# An Update to the FHWAR Method Used to Estimate Historical Recreational Landings
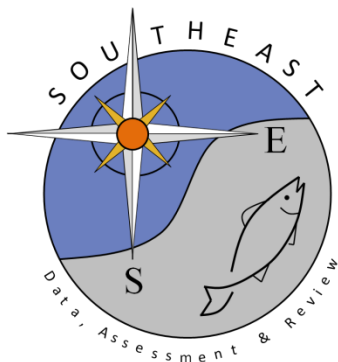
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## SEDAR98-DW-08

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# An Update to the FHWAR Method Used to Estimate Historical Recreational Landings

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## Introduction

During previous SEDAR Data Workshops, considerable time and effort has been devoted to developing methods for back-calculating recreational landings for years prior to the implementation of modern data collection programs. The historic period is defined as pre-1981 for the shore, charter, headboat, and private sectors since 1981 is the first year when the continuous time series for the Marine Recreational Information Program (MRIP) is available. Methods used in past stock assessments to estimate historic recreational landings include applications of: ratios of commercial landings to recreational landings, estimates from the U.S. Fish and Wildlife Saltwater Angling Survey (SWAS), U.S. Census data as a proxy for recreational fishing effort to produce regression estimates of catch, and most recently using data from the FHWAR (National Survey of Fishing, Hunting, and Wildlife-Associated Recreation) survey (SEDAR-PW-07).

During the SEDAR best practices workshop, the FHWAR method was determined to be the best practice for estimating recreational landings for the historic time period (SEDAR-PW-07). Recent updates have been made to improve how FHWAR angler days for the west coast of Florida (FLW) are delineated from the South Atlantic (SA) as well as an update to the recall bias adjustment. This paper documents the methodological improvements made to the FHWAR method as part of the SEDAR 98 Gulf of Mexico (GOM) Red Snapper (*Lutjanus campechanus*) assessment. Because final estimates are not currently available for SEDAR 98, this report summarizes the historical time series generated from the final data from SEDAR 74, including a comparison of historical estimates using the original FHWAR method versus those from the new updated method. Final historical estimates for SEDAR 98 GOM Red Snapper will be calculated once the final recreational landings are available and will be documented in the final SEDAR assessment report.

## National Survey of Fishing, Hunting, and Wildlife-Associated Recreation (FHWAR)

The FHWAR survey interviews U.S. residents about their fishing, hunting, and wildlife-associated (e.g. bird watching) activities. The U.S. Fish and Wildlife Service (USFWS) began conducting the FHWAR Survey in 1955 and it is one of the oldest and most comprehensive recreational surveys available. The survey is conducted every 5 years and gathers information on the number of anglers in the United States and their frequency and time spent fishing (FHWAR 1991). FHWAR provides estimates for the number of saltwater anglers, freshwater anglers, and

saltwater fishing days for the entire U.S. (Tables 1 and 2). Angler estimates are also broken down into nine regions (Figure 1), however, only estimates for total anglers (i.e. saltwater and freshwater combined) are available for these smaller regions.

## FHWAR Method

To estimate the number of saltwater anglers in each region, the ratio of U.S. saltwater anglers to total U.S. anglers is applied to the region-wide estimates of total number of anglers. For SEDAR 98 GOM Red Snapper, the East South Central (ESC) and West South Central (WSC) regions are included to provide estimates for the total number of saltwater anglers from TX-AL. The total number of saltwater anglers in ESC and WSC is then divided by the total number of U.S. saltwater anglers to obtain the proportion of saltwater anglers in ESC and WSC. This proportion is then multiplied by the total number of U.S. saltwater days to estimate the number of saltwater days in ESC and WSC, which are used as our effort estimates for TX-AL during the historical period.

Effort for Florida (FL) must be calculated separately because in the FHWAR survey FL is included in the South Atlantic (SA) region (Figure 1). The above process is repeated for the SA region to estimate the number of saltwater days the entire SA region. For GOM Red Snapper, only saltwater days in west FL (FLW) are needed. The first improvement made to the FHWAR method is how FLW saltwater days are delineated from the rest of the SA. In previous assessments, combined effort data from the Marine Recreational Information Program (MRIP) and Southeast Region Headboat Survey (SRHS) was used to calculate the mean ratio of FLW angler trips to the total number of angler trips in the SA. This ratio was then used to apportion the number of FLW saltwater angler days from the SA region. Previously, when calculating this ratio for FLW, only MRIP and SRHS effort from North Carolina (NC), South Carolina (SC), Georgia (GA) and FL were included. However, Delaware (DE), Maryland (MD), and Virginia (VA) are also included in the FHWAR survey's definition of the SA region, and so effort from these SA states were not being properly accounted for when calculating the ratio of FLW to the rest of the SA. Note, this is not an issue for the SRHS data because NC is its northernmost boundary. The updated method ensures the spatial domains of the SA region match between the MRIP, SRHS, and FHWAR surveys, with MRIP effort estimates from DE, MD, and VA now included when calculating the FLW proportion. Once FLW saltwater angler days has been estimated, it is combined with the saltwater angler days from TX-AL for the total number of saltwater days in the GOM.

From 1955-1985, the FHWAR survey was based on a 12-month recall period for respondents. As part of the 1991 FHWAR survey, a study was conducted comparing estimates using the 12-month recall period versus a 4-month recall period. The recall study found the estimates for annual saltwater fishing days were on average 46% higher than estimates produced from the 4-month recall period (FHWAR 1991). In previous assessments, recall bias was adjusted by calculating the ratio of MRIP, SRHS, and TPWD 1985 effort to FHWAR 1985 saltwater days and multiplying this ratio by the FHWAR saltwater angler days for each survey year (e.g. 1955, 1960) to produce adjusted effort. This adjustment seems more like a calibration between modern survey units (e.g. MRIP, SRHS, and TPWD) to FHWAR. In the updated FHWAR method, recall bias is now accounted for by reducing saltwater angler days by 46%, since that is the average estimate for recall bias between the 12-month and 4-month surveys. After effort is adjusted for recall bias, then the ratio of MRIP, SRHS, and TPWD 1985 effort to adjusted FHWAR 1985

saltwater days is applied to adjusted saltwater days to calibrate FHWAR units to modern survey units.

Mean CPUE from MRIP, SRHS, and TPWD (e.g., from 1981-1989) is then applied to the calibrated FHWAR saltwater days to estimate historical landings (Table 3). This year range was selected for calculation of mean CPUE in SEDAR 74 (SEDAR74 DW). Linear interpolation is used to impute historical estimates of landings for the years between FHWAR surveys.

## Historical Landings Estimates

To evaluate the effect of these methodological improvements on the resultant time series, historical recreational landings were estimated by applying the original and updated FHWAR methods to data provided for the SEDAR 74 GOM Red Snapper assessment (Table 4, Figure 2). The improvements to the FHWAR method produced comparable estimates, which were ≤ 1% higher than the original method.

In SEDAR 74, the single (GOM-wide) time series for historical recreational landings was delineated into nine separate time series to represent each fleet and stock-ID region (West, Central, and East; SEDAR74 DW). The recreational data workshop (DW) members assumed the proportions of landings from each stock region from 1981-1989 extended back to the beginning of the historic time series. The DW members then split the separate regional time series into three time periods to reflect changes in technology that would influence the prevalence of each fleet. From 1955-1964, Loran A had very limited availability for commercial and for-hire vessels and was rarely used by private anglers. From 1965-1974, Loran A was more widely used by commercial and for-hire vessels and also Loran C was developed. From 1975-1980, Loran C has become more prevalent and affordable for private anglers, which increases private angler effort offshore. For the 1975-1980 time period, the DW members used the proportion of landings of each fleet from 1981-1989 to delineate the landings among the fleets. For the two earlier time periods, adjustments were made to these ratios to down-weight private angler effort (SEDAR 74 DW). This down-weighting resulted in the proportions used to apportion the fleets not summing to 1 past the second decimal place (Table 5) and additional landings being estimated for these earlier time periods (Table 6). While these differences are minimal (< 1%), it is still recommended to reevaluate these proportions prior to submitting historic recreational landings for SEDAR 98, so the proportions will sum to 1 and additional landings are not estimated for these earlier time blocks.

## Works Cited

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# Tables

Table 1: Numbers (in thousands) of sportsman, anglers, and hunters in the United States and by FHWAR Survey region from 1955-1985. Table copied from FHWAR 1991.

(U.S. population 12 years old and older. Numbers in thousands)

| Year | Population | | Sportsmen (fished or hunted) | | Anglers | | Hunters | |
|---|---|---|---|---|---|---|---|---|
| | Number | Percent | Number | Percent | Number | Percent | Number | Percent |
| **Total, United States** | | | | | | | | |
| 1955 | 118,366 | 100 | 24,917 | 21.1 | 20,813 | 17.6 | 11,784 | 10.0 |
| 1960 | 131,226 | 100 | 30,435 | 23.2 | 25,323 | 19.3 | 14,637 | 11.2 |
| 1965 | 141,928 | 100 | 32,881 | 23.2 | 28,348 | 20.0 | 13,585 | 9.6 |
| 1970 | 155,230 | 100 | 36,277 | 23.4 | 33,158 | 21.4 | 14,336 | 9.2 |
| 1975 | 171,860 | 100 | 45,773 | 26.6 | 41,299 | 24.0 | 17,094 | 9.9 |
| 1980 | 184,691 | 100 | 46,966 | 25.4 | 41,873 | 22.7 | 16,758 | 9.1 |
| 1985 | 195,659 | 100 | 49,827 | 25.5 | 45,345 | 23.2 | 16,340 | 8.4 |
| **New England** | | | | | | | | |
| 1955 | 7,919 | 100 | 1,224 | 15.4 | 1,002 | 12.7 | 589 | 7.4 |
| 1960 | 8,349 | 100 | 1,368 | 16.4 | 1,205 | 14.4 | 517 | 6.2 |
| 1965 | 9,256 | 100 | 1,650 | 17.8 | 1,488 | 16.0 | 583 | 6.3 |
| 1970 | 8,652 | 100 | 1,579 | 18.3 | 1,430 | 16.5 | 582 | 6.7 |
| 1975 | 9,910 | 100 | 2,004 | 20.2 | 1,861 | 18.8 | 566 | 5.7 |
| 1980 | 10,205 | 100 | 1,974 | 19.3 | 1,788 | 17.5 | 572 | 5.6 |
| 1985 | 10,554 | 100 | 2,058 | 19.5 | 1,914 | 18.1 | 552 | 5.2 |
| **Middle Atlantic** | | | | | | | | |
| 1955 | 24,869 | 100 | 3,539 | 14.2 | 2,811 | 11.3 | 1,608 | 6.5 |
| 1960 | 26,493 | 100 | 3,432 | 13.0 | 2,569 | 9.7 | 1,723 | 6.5 |
| 1965 | 27,346 | 100 | 3,602 | 13.2 | 2,760 | 10.1 | 1,631 | 6.0 |
| 1970 | 28,244 | 100 | 4,539 | 16.1 | 4,504 | 14.4 | 1,731 | 6.1 |
| 1975 | 30,449 | 100 | 5,919 | 19.4 | 5,097 | 16.7 | 2,096 | 6.9 |
| 1980 | 30,256 | 100 | 5,181 | 17.1 | 4,332 | 14.3 | 2,001 | 6.6 |
| 1985 | 31,099 | 100 | 5,565 | 17.9 | 4,820 | 15.5 | 1,972 | 6.3 |
| **East North Central** | | | | | | | | |
| 1955 | 25,733 | 100 | 5,489 | 21.3 | 4,583 | 17.8 | 2,538 | 9.9 |
| 1960 | 26,833 | 100 | 6,316 | 32.5 | 5,317 | 19.8 | 2,985 | 11.1 |
| 1965 | 28,124 | 100 | 6,214 | 22.1 | 5,336 | 19.0 | 2,563 | 9.1 |
| 1970 | 31,550 | 100 | 7,284 | 23.1 | 6,699 | 21.2 | 2,812 | 8.9 |
| 1975 | 32,796 | 100 | 9,049 | 27.6 | 8,181 | 24.9 | 3,392 | 10.3 |
| 1980 | 33,526 | 100 | 8,725 | 26.0 | 7,891 | 23.5 | 2,955 | 8.8 |
| 1985 | 33,747 | 100 | 8,973 | 26.6 | 8,270 | 24.5 | 2,814 | 8.3 |
| **West North Central** | | | | | | | | |
| 1955 | 9,201 | 100 | 2,913 | 31.7 | 2,346 | 25.5 | 1,534 | 16.7 |
| 1960 | 10,149 | 100 | 3,383 | 33.3 | 2,855 | 28.1 | 1,709 | 16.8 |
| 1965 | 11,681 | 100 | 3,678 | 31.5 | 3,226 | 27.6 | 1,620 | 13.9 |
| 1970 | 12,904 | 100 | 4,000 | 31.0 | 3,579 | 27.7 | 1,783 | 13.8 |
| 1975 | 13,564 | 100 | 4,524 | 33.3 | 4,089 | 30.1 | 1,863 | 13.7 |
| 1980 | 13,826 | 100 | 4,770 | 34.5 | 4,220 | 30.5 | 1,965 | 14.2 |
| 1985 | 14,137 | 100 | 5,140 | 36.4 | 4,681 | 33.1 | 1,971 | 13.9 |
| **South Atlantic** | | | | | | | | |
| 1955 | 14,336 | 100 | 3,223 | 22.5 | 2,805 | 19.6 | 1,449 | 10.1 |
| 1960 | 17,798 | 100 | 4,423 | 24.9 | 3,695 | 20.8 | 2,045 | 11.5 |
| 1965 | 20,593 | 100 | 5,626 | 27.3 | 5,054 | 24.5 | 1,900 | 9.2 |
| 1970 | 23,539 | 100 | 5,461 | 23.2 | 5,129 | 21.8 | 1,904 | 8.1 |
| 1975 | 27,127 | 100 | 7,110 | 26.2 | 6,479 | 23.9 | 2,494 | 9.2 |
| 1980 | 30,512 | 100 | 7,769 | 25.5 | 7,086 | 23.2 | 2,444 | 8.0 |
| 1985 | 33,636 | 100 | 8,721 | 25.9 | 8,056 | 24.0 | 2,467 | 7.3 |
| **East South Central** | | | | | | | | |
| 1955 | 7,959 | 100 | 1,963 | 24.7 | 1,665 | 20.9 | 989 | 12.4 |
| 1960 | 9,277 | 100 | 2,778 | 29.9 | 2,207 | 23.8 | 1,510 | 16.3 |
| 1965 | 9,652 | 100 | 2,587 | 26.8 | 2,201 | 22.8 | 1,294 | 13.4 |
| 1970 | 9,862 | 100 | 2,660 | 27.0 | 2,464 | 25.0 | 1,162 | 11.8 |
| 1975 | 10,798 | 100 | 3,007 | 27.8 | 2,689 | 24.9 | 1,355 | 12.5 |
| 1980 | 11,771 | 100 | 3,614 | 30.7 | 3,173 | 27.0 | 1,567 | 13.3 |
| 1985 | 12,364 | 100 | 3,671 | 29.7 | 3,308 | 26.8 | 1,441 | 11.7 |

Continued

(U.S. population 12 years old and older. Numbers in thousands)

| Year | Population | | Sportsmen (fished or hunted) | | Anglers | | Hunters | |
|---|---|---|---|---|---|---|---|---|
| | Number | Percent | Number | Percent | Number | Percent | Number | Percent |
| West South Central | | | | | | | | |
| 1955 | 10,250 | 100 | 2,560 | 25.0 | 2,237 | 21.8 | 1,165 | 11.4 |
| 1960 | 11,837 | 100 | 3,666 | 31.0 | 3,133 | 26.5 | 1,750 | 14.8 |
| 1965 | 12,724 | 100 | 3,713 | 29.2 | 3,278 | 25.8 | 1,571 | 12.3 |
| 1970 | 14,624 | 100 | 4,380 | 30.0 | 4,006 | 27.4 | 1,918 | 13.1 |
| 1975 | 16,628 | 100 | 5,781 | 34.8 | 5,267 | 31.7 | 2,563 | 15.4 |
| 1980 | 19,136 | 100 | 5,862 | 30.6 | 5,136 | 26.8 | 2,456 | 12.8 |
| 1985 | 21,184 | 100 | 6,418 | 30.3 | 5,704 | 26.9 | 2,572 | 12.1 |
| Mountain | | | | | | | | |
| 1955 | 4,529 | 100 | 1,369 | 30.2 | 1,112 | 24.6 | 796 | 17.6 |
| 1960 | 5,222 | 100 | 1,646 | 31.5 | 1,372 | 26.3 | 1,120 | 21.4 |
| 1965 | 5,029 | 100 | 1,565 | 31.1 | 1,261 | 25.1 | 988 | 19.6 |
| 1970 | 5,656 | 100 | 2,044 | 36.1 | 1,769 | 31.3 | 980 | 17.3 |
| 1975 | 7,576 | 100 | 2,570 | 33.9 | 2,252 | 29.7 | 1,159 | 15.3 |
| 1980 | 9,160 | 100 | 2,903 | 31.7 | 2,500 | 27.3 | 1,268 | 13.8 |
| 1985 | 10,215 | 100 | 3,128 | 30.6 | 2,765 | 27.1 | 1,241 | 12.1 |
| Pacific | | | | | | | | |
| 1955 | 13,570 | 100 | 2,637 | 19.4 | 2,252 | 16.6 | 1,116 | 8.2 |
| 1960 | 15,268 | 100 | 3,422 | 22.4 | 2,971 | 19.5 | 1,279 | 8.4 |
| 1965 | 17,523 | 100 | 4,246 | 24.2 | 3,744 | 21.4 | 1,433 | 8.2 |
| 1970 | 20,199 | 100 | 4,332 | 21.4 | 4,030 | 20.0 | 1,466 | 7.3 |
| 1975 | 23,012 | 100 | 5,811 | 25.2 | 5,386 | 23.4 | 1,607 | 7.0 |
| 1980 | 26,299 | 100 | 6,168 | 23.5 | 5,747 | 21.9 | 1,531 | 5.0 |
| 1985 | 38,725 | 100 | 6,154 | 21.4 | 5,829 | 20.3 | 1,310 | 4.6 |

Table 2: Comparison of major finding from the 1955-1985 FHWAR surveys. Numbers are in thousands. Table copied from FHWAR 1991.

(U.S. population 12 years old and older. Numbers in thousands)

| Sportsmen, expenditures, and days | 1955 | 1960 | 1965 | 1970 | 1975 | 1980 | 1985 |
|---|---|---|---|---|---|---|---|
| Total sportsmen | 24,917 | 30,435 | 32,881 | 36,277 | 45,773 | 46,966 | 49,827 |
| Anglers | 20,813 | 25,323 | 28,348 | 33,158 | 41,299 | 41,873 | 45,345 |
| Freshwater | 18,420 | 21,677 | 23,962 | 29,363 | 36,599 | 35,782 | 39,122 |
| Saltwater | 4,557 | 6,292 | 8,305 | 9,460 | 13,738 | 11,972 | 12,893 |
| Hunters | 11,784 | 14,637 | 13,583 | 14,336 | 17,094 | 16,758 | 16,340 |
| Small game | 9,822 | 12,105 | 10,576 | 11,671 | 14,182 | 12,496 | 11,130 |
| Big game | 4,414 | 6,277 | 6,566 | 7,774 | 11,037 | 11,047 | 12,576 |
| Waterfowl | 1,986 | 1,955 | 1,650 | 2,894 | 4,284 | 3,177 | 3,201 |
| Expenditures[1] | 13,904,225 | 17,010,944 | 18,282,320 | 23,925,058 | 40,730,094 | 42,094,416 | 51,101,515 |
| Anglers | 9,336,002 | 11,882,891 | 12,137,086 | 16,706,477 | 28,656,715 | 28,521,304 | 34,731,608 |
| Freshwater | 6,951,447 | 9,117,627 | 8,819,330 | 12,580,446 | 21,138,064 | 20,321,023 | 23,014,603 |
| Saltwater | 2,384,556 | 2,765,259 | 3,317,773 | 4,126,031 | 7,518,651 | 6,807,288 | 8,737,535 |
| Hunters | 4,568,222 | 5,128,045 | 4,651,589 | 7,218,581 | 12,073,379 | 13,185,436 | 12,461,852 |
| Small game | 2,409,399 | 3,206,537 | 2,552,606 | 3,185,841 | 5,519,441 | 4,068,112 | 2,846,575 |
| Big game | 1,579,704 | 1,526,585 | 1,737,452 | 3,209,185 | 5,168,708 | 6,876,092 | 6,494,911 |
| Waterfowl | 579,119 | 394,927 | 361,527 | 823,555 | 1,385,230 | 934,186 | 951,728 |
| Days | 566,870 | 658,308 | 708,578 | 909,876 | 1,459,551 | 1,300,983 | 1,415,379 |
| Fishing | 397,447 | 465,769 | 522,759 | 706,187 | 1,058,075 | 952,420 | 1,064,986 |
| Freshwater | 338,826 | 385,167 | 426,922 | 592,494 | 890,576 | 788,392 | 895,027 |
| Saltwater | 58,621 | 80,602 | 95,837 | 113,694 | 167,499 | 164,040 | 171,055 |
| Hunting | 169,423 | 192,539 | 185,819 | 203,689 | 401,476 | 348,543 | 350,393 |
| Small game | 118,630 | 138,192 | 128,448 | 124,041 | 269,653 | 225,793 | 214,544 |
| Big game | 30,834 | 39,190 | 43,845 | 54,536 | 100,600 | 117,406 | 135,447 |
| Waterfowl | 19,959 | 15,158 | 13,526 | 25,113 | 31,223 | 26,179 | 25,933 |

Table 3: Summary of estimates produced using the (a) original and (b) updated FHWAR method. The mean CPUE was calculated using combined MRIP, TPWD, and SRHS landing and effort estimates from 1981-1989. Adjusted saltwater days are regional saltwater days after they have been adjusted for recall bias. In table 3b, standardized saltwater days refers to calibrating FHWAR units to MRIP, SRHS, and TPWD Creel units.

(a)

| Year | U.S. Saltwater Days | Adjusted Saltwater Days | Mean CPUE | Historic Catch (n) | CV |
|---|---|---|---|---|---|
| 1955 | 58,621,000 | 7,434,289 | 0.180 | 1,334,975 | 0.791 |
| 1960 | 80,602,000 | 11,415,731 | 0.180 | 2,049,922 | 0.791 |
| 1965 | 95,837,000 | 13,204,297 | 0.180 | 2,371,094 | 0.791 |
| 1970 | 113,694,000 | 15,299,902 | 0.180 | 2,747,402 | 0.791 |
| 1975 | 167,499,000 | 22,378,491 | 0.180 | 4,018,504 | 0.791 |
| 1980 | 164,040,000 | 22,798,904 | 0.180 | 4,093,997 | 0.791 |

(b)

| Year | U.S. Saltwater Days | Adjusted Saltwater Days | Standardized Saltwater Days | Mean CPUE | Historic Catch (n) | CV |
|---|---|---|---|---|---|---|
| 1955 | 58,621,000 | 8,287,497 | 7,502,031 | 0.180 | 1,347,139 | 0.791 |
| 1960 | 80,602,000 | 12,744,494 | 11,536,607 | 0.180 | 2,071,627 | 0.791 |
| 1965 | 95,837,000 | 14,566,249 | 13,185,701 | 0.180 | 2,367,755 | 0.791 |
| 1970 | 113,694,000 | 16,989,122 | 15,378,941 | 0.180 | 2,761,595 | 0.791 |
| 1975 | 167,499,000 | 24,821,393 | 22,468,891 | 0.180 | 4,034,737 | 0.791 |
| 1980 | 164,040,000 | 25,238,008 | 22,846,021 | 0.180 | 4,102,458 | 0.791 |

Table 4: Comparison of historic recreational landings, using data from SEDAR 74, for GOM
Red Snapper using the original and updated FHWAR method.

| Year | Original Historic Landings(n) | Updated Historic Landings (n) | Difference | Percent Difference |
|------|-------------------------------|-------------------------------|------------|--------------------|
| 1955 | 1,334,975 | 1,347,139 | 12,165 | 0.911 |
| 1956 | 1,477,964 | 1,492,037 | 14,073 | 0.952 |
| 1957 | 1,620,953 | 1,636,934 | 15,981 | 0.986 |
| 1958 | 1,763,943 | 1,781,832 | 17,889 | 1.014 |
| 1959 | 1,906,932 | 1,926,730 | 19,797 | 1.038 |
| 1960 | 2,049,922 | 2,071,627 | 21,706 | 1.059 |
| 1961 | 2,114,156 | 2,130,853 | 16,697 | 0.790 |
| 1962 | 2,178,391 | 2,190,079 | 11,688 | 0.537 |
| 1963 | 2,242,625 | 2,249,304 | 6,679 | 0.297 |
| 1964 | 2,306,860 | 2,308,530 | 1,670 | 0.072 |
| 1965 | 2,371,094 | 2,367,755 | -3,339 | -0.141 |
| 1966 | 2,446,356 | 2,446,523 | 167 | 0.007 |
| 1967 | 2,521,618 | 2,525,291 | 3,674 | 0.146 |
| 1968 | 2,596,879 | 2,604,059 | 7,180 | 0.2766 |
| 1969 | 2,672,141 | 2,682,827 | 10,687 | 0.400 |
| 1970 | 2,747,402 | 2,761,595 | 14,193 | 0.518 |
| 1971 | 3,001,622 | 3,016,223 | 14,601 | 0.486 |
| 1972 | 3,255,843 | 3,270,852 | 15,009 | 0.461 |
| 1973 | 3,510,063 | 3,525,480 | 15,417 | 0.439 |
| 1974 | 3,764,283 | 3,780,109 | 15,825 | 0.420 |
| 1975 | 4,018,504 | 4,034,737 | 16,233 | 0.404 |
| 1976 | 4,033,602 | 4,048,281 | 14,679 | 0.364 |
| 1977 | 4,048,701 | 4,061,825 | 13,124 | 0.324 |
| 1978 | 4,063,800 | 4,075,370 | 11,570 | 0.285 |
| 1979 | 4,078,899 | 4,088,914 | 10,015 | 0.246 |
| 1980 | 4,093,997 | 4,102,458 | 8,461 | 0.207 |

Table 5: Proportions used in SEDAR 74 to delineate landings by stock region and fleet. W = west region, C = central region, E = east region, CB = charter fleet, PR = private fleet, and HB = headboat fleet.

| Time Block | W CB | W PR | W HB | C CB | C PR | C HB | E CB | E PR | E HB | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| 1955-1964 | 0.280 | 0.100 | 0.230 | 0.160 | 0.080 | 0.090 | 0.0450 | 0.0180 | 0.0021 | 1.005 |
| 1965-1974 | 0.173 | 0.270 | 0.166 | 0.130 | 0.124 | 0.075 | 0.025 | 0.037 | 0.002 | 1.003 |
| 1975-1980 | 0.066 | 0.440 | 0.102 | 0.100 | 0.167 | 0.060 | 0.006 | 0.057 | 0.002 | 1.00 |

Table 6: SEDAR 74 historical landings delineated by fleet and stock region and a comparison of the total landings estimated using the FHWAR method and the total after summing the fleet and stock region specific landings. The Difference is calculated by subtracting the estimated historic catch from the historic catch summed from fleet and region splits. CB = charter fleet, PR = private fleet, and HB = headboat fleet.

| Year | West-CB | West-PR | West-HB | Central-CB | Central-PR | Central-HB | East-CB | East-PR | East-HB | Estimated Historic Catch (n) | Historic Catch Summed from Fleet and Region Splits (n) | Difference | Percent Difference |
|------|---------|---------|---------|------------|------------|------------|---------|---------|---------|------------------------------|--------------------------------------------------------|------------|--------------------|
| 1955 | 377,199 | 134,714 | 309,842 | 215,542 | 107,771 | 121,243 | 60,621 | 24,249 | 2,867 | 1,347,139 | 1,354,048 | 6,909 | 0.513 |
| 1956 | 417,770 | 149,204 | 343,168 | 238,726 | 119,363 | 134,283 | 67,142 | 26,857 | 3,176 | 1,492,037 | 1,499,689 | 7,652 | 0.513 |
| 1957 | 458,342 | 163,693 | 376,495 | 261,910 | 130,955 | 147,324 | 73,662 | 29,465 | 3,484 | 1,636,934 | 1,645,330 | 8,395 | 0.513 |
| 1958 | 498,913 | 178,183 | 409,821 | 285,093 | 142,547 | 160,365 | 80,182 | 32,073 | 3,793 | 1,781,832 | 1,790,970 | 9,138 | 0.513 |
| 1959 | 539,484 | 192,673 | 443,148 | 308,277 | 154,138 | 173,406 | 86,703 | 34,681 | 4,101 | 1,926,730 | 1,936,611 | 9,881 | 0.513 |
| 1960 | 580,056 | 207,163 | 476,474 | 331,460 | 165,730 | 186,446 | 93,223 | 37,289 | 4,410 | 2,071,627 | 2,082,252 | 10,624 | 0.513 |
| 1961 | 596,639 | 213,085 | 490,096 | 340,936 | 170,468 | 191,777 | 95,888 | 38,355 | 4,536 | 2,130,853 | 2,141,781 | 10,928 | 0.513 |
| 1962 | 613,222 | 219,008 | 503,718 | 350,413 | 175,206 | 197,107 | 98,554 | 39,421 | 4,662 | 2,190,079 | 2,201,310 | 11,232 | 0.513 |
| 1963 | 629,805 | 224,930 | 517,340 | 359,889 | 179,944 | 202,437 | 101,219 | 40,487 | 4,788 | 2,249,304 | 2,260,840 | 11,536 | 0.513 |
| 1964 | 646,388 | 230,853 | 530,962 | 369,365 | 184,682 | 207,768 | 103,884 | 41,554 | 4,914 | 2,308,530 | 2,320,369 | 11,839 | 0.513 |
| 1965 | 410,077 | 639,290 | 392,813 | 307,948 | 292,497 | 177,669 | 60,219 | 88,275 | 5,040 | 2,367,755 | 2,373,827 | 6,072 | 0.256 |
| 1966 | 423,719 | 660,558 | 405,880 | 318,192 | 302,227 | 183,579 | 62,222 | 91,212 | 5,208 | 2,446,523 | 2,452,797 | 6,274 | 0.256 |
| 1967 | 437,361 | 681,825 | 418,948 | 328,437 | 311,958 | 189,490 | 64,225 | 94,148 | 5,375 | 2,525,291 | 2,531,767 | 6,476 | 0.256 |
| 1968 | 451,003 | 703,092 | 432,016 | 338,681 | 321,688 | 195,400 | 66,229 | 97,085 | 5,543 | 2,604,059 | 2,610,737 | 6,678 | 0.256 |
| 1969 | 464,645 | 724,359 | 445,084 | 348,926 | 331,419 | 201,310 | 68,232 | 100,022 | 5,710 | 2,682,827 | 2,689,707 | 6,879 | 0.256 |
| 1970 | 478,287 | 745,627 | 458,151 | 359,170 | 341,149 | 207,221 | 70,235 | 102,958 | 5,878 | 2,761,595 | 2,768,677 | 7,081 | 0.256 |
| 1971 | 522,387 | 814,376 | 500,394 | 392,287 | 372,604 | 226,327 | 76,711 | 112,451 | 6,420 | 3,016,223 | 3,023,958 | 7,734 | 0.256 |
| 1972 | 566,486 | 883,125 | 542,637 | 425,403 | 404,059 | 245,434 | 83,187 | 121,944 | 6,962 | 3,270,852 | 3,279,239 | 8,387 | 0.256 |

| Year | West-CB | West-PR | West-HB | Central-CB | Central-PR | Central-HB | East-CB | East-PR | East-HB | Estimated Historic Catch (n) | Historic Catch Summed from Fleet and Region Splits (n) | Difference | Percent Difference |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1973 | 610,586 | 951,875 | 584,880 | 458,520 | 435,514 | 264,540 | 89,663 | 131,437 | 7,504 | 3,525,480 | 3,534,520 | 9,040 | 0.256 |
| 1974 | 654,686 | 1,020,624 | 627,124 | 491,637 | 466,969 | 283,647 | 96,139 | 140,931 | 8,046 | 3,780,109 | 3,789,802 | 9,693 | 0.256 |
| 1975 | 267,844 | 1,775,273 | 410,744 | 403,949 | 674,070 | 242,380 | 23,667 | 228,222 | 8,588 | 4,034,737 | 4,034,737 | 0 | 0.000 |
| 1976 | 268,743 | 1,781,232 | 412,123 | 405,305 | 676,333 | 243,194 | 23,746 | 228,988 | 8,617 | 4,048,281 | 4,048,281 | 0 | 0.000 |
| 1977 | 269,643 | 1,787,191 | 413,501 | 406,661 | 678,596 | 244,008 | 23,826 | 229,754 | 8,646 | 4,061,825 | 4,061,825 | 0 | 0.000 |
| 1978 | 270,542 | 1,793,151 | 414,880 | 408,017 | 680,858 | 244,821 | 23,905 | 230,520 | 8,675 | 4,075,370 | 4,075,370 | 0 | 0.000 |
| 1979 | 271,441 | 1,799,110 | 416,259 | 409,373 | 683,121 | 245,635 | 23,984 | 231,286 | 8,703 | 4,088,914 | 4,088,914 | 0 | 0.000 |
| 1980 | 272,340 | 1,805,070 | 417,638 | 410,729 | 685,384 | 246,449 | 24,064 | 232,053 | 8,732 | 4,102,458 | 4,102,458 | 0 | 0.000 |

# Figures



**Fishing Participation**
National participation rate: 19%

Mountain 21%

West North Central 27%

East North Central 19%

New England 15%

Middle Atlantic 13%

Pacific 15%

South Atlantic 19%

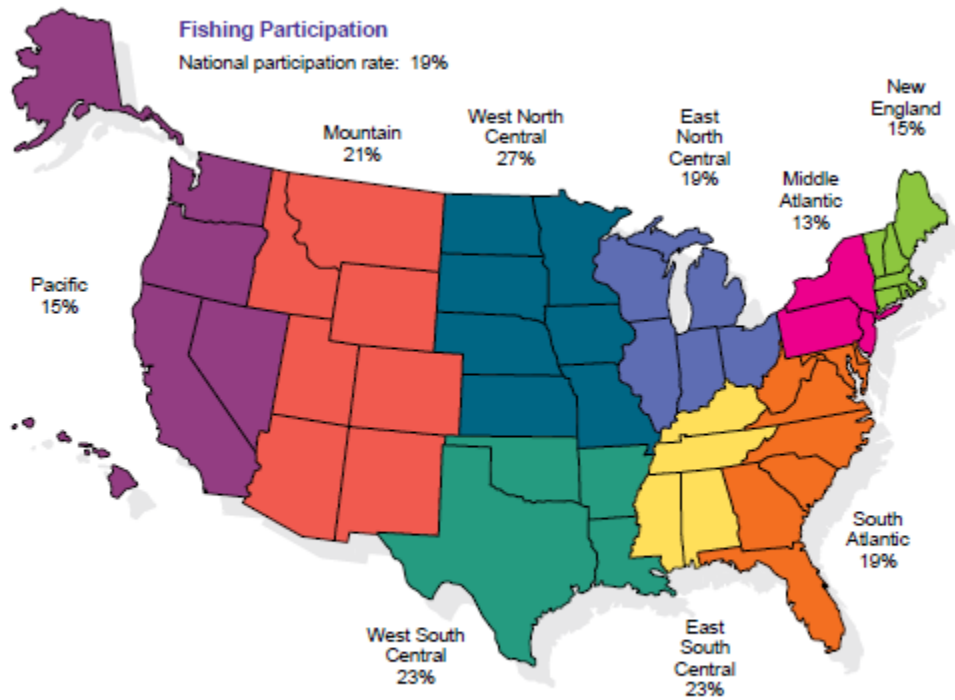West South Central 23%

East South Central 23%

Figure 1: Map of regions defined in the FHWAR survey. Figure is from FHWAR 1991. The numbers show the percentage of anglers by region in the 1991 survey.
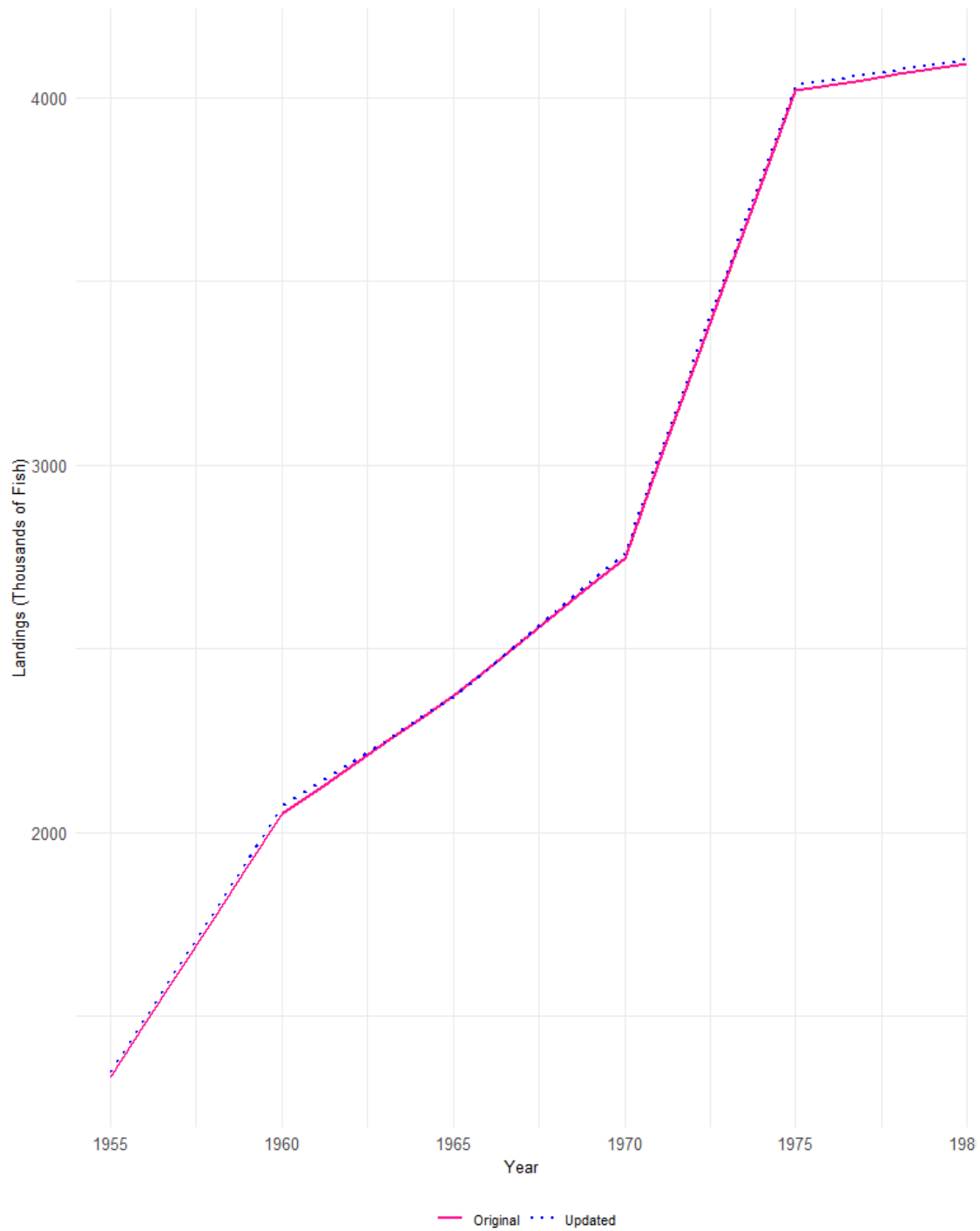
Figure 2. Comparison of historic red snapper landings from 1955 using the original (pink solid line) and updated (blue dotted line) FHWAR method.