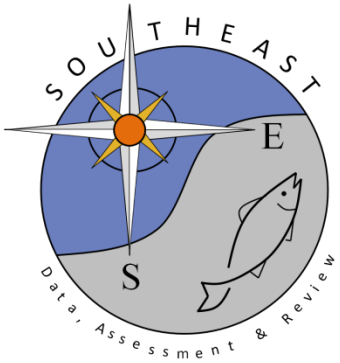
Standardized Catch-Per-Unit Effort Index for Gulf of Mexico Gray Snapper *Lutjanus griseus* Commercial Handline Fishery (1993 – 2015)

Matthew W. Smith

SEDAR51-DW-12

26 April 2017



Please cite this document as:

Smith, M.W. 2017. Standardized Catch-Per-Unit Effort Index for Gulf of Mexico Gray Snapper *Lutjanus griseus* Commercial Handline Fishery (1993 – 2015). SEDAR51-DW-12. SEDAR, North Charleston, SC. 6 pp.

Standardized Catch-Per-Unit Effort Index for Gulf of Mexico Gray Snapper *Lutjanus griseus* Commercial Handline Fishery (1993 – 2015)

Matthew W. Smith

24 April 2017

Data:

- National Marine Fisheries Service (NMFS) Gulf of Mexico (GoM) reef fish logbook data set
  - (1993 – 2015)
- Data subsetting (trips excluded):
  - Used any gear other than handline or electric reel
  - Multiple areas fished
  - Appearance of misreporting (e.g., zero hours fished)
  - Duplicate entry of a single trip
  - Incomplete in any way
  - Contained missing values for any of the independent variables
  - Trip occurred in an area where gray snapper are unlikely to be found (i.e., trip flagged using Stephens and MacCall, 2004 methodology).
- Prior to index standardization factors (other than year) were grouped into deterministic variables with a pre-determined number of discrete levels (Table 1).
- Effort was calculated as the number of hours a line soaked multiplied by the number of lines set per trip and the number of hooks per line (hook-hours).
- CPUE was calculated as the pounds of fish caught divided by effort expended.

Analysis:

- A single index was calculated for data collected from the entire Gulf of Mexico as well as the statistical areas that encompass Monroe County.
- Variables other than *Year* were included in the model based on the results of a forward stepwise regression analysis with a reduction in residual deviance of 1% or greater used as the criteria for inclusion in the model.
- Variable *Year* was forced to be in all models regardless of deviance reduction
- Two-way interaction terms were then investigated among each of the significant factors using the same stepwise approach.
- Variable selection was conducted separately for the proportion of positive trips and the log(CPUE) models.
- A two-step delta-lognormal generalized linear model (GLM; Lo et al., 1992) was used to standardize the indices.
- All variables and interactions were modeled as fixed effects.
- Interactions involving year were excluded from the model.

Results: Species Associates

- 68,418 of 251,723 possible trips (27%) were retained after implementing Stephens and MacCall trip selection (SM; Figure 1) procedure.
- The probability threshold for inclusion of a trip was equal to 0.34 (Figure 1).
- Prior to SM the proportion of trips catching gray snapper equaled 25% and after it increased to 50%

Results: Standardized Indices

- The binomial model significant variables were: *year, area, away*.
- The binomial model significant interactions were: *area*away*.
  - The log(CPUE) model significant variables were : *year, area, hook hours, season*.
- The log(CPUE) model significant interactions were: area*hook_hours, area*season
- The standardized index is essentially flat throughout the timeseries with the most recent years of the index indicating a slightly increasing abundance of gray snapper in the Gulf of Mexico (Figure 2). Annual CV's associated with the index are low ranging between 5% and 9%. It is recommended that during the assessment process the CV's for the commercial index be scaled to a common value shared by the other fishery dependent and independent indices. This will ensure that other indices, which typically have higher annual estimated CV's, will contribute to the overall picture of gray snapper abundance.

LITERATURE CITED

Lo, N.C., Jacobson, L.D., and Squire, J.L. 1992. Indices of relative abundance from fish spotter data based on delta-lognormal models. *Can. J. Fish. Aquat. Sci.* 49: 2515-2526.

Stephens, A., and MacCall, A. 2004. A multispecies approach to subsetting logbook data for purposes of estimating CPUE. *Fish. Res.* 70: 299-310.

TABLES and FIGURES

Table 1: Levels and values for the variables investigated for inclusion in the index standardization model.

Factor	Levels	Values
Year	23	1993 - 2015
Season	4	Jan-Mar, Apr-Jun, Jul-Sep, Oct-Dec
Area	5	1 (Monroe Cty), 2-6, 7, 8, 9-21
Days away from port	10	1, 2, 3, 4, 5, 6, 7, 8, 9, 10+
Crew Size	5	1, 2, 3, 4, 5+
Hook Hours	11	0 - 1000+ by 100
Red Snapper IFQ	6	0 (IFQ didn't exist); 1 (No IFQ); 2 (< 500); 3 (501 – 1,000); 4 (1,001 – 5,000); 5 (5000+)

Table 2: Commercial handline fishery standardized index of abundance for Gray Snapper in the Gulf of Mexico

Year	ALL TRIPS	PPOS	STDCPUE	CV
1993	1884	0.54	0.88	0.08
1994	2270	0.53	1.13	0.07
1995	2560	0.49	0.92	0.07
1996	2018	0.54	0.92	0.07
1997	2744	0.52	1.10	0.07
1998	2721	0.49	1.03	0.07
1999	3366	0.51	1.28	0.06
2000	4120	0.48	0.98	0.06
2001	4487	0.51	1.15	0.06
2002	4779	0.55	1.25	0.05
2003	4750	0.50	0.95	0.06
2004	4618	0.49	0.99	0.06
2005	3689	0.50	1.09	0.06
2006	3139	0.53	1.14	0.06
2007	2963	0.46	1.00	0.07
2008	2986	0.44	0.82	0.07
2009	2935	0.48	0.90	0.07
2010	1765	0.48	0.80	0.08
2011	1758	0.48	0.82	0.09
2012	1820	0.51	0.96	0.08
2013	1606	0.51	0.86	0.08
2014	1909	0.57	0.98	0.07
2015	1954	0.63	1.05	0.07

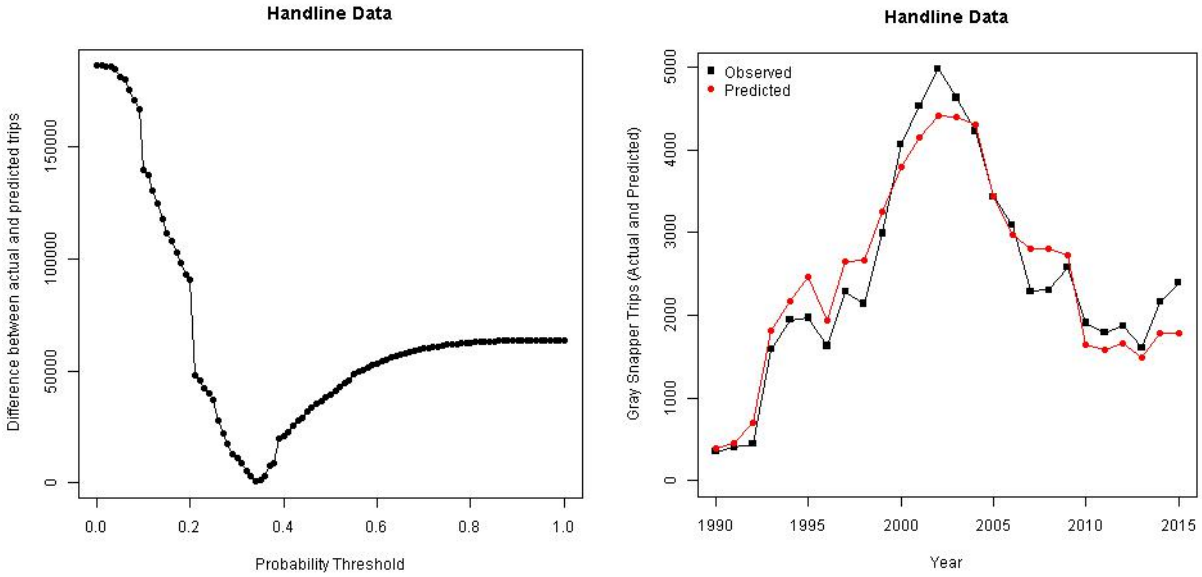


Figure 1: Stephens and MacCall diagnostic plots for Gray Snapper from the commercial handline fishery in the Gulf of Mexico

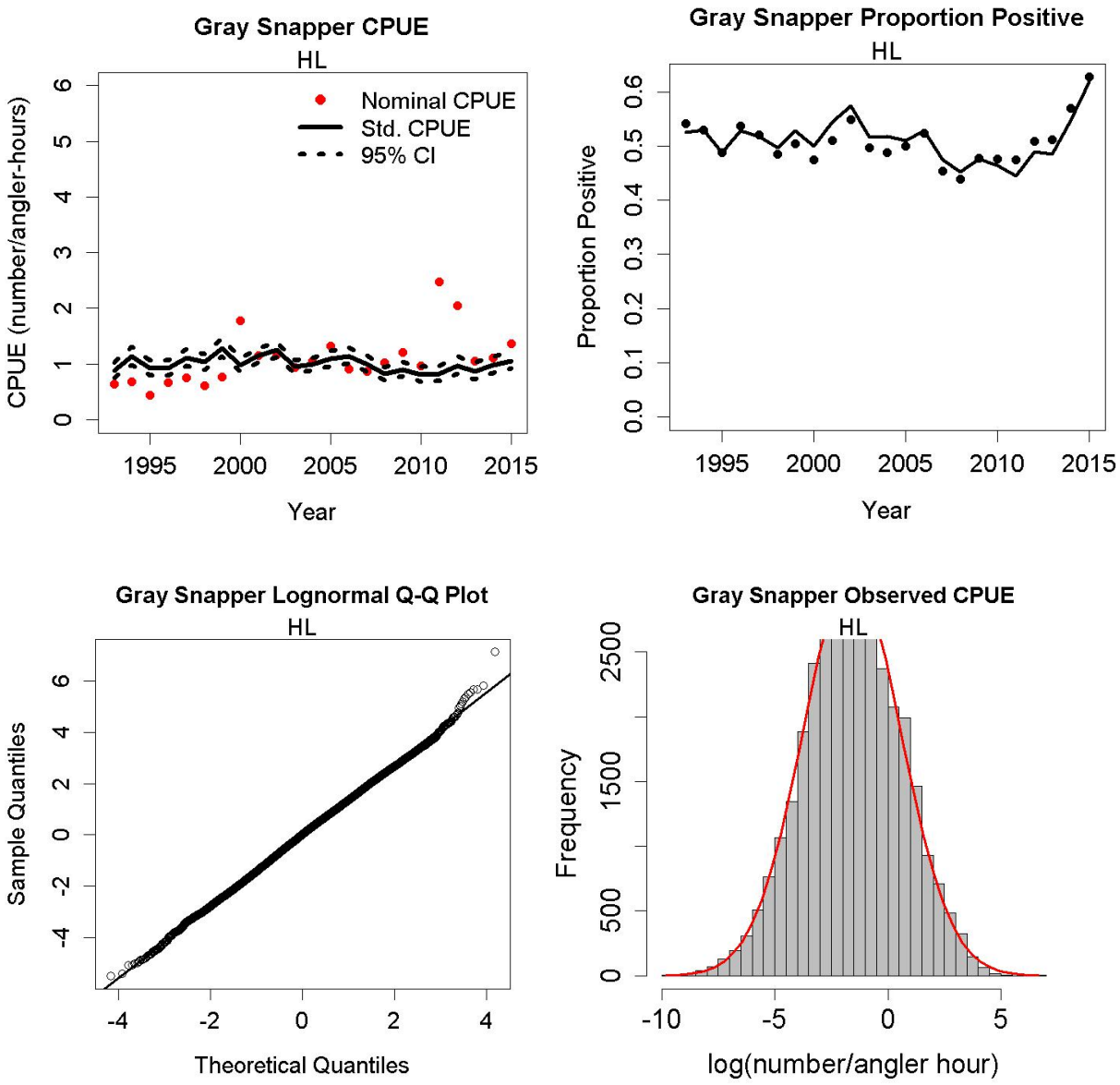


Figure 2: Index standardization diagnostic plots for Gray Snapper from the commercial handline fishery in the Gulf of Mexico.