Tab G, No. 4(a)

REPORT OF THE SIXTH RED DRUM

STOCK ASSESSMENT PANEL MEETING

PREPARED BY THE

RED DRUM STOCK ASSESSMENT PANEL

GULF OF MEXICO FISHERY MANAGEMENT COUNCIL

April 24, 2000

C:\Documents and Settings\marguerite\Local Settings\Temporary Internet Files\OLK5A\RDSAP_99_FINAL_RPT.wpd

Purpose

The Red Drum Fishery Management Plan (FMP) as revised by Amendments 1 and 2 specifies that 1) the Southeast Fisheries Science Center (SEFSC) will update the U.S. Gulf of Mexico stock assessment for red drum prior to October 1 every other year and 2) a special scientific stock assessment Panel will be convened by the Council to review the assessment and other relevant data and to prepare a written assessment report for the Council. The current stock assessment (Porch 2000b) was conducted three years after the last assessment (Goodyear 1996) to allow time for the NMFS tag/recapture experiment to be completed.

This report summarizes the Panel's review of the assessment and our conclusions on the status of the stock. It also recommends important research and data collection requirements needed for managing the fishery.

In reaching these recommendations and conclusions, the Panel reviewed and recommended changes to the initial assessment (Porch 1999) presented to the Panel during a 4-6 October 1999 meeting in Miami. The Panel then reviewed the revisions (Porch 2000a) at a meeting held 7-9 February 2000 in Miami where the Panel again asked for additional analyses. The final revised assessment (Porch 2000b) was reviewed during a conference call made April 17, 2000. Other information was provided by the states and NMFS. This constitutes the written report of the Red Drum Stock Assessment Panel meeting for 1999.

Stock Assessment Review

Most of the life history characteristics used in this assessment are the same as those used in the previous assessment. Growth of red drum was modeled by a 'double von Bertalanffy' equation and total egg production was modeled using spawning frequency and batch fecundity relationships as in Goodyear (1996).

A difference from the previous assessment were estimates of natural mortality made using several methods (Pauly 1979, Hoenig 1983). The method of Boudreau and Dickie (1989), which gives age-specific estimates, was chosen by the Panel as the most likely estimates of natural mortality. Generation time was estimated to be 14.2 years using the Boudreau and Dickie (1989) estimates.

Annual catches of red drum during 1979-1996 were given for the commercial and recreational fisheries and the shrimp bycatch. The shrimp bycatch was assigned to adult age classes in this assessment rather than to age 0 as in the previous assessment. All red drum in the estimated shrimp bycatch were assumed to have died although there is no direct estimate of their release mortality. Recreational landings, which decreased throughout the 1980's, increased after 1991 to over 75% of the average annual recreational landings made during 1979-84. If discards are included with a 16% release mortality (Jordan and Woodward 1994) then the 1991-96 average recreational catch is about the same as the 1979-84 average recreational landings.

The current assessment of red drum by the SEFSC-NMFS was conducted using a more statistically rigorous model (CATCHEM) than the 'probabilistic' method (VPA) used in previous assessments (Goodyear 1996). This change in models is believed to provide a more objective assessment of the condition of red drum in the Gulf. In this model the growth curve and recruitment indices were used to match length-frequency data from the inshore commercial and recreational catches. Age-frequency data obtained from the offshore catches were used to partition offshore catches and shrimp trawl bycatch into year classes. Four fishery-independent indices were used in most of the analysis (Texas and Louisiana bag seines for age 0, Louisiana trammel nets for age 1, and NMFS mark-recapture for age 2 and older) and four others were used in sensitivity analyses (summer and fall Louisiana gill nets for age 1, and aerial and SEAMAP larval surveys to represent abundance for ages 2 and older).

The model parameters that were estimated included the age structure in the initial year, abundances at age 0, selectivity patterns and fishing mortalities for each fishery. Selectivities were assumed constant across all years for the commercial fisheries and within each of three blocks of time (1979-85,1986-87, 1988-96) for the recreational fishery.

The original base fit of the model to the data was good except for the length-frequency data for the recreational fishery (Porch 1999). This fit was improved when the growth curve was used to match lengths within 6-month blocks of time and when landings were grouped within three separate areas (Texas, Louisiana-Mississippi-Alabama, and Florida). The estimated selectivities under this two-season, three-area model were also more similar to that found in simpler models used to assess red drum in Louisiana (Shepard 1999), Florida (Murphy 1998), and Texas (Fisher 1996). In the final analysis (Porch 2000b), partitioning was extended to quarterly time blocks and truncated length distributions were used. The fit to recreational length frequencies was much better.

Several sensitivity runs made little difference to the model outputs. These analyses included runs using different natural mortalities, year-specific selectivities, different levels of recreational release mortality, an emphasis on NMFS mark/recapture estimates, replacing mark/recapture estimates of abundance with those from aerial surveys or with larval surveys, dropping the Texas bag seine index, adding the Louisiana gill net series, and de-emphasizing the age-length composition data (Porch 1999). In the final runs the sensitivity of the analysis to the down-weighting of offshore data and to the assumption that selectivity was constant after age 3 did not significantly change the results. A retrospective analysis did not show any consistent biases in the estimation of fishing mortality for ages 1-6+ (Porch 2000b).

Condition of the Stock

The conclusions of the NMFS assessment are that red drum are currently overfished and that overfishing is occurring. However, Porch (2000b) noted that the assessment results as a whole were quite uncertain. He cited uncertainty in the stock structure, the flat stock-recruitment relationship even at very small stock sizes, the small sample size for offshore age composition, the unknown age composition of the shrimp bycatch, the unknown length composition on the

inshore commercial fishery, and the unknown magnitude and composition of the inshore shrimp fleet bycatch as reasons why the results of the assessment must be regarded as uncertainty.

The numerous changes suggested by the Panel and the senstitivities run by the analysts almost always resulted in the same conclusion that red drum were overfished. Exceptions were when the selectivity of age 1 and age 2 fish were assumed equal and when the marked/recapture estimates of adult abundance were assumed to be without error. In both of these cases the findings indicated that red drum in the Gulf of Mexico were not overfished and overfishing was not occurring (Figure 1). However, the Panel agreed that these two runs were not supported by the available data.

Given uncertainties about the assessment's findings that red drum are overfished in the Gulf, the Panel chose to recommend that the acceptable biological catch remain at zero in Federal waters.

The Panel chose not to estimate rebuilding schedules or MSY until the uncertainties in the assessment can be addressed with improved data. In the interim the states should provide the Council with reports indicating the status of stocks in their waters.

Response to Red Drum Management Council Concerns

The following requests were made directly to the Panel from the Council:

1) *Recommendations are needed for how to sampling of the offshore stock.*
This sampling needs to be representative and efficient. The sampling for age composition will require a stratified random design that will allow for the sampling of many different schools along the coast at various depths.

2) *Can angler behavior or environmental variability account for the M-shaped selectivity curve?*
Angler behaviour could account for this shaped selectivity, however, in the final analysis most selectivity curves were peaked at one or two subadult ages only.

3) *What effect does slot limits have on the model, particularly because they limit the fish available to fishery-dependent sampling.*
Fishery dependent sampling is designed to characterize the lengths, weights, and ages of red drum landed in the fishery. Slot limits make it difficult to infer the size and age of fishes that die after release (i.e., larger or smaller than slot limit).

4) *What is the effect of differences between past and present assessment models on the status of the stock.*
The past and present assessments differ in their forecasts both because the present assessment model uses more recent data and because the structure of the models is different. The effect of using more recent data, particularly the 1996-97 age composition data from the NMFS mark-recapture experiment, is clearly seen in the retrospective analysis. The estimates of fishing

mortality rate on ages 1, 2 and 3 in the more recent years are substantially lower when the more recent data are excluded and much more similar to the values estimated in the previous assessment (see Figure 27, Porch 1999).

The effect of the change in the type of assessment model from Goodyear's (1996) probabilistic approach to the present statistical method is more difficult to establish because it was not possible to repeat the 'probabilistic' analysis. The probabilistic approach is not generally practiced and there are perhaps only three people in the world capable of running the model. The method used in the present assessment, on the other hand, is fairly standard and based on well-established statistical principles. The primary differences in the models are in the way the data are handled. The probabilistic approach, for example, assumes the total catch, age-composition of the commercial purse seine catch, and relative levels of recruitment are all known exactly, whereas the present statistical method does not. The probabilistic method also requires gaps in the age and length composition data to be filled by substituting values from other strata. The statistical method does not.

The previous assessment also assumed the bycatch from the offshore shrimp fishery were all age 0, whereas in fact the bycatch consists mostly adults (the statistical method estimates the age composition). Sensitivity analyses with the statistical model showed that the way the bycatch is treated in the model has a profound influence on the results (Porch, 1999a,1999b,2000).

Still another important difference lies in the way the selectivity pattern was estimated. The present model estimates several selectivity patterns for each fishery-- one for each major change in the size limit regulations. The probabilistic method, on the other hand, estimated the selectivities in an *ad hoc* fashion with the result that the selectivity on age 1 was 50 percent greater than on age 2 (despite the fact that the patterns predicted for the three years immediately prior to that showed the opposite). Sensitivity trials with the statistical model demonstrated that artificially forcing the selectivity on age 1 to be as large or larger than the selectivity on age two leads to a much more optimistic, if unrealistic, picture of stock status (Porch, 1999). Similarly, the selectivities for the older ages were set in the previous assessment so as to force the predicted adult biomass in 1988 to approximate the 1987 NMFS mark-recapture estimate. Sensitivity trial 4 in Version 1.0 (Porch, 1999) made a similar assumption and was also more optimistic than the base case.

Recommended research

The age composition of the adults in the offshore area needs to be monitored using a design that would provide a representative sample of adult ages.

The absolute abundance of adult red drum in the Gulf of Mexico needs to be accurately measured. If this is to be done through a mark-recapture study then the sample size must be significantly (four or five times) higher than was used in the past. The utility of this data depends on the experimental design and the Panel and other experts should review this design.

A coordinated Gulf-wide sampling program needs to be implemented to randomly sample the commercial and recreational catches for age composition data.

Development of a standardized stock assessment methodology that can accept area (State)-specific data and work with these within the context of a Gulf stock assessment.

Determine the area (State)-specific contributions of red drum to the offshore adult stock.

Determine angler-release and shrimp-trawl bycatch mortality and the ages or lengths of caught-and-released fish.

Length composition of the commercial catch.

LITERATURE REVIEWED/CITED

Boudreau, P. R. and L. M. Dickie. 1989. Biological model of fisheries production based on physiological and ecological scalings of body size. Can. J. Fish. Aq. Sci. 46: 614-623.

Fisher, M. 1999. (Personal communication) Texas escapement, gillnet catch rates, age-length key, and F at age data. TPWD. Unpublished Report.

Goodyear, C. P. 1996. Status of the red drum stocks of the Gulf of Mexico. NMFS. SEFSC. MIA-95/96-47, 47 p. Appendices A-R.

Hoenig, J. M. 1983. Empirical use of longevity data to estimate mortality rates, Fishery Bulletin 82: 899-903.

Jordan, S.R. and A.G. Woodward. 1994. Survival of hook-caught red drum. Proc. 46th Annual Conf. Southeast Assoc. Fish Wildlife Agencies (in press).

Mitchell, K. M. and T. Henwood. 1999. Red drum (Sciaenops ocellatus) tag/recapture experiment (1997-1998). NMFS/SESC Pascagoula Facility. 15 pp.

Murphy, M.D. 1998. A stock assessment of red drum, *Sciaenops ocellatus*, in Florida: status of the stocks through 1997. Florida Marine Research Institute report to the Florida Marine Fisheries Commission. St. Petersburg.

Nichols, S., A. S hah, J. P. Gilmore, and K. Mullin. 1987. Estimates of annual shrimp fleet bycatch for thirteen finfish species in the offshore waters of the Gulf of Mexico. NMFS Pascagoula Facility. October 1987.

Nichols, S., A. S hah, J. P. Gilmore, and K. Mullin.1990. Updated estimates of shrimp fleet bycatch in the offshore waters of the US Gulf of Mexico 1972-1989. NMFS Pascagoula Facility. August 1990.

Pauly, D. 1979. On the inter-relationships between natural mortality, growth parameters and mean environmental temperature in 175 fish stocks. J. Cons. Int. Explor. Mer., 39(2):175-192.

Porch, C.E. 1999. Status of the red drum stocks of the Gulf of Mexico. September 1999. Sustainable Fisheries Division Contribution: SFD-98/99/DRAFT.

Porch, C.E. 2000a. Status of the red drum stocks of the Gulf of Mexico. Version 2.0. February 2000. Sustainable Fisheries Division Contribution: SFD-98/99/ DRAFT.

Porch, C.E. 2000b. Status of the red drum stocks of the Gulf of Mexico. Version 2.1. April 2000 Sustainable Fisheries Division Contribution: SFD-98/99/DRAFT.

Restrepo, V. R., G. G. Thompson, P. M. Mace, W. L. Gabriel, L. L. Low, A. D. MacCall, R. D. Methot, J. E. Powers, B. L. Taylor, P. R. Wade, J. F. Witzig. 1998. Technical guidance on the use of precautionary approaches to implementing National Standard 1 of the Magnuson-Stevens Fishery Conservation and Management Act. NOAA Tech. Mem. NMFS-F/SPO-31.54 pp.

Shepard, J. 1999. (Personal communication) Results of 1999 stock assessment for Louisiana red drum, (Sciaenops ocellatus). LDWF. Office of Fisheries. Unpublished Manuscript

LIST OF PARTICIPANTS

Members Present:
Dr. Richard Condrey, Louisiana State University
Dr. Mark Fisher, Texas Parks and Wildlife Department
Mark Van Hoose, Alabama Department of Conservation and Natural Resources
Michael Murphy, Florida Marine Research Institute
Dr. Clay E. Porch, NMFS-SEFSC Miami
Joseph Shepard, Louisiana Department of Wildlife and Fisheries
James "Tut" Warren, Gulf Coast Research Laboratory

Others Present:

Karen Foote, Chairman, Red Drum Management Committee, Gulf of Mexico Fishery Management Council
Peter Hood, Gulf of Mexico Fishery Management Council Staff
Crabtree, Eldrige, Cranmore, Kimmel, SERO-NMFS.

Figure 1. Control rule figures from Porch (1999, 2000a, and 2000b).

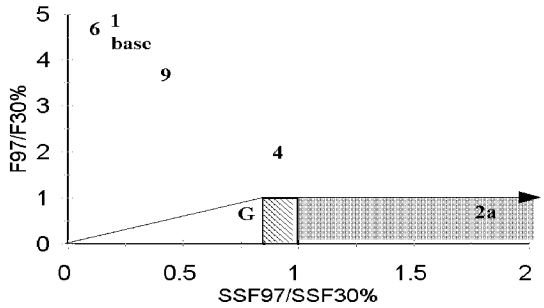

*Figure 25. Current status of Gulf red drum stocks relative to the proposed FMP (fishing mortality rate and spawning stock fecundity at 30% SPR) as estimated by the base case, sensitivity trials and Goodyear's 1996 assessment (G). Those trials not listed were similar to the base case. The vertical line bordering the leftside of the stippled region represents the minimum stock size threshold (1-M)*SSF$_{30\%}$ with M=0.15 yr^{-1}. The horizontal and sloped lines represent the maximum allowable fishing mortality rate (relative to F$_{30\%}$). Points falling outside the shaded region, are considered overfished. Points falling within the stippled region, however, indicate that the stock is expected to recover within ten years if current conditions persist.* From Porch (1999).

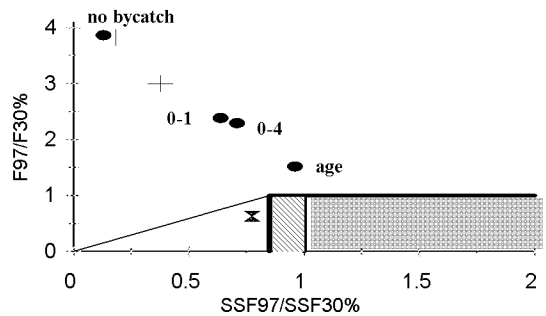

Figure 25. *Current status of Gulf red drum stocks relative to the proposed FMP (fishing mortality rate and spawning stock fecundity at 30% SPR) estimated by the 4-season base case and sensitivity trials (labeled). Also shown are the base annual model (|), base semiannual model (+) and 1996 assessment (hourglass). The vertical line bordering the left side of the stippled region represents the minimum stock size threshold (1-M)*SSF$_{30\%}$ with M=0.15 yr^{-1}. The horizontal and sloped lines represent the maximum allowable fishing mortality rate (relative to F$_{30\%}$). Points falling outside the shaded region, are considered overfished, but points falling within the stippled region indicate that the stock is expected to recover within ten years under current conditions.* From Porch (2000a)

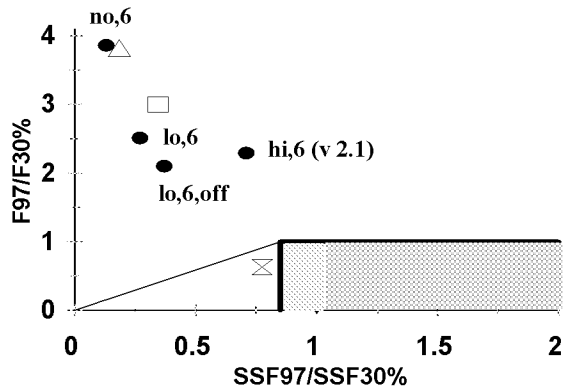

Figure 27. *Current status of Gulf red drum stocks relative to the proposed FMP (fishing mortality rate and spawning stock fecundity at 30% SPR) estimated by the 4-season base case (lo, 6) and several sensitivity trials. The labels 'hi', 'lo' and 'no' refer to the weight given to the bycatch data in the fitting (cv=0.1, 1.0, and data ignored, respectively). The labels 4 and 6 refer to the selectivities of the recreational fleets being assumed constant for ages 4 and older or 6 and older, respectively. Also shown are the base annual model (triangle), base semiannual model (square) and 1996 assessment (hourglass). The vertical line bordering the left side of the stippled region represents the minimum stock size threshold (1-M)*$SSF_{30\%}$ with M=0.15 yr^{-1}. The horizontal and sloped lines represent the maximum allowable fishing mortality rate (relative to $F_{30\%}$). Points falling outside the shaded region, are considered overfished, but points falling within the stippled region indicate that the stock is expected to recover within ten years under current conditions.* From Porch (2000b)