

sampling, where fish are measured to the nearest mm and weighed to the nearest 0.01 kg. These data are used to generate mean weights for all species by area and month. Port samplers also collect otoliths for ageing studies during dockside sampling events. 2) Information about total catch and effort are collected via the logbook, a form filled out by vessel personnel and containing total catch and effort data for individual trips. These logbooks are summarized by vessel to generate estimated landings by species, area, and time strata.

The headboat logbook was changed several times during the early years of the Headboat Survey. In the case of Spanish mackerel, the logbook used in North Carolina and South Carolina did not list Spanish mackerel until 1984. Georgia and Florida had a mix of the different versions in use from 1980 to 1983. The Headboat Survey did not have a universal logbook form that included Spanish mackerel for all areas until 1984.

Issue: From 1981-1983 Spanish mackerel was only listed on 1 of 3 versions of the Headboat Survey logbook form being used in the South Atlantic.

Option 1: Start headboat time series in 1984 when a universal form was in use in all areas from NC- FL. MFRSS headboat landings will be used 1981-1983.

Option 2: Use estimated headboat landings based on available logbook data 1981- 2011.

Decision: *Option 1*

Catch Estimates

Final SRHS landings estimates are shown in Table 4.11.3. by year and state and in Figure 4.12.6. SRHS areas 1-17 are included in the Atlantic Spanish mackerel stock. Figures 4.12.7, 4.12.8, 4.12.9, and 4.12.10 show the South Atlantic Spanish mackerel headboat landings from 1973-1979, 1980-1989, 1990-1999, and 2000-2011 respectively. Headboat landings of Spanish mackerel in the South Atlantic, from the 1970's to present, have mostly been concentrated in 3 areas: South Carolina, Fort Pierce, FL and Miami, FL. South Florida accounted for a large portion of the catch in the 1980s (Figure 4.12.8), however, since 1990 headboat landings indicate that Spanish mackerel are caught predominantly off Fort Pierce, FL and South Carolina (Figures 4.12.9 and 4.12.10).

4.3.3 Historic Recreational Landings

Introduction

The historic recreational landings time period is defined as pre-1981 for the charter boat, headboat, private boat, and shore fishing modes, which represents the start of the Marine Recreational Fisheries Statistics Survey (MRFSS) and availability of landings estimates for Spanish mackerel. The SEDAR 17 included historical recreational landings estimates for 1950 – 1980, based on linear interpolation using the Saltwater Angling Surveys (SWAS) from 1960, 1965 & 1970. Concerns were raised that these historical landings were overestimated due to recall bias, rounding bias and changes in methodologies in the SWAS.

The Recreational Working Group was tasked with reviewing the SWAS used in SEDAR 17 and to evaluate other potential historical sources and methods to compile landings of Spanish mackerel prior to the available time series of MRFSS and headboat estimated landings.

The sources of historical landings that were reviewed for potential use are as follows:

- Salt Water Angler Surveys (SWAS) from 1960, 1965 & 1970.
- Anderson, 1965, DW Reference Document 31.
- The U.S Fish and Wildlife Service (USFWS), 2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation Survey (FHWAR).

The 2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation Survey presented summary tables of U.S. population estimates, along with estimates of hunting and fishing participation and effort from surveys conducted by the USFWS every 5 years from 1955 to 1985 (SEDAR24-DW11). This information was used to develop an alternative method for estimating recreational landings prior to 1981.

During the SEDAR 28 data workshop the RWG reviewed the Salt Water Angler Surveys (SWAS) from 1960, 1965 & 1970. The workgroup noted that the salt-water angling survey estimates for Spanish mackerel are on the order of 6 times those in recent years. These high estimates have been attributed to recall bias and possible exaggeration of catches by anglers (SWAS 1960). This may have been compounded further by the small sample size of salt water angler interviews conducted in these surveys. The average interview sample size for the 3 surveys was 0.0002% of total estimated saltwater anglers in the United States. The changes in methodology were also discussed by the RWG as part of the overall discussion of using this method.

Anderson, 1965

The RWG discussed SEDAR-RD04 as a possible source of information for historical Spanish mackerel landings. The study area designated as the Cape Canveral area included Brevard and Volusia counties in Florida. The recreational data was obtained from field surveys from February to October, 1963. The RWG considered this spatially and temporally limiting for possibly expanding estimated landings prior to 1981.

FHWAR census method

The two key components from these FHWAR surveys that were used in the census method were the estimates of U.S. saltwater anglers and the estimates of U.S. saltwater days. The first objective was to determine the total saltwater anglers and saltwater days from New England to the South Atlantic (NE-SA) by using the summary information of U.S. anglers and U.S. saltwater anglers from the FHWAR surveys. The ratio of U.S saltwater anglers to the total U.S anglers was applied to the total number of anglers for the NE-SA to yield the total saltwater anglers for NE-SA. The same method was used to calculate the total saltwater days for the NE-SA from the FHWAR surveys from 1955-1985.

The FHWAR surveys the South Atlantic included the entire state of Florida, east and west coasts. In order to address the management boundaries for Spanish mackerel the saltwater angler days for Florida's west coast (FLW) were separated from the NE-SA saltwater angler days using

the ratio of the MRFSS total angler trips for FLW to the MRFSS total angler trips for the South Atlantic (Delaware to FLW). The average ratio from 1984-1986 was applied to the total saltwater days for the NE-SA 1955-1985 to remove FLW effort.

Similar to the SWAS there was a 12 month recall period for respondents, which resulted in greater reporting bias. Research concluded this bias resulted in overestimates of both the catch and effort estimates in the FHWAR surveys from 1955 to 1985. Consequently, as was case in SEDAR 17, an adjustment for recall bias was necessary. The total saltwater days for the NE-SA 1955-1985 were adjusted for recall bias in the FHWAR surveys. The MRFSS total angler trips for the east coast 1984 to 1986 was averaged and divided by the total saltwater days for 1985 from the FHWAR survey. This multiplier was then applied to the total NE-SA saltwater days 1955-1985 to adjust for recall bias.

The mean CPUE for Spanish mackerel in the South Atlantic from the MRFSS estimates from 1981 to 1985 was then applied to the adjusted saltwater angler days for the NE-SA 1955-1985 to estimate the historical Spanish mackerel landings for those years (Table 4.11.4).

A bootstrap analysis was used to capture the range of uncertainty in the historic recreational catch estimates. More specifically, the historic catch estimates are based on the average CPUE and the ratio of MRFSS effort to historic effort estimates. These two quantities were bootstrapped 200 times using the empirical estimates that went into each of them. The 5th and 95th percentiles were then computed from the distribution of bootstrap estimates to characterize the uncertainty (Figure 4.12.11).

Issue: Available historical Spanish mackerel landings limited 1950-1980.

Option 1: Use the Adjusted SWAS (SEDAR 17)

Option 2: Use average ratio from entire time series (1981-2010) applied to commercial landings to estimate recreational landings (1950-1980).

Option 3: Use available recreational time series for the MRFSS\MRIP and headboat estimates 1981- 2010.

Option 4: Use FHWAR census method to estimate Spanish mackerel landing 1955-1980 in the South Atlantic and Gulf of Mexico. Use interpolation to complete time series.

Decision: *Option 4.* Total Spanish mackerel landings using the FHWAR census method (NE-FLE 1955-1984) are presented with the MRFSS Spanish mackerel landings (NE-FLE 1981-2003) and MRIP Spanish Mackerel landings (NE-FLE 2004-2011) in Table 4.11.5 and Figure 4.12.12.

4.3.4 Potential Sources for Additional Landings Data

SCDNR Charter boat Logbook Program Data, 1993 – 2011