SEDAR

Southeast Data, Assessment, and Review

SEDAR 74

Gulf of Mexico Red Snapper

SECTION IV: Assessment Process Report

November 2023

SEDAR
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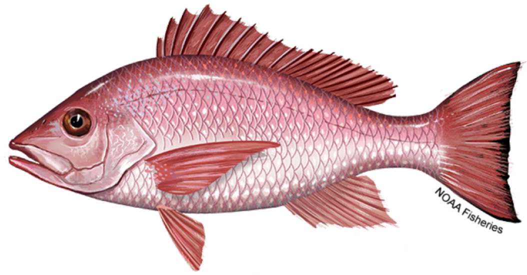

SEDAR 74 Gulf of Mexico Red Snapper Assessment Report

Gulf Branch
Sustainable Fisheries Division
NOAA Fisheries - Southeast Fisheries Science Center

November 21, 2023

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1. Assessment Process Proceedings

1.1. Introduction

SEDAR 74 addressed the stock assessment for Gulf of Mexico Red Snapper using data inputs through 2019 as implemented in the Stock Synthesis 3 modeling framework (Methot and Wetzel 2013).

1.1.1. Workshop Time and Place

The SEDAR 74 Assessment Process for Gulf of Mexico Red Snapper was conducted via a series of webinars held between October 2022 and July 2023.

1.1.2. Terms of Reference

The terms of reference approved by the Gulf of Mexico Fishery Management Council (GMFMC) are listed below.

1. Review any changes in data or analyses following the Data Workshop. Summarize data as used in each assessment model. Provide justification for any deviations from Data Workshop recommendations.

2. Develop population assessment model(s) that are appropriate for the available data

    a. Consider and incorporate as appropriate the information derived from the "Great Red Snapper Count" and other independent studies.
    b. Evaluate selectivity and retention functions for all directed, discard, and bycatch fleets as appropriate.
    c. Consider incorporating the Connectivity Modeling Simulation recruitment index to inform trends in recruitment for forecasting.
    d. Investigate fitting length composition data directly within the SS3 model as opposed to developing age-length keys and converting length frequency to age composition external to the modeling process.
    e. Explore whether available data supports the estimation of growth parameters within the model.
    f. Explore whether alternate recreational fleet structures are supported in the assessment model. Specifically, determine whether selectivity functions are estimable and model stability is maintained.

3. Provide estimates of stock population parameters, including:

    a. Fishing mortality, abundance, biomass, selectivity, stock-recruitment relationship, sex ratio, and other parameters as necessary to describe the population.

4. Characterize uncertainty in the assessment and estimated values.

    a. Consider uncertainty in input data, modeling approach, and model configuration.
    b. Provide appropriate measures of model performance, reliability, and 'goodness of fit'.

   c. Provide measures of uncertainty for estimated parameters.

5. Provide recommendations for future research and data collection. Emphasize items that will improve future assessment capabilities and reliability. Consider data, monitoring, and assessment needs.

6. Complete an Assessment Workshop Report in accordance with project schedule deadlines.

1.1.3. List of Participants

Assessment Development Team

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Ellie Corbett............ FWC
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Michael Drexler............ Ocean Conservancy
Francesca Forrestal............ NMFS Miami
Carissa Gervasi............ UM/CIMAS
Bob Gill............
Buddy Guindon............ Katie's Seafood
Martha Guyas............ ASA
David Hanisko............ NMFS Pascagoula
Mandy Karnauskas............ NMFS Miami
Rich Malinowski............ NOAA
John Mareska............ AL DCNR
Johnny Marquez............ MS Wildlife Fed
Craig Newton............ ADCNR/MRD
Adam Pollack............ NMFS Pascagoula
Kellie Ralston............ Bonefish & Tarpon Trust
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Carly Somerset .... GMFMC Staff

1.1.4. List of Assessment Process Working Papers and Reference Documents

Document #	Title	Authors	Date Submitted
Documents Prepared for the Assessment Process			
SEDAR74-AP-01	A meta-analysis of red snapper (*Lutjanus campechanus*) discard mortality in the Gulf of Mexico	Chloe Ramsay, Julie Vecchio, Dominque Lazarre, Beverly Sauls	16 November 2022
SEDAR74-AP-02	Final Report of the SEDAR 74 Ad-hoc Discard Mortality Working Group for Gulf of Mexico Red Snapper (*Lutjanus campechanus*)	SEDAR 74 Discard Mortality Ad-Hoc Working Group	16 February 2023
Reference Documents			
SEDAR74-RD115	Relative Effects of Multiple Stressors on Reef Food Webs in the Northern Gulf of Mexico Revealed via Ecosystem Modeling	David D. Chagaris, William F. Patterson III and Michael S. Allen	

2. Data Review and Update

The Gulf of Mexico (GOM) Red Snapper Research Track assessment required all available and relevant data to be prepared for assessment following the recommended three-area stock structure approved through the stock ID workshop. This process was accomplished through a series of data-focused webinars and a dedicated in person Data Workshop. Per the terms of reference for the Research Track Assessment, all sources of data were evaluated, prepared following current best practices, and representative of the spatial and temporal bounds of the assessment. The majority of the data included in the previously approved Red Snapper stock assessment model were used in SEDAR 74. However, changes to the stock ID and efforts to eliminate redundancies, particularly among indexes of abundance, resulted in the elimination of some previously approved data while several new sources were recommended for inclusion.

Notable new or significantly adjusted sources of data include: an estimate of absolute abundance produced through a research project entitled “Estimating the Absolute Abundance of Age-2+ Red Snapper *(Lutjanus campechanus)* in the U.S. Gulf of Mexico” (Stunz et al., 2021) and commonly referred to as the Great Red Snapper Count (GRSC); the National Marine Fisheries Service’s (NMFS) Marine Recreational Information Program (MRIP) Fishing Effort Survey (FES) catch and discard time series; and, spatially and temporally explicit estimates of maturity and fecundity parameters. The complete data utilized in the SEDAR 74 base model are summarized below and illustrated in **Figure 1** along with their corresponding temporal scale. Data details are included in referenced working papers.

1. Life history
    a. Meristics
    b. Age and growth
    c. Natural mortality
    d. Maturity
    e. Fecundity
2. Landings
    a. Commercial Handline West: 1950-2019 (metric tons whole weight)
    b. Commercial Handline Central: 1950-2019 (metric tons whole weight)
    c. Commercial Handline East: 1950-2019 (metric tons whole weight)
    d. Commercial Longline West: 1980-2019 (metric tons whole weight)
    e. Commercial Longline Central: 1980-2019 (metric tons whole weight)
    f. Commercial Longline East: 1980-2019 (metric tons whole weight)
    g. Recreational Charter West: 1955-2019 (thousands of fish)
    h. Recreational Charter Central: 1955-2019 (thousands of fish)
    i. Recreational Charter East: 1955-2019 (thousands of fish)
    j. Recreational Headboat West: 1955-2019 (thousands of fish)
    k. Recreational Headboat Central: 1955-2019 (thousands of fish)
    l. Recreational Headboat East: 1955-2019 (thousands of fish)
    m. Recreational Private West: 1955-2019 (thousands of fish)
    n. Recreational Private Central: 1955-2019 (thousands of fish)
    o. Recreational Private East: 1955-2019 (thousands of fish)
3. Discards
    a. Commercial Handline West: 1995-2019 (metric tons whole weight)
    b. Commercial Handline Closed Season Discards West: 1995-2006 (metric tons whole weight)
    c. Commercial Handline Central: 1995-2019 (metric tons whole weight)

d. Commercial Handline Closed Season Discards Central: 1995-2006 (metric tons whole weight)
e. Commercial Handline East: 1995-2019 (metric tons whole weight)
f. Commercial Handline Closed Season Discards East: 1995-2006 (metric tons whole weight)
g. Commercial Longline West: 1995-2019 (metric tons whole weight)
h. Commercial Longline Closed Season Discards West: 1995-2006 (metric tons whole weight)
i. Commercial Longline Central: 1995-2019 (metric tons whole weight)
j. Commercial Longline Closed Season Discards Central: 1995-2006 (metric tons whole weight)
k. Commercial Longline East: 1995-2019 (metric tons whole weight)
l. Commercial Longline Closed Season Discards East: 1995-2006 (metric tons whole weight)
m. Recreational Charter West: 1982-2019 (thousands of fish)
n. Recreational Charter Closed Season Discards West: 1997-2019 (thousands of fish)
o. Recreational Charter Central: 1981-2019 (thousands of fish)
p. Recreational Charter Closed Season Discards Central: 1997-2019 (thousands of fish)
q. Recreational Charter East: 1982-2019 (thousands of fish)
r. Recreational Charter Closed Season Discards East: 1997-2019 (thousands of fish)
s. Recreational Headboat West: 1982-2019 (thousands of fish)
t. Recreational Headboat Central: 1981-2019 (thousands of fish)
u. Recreational Headboat East: 1982-2019 (thousands of fish)
v. Recreational Private West: 1981-2019 (thousands of fish)
w. Recreational Private Closed Season Discards West: 1997-2016 (thousands of fish)
x. Recreational Private Central: 1981-2019 (thousands of fish)
y. Recreational Private Closed Season Discards Central: 1997-2019 (thousands of fish)
z. Recreational Private East: 1981-2019 (thousands of fish)
aa. Recreational Private Closed Season Discards East: 1998-2019 (thousands of fish)
bb. Shrimp Trawl West: 1950-2019 (metric tons whole weight)
cc. Shrimp Trawl Central: 1950-2019 (metric tons whole weight)
dd. Shrimp Trawl East: 1950-2019 (metric tons whole weight)

4. Length composition of landings
   a. Commercial Handline West: 1984-2019
   b. Commercial Handline Central: 1984-2019
   c. Commercial Handline East: 1984-2019
   d. Commercial Longline West: 1984-2019
   e. Commercial Longline Central: 2018-2018
   f. Commercial Longline East: 1984-2019

- g. Recreational Charter West: 1983-2019
- h. Recreational Charter Central: 1981-2019
- i. Recreational Charter East: 2002-2019
- j. Recreational Headboat West: 1982-2019
- k. Recreational Headboat Central: 1981-2019
- l. Recreational Headboat East: 1983-2019
- m. Recreational Private West: 1982-2019
- n. Recreational Private Central: 1981-2019
- o. Recreational Private East: 2008-2019
- p. Commercial Observer Program East: 2007-2019

5. Abundance indices
   - a. Fishery-independent:
     - i. Bottom Longline West: 2001-2019
     - ii. Bottom Longline Central: 2001-2019
     - iii. Bottom Longline East: 2001-2019
     - iv. SEAMAP Fall Trawl Pre-2007 West: 1988-2007
     - v. SEAMAP Fall Trawl Post-2007 West: 2008-2019
     - vi. SEAMAP Fall Trawl Post-2007 Central: 2008-2019
     - vii. SEAMAP Fall Trawl Post-2007 East: 2008-2019
     - viii. SEAMAP Reef Fish Video Survey West: 1993-2019
     - ix. Combined Video Survey Central: 1993-2019
     - x. Combined Video Survey East: 2010-2019
     - xi. SEAMAP Larval Survey West: 1986-2019
     - xii. SEAMAP Larval Survey Central: 1991-2019
     - xiii. SEAMAP Summer Trawl Pre-2007 West: 1984-2008
     - xiv. SEAMAP Summer Trawl Post-2007 West: 2009-2019
     - xv. SEAMAP Summer Trawl Post-2007 Central: 2009-2019
     - xvi. SEAMAP Summer Trawl Post-2007 East: 2009-2019
     - xvii. Red Snapper Count West: 2018
     - xviii. Red Snapper Count Central: 2018
     - xix. Red Snapper Count East: 2018
   - b. Fishery-dependent:
     - i. Shrimp Trawl West: 1950-2019 (effort as a "survey" of *F* to scale annual discards for the Shrimp Trawl West fleet)
     - ii. Shrimp Trawl Central: 1950-2019 (effort as a "survey" of *F* to scale annual discards for the Shrimp Trawl Central fleet)
     - iii. Shrimp Trawl East: 1950-2019 (effort as a "survey" of *F* to scale annual discards for the Shrimp Trawl East fleet)
     - iv. Commercial Handline East: 1993-2006
     - v. Commercial Observer Program East: 2007-2019
6. Length composition of surveys:
   - b. SEAMAP Fall Trawl Pre-2007 West: 1988-2007

c. SEAMAP Reef Fish Video Survey West: 1996-2019
d. Combined Video Survey Central: 2002-2019
e. Combined Video Survey East: 2010-2019
f. SEAMAP Summer Trawl Pre-2007 West: 1987-2008
g. SEAMAP Summer Trawl Post-2007 West: 2009-2019
h. SEAMAP Summer Trawl Post-2007 Central: 2009-2019
i. SEAMAP Summer Trawl Post-2007 East: 2015-2018

7. Age composition of surveys:
    a. Bottom Longline West: 2001-2019
    b. Bottom Longline Central: 2001-2019
    c. Bottom Longline East: 2001-2019
    d. SEAMAP Fall Trawl Post-2007 West: 2008-2019
    e. SEAMAP Fall Trawl Post-2007 Central: 2008-2019
    f. SEAMAP Fall Trawl Post-2007 East: 2008-2019

2.1. Stock Structure and Management Unit

The management unit for GOM Red Snapper extends from the United States–Mexico border in the west through the northern GOM waters and west of the Dry Tortugas and the Florida Keys (waters within the GOM Fishery Management Council boundaries). Based on the recommendations of the Stock ID Working Group, SEDAR 74 assumed there are three primary sub-stocks of Red Snapper within this region. Roughly, the western area comprised the waters between the U.S.–Mexico border and the Mississippi River outflow, the central area included the waters offshore from Mississippi, Alabama, and the panhandle of Florida, while the eastern area included the central and southern portions of the west Florida shelf. Currently, the Council manages the two Red Snapper sub-stocks (east and west) as one unit, but the option to utilize the new eastern, central, and western management units remains viable. For practical purposes, the east, central and west GOM assessment areas were defined based on GOM shrimp grids (grids 1 to 6 for the east GOM, 7 through 12 for the central GOM, and 13 to 21 for the west GOM). The areas are illustrated in **Figure 2** with further details available in the SEDAR 74 Stock ID Process Final Report (SEDAR 2021).

2.2. Life History Parameters

Life history data used in the assessment included length-length and length-weight relationships, age and growth, natural mortality, and reproduction data. All life history data incorporated into the population model (Stock Synthesis) were input as fixed parameters estimated external to the population model.

2.2.1. Meristics

All length-length and length-weight relationships ($W = aFL^b$) were developed using updated combined sex data and presented at the SEDAR 74 Data Workshop. Length-weight relationships did not vary by area and were incorporated as fixed model inputs (See Table 9 in SEDAR (2022)).

2.2.2. Age and Growth

Paired length and age data through 2019 were used to estimate spatially and temporally varying growth curves by the Life History Working Group during the Data Workshop. In all cases, size-adjusted von Bertalanffy growth models were fit to inverse weighted data (i.e., 1/age-specific n) because they provided improved fits to older age classes which had substantially smaller sample sizes than younger age classes. Growth parameters were estimated independently by assessment area and by time-stanza (1991-2008, 2009-2015, and 2016-2019) which were based on trends in biomass that were loosely interpreted as depleted, rebuilding, and asymptotic recovery. Temporal differences were non-significant, so the final analysis was restricted to estimating spatially varying growth curves. Area-specific growth parameters were estimated externally to Stock Synthesis for both sexes combined, and fixed within the model (See Section 2 of SEDAR (2022) for additional details) (**Figure 3**).

Ageing error estimates were provided during the Data Workshop. Estimates were developed using several different scenarios to model bias and precision for the primary reader, using the Northwest Fisheries Science Center's ageing error (nwfscAgeingError) package in R (Punt et al. 2008, Thorson et al. 2012). Ageing error models were not estimated separately for each subregion because there is no evidence to suggest a difference in readability among regions. The selected ageing error model included linear bias and curvilinear standard deviation. Age-specific pairwise comparisons indicated significant differences between expert and primary reader mean age estimates for ages 2, 3, 5-8, and 10, but mean ages between readers only differed by 0.02 to 0.31 years. Significant differences were likely due to large sample sizes within these age classes. The resulting ageing error matrix used in the SEDAR 74 base model is shown in **Figure 4** (further details provided in SEDAR74-DW-34).

2.2.3. Natural Mortality

An age-specific vector of natural mortality (***M***) was estimated during the SEDAR 74 Data Workshop. Review of available age data indicated a maximum validated age of 57 years for GOM Red Snapper. Natural mortality rate was estimated using the method of Then et al. (2015) with the Lutjanid-specific parameter subset and the resulting estimate was used to scale the Lorenzen age-specific natural mortality function (Lorenzen 2000). Following previous Red Snapper assessment recommendations, the natural mortality for age-0 and age-1 were fixed at 2.0 and 1.2 y^{-1}, respectively (see section 2.5 of SEDAR (2022) for additional details). Natural mortality vectors were assumed to be spatially and temporally constant and fixed in the model (**Table 1**, **Figure 3**).

2.2.4. Maturity

Spatially and temporally specific maturity relationships were estimated by the Life History Working Group during the Data Workshop (See Section 2 of SEDAR (2022) for additional details). Due to sample size limitations spatial estimates were limited to a western GOM estimate and an eastern GOM estimate which used combined samples from the central and east assessment areas. Temporal periods were specified as 1991-2008, 2009-2015, and 2016-2019 which were based on trends in biomass that were loosely interpreted as depleted, rebuilding, and asymptotic recovery. Estimates of age and length at 50% maturity varied by area and time. Results from the preferred random effects model indicated that Red Snapper in the west matured at an older age for a given time period (1.52, 1.71, and 2.46 years) than those in the east (1.36, 1.44, and 1.93 years) (See Table 5 in SEDAR (2022)). Conversely, the length at 50% maturity was uniformly smaller for a given time-period in the west (22.0, 23.8, and 31.5 cm) than in the east (25.6, 28.0, 32.8 cm) (See Table 6 in SEDAR (2022)). Age-based maturity curves were selected for use in the population model. The Life History Working Group recommended incorporating the time-varying aspects of maturity into the population model. However, attempts to do so resulted in enough computational instability that the Assessment Development Team determined it would be more appropriate to use time invariant estimates in the final model. Follow-up analysis (Claudia Friess, personal communication) produced spatially-specific, time-invariant age at 50% maturity and slope estimates that were input as fixed parameters with the central and east assessment areas both using the eastern GOM estimates (**Table 2**). Sex ratio at birth was assumed to be 50% female and 50% male.

2.2.5. Fecundity

Batch fecundity at age and length estimates were produced following the same spatial and temporal structure as the maturity estimates. Estimates, though highly uncertain, indicated that fecundity had a decreasing trend with time for a given area and was generally greater in the eastern area than in the west (See Section 2 of SEDAR (2022) for additional details). The Life History Working Group recommended using weight (Spawning Stock Biomass) as a proxy for fecundity, as the high level of uncertainty around the fecundity estimates, particularly for older fish (age-10+), caused the group to doubt the reliability of the estimates for use in the assessment.

2.3. Fishery-Dependent Data

2.3.1. Commercial Landings

Commercial landings and their corresponding estimates of uncertainty are presented in the SEDAR 74 GOM Red Snapper Data Workshop report (SEDAR 2022, Table 3.1 and Table 3.7). The primary commercial gears used for GOM Red Snapper are the Handline (vertical lines, bandit rigs, rod and reel, etc.) and Longline. Handline landings estimates were provided back to 1872; however, the historic estimates (prior to 1950) were not directly included in the final model because they were highly uncertain due to poor historic record keeping and uncertainty around assigning them into the new three-area model structure. For each assessment area, a Handline fleet (1950-2019) and a Longline fleet (1980-2019) were included in the model (**Figure 5**). Commercial landings were reported in pounds and converted to metric tons for input to the assessment model. The model was unable to converge when the Data Workshop recommended CVs were used for all years of the commercial data. Exploratory runs indicated that sufficient model stability was achieved if landings prior to 1995 were input as essentially known without error (CV 0.05). All other years (1995-2019) made use of the Data Workshop recommended CVs (see Table 3.7 in SEDAR (2022) for recommended CVs).

A large amount of commercial fishing occurred prior to the 1950 model start year, and as such the population for all assessment areas could not be assumed to be at or near unfished conditions at the start of the model. Therefore, area and fleet specific initial fishing mortality estimates (*F*) were required for all fleets thought to be operating prior to 1950. For the commercial fleets this was limited to the Handline fleets for each area as no Longline landings were recorded prior to

1980. Initial equilibrium catches were calculated for the Handline fleet as the average landings over the first twenty years of historic landings (1930-1949). CVs of 0.01 were used to force the model to fit the initial catch values and the resulting estimates of *F* were applied prior to the model start year to adjust the area-specific initial population structures.

2.3.2. Recreational Landings

Recreational landings data (1955-2019) used in the assessment are presented in (SEDAR 2022, Tables 4.12.4 and 4.12.15). For the data period (1981-2019), final recreational landings were computed using fully calibrated estimates from the MRIP using FES, the Southeast Region Headboat Survey (SRHS), Louisiana Creel, and the Texas Parks and Wildlife Department (TPWD) data (see SEDAR74-WP-01). Recreational landings are reported by mode and include data on the Charter Boat, Headboat, and Private fleets. For the assessment, each recreational mode was modeled separately for each assessment area. Recreational Private landings represented the dominant mode in the total recreational landings by numbers since 1981. Recreational landings were reported in numbers of fish and input into the assessment model as 1000s of fish (**Figure 6**).

Historical estimates (1955-1980) for recreational landings were estimated using the National Survey of Fishing, Hunting, & Wildlife-Associated Recreation (FHWAR) method (For a recent document detailing the methodology, see SEDAR72-WP-05). The FHWAR method utilizes a combination of information including U.S. angler population estimates and angling effort estimates from 1955-1985 to estimate effort (saltwater days) for the GOM for every five years when the survey is conducted. For the years in between, a linear interpolation of the estimates is applied. Estimates of effort for 1955-1980 are then multiplied by the mean catch per unit effort (CPUE) for GOM Red Snapper for 1981 to 1989 (MRIP, SRHS and TPWD combined) to estimate annual landings for the historical time period (1945-1980). For SEDAR 74, total historical recreational catches were apportioned by mode and stock assessment area using fleet- and area-specific mean ratios of recreational landings from 1981-1989. Lastly, the area-specific ratios of For-Hire landings: Recreational Private landings were adjusted back in time to account for a historically less robust Recreational Private angling fleet due to technological and accessibility limitations (see SEDAR (2022) for a complete description).

Uncertainty estimates were provided for the recreational fleet landings for 1981-2019 (SEDAR74-WP-01 or SEDAR 2022, Table 4.12.6). Attempts to directly use the Data Workshop supplied estimates of CV resulted in unacceptable levels of model instability. Consequently, workshop supplied CVs were used from 1995-2019 and earlier landings (1955-1994) had CVs fixed at 0.15 which was the value applied to all years of recreational landings in the most recently completed Red Snapper assessment (see Table 4.12.4-4.12.8 in SEDAR (2022) for recommended CVs).

Starting the assessment model in 1950, when the stock was already in a fished state, requires the estimation of initial conditions via initial equilibrium catches, which are used to calculate initial fishing mortality rates. Initial equilibrium catches were set equal to the reported landings in 1955. Furthermore, the years 1950-1954, for which no landings were reported, also had catch values set equal to the fleet and area-specific 1955 landings. These additional years of landings were required to allow Stock Synthesis (SS) to estimate an initial catch without assuming zero landings in the years between the model start year and the first data year. Initial equilibrium catch was set for all recreational fleets with the exception of the east area Headboat fleet. This fleet was excluded because it reported near zero landings in 1955.

2.3.3. Commercial Discards

Commercial discards used in SEDAR 74 are presented in SEDAR (2022), Tables 3.4.1.1. - 3.4.1.2. The commercial discards for GOM Red Snapper were estimated using two methodologies to accommodate differing levels of data quality and availability. Discards occurring between 1995 and 2006 were estimated separately for periods when the fishery was open and closed using methods developed during SEDAR 32 (McCarthy 2015, 2013). This approach, which makes use of commercial discard logbook data, has become standard practice for estimating commercial discards in the absence of observer data. Details on the approach are provided in the SEDAR 74 Data Workshop report (SEDAR 2022). Discards occurring after 2006 are estimated using an improved methodology which made use of CPUE from the Commercial Reef Fish Observer Program and total fishing effort from the Commercial Reef Fish Logbook Program to estimate total catch (SEDAR74-DW-19). Discards occurring after 2006 were assumed to all happen during an "open season" because the commercial fleets were allocated individual fishing quota which effectively extended the season year-round. For both methodologies, discard estimates were reported in numbers and were input into the assessment as 1,000s of fish (trends shown in **Figure 7** and proportions by fleet shown in **Figure 8**) with corresponding log-scale standard errors fixed at values provided (SEDAR 2022, Table 3.4.2.1). Area and fleet-specific discard mortality rates were provided in SEDAR 74-AP-02 (SEDAR 2023). Commercial discard mortality rates were estimated as the midpoint between the percent of Red Snapper reported discard dead and the percent of Red Snapper reported discarded dead plus those discarded with indications of barotrauma. Sample size limitations prevented the estimation of separate open and closed season discard mortality rates for the commercial fleets.

2.3.4. Recreational Discards

Recreational discard estimates used in the assessment were provided for all fleets during 1981-2019 and are presented in SEDAR (2022) Tables 4.12.11-4.12.13. When the data allowed, recreational discards were divided into those occurring when the fishing season was open and those occurring when the fishing season was closed (open and closed season, respectively). Open and closed season discards were tabulated for the Recreational Private and Charter Boat fleets for all areas, while the Headboat fleet, for all areas, had only combined discards treated as having occurred in an open season. Methodology for seasonal division of discards is discussed in SEDAR74-DW-35.

Recreational discards were reported as numbers of fish and input into the assessment as 1000s of fish (**Figure 9**) with Data Workshop supplied annual estimates of standard error (SEDAR 2022, Tables 4.12.11-4.12.13). Recreational discard mortality rates were estimated using the previously approved meta-analysis approach of Campbell et al. (2014) with updated data sets that accounted for depth of capture, assessment area of capture, season of release, and presence of venting/descending equipment. Detailed methodological description of area and fleet-specific recreational discard mortality rates were provided in SEDAR 74-AP-02 (SEDAR 2023). Where possible, separate open and closed season discard mortality rates were estimated. However, in many cases sample sizes were insufficient to support separate season-based estimates resulting in a single combined estimate.

2.3.5. Commercial Size Composition

Commercial Handline and Longline length compositions of landed (retained) fish are discussed in the SEDAR 74-DW-15 working paper. The annual length compositions were combined into 5-cm fork length interval bins (10 - 115). Length compositions of landings were constructed using data from the Commercial Trip Intercept Program (TIP) and GulfFIN and were processed following the procedures detailed in the SEDAR74-DW-15 working paper. For SEDAR 74 nominal length compositions were provided for the commercial fleets and not weighted by landings as is typically the case. Nominal length compositions were provided as they were deemed sufficient for model development as the intent of this assessment was not to estimate stock status or directly inform management. Weighted compositions will be requested for future Operational Track Assessments. The input sample sizes were simply the number of trips sampled for that year/fleet. Year/fleet combinations with less than 10 trips sampled were removed from the assessment model.

Data from the Commercial Reef Fish Observer Program were used to compile nominal length compositions for commercial discards occurring between 2007 and 2019 (SEDAR74-DW-38).

2.3.6. Recreational Size Composition

The Recreational Charter Boat, Southeast Regional Headboat Survey (Headboat), and Private sector length compositions of landed fish are discussed in SEDAR74-DW-15. The annual length compositions were combined into 5-cm fork length interval bins (10:115). Length compositions of landings were constructed using the MRFSS/MRIP, SRHS, TPWD, the GulfFIN database, and the TIP database. Nominal compositions were provided for the Research Track Assessment as they were deemed sufficient for model development as the intent of this assessment was not to estimate stock status or directly inform management. Weighted compositions will be requested for future Operational Track Assessments. A description of the revised methods used to develop the length composition data was provided in SEDAR74-DW-15. The input sample size associated with each year/fleet were provided in numbers of fish and trips, with trips used as sample sizes in the assessment model. Year/fleet combinations with less than 10 trips sampled were removed from the assessment model.

Data from the Florida Fish and Wildlife Commission (FWC) Fish and Wildlife Research Institute (FWRI) At-Sea Observer Program (2006-2019) were used to characterize the length compositions from recreational discards (SEDAR 74-DW-18). However, spatial limitations of the sampling and insufficient sample sizes prevented the data from being incorporated in SEDAR 74.

2.3.7. Commercial Age Composition

A detailed description of the commercial age compositions of landed fish were provided in SEDAR74-DW-15. Nominal age compositions for all year/fleet combinations were available; however, age composition data for the commercial fleets was not incorporated into the final assessment model since the fleet selectivities were modeled with length composition data. Models using age composition for the commercial fleets were developed as part of the Research Track Assessment but ultimately rejected in favor of the length-based models. Length-based models were ultimately preferred because they had reduced residual patterns in the fits to the composition data and generally improved fits to landings and discards.

2.3.8. Recreational Age Composition

A detailed description of the recreational age compositions of landed fish were provided in SEDAR74-DW-15. Nominal age compositions for all year/fleet combinations were available; however, age composition data for the recreational fleets was not incorporated into the final assessment model since the fleet selectivities were modeled with length composition data. Models using age composition for the recreational fleets were developed as part of the Research Track Assessment but ultimately rejected in favor of the length-based models. Length-based models were ultimately preferred because they greatly reduced residual patterns in the fits to the composition data and generally improved fits to landings and discards.

2.3.9 Commercial Catch Per Unit of Effort Indices of Abundance

Standardized catch per unit effort (CPUE) indices based on the Commercial Handline data (SEDAR 74-DW-17) and the Commercial Reef Fish Observer data (SEDAR 74-DW-38) were produced for the assessment. The Index Working Group at the Data Workshop recommended that the Handline east index (1993-2006) and the Commercial Reef Fish Observer Program east index (2007-2019) be included in the assessment (SEDAR 2022, Section 5) (**Table 3**). Annual CVs were scaled to a common mean CV of 0.2 (Francis et al. 2003) and converted to log-scale SEs for input in Stock Synthesis (**Table 4**), maintaining relative annual variation. Scaling CVs to a common mean was used in the previous Red Snapper assessment because indices are standardized using different techniques and the output SEs are not directly comparable, nor do they adequately characterize the relative confidence in the various indices. Scaling each index to a common mean allows them to be equally weighted within the assessment.

Length composition data were provided for the Commercial Reef Fish Observer data and were input as nominal composition with sample sizes equal to number of fish. The Commercial Handline index for the east area utilized the landed length composition for the eastern Commercial Handline fleet to model selectivity.

2.3.10. Recreational Catch Per Unit of Effort Indices of Abundance

Recreational indices were constructed using the Southeast Regional Headboat Survey and MRIP data and presented in SEDAR 74-DW-21 and SEDAR 74-DW-13. During the Data Workshop the indices were reviewed and the MRIP Private/Charter Boat derived indices (SEDAR 74-DW-13) were not recommended for inclusion in the assessment model due to the complexity of the management history for these fleets and sample size limitations, particularly in the east area. The indices constructed using the Headboat data (SEDAR 74-DW-21) for the east and central assessment areas were recommended for inclusion in the model. Initial model configurations attempted to include these indices; however, they were later removed due to concerns around the index standardization properly accounting for the complex Headboat management history and poor overall model fit for the index data. Therefore, no standardized CPUE indices based on the recreational fleet data were used in the assessment.

2.3.11 Shrimp Trawl Bycatch

Gulf of Mexico Shrimp Trawl bycatch data processing and analysis procedures are currently being re-evaluated to improve accuracy of Red Snapper bycatch estimates from the Shrimp Trawl fishery. This research is anticipated to be completed and reviewed for producing revised Shrimp Trawl bycatch estimates for the upcoming Red Snapper Operational Track Assessment. In the meantime, bycatch estimates from SEDAR 52 (SEDAR 2018) for statistical zones 1-12 (previous East subarea) were apportioned into the new Central (statistical zones 7-12) and East (statistical zones 1-6) areas (**Table 5**). Apportionment of the SEDAR 52 bycatch estimates into the SEDAR 74 three-area stock ID was done using refined estimates of 1985-2016 Shrimp Trawl effort for the new central and east areas (see section 3.5.1 in SEDAR (2022) for more details). For 1973-1984, the average proportion effort by area was computed for years 1985-1989 and then applied to the historical time series of Red Snapper bycatch estimates(**Figure 10**).

Because of the large uncertainty in the annual estimates of Shrimp Trawl bycatch, the bycatch discards were input as area-specific super period (i.e. median value from 1972-2017 of 264,000 east area fish, 727,000 central area fish and 13.9 million west area fish) which was then scaled annually by area-specific time series of Shrimp Trawl effort (available for 1950-2019; (**Figure 11**). Shrimp effort data were generated by the NMFS Galveston Lab using their SNpooled model (Linton, 2012; Nance 2004). The log SE for the mean discard numbers was set to 0.1. The Shrimp Trawl effort time series was scaled to a mean of 1 for input in the assessment model with an assumed constant CV of 0.2 (**Table 6**).

2.4. Fishery-Independent Surveys

2.4.1 SEAMAP Fall Plankton Survey

The primary objective of the SEAMAP Fall Plankton Survey (Larval Survey) is to collect and analyze ichthyoplankton samples in the Gulf of Mexico to produce a long-term database on the early life stages of fish in the region. These data were used to produce area-specific indices of abundance that were incorporated into the assessment model as indices of spawning stock biomass (SEDAR 74-DW-31). Central and west area indices were recommended for inclusion in the model with the east index being excluded due to low sample sizes. Indices were updated through 2019 and began in 1991 for the central area and 1986 for the west (**Tables 7-8** & **Figures 12-13**). Annual CVs were scaled to a common mean of 0.2 and converted to log-scale SEs for input into the assessment model (**Tables 9-10**).

2.4.2. SEAMAP Trawl Survey

The primary objective of the SEAMAP Trawl Survey is to collect data on the abundance and distribution of demersal organisms in the northern GOM. Two indices of abundance were produced for each assessment area utilizing data from the summer (2009-2019) and fall portions of the survey (2008-2019). Furthermore, in the west assessment area, where longer term sampling has occurred, additional indices were produced using Summer Trawl Survey data from 1984-2008 and Fall Trawl Survey data from 1988-2007. West indices of abundance were input into the model as a separate “Early” and “Late” indices due to a substantial survey design change that took place during 2008. See SEDAR74-DW-30 for a full description of the methods used to develop this index.

This index was updated through 2019 (**Tables 3, 7, and 8** & **Figures 12-14**). Annual CVs were standardized to a common mean of 0.2 and converted to log-scale SEs for input into the assessment model (**Tables 4, 9, and 10**).

Length composition for the SEAMAP Summer Trawl Surveys (See Figures 5 and 6 in SEDAR74-DW-30) were input as 5 cm binned nominal lengths with sample sizes specified as the number of stations sampled in a given year. Length converted age composition was used for the 2008-2019 SEAMAP Fall Trawl Surveys with sample size specified as number of fish. Development of the age-length keys is discussed in the working paper SEDAR74-DW-18. Age-length keys were not available far enough back in time to convert the west area 1988-2007 Fall Trawl Survey composition into age, so 5 cm binned length composition data were used with sample sizes input as the number of stations. Differences in composition approaches between the SEAMAP Summer and Fall Trawl Surveys stemmed from a need to limit requests on data providers during model development. Operational Track Red Snapper assessments following this Research Track Assessment will aim to utilize real age data for all fishery-independent indices and length-converted age if real age data are unavailable.

2.4.3. Video Surveys

An index of relative abundance was produced for the west assessment area using data collected by the NMFS SEAMAP Reef Fish Video Survey (SFRV). The combined video approach, briefly summarized below and described in SEDAR74-DW-23, was not used for the west area as the additional video surveys did not operate in the western assessment area. The SFRV west spans 1993-2019 with data gaps occurring in 1998-2001 and 2003 (**Table 8** & **Figure 12**). Annual CVs were standardized to a common mean of 0.2 and converted to log-scale SEs for input into the assessment model (**Table 10**).

For the central and east assessment areas, combined video indices were produced using three different stationary video surveys for reef fish in the northern Gulf of Mexico (GOM). The NMFS SEAMAP Reef Fish Video Survey (SFRV), carried out by the NMFS Mississippi Laboratory, has the longest running time series (1993-1997, 2002, and 2004-2019), followed by the NMFS Panama City lab survey (PC; 2005-2019), with the most recent survey being the Florida Fish and Wildlife Research Institute video survey (FWRI, starting in year 2010). For more information on the survey methodology, see SEDAR74-DW-23. The East Combined Video Survey spans 2010-2019 and the Central Combined Video Survey covers 1993-2019 with data gaps in 1998-2001 and 2003 (**Tables 3, and 7** & **Figures 13-14**). Annual CVs were standardized to a common mean of 0.2 and converted to log-scale SEs for input into the assessment model (**Tables 4, 9, and 10**).

Length compositions were input as nominal lengths with sample sizes specified as the number of survey stations from which successful measurements were obtained. Sample sizes below 10 trips annually were omitted.

2.4.4. NOAA NMFS Southeast Fisheries Science Center Bottom Longline Survey

The primary objective of NOAA NMFS Southeast Fisheries Science Center Bottom Longline Survey is to collect data on the abundance and distribution of fishes in the northern GOM. The survey has been conducted annually since 1995 and was used to provide area-specific indices of abundance for SEDAR 74 (SEDAR 74-DW-26). For index construction, data was limited to 2001-2019 due to gear and survey design changes that occurred prior to 2001. Sample size limitations also resulted in the elimination of 2005 and 2008 for the west area, 2007 and 2008 for the central area, and 2002, 2008 and 2015 for the east (**Tables 3, 7, and 8** & **Figures 12-14**). Annual CVs were standardized to a common mean of 0.2 and converted to log-scale SEs for input into the assessment model (**Tables 4, 9, and 10**).

Length-converted age composition was used for all areas and for all years for which samples were collected. Age compositions were input as nominal ages with sample sizes specified as the number of individuals measured.

2.4.5 Great Red Snapper Count (GRSC)

A comprehensive GOM wide study aimed at estimating the absolute abundance of Red Snapper in the GOM was conducted between 2017 and 2019 (GRSC, Stunz et al. 2021). This study produced state-specific estimates of absolute abundance with associated measures of uncertainty. The estimates provided in Stunz et al. 2021 differ from those used in the assessment due to a NMFS requested reanalysis of the GRSC Florida estimate, the adoption of Louisiana estimates from an accompanying study (LGL 2022), and the need to group the state-based GRSC estimates into the three stock assessment areas. To accommodate the stock assessment areas, the absolute abundance estimate for the state of Florida was split into the east and central assessment areas based on an unpublished analysis of the Florida data (Robert Ahrens, personal communication) which indicated a 47.4% and 52.6% split for the central and east areas, respectively. For the central assessment area, the GRSC Mississippi-Alabama estimate (8,461,085) was added to 47.4% of the post-stratified Florida estimate (22,261,780), which was then added to 16.47% of the pipeline estimate (83,632), resulting in a total absolute abundance of 30,806,497 fish in the central area. In the eastern area 52.6% of the post-stratified Florida estimate (24,704,000) was added to 0.53% of the pipeline estimate (2,670), resulting in a total of 24,706,670 fish in the eastern area. The west area was composed of the GRSC estimate from Texas (22,025,035), the LGL estimate of abundance from Louisiana (8,377,591) as well as the remaining 83% of the fish associated with pipelines (421,359) for a total of 30,823,985. The CVs for each assessment area were calculated as the numbers weighted average of the state/regional/pipeline estimated CVs for each area (**Table 11**). Estimates were input into the assessment model as a single 2018 data point and modeled with catchability coefficients fixed at 1 (**Figure 15**). Length composition data provided from the study were not spatially robust nor likely representative of the population structure over the whole study area and were consequently not included in the model. Regional differences in study design resulted in an assumed survey selectivity of 100%, fixed for fish age-2+ in the eastern area and assumed dome-shaped selectivities freely estimated in the central and western areas (See sections 3.1.7.2, 4.8.6, and 5 in this report for additional details on how GRSC selectivity decisions were reached).

2.5. Environmental Considerations & Contributions from Stakeholders

2.5.1 Connectivity Modeling System (CMS) Index

The Connectivity Modeling System (CMS) is a biophysical modeling system based on a Lagrangian framework, and was developed to study complex larval migrations. The CMS uses outputs from hydrodynamic models and tracks the three-dimensional movements of advected particles through time, given a specified set of release points and particle behaviors, while simulating realistic larval behaviors such as ontogenetic vertical migration. Specifics on the hydrodynamic model forcing the simulation, and other details on how the simulation was parameterized specific to Red Snapper biology, are described in SEDAR 74-DW-24.

The recruitment index is a measure of the proportion of larvae that are expected to successfully settle to suitable recruitment habitat within the given biological constraints, due to the effects of oceanographic currents. The index thus represents a scalar on the total larval supply expected each year, prior to any density-dependent processes that act on the larvae upon settlement. Variance estimates for the index are obtained by running a range of sensitivities to the assumed larval depth distribution, providing a mean and annual standard deviation for the index.

The CMS index would potentially be incorporated into the model as an index of recruitment; however, it was not considered during SEDAR 74. The primary value of the index is believed to lie in its ability to provide recruitment strength and potentially apportionment information in the most recent years of the assessment for which little other informative data (e.g., length/age composition) exist. The recent year class strength is influential in determining quantities like stock status and forecasting yields which were not undertaken during the Research Track process. Consequently, the index was not incorporated; however, its utility will be explored during the upcoming Operational Track Assessment of GOM Red Snapper.

2.5.2 Other Environmental Considerations Reviewed But Not Incorporated

A number of other environmental factors were identified during the Data Workshop which could potentially be considered for incorporation into the stock assessment as drivers of various population dynamic processes. Notable examples include the effects of seasonal and episodic hypoxia events in the northern GOM which are commonly observed with severe events found to be correlated with poor juvenile survival in the hypoxic zones; changes in diet and trophic ecology of Red Snapper associated with degraded habitat, particularly following the Deepwater Horizon oil spill, and increased competition from invasive Lionfish; and increased depredation following release due to the recovery of GOM shark and marine mammal populations. These and others detailed in SEDAR (2022) warrant further investigation; however, the lack of actionable timeseries of environmental covariates and testable hypotheses prevented the inclusion of these environmental factors in SEDAR 74.

3. Stock Assessment Model Configuration and Methods

3.1. Stock Synthesis Model Configuration

The assessment model used was Stock Synthesis (SS), version 3.30.20. Descriptions of SS algorithms and options are available in the SS User's Manual (Methot et al. 2020), the NOAA Fisheries Toolbox website (*http://nft.nefsc.noaa.gov/*), and Methot and Wetzel (2013). Stock Synthesis (SS) is a widely used integrated statistical catch-at-age model (SCAA) that has been tested for stock assessments in the United States (US), particularly on the West Coast and Southeast, and also throughout the world (see Dichmont et al. 2016 for review). SCAA models consist of three closely linked modules: the population dynamics module, an observation module, and a likelihood function. Input biological parameters (e.g., **Section 2.2**) are used to propagate abundance and biomass forward from initial conditions (population dynamics model) and SS develops predicted data sets based on estimates of fishing mortality, selectivity, and catchability (the observation model). The observed and predicted data are compared (the likelihood module) to determine best-fit parameter estimates using a statistical maximum likelihood framework (detailed in Methot and Wetzel (2013)). Because many inputs are correlated, the concept behind SS is that processes should be modeled together, which helps to ensure that uncertainties in the input data are properly accounted for in the assessment.

The GOM Red Snapper SS model assumed for SEDAR 74 differed greatly from any previous model configuration for GOM Red Snapper. The fully configured SS model included three distinct spatial areas (West, Central, and East) each with observations of catch and discards for five directed fishery fleets (Commercial Handline, Commercial Longline, Recreational Private, Charter Boat, and Headboat) and one bycatch fleet (Shrimp Trawl). For the commercial fleets and the Recreational Private and Charter Boat fleets, discards were separated into open and closed season components to enable the closed season discards to be modeled independently of the open season fishing dynamics. The model included 21 total indices of abundance spread among the three areas. The west spatial area incorporated the fishery-independent SEAMAP Video Survey, Bottom Longline Survey, SEAMAP Fall Plankton Survey (Larval Survey), a Great Red Snapper Count (GRSC) derived index of absolute abundance, and the Summer and Fall SEAMAP Trawl Surveys each split into two indices (Early and Late). The central spatial area utilized the fishery-independent Combined Video Survey, Bottom Longline Survey, Larval Survey, a GRSC derived index of absolute abundance, and the Late variant of the Summer and Fall SEAMAP Trawl Surveys. The east spatial area included two fishery-dependent indices of abundance (Commercial Handline and Commercial Reef Fish Observer), as well as the fishery-independent Combined Video Survey, Bottom Longline Survey, a GRSC derived index of absolute abundance, and the late variant of the Summer and Fall SEAMAP Trawl Surveys. Model estimated parameters include fishing mortality by fleet and spatial area for each year, selectivity and retention for each directed fleet, selectivity for the indices of abundance, excluding the east spatial area GRSC index (See **Section 3.1.7.2**), initial recruitment, stock-recruit deviations, recruitment base apportionment, recruitment apportionment deviations, index catchabilities, and Dirichlet-multinomial parameters.

The SS modeling framework provides estimates for key derived quantities including: time series of recruitment (units: 1,000s of age-0 recruits), abundance (units: 1,000s of fish), biomass (units: metric tons), SSB (units: metric tons), and harvest rate (units for Red Snapper: total biomass killed age 2+ / total biomass age 2+). The r4ss software (Taylor et al. 2021) was utilized extensively to develop various graphics for model outputs and was also used to summarize various output files.

Projections and the standard diagnostic runs were not completed as part of the Research Track Assessment as the data are not yet final. The assessment developed here is meant to serve as the structure with which final data will be fit during the Operational Track Assessment.

3.1.1. Initial Conditions

The Gulf of Mexico (GOM) Red Snapper assessment has a start year of 1950 and a terminal year of 2019. Removals of Red Snapper were known to occur in the GOM prior to 1950, primarily by the Commercial Handline fleets and to a lesser extent the recreational fisheries. Therefore, initial depletion was estimated using estimates of initial catch for fleets with significant landings at the beginning of the time series (i.e., Commercial Handline for all areas and all recreational fleets except Headboat in the east area). Initial catch values for the recreational fleets were set equal to each fleet's catch (in numbers of fish) in 1955, which was the first available data year. This resulted in initial fishing mortality rates of the recreational fleets being based on landings of 386,180 for West Charter Boat; 220,670 for Central Charter Boat; 62,070 for East Charter Boat; 317,220 for West Headboat; 124,130 for Central Headboat; 0 for East Headboat; 137,920 for West Recreational Private; 110,340 for Central Recreational Private; and, 24,830 for East Recreational Private. Commercial initial catch values were set equal to the average catch from 1930 to 1949. This resulted in initial fishing mortality rates for the commercial fleets being based on landings of 265 metric tons for the West Commercial Handline, 614 metric tons for the Central Commercial Handline, and 457 metric tons for the East Commercial Handline. For all fleets with initial catch, CVs of 0.01 were used to force the model to fit the initial catch values and the resulting estimates of F were applied by SS to achieve a plausible non-virgin initial population structure.

3.1.2. Temporal Structure

The Red Snapper population was modeled from age-0 through age-20+ fish, with the last age representing an accumulating plus group. The inclusion of a seasonal component to the removals was not considered for the Research Track Assessment thus the model time step was set equal to one year with fishery activity assumed to be continuous and homogeneously distributed throughout the year. Temporal structure in fleet behavior (i.e., selection and retention) were created using time blocking of parameter estimates (i.e., different values for retention parameters for one time period versus another). Larval settlement was specified to occur on July 1st corresponding with a period of elevated spawning during the protracted Red Snapper spawning season. Indices of abundance, length and age composition were assumed to be collected on July 1st for all fleets and surveys with the exception of the SEAMAP Fall Trawl Survey which was assumed to have occurred September 1st.

3.1.3. Spatial Structure

A three area model was implemented where recruits were assumed to be generated from a single stock recruitment relationship and then divided among the three assessment areas. Recruits were split into the three areas using the base recruitment apportionment parameters for all years until

1975 after which annual apportionment deviations were estimated and used to modify the base apportionment parameters. To improve model stability, priors were used to inform the estimation of the base apportionment parameters. The priors were calculated using the nominal catch per unit effort (CPUE) data from the SEAMAP Fall Plankton Survey (see Table 3 In SEDAR74-DW-31). Area-specific priors were calculated as the log of the average 2009-2019 CPUE divided by the average CPUE for the same time period from the reference area. Using the west area as the reference area, this resulted in priors of 0, -0.620 and -2.085 for the west, central and east areas, respectively. Priors were input as normal with a standard deviation (SD) of 0.5. The standard error of the apportionment deviations was fixed at 0.5 to moderate the model estimated variability in interannual recruitment deviations. Once settled, recruits followed area-specific life history and mortality parameters with no adult movement among areas assumed.

3.1.4. Life History

A fixed length-weight relationship was used to convert body length (cm Fork Length, FL) to body weight (kg whole weight; See Table 9 in SEDAR (2022), Figure **3**). Length-weight relationships were not estimated by spatial area so common parameters were applied to all three areas. Stock Synthesis (SS) moves fish among age classes and length bins on January 1^{st} of each modeled year starting from birth at age-0. The true birth data for Red Snapper in the GOM does not occur on January 1^{st}, with peak spawning occurring around July 1^{st}. Unlike previous SS versions, SS version 3.30.20 allows settlement timing to be specified in the model allowing for growth and natural mortality parameters to act for the appropriate amount of time on the age-0 cohort. Slight alterations in growth (t_0, or the age at length 0) and natural mortality parameters previously required to account for the difference between true age and modeled age were no longer needed.

Growth was modeled with a three parameter von Bertalanffy equation: (1) L_{Amin} (cm FL), the mean size at age-0.25 for Red Snapper; (2) L_{Amax} (cm FL), the mean size at maximum age for Red Snapper; and (3) K (year^{-1}), the growth coefficient. In SS, when fish recruit at the real age of 0.0 they have a body size equal to the lower limit of the first population bin (fixed at 10 cm FL). Fish then grow linearly until they reach a real age equal to the input value of A_{min} (growth age for L_{Amin}) and have a size equal to L_{Amin}. As they age further, they grow according to the von Bertalanffy growth equation (**Figure 3**). L_{Amax} was specified as equivalent to L_{inf}. Two additional parameters are used to describe the variability in size-at-age and represent the CV in length-at-age at A_{min} (age-0.25) and A_{max} (age-20). For intermediate ages, a linear interpolation of the CV on mean size-at-age is used.

Spatial area-specific von Bertalanffy growth model parameters L_{Amin}, L_{Amax} and K were estimated externally to SS using updated length and age compositions **Table 12**. Variance parameters for the west area CV_{Amin} (0.252) and CV_{Amax} (0.063), central area CV_{Amin} (0.318) and CV_{Amax} (0.057), and east area CV_{Amin} (0.394) and CV_{Amax} (0.041), were fixed at the values recommended at the SEDAR 74 (see Table 4 in SEDAR 2022) Data Workshop.

The age-specific vector of M (**Section 2.2.3**) was assumed to be constant across the three spatial areas and was fixed within the SS model (**Table 1**).

Maturity was modeled as an age-logistic relationship with no truncation on first mature age (i.e. fish could theoretically mature at age 0). Several time-varying approaches to modeling maturity were considered (**Section 3.4.7**); however, for the base model configuration, maturity was assumed to be area-specific and constant across time (**Table 2**). Fecundity was configured using a weight based relationship ($eggs = aWt^b$) that was parameterized with both the alpha and beta parameters fixed to 1 to ensure that derived population biomass metrics were in units of spawning stock biomass.

3.1.5. Recruitment Dynamics

A Beverton-Holt stock-recruit function was used to parameterize the relationship between spawning output and resulting recruitment of age-0 fish. The stock-recruit function (representing the arithmetic mean spawner-recruit levels) requires three parameters: (1) steepness (*h*) characterizes the initial slope of the ascending limb (i.e., the fraction of virgin recruits produced at 20% of the equilibrium spawning biomass); (2) the virgin recruitment (R_0, estimated in log space) represents the asymptote or virgin recruitment levels; and (3) the variance or recruitment variability term (*sigmaR*) which is the SD of the log of recruitment (it both penalizes deviations from the spawner-recruit curve and defines the offset between the arithmetic mean spawner-recruit curve and the expected geometric mean from which the deviations are calculated). The steepness parameter, *h* and *sigmaR* were fixed at 0.99, and 0.6, respectively, in the SEDAR 74 base model. Virgin recruitment (lnR_0) was freely estimated. Steepness was fixed as a computational convenience assuming no stock-recruitment relationship, but rather average recruitment from a mean. *SigmaR* was fixed at a recommended value for model stability.

Annual deviations from the stock-recruit function were estimated in SS as a vector of unconstrained deviations (i.e., deviations do not sum to zero) assuming a lognormal error structure, with the level of variability set by *sigmaR*. A lognormal bias adjustment factor was applied to recruitment estimates as recommended by Methot et al. (2020), but only to the data-rich years in the assessment. This was done so that SS will apply the full bias-correction only to those recruitment deviations that have enough data to inform the model about the full range of recruitment variability (Methot et al. 2020). For the SEDAR 74 base model, main period (i.e. data rich) recruitment deviations spanned 1990-2016. Full bias adjustment was used from 1984 to 2019 when length or age composition data were available. Bias adjustment was phased in linearly, from no bias adjustment prior to 1980 to full bias adjustment in 1984. Bias adjustment was phased out in 2019, decreasing from full bias adjustment to no bias adjustment in that year, because the age composition data contains less information on recruitment in more recent years. The years selected for full bias adjustment were estimated following the methods of Methot and Taylor (2011).

3.1.6. Fleet Structure and Surveys

For each of the three spatial areas (W, C, and E), five fishing fleets were modeled and had associated length compositions. No age composition was incorporated into the model for the fishing fleets. The SS fleet codes for these were: Commercial Handline (HL_W, HL_C, HL_E), Commercial Longline (LL_W, etc.), Recreational Charter Boat (CBT_W, etc.), Recreational Headboat (HBT_W, etc.), Recreational Private (PRIV_W, etc.). Discards were incorporated as total discards in 1000s of fish for all fleets in all areas. Prior to the onset of the commercial Individual Fishing Quota (IFQ) Program in 2007, discards in the commercial fleets were separated into those occurring in open and closed fishing seasons. With the IFQ program in place, commercial discards were assumed to occur continuously throughout the year in conjunction with an assumed year long fishing season. Recreational Private and Charter Boat discards were separated into open and closed season discards to account for the differing discard practices of anglers when harvest was or was not an option. Recreational Headboat discards could not be separated into their open and closed components due to the lack of a subannual breakdown of discards provided for the Research Track Assessment. Therefore the discards were modeled together and assumed to have consistent practices throughout the year. Separation of Headboat discards into open and closed season subsets can be attempted as part of the Operational Track Assessment if monthly or bimonthly estimates of Recreational Headboat discards are available.

Discards from the Shrimp Trawl fishery in the GOM were included by fitting median Shrimp Trawl bycatch levels and indices of Shrimp Trawl fishing effort. Shrimp Trawl bycatch was assumed to be 100% dead discards with no landings. For Shrimp discards the 'super-year' approach was utilized to avoid fitting to the extremely noisy and uncertain yearly estimates of Shrimp bycatch. The premise of a super-year is that, instead of fitting each observation directly, a measure of central tendency for the entire time series is fit. In the case of Shrimp bycatch, the median has typically been utilized (i.e., the observed median is fit to the predicted median). The model still predicts annual bycatch values using annual *F*s estimated from area-specific time series of Shrimp Trawl effort, but does not directly fit the annual Shrimp Trawl bycatch observations owing to the high uncertainty associated with them. The super-year covers years 1973-2019 (i.e., the median values correspond to observed and predicted bycatch values for these years).

Two fishery-dependent CPUE indices, both occurring in the east area, were included in the SEDAR 74 base model: Commercial Reef Fish Observer Program index (COMMOBS_E) and Commercial Handline index (HL_E). The fishery-dependent CPUE series were treated as indices of biomass where the observed standardized CPUE time series was assumed to reflect annual variation in population trajectories. Both fishery-dependent indices were input as surveys into SS (see **Section 2.3.9**) and the selectivity for the Commercial Reef Fish Observer Program was mirrored to length selectivity of the Commercial Handline East fleet.

The inclusion of fishery-independent surveys differed among the assessment areas with spatial, temporal and sample size limitations dictating availability. In the west assessment area, seven fishery-independent surveys, one absolute index of abundance (GRSC) and one time series of Shrimp Trawl effort were included in the SEDAR 74 base model. The fishery-independent surveys included: the SEAMAP Fall Plankton Survey, temporally split Early and Late Summer SEAMAP Trawl Surveys, temporally split Early and Late Fall SEAMAP Trawl Surveys, the Bottom Longline Survey and the SEAMAP Video Survey. The central assessment area had five fishery-independent surveys, one absolute index of abundance (GRSC) and one time series of Shrimp Trawl effort included in the SEDAR 74 base model. The fishery-independent surveys included: the SEAMAP Fall Plankton Survey, Late Summer and Late Fall SEAMAP Trawl Surveys, the Combined Video Survey, and the Bottom Longline Survey. The east assessment area had four fishery-independent surveys, one absolute index of abundance (GRSC), and one time series of Shrimp Trawl effort included in the SEDAR 74 base model. The fishery-independent surveys included: the Late Summer and Late Fall SEAMAP Trawl Surveys, the Combined Video Survey, and the Bottom Longline Survey.

The fishery-independent surveys, GRSC absolute abundance index, and Shrimp Trawl effort time series were incorporated consistently among areas when available. For the central and west areas, the Larval Survey was set up as a special survey of spawning stock biomass. The SEAMAP Trawl Surveys (early and late), Bottom Longline Surveys and the Video Surveys (SEAMAP in the west and Combined Video in the east and central) were incorporated as indices of relative abundance and had composition data (either age or length) available which was fit directly based on estimated area-specific selectivity functions. For all areas, the Shrimp Trawl effort time series was input as effort and used to scale the annual fishing mortality estimates associated with the bycatch fishery. In all areas, the GRSC index was input in 1000s of fish and incorporated as an index of absolute abundance (i.e., catchability coefficient fixed at 1). The lack of robust, GRSC survey-specific composition data precluded the direct fitting of selectivity curves for the survey in all areas. In the absence of data, regional differences in GRSC study design were used to inform the selectivity assumptions of the survey outlined in **Section 3.1.7.2**.

3.1.7. Selectivity

Selectivity represents the probability of capture by age or length for a given fleet and represents the net result of multiple interrelated factors (e.g., gear type, targeting, and availability of fish due to spatial and temporal constraints). Stock Synthesis (SS) allows users to specify length-based selectivity, age-based selectivity, or both. The final selectivity curve governing each fleet/survey reflects the additive effect of both age- and length- based processes when both data types are present.

Selectivity patterns were not assumed to be constant over time for each fleet and survey. The commercial and recreational fisheries have experienced numerous management changes to both minimum size and bag/trip limits since the mid-1980's. For the commercial fleets, the onset of restrictive trip limits in 1993 and the switch to an individual fishing quota system in 2007 were hypothesized to be events likely to result in angler selectivity changes. To accommodate this in the model, time blocks on commercial selectivity were implemented for 1950-1992, 1993-2006 and 2007-2019. Similarly, changes to recreational selectivity were thought to coincide with enforcement of a five fish bag limit in 1995 and the further reduction to a two fish bag limit in 2007. Assuming that fishers were shifting fishing locations and changing gear (i.e., hook size) to optimize their bag limit as it was reduced, thus impacting selectivity. In addition all fleets were required to switch from J hooks to circle hooks in 2007 which likely resulted in additional selectivity change across all angling sectors. Thus, three selectivity time blocks were used to model all recreational fleets and were 1950-1994, 1995-2006 and 2007-2019. Selectivity time blocks for a given sector were applied consistently across all assessment areas because relevant management events were enacted GOM wide for all components of a given sector at the same time (e.g., commercial changes affected both the Handline and Longline fleets simultaneously in all areas). There have been many changes to recreational and commercial minimum size limits throughout the GOM Red Snapper management history. These changes were assumed to influence the discard patterns more so than selectivity. As such, these changes were accounted for in the assessment model using time-varying retention patterns (see **Section 3.1.8.**) and modeling discards explicitly (see **Section 3.1.10.**).

In general, surveys were assumed to have constant selectivity; however, some exceptions did exist. In all but one case, surveys which likely experienced time-varying selectivity due to significant design or gear changes were handled by either truncating the index time series at the year of the change or by splitting the index into two parts (e.g., "early" and "late" SEAMAP Trawl Surveys in the west area). The one exception was the central Combined Video Survey which was modeled using time-varying selectivity. The central Combined Video Survey was composed of three separate video surveys which operated for different lengths of time in spatially restricted and disparate parts of the GOM. The longest running survey was restricted to deeper waters near the shelf break where older and larger Red Snapper are known to occur at higher relative abundance. The other two surveys operated in shallower water in the northern GOM and west Florida shelf and consequently were primarily observing a younger and smaller subset of the overall Red Snapper population. Selectivity blocks were introduced to account for the changing availability of various subsets of the Red Snapper populations as the three video surveys were introduced in the central assessment area (1993-2005, 2006-2015, and 2016-2019). Similar approaches were not needed for the west video survey because it only made use of one (SEAMAP Video Survey) survey or for the east because the time series was truncated to begin in 2010 when all three surveys were in operation in the east assessment area (see Table 1 SEDAR74-DW-23).

3.1.7.1. Length-based Selectivity

Length-based selectivity patterns were specified for each fleet and survey with included length composition data. Length-based selectivities were characterized as one of two functional forms: (1) a two-parameter logistic function (SS pattern 1) and (2) a six-parameter double normal function (SS pattern 24). A logistic curve typically implies that fish below a certain size range are not vulnerable, but gradually increase in vulnerability with increasing size until all fish are fully vulnerable (asymptotic selectivity curve). Two parameters describe logistic selectivity: (1) the length at 50% selectivity, and (2) the difference between the length at 95% selectivity and the length at 50% selectivity, which were both estimated in this assessment. The double normal has the feature that it allows for domed or logistic selectivity and is a combination of two normal distributions; the first describes the ascending limb, while the second describes the descending limb. A line segment joins the maximum selectivity of the two functions. However, the double normal functional form can be more unstable than other selectivity functions due to the increased number of parameters. When robust length or age compositions are available with sufficient numbers of larger or older fish, it may be appropriate to freely estimate all parameters (especially the descending limb). If that is not the case, certain parameters can be fixed to improve model stability as long as fixing the parameter does not largely influence the point estimates of the remaining selectivity parameters.

In the SEDAR 74 base model, selectivity patterns were defined for each fleet/survey/spatial area combination and forms were consistent across the spatial areas for any given fleet or survey. The selectivities of the Commercial Handline fleets, the east area Commercial Reef Fish Observer index of abundance, the Recreational Charter Boat fleets, Private fleets and the Headboat fleets were all modeled using double normal functional forms. Logistic selectivity was applied to the longline fleets and the video surveys since there was no evidence in their respective length composition data to suggest a lack of availability of larger size classes. Logistic selectivity was also used to model selectivity for the Early SEAMAP Fall Trawl Survey in the west area and for the Shrimp bycatch in all areas; however, in these cases the slope of the logistic function was constrained to be less than 0 forcing selectivity to decline toward 0 with increasing size. The SEAMAP Summer Trawl Surveys (Early and Late) were modeled using a 3-node cubic spline. The cubic spline form was adopted due to fit and stability issues that arose during earlier attempts to apply a negative slope logistic curve as was done for the Fall Trawl Surveys. Fit issues with the negative slope logistic curve were thought to be due to the timing of the Summer Trawl Surveys resulting in low catches of age-0 Red Snapper (i.e. the surveys occurred during or just prior to spawning) and high catches of age-1 Red Snapper in most years. Lastly, selectivity forms for all closed season discards followed the form of their open season counterpart (e.g. Longline closed season discards were modeled using logistic selectivity and Charter Boat closed season discards followed a double normal form, etc.).

Double normal selectivity was implemented for all recreational fleets and for the Commercial Handline fleets because dome-shaped selectivity was considered highly likely due to areas fished (e.g., closer to shore, shallower) and targeting behavior. For the Commercial Handline fleets, in the base selectivity time block (1950-1992), the estimation ignored the first and last size bins and allowed SS to decay the small and large fish selectivity according to parameters of ascending width and descending width, respectively, to reduce the number of parameters being estimated and improve model stability. All subsequent time blocks for the Commercial Handline fleet had sufficiently robust enough composition data to allow estimation of all six double normal parameters. For the non-mirrored (See **Section 3.1.7.3**) recreational fleet selectivities and the Commercial Reef Fish Observer Program, all six double normal parameters were estimated for all time blocks

All non-mirrored (See **Section 3.1.7.3**) fleets using logistic selectivity (longline fleets, video surveys, the Shrimp Trawl bycatch and the west area Fall Early SEAMAP Trawl Survey) had both parameters estimated for all time blocks. The Shrimp Trawl bycatch and Fall Early SEAMAP Trawl Survey had bounds set on the slope parameter to force it to be below 0. All other logistic forms had slopes greater than 0 ensuring that selectivity would approach 1 with increasing size.

The 3-node splines used to model the Summer SEAMAP Trawl Survey were set up following the guidance in Methot et al. (2020). Node locations were auto generated using the SS software and placed based on percentiles of the cumulative size distribution for each survey. Node locations were subsequently fixed and the slope of the curve at nodes 1 and 3 were freely estimated relative to node 2 which was fixed in all cases.

The selectivity of the Larval Surveys did not need to be specified as the surveys were set up as relative indices of spawning stock biomass.

3.1.7.2. Age-based Selectivity

Age-based selectivity was specified for the Bottom Longline Surveys, the Late Fall SEAMAP Trawl Surveys and the indices of absolute abundance derived from the Great Red Snapper Count (GRSC). The Bottom Longline Surveys were fit assuming age-logistic selectivity parameterizations with no time blocks and all parameters freely estimated. The Late Fall SEAMAP Trawl Survey composition was fit using an empirical random walk for age-0 to age-4 with no time-varying component. The Late Fall SEAMAP Trawl Survey was range restricted to force selectivity to be declining as age increases with age-4 having a final selectivity of 0. Restrictions were put in place based on the design of the survey (targeting age-0), previous assessment fits to the survey, and visual inspection of the composition. Initial attempts to freely estimate the random walk resulted in an unstable model that would occasionally produce implausible selectivity forms (e.g. the model estimated a logistic form selectivity curve despite no old fish in the observed composition).

The GRSC survey was modeled assuming 100% selectivity for all ages-2+ in the east area, while the west and central areas assumed double normal estimated selectivity with age-0 and age-1 forced to have 0% selectivity. Differences in selectivity form were due to regional differences in sampling design from the original study that were thought to lead to gear availability limitations for the oldest age groups in the central and west areas. The assumption of 0% selectivity for age-0 and age-1 was based on the original GRSC study design's explicitly stated goal of counting only age-2+ Red Snapper. The GRSC index was fit for 2018 only, so no time-varying component was necessary.

3.1.7.3. Mirroring

Compositional sample size limitations necessitated several fleets mirroring the selectivity of the same fleet in a neighboring spatial area. This need arose most commonly in the east area where all recreational fleets (Charter Boat, Private, and Headboat) were mirrored to their central area counterparts' length-based selectivity. Likewise, the central area Commercial Longline fleet lacked sufficient compositional data and had its length-based selectivity mirrored to the Commercial Longline fleet in the west area. In all cases, the area mirrored to was chosen because it had the most similar fleet dynamics to the area lacking compositional data. All closed season discard fleets had their length-based selectivities mirrored to their corresponding open season fleet. This assumed that angler behavior, as it relates to selectivity, was constant regardless of an angler's ability to land a Red Snapper.

3.1.7.4 Selectivity Priors

All estimated selectivity parameters for age and length selectivity used symmetric Beta priors with SE = 0.5. These priors are diffuse and serve primarily to help move parameters out of the tails of their range in situations where the parameter gradient has approached 0 despite failing to find a global minimum.

3.1.8. Retention

Time-varying retention functions are commonly used in GOM stock assessments to allow for varying discards at size due to the impacts of management regulations. For Red Snapper, time blocks were based on changes in the federal and state waters minimum size limits. The time varying retention blocks were defined as:

1. For commercial fishing fleets:
    a. 1950 - 1984: no minimum size limit regulation in place
    b. 1985 - 1994: 13 inch minimum size limit
    c. 1995 - 2006: 15 inch minimum size limit
    d. 2007 - 2019: 13 inch minimum size limit
2. For recreational fishing fleets:
    a. 1950 - 1989: no minimum size limit regulation in place
    b. 1990 - 1994: 13 inch minimum size limit
    c. 1995 - 1998: 15 inch minimum size limit

d. 1999 - 1999: 18 inch minimum size limit
e. 2000 - 2019: 16 inch minimum size limit

For each fleet, the retention function was specified as a logistic function consisting of four parameters: (1) the inflection point, (2) the slope, (3) the asymptote, and (4) the male offset inflection (not applicable to this model and assumed to be zero). The blocks listed above related to the minimum size limits were linked to the inflection point for all fleets and the slope parameters for all fleets except the east area recreational fleets which made use of one slope time block from 2007-2019. The east recreational fleet slope parameters were handled separately due to a lack of robust landed or discarded composition data in the area.

High grading, or the discard and release of legal-sized fish, was acknowledged as a possible concern for both the commercial and recreational fleets with the onset of IFQs and 2-fish bag limits, respectively. Consequently, all commercial and recreational fleets had a time-block implemented for asymptote parameters from 2007-2019. These blocked parameters were estimated to allow the model the flexibility to discard legal-sized fish which was supported by both the available discard composition and knowledge of recent angler behavior in response to regulation.

For the commercial fleets, prior to 1995 discards were not tabulated and before 2007 no commercial discard composition data were collected. Consequently, the first three commercial retention blocks had the inflection points fixed at 8 inches TL prior to regulation and at the minimum size limits of 13 and 15 inches total length for the 1985-1994 and 1995-2006 blocks, respectively. The inflection point for the 2007-2019 block was freely estimated to make use of the available discard compositional data from that time-period. In nearly all cases, slope parameters were freely estimated for all blocks except the first to allow the model flexibility to fit a small amount of sublegal fish that occurred in the landed composition data for the commercial fleets. The first time-block had the slope parameter fixed at 1 which imposes knife-edged retention, allowing for full selection at the minimum size limit. Additionally, the Commercial Longline East fleet had the slope parameter for the 1985 and 1995 time-block fixed at one due to the model initially trying to estimate these parameters near the lower bound of 0. Lastly, the asymptote parameter was fixed at 100% retention of legal sized fish for all periods prior to 2007 after which the parameter was freely estimated to allow for the possibility of high grading in the commercial fishing sector.

Recreational discards have been estimated since 1981; however, compositional data has only recently begun to be collected and only in Florida, limiting its utility for a GOM wide assessment. Given the lack of discard composition data, the decision was made to fix the inflection parameters at 8 inches total length for the pre-regulation period (prior to 1990) and at the minimum size limit for all subsequent recreational time blocks. For the central and west areas, retention was assumed to be knife-edged prior to 1990 with the slope parameter fixed at 1 for all recreational fleets. The remaining four slope parameter time blocks, for the central and west areas, had parameters freely estimated for all fleets to allow for the modeling of sublegal fish in the landed composition data. The east area had two time blocks for the slope parameters separated in 2007. Prior to 2007 the slope parameter was fixed at 1 and freely estimated after. Difference in approach among areas was due to the lack of both landed and discard composition data for the east area fleets prior to 2007. Lastly, the asymptote parameter was fixed at 100%

retention of legal sized fish for all areas, fleets, and time blocks prior to 2007. After 2007 the parameter was freely estimated for all areas and fleets to allow for the possibility of high grading in the recreational fishing sector.

3.1.9. Landings and Associated Length and Age Compositions

Landings by fleet and associated length and age compositions were estimated using fleet-specific continuous fishing mortality rates and length-specific selectivity curves following Baranov's catch equation.

The commercial landings were assumed to be the most representative and reliable data source in the model, especially over the most recent time period. Since 2007 this information was collected in the form of a census as opposed to being collected as part of a survey and a CV of 0.05 was assumed. Prior to 2007, commercial landings were estimated from self reported logbook data which led to fleet and area-specific estimates of annual CVs presented in the Data Workshop Report (SEDAR 2022). Attempts were made to utilize all recommended CVs but doing so resulted in unacceptable levels of model instability. Test runs indicated that sufficient model stability could be achieved if commercial landings CVs were fixed at 0.05 prior to 1995 and the data workshop recommended CVs were used for all other years. Stability was likely achieved here due to the onset of other sources of data, in particular robust compositional data. Similarly, the recreational landings were assumed to be less precise than the commercial landings and had a CV of 0.15 assumed for all recreational fleets prior to 1995 and the data workshop recommended CVs for all other years. All CVs were converted to a log-scale SE (see **Section 3.2.**).

The Dirichlet-multinomial (DM) which differs from the standard multinomial in that it includes an estimable parameter (theta) which scales the input sample size (Thorson et al. 2017; Methot et al. 2020) was used to weight the composition data for SEDAR 74. The DM is self-weighting, which avoids the potential for subjectivity as when the Francis re-weighting procedure is applied (Francis 2011). The DM likelihood also allows for observed zeros in the data, and the effective sample sizes calculated are directly interpretable. The DM uses the input sample sizes directly, adjusted by an estimated variance inflation factor. The more positive the inflation factor, the more weight the data carry in the likelihood. The DM is considered an improved practice and recommended for use by the SS model developers, and was first used in a GOM stock assessment during SEDAR70 in 2020 for GOM Greater Amberjack.

Because SS models individual fish growth internally and tracks fish from birth, it grows fish by length bins before eventually converting lengths to ages (based on the growth curve). As such, it is possible to fit both age and length composition simultaneously. For SEDAR 74, the age and length composition data for each fleet/survey were assumed to follow a Dirichlet-multinomial error structure where sample size represented either trips, survey stations, individual fish or number of sets , adjusted by an estimated variance inflation factor. Data sources varied in the units of sample sizes provided, leading to a mix of units used in the model. Future models aim to use a common unit of sample sizes. See **Sections 2.3.5-2.3.8** and **Sections 2.4.2-2.4.5** for more detail on input sample sizes for each fleet/survey. The final effective sample sizes for each year are provided on the figures illustrating the fits to the observed age and length composition data (given by N adj in each panel; **Figures 16-48**).

3.1.10. Discards

Discard data for each fleet were directly fit in the SS model using size-based retention functions, and a log-normal error structure was assumed. Annual estimated CVs were provided in the data workshop report (SEDAR 2022) and converted to log-scale SE for input into SS. The model estimates total discards based on the selectivity and retention functions, then calculates dead discards based on the spatially-specific but time invariant discard mortality rates which ranged from 16.9% to 41.2% for the recreational fleets and 19.2% to 40.7% for the commercial fleets (**Sections 2.3.3-2.3.4**). A lambda weighting factor was imposed on the east-area Recreational Private Closed Season discards to force the model to more closely fit the observed data. This discard time series is unique among the closed season discard fleets in that it typically has low observed discards with a couple years of very high and highly uncertain discards reported (if there is a figure for this ref here). When freely estimated the model would generally fit the observed discards; however, for the high observed discard years (2011 and 2016) the model would estimate expected discards far in excess of the observed discards. This resulted in extreme *F* estimates that had substantial impacts on east area population abundance and compositional structure. Given the highly uncertain nature of the closed season recreational discard data, it was determined to be more appropriate to constrain these estimates rather than allow for the irregular freely estimated results to exert undue influence over the other modeled quantities.

3.1.11. Indices

The indices are assumed to have a lognormal error structure. The CVs provided by the index standardization were standardized to a common mean CV of 0.2 and converted to a log-scale SE required for input to SS for lognormal error structures (**Section 3.2.**). Scaling CVs to a common mean was used in the previous Red Snapper assessment because indices are standardized using different techniques and the output SEs are not directly comparable, nor do they adequately characterize the relative confidence in the various indices. Scaling each index to a common mean allows them to be equally weighted within the assessment, while maintaining relative annual variation (Francis et al. 2003). This was a much needed model simplification assumption as trying to determine the correct scaling of one index to another can be subjective, and determining the criteria for judgment was out of the scope of the Research Track Assessment.

3.2. Goodness of Fit and Assumed Error Structure

A maximum likelihood approach was used to assess goodness of model fit to each of the data sources (e.g., catch, indices, compositions, etc.). For each separate data set, an assumed error distribution and an associated likelihood component was specified, the value of which was determined by the difference in observed and predicted values along with the assumed variance of the error distribution. The total likelihood was the sum of each individual component. A nonlinear iterative search algorithm was used to minimize the total negative log-likelihood across the multidimensional parameter space to determine the parameter values that provide the best fit to the data. With this type of integrated modeling approach, data weights (i.e., the variance associated with each data set) can impact model results, particularly if the various data sets indicate differing population trends.

SS allows, through a lambda parameter, for additional weight to be assigned to components of the overall likelihood to either increase or decrease the likelihood penalty associated with misfitting the specified data source. For SEDAR 74 lambdas were imposed for the east area Private landings, Closed Season Commercial Handline discards, Closed Season Private discards and Shrimp bycatch. Initial unconstrained models estimated "spikes" in the expectations for variable years of data across the above mentioned sources. These spikes often resulted in anomalously high levels of fishing mortality to occur at random intervals in the east area resulting in infeasible swings in area-specific abundance. By imposing a high penalty for data misfit the model was effectively constrained to fit the observed data, eliminating the spikes in F and increasing overall model stability.

Where lognormal error structures were used, annual CVs associated with each of the data sources were converted to log-scale SEs using the approximation: $log_e(SE) = \sqrt{\left(log_e(1 + CV^2)\right)}$ provided in Methot et al. (2020).

Estimated parameters with no other prior implemented were given weak symmetric-beta penalty functions to keep parameter estimates from hitting their bounds (Methot et al. 2020). Parameter bounds were set to be relatively wide and were unlikely to truncate the search algorithm.

Uncertainty in parameter estimates was quantified by computing asymptotic SEs for each parameter. Asymptotic SEs are calculated by inverting the Hessian matrix (i.e., the matrix of second derivatives) after the model fitting process (Methot and Wetzel, 2013). Asymptotic SEs provide a minimum estimate of uncertainty in parameter values.

3.3. Estimated Parameters

In all, 2210 parameters were included in the analysis for the SEDAR 74 base model, of which 1828 were active parameters. These parameters include: year-specific (1950-2019) fishing mortality for each fleet, the stock-recruit deviations for the data-poor time period (1985-1989) the stock-recruit deviations for the data-rich time period (1990-2016), one stock-recruit relationship parameter ($ln(R_0)$), recruitment apportionment to two of the three areas (**Table 13**), size and age selectivity parameters for each relevant fleet or survey, logistic retention parameters for each fleet, catchability parameters for each index, and 31 parameters informing the Dirichlet-multinomial length and age composition weightings. Parameters were estimated in five phases. The first phase initiated initial and annual fishing mortality (F) parameters and stock recruitment parameters (see **Table 13**). The second phase activated the base recruitment apportionment, survey catchability (q) parameters, and Dirichlet-multinomial parameters. Base and time varying selectivity parameters were initiated in phases two and three. Time varying retention parameters became active in phase four and phase five added parameters for the early recruitment deviations and the annual recruitment apportionment deviations.

3.4. Diagnostics for Model Structure

Due to the uncertain nature of the data used in a Research Track Assessment only a limited number of diagnostics were completed to determine model fit. Completed diagnostics included residual analyses, correlation analyses and model sensitivity runs. Additional diagnostics will be completed during the Operational Track Assessment phase when the final data are received. Future diagnostics include likelihood profiles over key parameters, retrospective analyses, hindcasting and jitter analysis.

3.4.1. Residual Analysis

The main approach used to address model fit and performance was residual analysis of model fit to each of the data sets (e.g., catch, indices, length/age compositions, discards). Any temporal trends in model residuals (or trends with age or length for composition data) can be indicative of model mis-specification and poor performance. It is not expected that any model will perfectly fit any of the observed data sets, but ideally residuals will be randomly distributed and conform to the assumed error structure for that data source. Any extreme patterns of positive or negative residuals are indicative of poor model performance and potential unaccounted for process or observation error.

3.4.2. Correlation Analysis

High correlation among parameters can lead to flat likelihood response surfaces and poor model stability. By performing a correlation analysis, modeling assumptions that lead to inadequate model parameterizations can be highlighted. Because of the highly parameterized nature of stock assessment models, it is expected that some parameters will always be correlated (e.g., stock recruit parameters). However, a large number of extremely correlated parameters warrant reconsideration of modeling assumptions and parametrization. A correlation analysis was carried out and correlations with an absolute value greater than 0.7 were reported.

3.4.3. Sensitivity Runs

Sensitivity runs were conducted with the SEDAR 74 base model to investigate critical uncertainty in data and reactivity to modeling assumptions. An exhaustive evaluation of model uncertainty was not carried out, but the aspects of model uncertainty judged to be the most important for model structure and design were investigated.

Only the most important sensitivity runs are presented below, but many additional exploratory runs were also implemented. The order in which they are presented is not intended to reflect their importance; each run included here provides important information for developing or evaluating the base case model and structure. The focus of the sensitivity runs was on population trajectories, improvements in fit and important parameter estimates (e.g., recruitment).

Time and Spatially Varying Maturity - Two alternative versions of time and spatially varying maturity were evaluated:

1. Using separate parameter blocks for changes in A_{50} and A_{slope} over three time periods. Parameter values were are fixed according to information received from the data workshop (**Table 14**).
2. A_{50} and A_{slope} as functions of Spawning Stock Biomass, representing a dynamic compensatory effect where maturity changes with stock size (i.e., fish mature at younger ages when stock sizes are low). See equation below:

$$P_y = P_{base} + P_t * E_y$$

Where, the parameter in year y (P_y) is a base value for the parameter adjusted by a fixed effect size or scaling parameter (P_t) multiplied by the log of the spawning biomass fraction in year y. P_t and P_{base} were calculated used a system of equations based on Data Workshop provided maturity values and model estimated spawning biomass in the associated years.

Great Red Snapper Count (GRSC) Estimate and Selectivity - Model sensitivity to the inclusion of the GRSC and the fleet selectivity were evaluated:

1. No GRSC estimates used in the model.
2. GRSC estimates are included in the assessment model and the selectivity is assumed to be 100% of all fish age-2+.

4. Stock Assessment Model - Results

4.1 Estimated Parameters

SEDAR 74 contained 2210 parameters with 1828 estimated with the majority of the parameters (~62%) being annual fleet-specific fishing mortality rates. Most parameter estimates and variances were reasonably well estimated (i.e., CV < 1). Of the active parameters, 89 had CVs exceeding 1 with most of these (58) occurring for the ascending and descending limbs of double normal selectivity functions. High CVs were also observed for portions of the recruitment distribution time series for the two areas where deviations were estimated.

4.2 Fishing Mortality

The exploitation rates (total biomass killed age 2+ / total biomass age 2+) for the entire stock are provided in **Table 15**. Since 1950, the exploitation rate for the stock has averaged around 0.273, and ranged between 0.043 in 1950 to 0.727 in 1983. The exploitation rate has gradually increased from low levels (less than ~0.05) to near 0.5 in the 1980s and early 1990s. It then remained elevated ranging between 0.3 and 0.5 throughout the remainder of the 1990s and early 2000s until 2005 when exploitation rate on the stock began to decline. These declines correspond with the onset of specific management actions designed to rebuild an overfished stock. Beginning in 2006 the exploitation rates declined rapidly achieving a new equilibrium around 0.15, with interannual variations, throughout the remainder of the time series. The terminal year (2019) exploitation rate for the entire stock was 0.183, which is well below the time series average of 0.273 but slightly above the average over the last decade (0.167).

Tables 16-22 & **Figures 49-50** show estimates of exploitation rates by area, fleet and year for the open season landed and discarded fish. The results show that in the west area (**Tables 16-19** & **Figure 49**), exploitation for the stock was initially split fairly evenly among all sectors except for the Commercial Longline. Beginning in the 1970s the Recreational Private and Commercial Handline fisheries became the dominant west area fleets and continue to be responsible for the majority of the exploitation in this area throughout the remainder of the time series. Similar to the west area, initial exploitation in the central area was split fairly evenly among the non-Longline fleets. This pattern continued in the central area until around 1990 when the Recreational Private and Charter-For-Hire fleets became dominant in the area. Beginning around the year 2000 the Recreational Private fleet emerged as the primary source of exploitation in the central area (**Tables 17-20** & **Figure 49**) and remained so throughout the rest of the time series. The Commercial Handline fleet has consistently been one of the larger contributors to total exploitation in the east area (**Figure 49**). The historic contribution of the recreational fleets is difficult to summarize in the east due to high levels of uncertainty associated with the recreational landings data in this area. However, the uptick in exploitation rate estimated for the

Recreational Private fleet in the east is supported by more robust sampling and indicates that the sector has increased in relative importance over the last decade.

Figure 50 depicts the estimated exploitation rates by area and year for the closed season discard and bycatch only fleets. Discards have been a significant source of mortality for the Red Snapper stock since the 1970s-1980s when the Shrimp Trawling industry expanded in the GOM. Most of the Commercial Shrimp activity is in the west area which is reflected in the high exploitation rate attributed to this fleet in the area. The central and east areas both experience significant Shrimp Trawl bycatch mortality; however, in recent years the magnitude of the Recreational Private and Charter Boat sectors has increased significantly, especially for the central area. In the central area, mortality from Recreational Private discards has been estimated as the second largest source of mortality for the area for the last two decades. Similarly in the east area, Recreational Private discards are becoming an increasingly large source of mortality as the stock continues to rebuild in this area and recreational effort expands.

4.3 Selectivity

4.3.1 Length-Based Selectivity

Estimated terminal year fleet and area-specific length selectivity curves for the directed fishery and bycatch fleets are shown in **Figure 51**. In all cases closed season discard-only fleets mirror the selectivity of their equivalent open season fleets (i.e., Commercial Handline Closed Season Discards West mirrored the selectivity for Commercial Handline West). Dome shaped selectivity curves were estimated for most fleet/area combinations when double normal selectivity was imposed. However, in several instances (e.g., Recreational Private East) the double normal parameterization estimated a form closely resembling a logistic selectivity curve. In most instances when this occurred the pseudo-logistic form was only observed for a portion of the fleets time blocks with a domed shape form occurring in the remaining time blocks. Stock Synthesis does not yet accommodate varying selectivity form by time block so in the cases where this occurred, double normal selectivity parameterizations were maintained to allow the model the flexibility to appropriately fit all available data.

As expected, the directed fisheries generally approached peak selectivity at or very near to the minimum size limit for a given time period. Notable exceptions to this were the Commercial Longline West fleet which achieved peak selectivity at sizes in excess of 60 cm for all time blocks and several of the recreational fleets particularly in the central and west areas that saw peak selectivity estimated well above the minimum size in the last time block (2000-2019) (**Figures 52-54**).

Time-varying aspects of the selectivity for each fleet and area are shown in **Figures 55-78**. In all cases, peak selectivity either remained fairly stable through time or increased to larger sizes through time. Generally speaking, those fleets that typically targeted fish larger than the minimum size (e.g. Longline fleets) had selectivity estimated as remaining nearly constant through time, while those that operated near the minimum size limit saw selectivity shift to larger sizes as regulations changed. For some fleets in some time blocks, the estimated curves were disjunct and lacked smooth transitions between length bins. It is possible that the overall complexity of the model and use of multiple selectivity time blocks led to overfitting of the selectivity parameters. Fixing some additional parameters or the application of appropriate priors on poorly estimated parameters should be considered in future Operational Track Assessments. Furthermore, the application of spline selectivity forms should also be considered as these could both reduce the number of estimated parameters as well as limit the ability of the model to overfit the composition data.

Estimated terminal year fleet and area-specific length selectivity curves for the surveys of abundance are shown in **Figure 79**. The video surveys were estimated to reach peak selectivity around 40-45 cm depending on area but were also estimated to be highly selective for fish as small as 25-30 cm. The Central GOM Combined Video Survey was the only survey with a time varying component (**Figure 80**). Estimated selectivity across time blocks for the central area video survey were very similar with only slight adjustments to the changes in survey design (i.e., selecting for smaller fish as survey design changed through time). Time blocks for the video survey were maintained in the final model but could be considered for removal during subsequent Operational Track Assessments. Selectivity for the Summer Trawl survey was modeled using a 3-node cubic spline function. Estimated parameters for these fleets produced sharply dome shaped fits with peak selectivity occurring at very small sizes (~15-20 cm) and then rapidly declining toward zero selectivity between 40-50 cm. Fits to the west area Early Fall Trawl Survey, and all areas of the Shrimp Trawl bycatch (**Figure 81**) were estimated as expected by the negative slope logistic parameterization. Selectivity peaked near 0-10 cm FL and then declined rapidly toward 0 selectivity by around 30 cm FL. The Commercial Reef Fish Observer Program was mirrored to the selectivity of the Commercial Handline fleet to reduce estimated parameters. Length composition data specific to this survey was available; however, it was not shown to differ from the fleet enough to warrant separate selectivity estimation.

4.3.2 Age-Based Selectivity

Selectivity fits for the three surveys modeled using age composition are shown in **Figure 82**. The central and west area fits were similar for the Bottom Longline Survey with both estimating 50% selectivity around ages 6-7 and maximum selectivity around ages 8-9. The east area Bottom Longline Survey was estimated to select for slightly younger fish with 50% selectivity around age-5 and maximum selectivity achieved around age-7. Differences in gear selectivity by area for this survey would primarily be attributable to differential age-class availability given uniform gear and survey design across areas. Estimated selectivity for the post 2007 Fall Trawl Survey was similar across areas, with fixed maximum selectivity at age-0 and then declining rapidly until selectivity was fixed at 0% for all age-4+ fish (**Figure 82**).

The GRSC Survey of absolute abundance was unique in that it was only operational for a single year in the assessment model (2018) and did not incorporate composition data. Selectivity was fixed in the east area with 0% selectivity for age-0 and age-1 fish and 100% selectivity for all age-2+ fish. This decision was reached through panel discussion and review of the proposed GRSC study design. Selectivities in the central and west areas were fit using double normal parameterizations and both curves were estimated to have domed-shaped selectivity with nearly 100% selectivity for ages 2-10 with selectivity gradually declining in both areas approaching approximately 30% selectivity in the west and 20% selectivity in the central area for age-20+ fish (**Figure 82**). It is unknown whether these estimated selectivity patterns actually represent the true selectivity of the survey in the central and west areas due to the lack of adequate composition data. It is likely that the model simply converged on a solution that resulted in the maximum reduction in the likelihood penalty for the survey abundance. Sensitivities around this assumption of selectivity were carried out and are detailed in section 4.8.6.

4.4 Retention

Length-based, time-varying retention functions by time block are provided for each directed fleet and are shown in **Figures 83-97**. Most retention parameters appeared well estimated except for a few of the Commercial Longline parameters estimated with CVs in excess of 1: the slope and asymptote parameters for the central area 2007 time block and the 2007 time block slope parameter for the west area. The model estimated that a number of fleets were discarding a substantial amount (>20%) of legal sized fish from 2007-2019 (see **Figures 98-124** for terminal year length-based retention for all fleets). For the commercial sector, the Handline East fleet (**Figure 100**) and all three areas of Longline fleets (**Figures 101-103**) had asymptotic retention below 80% with the Longline fleets in the east and central area estimated to discard approximately 50% of legal sized catch. High-grading and/or regulatory discards were also estimated to occur in the 2007-2019 time block for the central and east areas Recreational Charter Boat and Recreational Headboat-for-hire fleets. In both the central and east areas, Charter boats were estimated as discarding around 20-30% (**Figures 105 & 106**) of legal-sized fish while Recreational Headboats were estimated to discard roughly 40% (**Figures 107-109**). Of the Recreational Private fleets, the east area fleet was estimated to discard approximately 30% of legal sized catch while the central and west area fleets retained nearly all caught fish.

4.5. Recruitment

As noted in the description of the SS model configuration, two of the three S/R parameters were fixed: steepness (0.99) and *sigmaR* (0.6). Steepness was fixed as a computational convenience and *sigmaR* was fixed at a recommended value for model stability. The corresponding Beverton-Holt stock recruit curve is shown in **Figure 125**. Estimated annual recruitment of age-0 fish (1000s) from 1990-2016 including recruitment deviations and variance are shown in **Tables 23-25** and **Figures 126-127**. Virgin recruitment in log-space (Ln(R_0)) was estimated at 11.354, which equates to 85.26 million age-0 Red Snapper. The estimated (and applied) recruitment bias adjustment ramp is shown in **Figure 128**.

During the main recruitment period (1990-2016, see **Section 3.1.5**), estimated recruitment averaged 118.81 million Red Snapper and was lowest in 2008 at 34.38 million Red Snapper and highest in 2015 at 205.65 million Red Snapper (**Figure 129**). Recruitment deviations were characterized by a generally upward trend from the 1980s to present with reasonable interannual variations. There was a noticeable drop in recruitment in 2008 (an 80% drop from the previous year), which coincides with low, but not abnormally so, index values across all areas for the 2008 Fall Trawl Survey which predominantly indexes age-0 Red Snapper and the 2009 Summer Trawl Survey, which predominantly indexes age-1 Red Snapper (**Figures 12-14**).

Estimated base recruitment apportionment placed 72%, 22% and 6% of recruits into the west, central and east areas, respectively (**Figure 129**). These percentages were applied from 1950 until 1973 after which annual deviations were estimated and applied resulting in variable recruitment across the areas. In general, mean apportionment remained around the base values until the early 1990s after which the central area received a gradually increasing proportion of the total recruitment at the expense of the west area which saw its share of total recruitment decline. By the end of the time series, the average apportionment from 2010-2019 was 58%, 31%, 11% for the west, central and east areas, respectively. Recent estimated apportionment is likely more appropriate for use in forecasting. Care must be taken to ensure the apportionment values are applied during the Operational Track Assessment since the SS default is to apply the base values in projections. Apportionment deviations were generally well estimated with moderate levels of interannual variability and no area-specific recruitment failures present.

CVs for recruitment deviations during the main recruitment period averaged 0.096 between 1990 and 2016, and ranged from 0.066 in 2009 to 0.14 in 2008 (**Figure 127**). For the last two years of the assessment (2018, 2019), recruitment deviations were largely informed by the age-0 index, as age-0 and age-1 fish had not yet fully recruited to the fisheries. Estimated recruitment for those terminal years were at or slightly above average but not dissimilar from the immediately preceding years. Their estimated values and associated CVs were 179.694 million Red Snapper (CV=0.091) and 122.854 million Red Snapper (CV=0.138), respectively.

4.6. Biomass and Abundance Trajectories

The estimated annual total biomass (metric tons), exploitable biomass (age-2+, metric tons), SSB (metric tons), SSB ratio (SSB/virgin SSB) and exploitable abundance (1,000s of fish) from 1950 to 2019 are provided in **Tables 23-25**. Total biomass was consistently greater in the west area than in either the central or east areas and averaged 59,811 metric tons, and ranged from 8,633 metric tons in 1988 to 171,571 metric tons in 1950 (**Figure 130**). West area exploitable biomass and numbers, which comprised Red Snapper age-2 or older, averaged 55,298 metric tons and 19,368,888 Red Snapper, respectively. Exploitable biomass in the west was lowest in 1990 at 5,240 metric tons and peaked in 1950 at 167,041 metric tons, whereas exploitable numbers in the west ranged from 4,110,250 Red Snapper in 1990 to 47,482,100 Red Snapper in 1950 (**Table 23**). West area SSB averaged 53,274 metric tons, and ranged from 4,894 metric tons in 1989 to 163,037 metric tons in 1950 (**Figure 131**).

Total biomass in the central area averaged 18,030 metric tons, and ranged from 2,954 metric tons in 1989 to 37,723 in 1955, (**Figure 130**). Central area exploitable biomass and numbers, which comprised Red Snapper age-2 or older, averaged 15,910 metric tons and 7,475,271 Red Snapper, respectively. Exploitable biomass in the central area was lowest in 1990 at 1,818 metric tons and peaked in 1955 at 36,277 metric tons, whereas exploitable numbers in the central ranged from 1,248,010 Red Snapper in 1990 to 19,334,700 Red Snapper in 2018 (**Table 24**). Central area SSB averaged 15,312 metric tons, and ranged from 1,795 metric tons in 1995 to 35,723 metric tons in 1955 (**Figure 131**).

Total biomass in the east area averaged 3,795 metric tons, and ranged from 103 metric tons in 1992 to 10,674 in 1952, (**Figure 130**). East area exploitable biomass and numbers, which comprised Red Snapper age-2 or older, averaged 3,528 metric tons and 1,331,770 Red Snapper, respectively. Exploitable biomass in the east area was lowest in 1992 at 81 metric tons and peaked in 1952 at 10,341 metric tons, whereas exploitable numbers in the east ranged from 52,344 Red Snapper in 1992 to 3,424,380 Red Snapper in 2018 (**Table 25**). East area SSB averaged 3,425 metric tons, and ranged from 76 metric tons in 1992 to 10,170 metric tons in 1952 (**Figure 131**).

In all three areas total biomass and SSB show a steady decline from 1950 to the late 1980s, followed by a plateauing off in the 1990s to early 2000s. Starting in the mid 2000s, biomass began to rapidly recover across all three areas with the onset of management actions aimed at rebuilding the stock. Biomass and SSB growth in the west has continued in a near linear fashion from 2005 (**Figure 130**) to 2019 and is estimated to be at its highest post-crash abundance in the assessment terminal year. Biomass recovery in the central and east areas was estimated to have occurred at a somewhat faster rate than in the west up until 2010 when biomass was estimated to have stabilized or even declined slightly in both areas (**Figure 130**). However, the rate of recovery in the east and central areas has increased in recent years with several large year classes entering the stock. Like biomass in the west area, central and east area biomass are at their highest estimated post-crash level in the terminal year (2019).

Initial depletion in 1950 (SSB/SSB_0) was estimated to be 0.78 in the west area while the central and east areas were estimated to be at 0.46 and 0.43, respectively (**Tables 23-25** & **Figure 132**). SSB ratios in all areas declined rapidly from 1950 falling below the current overfished limit of 0.26 in 1974 for the west, 1970 for the central area and 1965 for the east. Stocks are on an upward trajectory in recent years with the terminal 2019 SSB ratios estimated to be 0.24, 0.30, and 0.21 for the west, central and east areas, respectively. GOM wide trends in SSB ratio follow a similar pattern to the area-specific trends with the highest estimated ratio occurring in 1950, bottoming out in 1989 at 0.023 and then increasing rapidly beginning in 2005.

4.7. Model Fit and Residual Analysis

4.7.1. Landings

Landings for all areas and all fleets were fit almost exactly prior to 1995 given their relatively small SEs (**Figures 133-135**). After 1995, the Data Workshop participants recommended SEs were used across all fleets and areas and allowed more flexibility in the fit to the landings (**Tables 26-40**). Despite the increased uncertainty in the landed data, fits generally remained good without signs of extreme variability or directional bias. The upweighting lambda applied to the Recreational Private fleet in the east forced the model to closely fit the observed data as expected (**Figure 135**). Some spiking in the expected landings of the east area Charter Boat fleet were observed in the final model fit. However, the magnitude of these errant fits (~40,000 fish in the most severe case) were not deemed large enough to warrant further model restriction through additional weighting factors.

4.7.2. Discards

The time series of commercial discards began in 1995 for all fleets and all areas. Observed and expected values are shown in **Tables 41-67** & **Figures 136-138**. Discards from the Commercial Handline fleets historically made up a significant part of the total catch for the west and central areas, but have been greatly reduced since the onset of the IFQ program in 2007 (**Figures 136-137**). Commercial Longline discards in the central and west area are low throughout the time series and contribute little to the total catch of Red Snapper in the GOM (**Figure 8**). Fits to all commercial open and closed season discard fleets in the west and central areas are good with reasonable deviations and no apparent systematic biases. Commercial discards in the east follow a different pattern than the central and west areas and show some model fit issues particularly in the later part of the time series. Both the Handline and Longline fleets in the east produced very few open season discards historically but have seen those increase in recent years (**Figure 138**). However, when taken on aggregate with the closed season discards, total discards for the east area commercial fleets have remained fairly stable throughout the time series. Model fits were reasonably good for the east area commercial open and closed season discards until 2014 and 2018 for the Handline and Longline fleets, respectively. After which, expected discards exceed observed discards for all remaining years by a significant margin. The upweighting lambda applied to the closed season Handline discards in the east forced the model to closely fit the observed data as expected (**Figue 138**). Despite the few noted misfit issues, commercial discards are in general well estimated given the high levels of uncertainty associated with the data and lack of robust composition samples throughout most areas and years.

Recreational open season discards beginning in 1981 or 1982 depending on fleet and area. Open and closed season discards begin to be separated out and modeled separately around 1997 for most fleets except the Headboat fleets for which the calculation was not possible. The model was able to fit discard observations relatively well throughout the time series for recreational fleets (**Figures 136-138**). For the Headboat west fleet the model greatly overestimated the expected discards from 1990 to 1994 indicating a possible misspecification of the retention blocking for this time-period (**Figure 137**). All other open and closed season recreational discard fleets were fit well with no apparent systematic bias or excessive variability. The upweighting lambda applied to the Closed Season Recreational Private discards in the east forced the model to more closely fit the observed data; however, the fit was not perfect with the 2011 estimate still exceeding the observed value by a substantial, but acceptable amount. (**Figure 138**).

4.7.3. Indices

Across all three assessment areas, fits to the relative indices of abundance were generally good (**Tables 68-81** & **Figure 12-14**). In the west, fits to the observed indices of the exploitable age range of the population (age-2+) were acceptable with RMSE ranging from 0.32 to 0.56 (**Figure 12**). Fits to the west area trawl surveys, which predominantly index age-0 (Fall, **Tables 68 & 69**) and age-1 fish (Summer, **Table 72 & 73**) Red Snapper were good, and had RMSEs ranging from 0.179 to 0.358. In general, the expected fits to the west area indices matched the observed increase in biomass beginning around 2010 and captured the strong year classes observed in the age-0 Fall Trawl survey. Fits to the relative indices of abundance in the central area were acceptable though generally did not fit as well as the west area indices (**Figure 13**). In particular, the fit to the Larval Survey was poor with a RMSE of 0.908 (**Tables 76-77**). This was likely more a result of the highly uncertain and variable nature of the index rather than pathological model issues. The remaining indices fit well with RMSE ranging from 0.331 to 0.518. Fits to the east area indices of abundance also were generally good (**Figure 14**). High RMSE values of 0.998 and 0.734 were estimated for the east area summer trawl late and bottom longline surveys, respectively. The remaining east area surveys had RMSE estimates of between 0.27 and 0.441.

Fits to the GRSC survey varied widely by area. In general the model as configured fit the GRSC estimates of abundance for the western and central GOM areas reasonably well, but did not fit the GRSC estimate for the eastern area (**Figure 15** & **Tables 82-84**). In the west and to a lesser extent central areas, the model derived area-specific abundances largely agreed with the estimate obtained from the snapper count and the resulting fits, while the RMSE values were reasonable. However, in the east the model estimated a substantially lower abundance for the area than was obtained from the GRSC resulting in poor overall fit and large RMSE of 2.155. An exploratory model run was completed that used upweighted likelihood penalties to effectively force the model to fit to the GRSC estimate in the east. Results of this run showed improved fit to the GRSC survey which came at the expense of degraded fits to the discard and length composition data (**Figure 139**) as well as fits to the east area Bottom Longline and Commercial Reef Fish Observer indices of abundance (**Figure 140**).

4.7.4 Shrimp Trawl Effort and Bycatch Data

Fits to the Shrimp Trawl effort time series and bycatch data are shown in **Figures 11 and 10**. Generally, fits to the effort and bycatch were good across all areas with low RMSE for the effort series and reasonable fits for the bycatch superperiod. The upweighting lambda applied to the Shrimp Trawl bycatch in the east forced the model to closely fit the observed data. Initial unconstrained estimates for the bycatch in the east resulted in greatly elevated expected bycatch for the area, necessitating the use of a weighting factor.

4.7.5. Length Compositions

Model fits to the retained length composition data are provided in **Figures 16-30**.

Model fits to the discard length composition data are provided in **Figures 141-144**.

Model fits to the survey length composition data are provided in **Figures 31-48**.

Model fits to the Shrimp Trawl bycatch length composition data are provided in **Figures 40-42**.

The aggregate fits to the length composition data were acceptable across all fleets and surveys (**Figure 145**), with only a few low sample size fleets showing signs of misfitting. Pearson residuals for length composition fits are provided in **Figure 146** are generally small in magnitude and un-patterned. However, some residual patterns were present in the Handline Central (HL_C retained) and Charter Boat Central (CBT_C retained) fleets and indicate a possible retention or selectivity mis-specification in the 2007-2019 time-block for the Handline fleet and in the 1995-2006 time-block for the Charter Boat fleet. There was no a priori evidence in discussions with fishers to suggest that the Commercial Handline central and Recreational Charter Boat central fleets should follow different retention blocks. Thus the decision was made to maintain the specified blocks rather than chase potential noise in the data.

4.7.6. Age Compositions

Model fits to the age composition data are provided in **Figure 147**. Generally, the model fit the age composition well however there was a residual pattern observed for the Bottom Longline East Survey (**Figure 148**). Patterns in the east Bottom Longline fits are likely due to low composition sample sizes resulting in truncated age distributions for most years.

4.8. Model Diagnostics

4.8.1. Correlation Analysis

A summary of correlations for the base model parameters considered as outliers is contained in **Table 85**. Given the highly parameterized nature of this model, some parameters were mildly correlated (correlation coefficient >70%) and eight combinations of selectivity parameters displayed a strong correlation (>95%; **Table 86**). Correlation among many of these parameters is not surprising, especially for the selectivity parameters, because the parameters of selectivity functions are inherently correlated (i.e., as the value of one parameter changes the other value will compensate). The decision was made not to fix highly correlated parameters as part of the Research Track Assessment, given that the data are influx and correlations may shift as the data is updated for the Operational Track Assessment. The strongest correlations occurred between the parameters defining the peak and the width of the ascending and/or descending limb of the double normal selectivity functions for some fleets.

4.8.2. Sensitivity Model Runs

Results for the sensitivity runs summarized in **Section 3.4.3** are discussed below. Making use of time-blocked or SSB linked maturity had a moderate impact on model estimates of spawning biomass (**Figure 149**). Use of time-varying maturity (blocks or linked to SSB) resulted in reduced estimates of virgin SSB and slightly increased estimates of SSB throughout most of the time series. The combination of lower SSB_0 values and higher terminal year SSB resulted in about a two point difference in SPR between the base case and the time-varying cases (**Figure 150**). Neither approach was preferred to the base model constant maturity assumption due to uncertainty around the implication of time-varying maturity on the projections.

Sensitivity models looking at the GRSC showed that the choice of selectivity made very little difference on derived model quantities. The base selectivity options and the sensitivity using fixed 100% selectivity for all age-2+ fish had nearly identical SSB estimates and consequently similar patterns of depletion (**Figure 150**). On the other hand, removal of the GRSC survey altogether resulted in noticeable declines in estimated SSB in the later years of the model and a roughly 5% drop in terminal year depletion.

5. Discussion

The SEDAR 74 Red Snapper Research Track Assessment encompassed a complete re-evaluation of all aspects of the Gulf of Mexico Red Snapper stock assessment enterprise. This collective effort spanned multiple years and could not have been completed without the dedicated work of countless private, academic, state and federal stakeholders from all corners of the southeastern United States. SEDAR 74 is the culmination of that work, and represents the most complex and ambitious stock assessment model developed in the Southeast region to date. First, as part of this process the stock ID was re-evaluated and changed from a two-area to a three-area metapopulation model. Secondly, every source of available data from life history, commercial and recreational catch and discard statistics, discard mortality rates, composition databases, surveys of relative and absolute abundance and environmental covariates were compiled, updated to conform to current best practices and reconsidered for inclusion in the model. Lastly, the model was critically evaluated throughout development in public forums by a panel of regional Red Snapper and fishery science experts. The true value of this endeavor will only be known once the assessment model becomes operational and is evaluated for use in management. However, from a strictly model development perspective, a number of significant advancements were achieved.

SEDAR 74 made many changes to the model structure when compared to the most recently accepted assessment model (SEDAR 52). Among the most significant of these were the change to a three-area stock ID, switching from MRIP Coastal Household Telephone Survey (CHTS) based recreational statistics to Fishing Effort Survey (FES) based statistics, the inclusion of an independently derived index of absolute abundance, and adopting length-based instead of age-based selectivity for the directed fleets. In addition to the major changes in model structure that accompanied the update in stock ID, this Research Track Assessment also implemented various new procedures and methodologies for GOM Red Snapper including: utilizing the Dirichlet-multinomial likelihood for composition data, utilizing unconstrained (i.e., no zero sum penalty) recruitment deviations to account for unknown causes of shifts in population productivity, revisiting the Then et al. (2015) approach to estimating natural mortality by subsetting data to the family level, and switching to spawning stock biomass, as a proxy for reproduction, rather than total egg production based on the most recent data provided by the Life History Working Group.

During the Stock ID Workshop the decision to move forward with a three-area model was in no way unanimous. One approach proposed during the Stock ID process was a two-area stock structure with a dividing line located at the DeSoto Canyon which is located at the shelf edge roughly south of the Florida/Alabama border. Requests for the Research Track Assessment to develop both three-area and two-area models were considered but ultimately rejected due to the time it would take for both the data compilers and the assessment team to accommodate the request. It is impossible to know with certainty how the two-area model would have performed relative to the final three-area model. However, from a GOM wide perspective, metrics like initial depletion, biomass trajectories, and terminal year depletion did not differ greatly between the three-area SEDAR 74 model and the previously accepted two-area SEDAR 52 model. This makes some intuitive sense when one considers that the totality of the data is quite similar between the two model configurations. Thus, it is likely that GOM wide, the current three-area model and the hypothetical two-area model proposed during stock ID would have exhibited similar biomass, depletion, reference point and stock status metrics. The advantage of the three-area model is that it allows regions of the GOM with different fishery and population dynamics to be modeled and subsequently monitored independently. The ability to monitor the population at finer scales will allow for more responsive Red Snapper management at the federal and state levels.

The switch to recreational statistics based on the FES represents current best practices for handling estimates of recreational landings and discards in the southeast United States. However, numerous concerns have been raised regarding the accuracy of the FES based estimates, particularly for Red Snapper where estimates of recreational statistics derived from state run surveys exist and tend to differ substantially from FES estimates. Research efforts are underway to better understand potential biases in the FES survey design as well as explore the use of state collected data for assessment purposes. There are numerous advantages for the states to operate the surveys collecting recreational catch data for Red Snapper and other managed species in their coastal waters. These include, among others, allowing the states to be more responsive to in-season management needs, being able to better tailor the surveys to the specific conditions and needs of the states' fisheries, and leveraging local knowledge and relationships to promote stakeholder engagement and participation. While great promise exists for the state run surveys, there are a number of challenges prohibiting their adoption as the preferred source of recreational removals in stock assessment. Paramount among these is the length of time most surveys have been operating and the collection of discard data. Current MRIP estimates for recreational landings go back to 1981 and historic extrapolations of landings can be generated back to 1955.

Many of the state run surveys have been active for less than a decade and have no known way of generating reliable estimates of prior landings that are independent from the federally collected MRIP data. In addition, the state surveys do not have uniform statistical survey designs among them which creates calibration issues among the surveys that must be resolved before they can be used for GOM wide assessment purposes. While these issues are substantial they are not necessarily insurmountable, and federal and state agencies responsible for fisheries data collection must continue to conduct collaborative research in order to resolve the remaining issues and ensure that the highest quality data is available for Red Snapper assessment and management in the future.

The Great Red Snapper Count (GRSC) was an unprecedented study in the GOM which provided invaluable insight on the abundance and distribution of GOM Red Snapper. Incorporating an absolute abundance study like the GRSC into an assessment had never been attempted in the GOM and required a number of methodological decisions and assumptions to be made around the catchability coefficient (q), data weighting, and selectivity. Given that the study's stated goal was to produce an index of absolute abundance, the base assumption for q was to fix it at one for all areas. Allowing the model to estimate q for the surveys resulted in perfect fits to the survey abundance with no change in area-specific or GOM wide abundance. In other words, estimating q essentially allowed the model to reduce the impact of the survey in favor of other data sources, and was therefore rejected in favor of the fixed q approach.

During model development, a number of different data weighting schemes were attempted to see how the base model would respond when forced to fit the GRSC estimates more or less closely. As weights on the GRSC survey were decreased the model simply converged back to the result achieved with no GRSC survey included. Increasing weights led to tighter fits in the west and central region where the base model fits were already reasonably good. The east area, which shows the greatest lack of fit in the base model, responded only slightly to the increased weights. Ultimately, the Assessment Development Team decided that the GRSC indices of abundance should be given equal weight to all other sources of data.

The lack of fit in the east area suggests that there are substantive and data-supported differences between the model-derived estimate of east area abundance and the GRSC-derived estimate of east area abundance. It was noted during review of the GRSC study that the overwhelming majority of Red Snapper observed in the east area appeared to be from a single strong year class that had likely not yet fully recruited to the fisheries. Given a terminal data year of 2019, this year class was not fully represented in the landings and composition data available for the Research Track Assessment. Thus, it remains possible that the disconnect between the GRSC and assessment based estimates of east area abundance will resolve as additional years of data are incorporated into future assessments. Further exploration into this conflict between the GRSC estimates of area-specific abundance and the comparable model based estimates is clearly warranted for future assessments.

Fitting the GRSC abundance estimates required selectivity assumptions be made for each area as there was not an adequate amount of survey associated composition data available for the model. The GRSC specifically set out to estimate abundance for age-2+ Red Snapper which made fixing selectivity at 100% for all age-2+ Red Snapper a logical assumption. However, in practice differences in area-specific sampling designs and gear application led the Assessment Development Team to conclude that it was probable, if not likely, that the central and west area components of the survey achieved less than 100% selectivity for all age-2+ fish. Therefore the decision was made to model selectivity for the central and west using double normal parameterizations. This decision was not without risk as the efficacy and value of estimating selectivity curves in the absence of composition data is debatable. Nonetheless, sensitivity runs around the decision indicated the final choice of selectivity for the survey was not overly influential, supporting the base model configuration of fixed selectivity in the east and estimated in the central and west areas.

The decision to use length composition data to model the selectivity of the directed fishing fleets differs from previous Red Snapper assessments that relied solely on age composition data. Previously, age composition was used out of necessity as the modeling framework was age-structured and incapable of accepting length composition data as an input. Advancements in the SS model framework now allow length composition data to be easily incorporated into the model as a stand alone composition data source or along with age composition data. SEDAR 74 opted to rely on length composition for the directed fleets to facilitate the simultaneous fitting of landed and discard fish, as retention functions were length-based. Previous Red Snapper models had experienced difficulty modeling the discarding process due to inherent conflicts between the externally estimated and fixed growth curve, fixed length-based retention curves, and the estimated age composition of the landed fish. Essentially, in fitting the more robust, age-based landings composition the model was unable to select enough young and therefore small fish to fit the observed discard data. Allowing both the selectivity and retention process to work in the same compositional units appears to have successfully alleviated that issue for SEDAR 74 as fits to discard and landing data have generally improved. However, the shift to length composition sacrifices some of the robust cohort tracking information that is often contained in age composition data. For SEDAR 74 age composition for a number of the fishery-independent indices of abundance were included to provide needed information on year class strength. Several Gulf of Mexico assessments have included both age and length composition data for some fleets with mixed results. In most cases tension between the two compositional data sources exists resulting in degraded fits to both. Incorporating both age and length composition for the same fleet/survey could be explored in future Red Snapper assessments, but was not attempted as part of SEDAR 74.

During model development and review a number of data issues were observed that should be considered for the upcoming Operational Track Assessment. MRIP derived estimates of Recreational Private landings, regardless of FES or CHTS survey design, produce highly variable and inconsistent estimates of Recreational Private landings in the earliest few years of the time series for all assessment areas (1981-1985; **Figure 6**). These estimates have long been considered anomalies with the 1981 and 1983 landings data specifically singled out in the SEDAR 74 recreational statistics working paper (SEDAR 74-DW-01). Other recent Gulf of Mexico assessments have dealt with similar issues by replacing anomalous landings data with an average value derived from adjacent years or substituting reasonable alternatives if adjacent year landings are also suspect or missing. It is strongly suggested that these data should be re-evaluated during the upcoming Operational Track Assessment given the issues they cause with the fitting of the landings and discards as well as their influence on the estimation of the historical recreational landings.

Estimates of the Recreational Private discards in the east area were highly variable with most years observing low levels of discarding punctuated by a few extremely high estimates that were largely attributed to the closed season fleet (**Figure 9**). These dynamics are almost certainly the result of sample size issues rather than a reflection of actual fleet dynamics in the east area. The model would benefit from having these points addressed as they resulted in fit issues throughout model development as well as high *F* estimates that caused noticeable and implausible shifts in the east area-specific biomass (**Figure 130**). Approaches like those proposed for the landings data issues could be applied here. Correcting this issue would likely eliminate the need to use a data weighting factor to constrain the Recreational Private east closed season discard fleet and may generally improve fit to all sources of data in the east area.

Finally, the decision to use unconstrained (non-zero summed) recruitment deviations as opposed to a parameterized regime shift and penalized recruitment deviations, used in previous Red Snapper assessments resulted in similar and sensical trends in Red Snapper recruitment. This decision reduced the number of estimated parameters in the model and allowed recruitment to be informed by the data rather than a model structure decision. Despite the model structure change, trends in recruitment generally increased over time as expected given changes in observed landings and catch per unit effort (CPUE). The average trend in recruitment appeared to begin to stabilize in the early 2000s likely as a result of effective management and a recovered spawning population. In contrast to the generally positive trend in recruitment is the relatively low estimate of recruitment in 2009. It's unclear what may have caused the estimated recruitment failure in 2009, indicated by the dip in the Summer Trawl index. Hurricane Ike traveled through the GOM during September of 2008 eventually making landfall in Texas. This corresponds with peak Red Snapper spawning and may have played a role in disrupting settlement; however, GOM hurricanes are not uncommon with many others occurring during the assessment time period without noticeable impacting recruitment. Continued investigation into environmental impacts on the Red Snapper population is warranted.

6. Acknowledgements

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7. Research Recommendations

Recommendations for considerations of future research are provided below in no particular order of priority.

Recreational Landings and Discards data

- Further develop best practices for correcting for prominent peaks and troughs in the earlier part of the time series where uncertainty is high and catch/discard estimates are driven by few but influential intercept records.
- Investigate influence of depredation as a contributor to discard mortality and its significance on observed discard data used in the assessment.

Composition Data Alternatives

- Incorporating age composition and length composition data for the directed fleets and estimating growth internally to the model to facilitate fit of multiple simultaneous sources of composition data.
- Consider the application of conditional age-at-length data for use in red snapper stock assessment.

Alternate Start Years

- SEDAR 74 moved the model start year from 1872 to 1950, but other later years would have been considered if not for modeling limitations. The determining factor in selecting 1950 was the shrimp bycatch data and the lack of an ability to specify an initial *F* for a bycatch only fleet. This issue should be further explored and possible modifications to SS should be considered to allow the consideration of later start years.

Additional Data Needs

- Currently the model includes length-converted age composition data for surveys, where possible. It would benefit the model to include real age composition for trawl surveys in the future.
- Incorporating recreational discard composition into the east assessment area.
- Investigate the impact of using state survey derived landing statistics on the assessment model.

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Tables

Table 1. Age-specific natural mortality (per year) for Gulf of Mexico Red Snapper used in SEDAR 74.

Age	M	Adj. M
0	0.86	2.00
1	0.64	1.20
2	0.21	0.21
3	0.17	0.17
4	0.15	0.15
5	0.14	0.14
6	0.13	0.13
7	0.12	0.12
8	0.12	0.12
9	0.11	0.11
10	0.11	0.11
11	0.11	0.11
12	0.10	0.10
13	0.10	0.10
14	0.10	0.10
15	0.10	0.10
16	0.10	0.10
17	0.10	0.10
18	0.10	0.10
19	0.10	0.10
20	0.10	0.10

Table 2. Maturity parameters for Gulf of Mexico Red Snapper. All parameters were fixed to values provided from the data workshop (base model maturity).

Parameter	East	Central	West
M_{A50}	1.95	1.95	2.47
M $Slope_{A50}$	-1.57	-1.57	-1.18

Table 3. Standardized indices of relative abundance for Eastern Gulf of Mexico Red Snapper used in SEDAR 74.

Year	CPUE Handline	CPUE Combined Video	CPUE Bottom Longline	CPUE Summer Trawl Late	CPUE Fall Trawl Late	CPUE Comm Obs.
1993	0.300					
1994	0.113					
1995	0.251					
1996	0.242					
1997	0.382					
1998	0.264					
1999	1.016					
2000	1.587					
2001	1.102		0.120			
2002	0.952					
2003	1.220		0.426			
2004	2.073		0.687			
2005	1.857		0.525			
2006	2.641		0.257			
2007			1.736			0.397
2008					0.665	0.477
2009			1.161	0.097	0.409	0.822
2010		0.461	1.851	0.034	0.721	0.835
2011		0.605	1.771	1.170		0.851
2012		0.307	0.483	0.556	0.933	0.702

Table 3 Continued. Standardized indices of relative abundance for Eastern Gulf of Mexico Red Snapper used in SEDAR 74.

Year	CPUE Handline	CPUE Combined Video	CPUE Bottom Longline	CPUE Summer Trawl Late	CPUE Fall Trawl Late	CPUE Comm Obs.
2013		0.692	2.852	0.174	0.174	0.748
2014		0.389	0.360	0.379	3.262	0.837
2015		1.509		3.356	1.253	0.910
2016		2.036	1.681	2.029	1.602	2.027
2017		1.458	0.646	1.494	0.860	1.493
2018		1.449	0.510	1.179	0.343	1.752
2019		1.094	0.935	0.532	0.777	1.150

Table 4. Log scale standard error (SE) associated with each standardized relative abundance index for Eastern Gulf of Mexico Red Snapper.

Year	SE Handline	SE Combined Video	SE Bottom Longline	SE Summer Trawl Late	SE Fall Trawl Late	SE Comm Obs.
1993	0.258					
1994	0.344					
1995	0.234					
1996	0.214					
1997	0.200					
1998	0.240					
1999	0.202					
2000	0.158					
2001	0.189		0.259			
2002	0.185					
2003	0.153		0.201			
2004	0.144		0.170			
2005	0.149		0.259			
2006	0.131		0.258			
2007			0.198			0.218
2008					0.290	0.209
2009			0.150	0.304	0.209	0.213
2010		0.257	0.133	0.379	0.172	0.149
2011		0.181	0.088	0.185		0.110
2012		0.181	0.200	0.164	0.286	0.080

Table 4 Continued. Log scale standard error (SE) associated with each standardized relative abundance index for Eastern Gulf of Mexico Red Snapper.

Year	SE Handline	SE Combined Video	SE Bottom Longline	SE Summer Trawl Late	SE Fall Trawl Late	SE Comm Obs.
2013		0.242	0.258	0.304	0.287	0.121
2014		0.179	0.257	0.164	0.140	0.166
2015		0.320		0.129	0.122	0.283
2016		0.126	0.168	0.111	0.171	0.127
2017		0.148	0.199	0.136	0.146	0.411
2018		0.157	0.202	0.128	0.217	0.210
2019		0.208	0.200	0.195	0.160	0.303

Table 5. Shrimp Trawl bycatch time series used in SEDAR 74 input as 1000s of fish.

Year	Shrimp Bycatch West	Shrimp Bycatch Central	Shrimp Bycatch East
1950	13889.70	727.27	264.01
1973	14460.00	908.33	308.67
1974	17550.00	516.86	175.64
1975	8357.00	907.58	308.42
1976	30000.00	808.31	274.69
1977	11320.00	1125.52	382.48
1978	6575.00	180.92	61.48
1979	21970.00	812.04	275.95
1980	25550.00	333.40	113.30
1981	53210.00	977.74	332.26
1982	23920.00	1207.62	410.38
1983	17560.00	853.84	290.16
1984	12510.00	611.42	207.78
1985	10440.00	506.10	191.10
1986	5441.00	165.69	51.81
1987	11760.00	233.47	91.53
1988	9602.00	282.27	98.53
1989	10500.00	517.83	137.47
1990	40970.00	1725.73	456.27
1991	40890.00	1402.15	435.85
1992	31660.00	944.17	345.83
1993	34900.00	486.69	264.31
1994	34400.00	702.32	388.68

Table 5 Continued. Shrimp Trawl bycatch time series used in SEDAR 74 input as 1000s of fish.

Year	Shrimp Bycatch West	Shrimp Bycatch Central	Shrimp Bycatch East
1995	47470.00	934.17	527.83
1996	36260.00	493.63	567.37
1997	26290.00	1078.91	610.09
1998	56070.00	972.88	645.12
1999	23870.00	1396.53	467.47
2000	11960.00	1657.82	469.18
2001	23970.00	1633.46	682.54
2002	22140.00	1476.17	704.83
2003	30510.00	892.34	380.66
2004	27840.00	1019.89	393.11
2005	12250.00	423.02	202.48
2006	11430.00	1417.67	420.33
2007	6812.00	1055.98	161.02
2008	2710.00	126.64	33.86
2009	3726.00	282.75	68.65
2010	2779.00	119.95	70.25
2011	6389.00	453.82	151.58
2012	8494.00	314.85	71.65
2013	5979.00	394.96	114.04
2014	20170.00	95.09	32.41
2015	17260.00	563.43	162.97
2016	17260.00	583.33	143.07
2017	18230.00	413.95	112.82
2018	18230.00	413.95	112.82
2019	18230.00	413.95	112.82

Table 6. Standardized index of relative abundance and corresponding standard errors (SE) for Shrimp Trawl bycatch effort time series used in the assessment.

Year	CPUE Shrimp Effort west	CPUE Shrimp Effort central	CPUE Shrimp Effort east	SE Shrimp Effort west	SE Shrimp Effort central	SE Shrimp Effort east
1950	0.232	0.219	0.198	0.200	0.200	0.200
1951	0.244	0.377	0.341	0.200	0.200	0.200
1952	0.288	0.445	0.404	0.200	0.200	0.200
1953	0.281	0.492	0.446	0.200	0.200	0.200
1954	0.371	0.630	0.572	0.200	0.200	0.200
1955	0.306	0.744	0.675	0.200	0.200	0.200
1956	0.399	0.943	0.855	0.200	0.200	0.200
1957	0.501	1.032	0.936	0.200	0.200	0.200
1958	0.772	1.092	0.990	0.200	0.200	0.200
1959	0.825	1.185	1.075	0.200	0.200	0.200
1960	0.714	1.102	0.999	0.200	0.200	0.200
1961	0.596	0.808	0.733	0.200	0.200	0.200
1962	0.724	1.102	0.999	0.200	0.200	0.200
1963	0.805	1.065	0.965	0.200	0.200	0.200
1964	0.984	1.181	1.071	0.200	0.200	0.200
1965	0.820	1.097	0.994	0.200	0.200	0.200
1966	0.831	1.026	0.930	0.200	0.200	0.200
1967	0.966	1.002	0.908	0.200	0.200	0.200
1968	1.027	1.185	1.074	0.200	0.200	0.200
1969	1.153	1.110	1.007	0.200	0.200	0.200

Table 6 Continued. Standardized index of relative abundance and corresponding standard errors (SE) for Shrimp Trawl bycatch effort time series used in the assessment.

Year	CPUE Shrimp Effort west	CPUE Shrimp Effort central	CPUE Shrimp Effort east	SE Shrimp Effort west	SE Shrimp Effort central	SE Shrimp Effort east
1970	0.979	1.071	0.971	0.200	0.200	0.200
1971	1.035	0.998	0.905	0.200	0.200	0.200
1972	1.275	1.038	0.942	0.200	0.200	0.200
1973	1.191	1.158	1.050	0.200	0.200	0.200
1974	1.219	1.072	0.972	0.200	0.200	0.200
1975	1.084	1.100	0.997	0.200	0.200	0.200
1976	1.180	1.017	0.923	0.200	0.200	0.200
1977	1.209	1.184	1.073	0.200	0.200	0.200
1978	1.389	1.158	1.050	0.200	0.200	0.200
1979	1.632	1.294	1.174	0.200	0.200	0.200
1980	1.163	0.732	0.664	0.200	0.200	0.200
1981	1.309	1.123	1.018	0.200	0.200	0.200
1982	1.283	1.345	1.219	0.200	0.200	0.200
1983	1.301	1.501	1.361	0.200	0.200	0.200
1984	1.354	1.767	1.603	0.200	0.200	0.200
1985	1.339	1.588	1.600	0.200	0.200	0.200
1986	1.767	1.557	1.299	0.200	0.200	0.200
1987	1.862	1.691	1.769	0.200	0.200	0.200
1988	1.672	1.701	1.585	0.200	0.200	0.200
1989	1.693	1.636	1.159	0.200	0.200	0.200

Table 6 Continued. Standardized index of relative abundance and corresponding standard errors (SE) for Shrimp Trawl bycatch effort time series used in the assessment.

Year	CPUE Shrimp Effort west	CPUE Shrimp Effort central	CPUE Shrimp Effort east	SE Shrimp Effort west	SE Shrimp Effort central	SE Shrimp Effort east
1990	1.729	1.577	1.113	0.200	0.200	0.200
1991	1.776	1.215	1.008	0.200	0.200	0.200
1992	1.885	1.275	1.247	0.200	0.200	0.200
1993	1.675	1.097	1.590	0.200	0.200	0.200
1994	1.732	1.130	1.669	0.200	0.200	0.200
1995	1.327	1.271	1.917	0.200	0.200	0.200
1996	1.363	0.892	2.735	0.200	0.200	0.200
1997	1.604	1.315	1.985	0.200	0.200	0.200
1998	1.499	1.301	2.301	0.200	0.200	0.200
1999	1.503	1.383	1.235	0.200	0.200	0.200
2000	1.501	1.205	0.910	0.200	0.200	0.200
2001	1.593	1.196	1.334	0.200	0.200	0.200
2002	1.685	1.429	1.820	0.200	0.200	0.200
2003	1.447	1.125	1.280	0.200	0.200	0.200
2004	1.215	0.991	1.020	0.200	0.200	0.200
2005	0.851	0.645	0.824	0.200	0.200	0.200
2006	0.826	0.562	0.445	0.200	0.200	0.200
2007	0.718	0.667	0.272	0.200	0.200	0.200
2008	0.586	0.602	0.430	0.200	0.200	0.200
2009	0.724	0.778	0.504	0.200	0.200	0.200

Table 6 Continued. Standardized index of relative abundance and corresponding standard errors (SE) for Shrimp Trawl bycatch effort time series used in the assessment.

Year	CPUE Shrimp Effort west	CPUE Shrimp Effort central	CPUE Shrimp Effort east	SE Shrimp Effort west	SE Shrimp Effort central	SE Shrimp Effort east
2010	0.609	0.449	0.701	0.200	0.200	0.200
2011	0.687	0.591	0.527	0.200	0.200	0.200
2012	0.685	0.537	0.326	0.200	0.200	0.200
2013	0.609	0.538	0.415	0.200	0.200	0.200
2014	0.693	0.294	0.267	0.200	0.200	0.200
2015	0.669	0.432	0.333	0.200	0.200	0.200
2016	0.739	0.573	0.375	0.200	0.200	0.200
2017	0.682	0.424	0.631	0.200	0.200	0.200
2018	0.674	0.444	0.709	0.200	0.200	0.200
2019	0.569	0.496	0.571	0.200	0.200	0.200

Table 7. Standardized indices of relative abundance for Central Gulf of Mexico Red Snapper used in SEDAR 74.

Year	CPUE Combined Video	CPUE Bottom Longline	CPUE Larval Survey	CPUE Summer Trawl Late	CPUE Fall Trawl Late
1991			0.120		
1992					
1993	0.100				
1994	0.088		0.031		
1995	0.050		0.060		
1996	0.140				
1997	0.265		0.088		
1998					
1999			0.369		
2000			0.804		
2001		0.171	0.153		
2002	0.624	0.117			
2003		0.269	0.397		
2004	1.216	0.114	0.159		
2005	0.998	0.093			
2006	0.986	0.165	0.608		
2007	1.601		0.891		
2008	1.420		0.091		0.604
2009	1.864	0.369	0.506	0.447	2.281
2010	1.688	1.264	2.725	1.014	0.693

Table 7 Continued. Standardized indices of relative abundance for Central Gulf of Mexico Red Snapper used in SEDAR 74.

Year	CPUE Combined Video	CPUE Bottom Longline	CPUE Larval Survey	CPUE Summer Trawl Late	CPUE Fall Trawl Late
2011	1.633	1.691	0.906	0.568	0.570
2012	0.875	1.158	0.788	1.077	1.368
2013	1.069	0.553	0.855	1.372	0.701
2014	0.977	2.080	1.484	0.684	0.978
2015	0.805	2.389	0.469	0.653	1.292
2016	1.406	2.560	1.032	0.952	0.985
2017	1.543	0.886	4.255	1.672	0.563
2018	1.111	1.200	1.805	1.144	1.271
2019	1.542	1.922	4.405	1.416	0.695

Table 8. Standardized indices of relative abundance for Western Gulf of Mexico Red Snapper used in SEDAR 74.

Year	CPUE SEAMAP Video	CPUE Bottom Longline	CPUE Larval Survey	CPUE Summer Trawl Late	CPUE Summer Trawl Early	CPUE Fall Trawl Late	CPUE Fall Trawl Early
1984					0.747		
1985					1.110		
1986			0.282		0.294		
1987			0.439		0.710		
1988					0.347		0.428
1989			0.549		0.256		0.857
1990			0.445		2.262		0.909
1991			0.215		1.021		1.027
1992			0.254		0.644		0.316
1993	0.137		0.269		0.704		0.574
1994	0.345		0.197		1.345		1.625
1995	0.306		0.759		1.176		1.747
1996	0.702		0.534		1.309		0.870
1997	1.550		0.892		0.994		1.290
1998					0.886		0.595
1999			0.380		0.759		1.374
2000			1.219		1.391		0.907
2001		0.323	0.847		0.787		0.681
2002	1.082	0.247	0.644		1.094		0.650
2003		0.289	1.207		0.614		1.152

Table 8 Continued. Standardized indices of relative abundance for Western Gulf of Mexico Red Snapper used in SEDAR 74.

Year	CPUE SEAMAP Video	CPUE Bottom Longline	CPUE Larval Survey	CPUE Summer Trawl Late	CPUE Summer Trawl Early	CPUE Fall Trawl Late	CPUE Fall Trawl Early
2004	0.948	0.345	0.685		1.331		1.798
2005	0.961				1.502		1.272
2006	0.380	0.276	1.194		1.419		1.084
2007	1.020	0.299	1.047		1.166		0.845
2008	0.723				1.134	0.445	
2009	1.077	0.514	1.276	0.366		1.472	
2010	2.245	0.252	0.521	0.870		0.693	
2011	1.739	0.705	2.104	1.210		0.816	
2012	1.874	1.240	1.980	0.835		1.575	
2013	2.625	1.143	1.054	1.308		0.664	
2014	3.487	0.864	1.550	0.793		0.900	
2015	2.137	2.125		1.086		1.649	
2016	2.640	1.761	3.178	0.894		1.106	
2017	3.036	2.698	0.839	0.854		0.765	
2018	6.044	1.561	1.593	1.639		1.077	
2019	3.342	2.357	2.848	1.145		0.837	

Table 9. Log scale standard error (SE) associated with each standardized relative abundance index for Central Gulf of Mexico Red Snapper.

Year	SE Combined Video	SE Bottom Longline	SE Larval Survey	SE Summer Trawl Late	SE Fall Trawl Late
1991			0.294		
1992					
1993	0.433				
1994	0.518		0.296		
1995	0.722		0.296		
1996	0.347				
1997	0.267		0.295		
1998					
1999			0.200		
2000			0.178		
2001		0.242	0.198		
2002	0.208	0.243			
2003		0.208	0.177		
2004	0.164	0.304	0.296		
2005	0.140	0.304			
2006	0.147	0.305	0.199		
2007	0.154		0.146		
2008	0.122		0.294		0.223
2009	0.114	0.209	0.199	0.175	0.126
2010	0.099	0.151	0.123	0.204	0.186

Table 9 Continued. Log scale standard error (SE) associated with each standardized relative abundance index for Central Gulf of Mexico Red Snapper.

Year	SE Combined Video	SE Bottom Longline	SE Larval Survey	SE Summer Trawl Late	SE Fall Trawl Late
2011	0.085	0.092	0.200	0.240	0.227
2012	0.106	0.207	0.157	0.201	0.192
2013	0.127	0.211	0.157	0.224	0.220
2014	0.148	0.140	0.159	0.203	0.195
2015	0.113	0.127	0.295	0.223	0.183
2016	0.080	0.138	0.132	0.193	0.269
2017	0.090	0.169	0.089	0.146	0.184
2018	0.129	0.168	0.125	0.201	0.181
2019	0.086	0.182	0.096	0.190	0.215

Table 10. Log scale standard error (SE) associated with each standardized relative abundance index for Western Gulf of Mexico Red Snapper.

Year	SE SEAMAP Video	SE Bottom Longline	SE Larval Survey	SE Summer Trawl Late	SE Summer Trawl Early	SE Fall Trawl Late	SE Fall Trawl Early
1984					0.272		
1985					0.292		
1986			0.300		0.406		
1987			0.300		0.211		
1988					0.236		0.234
1989			0.295		0.289		0.220
1990			0.247		0.154		0.194
1991			0.335		0.181		0.184
1992			0.234		0.190		0.235
1993	0.156		0.234		0.186		0.220
1994	0.183		0.300		0.172		0.190
1995	0.215		0.170		0.164		0.173
1996	0.198		0.206		0.164		0.201
1997	0.208		0.163		0.166		0.196
1998					0.184		0.225
1999			0.218		0.185		0.182
2000			0.160		0.148		0.185
2001		0.194	0.232		0.251		0.211
2002	0.218	0.168	0.177		0.164		0.209
2003		0.212	0.152		0.202		0.189

Table 10 Continued. Log scale standard error (SE) associated with each standardized relative abundance index for Western Gulf of Mexico Red Snapper.

Year	SE SEAMAP Video	SE Bottom Longline	SE Larval Survey	SE Summer Trawl Late	SE Summer Trawl Early	SE Fall Trawl Late	SE Fall Trawl Early
2004	0.167	0.212	0.179		0.156		0.171
2005	0.204				0.160		0.161
2006	0.215	0.259	0.178		0.142		0.193
2007	0.173	0.258	0.151		0.175		0.225
2008	0.192				0.149	0.155	
2009	0.235	0.195	0.147	0.201		0.142	
2010	0.198	0.334	0.218	0.196		0.200	
2011	0.241	0.144	0.169	0.194		0.188	
2012	0.198	0.206	0.147	0.186		0.188	
2013	0.207	0.188	0.151	0.218		0.276	
2014	0.174	0.227	0.162	0.212		0.195	
2015	0.200	0.173		0.197		0.180	
2016	0.228	0.166	0.136	0.198		0.232	
2017	0.207	0.124	0.177	0.211		0.225	
2018	0.200	0.169	0.141	0.183		0.193	
2019	0.183	0.169	0.122	0.204		0.226	

Table 11. Derived base Red Snapper Count numbers and weighted Coefficients of Variation (CV) by Stock ID area.

Area	Count	Weighted CV
West	30,823,985	27.30
East	24,706,670	21.80
Central	30,806,497	22.00

Table 12. Growth parameters for Gulf of Mexico Red Snapper. All parameters were fixed at values provided as a result of the Data Workshop (see Data Workshop report, SEDAR 2022).

Parameter	East	Central	West
A_{min}	0.25	0.25	0.25
L_{Amin}	15.94	17.11	15.94
L_{Amax}	85.99	85.43	81.88
K ($year^{-1}$)	0.17	0.15	0.14

Table 13. List of relevant Stock Synthesis recruitment related parameters for Gulf of Mexico Red Snapper. The list includes predicted parameter values, lower and upper bounds of the parameters, associated standard errors and coefficients of variation, prior type and densities (value, SE) if applicable, and phases. Parameters designated as 'F' (Fixed) were held at their initial values and have no associated range or SE.

Label	Value	Range	SE	CV	Prior	Phase
SR_LN(R0)	11.35	(10,15)	0.042	0.004	Sym_Beta(0.5)	1
SR_BH_steep	0.99					F
SR_sigmaR	0.6					F
SR_regime	0.00e+00					F
SR_autocorr	0.00e+00					F
RecrDist_GP_1_area_1	-2.48	(-6,4)	0.063	-	Normal(-2.085,0.5)	2
RecrDist_GP_2_area_2	-1.19	(-6,4)	0.07	-	Normal(-0.62,0.5)	2
RecrDist_GP_3_area_3	0.00e+00					F
RecrDist_GP_1_area_1_dev_se	0.5					F
RecrDist_GP_2_area_2_dev_se	0.5					F

Table 14. Time varying maturity parameters used for blocking for Gulf of Mexico Red Snapper (sensitivity run).

Year	Parameter	East	Central	West
1970	M_{A50}	1.49	1.49	1.71
	M $Slope_{A50}$	-2.39	-2.39	-1.99
1991	M_{A50}	1.39	1.39	1.51
	M $Slope_{A50}$	-3.61	-3.61	-3.21
2009	M_{A50}	1.49	1.49	1.71
	M $Slope_{A50}$	-2.39	-2.39	-1.99

Table 15. Estimates of annual exploitation rate (total biomass killed age 2+ / total biomass age 2+) combined across all fleets for Gulf of Mexico Red Snapper, which was used as the proxy for annual fishing mortality rate.

Year	S74
1950	0.043
1951	0.046
1952	0.050
1953	0.048
1954	0.053
1955	0.052
1956	0.063
1957	0.071
1958	0.100
1959	0.106
1960	0.110
1961	0.111
1962	0.125
1963	0.133
1964	0.150
1965	0.147
1966	0.147
1967	0.168
1968	0.182
1969	0.190
1970	0.190
1971	0.214
1972	0.247
1973	0.269
1974	0.307

Table 15 Continued. Estimates of annual exploitation rate (total biomass killed age 2+ / total biomass age 2+) combined across all fleets for Gulf of Mexico Red Snapper, which was used as the proxy for annual fishing mortality rate.

Year	S74
1975	0.323
1976	0.350
1977	0.353
1978	0.378
1979	0.408
1980	0.375
1981	0.496
1982	0.400
1983	0.727
1984	0.470
1985	0.472
1986	0.504
1987	0.439
1988	0.496
1989	0.455
1990	0.315
1991	0.333
1992	0.360
1993	0.448
1994	0.406
1995	0.327
1996	0.363
1997	0.434
1998	0.398
1999	0.430

Table 15 Continued. Estimates of annual exploitation rate (total biomass killed age 2+ / total biomass age 2+) combined across all fleets for Gulf of Mexico Red Snapper, which was used as the proxy for annual fishing mortality rate.

Year	S74
2000	0.401
2001	0.402
2002	0.492
2003	0.463
2004	0.503
2005	0.429
2006	0.351
2007	0.274
2008	0.163
2009	0.171
2010	0.164
2011	0.196
2012	0.162
2013	0.186
2014	0.140
2015	0.156
2016	0.152
2017	0.189
2018	0.145
2019	0.183

Table 16. Estimates of annual exploitation rate (total biomass killed age 2+ / total biomass age 2+) by commercial fleets for Western Gulf of Mexico Red Snapper.

Year	Charter Closed Season Discards	Charter	Headboat	Private Closed Season Discards	Private
1950	0	0.007	0.004	0	0.002
1951	0	0.007	0.004	0	0.002
1952	0	0.007	0.005	0	0.002
1953	0	0.007	0.005	0	0.002
1954	0	0.007	0.005	0	0.002
1955	0	0.007	0.005	0	0.002
1956	0	0.008	0.005	0	0.003
1957	0	0.009	0.006	0	0.003
1958	0	0.011	0.007	0	0.004
1959	0	0.012	0.008	0	0.004
1960	0	0.014	0.009	0	0.005
1961	0	0.015	0.009	0	0.005
1962	0	0.016	0.010	0	0.005
1963	0	0.017	0.011	0	0.006
1964	0	0.018	0.011	0	0.006
1965	0	0.012	0.009	0	0.018
1966	0	0.013	0.009	0	0.019
1967	0	0.014	0.010	0	0.020
1968	0	0.015	0.011	0	0.022
1969	0	0.016	0.012	0	0.024
1970	0	0.018	0.013	0	0.026
1971	0	0.021	0.015	0	0.030
1972	0	0.024	0.017	0	0.035
1973	0	0.028	0.020	0	0.041
1974	0	0.033	0.023	0	0.047

Table 16 Continued. Estimates of annual exploitation rate (total biomass killed age 2+ / total biomass age 2+) by recreational fleets for Western Gulf of Mexico Red Snapper.

Year	Charter Closed Season Discards	Charter	Headboat	Private Closed Season Discards	Private
1975	0	0.014	0.016	0.000	0.091
1976	0	0.015	0.017	0.000	0.097
1977	0	0.016	0.018	0.000	0.103
1978	0	0.017	0.019	0.000	0.112
1979	0	0.020	0.022	0.000	0.128
1980	0	0.023	0.026	0.000	0.148
1981	0	0.018	0.021	0.000	0.222
1982	0	0.025	0.024	0.000	0.119
1983	0	0.036	0.020	0.000	0.251
1984	0	0.032	0.032	0.000	0.079
1985	0	0.056	0.036	0.000	0.149
1986	0	0.012	0.029	0.000	0.197
1987	0	0.009	0.033	0.000	0.067
1988	0	0.002	0.047	0.000	0.126
1989	0	0.011	0.048	0.000	0.093
1990	0	0.007	0.038	0.000	0.081
1991	0	0.019	0.028	0.000	0.067
1992	0	0.017	0.037	0.000	0.070
1993	0	0.012	0.038	0.000	0.102
1994	0	0.010	0.048	0.000	0.122
1995	0	0.012	0.047	0.000	0.138
1996	0	0.010	0.034	0.000	0.092
1997	0	0.010	0.030	0.000	0.102
1998	0	0.012	0.030	0.001	0.113
1999	0	0.004	0.011	0.005	0.119

Table 16 Continued. Estimates of annual exploitation rate (total biomass killed age 2+ / total biomass age 2+) by recreational fleets for Western Gulf of Mexico Red Snapper.

Year	Charter Closed Season Discards	Charter	Headboat	Private Closed Season Discards	Private
2000	0.000	0.002	0.012	0.003	0.098
2001	0.000	0.003	0.016	0.002	0.069
2002	0.000	0.008	0.020	0.003	0.069
2003	0.000	0.010	0.016	0.009	0.075
2004	0.000	0.020	0.020	0.012	0.075
2005	0.001	0.017	0.018	0.009	0.116
2006	0.000	0.018	0.017	0.008	0.134
2007	0.000	0.021	0.021	0.005	0.092
2008	0.001	0.009	0.010	0.017	0.059
2009	0.001	0.005	0.009	0.008	0.049
2010	0.000	0.007	0.006	0.009	0.028
2011	0.000	0.002	0.005	0.012	0.035
2012	0.000	0.003	0.005	0.005	0.034
2013	0.000	0.004	0.003	0.005	0.051
2014	0.000	0.001	0.003	0.001	0.043
2015	0.000	0.003	0.004	0.001	0.046
2016	0.000	0.002	0.004	0.000	0.021
2017	0.000	0.002	0.004	0.000	0.032
2018	0.000	0.001	0.003	0.000	0.034
2019	0.000	0.004	0.004	0.000	0.056

Table 17. Estimates of annual exploitation rate (total biomass killed age 2+ / total biomass age 2+) by commercial fleets for Central Gulf of Mexico Red Snapper.

Year	Charter Closed Season Discards	Charter	Headboat	Private Closed Season Discards	Private
1950	0	0.020	0.010	0	0.007
1951	0	0.020	0.010	0	0.007
1952	0	0.020	0.010	0	0.007
1953	0	0.020	0.010	0	0.007
1954	0	0.020	0.010	0	0.007
1955	0	0.020	0.010	0	0.007
1956	0	0.022	0.011	0	0.008
1957	0	0.025	0.012	0	0.008
1958	0	0.027	0.013	0	0.009
1959	0	0.030	0.015	0	0.010
1960	0	0.034	0.016	0	0.011
1961	0	0.036	0.017	0	0.012
1962	0	0.038	0.019	0	0.012
1963	0	0.041	0.020	0	0.013
1964	0	0.044	0.021	0	0.014
1965	0	0.038	0.019	0	0.023
1966	0	0.040	0.020	0	0.024
1967	0	0.043	0.021	0	0.025
1968	0	0.045	0.022	0	0.026
1969	0	0.048	0.023	0	0.028
1970	0	0.050	0.024	0	0.029
1971	0	0.056	0.027	0	0.032
1972	0	0.063	0.030	0	0.036
1973	0	0.071	0.034	0	0.040
1974	0	0.082	0.038	0	0.045

Table 17 Continued. Estimates of annual exploitation rate (total biomass killed age 2+ / total biomass age 2+) by commercial fleets for Central Gulf of Mexico Red Snapper.

Year	Charter Closed Season Discards	Charter	Headboat	Private Closed Season Discards	Private
1975	0.000	0.072	0.035	0.000	0.068
1976	0.000	0.084	0.041	0.000	0.083
1977	0.000	0.096	0.046	0.000	0.090
1978	0.000	0.105	0.049	0.000	0.093
1979	0.000	0.105	0.048	0.000	0.086
1980	0.000	0.099	0.045	0.000	0.080
1981	0.000	0.016	0.008	0.000	0.257
1982	0.000	0.123	0.059	0.000	0.034
1983	0.000	0.249	0.118	0.000	0.105
1984	0.000	0.086	0.042	0.000	0.058
1985	0.000	0.092	0.045	0.000	0.108
1986	0.000	0.209	0.005	0.000	0.058
1987	0.000	0.250	0.004	0.000	0.160
1988	0.000	0.230	0.006	0.000	0.089
1989	0.000	0.137	0.005	0.000	0.215
1990	0.000	0.109	0.009	0.000	0.310
1991	0.000	0.116	0.007	0.000	0.430
1992	0.000	0.187	0.012	0.000	0.369
1993	0.000	0.344	0.011	0.000	0.476
1994	0.000	0.237	0.014	0.000	0.396
1995	0.000	0.307	0.017	0.000	0.210
1996	0.000	0.347	0.016	0.000	0.331
1997	0.001	0.414	0.025	0.018	0.442
1998	0.005	0.389	0.018	0.015	0.185
1999	0.007	0.259	0.013	0.019	0.382

Table 17 Continued. Estimates of annual exploitation rate (total biomass killed age 2+ / total biomass age 2+) by commercial fleets for Central Gulf of Mexico Red Snapper.

Year	Charter Closed Season Discards	Charter	Headboat	Private Closed Season Discards	Private
2000	0.007	0.192	0.018	0.067	0.316
2001	0.005	0.197	0.014	0.119	0.306
2002	0.004	0.205	0.014	0.126	0.498
2003	0.004	0.233	0.016	0.090	0.430
2004	0.004	0.246	0.014	0.051	0.595
2005	0.004	0.205	0.013	0.085	0.454
2006	0.007	0.206	0.015	0.049	0.359
2007	0.003	0.124	0.005	0.041	0.477
2008	0.007	0.039	0.009	0.096	0.144
2009	0.005	0.039	0.009	0.055	0.194
2010	0.003	0.012	0.004	0.091	0.181
2011	0.005	0.023	0.008	0.084	0.206
2012	0.004	0.018	0.007	0.099	0.162
2013	0.008	0.023	0.006	0.079	0.239
2014	0.007	0.004	0.006	0.089	0.102
2015	0.004	0.018	0.006	0.050	0.135
2016	0.006	0.028	0.005	0.071	0.151
2017	0.006	0.035	0.006	0.103	0.279
2018	0.005	0.023	0.006	0.073	0.135
2019	0.005	0.028	0.004	0.093	0.182

Table 18. Estimates of annual exploitation rate (total biomass killed age 2+ / total biomass age 2+) by commercial fleets for Eastern Gulf of Mexico Red Snapper.

Year	Charter Closed Season Discards	Charter	Headboat	Private Closed Season Discards	Private
1950	0	0.019	0.000	0	0.005
1951	0	0.019	0.000	0	0.005
1952	0	0.019	0.000	0	0.005
1953	0	0.020	0.000	0	0.005
1954	0	0.020	0.000	0	0.005
1955	0	0.020	0.001	0	0.005
1956	0	0.022	0.001	0	0.006
1957	0	0.025	0.001	0	0.007
1958	0	0.028	0.001	0	0.008
1959	0	0.032	0.001	0	0.009
1960	0	0.035	0.002	0	0.009
1961	0	0.038	0.002	0	0.010
1962	0	0.041	0.002	0	0.011
1963	0	0.044	0.002	0	0.011
1964	0	0.048	0.002	0	0.012
1965	0	0.031	0.002	0	0.027
1966	0	0.033	0.002	0	0.029
1967	0	0.036	0.003	0	0.031
1968	0	0.038	0.003	0	0.032
1969	0	0.040	0.003	0	0.034
1970	0	0.042	0.003	0	0.035
1971	0	0.047	0.003	0	0.039
1972	0	0.052	0.004	0	0.043
1973	0	0.057	0.004	0	0.047
1974	0	0.062	0.004	0	0.050

Table 18 Continued. Estimates of annual exploitation rate (total biomass killed age 2+ / total biomass age 2+) by commercial fleets for Eastern Gulf of Mexico Red Snapper.

Year	Charter Closed Season Discards	Charter	Headboat	Private Closed Season Discards	Private
1975	0.000	0.018	0.005	0.000	0.089
1976	0.000	0.017	0.005	0.000	0.074
1977	0.000	0.019	0.005	0.000	0.089
1978	0.000	0.020	0.006	0.000	0.100
1979	0.000	0.021	0.006	0.000	0.102
1980	0.000	0.020	0.006	0.000	0.089
1981	0.000	0.015	0.007	0.000	0.190
1982	0.000	0.004	0.002	0.000	0.006
1983	0.000	0.035	0.018	0.000	0.372
1984	0.000	0.061	0.032	0.000	0.027
1985	0.000	0.025	0.013	0.000	0.181
1986	0.000	0.228	0.004	0.000	0.281
1987	0.000	0.018	0.002	0.000	0.225
1988	0.000	0.036	0.004	0.000	0.150
1989	0.000	0.065	0.002	0.000	0.353
1990	0.000	0.000	0.001	0.000	0.436
1991	0.000	0.002	0.004	0.000	0.356
1992	0.000	0.065	0.001	0.000	0.095
1993	0.000	0.000	0.009	0.000	0.000
1994	0.000	0.001	0.003	0.000	0.000
1995	0.000	0.000	0.001	0.000	0.065
1996	0.000	0.005	0.001	0.000	0.600
1997	0.001	0.027	0.000	0.000	0.000
1998	0.000	0.155	0.001	0.067	0.000
1999	0.000	0.012	0.017	0.032	0.131

Table 18 Continued. Estimates of annual exploitation rate (total biomass killed age 2+ / total biomass age 2+) by commercial fleets for Eastern Gulf of Mexico Red Snapper.

Year	Charter Closed Season Discards	Charter	Headboat	Private Closed Season Discards	Private
2000	0.000	0.005	0.005	0.002	0.035
2001	0.004	0.006	0.004	0.000	0.000
2002	0.000	0.003	0.001	0.000	0.042
2003	0.002	0.006	0.001	0.002	0.011
2004	0.001	0.001	0.003	0.035	0.028
2005	0.001	0.006	0.009	0.015	0.314
2006	0.006	0.127	0.002	0.008	0.054
2007	0.001	0.001	0.001	0.000	0.112
2008	0.005	0.006	0.002	0.011	0.009
2009	0.003	0.009	0.004	0.014	0.027
2010	0.001	0.003	0.002	0.027	0.005
2011	0.000	0.000	0.003	0.485	0.018
2012	0.000	0.002	0.004	0.004	0.025
2013	0.002	0.013	0.004	0.002	0.006
2014	0.003	0.003	0.003	0.012	0.008
2015	0.003	0.013	0.005	0.004	0.003
2016	0.008	0.007	0.003	0.106	0.028
2017	0.021	0.013	0.005	0.026	0.052
2018	0.005	0.013	0.005	0.071	0.064
2019	0.002	0.010	0.005	0.048	0.064

Table 19. Estimates of annual exploitation rate (total biomass killed age 2+ / total biomass age 2+) by recreational fleets for Western Gulf of Mexico Red Snapper.

Year	Charter Closed Season Discards	Charter	Headboat	Private Closed Season Discards	Private
1950	0	0.007	0.004	0	0.002
1951	0	0.007	0.004	0	0.002
1952	0	0.007	0.005	0	0.002
1953	0	0.007	0.005	0	0.002
1954	0	0.007	0.005	0	0.002
1955	0	0.007	0.005	0	0.002
1956	0	0.008	0.005	0	0.003
1957	0	0.009	0.006	0	0.003
1958	0	0.011	0.007	0	0.004
1959	0	0.012	0.008	0	0.004
1960	0	0.014	0.009	0	0.005
1961	0	0.015	0.009	0	0.005
1962	0	0.016	0.010	0	0.005
1963	0	0.017	0.011	0	0.006
1964	0	0.018	0.011	0	0.006
1965	0	0.012	0.009	0	0.018
1966	0	0.013	0.009	0	0.019
1967	0	0.014	0.010	0	0.020
1968	0	0.015	0.011	0	0.022
1969	0	0.016	0.012	0	0.024
1970	0	0.018	0.013	0	0.026
1971	0	0.021	0.015	0	0.030
1972	0	0.024	0.017	0	0.035
1973	0	0.028	0.020	0	0.041
1974	0	0.033	0.023	0	0.047

Table 19 Continued. Estimates of annual exploitation rate (total biomass killed age 2+ / total biomass age 2+) by recreational fleets for Western Gulf of Mexico Red Snapper.

Year	Charter Closed Season Discards	Charter	Headboat	Private Closed Season Discards	Private
1975	0	0.014	0.016	0.000	0.091
1976	0	0.015	0.017	0.000	0.097
1977	0	0.016	0.018	0.000	0.103
1978	0	0.017	0.019	0.000	0.112
1979	0	0.020	0.022	0.000	0.128
1980	0	0.023	0.026	0.000	0.148
1981	0	0.018	0.021	0.000	0.222
1982	0	0.025	0.024	0.000	0.119
1983	0	0.036	0.020	0.000	0.251
1984	0	0.032	0.032	0.000	0.079
1985	0	0.056	0.036	0.000	0.149
1986	0	0.012	0.029	0.000	0.197
1987	0	0.009	0.033	0.000	0.067
1988	0	0.002	0.047	0.000	0.126
1989	0	0.011	0.048	0.000	0.093
1990	0	0.007	0.038	0.000	0.081
1991	0	0.019	0.028	0.000	0.067
1992	0	0.017	0.037	0.000	0.070
1993	0	0.012	0.038	0.000	0.102
1994	0	0.010	0.048	0.000	0.122
1995	0	0.012	0.047	0.000	0.138
1996	0	0.010	0.034	0.000	0.092
1997	0	0.010	0.030	0.000	0.102
1998	0	0.012	0.030	0.001	0.113
1999	0	0.004	0.011	0.005	0.119

Table 19 Continued. Estimates of annual exploitation rate (total biomass killed age 2+ / total biomass age 2+) by recreational fleets for Western Gulf of Mexico Red Snapper.

Year	Charter Closed Season Discards	Charter	Headboat	Private Closed Season Discards	Private
2000	0.000	0.002	0.012	0.003	0.098
2001	0.000	0.003	0.016	0.002	0.069
2002	0.000	0.008	0.020	0.003	0.069
2003	0.000	0.010	0.016	0.009	0.075
2004	0.000	0.020	0.020	0.012	0.075
2005	0.001	0.017	0.018	0.009	0.116
2006	0.000	0.018	0.017	0.008	0.134
2007	0.000	0.021	0.021	0.005	0.092
2008	0.001	0.009	0.010	0.017	0.059
2009	0.001	0.005	0.009	0.008	0.049
2010	0.000	0.007	0.006	0.009	0.028
2011	0.000	0.002	0.005	0.012	0.035
2012	0.000	0.003	0.005	0.005	0.034
2013	0.000	0.004	0.003	0.005	0.051
2014	0.000	0.001	0.003	0.001	0.043
2015	0.000	0.003	0.004	0.001	0.046
2016	0.000	0.002	0.004	0.000	0.021
2017	0.000	0.002	0.004	0.000	0.032
2018	0.000	0.001	0.003	0.000	0.034
2019	0.000	0.004	0.004	0.000	0.056

Table 20. Estimates of annual exploitation rate (total biomass killed age 2+ / total biomass age 2+) by recreational fleets for Central Gulf of Mexico Red Snapper.

Year	Charter Closed Season Discards	Charter	Headboat	Private Closed Season Discards	Private
1950	0	0.020	0.010	0	0.007
1951	0	0.020	0.010	0	0.007
1952	0	0.020	0.010	0	0.007
1953	0	0.020	0.010	0	0.007
1954	0	0.020	0.010	0	0.007
1955	0	0.020	0.010	0	0.007
1956	0	0.022	0.011	0	0.008
1957	0	0.025	0.012	0	0.008
1958	0	0.027	0.013	0	0.009
1959	0	0.030	0.015	0	0.010
1960	0	0.034	0.016	0	0.011
1961	0	0.036	0.017	0	0.012
1962	0	0.038	0.019	0	0.012
1963	0	0.041	0.020	0	0.013
1964	0	0.044	0.021	0	0.014
1965	0	0.038	0.019	0	0.023
1966	0	0.040	0.020	0	0.024
1967	0	0.043	0.021	0	0.025
1968	0	0.045	0.022	0	0.026
1969	0	0.048	0.023	0	0.028
1970	0	0.050	0.024	0	0.029
1971	0	0.056	0.027	0	0.032
1972	0	0.063	0.030	0	0.036
1973	0	0.071	0.034	0	0.040
1974	0	0.082	0.038	0	0.045

Table 20 Continued. Estimates of annual exploitation rate (total biomass killed age 2+ / total biomass age 2+) by recreational fleets for Central Gulf of Mexico Red Snapper.

Year	Charter Closed Season Discards	Charter	Headboat	Private Closed Season Discards	Private
1975	0.000	0.072	0.035	0.000	0.068
1976	0.000	0.084	0.041	0.000	0.083
1977	0.000	0.096	0.046	0.000	0.090
1978	0.000	0.105	0.049	0.000	0.093
1979	0.000	0.105	0.048	0.000	0.086
1980	0.000	0.099	0.045	0.000	0.080
1981	0.000	0.016	0.008	0.000	0.257
1982	0.000	0.123	0.059	0.000	0.034
1983	0.000	0.249	0.118	0.000	0.105
1984	0.000	0.086	0.042	0.000	0.058
1985	0.000	0.092	0.045	0.000	0.108
1986	0.000	0.209	0.005	0.000	0.058
1987	0.000	0.250	0.004	0.000	0.160
1988	0.000	0.230	0.006	0.000	0.089
1989	0.000	0.137	0.005	0.000	0.215
1990	0.000	0.109	0.009	0.000	0.310
1991	0.000	0.116	0.007	0.000	0.430
1992	0.000	0.187	0.012	0.000	0.369
1993	0.000	0.344	0.011	0.000	0.476
1994	0.000	0.237	0.014	0.000	0.396
1995	0.000	0.307	0.017	0.000	0.210
1996	0.000	0.347	0.016	0.000	0.331
1997	0.001	0.414	0.025	0.018	0.442
1998	0.005	0.389	0.018	0.015	0.185
1999	0.007	0.259	0.013	0.019	0.382

Table 20 Continued. Estimates of annual exploitation rate (total biomass killed age 2+ / total biomass age 2+) by recreational fleets for Central Gulf of Mexico Red Snapper.

Year	Charter Closed Season Discards	Charter	Headboat	Private Closed Season Discards	Private
2000	0.007	0.192	0.018	0.067	0.316
2001	0.005	0.197	0.014	0.119	0.306
2002	0.004	0.205	0.014	0.126	0.498
2003	0.004	0.233	0.016	0.090	0.430
2004	0.004	0.246	0.014	0.051	0.595
2005	0.004	0.205	0.013	0.085	0.454
2006	0.007	0.206	0.015	0.049	0.359
2007	0.003	0.124	0.005	0.041	0.477
2008	0.007	0.039	0.009	0.096	0.144
2009	0.005	0.039	0.009	0.055	0.194
2010	0.003	0.012	0.004	0.091	0.181
2011	0.005	0.023	0.008	0.084	0.206
2012	0.004	0.018	0.007	0.099	0.162
2013	0.008	0.023	0.006	0.079	0.239
2014	0.007	0.004	0.006	0.089	0.102
2015	0.004	0.018	0.006	0.050	0.135
2016	0.006	0.028	0.005	0.071	0.151
2017	0.006	0.035	0.006	0.103	0.279
2018	0.005	0.023	0.006	0.073	0.135
2019	0.005	0.028	0.004	0.093	0.182

Table 21. Estimates of annual exploitation rate (total biomass killed age 2+ / total biomass age 2+) by recreational fleets for Eastern Gulf of Mexico Red Snapper.

Year	Charter Closed Season Discards	Charter	Headboat	Private Closed Season Discards	Private
1950	0	0.019	0.000	0	0.005
1951	0	0.019	0.000	0	0.005
1952	0	0.019	0.000	0	0.005
1953	0	0.020	0.000	0	0.005
1954	0	0.020	0.000	0	0.005
1955	0	0.020	0.001	0	0.005
1956	0	0.022	0.001	0	0.006
1957	0	0.025	0.001	0	0.007
1958	0	0.028	0.001	0	0.008
1959	0	0.032	0.001	0	0.009
1960	0	0.035	0.002	0	0.009
1961	0	0.038	0.002	0	0.010
1962	0	0.041	0.002	0	0.011
1963	0	0.044	0.002	0	0.011
1964	0	0.048	0.002	0	0.012
1965	0	0.031	0.002	0	0.027
1966	0	0.033	0.002	0	0.029
1967	0	0.036	0.003	0	0.031
1968	0	0.038	0.003	0	0.032
1969	0	0.040	0.003	0	0.034
1970	0	0.042	0.003	0	0.035
1971	0	0.047	0.003	0	0.039
1972	0	0.052	0.004	0	0.043
1973	0	0.057	0.004	0	0.047
1974	0	0.062	0.004	0	0.050

Table 21 Continued. Estimates of annual exploitation rate (total biomass killed age 2+ / total biomass age 2+) by recreational fleets for Eastern Gulf of Mexico Red Snapper.

Year	Charter Closed Season Discards	Charter	Headboat	Private Closed Season Discards	Private
1975	0.000	0.018	0.005	0.000	0.089
1976	0.000	0.017	0.005	0.000	0.074
1977	0.000	0.019	0.005	0.000	0.089
1978	0.000	0.020	0.006	0.000	0.100
1979	0.000	0.021	0.006	0.000	0.102
1980	0.000	0.020	0.006	0.000	0.089
1981	0.000	0.015	0.007	0.000	0.190
1982	0.000	0.004	0.002	0.000	0.006
1983	0.000	0.035	0.018	0.000	0.372
1984	0.000	0.061	0.032	0.000	0.027
1985	0.000	0.025	0.013	0.000	0.181
1986	0.000	0.228	0.004	0.000	0.281
1987	0.000	0.018	0.002	0.000	0.225
1988	0.000	0.036	0.004	0.000	0.150
1989	0.000	0.065	0.002	0.000	0.353
1990	0.000	0.000	0.001	0.000	0.436
1991	0.000	0.002	0.004	0.000	0.356
1992	0.000	0.065	0.001	0.000	0.095
1993	0.000	0.000	0.009	0.000	0.000
1994	0.000	0.001	0.003	0.000	0.000
1995	0.000	0.000	0.001	0.000	0.065
1996	0.000	0.005	0.001	0.000	0.600
1997	0.001	0.027	0.000	0.000	0.000
1998	0.000	0.155	0.001	0.067	0.000
1999	0.000	0.012	0.017	0.032	0.131

Table 21 Continued. Estimates of annual exploitation rate (total biomass killed age 2+ / total biomass age 2+) by recreational fleets for Eastern Gulf of Mexico Red Snapper.

Year	Charter Closed Season Discards	Charter	Headboat	Private Closed Season Discards	Private
2000	0.000	0.005	0.005	0.002	0.035
2001	0.004	0.006	0.004	0.000	0.000
2002	0.000	0.003	0.001	0.000	0.042
2003	0.002	0.006	0.001	0.002	0.011
2004	0.001	0.001	0.003	0.035	0.028
2005	0.001	0.006	0.009	0.015	0.314
2006	0.006	0.127	0.002	0.008	0.054
2007	0.001	0.001	0.001	0.000	0.112
2008	0.005	0.006	0.002	0.011	0.009
2009	0.003	0.009	0.004	0.014	0.027
2010	0.001	0.003	0.002	0.027	0.005
2011	0.000	0.000	0.003	0.485	0.018
2012	0.000	0.002	0.004	0.004	0.025
2013	0.002	0.013	0.004	0.002	0.006
2014	0.003	0.003	0.003	0.012	0.008
2015	0.003	0.013	0.005	0.004	0.003
2016	0.008	0.007	0.003	0.106	0.028
2017	0.021	0.013	0.005	0.026	0.052
2018	0.005	0.013	0.005	0.071	0.064
2019	0.002	0.010	0.005	0.048	0.064

Table 22. Estimates of annual exploitation rate (total biomass killed age 2+ / total biomass age 2+) for Shrimp Trawl bycatch for Gulf of Mexico Red Snapper.

Year	Shrimp Bycatch central	Shrimp Bycatch east	Shrimp Bycatch west
1950	0.000	0.001	0.002
1951	0.000	0.001	0.002
1952	0.000	0.001	0.002
1953	0.000	0.001	0.002
1954	0.001	0.002	0.002
1955	0.001	0.002	0.002
1956	0.001	0.002	0.003
1957	0.001	0.002	0.003
1958	0.001	0.003	0.005
1959	0.001	0.003	0.005
1960	0.001	0.003	0.005
1961	0.001	0.002	0.004
1962	0.001	0.003	0.005
1963	0.001	0.004	0.006
1964	0.001	0.004	0.007
1965	0.001	0.004	0.006
1966	0.001	0.005	0.007
1967	0.001	0.005	0.009
1968	0.001	0.006	0.010
1969	0.001	0.006	0.011
1970	0.001	0.006	0.010
1971	0.001	0.006	0.012
1972	0.002	0.007	0.016
1973	0.002	0.007	0.016
1974	0.002	0.007	0.019

Table 22 Continued. Estimates of annual exploitation rate (total biomass killed age 2+ / total biomass age 2+) for Shrimp Trawl bycatch for Gulf of Mexico Red Snapper.

Year	Shrimp Bycatch central	Shrimp Bycatch east	Shrimp Bycatch west
1975	0.002	0.009	0.019
1976	0.002	0.016	0.024
1977	0.002	0.015	0.029
1978	0.003	0.012	0.036
1979	0.005	0.014	0.042
1980	0.003	0.011	0.033
1981	0.003	0.014	0.050
1982	0.004	0.008	0.064
1983	0.006	0.004	0.086
1984	0.010	0.006	0.133
1985	0.009	0.010	0.101
1986	0.006	0.008	0.108
1987	0.004	0.021	0.133
1988	0.009	0.016	0.087
1989	0.010	0.019	0.116
1990	0.023	0.012	0.212
1991	0.015	0.015	0.127
1992	0.013	0.028	0.094
1993	0.006	0.068	0.051
1994	0.007	0.085	0.071
1995	0.018	0.071	0.096
1996	0.012	0.091	0.096
1997	0.029	0.162	0.105
1998	0.016	0.123	0.084
1999	0.009	0.020	0.075

Table 22 Continued. Estimates of annual exploitation rate (total biomass killed age 2+ / total biomass age 2+) for Shrimp Trawl bycatch for Gulf of Mexico Red Snapper.

Year	Shrimp Bycatch central	Shrimp Bycatch east	Shrimp Bycatch west
2000	0.012	0.026	0.099
2001	0.013	0.043	0.097
2002	0.012	0.038	0.087
2003	0.011	0.020	0.090
2004	0.011	0.018	0.123
2005	0.009	0.013	0.098
2006	0.014	0.013	0.073
2007	0.008	0.006	0.067
2008	0.005	0.009	0.042
2009	0.002	0.003	0.028
2010	0.002	0.003	0.033
2011	0.001	0.003	0.024
2012	0.001	0.002	0.023
2013	0.002	0.002	0.020
2014	0.001	0.002	0.018
2015	0.002	0.012	0.019
2016	0.003	0.008	0.026
2017	0.002	0.007	0.015
2018	0.002	0.003	0.012
2019	0.002	0.002	0.014

Table 23. Expected biomass (metric tons) for all Western Gulf of Mexico Red Snapper and exploited (2+ years) Red Snapper, spawning stock biomass (SSB, metric tons), exploited numbers (1,000s of fish), age-0 recruits (1,000s of fish), and SSB ratio (SSB/SSB_0) where SSB_0 = 307971.3 metric tons for Gulf of Mexico Red Snapper.

Year	Biomass (all)	Biomass (exploited)	SSB	Abundance (exploited)	Recruits	SSB ratio
1950	171,571	167,041	163,037	47,482	61,397	0.78
1951	170,421	165,987	162,158	46,512	61,396	0.78
1952	169,022	164,592	160,968	45,496	61,395	0.77
1953	167,185	162,772	159,303	44,474	61,393	0.76
1954	165,297	160,882	157,493	43,643	61,391	0.76
1955	163,009	158,629	155,339	42,642	61,388	0.75
1956	160,672	156,267	153,012	41,910	61,386	0.74
1957	157,515	153,147	149,970	40,870	61,381	0.72
1958	153,768	149,439	146,406	39,526	61,376	0.70
1959	148,345	144,122	141,395	37,285	61,367	0.68
1960	142,307	138,106	135,650	35,066	61,356	0.65
1961	136,029	131,787	129,432	33,368	61,342	0.62
1962	129,621	125,334	122,938	32,129	61,327	0.59
1963	123,068	118,833	116,458	30,696	61,310	0.56
1964	116,951	112,749	110,460	29,256	61,292	0.53
1965	110,239	106,109	104,004	27,405	61,271	0.50
1966	103,874	99,682	97,639	26,101	61,248	0.47
1967	97,947	93,762	91,717	25,057	61,224	0.44
1968	91,409	87,280	85,328	23,563	61,196	0.41
1969	84,496	80,394	78,579	21,893	61,163	0.38
1970	77,974	73,927	72,257	20,258	61,127	0.35
1971	71,776	67,663	66,030	19,084	61,086	0.32
1972	65,206	61,119	59,529	17,766	61,035	0.29
1973	58,489	54,508	53,081	15,996	60,973	0.26
1974	51,961	47,949	46,646	14,467	60,893	0.22

Table 23 Continued. Expected biomass (metric tons) for all Western Gulf of Mexico Red Snapper and exploited (2+ years) Red Snapper, spawning stock biomass (SSB, metric tons), exploited numbers (1,000s of fish), age-0 recruits (1,000s of fish), and SSB ratio (SSB/SSB_0) where SSB_0 = 307971.3 metric tons for Gulf of Mexico Red Snapper.

Year	Biomass (all)	Biomass (exploited)	SSB	Abundance (exploited)	Recruits	SSB ratio
1975	45,755	41,742	40,521	13,092	61,919	0.20
1976	40,204	36,055	34,862	12,062	63,603	0.17
1977	35,419	31,260	30,093	11,172	62,481	0.14
1978	31,231	27,240	26,083	10,446	57,336	0.12
1979	27,082	23,510	22,430	9,412	51,434	0.11
1980	23,127	19,686	18,809	7,897	61,302	0.09
1981	20,508	16,306	15,598	7,053	68,180	0.07
1982	17,215	12,847	12,160	6,468	63,300	0.06
1983	15,766	11,515	10,542	7,083	66,688	0.05
1984	12,935	8,720	8,022	5,601	64,138	0.04
1985	11,427	7,814	7,062	5,586	45,274	0.03
1986	10,340	7,181	6,250	5,775	55,595	0.03
1987	9,294	6,103	5,459	4,799	37,359	0.03
1988	8,633	6,367	5,451	5,494	31,254	0.03
1989	9,303	5,625	4,894	4,549	112,268	0.02
1990	11,770	5,240	5,185	4,110	70,417	0.03
1991	12,321	7,731	6,016	9,504	65,117	0.03
1992	13,125	9,457	7,516	10,121	32,649	0.04
1993	13,077	10,468	8,548	9,884	54,972	0.04
1994	14,770	10,175	9,073	7,821	99,324	0.04
1995	16,436	10,259	9,439	8,135	74,158	0.04
1996	16,759	11,971	9,973	11,778	63,328	0.05
1997	17,206	13,008	10,909	11,686	65,101	0.05
1998	16,403	12,481	10,987	9,675	57,341	0.05
1999	16,013	11,735	10,472	8,732	87,104	0.05

Table 23 Continued. Expected biomass (metric tons) for all Western Gulf of Mexico Red Snapper and exploited (2+ years) Red Snapper, spawning stock biomass (SSB, metric tons), exploited numbers (1,000s of fish), age-0 recruits (1,000s of fish), and SSB ratio (SSB/SSB_0) where SSB_0 = 307971.3 metric tons for Gulf of Mexico Red Snapper.

Year	Biomass (all)	Biomass (exploited)	SSB	Abundance (exploited)	Recruits	SSB ratio
2000	16,593	11,289	10,278	8,429	65,988	0.05
2001	15,924	11,823	10,165	10,202	54,355	0.05
2002	15,475	11,935	10,325	9,567	56,966	0.05
2003	15,622	11,435	10,212	8,306	84,916	0.05
2004	16,618	10,873	9,976	7,795	99,558	0.05
2005	17,211	10,827	9,673	8,936	99,060	0.05
2006	18,425	11,803	9,971	11,437	97,166	0.05
2007	19,599	13,164	10,693	13,845	84,172	0.05
2008	20,945	16,428	13,185	16,984	20,303	0.06
2009	23,644	20,504	16,597	18,986	105,263	0.08
2010	28,864	22,698	20,767	15,427	52,326	0.10
2011	31,744	27,511	24,369	20,418	81,467	0.12
2012	36,762	30,696	28,035	19,514	102,292	0.14
2013	41,057	34,713	31,896	21,753	63,098	0.15
2014	43,328	38,760	34,853	25,179	69,627	0.17
2015	47,638	41,887	38,408	24,228	114,180	0.18
2016	51,330	44,079	41,304	23,816	81,952	0.20
2017	53,522	48,266	44,582	27,109	64,072	0.21
2018	56,942	51,523	47,676	27,408	110,564	0.23
2019	61,228	54,101	51,029	26,604	79,721	0.24

Table 24. Expected biomass (metric tons) for all Central Gulf of Mexico Red Snapper and exploited (2+ years) Red Snapper, spawning stock biomass (SSB, metric tons), exploited numbers (1,000s of fish), age-0 recruits (1,000s of fish), and SSB ratio (SSB/SSB_0) where SSB_0 = 307971.3 metric tons for Gulf of Mexico Red Snapper.

Year	Biomass (all)	Biomass (exploited)	SSB	Abundance (exploited)	Recruits	SSB ratio
1950	37,502	36,044	35,475	10,515	18,601	0.46
1951	37,664	36,210	35,635	10,565	18,600	0.47
1952	37,723	36,272	35,705	10,546	18,600	0.47
1953	37,694	36,245	35,686	10,493	18,599	0.47
1954	37,702	36,254	35,697	10,468	18,599	0.47
1955	37,723	36,277	35,723	10,447	18,598	0.47
1956	37,653	36,210	35,662	10,389	18,597	0.47
1957	37,277	35,837	35,304	10,228	18,596	0.46
1958	36,785	35,347	34,823	10,066	18,594	0.45
1959	35,690	34,253	33,751	9,710	18,591	0.44
1960	34,485	33,050	32,560	9,386	18,588	0.42
1961	33,008	31,571	31,093	9,020	18,584	0.41
1962	31,583	30,142	29,663	8,742	18,580	0.39
1963	30,085	28,649	28,177	8,436	18,574	0.37
1964	28,518	27,082	26,621	8,111	18,569	0.35
1965	27,060	25,626	25,170	7,839	18,562	0.33
1966	25,667	24,232	23,787	7,561	18,556	0.31
1967	24,509	23,074	22,626	7,395	18,548	0.30
1968	23,284	21,849	21,407	7,173	18,540	0.28
1969	22,236	20,805	20,365	7,009	18,530	0.27
1970	21,258	19,826	19,390	6,851	18,519	0.25
1971	20,388	18,957	18,522	6,726	18,506	0.24
1972	19,396	17,964	17,536	6,534	18,491	0.23
1973	18,253	16,823	16,410	6,270	18,472	0.21
1974	16,769	15,343	14,958	5,847	18,448	0.20

Table 24 Continued. Expected biomass (metric tons) for all Central Gulf of Mexico Red Snapper and exploited (2+ years) Red Snapper, spawning stock biomass (SSB, metric tons), exploited numbers (1,000s of fish), age-0 recruits (1,000s of fish), and SSB ratio (SSB/SSB_0) where SSB_0 = 307971.3 metric tons for Gulf of Mexico Red Snapper.

Year	Biomass (all)	Biomass (exploited)	SSB	Abundance (exploited)	Recruits	SSB ratio
1975	15,079	13,751	13,388	5,415	13,153	0.17
1976	13,267	12,226	11,833	4,985	14,464	0.15
1977	11,500	10,346	10,094	4,089	16,365	0.13
1978	10,078	8,727	8,521	3,600	21,167	0.11
1979	9,174	7,476	7,293	3,409	24,689	0.10
1980	8,565	6,862	6,610	3,712	13,901	0.09
1981	7,872	6,833	6,333	4,320	11,769	0.08
1982	6,747	5,738	5,478	3,149	17,240	0.07
1983	6,253	4,979	4,844	2,692	14,292	0.06
1984	4,398	3,296	3,146	2,084	14,528	0.04
1985	4,352	3,314	3,112	2,319	10,455	0.04
1986	3,953	3,263	3,003	2,415	4,331	0.04
1987	3,665	3,206	2,928	2,280	11,151	0.04
1988	3,099	2,322	2,294	1,347	6,960	0.03
1989	2,954	2,147	1,985	1,576	21,746	0.03
1990	3,477	1,818	1,874	1,248	21,313	0.02
1991	3,965	2,311	2,072	2,473	22,342	0.03
1992	4,340	2,753	2,445	2,997	15,139	0.03
1993	4,214	3,160	2,739	3,355	9,139	0.04
1994	3,216	2,313	2,043	2,273	19,932	0.03
1995	3,298	1,826	1,795	1,633	16,566	0.02
1996	4,162	2,365	2,024	2,781	44,738	0.03
1997	5,805	2,522	2,478	2,915	34,959	0.03
1998	6,249	3,838	3,110	5,471	19,633	0.04
1999	6,949	5,177	4,220	6,353	33,632	0.06

Table 24 Continued. Expected biomass (metric tons) for all Central Gulf of Mexico Red Snapper and exploited (2+ years) Red Snapper, spawning stock biomass (SSB, metric tons), exploited numbers (1,000s of fish), age-0 recruits (1,000s of fish), and SSB ratio (SSB/SSB_0) where SSB_0 = 307971.3 metric tons for Gulf of Mexico Red Snapper.

Year	Biomass (all)	Biomass (exploited)	SSB	Abundance (exploited)	Recruits	SSB ratio
2000	7,624	4,868	4,480	4,845	42,650	0.06
2001	8,427	5,235	4,769	5,514	37,321	0.06
2002	8,696	5,851	5,067	6,614	35,430	0.07
2003	7,890	5,053	4,407	5,761	41,383	0.06
2004	7,960	4,870	4,323	5,587	35,664	0.06
2005	8,528	4,662	3,969	5,780	95,569	0.05
2006	12,065	5,020	4,991	5,925	75,015	0.06
2007	15,005	9,109	7,387	12,716	78,302	0.10
2008	16,847	12,014	10,187	14,625	11,991	0.13
2009	19,254	17,439	14,649	18,056	59,862	0.19
2010	22,870	18,851	18,078	13,410	26,542	0.24
2011	22,879	20,855	19,300	15,040	24,455	0.25
2012	22,342	19,875	18,759	12,406	55,329	0.24
2013	22,543	18,733	18,271	10,599	29,126	0.24
2014	20,305	17,593	16,232	12,078	53,581	0.21
2015	22,988	18,384	17,539	11,509	76,864	0.23
2016	26,077	19,859	18,868	13,538	89,672	0.25
2017	28,160	22,092	20,478	17,081	41,303	0.27
2018	26,004	22,338	19,705	19,335	66,101	0.26
2019	29,076	24,500	22,970	17,637	35,640	0.30

Table 25. Expected biomass (metric tons) for all East Gulf of Mexico Red Snapper and exploited (2+ years) Red Snapper, spawning stock biomass (SSB, metric tons), exploited numbers (1,000s of fish), age-0 recruits (1,000s of fish), and SSB ratio (SSB/SSB_0) where SSB_0 = 307971.3 metric tons for Gulf of Mexico Red Snapper.

Year	Biomass (all)	Biomass (exploited)	SSB	Abundance (exploited)	Recruits	SSB ratio
1950	10,528	10,189	10,010	2,902	5,164	0.43
1951	10,642	10,306	10,128	2,911	5,164	0.44
1952	10,674	10,341	10,170	2,884	5,164	0.44
1953	10,642	10,309	10,144	2,842	5,164	0.44
1954	10,628	10,295	10,134	2,812	5,163	0.44
1955	10,615	10,284	10,127	2,780	5,163	0.44
1956	10,524	10,195	10,043	2,729	5,163	0.43
1957	10,293	9,966	9,821	2,642	5,163	0.42
1958	10,054	9,727	9,588	2,561	5,162	0.41
1959	9,485	9,159	9,027	2,417	5,161	0.39
1960	8,928	8,603	8,476	2,289	5,160	0.37
1961	8,267	7,942	7,817	2,157	5,159	0.34
1962	7,680	7,351	7,223	2,073	5,158	0.31
1963	7,073	6,748	6,622	1,967	5,157	0.29
1964	6,445	6,119	5,997	1,854	5,155	0.26
1965	5,815	5,491	5,373	1,736	5,153	0.23
1966	5,269	4,944	4,830	1,635	5,151	0.21
1967	4,824	4,499	4,385	1,565	5,149	0.19
1968	4,584	4,258	4,142	1,548	5,147	0.18
1969	4,337	4,013	3,900	1,505	5,144	0.17
1970	4,157	3,832	3,720	1,479	5,141	0.16
1971	3,984	3,659	3,548	1,453	5,138	0.15
1972	3,867	3,542	3,429	1,442	5,133	0.15
1973	3,705	3,381	3,271	1,406	5,128	0.14
1974	3,568	3,244	3,137	1,372	5,122	0.14

Table 25 Continued. Expected biomass (metric tons) for all East Gulf of Mexico Red Snapper and exploited (2+ years) Red Snapper, spawning stock biomass (SSB, metric tons), exploited numbers (1,000s of fish), age-0 recruits (1,000s of fish), and SSB ratio (SSB/SSB_0) where SSB_0 = 307971.3 metric tons for Gulf of Mexico Red Snapper.

Year	Biomass (all)	Biomass (exploited)	SSB	Abundance (exploited)	Recruits	SSB ratio
1975	3,027	2,633	2,538	1,183	9,243	0.11
1976	2,687	2,157	2,106	1,041	6,069	0.09
1977	2,348	1,980	1,828	1,297	5,077	0.08
1978	2,312	1,990	1,851	1,252	5,186	0.08
1979	2,367	2,003	1,900	1,161	7,300	0.08
1980	2,458	1,989	1,915	1,106	7,906	0.08
1981	2,585	2,166	2,050	1,330	2,839	0.09
1982	2,332	2,173	2,011	1,336	1,677	0.09
1983	2,480	2,389	2,270	1,214	884	0.10
1984	1,499	1,428	1,397	566	1,819	0.06
1985	1,260	1,159	1,150	405	1,228	0.05
1986	932	856	839	312	1,302	0.04
1987	525	454	449	165	717	0.02
1988	421	367	354	156	1,325	0.01
1989	370	302	298	130	560	0.01
1990	256	225	213	120	304	0.01
1991	121	103	96	67	260	0.00
1992	103	81	76	52	579	0.00
1993	128	86	84	54	903	0.00
1994	156	101	96	76	944	0.00
1995	199	141	129	116	1,019	0.01
1996	252	172	159	136	2,169	0.01
1997	250	124	124	103	2,178	0.00
1998	309	204	184	206	684	0.01
1999	315	264	227	245	1,389	0.01

Table 25 Continued. Expected biomass (metric tons) for all East Gulf of Mexico Red Snapper and exploited (2+ years) Red Snapper, spawning stock biomass (SSB, metric tons), exploited numbers (1,000s of fish), age-0 recruits (1,000s of fish), and SSB ratio (SSB/SSB_0) where SSB_0 = 307971.3 metric tons for Gulf of Mexico Red Snapper.

Year	Biomass (all)	Biomass (exploited)	SSB	Abundance (exploited)	Recruits	SSB ratio
2000	383	281	266	200	2,325	0.01
2001	511	364	347	263	2,337	0.01
2002	644	505	465	389	1,984	0.02
2003	799	659	609	463	3,072	0.03
2004	1,025	836	796	517	2,942	0.03
2005	1,267	1,031	970	647	5,898	0.04
2006	1,322	973	935	634	4,393	0.04
2007	1,559	1,221	1,093	1,006	7,618	0.05
2008	2,021	1,622	1,504	1,215	2,087	0.06
2009	2,473	2,340	2,099	1,749	1,998	0.09
2010	3,033	2,873	2,721	1,585	3,831	0.12
2011	3,522	3,293	3,220	1,448	2,897	0.14
2012	2,287	2,110	2,031	1,001	2,455	0.09
2013	2,477	2,344	2,250	1,074	974	0.10
2014	2,898	2,512	2,412	1,079	19,828	0.10
2015	3,732	2,535	2,640	923	14,605	0.11
2016	4,166	3,303	2,942	2,712	9,789	0.13
2017	4,627	4,105	3,608	3,399	3,309	0.16
2018	5,167	4,960	4,523	3,424	3,029	0.20
2019	5,439	5,170	4,947	2,701	7,493	0.21

Table 26. Input (with log-scale standard errors, SE) and expected (Exp) landings for the Commercial Handline West fleet in weight (B, million pounds whole weight) and number (1,000s of fish) for Gulf of Mexico Red Snapper. The mean body weight (MW, whole pounds per fish) was determined by dividing the expected landings in weights by the expected landings in numbers.

Year	Input B SE	Input B	Exp B	Exp N	MW
1950	0.05	1.48	1.48	253	5.8
1951	0.05	1.48	1.48	250	5.9
1952	0.05	1.65	1.65	277	6.0
1953	0.05	1.36	1.36	226	6.0
1954	0.05	1.37	1.37	226	6.1
1955	0.05	1.49	1.49	246	6.1
1956	0.05	2.02	2.02	332	6.1
1957	0.05	2.01	2.01	330	6.1
1958	0.05	3.36	3.36	544	6.2
1959	0.05	3.43	3.43	547	6.3
1960	0.05	3.60	3.60	571	6.3
1961	0.05	4.25	4.25	679	6.3
1962	0.05	4.13	4.14	671	6.2
1963	0.05	3.00	3.00	493	6.1
1964	0.05	3.59	3.60	593	6.1
1965	0.05	3.65	3.65	608	6.0
1966	0.05	3.04	3.04	518	5.9
1967	0.05	4.23	4.24	735	5.8
1968	0.05	5.16	5.17	910	5.7
1969	0.05	4.19	4.20	748	5.6
1970	0.05	4.65	4.66	850	5.5
1971	0.05	5.37	5.38	1,015	5.3
1972	0.05	4.84	4.86	940	5.2
1973	0.05	4.87	4.89	968	5.0
1974	0.05	4.43	4.45	919	4.8

Table 26 Continued. Input (with log-scale standard errors, SE) and expected (Exp) landings for the Commercial Handline West fleet in weight (B, million pounds whole weight) and number (1,000s of fish) for Gulf of Mexico Red Snapper. The mean body weight (MW, whole pounds per fish) was determined by dividing the expected landings in weights by the expected landings in numbers.

Year	Input B SE	Input B	Exp B	Exp N	MW
1975	0.05	3.93	3.95	861	4.6
1976	0.05	3.33	3.34	779	4.3
1977	0.05	2.87	2.88	719	4.0
1978	0.05	2.69	2.70	708	3.8
1979	0.05	2.47	2.48	660	3.8
1980	0.05	2.52	2.53	691	3.7
1981	0.05	3.14	3.16	989	3.2
1982	0.05	3.66	3.68	1,327	2.8
1983	0.05	3.82	3.84	1,466	2.6
1984	0.05	2.91	2.94	1,205	2.4
1985	0.05	1.85	1.86	602	3.1
1986	0.05	1.93	1.94	629	3.1
1987	0.05	1.47	1.48	497	3.0
1988	0.05	2.35	2.35	765	3.1
1989	0.05	1.89	1.89	598	3.2
1990	0.05	1.76	1.75	695	2.5
1991	0.05	1.73	1.72	659	2.6
1992	0.05	2.67	2.64	948	2.8
1993	0.05	2.90	2.82	915	3.1
1994	0.05	2.67	2.58	809	3.2
1995	0.20	2.73	1.79	500	3.6
1996	0.20	4.04	2.51	711	3.5
1997	0.20	4.59	3.26	888	3.7
1998	0.20	4.27	3.54	916	3.9
1999	0.20	4.23	3.49	879	4.0

Table 26 Continued. Input (with log-scale standard errors, SE) and expected (Exp) landings for the Commercial Handline West fleet in weight (B, million pounds whole weight) and number (1,000s of fish) for Gulf of Mexico Red Snapper. The mean body weight (MW, whole pounds per fish) was determined by dividing the expected landings in weights by the expected landings in numbers.

Year	Input B SE	Input B	Exp B	Exp N	MW
2000	0.16	3.98	3.86	1,010	3.8
2001	0.17	3.71	3.72	980	3.8
2002	0.17	3.57	3.63	929	3.9
2003	0.17	3.21	3.63	901	4.0
2004	0.18	3.22	3.60	920	3.9
2005	0.18	3.00	3.59	981	3.7
2006	0.18	3.62	4.87	1,427	3.4
2007	0.05	2.10	2.16	658	3.3
2008	0.05	1.58	1.60	473	3.4
2009	0.05	1.50	1.53	411	3.7
2010	0.05	1.88	1.90	490	3.9
2011	0.05	1.88	1.90	467	4.1
2012	0.05	2.12	2.15	514	4.2
2013	0.05	3.00	3.00	717	4.2
2014	0.05	3.26	3.20	750	4.3
2015	0.05	3.97	3.90	892	4.4
2016	0.05	3.95	3.89	886	4.4
2017	0.05	4.00	3.94	886	4.4
2018	0.05	3.94	3.88	857	4.5
2019	0.05	4.12	4.05	898	4.5

Table 27. Input (with log-scale standard errors, SE) and expected (Exp) landings for the Commercial Handline Central fleet in weight (B, million pounds whole weight) and number (1,000s of fish) for Gulf of Mexico Red Snapper. The mean body weight (MW, whole pounds per fish) was determined by dividing the expected landings in weights by the expected landings in numbers.

Year	Input B SE	Input B	Exp B	Exp N	MW
1950	0.05	0.97	0.97	244	4.0
1951	0.05	1.16	1.16	289	4.0
1952	0.05	1.29	1.29	321	4.0
1953	0.05	1.16	1.16	289	4.0
1954	0.05	1.08	1.08	268	4.0
1955	0.05	1.21	1.21	299	4.0
1956	0.05	1.44	1.45	357	4.0
1957	0.05	1.30	1.30	320	4.0
1958	0.05	2.13	2.13	528	4.0
1959	0.05	1.95	1.95	487	4.0
1960	0.05	2.19	2.19	552	4.0
1961	0.05	2.01	2.01	517	3.9
1962	0.05	2.07	2.07	544	3.8
1963	0.05	2.19	2.19	587	3.7
1964	0.05	1.95	1.95	534	3.7
1965	0.05	2.09	2.09	584	3.6
1966	0.05	1.66	1.66	475	3.5
1967	0.05	1.88	1.88	550	3.4
1968	0.05	1.55	1.56	463	3.4
1969	0.05	1.50	1.50	455	3.3
1970	0.05	1.36	1.36	419	3.2
1971	0.05	1.42	1.43	446	3.2
1972	0.05	1.51	1.51	481	3.1
1973	0.05	1.95	1.96	635	3.1
1974	0.05	1.94	1.95	651	3.0

Table 27 Continued. Input (with log-scale standard errors, SE) and expected (Exp) landings for the Commercial Handline Central fleet in weight (B, million pounds whole weight) and number (1,000s of fish) for Gulf of Mexico Red Snapper. The mean body weight (MW, whole pounds per fish) was determined by dividing the expected landings in weights by the expected landings in numbers.

Year	Input B SE	Input B	Exp B	Exp N	MW
1975	0.05	1.96	1.97	680	2.9
1976	0.05	1.74	1.75	579	3.0
1977	0.05	1.35	1.35	469	2.9
1978	0.05	1.24	1.24	474	2.6
1979	0.05	1.28	1.28	567	2.3
1980	0.05	1.30	1.30	638	2.0
1981	0.05	1.57	1.57	678	2.3
1982	0.05	1.75	1.76	718	2.5
1983	0.05	1.95	1.96	922	2.1
1984	0.05	1.23	1.24	631	2.0
1985	0.05	1.21	1.22	434	2.8
1986	0.05	0.72	0.72	250	2.9
1987	0.05	0.69	0.69	215	3.2
1988	0.05	0.75	0.75	252	3.0
1989	0.05	0.61	0.61	205	3.0
1990	0.05	0.58	0.58	245	2.4
1991	0.05	0.37	0.37	164	2.3
1992	0.05	0.39	0.39	170	2.3
1993	0.05	0.40	0.40	135	3.0
1994	0.05	0.50	0.50	159	3.1
1995	0.18	0.16	0.17	46	3.6
1996	0.18	0.22	0.22	66	3.4
1997	0.18	0.18	0.18	59	3.0
1998	0.18	0.37	0.36	119	3.0
1999	0.16	0.50	0.51	153	3.3

Table 27 Continued. Input (with log-scale standard errors, SE) and expected (Exp) landings for the Commercial Handline Central fleet in weight (B, million pounds whole weight) and number (1,000s of fish) for Gulf of Mexico Red Snapper. The mean body weight (MW, whole pounds per fish) was determined by dividing the expected landings in weights by the expected landings in numbers.

Year	Input B SE	Input B	Exp B	Exp N	MW
2000	0.16	0.63	0.64	184	3.5
2001	0.16	0.75	0.73	212	3.5
2002	0.15	1.02	0.99	294	3.4
2003	0.15	0.97	0.97	291	3.3
2004	0.15	0.90	0.91	281	3.2
2005	0.15	0.72	0.75	233	3.2
2006	0.15	0.67	0.69	231	3.0
2007	0.05	0.82	0.83	339	2.5
2008	0.05	0.76	0.75	278	2.7
2009	0.05	0.81	0.82	248	3.3
2010	0.05	1.19	1.20	322	3.7
2011	0.05	1.36	1.39	338	4.1
2012	0.05	1.61	1.65	372	4.4
2013	0.05	1.99	1.96	455	4.3
2014	0.05	1.71	1.71	402	4.3
2015	0.05	2.37	2.32	564	4.1
2016	0.05	2.12	2.07	542	3.8
2017	0.05	2.24	2.20	629	3.5
2018	0.05	2.10	2.06	573	3.6
2019	0.05	2.21	2.18	577	3.8

Table 28. Input (with log-scale standard errors, SE) and expected (Exp) landings for the Commercial Handline East fleet in weight (B, million pounds whole weight) and number (1,000s of fish) for Gulf of Mexico Red Snapper. The mean body weight (MW, whole pounds per fish) was determined by dividing the expected landings in weights by the expected landings in numbers.

Year	Input B SE	Input B	Exp B	Exp N	MW
1950	0.05	0.72	0.72	85	8.5
1951	0.05	0.86	0.86	100	8.5
1952	0.05	0.96	0.96	111	8.6
1953	0.05	0.86	0.86	99	8.7
1954	0.05	0.80	0.80	91	8.8
1955	0.05	0.90	0.90	101	8.9
1956	0.05	1.08	1.07	120	8.9
1957	0.05	0.97	0.96	107	9.0
1958	0.05	1.59	1.58	175	9.0
1959	0.05	1.46	1.45	160	9.0
1960	0.05	1.63	1.62	181	8.9
1961	0.05	1.50	1.48	170	8.7
1962	0.05	1.54	1.53	181	8.4
1963	0.05	1.63	1.61	197	8.2
1964	0.05	1.66	1.64	208	7.9
1965	0.05	1.62	1.60	212	7.6
1966	0.05	1.44	1.42	196	7.2
1967	0.05	1.02	1.01	146	6.9
1968	0.05	1.06	1.05	157	6.7
1969	0.05	0.94	0.93	144	6.5
1970	0.05	0.95	0.94	149	6.3
1971	0.05	0.80	0.79	128	6.2
1972	0.05	0.87	0.86	142	6.0
1973	0.05	0.76	0.75	127	5.9
1974	0.05	1.82	1.78	310	5.8

Table 28 Continued. Input (with log-scale standard errors, SE) and expected (Exp) landings for the Commercial Handline East fleet in weight (B, million pounds whole weight) and number (1,000s of fish) for Gulf of Mexico Red Snapper. The mean body weight (MW, whole pounds per fish) was determined by dividing the expected landings in weights by the expected landings in numbers.

Year	Input B SE	Input B	Exp B	Exp N	MW
1975	0.05	1.62	1.58	292	5.4
1976	0.05	1.55	1.52	335	4.5
1977	0.05	0.92	0.91	221	4.1
1978	0.05	0.76	0.75	179	4.2
1979	0.05	0.76	0.75	170	4.4
1980	0.05	0.59	0.59	136	4.3
1981	0.05	0.56	0.55	133	4.2
1982	0.05	0.54	0.54	118	4.5
1983	0.05	0.43	0.43	82	5.3
1984	0.05	0.40	0.40	64	6.3
1985	0.05	0.41	0.41	58	7.1
1986	0.05	0.14	0.14	19	7.2
1987	0.05	0.10	0.10	15	6.8
1988	0.05	0.11	0.11	16	6.5
1989	0.05	0.06	0.06	11	5.8
1990	0.05	0.12	0.12	24	5.1
1991	0.05	0.02	0.02	6	4.5
1992	0.05	0.01	0.01	3	4.5
1993	0.05	0.04	0.04	8	4.6
1994	0.05	0.02	0.02	6	4.1
1995	0.15	0.01	0.01	3	4.9
1996	0.15	0.01	0.01	2	4.8
1997	0.15	0.01	0.01	2	4.6
1998	0.15	0.01	0.01	3	4.4
1999	0.15	0.05	0.05	11	4.4

Table 28 Continued. Input (with log-scale standard errors, SE) and expected (Exp) landings for the Commercial Handline East fleet in weight (B, million pounds whole weight) and number (1,000s of fish) for Gulf of Mexico Red Snapper. The mean body weight (MW, whole pounds per fish) was determined by dividing the expected landings in weights by the expected landings in numbers.

Year	Input B SE	Input B	Exp B	Exp N	MW
2000	0.15	0.03	0.03	7	4.8
2001	0.15	0.04	0.04	7	5.2
2002	0.15	0.04	0.04	7	5.2
2003	0.15	0.05	0.06	11	5.3
2004	0.15	0.05	0.06	10	5.6
2005	0.15	0.07	0.08	13	5.8
2006	0.15	0.10	0.09	17	5.6
2007	0.05	0.06	0.06	11	5.1
2008	0.05	0.06	0.06	11	5.0
2009	0.05	0.11	0.11	21	5.2
2010	0.05	0.21	0.21	37	5.7
2011	0.05	0.25	0.26	40	6.4
2012	0.05	0.24	0.24	36	6.7
2013	0.05	0.30	0.31	45	6.8
2014	0.05	0.41	0.41	59	6.9
2015	0.05	0.54	0.53	79	6.7
2016	0.05	0.40	0.40	75	5.3
2017	0.05	0.49	0.49	105	4.7
2018	0.05	0.57	0.56	112	5.0
2019	0.05	0.75	0.74	130	5.7

Table 29. Input (with log-scale standard errors, SE) and expected (Exp) landings for the Commercial Longline West fleet in weight (B, million pounds whole weight) and number (1,000s of fish) for Gulf of Mexico Red Snapper. The mean body weight (MW, whole pounds per fish) was determined by dividing the expected landings in weights by the expected landings in numbers.

Year	Input B SE	Input B	Exp B	Exp N	MW
1980	0.05	0.04	0.04	4	11.1
1981	0.05	0.05	0.05	5	10.4
1982	0.05	0.07	0.07	8	9.5
1983	0.05	0.10	0.10	11	8.8
1984	0.05	0.76	0.76	95	8.0
1985	0.05	0.60	0.61	70	8.6
1986	0.05	0.83	0.83	103	8.1
1987	0.05	0.73	0.73	99	7.4
1988	0.05	0.67	0.67	92	7.3
1989	0.05	0.46	0.46	63	7.2
1990	0.05	0.12	0.12	20	6.0
1991	0.05	0.07	0.07	13	5.7
1992	0.05	0.02	0.02	3	5.8
1993	0.05	0.02	0.02	2	8.3
1994	0.05	0.02	0.02	2	8.5
1995	0.20	0.02	0.02	2	9.0
1996	0.20	0.03	0.03	3	9.1
1997	0.20	0.03	0.03	3	9.2
1998	0.20	0.03	0.03	3	9.4
1999	0.20	0.09	0.10	10	9.7
2000	0.16	0.18	0.17	18	9.7
2001	0.17	0.12	0.12	12	9.7
2002	0.17	0.15	0.14	15	9.8
2003	0.17	0.17	0.17	18	10.0
2004	0.18	0.46	0.43	43	10.0

Table 29 Continued. Input (with log-scale standard errors, SE) and expected (Exp) landings for the Commercial Longline West fleet in weight (B, million pounds whole weight) and number (1,000s of fish) for Gulf of Mexico Red Snapper. The mean body weight (MW, whole pounds per fish) was determined by dividing the expected landings in weights by the expected landings in numbers.

Year	Input B SE	Input B	Exp B	Exp N	MW
2005	0.18	0.28	0.27	28	9.8
2006	0.18	0.26	0.25	26	9.4
2007	0.05	0.19	0.19	19	10.0
2008	0.05	0.06	0.06	6	9.6
2009	0.05	0.05	0.05	5	9.6
2010	0.05	0.04	0.04	4	9.8
2011	0.05	0.02	0.02	2	10.1
2012	0.05	0.01	0.01	1	10.4
2013	0.05	0.05	0.05	5	10.7
2014	0.05	0.06	0.06	5	11.0
2015	0.05	0.05	0.05	4	11.3
2016	0.05	0.07	0.07	6	11.5
2017	0.05	0.07	0.07	6	11.7
2018	0.05	0.07	0.07	6	11.9
2019	0.05	0.16	0.16	13	12.1

Table 30. Input (with log-scale standard errors, SE) and expected (Exp) landings for the Commercial Longline Central fleet in weight (B, million pounds whole weight) and number (1,000s of fish) for Gulf of Mexico Red Snapper. The mean body weight (MW, whole pounds per fish) was determined by dividing the expected landings in weights by the expected landings in numbers.

Year	Input B SE	Input B	Exp B	Exp N	MW
1980	0.05	0.06	0.06	7	8.5
1981	0.05	0.09	0.09	10	8.5
1982	0.05	0.08	0.08	10	8.4
1983	0.05	0.11	0.11	14	7.9
1984	0.05	0.10	0.10	14	7.4
1985	0.05	0.03	0.03	4	8.0
1986	0.05	0.03	0.03	4	7.6
1987	0.05	0.03	0.03	4	7.7
1988	0.05	0.05	0.05	7	7.5
1989	0.05	0.06	0.06	7	7.5
1990	0.05	0.01	0.01	2	6.3
1991	0.05	0.01	0.01	1	5.4
1992	0.05	0.00	0.00	0	4.9
1993	0.05	0.00	0.00	0	7.0
1994	0.05	0.00	0.00	0	7.0
1995	0.18	0.00	0.00	0	7.1
1996	0.18	0.00	0.00	1	6.7
1997	0.18	0.00	0.00	0	5.9
1998	0.18	0.00	0.00	0	5.5
1999	0.16	0.00	0.00	0	5.8
2000	0.16	0.00	0.00	0	6.2
2001	0.16	0.00	0.00	0	6.5
2002	0.15	0.01	0.01	1	6.4
2003	0.15	0.00	0.00	1	6.2
2004	0.15	0.00	0.00	1	6.0

Table 30 Continued. Input (with log-scale standard errors, SE) and expected (Exp) landings for the Commercial Longline Central fleet in weight (B, million pounds whole weight) and number (1,000s of fish) for Gulf of Mexico Red Snapper. The mean body weight (MW, whole pounds per fish) was determined by dividing the expected landings in weights by the expected landings in numbers.

Year	Input B SE	Input B	Exp B	Exp N	MW
2005	0.15	0.00	0.00	0	5.9
2006	0.15	0.00	0.00	0	5.6
2007	0.05	0.01	0.01	2	6.3
2008	0.05	0.02	0.02	3	6.5
2009	0.05	0.01	0.01	1	7.3
2010	0.05	0.01	0.01	1	8.2
2011	0.05	0.00	0.00	1	9.0
2012	0.05	0.00	0.00	0	9.7
2013	0.05	0.00	0.00	0	10.2
2014	0.05	0.01	0.01	1	10.6
2015	0.05	0.04	0.04	4	10.7
2016	0.05	0.02	0.02	2	10.7
2017	0.05	0.01	0.01	1	10.4
2018	0.05	0.05	0.04	4	10.0
2019	0.05	0.03	0.03	3	9.8

Table 31. Input (with log-scale standard errors, SE) and expected (Exp) landings for the Commercial Longline East fleet in weight (B, million pounds whole weight) and number (1,000s of fish) for Gulf of Mexico Red Snapper. The mean body weight (MW, whole pounds per fish) was determined by dividing the expected landings in weights by the expected landings in numbers.

Year	Input B SE	Input B	Exp B	Exp N	MW
1980	0.05	0.03	0.03	4	7.8
1981	0.05	0.09	0.09	12	7.8
1982	0.05	0.14	0.14	18	7.9
1983	0.05	0.34	0.34	41	8.1
1984	0.05	0.26	0.26	30	8.7
1985	0.05	0.08	0.08	9	9.4
1986	0.05	0.04	0.04	4	10.1
1987	0.05	0.04	0.04	3	10.4
1988	0.05	0.02	0.02	2	10.3
1989	0.05	0.02	0.02	2	9.9
1990	0.05	0.06	0.06	7	9.2
1991	0.05	0.01	0.01	2	8.0
1992	0.05	0.00	0.00	1	7.6
1993	0.05	0.01	0.01	2	7.1
1994	0.05	0.00	0.00	1	6.4
1995	0.15	0.01	0.01	1	6.9
1996	0.15	0.00	0.00	1	6.6
1997	0.15	0.00	0.00	1	6.2
1998	0.15	0.00	0.00	1	5.8
1999	0.15	0.01	0.01	1	5.7
2000	0.15	0.01	0.01	1	6.2
2001	0.15	0.01	0.01	2	6.7
2002	0.15	0.01	0.01	2	6.9
2003	0.15	0.01	0.01	2	7.1
2004	0.15	0.02	0.02	2	7.5

Table 31 Continued. Input (with log-scale standard errors, SE) and expected (Exp) landings for the Commercial Longline East fleet in weight (B, million pounds whole weight) and number (1,000s of fish) for Gulf of Mexico Red Snapper. The mean body weight (MW, whole pounds per fish) was determined by dividing the expected landings in weights by the expected landings in numbers.

Year	Input B SE	Input B	Exp B	Exp N	MW
2005	0.15	0.02	0.02	3	7.8
2006	0.15	0.02	0.02	2	7.6
2007	0.05	0.01	0.01	1	6.9
2008	0.05	0.01	0.01	2	6.7
2009	0.05	0.01	0.01	1	6.8
2010	0.05	0.06	0.06	9	7.2
2011	0.05	0.08	0.08	10	7.8
2012	0.05	0.05	0.05	6	8.4
2013	0.05	0.11	0.11	12	8.7
2014	0.05	0.11	0.11	13	9.0
2015	0.05	0.21	0.21	23	9.1
2016	0.05	0.16	0.16	20	8.2
2017	0.05	0.17	0.17	25	6.9
2018	0.05	0.26	0.25	37	6.7
2019	0.05	0.39	0.37	52	7.1

Table 32. Input (with log-scale standard errors, SE) and expected (Exp) landings for the Recreational Private West fleet in numbers (N, 1,000s of fish) and weight (B, million pounds whole weight) for Gulf of Mexico Red Snapper. The mean body weight (MW, whole pounds per fish) was determined by dividing the expected landings in weights by the expected landings in numbers.

Year	Input N SE	Input N	Exp N	Exp B	MW
1950	0.15	138	138	0.83	6.0
1951	0.15	138	138	0.84	6.1
1952	0.15	138	138	0.85	6.2
1953	0.15	138	138	0.86	6.2
1954	0.15	138	138	0.86	6.2
1955	0.15	138	138	0.87	6.3
1956	0.15	153	153	0.96	6.3
1957	0.15	167	168	1.06	6.3
1958	0.15	182	182	1.17	6.4
1959	0.15	197	197	1.29	6.5
1960	0.15	212	212	1.39	6.5
1961	0.15	219	219	1.41	6.4
1962	0.15	226	226	1.43	6.3
1963	0.15	233	234	1.46	6.2
1964	0.15	240	241	1.49	6.2
1965	0.15	667	675	4.13	6.1
1966	0.15	687	696	4.13	5.9
1967	0.15	707	718	4.16	5.8
1968	0.15	728	740	4.22	5.7
1969	0.15	748	762	4.26	5.6
1970	0.15	769	784	4.25	5.4
1971	0.15	840	860	4.45	5.2
1972	0.15	911	937	4.69	5.0
1973	0.15	983	1,015	4.91	4.8
1974	0.15	1,054	1,093	4.99	4.6

Table 32 Continued. Input (with log-scale standard errors, SE) and expected (Exp) landings for the Recreational Private West fleet in numbers (N, 1,000s of fish) and weight (B, million pounds whole weight) for Gulf of Mexico Red Snapper. The mean body weight (MW, whole pounds per fish) was determined by dividing the expected landings in weights by the expected landings in numbers.

Year	Input N SE	Input N	Exp N	Exp B	MW
1975	0.15	1,834	1,966	8.34	4.2
1976	0.15	1,841	1,979	7.67	3.9
1977	0.15	1,848	1,993	7.09	3.6
1978	0.15	1,856	2,008	6.70	3.3
1979	0.15	1,863	2,029	6.64	3.3
1980	0.15	1,871	2,040	6.40	3.1
1981	0.15	3,075	3,065	7.97	2.6
1982	0.15	1,863	1,544	3.36	2.2
1983	0.15	3,554	3,123	6.37	2.0
1984	0.15	790	822	1.52	1.9
1985	0.15	1,273	1,464	2.55	1.7
1986	0.15	1,731	1,737	3.11	1.8
1987	0.15	521	547	0.90	1.6
1988	0.15	806	989	1.76	1.8
1989	0.15	531	625	1.15	1.8
1990	0.15	396	379	0.80	2.1
1991	0.15	471	449	1.00	2.2
1992	0.15	625	542	1.31	2.4
1993	0.15	1,043	777	2.20	2.8
1994	0.15	1,205	879	2.52	2.9
1995	0.22	1,528	911	2.78	3.1
1996	0.18	1,067	707	2.16	3.0
1997	0.17	1,048	826	2.62	3.2
1998	0.25	1,012	847	2.81	3.3
1999	0.18	657	640	2.45	3.8

Table 32 Continued. Input (with log-scale standard errors, SE) and expected (Exp) landings for the Recreational Private West fleet in numbers (N, 1,000s of fish) and weight (B, million pounds whole weight) for Gulf of Mexico Red Snapper. The mean body weight (MW, whole pounds per fish) was determined by dividing the expected landings in weights by the expected landings in numbers.

Year	Input N SE	Input N	Exp N	Exp B	MW
2000	0.19	656	599	2.11	3.5
2001	0.19	468	447	1.57	3.5
2002	0.18	428	443	1.60	3.6
2003	0.18	382	452	1.68	3.7
2004	0.19	360	437	1.57	3.6
2005	0.18	558	701	2.36	3.4
2006	0.17	697	922	2.93	3.2
2007	0.16	538	558	2.43	4.3
2008	0.22	418	447	1.97	4.4
2009	0.18	419	445	2.10	4.7
2010	0.22	256	262	1.30	5.0
2011	0.20	380	390	2.04	5.2
2012	0.18	449	406	2.21	5.4
2013	0.18	579	671	3.71	5.5
2014	0.18	587	616	3.47	5.6
2015	0.15	714	713	4.11	5.8
2016	0.17	456	330	1.93	5.8
2017	0.16	564	550	3.27	5.9
2018	0.15	634	623	3.76	6.0
2019	0.17	942	1,057	6.40	6.1

Table 33. Input (with log-scale standard errors, SE) and expected (Exp) landings for the Recreational Private Central fleet in numbers (N, 1,000s of fish) and weight (B, million pounds whole weight) for Gulf of Mexico Red Snapper. The mean body weight (MW, whole pounds per fish) was determined by dividing the expected landings in weights by the expected landings in numbers.

Year	Input N SE	Input N	Exp N	Exp B	MW
1950	0.15	110	110	0.53	4.8
1951	0.15	110	110	0.53	4.8
1952	0.15	110	110	0.54	4.9
1953	0.15	110	110	0.54	4.9
1954	0.15	110	110	0.54	4.9
1955	0.15	110	110	0.54	4.9
1956	0.15	122	122	0.60	4.9
1957	0.15	134	134	0.66	4.9
1958	0.15	146	146	0.72	4.9
1959	0.15	157	158	0.77	4.9
1960	0.15	169	169	0.81	4.8
1961	0.15	175	175	0.82	4.7
1962	0.15	181	181	0.83	4.6
1963	0.15	186	187	0.83	4.5
1964	0.15	192	192	0.83	4.3
1965	0.15	305	306	1.28	4.2
1966	0.15	314	316	1.28	4.1
1967	0.15	324	325	1.28	3.9
1968	0.15	333	335	1.27	3.8
1969	0.15	342	344	1.27	3.7
1970	0.15	352	354	1.26	3.6
1971	0.15	384	388	1.34	3.5
1972	0.15	417	421	1.41	3.3
1973	0.15	450	455	1.47	3.2
1974	0.15	482	489	1.50	3.1

Table 33 Continued. Input (with log-scale standard errors, SE) and expected (Exp) landings for the Recreational Private Central fleet in numbers (N, 1,000s of fish) and weight (B, million pounds whole weight) for Gulf of Mexico Red Snapper. The mean body weight (MW, whole pounds per fish) was determined by dividing the expected landings in weights by the expected landings in numbers.

Year	Input N SE	Input N	Exp N	Exp B	MW
1975	0.15	696	712	2.07	2.9
1976	0.15	699	717	2.24	3.1
1977	0.15	702	720	2.06	2.9
1978	0.15	705	721	1.78	2.5
1979	0.15	707	716	1.42	2.0
1980	0.15	710	711	1.21	1.7
1981	0.15	1,815	1,873	3.87	2.1
1982	0.15	212	199	0.43	2.1
1983	0.15	752	674	1.15	1.7
1984	0.15	273	277	0.42	1.5
1985	0.15	612	531	0.78	1.5
1986	0.15	262	258	0.42	1.6
1987	0.15	492	518	1.13	2.2
1988	0.15	366	305	0.45	1.5
1989	0.15	588	622	1.01	1.6
1990	0.15	349	332	1.00	3.0
1991	0.15	807	656	1.78	2.7
1992	0.15	1,422	690	1.86	2.7
1993	0.15	1,435	1,004	2.87	2.9
1994	0.15	1,002	588	1.79	3.0
1995	0.26	647	202	0.72	3.6
1996	0.20	507	443	1.49	3.4
1997	0.20	818	650	1.95	3.0
1998	0.21	563	436	1.31	3.0
1999	0.23	1,301	827	3.33	4.0

Table 33 Continued. Input (with log-scale standard errors, SE) and expected (Exp) landings for the Recreational Private Central fleet in numbers (N, 1,000s of fish) and weight (B, million pounds whole weight) for Gulf of Mexico Red Snapper. The mean body weight (MW, whole pounds per fish) was determined by dividing the expected landings in weights by the expected landings in numbers.

Year	Input N SE	Input N	Exp N	Exp B	MW
2000	0.21	865	727	2.88	4.0
2001	0.22	1,393	733	2.92	4.0
2002	0.20	1,872	1,374	5.33	3.9
2003	0.19	1,288	1,040	3.96	3.8
2004	0.27	1,633	1,377	5.14	3.7
2005	0.24	900	1,030	3.78	3.7
2006	0.20	985	827	2.91	3.5
2007	0.22	1,526	2,250	8.54	3.8
2008	0.17	898	874	3.47	4.0
2009	0.21	1,079	1,599	7.02	4.4
2010	0.30	1,033	1,443	7.11	4.9
2011	0.20	1,243	1,670	9.00	5.4
2012	0.21	1,161	1,175	6.75	5.7
2013	0.30	2,092	1,559	9.35	6.0
2014	0.21	893	627	3.74	6.0
2015	0.23	1,023	872	5.16	5.9
2016	0.14	1,281	1,076	6.20	5.8
2017	0.19	2,568	2,349	12.66	5.4
2018	0.24	1,751	1,221	6.28	5.1
2019	0.20	1,947	1,758	9.25	5.3

Table 34. Input (with log-scale standard errors, SE) and expected (Exp) landings for the Recreational Private East fleet in numbers (N, 1,000s of fish) and weight (B, million pounds whole weight) for Gulf of Mexico Red Snapper. The mean body weight (MW, whole pounds per fish) was determined by dividing the expected landings in weights by the expected landings in numbers.

Year	Input N SE	Input N	Exp N	Exp B	MW
1950	0.15	25	25	0.12	4.7
1951	0.15	25	25	0.12	4.8
1952	0.15	25	25	0.12	4.9
1953	0.15	25	25	0.12	4.9
1954	0.15	25	25	0.12	4.9
1955	0.15	25	25	0.12	5.0
1956	0.15	27	27	0.14	5.0
1957	0.15	30	30	0.15	5.0
1958	0.15	33	33	0.16	5.0
1959	0.15	35	35	0.17	4.9
1960	0.15	38	38	0.18	4.7
1961	0.15	39	39	0.17	4.5
1962	0.15	41	41	0.17	4.2
1963	0.15	42	42	0.17	4.0
1964	0.15	43	43	0.16	3.8
1965	0.15	92	92	0.33	3.6
1966	0.15	95	95	0.31	3.3
1967	0.15	98	97	0.30	3.1
1968	0.15	100	100	0.30	3.0
1969	0.15	103	103	0.30	2.9
1970	0.15	106	106	0.30	2.8
1971	0.15	116	115	0.32	2.7
1972	0.15	126	125	0.33	2.7
1973	0.15	136	135	0.35	2.6
1974	0.15	146	145	0.36	2.5

Table 34 Continued. Input (with log-scale standard errors, SE) and expected (Exp) landings for the Recreational Private East fleet in numbers (N, 1,000s of fish) and weight (B, million pounds whole weight) for Gulf of Mexico Red Snapper. The mean body weight (MW, whole pounds per fish) was determined by dividing the expected landings in weights by the expected landings in numbers.

Year	Input N SE	Input N	Exp N	Exp B	MW
1975	0.15	236	234	0.52	2.2
1976	0.15	237	236	0.35	1.5
1977	0.15	238	237	0.39	1.6
1978	0.15	239	238	0.44	1.8
1979	0.15	240	239	0.45	1.9
1980	0.15	240	240	0.39	1.6
1981	0.15	568	568	0.90	1.6
1982	0.15	12	12	0.03	2.4
1983	0.15	581	583	1.96	3.4
1984	0.15	21	22	0.09	4.0
1985	0.15	157	159	0.46	2.9
1986	0.15	181	183	0.53	2.9
1987	0.15	106	106	0.22	2.1
1988	0.15	49	50	0.12	2.4
1989	0.15	142	144	0.23	1.6
1990	0.15	42	42	0.20	4.7
1991	0.15	17	18	0.07	4.1
1992	0.15	4	4	0.01	4.2
1993	0.15	0	0	0.00	3.8
1994	0.15	0	0	0.00	3.4
1995	0.83	3	4	0.02	4.4
1996	0.59	37	47	0.20	4.3
1997	0.59	0	0	0.00	4.1
1998	0.59	0	0	0.00	3.9
1999	0.49	12	12	0.06	5.4

Table 34 Continued. Input (with log-scale standard errors, SE) and expected (Exp) landings for the Recreational Private East fleet in numbers (N, 1,000s of fish) and weight (B, million pounds whole weight) for Gulf of Mexico Red Snapper. The mean body weight (MW, whole pounds per fish) was determined by dividing the expected landings in weights by the expected landings in numbers.

Year	Input N SE	Input N	Exp N	Exp B	MW
2000	0.83	2	4	0.02	4.9
2001	0.83	0	0	0.00	5.2
2002	0.65	8	8	0.04	5.2
2003	0.70	3	3	0.01	5.3
2004	0.78	7	9	0.05	5.6
2005	0.55	81	114	0.66	5.8
2006	0.70	19	18	0.10	5.6
2007	0.72	41	45	0.25	5.5
2008	0.83	6	5	0.03	5.4
2009	0.55	19	22	0.12	5.5
2010	0.65	3	5	0.03	6.0
2011	0.60	16	16	0.11	6.8
2012	0.65	15	14	0.10	7.2
2013	0.70	4	4	0.03	7.4
2014	0.67	5	5	0.04	7.6
2015	0.83	2	2	0.01	7.8
2016	0.57	27	27	0.17	6.3
2017	0.40	77	75	0.39	5.3
2018	0.44	101	111	0.60	5.4
2019	0.50	106	103	0.62	6.0

Table 35. Input (with log-scale standard errors, SE) and expected (Exp) landings for the Recreational Charter West fleet in numbers (N, 1,000s of fish) and weight (B, million pounds whole weight) for Gulf of Mexico Red Snapper. The mean body weight (MW, whole pounds per fish) was determined by dividing the expected landings in weights by the expected landings in numbers.

Year	Input N SE	Input N	Exp N	Exp B	MW
1950	0.15	386	387	2.46	6.3
1951	0.15	386	387	2.50	6.4
1952	0.15	386	387	2.53	6.5
1953	0.15	386	387	2.55	6.6
1954	0.15	386	387	2.56	6.6
1955	0.15	386	387	2.58	6.7
1956	0.15	427	429	2.85	6.7
1957	0.15	469	471	3.15	6.7
1958	0.15	510	513	3.48	6.8
1959	0.15	551	555	3.84	6.9
1960	0.15	592	597	4.15	7.0
1961	0.15	612	617	4.23	6.9
1962	0.15	632	638	4.29	6.7
1963	0.15	652	658	4.38	6.7
1964	0.15	671	679	4.50	6.6
1965	0.15	428	431	2.82	6.5
1966	0.15	441	445	2.83	6.4
1967	0.15	454	458	2.85	6.2
1968	0.15	467	472	2.89	6.1
1969	0.15	480	486	2.92	6.0
1970	0.15	493	500	2.92	5.9
1971	0.15	539	547	3.06	5.6
1972	0.15	585	595	3.23	5.4
1973	0.15	630	644	3.38	5.2
1974	0.15	676	693	3.44	5.0

Table 35 Continued. Input (with log-scale standard errors, SE) and expected (Exp) landings for the Recreational Charter West fleet in numbers (N, 1,000s of fish) and weight (B, million pounds whole weight) for Gulf of Mexico Red Snapper. The mean body weight (MW, whole pounds per fish) was determined by dividing the expected landings in weights by the expected landings in numbers.

Year	Input N SE	Input N	Exp N	Exp B	MW
1975	0.15	277	280	1.30	4.6
1976	0.15	278	281	1.19	4.2
1977	0.15	279	282	1.10	3.9
1978	0.15	280	283	1.04	3.7
1979	0.15	281	285	1.02	3.6
1980	0.15	282	286	0.99	3.4
1981	0.15	226	228	0.66	2.9
1982	0.15	275	296	0.71	2.4
1983	0.15	422	403	0.91	2.2
1984	0.15	378	304	0.62	2.0
1985	0.15	613	505	0.97	1.9
1986	0.15	77	94	0.18	2.0
1987	0.15	64	69	0.12	1.8
1988	0.15	15	17	0.03	1.9
1989	0.15	63	67	0.13	2.0
1990	0.15	28	29	0.07	2.3
1991	0.15	115	117	0.28	2.4
1992	0.15	123	121	0.31	2.6
1993	0.15	82	83	0.25	3.0
1994	0.15	57	67	0.20	3.1
1995	0.47	74	72	0.25	3.4
1996	0.46	57	73	0.25	3.4
1997	0.29	68	71	0.25	3.5
1998	0.33	106	83	0.31	3.7
1999	0.41	57	19	0.08	4.4

Table 35 Continued. Input (with log-scale standard errors, SE) and expected (Exp) landings for the Recreational Charter West fleet in numbers (N, 1,000s of fish) and weight (B, million pounds whole weight) for Gulf of Mexico Red Snapper. The mean body weight (MW, whole pounds per fish) was determined by dividing the expected landings in weights by the expected landings in numbers.

Year	Input N SE	Input N	Exp N	Exp B	MW
2000	0.25	20	13	0.05	4.0
2001	0.30	19	18	0.07	3.9
2002	0.24	54	48	0.19	4.0
2003	0.26	56	55	0.22	4.1
2004	0.25	82	105	0.42	4.1
2005	0.27	74	96	0.37	3.8
2006	0.20	95	115	0.41	3.6
2007	0.20	64	97	0.57	5.9
2008	0.37	25	56	0.33	5.8
2009	0.38	29	36	0.21	6.1
2010	0.41	8	52	0.33	6.4
2011	0.42	10	15	0.10	6.7
2012	0.41	28	24	0.17	6.9
2013	0.44	20	38	0.27	7.1
2014	0.20	11	14	0.10	7.3
2015	0.12	29	32	0.23	7.4
2016	0.10	34	26	0.20	7.5
2017	0.11	37	23	0.18	7.7
2018	0.15	26	14	0.11	7.8
2019	0.15	29	59	0.46	7.8

Table 36. Input (with log-scale standard errors, SE) and expected (Exp) landings for the Recreational Charter Central fleet in numbers (N, 1,000s of fish) and weight (B, million pounds whole weight) for Gulf of Mexico Red Snapper. The mean body weight (MW, whole pounds per fish) was determined by dividing the expected landings in weights by the expected landings in numbers.

Year	Input N SE	Input N	Exp N	Exp B	MW
1950	0.15	221	221	1.57	7.1
1951	0.15	221	221	1.57	7.1
1952	0.15	221	221	1.58	7.2
1953	0.15	221	221	1.58	7.2
1954	0.15	221	221	1.59	7.2
1955	0.15	221	221	1.59	7.2
1956	0.15	244	245	1.77	7.2
1957	0.15	268	268	1.95	7.3
1958	0.15	291	292	2.12	7.3
1959	0.15	315	316	2.29	7.3
1960	0.15	338	340	2.45	7.2
1961	0.15	350	351	2.50	7.1
1962	0.15	361	363	2.54	7.0
1963	0.15	372	374	2.58	6.9
1964	0.15	384	386	2.61	6.8
1965	0.15	321	323	2.14	6.6
1966	0.15	331	333	2.15	6.5
1967	0.15	341	343	2.17	6.3
1968	0.15	351	353	2.18	6.2
1969	0.15	360	363	2.19	6.0
1970	0.15	370	374	2.20	5.9
1971	0.15	405	409	2.36	5.8
1972	0.15	439	445	2.51	5.6
1973	0.15	473	481	2.65	5.5
1974	0.15	508	517	2.77	5.4

Table 36 Continued. Input (with log-scale standard errors, SE) and expected (Exp) landings for the Recreational Charter Central fleet in numbers (N, 1,000s of fish) and weight (B, million pounds whole weight) for Gulf of Mexico Red Snapper. The mean body weight (MW, whole pounds per fish) was determined by dividing the expected landings in weights by the expected landings in numbers.

Year	Input N SE	Input N	Exp N	Exp B	MW
1975	0.15	417	424	2.19	5.2
1976	0.15	419	427	2.26	5.3
1977	0.15	421	430	2.19	5.1
1978	0.15	422	431	2.02	4.7
1979	0.15	424	431	1.73	4.0
1980	0.15	426	430	1.50	3.5
1981	0.15	72	63	0.24	3.8
1982	0.15	409	395	1.56	3.9
1983	0.15	760	787	2.73	3.5
1984	0.15	211	200	0.63	3.1
1985	0.15	239	226	0.67	3.0
1986	0.15	507	485	1.51	3.1
1987	0.15	457	480	1.77	3.7
1988	0.15	358	384	1.18	3.1
1989	0.15	204	203	0.65	3.2
1990	0.15	144	132	0.42	3.2
1991	0.15	190	199	0.57	2.9
1992	0.15	352	384	1.10	2.9
1993	0.15	836	771	2.35	3.0
1994	0.15	373	366	1.19	3.2
1995	0.27	297	284	1.18	4.1
1996	0.30	423	448	1.72	3.8
1997	0.15	544	629	2.16	3.4
1998	0.10	871	915	3.09	3.4
1999	0.10	632	683	2.66	3.9

Table 36 Continued. Input (with log-scale standard errors, SE) and expected (Exp) landings for the Recreational Charter Central fleet in numbers (N, 1,000s of fish) and weight (B, million pounds whole weight) for Gulf of Mexico Red Snapper. The mean body weight (MW, whole pounds per fish) was determined by dividing the expected landings in weights by the expected landings in numbers.

Year	Input N SE	Input N	Exp N	Exp B	MW
2000	0.08	376	483	1.94	4.0
2001	0.09	396	530	2.13	4.0
2002	0.09	556	633	2.48	3.9
2003	0.09	526	635	2.43	3.8
2004	0.09	532	658	2.46	3.7
2005	0.10	386	537	1.96	3.7
2006	0.11	388	607	2.11	3.5
2007	0.11	476	582	2.24	3.8
2008	0.12	265	229	0.93	4.1
2009	0.16	205	298	1.36	4.6
2010	0.17	69	87	0.45	5.2
2011	0.19	153	170	0.97	5.7
2012	0.17	150	121	0.74	6.1
2013	0.34	166	139	0.88	6.4
2014	0.27	35	21	0.14	6.4
2015	0.23	205	108	0.68	6.3
2016	0.22	218	186	1.14	6.1
2017	0.26	239	279	1.60	5.7
2018	0.23	229	196	1.07	5.5
2019	0.27	282	255	1.42	5.6

Table 37. Input (with log-scale standard errors, SE) and expected (Exp) landings for the Recreational Charter East fleet in numbers (N, 1,000s of fish) and weight (B, million pounds whole weight) for Gulf of Mexico Red Snapper. The mean body weight (MW, whole pounds per fish) was determined by dividing the expected landings in weights by the expected landings in numbers.

Year	Input N SE	Input N	Exp N	Exp B	MW
1950	0.15	62	61	0.43	7.1
1951	0.15	62	61	0.44	7.2
1952	0.15	62	61	0.44	7.2
1953	0.15	62	61	0.45	7.3
1954	0.15	62	61	0.45	7.4
1955	0.15	62	61	0.45	7.4
1956	0.15	69	67	0.50	7.5
1957	0.15	75	74	0.55	7.5
1958	0.15	82	80	0.60	7.5
1959	0.15	89	86	0.64	7.4
1960	0.15	95	92	0.67	7.3
1961	0.15	98	95	0.67	7.1
1962	0.15	102	98	0.67	6.8
1963	0.15	105	100	0.66	6.6
1964	0.15	108	103	0.65	6.3
1965	0.15	63	61	0.37	6.0
1966	0.15	65	63	0.36	5.8
1967	0.15	67	65	0.36	5.5
1968	0.15	69	66	0.36	5.4
1969	0.15	70	68	0.36	5.2
1970	0.15	72	70	0.36	5.1
1971	0.15	79	76	0.38	5.0
1972	0.15	86	82	0.40	4.9
1973	0.15	93	88	0.43	4.9
1974	0.15	99	94	0.44	4.7

Table 37 Continued. Input (with log-scale standard errors, SE) and expected (Exp) landings for the Recreational Charter East fleet in numbers (N, 1,000s of fish) and weight (B, million pounds whole weight) for Gulf of Mexico Red Snapper. The mean body weight (MW, whole pounds per fish) was determined by dividing the expected landings in weights by the expected landings in numbers.

Year	Input N SE	Input N	Exp N	Exp B	MW
1975	0.15	24	24	0.11	4.4
1976	0.15	25	24	0.08	3.3
1977	0.15	25	24	0.08	3.3
1978	0.15	25	25	0.09	3.5
1979	0.15	25	25	0.09	3.7
1980	0.15	25	25	0.09	3.5
1981	0.15	22	22	0.07	3.4
1982	0.15	4	4	0.02	4.1
1983	0.15	37	37	0.18	4.9
1984	0.15	32	33	0.19	5.8
1985	0.15	11	12	0.06	5.6
1986	0.15	62	76	0.43	5.6
1987	0.15	3	4	0.02	4.8
1988	0.15	6	6	0.03	4.8
1989	0.15	11	12	0.04	3.8
1990	0.15	0	0	0.00	4.9
1991	0.15	0	0	0.00	4.3
1992	0.15	3	3	0.01	4.3
1993	0.15	0	0	0.00	4.1
1994	0.15	0	0	0.00	3.7
1995	0.83	0	0	0.00	4.7
1996	0.83	0	0	0.00	4.6
1997	0.67	2	2	0.01	4.4
1998	0.62	8	17	0.07	4.1
1999	0.44	1	1	0.01	5.4

Table 37 Continued. Input (with log-scale standard errors, SE) and expected (Exp) landings for the Recreational Charter East fleet in numbers (N, 1,000s of fish) and weight (B, million pounds whole weight) for Gulf of Mexico Red Snapper. The mean body weight (MW, whole pounds per fish) was determined by dividing the expected landings in weights by the expected landings in numbers.

Year	Input N SE	Input N	Exp N	Exp B	MW
2000	0.67	0	1	0.00	4.9
2001	0.50	2	1	0.00	5.2
2002	0.50	1	1	0.00	5.2
2003	0.38	2	2	0.01	5.4
2004	0.45	0	0	0.00	5.7
2005	0.43	2	2	0.01	5.8
2006	0.74	11	48	0.27	5.6
2007	0.66	1	0	0.00	5.7
2008	0.56	3	3	0.02	5.6
2009	0.57	2	7	0.04	5.7
2010	0.68	4	3	0.02	6.2
2011	0.68	0	0	0.00	7.0
2012	0.72	3	1	0.01	7.5
2013	0.68	0	8	0.06	7.7
2014	0.60	4	2	0.01	7.9
2015	0.62	8	8	0.06	8.1
2016	0.51	8	6	0.04	6.6
2017	0.48	19	18	0.10	5.5
2018	0.57	23	22	0.13	5.6
2019	0.30	18	15	0.10	6.2

Table 38. Input (with log-scale standard errors, SE) and expected (Exp) landings for the Recreational Headboat West fleet in numbers (N, 1,000s of fish) and weight (B, million pounds whole weight) for Gulf of Mexico Red Snapper. The mean body weight (MW, whole pounds per fish) was determined by dividing the expected landings in weights by the expected landings in numbers.

Year	Input N SE	Input N	Exp N	Exp B	MW
1950	0.15	317	318	1.59	5.0
1951	0.15	317	318	1.62	5.1
1952	0.15	317	318	1.64	5.2
1953	0.15	317	318	1.65	5.2
1954	0.15	317	318	1.66	5.2
1955	0.15	317	318	1.67	5.2
1956	0.15	351	352	1.84	5.2
1957	0.15	385	386	2.03	5.3
1958	0.15	419	420	2.25	5.4
1959	0.15	453	455	2.48	5.5
1960	0.15	487	489	2.68	5.5
1961	0.15	503	506	2.71	5.4
1962	0.15	519	523	2.73	5.2
1963	0.15	535	539	2.78	5.1
1964	0.15	552	556	2.85	5.1
1965	0.15	410	412	2.08	5.0
1966	0.15	422	425	2.07	4.9
1967	0.15	435	438	2.08	4.7
1968	0.15	447	451	2.10	4.7
1969	0.15	460	464	2.12	4.6
1970	0.15	472	477	2.10	4.4
1971	0.15	516	523	2.18	4.2
1972	0.15	560	568	2.29	4.0
1973	0.15	604	614	2.39	3.9
1974	0.15	648	660	2.42	3.7

Table 38 Continued. Input (with log-scale standard errors, SE) and expected (Exp) landings for the Recreational Headboat West fleet in numbers (N, 1,000s of fish) and weight (B, million pounds whole weight) for Gulf of Mexico Red Snapper. The mean body weight (MW, whole pounds per fish) was determined by dividing the expected landings in weights by the expected landings in numbers.

Year	Input N SE	Input N	Exp N	Exp B	MW
1975	0.15	424	430	1.46	3.4
1976	0.15	426	432	1.33	3.1
1977	0.15	428	434	1.23	2.8
1978	0.15	429	436	1.16	2.7
1979	0.15	431	438	1.15	2.6
1980	0.15	433	440	1.11	2.5
1981	0.15	355	358	0.75	2.1
1982	0.15	359	382	0.68	1.8
1983	0.15	371	300	0.51	1.7
1984	0.15	368	398	0.62	1.6
1985	0.15	388	418	0.62	1.5
1986	0.15	316	306	0.47	1.5
1987	0.15	319	312	0.44	1.4
1988	0.15	423	434	0.66	1.5
1989	0.15	372	377	0.59	1.6
1990	0.15	187	172	0.34	2.0
1991	0.15	265	189	0.40	2.1
1992	0.15	413	295	0.66	2.2
1993	0.15	459	304	0.78	2.6
1994	0.15	498	366	0.96	2.6
1995	0.18	355	280	0.91	3.3
1996	0.31	349	243	0.78	3.2
1997	0.24	347	225	0.76	3.4
1998	0.14	245	206	0.73	3.5
1999	0.22	99	51	0.23	4.5

Table 38 Continued. Input (with log-scale standard errors, SE) and expected (Exp) landings for the Recreational Headboat West fleet in numbers (N, 1,000s of fish) and weight (B, million pounds whole weight) for Gulf of Mexico Red Snapper. The mean body weight (MW, whole pounds per fish) was determined by dividing the expected landings in weights by the expected landings in numbers.

Year	Input N SE	Input N	Exp N	Exp B	MW
2000	0.19	111	69	0.26	3.7
2001	0.21	116	97	0.36	3.7
2002	0.09	138	127	0.48	3.8
2003	0.39	158	96	0.37	3.9
2004	0.12	110	109	0.42	3.8
2005	0.21	100	102	0.37	3.6
2006	0.20	121	112	0.38	3.4
2007	0.53	110	118	0.60	5.1
2008	0.24	58	71	0.36	5.1
2009	0.09	76	77	0.41	5.3
2010	0.05	52	52	0.28	5.5
2011	0.05	51	51	0.29	5.7
2012	0.09	54	55	0.32	5.8
2013	0.05	44	44	0.26	5.9
2014	0.05	36	36	0.21	6.0
2015	0.05	63	62	0.38	6.1
2016	0.05	61	60	0.37	6.2
2017	0.07	60	60	0.37	6.2
2018	0.05	63	62	0.39	6.3
2019	0.06	67	67	0.42	6.3

Table 39. Input (with log-scale standard errors, SE) and expected (Exp) landings for the Recreational Headboat Central fleet in numbers (N, 1,000s of fish) and weight (B, million pounds whole weight) for Gulf of Mexico Red Snapper. The mean body weight (MW, whole pounds per fish) was determined by dividing the expected landings in weights by the expected landings in numbers.

Year	Input N SE	Input N	Exp N	Exp B	MW
1950	0.15	124	124	0.77	6.2
1951	0.15	124	124	0.77	6.2
1952	0.15	124	124	0.78	6.2
1953	0.15	124	124	0.78	6.3
1954	0.15	124	124	0.78	6.3
1955	0.15	124	124	0.78	6.3
1956	0.15	137	138	0.87	6.3
1957	0.15	151	151	0.95	6.3
1958	0.15	164	164	1.04	6.3
1959	0.15	177	177	1.12	6.3
1960	0.15	190	191	1.20	6.3
1961	0.15	197	197	1.22	6.2
1962	0.15	203	204	1.23	6.0
1963	0.15	209	210	1.25	5.9
1964	0.15	216	216	1.25	5.8
1965	0.15	185	186	1.05	5.6
1966	0.15	191	191	1.05	5.5
1967	0.15	197	197	1.05	5.3
1968	0.15	202	203	1.05	5.2
1969	0.15	208	209	1.05	5.0
1970	0.15	214	215	1.05	4.9
1971	0.15	233	235	1.12	4.8
1972	0.15	253	255	1.18	4.6
1973	0.15	273	275	1.24	4.5
1974	0.15	293	296	1.29	4.4

Table 39 Continued. Input (with log-scale standard errors, SE) and expected (Exp) landings for the Recreational Headboat Central fleet in numbers (N, 1,000s of fish) and weight (B, million pounds whole weight) for Gulf of Mexico Red Snapper. The mean body weight (MW, whole pounds per fish) was determined by dividing the expected landings in weights by the expected landings in numbers.

Year	Input N SE	Input N	Exp N	Exp B	MW
1975	0.15	250	253	1.05	4.2
1976	0.15	251	254	1.09	4.3
1977	0.15	252	255	1.05	4.1
1978	0.15	253	256	0.95	3.7
1979	0.15	254	256	0.80	3.1
1980	0.15	255	256	0.69	2.7
1981	0.15	44	40	0.12	3.0
1982	0.15	247	240	0.75	3.1
1983	0.15	475	483	1.29	2.7
1984	0.15	132	127	0.31	2.4
1985	0.15	149	143	0.33	2.3
1986	0.15	15	14	0.03	2.4
1987	0.15	9	9	0.03	2.9
1988	0.15	13	13	0.03	2.4
1989	0.15	10	10	0.02	2.4
1990	0.15	15	13	0.03	2.4
1991	0.15	15	15	0.03	2.2
1992	0.15	34	31	0.07	2.2
1993	0.15	37	32	0.08	2.4
1994	0.15	29	26	0.07	2.5
1995	0.14	23	23	0.06	2.7
1996	0.09	28	28	0.07	2.6
1997	0.13	48	51	0.12	2.3
1998	0.14	76	57	0.14	2.4
1999	0.17	65	41	0.12	2.8

Table 39 Continued. Input (with log-scale standard errors, SE) and expected (Exp) landings for the Recreational Headboat Central fleet in numbers (N, 1,000s of fish) and weight (B, million pounds whole weight) for Gulf of Mexico Red Snapper. The mean body weight (MW, whole pounds per fish) was determined by dividing the expected landings in weights by the expected landings in numbers.

Year	Input N SE	Input N	Exp N	Exp B	MW
2000	0.11	56	55	0.17	3.1
2001	0.13	50	48	0.15	3.0
2002	0.16	75	54	0.16	3.0
2003	0.25	71	52	0.15	3.0
2004	0.24	62	46	0.13	2.9
2005	0.25	42	39	0.11	2.9
2006	0.37	47	50	0.14	2.8
2007	0.41	63	25	0.08	3.2
2008	0.09	61	57	0.19	3.3
2009	0.05	78	76	0.28	3.7
2010	0.06	34	35	0.14	4.2
2011	0.05	66	66	0.30	4.6
2012	0.08	52	52	0.25	4.9
2013	0.05	41	42	0.21	5.0
2014	0.05	41	40	0.20	4.9
2015	0.05	42	41	0.20	4.9
2016	0.05	36	36	0.17	4.7
2017	0.05	50	51	0.22	4.4
2018	0.05	57	57	0.24	4.2
2019	0.05	41	42	0.18	4.4

Table 40. Input (with log-scale standard errors, SE) and expected (Exp) landings for the Recreational Headboat East fleet in numbers (N, 1,000s of fish) and weight (B, million pounds whole weight) for Gulf of Mexico Red Snapper. The mean body weight (MW, whole pounds per fish) was determined by dividing the expected landings in weights by the expected landings in numbers.

Year	Input N SE	Input N	Exp N	Exp B	MW
1955	0.15	3	3	0.02	6.7
1956	0.15	3	3	0.02	6.7
1957	0.15	4	4	0.02	6.8
1958	0.15	4	4	0.03	6.8
1959	0.15	4	4	0.03	6.7
1960	0.15	4	4	0.03	6.5
1961	0.15	5	5	0.03	6.3
1962	0.15	5	5	0.03	6.0
1963	0.15	5	5	0.03	5.8
1964	0.15	5	5	0.03	5.5
1965	0.15	5	5	0.03	5.2
1966	0.15	5	5	0.03	4.9
1967	0.15	6	6	0.03	4.7
1968	0.15	6	6	0.03	4.5
1969	0.15	6	6	0.03	4.4
1970	0.15	6	6	0.03	4.2
1971	0.15	7	7	0.03	4.1
1972	0.15	7	7	0.03	4.0
1973	0.15	8	8	0.03	3.9
1974	0.15	8	8	0.03	3.8
1975	0.15	9	9	0.03	3.5
1976	0.15	9	9	0.02	2.6
1977	0.15	9	9	0.02	2.6
1978	0.15	9	9	0.02	2.8
1979	0.15	9	9	0.03	2.9

Table 40 Continued. Input (with log-scale standard errors, SE) and expected (Exp) landings for the Recreational Headboat East fleet in numbers (N, 1,000s of fish) and weight (B, million pounds whole weight) for Gulf of Mexico Red Snapper. The mean body weight (MW, whole pounds per fish) was determined by dividing the expected landings in weights by the expected landings in numbers.

Year	Input N SE	Input N	Exp N	Exp B	MW
1980	0.15	9	9	0.02	2.7
1981	0.15	14	13	0.04	2.6
1982	0.15	3	3	0.01	3.2
1983	0.15	23	23	0.10	4.1
1984	0.15	19	20	0.10	5.0
1985	0.15	7	7	0.03	4.5
1986	0.15	1	2	0.01	4.4
1987	0.15	0	0	0.00	3.6
1988	0.15	1	1	0.00	3.7
1989	0.15	0	0	0.00	2.9
1990	0.15	0	0	0.00	3.8
1991	0.15	0	0	0.00	3.4
1992	0.15	0	0	0.00	3.5
1993	0.15	1	1	0.00	3.1
1994	0.15	0	0	0.00	2.8
1995	0.46	0	0	0.00	3.1
1996	0.41	0	0	0.00	3.1
1997	0.33	0	0	0.00	3.0
1998	0.54	0	0	0.00	2.8
1999	0.52	3	1	0.01	4.8
2000	0.56	1	1	0.00	3.7
2001	0.56	1	1	0.00	3.9
2002	0.46	0	0	0.00	3.8
2003	0.40	0	0	0.00	4.0
2004	0.32	1	1	0.01	4.2

Table 40 Continued. Input (with log-scale standard errors, SE) and expected (Exp) landings for the Recreational Headboat East fleet in numbers (N, 1,000s of fish) and weight (B, million pounds whole weight) for Gulf of Mexico Red Snapper. The mean body weight (MW, whole pounds per fish) was determined by dividing the expected landings in weights by the expected landings in numbers.

Year	Input N SE	Input N	Exp N	Exp B	MW
2005	0.25	5	4	0.02	4.3
2006	0.26	1	1	0.00	4.1
2007	0.25	1	1	0.00	4.5
2008	0.07	1	1	0.01	4.5
2009	0.05	3	3	0.01	4.7
2010	0.10	2	2	0.01	5.3
2011	0.06	3	3	0.02	6.1
2012	0.05	2	2	0.02	6.4
2013	0.05	3	3	0.02	6.5
2014	0.05	2	2	0.01	6.7
2015	0.05	3	3	0.02	6.6
2016	0.05	3	3	0.01	4.8
2017	0.05	8	8	0.04	4.3
2018	0.05	9	9	0.04	4.6
2019	0.05	9	9	0.05	5.4

Table 41. Gulf of Mexico Red Snapper Commercial Handline West discards in numbers. Discards refer to the total number of fish discarded before applying the discard mortality rate. In SEDAR 74, catches were modelled as total catch, by summing the landings with the dead discards.

Year	Input N SE	Input N	Exp N	Exp Dead N	Exp B	Exp Dead B	MW
1995	0.555	367.594	510.486	108.223	394.012	83.531	0.8
1996	0.555	639.217	604.817	128.221	518.615	109.944	0.9
1997	0.555	771.885	670.792	142.212	570.930	121.034	0.9
1998	0.555	867.539	678.205	143.775	564.184	119.623	0.8
1999	0.555	926.415	784.060	166.220	547.892	116.139	0.7
2000	0.555	843.145	938.820	199.030	739.253	156.726	0.8
2001	0.555	978.141	786.948	166.838	672.563	142.573	0.9
2002	0.555	962.175	694.682	147.272	577.170	122.356	0.8
2003	0.555	979.275	800.286	169.656	557.703	118.234	0.7
2004	0.555	1,022.330	990.647	210.017	667.405	141.493	0.7
2005	0.555	1,062.370	1,106.697	234.617	794.170	168.367	0.7
2006	0.555	1,178.930	1,522.700	322.820	1,177.752	249.695	0.8
2007	0.531	466.911	87.761	18.605	168.539	35.730	1.9
2008	0.452	131.928	55.889	11.848	117.663	24.943	2.1
2009	0.452	111.757	37.169	7.880	98.930	20.973	2.7
2010	0.452	92.165	51.294	10.874	128.335	27.207	2.5
2011	0.452	90.972	43.783	9.282	122.954	26.065	2.8
2012	0.452	103.466	49.877	10.574	139.810	29.641	2.8
2013	0.452	100.966	73.435	15.568	199.254	42.241	2.7
2014	0.432	27.537	70.533	14.953	205.779	43.629	2.9
2015	0.432	33.730	81.595	17.298	247.579	52.492	3.0
2016	0.432	31.153	87.566	18.564	252.716	53.572	2.9
2017	0.432	30.065	83.515	17.705	252.032	53.440	3.0
2018	0.432	25.897	76.632	16.246	243.611	51.632	3.2
2019	0.432	27.484	87.175	18.481	260.740	55.270	3.0

Table 42. Gulf of Mexico Red Snapper Commercial Handline Central discards in numbers. Discards refer to the total number of fish discarded before applying the discard mortality rate. In SEDAR 74, catches were modelled as total catch, by summing the landings with the dead discards.

Year	Input N SE	Input N	Exp N	Exp Dead N	Exp B	Exp Dead B	MW
1995	0.555	131.749	75.922	14.577	56.104	10.772	0.7
1996	0.555	154.510	128.670	24.705	76.002	14.592	0.6
1997	0.555	150.278	125.396	24.076	92.259	17.714	0.7
1998	0.555	166.751	169.051	32.458	147.390	28.301	0.9
1999	0.555	206.946	166.056	31.883	132.187	25.380	0.8
2000	0.555	259.730	244.389	46.922	176.363	33.863	0.7
2001	0.555	314.874	301.843	57.953	233.941	44.917	0.8
2002	0.555	366.366	395.516	75.939	313.532	60.197	0.8
2003	0.555	439.970	417.736	80.205	314.042	60.296	0.8
2004	0.555	396.933	429.204	82.407	333.054	63.945	0.8
2005	0.555	387.232	458.670	88.065	268.238	51.500	0.6
2006	0.555	426.410	485.194	93.157	358.332	68.800	0.7
2007	0.165	83.383	71.097	13.651	121.543	23.336	1.7
2008	0.241	49.728	52.817	10.141	101.289	19.447	1.9
2009	0.241	51.755	36.795	7.064	94.501	18.144	2.6
2010	0.241	58.449	50.978	9.788	138.838	26.656	2.7
2011	0.241	71.009	49.872	9.575	155.320	29.822	3.1
2012	0.241	77.763	53.583	10.288	181.134	34.778	3.4
2013	0.241	62.341	75.848	14.563	226.340	43.457	3.0
2014	0.289	66.197	63.648	12.220	194.229	37.293	3.1
2015	0.289	66.713	94.806	18.203	270.066	51.853	2.8
2016	0.289	72.065	97.872	18.792	250.985	48.189	2.6
2017	0.289	74.403	115.789	22.232	274.402	52.684	2.4
2018	0.289	62.429	92.450	17.751	241.512	46.370	2.6
2019	0.289	63.248	93.341	17.922	253.908	48.746	2.7

Table 43. Gulf of Mexico Red Snapper Commercial Handline East discards in numbers. Discards refer to the total number of fish discarded before applying the discard mortality rate. In SEDAR 74, catches were modelled as total catch, by summing the landings with the dead discards.

Year	Input N SE	Input N	Exp N	Exp Dead N	Exp B	Exp Dead B	MW
1995	0.555	7.949	4.861	1.201	2.336	0.577	0.5
1996	0.555	13.888	4.986	1.232	1.789	0.442	0.4
1997	0.555	10.113	6.221	1.536	2.685	0.663	0.4
1998	0.555	10.295	6.162	1.522	3.603	0.890	0.6
1999	0.555	11.262	10.591	2.616	5.255	1.298	0.5
2000	0.555	10.981	9.721	2.401	4.036	0.997	0.4
2001	0.555	9.214	11.599	2.865	5.567	1.375	0.5
2002	0.555	12.238	9.065	2.239	4.846	1.197	0.5
2003	0.555	13.150	10.213	2.523	4.890	1.208	0.5
2004	0.555	12.099	10.460	2.584	5.243	1.295	0.5
2005	0.555	13.601	16.569	4.092	6.990	1.727	0.4
2006	0.555	15.648	29.064	7.179	14.801	3.656	0.5
2007	0.225	8.544	6.842	1.690	27.382	6.763	4.0
2008	0.246	8.598	6.763	1.670	27.255	6.732	4.0
2009	0.246	12.487	11.518	2.845	51.446	12.707	4.5
2010	0.246	18.723	18.386	4.541	94.353	23.305	5.1
2011	0.246	21.726	19.813	4.894	113.362	28.001	5.7
2012	0.246	21.279	18.272	4.513	106.580	26.325	5.8
2013	0.246	24.330	22.910	5.659	136.003	33.594	5.9
2014	0.406	24.698	29.729	7.343	181.826	44.910	6.1
2015	0.406	22.529	50.044	12.361	244.788	60.464	4.9
2016	0.406	29.146	50.368	12.441	196.138	48.447	3.9
2017	0.406	28.138	62.472	15.430	240.945	59.514	3.9
2018	0.406	25.139	59.736	14.754	263.600	65.109	4.4
2019	0.406	24.532	64.003	15.809	332.452	82.115	5.2

Table 44. Gulf of Mexico Red Snapper Commercial Longline West discards in numbers. Discards refer to the total number of fish discarded before applying the discard mortality rate. In SEDAR 74, catches were modelled as total catch, by summing the landings with the dead discards.

Year	Input N SE	Input N	Exp N	Exp Dead N	Exp B	Exp Dead B	MW
1995	0.555	1.608	0.463	0.102	1.383	0.306	3.0
1996	0.555	1.031	0.609	0.135	1.910	0.422	3.1
1997	0.555	0.662	0.581	0.128	1.978	0.437	3.4
1998	0.555	0.744	0.472	0.104	1.689	0.373	3.6
1999	0.555	2.331	1.496	0.330	5.294	1.170	3.5
2000	0.555	2.014	2.972	0.657	9.698	2.143	3.3
2001	0.555	1.192	1.901	0.420	6.453	1.426	3.4
2002	0.555	1.881	2.130	0.471	7.652	1.691	3.6
2003	0.555	3.543	2.549	0.563	9.079	2.007	3.6
2004	0.555	5.295	6.985	1.544	22.516	4.976	3.2
2005	0.555	4.387	5.161	1.141	15.124	3.342	2.9
2006	0.555	4.110	5.502	1.216	15.225	3.364	2.8
2007	0.750	0.878	7.007	1.549	63.258	13.980	9.0
2008	0.750	1.808	2.132	0.471	18.961	4.191	8.9
2009	0.750	3.042	1.899	0.420	17.463	3.859	9.2
2010	0.750	1.090	1.385	0.306	12.890	2.849	9.3
2011	0.750	0.364	0.630	0.139	6.157	1.361	9.8
2012	0.750	0.858	0.452	0.100	4.552	1.006	10.1
2013	0.750	2.955	1.647	0.364	17.071	3.773	10.4
2014	0.750	1.844	1.738	0.384	18.616	4.114	10.7
2015	0.750	5.293	1.535	0.339	16.851	3.724	11.0
2016	0.750	3.057	2.138	0.472	23.917	5.286	11.2
2017	0.750	3.195	1.920	0.424	22.031	4.869	11.5
2018	0.750	1.175	1.901	0.420	22.268	4.921	11.7
2019	0.750	3.163	4.442	0.982	52.686	11.643	11.9

Table 45. Gulf of Mexico Red Snapper Commercial Longline Central discards in numbers. Discards refer to the total number of fish discarded before applying the discard mortality rate. In SEDAR 74, catches were modelled as total catch, by summing the landings with the dead discards.

Year	Input N SE	Input N	Exp N	Exp Dead N	Exp B	Exp Dead B	MW
1995	0.555	0.048	0.040	0.016	0.053	0.022	1.3
1996	0.555	0.074	0.144	0.059	0.189	0.077	1.3
1997	0.555	0.065	0.079	0.032	0.096	0.039	1.2
1998	0.555	0.052	0.120	0.049	0.167	0.068	1.4
1999	0.555	0.051	0.027	0.011	0.044	0.018	1.6
2000	0.555	0.054	0.036	0.014	0.052	0.021	1.5
2001	0.555	0.062	0.025	0.010	0.035	0.014	1.4
2002	0.555	0.092	0.215	0.088	0.311	0.127	1.4
2003	0.555	0.094	0.139	0.057	0.198	0.081	1.4
2004	0.555	0.138	0.161	0.066	0.222	0.090	1.4
2005	0.555	0.094	0.091	0.037	0.119	0.048	1.3
2006	0.555	0.117	0.082	0.033	0.100	0.041	1.2
2007	0.218	2.798	2.146	0.873	11.620	4.729	5.4
2008	0.218	2.916	3.539	1.441	20.763	8.450	5.9
2009	0.218	1.087	1.026	0.418	7.198	2.930	7.0
2010	0.218	1.515	1.547	0.629	12.171	4.953	7.9
2011	0.218	0.804	0.594	0.242	5.228	2.128	8.8
2012	0.218	0.206	0.150	0.061	1.429	0.582	9.5
2013	0.218	0.310	0.254	0.103	2.520	1.026	9.9
2014	0.218	1.242	0.855	0.348	8.803	3.583	10.3
2015	0.218	3.907	4.116	1.675	42.800	17.420	10.4
2016	0.218	1.833	2.210	0.899	22.746	9.258	10.3
2017	0.218	0.706	0.783	0.319	7.773	3.164	9.9
2018	0.218	3.390	5.076	2.066	48.784	19.855	9.6
2019	0.218	2.201	3.705	1.508	35.039	14.261	9.5

Table 46. Gulf of Mexico Red Snapper Commercial Longline East discards in numbers. Discards refer to the total number of fish discarded before applying the discard mortality rate. In SEDAR 74, catches were modelled as total catch, by summing the landings with the dead discards.

Year	Input N SE	Input N	Exp N	Exp Dead N	Exp B	Exp Dead B	MW
1995	0.555	2.106	0.918	0.242	0.615	0.162	0.7
1996	0.555	3.343	0.590	0.156	0.327	0.086	0.6
1997	0.555	3.238	0.970	0.256	0.584	0.154	0.6
1998	0.555	2.528	0.667	0.176	0.495	0.131	0.7
1999	0.555	3.432	0.585	0.154	0.425	0.112	0.7
2000	0.555	2.959	0.863	0.228	0.523	0.138	0.6
2001	0.555	2.660	1.145	0.302	0.752	0.199	0.7
2002	0.555	3.151	1.087	0.287	0.781	0.206	0.7
2003	0.555	2.831	0.716	0.189	0.491	0.129	0.7
2004	0.555	3.604	1.069	0.282	0.731	0.193	0.7
2005	0.555	3.151	1.361	0.359	0.849	0.224	0.6
2006	0.555	4.153	1.691	0.446	1.143	0.302	0.7
2007	0.216	2.686	1.090	0.288	7.473	1.973	6.9
2008	0.216	3.437	2.773	0.732	18.388	4.854	6.6
2009	0.216	1.560	1.510	0.399	10.202	2.693	6.8
2010	0.216	10.052	11.233	2.965	80.075	21.140	7.1
2011	0.216	13.312	12.562	3.316	97.496	25.739	7.8
2012	0.216	8.534	7.654	2.021	63.675	16.810	8.3
2013	0.216	14.302	15.466	4.083	134.439	35.492	8.7
2014	0.216	17.923	15.817	4.176	141.579	37.377	9.0
2015	0.216	26.677	29.038	7.666	261.163	68.946	9.0
2016	0.216	26.989	25.300	6.679	204.313	53.939	8.1
2017	0.216	27.870	30.984	8.180	210.533	55.582	6.8
2018	0.216	27.553	46.942	12.393	311.090	82.129	6.6
2019	0.216	33.807	65.131	17.194	461.736	121.898	7.1

Table 47. Gulf of Mexico Red Snapper Commercial Handline Closed Season Discards West discards in numbers. Discards refer to the total number of fish discarded before applying the discard mortality rate. In SEDAR 74, catches were modelled as total catch, by summing the landings with the dead discards.

Year	Input N SE	Input N	Exp N	Exp Dead N	Exp B	Exp Dead B	MW
1995	0.555	97.838	93.201	19.759	201.112	42.636	2.2
1996	0.555	86.784	83.277	17.655	191.846	40.671	2.3
1997	0.555	146.697	140.626	29.813	345.691	73.287	2.5
1998	0.555	112.030	109.903	23.299	282.683	59.929	2.6
1999	0.555	141.937	138.581	29.379	336.559	71.350	2.4
2000	0.555	140.452	140.140	29.710	330.792	70.128	2.4
2001	0.555	96.650	96.540	20.467	240.063	50.893	2.5
2002	0.555	113.240	113.180	23.994	293.572	62.237	2.6
2003	0.555	113.700	115.615	24.510	284.475	60.309	2.5
2004	0.555	89.771	90.845	19.259	202.800	42.994	2.2
2005	0.555	71.675	72.729	15.419	152.584	32.348	2.1
2006	0.555	44.702	45.148	9.571	92.528	19.616	2.0

Table 48. Gulf of Mexico Red Snapper Commercial Handline Closed Season Discards Central discards in numbers. Discards refer to the total number of fish discarded before applying the discard mortality rate. In SEDAR 74, catches were modelled as total catch, by summing the landings with the dead discards.

Year	Input N SE	Input N	Exp N	Exp Dead N	Exp B	Exp Dead B	MW
1995	0.555	814.917	623.461	119.705	1,133.821	217.694	1.8
1996	0.555	776.910	670.714	128.777	1,028.219	197.418	1.5
1997	0.555	625.567	571.326	109.695	834.596	160.242	1.5
1998	0.555	613.507	575.080	110.415	1,007.458	193.432	1.8
1999	0.555	715.912	687.119	131.927	1,374.380	263.880	2.0
2000	0.555	568.572	602.177	115.618	1,154.650	221.692	1.9
2001	0.555	524.182	503.319	96.637	949.126	182.232	1.9
2002	0.555	506.465	496.779	95.382	942.570	180.974	1.9
2003	0.555	602.113	603.915	115.952	1,092.863	209.830	1.8
2004	0.555	462.990	484.791	93.080	848.377	162.888	1.7
2005	0.555	320.799	341.833	65.632	500.907	96.174	1.5
2006	0.555	341.403	360.550	69.226	527.435	101.268	1.5

Table 49. Gulf of Mexico Red Snapper Commercial Handline Closed Season Discards East discards in numbers. Discards refer to the total number of fish discarded before applying the discard mortality rate. In SEDAR 74, catches were modelled as total catch, by summing the landings with the dead discards.

Year	Input N SE	Input N	Exp N	Exp Dead N	Exp B	Exp Dead B	MW
1995	0.555	49.407	52.116	12.873	110.262	27.235	2.1
1996	0.555	44.801	46.038	11.371	80.175	19.803	1.7
1997	0.555	45.591	46.334	11.445	64.637	15.965	1.4
1998	0.555	40.922	41.351	10.214	78.340	19.350	1.9
1999	0.555	45.994	46.839	11.569	117.747	29.084	2.5
2000	0.555	43.318	45.135	11.148	102.522	25.323	2.3
2001	0.555	35.597	36.903	9.115	83.621	20.654	2.3
2002	0.555	34.744	35.775	8.836	94.511	23.344	2.6
2003	0.555	30.947	31.507	7.782	92.518	22.852	2.9
2004	0.555	47.398	48.496	11.979	146.438	36.170	3.0
2005	0.555	24.559	24.791	6.123	68.918	17.023	2.8
2006	0.555	26.249	26.392	6.519	62.192	15.361	2.4

Table 50. Gulf of Mexico Red Snapper Commercial Longline Closed Season Discards West discards in numbers. Discards refer to the total number of fish discarded before applying the discard mortality rate. In SEDAR 74, catches were modelled as total catch, by summing the landings with the dead discards.

Year	Input N SE	Input N	Exp N	Exp Dead N	Exp B	Exp Dead B	MW
1995	0.555	0.710	0.709	0.157	5.670	1.253	8.0
1996	0.555	0.564	0.563	0.124	4.574	1.011	8.1
1997	0.555	0.348	0.348	0.077	2.909	0.643	8.4
1998	0.555	0.398	0.397	0.088	3.439	0.760	8.7
1999	0.555	0.786	0.785	0.173	6.953	1.537	8.9
2000	0.555	0.590	0.589	0.130	5.177	1.144	8.8
2001	0.555	0.410	0.409	0.090	3.634	0.803	8.9
2002	0.555	0.517	0.517	0.114	4.674	1.033	9.0
2003	0.555	0.656	0.655	0.145	5.997	1.325	9.2
2004	0.555	0.560	0.560	0.124	5.053	1.117	9.0
2005	0.555	0.465	0.465	0.103	4.060	0.897	8.7
2006	0.555	0.334	0.334	0.074	2.758	0.609	8.3

Table 51. Gulf of Mexico Red Snapper Commercial Longline Closed Season Discards Central discards in numbers. Discards refer to the total number of fish discarded before applying the discard mortality rate. In SEDAR 74, catches were modelled as total catch, by summing the landings with the dead discards.

Year	Input N SE	Input N	Exp N	Exp Dead N	Exp B	Exp Dead B	MW
1995	0.555	0.596	0.594	0.242	3.603	1.466	6.1
1996	0.555	0.531	0.530	0.216	2.976	1.211	5.6
1997	0.555	0.588	0.587	0.239	2.669	1.086	4.5
1998	0.555	0.410	0.410	0.167	1.845	0.751	4.5
1999	0.555	0.275	0.274	0.112	1.383	0.563	5.0
2000	0.555	0.534	0.534	0.217	2.889	1.176	5.4
2001	0.555	0.507	0.507	0.206	2.826	1.150	5.6
2002	0.555	0.498	0.497	0.202	2.743	1.116	5.5
2003	0.555	0.642	0.641	0.261	3.386	1.378	5.3
2004	0.555	0.404	0.404	0.165	2.036	0.828	5.0
2005	0.555	0.430	0.430	0.175	2.081	0.847	4.8
2006	0.555	0.403	0.403	0.164	1.753	0.713	4.3

Table 52. Gulf of Mexico Red Snapper Commercial Longline Closed Season Discards East discards in numbers. Discards refer to the total number of fish discarded before applying the discard mortality rate. In SEDAR 74, catches were modelled as total catch, by summing the landings with the dead discards.

Year	Input N SE	Input N	Exp N	Exp Dead N	Exp B	Exp Dead B	MW
1995	0.555	10.629	12.486	3.296	51.396	13.569	4.1
1996	0.555	10.996	11.648	3.075	42.318	11.172	3.6
1997	0.555	13.103	13.260	3.501	36.757	9.704	2.8
1998	0.555	13.039	12.946	3.418	41.369	10.922	3.2
1999	0.555	14.040	14.140	3.733	57.662	15.223	4.1
2000	0.555	11.891	14.098	3.722	56.806	14.997	4.0
2001	0.555	11.817	15.223	4.019	62.549	16.513	4.1
2002	0.555	9.608	11.587	3.059	53.537	14.134	4.6
2003	0.555	10.705	12.699	3.353	65.735	17.354	5.2
2004	0.555	9.411	10.552	2.786	56.953	15.036	5.4
2005	0.555	6.199	6.596	1.741	35.559	9.387	5.4
2006	0.555	7.622	8.006	2.114	37.049	9.781	4.6

Table 53. Input (with log-scale standard errors, SE) and expected (Exp) discards for the Recreational Charter West fleet in number (N, 1,000s of fish) and biomass (B, thousand pounds whole weight) for Gulf of Mexico Red Snapper. Dead discards in numbers (discard mortality rate = 0.412), dead discards in biomass, and mean weight (MW, whole pounds per fish) are included. Mean weight was determined by dividing the expected discards in weights by the expected discards in numbers.

Year	Input N SE	Input N	Exp N	Exp Dead N	Exp B	Exp Dead B	MW
1982	0.82	13.00	2.53	1.04	0.36	0.15	0.10
1983	0.65	1.53	3.68	1.52	0.49	0.20	0.10
1984	0.83	0.01	2.81	1.16	0.38	0.16	0.10
1985	0.78	0.03	3.87	1.59	0.59	0.24	0.20
1986	0.39	2.57	0.87	0.36	0.11	0.04	0.10
1987	0.73	1.80	0.49	0.20	0.08	0.03	0.20
1988	0.74	1.21	0.12	0.05	0.02	0.01	0.20
1989	0.82	4.60	1.28	0.53	0.10	0.04	0.10
1990	0.61	64.07	41.81	17.23	30.16	12.43	0.70
1991	0.32	140.53	127.31	52.45	93.25	38.42	0.70
1992	0.36	111.92	112.41	46.31	82.93	34.17	0.70
1993	0.31	67.21	57.84	23.83	42.87	17.66	0.70
1994	0.31	107.78	57.10	23.52	41.43	17.07	0.70
1995	0.47	89.03	71.82	29.59	69.73	28.73	1.00
1996	0.44	90.82	61.91	25.50	68.57	28.25	1.10
1997	0.32	61.02	55.29	22.78	62.93	25.93	1.10
1998	0.46	47.40	63.89	26.32	71.56	29.48	1.10
1999	0.50	12.32	35.45	14.61	48.82	20.11	1.40
2000	0.33	8.45	15.24	6.28	14.96	6.16	1.00
2001	0.52	15.10	17.98	7.41	19.30	7.95	1.10
2002	0.35	36.58	44.96	18.52	47.77	19.68	1.10
2003	0.28	55.88	58.73	24.20	53.15	21.90	0.90
2004	0.30	177.15	136.09	56.07	115.89	47.74	0.90
2005	0.31	166.53	132.32	54.52	118.15	48.68	0.90
2006	0.26	188.84	152.11	62.67	146.36	60.30	1.00
2007	0.22	121.51	78.69	32.42	60.95	25.11	0.80
2008	0.24	39.65	29.29	12.07	29.19	12.03	1.00
2009	0.09	13.88	13.75	5.66	11.46	4.72	0.80
2010	0.06	20.18	19.41	8.00	17.43	7.18	0.90

Table 53 Continued. Input (with log-scale standard errors, SE) and expected (Exp) discards for the Recreational Charter West fleet in number (N, 1,000s of fish) and biomass (B, thousand pounds whole weight) for Gulf of Mexico Red Snapper. Dead discards in numbers (discard mortality rate = 0.412), dead discards in biomass, and mean weight (MW, whole pounds per fish) are included. Mean weight was determined by dividing the expected discards in weights by the expected discards in numbers.

Year	Input N SE	Input N	Exp N	Exp Dead N	Exp B	Exp Dead B	MW
2011	0.05	4.56	4.54	1.87	3.99	1.64	0.90
2012	0.09	7.70	7.74	3.19	6.31	2.60	0.80
2013	0.05	11.48	11.40	4.70	10.31	4.25	0.90
2014	0.05	3.61	3.57	1.47	3.39	1.40	0.90
2015	0.05	8.45	8.33	3.43	7.01	2.89	0.80
2016	0.05	6.60	6.96	2.87	6.15	2.53	0.90
2017	0.07	4.60	5.30	2.18	5.10	2.10	1.00
2018	0.05	2.99	3.15	1.30	2.75	1.13	0.90
2019	0.06	15.86	14.32	5.90	12.98	5.35	0.90

Table 54. Input (with log-scale standard errors, SE) and expected (Exp) discards for the Recreational Charter Central fleet in number (N, 1,000s of fish) and biomass (B, thousand pounds whole weight) for Gulf of Mexico Red Snapper. Dead discards in numbers (discard mortality rate = 0.169), dead discards in biomass, and mean weight (MW, whole pounds per fish) are included. Mean weight was determined by dividing the expected discards in weights by the expected discards in numbers.

Year	Input N SE	Input N	Exp N	Exp Dead N	Exp B	Exp Dead B	MW
1981	0.64	0.49	3.85	0.65	0.38	0.06	0.10
1982	0.83	7.74	35.62	6.02	2.79	0.47	0.10
1984	0.83	3.78	21.13	3.57	1.89	0.32	0.10
1985	0.83	2.29	18.79	3.18	1.93	0.33	0.10
1986	0.58	7.33	24.98	4.22	3.19	0.54	0.10
1987	0.38	42.60	44.12	7.46	2.83	0.48	0.10
1988	0.74	64.91	32.61	5.51	3.45	0.58	0.10
1989	0.43	35.09	40.35	6.82	2.27	0.38	0.10
1990	0.38	80.69	133.37	22.54	76.78	12.98	0.60
1991	0.28	196.02	171.38	28.96	104.54	17.67	0.60
1992	0.20	317.61	281.20	47.52	183.91	31.08	0.70
1993	0.43	260.03	447.24	75.58	307.30	51.92	0.70
1994	0.24	273.36	228.56	38.63	131.10	22.16	0.60
1995	0.41	401.69	148.13	25.04	342.79	57.93	2.30
1996	0.28	486.47	262.24	44.32	556.84	94.11	2.10
1997	0.25	833.41	393.32	66.47	817.97	138.24	2.10
1998	0.11	588.80	522.66	88.33	1,196.20	202.16	2.30
1999	0.09	715.19	661.66	111.82	1,716.74	290.13	2.60
2000	0.08	369.34	299.92	50.69	749.62	126.68	2.50
2001	0.10	472.44	337.60	57.05	825.62	139.52	2.40
2002	0.09	465.10	410.02	69.29	999.58	168.94	2.40
2003	0.09	498.26	420.95	71.14	1,010.22	170.73	2.40
2004	0.09	531.11	447.76	75.67	1,057.51	178.73	2.40
2005	0.09	484.19	395.99	66.92	866.86	146.50	2.20
2006	0.11	651.50	466.08	78.77	1,005.03	169.85	2.20
2007	0.11	581.52	508.70	85.97	1,437.59	242.95	2.80
2008	0.09	166.67	178.87	30.23	561.25	94.85	3.10
2009	0.05	213.61	206.80	34.95	725.04	122.53	3.50
2010	0.06	55.90	54.57	9.22	210.92	35.65	3.90

Table 54 Continued. Input (with log-scale standard errors, SE) and expected (Exp) discards for the Recreational Charter Central fleet in number (N, 1,000s of fish) and biomass (B, thousand pounds whole weight) for Gulf of Mexico Red Snapper. Dead discards in numbers (discard mortality rate = 0.169), dead discards in biomass, and mean weight (MW, whole pounds per fish) are included. Mean weight was determined by dividing the expected discards in weights by the expected discards in numbers.

Year	Input N SE	Input N	Exp N	Exp Dead N	Exp B	Exp Dead B	MW
2011	0.05	99.76	99.36	16.79	414.65	70.08	4.20
2012	0.08	65.41	68.22	11.53	295.18	49.88	4.30
2013	0.05	77.99	78.11	13.20	341.69	57.75	4.40
2014	0.05	12.23	12.38	2.09	52.79	8.92	4.30
2015	0.05	63.24	64.54	10.91	267.03	45.13	4.10
2016	0.05	116.90	117.00	19.77	462.89	78.23	4.00
2017	0.05	184.25	183.12	30.95	693.54	117.21	3.80
2018	0.05	128.46	128.92	21.79	485.44	82.04	3.80
2019	0.05	158.79	159.35	26.93	626.76	105.92	3.90

Table 55. Input (with log-scale standard errors, SE) and expected (Exp) discards for the Recreational Charter East fleet in number (N, 1,000s of fish) and biomass (B, thousand pounds whole weight) for Gulf of Mexico Red Snapper. Dead discards in numbers (discard mortality rate = 0.268), dead discards in biomass, and mean weight (MW, whole pounds per fish) are included. Mean weight was determined by dividing the expected discards in weights by the expected discards in numbers.

Year	Input N SE	Input N	Exp N	Exp Dead N	Exp B	Exp Dead B	MW
1982	0.83	0.40	0.10	0.03	0.01	0.00	0.10
1984	0.83	3.59	1.09	0.29	0.09	0.02	0.10
1985	0.83	1.01	0.46	0.12	0.06	0.01	0.10
1986	0.43	17.13	4.08	1.09	0.40	0.11	0.10
1987	0.83	1.64	0.20	0.05	0.03	0.01	0.10
1992	0.62	1.02	1.35	0.36	0.72	0.19	0.50
1994	0.83	0.06	0.05	0.01	0.03	0.01	0.60
1997	0.83	0.23	0.28	0.07	0.26	0.07	0.90
1998	0.50	2.89	2.10	0.56	2.52	0.68	1.20
1999	0.69	1.92	0.90	0.24	1.90	0.51	2.10
2000	0.66	0.17	0.12	0.03	0.18	0.05	1.50
2001	0.65	0.08	0.18	0.05	0.27	0.07	1.50
2003	0.77	0.30	0.30	0.08	0.48	0.13	1.60
2005	0.56	0.52	0.40	0.11	0.61	0.16	1.50
2006	0.50	7.99	10.91	2.92	16.30	4.37	1.50
2007	0.58	0.23	0.34	0.09	1.42	0.38	4.10
2008	0.07	2.38	2.39	0.64	10.06	2.69	4.20
2009	0.06	4.88	4.83	1.29	21.77	5.84	4.50
2010	0.10	1.81	1.82	0.49	9.21	2.47	5.10
2012	0.05	0.62	0.63	0.17	3.78	1.01	6.00
2013	0.05	4.88	4.82	1.29	29.69	7.96	6.20
2014	0.05	1.13	1.13	0.30	6.95	1.86	6.10
2015	0.05	5.52	5.52	1.48	31.28	8.38	5.70
2016	0.05	5.40	5.41	1.45	23.98	6.43	4.40
2017	0.05	14.47	14.51	3.89	59.66	15.99	4.10
2018	0.05	15.93	15.96	4.28	71.48	19.16	4.50
2019	0.05	9.61	9.65	2.59	49.85	13.36	5.20

Table 56. Input (with log-scale standard errors, SE) and expected (Exp) discards for the Recreational Headboat West fleet in number (N, 1,000s of fish) and biomass (B, thousand pounds whole weight) for Gulf of Mexico Red Snapper. Dead discards in numbers (discard mortality rate = 0.406), dead discards in biomass, and mean weight (MW, whole pounds per fish) are included. Mean weight was determined by dividing the expected discards in weights by the expected discards in numbers.

Year	Input N SE	Input N	Exp N	Exp Dead N	Exp B	Exp Dead B	MW
1982	0.82	18.09	4.71	1.91	1.35	0.55	0.30
1983	0.65	0.13	3.62	1.47	1.03	0.42	0.30
1984	0.83	19.58	4.97	2.02	1.41	0.57	0.30
1985	0.78	15.66	5.11	2.08	1.47	0.60	0.30
1986	0.39	2.85	3.55	1.44	1.00	0.41	0.30
1987	0.73	2.43	3.78	1.54	1.09	0.44	0.30
1988	0.74	9.28	4.72	1.92	1.36	0.55	0.30
1989	0.82	7.36	4.64	1.88	1.20	0.49	0.30
1990	0.61	114.39	325.86	132.30	220.25	89.42	0.70
1991	0.32	87.51	275.61	111.90	190.66	77.41	0.70
1992	0.36	102.00	378.94	153.85	263.67	107.05	0.70
1993	0.31	102.38	300.23	121.89	212.40	86.23	0.70
1994	0.31	254.27	444.45	180.44	306.77	124.55	0.70
1995	0.47	116.36	171.81	69.75	355.70	144.41	2.10
1996	0.44	150.72	147.28	59.80	308.96	125.44	2.10
1997	0.32	85.01	130.66	53.05	280.95	114.06	2.20
1998	0.46	30.06	115.79	47.01	251.68	102.18	2.20
1999	0.50	6.08	71.68	29.10	148.87	60.44	2.10
2000	0.33	14.75	45.63	18.52	81.70	33.17	1.80
2001	0.52	24.75	62.00	25.17	112.43	45.65	1.80
2002	0.35	26.04	75.69	30.73	138.67	56.30	1.80
2003	0.28	45.14	56.40	22.90	102.52	41.62	1.80
2004	0.30	65.34	71.47	29.02	127.26	51.67	1.80
2005	0.31	72.08	73.54	29.86	130.08	52.81	1.80
2006	0.26	70.06	82.61	33.54	146.98	59.67	1.80
2007	0.22	58.53	60.06	24.38	55.87	22.68	0.90
2008	0.45	41.53	22.66	9.20	28.68	11.64	1.30
2009	0.48	30.97	20.54	8.34	22.72	9.22	1.10
2010	0.83	18.41	12.59	5.11	14.85	6.03	1.20

Table 56 Continued. Input (with log-scale standard errors, SE) and expected (Exp) discards for the Recreational Headboat West fleet in number (N, 1,000s of fish) and biomass (B, thousand pounds whole weight) for Gulf of Mexico Red Snapper. Dead discards in numbers (discard mortality rate = 0.406), dead discards in biomass, and mean weight (MW, whole pounds per fish) are included. Mean weight was determined by dividing the expected discards in weights by the expected discards in numbers.

Year	Input N SE	Input N	Exp N	Exp Dead N	Exp B	Exp Dead B	MW
2011	0.67	23.09	10.78	4.38	12.63	5.13	1.20
2012	0.41	15.91	12.46	5.06	13.41	5.44	1.10
2013	0.50	9.85	9.33	3.79	11.04	4.48	1.20
2014	0.33	8.57	6.71	2.72	8.45	3.43	1.30
2015	0.26	9.71	12.45	5.05	13.97	5.67	1.10
2016	0.23	9.78	12.12	4.92	14.11	5.73	1.20
2017	0.18	10.28	10.48	4.26	13.42	5.45	1.30
2018	0.21	9.50	11.23	4.56	13.16	5.34	1.20
2019	0.23	11.31	12.51	5.08	14.97	6.08	1.20

Table 57. Input (with log-scale standard errors, SE) and expected (Exp) discards for the Recreational Headboat Central fleet in number (N, 1,000s of fish) and biomass (B, thousand pounds whole weight) for Gulf of Mexico Red Snapper. Dead discards in numbers (discard mortality rate = 0.244), dead discards in biomass, and mean weight (MW, whole pounds per fish) are included. Mean weight was determined by dividing the expected discards in weights by the expected discards in numbers.

Year	Input N SE	Input N	Exp N	Exp Dead N	Exp B	Exp Dead B	MW
1981	0.64	0.30	1.40	0.34	0.12	0.03	0.10
1982	0.83	4.84	13.42	3.27	0.88	0.21	0.10
1984	0.83	2.37	7.42	1.81	0.55	0.13	0.10
1985	0.83	1.43	6.33	1.54	0.54	0.13	0.10
1986	0.58	0.14	0.36	0.09	0.04	0.01	0.10
1987	0.38	0.55	0.55	0.14	0.03	0.01	0.10
1988	0.74	1.49	0.62	0.15	0.06	0.01	0.10
1989	0.43	1.14	1.25	0.30	0.06	0.01	0.00
1990	0.38	5.51	11.90	2.90	8.10	1.98	0.70
1991	0.28	10.10	11.36	2.77	7.96	1.94	0.70
1992	0.20	19.40	21.57	5.26	15.74	3.84	0.70
1993	0.43	7.27	18.44	4.50	13.77	3.36	0.70
1994	0.24	13.40	15.86	3.87	10.45	2.55	0.70
1995	0.41	19.78	17.09	4.17	33.16	8.09	1.90
1996	0.28	20.72	20.93	5.11	40.60	9.91	1.90
1997	0.25	48.05	40.41	9.86	75.47	18.41	1.90
1998	0.11	37.80	43.44	10.60	83.87	20.46	1.90
1999	0.09	55.91	61.52	15.01	127.36	31.07	2.10
2000	0.08	48.14	48.67	11.87	80.05	19.53	1.60
2001	0.10	46.24	47.28	11.54	77.32	18.86	1.60
2002	0.09	47.61	51.74	12.62	85.07	20.76	1.60
2003	0.09	48.92	50.47	12.31	82.91	20.23	1.60
2004	0.09	45.55	47.17	11.51	77.13	18.82	1.60
2005	0.09	39.29	39.63	9.67	64.70	15.79	1.60
2006	0.11	61.51	61.52	15.01	99.07	24.17	1.60
2007	0.11	57.59	60.34	14.72	94.02	22.94	1.60
2008	0.11	94.05	100.91	24.62	203.13	49.56	2.00
2009	0.12	94.20	105.97	25.86	255.86	62.43	2.40
2010	0.15	52.80	48.11	11.74	125.82	30.70	2.60

Table 57 Continued. Input (with log-scale standard errors, SE) and expected (Exp) discards for the Recreational Headboat Central fleet in number (N, 1,000s of fish) and biomass (B, thousand pounds whole weight) for Gulf of Mexico Red Snapper. Dead discards in numbers (discard mortality rate = 0.244), dead discards in biomass, and mean weight (MW, whole pounds per fish) are included. Mean weight was determined by dividing the expected discards in weights by the expected discards in numbers.

Year	Input N SE	Input N	Exp N	Exp Dead N	Exp B	Exp Dead B	MW
2011	0.12	82.10	83.75	20.43	251.51	61.37	3.00
2012	0.12	71.58	70.46	17.19	207.37	50.60	2.90
2013	0.21	80.01	63.36	15.46	178.88	43.65	2.80
2014	0.17	59.83	61.06	14.90	168.79	41.19	2.80
2015	0.15	53.35	69.08	16.86	171.88	41.94	2.50
2016	0.19	81.82	67.00	16.35	152.86	37.30	2.30
2017	0.20	115.41	89.29	21.79	209.61	51.15	2.30
2018	0.15	95.23	87.08	21.25	217.11	52.98	2.50
2019	0.25	77.43	59.84	14.60	159.57	38.94	2.70

Table 58. Input (with log-scale standard errors, SE) and expected (Exp) discards for the Recreational Headboat East fleet in number (N, 1,000s of fish) and biomass (B, thousand pounds whole weight) for Gulf of Mexico Red Snapper. Dead discards in numbers (discard mortality rate = 0.279), dead discards in biomass, and mean weight (MW, whole pounds per fish) are included. Mean weight was determined by dividing the expected discards in weights by the expected discards in numbers.

Year	Input N SE	Input N	Exp N	Exp Dead N	Exp B	Exp Dead B	MW
1982	0.83	0.25	0.04	0.01	0.00	0.00	0.10
1984	0.83	2.25	0.51	0.14	0.04	0.01	0.10
1985	0.83	0.63	0.19	0.05	0.02	0.01	0.10
1986	0.43	0.12	0.06	0.02	0.00	0.00	0.10
1987	0.83	0.06	0.01	0.00	0.00	0.00	0.10
1992	0.62	0.00	0.02	0.01	0.01	0.00	0.70
1994	0.83	0.07	0.18	0.05	0.13	0.04	0.70
1997	0.83	0.00	0.01	0.00	0.02	0.01	1.40
1998	0.50	0.03	0.06	0.01	0.08	0.02	1.50
1999	0.69	1.89	4.51	1.26	8.87	2.48	2.00
2000	0.66	0.24	0.45	0.12	0.73	0.20	1.60
2001	0.65	0.50	0.64	0.18	1.03	0.29	1.60
2003	0.77	0.25	0.29	0.08	0.48	0.13	1.70
2004	0.50	0.67	0.82	0.23	1.34	0.37	1.60
2005	0.56	1.36	2.87	0.80	4.69	1.31	1.60
2006	0.50	0.54	0.81	0.23	1.30	0.36	1.60
2007	0.58	0.59	1.23	0.34	2.86	0.80	2.30
2008	0.68	3.92	2.34	0.65	5.98	1.67	2.60
2009	0.59	5.84	4.22	1.18	13.48	3.76	3.20
2010	0.68	1.53	2.33	0.65	8.61	2.40	3.70
2011	0.80	6.29	3.62	1.01	14.34	4.00	4.00
2012	0.76	2.10	3.14	0.88	12.29	3.43	3.90
2013	0.78	1.57	3.22	0.90	13.55	3.78	4.20
2014	0.51	1.82	3.35	0.94	11.28	3.15	3.40
2015	0.60	1.49	7.82	2.18	17.67	4.93	2.30
2016	0.41	11.35	6.11	1.70	14.44	4.03	2.40
2017	0.64	15.27	13.11	3.66	35.91	10.02	2.70
2018	0.36	14.26	10.91	3.04	36.23	10.11	3.30
2019	0.37	12.68	9.86	2.75	37.59	10.49	3.80

Table 59. Input (with log-scale standard errors, SE) and expected (Exp) discards for the Recreational Private West fleet in number (N, 1,000s of fish) and biomass (B, thousand pounds whole weight) for Gulf of Mexico Red Snapper. Dead discards in numbers (discard mortality rate = 0.355), dead discards in biomass, and mean weight (MW, whole pounds per fish) are included. Mean weight was determined by dividing the expected discards in weights by the expected discards in numbers.

Year	Input N SE	Input N	Exp N	Exp Dead N	Exp B	Exp Dead B	MW
1981	0.54	63.44	216.82	76.97	33.97	12.06	0.20
1982	0.58	6.49	109.80	38.98	17.95	6.37	0.20
1983	0.86	0.69	224.69	79.77	35.52	12.61	0.20
1984	0.76	43.56	60.93	21.63	9.73	3.46	0.20
1985	0.65	204.99	99.63	35.37	16.91	6.02	0.20
1986	0.79	38.58	122.77	43.58	18.98	6.72	0.20
1987	0.82	120.04	36.15	12.83	6.24	2.22	0.20
1988	0.51	529.27	59.10	20.98	9.97	3.54	0.20
1989	0.51	371.12	66.08	23.46	7.41	2.63	0.10
1990	0.64	422.26	616.64	218.91	392.16	139.22	0.60
1991	0.82	410.62	566.50	201.11	378.75	134.46	0.70
1992	0.32	450.63	590.88	209.77	404.82	143.71	0.70
1993	0.31	528.83	656.77	233.15	457.80	162.51	0.70
1994	0.50	1,213.19	923.49	327.84	600.87	213.32	0.70
1995	0.46	1,942.65	911.26	323.50	977.13	346.88	1.10
1996	0.47	413.06	619.42	219.90	736.70	261.54	1.20
1997	0.48	477.80	666.83	236.73	809.69	287.44	1.20
1998	0.50	739.98	674.78	239.54	808.50	287.02	1.20
1999	0.39	1,786.42	1,232.01	437.36	1,792.93	636.50	1.50
2000	0.39	542.97	770.64	273.57	913.23	324.20	1.20
2001	0.47	402.47	520.78	184.88	663.68	235.60	1.30
2002	0.66	643.37	485.75	172.44	620.10	220.13	1.30
2003	0.61	1,347.95	553.28	196.41	625.55	222.07	1.10
2004	0.75	2,647.41	621.14	220.50	660.18	234.36	1.10
2005	0.55	1,580.28	1,044.43	370.77	1,141.73	405.32	1.10
2006	0.40	1,769.55	1,328.35	471.57	1,538.03	546.02	1.20
2007	0.36	770.10	925.07	328.40	685.79	243.46	0.70
2008	0.48	564.89	440.78	156.48	485.13	172.22	1.10
2009	0.43	516.49	420.97	149.44	378.12	134.24	0.90

Table 59 Continued. Input (with log-scale standard errors, SE) and expected (Exp) discards for the Recreational Private West fleet in number (N, 1,000s of fish) and biomass (B, thousand pounds whole weight) for Gulf of Mexico Red Snapper. Dead discards in numbers (discard mortality rate = 0.355), dead discards in biomass, and mean weight (MW, whole pounds per fish) are included. Mean weight was determined by dividing the expected discards in weights by the expected discards in numbers.

Year	Input N SE	Input N	Exp N	Exp Dead N	Exp B	Exp Dead B	MW
2010	0.87	360.75	227.06	80.61	229.37	81.42	1.00
2011	0.55	353.80	304.21	108.00	303.51	107.75	1.00
2012	0.46	183.27	348.09	123.57	315.77	112.11	0.90
2013	0.45	1,288.67	518.75	184.16	537.07	190.66	1.00
2014	0.32	537.59	414.51	147.15	462.40	164.16	1.10
2015	0.32	609.31	536.79	190.56	517.29	183.65	1.00
2016	0.32	99.17	243.81	86.55	249.29	88.50	1.00
2017	0.27	320.40	345.22	122.55	399.08	141.67	1.20
2018	0.27	380.82	421.66	149.69	433.14	153.75	1.00
2019	0.24	844.18	724.12	257.06	773.58	274.63	1.10

Table 60. Input (with log-scale standard errors, SE) and expected (Exp) discards for the Recreational Private Central fleet in number (N, 1,000s of fish) and biomass (B, thousand pounds whole weight) for Gulf of Mexico Red Snapper. Dead discards in numbers (discard mortality rate = 0.297), dead discards in biomass, and mean weight (MW, whole pounds per fish) are included. Mean weight was determined by dividing the expected discards in weights by the expected discards in numbers.

Year	Input N SE	Input N	Exp N	Exp Dead N	Exp B	Exp Dead B	MW
1981	0.65	179.40	195.67	58.11	19.91	5.91	0.10
1982	0.60	13.17	31.63	9.39	2.50	0.74	0.10
1983	0.83	4.47	94.01	27.92	8.94	2.66	0.10
1985	0.83	0.92	61.85	18.37	6.63	1.97	0.10
1986	0.74	13.53	19.77	5.87	2.71	0.80	0.10
1987	0.36	113.80	97.24	28.88	6.24	1.85	0.10
1988	0.45	9.13	35.66	10.59	3.94	1.17	0.10
1989	0.55	323.03	201.16	59.74	11.29	3.35	0.10
1990	0.55	772.21	1,707.53	507.14	819.50	243.39	0.50
1991	0.28	1,587.53	2,786.73	827.66	1,360.66	404.12	0.50
1992	0.17	1,315.58	2,524.68	749.83	1,285.96	381.94	0.50
1993	0.23	1,657.18	2,889.42	858.16	1,497.80	444.85	0.50
1994	0.24	940.42	1,745.24	518.34	781.54	232.12	0.40
1995	0.31	226.08	462.19	137.27	409.51	121.63	0.90
1996	0.26	1,014.85	877.42	260.59	801.79	238.13	0.90
1997	0.25	2,024.07	1,945.96	577.95	1,713.48	508.90	0.90
1998	0.22	831.32	941.68	279.68	864.02	256.61	0.90
1999	0.22	2,312.35	2,659.31	789.81	3,473.91	1,031.76	1.30
2000	0.23	1,316.59	1,723.23	511.80	1,709.64	507.77	1.00
2001	0.19	1,673.86	2,093.54	621.78	2,053.63	609.93	1.00
2002	0.22	3,289.22	3,693.38	1,096.94	3,691.84	1,096.47	1.00
2003	0.20	2,425.09	2,831.27	840.88	2,821.47	837.98	1.00
2004	0.19	3,415.21	4,298.60	1,276.68	4,219.99	1,253.35	1.00
2005	0.18	2,388.49	3,004.66	892.38	2,988.23	887.51	1.00
2006	0.16	2,892.93	3,788.46	1,125.17	3,585.70	1,064.94	0.90
2007	0.16	4,146.94	4,741.30	1,408.17	3,533.98	1,049.60	0.70
2008	0.21	929.75	1,018.30	302.43	1,128.24	335.10	1.10
2009	0.17	1,497.50	1,131.34	336.01	1,468.26	436.07	1.30
2010	0.19	1,024.48	1,029.89	305.88	1,447.16	429.81	1.40

Table 60 Continued. Input (with log-scale standard errors, SE) and expected (Exp) discards for the Recreational Private Central fleet in number (N, 1,000s of fish) and biomass (B, thousand pounds whole weight) for Gulf of Mexico Red Snapper. Dead discards in numbers (discard mortality rate = 0.297), dead discards in biomass, and mean weight (MW, whole pounds per fish) are included. Mean weight was determined by dividing the expected discards in weights by the expected discards in numbers.

Year	Input N SE	Input N	Exp N	Exp Dead N	Exp B	Exp Dead B	MW
2011	0.17	881.73	944.51	280.52	1,625.11	482.66	1.70
2012	0.16	684.47	788.90	234.31	1,154.52	342.91	1.50
2013	0.29	1,641.12	1,289.26	382.91	1,805.85	536.34	1.40
2014	0.22	453.37	523.54	155.49	699.64	207.78	1.30
2015	0.19	1,029.77	920.26	273.32	1,030.57	306.09	1.10
2016	0.17	1,533.35	1,341.00	398.28	1,375.95	408.67	1.00
2017	0.17	2,727.02	2,594.06	770.43	3,061.22	909.18	1.20
2018	0.19	1,052.64	1,040.80	309.12	1,327.09	394.14	1.30
2019	0.17	1,186.89	1,329.98	395.00	1,892.34	562.02	1.40

Table 61. Input (with log-scale standard errors, SE) and expected (Exp) discards for the Recreational Private East fleet in number (N, 1,000s of fish) and biomass (B, thousand pounds whole weight) for Gulf of Mexico Red Snapper. Dead discards in numbers (discard mortality rate = 0.315), dead discards in biomass, and mean weight (MW, whole pounds per fish) are included. Mean weight was determined by dividing the expected discards in weights by the expected discards in numbers.

Year	Input N SE	Input N	Exp N	Exp Dead N	Exp B	Exp Dead B	MW
1981	0.64	76.36	31.97	10.07	5.56	1.75	0.20
1984	0.70	82.41	1.85	0.58	0.16	0.05	0.10
1985	0.71	41.32	11.33	3.57	1.49	0.47	0.10
1986	0.64	11.69	17.49	5.51	1.80	0.57	0.10
1987	0.64	3.10	7.97	2.51	1.13	0.36	0.10
1988	0.46	35.69	6.69	2.11	0.56	0.18	0.10
1989	0.64	7.02	10.42	3.28	1.60	0.50	0.20
1990	0.83	21.54	118.86	37.44	63.46	19.99	0.50
1991	0.40	78.28	45.62	14.37	24.03	7.57	0.50
1992	0.42	80.07	10.16	3.20	4.93	1.55	0.50
1993	0.45	29.73	0.05	0.01	0.02	0.01	0.50
1994	0.55	38.86	0.05	0.01	0.02	0.01	0.50
1995	0.69	13.97	7.26	2.29	6.37	2.01	0.90
1996	0.46	35.81	80.19	25.26	69.86	22.01	0.90
1997	0.83	25.99	0.04	0.01	0.04	0.01	0.80
1998	0.55	12.66	0.05	0.01	0.04	0.01	0.90
1999	0.44	26.44	29.08	9.16	38.51	12.13	1.30
2000	0.62	66.17	6.53	2.06	6.18	1.95	0.90
2001	0.83	5.73	0.04	0.01	0.04	0.01	0.90
2002	0.83	6.87	14.84	4.67	14.45	4.55	1.00
2003	0.65	2.07	3.54	1.12	3.56	1.12	1.00
2004	0.67	25.30	12.53	3.95	11.95	3.77	1.00
2005	0.46	92.92	171.41	53.99	166.54	52.46	1.00
2006	0.51	30.94	46.15	14.54	42.23	13.30	0.90
2007	0.49	43.27	85.63	26.97	161.42	50.85	1.90
2008	0.57	4.08	7.76	2.44	16.98	5.35	2.20
2009	0.61	51.47	20.77	6.54	68.38	21.54	3.30
2010	0.52	24.25	3.71	1.17	14.41	4.54	3.90
2011	0.82	8.01	14.98	4.72	57.60	18.14	3.80

Table 61 Continued. Input (with log-scale standard errors, SE) and expected (Exp) discards for the Recreational Private East fleet in number (N, 1,000s of fish) and biomass (B, thousand pounds whole weight) for Gulf of Mexico Red Snapper. Dead discards in numbers (discard mortality rate = 0.315), dead discards in biomass, and mean weight (MW, whole pounds per fish) are included. Mean weight was determined by dividing the expected discards in weights by the expected discards in numbers.

Year	Input N SE	Input N	Exp N	Exp Dead N	Exp B	Exp Dead B	MW
2012	0.83	3.69	13.92	4.38	53.02	16.70	3.80
2013	0.46	3.03	3.20	1.01	13.95	4.39	4.40
2014	0.55	6.50	7.05	2.22	20.20	6.37	2.90
2015	0.58	3.80	5.12	1.61	8.81	2.77	1.70
2016	0.60	38.49	58.82	18.53	114.43	36.05	1.90
2017	0.33	61.76	96.37	30.36	247.06	77.83	2.60
2018	0.38	123.73	94.41	29.74	334.59	105.40	3.50
2019	0.35	61.01	82.45	25.97	325.93	102.67	4.00

Table 62. Input (with log-scale standard errors, SE) and expected (Exp) discards for the Recreational Private Closed Season Discards West fleet in number (N, 1,000s of fish) and biomass (B, thousand pounds whole weight) for Gulf of Mexico Red Snapper. Dead discards in numbers (discard mortality rate = 0.211), dead discards in biomass, and mean weight (MW, whole pounds per fish) are included. Mean weight was determined by dividing the expected discards in weights by the expected discards in numbers.

Year	Input N SE	Input N	Exp N	Exp Dead N	Exp B	Exp Dead B	MW
1997	0.48	10.63	10.62	2.24	24.42	5.15	2.30
1998	0.50	51.69	51.47	10.86	122.52	25.85	2.40
1999	0.39	250.97	247.73	52.27	561.78	118.53	2.30
2000	0.39	183.00	183.48	38.72	405.03	85.46	2.20
2001	0.47	112.14	112.40	23.72	259.35	54.72	2.30
2002	0.66	144.24	145.52	30.70	348.04	73.44	2.40
2003	0.61	404.23	446.40	94.19	1,022.29	215.70	2.30
2004	0.75	539.52	662.12	139.71	1,396.00	294.56	2.10
2005	0.55	444.25	501.63	105.84	1,007.87	212.66	2.00
2006	0.40	470.84	501.91	105.90	996.71	210.31	2.00
2007	0.36	300.11	305.19	64.40	640.41	135.13	2.10
2008	0.48	1,042.73	1,062.49	224.19	2,935.65	619.42	2.80
2009	0.43	608.94	619.49	130.71	1,771.26	373.74	2.90
2010	0.87	692.12	662.43	139.77	2,070.39	436.85	3.10
2011	0.55	981.43	990.36	208.97	3,347.87	706.40	3.40
2012	0.46	506.70	514.20	108.50	1,718.10	362.52	3.30
2013	0.45	547.57	538.54	113.63	1,922.57	405.66	3.60
2014	0.32	87.80	87.55	18.47	333.98	70.47	3.80
2015	0.32	143.82	143.33	30.24	530.27	111.89	3.70
2016	0.32	19.68	19.68	4.15	74.75	15.77	3.80

Table 63. Input (with log-scale standard errors, SE) and expected (Exp) discards for the Recreational Private Closed Season Discards Central fleet in number (N, 1,000s of fish) and biomass (B, thousand pounds whole weight) for Gulf of Mexico Red Snapper. Dead discards in numbers (discard mortality rate = 0.297), dead discards in biomass, and mean weight (MW, whole pounds per fish) are included. Mean weight was determined by dividing the expected discards in weights by the expected discards in numbers.

Year	Input N SE	Input N	Exp N	Exp Dead N	Exp B	Exp Dead B	MW
1997	0.25	243.97	241.67	71.78	340.67	101.18	1.40
1998	0.22	281.52	279.94	83.14	440.89	130.94	1.60
1999	0.22	371.64	370.25	109.96	722.22	214.50	2.00
2000	0.23	1,245.76	1,292.48	383.87	2,423.08	719.65	1.90
2001	0.19	2,698.90	2,625.39	779.74	4,622.52	1,372.88	1.80
2002	0.22	3,136.65	3,067.59	911.08	5,460.78	1,621.85	1.80
2003	0.20	1,924.07	1,934.68	574.60	3,387.02	1,005.95	1.80
2004	0.19	1,089.85	1,110.62	329.85	1,831.27	543.89	1.60
2005	0.18	1,639.57	1,744.38	518.08	2,925.31	868.82	1.70
2006	0.16	1,280.18	1,308.91	388.75	1,843.22	547.44	1.40
2007	0.16	1,549.03	1,590.73	472.45	2,746.03	815.57	1.70
2008	0.21	3,426.38	3,539.36	1,051.19	8,605.76	2,555.90	2.40
2009	0.17	2,339.13	2,297.21	682.27	7,138.80	2,120.22	3.10
2010	0.19	3,401.43	3,673.36	1,090.99	12,708.80	3,774.51	3.50
2011	0.17	2,847.78	3,195.68	949.12	12,987.61	3,857.31	4.10
2012	0.16	3,286.85	3,611.79	1,072.70	14,532.61	4,316.18	4.00
2013	0.29	3,230.27	2,818.79	837.18	11,042.35	3,279.57	3.90
2014	0.22	3,411.62	3,018.37	896.46	11,642.69	3,457.88	3.90
2015	0.19	2,127.99	1,975.29	586.66	6,818.89	2,025.21	3.50
2016	0.17	3,949.25	3,358.92	997.60	10,529.57	3,127.28	3.10
2017	0.17	5,539.61	5,303.41	1,575.11	16,873.76	5,011.50	3.20
2018	0.19	3,972.81	3,590.33	1,066.33	12,067.52	3,584.05	3.40
2019	0.17	4,577.79	4,703.63	1,396.98	16,976.12	5,041.92	3.60

Table 64. Input (with log-scale standard errors, SE) and expected (Exp) discards for the Recreational Private Closed Season Discards East fleet in number (N, 1,000s of fish) and biomass (B, thousand pounds whole weight) for Gulf of Mexico Red Snapper. Dead discards in numbers (discard mortality rate = 0.315), dead discards in biomass, and mean weight (MW, whole pounds per fish) are included. Mean weight was determined by dividing the expected discards in weights by the expected discards in numbers.

Year	Input N SE	Input N	Exp N	Exp Dead N	Exp B	Exp Dead B	MW
1998	0.55	52.95	54.09	17.04	95.77	30.17	1.80
1999	0.44	23.42	23.70	7.47	59.44	18.73	2.50
2000	0.62	1.56	1.56	0.49	3.81	1.20	2.40
2003	0.65	2.92	2.93	0.92	8.40	2.65	2.90
2004	0.67	67.29	70.99	22.36	202.17	63.69	2.80
2005	0.46	36.26	36.67	11.55	106.09	33.42	2.90
2006	0.51	24.38	24.48	7.71	54.99	17.32	2.20
2008	0.57	36.40	37.00	11.65	126.82	39.95	3.40
2009	0.61	51.36	52.56	16.56	232.93	73.37	4.40
2010	0.52	105.22	107.39	33.83	541.47	170.56	5.00
2011	0.82	1,492.56	2,084.43	656.60	11,174.07	3,519.83	5.40
2012	0.83	10.60	10.68	3.36	58.79	18.52	5.50
2013	0.46	5.49	5.49	1.73	32.81	10.34	6.00
2014	0.55	42.88	42.92	13.52	209.14	65.88	4.90
2015	0.58	20.21	20.20	6.36	66.33	20.89	3.30
2016	0.60	669.67	744.46	234.50	2,455.11	773.36	3.30
2017	0.33	198.97	201.34	63.42	753.81	237.45	3.70
2018	0.38	523.31	541.69	170.63	2,462.58	775.72	4.50
2019	0.35	334.14	338.68	106.68	1,730.82	545.21	5.10

Table 65. Input (with log-scale standard errors, SE) and expected (Exp) discards for the Recreational Charter Closed Season Discards West fleet in number (N, 1,000s of fish) and biomass (B, thousand pounds whole weight) for Gulf of Mexico Red Snapper. Dead discards in numbers (discard mortality rate = 0.262), dead discards in biomass, and mean weight (MW, whole pounds per fish) are included. Mean weight was determined by dividing the expected discards in weights by the expected discards in numbers.

Year	Input N SE	Input N	Exp N	Exp Dead N	Exp B	Exp Dead B	MW
1997	0.32	0.40	0.40	0.10	0.98	0.26	2.50
1998	0.46	0.62	0.62	0.16	1.61	0.42	2.60
1999	0.50	0.56	0.56	0.15	1.35	0.35	2.40
2000	0.33	1.53	1.53	0.40	3.65	0.96	2.40
2002	0.35	1.14	1.14	0.30	2.96	0.78	2.60
2003	0.28	3.54	3.54	0.93	8.71	2.28	2.50
2004	0.30	1.38	1.38	0.36	3.10	0.81	2.20
2005	0.31	30.36	30.44	7.97	64.88	17.00	2.10
2006	0.26	13.50	13.51	3.54	28.33	7.42	2.10
2007	0.22	4.11	4.11	1.08	14.85	3.89	3.60
2008	0.24	28.55	28.52	7.47	119.16	31.22	4.20
2009	0.09	19.25	19.25	5.04	88.56	23.20	4.60
2010	0.06	2.65	2.65	0.69	12.94	3.39	4.90
2011	0.05	2.82	2.82	0.74	15.06	3.94	5.30
2012	0.09	11.46	11.46	3.00	62.59	16.40	5.50
2013	0.05	16.23	16.23	4.25	92.18	24.15	5.70
2014	0.05	3.36	3.36	0.88	20.14	5.28	6.00
2015	0.05	9.33	9.33	2.44	56.40	14.78	6.00
2016	0.05	6.45	6.45	1.69	39.60	10.38	6.10
2017	0.07	5.32	5.32	1.40	34.22	8.97	6.40
2018	0.05	3.95	3.95	1.04	25.65	6.72	6.50
2019	0.06	18.10	18.10	4.74	117.41	30.76	6.50

Table 66. Input (with log-scale standard errors, SE) and expected (Exp) discards for the Recreational Charter Closed Season Discards West fleet in number (N, 1,000s of fish) and biomass (B, thousand pounds whole weight) for Gulf of Mexico Red Snapper. Dead discards in numbers (discard mortality rate = 0.211), dead discards in biomass, and mean weight (MW, whole pounds per fish) are included. Mean weight was determined by dividing the expected discards in weights by the expected discards in numbers.

Year	Input N SE	Input N	Exp N	Exp Dead N	Exp B	Exp Dead B	MW
1997	0.25	14.87	14.85	2.51	43.30	7.32	2.90
1998	0.11	88.15	88.08	14.88	262.70	44.40	3.00
1999	0.09	143.26	143.19	24.20	466.35	78.81	3.30
2000	0.08	135.40	135.44	22.89	464.58	78.52	3.40
2001	0.10	99.10	99.03	16.74	337.88	57.10	3.40
2002	0.09	90.03	90.00	15.21	300.15	50.73	3.30
2003	0.09	75.09	75.08	12.69	244.67	41.35	3.30
2004	0.09	82.52	82.55	13.95	262.48	44.36	3.20
2005	0.09	87.76	87.82	14.84	266.50	45.04	3.00
2006	0.11	151.70	151.97	25.68	440.98	74.53	2.90
2007	0.11	103.57	103.66	17.52	349.19	59.01	3.40
2008	0.09	319.82	320.02	54.08	1,170.93	197.89	3.70
2009	0.05	262.25	262.21	44.31	1,083.75	183.15	4.10
2010	0.06	170.75	170.78	28.86	796.63	134.63	4.70
2011	0.05	276.19	276.34	46.70	1,418.87	239.79	5.10
2012	0.08	193.05	193.23	32.66	1,054.69	178.24	5.50
2013	0.05	324.96	324.83	54.90	1,835.75	310.24	5.70
2014	0.05	269.32	269.18	45.49	1,505.30	254.40	5.60
2015	0.05	195.17	195.08	32.97	1,072.45	181.24	5.50
2016	0.05	299.90	299.55	50.62	1,587.24	268.24	5.30
2017	0.05	353.69	353.62	59.76	1,755.94	296.75	5.00
2018	0.05	293.57	293.43	49.59	1,406.73	237.74	4.80
2019	0.05	338.37	338.42	57.19	1,676.07	283.25	5.00

Table 67. Input (with log-scale standard errors, SE) and expected (Exp) discards for the Recreational Charter Closed Season Discards Central fleet in number (N, 1,000s of fish) and biomass (B, thousand pounds whole weight) for Gulf of Mexico Red Snapper. Dead discards in numbers (discard mortality rate = 0.169), dead discards in biomass, and mean weight (MW, whole pounds per fish) are included. Mean weight was determined by dividing the expected discards in weights by the expected discards in numbers.

Year	Input N SE	Input N	Exp N	Exp Dead N	Exp B	Exp Dead B	MW
1997	0.83	0.31	0.31	0.08	1.22	0.33	3.90
1998	0.50	0.18	0.18	0.05	0.70	0.19	3.80
2000	0.66	0.09	0.09	0.02	0.39	0.10	4.40
2001	0.65	2.68	2.94	0.79	13.43	3.60	4.60
2003	0.77	2.58	2.72	0.73	13.06	3.50	4.80
2004	0.50	0.69	0.70	0.19	3.55	0.95	5.10
2005	0.56	1.04	1.05	0.28	5.42	1.45	5.10
2006	0.50	9.69	10.12	2.71	49.23	13.19	4.90
2007	0.58	2.00	2.03	0.54	10.20	2.73	5.00
2008	0.07	13.72	13.74	3.68	68.63	18.39	5.00
2009	0.06	12.78	12.79	3.43	66.78	17.90	5.20
2010	0.10	2.24	2.24	0.60	12.93	3.46	5.80
2011	0.06	1.95	1.95	0.52	12.73	3.41	6.50
2012	0.05	0.72	0.72	0.19	4.98	1.33	6.90
2013	0.05	6.32	6.32	1.69	44.95	12.05	7.10
2014	0.05	7.95	7.95	2.13	57.47	15.40	7.20
2015	0.05	9.62	9.62	2.58	68.43	18.34	7.10
2016	0.05	36.88	36.90	9.89	206.65	55.38	5.60
2017	0.05	145.53	145.93	39.11	712.95	191.07	4.90
2018	0.05	43.09	43.12	11.55	221.65	59.40	5.10
2019	0.05	15.55	15.55	4.17	90.64	24.29	5.80

Table 68. Observed (Obs) versus predicted (Exp) standardized SEAMAP Fall Trawl Pre-2007 West index and associated lognormal standard error (as estimated by the standardization process) for Gulf of Mexico Red Snapper. Values are normalized to the mean. CVs as estimated by the standardization process were converted to log-scale SEs.

Year	SEAMAP Video (Obs)	SEAMAP Video (Exp)	SEAMAP Video (SE)
1988	0.43	0.43	0.23
1989	0.86	1.25	0.22
1990	0.91	1.07	0.19
1991	1.03	0.93	0.18
1992	0.32	0.57	0.24
1993	0.57	0.71	0.22
1994	1.63	1.22	0.19
1995	1.75	1.11	0.17
1996	0.87	0.93	0.20
1997	1.29	0.85	0.20
1998	0.60	0.77	0.22
1999	1.37	1.08	0.18
2000	0.91	0.95	0.18
2001	0.68	0.77	0.21
2002	0.65	0.75	0.21
2003	1.15	1.03	0.19
2004	1.80	1.25	0.17
2005	1.27	1.35	0.16
2006	1.08	1.40	0.19
2007	0.84	1.30	0.22

Table 69. Observed (Obs) versus predicted (Exp) standardized SEAMAP Fall Trawl Pre-2007 West index and associated lognormal standard error (as estimated by the standardization process) for Gulf of Mexico Red Snapper. Values are normalized to the mean. CVs as estimated by the standardization process were converted to log-scale SEs.

Year	SEAMAP Video (Obs)	SEAMAP Video (Exp)	SEAMAP Video (SE)
2008	0.45	0.41	0.15
2009	1.47	1.22	0.14
2010	0.69	0.73	0.20
2011	0.82	1.00	0.19
2012	1.58	1.27	0.19
2013	0.66	0.88	0.28
2014	0.90	0.92	0.20
2015	1.65	1.38	0.18
2016	1.11	1.06	0.23
2017	0.76	0.88	0.22
2018	1.08	1.36	0.19
2019	0.84	1.08	0.23

Table 70. Observed (Obs) versus predicted (Exp) standardized SEAMAP Fall Trawl Pre-2007 West index and associated lognormal standard error (as estimated by the standardization process) for Gulf of Mexico Red Snapper. Values are normalized to the mean. CVs as estimated by the standardization process were converted to log-scale SEs.

Year	Combined Video (Obs)	Combined Video (Exp)	Combined Video (SE)
2008	0.60	0.48	0.22
2009	2.28	1.25	0.13
2010	0.69	0.68	0.19
2011	0.57	0.57	0.23
2012	1.37	1.15	0.19
2013	0.70	0.70	0.22
2014	0.98	1.14	0.19
2015	1.29	1.63	0.18
2016	0.98	1.93	0.27
2017	0.56	1.05	0.18
2018	1.27	1.45	0.18
2019	0.69	0.89	0.22

Table 71. Observed (Obs) versus predicted (Exp) standardized SEAMAP Fall Trawl Pre-2007 West index and associated lognormal standard error (as estimated by the standardization process) for Gulf of Mexico Red Snapper. Values are normalized to the mean. CVs as estimated by the standardization process were converted to log-scale SEs.

Year	Combined Video (Obs)	Combined Video (Exp)	Combined Video (SE)
2008	0.67	0.62	0.29
2009	0.41	0.36	0.21
2010	0.72	0.47	0.17
2012	0.93	0.38	0.29
2013	0.17	0.25	0.29
2014	3.26	1.70	0.14
2015	1.25	2.20	0.12
2016	1.60	1.70	0.17
2017	0.86	0.98	0.15
2018	0.34	0.56	0.22
2019	0.78	0.82	0.16

Table 72. Observed (Obs) versus predicted (Exp) standardized SEAMAP Summer Trawl Pre-2007 West index and associated lognormal standard error (as estimated by the standardization process) for Gulf of Mexico Red Snapper. Values are normalized to the mean. CVs as estimated by the standardization process were converted to log-scale SEs.

Year	SEAMAP Video (Obs)	SEAMAP Video (Exp)	SEAMAP Video (SE)
1984	0.75	0.80	0.27
1985	1.11	0.73	0.29
1986	0.29	0.64	0.41
1987	0.71	0.65	0.21
1988	0.35	0.49	0.24
1989	0.26	0.79	0.29
1990	2.26	1.34	0.15
1991	1.02	1.08	0.18
1992	0.64	0.85	0.19
1993	0.70	0.66	0.19
1994	1.35	1.01	0.17
1995	1.18	1.36	0.16
1996	1.31	1.12	0.16
1997	0.99	0.92	0.17
1998	0.89	0.85	0.18
1999	0.76	0.96	0.19
2000	1.39	1.14	0.15
2001	0.79	0.92	0.25
2002	1.09	0.79	0.16
2003	0.61	0.90	0.20
2004	1.33	1.19	0.16
2005	1.50	1.42	0.16
2006	1.42	1.57	0.14

Table 73. Observed (Obs) versus predicted (Exp) standardized SEAMAP Summer Trawl Post-2007 West index and associated lognormal standard error (as estimated by the standardization process) for Gulf of Mexico Red Snapper. Values are normalized to the mean. CVs as estimated by the standardization process were converted to log-scale SEs.

Year	SEAMAP Video (Obs)	SEAMAP Video (Exp)	SEAMAP Video (SE)
2009	0.37	0.67	0.20
2010	0.87	0.93	0.20
2011	1.21	0.79	0.19
2012	0.84	1.01	0.19
2013	1.31	1.05	0.22
2014	0.79	0.86	0.21
2015	1.09	1.00	0.20
2016	0.89	1.14	0.20
2017	0.85	0.95	0.21
2018	1.64	1.00	0.18
2019	1.14	1.17	0.20

Table 74. Observed (Obs) versus predicted (Exp) standardized SEAMAP Summer Trawl Post-2007 Central index and associated lognormal standard error (as estimated by the standardization process) for Gulf of Mexico Red Snapper. Values are normalized to the mean. CVs as estimated by the standardization process were converted to log-scale SEs.

Year	Combined Video (Obs)	Combined Video (Exp)	Combined Video (SE)
2009	0.45	0.70	0.18
2010	1.01	0.92	0.20
2011	0.57	0.61	0.24
2012	1.08	0.67	0.20
2013	1.37	0.85	0.22
2014	0.68	0.75	0.20
2015	0.65	1.09	0.22
2016	0.95	1.45	0.19
2017	1.67	1.42	0.15
2018	1.14	1.07	0.20
2019	1.42	1.11	0.19

Table 75. Observed (Obs) versus predicted (Exp) standardized SEAMAP Summer Trawl Post-2007 East index and associated lognormal standard error (as estimated by the standardization process) for Gulf of Mexico Red Snapper. Values are normalized to the mean. CVs as estimated by the standardization process were converted to log-scale SEs.

Year	Combined Video (Obs)	Combined Video (Exp)	Combined Video (SE)
2009	0.10	0.50	0.30
2010	0.03	0.43	0.38
2011	1.17	0.53	0.18
2012	0.56	0.47	0.16
2013	0.17	0.41	0.30
2014	0.38	0.53	0.16
2015	3.36	2.52	0.13
2016	2.03	2.20	0.11
2017	1.49	1.57	0.14
2018	1.18	0.78	0.13
2019	0.53	0.67	0.20

Table 76. Observed (Obs) versus predicted (Exp) standardized SEAMAP Larval Survey West index and associated lognormal standard error (as estimated by the standardization process) for Gulf of Mexico Red Snapper. Values are normalized to the mean. CVs as estimated by the standardization process were converted to log-scale SEs.

Year	SEAMAP Video (Obs)	SEAMAP Video (Exp)	SEAMAP Video (SE)
1986	0.28	0.38	0.30
1987	0.44	0.33	0.30
1989	0.55	0.30	0.29
1990	0.45	0.32	0.25
1991	0.21	0.37	0.33
1992	0.25	0.46	0.23
1993	0.27	0.52	0.23
1994	0.20	0.55	0.30
1995	0.76	0.57	0.17
1996	0.53	0.61	0.21
1997	0.89	0.66	0.16
1999	0.38	0.64	0.22
2000	1.22	0.63	0.16
2001	0.85	0.62	0.23
2002	0.64	0.63	0.18
2003	1.21	0.62	0.15
2004	0.68	0.61	0.18
2006	1.19	0.61	0.18
2007	1.05	0.65	0.15
2009	1.28	1.01	0.15
2010	0.52	1.26	0.22
2011	2.10	1.48	0.17
2012	1.98	1.71	0.15

Table 77. Observed (Obs) versus predicted (Exp) standardized SEAMAP Larval Survey Central index and associated lognormal standard error (as estimated by the standardization process) for Gulf of Mexico Red Snapper. Values are normalized to the mean. CVs as estimated by the standardization process were converted to log-scale SEs.

Year	Combined Video (Obs)	Combined Video (Exp)	Combined Video (SE)
1991	0.12	0.19	0.29
1994	0.03	0.19	0.30
1995	0.06	0.16	0.30
1997	0.09	0.23	0.29
1999	0.37	0.39	0.20
2000	0.80	0.41	0.18
2001	0.15	0.44	0.20
2003	0.40	0.40	0.18
2004	0.16	0.40	0.30
2006	0.61	0.46	0.20
2007	0.89	0.68	0.15
2008	0.09	0.93	0.29
2009	0.51	1.34	0.20
2010	2.72	1.66	0.12
2011	0.91	1.77	0.20
2012	0.79	1.72	0.16
2013	0.85	1.67	0.16
2014	1.48	1.49	0.16
2015	0.47	1.61	0.30
2016	1.03	1.73	0.13
2017	4.26	1.88	0.09
2018	1.80	1.80	0.12
2019	4.41	2.10	0.10

Table 78. Observed (Obs) versus predicted (Exp) standardized SEAMAP Reef Fish Video Survey West index and associated lognormal standard error (as estimated by the standardization process) for Gulf of Mexico Red Snapper. Values are normalized to the mean. CVs as estimated by the standardization process were converted to log-scale SEs.

Year	SEAMAP Video (Obs)	SEAMAP Video (Exp)	SEAMAP Video (SE)
1993	0.14	0.63	0.16
1994	0.34	0.62	0.18
1995	0.31	0.72	0.21
1996	0.70	0.78	0.20
1997	1.55	0.76	0.21
2002	1.08	0.66	0.22
2004	0.95	0.64	0.17
2005	0.96	0.70	0.20
2006	0.38	0.81	0.22
2007	1.02	0.98	0.17
2008	0.72	1.19	0.19
2009	1.08	1.26	0.24
2010	2.24	1.49	0.20
2011	1.74	1.57	0.24
2012	1.87	1.72	0.20
2013	2.62	1.90	0.21
2014	3.49	1.99	0.17
2015	2.14	2.06	0.20
2016	2.64	2.20	0.23
2017	3.04	2.28	0.21
2018	6.04	2.34	0.20
2019	3.34	2.47	0.18

Table 79. Observed (Obs) versus predicted (Exp) standardized Combined Video Survey Central index and associated lognormal standard error (as estimated by the standardization process) for Gulf of Mexico Red Snapper. Values are normalized to the mean. CVs as estimated by the standardization process were converted to log-scale SEs.

Year	Combined Video (Obs)	Combined Video (Exp)	Combined Video (SE)
1993	0.10	0.25	0.43
1994	0.09	0.18	0.52
1995	0.05	0.21	0.72
1996	0.14	0.24	0.35
1997	0.27	0.39	0.27
2002	0.62	0.53	0.21
2004	1.22	0.50	0.16
2005	1.00	0.51	0.14
2006	0.99	0.86	0.15
2007	1.60	1.12	0.15
2008	1.42	1.44	0.12
2009	1.86	1.41	0.11
2010	1.69	1.49	0.10
2011	1.63	1.33	0.09
2012	0.87	1.18	0.11
2013	1.07	1.17	0.13
2014	0.98	1.12	0.15
2015	0.80	1.26	0.11
2016	1.41	1.49	0.08
2017	1.54	1.67	0.09
2018	1.11	1.65	0.13
2019	1.54	1.75	0.09

Table 80. Observed (Obs) versus predicted (Exp) standardized Combined Video Survey East index and associated lognormal standard error (as estimated by the standardization process) for Gulf of Mexico Red Snapper. Values are normalized to the mean. CVs as estimated by the standardization process were converted to log-scale SEs.

Year	Combined Video (Obs)	Combined Video (Exp)	Combined Video (SE)
2010	0.46	0.72	0.26
2011	0.60	0.59	0.18
2012	0.31	0.50	0.18
2013	0.69	0.51	0.24
2014	0.39	0.47	0.18
2015	1.51	1.10	0.32
2016	2.04	1.45	0.13
2017	1.46	1.58	0.15
2018	1.45	1.38	0.16
2019	1.09	1.15	0.21

Table 81. Observed (Obs) versus predicted (Exp) standardized fishery-dependent catch-per-unit-effort (CPUE) indices for Eastern Gulf of Mexico Red Snapper . Values are normalized to the mean. CVs estimated by the standardization process were scaled to have a mean equal to the minimum CV from the SEAMAP index and converted to log-scale SEs.

Yr	HL (Obs)	HL (Exp)	HL (SE)	Comm RF (Obs)	Comm RF (Exp)	Comm RF (SE)
1993	0.30	0.22	0.26			
1994	0.11	0.27	0.34			
1995	0.25	0.33	0.23			
1996	0.24	0.32	0.21			
1997	0.38	0.32	0.20			
1998	0.26	0.46	0.24			
1999	1.02	0.59	0.20			
2000	1.59	0.73	0.16			
2001	1.10	0.95	0.19			
2002	0.95	1.28	0.18			
2003	1.22	1.72	0.15			
2004	2.07	2.18	0.14			
2005	1.86	2.33	0.15			
2006	2.64	2.37	0.13			
2007				0.40	0.42	0.22
2008				0.48	0.61	0.21
2009				0.82	0.85	0.21
2010				0.84	1.09	0.15
2011				0.85	0.93	0.11
2012				0.70	0.76	0.08
2013				0.75	0.81	0.12
2014				0.84	0.84	0.17
2015				0.91	0.84	0.28

Table 81 Continued. Observed (Obs) versus predicted (Exp) standardized fishery-dependent catch-per-unit-effort (CPUE) indices for Eastern Gulf of Mexico Red Snapper . Values are normalized to the mean. CVs estimated by the standardization process were scaled to have a mean equal to the minimum CV from the SEAMAP index and converted to log-scale SEs.

Yr	HL (Obs)	HL (Exp)	HL (SE)	Comm RF (Obs)	Comm RF (Exp)	Comm RF (SE)
2016				2.03	0.96	0.13
2017				1.49	1.31	0.41
2018				1.75	1.66	0.21
2019				1.15	1.81	0.30

Table 82. Observed (Obs) versus predicted (Exp) standardized Bottom Longline West and Red Snapper Count West indices and associated lognormal standard error (as estimated by the standardization process) for Western Gulf of Mexico Red Snapper. Values are normalized to the mean. CVs as estimated by the standardization process were converted to log-scale SEs.

Year	Bottom Longline (Obs)	Bottom Longline (Exp)	Bottom Longline (SE)	RSC (Obs)	RSC (Exp)	RSC (SE)
2001	0.32	0.33	0.19			
2002	0.25	0.32	0.17			
2003	0.29	0.31	0.21			
2004	0.34	0.31	0.21			
2006	0.28	0.28	0.26			
2007	0.30	0.27	0.26			
2009	0.51	0.44	0.19			
2010	0.25	0.65	0.33			
2011	0.71	0.92	0.14			
2012	1.24	1.18	0.21			
2013	1.14	1.34	0.19			
2014	0.86	1.41	0.23			
2015	2.12	1.52	0.17			
2016	1.76	1.64	0.17			
2017	2.70	1.79	0.12			
2018	1.56	1.94	0.17	30824.00	23049.10	0.27
2019	2.36	2.01	0.17			

Table 83. Observed (Obs) versus predicted (Exp) standardized Bottom Longline Central and Red Snapper Count Central indices and associated lognormal standard error (as estimated by the standardization process) for Western Gulf of Mexico Red Snapper. Values are normalized to the mean. CVs as estimated by the standardization process were converted to log-scale SEs.

Year	Bottom Longline (Obs)	Bottom Longline (Exp)	Bottom Longline (SE)	RSC (Obs)	RSC (Exp)	RSC (SE)
2001	0.17	0.16	0.24			
2002	0.12	0.16	0.24			
2003	0.27	0.13	0.21			
2004	0.11	0.11	0.30			
2005	0.09	0.11	0.30			
2006	0.17	0.14	0.31			
2009	0.37	0.52	0.21			
2010	1.26	0.89	0.15			
2011	1.69	1.37	0.09			
2012	1.16	1.81	0.21			
2013	0.55	1.98	0.21			
2014	2.08	1.98	0.14			
2015	2.39	2.02	0.13			
2016	2.56	2.00	0.14			
2017	0.89	1.75	0.17			
2018	1.20	1.63	0.17	30806.00	15868.50	0.22
2019	1.92	1.74	0.18			

Table 84. Observed (Obs) versus predicted (Exp) standardized Bottom Longline East and Red Snapper Count East indices and associated lognormal standard error (as estimated by the standardization process) for Western Gulf of Mexico Red Snapper. Values are normalized to the mean. CVs as estimated by the standardization process were converted to log-scale SEs.

Year	Bottom Longline (Obs)	Bottom Longline (Exp)	Bottom Longline (SE)	RSC (Obs)	RSC (Exp)	RSC (SE)
2001	0.12	0.19	0.26			
2003	0.43	0.30	0.20			
2004	0.69	0.40	0.17			
2005	0.53	0.46	0.26			
2006	0.26	0.44	0.26			
2007	1.74	0.49	0.20			
2009	1.16	1.00	0.15			
2010	1.85	1.52	0.13			
2011	1.77	1.47	0.09			
2012	0.48	1.31	0.20			
2013	2.85	1.28	0.26			
2014	0.36	1.26	0.26			
2016	1.68	1.24	0.17			
2017	0.65	1.16	0.20			
2018	0.51	1.57	0.20	24707.00	2862.70	0.22
2019	0.93	2.65	0.20			

Table 85. Summary of correlated parameters with correlation coefficients > 0.7 for Gulf of Mexico Red Snapper from the SEDAR 74 base model.

Parameter 1	Parameter 2	Correlation
Size_DblN_descend_se_HBT_C(17)_BLK5repl_1995	Size_DblN_top_logit_HBT_C(17)_BLK5repl_1995	-0.943
Size_DblN_top_logit_PRIV_C(20)	Size_DblN_peak_PRIV_C(20)	-0.896
Size_DblN_descend_se_HL_W(1)_BLK4repl_2007	Size_DblN_top_logit_HL_W(1)_BLK4repl_2007	-0.874
Size_DblN_top_logit_CBT_W(14)	Size_DblN_peak_CBT_W(14)	-0.865
Size_DblN_descend_se_HL_E(3)_BLK4repl_2007	Size_DblN_top_logit_HL_E(3)_BLK4repl_2007	-0.857
Size_DblN_descend_se_HL_W(1)	InitF_seas_1_flt_1HL_W	-0.852
InitF_seas_1_flt_16HBT_W	SR_LN(R0)	-0.844
Size_DblN_ascend_se_CBT_W(14)	Size_DblN_top_logit_CBT_W(14)	-0.839
Size_DblN_descend_se_HBT_W(16)_BLK5repl_1995	Size_DblN_top_logit_HBT_W(16)_BLK5repl_1995	-0.836
Size_DblN_top_logit_CBT_W(14)_BLK5repl_1995	Size_DblN_peak_CBT_W(14)_BLK5repl_1995	-0.835
Size_DblN_end_logit_CBT_W(14)	InitF_seas_1_flt_14CBT_W	-0.834
Size_DblN_descend_se_HBT_C(17)_BLK5repl_2007	Size_DblN_top_logit_HBT_C(17)_BLK5repl_2007	-0.831
Size_DblN_top_logit_HBT_W(16)	Size_DblN_peak_HBT_W(16)	-0.828
Size_DblN_descend_se_HBT_W(16)_BLK5repl_2007	Size_DblN_top_logit_HBT_W(16)_BLK5repl_2007	-0.821
Size_DblN_top_logit_PRIV_W(19)_BLK5repl_1995	Size_DblN_peak_PRIV_W(19)_BLK5repl_1995	-0.815
SR_LN(R0)	RecrDist_GP_1_area_1_month_7	-0.813
Size_DblN_ascend_se_CBT_W(14)_BLK5repl_1995	Size_DblN_top_logit_CBT_W(14)_BLK5repl_1995	-0.805
Size_DblN_end_logit_PRIV_W(19)	InitF_seas_1_flt_19PRIV_W	-0.793

Table 85 Continued. Summary of correlated parameters with correlation coefficients > 0.7 for Gulf of Mexico Red Snapper from the SEDAR 74 base model.

Parameter 1	Parameter 2	Correlation
Size_DblN_ascend_se_PRIV_W(19)_BLK5repl_1995	Size_DblN_top_logit_PRIV_W(19)_BLK5repl_1995	-0.783
Size_DblN_ascend_se_HBT_W(16)	Size_DblN_top_logit_HBT_W(16)	-0.779
InitF_seas_1_flt_19PRIV_W	SR_LN(R0)	-0.766
Size_DblN_top_logit_PRIV_W(19)	Size_DblN_peak_PRIV_W(19)	-0.749
Size_DblN_descend_se_PRIV_W(19)_BLK5repl_2007	Size_DblN_top_logit_PRIV_W(19)_BLK5repl_2007	-0.738
Size_DblN_descend_se_HL_W(1)_BLK4repl_1993	Size_DblN_top_logit_HL_W(1)_BLK4repl_1993	-0.729
Retain_L_width_PRIV_W(19)_BLK2repl_2000	Size_DblN_start_logit_PRIV_W(19)_BLK5repl_2007	-0.718
Size_DblN_end_logit_HBT_C(17)	InitF_seas_1_flt_17HBT_C	-0.717
AgeSel_P3_FALLLATE_C(29)	AgeSel_P2_FALLLATE_C(29)	-0.706
InitF_seas_1_flt_15CBT_E	InitF_seas_1_flt_3HL_E	0.702
InitF_seas_1_flt_19PRIV_W	InitF_seas_1_flt_16HBT_W	0.705
Size_95%width_SEAVID_W(4)	Size_inflection_SEAVID_W(4)	0.727
Size_95%width_LL_W(7)_BLK4repl_2007	Size_inflection_LL_W(7)_BLK4repl_2007	0.728
Size_95%width_GFISHER_C(5)_BLK6repl_2006	Size_inflection_GFISHER_C(5)_BLK6repl_2006	0.730
InitF_seas_1_flt_16HBT_W	RecrDist_GP_1_area_1_month_7	0.747
Age_DblN_ascend_se_GRSC_W(48)	Age_DblN_peak_GRSC_W(48)	0.753
Size_DblN_ascend_se_CBT_W(14)_BLK5repl_2007	Size_DblN_peak_CBT_W(14)_BLK5repl_2007	0.758
Age_95%width_BLL_W(10)	Age_inflection_BLL_W(10)	0.800

Table 85 Continued. Summary of correlated parameters with correlation coefficients > 0.7 for Gulf of Mexico Red Snapper from the SEDAR 74 base model.

Parameter 1	Parameter 2	Correlation
Retain_L_asymptote_logit_PRIV_W(19)_BLK3repl_2007	Size_DblN_start_logit_PRIV_W(19)_BLK5repl_2007	0.803
Size_95%width_LL_E(8)	Size_inflection_LL_E(8)	0.804
Size_DblN_ascend_se_HL_E(3)_BLK4repl_1993	Size_DblN_peak_HL_E(3)_BLK4repl_1993	0.832
Size_95%width_FALLEARLY_W(31)	Size_inflection_FALLEARLY_W(31)	0.834
Age_DblN_ascend_se_GRSC_C(49)	Age_DblN_peak_GRSC_C(49)	0.856
Size_DblN_ascend_se_PRIV_C(20)_BLK5repl_2007	Size_DblN_peak_PRIV_C(20)_BLK5repl_2007	0.856
Size_95%width_GFISHER_C(5)_BLK6repl_2016	Size_inflection_GFISHER_C(5)_BLK6repl_2016	0.870
Size_95%width_LL_W(7)_BLK4repl_1993	Size_inflection_LL_W(7)_BLK4repl_1993	0.872
Size_DblN_ascend_se_HBT_W(16)_BLK5repl_2007	Size_DblN_peak_HBT_W(16)_BLK5repl_2007	0.881
Size_DblN_ascend_se_PRIV_W(19)_BLK5repl_2007	Size_DblN_peak_PRIV_W(19)_BLK5repl_2007	0.887
Size_DblN_ascend_se_HBT_C(17)_BLK5repl_2007	Size_DblN_peak_HBT_C(17)_BLK5repl_2007	0.890
Age_95%width_BLL_C(11)	Age_inflection_BLL_C(11)	0.898
Size_95%width_LL_W(7)	Size_inflection_LL_W(7)	0.909
Size_DblN_ascend_se_HL_W(1)_BLK4repl_2007	Size_DblN_peak_HL_W(1)_BLK4repl_2007	0.913
Retain_L_asymptote_logit_PRIV_C(20)_BLK3repl_2007	Size_DblN_start_logit_PRIV_C(20)_BLK5repl_2007	0.920
Size_DblN_ascend_se_PRIV_C(20)_BLK5repl_1995	Size_DblN_peak_PRIV_C(20)_BLK5repl_1995	0.928
Retain_L_asymptote_logit_HBT_C(17)_BLK3repl_2007	Size_DblN_start_logit_HBT_C(17)_BLK5repl_2007	0.933
Size_DblN_ascend_se_CBT_C(13)	Size_DblN_peak_CBT_C(13)	0.934

Table 85 Continued. Summary of correlated parameters with correlation coefficients > 0.7 for Gulf of Mexico Red Snapper from the SEDAR 74 base model.

Parameter 1	Parameter 2	Correlation
Size_DblN_ascend_se_HL_W(1)_BLK4repl_1993	Size_DblN_peak_HL_W(1)_BLK4repl_1993	0.938
Size_DblN_ascend_se_CBT_C(13)_BLK5repl_2007	Size_DblN_peak_CBT_C(13)_BLK5repl_2007	0.940
Size_DblN_ascend_se_HBT_W(16)	Size_DblN_peak_HBT_W(16)	0.941
Size_DblN_ascend_se_HL_C(2)	Size_DblN_peak_HL_C(2)	0.946
Size_DblN_ascend_se_HL_C(2)_BLK4repl_2007	Size_DblN_peak_HL_C(2)_BLK4repl_2007	0.951
Size_DblN_ascend_se_HBT_W(16)_BLK5repl_1995	Size_DblN_peak_HBT_W(16)_BLK5repl_1995	0.962
Size_DblN_ascend_se_HBT_C(17)_BLK5repl_1995	Size_DblN_peak_HBT_C(17)_BLK5repl_1995	0.966
Size_DblN_ascend_se_HL_E(3)_BLK4repl_2007	Size_DblN_peak_HL_E(3)_BLK4repl_2007	0.968
Size_DblN_ascend_se_PRIV_W(19)_BLK5repl_1995	Size_DblN_peak_PRIV_W(19)_BLK5repl_1995	0.971
Size_DblN_ascend_se_CBT_W(14)	Size_DblN_peak_CBT_W(14)	0.975
Size_DblN_ascend_se_CBT_W(14)_BLK5repl_1995	Size_DblN_peak_CBT_W(14)_BLK5repl_1995	0.979
Size_DblN_ascend_se_CBT_C(13)_BLK5repl_1995	Size_DblN_peak_CBT_C(13)_BLK5repl_1995	0.995

Table 86. Summary of correlated parameters with correlation coefficients > 0.95 for Gulf of Mexico Red Snapper from the SEDAR 74 base model.

Parameter 1	Parameter 2	Correlation
Size_DblN_ascend_se_HL_C(2)_BLK4repl_2007	Size_DblN_peak_HL_C(2)_BLK4repl_2007	0.951
Size_DblN_ascend_se_HBT_W(16)_BLK5repl_1995	Size_DblN_peak_HBT_W(16)_BLK5repl_1995	0.962
Size_DblN_ascend_se_HBT_C(17)_BLK5repl_1995	Size_DblN_peak_HBT_C(17)_BLK5repl_1995	0.966
Size_DblN_ascend_se_HL_E(3)_BLK4repl_2007	Size_DblN_peak_HL_E(3)_BLK4repl_2007	0.968
Size_DblN_ascend_se_PRIV_W(19)_BLK5repl_1995	Size_DblN_peak_PRIV_W(19)_BLK5repl_1995	0.971
Size_DblN_ascend_se_CBT_W(14)	Size_DblN_peak_CBT_W(14)	0.975
Size_DblN_ascend_se_CBT_W(14)_BLK5repl_1995	Size_DblN_peak_CBT_W(14)_BLK5repl_1995	0.979
Size_DblN_ascend_se_CBT_C(13)_BLK5repl_1995	Size_DblN_peak_CBT_C(13)_BLK5repl_1995	0.995

Figures

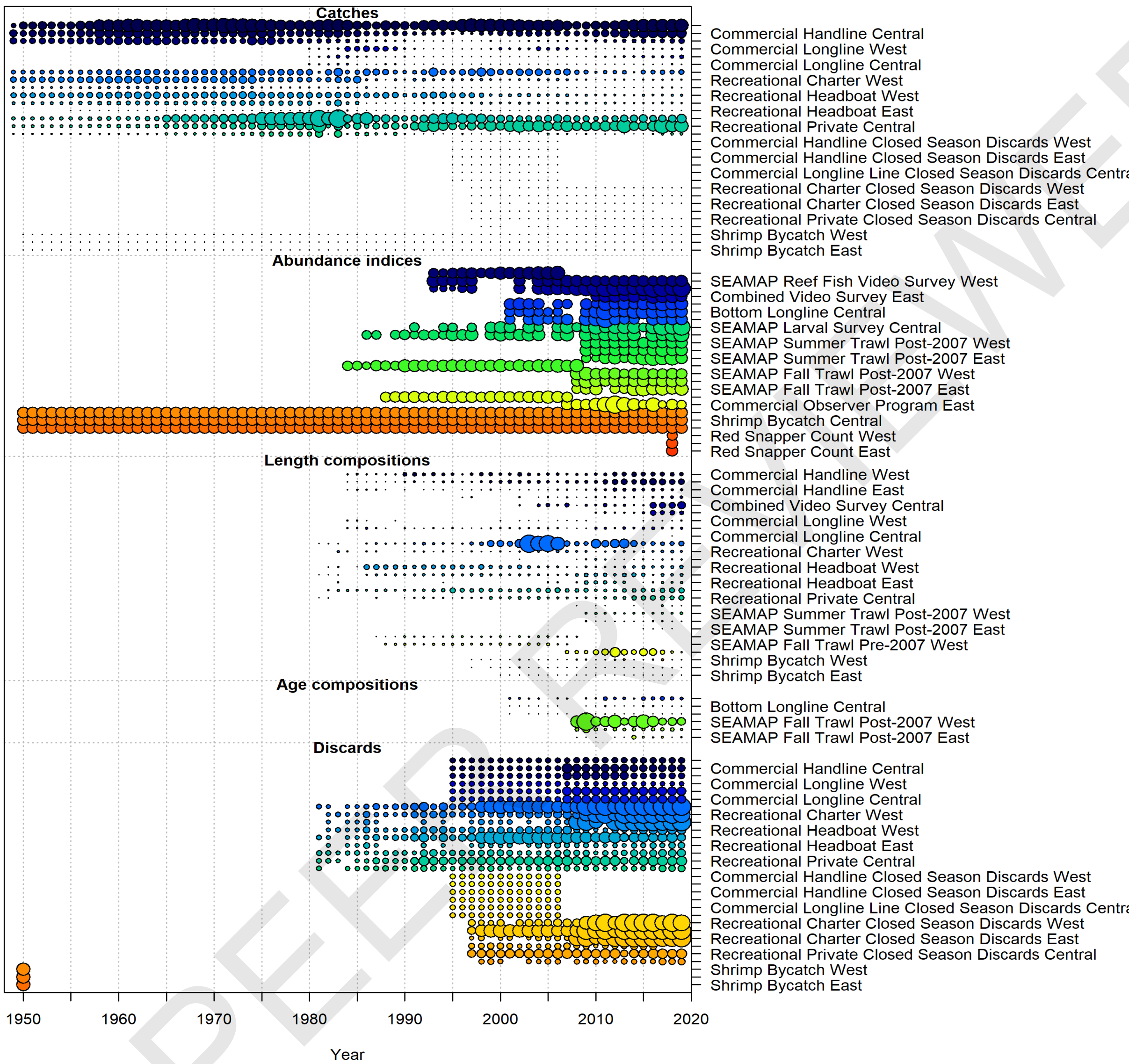


Figure 1. Data sources used in the Gulf of Mexico Red Snapper Stock Synthesis assessment model. Circle area is relative within a data type. Circles are proportional to total catch for catches; to precision for indices, discards, and mean body weight observations; and to total sample size for compositions and mean weight- or length-at-age observations. Note that since the circles are scaled relative to maximum within each type, the scaling between separate data types should not be compared. Due to the number of data sources used in this assessment some labels may be missing. See section 2 (Data Review and Update) for complete list of data sources and time frames.

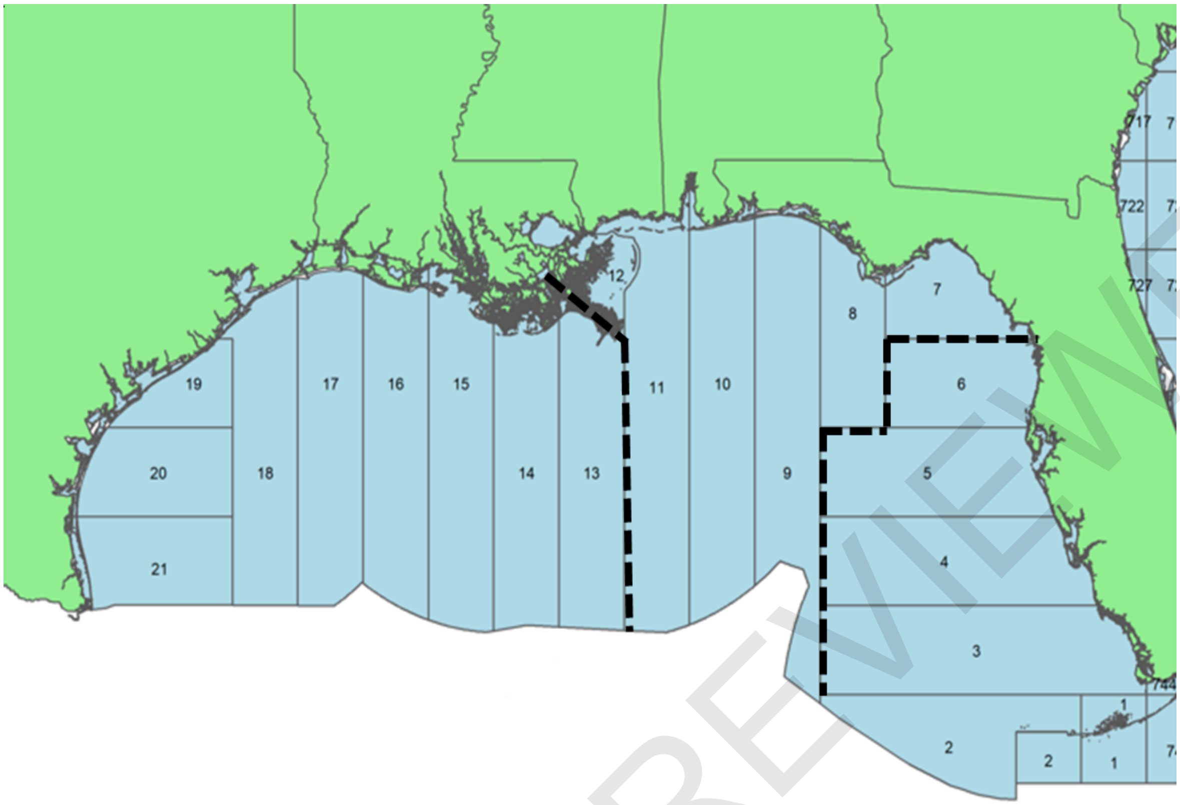


Figure 2. National Marine Fisheries Service (NMFS) fishing area in the Gulf of Mexico, divided into 23 statistical fishing zones. Thick black dashed lines indicate stock boundaries used for SEDAR 74: statistical zone 12/13- Mississippi River outflow, zone 9/10 - De Soto Canyon, zone 7/8 - Cape San Blas, and zone 7/6 - Big Bend.

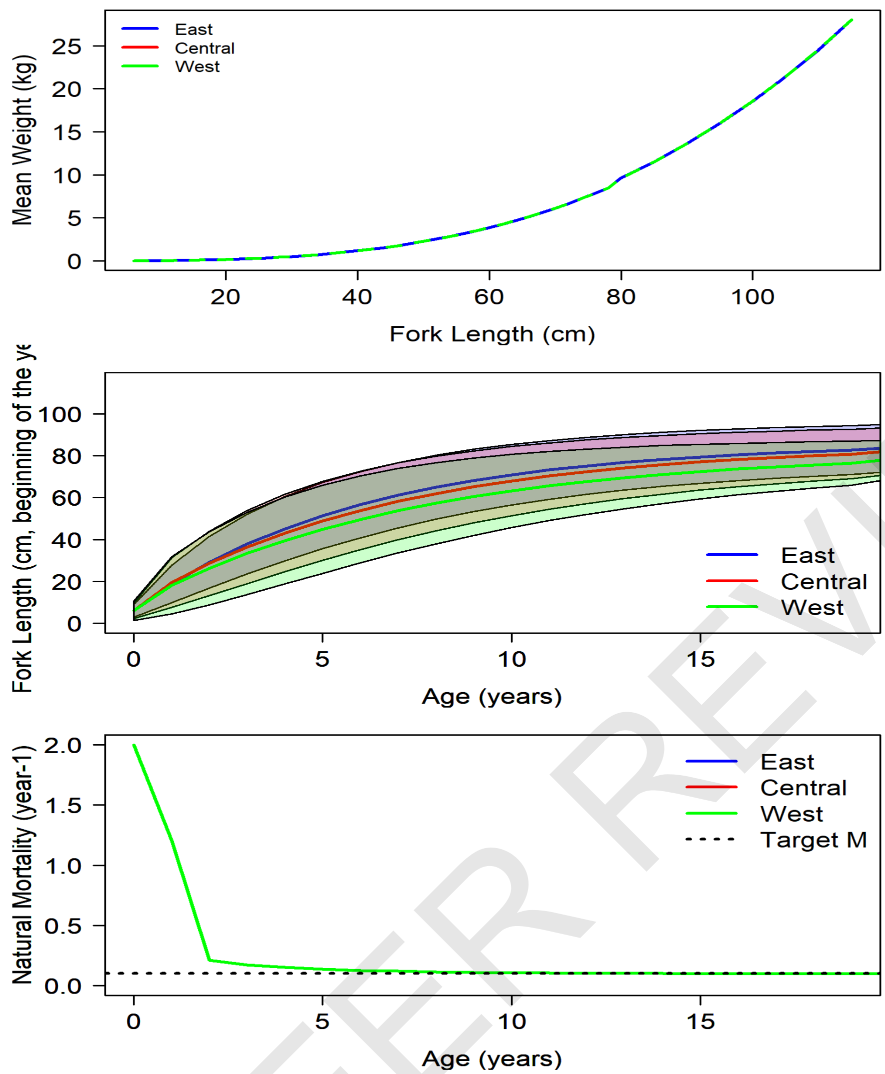


Figure 3. Mean weight-at-length (top panel), growth curves (with 95% confidence intervals; middle panel), and natural mortality (bottom panel) used in the assessment model for Gulf of Mexico Red Snapper.

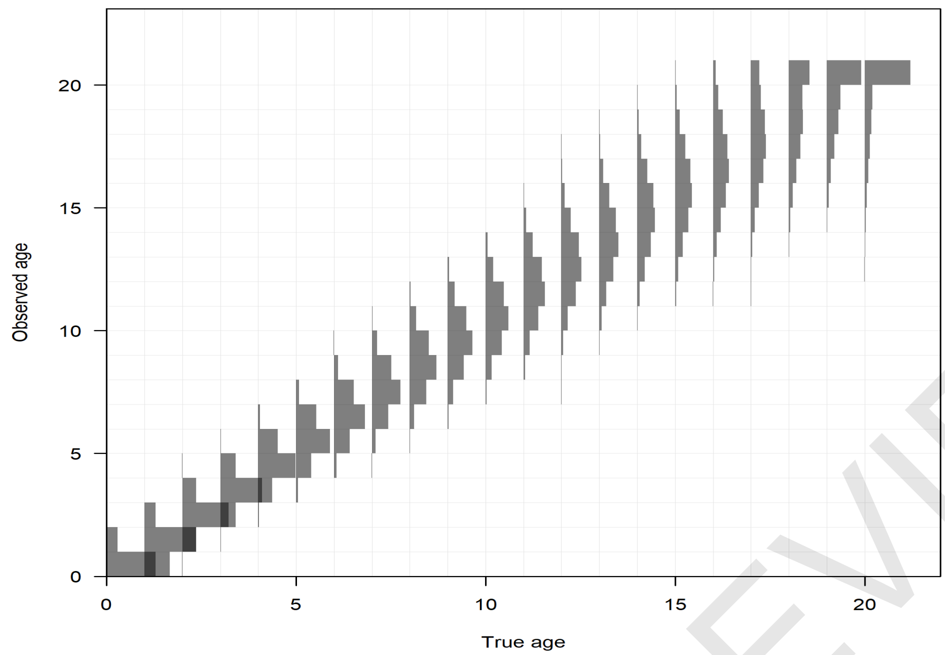
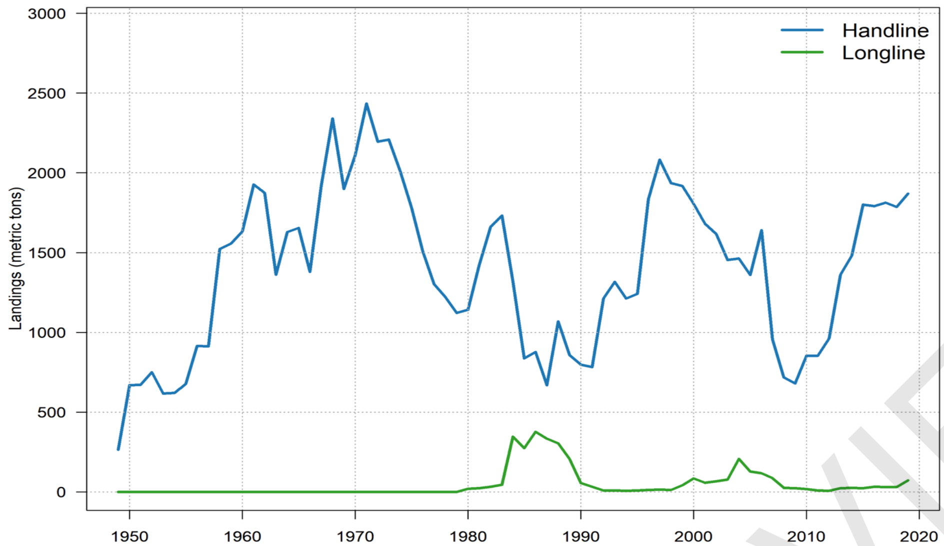


Figure 4. Distribution of observed age at true age for the ageing error matrix used for all ages input in SEDAR 74.

West



Central

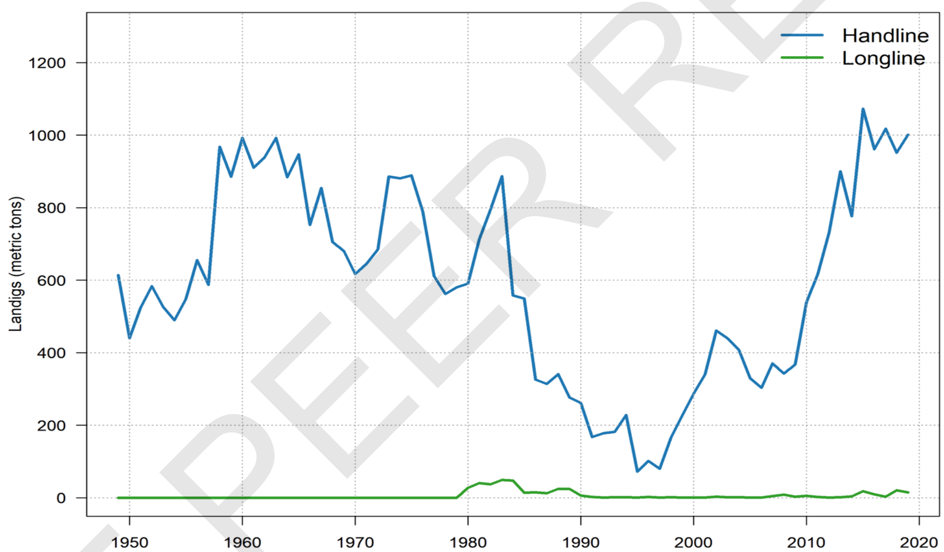


Figure 5. Gulf of Mexico Red Snapper observed commercial landings by fishery and region for SEDAR 74. Commercial landings in weight (mt).

East

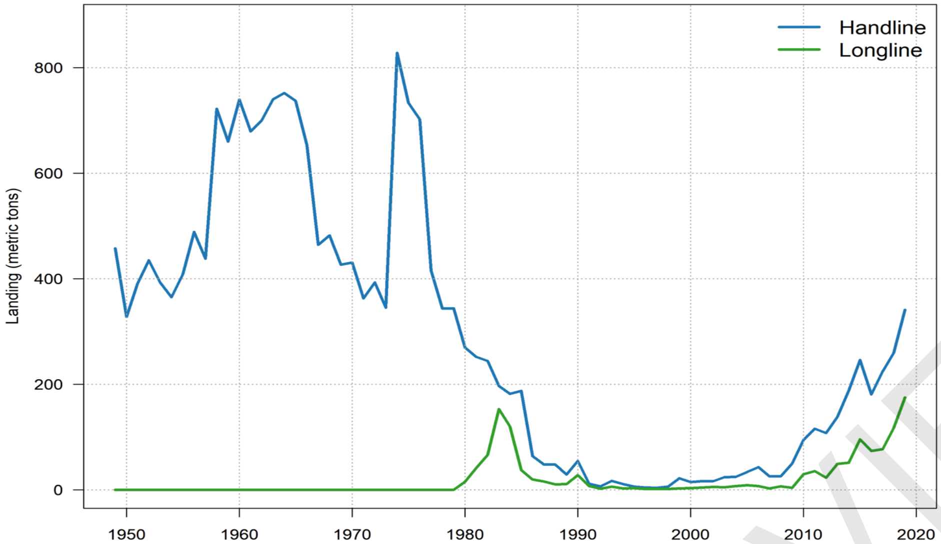
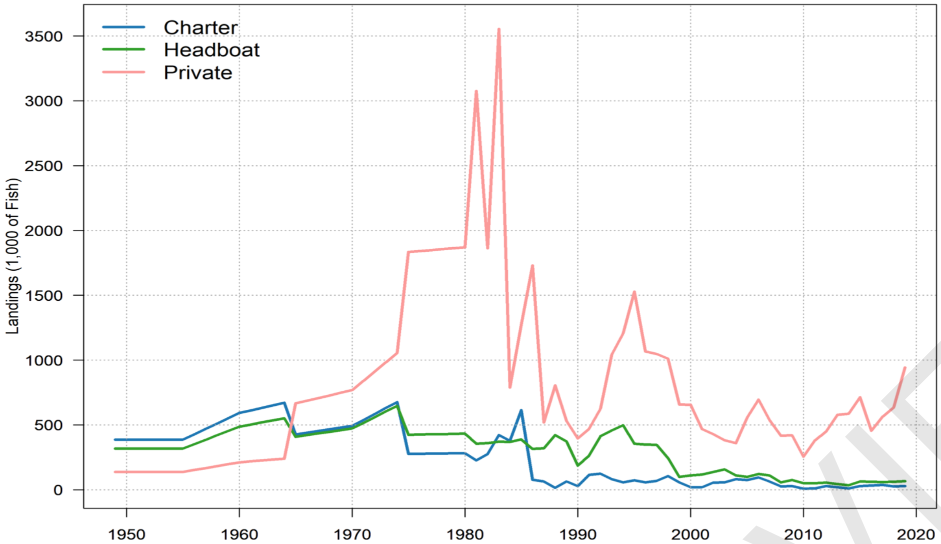


Figure 5 Continued. Gulf of Mexico Red Snapper observed commercial landings by fishery and region for SEDAR 74. Commercial landings in weight (mt).

West



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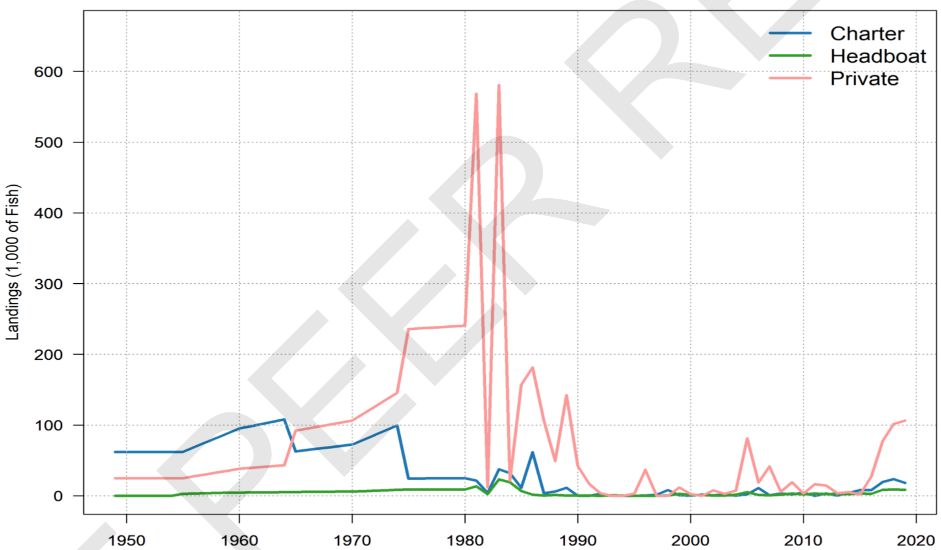


Figure 6. Gulf of Mexico Red Snapper observed recreational landings by fishery for SEDAR 74. Recreational landings are in thousands of fish.

East

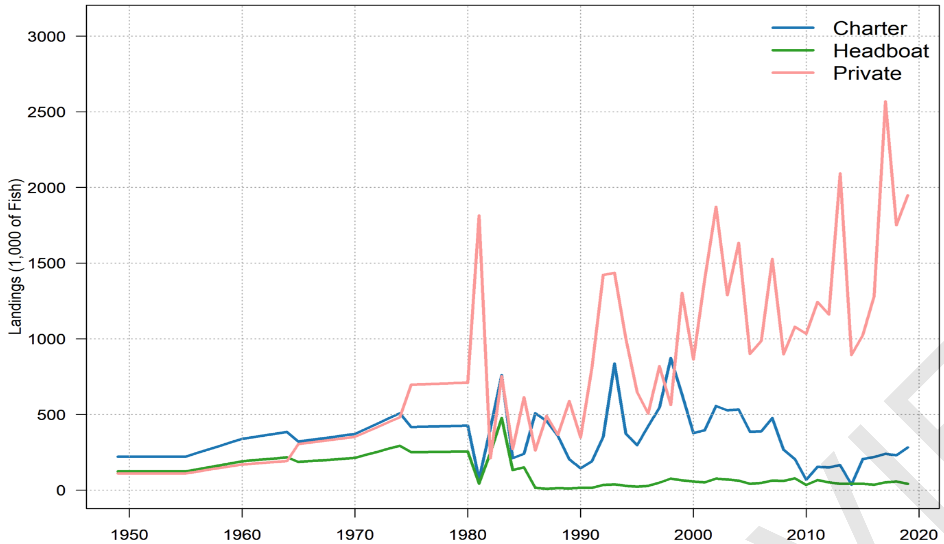
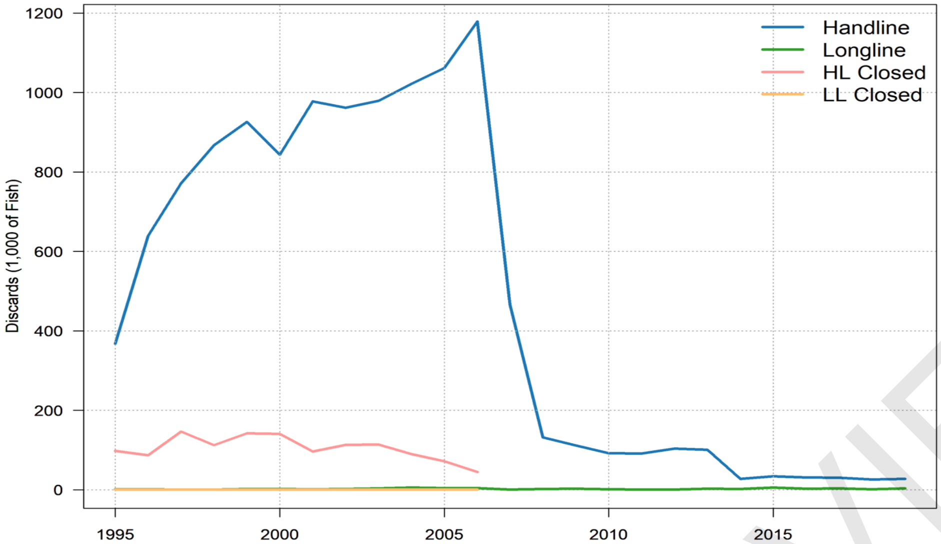


Figure 6 Continued. Gulf of Mexico Red Snapper observed recreational landings by fishery for SEDAR 74. Recreational landings are in thousands of fish.

West



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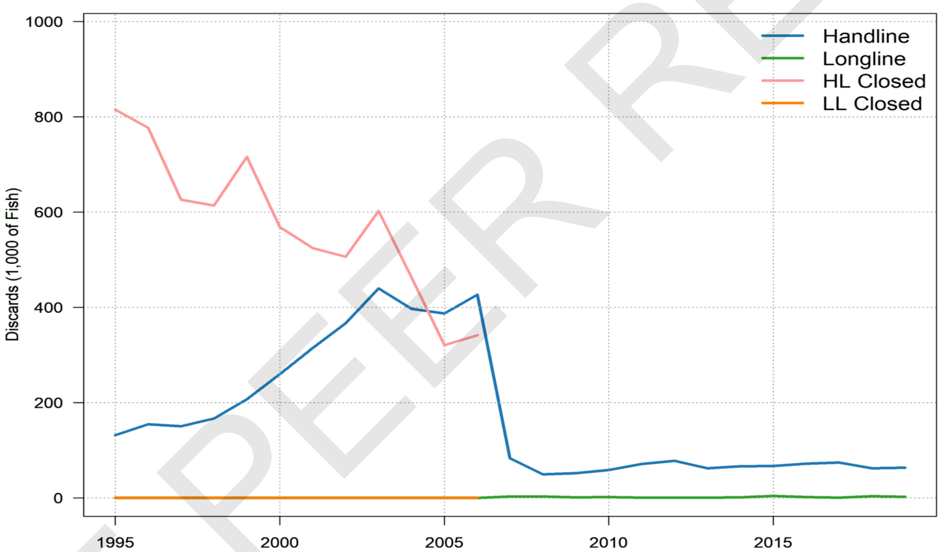


Figure 7. Gulf of Mexico Red Snapper observed commercial discards by fishery and region for SEDAR 74. Commercial discards are in thousands of fish.

East

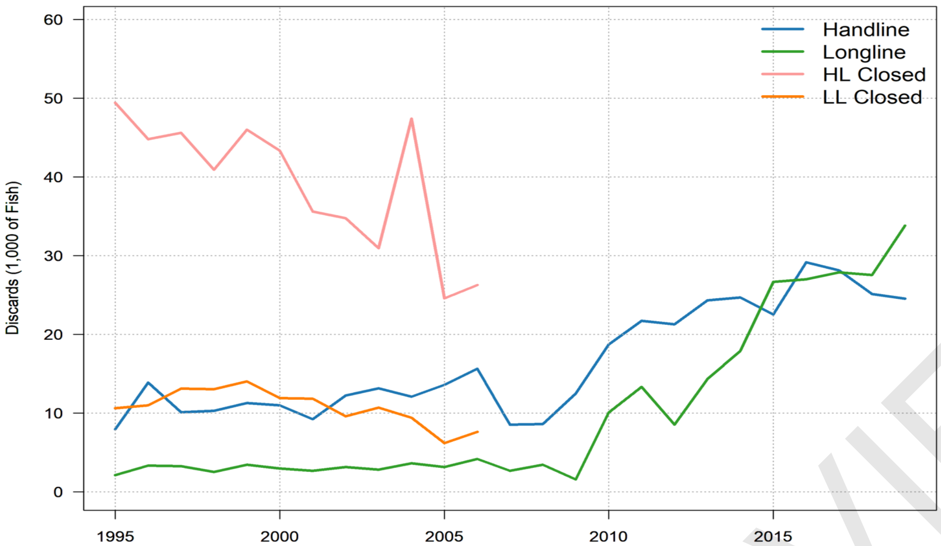
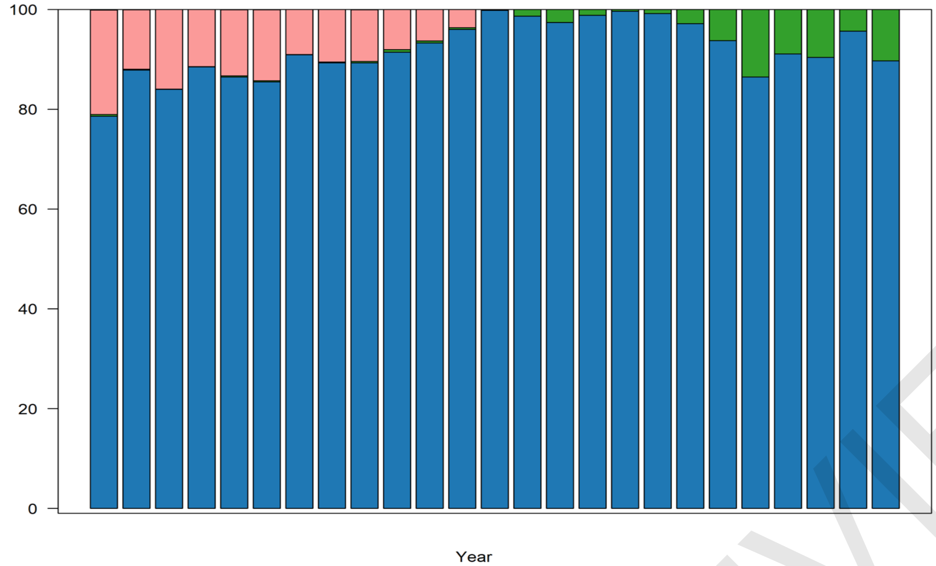


Figure 7 Continued. Gulf of Mexico Red Snapper observed commercial discards by fishery and region for SEDAR 74. Commercial discards are in thousands of fish.

West



Central

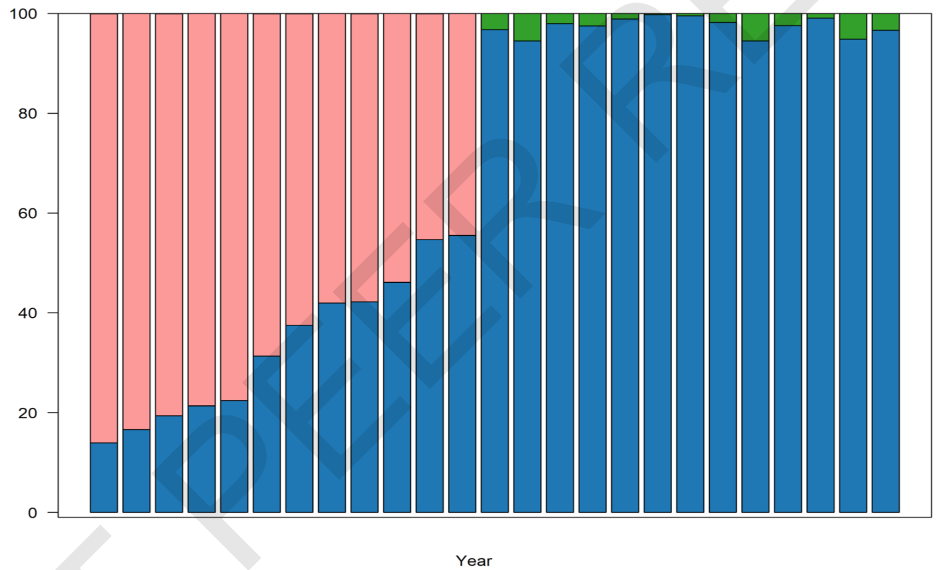


Figure 8. Proportion of Gulf of Mexico Red Snapper observed commercial discards by fishery and region for SEDAR 74. Colors align with those in the previous figure.

East

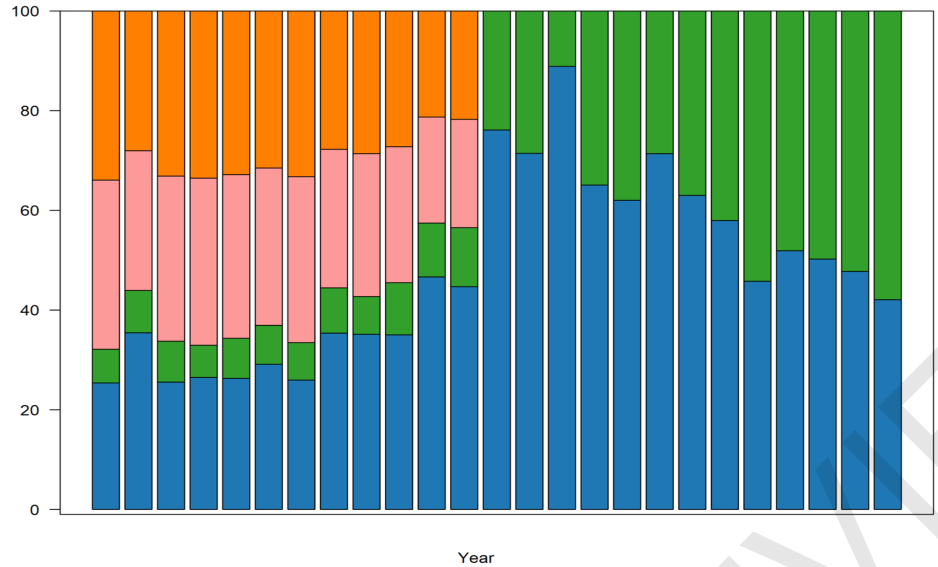
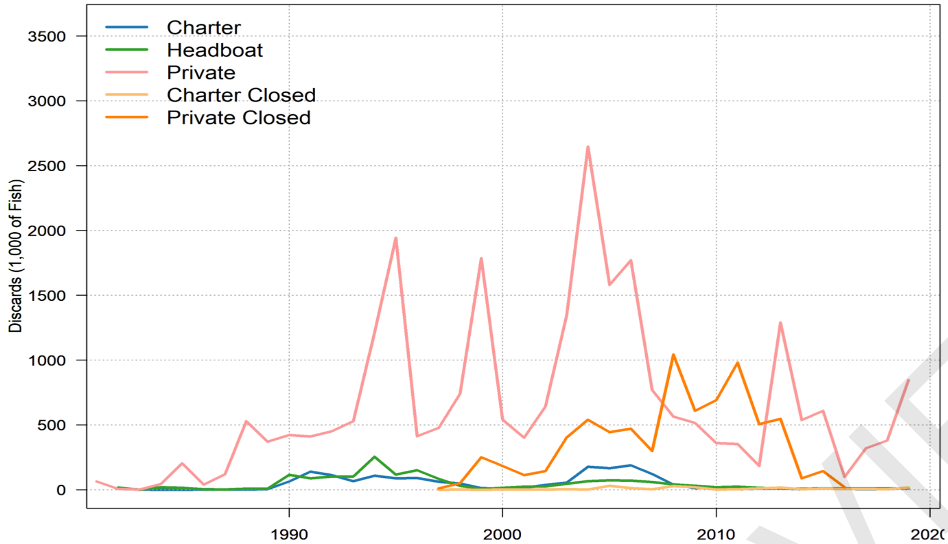


Figure 8 Continued. Proportion of Gulf of Mexico Red Snapper observed commercial discards by fishery and region for SEDAR 74. Colors align with those in the previous figure.

West



Central

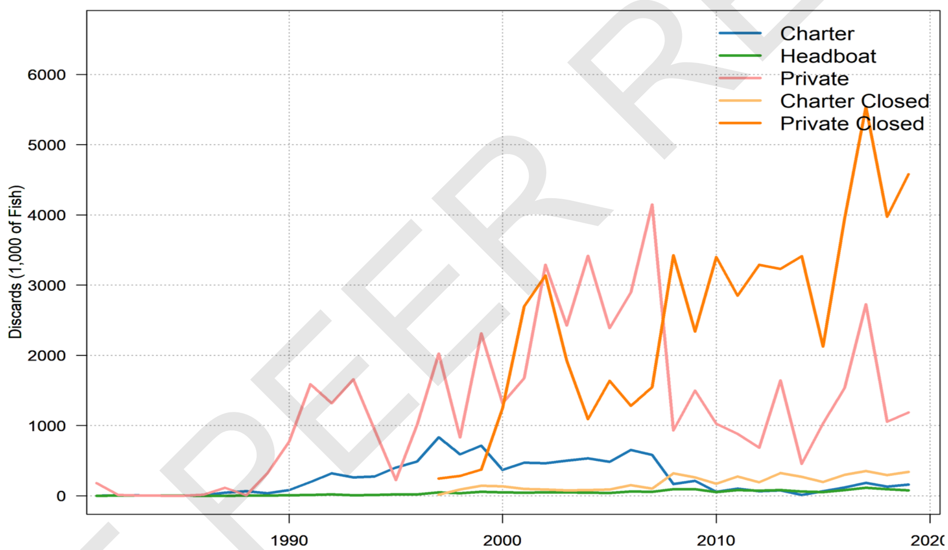


Figure 9. Gulf of Mexico Red Snapper observed recreational discards by fishery for SEDAR 74. Recreational discards are in thousands of fish. East area y-axis is reduced to ensure trends in fleets that were not the Private Closed Season Discards were still visible. Unseen values for Private Closed season discards are 1492.56 in 2011, 669.67 in 2016, 523.3 in 2018 and 334.14 thousand fish in 2019.

East

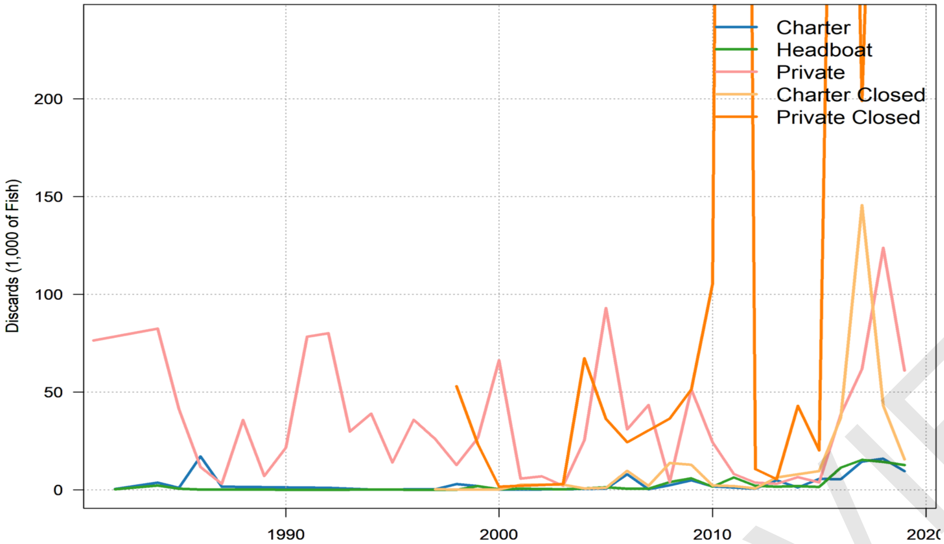


Figure 9 Continued. Gulf of Mexico Red Snapper observed recreational discards by fishery for SEDAR 74. Recreational discards are in thousands of fish. East area y-axis is reduced to ensure trends in fleets that were not the Private Closed Season Discards were still visible. Unseen values for Private Closed season discards are 1492.56 in 2011, 669.67 in 2016, 523.3 in 2018 and 334.14 thousand fish in 2019.

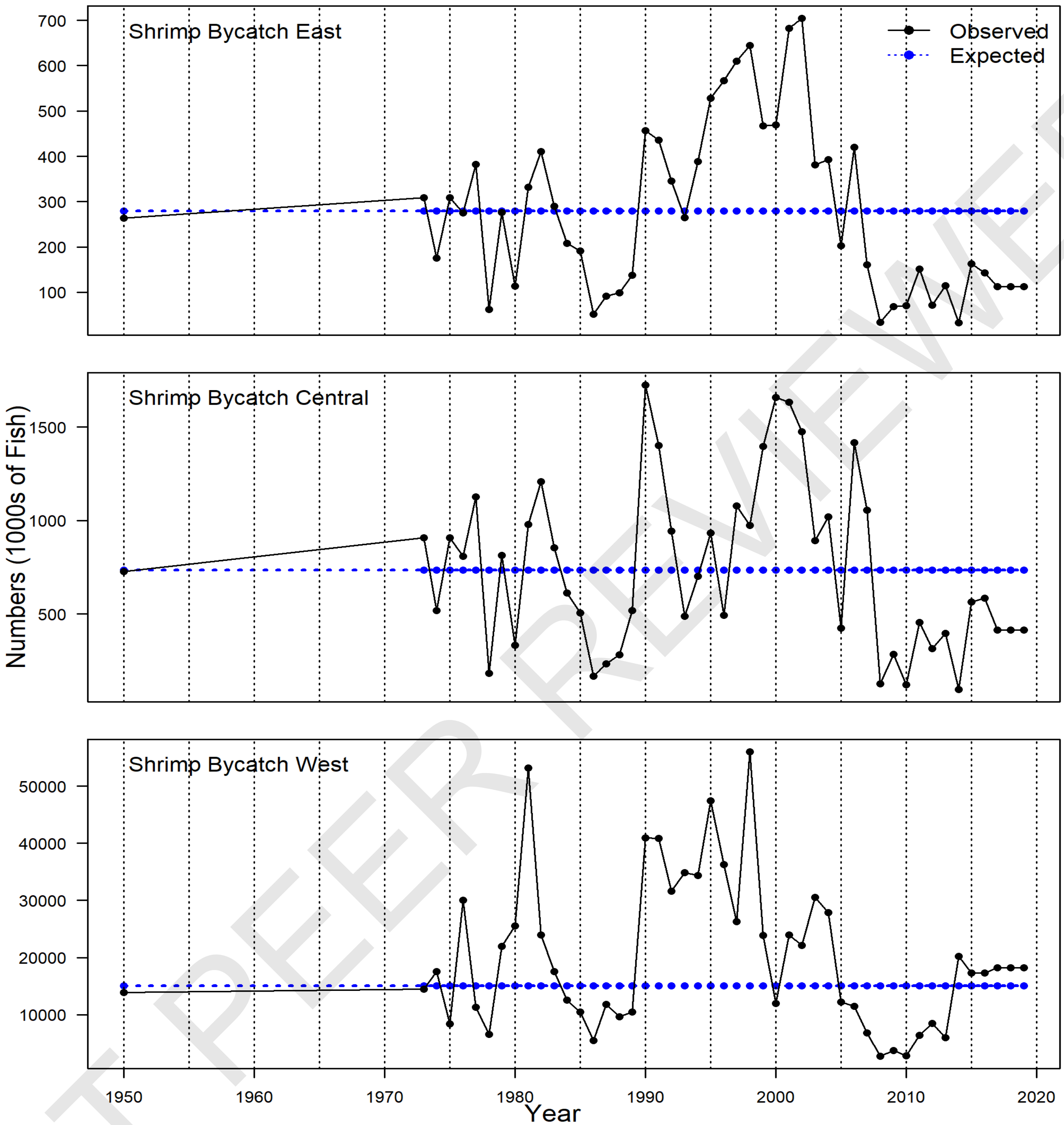


Figure 10. Shrimp Trawl bycatch for Gulf of Mexico Red Snapper observed and expected indices (blue lines) for SEDAR 74. Dashed vertical lines identify five year intervals.

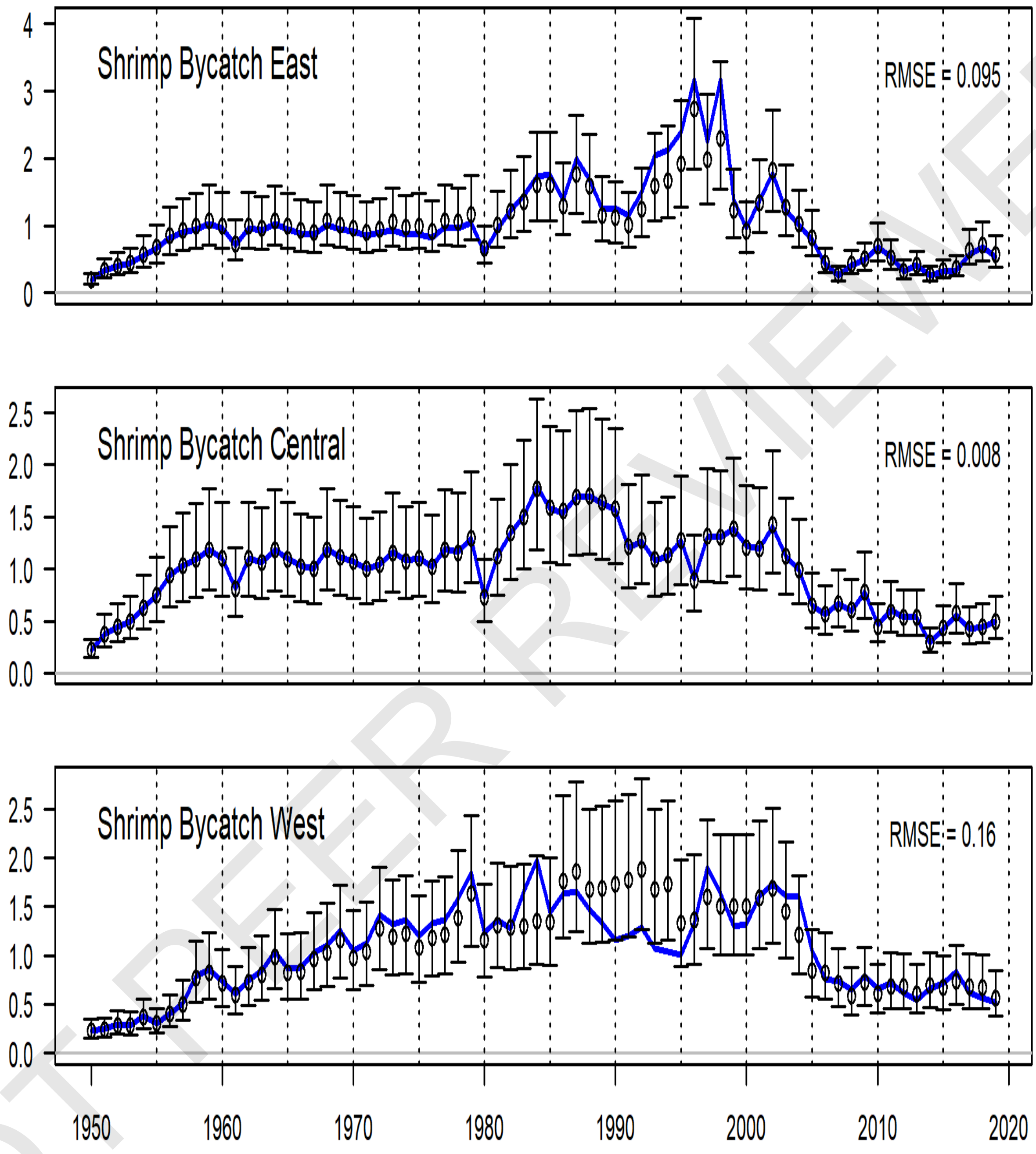


Figure 11. Effort time series for Shrimp Trawl bycatch and associated 95% uncertainty interval around index values based on the model assumption of lognormal error for Gulf of Mexico Red Snapper.

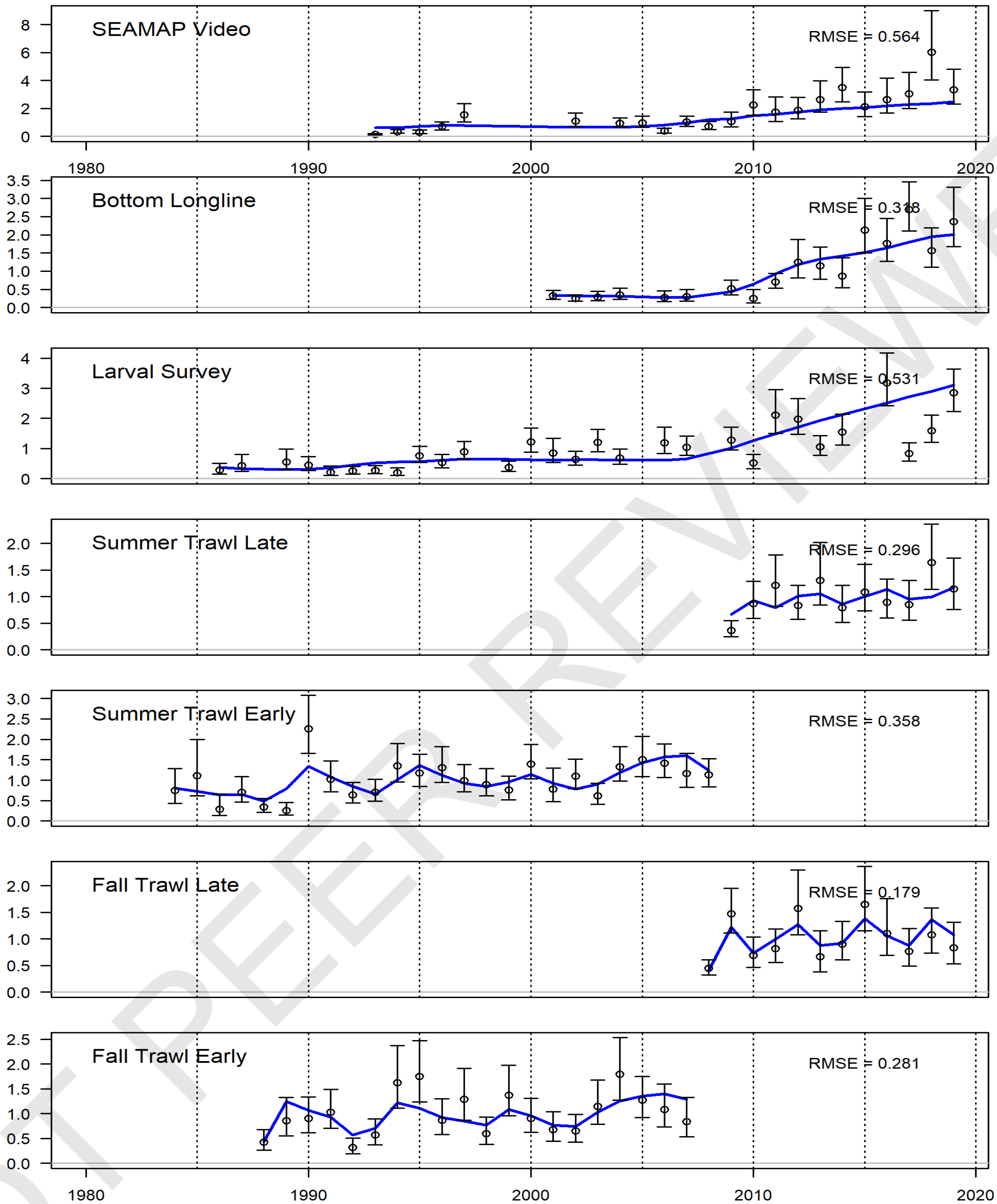


Figure 12. Western Gulf of Mexico Red Snapper observed and expected indices (blue lines) for SEDAR 74. Dashed vertical lines identify five year intervals. The root mean squared error (RMSE) is also provided.

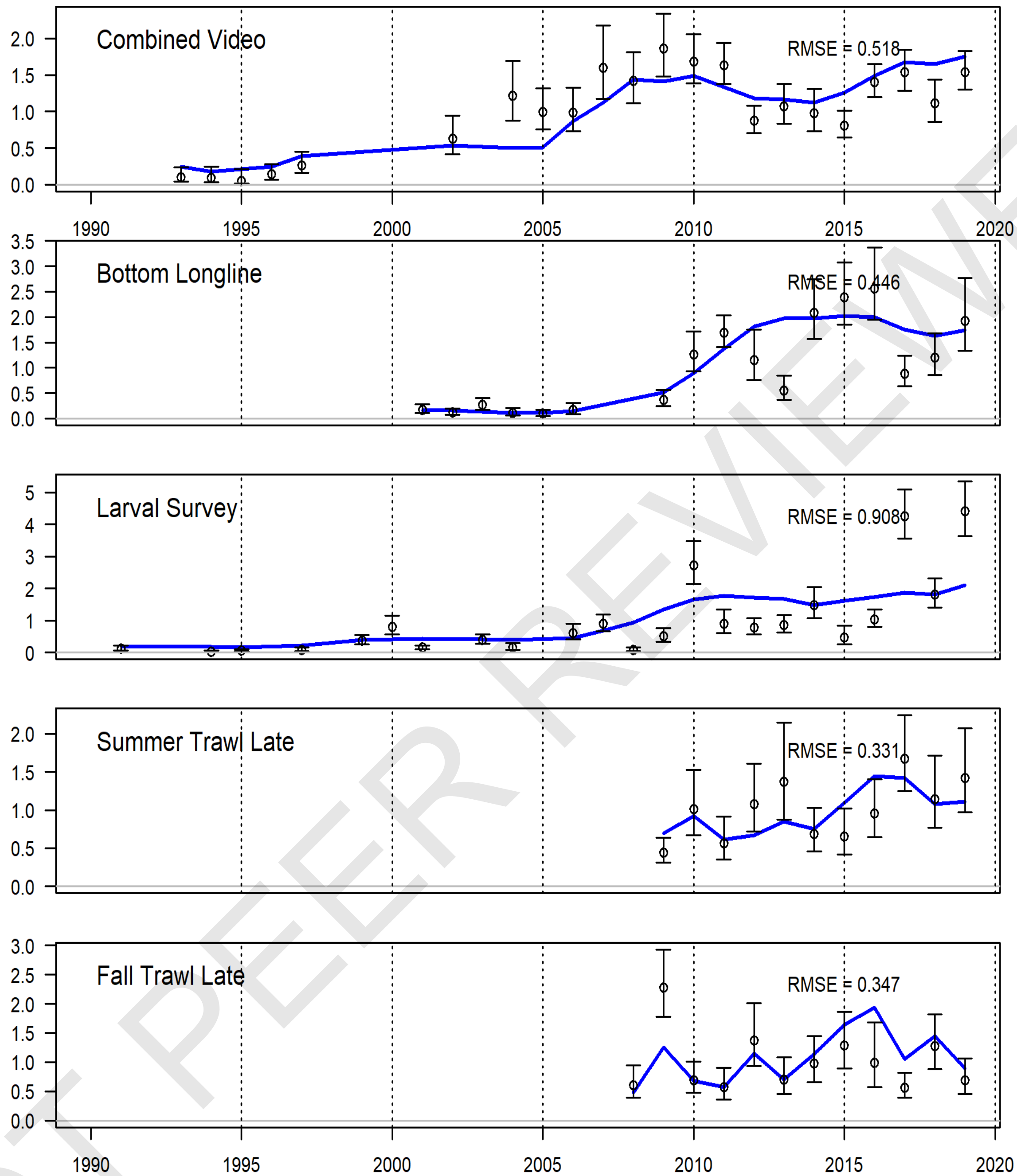


Figure 13. Central Gulf of Mexico Red Snapper observed and expected indices (blue lines) for SEDAR 74. Dashed vertical lines identify five year intervals. The root mean squared error (RMSE) is also provided.

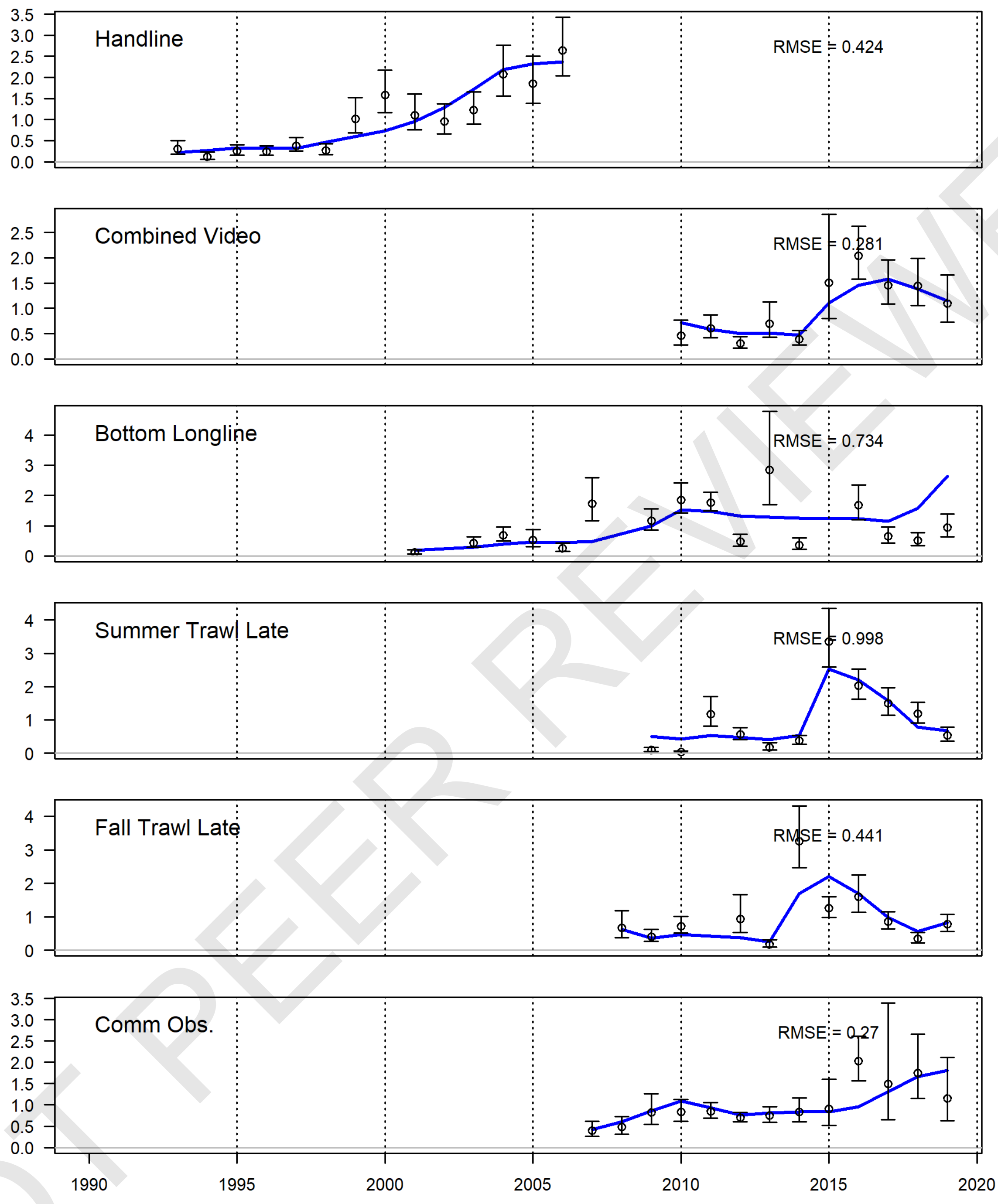


Figure 14. Eastern Gulf of Mexico Red Snapper observed and expected indices (blue lines) for SEDAR 74. Dashed vertical lines identify five year intervals. The root mean squared error (RMSE) is also provided.

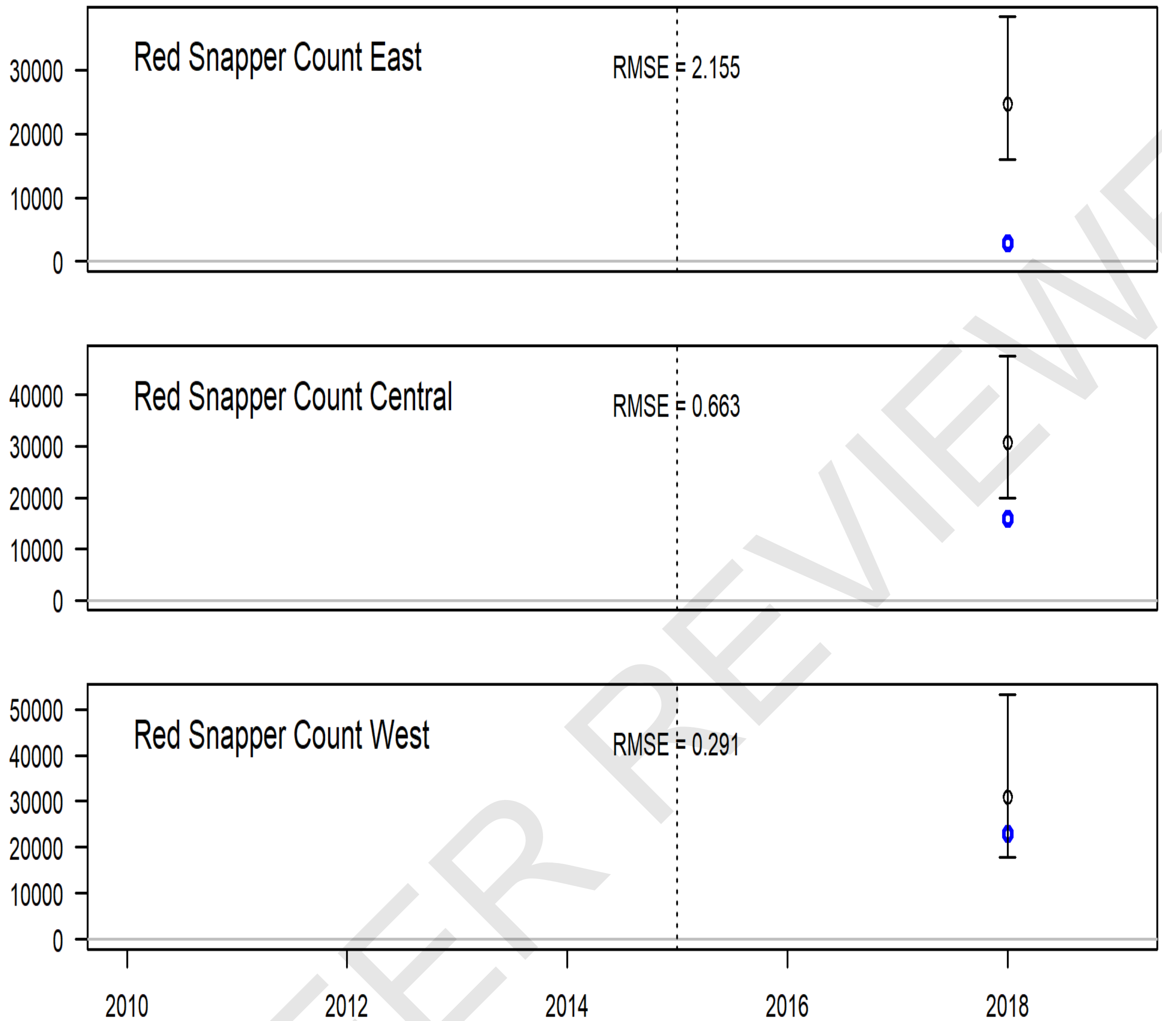


Figure 15. Absolute abundance and associated 95% uncertainty interval around values based on the model assumption of lognormal error for Gulf of Mexico Red Snapper.

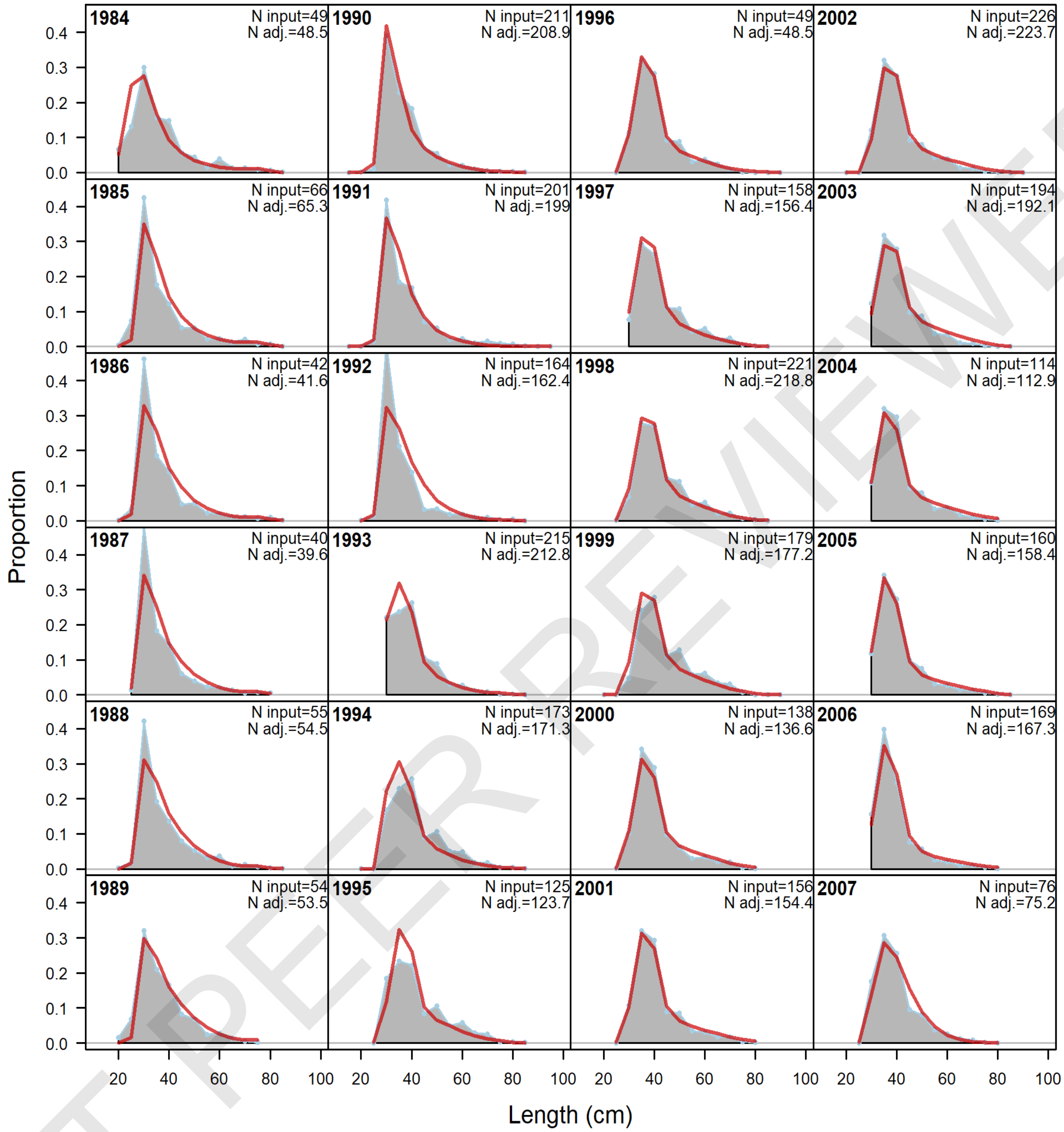


Figure 16. Length compositions, retained, Commercial Handline West. 'N input' is the input sample size. 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial Θ parameter based on the formula N adj. = 1 / (1+Θ) + N Θ / (1+Θ). For this fleet, Θ = 69.402 and the sample size multiplier is approximately Θ / (1+Θ) = 0.986.*

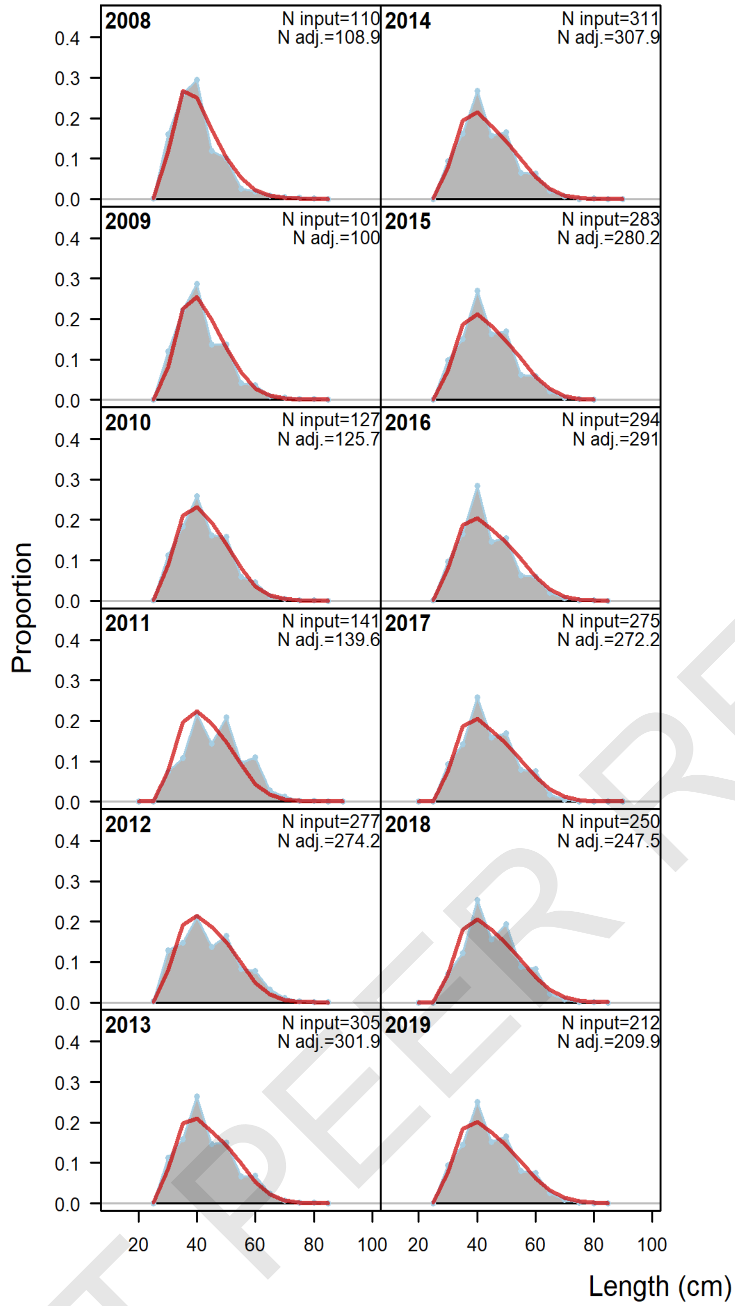


Figure 16 Continued. Length compositions, retained, Commercial Handline West. 'N input' is the input sample size. 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial Θ parameter based on the formula N adj. = 1 / (1+Θ) + N Θ / (1+Θ). For this fleet, Θ = 69.402 and the sample size multiplier is approximately Θ / (1+Θ) = 0.986.*

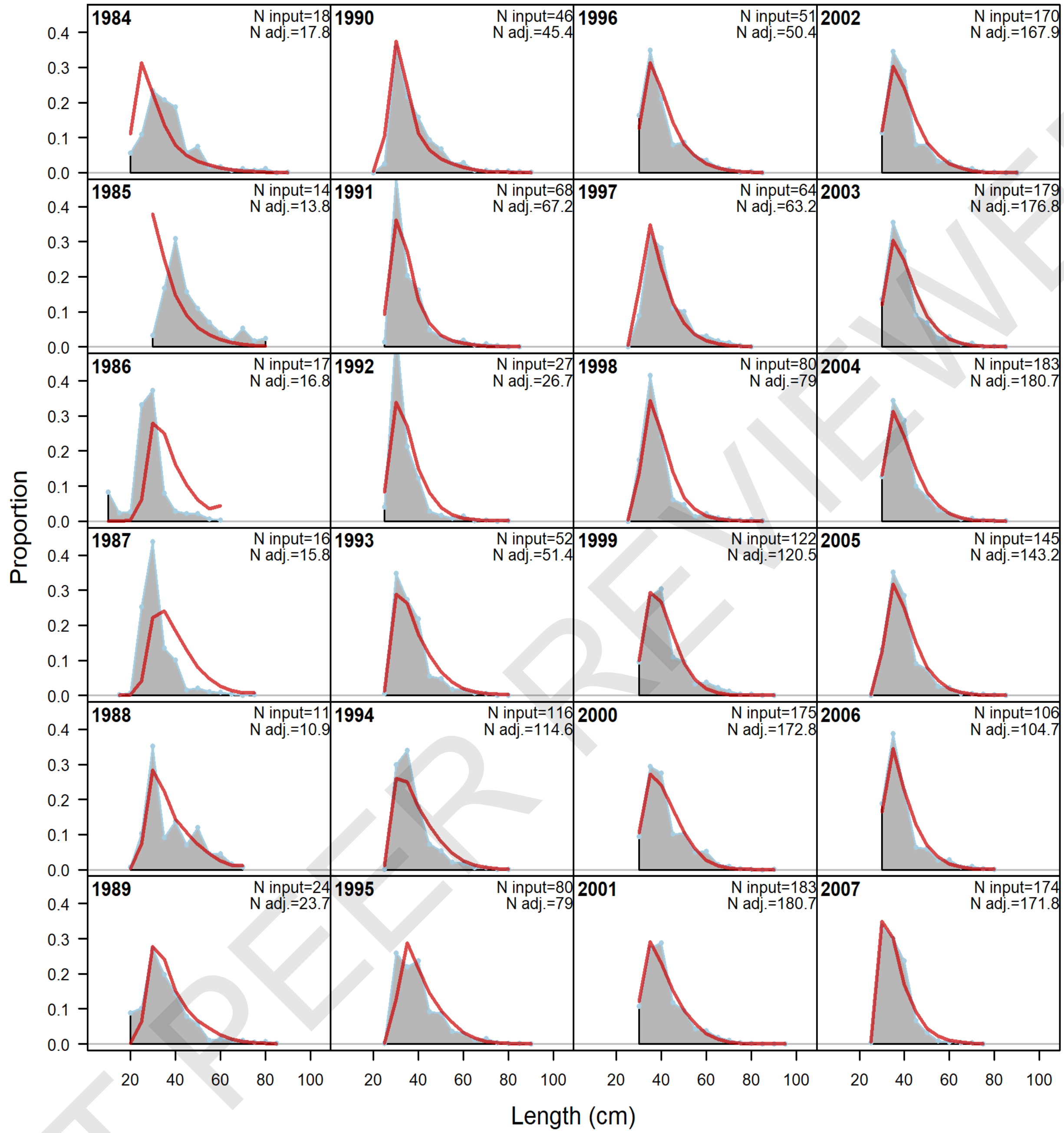


Figure 17. Length compositions, retained, Commercial Handline Central. 'N input' is the input sample size. 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial Θ parameter based on the formula N adj. = 1 / (1+Θ) + N Θ / (1+Θ). For this fleet, Θ = 81.396 and the sample size multiplier is approximately Θ / (1+Θ) = 0.988.*

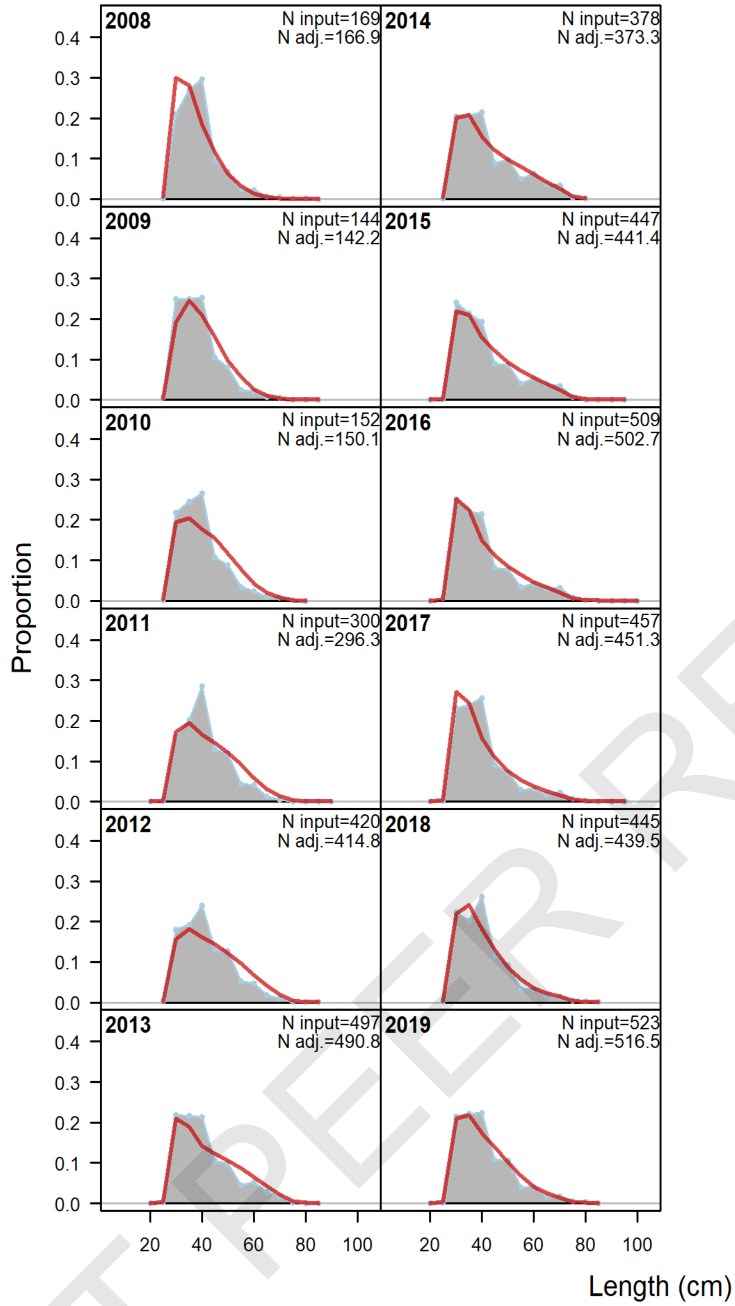


Figure 17 Continued. Length compositions, retained, Commercial Handline Central. 'N input' is the input sample size. 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial Θ parameter based on the formula N adj. = 1 / (1+Θ) + N Θ / (1+Θ). For this fleet, Θ = 81.396 and the sample size multiplier is approximately Θ / (1+Θ) = 0.988.*

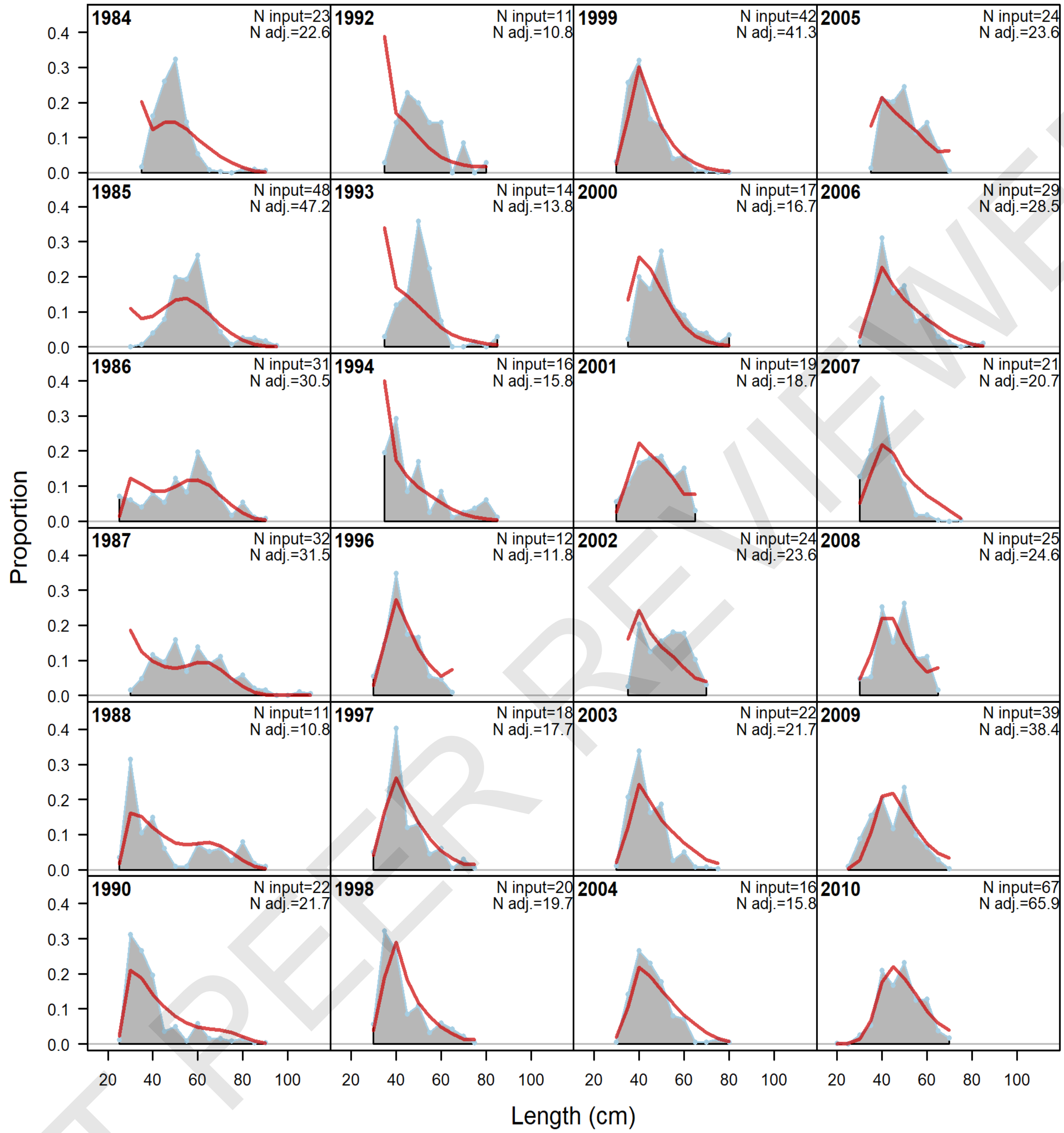


Figure 18. Length compositions, retained, Commercial Handline East. 'N input' is the input sample size. 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial Θ parameter based on the formula N adj. = 1 / (1+Θ) + N Θ / (1+Θ). For this fleet, Θ = 69.402 and the sample size multiplier is approximately Θ / (1+Θ) = 0.986.*

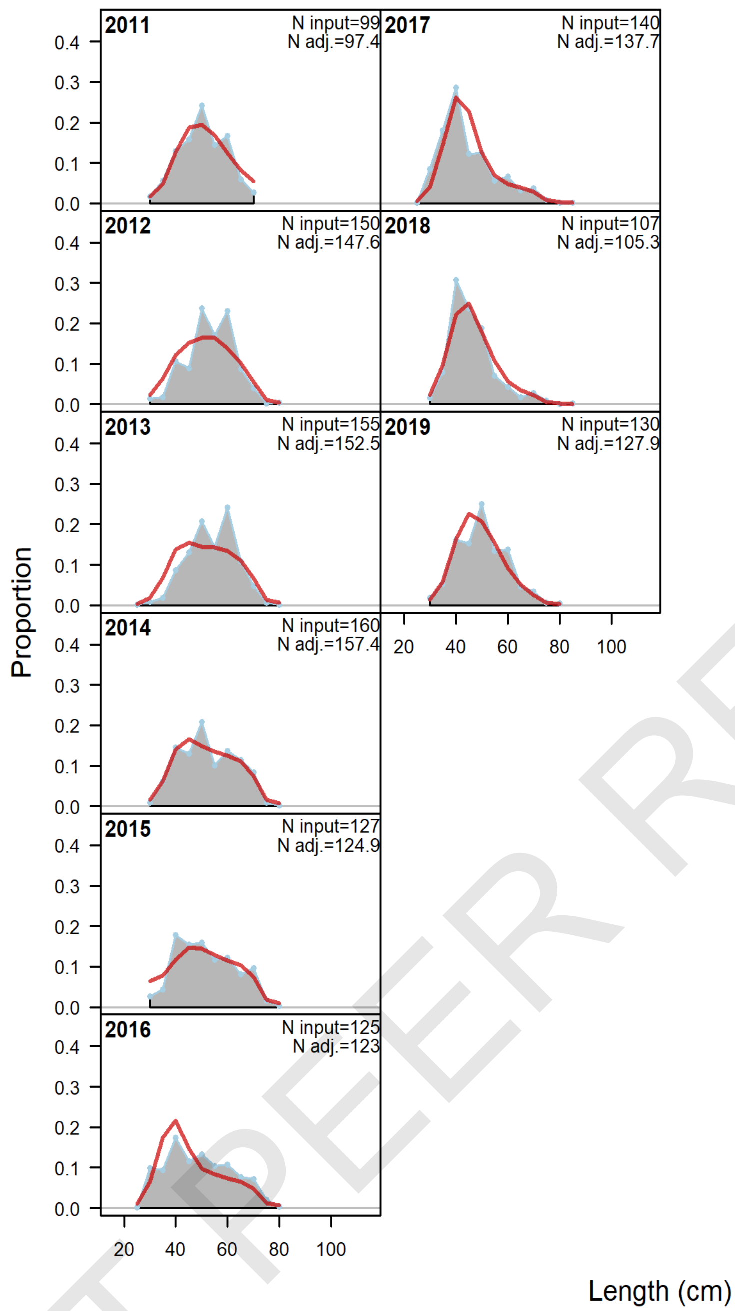


Figure 18 Continued. Length compositions, retained, Commercial Handline East. 'N input' is the input sample size. 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial Θ parameter based on the formula N adj. = 1 / (1+Θ) + N Θ / (1+Θ). For this fleet, Θ = 69.402 and the sample size multiplier is approximately Θ / (1+Θ) = 0.986.*

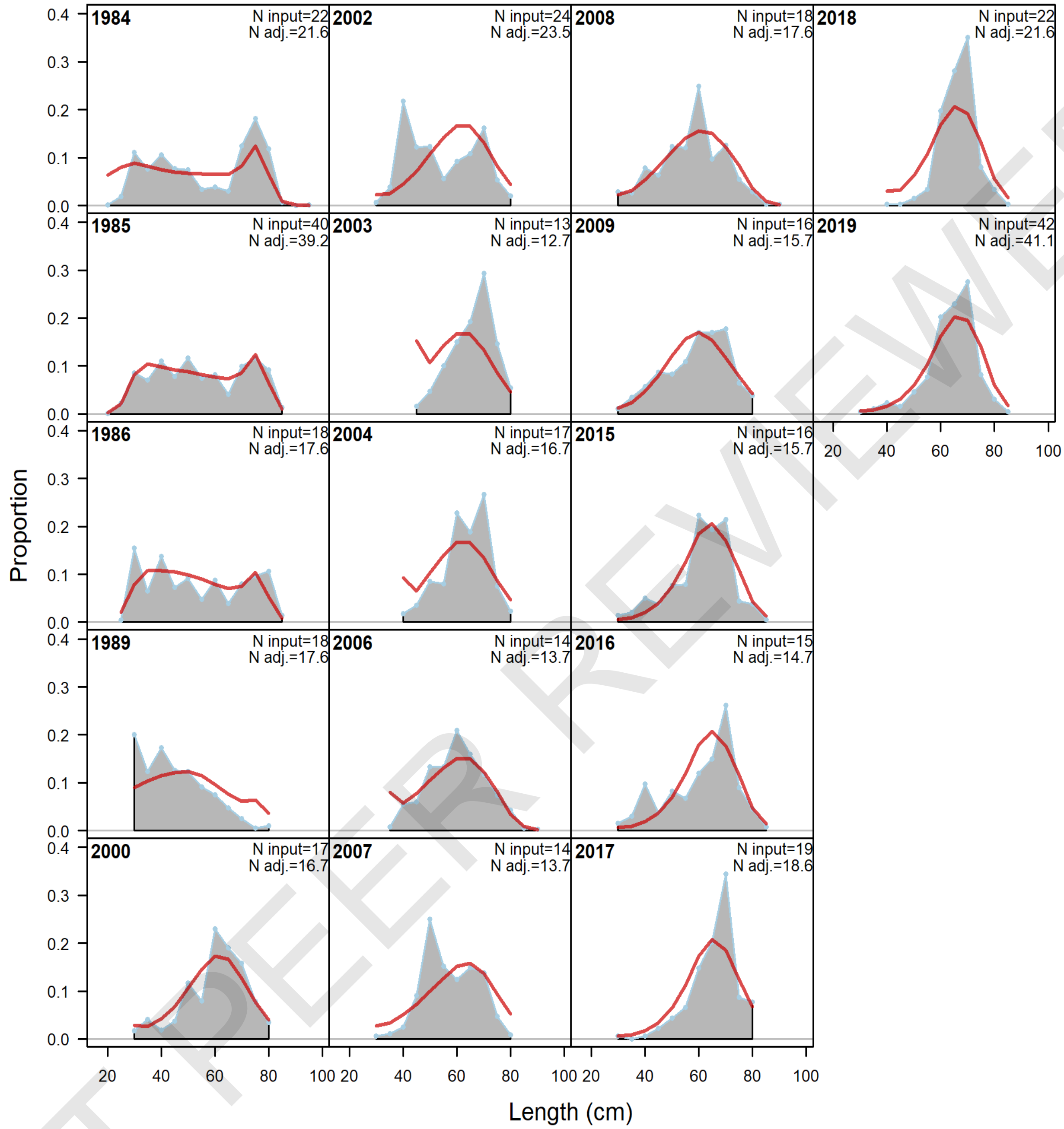


Figure 19. Length compositions, retained, Commercial Longline West. 'N input' is the input sample size. 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial Θ parameter based on the formula N adj. = 1 / (1+Θ) + N Θ / (1+Θ). For this fleet, Θ = 52.823 and the sample size multiplier is approximately Θ / (1+Θ) = 0.981.*

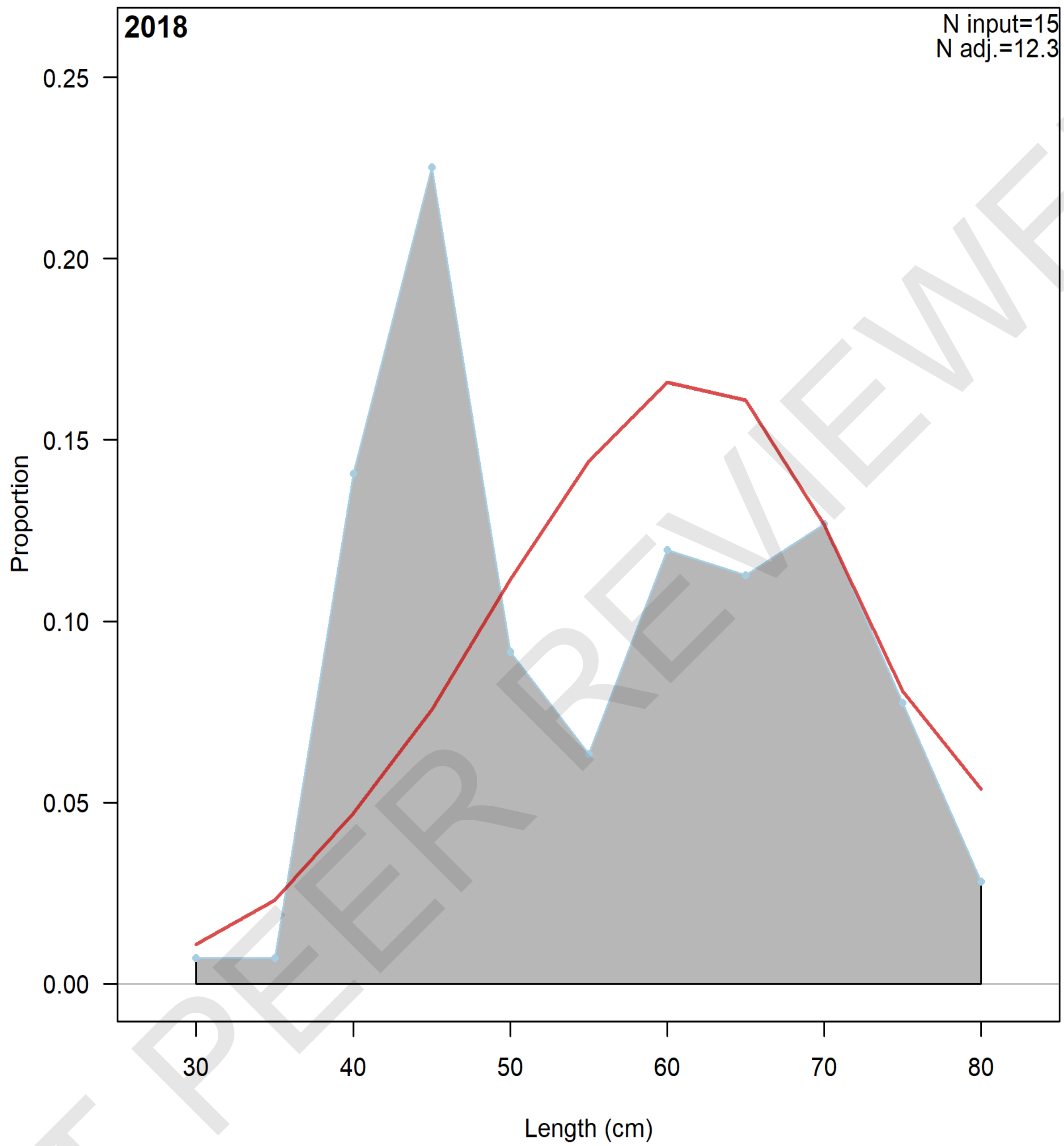


Figure 20. Length compositions, retained, Commercial Longline Central. 'N input' is the input sample size. 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial Θ parameter based on the formula N adj. = 1 / (1+Θ) + N Θ / (1+Θ). For this fleet, Θ = 3.034 and the sample size multiplier is approximately Θ / (1+Θ) = 0.752.*

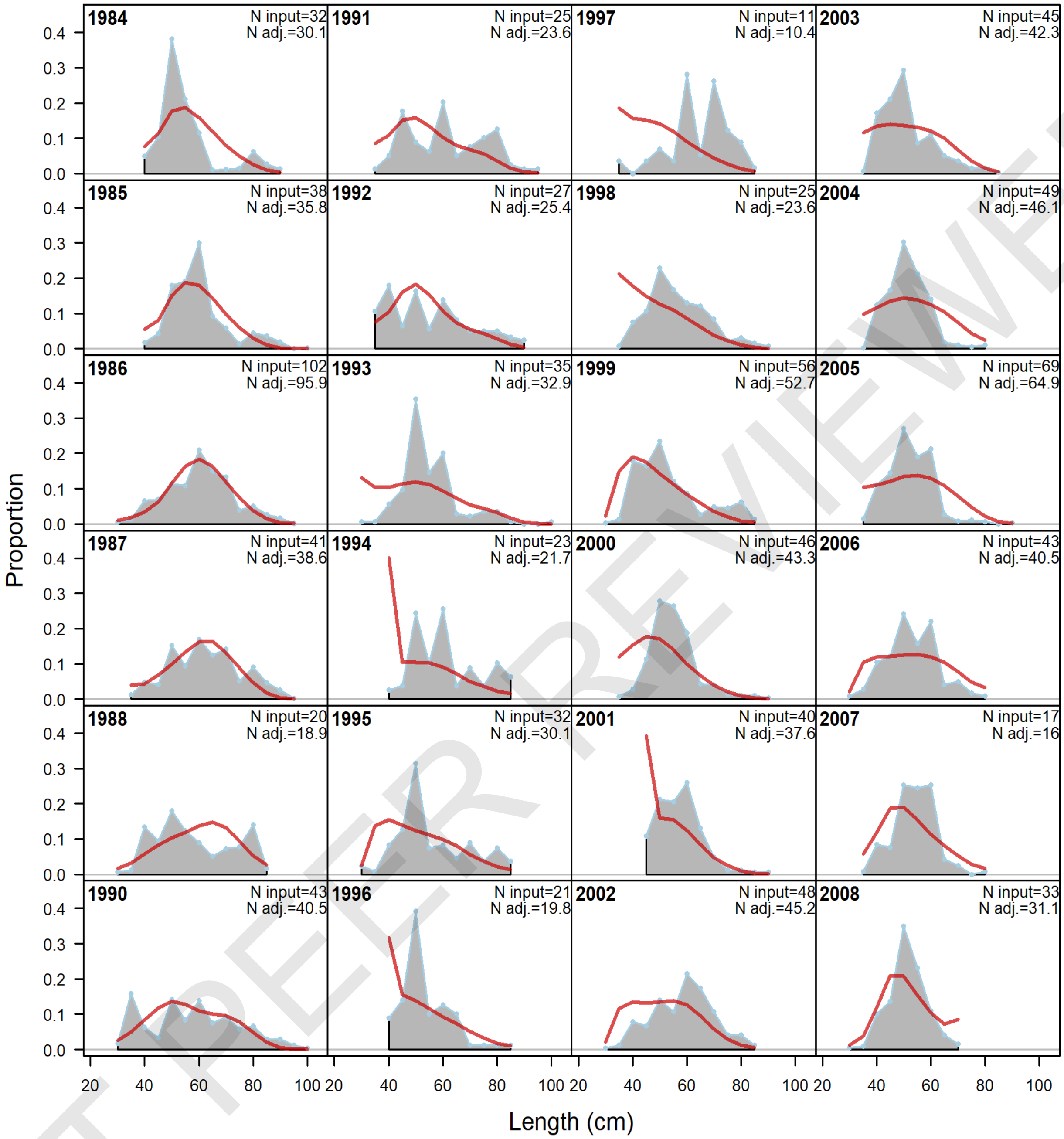


Figure 21. Length compositions, retained, Commercial Longline East. 'N input' is the input sample size. 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial Θ parameter based on the formula N adj. = 1 / (1+Θ) + N Θ / (1+Θ). For this fleet, Θ = 57.973 and the sample size multiplier is approximately Θ / (1+Θ) = 0.983.*

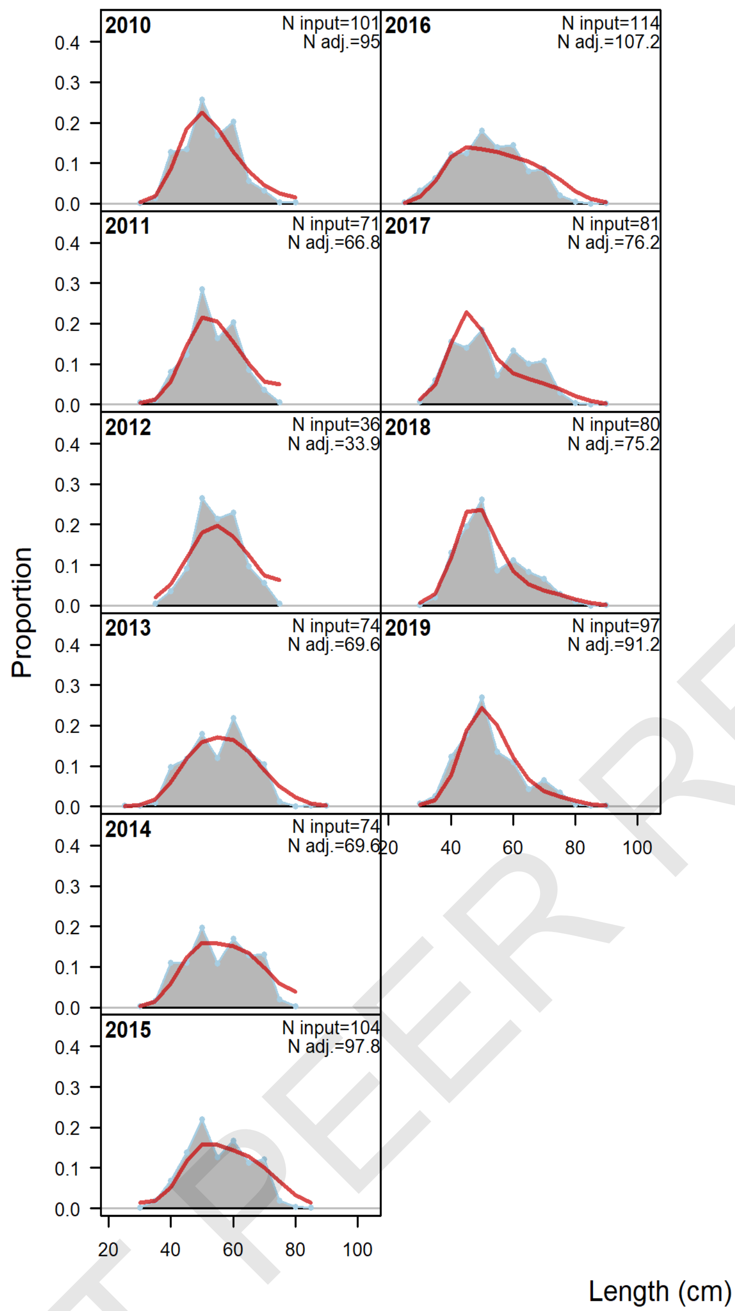


Figure 21 Continued. Length compositions, retained, Commercial Longline East. 'N input' is the input sample size. 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial Θ parameter based on the formula N adj. = 1 / (1+Θ) + N Θ / (1+Θ). For this fleet, Θ = 57.973 and the sample size multiplier is approximately Θ / (1+Θ) = 0.983.*

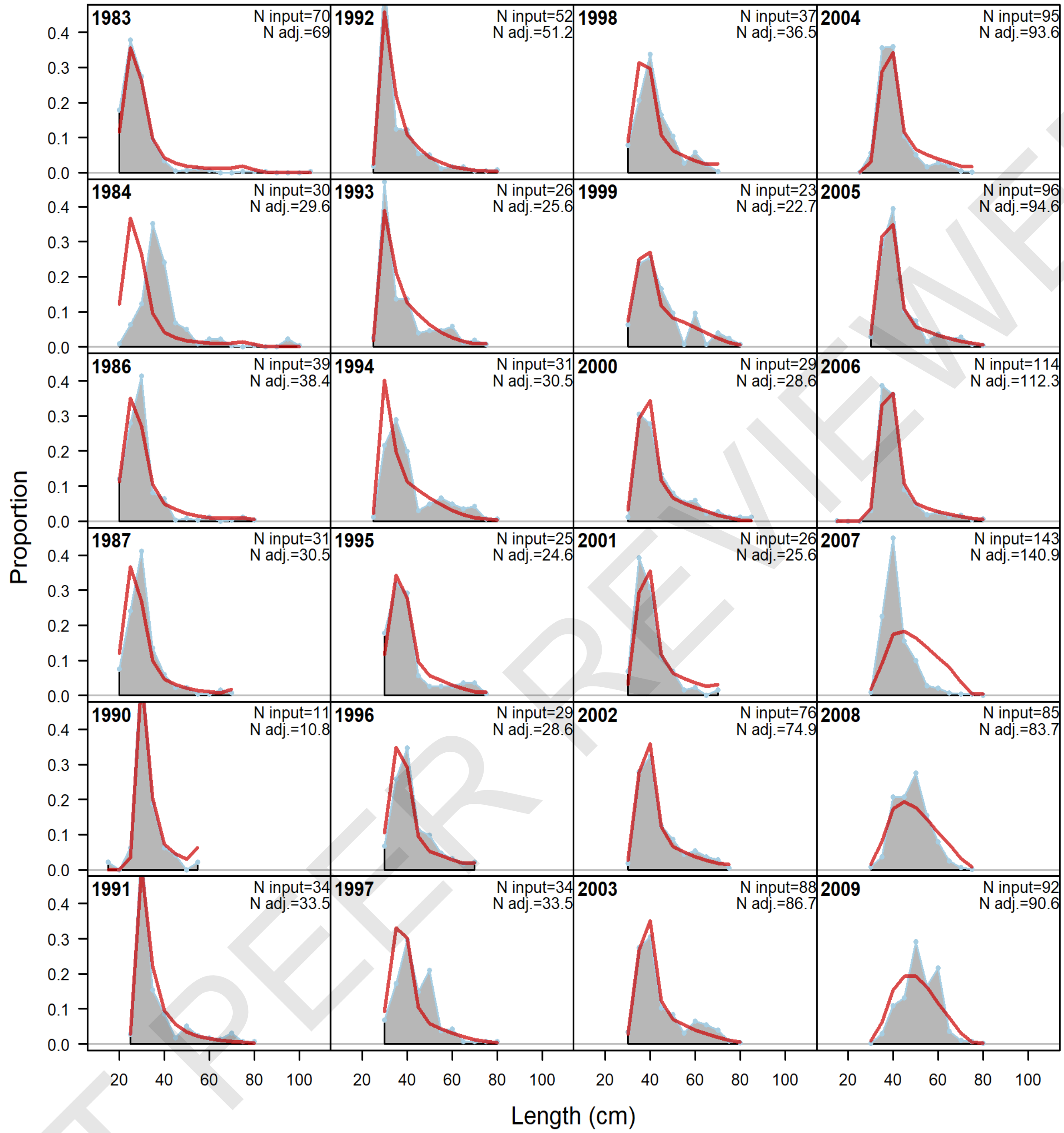


Figure 22. Length compositions, retained, Recreational Charter West. 'N input' is the input sample size. 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial Θ parameter based on the formula N adj. = 1 / (1+Θ) + N Θ / (1+Θ). For this fleet, Θ = 132.445 and the sample size multiplier is approximately Θ / (1+Θ) = 0.993.*

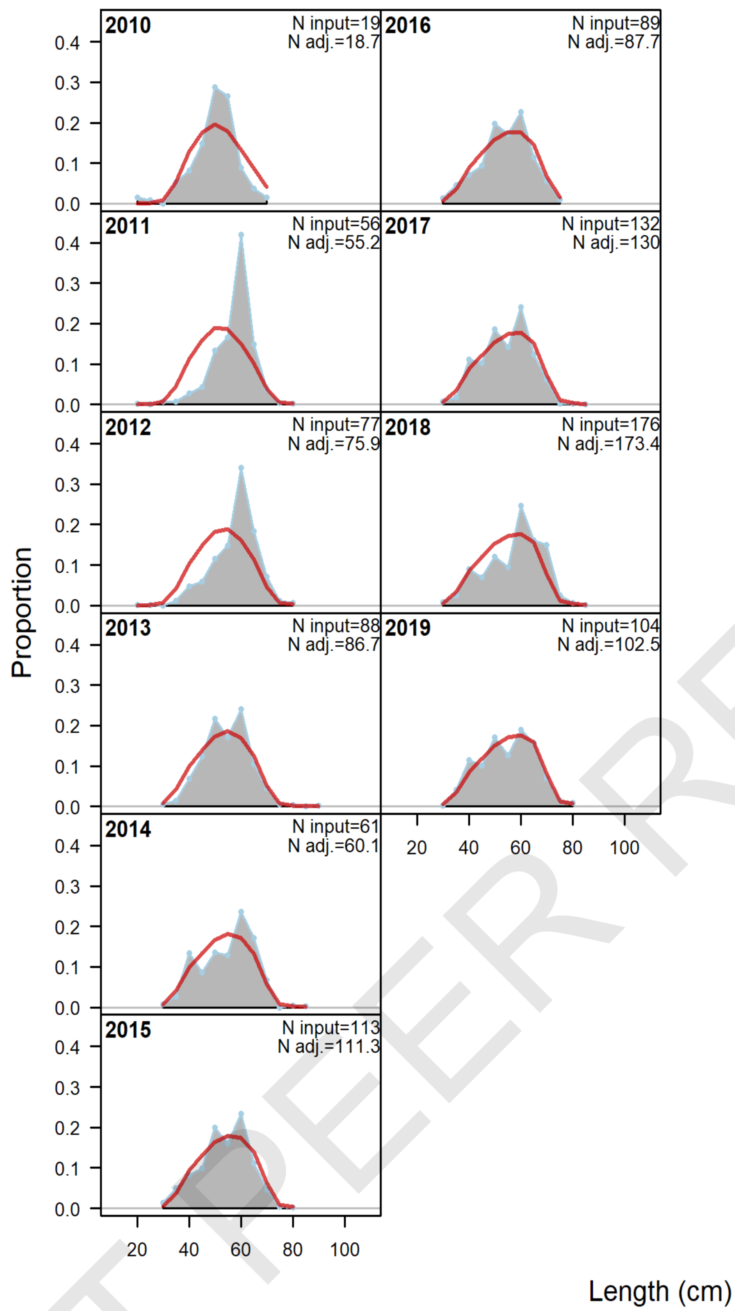


Figure 22 Continued. Length compositions, retained, Recreational Charter West. 'N input' is the input sample size. 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial Θ parameter based on the formula N adj. = 1 / (1+Θ) + N Θ / (1+Θ). For this fleet, Θ = 132.445 and the sample size multiplier is approximately Θ / (1+Θ) = 0.993.*

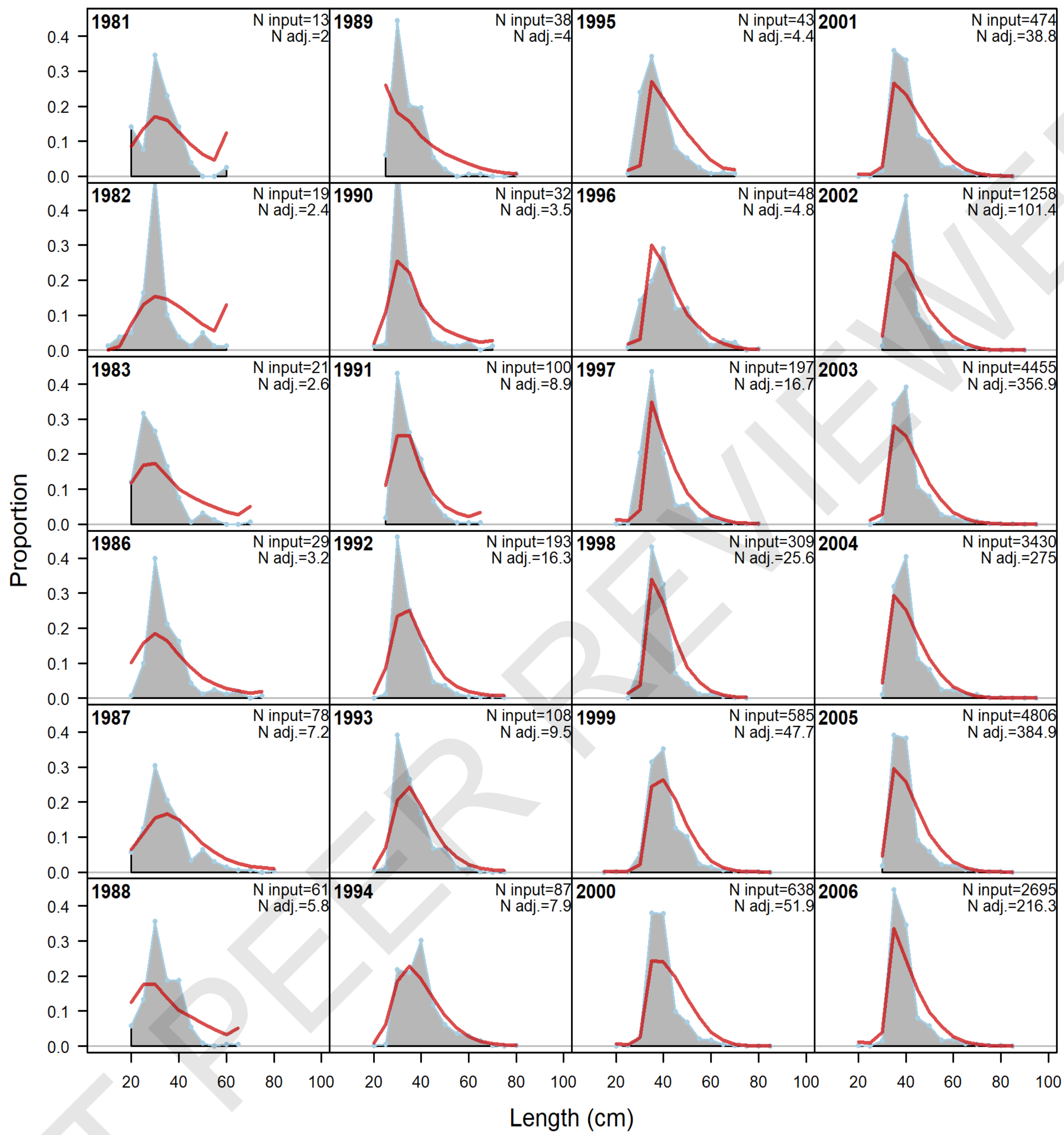


Figure 23. Length compositions, retained, Recreational Charter Central. 'N input' is the input sample size. 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial Θ parameter based on the formula N adj. = 1 / (1+Θ) + N Θ / (1+Θ). For this fleet, Θ = 0.104 and the sample size multiplier is approximately Θ / (1+Θ) = 0.094.*

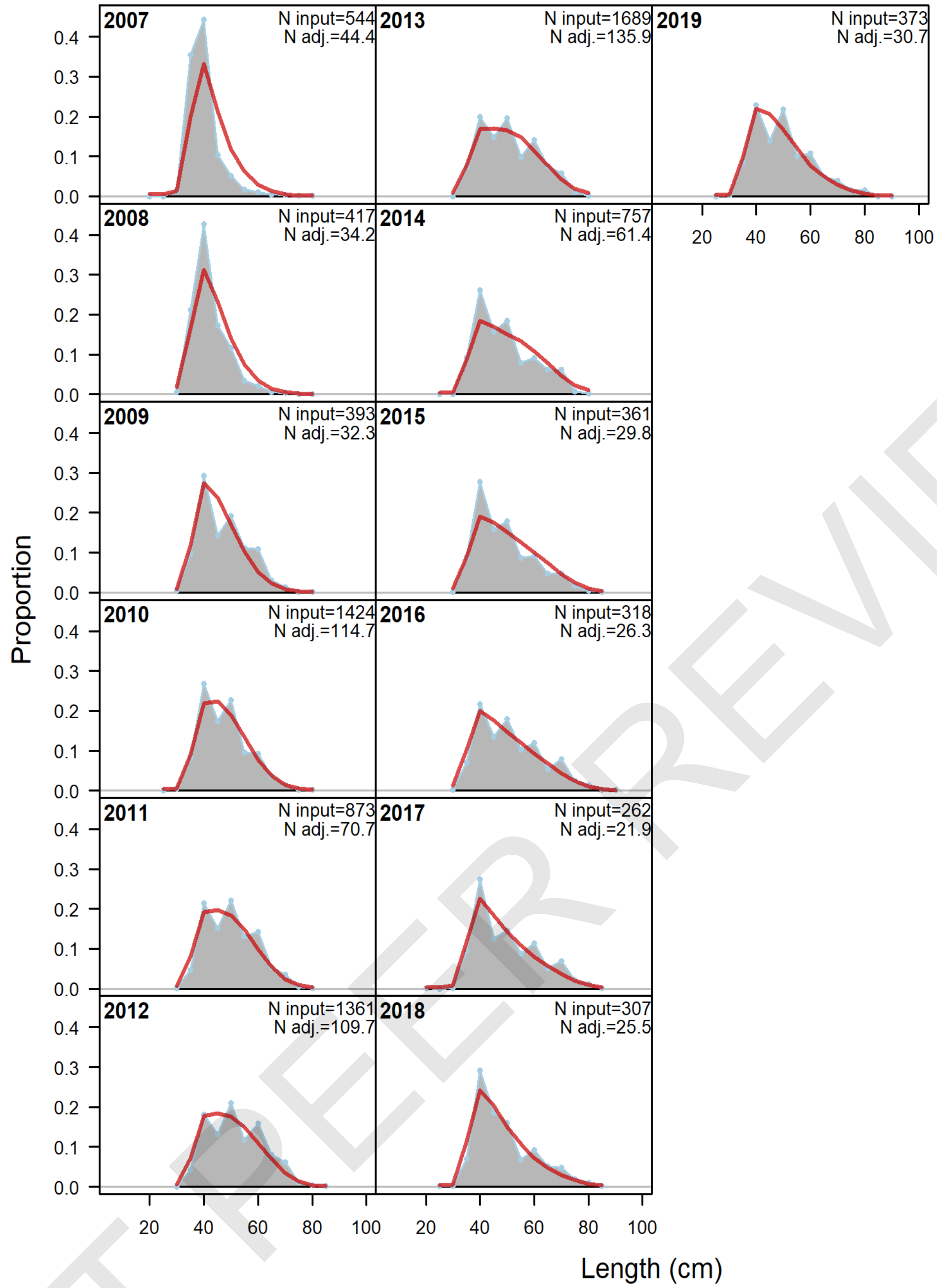


Figure 23 Continued. Length compositions, retained, Recreational Charter Central. 'N input' is the input sample size. 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial Θ parameter based on the formula N adj. = 1 / (1+Θ) + N Θ / (1+Θ). For this fleet, Θ = 0.104 and the sample size multiplier is approximately Θ / (1+Θ) = 0.094.*

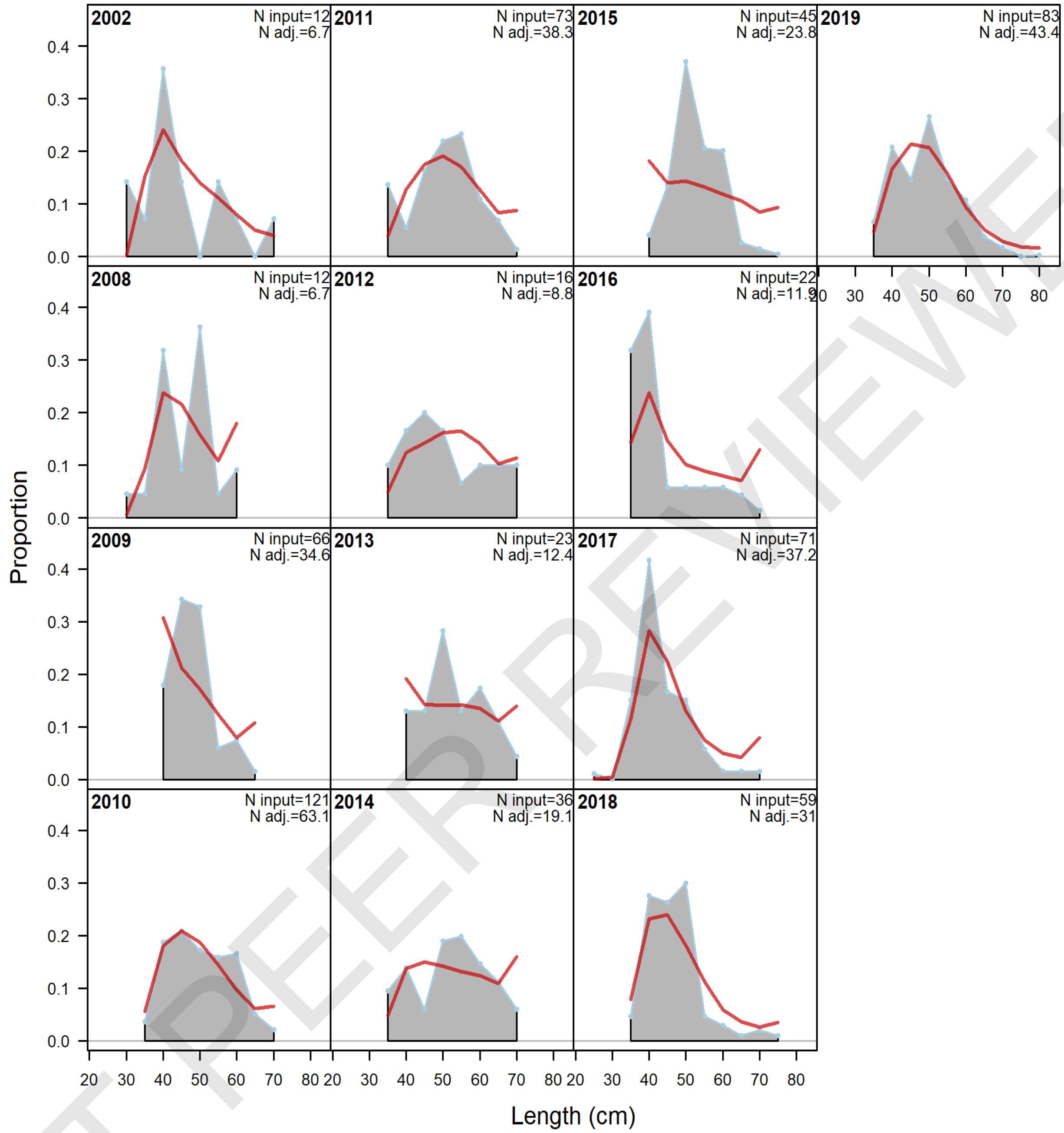


Figure 24. Length compositions, retained, Recreational Charter East. 'N input' is the input sample size. 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial Θ parameter based on the formula N adj. = 1 / (1+Θ) + N Θ / (1+Θ). For this fleet, Θ = 2.43 and the sample size multiplier is approximately Θ / (1+Θ) = 0.708.*

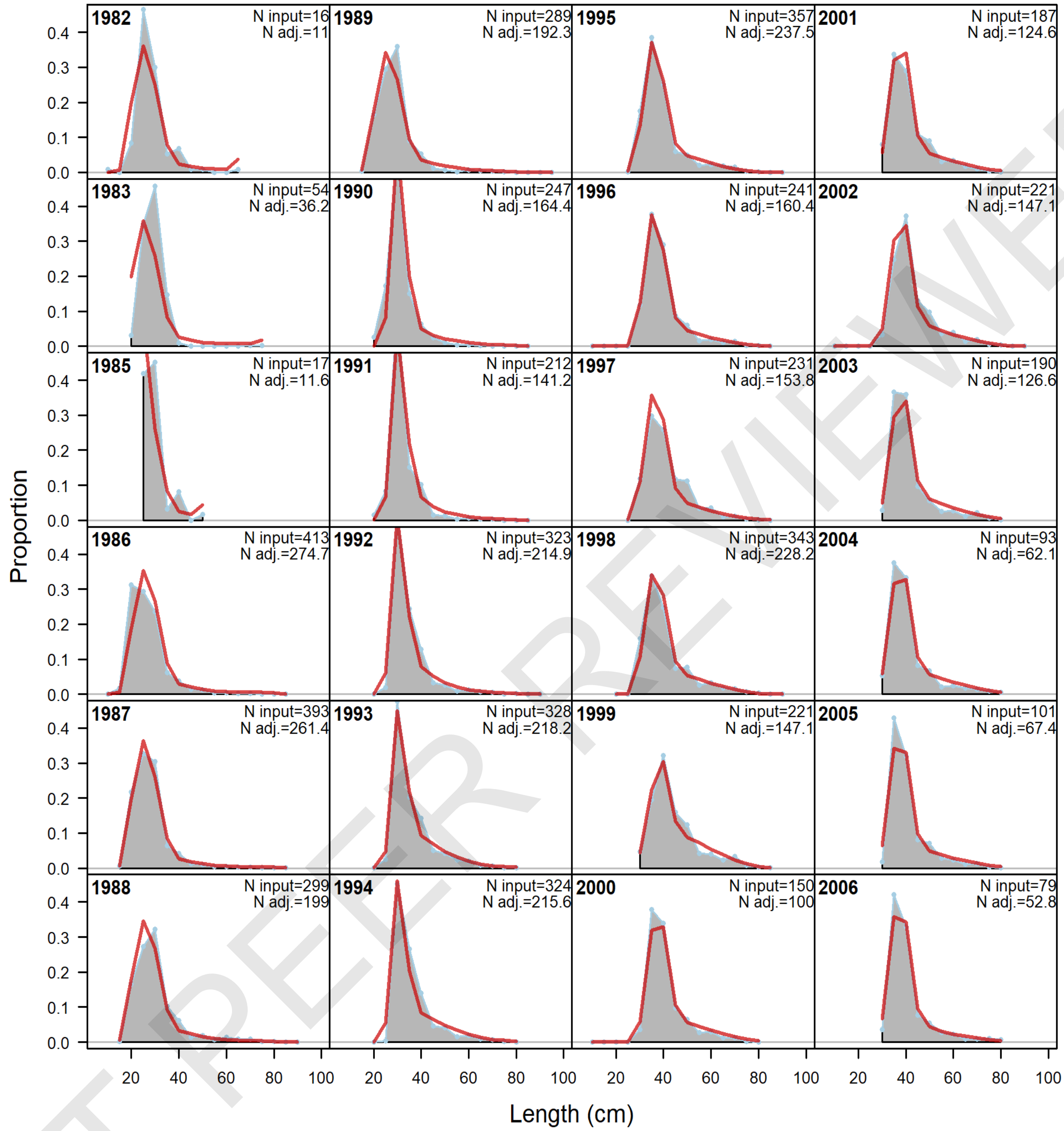


Figure 25. Length compositions, retained, Recreational Headboat West. 'N input' is the input sample size. 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial Θ parameter based on the formula N adj. = 1 / (1+Θ) + N Θ / (1+Θ). For this fleet, Θ = 1.092 and the sample size multiplier is approximately Θ / (1+Θ) = 0.522.*

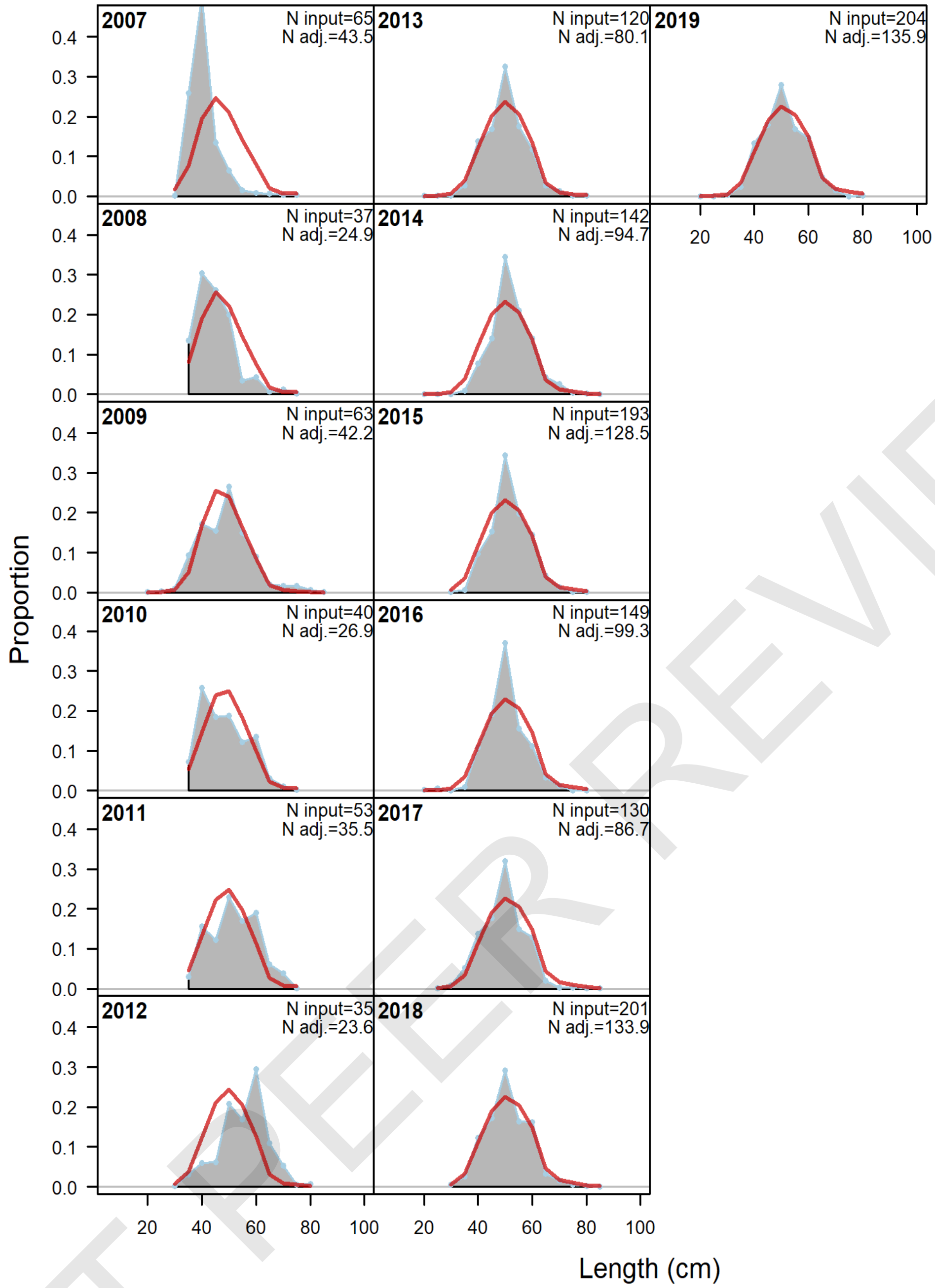


Figure 25 Continued. Length compositions, retained, Recreational Headboat West. 'N input' is the input sample size. 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial Θ parameter based on the formula N adj. = 1 / (1+Θ) + N Θ / (1+Θ). For this fleet, Θ = 1.092 and the sample size multiplier is approximately Θ / (1+Θ) = 0.522.*

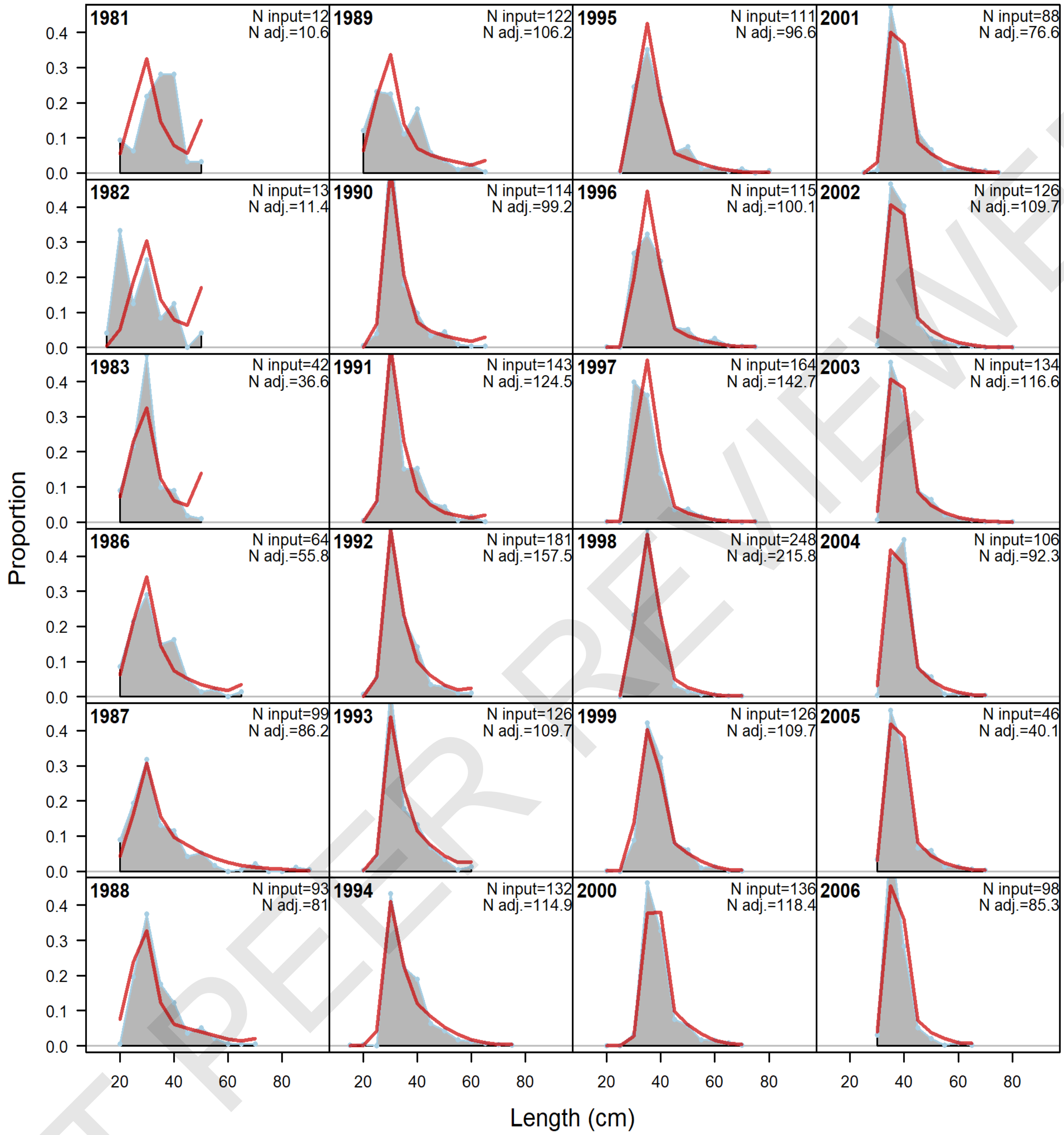


Figure 26. Length compositions, retained, Recreational Headboat Central. 'N input' is the input sample size. 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial Θ parameter based on the formula N adj. = 1 / (1+Θ) + N Θ / (1+Θ). For this fleet, Θ = 0.695 and the sample size multiplier is approximately Θ / (1+Θ) = 0.41.*

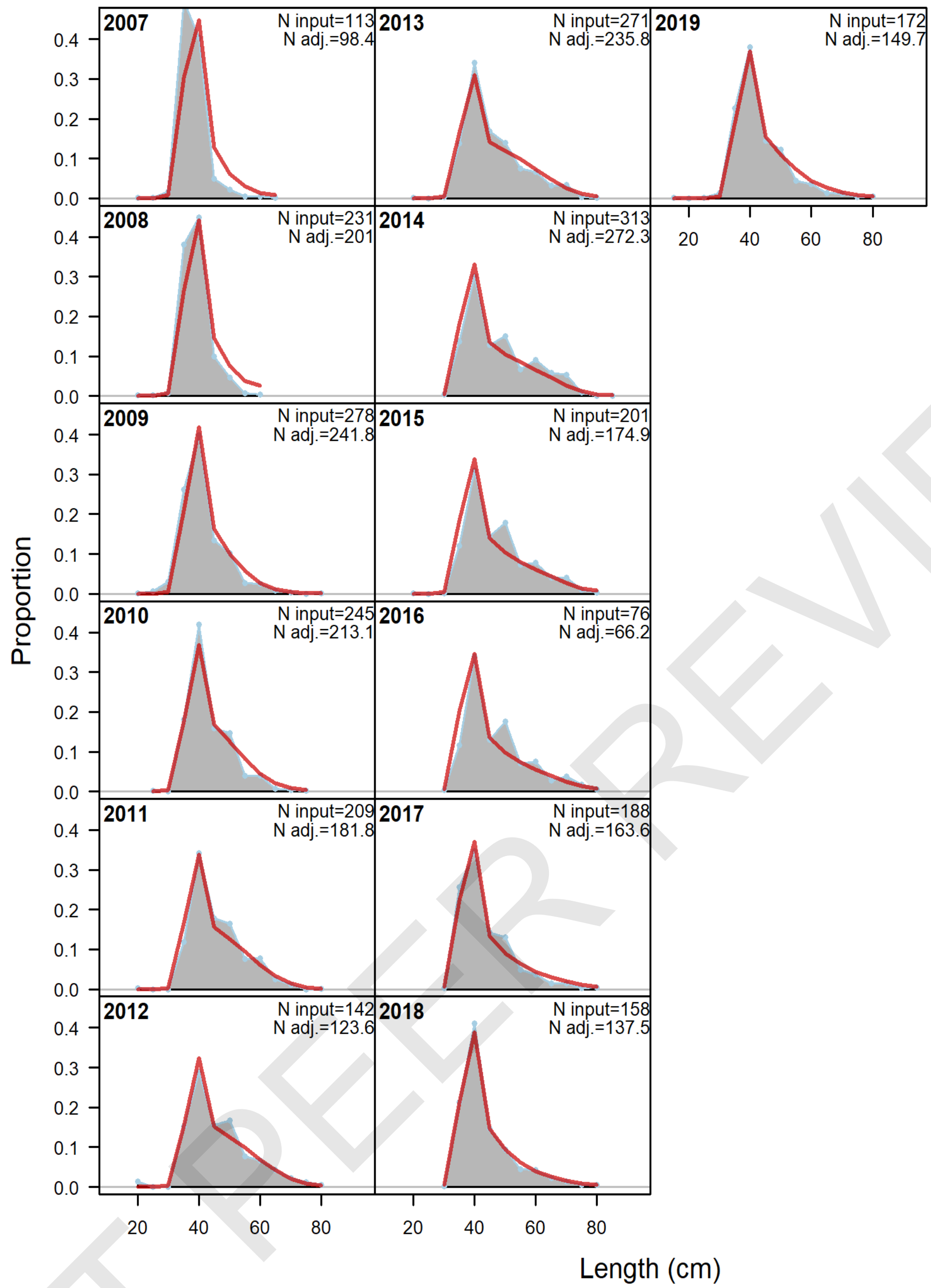


Figure 26 Continued. Length compositions, retained, Recreational Headboat Central. 'N input' is the input sample size. 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial Θ parameter based on the formula N adj. = 1 / (1+Θ) + N Θ / (1+Θ). For this fleet, Θ = 0.695 and the sample size multiplier is approximately Θ / (1+Θ) = 0.41.*

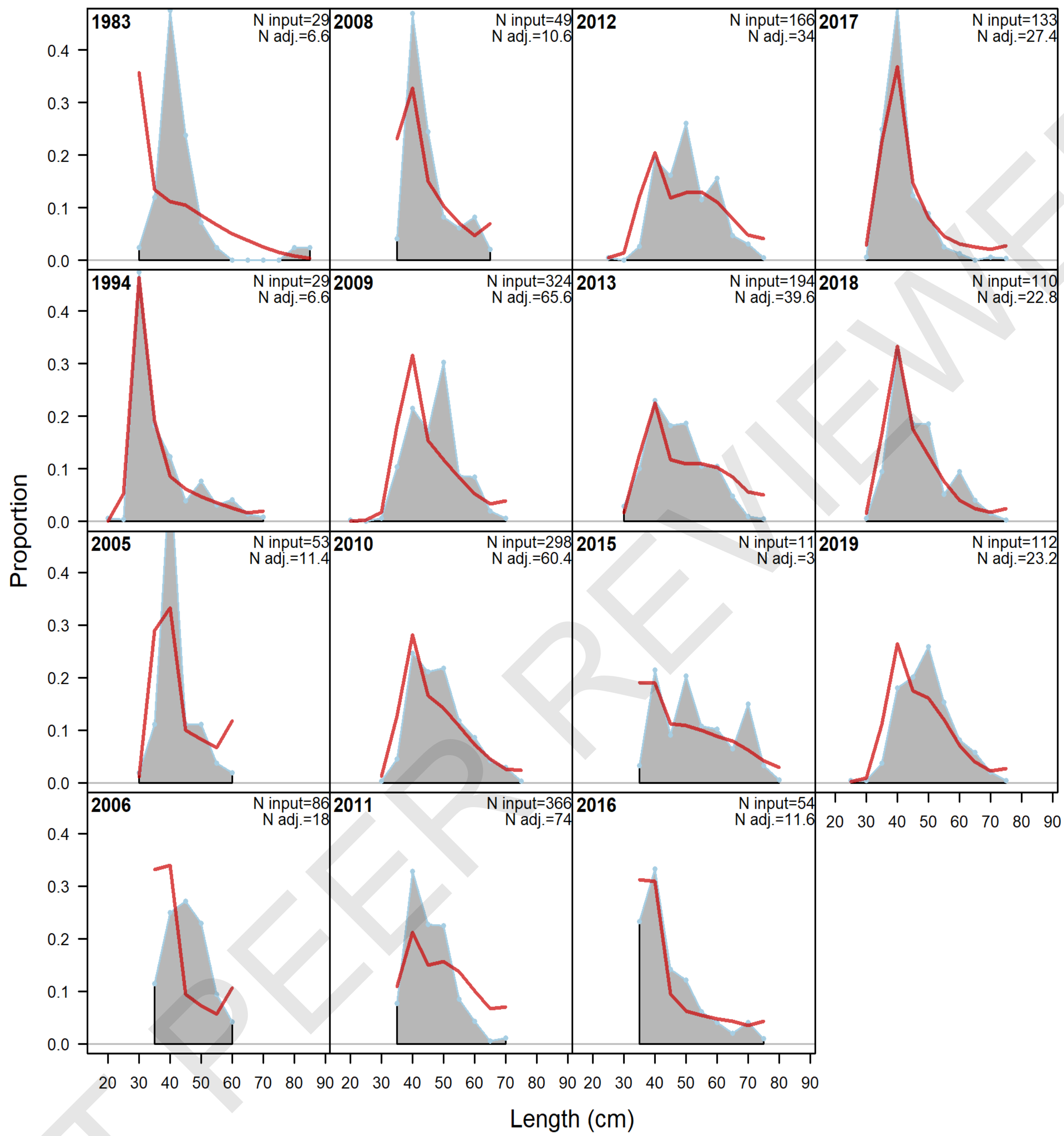


Figure 27. Length compositions, retained, Recreational Headboat East. 'N input' is the input sample size. 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial Θ parameter based on the formula N adj. = 1 / (1+Θ) + N Θ / (1+Θ). For this fleet, Θ = 0.718 and the sample size multiplier is approximately Θ / (1+Θ) = 0.418.*

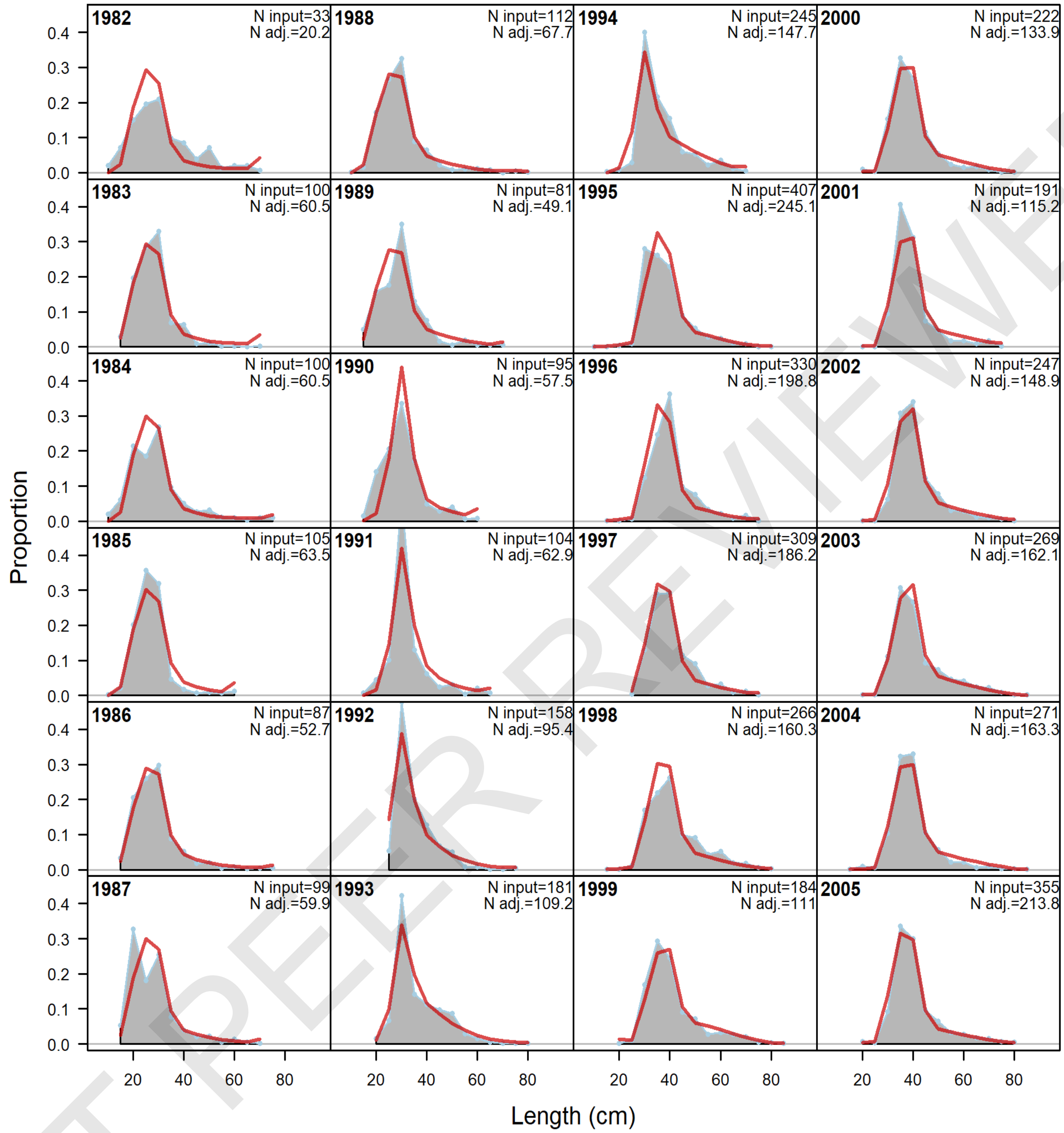


Figure 28. Length compositions, retained, Recreational Private West. 'N input' is the input sample size. 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial Θ parameter based on the formula N adj. = 1 / (1+Θ) + N Θ / (1+Θ). For this fleet, Θ = 1.333 and the sample size multiplier is approximately Θ / (1+Θ) = 0.571.*

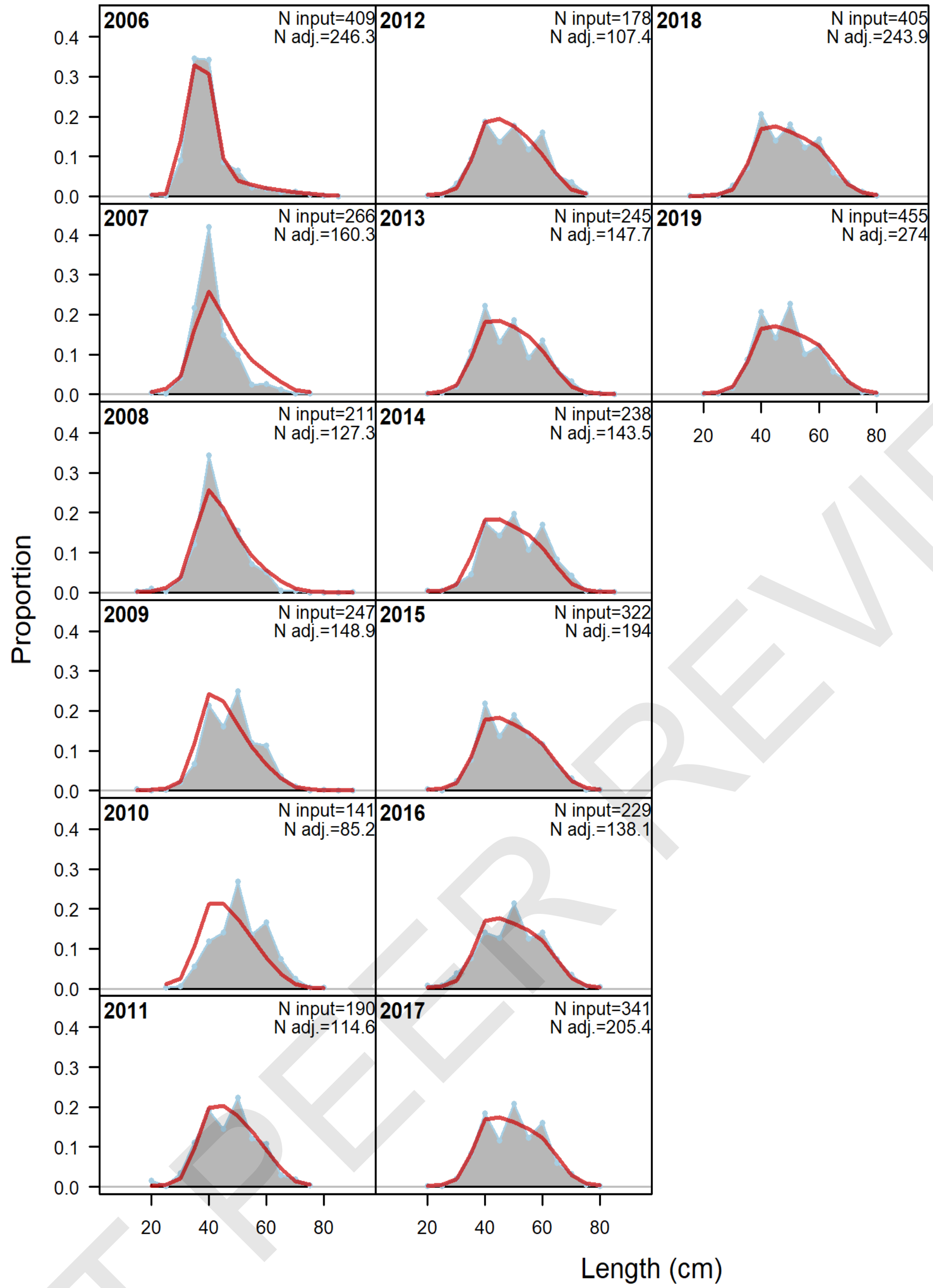


Figure 28 Continued. Length compositions, retained, Recreational Private West. 'N input' is the input sample size. 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial Θ parameter based on the formula N adj. = 1 / (1+Θ) + N Θ / (1+Θ). For this fleet, Θ = 1.333 and the sample size multiplier is approximately Θ / (1+Θ) = 0.571.*

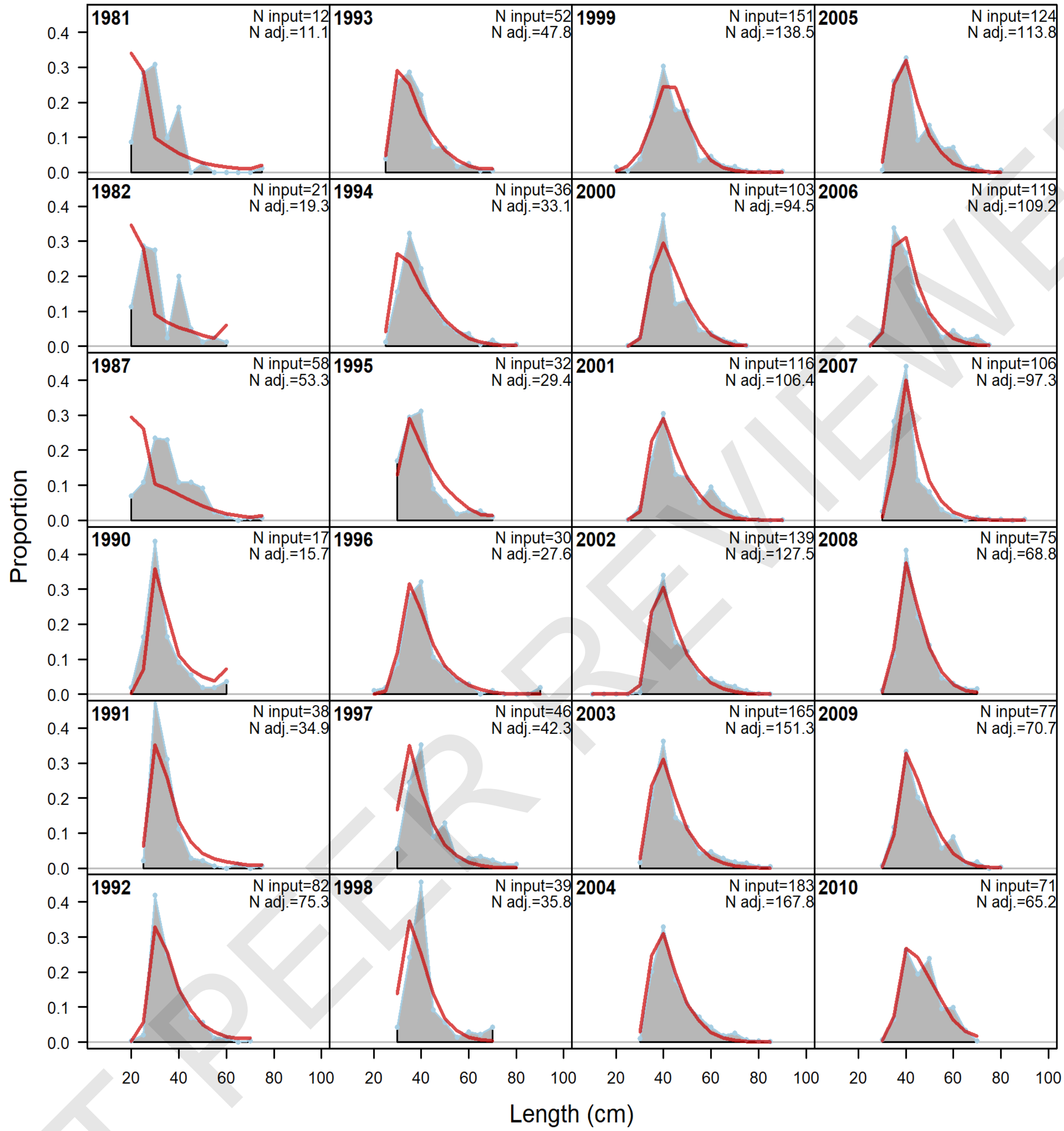


Figure 29. Length compositions, retained, Recreational Private Central. 'N input' is the input sample size. 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial Θ parameter based on the formula N adj. = 1 / (1+Θ) + N Θ / (1+Θ). For this fleet, Θ = 67.053 and the sample size multiplier is approximately Θ / (1+Θ) = 0.985.*

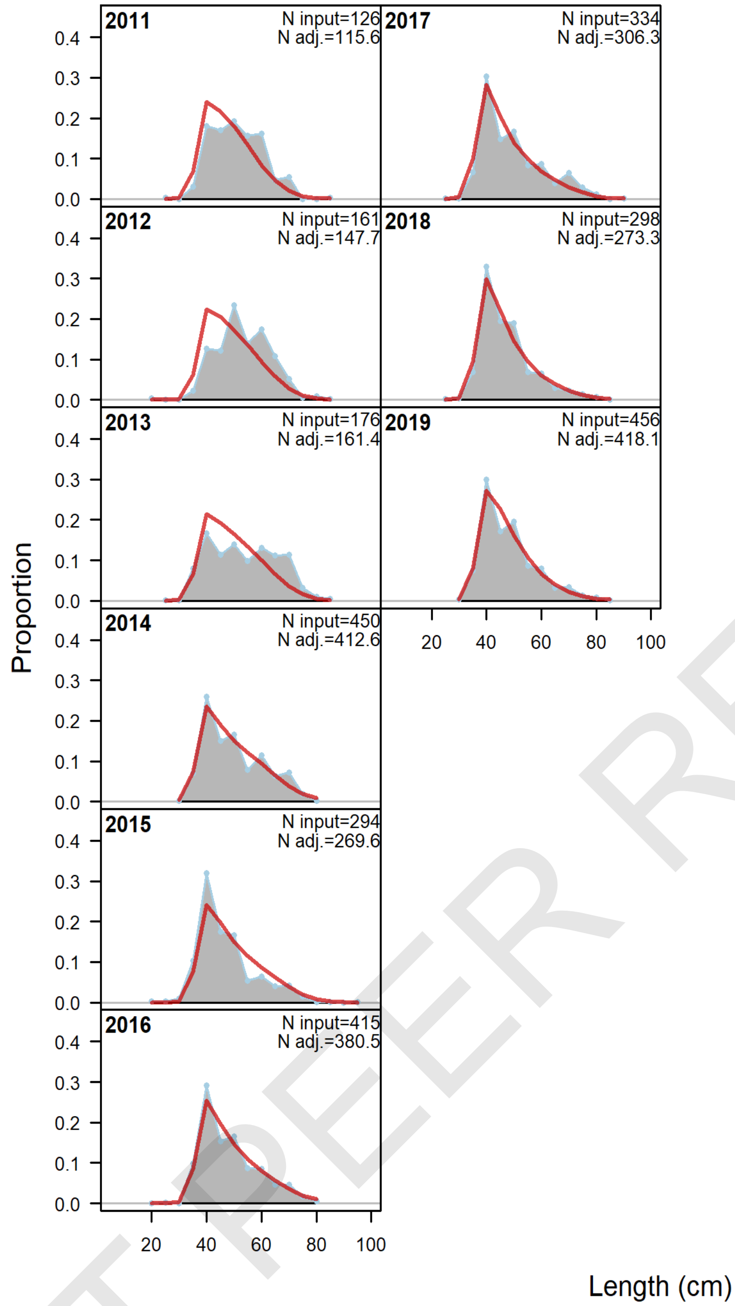


Figure 29 Continued. Length compositions, retained, Recreational Private Central. 'N input' is the input sample size. 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial Θ parameter based on the formula N adj. = 1 / (1+Θ) + N Θ / (1+Θ). For this fleet, Θ = 67.053 and the sample size multiplier is approximately Θ / (1+Θ) = 0.985.*

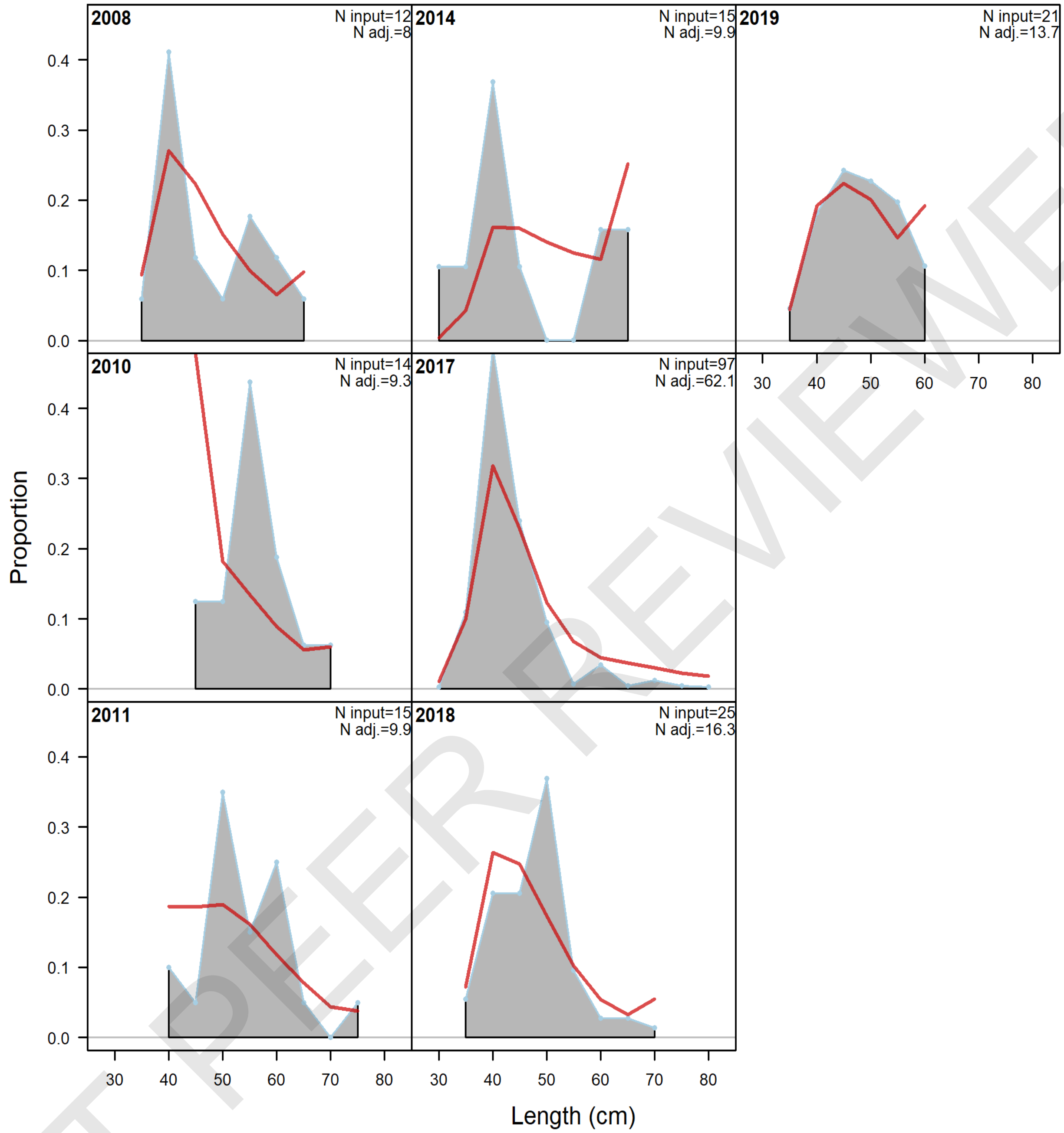


Figure 30. Length compositions, retained, Recreational Private East. 'N input' is the input sample size. 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial Θ parameter based on the formula N adj. = 1 / (1+Θ) + N Θ / (1+Θ). For this fleet, Θ = 2.305 and the sample size multiplier is approximately Θ / (1+Θ) = 0.697.*

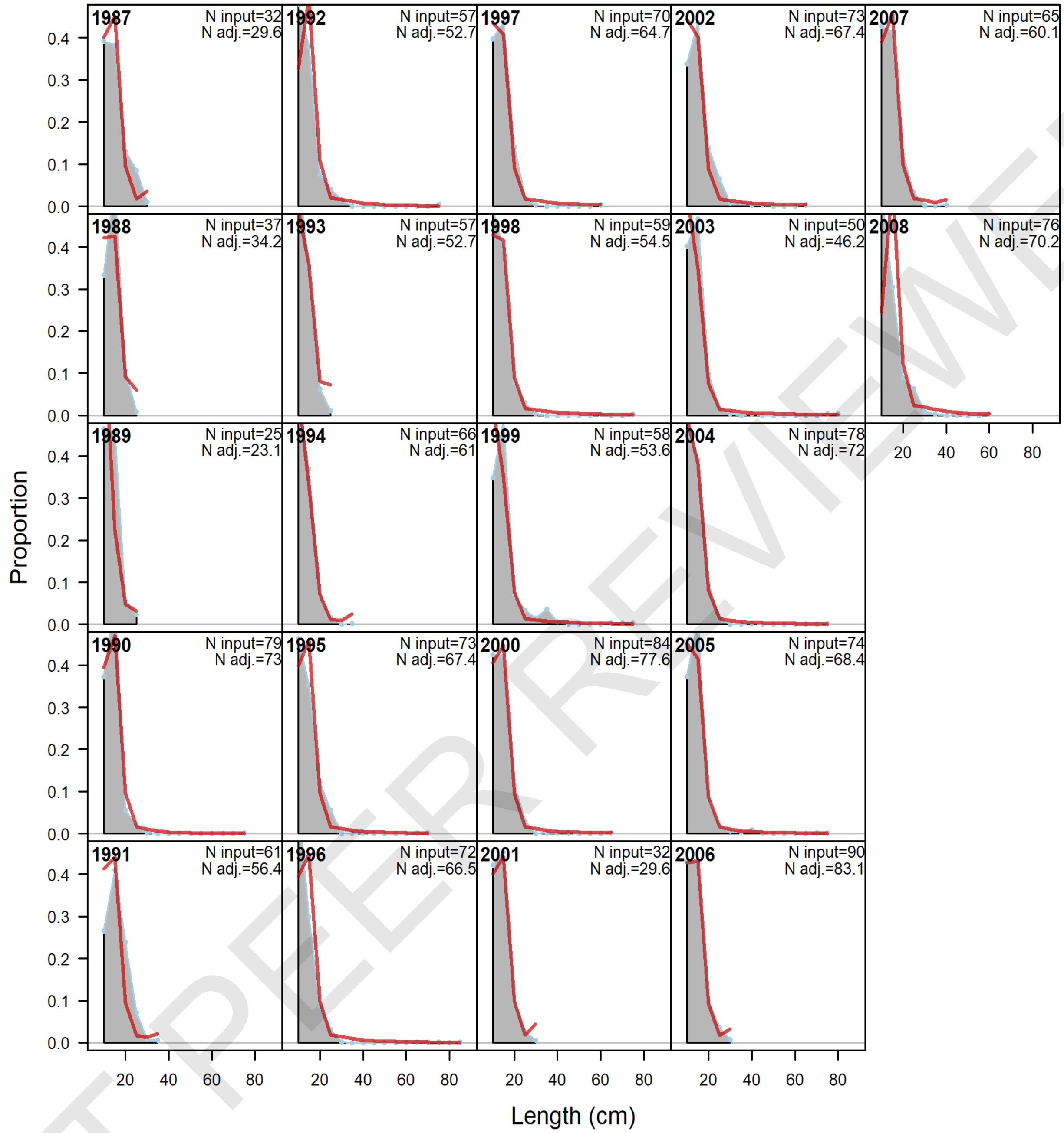


Figure 31. Length compositions, whole catch, SEAMAP Summer Trawl Pre-2007 West. 'N input' is the input sample size. 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial Θ parameter based on the formula N adj. = 1 / (1+Θ) + N Θ / (1+Θ). For this fleet, Θ = 4.972 and the sample size multiplier is approximately Θ / (1+Θ) = 0.833.*

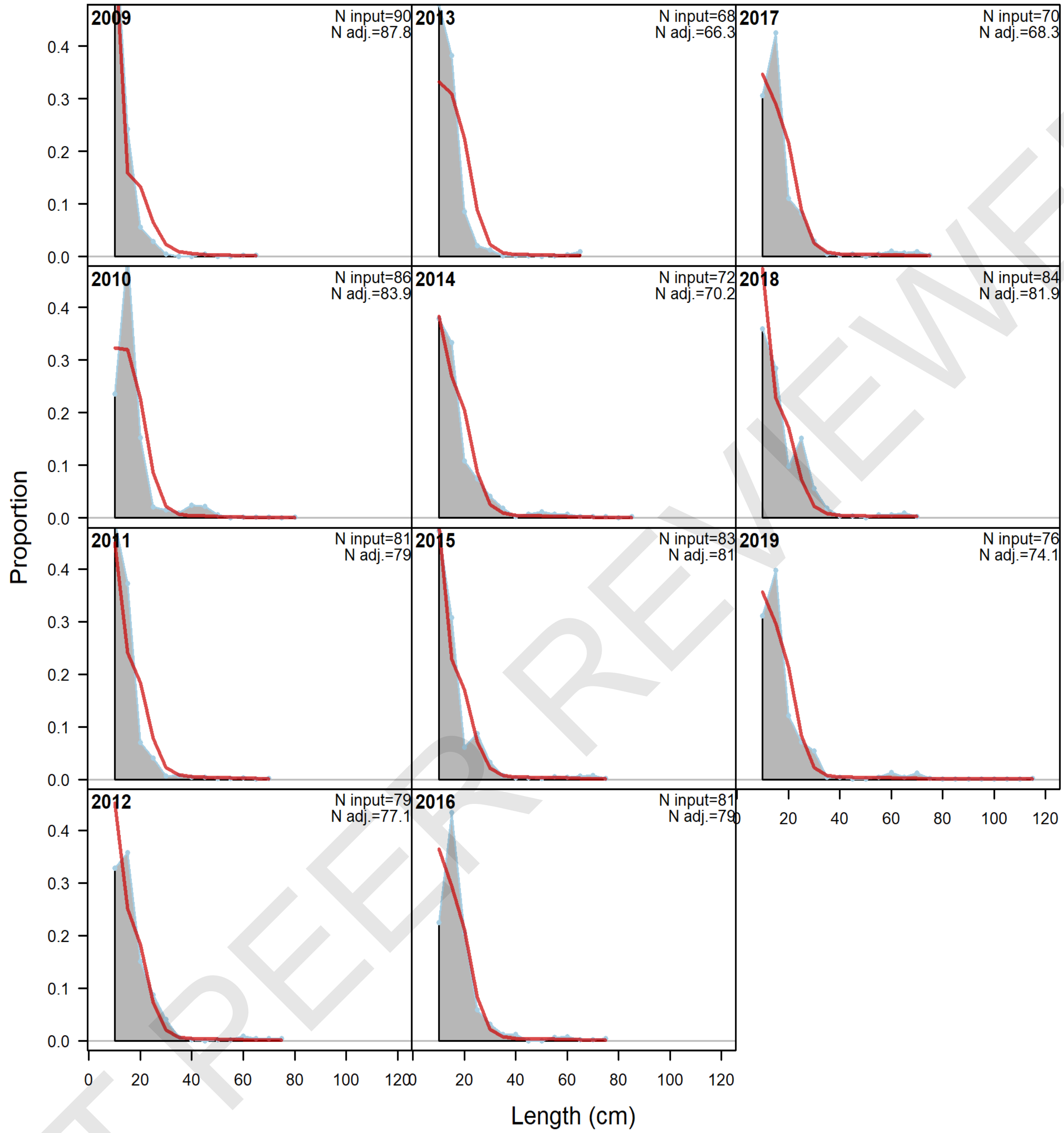


Figure 32. Length compositions, whole catch, SEAMAP Summer Trawl Post-2007 West.

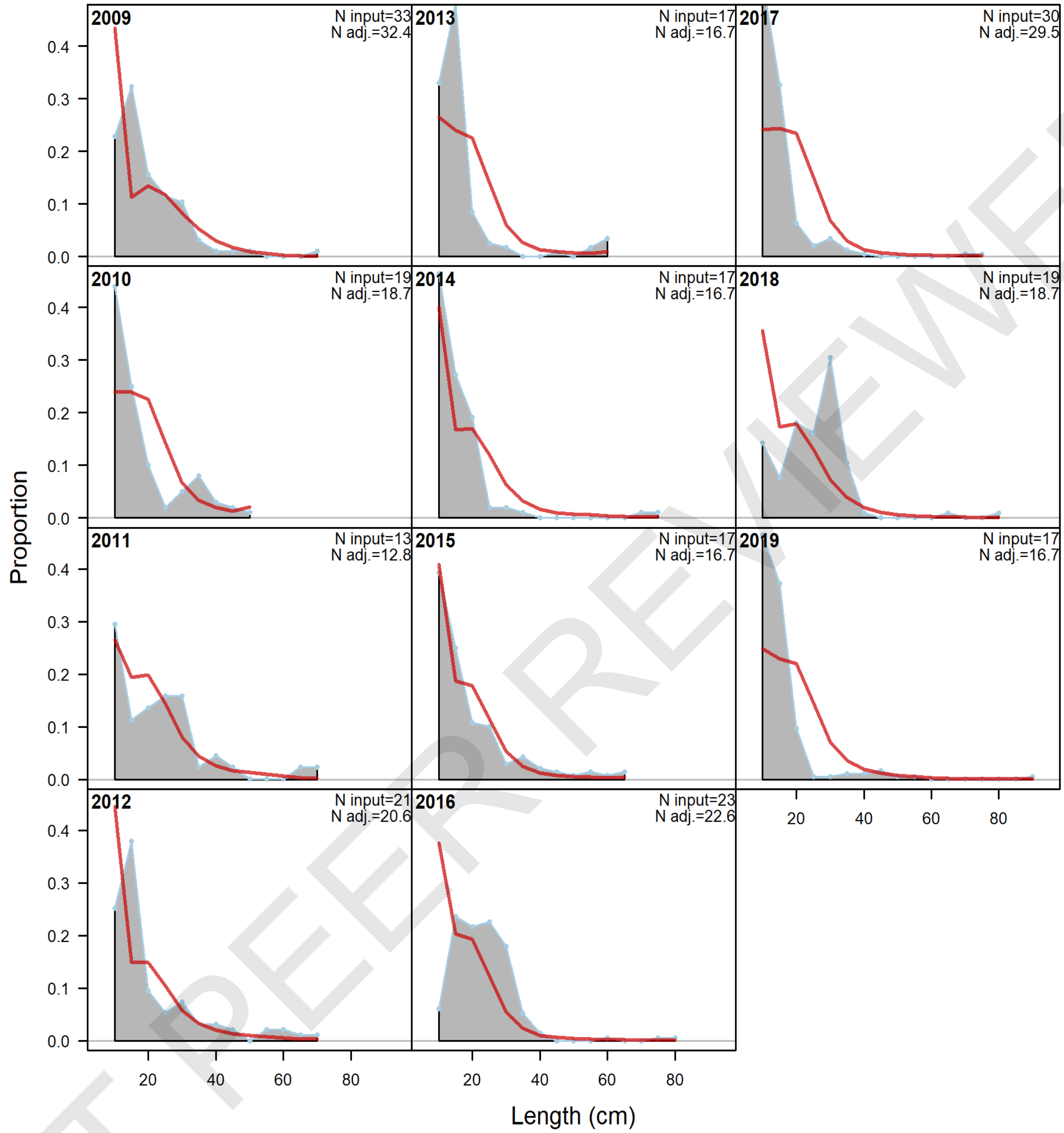


Figure 33. Length compositions, whole catch, SEAMAP Summer Trawl Post-2007 Central. 'N input' is the input sample size. 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial Θ parameter based on the formula N adj. = 1 / (1+Θ) + N Θ / (1+Θ). For this fleet, Θ = 32.672 and the sample size multiplier is approximately Θ / (1+Θ) = 0.97.*

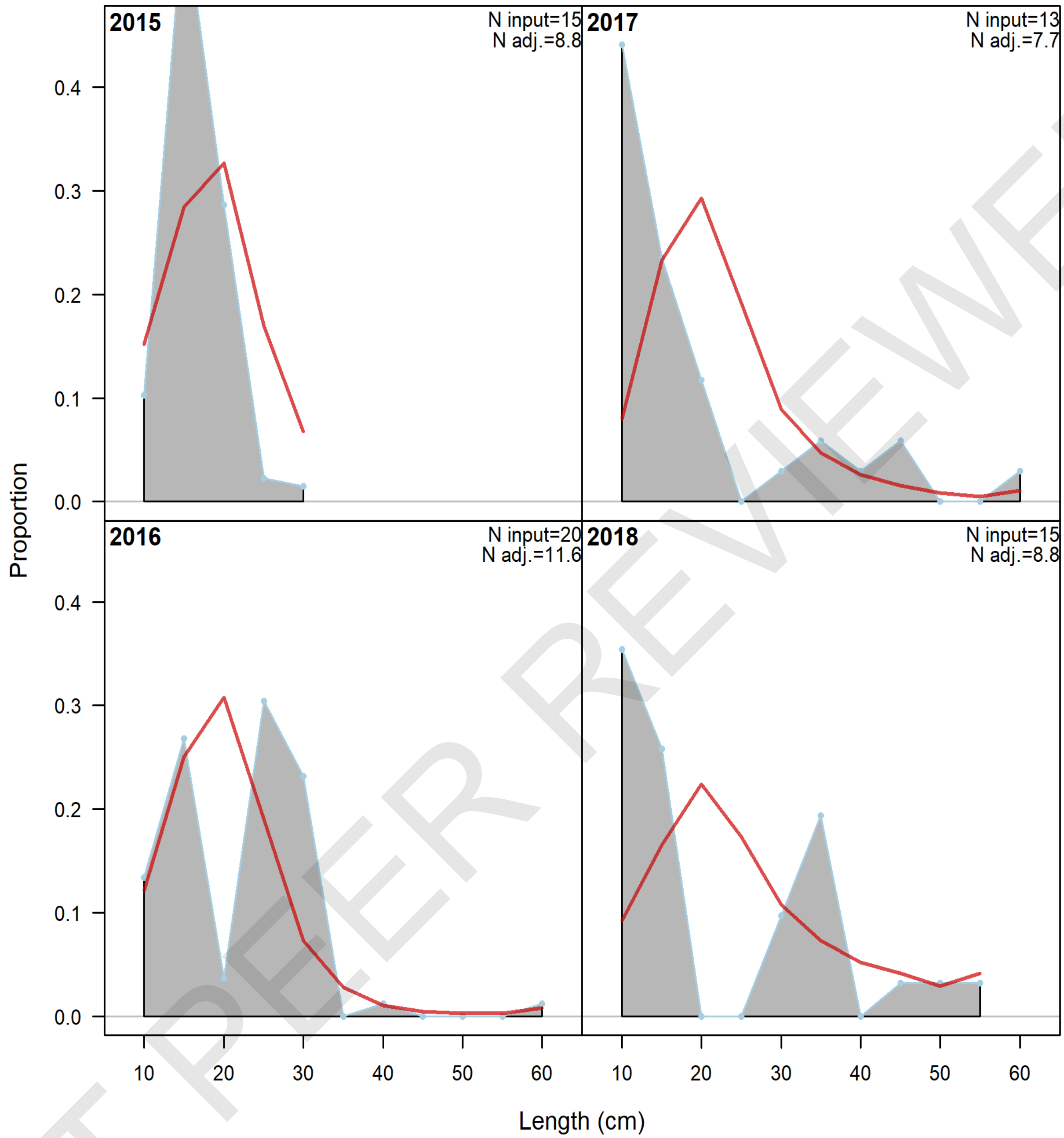


Figure 34. Length compositions, whole catch, SEAMAP Summer Trawl Post-2007 East. 'N input' is the input sample size. 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial Θ parameter based on the formula N adj. = 1 / (1+Θ) + N Θ / (1+Θ). For this fleet, Θ = 1.581 and the sample size multiplier is approximately Θ / (1+Θ) = 0.613.*

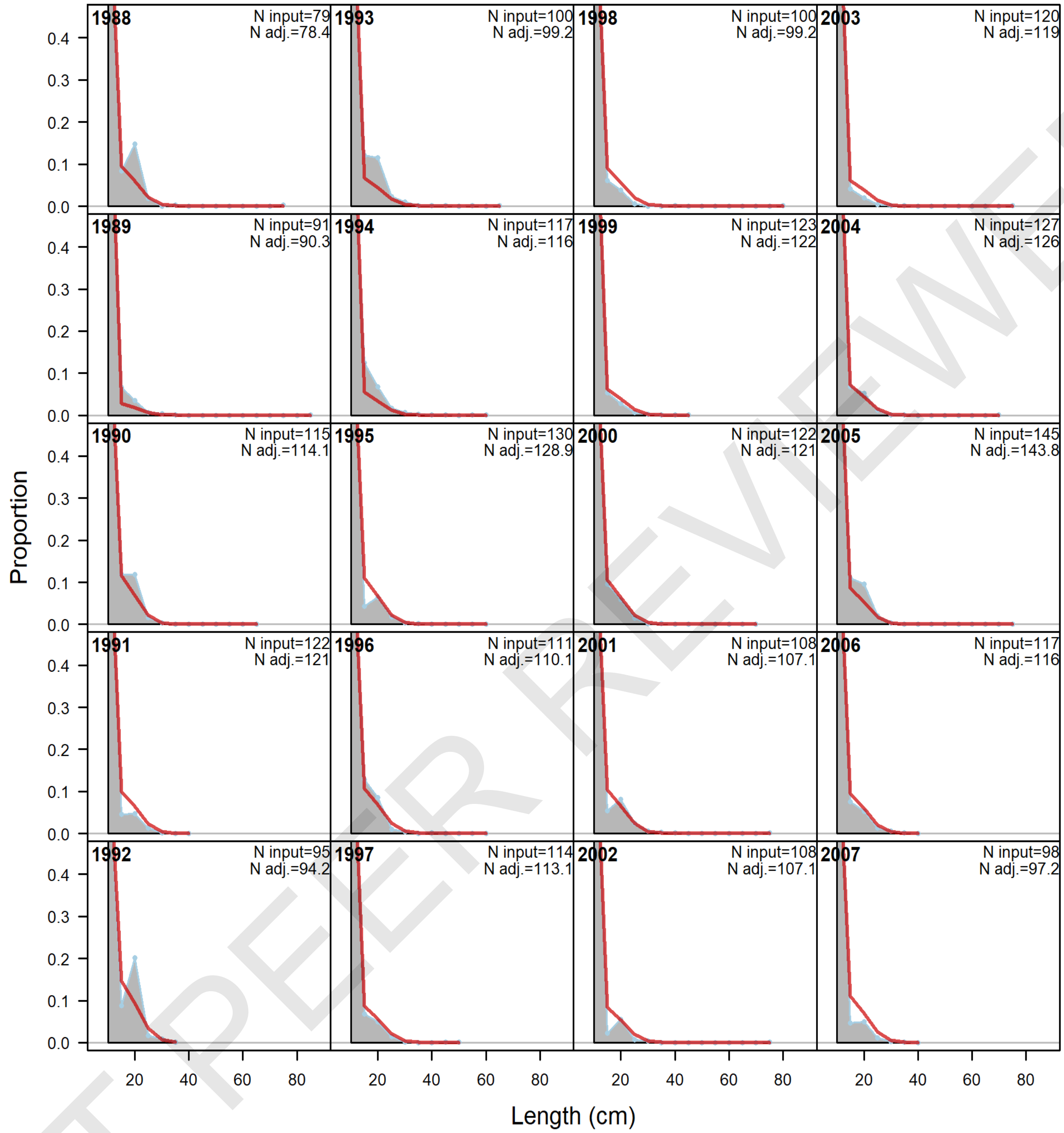


Figure 35. Length compositions, whole catch, SEAMAP Fall Trawl Pre-2007 West. 'N input' is the input sample size. 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial Θ parameter based on the formula N adj. = 1 / (1+Θ) + N Θ / (1+Θ). For this fleet, Θ = 117.117 and the sample size multiplier is approximately Θ / (1+Θ) = 0.992.*

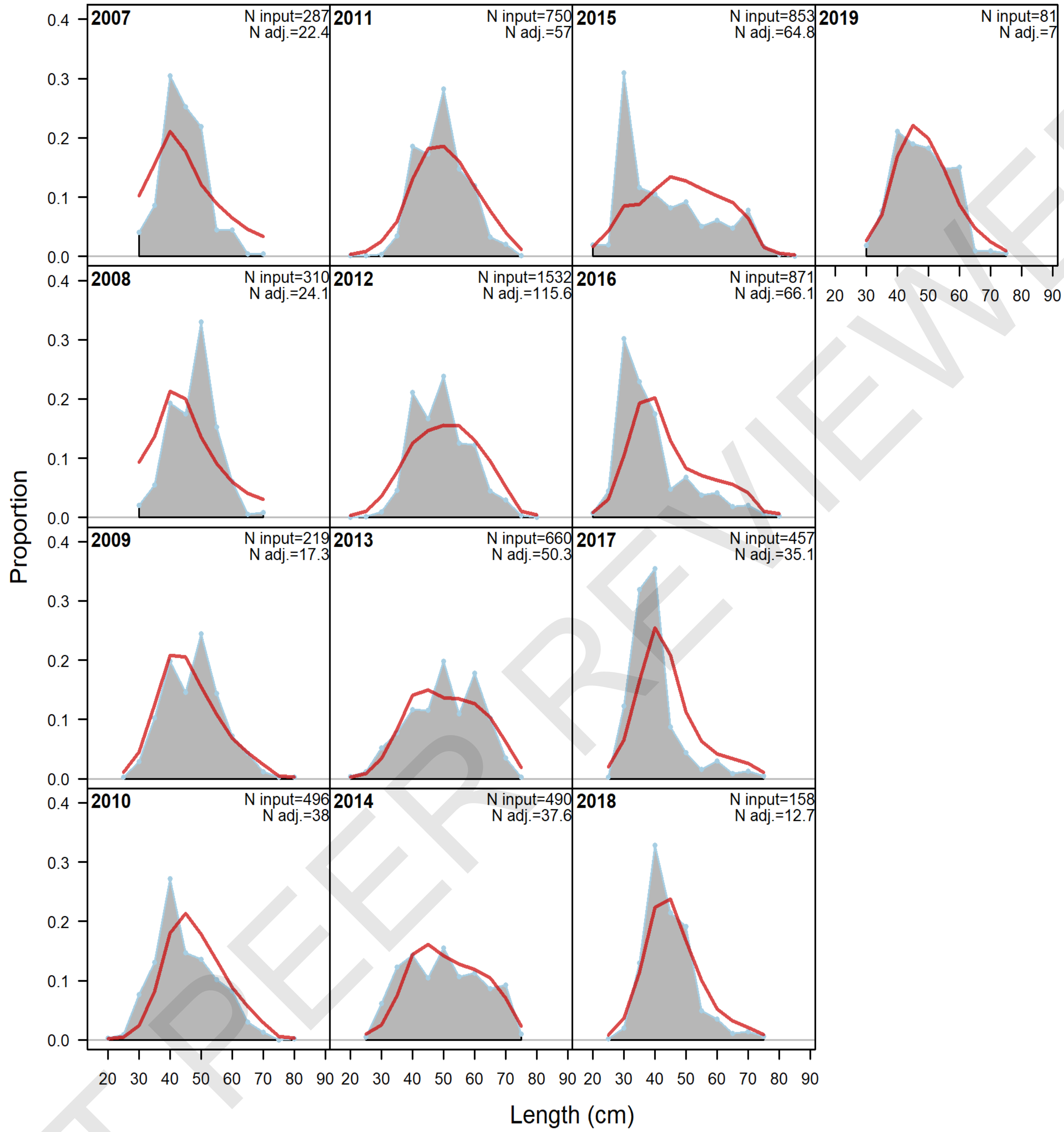


Figure 36. Length compositions, whole catch, Commercial Observer Program East. 'N input' is the input sample size. 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial Θ parameter based on the formula N adj. = 1 / (1+Θ) + N Θ / (1+Θ). For this fleet, Θ = 0.083 and the sample size multiplier is approximately Θ / (1+Θ) = 0.077.*

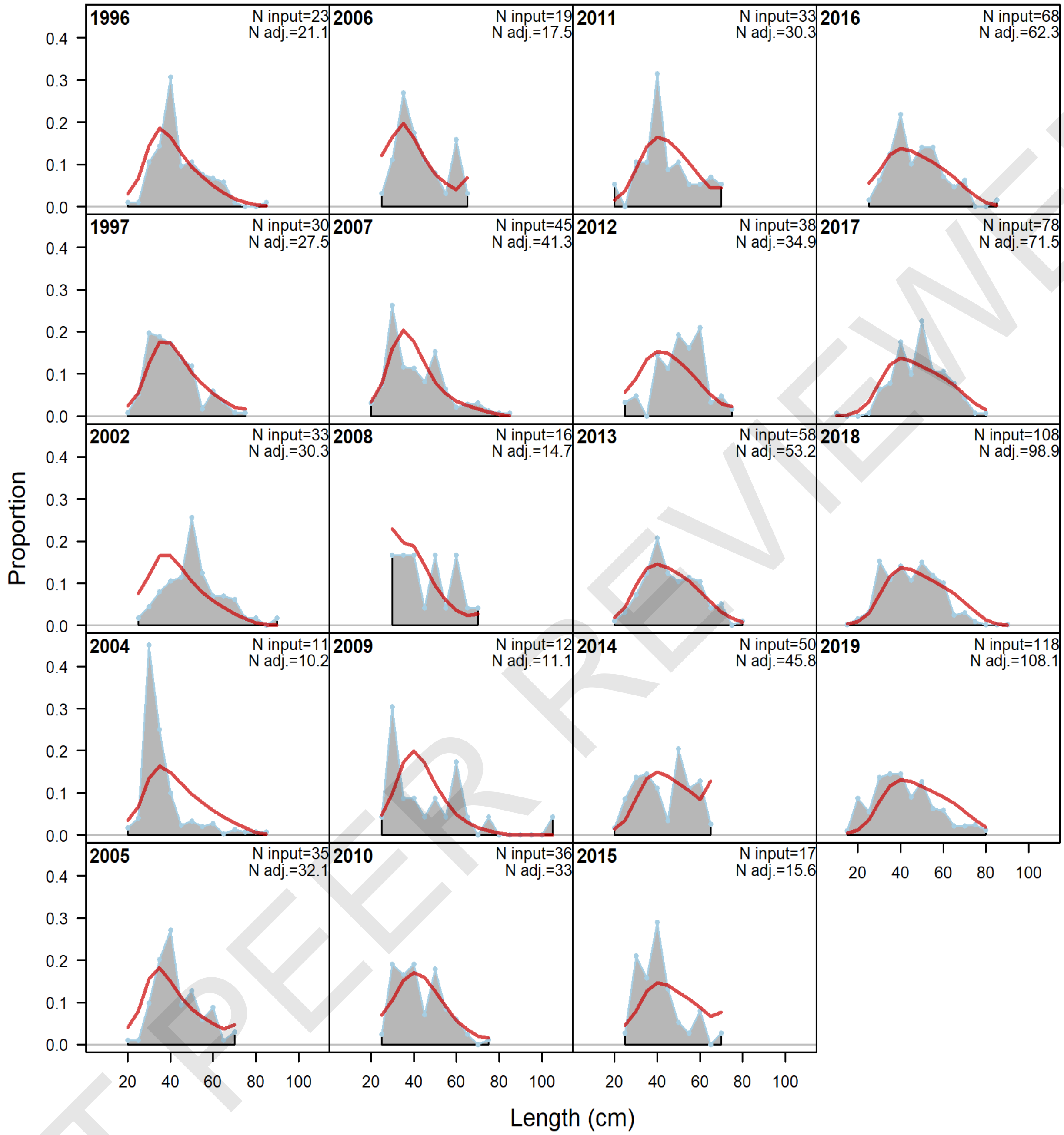


Figure 37. Length compositions, whole catch, SEAMAP Video Survey West. 'N input' is the input sample size. 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial Θ parameter based on the formula N adj. = 1 / (1+Θ) + N Θ / (1+Θ). For this fleet, Θ = 7.024 and the sample size multiplier is approximately Θ / (1+Θ) = 0.875.*

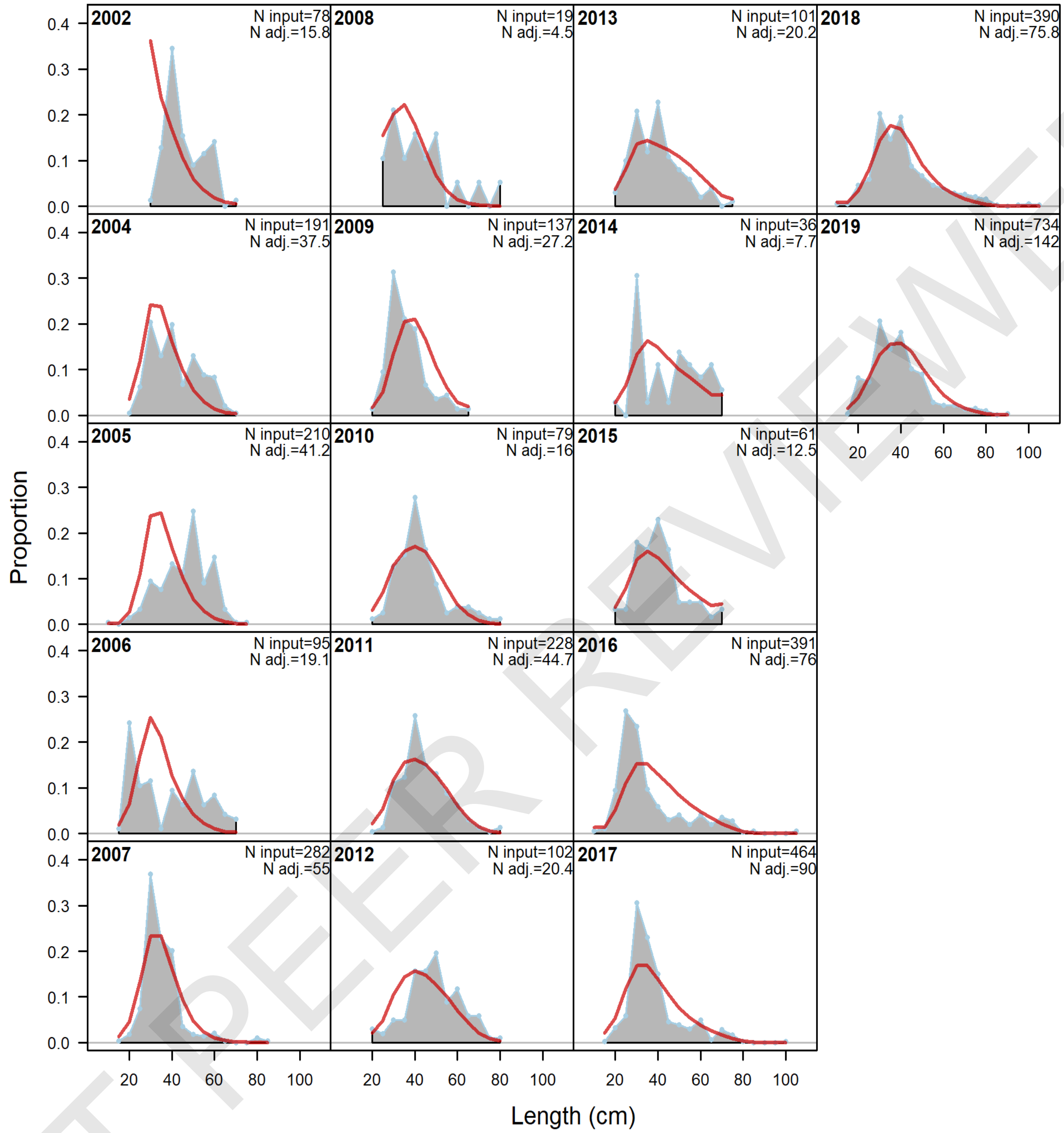


Figure 38. Length compositions, whole catch, Combined Video Survey Central (G-FISHER). 'N input' is the input sample size. 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial Θ parameter based on the formula N adj. = 1 / (1+Θ) + N Θ / (1+Θ). For this fleet, Θ = 0.236 and the sample size multiplier is approximately Θ / (1+Θ) = 0.191.*

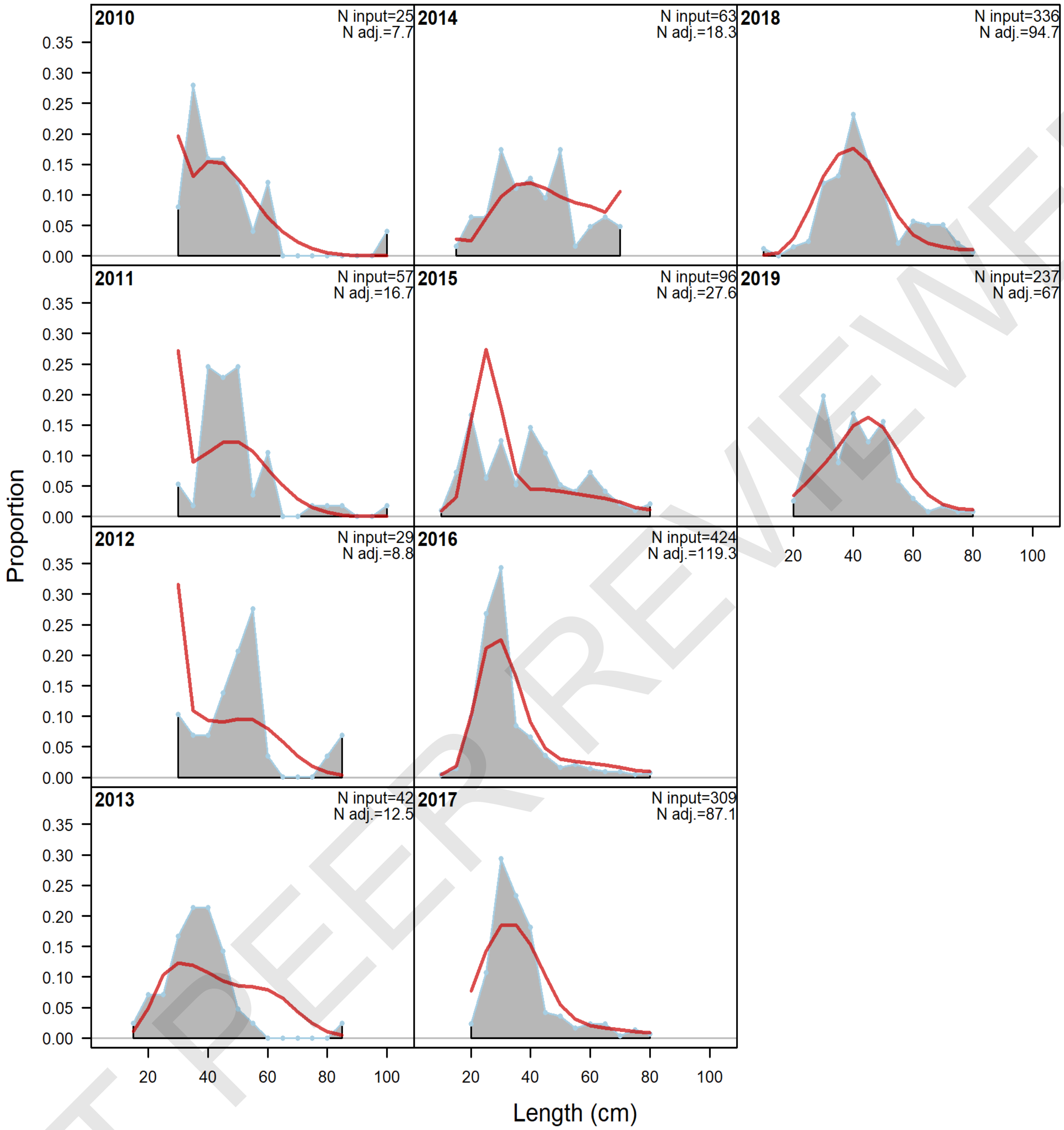


Figure 39. Length compositions, whole catch, Combined Video Survey East (G-FISHER). 'N input' is the input sample size. 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial Θ parameter based on the formula N adj. = 1 / (1+Θ) + N Θ / (1+Θ). For this fleet, Θ = 0.376 and the sample size multiplier is approximately Θ / (1+Θ) = 0.273.*

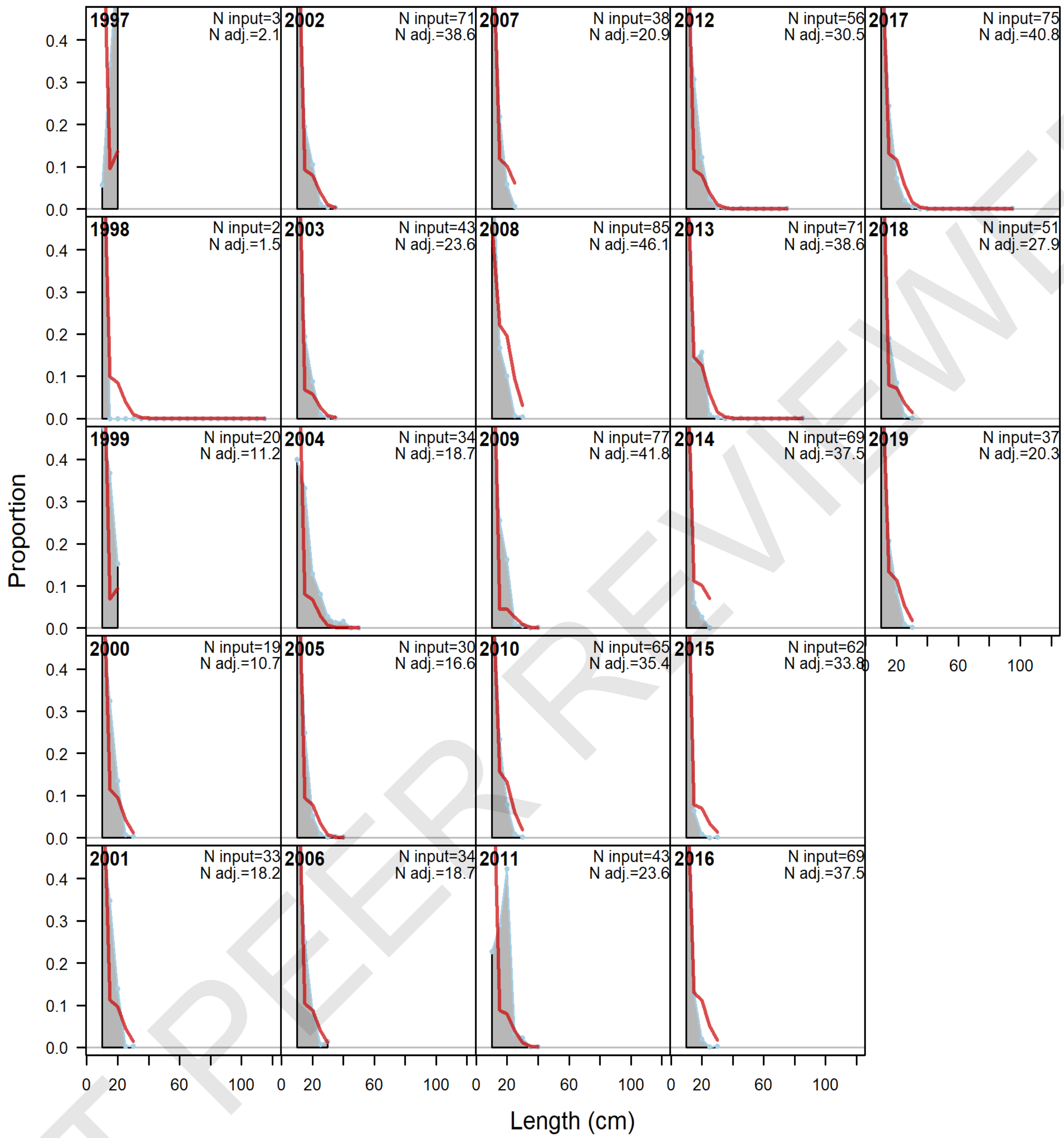


Figure 40. Length compositions, discard, Shrimp Bycatch West. 'N input' is the input sample size. 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial Θ parameter based on the formula N adj. = 1 / (1+Θ) + N Θ / (1+Θ). For this fleet, Θ = 69.402 and the sample size multiplier is approximately Θ / (1+Θ) = 0.986.*

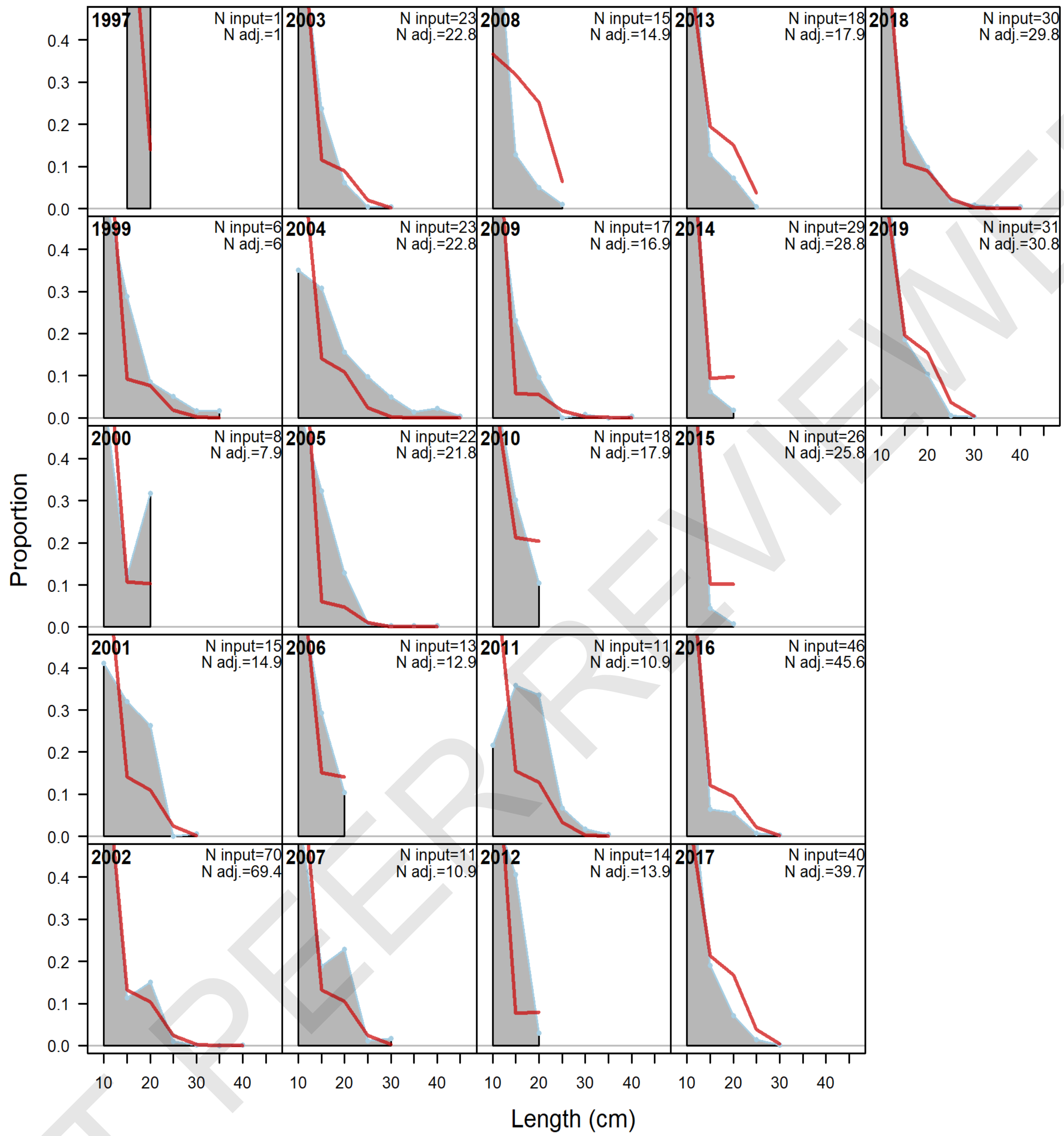


Figure 41. Length compositions, discard, Shrimp Bycatch Central. 'N input' is the input sample size. 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial Θ parameter based on the formula N adj. = 1 / (1+Θ) + N Θ / (1+Θ). For this fleet, Θ = 121.52 and the sample size multiplier is approximately Θ / (1+Θ) = 0.992.*

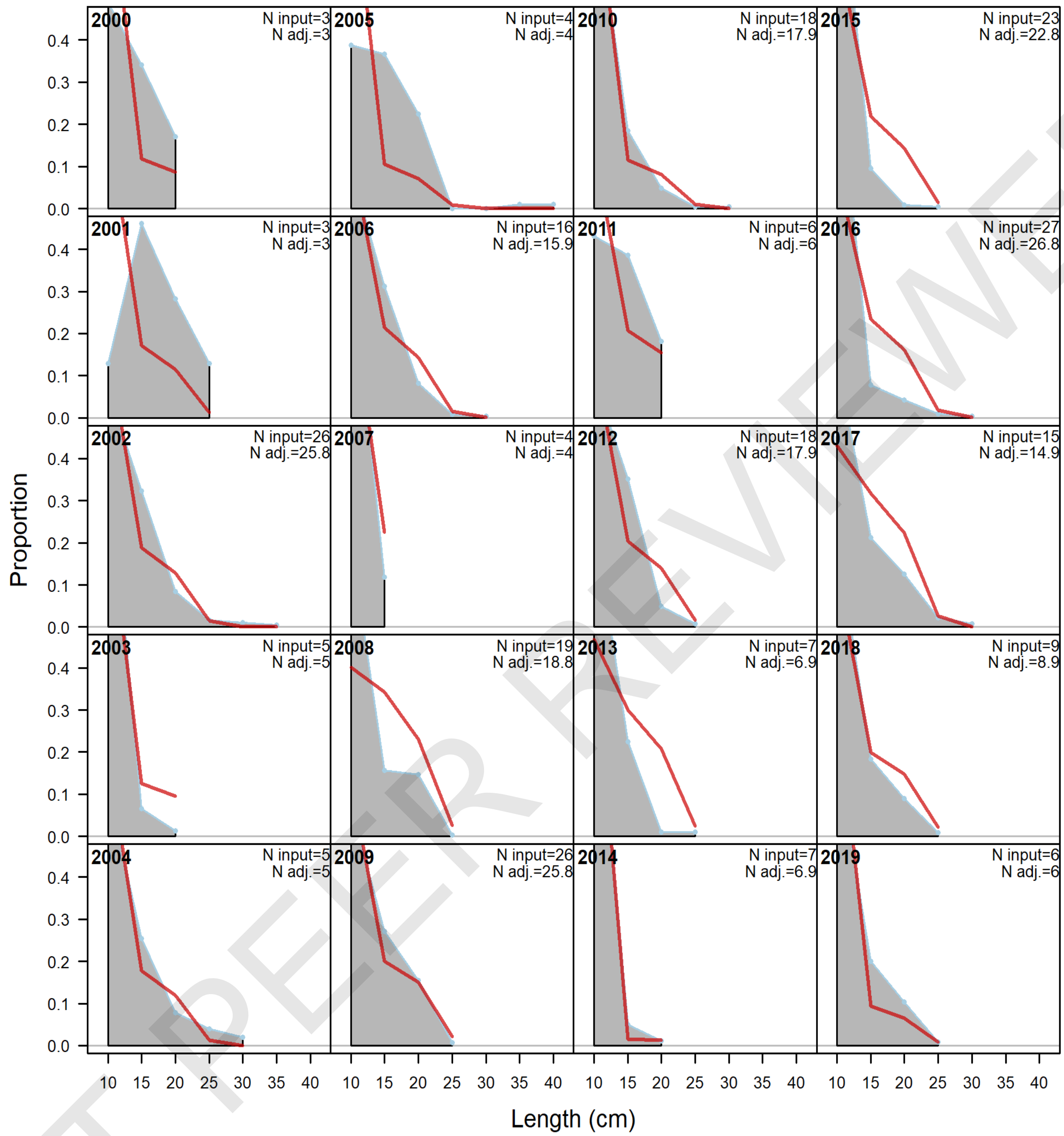


Figure 42. Length compositions, discard, Shrimp Bycatch East. 'N input' is the input sample size. 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial Θ parameter based on the formula N adj. = 1 / (1+Θ) + N Θ / (1+Θ). For this fleet, Θ = 138.238 and the sample size multiplier is approximately Θ / (1+Θ) = 0.993.*

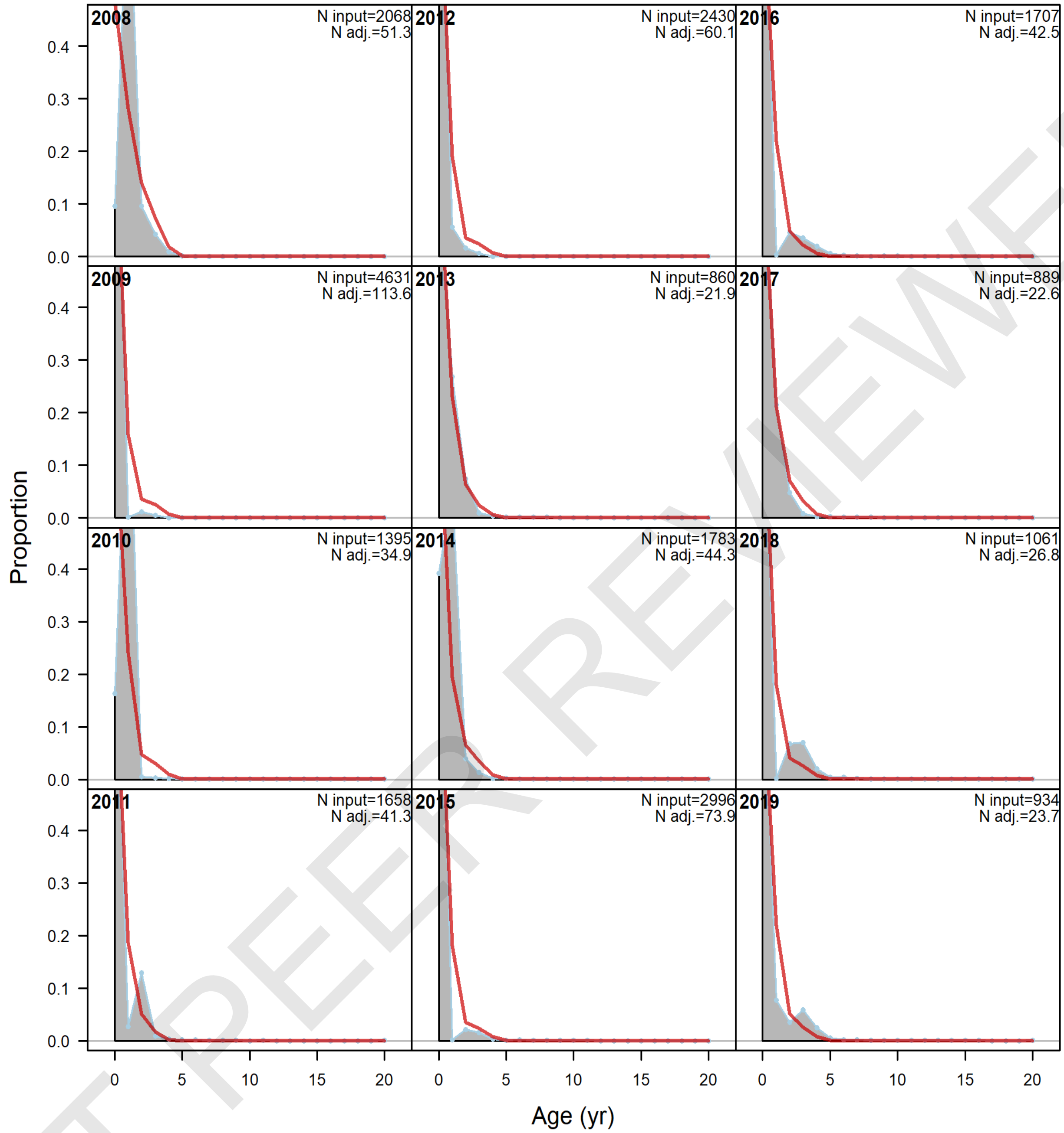


Figure 43. Age compositions, whole catch, SEAMAP Fall Trawl Post-2007 West. 'N input' is the input sample size. 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial Θ parameter based on the formula N adj. = 1 / (1+Θ) + N Θ / (1+Θ). For this fleet, Θ = 0.024 and the sample size multiplier is approximately Θ / (1+Θ) = 0.023.*

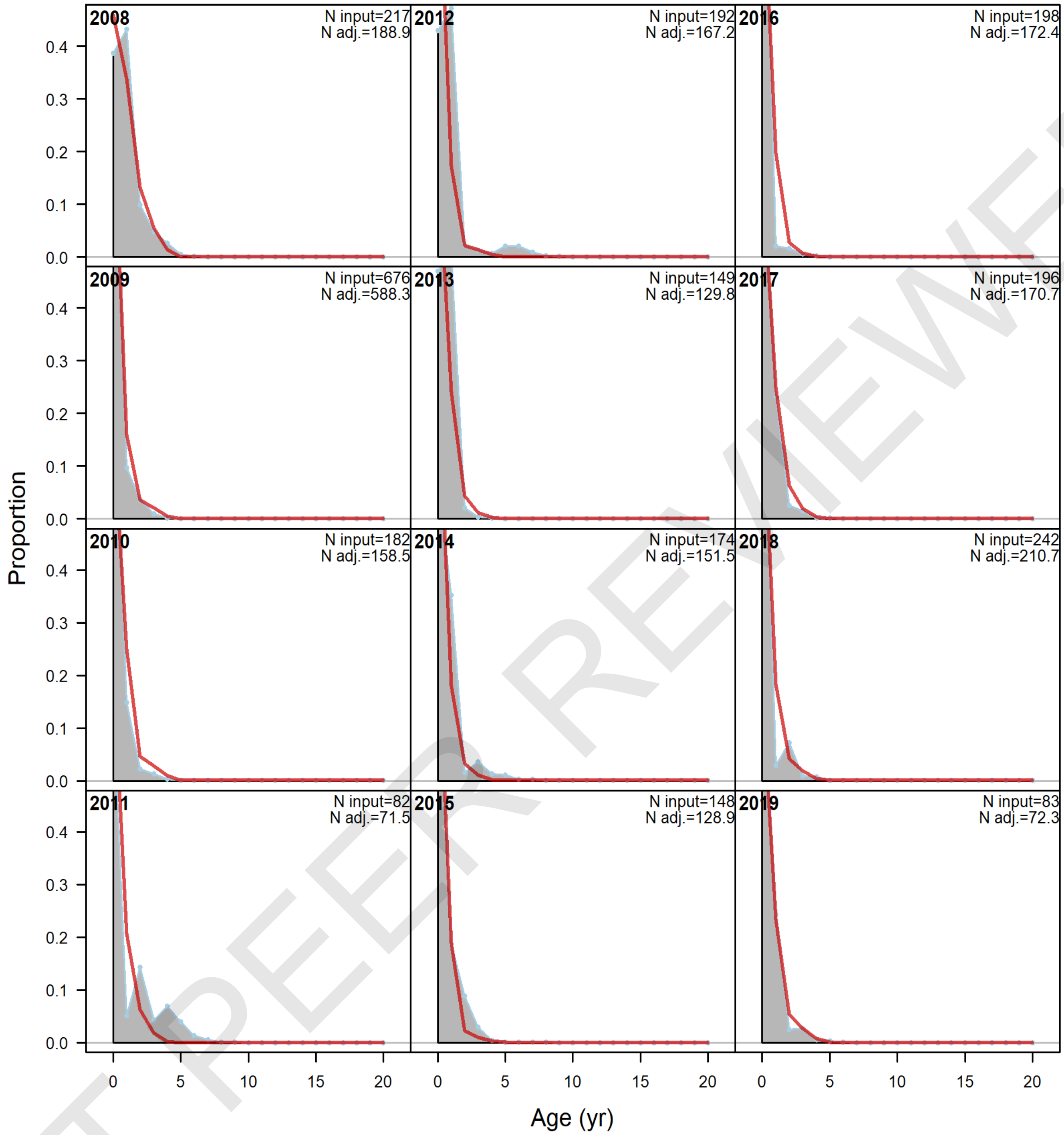


Figure 44. Age compositions, whole catch, SEAMAP Fall Trawl Post-2007 Central. 'N input' is the input sample size. 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial Θ parameter based on the formula N adj. = 1 / (1+Θ) + N Θ / (1+Θ). For this fleet, Θ = 6.828 and the sample size multiplier is approximately Θ / (1+Θ) = 0.872.*

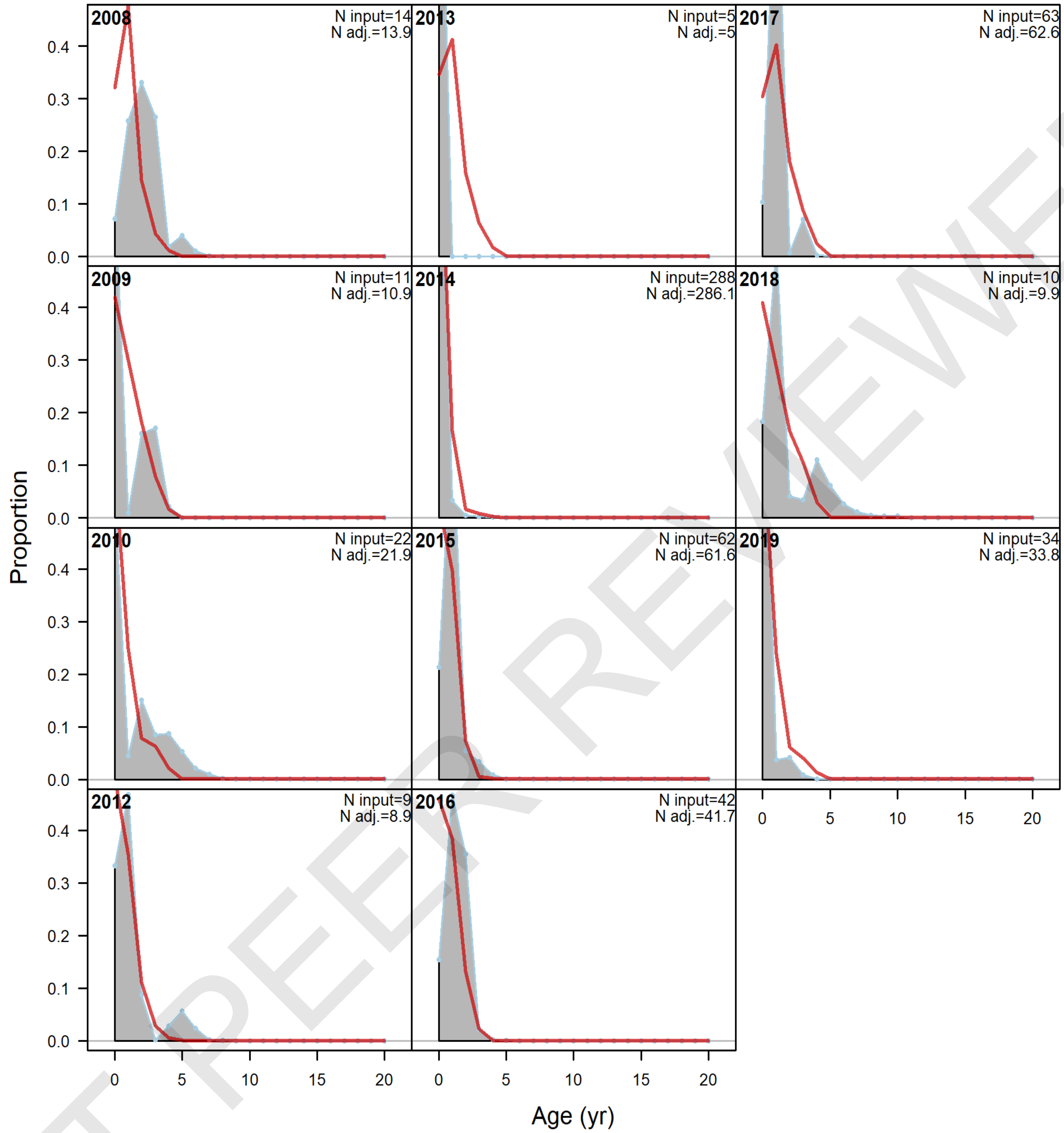


Figure 45. Age compositions, whole catch, SEAMAP Fall Trawl Post-2007 East. 'N input' is the input sample size. 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial Θ parameter based on the formula N adj. = 1 / (1+Θ) + N Θ / (1+Θ). For this fleet, Θ = 120.621 and the sample size multiplier is approximately Θ / (1+Θ) = 0.992.*

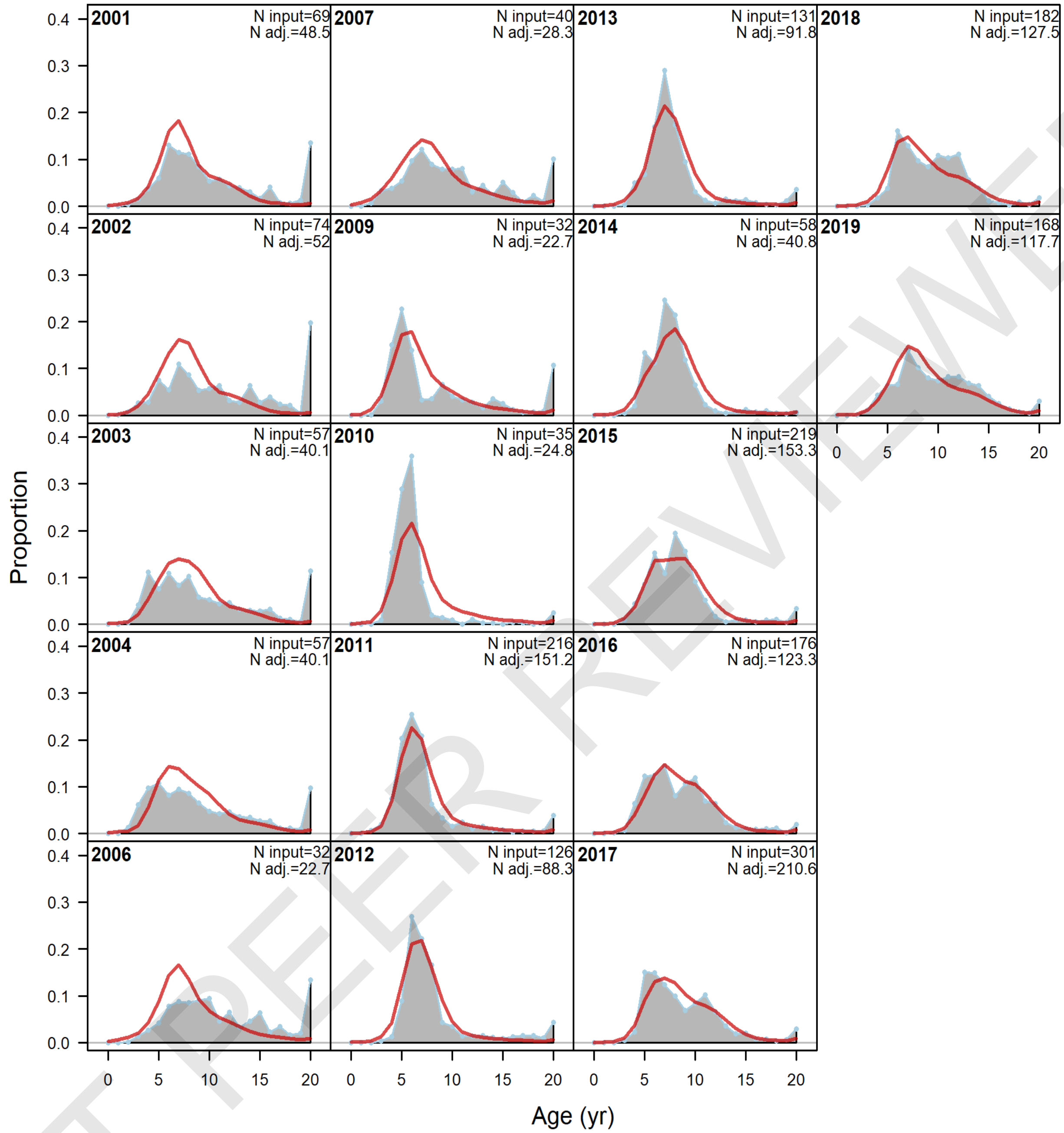


Figure 46. Age compositions, whole catch, Bottom Longline West. 'N input' is the input sample size. 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial Θ parameter based on the formula N adj. = 1 / (1+Θ) + N Θ / (1+Θ). For this fleet, Θ = 10.858 and the sample size multiplier is approximately Θ / (1+Θ) = 0.916.*

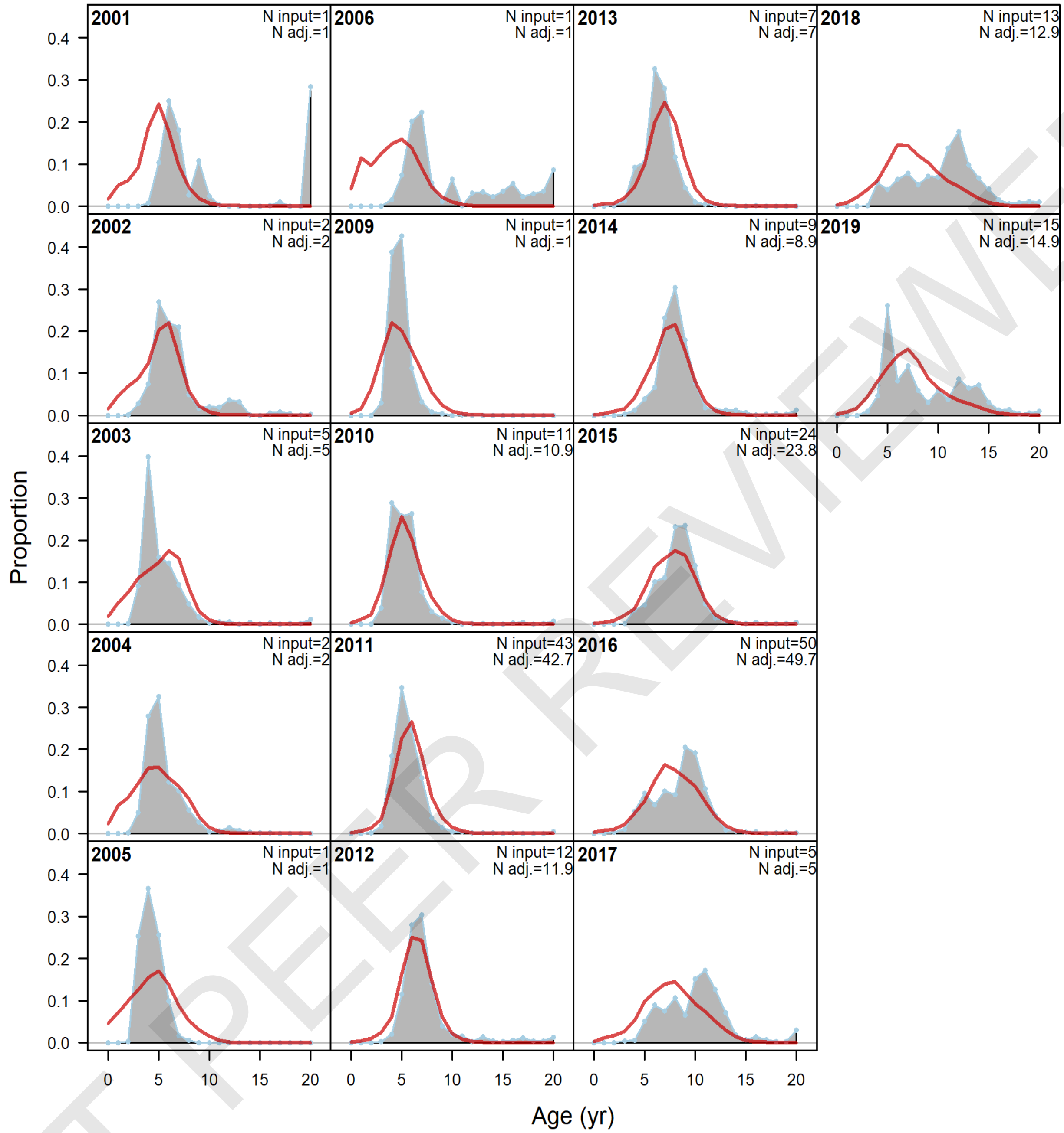


Figure 47. Age compositions, whole catch, Bottom Longline Central. 'N input' is the input sample size. 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial Θ parameter based on the formula N adj. = 1 / (1+Θ) + N Θ / (1+Θ). For this fleet, Θ = 148 and the sample size multiplier is approximately Θ / (1+Θ) = 0.993.*

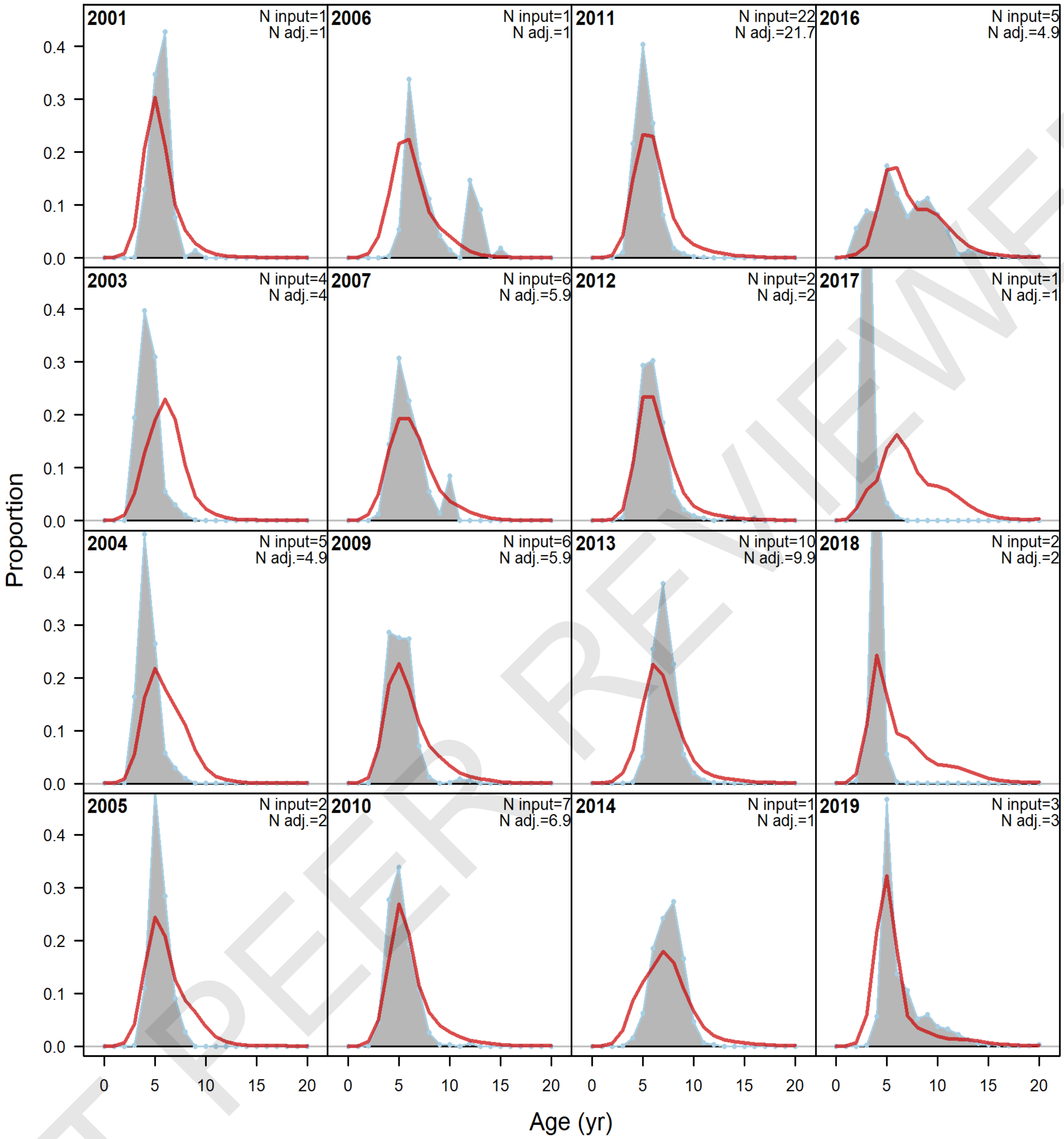
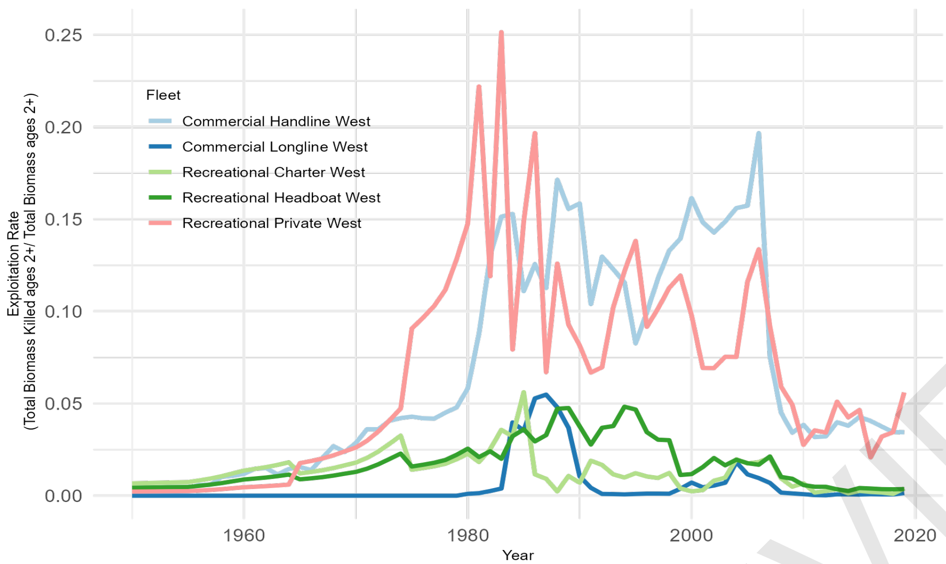


Figure 48. Age compositions, whole catch, Bottom Longline East. 'N input' is the input sample size. 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial Θ parameter based on the formula N adj. = 1 / (1+Θ) + N Θ / (1+Θ). For this fleet, Θ = 3.838 and the sample size multiplier is approximately Θ / (1+Θ) = 0.793.*

West



Central

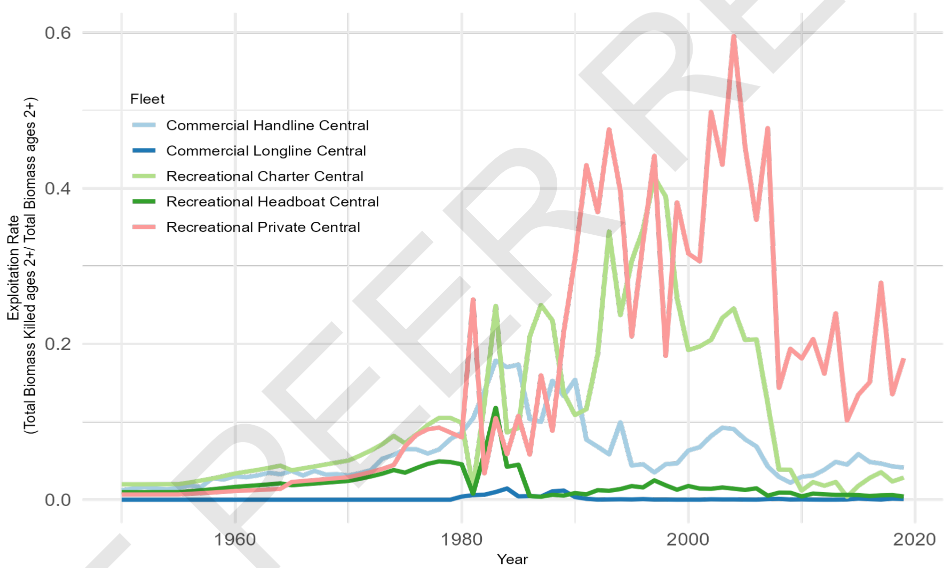


Figure 49. Annual exploitation rate (total biomass killed 2+/ total biomass age 2+) by fleet for Gulf of Mexico Red Snapper.

East

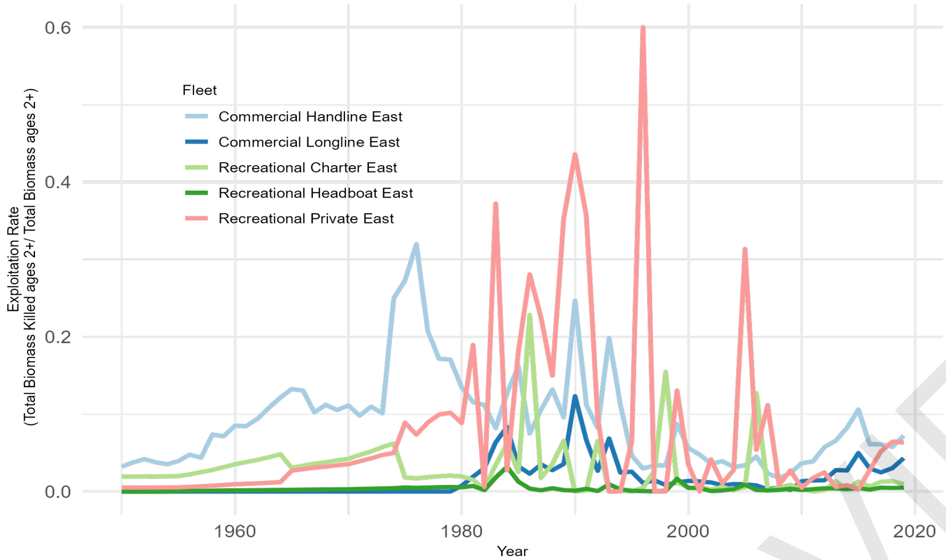
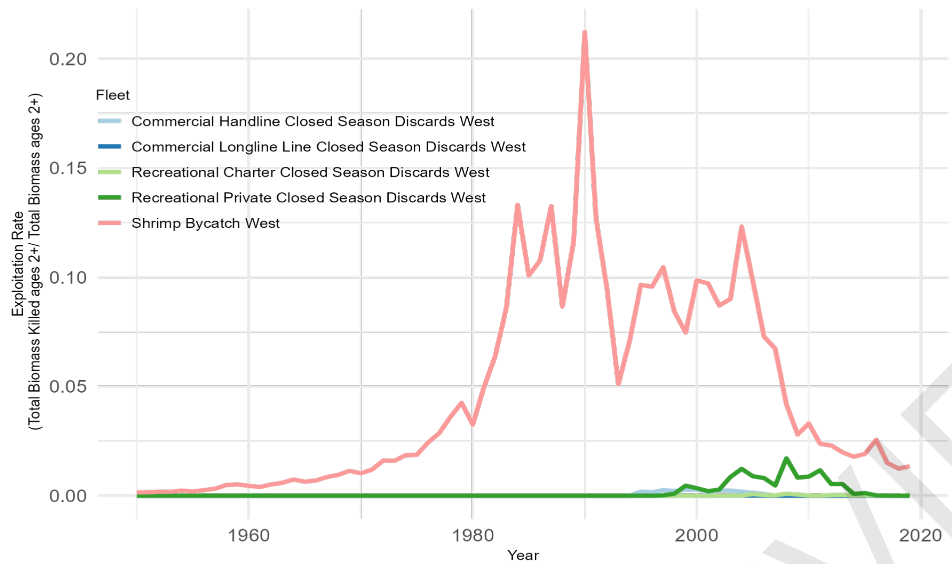


Figure 49 Continued. Annual exploitation rate (total biomass killed 2+/ total biomass age 2+) by fleet for Gulf of Mexico Red Snapper.

West



Central

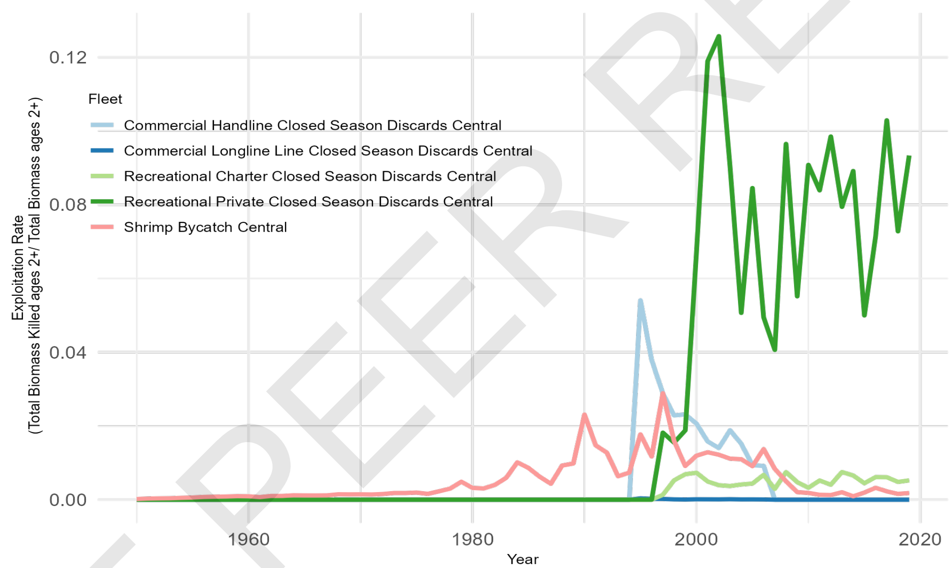


Figure 50. Annual exploitation rate for Gulf of Mexico Red Snapper discard and bycatch (total biomass killed 2+/ total biomass age 2+) fleets.

East

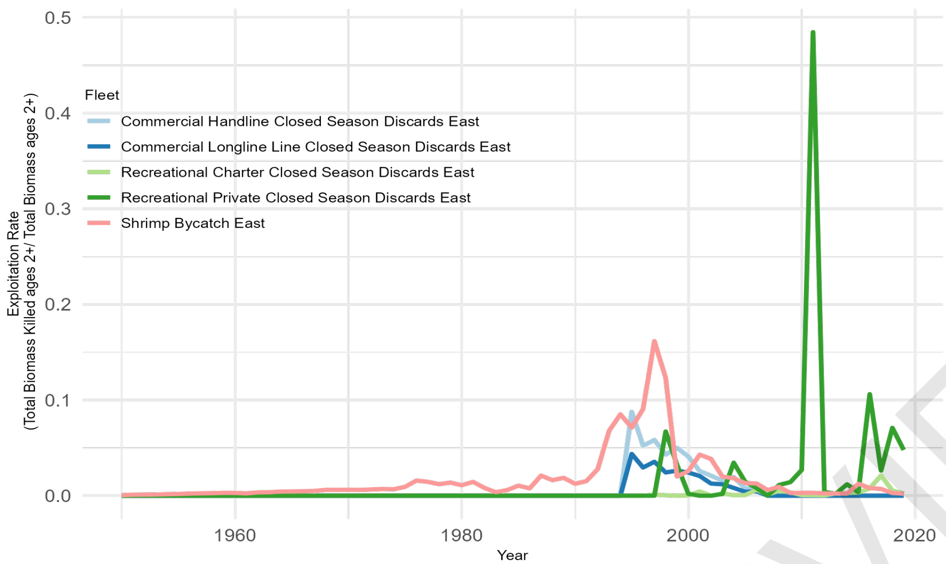


Figure 50 Continued. Annual exploitation rate for Gulf of Mexico Red Snapper discard and bycatch (total biomass killed 2+/ total biomass age 2+) fleets.

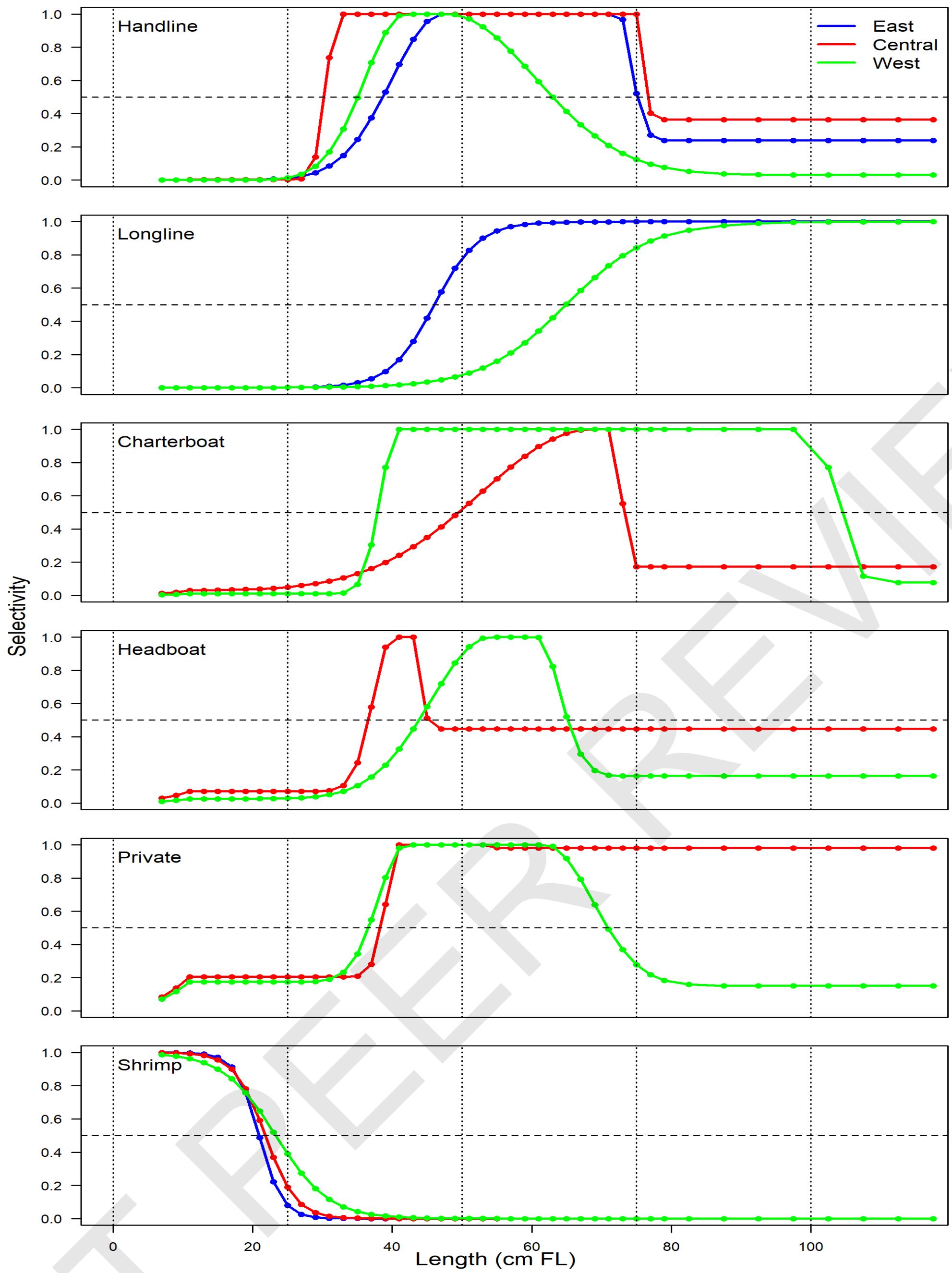


Figure 51. Length-based selectivity for commercial and recreatoinal fleets for Gulf of Mexico Red Snapper in the terminal year of the assessment. Dashed horizontal line indicates 50%, whereas the dashed vertical lines identify lengths in 25 cm FL intervals. Note: The east area selectivity curve mirrors the central area curve in the recreational fleets.

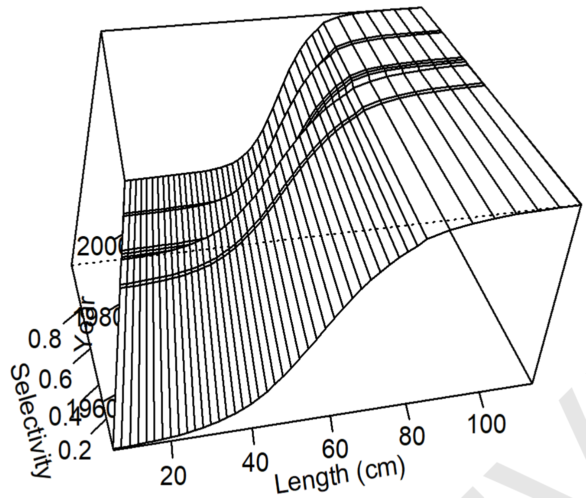


Figure 52. Time varying length-based selectivity for the Commercial Longline West fleet.

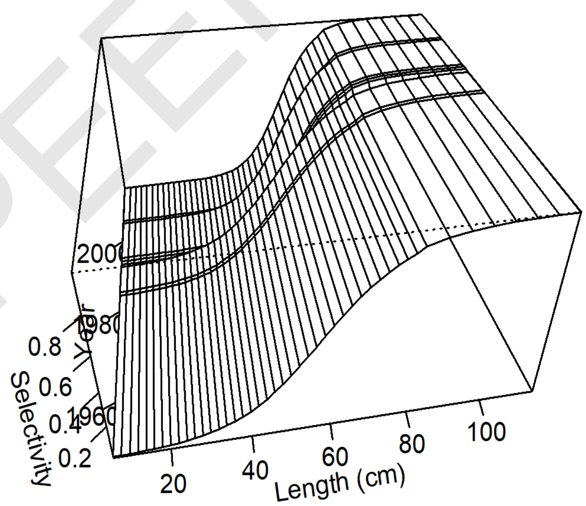


Figure 53. Time varying length-based selectivity for the Commercial Longline Central fleet.

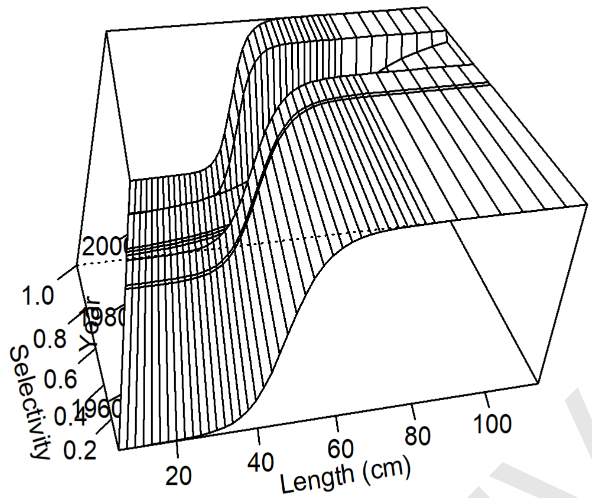


Figure 54. Time varying length-based selectivity for the Commercial Longline East fleet.

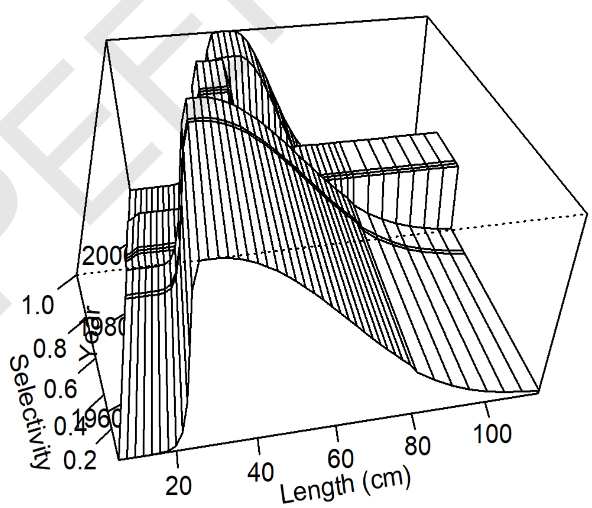


Figure 55. Time varying length-based selectivity for the Commercial Handline West fleet.

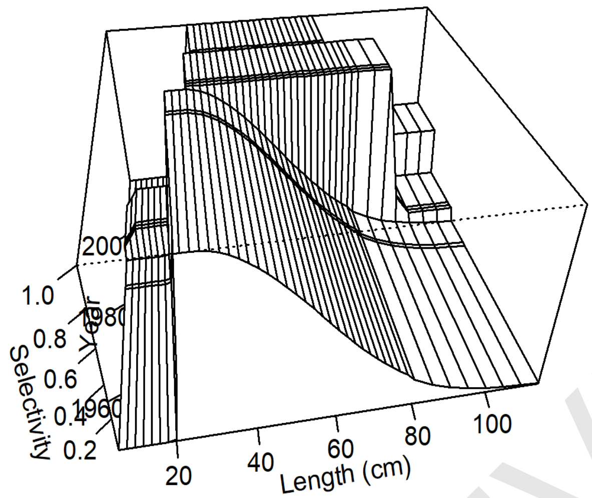


Figure 56. Time varying length-based selectivity for the Commercial Handline Central fleet.

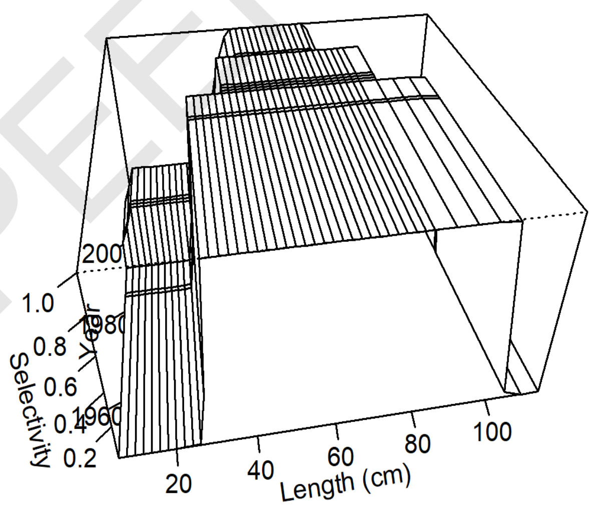


Figure 57. Time varying length-based selectivity for the Commercial Handline East fleet.

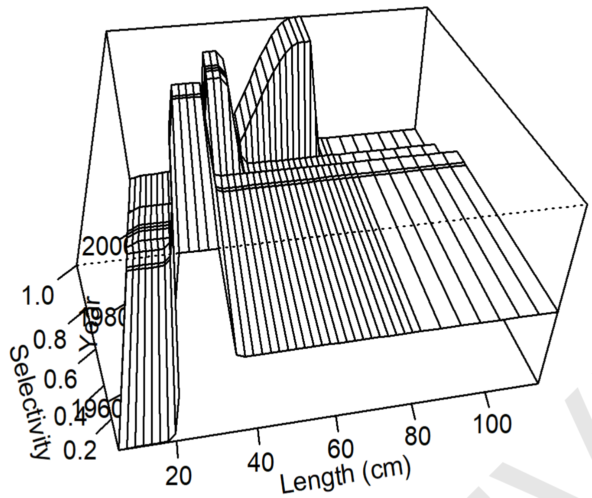


Figure 58. Time varying length-based selectivity for the Recreational Charter West fleet.

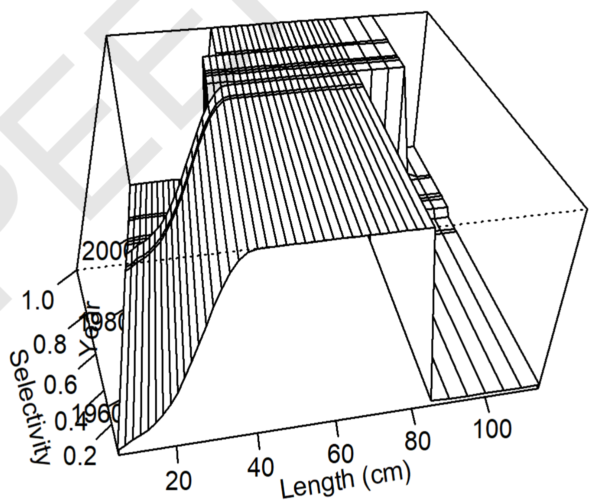


Figure 59. Time varying length-based selectivity for the Recreational Charter Central fleet.

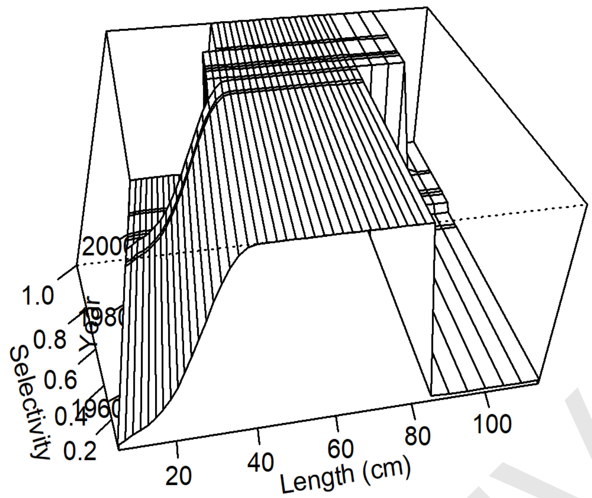


Figure 60. Time varying length-based selectivity for the Recreational Charter East fleet.

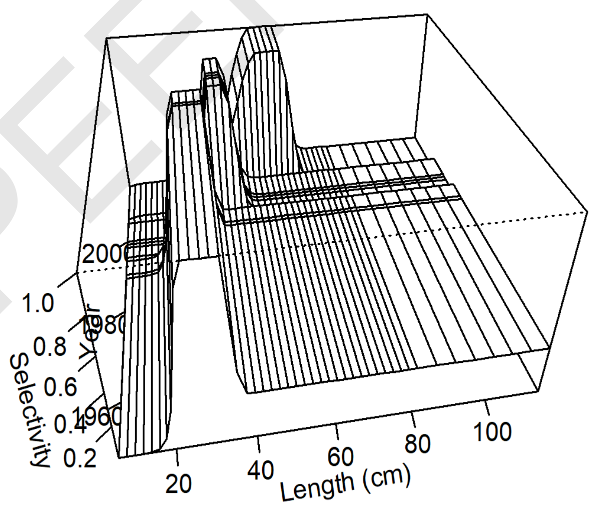


Figure 61. Time varying length-based selectivity for the Recreational Headboat West fleet.

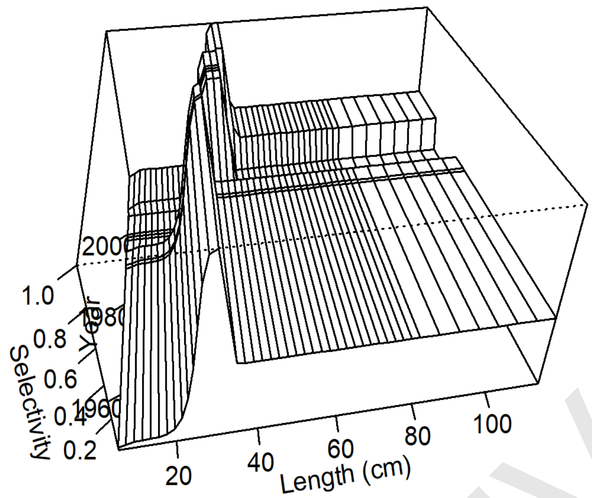


Figure 62. Time varying length-based selectivity for the Recreational Headboat Central fleet.

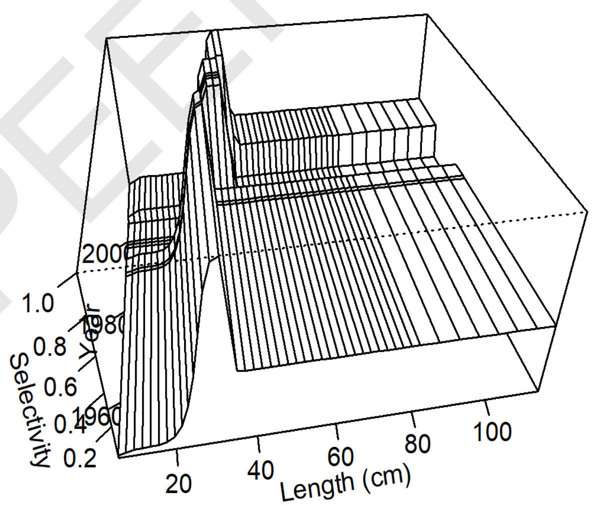


Figure 63. Time varying length-based selectivity for the Recreational Headboat East fleet.

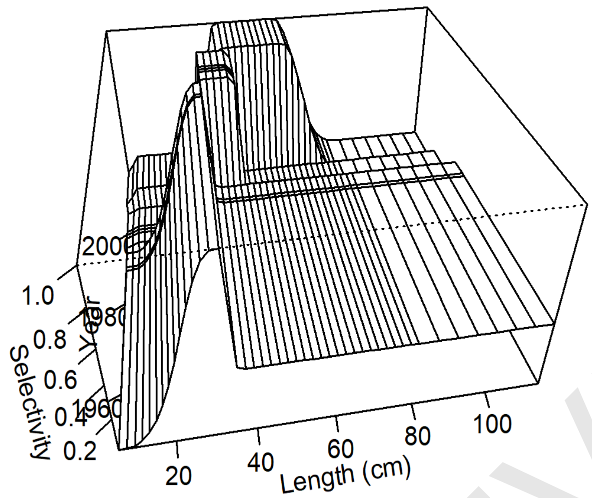


Figure 64. Time varying length-based selectivity for the Recreational Private West fleet.

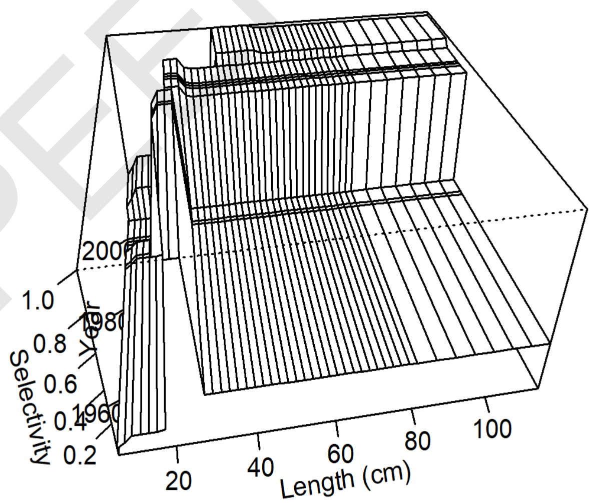


Figure 65. Time varying length-based selectivity for the Recreational Private Central fleet.

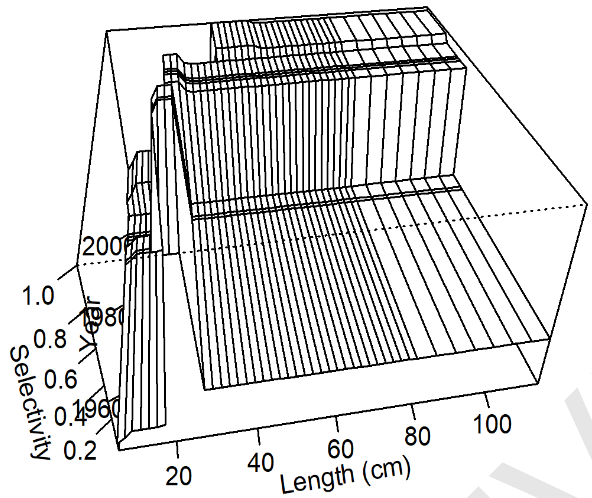


Figure 66. Time varying length-based selectivity for the Recreational Private East fleet.

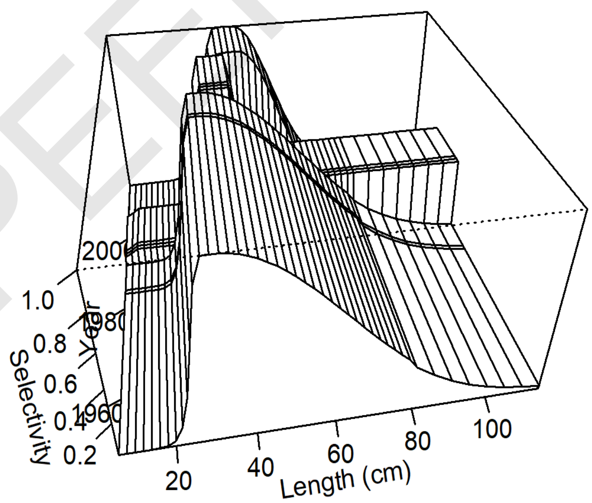


Figure 67. Time varying length-based selectivity for the Commercial Handline Closed Season Discards West fleet.

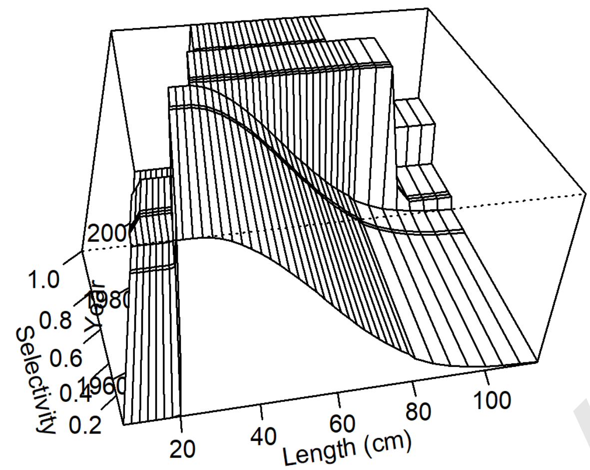


Figure 68. Time varying length-based selectivity for the Commercial Handline Closed Season Discards Central fleet.

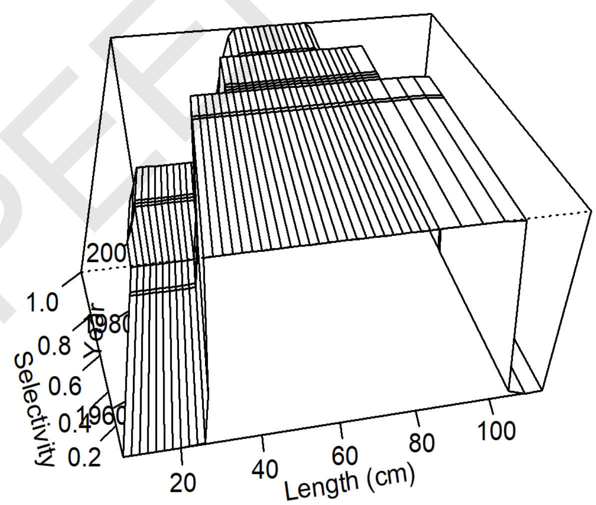


Figure 69. Time varying length-based selectivity for the Commercial Handline Closed Season Discards East fleet.

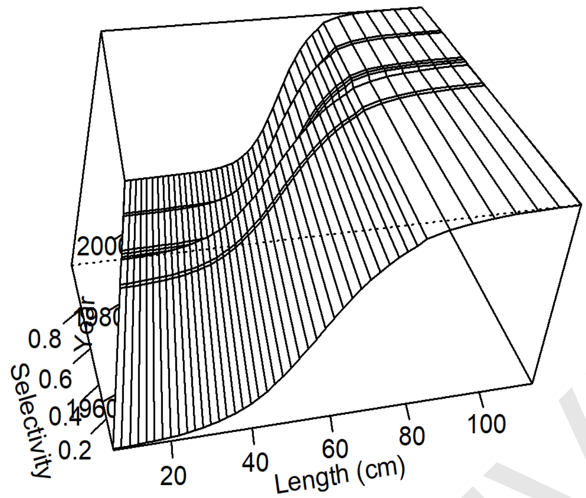


Figure 70. Time varying length-based selectivity for the Commercial Longline Closed Season Discards West fleet.

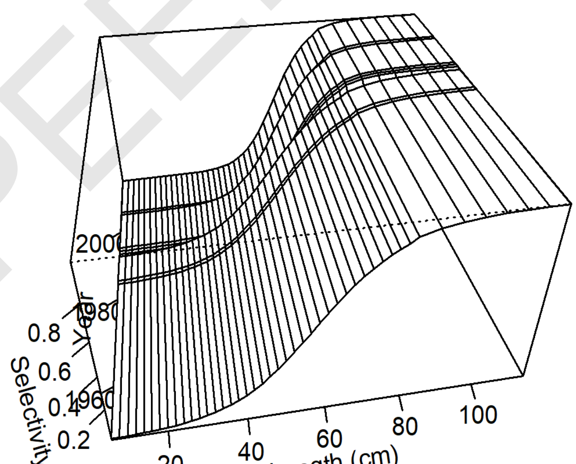


Figure 71. Time varying length-based selectivity for the Commercial Longline Closed Season Discards Central fleet.

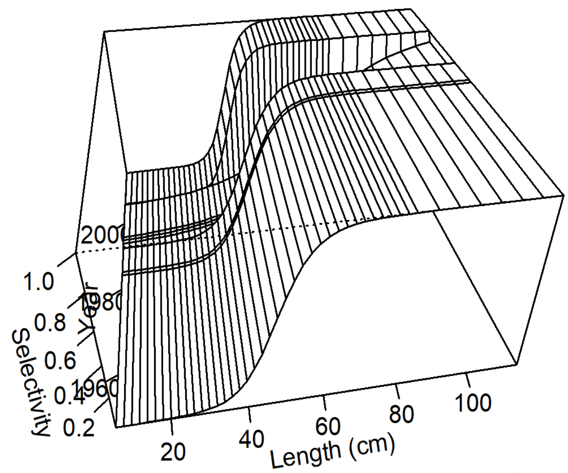


Figure 72. Time varying length-based selectivity for the Commercial Longline Closed Season Discards East fleet.

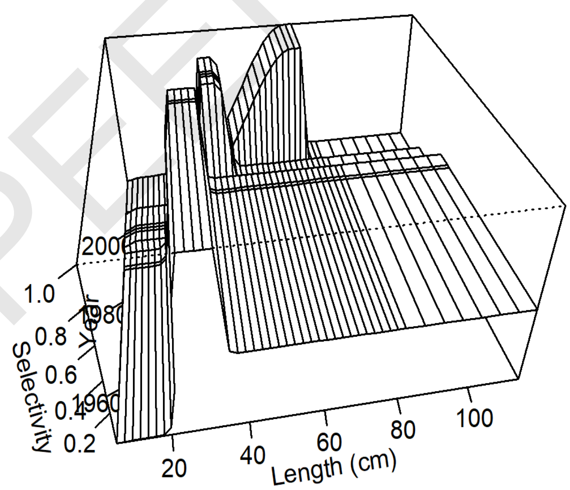


Figure 73. Time varying length-based selectivity for the Recreational Charter Closed Season Discards West fleet.

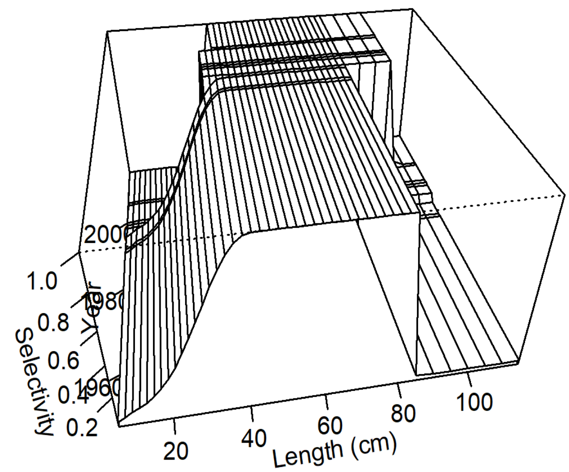


Figure 74. Time varying length-based selectivity for the Recreational Charter Closed Season Discards Central fleet.

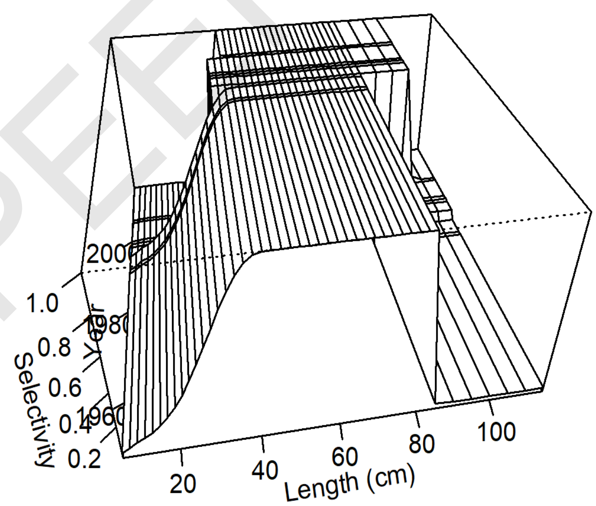


Figure 75. Time varying length-based selectivity for the Recreational Charter Closed Season Discards East fleet.

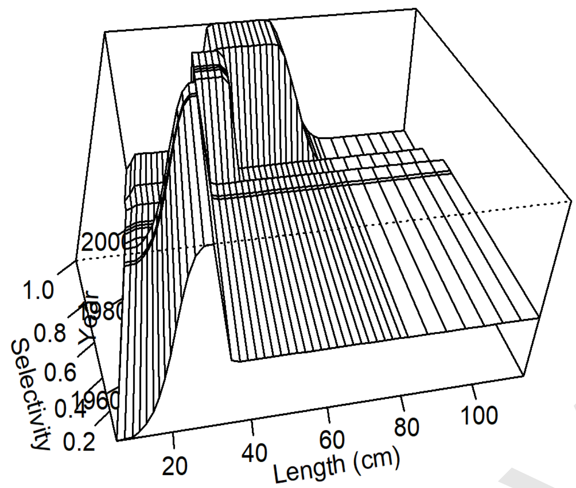


Figure 76. Time varying length-based selectivity for the Recreational Private Closed Season Discards West fleet.

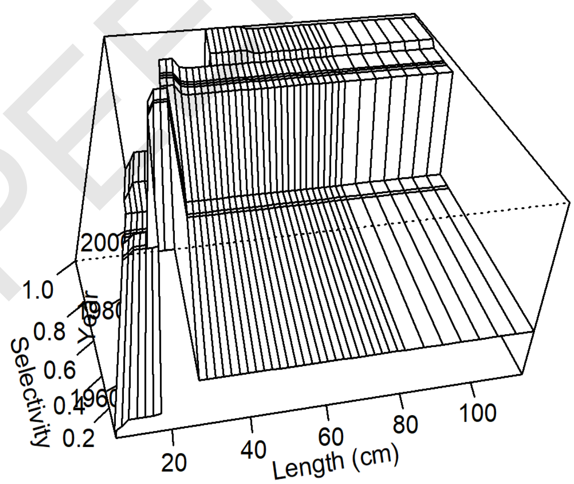


Figure 77. Time varying length-based selectivity for the Recreational Private Closed Season Discards Central fleet.

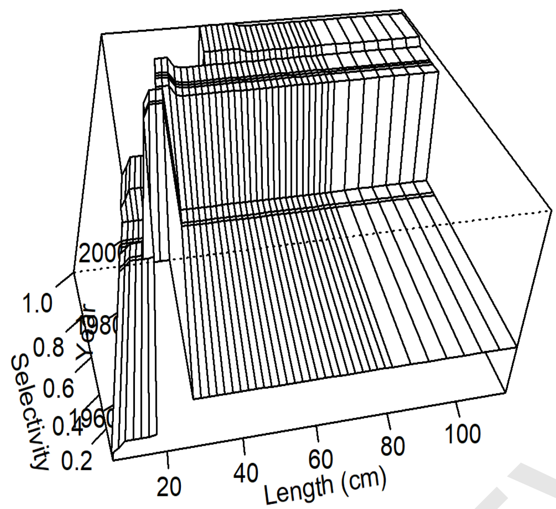


Figure 78. Time varying length-based selectivity for the Recreational Private Closed Season Discards East fleet.

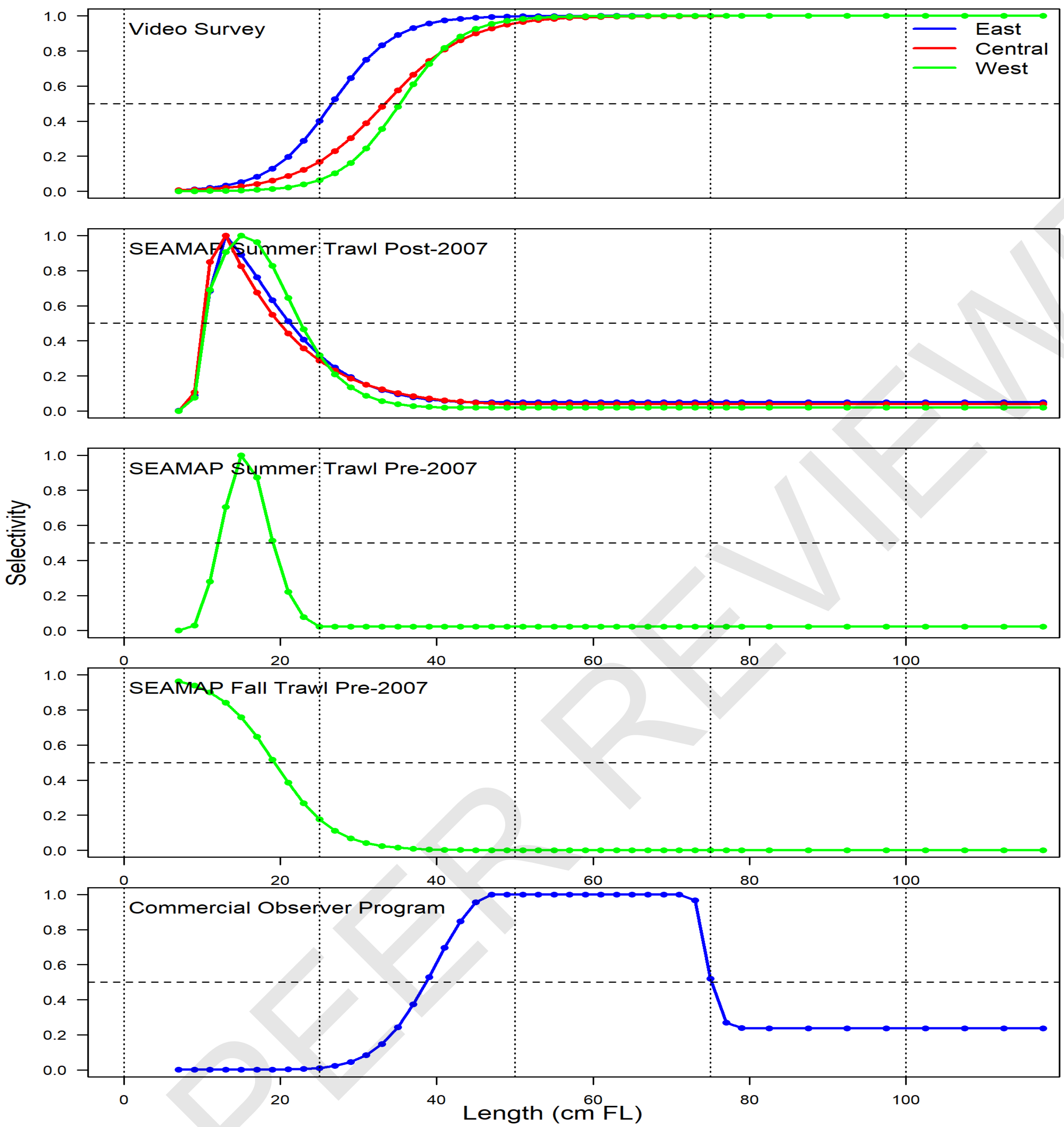


Figure 79. Length-based selectivity for surveys for Gulf of Mexico Red Snapper in the terminal year of the assessment. Dashed horizontal line indicates 50%, whereas the dashed vertical lines identify lengths in 25 cm FL intervals.

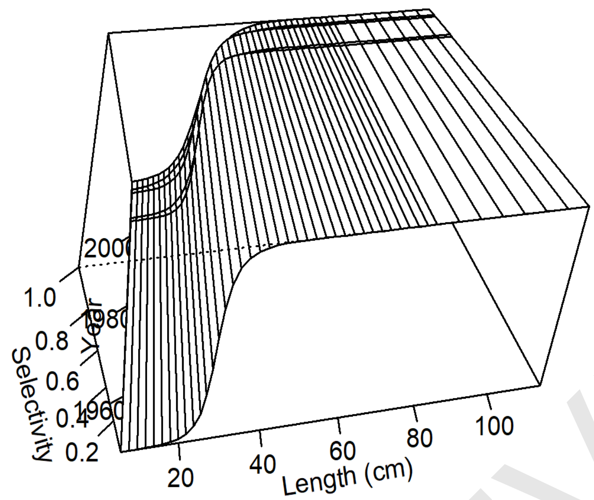
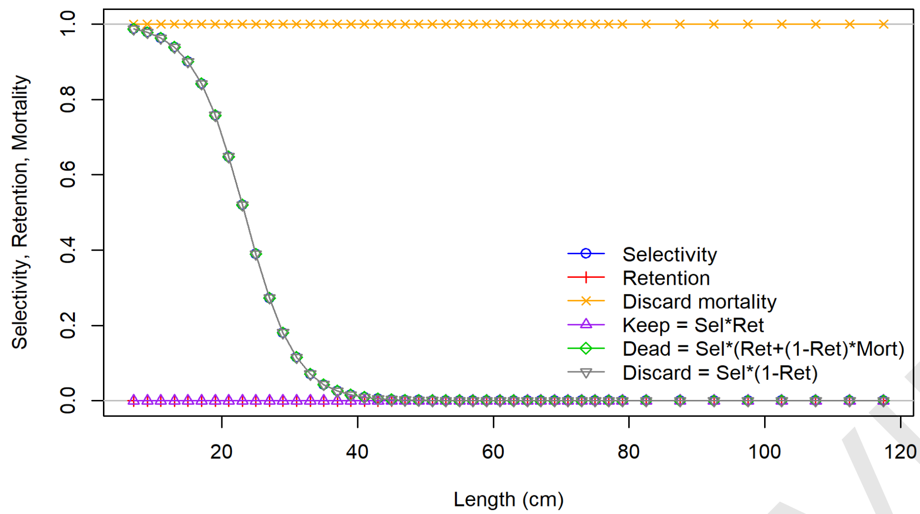


Figure 80. Time varying length-based selectivity for the Combined Video Survey Central fleet.

West



Central

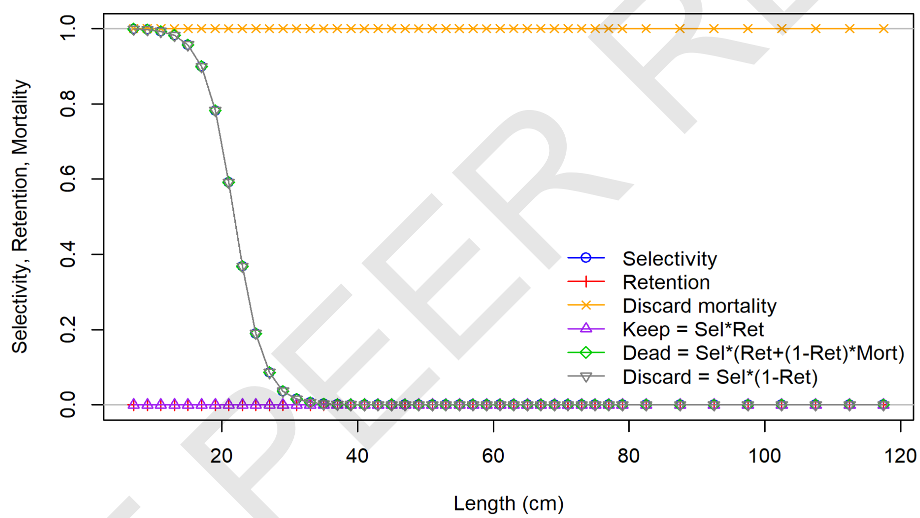


Figure 81. Length-based selectivity and retention for the Shrimp Bycatch fleet in the terminal year of the assessment. Selectivity (blue line) and retention (red line) vary, while discard mortality (orange line) is constant.

East

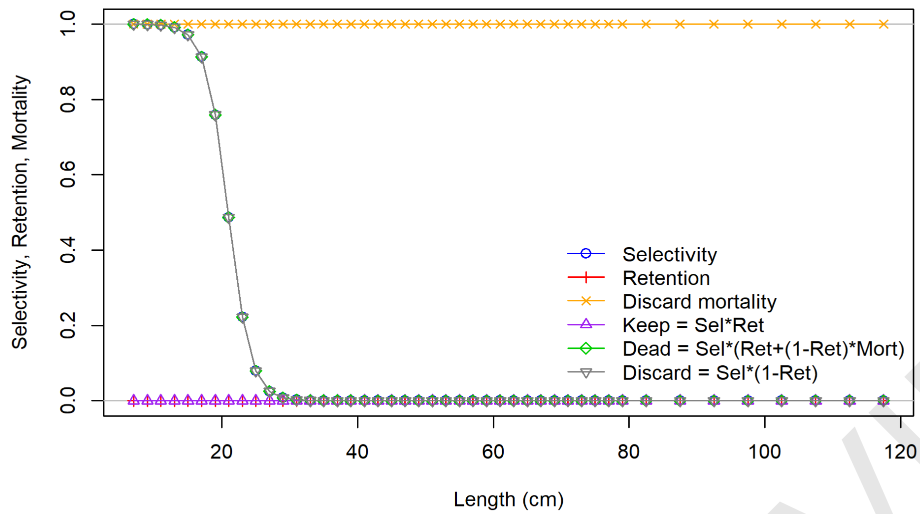


Figure 81 Continued. Length-based selectivity and retention for the Shrimp Bycatch fleet in the terminal year of the assessment. Selectivity (blue line) and retention (red line) vary, while discard mortality (orange line) is constant.

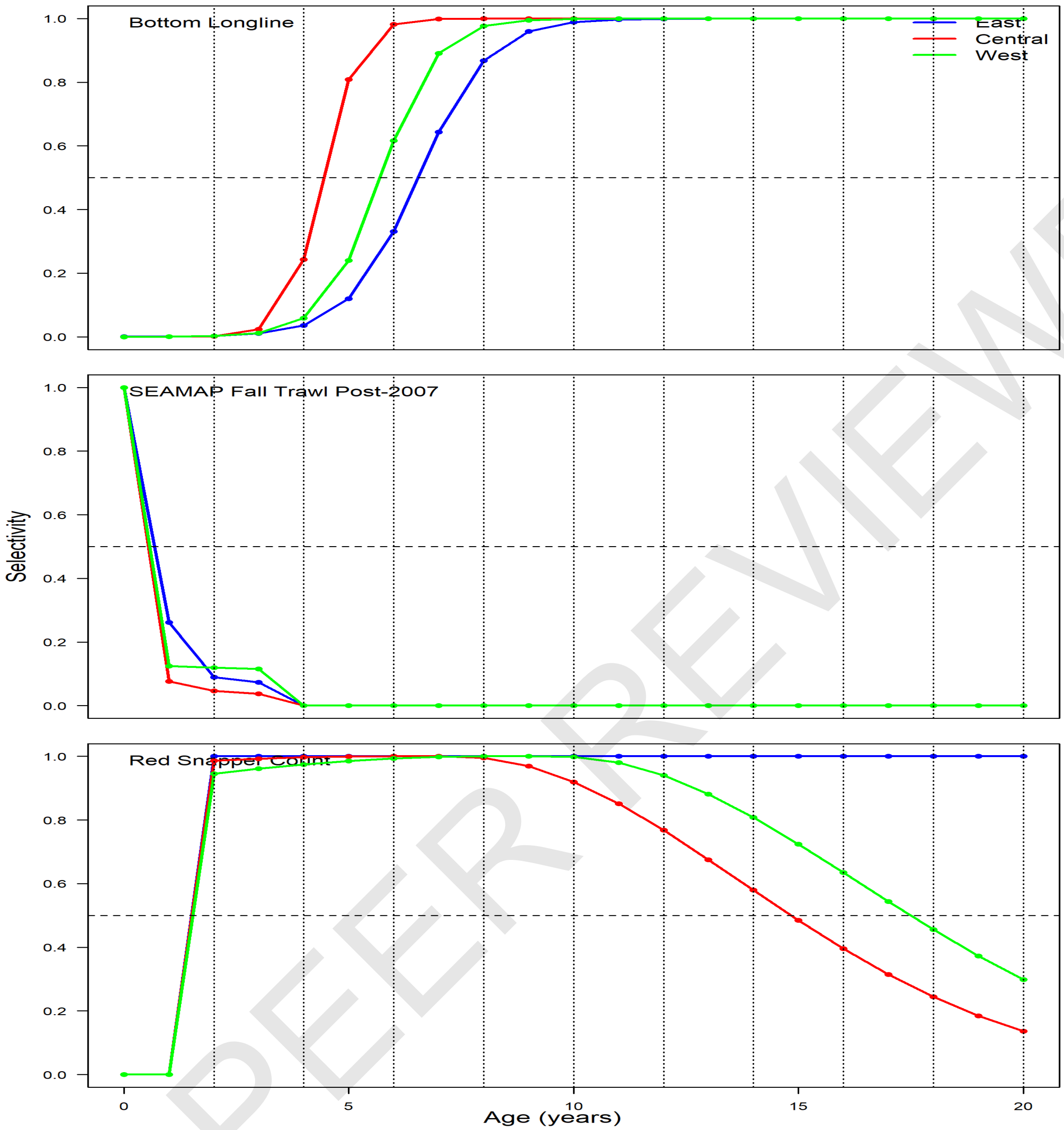


Figure 82. Derived age-based selectivity for specific surveys for Gulf of Mexico Red Snapper in the terminal year of the assessment. Dashed horizontal line indicates 50%, whereas the dashed vertical lines identify ages in 2 year intervals.

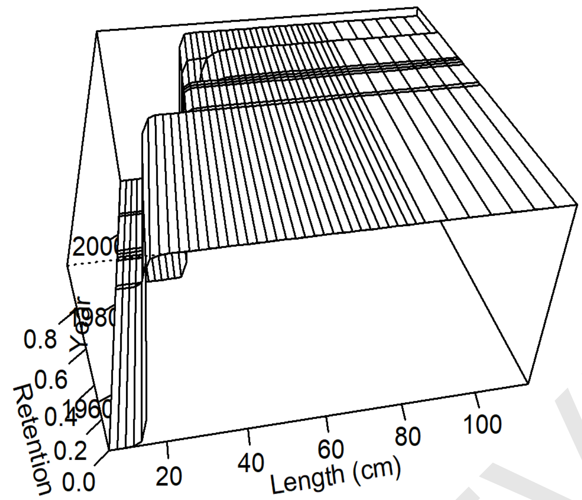


Figure 83. Time varying length-based retention for the Commercial Handline West fleet.

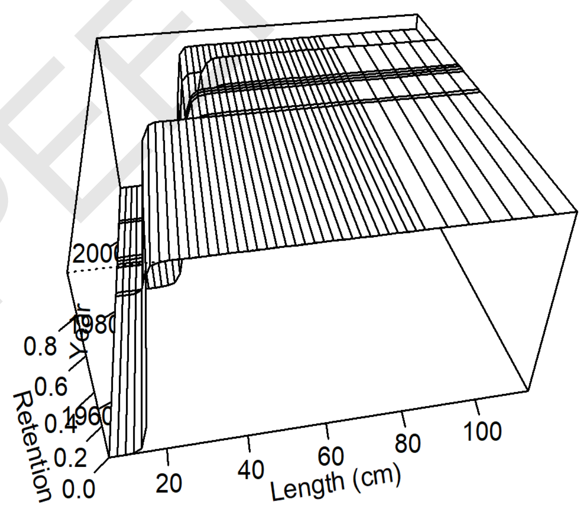


Figure 84. Time varying length-based retention for the Commercial Handline Central fleet.

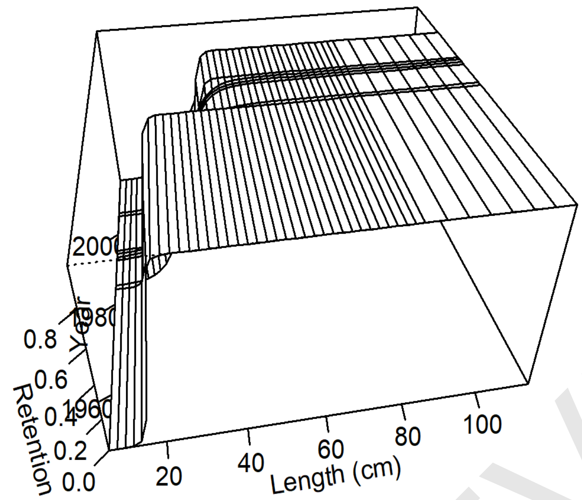


Figure 85. Time varying length-based retention for the Commercial Handline East fleet.

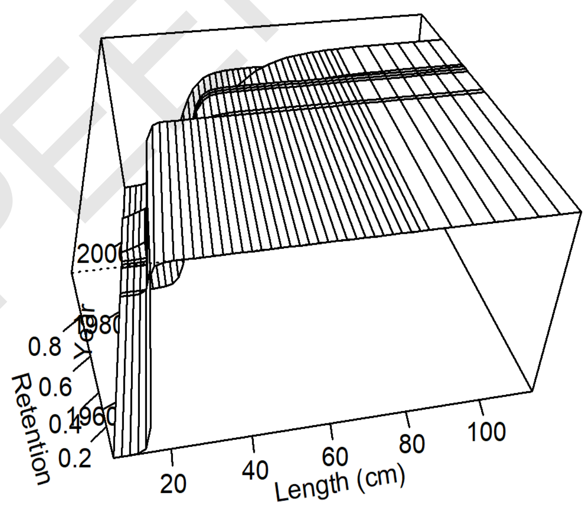


Figure 86. Time varying length-based retention for the Commercial Longline West fleet.

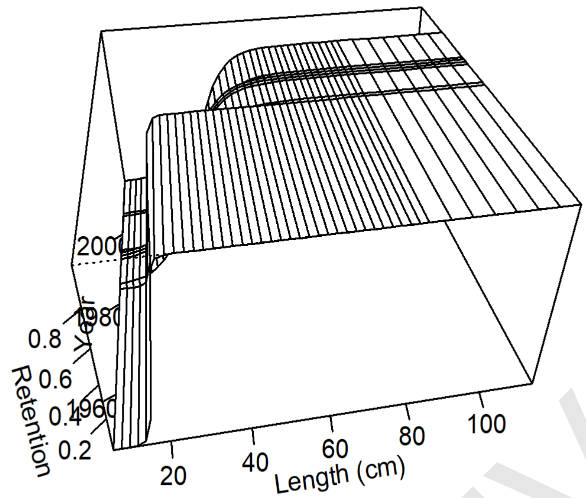


Figure 87. Time varying length-based retention for the Commercial Longline Central fleet.

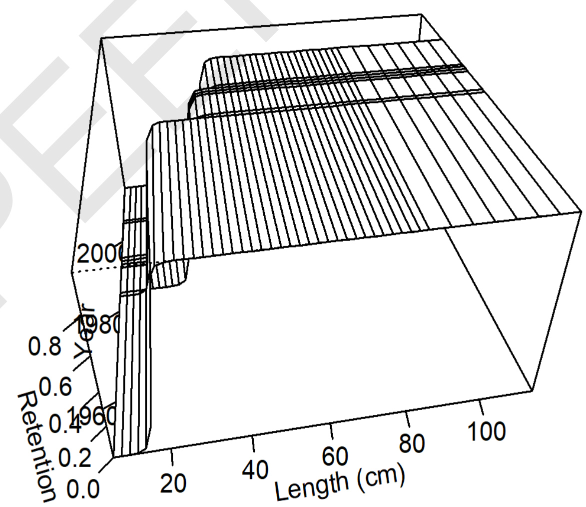


Figure 88. Time varying length-based retention for the Commercial Longline East fleet.

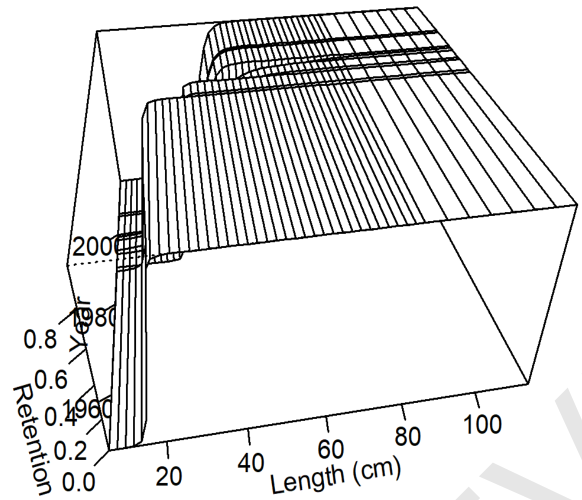


Figure 89. Time varying length-based retention for the Recreational Charter West fleet.

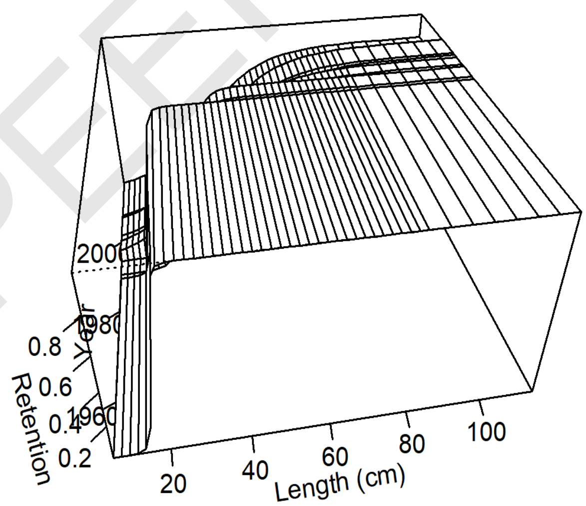


Figure 90. Time varying length-based retention for the Recreational Charter Central fleet.

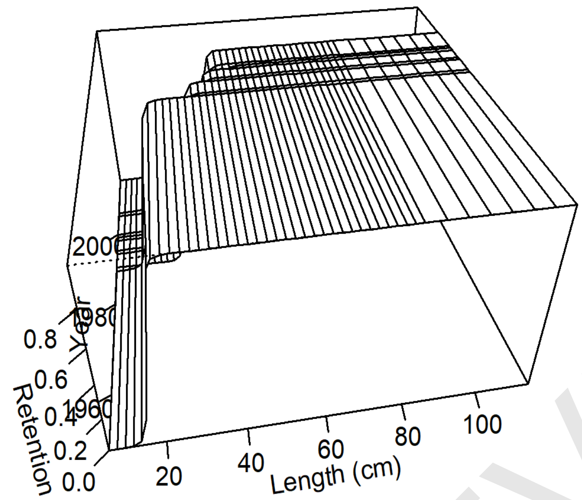


Figure 91. Time varying length-based retention for the Recreational Charter East fleet.

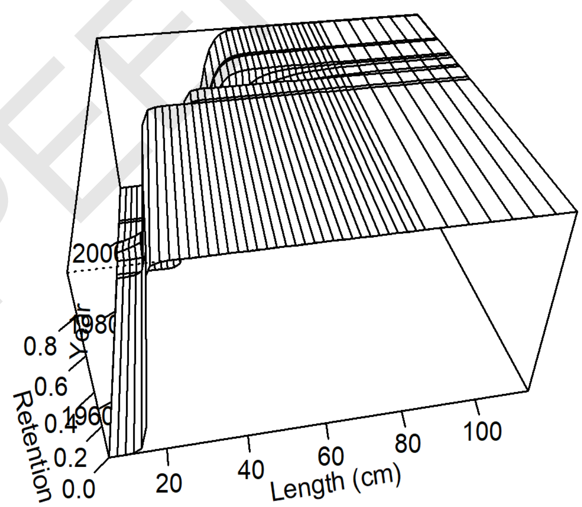


Figure 92. Time varying length-based retention for the Recreational Headboat West fleet.

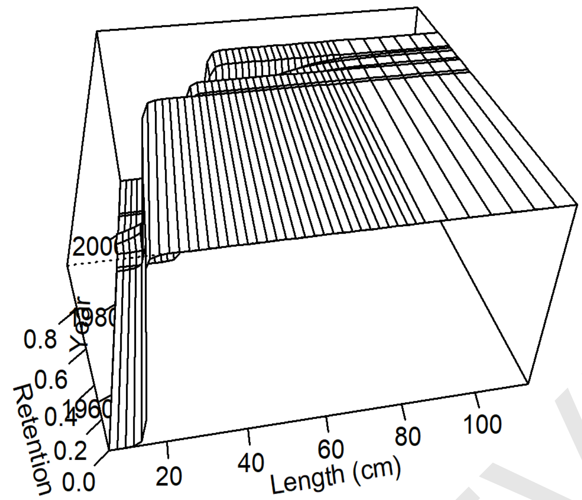


Figure 93. Time varying length-based retention for the Recreational Headboat Central fleet.

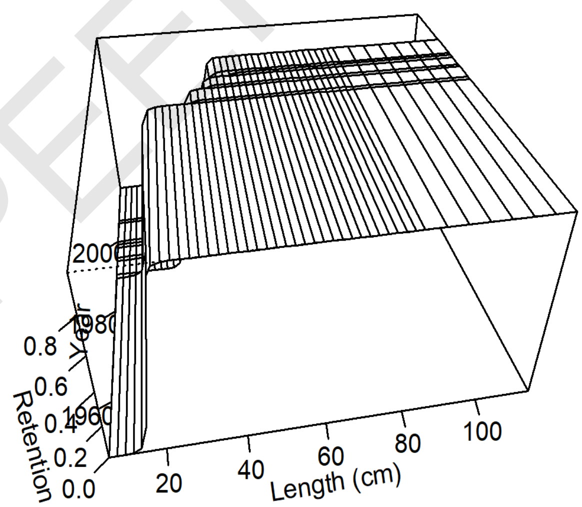


Figure 94. Time varying length-based retention for the Recreational Headboat East fleet.

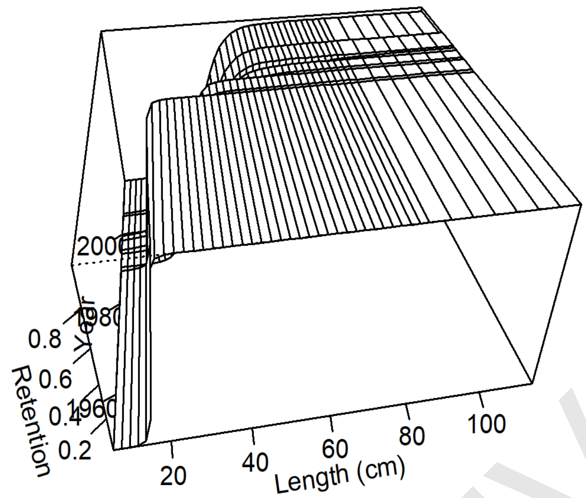


Figure 95. Time varying length-based retention for the Recreational Private West fleet.

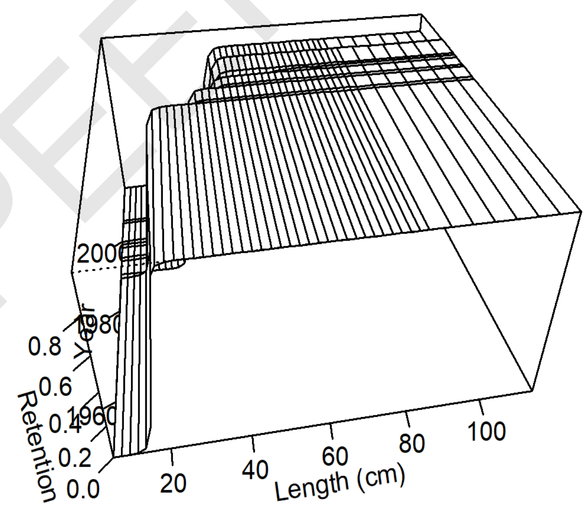


Figure 96. Time varying length-based retention for the Recreational Private Central fleet.

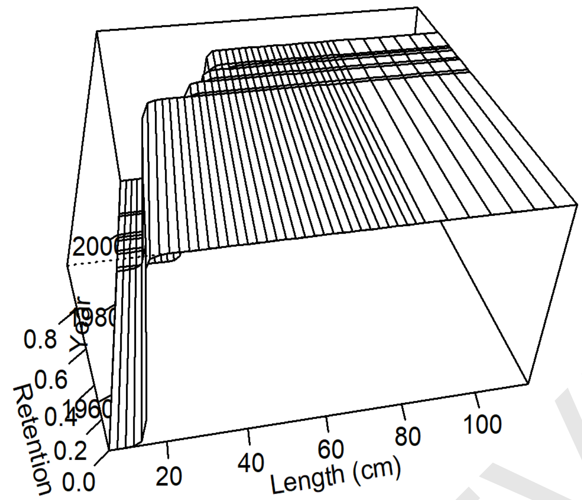


Figure 97. Time varying length-based retention for the Recreational Private East fleet.

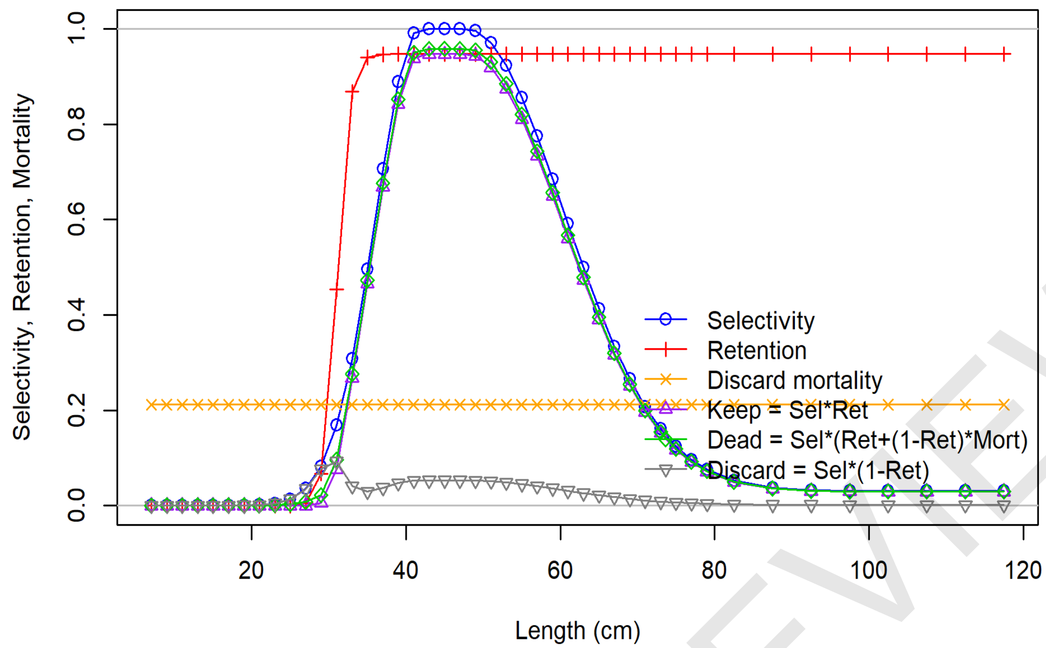


Figure 98. Length-based selectivity and retention for the Commercial Handline West fleet in the terminal year of the assessment. Selectivity (blue line) and retention (red line) vary, while discard mortality (orange line) is constant.

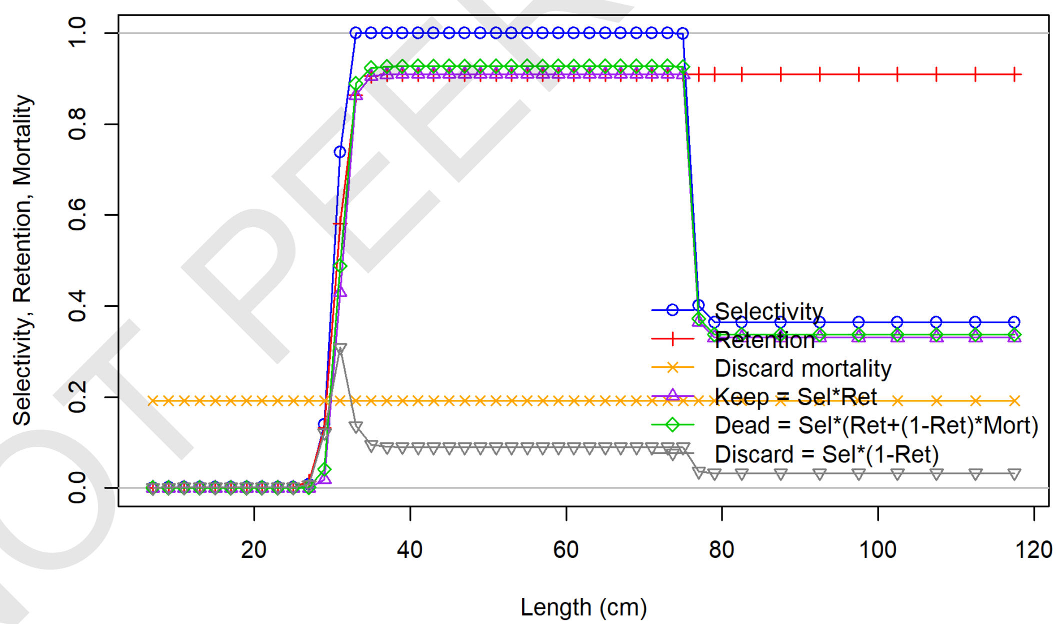


Figure 99. Length-based selectivity and retention for the Commercial Handline Central fleet in the terminal year of the assessment. Selectivity (blue line) and retention (red line) vary, while discard mortality (orange line) is constant.

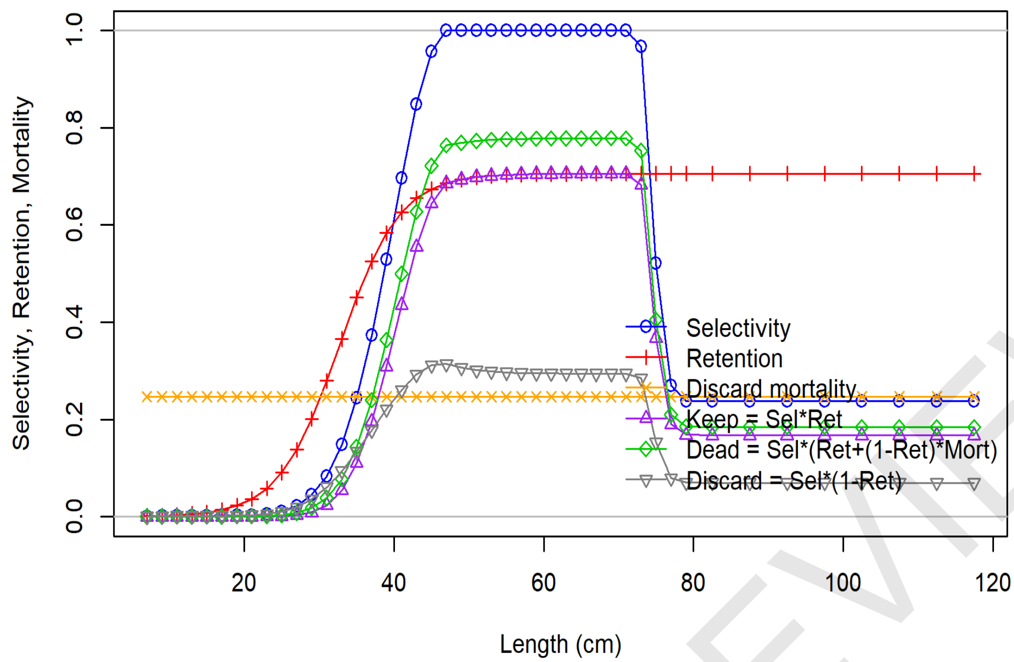


Figure 100. Length-based selectivity and retention for the Commercial Handline East fleet in the terminal year of the assessment. Selectivity (blue line) and retention (red line) vary, while discard mortality (orange line) is constant.

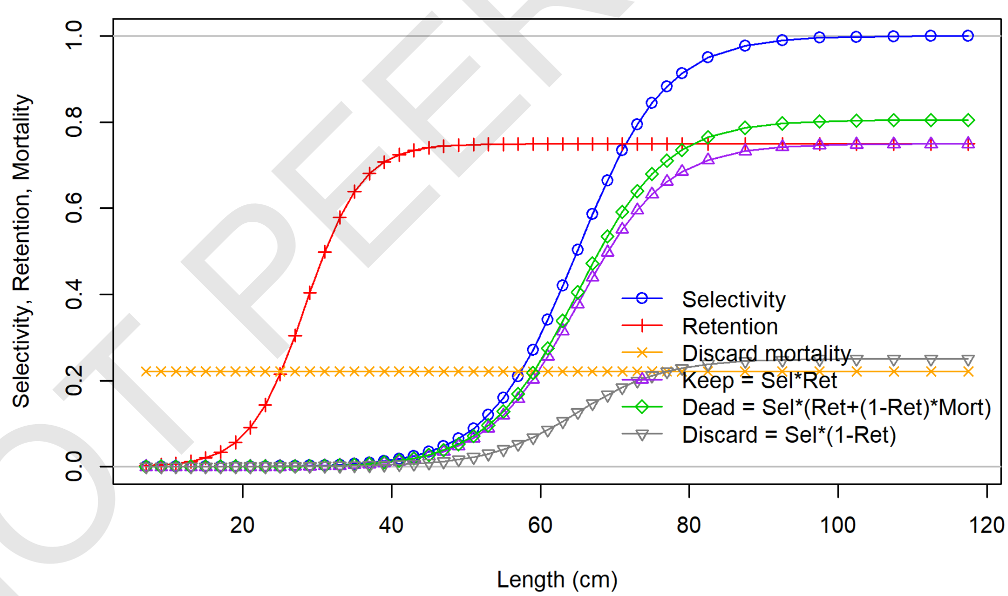


Figure 101. Length-based selectivity and retention for the Commercial Longline West fleet in the terminal year of the assessment. Selectivity (blue line) and retention (red line) vary, while discard mortality (orange line) is constant.

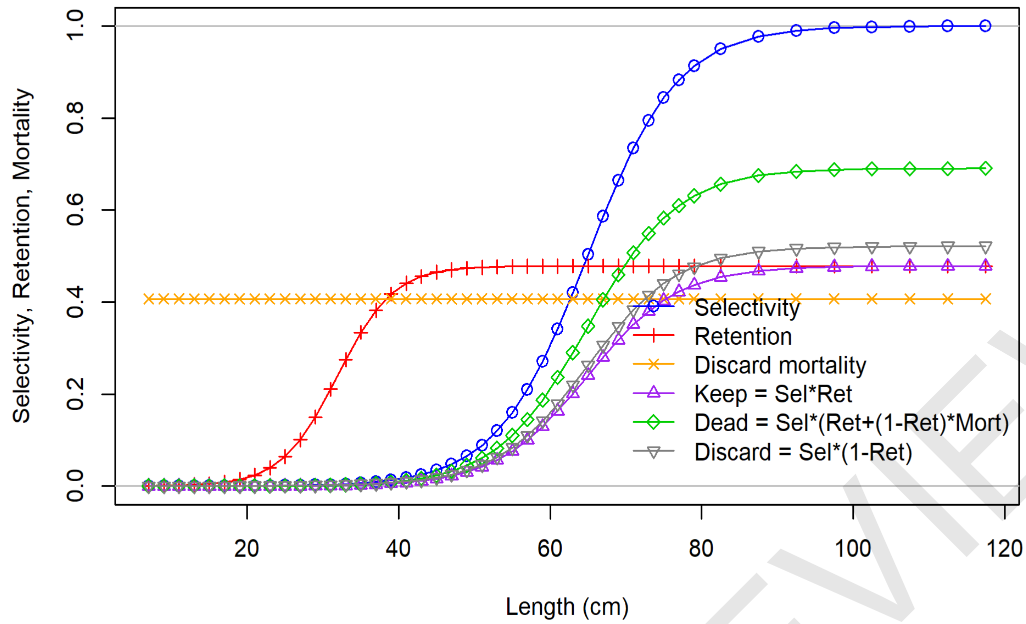


Figure 102. Length-based selectivity and retention for the Commercial Longline Central fleet in the terminal year of the assessment. Selectivity (blue line) and retention (red line) vary, while discard mortality (orange line) is constant.

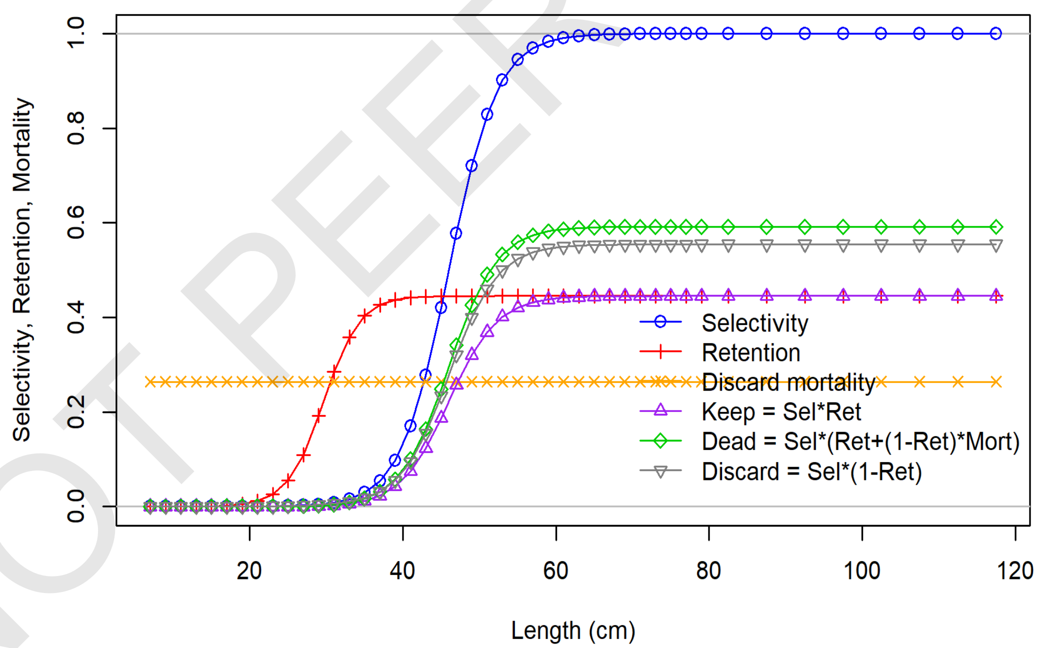


Figure 103. Length-based selectivity and retention for the Commercial Longline East fleet in the terminal year of the assessment. Selectivity (blue line) and retention (red line) vary, while discard mortality (orange line) is constant.

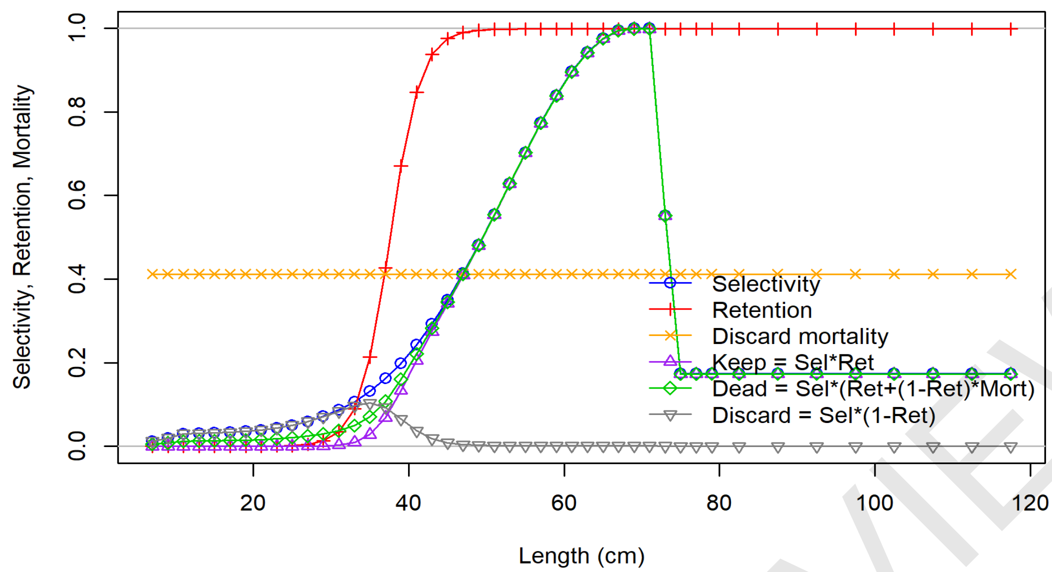


Figure 104. Length-based selectivity and retention for the Recreational Charter West fleet in the terminal year of the assessment. Selectivity (blue line) and retention (red line) vary, while discard mortality (orange line) is constant.

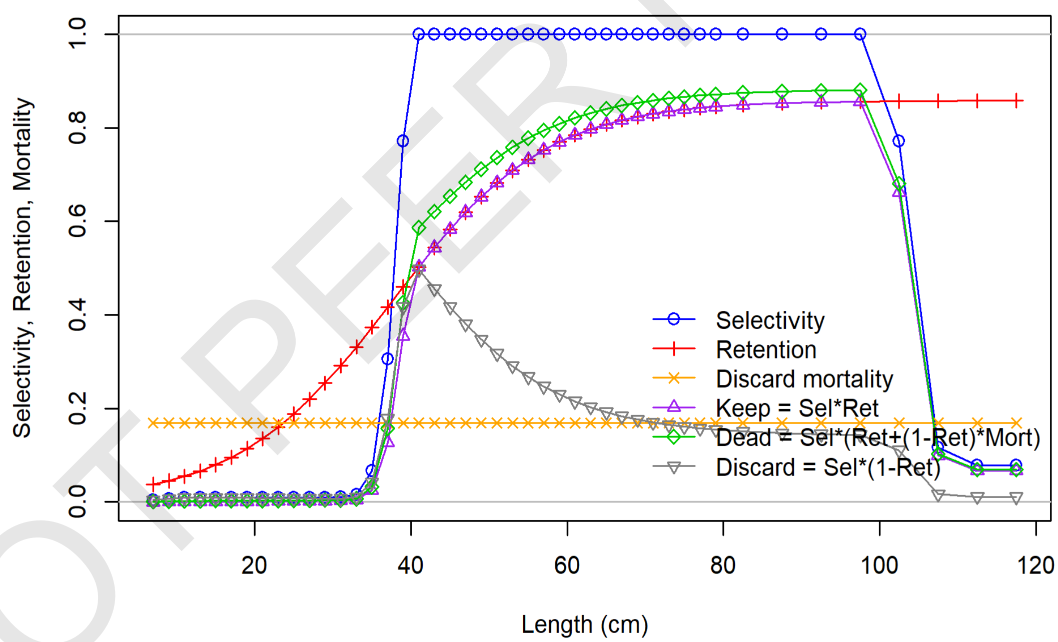


Figure 105. Length-based selectivity and retention for the Recreational Charter Central fleet in the terminal year of the assessment. Selectivity (blue line) and retention (red line) vary, while discard mortality (orange line) is constant.

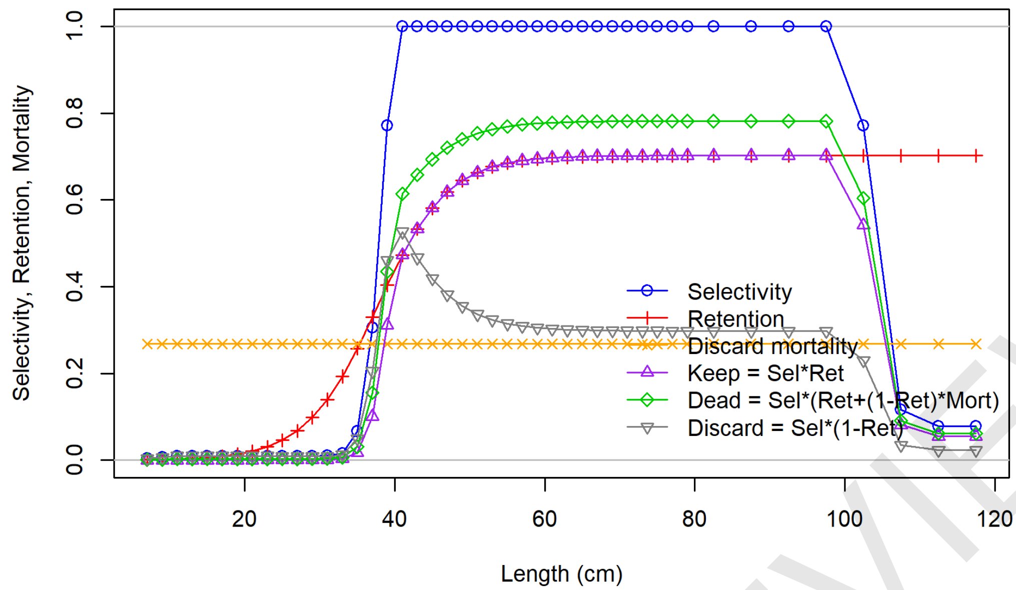


Figure 106. Length-based selectivity and retention for the Recreational Charter East fleet in the terminal year of the assessment. Selectivity (blue line) and retention (red line) vary, while discard mortality (orange line) is constant.

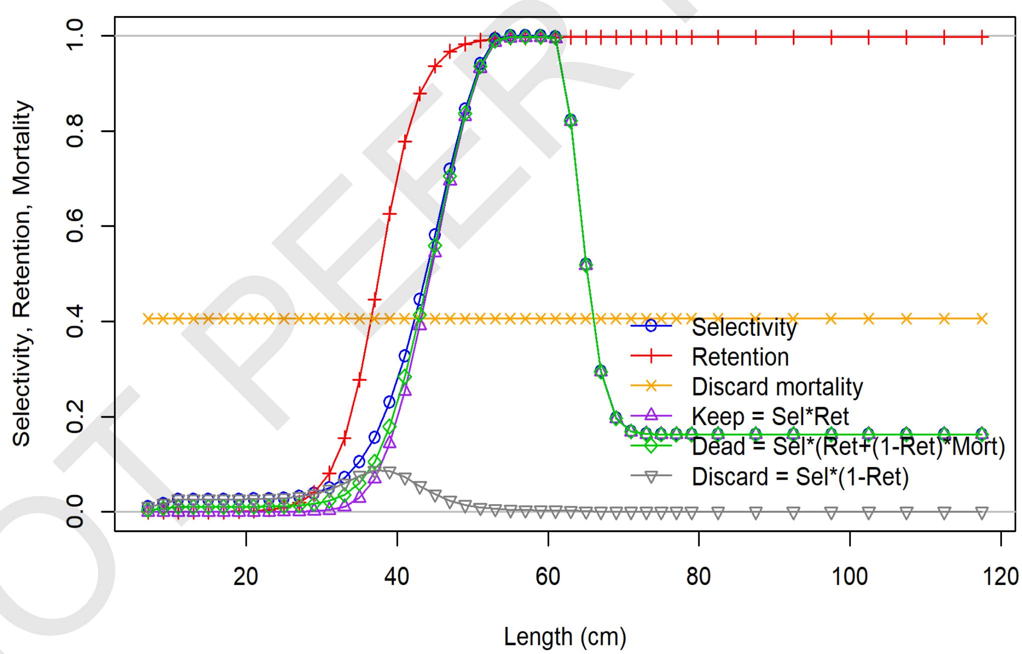


Figure 107. Length-based selectivity and retention for the Recreational Headboat West fleet in the terminal year of the assessment. Selectivity (blue line) and retention (red line) vary, while discard mortality (orange line) is constant.

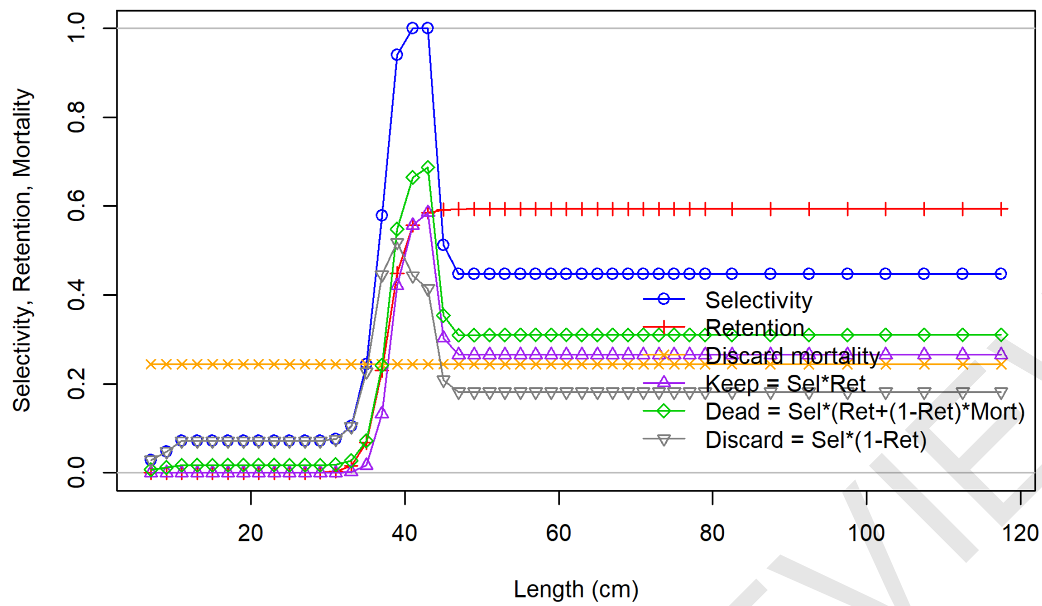


Figure 108. Length-based selectivity and retention for the Recreational Headboat Central fleet in the terminal year of the assessment. Selectivity (blue line) and retention (red line) vary, while discard mortality (orange line) is constant.

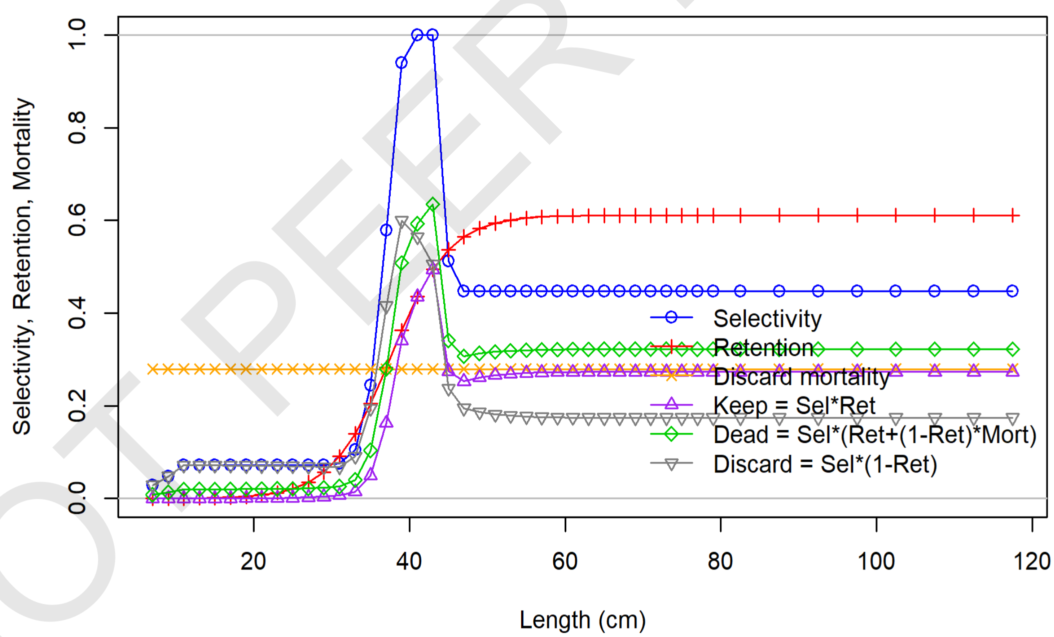


Figure 109. Length-based selectivity and retention for the Recreational Headboat East fleet in the terminal year of the assessment. Selectivity (blue line) and retention (red line) vary, while discard mortality (orange line) is constant.

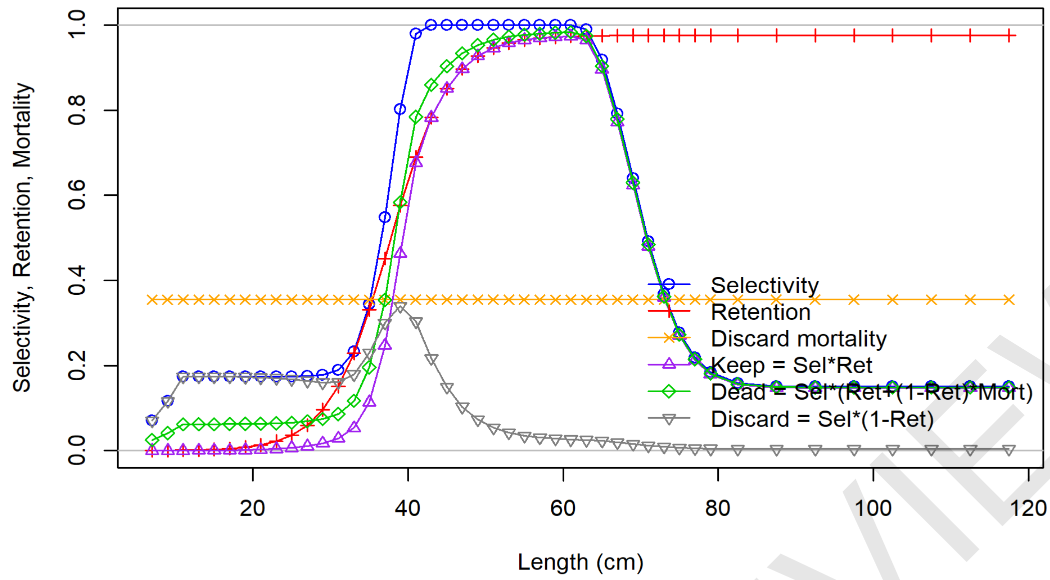


Figure 110. Length-based selectivity and retention for the Recreational Private West fleet in the terminal year of the assessment. Selectivity (blue line) and retention (red line) vary, while discard mortality (orange line) is constant.

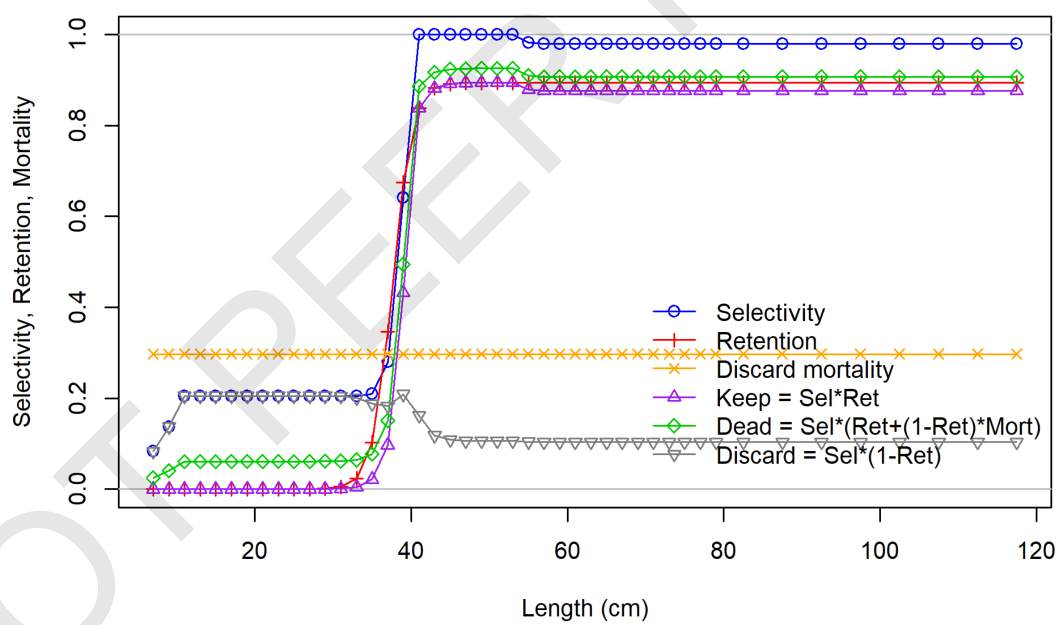


Figure 111. Length-based selectivity and retention for the Recreational Private Central fleet in the terminal year of the assessment. Selectivity (blue line) and retention (red line) vary, while discard mortality (orange line) is constant.

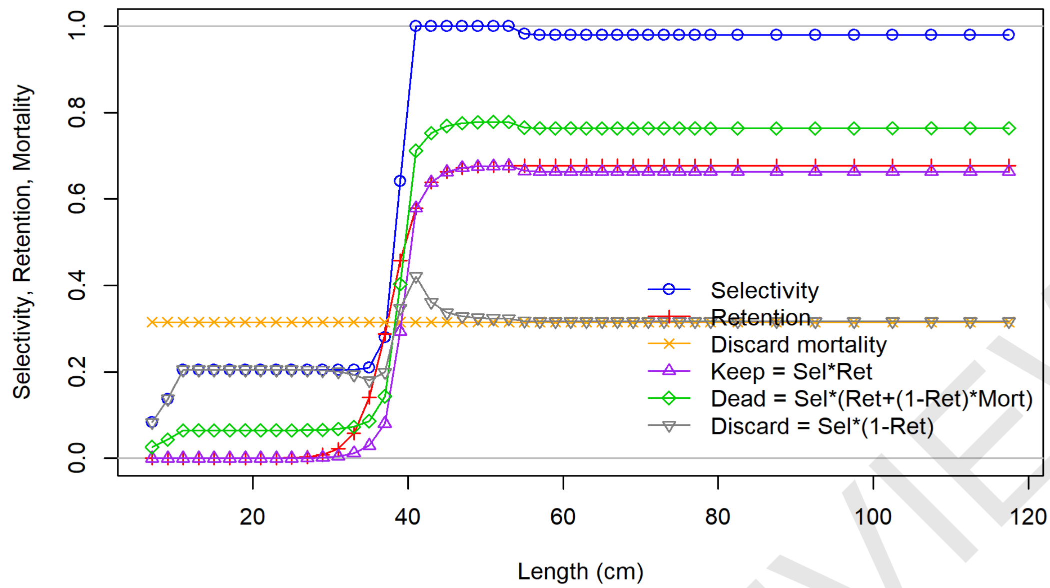


Figure 112. Length-based selectivity and retention for the Recreational Private East fleet in the terminal year of the assessment. Selectivity (blue line) and retention (red line) vary, while discard mortality (orange line) is constant.

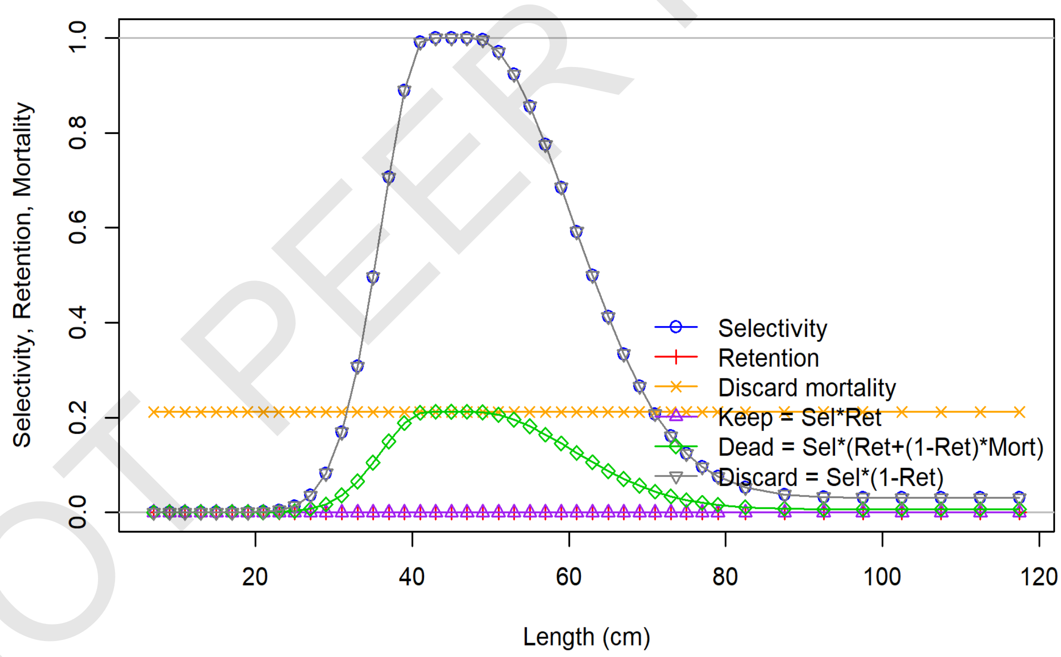


Figure 113. Length-based selectivity and retention for the Commercial Handline Closed Season Discards West fleet in the terminal year of the assessment. Selectivity (blue line) and retention (red line) vary, while discard mortality (orange line) is constant.

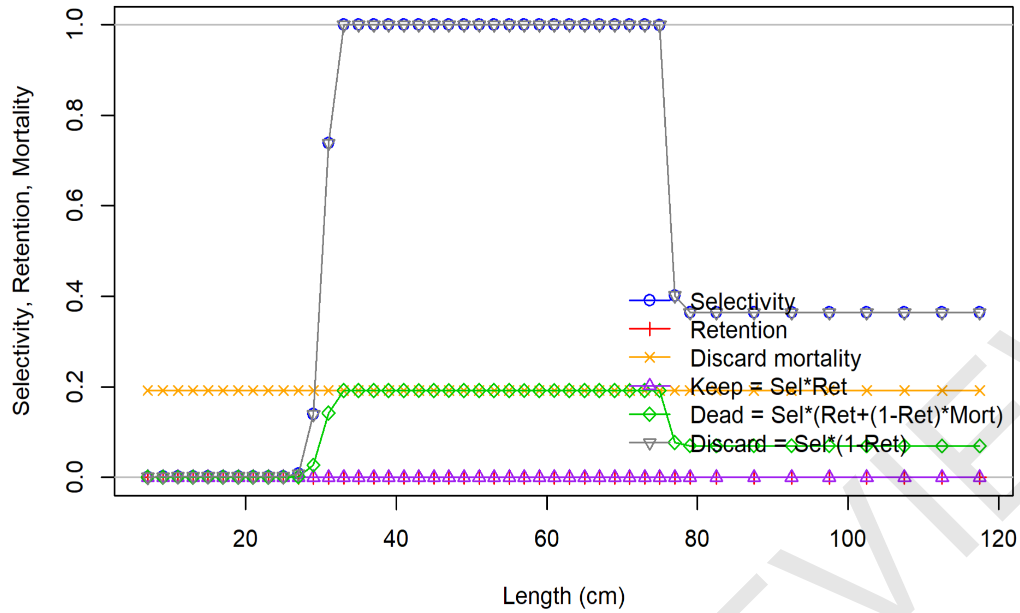


Figure 114. Length-based selectivity and retention for the Commercial Handline Closed Season Discards Central fleet in the terminal year of the assessment. Selectivity (blue line) and retention (red line) vary, while discard mortality (orange line) is constant.

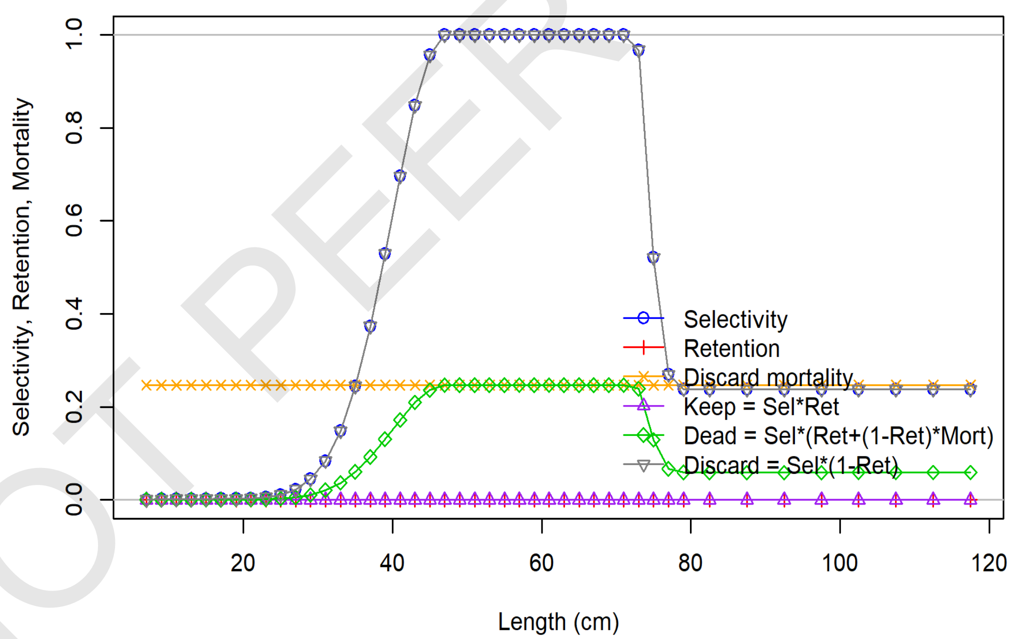


Figure 115. Length-based selectivity and retention for the Commercial Handline Closed Season Discards East fleet in the terminal year of the assessment. Selectivity (blue line) and retention (red line) vary, while discard mortality (orange line) is constant.

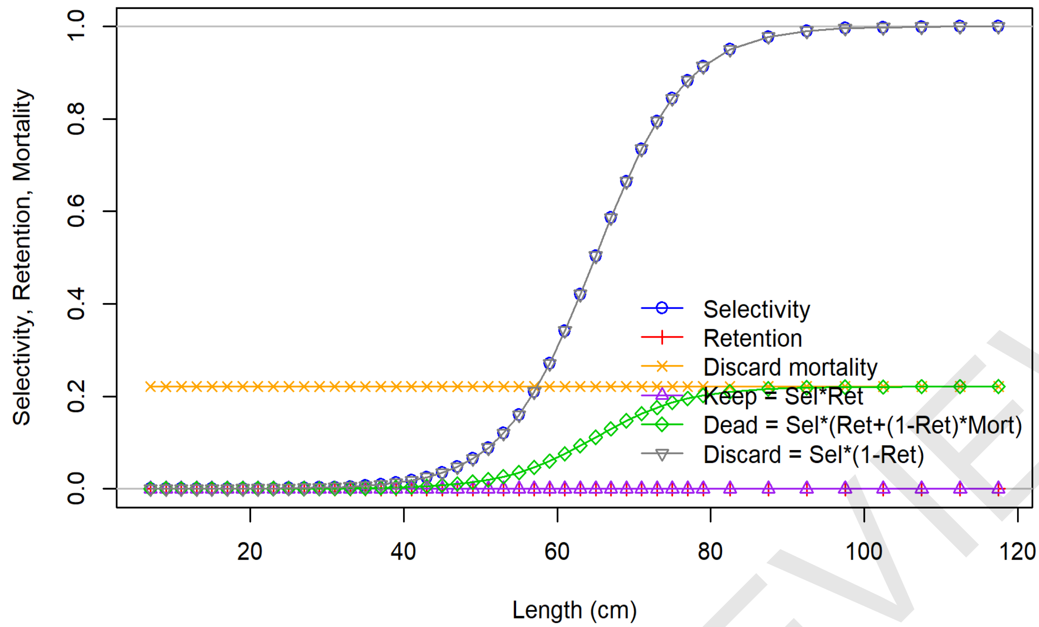


Figure 116. Length-based selectivity and retention for the Commercial Longline Closed Season Discards West fleet in the terminal year of the assessment. Selectivity (blue line) and retention (red line) vary, while discard mortality (orange line) is constant.

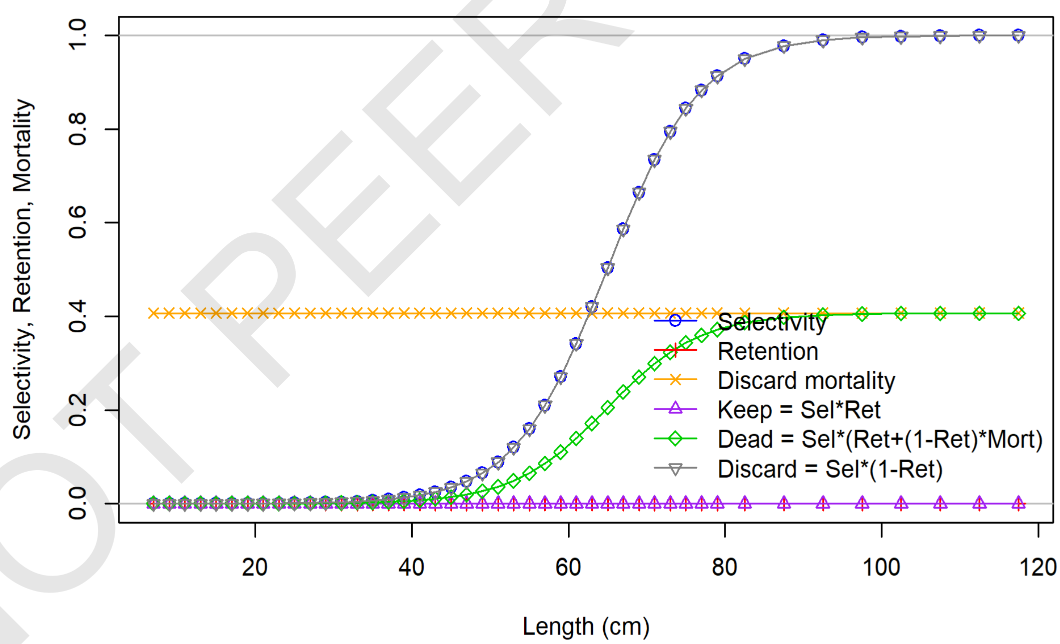


Figure 117. Length-based selectivity and retention for the Commercial Longline Closed Season Discards Central fleet in the terminal year of the assessment. Selectivity (blue line) and retention (red line) vary, while discard mortality (orange line) is constant.

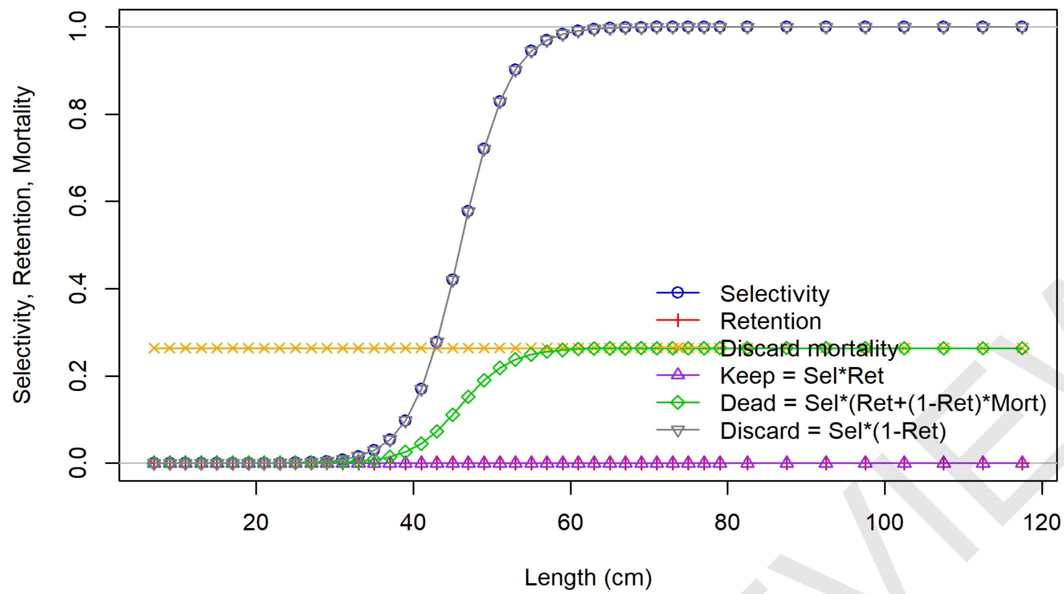


Figure 118. Length-based selectivity and retention for the Commercial Longline Closed Season Discards East fleet in the terminal year of the assessment. Selectivity (blue line) and retention (red line) vary, while discard mortality (orange line) is constant.

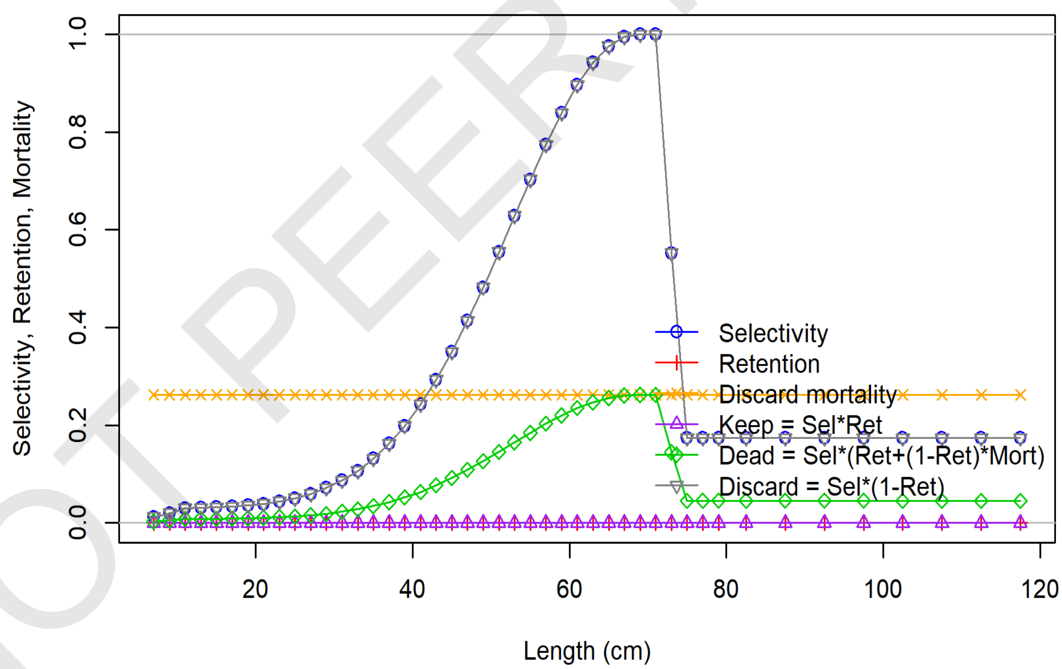


Figure 119. Length-based selectivity and retention for the Recreational Charter Closed Season Discards West fleet in the terminal year of the assessment. Selectivity (blue line) and retention (red line) vary, while discard mortality (orange line) is constant.

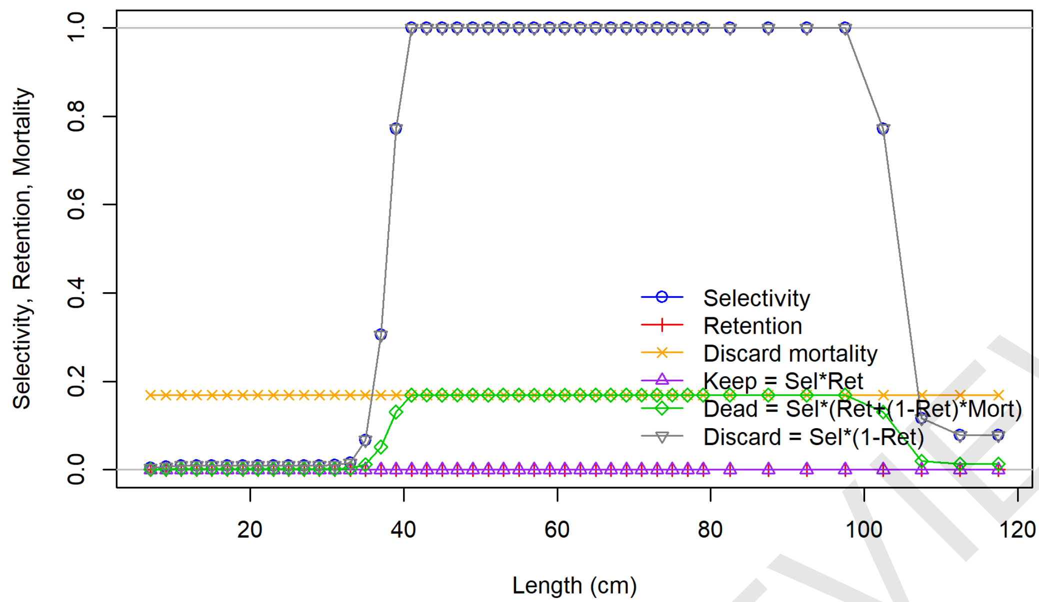


Figure 120. Length-based selectivity and retention for the Recreational Charter Closed Season Discards Central fleet in the terminal year of the assessment. Selectivity (blue line) and retention (red line) vary, while discard mortality (orange line) is constant.

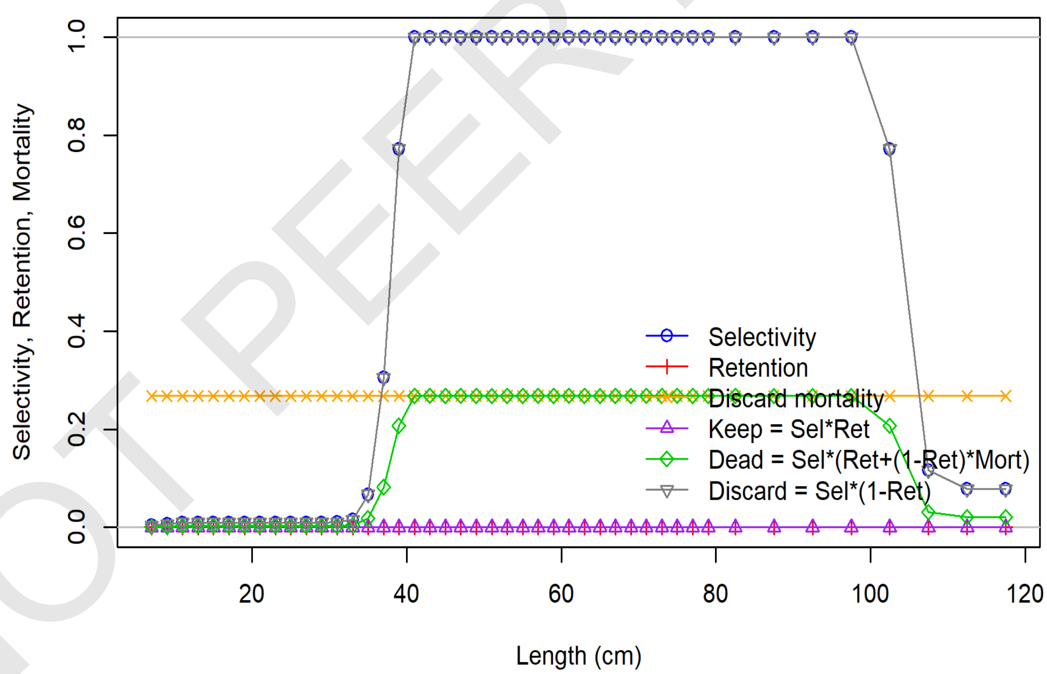


Figure 121. Length-based selectivity and retention for the Recreational Charter Closed Season Discards East fleet in the terminal year of the assessment. Selectivity (blue line) and retention (red line) vary, while discard mortality (orange line) is constant.

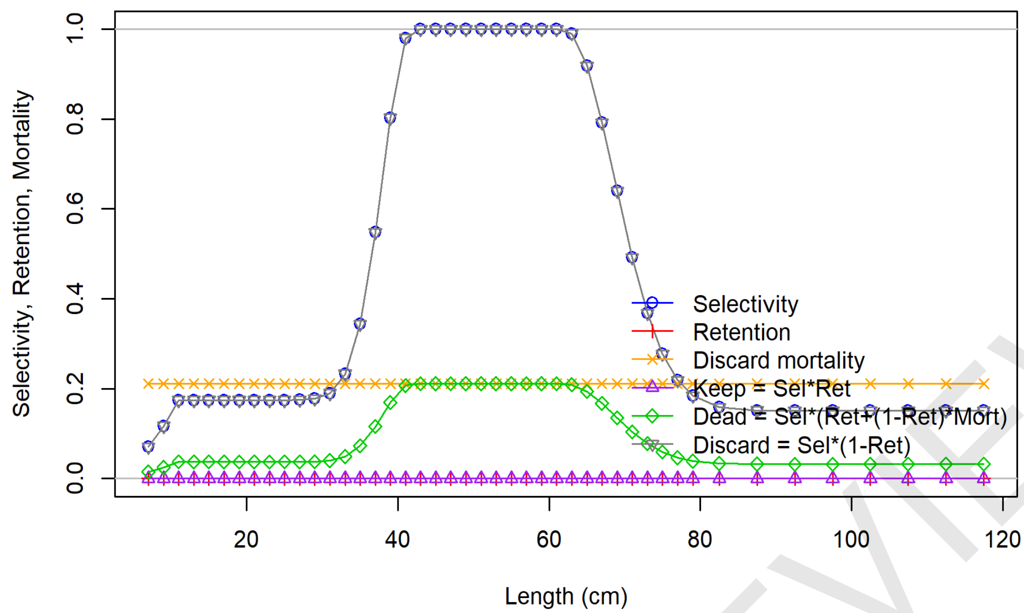


Figure 122. Length-based selectivity and retention for the Recreational Private Closed Season Discards West fleet in the terminal year of the assessment. Selectivity (blue line) and retention (red line) vary, while discard mortality (orange line) is constant.

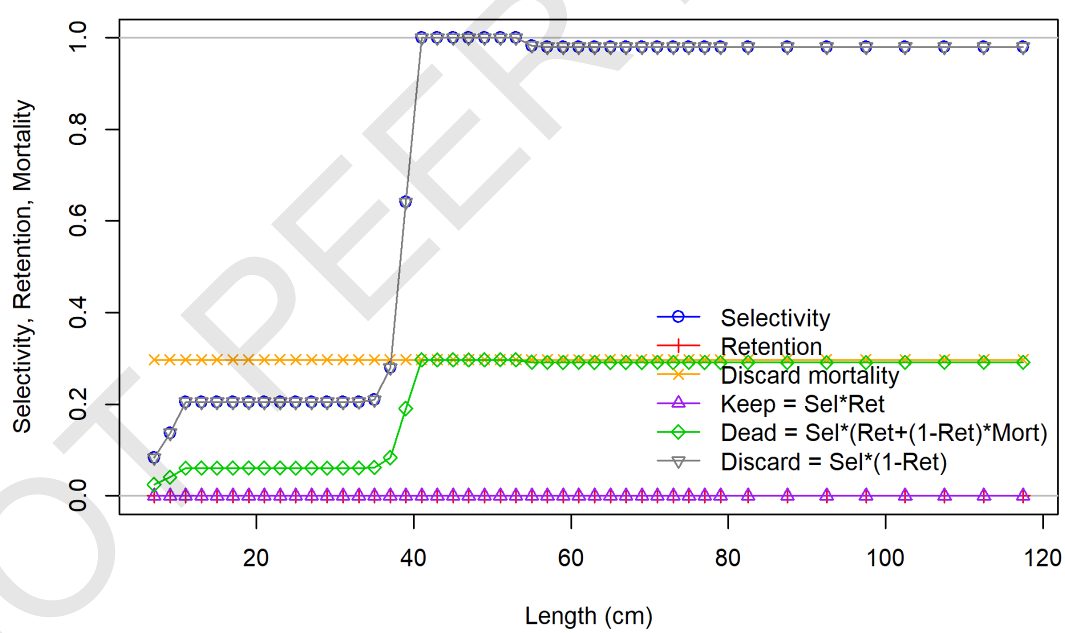


Figure 123. Length-based selectivity and retention for the Recreational Private Closed Season Discards Central fleet in the terminal year of the assessment. Selectivity (blue line) and retention (red line) vary, while discard mortality (orange line) is constant.

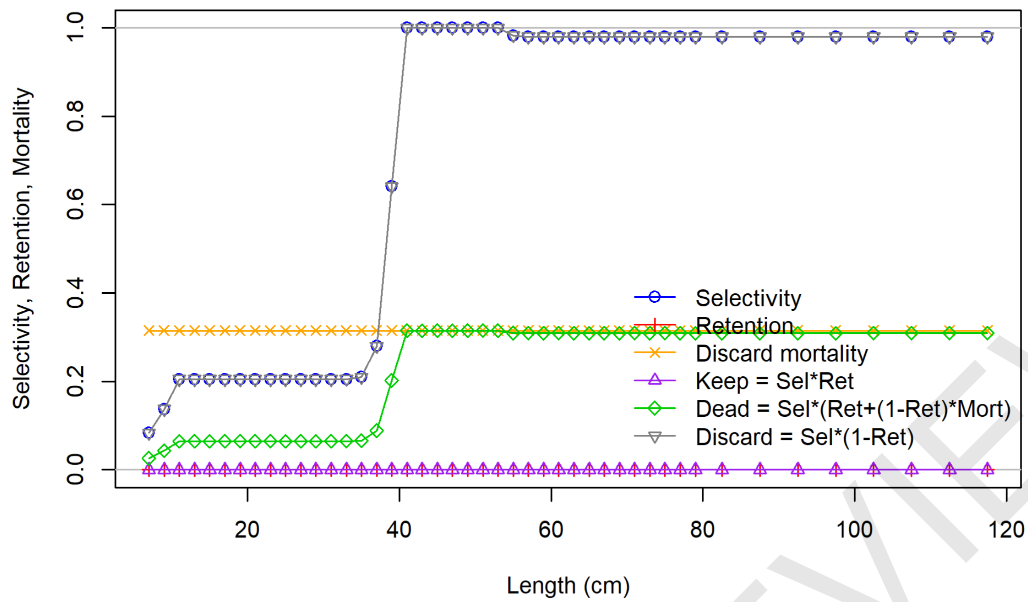


Figure 124. Length-based selectivity and retention for the Recreational Private Closed Season Discards East fleet in the terminal year of the assessment. Selectivity (blue line) and retention (red line) vary, while discard mortality (orange line) is constant.

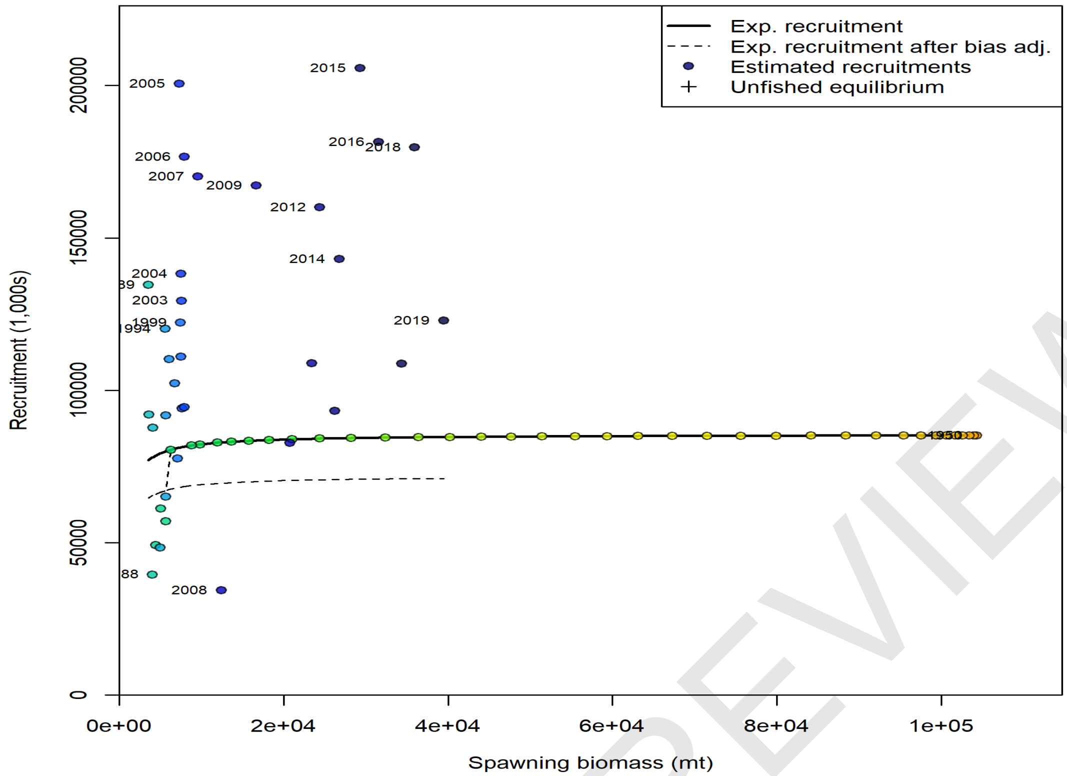


Figure 125. Stock-recruitment relationship for Gulf of Mexico Red Snapper with fixed steepness and SigmaR at 0.99 and 0.6, respectively. Plotted are predicted annual recruitments from Stock Synthesis (circles), expected recruitment from the stock-recruit relationship (black line), and bias adjusted recruitment from the stock-recruit relationship (dashed line).

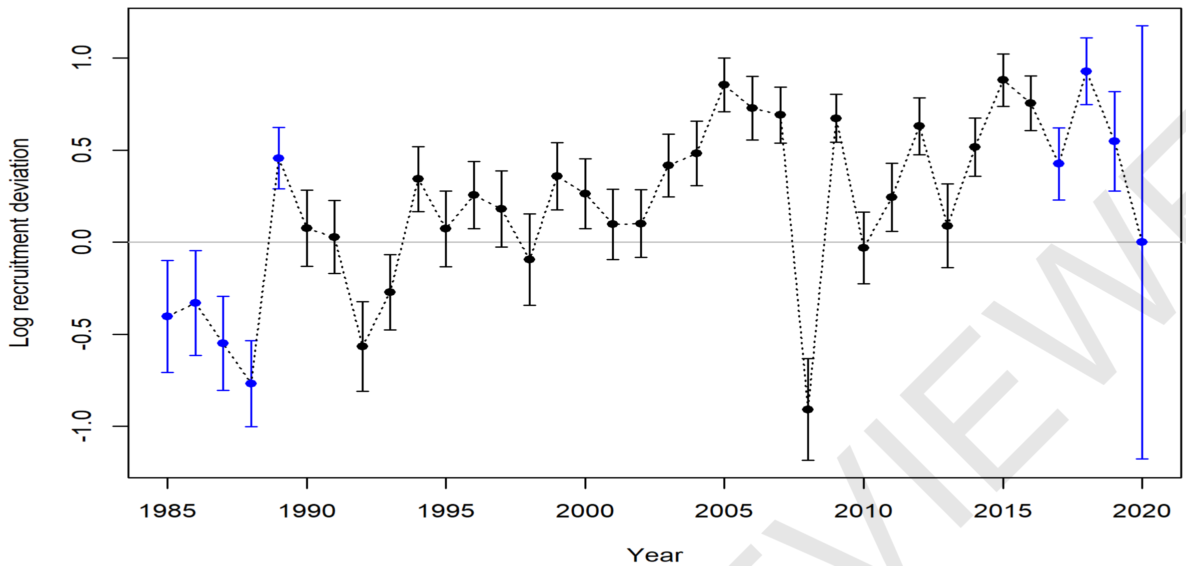


Figure 126. Estimated log recruitment deviations for Gulf of Mexico Red Snapper (steepness and SigmaR were fixed at 0.99 and 0.6, respectively).

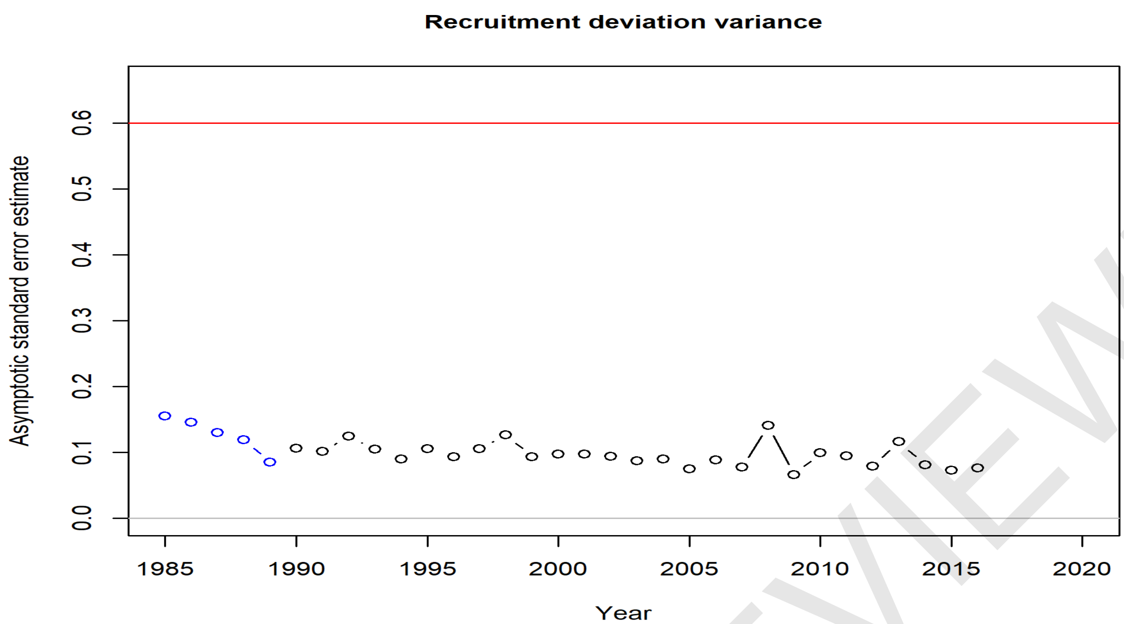


Figure 127. Asymptotic standard errors for recruitment deviations for Gulf of Mexico Red Snapper. The red line represents the fixed value of SigmaR of 0.6 used in the SEDAR 74 model.

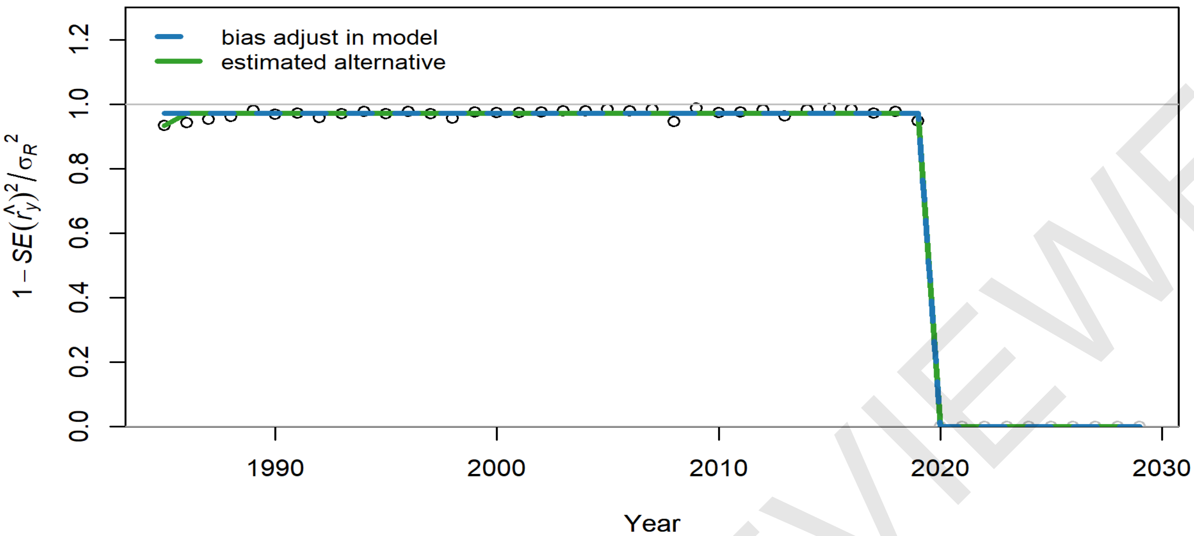


Figure 128. Points are transformed variances. The blue line shows current settings for bias adjustment specified for the Base Run, which coincides with the least squares estimate of alternative bias adjustment relationship for recruitment deviations (green line). For more information, see Methot and Taylor 2011.

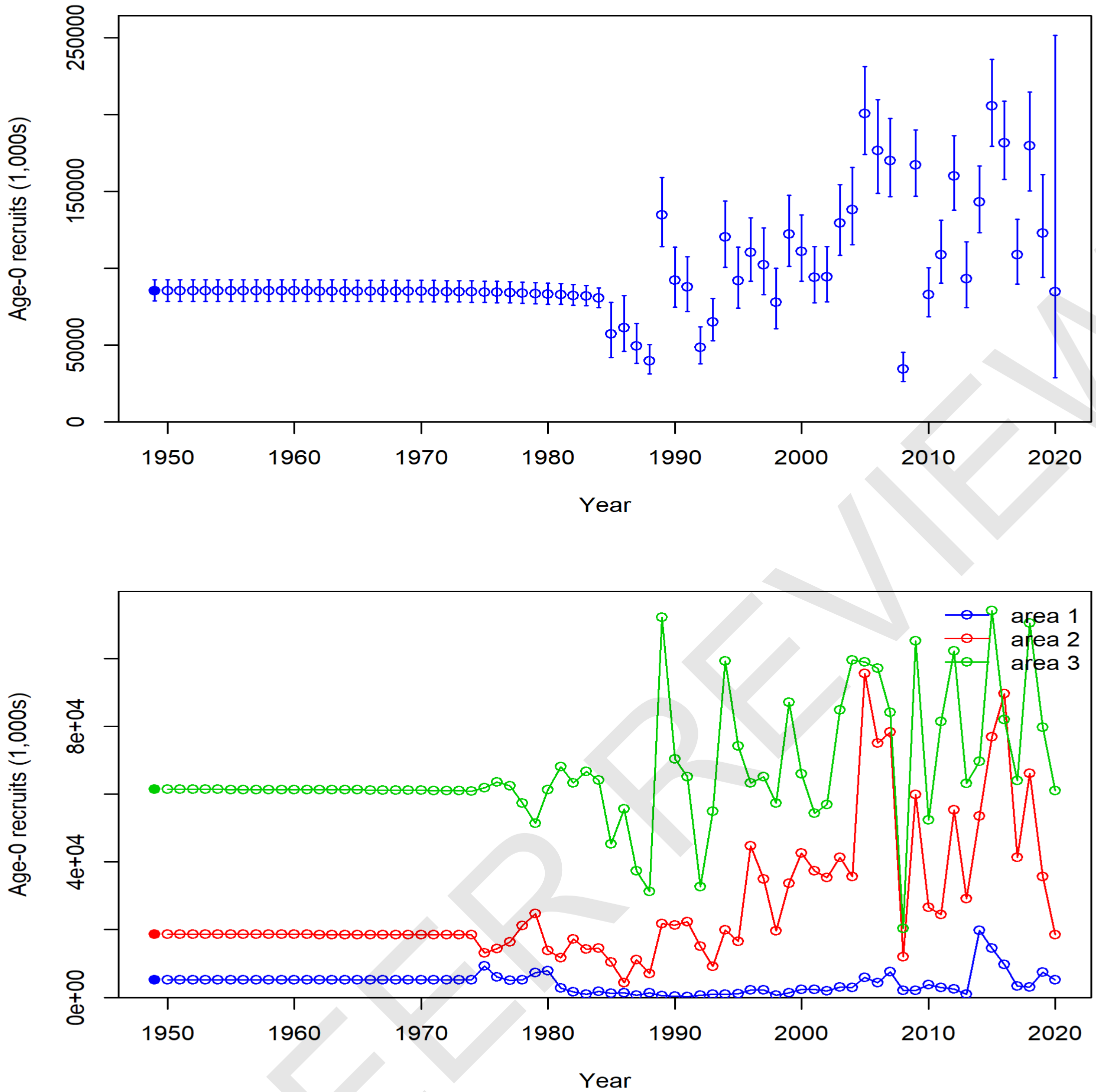


Figure 129. Estimated Age-0 recruitment with 95% confidence intervals for Gulf of Mexico Red Snapper (steepness and SigmaR were fixed at 0.99 and 0.6, respectively). Bottom figure represents estimated age-0 recruitment by area with area 1 (blue) indicating trends in the east, area 2 (red) indicating trends in the central area, and area3 (green) indicating trends in the west area.

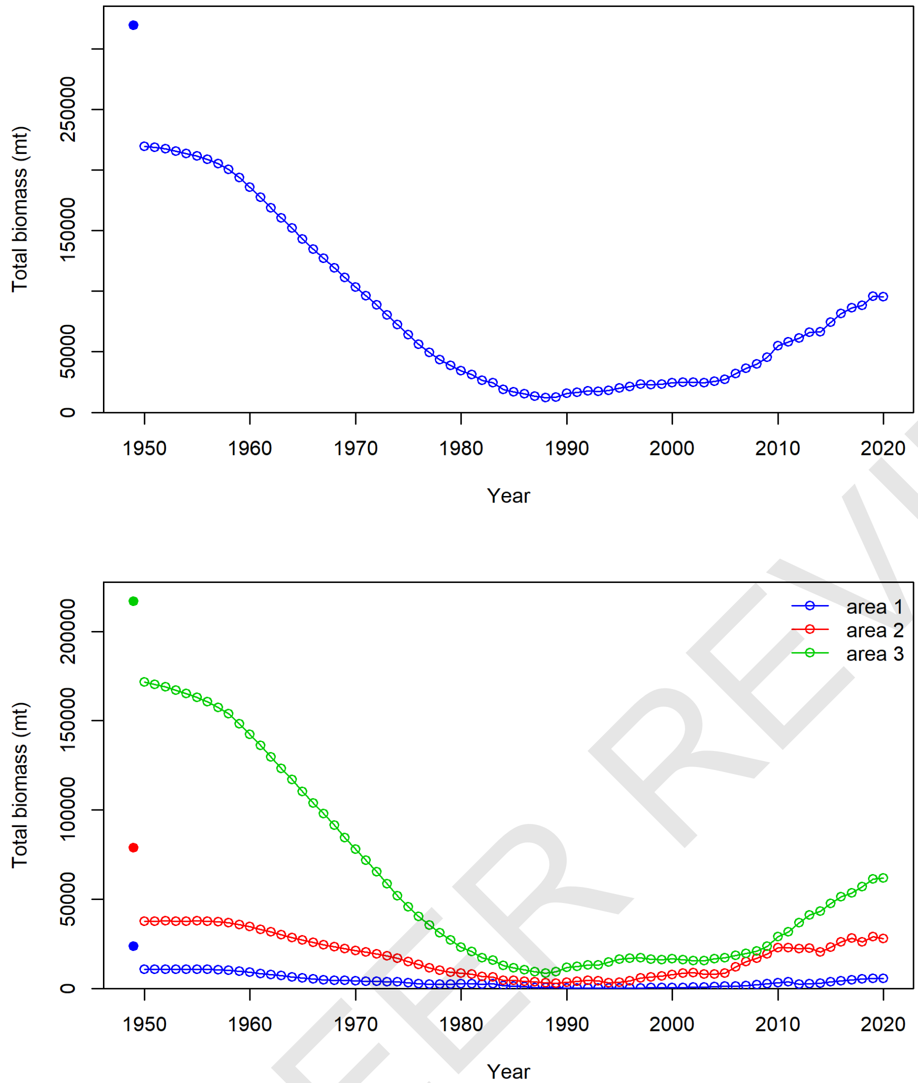


Figure 130. Estimate of total biomass (in metric tons) for Gulf of Mexico Red Snapper and by area with the blue, red and green lines representing the east, central and west areas, respectively.

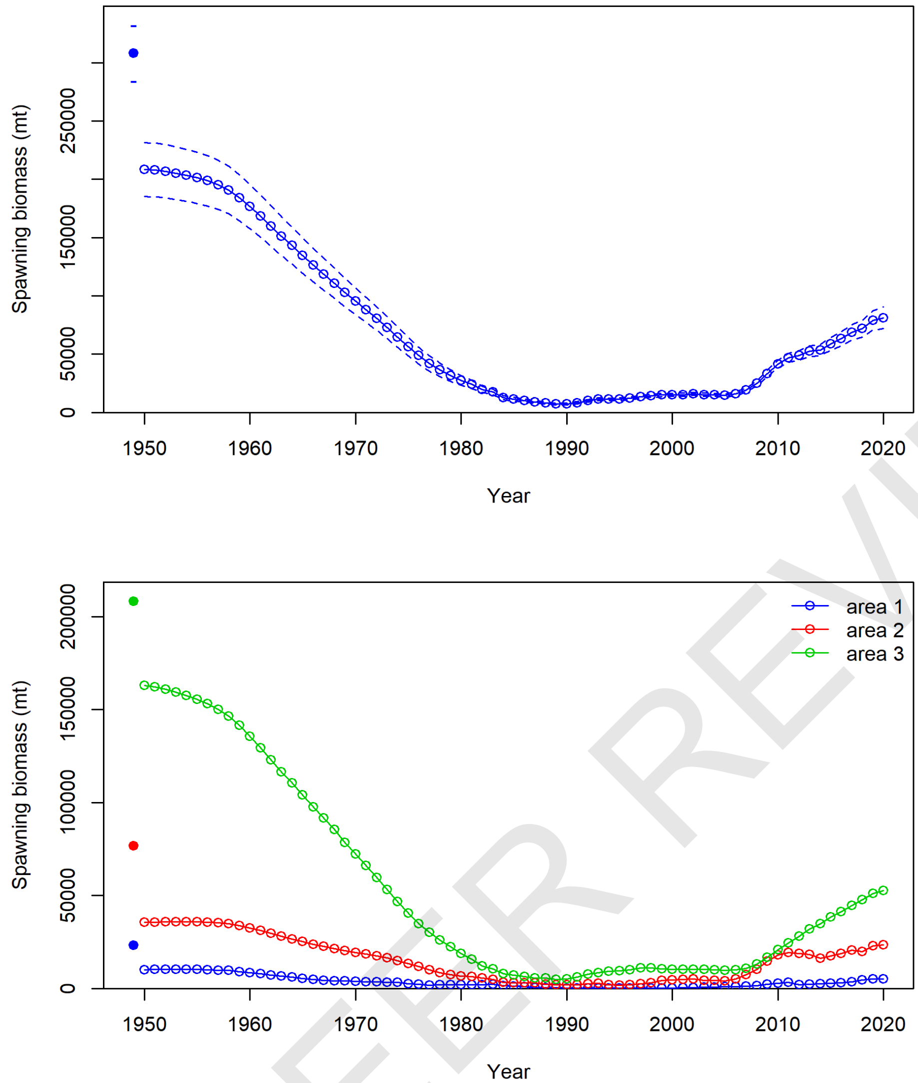
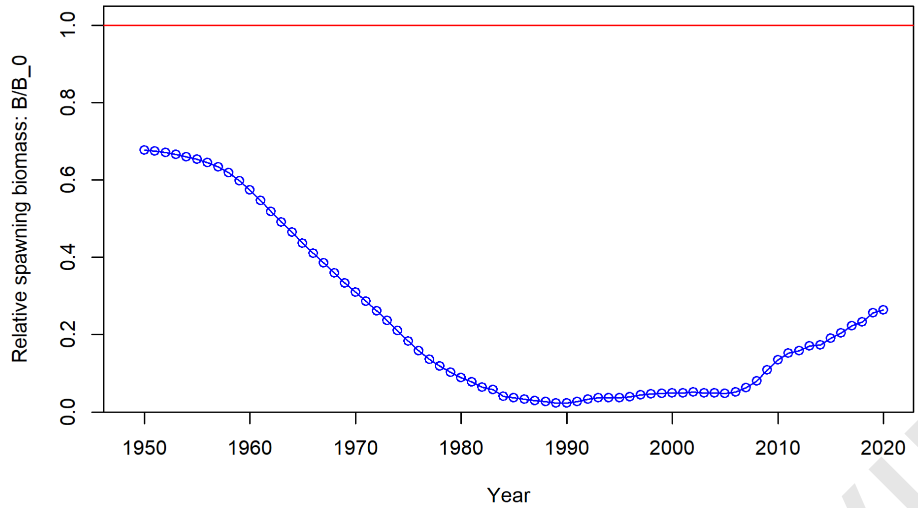


Figure 131. Estimate of spawning stock biomass (in metric tons) and associated 95% confidence intervals for Gulf of Mexico Red Snapper and by area with the blue, red and green lines representing the spawning stock biomass in the east, central and west area respectively.



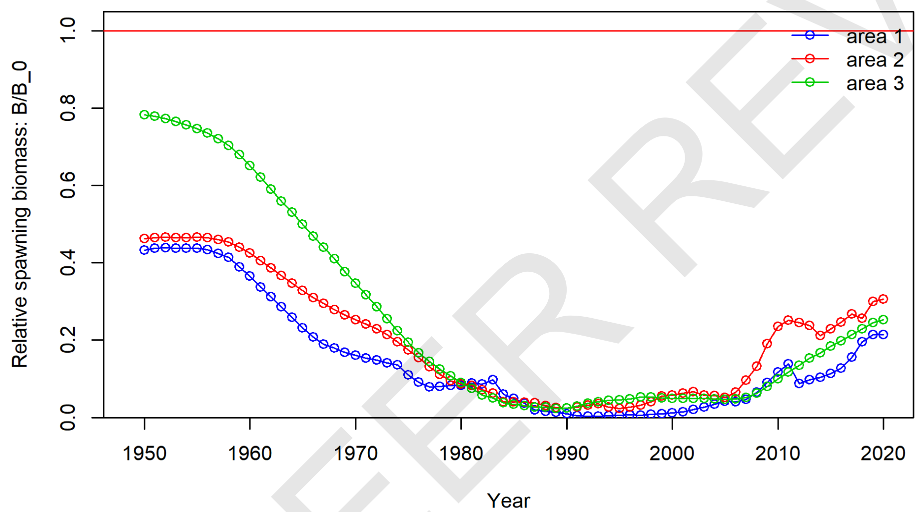


Figure 132. Estimates of fraction of unfished SSB (SSB/SSB$_0$) for Gulf of Mexico Red Snapper and by area with the blue, red and green lines representing the east, central and west area respectively.

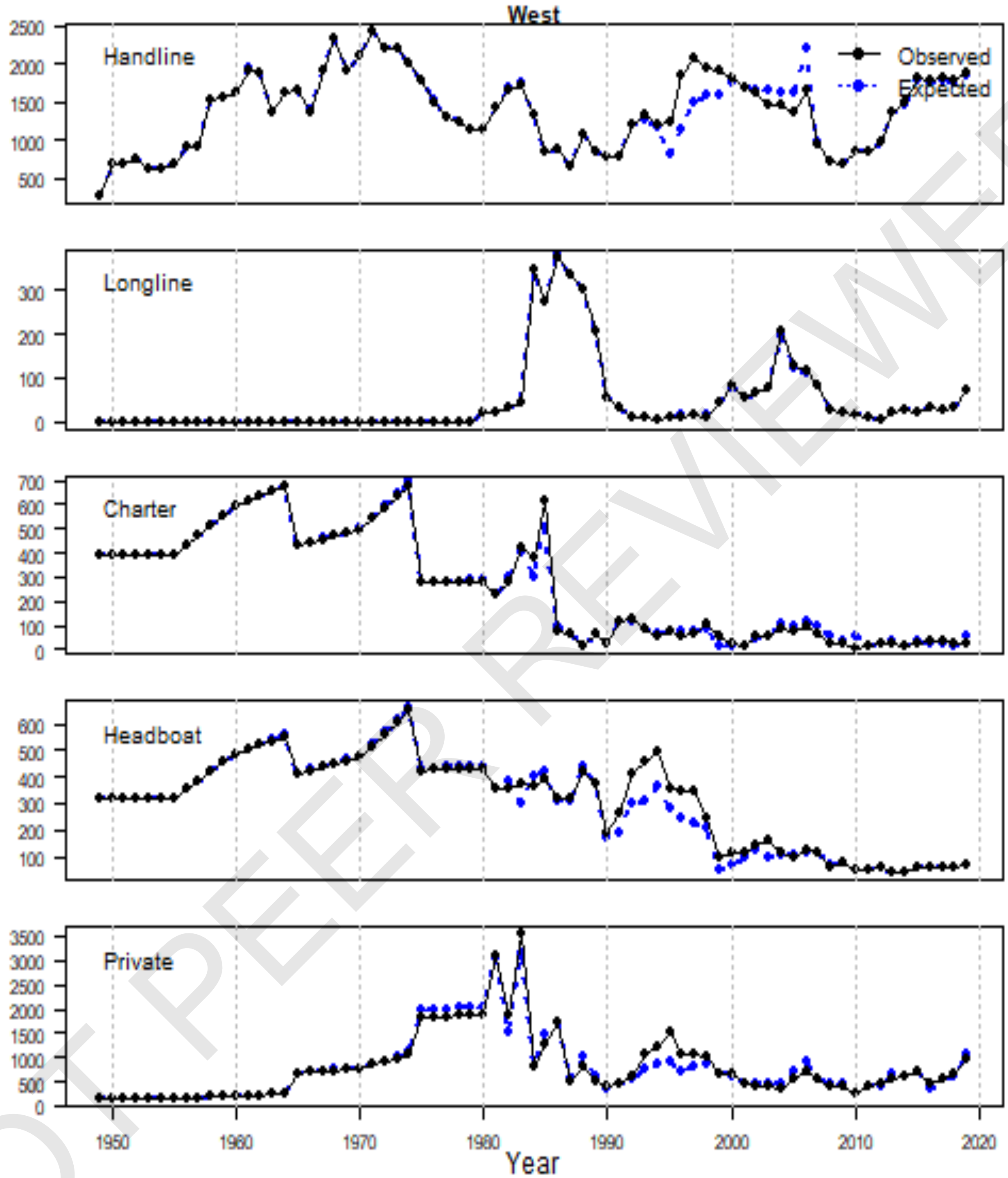


Figure 133. Western Gulf of Mexico Red Snapper observed and expected landings by fleet for SEDAR 74 . Commercial and recreational landings are in metric tons and thousands of fish, respectively. Dashed vertical lines identify ten year intervals.

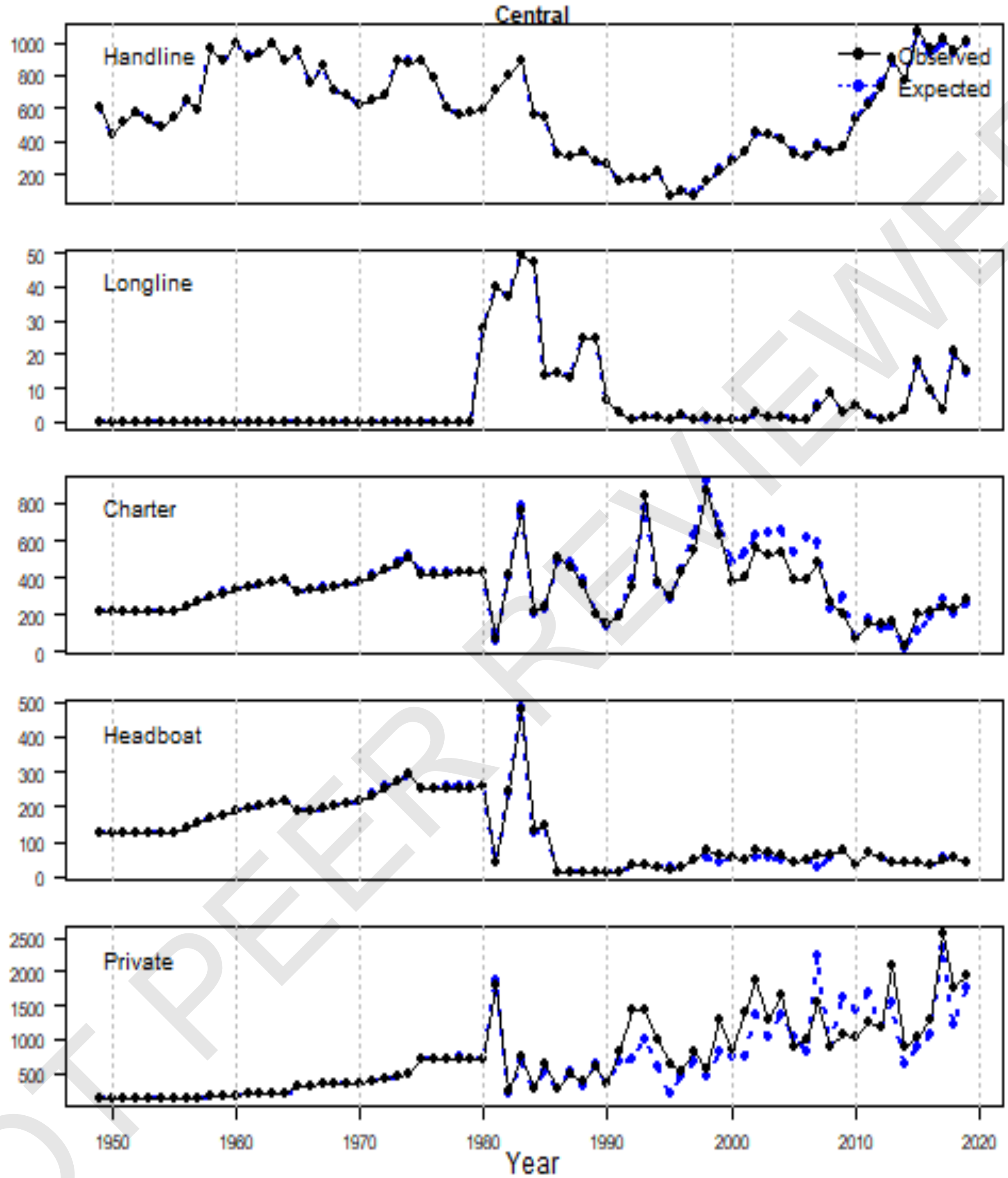


Figure 134. Central Gulf of Mexico Red Snapper observed and expected landings by fleet for SEDAR 74 . Commercial and recreational landings are in metric tons and thousands of fish, respectively. Dashed vertical lines identify ten year intervals.

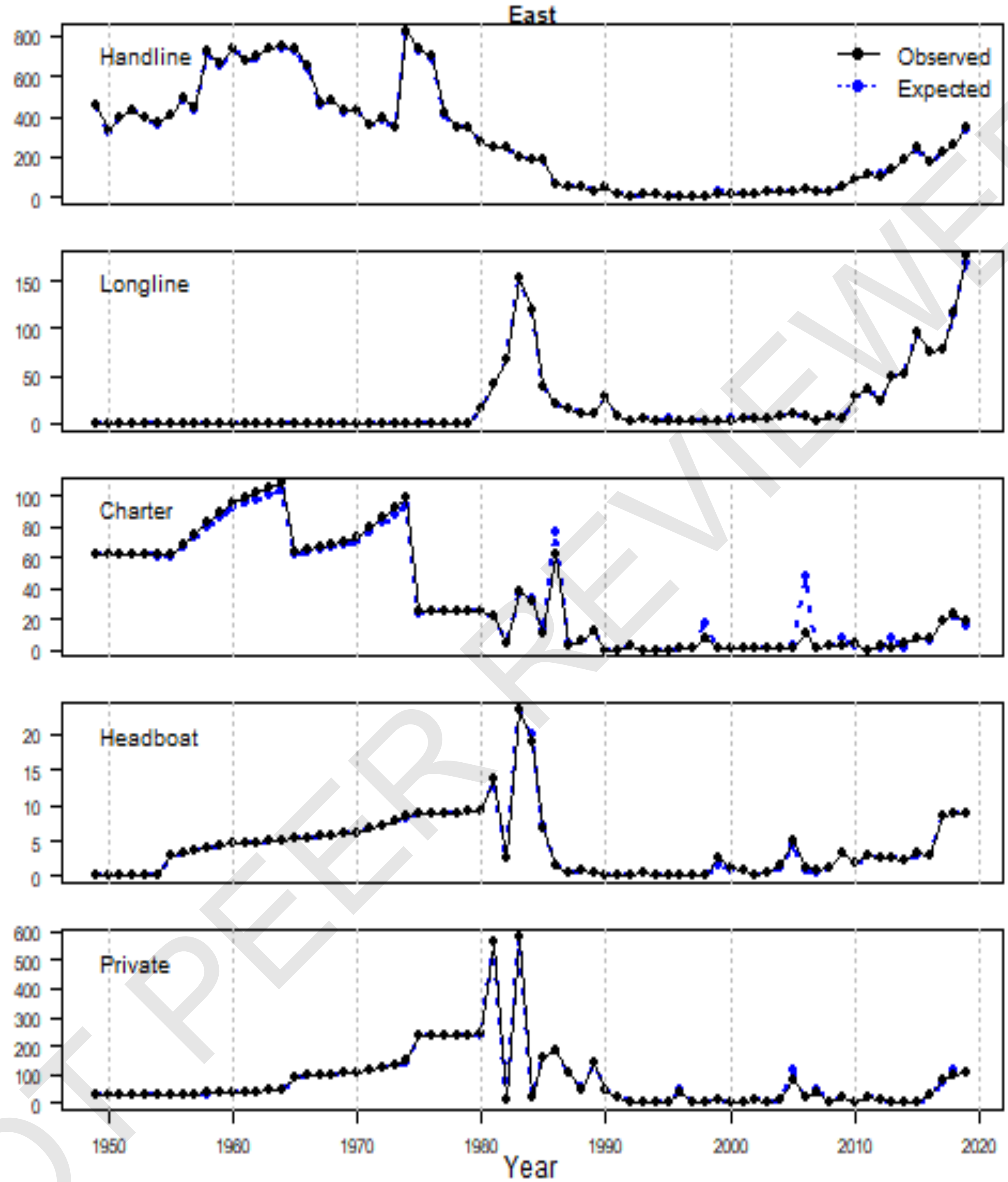


Figure 135. Eastern Gulf of Mexico Red Snapper observed and expected landings by fleet for SEDAR 74 . Commercial and recreational landings are in metric tons and thousands of fish, respectively. Dashed vertical lines identify ten year intervals.

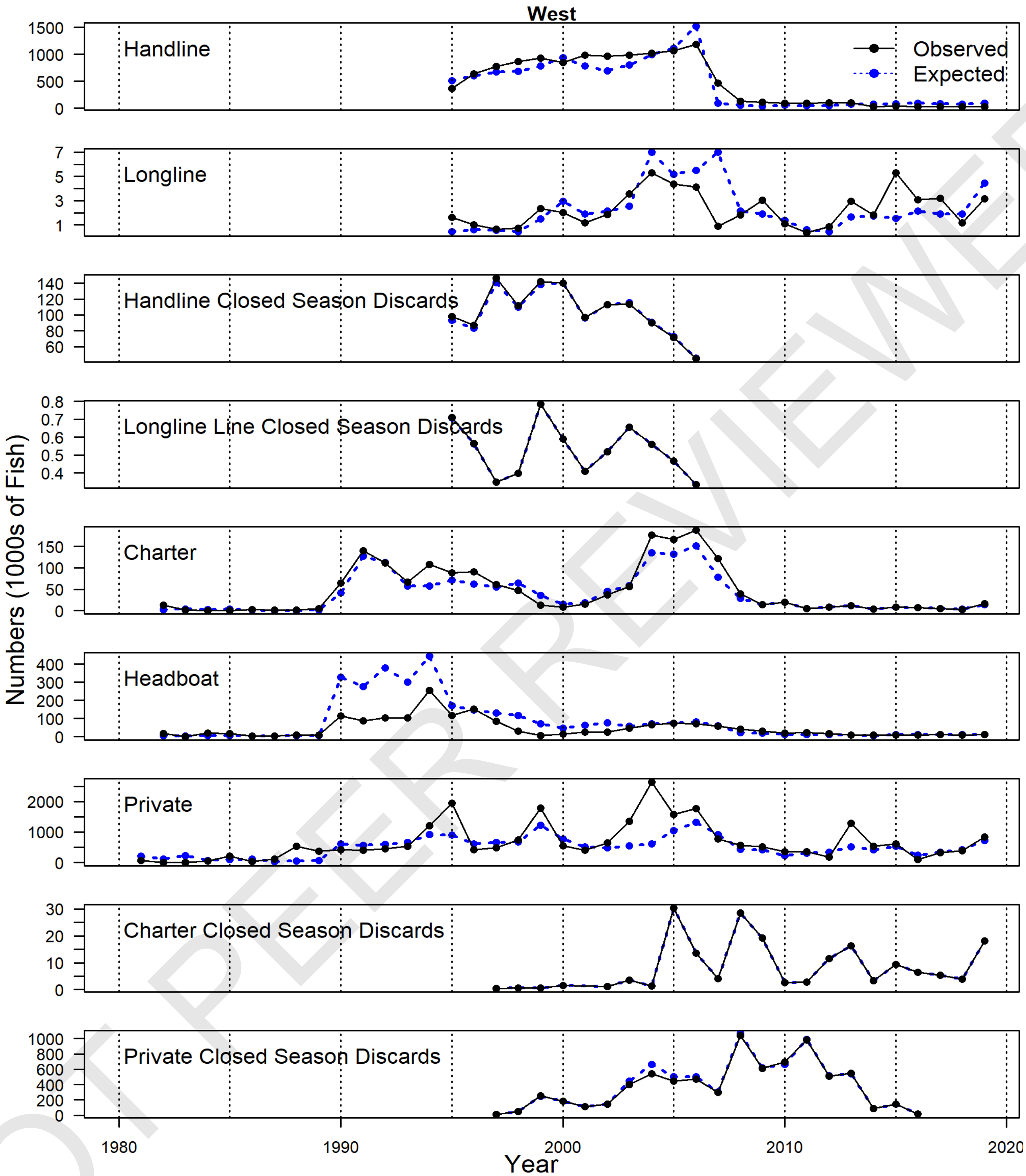


Figure 136. Western Gulf of Mexico Red Snapper observed and expected discards by fleet for SEDAR 74 (left panels). Commercial and recreational discards are in thousands of fish, respectively. Dashed vertical lines identify five year intervals.

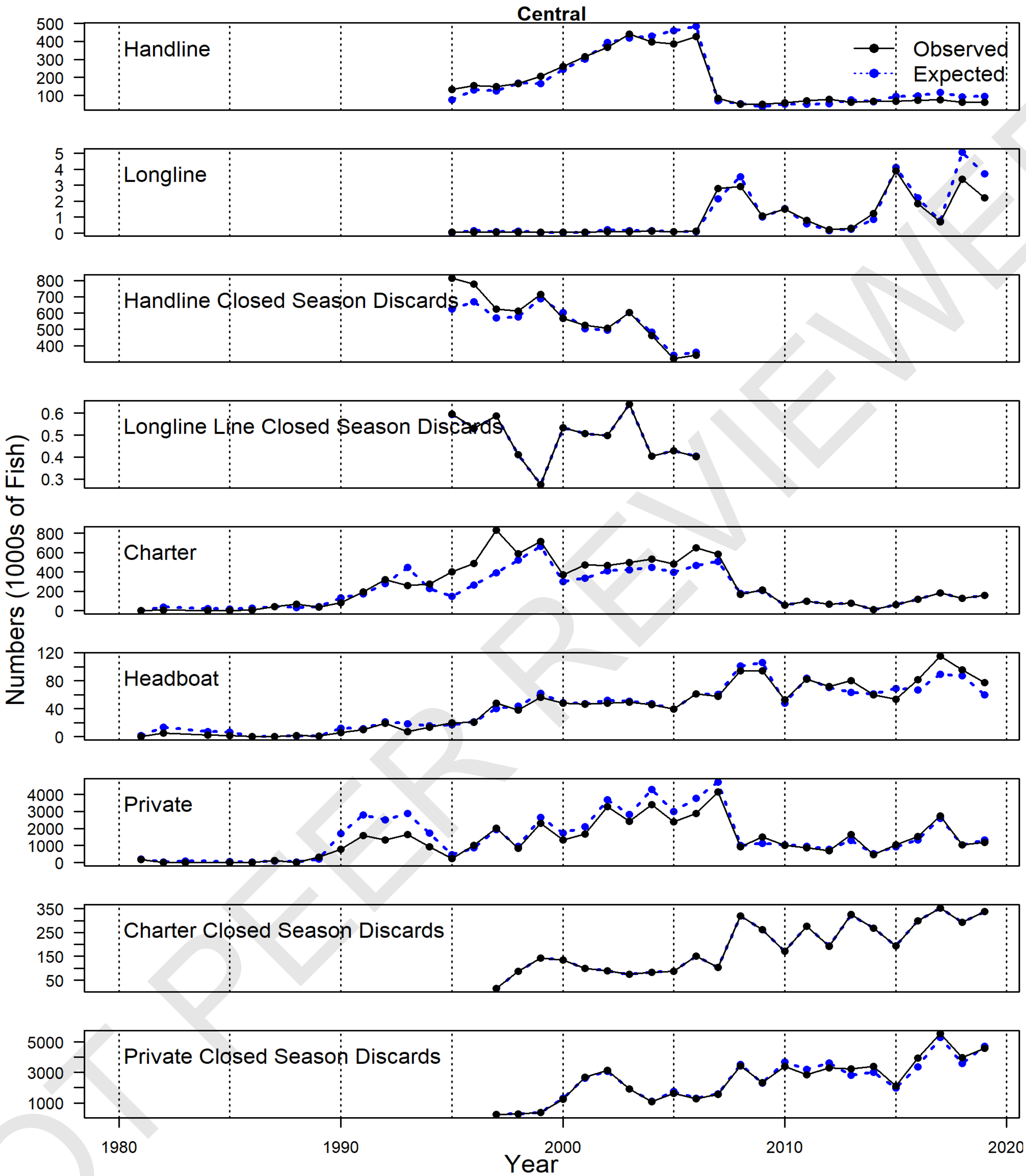


Figure 137. Central Gulf of Mexico Red Snapper observed and expected discards by fleet for SEDAR 74 (left panels). Commercial and recreational discards are in thousands of fish, respectively. Dashed vertical lines identify five year intervals.

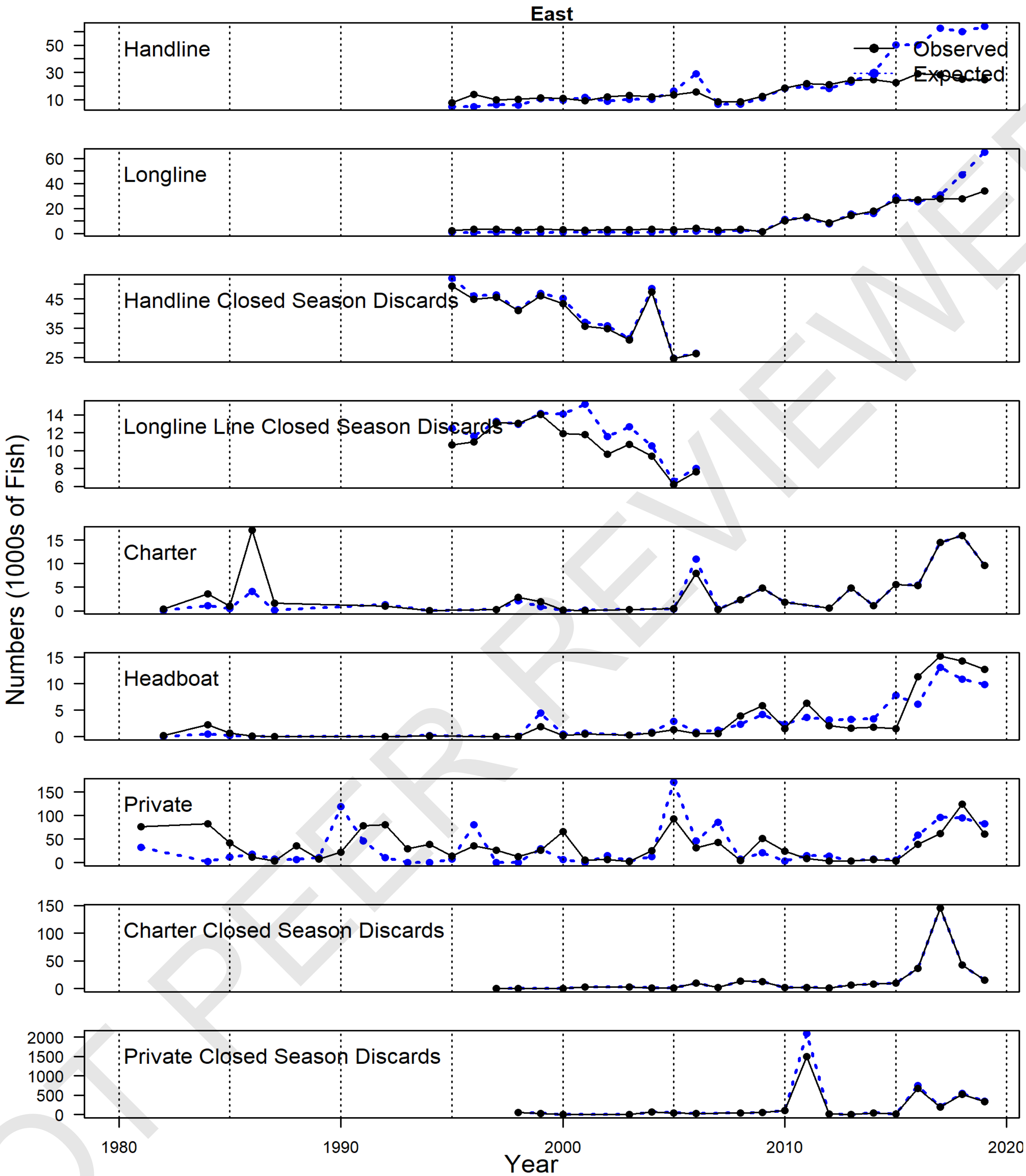


Figure 138. Eastern Gulf of Mexico Red Snapper observed and expected discards by fleet for SEDAR 74 (left panels). Commercial and recreational discards are in of fish, respectively. Dashed vertical lines identify five year intervals.

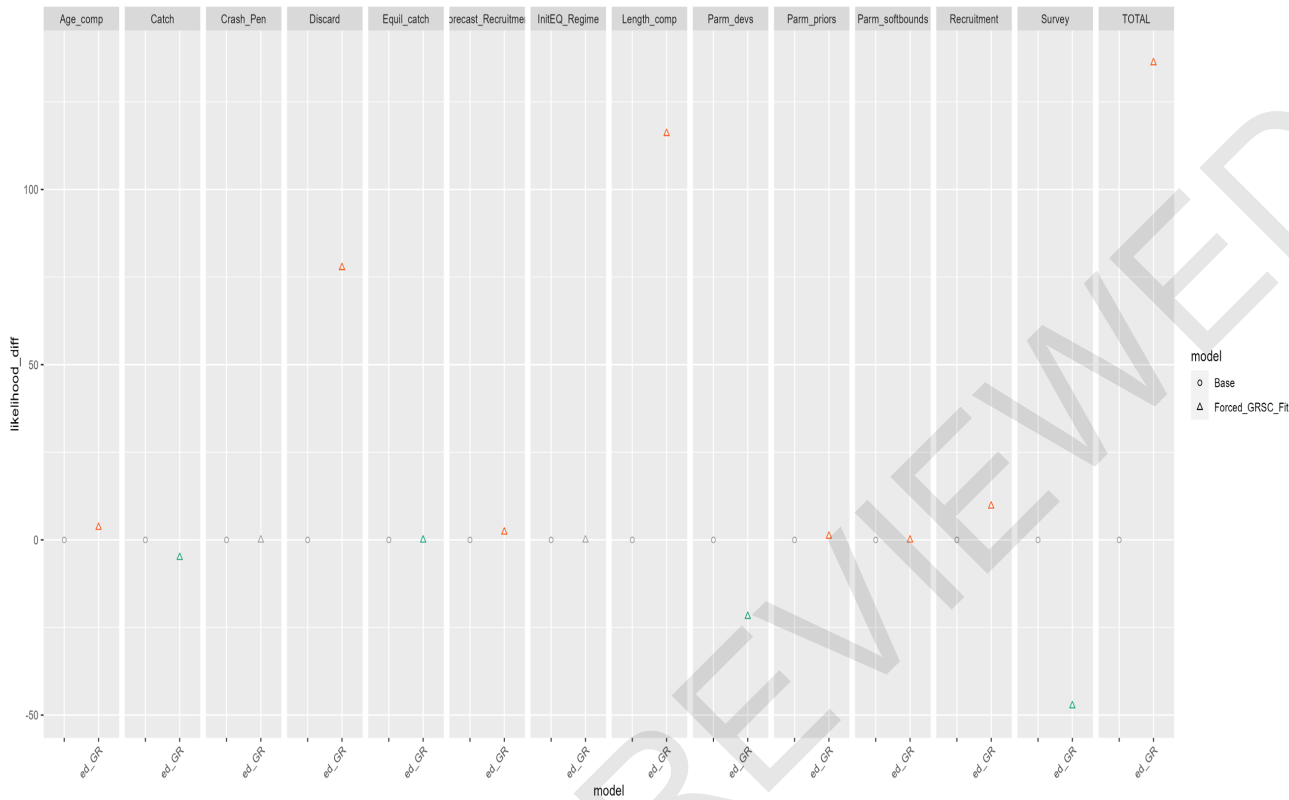
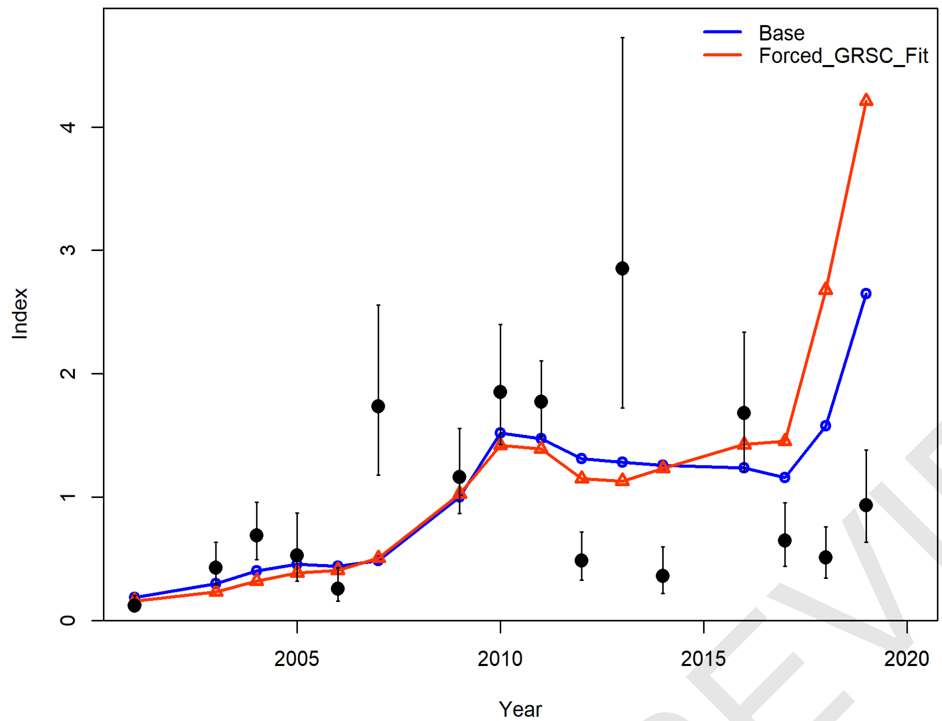


Figure 139. Likelihood component comparison of base model (circles) to a model with the Red Snapper Count data having an increased lambda (i.e., high penalty for model misfitting in the data) (triangles). Red symbols indicate decreased fit to a likelihood component, green symbol indicates and improved fit to a likelihood component.



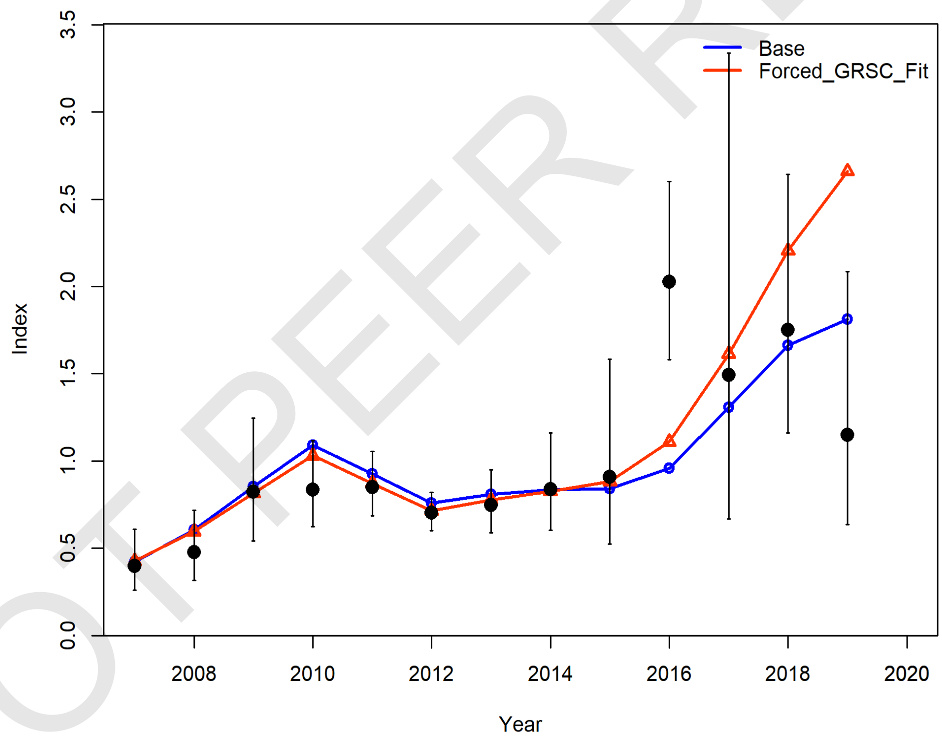


Figure 140. Comparison of fit to specific indices impacted by forced confidence in the GRSC data: Bottom Longline East (top) and Commercial Reed Fish Observer East index (bottom).

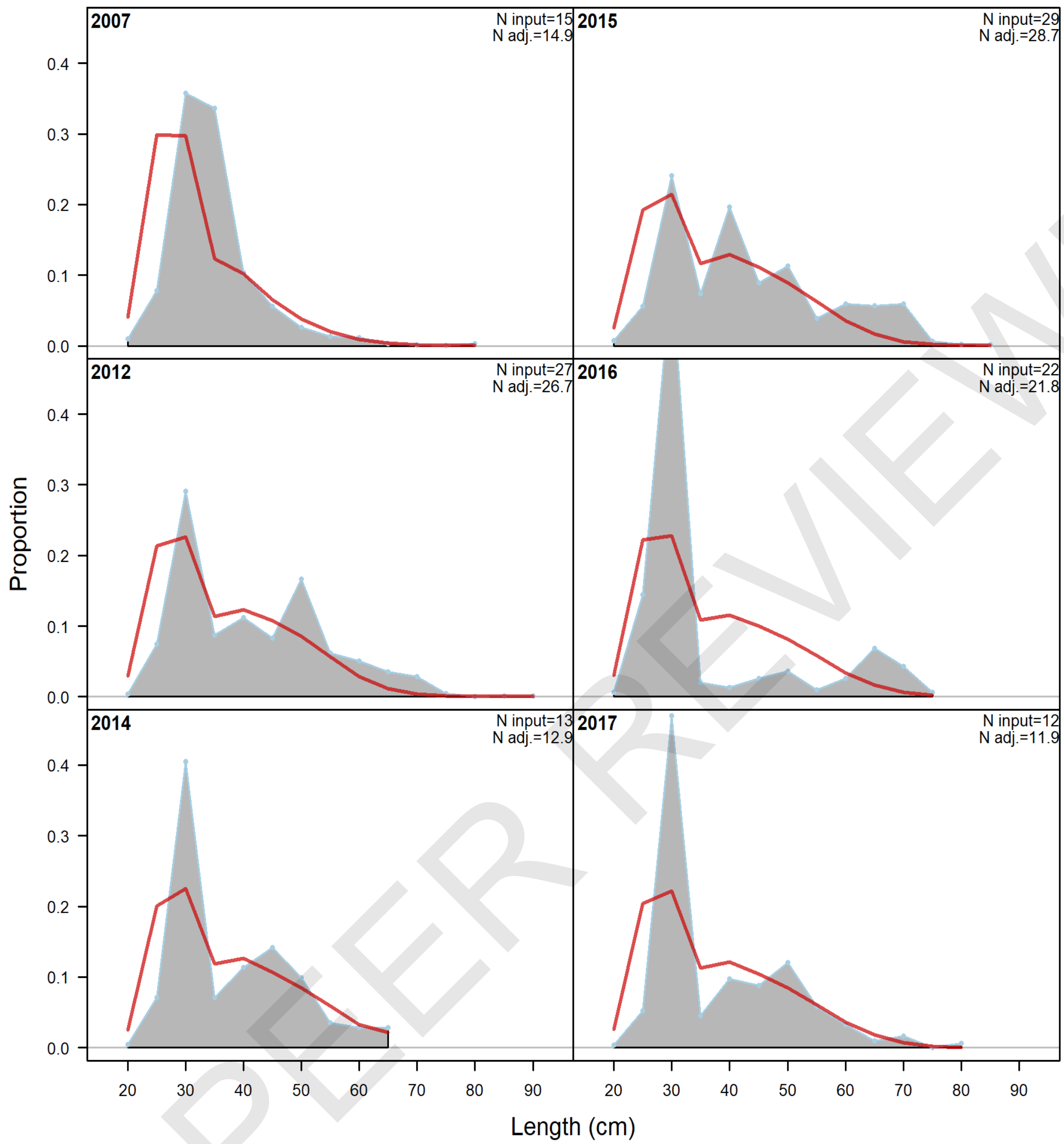


Figure 141. Length compositions, discard, Commercial Handline West. 'N input' is the input sample size. 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial Θ parameter based on the formula N adj. = 1 / (1+Θ) + N Θ / (1+Θ). For this fleet, Θ = 92.844 and the sample size multiplier is approximately Θ / (1+Θ) = 0.989.*

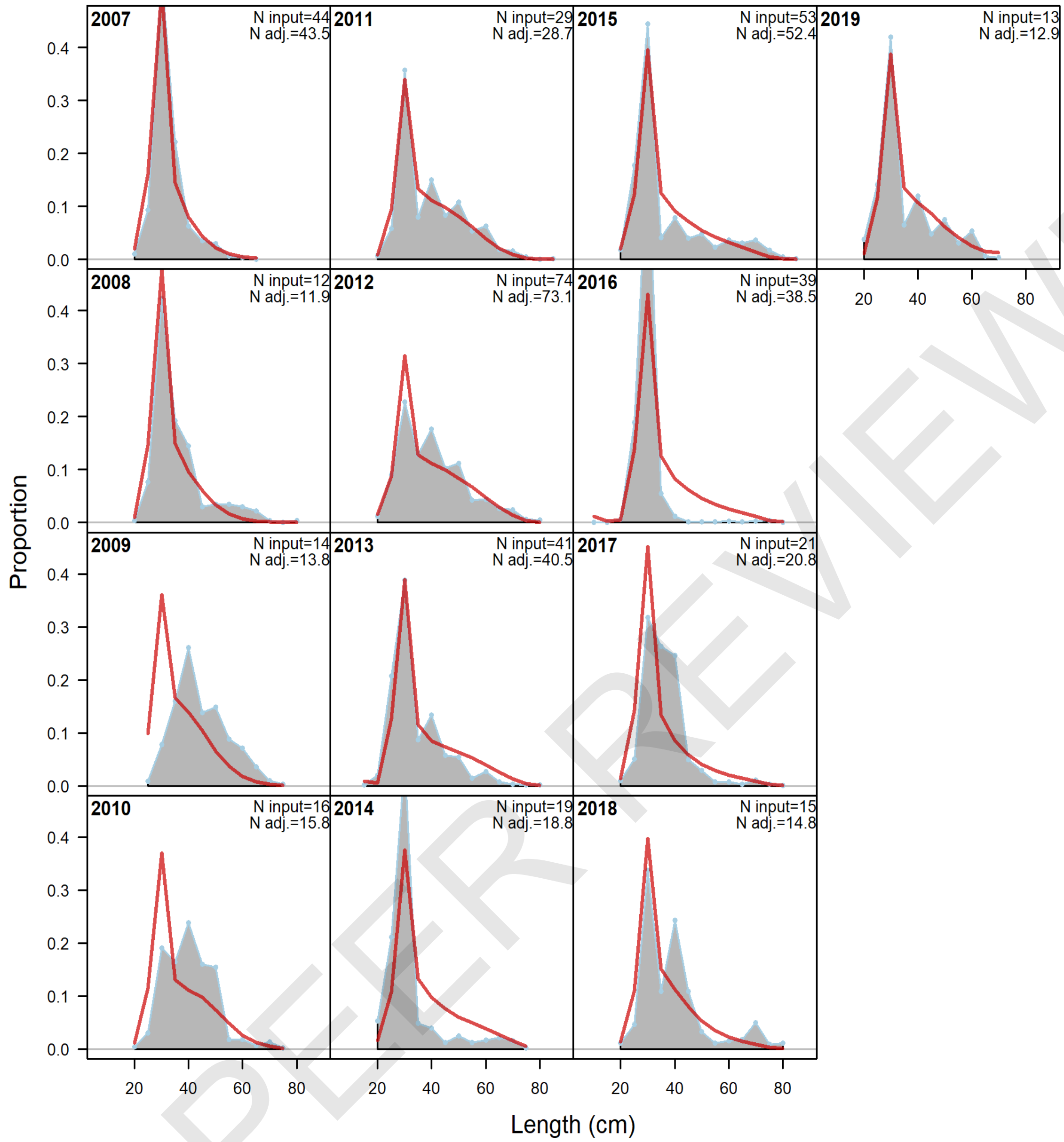


Figure 142. Length compositions, discard, Commercial Handline Central. 'N input' is the input sample size. 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial Θ parameter based on the formula N adj. = 1 / (1+Θ) + N Θ / (1+Θ). For this fleet, Θ = 70.442 and the sample size multiplier is approximately Θ / (1+Θ) = 0.986.*

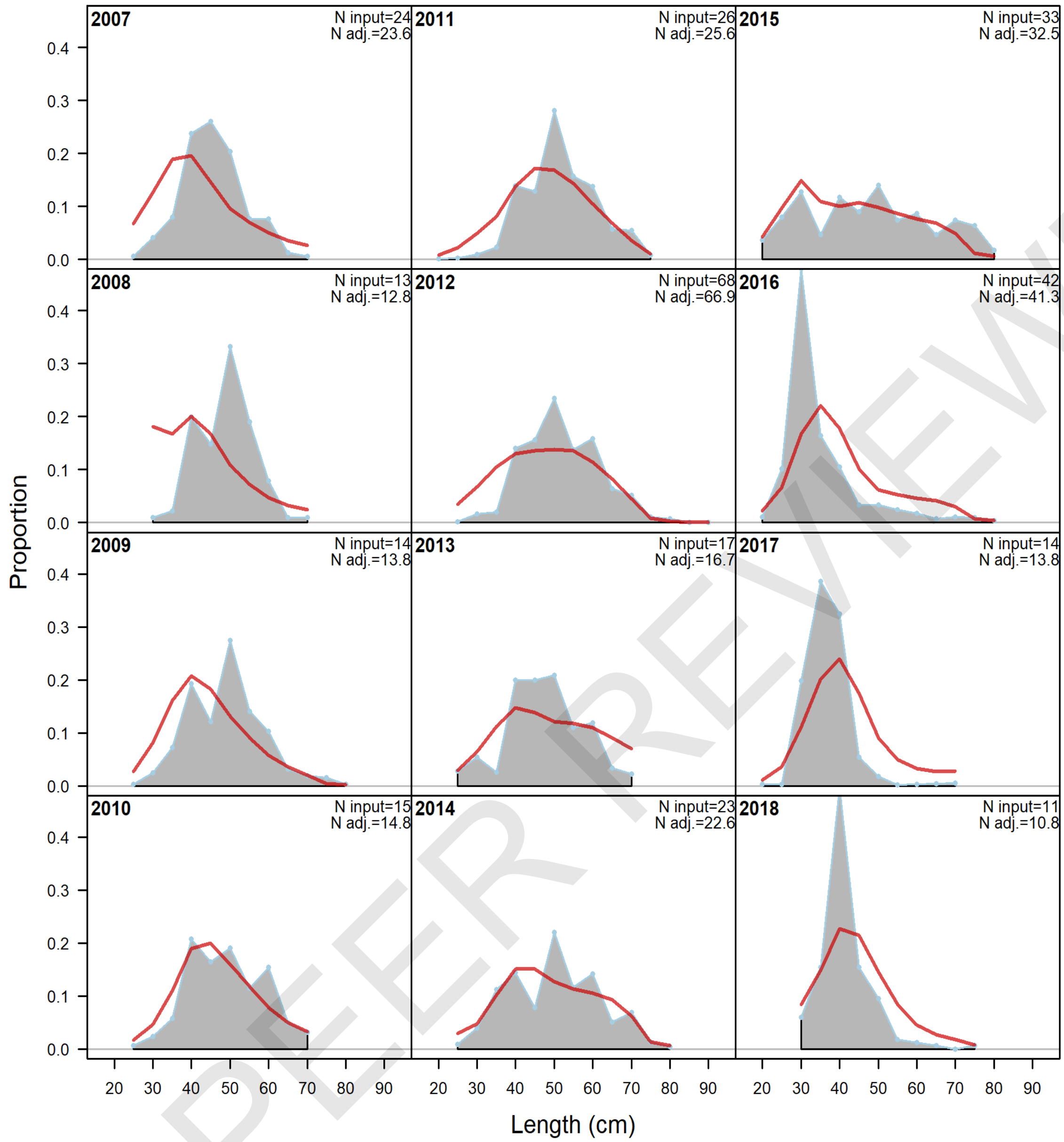


Figure 143. Length compositions, discard, Commercial Handline East. 'N input' is the input sample size. 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial Θ parameter based on the formula N adj. = 1 / (1+Θ) + N Θ / (1+Θ). For this fleet, Θ = 56.942 and the sample size multiplier is approximately Θ / (1+Θ) = 0.983.*

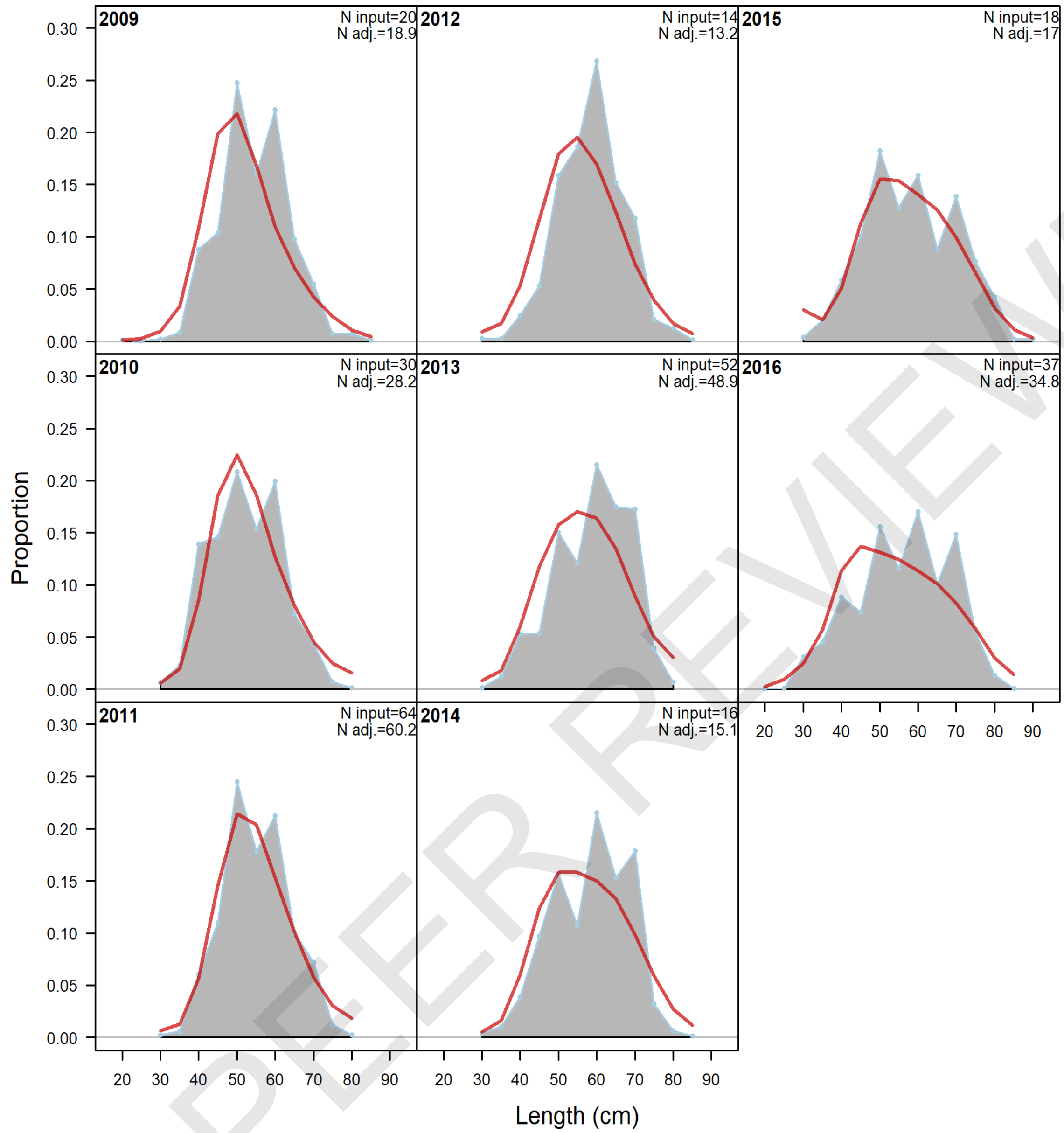


Figure 144. Length compositions, discard, Commercial Longline East. 'N input' is the input sample size. 'N adj.' is the sample size after adjustment by the Dirichlet-Multinomial Θ parameter based on the formula N adj. = 1 / (1+Θ) + N Θ / (1+Θ). For this fleet, Θ = 40.876 and the sample size multiplier is approximately Θ / (1+Θ) = 0.976.*

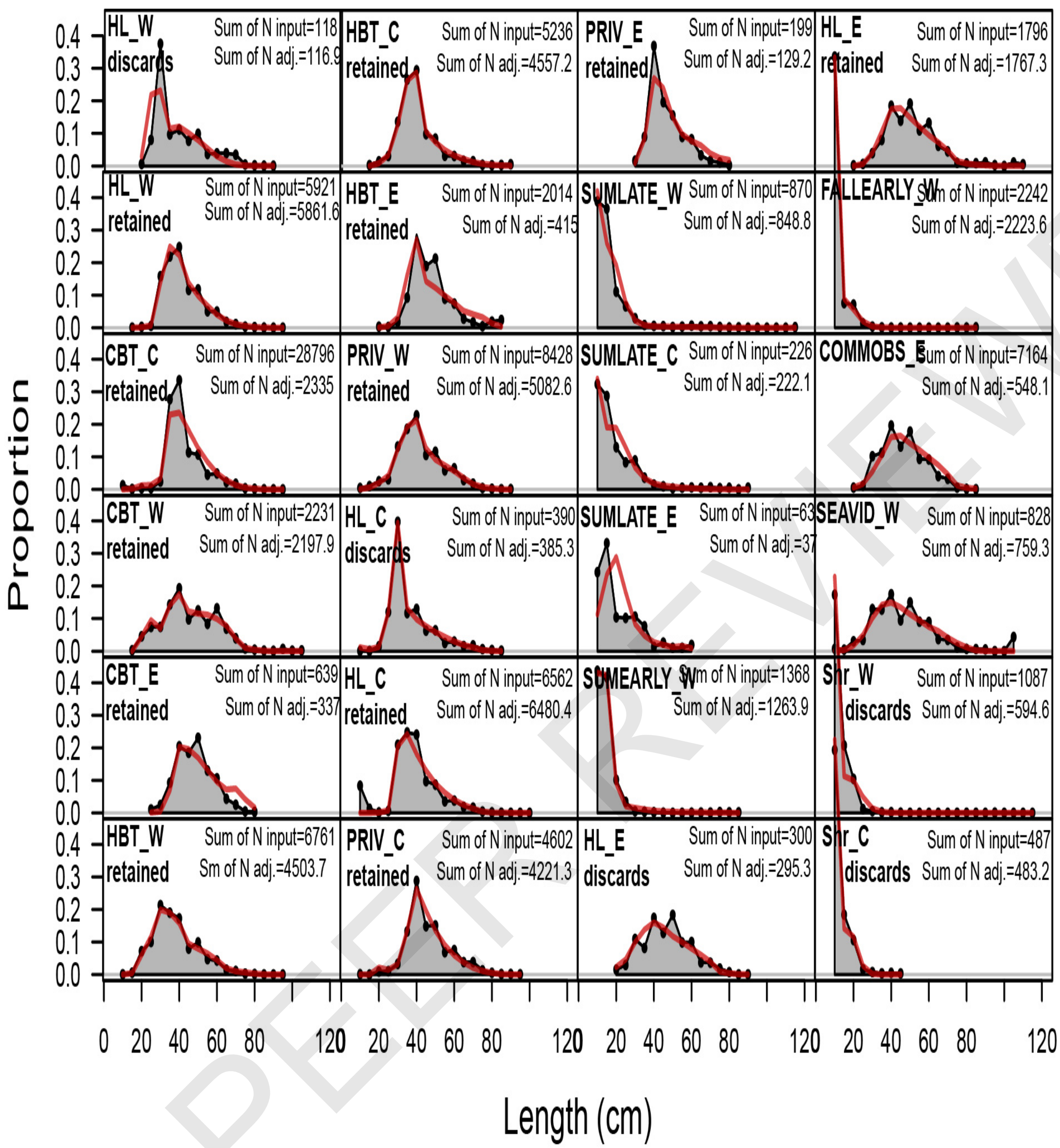


Figure 145. Length compositions, aggregated across time by fleet. Labels 'retained' and 'discard' indicate discarded or retained sampled for each fleet. Panels without this designation represent the whole catch.

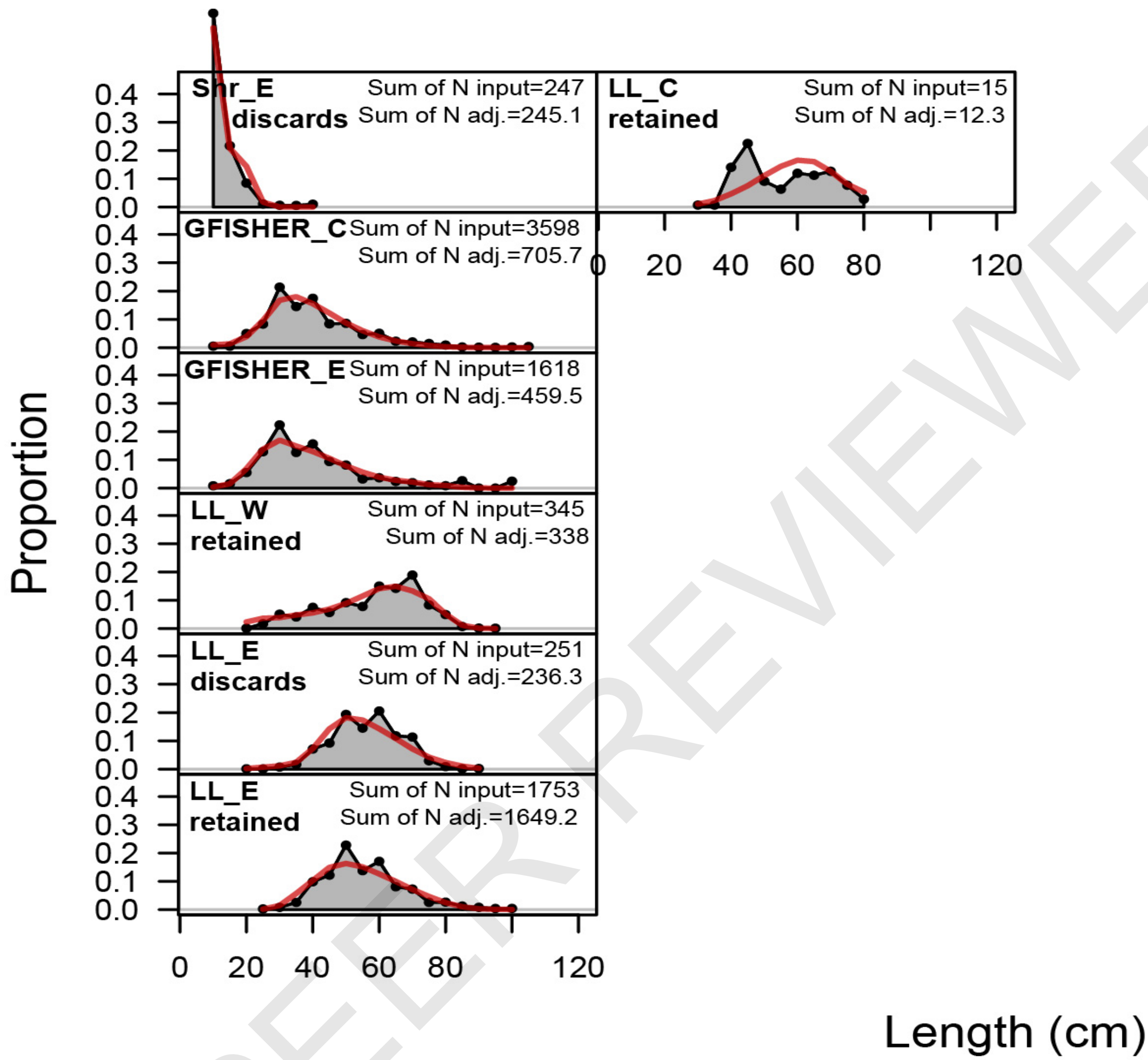


Figure 145 Continued. Length compositions, aggregated across time by fleet (plot 2 of 2).

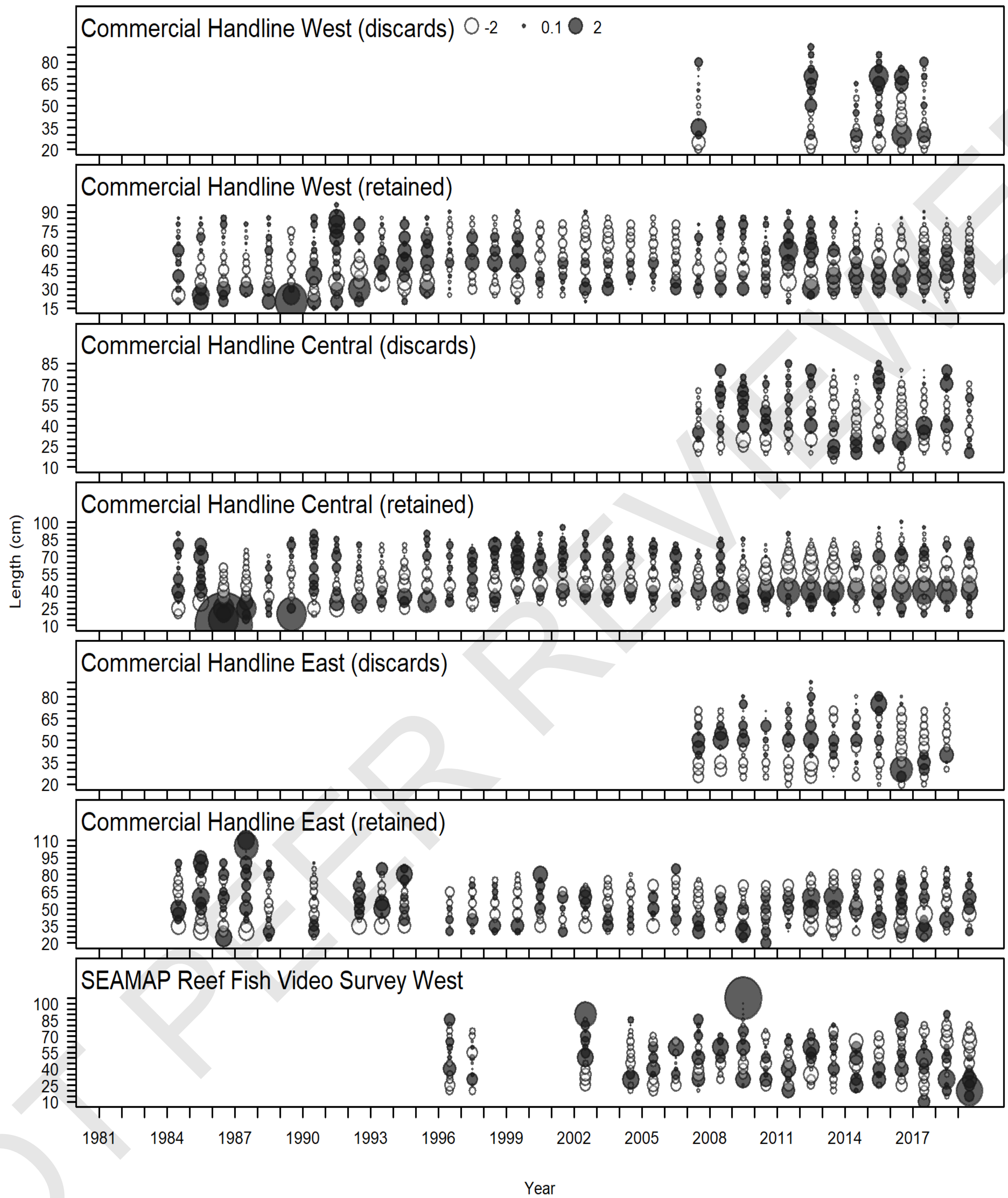


Figure 146. Pearson residuals for discard and retained length composition data by year compared across fleets and surveys for Gulf of Mexico Red Snapper for SEDAR 74. Closed bubbles are positive residuals (observed > expected) and open bubbles are negative residuals (observed < expected).

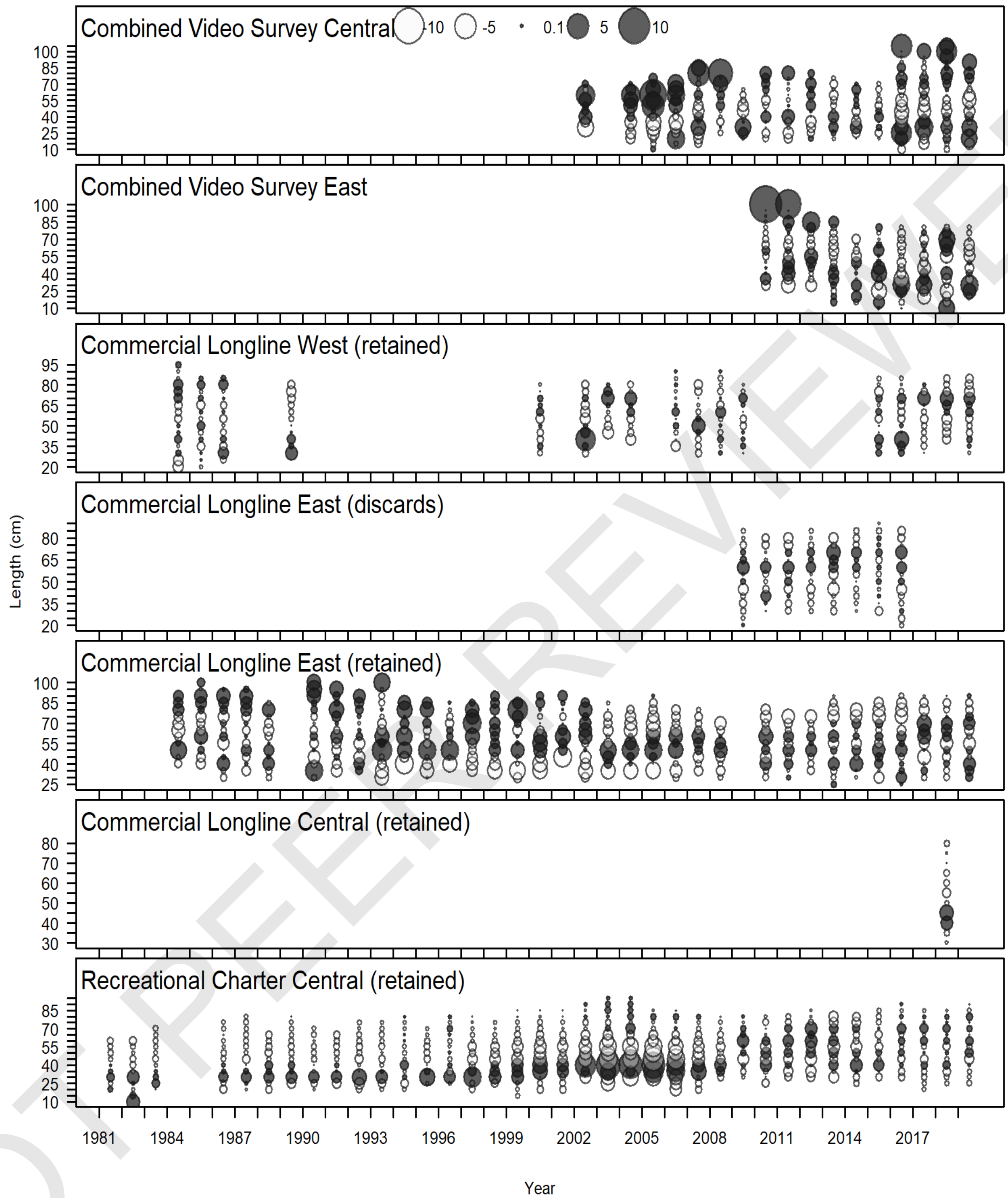


Figure 146 Continued. Pearson residuals for discard and retained length composition data by year compared across fleets and surveys for Gulf of Mexico Red Snapper for SEDAR 74. Closed bubbles are positive residuals (observed > expected) and open bubbles are negative residuals (observed < expected).

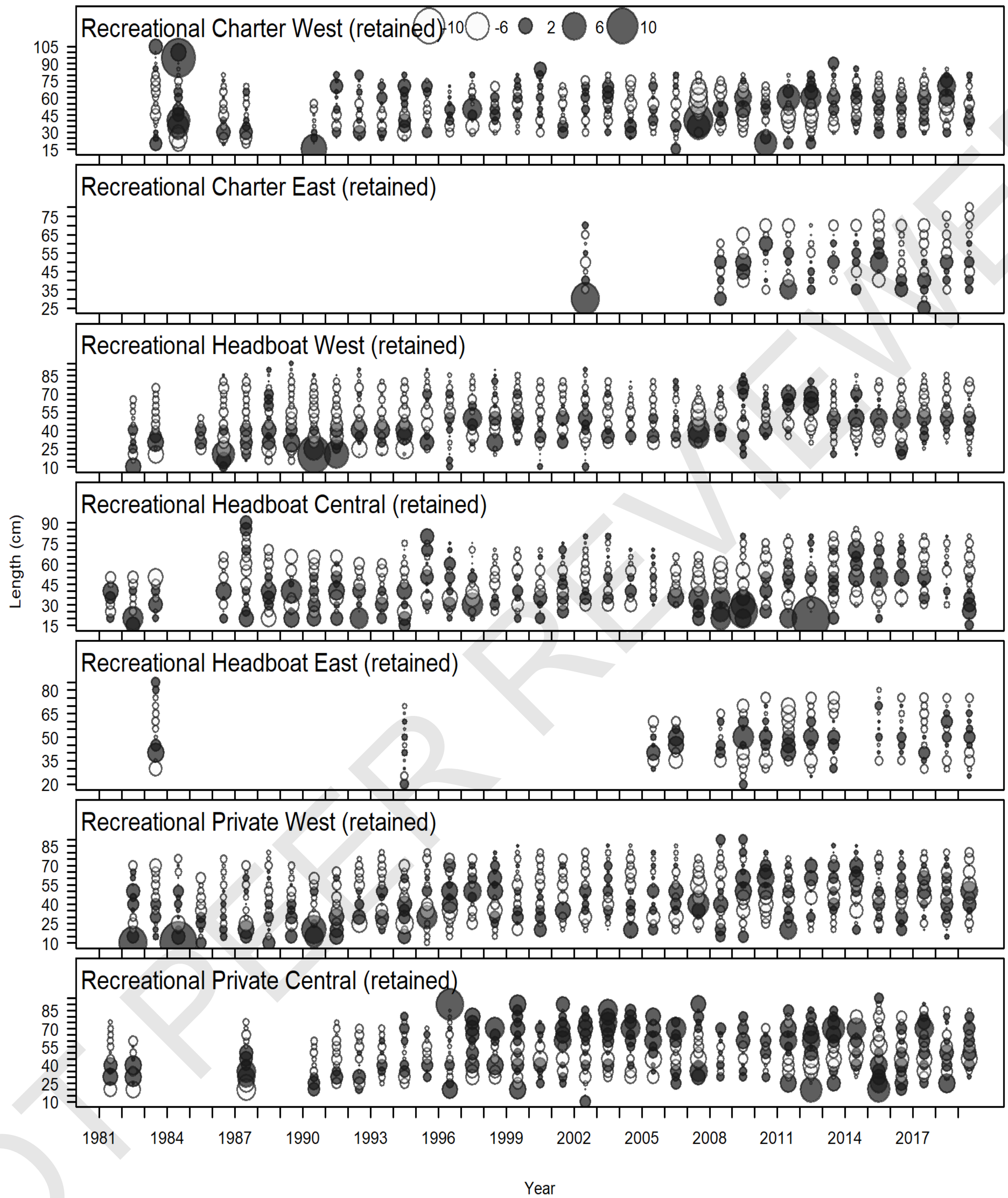


Figure 146 Continued. Pearson residuals for discard and retained length composition data by year compared across fleets and surveys for Gulf of Mexico Red Snapper for SEDAR 74. Closed bubbles are positive residuals (observed > expected) and open bubbles are negative residuals (observed < expected).

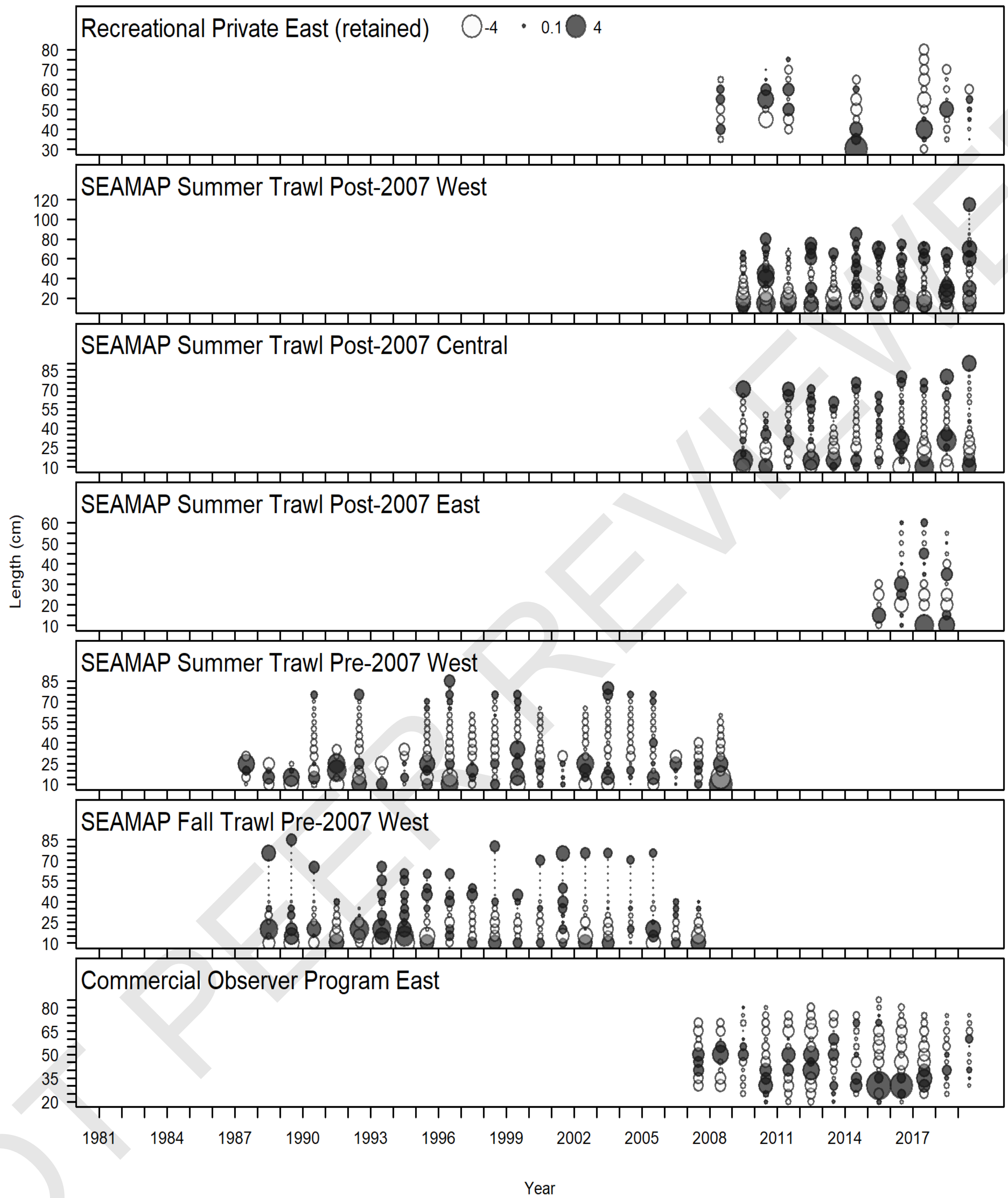


Figure 146 Continued. Pearson residuals for discard and retained length composition data by year compared across fleets and surveys for Gulf of Mexico Red Snapper for SEDAR 74. Closed bubbles are positive residuals (observed > expected) and open bubbles are negative residuals (observed < expected).

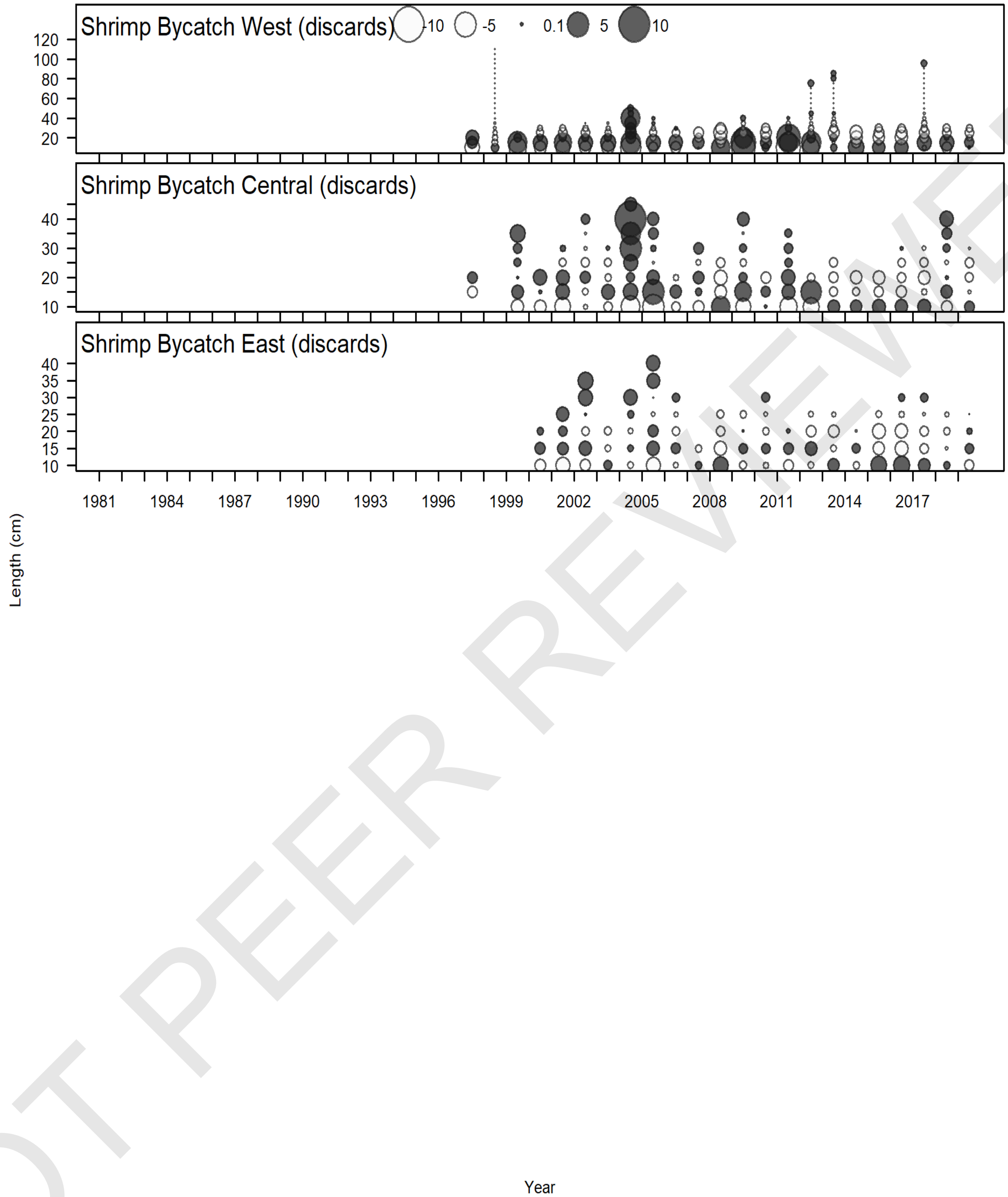


Figure 146 Continued. Pearson residuals for discard and retained length composition data by year compared across fleets and surveys for Gulf of Mexico Red Snapper for SEDAR 74. Closed bubbles are positive residuals (observed > expected) and open bubbles are negative residuals (observed < expected).

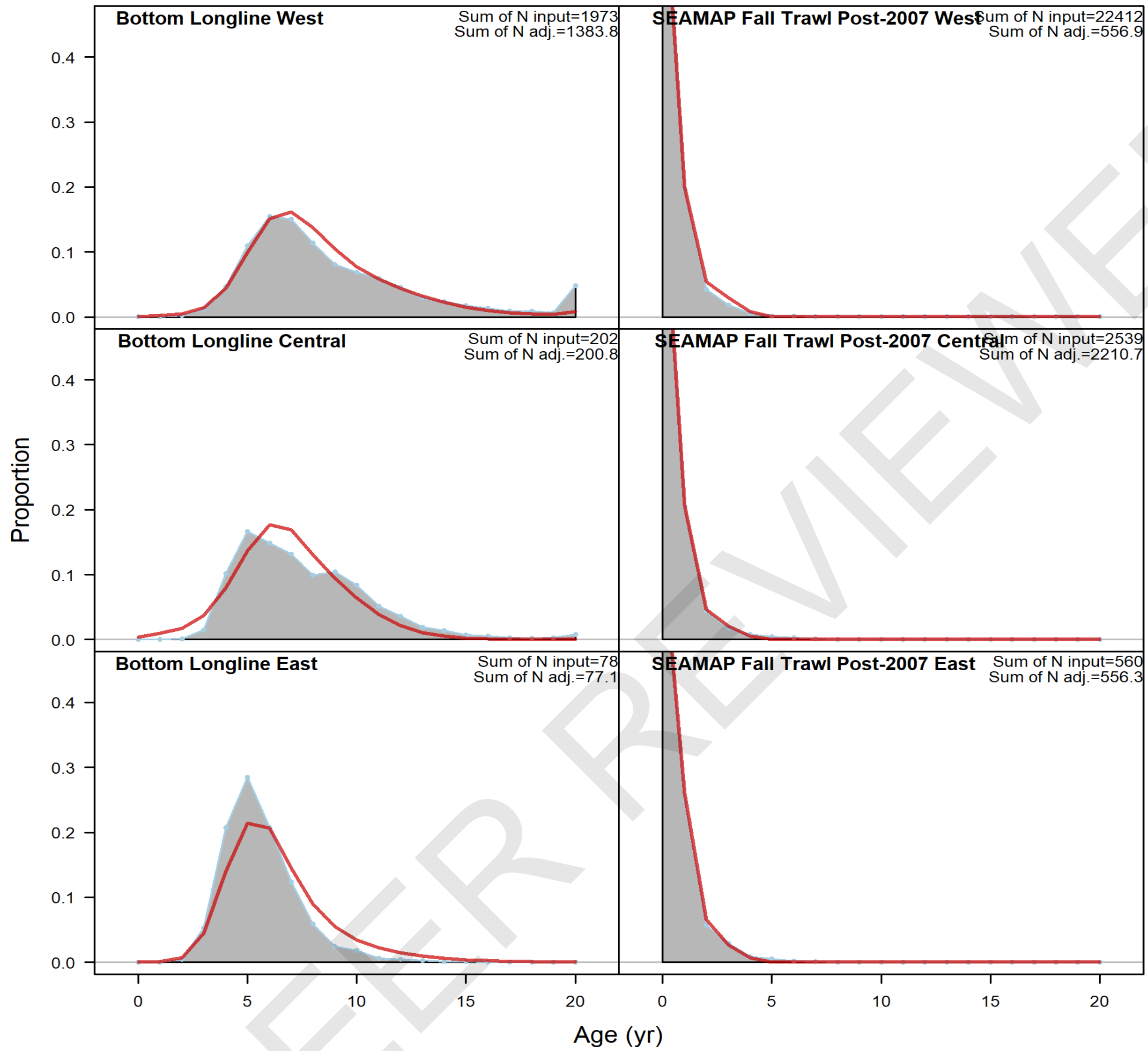


Figure 147. Age compositions, aggregated across time by fleet. Labels 'retained' and 'discard' indicate discarded or retained sampled for each fleet. Panels without this designation represent the whole catch.

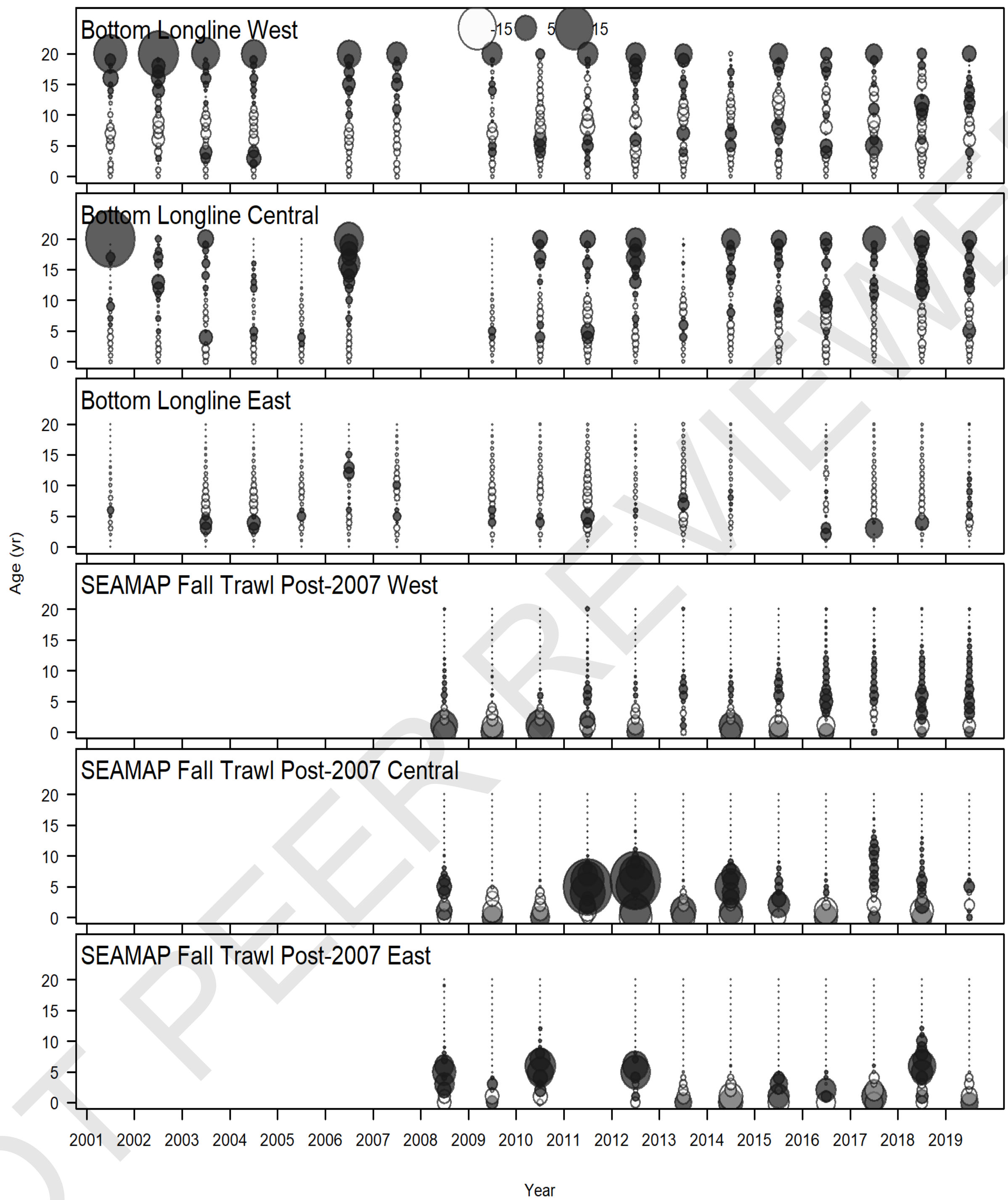


Figure 148. Pearson residuals for discard and retained length composition data by year compared across fleets and surveys for Gulf of Mexico Red Snapper for SEDAR 74. Closed bubbles are positive residuals (observed > expected) and open bubbles are negative residuals (observed < expected).

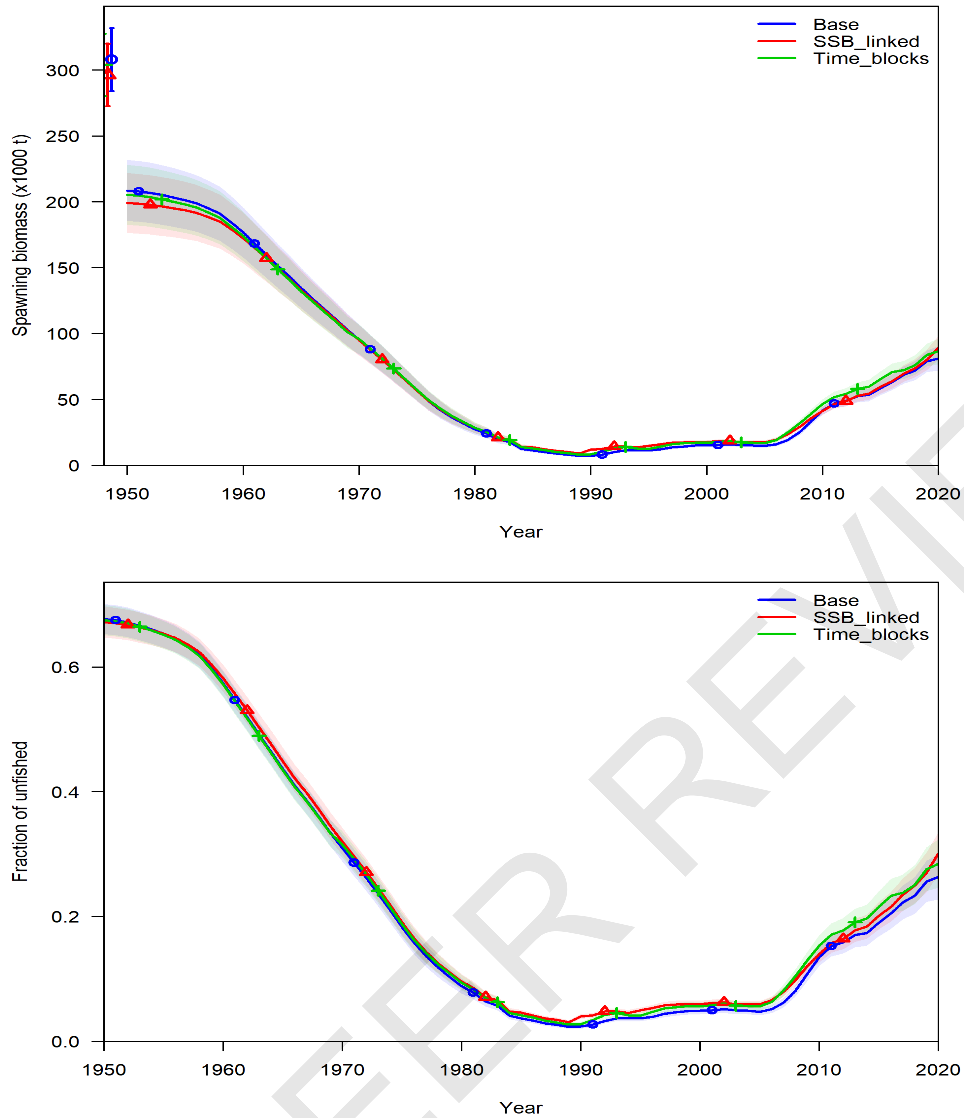
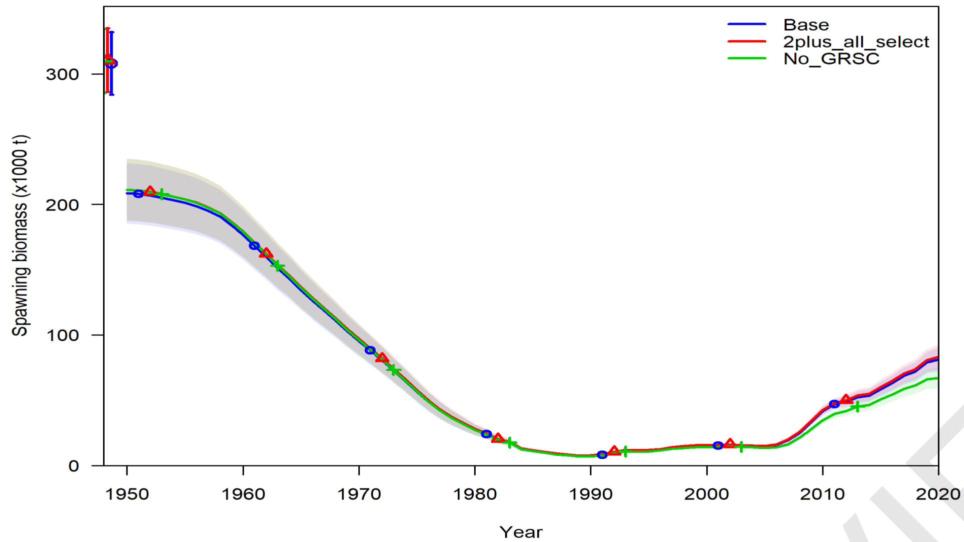


Figure 149. Differences in the time series of SSB and fraction unfished (SSB/SSB_0) between the SEDAR 74 base model and the two Maturity sensitivity runs.



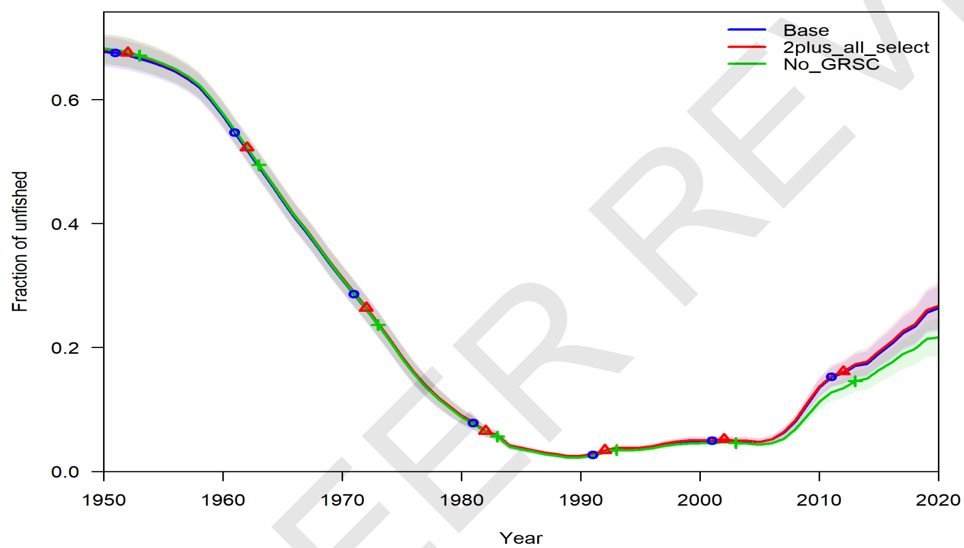


Figure 150. Differences in the time series of SSB and fraction unfished (SSB/SSB$_0$) between the SEDAR 74 base model and the Red Snapper Count sensitivity runs.