SCDNR Charterboat Logbook Program Data, 1993 – 2010

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SEDAR25-DW23

(replaces SEDAR25-DW16)

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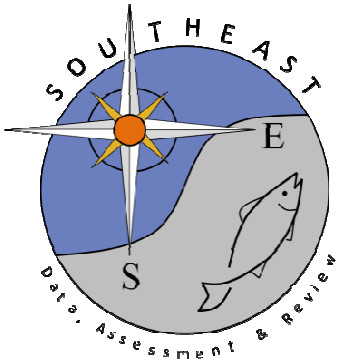

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Date: 4/29/2011
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For: SEDAR 25 Black Seabass Data Workshop, April 2011

NOTE:
This working paper replaces and reflects substantial changes made to the original working paper SEDAR25-DW16. These changes were made based on discussions at the SEDAR 25 data workshop. This working paper contains the data and index that were discussed and considered at the data workshop.

Abstract:
An index of abundance was developed for the South Carolina Department of Natural Resources (SCDNR) charterboat logbook program for 1993-2010. The index of abundance is standardized catch per unit effort (CPUE; catch per angler hour) of black seabass (BSB) using a delta-GLM model. Three explanatory variables were used in the delta-GLM model (year, locale, and season). The analysis is meant to describe the population trends of fish caught by V1 (6-pack) charter vessels operating in or off of South Carolina.

Background:
The South Carolina Department of Natural Resources (SCDNR) issues three types of charter vessel licenses: V1 (vessels carrying six or fewer passengers), V2 (vessels carrying 7 to 49 passengers), and V3 (vessels carrying 50 or more passengers). In 1993, SCDNR's Marine Resources Division (MRD) initiated a mandatory logbook reporting system for all charter vessels to collect basic catch and effort data. Under state law, vessel owners/operators purchasing South Carolina Charter Vessel Licenses (V1, V2, or V3) and carrying fishermen on a for-hire basis are required to submit trip level reports of their fishing activity in waters off of SC. Logbook reports are submitted by mail or fax to the SCDNR Fisheries Statistics section monthly. Reporting compliance is tracked by staff, and charter vessel owners/operators failing to submit reports can be charged with a misdemeanor. The charter boat logbook program is a complete census and should theoretically represent the total catch and effort of the charter boat trips in waters off of SC.

Logbook Data:
The charter logbook reports include: date, number of fishermen, fishing locale (inshore, 0-3 miles, >3miles), fishing location (based on a 10x10 mile grid map), fishing method, hours fished, target species, and catch (number of landed and released fish by species) per vessel per trip. The logbook forms have remained similar throughout the program's existence with a few exceptions: in 1999 the logbook forms were altered to begin collecting the number of fish released alive and the number of fish released dead (prior to 1999 only the total number of fish released were recorded) and in 2008 additional fishing methods were added to the logbook forms, including 4) cast, 5) cast and bottom, and 6) gig.

After being tracked for compliance each V1 charterboat logbook report is coded and entered into an existing Access database. (V2 and V3 charterboat logbook reports are tracked for compliance but are currently not coded and entered electronically.) Since the inception of the program, a variety of staff have coded the charterboat logbook data. From ~1999 to 2006, only information that was explicitly filled out by the charterboat owners/operators on the logbook forms was coded and entered into the database. No efforts were made to fill in incomplete reports. From 2007 to the present, staff have tried to fill in incomplete trip reports through conversations with charterboat owners/operators and by

making assumptions based on the submitted data (i.e. if a location description was given instead of a grid location – a grid location was determined, if fishing method was left blank – it was determined based on catch, etc.). From 1999 to 2006 each individual trip record was reviewed to look for anomalies in the data. Starting in 2007 queries were used to look for and correct anomalous data and staff began checking a component of the database records against the raw logbook reports. Coding and QA/QC measures prior to 1999 were likely similar to those used from 1999 to the present. However, details on these procedures were not available since staff members working on this project prior to 1998 are no longer with the SCDNR. Data are not validated in the field and currently no correction factors are used to account for reporting errors. Recall periods for logbook records are typically one month or less. However, in the case of delinquent reports recall periods could be up to several months.

Methods:

SCDNR charterboat logbook vessel trips included in this analysis represent fishing trips in nearshore (0-3 miles) and offshore (3+ miles) waters where at least one of a suite of bottom fishes (likely, or even possibly, to occur in association with black seabass) were caught using hook and line.

The CPUE for black seabass was standardized using a delta generalized linear model (GLM) approach. All analyses were conducted in R, based primarily on code adapted from Dick (2004). A delta GLM model was chosen due to the significant amount of zeros in the CPUE data. A delta model has 2 components to it. First, the probability of a positive catch is modeled. Then the positive catch rates are modeled separately. Finally, the two are multiplied together to get the predicted CPUE (Dick 2004, Li et al. 2011, Siquan et al. 2009, and Yu In press)

$$\widehat{CPUE} = \hat{d}\ x\ \hat{q}$$

Where $\widehat{CPUE}$ is the standardized CPUE, $\hat{d}$ is the predicted catch rate of the positive catches, and $\hat{q}$ is the probability of a positive catch. We used a GLM for each of these models. The models were built assuming a log normal distribution. The model of the positive catch rates used was:

$$ln(\hat{d}) = \beta_0 + \sum_{i=1} \beta_i X_i$$

Where β_0 is the intercept and β_i is the coefficient for the i^{th} explanatory variable X_i. The probability of a positive catch was modeled as:

$$ln\left(\frac{\hat{q}}{1-\hat{q}}\right) = \alpha_0 + \sum_{i=1} \alpha_i X_i$$

Where α_0 is the intercept and α_i is the coefficient for the i^{th} explanatory variable X_i.

There were 3 explanatory variables used in this modeling approach. They were the year (1993-2010), the locale of the catch (nearshore and offshore), and the season (winter, spring, summer, and fall). For locale, nearshore was considered for all trips that occurred in waters from 0-3 miles and offshore for waters >3 miles. For the seasons, winter was considered for all trips occurring from Dec. to Feb., spring from Mar. to May, summer from June to Aug., and fall from Sept. to Nov.

Results:

The SCDNR charterboat logbook data represent 20,661 fishing trips in which anglers caught 554,586 black seabass and harvested 250,076 black seabass. Summarized catch and effort data are presented in Table 1. The index is presented in Table 2 and Figure 1. Diagnostics suggest a good fit for the Lognormal GLM of the positive catch (Figure 2, 3, 4, and 5), while the Binomial GLM of the positive catch did not fit the data as well (Figure 6, 7, 8, and 9). The Binomial GLM showed many of the residuals being skewed to the positive for many of the factors.

Literature Cited:

Dick, E.J. 2004. Beyond 'lognormal versus gamma': discrimination among error distributions for generalized linear models. Fisheries Research 70:351-366.

Li, Y., Jiao, Y., He, Q. 2011. Decreasing uncertainty in catch rate analyses using Delta-AdaBoost: An alternative approach in catch and bycatch analyses with high percentage of zeros. Fisheries Research 107: 261-271.

Siquan, T., Xinjun, C.,Yong, C., Liuxiong, X., Xiaojie, D. 2009. Standardizing CPUE of *Ommastrephes bartramii* for Chinese squid-jigging fishery in Northwest Pacific Ocean. Chinese Journal of Oceanology and Limnology 27 (4): 729-739.

Yu, Hao. In press. Catch rate standardization of yellow perch in Lake Erie: a comparison of the spatial generalized linear model and generalized additive model. Transactions of the American Fisheries Society.

Table 1. Annual black seabass catch, harvest, and effort from SCDNR Charterboat Logbook Program, 1993-2010.

Year	Vessel Trips	Black Seabass Catch (# fish)	Black Seabass Harvest (# fish)	% Vessel Trips With BSB Catch
1993	896	15,055	10,237	43.86%
1994	984	19,755	13,677	51.32%
1995	801	15,255	9,968	50.44%
1996	987	28,536	18,975	59.17%
1997	960	25,083	16,151	65.42%
1998	1,165	23,608	14,906	64.29%
1999	1,140	21,235	12,578	64.56%
2000	1,307	26,478	13,209	63.81%
2001	1,283	32,023	16,292	69.29%
2002	1,173	30,047	15,517	70.33%
2003	1,156	31,012	17,339	69.55%
2004	1,188	32,676	17,155	82.83%
2005	1,258	35,496	15,654	81.56%
2006	1,331	40,018	16,835	80.24%
2007	1,381	35,260	10,003	76.32%
2008	1,328	51,803	11,701	78.69%
2009	1,082	31,966	6,805	69.59%
2010	1,241	50,280	13,074	76.71%

Table 2. Black seabass catch per unit effort (catch per angler hour).

Year	Nominal CPUE	Standardized CPUE	SE	CV
1993	1.2330	0.9838	0.0756	0.0768
1994	1.4527	1.1377	0.0770	0.0677
1995	1.0479	0.9353	0.0683	0.0731
1996	1.8130	1.3558	0.0848	0.0625
1997	1.5792	1.5713	0.0867	0.0552
1998	1.3534	1.2664	0.0665	0.0525
1999	1.1867	1.1679	0.0591	0.0506
2000	1.2860	1.3381	0.0640	0.0479
2001	1.4585	1.4461	0.0658	0.0455
2002	1.6701	1.5787	0.0764	0.0484
2003	1.5722	1.6119	0.0740	0.0459
2004	1.7706	1.8100	0.0716	0.0395

2005	1.9484	1.8771	0.0776	0.0413
2006	2.0412	1.9831	0.0794	0.0401
2007	1.7019	1.6331	0.0653	0.0400
2008	2.4110	2.2592	0.0933	0.0413
2009	1.8381	1.8905	0.0889	0.0470
2010	2.2239	2.4407	0.0987	0.0405

Figure 1. Black Seabass CPUE from SC DNR 6-pack Charterboat Logbook data from 1993-2010. Nominal (blue) and Standardized (red) catch per angler-hour are shown with the dotted line showing 1 standard error from the Standardized CPUE.

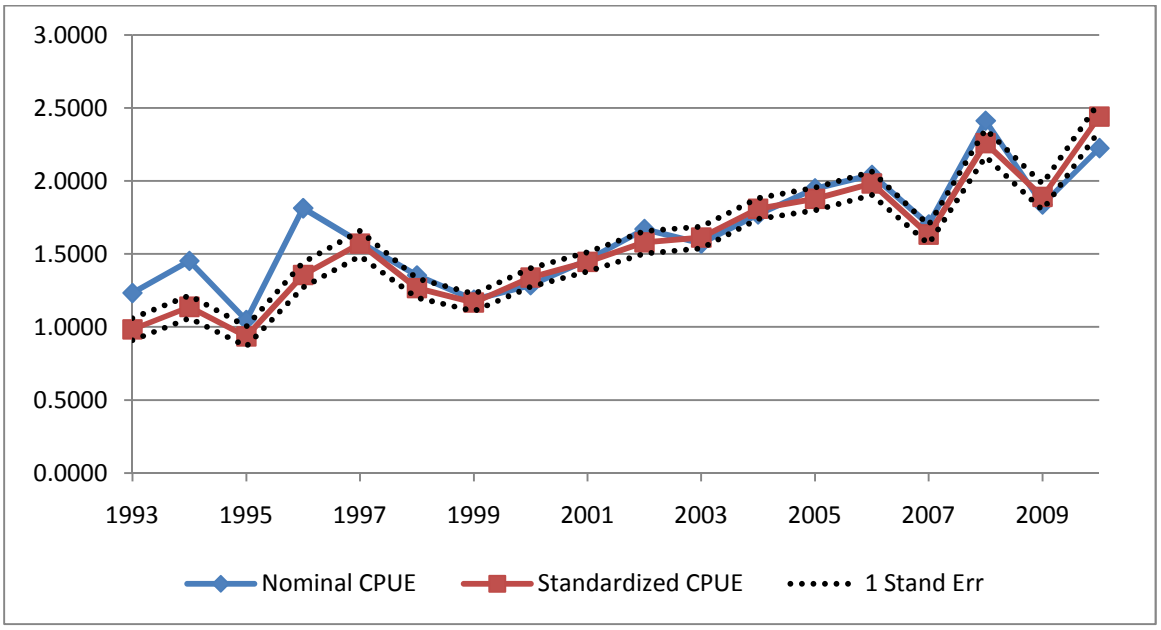

Figure 2. Residuals plotted against the predicted values for the Lognormal GLM of the positive values.

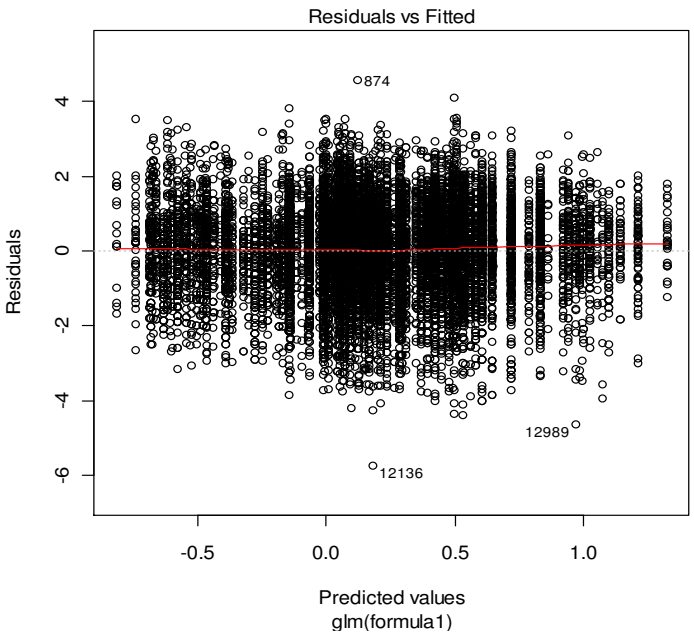

Figure 3. Residuals for the nearshore and offshore components of the Lognormal GLM of the positive values.

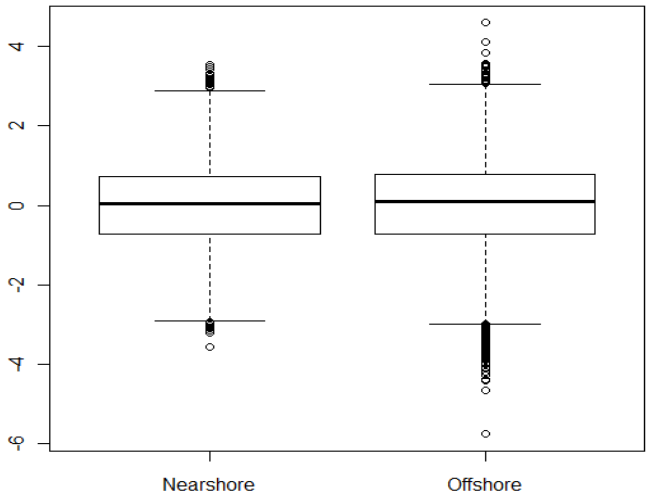

Figure 4. Residuals for the seasonal component of the Lognormal GLM of the positive values.

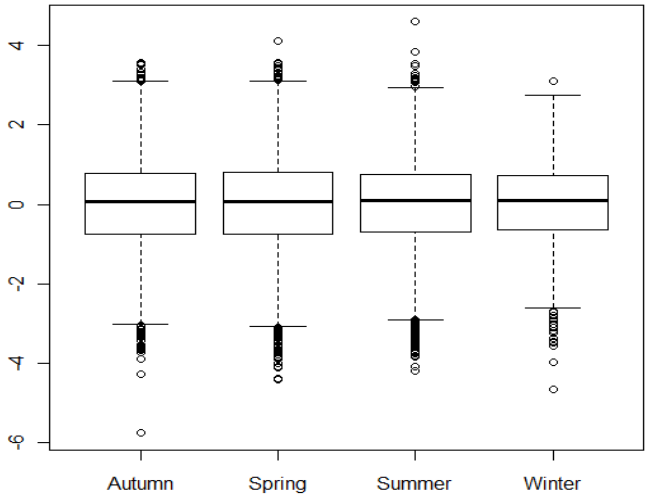

Figure 5. Residuals plotted against year for the Lognormal GLM of the positive values.

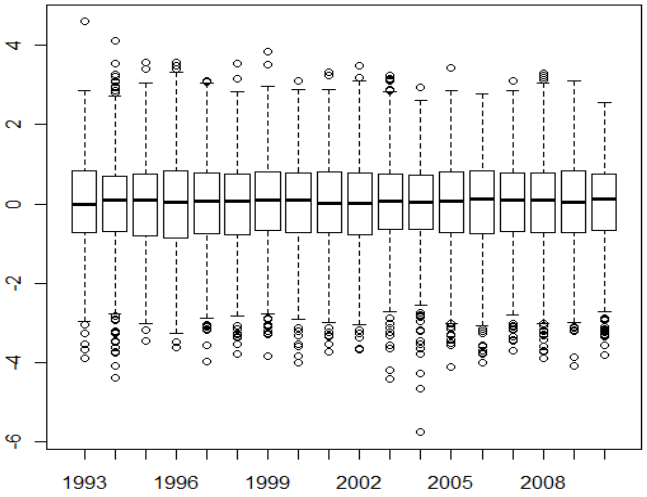

Figure 6. Residuals plotted against the predicted values for the Binomial GLM for the probability of a positive catch.

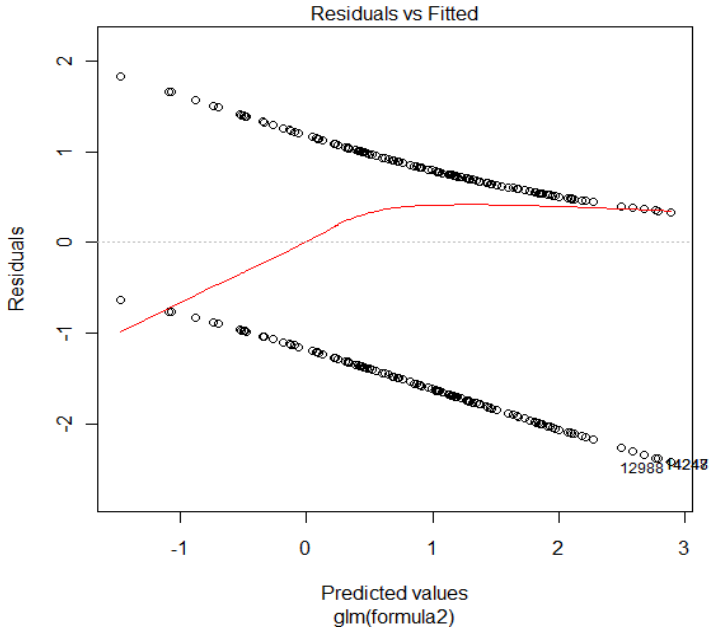

Figure 7. Residuals for the nearshore and offshore components of the Binomial GLM for the probability of a positive catch.

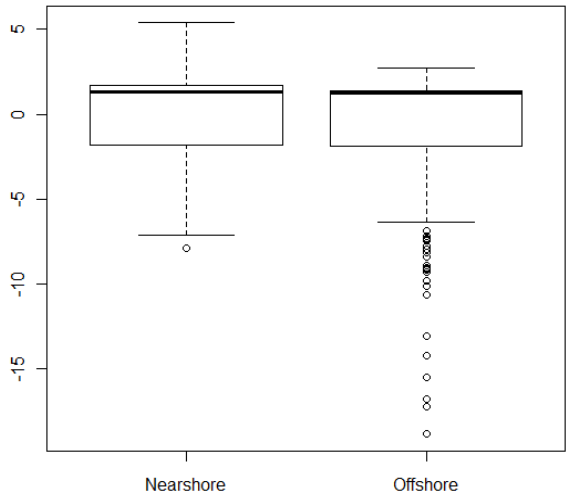

Figure 8. Residuals for the seasonal component of the Binomial GLM for the probability of a positive catch.

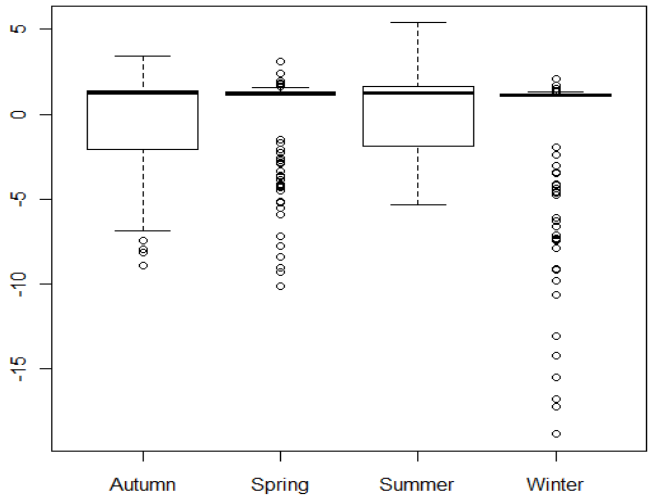

Figure 9. Residuals plotted against year for the Binomial GLM for the probability of a positive catch.