPUE data for years 1994 - 2017, CPUE range 5.66 - 43.4, smooth = TRUE
Prior for r = Medium, 0.31 - 0.71
Used prior range for r = 0.29 - 0.761
Prior for 1995 stock status = Small, 0.17 - 0.41
Used 1995 prior B/B₀ range = 0.17 - 0.41, prior B/B_{msy} = 0.34 - 0.82
Used prior range for kq = 38.3 - 88.5 [original range = 36.7 - 88.5]
Comment: B/B₀ prior from LBB. RF: OK
Source:

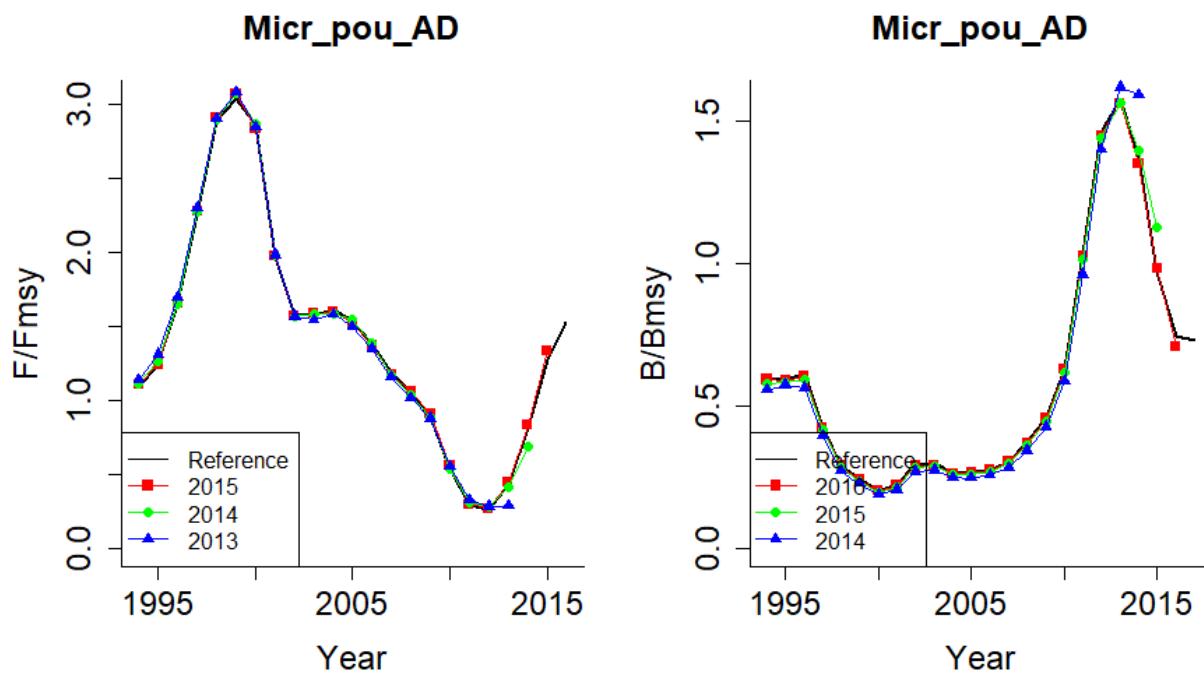
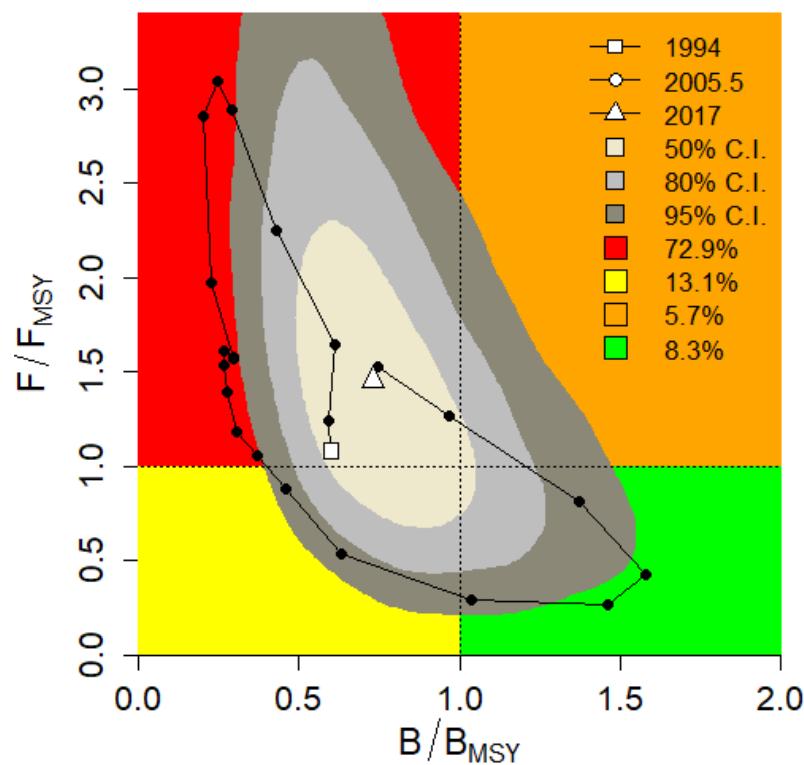
Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
Viable r-kq pairs = 5000

Results:

viable r-kq pairs = 5000
median kq = 56.1, 42.4 - 78.3
median MSY_q = 7.61, 5.46 - 10.8
r (4 MSY_q/kq) = 0.543, 0.374 - 0.77
F_{msy} (r/2) = 0.272, 0.187 - 0.385
F/F_{msy} = 1.53, 0.515 - 2.84 (2016)
B/B_{msy} = 0.731, 0.401 - 1.32 (2017)



AMSY Kobe plot and retrospective analysis for **Micr_pou_AD**, *Micromesistius poutassou*



LBB results for *Octopus vulgaris*, stock Octo_vul_AD, 2007-2017
 Files:LBB4AMSY_ID_2.csv, Octo_vul_AD.csv

Linf prior= 19, SD=0.19 cm (user-defined), Lmax=27, median Lmax=15

Z/K prior = 3.2, SD=0.56, M/K prior=1.5, SD=0.15

F/K prior = 1.67 (wide range with tau=4 in log-normal distribution)

Lc prior = 5.87, SD=0.59 cm, alpha prior=10.2, SD=1, Lm50=11 cm

General reference points (median across years):

Linf = 19.4 (19.1-19.7) cm

Lopt = 14 cm, Lopt/Linf=0.74

Lc_opt = 11 cm, Lc_opt/Linf=0.55, Lmean if F=M 9.2 cm

M/K = 1.03 (0.81-1.17)

F/M = 0.276 (0.141-0.519), F/K=0.26 (0.164-0.445), Z/K=1.29 (1.14-1.43)

B/B0 = 0.64 (0.23-1.3), B/B0 F=M Lc=Lc_opt 0.39

Y/R' = 0.045 (0.016-0.096), Y/R' F=M Lc=Lc_opt 0.077

Estimates for 2017 (mean of last 3 years with data):

Lc50 = 4.14 (3.9-4.4) cm, Lc/Linf=0.21 (0.2-0.23)

Lc95 = 7.81, alpha=0.804 (0.767-0.843)

Lmean/Lopt = 0.61, Lc/Lc_opt=0.39, L95th=17 cm, L95th/Linf=0.88, Mature=32%

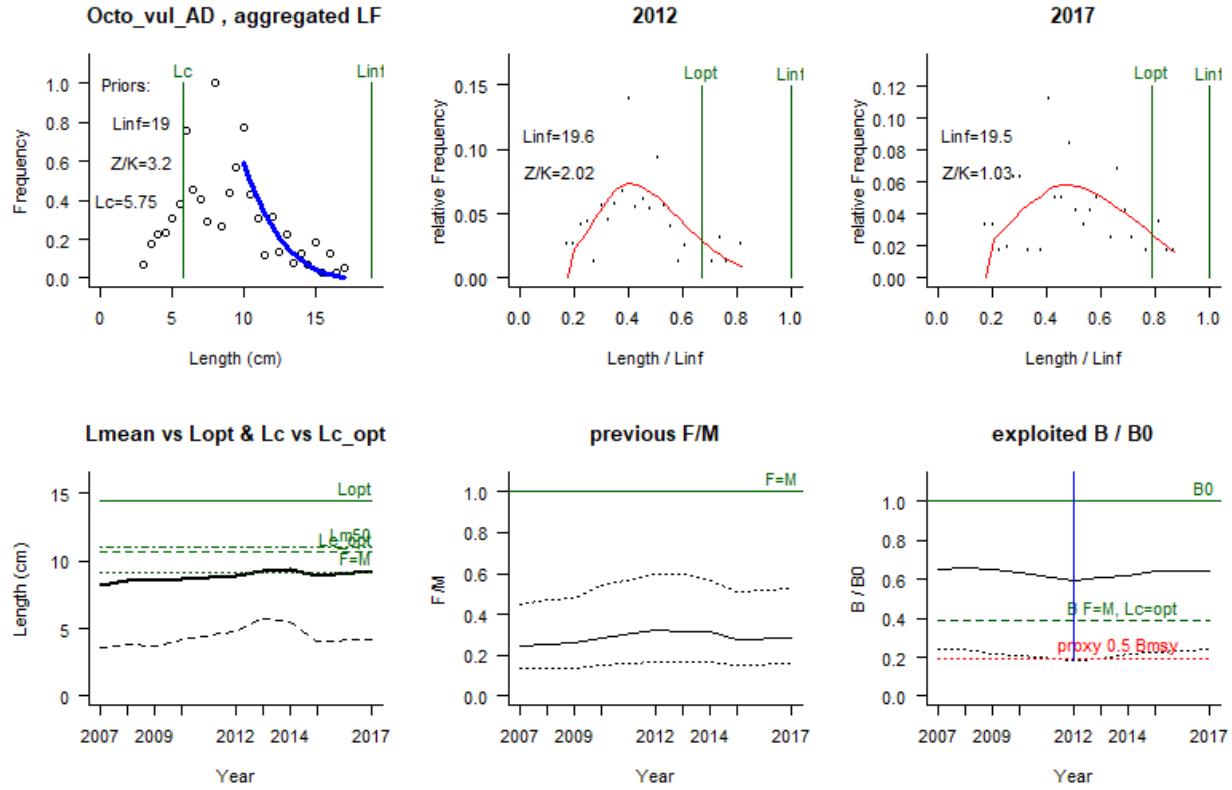
F/M = 0.29 (0.16-0.52), F/K=0.24 (0.14-0.37), Z/K=1.1 (0.98-1.2)

Y/R' = 0.055 (0.021-0.11)

B/B0 = 0.64 (0.24-1.3), best LF fit year 2009=0.647 (0.22-1.3)

B/Bmsy = 1.7 (0.63-3.4), selected B/B0 2012 = 0.59 (0.19-1.2)

RF: deleted outlier 75 cm in 2015; set Linf=19 cm, between median 15 and max 27 cm; merged LF to increase data per year; 2012 fit looked reasonable and is proposed for AMSY, albeit with high uncertainty.



AMSY Analysis, Fri Nov 01 16:43:40 2019

Stock Octo_vul_AD, *Octopus vulgaris*, Common octopus

CPUE data for years 1995 - 2017, CPUE range 1.02 - 2.47, smooth = TRUE

Prior for r = High, 0.53 - 1.21

Used prior range for r = 0.493 - 1.29

Prior for 2012 stock status = Small, 0.19 - 1.2

Used 2012 prior B/B₀ range = 0.19 - 1.2, prior B/B_{msy} = 0.38 - 2.4

Used prior range for kq = 2.31 - 5 [original range = 0.792 - 5]

Comment: B/B₀ prior from LBB. RF: OK

Source:

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
Viable r-kq pairs = 5013

Results:

viable r-kq pairs = 5013

median kq = 3.38, 2.45 - 4.87

median MSYq = 0.72, 0.507 - 1.01

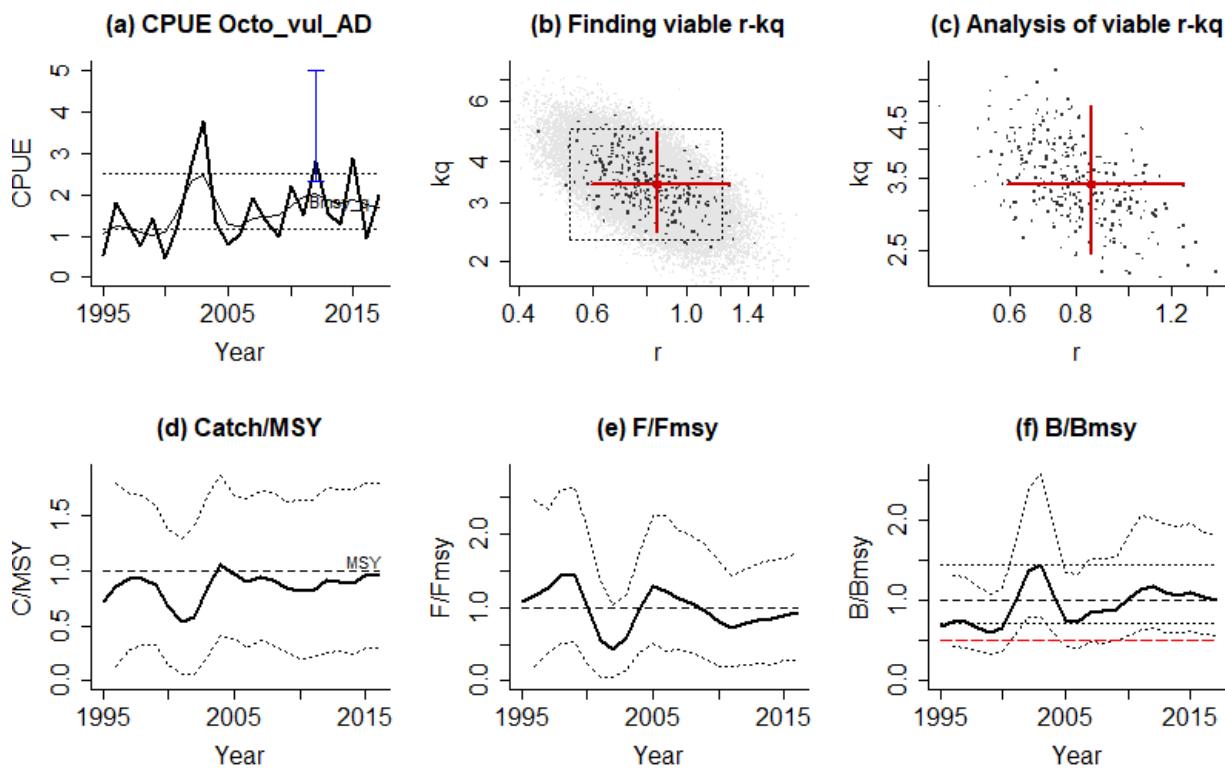
r (4 MSYq/kq) = 0.851, 0.595 - 1.26

F_{msy} (r/2) = 0.425, 0.297 - 0.631

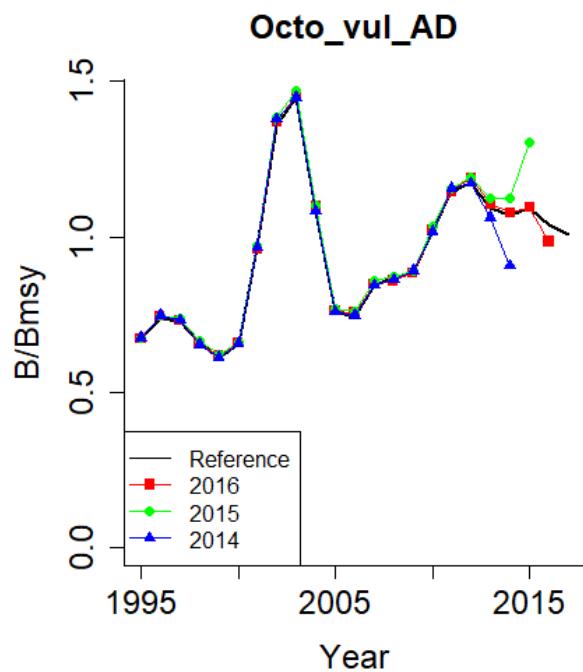
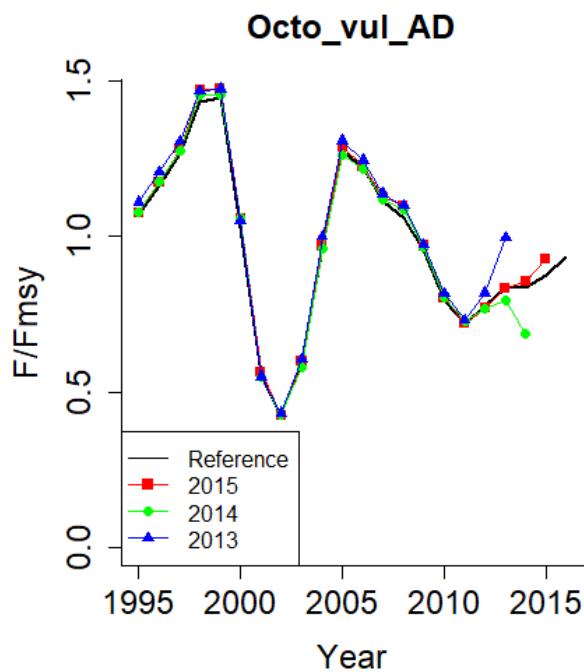
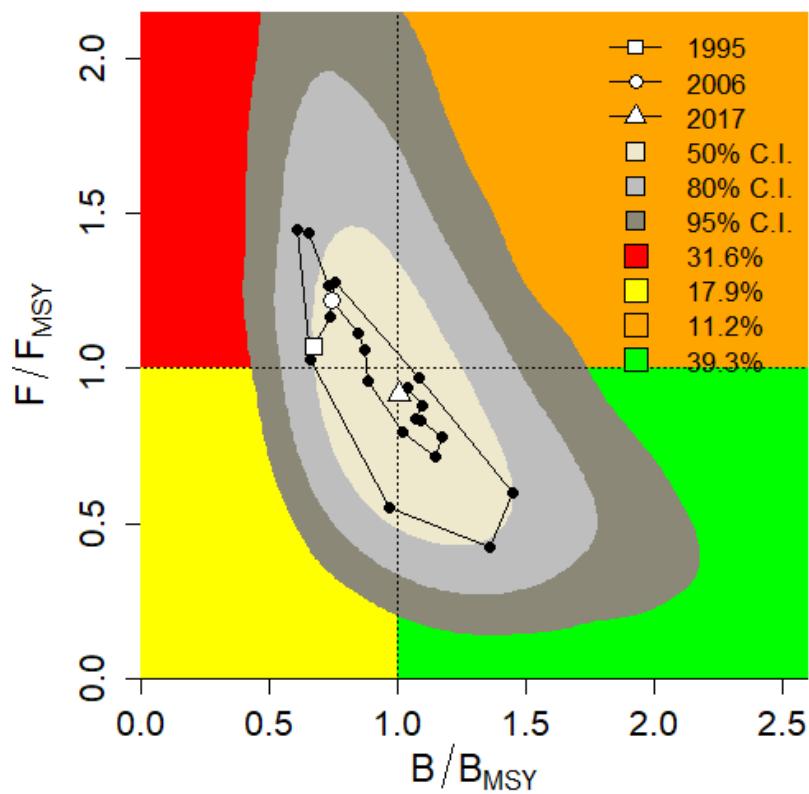
F/F_{msy}

= 0.937, 0.289 - 1.74 (2016)

B/B_{msy} = 1.01, 0.557 - 1.81 (2017)



AMSY Kobe plot and retrospective analysis for *Octopus vulgaris* Octo_vul_AD



Aegean Sea

LBB results for *Diplodus annularis*, stock ANN_GSA22, 1994-2016
Files:LBB4AMSY_ID_2.csv, ANN.csv

L_{inf} prior= 20, SD=0.2 cm (user-defined), $L_{max}=19.5$, median $L_{max}=18$

Z/K prior = 3.2, SD=0.13, M/K prior=1.5, SD=0.15

F/K prior = 1.7 (wide range with $\tau=4$ in log-normal distribution)

L_c prior = 10.7, SD=1.1 cm, alpha prior=23.6, SD=2.4, $L_{m50}=10$ cm

General reference points (median across years):

L_{inf} = 19.6 (19.3-19.9) cm

L_{opt} = 14 cm, $L_{opt}/L_{inf}=0.71$

L_c_{opt} = 13 cm, $L_c_{opt}/L_{inf}=0.65$, Lmean if $F=M$ 14 cm

M/K = 1.22 (0.97-1.6)

F/M = 2.81 (1.43-3.62), $F/K=2.94$ (2.24-3.45), $Z/K=4.16$ (3.78-4.51)

B/B_0 = 0.17 (0.083-0.23), $B/B_0 F=M L_c=L_c_{opt}$ 0.38

Y/R' = 0.042 (0.024-0.079) (reduced: $B/B_0 < 0.25$), $Y/R' F=M L_c=L_c_{opt}$ 0.062

Estimates for 2016 (mean of last 3 years with data):

L_{c50} = 10.9 (10.8-10.9) cm, $L_c/L_{inf}=0.56$ (0.56-0.56)

L_{c95} = 12.9, alpha=1.45 (1.41-1.49)

L_{mean}/L_{opt} = 0.83, $L_c/L_c_{opt}=0.85$, $L_{95th}/L_{inf}=0.87$, Mature=91%

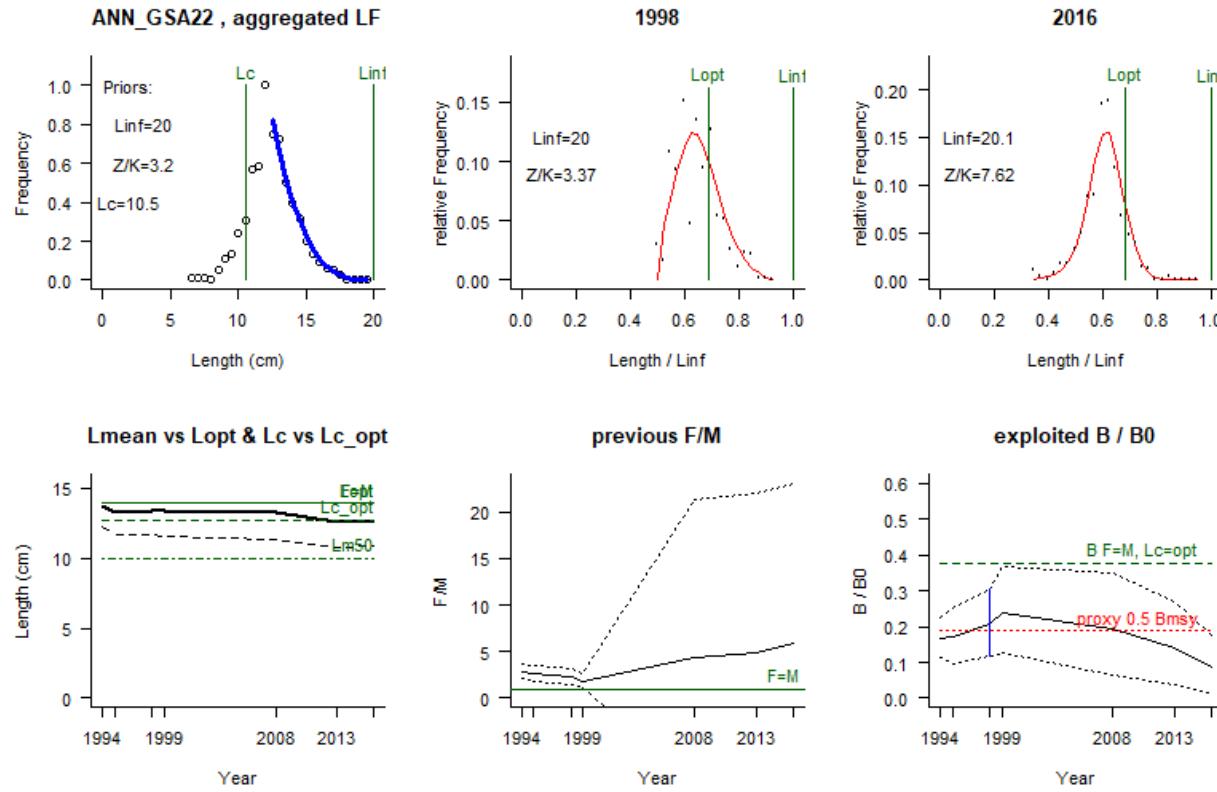
F/M = 5.9 (-7.9-23), $F/K=4$ (3.5-4.4), $Z/K=4.9$ (4.5-5.2)

Y/R' = 0.033 (-0.027-0.11) (reduced because $B/B_0 < 0.25$)

B/B_0 = 0.086 (0.011-0.18), best LF fit year 1998=0.208 (0.12-0.3)

B/B_{msy} = 0.23 (0.029-0.47), selected B/B_0 1998 = 0.21 (0.12-0.3)

RF: Set $L_{inf}=20$ to include $L_{max}=19.5$. Removed years with unsuitable LF; accepted best-fit year 1998 (high B/B_0 with narrow CV) as prior for AMSY.



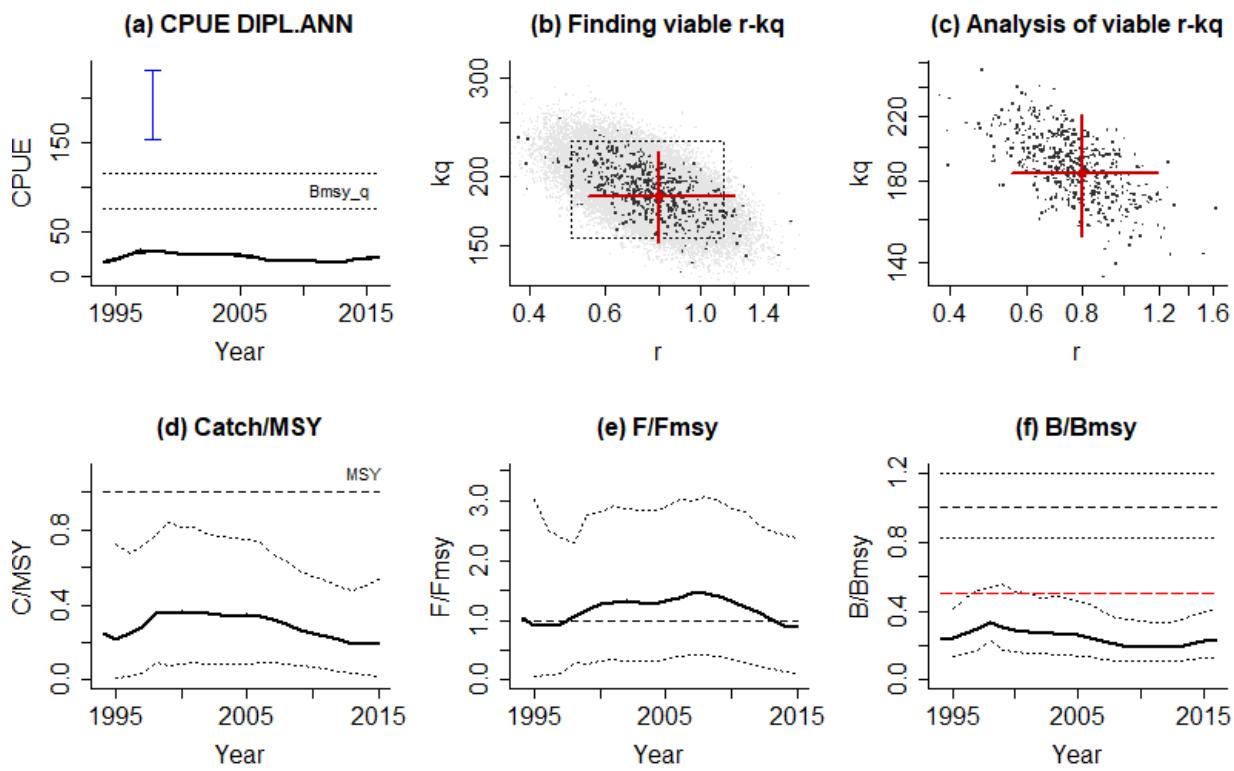
AMSY Analysis, Fri Nov 01 16:48:36 2019

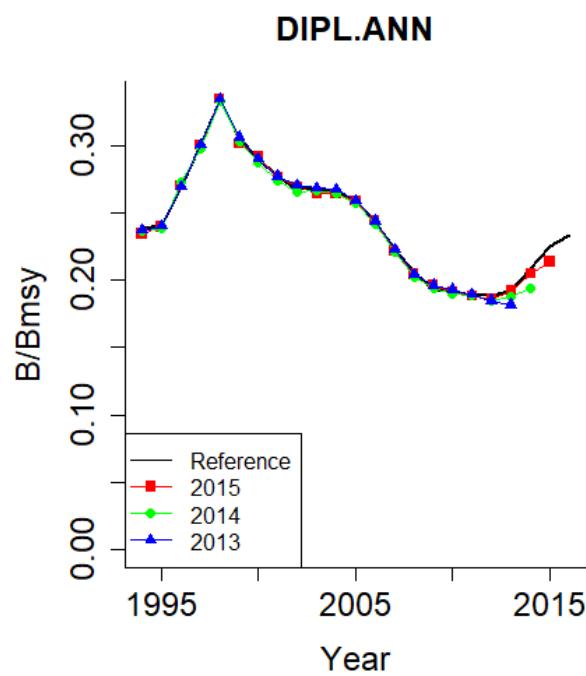
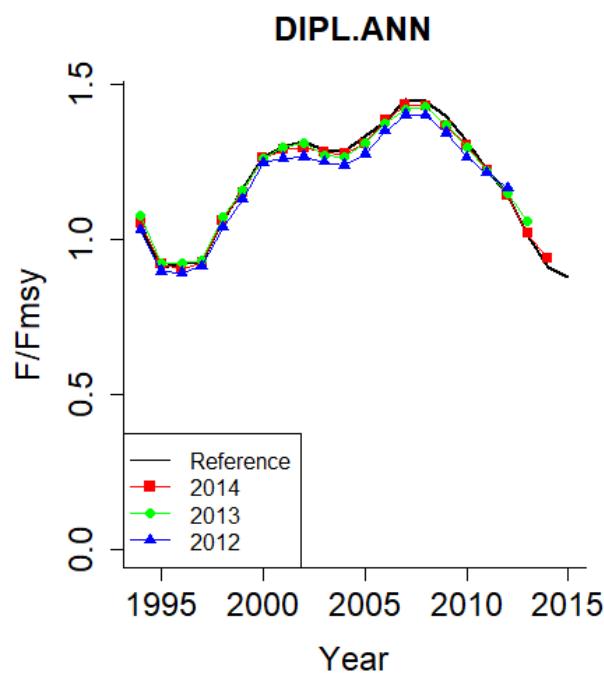
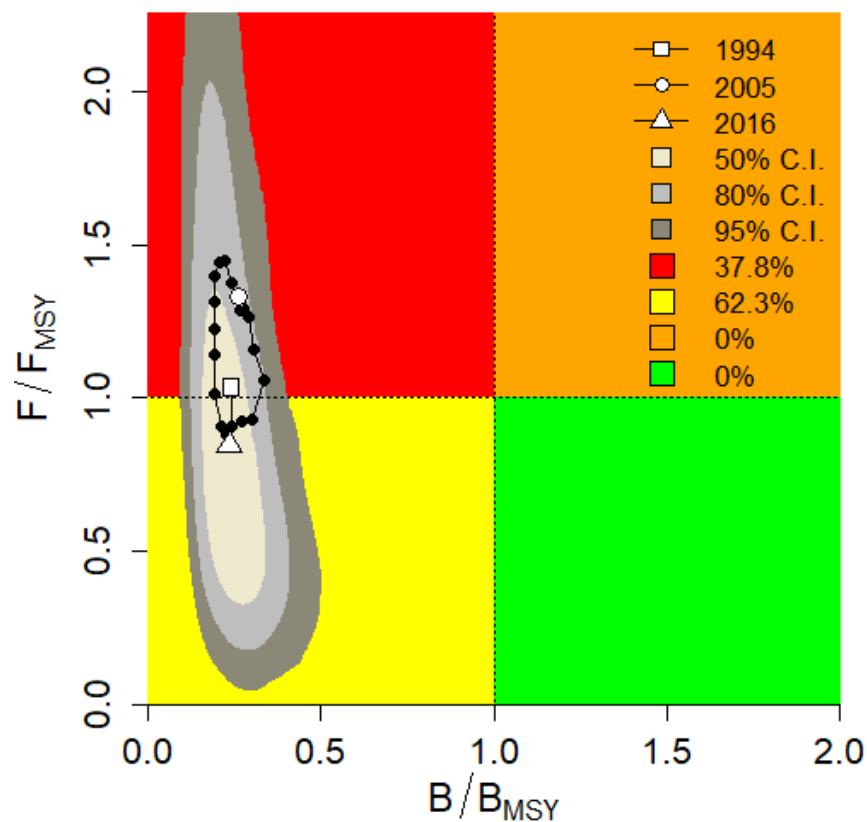
Stock DIPLO.ANN, *Diplodus annularis*, Annular seabream
CPUE data for years 1994 - 2016, CPUE range 17.1 - 28.4, smooth = TRUE
Prior for r = High, 0.5 - 1.13
Used prior range for r = 0.468 - 1.2
Prior for 1998 stock status = Small, 0.12 - 0.3
Used 1998 prior B/B₀ range = 0.12 - 0.3, prior B/B_{msy} = 0.24 - 0.6
Used prior range for kq = 154 - 232 [original range = 77.2 - 193]
Comment: B/B₀ prior from LBB. RF: OK
Source:

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
Viable r-kq pairs = 5003

Results:

viable r-kq pairs = 5003
median kq = 184, 152 - 221
median MSYq = 36.8, 27.2 - 51.4
r (4 MSYq/kq) = 0.8, 0.55 - 1.2
F_{msy} (r/2) = 0.4, 0.275 - 0.599
F/F_{msy} = 0.877, 0.106 - 2.38 (2015)
B/B_{msy} = 0.234, 0.131 - 0.416 (2016)





LBB results for *Capros aper*, stock BOC_GSA22, 1999–2013
 Files:LBB4AMSY_ID_2.csv, BOC.csv

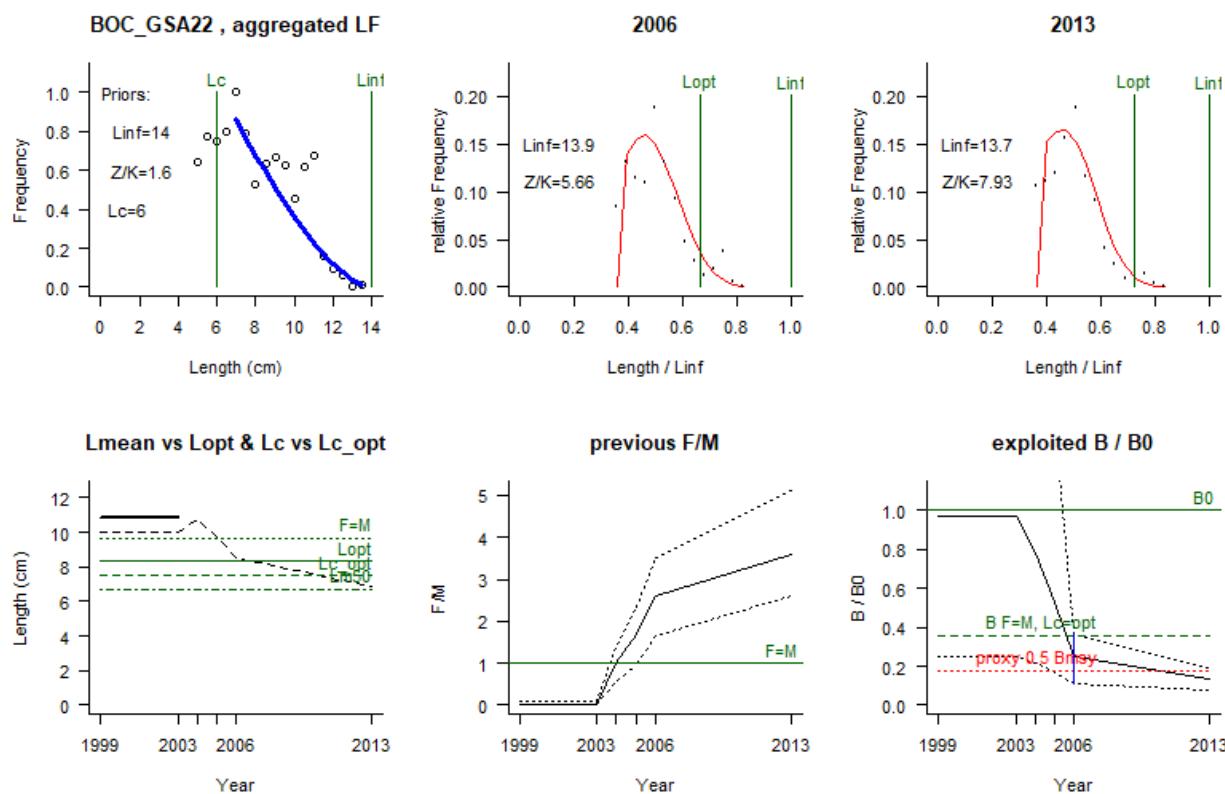
L_{inf} prior= 14, SD=0.14 cm (user-defined), $L_{max}=13.5$, median $L_{max}=11.2$
 Z/K prior = 1.6, SD=0.29, M/K prior=1.5, SD=0.15
 F/K prior = 0.0745 (wide range with $\tau=4$ in log-normal distribution)
 L_c prior = 6.12, SD=0.61 cm, alpha prior=7.97, SD=0.8, $L_{c50}=6.7$ cm

General reference points (median across years):

L_{inf} = 13.7 (13.5-14) cm
 L_{opt} = 8.3 cm, $L_{opt}/L_{inf}=0.61$
 L_c_{opt} = 7.5 cm, $L_c_{opt}/L_{inf}=0.54$, L_{mean} if $F=M$ 9.66 cm
 M/K = 1.98 (1.71-2.22)
 F/M = 2.43 (1.45-3.29), $F/K=3.64$ (2.91-4.28), $Z/K=5.15$ (4.55-5.76)
 B/B_0 = 0.31 (0.12-0.45), $B/B_0 F=M L_c=L_c_{opt} 0.36$
 Y/R' = 0.013 (0.0064-0.02), $Y/R' F=M L_c=L_c_{opt} 0.028$

Estimates for 2013 (mean of last 3 years with data):

L_{c50} = 6.92 (6.58-7.28) cm, $L_c/L_{inf}=0.5$ (0.48-0.53)
 L_{c95} = 11.7, alpha=0.62 (0.596-0.647)
 L_{mean}/L_{opt} = 0.86, $L_c/L_c_{opt}=0.93$, $L_{95th}/L_{inf}=0.82$, Mature=51%
 F/M = 3.6 (2.6-5.1), $F/K=4.7$ (4-5.4), $Z/K=6.1$ (5.5-6.7)
 Y/R' = 0.025 (0.014-0.037)
 B/B_0 = 0.13 (0.075-0.2), best LF fit year 2005=0.526 (0.17-1.5)
 B/B_{msy} = 0.37 (0.21-0.55), selected B/B_0 2006 = 0.25 (0.11-0.36)
 RF: Set $L_{inf}=14$ to include $L_{max}=13.5$; merged LF to get more points per year; set $L_{cut}=4$ to exclude early juveniles; set $L_{start}=7$ to increase prior fit; 2006 seems least problematic.



AMSY Analysis, Fri Nov 01 17:01:55 2019

Stock CAPO.APE, *Capros aper*, Boarfish

CPUE data for years 1994 - 2016, CPUE range 9.39 - 16.6, smooth = TRUE

Prior for r = Medium, 0.29 - 0.69

Used prior range for r = 0.272 - 0.735

Prior for 2006 stock status = Small, 0.1 - 0.4

Used 2006 prior B/B₀ range = 0.1 - 0.4, prior B/B_{msy} = 0.2 - 0.8

Used prior range for k_q = 39.9 - 79.8 [original range = 19.9 - 79.8]

Comment: B/B₀ prior from LBB. RF: OK

Source:

Monte Carlo filtering of r-k_q space with 50000 points and 30 error patterns.
Viable r-k_q pairs = 5003

Results:

viable r-k_q pairs = 5003

median k_q = 54.4, 38.7 - 75.4

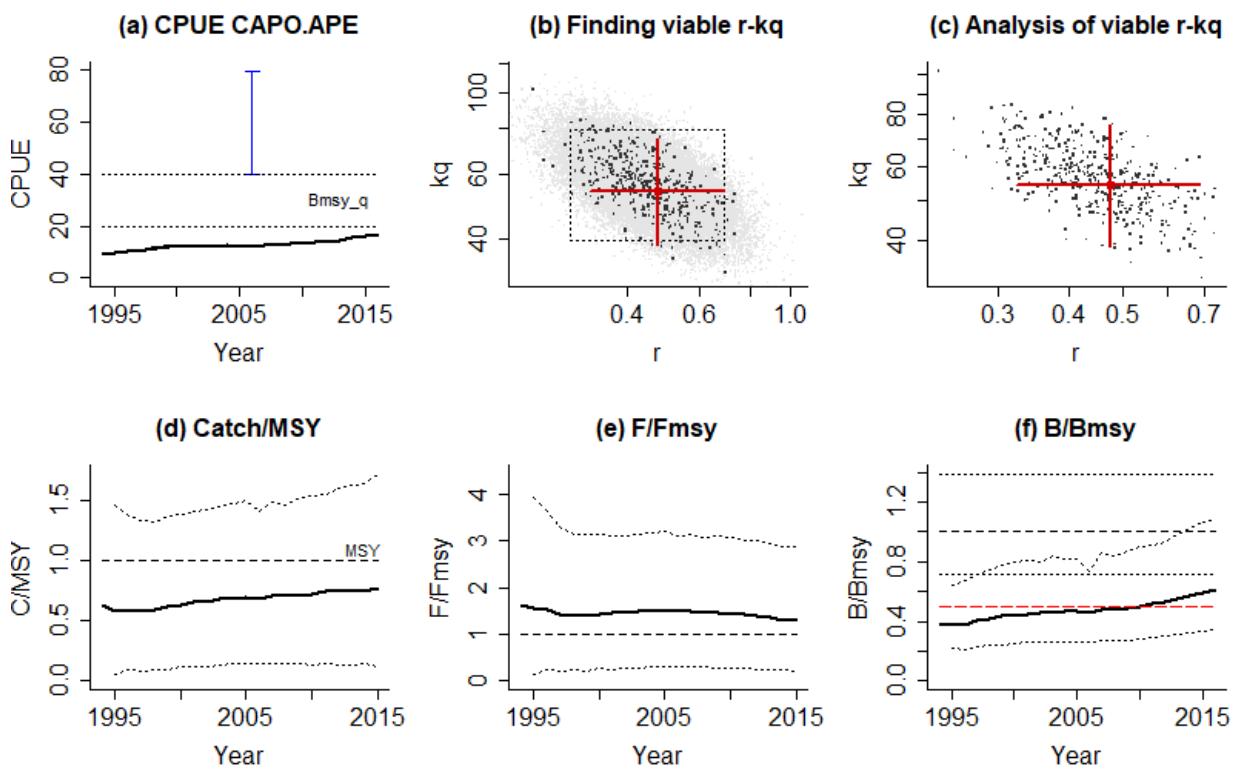
median MSY_q = 6.46, 4.45 - 9.18

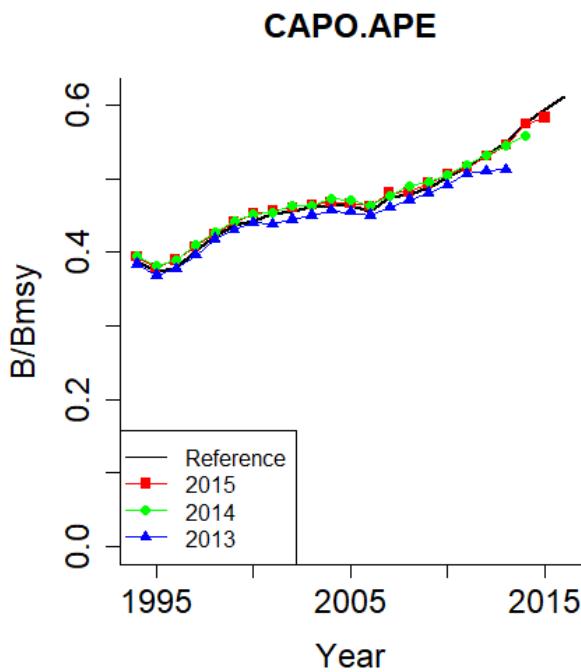
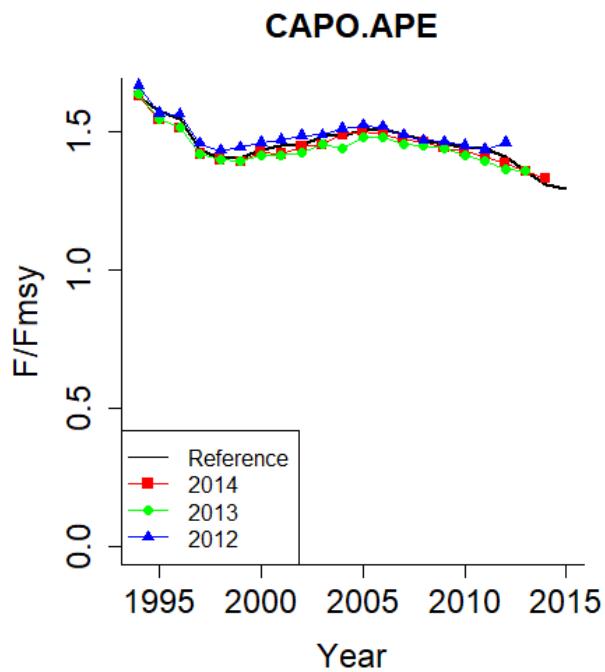
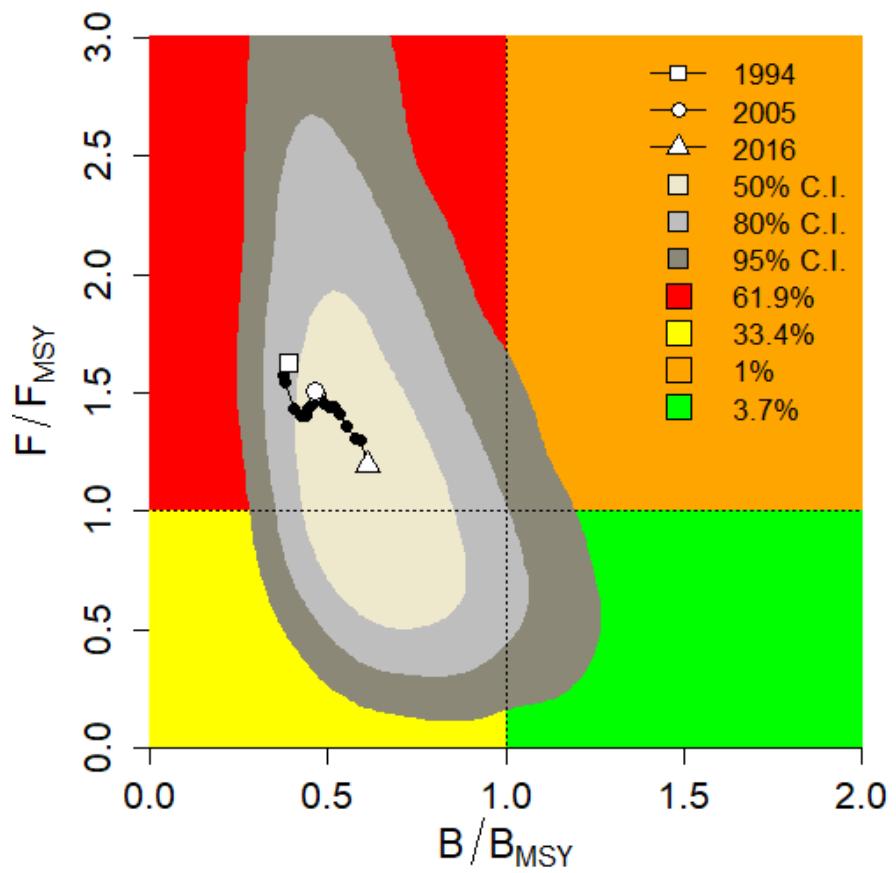
r (4 MSY_q/k_q) = 0.475, 0.323 - 0.688

F_{msy} (r/2) = 0.238, 0.162 - 0.344

F/F_{msy} = 1.3, 0.21 - 2.89 (2015)

B/B_{msy} = 0.612, 0.344 - 1.09 (2016)





LBB results for *Helicolenus dactylopterus*, stock BRF_GSA22, 1995–2016
 Files:LBB4AMSY_ID_2.csv, BRF.csv

L_{inf} prior= 36, SD=0.36 cm (user-defined), L_{max} =57, median L_{max} =32.8

Z/K prior = 2.3, SD=0.11, M/K prior=1.5, SD=0.15

F/K prior = 0.796 (wide range with tau=4 in log-normal distribution)

L_c prior = 11.2, SD=1.1 cm, alpha prior=13.7, SD=1.4, L_{m50} =NA cm

General reference points (median across years):

L_{inf} = 36 (35.4-36.7) cm

L_{opt} = 24 cm, $L_{opt}/L_{inf}=0.65$

L_c_{opt} = 19 cm, $L_c_{opt}/L_{inf}=0.54$, Lmean if $F=M$ 18.9 cm

M/K = 1.58 (1.29-1.82)

F/M = 0.829 (0.502-1.22), F/K=1.38 (1.05-1.84), Z/K=2.75 (2.5-3.02)

B/B₀ = 0.39 (0.16-0.6), B/B₀ F=M $L_c=L_c_{opt}$ 0.36

Y/R' = 0.033 (0.014-0.052), Y/R' F=M $L_c=L_c_{opt}$ 0.04

Estimates for 2016 (mean of last 3 years with data):

L_{c50} = 13 (12.4-13.5) cm, $L_c/L_{inf}=0.36$ (0.35-0.38)

L_{c95} = 21.4, alpha=0.347 (0.332-0.362)

Lmean/ L_{opt} = 0.8, $L_c/L_c_{opt}=0.67$, $L_{95th}/L_{inf}=0.9$, Mature=NA%

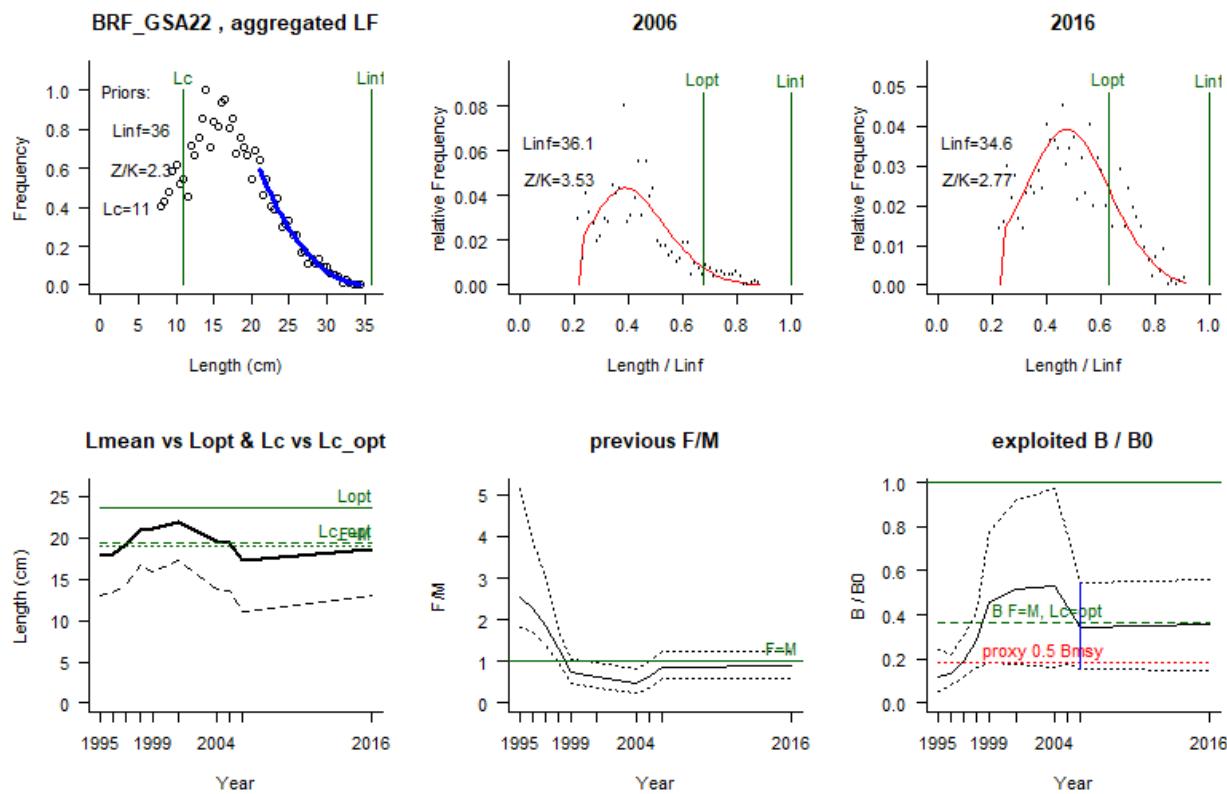
F/M = 0.89 (0.58-1.3), F/K=1.4 (1-1.7), Z/K=3 (2.7-3.3)

Y/R' = 0.031 (0.015-0.048)

B/B₀ = 0.36 (0.15-0.56), best LF fit year 2004=0.533 (0.16-0.97)

B/B_ms = 0.99 (0.41-1.5), selected B/B₀ 2006 = 0.34 (0.16-0.54)

RF: L_{max} =57 is probably an error, setting L_{inf} =36 close to several annual L_{max} ; L_m unknown for the area; set L_{cut} =8 to exclude early juveniles; excluded years with unsuitable LF patterns; 2006 possible for AMSY.



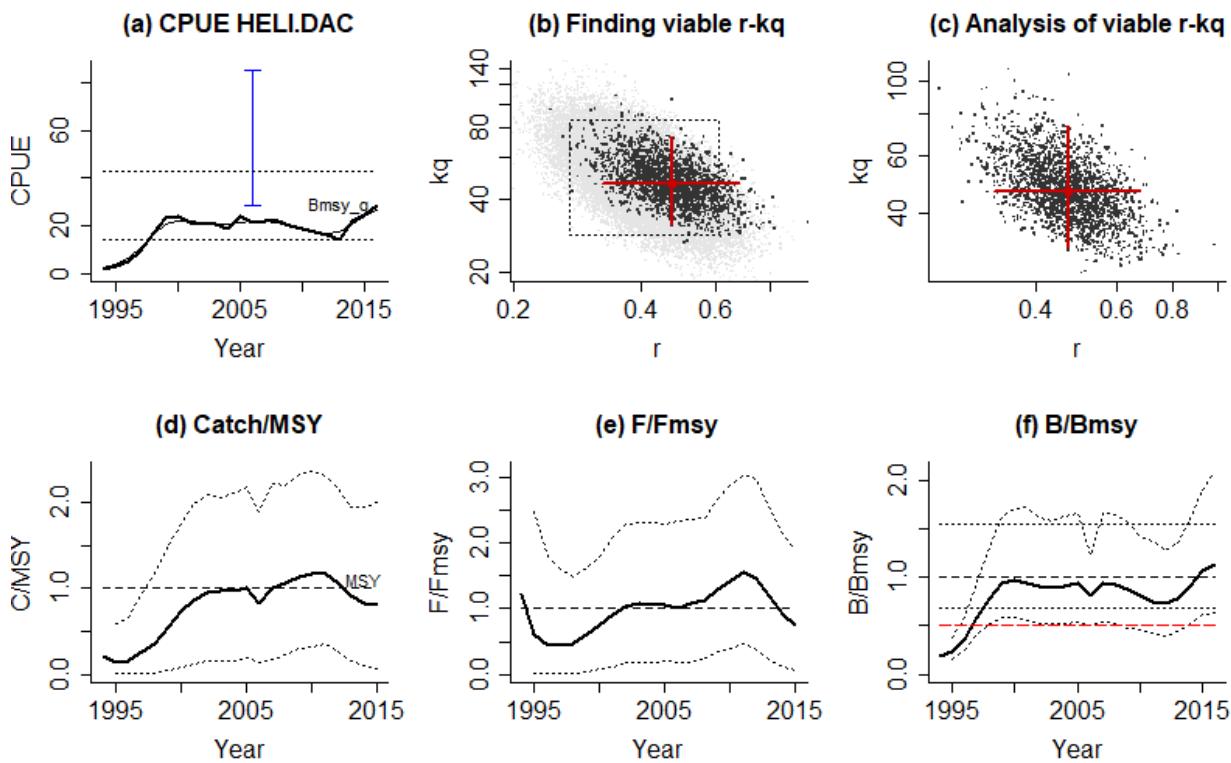
AMSY Analysis, Fri Nov 01 17:14:11 2019

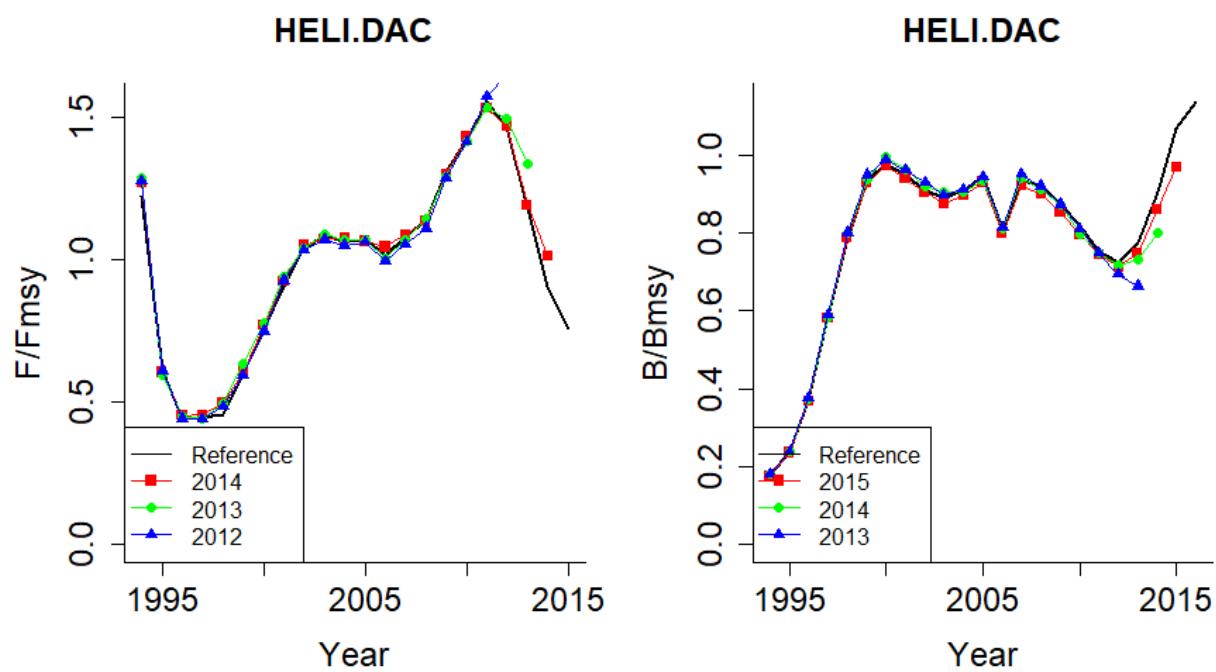
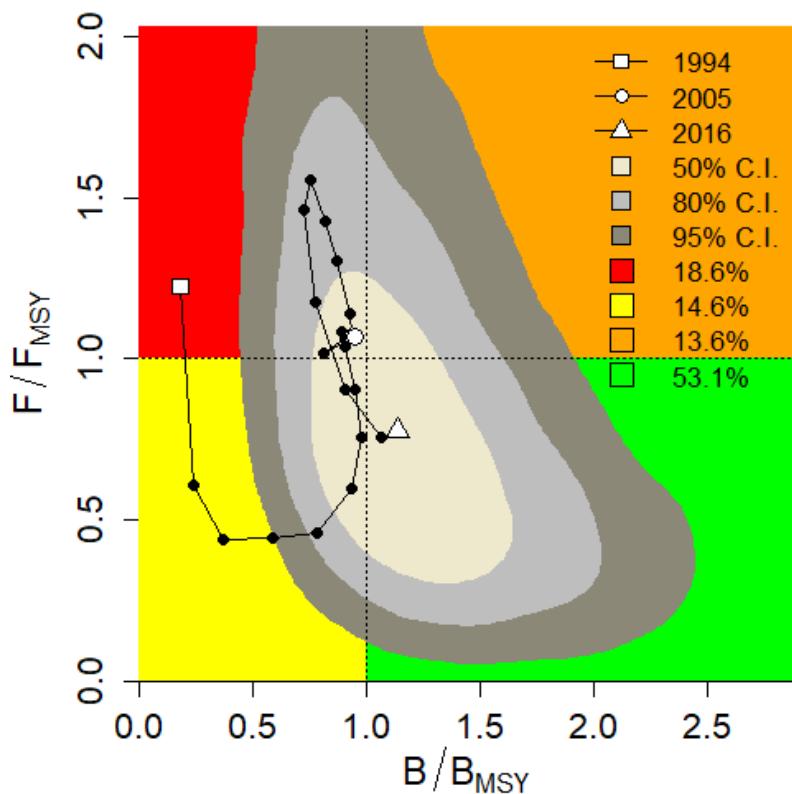
Stock HELI.DAC, *Helicolenus dactylopterus*, Blackbelly rosefish
CPUE data for years 1994 - 2016, CPUE range 2.56 - 26.5, smooth = TRUE
Prior for r = Medium, 0.27 - 0.61
Used prior range for r = 0.253 - 0.652
Prior for 2006 stock status = About half, 0.16 - 0.54
Used 2006 prior B/B0 range = 0.16 - 0.54, prior B/Bmsy = 0.32 - 1.08
Used prior range for kq = 28.6 - 85.7 [original range = 28.6 - 96.4]
Comment: B/B0 prior from LBB. RF: OK
Source:

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
Viable r-kq pairs = 2115

Results:

viable r-kq pairs = 2115
median kq = 46.9, 31.8 - 72.9
median MSYq = 5.53, 3.89 - 8.2
 r (4 MSYq/kq) = 0.472, 0.324 - 0.676
 $F_{\text{msy}} (r/2)$ = 0.236, 0.162 - 0.338
 F/F_{msy} = 0.757, 0.0695 - 1.88 (2015)
 B/B_{msy} = 1.14, 0.633 - 2.1 (2016)





LBB results for *Citharus lingeatus*, stock CIL_GSA22, 1994-2016
 Files: Stock_ID_Greece2.csv, CIL.csv

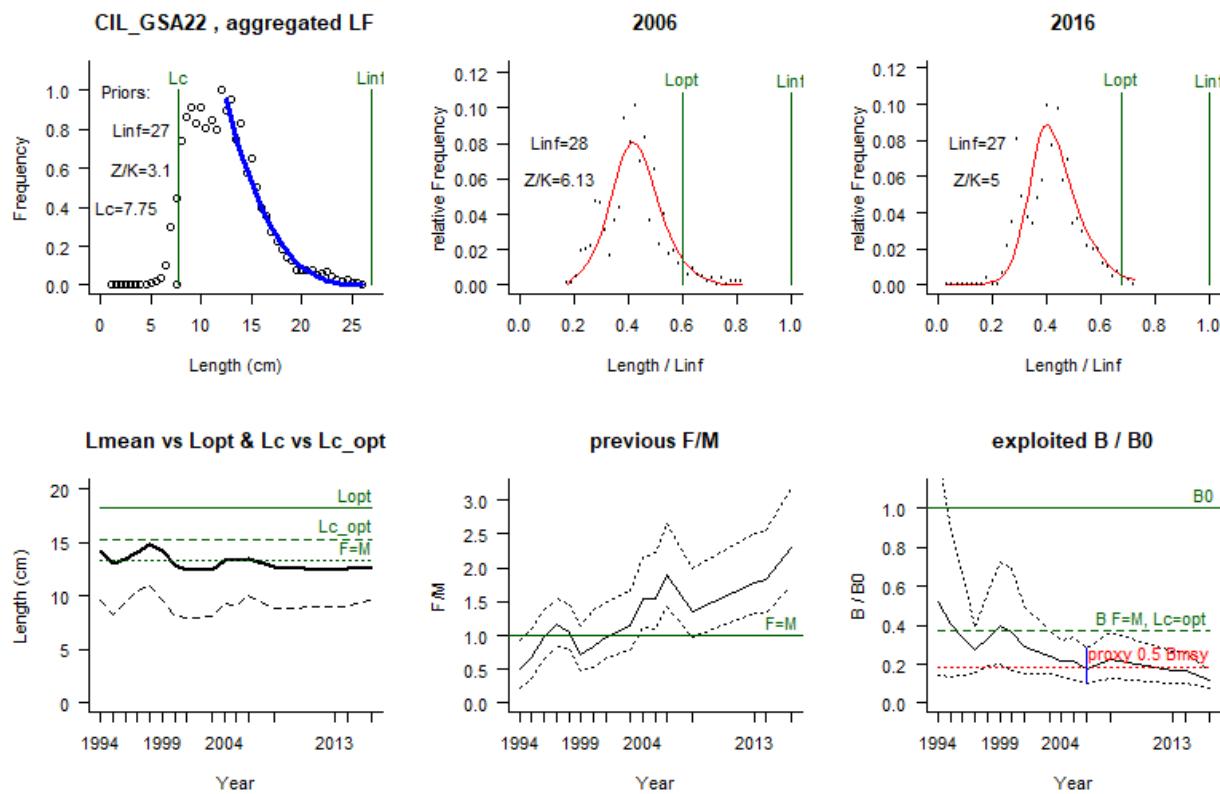
Linf prior= 27, SD=0.27 cm (user-defined), Lmax=33.5, median Lmax=25.2
 Z/K prior = 3.1, SD=0.13, M/K prior=1.5, SD=0.15
 F/K prior = 1.65 (wide range with tau=4 in log-normal distribution)
 Lc prior = 7.91, SD=0.79 cm, alpha prior=32.9, SD=3.3, Lm50=NA cm

General reference points (median across years):

Linf = 26.9 (26.5-27.4) cm
 Lopt = 18 cm, Lopt/Linf=0.68
 Lc_opt = 15 cm, Lc_opt/Linf=0.57, Lmean if F=M 13.3 cm
 M/K = 1.42 (1.12-1.73)
 F/M = 1.07 (0.768-1.58), F/K=1.59 (1.3-1.94), Z/K=3 (2.79-3.25)
 B/B0 = 0.26 (0.14-0.4), B/B0 F=M Lc=Lc_opt 0.37
 Y/R' = 0.036 (0.018-0.061), Y/R' F=M LC=Lc_opt 0.05

Estimates for 2016 (mean of last 3 years with data):

Lc50 = 9.55 (9.4-9.69) cm, Lc/Linf=0.35 (0.35-0.36)
 Lc95 = 12.1, alpha=1.16 (1.13-1.2)
 Lmean/Lopt= 0.7, Lc/Lc_opt=0.62, L95th=20.3 cm, L95th/Linf=0.75, Mature=NA%
 F/M = 2.3 (1.7-3.2), F/K=3.3 (2.9-3.8), Z/K=4.8 (4.5-5.1)
 Y/R' = 0.019 (0.013-0.028)
 B/B0 = 0.12 (0.077-0.17), best LF fit year 2016=0.118 (0.077-0.17)
 B/Bmsy = 0.32 (0.21-0.46), selected B/B0 2006 = 0.18 (0.1-0.28)
 RF: Set Linf=27 close to median=26 below max=33. Selected 2006 because of reasonable LF fit and reasonable B/B0, compared to adjacent estimates.



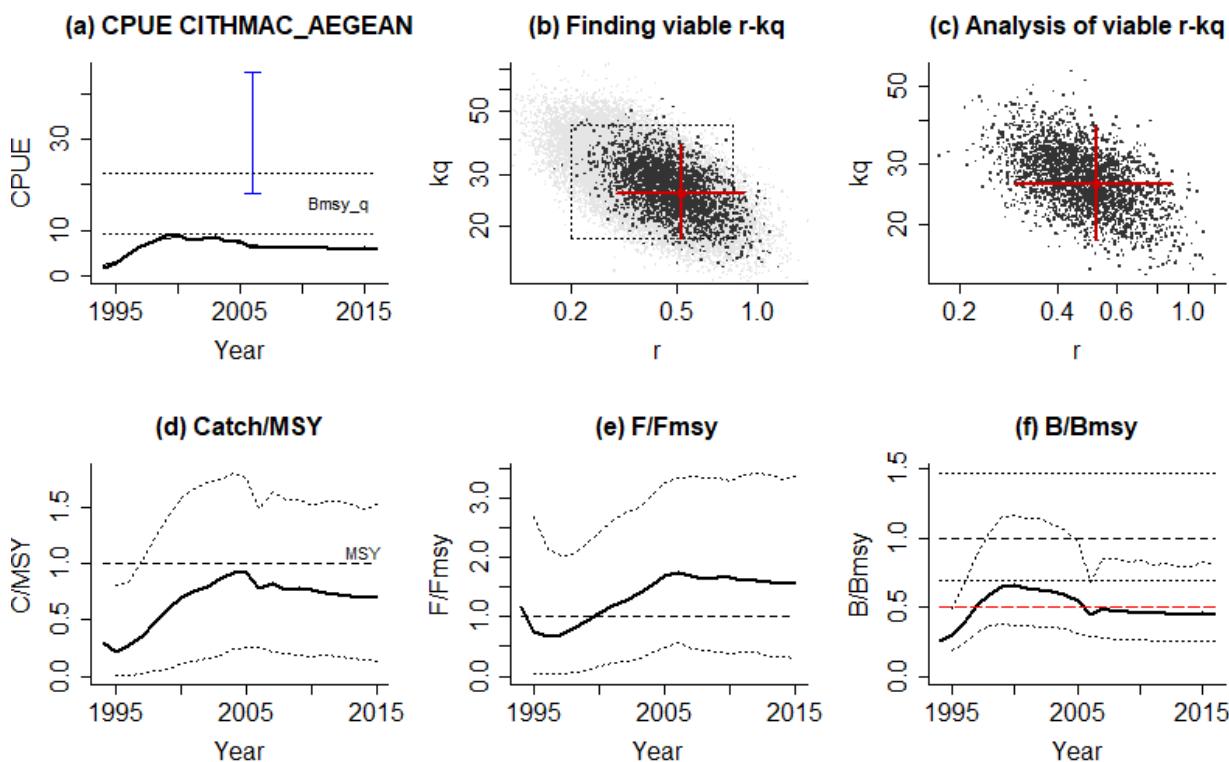
AMSY Analysis, Fri Nov 01 17:22:35 2019

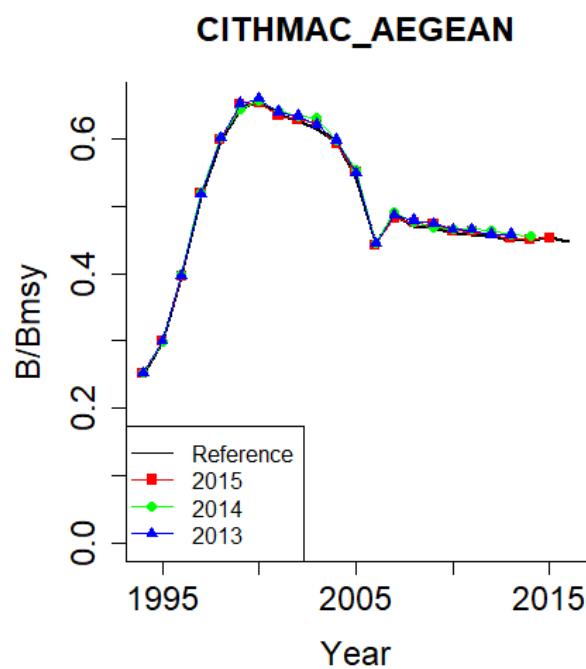
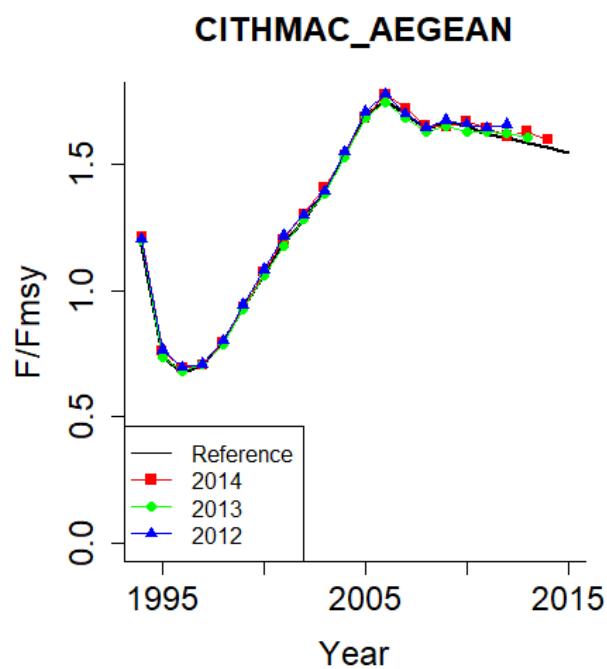
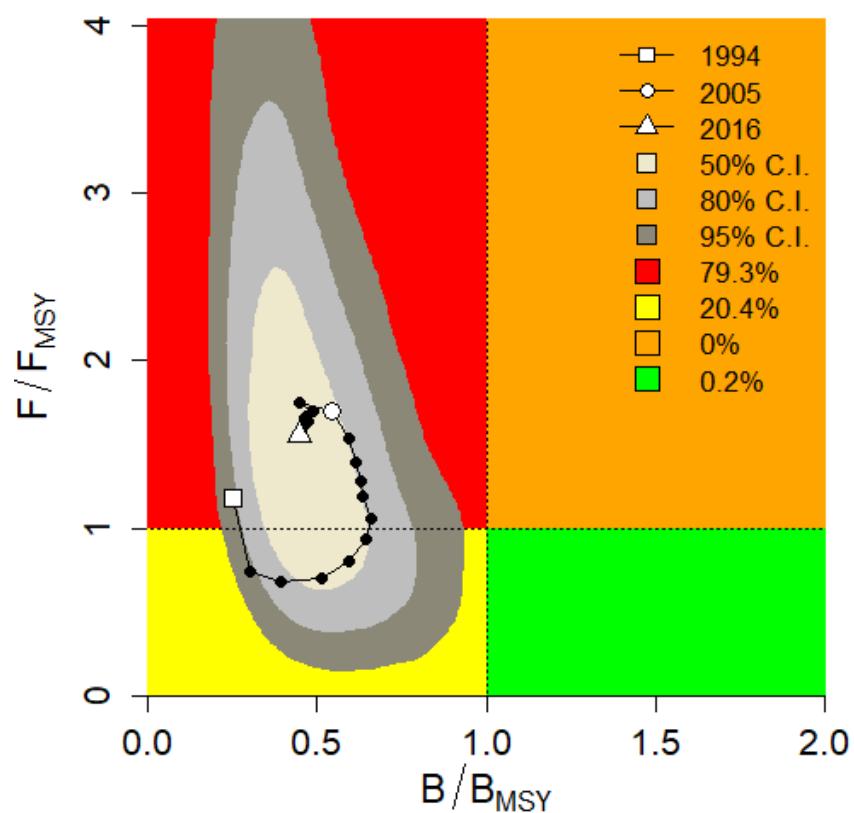
Stock CITHMAC_AEGEAN, *Citharus linguatula*, Spotted flounder
CPUE data for years 1994 - 2016, CPUE range 2.24 - 8.34, smooth = TRUE
Prior for r = Medium, NA - NA
Used prior range for r = 0.2 - 0.8
Prior for 2006 stock status = Small, 0.12 - 0.3
Used 2006 prior B/B₀ range = 0.12 - 0.3, prior B/B_{msy} = 0.24 - 0.6
Used prior range for kq = 18 - 44.9 [original range = 18 - 44.9]
Comment: B/B₀ prior from LBB. RF: OK
Source:

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
Viable r-kq pairs = 5000

Results:

viable r-kq pairs = 5000
median kq = 26, 18 - 38.3
median MSYq = 3.39, 2.03 - 5.49
r (4 MSYq/kq) = 0.521, 0.295 - 0.887
F_{msy} (r/2) = 0.26, 0.147 - 0.443
F/F_{msy} = 1.55, 0.307 - 3.36 (2015)
B/B_{msy} = 0.447, 0.251 - 0.803 (2016)





LBB results for *Hymenocephalus italicus*, stock HYS_GSA22, 1999-2014
 Files: Stock_ID_Greece2.csv, HYS.csv

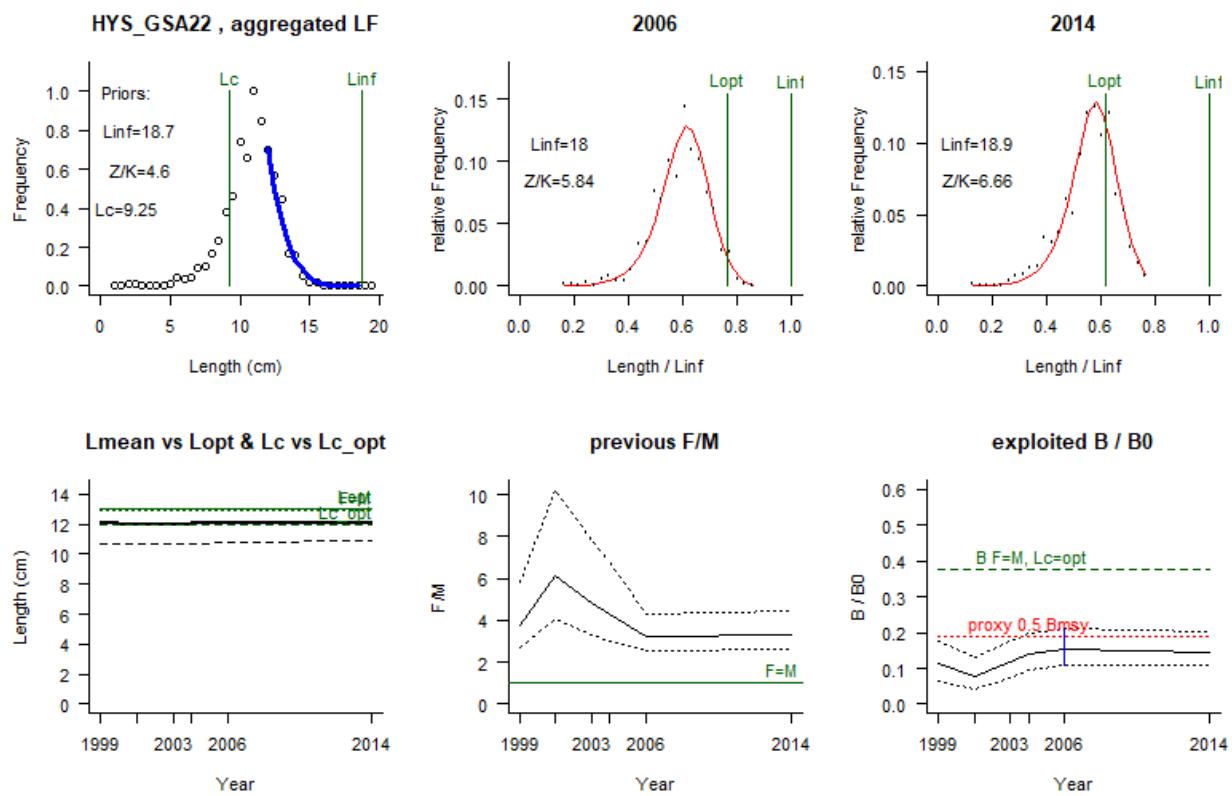
Linf prior= 18.7, SD=0.19 cm Lmax=21, median Lmax=18.8
 Z/K prior = 4.6, SD=3.5, M/K prior=1.5, SD=0.15
 F/K prior = 3.14 (wide range with tau=4 in log-normal distribution)
 Lc prior = 9.44, SD=0.94 cm, alpha prior=23.7, SD=2.4, Lm50=NA cm

General reference points (median across years):

Linf = 18.4 (18.1-18.7) cm
 Lopt = 13 cm, Lopt/Linf=0.71
 Lc_opt = 12 cm, Lc_opt/Linf=0.65, Lmean if F=M 12.9 cm
 M/K = 1.26 (1.02-1.47)
 F/M = 3.2 (2.47-4.61), F/K=4.41 (3.87-5.06), Z/K=5.61 (5.1-6.23)
 B/B0 = 0.14 (0.098-0.2), B/B0 F=M Lc=Lc_opt 0.38
 Y/R' = 0.031 (0.021-0.05) (reduced: B/B0<0.25), Y/R' F=M Lc=Lc_opt 0.059

Estimates for 2014 (mean of last 3 years with data):

Lc50 = 10.9 (10.7-11) cm, Lc/Linf=0.58 (0.58-0.59)
 Lc95 = 13.6, alpha=1.08 (1.05-1.12)
 Lmean/Lopt= 0.95, Lc/Lc_opt=0.91, L95th=15.2 cm, L95th/Linf=0.82, Mature=NA%
 F/M = 3.3 (2.7-4.4), F/K=4.4 (3.9-5), Z/K=5.8 (5.3-6.4)
 Y/R' = 0.032 (0.023-0.045) (reduced because B/B0 < 0.25)
 B/B0 = 0.15 (0.11-0.2), best LF fit year 2004=0.141 (0.098-0.2)
 B/Bmsy = 0.39 (0.29-0.54), selected B/B0 2006 = 0.15 (0.11-0.21)
 RF: Set Linf=Lmax=21, close to median=18.5. Excluded years with unrealistic LF fits. Selected 2006 because of good LF fit and reasonable B/B0 compared to adjacent estimates.



File FirstAss_ID_4.csv read successfully

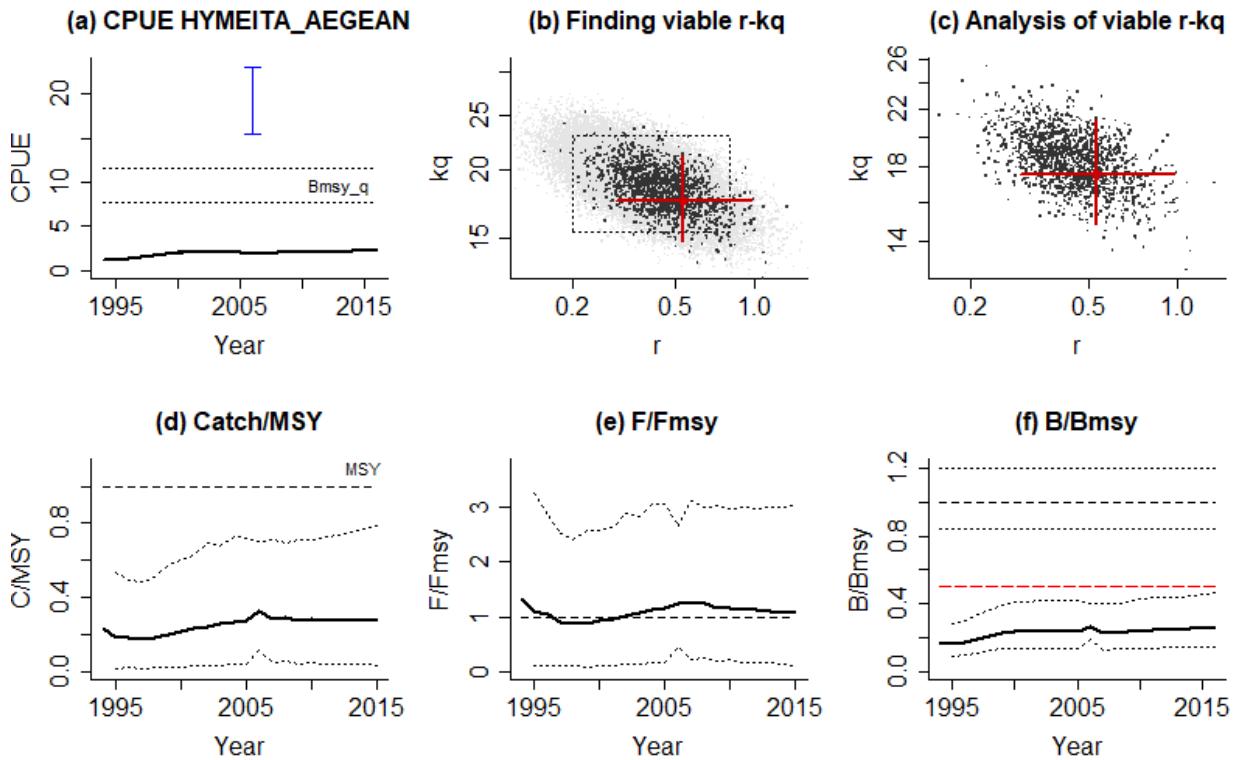
AMSY Analysis, Fri Nov 01 17:30:01 2019

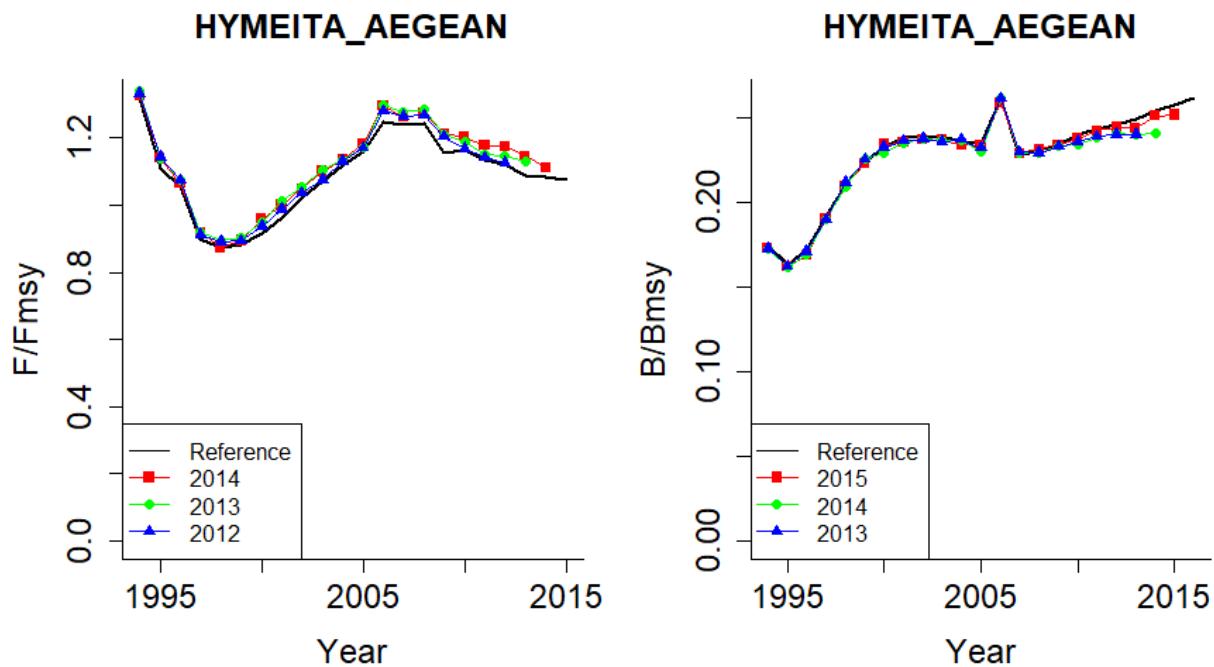
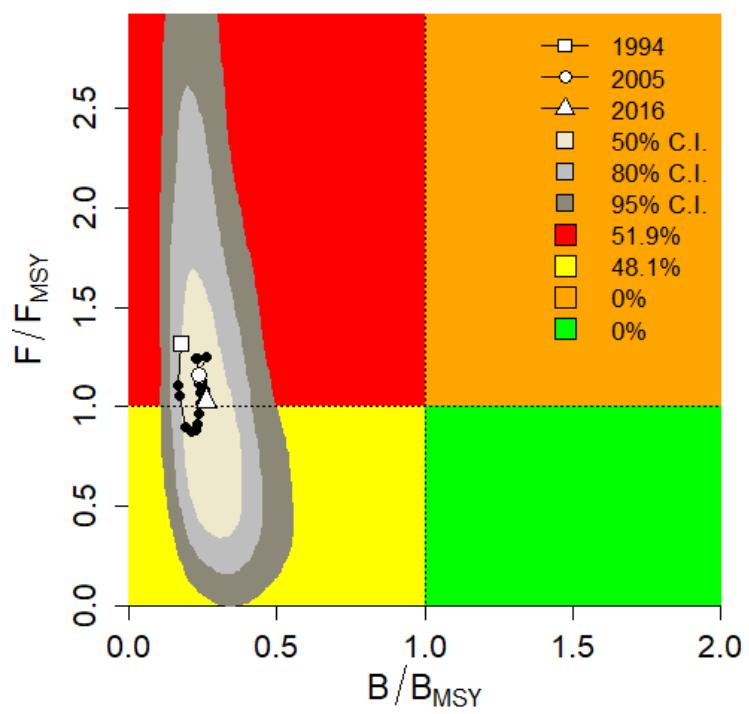
Stock HYMEITA_AEGEAN, *Hymenocephalus italicus*, Glasshead grenadier
CPUE data for years 1994 - 2016, CPUE range 1.22 - 2.3, smooth = TRUE
Prior for r = Medium, NA - NA
Used prior range for r = 0.2 - 0.8
Prior for 2006 stock status = Very small, 0.1 - 0.22
Used 2006 prior B/B₀ range = 0.1 - 0.22, prior B/B_{msy} = 0.2 - 0.44
Used prior range for k_q = 15.4 - 23.1 [original range = 7.7 - 16.9]
Comment: B/B₀ prior from LBB. RF: OK
Source:

Monte Carlo filtering of r-k_q space with 50000 points and 30 error patterns.
Viable r-k_q pairs = 5000

Results:

viable r-k_q pairs = 5000
median k_q = 17.6, 14.8 - 21.2
median MSY_q = 2.34, 1.39 - 3.91
r (4 MSY_q/k_q) = 0.533, 0.294 - 0.975
F_{msy} (r/2) = 0.267, 0.147 - 0.488
F/F_{msy} = 1.07, 0.111 - 3.05 (2015)
B/B_{msy} = 0.262, 0.147 - 0.471 (2016)





LBB results for *Scorpaena notata*, stock SNQ_GSA22, 1996-2014
 Files: Stock_ID_Greece2.csv, SNQ.csv

L_{inf} prior= 19, SD=0.19 cm (user-defined), $L_{max}=20$, median $L_{max}=17.5$
 Z/K prior = 2.3, SD=0.22, M/K prior=1.5, SD=0.15

F/K prior = 0.763 (wide range with $\tau=4$ in log-normal distribution)

L_c prior = 8.93, SD=0.89 cm, alpha prior=19.6, SD=2, $L_{m50}=NA$ cm

General reference points (median across years):

L_{inf} = 18.8 (18.5-19.1) cm

L_{opt} = 12 cm, $L_{opt}/L_{inf}=0.66$

L_c_{opt} = 11 cm, $L_c_{opt}/L_{inf}=0.6$, Lmean if $F=M$ 13.4 cm

M/K = 1.57 (1.32-1.86)

F/M = 2.69 (1.33-3.69), $F/K=4.35$ (2.3-4.99), $Z/K=5.81$ (3.93-6.42)

B/B_0 = 0.24 (0.13-0.33), $B/B_0 F=M L_c=L_c_{opt}$ 0.36

Y/R' = 0.035 (0.024-0.049)(reduced: $B/B_0 < 0.25$), $Y/R' F=M L_c=L_c_{opt}$ 0.041

Estimates for 2014 (mean of last 3 years with data):

L_{c50} = 12.4 (12.2-12.9) cm, $L_c/L_{inf}=0.68$ (0.67-0.7)

L_{c95} = 15.5, alpha=0.953 (0.888-0.986)

L_{mean}/L_{opt} = NA, $L_c/L_c_{opt}=1.1$, $L_{95th}/L_{inf}=0.88$, Mature=NA%

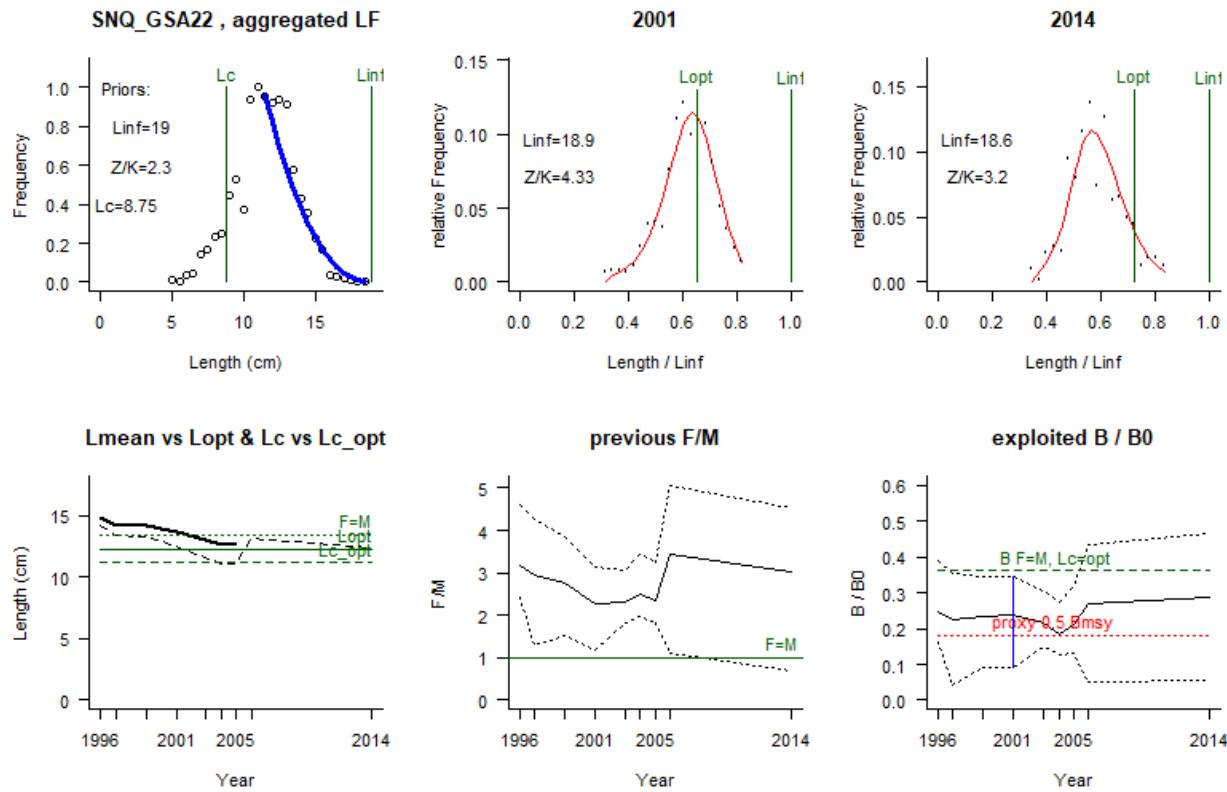
F/M = 3 (0.71-4.5), $F/K=7.2$ (1-10), $Z/K=9$ (2.6-12)

Y/R' = 0.041 (0.021-0.065)(reduced because $B/B_0 < 0.25$)

B/B_0 = 0.29 (0.055-0.47), best LF fit year 2001=0.236 (0.093-0.35)

B/B_{msy} = 0.79 (0.15-1.3), selected B/B_0 2001 = 0.24 (0.093-0.35)

RF: Set $L_{inf}=19$ between median18 and max 20. Excluded years with unreasonable LF fits. Selected 2001 because of good fit and reasonable B/B_0 compared to adjacent estimates.



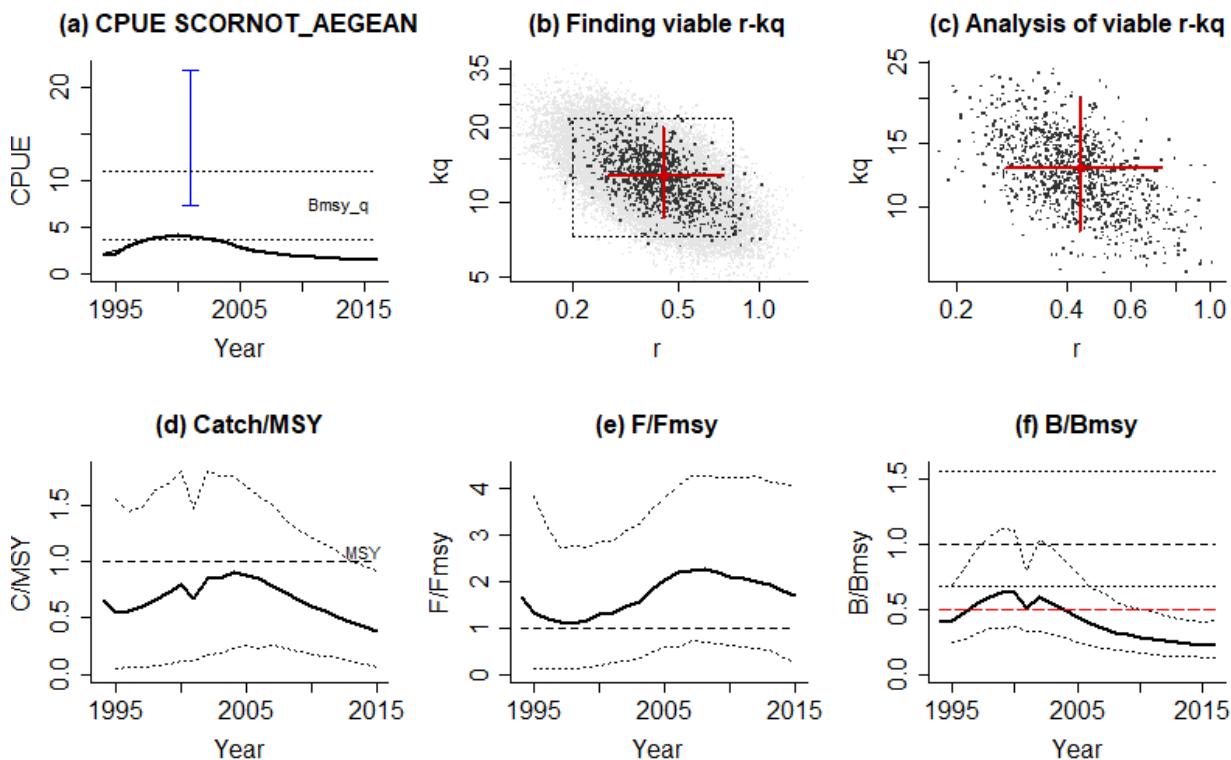
AMSY Analysis, Fri Nov 01 17:33:46 2019

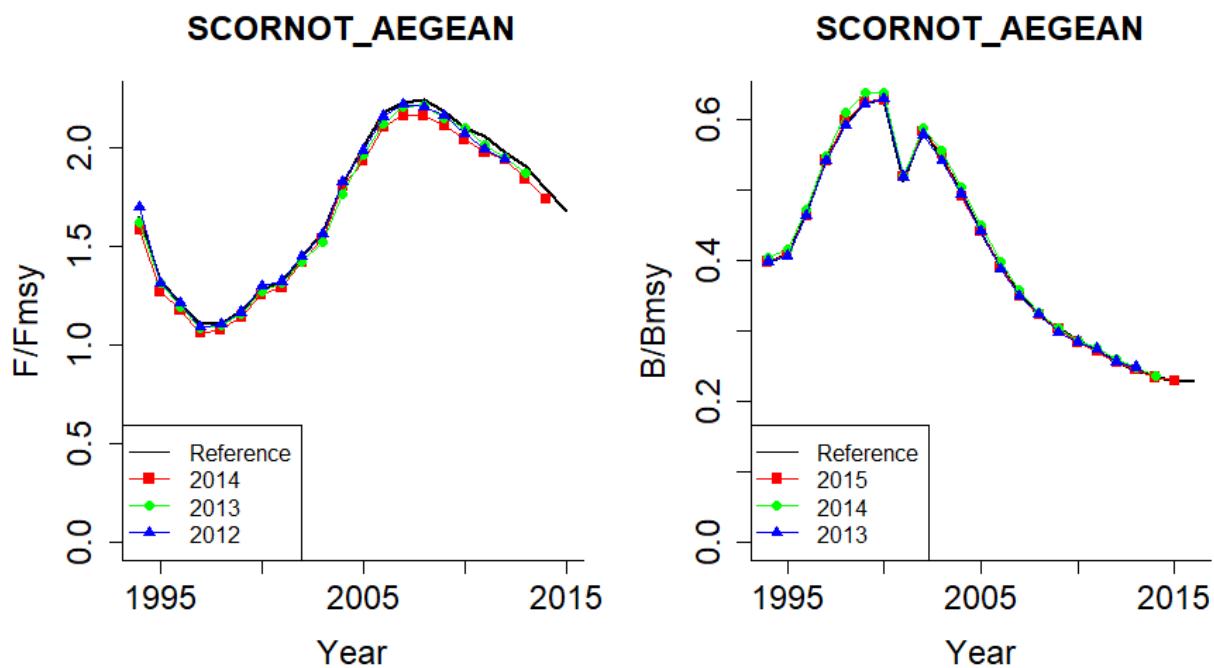
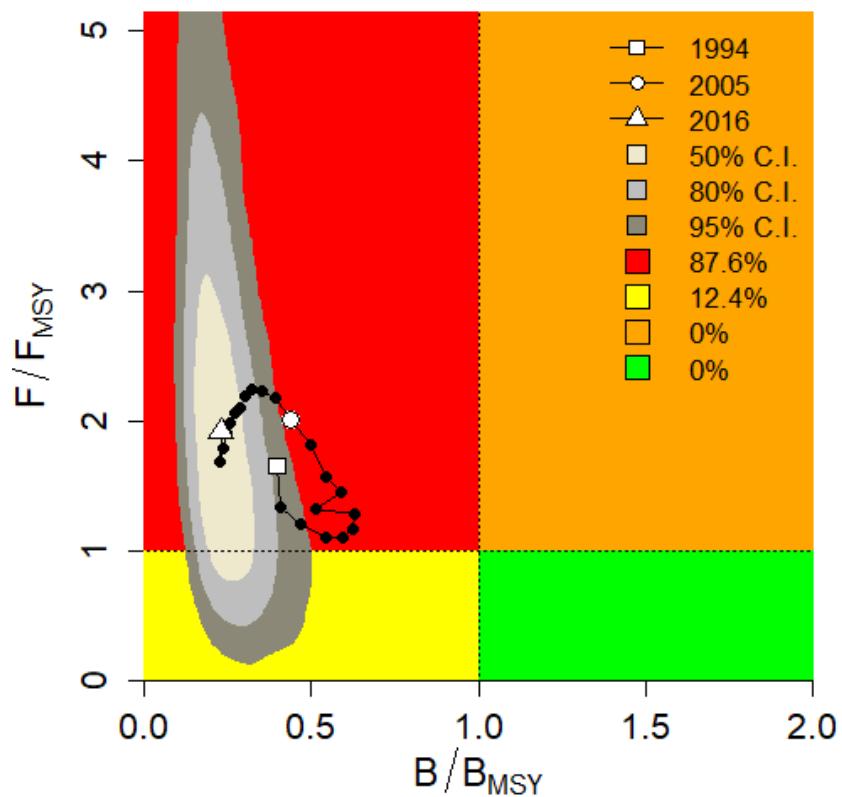
Stock SCORNOT_AEGEAN, *Scorpaena notata*, Small red scorpionfish
CPUE data for years 1994 - 2016, CPUE range 1.46 - 4, smooth = TRUE
Prior for r = Medium, NA - NA
Used prior range for r = 0.2 - 0.8
Prior for 2001 stock status = Small, 0.09 - 0.35
Used 2001 prior B/B₀ range = 0.09 - 0.35, prior B/B_{msy} = 0.18 - 0.7
Used prior range for kq = 7.28 - 21.8 [original range = 7.28 - 28.3]
Comment: B/B₀ prior from LBB. RF: OK
Source:

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
Viable r-kq pairs = 5001

Results:

viable r-kq pairs = 5001
median kq = 12.8, 8.64 - 20
median MSY_q = 1.41, 0.879 - 2.25
r (4 MSY_q/kq) = 0.441, 0.269 - 0.734
F_{msy} (r/2) = 0.22, 0.135 - 0.367
F/F_{msy} = 1.68, 0.264 - 4.03 (2015)
B/B_{msy} = 0.229, 0.127 - 0.409 (2016)





Cyprus

LBB results for *Merluccius merluccius*, stock Merl_mer_CY, 2012-2017
 Files:LBB4AMSY_ID_2.csv, Merl_mer_CY.csv

Linf prior= 55, SD=0.55 cm (user-defined), Lmax=54, median Lmax=50

Z/K prior = 5.3, SD=0.71, M/K prior=1.5, SD=0.15

F/K prior = 3.81 (wide range with tau=4 in log-normal distribution)

Lc prior = 19.6, SD=2 cm, alpha prior=14.9, SD=1.5, Lm50=27 cm

General reference points (median across years):

Linf = 55.3 (54.4-56.4) cm

Lopt = 37 cm, Lopt/Linf=0.68

Lc_opt = 33 cm, Lc_opt/Linf=0.6, Lmean if F=M 27.4 cm

M/K = 1.44 (1.16-1.68)

F/M = 2.02 (1.57-2.87), F/K=2.83 (2.48-3.29), Z/K=4.24 (3.96-4.57)

B/B0 = 0.13 (0.087-0.19), B/B0 F=M Lc=Lc_opt 0.37

Y/R' = 0.022 (0.015-0.029) (reduced: B/B0<0.25), Y/R' F=M Lc=Lc_opt 0.047

Estimates for 2017 (mean of last 3 years with data):

Lc50 = 19.7 (19.2-20.1) cm, Lc/Linf=0.36 (0.35-0.36)

Lc95 = 28.7, alpha=0.327 (0.313-0.338)

Lmean/Lopt= 0.72, Lc/Lc_opt=0.59, L95th/Linf=0.96, Mature=21%

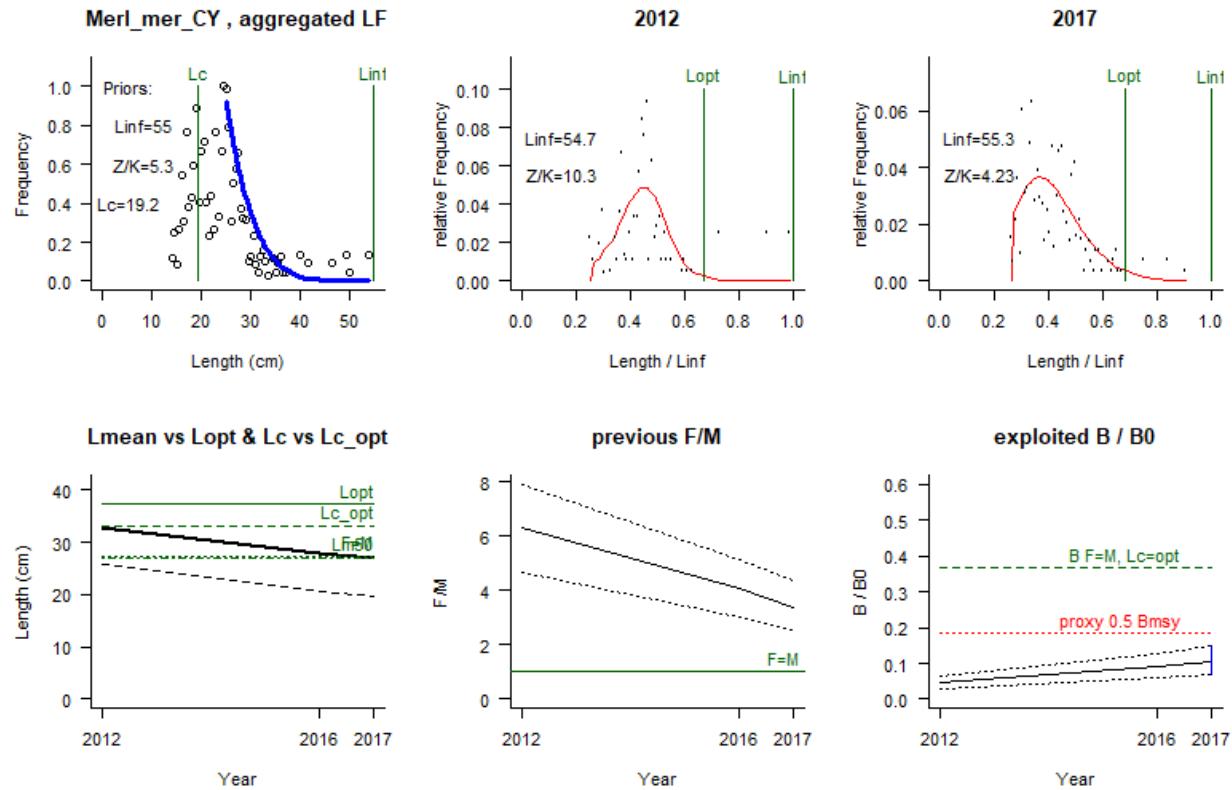
F/M = 3.4 (2.5-4.4), F/K=4.8 (4.1-5.5), Z/K=6.2 (5.6-6.9)

Y/R' = 0.018 (0.012-0.025) (reduced because B/B0 < 0.25)

B/B0 = 0.11 (0.071-0.15), best LF fit year 2017=0.107 (0.071-0.15)

B/Bmsy = 0.29 (0.19-0.41), selected B/B0 2017 = 0.11 (0.071-0.15)

RF: set Linf to 55, between median 50.2 and max 59.5. Set Lcut=14 to exclude early juveniles. Set Lstart=25 to improve fit to aggregated data. Merged LF to increase data per year. 2017 selected for AMSY.



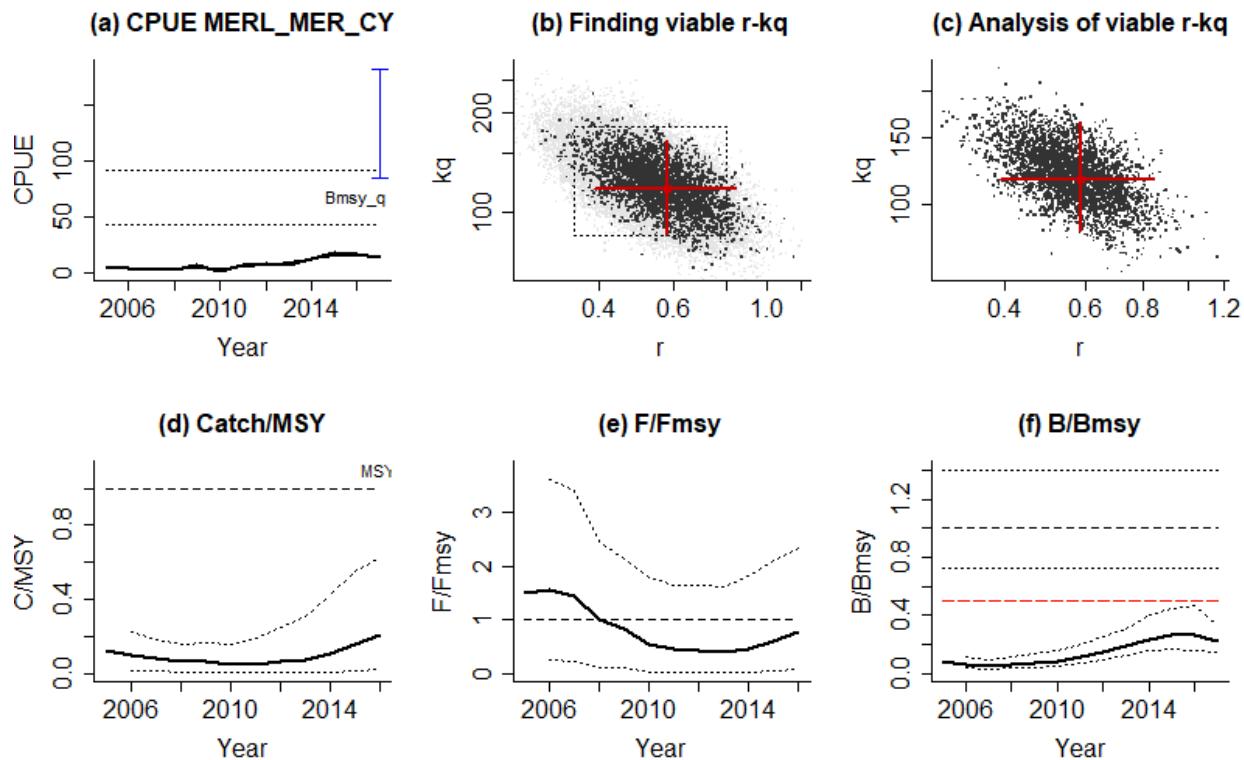
AMSY Analysis, Fri Nov 01 17:37:03 2019
 Warning: Retrospective analysis not meaningful and omitted if B/k prior is in the final year(s)

Stock MERL_MER_CY, *Merluccius merluccius*, European hake
 CPUE data for years 2005 - 2017, CPUE range 2.94 - 15.1, smooth = TRUE
 Prior for r = Medium, 0.35 - 0.8
 Used prior range for r = 0.327 - 0.851
 Prior for 2017 stock status = Very small, 0.07 - 0.15
 Used 2017 prior B/B0 range = 0.07 - 0.15, prior B/Bmsy = 0.14 - 0.3
 Used prior range for kq = 84.9 - 182 [original range = 84.9 - 182]
 Comment: B/B0 prior from LBB. RF: OK
 Source:

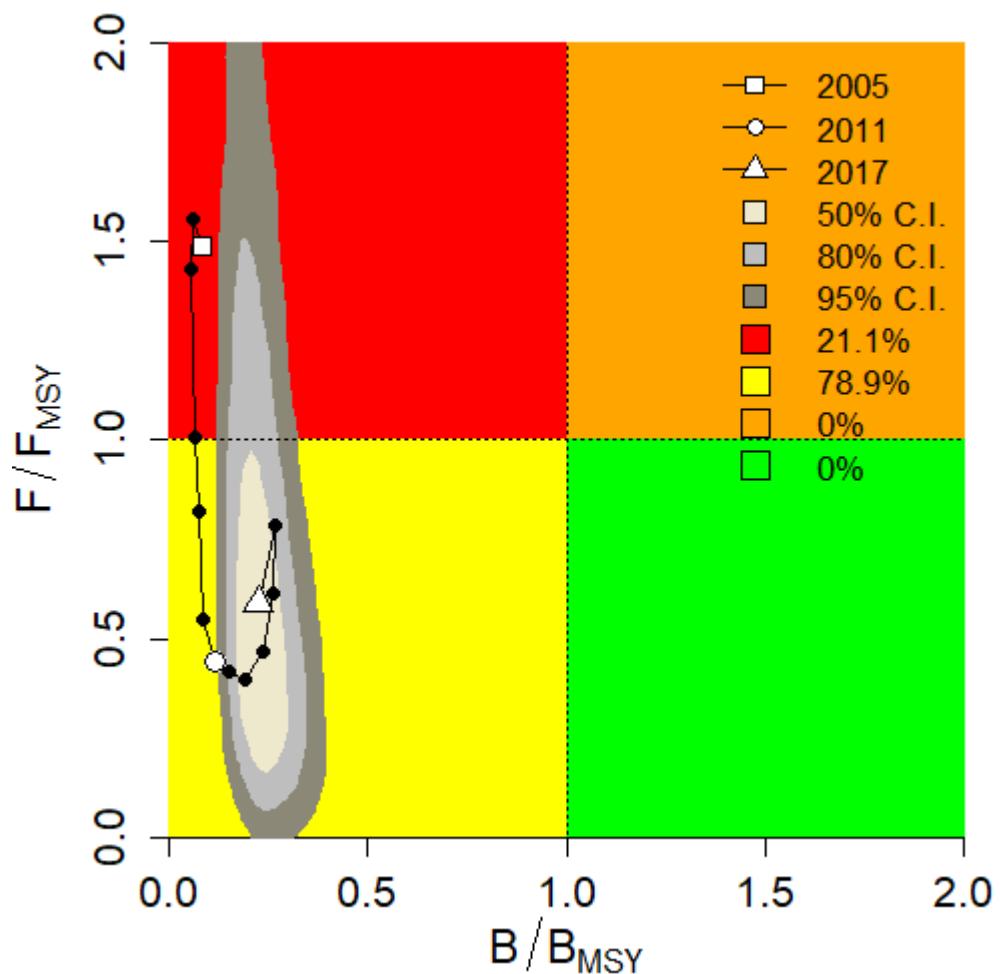
Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
 Viable r-kq pairs = 5000

Results:

viable r-kq pairs	= 5000
median kq	= 117, 85.2 - 164
median MSYq	= 17.1, 12.2 - 23.9
r (4 MSYq/kq)	= 0.584, 0.39 - 0.842
Fmsy (r/2)	= 0.292, 0.195 - 0.421
F/Fmsy	= 0.785, 0.07 - 2.35 (2016)
B/Bmsy	= 0.224, 0.146 - 0.333 (2017)



AMSY Kobe plot for MERL_MERL_CY, *Merluccius merluccius* in Cyprus



LBB results for *Sepia officinalis*, stock SEPIOFF_CY, 2005-2017
 Files:LBB4AMSY_ID_2.csv, SEPIOFF_CY.csv

L_{inf} prior= 12, SD=0.12 cm (user-defined), $L_{max}=12$, median $L_{max}=10.2$
 Z/K prior = 3.4, SD=0.65, M/K prior=1.5, SD=0.15

F/K prior = 1.86 (wide range with tau=4 in log-normal distribution)

L_c prior = 6.63, SD=0.66 cm, alpha prior=17.4, SD=1.7, $L_{m50}=9$ cm

General reference points (median across years):

L_{inf} = 11.9 (11.8-12.1) cm

L_{opt} = 9.2 cm, $L_{opt}/L_{inf}=0.77$

L_c _opt = 8.6 cm, L_c _opt/ $L_{inf}=0.72$, Lmean if F=M 9.35 cm

M/K = 0.877 (0.591-1.15)

F/M = 3.77 (2.58-6), F/K=3.12 (2.57-3.58), Z/K=3.95 (3.55-4.39)

B/B₀ = 0.13 (0.076-0.23), B/B₀ F=M $L_c=L_c$ _opt 0.4

Y/R' = 0.057 (0.025-0.092) (reduced: B/B₀<0.25), Y/R' F=M $L_c=L_c$ _opt 0.093

Estimates for 2017 (mean of last 3 years with data):

L_{c50} = 7.98 (7.82-8.11) cm, $L_c/L_{inf}=0.65$ (0.64-0.66)

L_{c95} = 10.4, alpha=1.2 (1.16-1.23)

Lmean/ L_{opt} = 1, L_c/L_c _opt=0.93, L95th= $L_{inf}=11.2$ cm, L95th/ $L_{inf}=0.91$, Mature=15%

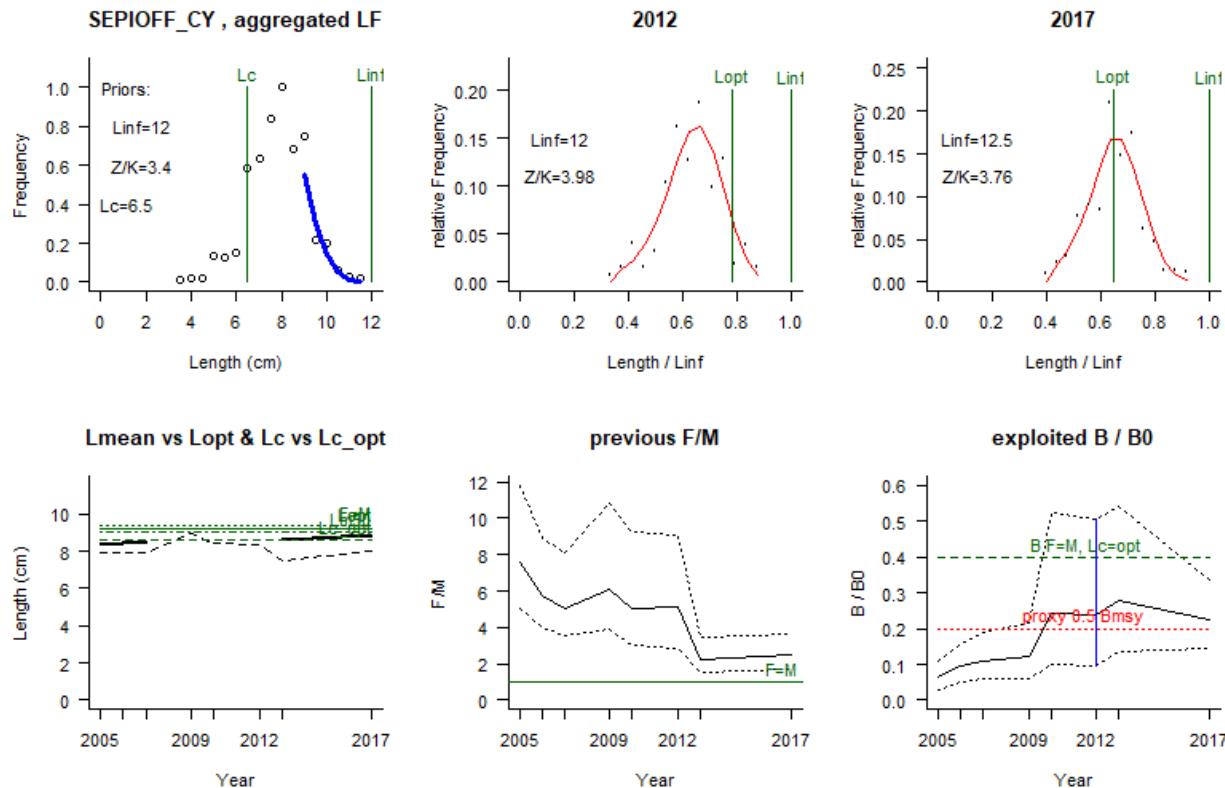
F/M = 2.5 (1.7-3.6), F/K=2.7 (2.2-3.1), Z/K=3.9 (3.5-4.3)

Y/R' = 0.053 (0.032-0.08) (reduced because B/B₀ < 0.25)

B/B₀ = 0.23 (0.14-0.34), best LF fit year 2010=0.245 (0.1-0.52)

B/B_ms = 0.57 (0.36-0.85), selected B/B₀ 2012 = 0.24 (0.094-0.5)

RF: Set $L_{inf}=12$ with median 10.5 and L_{max} 12. Merged LF to get more data per year. Discarded years with unsuitable LFs. Chose 2012 for AMSY prior because of good fit with reasonable CL.



AMSY Analysis, Fri Nov 01 17:42:28 2019

Stock SEPIOFF_CY, *Sepia officinalis*, common cuttlefish

CPUE data for years 2005 - 2017, CPUE range 0.477 - 1.35, smooth = TRUE

Prior for r = Medium, 0.37 - 0.84

Used prior range for r = 0.346 - 0.897

Prior for 2012 stock status = Small, 0.09 - 0.5

Used 2012 prior B/B₀ range = 0.09 - 0.5, prior B/B_msy = 0.18 - 1

Used prior range for kq = 1.15 - 3.45 [original range = 0.829 - 4.6]

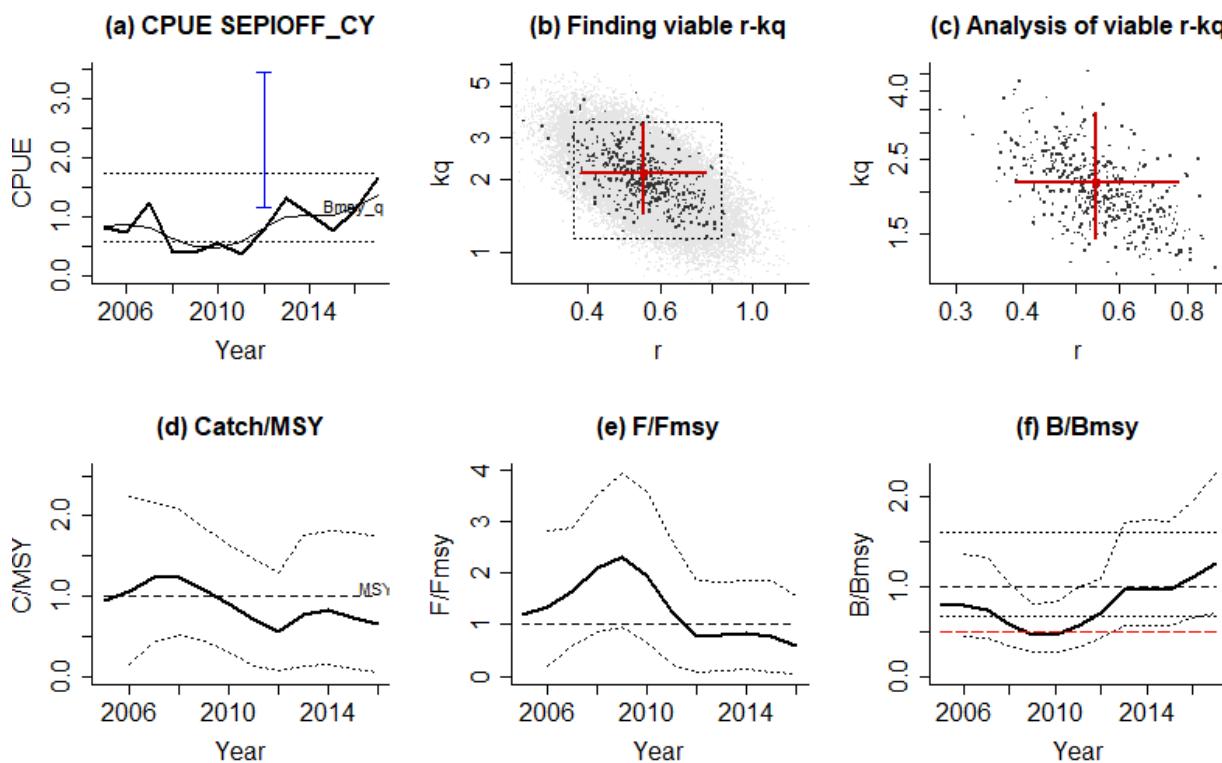
Comment: B/B₀ prior from LBB. RF: OK

Source:

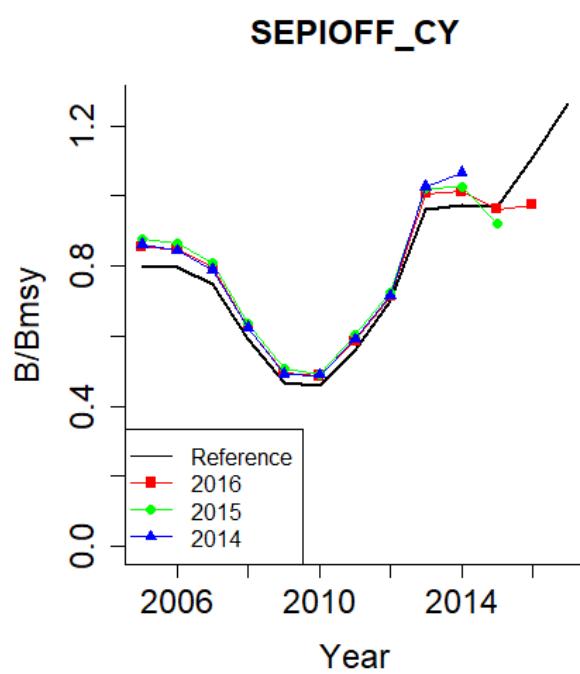
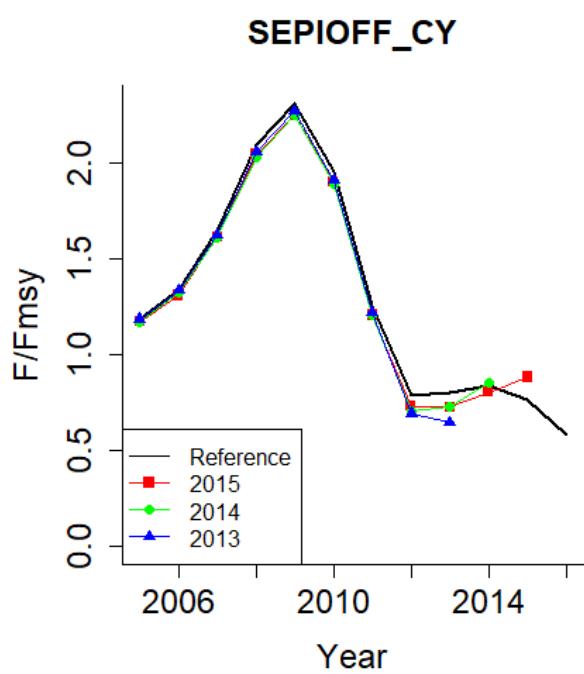
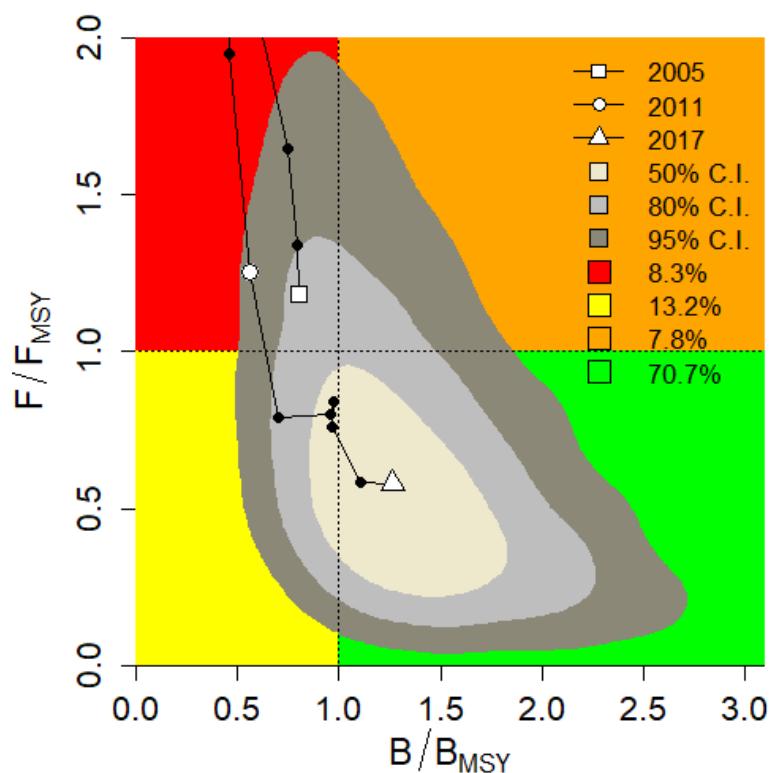
Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
Viable r-kq pairs = 5010

Results:

viable r-kq pairs	= 5010
median kq	= 2.13, 1.44 - 3.42
median MSY _q	= 0.29, 0.204 - 0.448
r (4 MSY _q /kq)	= 0.544, 0.385 - 0.768
F _{msy} (r/2)	= 0.272, 0.193 - 0.384
F/F _{msy}	= 0.583, 0.0444 - 1.57 (2016)
B/B _{msy}	= 1.26, 0.708 - 2.27 (2017)



AMSY Kobe plot and retrospective analysis for *Sepia officinalis* in Cyprus



North Sea

LBB results for *Agonus cataphractus*, stock *Agonus cataphractus*, 1983-2017
 Files:LBB4AMSY_ID_3.csv, LBB_June042019_Agonus cataphractus.csv

L_{inf} prior= 18, SD=0.18 cm (user-defined), $L_{max}=22$, median $L_{max}=15$

Z/K prior = 3.6, SD=0.056, M/K prior=1.5, SD=0.15

F/K prior = 2.12 (wide range with tau=4 in log-normal distribution)

L_c prior = 8.67, SD=0.87 cm, alpha prior=18.9, SD=1.9, $L_{m50}=NA$ cm

General reference points (median across years):

L_{inf} = 18 (17.6-18.3) cm

L_{opt} = 12 cm, $L_{opt}/L_{inf}=0.66$

L_{c_opt} = 10 cm, $L_{c_opt}/L_{inf}=0.58$, Lmean if F=M 12 cm

M/K = 1.57 (1.28-1.82)

F/M = 1.99 (1.46-2.69), F/K=3.08 (2.6-3.63), Z/K=4.6 (4.15-5.06)

B/B₀ = 0.21 (0.14-0.31), B/B₀ F=M $L_c=L_{c_opt}$ 0.37

Y/R' = 0.036 (0.022-0.053)(reduced: B/B₀<0.25), Y/R' F=M $L_c=L_{c_opt}$ 0.041

Estimates for 2017 (mean of last 3 years with data):

L_{c50} = 10.9 (10.6-11.3) cm, $L_c/L_{inf}=0.62$ (0.6-0.64)

L_{c95} = 15.3, alpha=0.681 (0.654-0.712)

Lmean/ L_{opt} = 1.1, $L_c/L_{c_opt}=1$, $L_{95th}/L_{inf}=0.88$, Mature=NA%

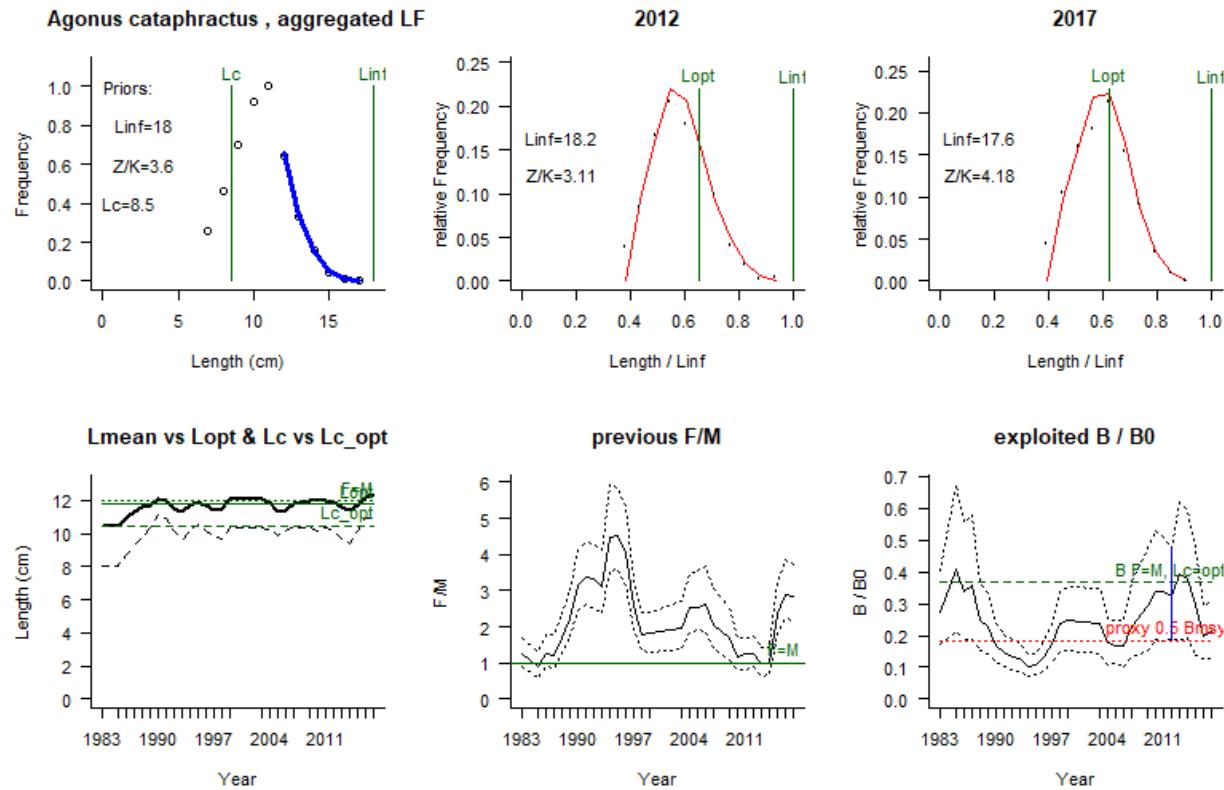
F/M = 2.8 (2.2-3.7), F/K=4.2 (3.5-5.1), Z/K=5.9 (5.2-6.7)

Y/R' = 0.031 (0.019-0.045)(reduced because B/B₀ < 0.25)

B/B₀ = 0.21 (0.13-0.31), best LF fit year 1996=0.132 (0.088-0.18)

B/B_{msy} = 0.58 (0.35-0.84), selected B/B₀ 2012 = 0.32 (0.19-0.47)

RF: Uses SMFS 2017 data. Set Lcut to 7 cm to avoid early juveniles. Set L_{inf} to 18 cm between median=15 and max=22. Merged LFs of subsequent years to reduce variability.



AMSY Analysis, Fri Nov 01 17:46:47 2019

Stock *Agonus cataphractus*, *Agonus cataphractus*, Hooknose

CPUE data for years 1983 - 2017, CPUE range 0.37 - 0.739, smooth = TRUE

Prior for r = Medium, NA - NA

Used prior range for r = 0.2 - 0.8

Prior for 2012 stock status = About half, 0.19 - 0.47

Used 2012 prior B/B₀ range = 0.19 - 0.47, prior B/B_{msy} = 0.38 - 0.94

Used prior range for k_q = 1.22 - 2.02 [original range = 0.815 - 2.02]

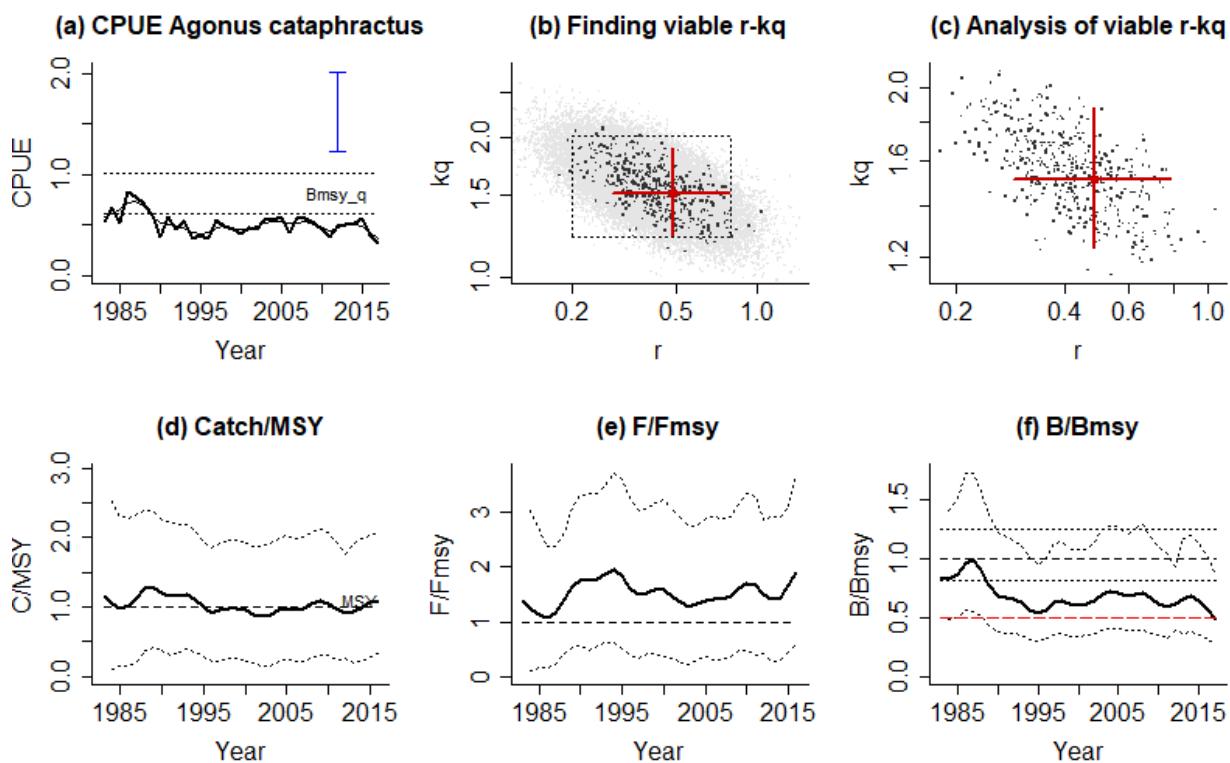
Comment: B/B₀ prior from LBB. RF: OK

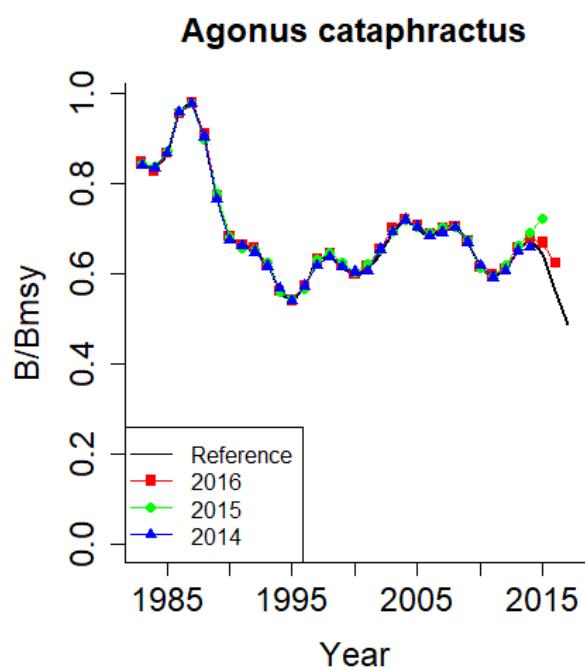
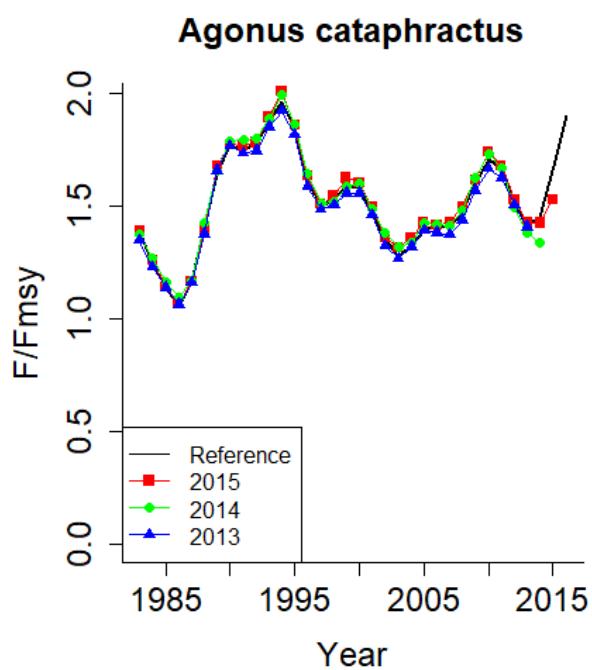
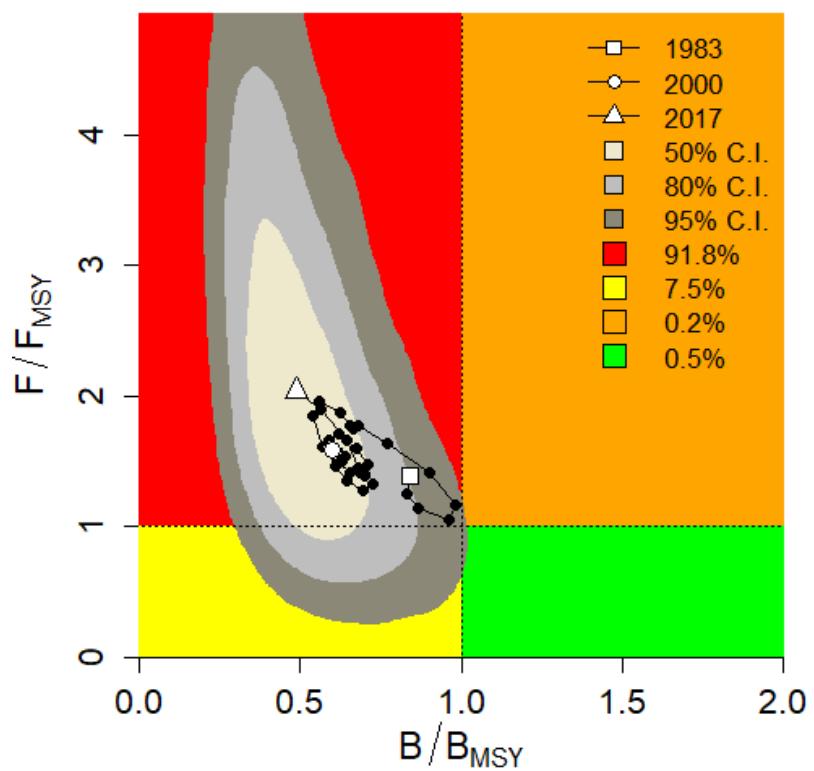
Source: SMFS 2017

Monte Carlo filtering of r-k_q space with 50000 points and 30 error patterns.
Viable r-k_q pairs = 5001

Results:

viable r-k _q pairs	= 5001
median k _q	= 1.52, 1.23 - 1.88
median MSY _q	= 0.184, 0.12 - 0.278
r (4 MSY _q /k _q)	= 0.485, 0.287 - 0.783
F _{msy} (r/2)	= 0.243, 0.143 - 0.391
F/F _{msy}	= 1.9, 0.585 - 3.68 (2016)
B/B _{msy}	= 0.487, 0.272 - 0.858 (2017)





LBB results for *Amblyraja radiata*, stock ***Amblyraja radiata***, 1983-2017
 Files:LBB4AMSY_ID_3.csv, LBB_June052019_Amblyraja radiata.csv

Linf prior= 75, SD=0.75 cm (user-defined), Lmax=82, median Lmax=58

Z/K prior = 3.4, SD=0.46, M/K prior=1.5, SD=0.15

F/K prior = 1.9 (wide range with tau=4 in log-normal distribution)

Lc prior = 20.4, SD=2 cm, alpha prior=11.8, SD=1.2, Lm50=46 cm

General reference points (median across years):

Linf = 73.8 (72.6-75.1) cm

Lopt = 50 cm, Lopt/Linf=0.68

Lc_opt = 48 cm, Lc_opt/Linf=0.65, Lmean if F=M 50.4 cm

M/K = 1.39 (1.14-1.64)

F/M = 5.74 (4.36-8.33), F/K=8.23 (7.14-9.33), Z/K=9.25 (8.36-10.4)

B/B0 = 0.066 (0.042-0.1), B/B0 F=M Lc=Lc_opt 0.37

Y/R' = 0.012 (0.0083-0.016)(reduced: B/B0<0.25), Y/R' F=M Lc=Lc_opt 0.048

Estimates for 2017 (mean of last 3 years with data):

Lc50 = 40 (38.9-41) cm, Lc/Linf=0.54 (0.53-0.56)

Lc95 = 58.8, alpha=0.156 (0.152-0.161)

Lmean/Lopt = 0.86, Lc/Lc_opt=0.83, L95th=57.3 cm, L95th/Linf=0.78, Mature=6.3%

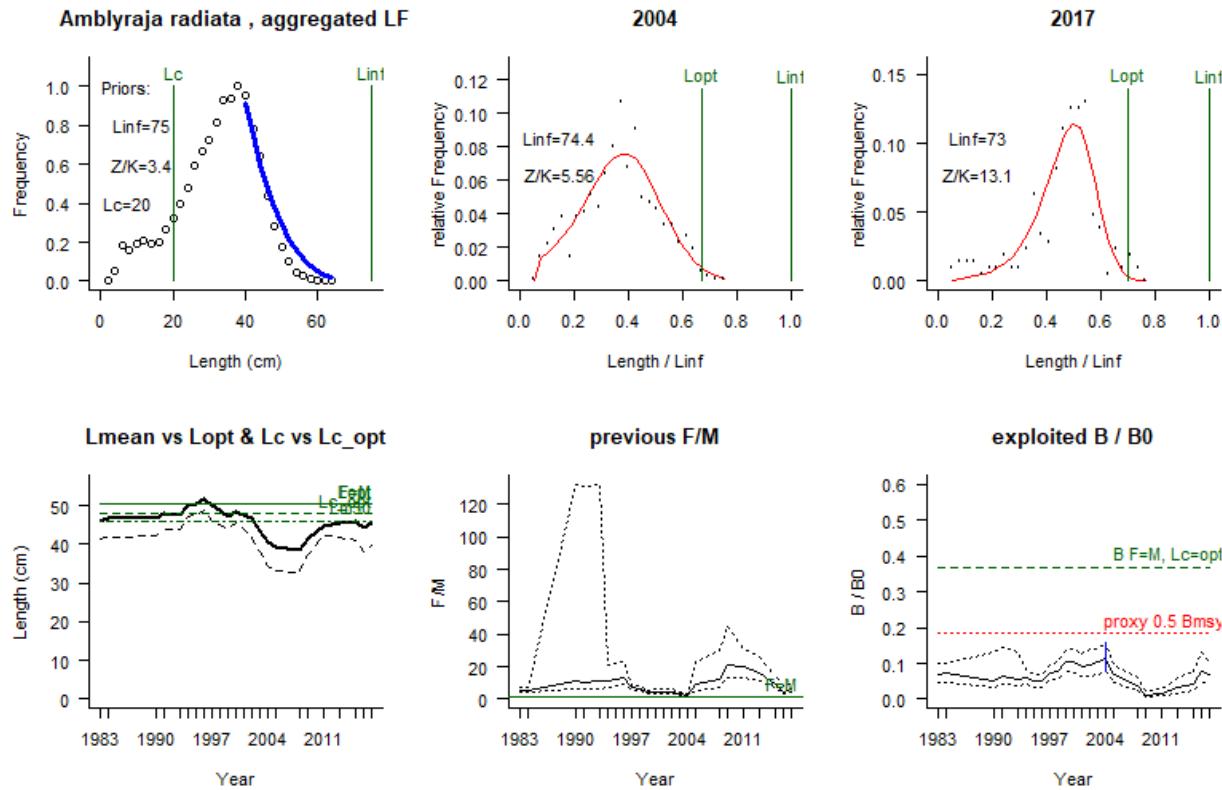
F/M = 6.4 (4.7-8.9), F/K=7.2 (6.2-8.4), Z/K=8.4 (7.4-9.5)

Y/R' = 0.015 (0.0098-0.024)(reduced because B/B0 < 0.25)

B/B0 = 0.071 (0.046-0.11), best LF fit year 1983=0.0695 (0.046-0.1)

B/Bmsy = 0.19 (0.12-0.29), selected B/B0 2004 = 0.11 (0.078-0.16)

RF: Set Lstart=40 to avoid error in prior fit. Set Linf=75 between Lmax=82 and Lmedian=58. Selected 2004 for reasonable fit and CLS.



AMSY Analysis, Fri Nov 01 17:50:42 2019

Stock *Amblyraja radiata*, *Amblyraja radiata*, Starry ray

CPUE data for years 1983 - 2017, CPUE range 10.5 - 27.6, smooth = TRUE

Prior for r = Low, NA - NA

Used prior range for r = 0.05 - 0.5

Prior for 2004 stock status = Very small, 0.08 - 0.16

Used 2004 prior B/B₀ range = 0.08 - 0.16, prior B/B_{MSY} = 0.16 - 0.32

Used prior range for kq = 78.6 - 157 [original range = 78.6 - 157]

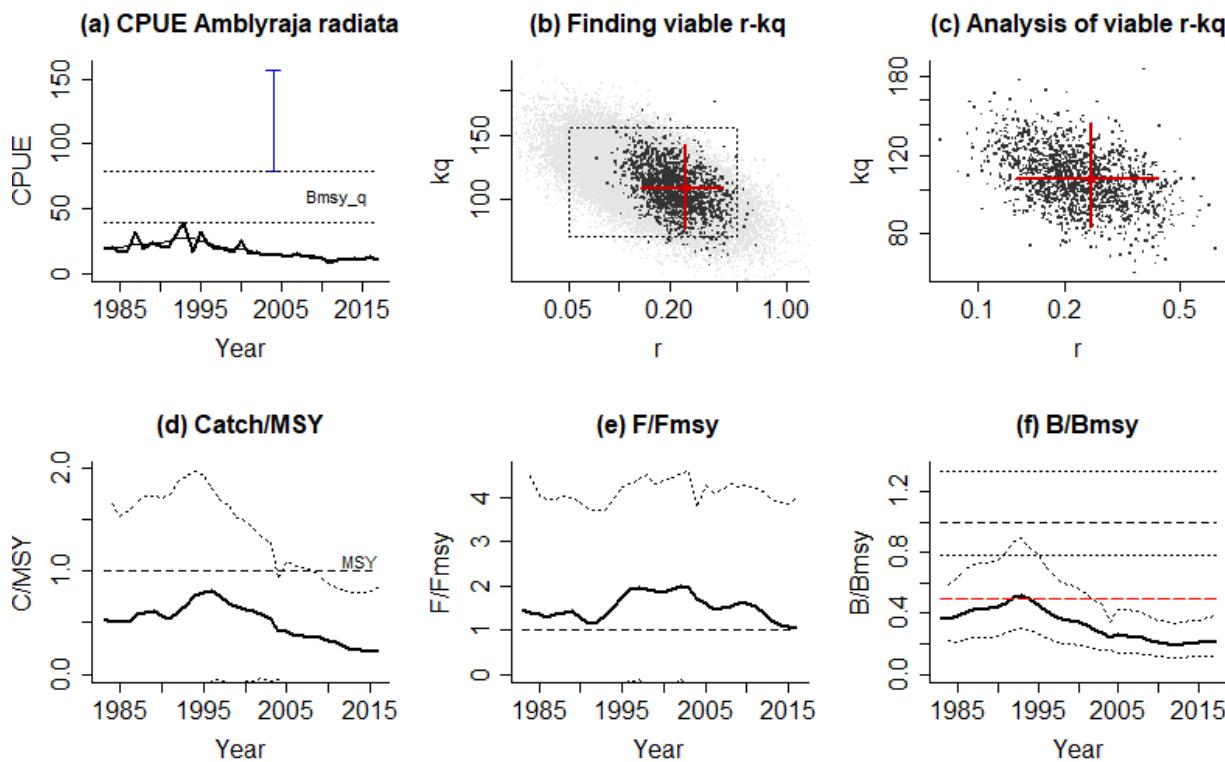
Comment: B/B₀ prior from LBB. RF: OK

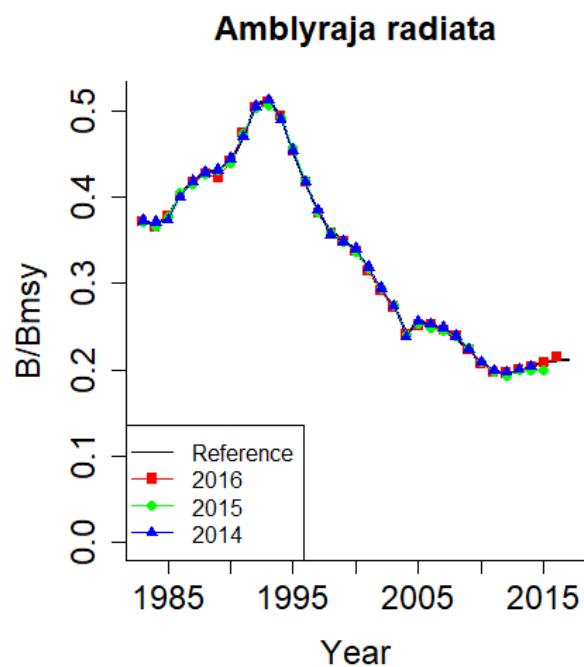
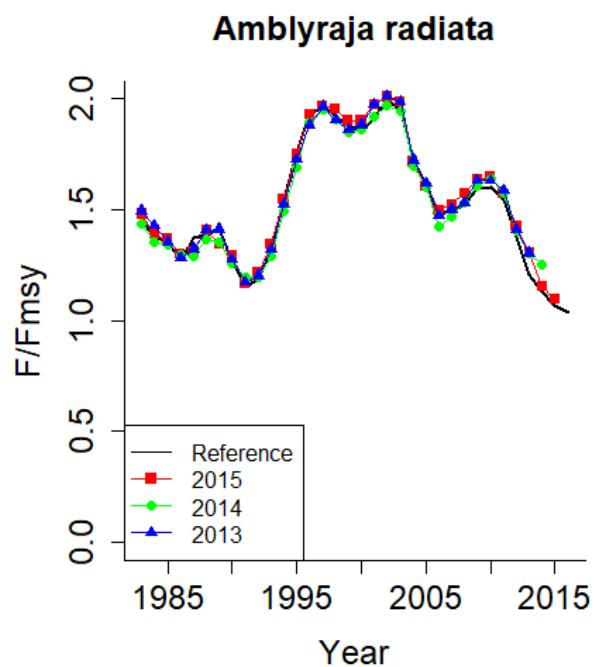
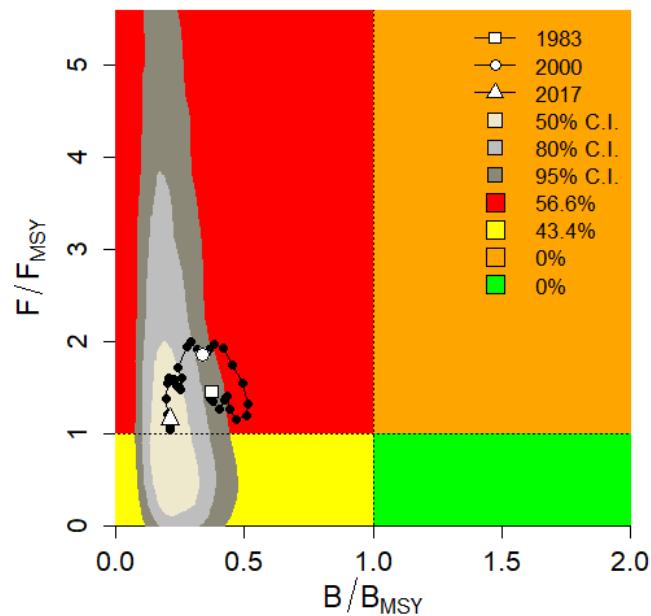
Source: SMFS 2017

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
Viable r-kq pairs = 5000

Results:

viable r-kq pairs	= 5000
median kq	= 106, 82.7 - 142
median MSYq	= 6.59, 3.79 - 10.8
r (4 MSYq/kq)	= 0.248, 0.134 - 0.418
F _{MSY} (r/2)	= 0.124, 0.0671 - 0.209
F/F _{MSY}	= 1.04, -0.84 - 3.99 (2016)
B/B _{MSY}	= 0.211, 0.119 - 0.385 (2017)





LBB results for *Buglossidium luteum*, stock *Buglossidium luteum*, 1983-2017
 Files:LBB4AMSY_ID_3.csv, LBB_June052019_Buglossidium luteum.csv

L_{inf} prior= 16, SD=0.16 cm (user-defined), $L_{max}=20$, median $L_{max}=13$

Z/K prior = 5.5, SD=0.3, M/K prior=1.5, SD=0.15

F/K prior = 3.97 (wide range with $\tau=4$ in log-normal distribution)

L_c prior = 5.1, SD=0.51 cm, alpha prior=27.3, SD=2.7, $L_{m50}=7.5$ cm

General reference points (median across years):

L_{inf} = 16 (15.8-16.3) cm

L_{opt} = 11 cm, $L_{opt}/L_{inf}=0.66$

L_c_{opt} = 9.9 cm, $L_c_{opt}/L_{inf}=0.62$, L_{mean} if $F=M$ 8.28 cm

M/K = 1.51 (1.24-1.8)

F/M = 3.79 (3.01-5.12), $F/K=6.03$ (5.48-6.71), $Z/K=7.77$ (7.3-8.38)

B/B_0 = 0.058 (0.042-0.082), B/B_0 $F=M$ $L_c=L_c_{opt}$ 0.37

Y/R' = 0.0073 (0.0055-0.0099) (reduced: $B/B_0 < 0.25$), Y/R' $F=M$ $L_c=L_c_{opt}$ 0.045

Estimates for 2017 (mean of last 3 years with data):

L_{c50} = 5.52 (5.44-5.61) cm, $L_c/L_{inf}=0.34$ (0.34-0.35)

L_{c95} = 7.2, alpha=1.75 (1.69-1.82)

$L_{mean}/L_{opt}=0.66$, $L_c/L_c_{opt}=0.56$, $L_{95th}=10.3$ cm, $L_{95th}/L_{inf}=0.64$, Mature=17%

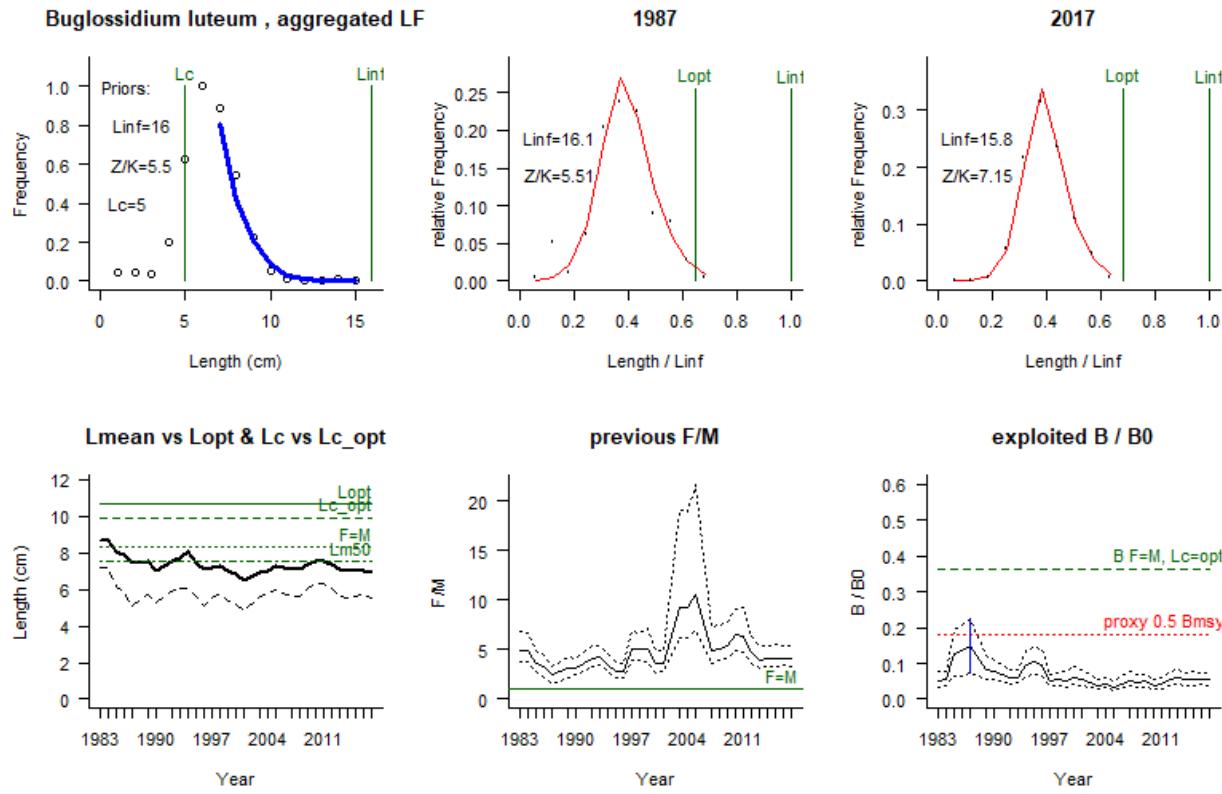
F/M = 4.1 (3.4-5.4), $F/K=6.4$ (5.9-7), $Z/K=8$ (7.5-8.4)

Y/R' = 0.0068 (0.005-0.0094) (reduced because $B/B_0 < 0.25$)

B/B_0 = 0.055 (0.04-0.076), best LF fit year 1995=0.103 (0.071-0.15)

B/B_{msy} = 0.15 (0.11-0.21), selected B/B_0 1987 = 0.15 (0.073-0.23)

RF: Set $L_{inf}=15$ cm above median=14. Selected 1987 because of reasonable fit and CL with not too low B/B_0 .



AMSY Analysis, Fri Nov 01 17:55:47 2019

Stock *Buglossidium luteum*, *Buglossidium luteum*, Solonette

CPUE data for years 1983 - 2017, CPUE range 0.527 - 2.07, smooth = TRUE

Prior for r = Medium, NA - NA

Used prior range for r = 0.2 - 0.8

Prior for 1987 stock status = Very small, 0.07 - 0.23

Used 1987 prior B/B₀ range = 0.07 - 0.23, prior B/B_{msy} = 0.14 - 0.46

Used prior range for k_q = 2.26 - 6.79 [original range = 2.26 - 7.44]

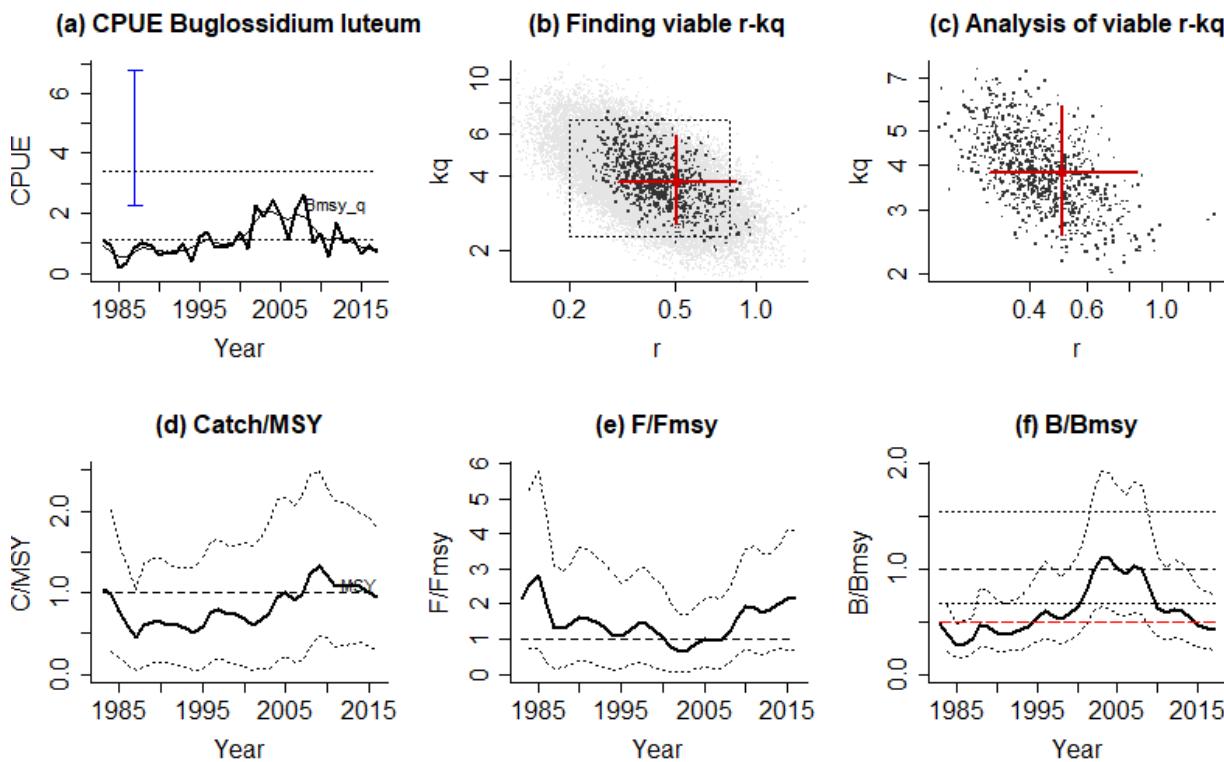
Comment: B/B₀ prior from LBB. RF: OK

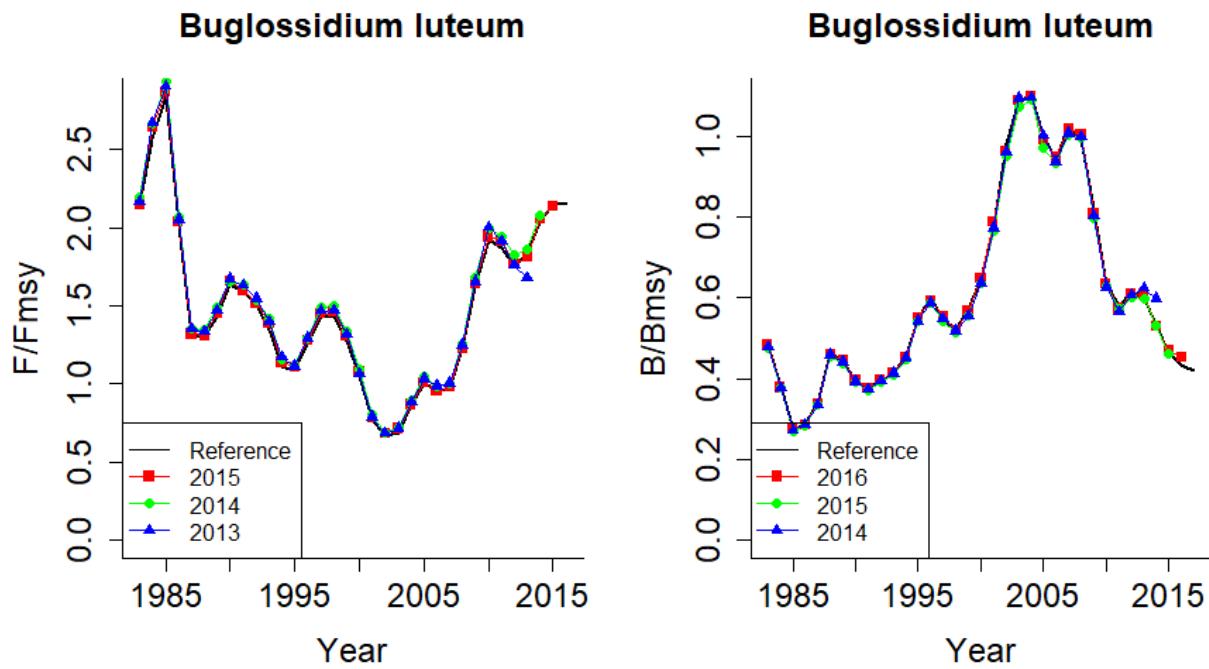
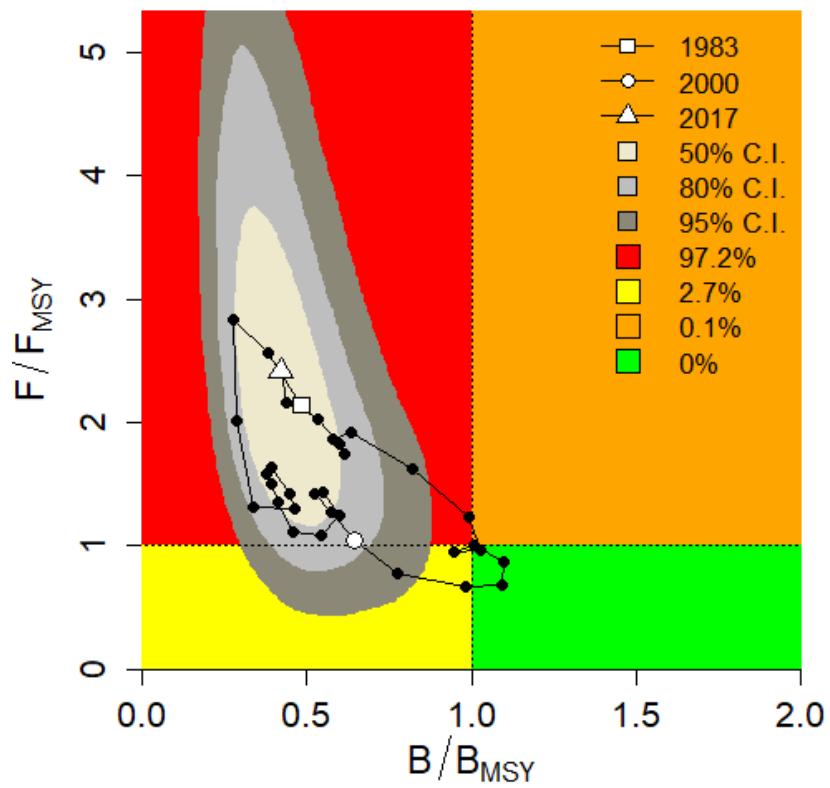
Source: SMFS 2017

Monte Carlo filtering of r-k_q space with 50000 points and 30 error patterns.
Viable r-k_q pairs = 5003

Results:

viable r-k _q pairs	= 5003
median k _q	= 3.8, 2.56 - 5.86
median MSY _q	= 0.48, 0.301 - 0.805
r (4 MSY _q /k _q)	= 0.505, 0.304 - 0.844
F _{msy} (r/2)	= 0.252, 0.152 - 0.422
F/F _{msy}	= 2.16, 0.686 - 4.09 (2016)
B/B _{msy}	= 0.42, 0.233 - 0.759 (2017)





LBB results for *Callionymus lyra*, stock *Callionymus lyra*, 1993-2017
 Files:LBB4AMSY_ID_3.csv, LBB_June052019_Callionymus lyra.csv

Linf prior= 31, SD=0.31 cm (user-defined), Lmax=37, median Lmax=25
 Z/K prior = 2.8, SD=0.25, M/K prior=1.5, SD=0.15

F/K prior = 1.34 (wide range with tau=4 in log-normal distribution)

Lc prior = 7.65, SD=0.77 cm, alpha prior=12, SD=1.2, Lm50=17 cm

General reference points (median across years):

Linf = 31.1 (30.4-31.7) cm

Lopt = 20 cm, Lopt/Linf=0.64

Lc_opt = 18 cm, Lc_opt/Linf=0.57, Lmean if F=M 19.1 cm

M/K = 1.71 (1.45-1.97)

F/M = 2.04 (1.61-2.54), F/K=4.11 (3.46-4.83), Z/K=5.48 (5.05-6.15)

B/B0 = 0.17 (0.12-0.24), B/B0 F=M Lc=Lc_opt 0.36

Y/R' = 0.02 (0.014-0.033)(reduced: B/B0<0.25), Y/R' F=M Lc=Lc_opt 0.034

Estimates for 2017 (mean of last 3 years with data):

Lc50 = 13.2 (12.7-13.8) cm, Lc/Linf=0.43 (0.42-0.45)

Lc95 = 21.2, alpha=0.365 (0.352-0.378)

Lmean/Lopt= 0.78, Lc/Lc_opt=0.75, L95th=24.3 cm, L95th/Linf=0.8, Mature=22%

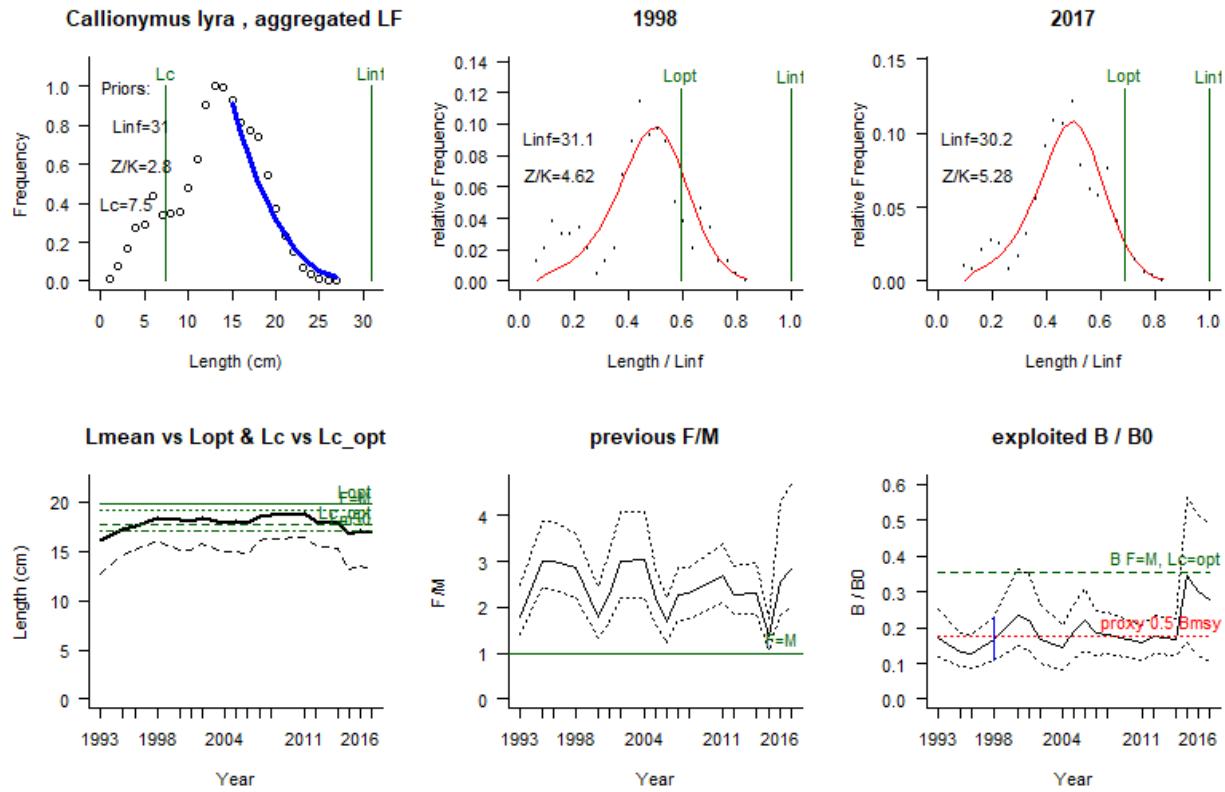
F/M = 2.8 (2-4.7), F/K=2.7 (2.3-3.2), Z/K=4 (3.6-4.4)

Y/R' = 0.021 (0.011-0.035)(reduced because B/B0 < 0.25)

B/B0 = 0.28 (0.1-0.49), best LF fit year 2017=0.278 (0.1-0.49)

B/Bmsy = 0.78 (0.29-1.4), selected B/B0 1998 = 0.17 (0.11-0.23)

RF: Set Linf=31 between median and max. Deleted unrealstic LF years. Selected 1998 because of reasonable fit and LC.



AMSY Analysis, Fri Nov 01 17:59:19 2019

Stock *Callionymus lyra*, *Callionymus lyra*, Dragonet

CPUE data for years 1983 - 2017, CPUE range 0.729 - 1.32, smooth = TRUE

Prior for r = Medium, NA - NA

Used prior range for r = 0.2 - 0.8

Prior for 1998 stock status = Very small, 0.11 - 0.23

Used 1998 prior B/B₀ range = 0.11 - 0.23, prior B/B_{MSY} = 0.22 - 0.46

Used prior range for k_q = 5.81 - 8.71 [original range = 2.9 - 6.07]

Comment: B/B₀ prior from LBB. RF: OK

Source: SMFS 2017

Monte Carlo filtering of r-k_q space with 50000 points and 30 error patterns.
Viable r-k_q pairs = 5000

Results:

viable r-k_q pairs = 5000

median k_q = 6.66, 5.61 - 7.87

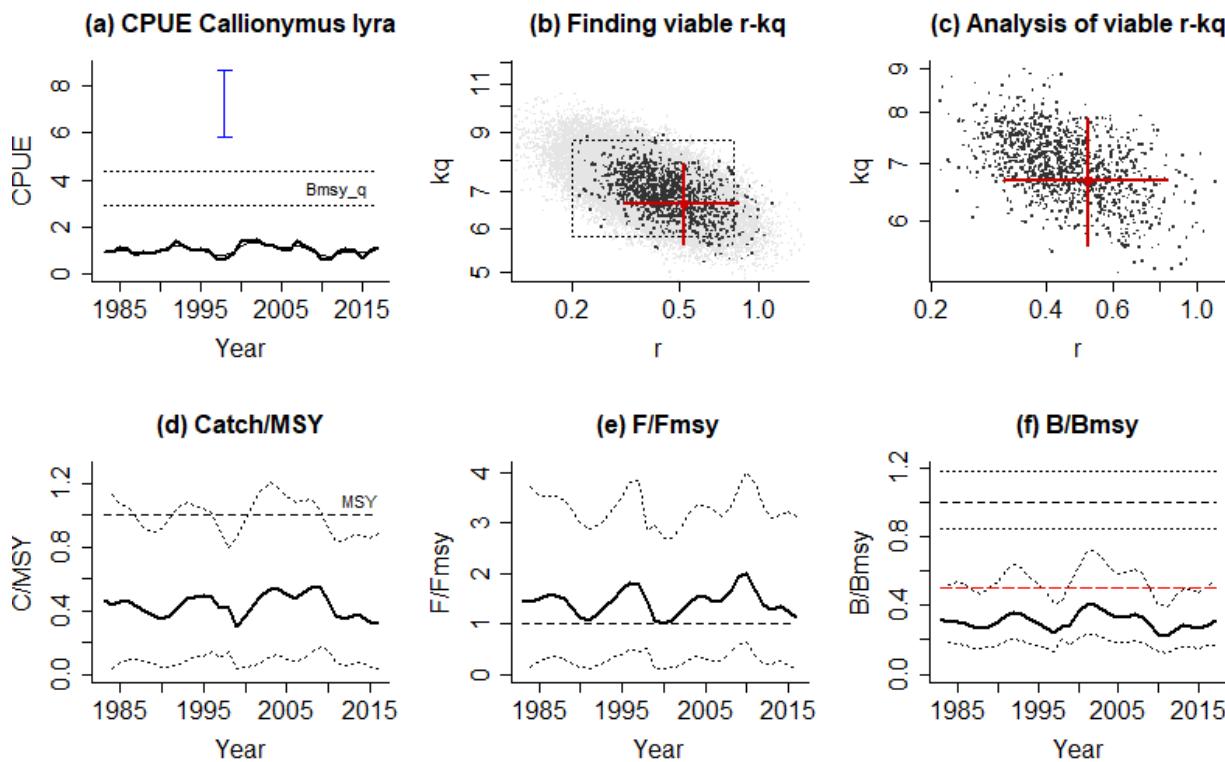
median MSY_q = 0.866, 0.547 - 1.39

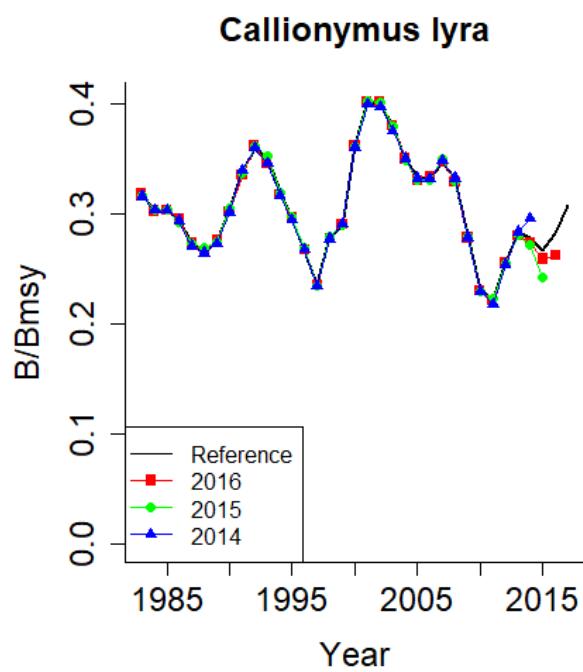
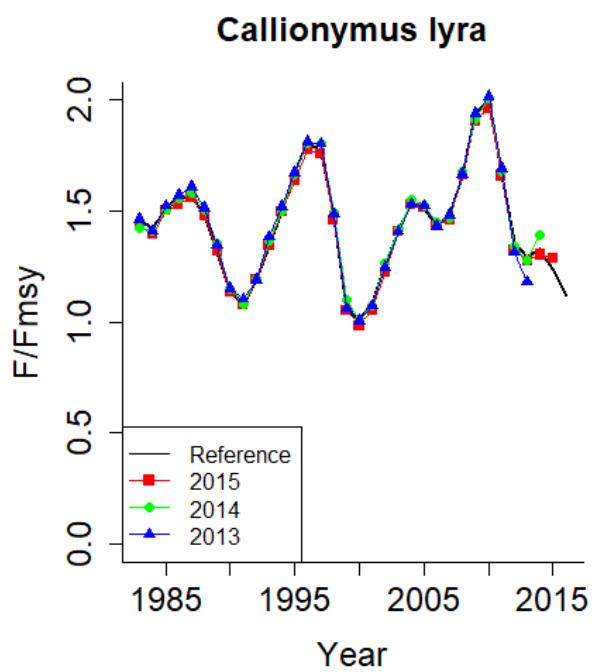
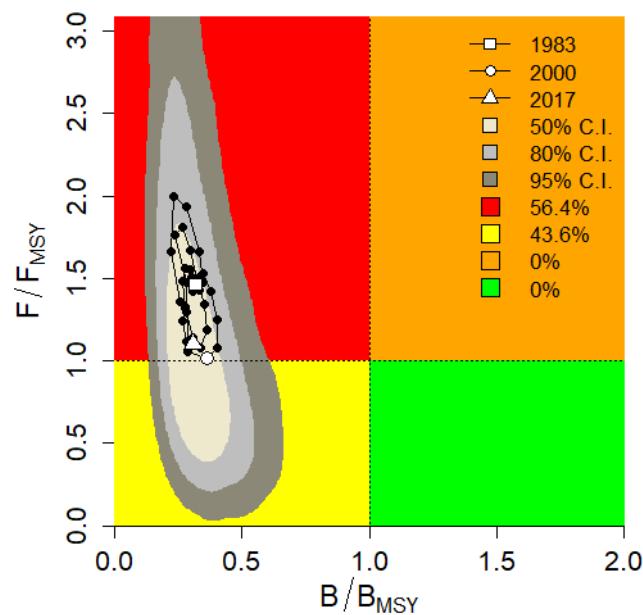
r (4 MSY_q/k_q) = 0.52, 0.308 - 0.835

F_{MSY} (r/2) = 0.26, 0.154 - 0.418

F/F_{MSY} = 1.12, 0.12 - 3.15 (2016)

B/B_{MSY} = 0.308, 0.172 - 0.555 (2017)





LBB results for *Callionymus maculatus*, stock *Callionymus maculatus*, 1983-2016
 Files:LBB4AMSY_ID_3.csv, LBB_June052019_Callionymus maculatus.csv

Linf prior= 18, SD=0.18 cm (user-defined), Lmax=21, median Lmax=15

Z/K prior = 3.1, SD=0.25, M/K prior=1.5, SD=0.15

F/K prior = 1.63 (wide range with tau=4 in log-normal distribution)

Lc prior = 6.12, SD=0.61 cm, alpha prior=17.8, SD=1.8, Lm50=NA cm

General reference points (median across years):

Linf = 17.7 (17.3-18) cm

Lopt = 12 cm, Lopt/Linf=0.68

Lc_opt = 11 cm, Lc_opt/Linf=0.61, Lmean if F=M 10.3 cm

M/K = 1.41 (1.15-1.64)

F/M = 2.35 (1.76-3.03), F/K=3.18 (2.83-3.7), Z/K=4.31 (3.96-4.66)

B/B0 = 0.13 (0.087-0.18), B/B0 F=M Lc=Lc_opt 0.37

Y/R' = 0.022 (0.013-0.032) (reduced: B/B0<0.25), Y/R' F=M Lc=Lc_opt 0.049

Estimates for 2016 (mean of last 3 years with data):

Lc50 = 8.2 (7.97-8.4) cm, Lc/Linf=0.45 (0.44-0.46)

Lc95 = 11.8, alpha=0.823 (0.796-0.85)

Lmean/Lopt= 0.84, Lc/Lc_opt=0.76, L95th=15 cm, L95th/Linf=0.83, Mature=NA%

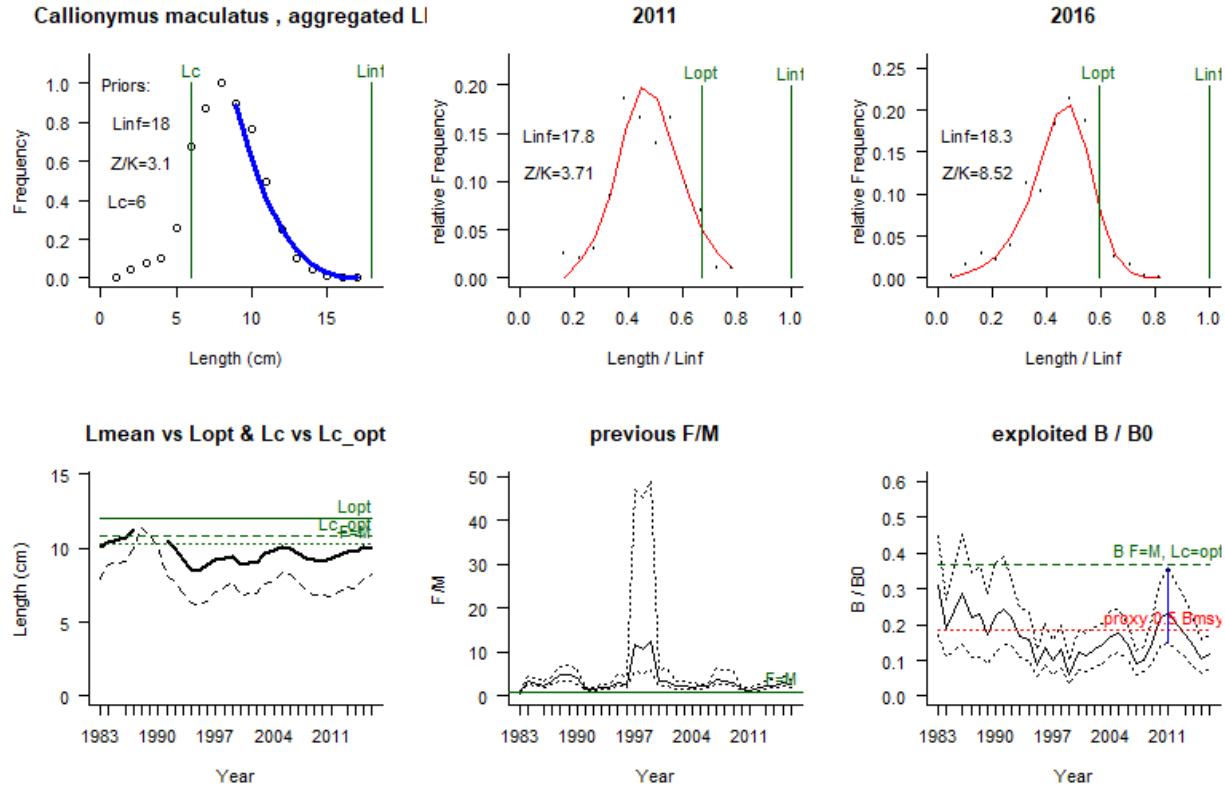
F/M = 2.9 (2.2-3.7), F/K=4.8 (4.2-5.5), Z/K=6.5 (5.8-7.1)

Y/R' = 0.02 (0.013-0.028) (reduced because B/B0 < 0.25)

B/B0 = 0.12 (0.08-0.17), best LF fit year 2003=0.143 (0.092-0.2)

B/Bmsy = 0.32 (0.22-0.46), selected B/B0 2011 = 0.24 (0.15-0.36)

RF: Set Linf=18cm between median and max. Selected 2011 because of reasonable fit and CL and not too low B/B0.



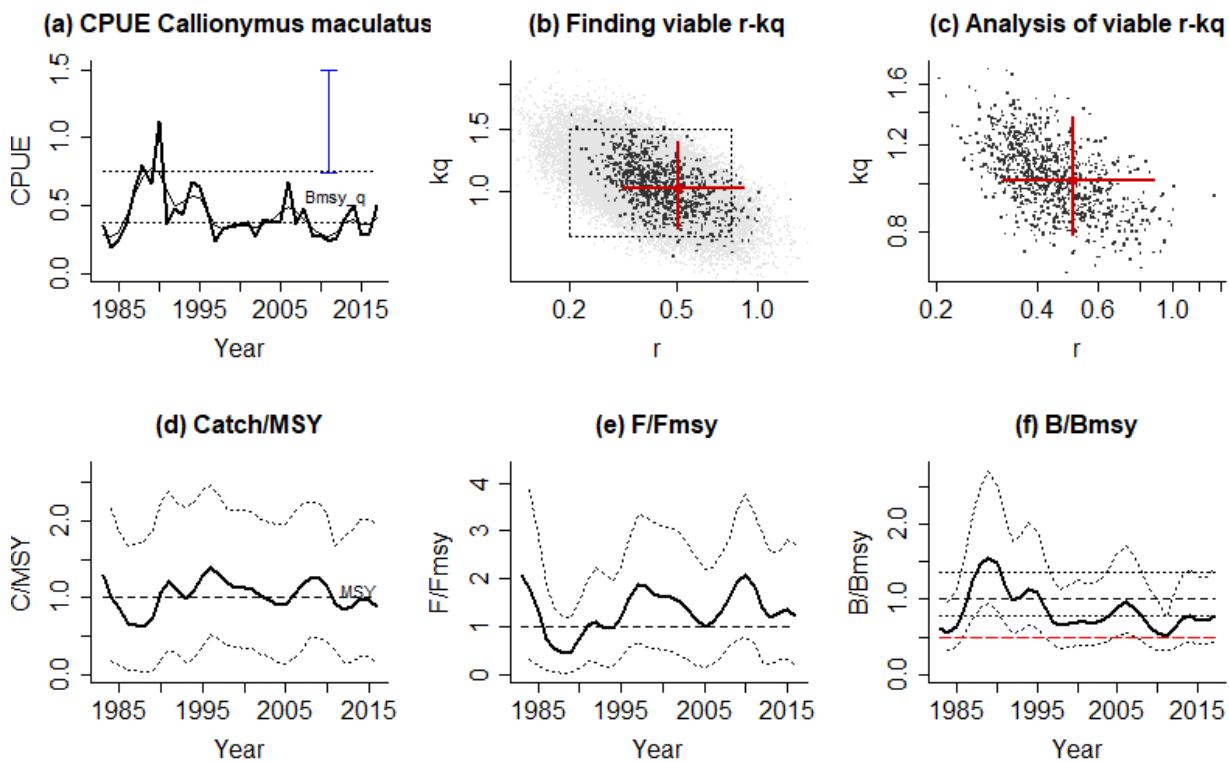
AMSY Analysis, Fri Nov 01 18:03:38 2019

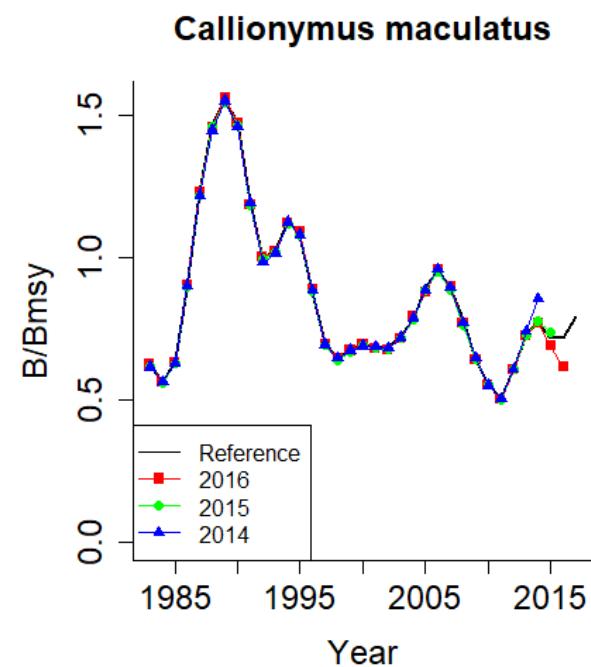
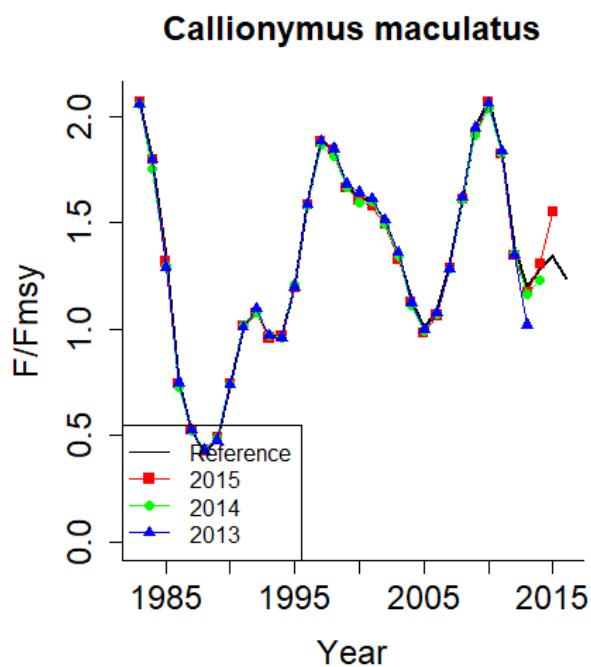
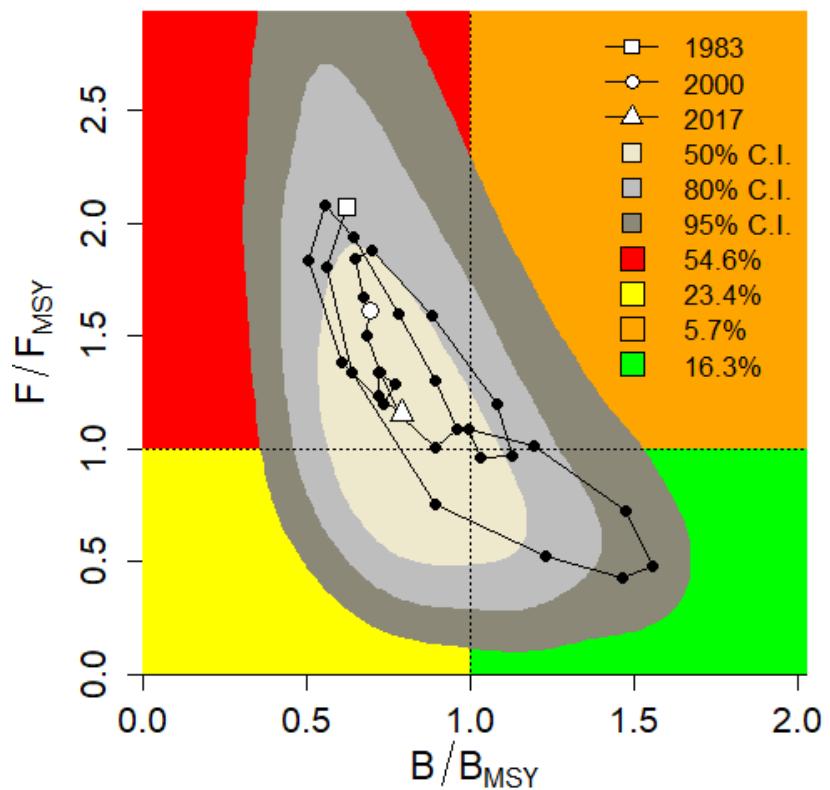
Stock *Callionymus maculatus*, *Callionymus maculatus*, Spotted dragonet
CPUE data for years 1983 - 2017, CPUE range 0.265 - 0.771, smooth = TRUE
Prior for r = Medium, NA - NA
Used prior range for r = 0.2 - 0.8
Prior for 2011 stock status = Small, 0.15 - 0.36
Used 2011 prior B/B₀ range = 0.15 - 0.36, prior B/B_{MSY} = 0.3 - 0.72
Used prior range for kq = 0.745 - 1.5 [original range = 0.625 - 1.5]
Comment: B/B₀ prior from LBB. RF: OK
Source: SMFS 2017

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
Viable r-kq pairs = 5000

Results:

viable r-kq pairs = 5000
median kq = 1.02, 0.787 - 1.38
median MSY_q = 0.129, 0.0829 - 0.205
r (4 MSY_q/kq) = 0.509, 0.314 - 0.884
F_{MSY} (r/2) = 0.254, 0.157 - 0.442
F/F_{MSY} = 1.23, 0.191 - 2.71 (2016)
B/B_{MSY} = 0.79, 0.438 - 1.43 (2017)





LBB results for *Chelidonichthys cuculus*, stock *Chelidonichthys cuculus*, 2001-2013

Files:LBB4AMSY_ID_3.csv, LBB_June052019_Chelidonichthys cuculus.csv

L_{inf} prior= 36, SD=0.36 cm (user-defined), $L_{max}=40$, median $L_{max}=35$

Z/K prior = 2, SD=0.066, M/K prior=1.5, SD=0.15

F/K prior = 0.544 (wide range with $\tau=4$ in log-normal distribution)

L_c prior = 18.4, SD=1.8 cm, alpha prior=13.4, SD=1.3, $L_{m50}=25$ cm

General reference points (median across years):

L_{inf} = 35.8 (35.2-36.4) cm

L_{opt} = 23 cm, $L_{opt}/L_{inf}=0.64$

L_c_{opt} = 20 cm, $L_c_{opt}/L_{inf}=0.56$, L_{mean} if $F=M$ 25.4 cm

M/K = 1.67 (1.43-1.83)

F/M = 1.49 (1.2-2.03), $F/K=2.01$ (1.43-2.57), $Z/K=2.89$ (2.63-3.23)

B/B_0 = 0.29 (0.14-0.47), $B/B_0 F=M L_c=L_c_{opt} 0.36$

Y/R' = 0.03 (0.021-0.048), $Y/R' F=M L_c=L_c_{opt} 0.037$

Estimates for 2013 (mean of last 3 years with data):

L_{c50} = 22.7 (22.2-23.2) cm, $L_c/L_{inf}=0.63$ (0.62-0.64)

L_{c95} = 30, alpha=0.402 (0.389-0.413)

$L_{mean}/L_{opt}=0.95$, $L_c/L_c_{opt}=1.1$, $L_{95th}=33.3$ cm, $L_{95th}/L_{inf}=0.93$, Mature=37%

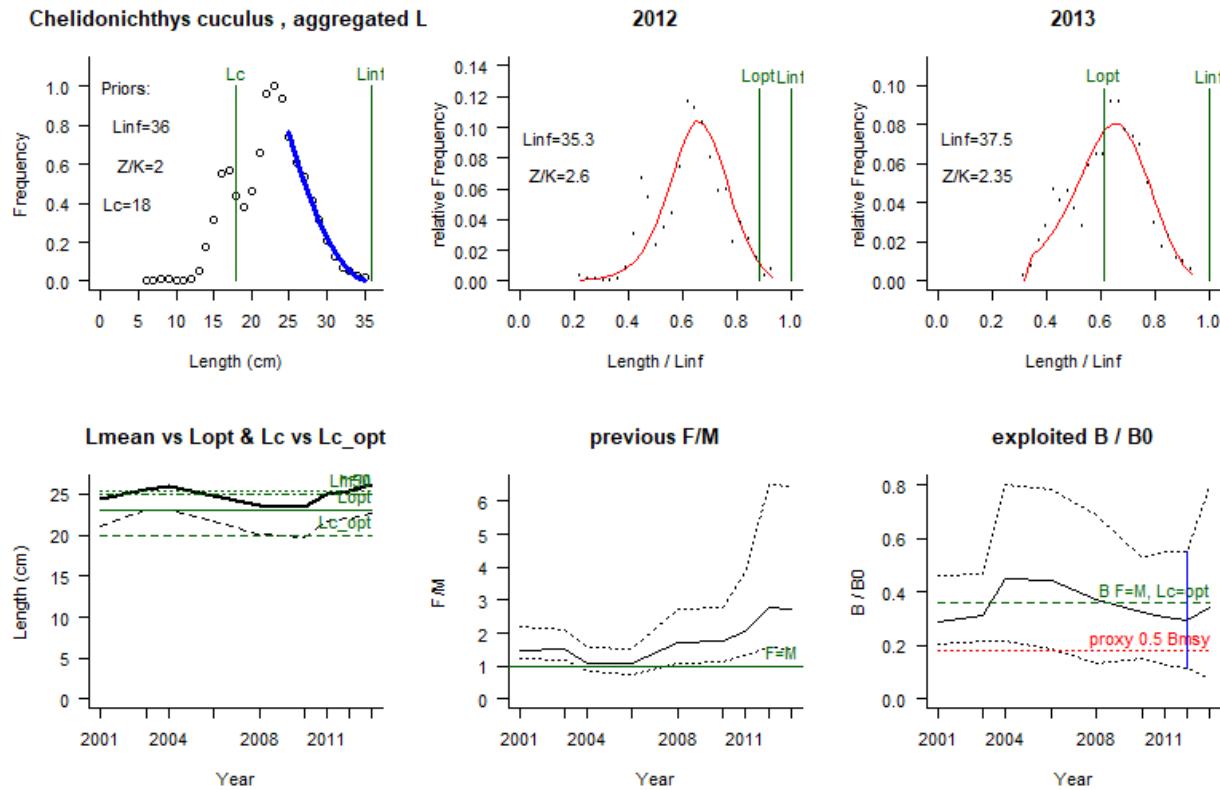
F/M = 2.7 (1.5-6.4), $F/K=1.5$ (1.2-1.9), $Z/K=2.5$ (2.2-2.8)

Y/R' = 0.059 (0.018-0.14)

B/B_0 = 0.35 (0.076-0.79), best LF fit year 2010=0.328 (0.15-0.53)

B/B_{msy} = 0.96 (0.21-2.2), selected B/B_0 2012 = 0.29 (0.12-0.55)

RF: Set $L_{inf}=36$ between median and max. Used 2012 because of good fit and CL.



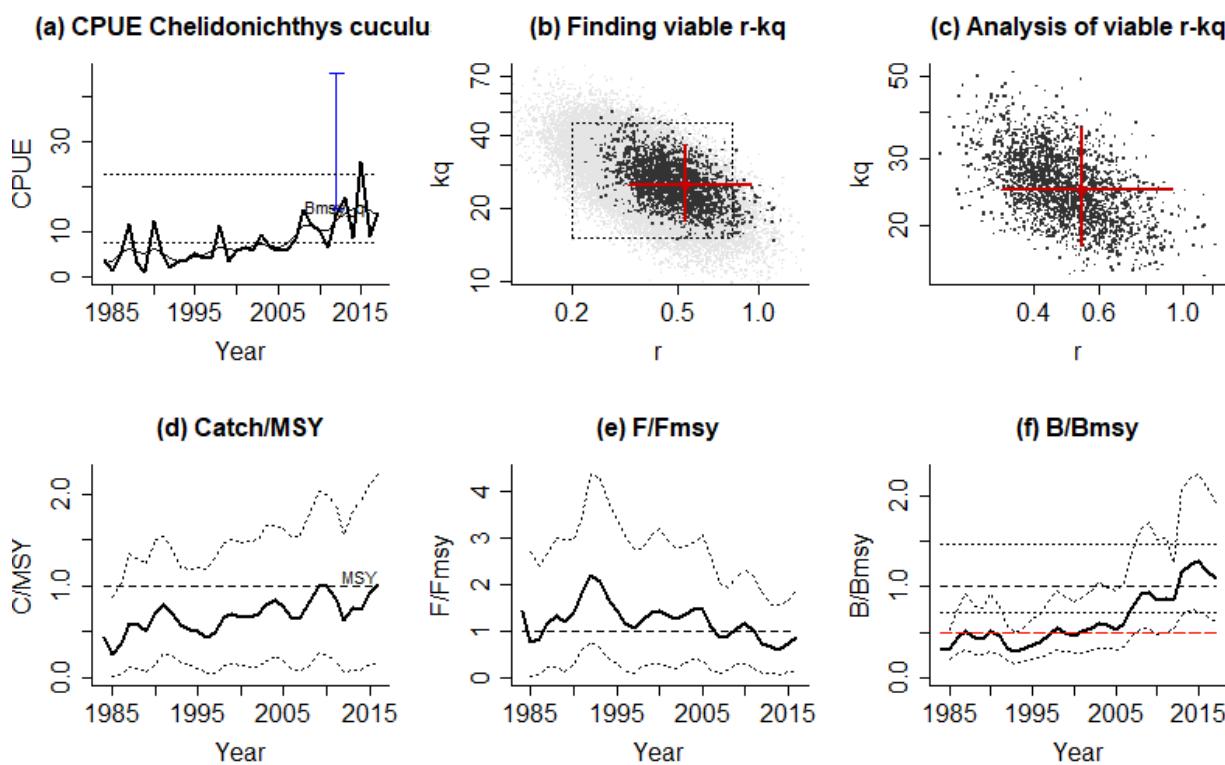
AMSY Analysis, Fri Nov 01 18:08:05 2019

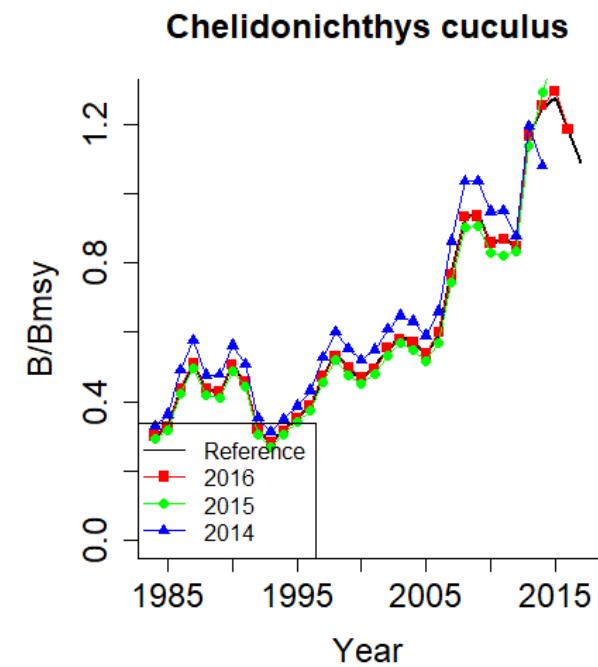
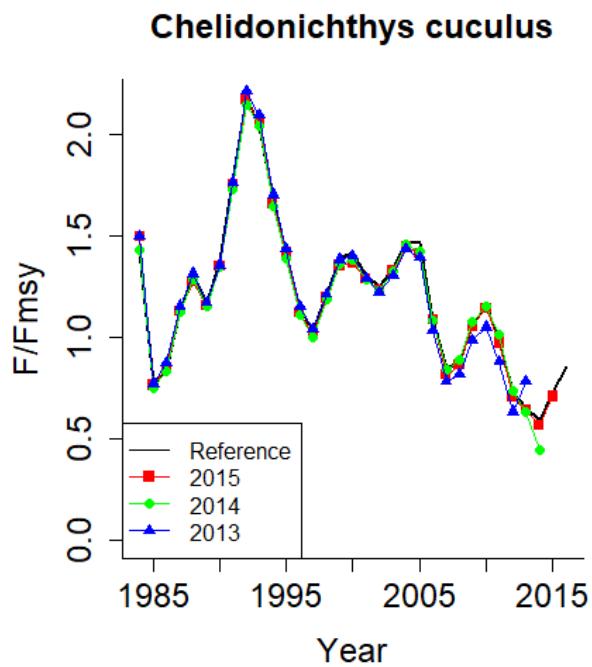
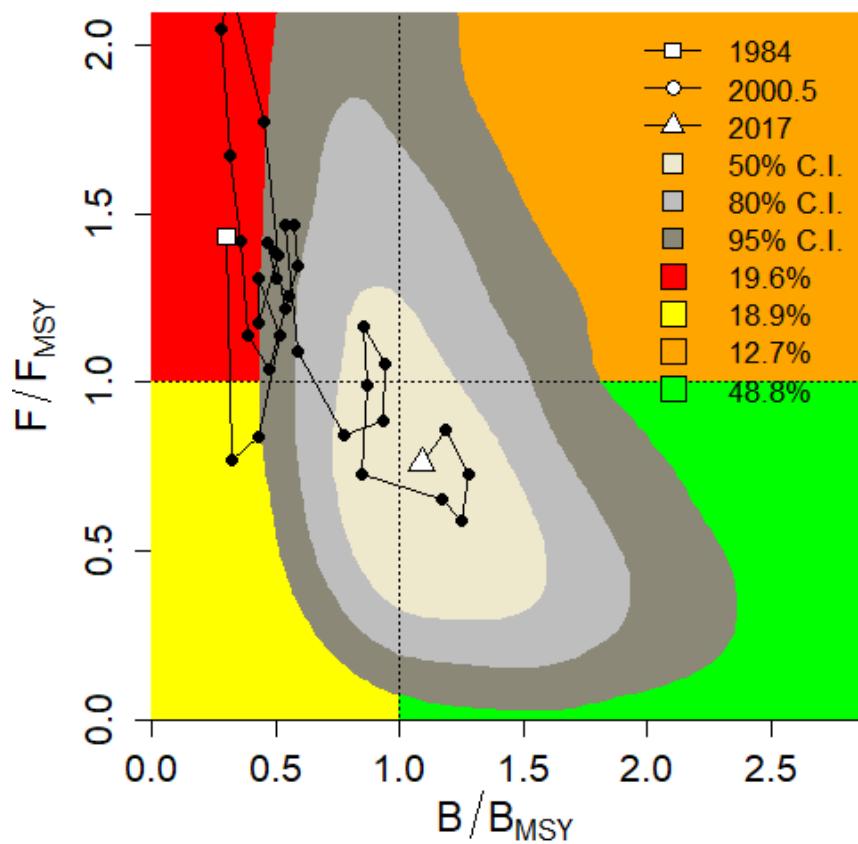
Stock *Chelidonichthys cuculus*, *Chelidonichthys cuculus*, Red gurnard
CPUE data for years 1984 - 2017, CPUE range 2.86 - 15.7, smooth = TRUE
Prior for r = Medium, NA - NA
Used prior range for r = 0.2 - 0.8
Prior for 2012 stock status = Small, 0.12 - 0.55
Used 2012 prior B/B_0 range = 0.12 - 0.55, prior B/B_{MSY} = 0.24 - 1.1
Used prior range for kq = 15 - 45.1 [original range = 13.1 - 60.2]
Comment: B/B_0 prior from LBB. RF: OK
Source: SMFS 2017

Monte Carlo filtering of r - kq space with 50000 points and 30 error patterns.
Viable r - kq pairs = 5000

Results:

viable r - kq pairs = 5000
median kq = 24.8, 17.6 - 36.5
median MSYq = 3.33, 2.11 - 5.62
 r (4 MSYq/ kq) = 0.537, 0.325 - 0.94
 F_{MSY} ($r/2$) = 0.269, 0.163 - 0.47
 F/F_{MSY} = 0.859, 0.13 - 1.88 (2016)
 B/B_{MSY} = 1.09, 0.607 - 1.94 (2017)





LBB results for *Echiichthys vipera*, stock *Echiichthys vipera*, 1998-2017
 Files:LBB4AMSY_ID_3.csv, LBB_June052019_Echiichthys vipera.csv

L_{inf} prior= 17, SD=0.17 cm (user-defined), $L_{max}=19$, median $L_{max}=15$
 Z/K prior = 4, SD=0.091, M/K prior=1.5, SD=0.15

F/K prior = 2.55 (wide range with tau=4 in log-normal distribution)

L_c prior = 7.14, SD=0.71 cm, alpha prior=12.6, SD=1.3, $L_{m50}=NA$ cm

General reference points (median across years):

L_{inf} = 16.9 (16.7-17.3) cm

L_{opt} = 12 cm, $L_{opt}/L_{inf}=0.69$

L_{c_opt} = 11 cm, $L_{c_opt}/L_{inf}=0.63$, L_{mean} if $F=M$ 10.8 cm

M/K = 1.33 (1.09-1.6)

F/M = 2.84 (2.12-4.1), $F/K=3.88$ (3.36-4.45), $Z/K=4.88$ (4.5-5.36)

B/B_0 = 0.13 (0.081-0.19), $B/B_0 F=M$ $L_c=L_{c_opt}$ 0.37

Y/R' = 0.029 (0.019-0.041) (reduced: $B/B_0 < 0.25$), $Y/R' F=M L_c=L_{c_opt}$ 0.053

Estimates for 2017 (mean of last 3 years with data):

L_{c50} = 8.41 (8.22-8.63) cm, $L_c/L_{inf}=0.48$ (0.47-0.5)

L_{c95} = 12.1, alpha=0.808 (0.778-0.841)

L_{mean}/L_{opt} = 0.94, $L_c/L_{c_opt}=0.78$, $L_{95th}/L_{inf}=0.9$, Mature=NA%

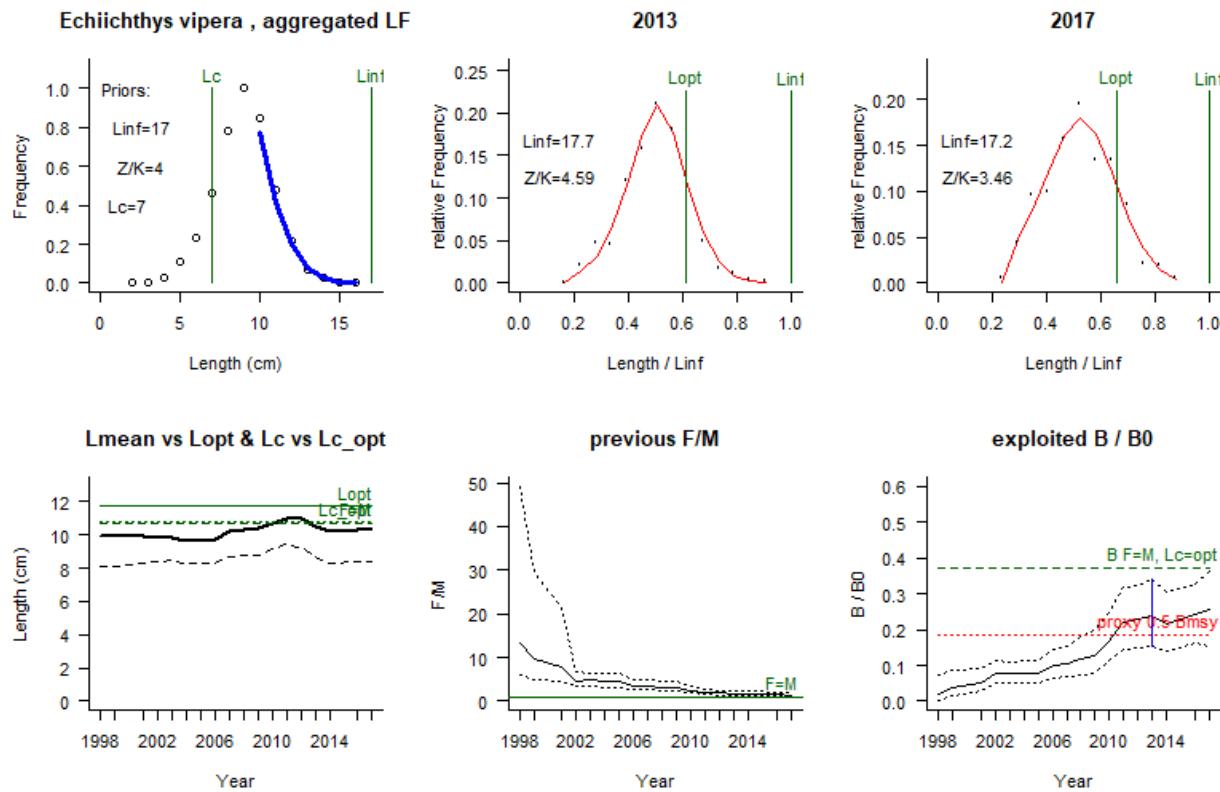
F/M = 1.4 (0.99-1.8), $F/K=2.5$ (2-2.9), $Z/K=4.2$ (3.9-4.6)

Y/R' = 0.036 (0.022-0.051) (reduced because $B/B_0 < 0.25$)

B/B_0 = 0.25 (0.15-0.36), best LF fit year 2005=0.0774 (0.05-0.11)

B/B_{msy} = 0.68 (0.42-0.97), selected B/B_0 2013 = 0.24 (0.15-0.34)

RF: Set $L_{inf}=17$ between median and max. Excluded years with unrealistic LF fits
 . Selected 2013 for reasonable fit and CL.



AMSY Analysis, Fri Nov 01 18:12:40 2019

Stock *Echiichthys vipera*, *Echiichthys vipera*, Lesser weever

CPUE data for years 1983 - 2017, CPUE range 0.489 - 2.16, smooth = TRUE

Prior for r = Medium, NA - NA

Used prior range for r = 0.2 - 0.8

Prior for 2013 stock status = Small, 0.15 - 0.34

Used 2013 prior B/B₀ range = 0.15 - 0.34, prior B/B_msy = 0.3 - 0.68

Used prior range for kq = 3.54 - 8.02 [original range = 3.54 - 8.02]

Comment: B/B₀ prior from LBB. RF: OK

Source: SMFS 2017

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
Viable r-kq pairs = 5004

Results:

viable r-kq pairs = 5004

median kq = 4.89, 3.64 - 6.86

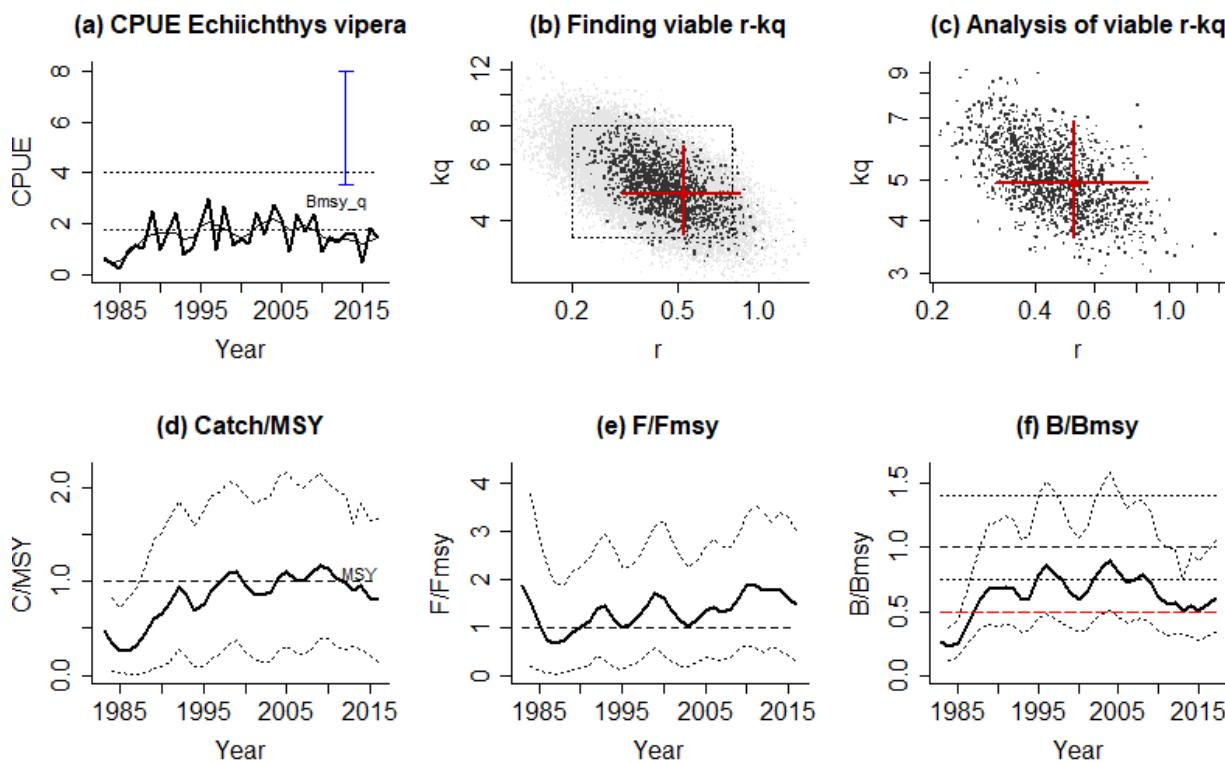
median MSY_q = 0.641, 0.404 - 1.01

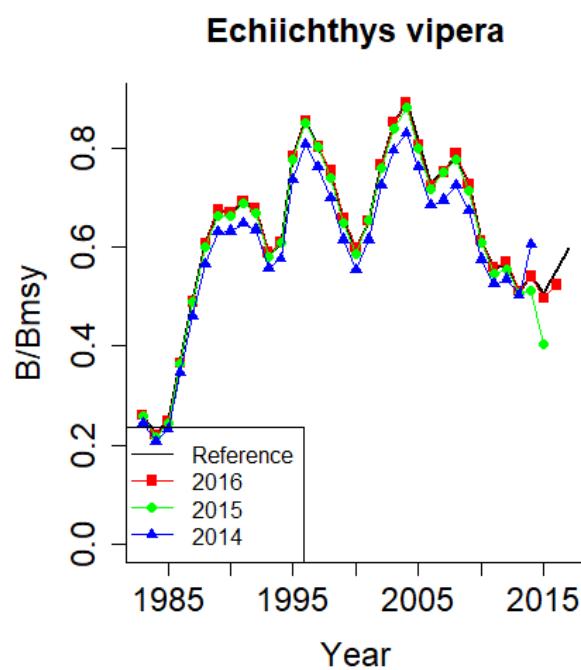
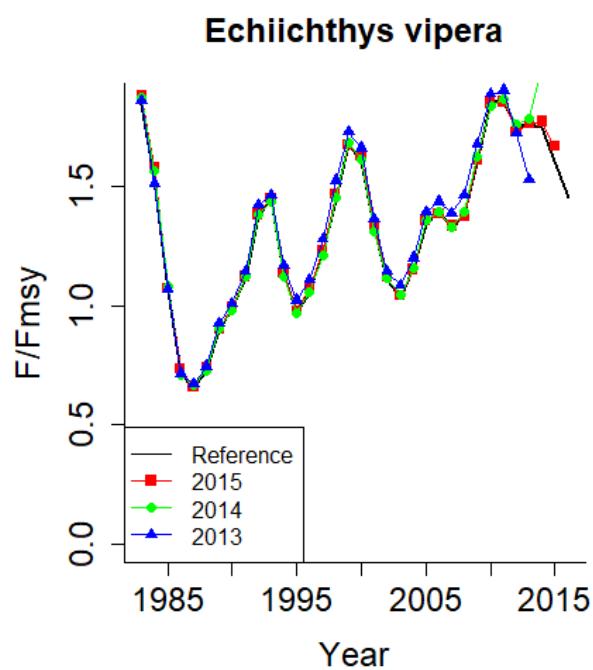
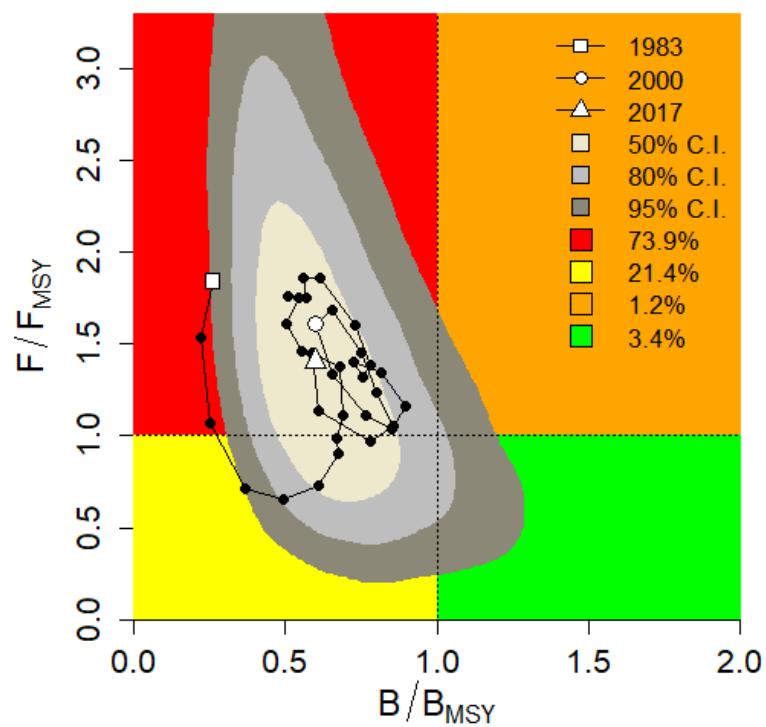
r (4 MSY_q/kq) = 0.524, 0.306 - 0.859

F_msy (r/2) = 0.262, 0.153 - 0.43

F/F_msy = 1.46, 0.266 - 3.03 (2016)

B/B_msy = 0.599, 0.331 - 1.06 (2017)





LBB results for *Enchelyopus cimbrius*, stock *Enchelyopus cimbrius*, 1983-2017
 Files:LBB4AMSY_ID_3.csv, LBB_June052019_Enchelyopus cimbrius.csv

Linf prior= 36, SD=0.36 cm (user-defined), Lmax=44, median Lmax=32

Z/K prior = 3, SD=0.076, M/K prior=1.5, SD=0.15

F/K prior = 1.52 (wide range with tau=4 in log-normal distribution)

Lc prior = 12.8, SD=1.3 cm, alpha prior=16.6, SD=1.7, Lm50=25 cm

General reference points (median across years):

Linf = 35.6 (35-36.2) cm

Lopt = 25 cm, Lopt/Linf=0.69

Lc_opt = 21 cm, Lc_opt/Linf=0.6, Lmean if F=M 20.4 cm

M/K = 1.36 (1.16-1.59)

F/M = 1.65 (1.3-2.42), F/K=2.32 (1.94-2.73), Z/K=3.83 (3.5-4.11)

B/B0 = 0.2 (0.11-0.31), B/B0 F=M Lc=Lc_opt 0.37

Y/R' = 0.036 (0.02-0.051)(reduced: B/B0<0.25), Y/R' F=M Lc=Lc_opt 0.052

Estimates for 2017 (mean of last 3 years with data):

Lc50 = 14.2 (13.9-14.7) cm, Lc/Linf=0.4 (0.39-0.42)

Lc95 = 20.6, alpha=0.459 (0.444-0.474)

Lmean/Lopt= 0.81, Lc/Lc_opt=0.66, L95th=29.3 cm, L95th/Linf=0.83, Mature=5.7%

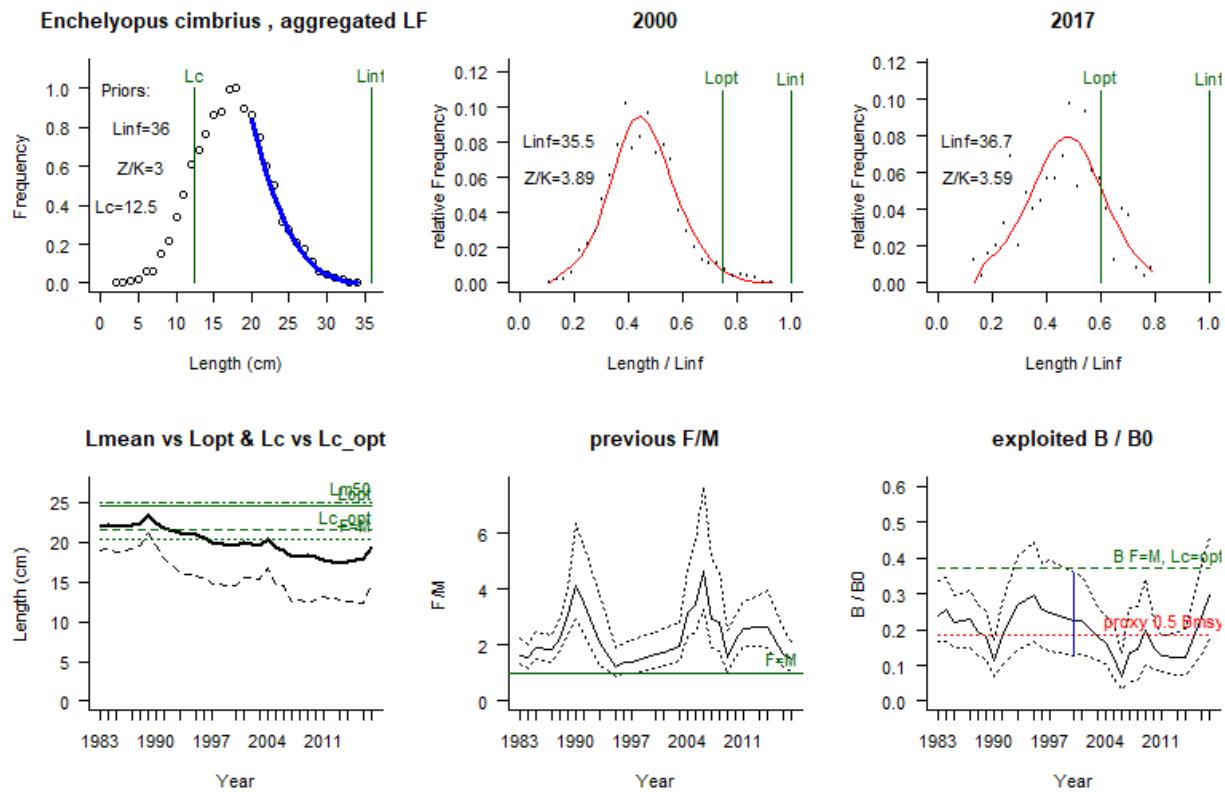
F/M = 1.5 (1.1-2.2), F/K=1.9 (1.5-2.3), Z/K=3.4 (3.1-3.7)

Y/R' = 0.029 (0.017-0.045)(reduced because B/B0 < 0.25)

B/B0 = 0.3 (0.17-0.46), best LF fit year 1985=0.22 (0.15-0.3)

B/Bmsy = 0.8 (0.46-1.2), selected B/B0 2000 = 0.23 (0.13-0.36)

RF: Set Linf between median and max. Excluded years with unrealistic LF fits.
 Selected 2000 because of reasonable fit and CL



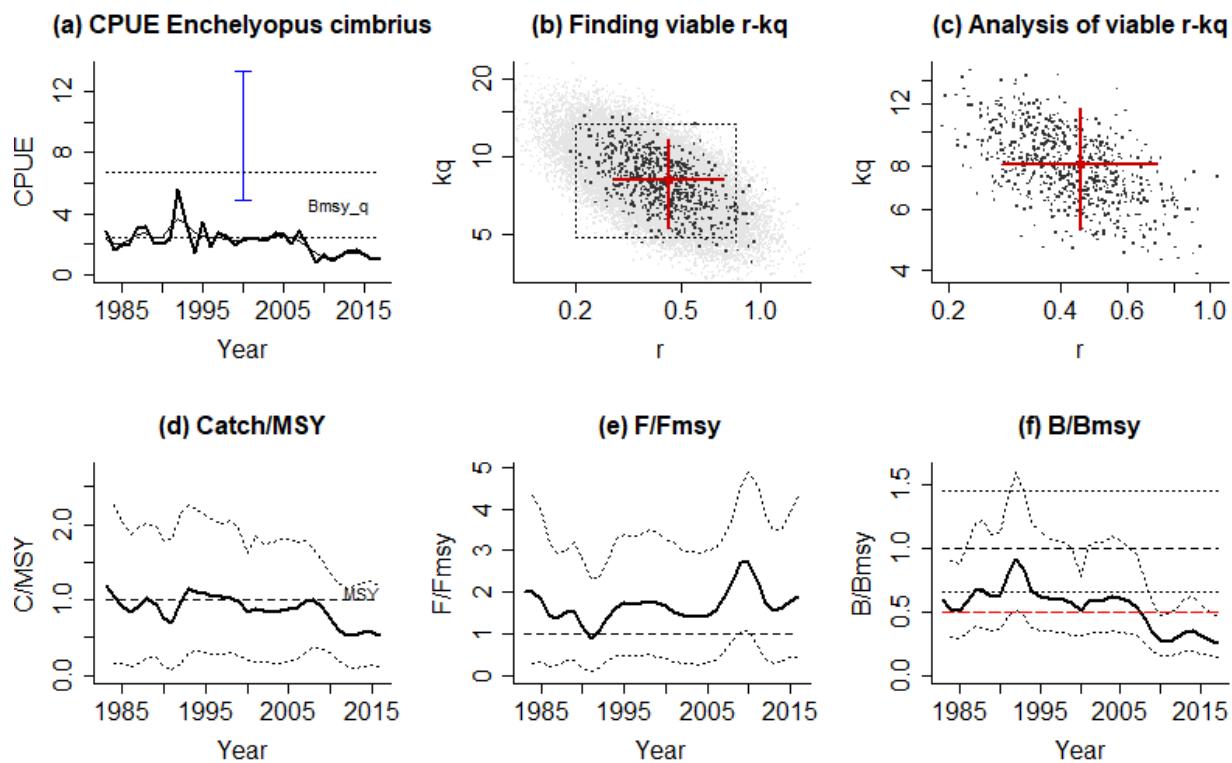
AMSY Analysis, Fri Nov 01 18:16:36 2019

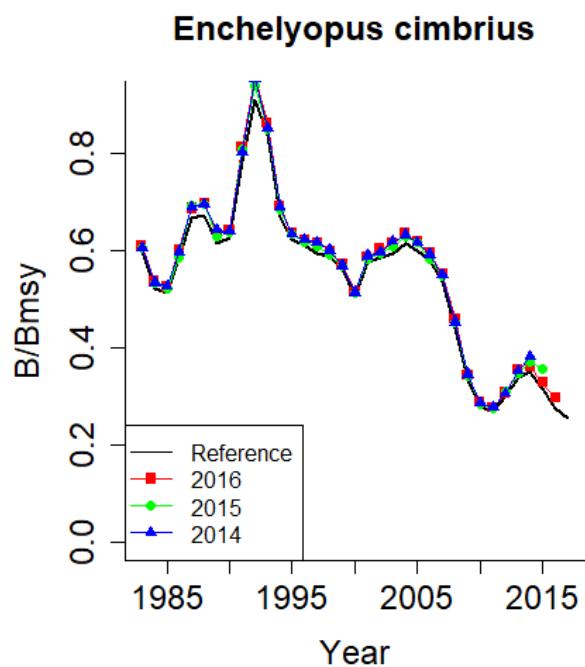
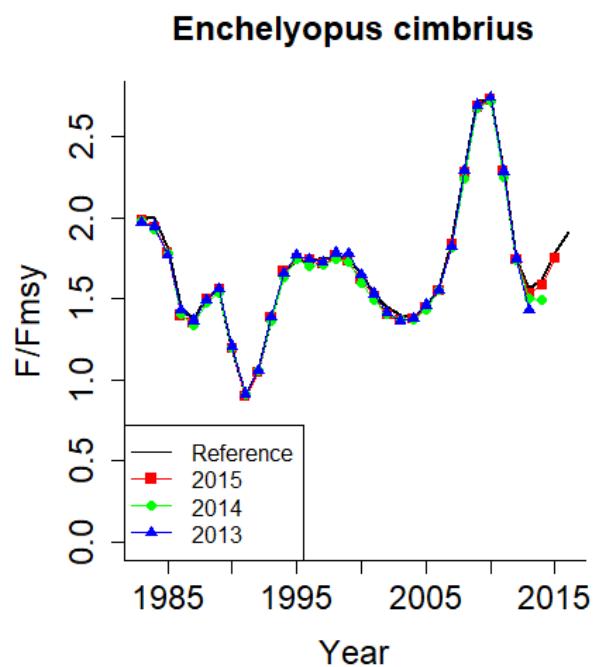
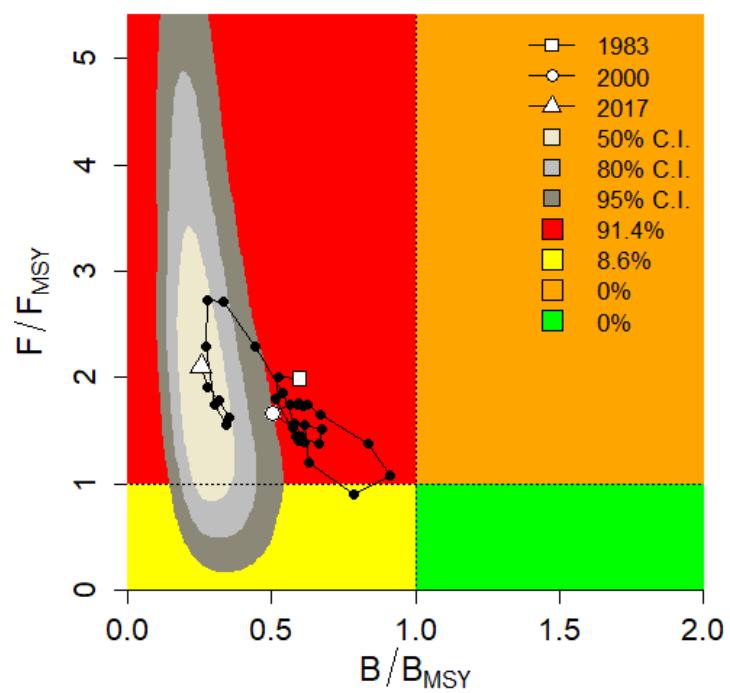
Stock *Enchelyopus cimbrius*, *Enchelyopus cimbrius*, Fourbeard rockling
CPUE data for years 1983 - 2017, CPUE range 1.02 - 3.68, smooth = TRUE
Prior for r = Medium, NA - NA
Used prior range for r = 0.2 - 0.8
Prior for 2000 stock status = Small, 0.13 - 0.36
Used 2000 prior B/B0 range = 0.13 - 0.36, prior B/B_msy = 0.26 - 0.72
Used prior range for kq = 4.84 - 13.4 [original range = 4.84 - 13.4]
Comment: B/B0 prior from LBB. RF: OK
Source: SMFS 2017

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
Viable r-kq pairs = 5007

Results:

viable r-kq pairs = 5007
median kq = 8.07, 5.26 - 11.7
median MSYq = 0.912, 0.562 - 1.41
r (4 MSYq/kq) = 0.452, 0.277 - 0.724
F_msy (r/2) = 0.226, 0.138 - 0.362
F/F_msy = 1.91, 0.447 - 4.29 (2016)
B/B_msy = 0.254, 0.142 - 0.455 (2017)





LBB results for *Lumpenus lampretaeformis*, *Lumpenus lampretaeformis*, 1999-2017
 Files:LBB4AMSY_ID_3.csv, LBB_June052019_Lumpenus_lampretaeformis.csv

L_{inf} prior= 33, SD=0.33 cm (user-defined), $L_{max}=36$, median $L_{max}=31.5$

Z/K prior = 2.8, SD=0.12, M/K prior=1.5, SD=0.15

F/K prior = 1.28 (wide range with tau=4 in log-normal distribution)

L_c prior = 16.3, SD=1.6 cm, alpha prior=19.9, SD=2, $L_{m50}=20$ cm

General reference points (median across years):

L_{inf} = 33 (32.5-33.6) cm

L_{opt} = 21 cm, $L_{opt}/L_{inf}=0.65$

L_c_{opt} = 19 cm, $L_c_{opt}/L_{inf}=0.56$, Lmean if $F=M$ 23 cm

M/K = 1.62 (1.36-1.9)

F/M = 1.49 (1.05-2.04), F/K=2.35 (1.82-2.87), Z/K=3.93 (3.52-4.37)

B/B₀ = 0.3 (0.18-0.45), B/B₀ F=M $L_c=L_c_{opt}$ 0.36

Y/R' = 0.032 (0.019-0.052), Y/R' F=M $L_c=L_c_{opt}$ 0.039

Estimates for 2017 (mean of last 3 years with data):

L_{c50} = 20.6 (20.2-21) cm, $L_c/L_{inf}=0.63$ (0.61-0.64)

L_{c95} = 26.8, alpha=0.482 (0.466-0.497)

Lmean/ L_{opt} = 1.1, $L_c/L_c_{opt}=1.1$, $L_{95th}/L_{inf}=0.86$, Mature=38%

F/M = 6.5 (5.1-8), F/K=10 (8.5-11), Z/K=12 (10-13)

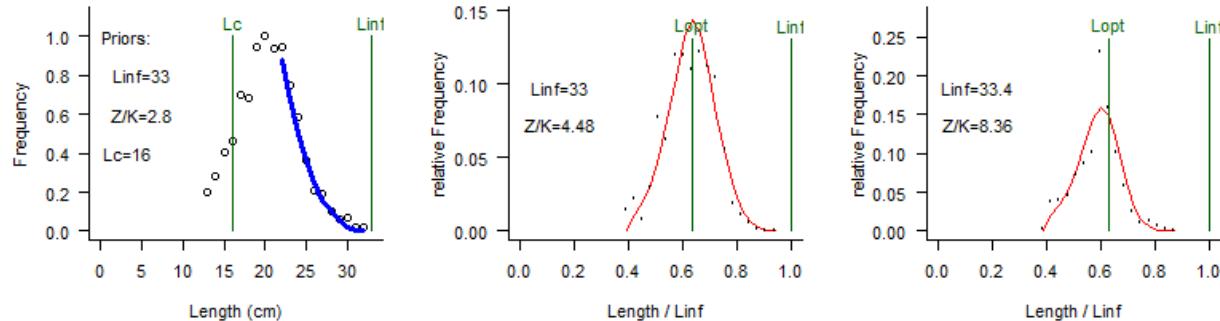
Y/R' = 0.02 (0.013-0.028)

B/B₀ = 0.11 (0.072-0.15), best LF fit year 2014=0.097 (0.048-0.19)

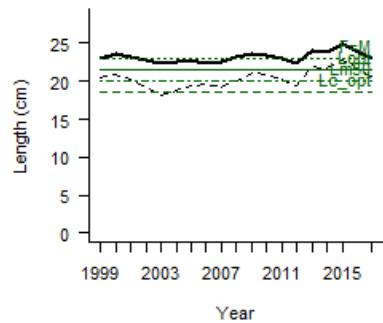
B/B_{masy} = 0.29 (0.2-0.41), selected B/B₀ 1999 = 0.28 (0.19-0.45)

RF: Set L_{inf} between median and max. Set $L_{cut}=13$ to exclude early juveniles.
 Selected 1999 because of reasonable fit and CL.

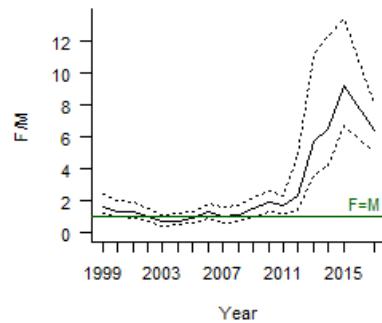
Lumpenus lampretaeformis, aggregated



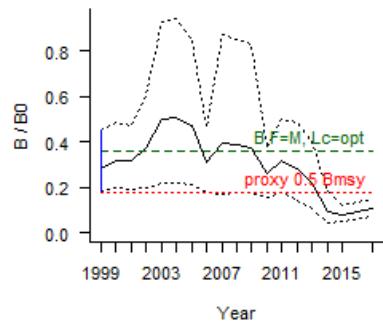
Lmean vs Lopt & Lc vs Lc_opt



previous F/M



exploited B / B₀



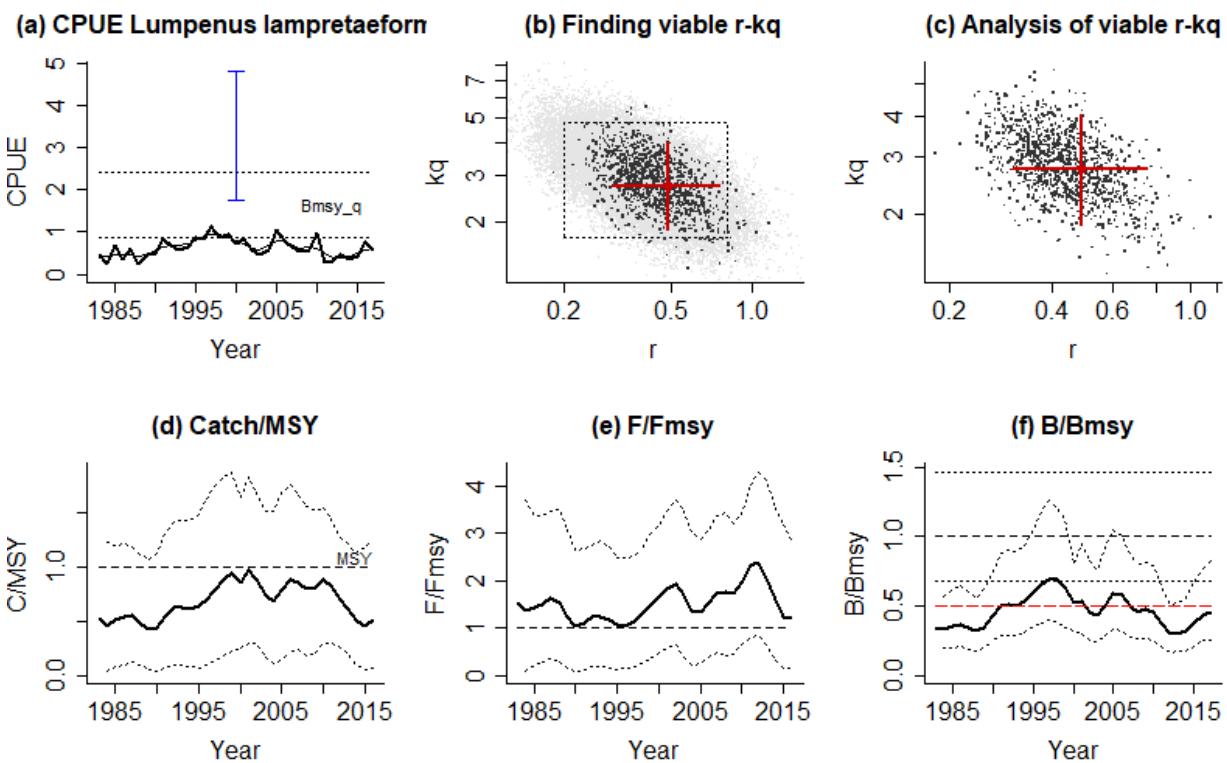
AMSY Analysis, Fri Nov 01 18:20:05 2019

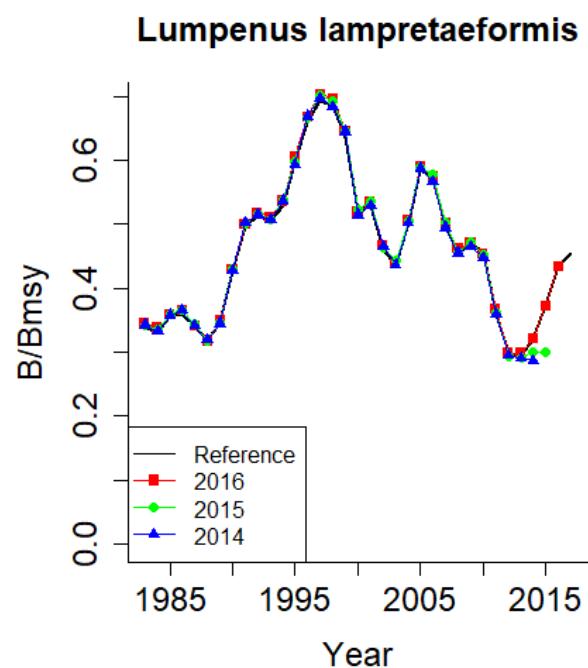
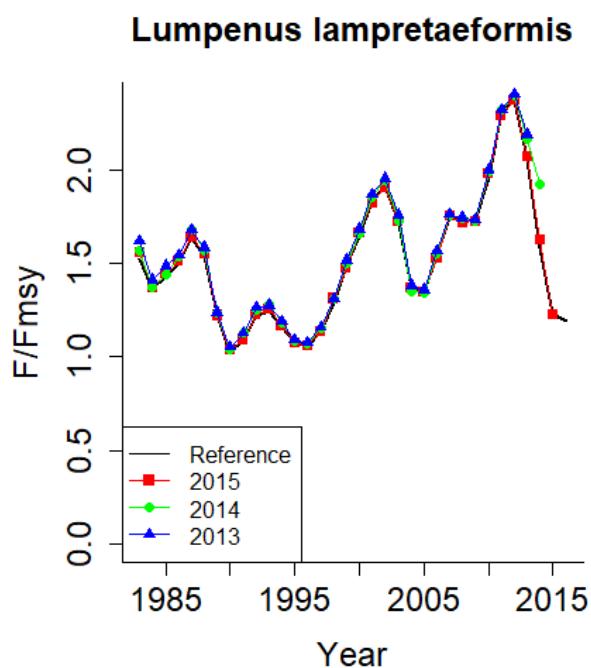
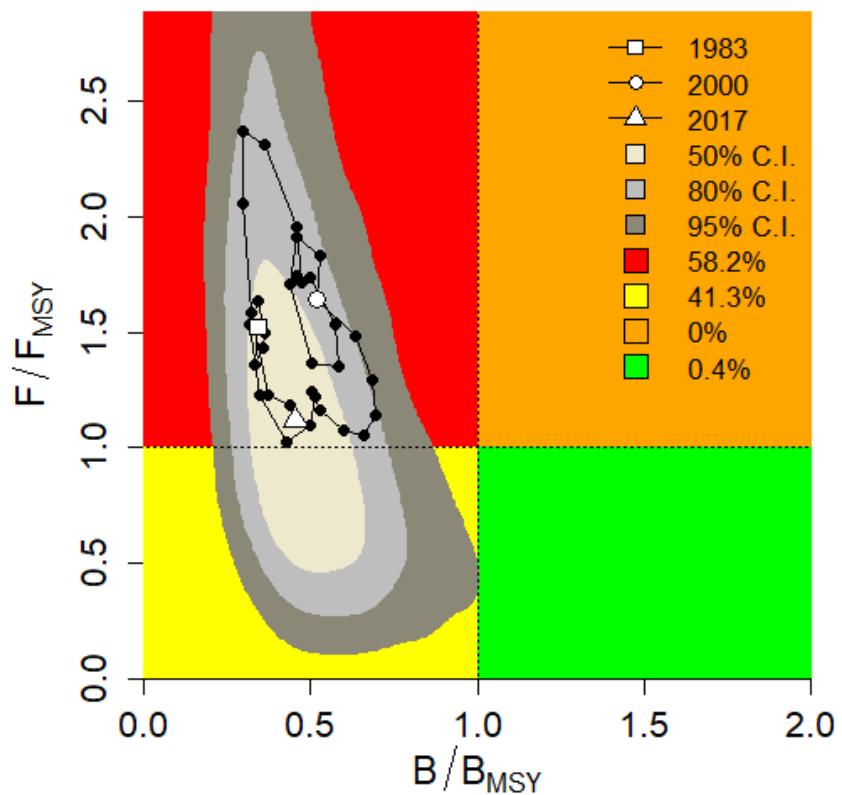
Stock *Lumpenus lampretaeformis*, *Lumpenus lampretaeformis*, Snake blenny
CPUE data for years 1983 - 2017, CPUE range 0.401 - 0.948, smooth = TRUE
Prior for r = Medium, NA - NA
Used prior range for r = 0.2 - 0.8
Prior for 2000 stock status = Small, 0.13 - 0.36
Used 2000 prior B/B0 range = 0.13 - 0.36, prior B/Bmsy = 0.26 - 0.72
Used prior range for kq = 1.74 - 4.82 [original range = 1.74 - 4.82]
Comment: B/B0 prior from LBB. RF: OK
Source: SMFS 2017

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
Viable r-kq pairs = 5000

Results:

viable r-kq pairs = 5000
median kq = 2.75, 1.86 - 4.04
median MSYq = 0.335, 0.208 - 0.533
r (4 MSYq/kq) = 0.486, 0.302 - 0.755
Fmsy (r/2) = 0.243, 0.151 - 0.377
F/Fmsy = 1.19, 0.138 - 2.88 (2016)
B/Bmsy = 0.454, 0.252 - 0.824 (2017)





LBB results for *Lycodes vahlii*, stock *Lycodes vahlii*, 1994-2013
 Files:LBB4AMSY_ID_3.csv, LBB_June052019_Lycodes_vahlii.csv

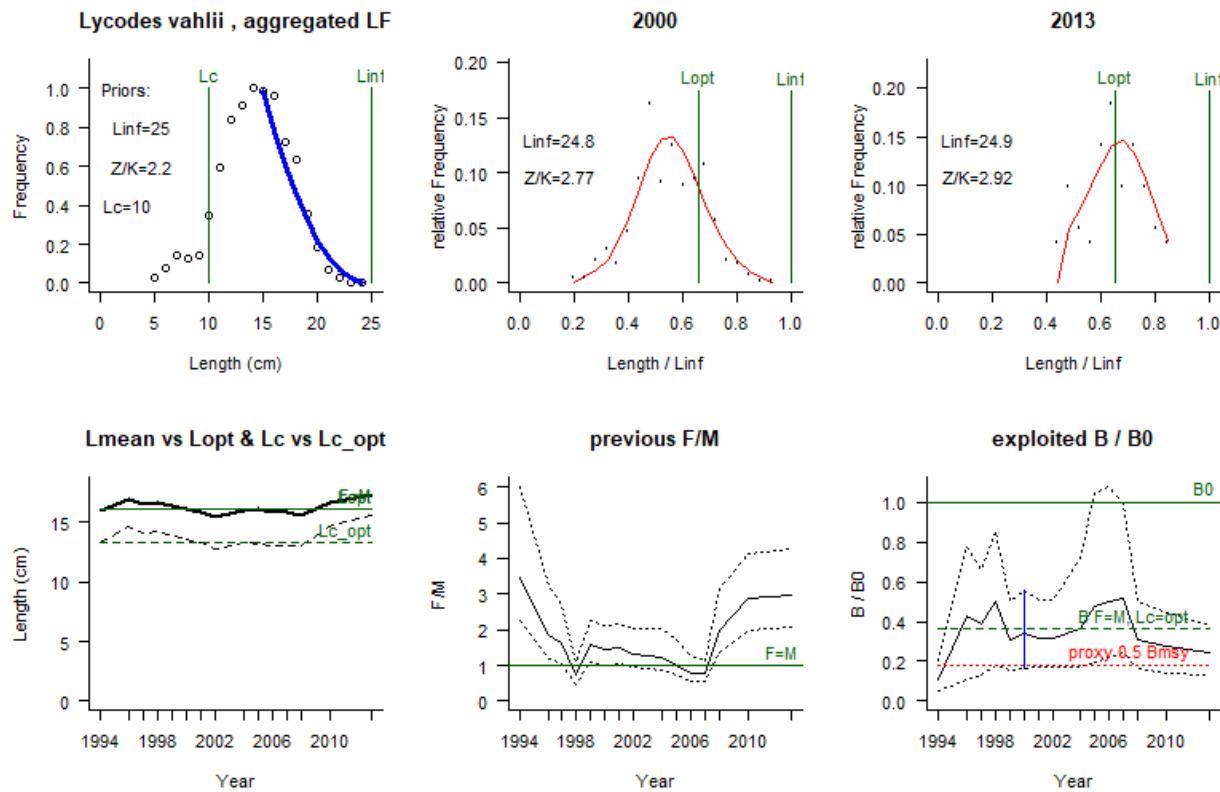
Linf prior= 25, SD=0.25 cm (user-defined), Lmax=32, median Lmax=22
 Z/K prior = 2.2, SD=0.21, M/K prior=1.5, SD=0.15
 F/K prior = 0.679 (wide range with tau=4 in log-normal distribution)
 Lc prior = 10.2, SD=1 cm, alpha prior=12.2, SD=1.2, Lm50=NA cm

General reference points (median across years):

Linf = 24.3 (23.8-24.7) cm
 Lopt = 16 cm, Lopt/Linf=0.66
 Lc_opt = 13 cm, Lc_opt/Linf=0.55, Lmean if F=M 16.1 cm
 M/K = 1.54 (1.24-1.75)
 F/M = 0.921 (0.601-1.45), F/K=1.44 (1.09-1.88), Z/K=3.01 (2.73-3.36)
 B/B0 = 0.37 (0.18-0.62), B/B0 F=M Lc=Lc_opt 0.36
 Y/R' = 0.033 (0.019-0.069), Y/R' F=M LC=Lc_opt 0.042

Estimates for 2013 (mean of last 3 years with data):

Lc50 = 15.6 (15.2-15.9) cm, Lc/Linf=0.64 (0.62-0.65)
 Lc95 = 20.1, alpha=0.66 (0.636-0.678)
 Lmean/Lopt= 1, Lc/Lc_opt=1.2, L95th/Linf=20.3 cm, L95th/Linf=0.83, Mature=NA%
 F/M = 3 (2.1-4.3), F/K=4.1 (3.1-4.7), Z/K=5.5 (4.6-6.2)
 Y/R' = 0.032 (0.017-0.052)
 B/B0 = 0.24 (0.13-0.38), best LF fit year 2001=0.313 (0.17-0.51)
 B/Bmsy = 0.67 (0.35-1), selected B/B0 2000 = 0.34 (0.16-0.56)
 RF: Set Linf=26cm between median and max. Excluded years with unrealistic LF fits. Selected 2000 for reasonable fit, CL and B/B0



AMSY Analysis, Fri Nov 01 18:23:28 2019

Stock *Lycodes vahlii*, *Lycodes vahlii*, vahl's eelpout

CPUE data for years 1983 - 2017, CPUE range 0.295 - 1.59, smooth = TRUE

Prior for r = Medium, NA - NA

Used prior range for r = 0.2 - 0.8

Prior for 2000 stock status = About half, 0.16 - 0.56

Used 2000 prior B/B₀ range = 0.16 - 0.56, prior B/B_msy = 0.32 - 1.12

Used prior range for k_q = 1.85 - 5.56 [original range = 1.85 - 6.49]

Comment: B/B₀ prior from LBB. RF: OK

Source: SMFS 2017

Monte Carlo filtering of r-k_q space with 50000 points and 30 error patterns.
Viable r-k_q pairs = 5000

Results:

viable r-k_q pairs = 5000

median k_q = 3, 2.04 - 4.58

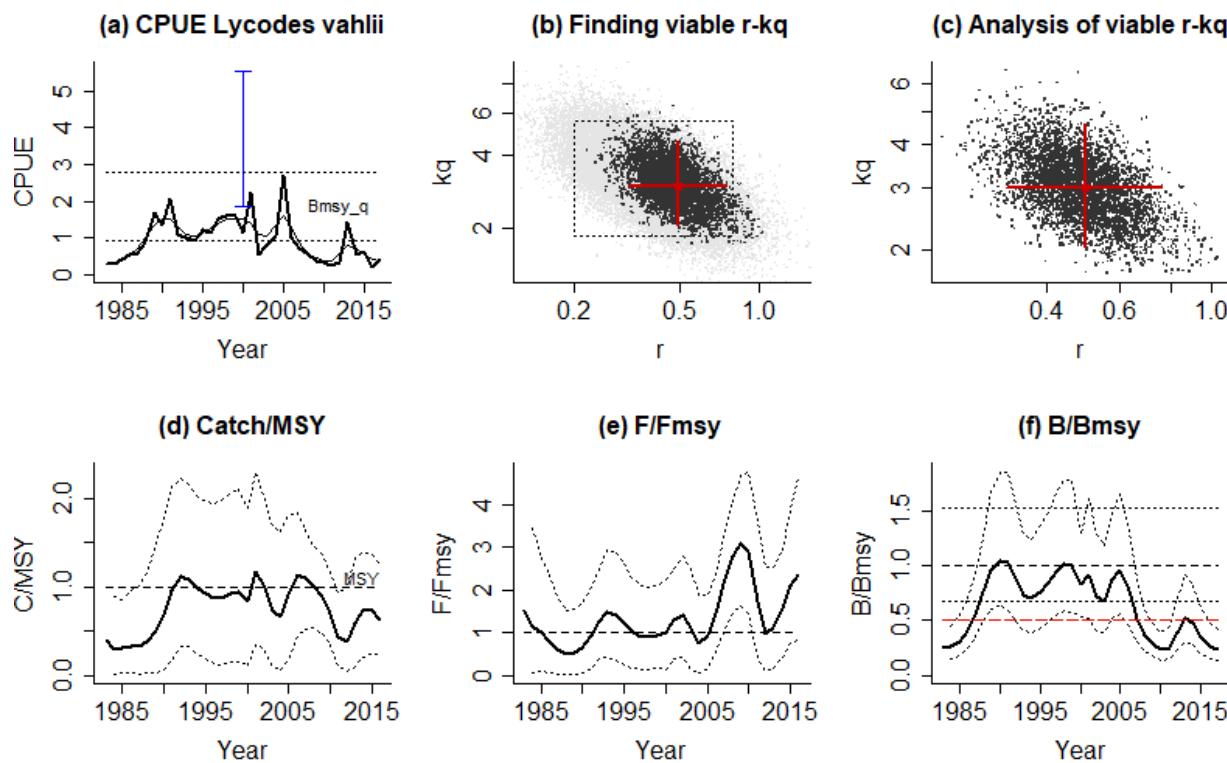
median MSY_q = 0.37, 0.243 - 0.562

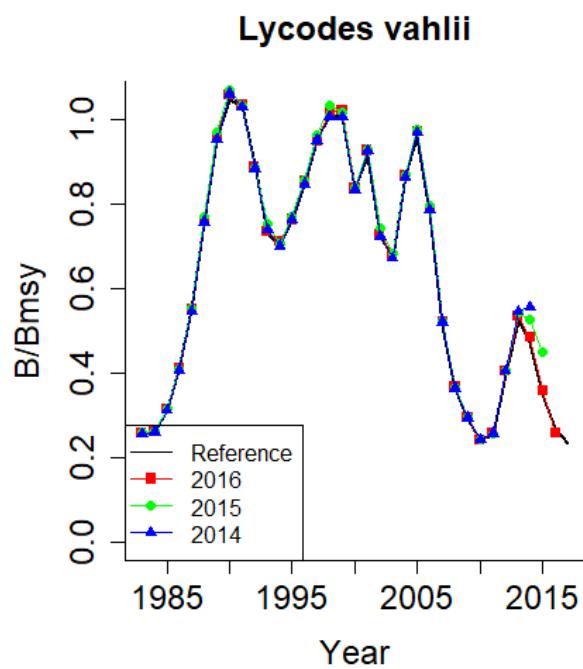
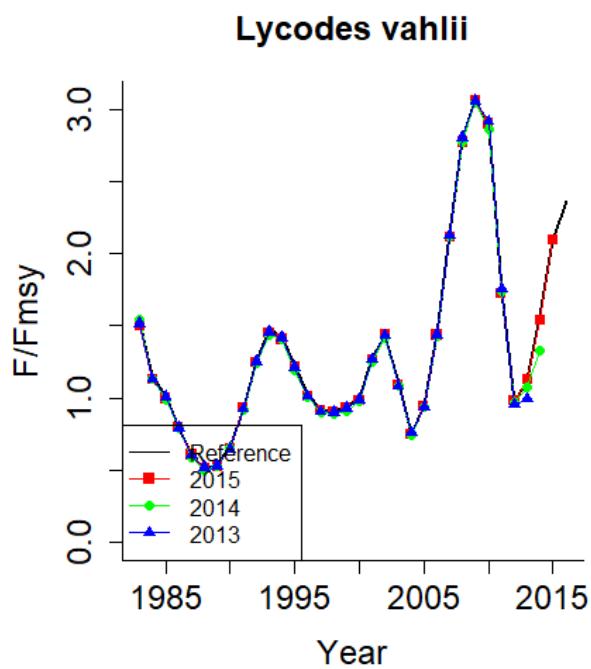
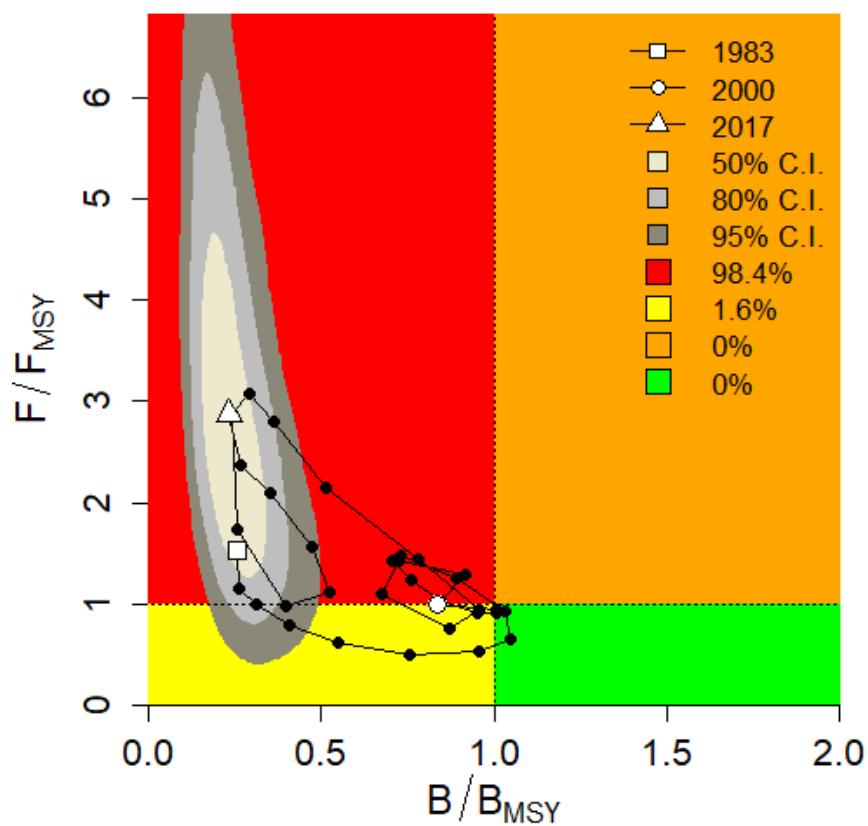
r (4 MSY_q/k_q) = 0.493, 0.319 - 0.756

F_msy (r/2) = 0.247, 0.159 - 0.378

F/F_msy = 2.36, 0.812 - 4.64 (2016)

B/B_msy = 0.232, 0.13 - 0.425 (2017)





LBB results for *Myoxocephalus scorpius*, stock *Myoxocephalus scorpius*, 1983-2016

Files:LBB4AMSY_ID_3.csv, LBB_June052019_Myoxocephalus scorpius.csv

L_{inf} prior= 31, SD=0.31 cm (user-defined), L_{max} =34, median L_{max} =29

Z/K prior = 2.1, SD=0.079, M/K prior=1.5, SD=0.15

F/K prior = 0.563 (wide range with $\tau=4$ in log-normal distribution)

L_c prior = 12.2, SD=1.2 cm, alpha prior=17.3, SD=1.7, L_{m50} =16 cm

General reference points (median across years):

L_{inf} = 30.2 (29.8-30.7) cm

L_{opt} = 22 cm, $L_{opt}/L_{inf}=0.72$

L_c_{opt} = 20 cm, $L_c_{opt}/L_{inf}=0.65$, Lmean if $F=M$ 20.2 cm

M/K = 1.14 (0.9-1.33)

F/M = 2.09 (1.23-3.04), $F/K=2.21$ (1.53-2.53), $Z/K=3.21$ (2.99-3.51)

B/B_0 = 0.19 (0.11-0.31), $B/B_0 F=M$ $L_c=L_c_{opt}$ 0.38

Y/R' = 0.04 (0.021-0.08) (reduced: $B/B_0 < 0.25$), $Y/R' F=M L_c=L_c_{opt}$ 0.066

Estimates for 2016 (mean of last 3 years with data):

L_{c50} = 14.3 (13.9-14.6) cm, $L_c/L_{inf}=0.47$ (0.46-0.48)

L_{c95} = 20.5, alpha=0.472 (0.454-0.486)

$L_{mean}/L_{opt}=0.84$, $L_c/L_c_{opt}=0.73$, $L_{95th}/L_{inf}=0.86$, Mature=39%

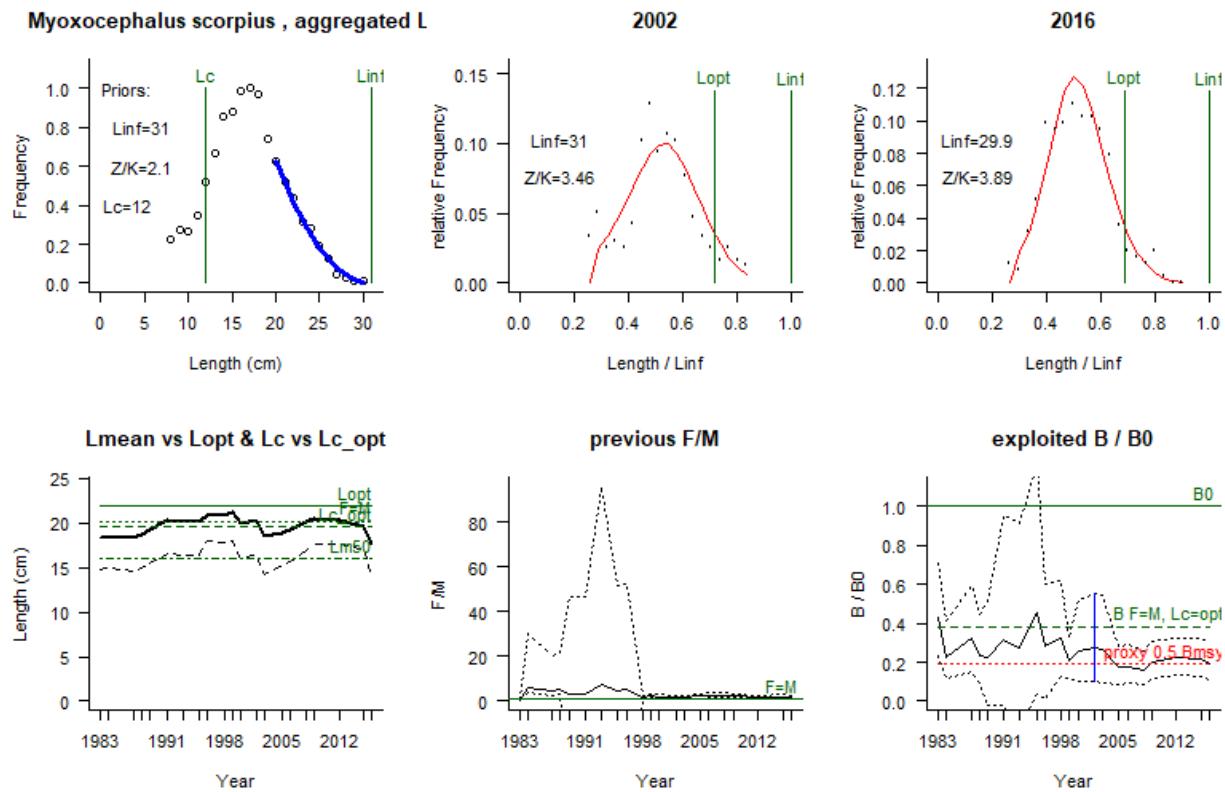
F/M = 1.9 (1.3-2.8), $F/K=2.5$ (2-3), $Z/K=3.9$ (3.5-4.3)

Y/R' = 0.038 (0.021-0.059) (reduced because $B/B_0 < 0.25$)

B/B_0 = 0.19 (0.11-0.3), best LF fit year 2012=0.224 (0.14-0.32)

B/B_{msy} = 0.51 (0.29-0.77), selected B/B_0 2002 = 0.28 (0.1-0.55)

RF: Set $L_{inf}=31$ between median and max. Set $L_{cut}=8$ cm to exclude peaks of early juveniles. Excluded years with unrealistic LF patterns. Selected 2002 because of reasonable fit, CL and B/B_0 compared to other years.



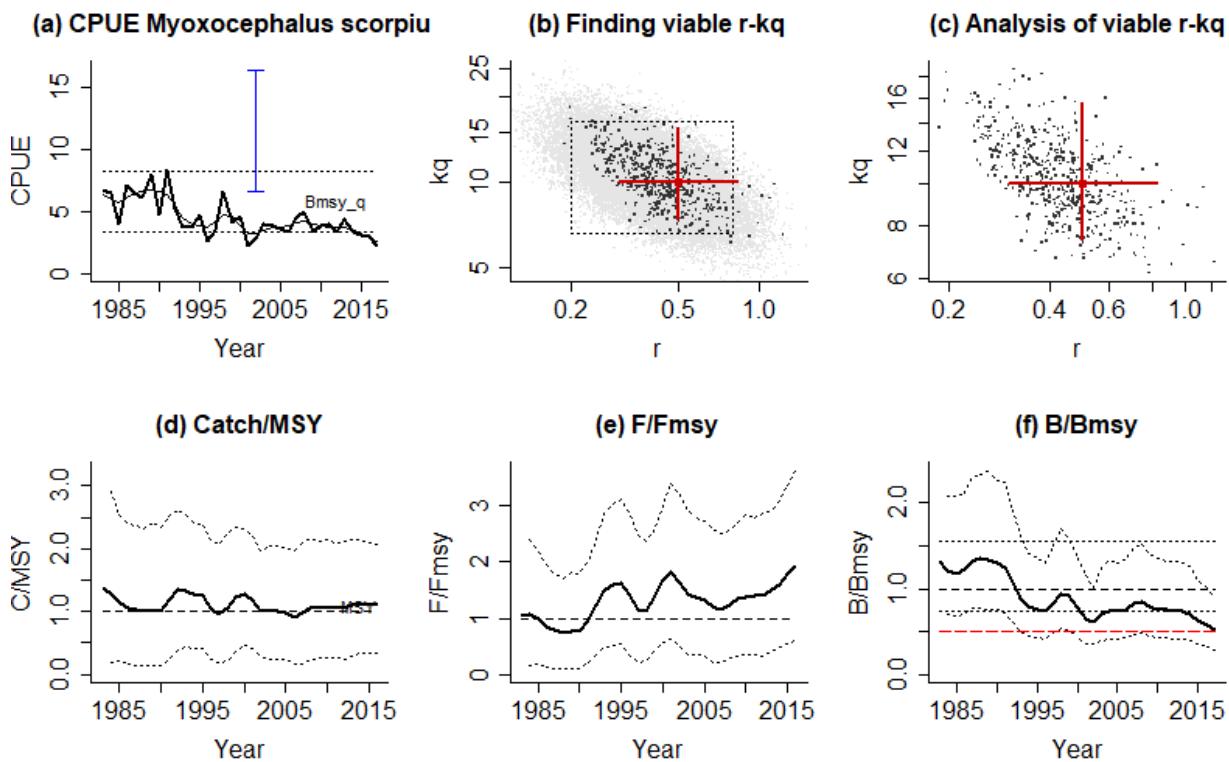
AMSY Analysis, Fri Nov 01 18:29:22 2019

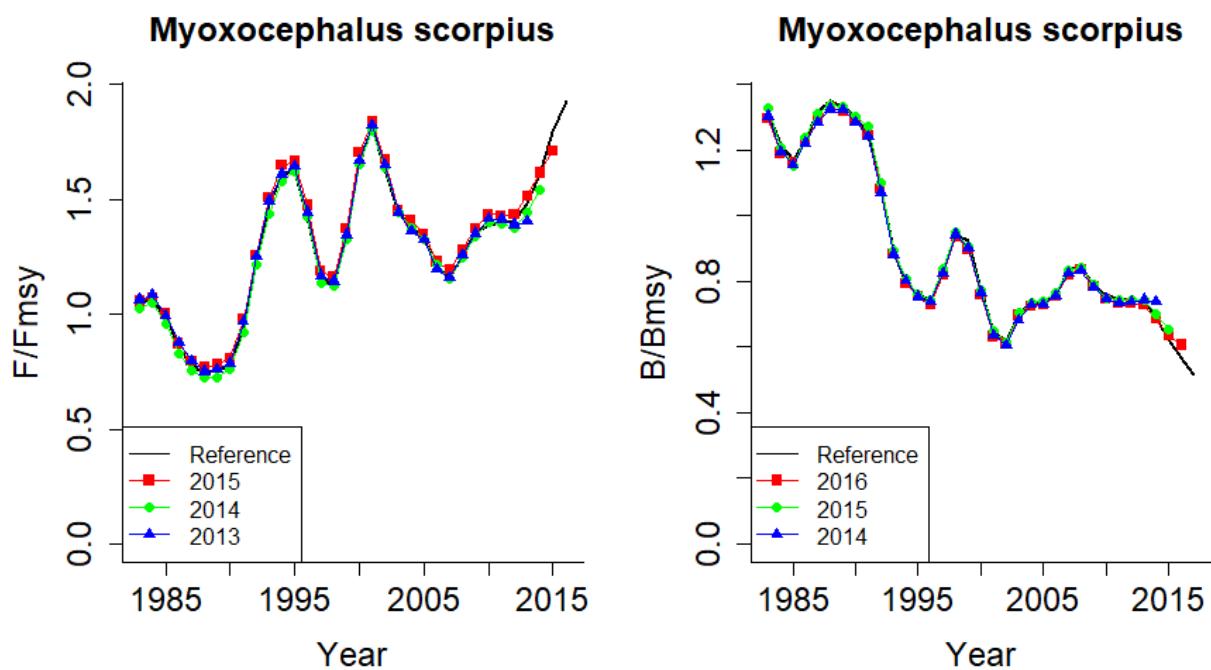
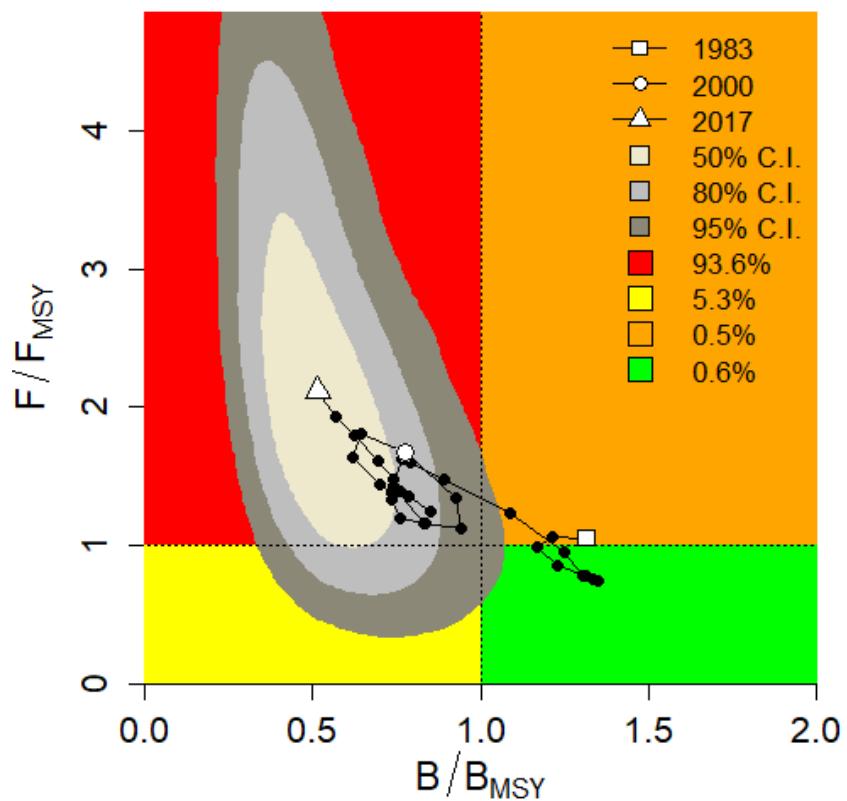
Stock *Myoxocephalus scorpius*, *Myoxocephalus scorpius*, Shorthorn sculpin
CPUE data for years 1983 - 2017, CPUE range 2.59 - 6.64, smooth = TRUE
Prior for r = Medium, NA - NA
Used prior range for r = 0.2 - 0.8
Prior for 2002 stock status = About half, 0.1 - 0.55
Used 2002 prior B/B₀ range = 0.1 - 0.55, prior B/B_msy = 0.2 - 1.1
Used prior range for kq = 6.62 - 16.4 [original range = 2.97 - 16.4]
Comment: B/B₀ prior from LBB. RF: OK
Source: SMFS 2017

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
Viable r-kq pairs = 5001

Results:

viable r-kq pairs = 5001
median kq = 10, 7.42 - 15.6
median MSY_q = 1.26, 0.836 - 2
r (4 MSY_q/kq) = 0.5, 0.299 - 0.832
F_msy (r/2) = 0.25, 0.15 - 0.416
F/F_msy = 1.93, 0.611 - 3.63 (2016)
B/B_msy = 0.515, 0.287 - 0.906 (2017)





LBB results for *Myxine glutinosa*, stock *Myxine glutinosa*, 1995-2017
 Files:LBB4AMSY_ID_3.csv, LBB_June052019_Myxine glutinosa.csv

L_{inf} prior= 40, SD=0.4 cm (user-defined), L_{max} =76, median L_{max} =36

Z/K prior = 3.1, SD=0.082, M/K prior=1.5, SD=0.15

F/K prior = 1.56 (wide range with $\tau=4$ in log-normal distribution)

L_c prior = 17.3, SD=1.7 cm, alpha prior=16.7, SD=1.7, L_{m50} =30 cm

General reference points (median across years):

L_{inf} = 39.7 (39-40.4) cm

L_{opt} = 27 cm, $L_{opt}/L_{inf}=0.69$

L_{c_opt} = 25 cm, $L_{c_opt}/L_{inf}=0.62$, L_{mean} if $F=M$ 26.7 cm

M/K = 1.36 (1.07-1.63)

F/M = 2.6 (2.03-3.73), $F/K=3.26$ (2.85-3.97), $Z/K=4.57$ (4.21-5.11)

B/B_0 = 0.15 (0.1-0.23), $B/B_0 F=M L_c=L_{c_opt}$ 0.37

Y/R' = 0.034 (0.02-0.053)(reduced: $B/B_0 < 0.25$), $Y/R' F=M L_c=L_{c_opt}$ 0.051

Estimates for 2017 (mean of last 3 years with data):

L_{c50} = 23.7 (23.1-24.2) cm, $L_c/L_{inf}=0.6$ (0.58-0.61)

L_{c95} = 31.2, alpha=0.392 (0.379-0.405)

$L_{mean}/L_{opt}=1$, $L_c/L_{c_opt}=0.96$, $L_{95th}/L_{inf}=0.84$, Mature=0.63%

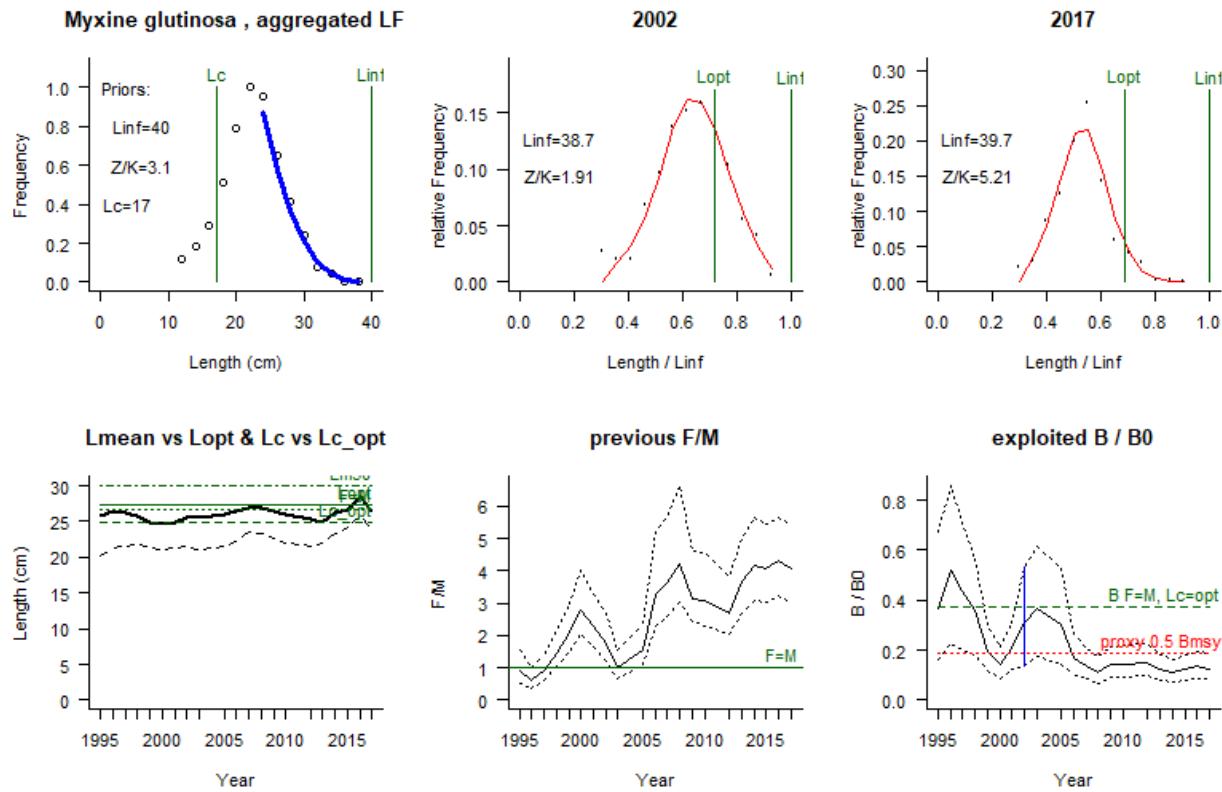
F/M = 4 (3-5.4), $F/K=6.8$ (5.5-7.9), $Z/K=8.4$ (7.1-9.4)

Y/R' = 0.025 (0.016-0.036)(reduced because $B/B_0 < 0.25$)

B/B_0 = 0.13 (0.083-0.19), best LF fit year 2005=0.305 (0.14-0.53)

B/B_{msy} = 0.34 (0.22-0.5), selected B/B_0 2002 = 0.31 (0.14-0.53)

RF: Set $L_{inf}=40$. Set L_{cut} to 12 to exclude early juveniles. Excluded years with unrealistic LF fits. Selected 2002 because of reasonable LF fit and B/B_0 compatible with adjacent estimates.



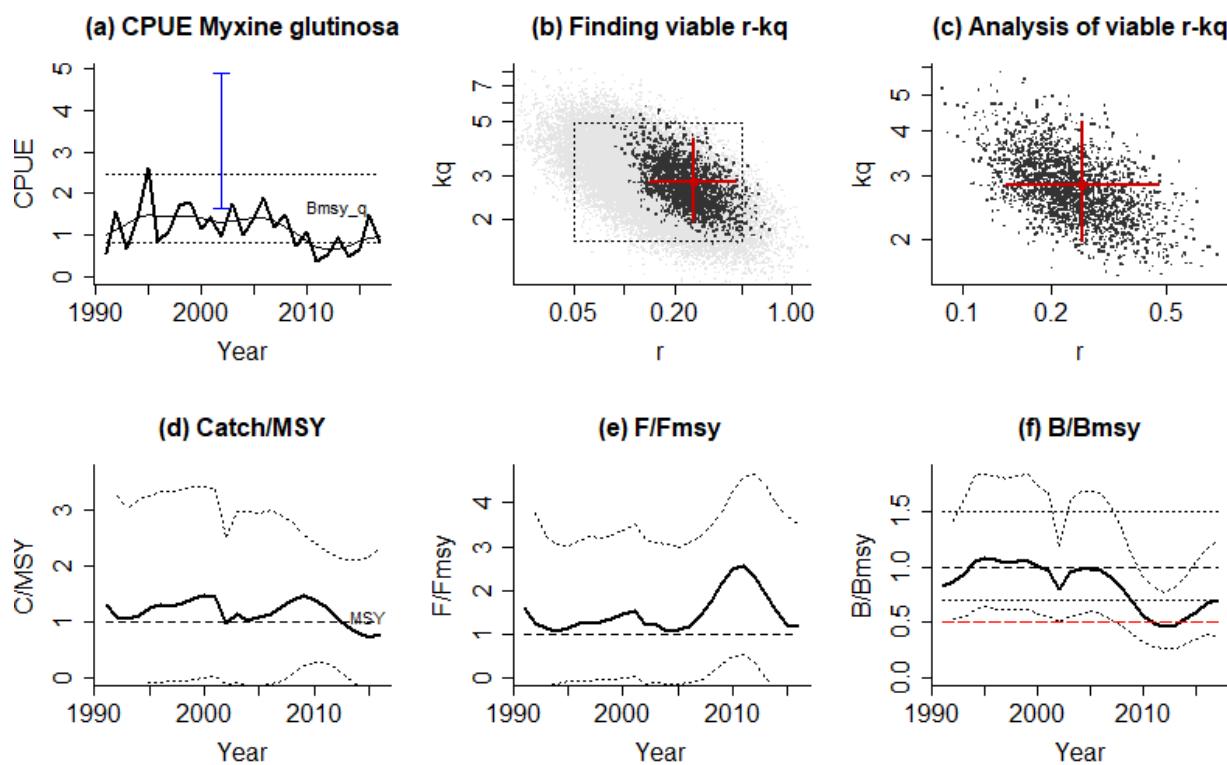
AMSY Analysis, Fri Nov 01 18:33:43 2019

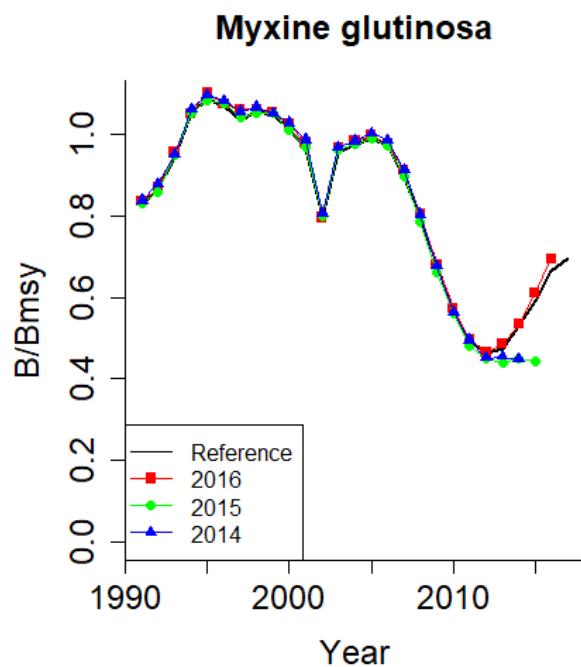
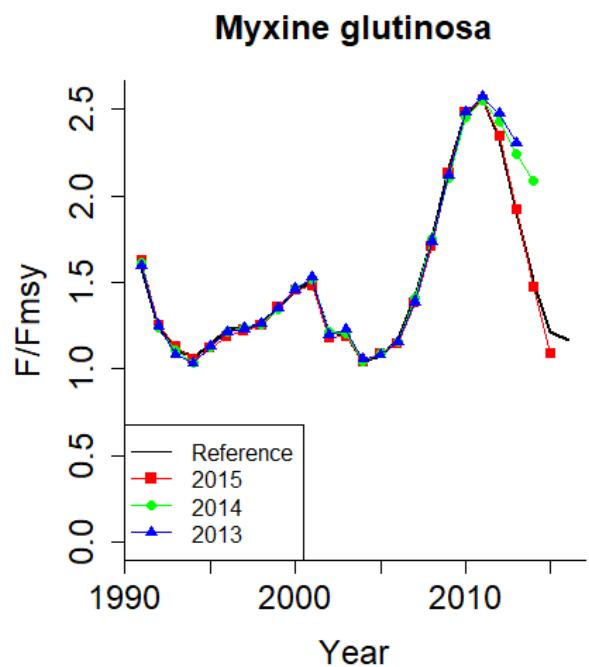
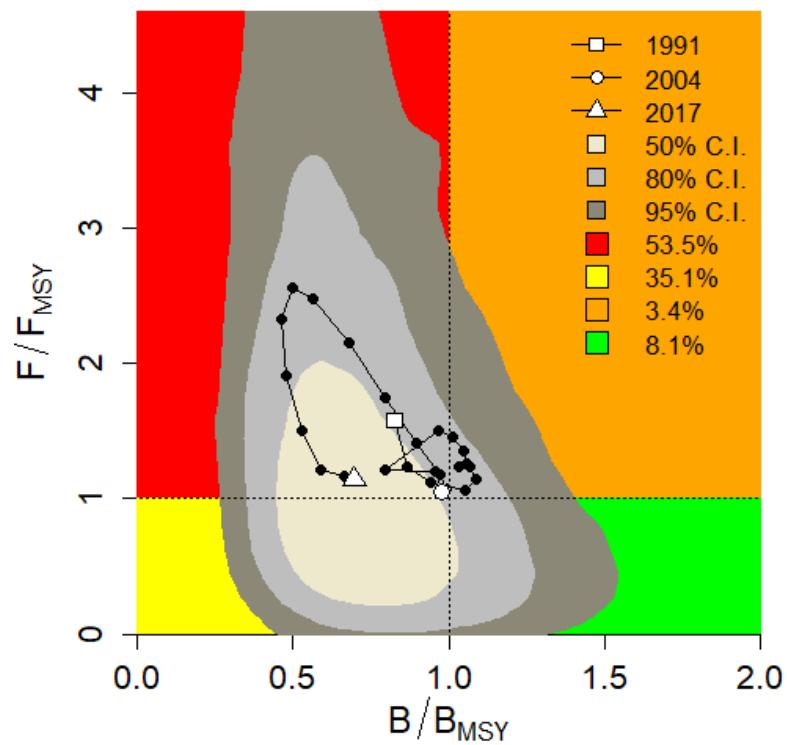
Stock *Myxine glutinosa*, *Myxine glutinosa*, Atlantic hagfish
CPUE data for years 1991 - 2017, CPUE range 0.66 - 1.48, smooth = TRUE
Prior for r = Low, NA - NA
Used prior range for r = 0.05 - 0.5
Prior for 2002 stock status = About half, 0.14 - 0.53
Used 2002 prior B/B0 range = 0.14 - 0.53, prior B/Bmsy = 0.28 - 1.06
Used prior range for kq = 1.64 - 4.91 [original range = 1.64 - 6.19]
Comment: B/B0 prior from LBB. RF: OK
Source: SMFS 2017

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
Viable r-kq pairs = 5001

Results:

viable r-kq pairs	= 5001
median kq	= 2.83, 1.98 - 4.25
median MSYq	= 0.183, 0.107 - 0.317
r (4 MSYq/kq)	= 0.258, 0.14 - 0.467
Fmsy (r/2)	= 0.129, 0.0698 - 0.233
F/Fmsy	= 1.16, -0.322 - 3.5 (2016)
B/Bmsy	= 0.696, 0.379 - 1.25 (2017)





LBB results for *Raja clavata*, stock rjc.27.3a47d, 1983-2015
 Files:LBB4AMSY_ID_3.csv, LBB_June052019_Raja clavata.csv

Linf prior= 90, SD=0.9 cm (user-defined), Lmax=95, median Lmax=85

Z/K prior = 2.9, SD=0.3, M/K prior=1.5, SD=0.15

F/K prior = 1.43 (wide range with tau=4 in log-normal distribution)

Lc prior = 22.9, SD=2.3 cm, alpha prior=15.7, SD=1.6, Lm50=40 cm

General reference points (median across years):

Linf = 92.6 (91.2-94.2) cm

Lopt = 63 cm, Lopt/Linf=0.68

Lc_opt = 53 cm, Lc_opt/Linf=0.58, Lmean if F=M 40.2 cm

M/K = 1.43 (1.17-1.67)

F/M = 1.23 (0.921-1.91), F/K=1.89 (1.62-2.35), Z/K=3.45 (3.26-3.67)

B/B0 = 0.2 (0.096-0.31), B/B0 F=M Lc=Lc_opt 0.37

Y/R' = 0.025 (0.012-0.041)(reduced: B/B0<0.25), Y/R' F=M Lc=Lc_opt 0.048

Estimates for 2015 (mean of last 3 years with data):

Lc50 = 21.9 (20.1-23.7) cm, Lc/Linf=0.24 (0.22-0.26)

Lc95 = 35.1, alpha=0.223 (0.217-0.228)

Lmean/Lopt= 0.59, Lc/Lc_opt=0.41, L95th=81.7 cm, L95th/Linf=0.91, Mature=33%

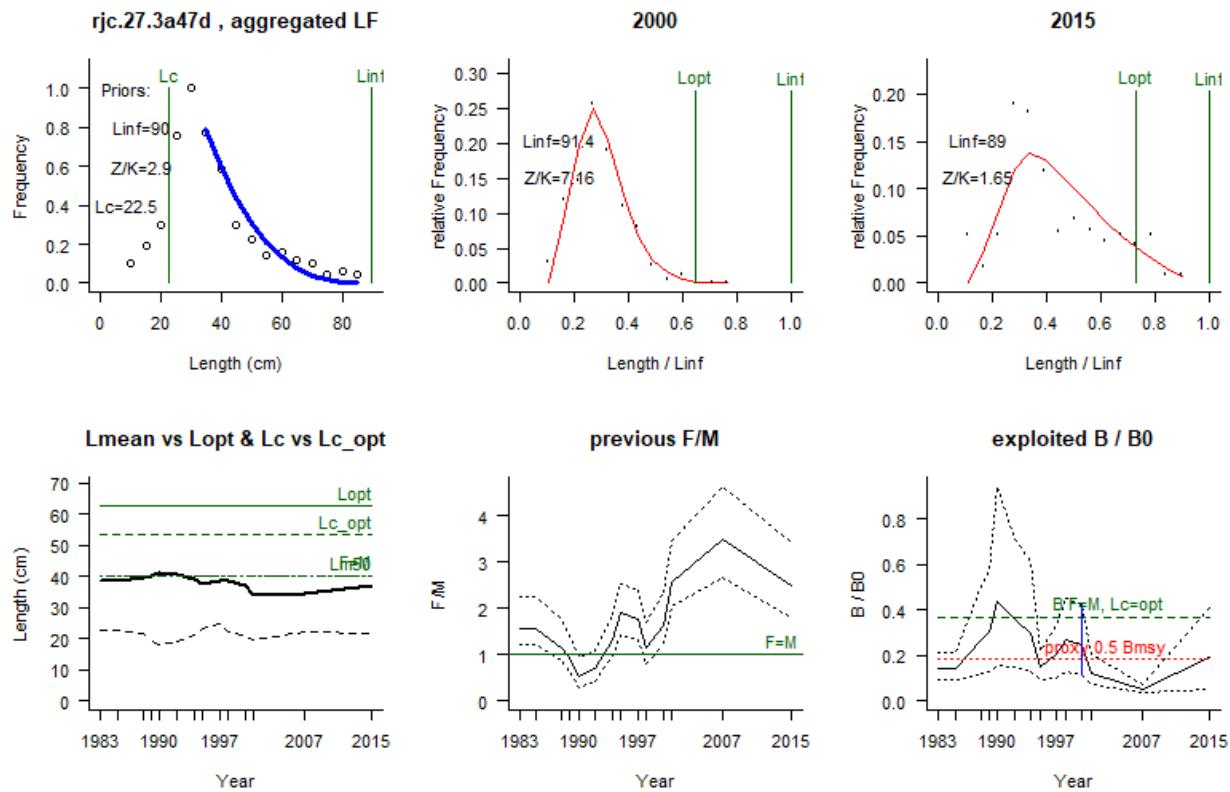
F/M = 2.5 (1.8-3.4), F/K=3.5 (3.1-3.9), Z/K=4.8 (4.5-5)

Y/R' = 0.021 (0.0055-0.043)(reduced because B/B0 < 0.25)

B/B0 = 0.19 (0.053-0.41), best LF fit year 2001=0.122 (0.074-0.21)

B/Bmsy = 0.53 (0.14-1.1), selected B/B0 2000 = 0.25 (0.11-0.42)

RF: Set Linf between median and max. Set Lcut=10 to remove peaks of early juveniles. Set Lstart=34 to have better fit of aggregated prior Z/K. Used MergeLF to increase numbers. Excluded years with unrealistic LF fits. Selected 2000 because of intermediate B/B0 and reasonable LF fit.



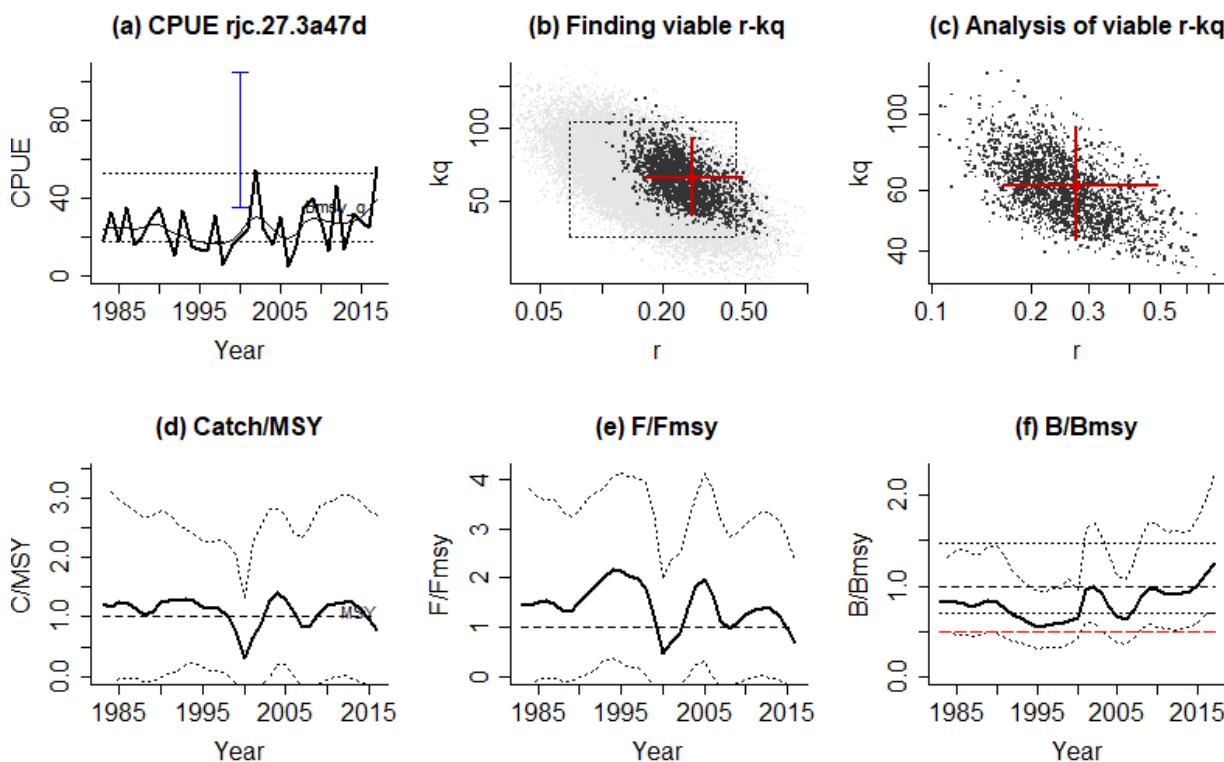
AMSY Analysis, Fri Nov 01 18:41:58 2019

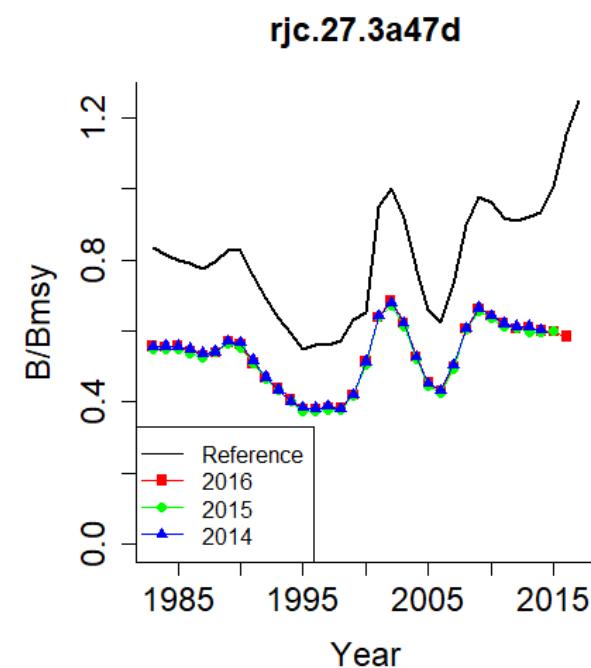
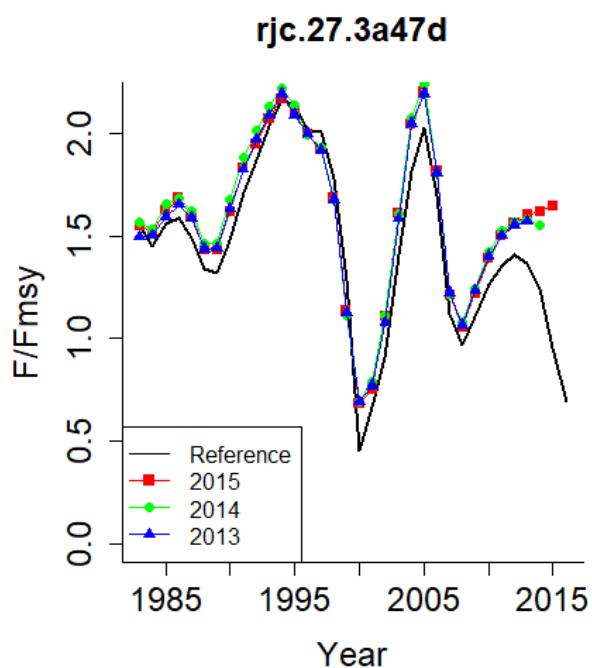
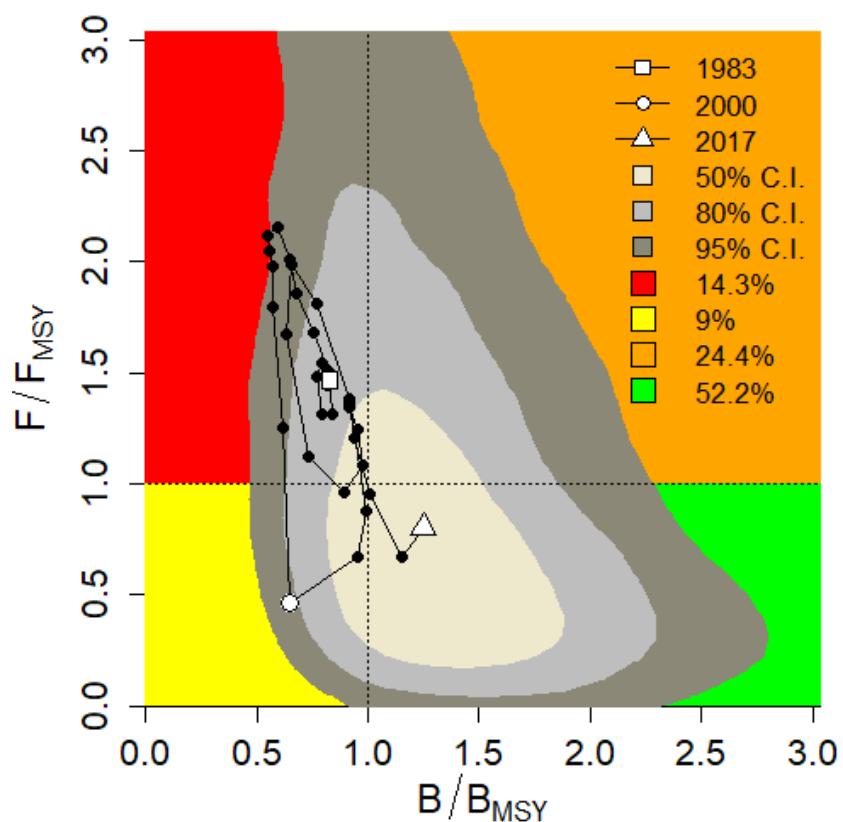
Stock rjc.27.3a47d, *Raja clavata*, Thornback ray
CPUE data for years 1983 - 2017, CPUE range 16.7 - 39, smooth = TRUE
Prior for r = Low, 0.07 - 0.45
Used prior range for r = 0.0606 - 0.522
Prior for 2000 stock status = Small, 0.11 - 0.42
Used 2000 prior B/B_0 range = 0.11 - 0.42, prior B/B_{msy} = 0.22 - 0.84
Used prior range for kq = 35.1 - 105 [original range = 35.1 - 134]
Comment: B/B_0 prior from LBB. RF: Note that the steep increase in cpue in the last year changes the whole assessment, as nicely shown by the retrospective analysis. Thus, for management, the analysis should be restricted to 2016 until new data come in to evaluate the peak in 2017.
Source: SMFS 2017 for length and CPUE

Monte Carlo filtering of r - kq space with 50000 points and 30 error patterns.
Viable r - kq pairs = 5000

Results:

viable r - kq pairs = 5000
median kq = 62, 43.3 - 91.6
median MSYq = 4.28, 2.62 - 7.01
 r (4 MSYq/ kq) = 0.277, 0.162 - 0.488
 F_{msy} ($r/2$) = 0.138, 0.0812 - 0.244
 F/F_{msy} = 0.675, -0.197 - 2.36 (2016)
 B/B_{msy} = 1.25, 0.702 - 2.25 (2017)





LBB results for *Raja montagui*, stock rjm.27.3a47d, 1983-2016
 Files:LBB4AMSY_ID_3.csv, LBB_June052019_Raja montagui.csv

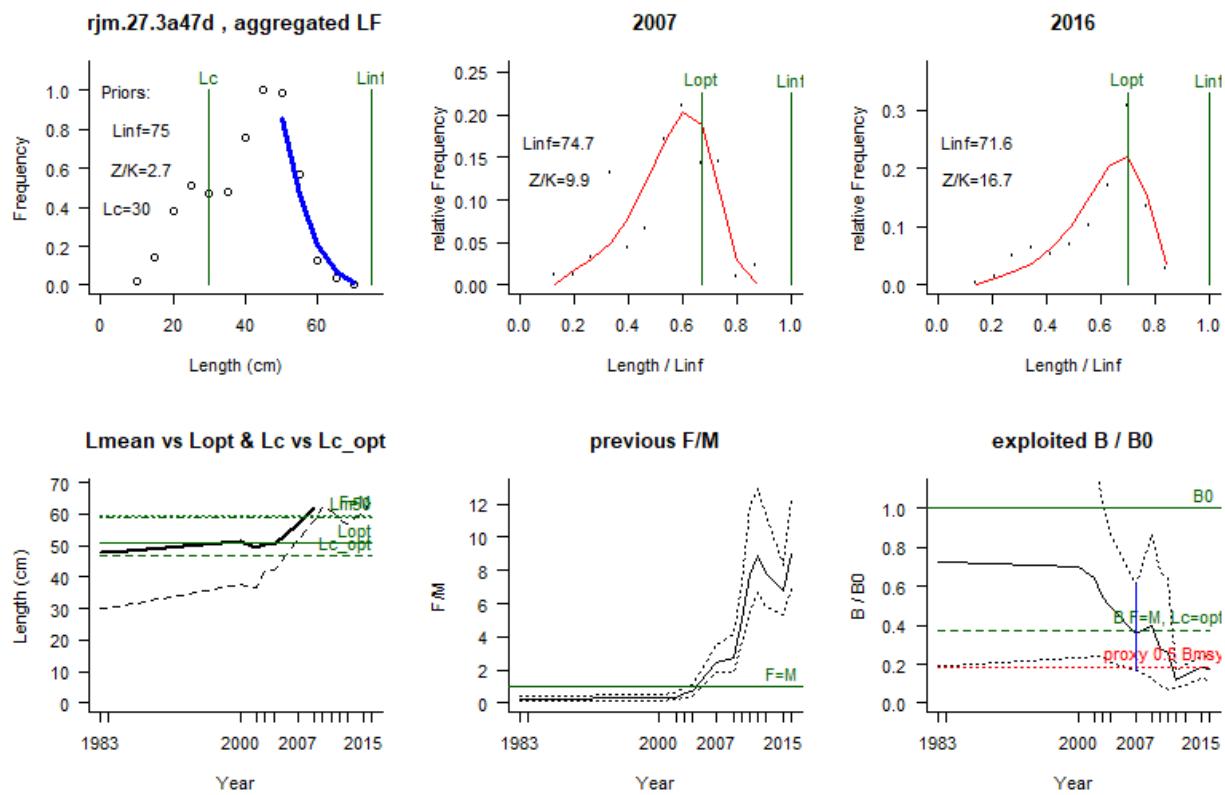
Linf prior= 75, SD=0.75 cm (user-defined), Lmax=95, median Lmax=60
 Z/K prior = 2.7, SD=0.38, M/K prior=1.5, SD=0.15
 F/K prior = 1.24 (wide range with tau=4 in log-normal distribution)
 Lc prior = 30.6, SD=3.1 cm, alpha prior=9.04, SD=0.9, Lm50=59 cm

General reference points (median across years):

Linf	= 73.9 (72.4-75.2) cm
Lopt	= 51 cm, Lopt/Linf=0.69
Lc_opt	= 47 cm, Lc_opt/Linf=0.63, Lmean if F=M 59.6 cm
M/K	= 1.37 (1.17-1.56)
F/M	= 3.04 (2.1-4.63), F/K=5.41 (3.8-8.77), Z/K=6.96 (5.36-10.3)
B/B0	= 0.34 (0.15-0.58), B/B0 F=M Lc=Lc_opt 0.37
Y/R'	= 0.024 (0.014-0.039), Y/R' F=M LC=Lc_opt 0.048

Estimates for 2016 (mean of last 3 years with data):

Lc50	= 64.6 (62.9-66.7) cm, Lc/Linf=0.89 (0.87-0.92)
Lc95	= 87.5, alpha=0.129 (0.124-0.133)
Lmean/Lopt	= NA, Lc/Lc_opt=1.4, L95th=60 cm, L95th/Linf=0.83, Mature=3%
F/M	= 9 (6.9-12), F/K=15 (12-19), Z/K=17 (14-21)
Y/R'	= 0.023 (0.015-0.034)
B/B0	= 0.17 (0.12-0.24), best LF fit year 2012=0.118 (0.08-0.17)
B/Bmsy	= 0.47 (0.32-0.65), selected B/B0 2007 = 0.36 (0.17-0.61)
RF:	Set Lstart to 50cm to avoid error in aggregated fit. Set Lcut=10cm to avoid peaks of early juveniles. Used MergeLF to increase numbers per year. Set Linf between median and max. All fits are close to unsatisfactory. Selected 2007 for intermediate B/B0 and reasonable fit.



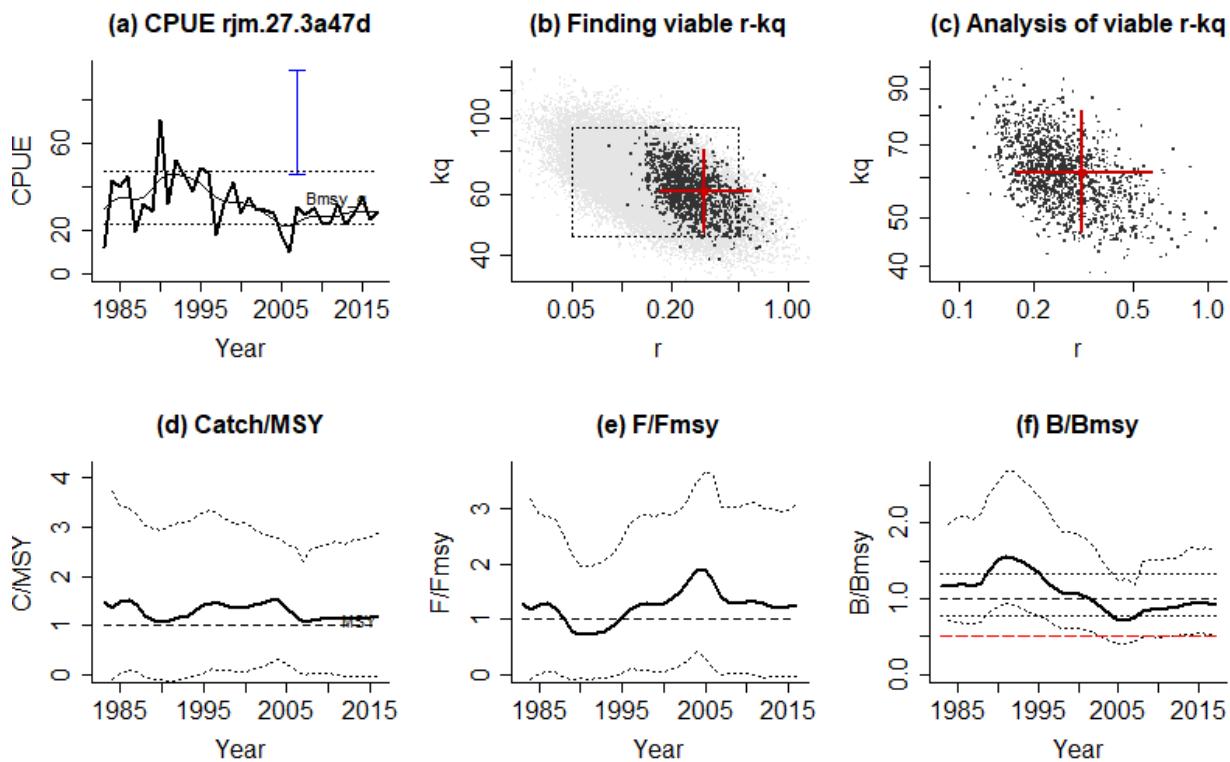
AMSY Analysis, Fri Nov 01 19:21:23 2019

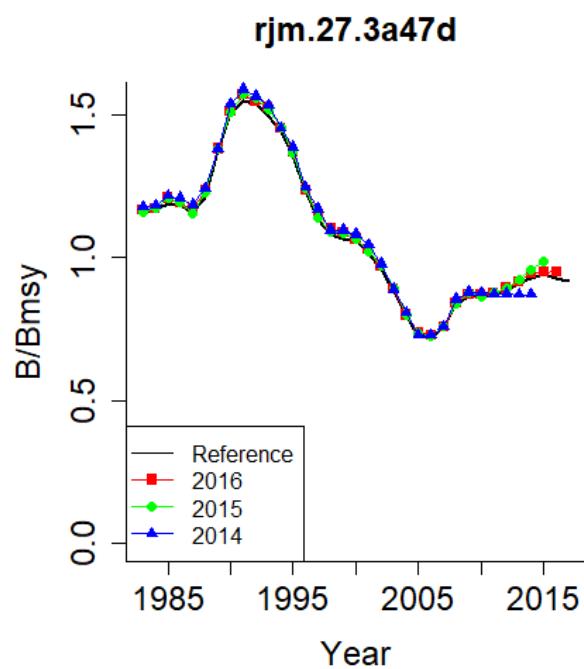
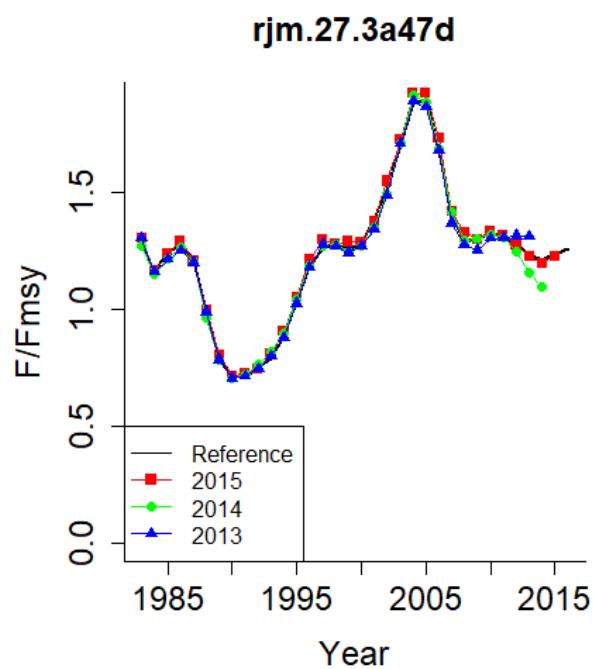
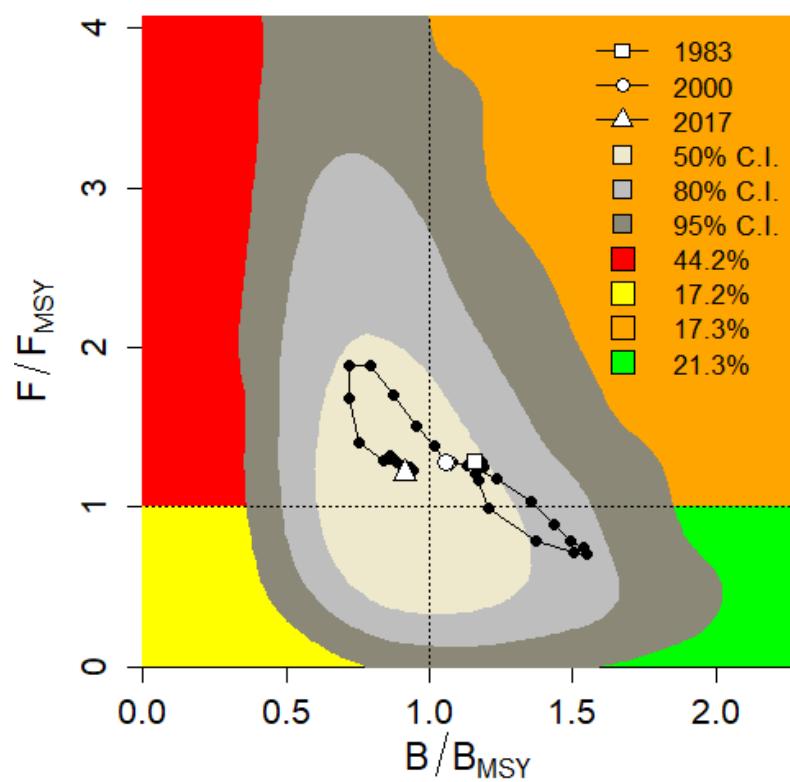
Stock **rjm.27.3a47d**, *Raja montagui*, Spotted ray
CPUE data for years 1983 - 2017, CPUE range 21.8 - 45.4, smooth = TRUE
Prior for r = Low, NA - NA
Used prior range for r = 0.05 - 0.5
Prior for 2007 stock status = About half, 0.17 - 0.61
Used 2007 prior B/B0 range = 0.17 - 0.61, prior B/Bmsy = 0.34 - 1.22
Used prior range for kq = 45.3 - 93.8 [original range = 26.1 - 93.8]
Comment: B/B0 prior from LBB. RF: OK
Source: SMFS 2017 for length and CPUE.

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
Viable r-kq pairs = 5003

Results:

viable r-kq pairs = 5003
median kq = 61.3, 46.8 - 81.6
median MSYq = 4.8, 2.78 - 8.18
r (4 MSYq/kq) = 0.313, 0.169 - 0.601
Fmsy (r/2) = 0.157, 0.0846 - 0.3
F/Fmsy = 1.26, -0.0468 - 3.1 (2016)
B/Bmsy = 0.915, 0.505 - 1.62 (2017)





LBB results for *Scyliorhinus canicula*, stock syc.27.3a47d, 1984–2017
 Files:LBB4AMSY_ID_3.csv, LBB_June052019_Scyliorhinus canicula.csv

Linf prior= 85, SD=0.85 cm (user-defined), Lmax=112, median Lmax=72
 Z/K prior = 2.4, SD=0.32, M/K prior=1.5, SD=0.15

F/K prior = 0.933 (wide range with tau=4 in log-normal distribution)

Lc prior = 39.8, SD=4 cm, alpha prior=8.9, SD=0.89, Lm50=57 cm

General reference points (median across years):

Linf = 81.2 (79.8-82.9) cm

Lopt = 58 cm, Lopt/Linf=0.72

Lc_opt = 56 cm, Lc_opt/Linf=0.69, Lmean if F=M 76.4 cm

M/K = 1.19 (0.959-1.42)

F/M = 8.43 (6.16-12.6), F/K=8.92 (7.26-10.3), Z/K=10.6 (8.16-12.1)

B/B0 = 0.16 (0.09-0.22), B/B0 F=M Lc=Lc_opt 0.38

Y/R' = 0.032 (0.018-0.056) (reduced: B/B0<0.25), Y/R' F=M Lc=Lc_opt 0.06

Estimates for 2017 (mean of last 3 years with data):

Lc50 = 71.5 (69.1-73.8) cm, Lc/Linf=0.87 (0.85-0.9)

Lc95 = 100, alpha=0.103 (0.099-0.106)

Lmean/Lopt= NA, Lc/Lc_opt=1.3, L95th=74.7 cm, L95th/Linf=0.91, Mature=27%

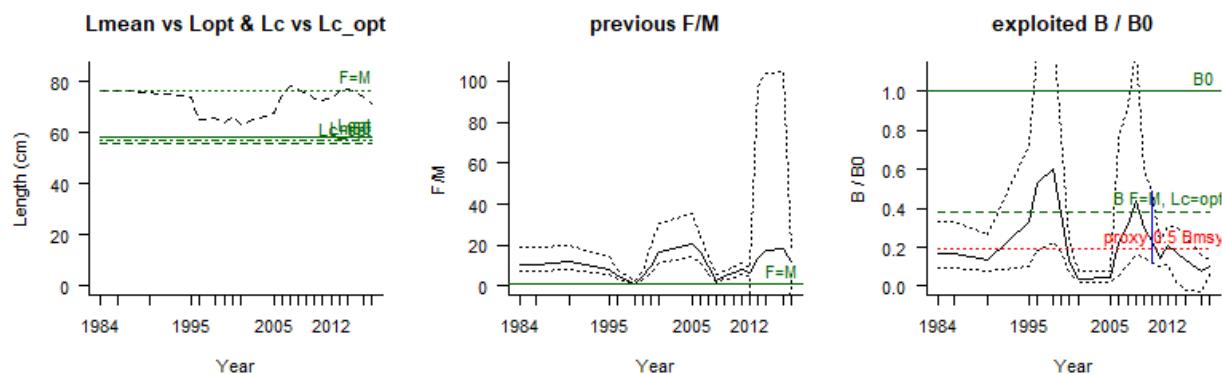
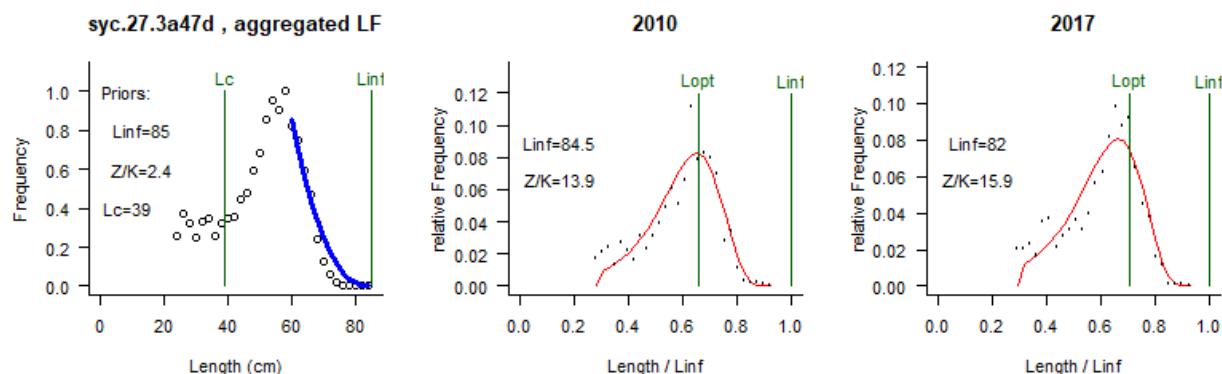
F/M = 12 (8.1-17), F/K=11 (9-14), Z/K=13 (10-15)

Y/R' = 0.028 (0.016-0.041) (reduced because B/B0 < 0.25)

B/B0 = 0.1 (0.064-0.14), best LF fit year 2009=0.301 (0.15-0.6)

B/Bmsy = 0.26 (0.17-0.36), selected B/B0 2010 = 0.23 (0.12-0.48)

RF: Set Linf between median and max. Set Lcut to avoid peaks of early juveniles. Set Lstart=60 to avoid error message. Excluded years with unrealistic LF fits. Selected 2010 because of intermediate B/B0 and reasonable LF fit. 201



AMSY Analysis, Fri Nov 01 19:25:55 2019

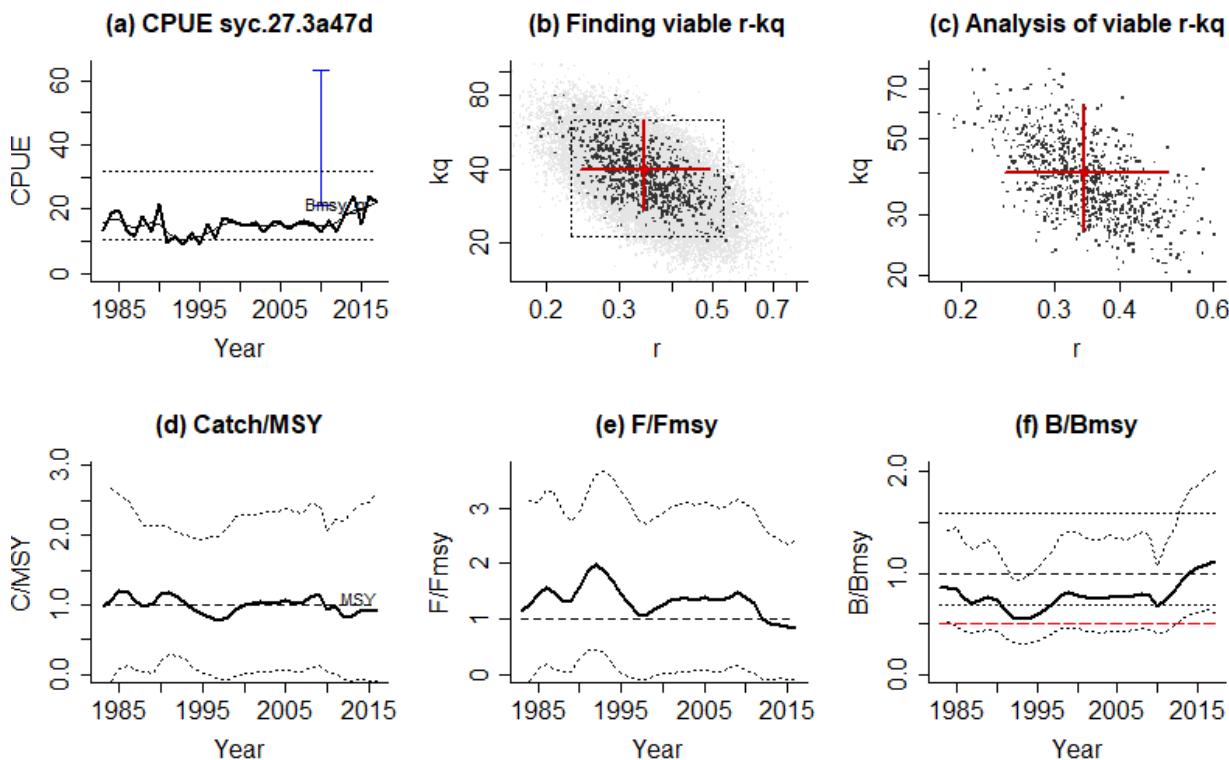
Stock syc.27.3a47d, *Scyliorhinus canicula*, Lesser spotted dogfish
CPUE data for years 1983 - 2017, CPUE range 10.6 - 22, smooth = TRUE
Prior for r = Low, 0.23 - 0.53
Used prior range for r = 0.215 - 0.564
Prior for 2010 stock status = Small, 0.12 - 0.48
Used 2010 prior B/B0 range = 0.12 - 0.48, prior B/Bmsy = 0.24 - 0.96
Used prior range for kq = 21.1 - 63.4 [original range = 19.4 - 77.8]
Comment: B/B0 prior from LBB. RF: the last year sets a new max CPUE and thus
changes the setting of prior kq. This is nicely shown in the retrospective
analysis. For management, the last year should be excluded until confirmed by
more data.

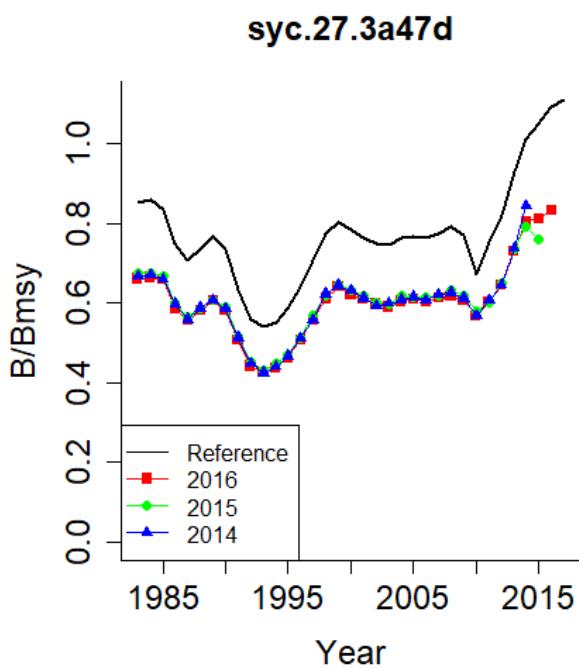
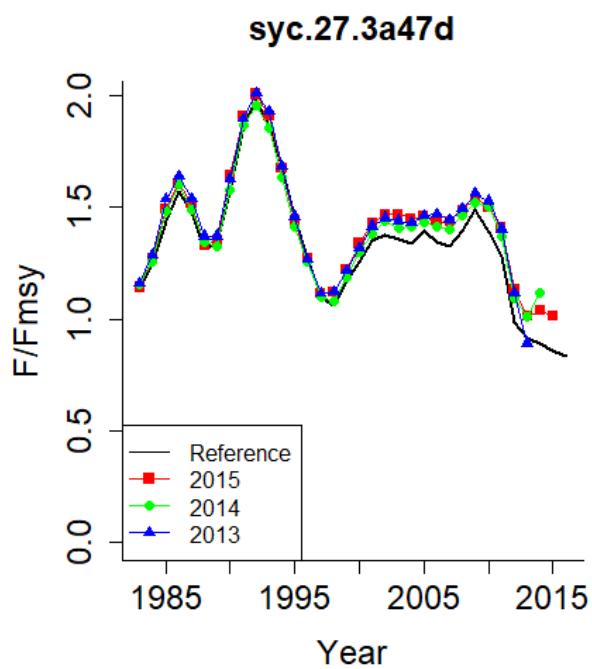
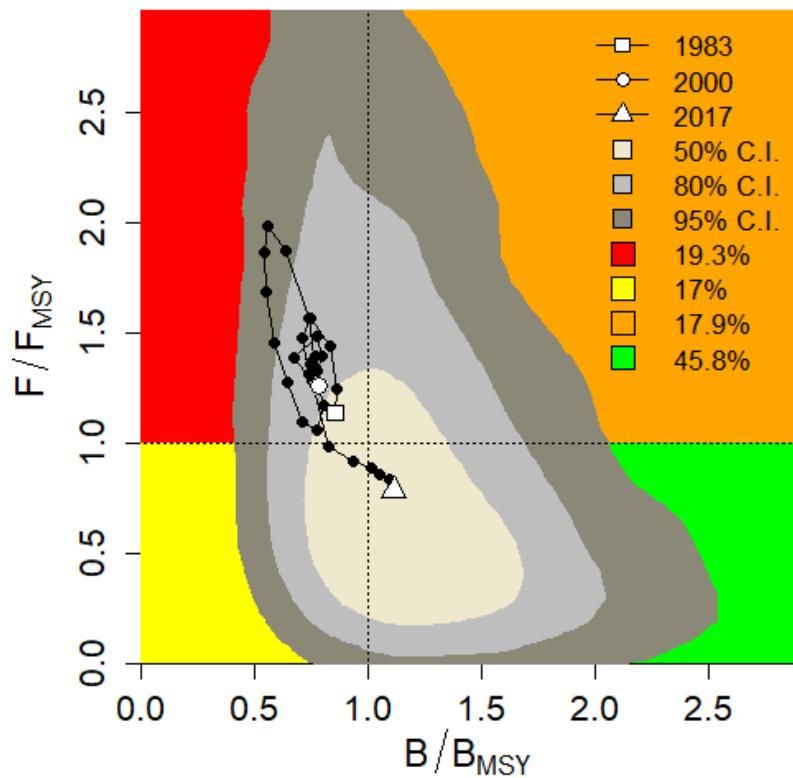
Source: SMFS 2017 for length and CPUE.

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
Viable r-kq pairs = 5003

Results:

viable r-kq pairs	= 5003
median kq	= 39.7, 27.2 - 63
median MSYq	= 3.4, 2.37 - 5.19
r (4 MSYq/kq)	= 0.342, 0.242 - 0.492
Fmsy (r/2)	= 0.171, 0.121 - 0.246
F/Fmsy	= 0.834, -0.0937 - 2.41 (2016)
B/Bmsy	= 1.11, 0.601 - 2.01 (2017)





LBB results for *Trisopterus luscus*, stock *Trisopterus luscus*, 1983-2017
 Files:LBB4AMSY_ID_3.csv, LBB_June052019_Trisopterus luscus.csv

L_{inf} prior= 38, SD=0.38 cm (user-defined), $L_{max}=44$, median $L_{max}=33$
 Z/K prior = 3.7, SD=0.18, M/K prior=1.5, SD=0.15

F/K prior = 2.19 (wide range with $\tau=4$ in log-normal distribution)

L_c prior = 12.8, SD=1.3 cm, alpha prior=24.5, SD=2.4, $L_{m50}=23$ cm

General reference points (median across years):

L_{inf} = 37.6 (36.9-38.2) cm

L_{opt} = 26 cm, $L_{opt}/L_{inf}=0.68$

L_c _opt = 23 cm, L_c _opt/ $L_{inf}=0.62$, Lmean if $F=M$ 20.2 cm

M/K = 1.41 (1.11-1.66)

F/M = 2.66 (1.24-3.74), $F/K=3.4$ (3-3.92), $Z/K=4.54$ (4.26-4.92)

B/B_0 = 0.14 (0.08-0.2), B/B_0 $F=M$ $L_c=L_c$ _opt 0.37

Y/R' = 0.027 (0.016-0.04) (reduced: $B/B_0 < 0.25$), Y/R' $F=M$ $L_c=L_c$ _opt 0.05

Estimates for 2017 (mean of last 3 years with data):

L_{c50} = 14.7 (14.6-14.8) cm, $L_c/L_{inf}=0.4$ (0.4-0.41)

L_{c95} = 17.9, alpha=0.898 (0.874-0.92)

$L_{mean}/L_{opt}=0.75$, L_c/L_c _opt=0.63, $L_{95th}/L_{inf}=0.78$, Mature=14%

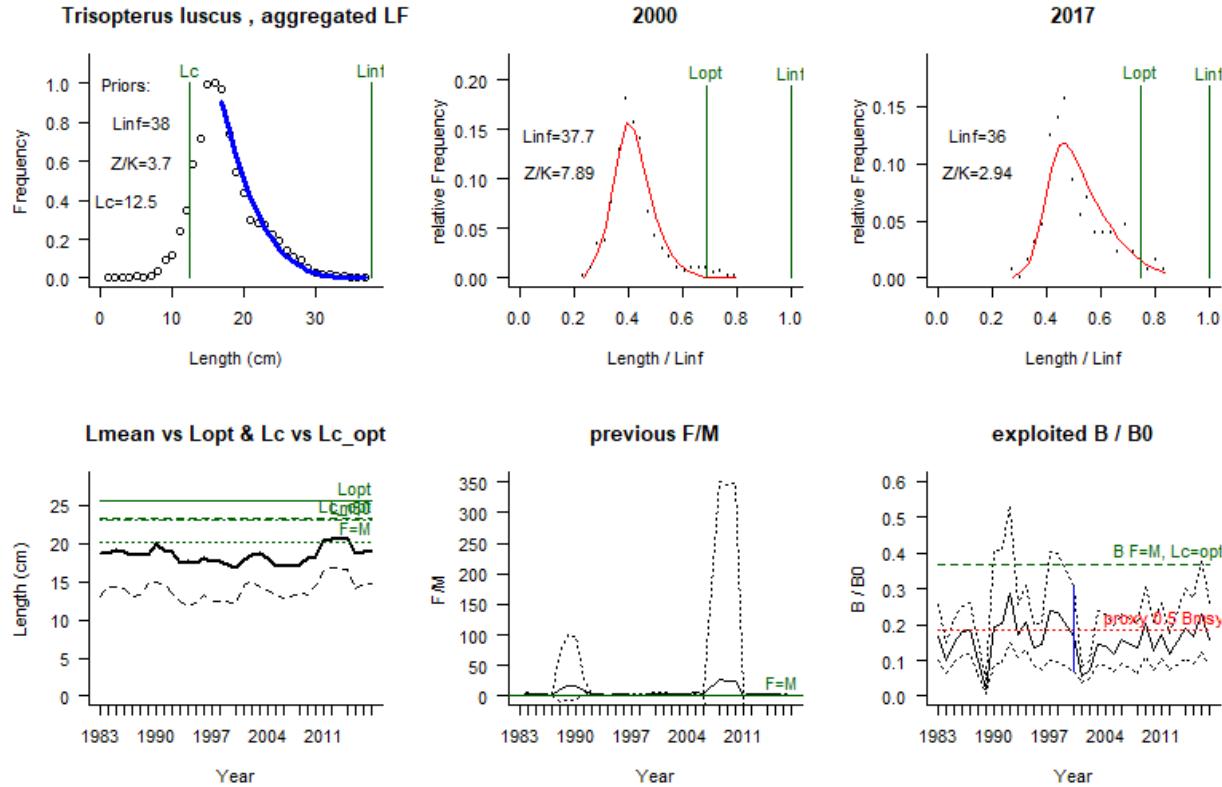
F/M = 2.4 (1.7-3.7), $F/K=3.2$ (2.9-3.7), $Z/K=4.5$ (4.2-4.8)

Y/R' = 0.036 (0.019-0.059) (reduced because $B/B_0 < 0.25$)

B/B_0 = 0.16 (0.086-0.26), best LF fit year 2015=0.168 (0.091-0.27)

B/B_{msy} = 0.43 (0.23-0.71), selected B/B_0 2000 = 0.17 (0.071-0.31)

RF: Set L_{inf} between median and max. Excluded years with unrealistic LF fits.
 Selected 2000 for intermediate B/B_0 and reasonable LF fit.



AMSY Analysis, Fri Nov 01 19:33:23 2019

Stock *Trisopterus luscus*, *Trisopterus luscus*, Pouting

CPUE data for years 1983 - 2017, CPUE range 2.89 - 7.57, smooth = TRUE

Prior for r = Medium, NA - NA

Used prior range for r = 0.2 - 0.8

Prior for 2000 stock status = Very small, 0.07 - 0.31

Used 2000 prior B/B₀ range = 0.07 - 0.31, prior B/B_{msy} = 0.14 - 0.62

Used prior range for kq = 12.5 - 37.4 [original range = 12.5 - 55.2]

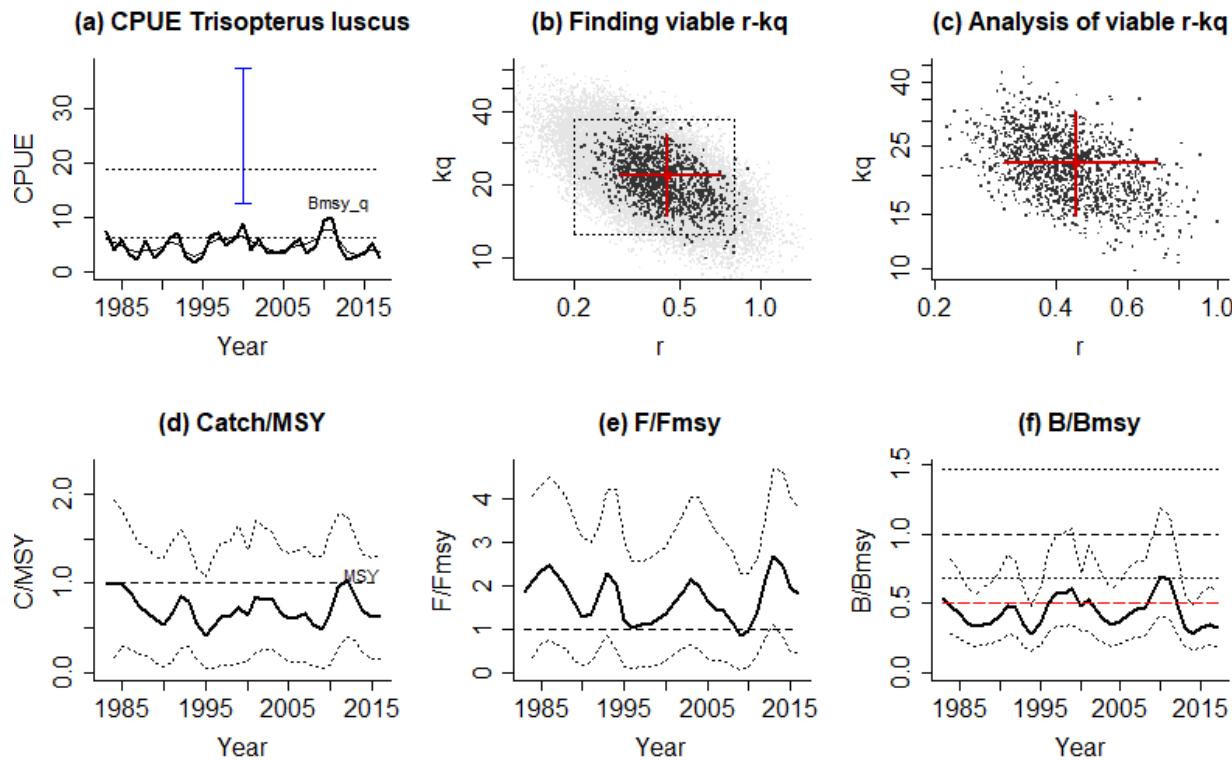
Comment: B/B₀ prior from LBB. RF: OK

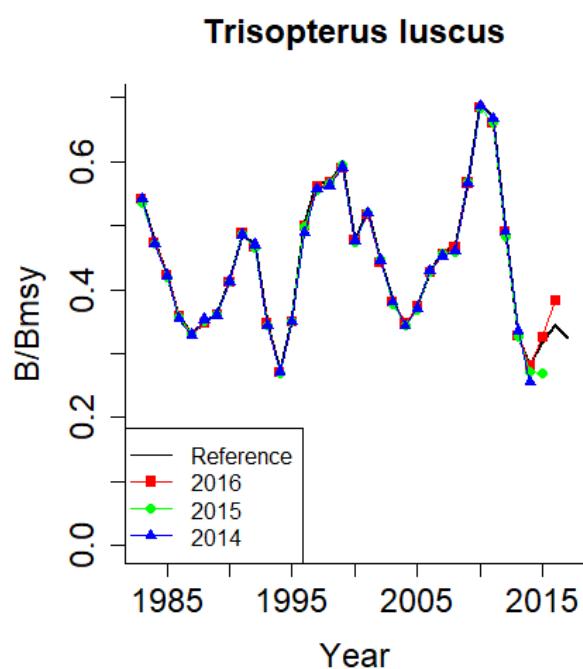
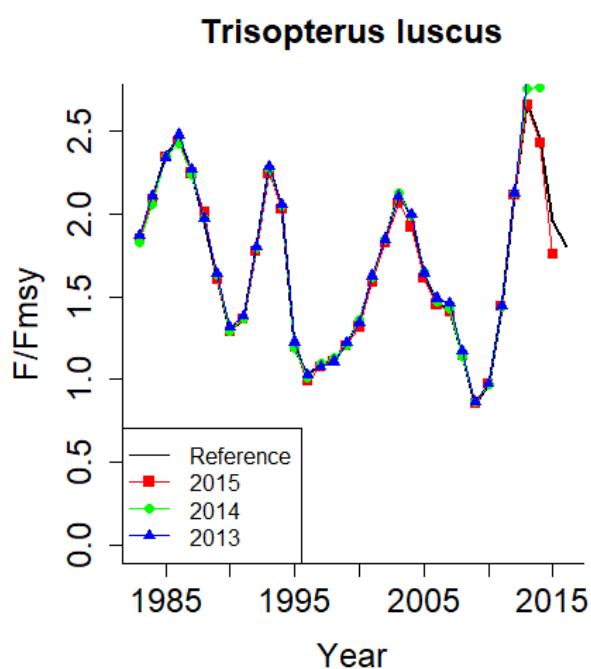
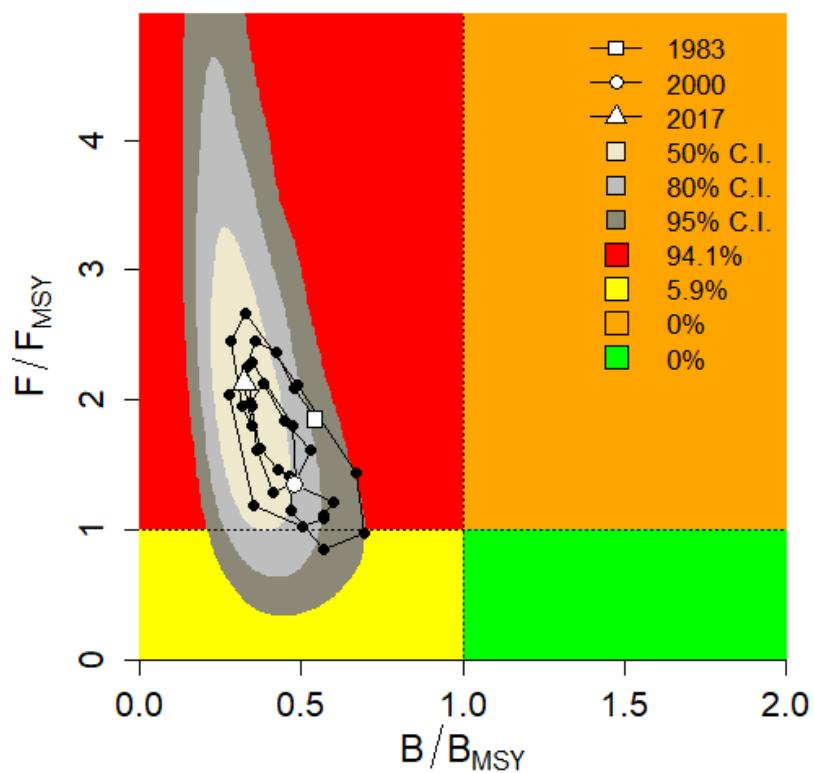
Source: SMFS 2017

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
Viable r-kq pairs = 5003

Results:

viable r-kq pairs	= 5003
median kq	= 21.8, 14.8 - 32.2
median MSY _q	= 2.45, 1.53 - 3.68
r (4 MSY _q /kq)	= 0.449, 0.295 - 0.707
F _{msy} (r/2)	= 0.224, 0.147 - 0.354
F/F _{msy}	= 1.8, 0.46 - 3.83 (2016)
B/B _{msy}	= 0.324, 0.183 - 0.583 (2017)





Baltic Sea

LBB results for *Enchelyopus cimbrius*, stock Ench_cim22-24, 1993-2018
 Files:LBB4AMSY_ID_4.csv, LBB_June102019_Enchelyopus cimbrius.csv

Linf prior= 37, SD=0.37 cm (user-defined), Lmax=37, median Lmax=34

Z/K prior = 1.7, SD=0.16, M/K prior=1.5, SD=0.15

F/K prior = 0.209 (wide range with tau=4 in log-normal distribution)

Lc prior = 16.8, SD=1.7 cm, alpha prior=15.3, SD=1.5, Lm50=25 cm

General reference points (median across years):

Linf = 37.5 (36.9-38) cm

Lopt = 26 cm, Lopt/Linf=0.7

Lc_opt = 21 cm, Lc_opt/Linf=0.55, Lmean if F=M 24.8 cm

M/K = 1.29 (1.05-1.61)

F/M = 0.545 (0.246-1.01), F/K=0.797 (0.414-1.3), Z/K=2.2 (1.97-2.35)

B/B0 = 0.51 (0.13-1), B/B0 F=M Lc=Lc_opt 0.37

Y/R' = 0.045 (0.012-0.093), Y/R' F=M Lc=Lc_opt 0.056

Estimates for 2018 (mean of last 3 years with data):

Lc50 = 20.3 (20-20.6) cm, Lc/Linf=0.54 (0.53-0.55)

Lc95 = 26.7, alpha=0.459 (0.444-0.476)

Lmean/Lopt= 0.94, Lc/Lc_opt=0.99, L95th=34.7 cm, L95th/Linf=0.92, Mature=32%

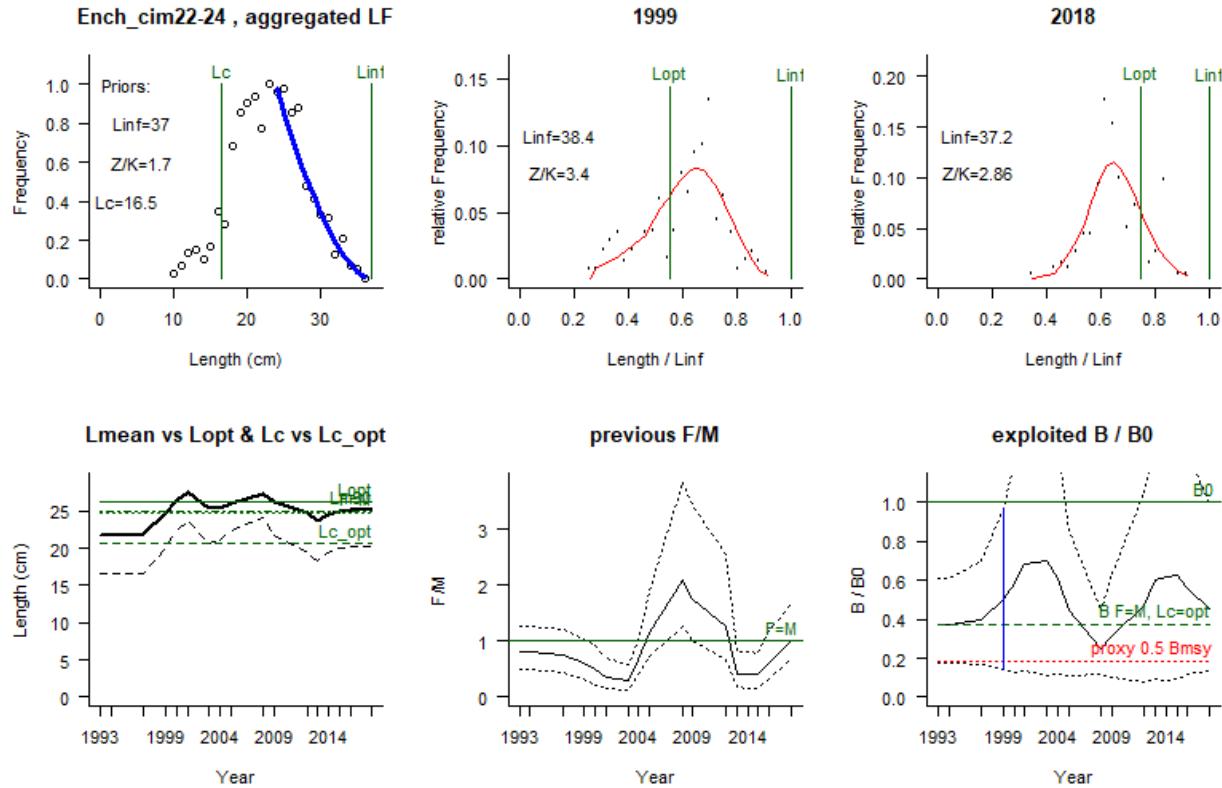
F/M = 1 (0.7-1.7), F/K=1.1 (0.87-1.5), Z/K=2.4 (2.2-2.6)

Y/R' = 0.059 (0.03-0.1)

B/B0 = 0.45 (0.13-0.99), best LF fit year 2001=0.683 (0.13-1.5)

B/Bmsy = 1.2 (0.36-2.6), selected B/B0 1999 = 0.51 (0.15-0.97)

RF: Set Linf = Lmax because of relatively undisturbed population. Merged LFs of adjacent years. Excluded years with unrealistic fits. Selected 1999 because of reasonable LF and B/B0 fit.



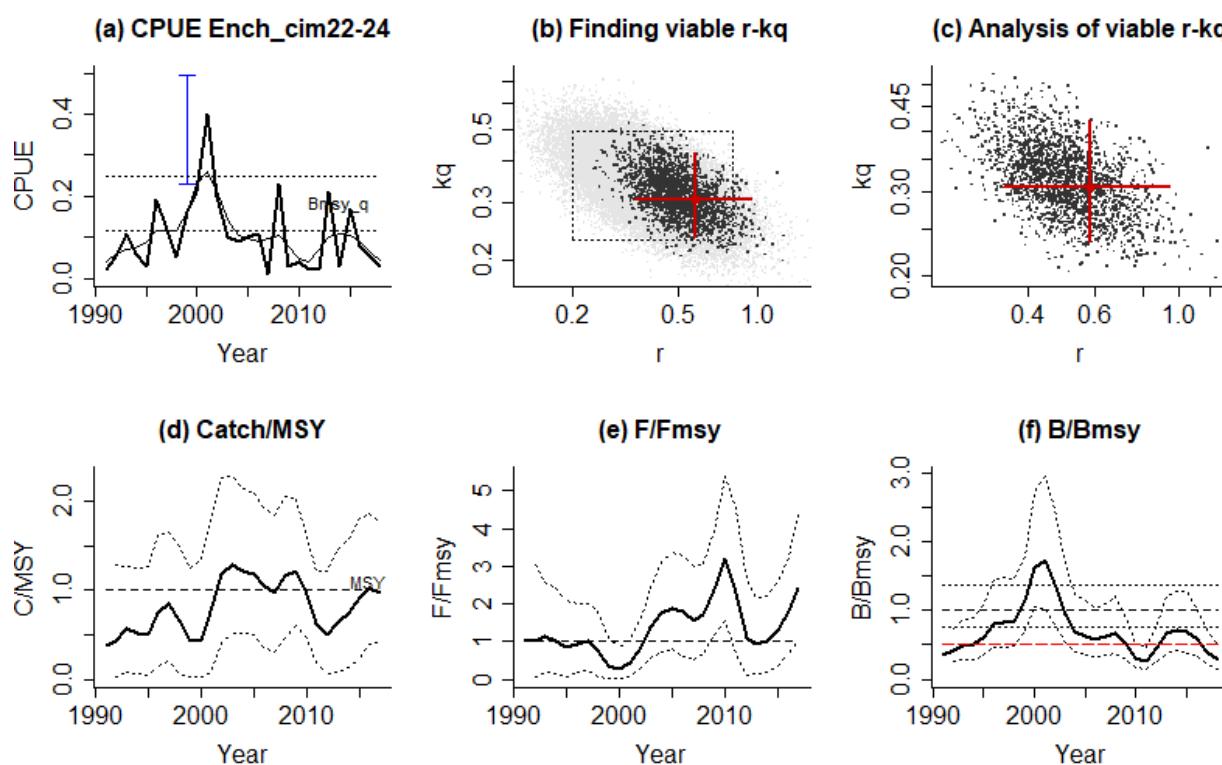
AMSY Analysis, Fri Nov 01 19:37:40 2019

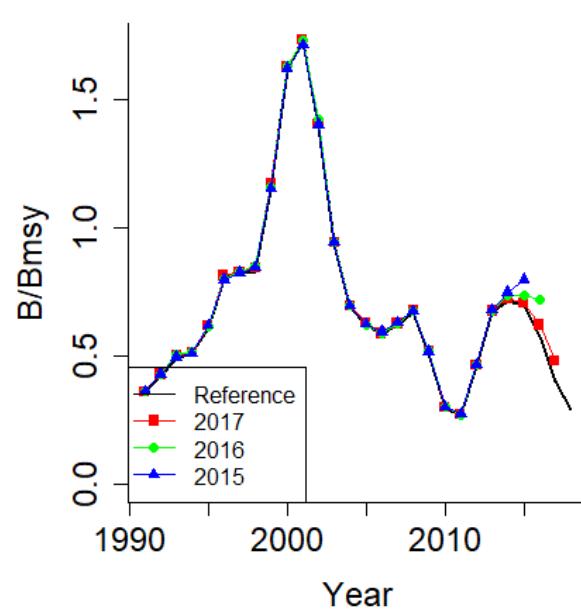
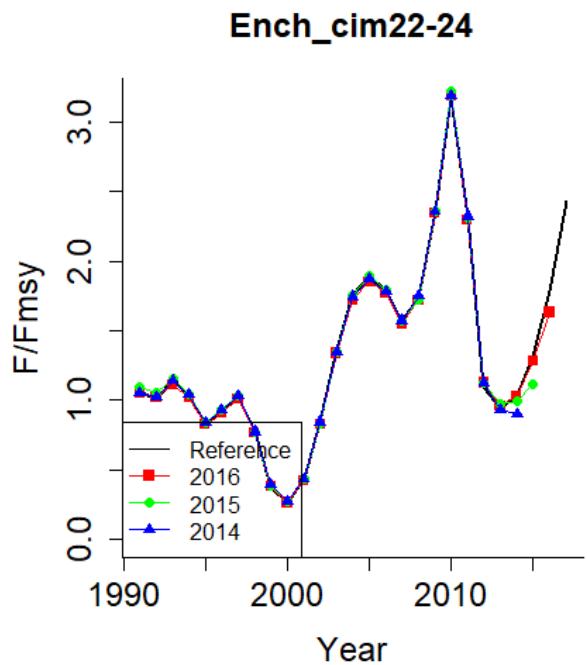
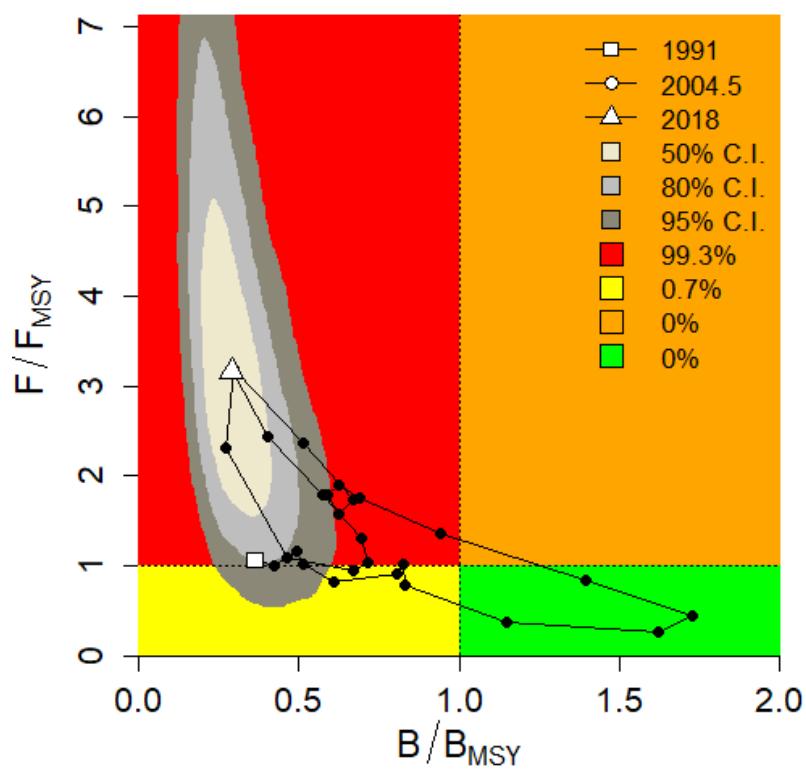
Stock **Ench_cim22-24**, *Enchelyopus cimbrius*, Fourbeard rockling
CPUE data for years 1991 - 2018, CPUE range 0.0406 - 0.262, smooth = TRUE
Prior for r = Medium, NA - NA
Used prior range for r = 0.2 - 0.8
Prior for 1999 stock status = About half, 0.15 - 0.97
Used 1999 prior B/B₀ range = 0.15 - 0.97, prior B/B_{msy} = 0.3 - 1.94
Used prior range for kq = 0.229 - 0.496 [original range = 0.0767 - 0.496]
Comment: B/B₀ prior from LBB. RF: OK
Source: SMFS 2017

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
Viable r-kq pairs = 5000

Results:

viable r-kq pairs = 5000
median kq = 0.307, 0.236 - 0.423
median MSYq = 0.0446, 0.0282 - 0.0702
r (4 MSYq/kq) = 0.581, 0.343 - 0.943
F_{msy} (r/2) = 0.291, 0.172 - 0.471
F/F_{msy} = 2.43, 1.01 - 4.38 (2017)
B/B_{msy} = 0.289, 0.161 - 0.518 (2018)





LBB results for *Eutrigla gurnardus*, stock **Eut_gurn_Balt**, 2004-2018
 Files:LBB4AMSY_ID_4.csv, LBB_June182019_Eutrigla gurnardus.csv

Linf prior= 35, SD=0.35 cm (user-defined), Lmax=39, median Lmax=29

Z/K prior = 2.7, SD=0.16, M/K prior=1.5, SD=0.15

F/K prior = 1.16 (wide range with tau=4 in log-normal distribution)

Lc prior = 13.8, SD=1.4 cm, alpha prior=17.8, SD=1.8, Lm50=19 cm

General reference points (median across years):

Linf = 34.8 (34.1-35.3) cm

Lopt = 24 cm, Lopt/Linf=0.7

Lc_opt = 22 cm, Lc_opt/Linf=0.63, Lmean if F=M 22.9 cm

M/K = 1.26 (0.991-1.5)

F/M = 2.31 (1.65-3.21), F/K=2.74 (2.3-3.22), Z/K=3.93 (3.64-4.22)

B/B0 = 0.16 (0.095-0.23), B/B0 F=M Lc=Lc_opt 0.38

Y/R' = 0.031 (0.02-0.046)(reduced: B/B0<0.25), Y/R' F=M Lc=Lc_opt 0.058

Estimates for 2018 (mean of last 3 years with data):

Lc50 = 16 (15.6-16.3) cm, Lc/Linf=0.45 (0.44-0.46)

Lc95 = 22.5, alpha=0.454 (0.438-0.469)

Lmean/Lopt= 0.87, Lc/Lc_opt=0.73, L95th=30.3 cm, L95th/Linf=0.85, Mature=28%

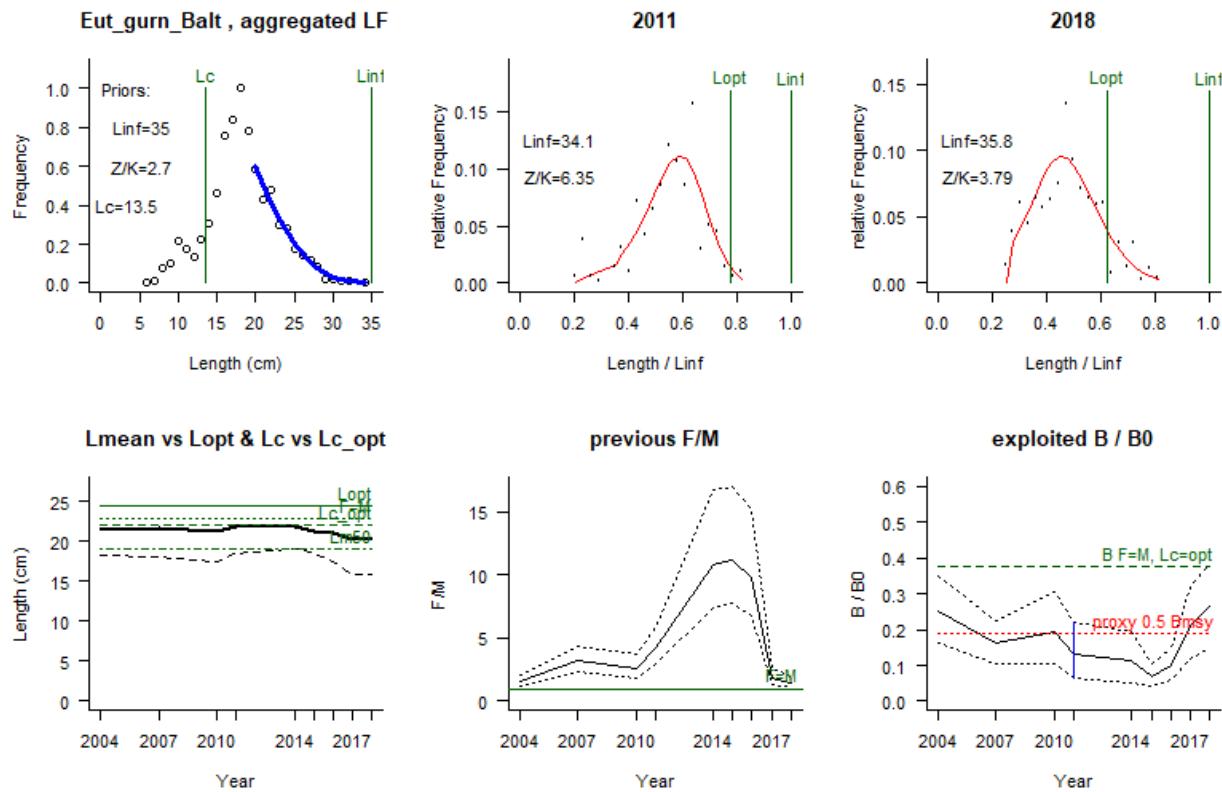
F/M = 1.4 (1-2), F/K=2.2 (1.8-2.6), Z/K=3.8 (3.5-4.1)

Y/R' = 0.034 (0.02-0.05)(reduced because B/B0 < 0.25)

B/B0 = 0.26 (0.15-0.38), best LF fit year 2004=0.25 (0.16-0.35)

B/Bmsy = 0.7 (0.39-1), selected B/B0 2011 = 0.13 (0.062-0.22)

RF: Set Linf between median and max. Excluded years with unrealistic LF fits.
 Selected 2011 because of good fit and similar B/B0 as preceding years.



AMSY Analysis, Fri Nov 01 19:41:14 2019

Stock **Eut_gurn_Balt**, *Eutrigla gurnardus*, Grey gurnard

CPUE data for years 2002 - 2018, CPUE range 0.0262 - 0.113, smooth = TRUE

Prior for r = Medium, NA - NA

Used prior range for r = 0.2 - 0.8

Prior for 2011 stock status = Very small, 0.06 - 0.22

Used 2011 prior B/B0 range = 0.06 - 0.22, prior B/Bmsy = 0.12 - 0.44

Used prior range for kq = 0.212 - 0.636 [original range = 0.212 - 0.777]

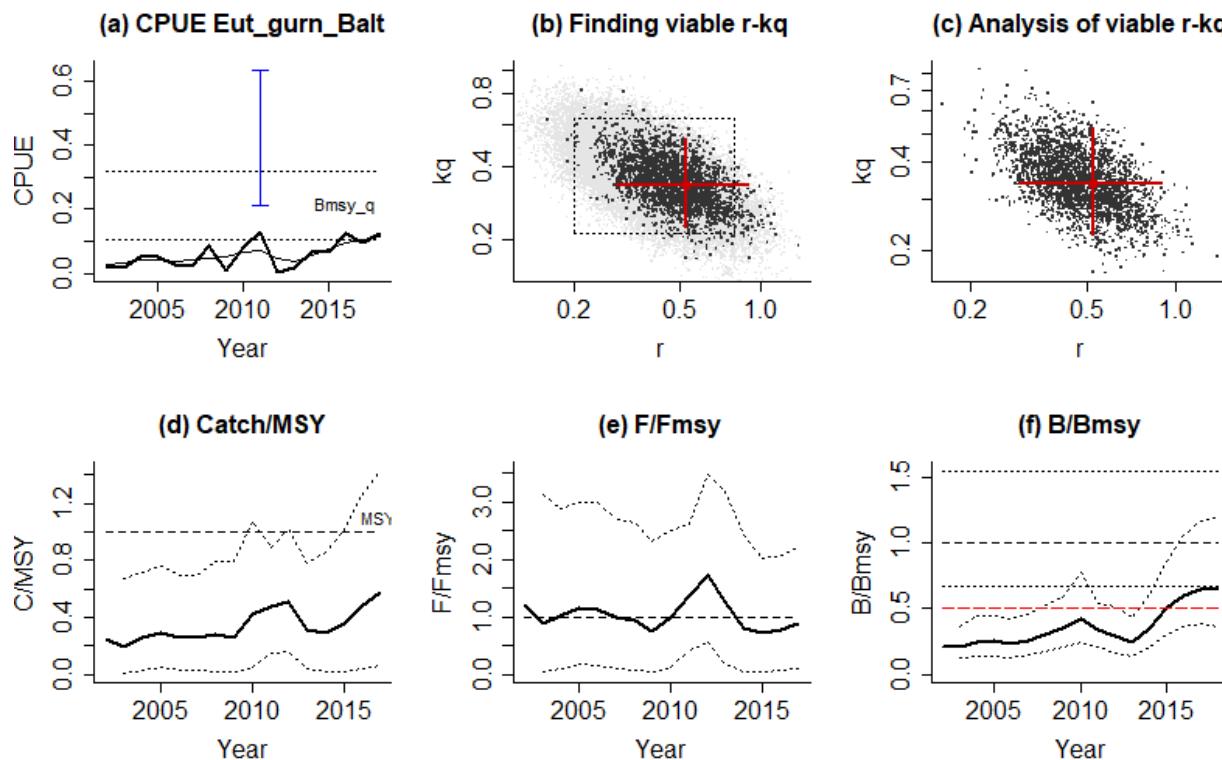
Comment: B/B0 prior from LBB. RF: OK

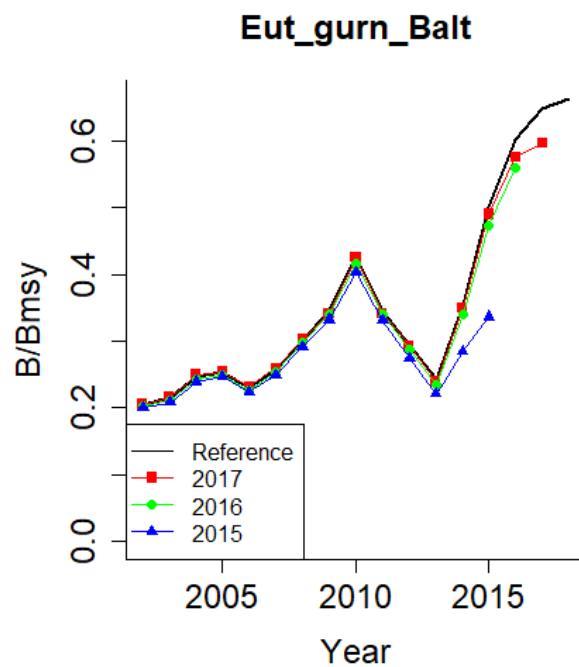
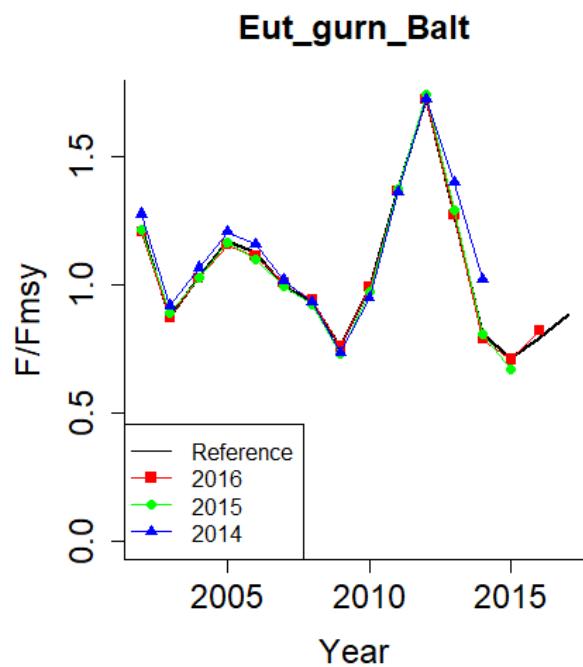
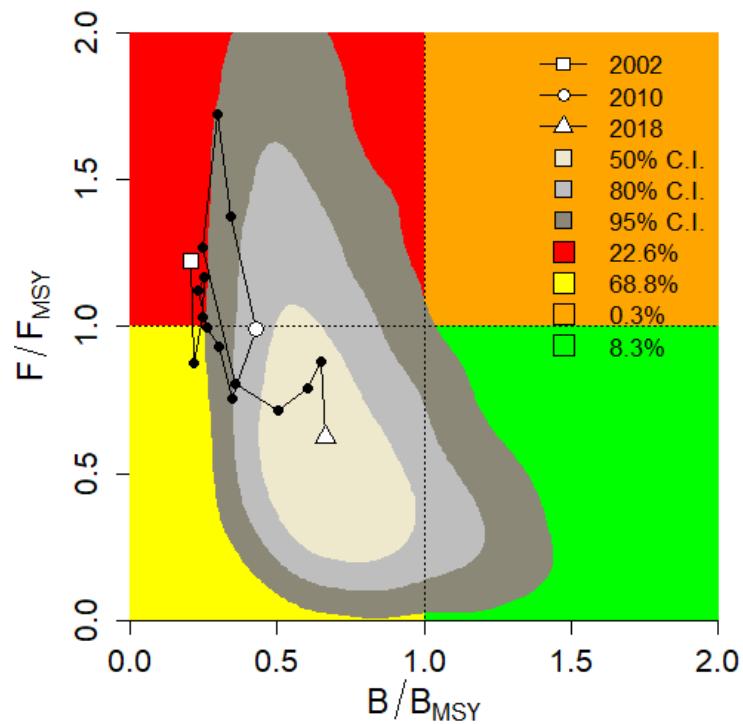
Source: DATRAS IBTS

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
Viable r-kq pairs = 5001

Results:

viable r-kq pairs	= 5001
median kq	= 0.338, 0.225 - 0.517
median MSYq	= 0.0434, 0.0261 - 0.074
r (4 MSYq/kq)	= 0.513, 0.29 - 0.89
Fmsy (r/2)	= 0.256, 0.145 - 0.445
F/Fmsy	= 0.876, 0.0965 - 2.25 (2017)
B/Bmsy	= 0.669, 0.37 - 1.22 (2018)





LBB results for *Myoxocephalus scorpius*, stock Myox_scor_22-24, 2000-2017
 Files:LBB4AMSY_ID_4.csv, LBB_June102019_Myoxocephalus scorpius.csv

Linf prior= 32, SD=0.32 cm (user-defined), Lmax=33, median Lmax=29

Z/K prior = 3.3, SD=0.32, M/K prior=1.5, SD=0.15

F/K prior = 1.76 (wide range with tau=4 in log-normal distribution)

Lc prior = 13.8, SD=1.4 cm, alpha prior=11.5, SD=1.2, Lm50=16 cm

General reference points (median across years):

Linf = 32 (31.5-32.6) cm

Lopt = 23 cm, Lopt/Linf=0.71

Lc_opt = 21 cm, Lc_opt/Linf=0.65, Lmean if F=M 20.6 cm

M/K = 1.24 (1.01-1.55)

F/M = 2.85 (2.13-3.94), F/K=3.73 (3.21-4.26), Z/K=4.92 (4.46-5.34)

B/B0 = 0.13 (0.079-0.18), B/B0 F=M Lc=Lc_opt 0.38

Y/R' = 0.035 (0.02-0.052)(reduced: B/B0<0.25), Y/R' F=M Lc=Lc_opt 0.06

Estimates for 2017 (mean of last 3 years with data):

Lc50 = 17.9 (17.6-18.2) cm, Lc/Linf=0.56 (0.55-0.57)

Lc95 = 22.5, alpha=0.632 (0.613-0.655)

Lmean/Lopt= 0.91, Lc/Lc_opt=0.86, L95th=29 cm, L95th/Linf=0.91, Mature=83%

F/M = 2.9 (2.1-4), F/K=3.4 (2.9-4), Z/K=4.6 (4.2-5.1)

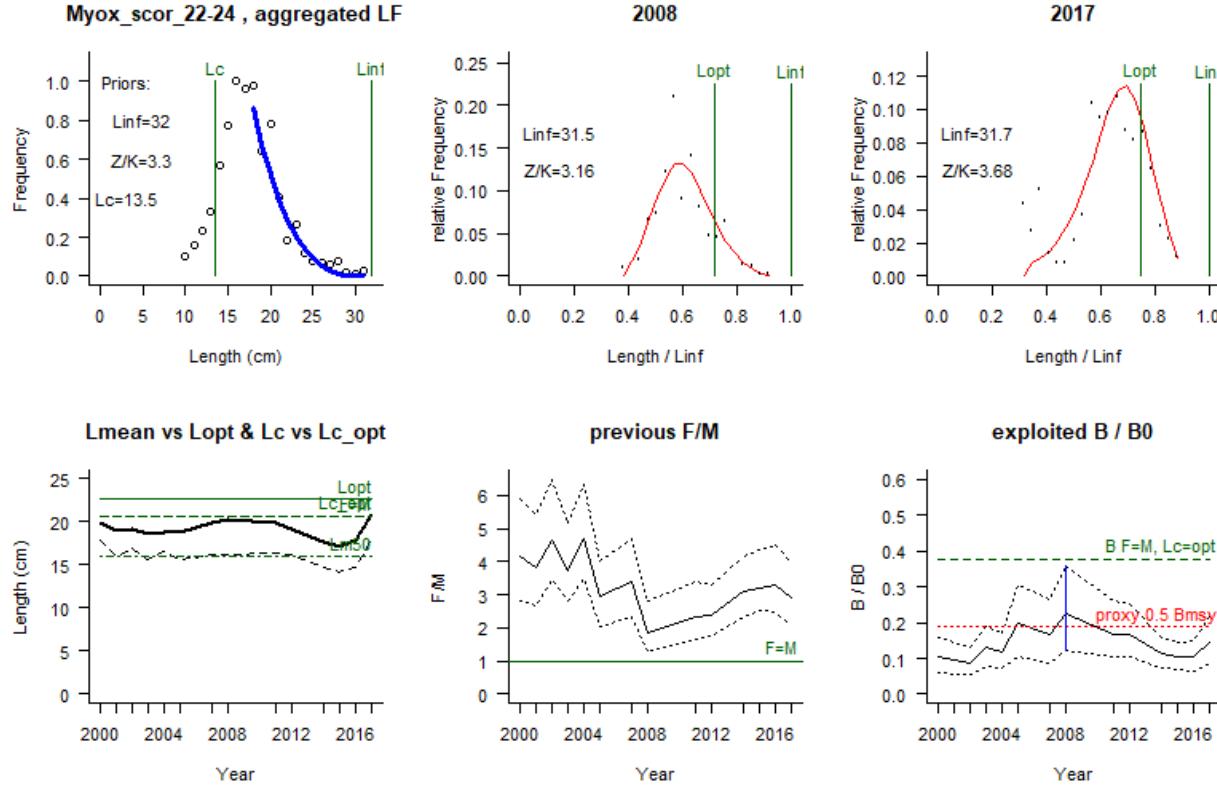
Y/R' = 0.044 (0.025-0.066)(reduced because B/B0 < 0.25)

B/B0 = 0.15 (0.087-0.22), best LF fit year 2002=0.0873 (0.055-0.13)

B/Bmsy = 0.39 (0.23-0.58), selected B/B0 2008 = 0.22 (0.12-0.36)

RF: Set Linf between median and max. Excluded years with unrealistic fit.

Selected 2008 because of reasonable LF and B/B0.



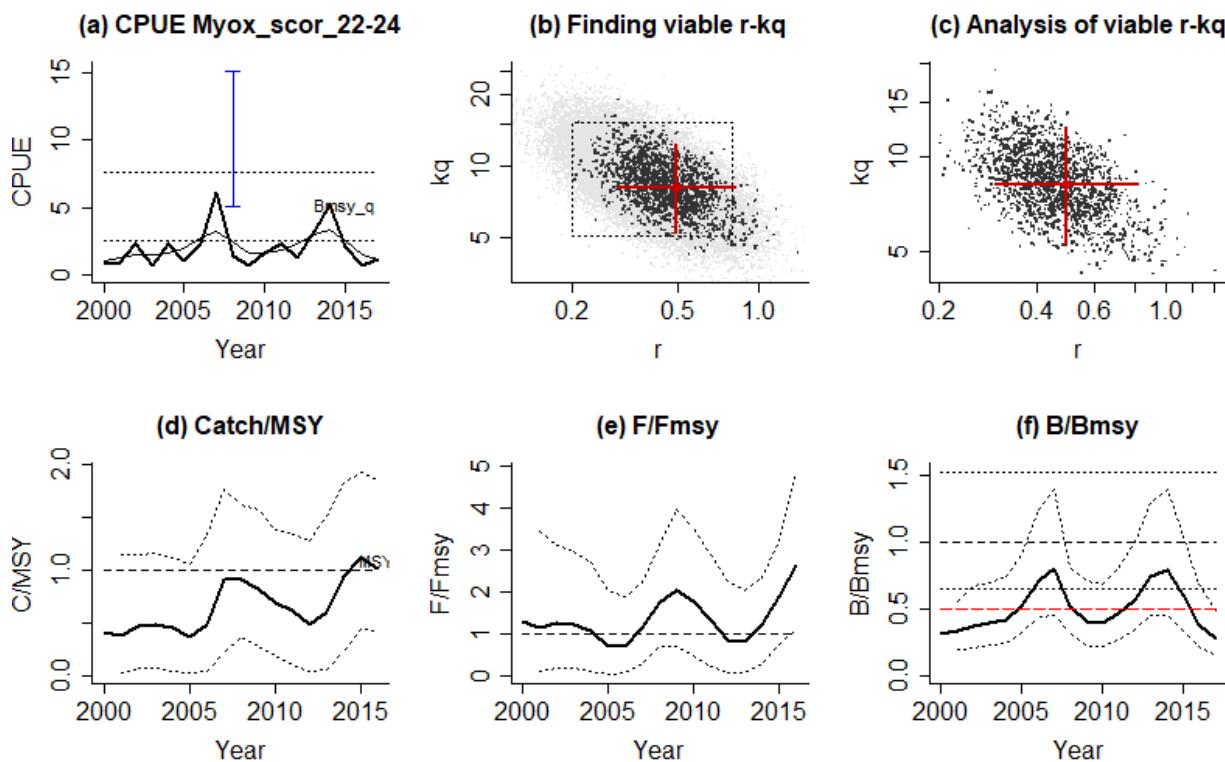
AMSY Analysis, Fri Nov 01 19:45:13 2019

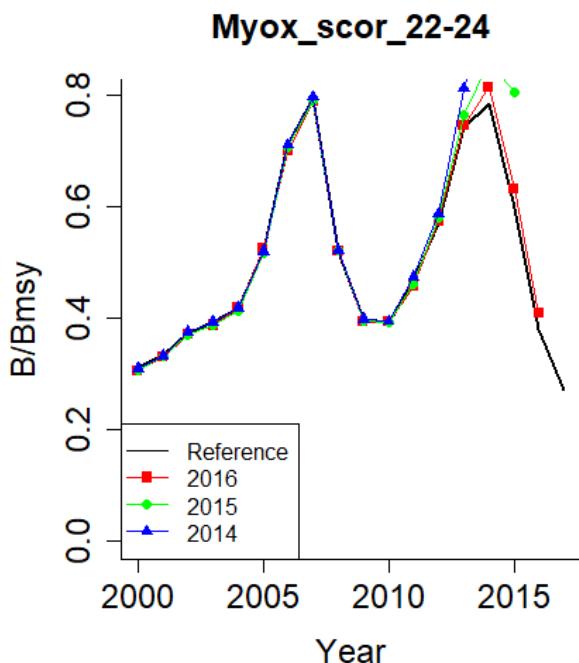
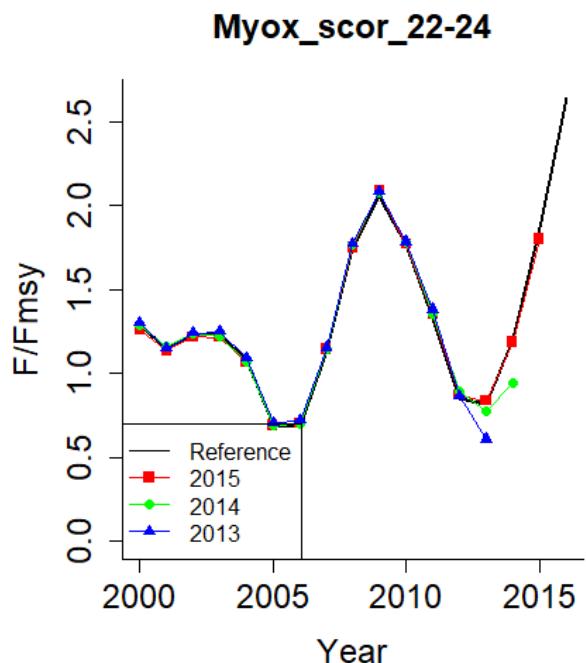
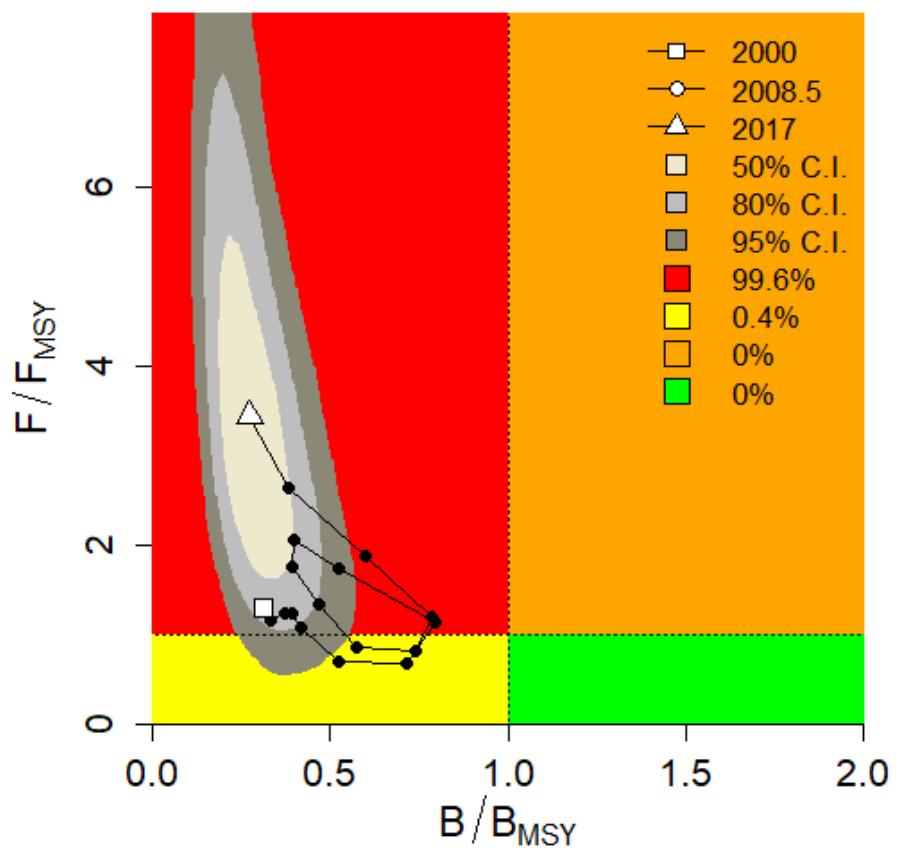
Stock **Myox_scor_22-24**, *Myoxocephalus scorpius*, Shorthorn sculpin
CPUE data for years 2000 - 2017, CPUE range 0.974 - 3.28, smooth = TRUE
Prior for r = Medium, NA - NA
Used prior range for r = 0.2 - 0.8
Prior for 2008 stock status = Small, 0.12 - 0.36
Used 2008 prior B/B0 range = 0.12 - 0.36, prior B/Bmsy = 0.24 - 0.72
Used prior range for kq = 5.06 - 15.2 [original range = 5.06 - 15.2]
Comment: B/B0 prior from LBB. RF: OK
Source: SMFS 2017

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
Viable r-kq pairs = 5000

Results:

viable r-kq pairs = 5000
median kq = 8.12, 5.22 - 12.4
median MSYq = 1.01, 0.606 - 1.57
r (4 MSYq/kq) = 0.496, 0.298 - 0.824
Fmsy (r/2) = 0.248, 0.149 - 0.412
F/Fmsy = 2.64, 1.1 - 4.87 (2016)
B/Bmsy = 0.272, 0.151 - 0.482 (2017)





LBB results for *Zoarces viviparus*, stock **Zoar_vivi_Balt**, 2000-2017
 Files:LBB4AMSY_ID_4.csv, LBB_June182019_Zoar_vivi_Balt.csv

L_{inf} prior= 38, SD=0.38 cm (user-defined), $L_{max}=38$, median $L_{max}=34$
 Z/K prior = 4.4, SD=0.29, M/K prior=1.5, SD=0.15

F/K prior = 2.88 (wide range with $\tau=4$ in log-normal distribution)
 L_c prior = 15.8, SD=1.6 cm, alpha prior=17.7, SD=1.8, $L_{m50}=17$ cm

General reference points (median across years):

L_{inf} = 37.8 (37.2-38.5) cm
 L_{opt} = 25 cm, $L_{opt}/L_{inf}=0.67$
 L_c_{opt} = 24 cm, $L_c_{opt}/L_{inf}=0.63$, L_{mean} if $F=M$ 24.5 cm
 M/K = 1.46 (1.18-1.7)
 F/M = 4.34 (3.4-5.58), $F/K=5.44$ (5.01-6.81), $Z/K=7.48$ (6.48-9.02)
 B/B_0 = 0.07 (0.044-0.099), $B/B_0 F=M L_c=L_c_{opt} 0.37$
 Y/R' = 0.012 (0.0085-0.016)(reduced: $B/B_0 < 0.25$), $Y/R' F=M L_c=L_c_{opt} 0.047$

Estimates for 2017 (mean of last 3 years with data):

L_{c50} = 18.8 (18.2-19.2) cm, $L_c/L_{inf}=0.49$ (0.48-0.5)
 L_{c95} = 24.2, alpha=0.547 (0.527-0.563)

$L_{mean}/L_{opt}=0.87$, $L_c/L_c_{opt}=0.79$, $L_{95th}=33$ cm, $L_{95th}/L_{inf}=0.87$, Mature=50%

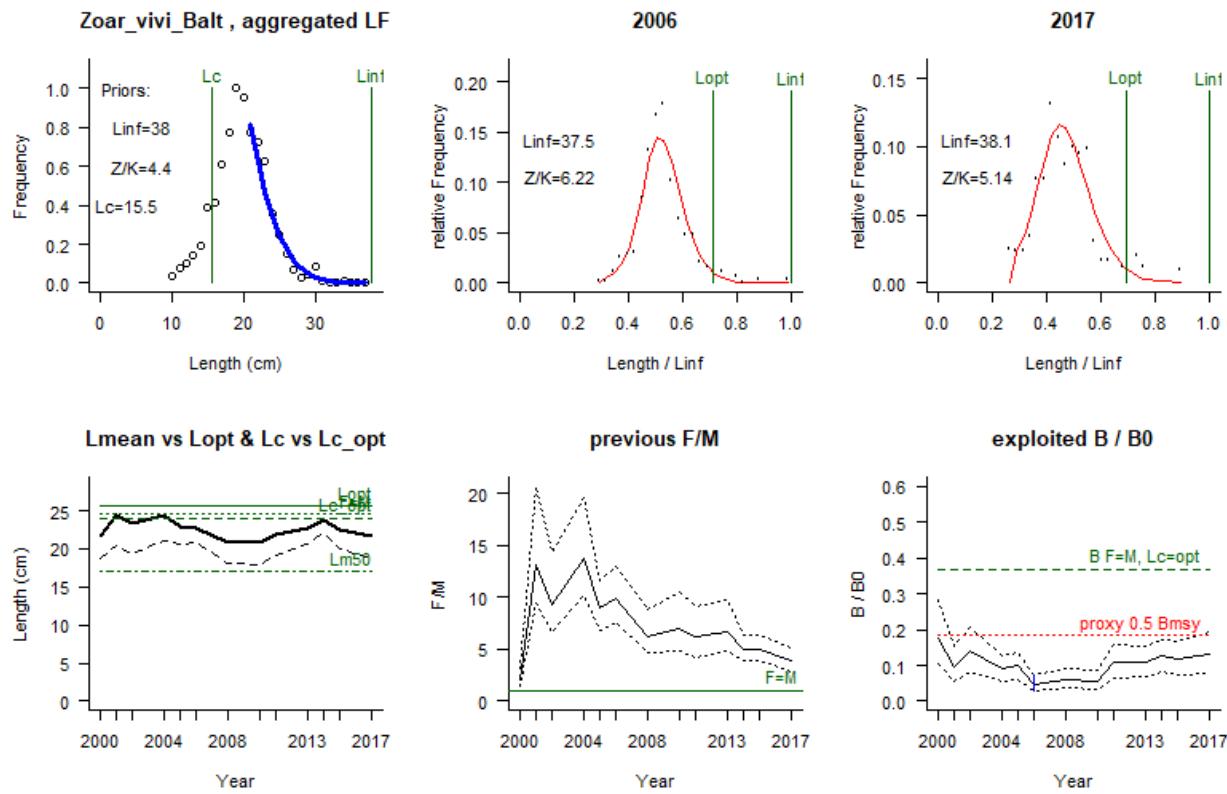
F/M = 4 (2.9-5.3), $F/K=6.9$ (5.2-8.5), $Z/K=8.4$ (6.8-10)

Y/R' = 0.024 (0.015-0.037)(reduced because $B/B_0 < 0.25$)

B/B_0 = 0.13 (0.082-0.2), best LF fit year 2004=0.0943 (0.061-0.13)

B/B_{msy} = 0.36 (0.22-0.54), selected B/B_0 2002 = 0.15 (0.095-0.21)

RF: Set L_{inf} between median and max. Set $L_{cut}=10$ to exclude peaks of early juveniles. Excluded years with unrealistic fits. Selected 2002 because of reasonable B/B_0 .



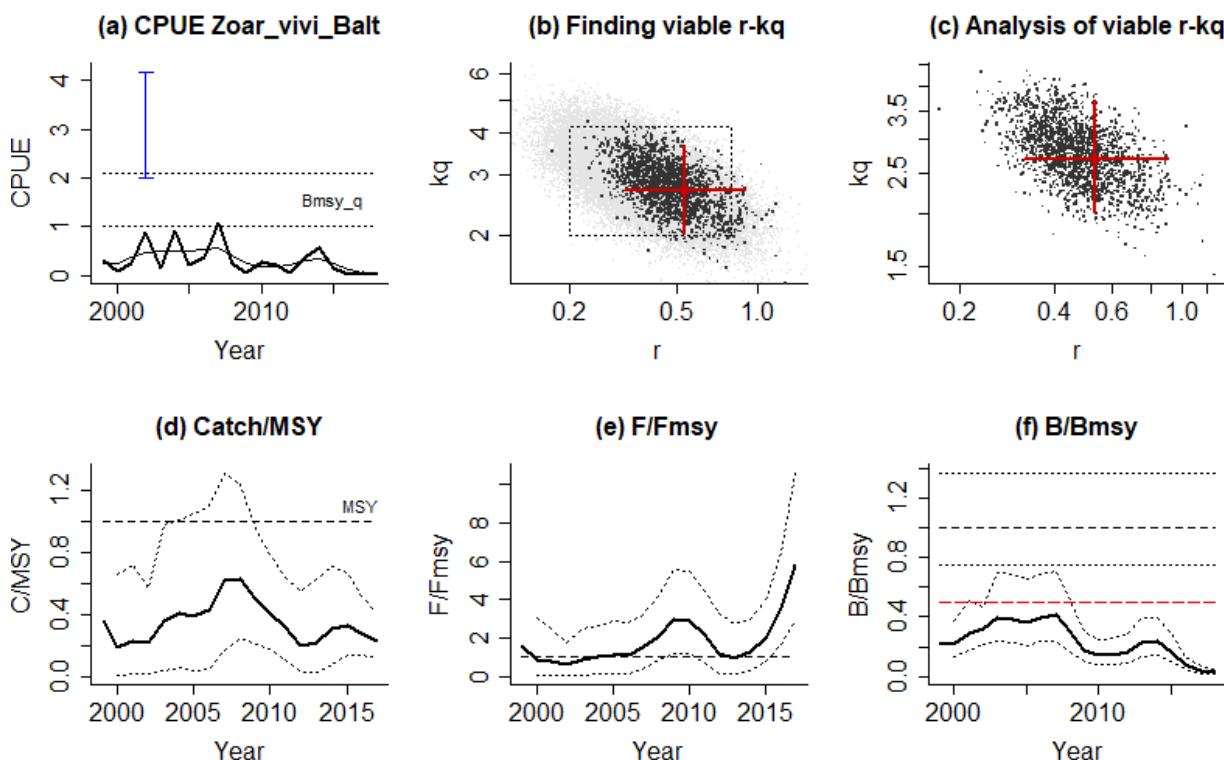
AMSY Analysis, Fri Nov 01 19:48:23 2019

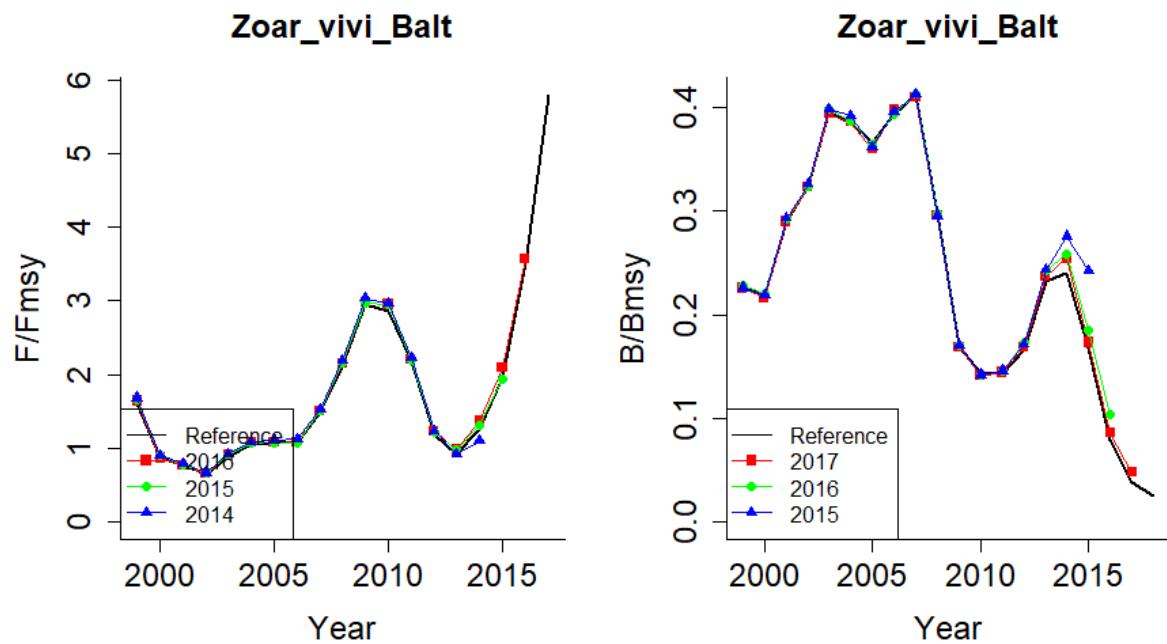
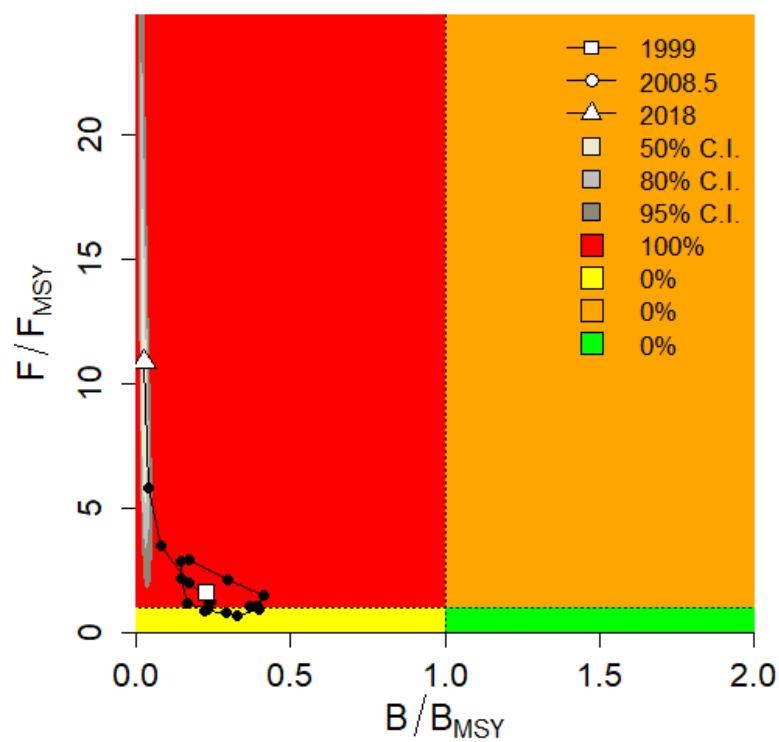
Stock *Zoar_vivi_Balt*, *zoarces viviparus*, Eelpout
CPUE data for years 1999 - 2018, CPUE range 0.0339 - 0.568, smooth = TRUE
Prior for r = Medium, NA - NA
Used prior range for r = 0.2 - 0.8
Prior for 2002 stock status = Very small, 0.1 - 0.21
Used 2002 prior B/B0 range = 0.1 - 0.21, prior B/Bmsy = 0.2 - 0.42
Used prior range for kq = 1.99 - 4.18 [original range = 1.99 - 4.18]
Comment: B/B0 prior from LBB. RF: OK
Source: DATRAS IBTS

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
Viable r-kq pairs = 5002

Results:

viable r-kq pairs = 5002
median kq = 2.7, 2.02 - 3.7
median MSYq = 0.361, 0.23 - 0.586
r (4 MSYq/kq) = 0.535, 0.32 - 0.901
Fmsy (r/2) = 0.267, 0.16 - 0.45
F/Fmsy = 5.8, 2.89 - 10.6 (2017)
B/Bmsy = 0.0252, 0.014 - 0.0453 (2018)





Northwest Atlantic

LBB results for *Leucoraja erinacea*, Little skate Eastern Canada, 2007-2018

L_{inf} prior= 65, SD=0.65 cm (user-defined), L_{max} =76, median L_{max} =62.5

Z/K prior = 5.1, SD=0.37, M/K prior=1.5, SD=0.15

F/K prior = 3.64 (wide range with $\tau=4$ in log-normal distribution)

L_c prior = 44.4, SD=4.4 cm, alpha prior=23.2, SD=2.3, $L_{m50}=47.4$ cm

General reference points (median across years):

L_{inf} = 65.3 (64.2-66.4) cm

L_{opt} = 43 cm, $L_{opt}/L_{inf}=0.66$

L_c _opt = 40 cm, L_c _opt/ L_{inf} =0.61, Lmean if $F=M$ 51.2 cm

M/K = 1.54 (1.25-1.83)

F/M = 3.16 (2.49-4.21), $F/K=5$ (4.21-5.85), $Z/K=6.44$ (5.68-7.29)

B/B_0 = 0.18 (0.12-0.25), $B/B_0 F=M L_c=L_c$ _opt 0.39

Y/R' = 0.034 (0.022-0.047)(reduced: $B/B_0 < 0.25$), $Y/R' F=M L_c=L_c$ _opt 0.042

Estimates for 2018 (mean of last 3 years with data):

L_{c50} = 45.9 (45.5-46.4) cm, $L_c/L_{inf}=0.71$ (0.7-0.72)

L_{c95} = 53, alpha=0.417 (0.399-0.432)

L_{mean}/L_{opt} = 1.1, L_c/L_c _opt=1.2, $L_{95th}/L_{inf}=0.88$, Mature=30%

F/M = 4.3 (3.2-5.7), $F/K=6.2$ (5.3-7.3), $Z/K=7.6$ (6.8-8.7)

Y/R' = 0.032 (0.021-0.047)(reduced because $B/B_0 < 0.25$)

B/B_0 = 0.15 (0.098-0.22), best LF fit year 2011=0.205 (0.14-0.28)

B/B_{msy} = 0.38 (0.25-0.55), selected B/B_0 2015 = 0.13 (0.085-0.2)

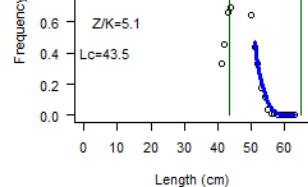
LF data from scientific research surveys provided by Fisheries and Oceans Canada (DFO); L_{m50} average of male and female taken from McPhie, R.P. and Campana, S.E., 2009. Reproductive characteristics and population decline of four species of skate (Rajidae) off the eastern coast of Canada. Journal of Fish Biology, 75(1), pp.223-246.; specimens under 40 cm not considered because of confusion with winter skate. RF: set L_{inf} to 65 cm slightly above median. Excluded years with unreasonable fits. Selected 2015 because of good fit and reasonable B/B_0 compared with adjacent estimates.

Little skate Eastern Canada , aggregated

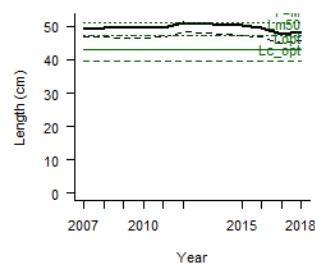


2015

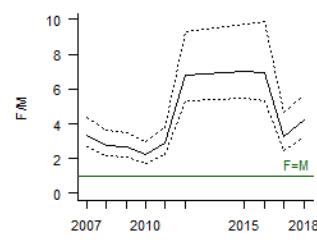
2018



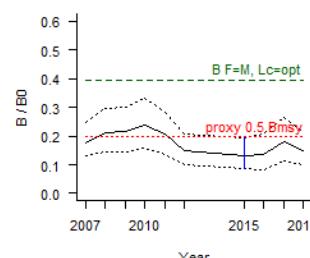
Lmean vs Lopt & Lc vs Lc_opt



previous F/M



exploited B / B₀



AMSY Analysis, Fri Nov 01 19:53:16 2019

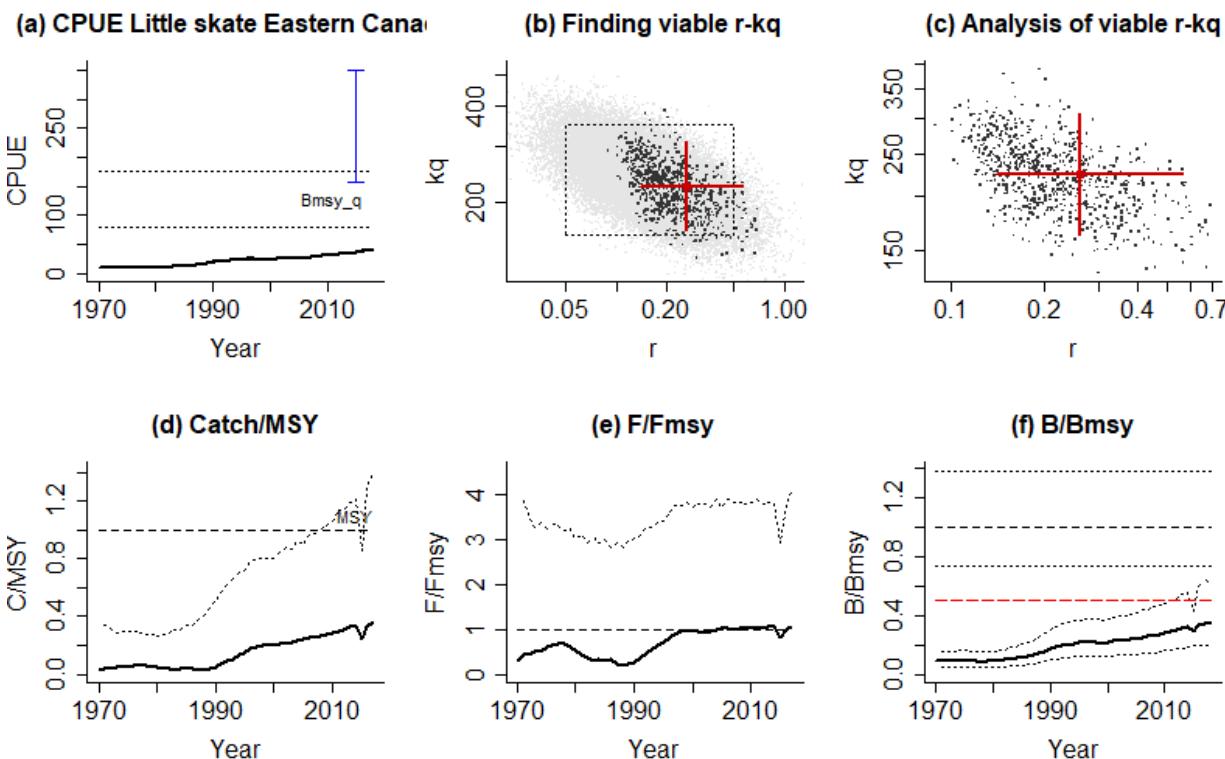
Stock **Little skate Eastern Canada, *Leucoraja erinacea***, Little skate
CPUE data for years 1970 - 2018, CPUE range 9.57 - 38.7, smooth = TRUE
Prior for r = Low, NA - NA
Used prior range for r = 0.05 - 0.5
Prior for 2015 stock status = Very small, 0.09 - 0.2
Used 2015 prior B/B₀ range = 0.09 - 0.2, prior B/B_{MSY} = 0.18 - 0.4
Used prior range for kq = 158 - 351 [original range = 158 - 351]
Comment: CPUE from research surveys provided by Fisheries and Oceans Canada
(DFO); B_k priors from LBB; Correspondence with Dave Kulka suggests 0.5 to 0.85
in 2018

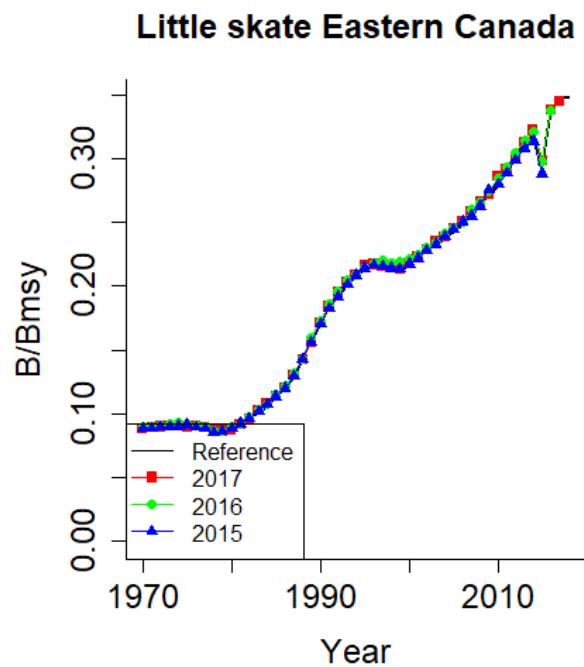
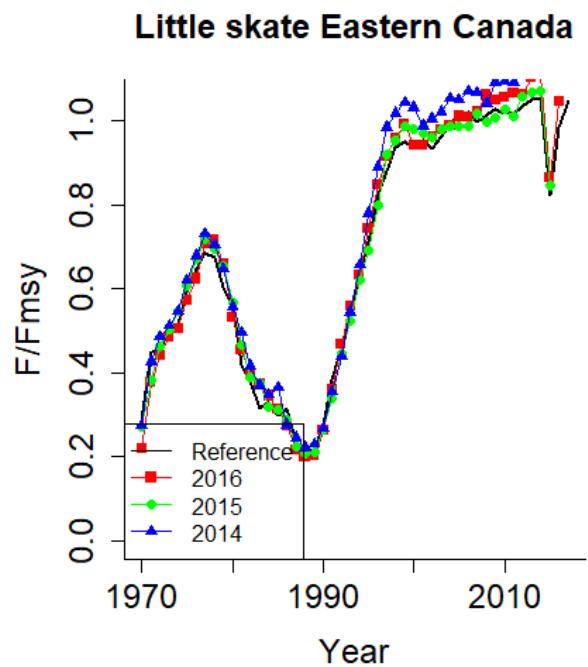
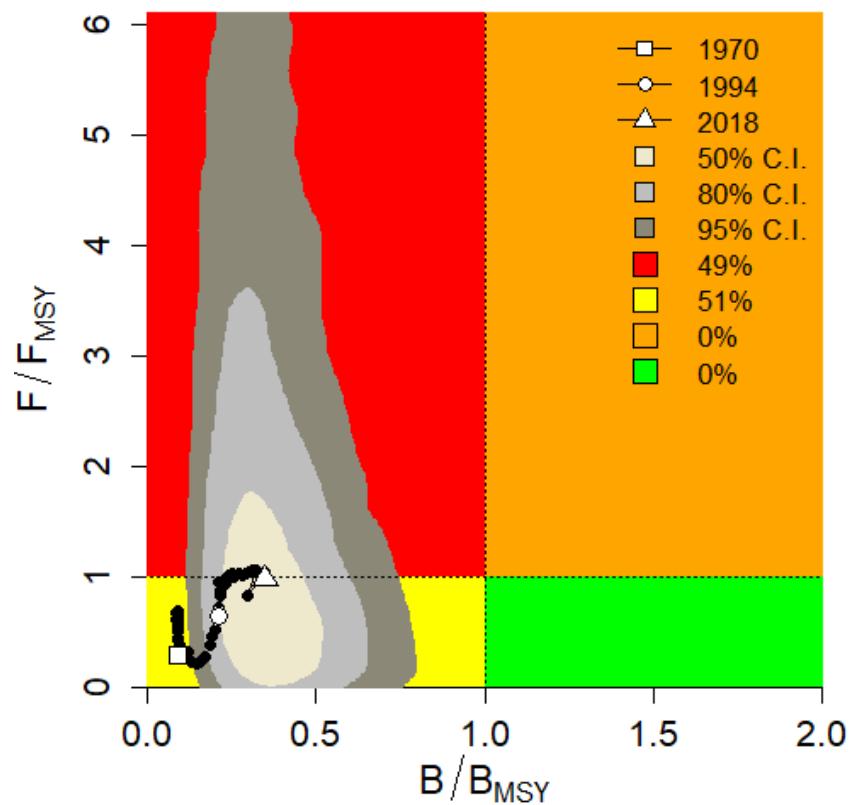
Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
Viable r-kq pairs = 5008

Results:

viable r-kq pairs = 5008
median kq = 223, 164 - 308
median MSYq = 14.6, 8.27 - 28
r (4 MSYq/kq) = 0.262, 0.139 - 0.565
F_{MSY} (r/2) = 0.131, 0.0696 - 0.282
F/F_{MSY} = 1.05, -0.619 - 4.05 (2017)
B/B_{MSY} = 0.348, 0.191 - 0.622 (2018)

)





LBB results for *Malacoraja senta*, Smooth skate Laurentian Scotian, 1975-1981
 Files: Little_smooth_skate_LBB_ID.csv, LBB_smooth_skate.csv

Linf prior= 67.9, SD=0.68 cm Lmax=94, median Linf=68
 Z/K prior = 2.3, SD=1.6, M/K prior=1.5, SD=0.15
 F/K prior = 0.761 (wide range with tau=4 in log-normal distribution)
 Lc prior = 36.2, SD=3.6 cm, alpha prior=11.3, SD=1.1, Lm50=50.8 cm

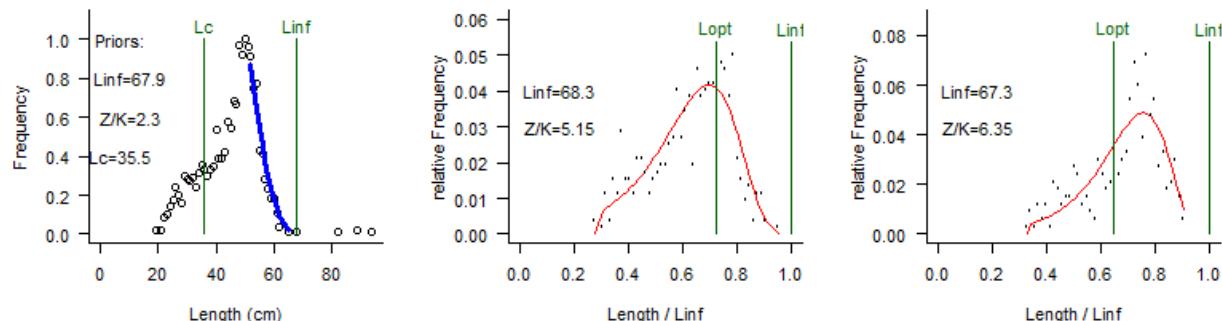
General reference points (median across years):

Linf = 67.3 (66-68.7) cm
 Lopt = 44 cm, Lopt/Linf=0.65
 Lc_opt = 40 cm, Lc_opt/Linf=0.6, Lmean if F=M 63.8 cm
 M/K = 1.62 (1.42-1.79)
 F/M = 3.54 (2.07-5.18), F/K=4.73 (2.82-7.88), Z/K=6.27 (4.42-9.37)
 B/B0 = 0.24 (0.16-0.35), B/B0 F=M Lc=Lc_opt 0.36
 Y/R' = 0.03 (0.02-0.057) (reduced: B/B0<0.25), Y/R' F=M Lc=Lc_opt 0.038

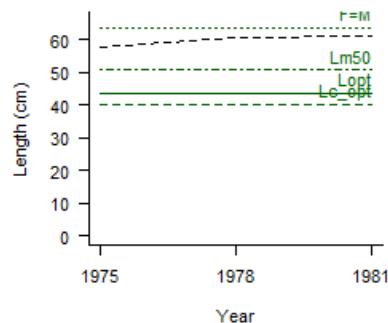
Estimates for 1981 (mean of last 3 years with data):

Lc50 = 61.4 (59.7-63.4) cm, Lc/Linf=0.91 (0.88-0.94)
 Lc95 = 80.9, alpha=0.151 (0.146-0.157)
 Lmean/Lopt= NA, Lc/Lc_opt=1.5, L95th=62.7 cm, L95th/Linf=0.93, Mature=36%
 F/M = 4.6 (3.1-6.3), F/K=7.1 (5.2-9.4), Z/K=8.6 (6.8-11)
 Y/R' = 0.042 (0.021-0.066) (reduced because B/B0 < 0.25)
 B/B0 = 0.29 (0.15-0.49), best LF fit year 1975=0.233 (0.11-0.35)
 B/Bmsy = 0.8 (0.4-1.4), selected B/B0 1975 = 0.23 (0.11-0.35)
 LF data (average over 3 years) from scientific research surveys provided by
 Fisheries and Oceans Canada (DFO); Lm50 average of male and female and
 different studies taken from COSEWIC assessment and status report on the
 Smooth skate *Malacoraja senta*, 2012. RF: Selected 2015 because of best LF fit.

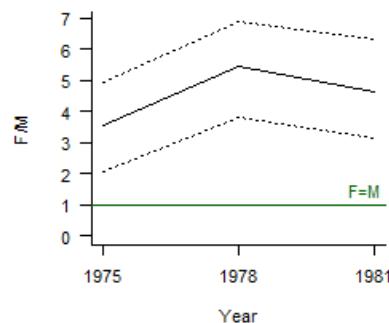
Smooth skate Laurentian Scotian , aggregat



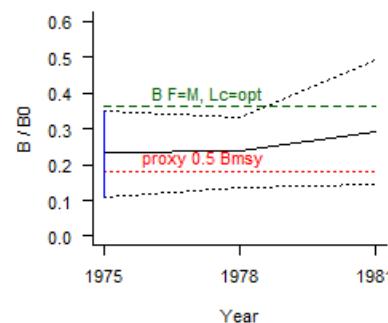
Lmean vs Lopt & Lc vs Lc_opt



previous F/M



exploited B / B0



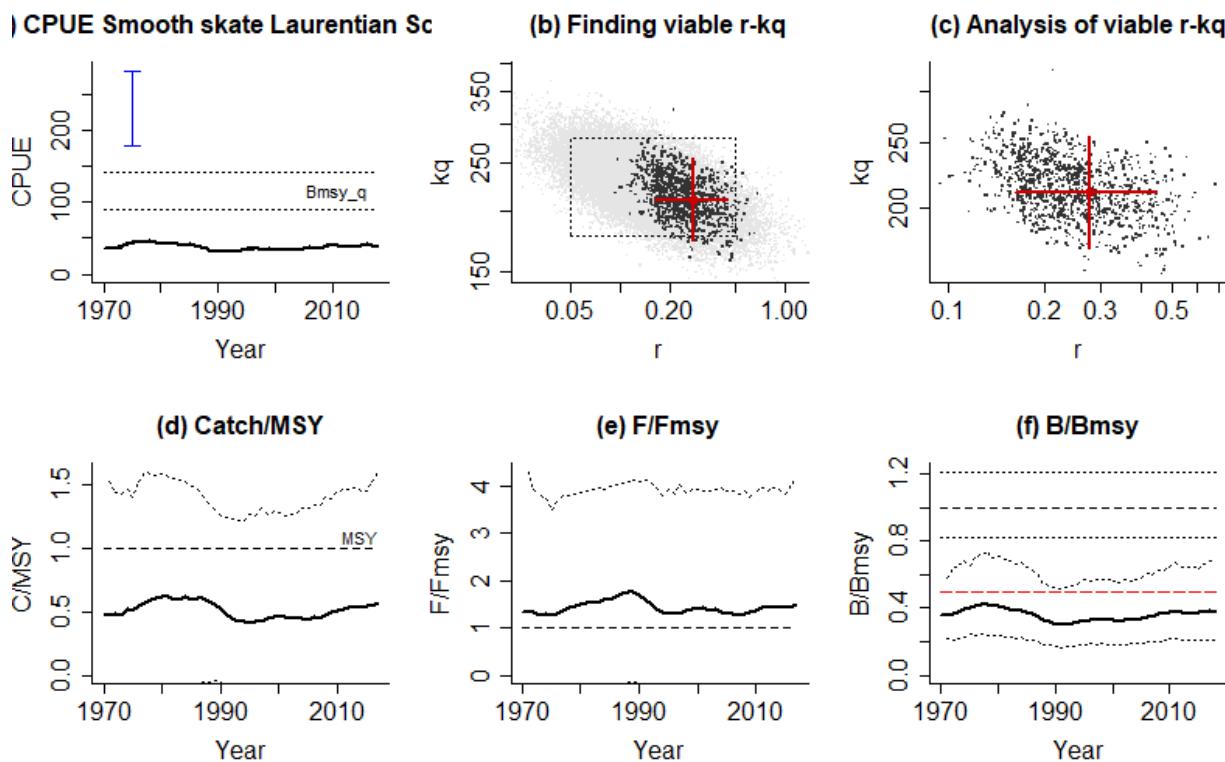
AMSY Analysis, Fri Nov 01 19:57:42 2019

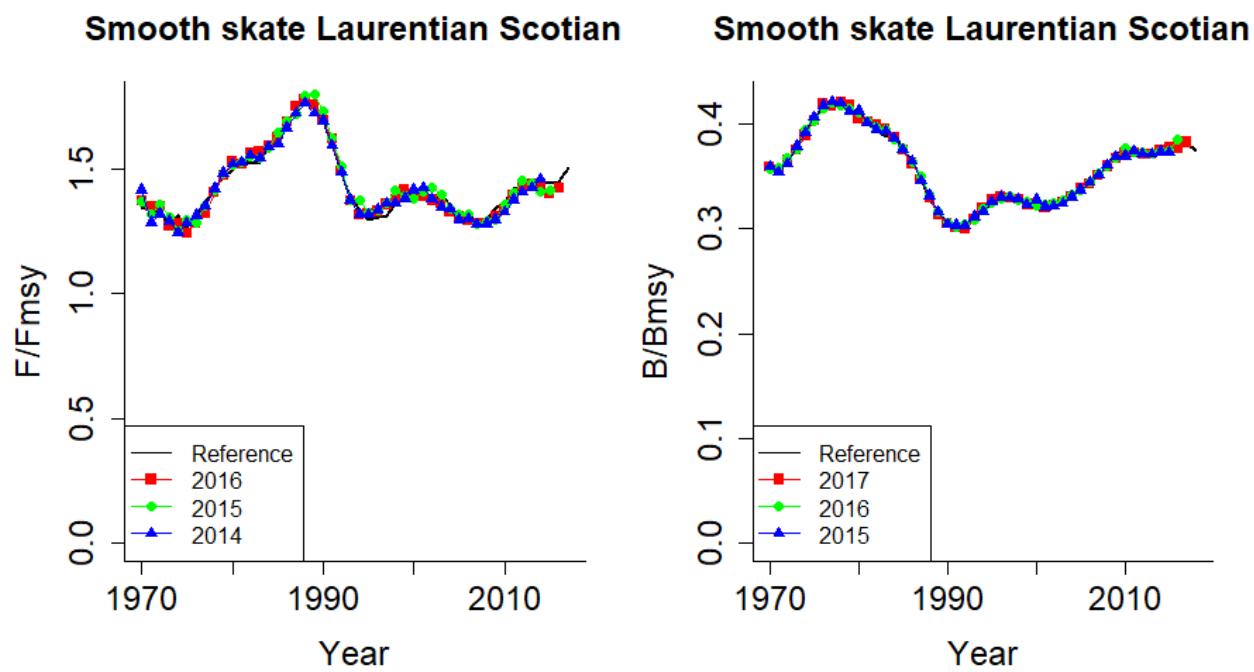
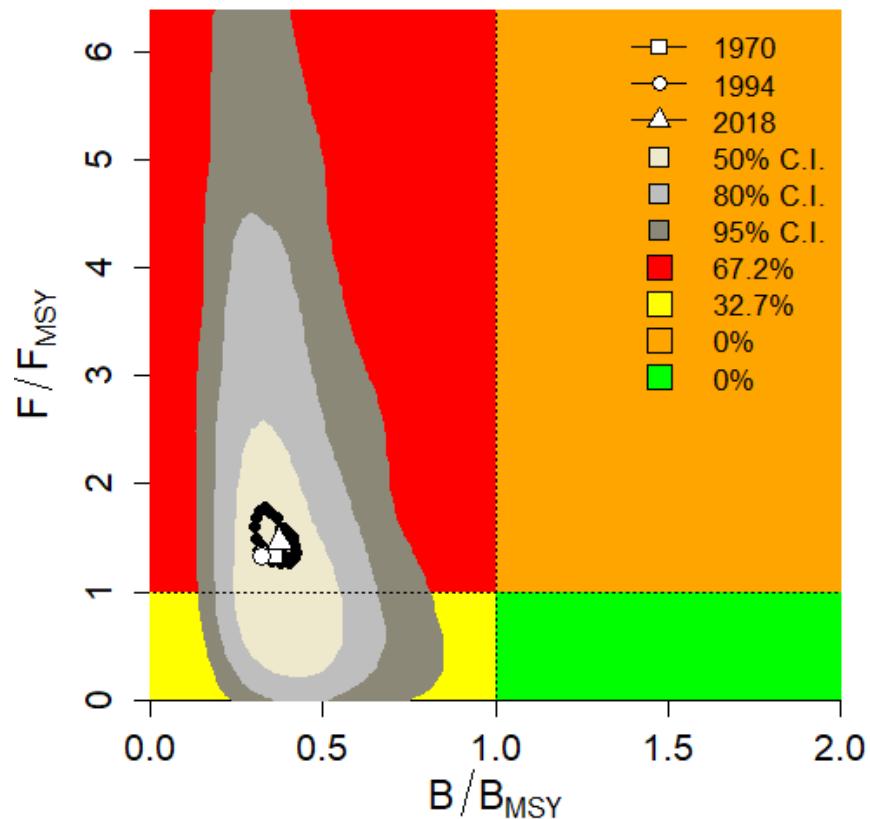
Stock **Smooth skate Laurentian Scotian, *Malacoraja senta***, Smooth skate
CPUE data for years 1970 - 2018, CPUE range 32.1 - 44.6, smooth = TRUE
Prior for r = Low, NA - NA
Used prior range for r = 0.05 - 0.5
Prior for 1975 stock status = Small, 0.11 - 0.35
Used 1975 prior B/B₀ range = 0.11 - 0.35, prior B/B_{msy} = 0.22 - 0.7
Used prior range for k_q = 178 - 282 [original range = 88.8 - 282]
Comment: CPUE from research surveys provided by Fisheries and Oceans Canada
(DFO); B_k priors from LBB; Correspondence with Dave Kulka suggests 0.25 to
0.85 in 2018

Monte Carlo filtering of r-k_q space with 50000 points and 30 error patterns.
Viable r-k_q pairs = 5000

Results:

viable r-k_q pairs = 5000
median k_q = 211, 174 - 255
median MSY_q = 14.6, 8.69 - 23.5
r (4 MSY_q/k_q) = 0.276, 0.162 - 0.451
F_{msy} (r/2) = 0.138, 0.0809 - 0.225
F/F_{msy} = 1.51, -0.323 - 4.2 (2017)
B/B_{msy} = 0.374, 0.209 - 0.676 (2018)





South Africa

LBB results for *Helicolenus dactylopterus*, stock HELDAC, 1993-2017
 Files:LBB4AMSY_ID_ZAdem_AMSY.csv, LBBdatZAdem_AMSY.csv

Linf prior= 50, SD=0.5 cm Lmax=84, median Lmax=50
 Z/K prior = 5.3, SD=2.5, M/K prior=1.5, SD=0.075(user-defined)
 F/K prior = 3.78 (wide range with tau=4 in log-normal distribution)
 Lc prior = 11.2, SD=1.1 cm, alpha prior=12.8, SD=1.3, Lm50=32 cm

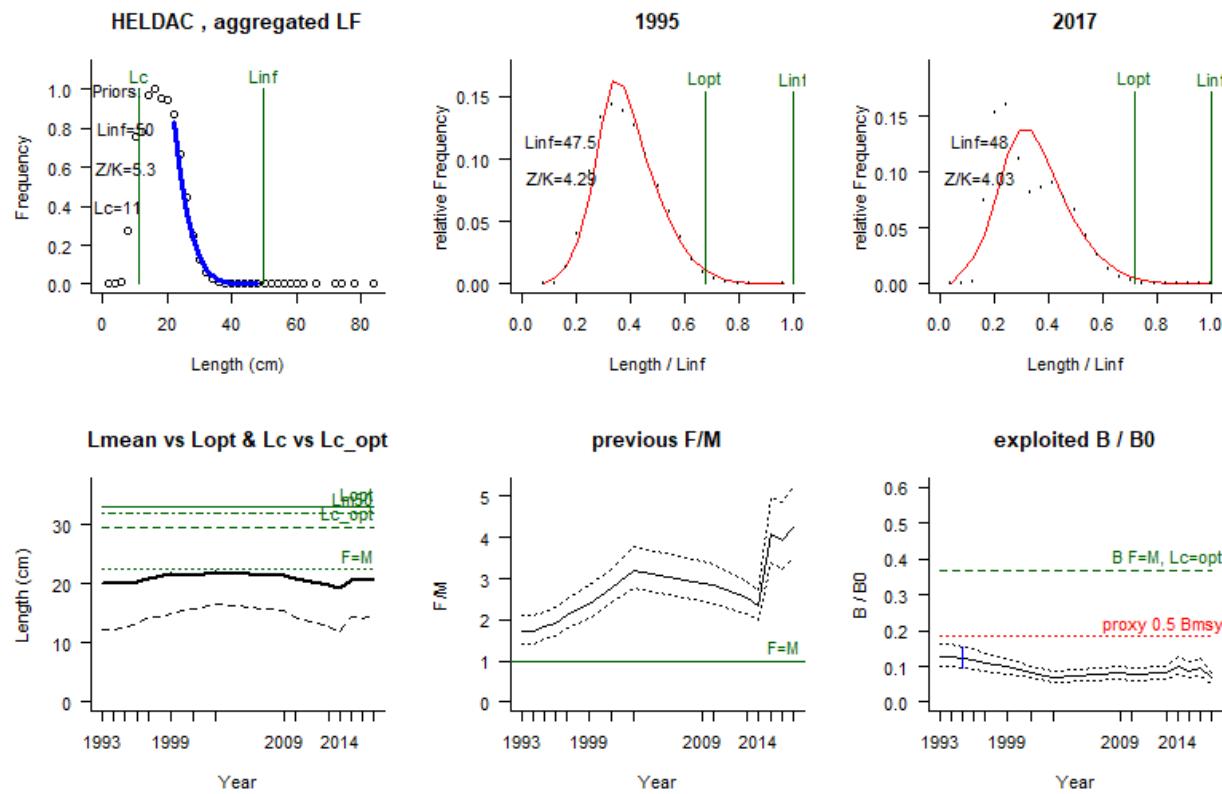
General reference points (median across years):

Linf = 48.4 (48-49.1) cm
 Lopt = 33 cm, Lopt/Linf=0.68
 Lc_opt = 30 cm, Lc_opt/Linf=0.61, Lmean if F=M 22.3 cm
 M/K = 1.41 (1.27-1.55)
 F/M = 2.27 (1.97-2.68), F/K=2.99 (2.72-3.24), Z/K=4.38 (4.2-4.6)
 B/B0 = 0.097 (0.076-0.12), B/B0 F=M Lc=Lc_opt 0.37
 Y/R' = 0.013 (0.01-0.017)(reduced: B/B0<0.25), Y/R' F=M Lc=Lc_opt 0.05

Estimates for 2017 (mean of last 3 years with data):

Lc50 = 14.4 (14.1-14.7) cm, Lc/Linf=0.3 (0.3-0.31)
 Lc95 = 22.3, alpha=0.371 (0.362-0.381)
 Lmean/Lopt= 0.59, Lc/Lc_opt=0.49, L95th=47.3 cm, L95th/Linf=0.99, Mature=0.7%
 F/M = 4.3 (3.5-5.2), F/K=4.2 (3.9-4.6), Z/K=5.4 (5.1-5.6)
 Y/R' = 0.01 (0.0081-0.013)(reduced because B/B0 < 0.25)
 B/B0 = 0.067 (0.053-0.084), best LF fit year 1997=0.111 (0.087-0.14)
 B/Bmsy = 0.18 (0.14-0.23), selected B/B0 1995 = 0.12 (0.095-0.15)

Trawl Survey data; RF set MK.user=1.5 to avoid negative M/K; excluded years with unreasonable LFs; selected 1995 because of good fit and reasonable B/B0 compared with adjacent years.



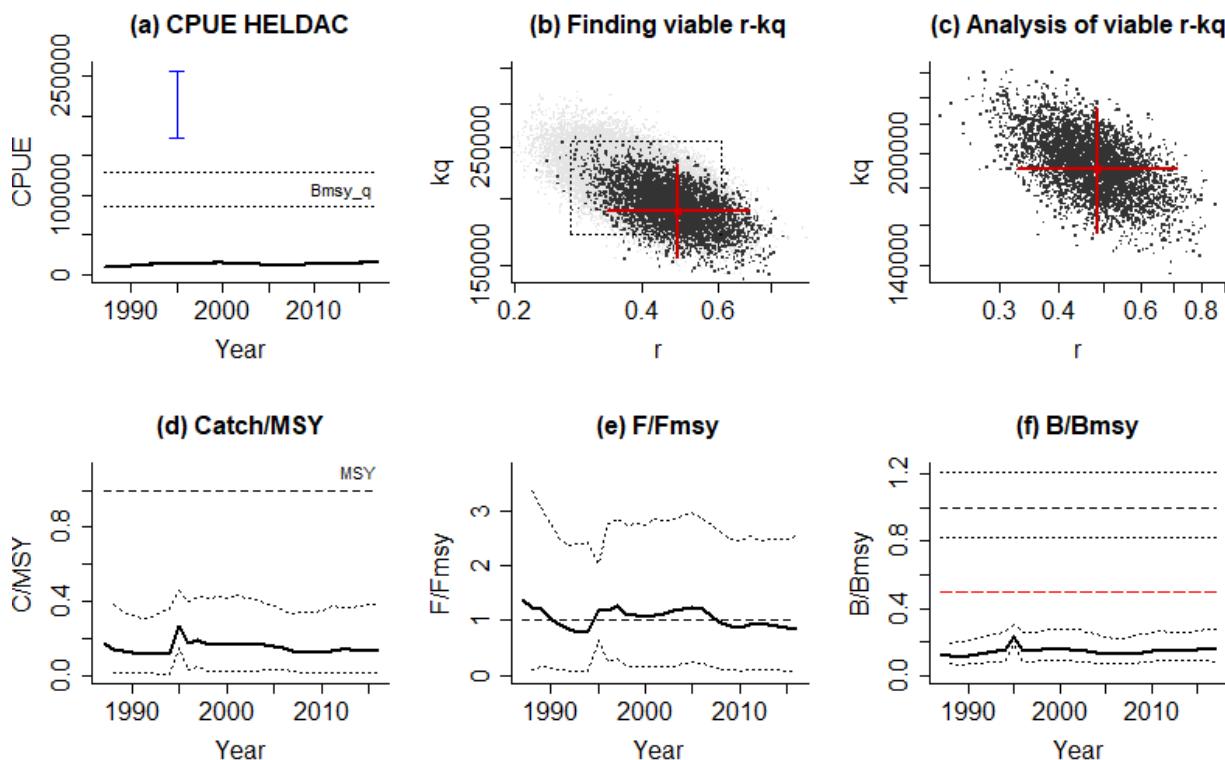
AMSY Analysis, Fri Nov 01 20:01:47 2019

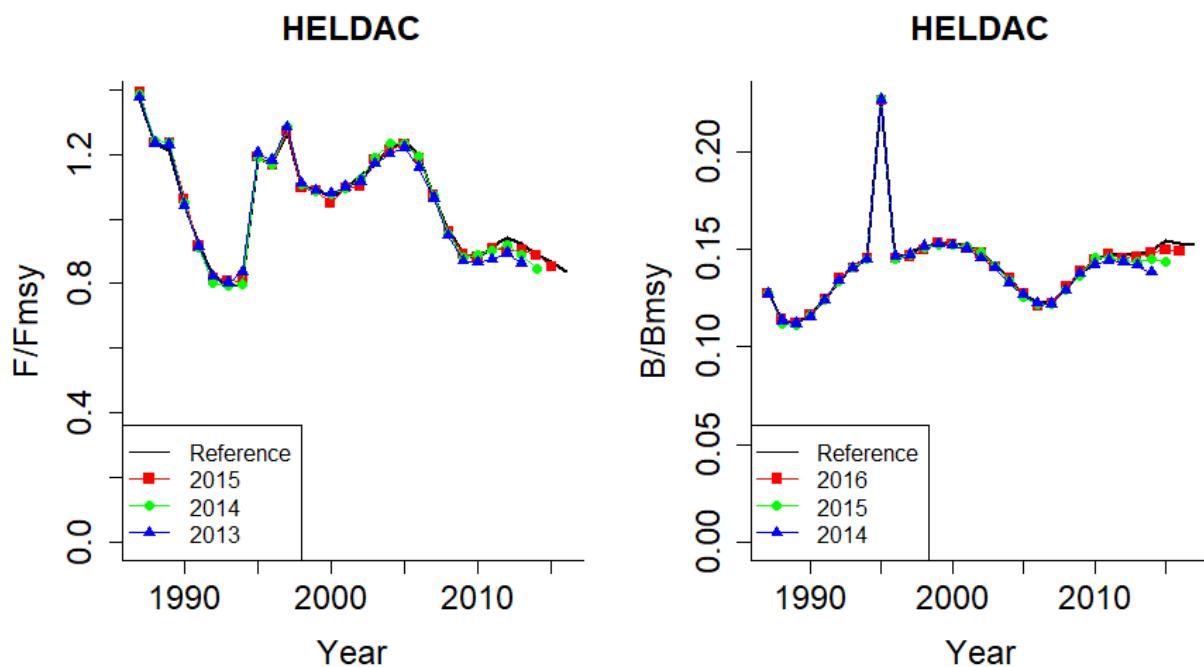
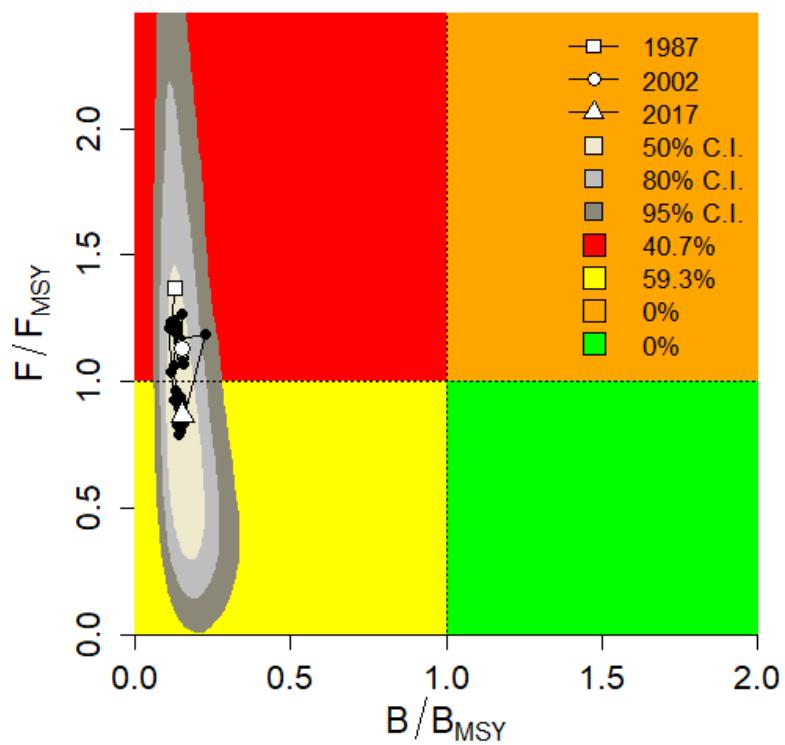
Stock HELDAC, *Helicolenus dactylopterus*, Blackbelly rosefish
CPUE data for years 1987 - 2017, CPUE range 9705 - 14521, smooth = TRUE
Prior for r = Medium, 0.27 - 0.61
Used prior range for r = 0.254 - 0.652
Prior for 1995 stock status = Very small, 0.1 - 0.15
Used 1995 prior B/B0 range = 0.1 - 0.15, prior B/Bmsy = 0.2 - 0.3
Used prior range for kq = 171295 - 256942 [original range = 85647 - 128471]
Comment: B/B0 prior from LBB. RF: OK
Source:

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
Viable r-kq pairs = 5000

Results:

viable r-kq pairs = 5000
median kq = 190329, 155676 - 231260
median MSYq = 22964, 16864 - 31517
r (4 MSYq/kq) = 0.483, 0.328 - 0.711
Fmsy (r/2) = 0.241, 0.164 - 0.355
F/Fmsy = 0.836, 0.0679 - 2.53 (2016)
B/Bmsy = 0.153, 0.0838 - 0.274 (2017)





LBB results for *Cymatoceps nasutus*, stock PNSK, 2009-2009
 Files:LBB4AMSY_ID_2.csv, LBBdatZA.csv

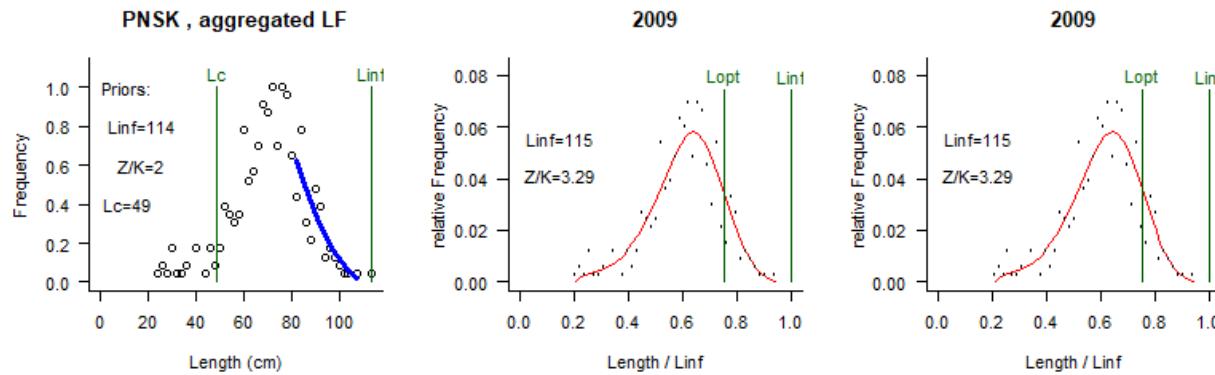
Linf prior= 114, SD=1.1 cm Lmax=114, median Lmax=114
 Z/K prior = 2, SD=3, M/K prior=1.5, SD=0.15
 F/K prior = 0.517 (wide range with tau=4 in log-normal distribution)
 Lc prior = 50, SD=5 cm, alpha prior=10.5, SD=1, Lm50=53 cm

General reference points (median across years):

Linf = 115 (113-116) cm
 Lopt = 86 cm, Lopt/Linf=0.75
 Lc_opt = 78 cm, Lc_opt/Linf=0.68, Lmean if F=M 86.8 cm
 M/K = 0.985 (0.763-1.25)
 F/M = 2.35 (1.58-3.55), F/K=2.31 (1.98-2.9), Z/K=3.32 (2.97-3.82)
 B/B0 = 0.2 (0.11-0.32), B/B0 F=M Lc=Lc_opt 0.39
 Y/R' = 0.072 (0.042-0.12)(reduced: B/B0<0.25), Y/R' F=M Lc=Lc_opt 0.079

Estimates for 2009 (mean of last 3 years with data):

Lc50 = 72.8 (71.4-74.3) cm, Lc/Linf=0.63 (0.62-0.65)
 Lc95 = 100, alpha=0.107 (0.103-0.109)
 Lmean/Lopt= 0.96, Lc/Lc_opt=0.94, L95th=108 cm, L95th/Linf=0.94, Mature=89%
 F/M = 2.4 (1.6-3.6), F/K=2.3 (2-2.9), Z/K=3.3 (3-3.8)
 Y/R' = 0.072 (0.042-0.12)(reduced because B/B0 < 0.25)
 B/B0 = 0.2 (0.11-0.32), best LF fit year 2009=0.196 (0.11-0.32)
 B/Bmsy = 0.5 (0.29-0.82)



AMSY Analysis, Fri Nov 01 20:09:39 2019

Stock PNSK, *Cymatoceps nasutus*, Black musselcracker

CPUE data for years 1987 - 2017, CPUE range 0.374 - 1.29, smooth = TRUE

Prior for r = Low, NA - NA

Used prior range for r = 0.05 - 0.5

Prior for 2009 stock status = Small, 0.11 - 0.34

Used 2009 prior B/B₀ range = 0.11 - 0.34, prior B/B_{msy} = 0.22 - 0.68

Used prior range for kq = 1.38 - 4.15 [original range = 1.38 - 4.28]

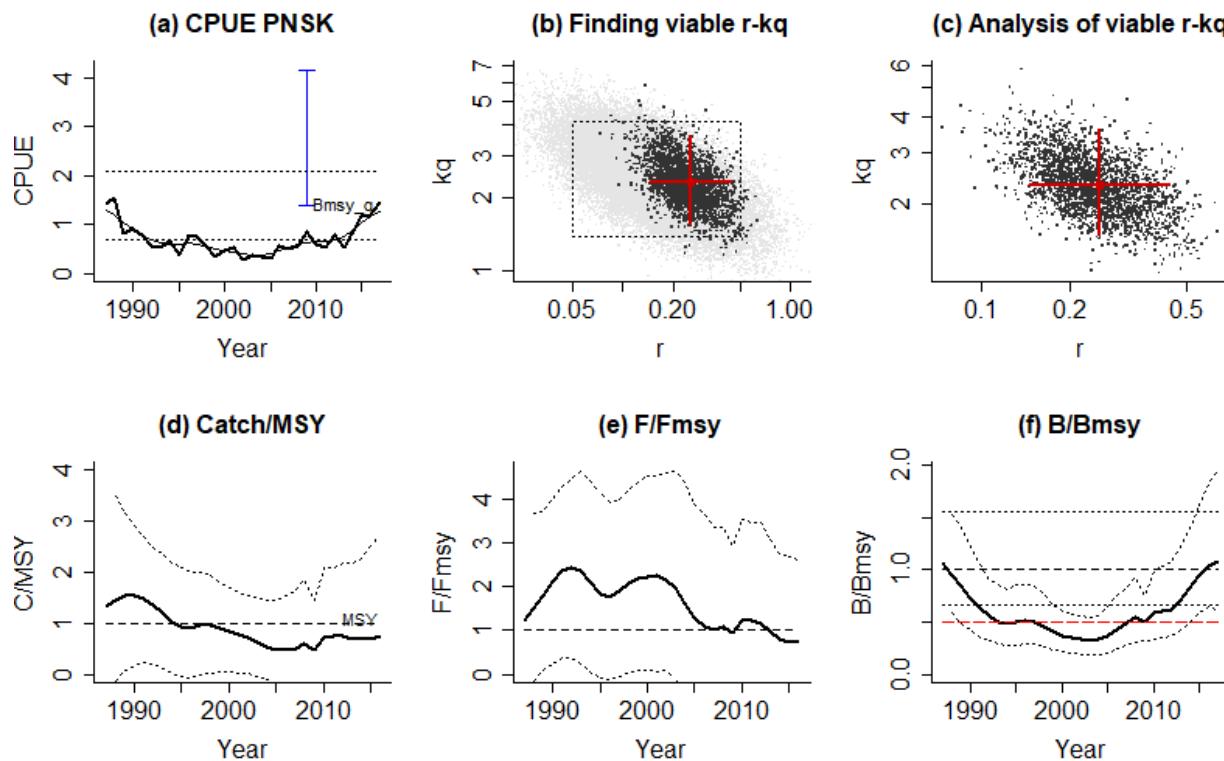
Comment: B/B₀ prior from LBB for 2009 (landing observer programm)

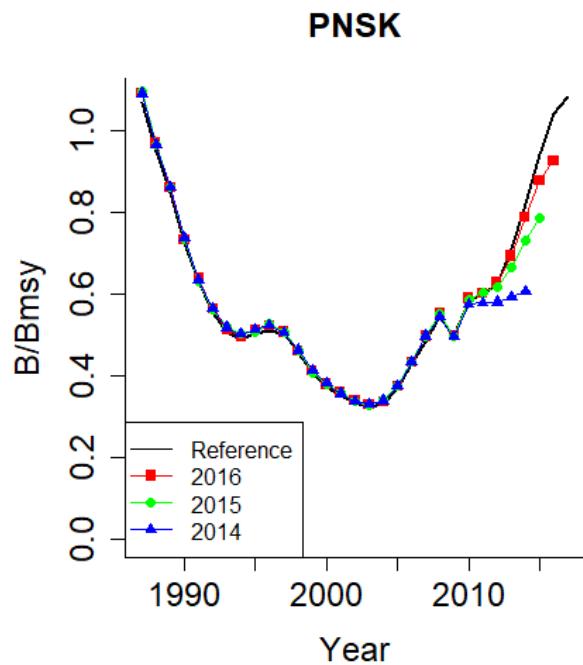
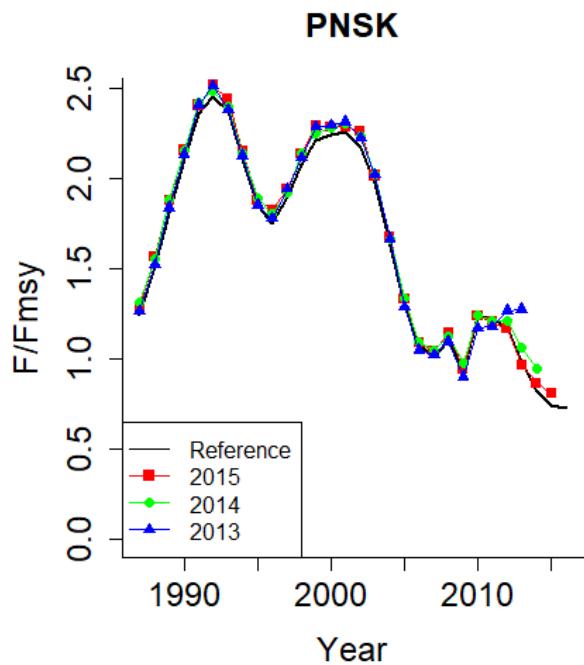
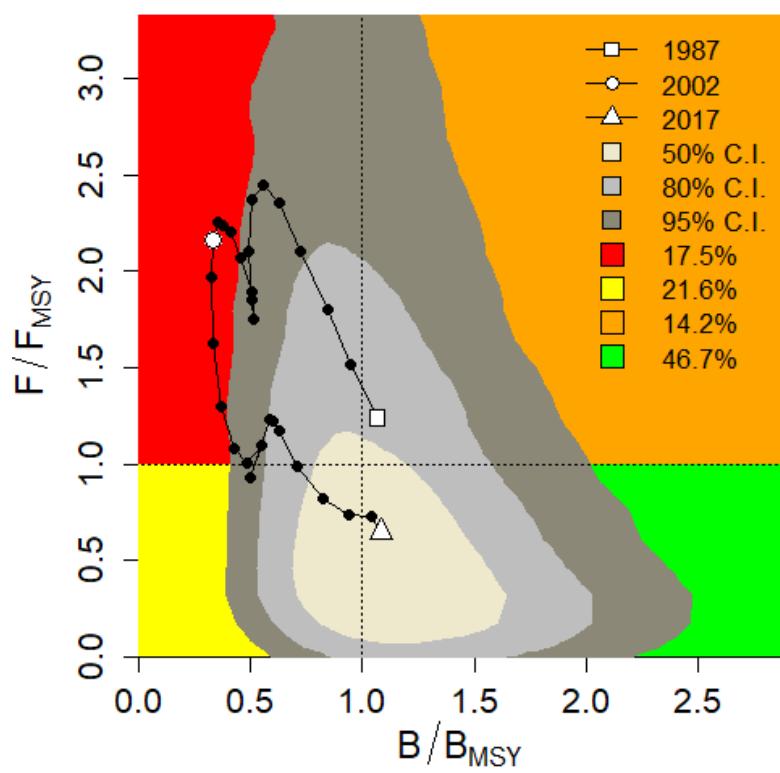
Source:

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
Viable r-kq pairs = 5000

Results:

viable r-kq pairs	= 5000
median kq	= 2.33, 1.56 - 3.61
median MSYq	= 0.148, 0.0889 - 0.247
r (4 MSYq/kq)	= 0.254, 0.144 - 0.438
F _{msy} (r/2)	= 0.127, 0.0719 - 0.219
F/F _{msy}	= 0.727, -0.246 - 2.62 (2016)
B/B _{msy}	= 1.08, 0.598 - 1.95 (2017)





LBB results for *Argyrosomus thorpaei*, stock STKB1, 2008-2008
 Files:LBB4AMSY_ID_2.csv, LBBdatZA.csv

L_{∞} prior= 81.6, SD=0.82 cm $L_{max}=106$, median $L_{max}=68$
 Z/K prior = 1.9, SD=11, M/K prior=1.5, SD=0.15
 F/K prior = 0.401 (wide range with $\tau=4$ in log-normal distribution)
 L_c prior = 43.9, SD=4.4 cm, alpha prior=20.1, SD=2, $L_{m50}=33$ cm

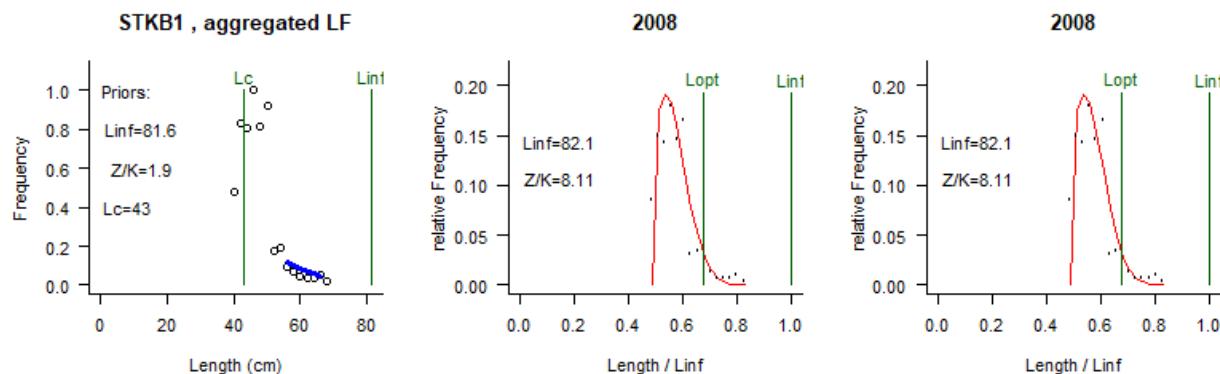
General reference points (median across years):

L_{∞} = 82.1 (80.3-83.6) cm
 L_{opt} = 55 cm, $L_{opt}/L_{\infty}=0.68$
 L_{c_opt} = 52 cm, $L_{c_opt}/L_{\infty}=0.64$, Lmean if $F=M$ 53.4 cm
 M/K = 1.44 (1.12-1.74)
 F/M = 4.67 (3.63-6.18), $F/K=6.67$ (5.99-7.49), $Z/K=8.09$ (7.36-8.99)
 B/B_0 = 0.083 (0.055-0.12), $B/B_0 F=M L_c=L_{c_opt} 0.37$
 Y/R' = 0.017 (0.011-0.024) (reduced: $B/B_0 < 0.25$), $Y/R' F=M L_c=L_{c_opt} 0.048$

Estimates for 2008 (mean of last 3 years with data):

L_{c50} = 43.5 (42.9-43.9) cm, $L_c/L_{\infty}=0.53$ (0.52-0.54)
 L_{c95} = 54.5, alpha=0.268 (0.259-0.278)
 L_{mean}/L_{opt} = 0.88, $L_c/L_{c_opt}=0.83$, $L_{95th}/L_{\infty}=0.83$, Mature=100%
 F/M = 4.7 (3.6-6.2), $F/K=6.7$ (6-7.5), $Z/K=8.1$ (7.4-9)
 Y/R' = 0.017 (0.011-0.024) (reduced because $B/B_0 < 0.25$)
 B/B_0 = 0.083 (0.055-0.12), best LF fit year 2008=0.0826 (0.055-0.12)
 B/B_{msy} = 0.22 (0.15-0.32)

Fixed L_{∞} to mean between L_{∞} (too low) and L_{max}



AMSY Analysis, Fri Nov 01 20:14:58 2019

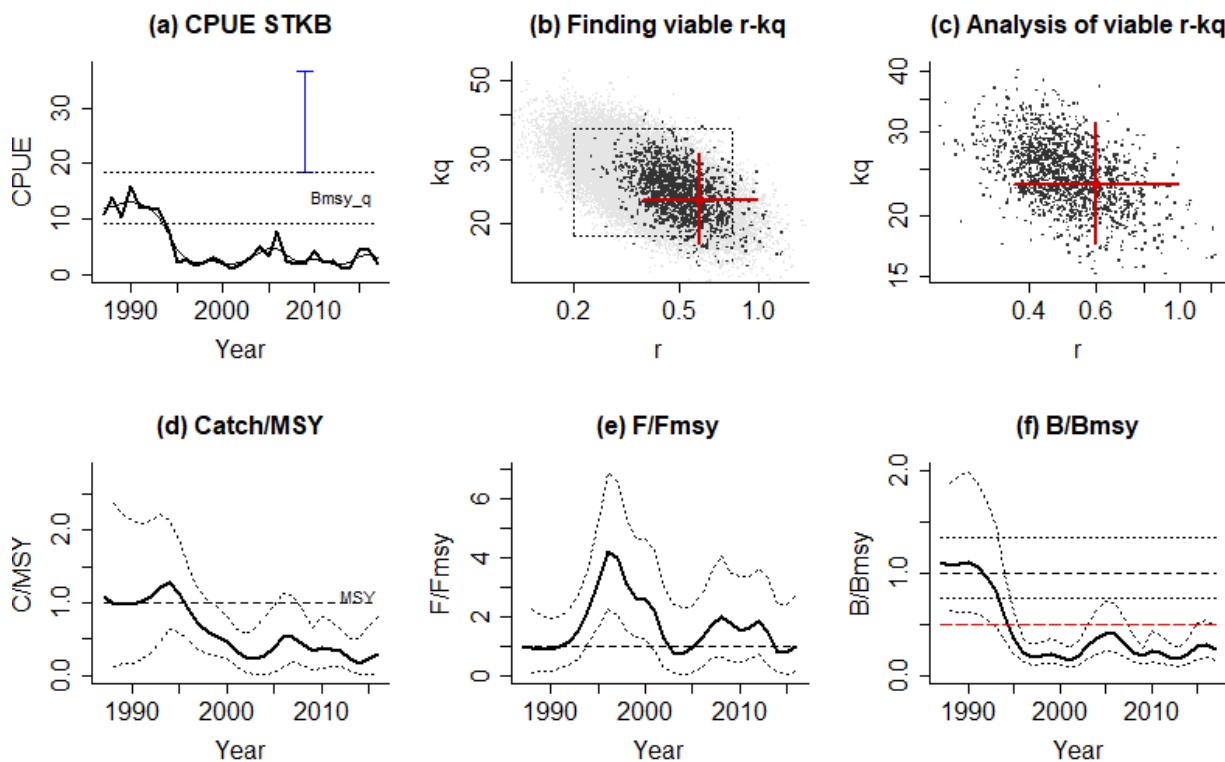
Stock STKB, *Argyrosomus thorpaei*, Squaretail kob
CPUE data for years 1987 - 2017, CPUE range 1.73 - 13.2, smooth = TRUE
Prior for r = Medium, NA - NA
Used prior range for r = 0.2 - 0.8
Prior for 2009 stock status = Very small, 0.06 - 0.12
Used 2009 prior B/B0 range = 0.06 - 0.12, prior B/B_{msy} = 0.12 - 0.24
Used prior range for kq = 18.4 - 36.7 [original range = 18.4 - 36.7]
Comment: B/B0 prior from LBB for 2009 (landing observer programm)
Source:

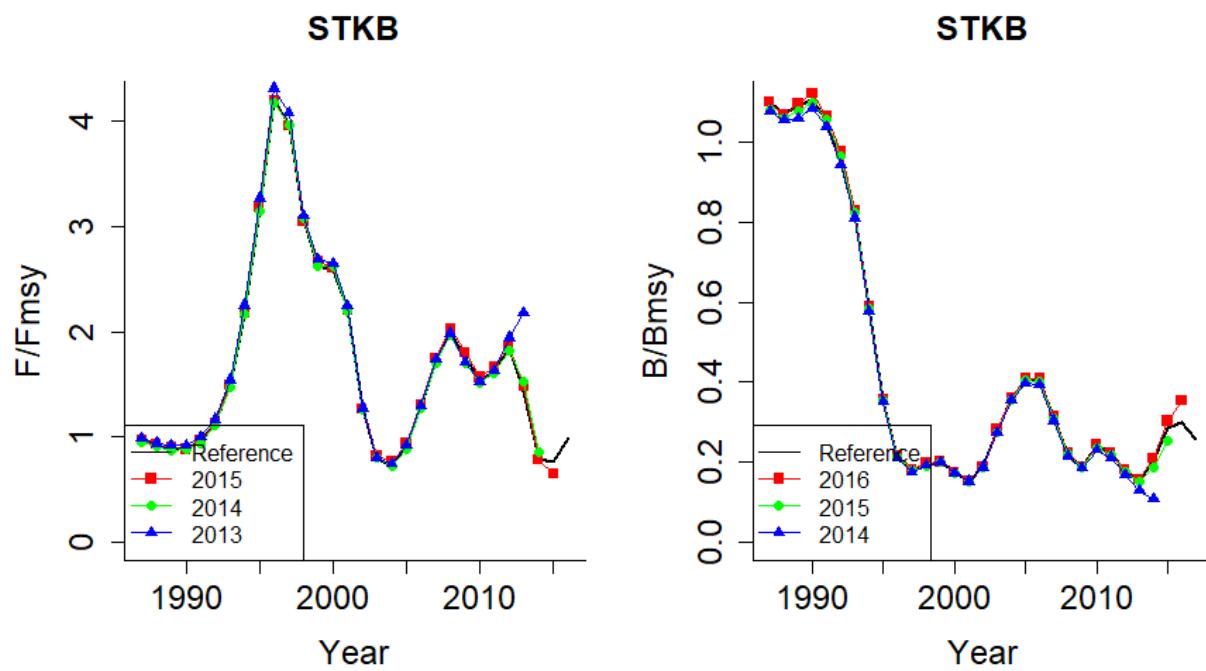
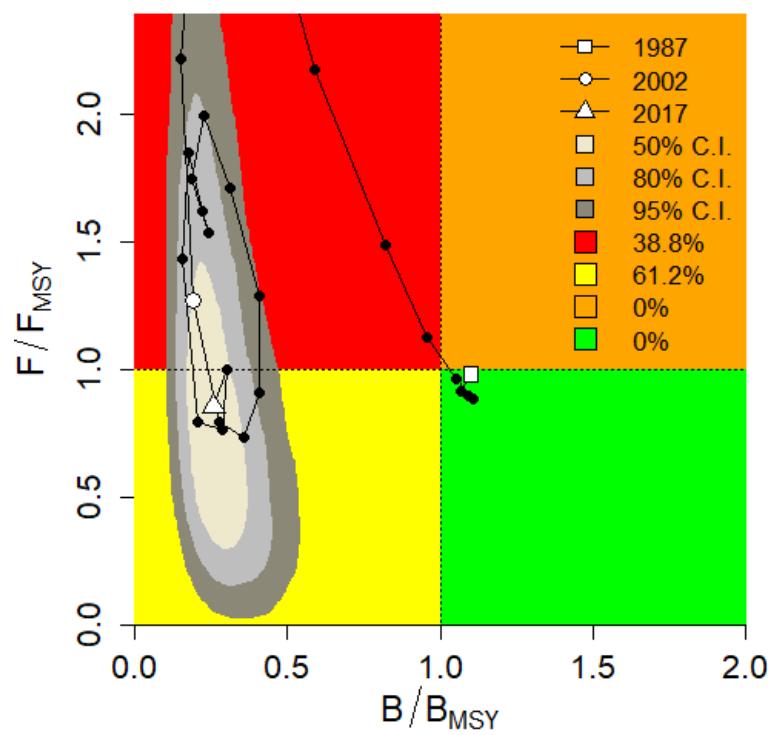
Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
Viable r-kq pairs = 5000

Results:

viable r-kq pairs = 5000
median kq = 23.2, 17.5 - 31.2
median MSY_q = 3.48, 2.22 - 5.66
r (4 MSY_q/kq) = 0.601, 0.363 - 0.988
F_{msy} (r/2) = 0.301, 0.182 - 0.494
F/F_{msy} = 0.996, 0.122 - 2.7 (2016)
B/B_{msy} = 0.258, 0.146 - 0.465 (2017)

)





LBB results for *Raja straeleni*, stock TBSK, 2007-2017
 Files:LBB4AMSY_ID_ZAdem_AMSY.csv, LBBdatZAdem_AMSY.csv

Linf prior= 83.9, SD=0.84 cm Lmax=94, median Lmax=84
 Z/K prior = 3.2, SD=1.9, M/K prior=1.5, SD=0.15
 F/K prior = 1.73 (wide range with tau=4 in log-normal distribution)
 Lc prior = 26.5, SD=2.7 cm, alpha prior=25.6, SD=2.6, Lm50=NA cm

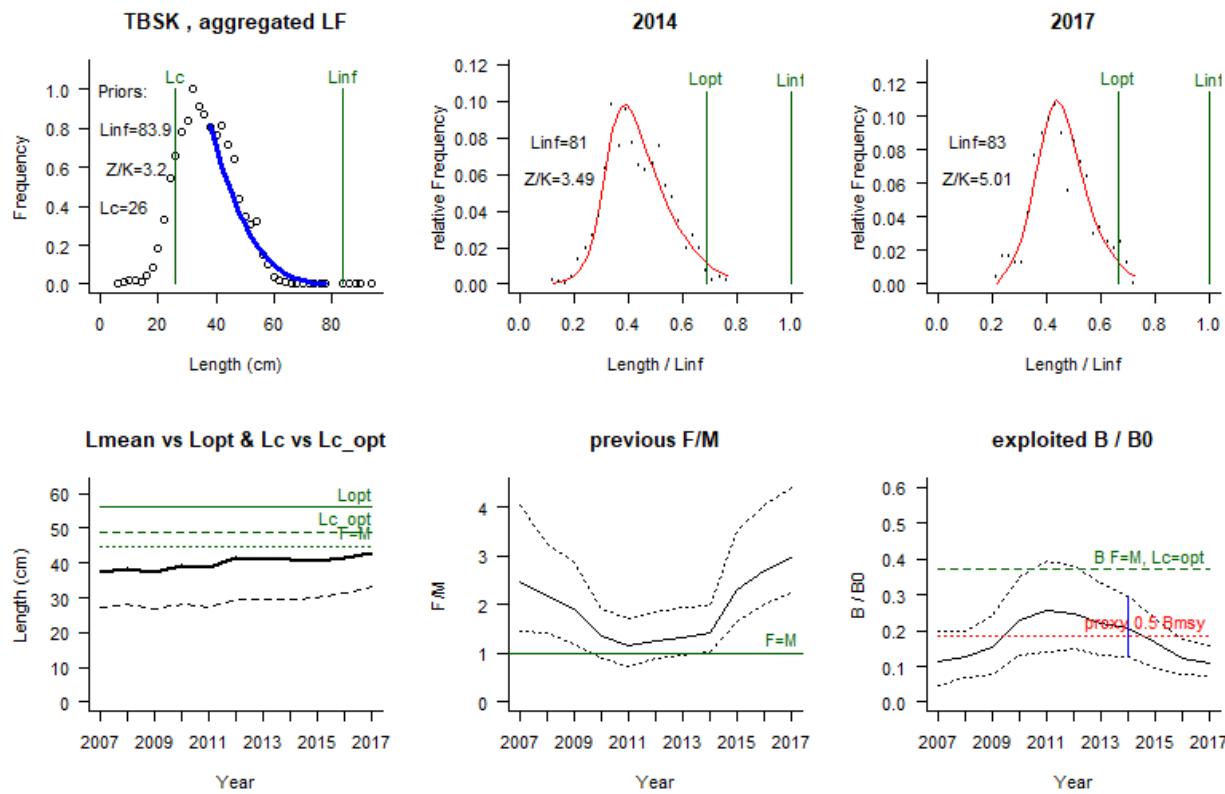
General reference points (median across years):

Linf = 81.6 (80-83.1) cm
 Lopt = 56 cm, Lopt/Linf=0.69
 Lc_opt = 49 cm, Lc_opt/Linf=0.6, Lmean if F=M 44.9 cm
 M/K = 1.36 (1.14-1.72)
 F/M = 1.62 (1.26-2.46), F/K=2.13 (1.76-2.45), Z/K=3.46 (3.22-3.67)
 B/B0 = 0.17 (0.094-0.24), B/B0 F=M Lc=Lc_opt 0.37
 Y/R' = 0.031 (0.017-0.042) (reduced: B/B0<0.25), Y/R' F=M Lc=Lc_opt 0.053

Estimates for 2017 (mean of last 3 years with data):

Lc50 = 33.3 (32.8-33.9) cm, Lc/Linf=0.41 (0.4-0.41)
 Lc95 = 45.6, alpha=0.239 (0.231-0.249)
 Lmean/Lopt= 0.75, Lc/Lc_opt=0.68, L95th=62.7 cm, L95th/Linf=0.77, Mature=NA%
 F/M = 3 (2.2-4.4), F/K=3.8 (3.3-4.2), Z/K=5.1 (4.7-5.5)
 Y/R' = 0.019 (0.013-0.029) (reduced because B/B0 < 0.25)
 B/B0 = 0.11 (0.073-0.16), best LF fit year 2017=0.108 (0.073-0.16)
 B/Bmsy = 0.29 (0.2-0.42), selected B/B0 2014 = 0.21 (0.12-0.3)

Trawl Survey data; sharks and rays more consistently measured in chosen recent period from 2007 onward. RF selected 2014 because of good fit and reasonable B/B0 compared to adjacent estimates.



AMSY Analysis, Fri Nov 01 20:18:57 2019

Stock **TBSK**, *Raja straeleni*, Biscuit skate

CPUE data for years 1991 - 2017, CPUE range 15383 - 21126, smooth = TRUE

Prior for r = Low, NA - NA

Used prior range for r = 0.05 - 0.5

Prior for 2014 stock status = Small, 0.12 - 0.3

Used 2014 prior B/B₀ range = 0.12 - 0.3, prior B/B_{msy} = 0.24 - 0.6

Used prior range for kq = 86428 - 129642 [original range = 43214 - 108035]

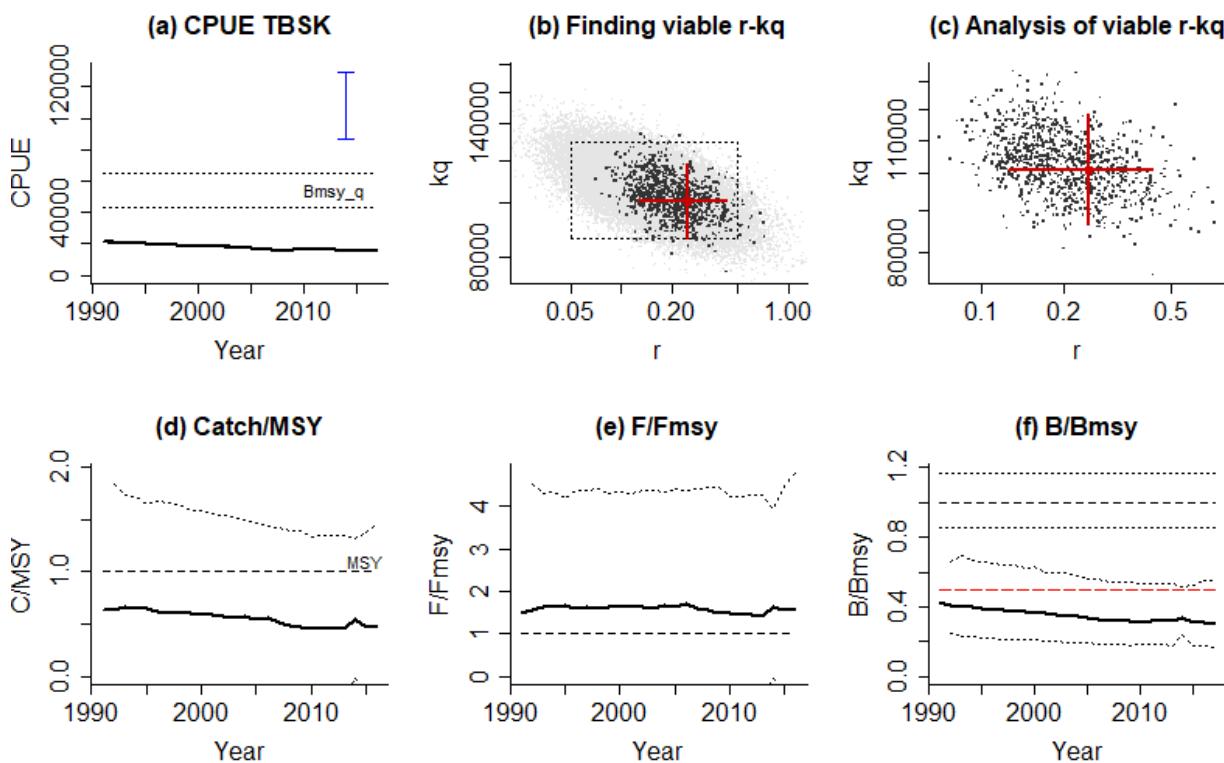
Comment: B/B₀ prior from LBB. RF: OK

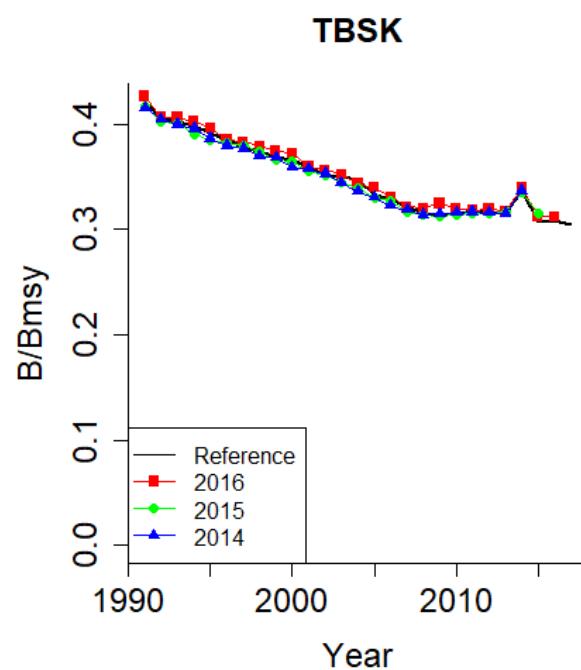
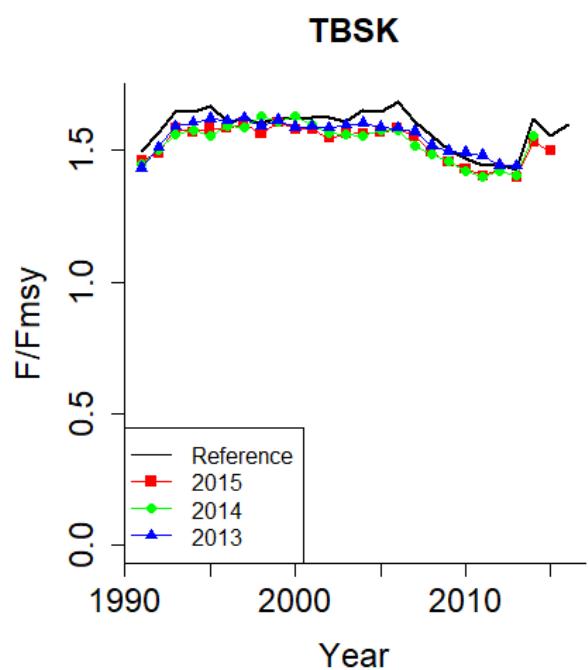
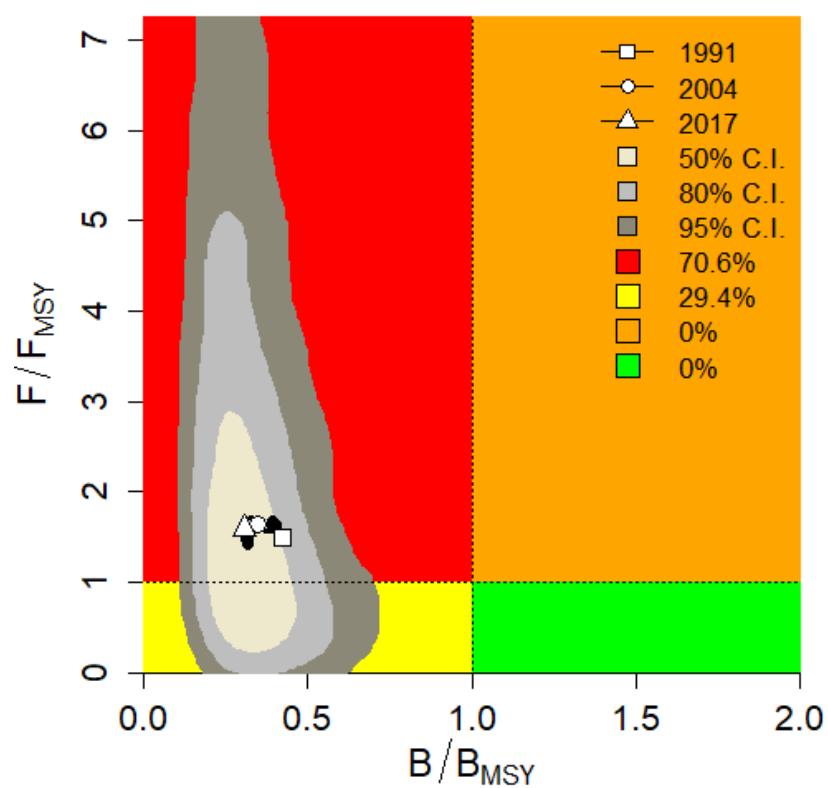
Source:

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
Viable r-kq pairs = 5003

Results:

viable r-kq pairs	= 5003
median kq	= 101005, 86440 - 118314
median MSYq	= 6243, 3326 - 10390
r (4 MSYq/kq)	= 0.247, 0.126 - 0.424
F _{msy} (r/2)	= 0.124, 0.0628 - 0.212
F/F _{msy}	= 1.6, -0.409 - 4.78 (2016)
B/B _{msy}	= 0.305, 0.168 - 0.555 (2017)





LBB results for *Rhabdosargus globiceps*, stock WSTM, 1987-2007
 Files:LBB4AMSY_ID_ZAdem_AMSY.csv, LBBdatZAdem_AMSY.csv

Linf prior= 51, SD=0.51 cm Lmax=58, median Lmax=48
 Z/K prior = 3, SD=0.68, M/K prior=1.45, SD=0.075(user-defined)
 F/K prior = 1.58 (wide range with tau=4 in log-normal distribution)
 Lc prior = 25.5, SD=2.6 cm, alpha prior=22.8, SD=2.3, Lm50=NA cm

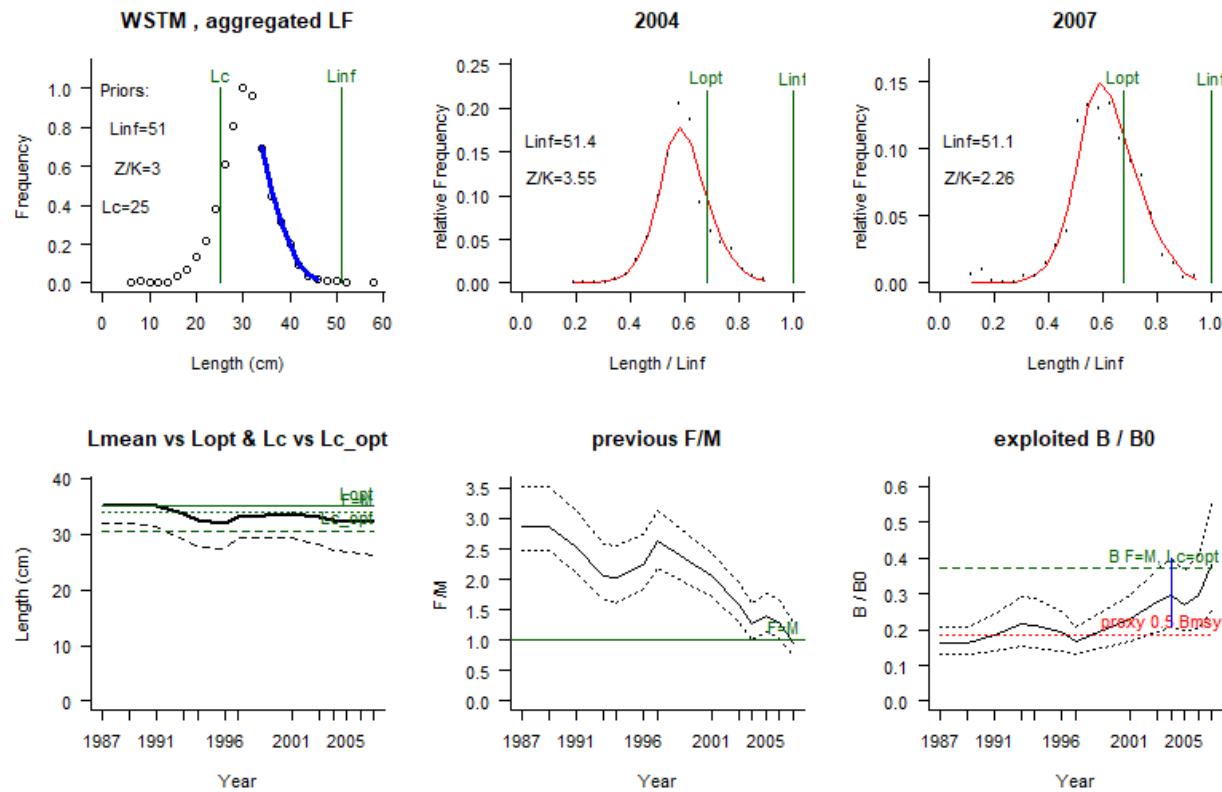
General reference points (median across years):

Linf = 51 (50.3-51.6) cm
 Lopt = 35 cm, Lopt/Linf=0.69
 Lc_opt = 30 cm, Lc_opt/Linf=0.6, Lmean if F=M 33.8 cm
 M/K = 1.37 (1.21-1.49)
 F/M = 1.58 (1.3-1.96), F/K=2.18 (1.86-2.47), Z/K=3.55 (3.26-3.83)
 B/B0 = 0.24 (0.18-0.31), B/B0 F=M Lc=Lc_opt 0.37
 Y/R' = 0.049 (0.035-0.062)(reduced: B/B0<0.25), Y/R' F=M Lc=Lc_opt 0.052

Estimates for 2007 (mean of last 3 years with data):

Lc50 = 26.2 (25.9-26.5) cm, Lc/Linf=0.52 (0.52-0.53)
 Lc95 = 33.1, alpha=0.426 (0.416-0.438)
 Lmean/Lopt= 0.92, Lc/Lc_opt=0.86, L95th=46.7 cm, L95th/Linf=0.93, Mature=NA%
 F/M = 0.97 (0.75-1.3), F/K=1.3 (1-1.5), Z/K=2.5 (2.3-2.8)
 Y/R' = 0.055 (0.037-0.078)(reduced because B/B0 < 0.25)
 B/B0 = 0.38 (0.25-0.55), best LF fit year 2007=0.382 (0.25-0.55)
 B/Bmsy = 1 (0.68-1.5), selected B/B0 2004 = 0.3 (0.21-0.4)

Trawl Survey data; excluded unsuitable LF data; only first period covered. RF selected 2004 because of good fit and reasonable B/B0 compared to adjacent estimates.



AMSY Analysis, Fri Nov 01 20:22:08 2019

Stock WSTM, *Rhabdosargus globiceps*, white stumpnose

CPUE data for years 1987 - 2016, CPUE range 1500 - 3844, smooth = TRUE

Prior for r = Medium, NA - NA

Used prior range for r = 0.2 - 0.8

Prior for 2004 stock status = Small, 0.21 - 0.4

Used 2004 prior B/B₀ range = 0.21 - 0.4, prior B/B_{MSY} = 0.42 - 0.8

Used prior range for kq = 5603 - 10672 [original range = 5603 - 10672]

Comment: B/B₀ prior from LBB. RF: OK

Source:

Monte Carlo filtering of r-kq space with 50000 points and 30 error patterns.
Viable r-kq pairs = 5009

Results:

viable r-kq pairs = 5009

median kq = 7437, 5532 - 9572

median MSYq = 899, 572 - 1419

r (4 MSYq/kq) = 0.484, 0.293 - 0.806

F_{MSY} (r/2) = 0.242, 0.146 - 0.403

F/F_{MSY} = 0.887, 0.106 - 2.03 (2015)

B/B_{MSY} = 1.03, 0.572 - 1.85 (2016)

