Appendix K1:

Model Comparisons for TCSAM02 Models B1, AG4, and AG1c

William Stockhausen

Population processes

Natural mortality

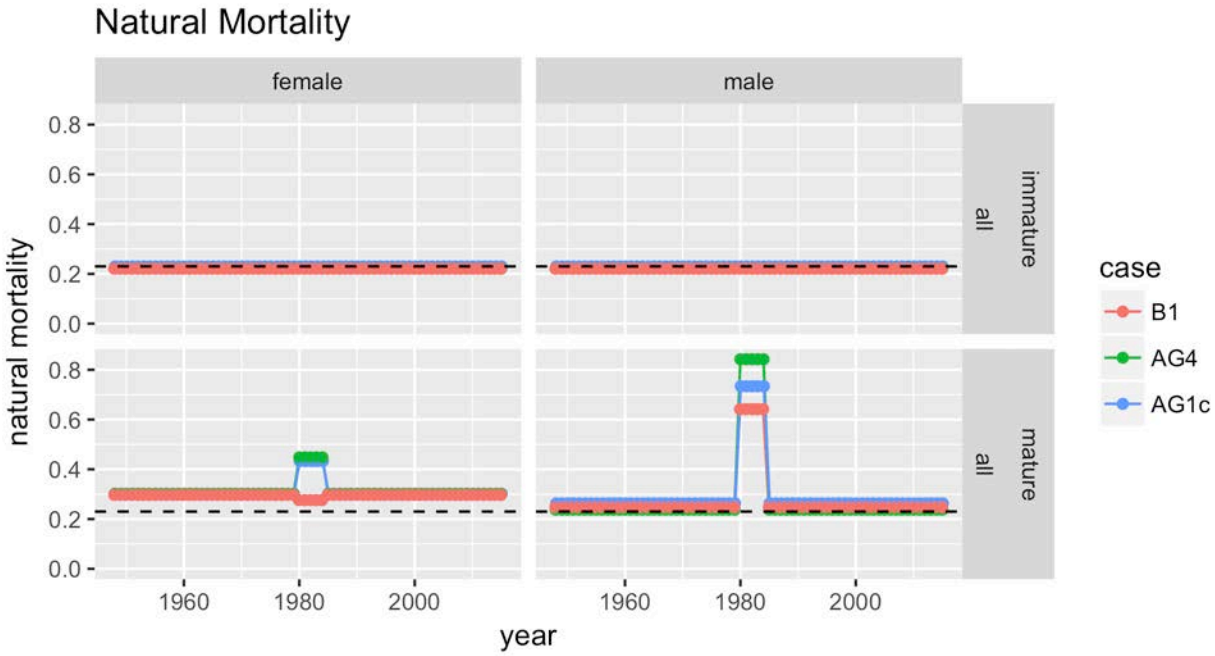


Figure 1. Estimated natural mortality rates, by year.

Probability of terminal molt

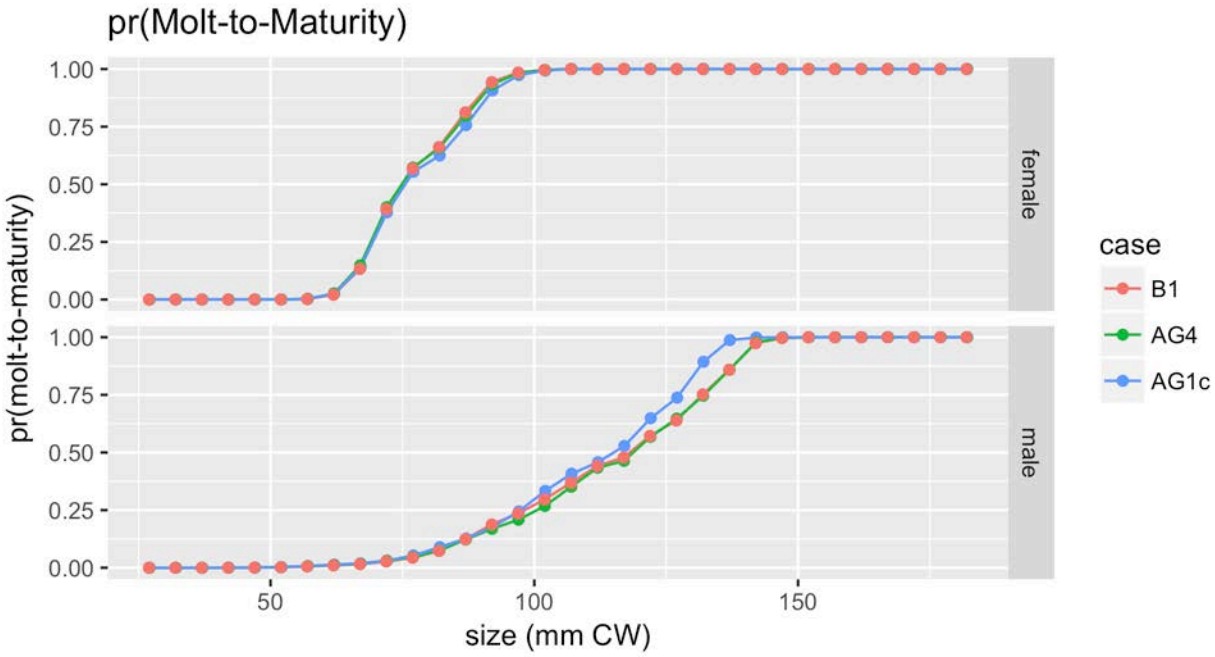


Figure 2. Probability of terminal molt.

Mean growth

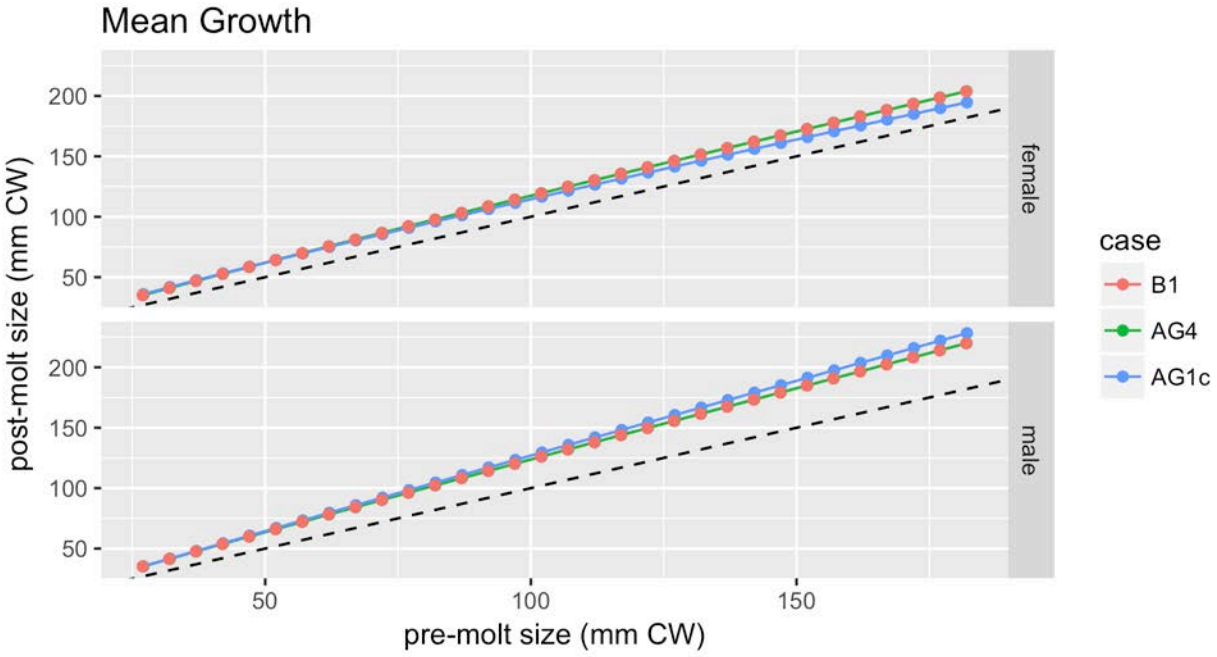


Figure 3. Mean growth.

Growth matrices

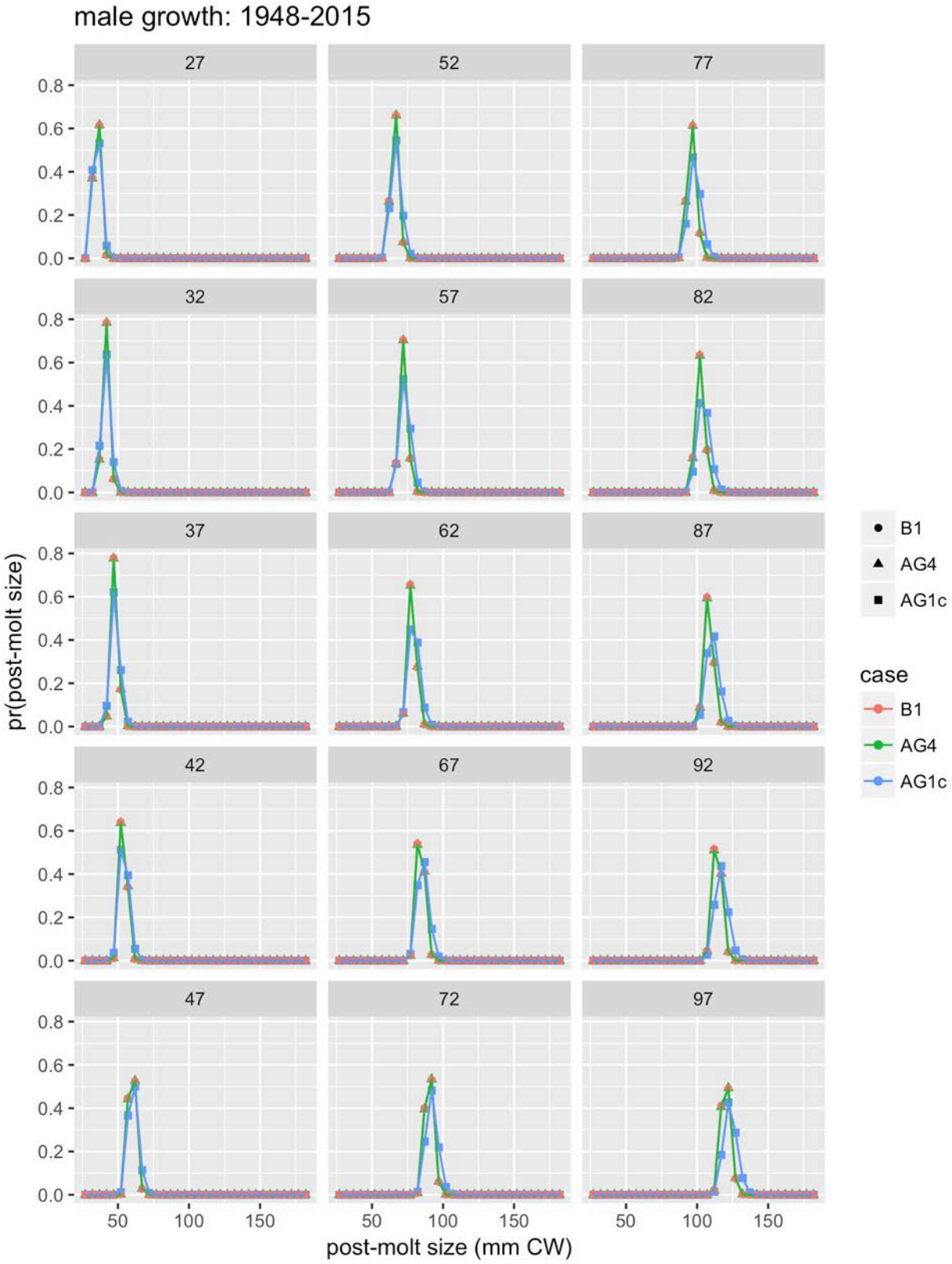


Figure 4. Growth matrices for males during 1948-2015, page 1.

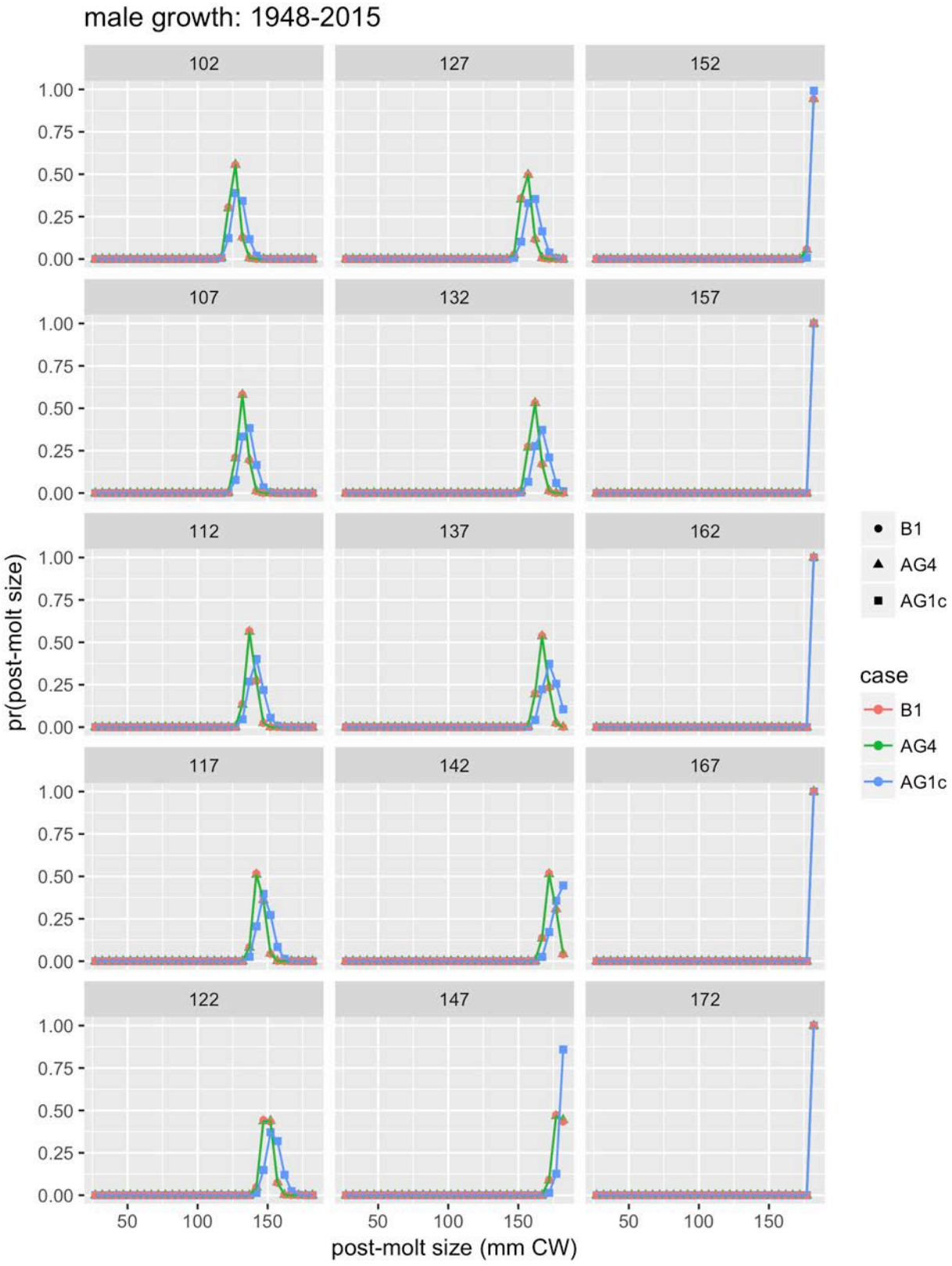


Figure 5. Growth matrices for males during 1948-2015, page 2.

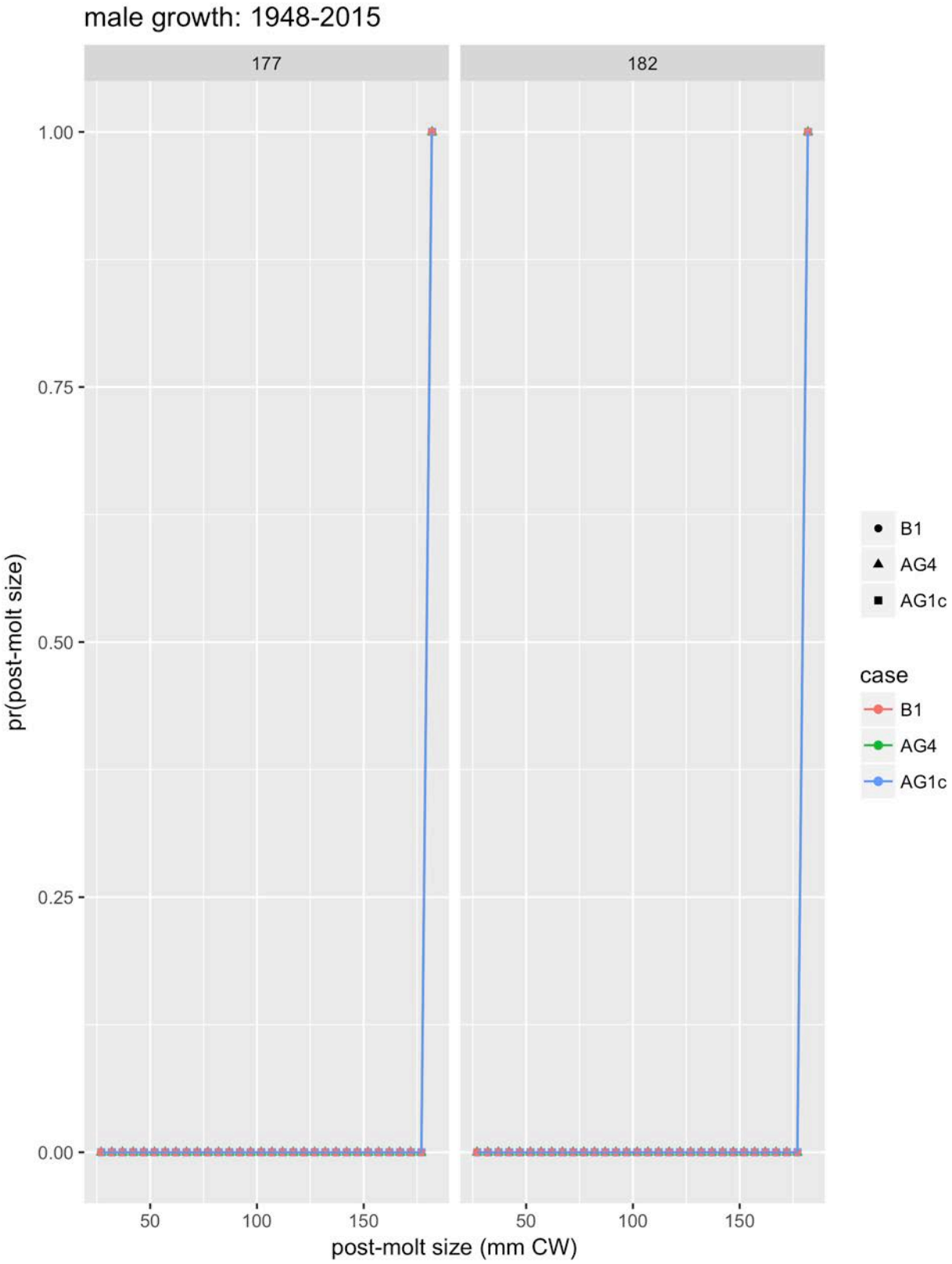


Figure 6. Growth matrices for males during 1948-2015, page 3.

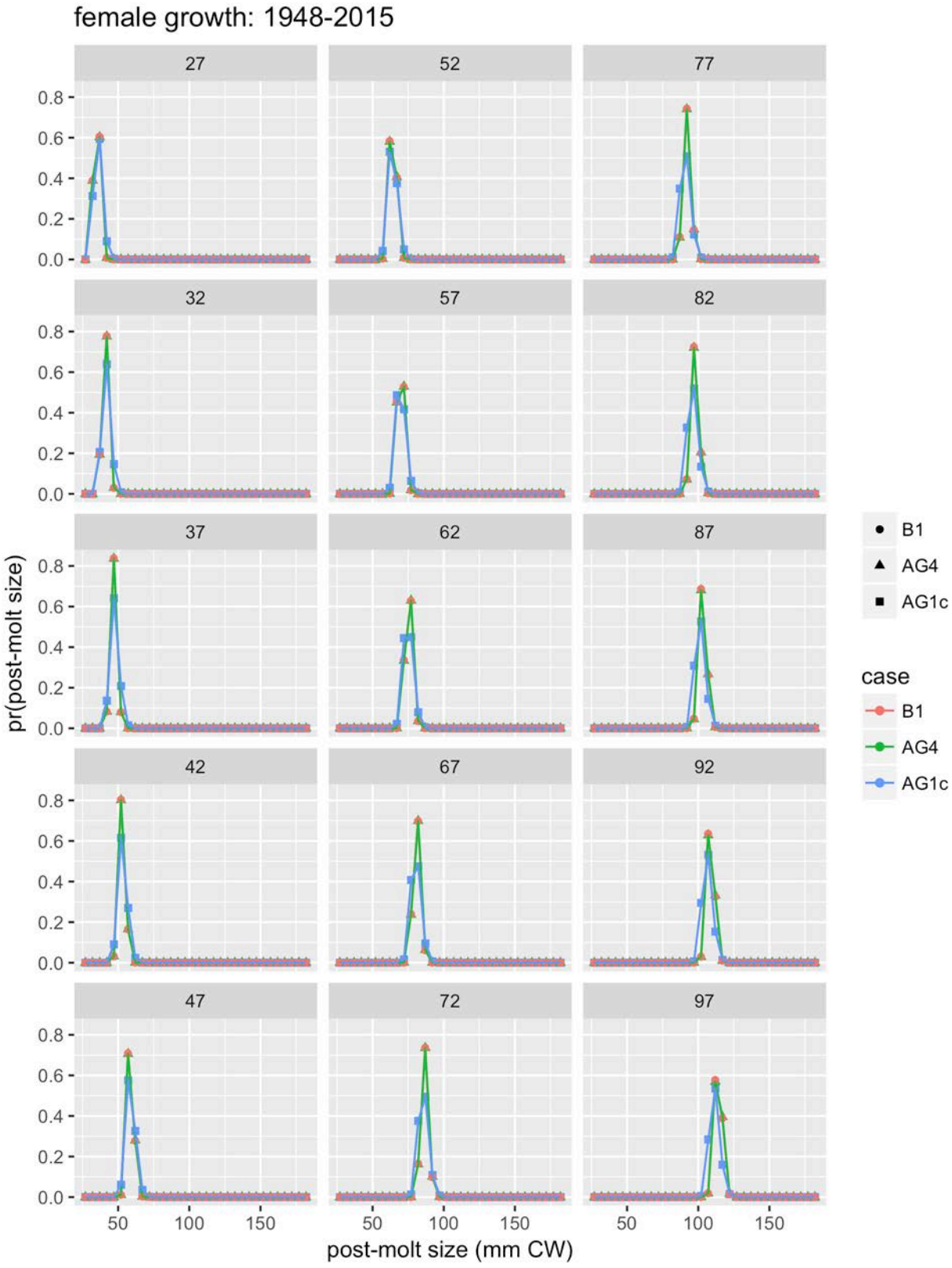


Figure 7. Growth matrices for females during 1948-2015, page 1.

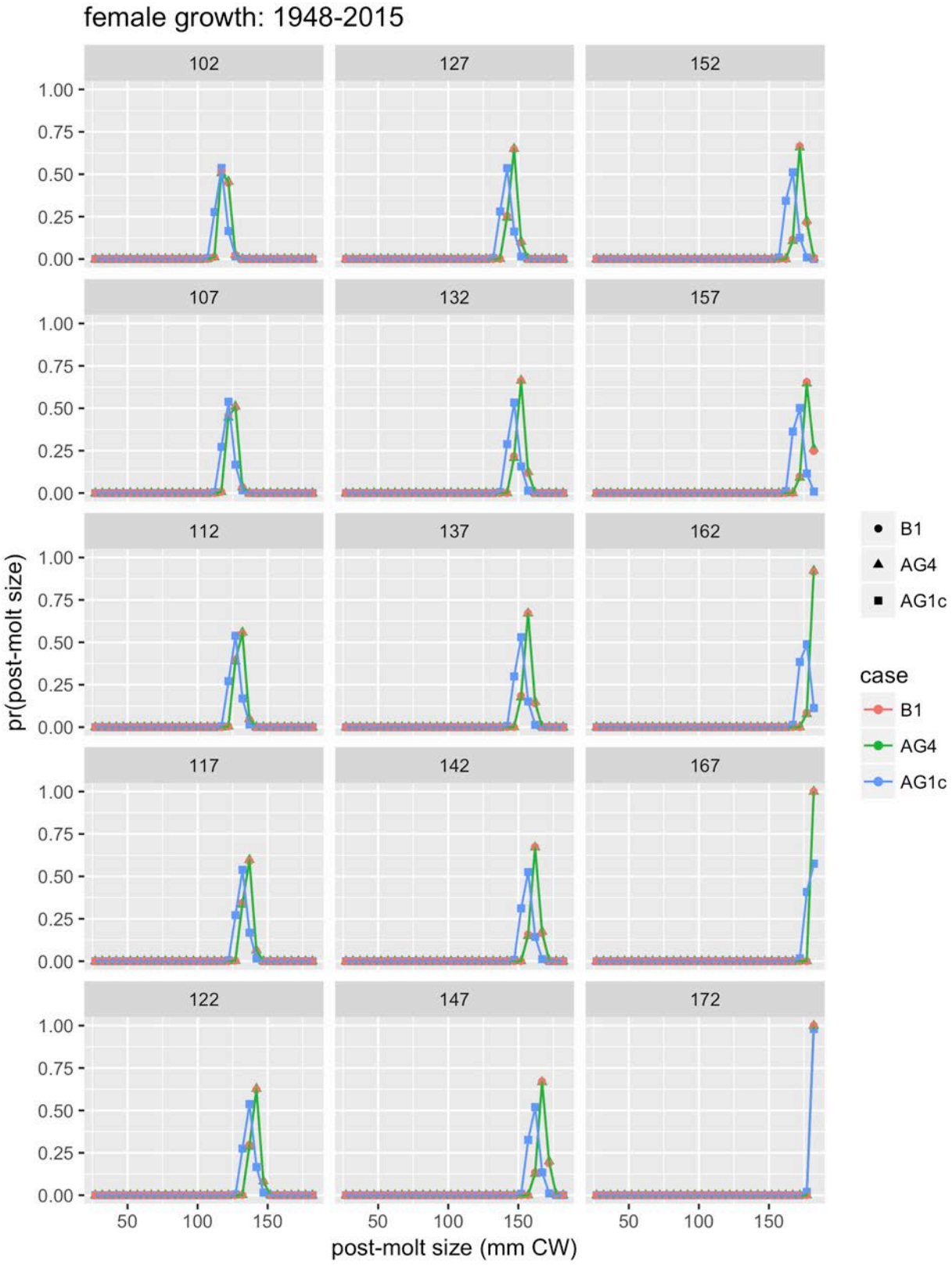


Figure 8. Growth matrices for females during 1948-2015, page 2.

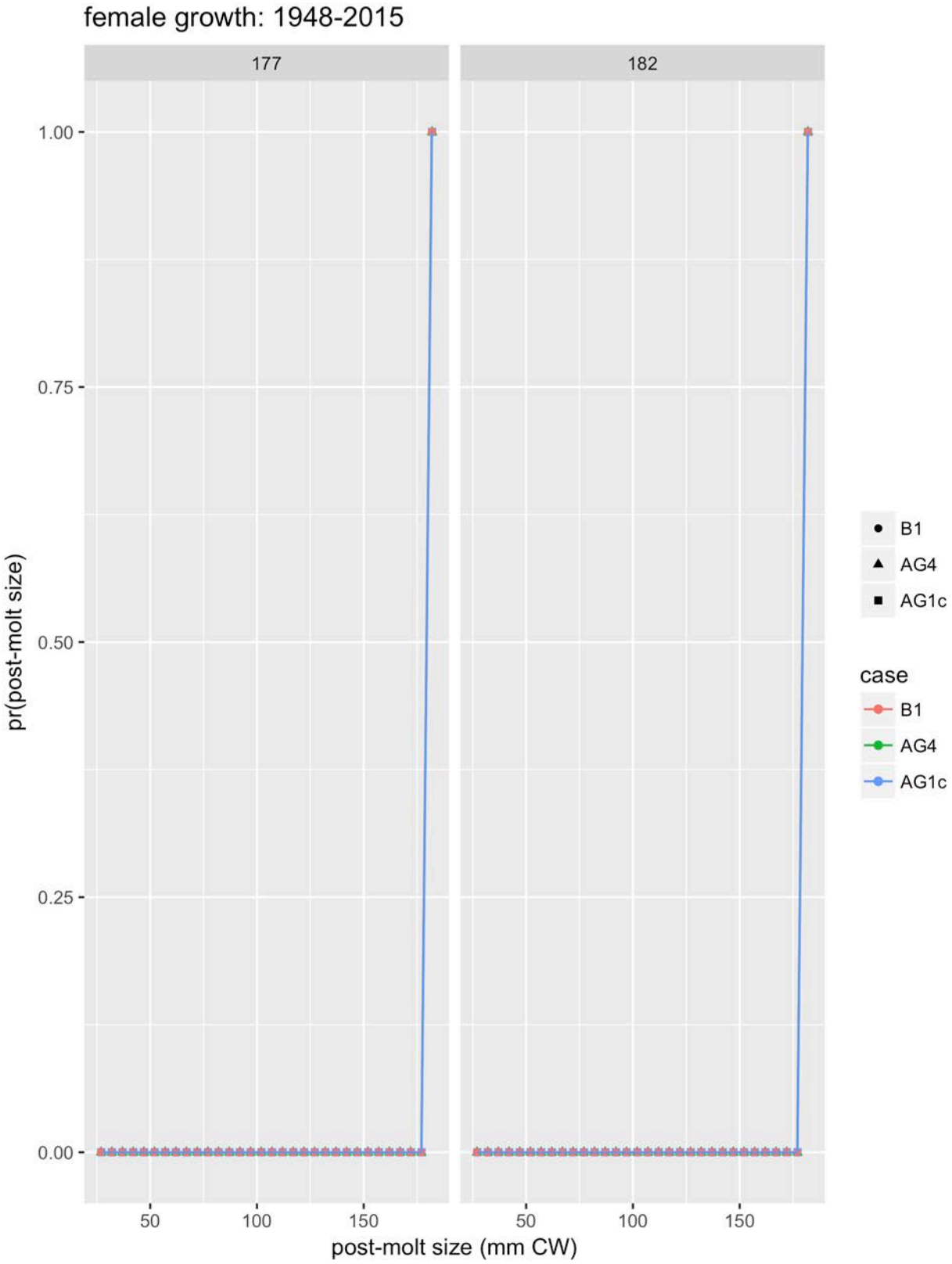


Figure 9. Growth matrices for females during 1948-2015, page 3.

Size distribution for recruits

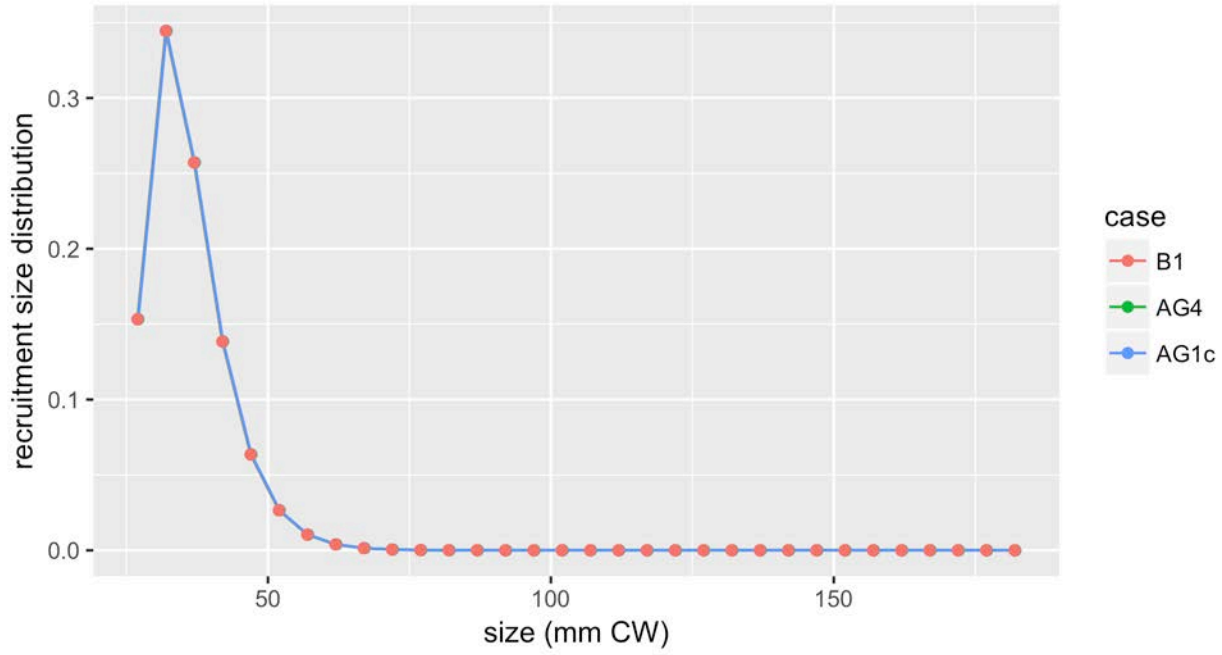


Figure 10. Size distribution for recruits.

Population results

Recruitment

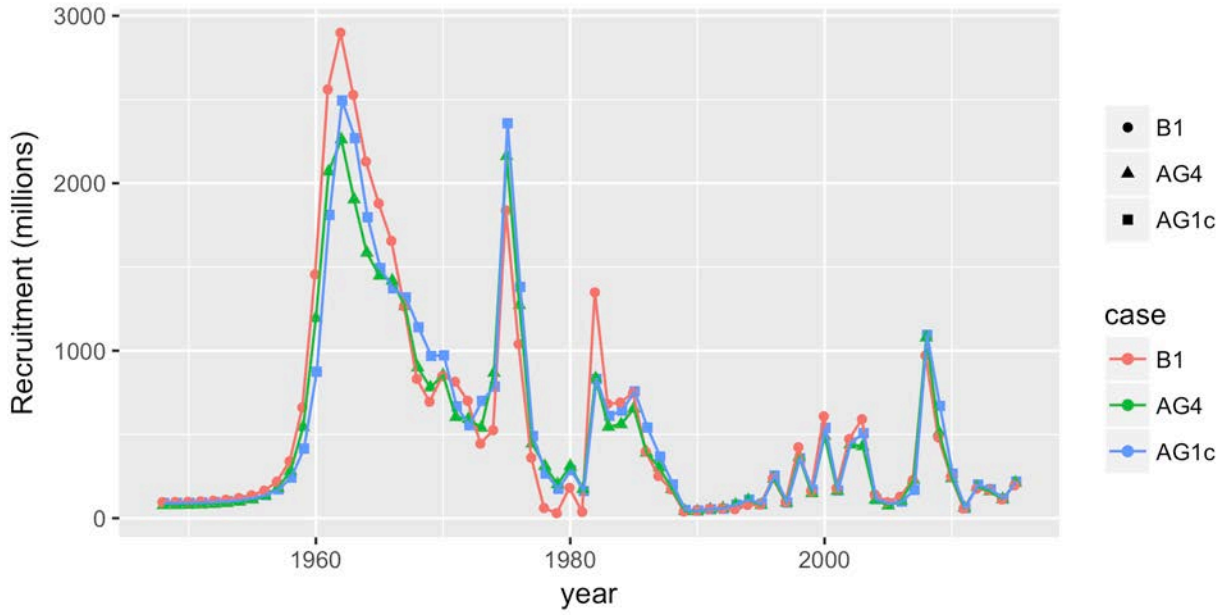


Figure 11. Estimated annual recruitment.

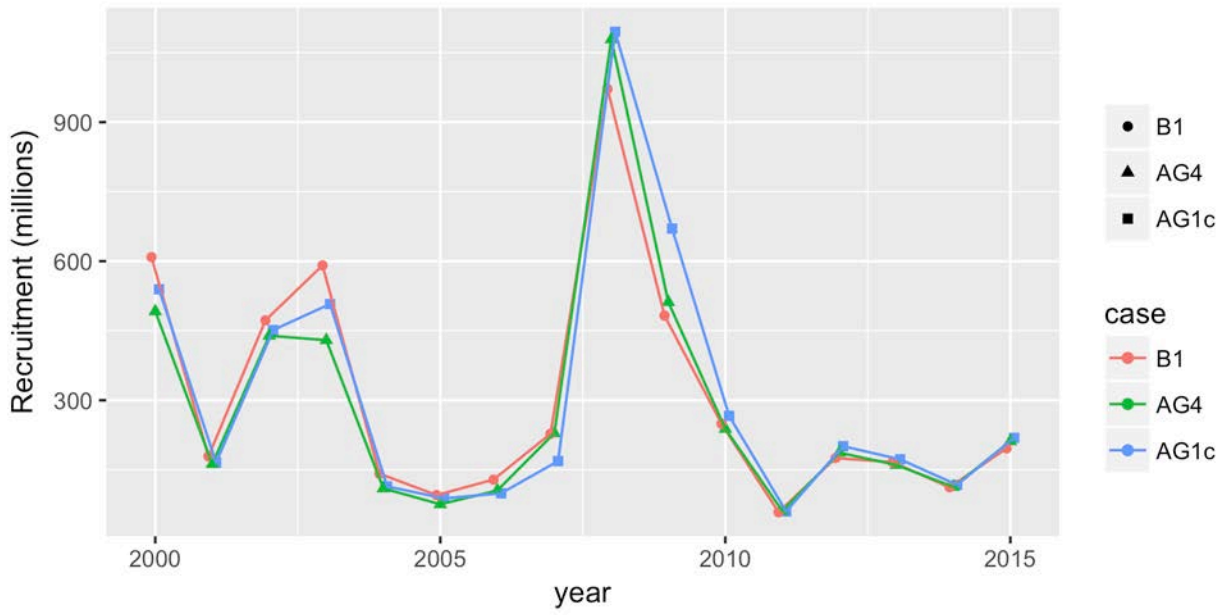


Figure 12. Estimated recent recruitment.

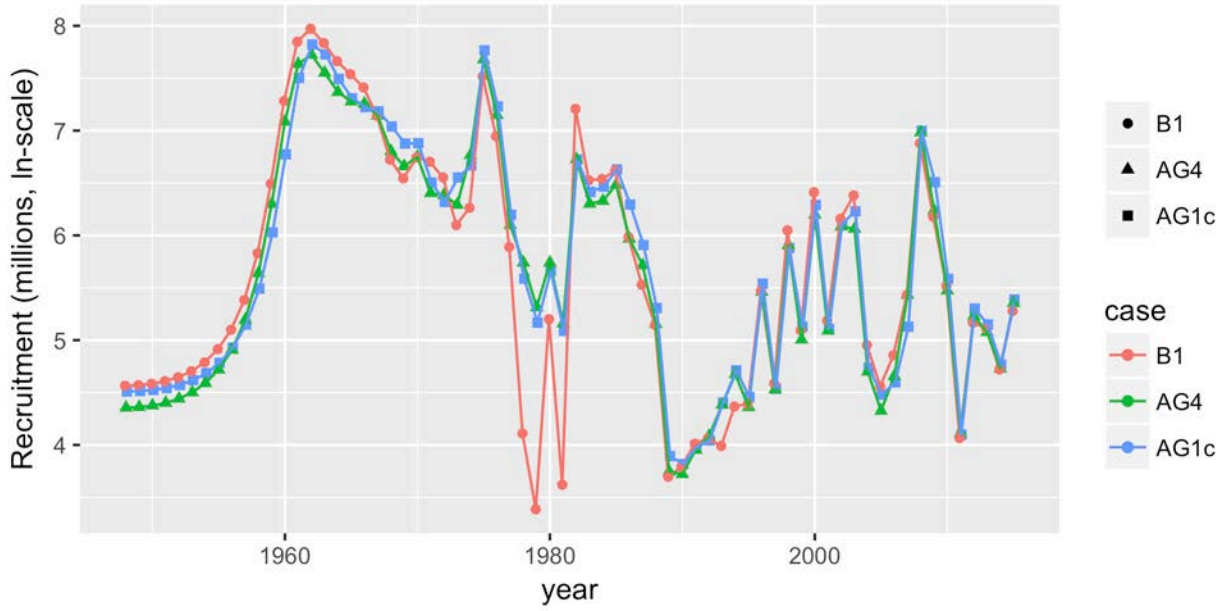


Figure 13. Estimated annual recruitment, on ln-scale.

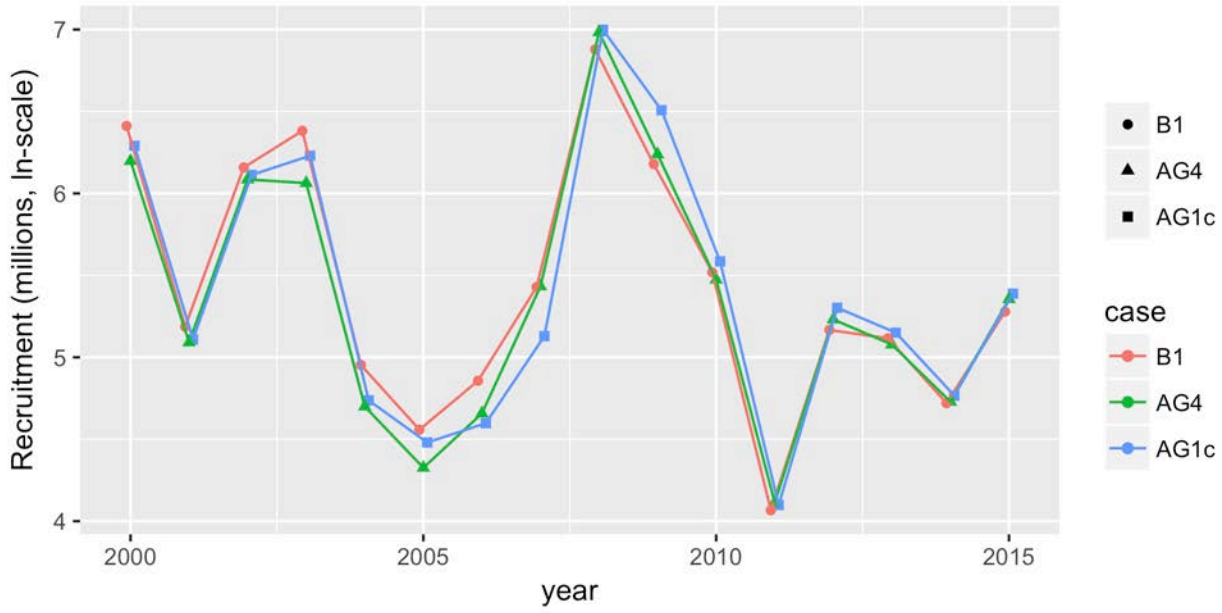


Figure 14. Estimated recent recruitment, on ln-scale.

Mature biomass

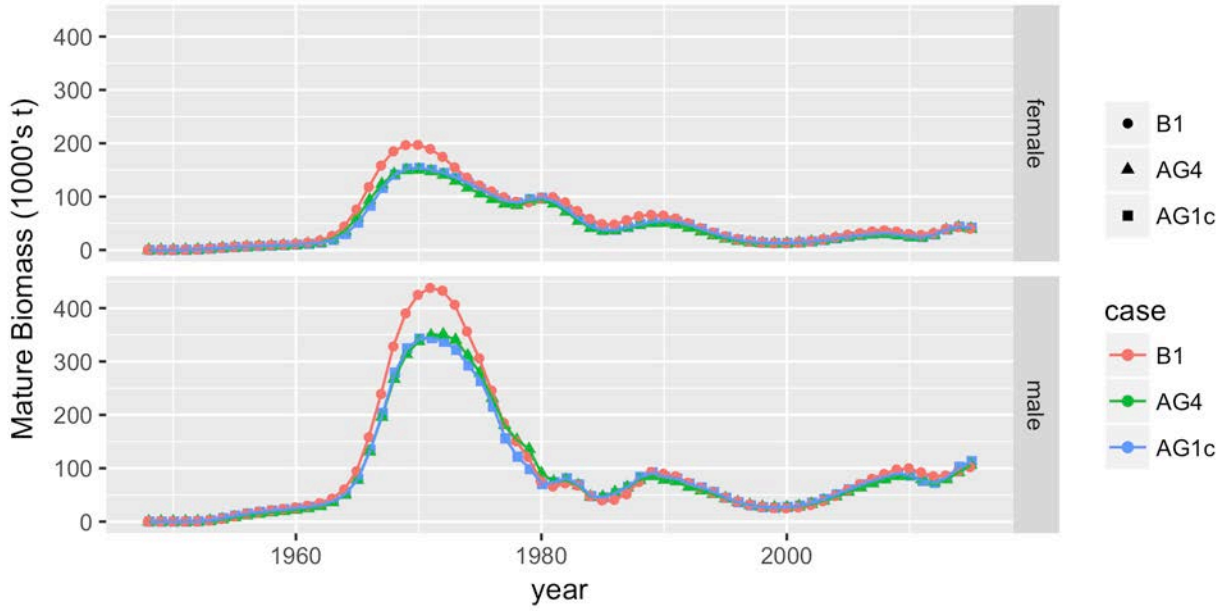


Figure 15. Estimated annual mature biomass.

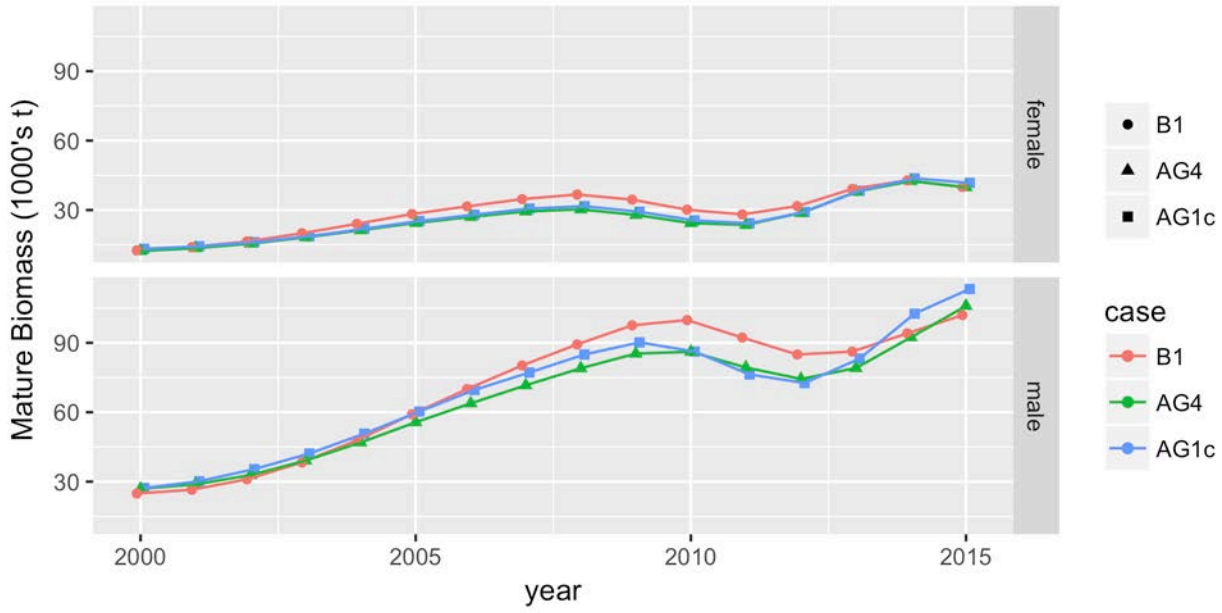


Figure 16. Estimated recent mature biomass.

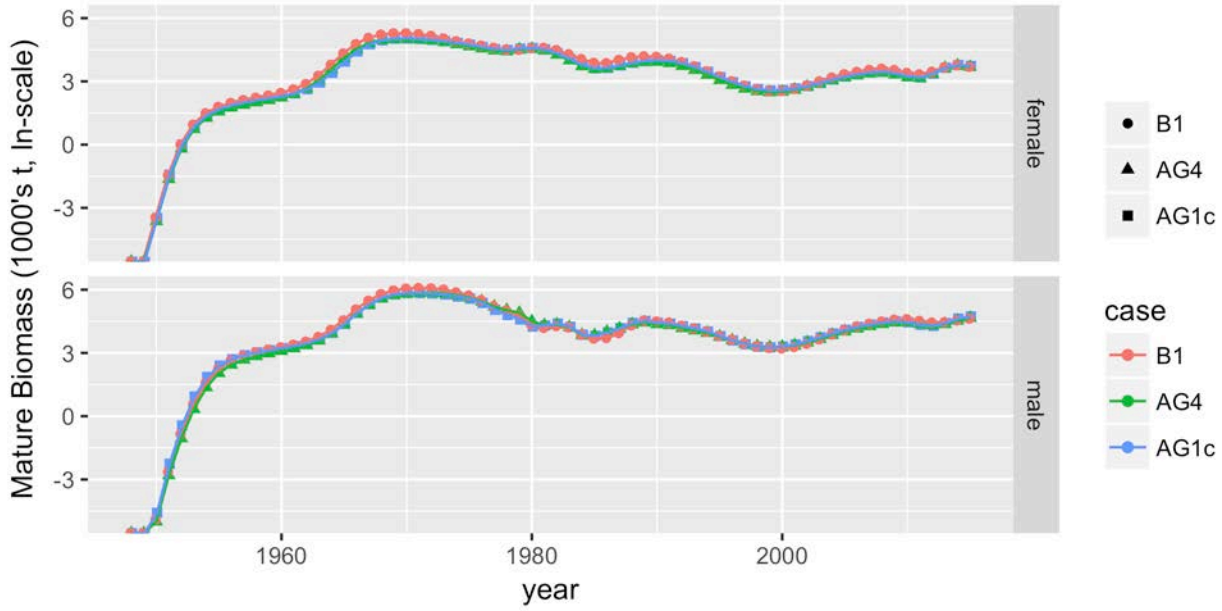


Figure 17. Estimated annual mature biomass, on ln-scale.

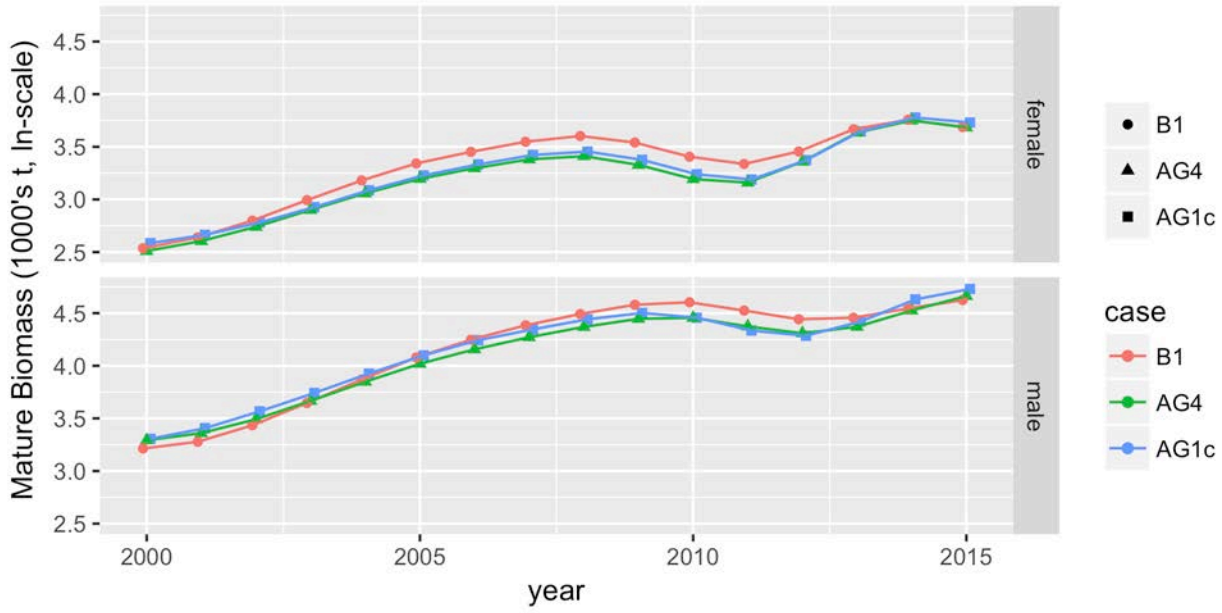


Figure 18. Estimated recent mature biomass, on ln-scale.

Population abundance

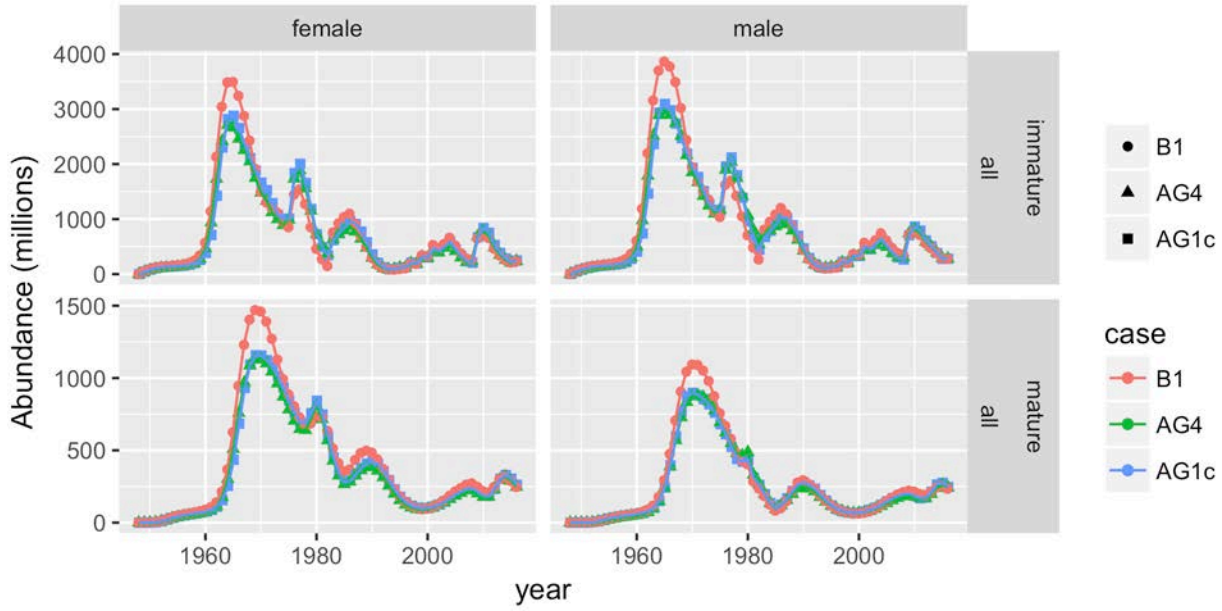


Figure 19. Population abundance trends.

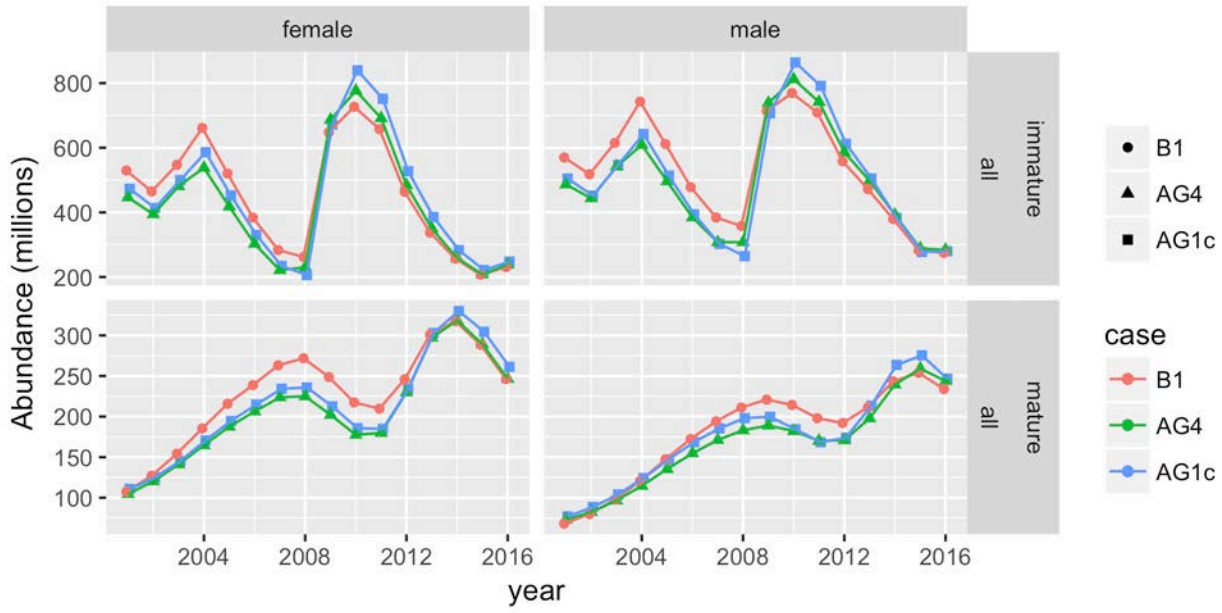


Figure 20. Recent population abundance trends.

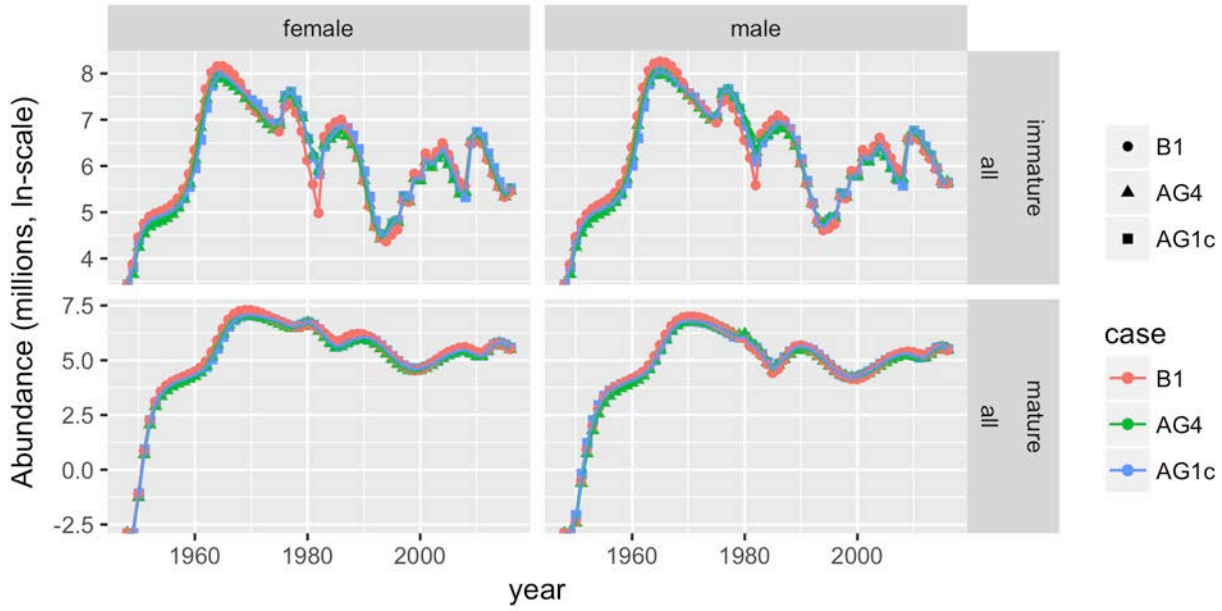


Figure 21. Ln-scale population abundance trends.

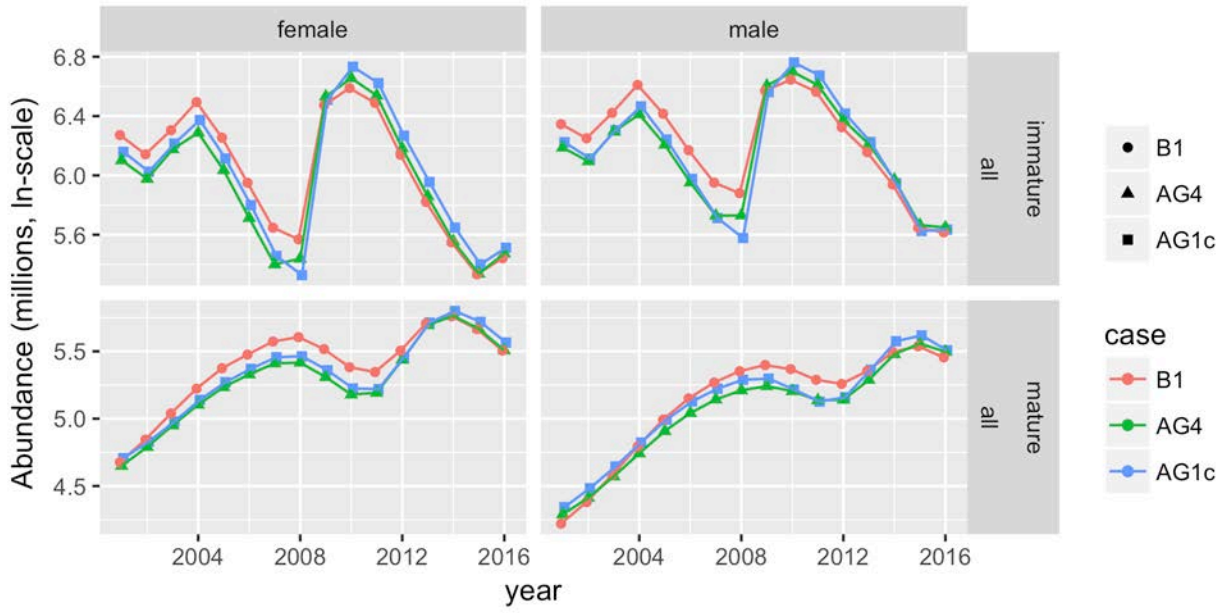


Figure 22. Recent ln-scale population abundance trends.

Biomass

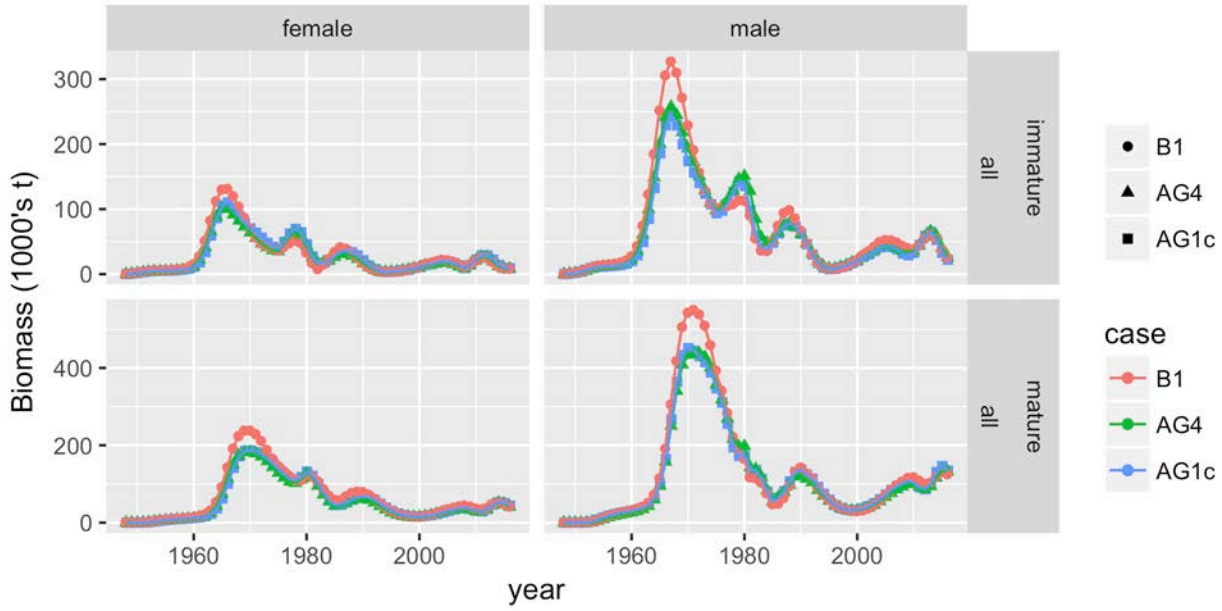


Figure 23. Population biomass trends.

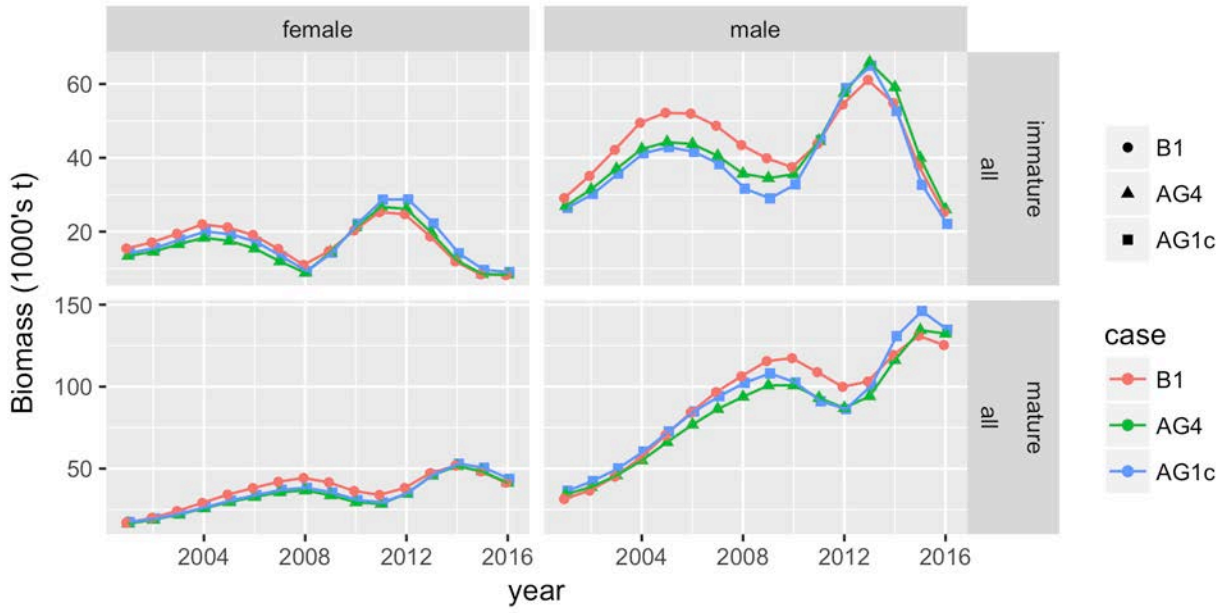


Figure 24. Recent population biomass trends.

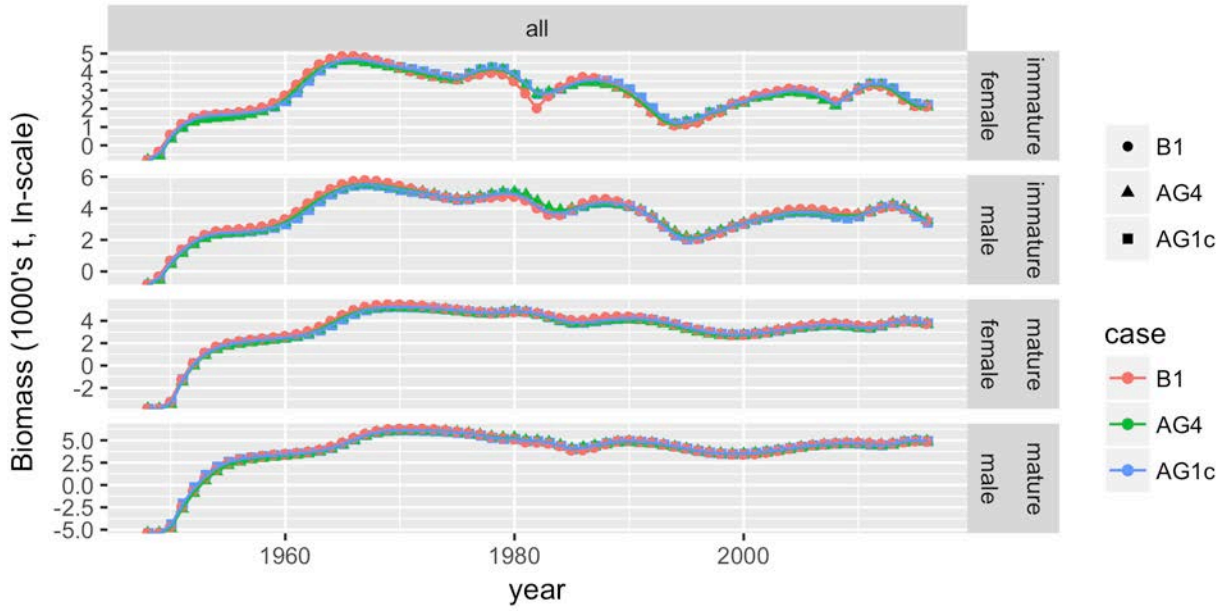


Figure 25. Ln-scale population biomass trends.

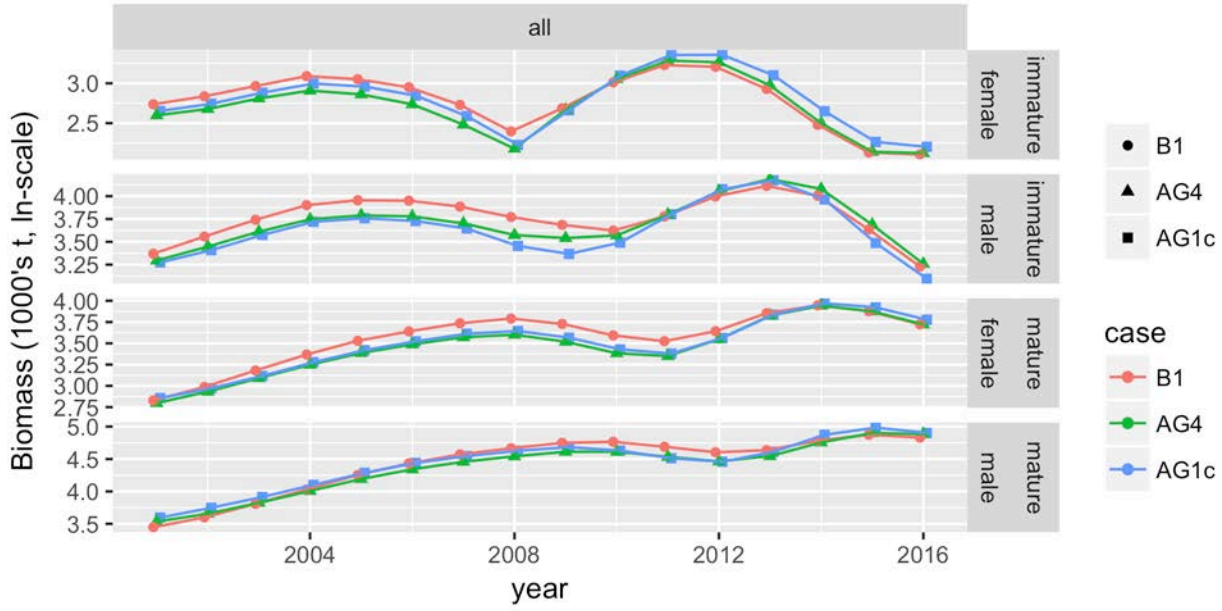


Figure 26. Recent ln-scale population biomass trends.

Surveys

Survey catchability

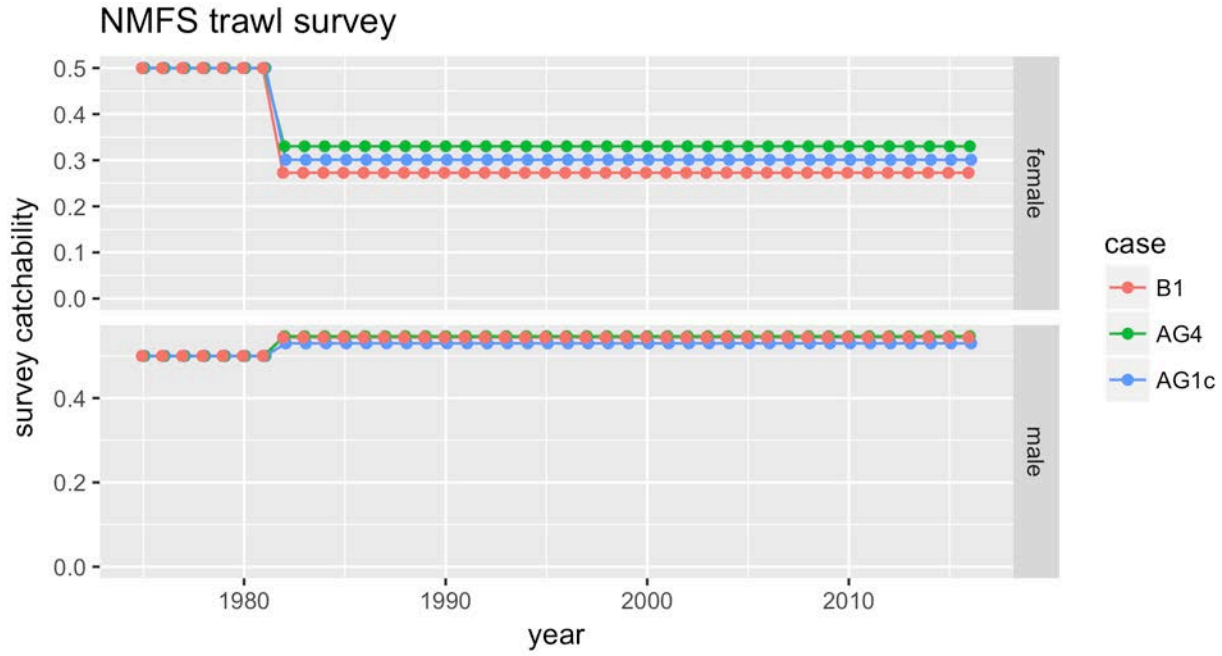
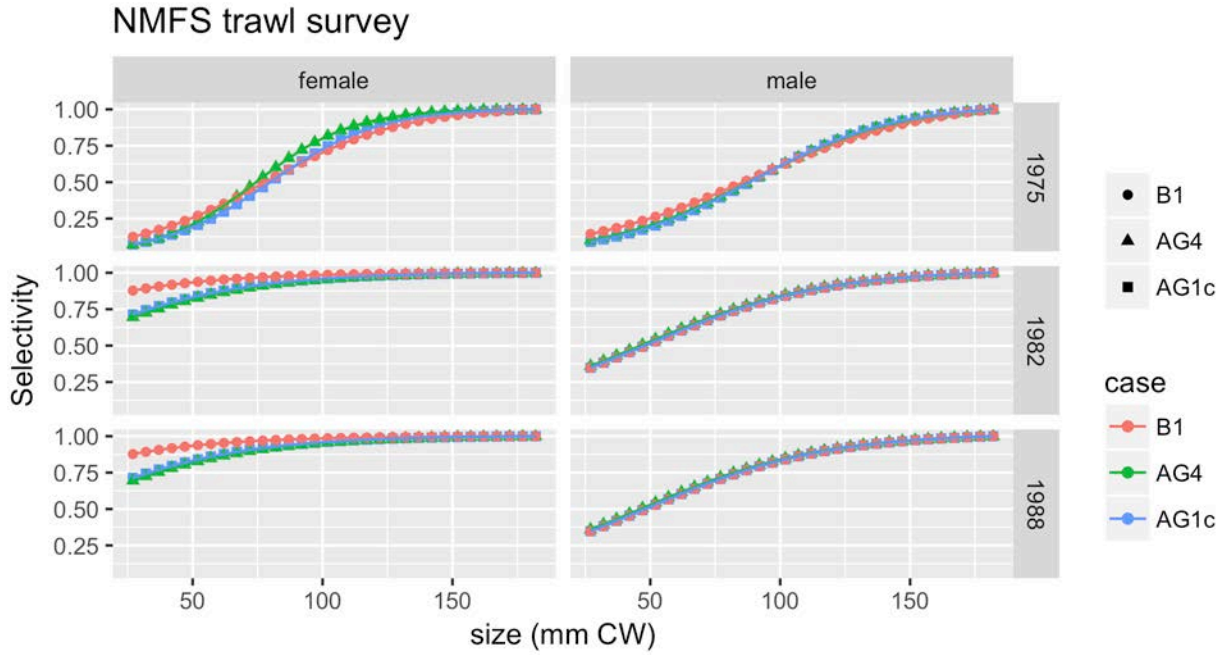


Figure 27. Survey catchabilities for NMFS trawl survey.

Survey selectivity functions



NMFS trawl survey.1

Survey abundance

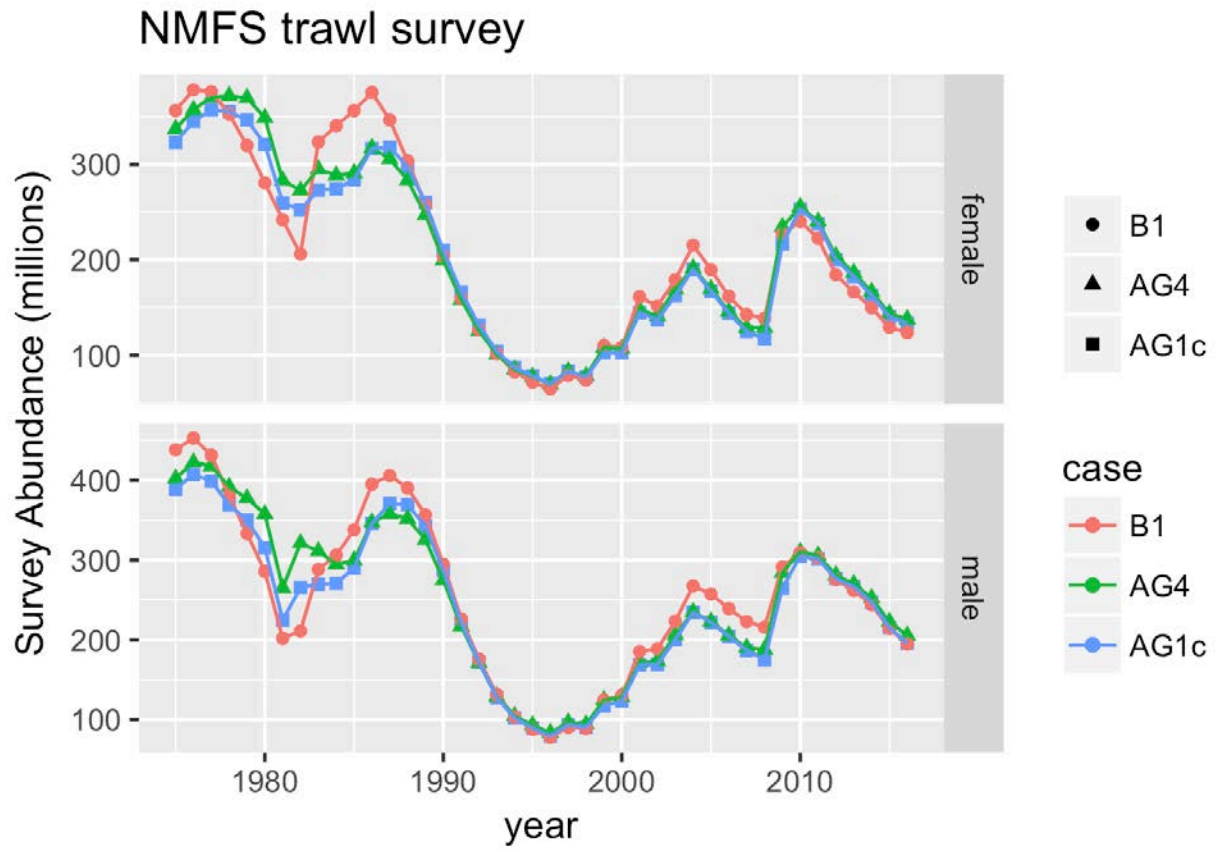


Figure 29. NMFS trawl survey catch abundance.

Survey biomass

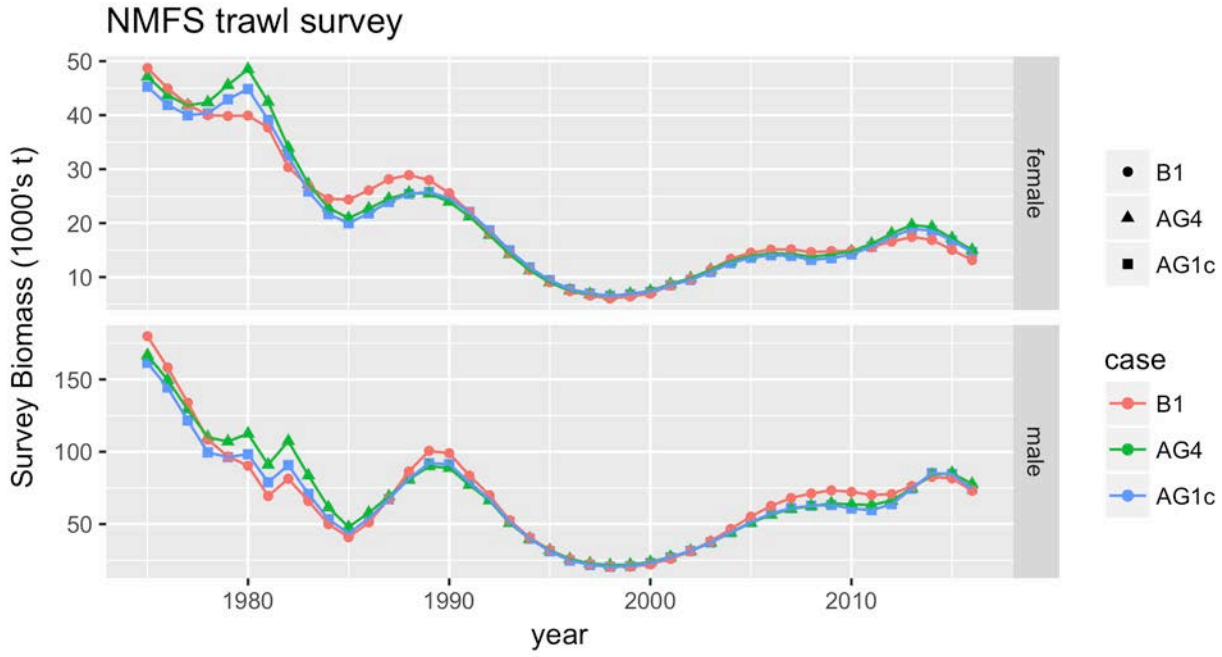


Figure 30. NMFS trawl survey catch biomass.

Survey size compositions

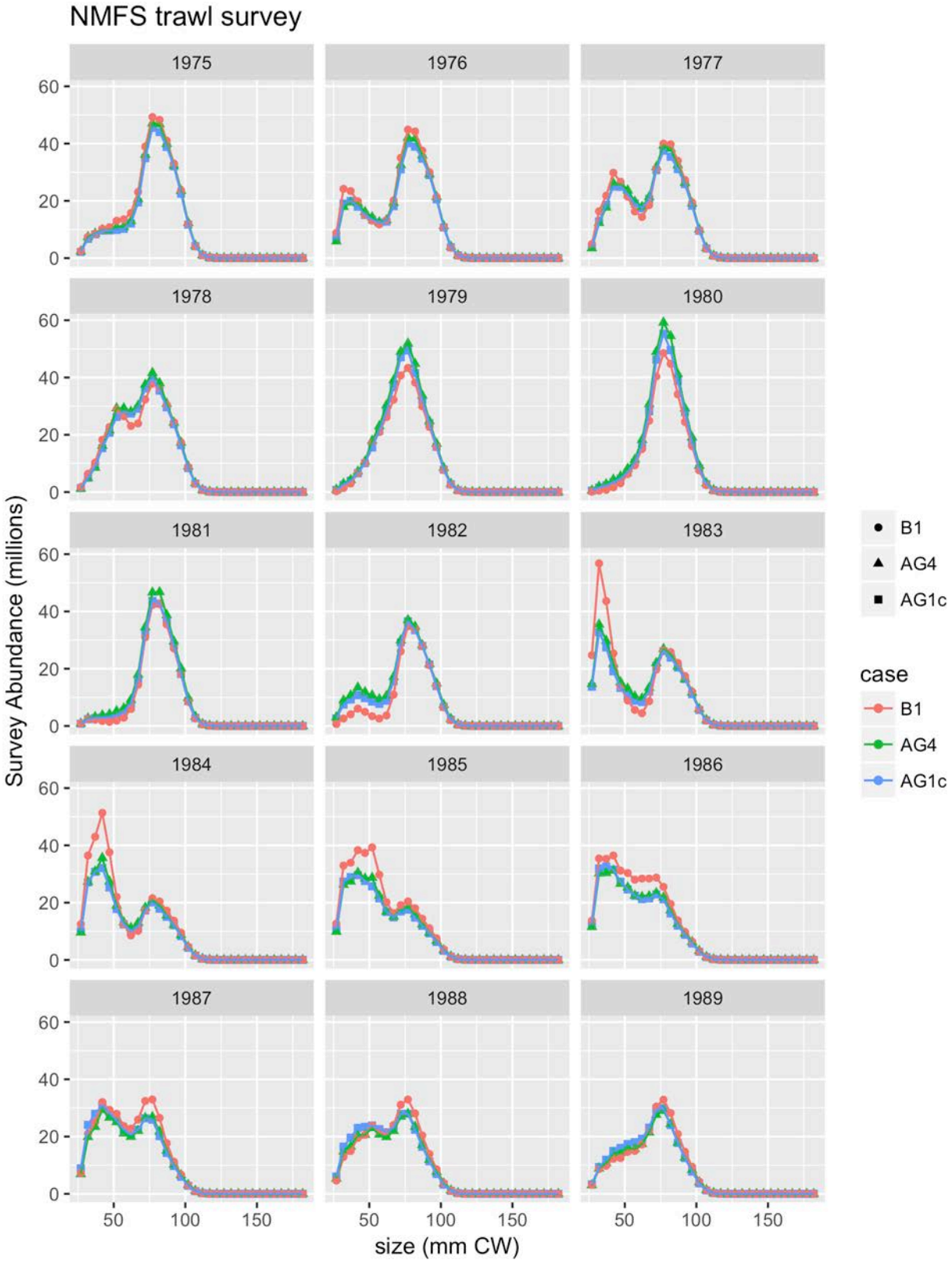


Figure 31. NMFS trawl survey catch abundance for female all all, (1 of 3).

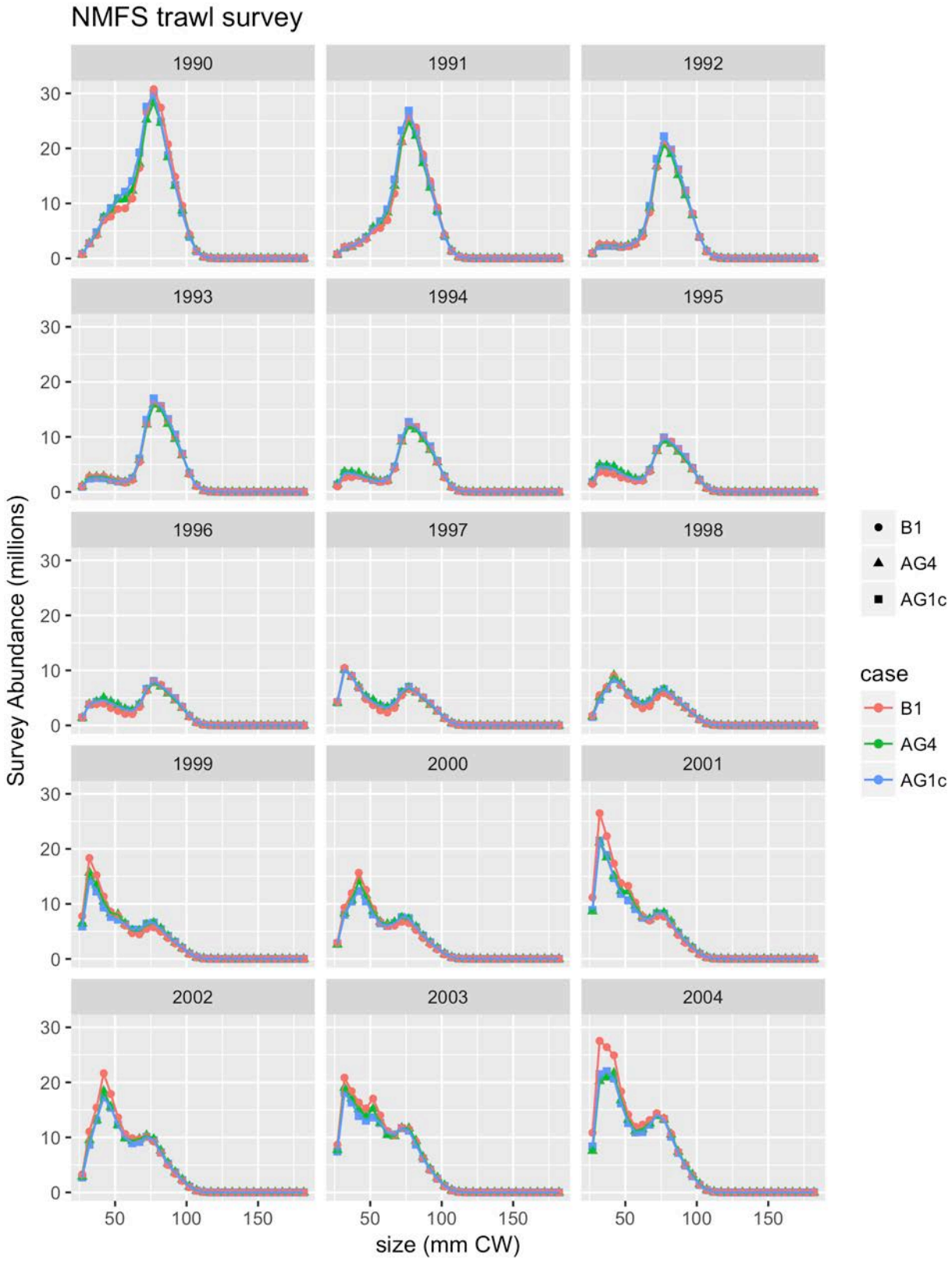


Figure 32. NMFS trawl survey catch abundance for female all all, (2 of 3).

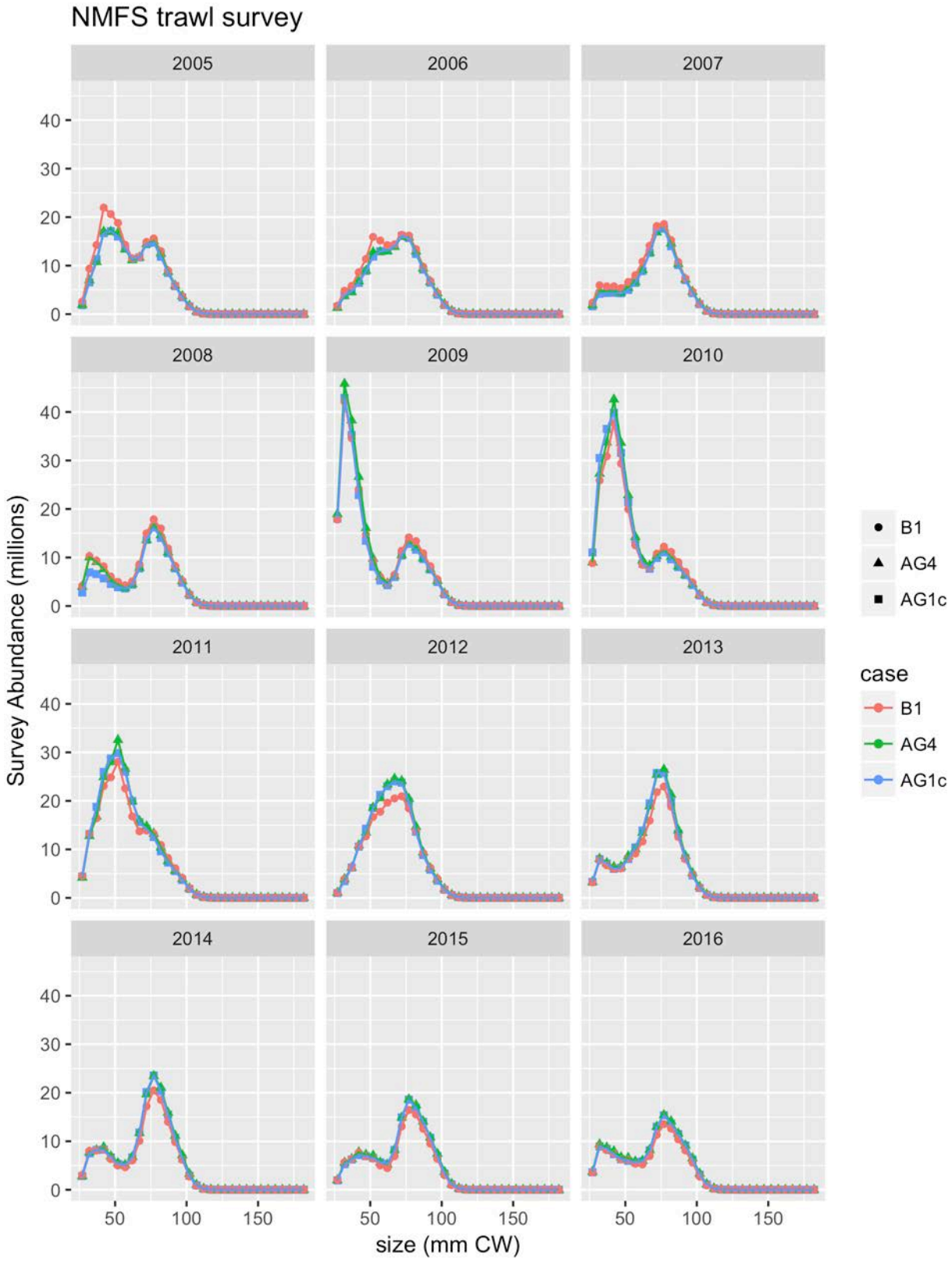


Figure 33. NMFS trawl survey catch abundance for female all all, (3 of 3).

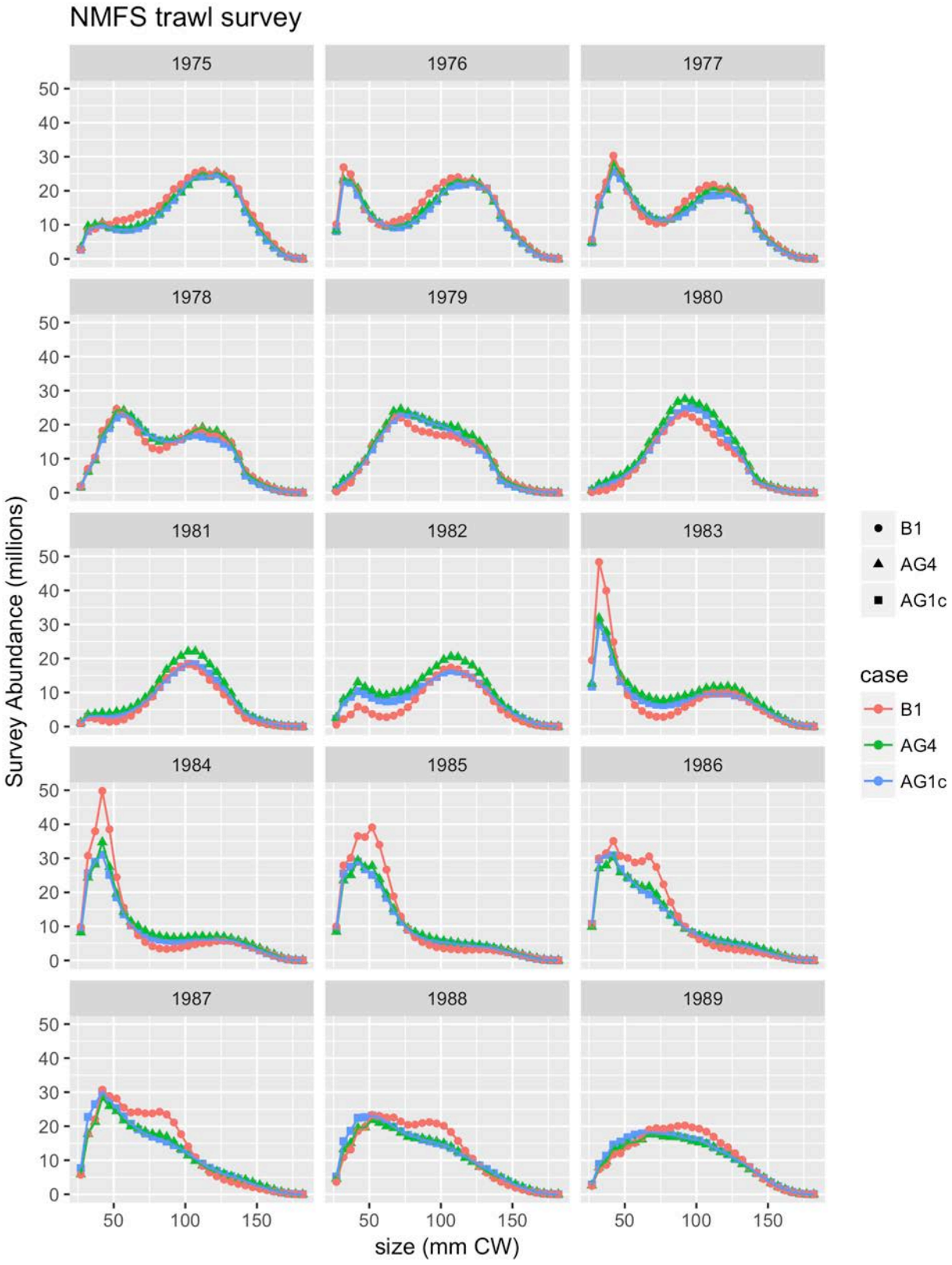


Figure 34. NMFS trawl survey catch abundance for male all all, (1 of 3).

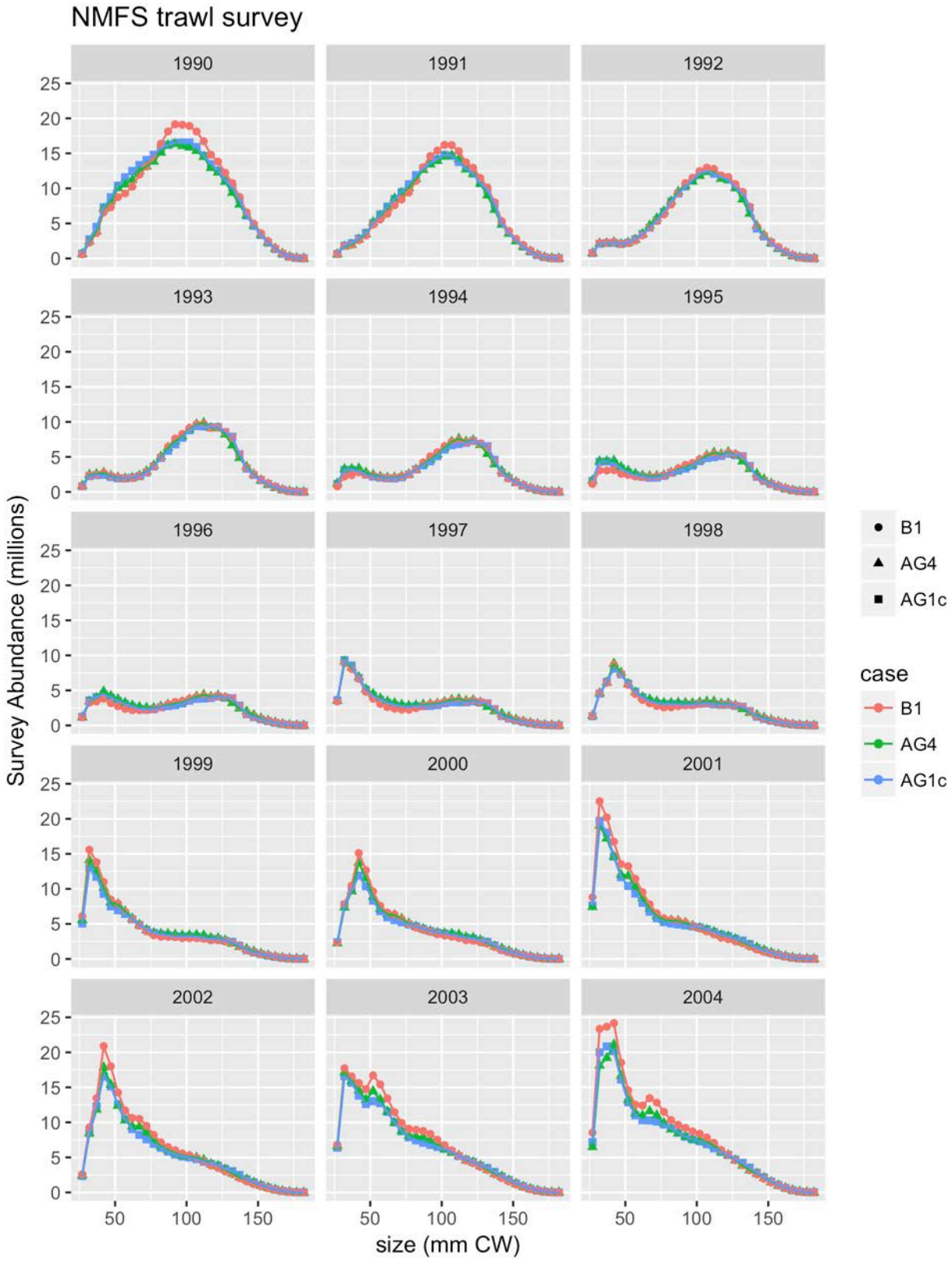


Figure 35. NMFS trawl survey catch abundance for male all all, (2 of 3).

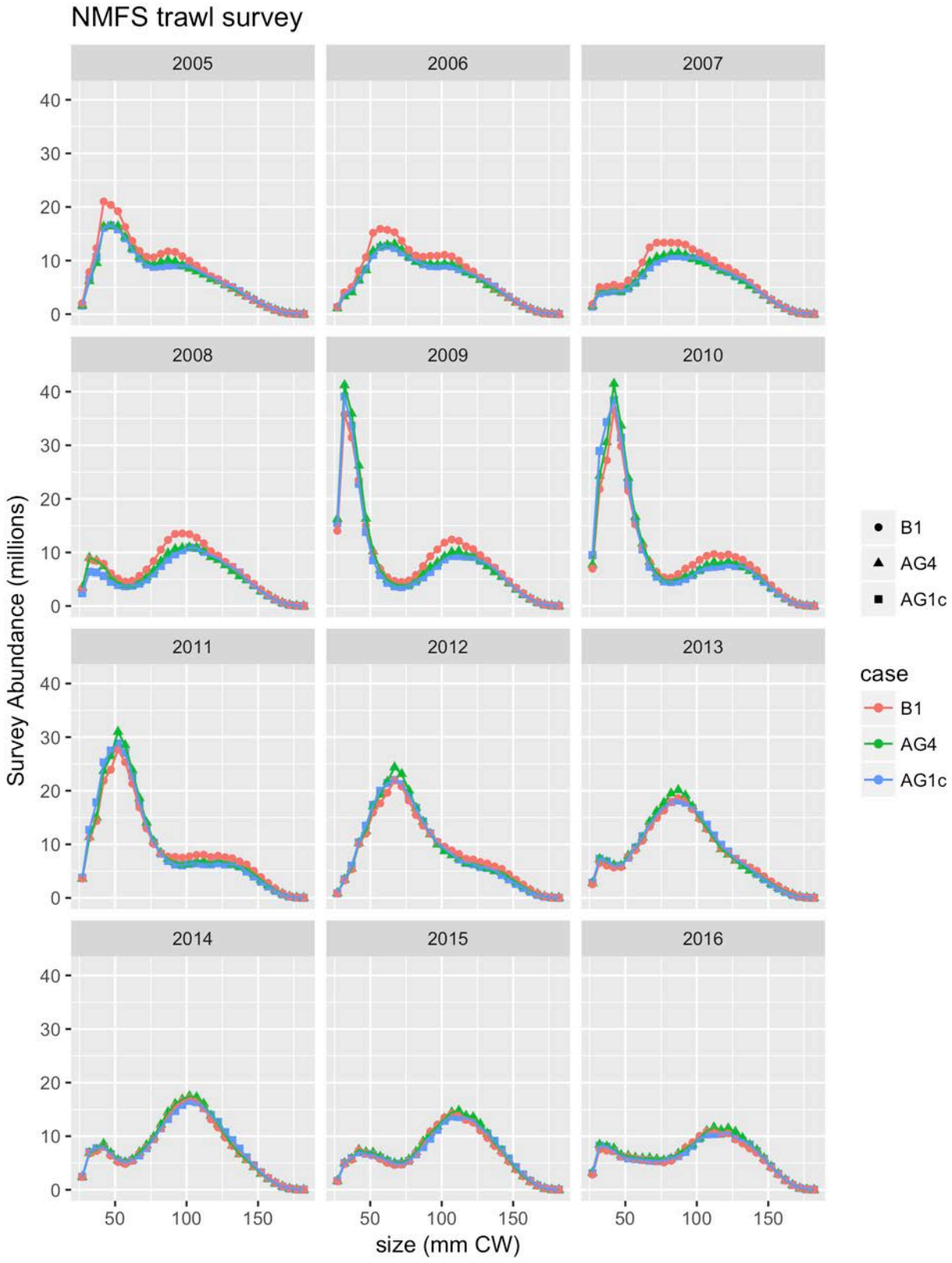


Figure 36. NMFS trawl survey catch abundance for male all all, (3 of 3).

Fisheries

Fishery catchability

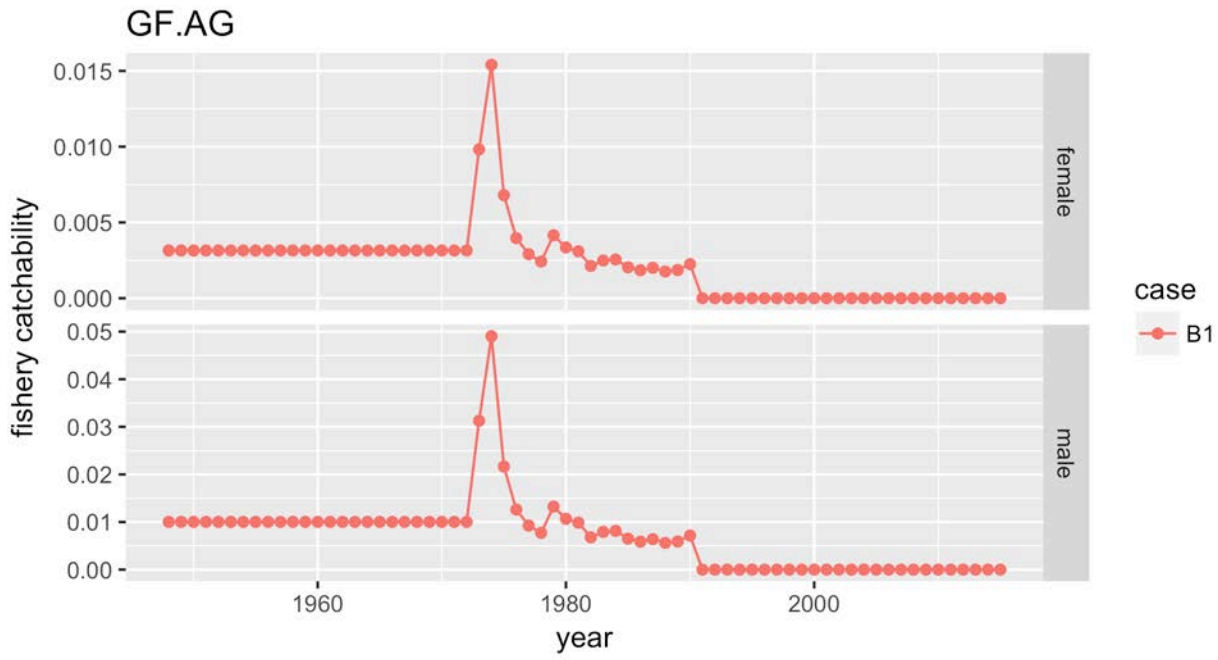


Figure 37. Fishery catchabilities for GF.AG.

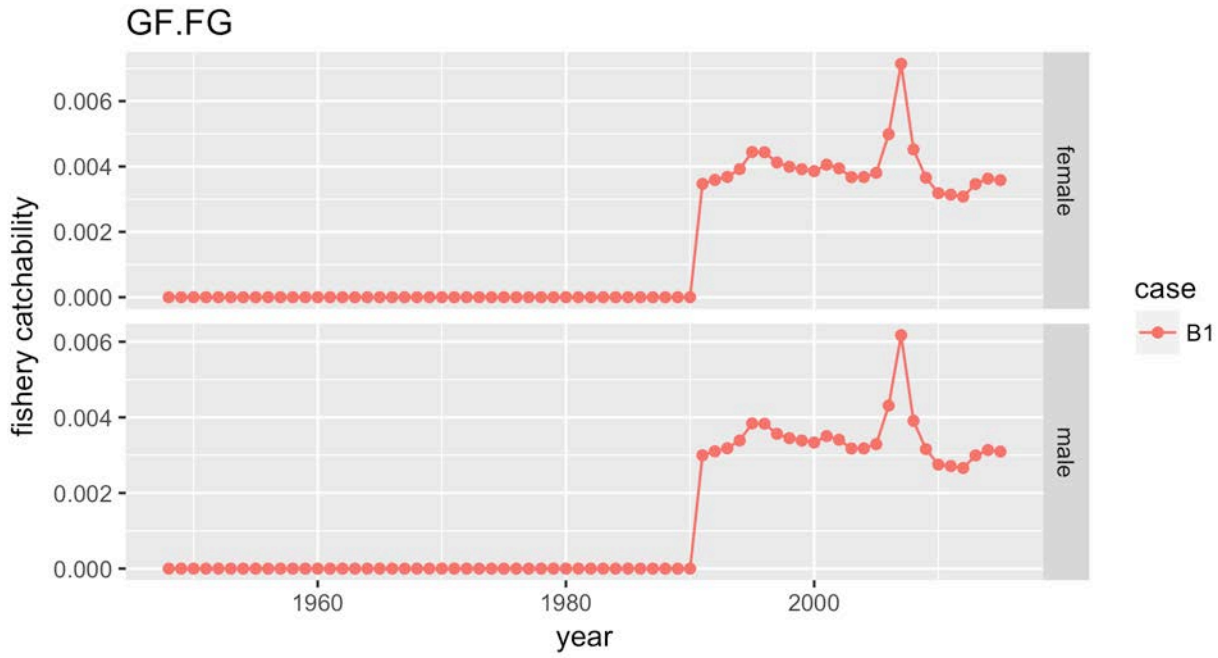


Figure 38. Fishery catchabilities for GF.FG.

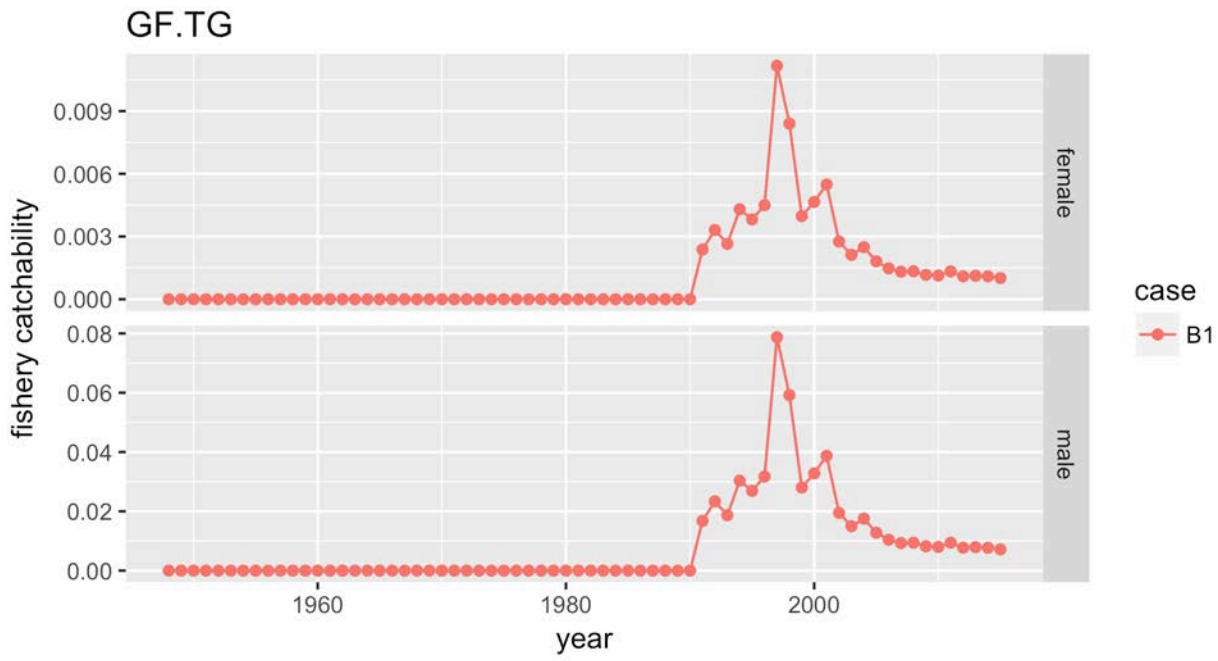


Figure 39. Fishery catchabilities for GF.TG.

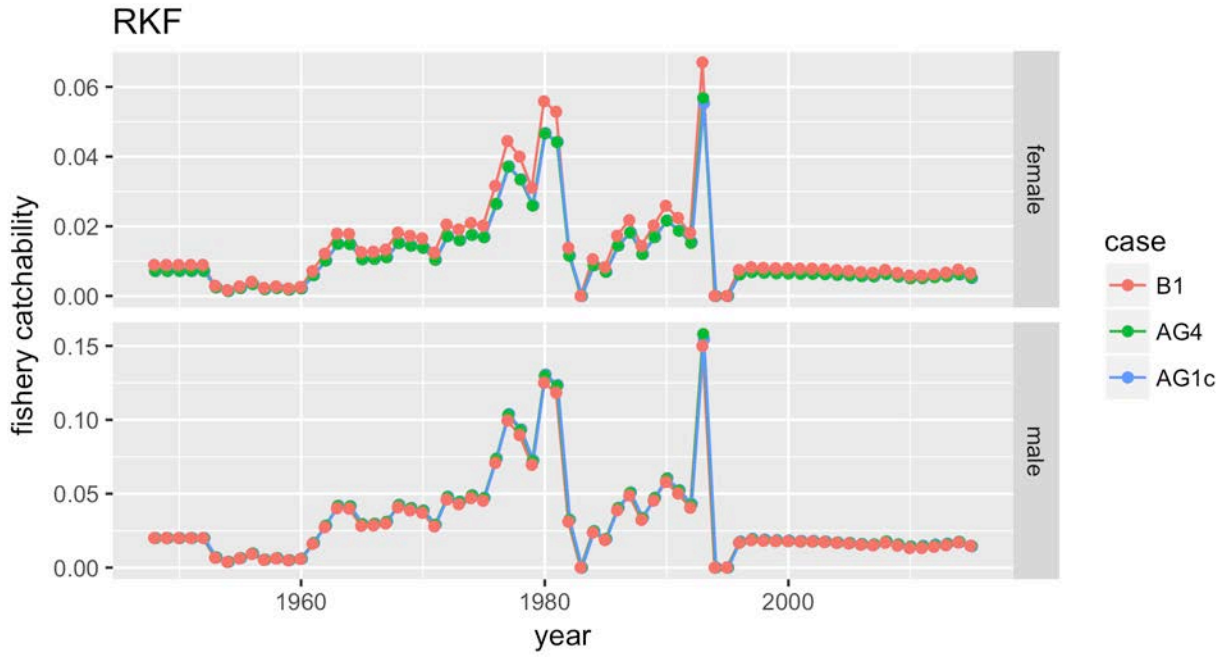


Figure 40. Fishery catchabilities for RKF.

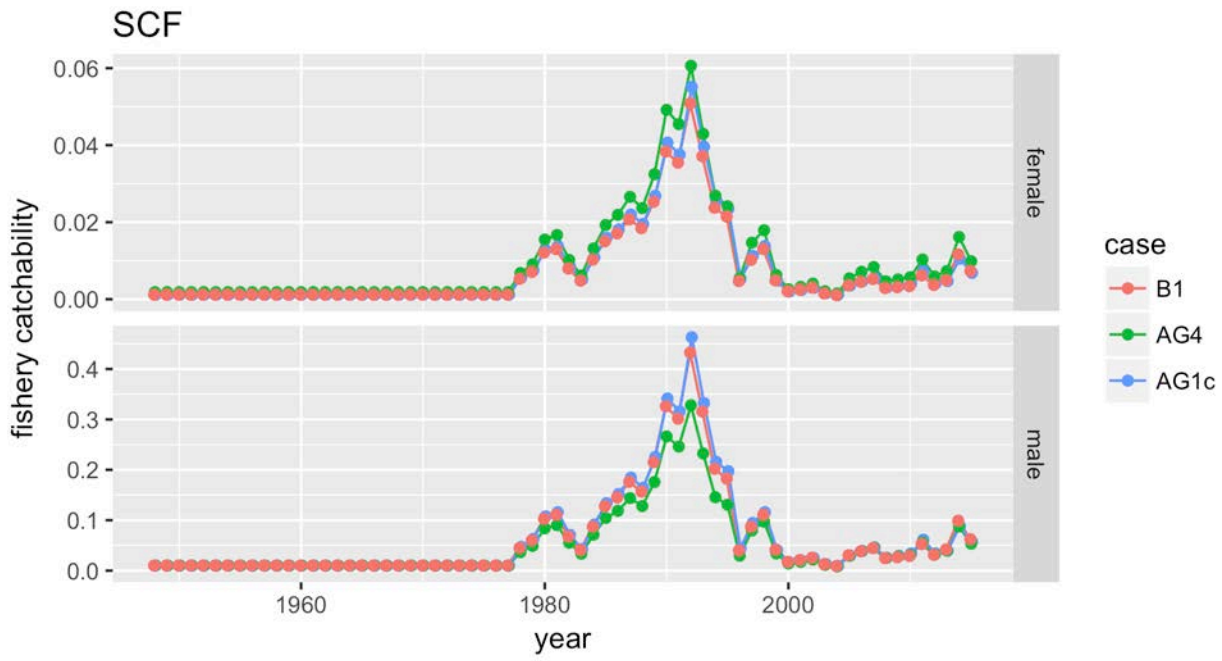


Figure 41. Fishery catchabilities for SCF.

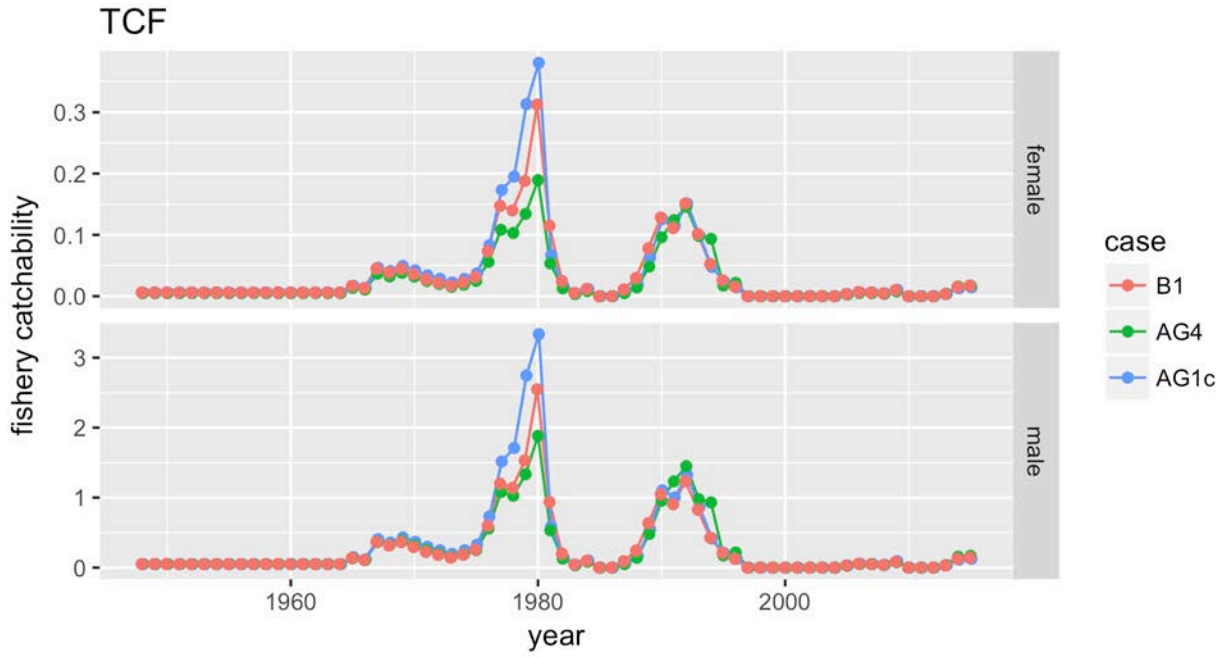


Figure 42. Fishery catchabilities for TCF.

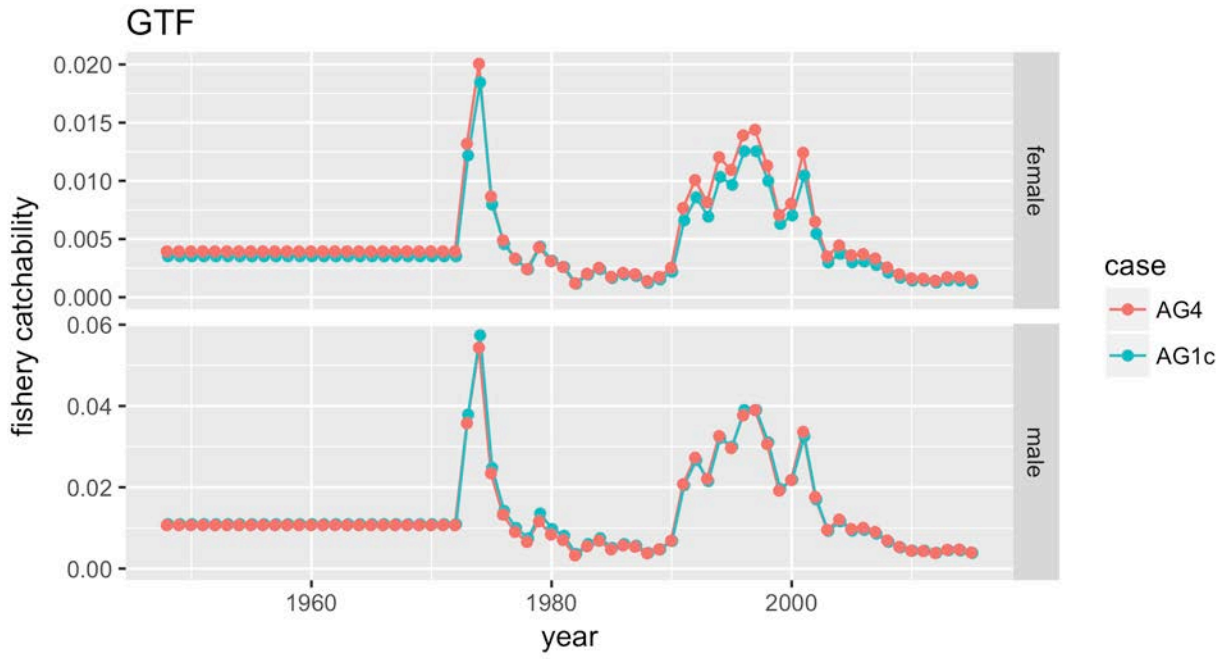


Figure 43. Fishery catchabilities for GTF.

Total selectivity functions

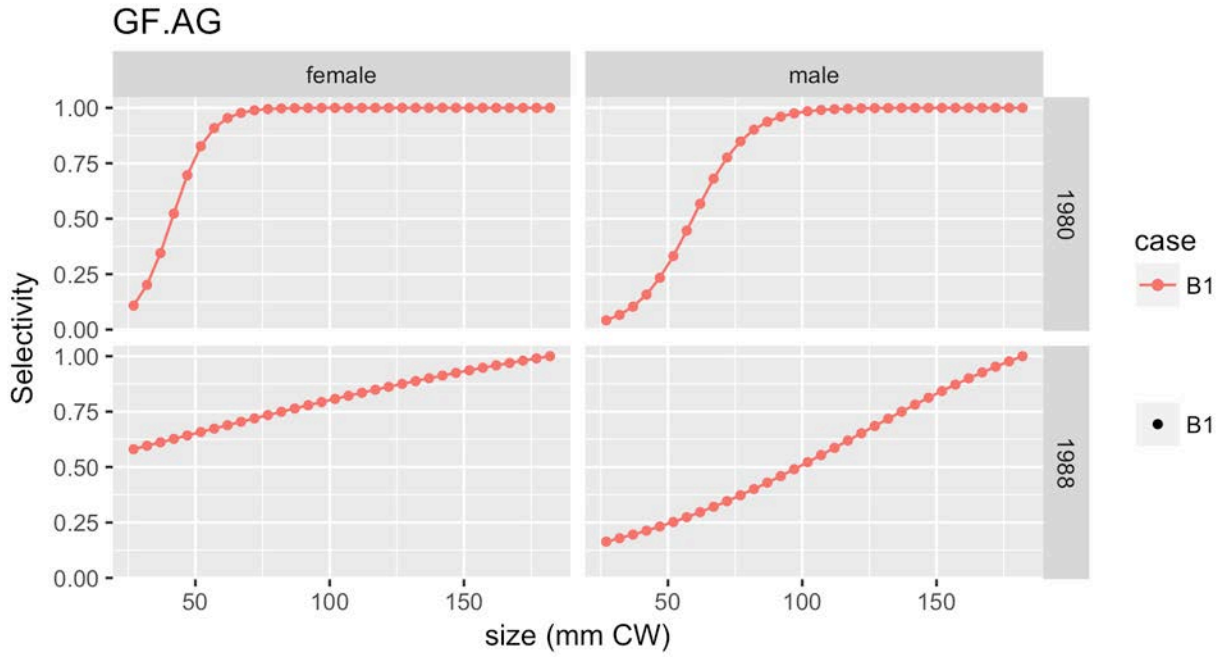


Figure 44. Selectivity functions for GF.AG(1 of 1).

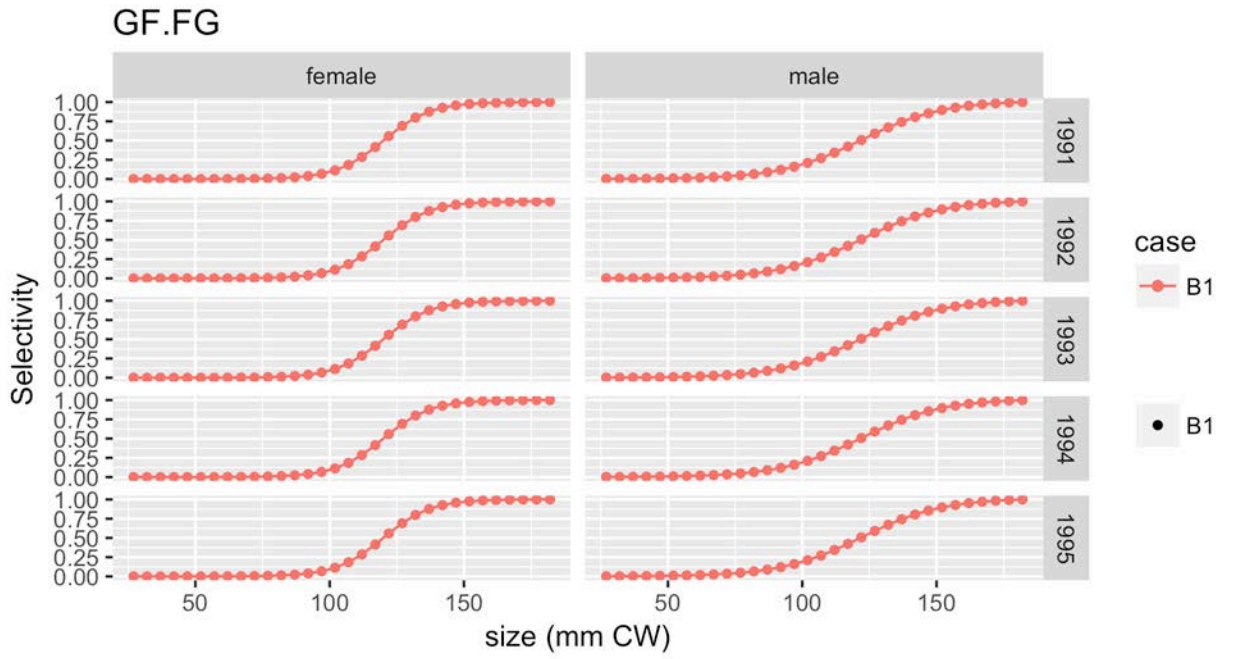


Figure 45. Selectivity functions for GF.FG(1 of 5).

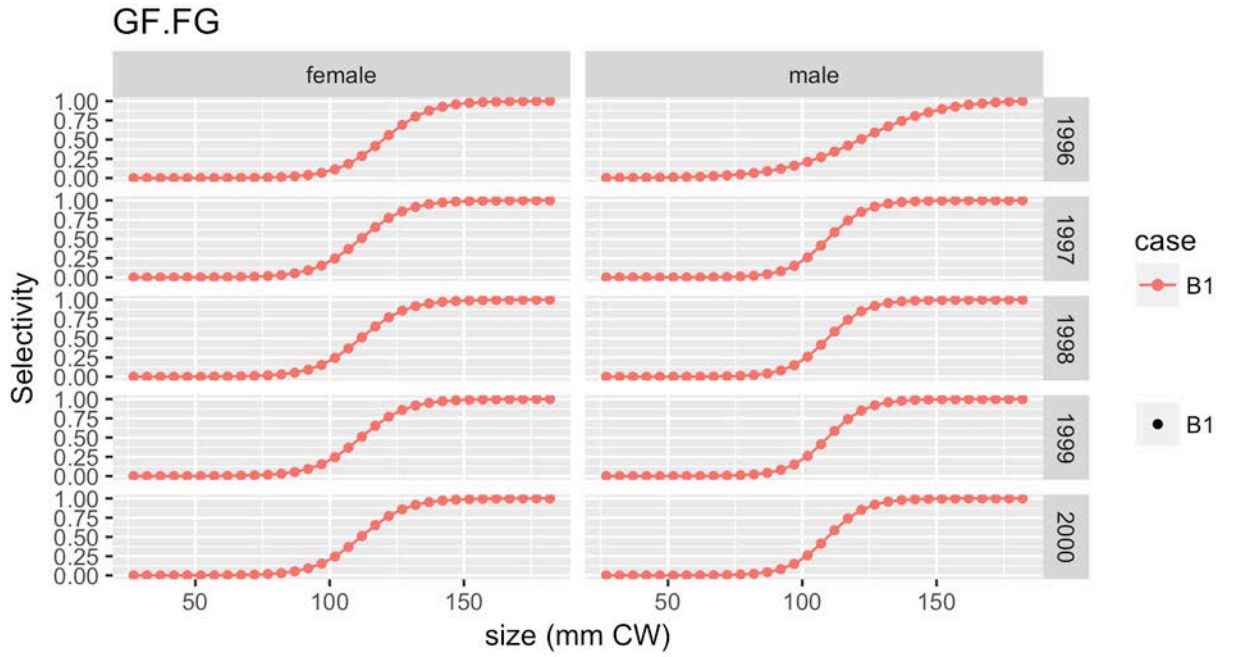


Figure 46. Selectivity functions for GF.FG(2 of 5).

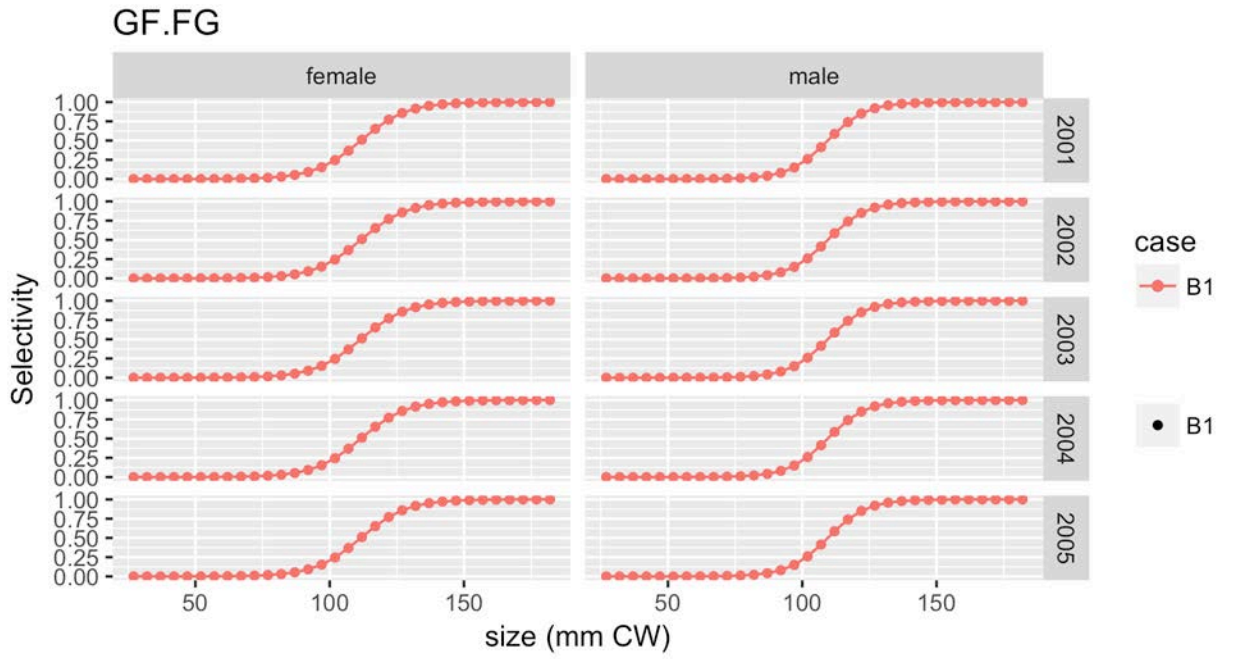


Figure 47. Selectivity functions for GF.FG(3 of 5).

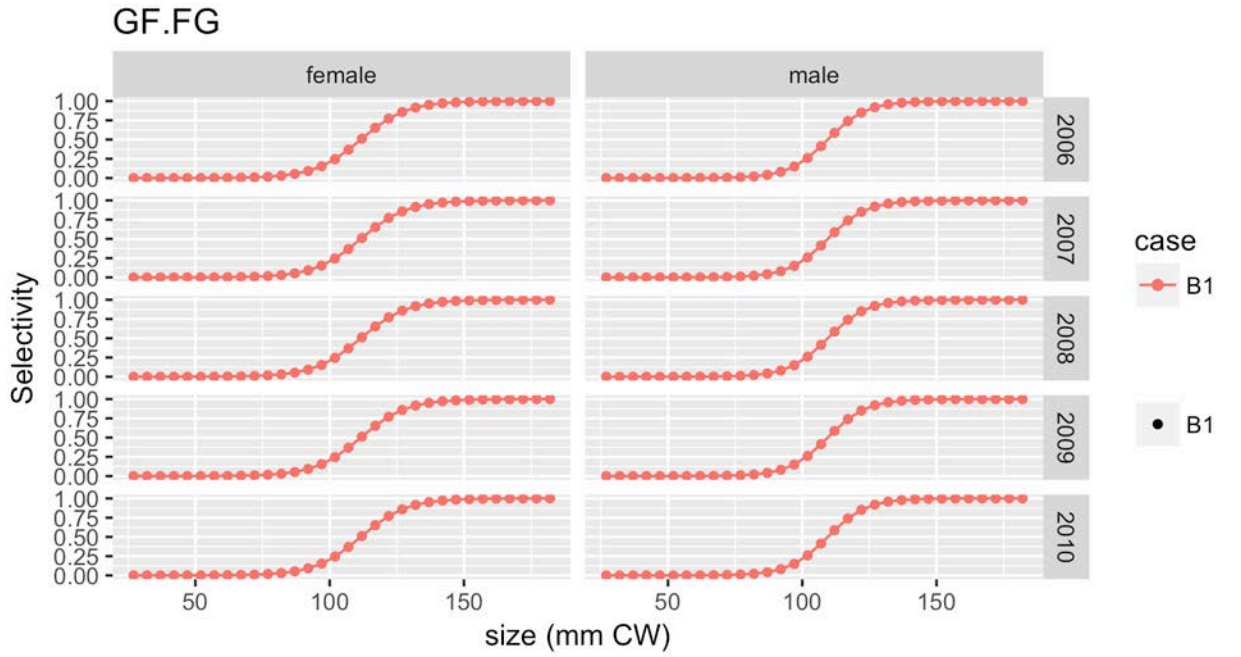


Figure 48. Selectivity functions for GF.FG(4 of 5).

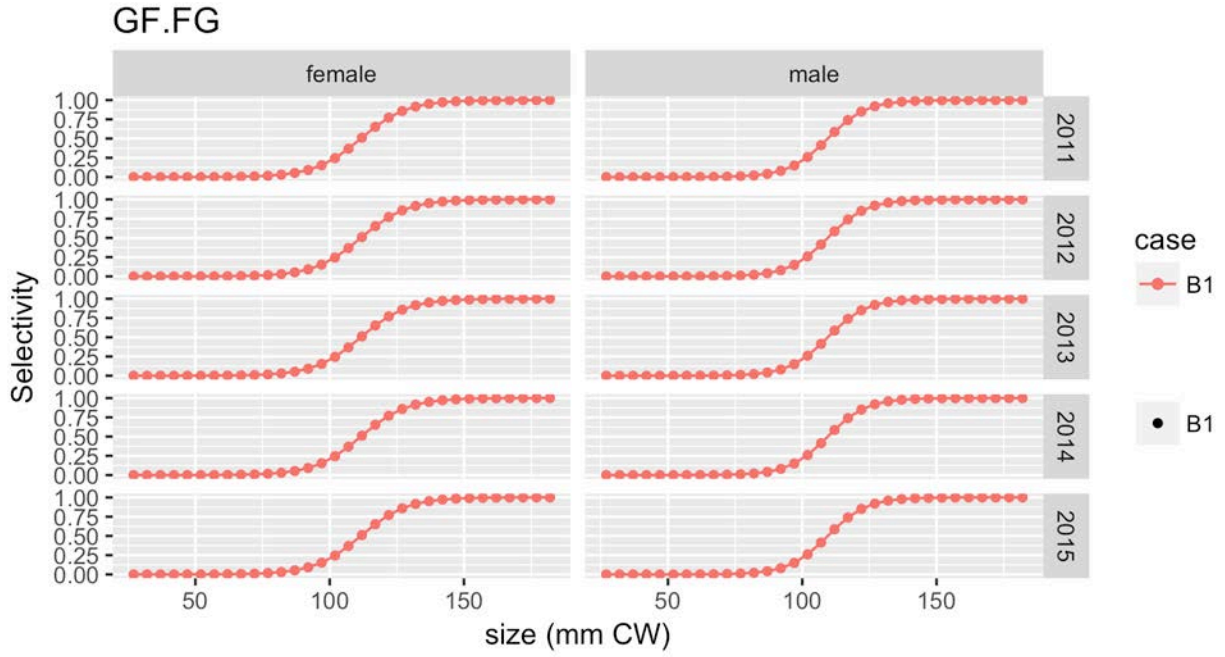


Figure 49. Selectivity functions for GF.FG(5 of 5).

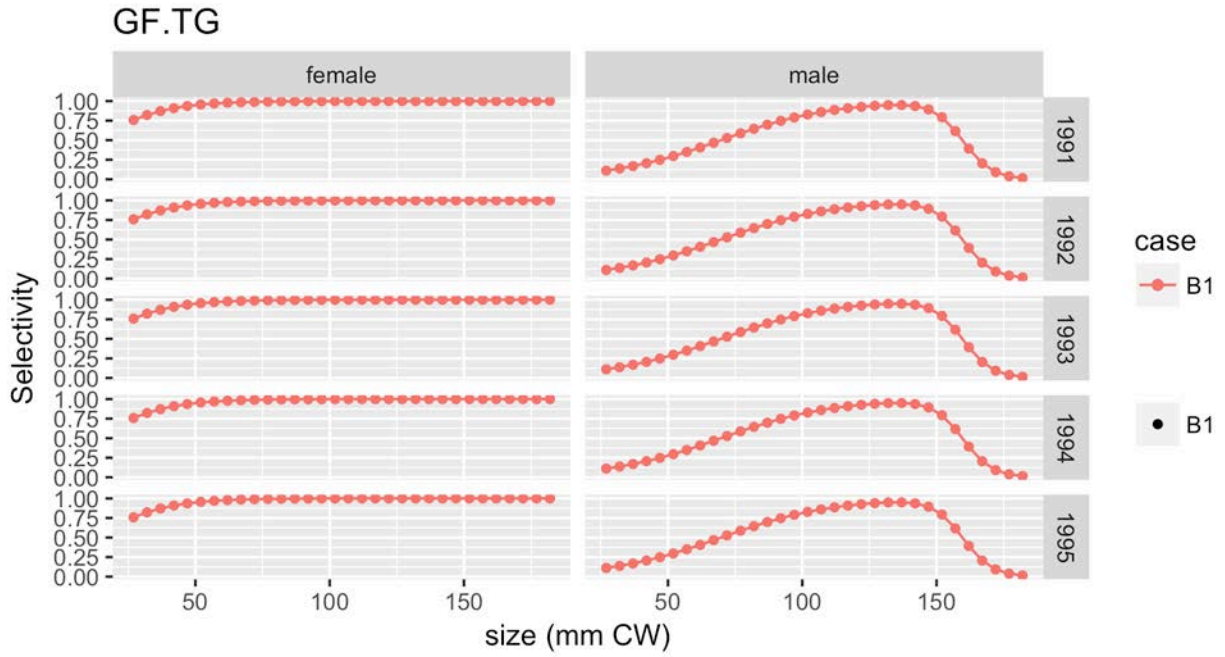


Figure 50. Selectivity functions for GF.TG(1 of 5).

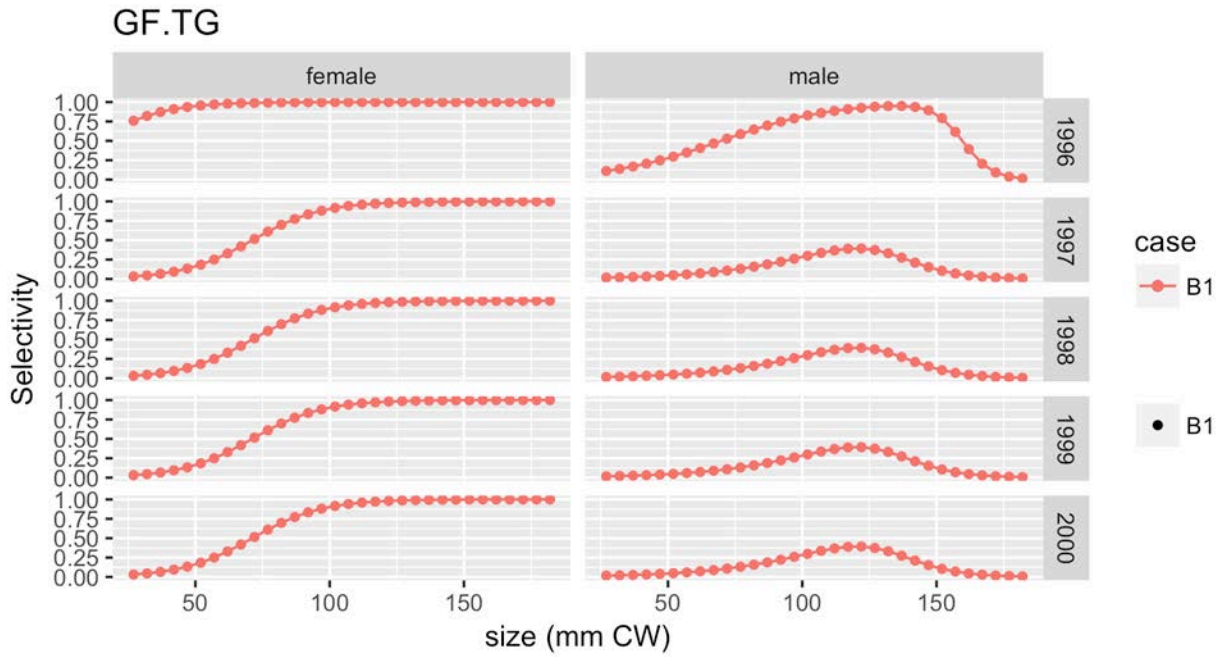


Figure 51. Selectivity functions for GF.TG(2 of 5).

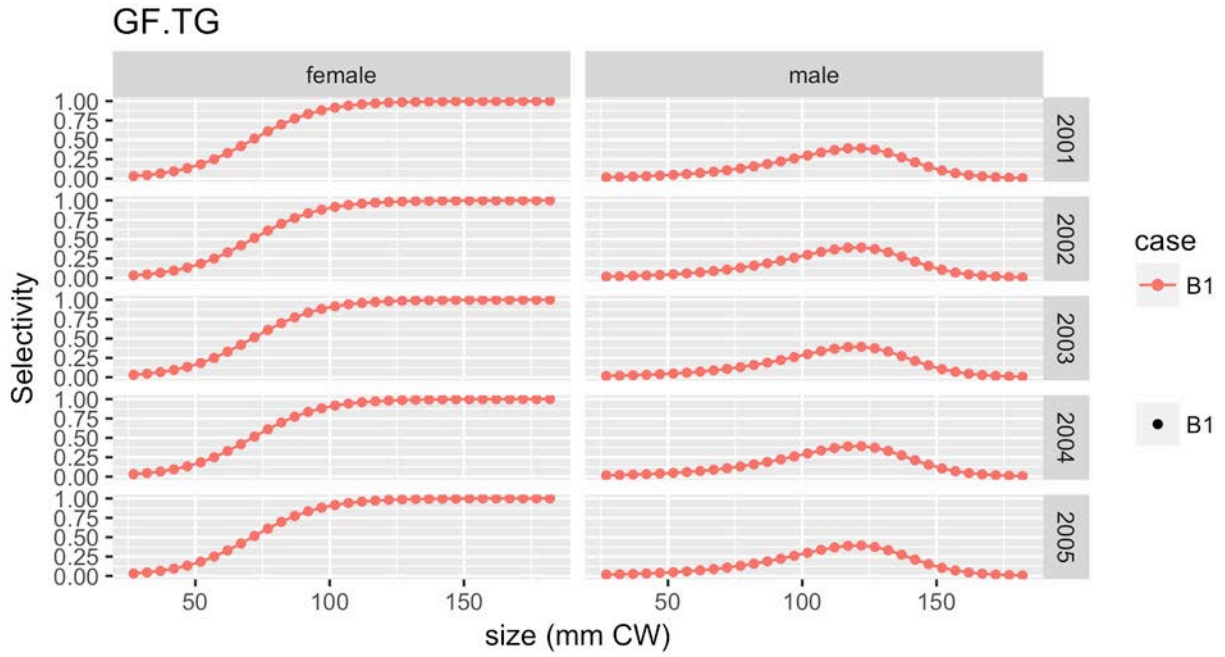


Figure 52. Selectivity functions for GF.TG(3 of 5).

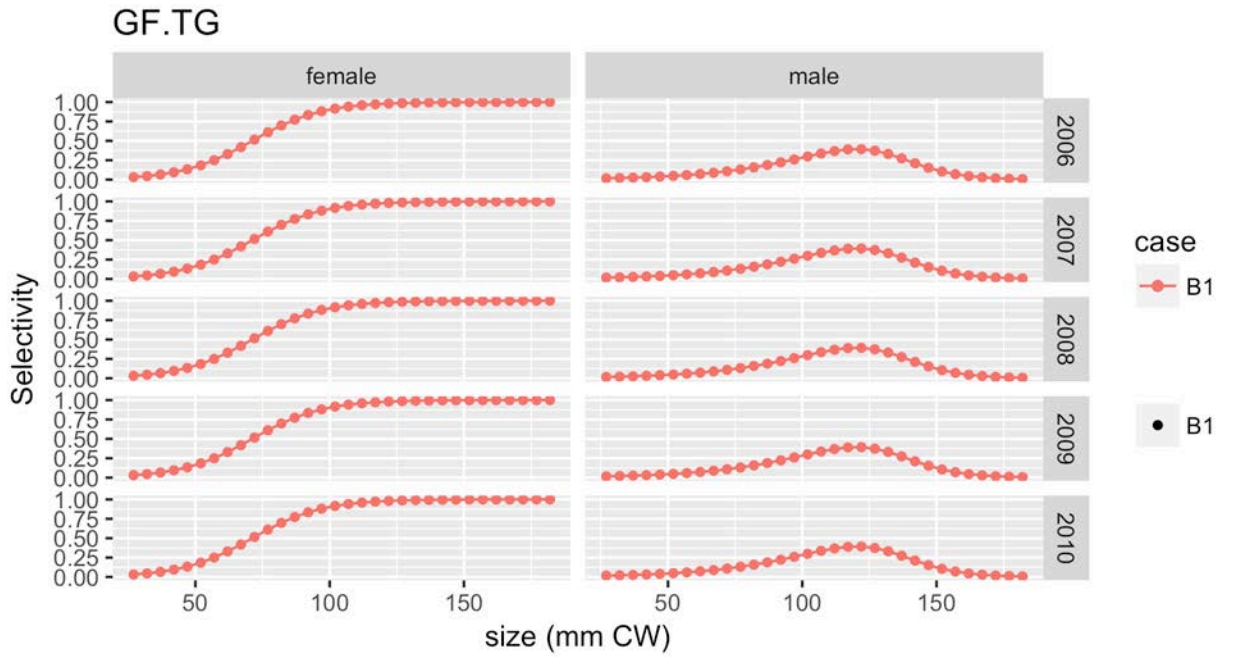


Figure 53. Selectivity functions for GF.TG(4 of 5).

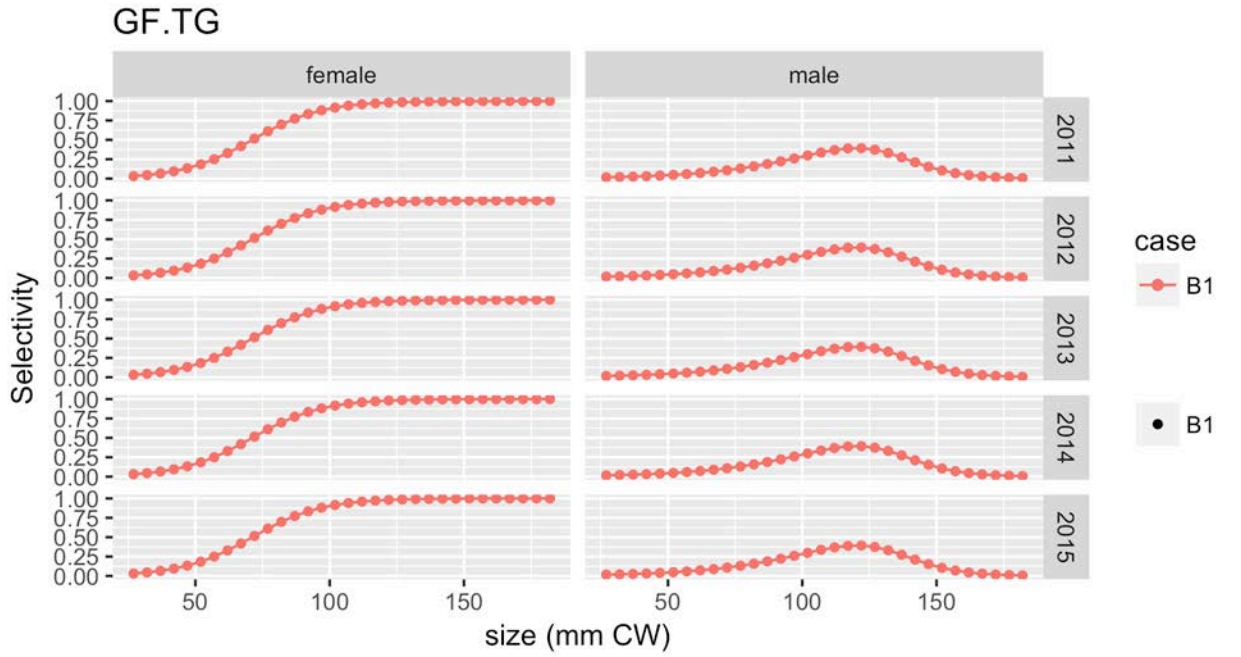


Figure 54. Selectivity functions for GF.TG(5 of 5).

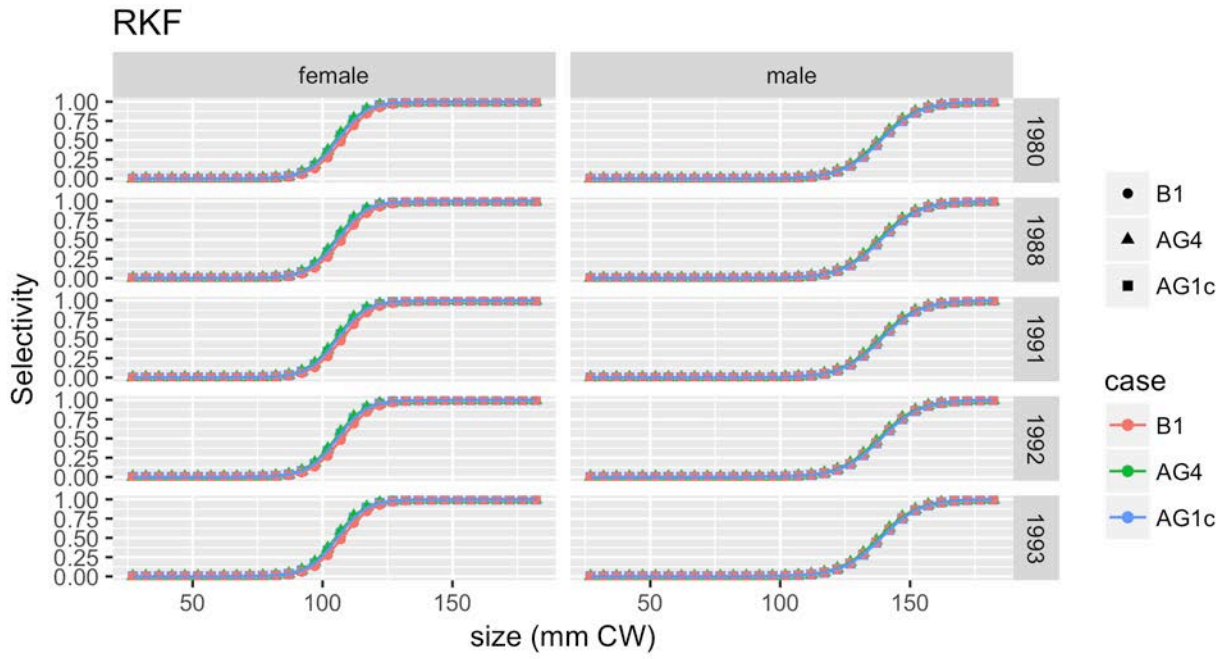


Figure 55. Selectivity functions for RKF(1 of 5).

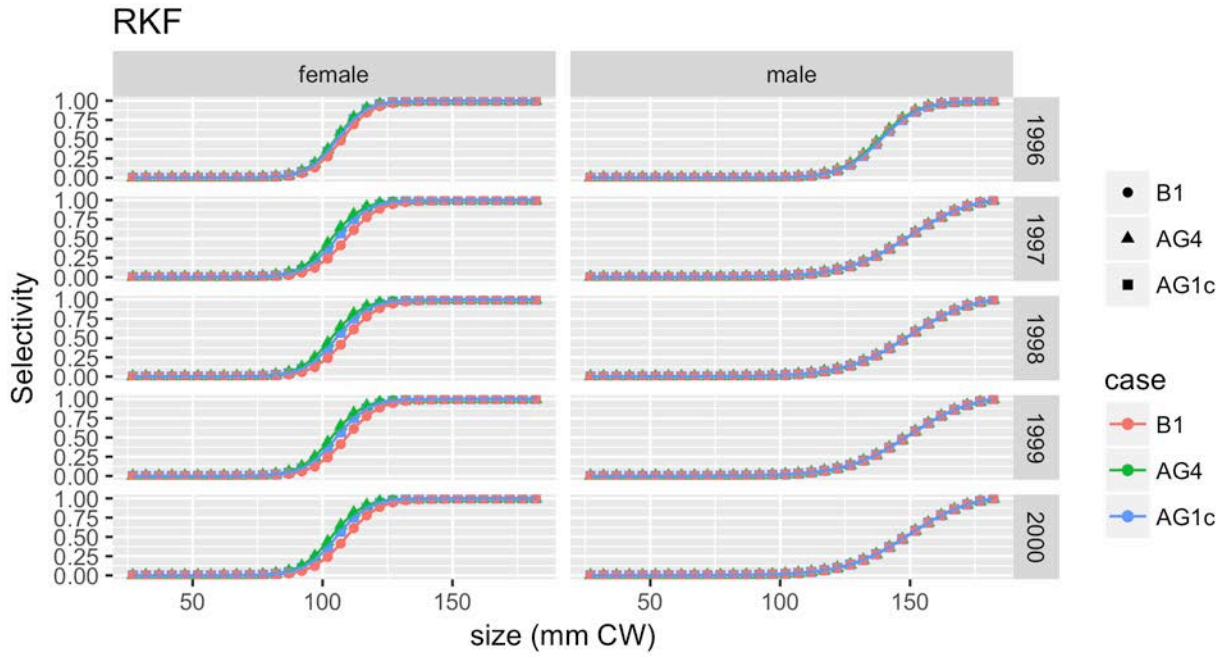


Figure 56. Selectivity functions for RKF(2 of 5).

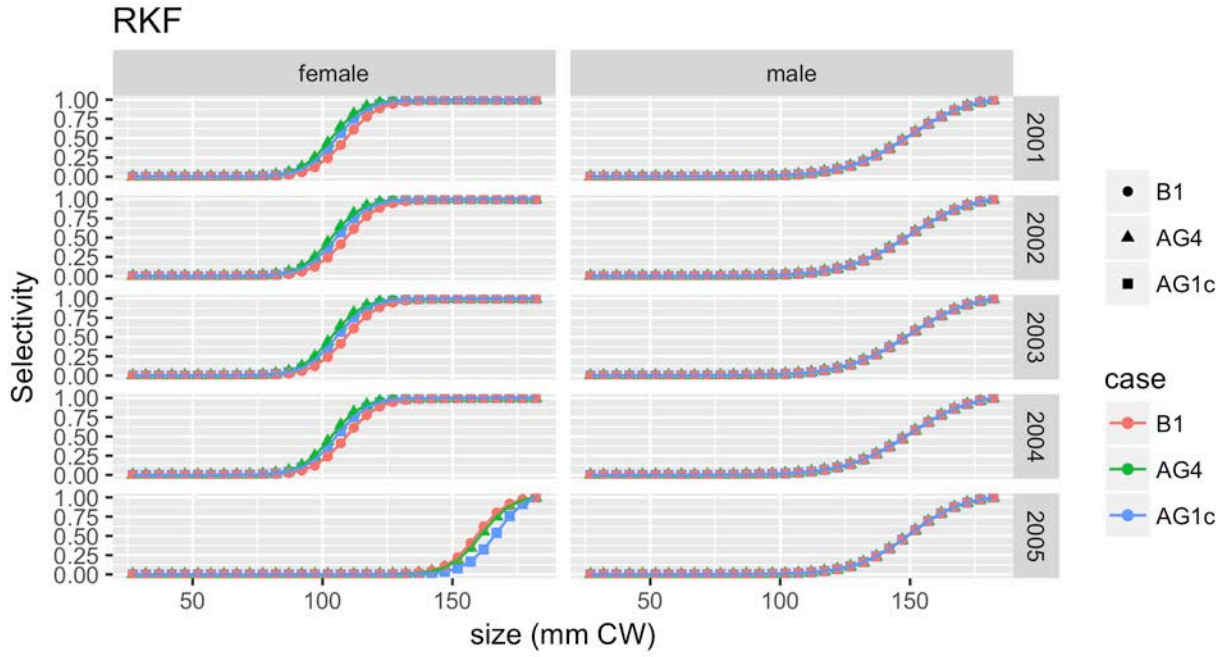


Figure 57. Selectivity functions for RKF(3 of 5).

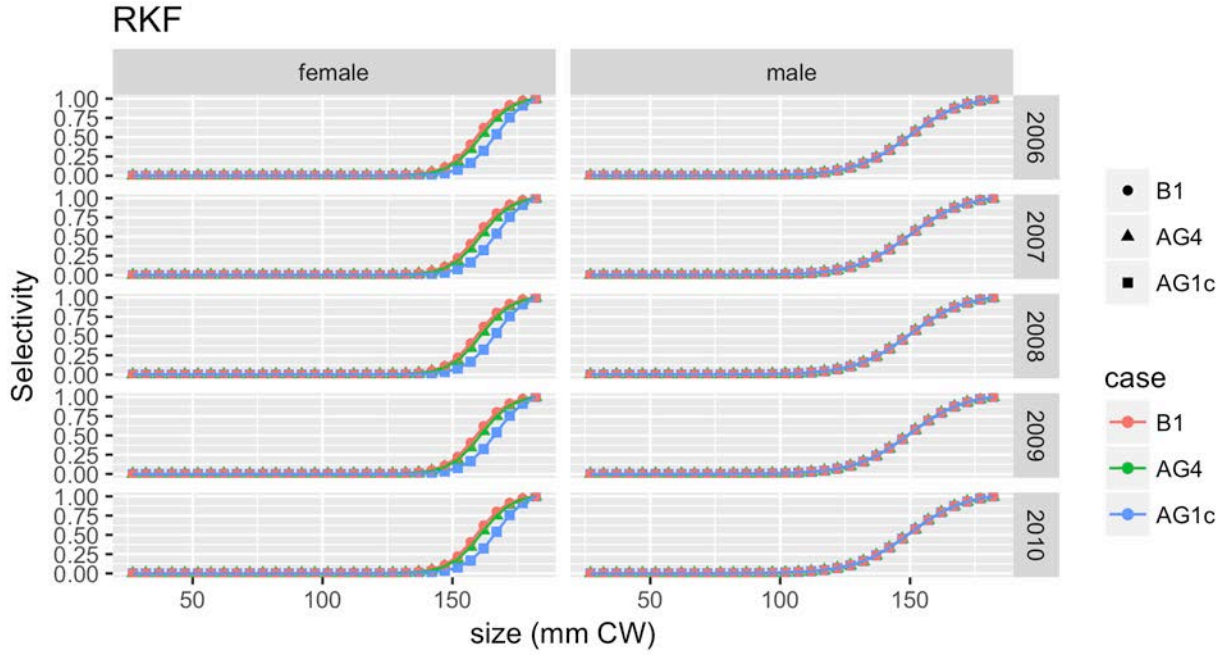


Figure 58. Selectivity functions for RKF(4 of 5).

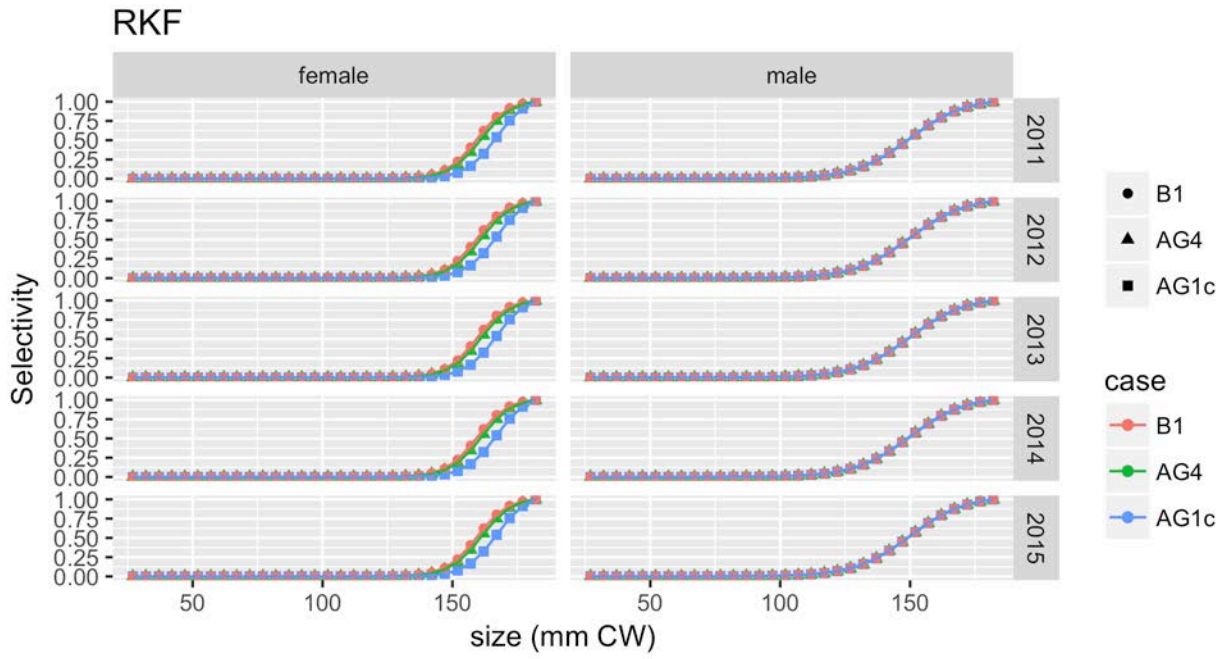


Figure 59. Selectivity functions for RKF(5 of 5).

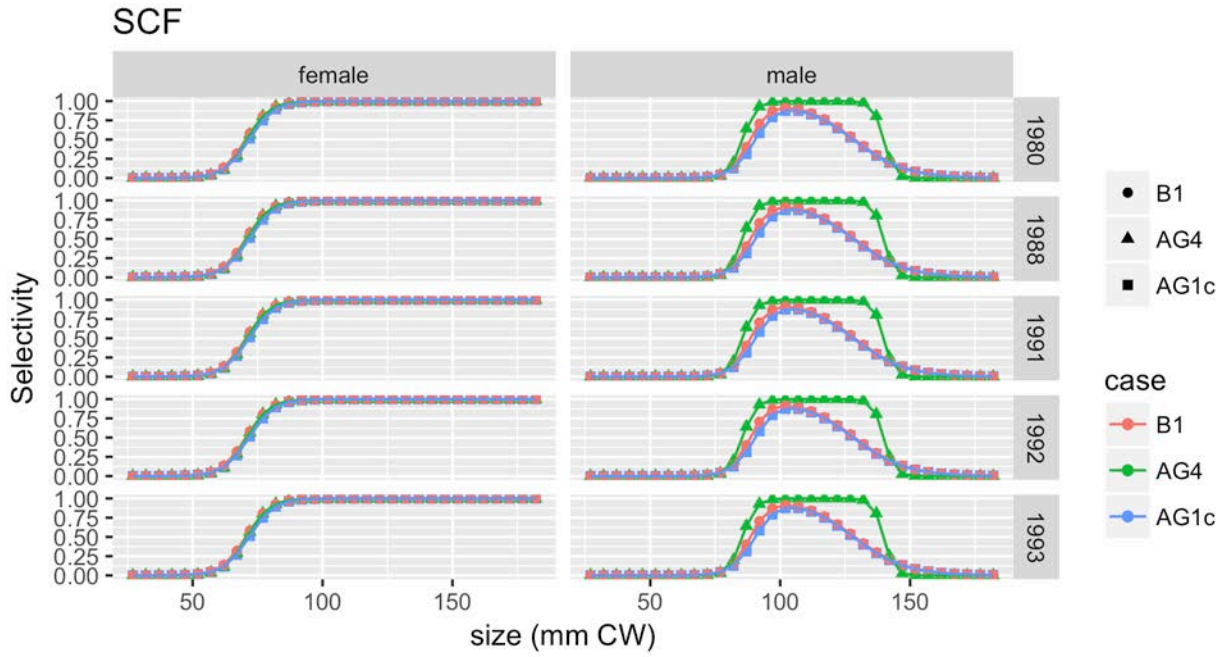


Figure 60. Selectivity functions for SCF(1 of 6).

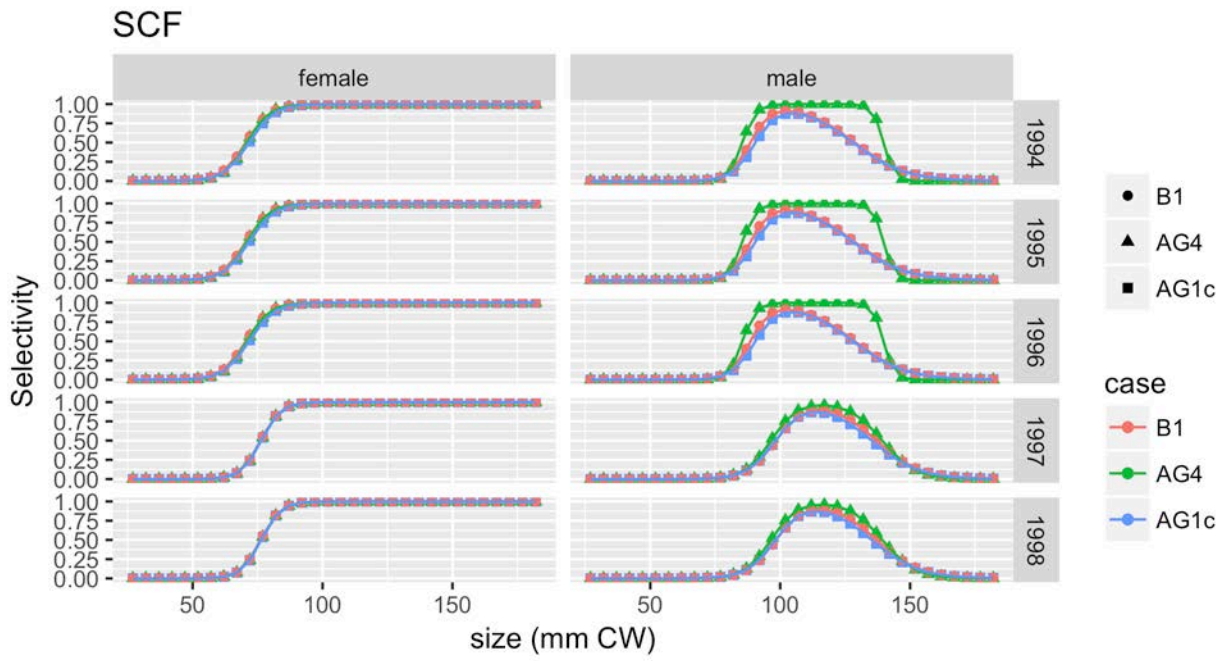


Figure 61. Selectivity functions for SCF(2 of 6).

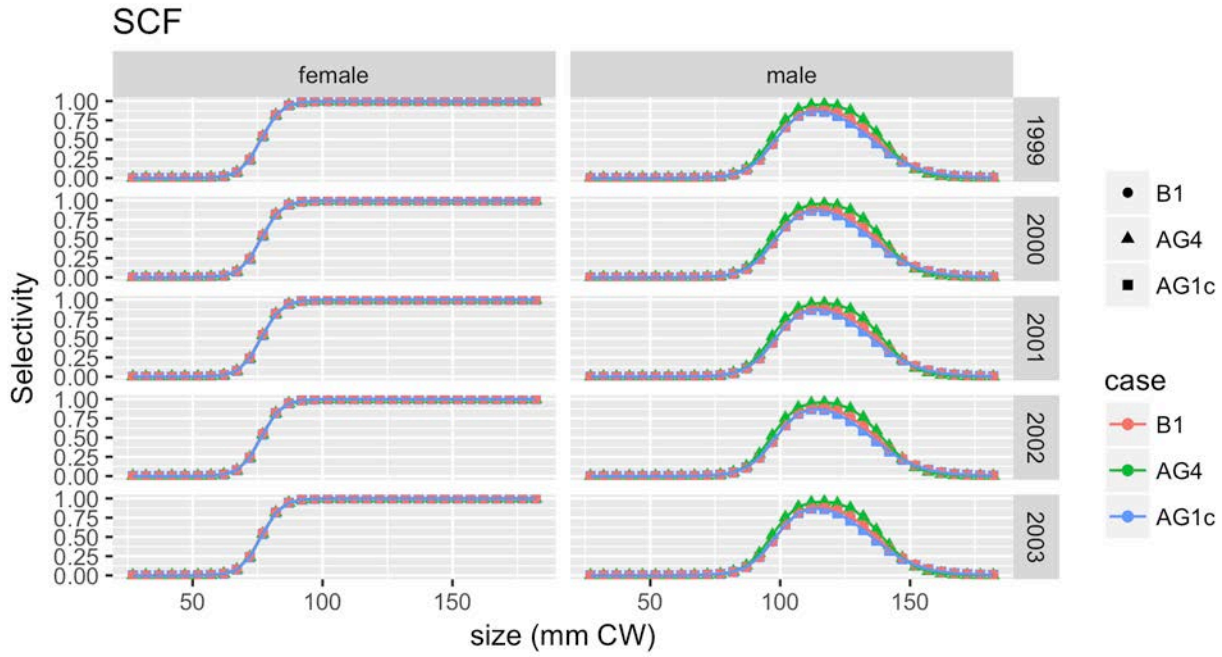


Figure 62. Selectivity functions for SCF(3 of 6).

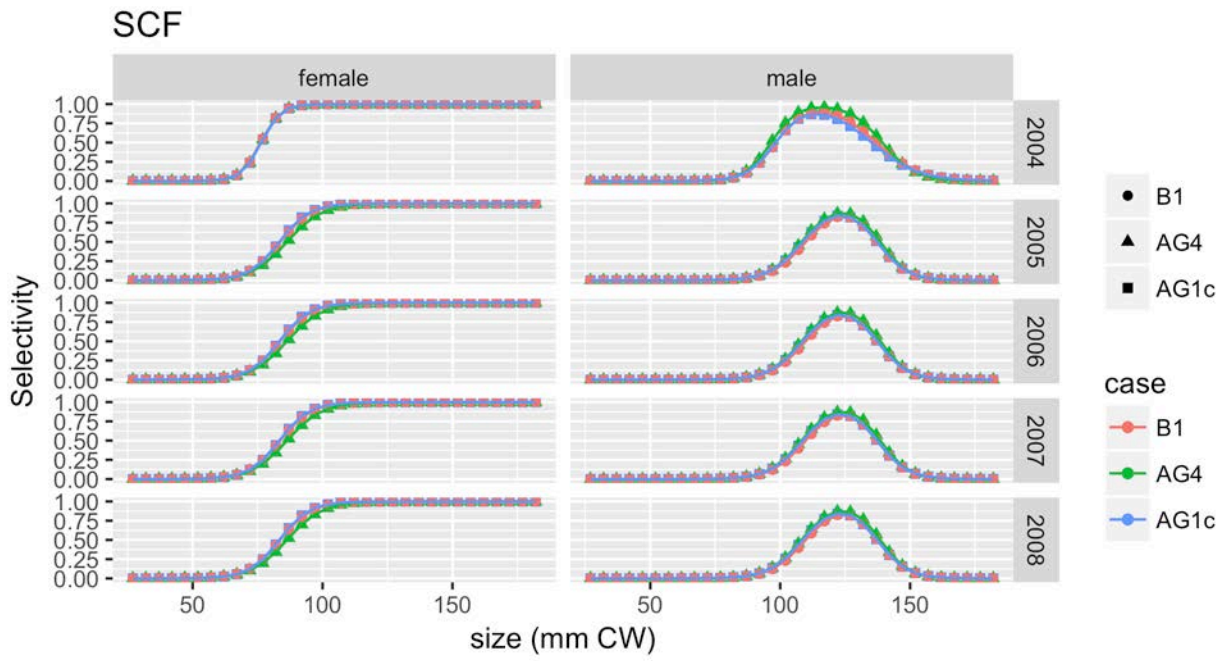


Figure 63. Selectivity functions for SCF(4 of 6).

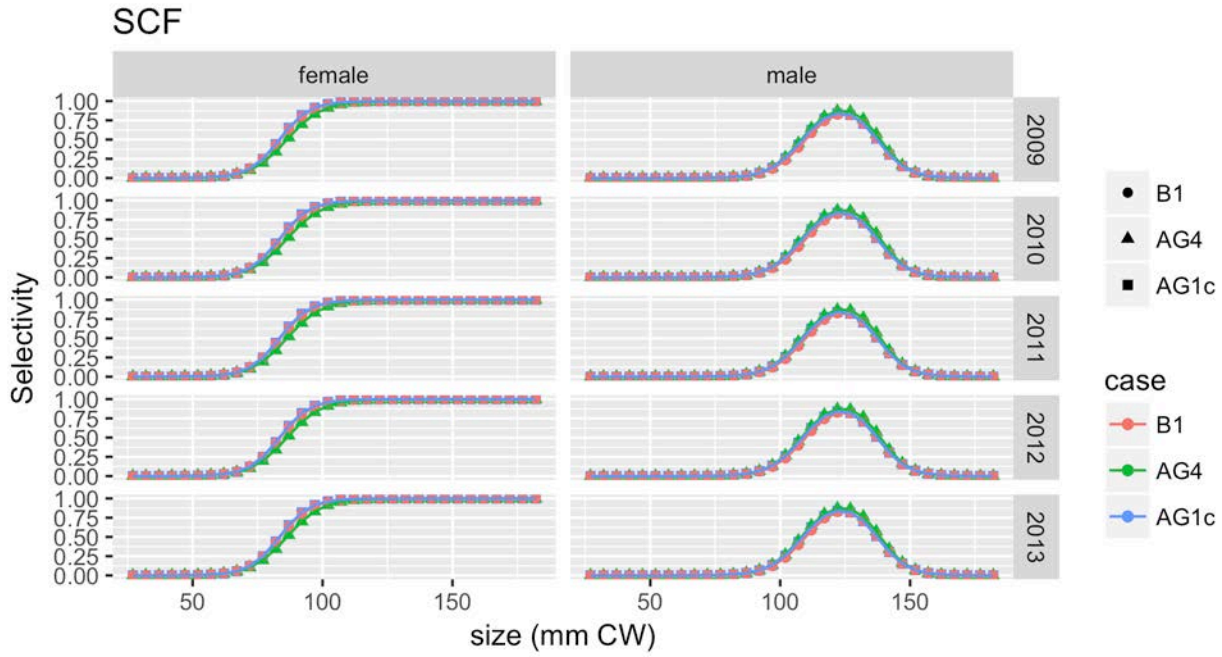


Figure 64. Selectivity functions for SCF(5 of 6).

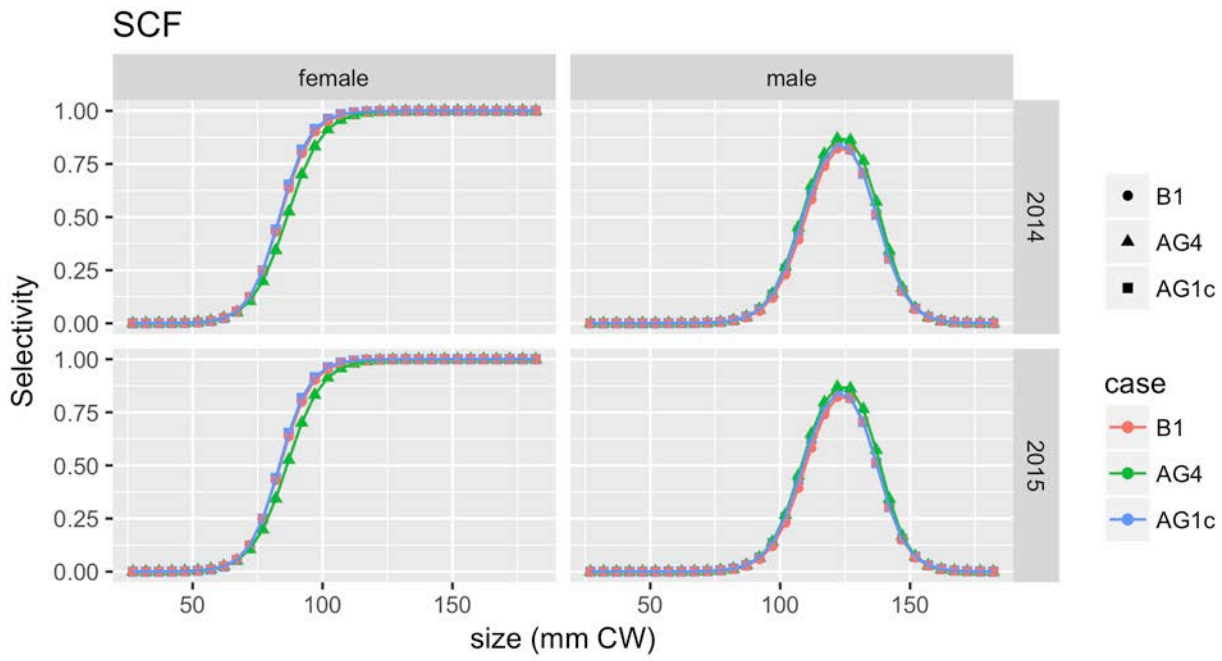


Figure 65. Selectivity functions for SCF(6 of 6).

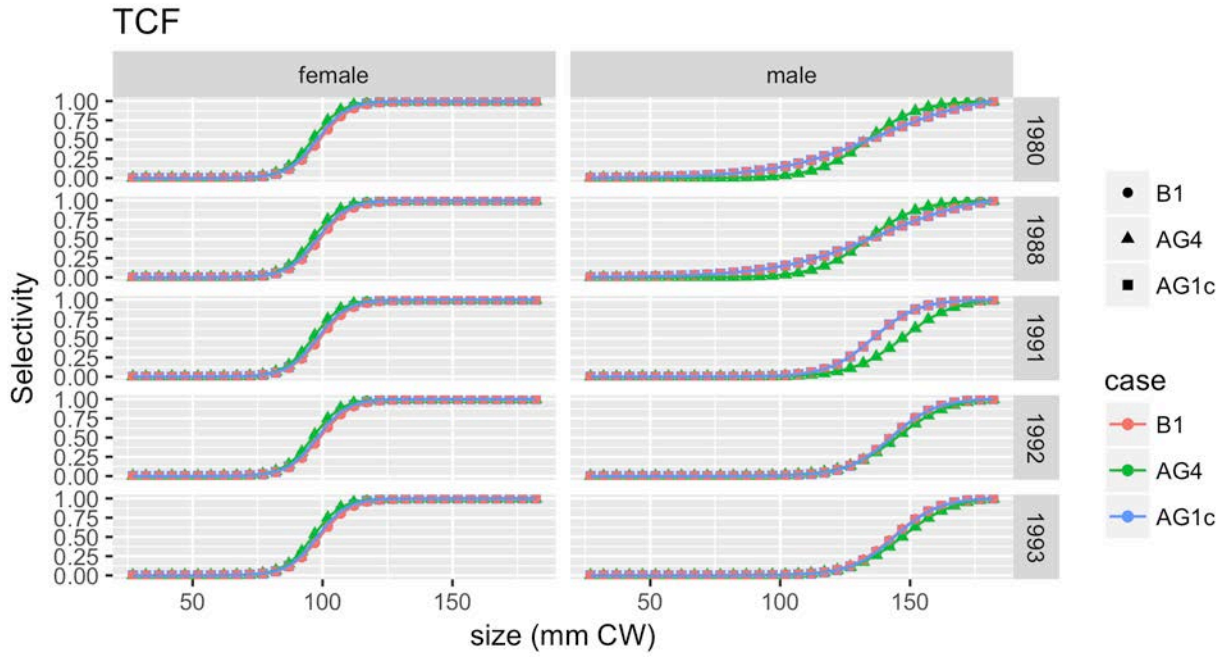


Figure 66. Selectivity functions for TCF(1 of 4).

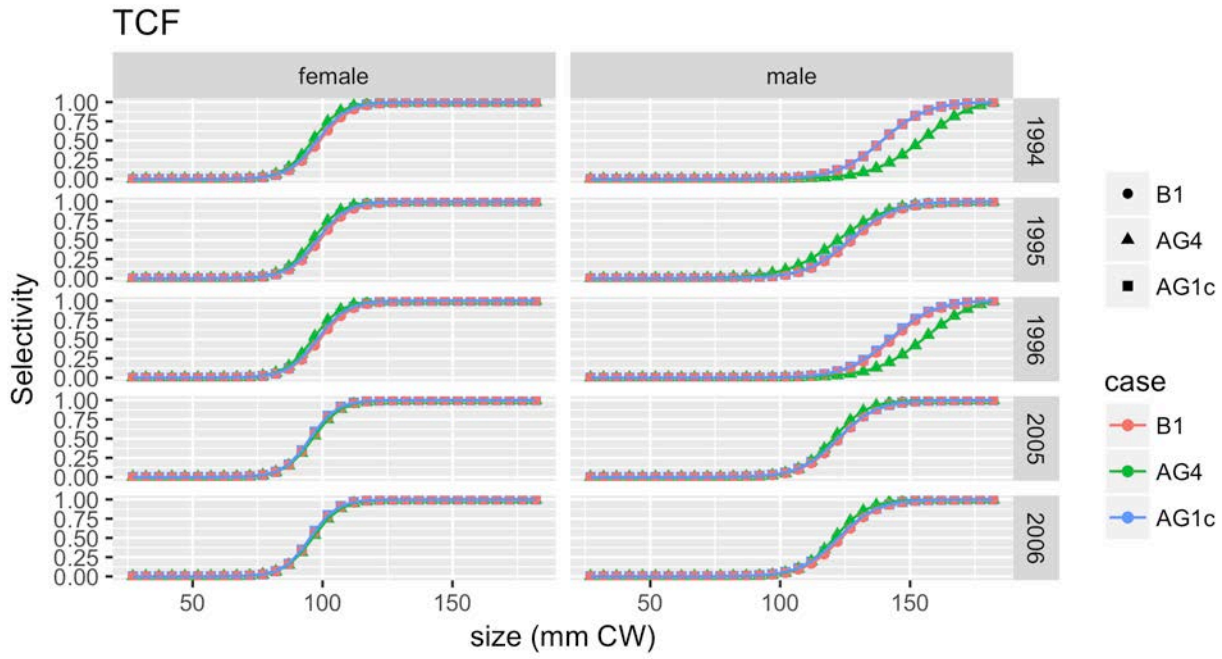


Figure 67. Selectivity functions for TCF(2 of 4).

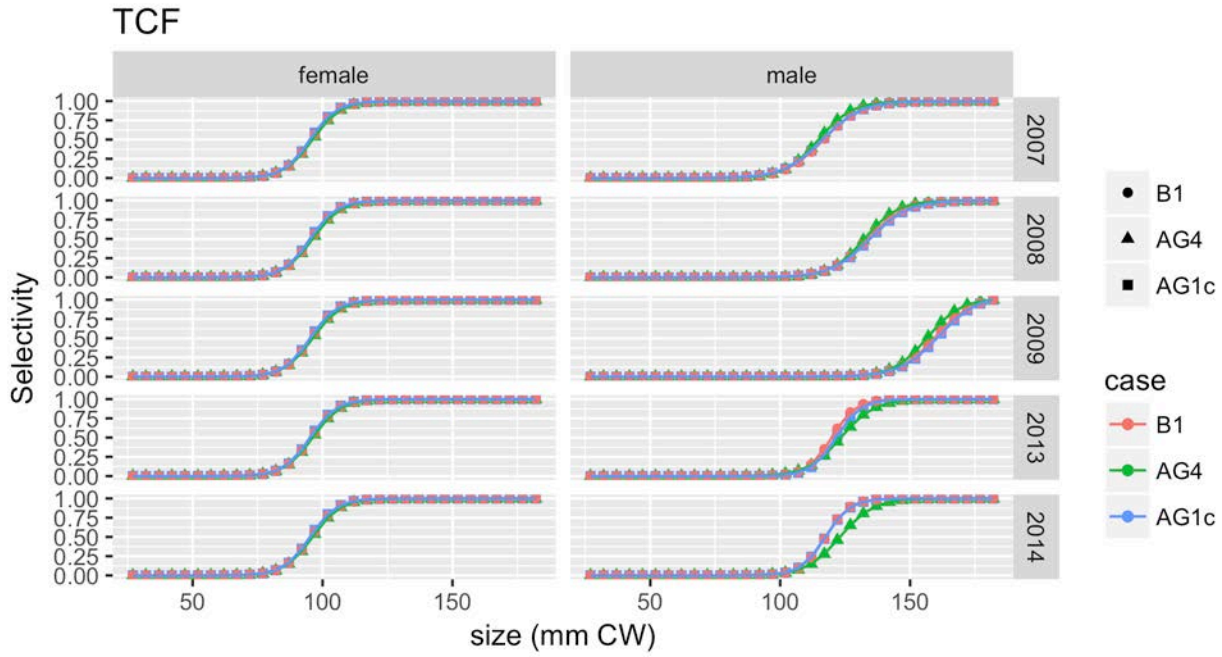


Figure 68. Selectivity functions for TCF(3 of 4).

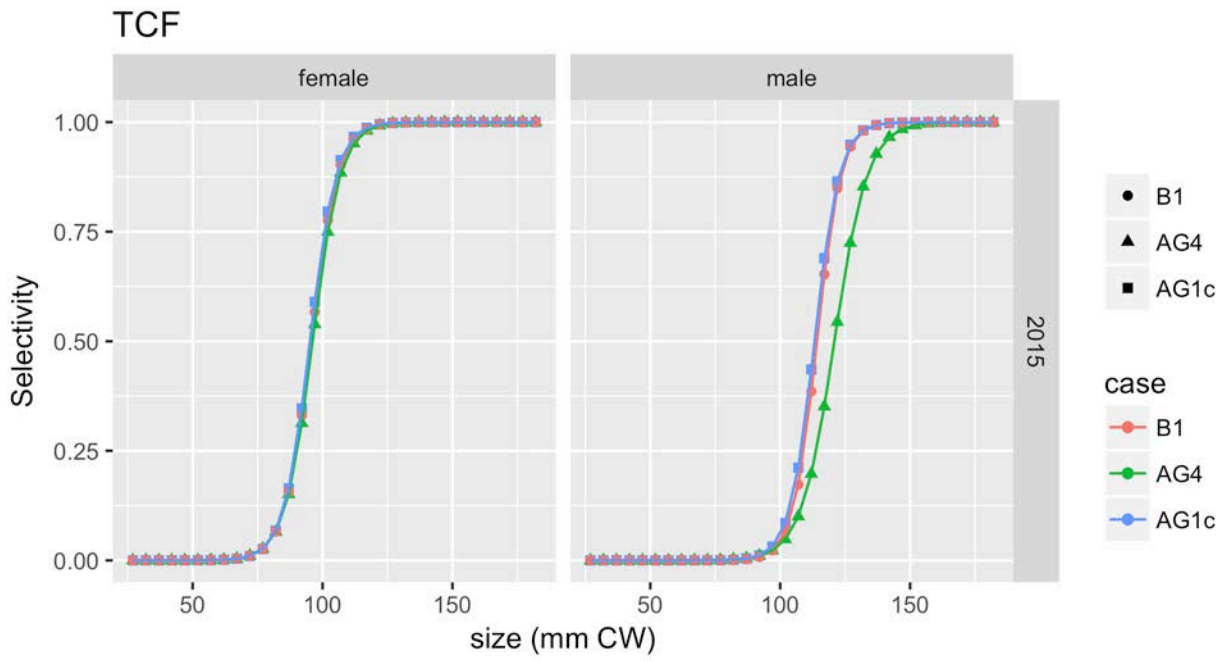


Figure 69. Selectivity functions for TCF(4 of 4).

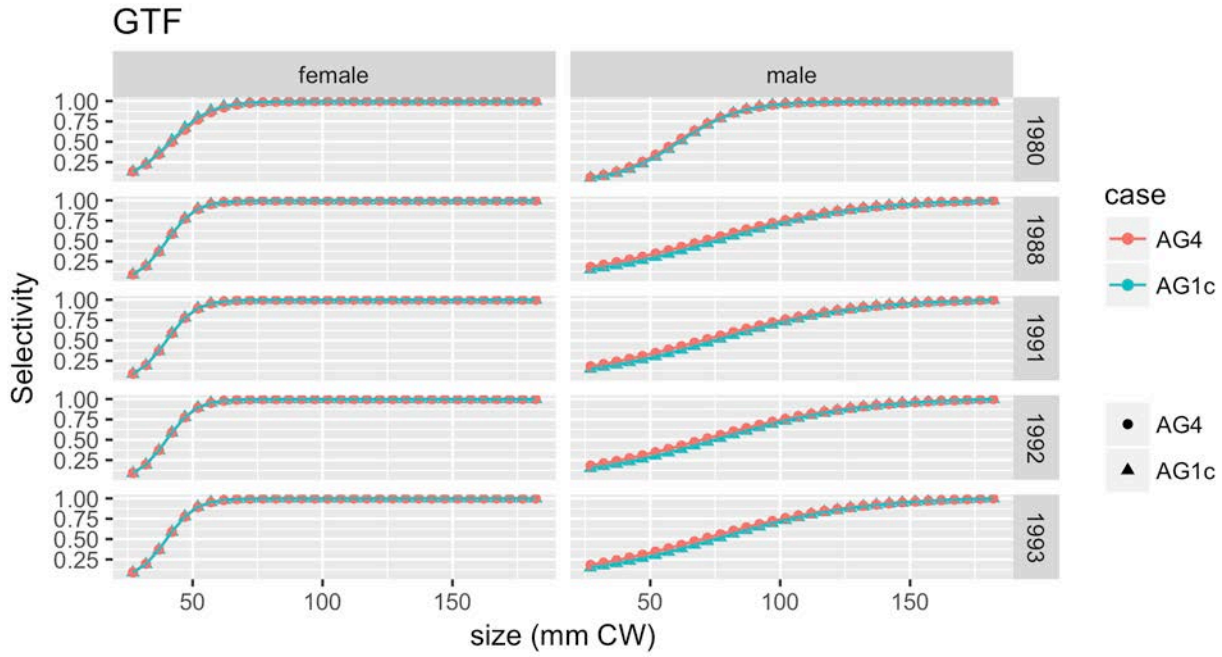


Figure 70. Selectivity functions for GTF(1 of 6).

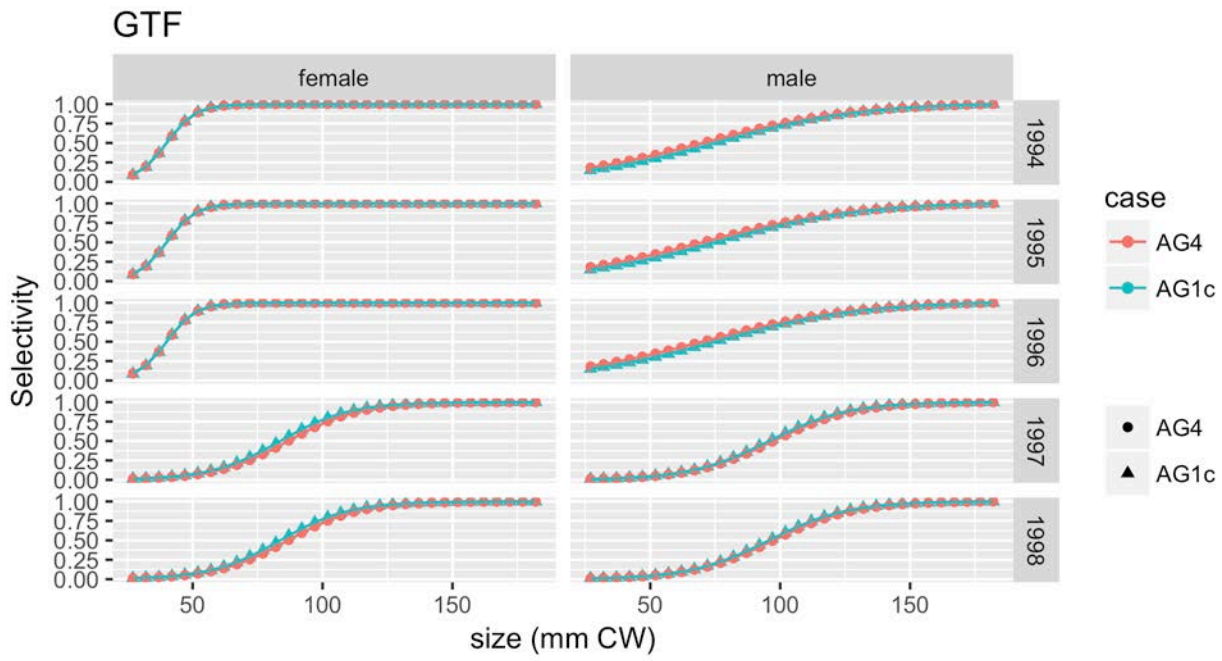


Figure 71. Selectivity functions for GTF(2 of 6).

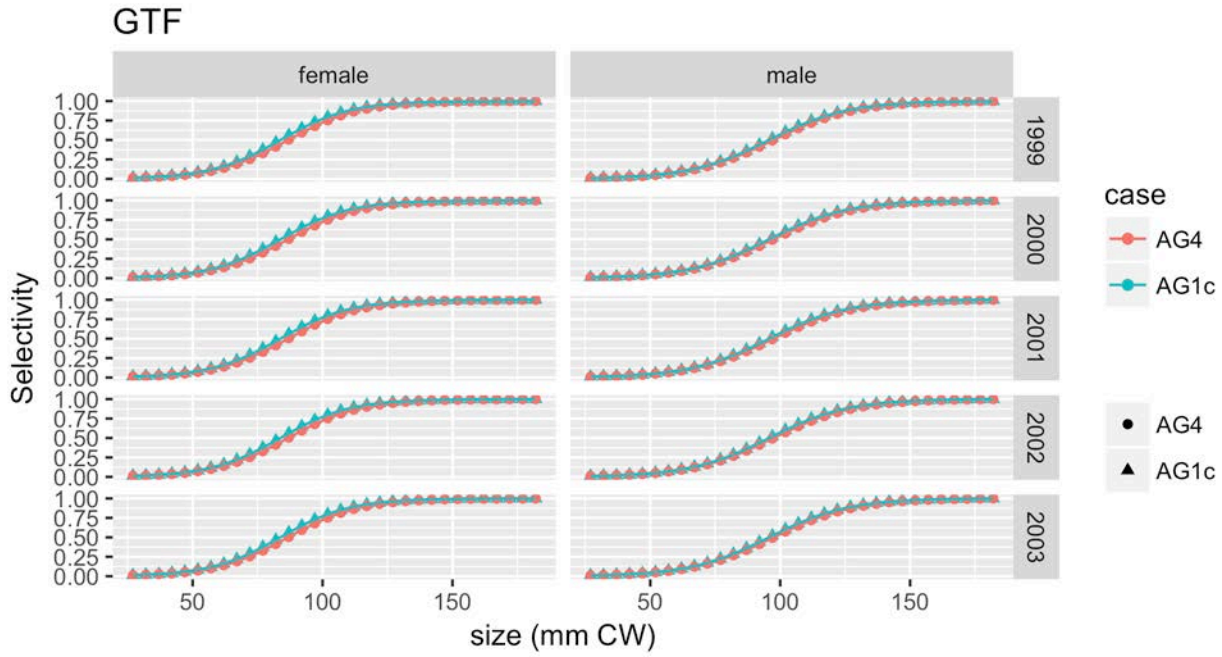


Figure 72. Selectivity functions for GTF(3 of 6).

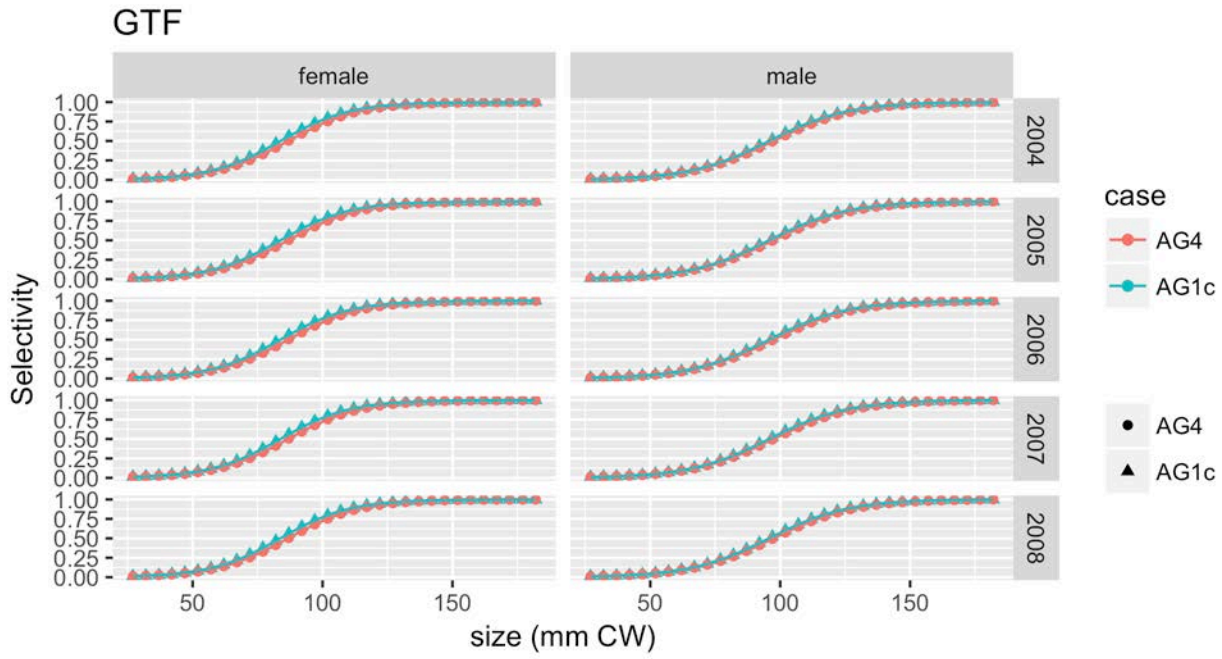


Figure 73. Selectivity functions for GTF(4 of 6).

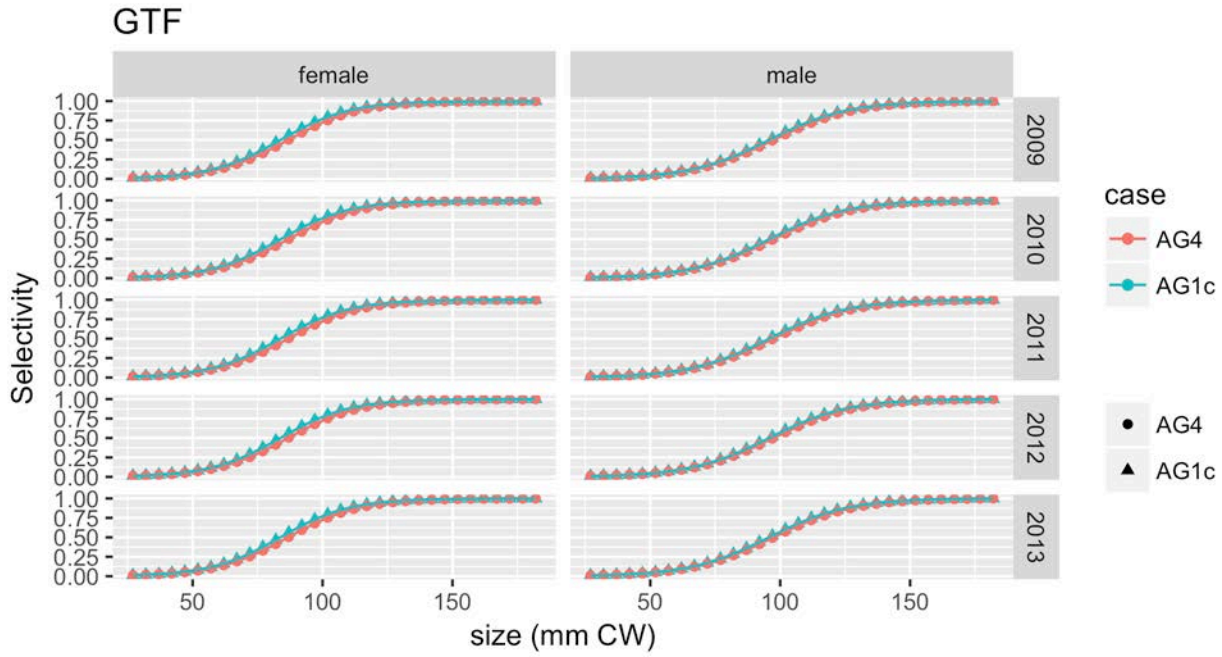


Figure 74. Selectivity functions for GTF(5 of 6).

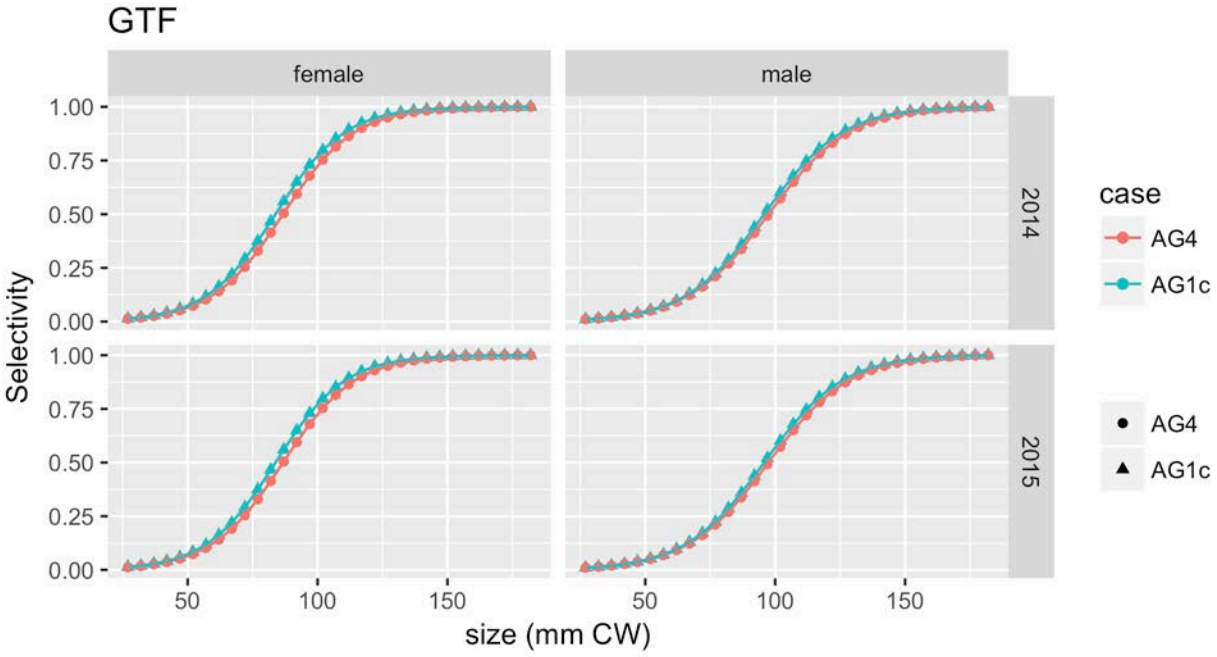


Figure 75. Selectivity functions for GTF(6 of 6).

Retention functions

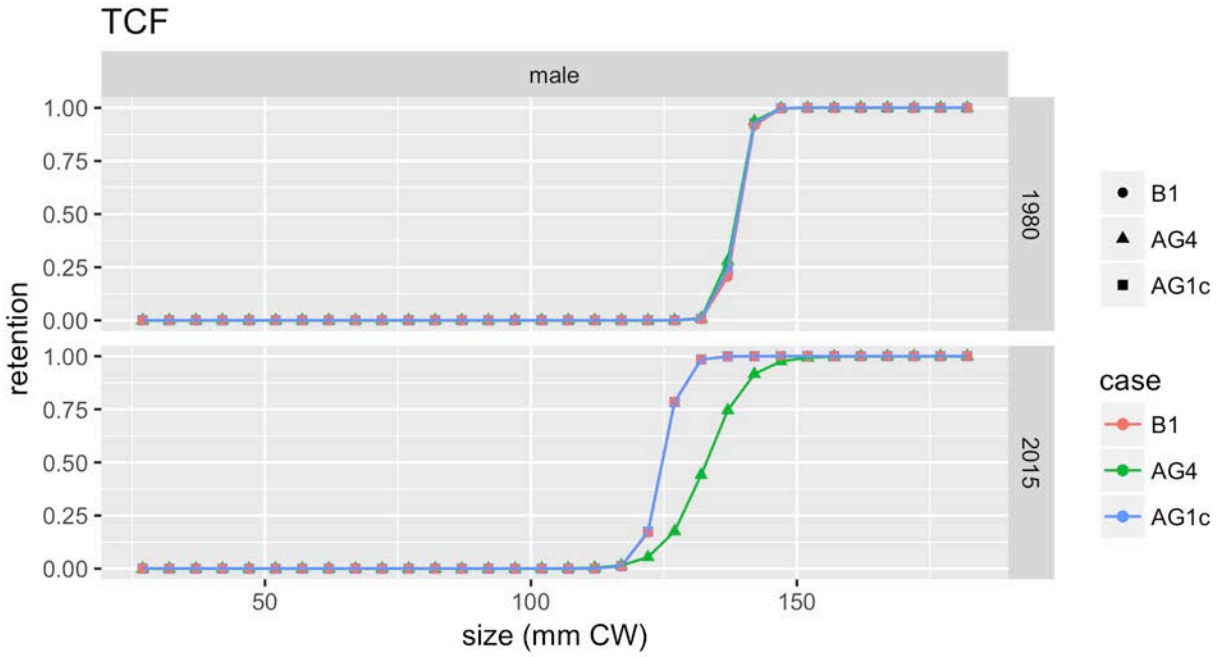


Figure 76. Retention functions for TCF(1 of 1).

Total catch abundance

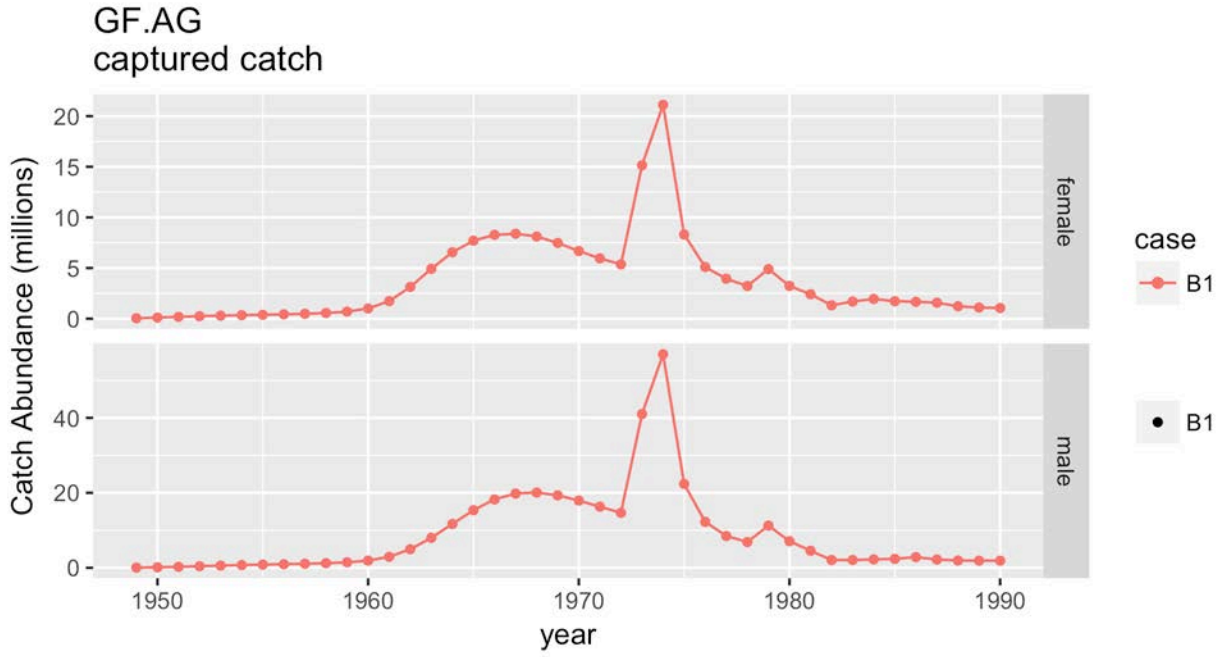


Figure 77. Predicted GF.AG captured catch abundance.

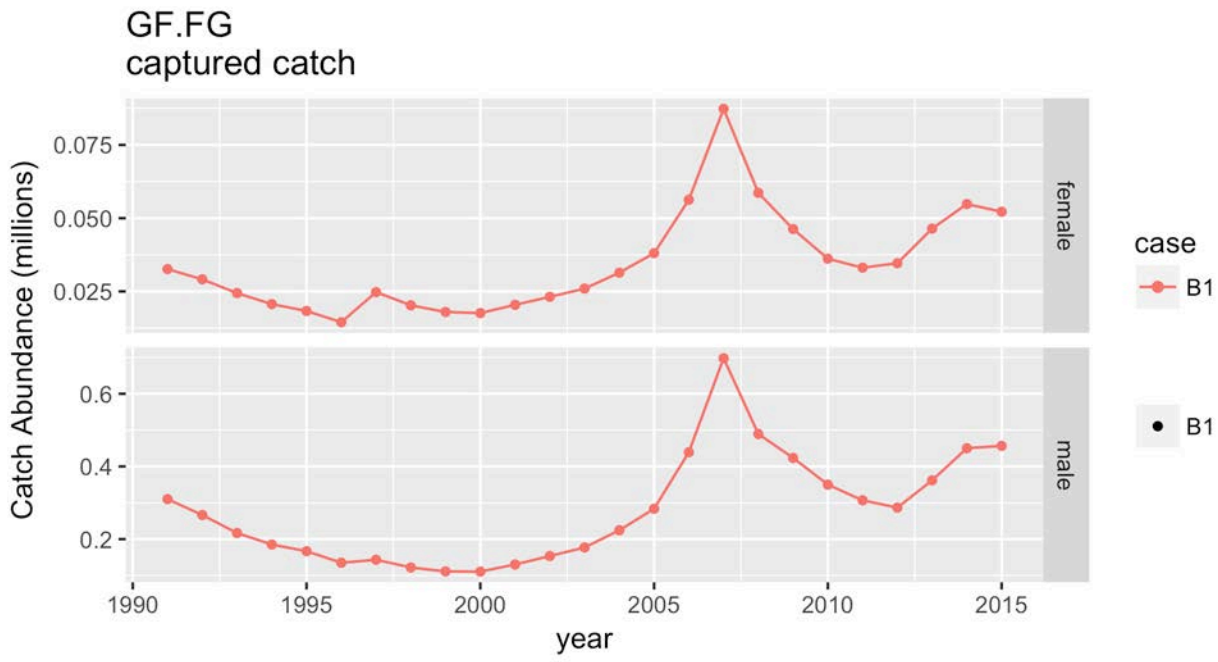


Figure 78. Predicted GF.FG captured catch abundance.

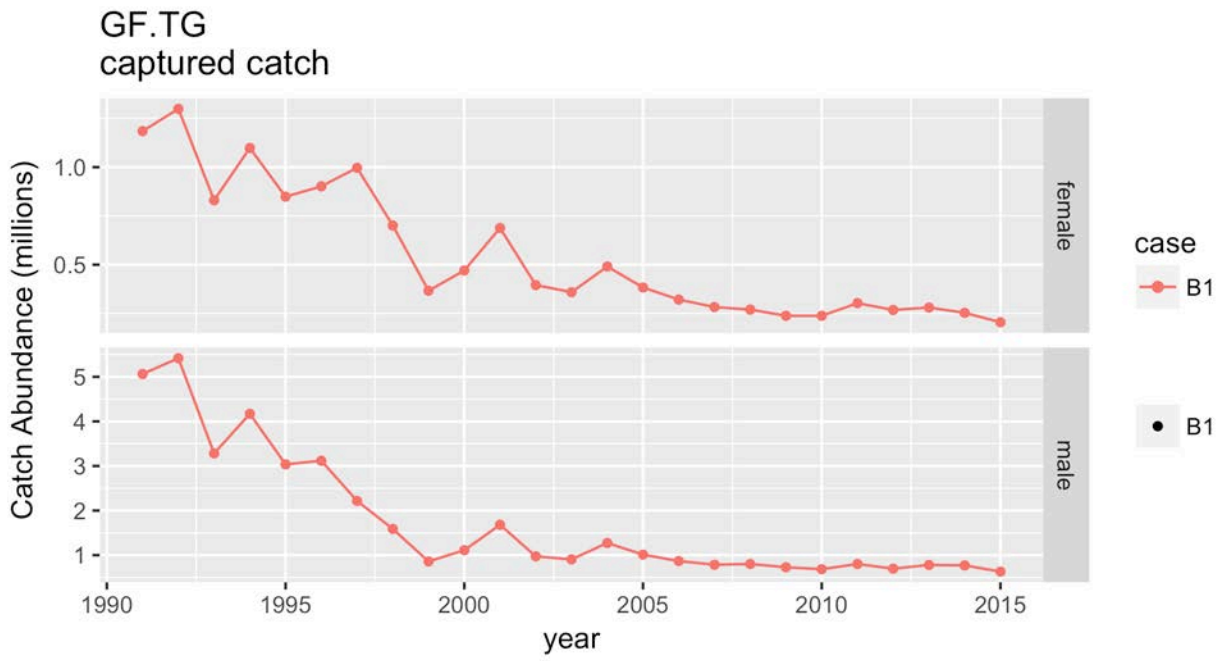


Figure 79. Predicted GF.TG captured catch abundance.

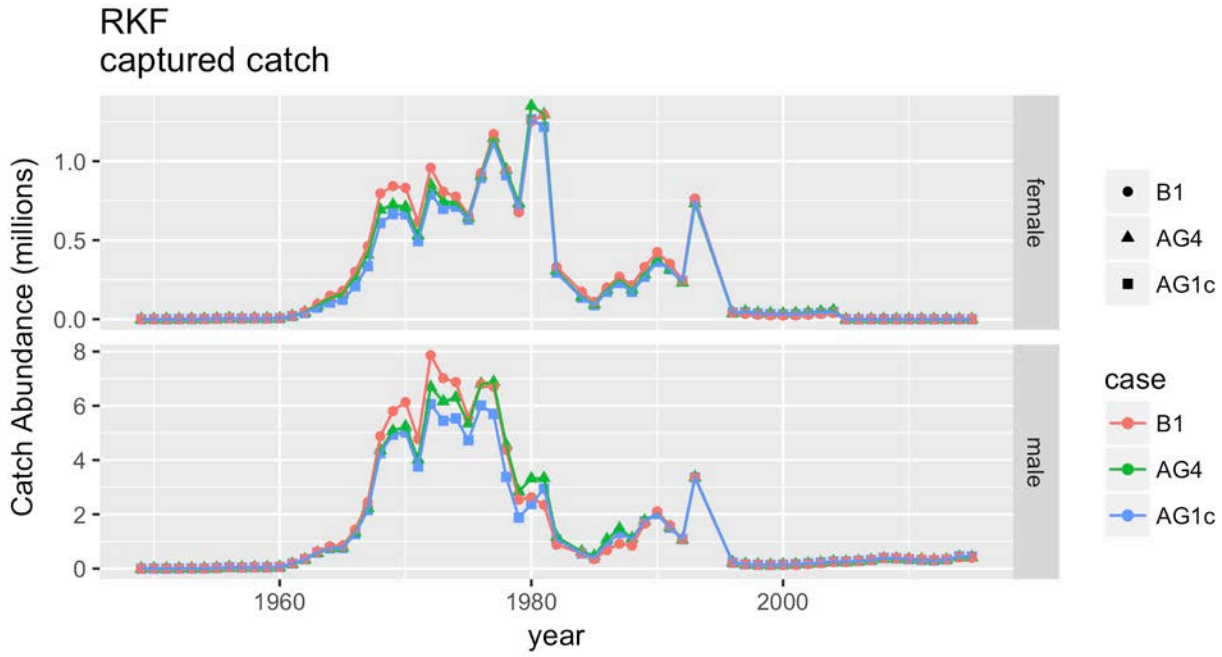


Figure 80. Predicted RKF captured catch abundance.

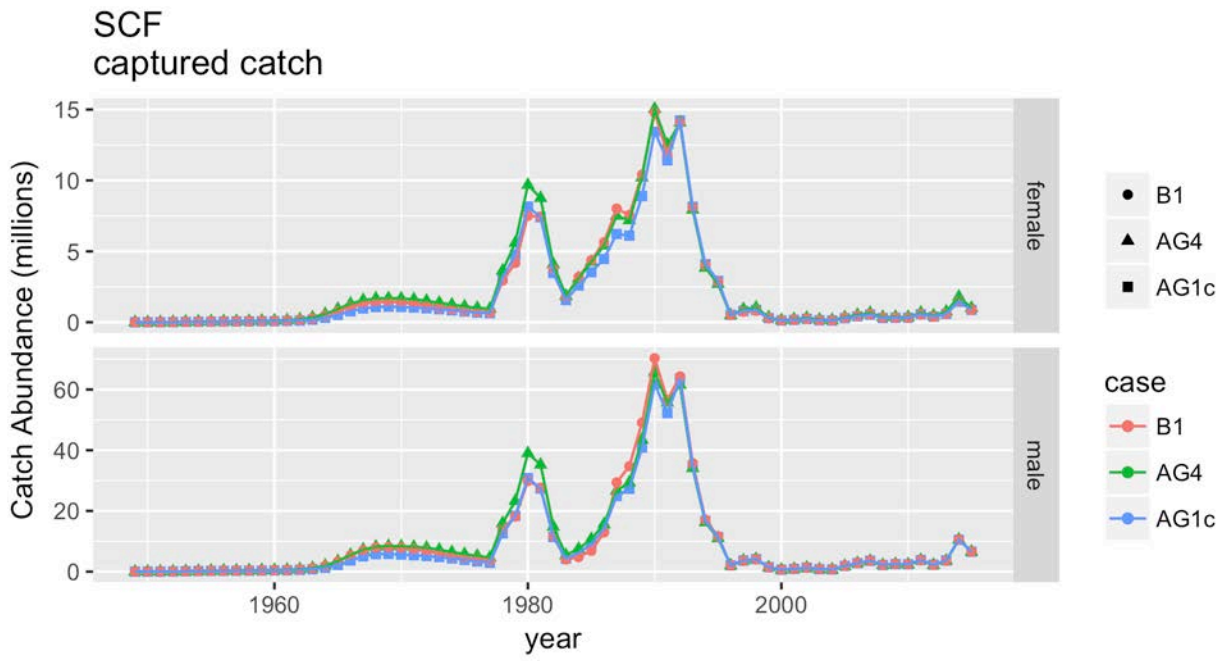


Figure 81. Predicted SCF captured catch abundance.

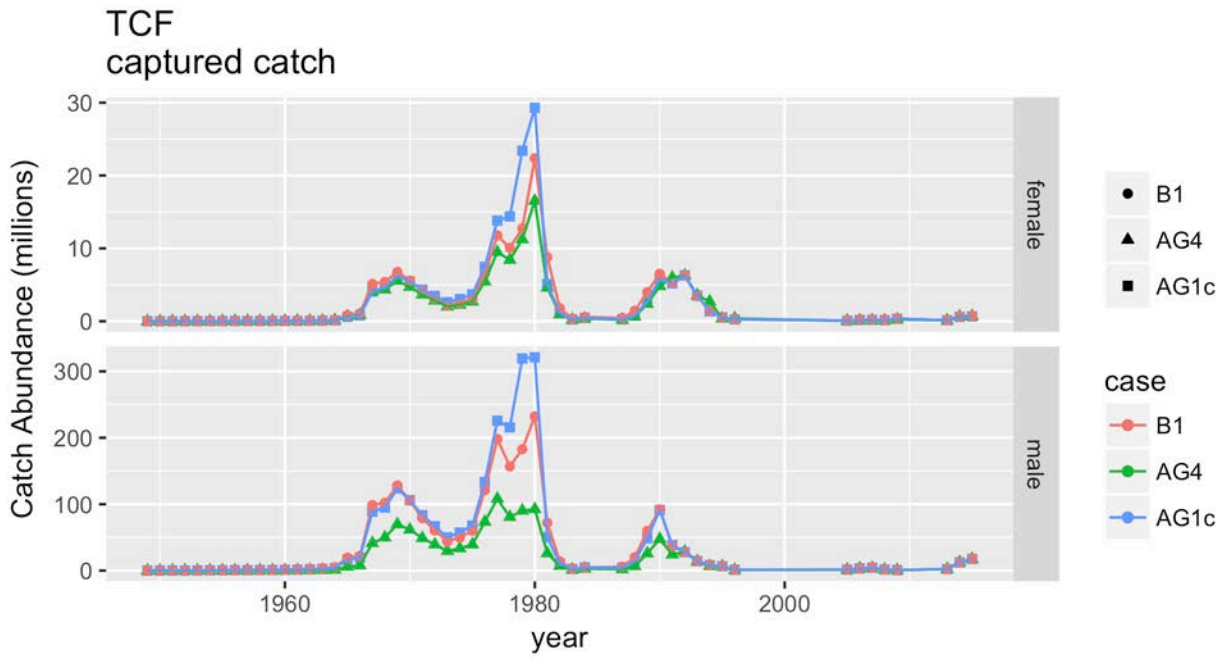


Figure 82. Predicted TCF captured catch abundance.

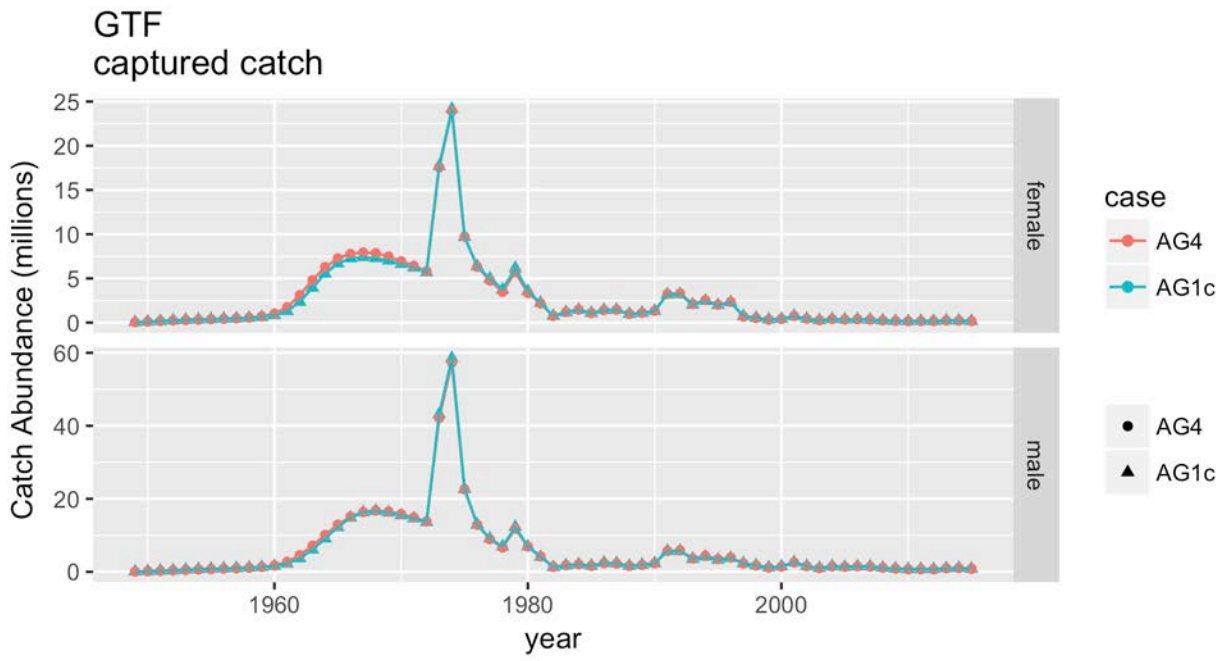


Figure 83. Predicted GTF captured catch abundance.

Total catch biomass

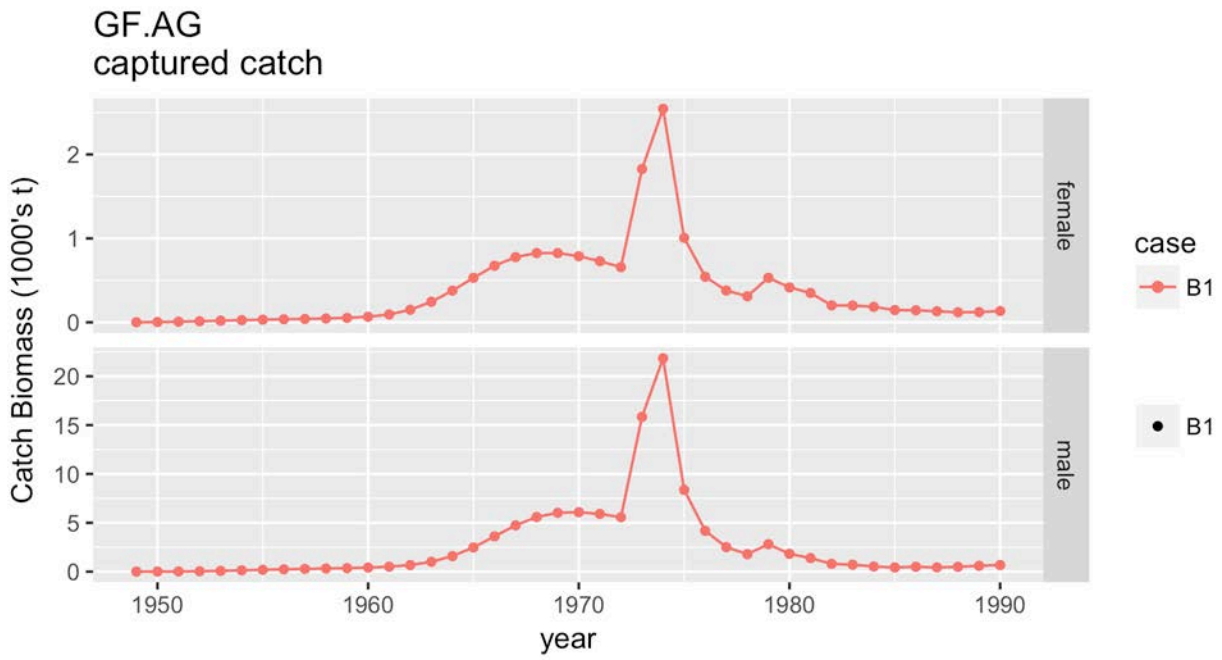


Figure 84. Predicted GF.AG captured catch biomass.

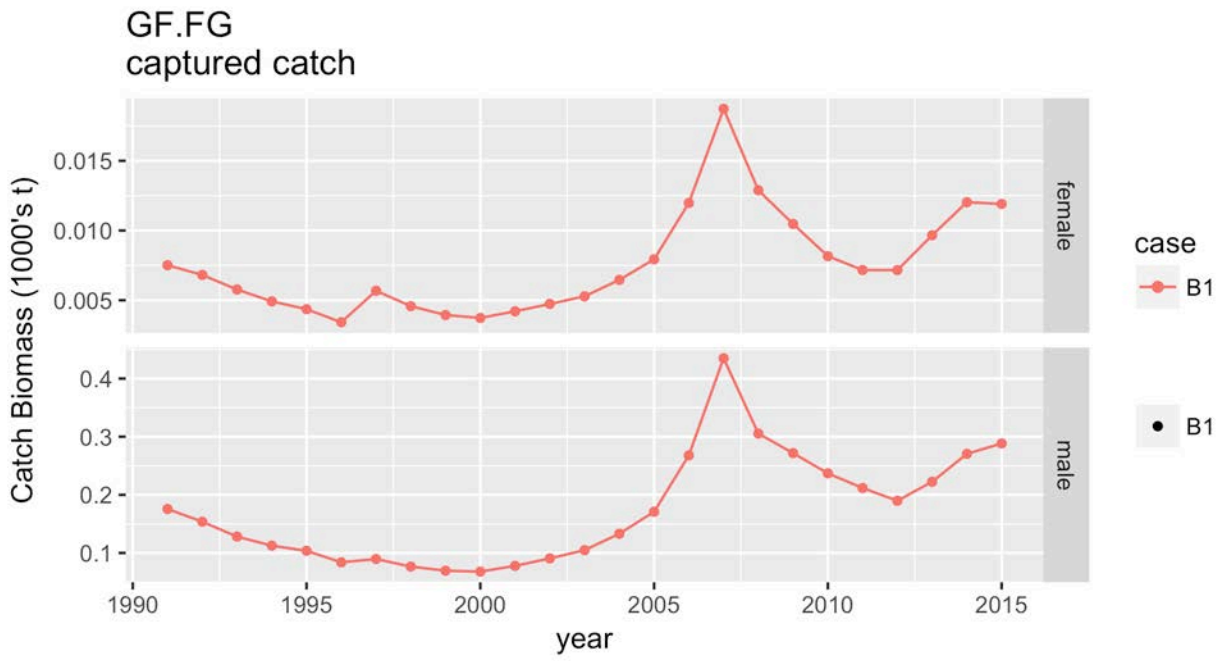


Figure 85. Predicted GF.FG captured catch biomass.

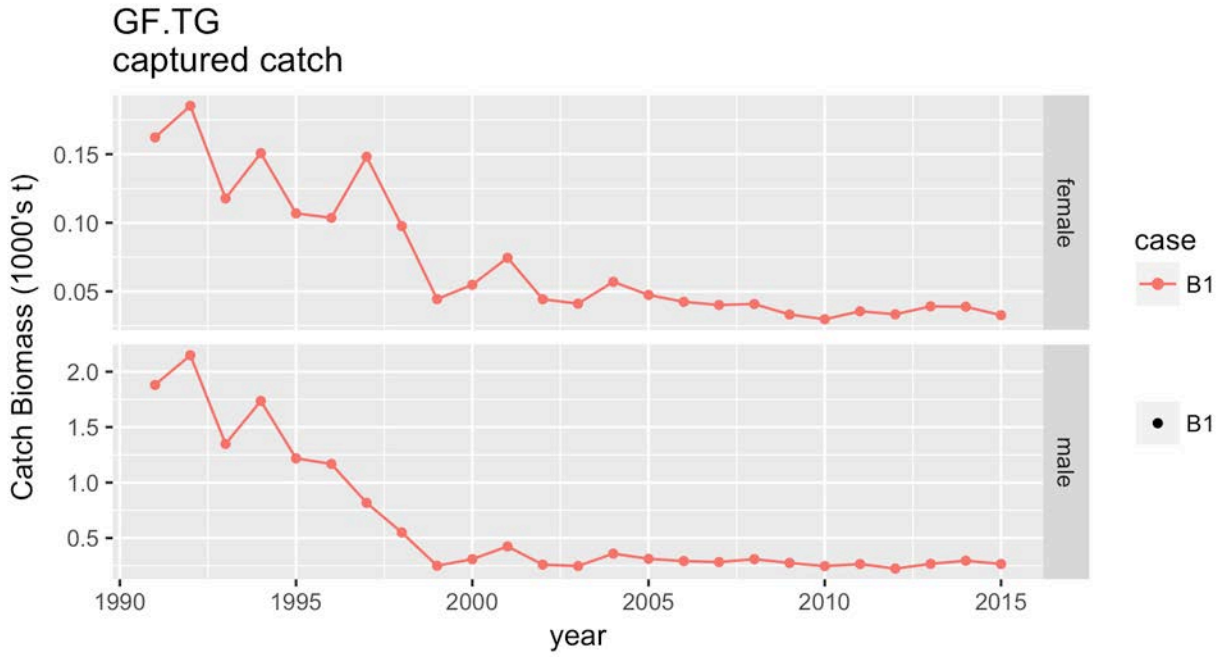


Figure 86. Predicted GF.TG captured catch biomass.

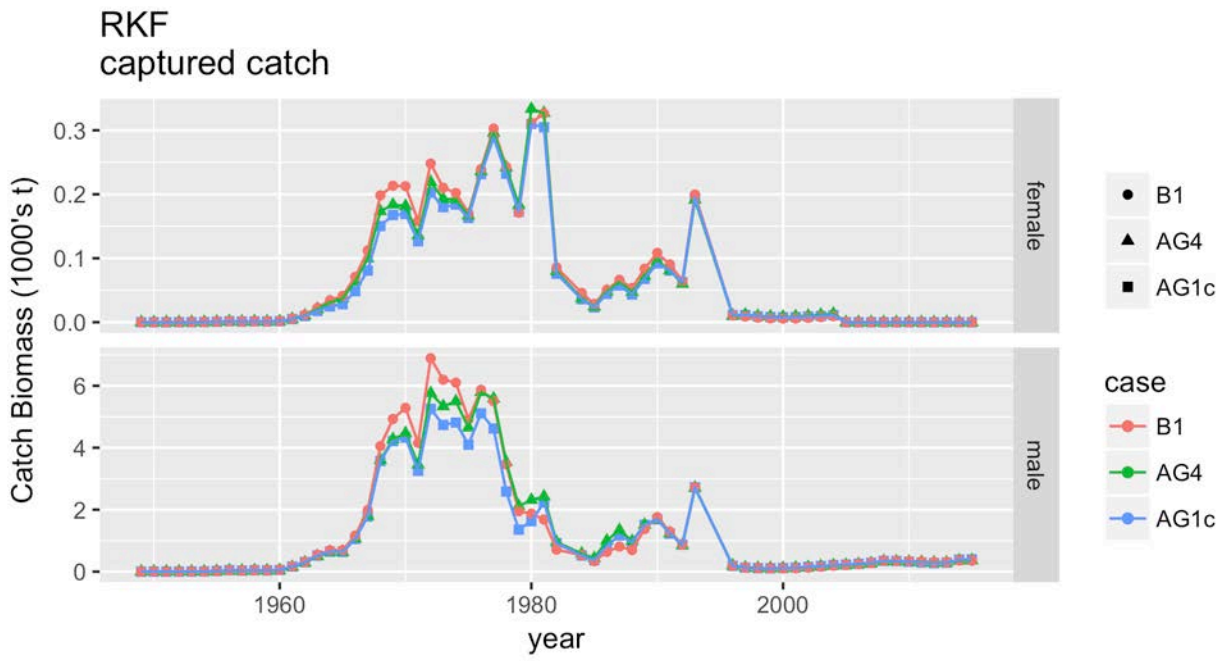


Figure 87. Predicted RKF captured catch biomass.

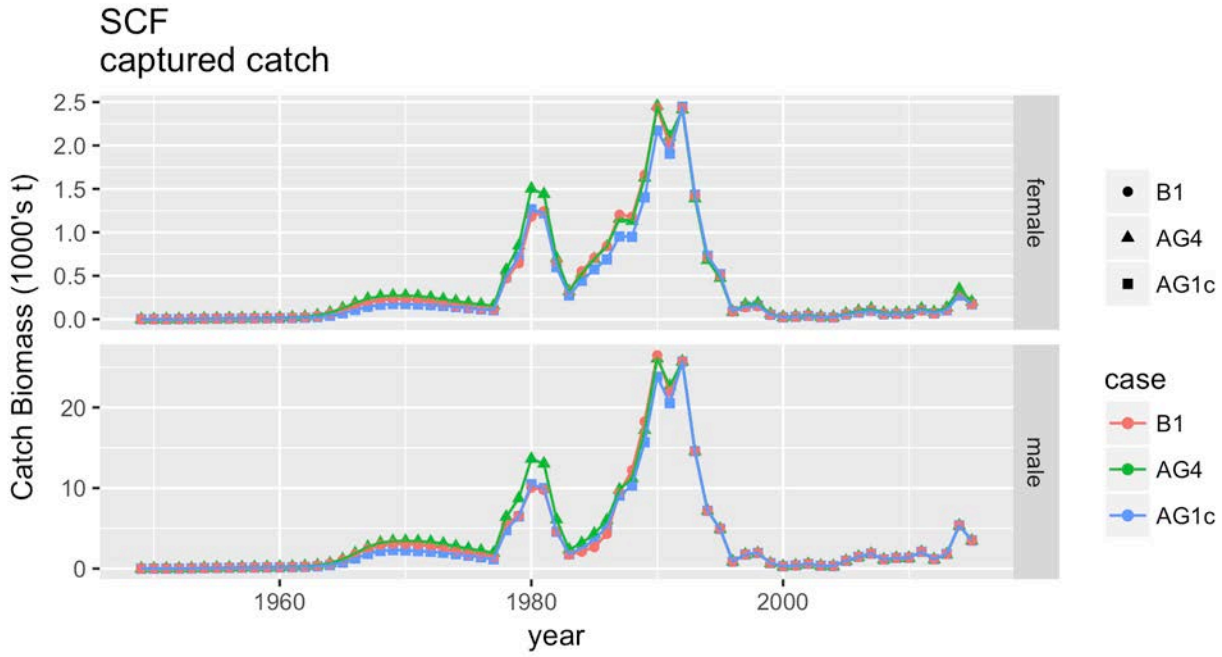


Figure 88. Predicted SCF captured catch biomass.

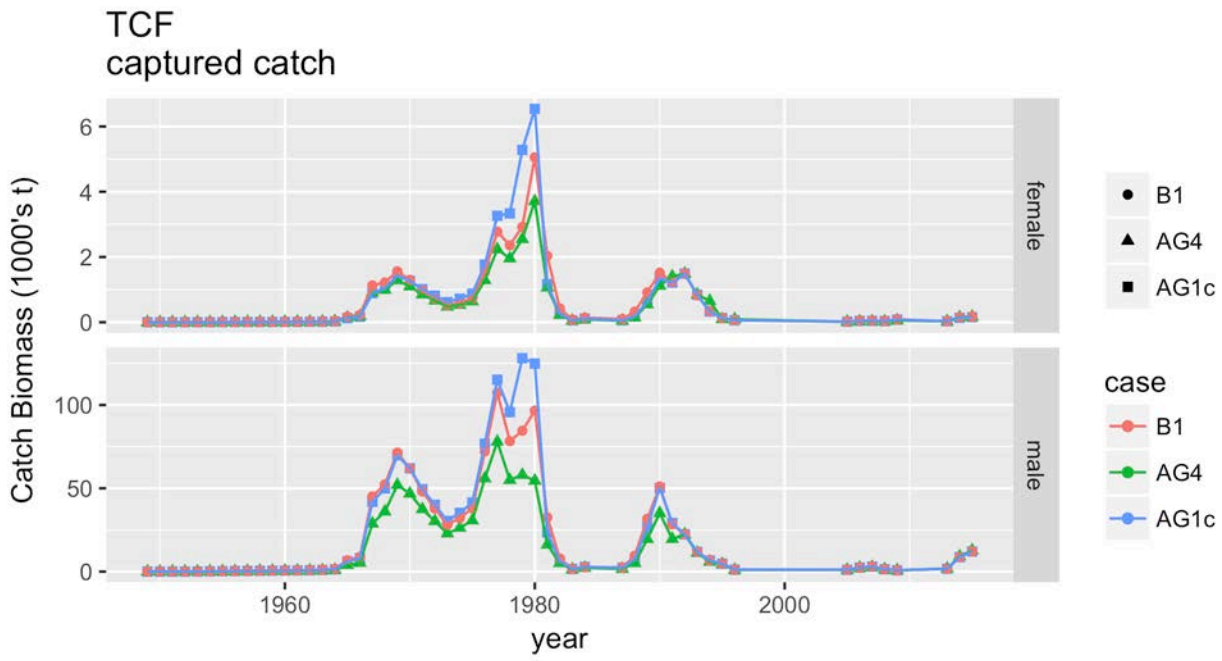


Figure 89. Predicted TCF captured catch biomass.

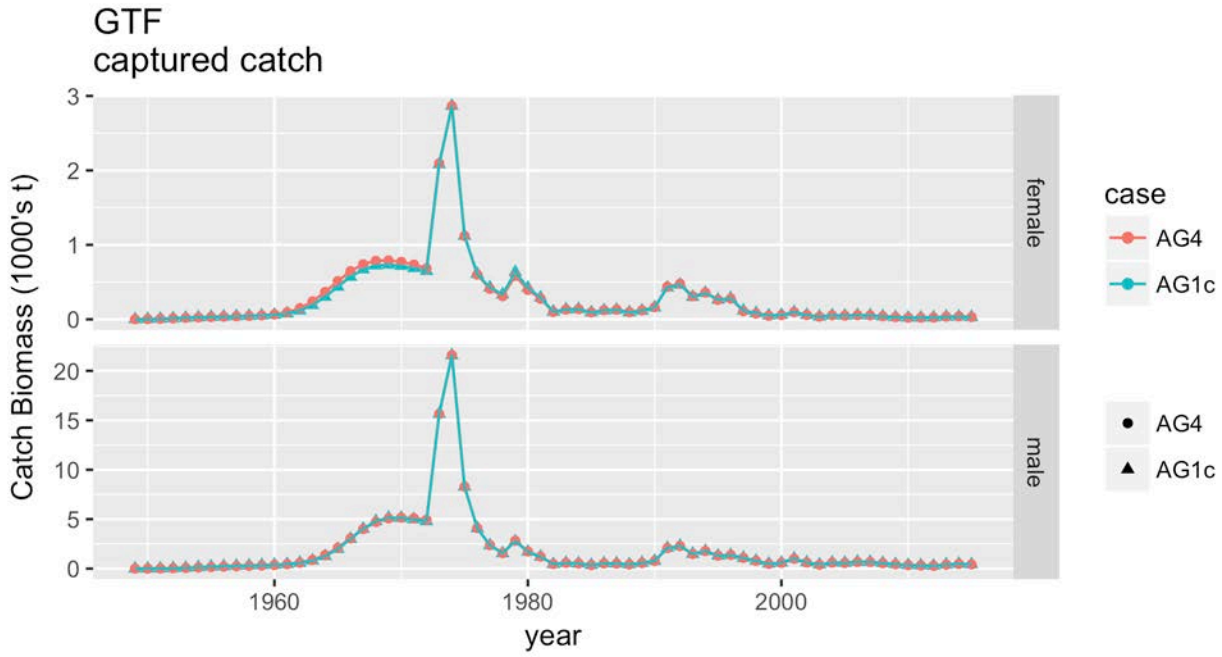


Figure 90. Predicted GTF captured catch biomass.

Retained catch abundance

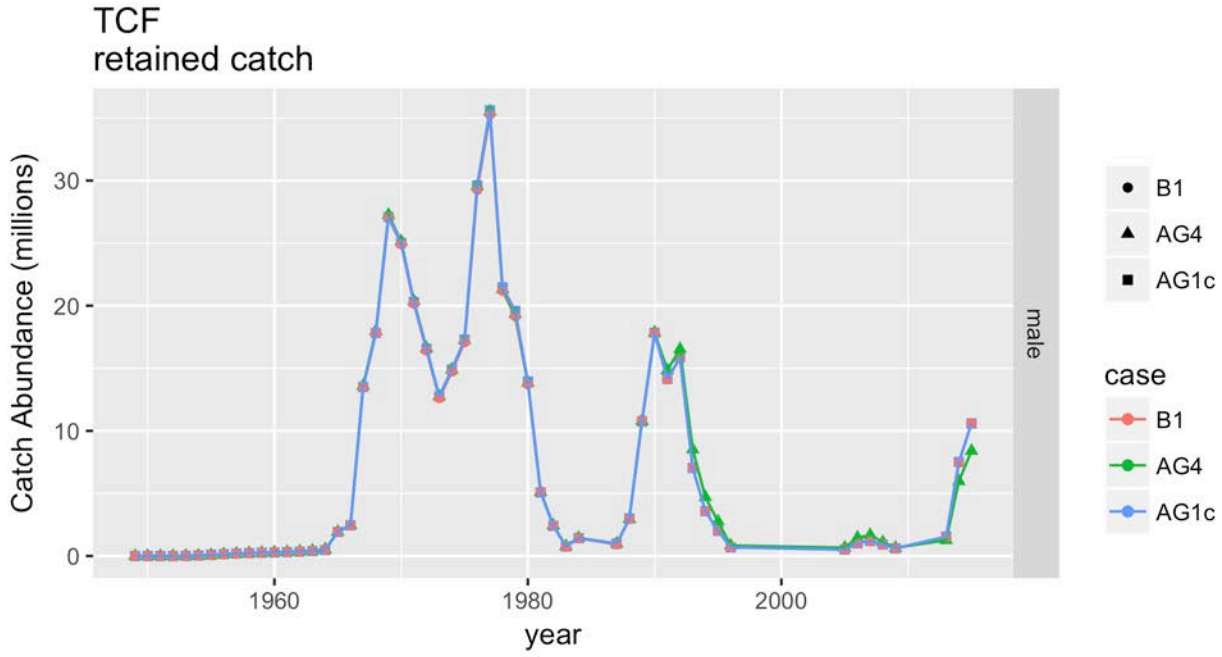


Figure 91. Predicted TCF retained catch abundance.

Retained catch biomass

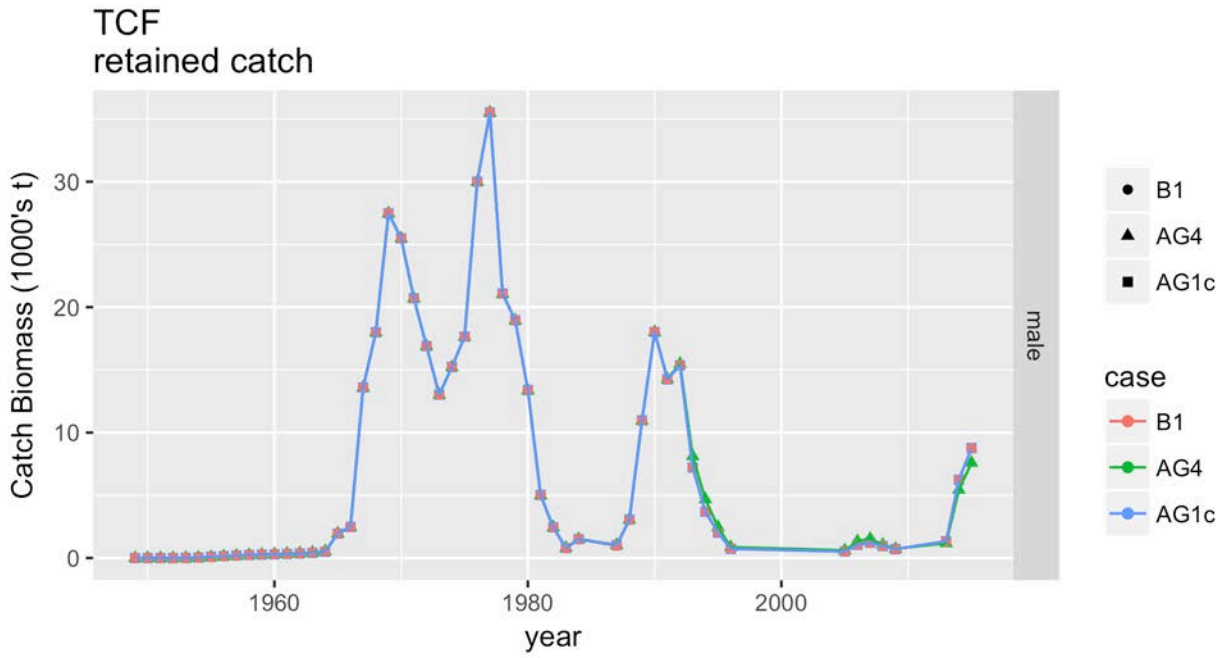


Figure 92. Predicted TCF retained catch biomass.

Total catch size compositions

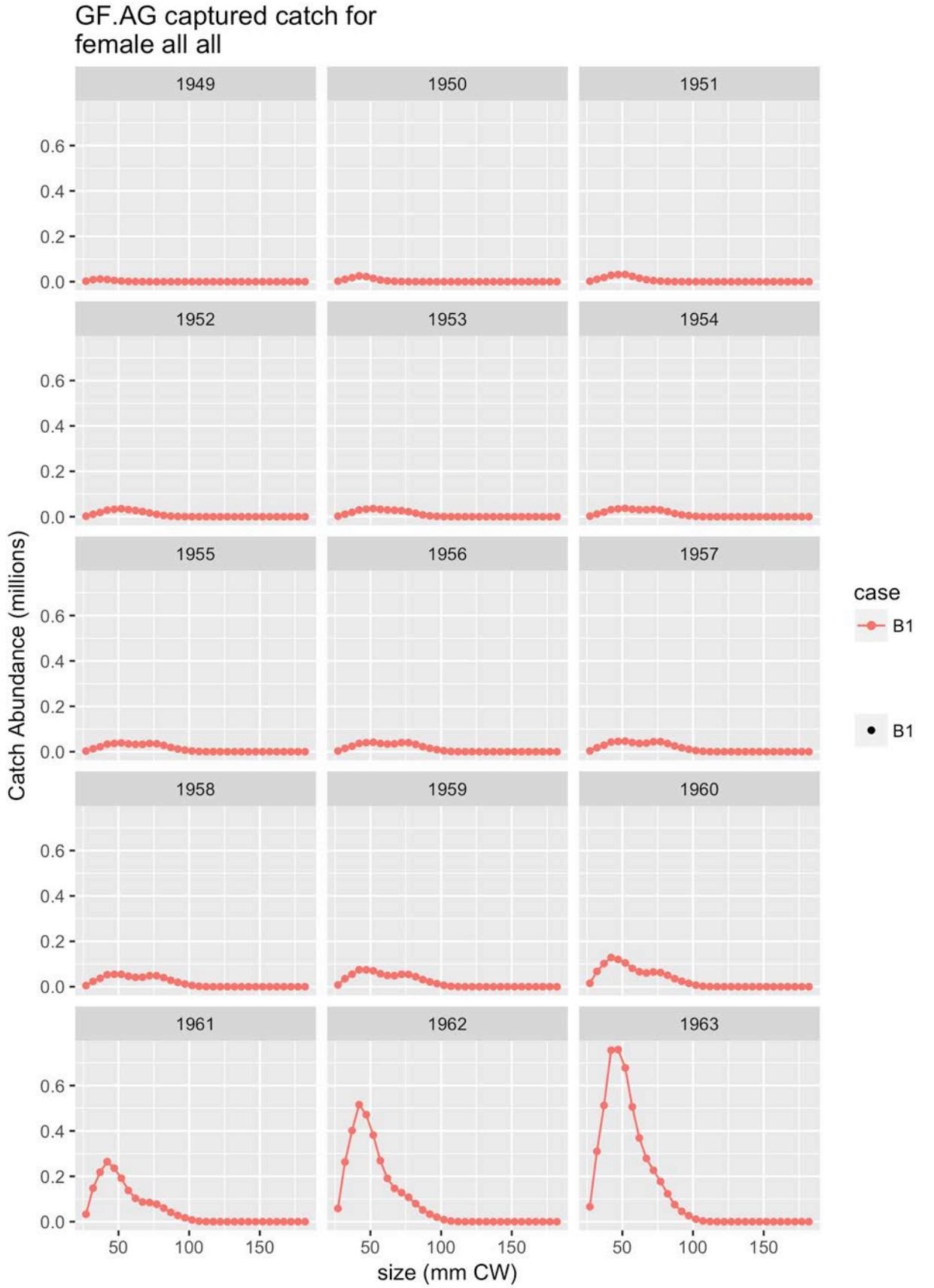


Figure 93. Predicted GF.AG captured catch abundance for female all all, (1 of 3).

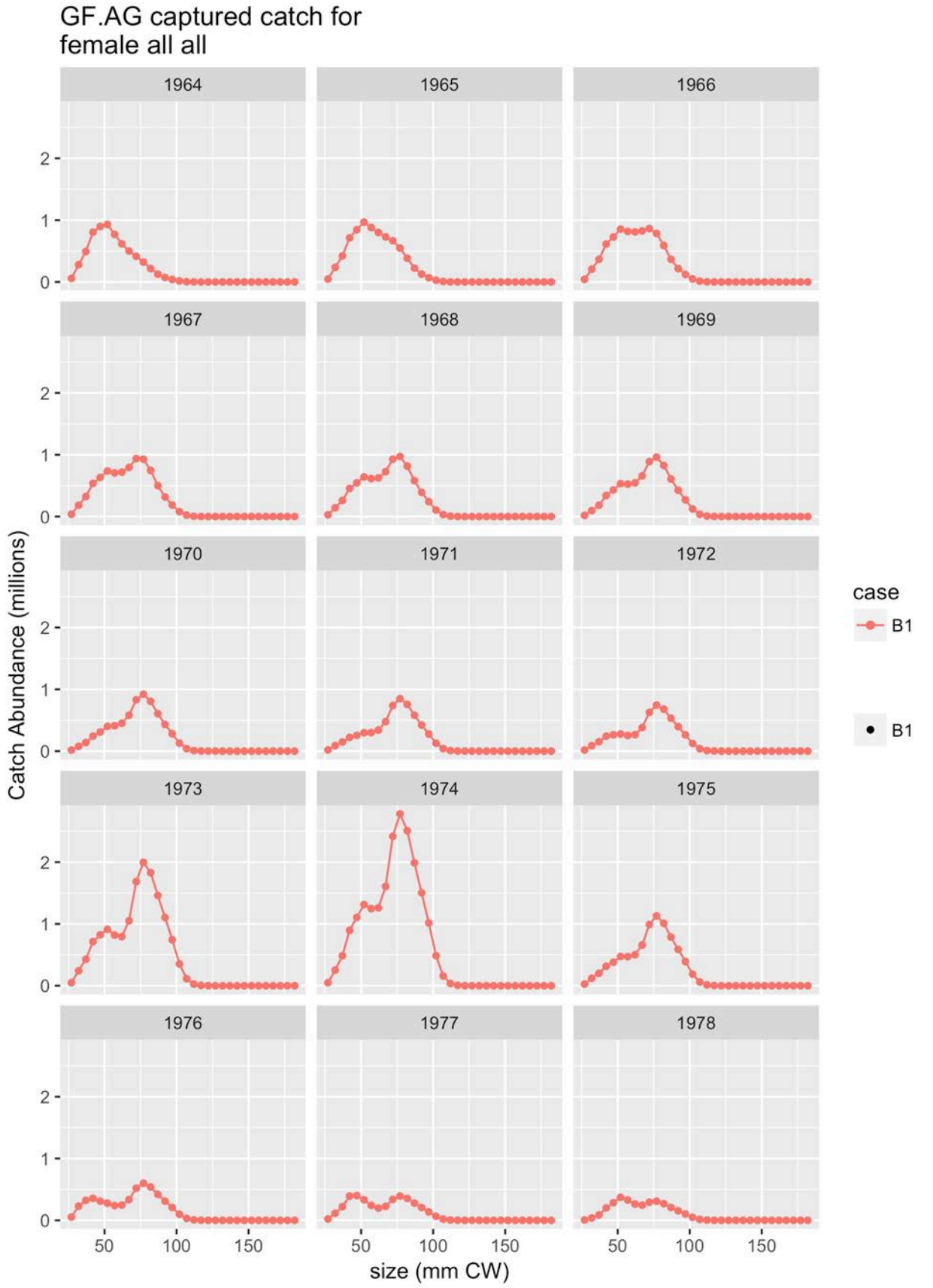


Figure 94. Predicted GF.AG captured catch abundance for female all all, (2 of 3).

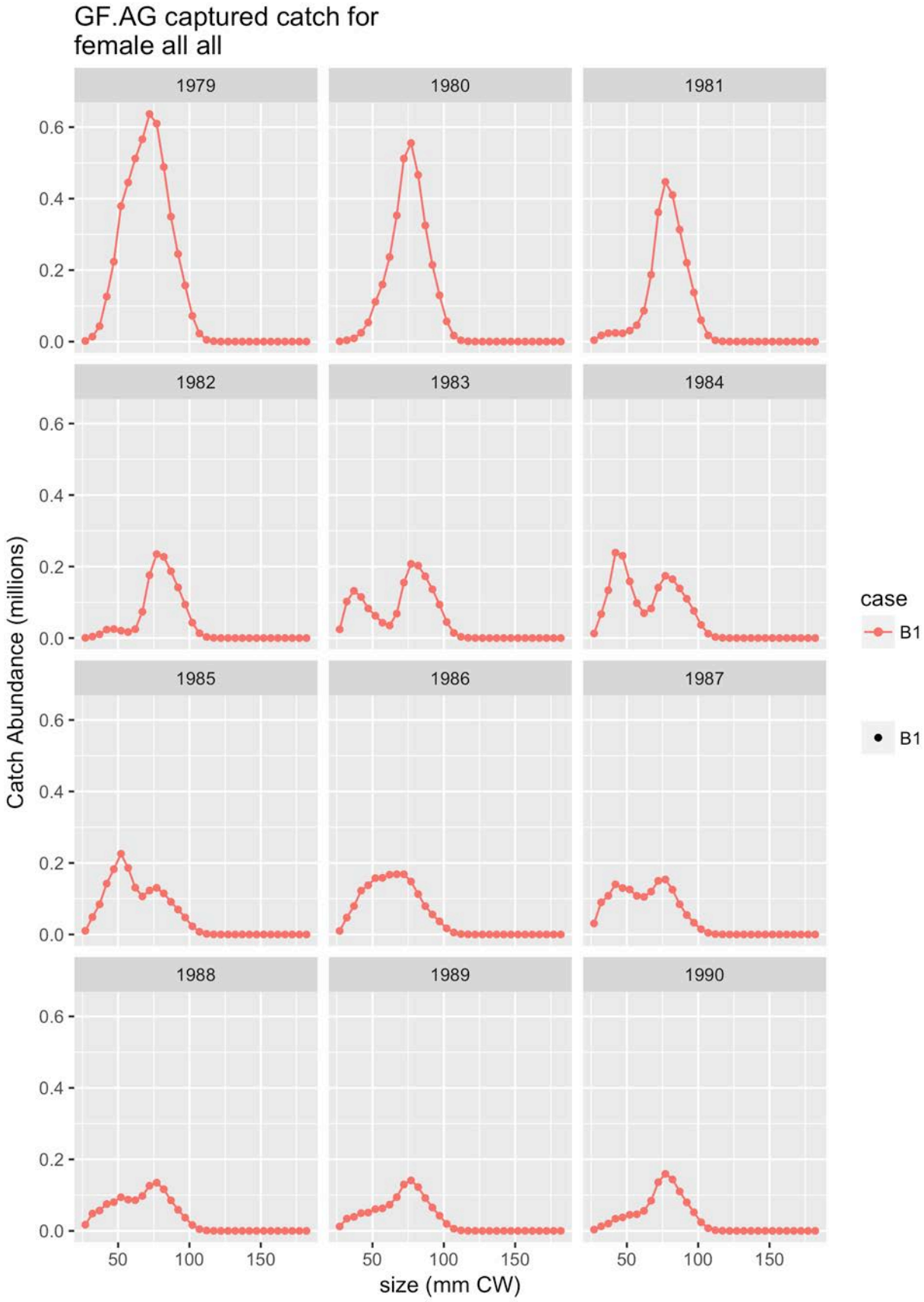


Figure 95. Predicted GF.AG captured catch abundance for female all all, (3 of 3).

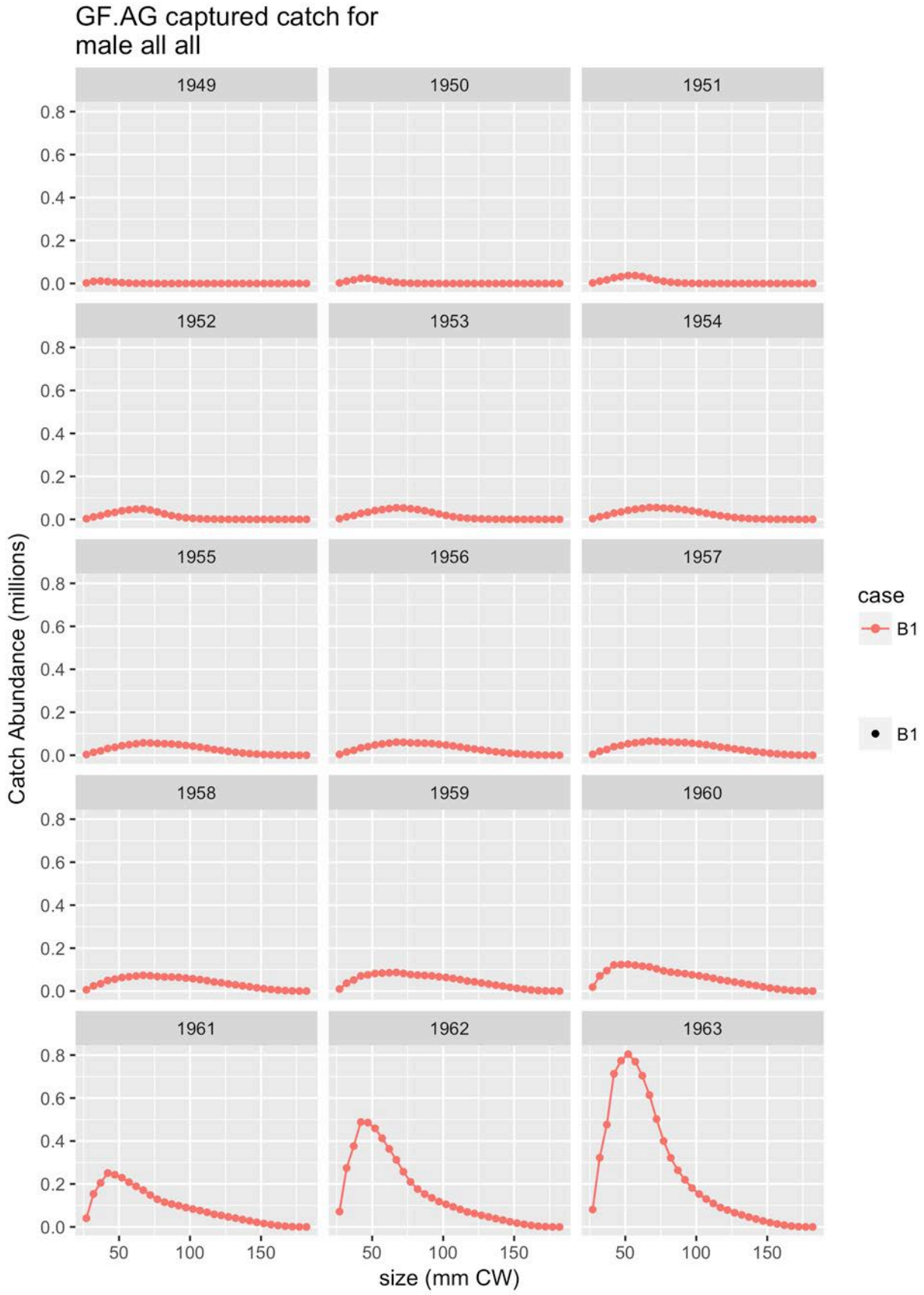


Figure 96. Predicted GF.AG captured catch abundance for male all all, (1 of 3).

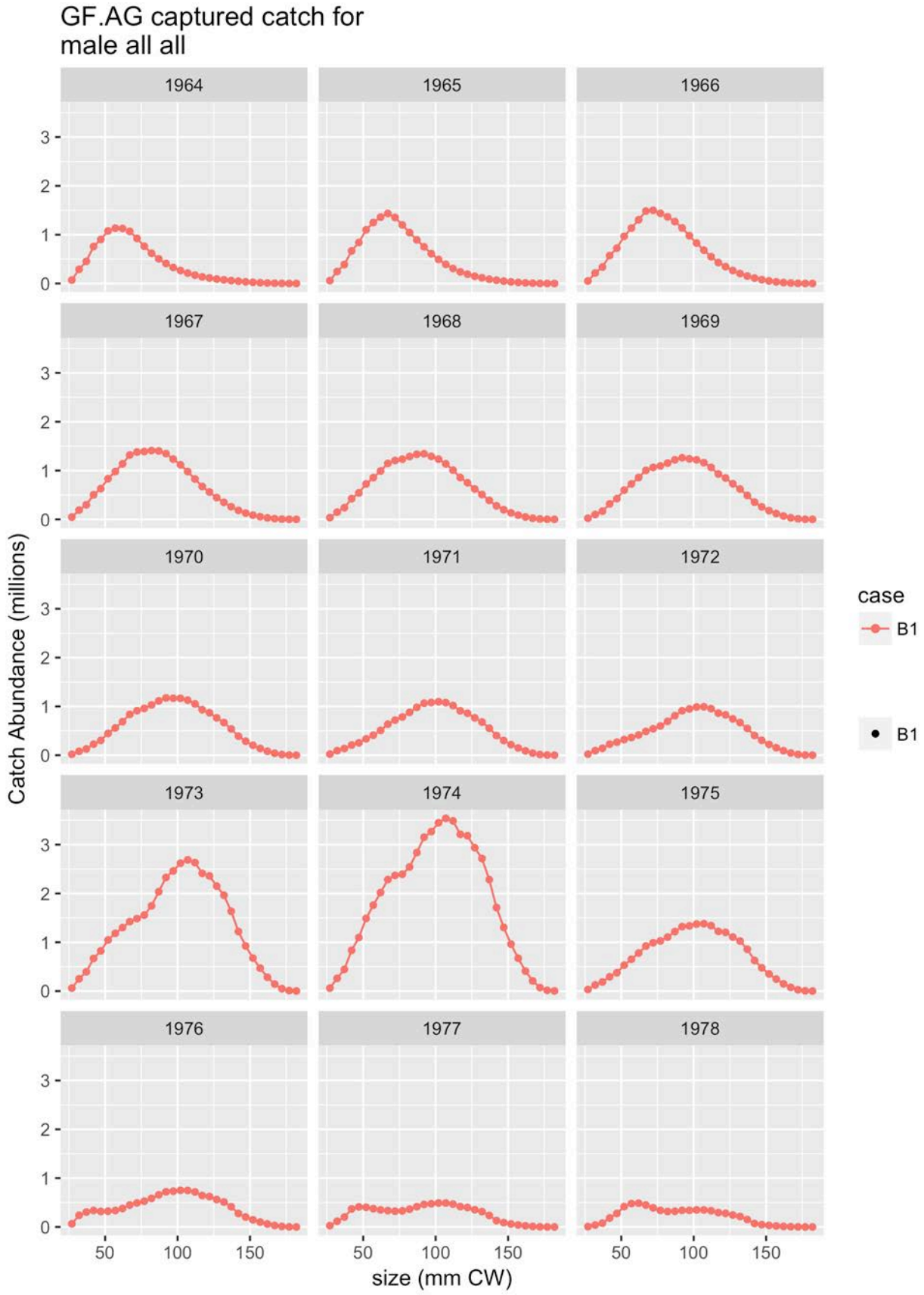


Figure 97. Predicted GF.AG captured catch abundance for male all all, (2 of 3).

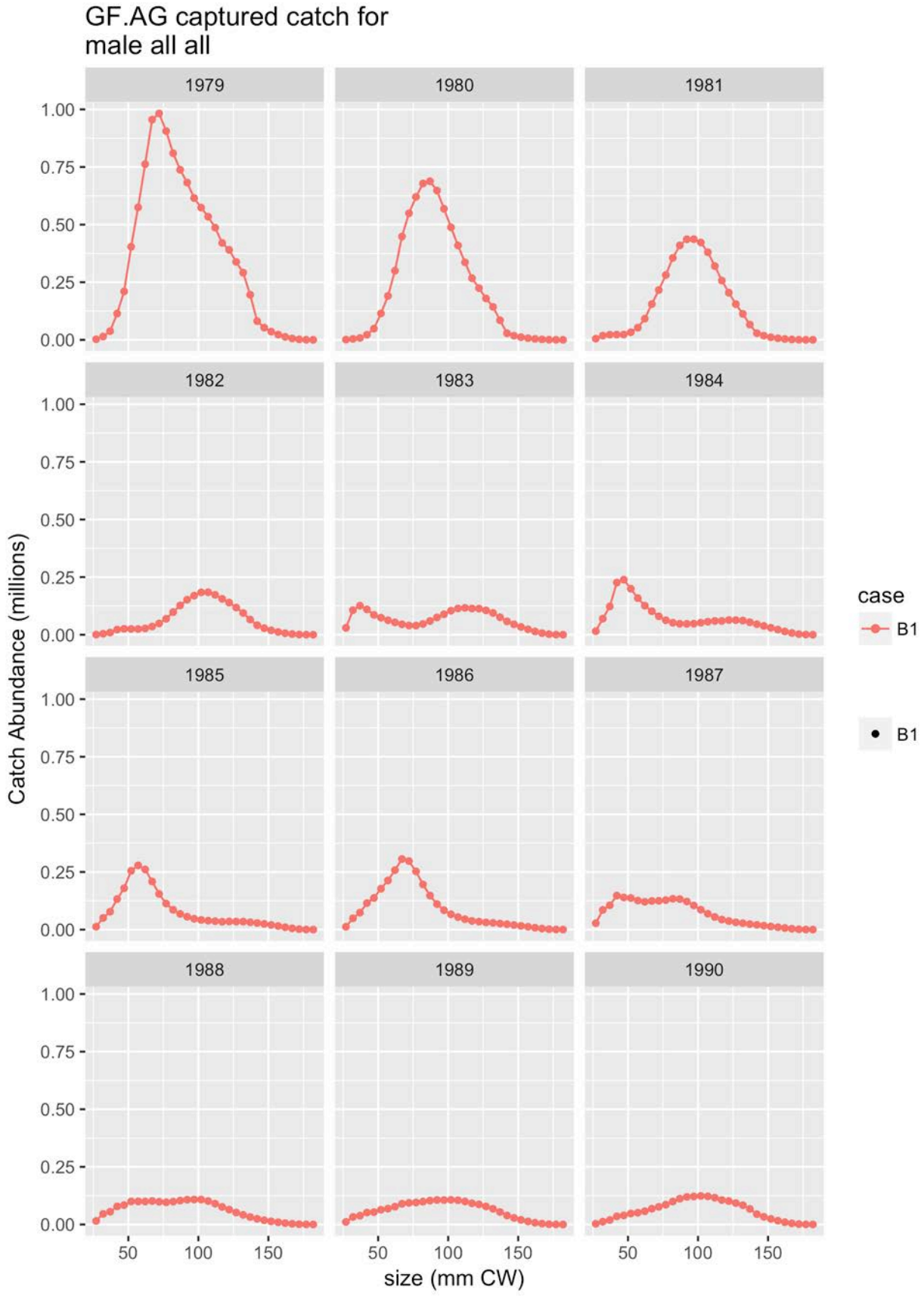


Figure 98. Predicted GF.AG captured catch abundance for male all all, (3 of 3).

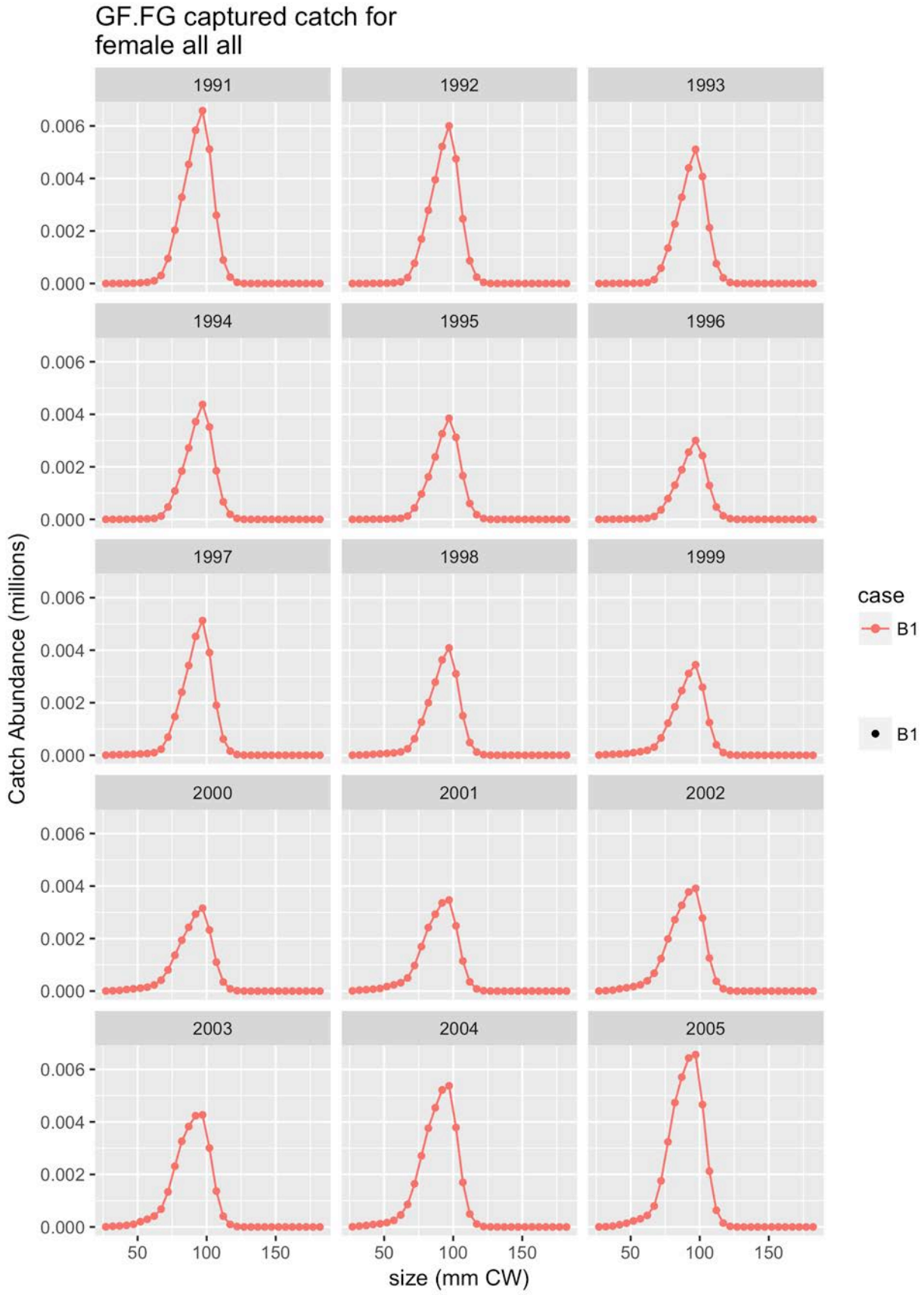


Figure 99. Predicted GF.FG captured catch abundance for female all all, (1 of 2).

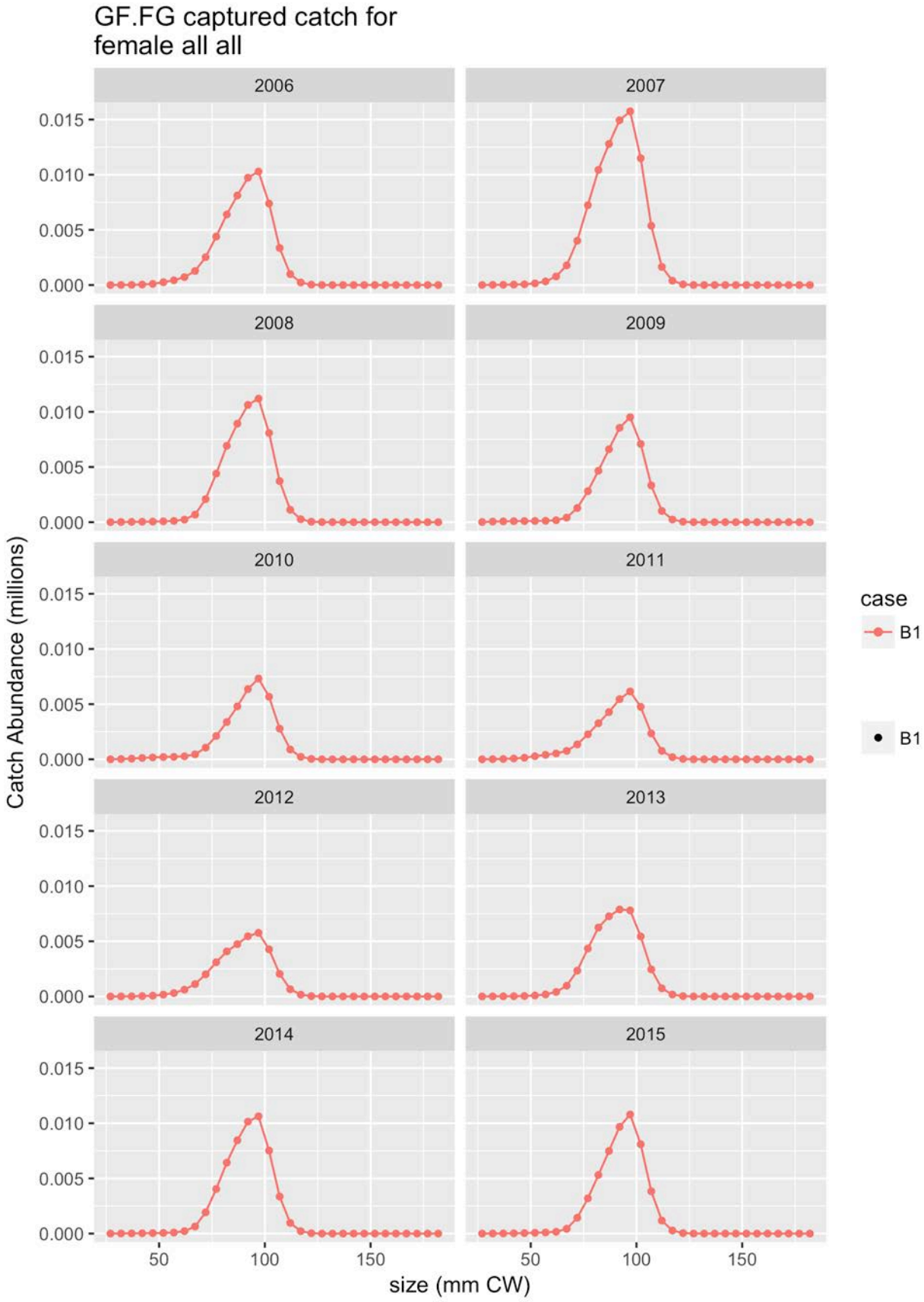


Figure 100. Predicted GF.FG captured catch abundance for female all all, (2 of 2).

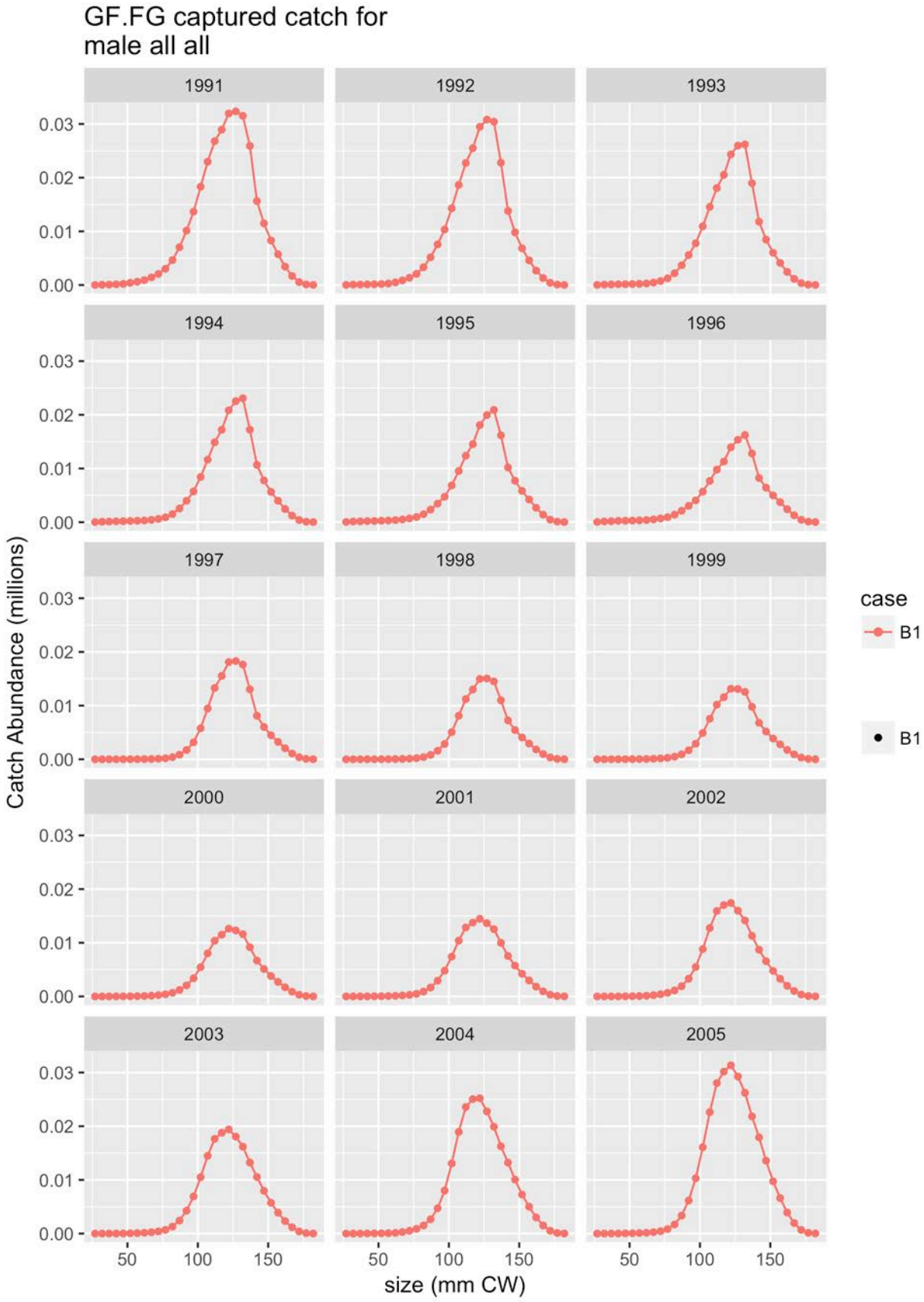


Figure 101. Predicted GF.FG captured catch abundance for male all all, (1 of 2).

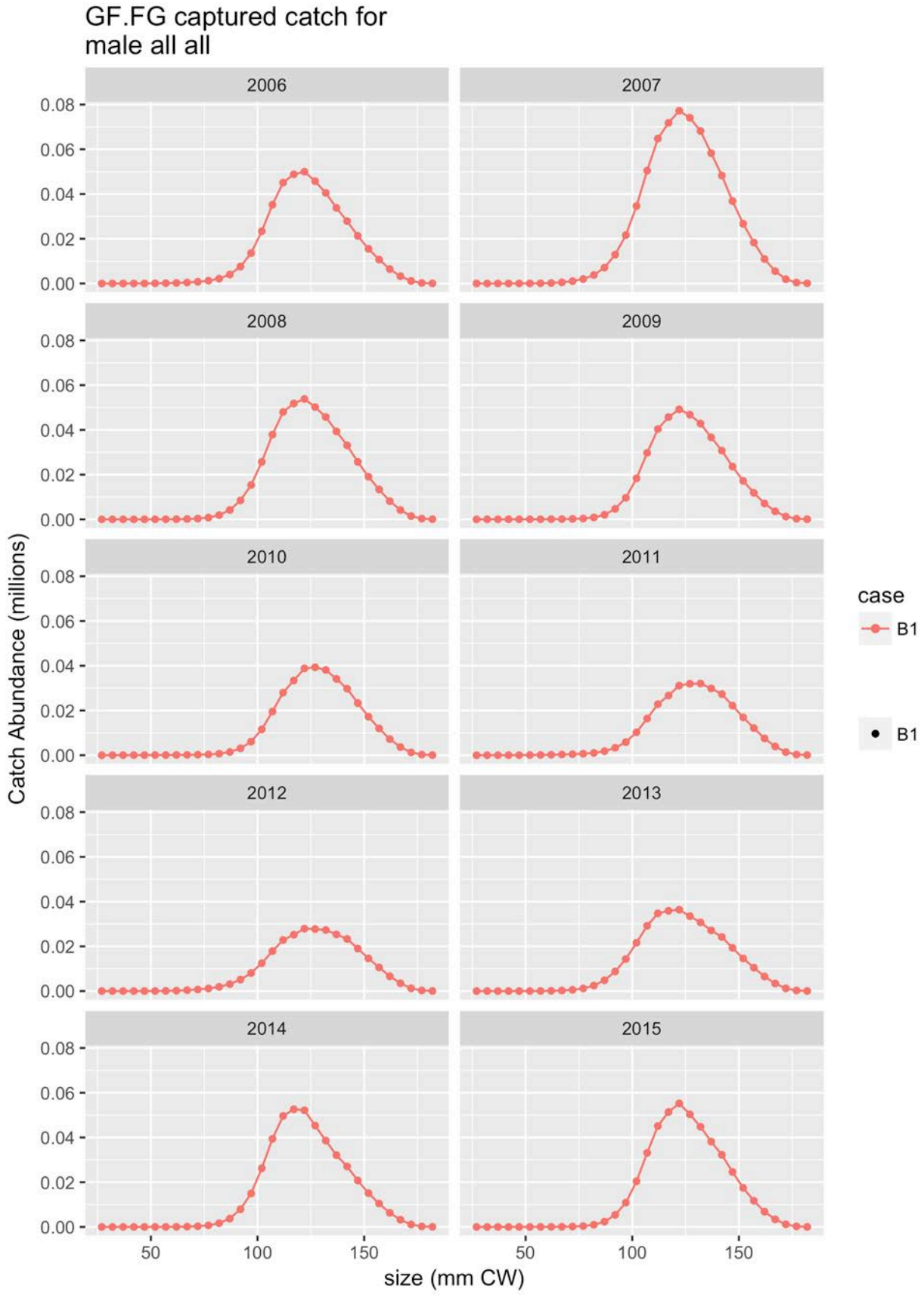


Figure 102. Predicted GF.FG captured catch abundance for male all all, (2 of 2).

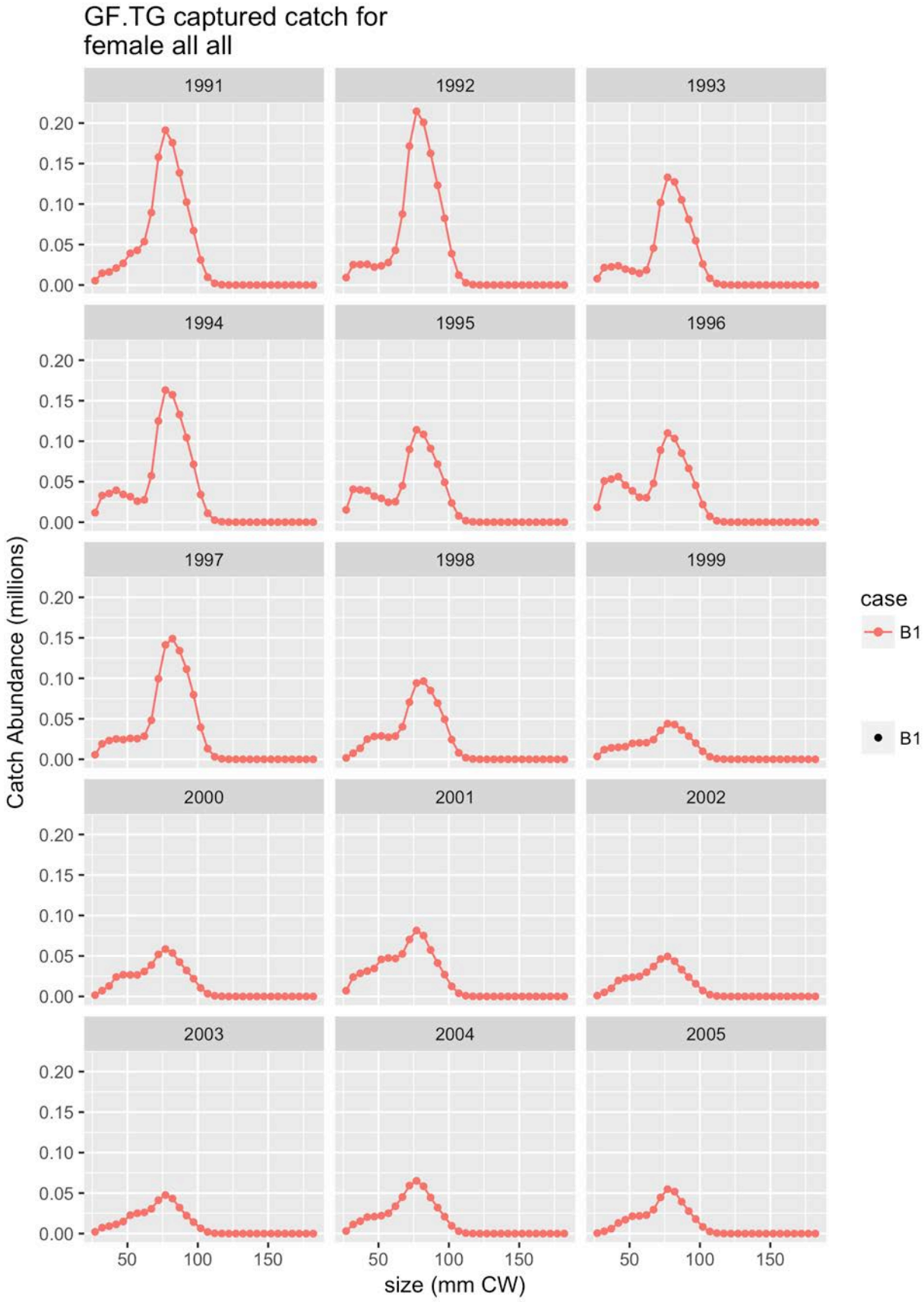


Figure 103. Predicted GF.TG captured catch abundance for female all all, (1 of 2).

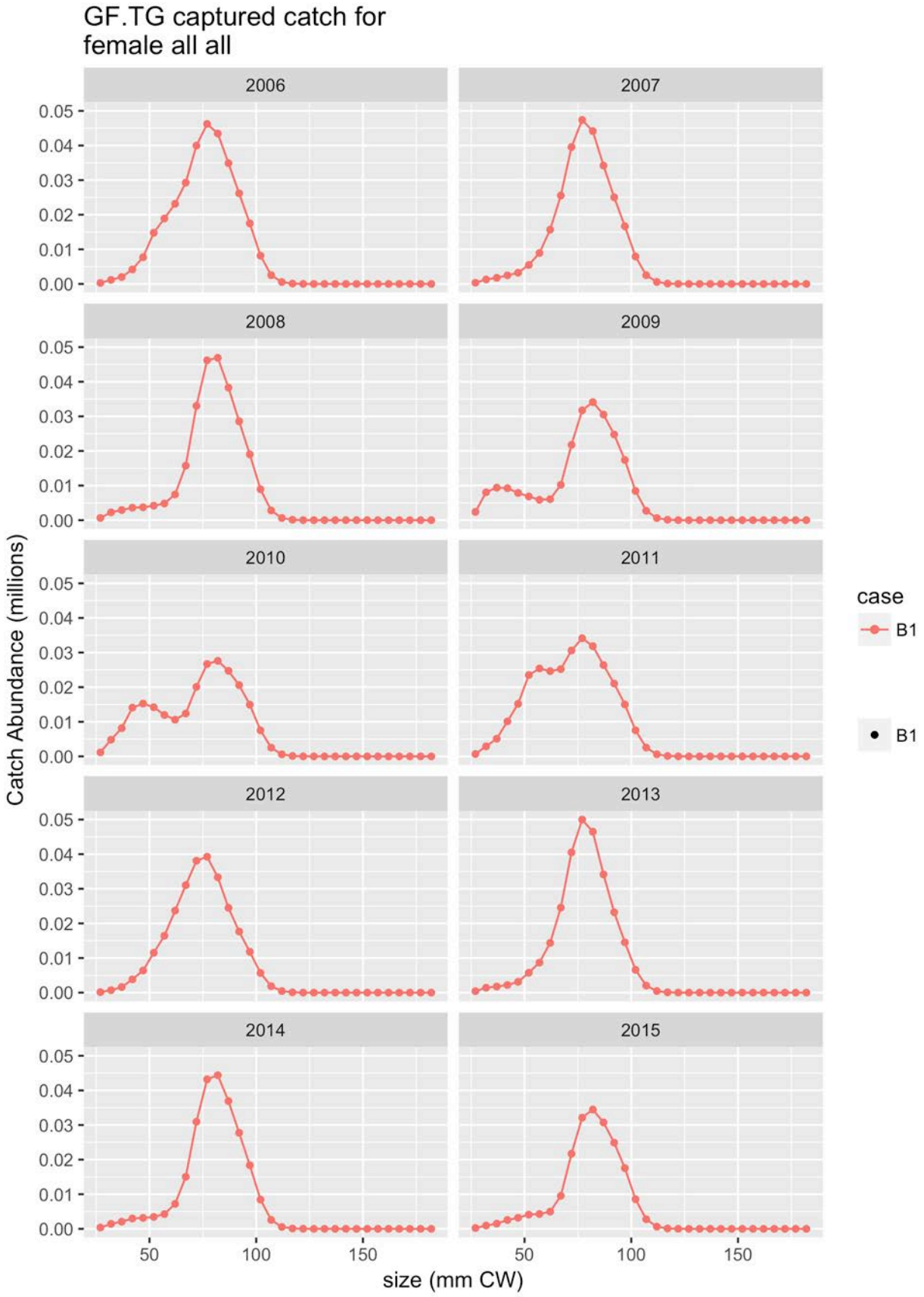


Figure 104. Predicted GF.TG captured catch abundance for female all all, (2 of 2).

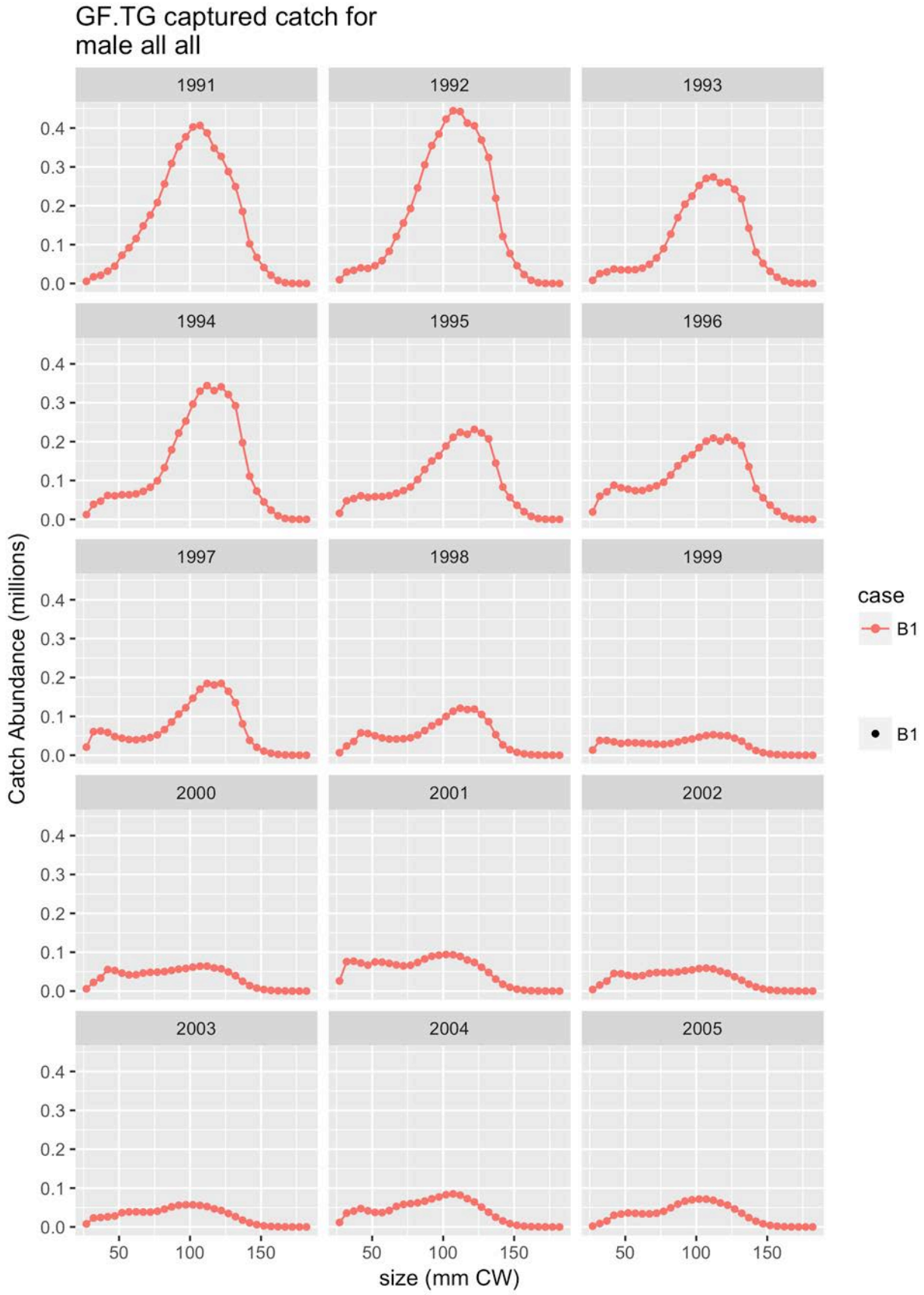


Figure 105. Predicted GF.TG captured catch abundance for male all all, (1 of 2).

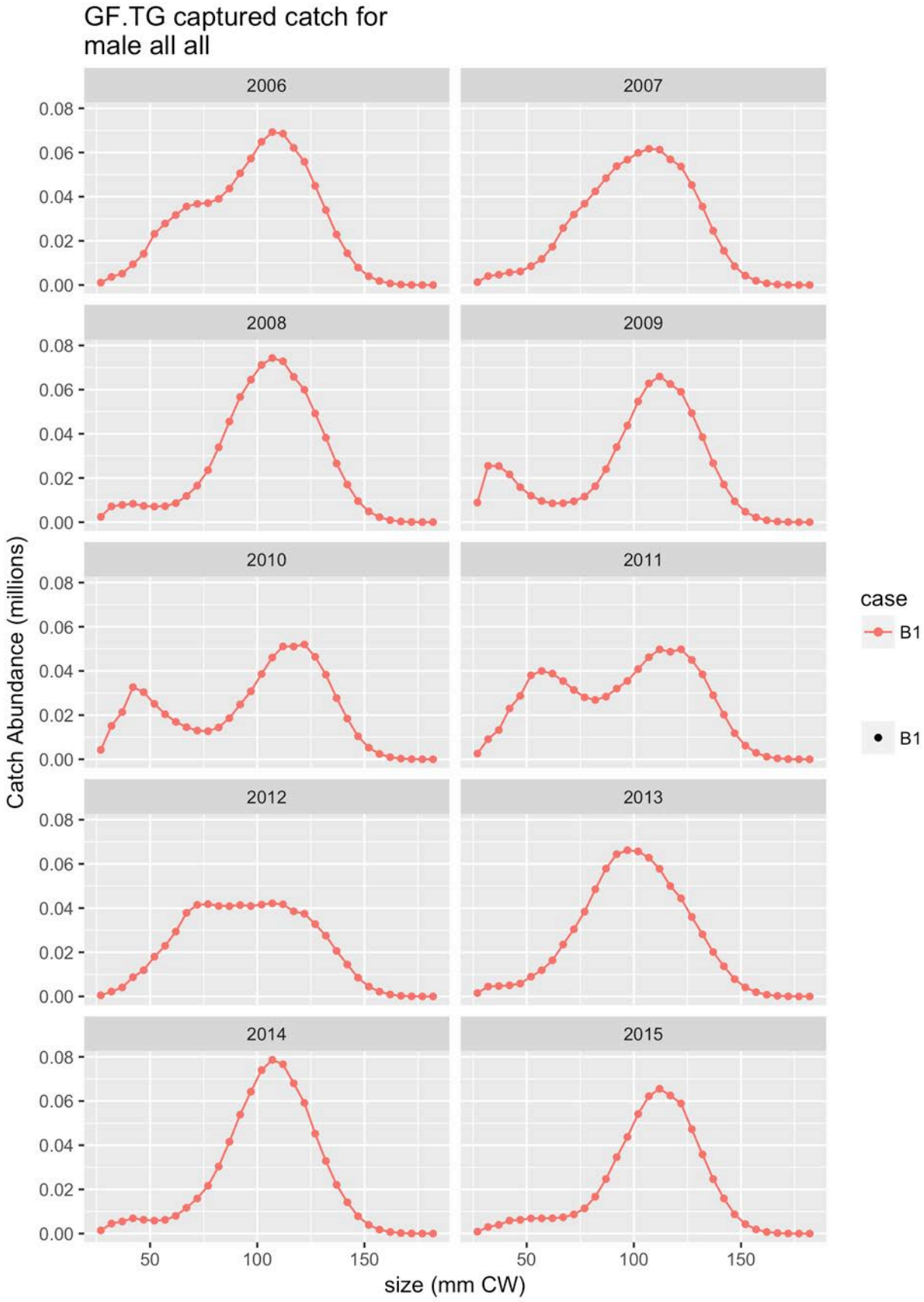


Figure 106. Predicted GF.TG captured catch abundance for male all all, (2 of 2).

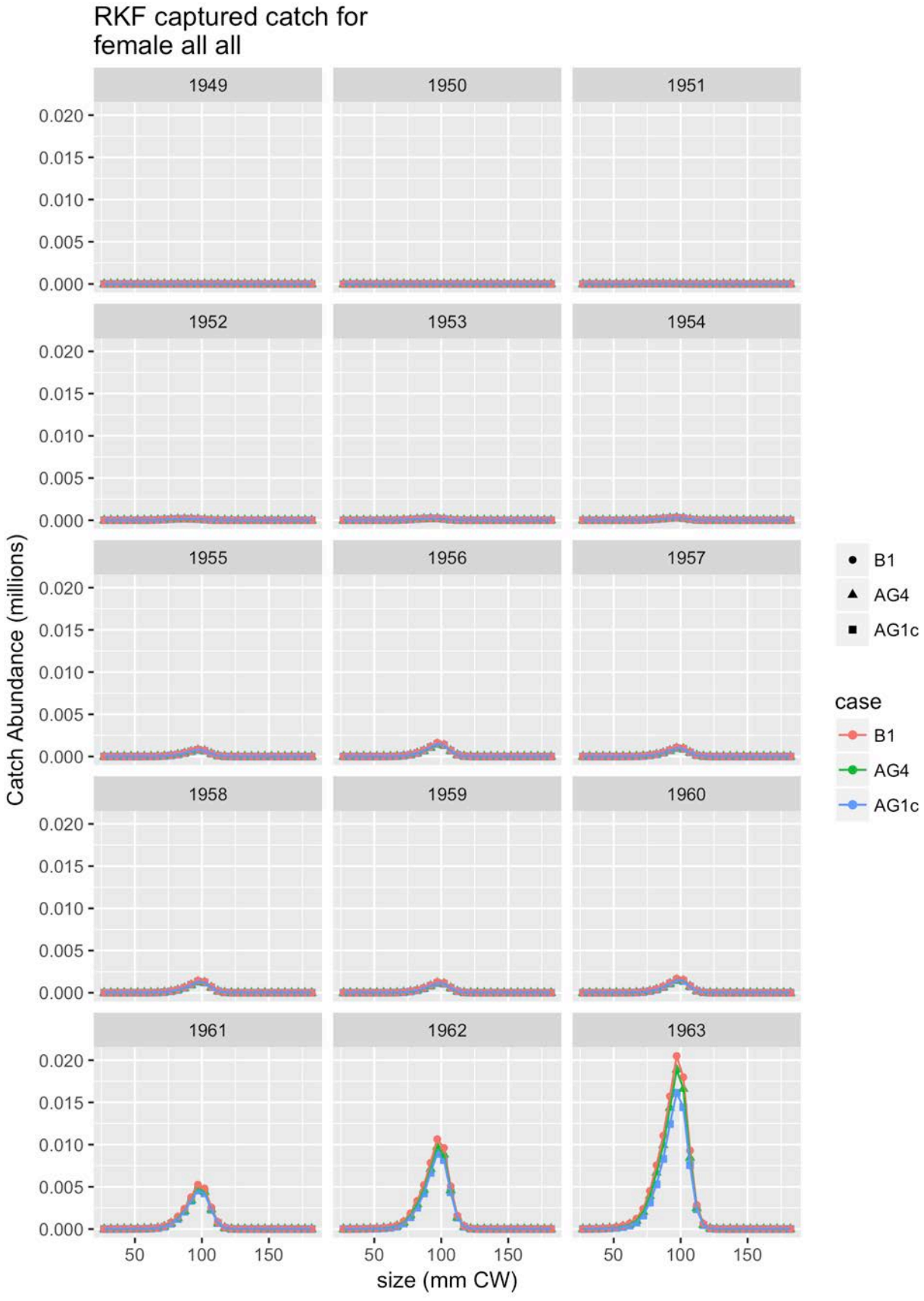


Figure 107. Predicted RKF captured catch abundance for female all all, (1 of 5).

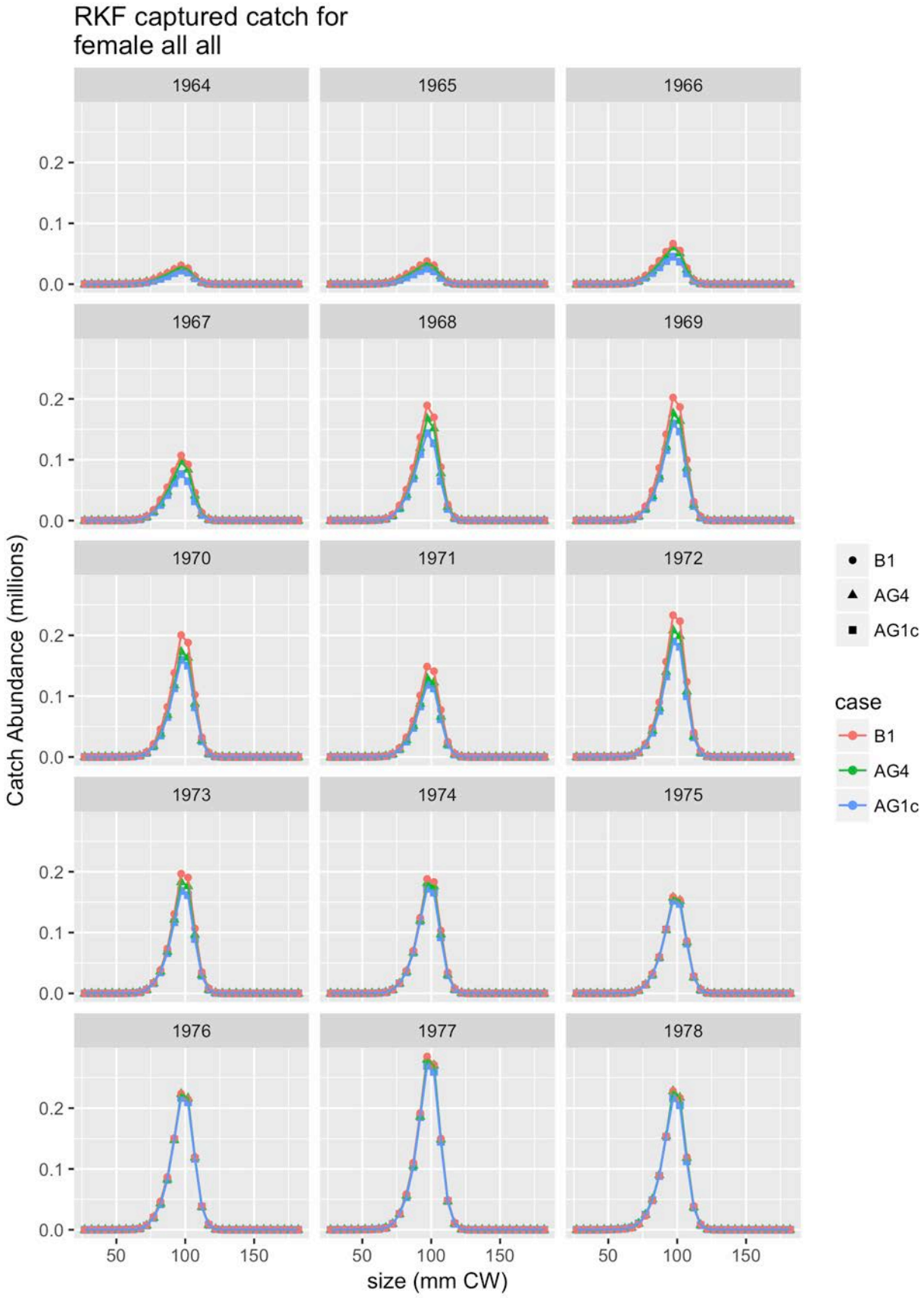


Figure 108. Predicted RKF captured catch abundance for female all all, (2 of 5).

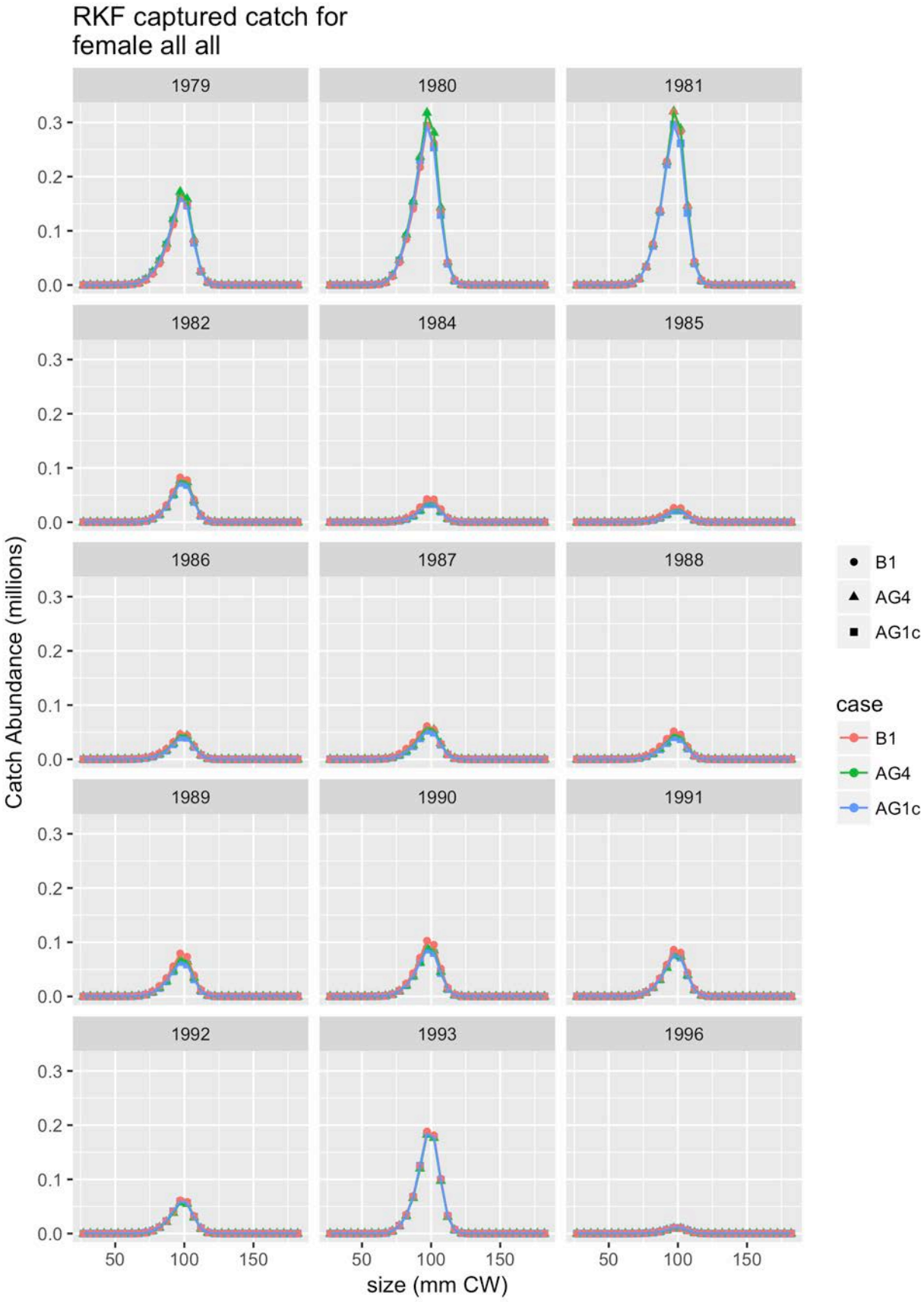


Figure 109. Predicted RKF captured catch abundance for female all all, (3 of 5).

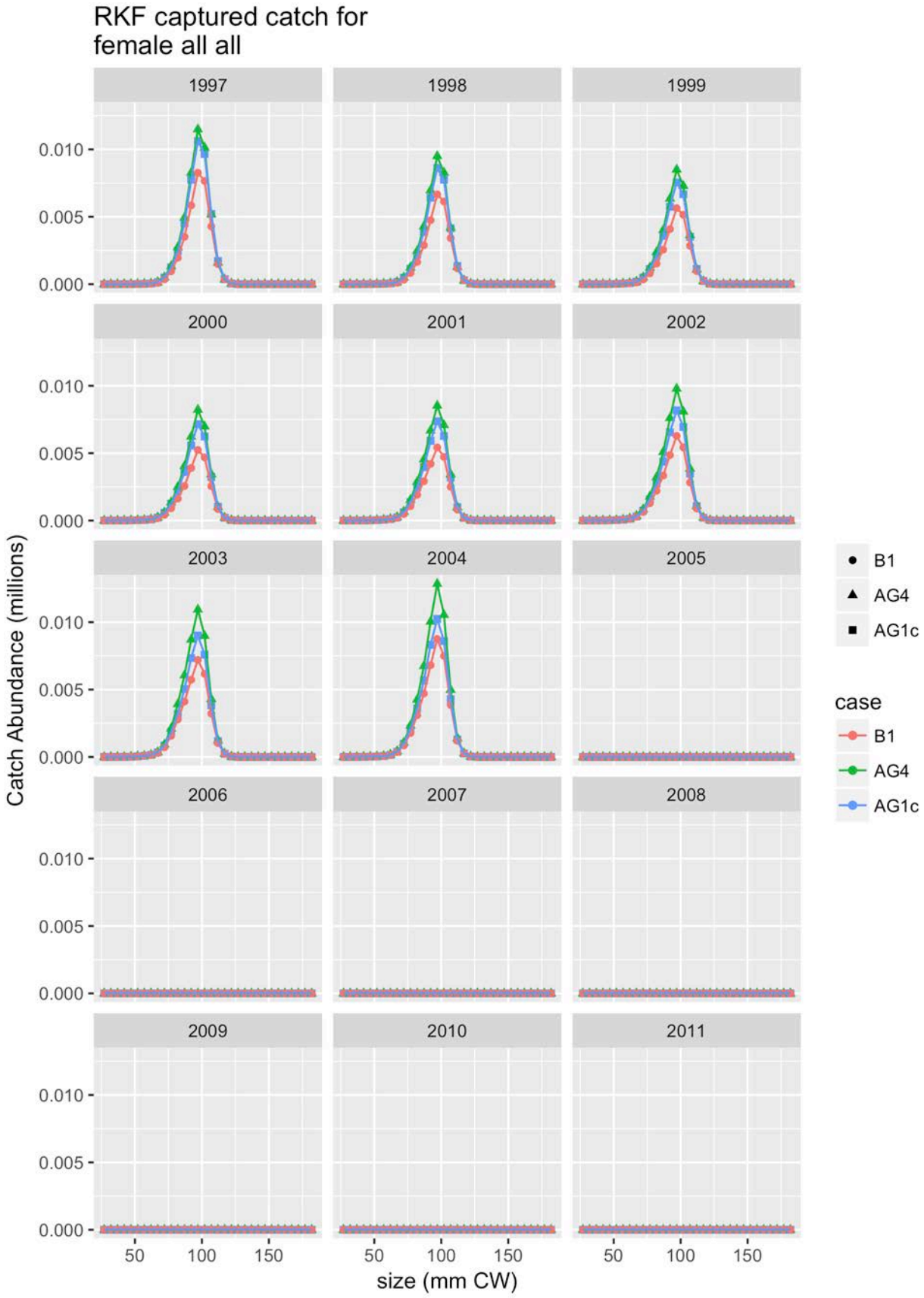


Figure 110. Predicted RKF captured catch abundance for female all all, (4 of 5).

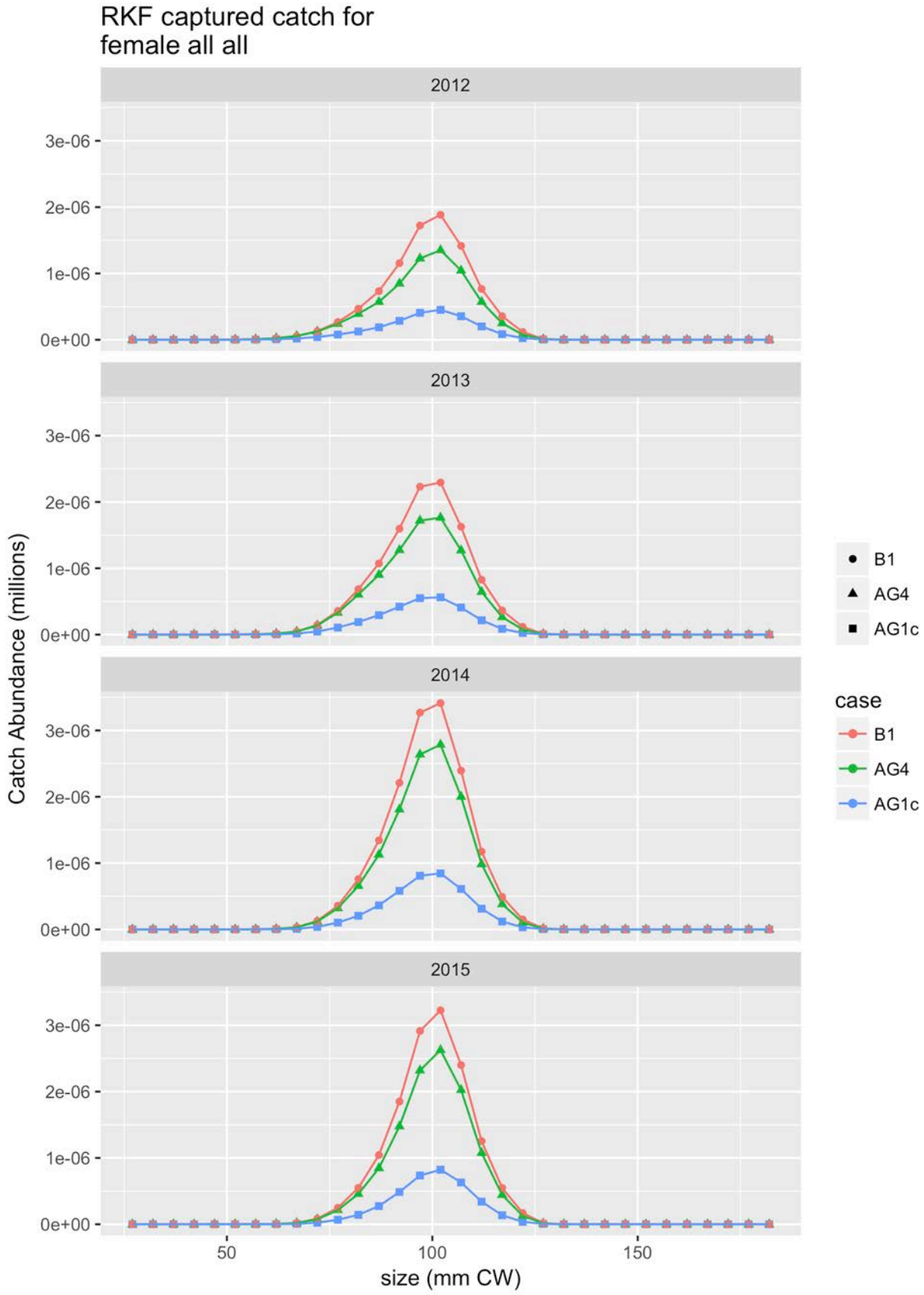


Figure 111. Predicted RKF captured catch abundance for female all all, (5 of 5).

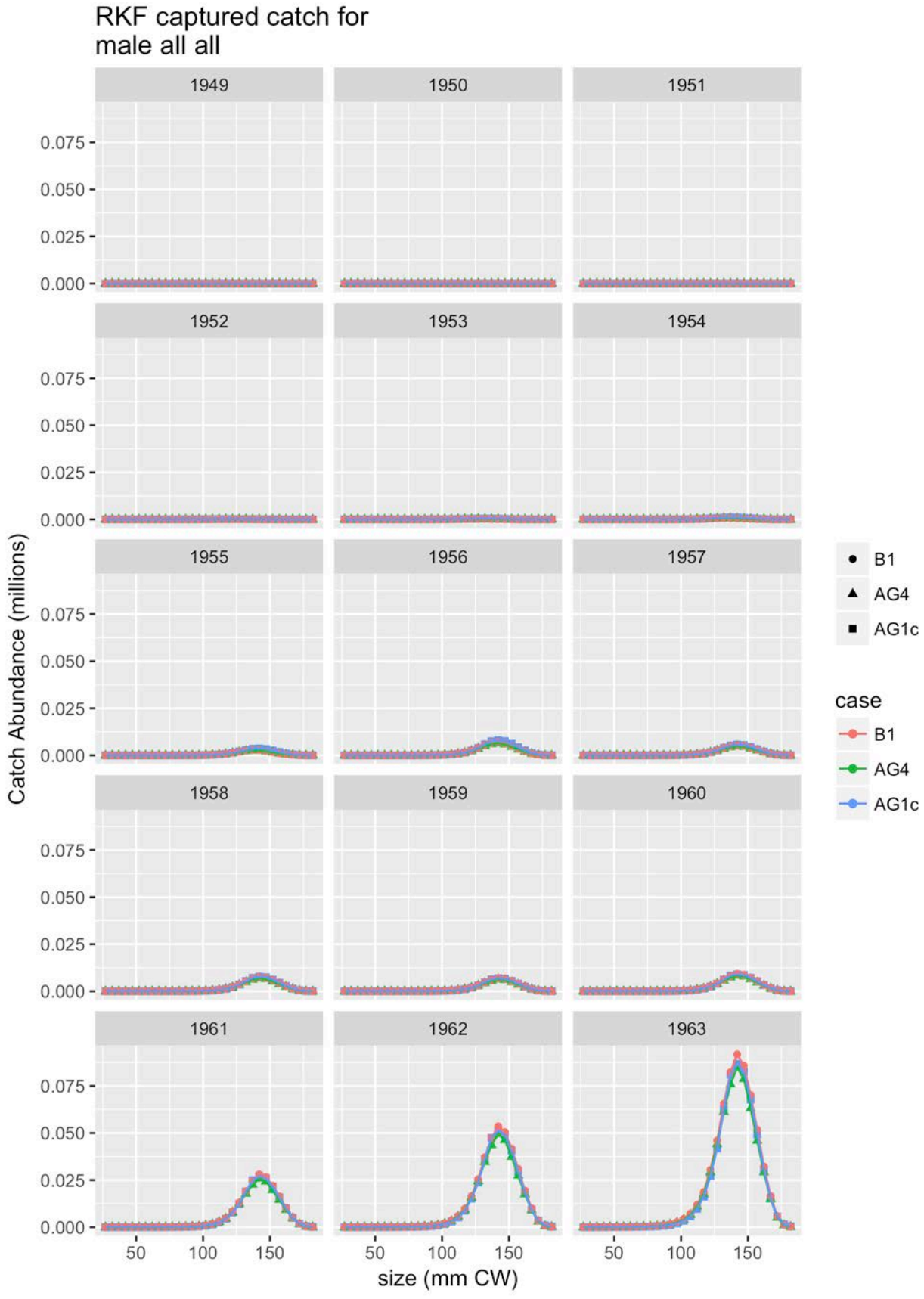


Figure 112. Predicted RKF captured catch abundance for male all all, (1 of 5).

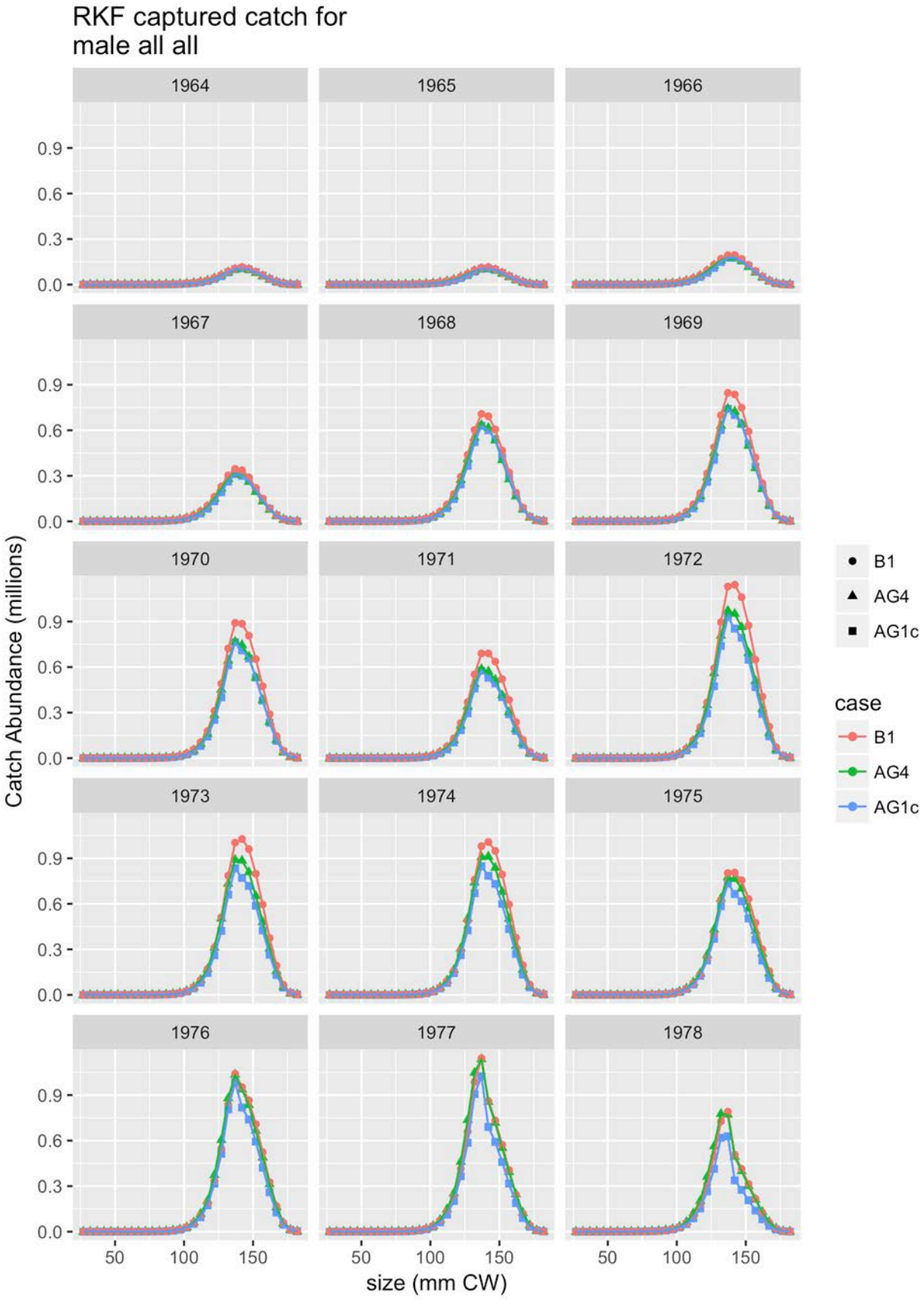


Figure 113. Predicted RKF captured catch abundance for male all all, (2 of 5).

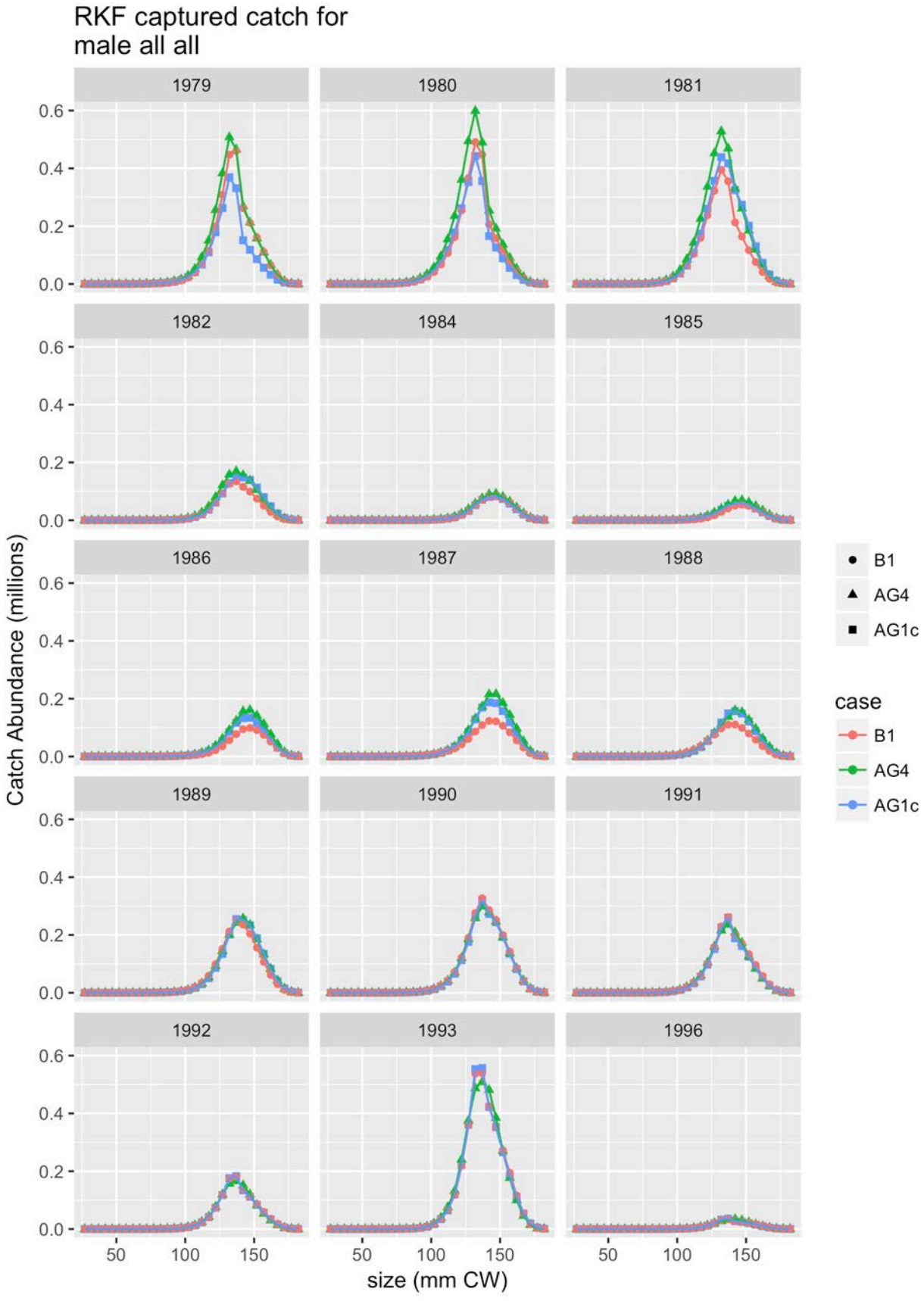


Figure 114. Predicted RKF captured catch abundance for male all all, (3 of 5).

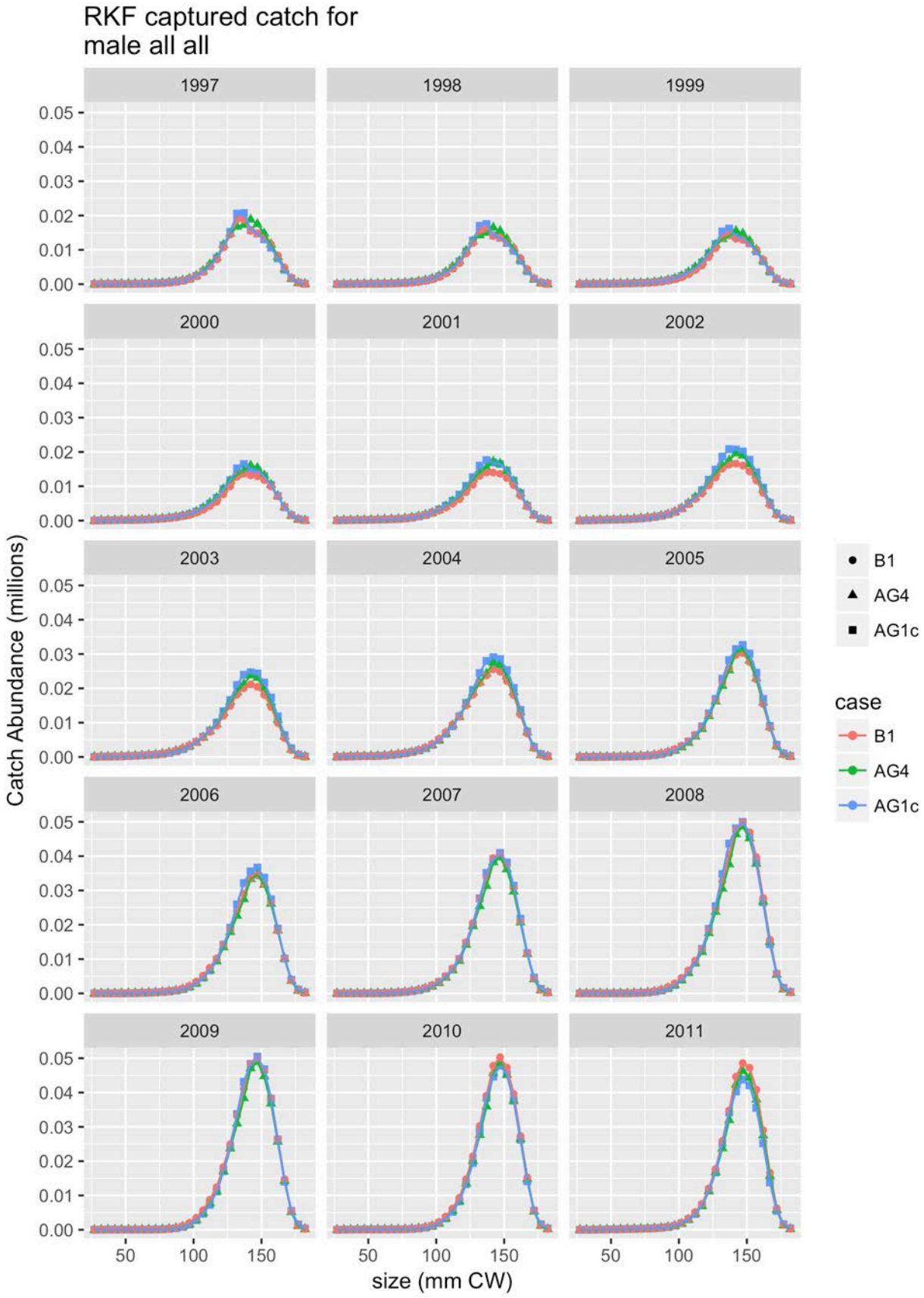


Figure 115. Predicted RKF captured catch abundance for male all all, (4 of 5).

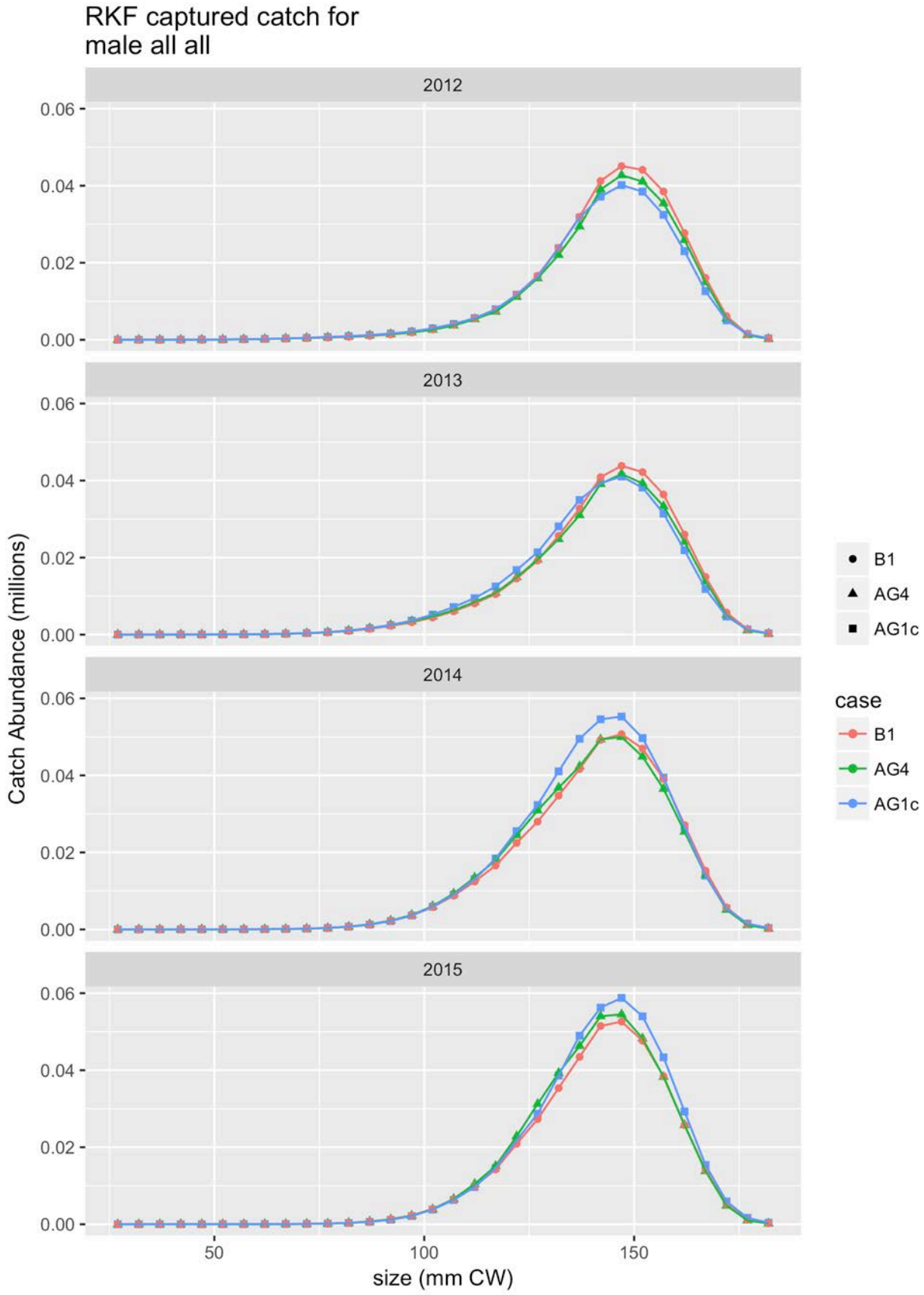


Figure 116. Predicted RKF captured catch abundance for male all all, (5 of 5).

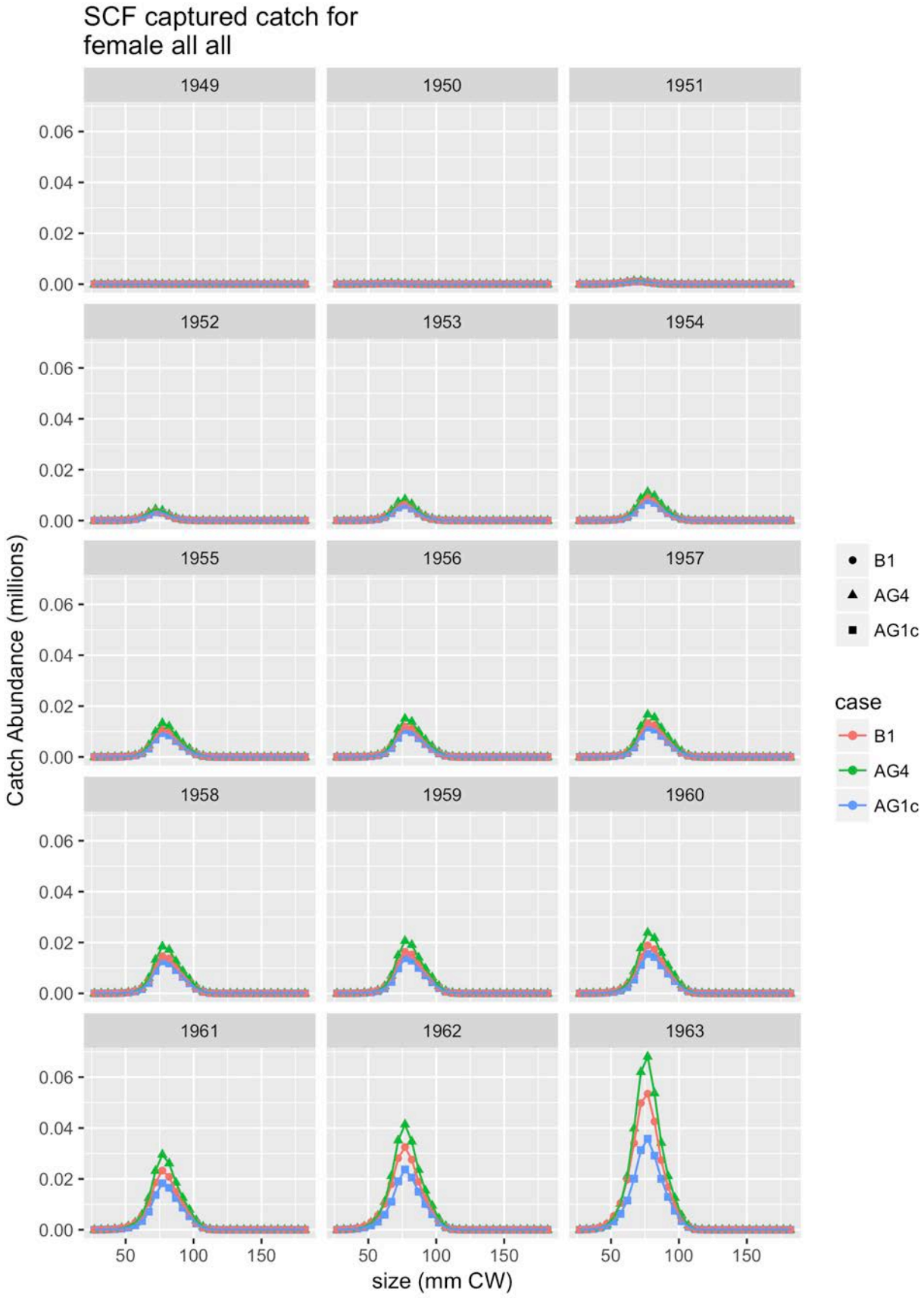


Figure 117. Predicted SCF captured catch abundance for female all all, (1 of 5).

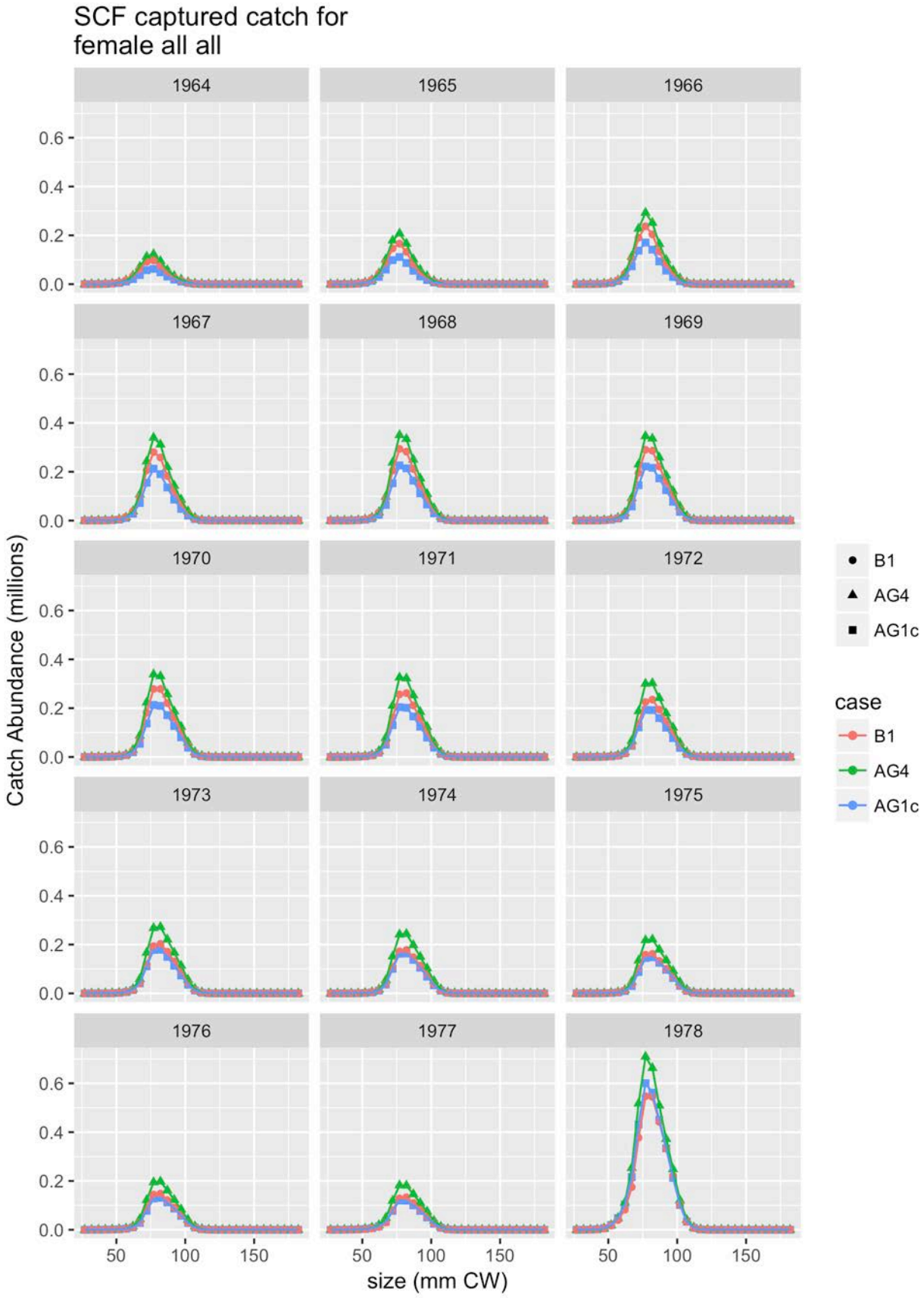


Figure 118. Predicted SCF captured catch abundance for female all all, (2 of 5).

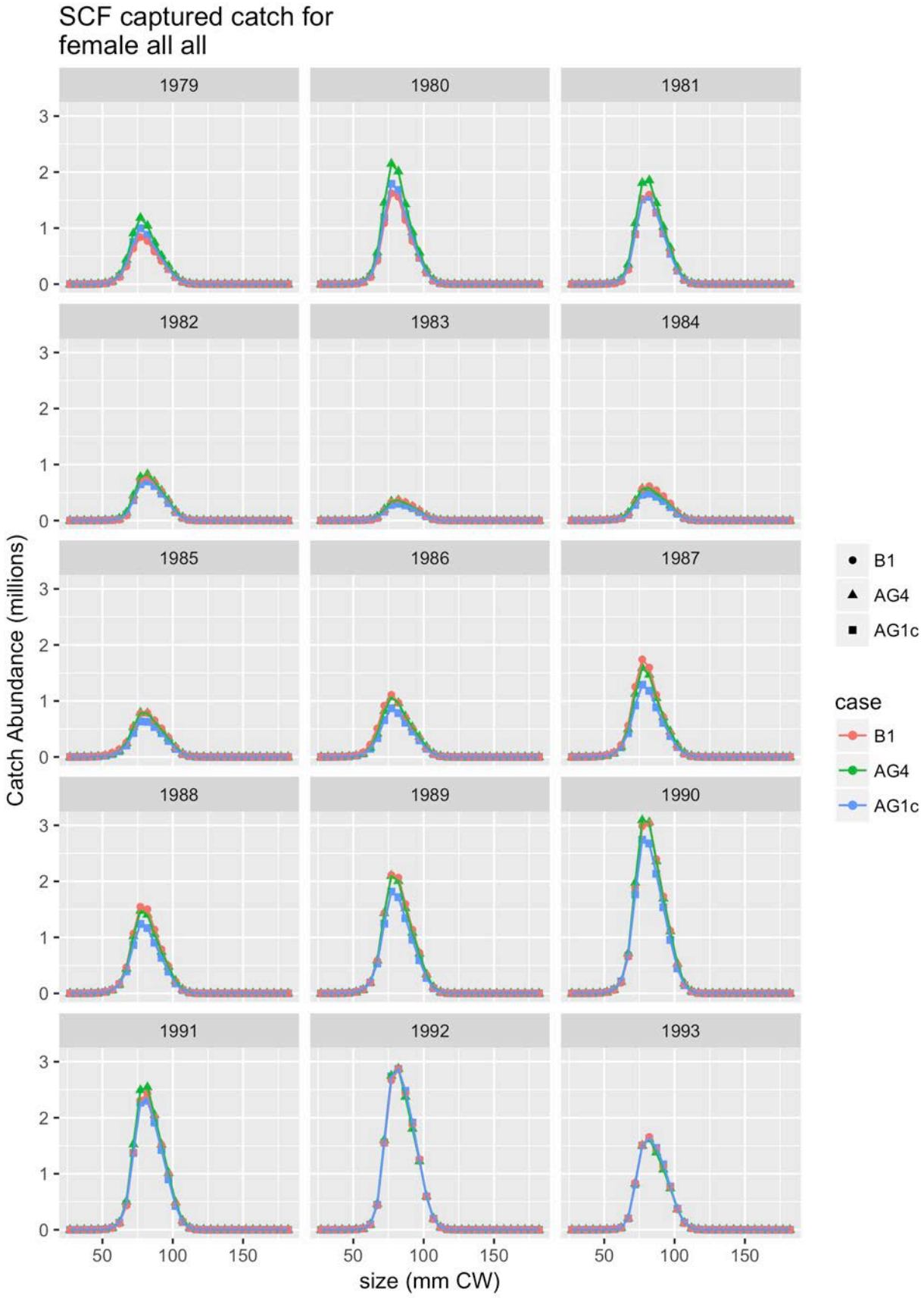


Figure 119. Predicted SCF captured catch abundance for female all all, (3 of 5).

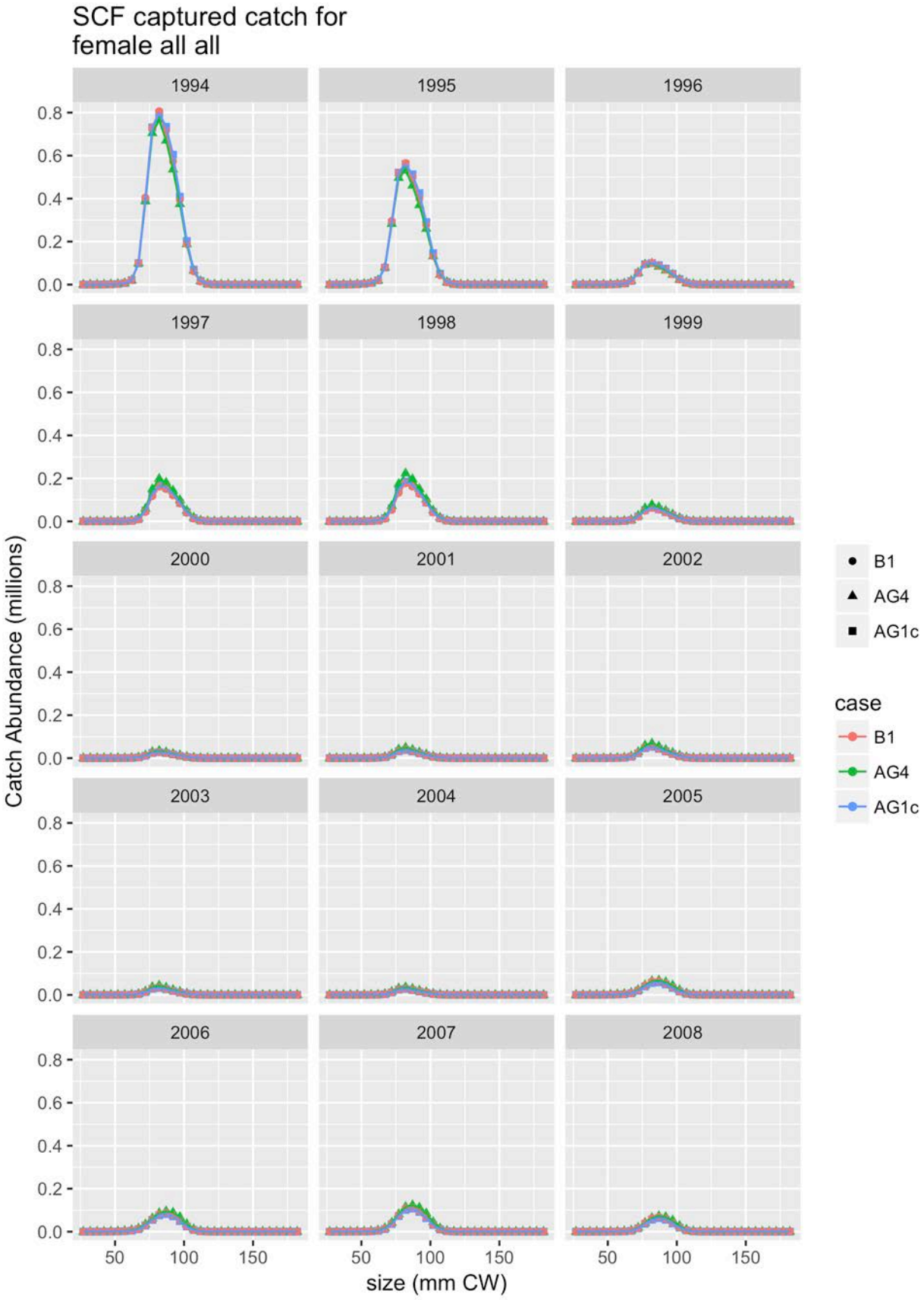


Figure 120. Predicted SCF captured catch abundance for female all all, (4 of 5).

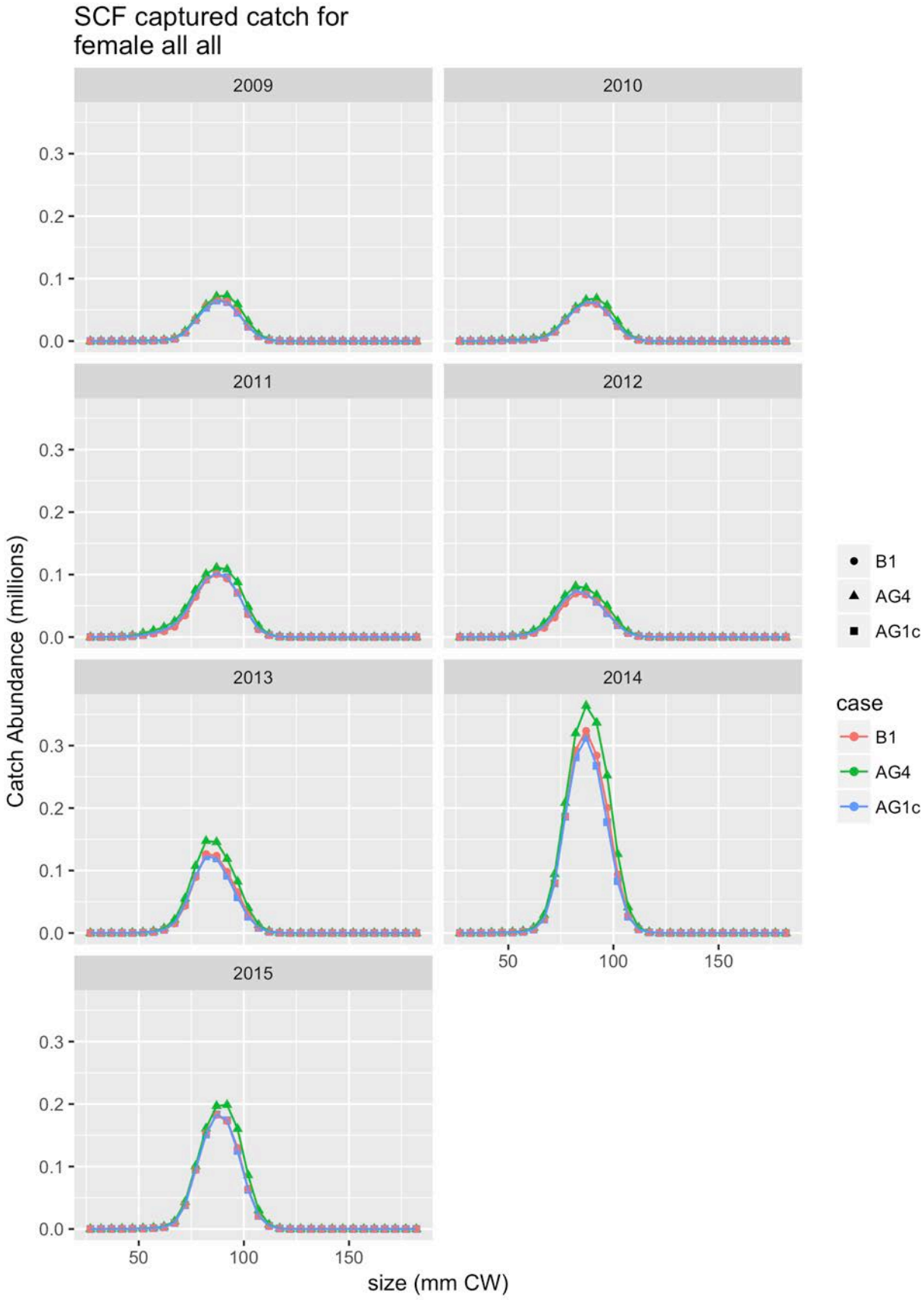


Figure 121. Predicted SCF captured catch abundance for female all all, (5 of 5).

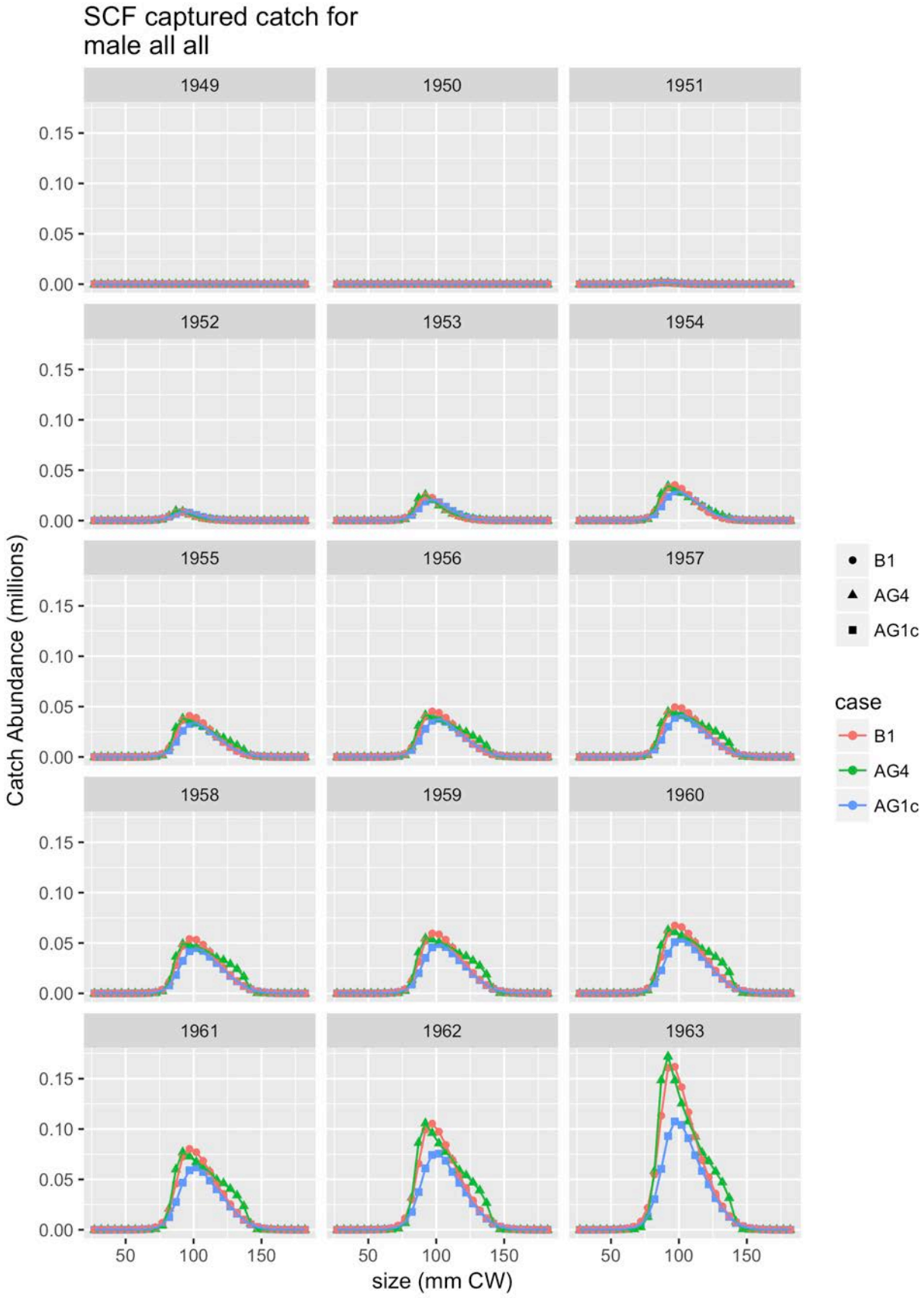


Figure 122. Predicted SCF captured catch abundance for male all all, (1 of 5).

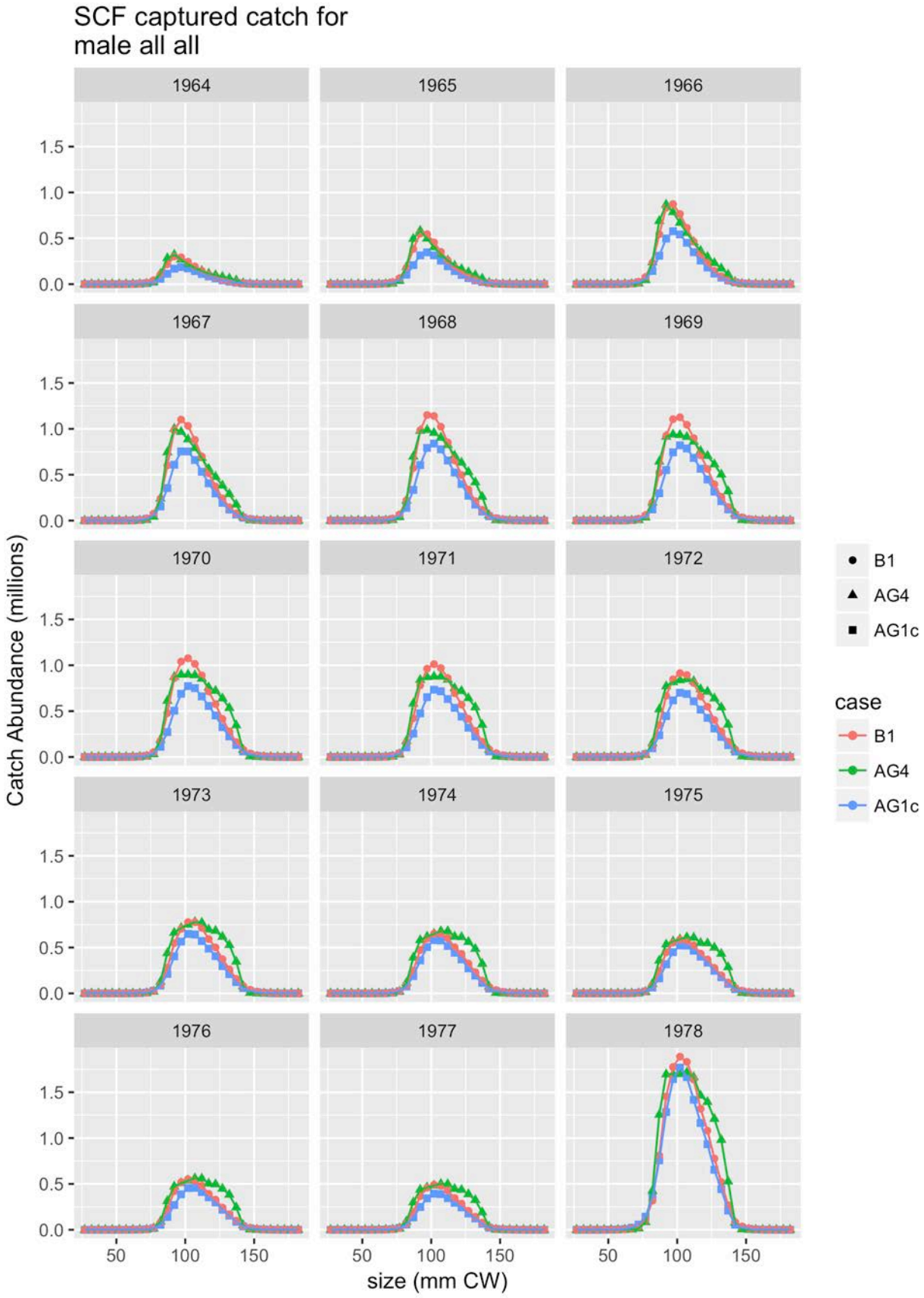


Figure 123. Predicted SCF captured catch abundance for male all all, (2 of 5).

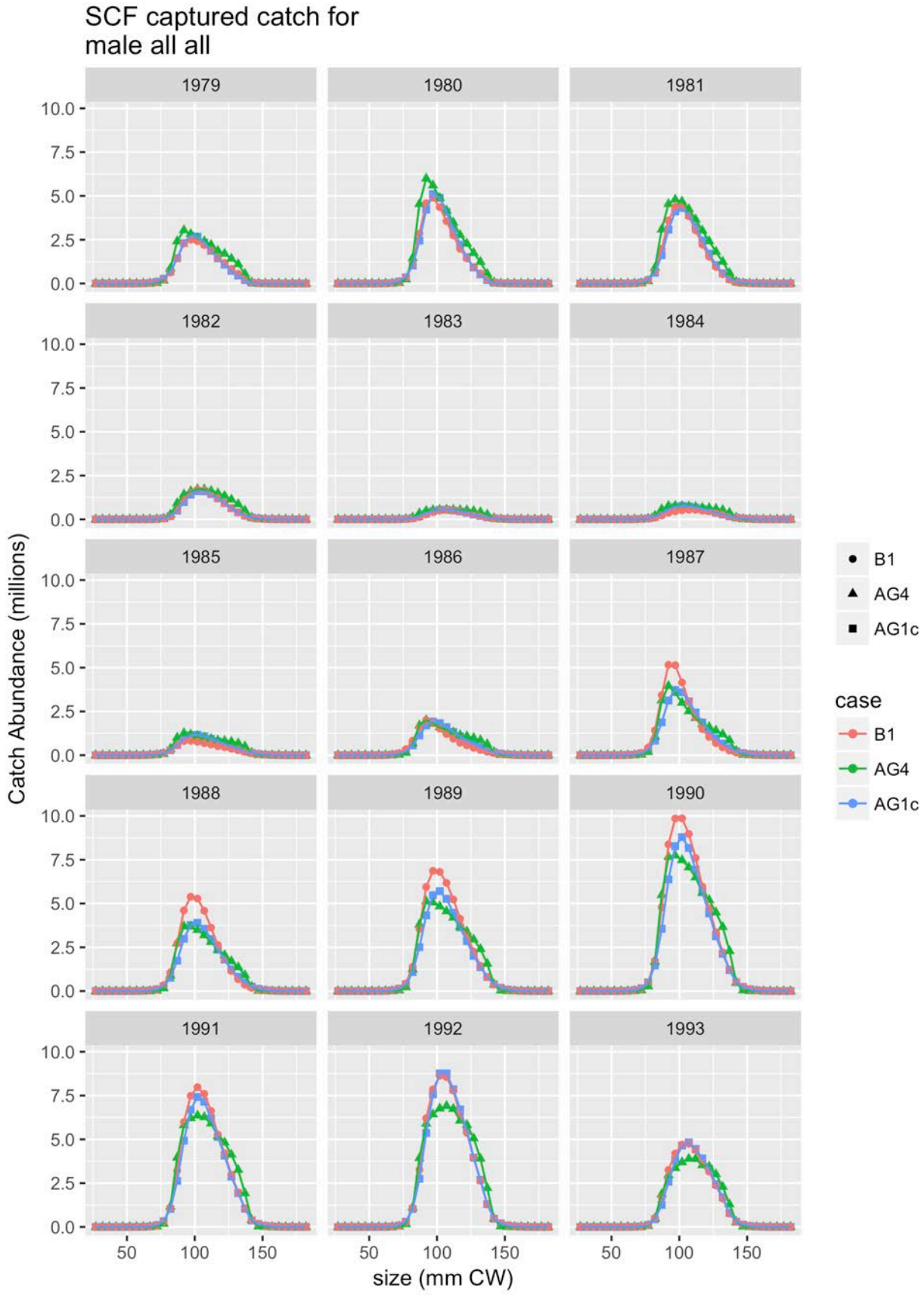


Figure 124. Predicted SCF captured catch abundance for male all all, (3 of 5).

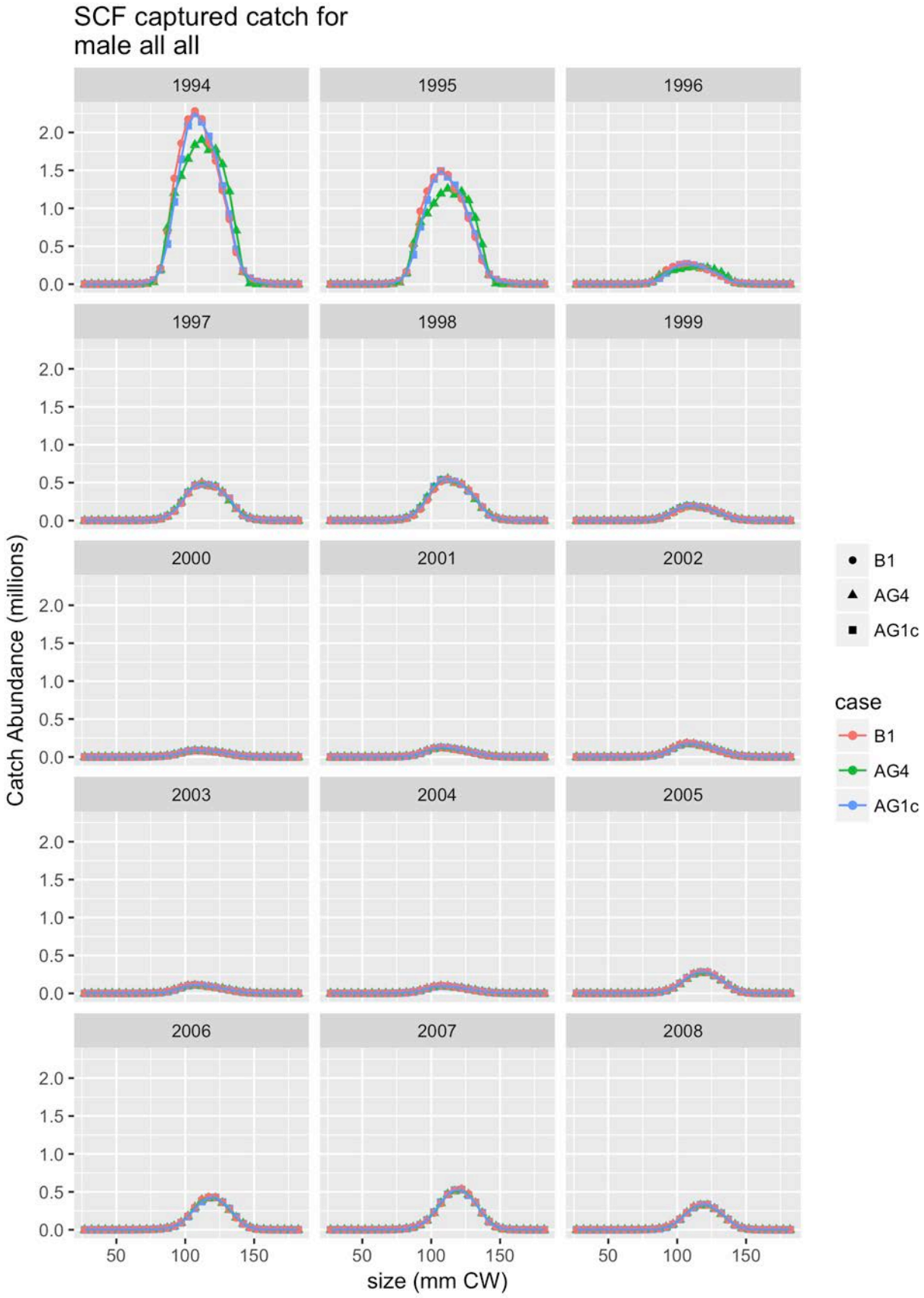


Figure 125. Predicted SCF captured catch abundance for male all all, (4 of 5).

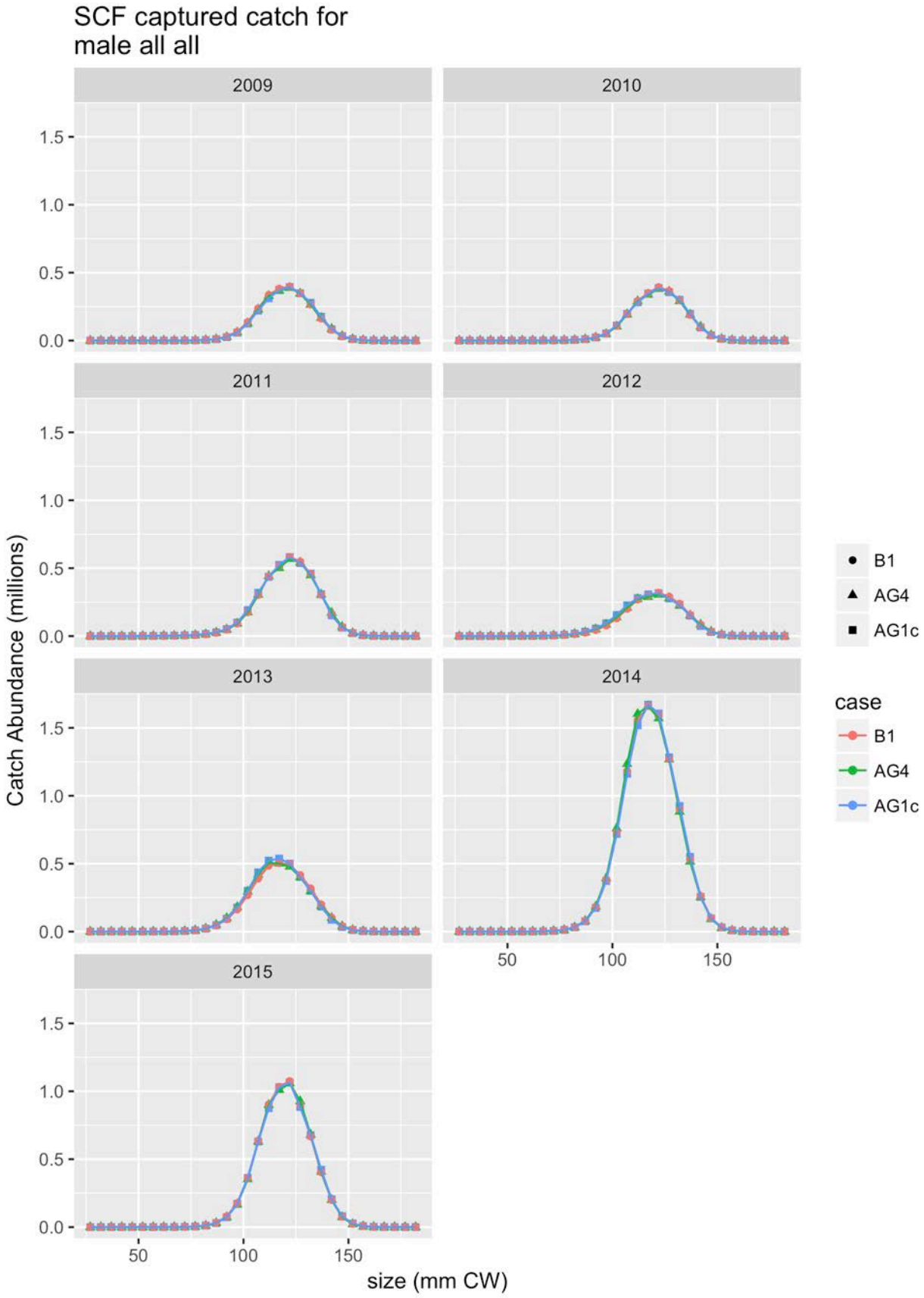


Figure 126. Predicted SCF captured catch abundance for male all all, (5 of 5).

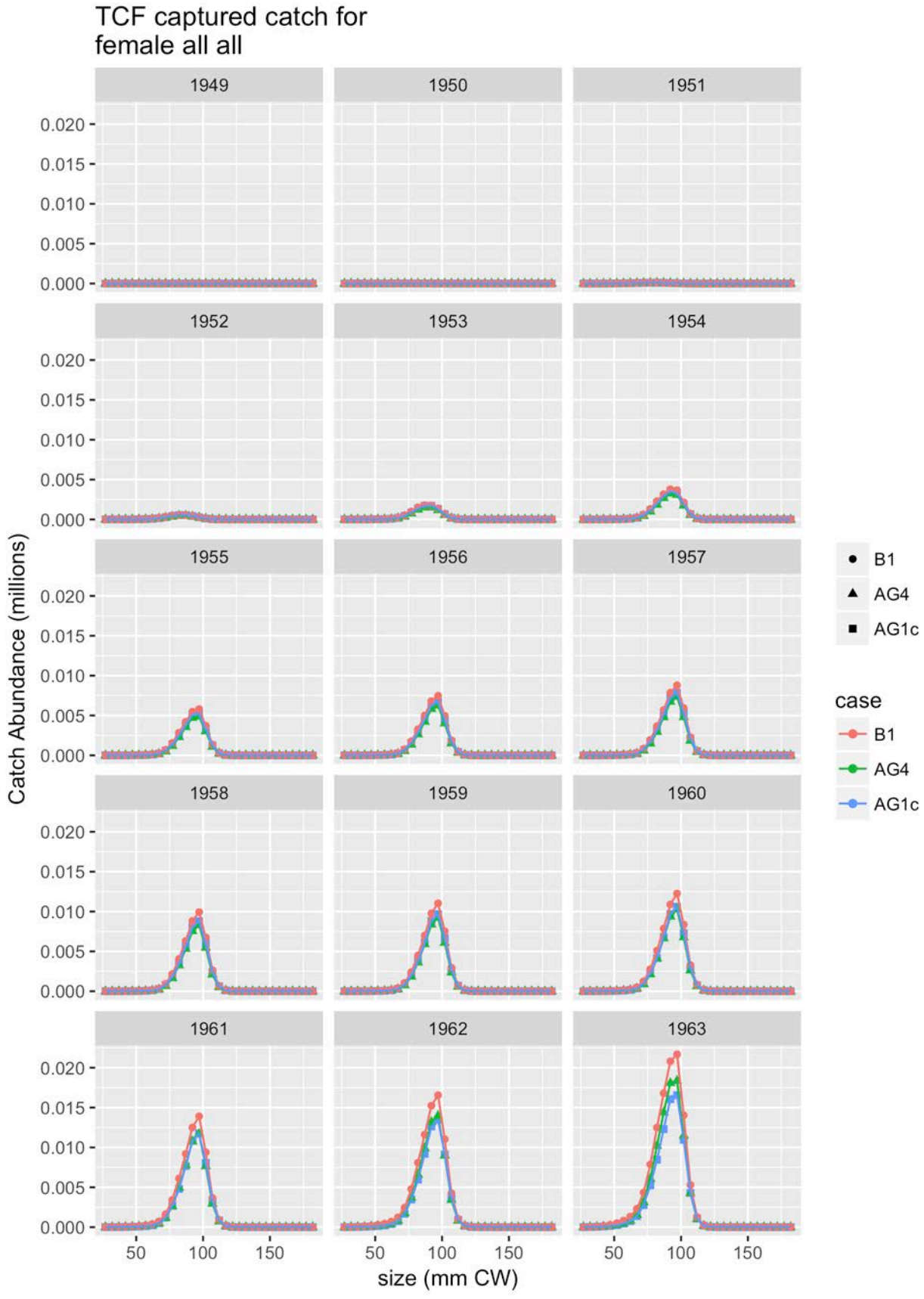


Figure 127. Predicted TCF captured catch abundance for female all all, (1 of 4).

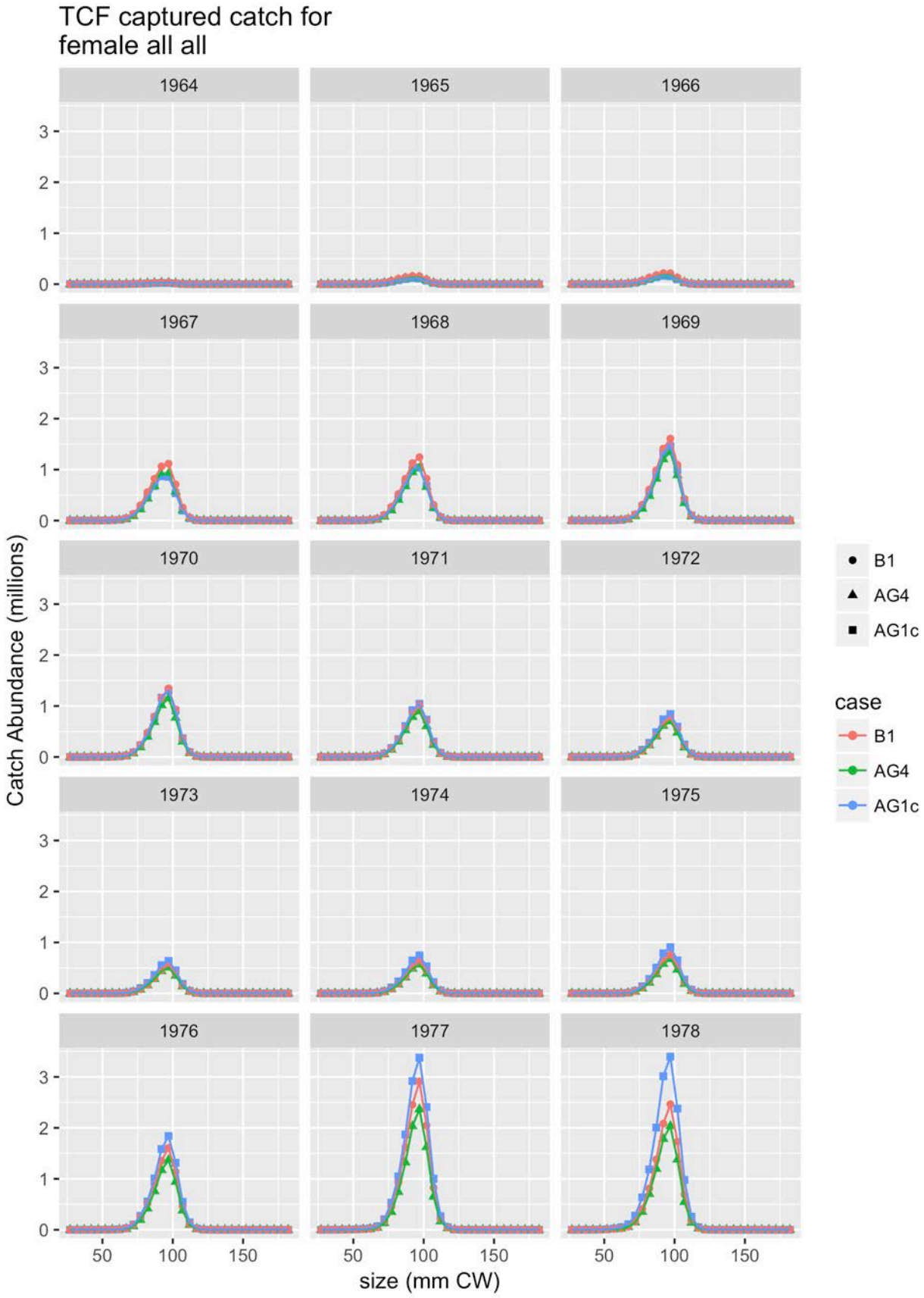


Figure 128. Predicted TCF captured catch abundance for female all all, (2 of 4).

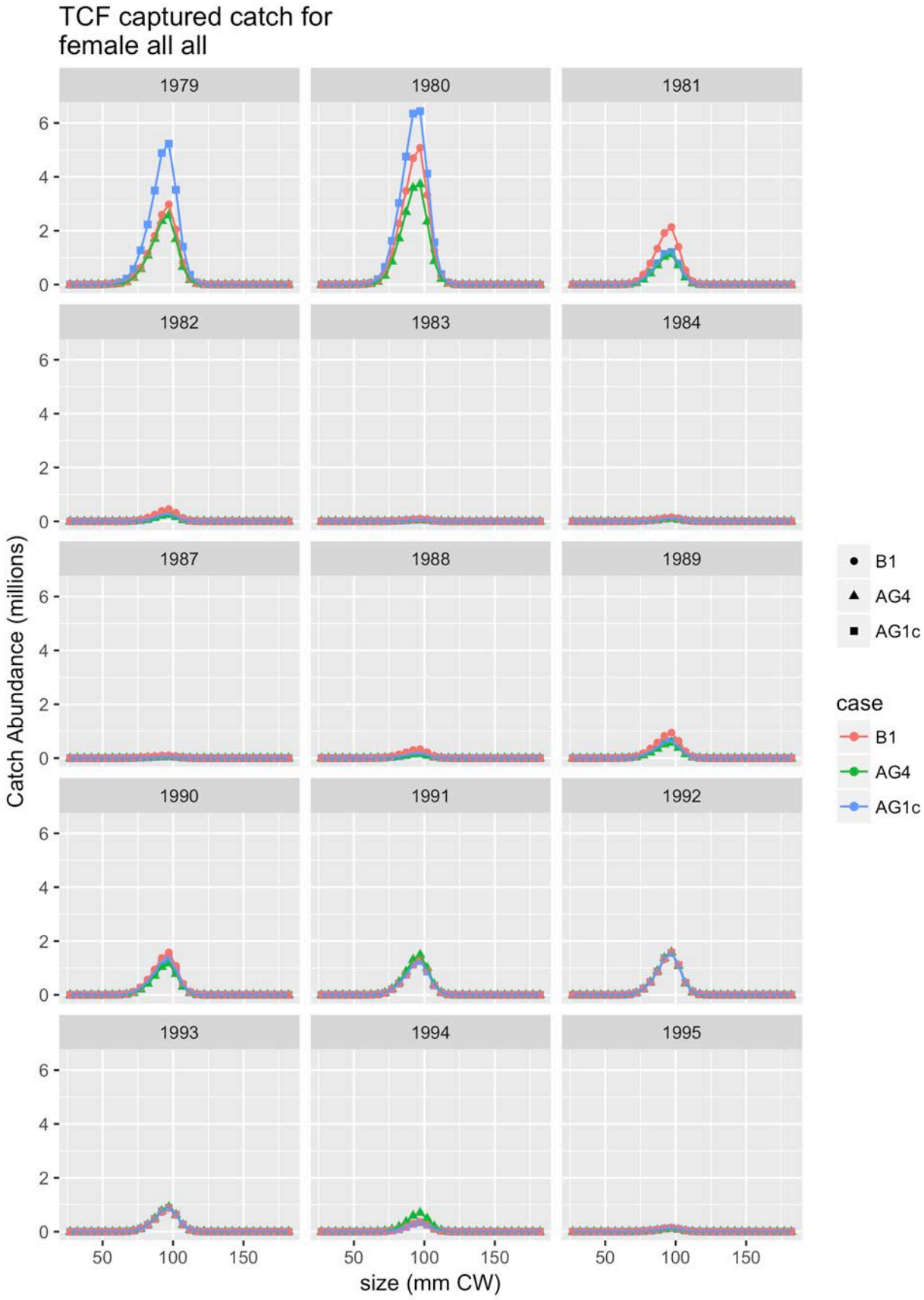


Figure 129. Predicted TCF captured catch abundance for female all all, (3 of 4).

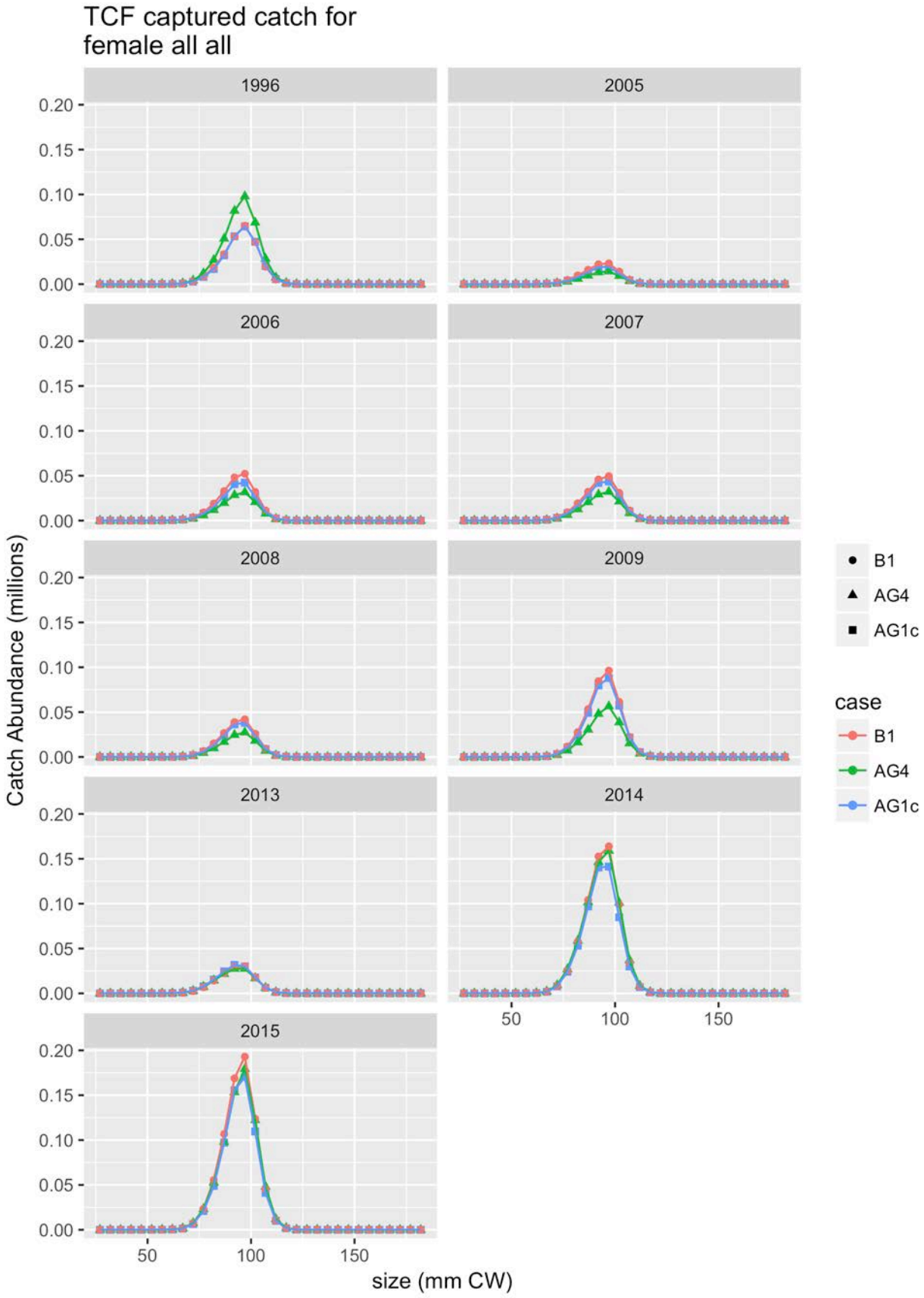


Figure 130. Predicted TCF captured catch abundance for female all all, (4 of 4).

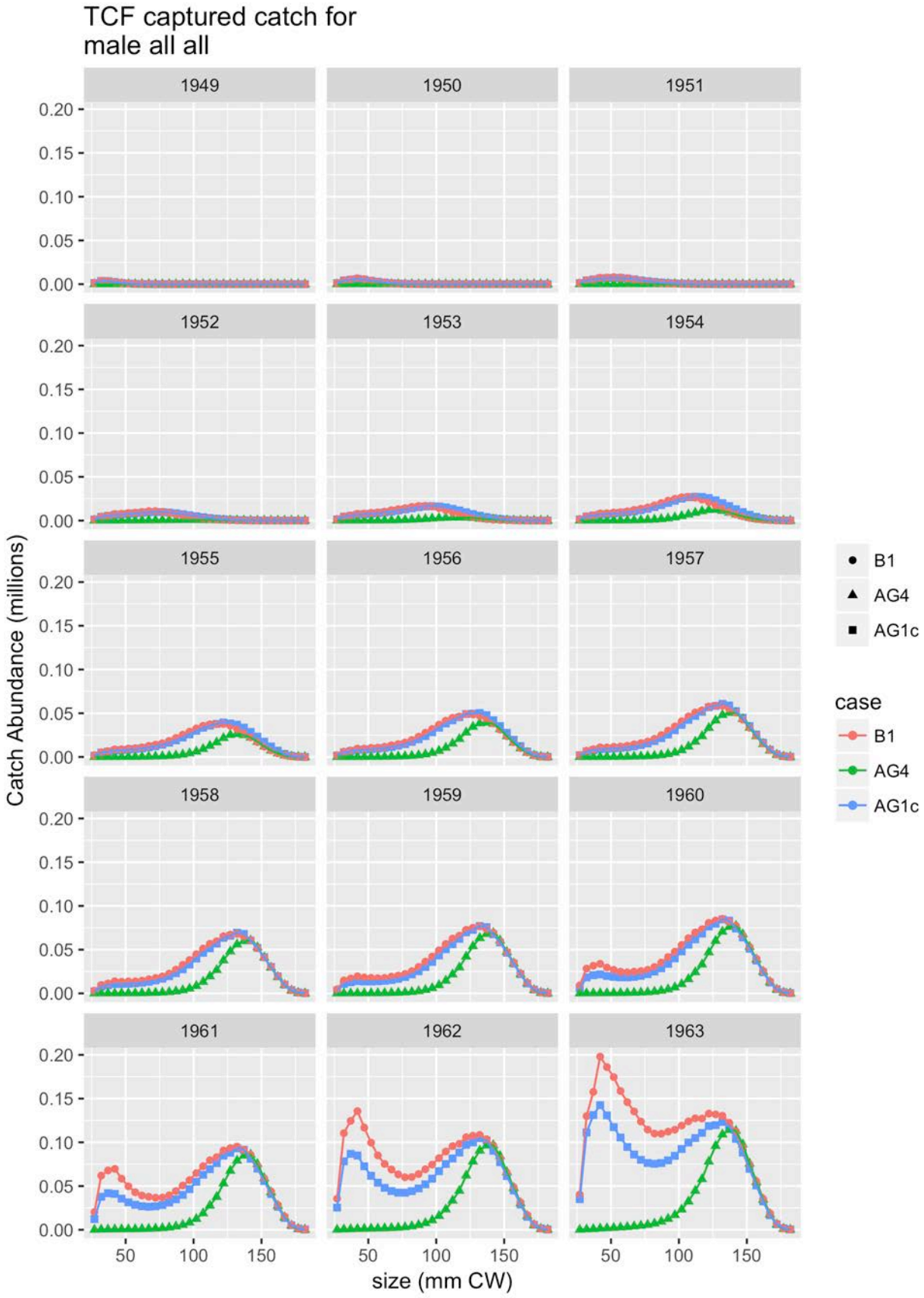


Figure 131. Predicted TCF captured catch abundance for male all all, (1 of 4).

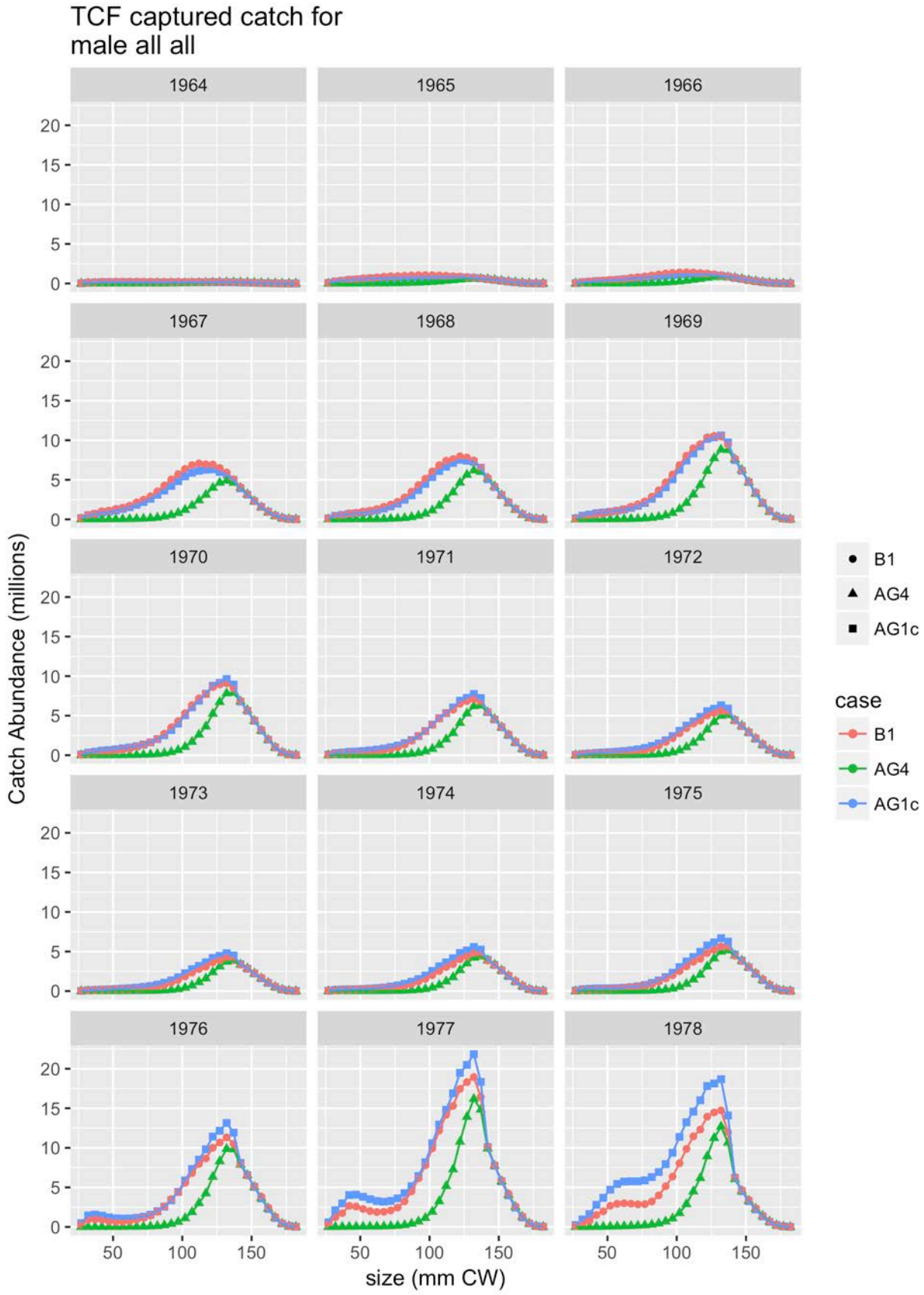


Figure 132. Predicted TCF captured catch abundance for male all all, (2 of 4).

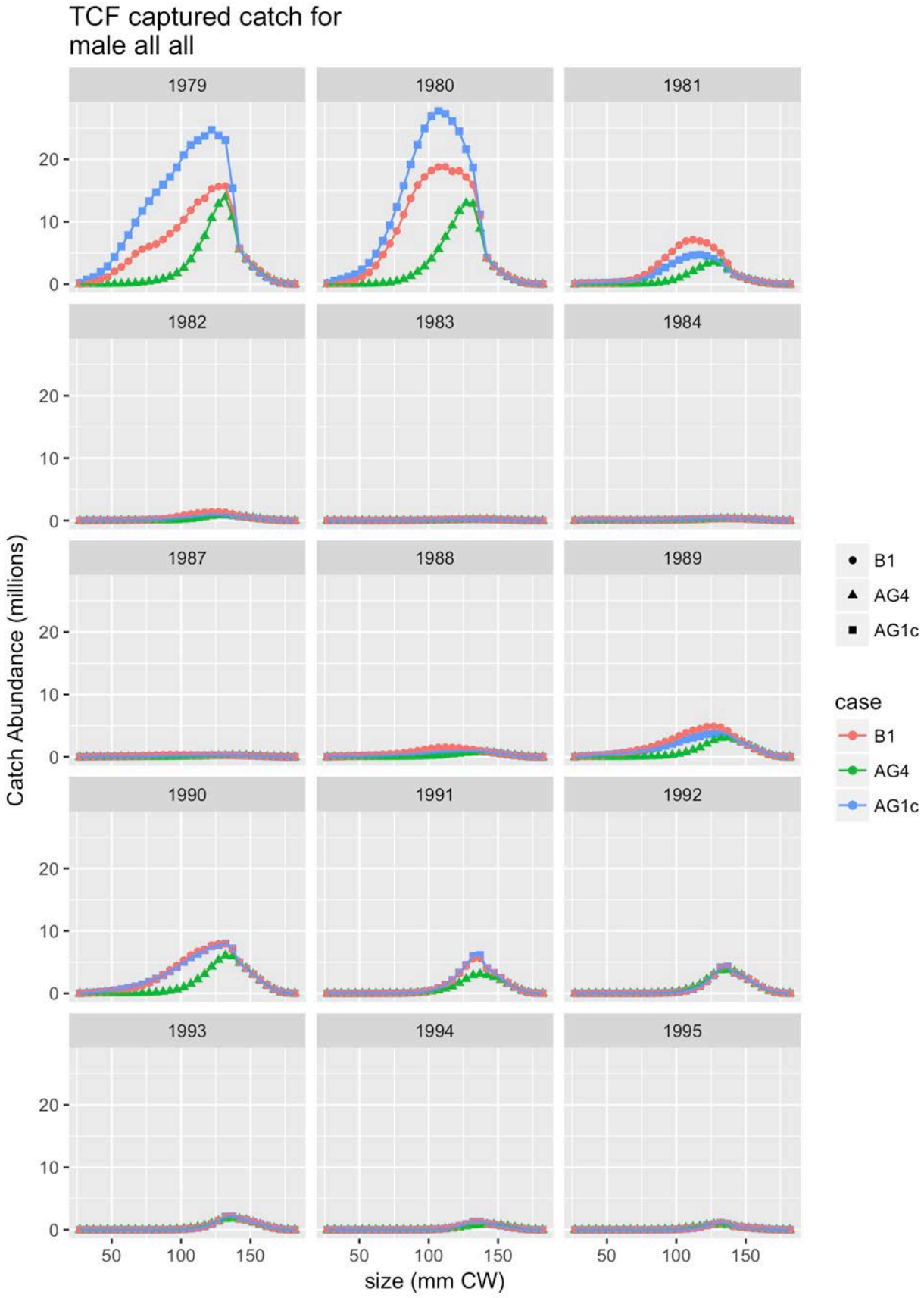


Figure 133. Predicted TCF captured catch abundance for male all all, (3 of 4).

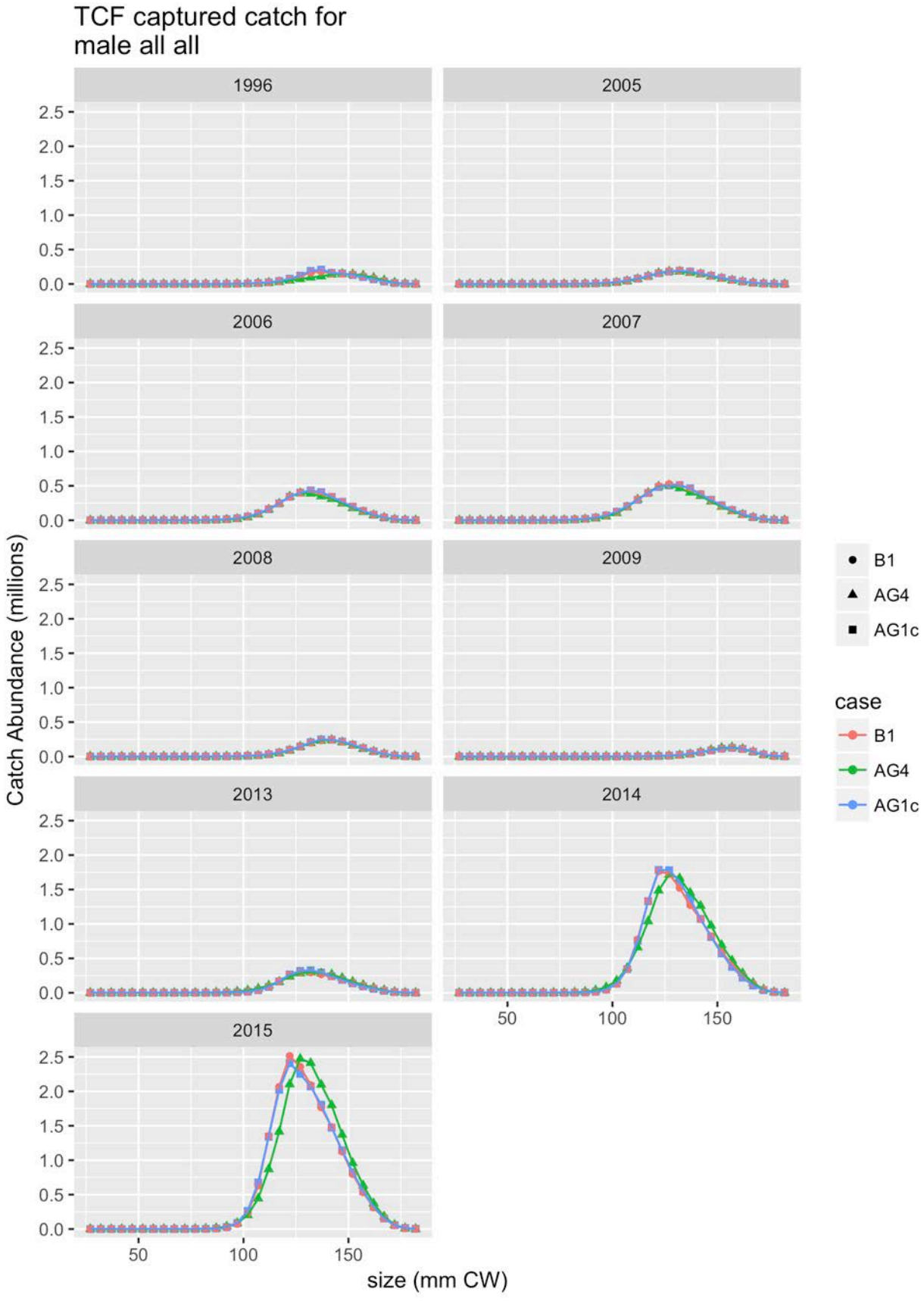


Figure 134. Predicted TCF captured catch abundance for male all all, (4 of 4).

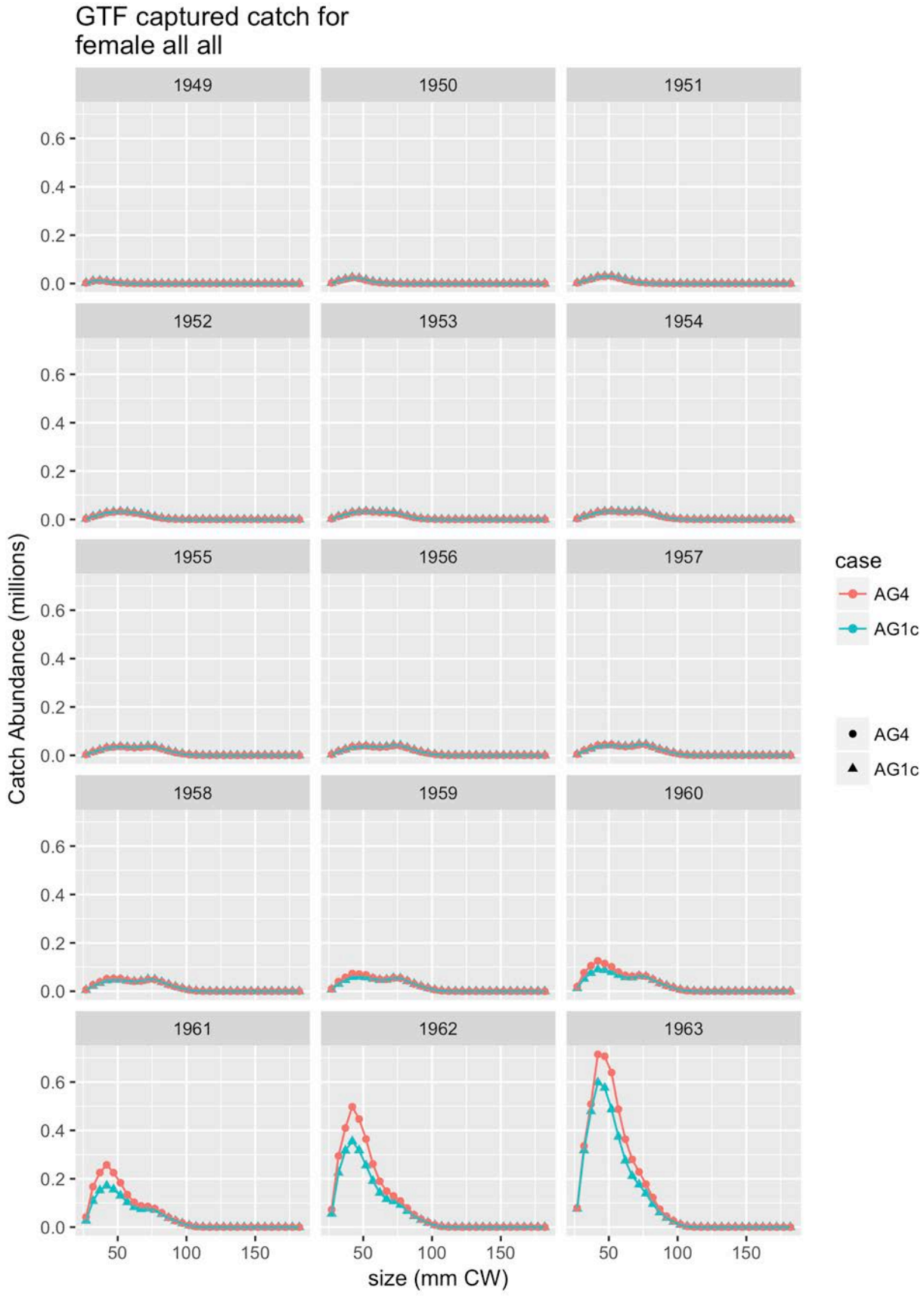


Figure 135. Predicted GTF captured catch abundance for female all all, (1 of 5).

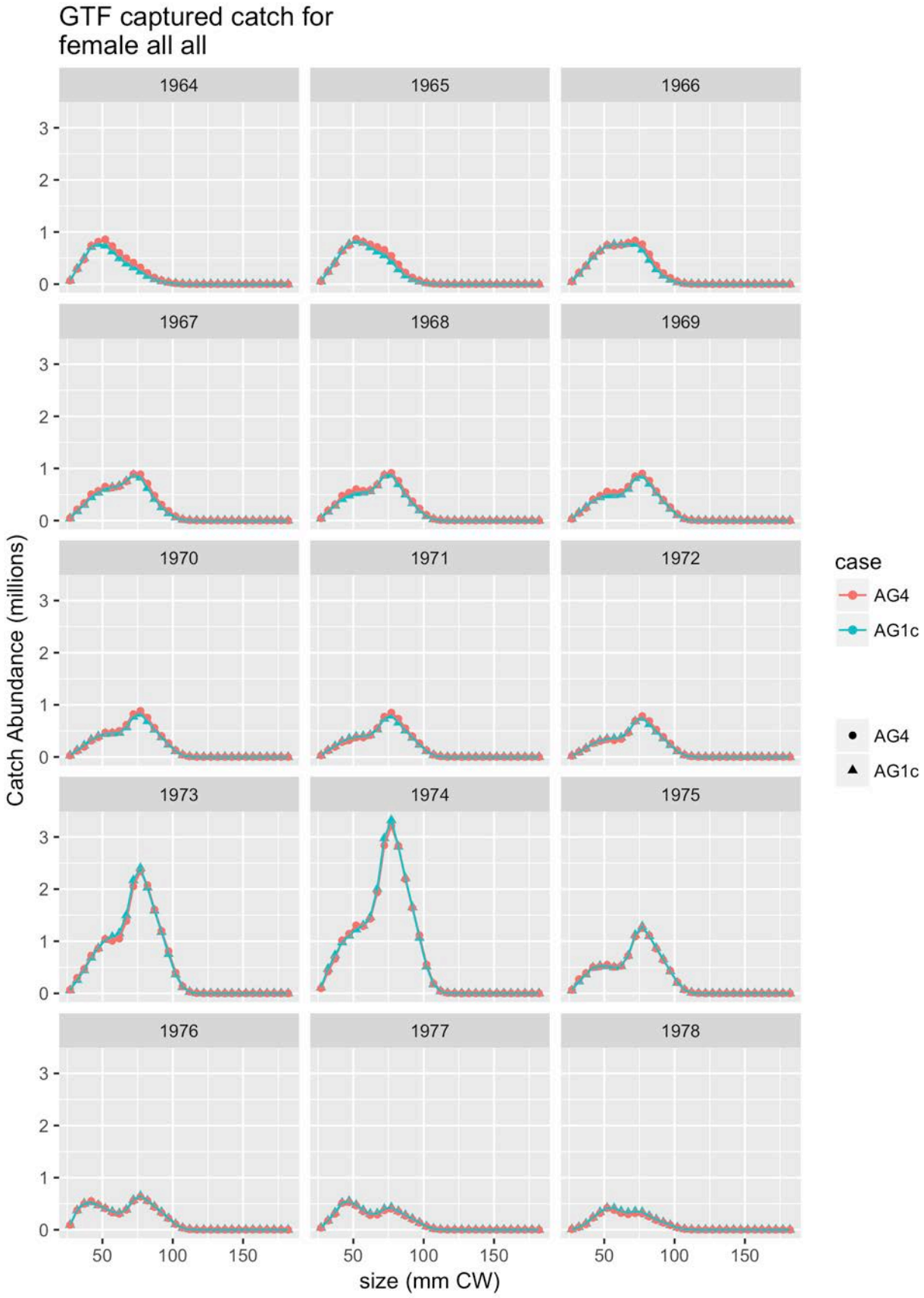


Figure 136. Predicted GTF captured catch abundance for female all all, (2 of 5).

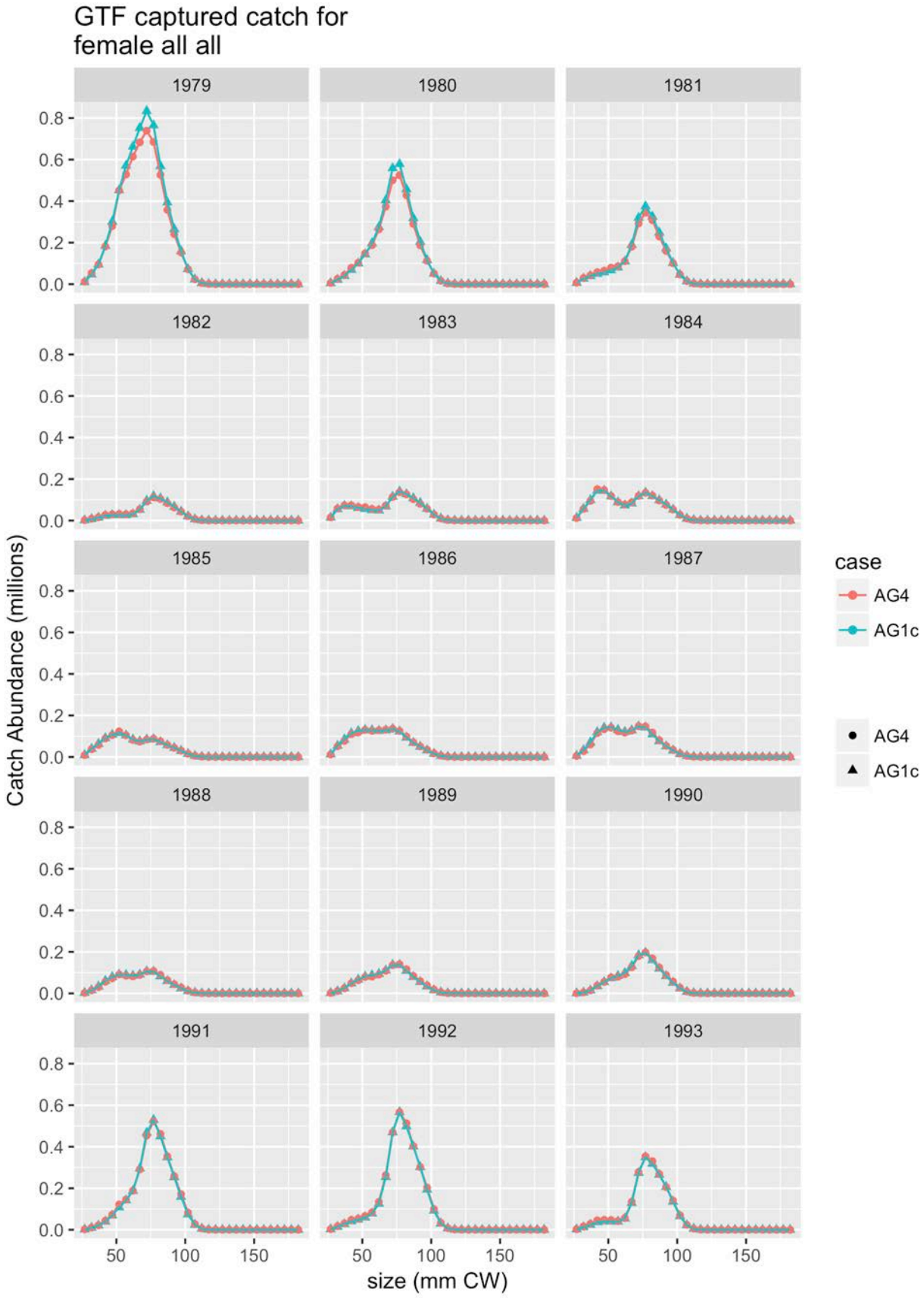


Figure 137. Predicted GTF captured catch abundance for female all all, (3 of 5).

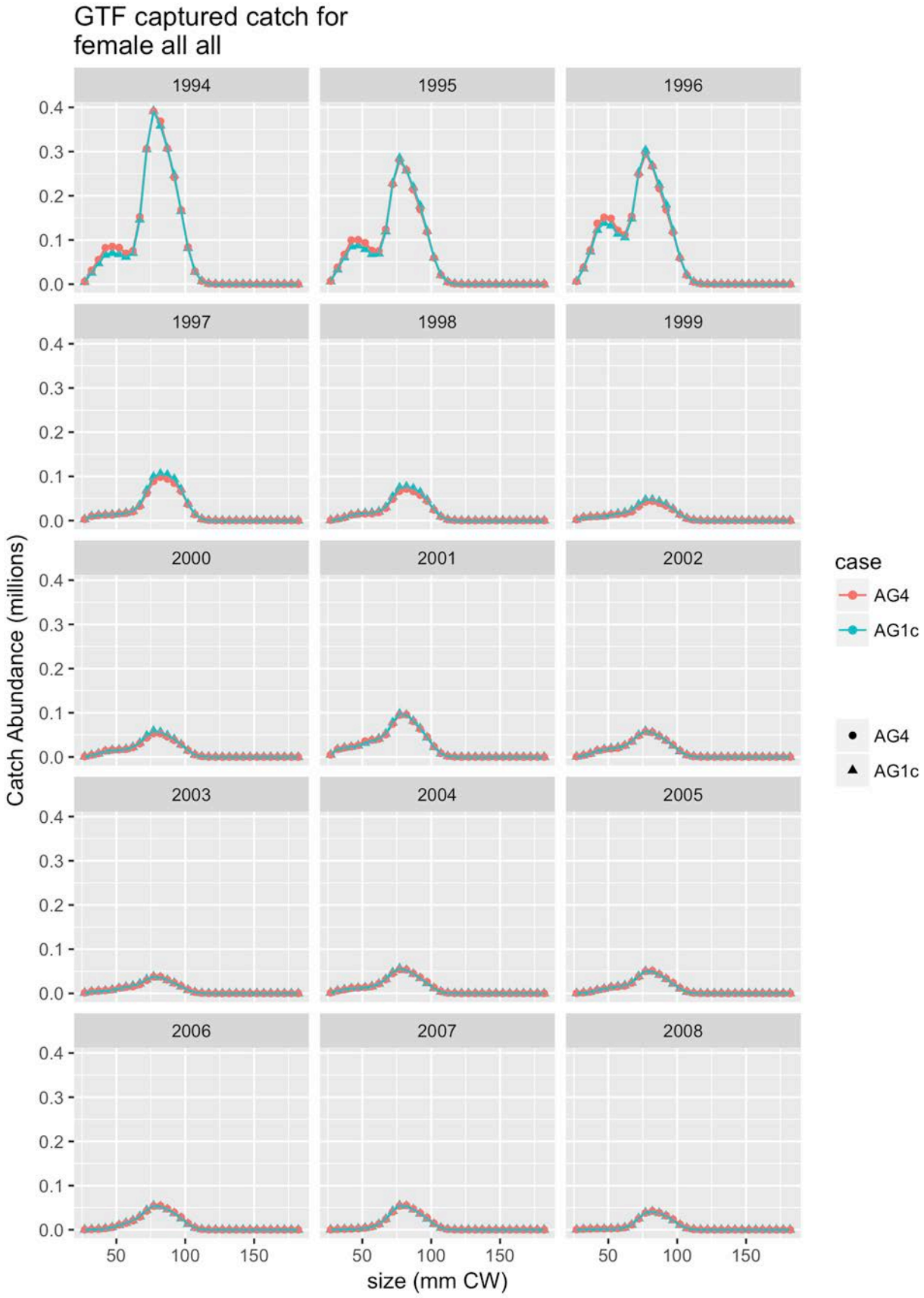


Figure 138. Predicted GTF captured catch abundance for female all all, (4 of 5).

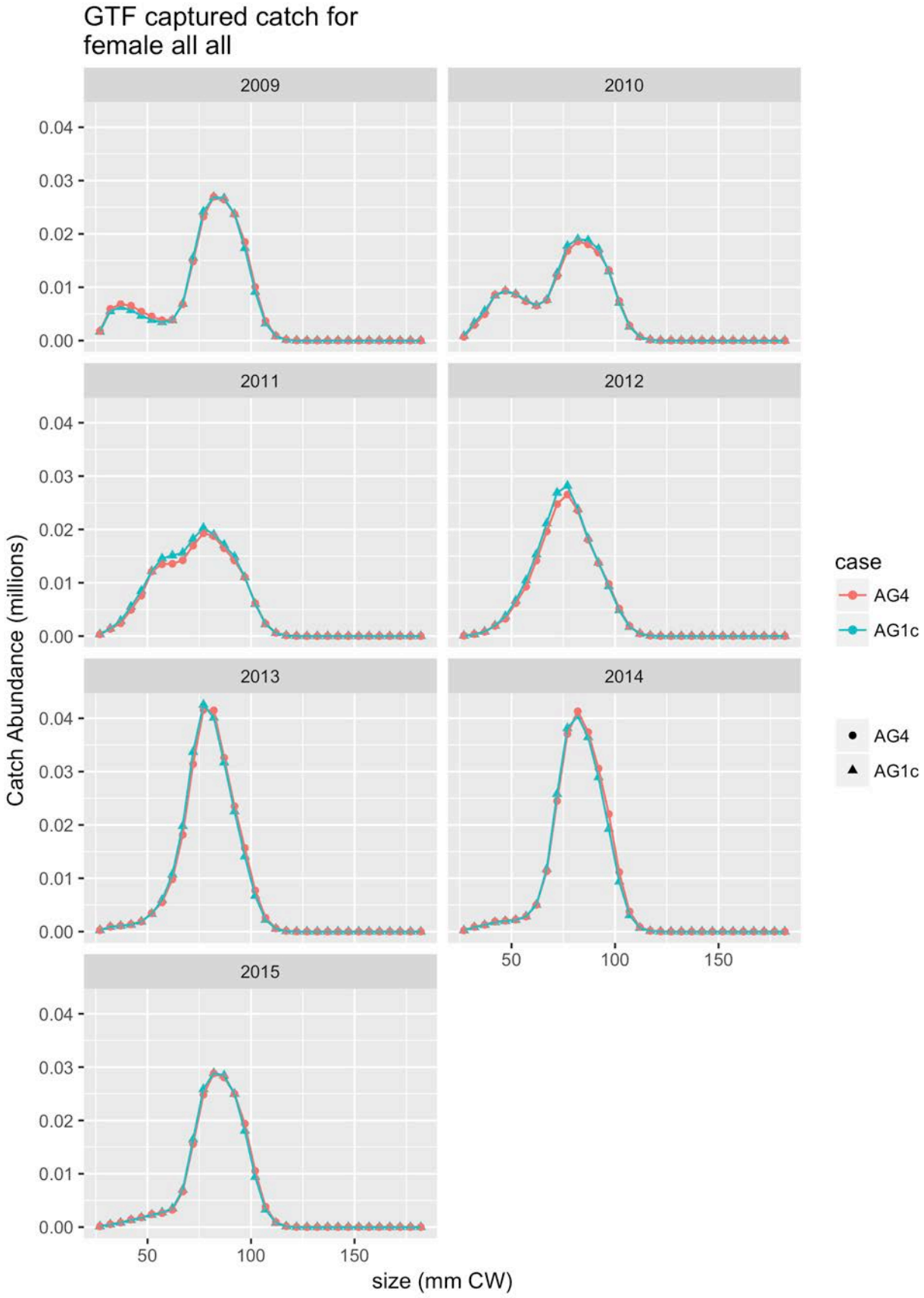


Figure 139. Predicted GTF captured catch abundance for female all all, (5 of 5).

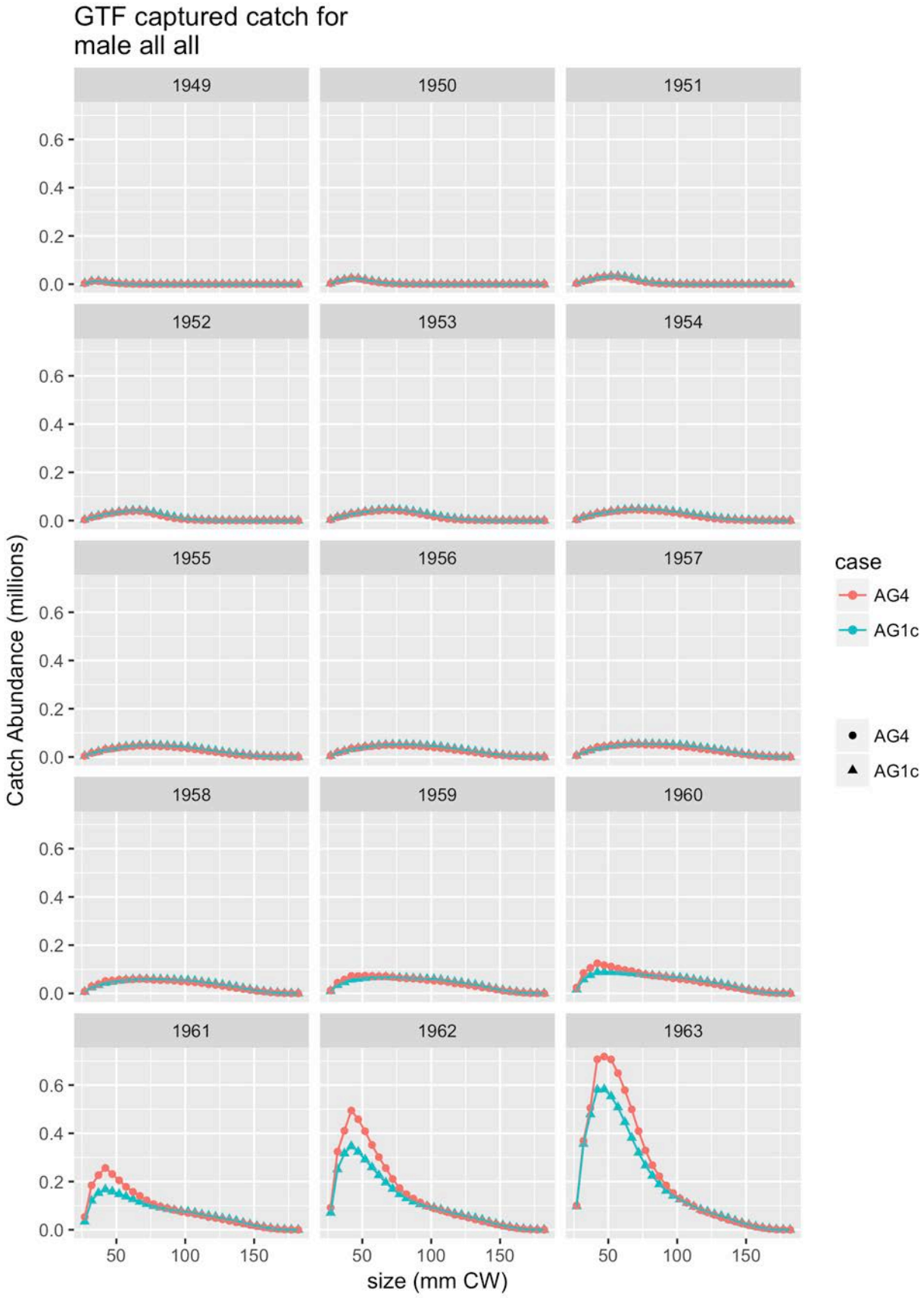


Figure 140. Predicted GTF captured catch abundance for male all all, (1 of 5).

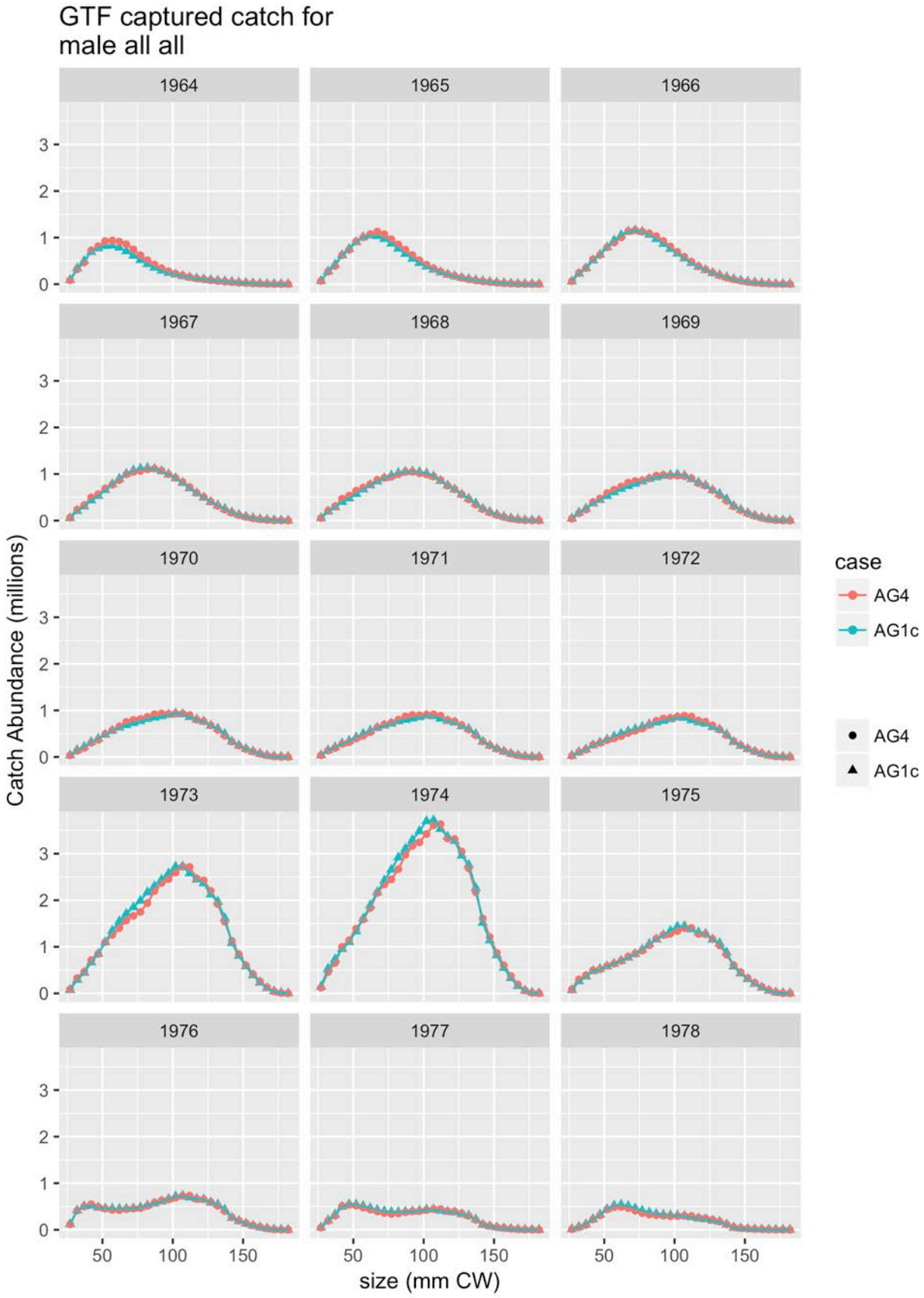


Figure 141. Predicted GTF captured catch abundance for male all all, (2 of 5).

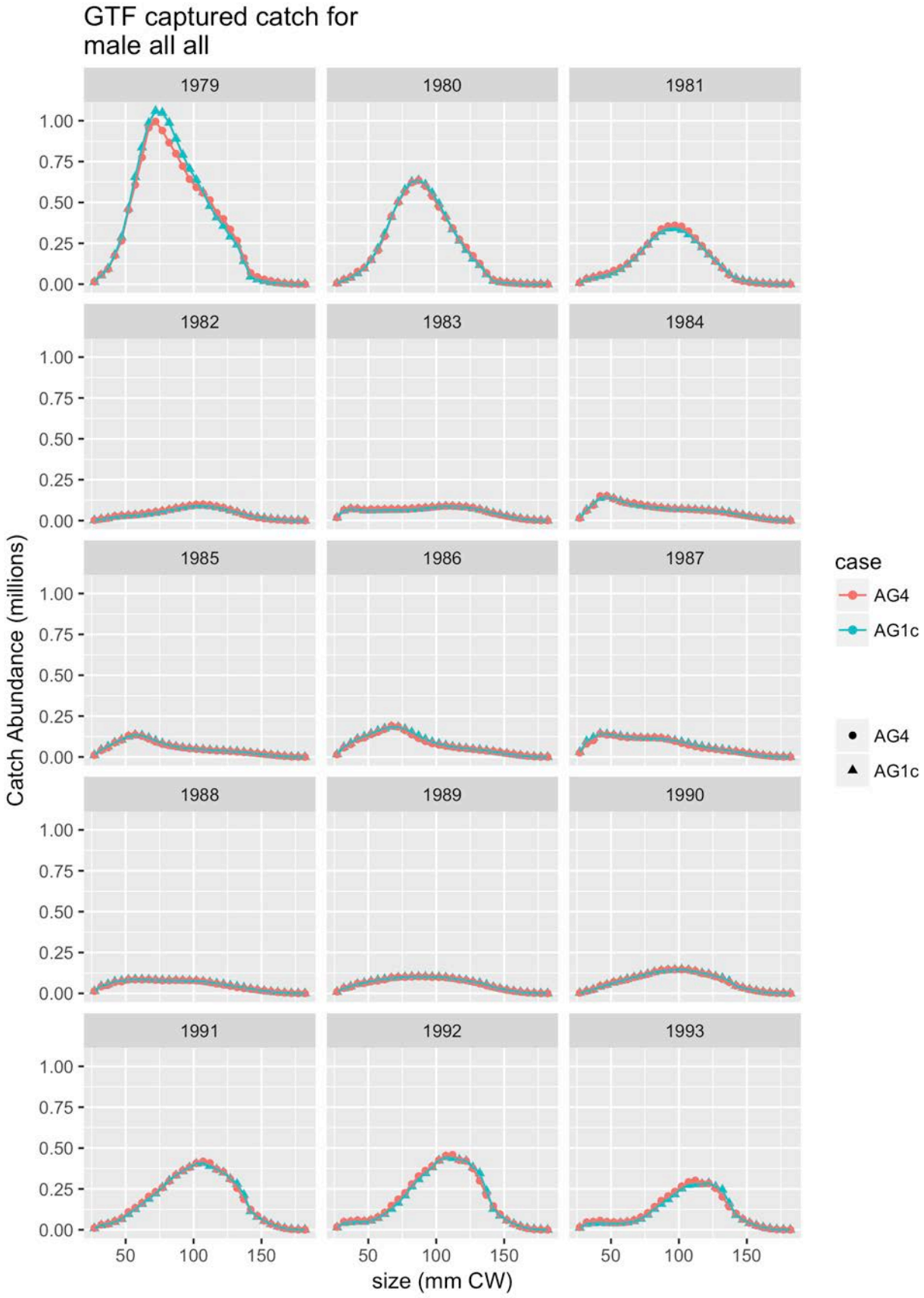


Figure 142. Predicted GTF captured catch abundance for male all all, (3 of 5).

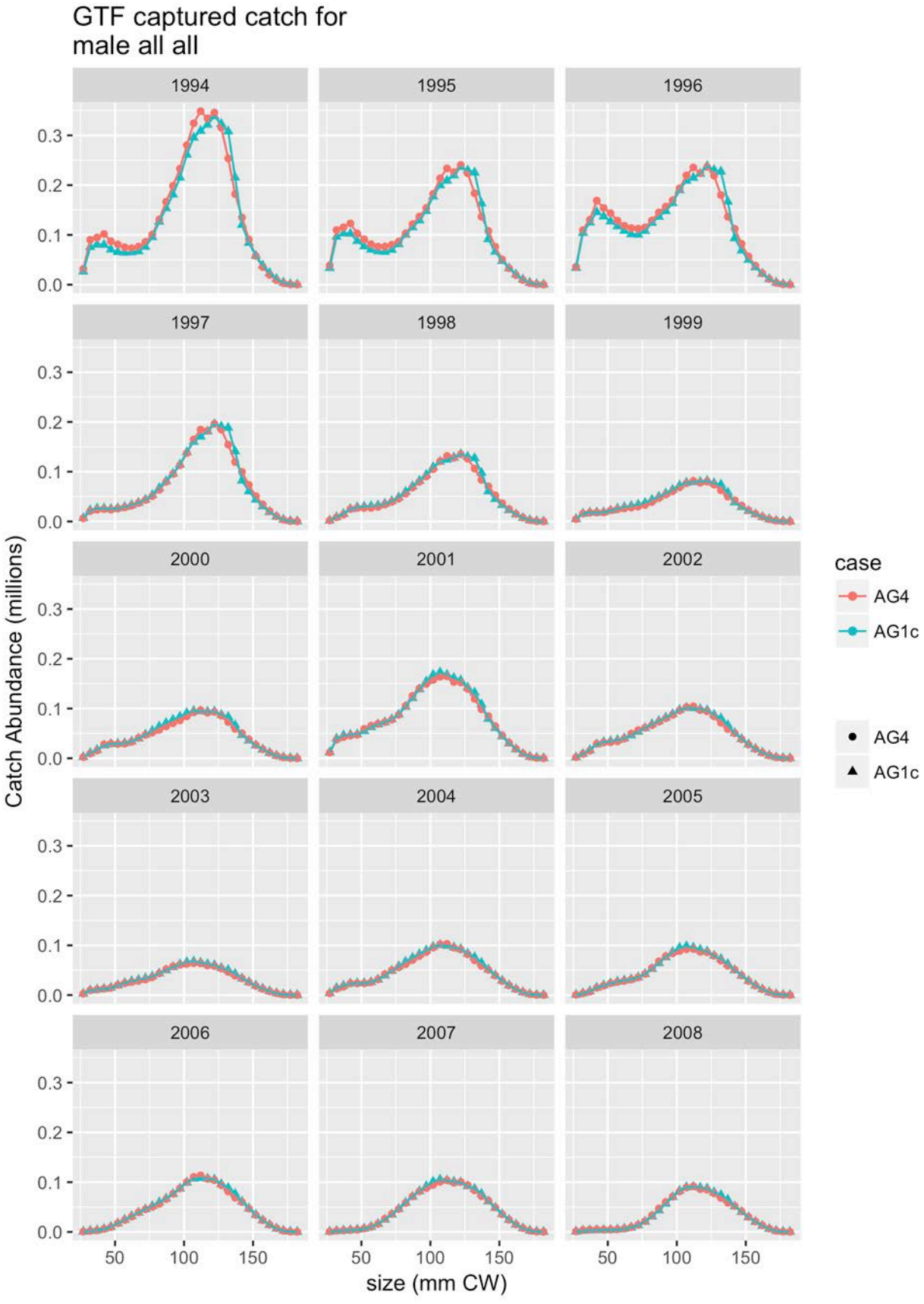


Figure 143. Predicted GTF captured catch abundance for male all all, (4 of 5).

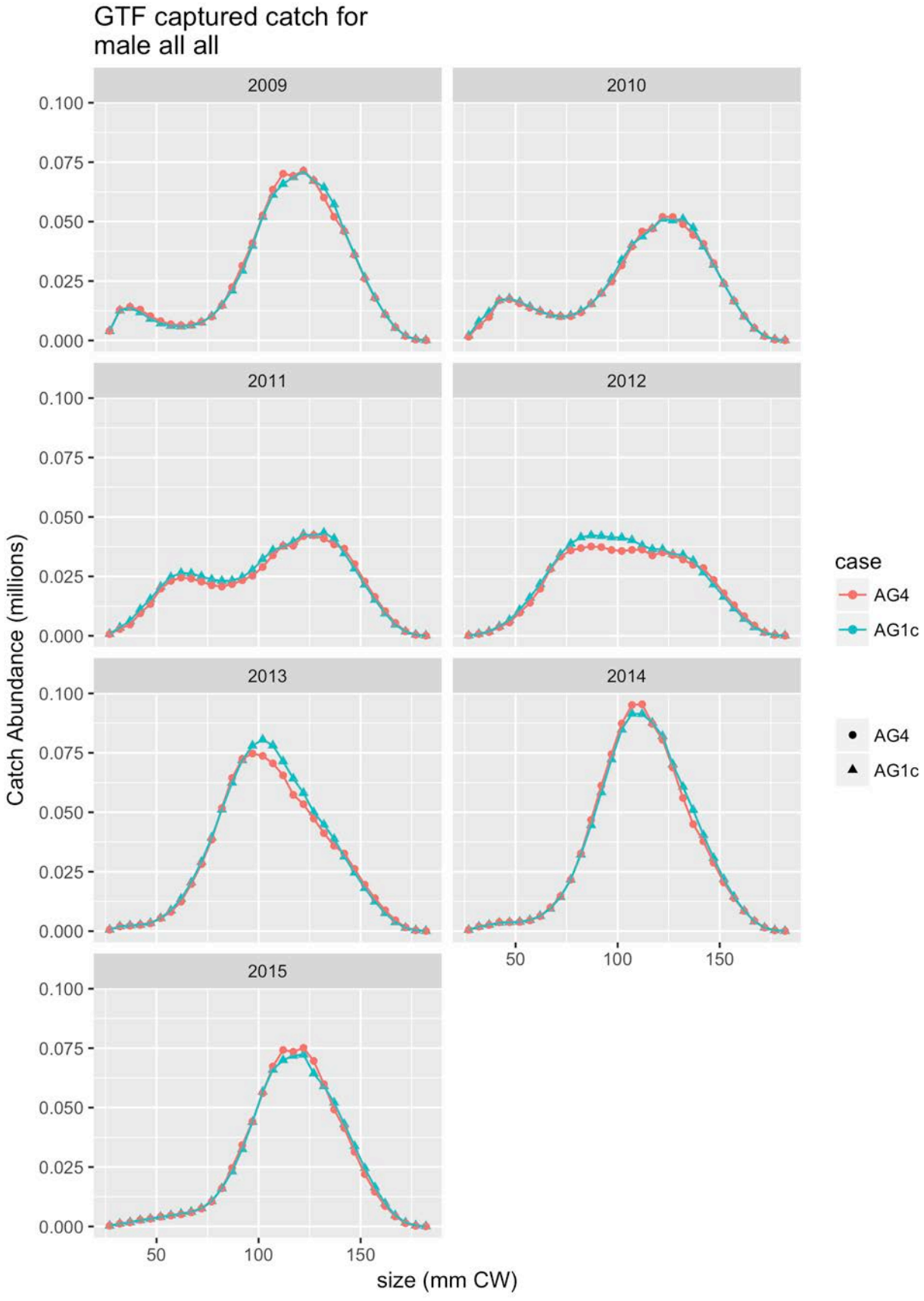


Figure 144. Predicted GTF captured catch abundance for male all all, (5 of 5).

Retained catch size compositions

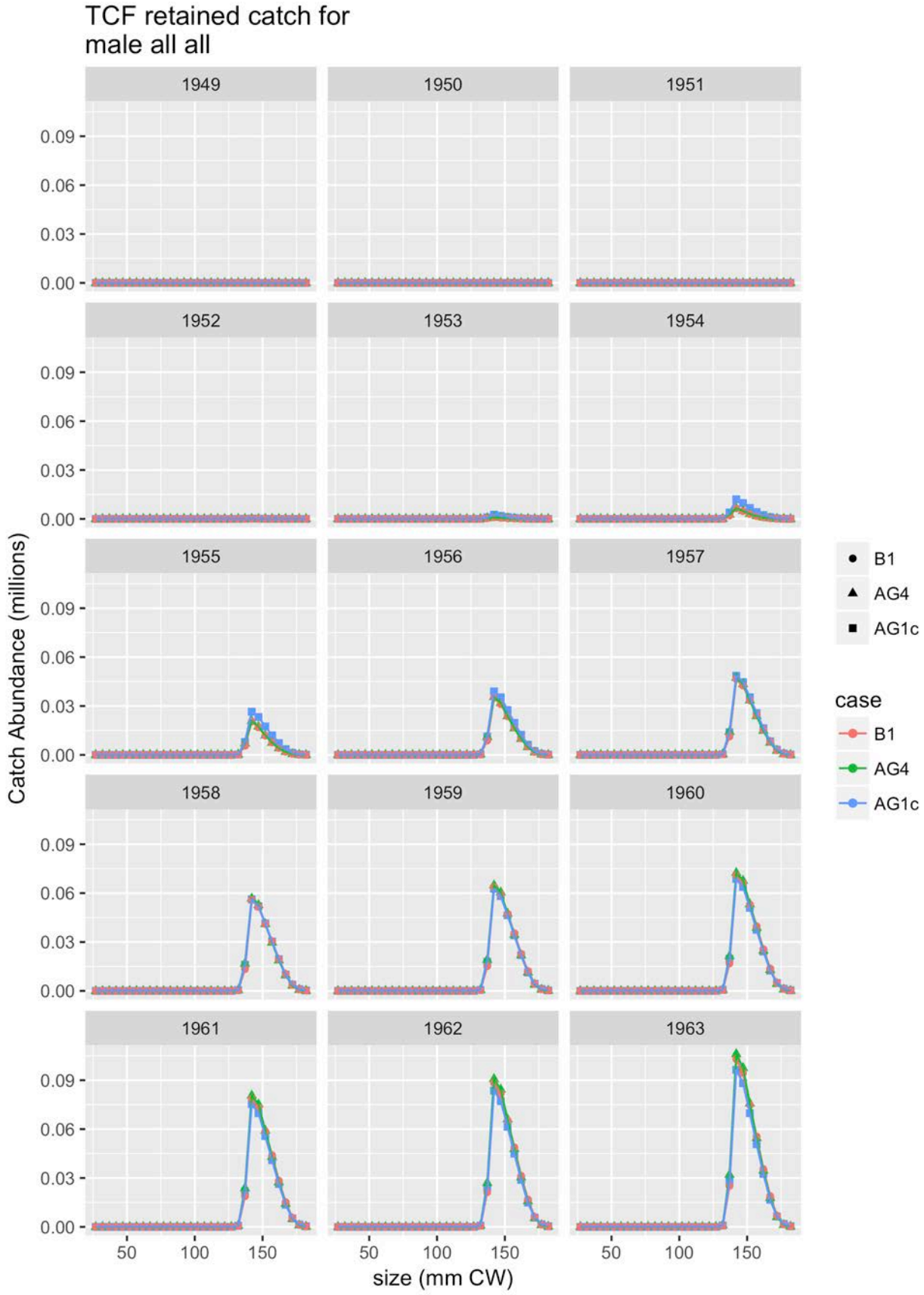


Figure 145. Predicted TCF retained catch abundance for male all all, (1 of 4).

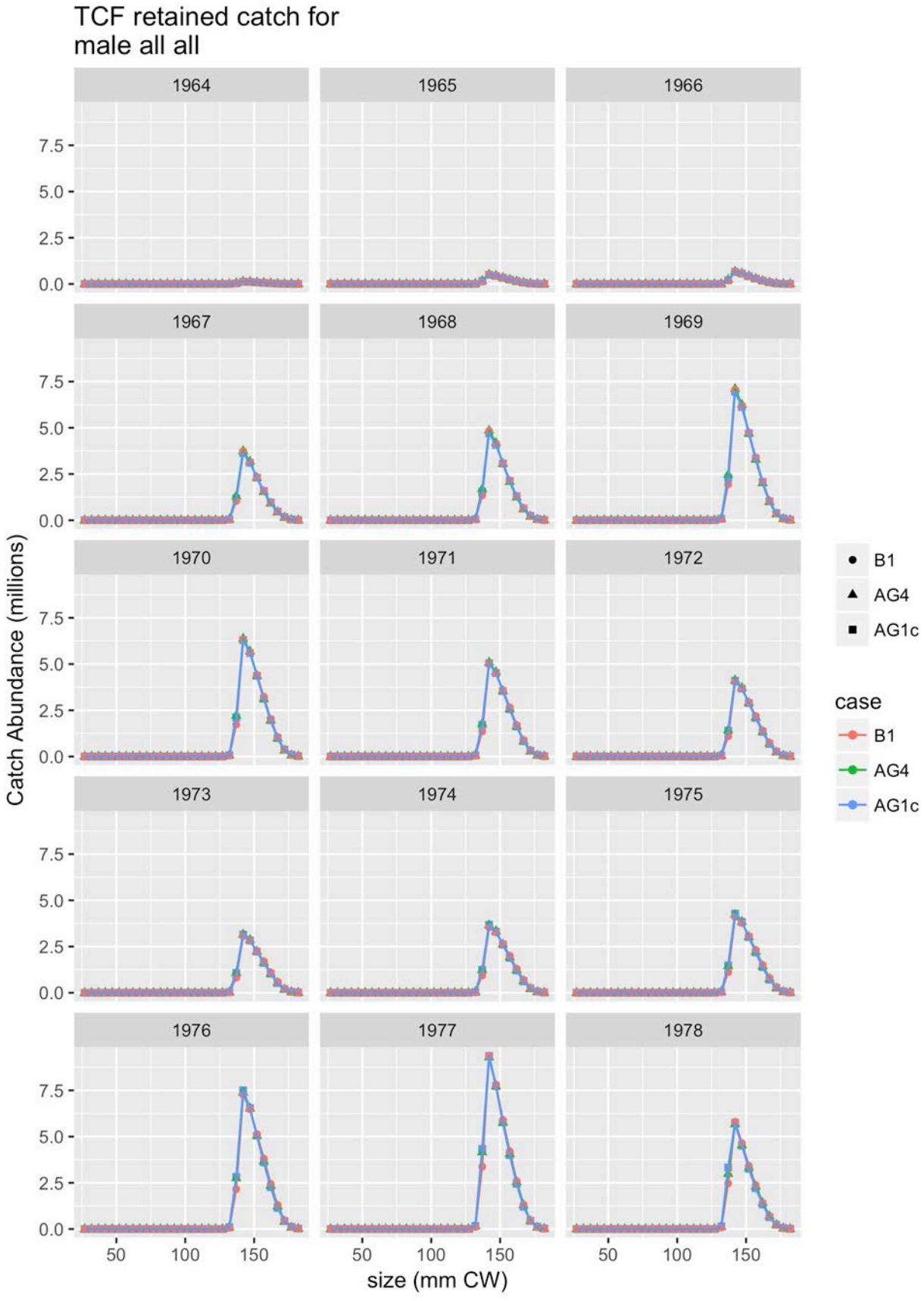


Figure 146. Predicted TCF retained catch abundance for male all all, (2 of 4).

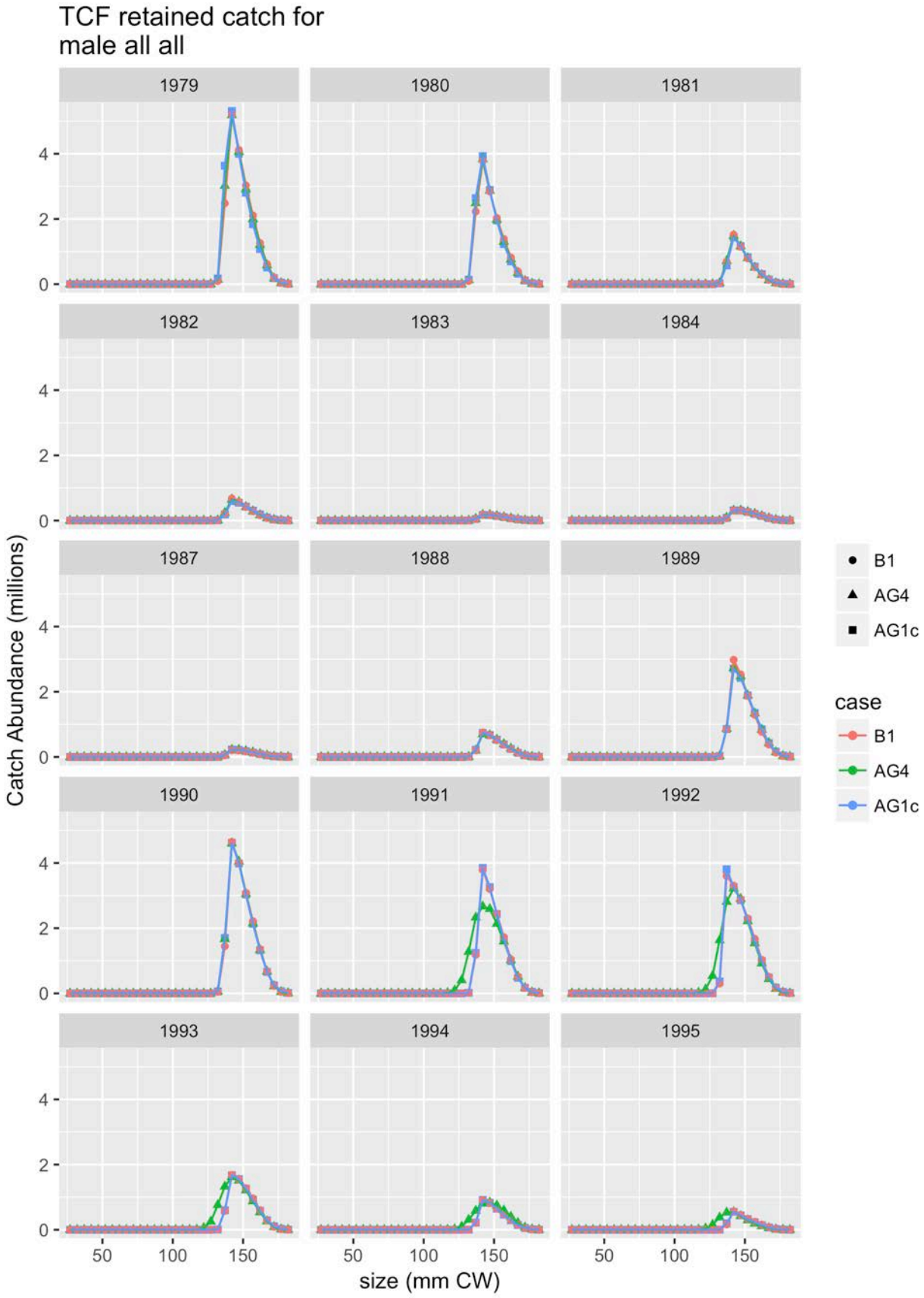


Figure 147. Predicted TCF retained catch abundance for male all all, (3 of 4).

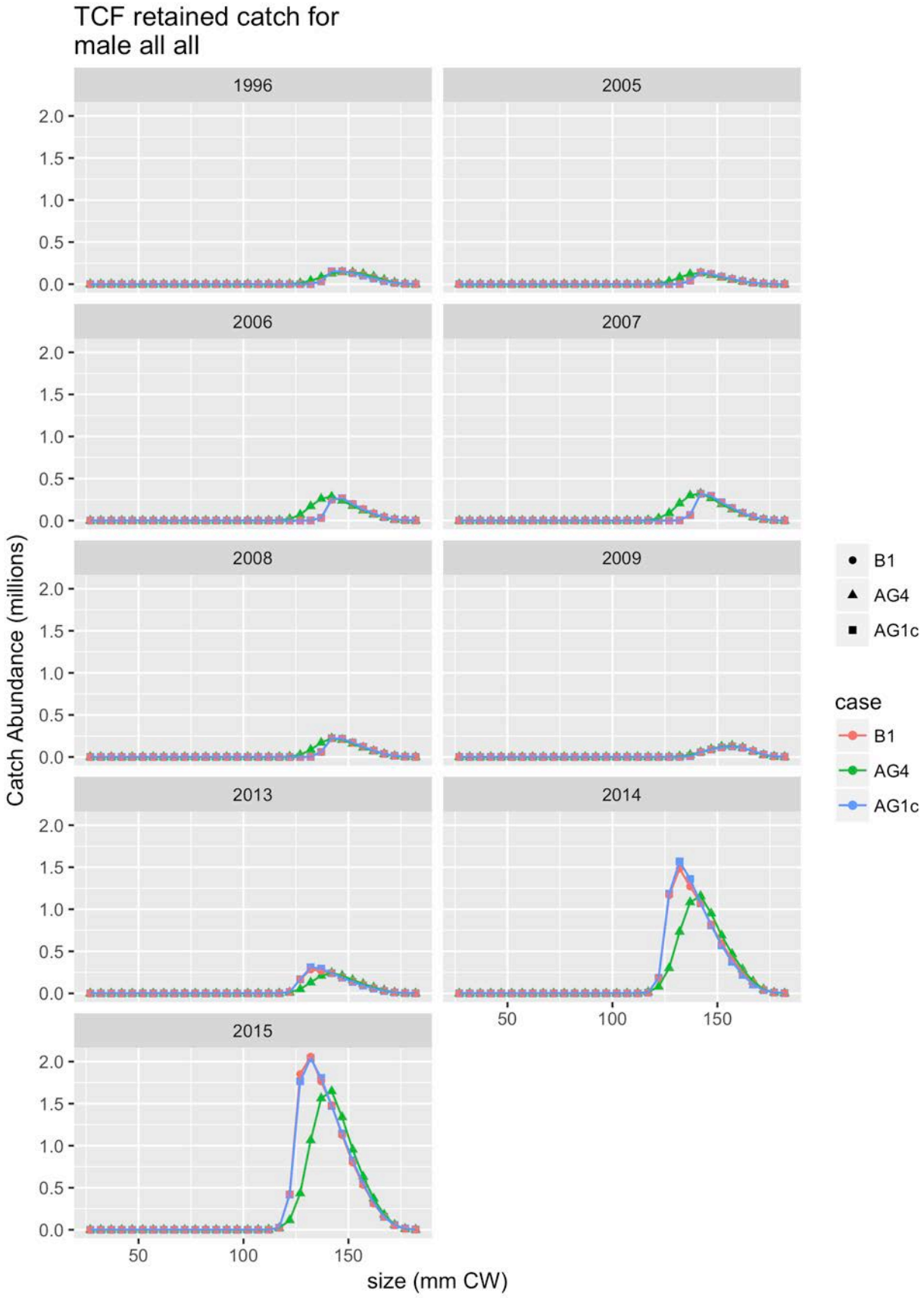


Figure 148. Predicted TCF retained catch abundance for male all all, (4 of 4).

Model fits

Survey biomass

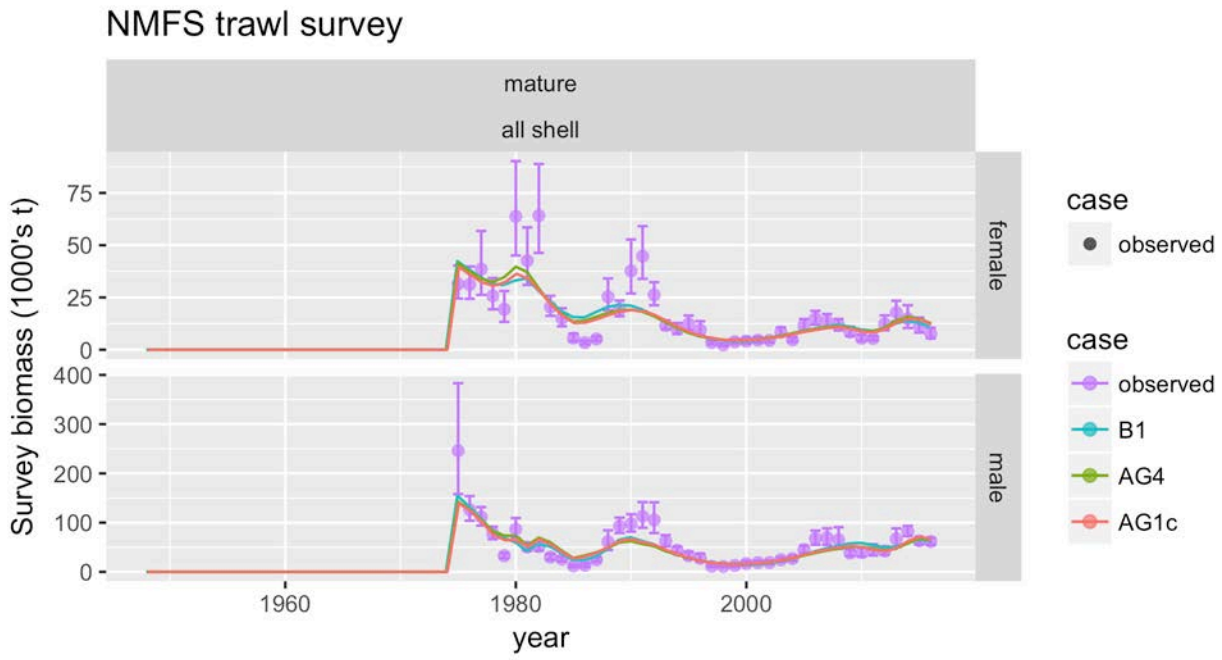


Figure 149. Comparison of observed and predicted survey biomass for NMFS trawl survey.

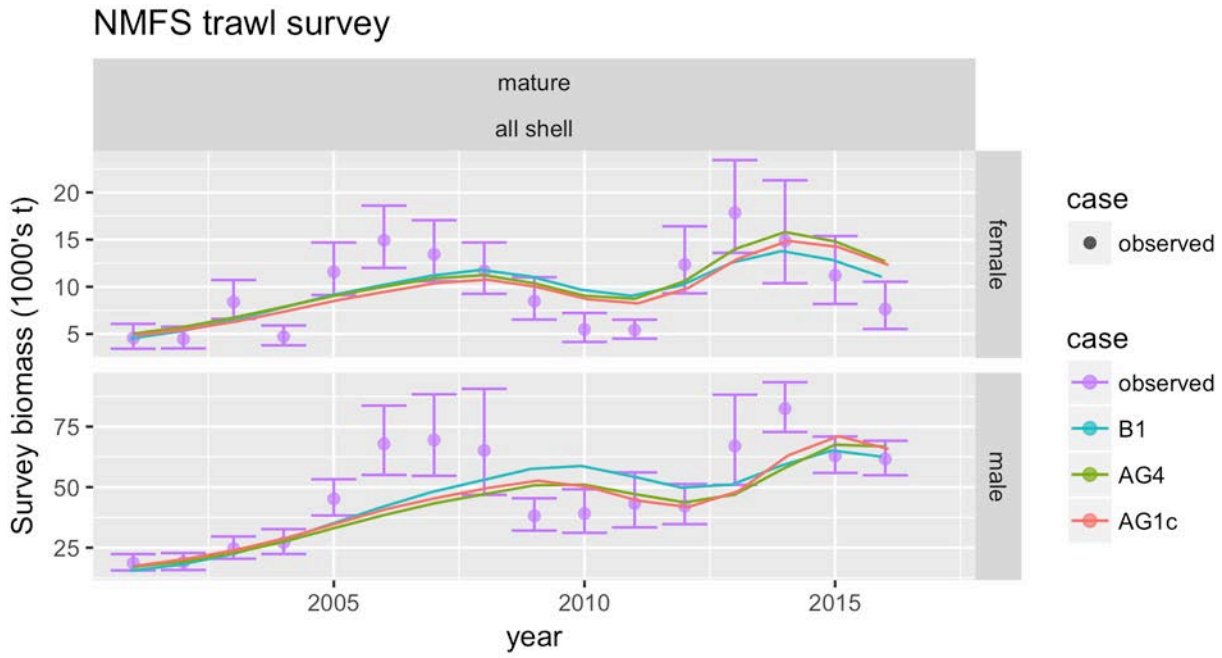


Figure 150. Comparison of observed and predicted survey biomass for NMFS trawl survey. Recent time period.

Mean survey size compositions

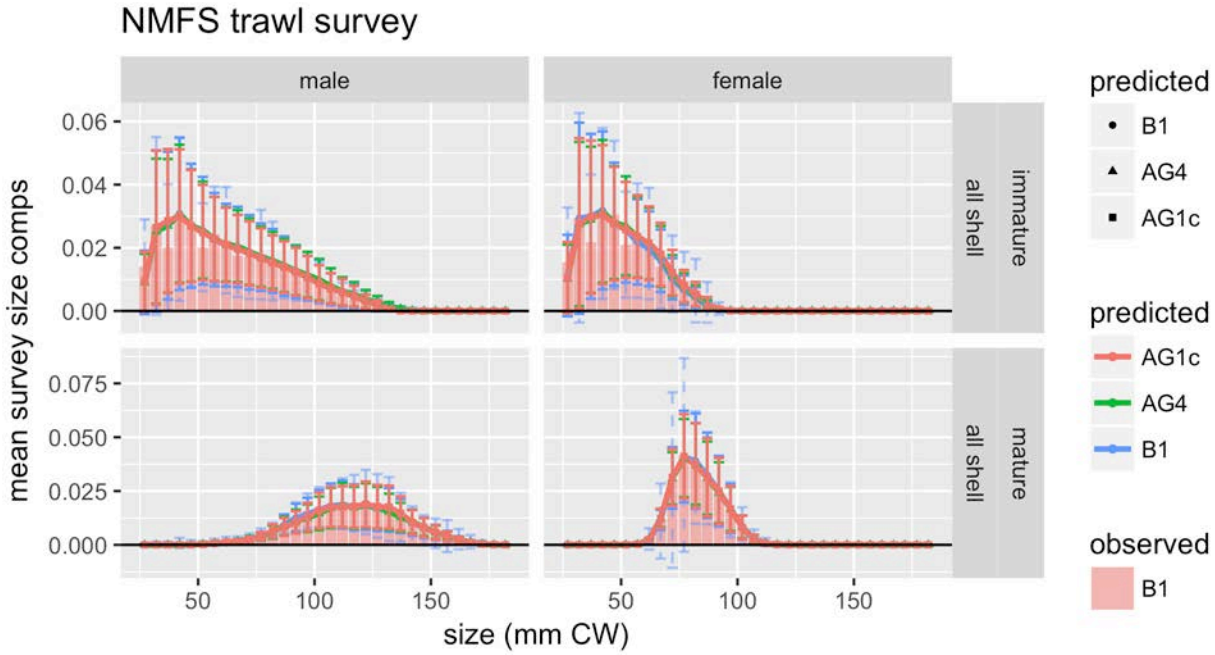


Figure 151. Comparison of observed and predicted &&xms mean survey size comps for NMFS trawl survey.

Survey size compositions

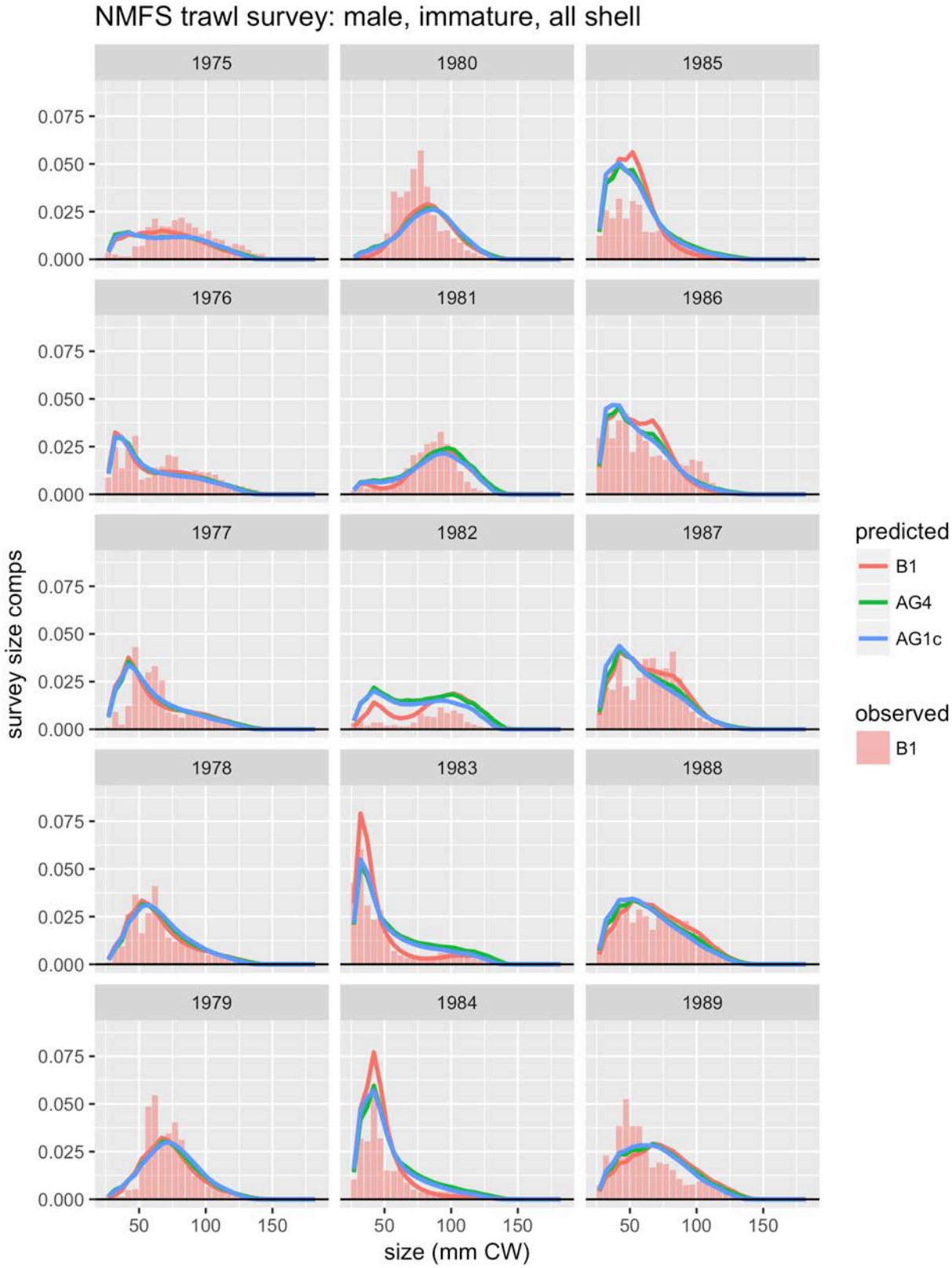


Figure 152. Comparison of observed and predicted male, immature, all shell survey size comps for NMFS trawl survey. Page 1 of 3.

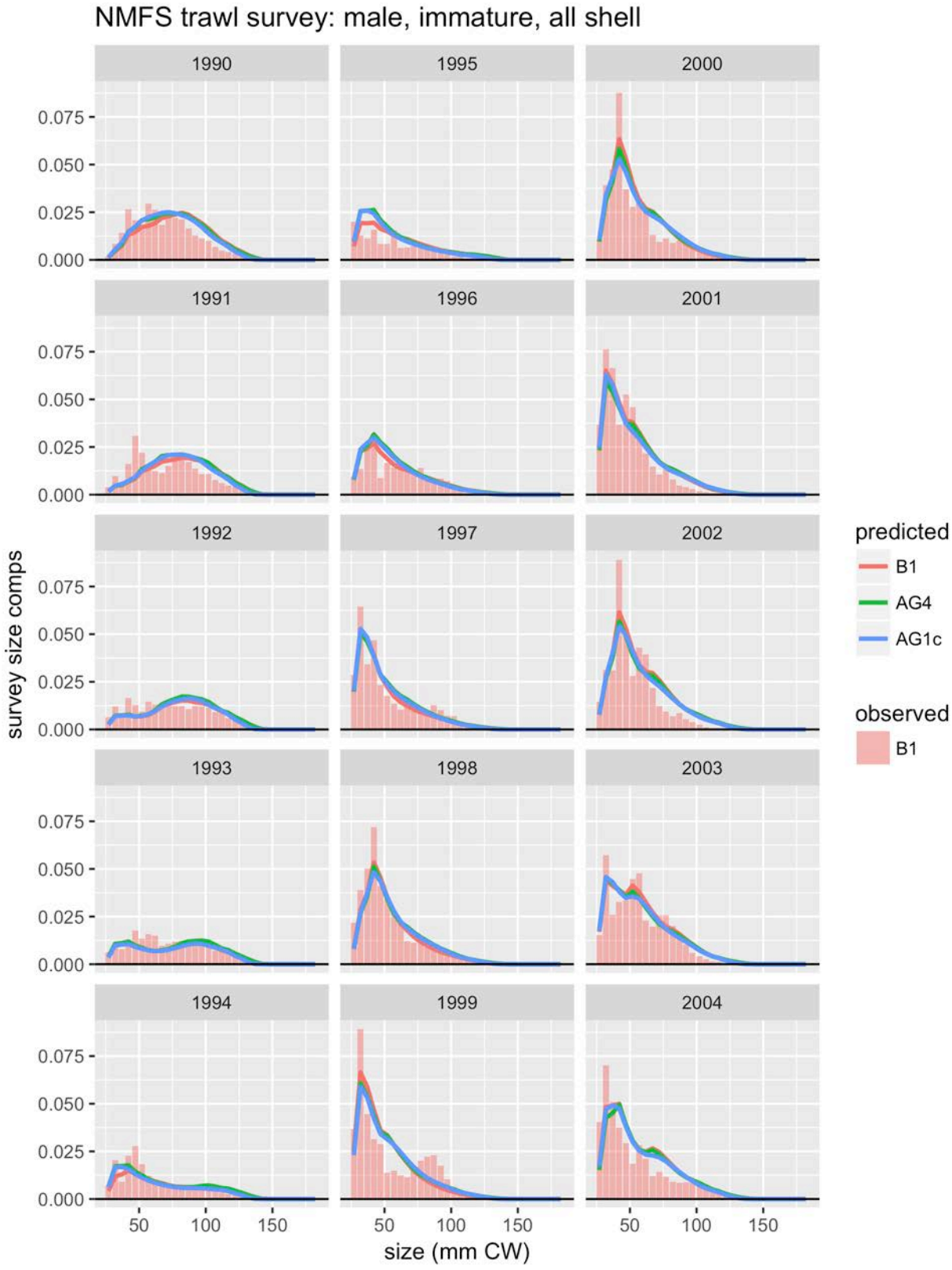


Figure 153. Comparison of observed and predicted male, immature, all shell survey size comps for NMFS trawl survey. Page 2 of 3.

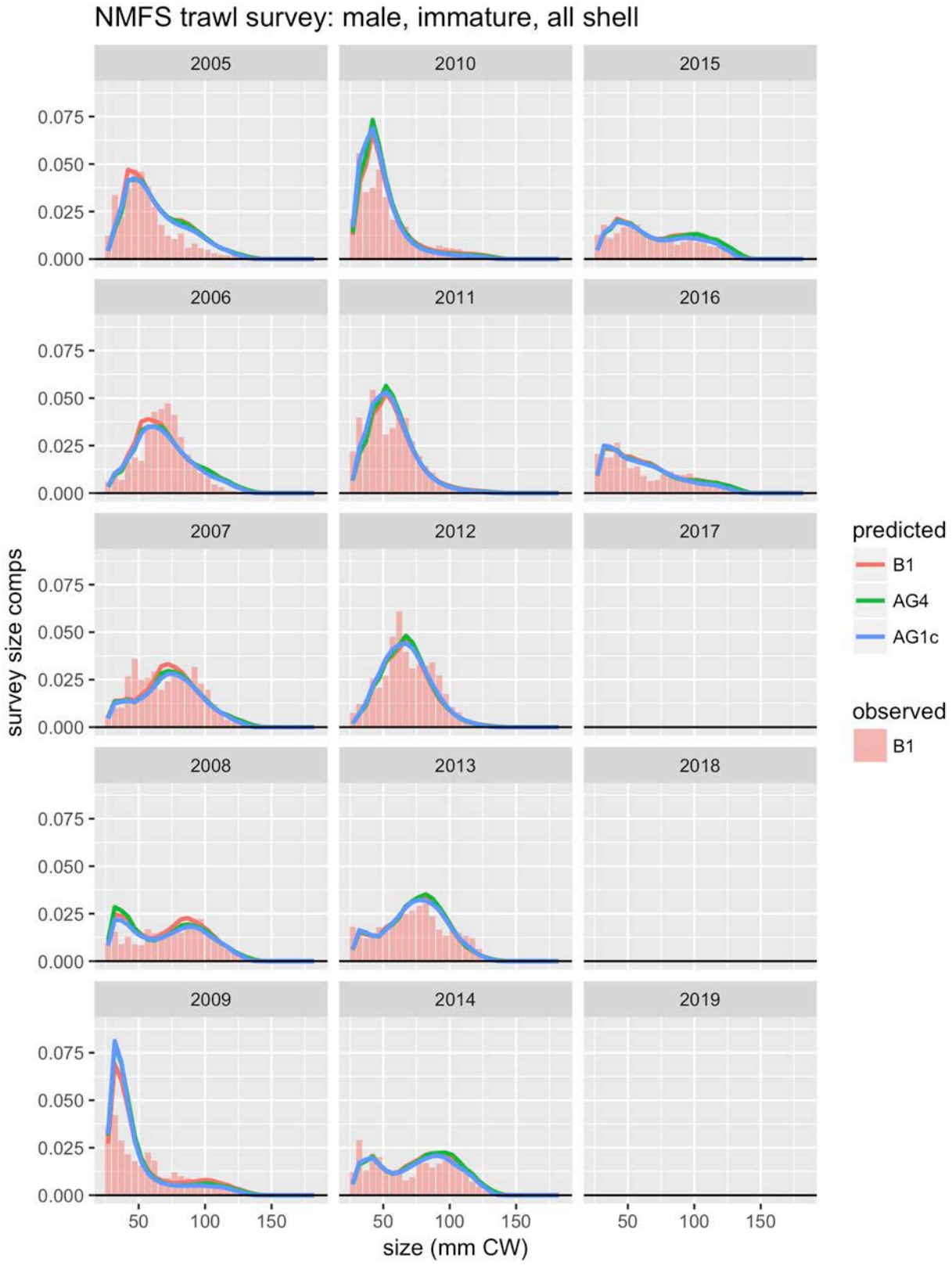


Figure 154. Comparison of observed and predicted male, immature, all shell survey size comps for NMFS trawl survey. Page 3 of 3.

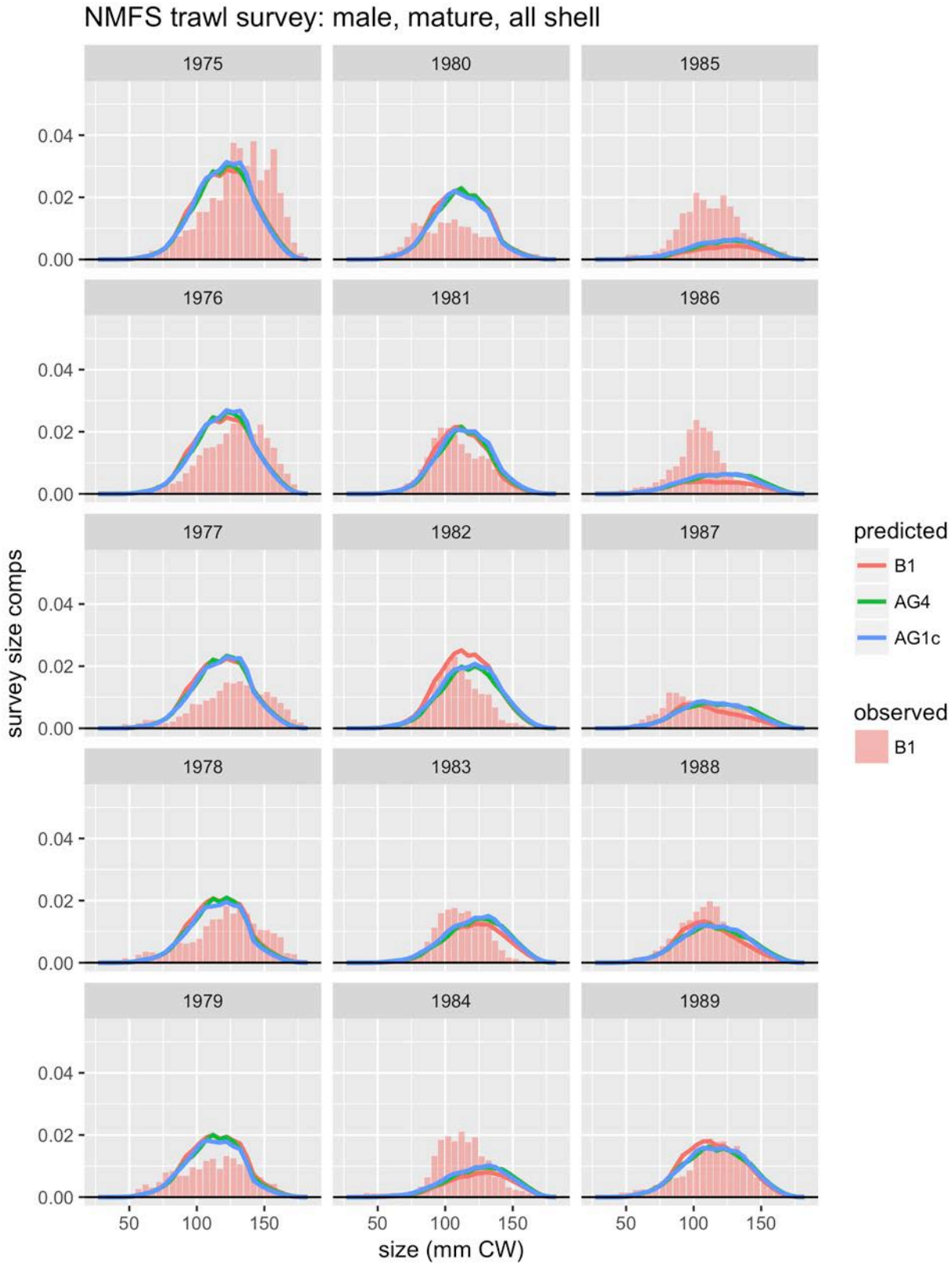


Figure 155. Comparison of observed and predicted male, mature, all shell survey size comps for NMFS trawl survey. Page 1 of 3.

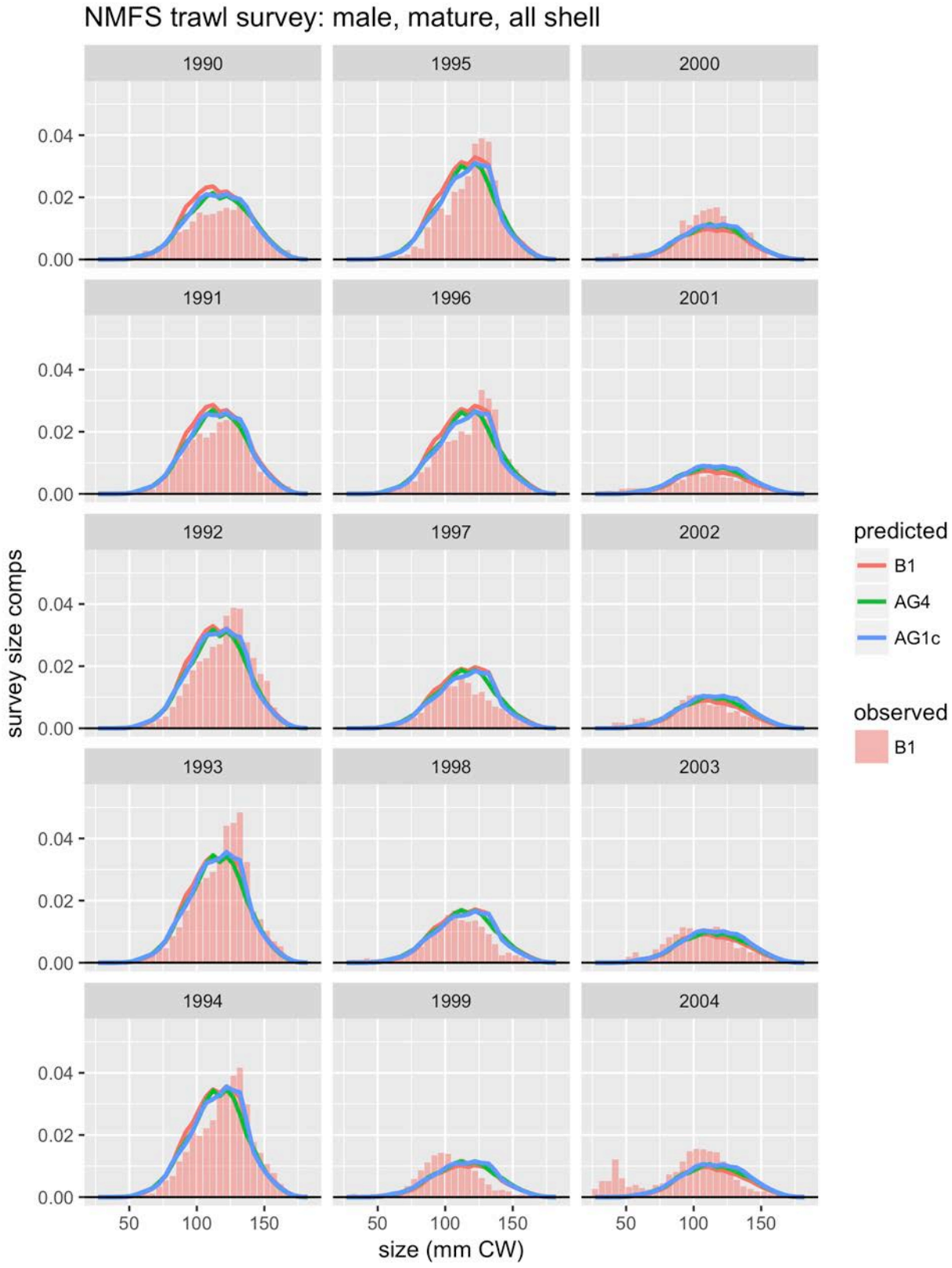


Figure 156. Comparison of observed and predicted male, mature, all shell survey size comps for NMFS trawl survey. Page 2 of 3.

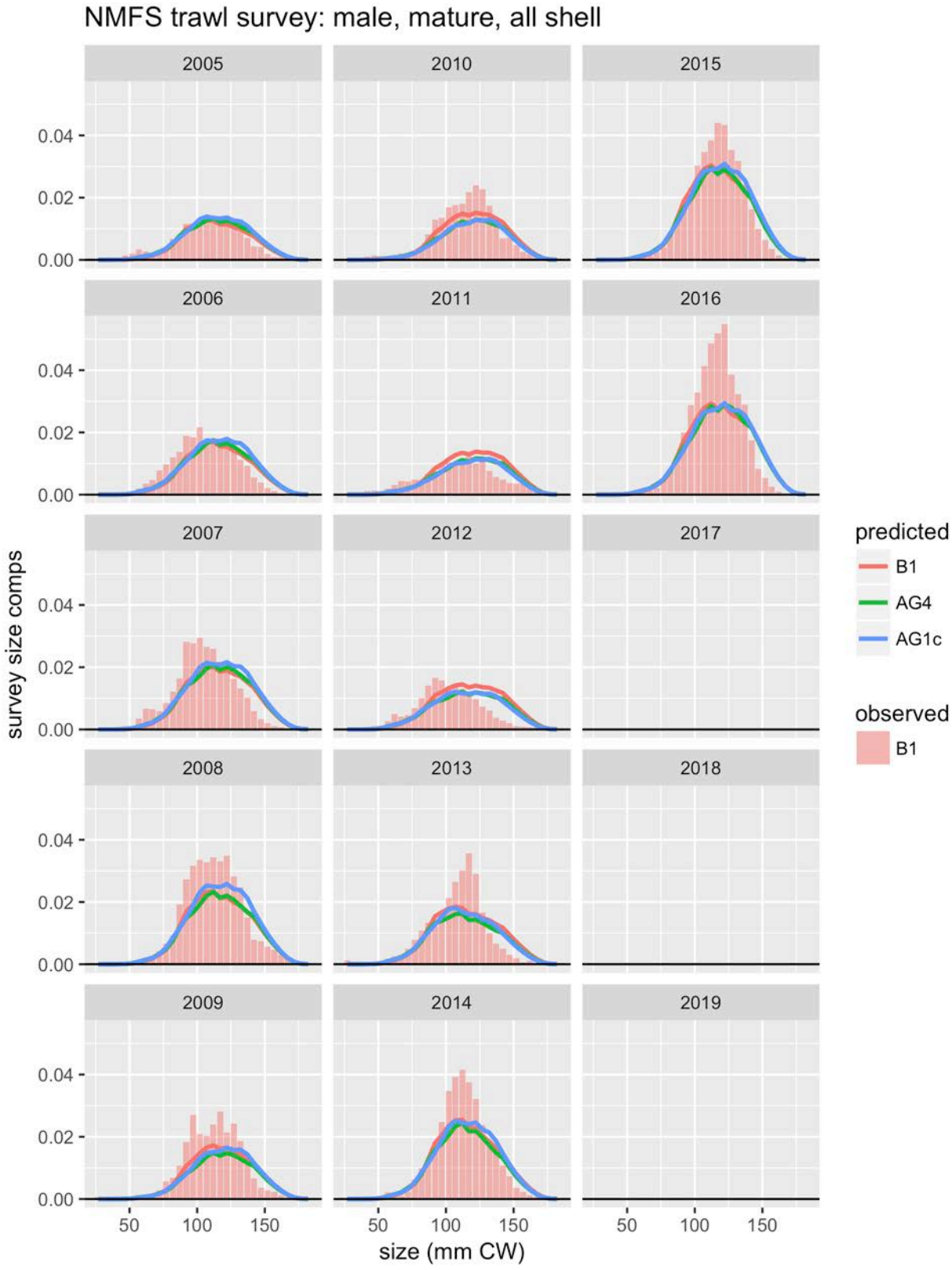


Figure 157. Comparison of observed and predicted male, mature, all shell survey size comps for NMFS trawl survey. Page 3 of 3.

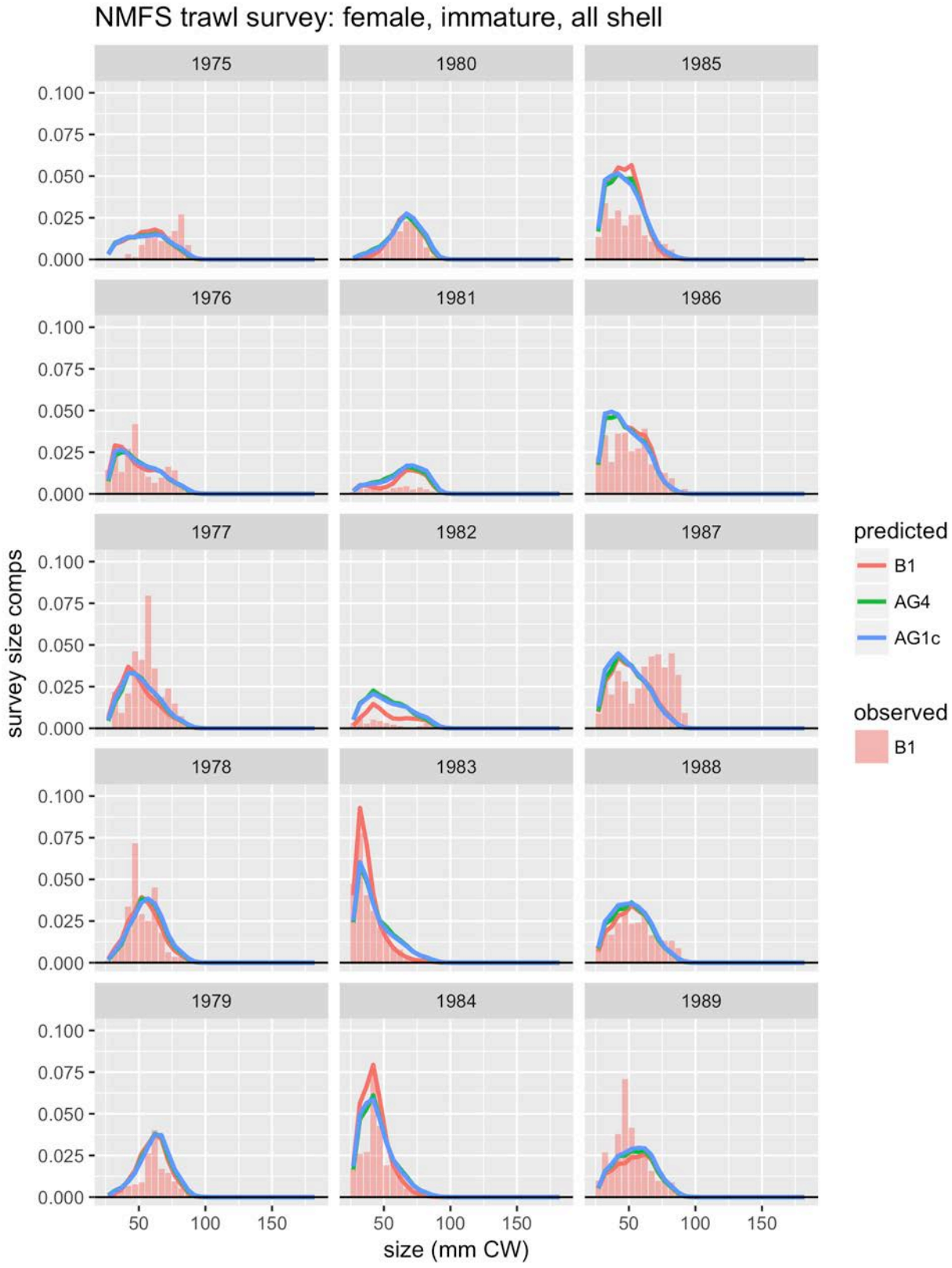


Figure 158. Comparison of observed and predicted female, immature, all shell survey size comps for NMFS trawl survey. Page 1 of 3.

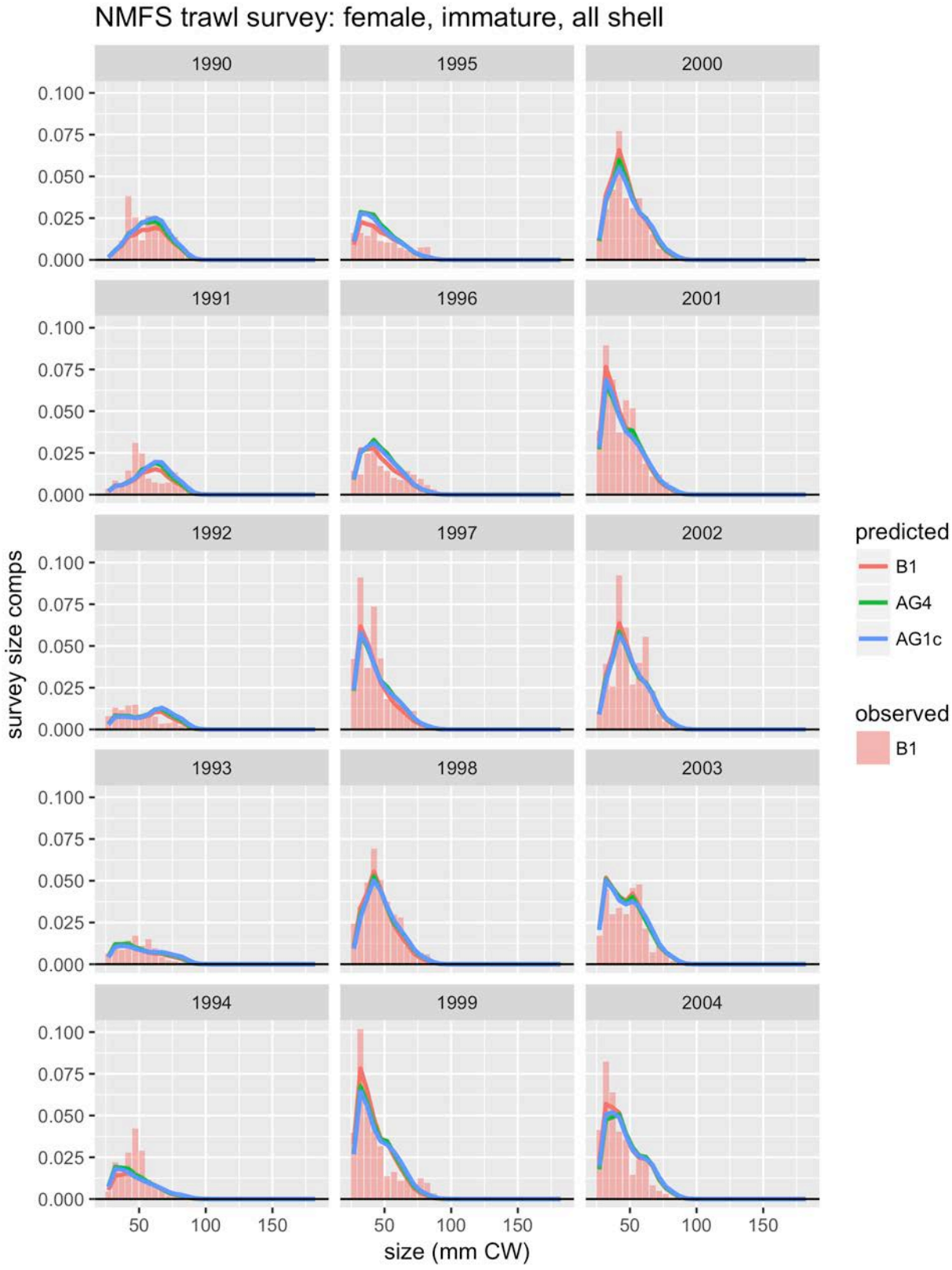


Figure 159. Comparison of observed and predicted female, immature, all shell survey size comps for NMFS trawl survey. Page 2 of 3.

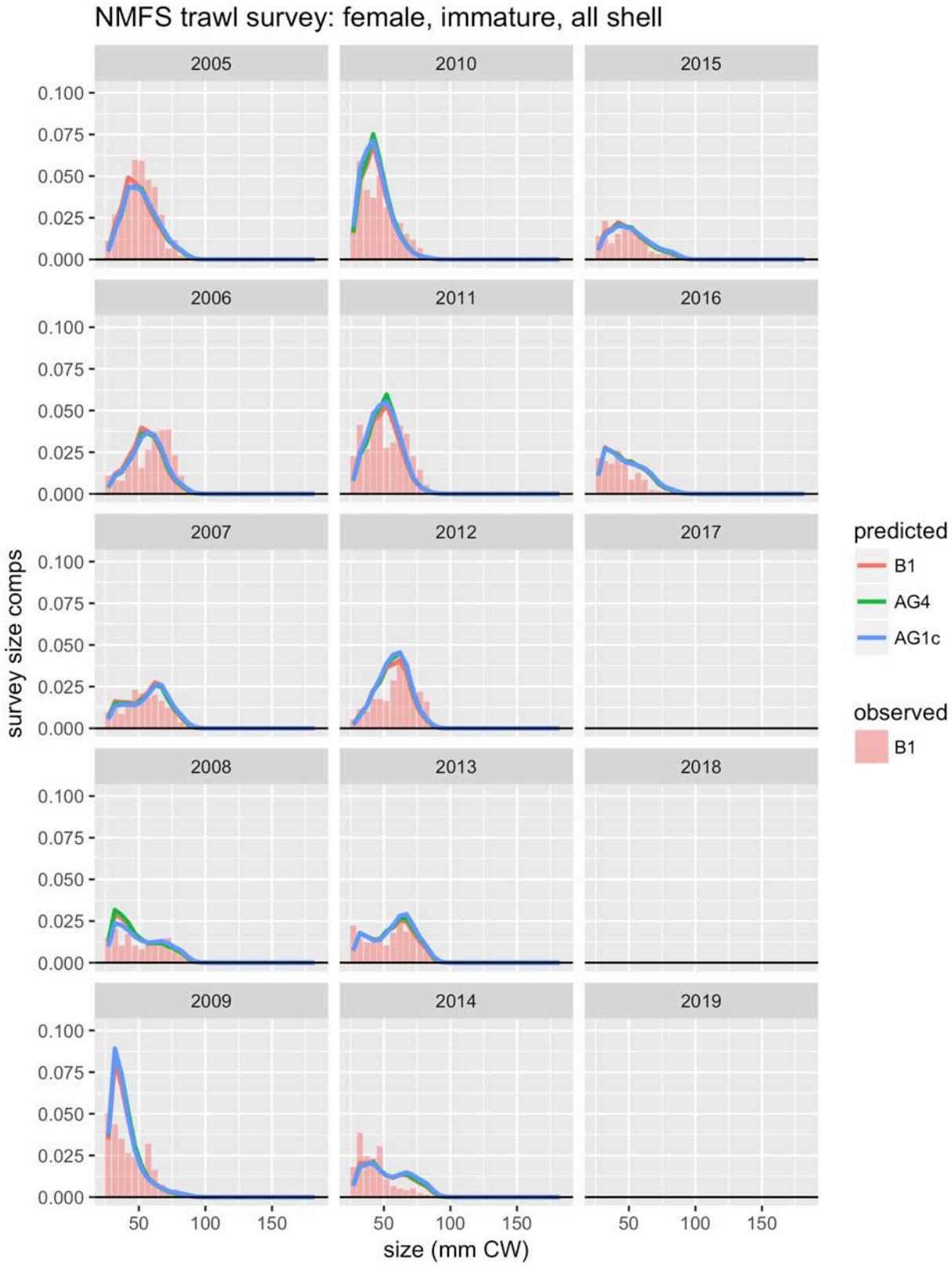


Figure 160. Comparison of observed and predicted female, immature, all shell survey size comps for NMFS trawl survey. Page 3 of 3.

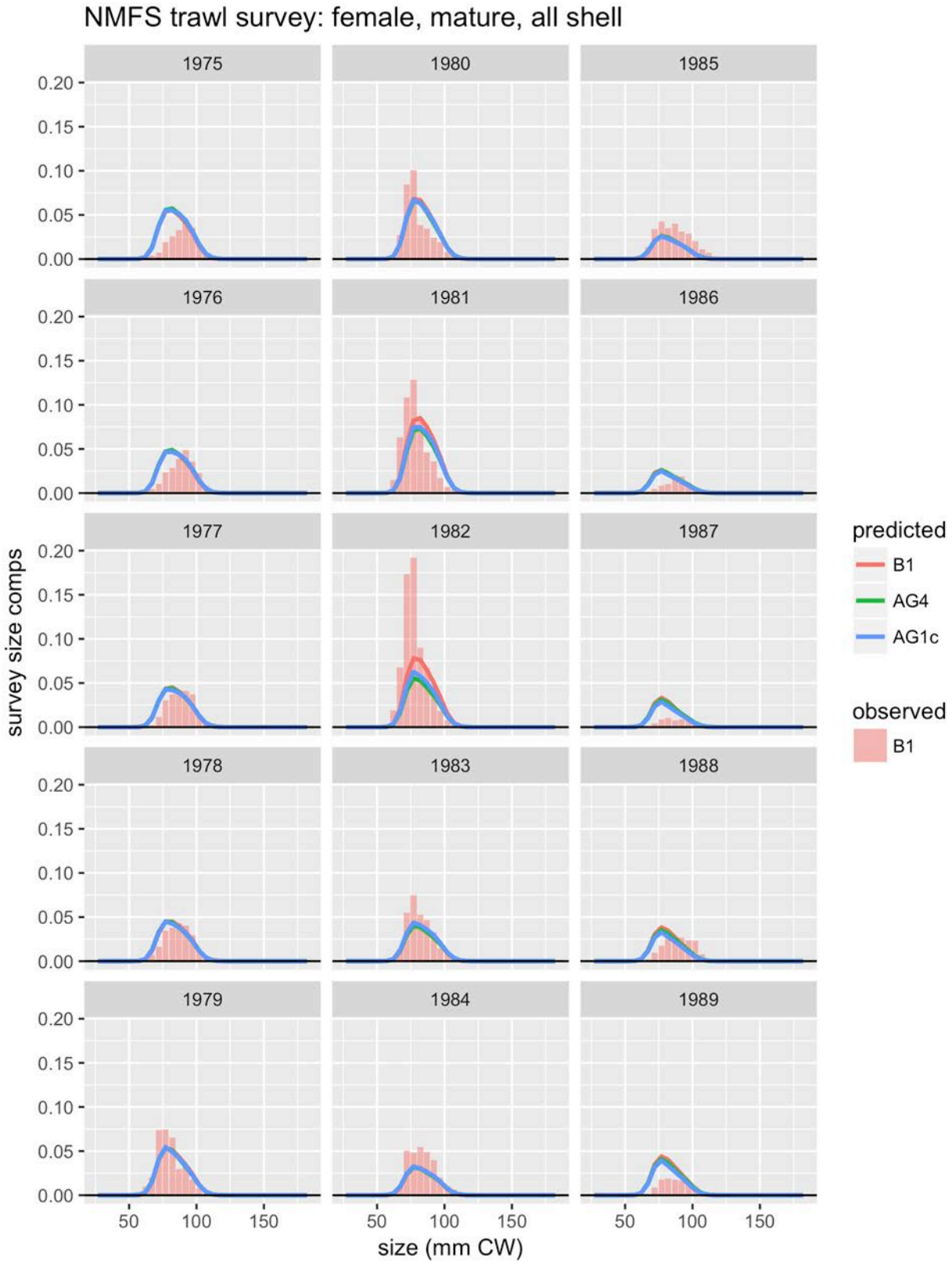


Figure 161. Comparison of observed and predicted female, mature, all shell survey size comps for NMFS trawl survey. Page 1 of 3.

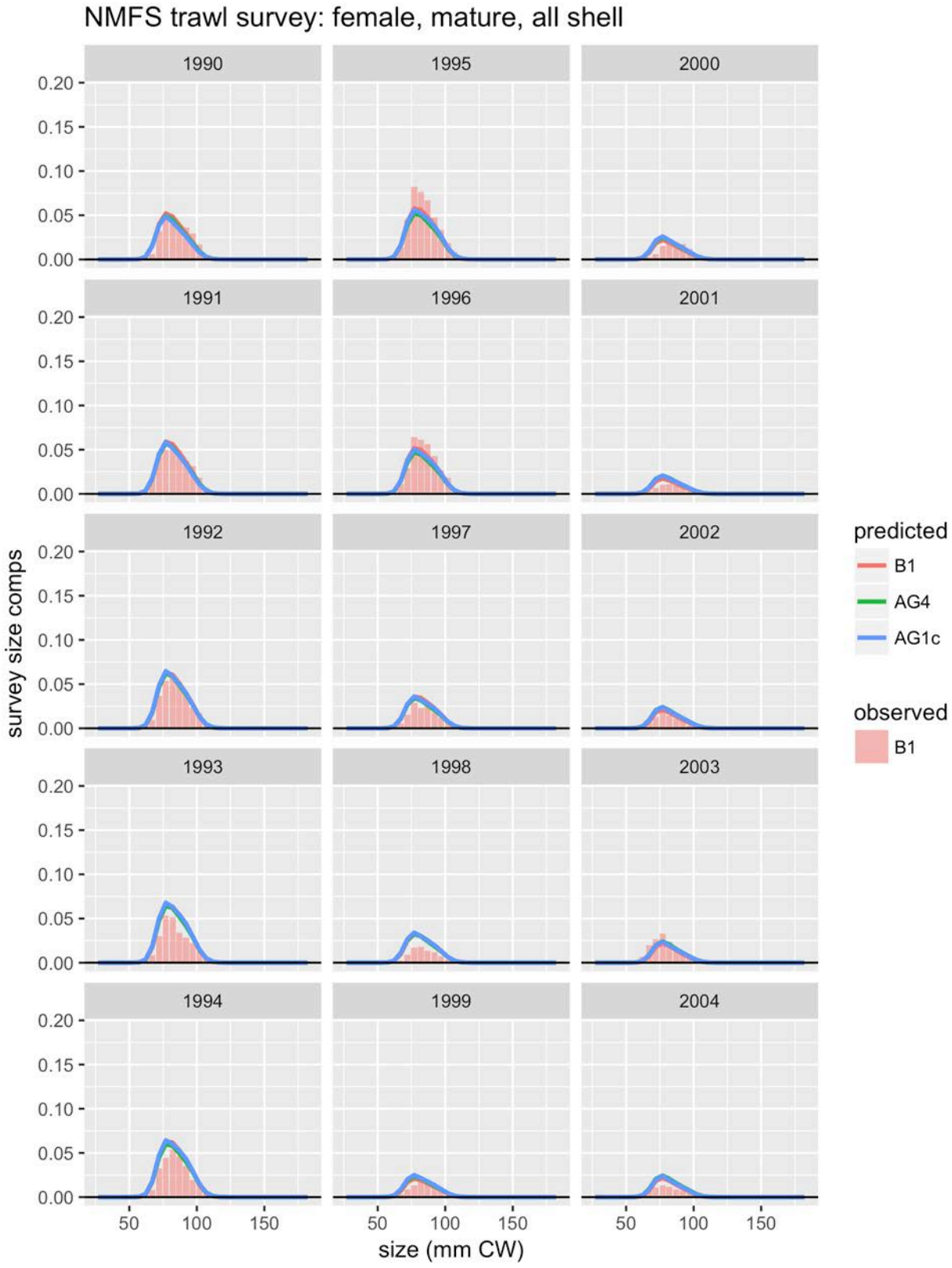


Figure 162. Comparison of observed and predicted female, mature, all shell survey size comps for NMFS trawl survey. Page 2 of 3.

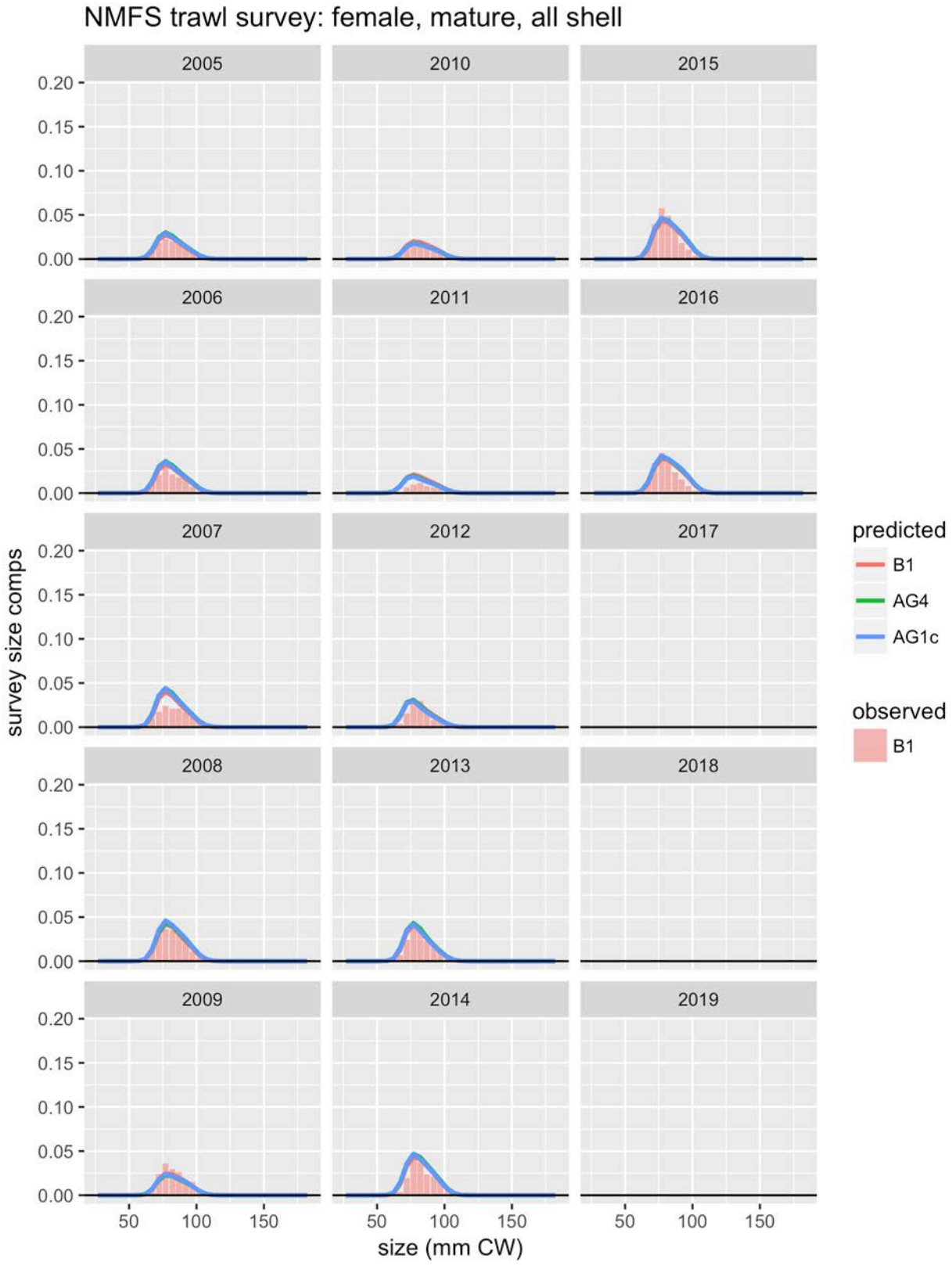


Figure 163. Comparison of observed and predicted female, mature, all shell survey size comps for NMFS trawl survey. Page 3 of 3.

Growth data

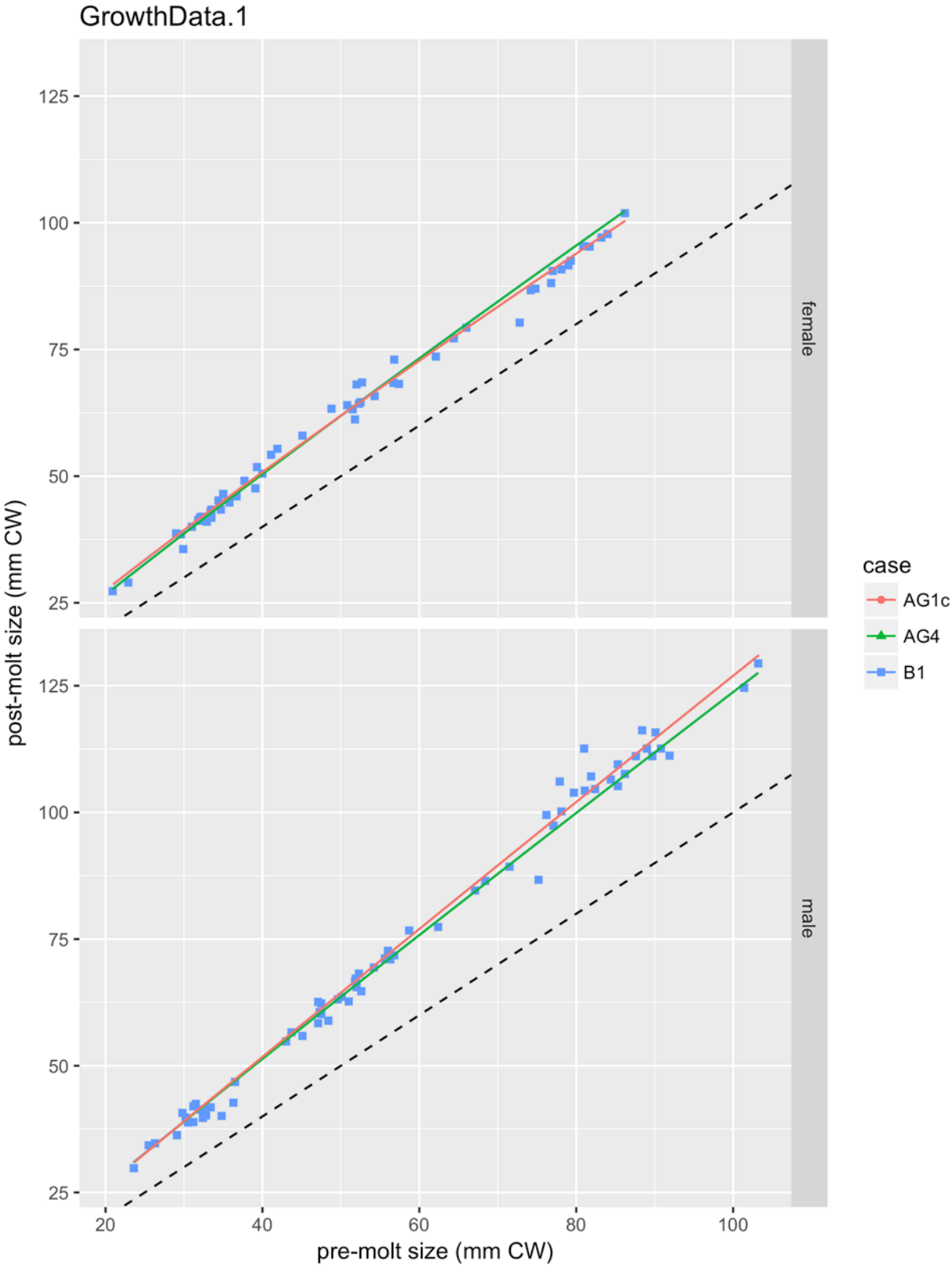


Figure 164. Model fits to GrowthData.1.

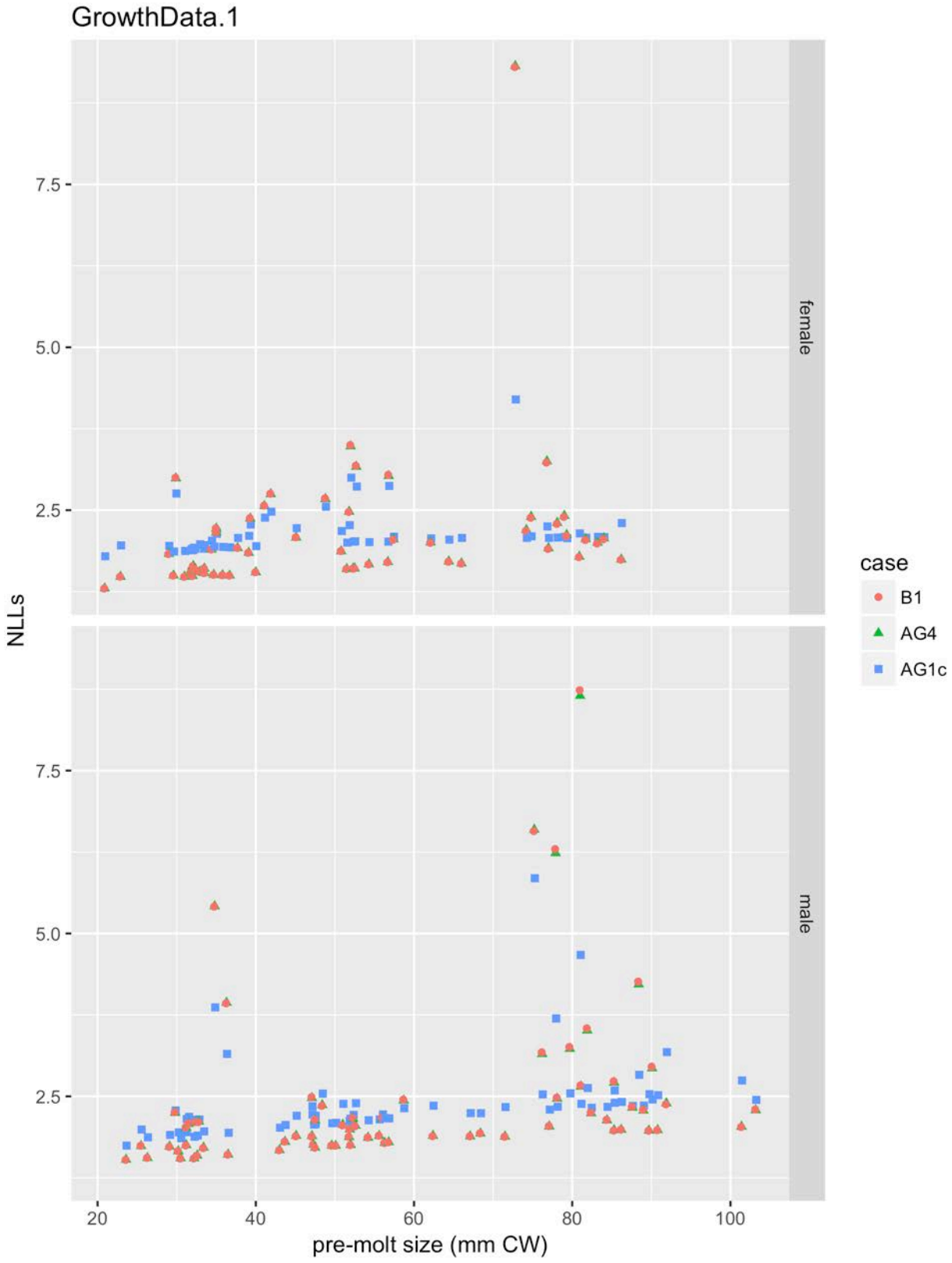


Figure 165. Negative log-likelihood values for fits to GrowthData.1.

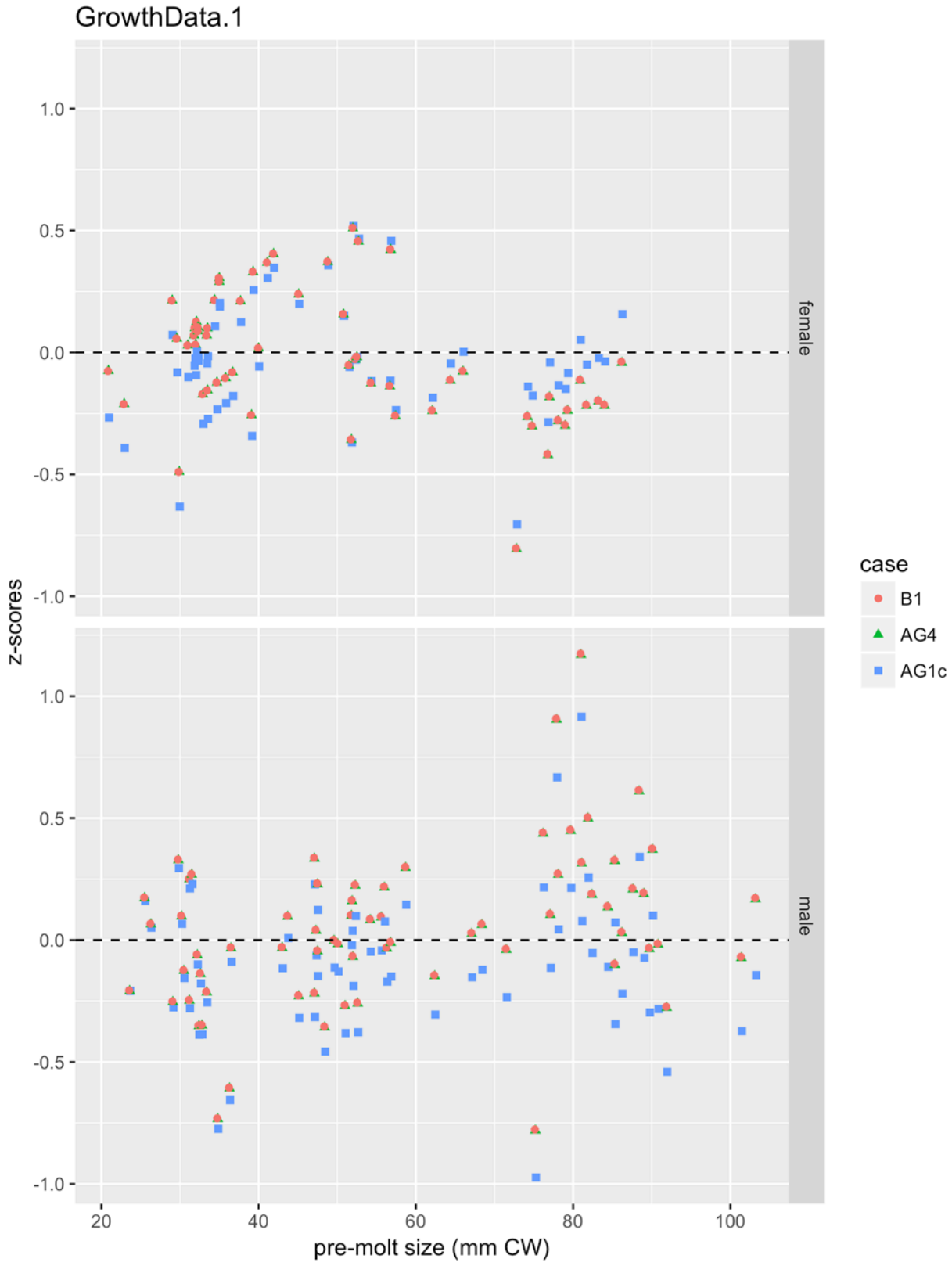


Figure 166.

Z-scores for fits to GrowthData.1.

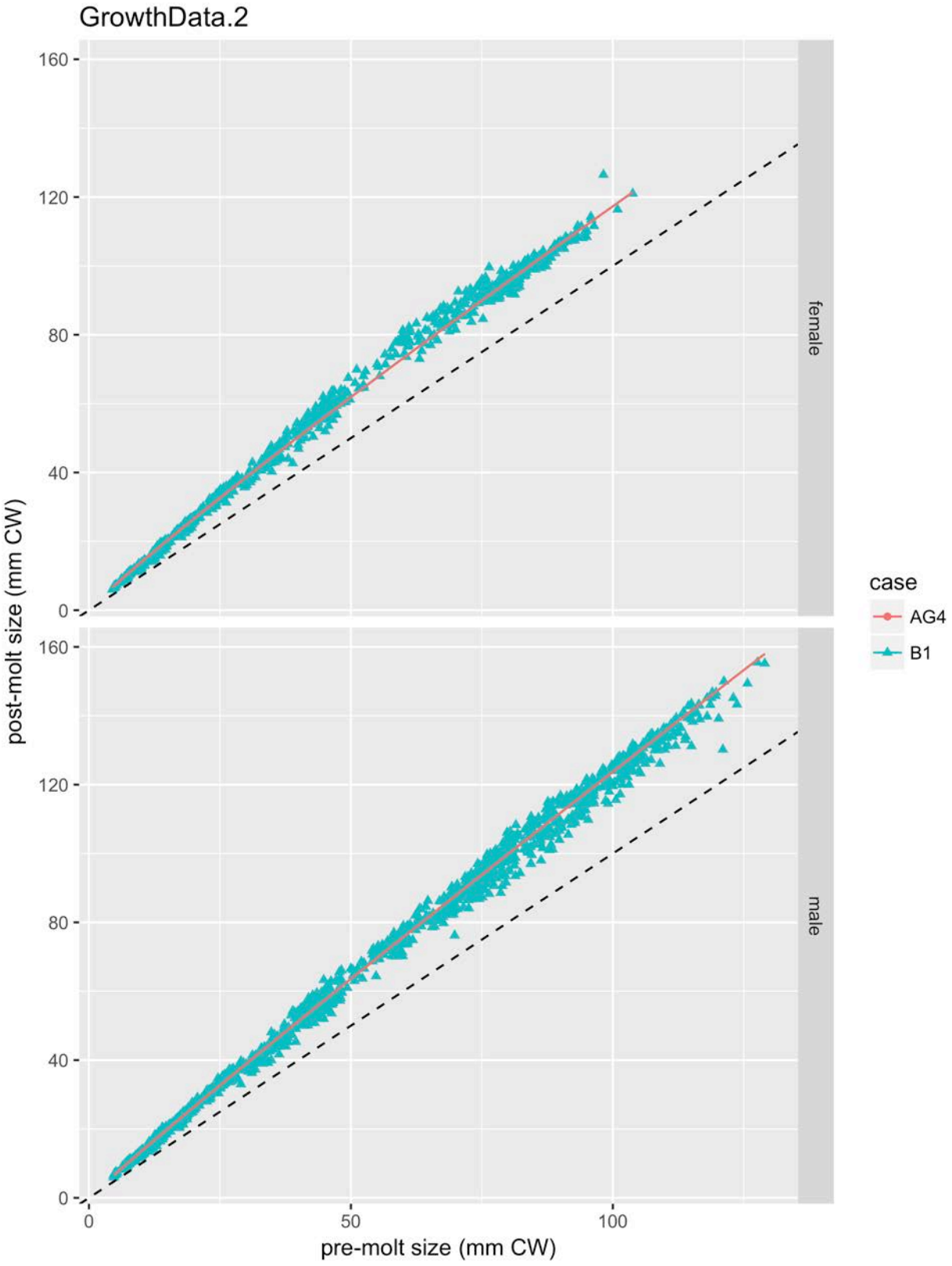


Figure 167. Model fits to GrowthData.2.

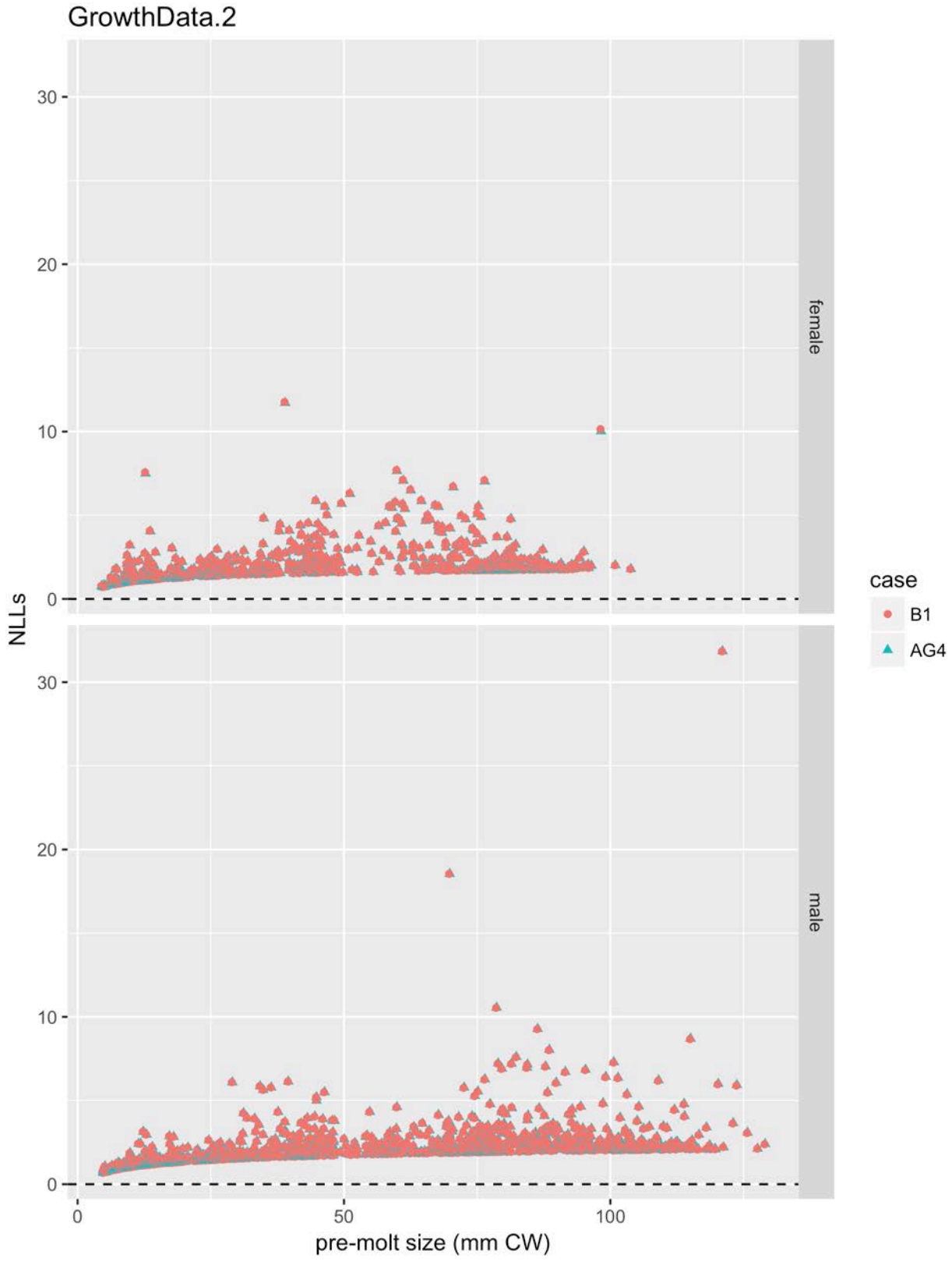


Figure 168. Negative log-likelihood values for fits to GrowthData.2.

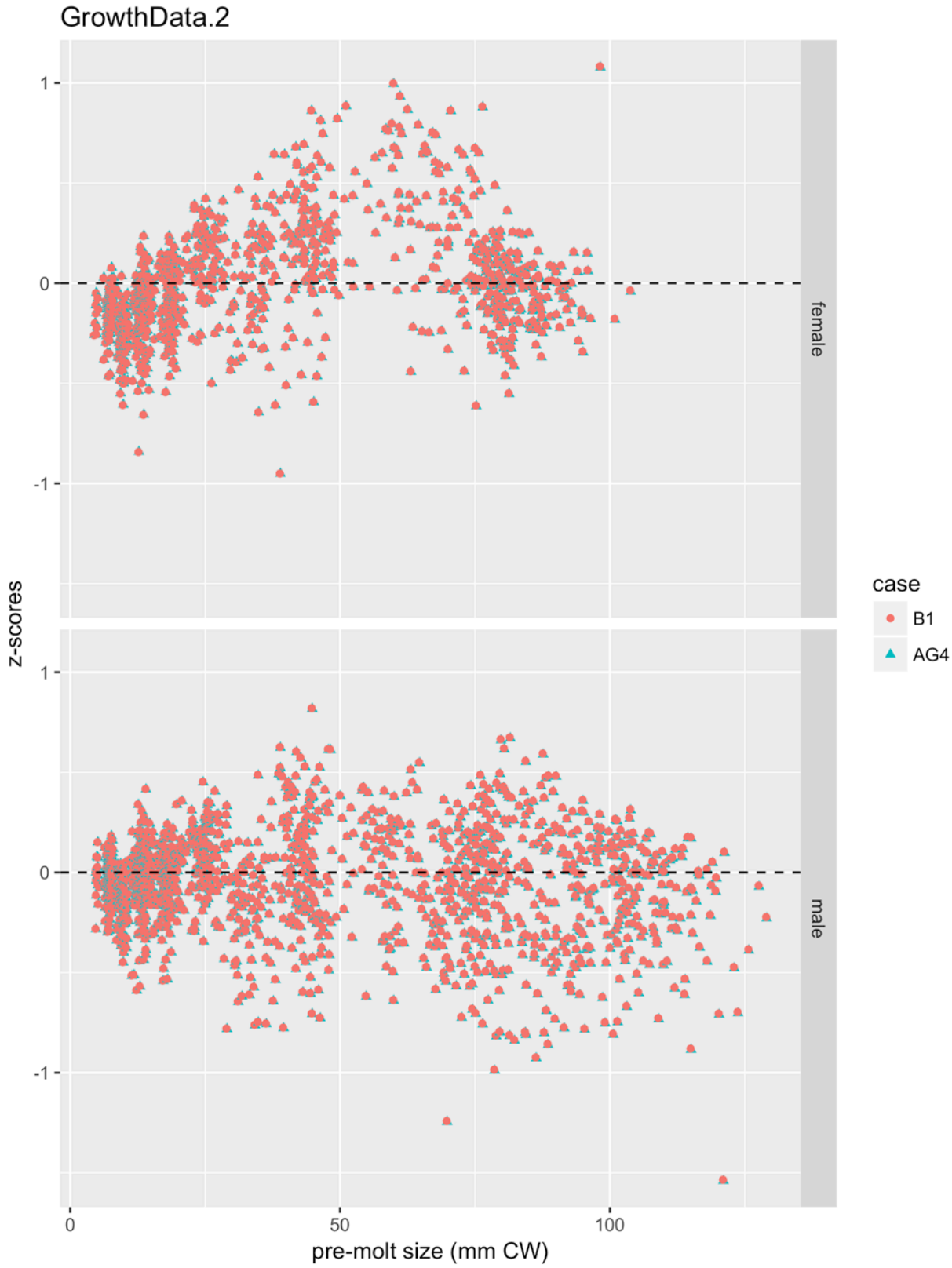


Figure 169.

Z-scores for fits to GrowthData.2.

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.

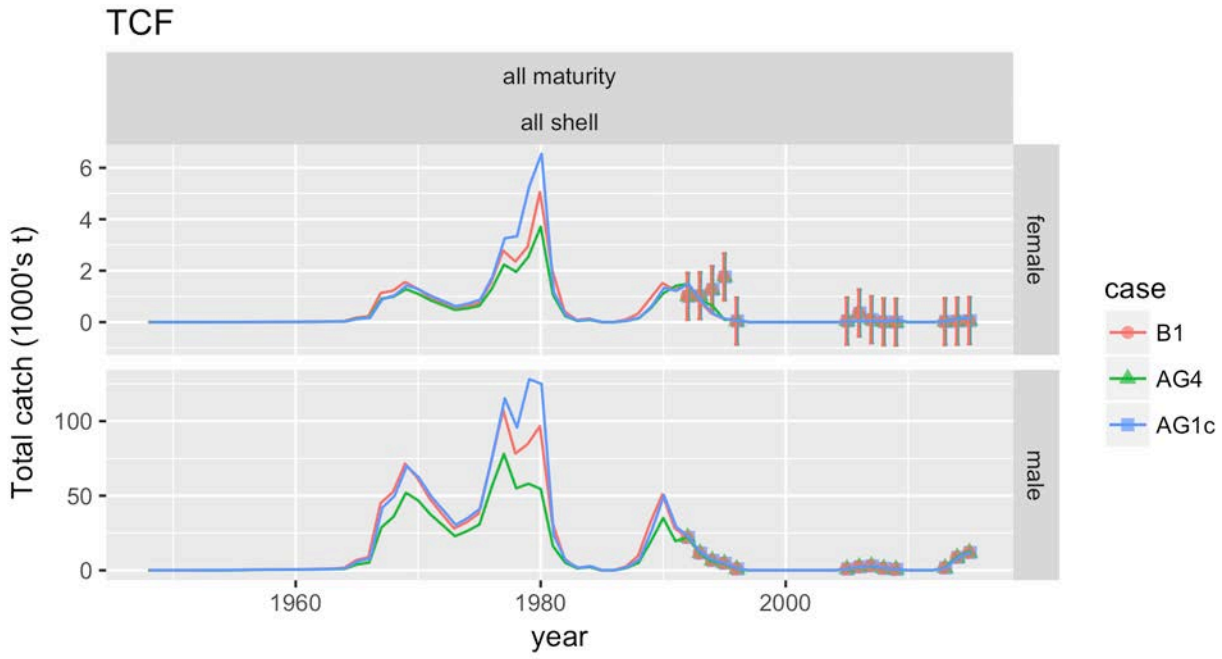


Figure 170. Comparison of observed and predicted total catch for TCF.

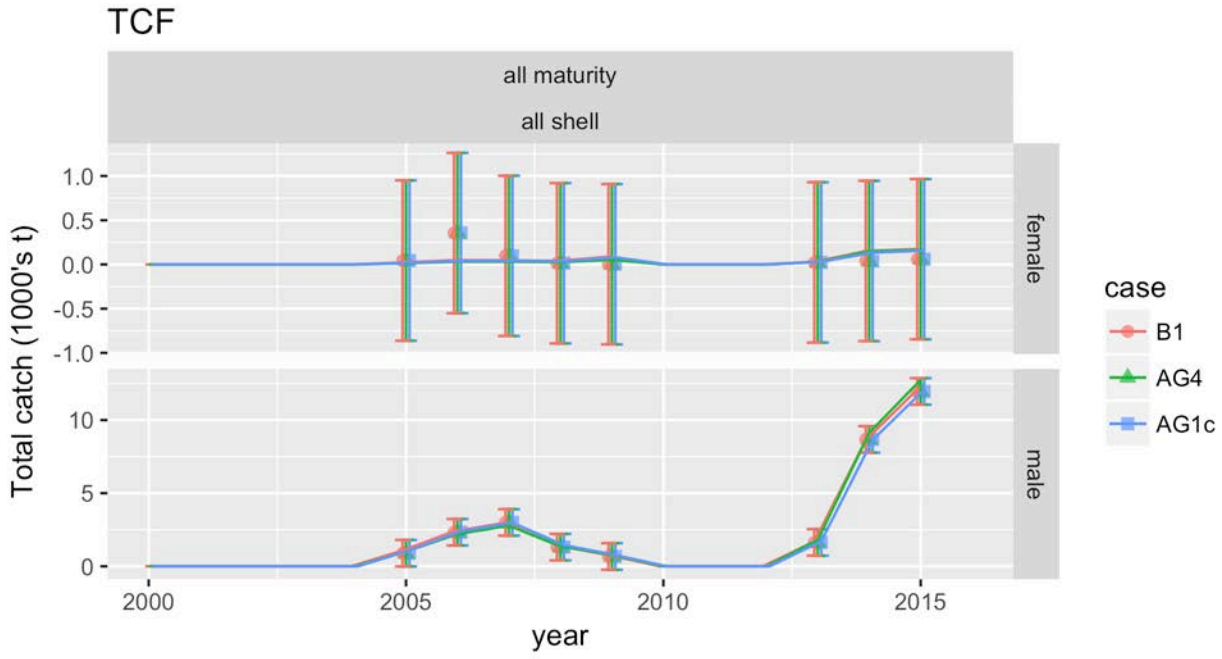


Figure 171. Comparison of observed and predicted total catch for TCF. Recent time period.

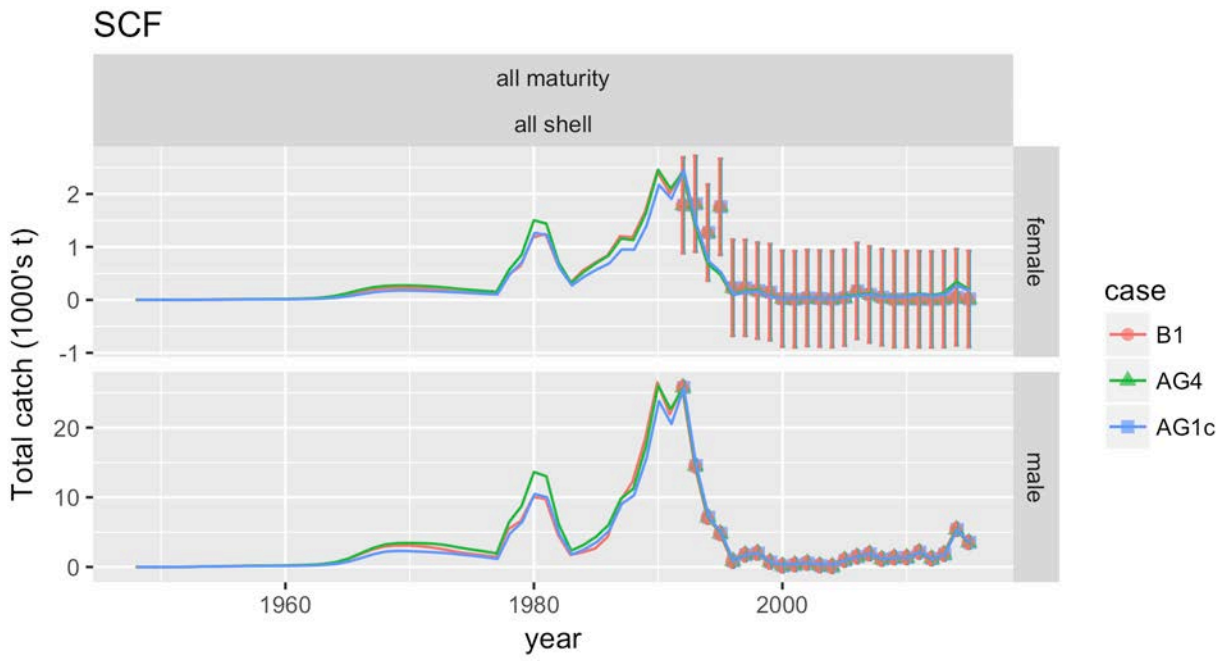


Figure 172. Comparison of observed and predicted total catch for SCF.

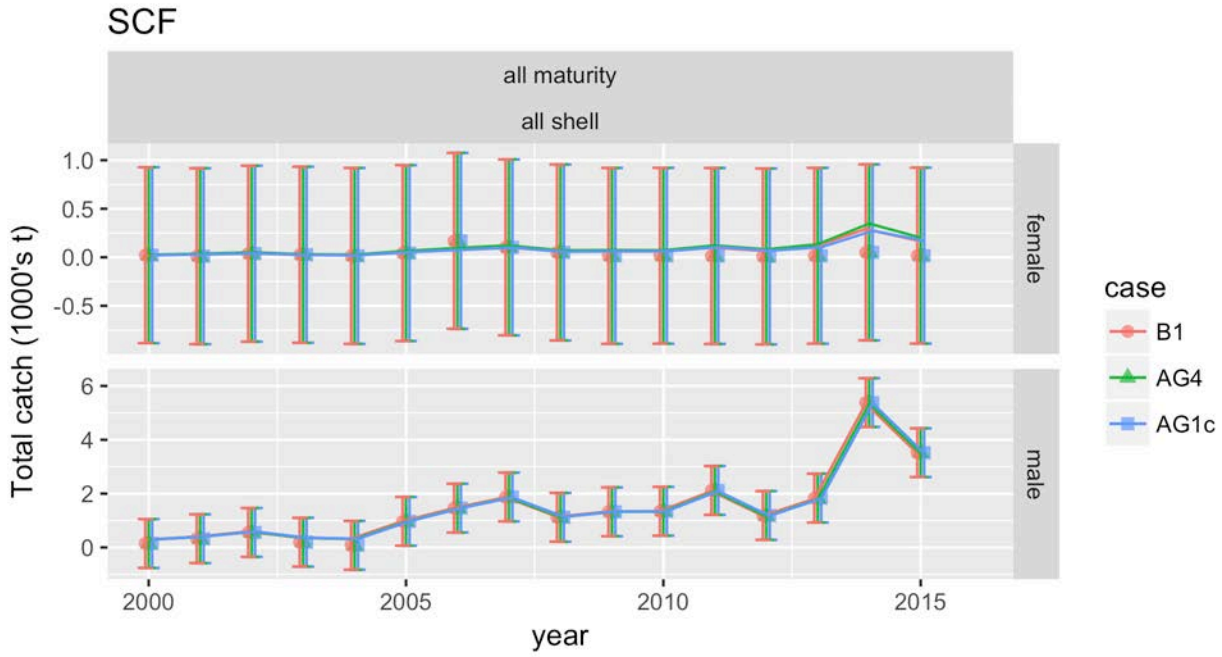


Figure 173. Comparison of observed and predicted total catch for SCF. Recent time period.

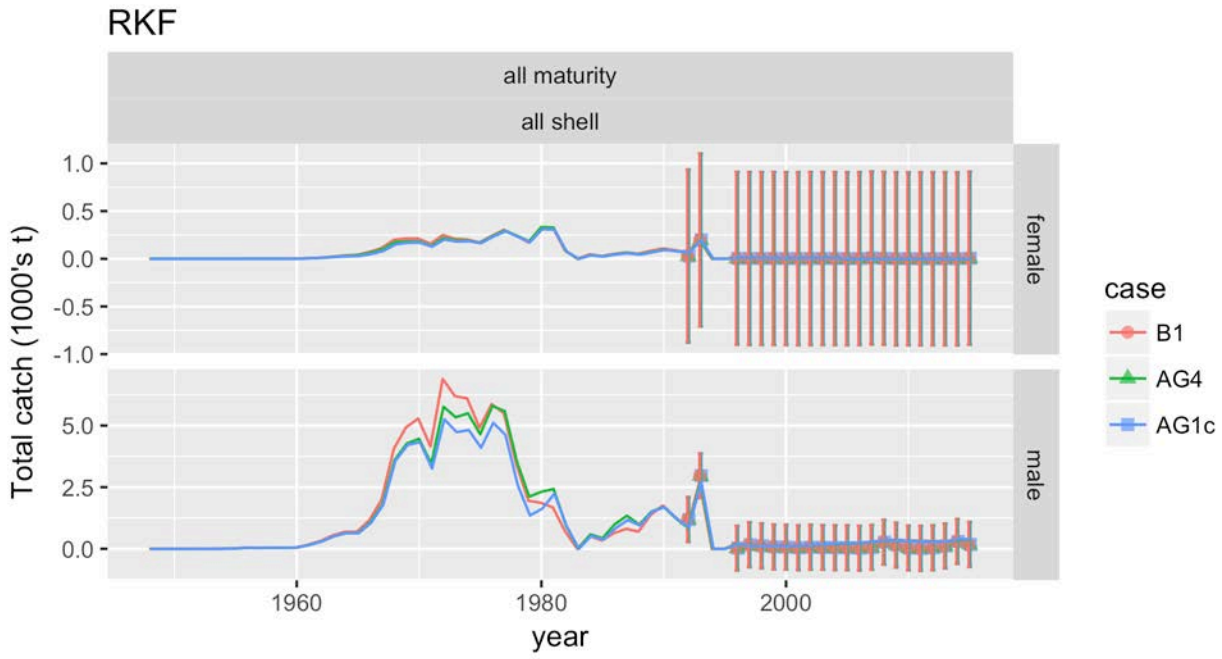


Figure 174. Comparison of observed and predicted total catch for RKF.

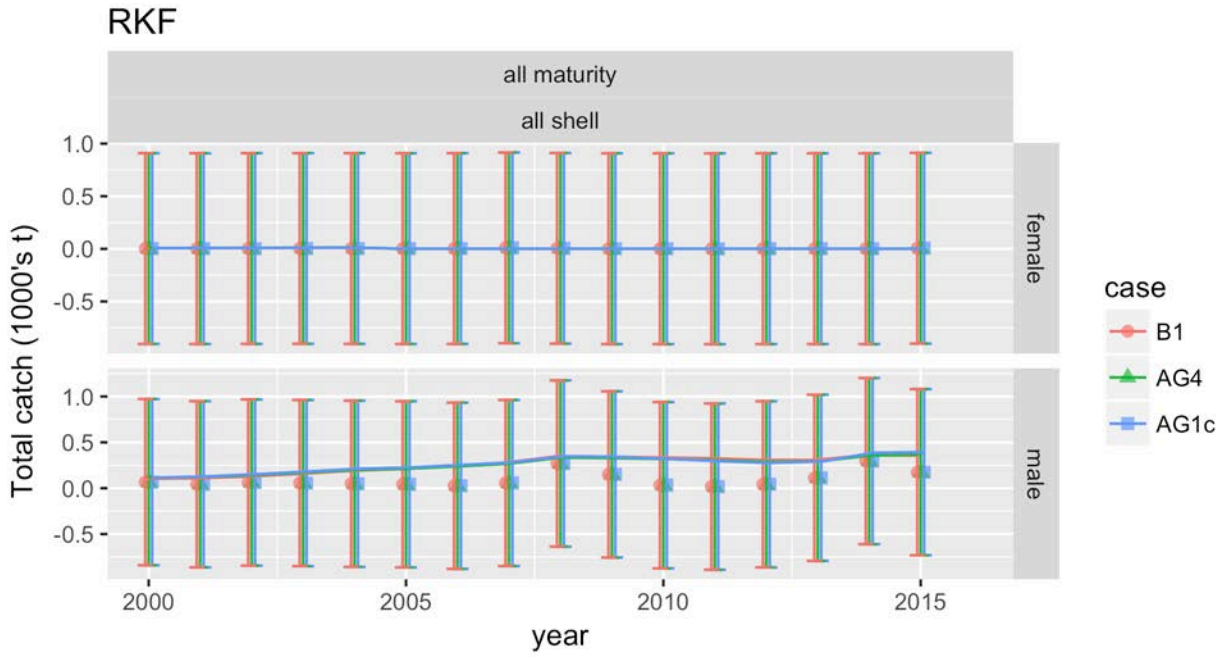


Figure 175. Comparison of observed and predicted total catch for RKF. Recent time period.

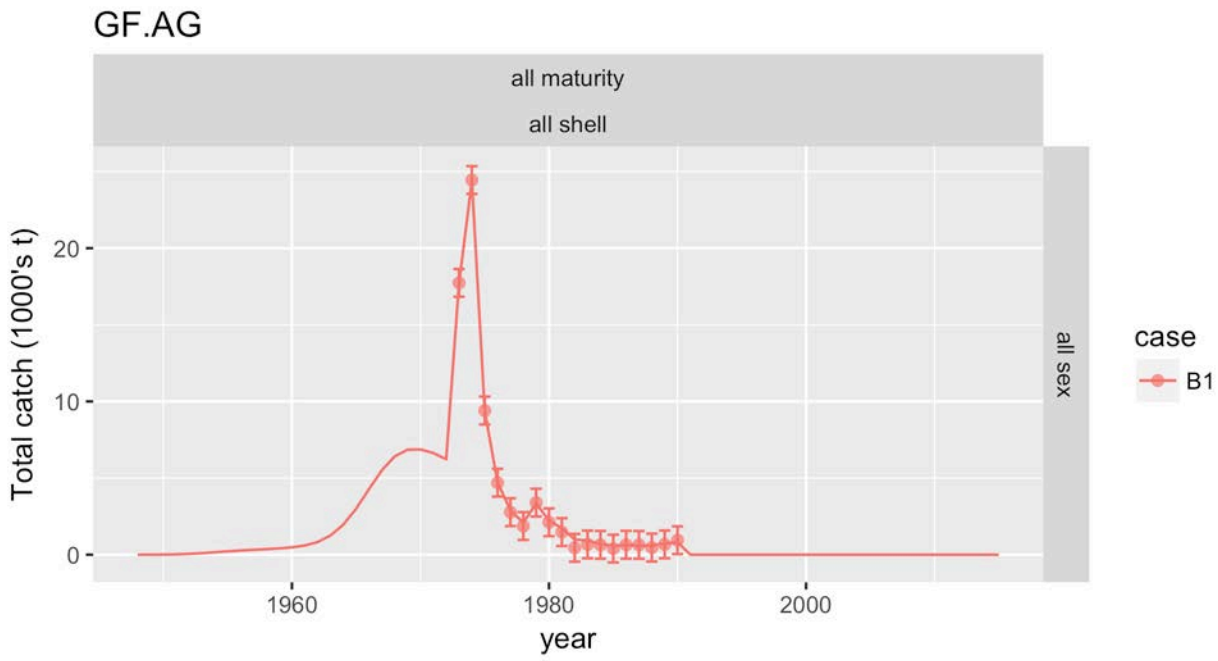


Figure 176. Comparison of observed and predicted total catch for GF.AG.

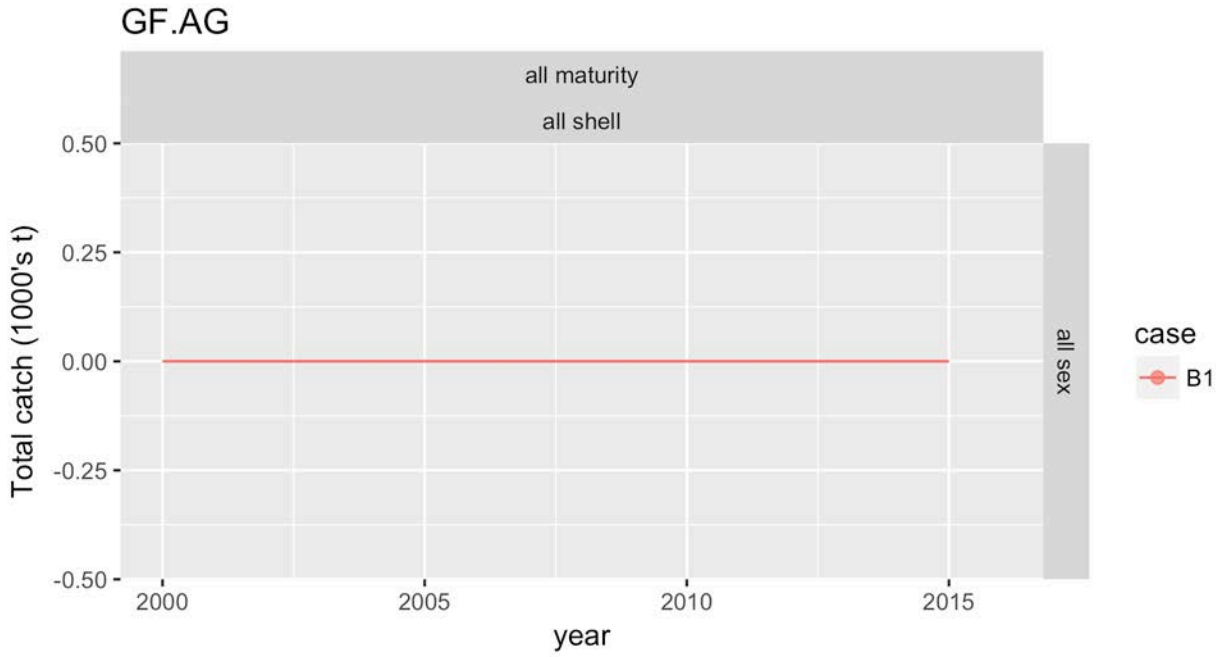


Figure 177. Comparison of observed and predicted total catch for GF.AG. Recent time period.

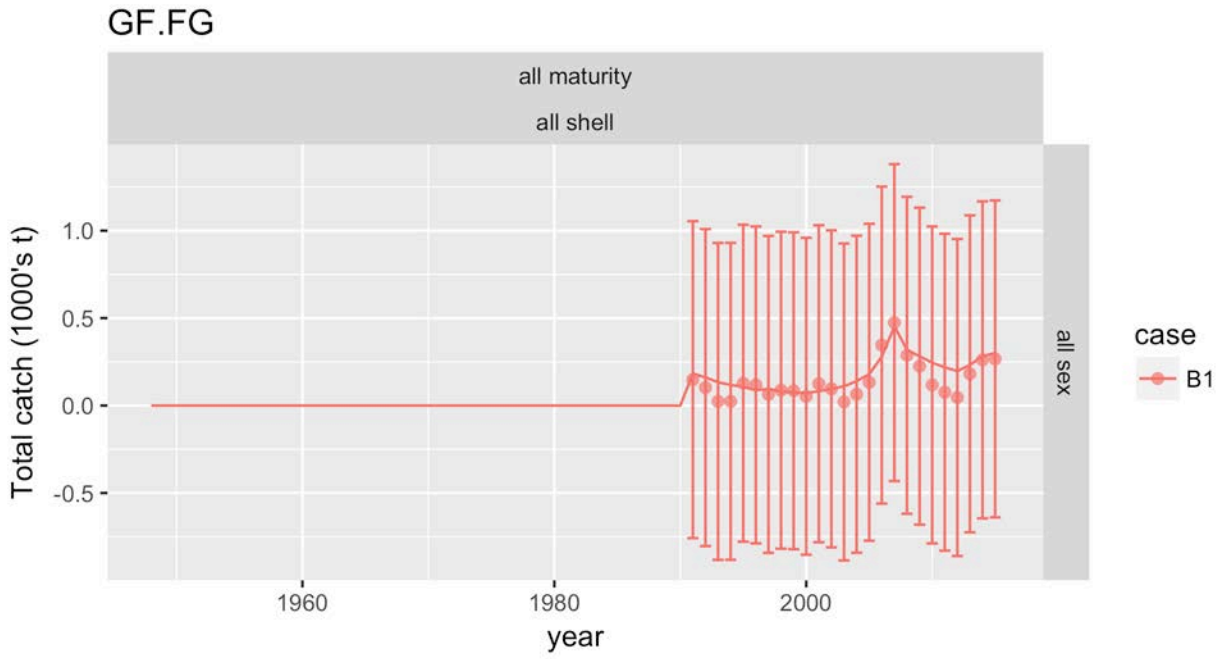


Figure 178. Comparison of observed and predicted total catch for GF.FG.

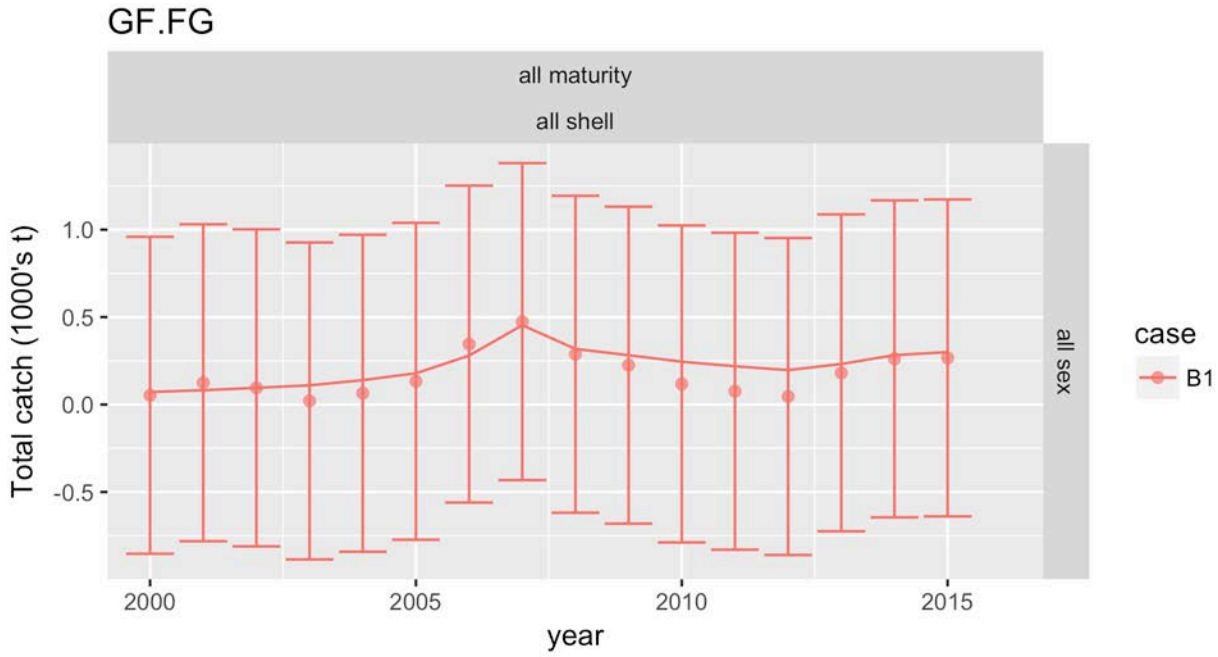


Figure 179. Comparison of observed and predicted total catch for GF.FG. Recent time period.

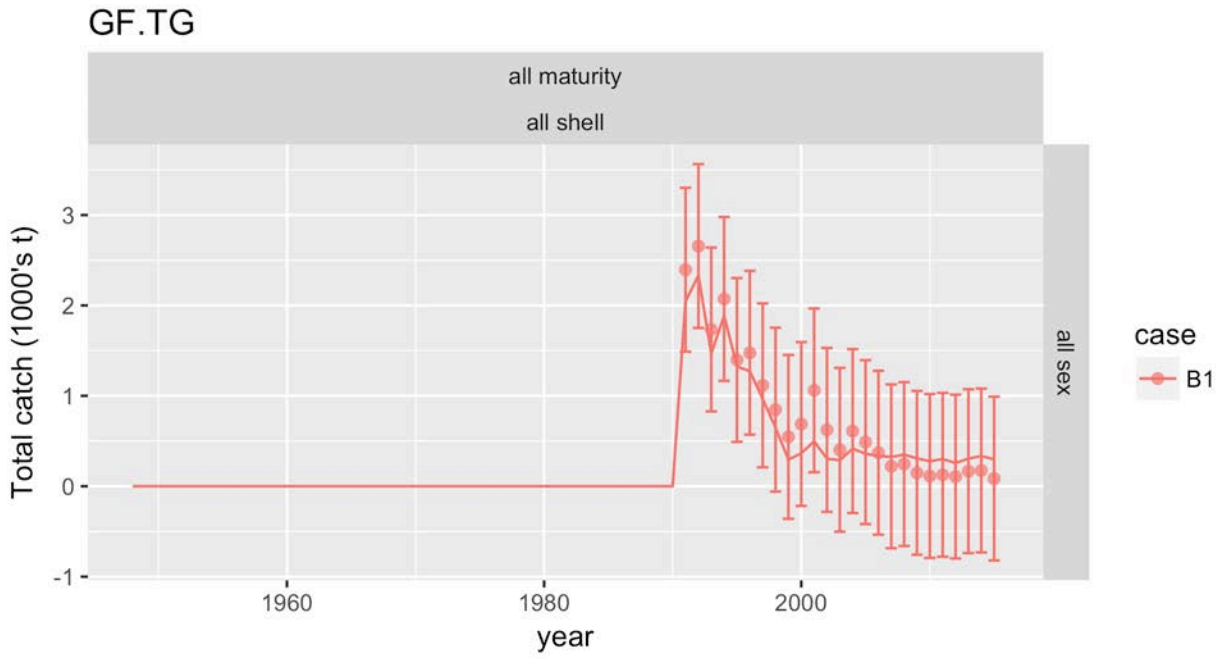


Figure 180. Comparison of observed and predicted total catch for GF.TG.

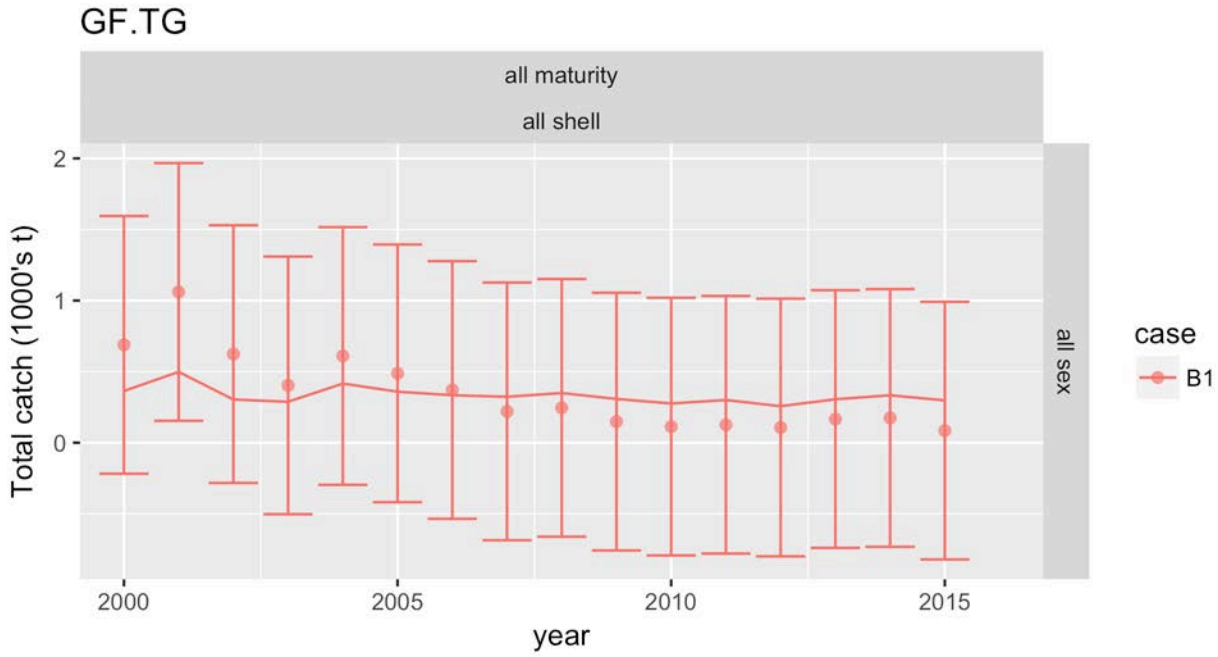


Figure 181. Comparison of observed and predicted total catch for GF.TG. Recent time period.

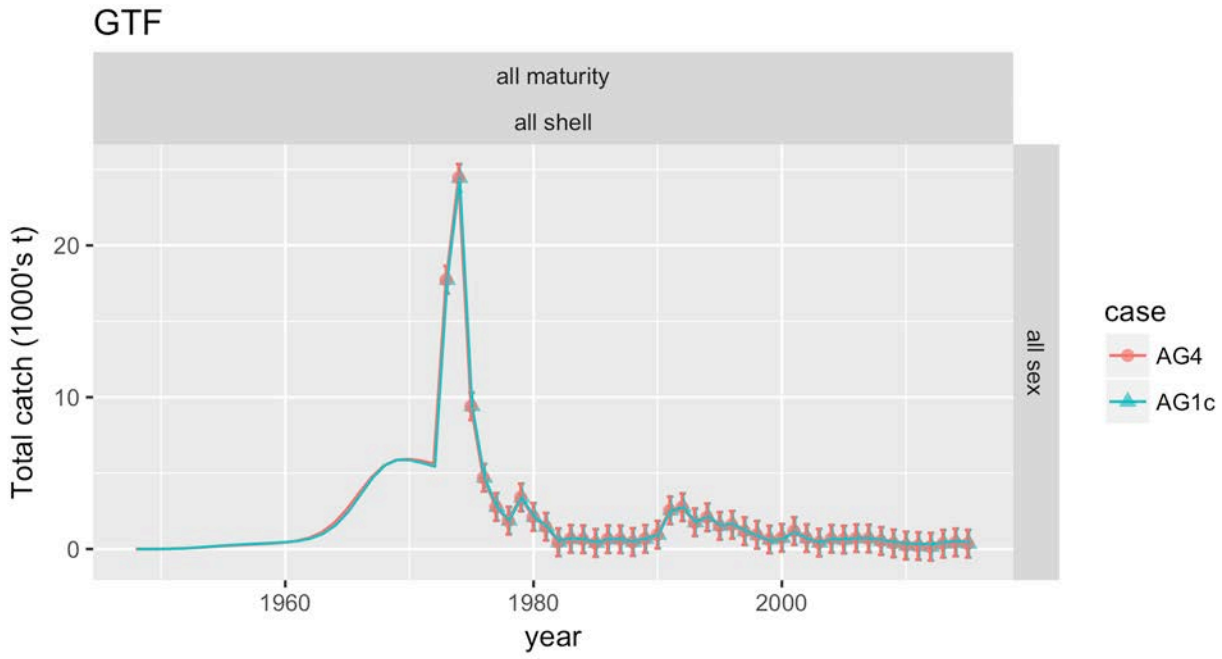


Figure 182. Comparison of observed and predicted total catch for GTF.

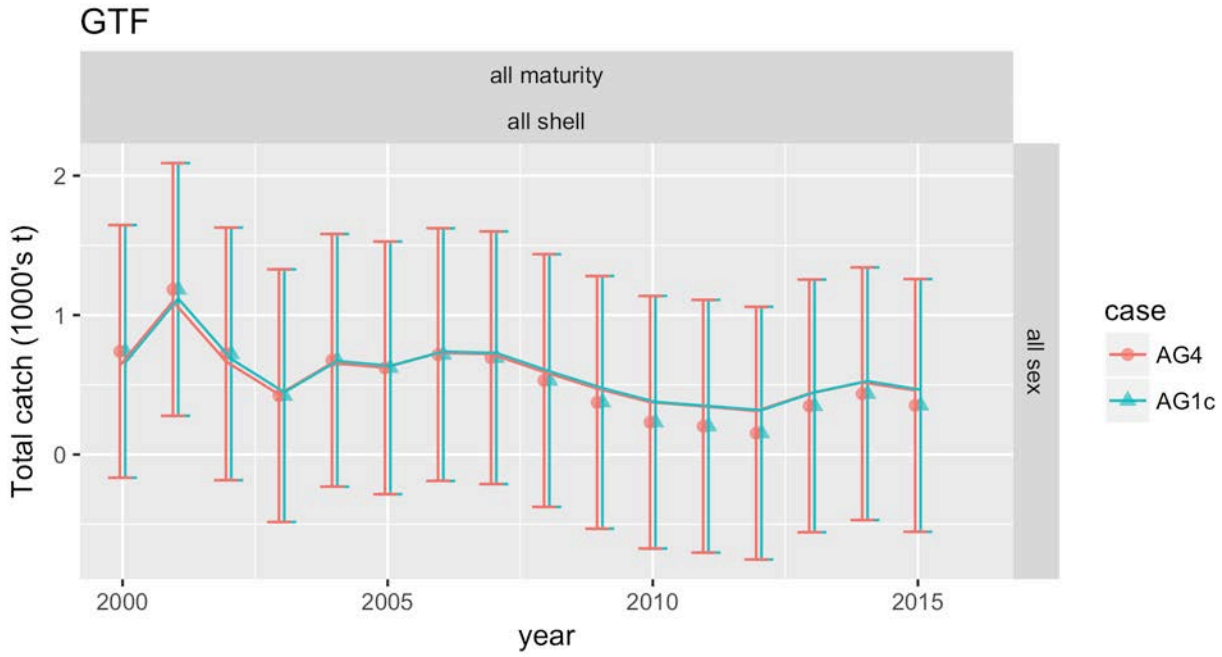


Figure 183. Comparison of observed and predicted total catch for GTF. Recent time period.

Total fishery mean size comps

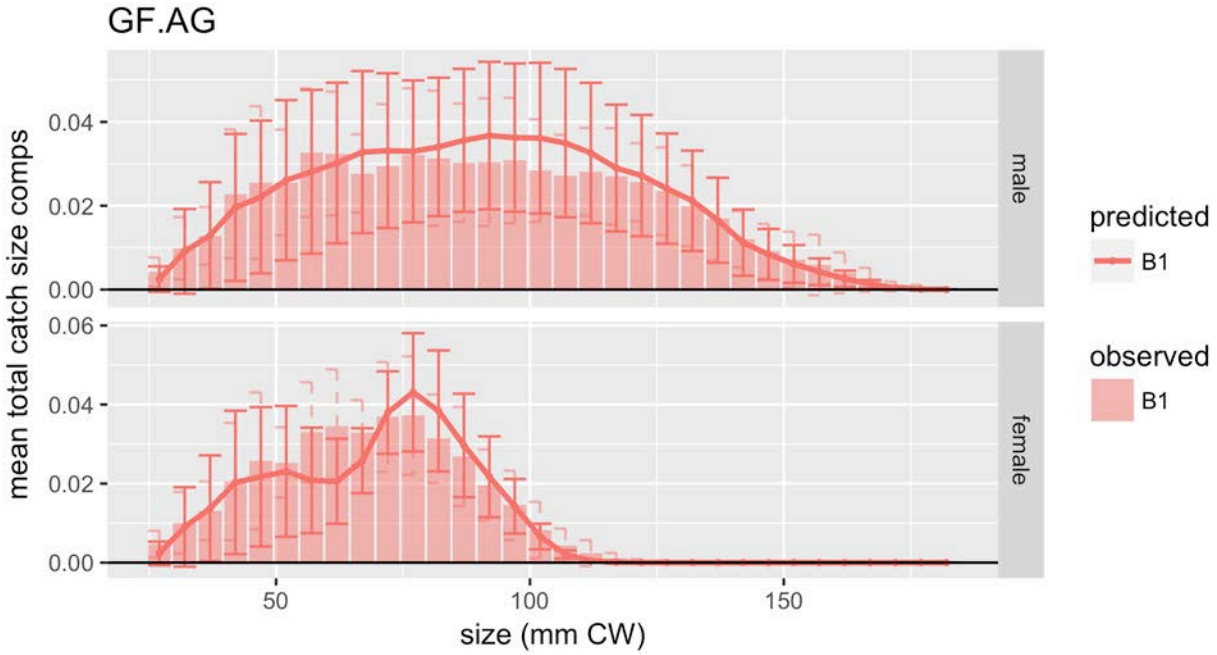


Figure 184. Comparison of observed and predicted &&xms mean total catch size comps for GF.AG.

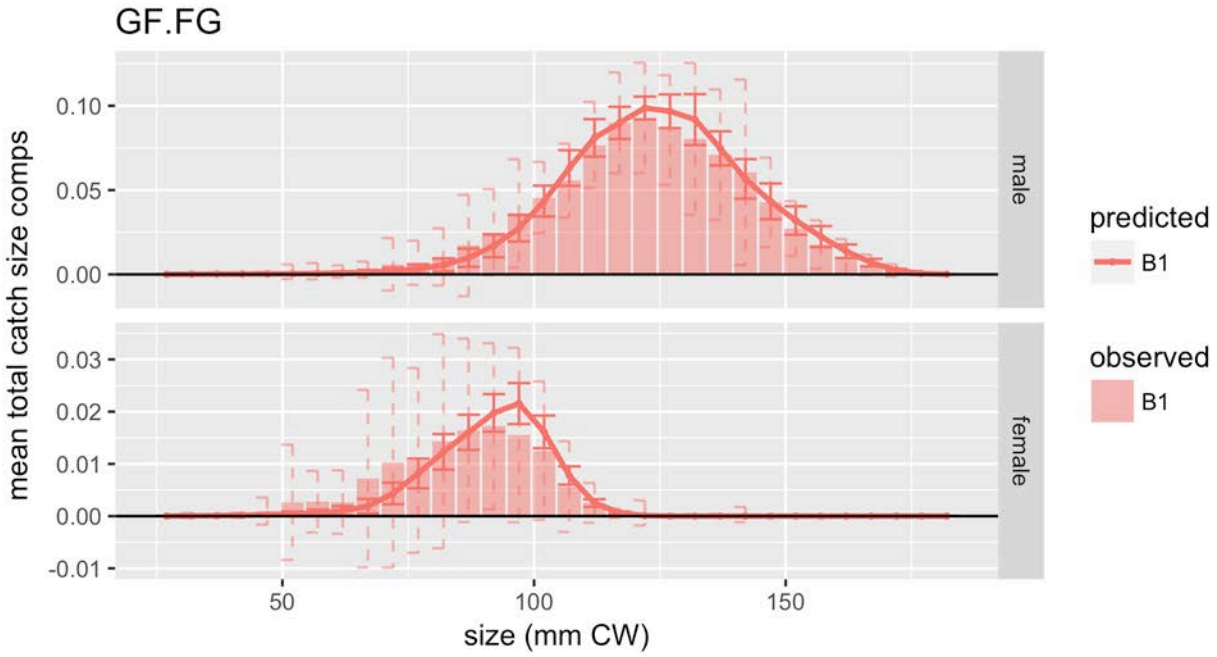


Figure 185. Comparison of observed and predicted &&xms mean total catch size comps for GF.FG.

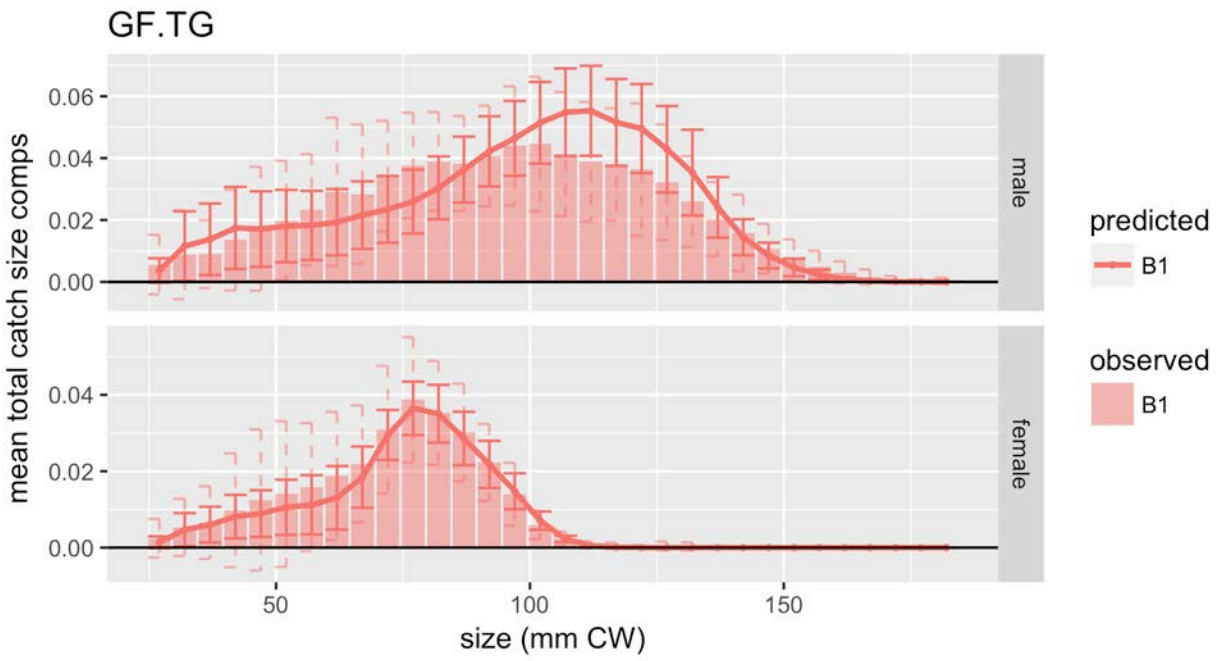


Figure 186. Comparison of observed and predicted &&xms mean total catch size comps for GF.TG.

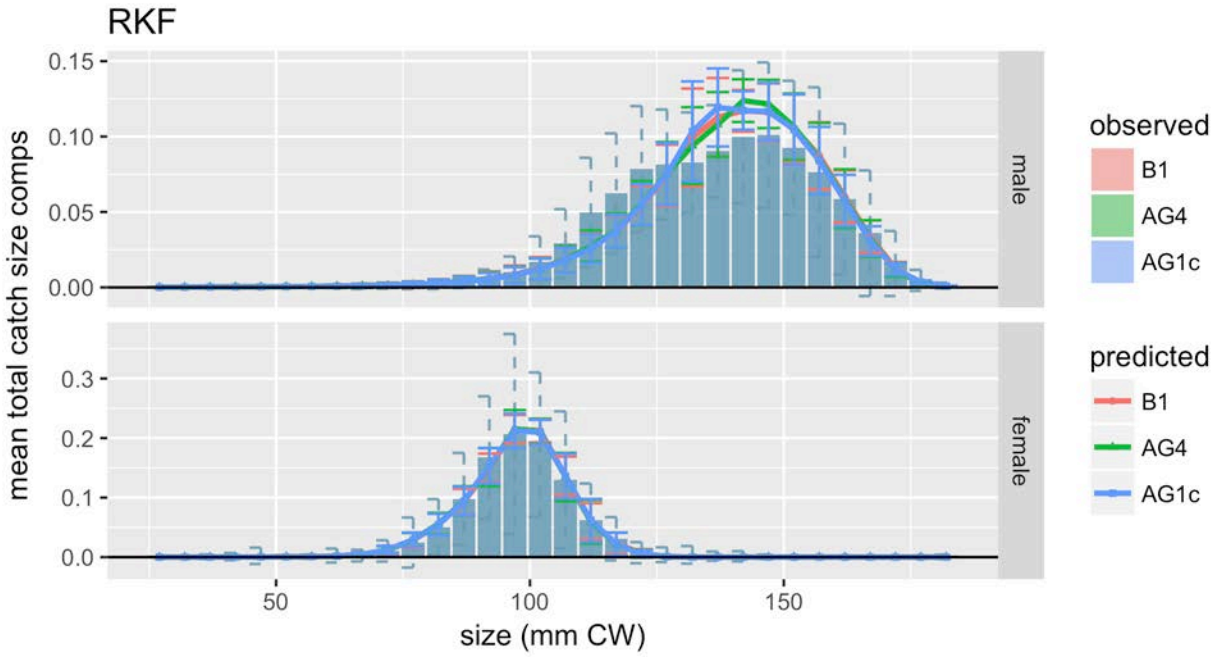


Figure 187. Comparison of observed and predicted &&xms mean total catch size comps for RKF.

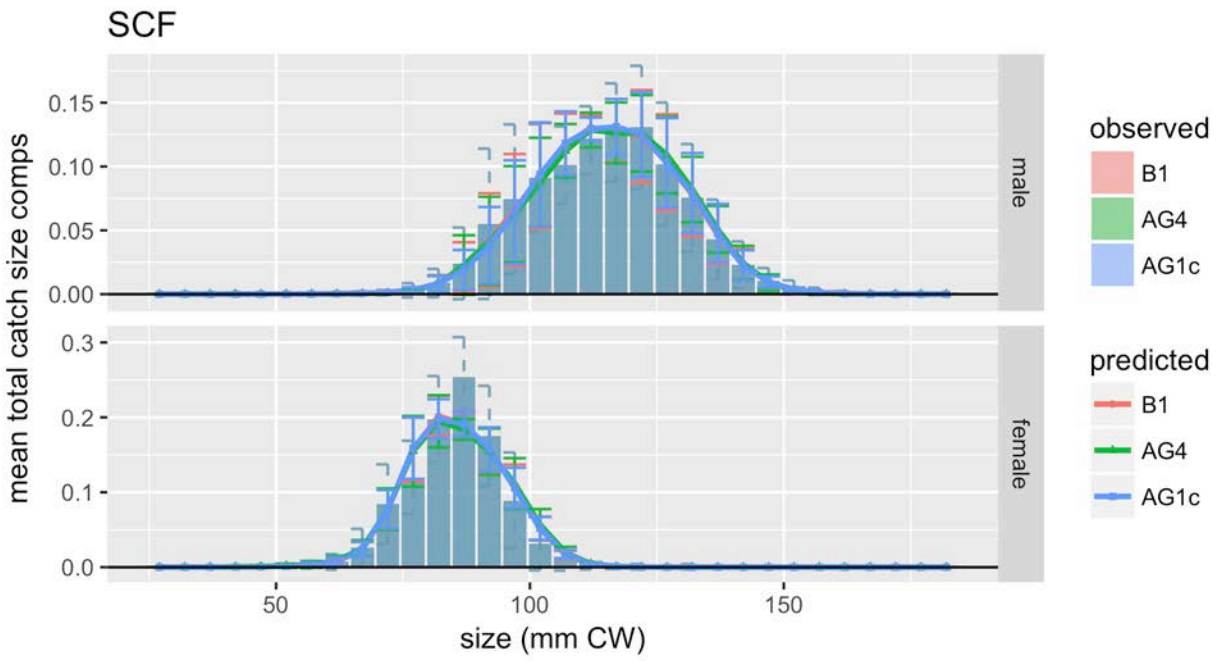


Figure 188. Comparison of observed and predicted &&xms mean total catch size comps for SCF.

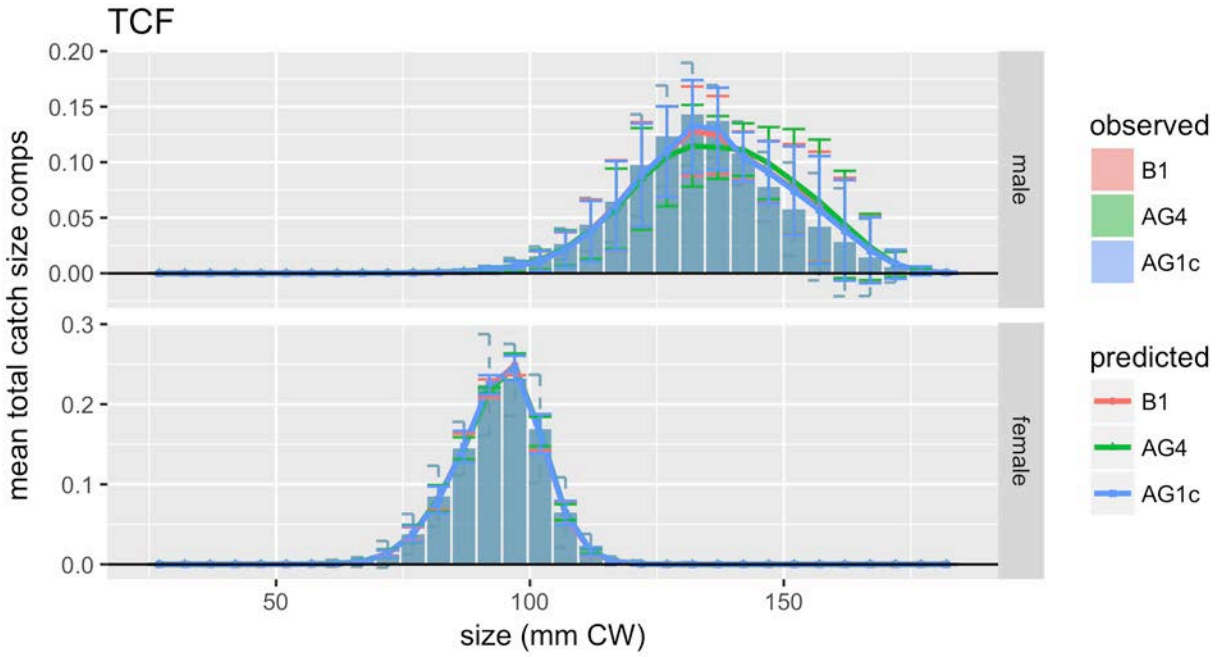


Figure 189. Comparison of observed and predicted &&xms mean total catch size comps for TCF.

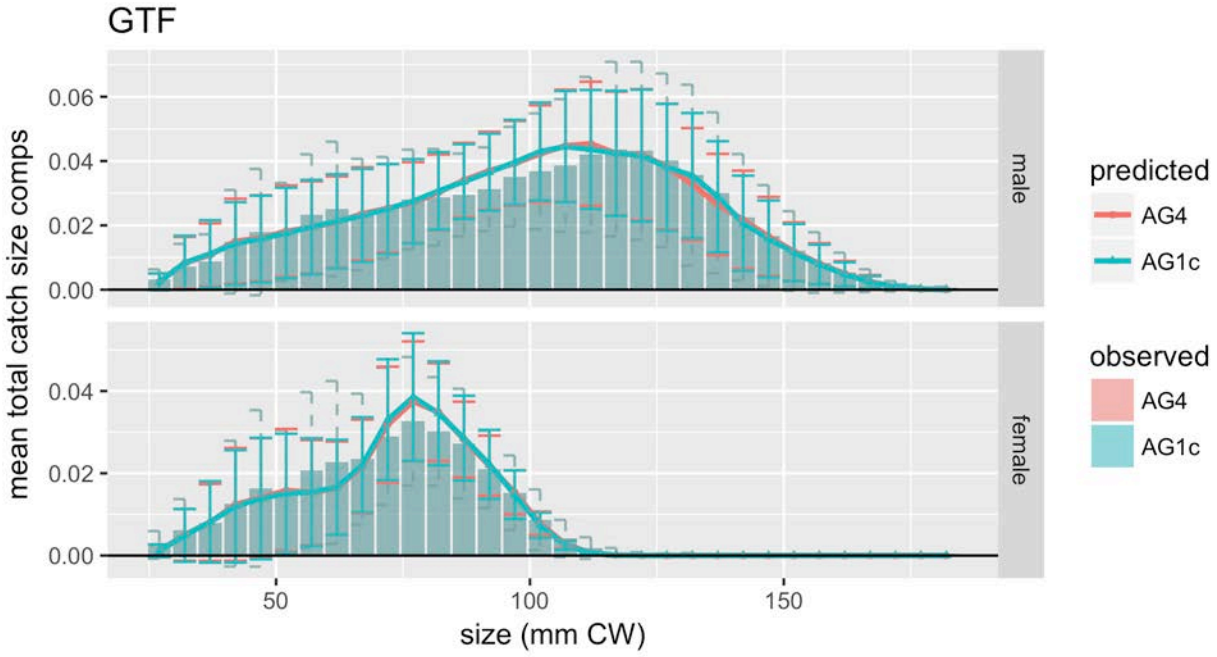


Figure 190. Comparison of observed and predicted &&xms mean total catch size comps for GTF.

Total fishery catch size comps

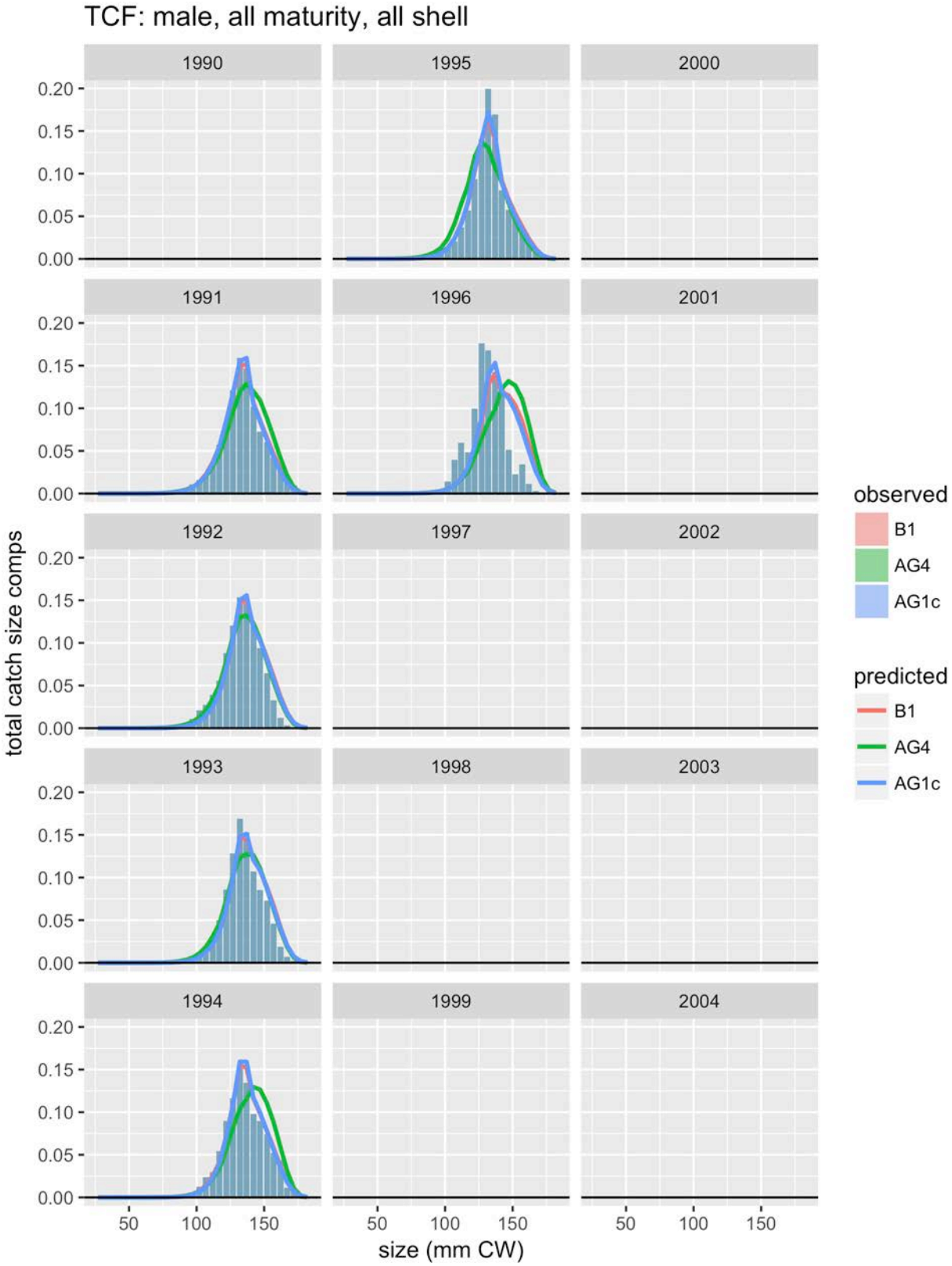


Figure 191. Comparison of observed and predicted male, all maturity, all shell total catch size comps for TCF. Page 1 of 2.

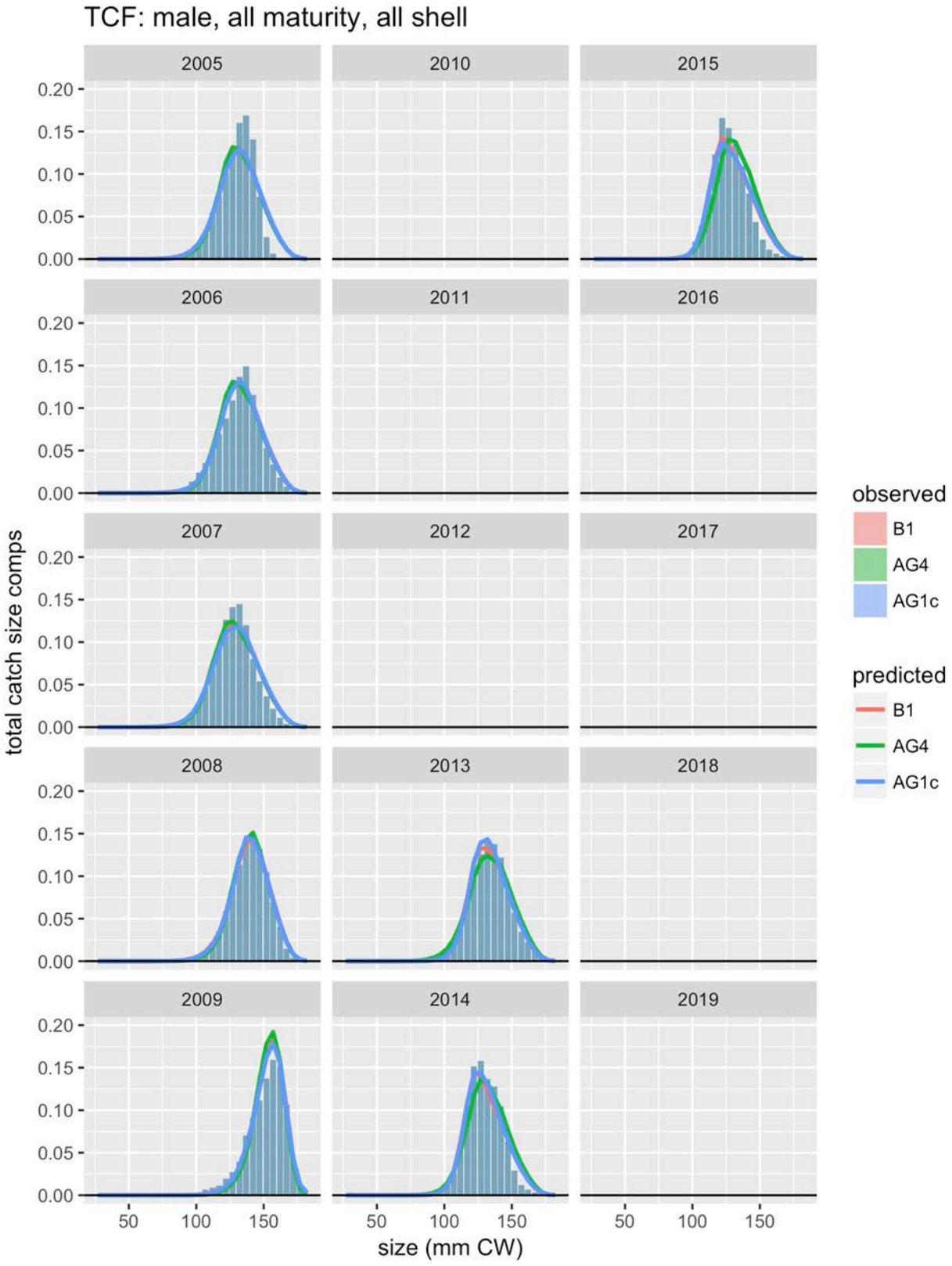


Figure 192. Comparison of observed and predicted male, all maturity, all shell total catch size comps for TCF. Page 2 of 2.

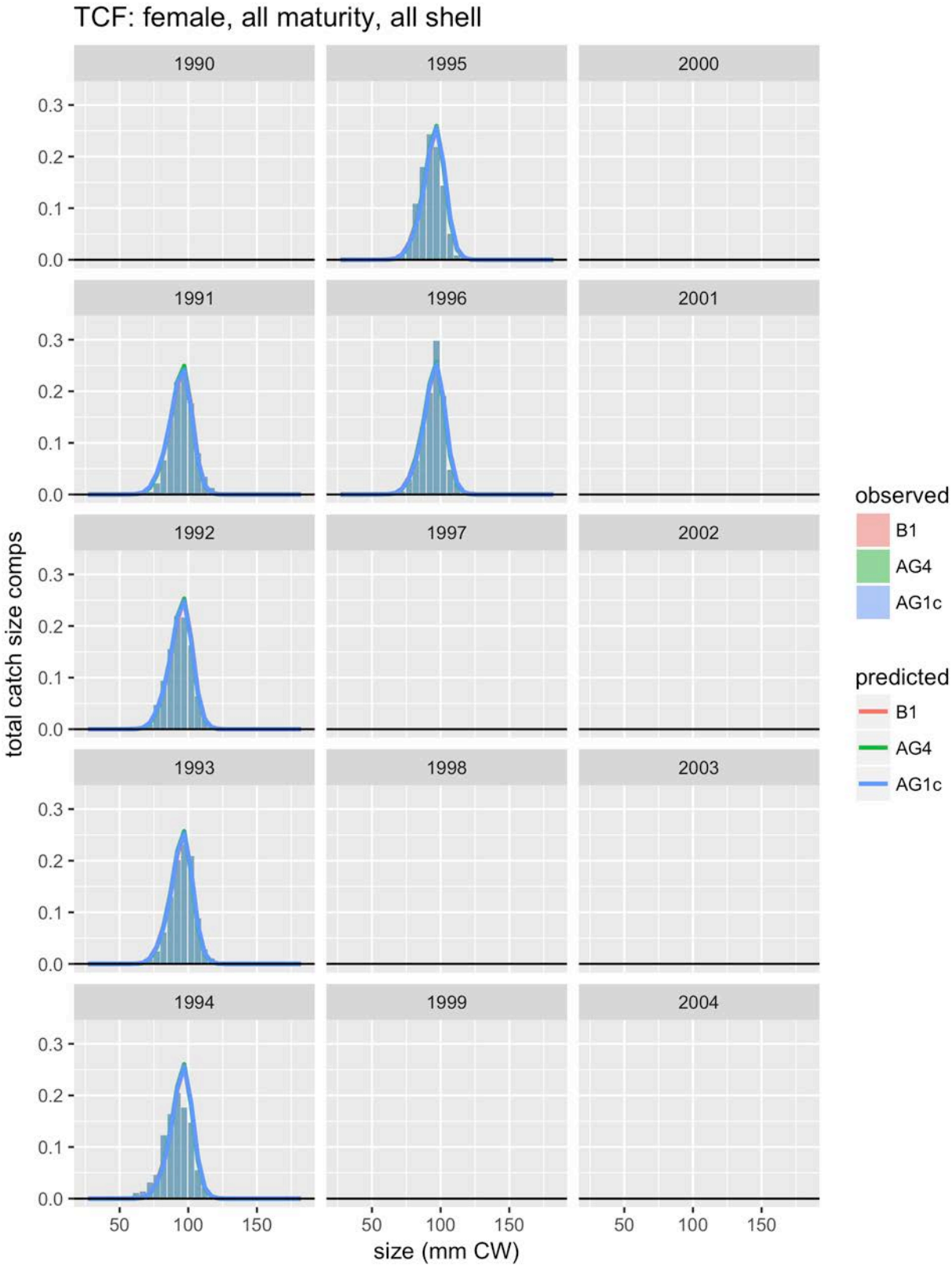


Figure 193. Comparison of observed and predicted female, all maturity, all shell total catch size comps for TCF. Page 1 of 2.

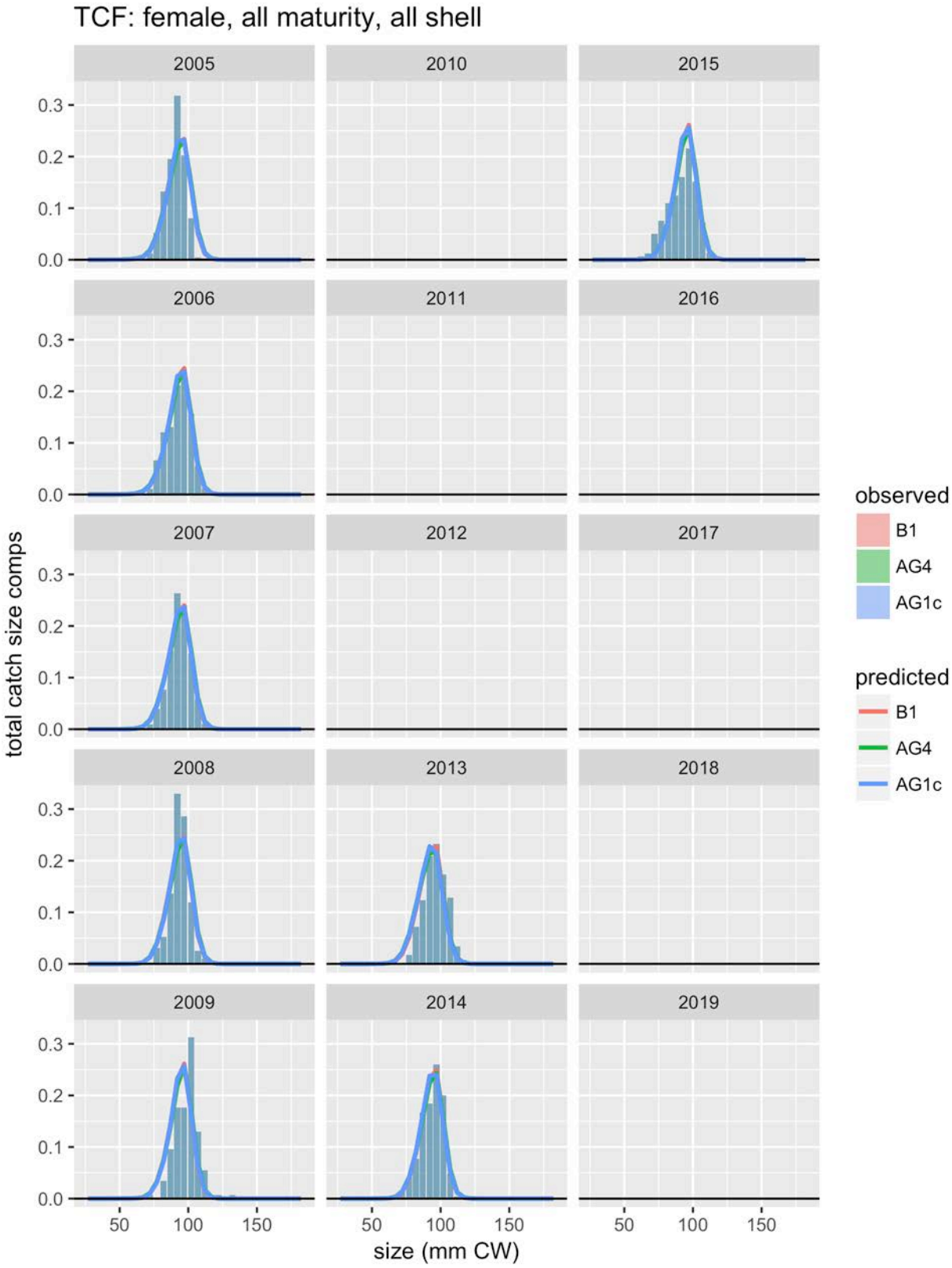


Figure 194. Comparison of observed and predicted female, all maturity, all shell total catch size comps for TCF. Page 2 of 2.

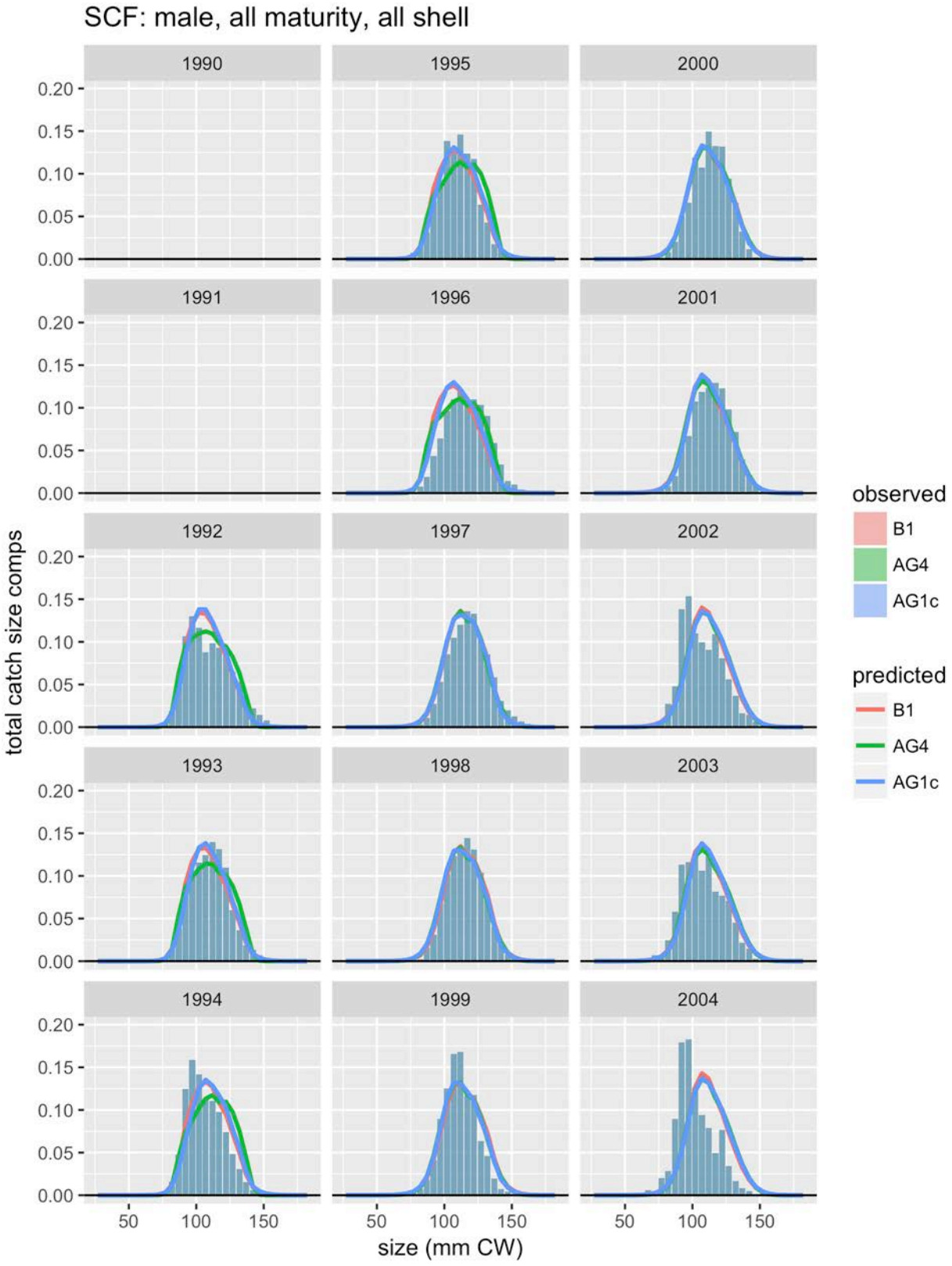


Figure 195. Comparison of observed and predicted male, all maturity, all shell total catch size comps for SCF. Page 1 of 2.

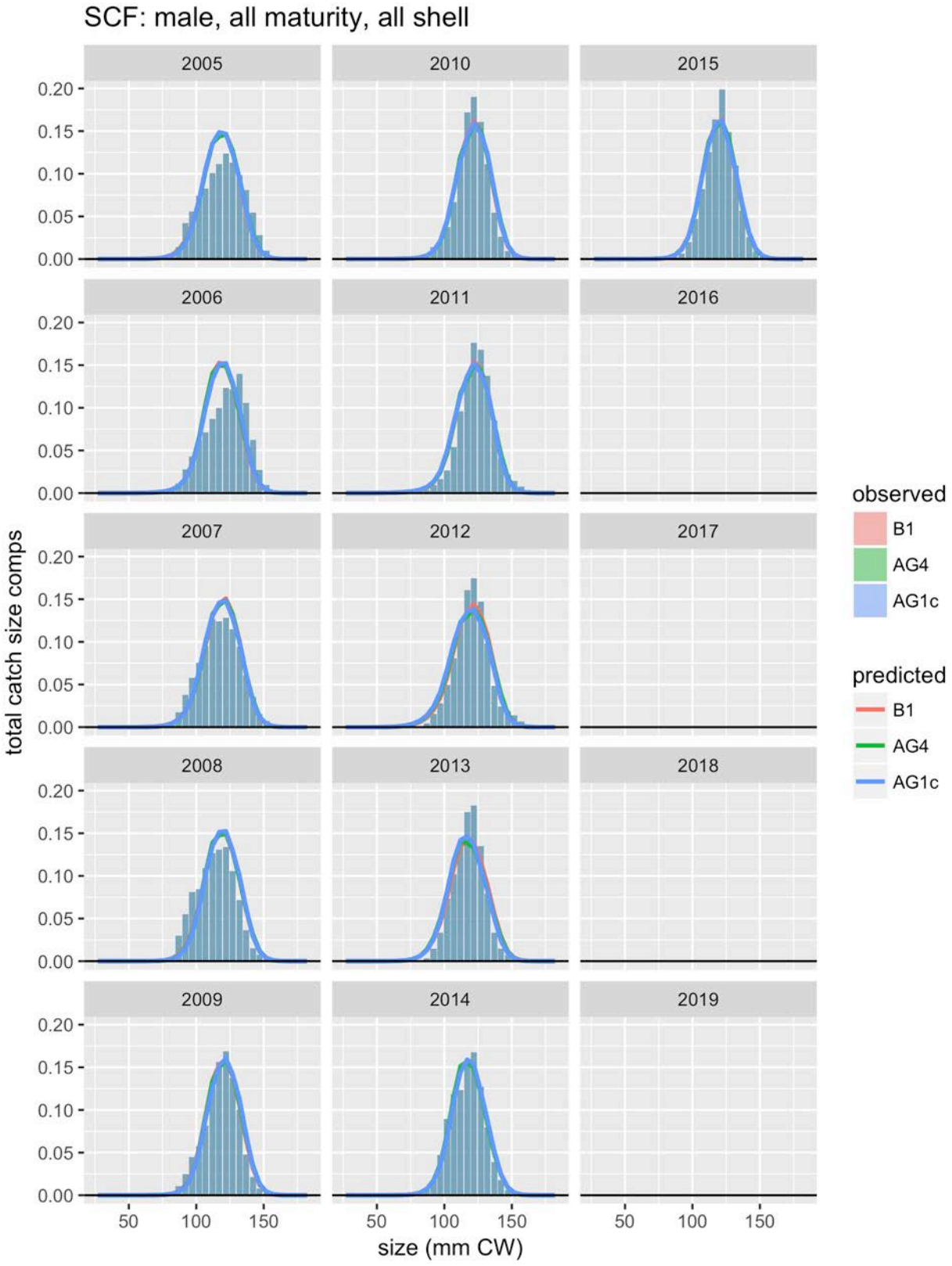


Figure 196. Comparison of observed and predicted male, all maturity, all shell total catch size comps for SCF. Page 2 of 2.

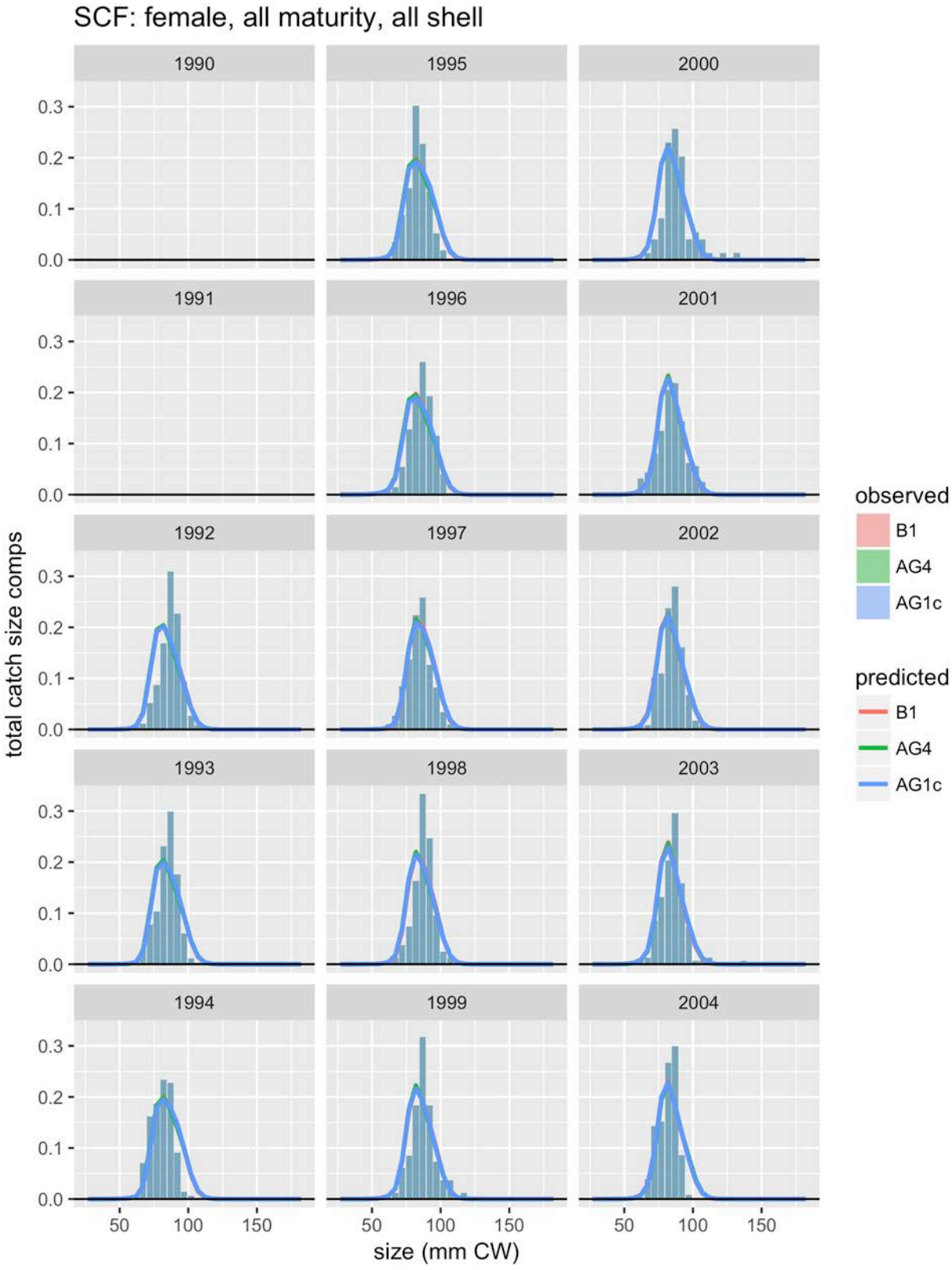


Figure 197. Comparison of observed and predicted female, all maturity, all shell total catch size comps for SCF. Page 1 of 2.

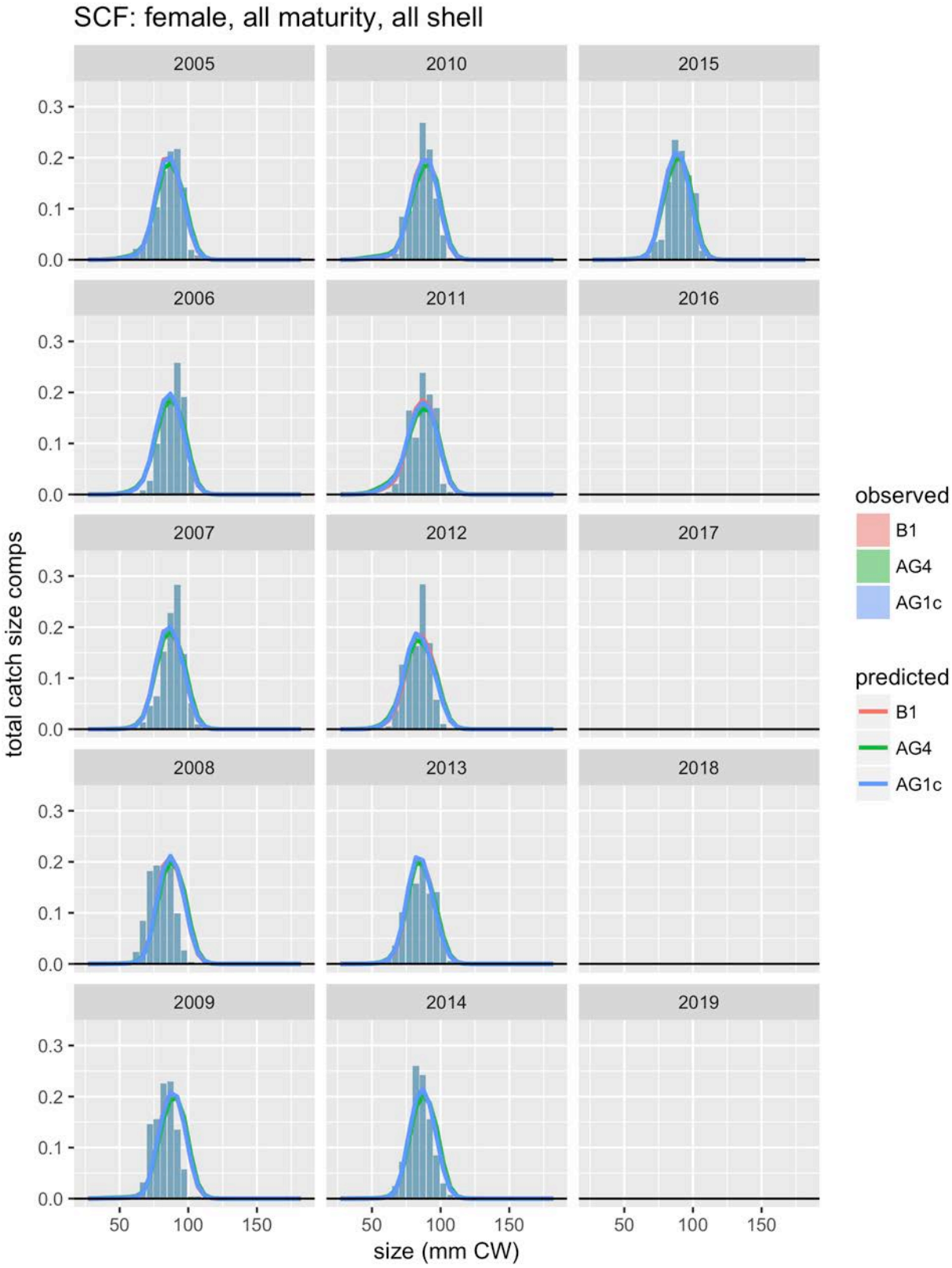


Figure 198. Comparison of observed and predicted female, all maturity, all shell total catch size comps for SCF. Page 2 of 2.

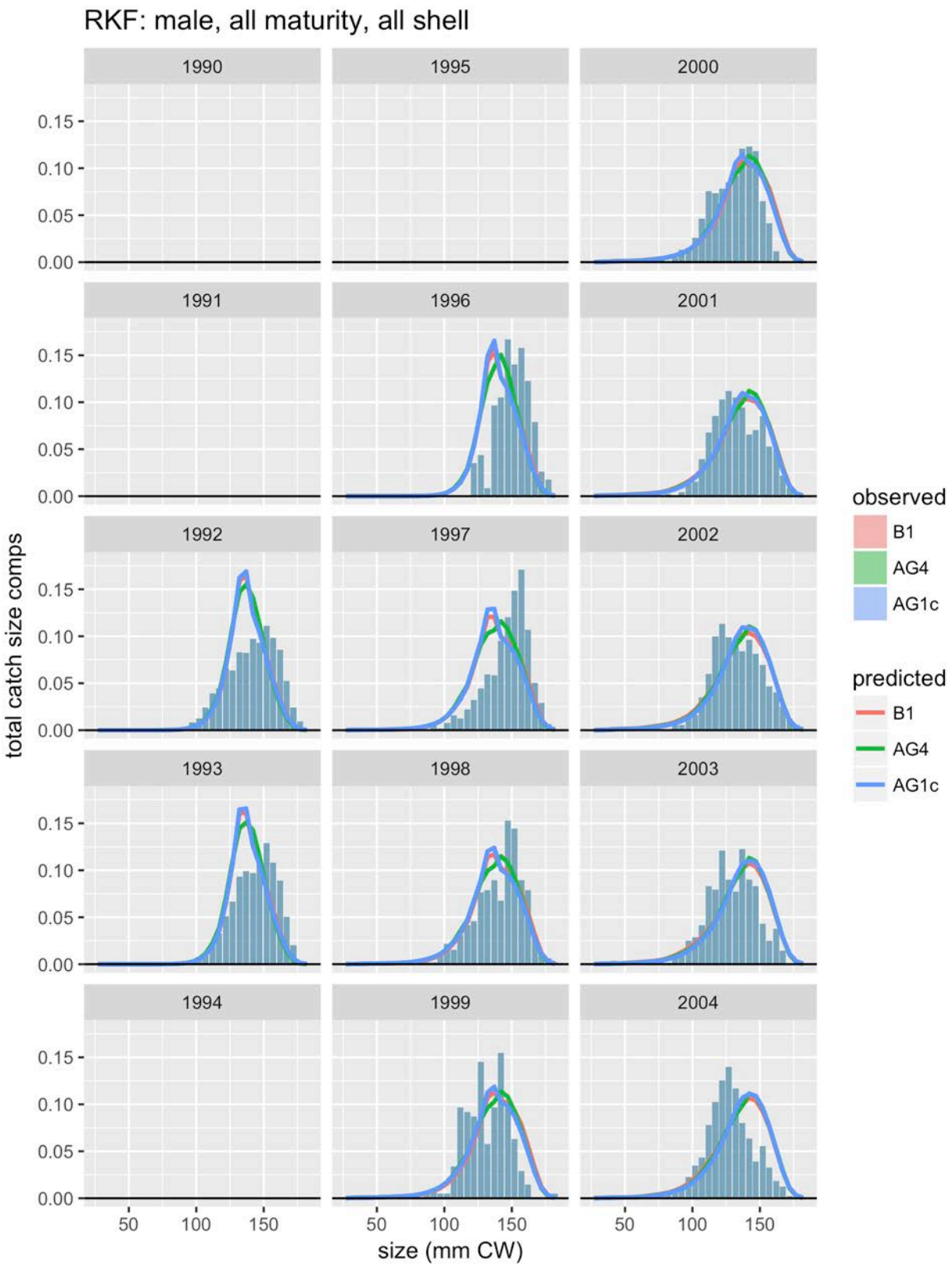


Figure 199. Comparison of observed and predicted male, all maturity, all shell total catch size comps for RKF. Page 1 of 2.

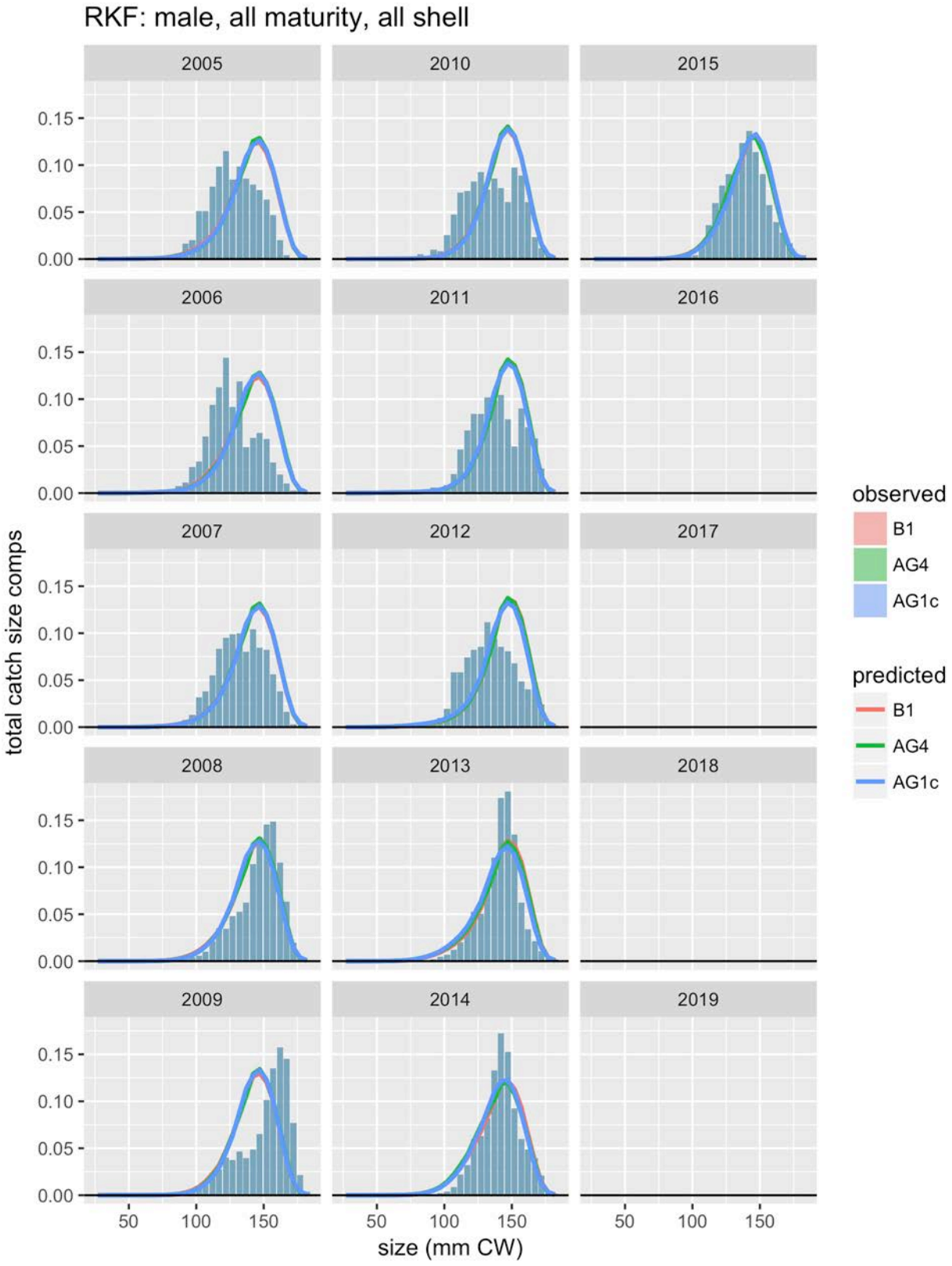


Figure 200. Comparison of observed and predicted male, all maturity, all shell total catch size comps for RKF. Page 2 of 2.

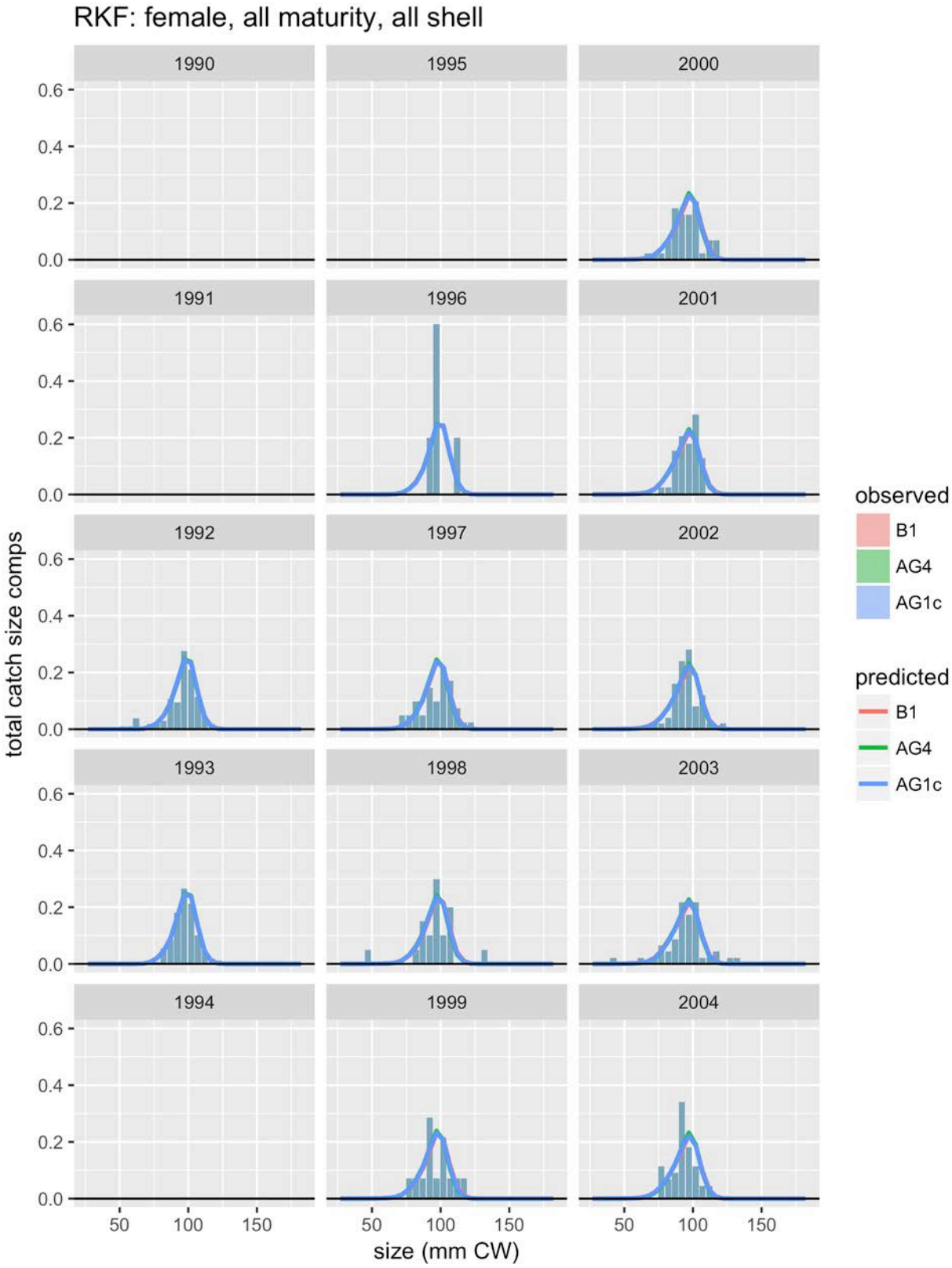


Figure 201. Comparison of observed and predicted female, all maturity, all shell total catch size comps for RKF. Page 1 of 2.

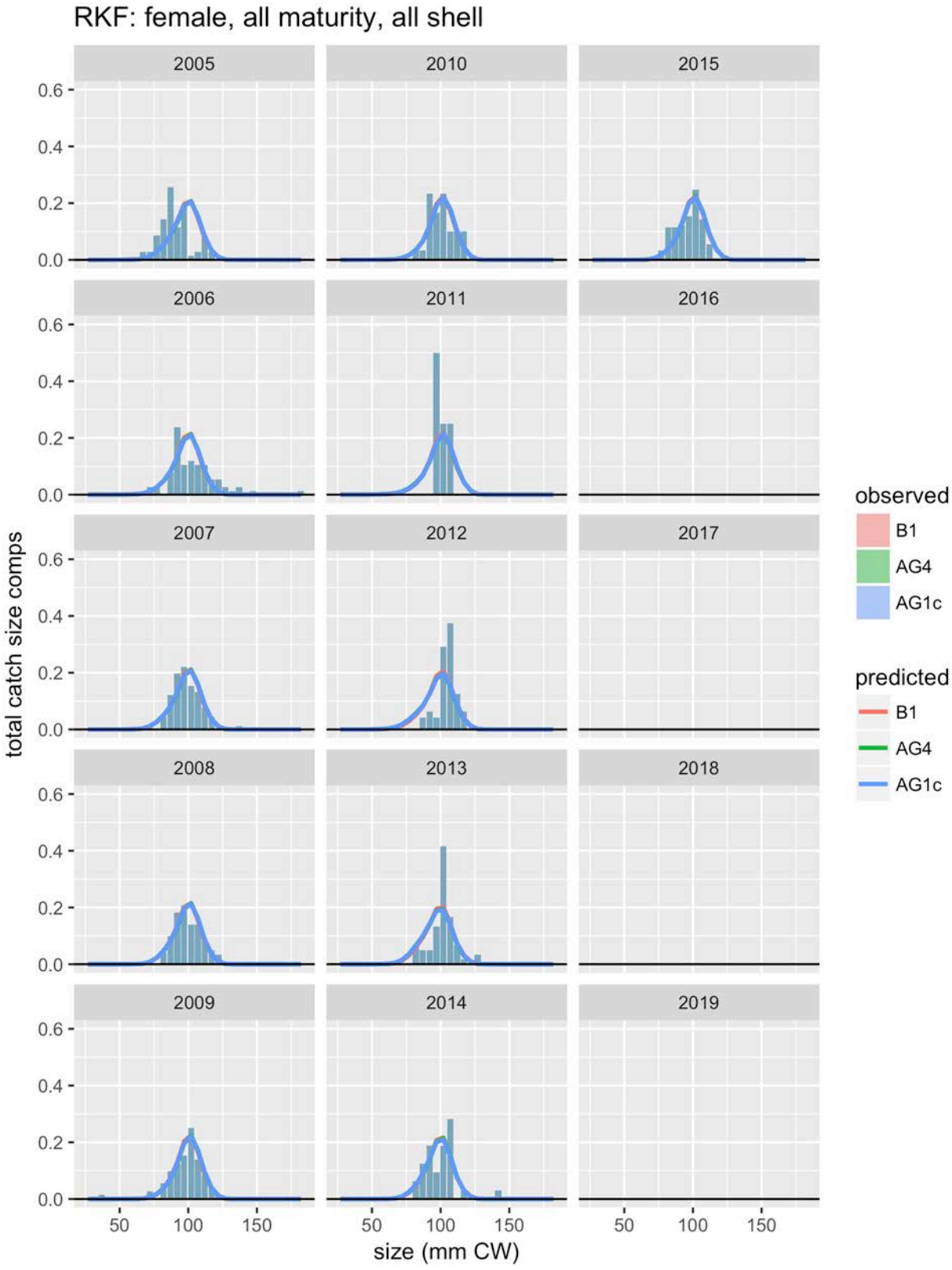


Figure 202. Comparison of observed and predicted female, all maturity, all shell total catch size comps for RKF. Page 2 of 2.

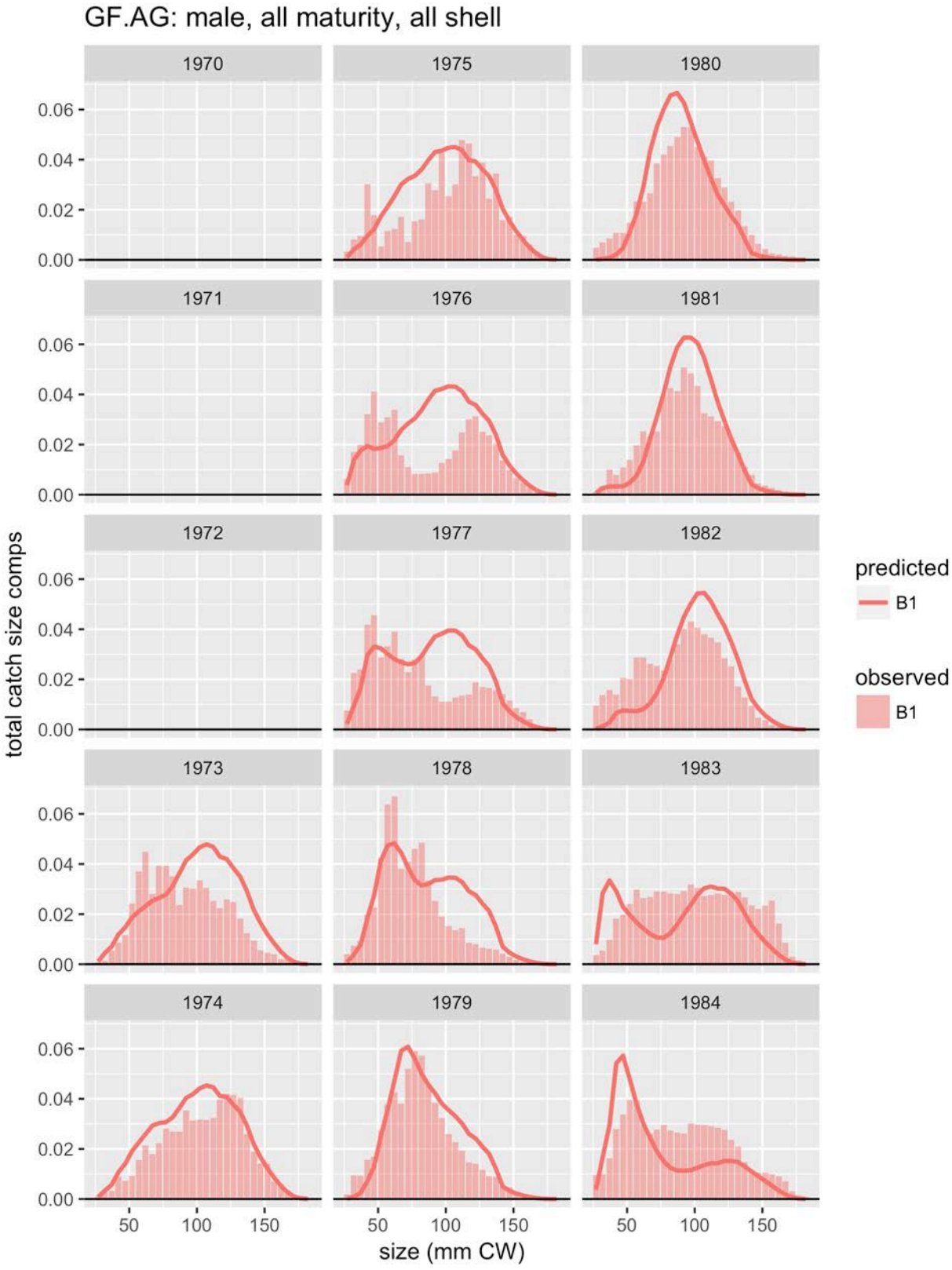


Figure 203. Comparison of observed and predicted male, all maturity, all shell total catch size comps for GF.AG. Page 1 of 2.

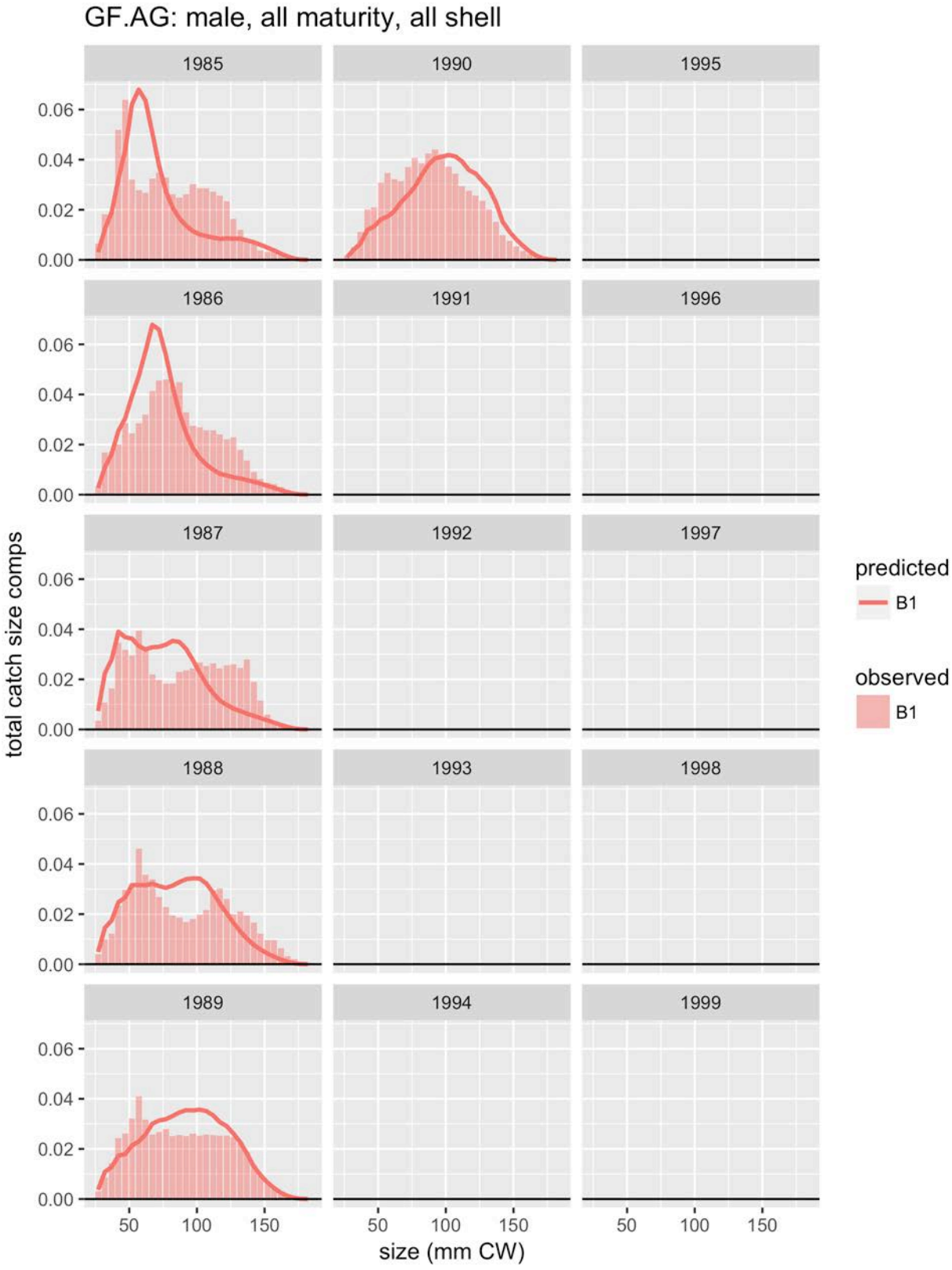


Figure 204. Comparison of observed and predicted male, all maturity, all shell total catch size comps for GF.AG. Page 2 of 2.

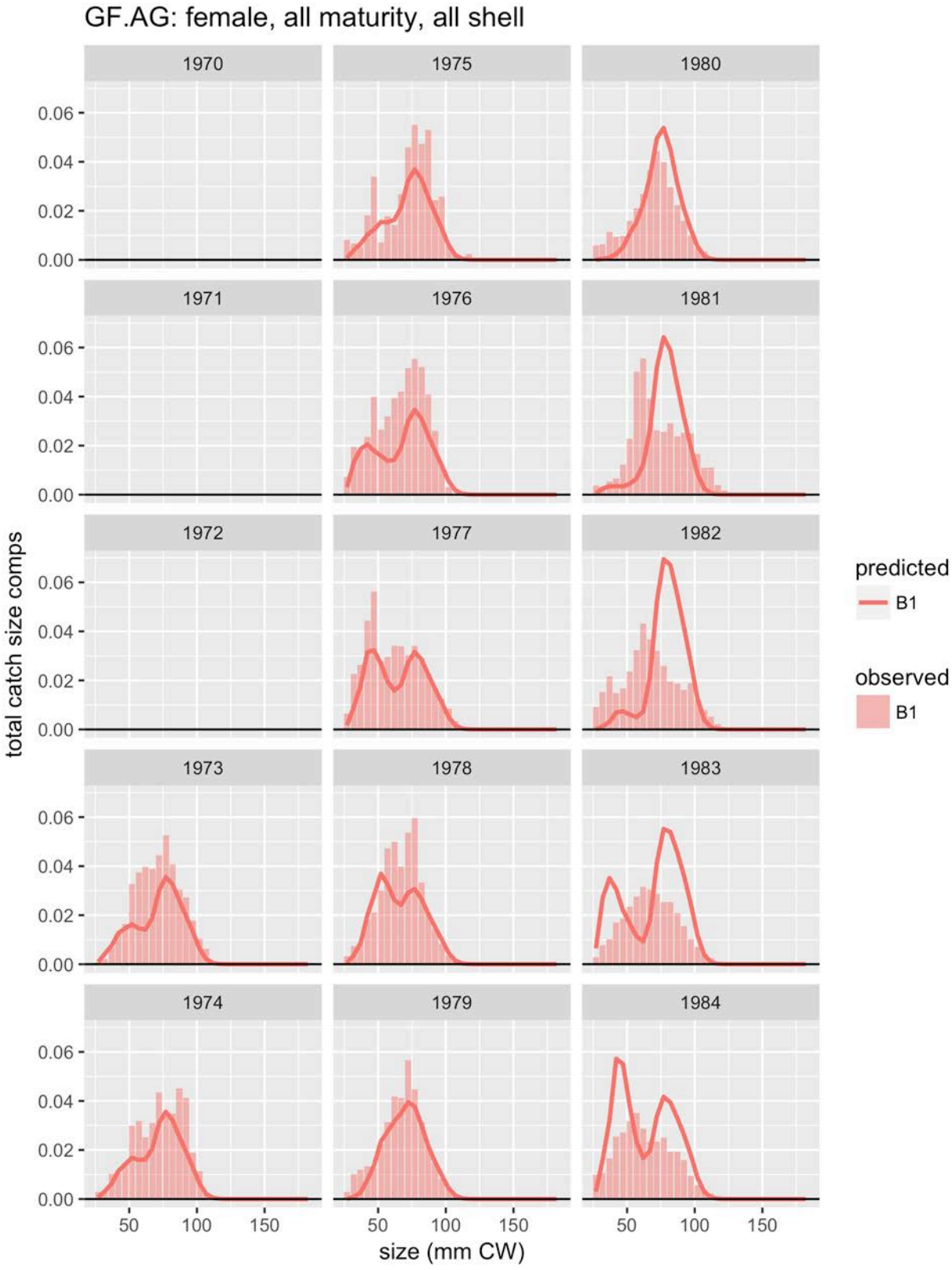


Figure 205. Comparison of observed and predicted female, all maturity, all shell total catch size comps for GF.AG. Page 1 of 2.

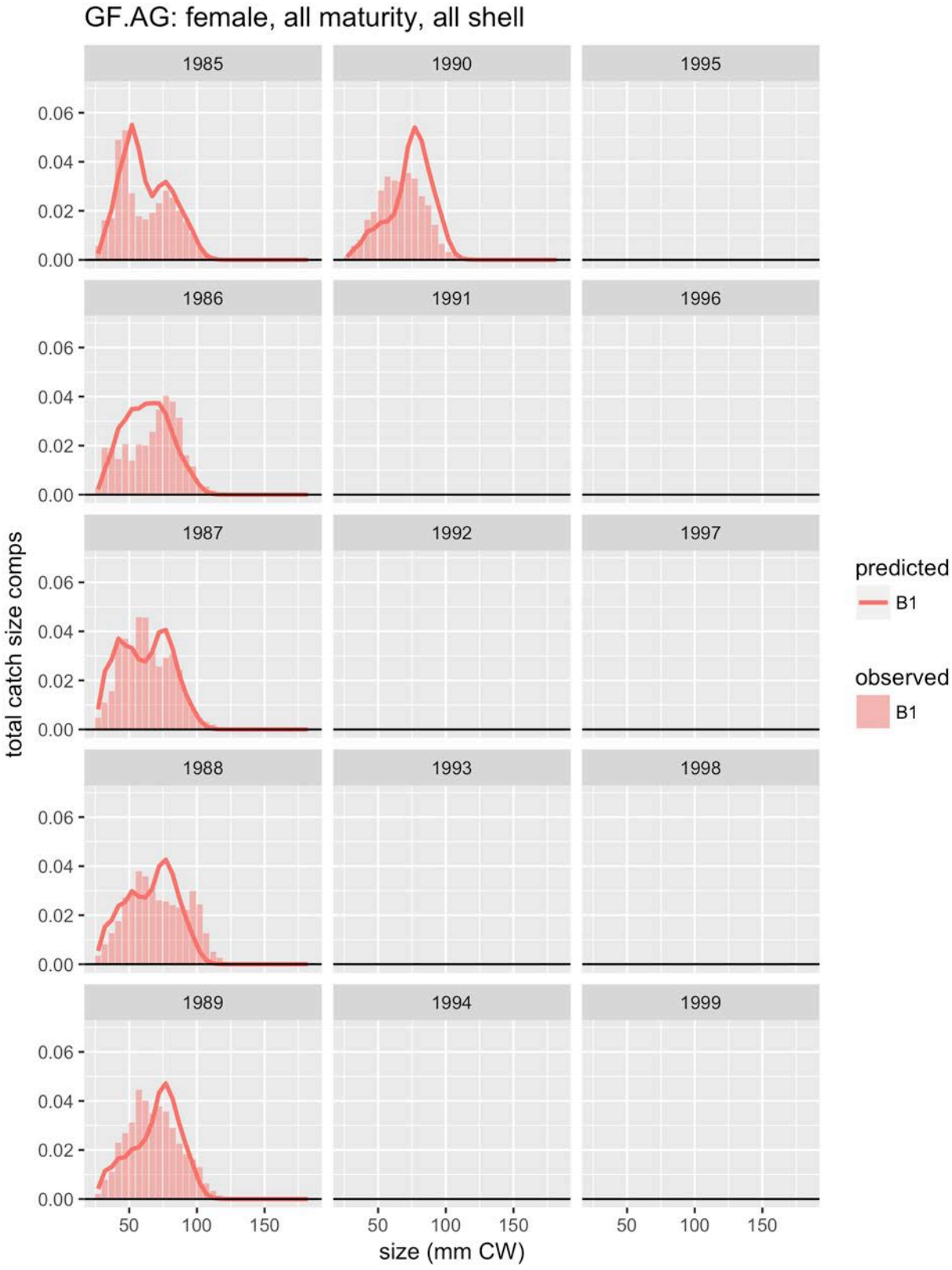


Figure 206. Comparison of observed and predicted female, all maturity, all shell total catch size comps for GF.AG. Page 2 of 2.

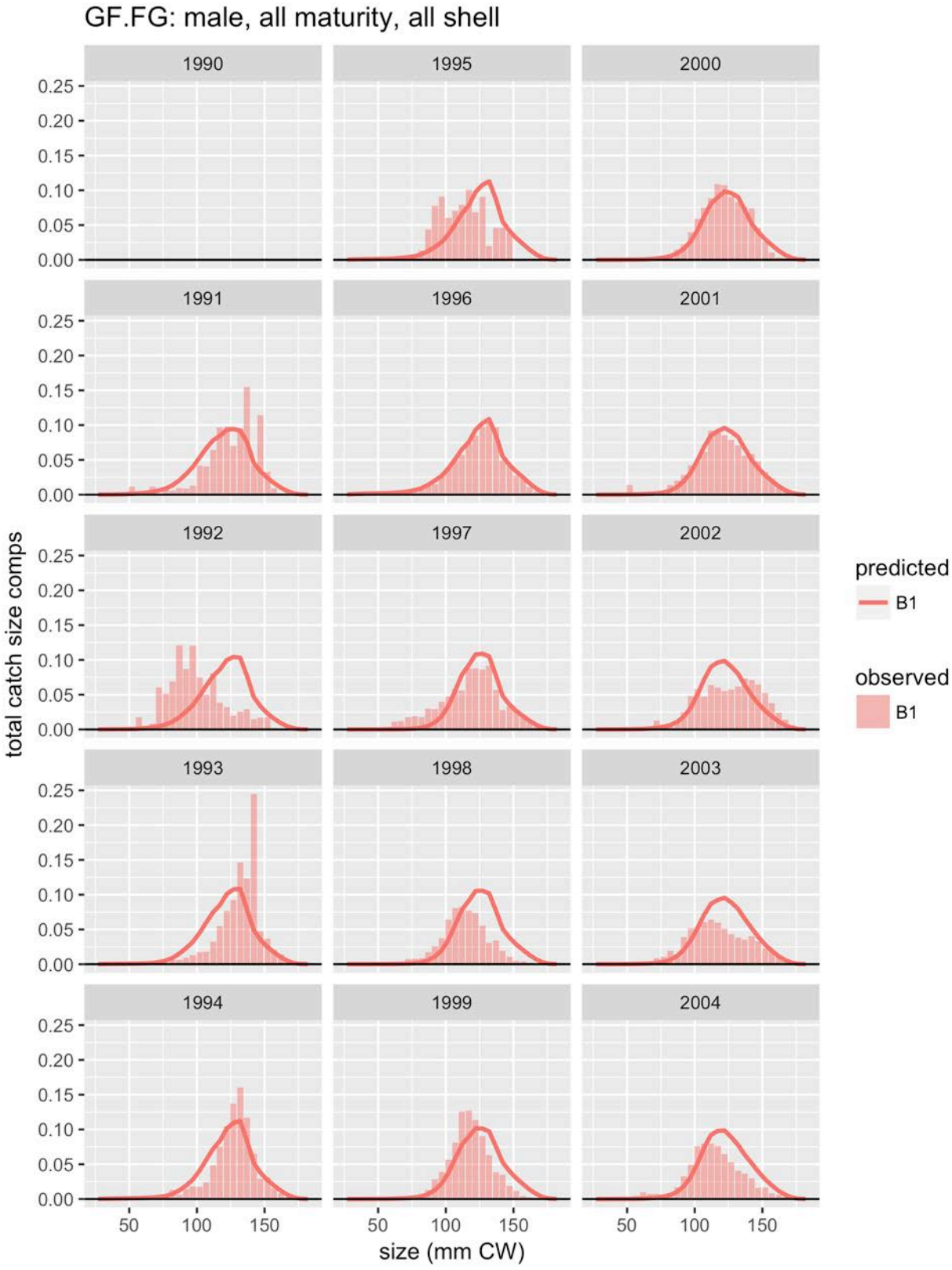


Figure 207. Comparison of observed and predicted male, all maturity, all shell total catch size comps for GF.FG. Page 1 of 2.

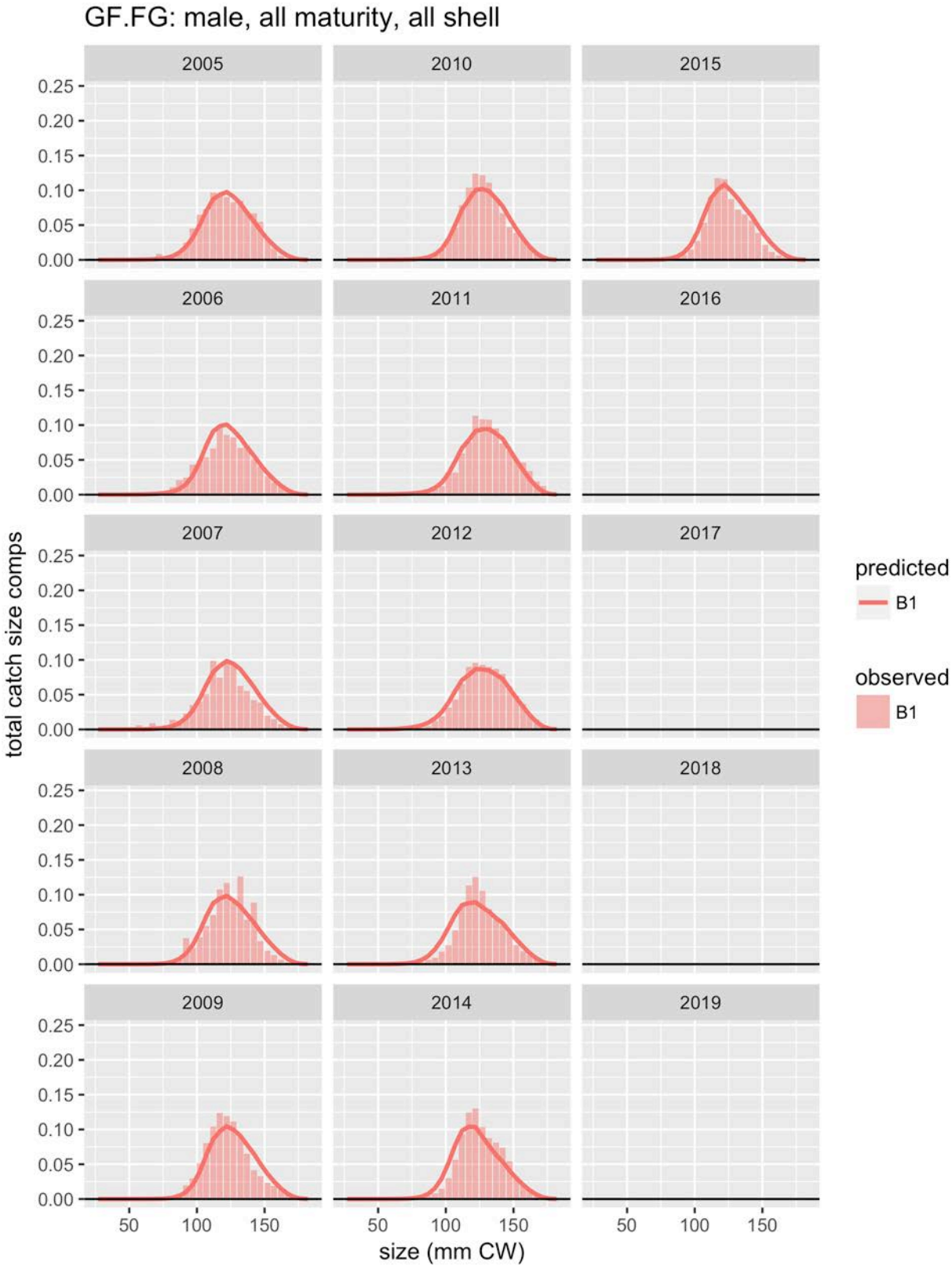


Figure 208. Comparison of observed and predicted male, all maturity, all shell total catch size comps for GF.FG. Page 2 of 2.

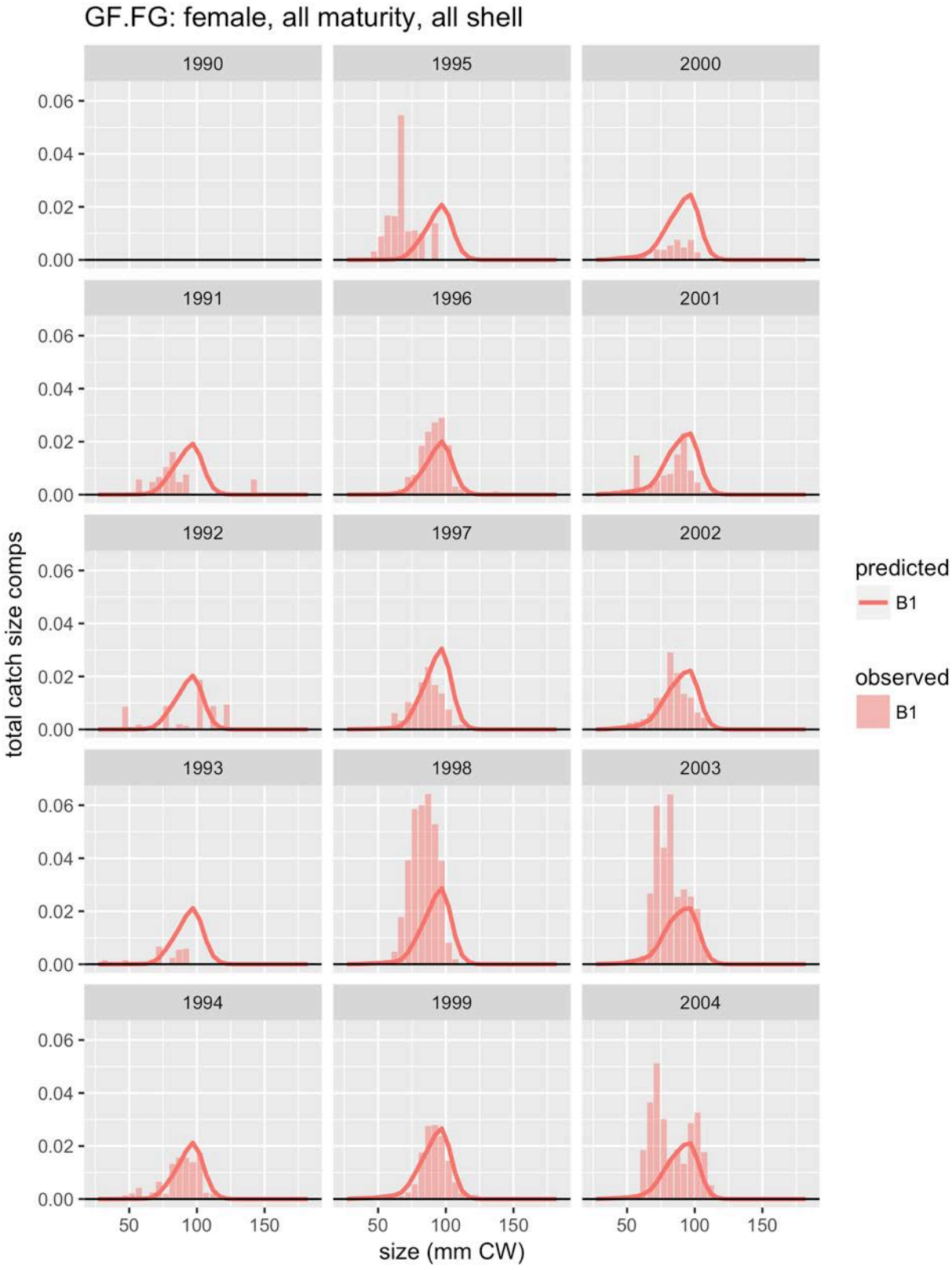


Figure 209. Comparison of observed and predicted female, all maturity, all shell total catch size comps for GF.FG. Page 1 of 2.

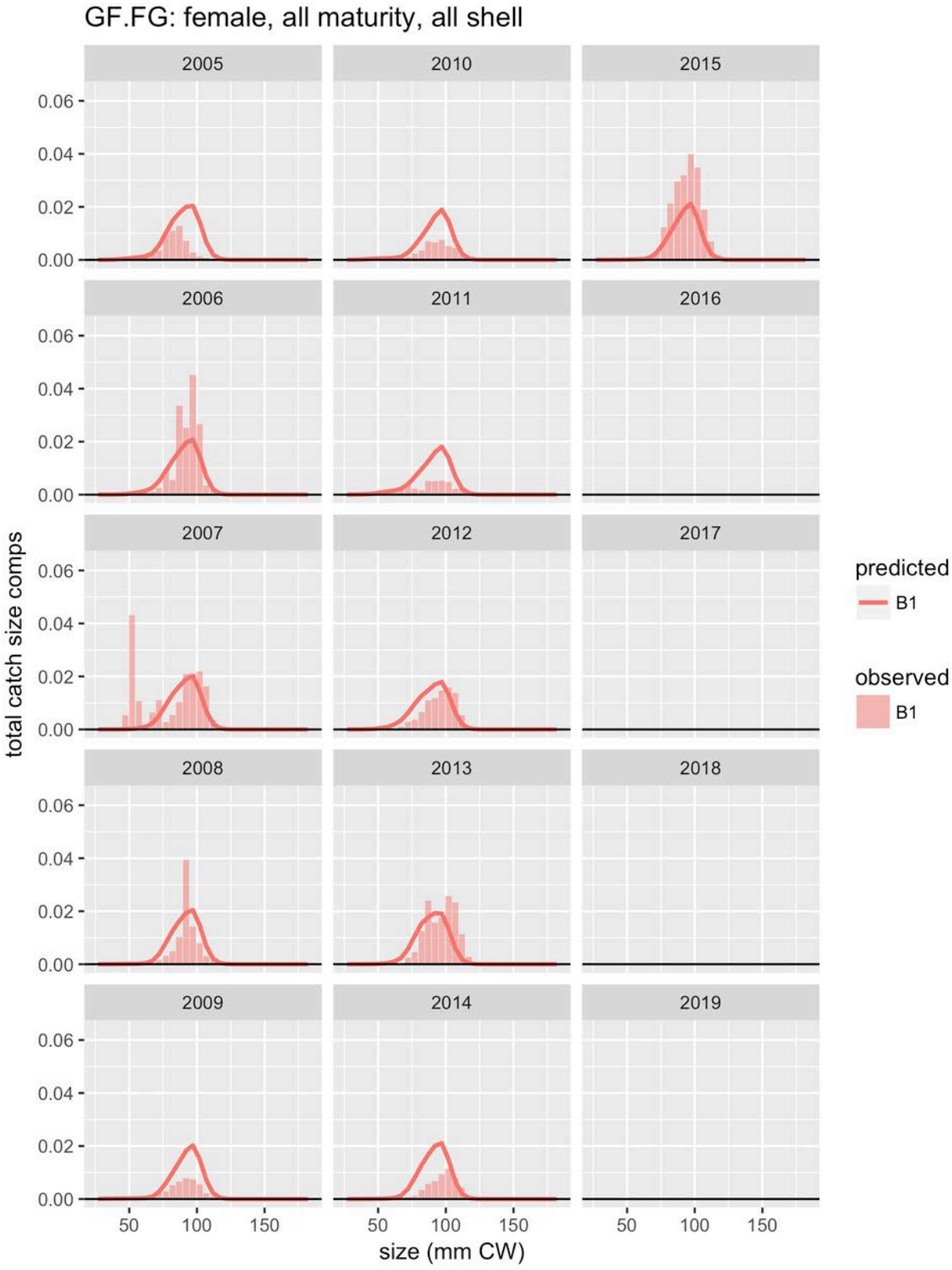


Figure 210. Comparison of observed and predicted female, all maturity, all shell total catch size comps for GF.FG. Page 2 of 2.

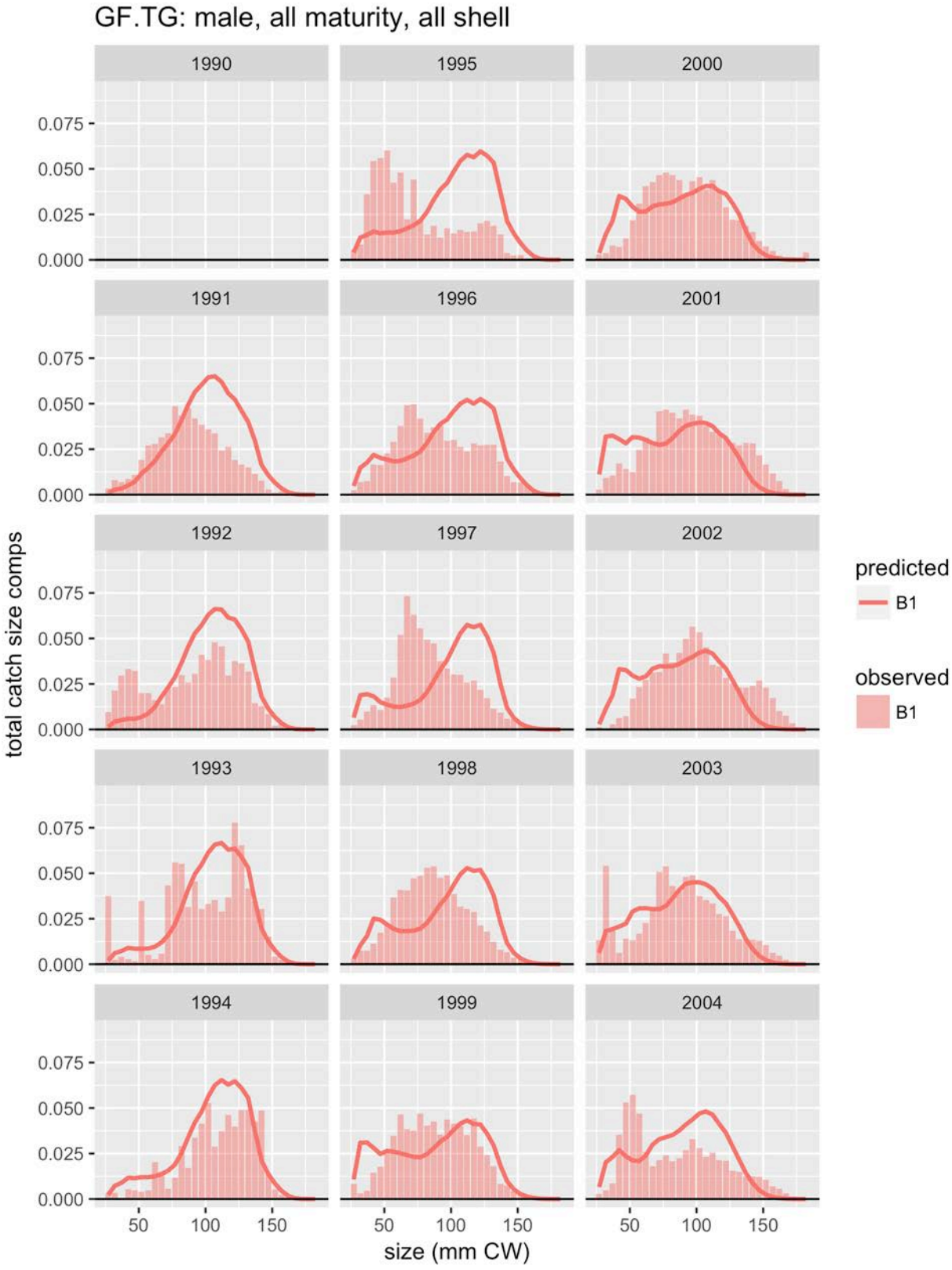


Figure 211. Comparison of observed and predicted male, all maturity, all shell total catch size comps for GF.TG. Page 1 of 2.

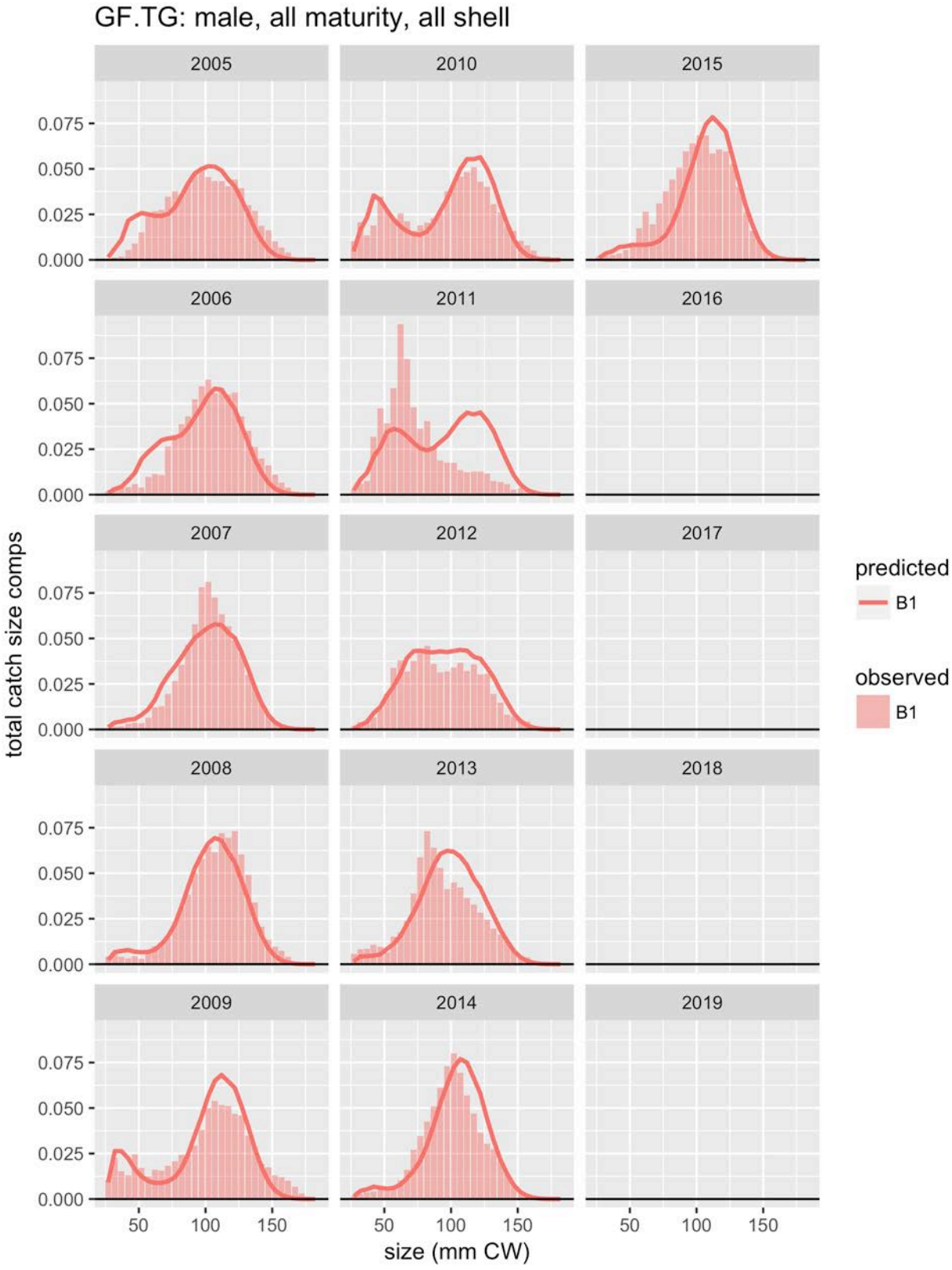


Figure 212. Comparison of observed and predicted male, all maturity, all shell total catch size comps for GF.TG. Page 2 of 2.

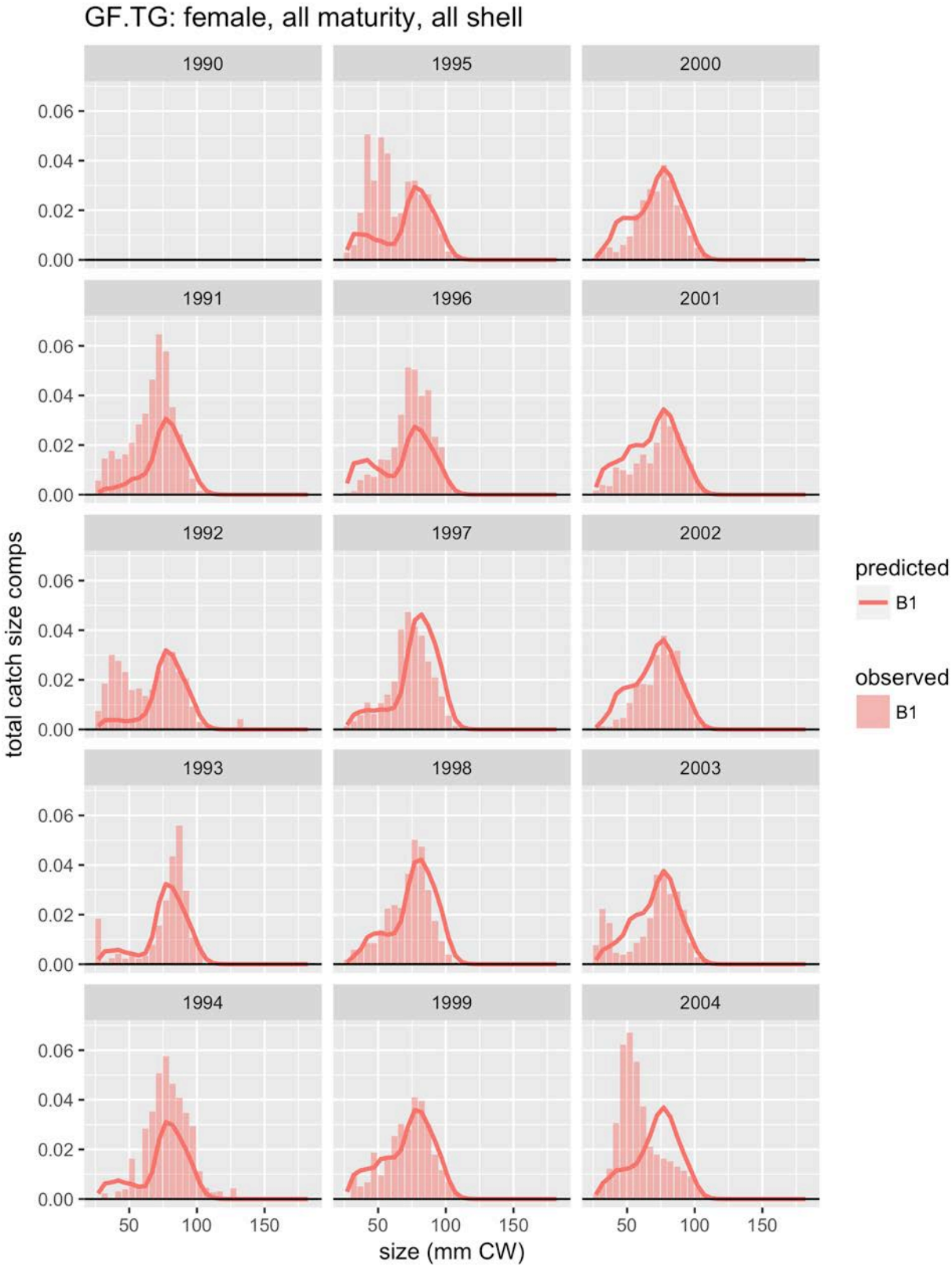


Figure 213. Comparison of observed and predicted female, all maturity, all shell total catch size comps for GF.TG. Page 1 of 2.

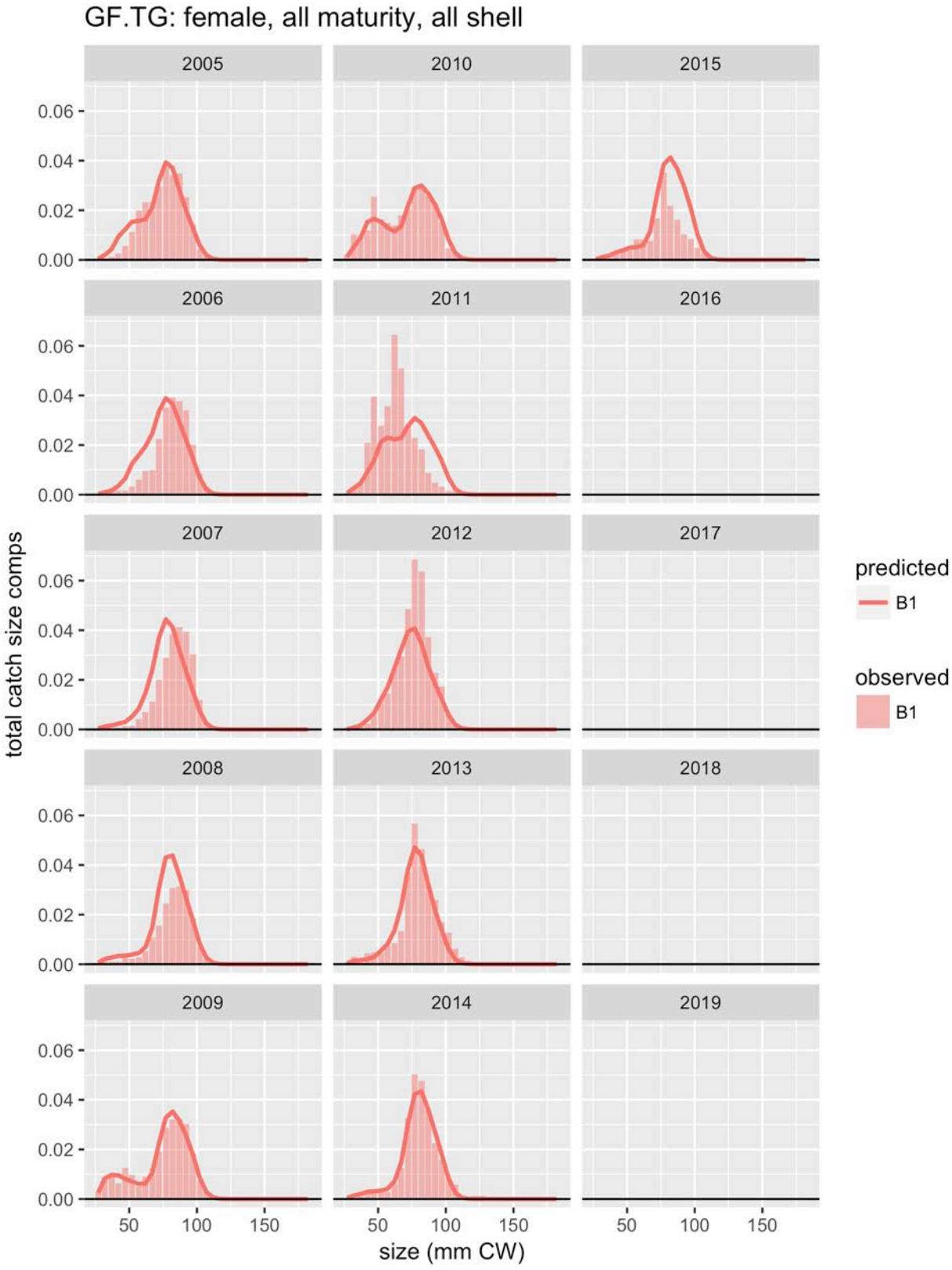


Figure 214. Comparison of observed and predicted female, all maturity, all shell total catch size comps for GF.TG. Page 2 of 2.

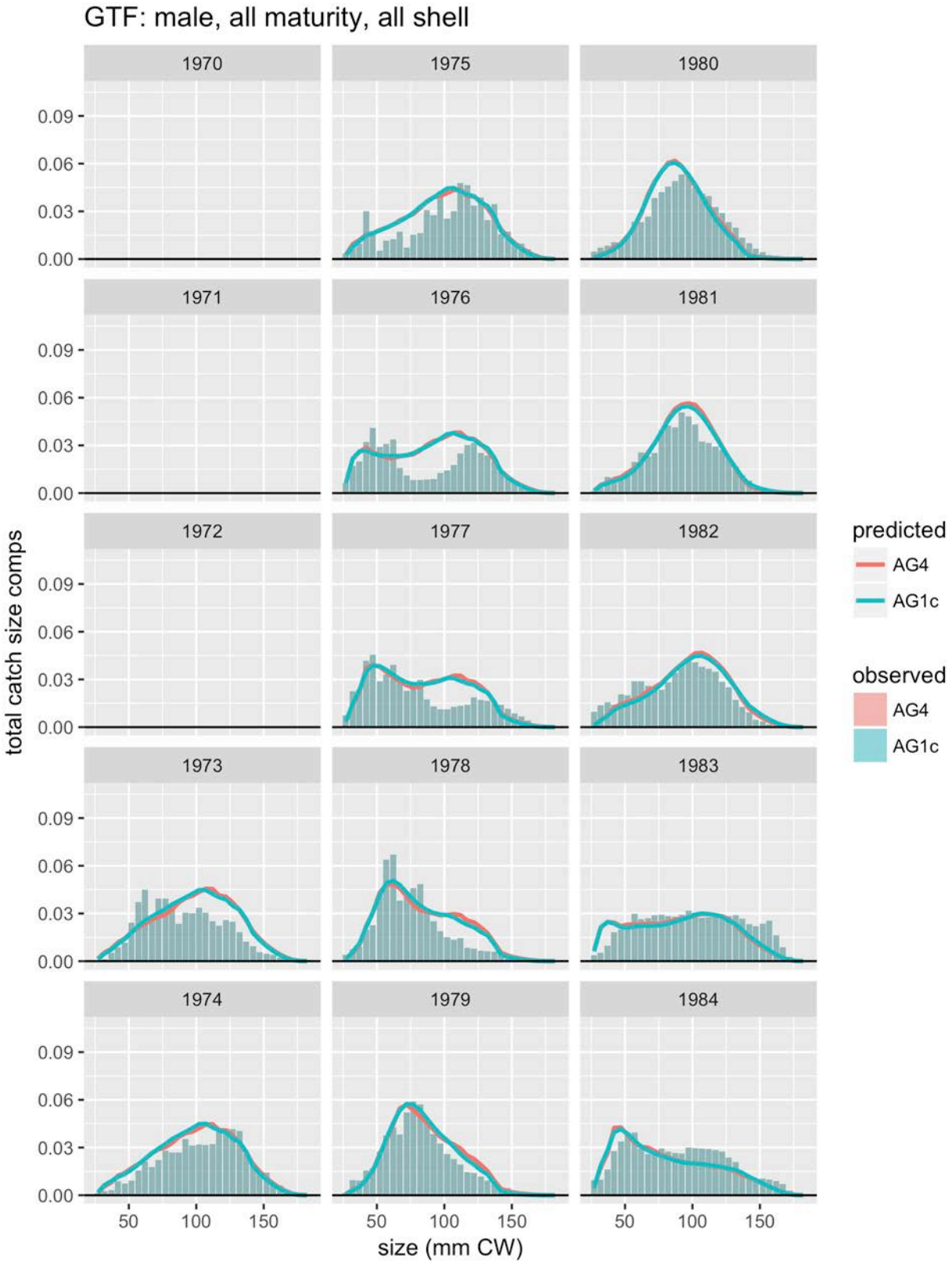


Figure 215. Comparison of observed and predicted male, all maturity, all shell total catch size comps for GTF. Page 1 of 4.

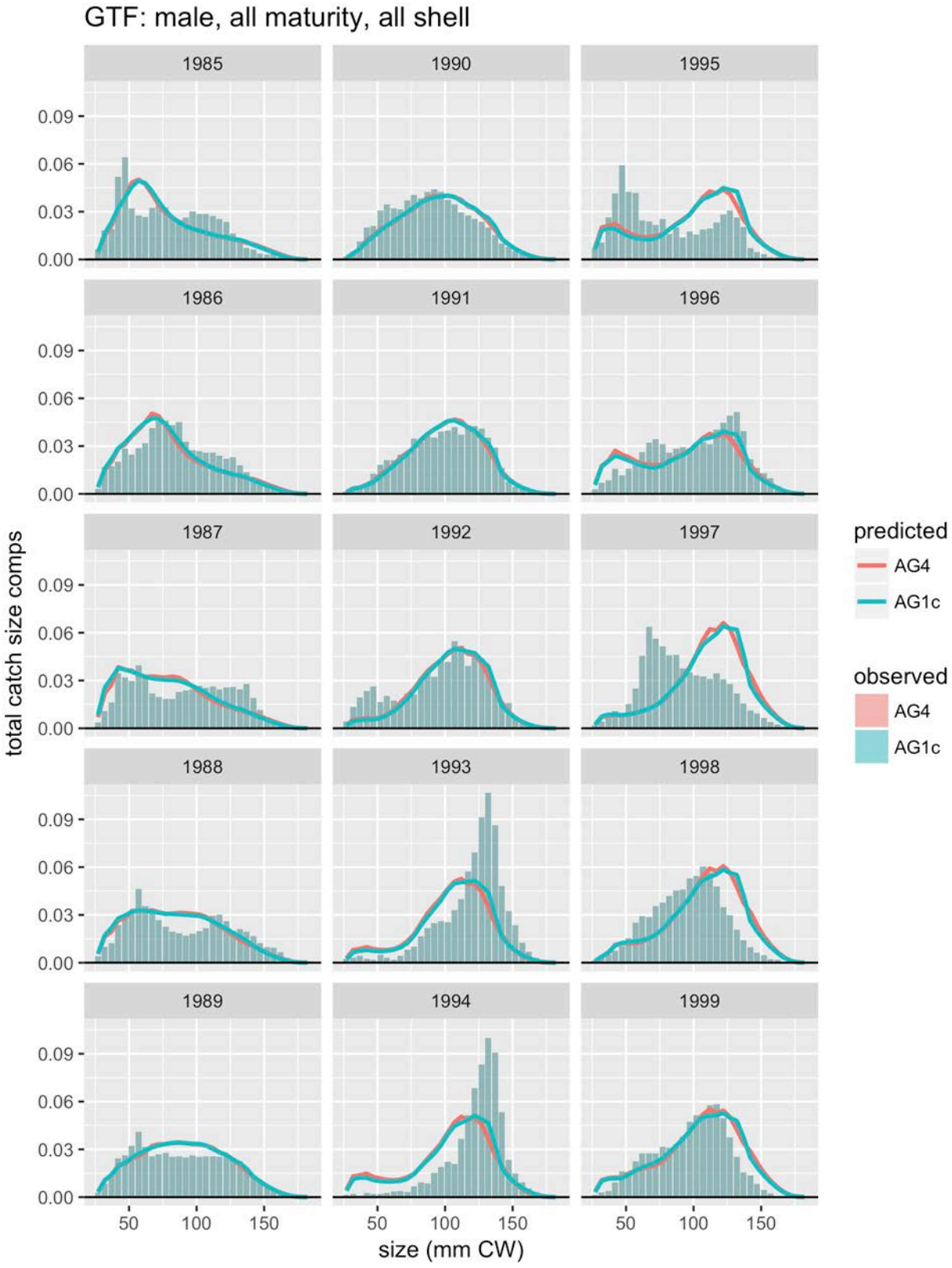


Figure 216. Comparison of observed and predicted male, all maturity, all shell total catch size comps for GTF. Page 2 of 4.

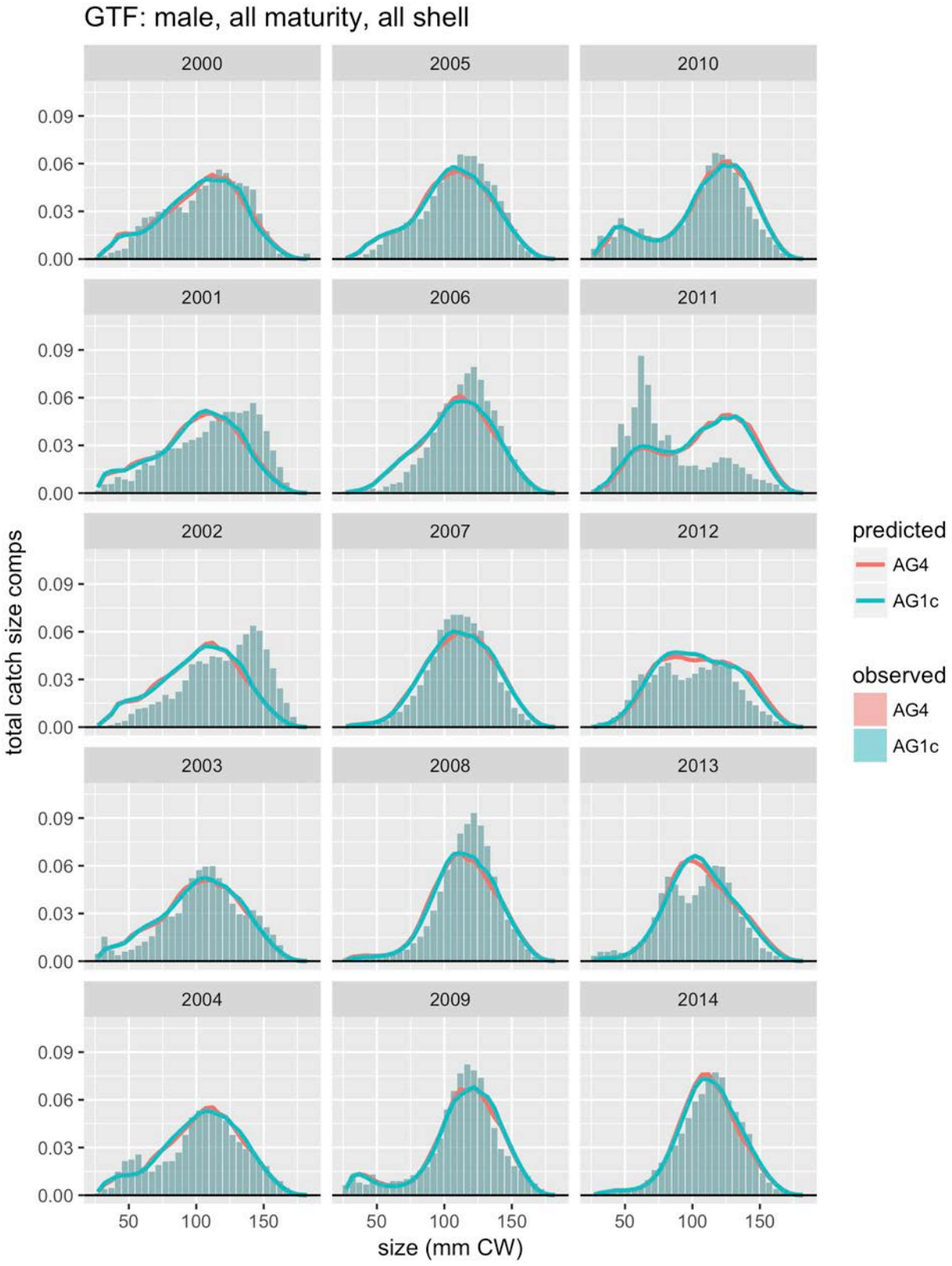


Figure 217. Comparison of observed and predicted male, all maturity, all shell total catch size comps for GTF. Page 3 of 4.

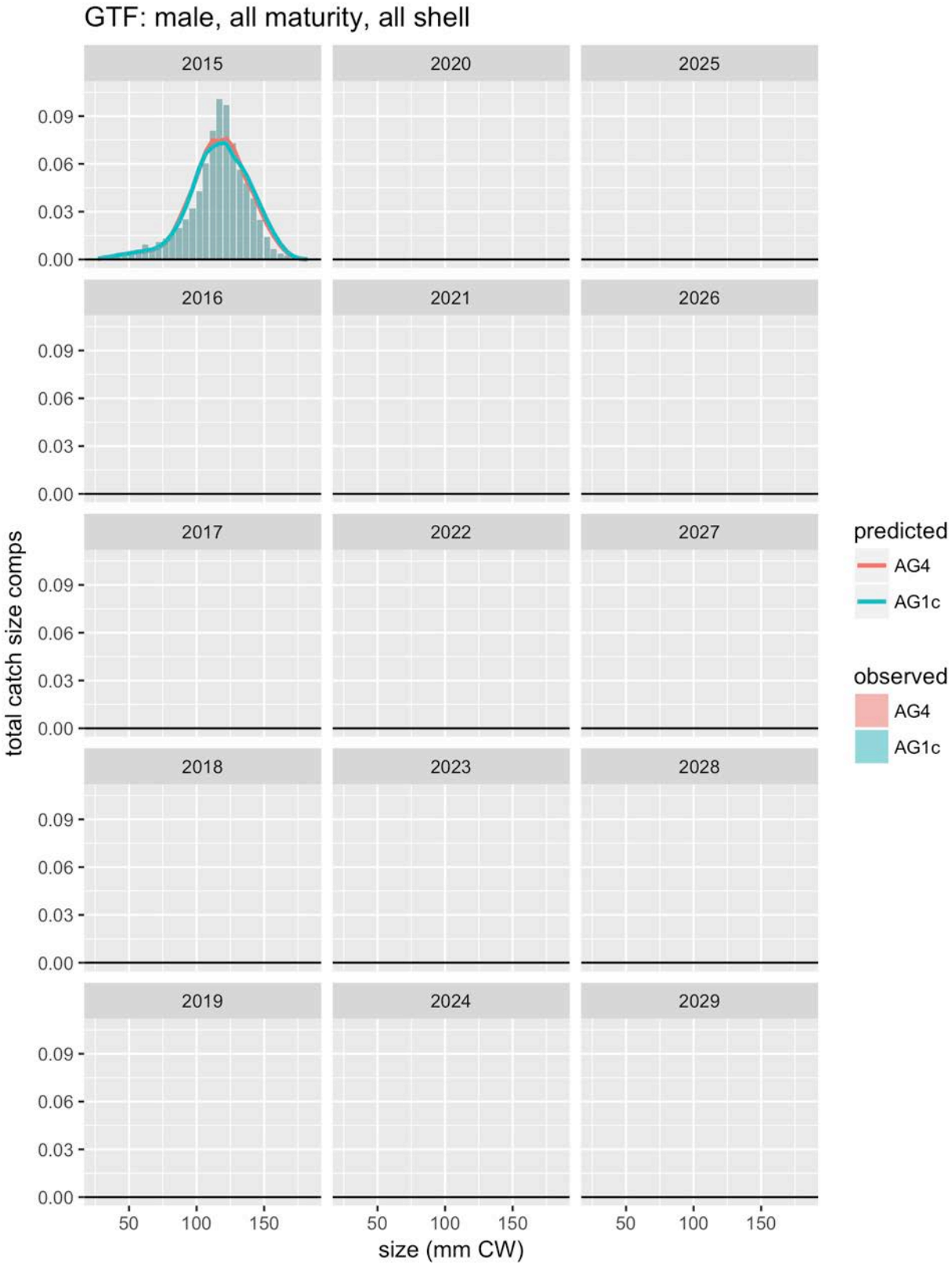


Figure 218. Comparison of observed and predicted male, all maturity, all shell total catch size comps for GTF. Page 4 of 4.

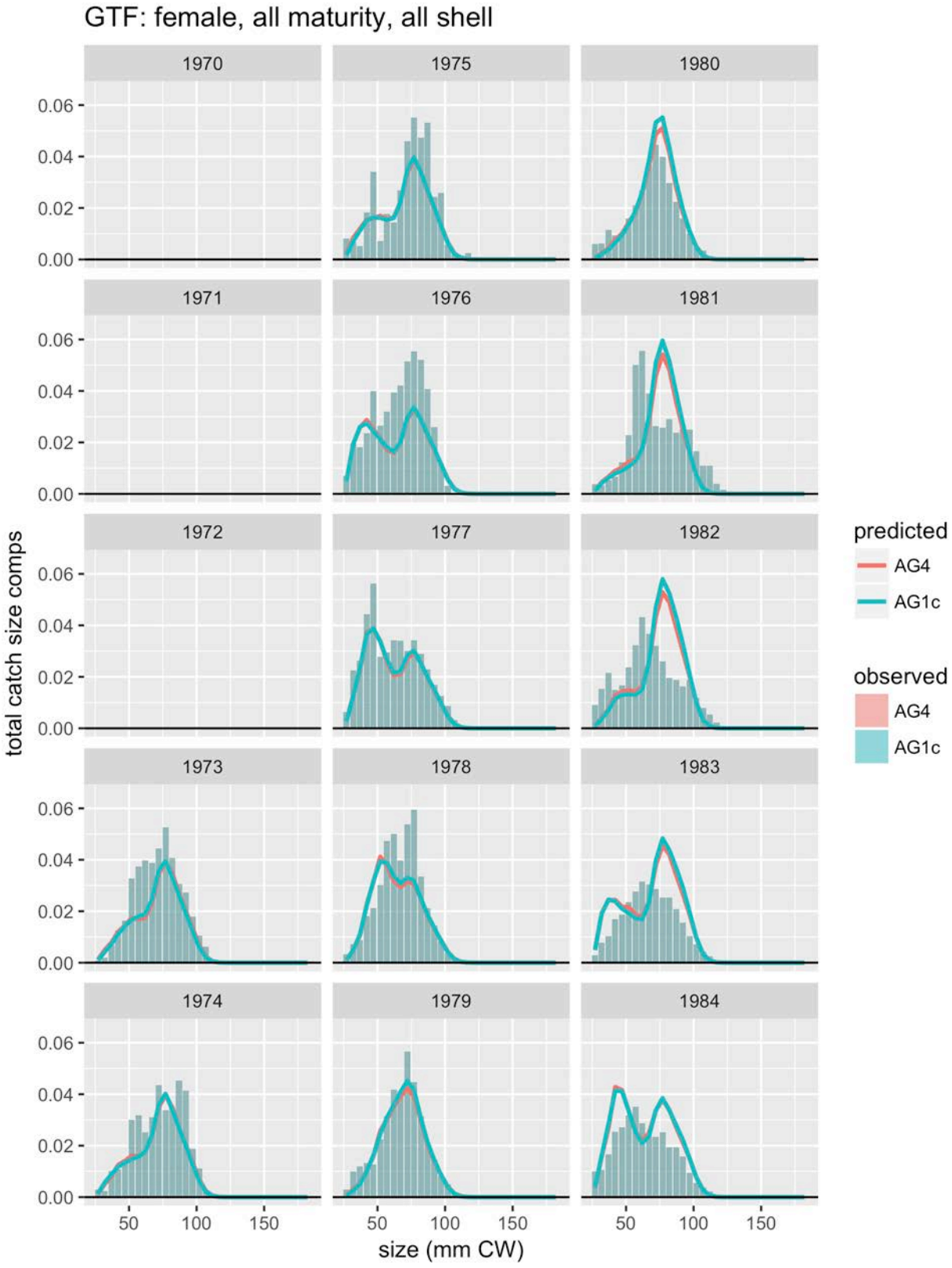


Figure 219. Comparison of observed and predicted female, all maturity, all shell total catch size comps for GTF. Page 1 of 4.

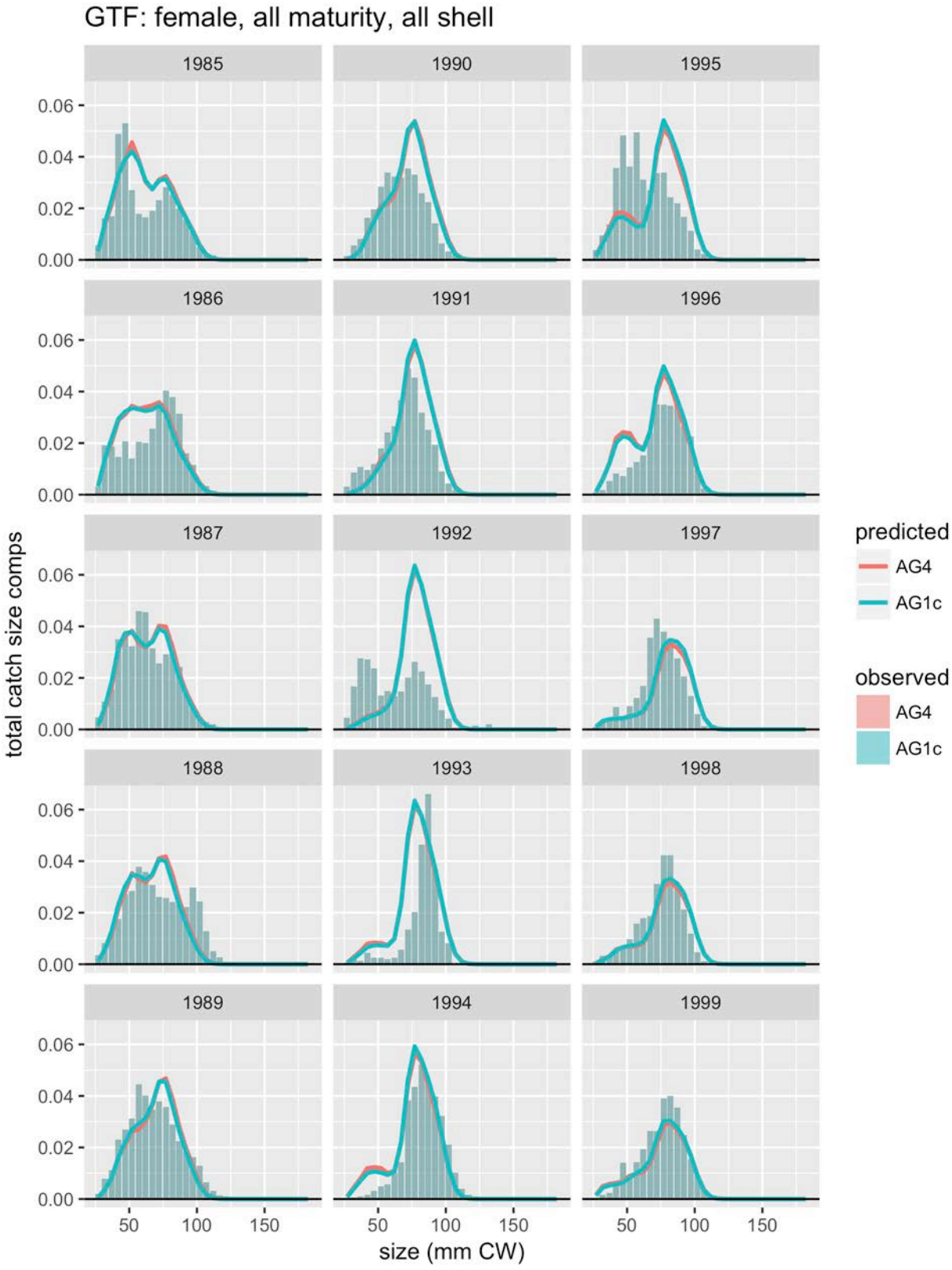


Figure 220. Comparison of observed and predicted female, all maturity, all shell total catch size comps for GTF. Page 2 of 4.

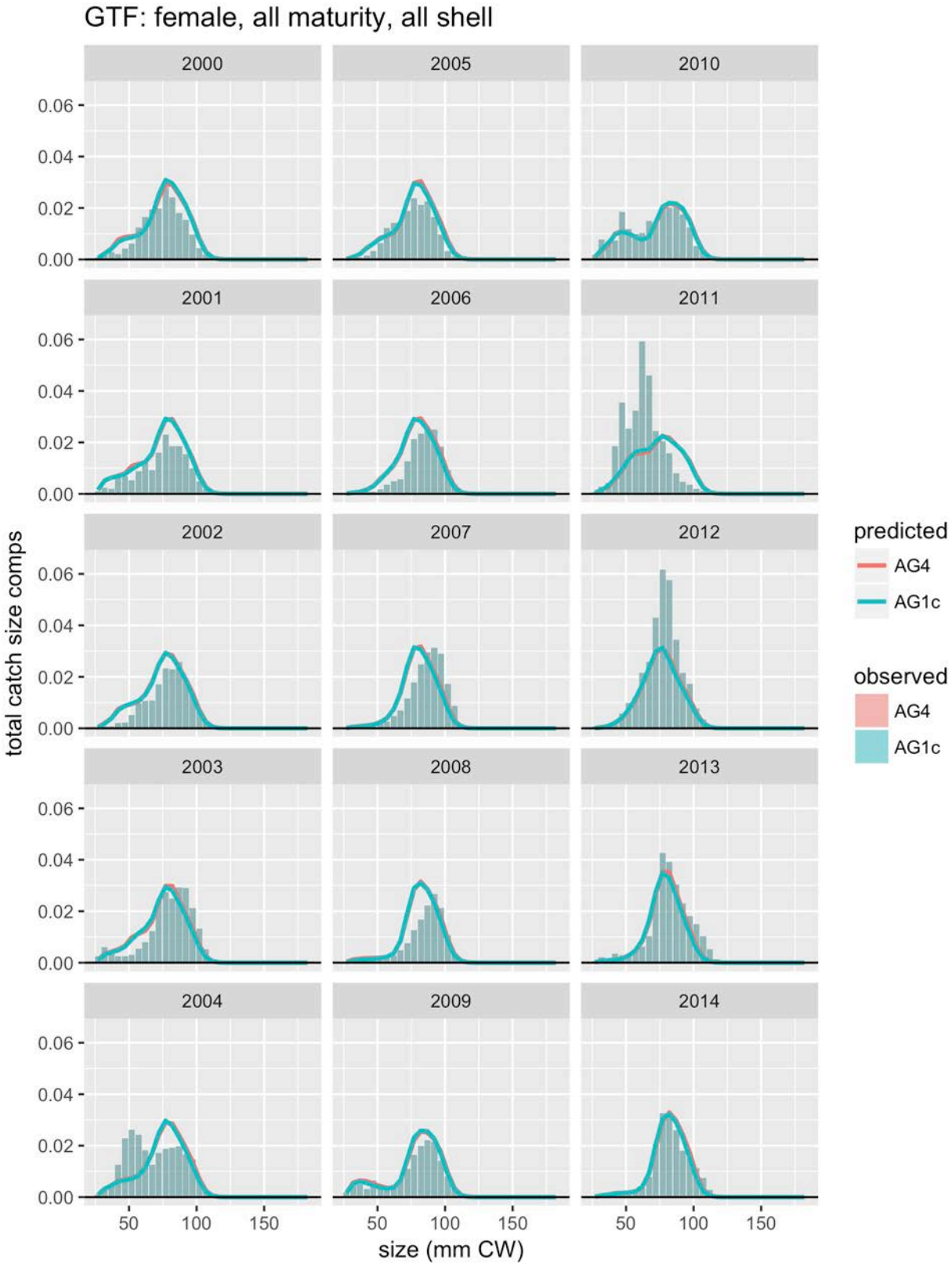


Figure 221. Comparison of observed and predicted female, all maturity, all shell total catch size comps for GTF. Page 3 of 4.

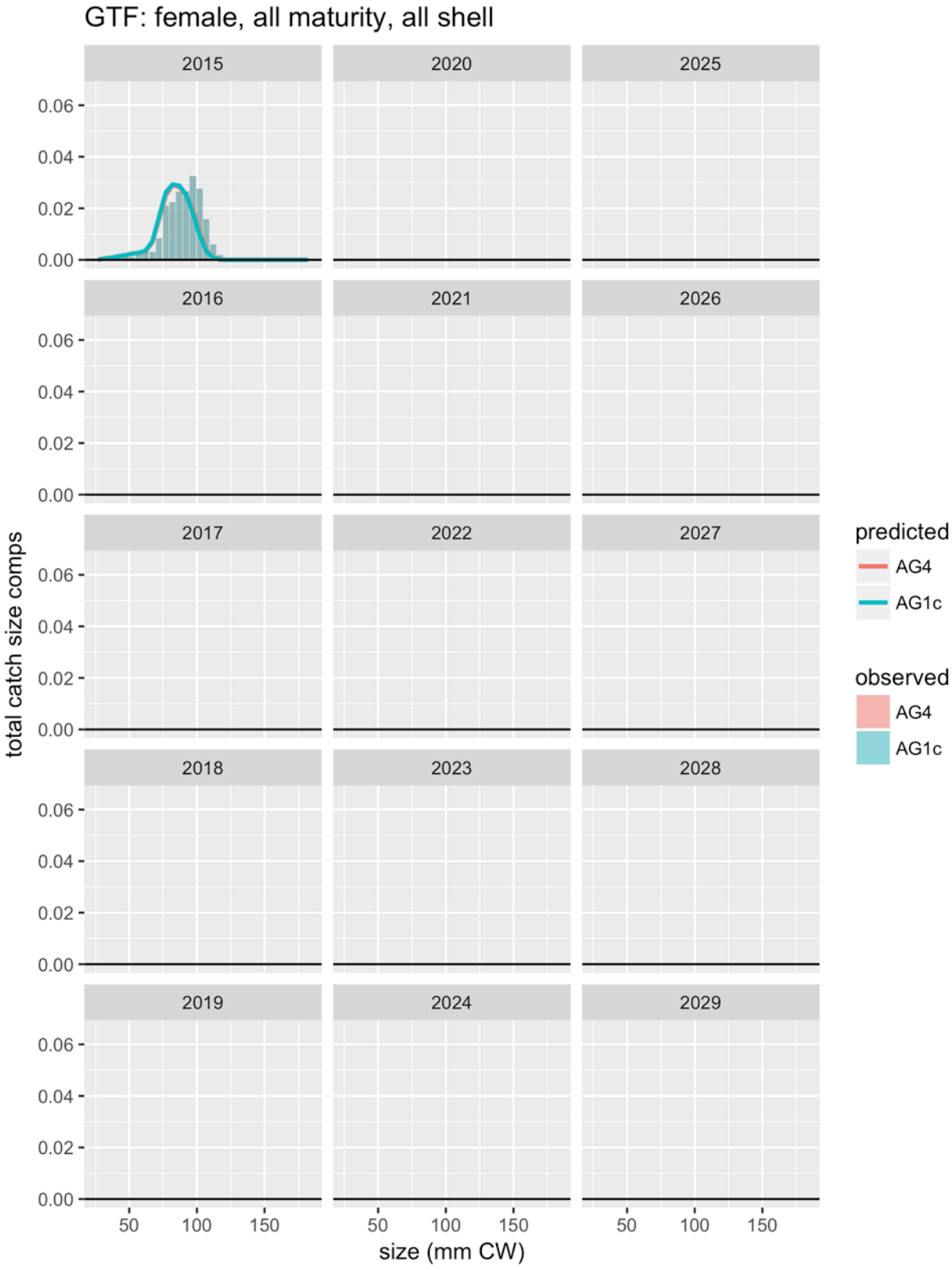


Figure 222. Comparison of observed and predicted female, all maturity, all shell total catch size comps for GTF. Page 4 of 4.

Retained fishery catch biomass

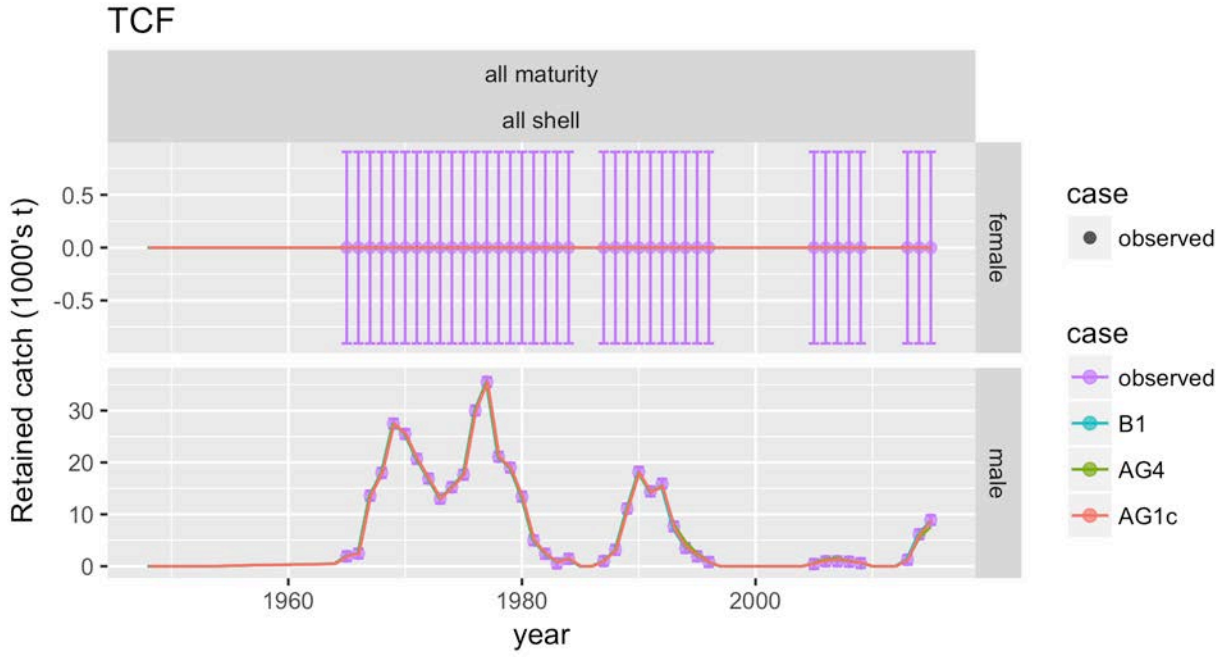


Figure 223. Comparison of observed and predicted retained catch mortality for TCF.

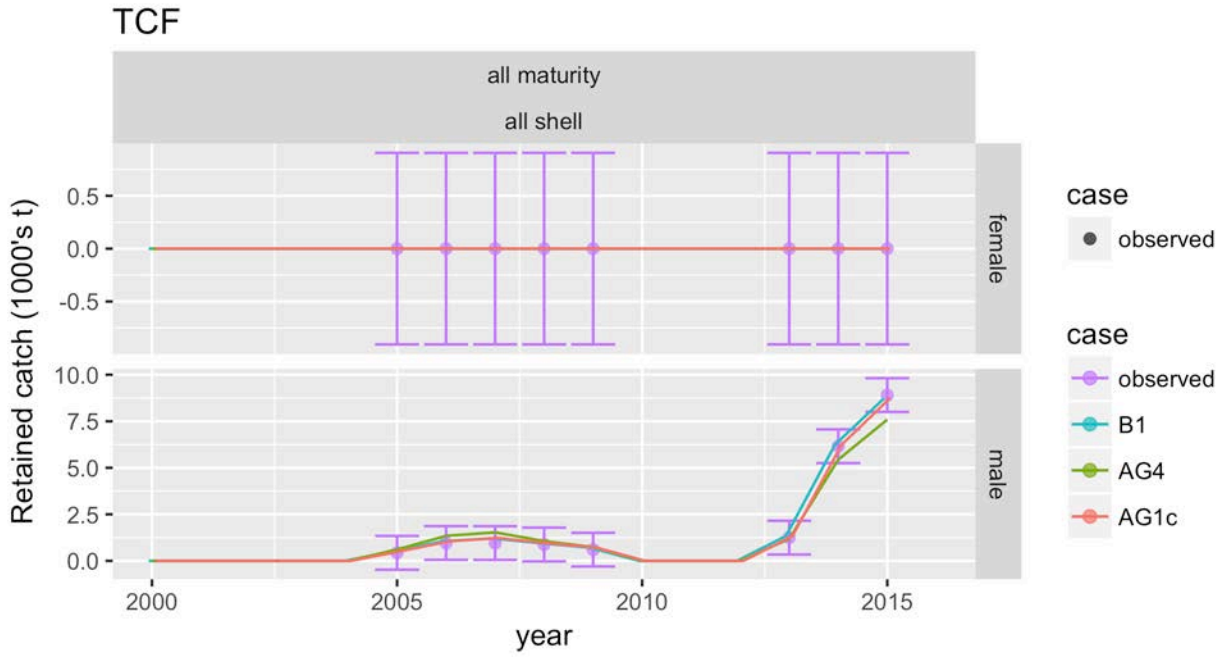


Figure 224. Comparison of observed and predicted retained catch mortality for TCF. Recent time period.

Mean retained fishery size compositions

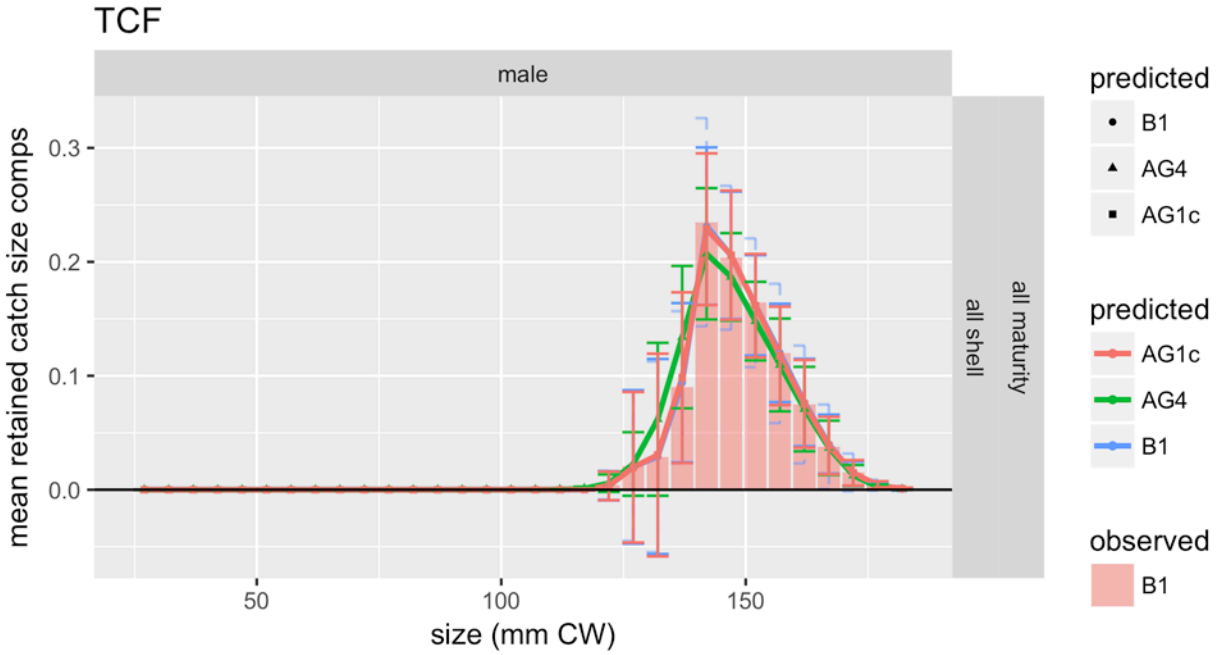


Figure 225. Comparison of observed and predicted &&xms mean retained catch size comps for TCF.

Retained fishery size compositions

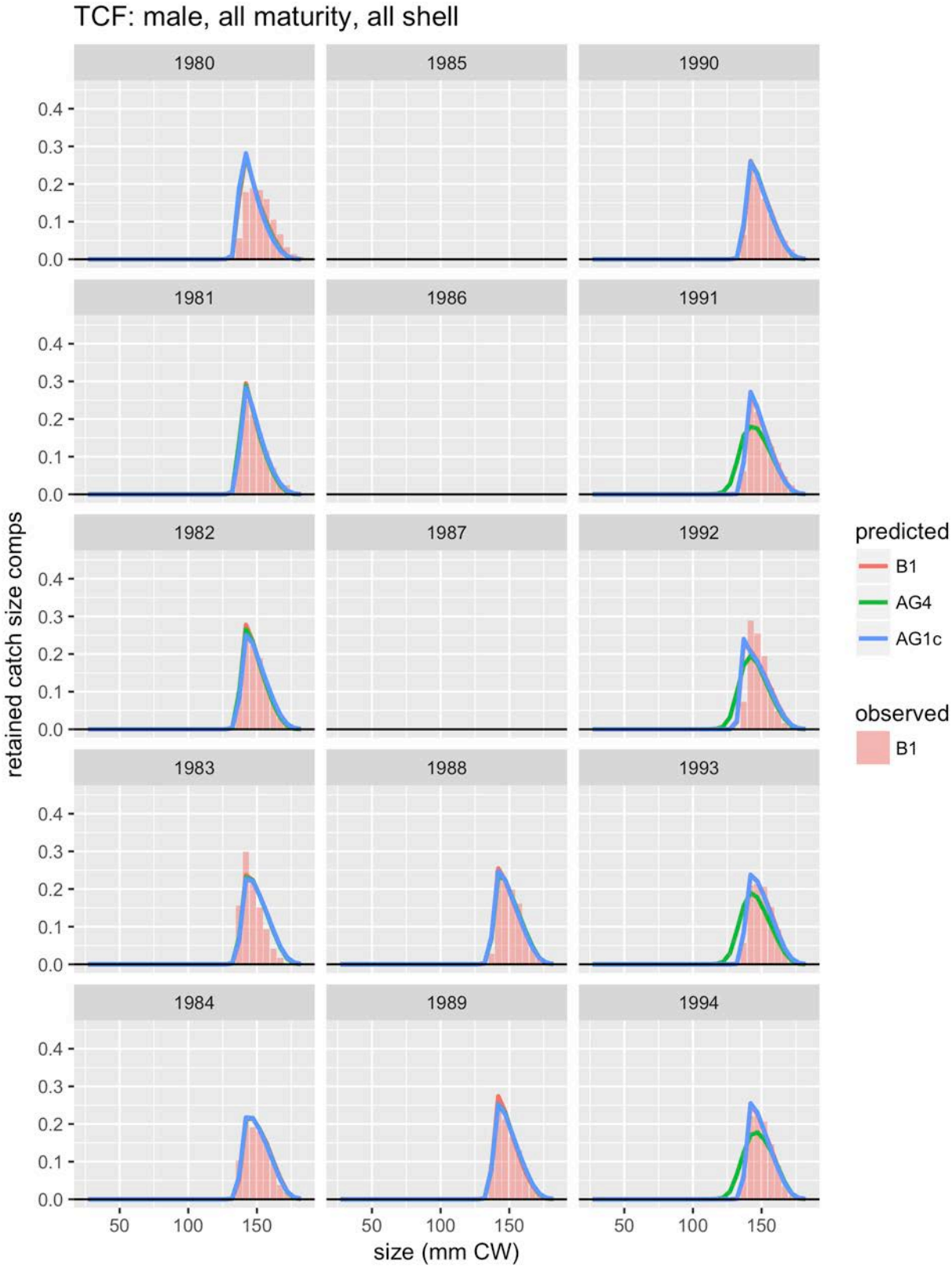


Figure 226. Comparison of observed and predicted male, all maturity, all shell retained catch size comps for TCF. Page 1 of 3.

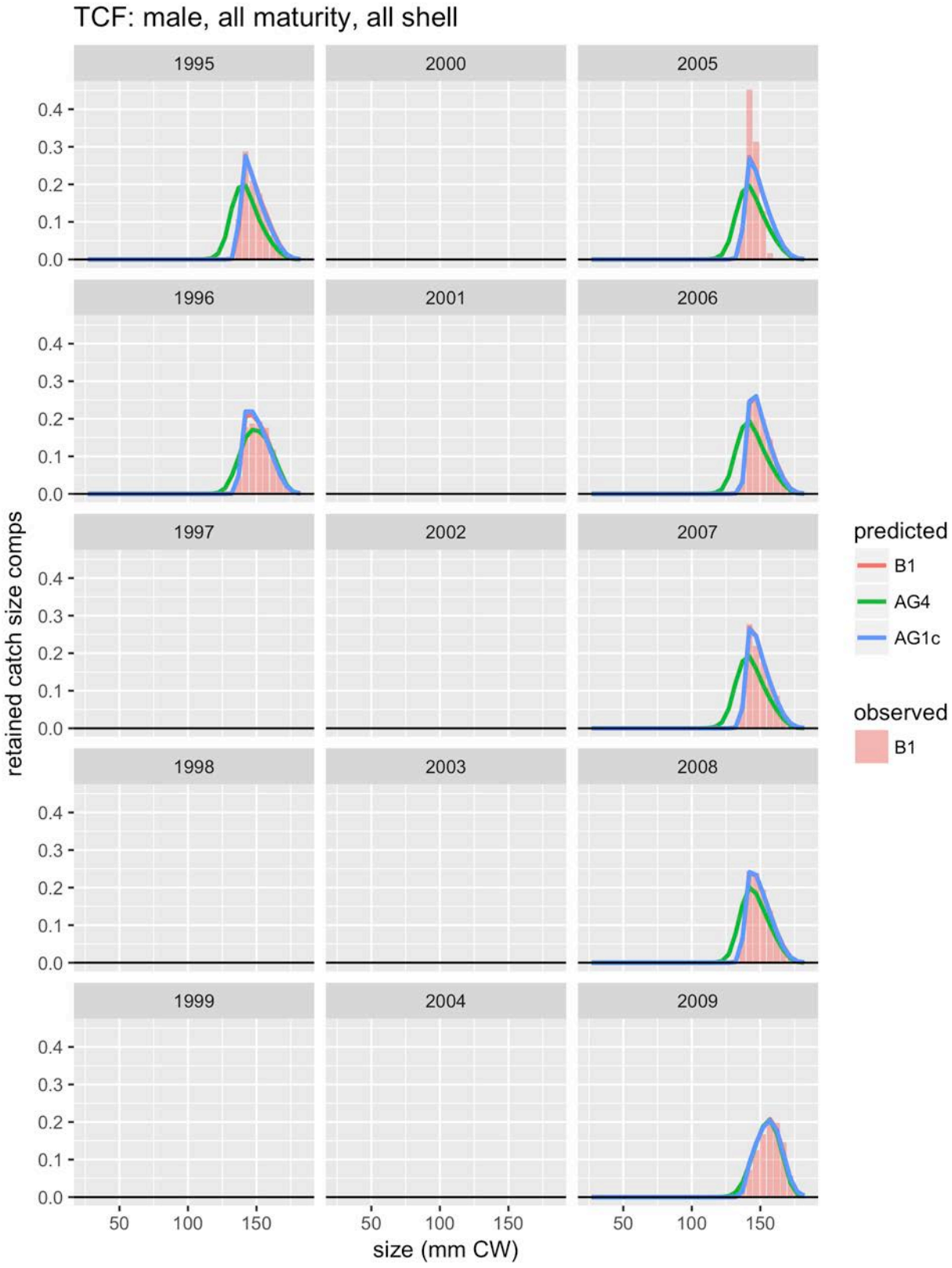


Figure 227. Comparison of observed and predicted male, all maturity, all shell retained catch size comps for TCF. Page 2 of 3.

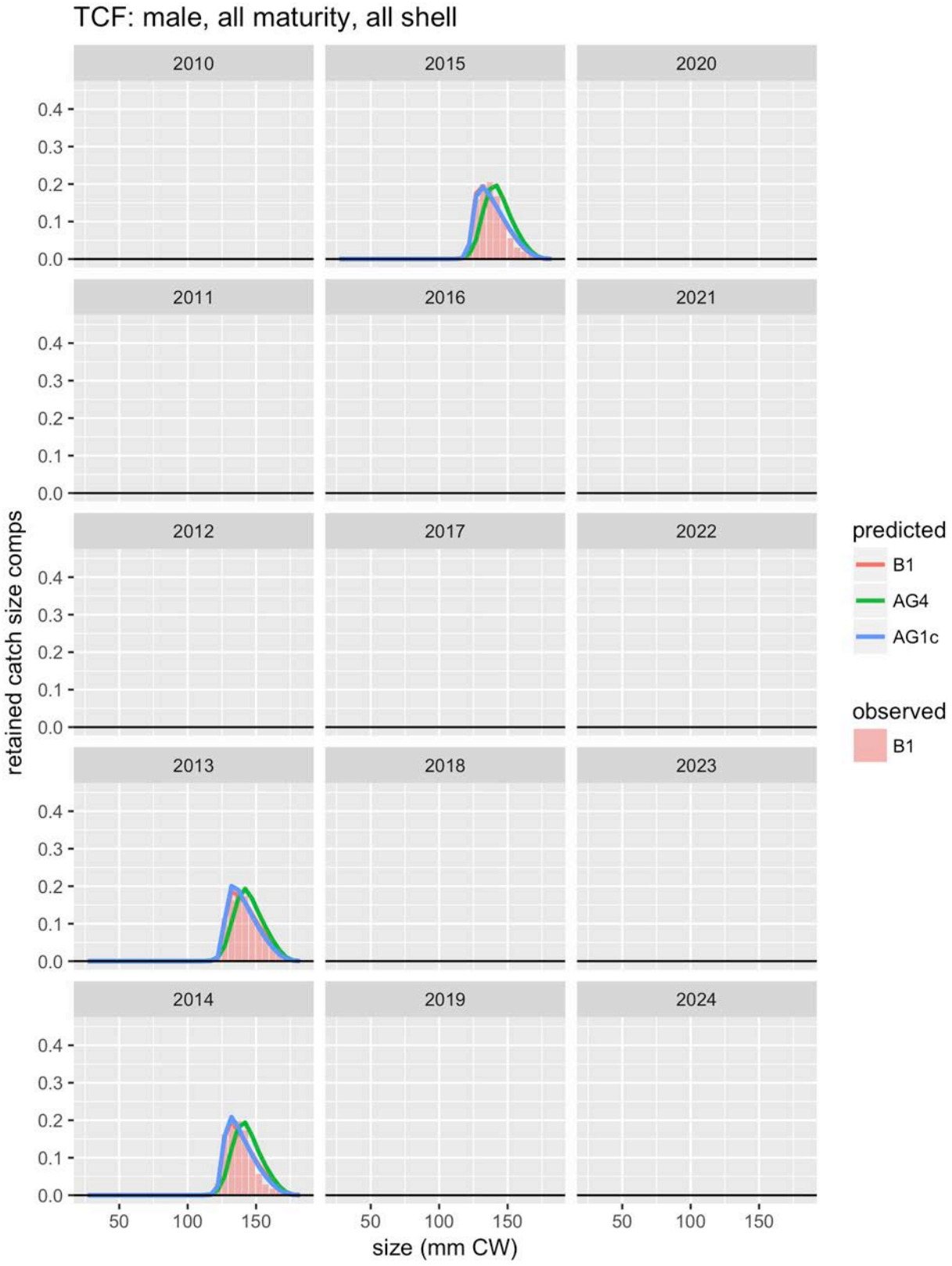


Figure 228. Comparison of observed and predicted male, all maturity, all shell retained catch size comps for TCF. Page 3 of 3.