

Figure 1. Historical commercial harvest (from fish tickets; metric tons) and catch-per-unit effort (CPUE, number of crabs per pot lift) of golden king crab in the **EAG**, 1985/86–2015/16 fisheries (note: 1985 refers to the 1985/86 fishing year).

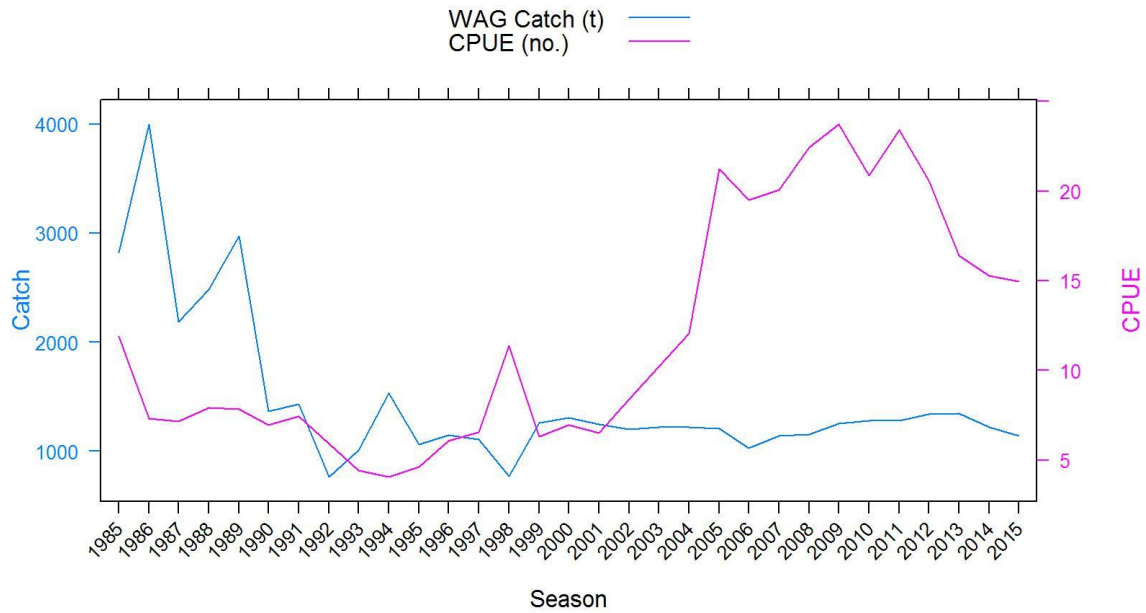


Figure 2. Historical commercial harvest (from fish tickets; metric tons) and catch-per-unit effort (CPUE, number of crabs per pot lift) of golden king crab in the **WAG**, 1985/86–2015/16 fisheries (note: 1985 refers to the 1985/86 fishing year).

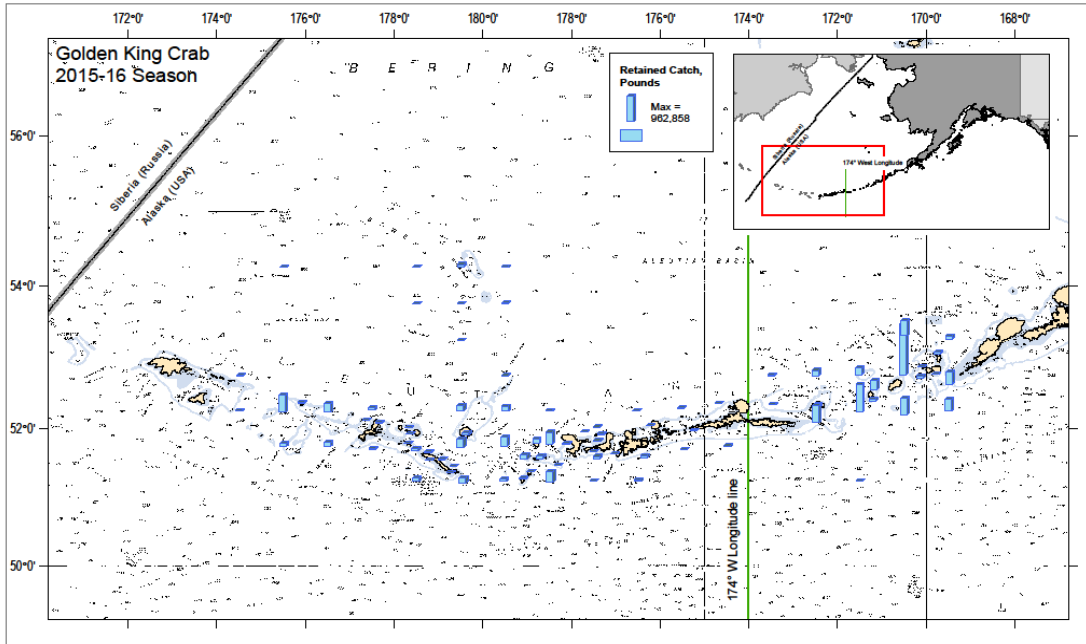


Figure 3. Catch distribution by statistical area.in 2015/16.

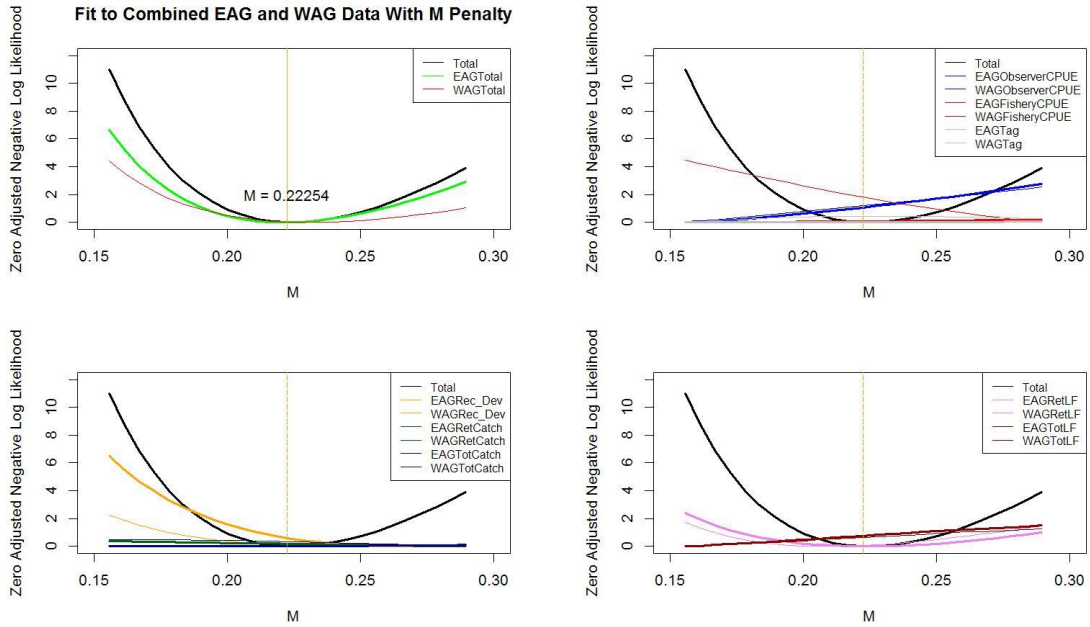


Figure 4. Total and components negative log-likelihoods vs. M for **scenario 0a** model fit for **EAG** and **WAG** combined data. The M estimate was obtained using an M penalty. The M estimate was 0.2225 yr^{-1} ($\pm 0.0191 \text{ yr}^{-1}$). The negative log likelihood values were estimated for fixed proportions of estimated M without using an M penalty and they were zero adjusted.

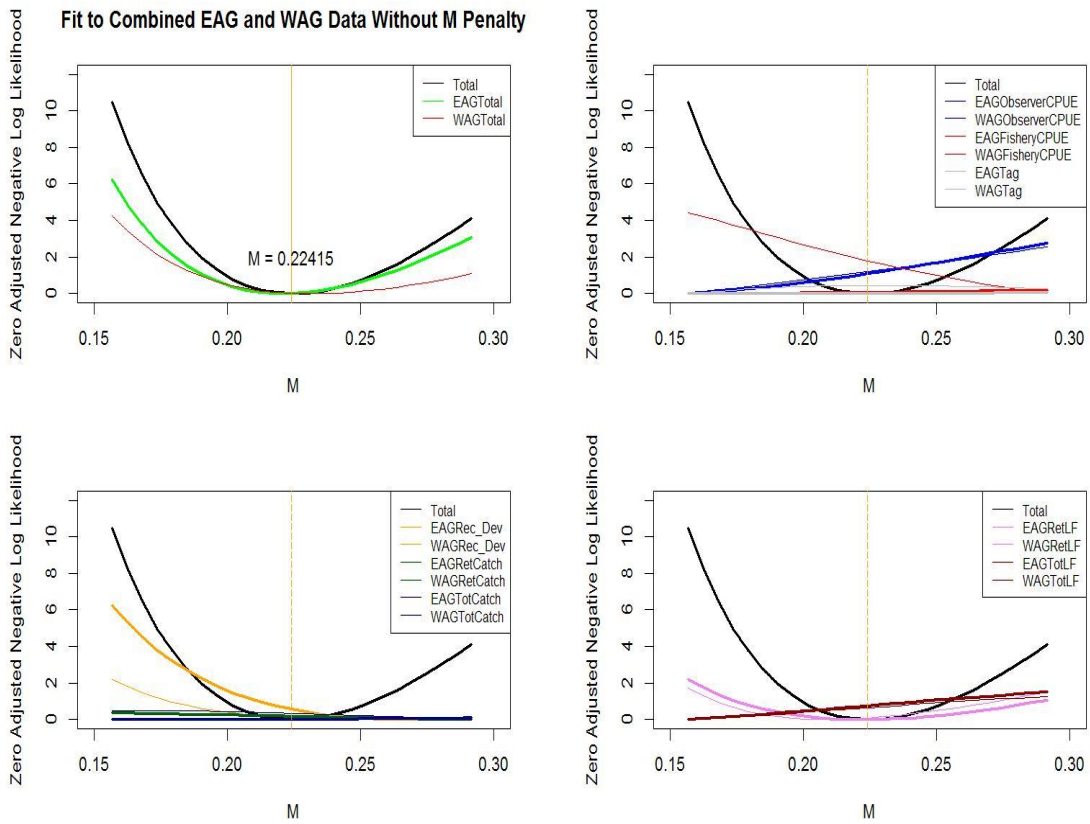


Figure 5. Total and components negative log-likelihoods vs. M for **scenario 0b** model fit for **EAG** and **WAG** combined data. The M estimate was obtained without using an M penalty. The M estimate was $0.2242 \text{ yr}^{-1} (\pm 0.0196 \text{ yr}^{-1})$. The negative log likelihood values were estimated for fixed proportions of estimated M without using an M penalty and they were zero adjusted.

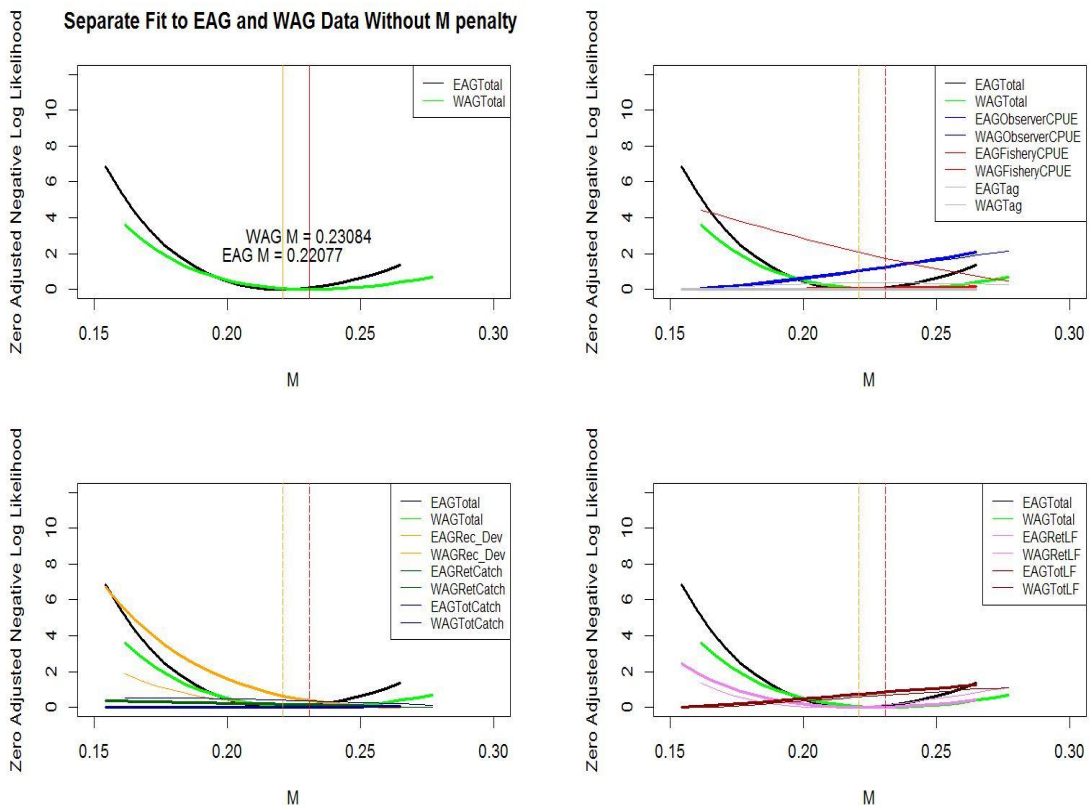


Figure 6. Total and components negative log-likelihoods vs. M for **scenario 1b** model separate fit to **EAG** data and **WAG** data. The M estimate was obtained without using an M penalty. The M estimate for **EAG** was 0.2208 yr^{-1} ($\pm 0.0238 \text{ yr}^{-1}$) and that for **WAG** was 0.2308 yr^{-1} ($\pm 0.0350 \text{ yr}^{-1}$). The negative log likelihood values were estimated for fixed proportions of estimated M without using an M penalty and they were zero adjusted.

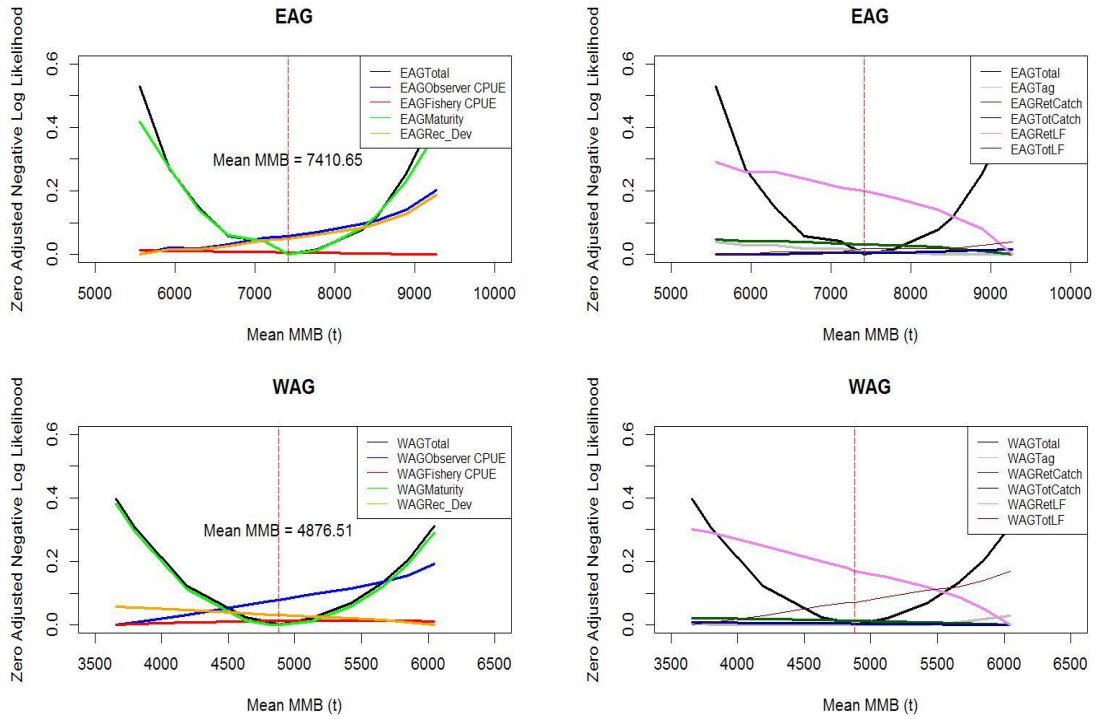


Figure 7. Total and components negative log-likelihoods vs. mean *MMB* for **scenario 1** model fit to **EAG** and **WAG** data, respectively. The negative log likelihood values were estimated for fixed proportions of the scenario 1 estimate of mean *MMB* and they were zero adjusted.

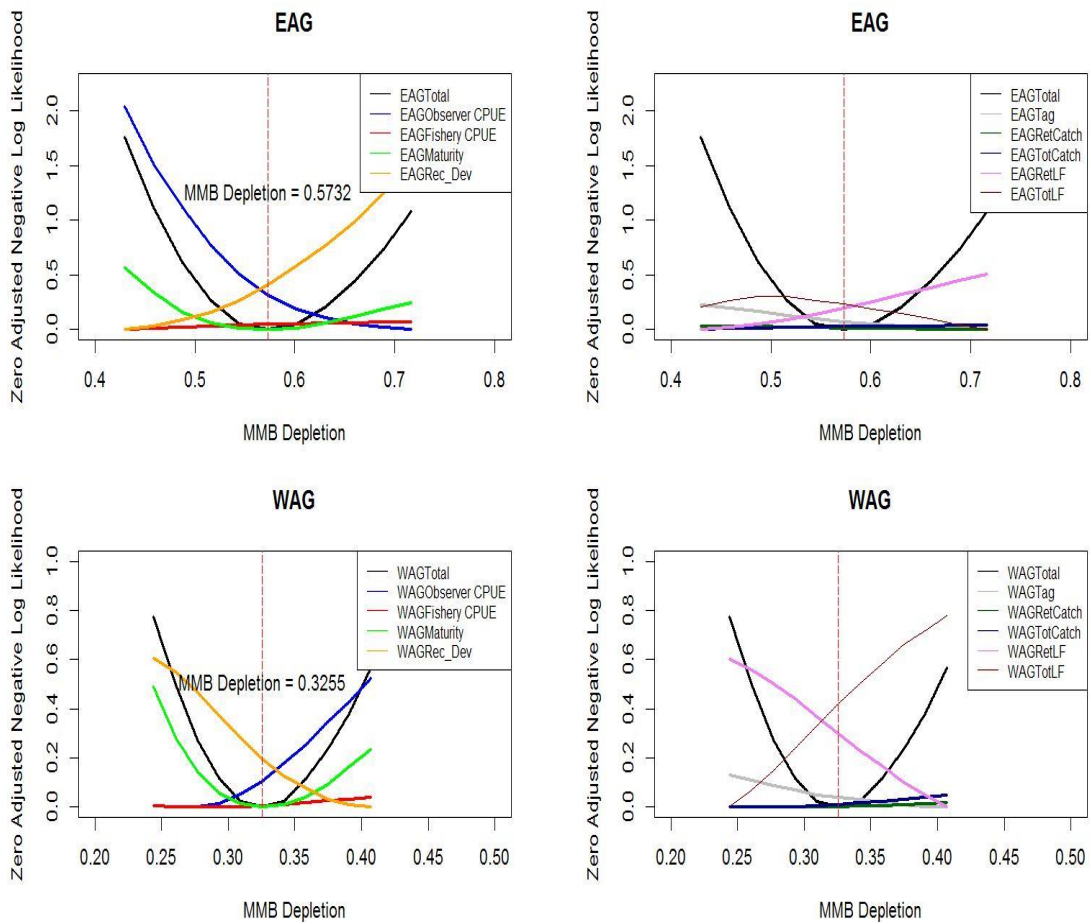


Figure 8. Total and components negative log-likelihoods vs. MMB depletion (i.e., MMB_{2015}/MMB_{1960}) for **scenario 1** model fit to **EAG** and **WAG** data, respectively. The negative log likelihood values were estimated for fixed proportions of the scenario 1 estimate of MMB depletion and they were zero adjusted.

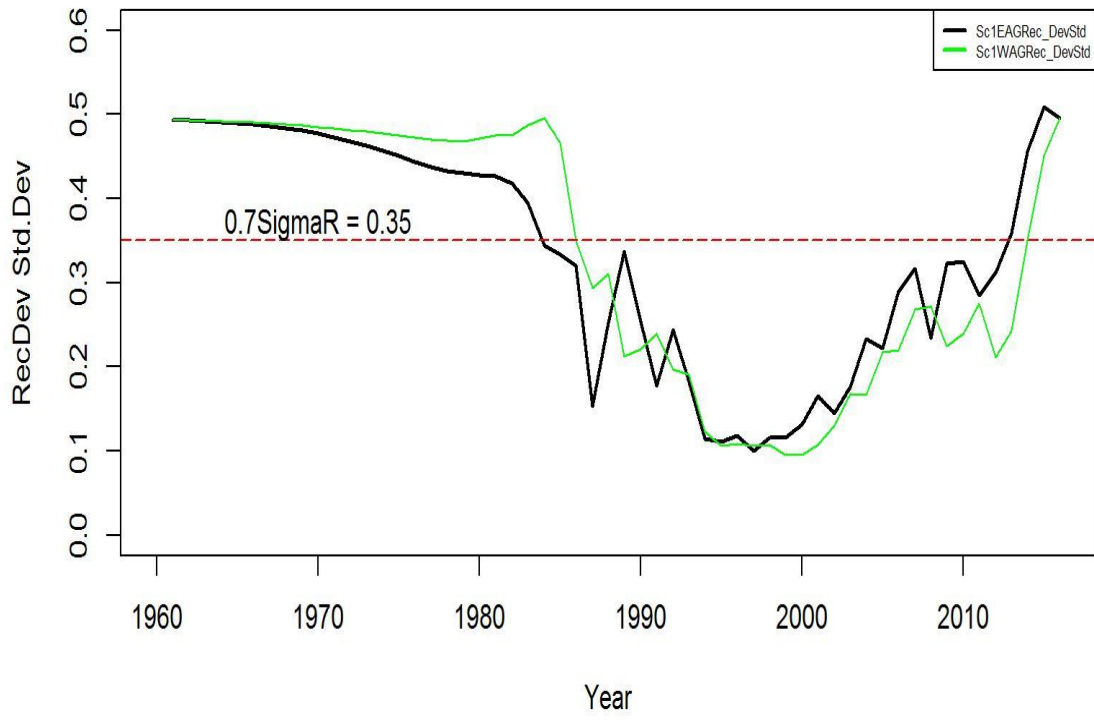


Figure 9. Standard deviation of recruit_dev plot for **EAG** and **WAG**. The mean recruit for years with standard deviation less than 0.7 sigma R was used to initialize model. We selected the 1987–2012 period for mean recruit estimation.

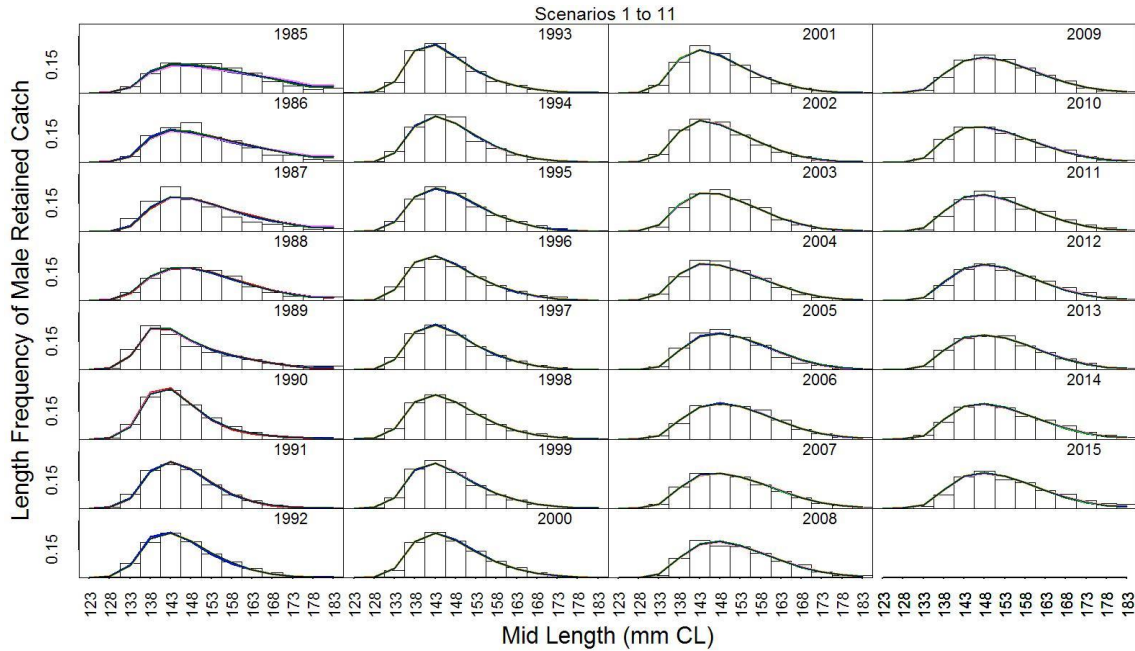


Figure 10. Predicted (line) vs. observed (bar) retained catch relative length frequency distributions under scenarios 1 (black line), 2 (orange line), 3 (red line), 4 (blue line), 5 (violet line), 6 (dark green line), 9 (green line), 10 (dark red line), and 11 (dark blue line) for golden king crab in the **EAG**, 1985/86 to 2015/16. This color scheme is used in all other graphs.

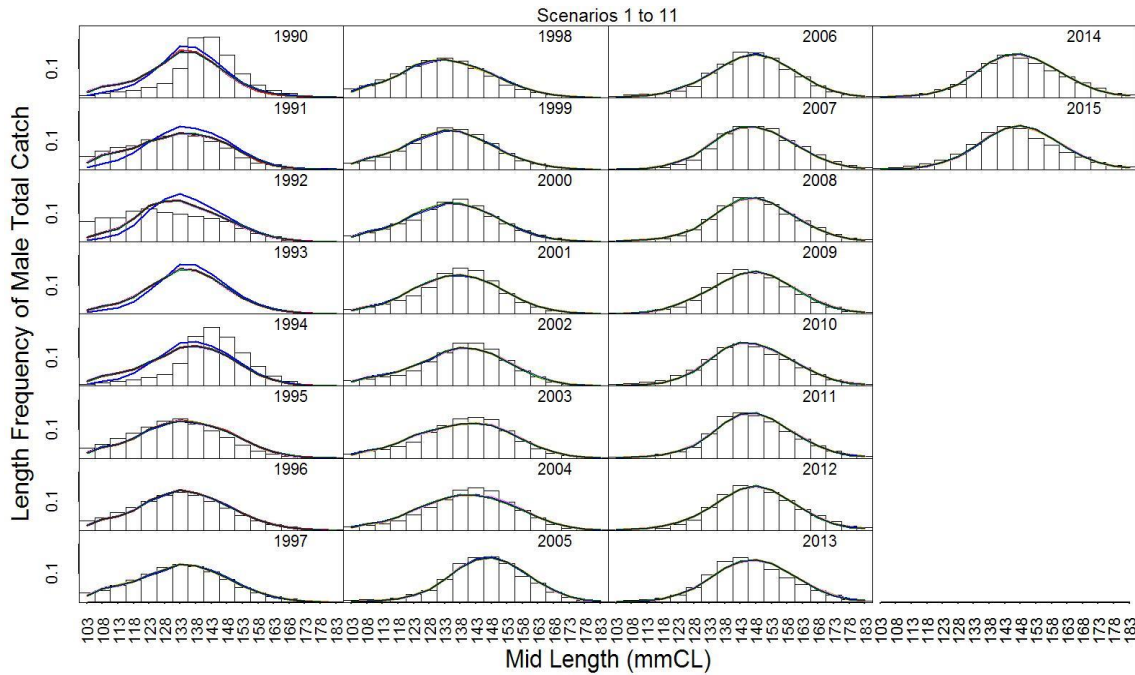


Figure 11. Predicted (line) vs. observed (bar) total catch relative length frequency distributions under scenarios 1 to 11 for golden king crab in the **EAG**, 1990/91 to 2015/16.

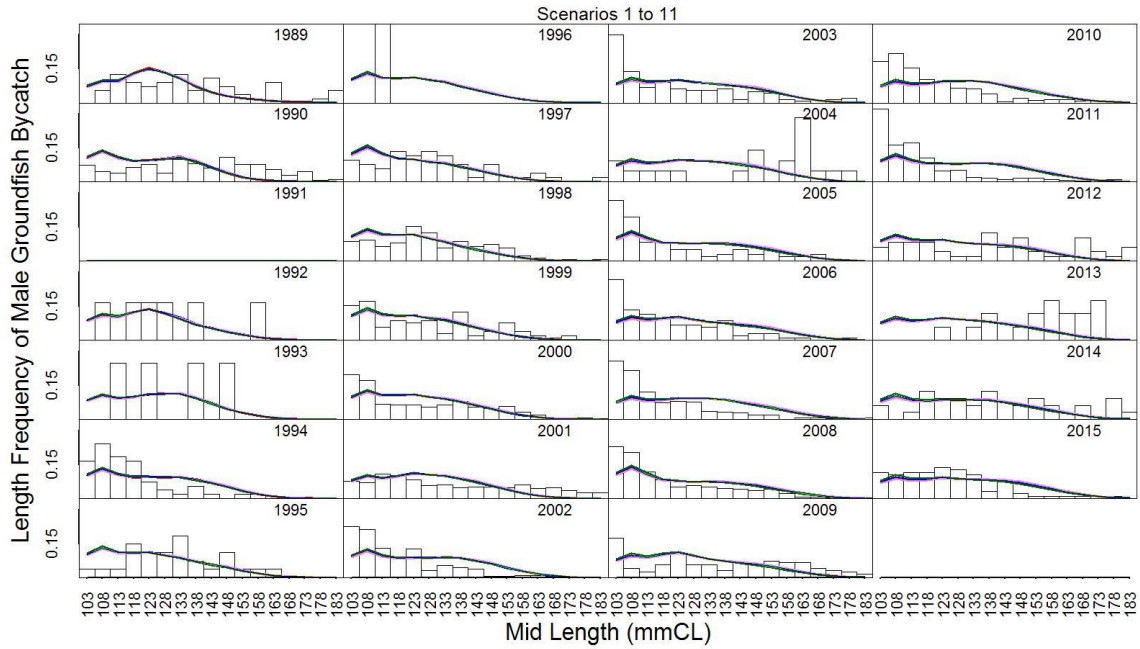


Figure 12. Predicted (line) vs. observed (bar) groundfish (or trawl) discarded bycatch relative length frequency distributions under scenarios 1 to 11 for golden king crab in the **EAG**, 1989/90 to 2015/16. Note that this data set was not used in the model fitting.

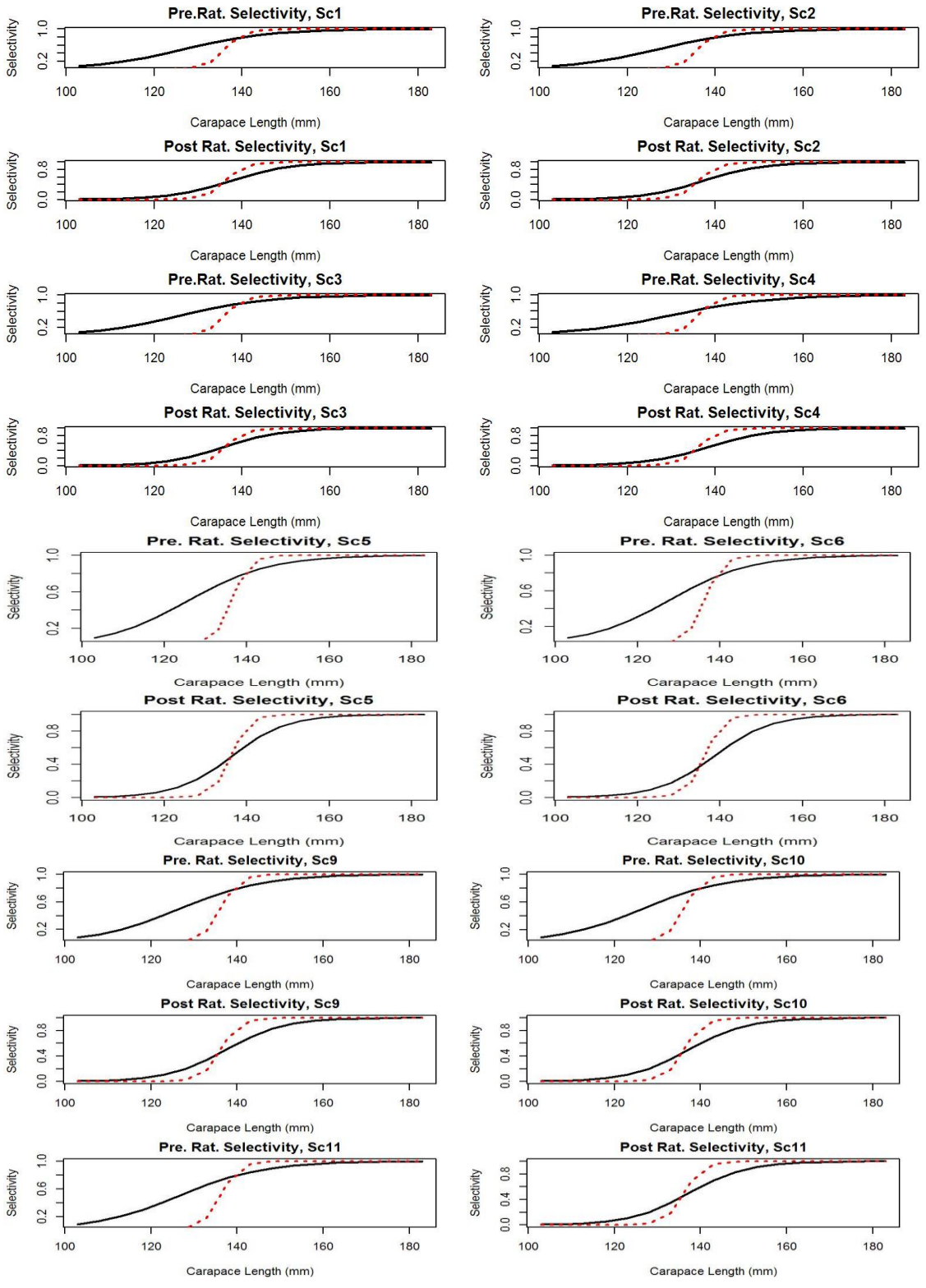


Figure 13. Estimated total (black solid line) and retained selectivity (red dotted line) for pre- and post-rationalization periods under scenarios 1 to 11 fits to golden king crab data in the **EAG**.

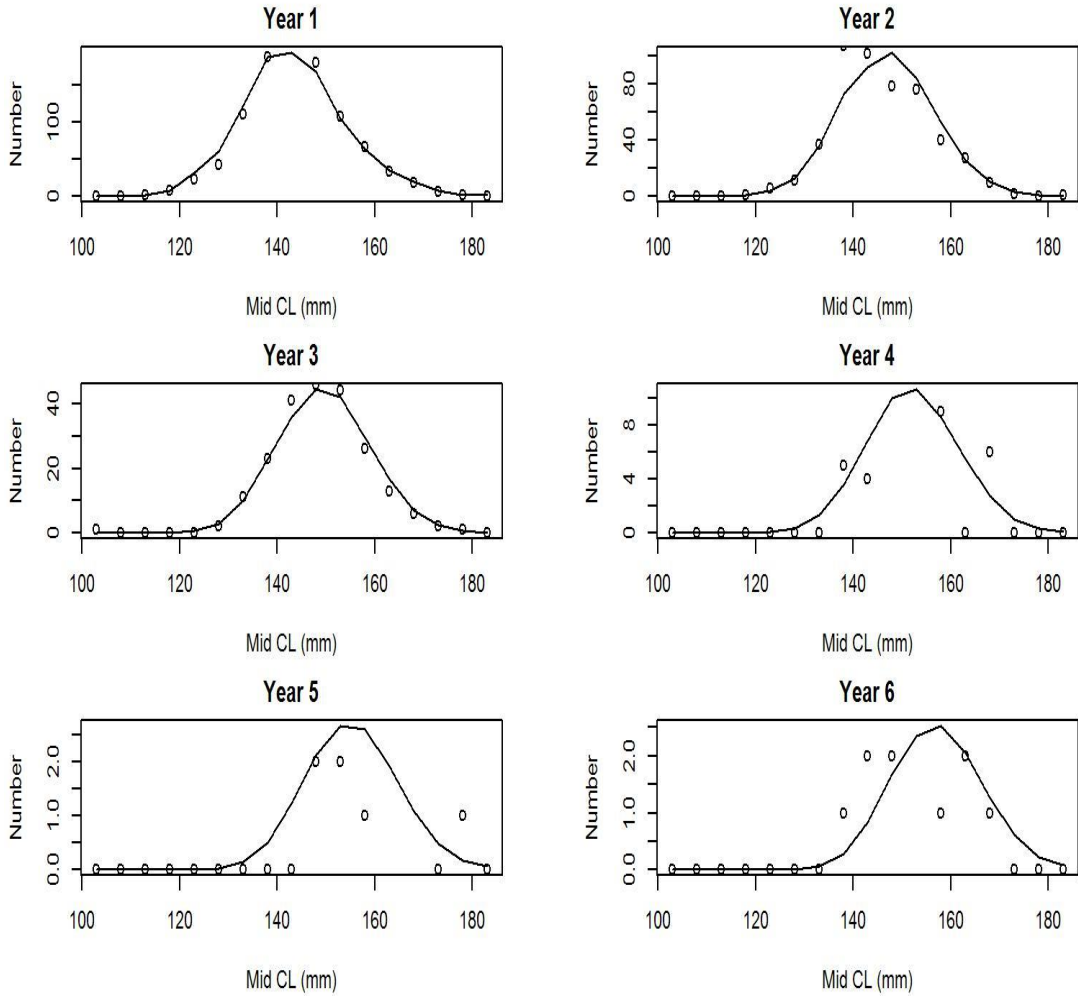


Figure 14. Observed (open circles) vs. predicted (solid line) tag recaptures by size bin for years 1 to 6 recaptures under scenario 1 for **EAG** golden king crab.

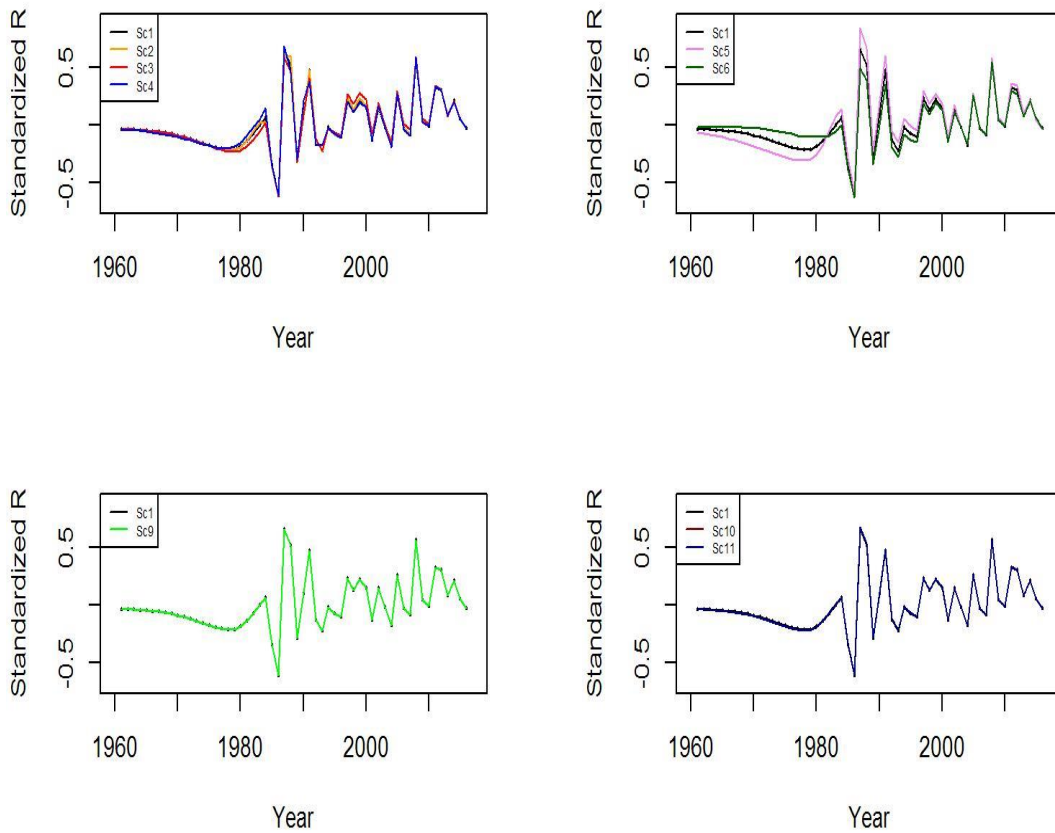


Figure 15. Estimated number of male recruits (crab size ≥ 101 mm CL) to the assessment model under scenarios (Sc) 1 to 11 for **EAG** golden king crab data, 1961–2016. Top left: scenarios 1 to 4; top right: scenarios 1, 5, and 6; bottom left: scenarios 1 and 9; and bottom right: scenarios 1, 10, and 11. This grouping scheme was used in a number of subsequent figures. The number of recruits are centralized using $(R - \text{mean } R) / \text{mean } R$ for comparing different scenarios' results.

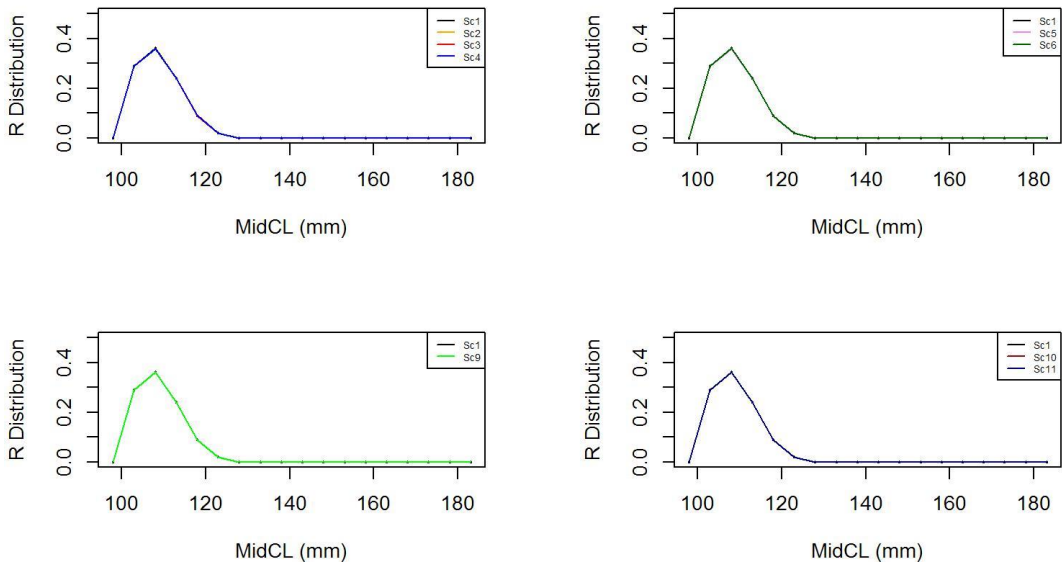


Figure 16. Recruit size distribution to the assessment model under scenarios (Sc) 1 to 11 for **EAG** golden king crab.

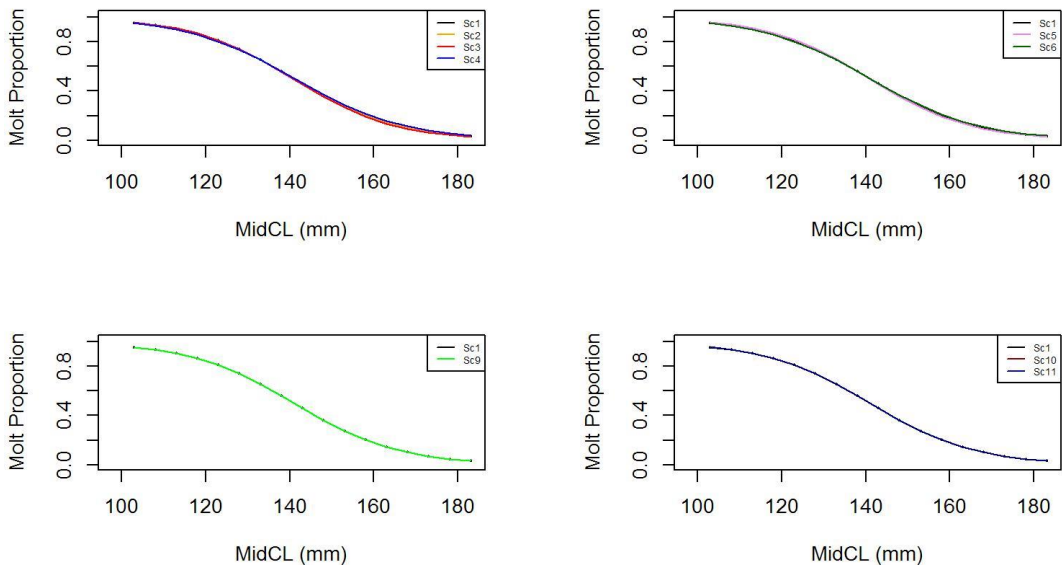


Figure 17. Estimated molt probability vs. carapace length of golden king crab for scenarios (Sc) 1 to 11 in the **EAG**.

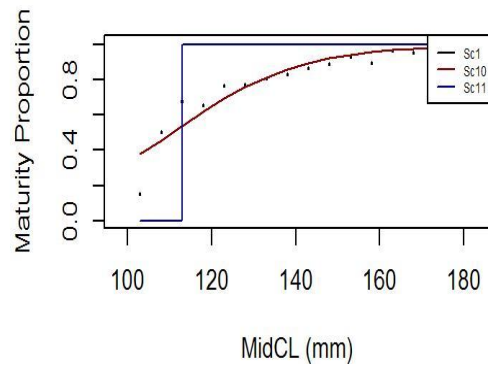
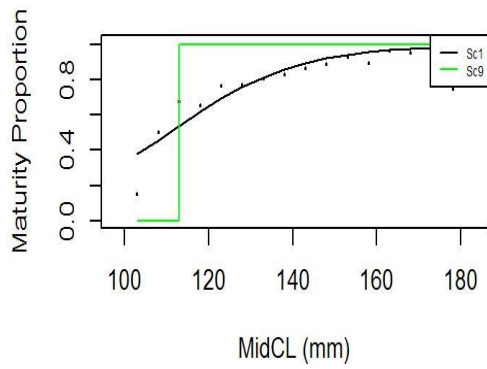
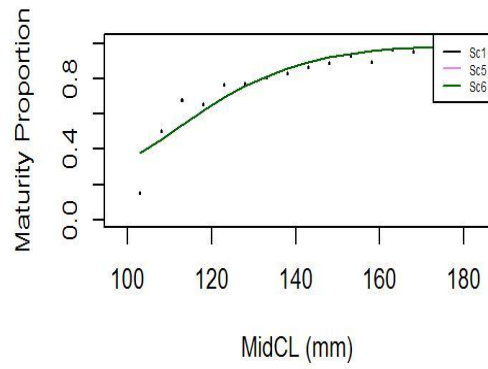
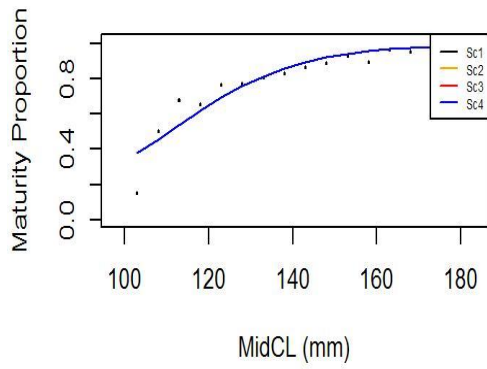
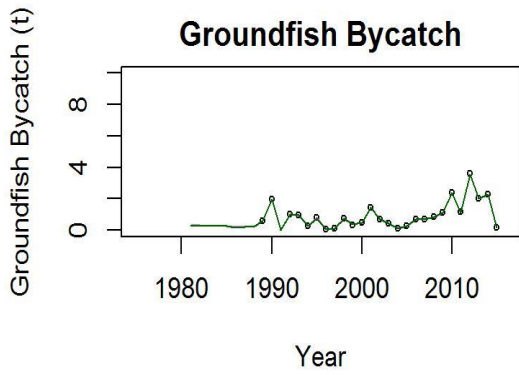
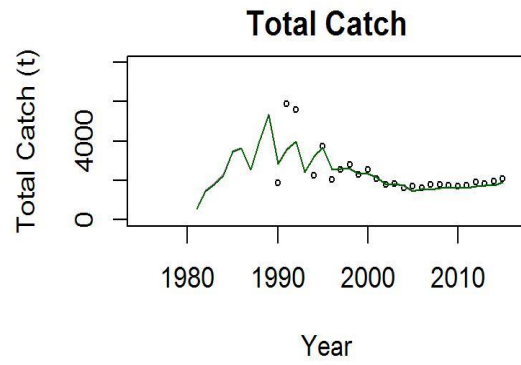
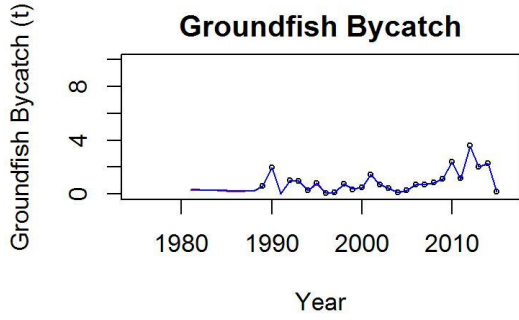
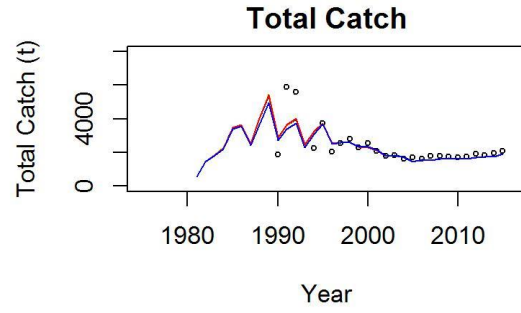
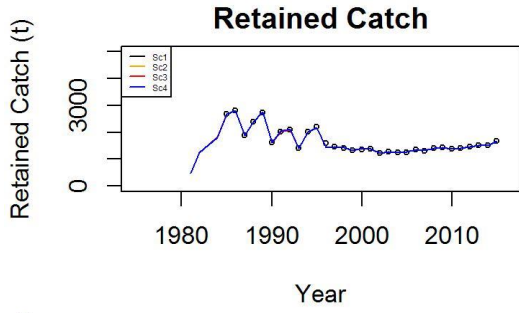


Figure 18. Estimated maturity probability vs. carapace length of golden king crab for scenarios (Sc) 1 to 11 in the **EAG**.



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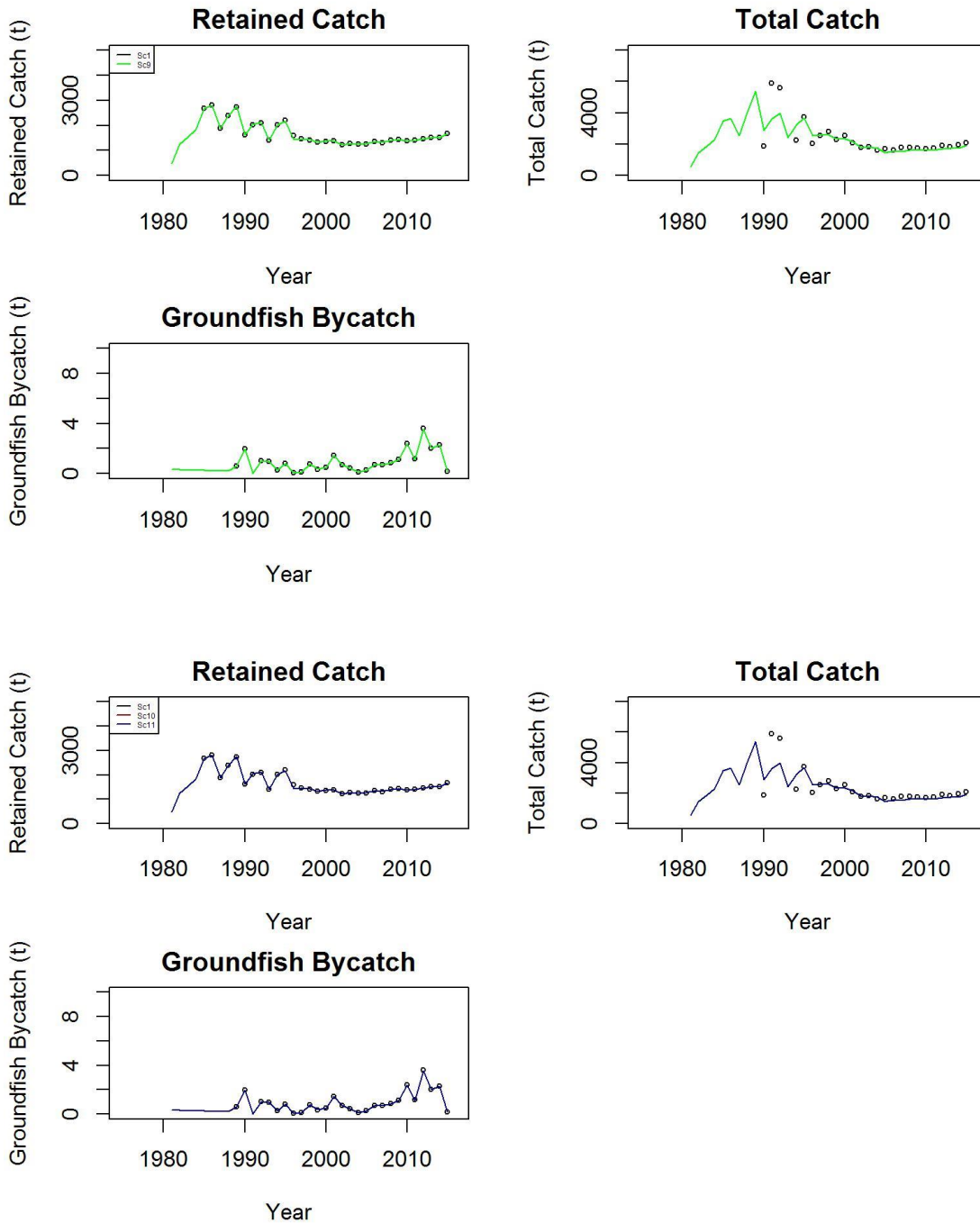


Figure 19. Observed (open circle) vs. predicted (solid line) retained catch (top left in each scenario set), total catch (top right in each scenario set), and groundfish bycatch (bottom left in each scenario set) of golden king crab for scenarios (Sc) 1 to 11, in **EAG**, 1985–2015.

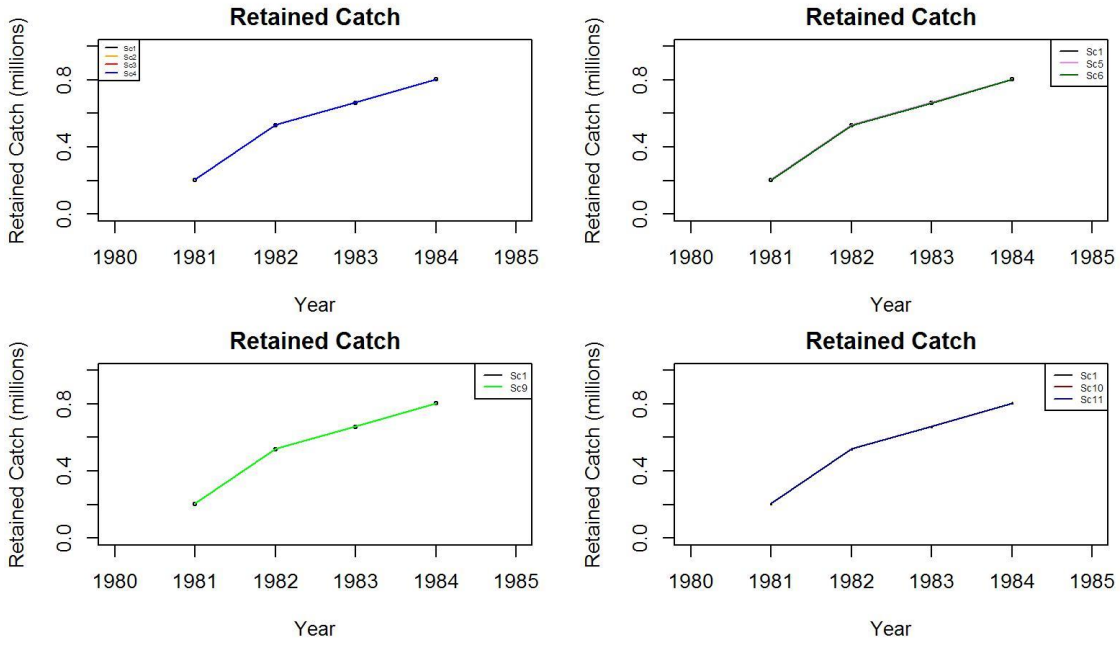


Figure 20. Observed (open circle) vs. predicted (solid line) retained catch of golden king crab for scenarios (Sc) 1 to 11 fits in the **EAG**, 1981–1984. Note: Input retained catches to the model during pre-1985 fishery period were in number of crabs.

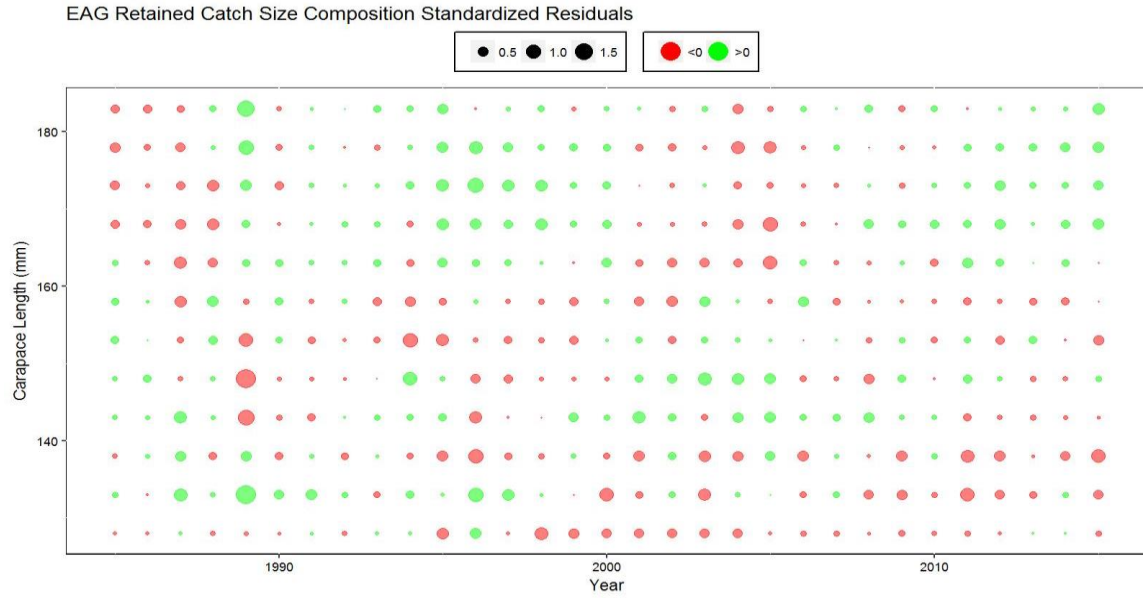


Figure 21. Bubble plot of standardized residuals of retained catch length composition for scenario 1 fit for **EAG** golden king crab, 1985/86–2015/16. Green circles are the positive and pink circles are the negative standardized residuals. The area of the circle is the relative magnitude of the residual.

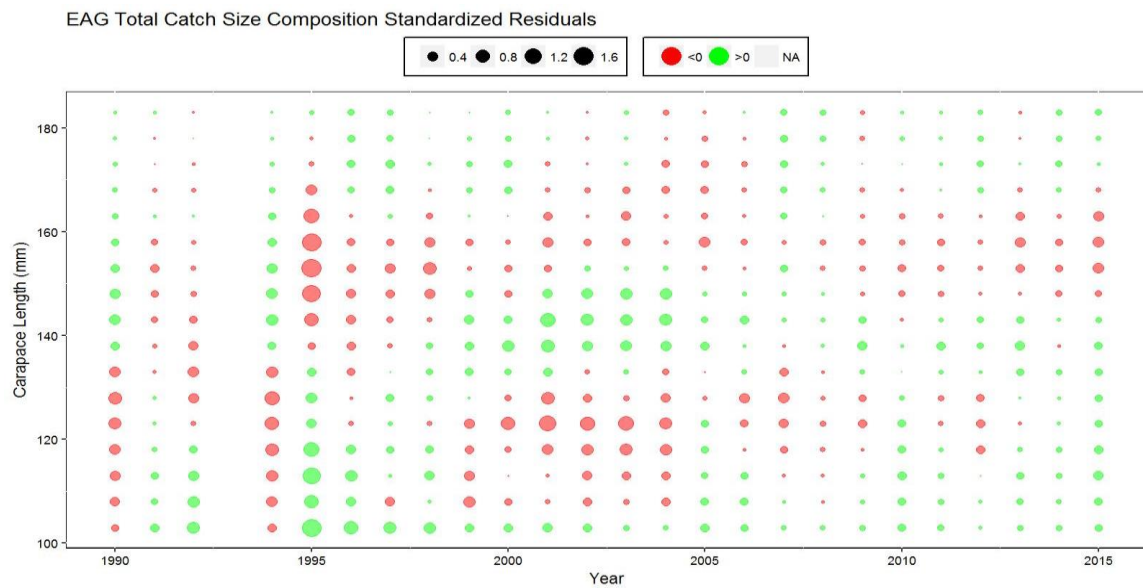


Figure 22 Bubble plot of standardized residuals of total catch length composition for scenario 1 fit for **EAG** golden king crab, 1990/91–2015/16. Green circles are the positive and pink circles are the negative standardized residuals. The area of the circle is the relative magnitude of the residual.

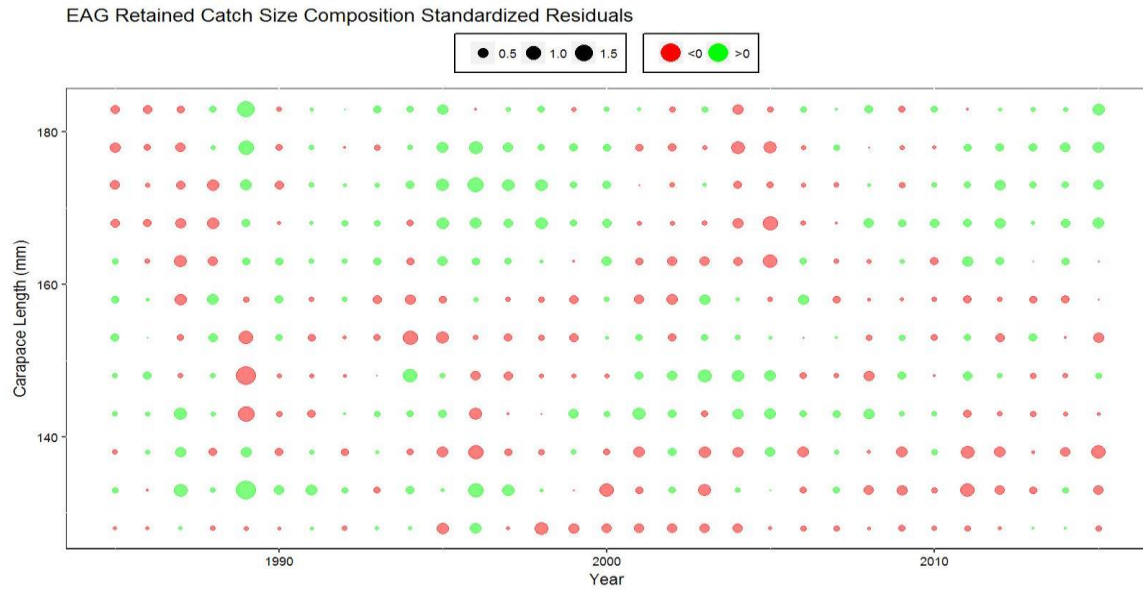


Figure 23. Bubble plot of standardized residuals of retained catch length composition for scenario 9 fit for **EAG** golden king crab, 1985/86–2015/16. Blue circles are the positive and pink circles are the negative standardized residuals. The area of the circle is the relative magnitude of the residual.

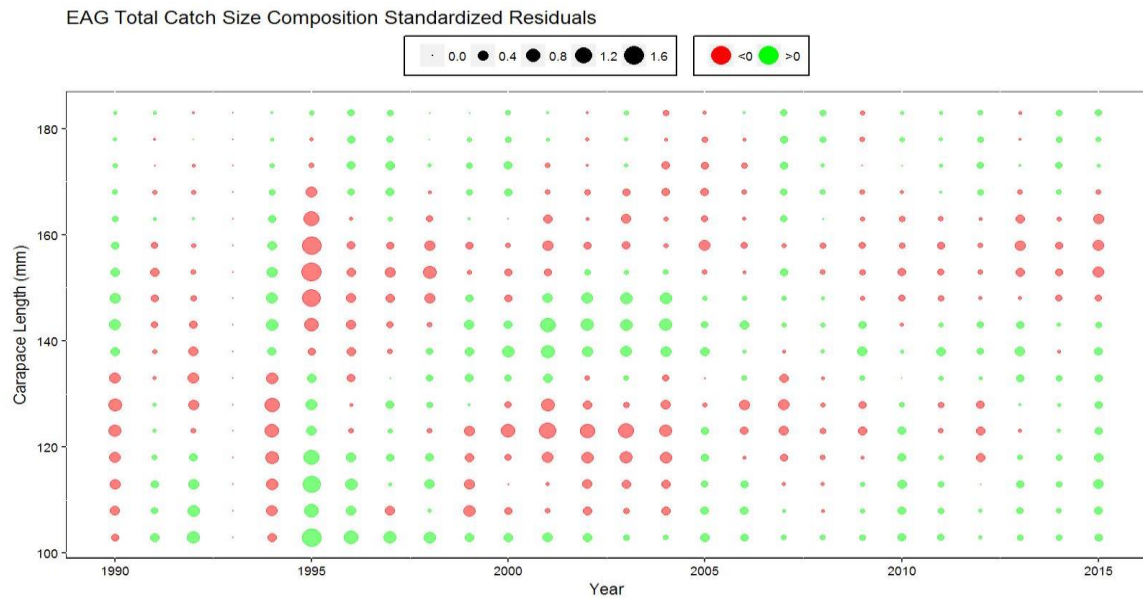


Figure 24. Bubble plot of standardized residuals of total catch length composition for scenario 9 fit for **EAG** golden king crab, 1990/91–2015/16. Blue circles are the positive and pink circles are the negative standardized residuals. The area of the circle is the relative magnitude of the residual.

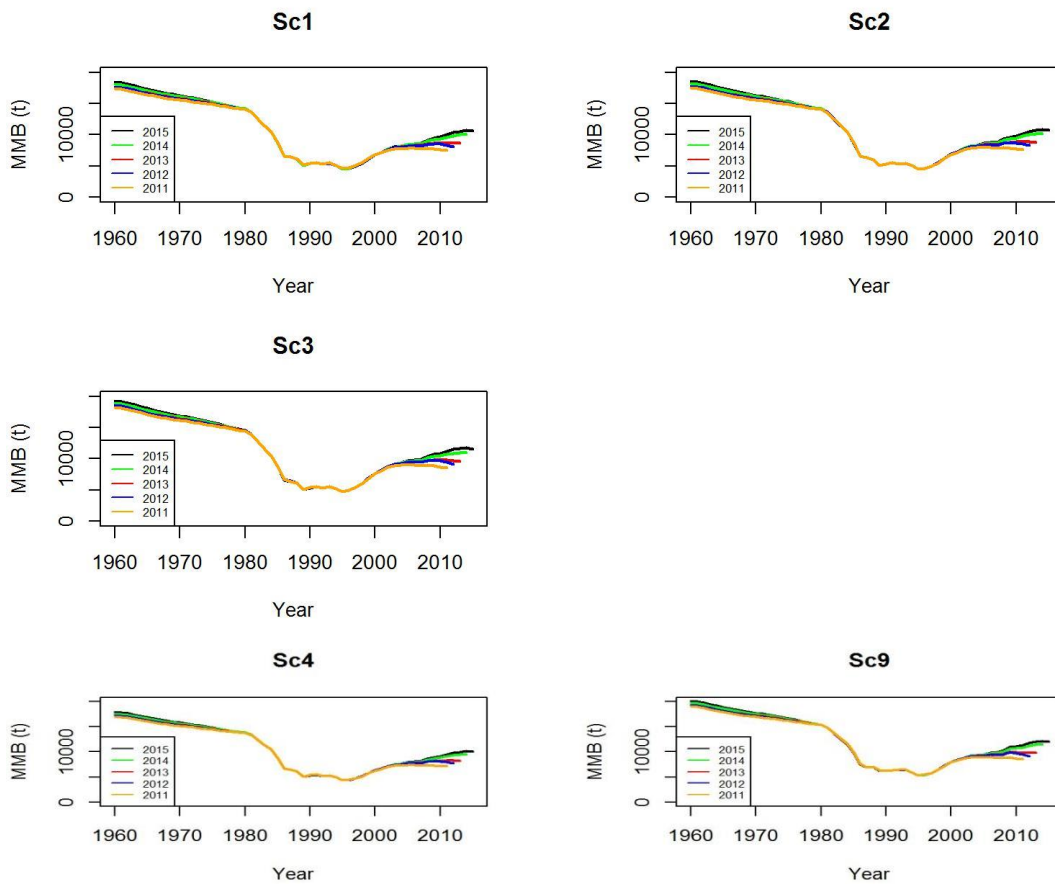


Figure 25. Retrospective fits of MMB by the model following removal of terminal year data under scenarios (Sc) 1 to 9 for golden king crab in the **EAG**, 1960–2015.

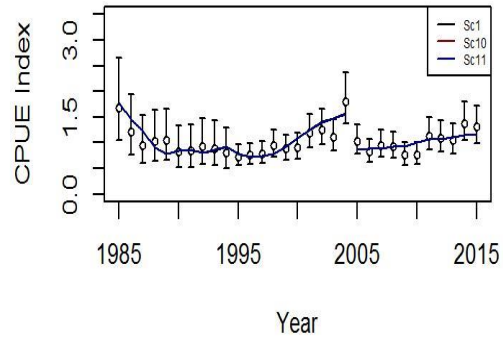
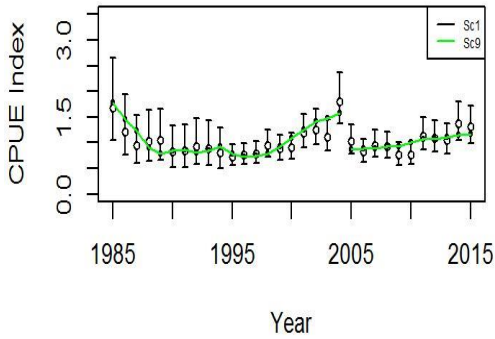
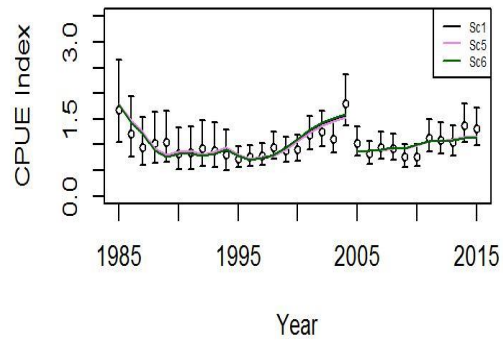
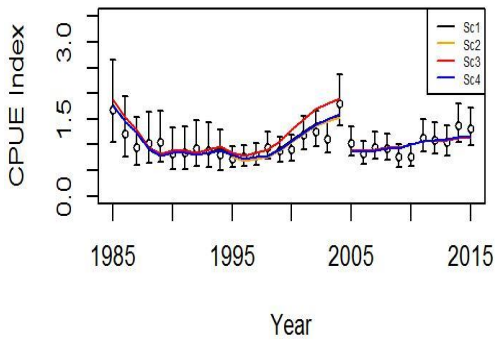


Figure 26. Comparison of input CPUE indices (open circles with ± 2 SE) with predicted CPUE indices (colored solid lines) under scenarios (Sc) 1 to 11 for **EAG** golden king crab data, 1985/86–2015/16. Model estimated additional standard error was added to each input standard error.

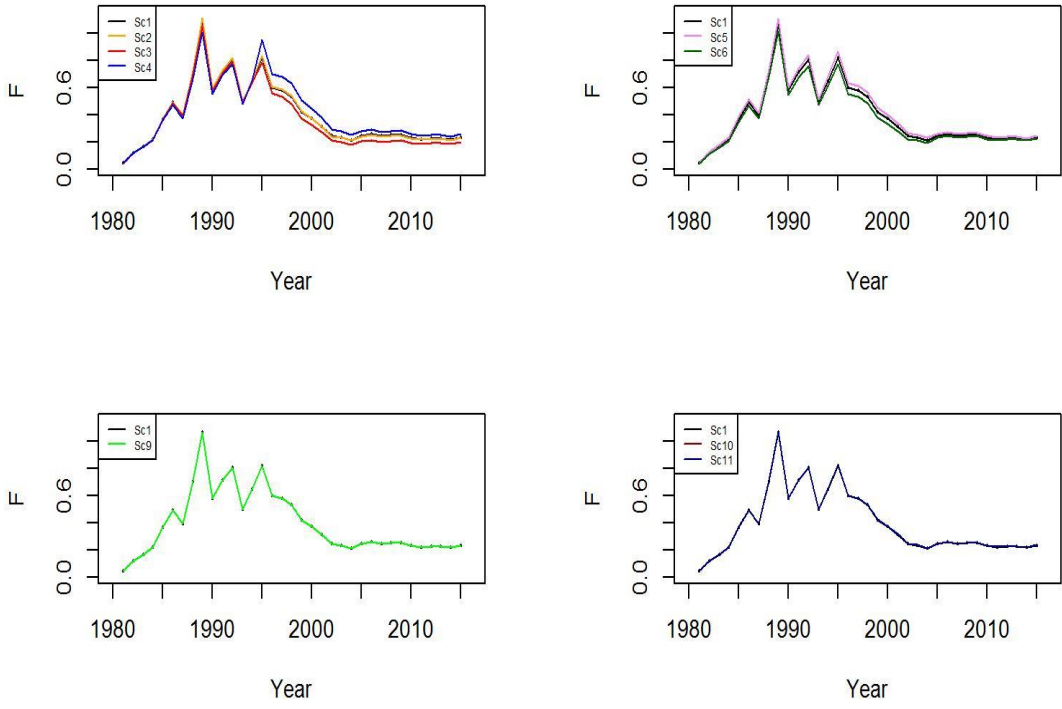


Figure 27. Trends in pot fishery full selection total fishing mortality of golden king crab for scenarios (Sc) 1 to 11 model fits in the **EAG**, 1981–2015.

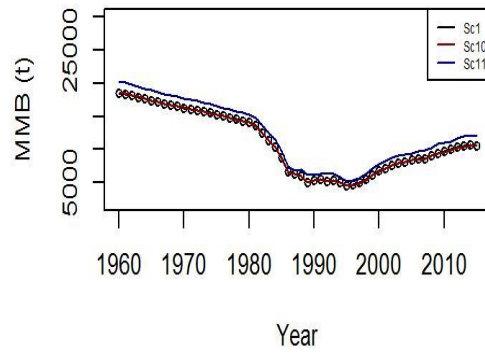
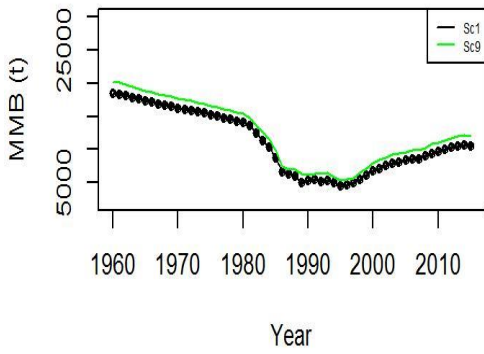
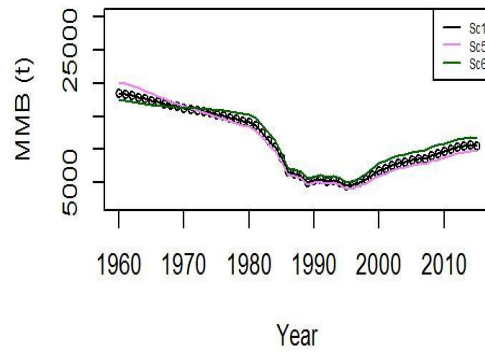
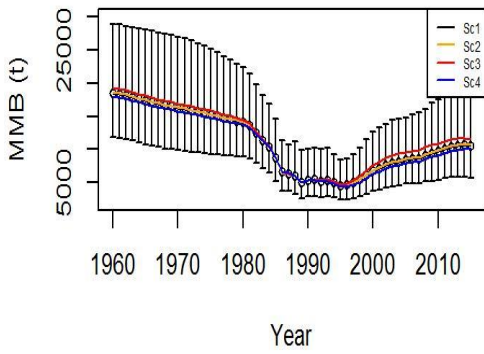


Figure 28. Trends in golden king crab mature male biomass for scenarios (Sc) 1 to 11 fits in the **EAG**, 1960/61–2015/16. Scenario 1 estimates have two standard errors confidence limits.

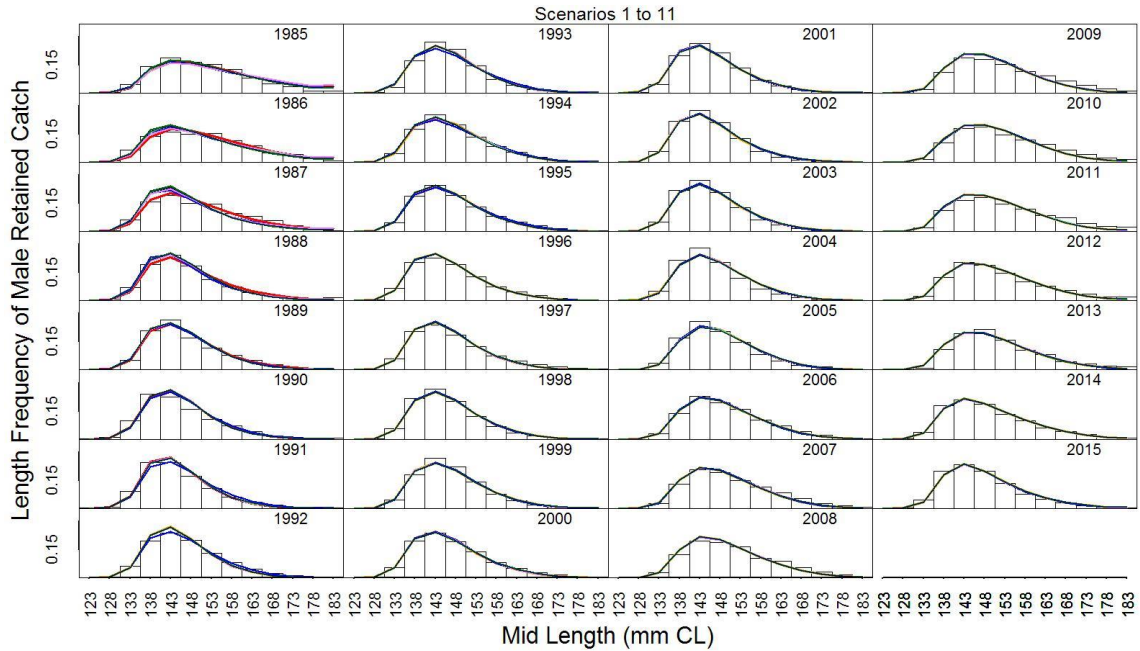


Figure 29. Predicted (line) vs. observed (bar) retained catch relative length frequency distributions under scenarios 1 (black line), 2 (orange line), 3 (red line), 4 (blue line), 5 (violet line), 6 (dark green line), 9 (green line), 10 (dark red line), and 11 (dark blue line) for golden king crab in the **WAG**, 1985/86 to 2015/16. This color scheme is used in all other graphs.

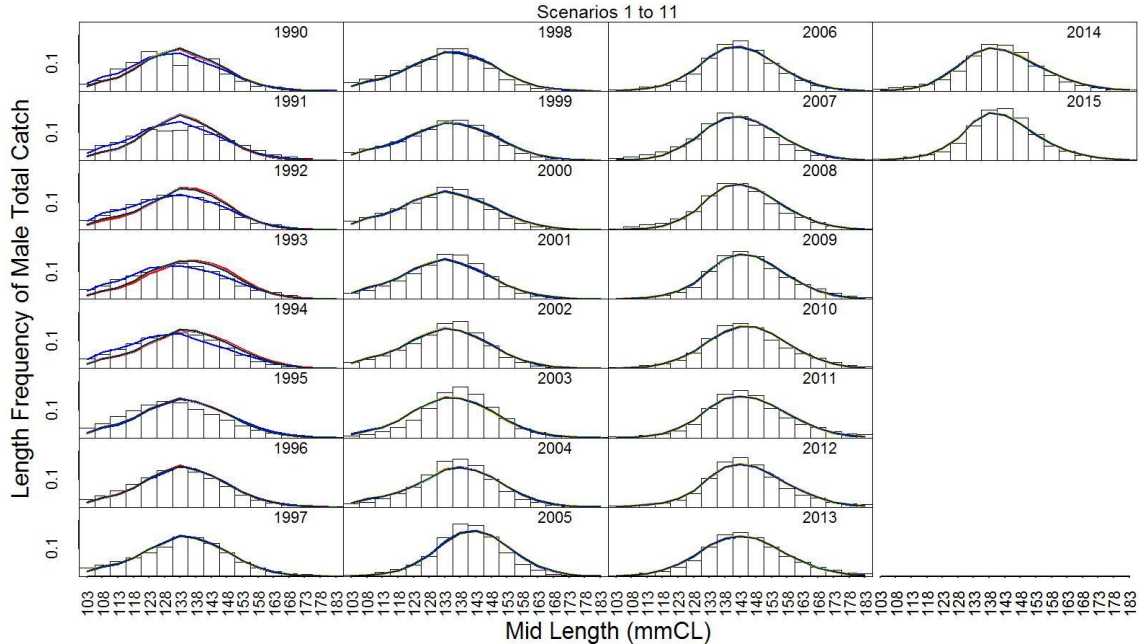


Figure 30. Predicted (line) vs. observed (bar) total catch relative length frequency distributions under scenarios 1 to 11 for golden king crab in the **WAG**, 1990/91 to 2015/16.

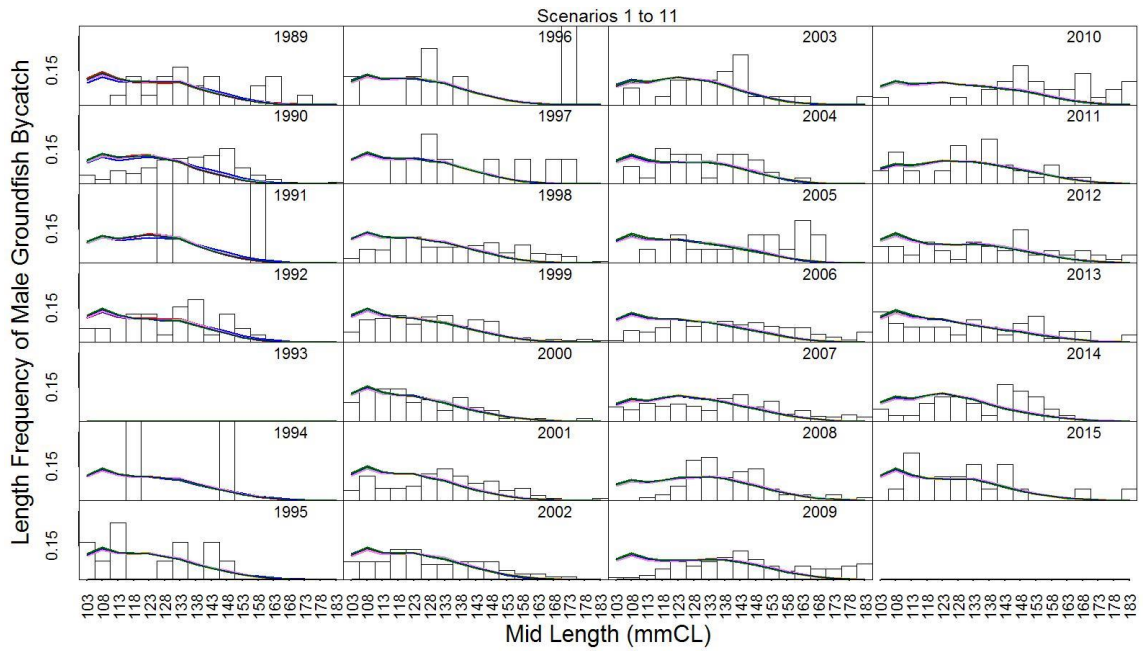


Figure 31. Predicted (line) vs. observed (bar) groundfish (or trawl) discarded bycatch relative length frequency distributions under scenarios 1 to 11 for golden king crab in the **WAG**, 1989/90 to 2015/16. Note that this data set was not used in the model fitting.

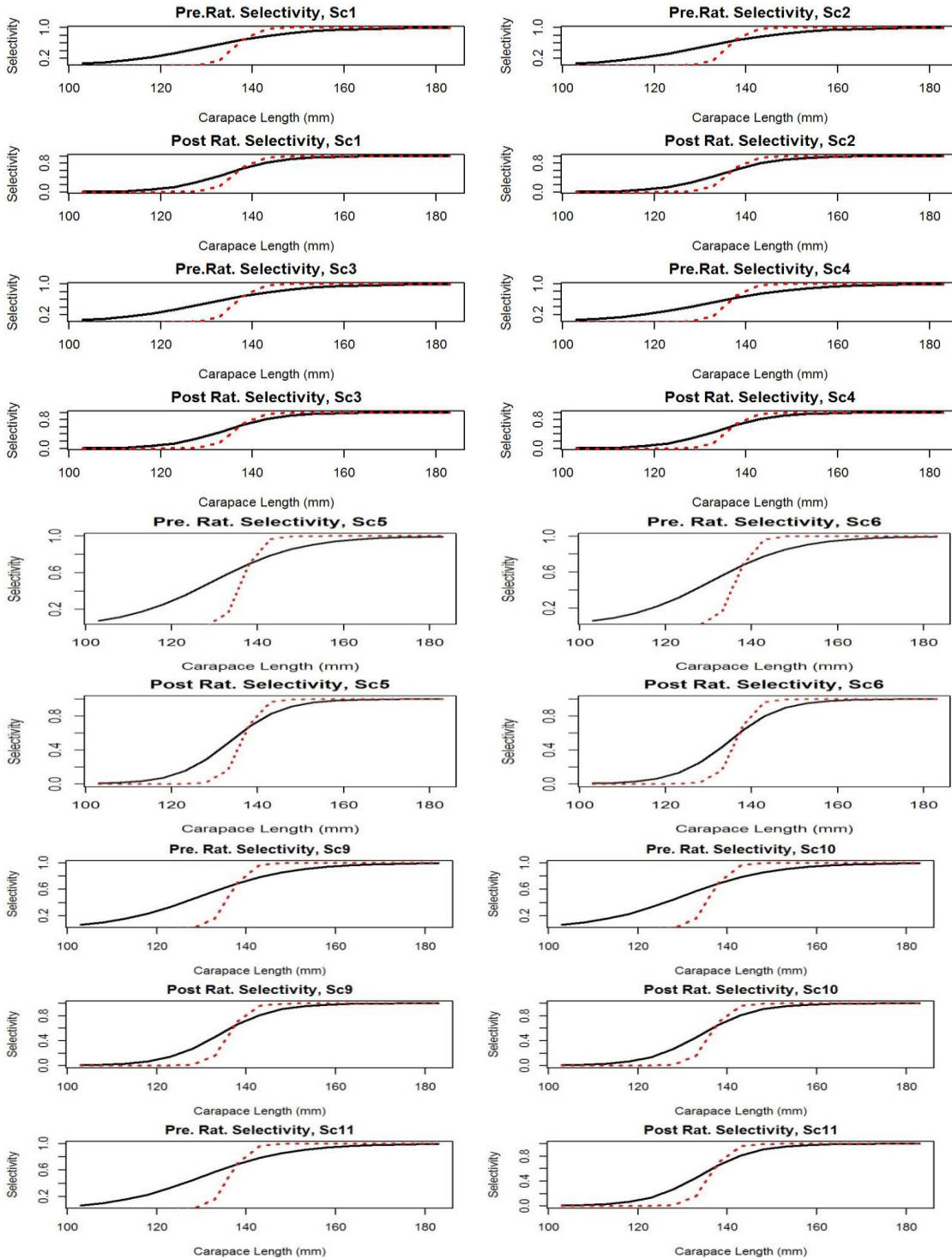


Figure 32. Estimated total (black solid line) and retained selectivity (red dotted line) for pre- and post-rationalization periods under scenarios 1 to 11 fits to golden king crab data in the **WAG**.

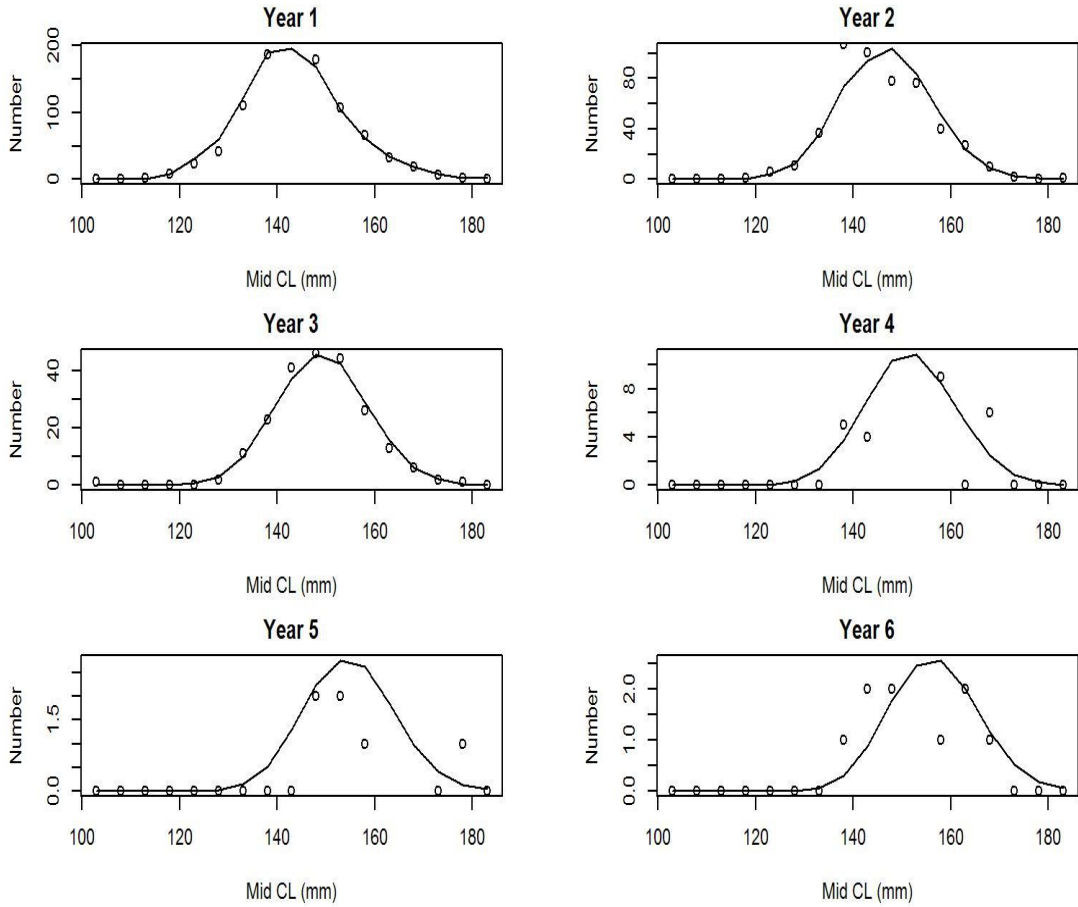


Figure 33. Observed (open circles) vs. predicted (solid line) tag recaptures by size bin for years 1 to 6 recaptures under scenario 1 for **WAG** golden king crab.

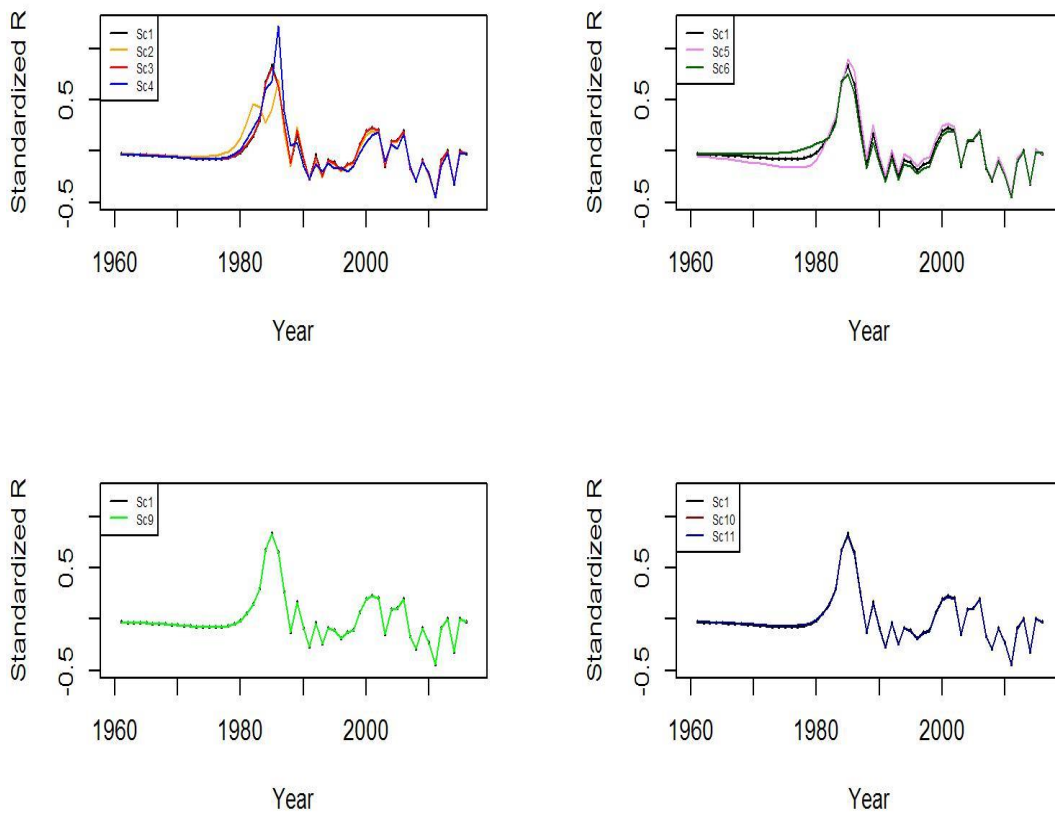


Figure 34. Estimated number of male recruits (crab size ≥ 101 mm CL) to the assessment model under scenarios (Sc) 1 to 11 for **WAG** golden king crab data, 1961–2016. Top left: scenarios 1 to 4; top right: scenarios 1, 5, and 6; bottom left: scenarios 1 and 9; and bottom right: scenarios 1, 10, and 11. The number of recruits are centralized using $(R - \text{mean } R) / \text{mean } R$ for comparing different scenarios' results.

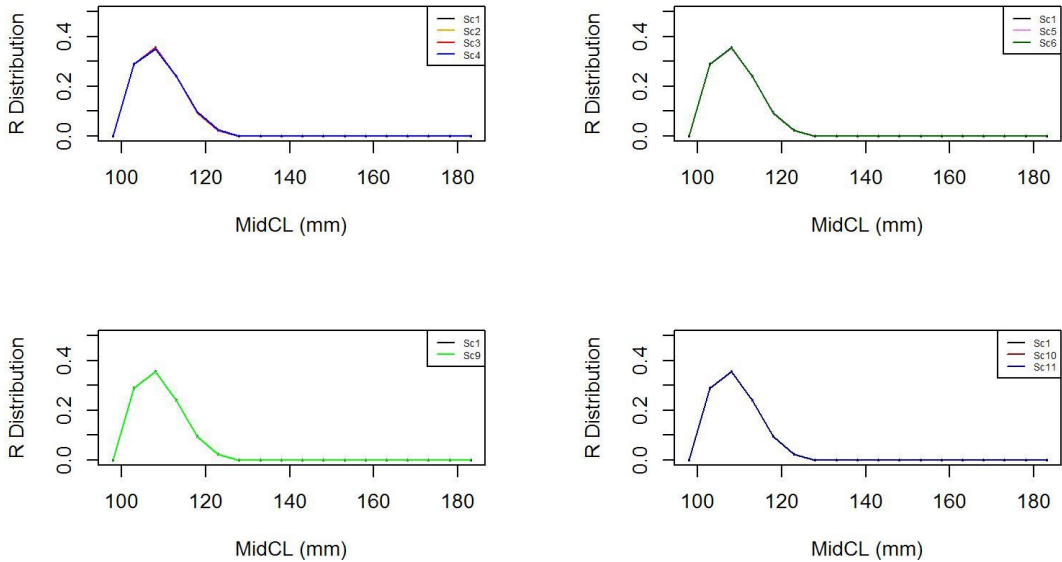


Figure 35. Recruit size distribution to the assessment model under scenarios (Sc) 1 to 11 for **WAG** golden king crab.

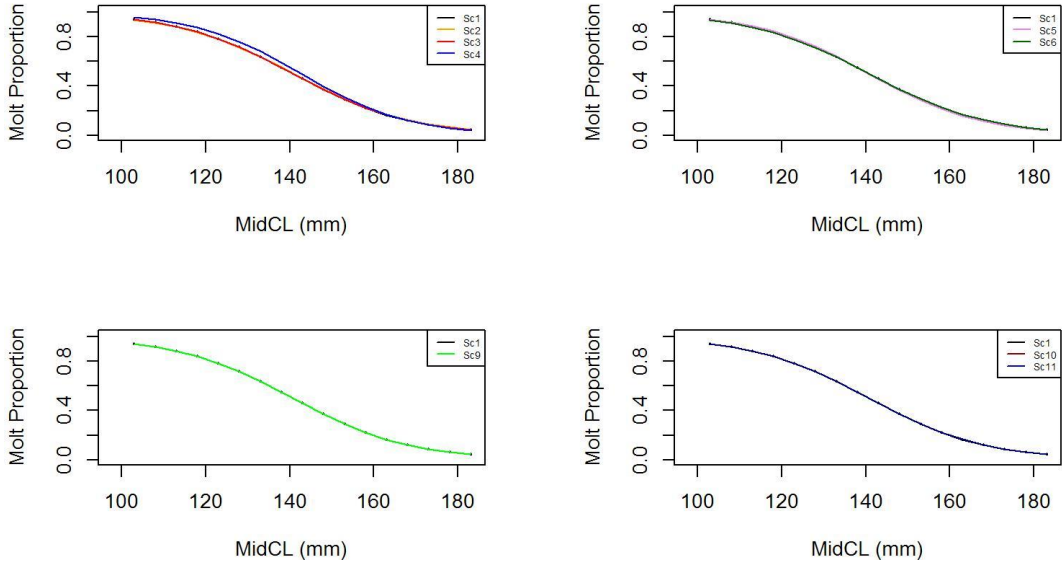


Figure 36. Estimated molt probability vs. carapace length of golden king crab for scenarios (Sc) 1 to 11 in the **WAG**.

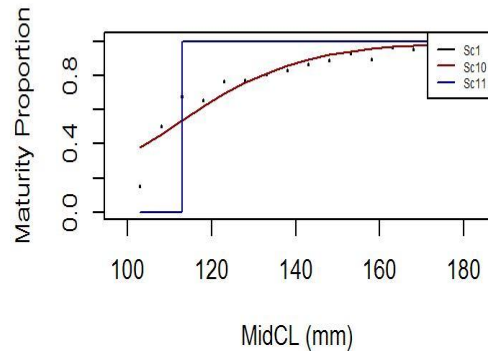
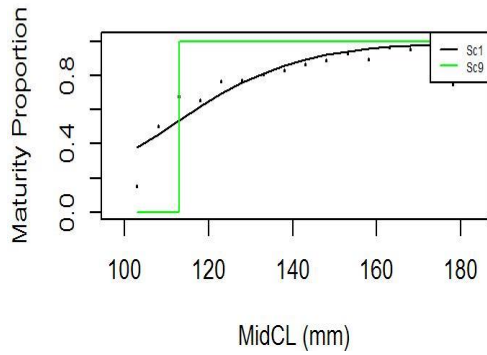
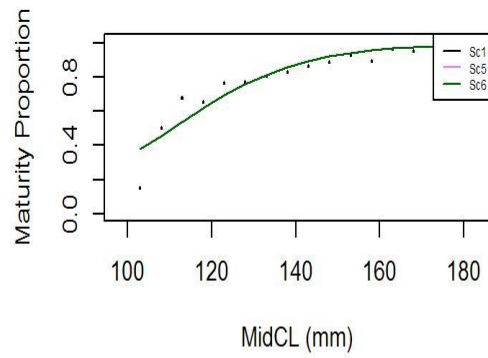
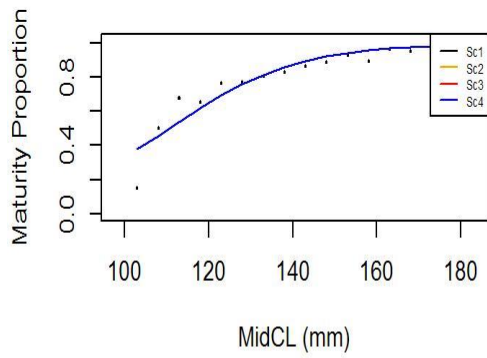
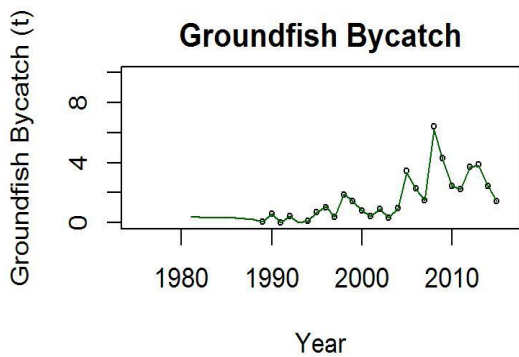
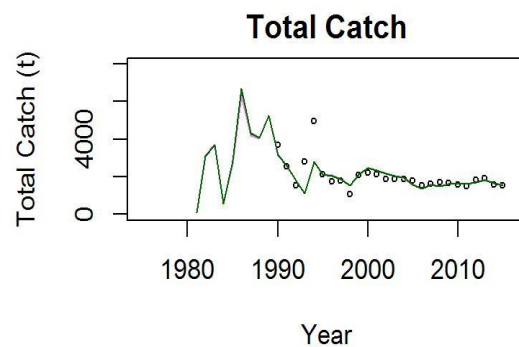
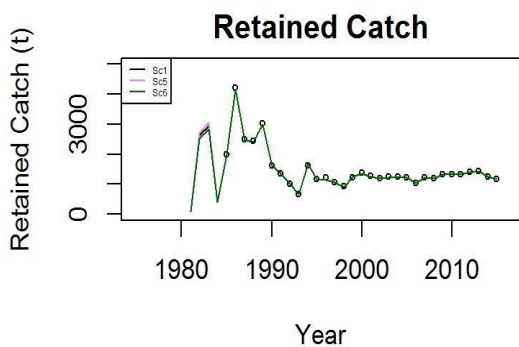
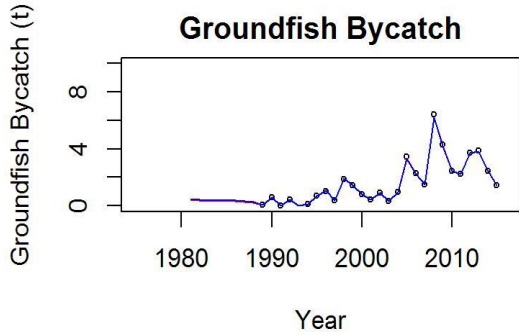
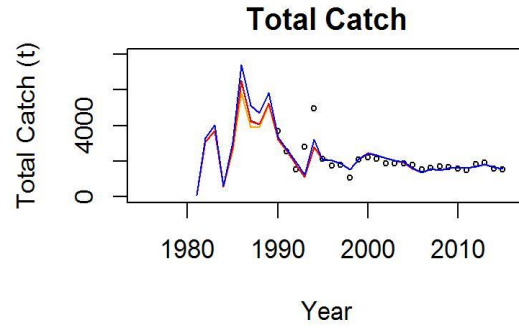
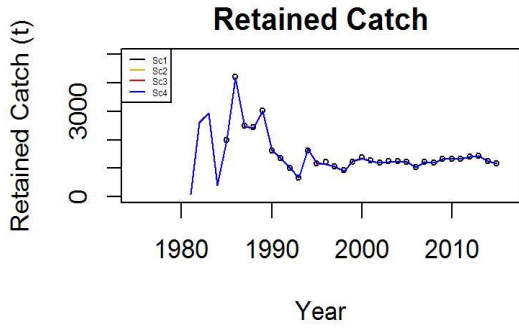


Figure 37. Estimated maturity probability vs. carapace length of golden king crab for scenarios (Sc) 1 to 11 in the **WAG**.



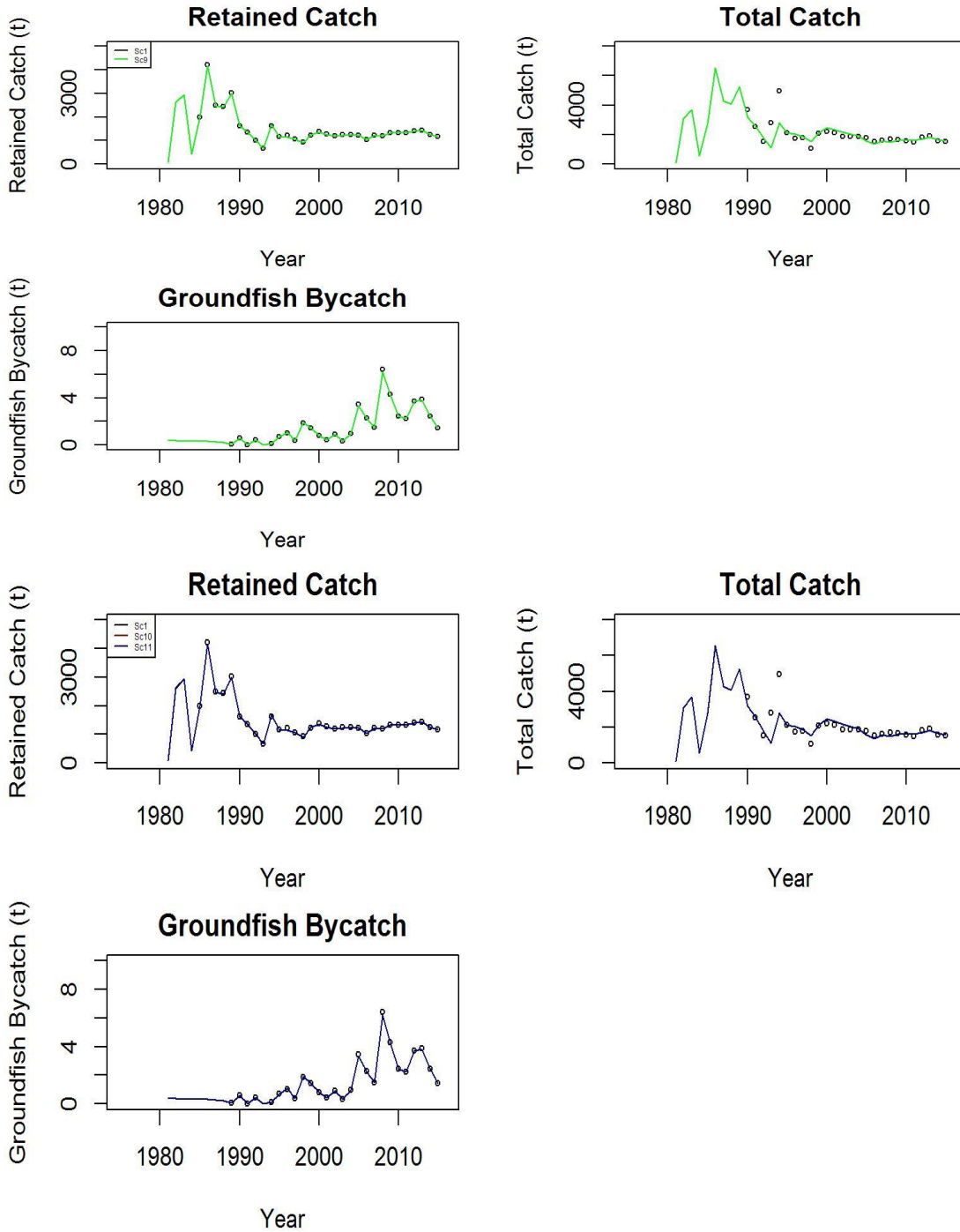


Figure 38. Observed (open circle) vs. predicted (solid line) retained catch (top left in each scenario set), total catch (top right in each scenario set), and groundfish bycatch (bottom left in each scenario set) of golden king crab for scenarios (Sc) 1 to 11, in **WAG**, 1985–2015.

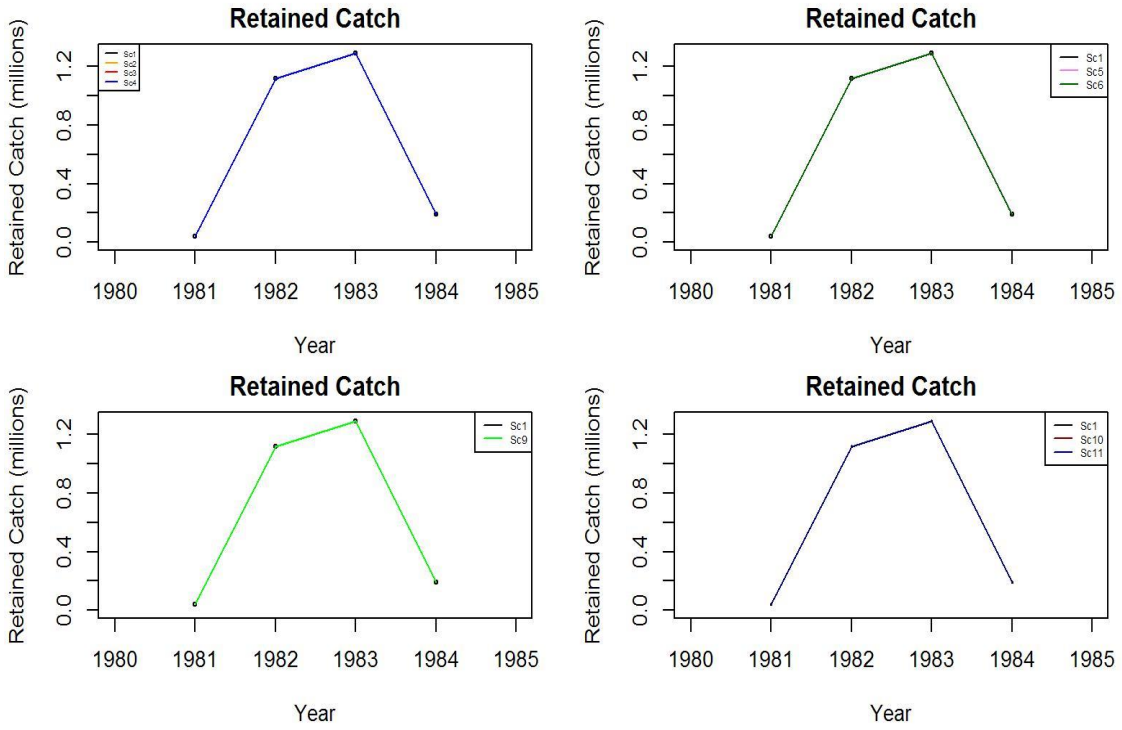


Figure 39. Observed (open circle) vs. predicted (solid line) retained catch of golden king crab for scenarios (Sc) 1 to 11 fits in the WAG, 1981–1984. Note: Input retained catches to the model during pre-1985 fishery period were in number of crabs.

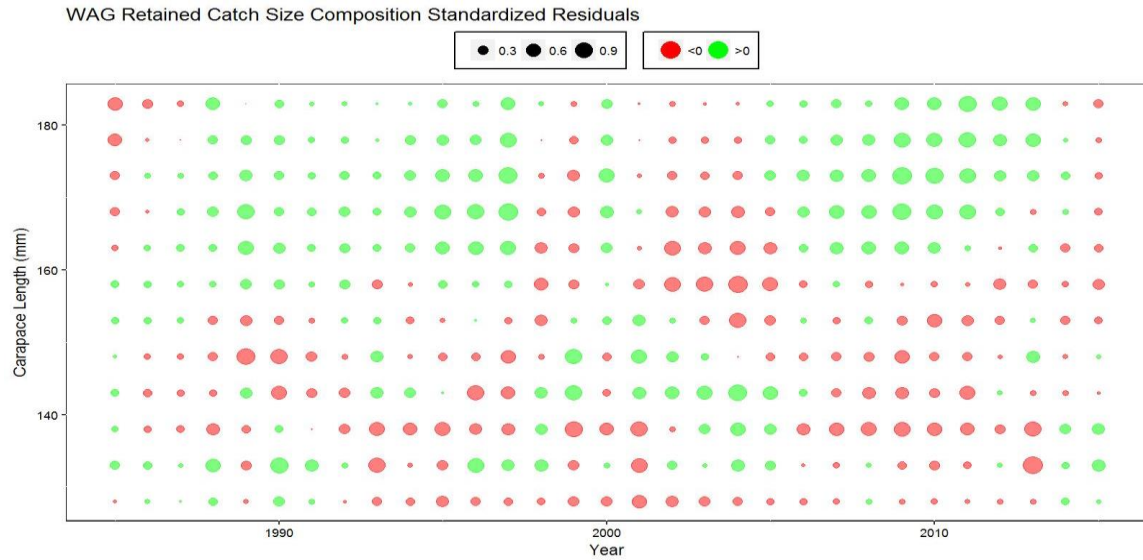


Figure 40. Bubble plot of standardized residuals of retained catch length composition for scenario 1 fit for **WAG** golden king crab, 1985/86–2015/16. Green circles are the positive and pink circles are the negative standardized residuals. The area of the circle is the relative magnitude of the residual.

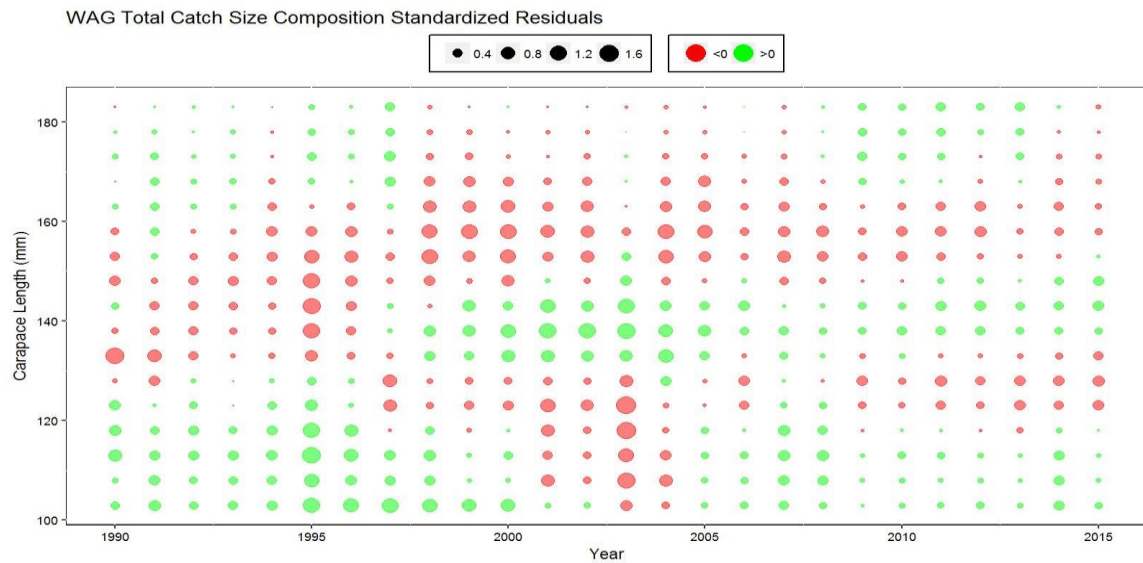


Figure 41. Bubble plot of standardized residuals of total catch length composition for scenario 1 fit for **WAG** golden king crab, 1990/91–2015/16. Green circles are the positive and pink circles are the negative standardized residuals. The area of the circle is the relative magnitude of the residual.

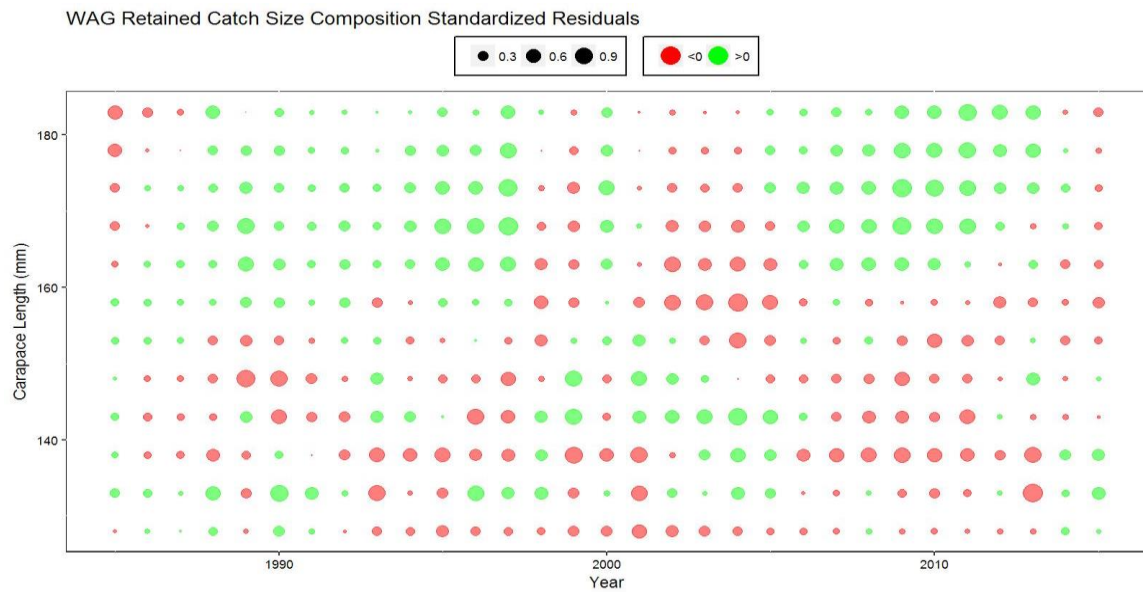


Figure 42. Bubble plot of standardized residuals of retained catch length composition for scenario 9 fit for **WAG** golden king crab, 1985/86–2015/16. Blue circles are the positive and pink circles are the negative standardized residuals. The area of the circle is the relative magnitude of the residual.

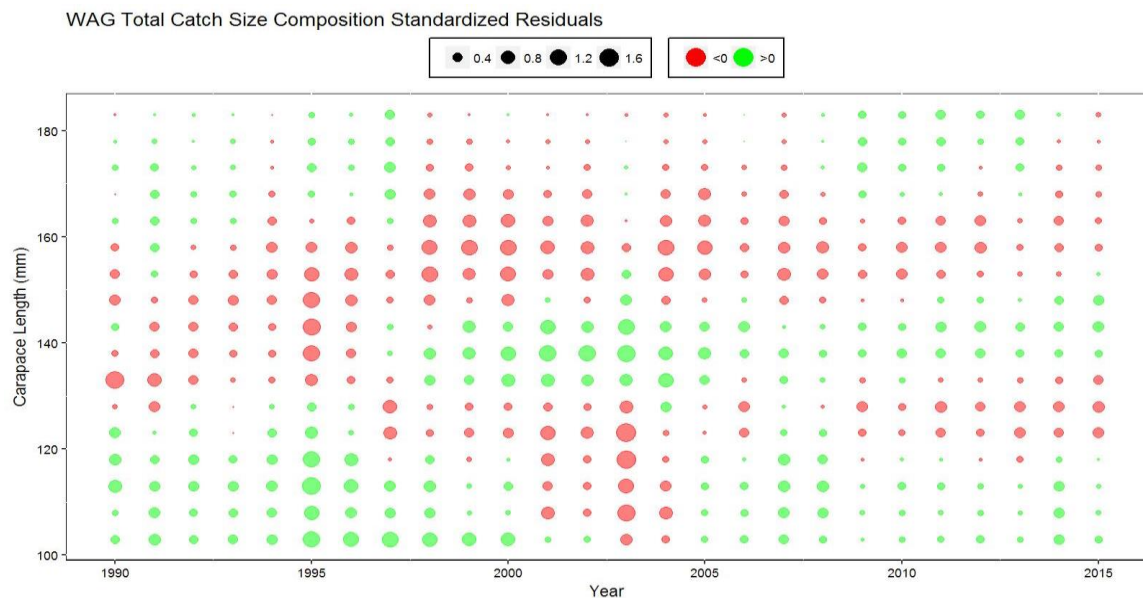


Figure 43. Bubble plot of standardized residuals of total catch length composition for scenario 9 fit for **WAG** golden king crab, 1990/91–2015/16. Blue circles are the positive and pink circles are the negative standardized residuals. The area of the circle is the relative magnitude of the residual.

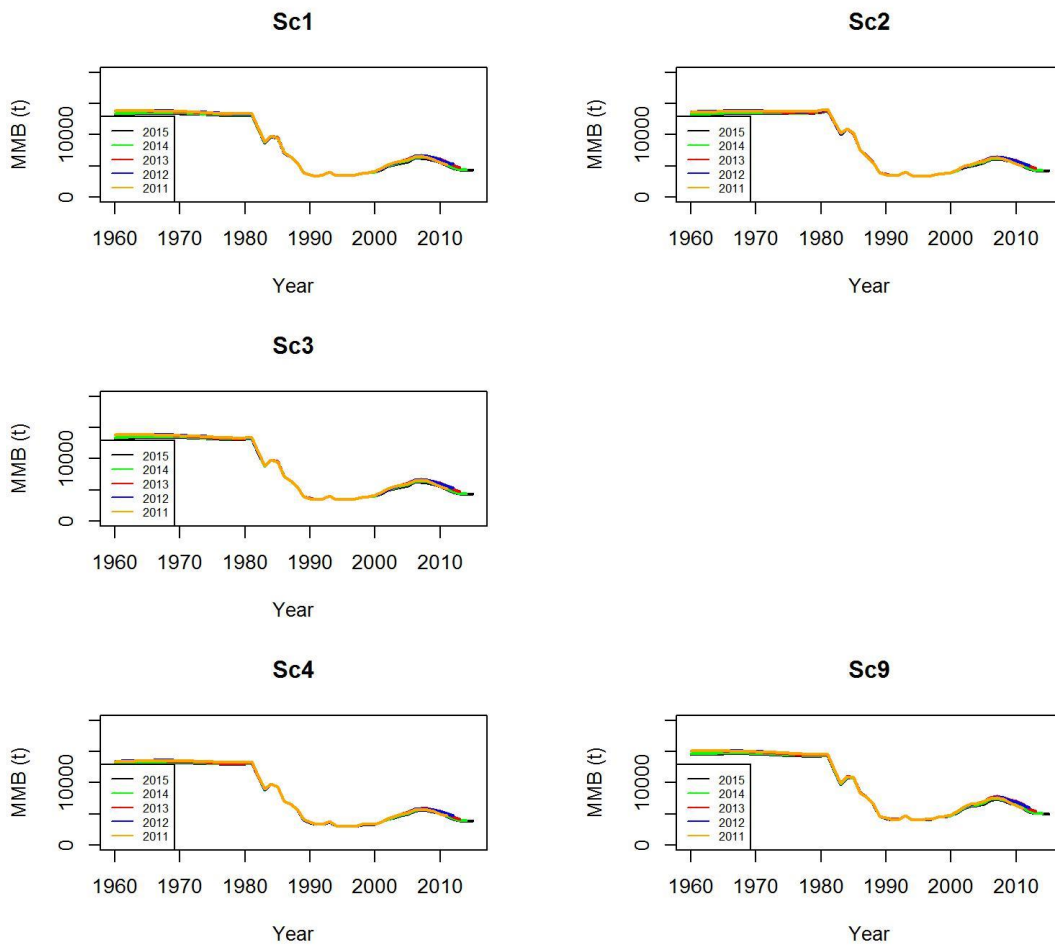


Figure 44. Retrospective fits of MMB by the model following removal of terminal year data under scenarios (Sc) 1 to 9 for golden king crab in the **WAG**, 1960–2015.

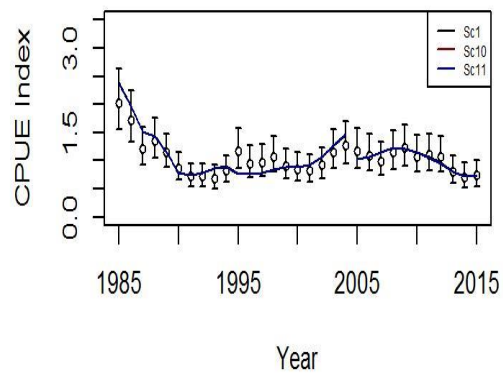
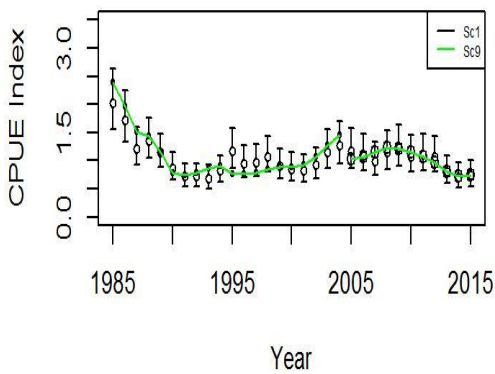
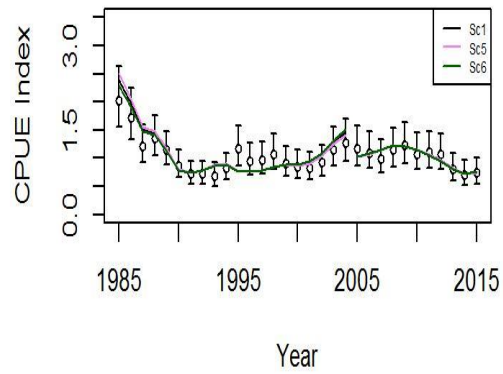
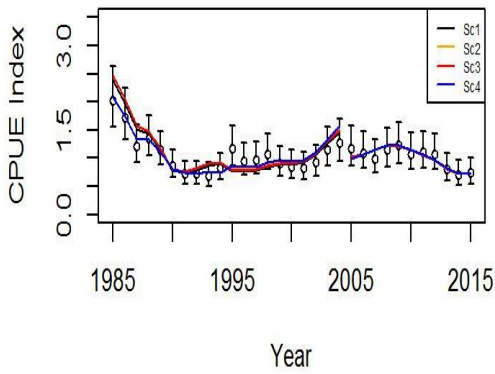


Figure 45. Comparison of input CPUE indices (open circles with ± 2 SE) with predicted CPUE indices (colored solid lines) under scenarios (Sc) 1 to 11 for **WAG** golden king crab data, 1985/86–2015/16. Model estimated additional standard error was added to each input standard error.

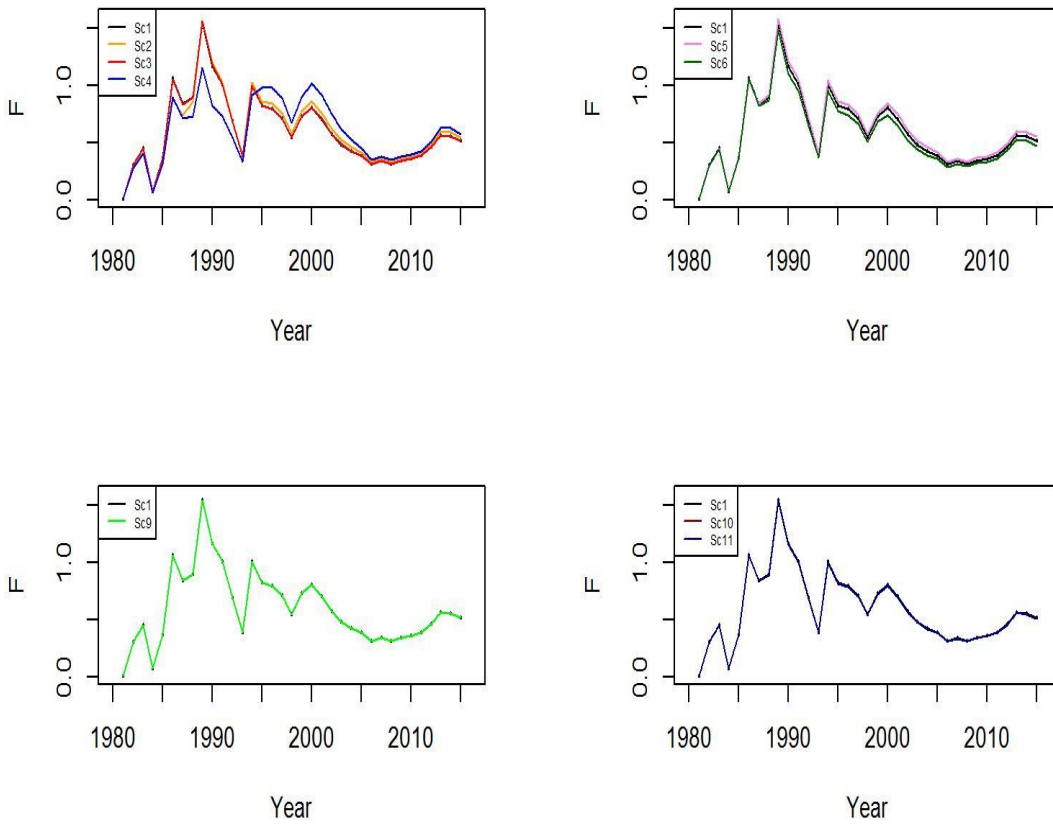


Figure 46. Trends in pot fishery full selection total fishing mortality of golden king crab for scenarios (Sc) 1 to 11 model fits in the **WAG**, 1981–2015.

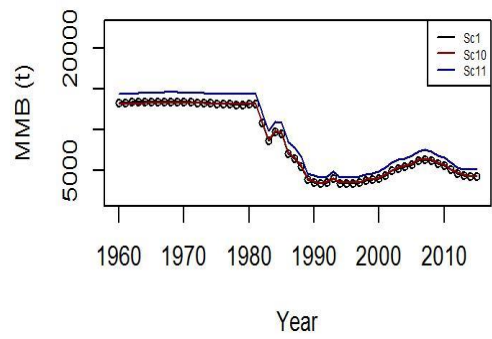
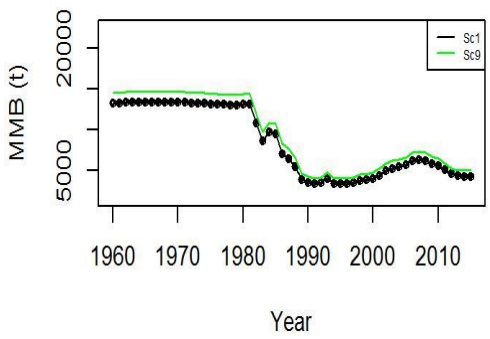
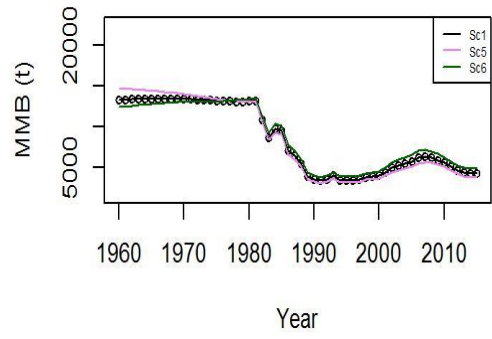
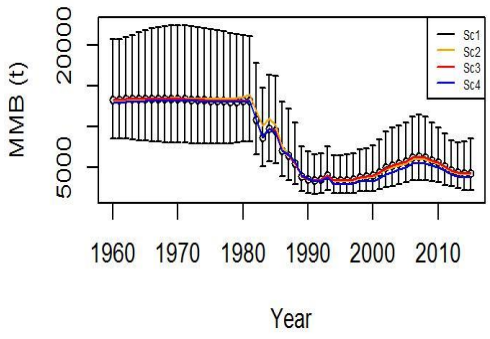


Figure 47. Trends in golden king crab mature male biomass for scenarios (Sc) 1 to 11 fits in the **WAG**, 1960/61–2015/16. Scenario 1 estimates have two standard errors confidence limits.

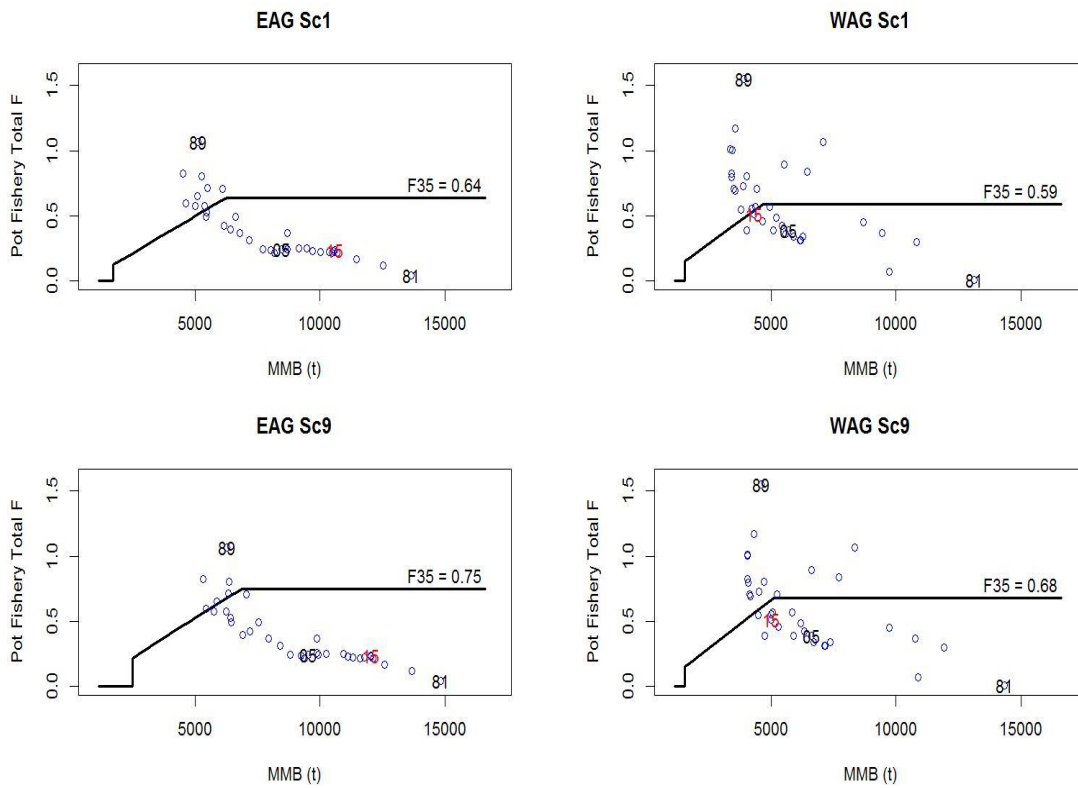


Figure 48. Relationships between full fishing mortalities for the directed pot fishery and mature male biomass on Feb. 15 during 1985–2015 under scenarios 1 and 9 for **EAG** and **WAG**. Average of recruitment from 1987 to 2012 was used to estimate $B_{35\%}$. Pot and groundfish handling mortality rates were assumed to be 0.2 and 0.65, respectively.

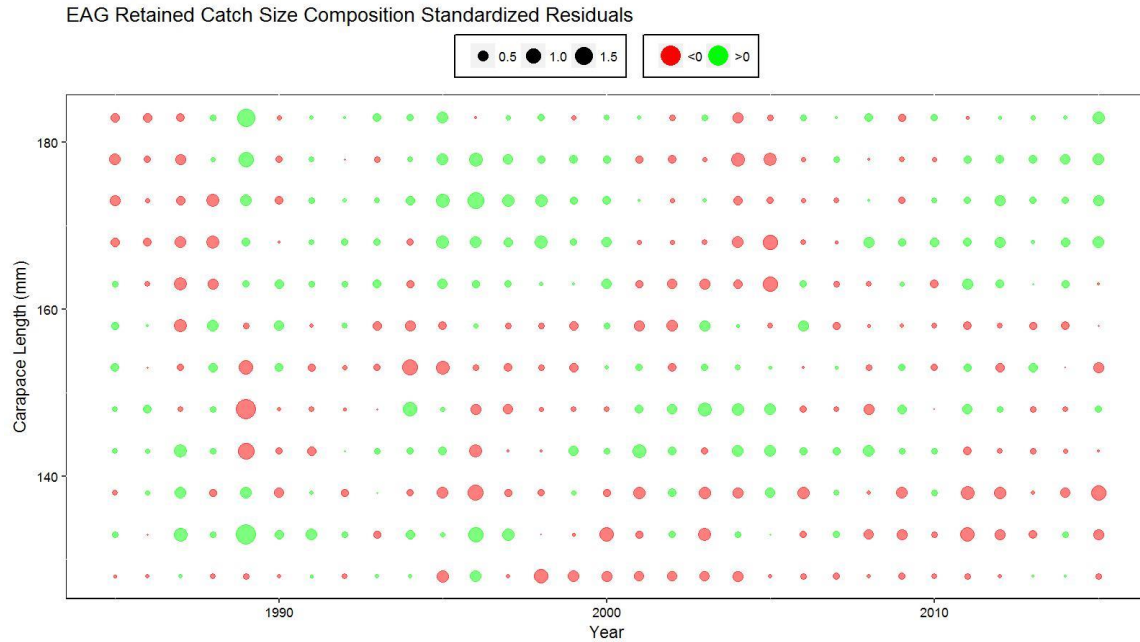


Figure 49. Bubble plot of standardized residuals of retained catch length composition for scenario 2 fit for **EAG** golden king crab, 1985/86–2015/16. Green circles are the positive and pink circles are the negative standardized residuals. The area of the circle is the relative magnitude of the residual.

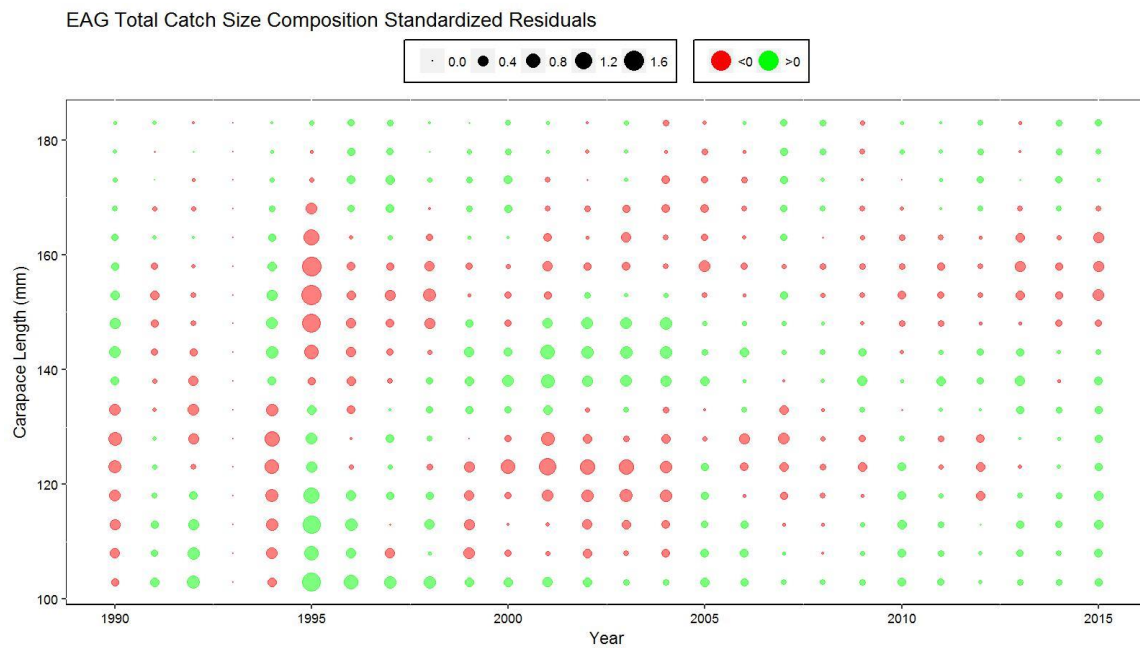


Figure 50. Bubble plot of standardized residuals of total catch length composition for scenario 2 fit for **EAG** golden king crab, 1990/91–2015/16. Green circles are the positive and pink circles are the negative standardized residuals. The area of the circle is the relative magnitude of the residual.

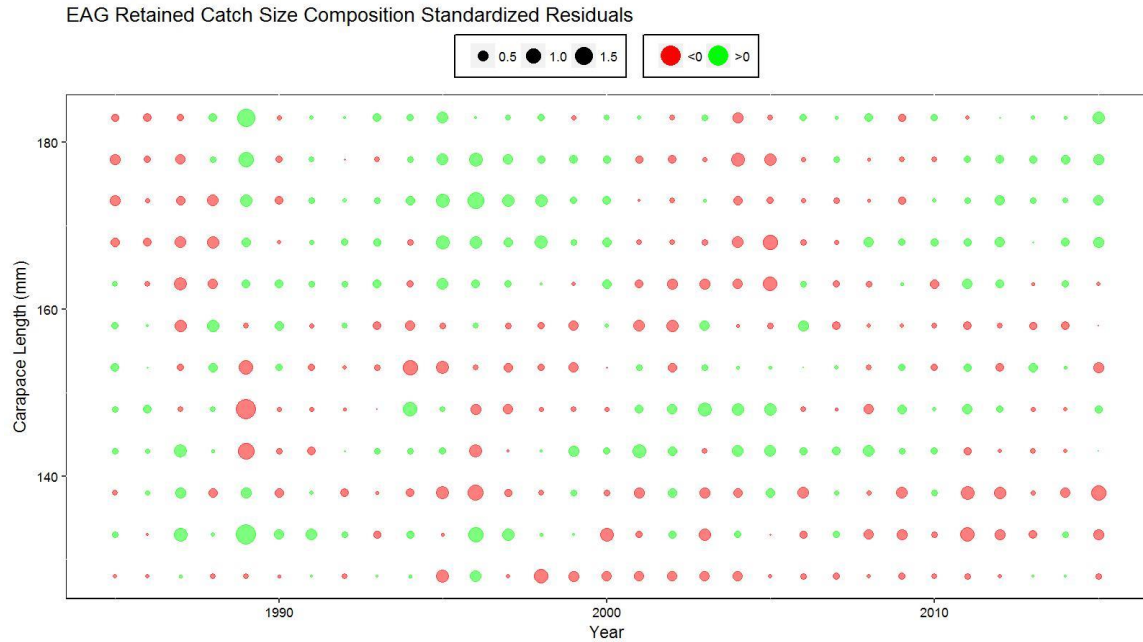


Figure 51. Bubble plot of standardized residuals of retained catch length composition for scenario 3 fit for **EAG** golden king crab, 1985/86–2015/16. Green circles are the positive and pink circles are the negative standardized residuals. The area of the circle is the relative magnitude of the residual.

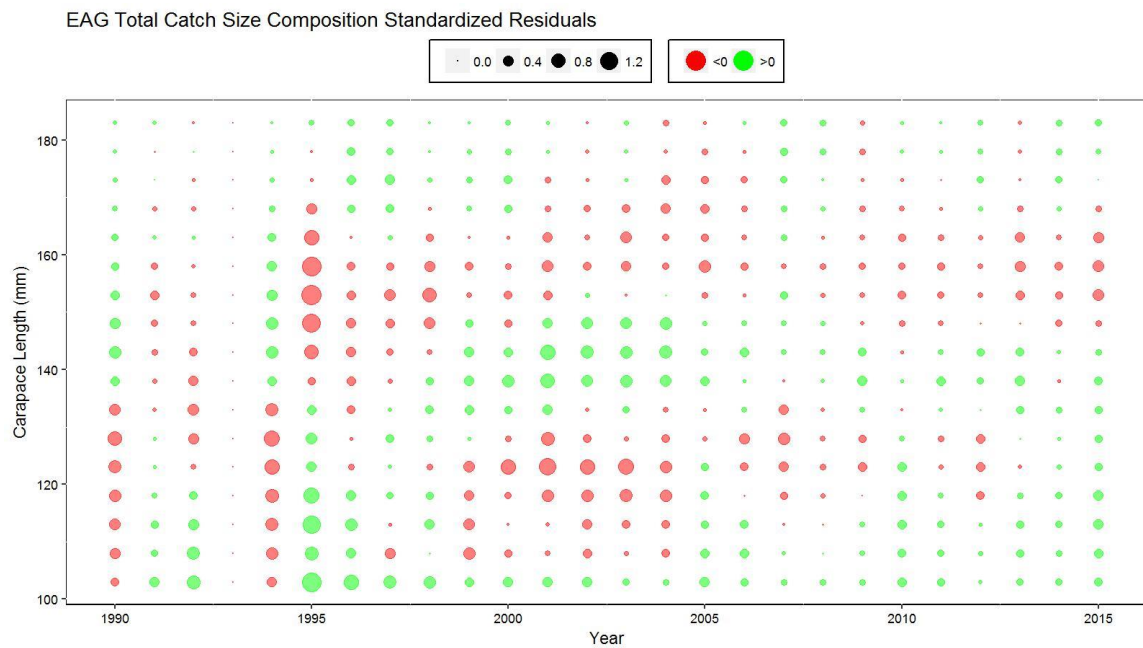


Figure 52. Bubble plot of standardized residuals of total catch length composition for scenario 3 fit for **EAG** golden king crab, 1990/91–2015/16. Green circles are the positive and pink circles are the negative standardized residuals. The area of the circle is the relative magnitude of the residual.

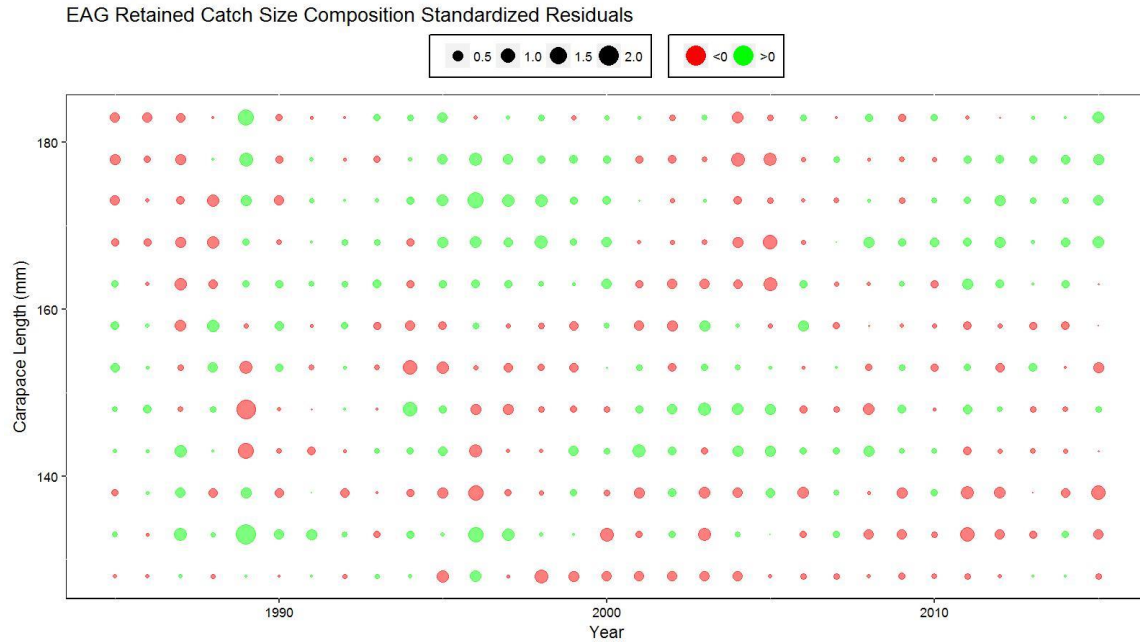


Figure 53. Bubble plot of standardized residuals of retained catch length composition for scenario 4 fit for **EAG** golden king crab, 1985/86–2015/16. Green circles are the positive and pink circles are the negative standardized residuals. The area of the circle is the relative magnitude of the residual.

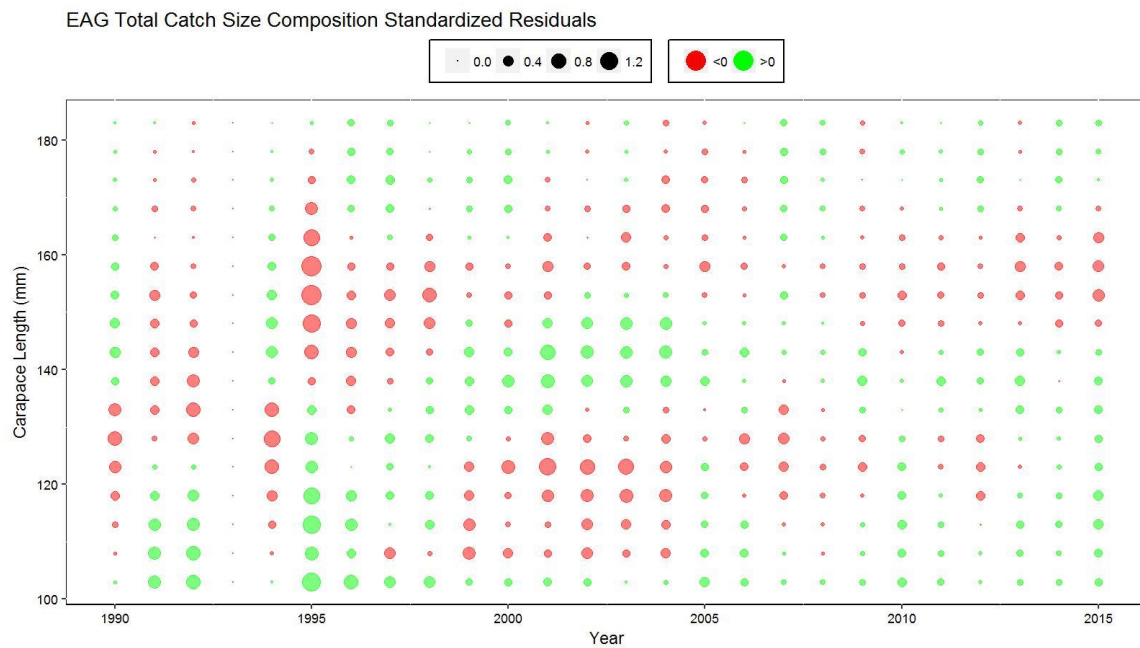


Figure 54. Bubble plot of standardized residuals of total catch length composition for scenario 4 fit for **EAG** golden king crab, 1990/91–2015/16. Green circles are the positive and pink circles are the negative standardized residuals. The area of the circle is the relative magnitude of the residual.

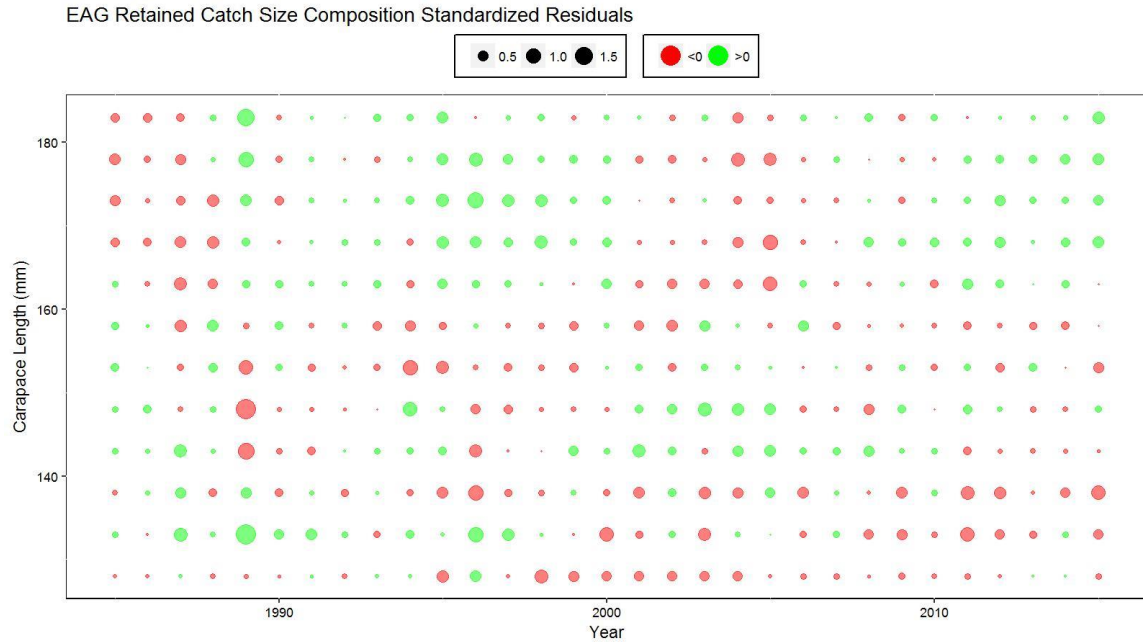


Figure 55. Bubble plot of standardized residuals of retained catch length composition for scenario 11 fit for **EAG** golden king crab, 1985/86–2015/16. Green circles are the positive and pink circles are the negative standardized residuals. The area of the circle is the relative magnitude of the residual.

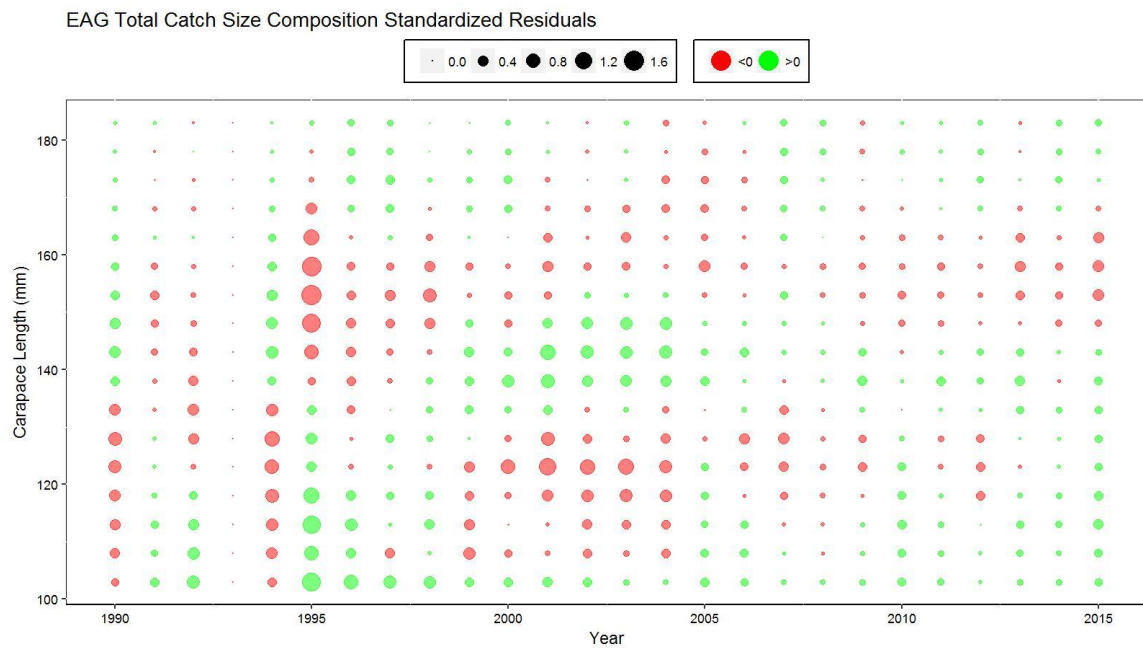


Figure 56. Bubble plot of standardized residuals of total catch length composition for scenario 11 fit for **EAG** golden king crab, 1990/91–2015/16. Green circles are the positive and pink circles are the negative standardized residuals. The area of the circle is the relative magnitude of the residual.

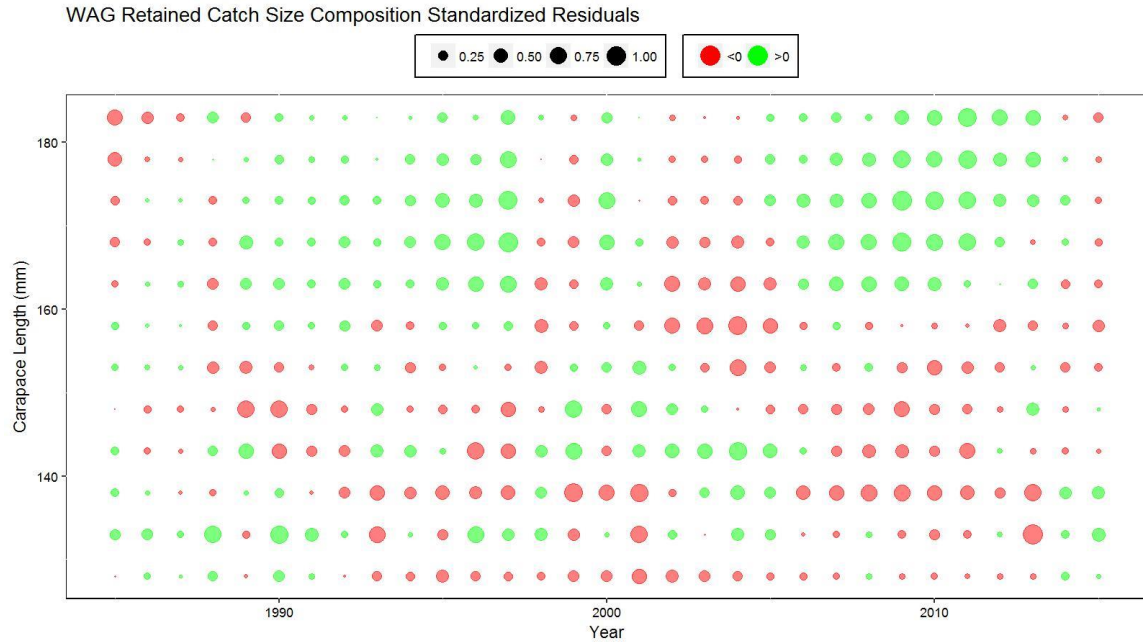


Figure 57. Bubble plot of standardized residuals of retained catch length composition for scenario 2 fit for **WAG** golden king crab, 1985/86–2015/16. Green circles are the positive and pink circles are the negative standardized residuals. The area of the circle is the relative magnitude of the residual.

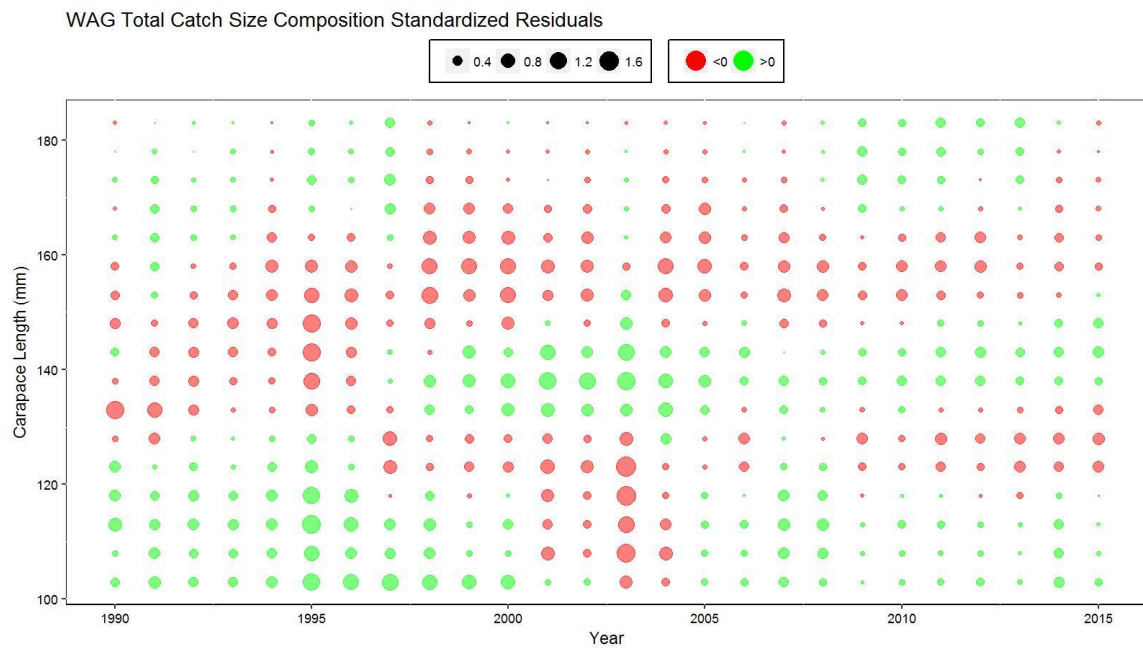


Figure 58. Bubble plot of standardized residuals of total catch length composition for scenario 2 fit for **WAG** golden king crab, 1990/91–2015/16. Green circles are the positive and pink circles are the negative standardized residuals. The area of the circle is the relative magnitude of the residual.

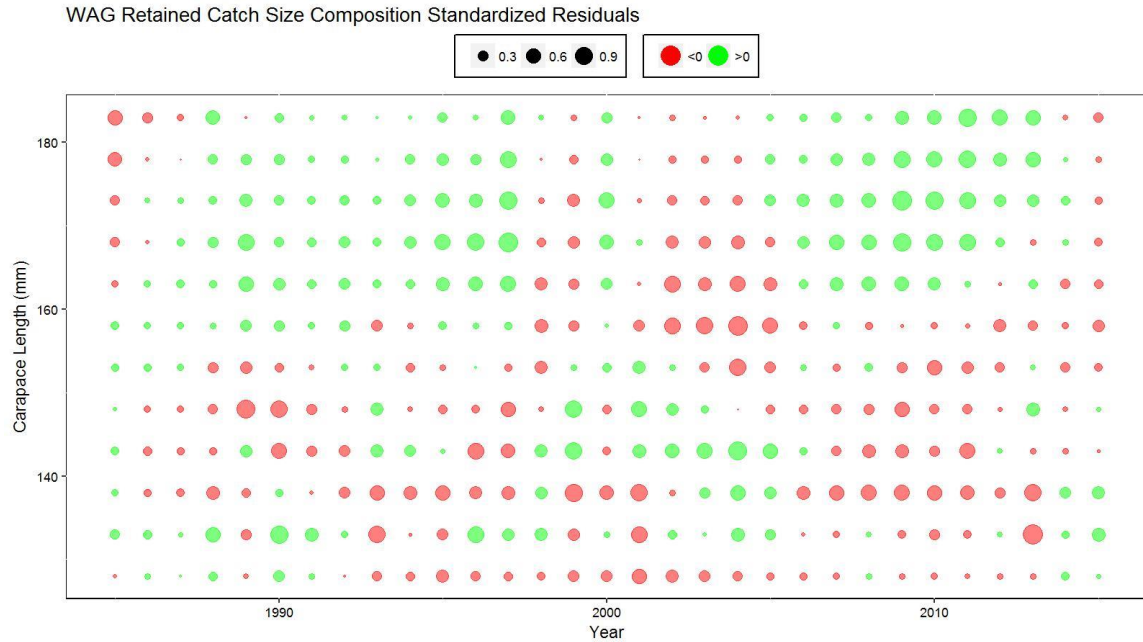


Figure 59. Bubble plot of standardized residuals of retained catch length composition for scenario 3 fit for **WAG** golden king crab, 1985/86–2015/16. Green circles are the positive and pink circles are the negative standardized residuals. The area of the circle is the relative magnitude of the residual.

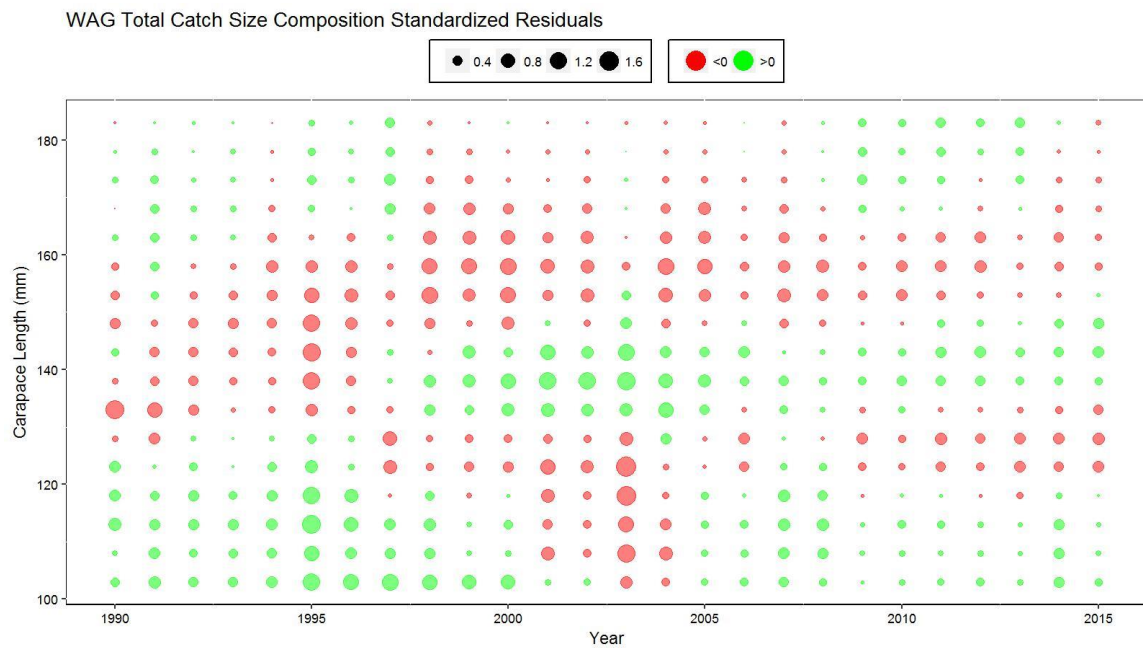


Figure 60. Bubble plot of standardized residuals of total catch length composition for scenario 3 fit for **WAG** golden king crab, 1990/91–2015/16. Green circles are the positive and pink circles are the negative standardized residuals. The area of the circle is the relative magnitude of the residual.

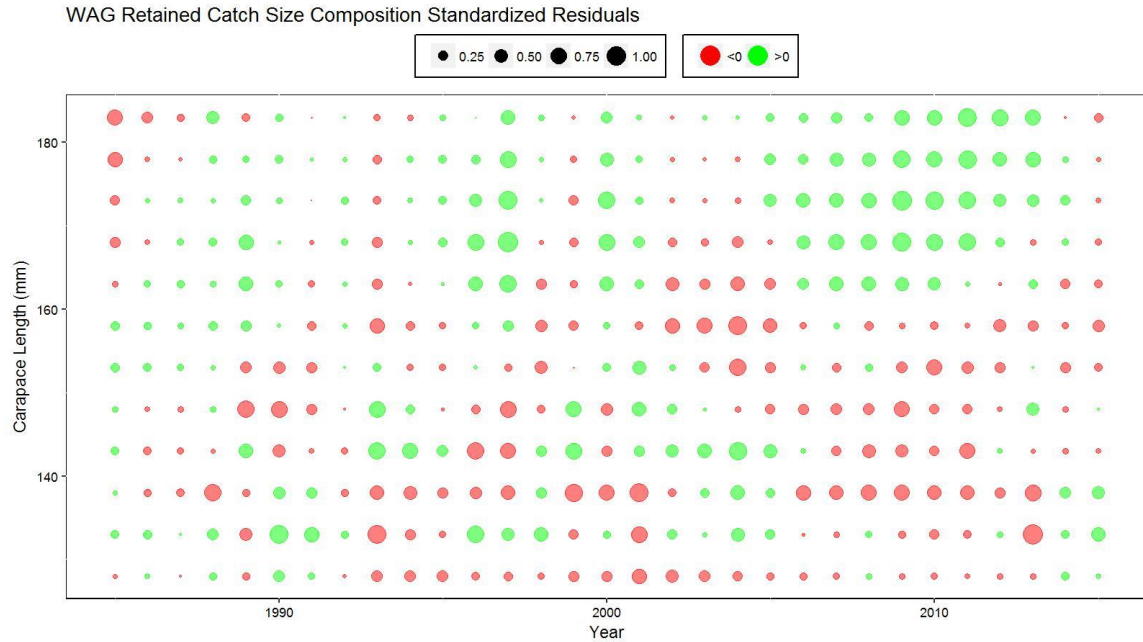


Figure 61. Bubble plot of standardized residuals of retained catch length composition for scenario 4 fit for **WAG** golden king crab, 1985/86–2015/16. Green circles are the positive and pink circles are the negative standardized residuals. The area of the circle is the relative magnitude of the residual.

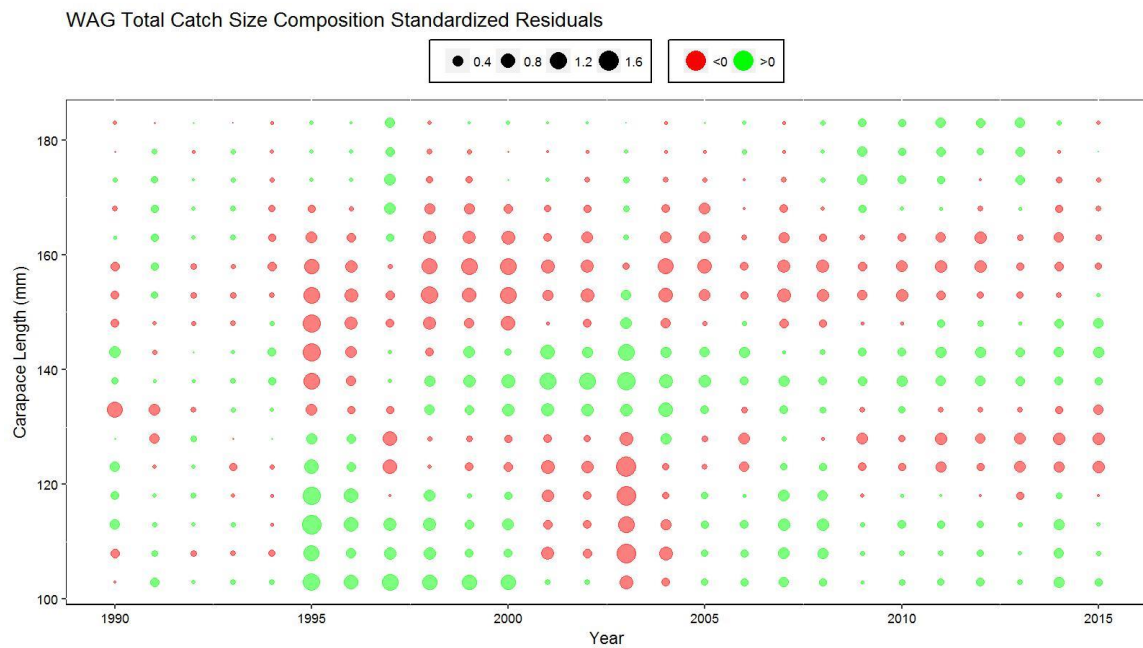


Figure 62. Bubble plot of standardized residuals of total catch length composition for scenario 4 fit for **WAG** golden king crab, 1990/91–2015/16. Green circles are the positive and pink circles are the negative standardized residuals. The area of the circle is the relative magnitude of the residual.

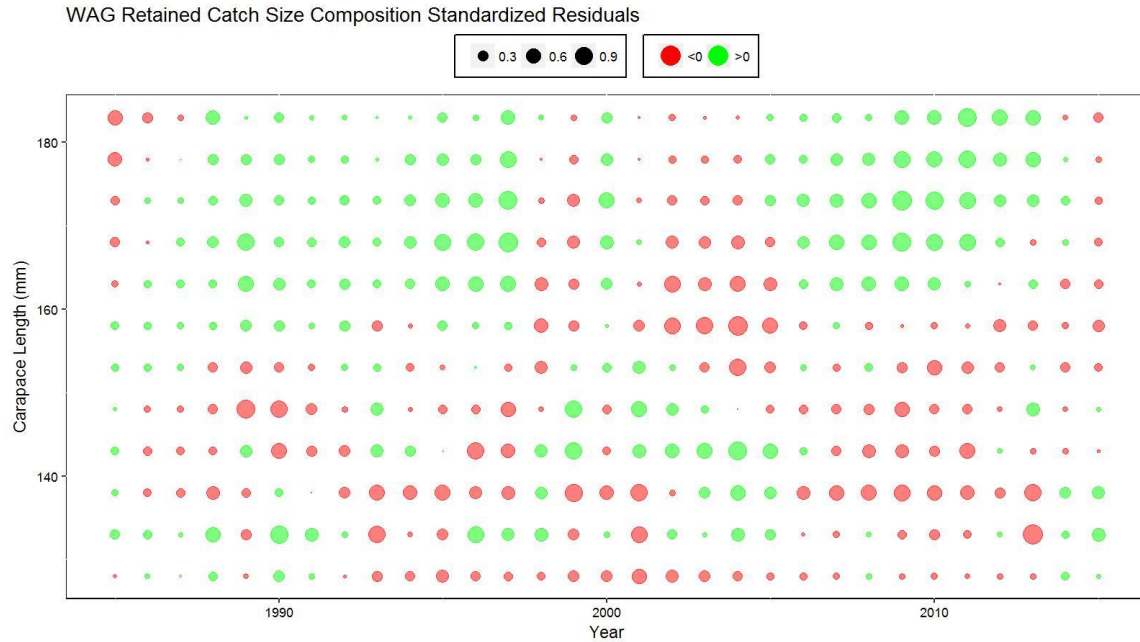


Figure 63. Bubble plot of standardized residuals of retained catch length composition for scenario 11 fit for **WAG** golden king crab, 1985/86–2015/16. Green circles are the positive and pink circles are the negative standardized residuals. The area of the circle is the relative magnitude of the residual.

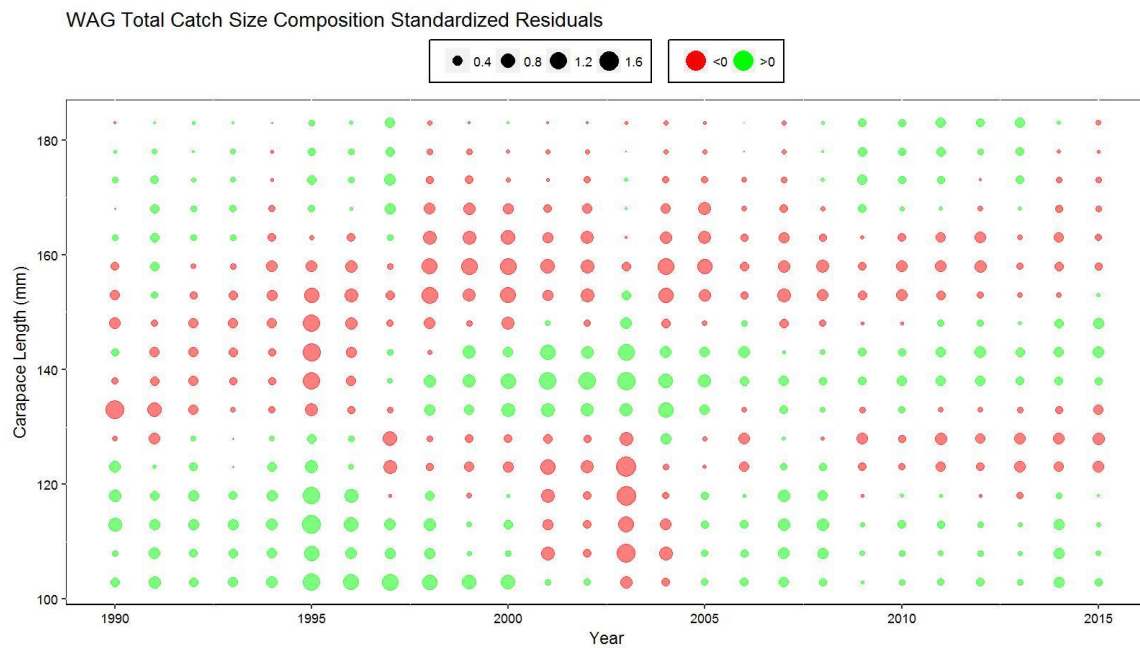


Figure 64. Bubble plot of standardized residuals of total catch length composition for scenario 11 fit for **WAG** golden king crab, 1990/91–2015/16. Green circles are the positive and pink circles are the negative standardized residuals. The area of the circle is the relative magnitude of the residual.