Excerpt from ASMFC Atlantic Croaker Stock Assessment & Peer Review Reports 2003 – Information on Jacquard Index

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similar to those observed for the northern range of the fishery. Prior to 1998, the ratio of fish released to those kept were lower for the southern range of the fishery than those observed for the northern range of the fishery (Figure 5.2.3.1). The estimated numbers and weight of recreational discards based on the different methods used are presented in Table 5.2.3.2.

5.2.4 Recreational Catch Rates

In developing a MRFSS catch rate index for Atlantic croaker, an important factor is defining a sampling unit. Based on the discussions at the data workshop an Atlantic croaker trip was identified using three methods. These were:

1. Original: defined a croaker intercept-sampling unit as one where either croaker was caught or where the angler recorded croaker as a targeted species, but did not catch any.
2. Jacquard: Used a binary similarity index to identify a suite of species with which Atlantic croaker were associated, and defined a sampling unit as one where any of those species were caught. This was based on a Jacquard type index (Krebs 1989) and was determined for each state. The species that had the six highest coefficients (this included croaker) were used to identify a sampling unit. Jacquard's index can be defined as:

$$S_j = \frac{a}{a+b+c}$$

Where:
a = no of samples where Atlantic croaker and species j was present
b = no of samples where Atlantic croaker were present and species j was not present (unique Croaker samples)
c= no of samples where species j was present but Atlantic croaker was not present.

3. Strata: identified all state-year-wave-area-mode strata where Atlantic croaker were caught and used all sampling units within those identified strata as potential Atlantic croaker trips.

In general, these three methods made changes to the number of zero cells added. Comparing the preliminary results using the three methods indicated that:

1. As Atlantic croakers are not commonly listed as a targeted species, the number of zero samples added to method 1 (original) was relatively small. This is probably the least appropriate method.
2. In states where the species occurred rarely in the early years (e.g. NJ and DE) the strata method cannot add samples. It is dependent on the species being present.
3. For some states, the differences between strata and the jaccard method reflect that within the strata there are different target species groups. However, for some states the strata and jaccard methods provide similar estimates.

Statistical Analysis of Catch-Rates

The base data set used for estimating the MRFSS catch rates was determined using the potential croaker sets identified using method 2 (jaccard). Table 5.2.4.1 shows the species included in

defining a croaker set for each of the states used in the analysis. Due to small sample sizes, data from Massachusetts, Rhode Island and New York were excluded. The data were further reduced to only include hook and line sets. The response variable used in the analyses was based on total number of Atlantic croaker per trip (Type A+B1+B2). Two statistical models were used to estimate MRFSS catch rates. These were:

1. A general linear model where log (total number of croaker catch +1) was the response variable. Explanatory variables used in the full model were state year, wave area and mode (treated as classes) and hours fished and contributors, which were, treated as continuous explanatory variables. A state by year interaction term was also included in the full model.
2. A generalized linear model using a negative binomial distribution, using a log link was also carried out. The response variable was the number of croaker per trip (A+B1+B2). The explanatory variables used were similar to the general linear model. However, as the model would not converge within the allotted trials, a state by year interaction term-was not included.

Preliminary evaluation of both statistical models revealed that all explanatory variables were statistically significant ($P < 0.01$). Given the significant year by state interaction term for the log transformed GLM, both models was re-run by state. A comparison of the normalized catch rates by state revealed that the fishery could be broadly categorized into a northern and southern region. These two groups were the region Virginia and North and the region South Carolina and south. Catch rate trends in North Carolina were intermediate to those seen for the northern and southern regions. For the northern states, the recent time trend indicates higher catch rates than normal while for the southern states, catch rates appear to be fluctuating around or just below their normal levels in recent years.

Based on an evaluation of abundance trends in the fishery independent indices, participants at the stock assessment workshop (see section 6.2), concluded that developing separate MRFSS indices for the northern and southern range of the fishery was the most appropriate approach to evaluating catch rates. As such, the data were partitioned into the mid-Atlantic (North Carolina, Virginia, Maryland, Delaware and New Jersey) and the South Atlantic (South Carolina, Georgia and the Atlantic coast of Florida) and analyses were conducted separately using the protocol described for the preliminary evaluation. Back transformed least square means by year were used as estimates of the catch rate.

Summary statistics for the models are presented in Table 5.2.4.2. For the negative binomial generalized linear model, all explanatory variables were statistically significant ($P < 0.01$). As such, a reduced model was not developed. For the general linear model, explanatory variables included for both regions were statistically significant with the exception of the number of hours fished in the southern model (Table 5.2.4.2).

Catch rates developed using the two statistical models are presented in Table 5.2.4.3. In general the catch trends from the negative binomial generalized linear model and log-transformed general linear model were similar. For the mid-Atlantic region in 1981/82, the log transformed GLM produced negative estimates that were not significantly different from 0. This was in part because of the low number of trips in which Atlantic croaker were caught.

For the northern range of the fishery, catch rates appear to have steadily increased over the time series with a peak in 1999 (Figure 5.2.4.1). For the southern region catch rates appear to be more stable over the time series, except between 1990-1992, when the catch rates were much higher (Figure 5.2.4.2).

5.2.5 Recreational Catch-at-Age

No information.

5.3 Fishery-Independent Survey data

For this analysis eight fishery independent surveys were available. An inspection of the fishery independent indices revealed that they primarily targeted juveniles to Age 1, though older age classes were evident in some indices (NMFS and SEAMAP). The eight fishery independent indices were the NMFS fall trawl survey, SEAMAP trawl survey, VIMS trawl survey, North Carolina DMF juvenile estuarine and sound surveys, Maryland DNR juvenile index, and the Florida FWC fishery independent trawl and seine surveys. However, of the available indices the NMFS trawl survey and SEAMAP indices were identified for use in this assessment (see section 6.2.1) together with the possible use of the VIMS trawl survey. As such, detailed descriptions of the available surveys were confined to the SEAMAP, NMFS and VIMS survey.

5.3.1 SEAMAP

5.3.1.1 Sampling Intensity

Samples were taken by trawl from the coastal zone of the South Atlantic Bight (SAB) between Cape Hatteras, North Carolina, and Cape Canaveral, Florida. Multi-legged cruises were conducted in spring (early April - mid-May), summer (mid-July - early August), and fall (October - mid-November).

Stations were randomly selected from a pool of stations within each stratum. The number of stations sampled in each stratum was determined by optimal allocation. A total of 102 stations were sampled each season within twenty-four shallow water strata, representing an increase from 78 stations previously sampled in those strata by the trawl survey (1990-2000). Strata were delineated by the 4 m depth contour inshore and the 10 m depth contour offshore. In previous years, stations were sampled in deeper strata with station depths ranging from 10 to 19 m in order to gather data on the reproductive condition of commercial penaeid shrimp. Those strata were abandoned in 2001 in order to intensify sampling in the shallower depth-zone.

The R/V *Lady Lisa*, a 75-ft (23-m) wooden-hulled, double-rigged, St. Augustine shrimp trawler owned and operated by the South Carolina Department of Natural Resources (SCDNR), was used to tow paired 75-ft (22.9-m) mongoose-type Falcon trawl nets without TEDs. The body of the trawl was constructed of #15 twine with 1.875-in (47.6-mm) stretch mesh. The cod end of the net was constructed of #30 twine with 1.625-in (41.3-mm) stretch mesh and was protected by chafing gear of #84 twine with 4-in (10-cm) stretch “scallop” mesh.