

## SEDAR-15A-DW-10

### Visual Census Surveys at Riley's Hump, Tortugas South Ecological Reserve.

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Visual census transects were begun in 2001 on Riley's Hump to enumerate snapper-grouper species and determine the effect of enactment of the Ecological Reserve on what were perceived to be overexploited stocks of snapper-grouper species. Our primary concern was mutton snapper, since Riley's Hump was the site of a historically large spawning aggregation, and anecdotal accounts from fishermen of harvest of mutton snapper from Riley's Hump during the summer spawning months were of catches in excess of 10,000 lbs of fish per vessel for a four-day trip in the heyday of the aggregation (late 1970s/early 1980s).

We selected 10 initial stations on Riley's Hump, an approximately 2 x 2 mile area in the northeast corner of the Tortugas South Ecological Reserve, by transiting the immediate area in a NOAA vessel and identifying hard bottom areas of diveable depth using the ship's depth recorder and color scope. Four more stations were added in 2002 with input provided from the commercial fisherman whose vessel we chartered for our dive work.

Sampling procedure consists of dropping a diver descent line on the GPS numbers for the station. Certainty of starting at the same point each time is good, since we have deployed temperature loggers at three different stations, and have been able to retrieve them from year to year with little difficulty. Once the dive team of two divers reach the bottom, they swim a pre-determined random number of fin kicks on a predetermined compass course, and then start from there to swim out a 30 m transect tape another random compass course, identifying and counting all snapper-grouper species they see. After completing the transect they swim the tape back in the starting point, obtaining a measure of visibility on the way. They then swim a second random number of fin kicks on another random compass course, from which point they will deploy the tape on a random compass transect course. This is done until bottom time is up. Dive teams are usually able to complete between two and four replicate transects per dive (average probably 3).

All stations are sampled within the course of a given summer, and most if not all of the stations are able to be sampled multiple times.

#### Modeling Methods and Results

A delta-lognormal modeling approach (Lo *et al.*, 1992) was employed in order to develop standardized indices of annual average CPUE (number per area surveyed) for mutton snapper. This index is a mathematical combination of yearly CPUE estimates from two distinct generalized linear models: a binomial (logistic) model, which describes proportion of positive CPUEs (i.e., presence/absence) and lognormal model, which describes variability in only the nonzero CPUE data. The GLMMIX and MIXED procedures in SAS were employed to provide yearly index values for both the binomial and lognormal sub-models, respectively. The parameters tested for inclusion in each sub-model were survey year, station nested within month, and replicate nested within station. The year variable was considered fixed, while the nested

variables (i.e., station nested within month and replicate nested within station) were considered random. Also, separate covariance structures were developed for each survey year. For the binomial sub-models, a logistic-type mixed model was employed. Both sub-models converged. The binomial converged while including all variables, and the lognormal sub-model converged while including year and station nested within month variables. Residual analyses indicated that the models sufficiently fit the data (Figures 1 – 2). The annual indices show a general increase over time (Figure 3).

### **Literature Cited**

Lo, N. C. H., L.D. Jacobson, and J.L. Squire. 1992. Indices of relative abundance from fish spotter data based on delta-lognormal models. *Can. J. Fish. Aquat. Sci.* 49: 2515-1526.

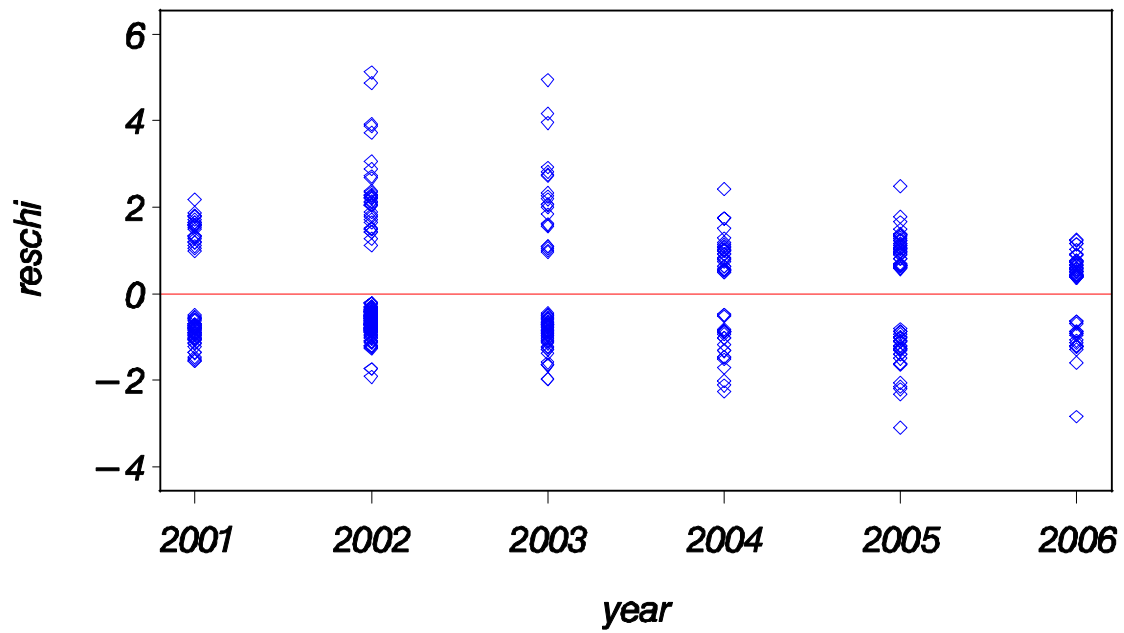


Figure 1. Residual plot for binomial sub-model.

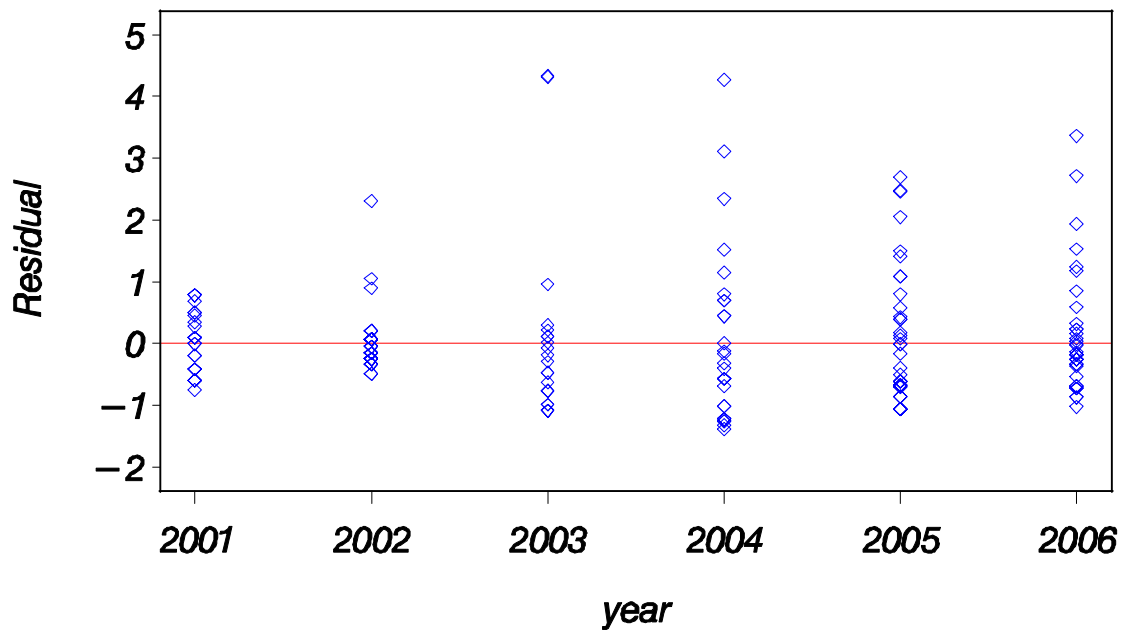
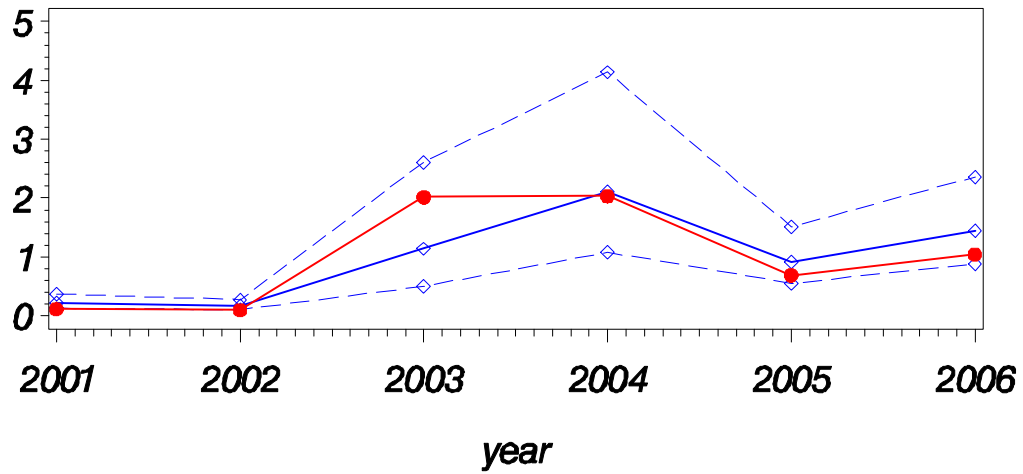


Figure 2. Residual plot for lognormal sub-model.



<i>Survey</i>							
<i>Year</i>	<i>Nominal Frequency</i>	<i>N</i>	<i>Delta-lognormal Index</i>	<i>Scaled Index</i>	<i>CV</i>	<i>Scaled LCL</i>	<i>Scaled UCL</i>
2001	0.36508	63	0.35060	0.21974	0.27170	0.12885	0.37472
2002	0.21212	165	0.26678	0.16720	0.24783	0.10261	0.27246
2003	0.31884	69	1.82359	1.14291	0.43112	0.50048	2.60998
2004	0.56000	50	3.37482	2.11513	0.34560	1.08039	4.14089
2005	0.57813	64	1.45573	0.91236	0.25603	0.55119	1.51020
2006	0.67308	52	2.30187	1.44267	0.25024	0.88126	2.36171

Figure 3. Annual abundance indices for mutton snapper. Delta-lognormal model results and 95% C.I. in blue. Nominal means in red.