Appendix D1: Model Comparisons for

TCSAM2013 Models B0, B1, B2, B3, B4, B5, B6

William Stockhausen

Results from TCSAM2013 models B0, B1, B2, B3, B4, B5 and B6 are illustrated in this appendix.

Population processes

Natural mortality

Natural Mortality

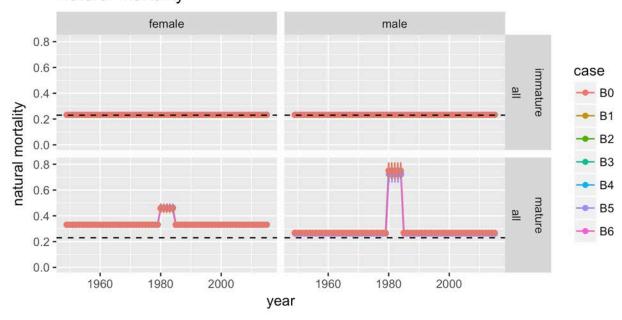


Figure 1. Estimated natural mortality rates, by year.

Probability of terminal molt

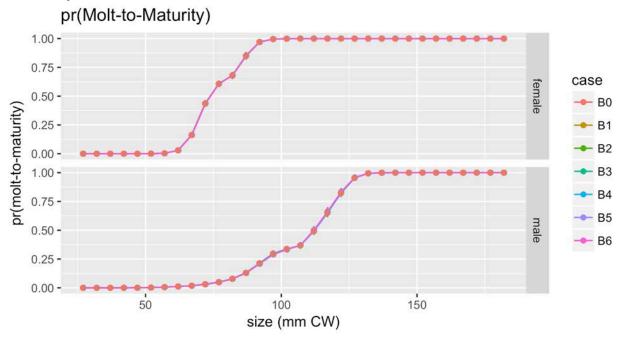


Figure 2. Probability of terminal molt.

Mean growth

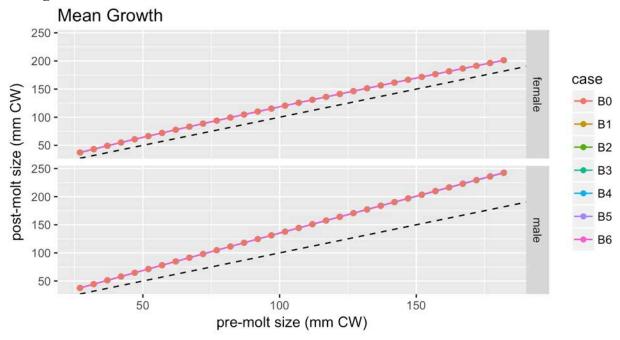


Figure 3. Mean growth.

Growth matrices

male growth: 1949-2016

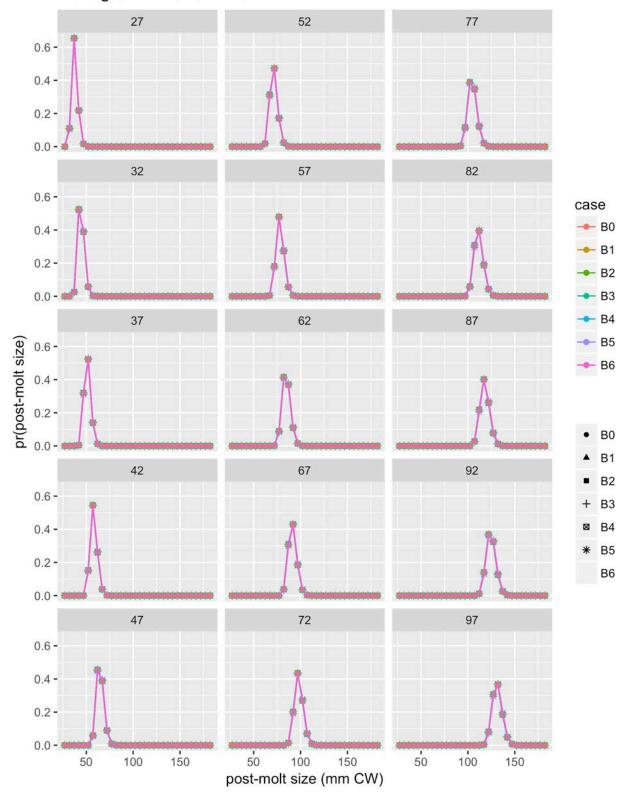


Figure 4. Growth matrices for males during 1949-2016, page 1.

male growth: 1949-2016 102 152 127 1.00 -0.75 -0.50 -0.25 -0.00 -107 132 157 1.00 case 0.75 -**→** B0 0.50 -**←** B1 0.25 -- B2 0.00 -- B3 112 137 162 ► B4 1.00 pr(post-molt size) ► B5 0.75 -► B6 0.50 -0.25 -B0 0.00 -B1 117 142 167 B2 1.00 -+ B3 0.75 -■ B4 0.50 -B5 0.25 -B6 0.00 -147 172 122 1.00 -0.75 -0.50 -0.25 -0.00 -50 50 100 150 50 100 100 150 150

post-molt size (mm CW)

Figure 5. Growth matrices for males during 1949-2016, page 2.

male growth: 1949-2016

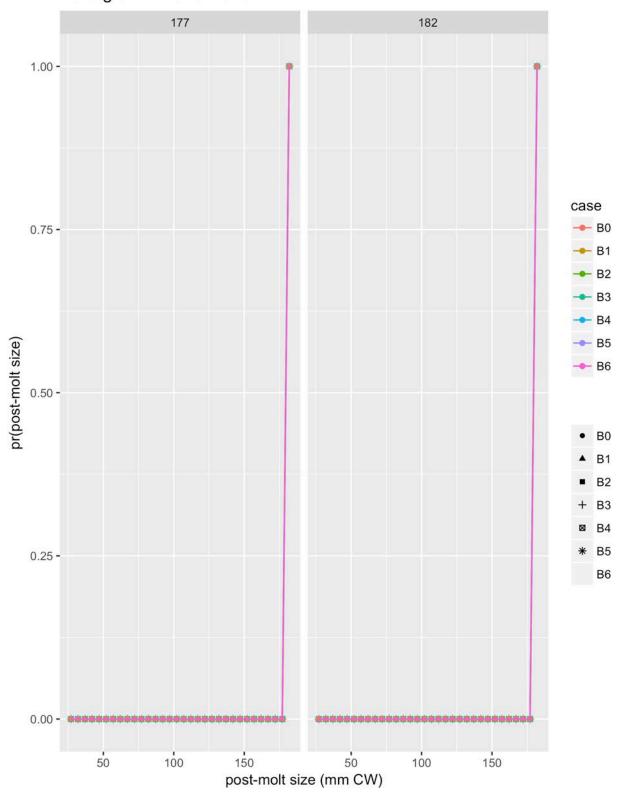


Figure 6. Growth matrices for males during 1949-2016, page 3.

female growth: 1949-2016 27 52 77 0.6 -0.4 -0.2 -0.0 -32 57 82 0.6 case **→** B0 0.4 -► B1 0.2 -- B2 0.0 -- B3 - B4 37 62 87 br(bost-molt size) - B5 - B6 B0 B1 42 67 92 B2 0.6 -+ B3 B4 0.4 -B5 0.2 -B6 0.0 -47 72 97 0.6 -0.4 -0.2 -0.0 -50 100 150 50 50 150 100 150 100 post-molt size (mm CW)

Figure 7. Growth matrices for females during 1949-2016, page 1.

female growth: 1949-2016 102 152 127 1.00 -0.75 -0.50 -0.25 -0.00 -107 132 157 1.00 case 0.75 -**→** B0 0.50 -**←** B1 0.25 -- B2 0.00 -- B3 112 137 162 - B4 1.00 pr(post-molt size) ► B5 0.75 -► B6 0.50 -0.25 -B0 0.00 -B1 117 142 167 B2 1.00 -+ B3 0.75 -■ B4 0.50 -B5 0.25 -B6 0.00 -147 172 122 1.00 -0.75 -0.50 -0.25 -0.00 -50 100 100 100 50 150 50 150 150

post-molt size (mm CW)

Figure 8. Growth matrices for females during 1949-2016, page 2.

female growth: 1949-2016

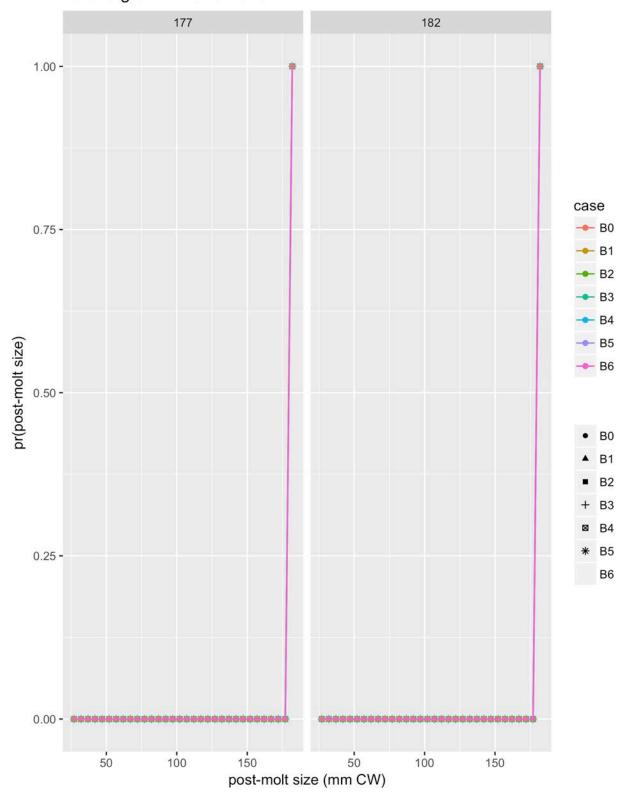


Figure 9. Growth matrices for females during 1949-2016, page 3.

Size distribution for recruits

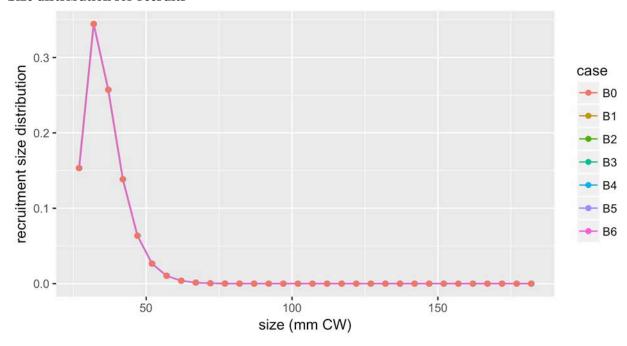


Figure 10. Size distribution for recruits.

Population results

Recruitment

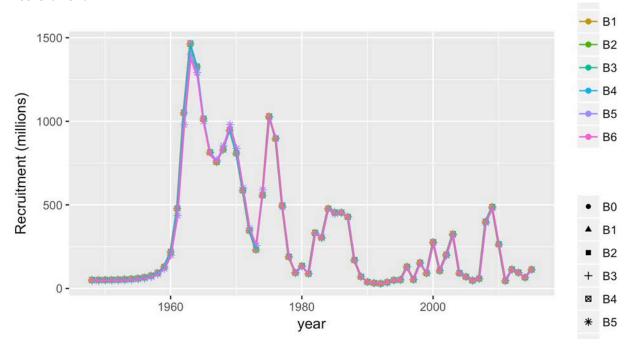


Figure 11. Estimated annual recruitment.

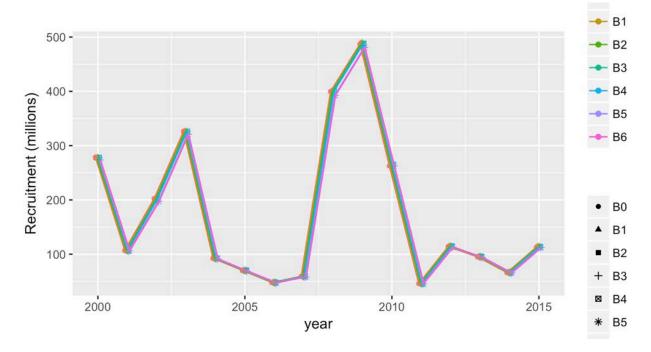


Figure 12. Estimated recent recruitment.

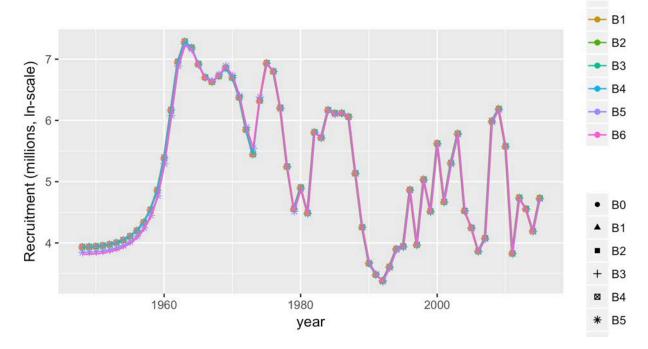


Figure 13. Estimated annual recruitment, on ln-scale.

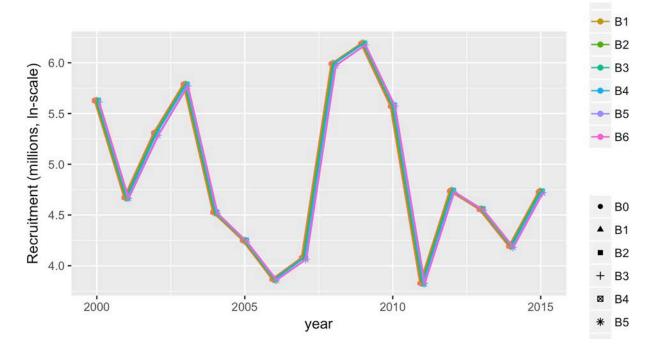


Figure 14. Estimated recent recruitment, on ln-scale.

Mature biomass

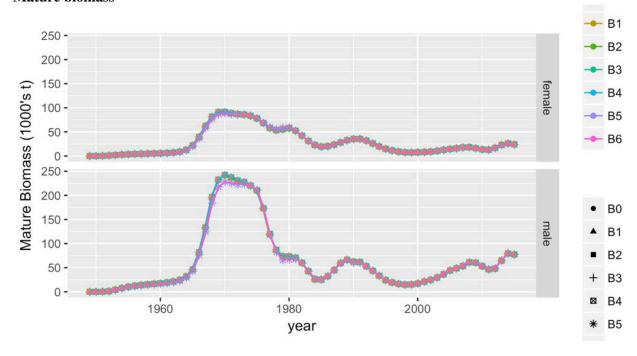


Figure 15. Estimated annual mature biomass.

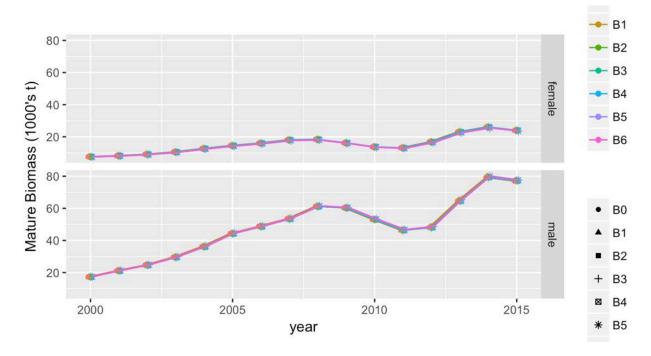


Figure 16. Estimated recent mature biomass.

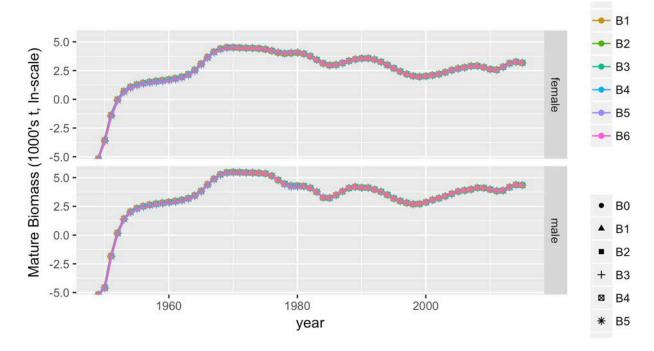


Figure 17. Estimated annual mature biomass, on ln-scale.

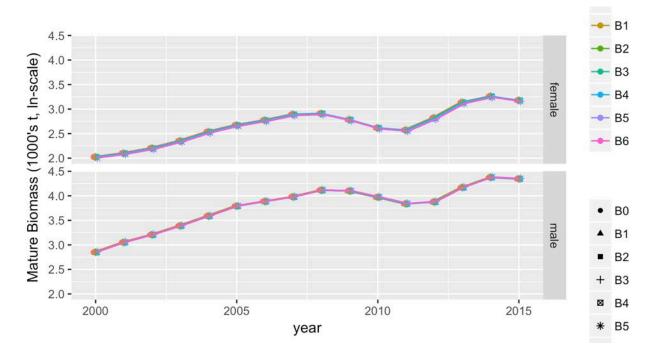


Figure 18. Estimated recent mature biomass, on ln-scale.

Population abundance

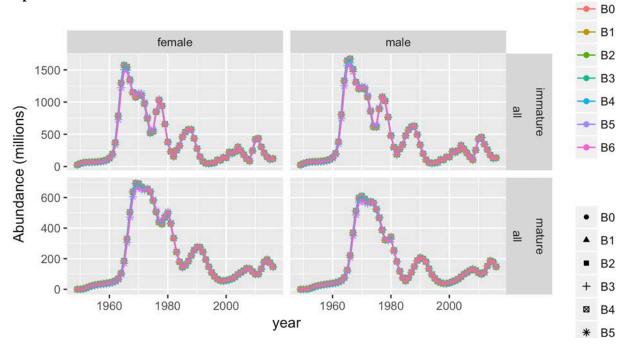


Figure 19. Population abundance trends.

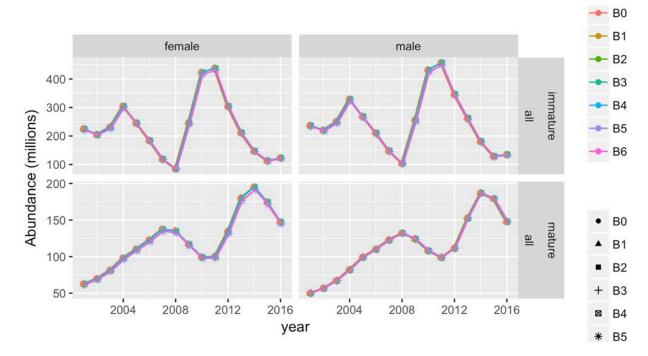


Figure 20. Recent population abundance trends.

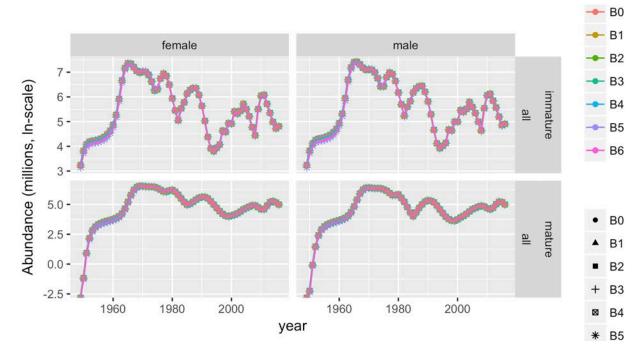


Figure 21. Ln-scale population abundance trends.

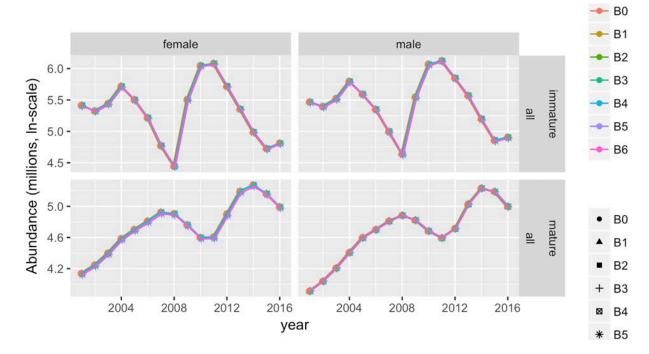


Figure 22. Recent ln-scale population abundance trends.

Biomass

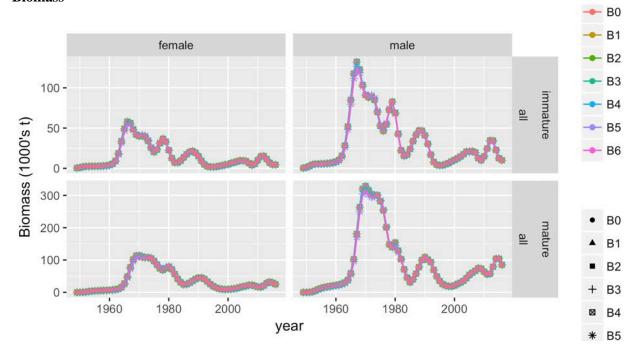


Figure 23. Population biomass trends.

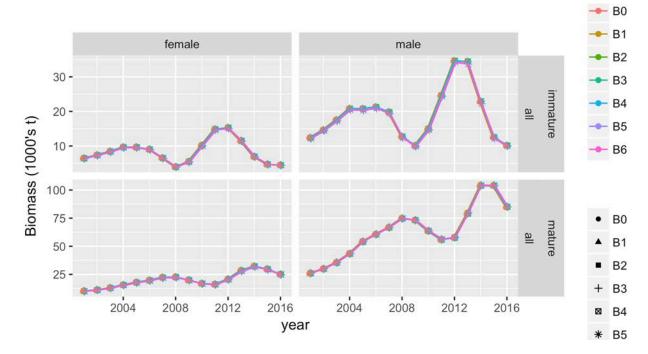


Figure 24. Recent population biomass trends.

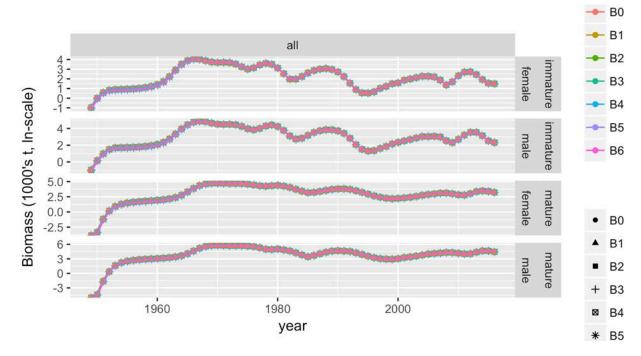


Figure 25. Ln-scale population biomass trends.

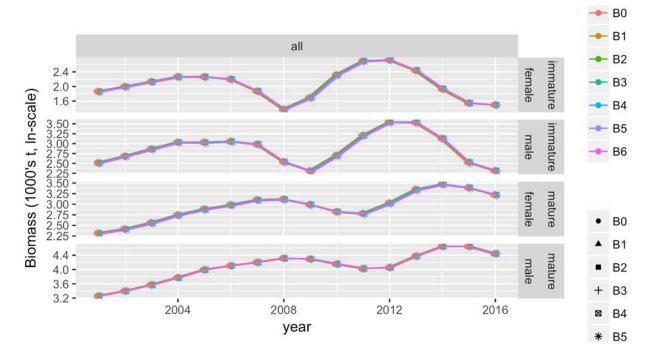


Figure 26. Recent In-scale population biomass trends.

Surveys

Survey catchability

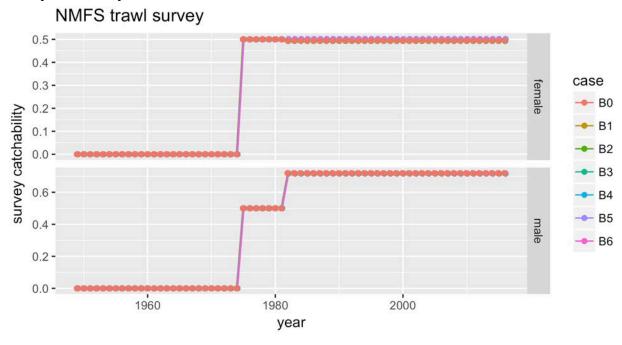


Figure 27. Survey catchabilities for NMFS trawl survey.

Survey selectivity functions → B0 NMFS trawl survey - B1 female male - B2 1.00 -0.75 -- B3 1975 0.50 -- B4 0.25 -0.00 **-**1.00 **-**► B5 Selectivity - B6 0.75 -1982 0.50 -0.25 -0.00 **-**1.00 **-**B0 0.75 -B1 1988 0.50 -B2 0.25 -В3 0.00 -150 100 100 150 50 50 ■ B4 size (mm CW) B5 NMFS trawl survey.1 **Survey abundance** NMFS trawl survey **B1** ► B2 **-** B3 400 -Survey Abundance (millions) female - B4 200 -► B5 ► B6 0 -600 -B0 400 male **B**1 200 -**B2 B**3 0 -1960 1980 2000 **B4**

year

Figure 29. NMFS trawl survey catch abundance.

B5

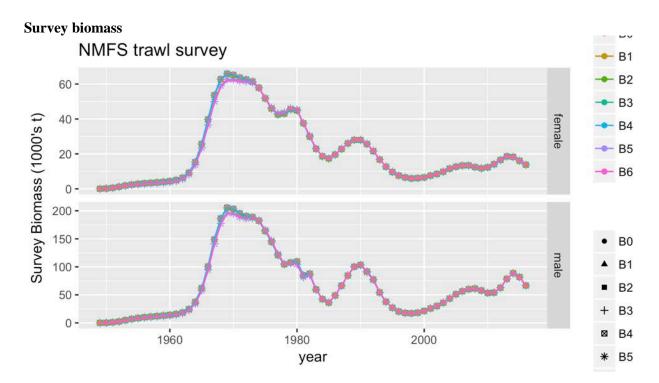


Figure 30. NMFS trawl survey catch biomass.

Survey size compositions

NMFS trawl survey

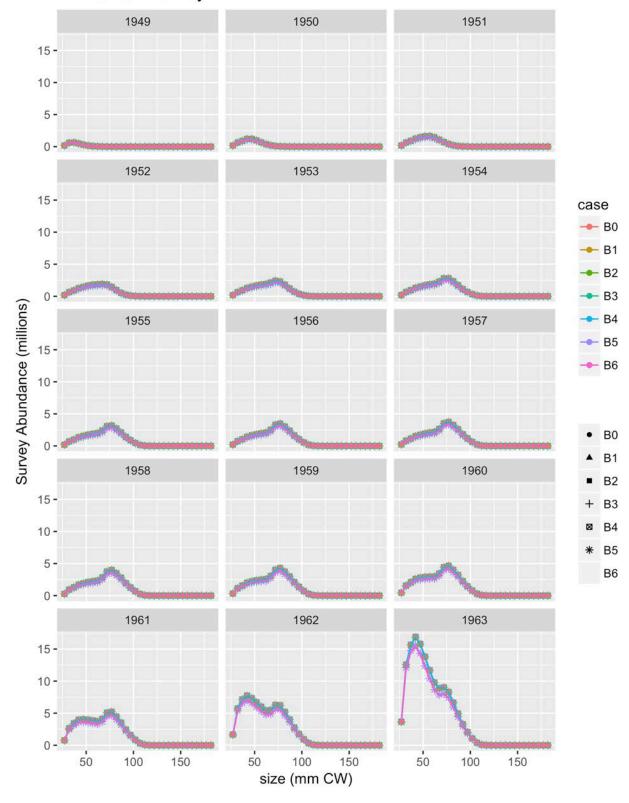


Figure 31. NMFS trawl survey catch abundance for female all all, (1 of 5).

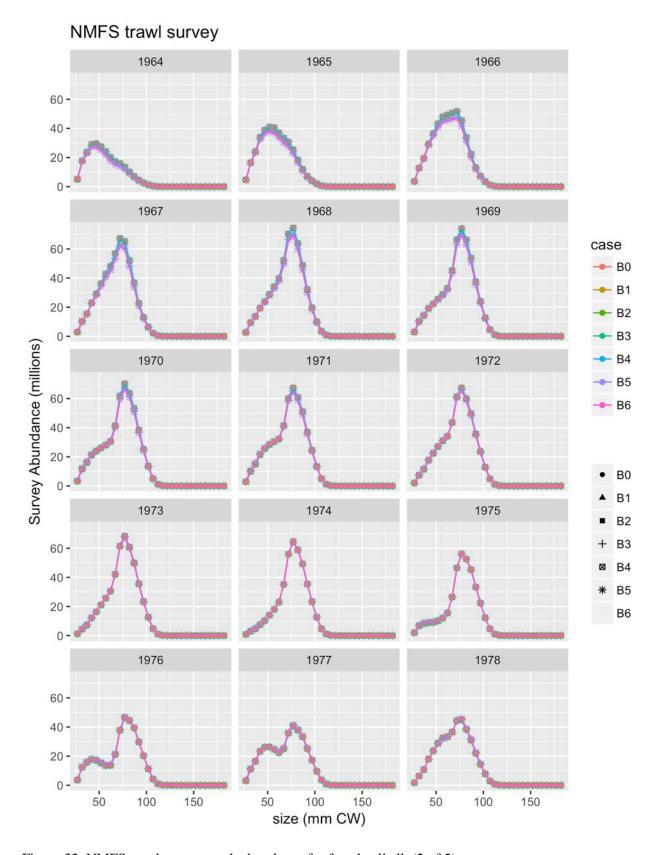


Figure 32. NMFS trawl survey catch abundance for female all all, (2 of 5).

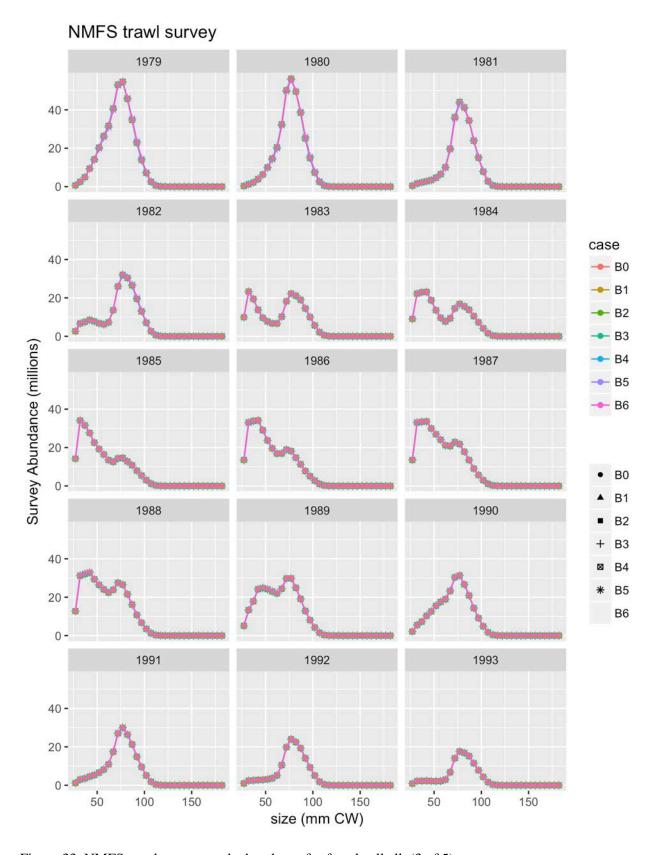


Figure 33. NMFS trawl survey catch abundance for female all all, (3 of 5).

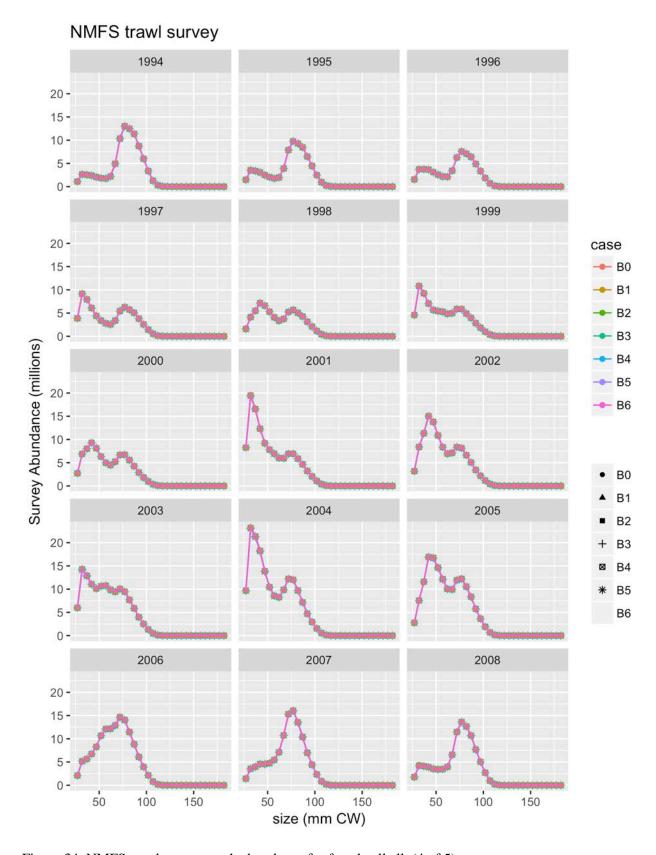


Figure 34. NMFS trawl survey catch abundance for female all all, (4 of 5).

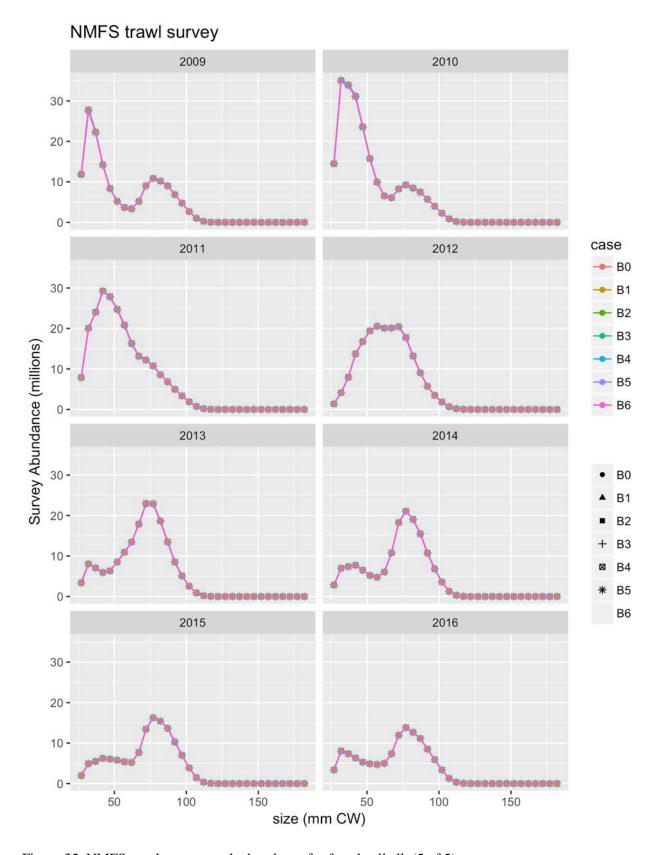


Figure 35. NMFS trawl survey catch abundance for female all all, (5 of 5).

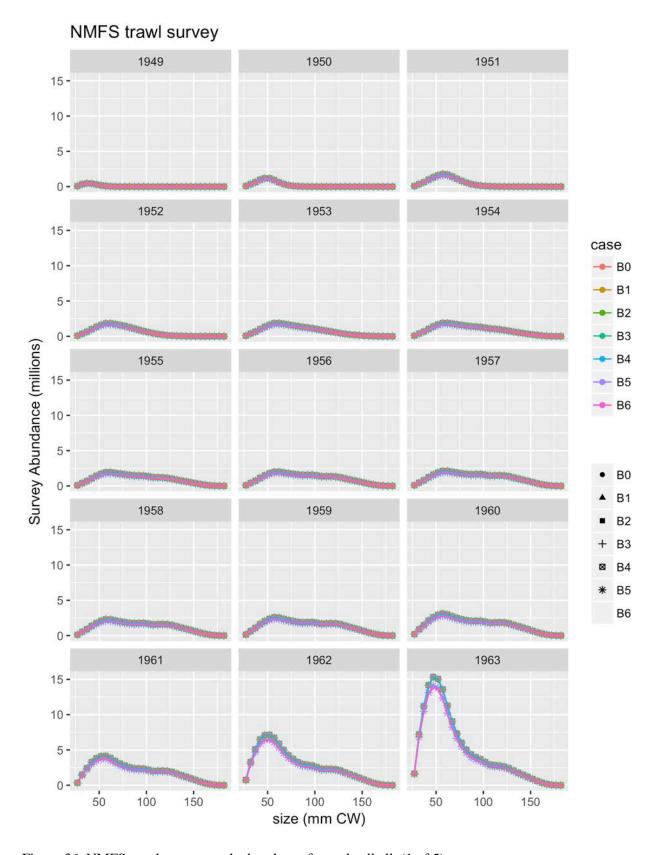


Figure 36. NMFS trawl survey catch abundance for male all all, (1 of 5).

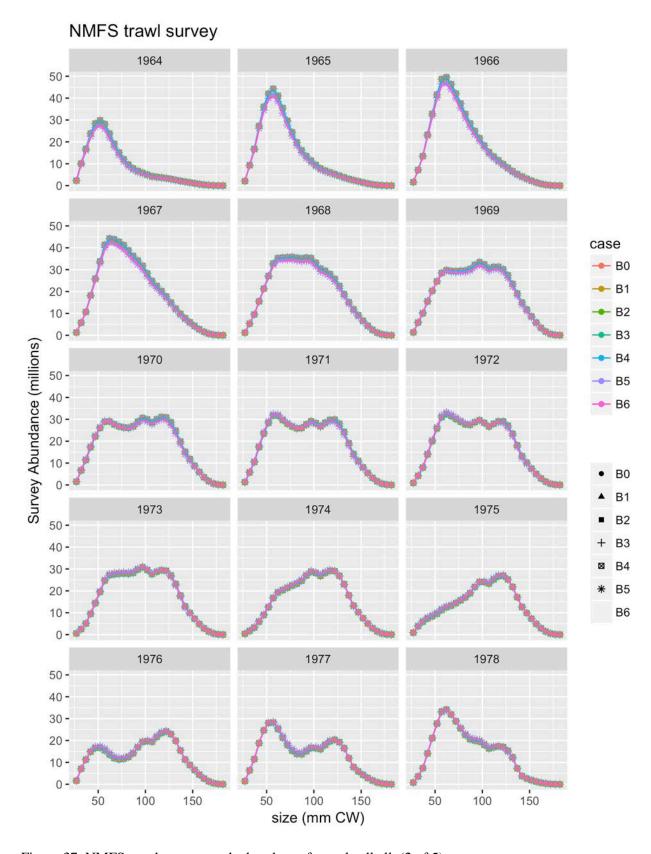


Figure 37. NMFS trawl survey catch abundance for male all all, (2 of 5).

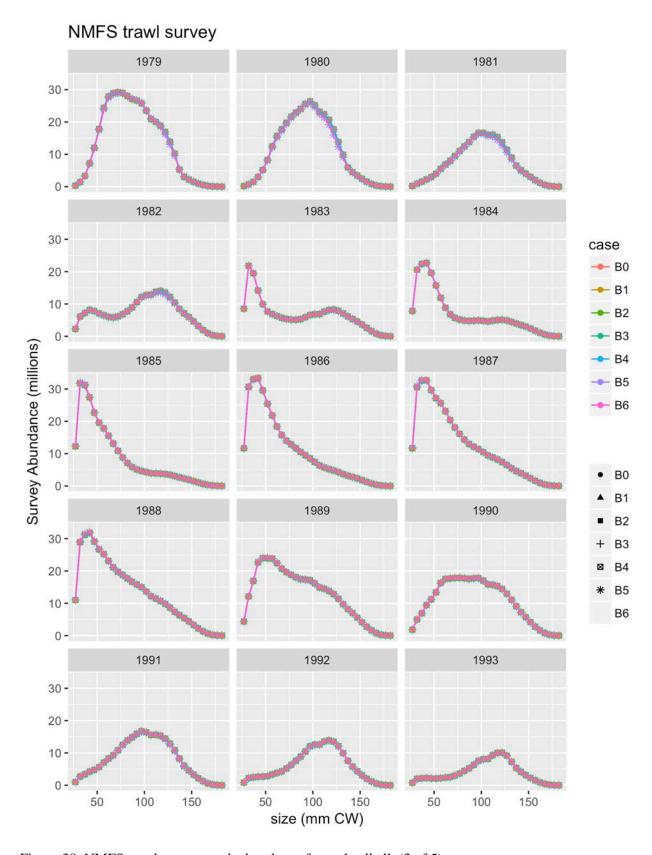


Figure 38. NMFS trawl survey catch abundance for male all all, (3 of 5).

NMFS trawl survey 1994 1995 1996 20 -15-10-5 -0 -1997 1998 1999 20 case 15**-→** B0 10-**←** B1 5 -- B2 0 -- B3 Survey Abundance (millions) 2000 2001 2002 ► B4 - B5 20 -► B6 15 -10 -5 -В0 0 -B1 2003 2004 2005 B2 20 -+ B3 15 -■ B4 10 -B5 5 - 1 B6 0 -2006 2007 2008 20 -15-10-5 -0 -100 50 100 150 100 50 150 50 150 size (mm CW)

Figure 39. NMFS trawl survey catch abundance for male all all, (4 of 5).

NMFS trawl survey 2009 2010 30 -20 -10-0 -2011 2012 case **→** B0 30 -**←** B1 - B2 20 -- B3 Survey Abundance (millions) - B4 10 -► B5 0 -- B6 2013 2014 30 -B0 B1 20 -B2 В3 10 -B4 B5 0 -B6 2015 2016 30 -20 -10-0 -100 50 150 100 150 50 size (mm CW)

Figure 40. NMFS trawl survey catch abundance for male all all, (5 of 5).

Fisheries

Fishery catchability

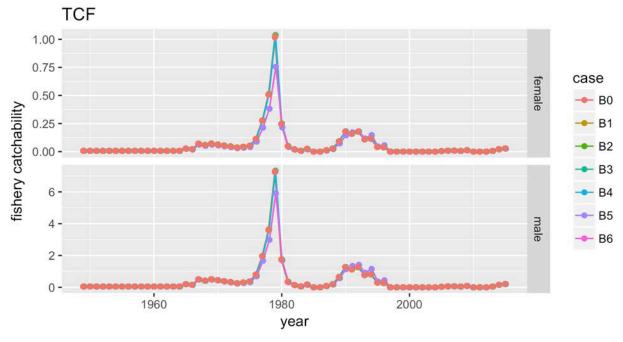


Figure 41. Fishery catchabilities for TCF.

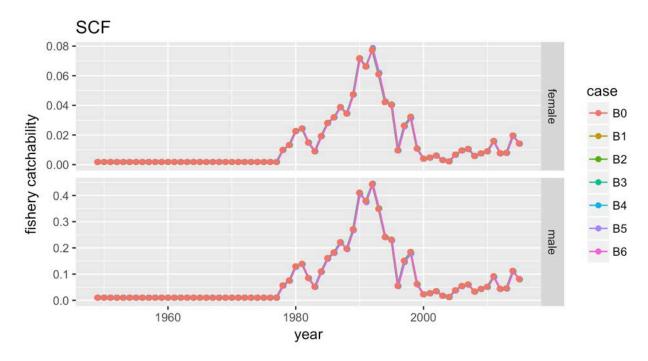


Figure 42. Fishery catchabilities for SCF.

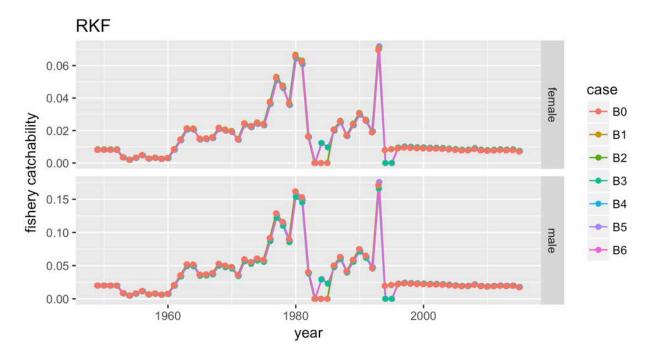


Figure 43. Fishery catchabilities for RKF.

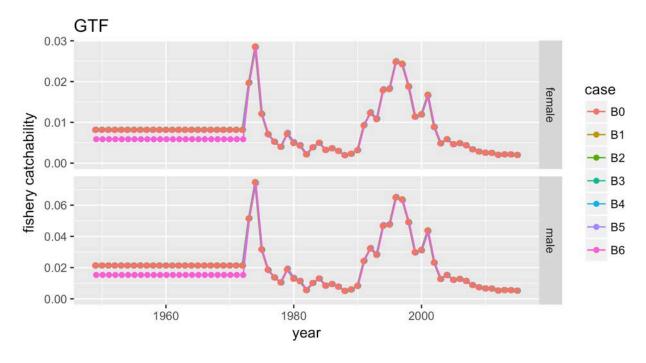


Figure 44. Fishery catchabilities for GTF.

Total selectivity functions

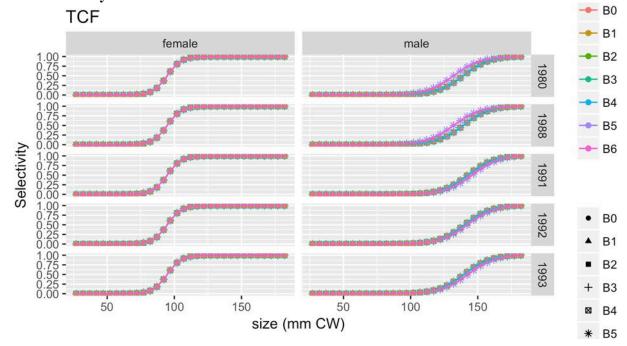


Figure 45. Selectivity functions for TCF(1 of 6).

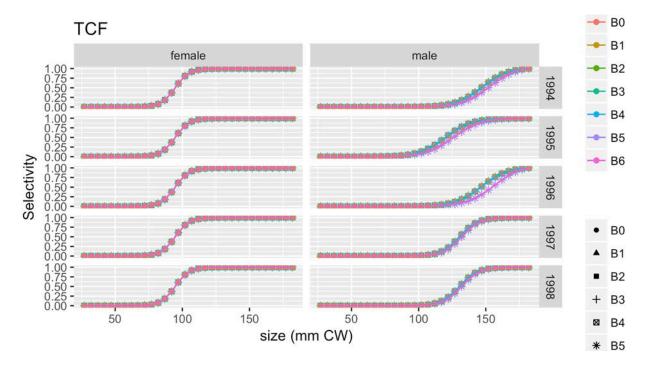


Figure 46. Selectivity functions for TCF(2 of 6).

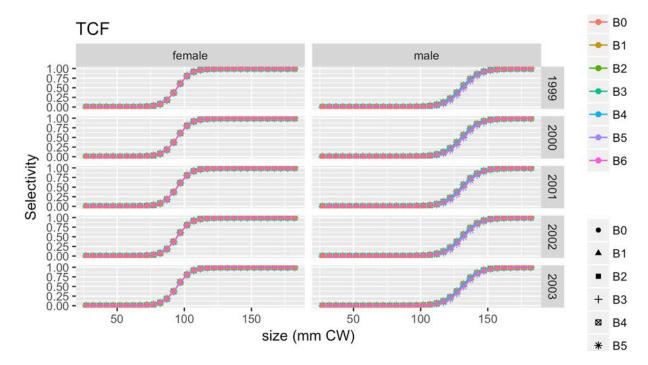


Figure 47. Selectivity functions for TCF(3 of 6).

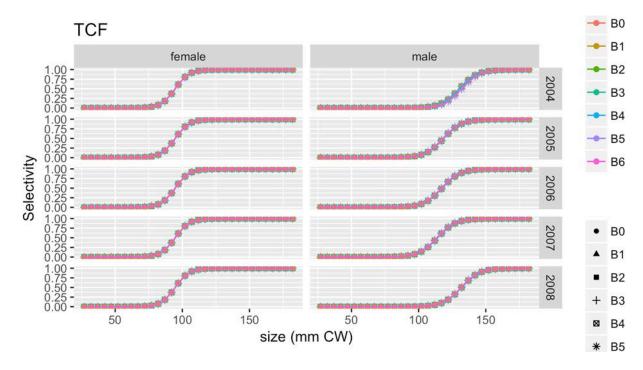


Figure 48. Selectivity functions for TCF(4 of 6).

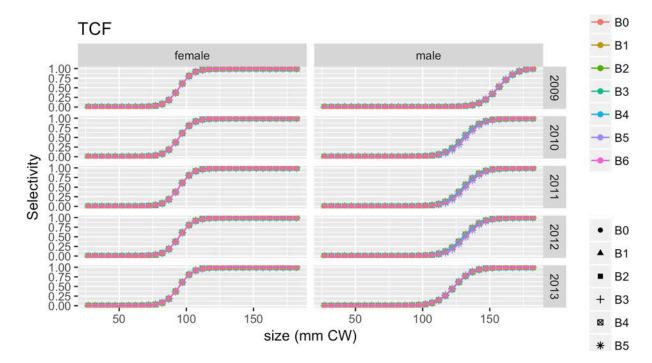


Figure 49. Selectivity functions for TCF(5 of 6).

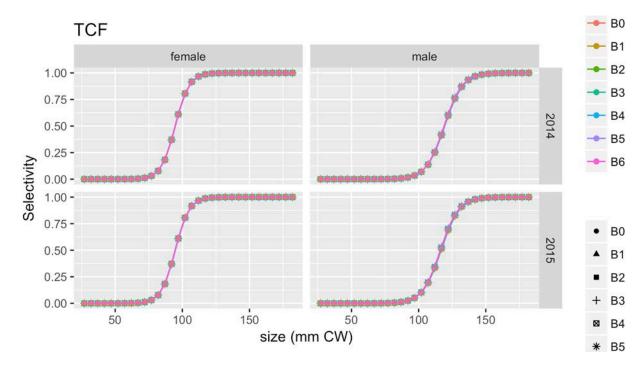


Figure 50. Selectivity functions for TCF(6 of 6).

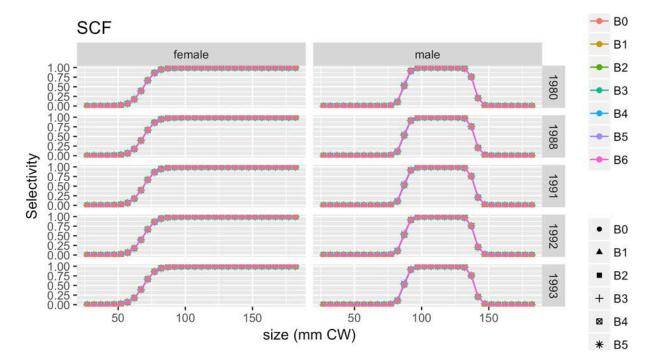


Figure 51. Selectivity functions for SCF(1 of 6).

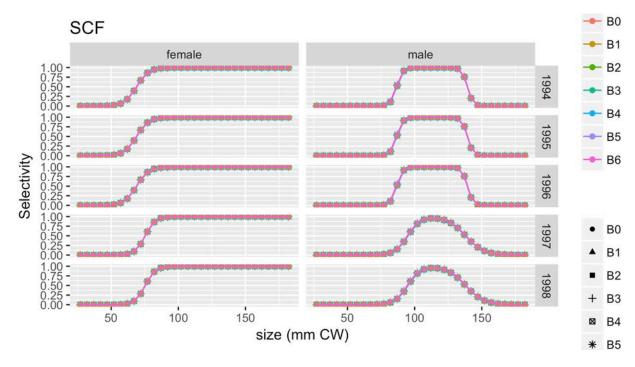


Figure 52. Selectivity functions for SCF(2 of 6).

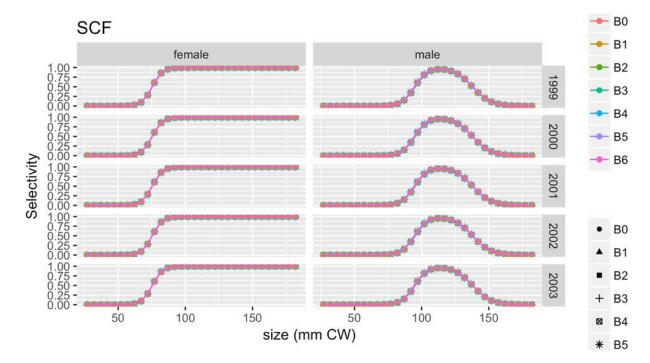


Figure 53. Selectivity functions for SCF(3 of 6).

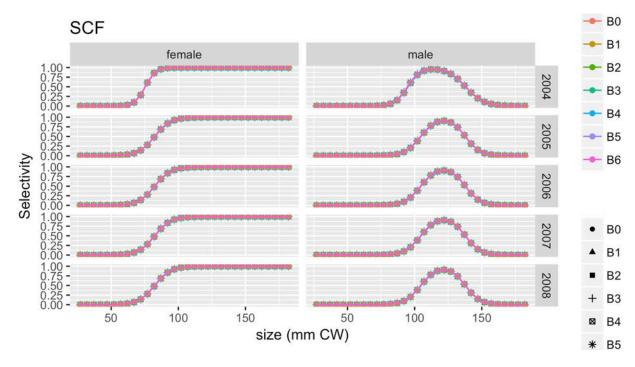


Figure 54. Selectivity functions for SCF(4 of 6).

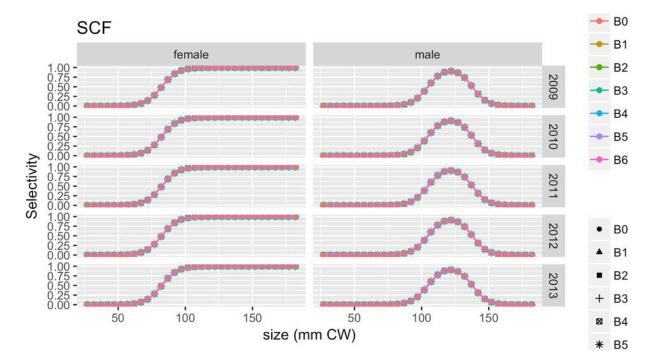


Figure 55. Selectivity functions for SCF(5 of 6).

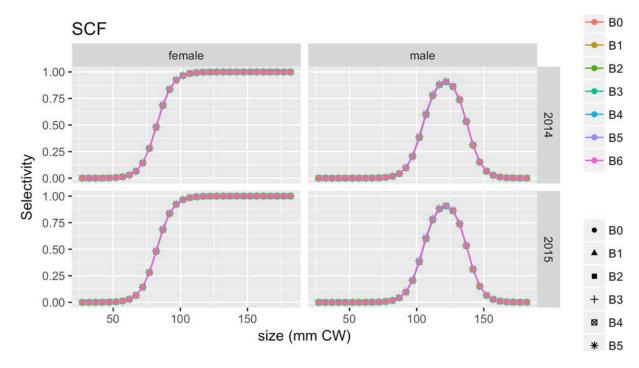


Figure 56. Selectivity functions for SCF(6 of 6).

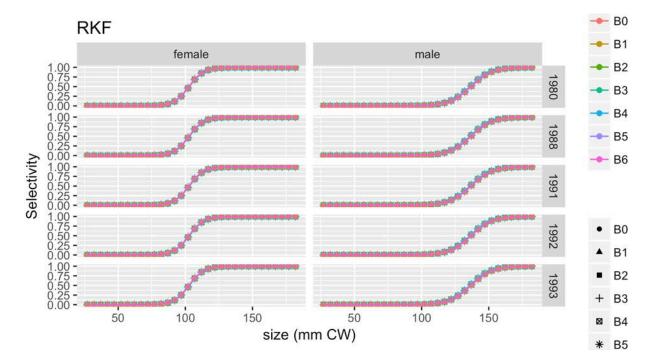


Figure 57. Selectivity functions for RKF(1 of 6).

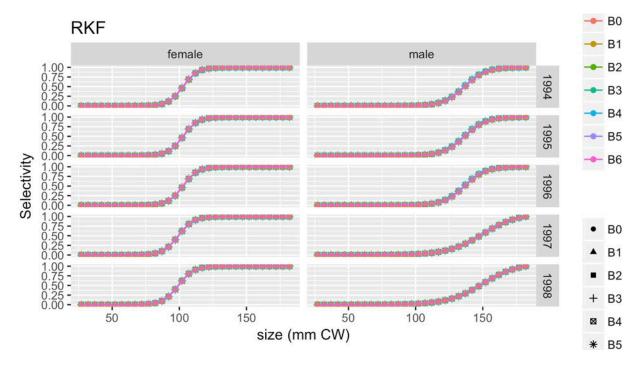


Figure 58. Selectivity functions for RKF(2 of 6).

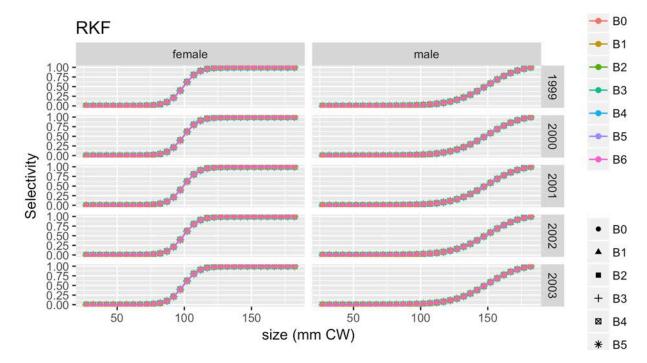


Figure 59. Selectivity functions for RKF(3 of 6).

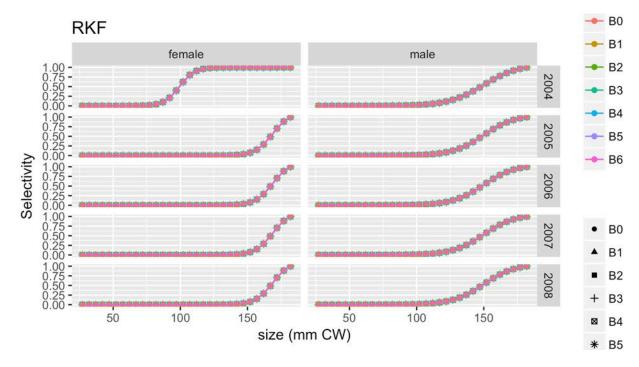


Figure 60. Selectivity functions for RKF(4 of 6).

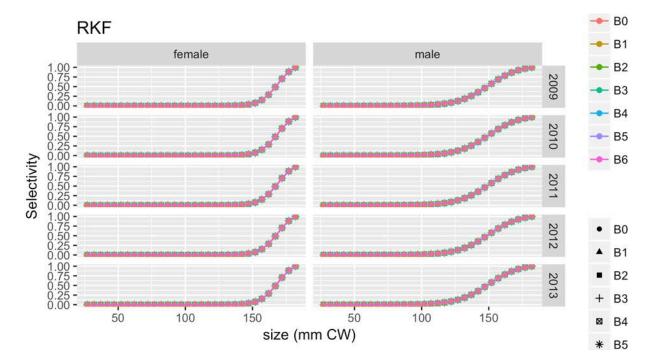


Figure 61. Selectivity functions for RKF(5 of 6).

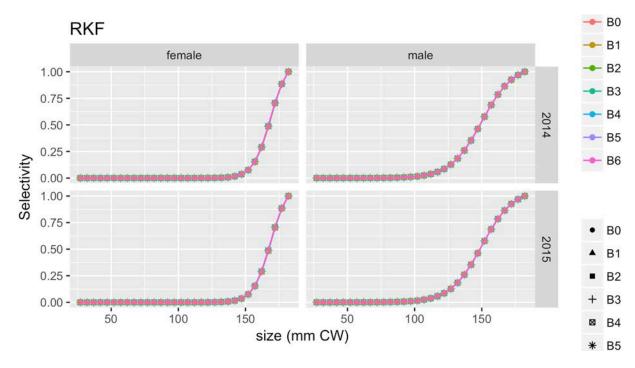


Figure 62. Selectivity functions for RKF(6 of 6).

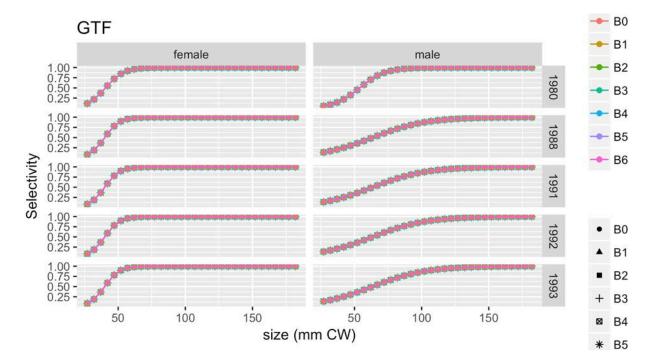


Figure 63. Selectivity functions for GTF(1 of 6).

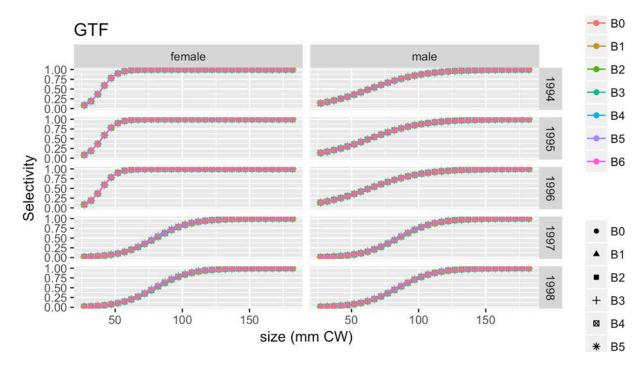


Figure 64. Selectivity functions for GTF(2 of 6).

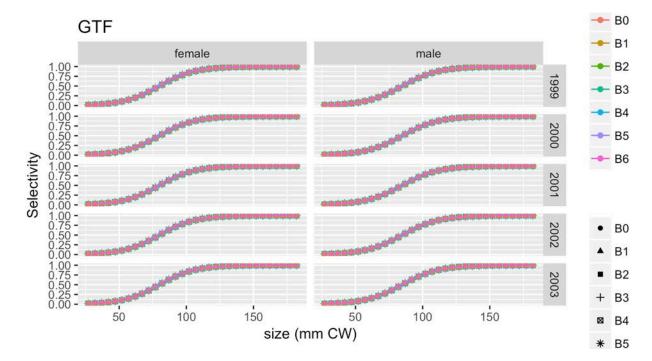


Figure 65. Selectivity functions for GTF(3 of 6).

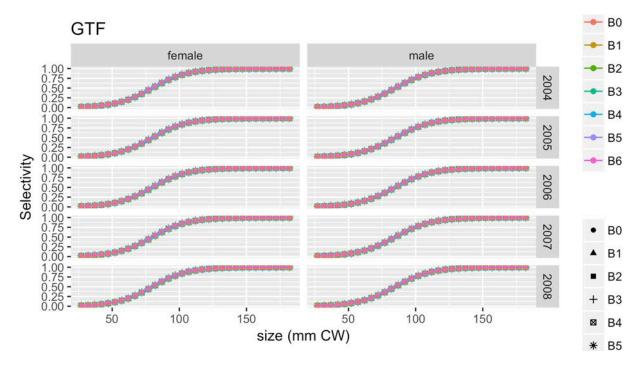


Figure 66. Selectivity functions for GTF(4 of 6).

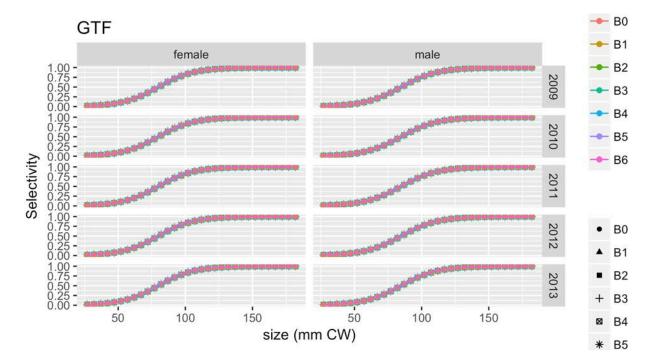


Figure 67. Selectivity functions for GTF(5 of 6).

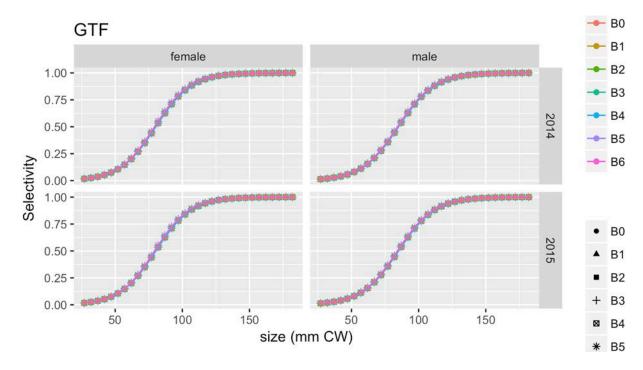


Figure 68. Selectivity functions for GTF(6 of 6).

Retention functions

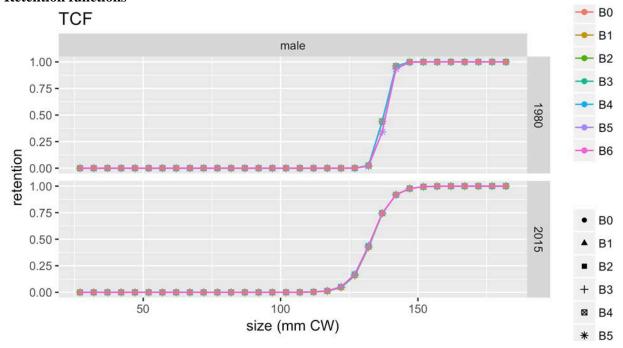


Figure 69. Retention functions for TCF(1 of 1).

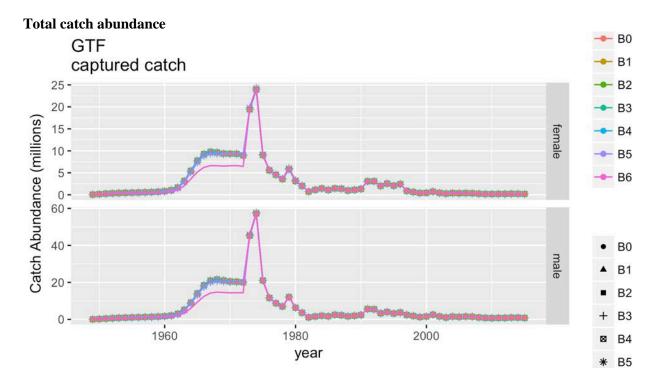


Figure 70. Predicted GTF captured catch abundance.

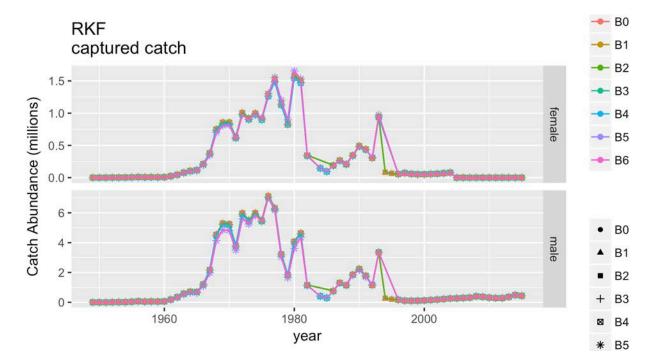


Figure 71. Predicted RKF captured catch abundance.

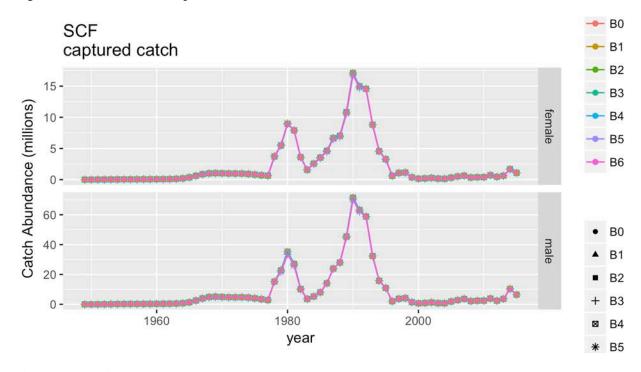


Figure 72. Predicted SCF captured catch abundance.

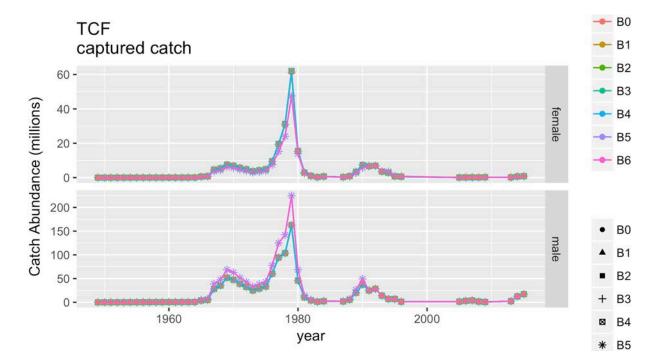


Figure 73. Predicted TCF captured catch abundance.

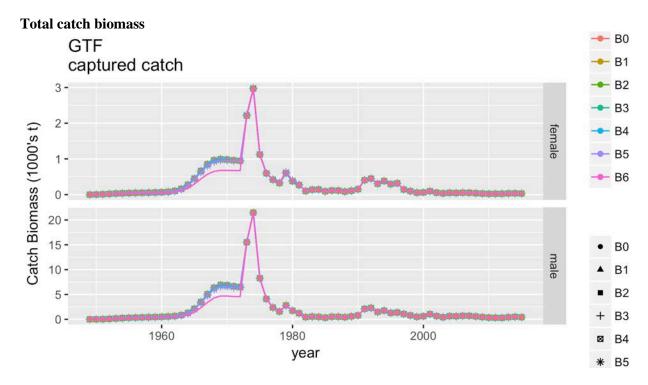


Figure 74. Predicted GTF captured catch biomass.

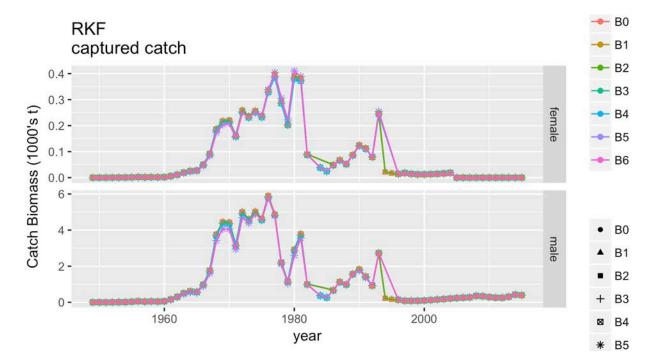


Figure 75. Predicted RKF captured catch biomass.

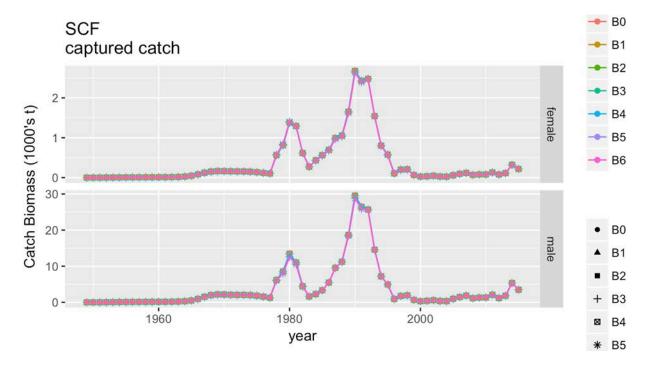


Figure 76. Predicted SCF captured catch biomass.

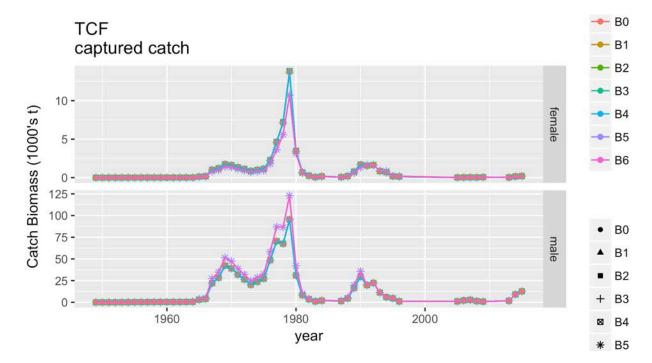


Figure 77. Predicted TCF captured catch biomass.

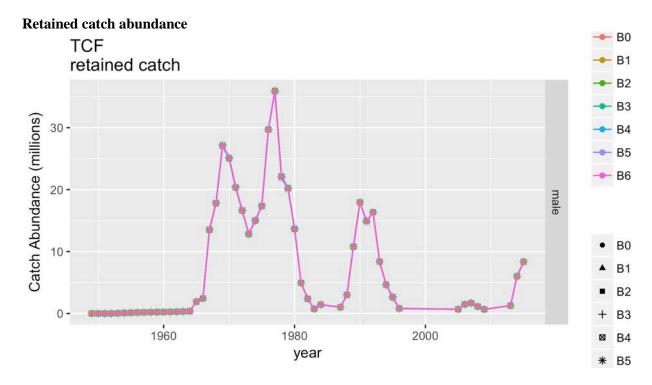


Figure 78. Predicted TCF retained catch abundance.

Retained catch biomass → B0 TCF **→** B1 retained catch - B2 **-** B3 Catch Biomass (1000's t) 30 -► B4 **►** B5 **←** B6 20 male В0 10-В1 B2 + B3 0 -1960 1980 2000 **⊠** B4 year * B5

Figure 79. Predicted TCF retained catch biomass.

Total catch size compositions

GTF captured catch for female all all

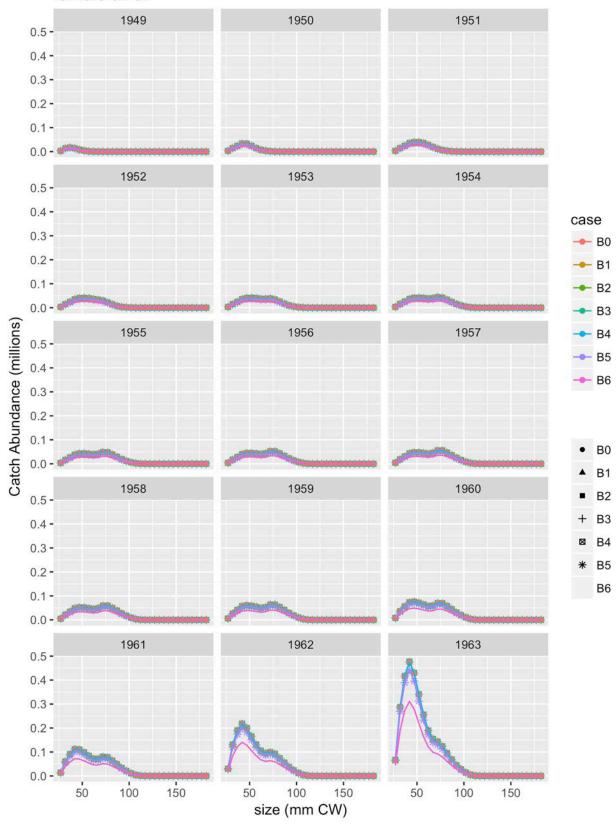


Figure 80. Predicted GTF captured catch abundance for female all all, (1 of 5).

GTF captured catch for female all all

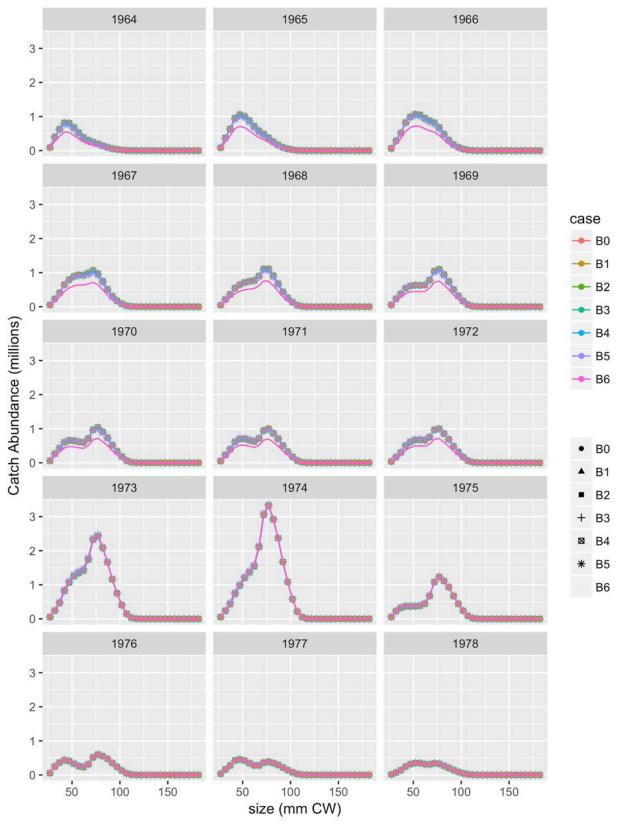


Figure 81. Predicted GTF captured catch abundance for female all all, (2 of 5).

GTF captured catch for female all all 1979 1980 1981 0.8 -0.6 -0.4 -0.2 -0.0 -1982 1983 1984 0.8 -0.6 case **→** B0 0.4 -- B1 0.2 -► B2 0.0 -- B3 Catch Abundance (millions) 1985 1987 1986 - B4 0.8 ► B5 0.6 -- B6 0.4 -0.2 -B0 0.0 -В1 1988 1989 1990 B2 0.8 В3 0.6 -■ B4 0.4 -B5 B6 0.2 -0.0 -1991 1992 1993 0.8 -0.6 -0.4 -0.2 -0.0 -100 150 100 150 50 150 100 50 50 size (mm CW)

Figure 82. Predicted GTF captured catch abundance for female all all, (3 of 5).

GTF captured catch for female all all 1994 1995 1996 0.4 -0.3 -0.2 -0.1 -0.0 -1997 1998 1999 0.4 -0.3 case **→** B0 0.2 -► B1 0.1 -**►** B2 0.0 -- B3 Catch Abundance (millions) 2000 2001 2002 - B4 0.4 -- B5 0.3 -- B6 0.2 -0.1 -B0 0.0 -В1 2003 2004 2005 B2 0.4 -В3 0.3 -■ B4 0.2 -B5 B6 0.1 -0.0 -2006 2007 2008 0.4 -0.3 -0.2 -0.1 -0.0 -50 100 150 50 100 150 50 150 100 size (mm CW)

Figure 83. Predicted GTF captured catch abundance for female all all, (4 of 5).

GTF captured catch for female all all 2009 2010 0.04 -0.03 -0.02 -0.01 -0.00 -2011 2012 case 0.04 -**→** B0 0.03 -► B1 ► B2 0.02 -- B3 Catch Abundance (millions) - B4 0.01 ► B5 - B6 0.00 2013 2014 0.04 -B0 0.03 -B1 B2 0.02 -В3 0.01 -■ B4 B5 0.00 -B6 50 100 150 2015 0.04 -0.03 -0.02 -0.01 -0.00 -100 150 50 size (mm CW)

Figure 84. Predicted GTF captured catch abundance for female all all, (5 of 5).

GTF captured catch for male all all

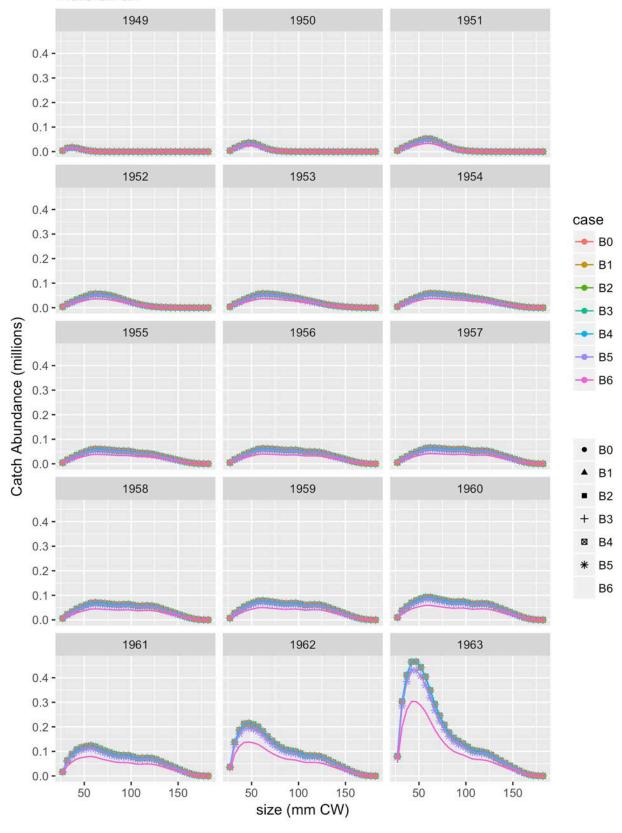


Figure 85. Predicted GTF captured catch abundance for male all all, (1 of 5).

GTF captured catch for male all all

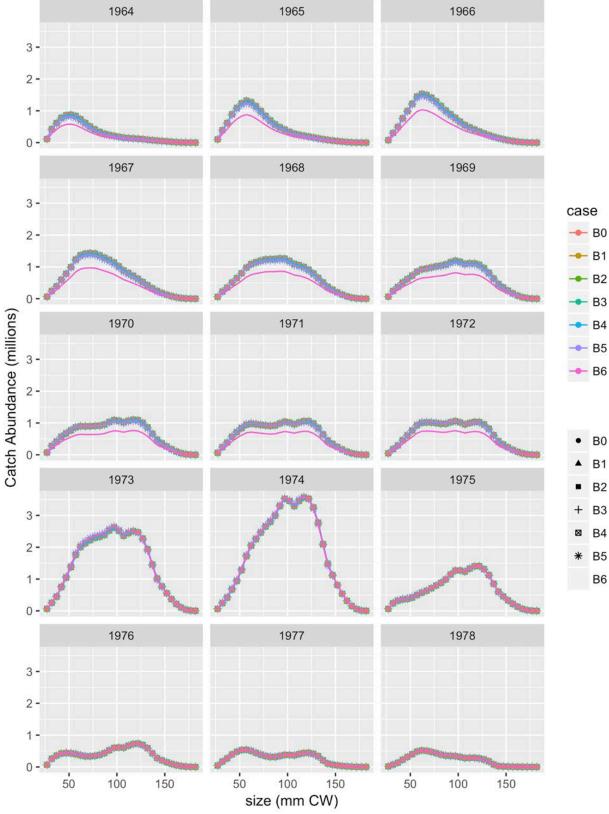


Figure 86. Predicted GTF captured catch abundance for male all all, (2 of 5).

GTF captured catch for male all all 1979 1980 1981 0.75 -0.50 -0.25 -0.00 1982 1983 1984 0.75 case 0.50 -**→** B0 ► B1 0.25 -→ B2 0.00 -- B3 Catch Abundance (millions) 1985 1986 1987 - B4 - B5 0.75 -► B6 0.50 -0.25 -В0 0.00 -В1 1988 1989 1990 B2 В3 0.75 -■ B4 0.50 -B5 0.25 -B6 0.00 -1991 1992 1993 0.75 -0.50 -0.25 -0.00 -100 100 100 150 150 50 150 50 50 size (mm CW)

Figure 87. Predicted GTF captured catch abundance for male all all, (3 of 5).

GTF captured catch for male all all 1994 1995 1996 0.3 -0.2 -0.1 -0.0 -1997 1998 1999 0.3 case **→** B0 0.2 -► B1 0.1 -● B2 0.0 -- B3 Catch Abundance (millions) 2001 2002 2000 - B4 ► B5 0.3 -- B6 0.2 -0.1 -В0 0.0 -В1 2003 2004 2005 B2 ВЗ 0.3 -■ B4 0.2 -B5 0.1 -B6 0.0 -2006 2008 2007 0.3 -0.2 -0.1 -0.0 - # 100 100 150 150 50 150 50 100 50 size (mm CW)

Figure 88. Predicted GTF captured catch abundance for male all all, (4 of 5).

GTF captured catch for male all all 2009 2010 0.08 -0.06 -0.04 -0.02 -0.00 -2011 2012 case 0.08 -**→** B0 - B1 0.06 -- B2 0.04 -- B3 Catch Abundance (millions) - B4 0.02 ► B5 - B6 0.00 -2013 2014 0.08 -B0 0.06 -В1 B2 0.04 -В3 0.02 -■ B4 B5 0.00 -B6 50 100 150 2015 0.08 -0.06 -0.04 -0.02 -0.00 -150 100 50 size (mm CW)

Figure 89. Predicted GTF captured catch abundance for male all all, (5 of 5).

RKF captured catch for female all all

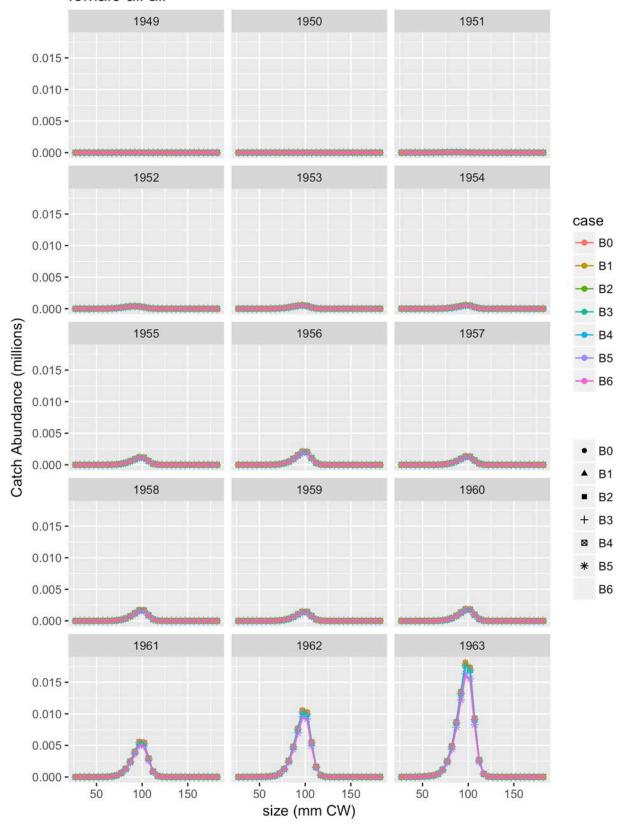


Figure 90. Predicted RKF captured catch abundance for female all all, (1 of 5).

RKF captured catch for female all all

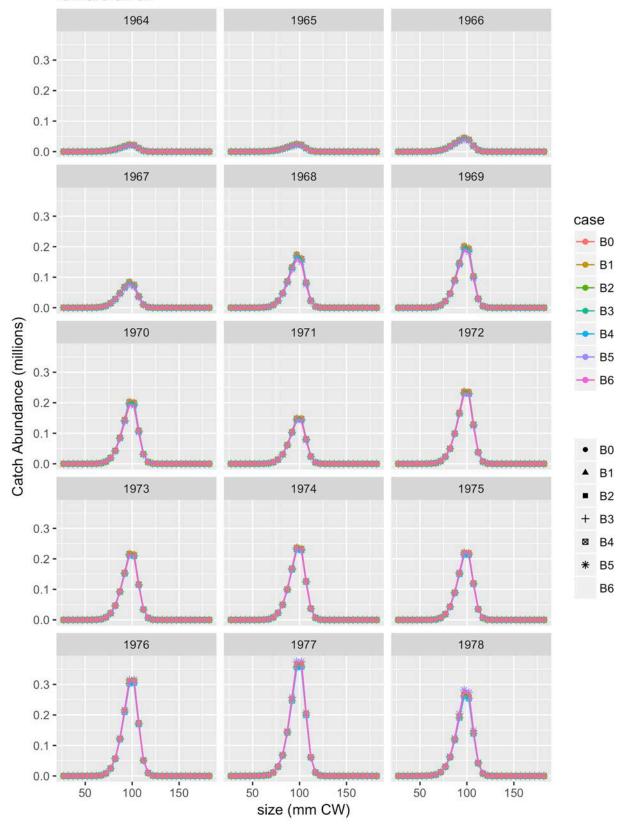


Figure 91. Predicted RKF captured catch abundance for female all all, (2 of 5).

RKF captured catch for female all all 1980 1979 1981 0.4 -0.3 -0.2 -0.1 -0.0 -1982 1984 1985 0.4 -0.3 case **→** B0 0.2 -► B1 0.1 -► B2 0.0 -- B3 Catch Abundance (millions) 1986 1987 1988 - B4 0.4 -► B5 0.3 -- B6 0.2 -0.1 -B0 0.0 -В1 1989 1990 1991 B2 0.4 -В3 0.3 -■ B4 0.2 -B5 B6 0.1 -0.0 -1992 1993 1994 0.4 -0.3 -0.2 -0.1 -0.0 -100 100 50 50 150 150 50 100 150 size (mm CW)

Figure 92. Predicted RKF captured catch abundance for female all all, (3 of 5).

RKF captured catch for female all all 1995 1996 1997 0.015 -0.010 -0.005 -0.000 -1998 1999 2000 0.015 case 0.010 -**→** B0 ► B1 0.005 -► B2 0.000 -- B3 Catch Abundance (millions) 2002 2003 2001 - B4 ► B5 0.015 -- B6 0.010 -0.005 -B0 0.000 -В1 2004 2005 2006 B2 В3 0.015 -■ B4 0.010 -B5 0.005 -B6 0.000 -2007 2008 2009 0.015 -0.010 -0.005 -0.000 - # 50 100 150 50 100 150 50 100 150 size (mm CW)

Figure 93. Predicted RKF captured catch abundance for female all all, (4 of 5).

RKF captured catch for female all all

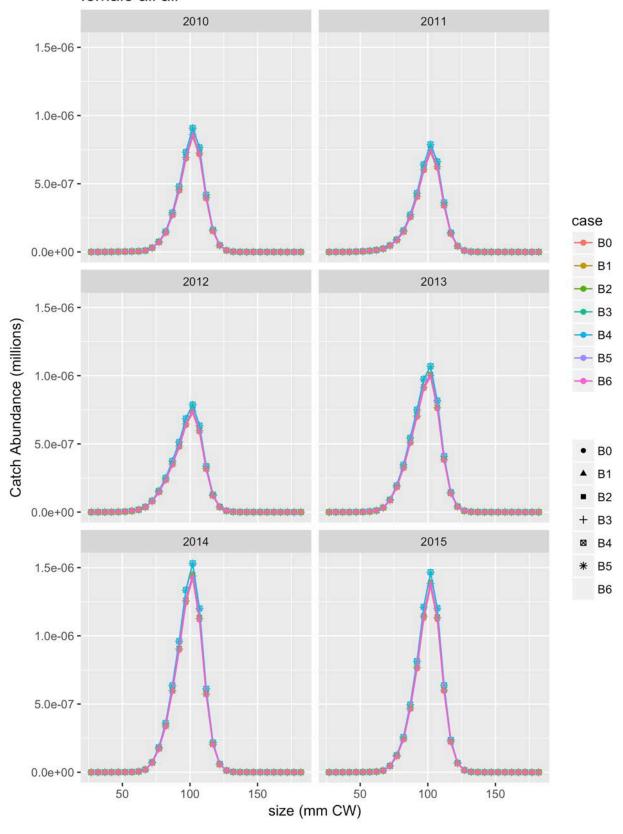


Figure 94. Predicted RKF captured catch abundance for female all all, (5 of 5).

RKF captured catch for male all all

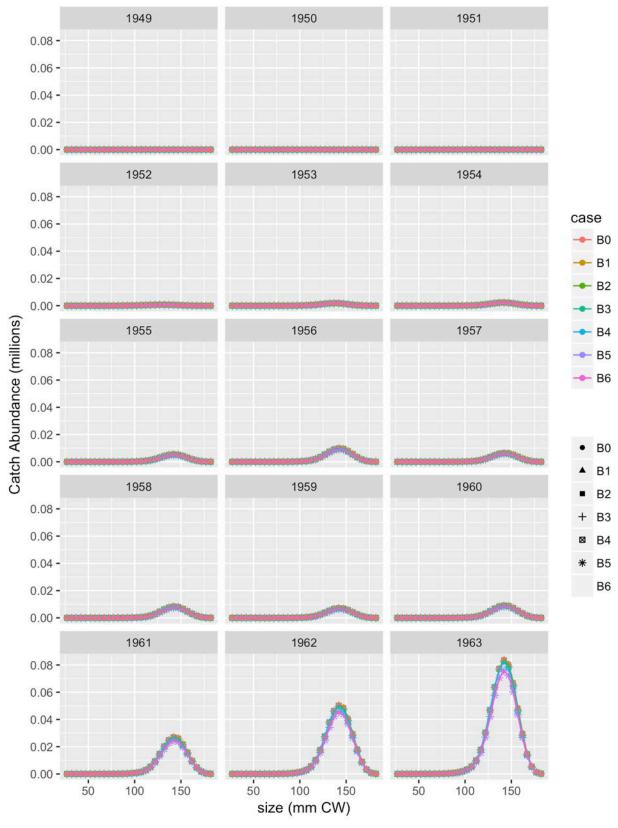


Figure 95. Predicted RKF captured catch abundance for male all all, (1 of 5).

RKF captured catch for male all all

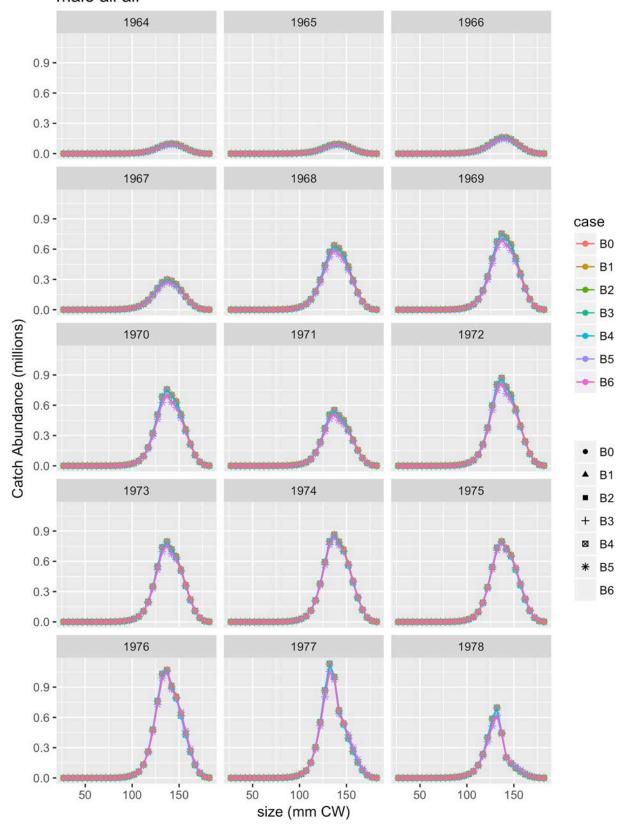


Figure 96. Predicted RKF captured catch abundance for male all all, (2 of 5).

RKF captured catch for male all all 1979 1980 1981 0.6 -0.4 -0.2 -0.0 -1984 1982 1985 0.6 case 0.4 -**→** B0 ► B1 0.2 -**►** B2 0.0 -- B3 Catch Abundance (millions) 1988 1986 1987 - B4 0.6 -► B5 - B6 0.4 -0.2 -В0 0.0 -В1 1989 1990 1991 B2 0.6 -ВЗ **⊠** B4 0.4 -B5 0.2 -B6 0.0 -1992 1993 1994 0.6 -0.4 -0.2 -0.0 -0 100 150 size (mm CW) 150 50 150 50 100 150 50 100

Figure 97. Predicted RKF captured catch abundance for male all all, (3 of 5).

RKF captured catch for male all all

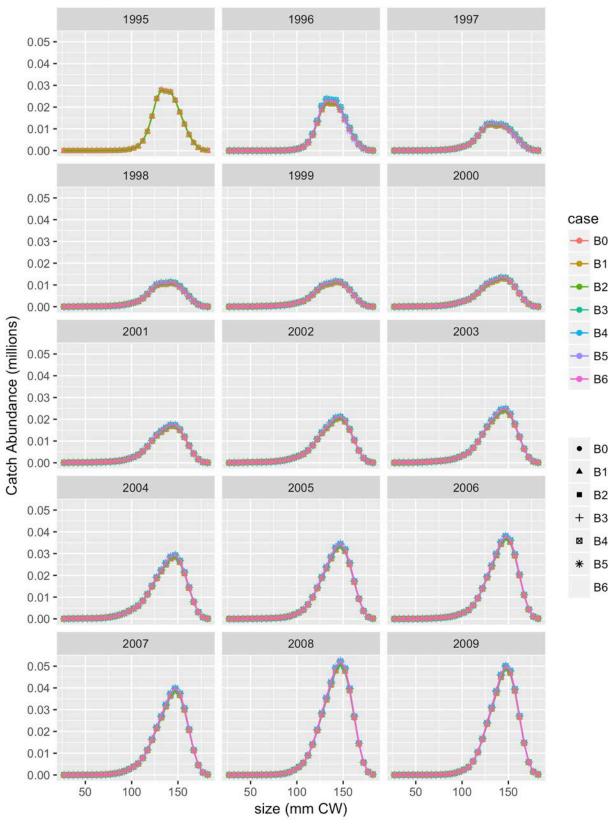


Figure 98. Predicted RKF captured catch abundance for male all all, (4 of 5).

RKF captured catch for male all all

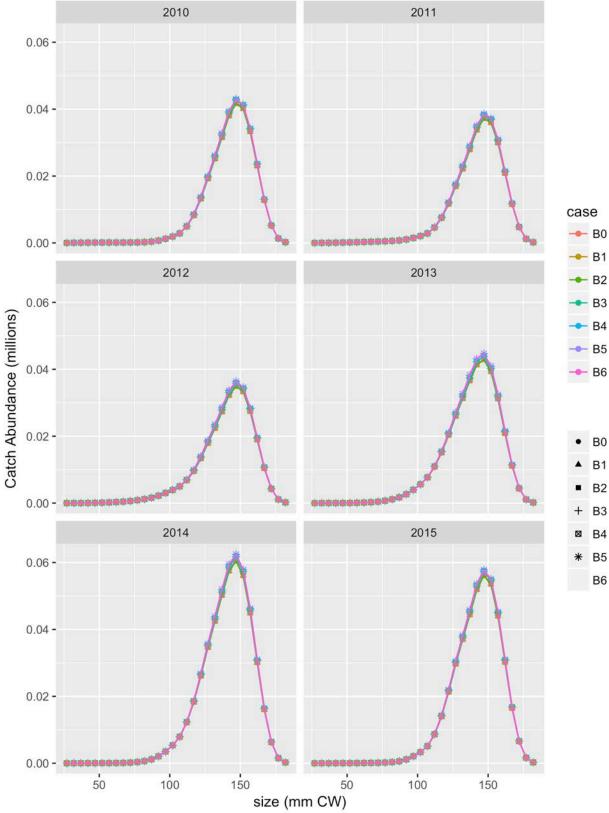


Figure 99. Predicted RKF captured catch abundance for male all all, (5 of 5).

SCF captured catch for female all all

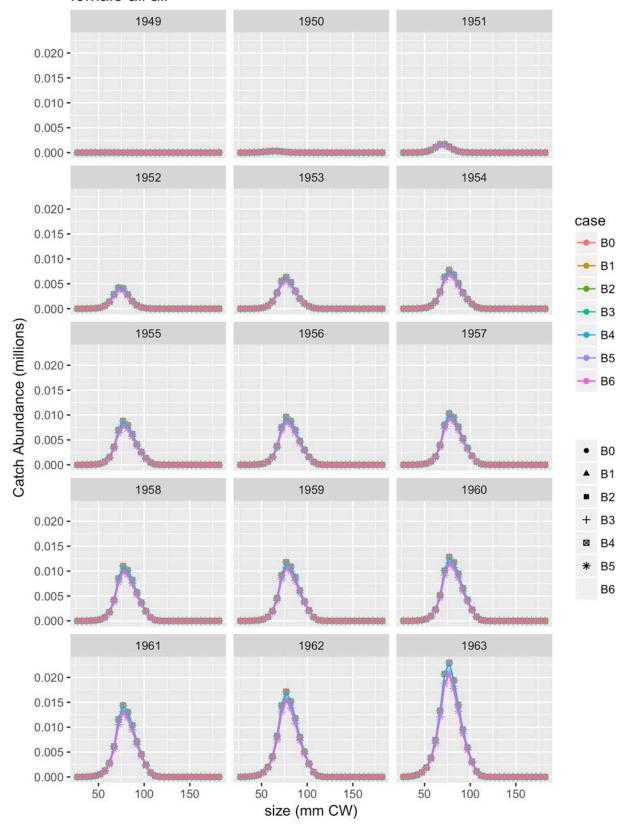


Figure 100. Predicted SCF captured catch abundance for female all all, (1 of 5).

SCF captured catch for female all all

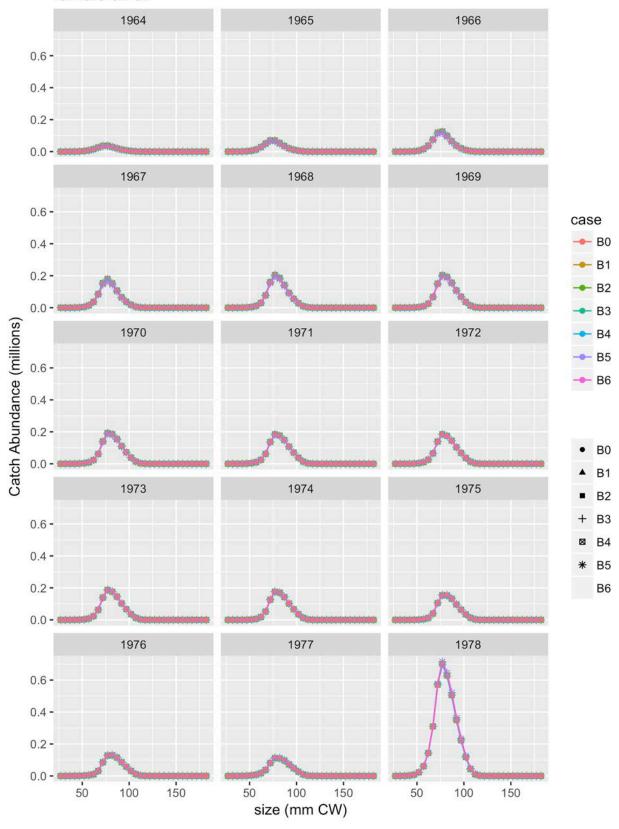


Figure 101. Predicted SCF captured catch abundance for female all all, (2 of 5).

SCF captured catch for female all all 1979 1980 1981 3 -2 -1 -0 -1982 1983 1984 3 case 2-**→** B0 ► B1 1 -► B2 - B3 Catch Abundance (millions) 1986 1985 1987 - B4 ► B5 - B6 B0 В1 1988 1990 1989 B2 3 -ВЗ **⊠** B4 2 -B5 1 -B6 0 -1991 1992 1993 3 -2 -

Figure 102. Predicted SCF captured catch abundance for female all all, (3 of 5).

50

150

50

100

size (mm CW)

150

100

1 -

0 -

50

150

100

SCF captured catch for female all all 1994 1995 1996 0.75 -0.50 -0.25 -0.00 -1997 1998 1999 0.75 case 0.50 -**→** B0 ► B1 0.25 -● B2 0.00 - B3 Catch Abundance (millions) 2000 2001 2002 - B4 - B5 0.75 -► B6 0.50 -0.25 -В0 0.00 -B1 2003 2004 2005 B2 0.75 -В3 ■ B4 0.50 -B5 0.25 -B6 0.00 -2006 2007 2008 0.75 -0.50 -0.25 -0.00 -50 150 50 100 150 50 100 150 100 size (mm CW)

Figure 103. Predicted SCF captured catch abundance for female all all, (4 of 5).

SCF captured catch for female all all

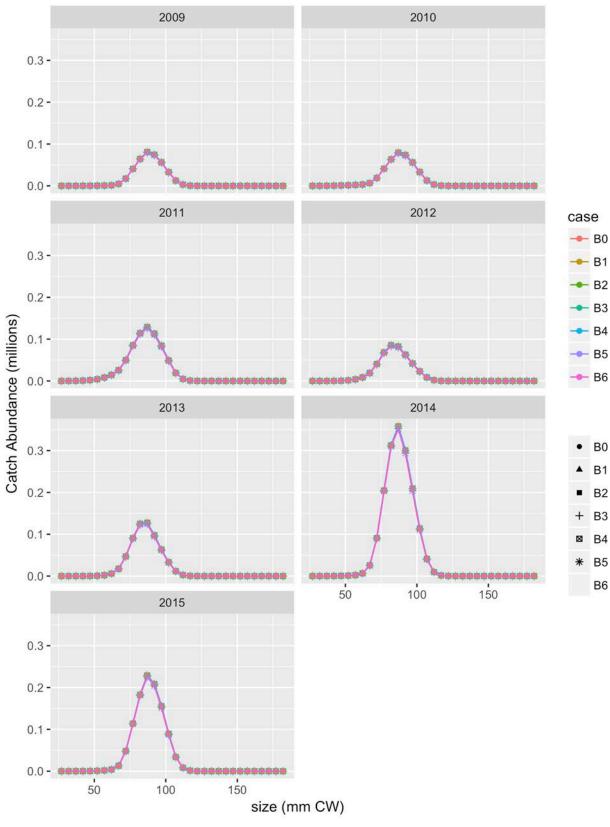


Figure 104. Predicted SCF captured catch abundance for female all all, (5 of 5).

SCF captured catch for male all all 1949 1950 1951 0.06 -0.04 -0.02 -0.00 -1952 1953 1954 0.06 case 0.04 -**→** B0 ► B1 0.02 -► B2 0.00 -- B3 Catch Abundance (millions) 1955 1956 1957 - B4 0.06 -► B5 - B6 0.04 -0.02 -В0 0.00 -B1 1958 1959 1960 B2 0.06 -В3 ■ B4 0.04 -B5 0.02 -B6 0.00 -1961 1962 1963 0.06 -0.04 -0.02 -0.00 -

Figure 105. Predicted SCF captured catch abundance for male all all, (1 of 5).

50

100

size (mm CW)

150

100

150

50

150

100

50

SCF captured catch for male all all

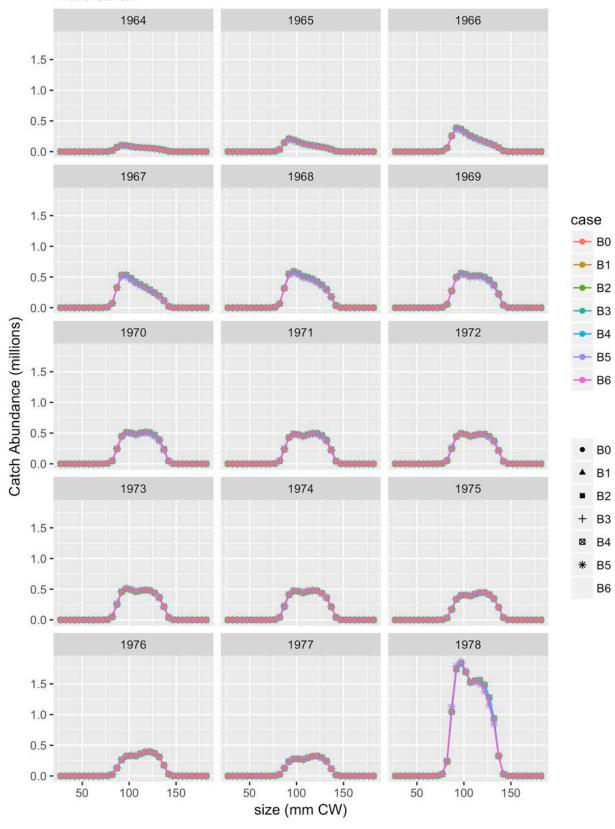


Figure 106. Predicted SCF captured catch abundance for male all all, (2 of 5).

SCF captured catch for male all all 1979 1980 1981 8 -6 -4 -2 -0 -1983 1984 1982 8 case 6 -**→** B0 4 -► B1 2-● B2 - B3 Catch Abundance (millions) 1986 1985 1987 - B4 - B5 ► B6 В0 В1 1988 1989 1990 B2 8 -ВЗ 6 -**⊠** B4 4 -B5 B6 2-0 -1991 1992 1993 8 -4 -

Figure 107. Predicted SCF captured catch abundance for male all all, (3 of 5).

50

100

size (mm CW)

150

50

100

150

2 -

0 -

50

100

150

SCF captured catch for male all all 1994 1995 1996 2.0 -1.5 -1.0 -0.5 -0.0 -1997 1998 1999 2.0 -1.5 case **→** B0 1.0 -► B1 0.5 -→ B2 0.0 -- B3 Catch Abundance (millions) 2000 2001 2002 - B4 2.0 -- B5 1.5 -− B6 1.0 -0.5 -В0 0.0 -B1 2003 2004 2005 B2 2.0 -В3 1.5 -■ B4 1.0 -B5 B6 0.5 -0.0 -2006 2007 2008 2.0 -1.5 -1.0 -0.5 -0.0 -100 50 100 50 50 150 150 150 100 size (mm CW)

Figure 108. Predicted SCF captured catch abundance for male all all, (4 of 5).

SCF captured catch for male all all

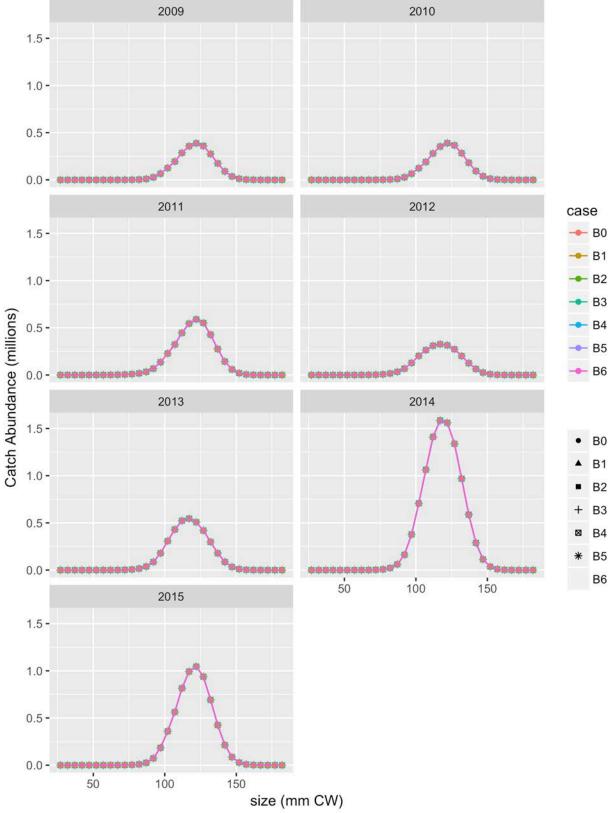


Figure 109. Predicted SCF captured catch abundance for male all all, (5 of 5).

TCF captured catch for female all all 1949 1951 1950 0.015 -0.010 -0.005 -0.000 -1952 1953 1954 0.015 case 0.010 -**→** B0 ► B1 0.005 -► B2 0.000 -- B3 Catch Abundance (millions) 1955 1956 1957 - B4 0.015 -► B5 - B6 0.010 -0.005 -В0 0.000 -B1 1958 1959 1960 B2 0.015 -В3 0.010 -■ B4 B5 0.005 -B6 0.000 -1961 1962 1963 0.015 -0.010 -0.005 -

Figure 110. Predicted TCF captured catch abundance for female all all, (1 of 4).

50

100

size (mm CW)

150

50

100

0.000 - #

50

100

150

150

TCF captured catch for female all all

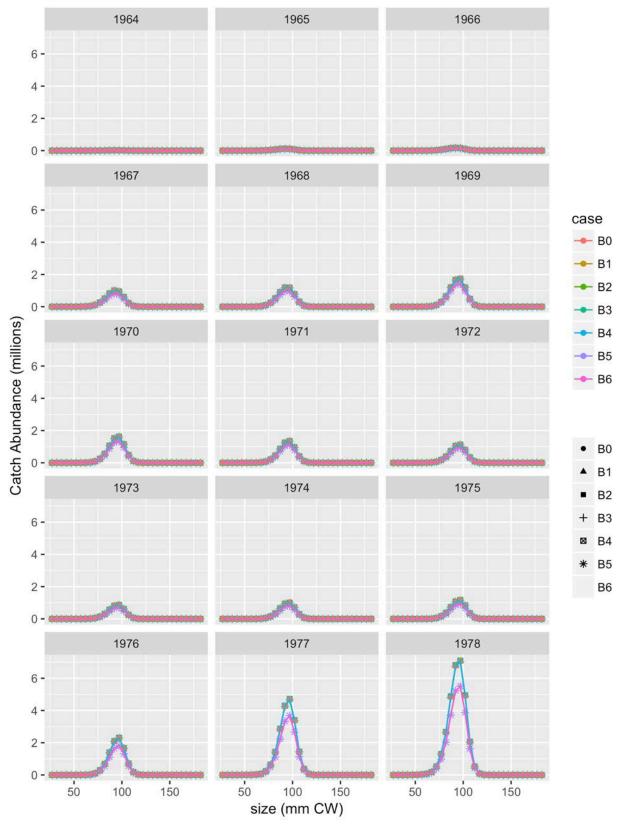


Figure 111. Predicted TCF captured catch abundance for female all all, (2 of 4).

TCF captured catch for female all all 1979 1980 1981 10 -5 -0 -1982 1983 1984 case 10-**→** B0 **←** B1 5 -→ B2 0 -- B3 Catch Abundance (millions) 1987 1988 1989 - B4 - B5 10 -**►** B6 5 В0 В1 1990 1991 1992 B2 В3 10-**⊠** B4 B5 5 -B6 0 -1993 1994 1995 10 -5 -0 -150 50 50 50 150 100 100 150 100 size (mm CW)

Figure 112. Predicted TCF captured catch abundance for female all all, (3 of 4).

TCF captured catch for female all all

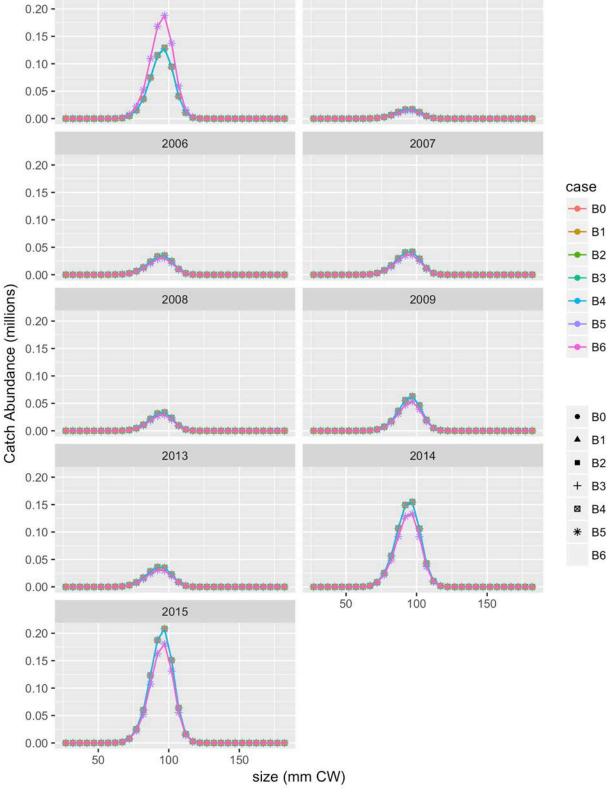


Figure 113. Predicted TCF captured catch abundance for female all all, (4 of 4).

TCF captured catch for male all all 1949 1950 1951 0.08 -0.06 -0.04 -0.02 -0.00 -1952 1953 1954 0.08 case 0.06 -**→** B0 0.04 -- B1 0.02 -► B2 0.00 -- B3 Catch Abundance (millions) 1955 1956 1957 B4 0.08 -- B5 - B6 0.06 -0.04 -0.02 -B0 0.00 -В1 1958 1959 1960 B2 0.08 -В3 0.06 -B4 0.04 -B5 B6 0.02 -0.00 -1963 1961 1962 0.08 -0.06 -0.04 -0.02 -0.00 -

Figure 114. Predicted TCF captured catch abundance for male all all, (1 of 4).

50

150

100

50

100

size (mm CW)

150

50

100

150

TCF captured catch for male all all

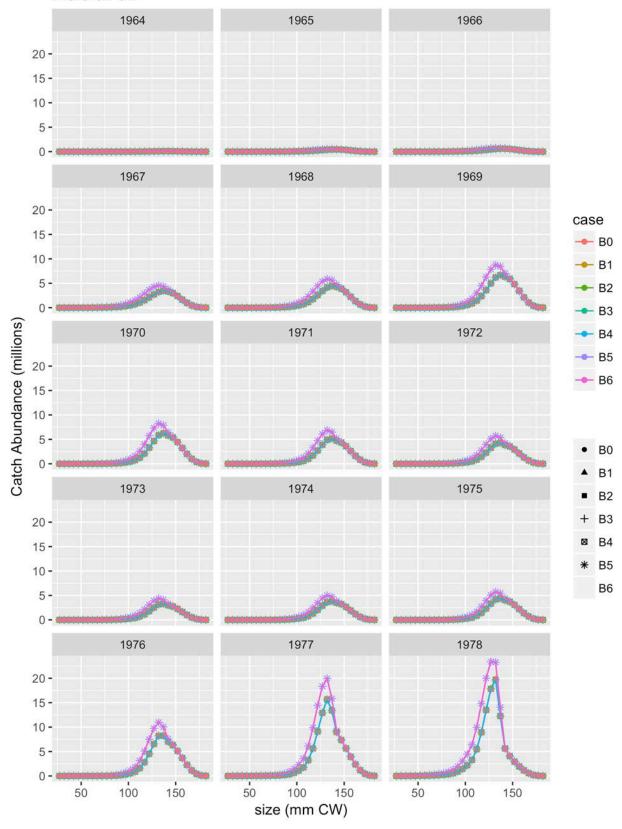


Figure 115. Predicted TCF captured catch abundance for male all all, (2 of 4).

TCF captured catch for male all all 1979 1980 1981 30 -20 -10-0 -1982 1983 1984 30 case 20 -**→** B0 **●** B1 10 -→ B2 0 -- B3 Catch Abundance (millions) 1987 1988 1989 - B4 - B5 30 -► B6 20 -10 -В0 0 В1 1990 1991 1992 B2 ВЗ 30 -**⊠** B4 20 -B5 10-B6 0 -1993 1994 1995 30 -20 -10-0 -50 150 50 100 50 150 100 150 100 size (mm CW)

Figure 116. Predicted TCF captured catch abundance for male all all, (3 of 4).

TCF captured catch for male all all

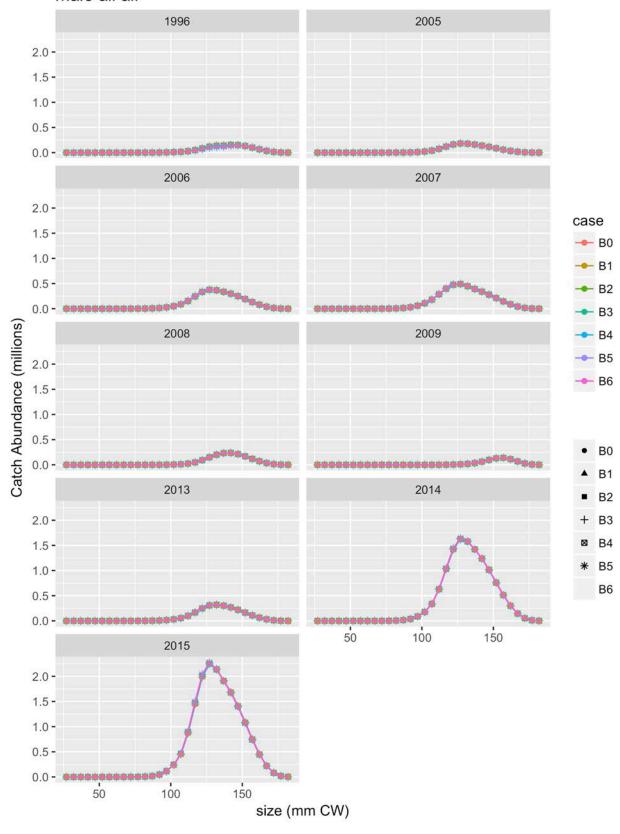


Figure 117. Predicted TCF captured catch abundance for male all all, (4 of 4).

Retained catch size compositions

TCF retained catch for male all all

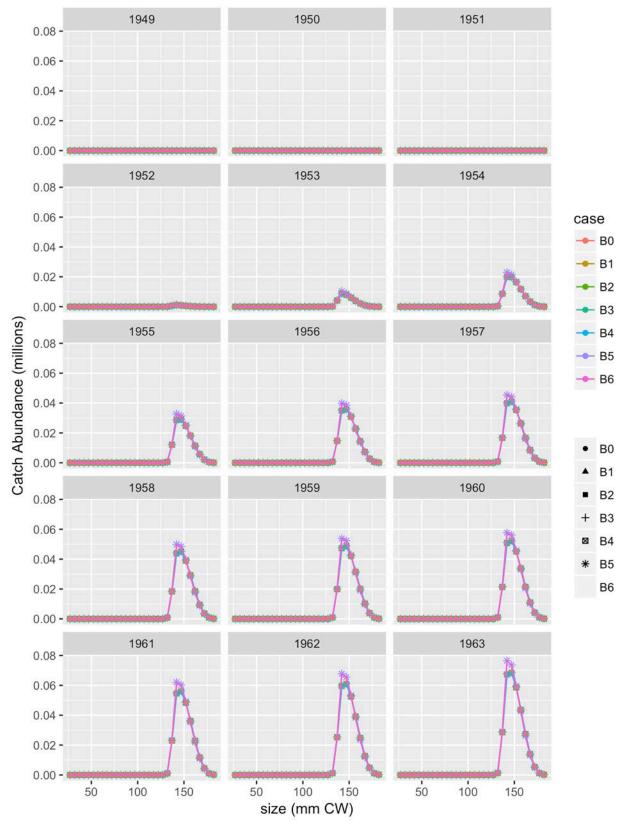


Figure 118. Predicted TCF retained catch abundance for male all all, (1 of 4).

TCF retained catch for male all all

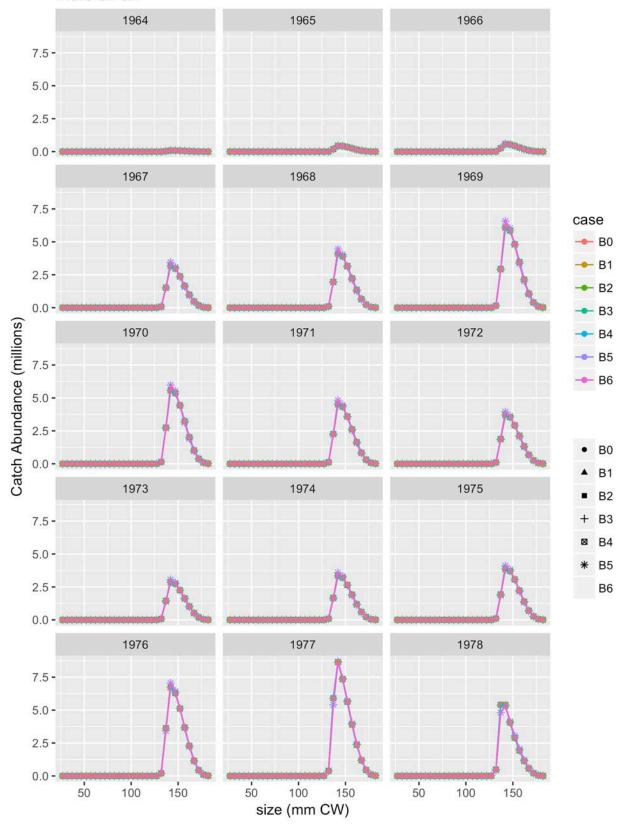


Figure 119. Predicted TCF retained catch abundance for male all all, (2 of 4).

TCF retained catch for male all all 1979 1980 1981 4 -2 -0 -1982 1983 1984 case 4 -**→** B0 2-**●** B1 → B2 - B3 Catch Abundance (millions) 1988 1987 1989 - B4 - B5 - B6 В0 В1 1990 1991 1992 B2 ВЗ 4 -**⊠** B4 B5 2-B6 0 -1993 1994 1995 4 -2-0 -150 50 100 50 150 50 100 150 100 size (mm CW)

Figure 120. Predicted TCF retained catch abundance for male all all, (3 of 4).

TCF retained catch for male all all

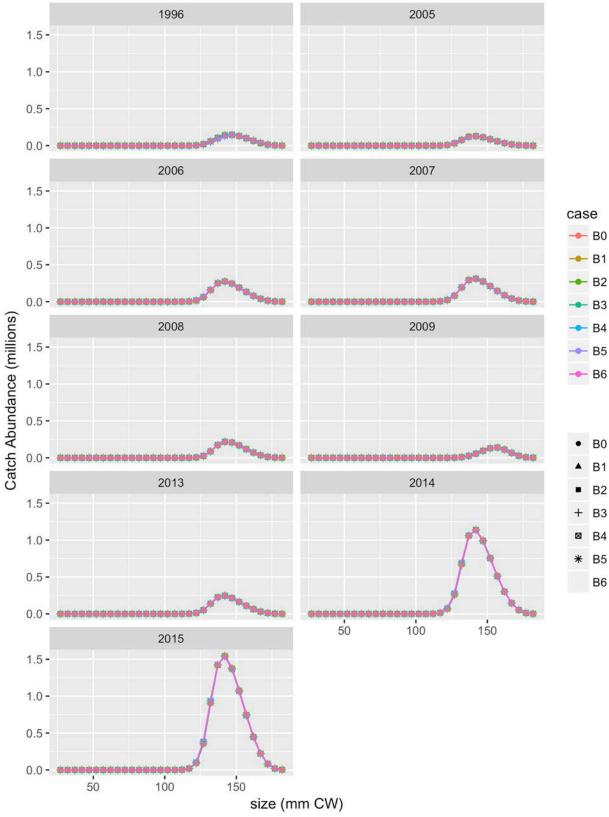


Figure 121. Predicted TCF retained catch abundance for male all all, (4 of 4).

Model fits

Survey biomass

NMFS trawl survey

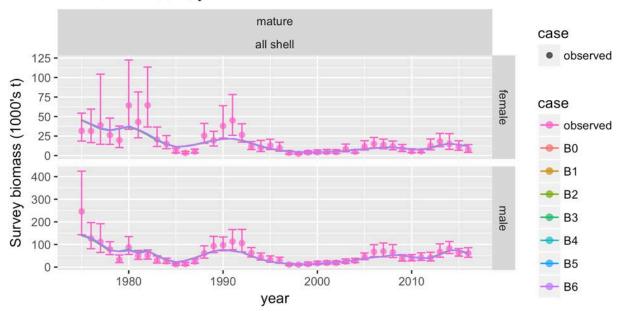


Figure 122. Comparison of observed and predicted survey biomass for NMFS trawl survey.

NMFS trawl survey

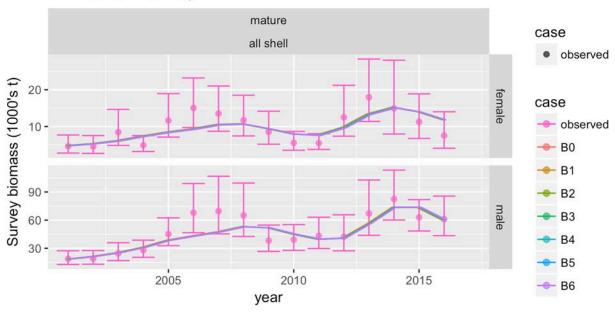


Figure 123. Comparison of observed and predicted survey biomass for NMFS trawl survey. Recent time period.

Mean survey size compositions

NMFS trawl survey

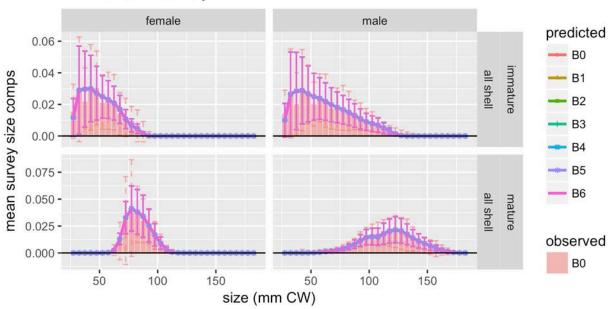


Figure 124. Comparison of observed and predicted &&xms mean survey size comps for NMFS trawl survey.

Survey size compositions

NMFS trawl survey: male, immature, all shell

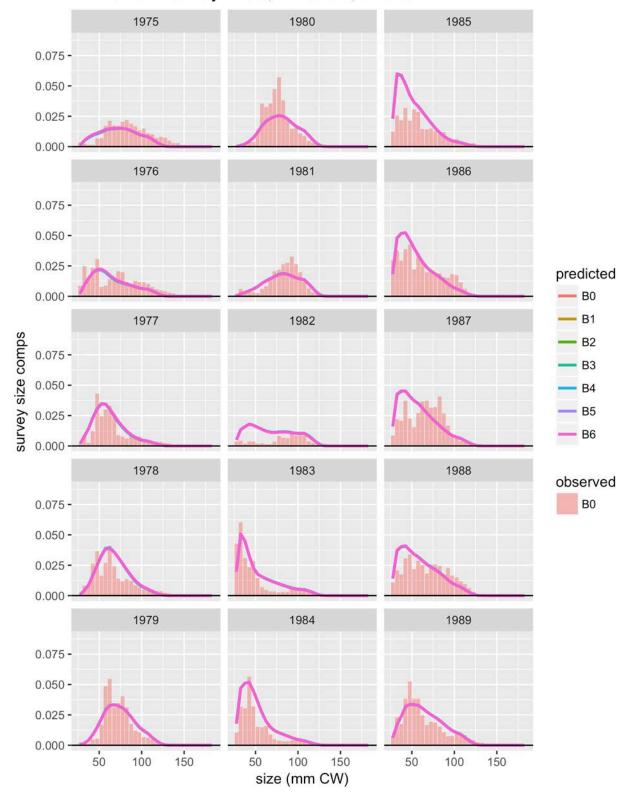


Figure 125. Comparison of observed and predicted male, immature, all shell survey size comps for NMFS trawl survey. Page 1 of 3.

NMFS trawl survey: male, immature, all shell 1990 1995 2000 0.075 -0.050 -0.025 -0.000 1991 1996 2001 0.075 -0.050 -0.025 predicted 0.000 **B**0 **B**1 1992 1997 2002 survey size comps B2 0.075 -B3 0.050 -B4 **B**5 0.025 -**B**6 0.000 1993 1998 2003 observed B0 0.075 -0.050 -0.025 -0.000 1994 1999 2004 0.075 -0.050 -0.025 -0.000 50 100 150 50 100 50 100 150 150 size (mm CW)

Figure 126. Comparison of observed and predicted male, immature, all shell survey size comps for NMFS trawl survey. Page 2 of 3.

NMFS trawl survey: male, immature, all shell 2010 2005 2015 0.075 -0.050 -0.025 -0.000 2006 2011 2016 0.075 -0.050 -0.025 predicted 0.000 **B**0 **B**1 2007 2012 2017 survey size comps B2 0.075 -B3 0.050 -B4 **B**5 0.025 -**B**6 0.000 2013 2018 2008 observed B0 0.075 -0.050 -0.025 -0.000 2009 2014 2019 0.075 -0.050 -0.025 -0.000 50 50 100 50 100 100 150 150 150 size (mm CW)

Figure 127. Comparison of observed and predicted male, immature, all shell survey size comps for NMFS trawl survey. Page 3 of 3.

NMFS trawl survey: male, mature, all shell 1975 1980 1985 0.04 -0.02 -0.00 -1976 1981 1986 0.04 -0.02 predicted 0.00 **B**0 **B**1 1977 1982 1987 survey size comps B2 0.04 -**B**3 **B**4 0.02 -**B**5 **B**6 0.00 1978 1983 1988 observed B0 0.04 -0.02 -0.00 1979 1984 1989 0.04 -0.02 -0.00 50 100 50 50 150 100 100 150 150 size (mm CW)

Figure 128. Comparison of observed and predicted male, mature, all shell survey size comps for NMFS trawl survey. Page 1 of 3.

NMFS trawl survey: male, mature, all shell 1990 1995 2000 0.04 -0.02 -0.00 -1991 1996 2001 0.04 -0.02 predicted 0.00 **B**0 **B**1 1992 1997 2002 survey size comps B2 0.04 -**B**3 **B**4 0.02 -**B**5 **B**6 0.00 1993 1998 2003 observed B0 0.04 -0.02 -0.00 1999 1994 2004 0.04 -0.02 -0.00 50 100 50 150 100 50 100 150 150 size (mm CW)

Figure 129. Comparison of observed and predicted male, mature, all shell survey size comps for NMFS trawl survey. Page 2 of 3.

NMFS trawl survey: male, mature, all shell 2005 2010 2015 0.04 -0.02 -0.00 -2006 2011 2016 0.04 -0.02 predicted 0.00 **B**0 2012 **B**1 2007 2017 survey size comps B2 0.04 -**B**3 **B**4 0.02 -**B**5 **B**6 0.00 2008 2013 2018 observed B0 0.04 -0.02 -0.00 2009 2014 2019 0.04 -0.02 -0.00 50 100 50 50 100 150 150 100 150 size (mm CW)

Figure 130. Comparison of observed and predicted male, mature, all shell survey size comps for NMFS trawl survey. Page 3 of 3.

NMFS trawl survey: female, immature, all shell 1975 1980 1985 0.100 -0.075 -0.050 -0.025 -0.000 -1976 1981 1986 0.100 -0.075 -0.050 -0.025 predicted 0.000 **B**0 **B**1 1977 1982 1987 survey size comps 0.100 -B2 0.075 -B3 B4 0.050 -**B**5 0.025 -**B**6 0.000 1978 1983 1988 observed 0.100 -B0 0.075 -0.050 -0.025 -0.000 1979 1984 1989 0.100 -0.075 -0.050 -0.025 -0.000 50 50 50 100 150 100 100 150 150 size (mm CW)

Figure 131. Comparison of observed and predicted female, immature, all shell survey size comps for NMFS trawl survey. Page 1 of 3.

NMFS trawl survey: female, immature, all shell 1990 1995 2000 0.100 -0.075 -0.050 -0.025 -0.000 1991 1996 2001 0.100 -0.075 -0.050 -0.025 predicted 0.000 **B**0 **B**1 1992 1997 2002 survey size comps 0.100 -B2 0.075 -B3 B4 0.050 -**B**5 0.025 -**B**6 0.000 1993 1998 2003 observed 0.100 -B0 0.075 -0.050 -0.025 -0.000 1994 1999 2004 0.100 -0.075 -0.050 -0.025 -0.000 50 50 50 100 150 100 100 150 150 size (mm CW)

Figure 132. Comparison of observed and predicted female, immature, all shell survey size comps for NMFS trawl survey. Page 2 of 3.

NMFS trawl survey: female, immature, all shell 2005 2010 2015 0.100 -0.075 -0.050 -0.025 -0.000 2006 2011 2016 0.100 -0.075 -0.050 -0.025 predicted 0.000 **B**0 **B**1 2007 2012 2017 survey size comps 0.100 -B2 0.075 -B3 B4 0.050 -**B**5 0.025 -**B**6 0.000 2008 2013 2018 observed 0.100 -B0 0.075 -0.050 -0.025 -0.000 2009 2014 2019 0.100 -0.075 -0.050 -0.025 -0.000 50 50 100 100 50 150 150 100 150 size (mm CW)

Figure 133. Comparison of observed and predicted female, immature, all shell survey size comps for NMFS trawl survey. Page 3 of 3.

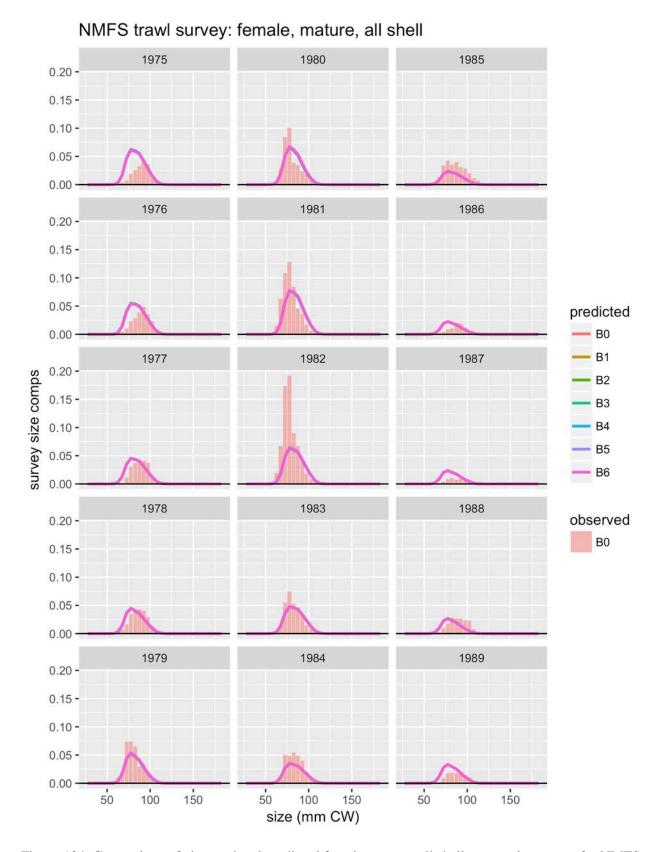


Figure 134. Comparison of observed and predicted female, mature, all shell survey size comps for NMFS trawl survey. Page 1 of 3.

NMFS trawl survey: female, mature, all shell 1990 1995 2000 0.20 -0.15 -0.10 -0.05 -0.00 -1991 1996 2001 0.20 -0.15 -0.10 -0.05 predicted 0.00 **B**0 **B**1 2002 1992 1997 0.20 survey size comps B2 0.15 -B3 0.10 -B4 **B**5 0.05 -**B**6 0.00 1993 1998 2003 observed 0.20 -B0 0.15 -0.10 -0.05 -0.00 -1994 1999 2004 0.20 -0.15 -0.10 -0.05 -0.00 150 50 50 100 150 50 100 100 150 size (mm CW)

Figure 135. Comparison of observed and predicted female, mature, all shell survey size comps for NMFS trawl survey. Page 2 of 3.

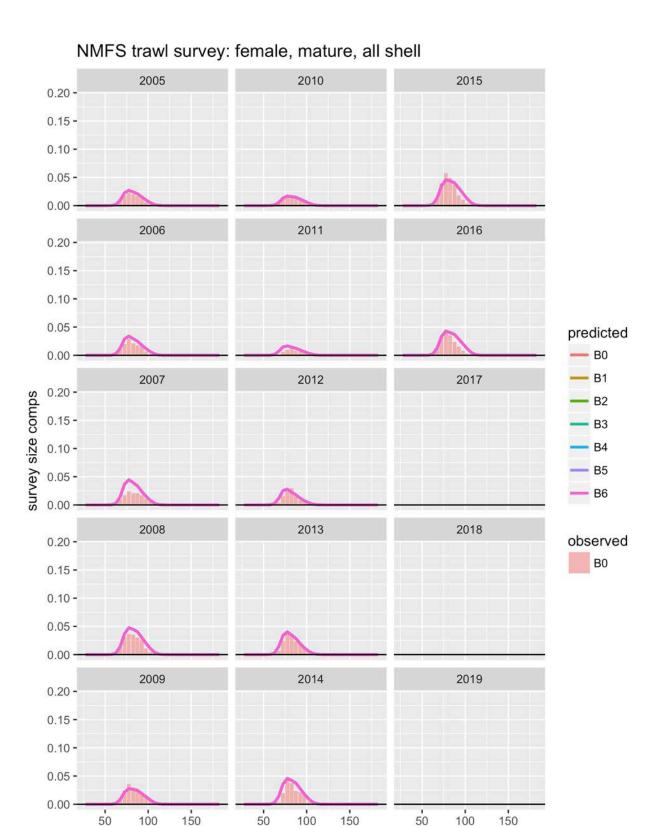


Figure 136. Comparison of observed and predicted female, mature, all shell survey size comps for NMFS trawl survey. Page 3 of 3.

size (mm CW)

Growth data

No fits to growth data.

No growth data fit.

Total fishery catch biomass

NOTE: Predicted and "observed" catch biomass for TCSAM2013 model results in the following plots always reflect "total catch mortality" biomass (even when "total capture" biomass was fit in the model), while TCSAM02 model results always reflect "total capture" biomass.

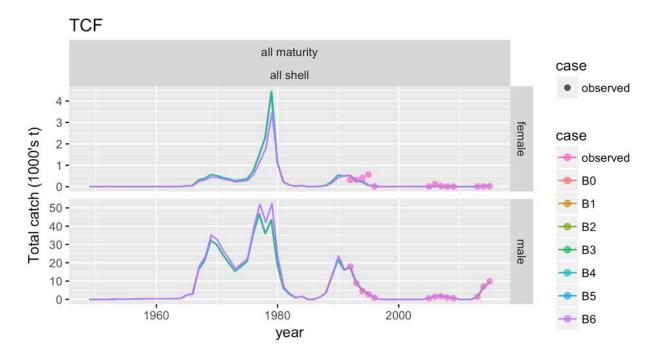


Figure 137. Comparison of observed and predicted total catch for TCF.

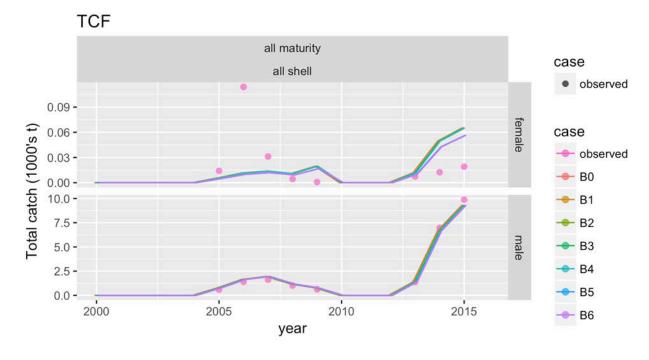


Figure 138. Comparison of observed and predicted total catch for TCF. Recent time period.

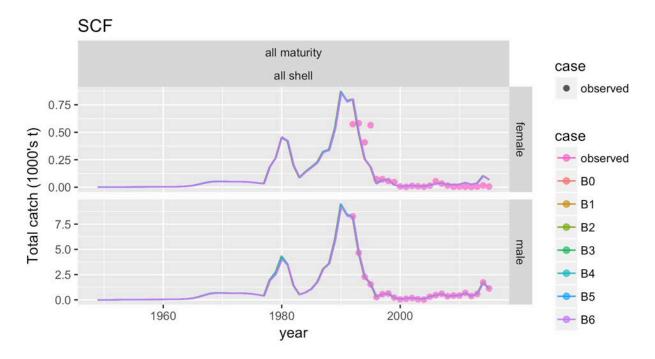


Figure 139. Comparison of observed and predicted total catch for SCF.

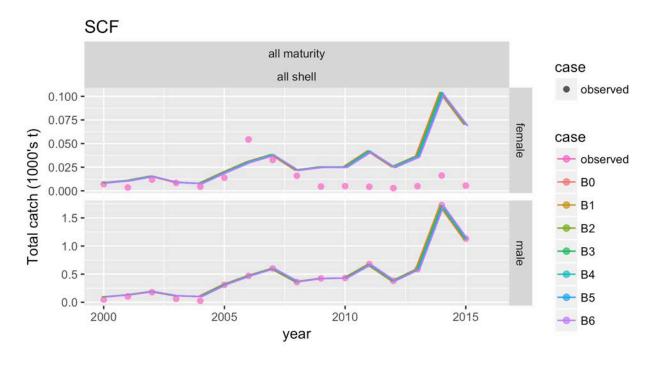


Figure 140. Comparison of observed and predicted total catch for SCF. Recent time period.

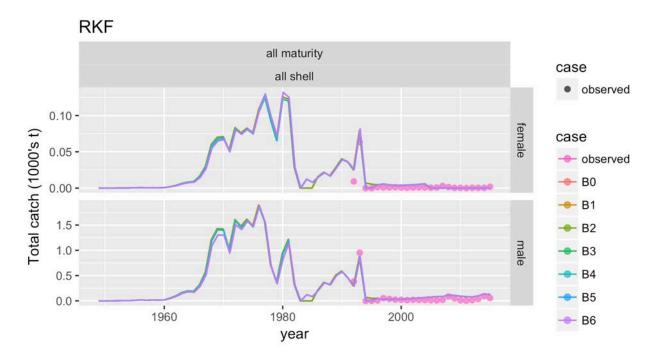


Figure 141. Comparison of observed and predicted total catch for RKF.

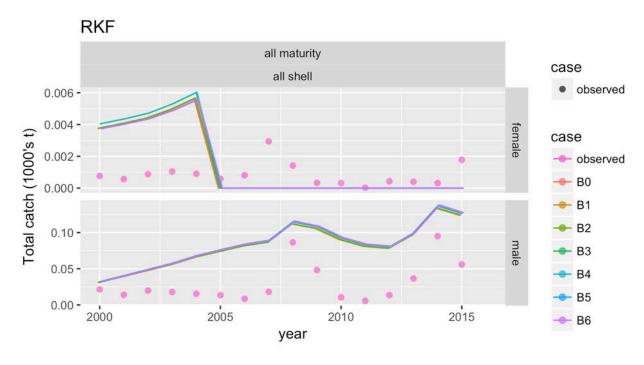


Figure 142. Comparison of observed and predicted total catch for RKF. Recent time period.

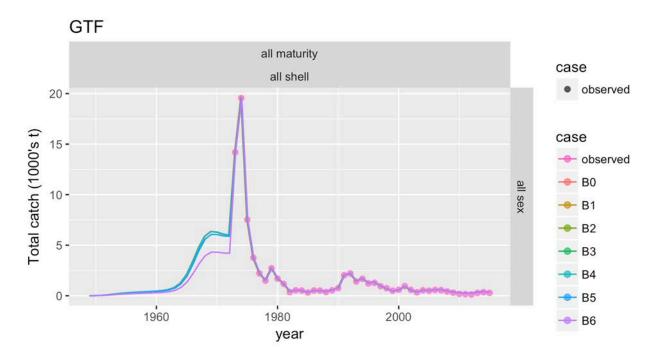


Figure 143. Comparison of observed and predicted total catch for GTF.

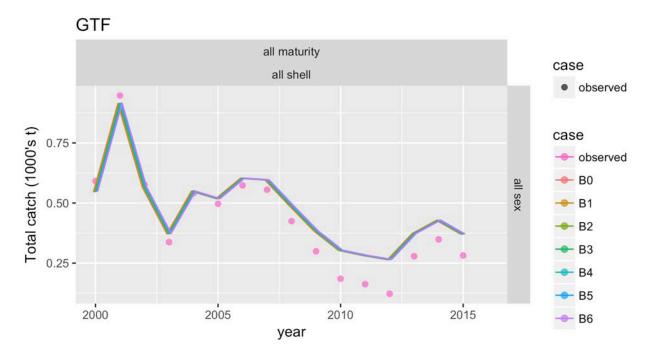


Figure 144. Comparison of observed and predicted total catch for GTF. Recent time period.

Total fishery mean size comps

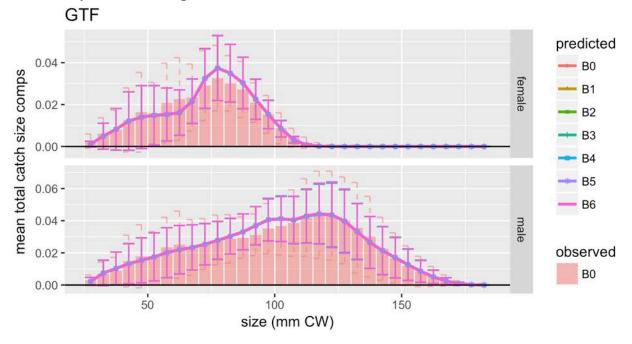


Figure 145. Comparison of observed and predicted &&xms mean total catch size comps for GTF.

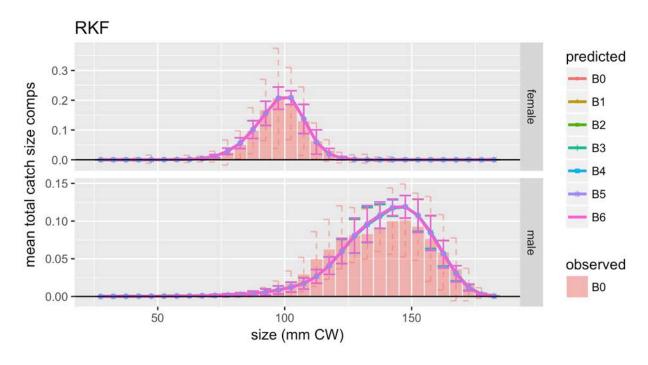


Figure 146. Comparison of observed and predicted &&xms mean total catch size comps for RKF.

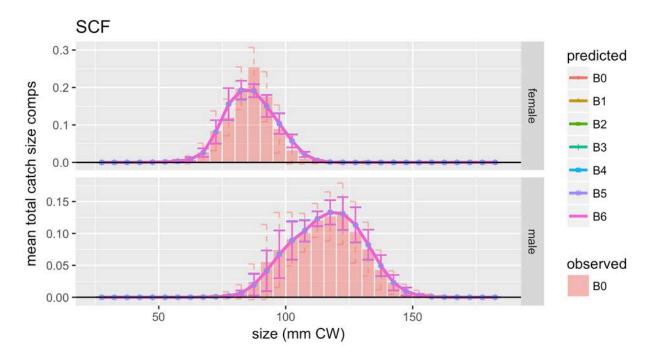


Figure 147. Comparison of observed and predicted &&xms mean total catch size comps for SCF.

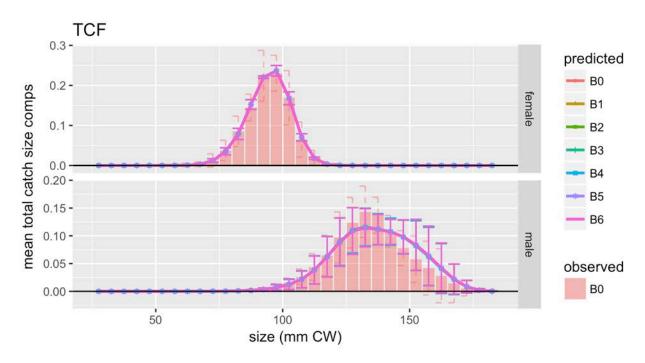


Figure 148. Comparison of observed and predicted &&xms mean total catch size comps for TCF.

Total fishery catch size comps

TCF: male, all maturity, all shell

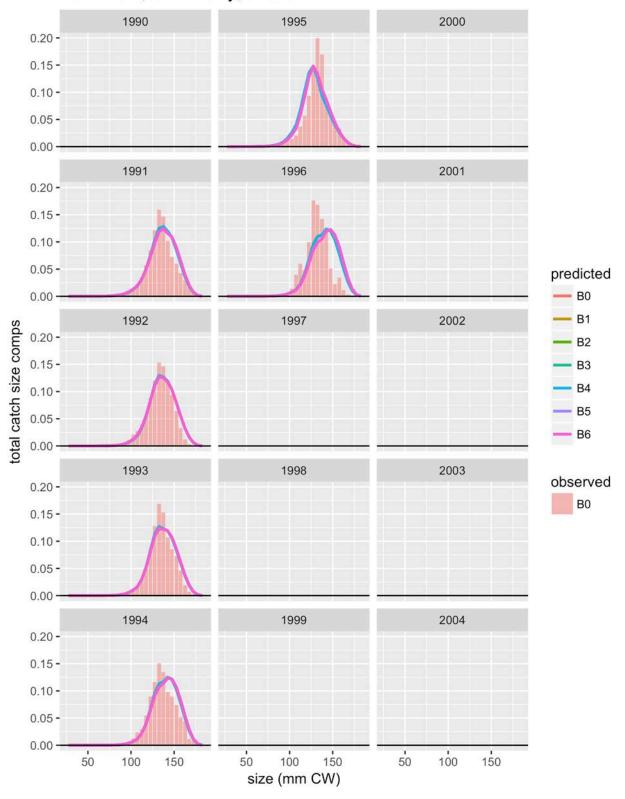


Figure 149. Comparison of observed and predicted male, all maturity, all shell total catch size comps for TCF. Page 1 of 2.

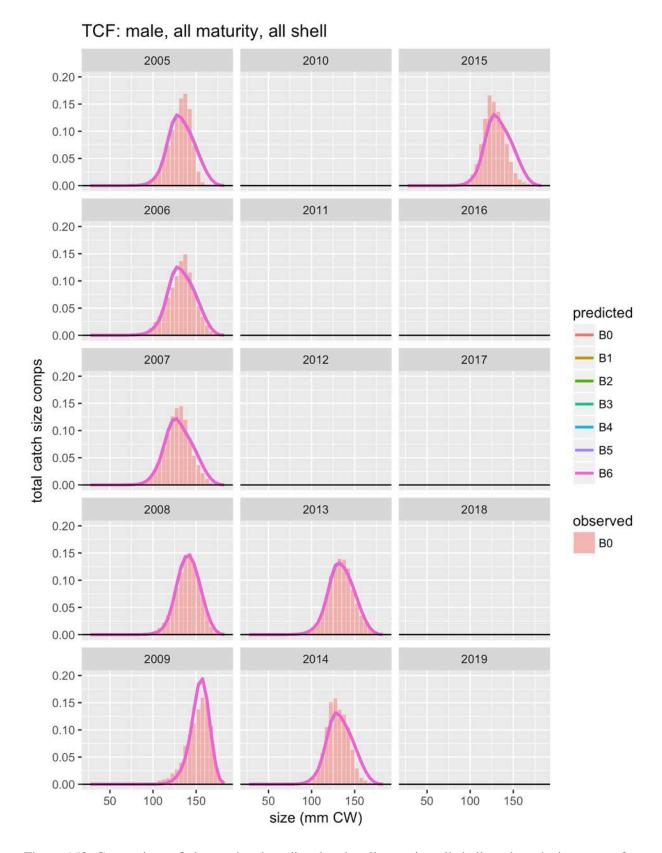


Figure 150. Comparison of observed and predicted male, all maturity, all shell total catch size comps for TCF. Page 2 of 2.

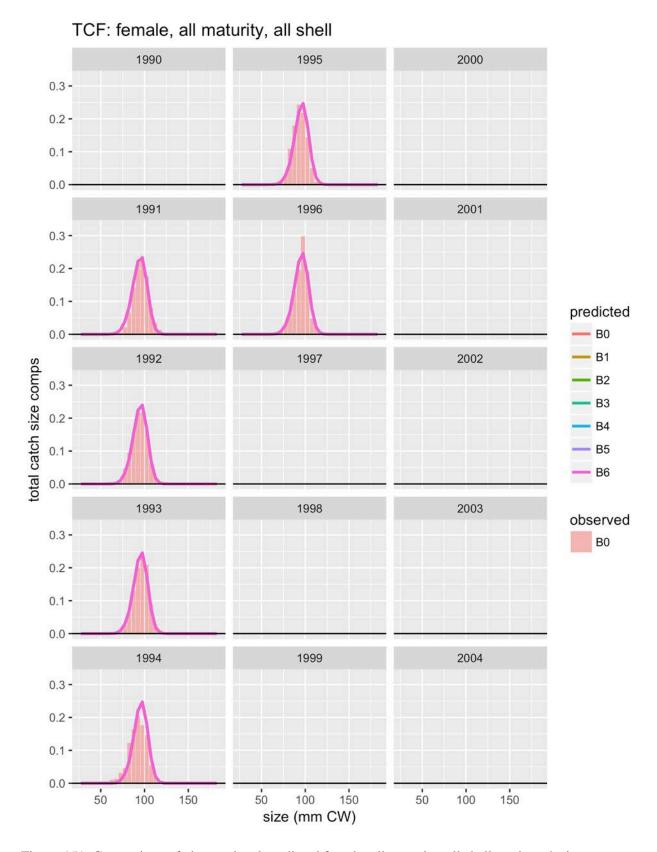


Figure 151. Comparison of observed and predicted female, all maturity, all shell total catch size comps for TCF. Page 1 of 2.

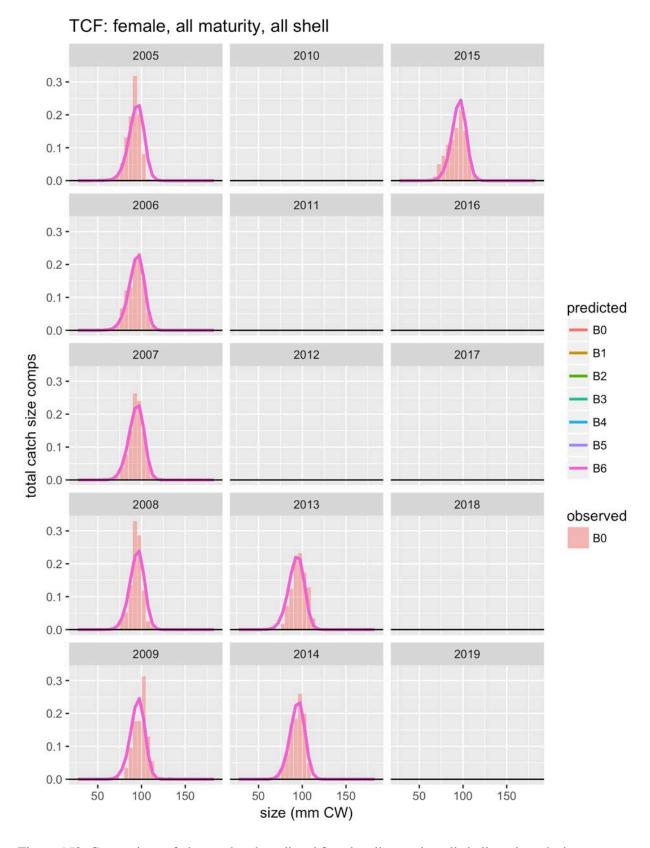


Figure 152. Comparison of observed and predicted female, all maturity, all shell total catch size comps for TCF. Page 2 of 2.

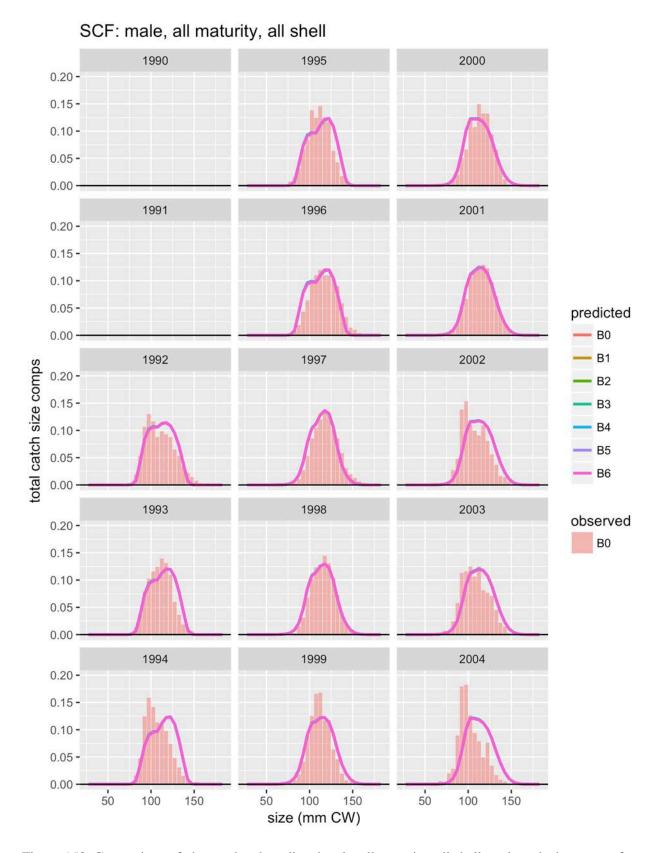


Figure 153. Comparison of observed and predicted male, all maturity, all shell total catch size comps for SCF. Page 1 of 2.

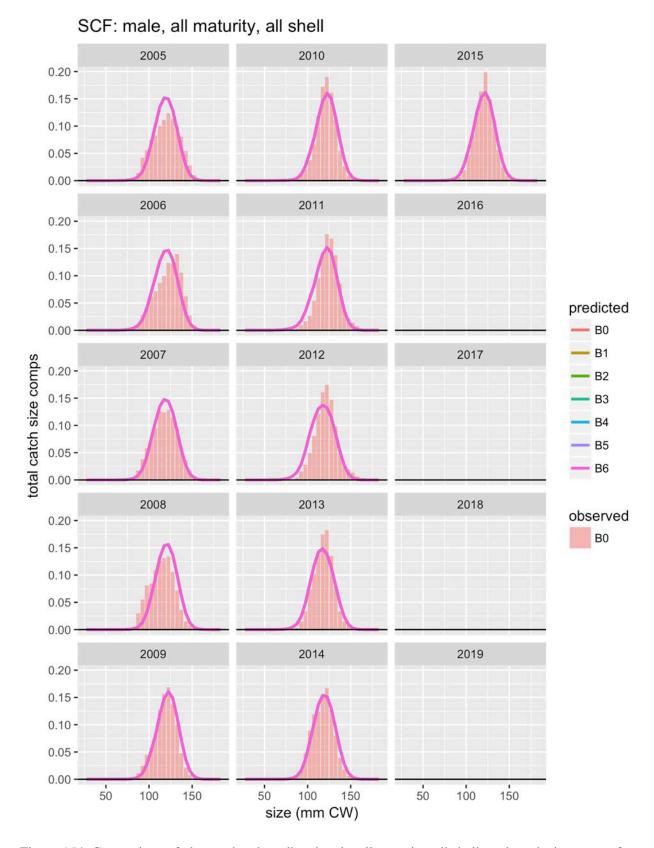


Figure 154. Comparison of observed and predicted male, all maturity, all shell total catch size comps for SCF. Page 2 of 2.

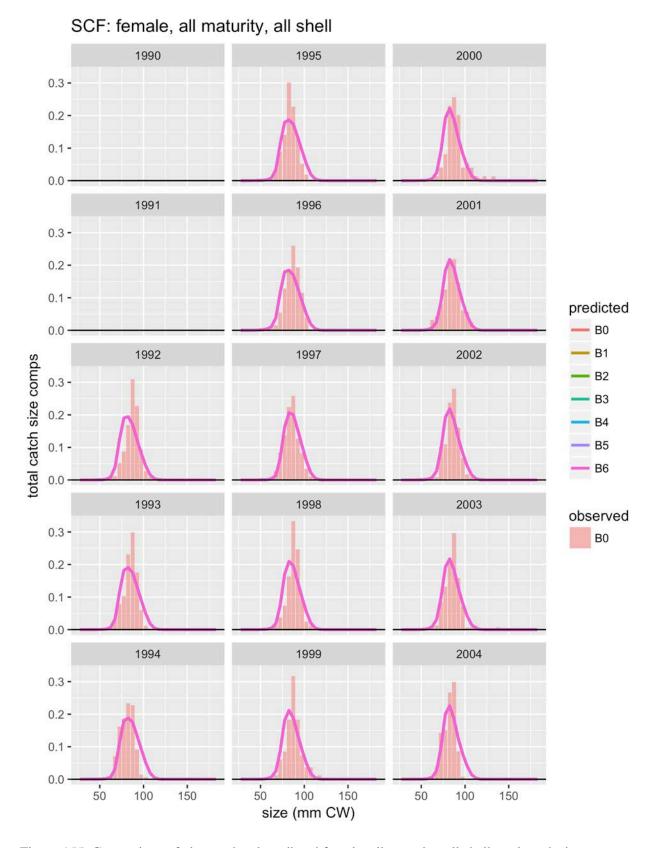


Figure 155. Comparison of observed and predicted female, all maturity, all shell total catch size comps for SCF. Page 1 of 2.

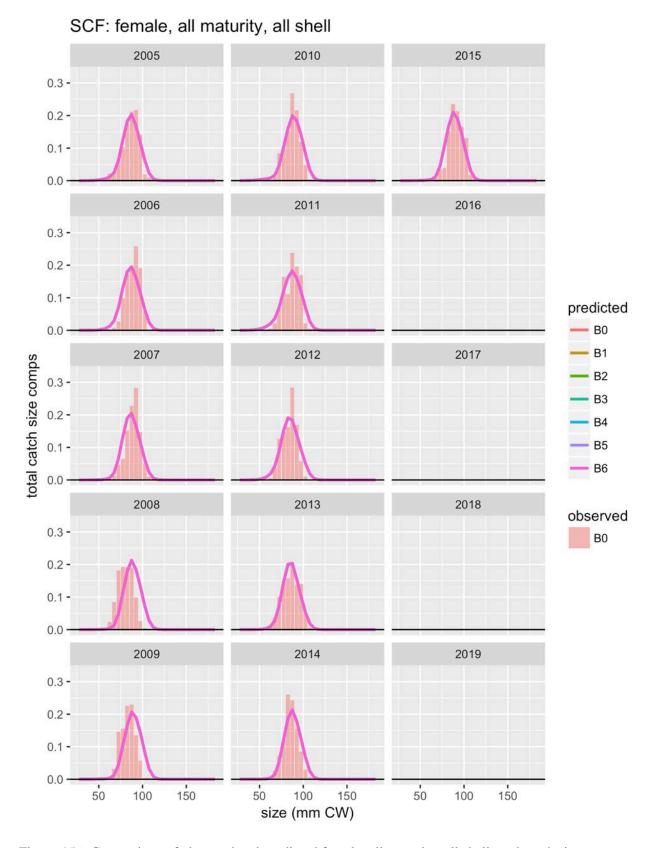


Figure 156. Comparison of observed and predicted female, all maturity, all shell total catch size comps for SCF. Page 2 of 2.

RKF: male, all maturity, all shell 1990 1995 2000 0.15 -0.10 -0.05 -0.00 -1991 1996 2001 0.15 -0.10 -0.05 predicted 0.00 **B**0 **B**1 1992 1997 2002 total catch size comps B2 0.15 -B3 0.10 -B4 **B**5 0.05 -B6 0.00 1993 2003 1998 observed B0 0.15 -0.10 -0.05 -0.00 1994 1999 2004 0.15 -0.10 -0.05 -0.00 50 100 150 50 100 50 100 150 150 size (mm CW)

Figure 157. Comparison of observed and predicted male, all maturity, all shell total catch size comps for RKF. Page 1 of 2.

RKF: male, all maturity, all shell 2005 2010 2015 0.15 -0.10 -0.05 -0.00 -2011 2006 2016 0.15 -0.10 -0.05 predicted 0.00 **B**0 2012 **B**1 2007 2017 total catch size comps B2 0.15 -B3 0.10 -B4 **B**5 0.05 -**B**6 0.00 2013 2008 2018 observed B0 0.15 -0.10 -0.05 -0.00 -2009 2014 2019 0.15 -0.10 -0.05 -0.00 50 100 50 100 50 100 150 150 150 size (mm CW)

Figure 158. Comparison of observed and predicted male, all maturity, all shell total catch size comps for RKF. Page 2 of 2.

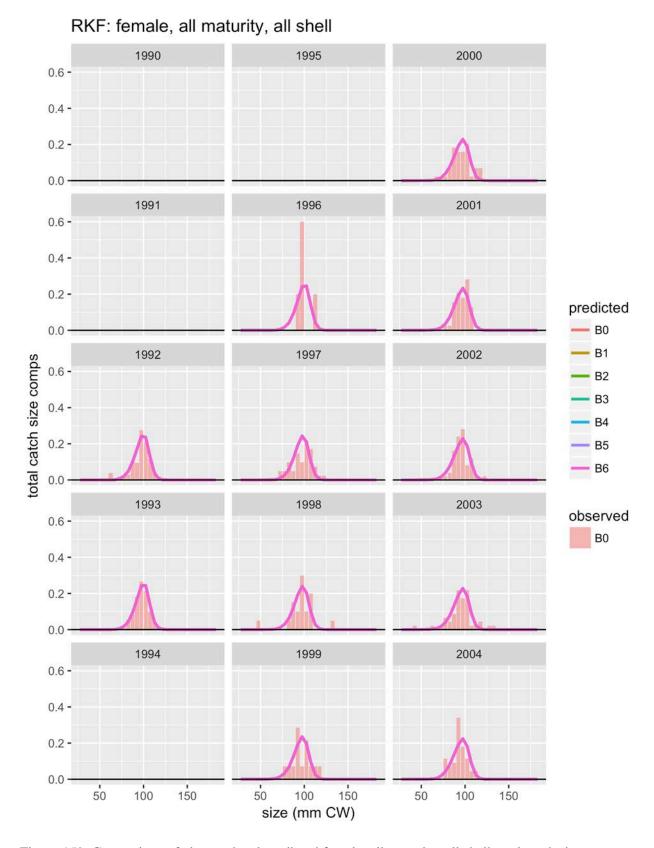


Figure 159. Comparison of observed and predicted female, all maturity, all shell total catch size comps for RKF. Page 1 of 2.

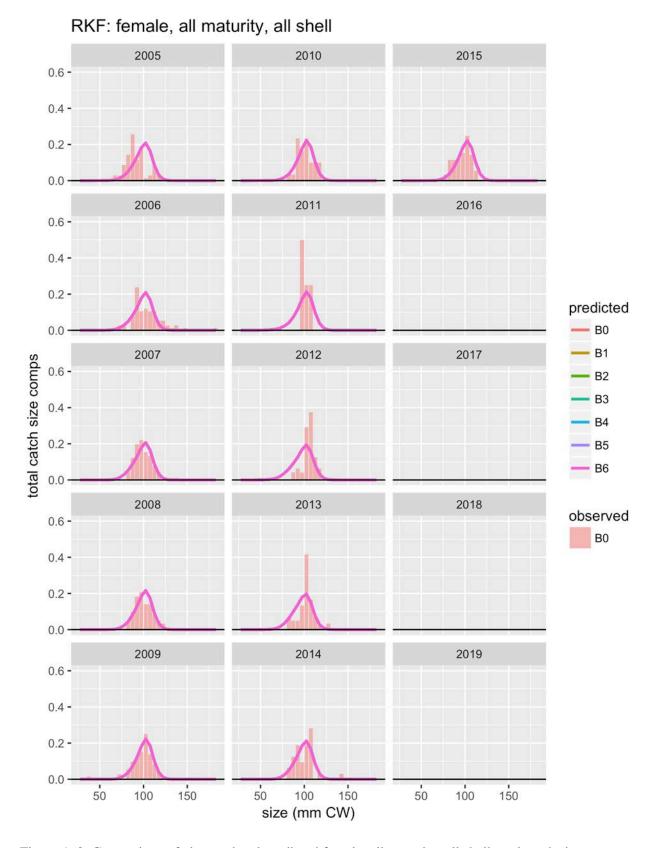


Figure 160. Comparison of observed and predicted female, all maturity, all shell total catch size comps for RKF. Page 2 of 2.

GTF: male, all maturity, all shell 1970 1975 1980 0.09 -0.06 -0.03 -0.00 -1971 1976 1981 0.09 -0.06 -0.03 predicted 0.00 **B**0 **B**1 1972 1977 1982 total catch size comps B2 0.09 -B3 0.06 -B4 **B**5 0.03 -**B**6 0.00 1973 1978 1983 observed B0 0.09 -0.06 -0.03 -0.00 1984 1974 1979 0.09 -0.06 -0.03 -0.00 50 100 50 50 100 150 100 150 150 size (mm CW)

Figure 161. Comparison of observed and predicted male, all maturity, all shell total catch size comps for GTF. Page 1 of 4.

GTF: male, all maturity, all shell 1985 1990 1995 0.09 -0.06 -0.03 -0.00 1986 1991 1996 0.09 -0.06 -0.03 predicted 0.00 **B**0 **B**1 1987 1992 1997 total catch size comps B2 0.09 -B3 0.06 -B4 **B**5 0.03 -**B**6 0.00 1988 1993 1998 observed B0 0.09 -0.06 -0.03 -0.00 1989 1994 1999 0.09 -0.06 -0.03 -0.00 50 100 50 50 100 150 100 150 150 size (mm CW)

Figure 162. Comparison of observed and predicted male, all maturity, all shell total catch size comps for GTF. Page 2 of 4.

GTF: male, all maturity, all shell 2000 2005 2010 0.09 -0.06 -0.03 -0.00 2001 2006 2011 0.09 -0.06 -0.03 predicted 0.00 **B**0 **B**1 2002 2007 2012 total catch size comps B2 0.09 -B3 0.06 -B4 **B**5 0.03 -B6 0.00 2008 2003 2013 observed B0 0.09 -0.06 -0.03 -0.00 2004 2009 2014 0.09 -0.06 -0.03 -0.00 50 100 50 50 100 100 150 150 150 size (mm CW)

Figure 163. Comparison of observed and predicted male, all maturity, all shell total catch size comps for GTF. Page 3 of 4.

GTF: male, all maturity, all shell 2015 2020 2025 0.09 -0.06 -0.03 -0.00 2016 2021 2026 0.09 -0.06 -0.03 predicted 0.00 **B**0 **B**1 2017 2022 2027 total catch size comps B2 0.09 -B3 0.06 -B4 **B**5 0.03 -**B**6 0.00 2018 2023 2028 observed B0 0.09 -0.06 -0.03 -0.00 -2024 2029 2019 0.09 -0.06 -0.03 -0.00 50 50 100 150 50 100 150 100 150 size (mm CW)

Figure 164. Comparison of observed and predicted male, all maturity, all shell total catch size comps for GTF. Page 4 of 4.

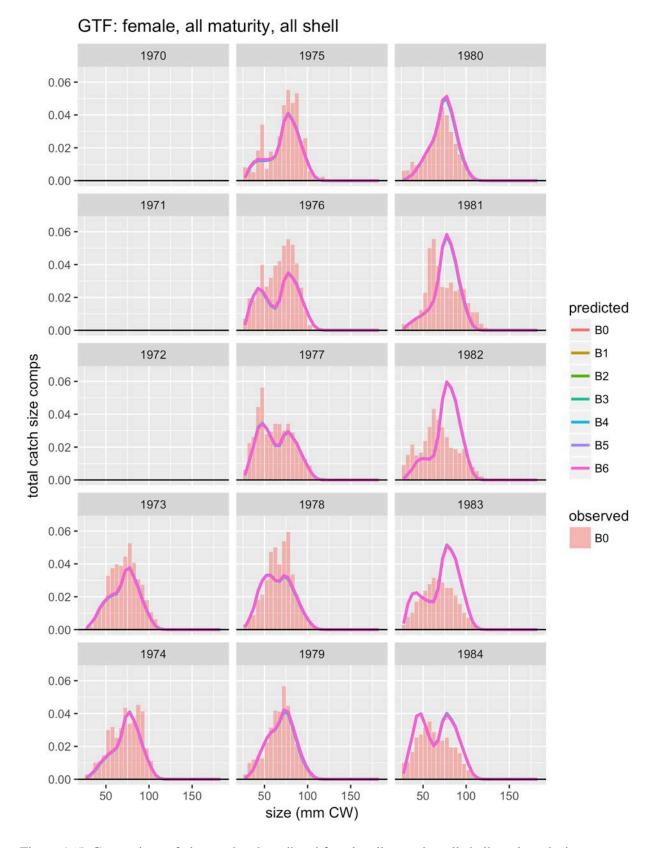


Figure 165. Comparison of observed and predicted female, all maturity, all shell total catch size comps for GTF. Page 1 of 4.

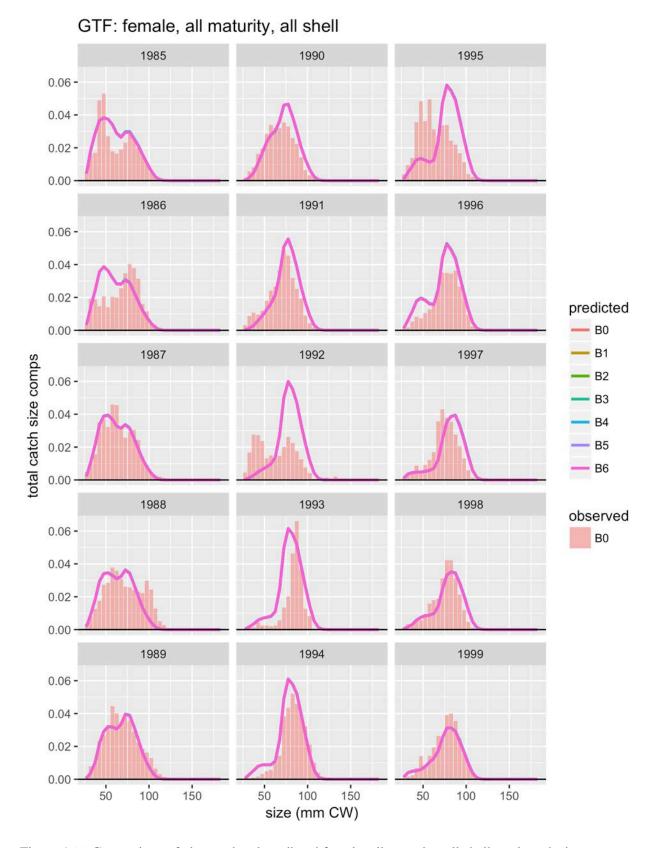


Figure 166. Comparison of observed and predicted female, all maturity, all shell total catch size comps for GTF. Page 2 of 4.

GTF: female, all maturity, all shell 2000 2005 2010 0.06 -0.04 -0.02 -0.00 2001 2006 2011 0.06 -0.04 -0.02 predicted 0.00 **B**0 **B**1 2002 2007 2012 total catch size comps B2 0.06 -ВЗ 0.04 -**B**4 0.02 -**B**5 B6 0.00 2013 2003 2008 observed 0.06 -B0 0.04 -0.02 -0.00 2004 2009 2014 0.06 -0.04 -0.02 -0.00 50 150 50 50 150 100 100 100 150 size (mm CW)

Figure 167. Comparison of observed and predicted female, all maturity, all shell total catch size comps for GTF. Page 3 of 4.

GTF: female, all maturity, all shell 2015 2020 2025 0.06 -0.04 -0.02 -0.00 -2016 2021 2026 0.06 -0.04 -0.02 predicted 0.00 **B**0 **-** B1 2017 2022 2027 total catch size comps B2 0.06 -**B**3 0.04 -B4 0.02 -B5 B6 0.00 2023 2018 2028 observed 0.06 -В0 0.04 -0.02 -0.00 -2019 2024 2029 0.06 -0.04 -0.02 -0.00

Figure 168. Comparison of observed and predicted female, all maturity, all shell total catch size comps for GTF. Page 4 of 4.

100

size (mm CW)

150

50

50

100

150

50

100

150

Retained fishery catch biomass

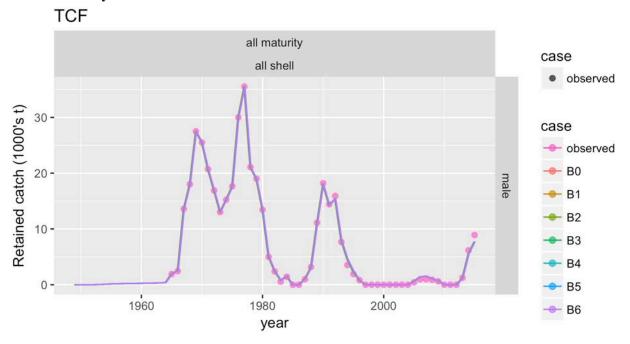


Figure 169. Comparison of observed and predicted retained catch mortality for TCF.

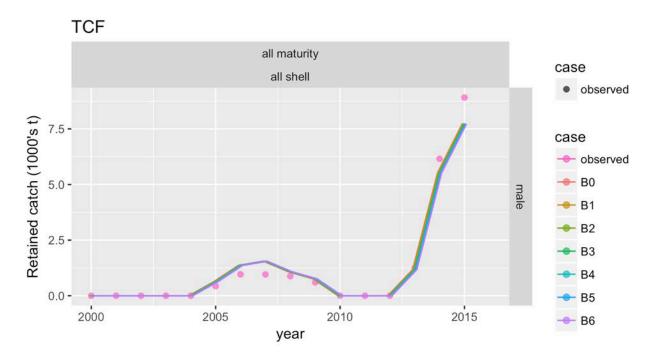


Figure 170. Comparison of observed and predicted retained catch mortality for TCF. Recent time period.

Mean retained fishery size compositions

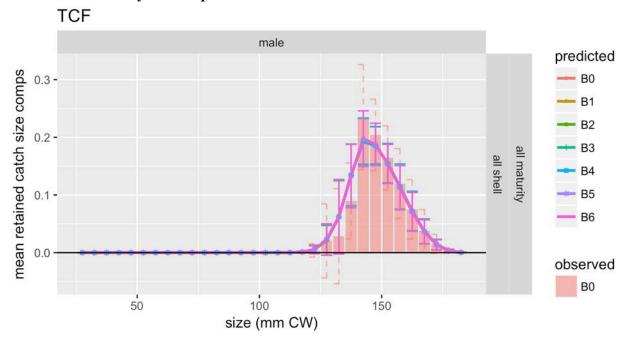


Figure 171. Comparison of observed and predicted &&xms mean retained catch size comps for TCF.

Retained fishery size compositions

TCF: male, all maturity, all shell

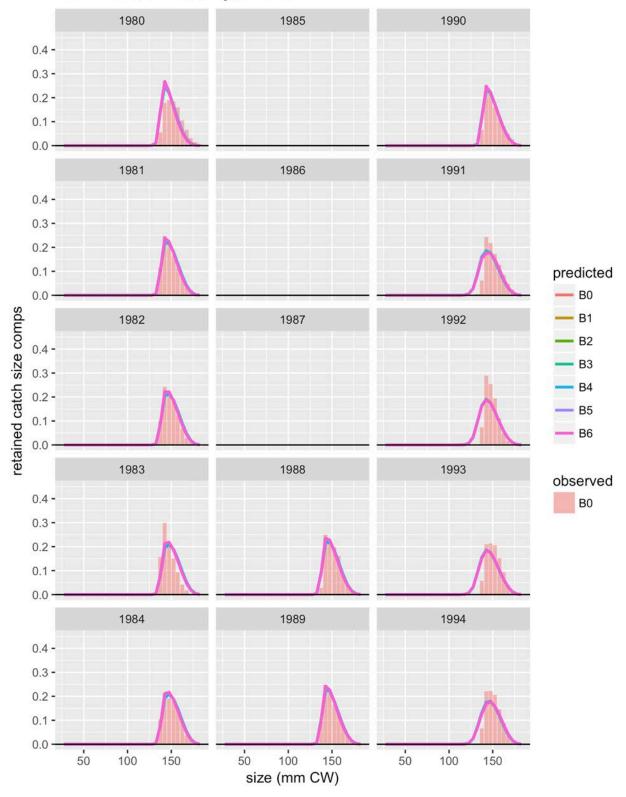


Figure 172. Comparison of observed and predicted male, all maturity, all shell retained catch size comps for TCF. Page 1 of 3.

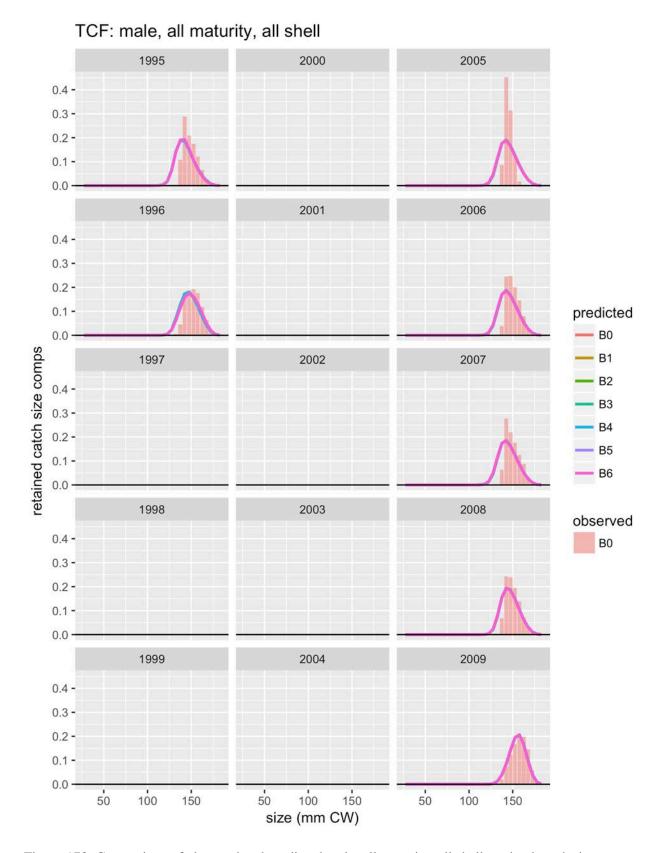


Figure 173. Comparison of observed and predicted male, all maturity, all shell retained catch size comps for TCF. Page 2 of 3.

TCF: male, all maturity, all shell 2010 2015 2020 0.4 -0.3 -0.2 -0.1 -0.0 -2011 2016 2021 0.4 -0.3 -0.2 -0.1 predicted 0.0 **B**0 retained catch size comps 2012 **B**1 2017 2022 - B2 0.4 -**B**3 0.3 -**B**4 0.2 -**B**5 0.1 -**B**6 0.0 2013 2018 2023 observed 0.4 -B0 0.3 -0.2 -0.1 -0.0 -2014 2019 2024 0.4 -0.3 -0.2 -0.1 -0.0 50 50 100 100 150 50 100 150 150 size (mm CW)

Figure 174. Comparison of observed and predicted male, all maturity, all shell retained catch size comps for TCF. Page 3 of 3.