Updated catch per unit abundance indices for silk and queen snapper from the commercial fisheries in Puerto Rico

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Introduction

Abundance indices for silk and queen snapper commercial fisheries in Puerto Rico were previously presented by Cummings (Unpublished Document, SEDAR Procedures III 2009). This document presents updated information on silk and queen snapper abundances through 2009. Background information relating to the commercial fisheries in Puerto Rico was presented by Cummings and Matos-Caraballo (SEDAR Procedures III, SP3) and Cummings and Matos-Carabbaloo (SEDAR26 DW-03) and Suarez-Caabro, (1975).

Data and Methods

Fisheries statistics data exist since about 1967 for Puerto Rico's commercial fisheries however, information is available electronically for stock assessment evaluations only from 1983-2007. Sales records documenting landed weight by fishing center (Figure 1) and some ancillary trip effort information were obtained through voluntary reports by fishers until 2005 when reporting became mandatory through Puerto Rico Law 278 of November 29th, 1998. Since that time, commercial fishers have been required to submit landings reports to the Puerto Rico, Department of Natural Resources and Environment (DNER). During many of the early years, landings reports were accomplished through the efforts of port agents to pick up the sales tickets. Attributes available for the Puerto Rican commercial fisheries statistics data are presented in Table 1.

Landings Records Trip Selection Base Case Runs

Queen Snapper

During the SEDAR 26 Data Workshop, the Puerto Rico platform Working Group reviewed DW03 and made recommendations for trip selection for use in catch per unit of effort (CPUE) abundance analyses. The Working Group recommended considering the following stratification in subsequent exploration of the commercial landings data for development of queen snapper catch per unit of effort abundance indices. The summarized landings data indicate two primary gears of importance in the fishery (reeffish bottom line gear and troll gear) during the entire time series, 1983-2009. The Working group recommended using trips from the bottom line gear only as this is the gear primarily used to target Queen Snapper.. Previous examinations of queen snapper abundance indices (Cummings and Matos-Caraballo, 2009) presented indices for combined gears and combined spatial areas. Prior to further index development, detailed examination of the area and gear specific and monthly observations were reviewed by the group and deemed sufficient for CPUE analyses. The queen snapper fishery is mainly conducted off the west coast of Puerto Rico corresponding to municipalities between Cabo Rojo and Aguadilla. Table 2 presents trip selection sub-criteria relating to year, area (fishing center, municipality), and gear selection.

In addition to the Base case data set, the Working Group suggested an alternative procedure for sub setting the landings data records using a fractional proportion that queen snapper contributed to each catch. Fractional cutoff levels of 10%, 25% and 50% were discussed.

Silk Snapper

As with Queen Snapper, the Puerto Rico platform Working Group reviewed DW03 and made recommendations for trip selection for use in catch per unit of effort abundance analyses (CPUE). The

summarized landings data indicate two primary gears of importance in the fishery (reeffish handlines and fish pots) over the entire time series, 1983-2009. Separate time series were deemed important for each of these primary gears as differences in gear selectivity were considered very likely. The Working Group reviewed detailed summaries by year, month, and and spatial area (fishing center/municipality/coast) and considered the data sufficient for analyses using CPUE index standardization techniques (ANOVAs, GLM, etc.). Previous examinations of silk snapper abundance indices (Cummings and Matos-Caraballo, 2009) presented indices for each of these gear groups, however observations were combined over areas of landings (e.g, fishing center). Table 2 presents trip selection sub-criteria relating to year, area (fishing center, municipality), and gear selection.

As with Queen Snapper data selection, the Puerto Rico Catch Statistics Working Group suggested an alternative procedure for sub setting the landings data records using a fractional proportion that silk snapper contributed to each catch. Fractional cutoff levels of 10%, 25% and 50% were recommended.

Model Fitting

For each data set evaluated, standardized CPUE indices were developed using the delta-lognormal modeling approach (Lo et al. 1992). This method applies a lognormal model to the positive CPUE observations and a binomial (logistic) model to the proportion of successful (positive) observations and combines the two to obtain a yearly abundance index. For each separate data set, the delta model was applied to obtain estimates of Queen or Silk Snapper yearly abundance. Parameter estimates were obtained using the SAS GLIMMIX and MIXED procedures in SAS (v. 9.2, 2004) to develop the binomial and lognormal sub models. Similar covariates were included in both sub models: Year, Municipality (proxy for fishing area) and Month. Factor (covariate) significance was evaluated using Type 3 residual analysis and overall performance was assessed from residual analysis graphics. Residuals by year were plotted and reviewed and QQ plots of the residuals against a normal distribution were plotted.

Updated CPUE Abundance Indices Results

Queen Snapper

Table 3 and Figure 2 provides updated summary of commercial landings in Puerto Rico since 1983 for the three SEDAR26 focus species (queen, snapper, silk snapper, and parrotfish). Table 4 provides the percentage breakdown of all species reported landings by gear category for all years for Queen Snapper.

Queen Snapper Fishery Standardized CPUE Base Model Results

Table 5 and 6 present type 3 tests of factor effects for the Queen Snapper fishery Base run. All fixed factors included in the model (Year, Municipality code, month, and gear) were significant. Table 7 presents standardized CPUE for Queen Snapper Base run. Figures 3 and 4 presents nominal CPUE and observed proportion of positives for the Base Run. The proportion of positives was very low, about 1-2% during the first 2-3 years of the fishery, and then increased only moderately to around 4% through about 2004. After 2002, the proportion of positives, increased again but again only moderately, ranging from 8-17%. The trend of proportion of positives over time, suggests that over the time series for which landings reports are available, that possibly the targeting behavior for queen snapper changed throughout the 23 year time period. During the first 16 years of the time series, 1987-2002, the proportion of positives was very low (1-2%) and though doubling during the next 7 years, remained <20% of all the trips. Model fits were further evaluated from graphical review. Figures 5 and 6 present plotted residual distribution of

expected CPUE and proportional of positives for the lognormal and binomial model fits. Figure 7 presents QQ plots for the Figure 8 presents standardized CPUE, 95% confidence intervals, and nominal CPUE for the Queen Snapper fishery. Estimated delta lognormal standardized Queen Snapper CPUE varies without trend until about 2000 and thereafter shows a steady increase. This point in time also corresponds to the increase in proportion of positives of queen snapper in the bottom line and troll catches, suggesting possibly a change in targeting.

Queen Snapper Alternative CPUE Models using 10% and 20% Trip Weight Selection Criterion

Fit results for the two alternative CPUE runs considering 10% and 50% trip landing weights as cutoff criteria for trip selection were also considered. Tabled results of the two lognormal fits are presented in Tables 8 and 9 and graphical results in Figures 9 and 10. Estimated lognormal Queen Snapper CPUE was similar for both cutoff cases (10%, 50% trip landing cutoff levels), suggesting only a slight increase in lognormal CPUE over the 22 year time period.

Silk Snapper

Table 3 and Figure 2 provides updated summary of commercial landings in Puerto Rico since 1983 for the three SEDAR26 focus species (queen, snapper, silk snapper, and parrotfish Table 10 provides the percentage breakdown of all species reported landings by gear category for all years for Silk snapper. On average throughout the time period, handline landings accounted for approximately 70-80% of the silk snapper landings. Fish pot accounted for on average 20%-30%. The SEDAR26 DW Panel recommended beginning the silk snapper CPUE analyses with 1988 as previous SEDAR stock assessment evaluations considered this the first year where reliable species identification probably occurs in the landings reports.

Silk Snapper Handline Fishery Standardized CPUE Base Model Results

Tables 11 and 12 present Type 3 tests of fixed factors for the binomial and lognormal models respectively the silk snapper handline base run. Figures 11 and 12 present the nominal CPUE and proportion of positives for the silk snapper handline base run. Figure 13, 14, and 5 present graphical results of the lognormal and binomial model fits and the QQ plot for the lognormal fit. The final silk handline fishery binomial model included germs for year, municipality code and gear. Month was not significant in model and thus was dropped. The final lognormal model included factors for year, municipality code and month; gear was excluded from the model as it was not significant.

Table 13 and Figure 16 presents standardized CPUE, upper and lower 95% confidence intervals and nominal CPUE for the silk snapper handline fishery base run. Standardized delta-lognormal silk snapper handline CPUE was variable without trend between 1988 and 1994, declined thereafter through 1996, then steadily declined through 2000, and has remained stable since about 2000.

Silk Snapper Alternative CPUE Models using 10% and 50% Trip Weight Selection Criterion

Fit results for two alternative CPUE runs that considered a 10% and 50% trip landing weights as the cutoff criteria for trip selection were also considered. Tabled results of the lognormal fit for the 10% trip landing weight cutoff run are presented in Tables 14 and 15 and graphical results in Figures 17 and 18.

The estimated trends for the two alternative runs were similar. The estimated lognormal trend in standardized CPUE for silk snapper from the handline fishery was also similar to the delta lognormal estimated trend. CPUE was variable without trend between 1988 and 1995, declined precipitously through 1998 and has remained stable since 1999.

Silk Snapper Fish Pot Fishery Standardized CPUE Base Model Results

Throughout the time period, fish pots represented on average from 20-30% of the silk snapper removals. Tables 16 and 17 present Type 3 tests of fixed factors for the binomial and lognormal models respectively the silk snapper handline base run. Figures 19 and 20 present the nominal CPUE and proportion of positives for the silk snapper handline base run. Figure 21, 22, and 23 present graphical results of the lognormal and binomial model fits and the QQ plot for the lognormal fit.

Table 18 and Figure 24 presents standardized CPUE, upper and lower 95% confidence intervals and nominal CPUE for the silk snapper handline fishery base run. Standardized delta-lognormal silk snapper handline CPUE was variable without trend between 1988 and 1994, declined thereafter through 1996, then steadily declined through 2000, and has remained stable since about 2000.

Silk Snapper Alternative CPUE Models using 10% Trip Weight Selection Criterion

Fit results for the one alternative CPUE runs considering a 10% landing weights as the cutoff criteria for trip selection were also considered. Tabled results of the lognormal fit for the 10% trip landing weight cutoff run are presented in Table 19 and graphical results in Figures 25. The estimated lognormal trend in standardized CPUE for silk snapper from the fish pot fishery for the 10% trip landing weight cutoff run was similar to the delta lognormal estimated trend. CPUE declined from 1988-991, increased through slightly through 19995, then declined through 2004, and again increased thereafter.

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Table 1. Data attributes available for the commercial fisheries landings records in Puerto Rico.

Data Attribute	**Availability**	**How to use**	**Notes**
Landings	1983-2007	Quantify level of removals	Consistent through time series
Trip Effort and units of gear measures (# hours fished, # pots, etc, # lines0)	1998	1. CPUE analyses, 2. Changes in trip effort over time spatially 3. Changes in trip units of gear over time	1. Not always entered 2. further work necessary to determine quantity of effort data on the landings records (i.e., number trip records, etc..)
Depth of fishing trip	1998+	1. Investigate inshore / offshore movement of fleet 2. For 2008 and after can link to biostatistical record and examine species size distribution vs depth	Frequency of entry is not high
Fisherman identification code	1983-2007	Link fisher trips	Not unique across years
Unique Trip identification	2003-2007	Link unique trips, linking began in 2003	
Computer generated trip id	1983-2002	Link unique trips	Problems in generating unique trip, dealer composite trips exist
Gear id	1983-2007	CPUE by fishery	Multiple gears occur on some trips, some result of dealer composite reports
Length samples per trip	2008 forward	Size composition of individual trips	Linking variable added to biostatistical form in 2008
Correction factors	1983-2007, some represent an interval of years, available annually, Per Daniel Matos- may be available on a region level	Expansion of reported landings to total	1. Only exist at annul level 2. Some estimates represent span of years due
Length frequency	1980-2007	1. Characterize size composition of catches 2. evaluate changes in size with depth, from 2008 on	1. Cannot link to individual landings records until 2008

Table 2. SEDAR26 Puerto Rico Platform Commercial Fishery Statistics Working Group Recommendations for CPUE abundance data selection and analyses. Recommendations for starting year, gears included, and geographical areas (i.e., municipalities) used in CPUE standardization.

	Gear				
Species	**Handline**	**Fishpots**	**Gillnet**	**Trammel Net**	**Dive**
Silk Snapper (with vermilion snapper, blackfin snapper, and black snapper)	Start Year = 1983+ Gear = 104 + 112 + 113 + 105 Fishing Centers = 01 + 02 + 03 + 05 + 06 + 12 + 13 + 15 + 16 + 18 + 20 + 21 + 22 + 25 + 28 + 29 + 32 + 33 + 35 + 36 + 37 + 38 + 39 + 40 + 41 + 42	Start Year = 1983+ Gear = 101 Fishing Centers = 01 + 05 + 06 + 08 + 09 + 10 + 12 + 13 + 14 + 15 + 16 + 18 + 20 + 22 + 23 + 25 + 28 + 32 + 36 + 37 + 38 + 39 + 40 + 41 + 42			
Queen Snapper (with cardinal snapper)	Start Year = 1987+ Gear = 104 + 105 Fishing Centers = 01 + 05 + 06 + 12 + 13 + 15 + 16 + 28 + 32 + 35 + 36 + 37 + 38 + 39 + 40 + 41 + 42				
Parrotfish		Start Year = 1983+ Gear = 101 Fishing Centers = 18 + 19 + 20 + 21 + 22 + 23 + 24 + 25 + 27 + 28 + 29 + 31 + 36 + 37	Start Year = 1988+ Gear = 103 Fishing Centers = 23 + 27 + 35 + 36 + 37	Start Year = 1988+ Gear = 118 Fishing Centers = 23 + 27 + 35 + 36 + 37	Start Year = 1997+ Gear = 110 + 114 + 115 + 116 + 119 Fishing Centers = 14 + 18 + 19 + 20 + 21 + 24 + 25 + 27 + 33 + 34 + 35 + 36 + 37 + 38 + 40

Table 3. Reported commercial landings of silk and queen snapper and parrotfish group in Puerto Rico 1983-2009, SEDAR26 focus species. Preliminary information. Data presented = number reported landings observations (N) and reported pounds (whole weight). Landings are reported (not expanded).

	Queen snapper		Silk snapper		Parrotfishes	
Year	#Reports	Pounds	# Reports	Pounds	#Reports	Pounds
1983	.	.	3,860	396,343	2,677	233,579
1984	.	.	2,713	357,156	1,698	231,387
1985	.	.	2,403	371,827	2,105	221,378
1986	.	.	2,664	356,899	1,763	105,546
1987	38	4,379	2,659	207,063	1,370	76,854
1988	209	14,763	2,232	170,034	265	12,208
1989	214	15,405	2,988	245,961	71	4,279
1990	220	11,390	2,303	176,884	470	36,849
1991	451	17,780	3,242	167,230	914	68,059
1992	492	25,285	3,004	207,966	1,134	91,932
1993	555	32,346	3,075	244,065	1,171	160,187
1994	496	27,765	3,826	338,852	1,549	115,750
1995	581	34,138	4,595	363,300	2,017	79,881
1996	575	36,685	4,340	311,324	2,547	102,799
1997	560	38,778	4,051	285,787	2,713	110,944
1998	567	46,073	3,779	209,384	2,433	97,503
1999	699	66,695	3,601	224,818	2,403	80,547
2000	761	82,869	3,493	188,270	3,054	74,041
2001	906	102,138	5,029	266,851	3,665	96,762
2002	838	110,061	4,637	198,148	3,172	107,485
2003	1,584	127,015	4,921	170,012	3,277	69,229
2004	1,068	79,553	3,634	118,997	2,488	51,152
2005	1,376	156,755	2,883	110,525	1,644	31,157
2006	1,032	102,889	2,291	83,399	1,792	31,922
2007	1,125	111,130	1,709	68,364	1,858	33,742
2008	1,290	137,292	2,185	108,634	1,740	28,134
2009	1,088	110,275	1,852	83,360	1,969	28,353
All Years	16,725	1,491,459	87,969	6,031,453	51,959	2,381,659

Table 4. Reported percentage composition of Queen Snapper commercial landings by gear category, 1983-2009. Shaded column denotes primary gear.

	GEAR						
	Cast Nets	***Diving Outfits, Other***	***Gill Nets, Other***	***Haul Seines, Long***	***Lines Hand, Other***	***Lines Long, Reef Fish***	***Lines Troll, Other***
YEAR	0.5				**76.6**		
1987							
1988		1.5	0.8		**88.2**		**9.0**
1989		0.2	0.4		**82.2**	**11.6**	**4.5**
1990		3.5			**90.7**	**1.6**	**0.4**
1991		1.2	0.3		**96.3**	**0.7**	**0.3**
1992	0.0	0.2	0.0		**88.2**		
1993	0.0		0.2	1.3	**86.3**		**0.6**
1994	0.1	0.5	0.1	0.2	**88.7**	**0.9**	**2.1**
1995	0.2	0.1			**92.2**	**0.3**	**1.1**
1996		1.2	1.6		**83.9**		**1.1**
1997	0.1	0.7	1.3	0.3	**89.4**	**5.0**	**0.7**
1998		1.2	0.3	2.0	**68.5**	**24.4**	**1.9**
1999	0.1	0.7			**80.7**	**15.6**	**0.9**
2000	0.1	0.4	0.1		**36.1**	**60.0**	**2.8**
2001	0.5	0.2	3.2	0.1	**77.4**	**10.1**	**5.8**
2002		5.9	0.3		**88.2**	**0.6**	**2.4**
2003			0.2	0.1	**96.8**	**0.5**	**1.6**
2004			0.1		**97.4**	**0.3**	**1.8**
2005			0.0	0.0	**79.7**	**0.0**	**20.1**
2006			0.0		**82.6**		**16.9**
2007	0.0		0.3		**96.4**	**0.2**	**2.6**
2008		2.0	0.5	0.1	**95.7**	**0.0**	**1.7**
2009		0.6	0.1		**94.7**	**0.0**	**4.4**
All	0.1	0.9	0.5	0.1	**85.3**	**5.9**	**5.3**

Table 4. (Continued). Reported percentage composition of queen snapper commercial landings by gear category, 1983-2009. Shaded column denotes primary gear.

	GEAR					All
	Pots And Traps, Fish	Pots And Traps, Spiny Lobster	Rod and Reel	Spears	Trammel Nets	
YEAR	22.9					100.0
1987						
1988	0.5			0.0		100.0
1989	1.1					100.0
1990	3.8					100.0
1991	1.3					100.0
1992	11.4				0.2	100.0
1993	10.0				1.6	100.0
1994	7.4					100.0
1995	6.0					100.0
1996	12.1				0.1	100.0
1997	2.5	0.1			0.1	100.0
1998	1.6		0.0			100.0
1999	2.1					100.0
2000	0.5		0.0			100.0
2001	2.7					100.0
2002	2.6				0.0	100.0
2003	0.8					100.0
2004	0.4					100.0
2005	0.1					100.0
2006	0.5					100.0
2007	0.4					100.0
2008	0.1					100.0
2009	0.0		0.1			100.0
All	1.9	0.0	0.0	0.0	0.0	100.0

Table 5. Type 3 Tests for Factor Effects for binomial mode Queen Snapper Base Mode.l.

Type 3 Tests of Fixed Effects						
Effect	*Num DF*	*Den DF*	*Chi-Square*	*F Value*	*Pr > ChiSq*	*Pr > F*
Year	21	11E3	252.70	12.03	<.0001	<.0001
municipality_code	16	11E3	2406.16	150.38	<.0001	<.0001
Month	11	11E3	37.71	3.43	<.0001	<.0001
PR_GEAR_CODE	1	11E3	21.68	21.68	<.0001	<.0001

Table 6. Type 3 Test of Factors for lognormal fit to positive observations for Queen Snapper Base Model

Type 3 Tests of Fixed Effects						
Effect	*Num DF*	*Den DF*	*Chi-Square*	*F Value*	*Pr > ChiSq*	*Pr > F*
Year	21	6160	242.02	11.52	<.0001	<.0001
municipality_code	16	6160	4395.10	274.69	<.0001	<.0001
Month	11	6160	23.09	2.10	0.0172	0.0173
PR_GEAR_CODE	1	6160	391.52	391.52	<.0001	<.0001

Table 7. Queen Snapper Base Model Standardized CPUE Results. STDCPUE, LCI, UCI, and obcpue = standardized index, lower and upper 95% Confidence Intervals, and nominal CPUE.

YEAR	Standard Error	obcpue	obppos	nobs	cv_i	MEANINDEX	STDCPUE	LCI	UCI	estcpue	obscpue
1988	0.2105	1.7679	0.02658	5605	0.21425	1.04583	0.93957	0.61505	1.43529	0.98262	0.29123
1989	0.09143	1.0358	0.02274	6639	0.21599	1.04583	0.40474	0.26406	0.62037	0.42329	0.17064
1990	0.07915	0.368	0.00625	2720	0.57192	1.04583	0.13233	0.04567	0.38348	0.1384	0.06062
1991	0.07628	0.5373	0.0176	3864	0.29515	1.04583	0.24714	0.13865	0.44052	0.25846	0.0885
1992	0.1496	2.647	0.06002	3482	0.19514	1.04583	0.73298	0.49794	1.07896	0.76656	0.43605
1993	0.1683	3.5579	0.07601	4447	0.16765	1.04583	0.95981	0.68799	1.33904	1.0038	0.5861
1994	0.1761	2.366	0.04973	6716	0.15677	1.04583	1.07406	0.78647	1.46681	1.12328	0.38975
1995	0.07848	1.324	0.02269	10136	0.1816	1.04583	0.41325	0.28824	0.59247	0.43219	0.2181
1996	0.1141	1.8722	0.03599	10613	0.14982	1.04583	0.72849	0.54077	0.98137	0.76187	0.30841
1997	0.1289	1.9023	0.02626	10813	0.16123	1.04583	0.76473	0.55509	1.05354	0.79977	0.31337
1998	0.1885	1.8253	0.02854	6166	0.19248	1.04583	0.93634	0.63939	1.37122	0.97925	0.30069
1999	0.1965	2.4266	0.03745	6034	0.17607	1.04583	1.06729	0.75251	1.51375	1.1162	0.39973
2000	0.1244	1.4181	0.02389	8122	0.18842	1.04583	0.63144	0.4346	0.91742	0.66037	0.23361
2001	0.1516	4.3708	0.03866	9285	0.15335	1.04583	0.94503	0.69666	1.28195	0.98834	0.72001
2002	0.1545	8.2308	0.04676	8576	0.15144	1.04583	0.97573	0.722	1.31864	1.02045	1.35586
2003	0.1262	10.2602	0.11438	10483	0.12222	1.04583	0.98766	0.77418	1.26001	1.03293	1.69018
2004	0.1379	8.4668	0.09897	8619	0.12772	1.04583	1.03222	0.80036	1.33126	1.07952	1.39474
2005	0.2513	17.2005	0.14095	8301	0.11918	1.04583	2.01577	1.58959	2.55622	2.10814	2.83344
2006	0.2475	12.9914	0.12506	6709	0.13073	1.04583	1.81022	1.39528	2.34857	1.89318	2.14007
2007	0.255	13.7191	0.13248	7465	0.12272	1.04583	1.9869	1.55591	2.53729	2.07795	2.25996
2008	0.2097	18.4581	0.16815	7071	0.12553	1.04583	1.59706	1.24369	2.05083	1.67024	3.04061
2009	0.2242	16.8052	0.15766	6330	0.13257	1.04583	1.61722	1.24199	2.10582	1.69133	2.76833

Table 8. Standardized CPUE, Upper and Lower 95% CI intervals and Nominal CPUE for Queen Snapper Fishery lognormal model fit for the 10% queen snapper cutoff trip weight case.

YEAR	Standard Error	obcpue	obppos	nobs	cv_i	MEANINDEX	STDCPUE	LCI	UCI	estcpue	obscpue
1988	5.2036	67.575	1	146	0.08093	53.2226	1.20803	1.02777	1.41991	64.2947	0.85361
1989	3.2954	46.291	1	148	0.07866	53.2226	0.78718	0.67276	0.92106	41.8958	0.58474
1990	10.7431	58.882	1	17	0.20706	53.2226	0.97483	0.64709	1.46858	51.8832	0.7438
1991	3.8825	31.348	1	66	0.11122	53.2226	0.65592	0.52547	0.81876	34.9096	0.39599
1992	2.6049	44.878	1	205	0.06943	53.2226	0.70496	0.61366	0.80983	37.5196	0.5669
1993	2.6044	49.065	1	321	0.06304	53.2226	0.77617	0.68431	0.88037	41.3098	0.61979
1994	2.8788	48.36	1	328	0.05849	53.2226	0.92483	0.82282	1.03949	49.2219	0.61088
1995	3.2643	58.982	1	227	0.065	53.2226	0.94366	0.82875	1.07451	50.2243	0.74507
1996	2.6689	52.332	1	379	0.05581	53.2226	0.89847	0.80365	1.00449	47.8191	0.66106
1997	3.5843	73.798	1	277	0.06073	53.2226	1.10899	0.98227	1.25207	59.0235	0.93221
1998	3.825	64.143	1	175	0.07203	53.2226	0.99774	0.86404	1.15213	53.1022	0.81025
1999	3.3289	65.761	1	222	0.06616	53.2226	0.94537	0.82832	1.07896	50.3151	0.8307
2000	3.7773	59.653	1	193	0.0702	53.2226	1.01097	0.8787	1.16317	53.8067	0.75354
2001	3.3354	114.071	1	353	0.05485	53.2226	1.14253	1.02391	1.2749	60.8085	1.44094
2002	3.2413	178.018	1	396	0.05277	53.2226	1.15407	1.03856	1.28244	61.4228	2.24872
2003	2.0344	90.186	1	1190	0.04151	53.2226	0.92094	0.84761	1.00062	49.0151	1.13923
2004	2.1168	86.026	1	848	0.04272	53.2226	0.9309	0.8547	1.01391	49.5451	1.08668
2005	2.7183	122.241	1	1168	0.04021	53.2226	1.27029	1.17218	1.37662	67.6084	1.54414
2006	2.7867	105.803	1	822	0.04323	53.2226	1.21114	1.11087	1.32047	64.4602	1.3365
2007	2.4493	104.688	1	976	0.04139	53.2226	1.1118	1.0235	1.20771	59.1729	1.32241
2008	2.4857	111.607	1	1166	0.04172	53.2226	1.11948	1.02989	1.21685	59.5814	1.40982
2009	2.7354	107.899	1	985	0.04277	53.2226	1.20169	1.10322	1.30896	63.9573	1.36299

Table 9. Standardized CPUE, Upper and Lower 95% CI intervals and Nominal CPUE for Queen Snapper Fishery lognormal model fit for the 50% queen snapper cutoff trip weight case.

YEAR	Standard Error	obcpue	obppos	nobs	cv_i	MEANINDEX	STDCPUE	LCI	UCI	estcpue	obscpue
1988	5.6834	64.3672	1	128	0.08637	63.25957768	1.040231	0.87549	1.23597	65.8046	0.73576
1989	3.9284	49.8769	1	130	0.08393	63.25957768	0.739874	0.62573	0.87485	46.8041	0.57013
1990	9.6430	59.0667	1	15	0.20988	63.25957768	0.726284	0.47947	1.10014	45.9444	0.67518
1991	3.8213	32.75	1	60	0.1141	63.25957768	0.529407	0.4217	0.66463	33.4901	0.37436
1992	3.8080	54.56	1	150	0.07921	63.25957768	0.759969	0.64879	0.8902	48.0753	0.62366
1993	3.7708	59.9916	1	239	0.07171	63.25957768	0.831207	0.72028	0.95922	52.5818	0.68575
1994	3.5866	50.88	1	275	0.06618	63.25957768	0.856745	0.75064	0.97784	54.1973	0.5816
1995	3.7538	61.8812	1	202	0.07032	63.25957768	0.843868	0.73328	0.97113	53.3827	0.70735
1996	3.2504	55.4062	1	325	0.06305	63.25957768	0.814976	0.71852	0.92438	51.5551	0.63333
1997	4.3539	78.5697	1	244	0.06706	63.25957768	1.026347	0.89766	1.17348	64.9263	0.89811
1998	4.1806	63.1395	1	129	0.08295	63.25957768	0.796698	0.6751	0.9402	50.3988	0.72173
1999	3.9919	51.8539	1	178	0.07433	63.25957768	0.848988	0.73186	0.98486	53.7066	0.59273
2000	5.7941	70.7829	1	129	0.08344	63.25957768	1.097724	0.92928	1.2967	69.4416	0.8091
2001	5.7145	141.696	1	230	0.0674	63.25957768	1.340236	1.17139	1.53341	84.7827	1.61969
2002	5.2815	223.834	1	302	0.06203	63.25957768	1.346051	1.18916	1.52365	85.1506	2.55859
2003	3.1699	98.8139	1	1037	0.05122	63.25957768	0.978345	0.88315	1.0838	61.8897	1.12952
2004	3.3062	96.0907	1	717	0.05176	63.25957768	1.009768	0.91053	1.11982	63.8775	1.09839
2005	4.1135	130.372	1	1051	0.04932	63.25957768	1.318321	1.19455	1.45492	83.3965	1.49025
2006	4.6125	119.273	1	578	0.05415	63.25957768	1.346595	1.20848	1.50049	85.1851	1.36338
2007	3.8403	116.996	1	737	0.05204	63.25957768	1.166458	1.05122	1.29432	73.7896	1.33735
2008	4.2631	128.543	1	860	0.05198	63.25957768	1.29658	1.16865	1.43851	82.0211	1.46934
2009	4.2120	115.891	1	872	0.0518	63.25957768	1.285329	1.15891	1.42554	81.3094	1.32472

Table 10. Percentage composition of commercial silk snapper landings by gear.

	GEAR							
	Cast Nets	***Combined Gears***	***Diving Outfits, Other***	***Gill Nets, Other***	***Haul Seines, Beach***	***Haul Seines, Long***	***Lines Hand, Other***	***Lines Long, Reef Fish***
YEAR	0.0		0.1	0.6	0.2	0.3	**25.0**	0.1
1983								
1984			0.2	0.6	0.2	0.2	**22.4**	
1985	0.0		0.5	0.8	0.1	0.3	**61.5**	0.1
1986	0.0		0.2	0.5	0.0	0.1	**88.0**	0.2
1987	0.1		0.3	0.5	0.0		**78.4**	1.3
1988	0.1		0.1	0.4		0.1	**83.1**	0.1
1989	0.0		0.0	0.6		0.0	**80.6**	0.6
1990			0.5	0.1		0.1	**80.3**	0.7
1991	0.1		0.4	0.2	0.0	0.0	**74.5**	0.4
1992	0.1		0.4	0.4		0.2	**73.2**	0.1
1993	0.2		0.3	0.1	0.0	0.0	**77.0**	0.2
1994	0.0		0.3	0.2		0.5	**77.6**	0.1
1995	0.2		0.3	0.4	0.0	0.1	**83.8**	0.1
1996	0.0		0.4	0.1	0.0	0.0	**83.9**	0.2
1997	0.0		0.4	0.2	0.0	0.1	**83.3**	0.6
1998	0.0		1.5	0.5		0.2	**69.0**	3.9
1999	0.0		0.3	0.5		0.0	**74.0**	1.3
2000			0.7	0.2			**58.7**	10.7
2001	0.2		0.5	0.5		0.1	**58.0**	1.5
2002	0.1		2.1	0.5		0.2	**70.5**	1.7
2003			0.5	0.2		0.1	**67.8**	0.5
2004			1.4	0.1		0.9	**79.5**	0.2
2005			4.0	0.1		0.3	**80.4**	0.2
2006			1.9	0.0		0.7	**83.2**	0.0
2007			1.6				**89.6**	0.1
2008	0.0		5.6	2.2			**83.9**	0.4
2009		0.1	6.2	1.5			**59.6**	0.1
All	0.1	0.0	0.7	0.4	0.0	0.2	**69.4**	0.9

Table 10. (Continued). Percentage silk snapper commercial landings by gear category.

	GEAR							All
	Lines Troll, Other	Pots And Traps, Crab, Other	Pots And Traps, Fish	Pots And Traps, Spiny Lobster	Rod and Reel	Spears	Trammel Nets	
YEAR	0.2		**73.4**					100.0
1983								
1984	0.1		**76.3**			0.0		100.0
1985	0.2		**36.5**	0.0				100.0
1986	0.3		**10.8**					100.0
1987	0.5	0.0	**18.8**					100.0
1988	0.8		**15.0**			0.3		100.0
1989	0.9		**15.8**			0.4	0.9	100.0
1990	1.4		**16.9**			0.0		100.0
1991	0.8		**23.5**				0.0	100.0
1992	0.1		**25.5**					100.0
1993	0.1		**22.1**					100.0
1994	1.1	0.0	**20.2**	0.1			0.0	100.0
1995	0.9		**14.1**	0.0	0.0	0.0	0.0	100.0
1996	0.7	0.0	**14.6**				0.0	100.0
1997	1.7		**13.6**	0.0	0.0		0.0	100.0
1998	2.4	0.0	**22.6**	0.0				100.0
1999	0.6		**23.1**				0.2	100.0
2000	0.6		**29.1**	0.0				100.0
2001	1.9		**37.2**		0.0		0.0	100.0
2002	1.7		**23.3**					100.0
2003	0.4		**30.4**	0.0			0.0	100.0
2004	1.1		**16.8**					100.0
2005	5.5		**9.4**				0.1	100.0
2006	3.9		**9.6**				0.6	100.0
2007	2.5		**6.1**	0.0			0.1	100.0
2008	2.3	0.0	**5.4**		0.1		0.0	100.0
2009	8.8		**7.2**				16.4	100.0
All	1.1	0.0	**27.0**	0.0	0.0	0.0	0.3	100.0

Table 11. Type 3 Tests for Factor Effects for the lognormal model Silk Snapper Handline Fishery Run

Type 3 Tests of Fixed Effects						
Effect	*Num DF*	*Den DF*	*Chi-Square*	*F Value*	*Pr > ChiSq*	*Pr > F*
Year	21	35E3	233.48	11.12	<.0001	<.0001
municipality_code	24	35E3	15519.1	646.63	<.0001	<.0001
Month	11	35E3	36.77	3.34	0.0001	0.0001

Table 12. Type 3 Tests for Factor Effects for the binomial model Silk Snapper Handline Fishery Run.

Type 3 Tests of Fixed Effects						
Effect	*Num DF*	*Den DF*	*Chi-Square*	*F Value*	*Pr > ChiSq*	*Pr > F*
Year	21	1034	10.70	0.51	0.9684	0.9676
municipality_code	24	1034	750.91	31.29	<.0001	<.0001
PR_GEAR_CODE	3	1034	409.29	136.43	<.0001	<.0001

Table 13. Silk Snapper Handline Fishery Base Model Standardized CPUE Results. STDCPUE, LCI, UCI, and obcpue = standardized index, lower and upper 95% Confidence Intervals, and nominal CPUE.

YEAR	Standard Error	obcpue	obppos	nobs	cv_i	MEANINDEX	STDCPUE	LCI	UCI	estcpue	obscpue
1988	0.4508	15.31689	0.171774	6526	0.077577	6.234501	0.932169	0.798386	1.088369	5.811607	1.321372
1989	0.4183	20.57794	0.20615	7480	0.066731	6.234501	1.005357	0.879879	1.148728	6.267896	1.775238
1990	0.8735	15.47449	0.150752	3058	0.114522	6.234501	1.22344	0.97372	1.537203	7.627539	1.334969
1991	0.5248	9.594536	0.14961	4612	0.097691	6.234501	0.86172	0.709111	1.047173	5.372393	0.827711
1992	0.6902	18.52337	0.2124	4129	0.086342	6.234501	1.282253	1.079237	1.523458	7.994206	1.597992
1993	0.4801	15.94713	0.167693	5844	0.081968	6.234501	0.939484	0.797649	1.106539	5.857213	1.375742
1994	0.4826	19.78484	0.198506	8166	0.064013	6.234501	1.209331	1.064146	1.374325	7.539578	1.706818
1995	0.3334	16.39671	0.17539	12629	0.055522	6.234501	0.963301	0.862131	1.076344	6.005702	1.414527
1996	0.3319	11.56139	0.182142	12902	0.054876	6.234501	0.970195	0.86942	1.082649	6.048679	0.997389
1997	0.3333	12.66999	0.178349	13154	0.054752	6.234501	0.976357	0.87516	1.089256	6.087102	1.093027
1998	0.3744	7.402687	0.162067	8262	0.070298	6.234501	0.854215	0.742306	0.982997	5.325607	0.638622
1999	0.3700	7.071689	0.152913	8495	0.071333	6.234501	0.831889	0.721414	0.959282	5.186414	0.610067
2000	0.2908	6.186542	0.147319	10759	0.065456	6.234501	0.712519	0.625177	0.812064	4.4422	0.533707
2001	0.3250	8.43254	0.181662	12815	0.054872	6.234501	0.950028	0.851355	1.060137	5.92295	0.727467
2002	0.3197	7.2327	0.179214	11835	0.056542	6.234501	0.906842	0.809951	1.015323	5.653706	0.623958
2003	0.2960	7.304172	0.199547	12368	0.053909	6.234501	0.880806	0.790842	0.981005	5.491387	0.630123
2004	0.3589	8.146056	0.207463	10585	0.055851	6.234501	1.030798	0.921933	1.152518	6.426511	0.702752
2005	0.3626	7.734368	0.192384	10635	0.058412	6.234501	0.995787	0.886081	1.119076	6.208237	0.667236
2006	0.4474	8.708468	0.208966	8030	0.062931	6.234501	1.140235	1.005513	1.293008	7.108799	0.751271
2007	0.4436	9.640311	0.201108	6678	0.070328	6.234501	1.011747	0.879146	1.164348	6.307738	0.83166
2008	0.5352	12.55673	0.233084	6813	0.065563	6.234501	1.309324	1.148578	1.492566	8.16298	1.083256
2009	0.4741	8.752825	0.209865	5575	0.075131	6.234501	1.012203	0.871167	1.176071	6.310579	0.755097

Table 14. Standardized CPUE, Upper and Lower 95% CI intervals and Nominal CPUE for Silk Snapper Handline Fishery lognormal model fit for the 10% silk snapper cutoff trip landing weight case.

YEAR	Standard Error	obcpue	obppos	nobs	cv_i	MEANINDEX	STDCPUE	LCI	UCI	estcpue	obscpue
1988	1.1467	91.06301	1	1095	0.029081	36.9174	1.068106	1.007768	1.132058	39.43172	1.409493
1989	0.9212	101.2475	1	1519	0.025099	36.9174	0.994172	0.945505	1.045344	36.70224	1.567131
1990	1.9729	104.1388	1	454	0.043606	36.9174	1.225558	1.123249	1.337187	45.24443	1.611882
1991	1.2933	65.0324	1	679	0.03626	36.9174	0.966113	0.898551	1.038754	35.66636	1.006586
1992	1.3782	89.16023	1	855	0.032655	36.9174	1.143246	1.070985	1.220383	42.20569	1.380041
1993	1.1399	98.8754	1	939	0.030983	36.9174	0.996589	0.936723	1.060281	36.79149	1.530415
1994	0.9860	101.3145	1	1593	0.024393	36.9174	1.094924	1.042798	1.149657	40.42177	1.568168
1995	0.7220	94.77075	1	2181	0.021063	36.9174	0.928465	0.890169	0.968408	34.27651	1.466882
1996	0.7224	64.62234	1	2301	0.02083	36.9174	0.939429	0.9011	0.979388	34.68126	1.000238
1997	0.7759	72.80491	1	2281	0.020891	36.9174	1.006042	0.964878	1.048964	37.14047	1.12689
1998	0.8924	46.42399	1	1309	0.026514	36.9174	0.911669	0.864592	0.961309	33.65644	0.71856
1999	0.9451	47.79137	1	1251	0.027118	36.9174	0.944047	0.894218	0.996652	34.85175	0.739725
2000	0.7696	42.98572	1	1541	0.024707	36.9174	0.843782	0.803107	0.886518	31.15024	0.665342
2001	0.7419	47.6768	1	2237	0.021179	36.9174	0.948835	0.909488	0.989884	35.02852	0.737952
2002	0.7176	41.10939	1	2066	0.021496	36.9174	0.904271	0.866222	0.943991	33.38333	0.6363
2003	0.6692	37.9428	1	2360	0.02052	36.9174	0.883354	0.847838	0.920358	32.61114	0.587287
2004	0.7556	40.2394	1	2122	0.021497	36.9174	0.952111	0.912049	0.993934	35.14947	0.622834
2005	0.8230	40.69509	1	2017	0.022126	36.9174	1.00758	0.963969	1.053164	37.19723	0.629887
2006	1.0135	43.83227	1	1568	0.024823	36.9174	1.105948	1.052391	1.16223	40.82873	0.678445
2007	1.0478	50.5327	1	1254	0.027073	36.9174	1.048379	0.993134	1.106698	38.70345	0.782156
2008	1.0743	56.31113	1	1501	0.025689	36.9174	1.132783	1.076063	1.192493	41.8194	0.871596
2009	1.0074	42.78199	1	1133	0.028586	36.9174	0.954596	0.901562	1.01075	35.24122	0.662189

Table 15. Standardized CPUE, Upper and Lower 95% CI intervals and Nominal CPUE for Silk Snapper Handline Fishery lognormal model fit for the 50% silk snapper cutoff trip landing weight case.

YEAR	Standard Error	obcpue	obppos	nobs	cv_i	MEANINDEX	STDCPUE	LCI	UCI	estcpue	obscpue
1988	1.3877	102.5171	1	936	0.031392	41.49817	1.065203	1.000396	1.134207	44.20397	1.403289
1989	1.1214	108.8097	1	1298	0.027197	41.49817	0.993566	0.940975	1.049097	41.23118	1.489424
1990	2.4283	124.6955	1	358	0.048443	41.49817	1.207924	1.096445	1.330737	50.12664	1.706875
1991	1.5214	74.82396	1	551	0.040103	41.49817	0.914164	0.843733	0.990474	37.93613	1.024216
1992	1.6995	101.9478	1	709	0.035636	41.49817	1.14921	1.070177	1.234079	47.69011	1.395496
1993	1.4072	116.7027	1	767	0.034065	41.49817	0.995429	0.929886	1.065591	41.30848	1.597466
1994	1.1290	109.9891	1	1376	0.026277	41.49817	1.035313	0.982317	1.091168	42.96359	1.505568
1995	0.8706	105.7754	1	1839	0.023104	41.49817	0.907982	0.866985	0.950917	37.67959	1.44789
1996	0.8856	73.49599	1	1869	0.023307	41.49817	0.915649	0.873952	0.959335	37.99776	1.006038
1997	0.9369	81.75027	1	1842	0.023371	41.49817	0.966015	0.921906	1.012234	40.08786	1.119025
1998	1.0599	50.04406	1	1044	0.029565	41.49817	0.863893	0.814302	0.916505	35.84999	0.68502
1999	1.1998	51.43404	1	993	0.03038	41.49817	0.951658	0.895569	1.011261	39.49209	0.704046
2000	0.9923	48.19757	1	1235	0.027614	41.49817	0.865887	0.819371	0.915044	35.93274	0.659745
2001	0.9447	51.35304	1	1793	0.023691	41.49817	0.960877	0.916417	1.007494	39.87464	0.702938
2002	0.8947	45.8821	1	1637	0.024264	41.49817	0.888502	0.84642	0.932676	36.8712	0.62805
2003	0.8977	44.03016	1	1724	0.023926	41.49817	0.904165	0.861924	0.948477	37.5212	0.6027
2004	0.9183	43.42759	1	1754	0.023734	41.49817	0.932354	0.889137	0.977672	38.691	0.594452
2005	1.0103	43.90578	1	1645	0.024624	41.49817	0.988699	0.941193	1.038602	41.0292	0.600997
2006	1.4391	51.30459	1	1090	0.029511	41.49817	1.175061	1.107727	1.246488	48.76288	0.702275
2007	1.4775	60.00826	1	847	0.032402	41.49817	1.098819	1.029887	1.172364	45.59897	0.821413
2008	1.5290	67.55005	1	1009	0.030837	41.49817	1.194781	1.123336	1.270771	49.58125	0.924648
2009	1.4221	49.56273	1	805	0.033437	41.49817	1.024849	0.958572	1.095709	42.52936	0.678431

Table 16. Type 3 Tests for Factor Effects for the lognormal model for the Silk Snapper Fish Pot Fishery Run.

Type 3 Tests of Fixed Effects						
Effect	*Num DF*	*Den DF*	*Chi-Square*	*F Value*	*Pr > ChiSq*	*Pr > F*
Year	21	12E3	1217.29	57.97	<.0001	<.0001
municipality_code	24	12E3	3633.57	151.40	<.0001	<.0001
Month	11	12E3	46.94	4.27	<.0001	<.0001

Table 17. Type 3 Tests for Factor Effects for the binomial model for the Silk Snapper Fish Pot Fishery Run.

Type 3 Tests of Fixed Effects						
Effect	*Num DF*	*Den DF*	*Chi-Square*	*F Value*	*Pr > ChiSq*	*Pr > F*
Year	21	3764	114.11	5.43	<.0001	<.0001
municipality_code	24	3764	4634.23	193.09	<.0001	<.0001
Month	11	3764	44.65	4.06	<.0001	<.0001

Table 18. Silk Snapper Fish Pot Fishery Base Model Standardized CPUE Results. STDCPUE, LCI, UCI, and obcpue = standardized index, lower and upper 95% Confidence Intervals, and nominal CPUE.

YEAR	Standard Error	obcpue	obppos	nobs	cv_i	MEANINDEX	STDCPUE	LCI	UCI	estcpue	obscpue
1988	1.1106	4.880409	0.094037	2935	0.14681	9.612565	0.787012	0.587683	1.053948	7.565202	0.640696
1989	1.2302	5.993335	0.126899	3751	0.115704	9.612565	1.106064	0.878244	1.392981	10.63211	0.7868
1990	1.5509	1.755343	0.052321	2714	0.195217	9.612565	0.826466	0.561364	1.216762	7.944457	0.23044
1991	1.1538	4.724585	0.120404	2774	0.138425	9.612565	0.867097	0.658269	1.142174	8.335031	0.62024
1992	1.3246	15.19965	0.234192	1708	0.148624	9.612565	0.927185	0.689887	1.246105	8.912623	1.995397
1993	1.9915	10.67045	0.209161	2467	0.097661	9.612565	2.121402	1.74581	2.5778	20.39212	1.400808
1994	1.4772	12.81882	0.166826	3135	0.109121	9.612565	1.408275	1.132886	1.750608	13.53713	1.682844
1995	1.3981	7.169495	0.127705	4714	0.105075	9.612565	1.384224	1.122509	1.706959	13.30595	0.941205
1996	1.1080	5.952849	0.121527	3563	0.120752	9.612565	0.954529	0.750385	1.21421	9.17547	0.781485
1997	1.5021	7.261924	0.143088	3711	0.108826	9.612565	1.435917	1.155798	1.783925	13.80284	0.953339
1998	1.2690	9.096642	0.220522	2680	0.107075	9.612565	1.232914	0.995848	1.526414	11.85147	1.194199
1999	1.1234	7.380315	0.200932	3434	0.111929	9.612565	1.044099	0.835264	1.305146	10.03647	0.968881
2000	1.1238	11.60387	0.19599	2893	0.122311	9.612565	0.95585	0.74911	1.219645	9.188166	1.523346
2001	0.7552	11.9187	0.242943	4145	0.100121	9.612565	0.784644	0.642578	0.958119	7.542443	1.564676
2002	0.7059	7.896847	0.286727	4091	0.088672	9.612565	0.828132	0.693795	0.988481	7.960474	1.036691
2003	0.7486	11.9145	0.351183	3380	0.0824	9.612565	0.94515	0.801771	1.11417	9.085319	1.564125
2004	0.6111	6.210662	0.292279	2720	0.101309	9.612565	0.627469	0.51265	0.768005	6.031589	0.81533
2005	0.6695	4.343147	0.21269	1970	0.13781	9.612565	0.505361	0.384117	0.664873	4.857811	0.570165
2006	0.8285	5.463656	0.232181	1417	0.149661	9.612565	0.575875	0.427616	0.775537	5.535636	0.717264
2007	0.9941	5.239295	0.199832	1191	0.187656	9.612565	0.551124	0.379893	0.799534	5.297716	0.68781
2008	1.9049	5.652517	0.253702	1013	0.17858	9.612565	1.109708	0.778595	1.581633	10.66714	0.742058
2009	1.6911	4.434822	0.203282	1097	0.172225	9.612565	1.021503	0.72567	1.437939	9.819267	0.5822

Table 19. Standardized CPUE, Upper and Lower 95% CI intervals and Nominal CPUE for Silk Snapper Fish Pot Fishery lognormal model fit for the 10% queen snapper cutoff trip weight case.

YEAR	Standard Error	obcpue	obppos	nobs	cv_i	MEANINDEX	STDCPUE	LCI	UCI	estcpue	obscpue
1988	2.3001	52.33955	1	268	0.051827	37.93141	1.170046	1.054914	1.297744	44.38151	1.249259
1989	1.9037	45.17495	1	463	0.043094	37.93141	1.164621	1.06849	1.2694	44.1757	1.078252
1990	2.8829	34.14388	1	139	0.073514	37.93141	1.033856	0.892674	1.197368	39.21562	0.814959
1991	1.5263	39.23952	1	334	0.050413	37.93141	0.79819	0.721682	0.882808	30.27645	0.936583
1992	1.7964	65.1608	1	398	0.049229	37.93141	0.962033	0.871878	1.06151	36.49125	1.555282
1993	1.8530	51.6752	1	508	0.042145	37.93141	1.159103	1.065446	1.260992	43.96639	1.233402
1994	2.0419	80.022	1	500	0.041867	37.93141	1.285758	1.182524	1.398004	48.77059	1.909994
1995	2.0764	56.6098	1	592	0.039446	37.93141	1.387725	1.282491	1.501594	52.63836	1.351183
1996	1.8465	49.77672	1	421	0.044089	37.93141	1.104113	1.010966	1.205841	41.88055	1.188089
1997	2.2779	51.64808	1	520	0.040996	37.93141	1.464842	1.349576	1.589953	55.56352	1.232755
1998	1.6942	43.22924	1	554	0.040461	37.93141	1.103904	1.018127	1.196908	41.87264	1.031811
1999	1.5866	37.00731	1	684	0.038488	37.93141	1.086781	1.006293	1.173707	41.22314	0.883304
2000	1.6098	59.84464	1	560	0.04066	37.93141	1.043745	0.962259	1.132132	39.59072	1.428394
2001	1.2966	49.75202	1	988	0.033687	37.93141	1.014701	0.948607	1.0854	38.48905	1.187499
2002	0.9511	28.08355	1	1137	0.03211	37.93141	0.780854	0.732295	0.832633	29.61888	0.670308
2003	.8671	35.92864	1	1107	0.03253	37.93141	0.7027	0.658449	0.749926	26.65441	0.857558
2004	0.8145	22.03836	1	756	0.037163	37.93141	0.577815	0.536439	0.622382	21.91734	0.52602
2005	1.2269	21.28571	1	399	0.046935	37.93141	0.689139	0.627426	0.756923	26.14002	0.508055
2006	1.3264	25.47079	1	291	0.051888	37.93141	0.673904	0.607518	0.747544	25.56211	0.607946
2007	1.9267	28.26087	1	207	0.060688	37.93141	0.836948	0.741368	0.944852	31.74663	0.674541
2008	2.2644	22.61847	1	249	0.056965	37.93141	1.047965	0.935206	1.174319	39.75079	0.539866
2009	2.0837	22.41204	1	216	0.060284	37.93141	0.911257	0.807843	1.02791	34.56527	0.534939

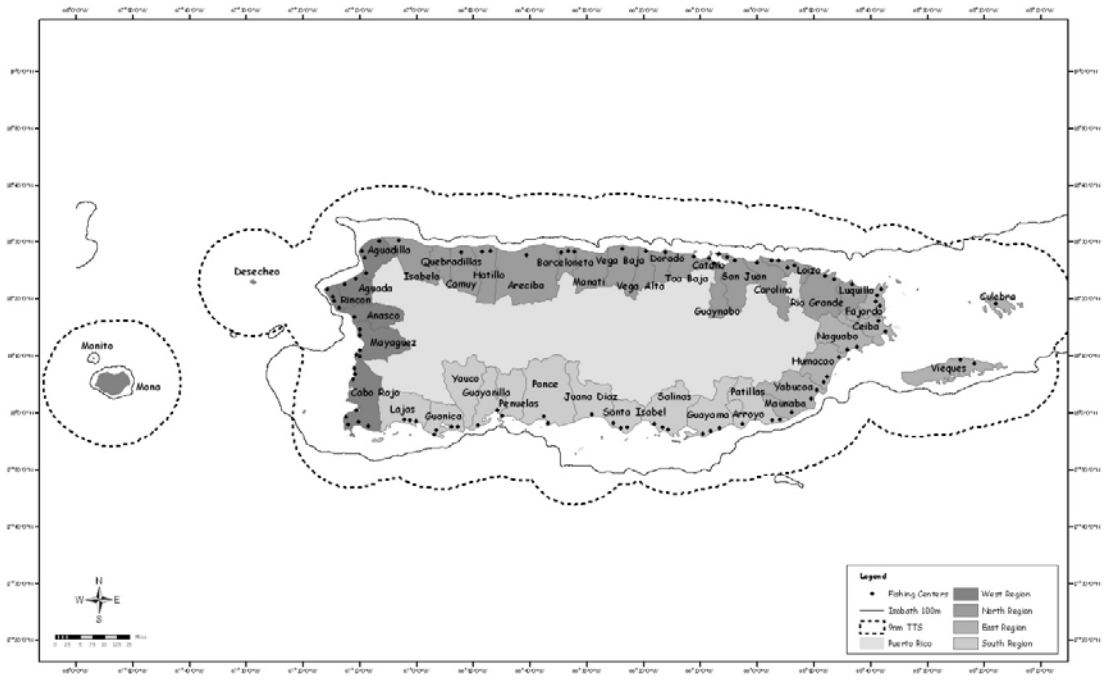

Figure 1. Map depicting fishing center (municipality) locations for the commercial fisheries in Puerto Rico.

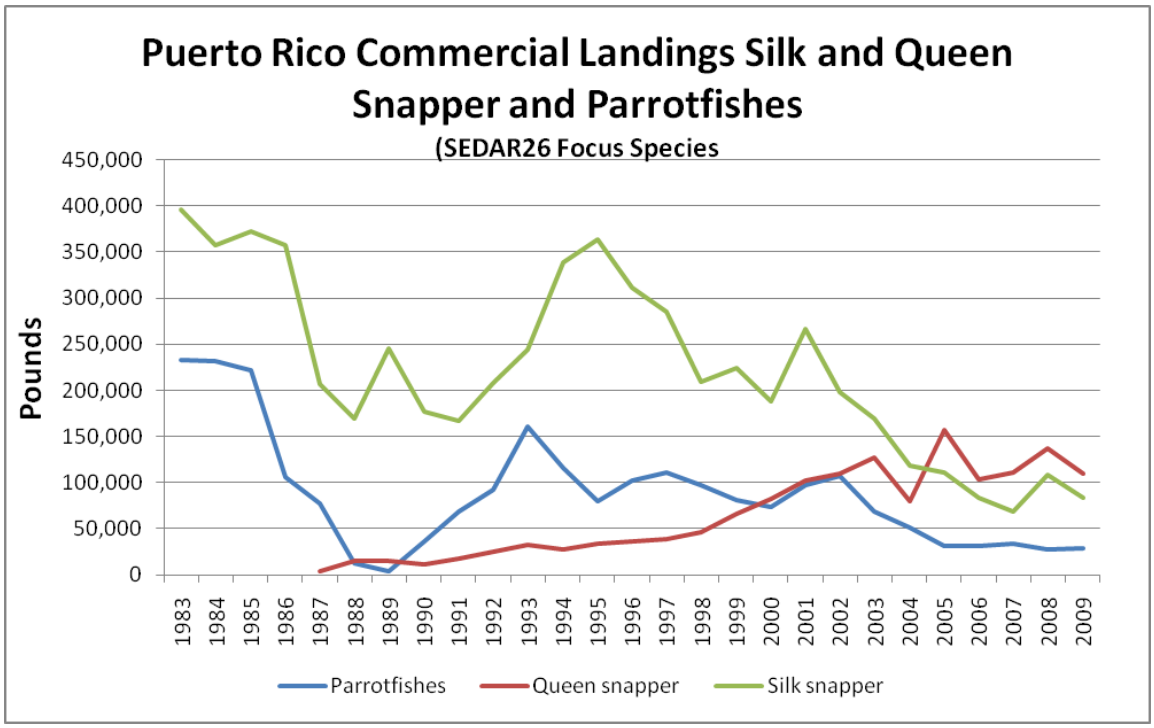

Figure 2. Reported commercial landings of silk and queen snapper and parrotfish group in Puerto Rico1983-2009. Preliminary information.

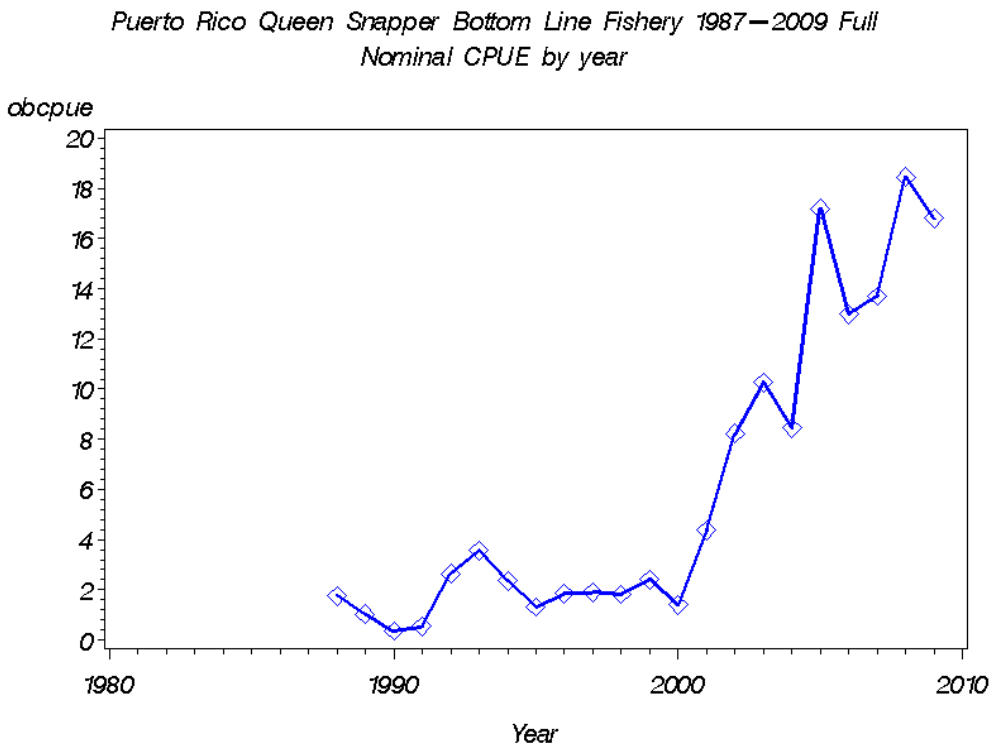

Figure 3. Queen Snapper fishery Base Run Nominal CPUE.

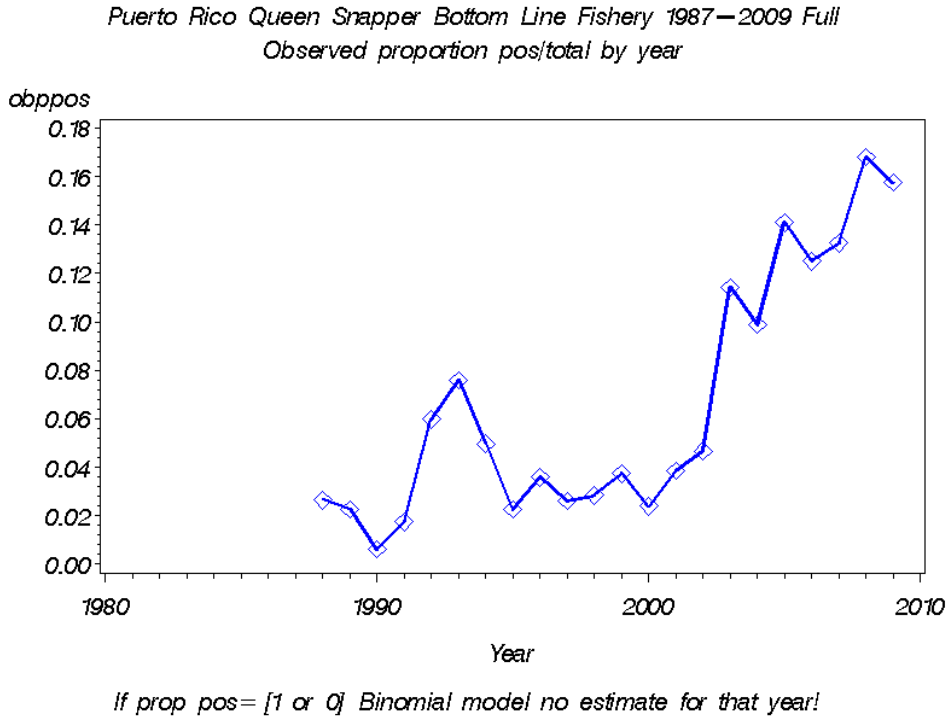

Figure 4. Queen Snapper Fishery Base Model Run for observed proportion of positives.

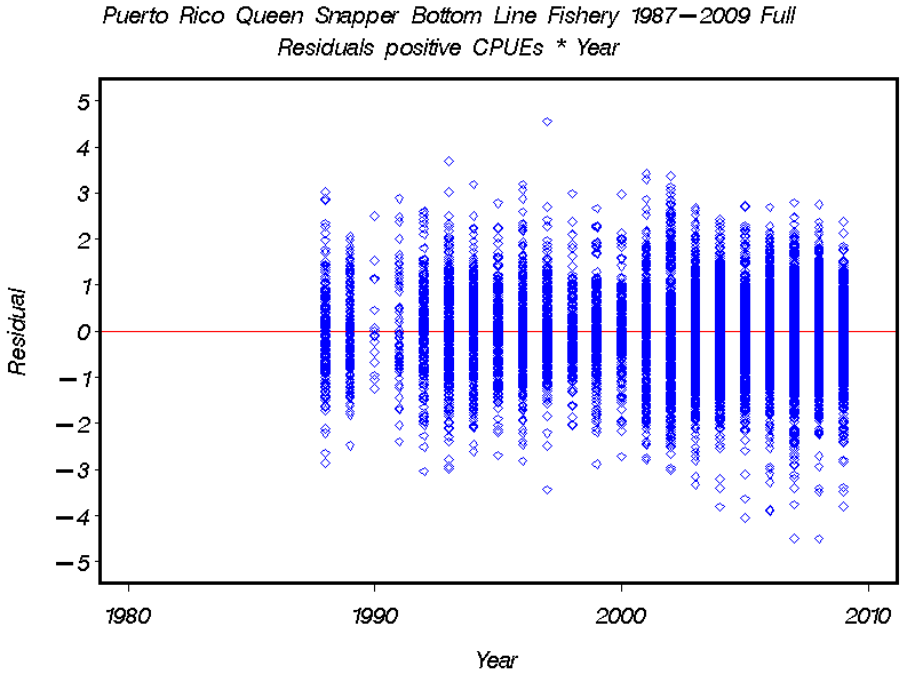

Figure 5. Plotted residual distribution for lognormal model fit for Queen Snapper Fishery Base Run.

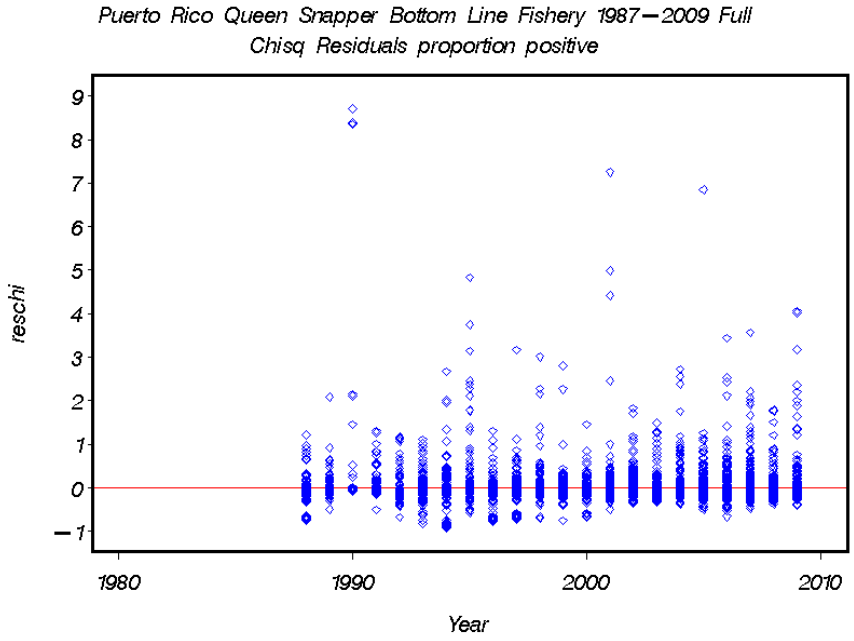

Figure 6. Plotted residual distribution for binomial model fit for Queen Snapper Fishery Base run.

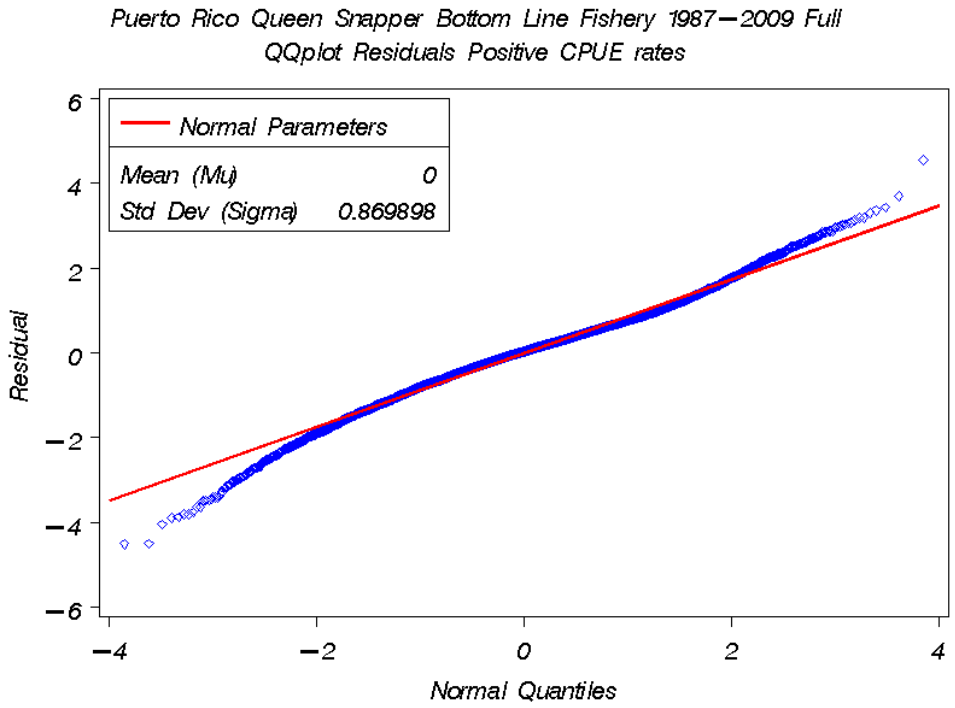

Figure 7. QQ plot for the lognormal model for Queen Snapper Base run.

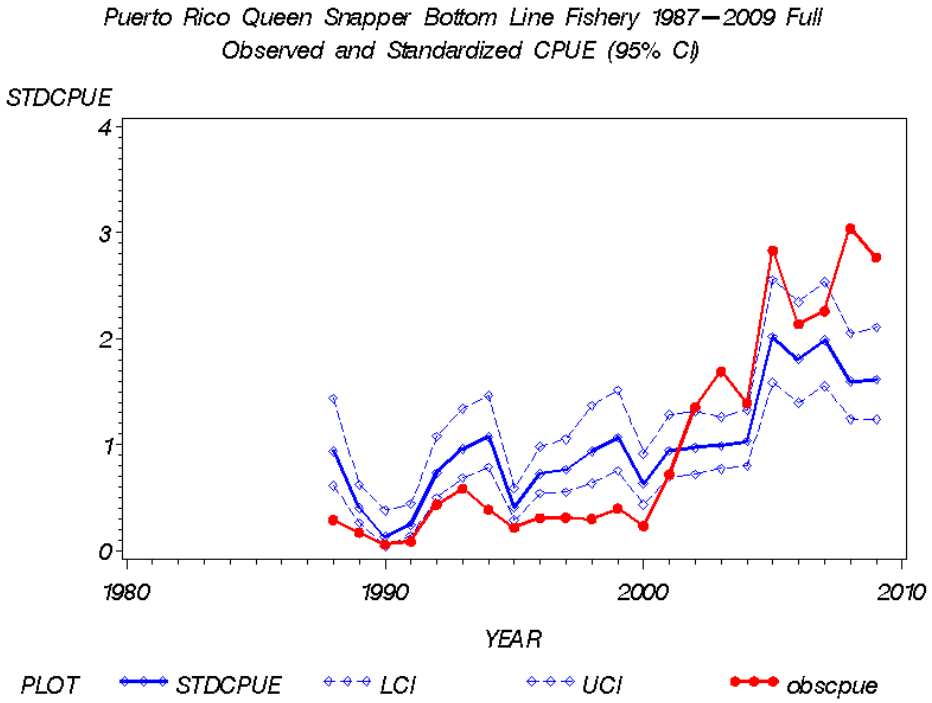

Figure 8. Standardized Delta –Lognormal CPUE, Upper and Lower 95% CI intervals and Nominal CPUE for Queen Snapper fishery Base Run.

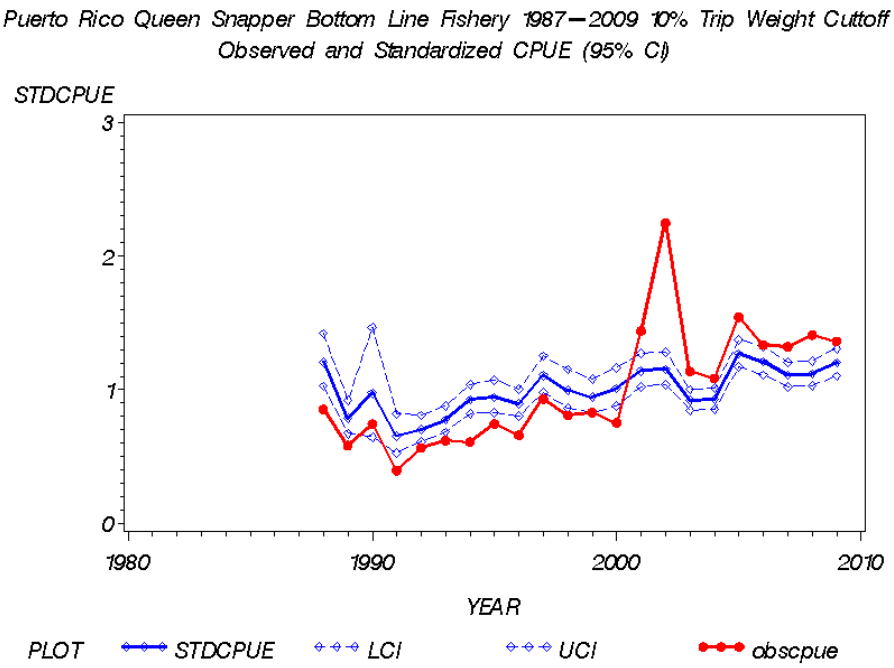

Figure 9. Standardized CPUE, Upper and Lower 95% CI intervals and Nominal CPUE for Queen Snapper Fishery lognormal model fit for the 10% queen snapper cutoff trip weight case.

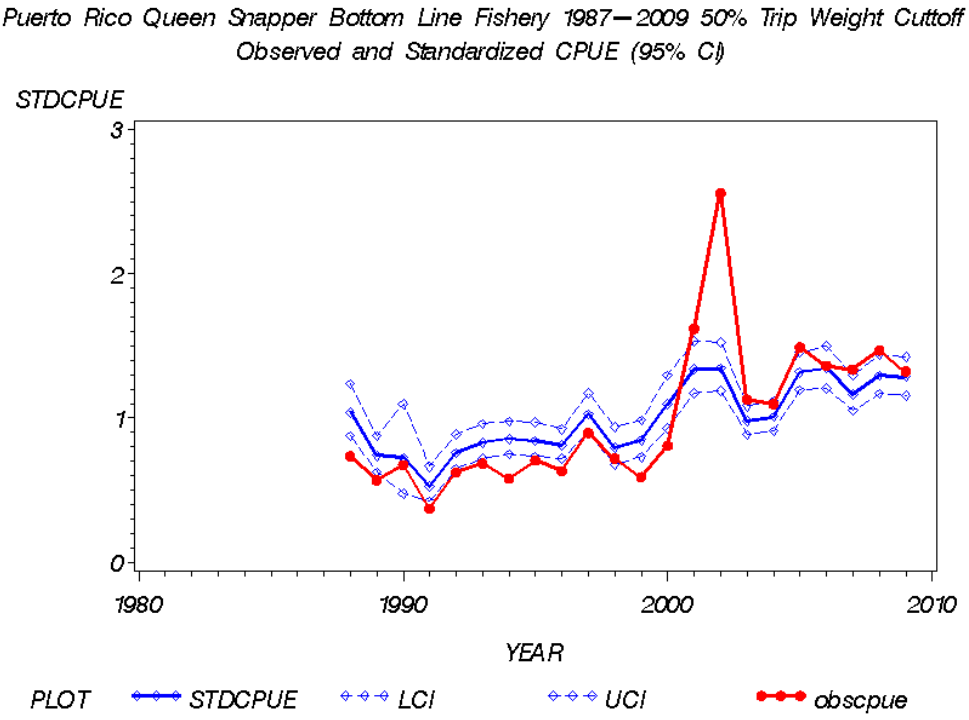

Figure 10. Standardized CPUE, Upper and Lower 95% CI intervals and Nominal CPUE for Queen Snapper Fishery lognormal model fit for the 50% queen snapper cutoff trip weight case.

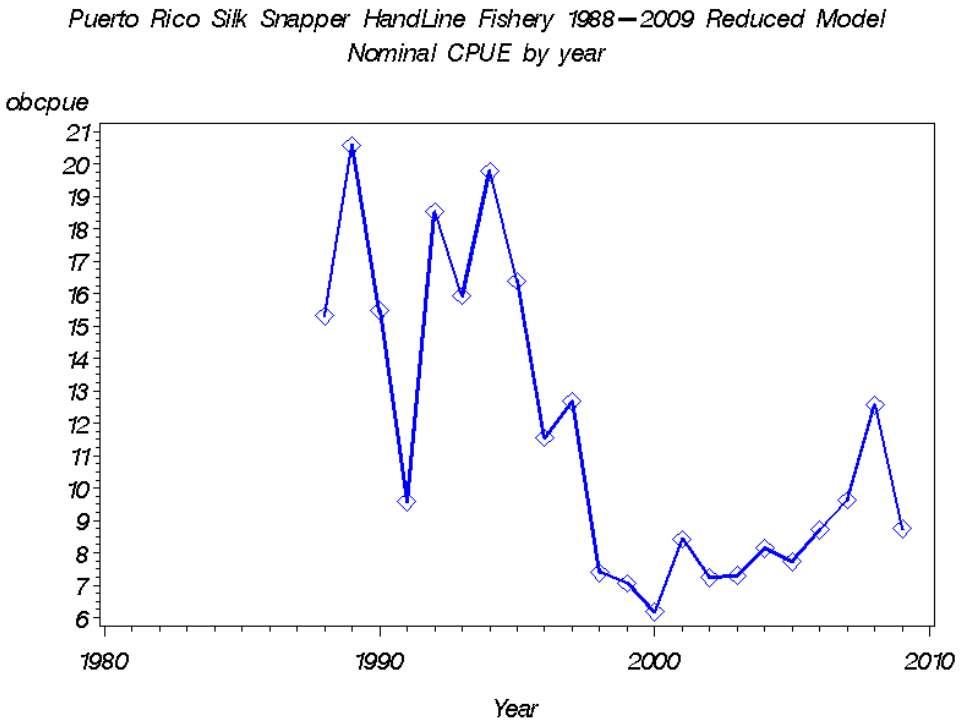

Figure 11. Nomial CPUE for silk snapper handline fishery base run.

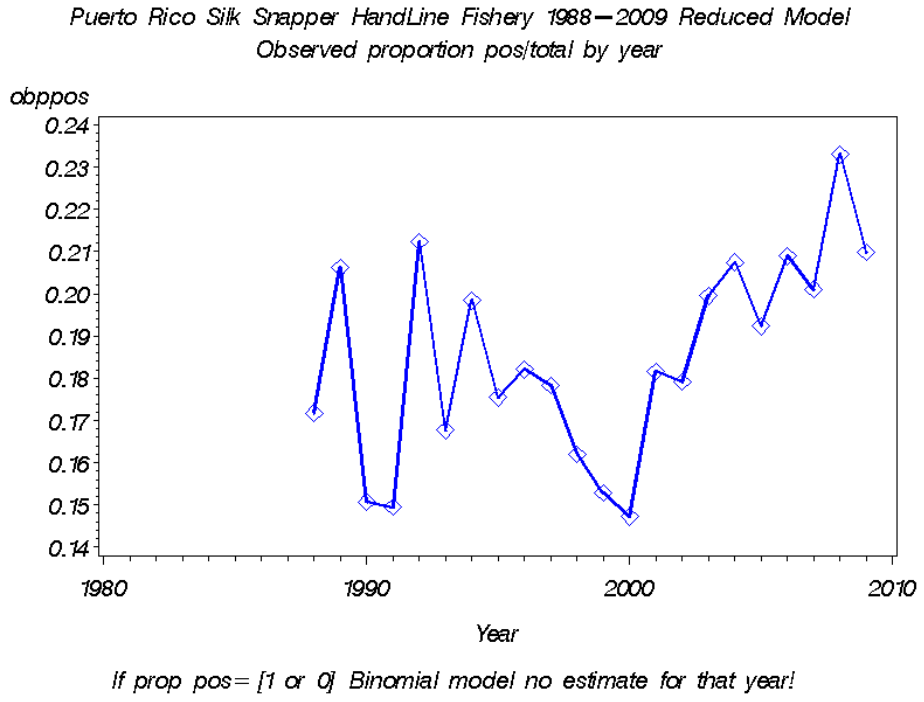

Figure 12. Proportion of positive observations for the silk snapper handline fishery.

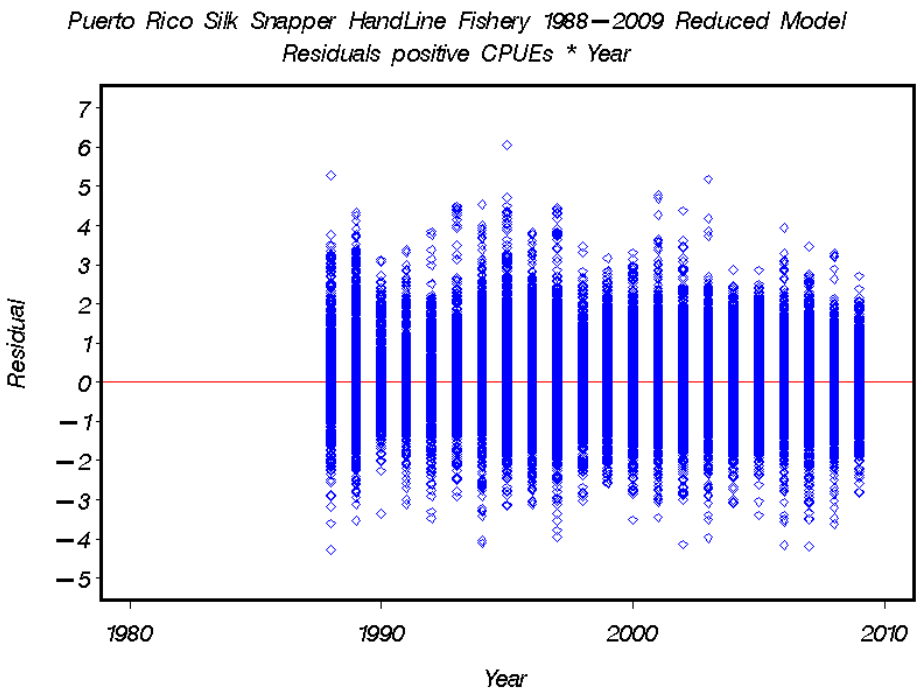

Figure 13. Residual distribution plot for the lognormal model fit to the sllk snapper handline fishery observations.

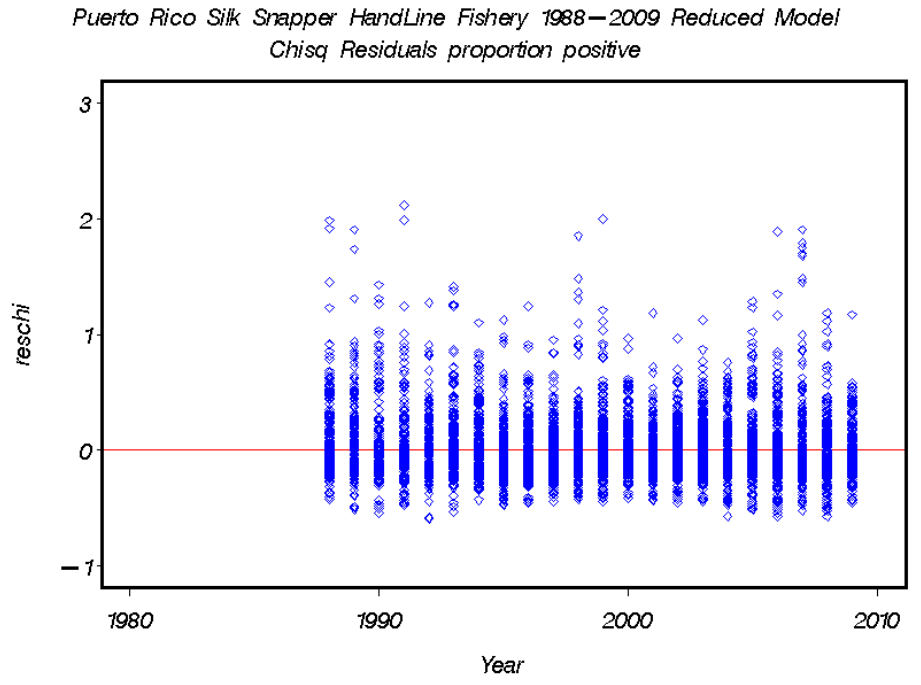

Figure 14. Residual distribution plot for the binomial model fit to the sillk snapper handline fishery observations.

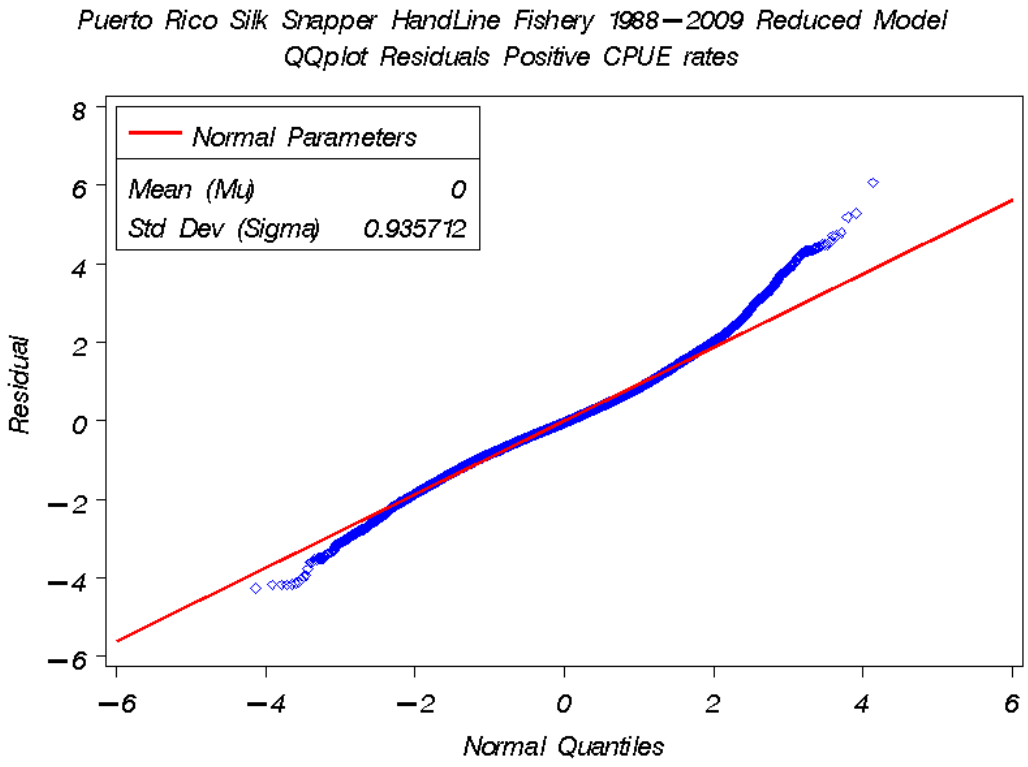

Figure 15. QQ plot for the lognormal fit to the silk snapper handline fishery observations.

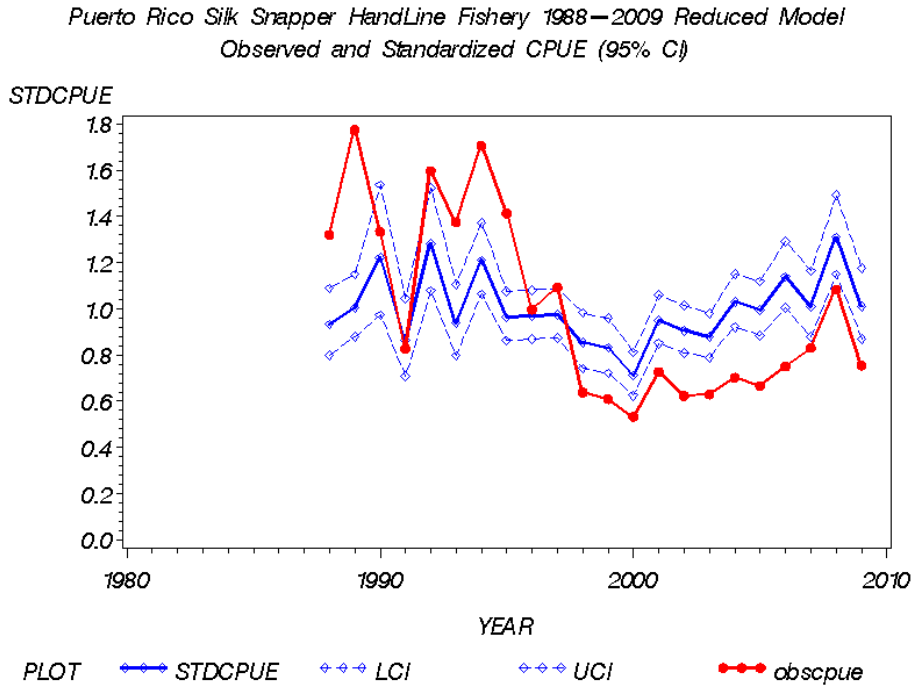

Figure 16. Standardized Delta –Lognormal CPUE, Upper and Lower 95% CI intervals and Nominal CPUE for silk Snapper handline fishery Base Run.

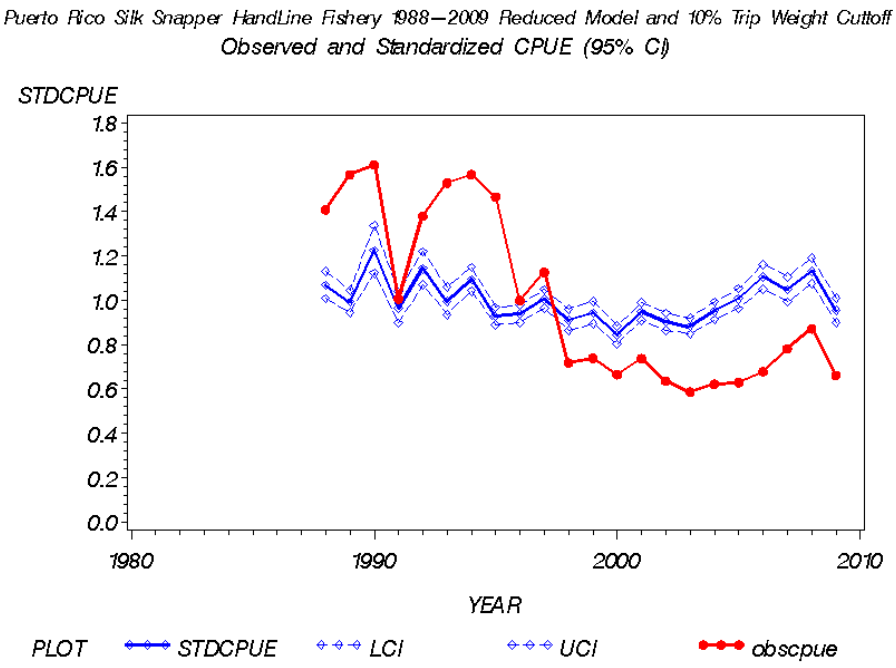

Figure 17. Standardized lognormal CPUE, Upper and Lower 95% CI intervals and Nominal CPUE for silk Snapper handline fishery 10% landing trip weight cutoff run.

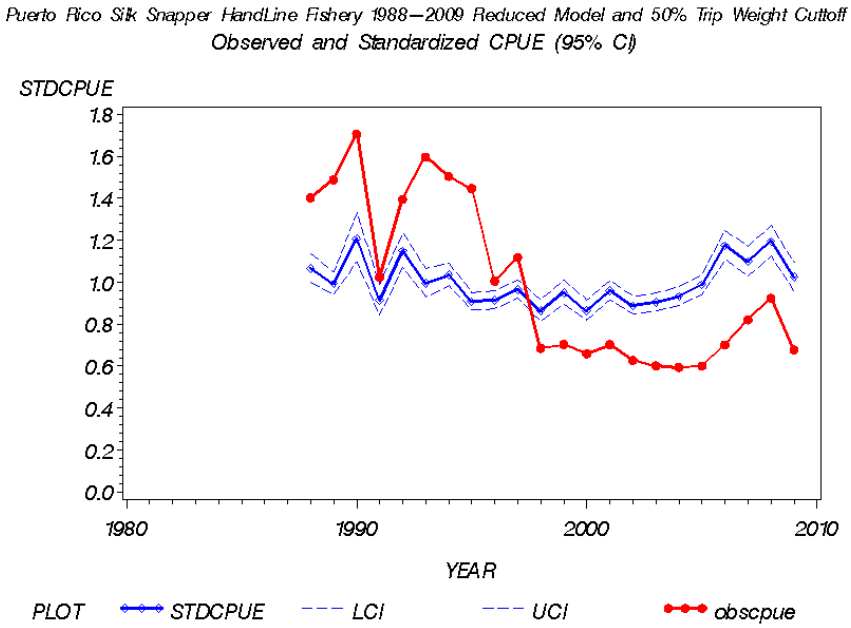

Figure 18. Standardized lognormal CPUE, Upper and Lower 95% CI intervals and Nominal CPUE for silk Snapper handline fishery 50% landing trip weight cutoff run.

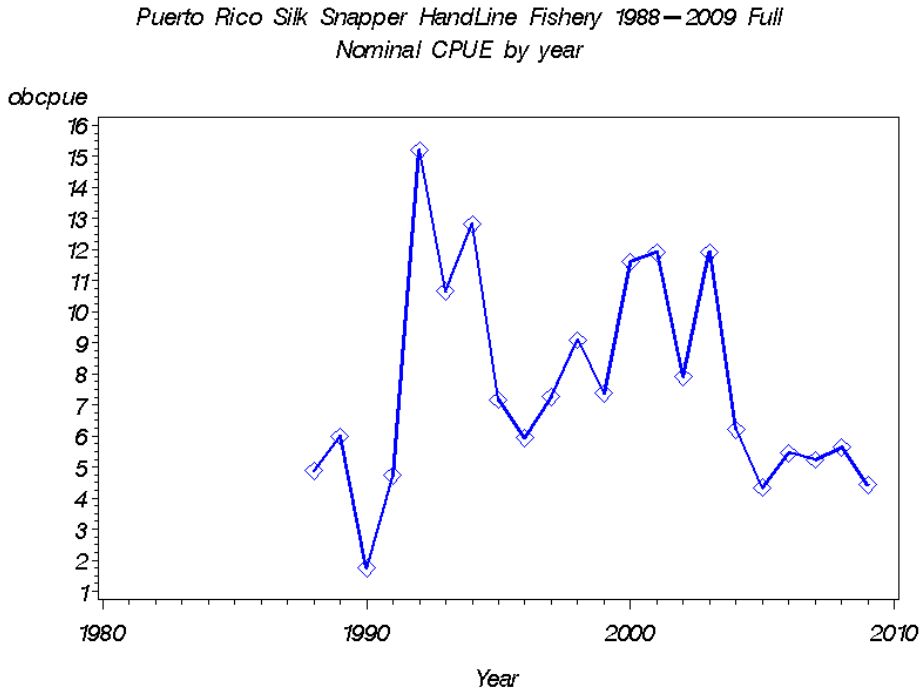

Figure 19. Nominal CPUE for silk snapper handline fishery.

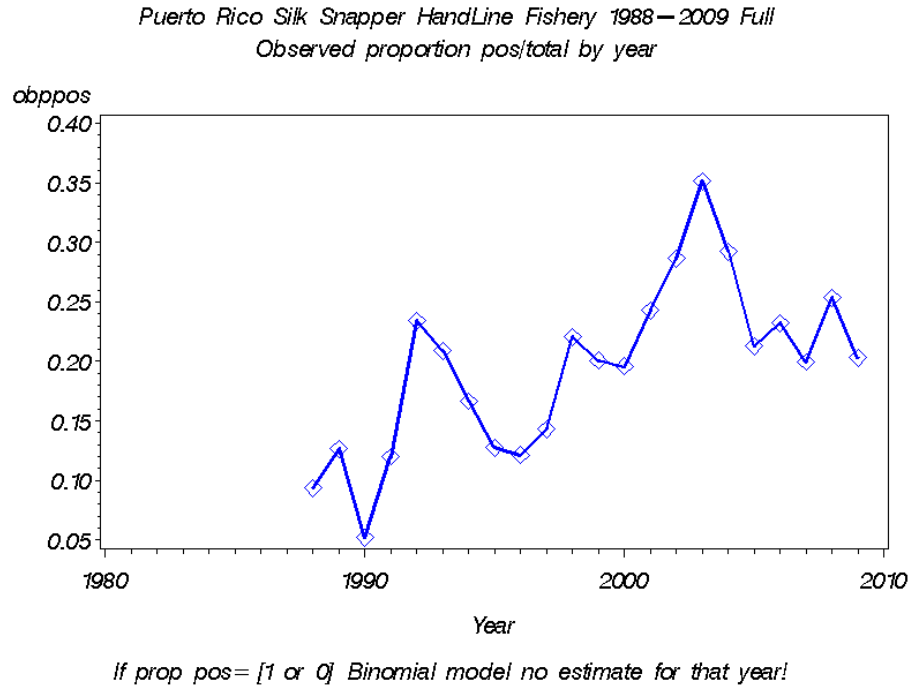

Figure 20.Proportion of Positives for silk snapper handline fishery.

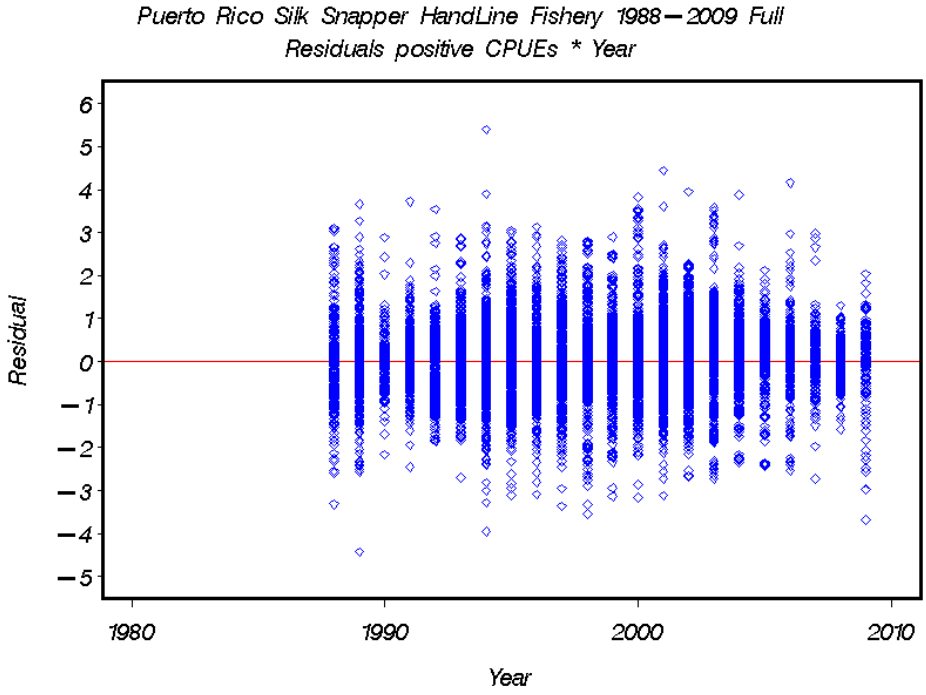

Figure 21. Residual distribution for binomial model fit to the silk snapper handline fishery data.

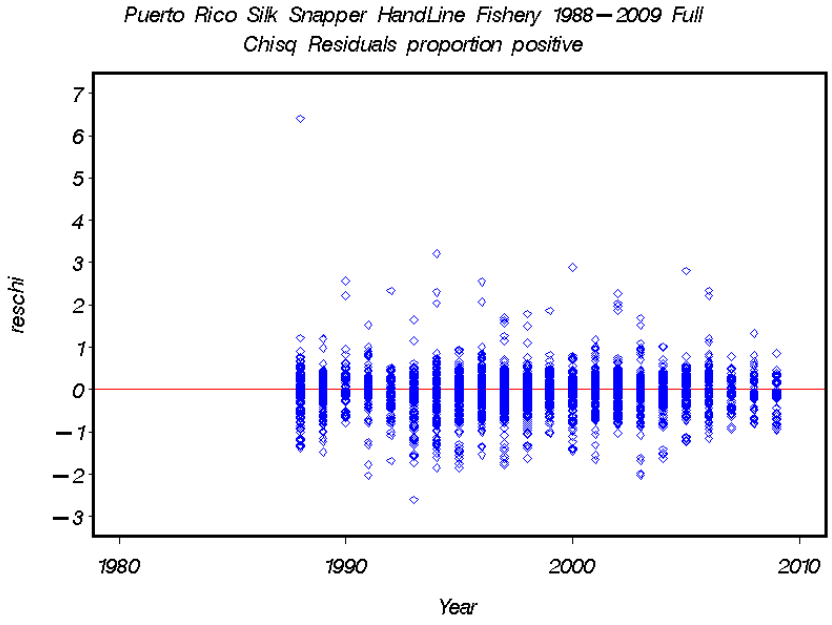

Figure 22. . Residual distribution for lognormal model fit to the silk snapper handline fishery data.

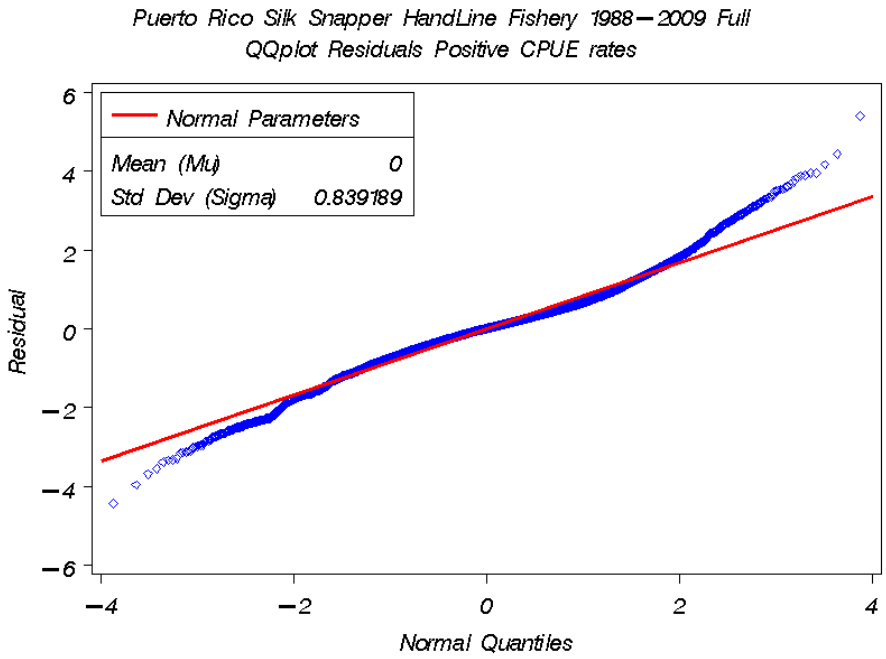

Figure 23. QQ plot for lognormal model fit to the silk snapper handline fishery data.

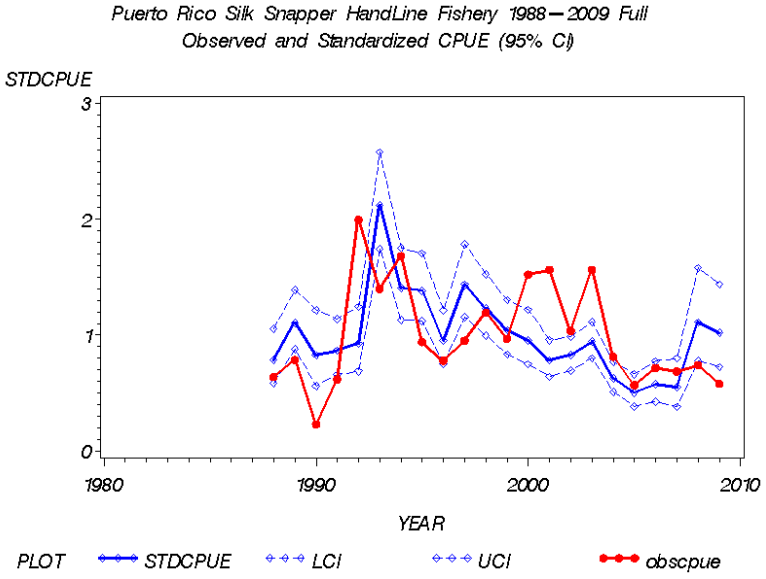

Figure 24. Standardized CPUE, upper and lower 95% confidence interval and nominal cpue for the silk snapper handline cpue data.

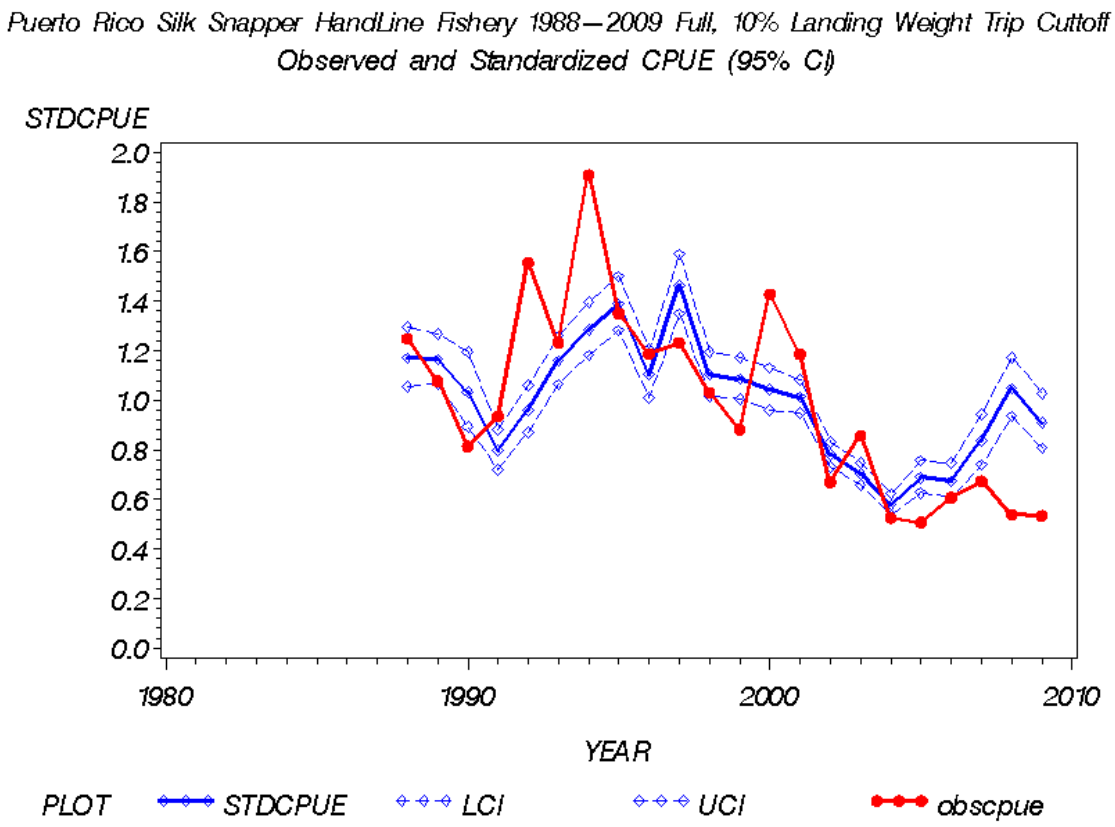

Figure 25. Figure 17. Standardized lognormal CPUE, Upper and Lower 95% CI intervals and Nominal CPUE for silk snapper fish pot fishery and the 10% landing trip weight cutoff run.