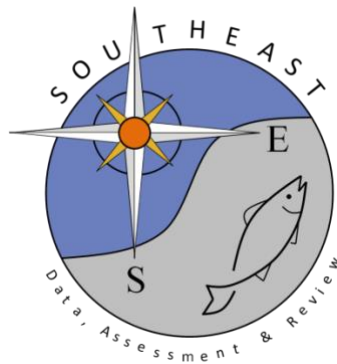# Insights into the Spatial Dynamics of Red Snapper in the Gulf of Mexico from Gulf-Wide Fishery Independent Surveys

Theodore S. Switzer, Adam G. Pollack, Katherine E. Overly, Christopher Gardner, Kevin A. Thompson, Matt Campbell

SEDAR74-SID-03

15 March 2021

Please cite this document as:

Insights into the Spatial Dynamics of Red Snapper in the Gulf of Mexico from Gulf-Wide Fishery Independent Surveys

Theodore S. Switzer[1], Adam G. Pollack[2], Katherine E. Overly[3], Christopher Gardner[3], Kevin A. Thompson[1], Matt Campbell[2]

[1]Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute, St. Petersburg, FL

[2]Southeast Fisheries Science Center, Mississippi Laboratories, Pascagoula, MS

[3] Southeast Fisheries Science Center, Panama City Laboratory, Panama City, FL

Introduction

Data from three region-wide fishery independent surveys were summarized to provide insight into the spatial dynamics of Red Snapper in the U.S. Gulf of Mexico, with a primary objective of determining whether there was evidence to suggest alternative stock boundaries to those currently used for assessment. Following are summary analyses of data from Reef Fish Video Surveys, Groundfish Trawl Surveys, and Bottom Longline Surveys conducted in the Gulf of Mexico.

Reef Fish Video Surveys

Although reef fish video survey efforts have recently been unified as the Gulf Fishery Independent Survey of Habitat and Ecosystem Resources (G-FISHER), three separate surveys of reef fishes were conducted using Stationary-Baited Remote Underwater Video (S-BRUV) camera arrays. The NMFS SEAMAP reef fish video survey, carried out by NMFS Mississippi Laboratory (MS Labs), was initiated in 1992 and focuses primarily on shelf-break natural reef habitats throughout the U.S. Gulf of Mexico. The NMFS Panama City lab survey (2005+), covering shallow natural reef habitats in the northeastern Gulf of Mexico, was initiated in 2005. The Florida Fish and Wildlife Research Institute survey (FWRI) was initiated in 2008 on natural reef habitats off mid-Peninsular Florida but has subsequently expanded to encompass the eastern Gulf of Mexico as well as artificial reef habitats. Although survey design and areas covered differ markedly among the three historical surveys, all utilize nearly-identical stereo-video technology, and quantify the relative abundance of observed fishes as MaxN, or the maximum number of individuals per taxon observed on a single image frame. Similarly, all three surveys estimate size of observed fishes using stereo-video imagery from a single image where most individuals can be measured.

Data from all three surveys were summarized independently to identify potential spatial patterns in relative abundance, abundance trends through time, and size composition of Red Snapper observed on video. Maps of spatial sampling coverage and site-specific abundance patterns of Red Snapper are shown in Figures 1 – 3. Spatially-explicit trends in interannual variability of nominal CPUE of Red Snapper (individuals per site) are shown in Figures 4 – 6. And spatially-explicit size-frequency distributions of Red Snapper are shown in Figures 7 – 9.
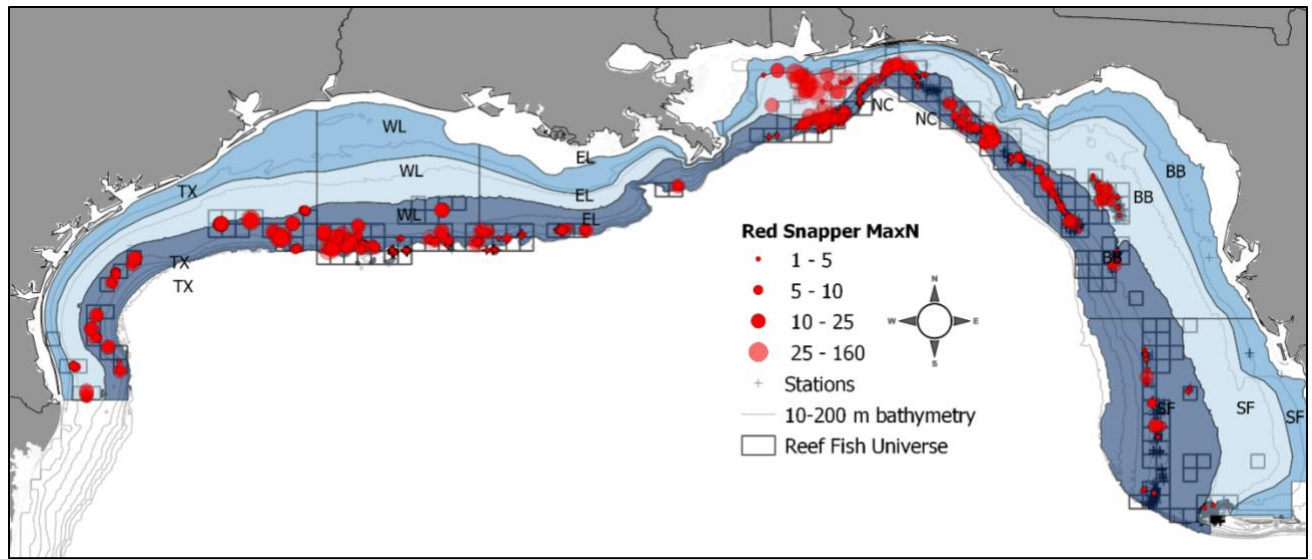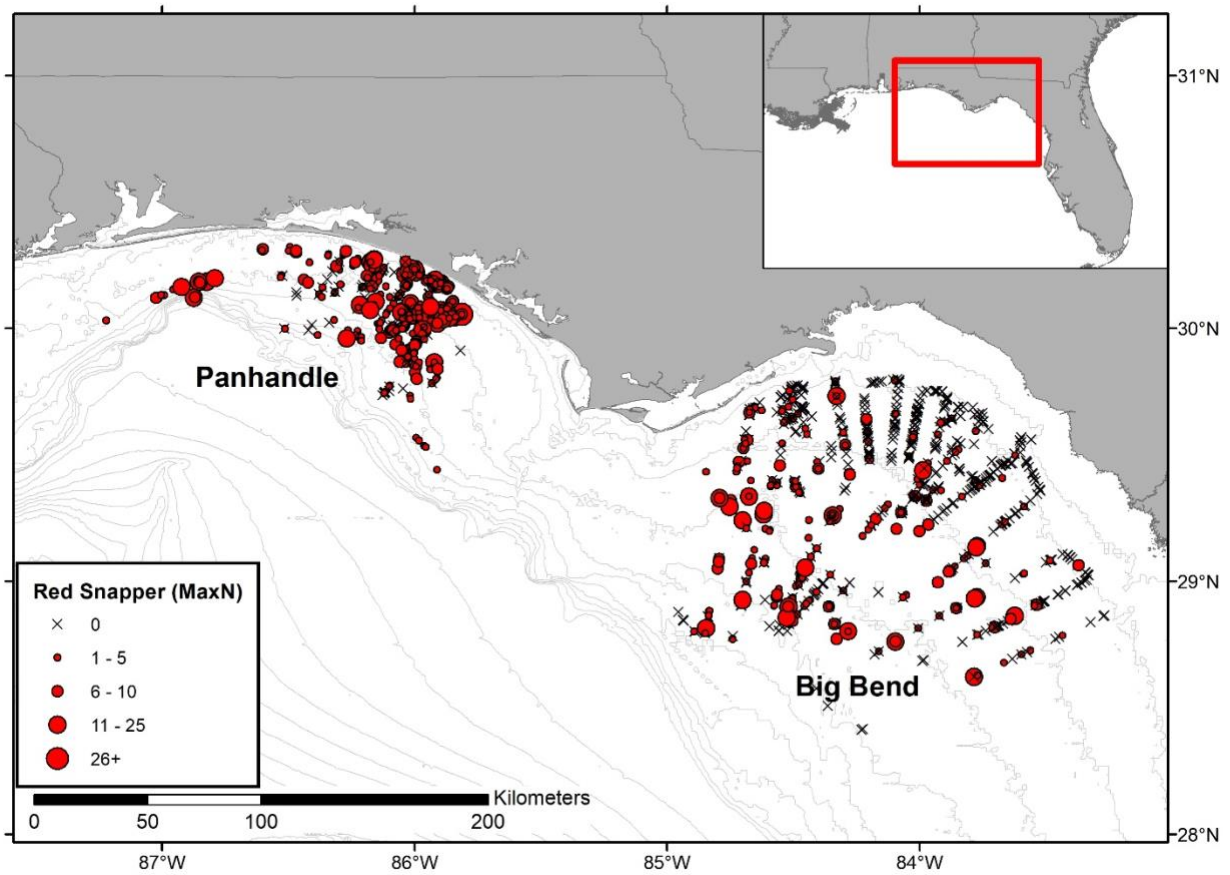
Figure 1. Map of the location of all sampling sites and site-specific abundance of Red Snapper from the MS Labs reef fish survey. Sampling strata reflect the GFISHER design implemented in 2020 across the three Gulf video surveys. Six regional strata: Texas (TX), West Louisiana (WL), East Louisiana (EL), North Central (NC), Big Bend (BB), and South Florida (SF). Three depth strata: near shore (medium blue), mid-shelf (light blue), and offshore (dark blue). Historic SEAMAP Reef Fish Video are shown as black squares.

Figure 2. Map of the location of all sampling sites and site-specific abundance of Red Snapper from the Panama City reef fish survey.
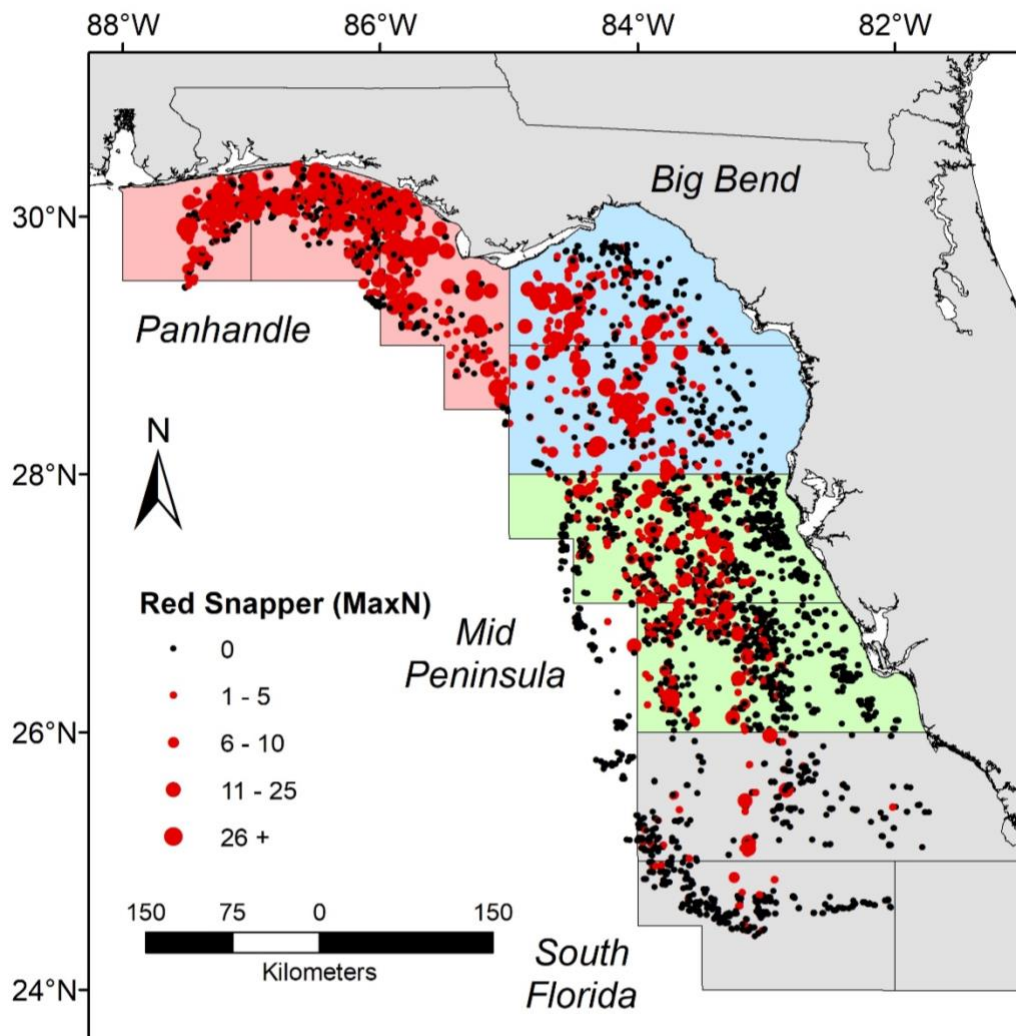
Figure 3. Map of the location of all sampling sites and site-specific abundance of Red Snapper from the FWRI reef fish survey.
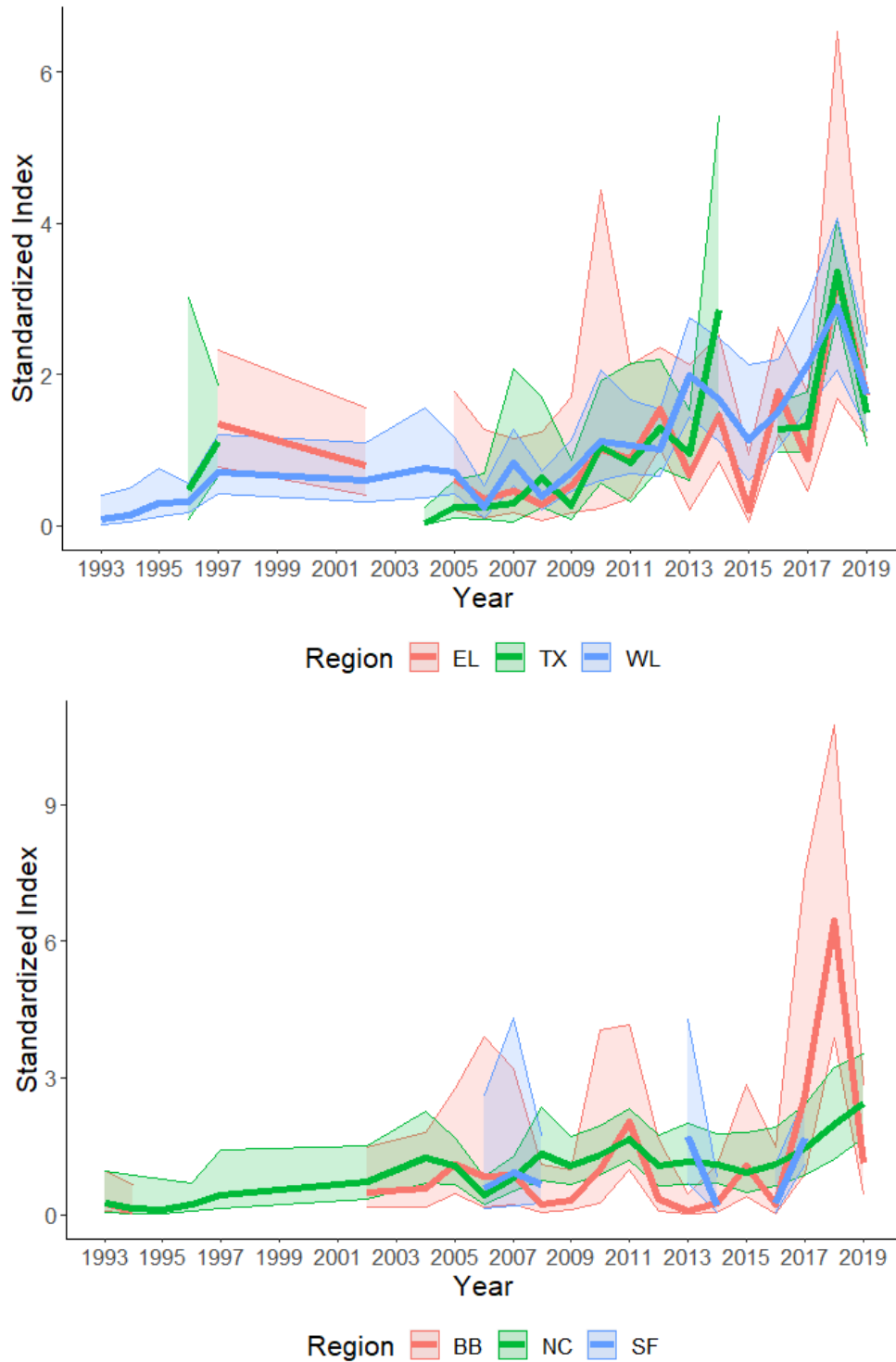
Figure 4. Regional differences in average annual Red Snapper observed per station from the MS Labs reef fish survey for the western Gulf (top panel): Texas (TX), East Louisiana (EL), West Louisiana (WL), and for the eastern Gulf (bottom panel): Big Bend (BB), North Central (NC), and South Florida (SF). Regions are shown geographically on Figure 1.
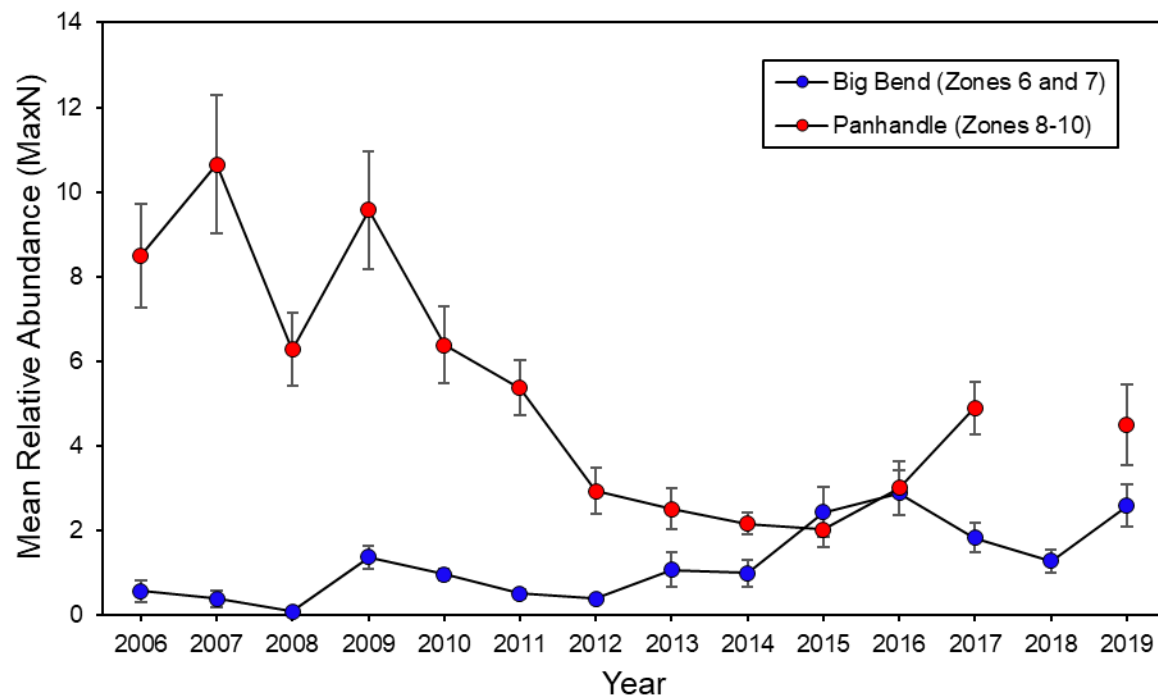
Figure 5. Regional differences in average annual Red Snapper observed per station from the Panama City reef fish survey.
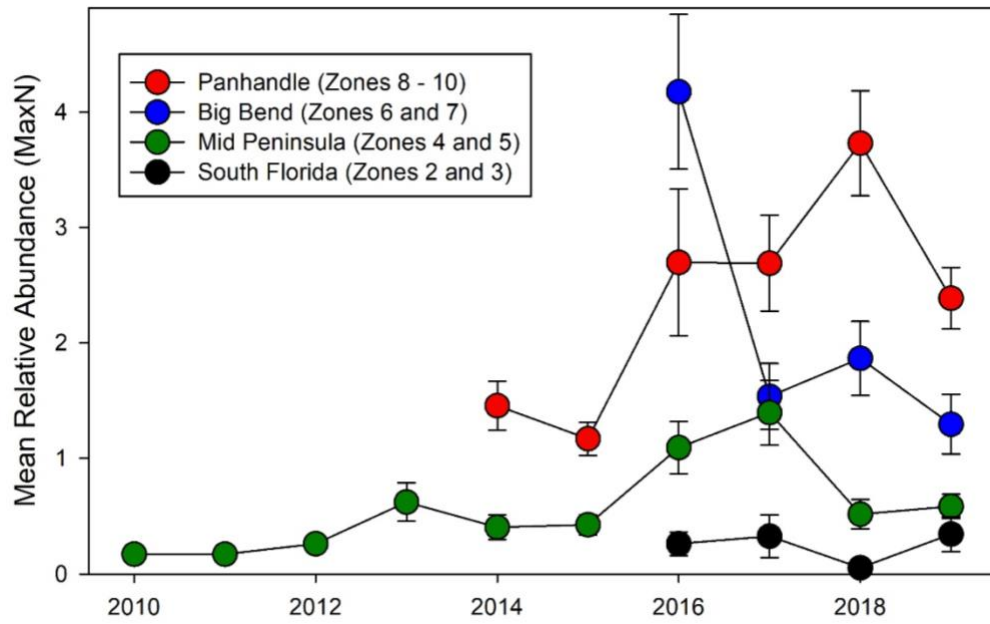
Figure 6. Regional differences in average annual Red Snapper observed per station from the FWRI reef fish survey.
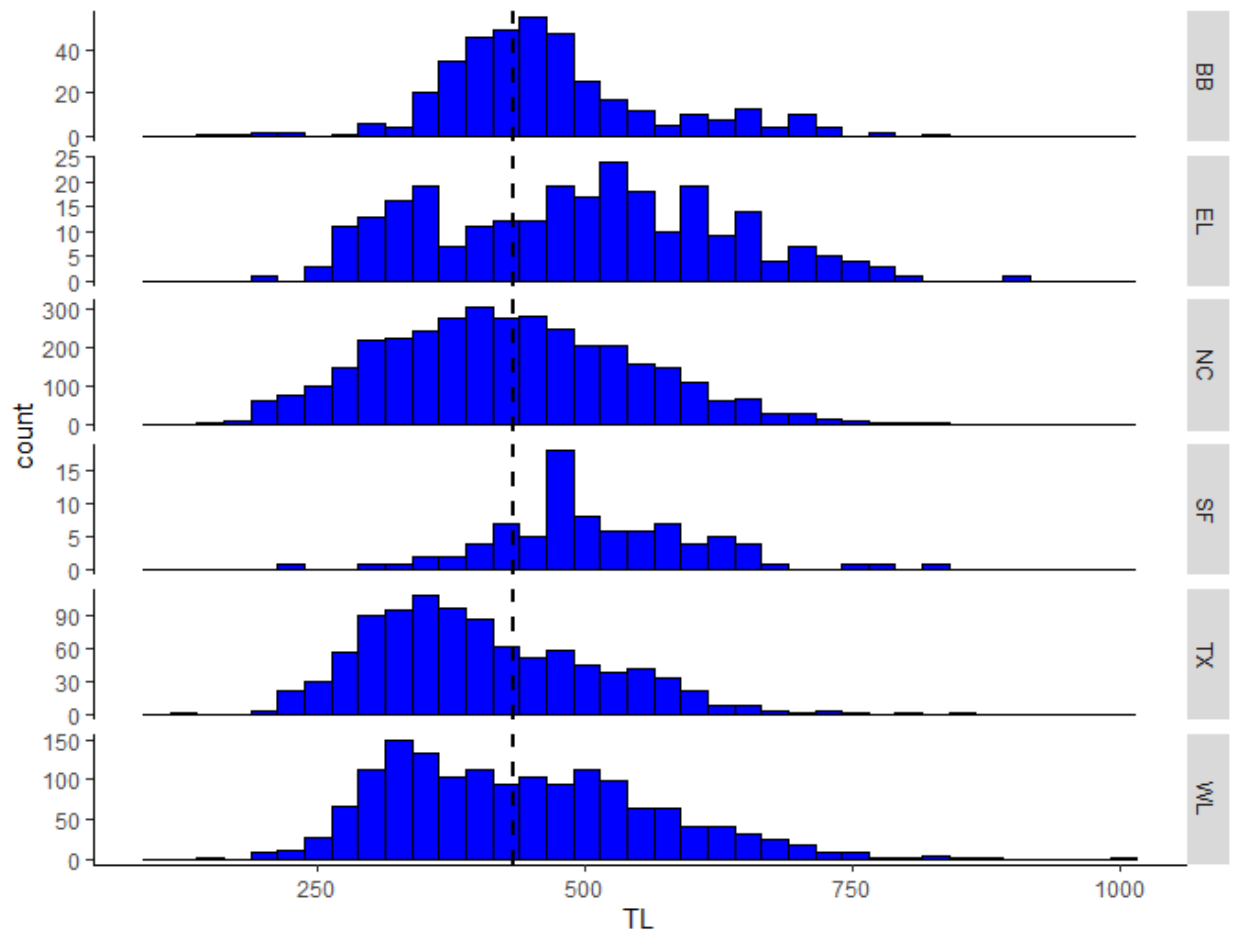
Figure 7. Regional differences in size composition of Red Snapper from the MS Labs reef fish survey for the western Gulf: Texas (TX), East Louisiana (EL), West Louisiana (WL), and for the eastern Gulf: Big Bend (BB), North Central (NC), and South Florida (SF). Regions are shown geographically on Figure 1. Dotted line indicates pooled Gulf-wide mean total length (a = 0, b − 0.95, Fish Base length conversion coefficients FL to TL).
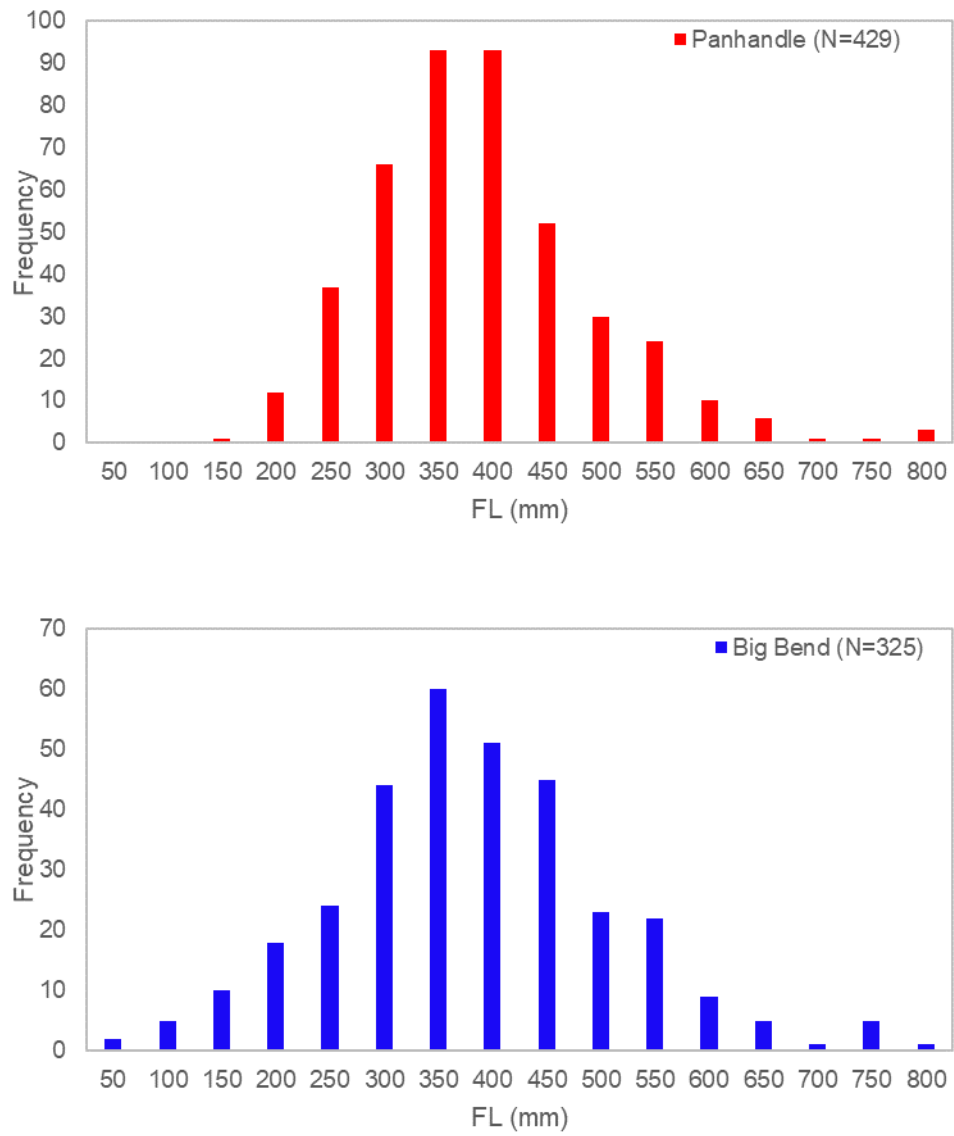
Figure 8. Regional differences in size composition of Red Snapper from the Panama City reef fish survey.
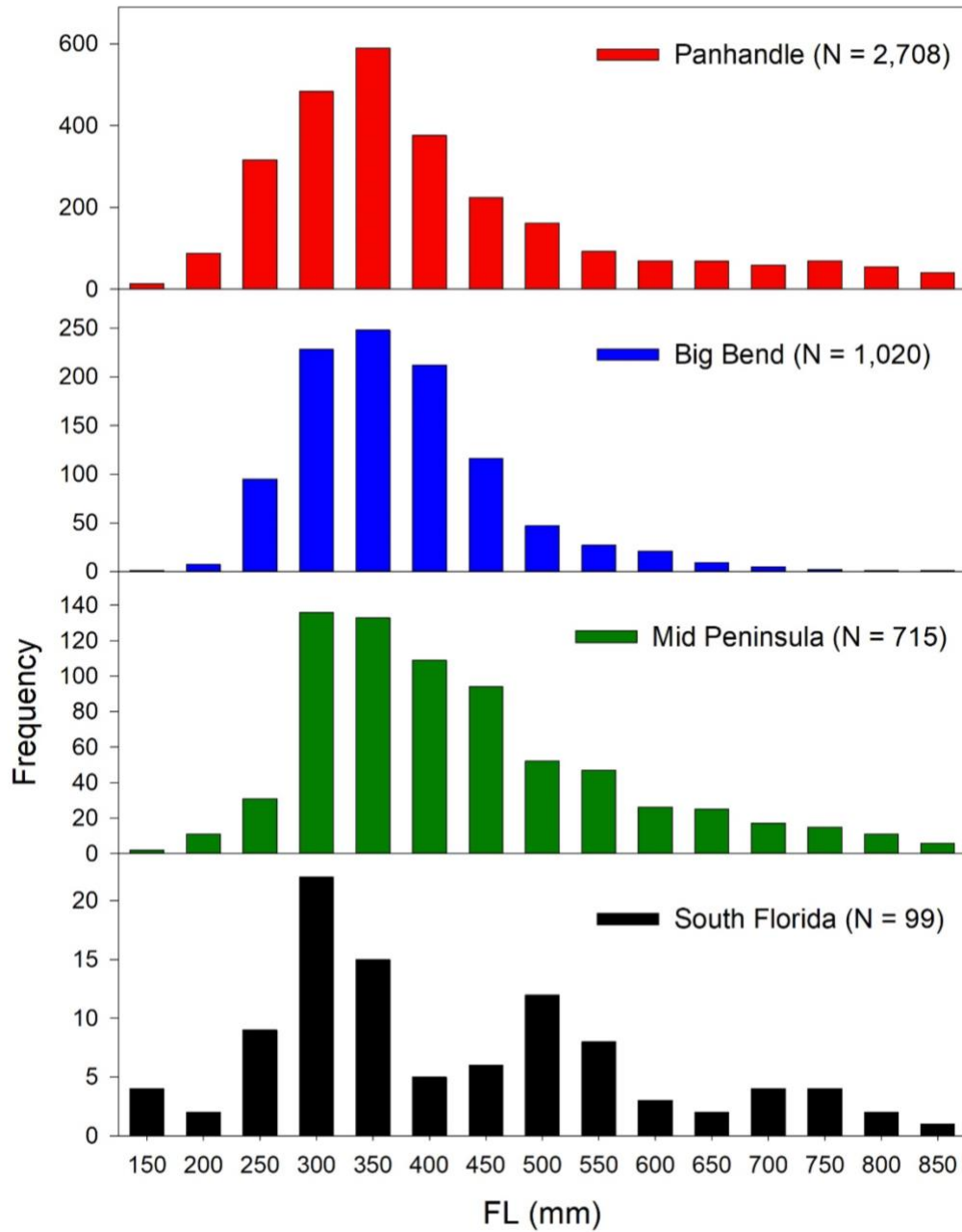
Figure 9. Regional differences in size composition of Red Snapper from the FWRI reef fish survey.

Bottom Longline Surveys

The Southeast Fisheries Science Center (SEFSC) Mississippi Laboratories (MSLABS) has conducted standardized bottom longline (NMFS BLL) surveys in the Gulf of Mexico (GOM), Caribbean, and Western North Atlantic Ocean (Atlantic) since 1995. The survey utilizes a one nm bottom longline with 100 equally spaced hooks. When the survey began in 1995, J-hooks were the standard gear. Over time a change was made to 15/0 circle hooks. Because of the spatial distribution of sampling (mostly less than 55m) and the use of J hooks instead of circle hooks, the years 1995 – 2000 were excluded from the analysis. Data for the NMFS BLL survey also was supplemented in 2011 (due to vessel breakdowns) with data from the Congressional Supplemental Sampling Program (CSSP). Although, the CSSP was conducted from April through October only data that matched up temporally in each region was used in the analysis. Data from both the NMFS BLL and CSSP BLL surveys was limited to stations sampled at depths less than 183 m, due to the lack of red snapper catch.

The distribution and abundance of red snapper from the combined NMFS BLL and CSSP BLL is presented in Figure 10. Catch rates by area are presented in Figures 11 and 12, with length distribution presented in Figure 13.
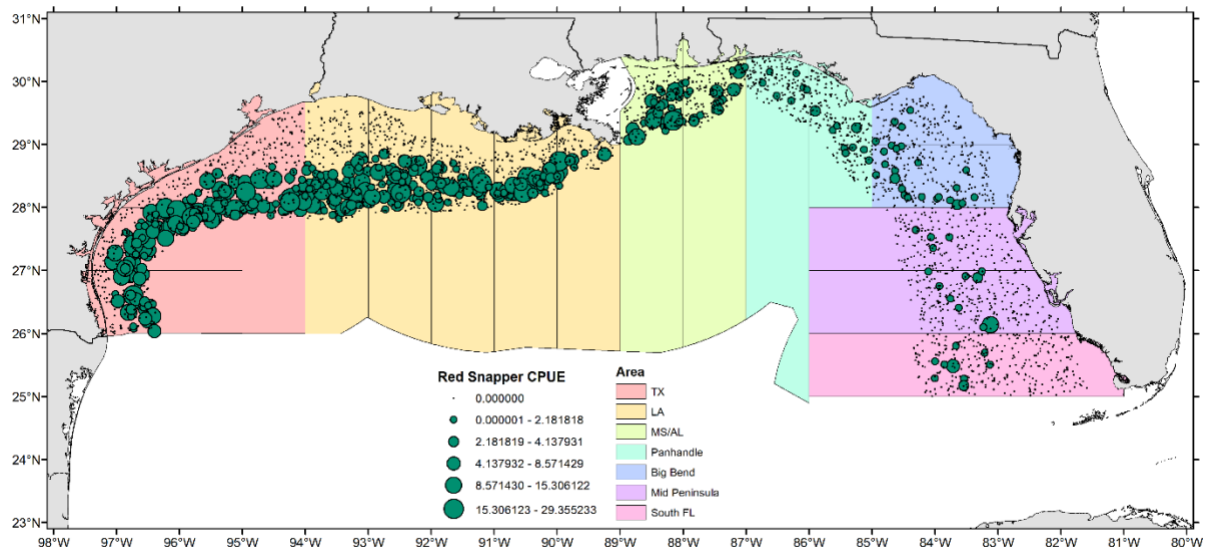

Figure 10. Distribution of bottom longline stations from the NMFS BLL and CSSP BLL surveys, with catch rates (number per 100 hook hour) of red snapper overlaid on the regional breakdown of the Gulf of Mexico used in the analysis.
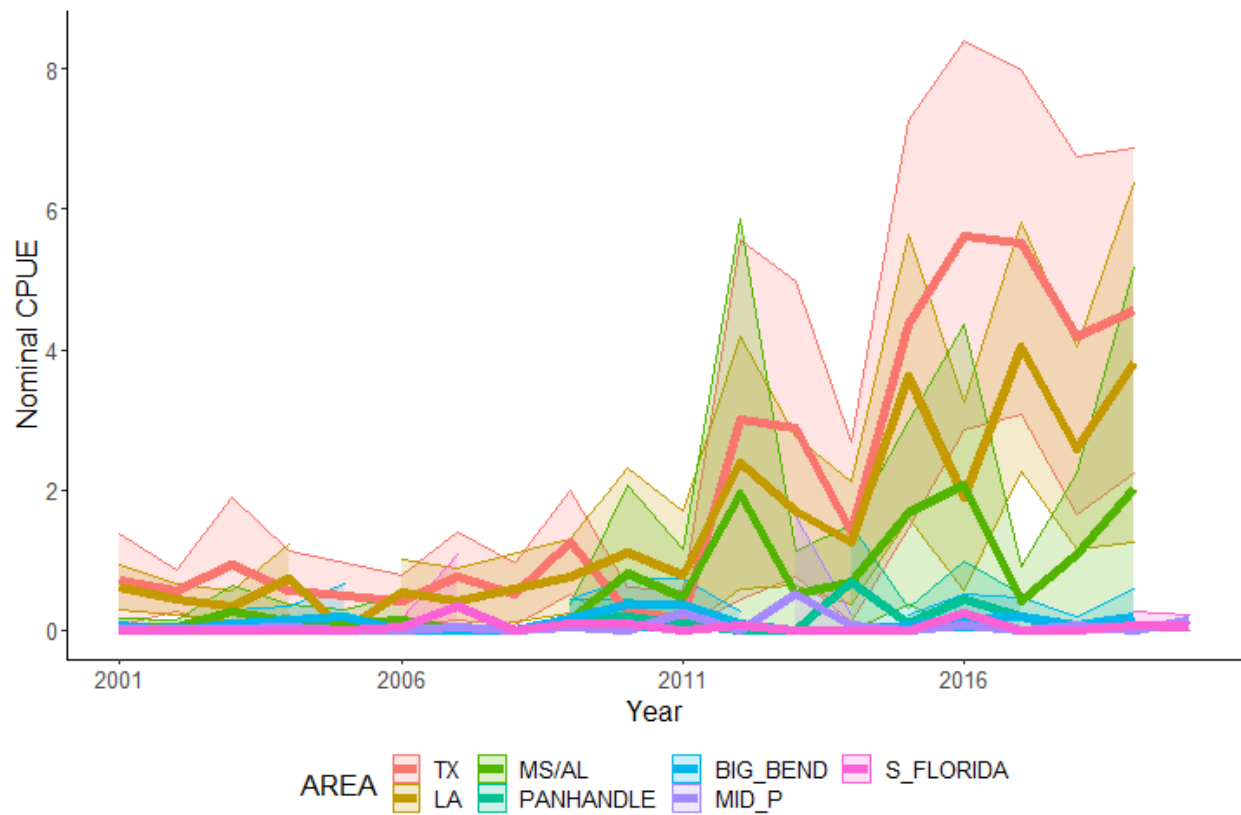
Figure 11. Regional differences in CPUE for red snapper from the NMFS BLL and CSSP BLL surveys for Texas (TX), Louisiana (LA), Mississippi/Alabama (MS/AL), Panhandle, Big Bend, Mid Peninsula (MID_P), and South Florida (S_FLORIDA).
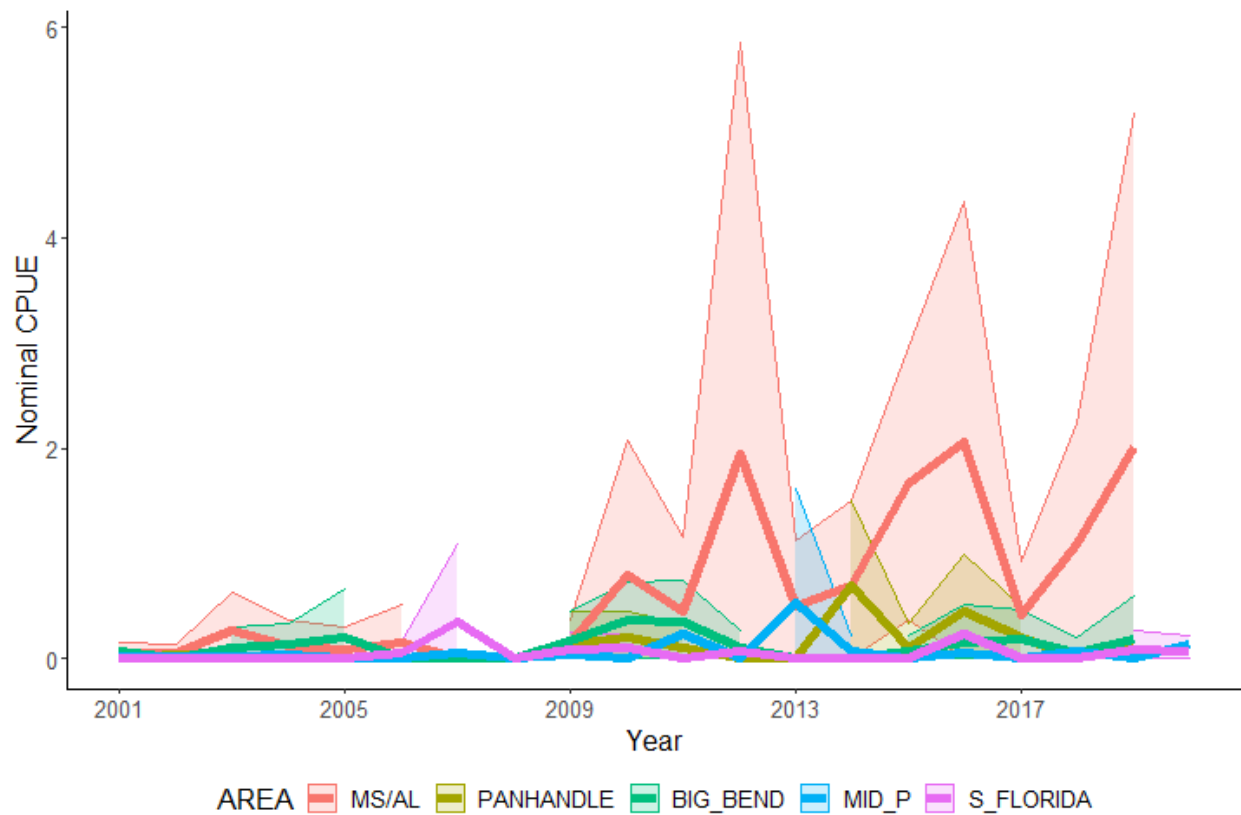
Figure 12. Regional differences in CPUE for red snapper from the NMFS BLL and CSSP BLL surveys for Mississippi/Alabama (MS/AL), Panhandle, Big Bend, Mid Peninsula (MID_P), and South Florida (S_FLORIDA).
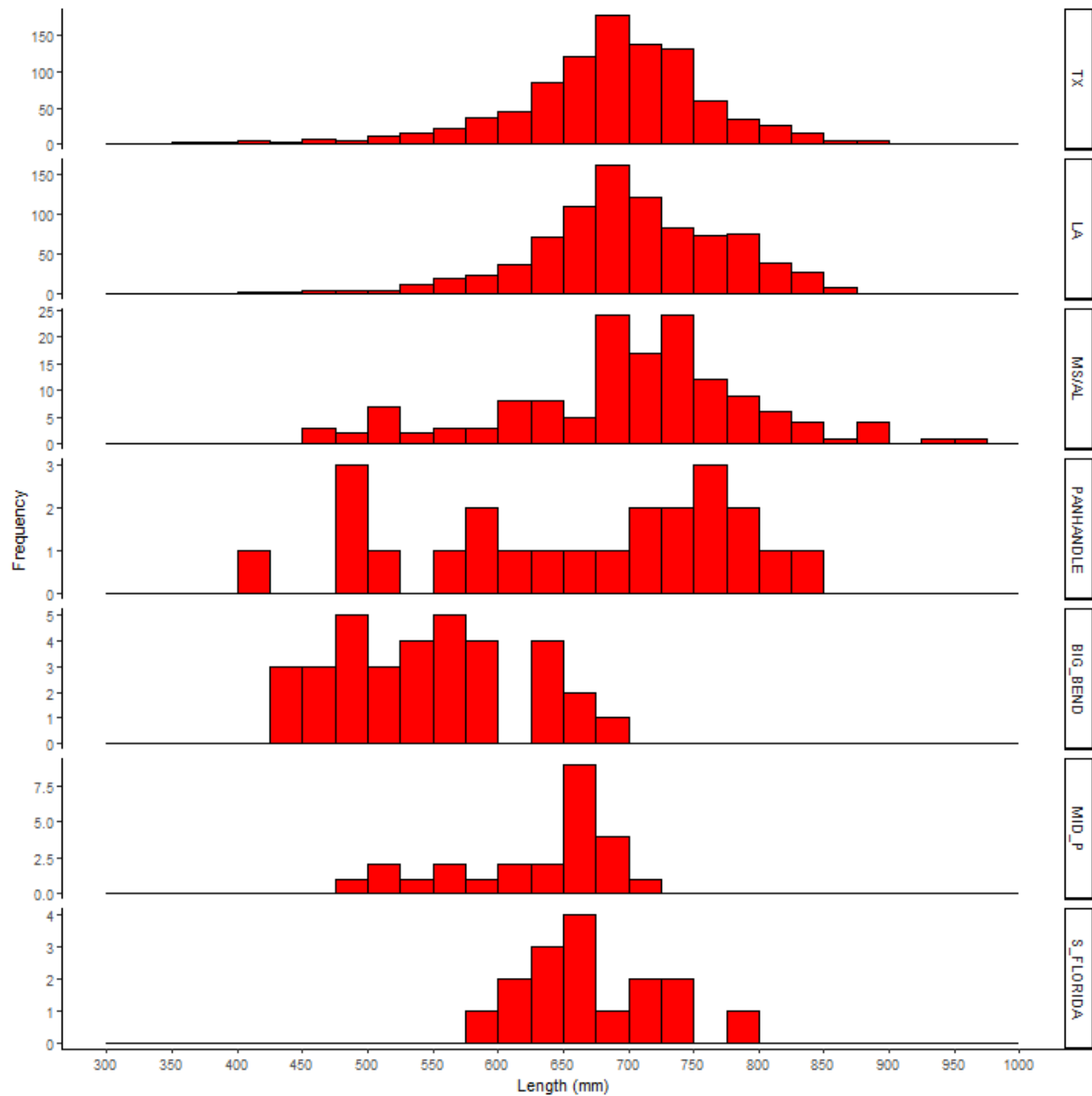
Figure 13. Regional differences in length distribution for red snapper from the NMFS BLL and CSSP BLL surveys for Texas (TX), Louisiana (LA), Mississippi/Alabama (MS/AL), Panhandle, Big Bend, Mid Peninsula (MID_P), and South Florida (S_FLORIDA).

Groundfish Trawl Surveys

The National Marine Fisheries Service (NMFS) Southeast Fisheries Science Center (SEFSC) Mississippi Laboratories (MSLABS) and state partners have conducted standardized summer and fall groundfish surveys under the Southeast Area Monitoring and Assessment Program (SEAMAP) in the Gulf of Mexico (GOM) since 1987. The survey area historically covered all trawlable bottom from 9 to 110 m from Brownsville, TX to Mobile Bay, AL and was expanded to the Florida Keys, FL in 2008. The survey uses a 12.8 m semi-balloon shrimp trawl towed at a speed of 2.5 – 3 knots for 30 minutes (current design, was towed until a depth zone was covered prior to 2008). In addition to the survey area expansion and change in tow time, several other design changes were made in 2008, which led to splitting the time series for the analysis of catch rates and length distribution.

For red snapper captured during the SEAMAP Summer Groundfish Survey, their abundance and distribution is presented in Figure 14. Regional catch rates are presented in Figures 15-17, with the length distribution presented in Figures 18 and 19.

For red snapper captured during the SEAMAP Fall Groundfish Survey, their abundance and distribution is presented in Figure 20. Regional catch rates are presented in Figures 21-23, with the length distribution presented in Figures 24 and 25.
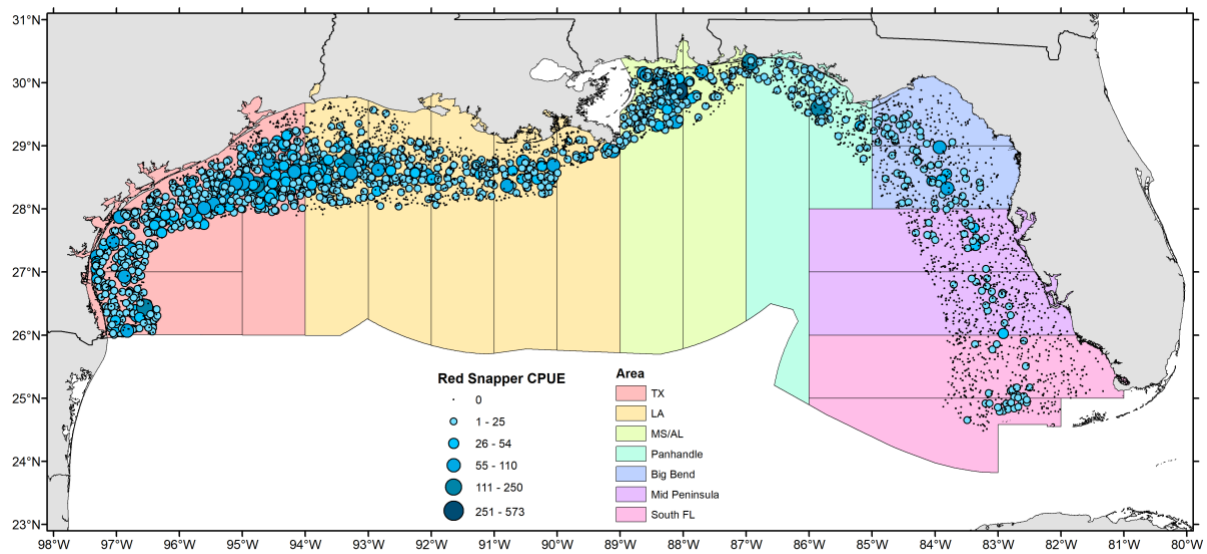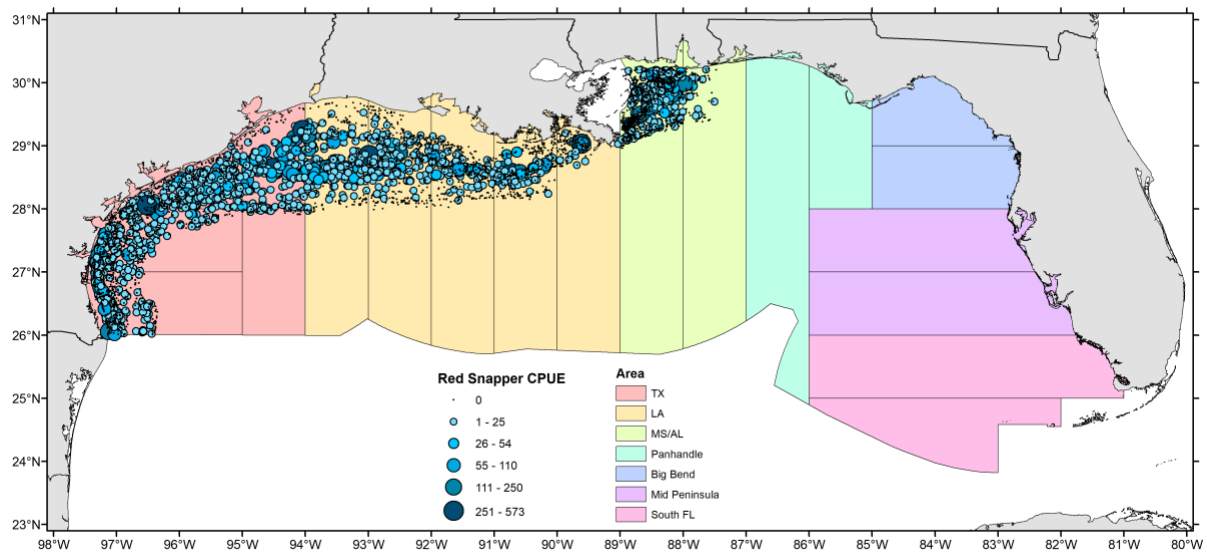
Figure 14. Distribution of trawl stations from the SEAMAP Summer Groundfish Survey from 1987-2007 (top) and 2008-2019 (bottom) with catch rates (number per trawl hour) of red snapper overlaid on the regional breakdown of the Gulf of Mexico used in the analysis.
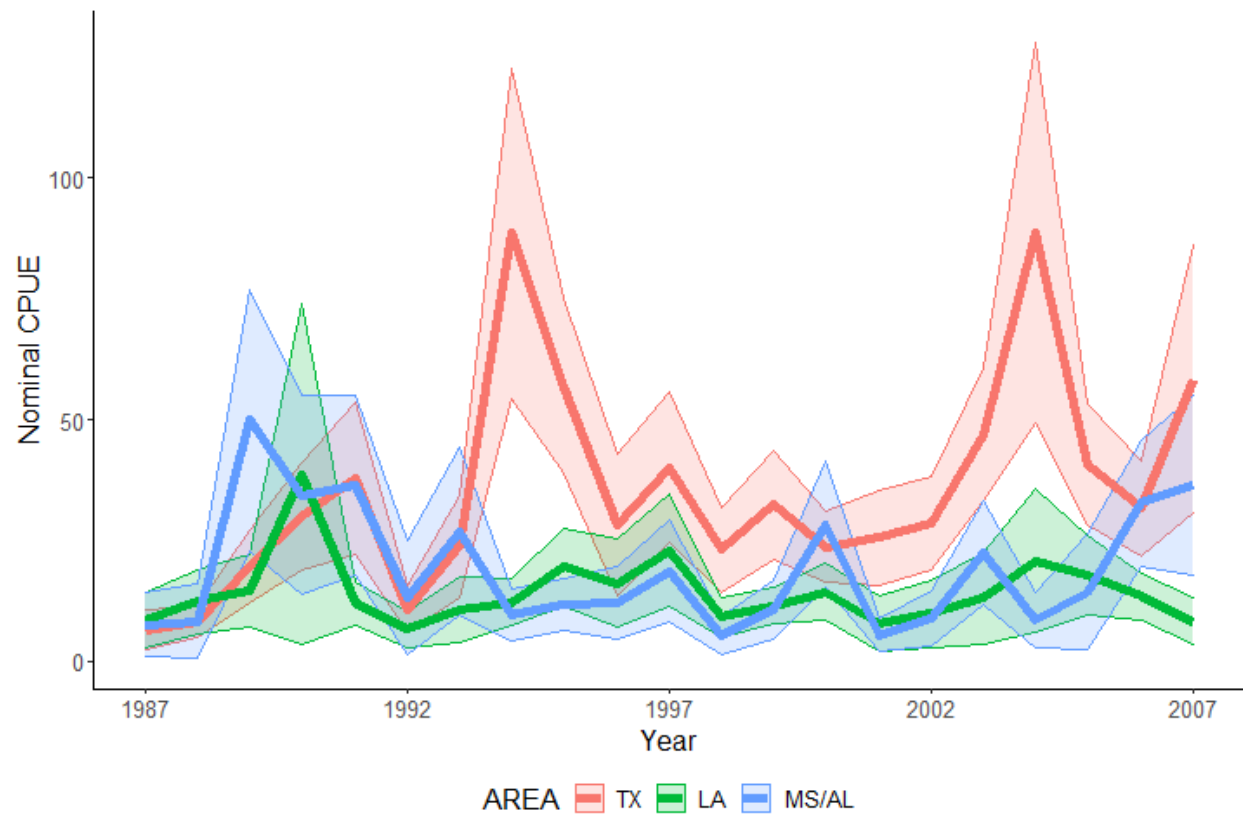
Figure 15. Regional differences in CPUE for red snapper from the SEAMAP Summer Groundfish Survey (1987-2007) for Texas (TX), Louisiana (LA), and Mississippi/Alabama (MS/AL).
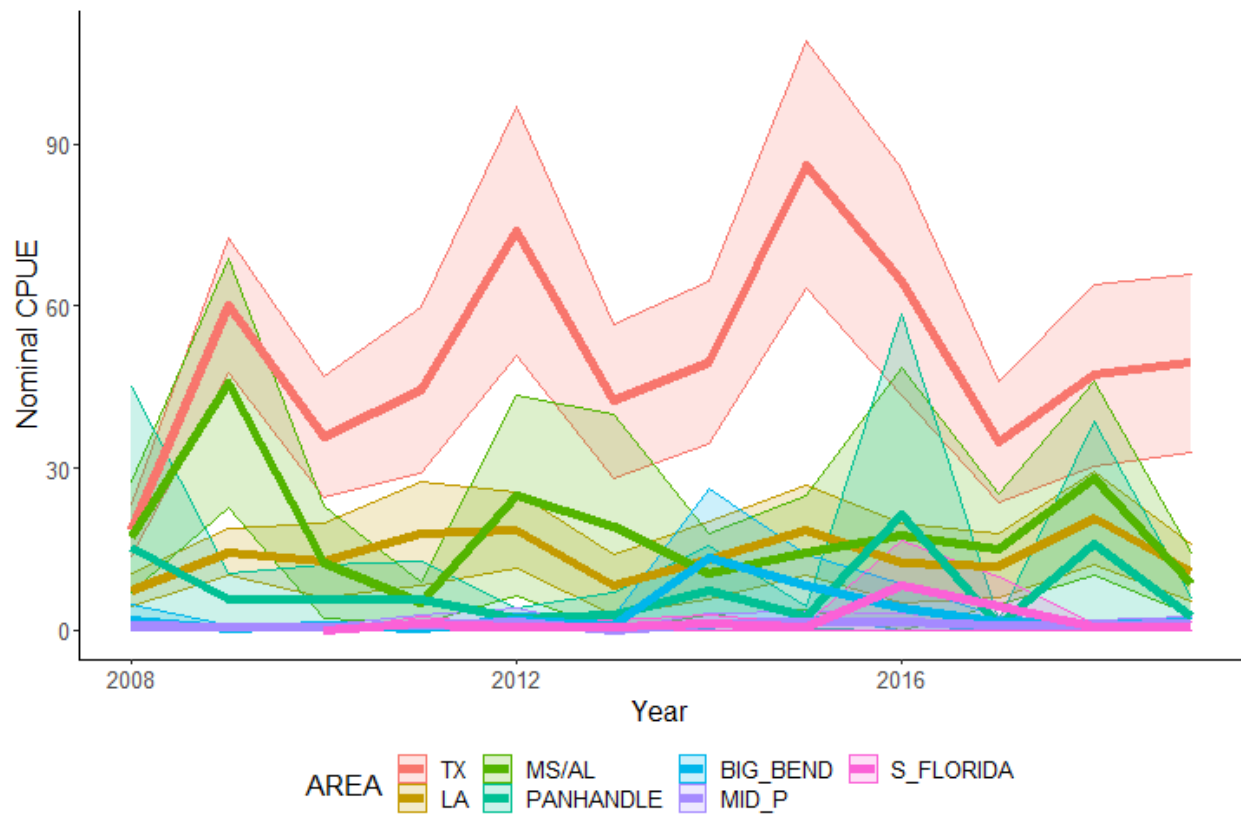
Figure 16. Regional differences in CPUE for red snapper from the SEAMAP Summer Groundfish Survey (2008-2019) for Texas (TX), Louisiana (LA), Mississippi/Alabama (MS/AL), Panhandle, Big Bend, Mid Peninsula (MID_P), and South Florida (S_FLORIDA).
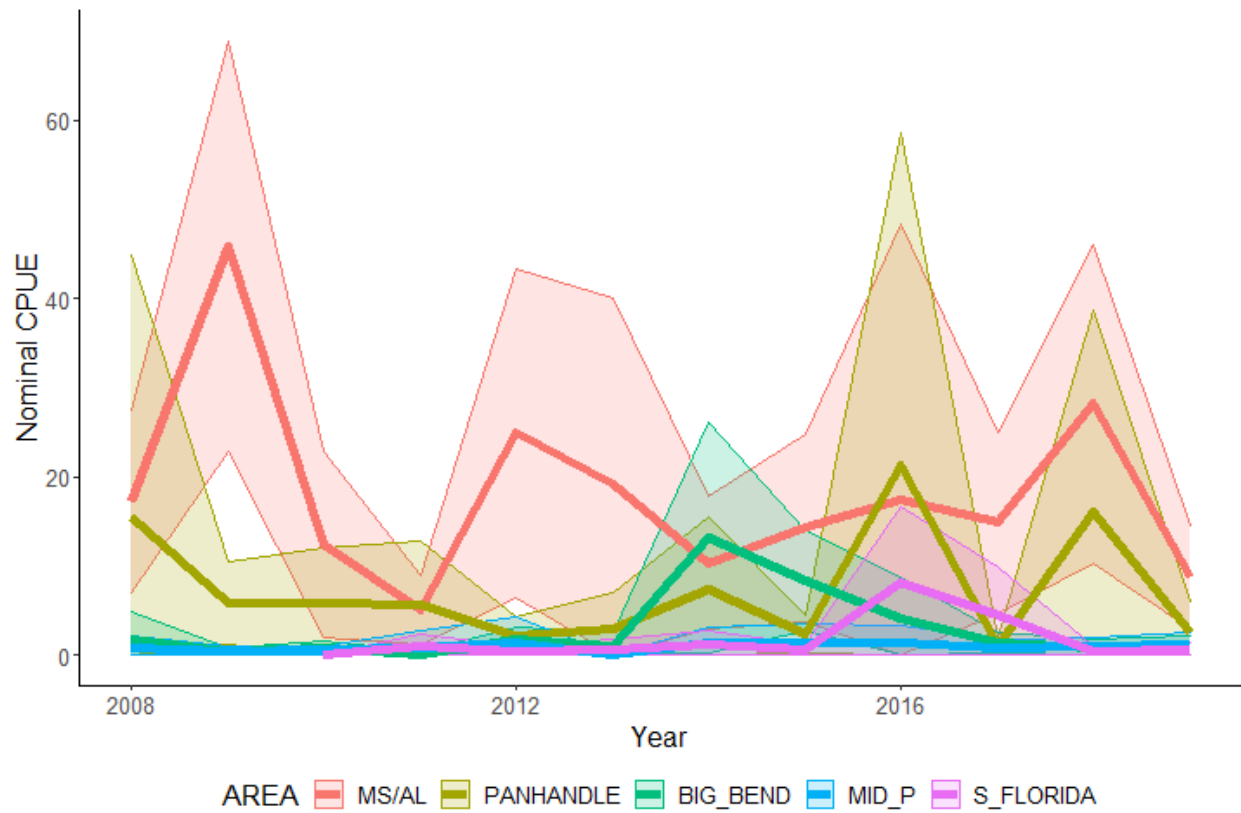
Figure 17. Regional differences in CPUE for red snapper from the SEAMAP Summer Groundfish Survey (2008-2019) for the eastern Gulf of Mexico from Mississippi/Alabama (MS/AL), Panhandle, Big Bend, Mid Peninsula (MID_P), and South Florida (S_FLORIDA).
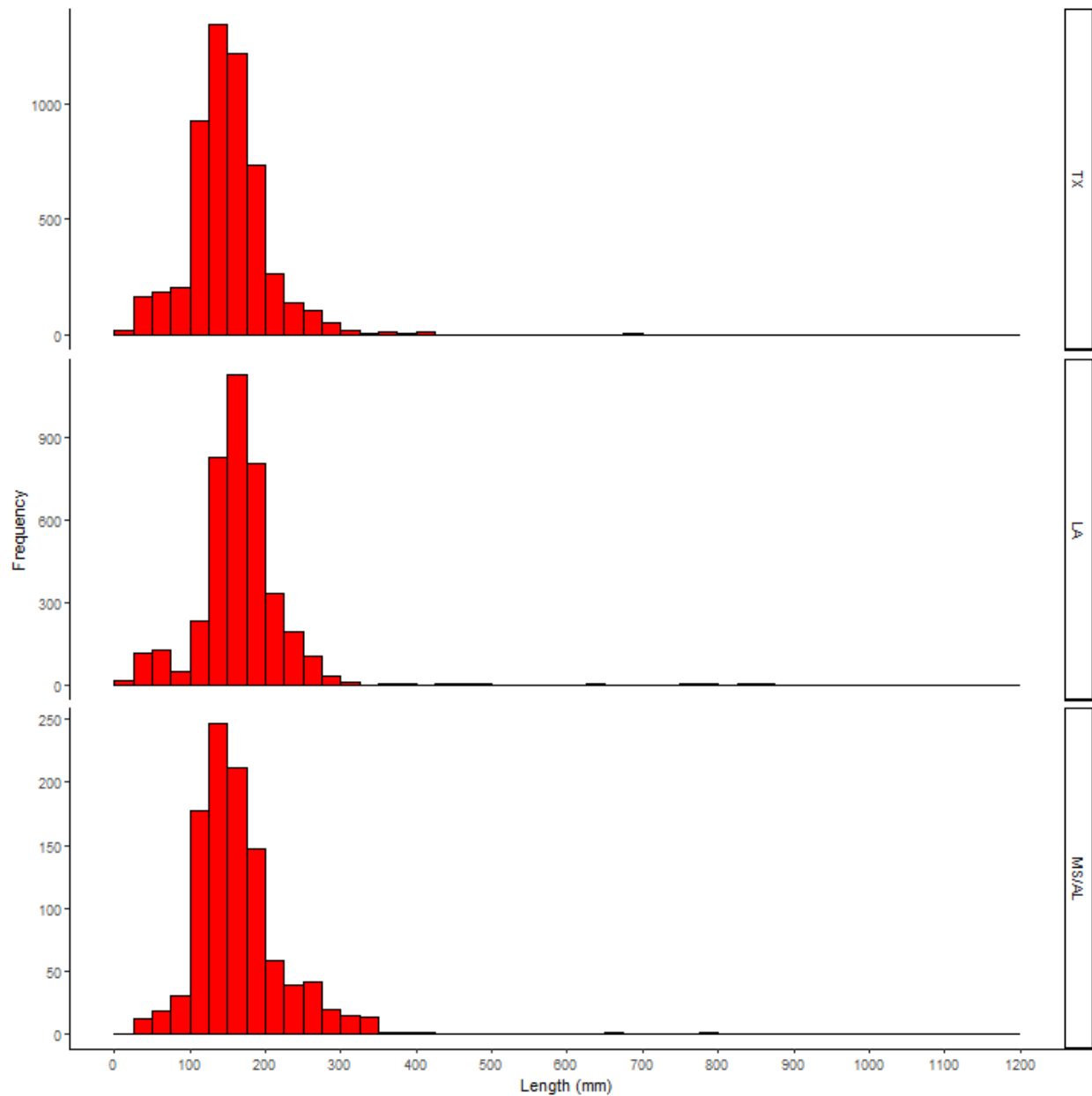
Figure 18. Regional differences in length distribution for red snapper from the SEAMAP Summer Groundfish Trawl Survey (1987-2007) for Texas (TX), Louisiana (LA), Mississippi/Alabama (MS/AL), Panhandle, Big Bend, Mid Peninsula (MID_P), and South Florida (S_FLORIDA).
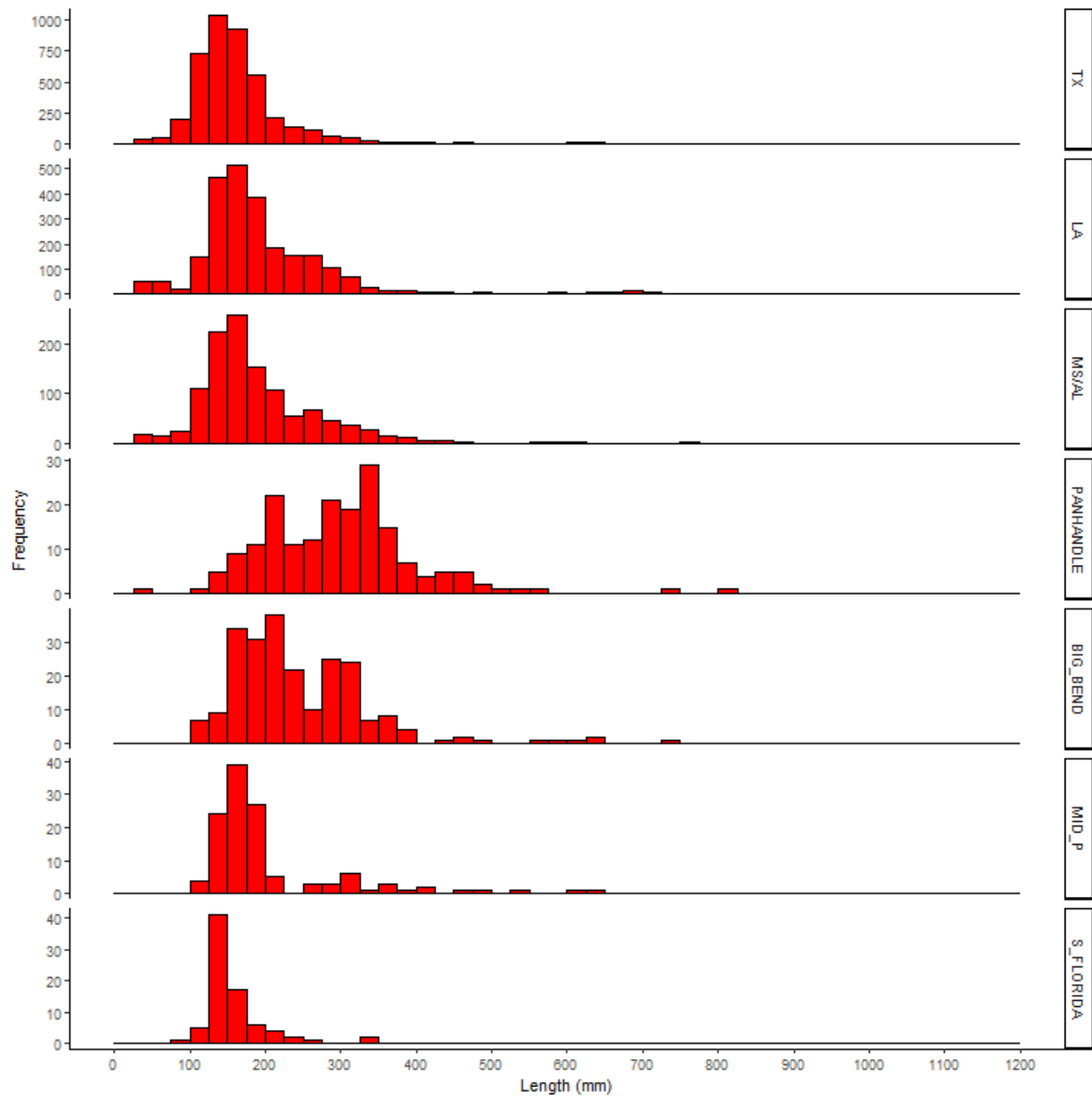
Figure 19. Regional differences in length distribution for red snapper from the SEAMAP Summer Groundfish (2008-2019) Trawl Survey for Texas (TX), Louisiana (LA), Mississippi/Alabama (MS/AL), Panhandle, Big Bend, Mid Peninsula (MID_P), and South Florida (S_FLORIDA).
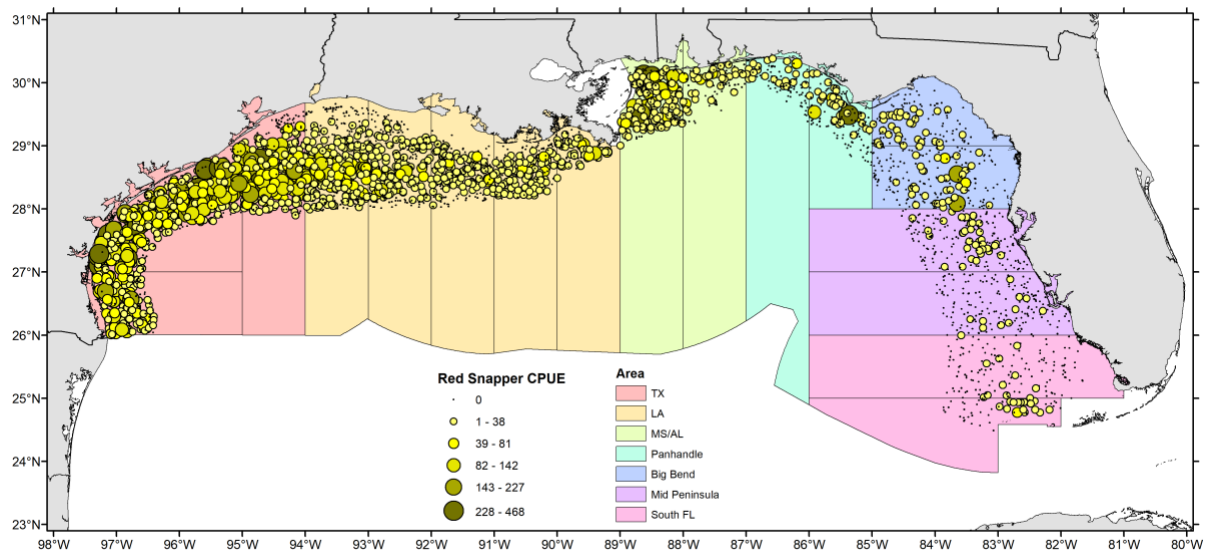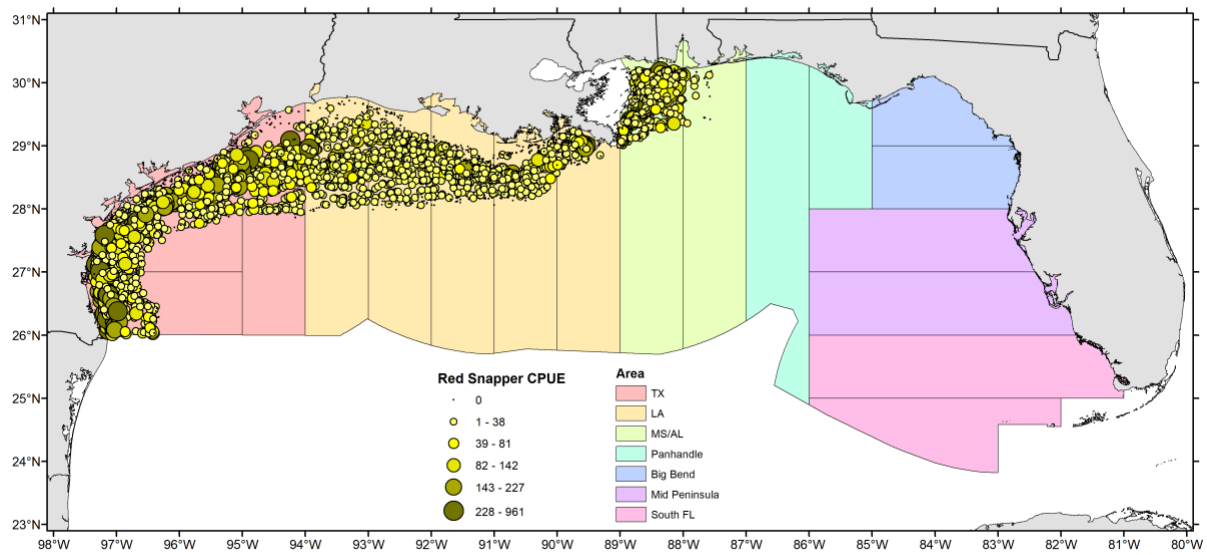
Figure 20. Distribution of trawl stations from the SEAMAP Fall Groundfish Survey from 1987-2007 (top) and 2008-2019 (bottom) with catch rates (number per trawl hour) of red snapper overlaid on the regional breakdown of the Gulf of Mexico used in the analysis.
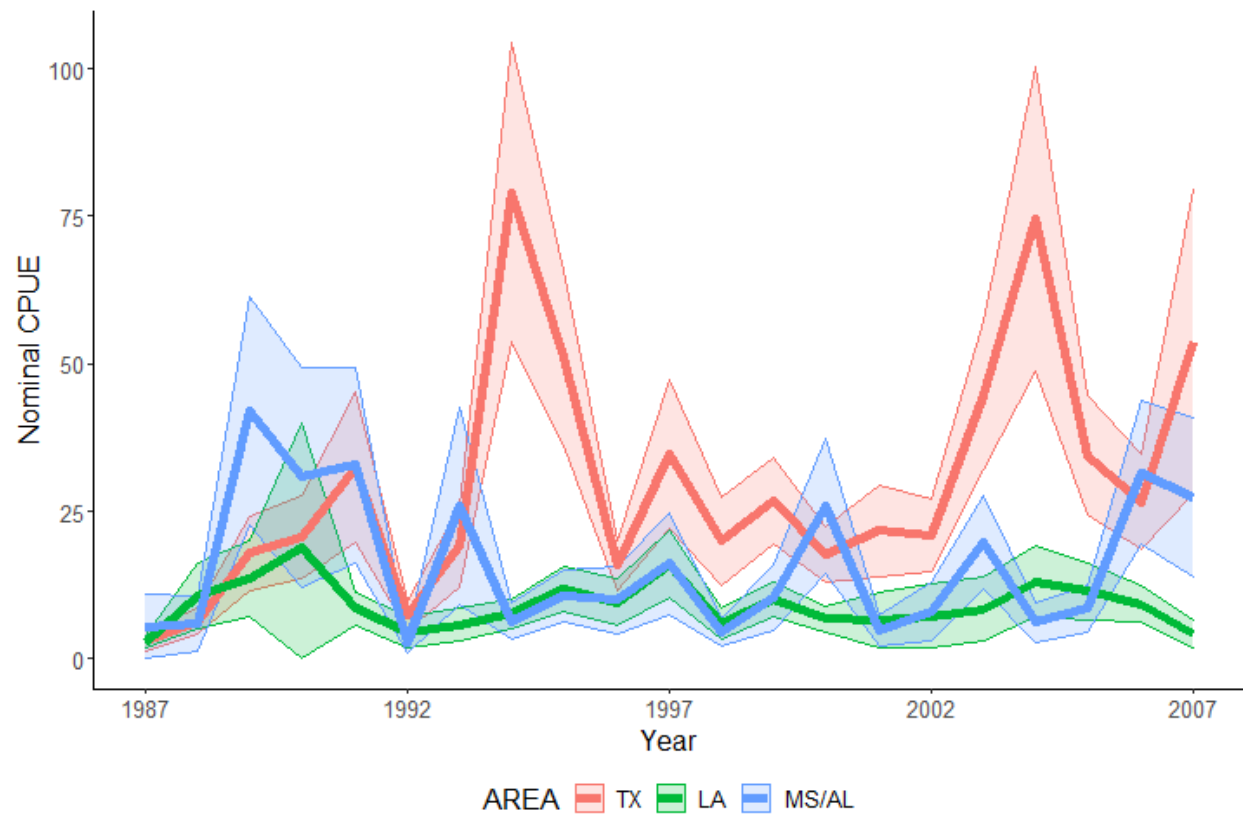
Figure 21. Regional differences in CPUE for red snapper from the SEAMAP Fall Groundfish Survey (1987-2007) for Texas (TX), Louisiana (LA), and Mississippi/Alabama (MS/AL).
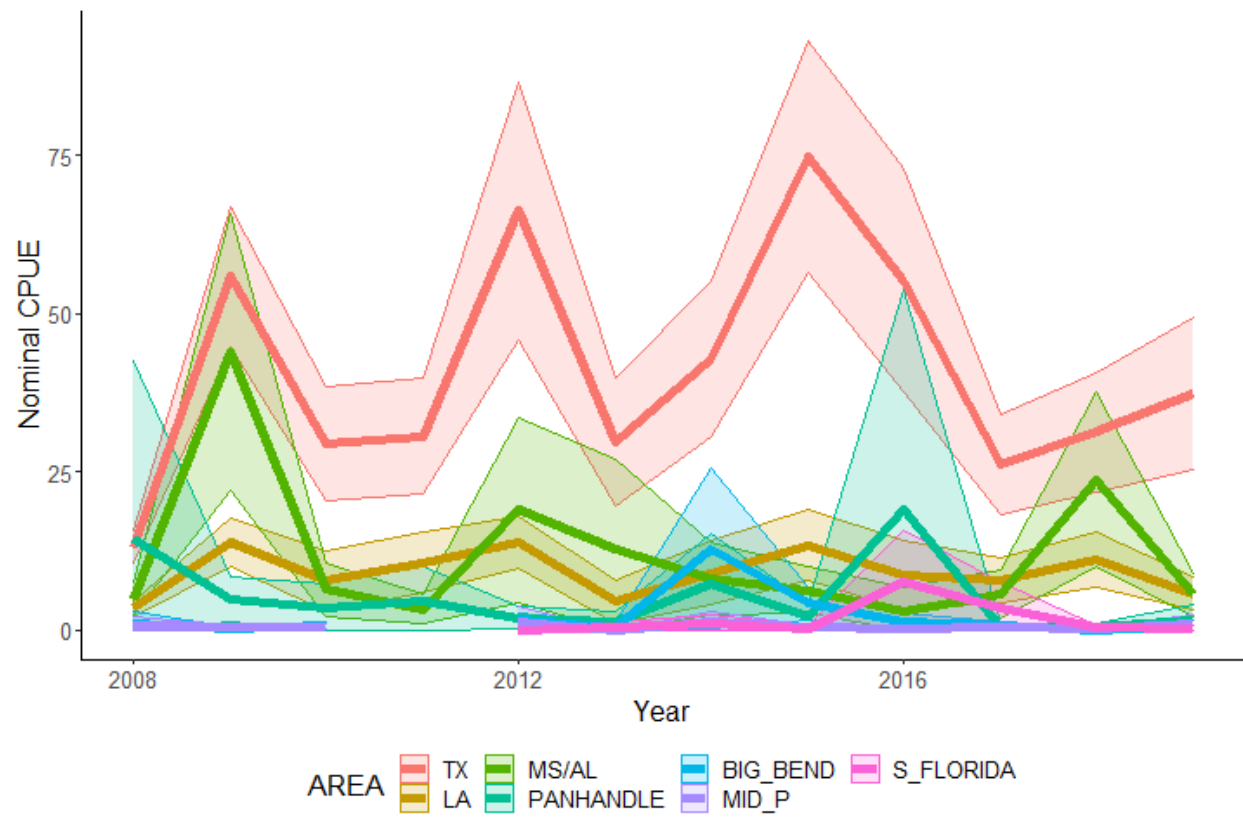
Figure 22. Regional differences in CPUE for red snapper from the SEAMAP Fall Groundfish Survey (2008-2019) for Texas (TX), Louisiana (LA), Mississippi/Alabama (MS/AL), Panhandle, Big Bend, Mid Peninsula (MID_P), and South Florida (S_FLORIDA).
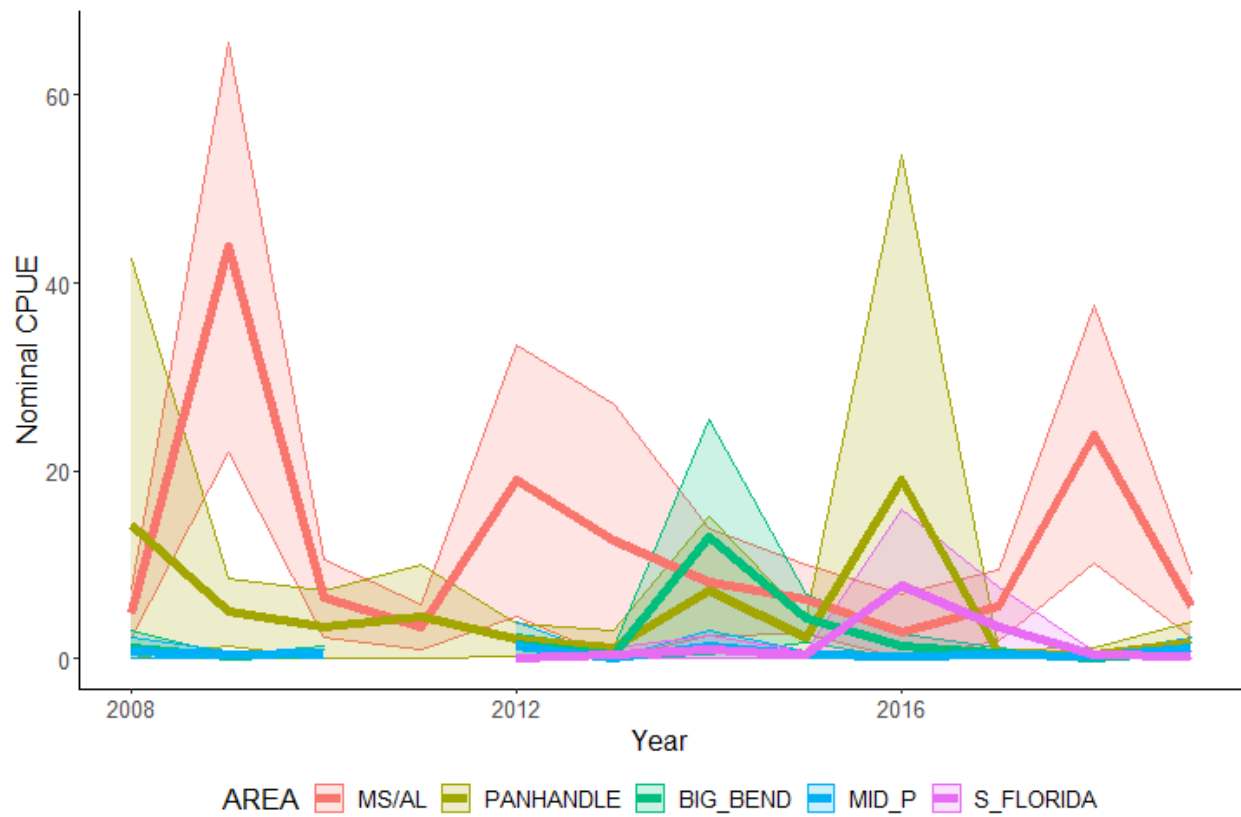
Figure 23. Regional differences in CPUE for red snapper from the SEAMAP Summer Groundfish Survey (2008-2019) for the eastern Gulf of Mexico from Mississippi/Alabama (MS/AL), Panhandle, Big Bend, Mid Peninsula (MID_P), and South Florida (S_FLORIDA).
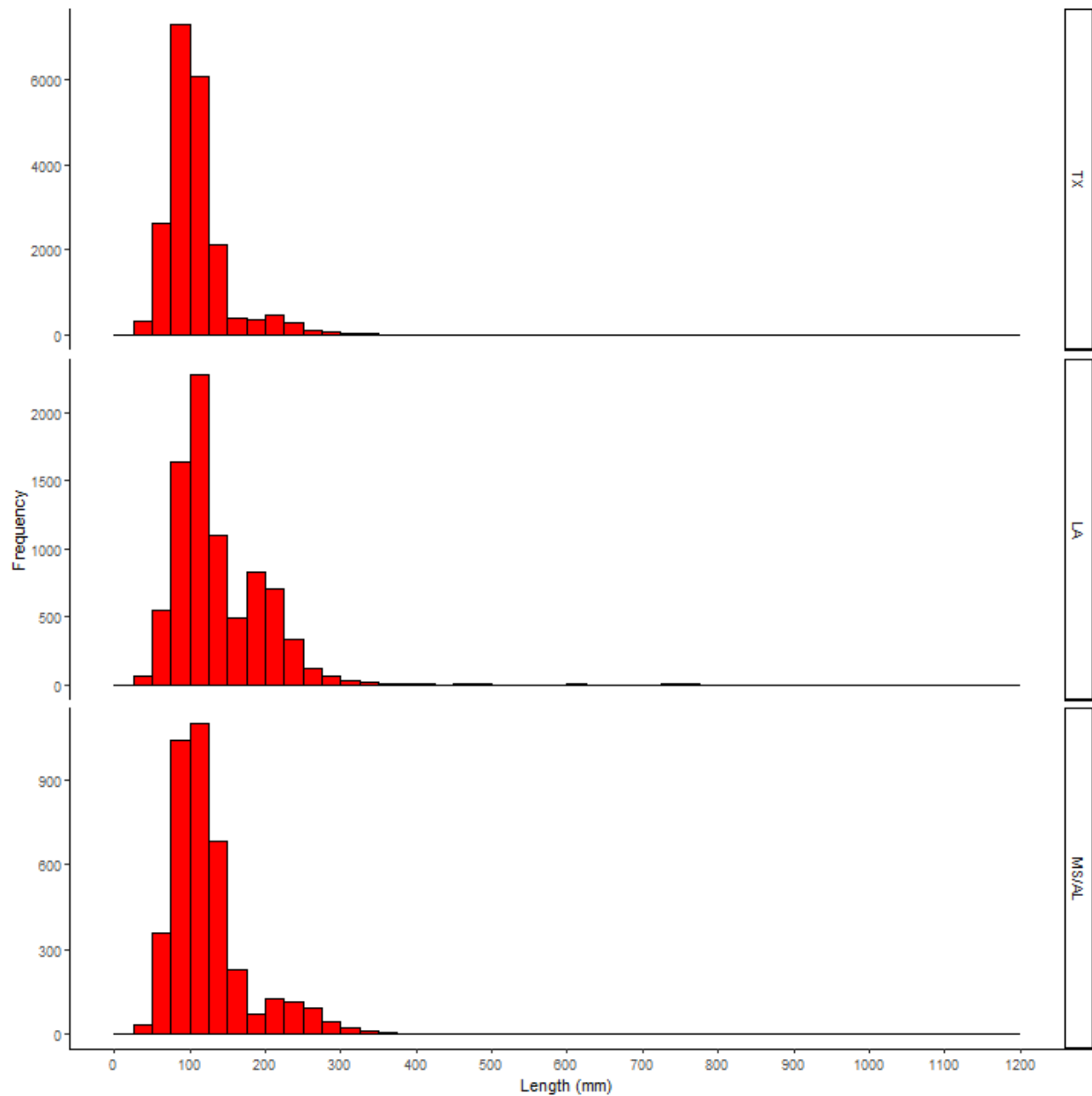
Figure 24. Regional differences in length distribution for red snapper from the SEAMAP Fall Groundfish Trawl Survey (1987-2007) for Texas (TX), Louisiana (LA), Mississippi/Alabama (MS/AL), Panhandle, Big Bend, Mid Peninsula (MID_P), and South Florida (S_FLORIDA).
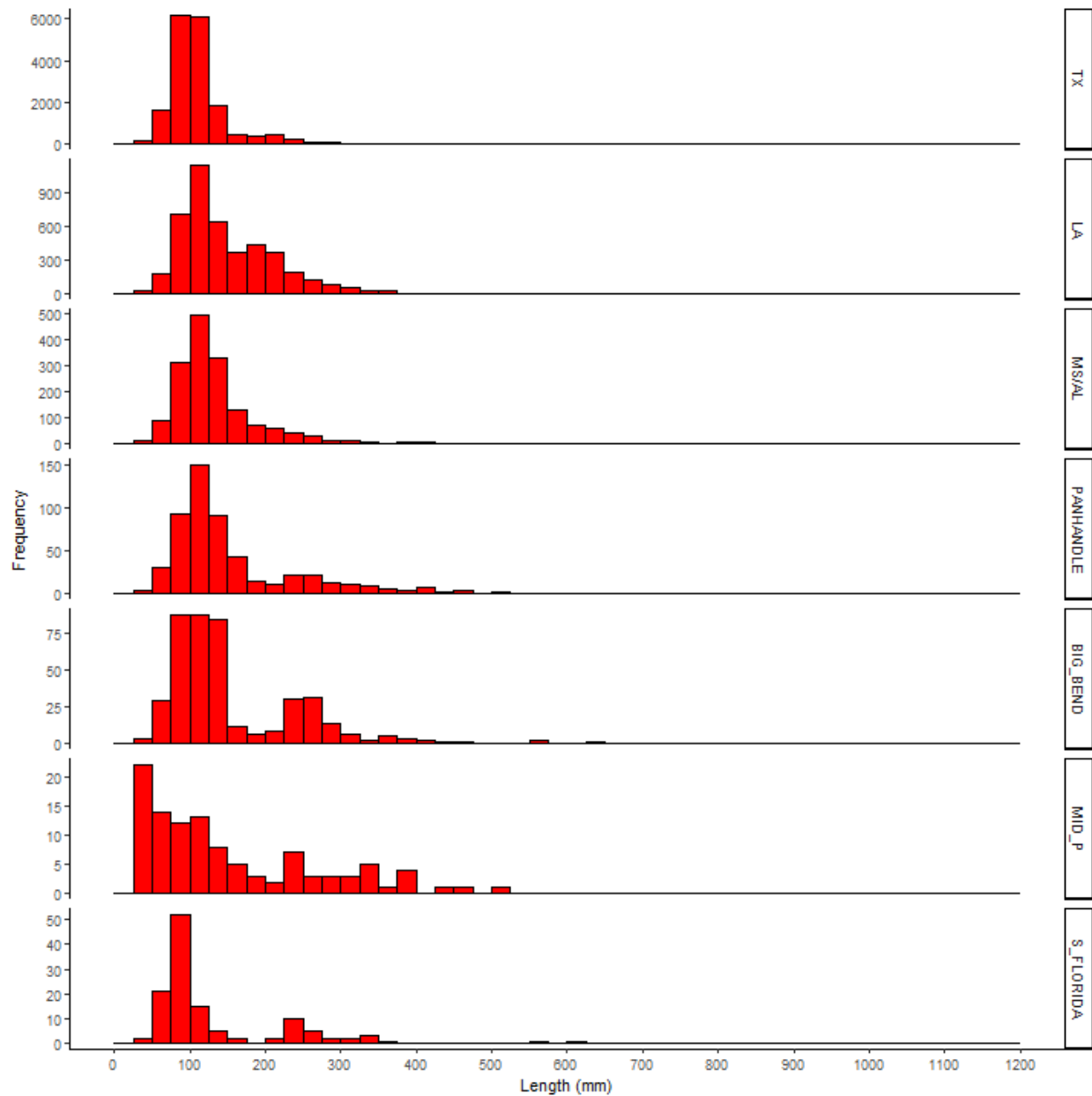
Figure 25. Regional differences in length distribution for red snapper from the SEAMAP Summer Groundfish (2008-2019) Trawl Survey for Texas (TX), Louisiana (LA), Mississippi/Alabama (MS/AL), Panhandle, Big Bend, Mid Peninsula (MID_P), and South Florida (S_FLORIDA).