SEDAR7-DW-42

STANDARDIZED CATCH RATES OF RED SNAPPER (*LUTJANUS CAMPECHANUS*) FROM THE UNITED STATES HEADBOAT FISHERY IN THE GULF OF MEXICO DURING 1986-2002

by

Craig A. Brown and Shannon L. Cass-Calay

NOAA Fisheries
Southeast Fisheries Center
Sustainable Fisheries Division
75 Virginia Beach Drive
Miami, FL, 33149-1099, USA

Sustainable Fisheries Division Contribution SFD-2004-012

Introduction

Rod and reel catch and effort from party (head) boats in the Gulf of Mexico have been monitored by the National Marine Fisheries Service (NMFS) Southeast Zone Headboat Survey (conducted by the NMFS Beaufort Laboratory). The available catch per unit effort (CPUE) series, from 1986 - 2002, was used to develop abundance indices for red snapper.

Material and Methods

The NMFS Southeast Zone Headboat Survey collects data on the catch and effort for a vessel trip. This includes information on the landing date and location, vessel identification, the number of anglers, a single fishing location (10' x 10' rectangle of latitude and longitude) for the entire trip, the type/duration of the trip (half/three-quarter/full/multi-day, day/night, morning/afternoon), and catch by species in number and weight.

Catch rate was calculated in number of fish per angler-hour. For trips less than or equal to one day in duration, the number of hours fished was assigned as the midpoint of the range of fishing hours assigned to the trip duration type . For the multi-day trips, for which the length of the trip in days was recorded, 12 hours fishing per day was assumed.

Records included the headboat statistical area of the landings; two zones (EAST and WEST) were defined (EAST=headboat statistical areas 18, 20, 21, 22, 23 or Dry Tortugas - Alabama; WEST=headboat statistical areas 24, 25, 26, 27 or Louisiana - Texas).

There was considerable variation in red snapper catch rates between vessels. It was clear that some vessels were more prone to catch red snapper than others, whether through differences in fishing methodology or location intended to direct effort at red snapper, or through unintentional differences in location, time, etc. which affected catch rates. Again, in order to reduce variance and to minimize the potential biases of year-to-year fluctuations in the proportion of vessels with tendencies to catch red snapper, a subset of higher catch rate vessels was defined. Vessels were ranked within each year and zone by average catch rate. To be included within the subset of higher catch rate vessels for a particular zone, a vessel needed to appear in the survey in more than half of the years and have an average CPUE rank above the median for the zone. By these criteria, 11 vessels were included in the analysis data set for the WEST zone and 21 vessels for the EAST zone. An examination of the data indicated that one of the 11 vessels included in the WEST zone was a clear outlier, having a proportion of positive sets that fell considerably below that of the other retained vessels from the WEST (about one-third the value of any other vessel in the subset); data for this vessel were therefore eliminated from the analysis data set, leaving 10 vessels to be included for the WEST zone. Restricting the data to this reduced set of vessels also narrowed the area coverage within the EAST zone to headboat statistical areas 22 and 23 (from the about the middle of Florida's Gulf coast through Alabama).

The process of calculating the indices of abundance from this data involves the standardization of yearly changes in catch rate, accounting for the influence of those factors which have a significant influence. Factors which were considered as possible influences on catch rates included year, zone, vessel, month, season (WINTER=Dec.-Feb., SPRING=Mar.-May, etc.), trip category (TRIPCAT: half day/3qtr-full day/multi day), and whether the fishing occurred during the day or night (DAYNIGHT: day/night/unknown). Regulatory changes were also considered as potential factors influencing catch rates. The analysis data set was first restricted to trips taken when the red snapper season was open (**Table 1**). In order to account for changes in bag limits, two variables were defined: 1) a categorical factor (BAGLIMIT) equal to the bag limit in place for each year (**Table 1**), set to 14 for years in which there was no bag limit (twice the 1990 limit, based in part on the nominal distributions from the earlier period, for which a value of 14 appeared to be an upper bound for about the same fraction of trips as did the actual bag limits implemented in later years); note that the value wasn't important in this case as this was a categorical variable, and 2) a continuous factor (TOTLIMIT) calculated by multiplying the number of anglers by the bag limit. An examination frequency distributions of the nominal catch values revealed that, for years in which a bag limit was in place, the total catch for a trip divided by the number of anglers tended to match the bag limit at a higher rate than either higher or lower levels of catch. This suggests that anglers were applying total bag limits across the vessel (bag limit * total anglers). In this case, the results may be sensitive to the value used for bag limit prior to 1990 (14); however, the use of an artificially high value for years in which there was no bag limit (*i.e.* 100 or 1000) would likely have caused difficulty in fitting the model (as the factor was treated as a continuous variable and the artificially high value would be used to predict proportionately changed catch rates). Information on fish released was not available in the data base, therefore it was not possible to directly evaluate the impact of changing minimum size limits on catch rates.

The Lo method (Lo et al. 1992) was used to develop standardized indices; with that method separate analyses are conducted of the positive catch rates and the proportions of the observed trips which were successful. This technique has been employed in calculating abundance indices for bluefin tuna, *Thunnus thynnus*, (Ortiz *et al.* 1999,Turner *et al.* 1999, Brown *et al.* 1999), wherein a delta-lognormal model approach was used; this used a delta distribution with an assumed binomial error distribution for the proportion of positive observations (trips), and assumed a lognormal error distribution for the catch rates on successful trips. For the present analyses, the delta-Poisson model approach of Brown and Turner (2001), Brown (2001) and Brown and Cass-Calay (2001) was used; differing from the delta-lognormal approach in that a Poisson error distribution is assumed for the catches on successful trips, with the natural log of the hours fished as an offset term.

Parameterization of the model was accomplished using a Generalized Linear Model (GLM) structure: The proportion of successful (i.e. positive observations) trips per stratum was assumed to follow a binomial distribution where the estimated probability was a linearized function of fixed factors, such as year, month, zone, vessel, month, season, trip category, and DAYNIGHT. The logit function linked the linear component and the assumed binomial distribution. Similarly, the estimated catch observed on positive trips was a function of similar fixed factors with the log function as a link. The number of angler-hours was used as the offset.

A stepwise approach was used to quantify the relative importance of the main factors explaining the variance in catch rates. That is, first the Null model was run, in which no factors were entered in the model. These results reflect the distribution of the nominal data. Each potential factor was then tested one at a time. The results were then ranked from greatest to least reduction in deviance per degree of freedom when compared to the Null model. The factor which resulted in the greatest reduction in deviance per degree of freedom was then incorporated into the model, provided two conditions were met: 1) the effect of the factor was determined to be significant at at least the 5% level based upon a ^{2} (Chi-Square) test, and 2) the deviance per degree of freedom was reduced by at least 1% from the less complex model. This process was repeated, adding factors (including factor interactions) one at a time at each step, until no factor met the criteria for incorporation into the final model.

Preliminary analyses indicated that ZONE was a significant factor in the positive catch rate analysis, but that there was also a significant YEAR interaction effect with ZONE. As this indicated the yearly pattern differed between zones, separate models were calculated for each ZONE.

Once the set of fixed effects was specified, possible random year interaction effects were evaluated. These random effects were tested for significance using the likelihood ratio taken as the difference of the –2*log likelihood estimator between the complete model (*i.e.* including the random variate) and the reduced model (*i.e.* dropping the random variate). The –2*log likelihood difference statistics follows a ^{2} distribution. Values greater than 3.84 (=0.05, df=1) were considered significant. The final model, therefore, included any significant fixed and random (year)*factors interactions.

The product of the standardized proportion positives and the standardized positive catch rates was used to calculate overall standardized catch rates. For comparative purposes, each relative index of abundance was obtained dividing the standardized catch rates by the mean value in each series.

An alternative model also was developed which avoided the initial treatment of splitting the data set into two zones (EAST and WEST), restricting the data instead to those observations deemed most likely to have the potential to catch red snapper. The data were first restricted to trips with TRIPCAT=3qtr-full day, the category for which for which catch rates are highest; they tend to be nearly an order of magnitude higher than on trips with TRIPCAT=half day. Then a list of species associated with red snapper in the catch was defined for each zone, based an increased incidence of catches of these species whenever red snapper were caught (**Table 2**). The data were then restricted to those trips for which at least one of the associated species (including red snapper) were caught; this approach is intended to further reduce the analysis data set to those trips which may be targetted toward red snapper or red snapper associated species. The nominal catch rate trends by headboat statistical AREA for this analysis data set are shown in **Figure 1**. Next, the subset of vessels directing effort at red snapper was defined as before, with the exception that ZONE was ignored (*i.e.*, vessels were ranked in comparison to all others making 3/4-full day trips). The nominal catch rate trends by headboat statistical AREA for this analysis data set, restricted to trips by this subset of vessels, are shown in **Figure 2**. The analyses were then conducted as before, dropping TRIPCAT as a potential explanatory factor and replacing it with headboat statistical AREA.

Results and Discussion

The stepwise construction of the WEST zone model is shown in **Table 3** for the proportion positive analysis and in **Table 4** for the positive catch rate analysis; the construction of the EAST zone model is shown in **Tables 5** and **6**.

The results of the model fits for the WEST zone indices are shown in **Tables 7** and **8**; the results of the model fits for the EAST zone model are shown in **Tables 9** and **10**. The index values for the WEST zone are shown in **Table 11** and in **Figure 3**; for the EAST zone, the values are shown in **Table 12** and in **Figure 4**.

The stepwise construction of the alternative model, using data from both the EAST and WEST which had been restricted to trips catching red snapper associated species, is shown in **Table 13** for the proportion positive analysis and in **Table 14** for the positive catch rate analysis. The results of the model fits for the alternative model are shown in **Tables 15** and **16**; the index values are shown in **Table 17** and in **Figure 5.**

The various indices are compared in **Figure 6**. The trend from this model is similar to the trend from the WEST zone; this is likely due in large part because vessels from the WEST dominated the data set after the vessel restriction criteria were applied. Overall standardized catch rates from the WEST and the alternative models indicate a generally declining trend, which may be due (at least in part) to changes in management measures over time which have affected the proportion of the catch which is retained. The horizontal bars shown indicate the specific minimum size limits in effect during various time periods. By comparing index values within each time period, it may be possible to obtain trend information while the influence of changing size limits are minimized (assuming that compliance rates are constant). Nevertheless, the overall abundance tracked represents a changing fraction of the entire stock.

Literature Cited

Brown, C.A., S.C. Turner and M. Ortiz. 1999. Standardized catch rates of large (> 195 cm) and large medium (178-195 cm) bluefin tuna, *Thunnus thynnus,* from the rod and reel/handline fishery off the northeast United States during 1983-1997. Int. Comm. Conserv. Atl. Tunas, Col. Vol. Sci. Pap. 49(2): 347-359.

Brown, C.A. and S.C. Turner. 2001. Updated standardized catch rates of bluefin tuna, *Thunnus thynnus,* from the rod and reel/handline fishery off the northeast United States during 1980-1999. Int. Comm. Conserv. Atl. Tunas, Col. Vol. Sci. Pap. 52: 984-1006.

Brown, C.A. 2001. Standardized catch rates of gag, *Mycteroperca microlepis*, from the United States headboat fishery in the Gulf of Mexico during 1986-1999. NMFS/SEFSC/Sustainable Fisheries Division Contribution-00/01-130.

Brown, C.A. and S.L. Cass-Calay. 2001. Standardized catch rates of vermilion snapper, *Rhomboplites aurorubens*, from the United States headboat fishery in the Gulf of Mexico during 1986-1999. NMFS/SEFSC/Sustainable Fisheries Division Contribution-00/01-132.

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

Ortiz, M., S.C. Turner and C.A. Brown. 1999. Standardized catch rates of small bluefin tuna, *Thunnus thynnus,* from the rod and reel/handline fishery off the northeast United States during 1983-1997. Int. Comm. Conserv. Atl. Tunas, Col. Vol. Sci. Pap. 49(2): 254-286.

Schirripa, M.J. 2000. Status of the red snapper fishery in the U.S. Gulf of Mexico Assessment 4.5. NMFS/SEFSC/Sustainable Fisheries Division Contribution No. SFD-99/00-??

Turner, S.C. and C.A. Brown. 1998. Update of standardized catch rates for large and small bluefin tuna, *Thunnus thynnus*, in the Virginia - Massachusetts (U.S.) rod and reel fishery. Int. Comm. Conserv. Atl. Tunas, Col. Vol. Sci. Pap. 48(1): 94-102.

Turner, S.C., C.A. Brown and M. Ortiz. 1999. Review of the available information on medium bluefin tuna, *Thunnus thynnus,* from the rod and reel/handline fishery off the northeast United States. Int. Comm. Conserv. Atl. Tunas, Col. Vol. Sci. Pap. 49(2): 334-343.

TABLE 1: History of Management -
Changes in recreational red snapper size limits, bag limits, and season length.

Year	Size Limit (Inches TL)	Daily Bag Limit (Number of Fish)	Season length (days)
1984	13[1]	no bag limit[2]	365
1990	13	7	365
1994	14	7	365
1995	15	5	365
1996	15	5	365
1997	15	5	330[3]
1998	15	4[6]	272[4]
1999	15[7]	4	240[5]
2000	16	4	194
2001	16	4	194
2002	16	4	194
2003	16	4	194

[1] for-hire boats exempted until 1987
[2] Allowed to keep 5 undersized fish per day
[3] Fishery closed on November 27, 1997.
[4] Fishery closed on September 30, 1998.
[5] Fishery closed on August 29, 1999.
[6] Bag limit was 5 fish from January through April, 1998.
[7] Size limit was 18 inches from June 4 through August 29, 1999.

Table provided by Peter Hood, NMFS, SERO, St. Petersburg, Florida, USA.

TABLE 2: Species Associated with Red Snapper in the Catch (by zone, listed in decreasing degree of association).

ZONE	Common Name	Scientific Name
EAST	red snapper	*Lutjanus campechanus*
	banded rudderfish	*Seriola zonata*
	whitebone porgy	*Calamus leucosteus*
	red porgy	*Pagrus pagrus*
	vermilion snapper	*Rhomboplites aurorubens*
	warsaw grouper	*Epinephelus nigritus*
	almaco jack	*Seriola rivoliana*
	gray triggerfish	*Balistes capriscus*
	scamp	*Mycteroperca phenax*
	snowy grouper	*Epinephelus niveatus*
	lesser amberjack	*Seriola fasciata*
	queen triggerfish	*Balistes vetula*
WEST	red snapper	*Lutjanus campechanus*
	lane snapper	*Lutjanus synagris*
	gag	*Mycteroperca microlepis*
	vermilion snapper	*Rhomboplites aurorubens*
	almaco jack	*Seriola rivoliana*
	gray triggerfish	*Balistes capriscus*

TABLE 3: Results of the stepwise procedure to develop the proportion positive catch rate model for the WEST indices.

There are no explanatory factors in the base model.

FACTOR	DEGF	DEVIANCE	DEV/DF	%REDUCTION	LOGLIKE	CHISQ	PROBCHISQ
BASE	13387	3727.8	0.2785		-1863.9		
YEAR	13371	3269.7	0.2445	12.18	-1634.9	458.04	0.00000
VESSEL	13378	3454.0	0.2582	7.28	-1727.0	273.82	0.00000
MONTH	13376	3475.9	0.2599	6.68	-1738.0	251.84	0.00000
AREA	13385	3576.8	0.2672	4.04	-1788.4	150.96	0.00000
BAGLIMIT	13385	3576.8	0.2672	4.04	-1788.4	.	.
SEASON	13384	3637.7	0.2718	2.40	-1818.8	90.12	0.00000
DAYNIGHT	13385	3668.3	0.2741	1.58	-1834.1	59.50	0.00000
TRIPCAT	13385	3709.2	0.2771	0.48	-1854.6	18.59	0.00009
TOTLIMIT	13386	3723.2	0.2781	0.12	-1861.6	4.63	0.03139

The explanatory factors in the base model are: YEAR

FACTOR	DEGF	DEVIANCE	DEV/DF	%REDUCTION	LOGLIKE	CHISQ	PROBCHISQ
BASE	13371	3269.7	0.2445		-1634.9		
MONTH	13360	2968.6	0.2222	9.14	-1484.3	301.19	0.00000
VESSEL	13362	3057.3	0.2288	6.43	-1528.7	212.41	0.00000
AREA	13369	3194.8	0.2390	2.28	-1597.4	74.98	0.00000
BAGLIMIT	13369	3194.8	0.2390	2.28	-1597.4	.	.
SEASON	13368	3209.7	0.2401	1.82	-1604.8	60.08	0.00000
TOTLIMIT	13370	3212.9	0.2403	1.73	-1606.5	56.81	0.00000
TRIPCAT	13369	3254.5	0.2434	0.45	-1627.2	15.29	0.00048
DAYNIGHT	13369	3260.8	0.2439	0.26	-1630.4	8.93	0.01149

The explanatory factors in the base model are: YEAR MONTH

FACTOR	DEGF	DEVIANCE	DEV/DF	%REDUCTION	LOGLIKE	CHISQ	PROBCHISQ
BASE	13360	2968.6	0.2222		-1484.3		
VESSEL	13351	2747.3	0.2058	7.39	-1373.6	221.29	0.00000
AREA	13358	2886.9	0.2161	2.74	-1443.4	81.70	0.00000
BAGLIMIT	13358	2886.9	0.2161	2.74	-1443.4	.	.
TOTLIMIT	13359	2902.8	0.2173	2.21	-1451.4	65.74	0.00000
DAYNIGHT	13358	2957.3	0.2214	0.36	-1478.7	11.22	0.00366
TRIPCAT	13358	2961.5	0.2217	0.22	-1480.7	7.09	0.02891
SEASON	13360	2968.6	0.2222	0.00	-1484.3	0.00	.

TABLE 3 (cont.): Results of the stepwise procedure to develop the proportion positive catch rate model for the WEST indices.

The explanatory factors in the base model are: YEAR MONTH VESSEL

FACTOR	DEGF	DEVIANCE	DEV/DF	%REDUCTION	LOGLIKE	CHISQ	PROBCHISQ
BASE	13351	2747.3	0.2058		-1373.6		
TOTLIMIT	13350	2630.1	0.1970	4.26	-1315.1	117.13	0.00000
TRIPCAT	13349	2739.1	0.2052	0.28	-1369.6	8.13	0.01719
DAYNIGHT	13349	2744.9	0.2056	0.07	-1372.4	2.39	0.30260
SEASON	13351	2747.3	0.2058	0.00	-1373.6	0.00	.
AREA	13351	2747.3	0.2058	0.00	-1373.6	0.00	.
BAGLIMIT	13351	2747.3	0.2058	0.00	-1373.6	.	.

The explanatory factors in the base model are: YEAR MONTH VESSEL TOTLIMIT

FACTOR	DEGF	DEVIANCE	DEV/DF	%REDUCTION	LOGLIKE	CHISQ	PROBCHISQ
BASE	13350	2630.1	0.1970		-1315.1		
TRIPCAT	13348	2622.3	0.1965	0.28	-1311.1	7.85	0.01979
DAYNIGHT	13348	2625.6	0.1967	0.16	-1312.8	4.52	0.10433
SEASON	13350	2630.1	0.1970	0.00	-1315.1	0.00	.
AREA	13350	2630.1	0.1970	0.00	-1315.1	0.00	.
BAGLIMIT	13350	2630.1	0.1970	0.00	-1315.1	.	.

% diff: percent difference in deviance/df between each factor and the null model**;** delta%: percent difference in deviance/df between the newly included factor and the previous factor entered into the model; L: log likelihood; ChiSquare: Pearson Chi-square statistic; Pr>Chi: significance level of the Chi-square statistic.

TABLE 4: Results of the stepwise procedure to develop the positive catch rate model for the WEST indices.

There are no explanatory factors in the base model.

FACTOR	DEGF	DEVIANCE	DEV/DF	%REDUCTION	LOGLIKE	CHISQ	PROBCHISQ
BASE	12968	885086.4	68.2516		11546482.0		
YEAR	12952	645251.0	49.8186	27.01	11666399.7	239835.38	0.00000
VESSEL	12959	738176.2	56.9624	16.54	11619937.1	146910.27	0.00000
AREA	12966	757543.4	58.4254	14.40	11610253.5	127543.00	0.00000
BAGLIMIT	12966	757543.4	58.4254	14.40	11610253.5	.	.
MONTH	12957	790867.3	61.0378	10.57	11593591.6	94219.11	0.00000
SEASON	12965	821208.0	63.3404	7.20	11578421.2	63878.40	0.00000
TRIPCAT	12966	871052.1	67.1797	1.57	11553499.2	14034.28	0.00000
TOTLIMIT	12967	883896.7	68.1651	0.13	11547076.9	1189.78	0.00000
DAYNIGHT	12966	884290.2	68.2007	0.07	11546880.1	796.20	0.00000

The explanatory factors in the base model are: YEAR

FACTOR	DEGF	DEVIANCE	DEV/DF	%REDUCTION	LOGLIKE	CHISQ	PROBCHISQ
BASE	12952	645251.0	49.8186		11666399.7		
VESSEL	12943	515213.3	39.8063	20.10	11731418.6	130037.77	0.00000
TOTLIMIT	12951	528378.5	40.7983	18.11	11724836.0	116872.52	0.00000
AREA	12950	531637.8	41.0531	17.59	11723206.3	113613.23	0.00000
BAGLIMIT	12950	531637.8	41.0531	17.59	11723206.3	.	.
MONTH	12941	594379.7	45.9300	7.81	11691835.4	50871.35	0.00000
SEASON	12949	605418.4	46.7541	6.15	11686316.0	39832.63	0.00000
TRIPCAT	12950	637300.1	49.2124	1.22	11670375.2	7950.92	0.00000
DAYNIGHT	12950	638942.3	49.3392	0.96	11669554.1	6308.71	0.00000

The explanatory factors in the base model are: YEAR VESSEL

FACTOR	DEGF	DEVIANCE	DEV/DF	%REDUCTION	LOGLIKE	CHISQ	PROBCHISQ
BASE	12943	515213.3	39.8063		11731418.6		
TOTLIMIT	12942	469615.9	36.2862	8.84	11754217.3	45597.35	0.00000
MONTH	12932	482108.6	37.2803	6.35	11747970.9	33104.72	0.00000
SEASON	12940	491093.8	37.9516	4.66	11743478.3	24119.51	0.00000
DAYNIGHT	12941	506896.4	39.1698	1.60	11735577.0	8316.86	0.00000
TRIPCAT	12941	507828.5	39.2418	1.42	11735111.0	7384.78	0.00000
AREA	12943	515213.3	39.8063	0.00	11731418.6	0.00	.
BAGLIMIT	12943	515213.3	39.8063	0.00	11731418.6	.	.

TABLE 4 (cont.): Results of the stepwise procedure to develop the positive catch rate model for the WEST indices.

The explanatory factors in the base model are: YEAR VESSEL TOTLIMIT

FACTOR	DEGF	DEVIANCE	DEV/DF	%REDUCTION	LOGLIKE	CHISQ	PROBCHISQ
BASE	12942	469615.9	36.2862		11754217.3		
MONTH	12931	444695.5	34.3899	5.23	11766677.5	24920.42	0.00000
SEASON	12939	454117.2	35.0968	3.28	11761966.6	15498.70	0.00000
TRIPCAT	12940	456849.4	35.3052	2.70	11760600.5	12766.56	0.00000
DAYNIGHT	12940	462262.1	35.7235	1.55	11757894.2	7353.85	0.00000
AREA	12942	469615.9	36.2862	0.00	11754217.3	0.00	.
BAGLIMIT	12942	469615.9	36.2862	0.00	11754217.3	.	.

The explanatory factors in the base model are: YEAR VESSEL TOTLIMIT MONTH

FACTOR	DEGF	DEVIANCE	DEV/DF	%REDUCTION	LOGLIKE	CHISQ	PROBCHISQ
BASE	12931	444695.5	34.3899		11766677.5		
TRIPCAT	12929	429924.7	33.2527	3.31	11774062.9	14770.83	0.00000
DAYNIGHT	12929	436044.1	33.7260	1.93	11771003.2	8651.43	0.00000
SEASON	12931	444695.5	34.3899	0.00	11766677.5	0.00	.
AREA	12931	444695.5	34.3899	0.00	11766677.5	0.00	.
BAGLIMIT	12931	444695.5	34.3899	0.00	11766677.5	.	.

The explanatory factors in the base model are: YEAR VESSEL TOTLIMIT MONTH TRIPCAT

FACTOR	DEGF	DEVIANCE	DEV/DF	%REDUCTION	LOGLIKE	CHISQ	PROBCHISQ
BASE	12929	429924.7	33.2527		11774062.9		
DAYNIGHT	12927	429187.7	33.2009	0.16	11774431.4	736.99	0.00000
SEASON	12929	429924.7	33.2527	0.00	11774062.9	0.00	.
AREA	12929	429924.7	33.2527	0.00	11774062.9	0.00	.
BAGLIMIT	12929	429924.7	33.2527	0.00	11774062.9	.	.

% diff: percent difference in deviance/df between each factor and the null model**;** delta%: percent difference in deviance/df between the newly included factor and the previous factor entered into the model; L: log likelihood; ChiSquare: Pearson Chi-square statistic; Pr>Chi: significance level of the Chi-square statistic.

TABLE 5: Results of the stepwise procedure to develop the proportion positive catch rate model for the EAST indices.

There are no explanatory factors in the base model.

FACTOR	DEGF	DEVIANCE	DEV/DF	%REDUCTION	LOGLIKE	CHISQ	PROBCHISQ
BASE	28083	37089.0	1.3207		-18544.5		
VESSEL	28063	32227.8	1.1484	13.05	-16113.9	4861.24	0.00000
TRIPCAT	28081	35177.4	1.2527	5.15	-17588.7	1911.58	0.00000
YEAR	28067	35656.4	1.2704	3.81	-17828.2	1432.58	0.00000
TOTLIMIT	28082	36281.4	1.2920	2.17	-18140.7	807.61	0.00000
MONTH	28072	36580.5	1.3031	1.33	-18290.2	508.56	0.00000
SEASON	28080	36899.7	1.3141	0.50	-18449.9	189.29	0.00000
AREA	28082	36987.3	1.3171	0.27	-18493.6	101.73	0.00000
BAGLIMIT	28082	36987.3	1.3171	0.27	-18493.6	.	.
DAYNIGHT	28081	37054.6	1.3196	0.09	-18527.3	34.41	0.00000

The explanatory factors in the base model are: VESSEL

FACTOR	DEGF	DEVIANCE	DEV/DF	%REDUCTION	LOGLIKE	CHISQ	PROBCHISQ
BASE	28063	32227.8	1.1484		-16113.9		
YEAR	28047	30671.3	1.0936	4.78	-15335.7	1556.45	0.00000
MONTH	28052	31690.2	1.1297	1.63	-15845.1	537.57	0.00000
TRIPCAT	28061	31756.3	1.1317	1.46	-15878.1	471.53	0.00000
TOTLIMIT	28062	31769.6	1.1321	1.42	-15884.8	458.15	0.00000
SEASON	28060	31993.5	1.1402	0.72	-15996.7	234.30	0.00000
DAYNIGHT	28061	32212.4	1.1479	0.04	-16106.2	15.36	0.00046
AREA	28063	32227.8	1.1484	0.00	-16113.9	0.00	.
BAGLIMIT	28063	32227.8	1.1484	0.00	-16113.9	.	.

The explanatory factors in the base model are: VESSEL YEAR

FACTOR	DEGF	DEVIANCE	DEV/DF	%REDUCTION	LOGLIKE	CHISQ	PROBCHISQ
BASE	28047	30671.3	1.0936		-15335.7		
MONTH	28036	29939.8	1.0679	2.35	-14969.9	731.50	0.00000
TRIPCAT	28045	30189.4	1.0765	1.56	-15094.7	481.93	0.00000
SEASON	28044	30333.5	1.0816	1.09	-15166.7	337.85	0.00000
TOTLIMIT	28046	30641.9	1.0926	0.09	-15321.0	29.41	0.00000
DAYNIGHT	28045	30665.0	1.0934	0.01	-15332.5	6.36	0.04157
AREA	28047	30671.3	1.0936	0.00	-15335.7	0.00	.
BAGLIMIT	28047	30671.3	1.0936	0.00	-15335.7	.	.

TABLE 5 (cont.): Results of the stepwise procedure to develop the proportion positive catch rate model for the EAST indices.

The explanatory factors in the base model are: VESSEL YEAR MONTH

FACTOR	DEGF	DEVIANCE	DEV/DF	%REDUCTION	LOGLIKE	CHISQ	PROBCHISQ
BASE	28036	29939.8	1.0679		-14969.9		
TRIPCAT	28034	29512.4	1.0527	1.42	-14756.2	427.42	0.00000
DAYNIGHT	28034	29929.1	1.0676	0.03	-14964.6	10.70	0.00474
TOTLIMIT	28035	29935.2	1.0678	0.01	-14967.6	4.59	0.03214
SEASON	28036	29939.8	1.0679	0.00	-14969.9	0.00	.
AREA	28036	29939.8	1.0679	0.00	-14969.9	0.00	.
BAGLIMIT	28036	29939.8	1.0679	0.00	-14969.9	.	.

The explanatory factors in the base model are: VESSEL YEAR MONTH TRIPCAT

FACTOR	DEGF	DEVIANCE	DEV/DF	%REDUCTION	LOGLIKE	CHISQ	PROBCHISQ
BASE	28034	29512.4	1.0527		-14756.2		
DAYNIGHT	28032	29079.8	1.0374	1.46	-14539.9	432.62	0.00000
SEASON	28034	29512.4	1.0527	0.00	-14756.2	0.00	.
AREA	28034	29512.4	1.0527	0.00	-14756.2	0.00	.
BAGLIMIT	28034	29512.4	1.0527	0.00	-14756.2	.	.
TOTLIMIT	28033	29512.0	1.0528	-0.00	-14756.0	0.42	0.51529

The explanatory factors in the base model are: VESSEL YEAR MONTH TRIPCAT DAYNIGHT

FACTOR	DEGF	DEVIANCE	DEV/DF	%REDUCTION	LOGLIKE	CHISQ	PROBCHISQ
BASE	28032	29079.8	1.0374		-14539.9		
SEASON	28032	29079.8	1.0374	0.00	-14539.9	0.00	.
AREA	28032	29079.8	1.0374	0.00	-14539.9	0.00	.
BAGLIMIT	28032	29079.8	1.0374	0.00	-14539.9	.	.
TOTLIMIT	28031	29079.7	1.0374	-0.00	-14539.9	0.07	0.79440

% diff: percent difference in deviance/df between each factor and the null model**;** delta%: percent difference in deviance/df between the newly included factor and the previous factor entered into the model; L: log likelihood; ChiSquare: Pearson Chi-square statistic; Pr>Chi: significance level of the Chi-square statistic.

TABLE 6: Results of the stepwise procedure to develop the positive catch rate model for the EAST indices.

There are no explanatory factors in the base model.

FACTOR	DEGF	DEVIANCE	DEV/DF	%REDUCTION	LOGLIKE	CHISQ	PROBCHISQ
BASE	17619	615921.0	34.9578		665597.7		
VESSEL	17599	425793.0	24.1942	30.79	760661.7	190127.99	0.00000
TOTLIMIT	17618	458232.0	26.0093	25.60	744442.2	157688.99	0.00000
YEAR	17603	561288.2	31.8859	8.79	692914.1	54632.88	0.00000
TRIPCAT	17617	574369.2	32.6031	6.74	686373.6	41551.85	0.00000
AREA	17618	588924.3	33.4274	4.38	679096.0	26996.75	0.00000
BAGLIMIT	17618	588924.3	33.4274	4.38	679096.0	.	.
MONTH	17608	594961.0	33.7892	3.34	676077.7	20960.05	0.00000
SEASON	17616	597284.0	33.9058	3.01	674916.2	18637.00	0.00000
DAYNIGHT	17617	615281.0	34.9254	0.09	665917.7	640.02	0.00000

The explanatory factors in the base model are: VESSEL

FACTOR	DEGF	DEVIANCE	DEV/DF	%REDUCTION	LOGLIKE	CHISQ	PROBCHISQ
BASE	17599	425793.0	24.1942		760661.7		
TOTLIMIT	17598	368265.8	20.9266	13.51	789425.3	57527.19	0.00000
YEAR	17583	381074.8	21.6729	10.42	783020.8	44718.20	0.00000
MONTH	17588	400861.2	22.7917	5.80	773127.6	24931.87	0.00000
SEASON	17596	403359.1	22.9233	5.25	771878.6	22433.95	0.00000
TRIPCAT	17597	416516.3	23.6697	2.17	765300.1	9276.77	0.00000
DAYNIGHT	17597	425192.6	24.1628	0.13	760961.9	600.47	0.00000
AREA	17599	425793.0	24.1942	0.00	760661.7	0.00	.
BAGLIMIT	17599	425793.0	24.1942	0.00	760661.7	.	.

The explanatory factors in the base model are: VESSEL TOTLIMIT

FACTOR	DEGF	DEVIANCE	DEV/DF	%REDUCTION	LOGLIKE	CHISQ	PROBCHISQ
BASE	17598	368265.8	20.9266		789425.3		
YEAR	17582	344256.8	19.5801	6.43	801429.8	24009.04	0.00000
MONTH	17587	349774.5	19.8882	4.96	798670.9	18491.36	0.00000
SEASON	17595	351478.6	19.9760	4.54	797818.9	16787.28	0.00000
TRIPCAT	17596	359988.1	20.4585	2.24	793564.1	8277.70	0.00000
DAYNIGHT	17596	367974.9	20.9124	0.07	789570.7	290.97	0.00000
AREA	17598	368265.8	20.9266	0.00	789425.3	0.00	.
BAGLIMIT	17598	368265.8	20.9266	0.00	789425.3	.	.

TABLE 6 (cont.): Results of the stepwise procedure to develop the positive catch rate model for the EAST indices.

The explanatory factors in the base model are: VESSEL TOTLIMIT YEAR

FACTOR	DEGF	DEVIANCE	DEV/DF	%REDUCTION	LOGLIKE	CHISQ	PROBCHISQ
BASE	17582	344256.8	19.5801		801429.8		
MONTH	17571	324920.3	18.4919	5.56	811098.0	19336.49	0.00000
SEASON	17579	326959.4	18.5994	5.01	810078.5	17297.41	0.00000
TRIPCAT	17580	336858.7	19.1615	2.14	805128.8	7398.14	0.00000
DAYNIGHT	17580	343671.6	19.5490	0.16	801722.4	585.25	0.00000
AREA	17582	344256.8	19.5801	0.00	801429.8	0.00	.
BAGLIMIT	17582	344256.8	19.5801	0.00	801429.8	.	.

The explanatory factors in the base model are: VESSEL TOTLIMIT YEAR MONTH

FACTOR	DEGF	DEVIANCE	DEV/DF	%REDUCTION	LOGLIKE	CHISQ	PROBCHISQ
BASE	17571	324920.3	18.4919		811098.0		
TRIPCAT	17569	319221.0	18.1696	1.74	813947.7	5699.27	0.00000
DAYNIGHT	17569	323923.4	18.4372	0.30	811596.5	996.87	0.00000
SEASON	17571	324920.3	18.4919	0.00	811098.0	0.00	.
AREA	17571	324920.3	18.4919	0.00	811098.0	0.00	.
BAGLIMIT	17571	324920.3	18.4919	0.00	811098.0	.	.

The explanatory factors in the base model are: VESSEL TOTLIMIT YEAR MONTH TRIPCAT

FACTOR	DEGF	DEVIANCE	DEV/DF	%REDUCTION	LOGLIKE	CHISQ	PROBCHISQ
BASE	17569	319221.0	18.1696		813947.7		
DAYNIGHT	17567	317144.5	18.0534	0.64	814985.9	2076.50	0.00000
SEASON	17569	319221.0	18.1696	0.00	813947.7	0.00	.
AREA	17569	319221.0	18.1696	0.00	813947.7	0.00	.
BAGLIMIT	17569	319221.0	18.1696	0.00	813947.7	.	.

% diff: percent difference in deviance/df between each factor and the null model**;** delta%: percent difference in deviance/df between the newly included factor and the previous factor entered into the model; L: log likelihood; ChiSquare: Pearson Chi-square statistic; Pr>Chi: significance level of the Chi-square statistic.

TABLE 7: Results of the WEST zone analysis (1986-2002). Lo method with binomial error assumption for proportion positives.

Class Level Information

Class	Levels	Values
year	17	1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002
month	12	1 2 3 4 5 6 7 8 9 10 11 12
vessel	10	560 561 562 563 564 566 575 577 584 641

Criteria For Assessing Goodness Of Fit

Criterion	DF	Value	Value/DF
Deviance	13E3	2630.1403	0.1970
Scaled Deviance	13E3	2630.1403	0.1970
Pearson Chi-Square	13E3	34642.7342	2.5950
Scaled Pearson X2	13E3	34642.7342	2.5950
Log Likelihood		-1315.0701	

Analysis Of Parameter Estimates

Parameter		DF	Estimate	Standard Error	Wald 95% Confidence Limits		Chi-Square	Pr > ChiSq
Intercept		1	-4.5429	1.1247	-6.7472	-2.3385	16.32	<.0001
year	1986	1	0.8193	0.3122	0.2073	1.4312	6.89	0.0087
year	1987	1	0.4358	0.3196	-0.1906	1.0623	1.86	0.1727
year	1988	1	0.3744	0.3262	-0.2649	1.0137	1.32	0.2510
year	1989	1	-0.2024	0.3567	-0.9016	0.4967	0.32	0.5703
year	1990	1	-0.4866	0.2910	-1.0569	0.0837	2.80	0.0945
year	1991	1	-0.8672	0.3033	-1.4616	-0.2727	8.17	0.0042
year	1992	1	-1.7166	0.3276	-2.3587	-1.0745	27.46	<.0001
year	1993	1	-2.2954	0.3818	-3.0438	-1.5471	36.15	<.0001
year	1994	1	-2.0127	0.3519	-2.7025	-1.3229	32.71	<.0001
year	1995	1	-2.8760	0.4021	-3.6641	-2.0879	51.16	<.0001
year	1996	1	-2.5706	0.3870	-3.3291	-1.8122	44.13	<.0001
year	1997	1	-4.5069	1.0252	-6.5162	-2.4977	19.33	<.0001
year	1998	1	-3.1422	0.4643	-4.0523	-2.2321	45.79	<.0001
year	1999	1	-2.6142	0.3982	-3.3946	-1.8339	43.11	<.0001
year	2000	1	0.6837	0.2602	0.1738	1.1936	6.91	0.0086
year	2001	1	-0.0901	0.2955	-0.6692	0.4890	0.09	0.7603
year	2002	0	0.0000	0.0000	0.0000	0.0000	.	.
month	1	1	0.8224	1.1683	-1.4674	3.1121	0.50	0.4815
month	2	1	2.4313	1.0424	0.3883	4.4742	5.44	0.0197
month	3	1	3.0142	1.0236	1.0079	5.0204	8.67	0.0032
month	4	1	1.9737	1.0293	-0.0436	3.9911	3.68	0.0552
month	5	1	-0.4059	1.0973	-2.5566	1.7447	0.14	0.7114
month	6	1	1.1092	1.0328	-0.9150	3.1335	1.15	0.2828
month	7	1	3.0099	1.0204	1.0100	5.0098	8.70	0.0032
month	8	1	3.1241	1.0204	1.1241	5.1240	9.37	0.0022
month	9	1	1.5145	1.0421	-0.5280	3.5571	2.11	0.1461
month	10	1	0.3685	1.1299	-1.8461	2.5831	0.11	0.7443
month	11	1	0.3057	1.2379	-2.1205	2.7318	0.06	0.8050
month	12	0	0.0000	0.0000	0.0000	0.0000	.	.

TABLE 7 (cont.): Results of the WEST zone analysis (1986-2002). Lo method with binomial error assumption for proportion positives.

Parameter		DF	Estimate	Standard Error	Wald 95% Confidence Limits		Chi-Square	Pr > ChiSq
vessel	560	1	0.4894	0.4910	-0.4729	1.4517	0.99	0.3189
vessel	561	1	2.1063	0.4832	1.1592	3.0533	19.00	<.0001
vessel	562	1	2.4978	0.5020	1.5139	3.4817	24.76	<.0001
vessel	563	1	1.8266	0.4532	0.9384	2.7149	16.25	<.0001
vessel	564	1	1.6958	0.4451	0.8235	2.5682	14.52	0.0001
vessel	566	1	1.6191	0.4468	0.7434	2.4948	13.13	0.0003
vessel	575	1	-1.2009	0.5125	-2.2054	-0.1965	5.49	0.0191
vessel	577	1	-0.3136	0.5009	-1.2953	0.6681	0.39	0.5312
vessel	584	1	-1.1377	0.8262	-2.7570	0.4816	1.90	0.1685
vessel	641	0	0.0000	0.0000	0.0000	0.0000	.	.
totlimit		1	-0.0053	0.0006	-0.0064	-0.0042	90.25	<.0001
Scale		0	1.0000	0.0000	1.0000	1.0000		

NOTE: The scale parameter was held fixed.

LR Statistics For Type 3 Analysis

Source	DF	Chi-Square	Pr > ChiSq
year	16	527.82	<.0001
month	11	335.67	<.0001
vessel	9	272.68	<.0001
totlimit	1	117.13	<.0001

TABLE 8: Results of the WEST zone analysis (1986-2002). Lo method with Poisson error assumption for positive trips.

Class Level Information

Class	Levels	Values
year	17	1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002
vessel	10	560 561 562 563 564 566 575 577 584 641
month	12	1 2 3 4 5 6 7 8 9 10 11 12
tripcat	3	3qtr-full day half day multi day

Criteria For Assessing Goodness Of Fit

Criterion	DF	Value	Value/DF
Deviance	13E3	429924.6908	33.2527
Scaled Deviance	13E3	429924.6908	33.2527
Pearson Chi-Square	13E3	437962.7283	33.8744
Scaled Pearson X2	13E3	437962.7283	33.8744
Log Likelihood		11774062.882	

Analysis Of Parameter Estimates

Parameter		DF	Estimate	Standard Error	Wald 95% Confidence Limits		Chi-Square	Pr > ChiSq
Intercept		1	-1.5253	0.0092	-1.5434	-1.5073	27509.1	<.0001
year	1986	1	1.2228	0.0064	1.2103	1.2353	36541.3	<.0001
year	1987	1	1.3150	0.0062	1.3028	1.3272	44561.0	<.0001
year	1988	1	1.3028	0.0063	1.2905	1.3151	42886.7	<.0001
year	1989	1	1.3081	0.0063	1.2957	1.3205	42711.5	<.0001
year	1990	1	0.6140	0.0063	0.6016	0.6263	9506.45	<.0001
year	1991	1	0.8026	0.0061	0.7907	0.8145	17459.6	<.0001
year	1992	1	0.9286	0.0059	0.9171	0.9402	24774.7	<.0001
year	1993	1	0.9094	0.0059	0.8978	0.9210	23606.5	<.0001
year	1994	1	0.8300	0.0059	0.8184	0.8415	19875.3	<.0001
year	1995	1	0.5633	0.0060	0.5515	0.5751	8746.66	<.0001
year	1996	1	0.5870	0.0060	0.5754	0.5987	9682.47	<.0001
year	1997	1	0.5492	0.0062	0.5371	0.5614	7862.15	<.0001
year	1998	1	0.2893	0.0063	0.2771	0.3016	2141.13	<.0001
year	1999	1	-0.3177	0.0071	-0.3317	-0.3038	1991.40	<.0001
year	2000	1	-0.1039	0.0081	-0.1198	-0.0879	163.21	<.0001
year	2001	1	-0.1809	0.0086	-0.1978	-0.1640	440.49	<.0001
year	2002	0	0.0000	0.0000	0.0000	0.0000	.	.
vessel	560	1	0.2658	0.0053	0.2554	0.2763	2489.50	<.0001
vessel	561	1	0.1905	0.0055	0.1796	0.2013	1179.99	<.0001
vessel	562	1	0.3135	0.0057	0.3024	0.3247	3049.43	<.0001
vessel	563	1	0.2069	0.0053	0.1964	0.2173	1507.93	<.0001
vessel	564	1	0.1259	0.0055	0.1151	0.1368	518.77	<.0001
vessel	566	1	0.0753	0.0059	0.0638	0.0869	162.95	<.0001
vessel	575	1	0.3834	0.0057	0.3722	0.3945	4529.75	<.0001
vessel	577	1	0.5715	0.0054	0.5608	0.5821	11075.0	<.0001
vessel	584	1	-0.1374	0.0068	-0.1507	-0.1240	406.87	<.0001
vessel	641	0	0.0000	0.0000	0.0000	0.0000	.	.
totlimit		1	-0.0009	0.0000	-0.0009	-0.0009	41921.3	<.0001

TABLE 8 (cont.): Results of the WEST zone analysis (1986-2002). Lo method with Poisson error assumption for positive trips.

Parameter		DF	Estimate	Standard Error	Wald 95% Confidence Limits		Chi-Square	Pr > ChiSq
month	1	1	-0.0060	0.0050	-0.0158	0.0039	1.42	0.2331
month	2	1	-0.0821	0.0048	-0.0915	-0.0728	294.62	<.0001
month	3	1	-0.1400	0.0045	-0.1489	-0.1312	954.43	<.0001
month	4	1	-0.1849	0.0046	-0.1939	-0.1759	1621.55	<.0001
month	5	1	-0.2924	0.0044	-0.3011	-0.2837	4337.97	<.0001
month	6	1	-0.3353	0.0044	-0.3438	-0.3267	5916.41	<.0001
month	7	1	-0.2311	0.0043	-0.2395	-0.2227	2931.57	<.0001
month	8	1	-0.1817	0.0043	-0.1901	-0.1733	1794.68	<.0001
month	9	1	-0.1372	0.0045	-0.1459	-0.1285	948.97	<.0001
month	10	1	0.0098	0.0046	0.0009	0.0187	4.65	0.0311
month	11	1	0.0124	0.0051	0.0025	0.0223	5.98	0.0145
month	12	0	0.0000	0.0000	0.0000	0.0000	.	.
tripcat	3qtr-full day	1	0.4395	0.0039	0.4319	0.4472	12735.2	<.0001
tripcat	half day	1	0.7375	0.0174	0.7035	0.7716	1806.70	<.0001
tripcat	multi day	0	0.0000	0.0000	0.0000	0.0000	.	.
Scale		0	1.0000	0.0000	1.0000	1.0000		

NOTE: The scale parameter was held fixed.

LR Statistics For Type 3 Analysis

Source	DF	Chi-Square	Pr > ChiSq
year	16	213254	<.0001
vessel	9	47840.5	<.0001
totlimit	1	42623.9	<.0001
month	11	26924.7	<.0001
tripcat	2	14770.8	<.0001

TABLE 9: Results of the EAST zone analysis (1986-2002). Lo method with binomial error assumption for proportion positives.

Class Level Information

Class	Levels	Values
vessel	21	534 535 536 537 538 539 540 542 543 546 547 548 552 553 634 644 652 660 665 666 667
year	17	1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002
month	12	1 2 3 4 5 6 7 8 9 10 11 12
tripcat	3	3qtr-full day half day multi day
daynight	3	day night unk/mix

Criteria For Assessing Goodness Of Fit

Criterion	DF	Value	Value/DF
Deviance	28E3	29079.8039	1.0374
Scaled Deviance	28E3	29079.8039	1.0374
Pearson Chi-Square	28E3	29017.9578	1.0352
Scaled Pearson X2	28E3	29017.9578	1.0352
Log Likelihood		-14539.9020	

Analysis Of Parameter Estimates

Parameter		DF	Estimate	Standard Error	Wald 95% Confidence Limits		Chi-Square	Pr > ChiSq
Intercept		1	-5.3684	0.2721	-5.9017	-4.8352	389.32	<.0001
vessel	534	1	0.8716	0.1287	0.6194	1.1238	45.89	<.0001
vessel	535	1	0.8068	0.1344	0.5433	1.0702	36.03	<.0001
vessel	536	1	0.9156	0.1290	0.6629	1.1684	50.40	<.0001
vessel	537	1	0.4035	0.1403	0.1286	0.6785	8.27	0.0040
vessel	538	1	1.8357	0.1260	1.5889	2.0826	212.42	<.0001
vessel	539	1	1.6676	0.1227	1.4272	1.9081	184.76	<.0001
vessel	540	1	1.0944	0.1292	0.8412	1.3476	71.75	<.0001
vessel	542	1	0.7104	0.1393	0.4375	0.9833	26.03	<.0001
vessel	543	1	0.2035	0.1431	-0.0771	0.4840	2.02	0.1552
vessel	546	1	0.1740	0.1273	-0.0755	0.4235	1.87	0.1716
vessel	547	1	0.0762	0.1288	-0.1762	0.3286	0.35	0.5542
vessel	548	1	0.2405	0.1396	-0.0330	0.5141	2.97	0.0848
vessel	552	1	0.2995	0.1292	0.0462	0.5528	5.37	0.0205
vessel	553	1	0.0822	0.1304	-0.1735	0.3378	0.40	0.5287
vessel	634	1	4.1144	0.2317	3.6602	4.5686	315.24	<.0001
vessel	644	1	2.1146	0.1263	1.8670	2.3622	280.19	<.0001
vessel	652	1	1.2248	0.1442	0.9421	1.5075	72.11	<.0001
vessel	660	1	1.8275	0.1260	1.5806	2.0743	210.49	<.0001
vessel	665	1	-1.9563	0.4657	-2.8690	-1.0436	17.65	<.0001
vessel	666	1	0.1230	0.1471	-0.1653	0.4114	0.70	0.4030
vessel	667	0	0.0000	0.0000	0.0000	0.0000	.	.
year	1986	1	1.5818	0.1465	1.2948	1.8689	116.65	<.0001
year	1987	1	2.2620	0.1248	2.0174	2.5065	328.68	<.0001
year	1988	1	1.6668	0.1063	1.4584	1.8752	245.74	<.0001
year	1989	1	1.5366	0.1072	1.3264	1.7468	205.32	<.0001
year	1990	1	1.3919	0.1041	1.1878	1.5960	178.62	<.0001
year	1991	1	1.0343	0.1040	0.8304	1.2382	98.86	<.0001

TABLE 9 (cont.): Results of the EAST zone analysis (1986-2002). Lo method with binomial error assumption for proportion positives.

Parameter		DF	Estimate	Standard Error	Wald 95% Confidence Limits		Chi-Square	Pr > ChiSq
year	1992	1	0.7441	0.1015	0.5451	0.9430	53.75	<.0001
year	1993	1	0.6906	0.0999	0.4949	0.8864	47.82	<.0001
year	1994	1	1.1254	0.1001	0.9292	1.3216	126.39	<.0001
year	1995	1	0.9943	0.0986	0.8012	1.1875	101.78	<.0001
year	1996	1	0.6626	0.1004	0.4658	0.8594	43.56	<.0001
year	1997	1	-0.2856	0.1048	-0.4909	-0.0803	7.43	0.0064
year	1998	1	-0.4832	0.1067	-0.6924	-0.2740	20.50	<.0001
year	1999	1	-0.8295	0.1147	-1.0543	-0.6048	52.34	<.0001
year	2000	1	0.5050	0.1091	0.2913	0.7188	21.44	<.0001
year	2001	1	0.7903	0.1094	0.5760	1.0047	52.23	<.0001
year	2002	0	0.0000	0.0000	0.0000	0.0000	.	.
month	1	1	1.6174	0.2064	1.2129	2.0219	61.41	<.0001
month	2	1	1.6951	0.1800	1.3423	2.0480	88.64	<.0001
month	3	1	1.9160	0.1622	1.5980	2.2339	139.46	<.0001
month	4	1	1.4604	0.1590	1.1489	1.7720	84.41	<.0001
month	5	1	0.9670	0.1582	0.6568	1.2772	37.34	<.0001
month	6	1	1.0767	0.1569	0.7692	1.3843	47.08	<.0001
month	7	1	1.1875	0.1567	0.8803	1.4947	57.41	<.0001
month	8	1	1.1457	0.1578	0.8364	1.4550	52.70	<.0001
month	9	1	0.7847	0.1613	0.4686	1.1008	23.68	<.0001
month	10	1	0.1457	0.1693	-0.1861	0.4774	0.74	0.3895
month	11	1	0.2006	0.1886	-0.1691	0.5702	1.13	0.2875
month	12	0	0.0000	0.0000	0.0000	0.0000	.	.
tripcat	3qtr-full day	1	2.1006	0.1783	1.7511	2.4501	138.78	<.0001
tripcat	half day	1	3.5230	0.1904	3.1499	3.8961	342.52	<.0001
tripcat	multi day	0	0.0000	0.0000	0.0000	0.0000	.	.
daynight	day	1	-1.0371	0.0524	-1.1398	-0.9344	392.10	<.0001
daynight	night	1	-2.2150	0.3353	-2.8720	-1.5579	43.65	<.0001
daynight	unk/mix	0	0.0000	0.0000	0.0000	0.0000	.	.
Scale		0	1.0000	0.0000	1.0000	1.0000		

NOTE: The scale parameter was held fixed.

LR Statistics For Type 3 Analysis

Source	DF	Chi-Square	Pr > ChiSq
vessel	20	2937.44	<.0001
year	16	1989.09	<.0001
month	11	673.16	<.0001
tripcat	2	849.33	<.0001
daynight	2	432.62	<.0001

TABLE 10: Results of the EAST zone analysis (1986-2002). Lo method with Poisson error assumption for positive trips.

Class Level Information

Class	Levels	Values
vessel	21	534 535 536 537 538 539 540 542 543 546 547 548 552 553 634 644 652 660 665 666 667
year	17	1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002
month	12	1 2 3 4 5 6 7 8 9 10 11 12
tripcat	3	3qtr-full day half day multi day

Criteria For Assessing Goodness Of Fit

Criterion	DF	Value	Value/DF
Deviance	18E3	319221.0482	18.1696
Scaled Deviance	18E3	319221.0482	18.1696
Pearson Chi-Square	18E3	712290.5689	40.5425
Scaled Pearson X2	18E3	712290.5689	40.5425
Log Likelihood		813947.6561	

Analysis Of Parameter Estimates

Parameter		DF	Estimate	Standard Error	Wald 95% Confidence Limits		Chi-Square	Pr > ChiSq
Intercept		1	-0.8060	0.0225	-0.8501	-0.7620	1284.78	<.0001
vessel	534	1	-0.8339	0.0104	-0.8543	-0.8135	6406.84	<.0001
vessel	535	1	-0.4089	0.0089	-0.4264	-0.3915	2111.44	<.0001
vessel	536	1	-0.3512	0.0088	-0.3685	-0.3339	1587.77	<.0001
vessel	537	1	-0.6470	0.0091	-0.6648	-0.6293	5098.92	<.0001
vessel	538	1	-1.2006	0.0191	-1.2380	-1.1632	3954.93	<.0001
vessel	539	1	-1.1276	0.0119	-1.1508	-1.1044	9049.33	<.0001
vessel	540	1	-0.6615	0.0134	-0.6877	-0.6352	2435.79	<.0001
vessel	542	1	-0.2183	0.0111	-0.2401	-0.1965	384.43	<.0001
vessel	543	1	-0.7067	0.0112	-0.7286	-0.6847	3970.09	<.0001
vessel	546	1	-0.3279	0.0092	-0.3459	-0.3100	1281.92	<.0001
vessel	547	1	-0.5366	0.0107	-0.5576	-0.5157	2520.92	<.0001
vessel	548	1	-0.1926	0.0112	-0.2146	-0.1706	293.88	<.0001
vessel	552	1	-0.5483	0.0119	-0.5716	-0.5249	2122.70	<.0001
vessel	553	1	0.0335	0.0091	0.0156	0.0514	13.43	0.0002
vessel	634	1	-2.6288	0.0244	-2.6767	-2.5810	11582.6	<.0001
vessel	644	1	-1.6341	0.0197	-1.6728	-1.5954	6849.84	<.0001
vessel	652	1	-0.1606	0.0107	-0.1816	-0.1396	225.25	<.0001
vessel	660	1	-1.0759	0.0140	-1.1034	-1.0484	5872.72	<.0001
vessel	665	1	0.8275	0.0087	0.8105	0.8446	9052.69	<.0001
vessel	666	1	0.1227	0.0091	0.1048	0.1406	180.68	<.0001
vessel	667	0	0.0000	0.0000	0.0000	0.0000	.	.
totlimit		1	-0.0038	0.0000	-0.0038	-0.0037	23731.8	<.0001
year	1986	1	0.0101	0.0263	-0.0415	0.0616	0.15	0.7018
year	1987	1	-0.3246	0.0211	-0.3660	-0.2831	235.59	<.0001
year	1988	1	-0.2350	0.0149	-0.2643	-0.2058	248.33	<.0001
year	1989	1	-0.2440	0.0155	-0.2744	-0.2136	247.88	<.0001
year	1990	1	-0.8319	0.0122	-0.8559	-0.8079	4621.67	<.0001
year	1991	1	-0.6787	0.0119	-0.7021	-0.6554	3245.25	<.0001

TABLE 10 (cont.): Results of the EAST zone analysis (1986-2002). Lo method with Poisson error assumption for positive trips.

Parameter		DF	Estimate	Standard Error	Wald 95% Confidence Limits		Chi-Square	Pr > ChiSq
year	1992	1	-0.2286	0.0099	-0.2479	-0.2092	535.62	<.0001
year	1993	1	-0.3042	0.0096	-0.3230	-0.2855	1007.82	<.0001
year	1994	1	-0.5931	0.0097	-0.6120	-0.5742	3775.47	<.0001
year	1995	1	-0.9843	0.0098	-1.0034	-0.9651	10155.7	<.0001
year	1996	1	-0.8785	0.0092	-0.8966	-0.8603	9021.54	<.0001
year	1997	1	-0.5580	0.0087	-0.5751	-0.5409	4091.20	<.0001
year	1998	1	-0.3647	0.0084	-0.3812	-0.3481	1871.47	<.0001
year	1999	1	-0.2474	0.0085	-0.2641	-0.2307	840.55	<.0001
year	2000	1	-0.2128	0.0090	-0.2305	-0.1952	557.78	<.0001
year	2001	1	-0.4995	0.0102	-0.5194	-0.4796	2418.75	<.0001
year	2002	0	0.0000	0.0000	0.0000	0.0000	.	.
month	1	1	0.4102	0.0257	0.3598	0.4606	254.21	<.0001
month	2	1	0.2205	0.0224	0.1767	0.2644	97.28	<.0001
month	3	1	-0.0840	0.0208	-0.1248	-0.0432	16.29	<.0001
month	4	1	-0.1718	0.0202	-0.2114	-0.1321	72.15	<.0001
month	5	1	-0.2266	0.0201	-0.2659	-0.1872	127.28	<.0001
month	6	1	-0.5203	0.0201	-0.5598	-0.4808	667.06	<.0001
month	7	1	-0.5988	0.0202	-0.6385	-0.5592	876.79	<.0001
month	8	1	-0.3978	0.0203	-0.4376	-0.3580	383.94	<.0001
month	9	1	-0.0420	0.0203	-0.0818	-0.0022	4.28	0.0387
month	10	1	0.0876	0.0205	0.0474	0.1278	18.27	<.0001
month	11	1	0.1846	0.0223	0.1409	0.2282	68.66	<.0001
month	12	0	0.0000	0.0000	0.0000	0.0000	.	.
tripcat	3qtr-full day	1	0.3481	0.0072	0.3340	0.3621	2353.72	<.0001
tripcat	half day	1	-0.0098	0.0092	-0.0278	0.0083	1.12	0.2905
tripcat	multi day	0	0.0000	0.0000	0.0000	0.0000	.	.
Scale		0	1.0000	0.0000	1.0000	1.0000		

NOTE: The scale parameter was held fixed.

LR Statistics For Type 3 Analysis

Source	DF	Chi-Square	Pr > ChiSq
vessel	20	72575.2	<.0001
totlimit	1	26239.9	<.0001
year	16	24277.3	<.0001
month	11	17637.6	<.0001
tripcat	2	5699.27	<.0001

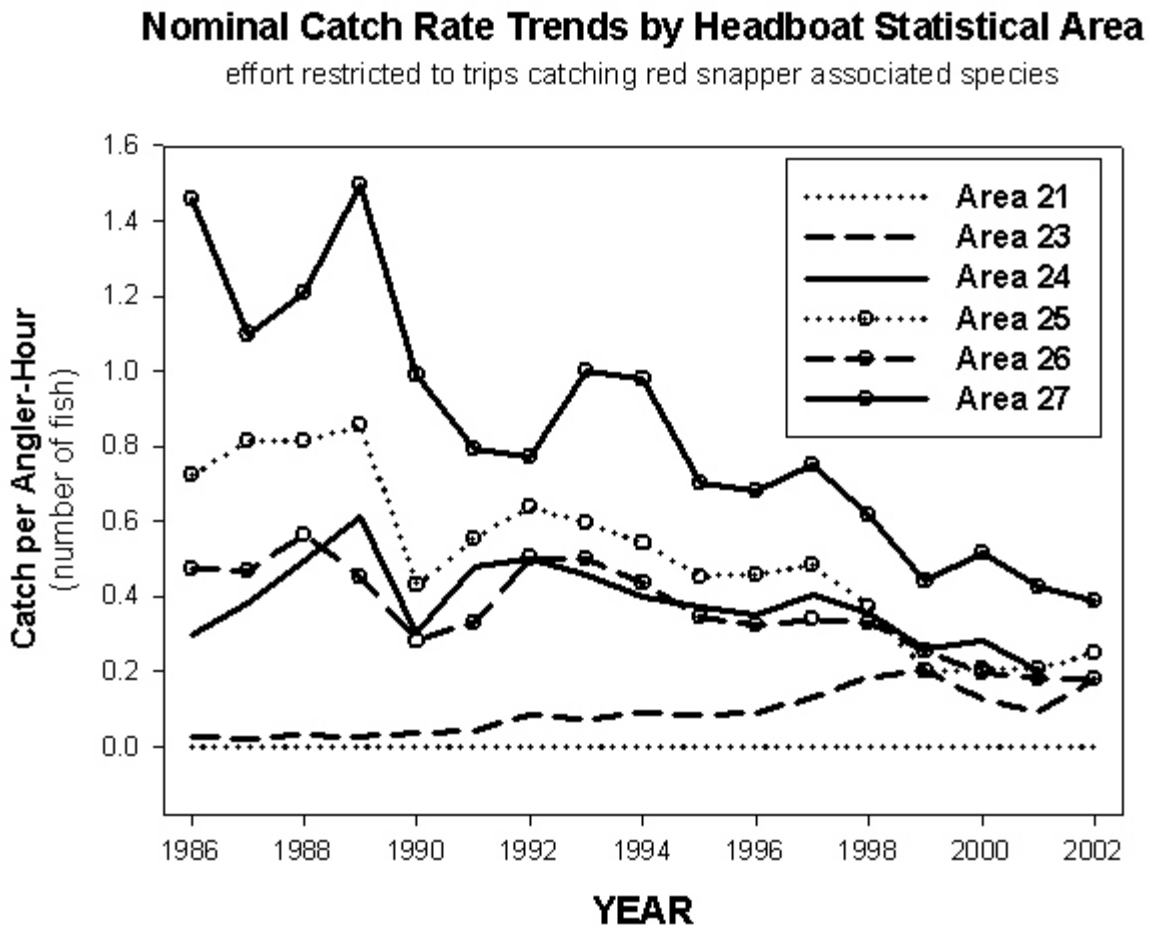

FIGURE 1. Observed nominal catch rate trends (number of fish caught per angler-hour) by headboat statistical area. Only full day trips which caught at least one of the associated species listed in **Table 2** are included. The approximate locations of these headboat statistical areas are: **18**=Dry Tortugas, **21**=Southwest Florida, **22**=mid-Gulf Florida, **23**=Northwest Florida-Alabama, **24**=Louisiana, **25**=Northeast Texas, **26**=Pt. Aransas, Texas, **27**=Pt. Isabel, Texas. Areas 23 and lower are in the EAST zone. Areas 18 and 22 contained observations, but the trends are not shown as the total number of observations were quite low (1 and 50, respectively).

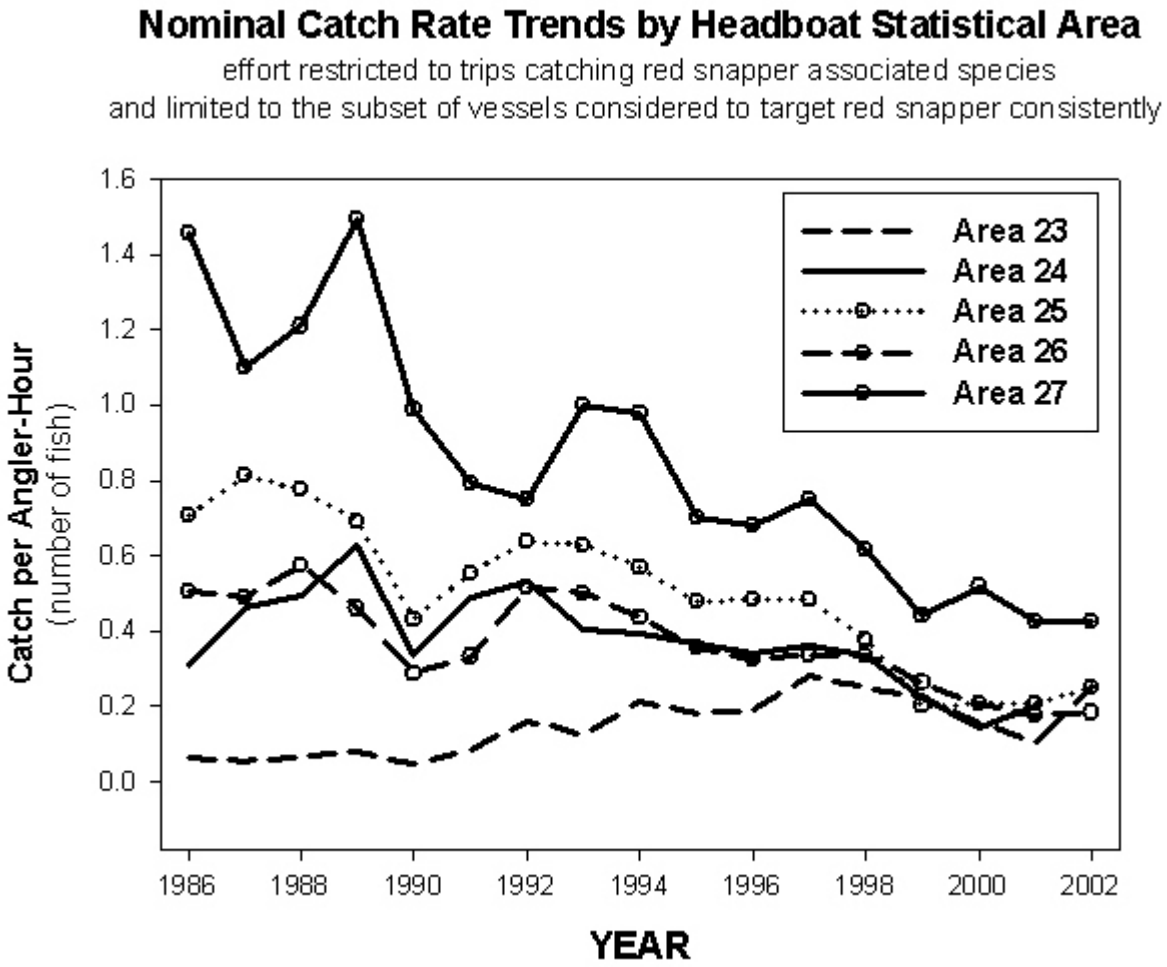

FIGURE 2. Observed nominal catch rate trends (number of fish caught per angler-hour) by headboat statistical area, limited to trips by the subset of vessels considered to be targeting red snapper consistently over time. Only full day trips which caught at least one of the associated species listed in **Table 2** are included. The approximate locations of these headboat statistical areas are: **18**=Dry Tortugas, **21**=Southwest Florida, **22**=mid-Gulf Florida, **23**=Northwest Florida-Alabama, **24**=Louisiana, **25**=Northeast Texas, **26**=Pt. Aransas, Texas, **27**=Pt. Isabel, Texas. Areas 23 and lower are in the EAST zone. Areas 18, 21, and 22 contained no observations.

TABLE 11: Relative Abundance Indices for Red Snapper in the Gulf of Mexico (WEST zone)				
YEAR	**INDEX**	**LCI**	**UCI**	**CV**
1986	1.344	1.149	1.540	0.074
1987	1.597	1.418	1.775	0.057
1988	1.594	1.411	1.777	0.059
1989	1.730	1.577	1.884	0.045
1990	0.887	0.830	0.944	0.033
1991	1.098	1.042	1.155	0.026
1992	1.287	1.246	1.327	0.016
1993	1.276	1.239	1.312	0.015
1994	1.173	1.138	1.208	0.015
1995	0.908	0.880	0.936	0.016
1996	0.927	0.899	0.956	0.016
1997	0.901	0.871	0.931	0.017
1998	0.692	0.665	0.718	0.019
1999	0.375	0.353	0.398	0.031
2000	0.368	0.298	0.438	0.097
2001	0.386	0.327	0.444	0.077
2002	0.457	0.396	0.518	0.068

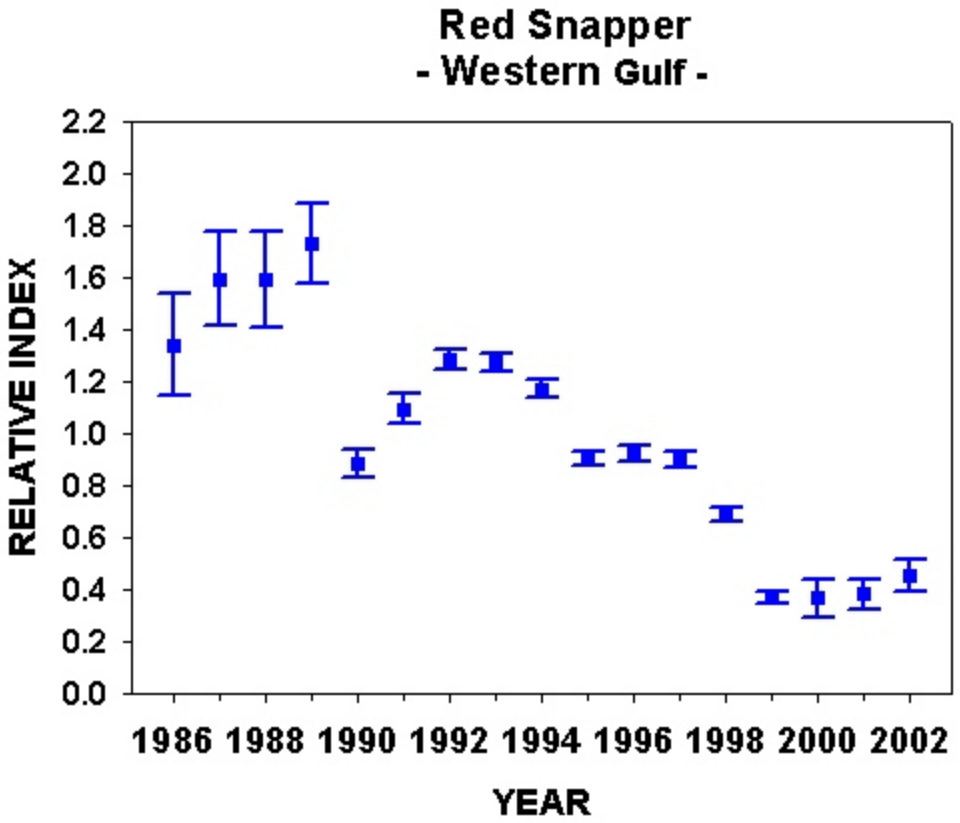

FIGURE 3. Relative abundance indices for red snapper in the Gulf of Mexico (WEST zone) with approximate 95% confidence intervals.

Proportion Positive Model = YEAR+MONTH+VESSEL+TOTLIMIT (success, error distribution: binomial)

Positive Trip Model= YEAR+VESSEL+TOTLIMIT+MONTH+TRIPCAT (fish caught per trip, offset: natural log angler*hours, error distribution: Poisson)

TABLE 12: Relative Abundance Indices for Red snapper in the Gulf of Mexico (EAST zone)				
YEAR	**INDEX**	**LCI**	**UCI**	**CV**
1986	1.018	0.644	1.391	0.187
1987	0.46	0.308	0.612	0.168
1988	0.756	0.616	0.897	0.095
1989	0.811	0.655	0.967	0.098
1990	0.489	0.41	0.568	0.082
1991	0.684	0.586	0.781	0.073
1992	1.214	1.097	1.331	0.049
1993	1.149	1.046	1.252	0.046
1994	0.713	0.637	0.79	0.055
1995	0.513	0.452	0.574	0.061
1996	0.654	0.587	0.721	0.052
1997	1.168	1.076	1.26	0.04
1998	1.466	1.353	1.579	0.039
1999	1.729	1.593	1.865	0.04
2000	1.345	1.204	1.487	0.054
2001	0.909	0.789	1.03	0.068
2002	1.921	1.722	2.12	0.053

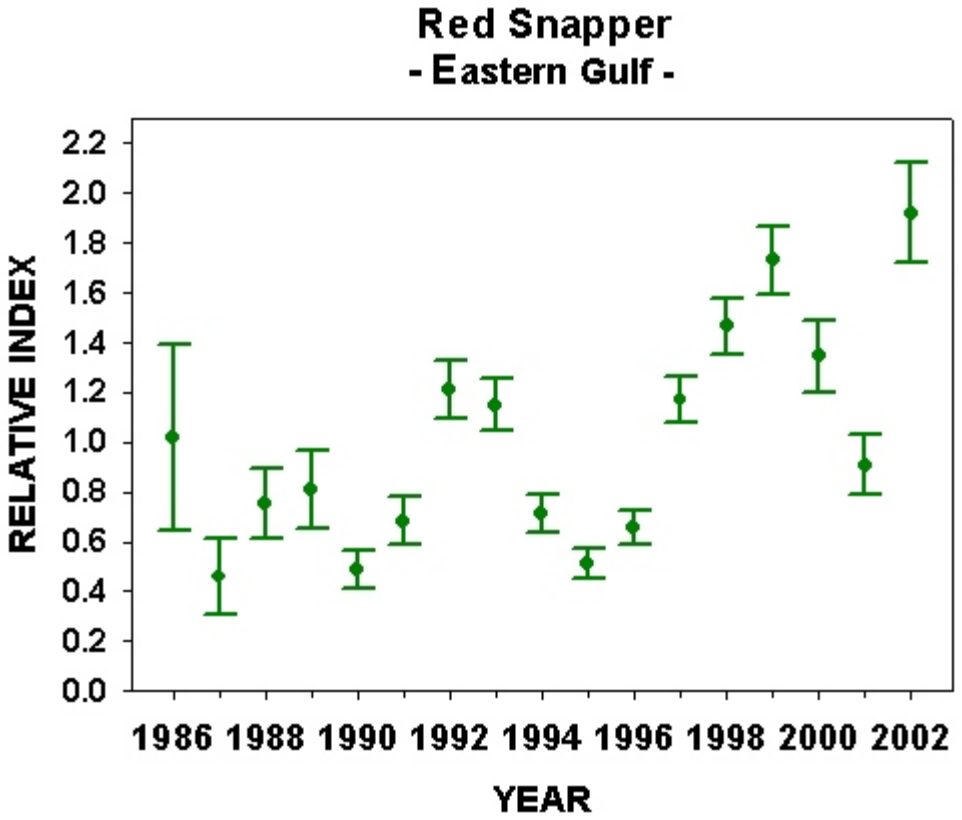

FIGURE 4. Relative abundance indices for red snapper in the Gulf of Mexico (EAST zone) with approximate 95% confidence intervals.

Proportion Positive Model = VESSEL+YEAR+MONTH+TRIPCAT+DAYNIGHT (success, error distribution: binomial)

Positive Trip Model= VESSEL+TOTLIMIT+YEAR+MONTH+TRIPCAT (fish caught per trip, offset: natural log angler*hours, error distribution: Poisson)

TABLE 13: Results of the stepwise procedure to develop the proportion positive catch rate model for the alternative analysis (derived using observations where red snapper associated species were caught).

There are no explanatory factors in the base model.

FACTOR	DEGF	DEVIANCE	DEV/DF	%REDUCTION	LOGLIKE	CHISQ	PROBCHISQ
BASE	29374	13309.6	0.4531		-6654.8		
VESSEL	29346	10852.2	0.3698	18.39	-5426.1	2457.38	0.00000
AREA	29370	11384.5	0.3876	14.45	-5692.2	1925.10	0.00000
YEAR	29358	11541.0	0.3931	13.24	-5770.5	1768.58	0.00000
MONTH	29363	12608.6	0.4294	5.23	-6304.3	700.94	0.00000
SEASON	29371	12992.9	0.4424	2.37	-6496.5	316.66	0.00000
BAGLIMIT	29371	12992.9	0.4424	2.37	-6496.5	.	.
DAYNIGHT	29372	13015.7	0.4431	2.20	-6507.9	293.85	0.00000
TOTLIMIT	29373	13197.7	0.4493	0.84	-6598.8	111.91	0.00000

The explanatory factors in the base model are: VESSEL

FACTOR	DEGF	DEVIANCE	DEV/DF	%REDUCTION	LOGLIKE	CHISQ	PROBCHISQ
BASE	29346	10852.2	0.3698		-5426.1		
YEAR	29330	9384.9	0.3200	13.47	-4692.5	1467.28	0.00000
MONTH	29335	10043.6	0.3424	7.42	-5021.8	808.60	0.00000
SEASON	29343	10539.3	0.3592	2.87	-5269.6	312.92	0.00000
BAGLIMIT	29343	10539.3	0.3592	2.87	-5269.6	.	.
TOTLIMIT	29345	10818.0	0.3687	0.31	-5409.0	34.14	0.00000
DAYNIGHT	29344	10840.4	0.3694	0.10	-5420.2	11.75	0.00280
AREA	29346	10852.2	0.3698	0.00	-5426.1	0.00	.

The explanatory factors in the base model are: VESSEL YEAR

FACTOR	DEGF	DEVIANCE	DEV/DF	%REDUCTION	LOGLIKE	CHISQ	PROBCHISQ
BASE	29330	9384.9	0.3200		-4692.5		
MONTH	29319	8530.6	0.2910	9.07	-4265.3	854.30	0.00000
SEASON	29327	9187.0	0.3133	2.10	-4593.5	197.90	0.00000
BAGLIMIT	29327	9187.0	0.3133	2.10	-4593.5	.	.
TOTLIMIT	29329	9369.9	0.3195	0.16	-4685.0	14.99	0.00011
DAYNIGHT	29328	9380.3	0.3198	0.04	-4690.1	4.61	0.10000
AREA	29330	9384.9	0.3200	0.00	-4692.5	0.00	.

The explanatory factors in the base model are: VESSEL YEAR MONTH

FACTOR	DEGF	DEVIANCE	DEV/DF	%REDUCTION	LOGLIKE	CHISQ	PROBCHISQ
BASE	29319	8530.6	0.2910		-4265.3		
TOTLIMIT	29318	8520.5	0.2906	0.12	-4260.2	10.10	0.00148
DAYNIGHT	29317	8529.2	0.2909	0.01	-4264.6	1.36	0.50770
AREA	29319	8530.6	0.2910	0.00	-4265.3	0.00	.
SEASON	29319	8530.6	0.2910	0.00	-4265.3	0.00	.
BAGLIMIT	29319	8530.6	0.2910	0.00	-4265.3	.	.

TABLE 14: Results of the stepwise procedure to develop the positive catch rate model for the alternative analysis(derived using observations where red snapper associated species were caught).

There are no explanatory factors in the base model.

FACTOR	DEGF	DEVIANCE	DEV/DF	%REDUCTION	LOGLIKE	CHISQ	PROBCHISQ
BASE	27616	1857072.3	67.2462		14501089.0		
VESSEL	27588	1336925.0	48.4604	27.94	14761162.6	520147.30	0.00000
AREA	27612	1413461.2	51.1901	23.88	14722894.6	443611.18	0.00000
YEAR	27600	1571887.0	56.9524	15.31	14643681.7	285185.38	0.00000
MONTH	27605	1708946.4	61.9071	7.94	14575151.9	148125.90	0.00000
SEASON	27613	1750326.4	63.3878	5.74	14554462.0	106745.98	0.00000
BAGLIMIT	27613	1750326.4	63.3878	5.74	14554462.0	.	.
DAYNIGHT	27614	1835499.0	66.4699	1.15	14511875.7	21573.38	0.00000
TOTLIMIT	27615	1847690.3	66.9089	0.50	14505780.0	9382.01	0.00000

The explanatory factors in the base model are: VESSEL

FACTOR	DEGF	DEVIANCE	DEV/DF	%REDUCTION	LOGLIKE	CHISQ	PROBCHISQ
BASE	27588	1336925.0	48.4604		14761162.6		
YEAR	27572	1119793.5	40.6134	16.19	14869728.4	217131.55	0.00000
MONTH	27577	1202310.3	43.5983	10.03	14828470.0	134614.75	0.00000
SEASON	27585	1237523.9	44.8622	7.42	14810863.2	99401.11	0.00000
BAGLIMIT	27585	1237523.9	44.8622	7.42	14810863.2	.	.
TOTLIMIT	27587	1329214.9	48.1827	0.57	14765017.7	7710.18	0.00000
DAYNIGHT	27586	1332522.9	48.3043	0.32	14763363.7	4402.13	0.00000
AREA	27588	1336925.0	48.4604	0.00	14761162.6	0.00	.

The explanatory factors in the base model are: VESSEL YEAR

FACTOR	DEGF	DEVIANCE	DEV/DF	%REDUCTION	LOGLIKE	CHISQ	PROBCHISQ
BASE	27572	1119793.5	40.6134		14869728.4		
MONTH	27561	1035513.5	37.5717	7.49	14911868.4	84280.01	0.00000
SEASON	27569	1053592.4	38.2166	5.90	14902828.9	66201.08	0.00000
BAGLIMIT	27569	1053592.4	38.2166	5.90	14902828.9	.	.
TOTLIMIT	27571	1065084.2	38.6306	4.88	14897083.1	54709.34	0.00000
DAYNIGHT	27570	1117187.6	40.5219	0.23	14871031.3	2605.91	0.00000
AREA	27572	1119793.5	40.6134	0.00	14869728.4	0.00	.

TABLE 14 (cont.): Results of the stepwise procedure to develop the positive catch rate model for the alternative analysis (derived using observations where red snapper associated species were caught).

The explanatory factors in the base model are: VESSEL YEAR MONTH

FACTOR	DEGF	DEVIANCE	DEV/DF	%REDUCTION	LOGLIKE	CHISQ	PROBCHISQ
BASE	27561	1035513.5	37.5717		14911868.4		
TOTLIMIT	27560	994988.1	36.1026	3.91	14932131.1	40525.39	0.00000
DAYNIGHT	27559	1033626.1	37.5059	0.18	14912812.1	1887.35	0.00000
AREA	27561	1035513.5	37.5717	0.00	14911868.4	0.00	.
SEASON	27561	1035513.5	37.5717	0.00	14911868.4	0.00	.
BAGLIMIT	27561	1035513.5	37.5717	0.00	14911868.4	.	.

The explanatory factors in the base model are: VESSEL YEAR MONTH TOTLIMIT

FACTOR	DEGF	DEVIANCE	DEV/DF	%REDUCTION	LOGLIKE	CHISQ	PROBCHISQ
BASE	27560	994988.1	36.1026		14932131.1		
DAYNIGHT	27558	992680.7	36.0215	0.22	14933284.8	2307.44	0.00000
AREA	27560	994988.1	36.1026	0.00	14932131.1	0.00	.
SEASON	27560	994988.1	36.1026	0.00	14932131.1	0.00	.
BAGLIMIT	27560	994988.1	36.1026	0.00	14932131.1	.	.

TABLE 15: Results of the analysis (1986-2002) of the alternative data set (derived using observations where red snapper associated species were caught). Lo method with binomial error assumption for proportion positives.

Class Level Information

Class	Levels	Values
vessel	29	542 546 548 553 555 556 557 560 561 562 563 564 566 567 568 570 571 572 575 576 577 584 641 647 652 653 665 666 667
year	17	1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002
month	12	1 2 3 4 5 6 7 8 9 10 11 12

Criteria For Assessing Goodness Of Fit

Criterion	DF	Value	Value/DF
Deviance	29E3	8530.6008	0.2910
Scaled Deviance	29E3	8530.6008	0.2910
Pearson Chi-Square	29E3	43939.0075	1.4987
Scaled Pearson X2	29E3	43939.0075	1.4987
Log Likelihood		-4265.3004	

Analysis Of Parameter Estimates

Parameter		DF	Estimate	Standard Error	Wald 95% Confidence Limits		Chi-Square	Pr > ChiSq
Intercept		1	-2.2983	0.5319	-3.3408	-1.2559	18.67	<.0001
vessel	542	1	2.2287	0.1735	1.8887	2.5688	165.01	<.0001
vessel	546	1	0.1307	0.1788	-0.2198	0.4812	0.53	0.4650
vessel	548	1	1.3635	0.1712	1.0280	1.6989	63.46	<.0001
vessel	553	1	0.8483	0.1751	0.5050	1.1915	23.46	<.0001
vessel	555	1	-0.0706	0.2152	-0.4924	0.3511	0.11	0.7427
vessel	556	1	-2.5830	0.5985	-3.7561	-1.4099	18.62	<.0001
vessel	557	1	-0.7285	0.2286	-1.1765	-0.2805	10.16	0.0014
vessel	560	1	-2.7168	0.3486	-3.4001	-2.0335	60.73	<.0001
vessel	561	1	-1.3819	0.2169	-1.8070	-0.9569	40.60	<.0001
vessel	562	1	-1.6540	0.2334	-2.1115	-1.1965	50.21	<.0001
vessel	563	1	-2.5581	0.2966	-3.1395	-1.9768	74.38	<.0001
vessel	564	1	-1.6487	0.2370	-2.1133	-1.1841	48.38	<.0001
vessel	566	1	-2.0268	0.3690	-2.7500	-1.3036	30.17	<.0001
vessel	567	1	-0.5349	0.1706	-0.8694	-0.2005	9.83	0.0017
vessel	568	1	-1.1609	0.2694	-1.6890	-0.6329	18.57	<.0001
vessel	570	1	-1.2664	0.1888	-1.6364	-0.8964	44.99	<.0001
vessel	571	1	-0.2829	0.2547	-0.7820	0.2163	1.23	0.2667
vessel	572	1	-1.0158	0.2025	-1.4127	-0.6189	25.16	<.0001
vessel	575	1	-4.3333	0.7228	-5.7500	-2.9166	35.94	<.0001
vessel	576	1	-3.2021	0.5975	-4.3732	-2.0310	28.72	<.0001
vessel	577	1	-2.9908	0.3828	-3.7410	-2.2406	61.05	<.0001
vessel	584	1	-22.3635	12946.18	-25396.4	25351.68	0.00	0.9986
vessel	641	1	-2.0759	0.5982	-3.2484	-0.9034	12.04	0.0005
vessel	647	1	-0.3564	0.2081	-0.7642	0.0514	2.93	0.0867
vessel	652	1	2.0302	0.1823	1.6730	2.3874	124.09	<.0001
vessel	653	1	-0.5241	0.1875	-0.8916	-0.1567	7.82	0.0052
vessel	665	1	-2.2057	0.5297	-3.2439	-1.1676	17.34	<.0001
vessel	666	1	0.2440	0.1778	-0.1044	0.5924	1.88	0.1699
vessel	667	0	0.0000	0.0000	0.0000	0.0000	.	.

TABLE 15 (cont.): Results of the analysis (1986-2002) of the alternative data set (derived using observations where red snapper associated species were caught). Lo method with binomial error assumption for proportion positives.

Parameter		DF	Estimate	Standard Error	Wald 95% Confidence Limits		Chi-Square	Pr > ChiSq
year	1986	1	-1.1505	0.1979	-1.5384	-0.7625	33.78	<.0001
year	1987	1	-1.2366	0.1663	-1.5625	-0.9106	55.29	<.0001
year	1988	1	-2.3005	0.1753	-2.6441	-1.9570	172.22	<.0001
year	1989	1	-1.7255	0.1706	-2.0599	-1.3911	102.28	<.0001
year	1990	1	-1.6685	0.1620	-1.9861	-1.3510	106.06	<.0001
year	1991	1	-1.9272	0.1652	-2.2510	-1.6034	136.06	<.0001
year	1992	1	-2.0848	0.1624	-2.4032	-1.7665	164.74	<.0001
year	1993	1	-2.5294	0.1608	-2.8445	-2.2142	247.45	<.0001
year	1994	1	-2.3147	0.1514	-2.6115	-2.0180	233.69	<.0001
year	1995	1	-2.5302	0.1592	-2.8423	-2.2182	252.50	<.0001
year	1996	1	-2.3343	0.1597	-2.6474	-2.0212	213.54	<.0001
year	1997	1	-3.3829	0.2194	-3.8129	-2.9528	237.65	<.0001
year	1998	1	-3.8006	0.2353	-4.2618	-3.3394	260.87	<.0001
year	1999	1	-3.0532	0.1932	-3.4318	-2.6746	249.86	<.0001
year	2000	1	0.0682	0.1250	-0.1769	0.3132	0.30	0.5856
year	2001	1	0.2338	0.1266	-0.0143	0.4818	3.41	0.0647
year	2002	0	0.0000	0.0000	0.0000	0.0000	.	.
month	1	1	2.8261	0.5184	1.8102	3.8421	29.73	<.0001
month	2	1	2.8903	0.5154	1.8801	3.9004	31.45	<.0001
month	3	1	2.9608	0.5111	1.9590	3.9626	33.55	<.0001
month	4	1	1.9151	0.5127	0.9103	2.9199	13.95	0.0002
month	5	1	0.4619	0.5181	-0.5535	1.4773	0.79	0.3726
month	6	1	0.7347	0.5156	-0.2760	1.7453	2.03	0.1542
month	7	1	1.6667	0.5126	0.6619	2.6714	10.57	0.0011
month	8	1	2.0309	0.5139	1.0236	3.0382	15.62	<.0001
month	9	1	1.5452	0.5206	0.5249	2.5654	8.81	0.0030
month	10	1	0.6302	0.5361	-0.4206	1.6809	1.38	0.2398
month	11	1	0.8367	0.5660	-0.2726	1.9461	2.19	0.1393
month	12	0	0.0000	0.0000	0.0000	0.0000	.	.
Scale		0	1.0000	0.0000	1.0000	1.0000		

NOTE: The scale parameter was held fixed.

LR Statistics For Type 3 Analysis

Source	DF	Chi-Square	Pr > ChiSq
vessel	28	2285.45	<.0001
year	16	1512.98	<.0001
month	11	854.30	<.0001

TABLE 16: Results of the analysis (1986-2002) of the alternative data set (derived using observations where red snapper associated species were caught). Lo method with Poisson error assumption for positive trips.

Class Level Information

Class	Levels	Values
vessel	29	542 546 548 553 555 556 557 560 561 562 563 564 566 567 568 570 571 572 575 576 577 584 641 647 652 653 665 666 667
year	17	1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002
month	12	1 2 3 4 5 6 7 8 9 10 11 12

Criteria For Assessing Goodness Of Fit

Criterion	DF	Value	Value/DF
Deviance	28E3	994988.0959	36.1026
Scaled Deviance	28E3	994988.0959	36.1026
Pearson Chi-Square	28E3	1050296.1640	38.1094
Scaled Pearson X2	28E3	1050296.1640	38.1094
Log Likelihood		14932131.087	

Analysis Of Parameter Estimates

Parameter		DF	Estimate	Standard Error	Wald 95% Confidence Limits		Chi-Square	Pr > ChiSq
Intercept		1	-1.2659	0.0082	-1.2819	-1.2499	24112.3	<.0001
vessel	542	1	-1.2038	0.0111	-1.2256	-1.1820	11716.4	<.0001
vessel	546	1	-0.4851	0.0096	-0.5040	-0.4662	2541.06	<.0001
vessel	548	1	-0.6793	0.0112	-0.7012	-0.6574	3694.17	<.0001
vessel	553	1	-0.7052	0.0093	-0.7235	-0.6870	5745.04	<.0001
vessel	555	1	-0.1977	0.0085	-0.2144	-0.1810	537.06	<.0001
vessel	556	1	0.3899	0.0082	0.3739	0.4058	2286.03	<.0001
vessel	557	1	-0.3100	0.0084	-0.3266	-0.2935	1354.46	<.0001
vessel	560	1	0.7801	0.0066	0.7672	0.7929	14133.5	<.0001
vessel	561	1	0.6681	0.0067	0.6550	0.6812	9961.83	<.0001
vessel	562	1	0.7767	0.0068	0.7635	0.7900	13234.4	<.0001
vessel	563	1	0.6917	0.0066	0.6789	0.7046	11144.5	<.0001
vessel	564	1	0.6121	0.0068	0.5989	0.6254	8219.42	<.0001
vessel	566	1	0.6218	0.0071	0.6079	0.6358	7609.07	<.0001
vessel	567	1	0.3016	0.0066	0.2886	0.3146	2057.04	<.0001
vessel	568	1	0.3684	0.0071	0.3545	0.3823	2696.91	<.0001
vessel	570	1	0.1258	0.0070	0.1121	0.1395	323.51	<.0001
vessel	571	1	-0.0290	0.0093	-0.0473	-0.0108	9.74	0.0018
vessel	572	1	0.1748	0.0073	0.1604	0.1892	567.23	<.0001
vessel	575	1	0.9306	0.0069	0.9171	0.9441	18254.1	<.0001
vessel	576	1	0.6480	0.0084	0.6315	0.6645	5920.17	<.0001
vessel	577	1	1.0963	0.0067	1.0833	1.1094	27079.8	<.0001
vessel	584	1	0.3920	0.0079	0.3766	0.4074	2486.92	<.0001
vessel	641	1	0.4938	0.0082	0.4778	0.5099	3631.43	<.0001
vessel	647	1	0.4058	0.0087	0.3888	0.4228	2184.19	<.0001
vessel	652	1	-0.4879	0.0120	-0.5113	-0.4644	1658.48	<.0001
vessel	653	1	0.1161	0.0073	0.1019	0.1303	256.19	<.0001
vessel	665	1	0.5480	0.0087	0.5310	0.5650	3992.71	<.0001
vessel	666	1	-0.0062	0.0094	-0.0247	0.0124	0.42	0.5145
vessel	667	0	0.0000	0.0000	0.0000	0.0000	.	.

TABLE 16 (cont.): Results of the analysis (1986-2002) of the alternative data set (derived using observations where red snapper associated species were caught). Lo method with Poisson error assumption for positive trips.

Parameter		DF	Estimate	Standard Error	Wald 95% Confidence Limits		Chi-Square	Pr > ChiSq
year	1986	1	0.8603	0.0051	0.8504	0.8703	28775.9	<.0001
year	1987	1	0.9251	0.0049	0.9156	0.9346	36132.7	<.0001
year	1988	1	0.9324	0.0049	0.9229	0.9420	36474.1	<.0001
year	1989	1	0.8965	0.0049	0.8868	0.9061	33000.1	<.0001
year	1990	1	0.2599	0.0049	0.2502	0.2695	2796.61	<.0001
year	1991	1	0.4975	0.0047	0.4883	0.5068	11110.0	<.0001
year	1992	1	0.6750	0.0045	0.6661	0.6839	22271.8	<.0001
year	1993	1	0.6559	0.0045	0.6471	0.6648	21156.1	<.0001
year	1994	1	0.5521	0.0045	0.5433	0.5609	15072.7	<.0001
year	1995	1	0.2960	0.0046	0.2870	0.3049	4181.67	<.0001
year	1996	1	0.2867	0.0046	0.2777	0.2956	3936.70	<.0001
year	1997	1	0.2855	0.0047	0.2763	0.2948	3670.41	<.0001
year	1998	1	0.1468	0.0048	0.1374	0.1561	949.60	<.0001
year	1999	1	-0.3232	0.0054	-0.3337	-0.3127	3646.90	<.0001
year	2000	1	-0.0901	0.0060	-0.1019	-0.0783	224.96	<.0001
year	2001	1	-0.2105	0.0065	-0.2233	-0.1978	1048.36	<.0001
year	2002	0	0.0000	0.0000	0.0000	0.0000	.	.
month	1	1	0.0195	0.0040	0.0117	0.0274	23.97	<.0001
month	2	1	-0.1273	0.0038	-0.1347	-0.1198	1112.61	<.0001
month	3	1	-0.2363	0.0036	-0.2435	-0.2292	4192.73	<.0001
month	4	1	-0.2878	0.0037	-0.2950	-0.2805	6090.40	<.0001
month	5	1	-0.4093	0.0036	-0.4163	-0.4023	12977.9	<.0001
month	6	1	-0.4550	0.0035	-0.4619	-0.4480	16497.2	<.0001
month	7	1	-0.3489	0.0035	-0.3557	-0.3421	10123.4	<.0001
month	8	1	-0.2767	0.0035	-0.2836	-0.2699	6276.65	<.0001
month	9	1	-0.1677	0.0036	-0.1747	-0.1606	2189.36	<.0001
month	10	1	-0.0238	0.0036	-0.0308	-0.0168	44.03	<.0001
month	11	1	-0.0009	0.0040	-0.0086	0.0069	0.05	0.8282
month	12	0	0.0000	0.0000	0.0000	0.0000	.	.
totlimit		1	-0.0008	0.0000	-0.0008	-0.0008	39822.9	<.0001
Scale		0	1.0000	0.0000	1.0000	1.0000		

NOTE: The scale parameter was held fixed.

LR Statistics For Type 3 Analysis

Source	DF	Chi-Square	Pr > ChiSq
vessel	28	468943	<.0001
year	16	201583	<.0001
month	11	70096.1	<.0001
totlimit	1	40525.4	<.0001

TABLE 17: Relative Abundance Indices for Red snapper in the Gulf of Mexico (derived using observations where red snapper associated species were caught)

YEAR	INDEX	LCI	UCI	CV
1986	1.386	1.27	1.502	0.043
1987	1.502	1.407	1.596	0.032
1988	1.707	1.642	1.771	0.019
1989	1.564	1.489	1.64	0.025
1990	0.822	0.782	0.862	0.025
1991	1.072	1.029	1.115	0.021
1992	1.298	1.256	1.341	0.017
1993	1.313	1.278	1.348	0.014
1994	1.168	1.136	1.2	0.014
1995	0.916	0.889	0.943	0.015
1996	0.897	0.869	0.925	0.016
1997	0.936	0.908	0.963	0.015
1998	0.821	0.796	0.846	0.016
1999	0.504	0.482	0.527	0.023
2000	0.371	0.329	0.413	0.058
2001	0.305	0.265	0.345	0.066
2002	0.418	0.37	0.466	0.058

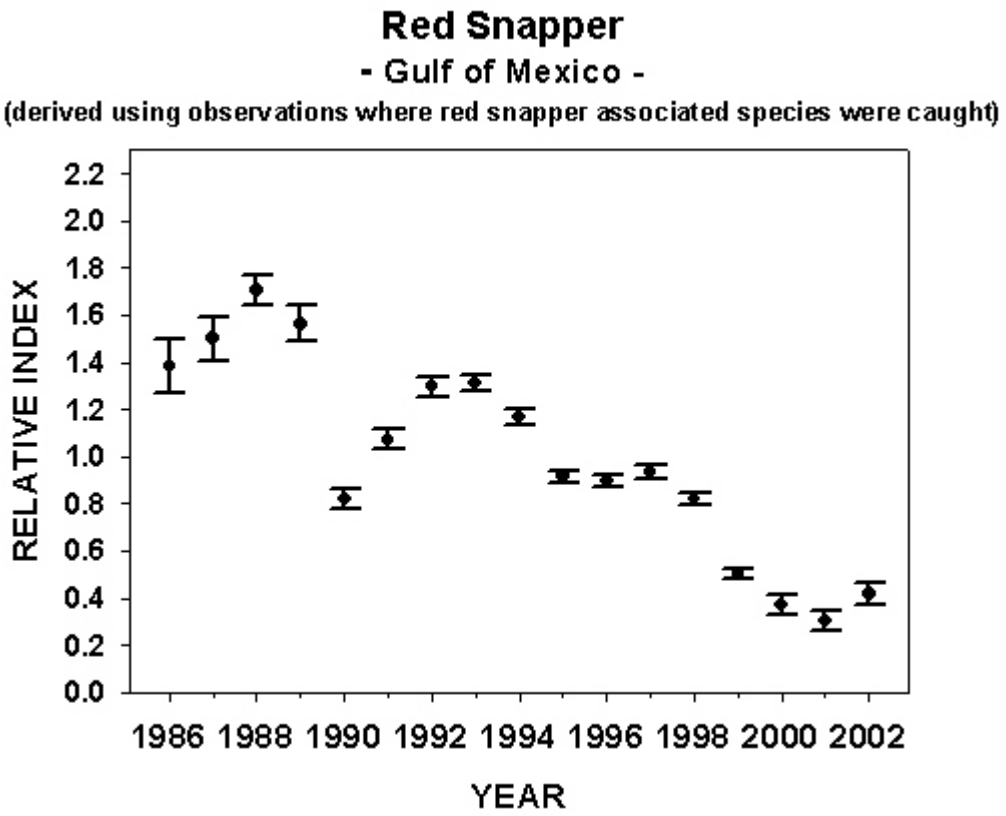

FIGURE 5. Relative abundance indices for red snapper in the Gulf of Mexico with approximate 95% confidence intervals (derived using observations where red snapper associated species were caught).

Proportion Positive Model = VESSEL+YEAR+MONTH (success, error distribution: binomial)

Positive Trip Model= VESSEL+YEAR+MONTH+TOTLIMIT (fish caught per trip, offset: natural log angler*hours, error distribution: Poisson)

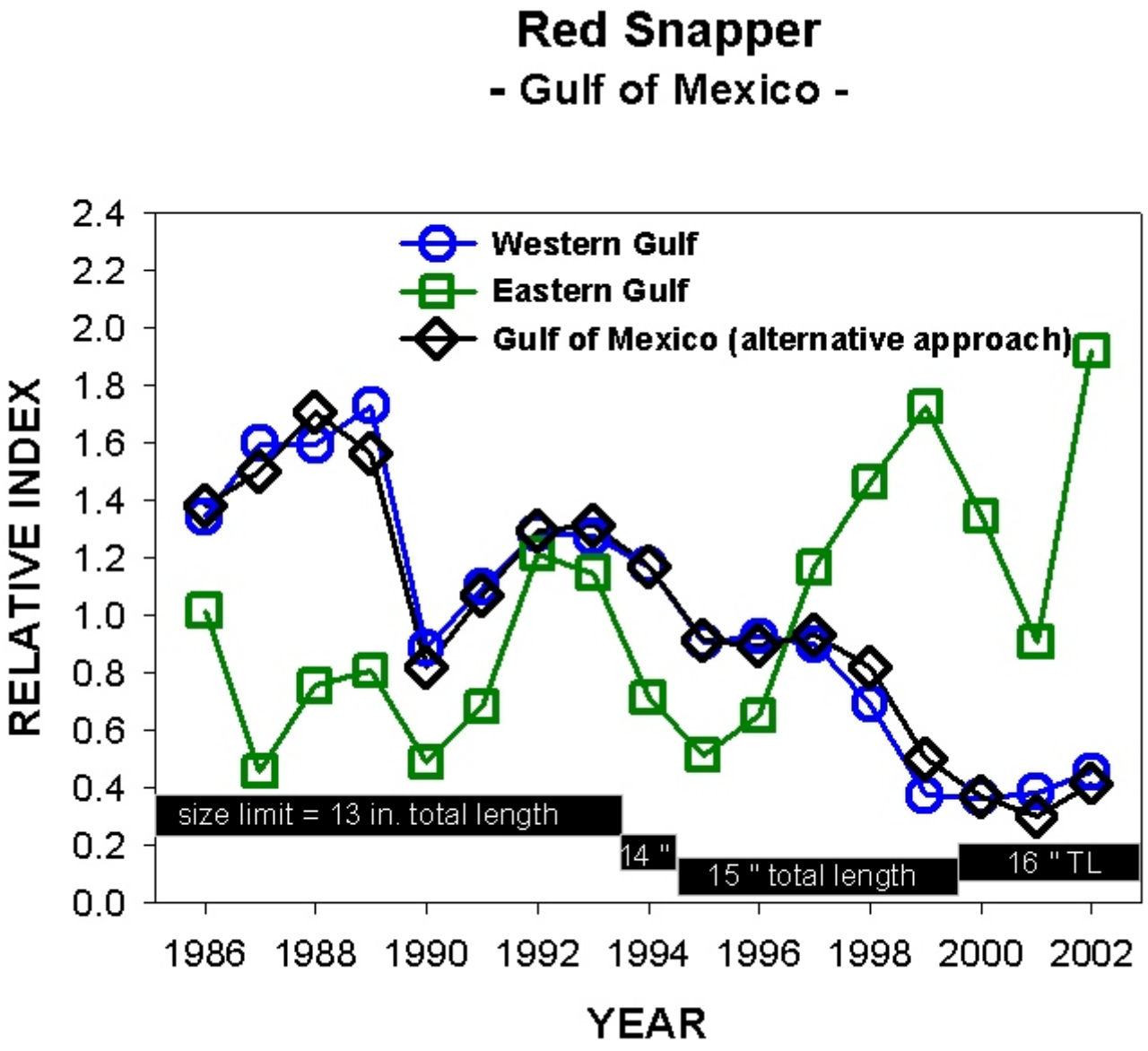

FIGURE 6. Comparison of relative abundance indices for red snapper in the Gulf of Mexico.

Horizontal bars indicate the specific minimum size limits in effect during various time periods. Note: The alternative approach includes restricting catch rate data to trips 3/4 - 1 full day in length and catching species generally associated with red snapper catches.