

Atlantic Fishery Management Council, 1 Southpark Cir., Ste 306, Charleston, S.C. 29407, 34 p.

Ward, John M., Teofilo Ozuma and Wade Griffen; 1995 Cost and Revenues in the Gulf of Mexico Shrimp Fishery. NOAA Tech. Mem. NMFS-SEFSC-371, 76 p.

#### Appendix H—Statistical Procedures for Analyzing BRD Evaluation Data Relative to the Western Gulf Criterion

NMFS will calculate the reduction in bycatch mortality (F) based on data gathered during the testing. Both age 0 and age 1 red snapper, ranging in length from 10 mm to 200 mm, occur frequently in shrimp trawls. During the July/August (July 1-August 31) period, the most recently spawned year class of fish have not fully recruited to the shrimp grounds; thus the catch is represented by a relatively narrow length range of individuals, all of which are considered to be age 1. The numerical reduction in catch-per-unit-effort (CPUE) of this specific age class is expected

to be a good predictor of fishing mortality (F) reduction, although the size composition data will be checked for any particular test. The analysis of the data collected under this testing protocol will be based on a modified paired t-test. Because of the varying age and size composition of the red snapper catch taken at other times of the year, more detailed analyses through use of a stock assessment model (Goodyear 1995) incorporating the size-specific reduction performance of the device and the seasonal progression of F must be conducted to determine if the BRD candidate will meet the bycatch reduction criterion. Based on the time of the year that the test is conducted, NMFS will utilize the appropriate technique to assess the performance of the BRD candidate as a service for the BRD sponsor.

All experimental tows must be conducted in conformance with the requirements of the BRD testing protocol. Data collected from no more than 20 tuning tows of the control and experimental trawls (without the BRD candidate installed) must be included to

determine if any net bias exists prior to beginning certification phase testing. To further reduce problems caused by no or low catches, a tow being considered for certification in the western Gulf must contain a minimum catch of 5 red snapper in at least one trawl for inclusion in the analysis. Once conducted, the tow and the corresponding collected data become the permanent part of the record and cannot be discarded. Only the successful tows will count toward the minimum required; however, information from other tows, if appropriate, will be used in the analysis.

#### Statistical Approach for Calculation of Bycatch Mortality (F) Reduction for Devices Tested in July/August

The statistical approach assumes that the BRD to be tested does not achieve the minimum required reduction rate, ( $R_o$ ). The hypotheses to be tested are as follows:

$H_o$ : BRD does not achieve the minimum required reduction rate,

$$R = \frac{\mu_c - \mu_b}{\mu_c} \leq R_o, \text{ i.e. } (1 - R_o) \mu_c - \mu_b \leq 0.$$

$H_a$ : BRD does achieve the minimum required reduction rate,

$$R = \frac{\mu_c - \mu_b}{\mu_c} > R_o, \text{ i.e. } (1 - R_o) \mu_c - \mu_b > 0.$$

R denotes the actual reduction rate (unknown),  $R_o$  denotes the minimum required reduction rate,  $\mu_c$  denotes the actual mean CPUE with the control, and  $\mu_b$  denotes the actual mean CPUE with the BRD.

With any hypothesis testing, there are two risks involved known as type I error (rejection of true  $H_o$ ) and type II error (acceptance of false  $H_o$ ). The probabilities of committing these errors are denoted by alpha and beta, respectively. The probabilities are inversely related to each other. As alpha increases, beta decreases and vice versa. An alpha of 10 percent will be used. The two hypotheses are tested using a "modified" paired t-test.

The CPUE values for the control and BRD trawls for each successful tow is computed first and is used in the following computations:

$$t = \frac{(1 - R_o) \bar{x} - \bar{y}}{s_{d0} / \sqrt{n}}$$

Where:

$\bar{x}$  the observed mean CPUE for the control,  
 $\bar{y}$  is the observed mean CPUE for the BRD,

$s_{d0}$  is the standard deviation of  $d_i = \{(1 - R_o)x_i - Y_i\}$  values,  
 n is the number of successful tows used in the analysis, and  
 $i = 1, 2, \dots, n$ .

The  $H_o$  will be rejected if  $t > t_{\alpha, n-1}$  where  $t_{\alpha, n-1}$  denotes the  $(1-\alpha)100$ th percentile score in the t distribution with  $(n-1)$  degrees of freedom.

A  $(1-\alpha)$  100-percent two-sided confidence interval on R consists of all values of  $R_o$  for which  $H_o: R = R_o$  (versus  $H_a: R \neq R_o$ ) cannot be rejected at the level of significance of alpha. One-sided confidence intervals on R could also be computed appropriately.

#### Appendix I—Qualifications of Observer

An observer:

1. Must have a Bachelor's degree in fisheries biology or closely related field from an accredited college, have at least 6 months experience working with a university, college, state fisheries agency, NMFS, or private research organization such as the Gulf and South Atlantic Fisheries Development Foundation as an observer on a trawler (including research trawlers) in the southeast region, or have successfully completed a

training course conducted or approved by the Director of the NMFS Southeast Fisheries Science Center.

2. Must not have a current or prior financial relationship with the entity seeking BRD certification. In addition, any individual:

1. Applying to serve as an observer must provide the names, addresses, and telephone numbers of at least three references who can attest to the applicant's background, experiences, and professional ability. These references will be contacted; unsatisfactory references may be a basis for disapproval of an applicant as an observer.

2. Wishing to serve as an observer should submit a resume and supporting documents to the Director, Southeast Fisheries Science Center, 75 Virginia Beach Drive, Miami, FL 33149. The Center will use this information to determine which names will be included on a list of qualified observers. If an applicant is not approved as an observer, the RA will notify the applicant of the disapproval and will provide an explanation for the denial.

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