

# **Spot Stock Monitoring Reports**

**2008**

A report to the South Atlantic State-Federal Fisheries Management Board  
from the Spot Plan Review Team

Prepared by:

Harry Rickabaugh and Harley Speir, Maryland Department of Natural Resources

Joe Grist, Virginia Marine Resources Commission

John Schoolfield, North Carolina Division of Marine Fisheries

Nichola Meserve, Atlantic States Marine Fisheries Commission, Chair

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*Martin O'Malley, Governor*  
*Anthony G. Brown, Lt. Governor*  
*John R. Griffin, Secretary*  
*Eric Schwaab, Deputy Secretary*

# Evaluation of the status of Spot in Maryland

**By Harry Rickabaugh**

**MD DNR Fisheries Service**

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## **Introduction**

Recent declining trends in spot landings have raised some concern about the long-term health of the stock. In the absence of a coast wide stock assessment, the South Atlantic State/Federal Fisheries Management Board requested that the Atlantic States Marine Fisheries Commission (ASMFC) Spot Plan Review Team compile and summarize catch per unit effort (CPUE) data for spot in 2007. The relationship between landings and abundance is not clear and before an amended spot plan is prepared, it should be determined if CPUE is actually declining. Participating states were to prepare individual reports using state specific data. A report for Maryland was completed in March of 2007 and since then juvenile indices were more closely examined and some adjustments were made for 2007.

Spot commercial CPUEs were updated through 2007 by making several assumptions and applying spatial and temporal limitations to the data. Recreational CPUEs were generated using the Marine Recreational Fishery Statistics Survey (MRFSS) estimates and updated Maryland charter boat log data. Juvenile indices (JI) were also updated, through 2007, using data from existing surveys conducted by the Maryland Department of Natural Resources (MD DNR). In addition data from Maryland pound net sampling was summarized and catch at age, mean weight at age, and mean length at age from 1998-2006 were calculated.

## **Methods**

### **Juvenile Indices**

Four juvenile indices (JIs) were utilized in this evaluation, two from the Maryland portion of Chesapeake Bay and two from the Maryland coastal bays. The first JI is derived from the MD DNR Blue Crab Trawl Survey (BCS). The survey uses a 16ft bottom trawl at fixed stations in six areas of Maryland's Chesapeake Bay. Survey details can be found in Davis et al. (1995). The BCS juvenile index is calculated as the geometric mean catch per tow and was updated through 2007. The survey has been conducted since 1980, but a review of the raw data revealed data entry omissions for spot in years prior to 1989. This data is currently being entered from the original data sheets, but was not available for this report.

The second JI was derived from the Striped Bass Juvenile Seine Survey (JSS). This survey uses a 100ft long by 4 foot deep beach seine at fixed stations in five areas of Maryland's Chesapeake Bay. Durell and Weedon (2005) describe the survey methods and index calculation in detail. The JSS index is calculated as a geometric mean from 1959 -2007. The JSS has permanent and auxiliary sites, both of which were used in past spot JI calculations. For this report, however, only permanent sites were used in JSS index calculations and analysis.

The two coastal bay JIs are calculated from trawl and seine data collected by MD DNR Fisheries Service's Atlantic Program (AP). The trawl survey uses the same type of trawl as the BCS at 20 fixed stations once a month from April through October (Luisi et al, 2005). The Coastal Trawl Index (CTI) was calculated using all 20 sites to derive an annual geometric mean. The seine portion of the AP sampling utilized a seine similar to the JSS, except for depth (6 ft vs 4 ft). Nineteen fixed stations were sampled once a month from June through September, and the corresponding Coastal Seine Index (CSI) was calculated using all sites to derive an annual geometric mean. Both AP sampling efforts have been conducted since 1972, but sites and frequency were not standardized until 1989 (Angel Bolinger personal communication, 2007). Therefore, only 1989-2007 data was used for this analysis.

An ANOVA and Tukey-Kramer multiple comparison and range test were used to detect differences between the standardized years for each JI (Sokal and Rohlf 1981) using SAS<sup>®</sup> software (SAS 2006). Differences at the 0.05 level were considered significant. Linear regression was used to compare the JIs and adult CPUEs, and any regression with a P value of 0.01 or less was considered significant.

## **Commercial Indices**

Commercial CPUE was calculated from data collected by the MD DNR mandatory reporting system. Effort data was only available for 1980-1984, 1990 and 1992 - 2007, and consequently are the only years commercial CPUEs were generated. **Maryland 2007 commercial effort and catch data are preliminary at this time.** The landing data will change, but since the majority of the 2007 data has been reported, only minor changes in 2007 CPUE are expected. Since pound nets and gill nets were the primary gear used to harvest spot in Maryland waters, CPUE was calculated for both gears. The majority of fishermen did not indicate a target species when using either gear, so other criteria had to be developed to determine which fishermen to include for each CPUE.

Pound net CPUE was limited to two regions that consistently produced spot annually, the main stem of Chesapeake Bay from the Chesapeake Bay Bridge south to the Maryland border with Virginia and the Maryland Potomac River tributaries. Any pound net set in either of these regions was included in this analysis. Only pound nets fished from May through October were included. Since Maryland reporting requirements did not require daily catch and effort entries prior to 2006, pound net data was reported monthly as the average number of nets fished, the hours fished in a day and the number of days fished. Even though the number of days the nets were in the water was unknown, it was assumed the net fished all month, consistent with the

manner the nets are observed by MD DNR biologists to be routinely fished. Because of these limitations in the data, pound net effort for each fishermen was calculated as the number of net months (average number of nets\*months fished) for each year. Since neither actual daily catch nor daily net catch was available, the CPUE for each year was the total catch in pounds divided by the total net months.

Since gill net catches were more sporadic and widely distributed than pound net catches, the area method for CPUE calculation was impractical, Atlantic Ocean catches were excluded from this analysis, and only fishermen that caught at least 100 pounds of spot in a given month were included. Effort for gill nets was reported as average length of net in yards, hours fished and days fished. CPUE effort was calculated by multiplying the average net length by hours fished multiplied by number of days (yards of net\*hours fished\*days fished). As with pound nets, gill net CPUE was the total effort for each year divided into the total catch in pounds for the year.

### **Recreational Indices**

The first recreational index was derived from MRFSS estimates of numbers of spot harvested and trips directed at spot and/or Atlantic croaker through 2005 (National Marine Fisheries Service, Fisheries Statistics Division, personal communication). Directed trips were from anglers that reported catching or targeting either species. Both croaker and spot were used since methods of fishing and areas fished for both species are very similar. Modes of fishing were limited to the private/rental boat and shore components and area fished was limited to Maryland inland waters. Annual CPUE was calculated for each year from 1981 to 2005. Data for 2006 and 2007 have been requested, but are not currently available.

The second recreational index was derived from the Maryland charter boat log data base. Charter captains are required to maintain daily logs of where they fish, how many fish of each species they catch and how many anglers participated. No indication of target species is recorded, so the CPUE includes only trips in which spot were captured. The number of anglers was used as effort and the number of spot captured was used as catch. The annual number of spot per angler was calculated for 1993-2007. The 2007 data is preliminary but should not change significantly.

Maryland anglers who catch spot of a minimum length may apply for a Maryland state citation. Until 2003 the minimum length required was 10 inches but was raised to 12 inches in 2004. Lengths of submitted entries were available from 1994 through 2007, excluding 2000, so only 12 inch and greater spot were included for each year. The 2000 data was unavailable for inclusion in this report.

The different JI and CPUE indices were compared to each other and to Maryland commercial landings when appropriate. Linear regression was used where appropriate and any regression with P values of 0.01 or less was considered significant. Juvenile indices were lagged one year when compared to landings and commercial and recreational CPUEs. For example, the 1990 landings would be compared to the 1989 BCS index. The juvenile indices lagged one year

should be comparable to harvest since the majority of harvested spot are age one and few fish reach older ages (Piner and Jones 2004).

### **Characterization Data**

From 1993- 2007 commercial pound nets were sampled from the mouth of the Potomac River and the lower portion of Maryland's Chesapeake Bay. Each area was sampled once every two weeks, weather and fisherman's schedule permitting. The commercial fishermen set all nets sampled as part of their regular fishing routine. Net soak time and manner in which they were fished were consistent with the fishermen's day-to-day operations. All spot captured were measured from each net when possible. In instances when it was not practical to measure all fish, a random sample of each species was measured and the remaining individuals enumerated if possible. All measurements were to the nearest mm total length (TL). Length frequency distributions were constructed for spot, using pound net length data divided into 20 mm length groups (i.e. 130 mm length group comprised fish from 130-149 mm).

Catch at age was estimated in pounds and numbers from 1998-2006 using Maryland pound net length frequency data, Maryland commercial landings data, Virginia Marine Resources Commission (VMRC) and North Carolina Department of Marine Fisheries (NCDMF) age data and VMRC length weight relationships by year. Length frequencies were in one centimeter size groups, and fish under 15 cm were not included, as they most likely would not be marketed and would not be part of the landings data. VMRC age data was used when available and NCDMF data was only used in the absence of VMRC data for spot in the smallest size classes. A weighted mean weight and length at age were calculated for each year and the mean weights were used to convert the catch at age to numbers.

### **Results and Discussion**

Since 1989, both Chesapeake Bay JIs have generally declined, with a few spikes in abundance (Table 1; Figure 1). The JSS and BCS indices were significantly correlated ( $p = 0.0007$ ,  $R^2 = 0.50$ ) from 1989 to 2007 (Table 2; Figure 2). The significant agreement between the JIs is encouraging, especially since different gears are utilized in different habitats, and neither was designed to capture spot. The 2007 BCS GM of 14.1 fish per tow was significantly higher than 10 other years, and significantly lower than 4 years, as determined by Tukey-Kramer multiple comparison and range test (ANOVA  $p < 0.001$ ; SAS 2006). The 2007 JSS GM indicated a weaker year class, significantly lower than 13 years and not significantly different than the remaining 35 years of the time series, as determined by Tukey-Kramer multiple comparison and range test (ANOVA  $p < 0.001$ ; SAS 2006). The differences in the comparison and range test are likely influenced by the longer time frame of the JSS, which for many years prior to 1989 had higher GMs than recent years.

The Maryland Coastal Bays JIs also indicate a slight downward trend in abundance (Table 1, Figure 3), for the 1989 to 2007 time period, the standardized years of the surveys. The CTI and CSI were significantly correlated for the standardized years ( $p < 0.0001$ ,  $R^2 = 0.92$ ; Table

2; Figure 4). The 2007 CSI GM of 12.6 fish per haul was significantly higher than 5 other years, and significantly lower than 2 years, as determined by Tukey-Kramer multiple comparison and range test (ANOVA  $p < 0.001$ ; SAS 2006). Similar to the BCS, the 2007 CTI GM of 19.4 fish per tow was significantly higher than 10 other years, and significantly lower than 3 years, as determined by Tukey-Kramer multiple comparison and range test (ANOVA  $p < 0.001$ ; SAS 2006). The JSS was not significantly correlated to the coastal bay indices, but both the CSI ( $p = 0.0079$ ,  $R^2 = 0.35$ ) and the CTI ( $p = 0.0074$ ,  $R^2 = 0.35$ ) were weakly correlated to the BCS (Table 2).

Maryland spot landings increased through much of the 1930's and 1940's, peaking in the mid 1950's before crashing in the early 1960's. Landings remained low, except for a few high years, until the late 1980's. Commercial landings have been variable at a relatively moderate level, staying above 75,000 pounds from 1989 – 2005 (Table 3; Figure 5). In 2006 landings dropped sharply to 37,774 pounds, but preliminary 2007 landings jumped to over 200,000 pounds. Maryland's long-term average harvest (1929 – 2006) is 139,826 pounds.

MRFSS recreational estimates of spot harvest in Maryland were highly variable early in the time series, fairly stable and near the mean from 1989-1995 and fairly stable below the mean from 1996-2002. The past several years estimates have gone from the third highest in 2003, to below average in 2004 but then increased steadily to the time series high in 2007 (Table 3, Figure 6). The majority of recreational spot catch is from inland waters (Figure 6).

The lagged BCS spot index was not significantly correlated with Maryland spot landings from 1989-2006 (Table 2). The JSS lagged one year compared to commercial landings from 1960-2006 revealed a large disparity in indications of abundance for most years from 1974-1985 (Figure 7). During this time period landings were very low while the JSS index was the highest of the time series. The CTI coastal JI lagged one year, or not lagged, was not significantly correlated to landings (Table 2), but the CSI lagged one year was ( $p = 0.0059$ ,  $R^2 = 0.41$ ; Table 2; Figure 8).

Both the pound net and gill net commercial CPUE indices generally increased over the time series (Table 4, Figure 9) until recently. The gill net CPUE has leveled off at a moderate level, while the pound net CPUE has declined sharply over the past two years. The preliminary 2007 pound net CPUE indicates a sharp decline to the fourth lowest of the 22 years of available data. The trend in pound net catch generally followed effort until 2006 and 2007, when effort remained fairly stable while catch declined (Figure 10). Years with very high JI values generally correspond to higher pound net CPUE values. It would appear that strong year classes begin to appear in the pound net fishery at age zero, influencing the composition of the catch. However, none of the JIs, lagged or not, are significantly correlated to pound net CPUE (Table 2).

Pound net caught spot may also be landed as bait, either mixed with Atlantic menhaden or sold live to recreational fishermen. It is unclear how or if watermen report these landings. It is possible they are reported as menhaden when sold dead as bait. Spot sold live as bait often command much higher prices, but may be going unreported, since they may not be sold through a dealer. The potentially changing proportion of spot landed as bait, because of their size or the

price at the time they were landed is a primary concern with a Maryland pound net CPUE. However, it should be a more robust indicator of actual stock size than the gillnet CPUE.

The gill net CPUE had zero values for 1980-1984. None of the lagged JIs had a significant relationship to the gill net CPUE, and the two commercial CPUEs were not statistically correlated (Table 2). The large spike in Maryland 2007 commercial landings can be attributed to the gill net fishery. The CPUE in 2007 was similar to that of 2006; however effort was 12 times greater in 2007 (Figure 11). Two gill net fishermen accounted for 88% of the 2007 gill net harvest, but neither had reported catching spot in previous years

Commercial gill net CPUE in the 1980s could have been low for several reasons. Neither pound or gill net, or any other gear, are generally used to target spot in Maryland. The majority of spot landings are by-catch or are selected from a mixed catch when more desirable species are unavailable. However, decreasing stocks of crabs and other fish species may result in a greater directed effort toward spot in the gill net fishery. A unit of effort for gill net may vary considerably from year to year, as mesh sizes and set locations. change as watermen target more profitable species. These effects would be exacerbated if spot are targeted some years and only by-catch in others, a likely possibility in the Maryland gill net fishery. Spot may be targeted when more profitable, since their dockside value adjusted to 2007 dollars has generally decreased in Maryland until 2006 (Figure 12). The 2007 and 2006 adjusted price per pound increased rapidly to the second and third highest levels, respectively, for the 22 years data are available, and may be responsible for the sudden increase in gill net effort and catch. Because of the shifting nature of Maryland's spot gill net fishery conclusions concerning year class strengths should be considered tenuous.

The lack of correlation between the commercial CPUEs and the JIs would indicate spot JIs are not a good predictor of future commercial landings in Maryland. Contributing factors could include the high mortality rate of spot, particularly juveniles, and the fact that some age zero fish are being harvested. Changes in predator abundance and/or the proportion of age zero spot being harvested, could also significantly alter the number of age one and older spot available for harvest in subsequent years. Therefore, under certain conditions, a strong year-class alone may not guarantee the availability of spot in the following year.

The MRFSS CPUE generally decreased through time, with a few spikes and a small amount of potential recovery from 2003 to 2005 (Table 4, Figure 13). The MRFSS index also was not significantly correlated to any of the JIs or commercial CPUEs (Table 2). The MRFSS indicates higher catches in the early part of the time series when JIs were generally higher but the commercial CPUEs either indicated zero catch or were missing values (Figure 14).

The Maryland charter boat CPUE declined slightly from 1993 to 2004, before rebounding in 2005 and 2006. (Table 4, Figure 15). The 2007 CPUE declined slightly to near the time series mean. Both the MRFSS and charter boat indices did appear to follow a similar trend of general decline over time even though some recovery occurred during the past several years (Figure 15). However, these CPUE values were not significantly correlated (Table 2). The charter boat CPUE was significantly correlated to the one year lagged BCS JI ( $p=0.0078$ ,  $R^2 = 0.43$ ; Table 2) and the one year lagged JSS ( $p=0.0055$ ,  $R^2 = 0.46$ ; Table 2) but not the other two

juvenile indices. The charter boat fishery for spot was prosecuted entirely in Chesapeake Bay as are the BCS and JSS. Submissions of 12 inch or greater spot to the Maryland citation program were very low (0-3 fish) from 1994 to 1998, increased rapidly to 141 in 2002, and then decreased sharply from 130 fish in 2003 to 0 fish in 2007 (Table 4). Interestingly, the highest years of citation submissions correspond to years of low catch in the charter boat CPUE indicating that anglers tend to keep fewer spot when larger spot are available.

Spot mean length from Maryland pound nets in 2007 was 208 mm TL, ranking in the middle of the 15 year time series (Table 5). The length frequency distribution in 2007 was somewhat truncated, with fish between 190 and 229 mm TL accounting for 63% of the catch (Figure 16). Percent jumbo spot remained low in 2007, with less than 1% of the 2007 sample comprised of spot >254 mm TL (<2% in 2006, 3% in 2005, 13% in 2004 and 10% in 2003), confirming the decrease in large spot indicated by decreasing citation numbers.

Catch at age estimates for Maryland's commercial spot harvest in pounds and numbers were dominated by age one spot (Table 6, Figures 17 and 18). Age zero and age two spot were present each year, and occasionally represented a significant portion of the catch. Spot age three through six were not present every year, and only accounted for a very small portion of the catch in any given year. Catch at age in pounds was highly variable with no clear trends evident. When converted to numbers there appears to be a declining trend in age one spot from 2003-2006. However, the estimated number at age was derived solely from pound net length frequencies and utilized VMRC length weight relationships and age structure. While the Virginia biological data is probably representative of the age and weight characteristics of Maryland spot, small differences in age structure or length at weight could cause a noticeable shift in numbers. Harvest from other gears may also produce slightly different length frequencies than pound net fish.

Mean weight at age for pound nets was more variable between years than expected, but did indicate lighter weights at a given age in recent years for age zero through three spot (Table 7, Figure 19). Age four through six sample sizes were too low to make reasonable comparisons between years for weight or length at age. Mean length at age for ages zero through three were also generally shorter in recent years (Table 8, Figure 20). As with catch at age in numbers, the mean weights at age may not be accurate if spot in Maryland had different length weight characteristics than those in Virginia for any of the years examined.



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Table 1. Maryland juvenile spot indices, 1959-2007.

Year	Chesapeake Bays		Coastal Bays	
	JSS (Seine)	BCS (Trawl)	CTI (Trawl)	CSI (Seine)
1959	0.21			
1960	0.06			
1961	0.04			
1962	0.36			
1963	0.45			
1964	0.09			
1965	0.02			
1966	0.51			
1967	0.02			
1968	0.60			
1969	1.23			
1970	0.08			
1971	0.86			
1972	1.16		1437.92	80.42
1973	3.26		139.51	83.35
1974	2.30		347.62	25.64
1975	4.42		24.78	51.00
1976	3.19		109.96	152.88
1977	6.89		27.42	44.37
1978	3.36		48.83	12.98
1979	2.71		62.32	28.45
1980	2.53		36.91	19.84
1981	1.65		257.48	186.54
1982	2.25		182.82	133.92
1983	1.07			
1984	3.43		24.21	
1985	1.50		4.63	
1986	1.77		824.36	
1987	1.17		1.41	2.39
1988	4.50		726.78	177.79
1989	0.70	41.607	23.08	13.12
1990	1.05	46.331	18.99	17.94
1991	0.81	19.519	14.11	8.12
1992	0.44	1.716	0.91	1.37
1993	1.42	10.532	4.20	5.48
1994	1.49	53.002	148.42	97.89
1995	0.10	0.356	2.00	3.33
1996	0.28	2.705	1.20	1.91
1997	1.34	15.320	57.98	46.51
1998	0.44	2.427	2.86	2.63
1999	0.61	2.857	6.38	8.08
2000	0.83	7.214	26.82	14.08
2001	0.37	2.021	1.84	1.71
2002	0.36	1.347	57.20	19.70
2003	0.31	1.772	2.22	2.88
2004	0.80	4.025	4.20	4.32
2005	3.49	52.959	38.97	16.18
2006	0.34	7.500	5.35	4.40
2007	0.61	14.090	19.37	12.58

Table 2. Matrix of regression results for Maryland spot indices and landings comparisons. Positive correlations with p values less than 0.01 are represented with a **YES** in the table.

	Pound Net	Gill Net	Charter	MRFSS	Com Landings	Rec Landings	BCS	JSS	CTI
Gill Net	NO								
Charter	NO	NO							
MRFSS	NO	NO	NO						
Com Landings	NO	NO	NO	NO					
Rec Landings	NO	NO	NO	<b>YES</b>	NO				
BCS	NO	NO	NO	NO	NO	NO			
BCS Lagged	NO	NO	<b>YES</b>	NO	NO	NO			
JSS	NO	NO	NO	NO	<b>YES</b>	NO	<b>YES</b>		
JSS Lagged	NO	NO	<b>YES</b>	NO	NO	NO			
CTI	NO	NO	NO	NO	NO	NO	<b>YES</b>	NO	
CTI Lagged	NO	NO	NO	NO	NO	NO			
CSI	NO	NO	NO	NO	NO	NO	<b>YES</b>	NO	<b>YES</b>
CSI Lagged	NO	NO	NO	NO	<b>YES</b>	NO			

Table 3. Maryland spot commercial landings in pounds, 1929-2005, and recreational numbers harvested and released, 1981-2006.

Year	Recreational Harvested	Recreational Released	Commercial Pounds
1929			117,557
1930			126,295
1931			100,526
1932			47,877
1933			30,527
1934			62,100
1935			18,000
1936			36,700
1937			27,600
1938			59,900
1939			171,200
1940			141,000
1941			141,000
1942			138,000
1943			
1944			186,803
1945			208,827
1946			129,328
1947			120,630
1948			111,950
1949			248,713
1950			100,725
1951			128,554
1952			420,098
1953			283,817
1954			258,178
1955			407,699
1956			300,502
1957			589,001
1958			593,120
1959			84,904
1960			498,376
1961			10,519
1962			26,900
1963			15,200
1964			33,900
1965			600
1966			4,100
1967			248,300

Year	Recreational Harvested	Recreational Released	Commercial Pounds
1968			45,600
1969			20,700
1970			572,600
1971			20,300
1972			73,700
1973			27,100
1974			37,000
1975			102,900
1976			16,400
1977			16,400
1978			31,300
1979			10,600
1980			6,265
1981	948,931	1,331,316	14,214
1982	2,864,603	1,677,415	6,154
1983	1,600,362	1,114,795	129,377
1984	904,793	1,150,599	43,318
1985	1,028,391	735,873	7,640
1986	3,789,796	2,720,343	104,373
1987	3,180,704	248,973	252,152
1988	277,964	716,258	57,975
1989	1,154,314	730,580	116,043
1990	2,120,655	1,811,434	103,991
1991	1,841,555	2,123,582	216,035
1992	1,671,897	493,597	255,010
1993	1,880,043	1,573,486	183,357
1994	1,761,701	1,037,498	149,889
1995	1,099,658	253,827	330,021
1996	591,300	208,897	89,149
1997	713,657	1,316,341	76,193
1998	1,327,259	633,914	261,523
1999	655,289	618,742	214,656
2000	1,389,505	1,080,310	137,438
2001	1,088,997	577,417	220,072
2002	690,515	501,111	127,914
2003	3,300,594	670,382	169,298
2004	1,517,831	600,827	177,914
2005	2,644,537	1,467,344	84,254
2006	3,816,573	1,400,081	37,774

Table 4. Maryland spot CPUE indices and number of 12 inch plus spot submissions to the citation program, 1980-2007. Shaded 2007 values are preliminary.

Year	Pound Net	Gill Net	MRFSS	Charter	# of Citations
1980	0.000	0.000			
1981	0.000	0.000	3.888		
1982	27.721	0.000	6.090		
1983	15.224	0.000	3.713		
1984	29.412	0.000	2.769		
1985			3.911		
1986			6.246		
1987			9.131		
1988			2.414		
1989			3.955		
1990	10.238	0.001	3.681		
1991			2.505		
1992	6.092	0.031	5.005		
1993	46.454	0.014	2.493	17.195	
1994	115.148	0.019	2.701	24.287	0
1995	99.193	0.025	3.011	23.450	3
1996	50.833	0.011	2.822	13.098	2
1997	31.616	0.013	1.318	19.092	3
1998	46.214	0.022	2.021	21.987	1
1999	45.421	0.016	1.105	17.529	35
2000	45.560	0.024	1.312	18.890	
2001	65.255	0.040	1.499	14.565	101
2002	57.968	0.055	1.396	16.422	141
2003	68.301	0.031	3.938	18.095	129
2004	43.157	0.050	2.326	15.071	70
2005	101.440	0.025	2.737	19.060	10
2006	31.301	0.025		22.734	4
2007	10.466	0.022		19.175	0

Index

Pound Net  
 Gill Net  
 MRFSS  
 Charter Boat

Units

Pounds per Net Month  
 Pounds per Yard Hour of Net  
 Fish per Trip  
 Catch per Angler

Table 5. Mean total length (mm), standard deviation, and sample size of spot from Maryland Chesapeake Bay pound nets, 1993-2007.

Year	Mean Legth (mm)	Standard Deviation	Number Sampled
1993	184	28	309
1994	207	21	451
1995	206	28	158
1996	235	28	275
1997	190	35	924
1998	230	16	60
1999	213	25	572
2000	230	21	510
2001	239	33	126
2002	184	36	681
2003	216	30	1,354
2004	208	36	882
2005	197	37	2,818
2006	191	29	2,195
2007	208	23	519

Table 6. Catch at age for the Maryland commercial spot fishery in Numbers and pounds, 1989-2006.

Catch Numbers

Year	age 0	age 1	age 2	age 3	age 4	age 5	age 6	Total
1998	42,160	564,537	4,149	0	0	0	0	610,845
1999	42,454	601,572	30,044	218	0	0	0	674,288
2000	30,412	318,798	12,625	833	0	0	0	362,669
2001	146,954	322,849	39,596	5,639	98	0	0	515,136
2002	179,735	434,061	7,664	2,005	315	28	0	623,809
2003	38,329	474,372	17,230	1,254	469	54	0	531,708
2004	40,353	406,511	168,289	3,034	104	135	0	618,426
2005	15,450	237,502	32,221	6,777	98	15	55	292,118
2006	53,201	109,520	5,417	672	370	0	0	169,179

Catch Pounds

Year	age 0	age 1	age 2	age 3	age 4	age 5	age 6	Total
1998	15,140	243,804	2,308	0	0	0	0	261,253
1999	9,440	191,110	13,804	302	0	0	0	214,656
2000	5,483	125,278	6,091	586	0	0	0	137,438
2001	43,115	142,044	28,574	6,236	103	0	0	220,072
2002	28,212	93,458	4,302	1,658	255	28	0	127,914
2003	5,359	152,542	9,782	1,075	476	63	0	169,298
2004	5,584	98,742	71,336	1,971	125	155	0	177,914
2005	15,450	237,502	32,221	6,777	98	15	55	292,118
2006	9,173	25,815	2,227	316	244	0	0	37,774

Table 7. Mean weight at age, in grams, of spot from Maryland commercial pound nets, 1989-2006.

Year	age 0	age 1	age 2	age 3	age 4	age 5	age 6
1998	162.9	195.9	252.4	0.0	0.0	0.0	0.0
1999	100.9	144.1	208.4	628.7	0.0	0.0	0.0
2000	81.8	178.2	218.8	318.8	0.0	0.0	0.0
2001	133.1	199.6	327.3	501.6	474.8	0.0	0.0
2002	71.2	97.7	254.6	375.0	367.4	448.0	0.0
2003	63.4	145.9	257.5	388.8	460.2	529.6	0.0
2004	62.8	110.2	192.3	294.7	545.7	520.1	0.0
2005	71.7	125.5	177.1	224.1	414.1	422.1	461.4
2006	78.2	106.9	186.5	213.1	299.2	0.0	0.0

Table 8. Mean length at age in, centimeters, of spot from Maryland commercial pound nets, 1989-2006.

Year	age 0	age 1	age 2	age 3	age 4	age 5	age 6
1998	21.6	23.2	25.2	0.0	0.0	0.0	0.0
1999	19.0	21.4	24.0	34.5	0.0	0.0	0.0
2000	18.2	23.2	24.6	27.8	0.0	0.0	0.0
2001	21.2	23.9	28.0	31.7	31.5	0.0	0.0
2002	17.4	18.8	26.0	29.7	29.5	31.5	0.0
2003	16.5	21.5	26.3	29.9	31.8	33.5	0.0
2004	16.0	19.4	23.7	27.8	34.7	34.1	0.0
2005	16.7	20.5	23.4	25.2	31.7	32.3	33.4
2006	17.7	19.3	23.7	24.7	27.8	0.0	0.0

Figure 1. Comparison of Maryland Chesapeake Bay juvenile spot geometric mean indices, 1980-2007.

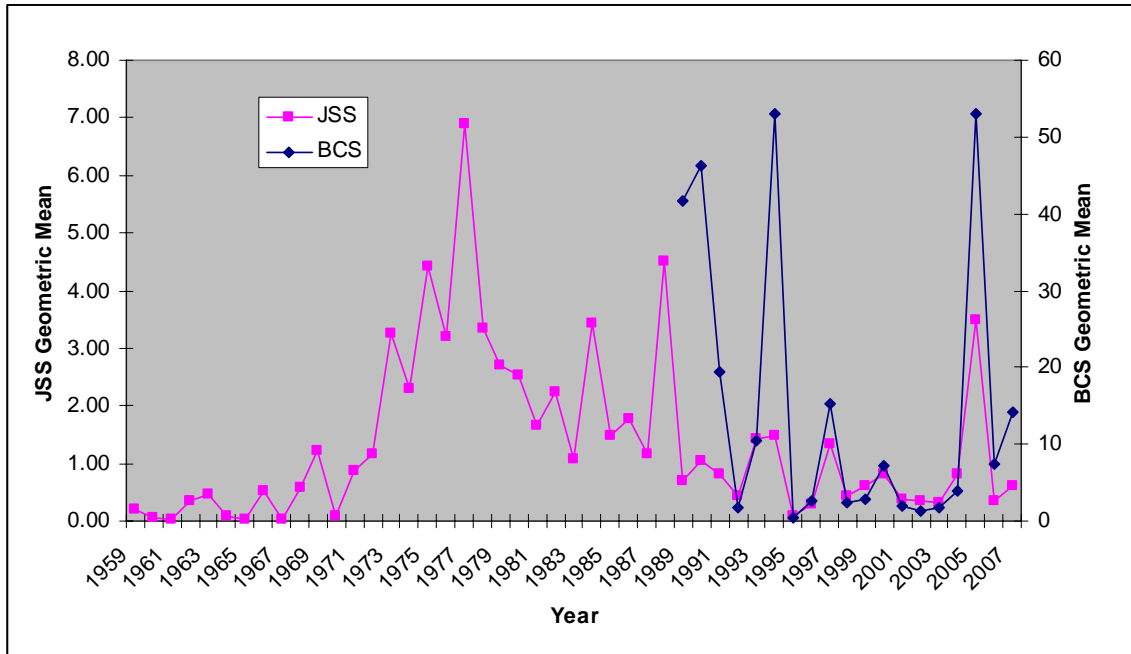


Figure 2. Comparison of JSS and BCS using linear regression, 1980 - 2006.

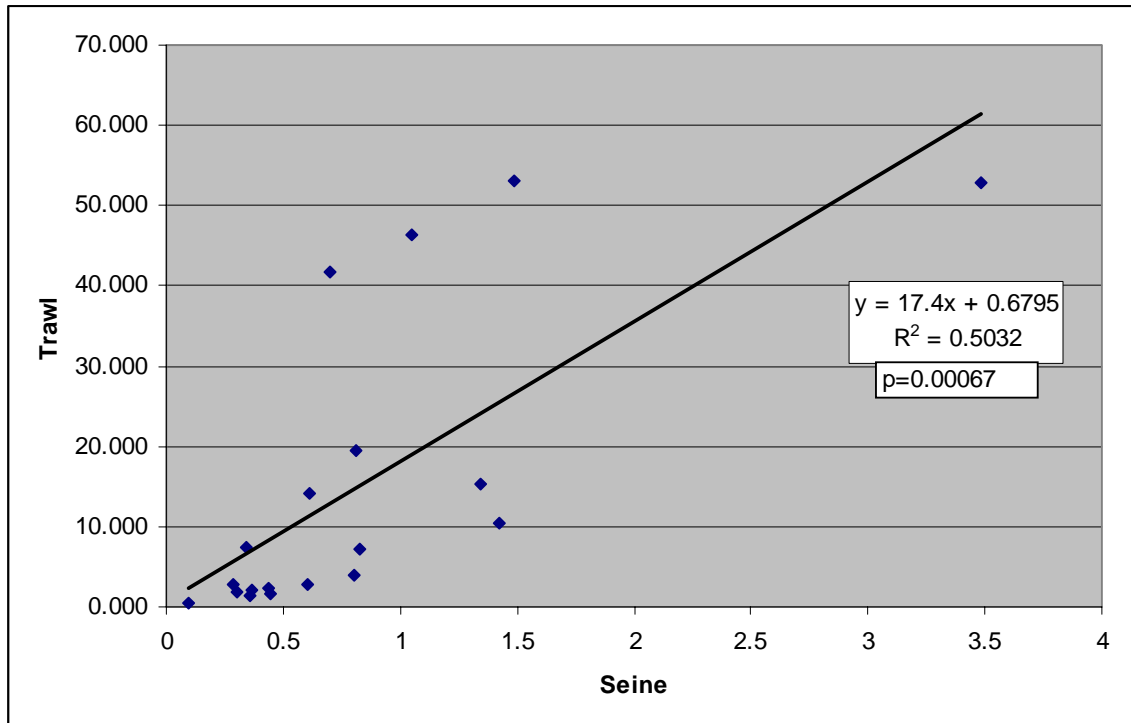




Figure 3. Comparison of Maryland Coastal Bay juvenile spot indices, 1972-2007. Both indices are geometric means (neither survey was standardized until 1989).

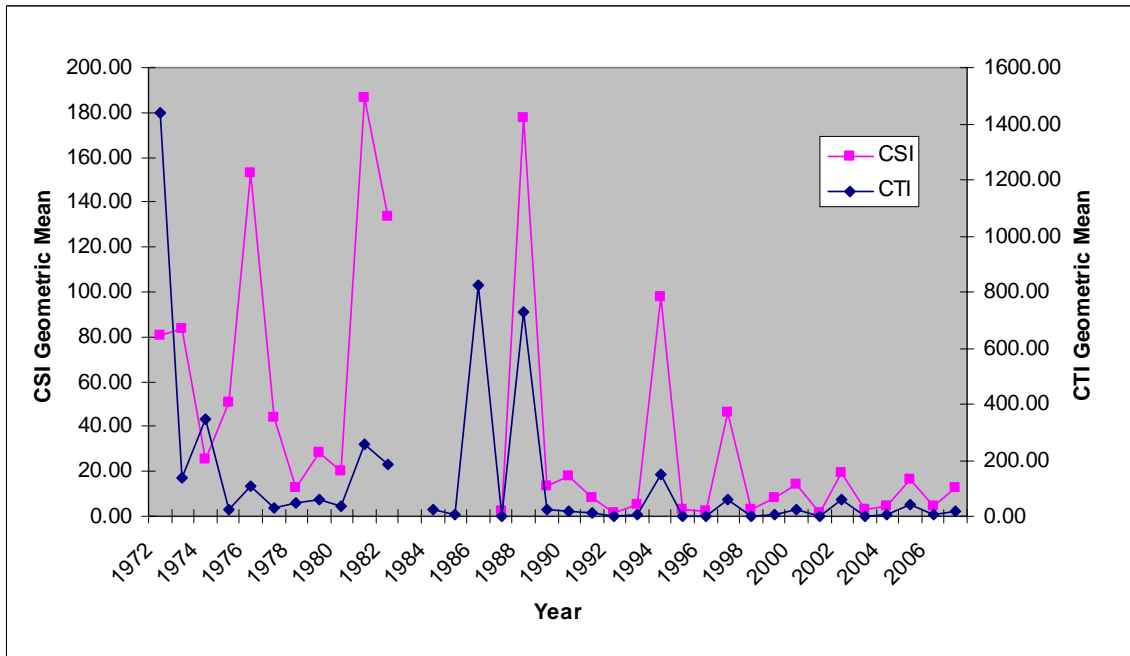


Figure 4. Comparison of spot CSI and CTI using linear regression, 1989-2007.

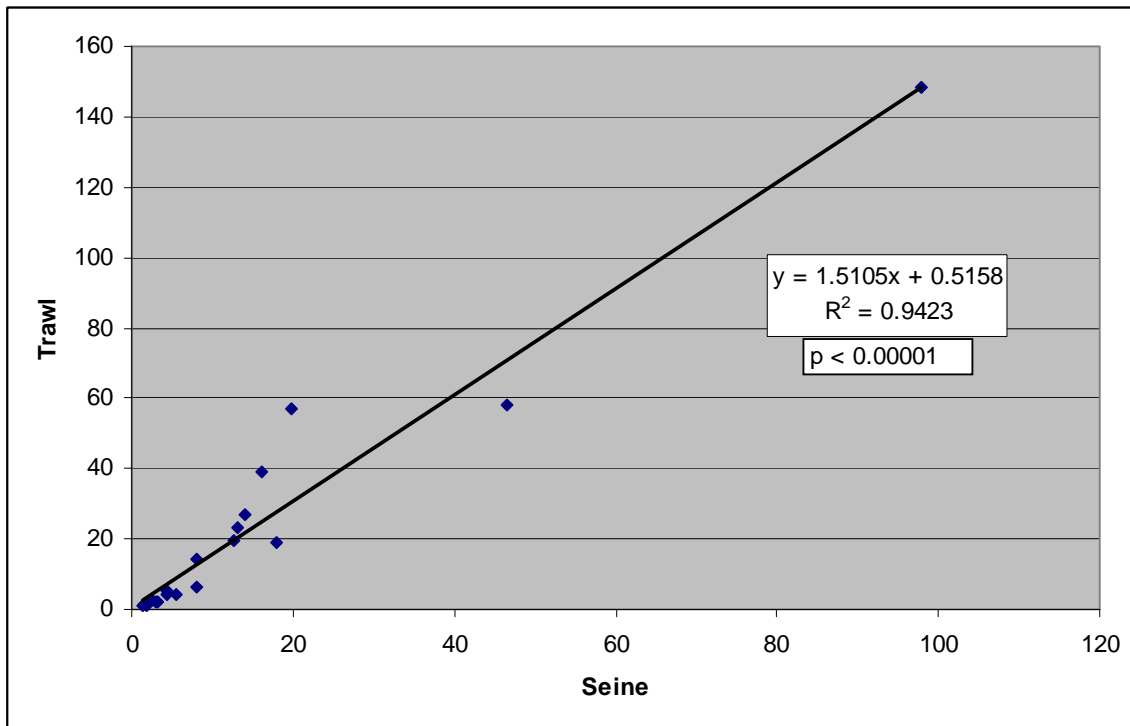


Figure 5. Maryland's spot commercial landings in pounds, 1929-2006.

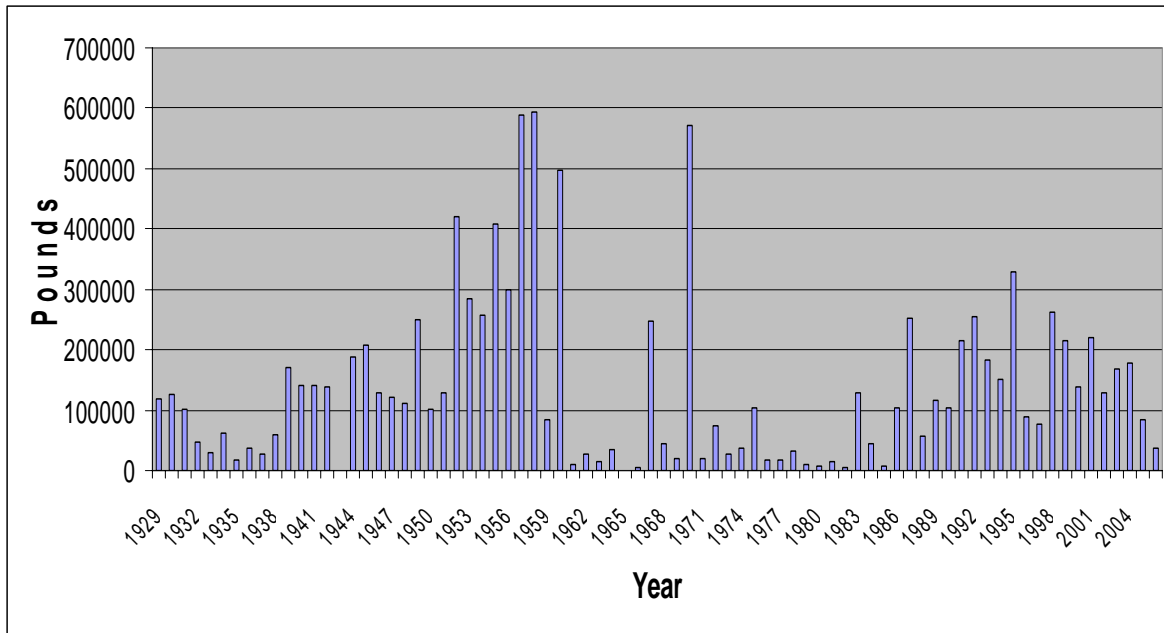


Figure 6. MRFSS estimates of Maryland spot harvest for all areas and inland waters. 1981-2007.

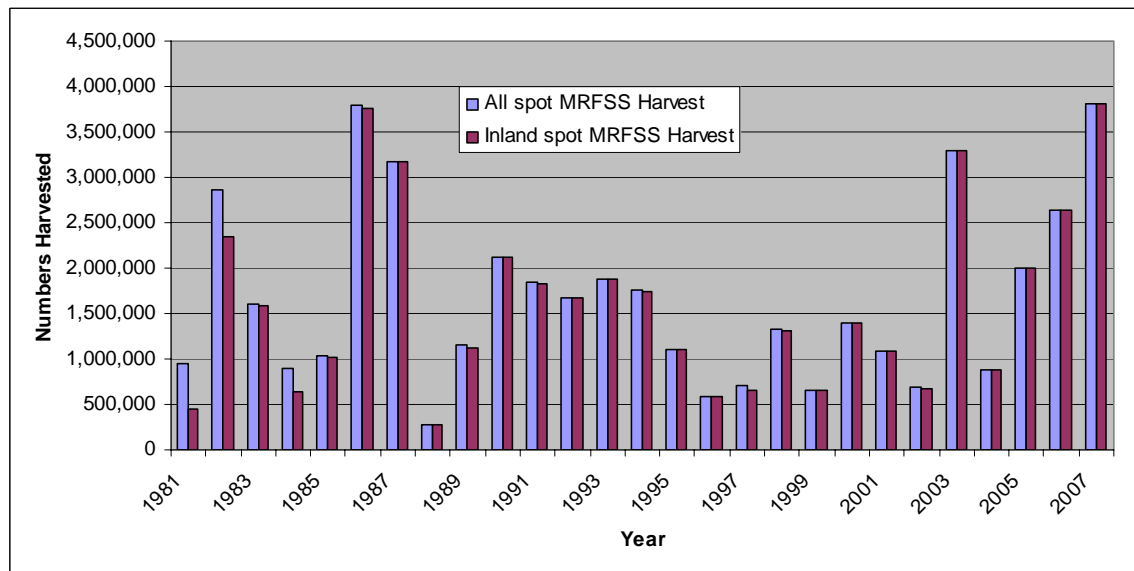


Figure 7. Maryland commercial spot landings and the JSS spot index lagged one year, 1960-2006.

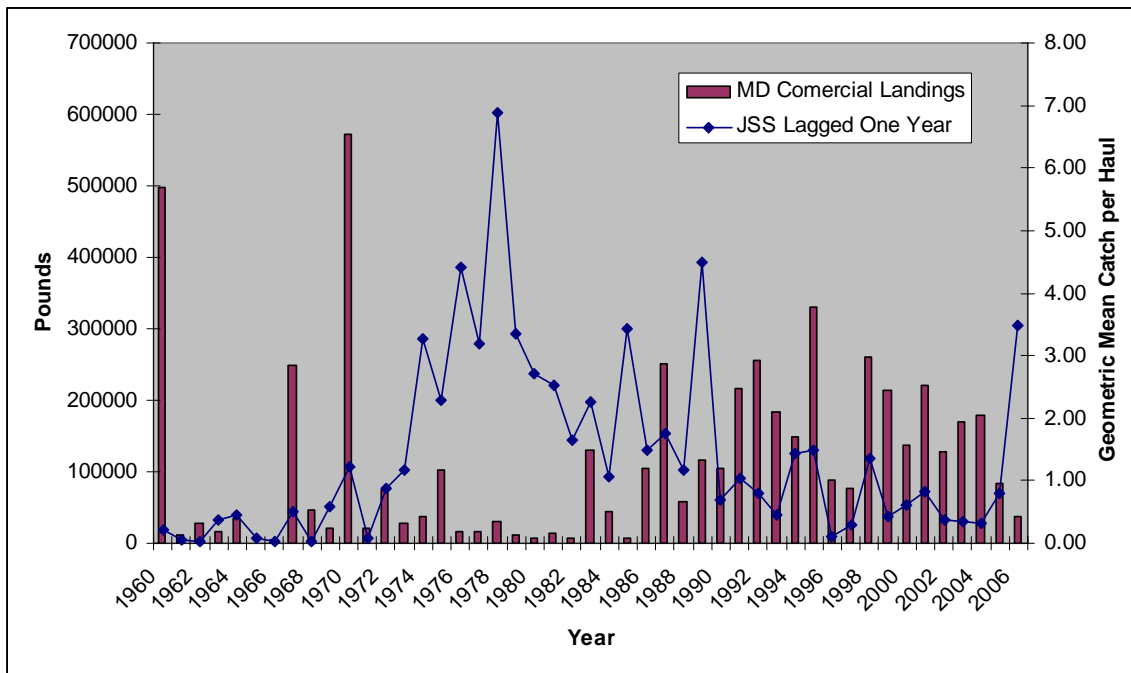


Figure 8. Comparison of spot CSI lagged one year and Maryland commercial spot landings using linear regression, 1990-2006.

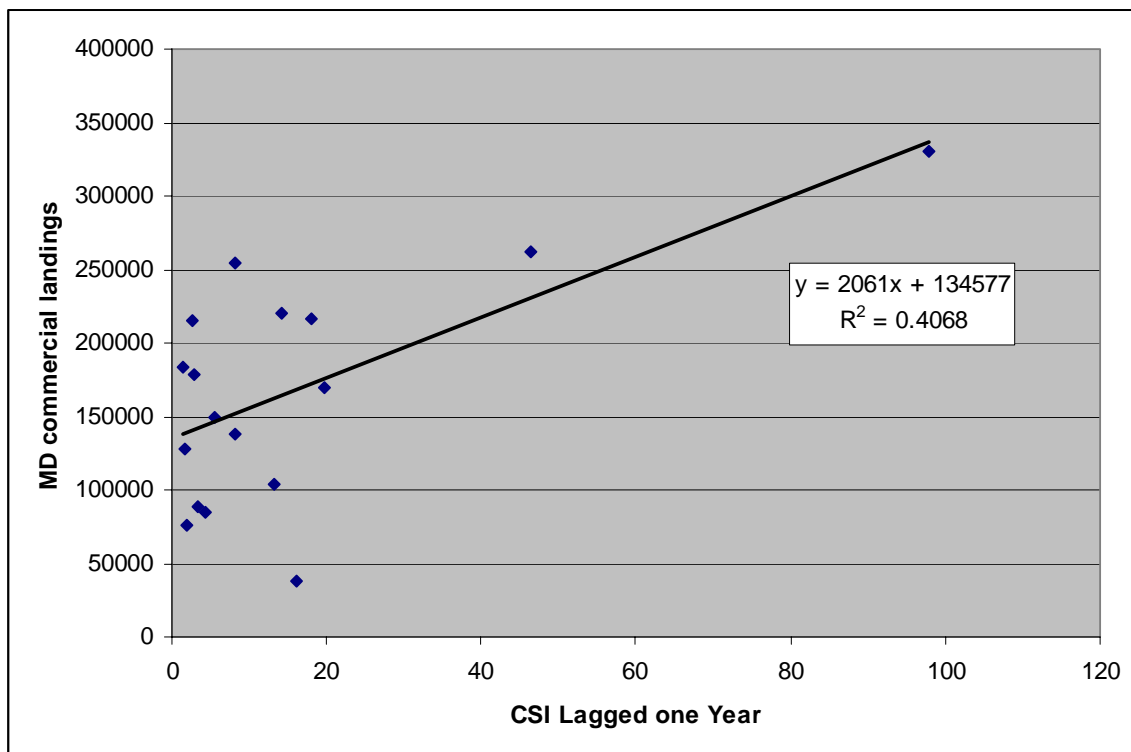


Figure 9. Maryland commercial spot pound net and gill net CPUE indices, 1980-2007, excluding years where effort was unavailable. 2007 data is preliminary.

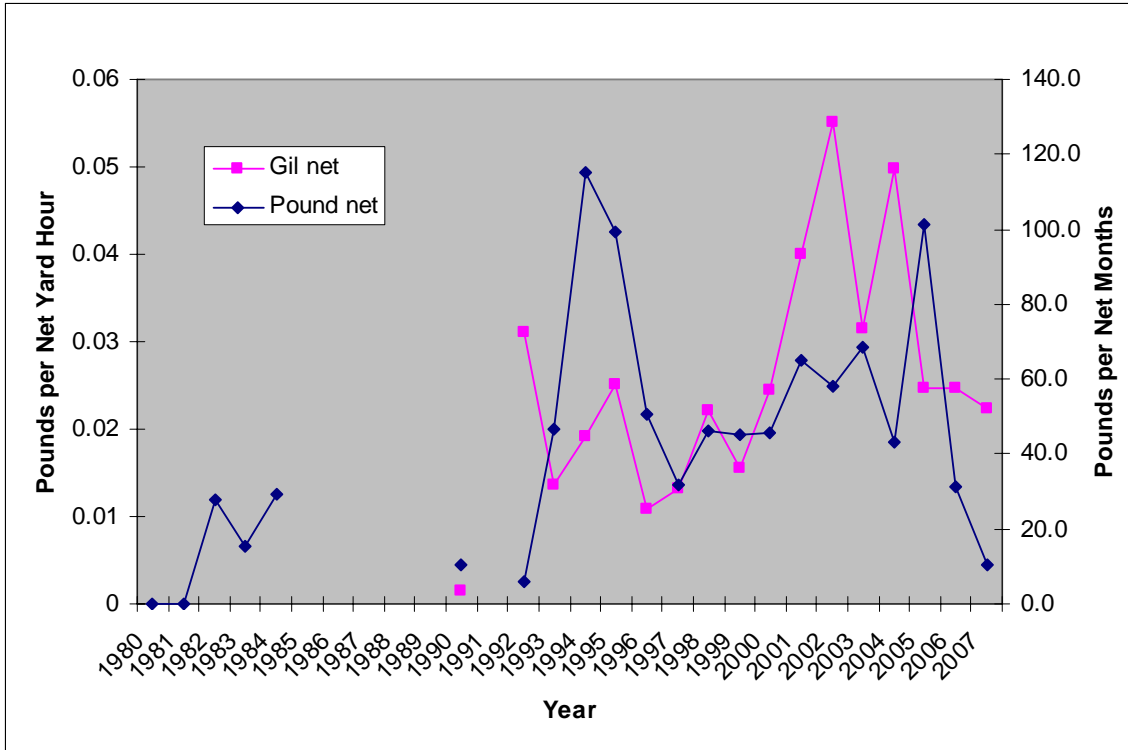


Figure 10. Maryland pound net catch and effort used in the derivation of the Pound net CPUE, 1980 – 2007, excluding 1985-1989 and 1991.

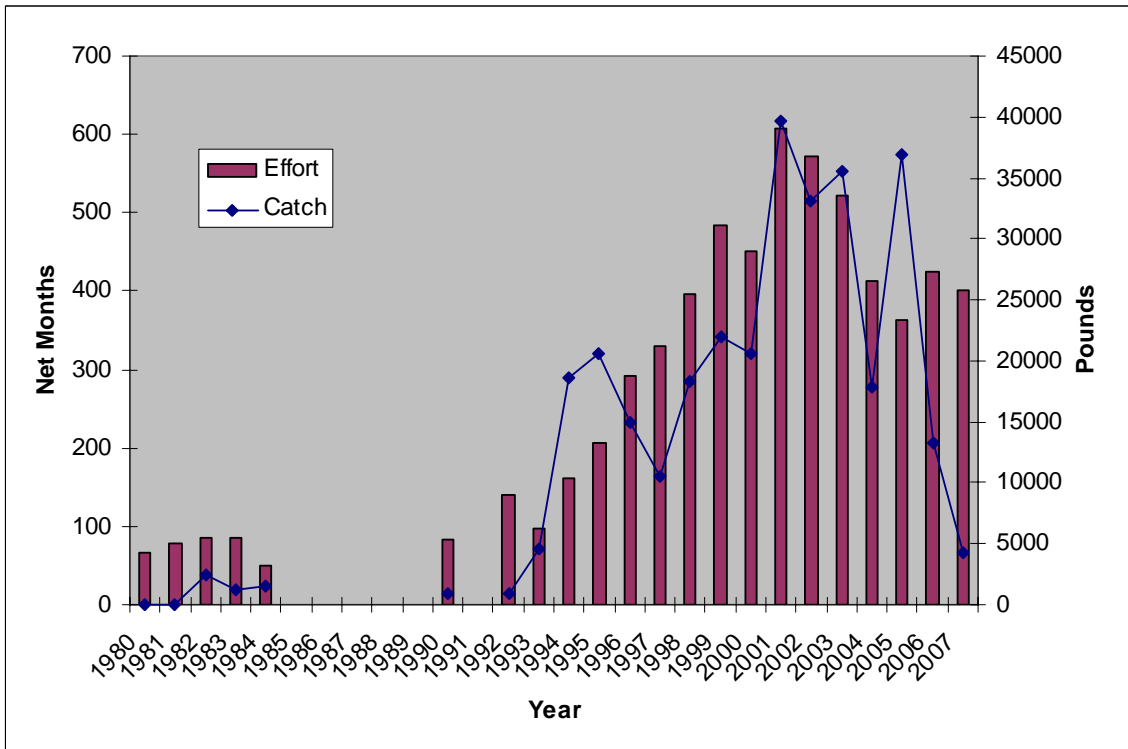


Figure 11. Maryland gill net catch and effort used in the derivation of the Pound net CPUE, 1980 – 2007, excluding 1985-1989 and 1991.

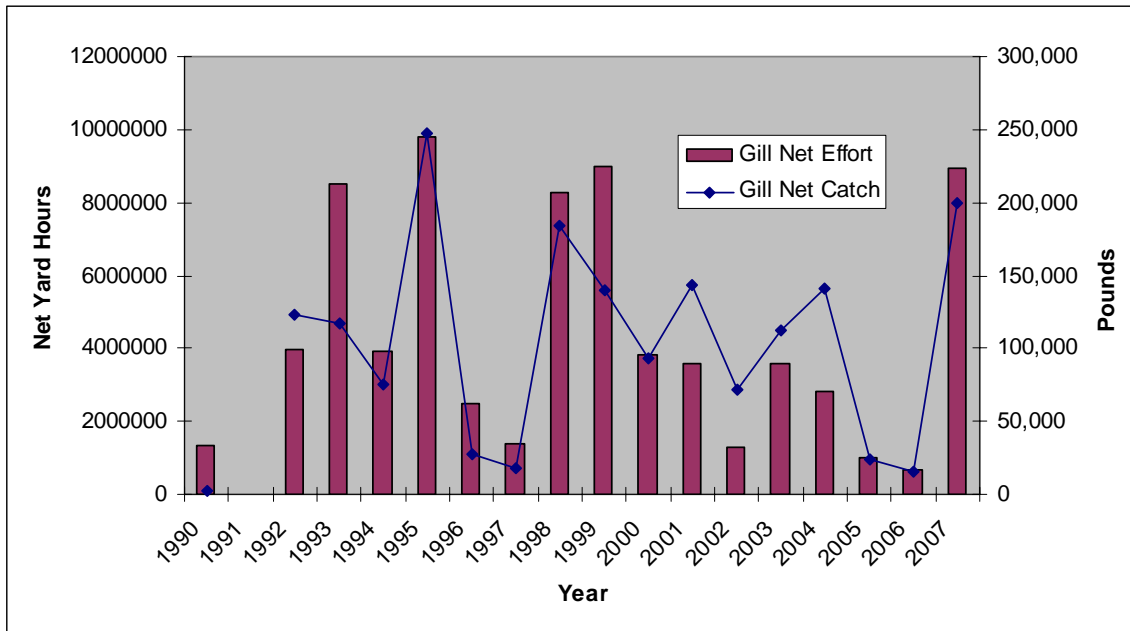


Figure 12. Price per pound, in 2007 dollars, for spot sold in Maryland, 1980-2007.

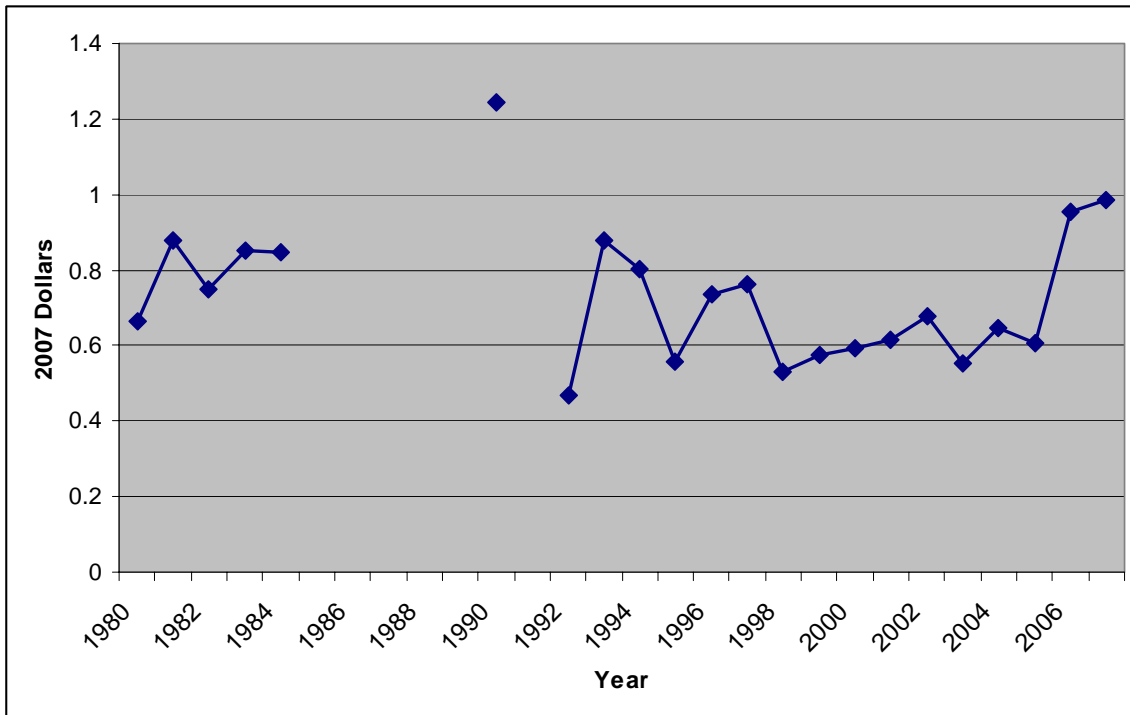


Figure 13. Maryland inland and shore angler MRFSS CPUE, 1981-2005.

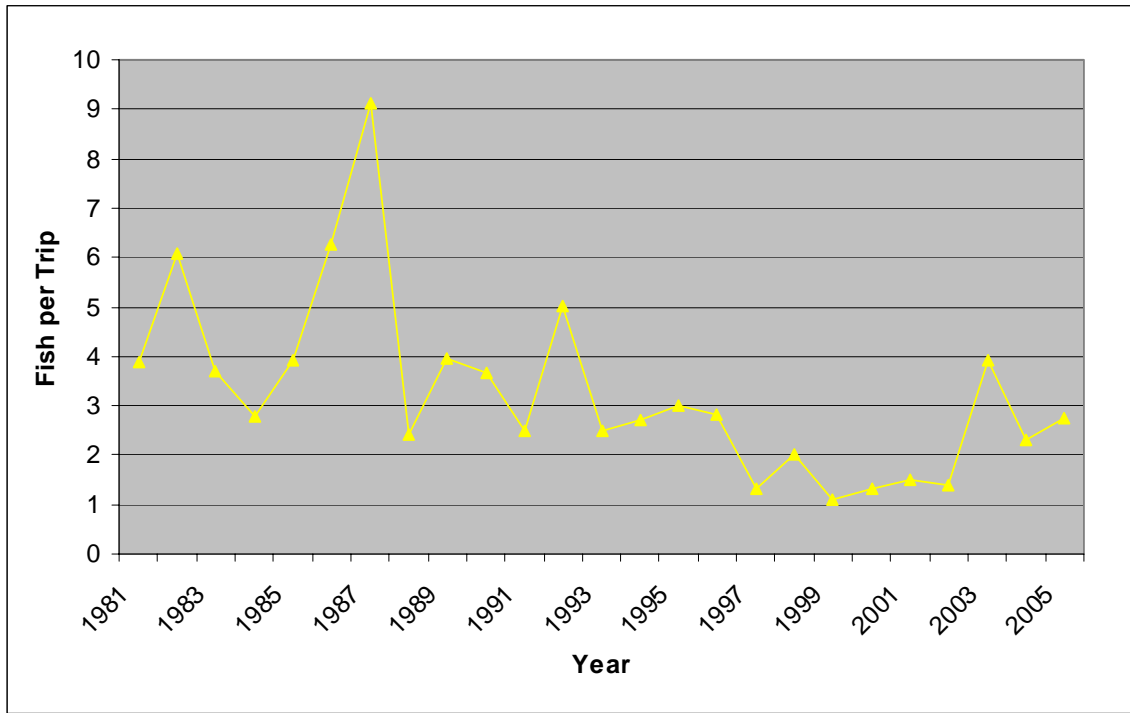


Figure 14. MRFSS index and JSS index lagged one year, 1981- 2005.

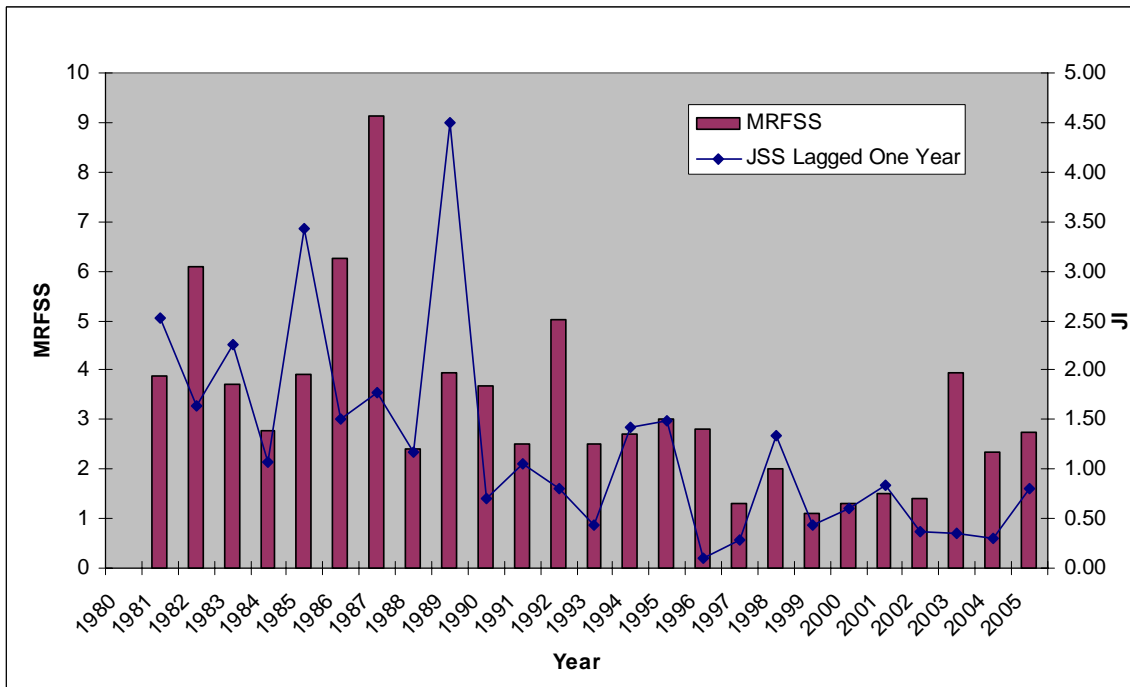


Figure 15. Maryland charter boat CPUE, 1993-2007 and inland MRFSS CPUE, 1981-2005.

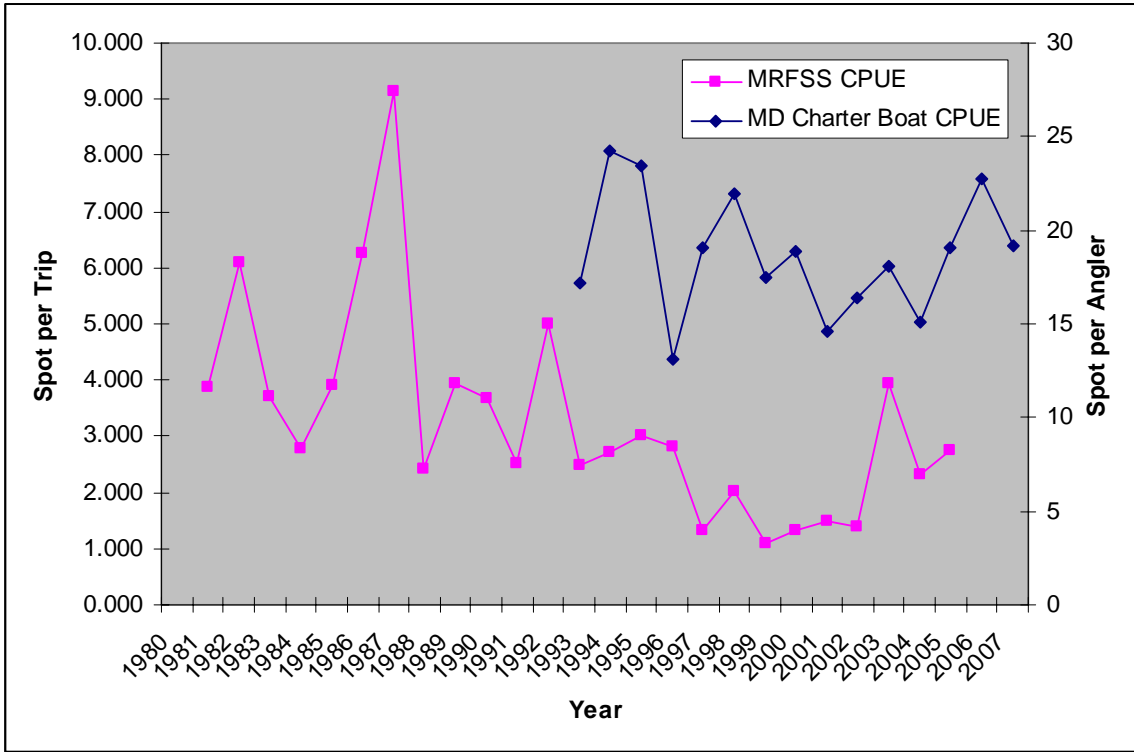


Figure 16. Spot length frequency distributions from pound nets, 2004-2007.

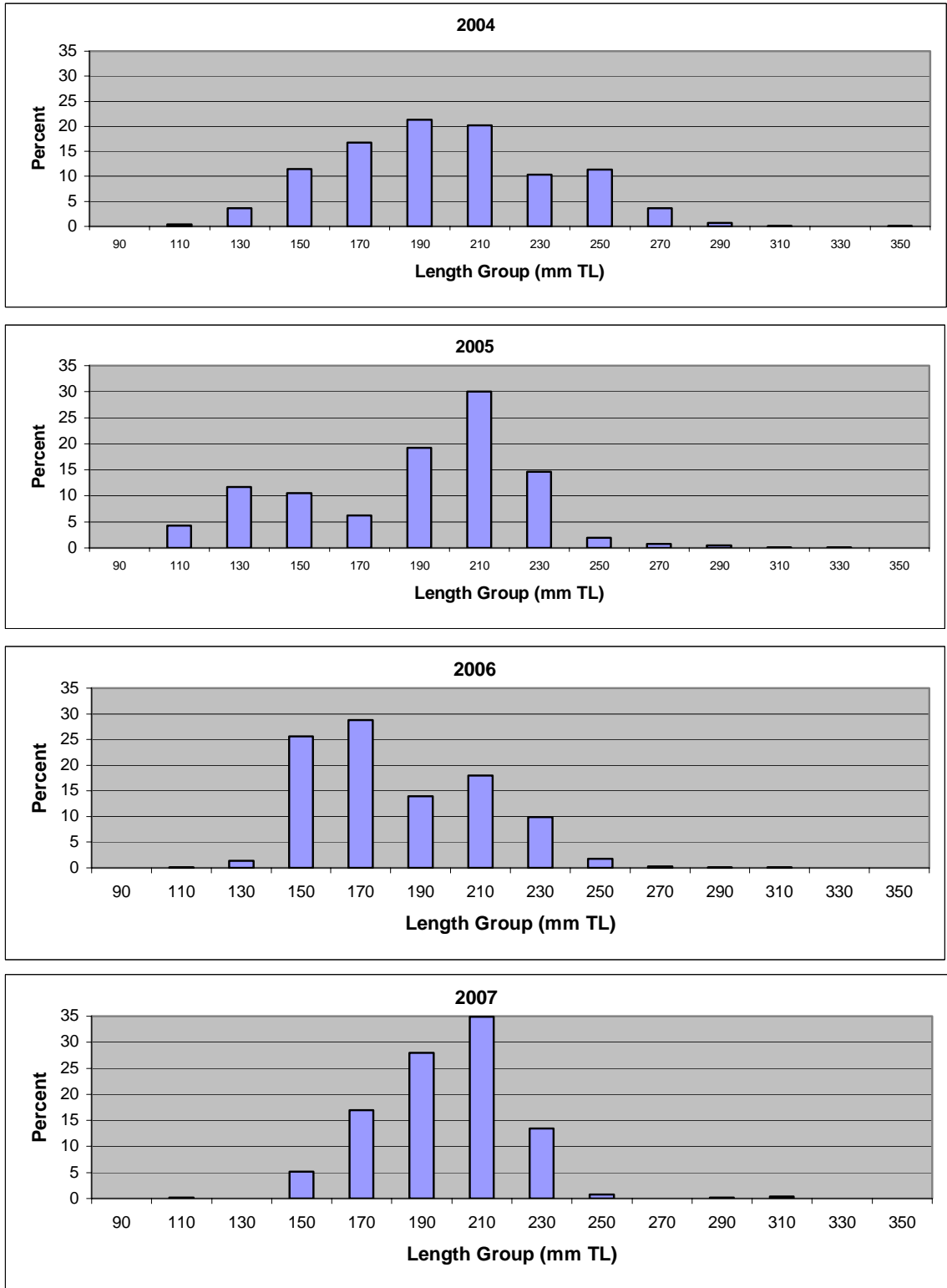


Figure 17. Spot catch at age in pounds for Maryland's commercial fishery, 1998-2006.



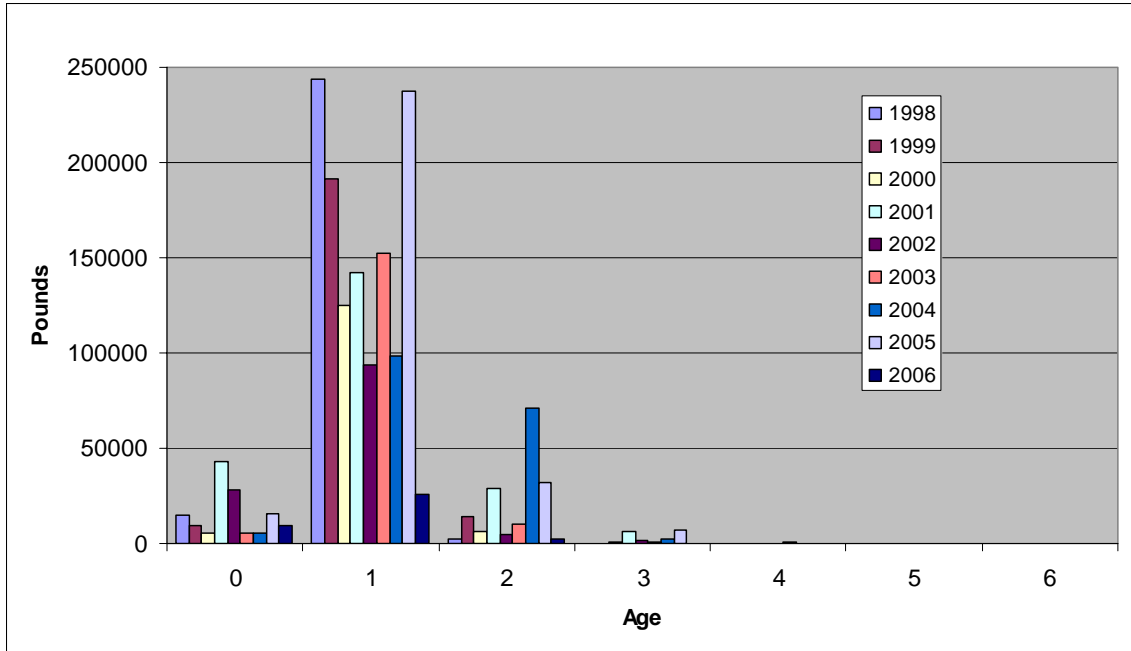


Figure 18. Spot catch at age in numbers for Maryland's commercial fishery, 1998-2006.

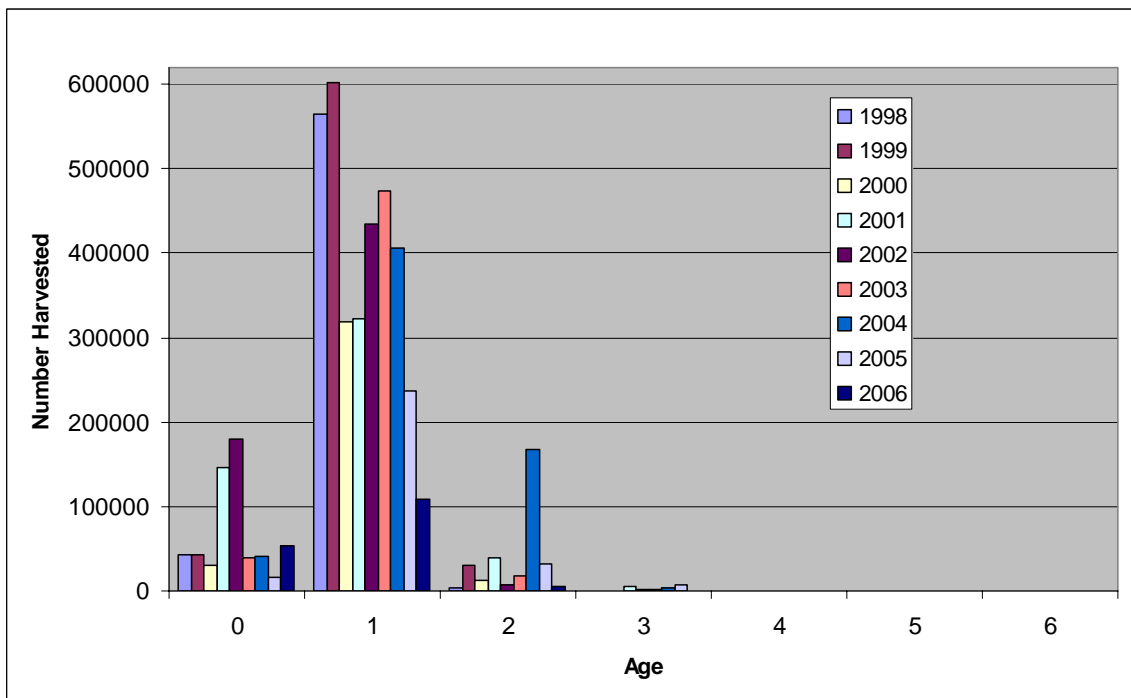


Figure 19. Spot mean weight at age in numbers for Maryland's commercial pound net fishery, 1998-2006.

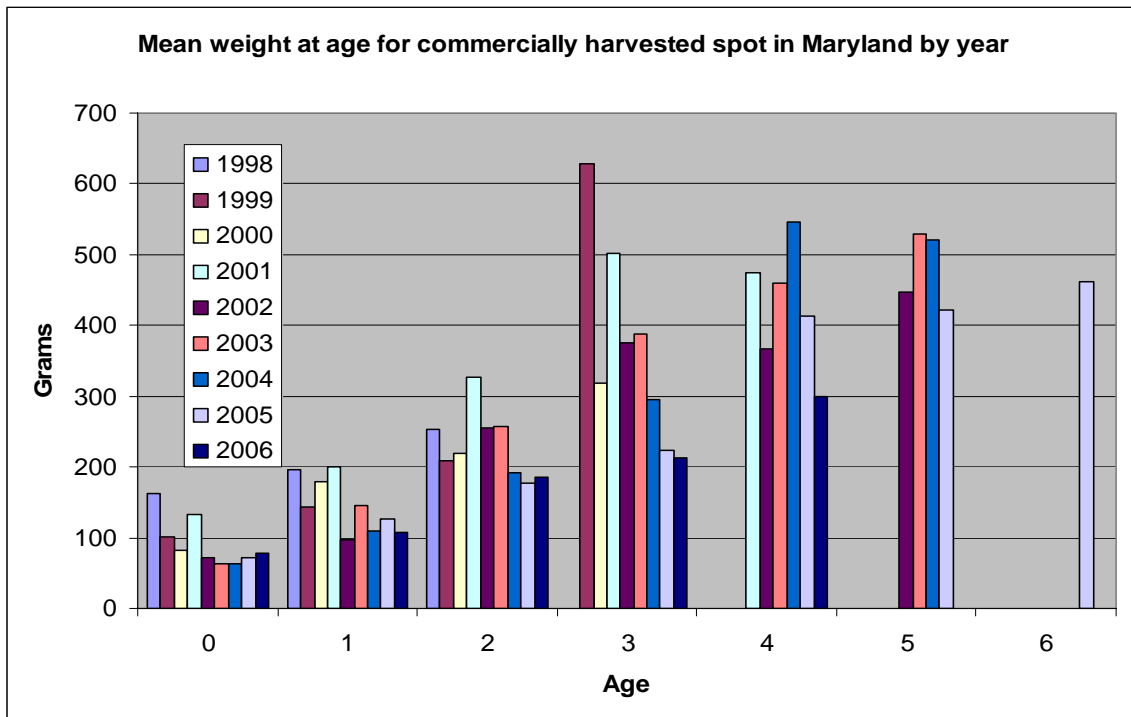
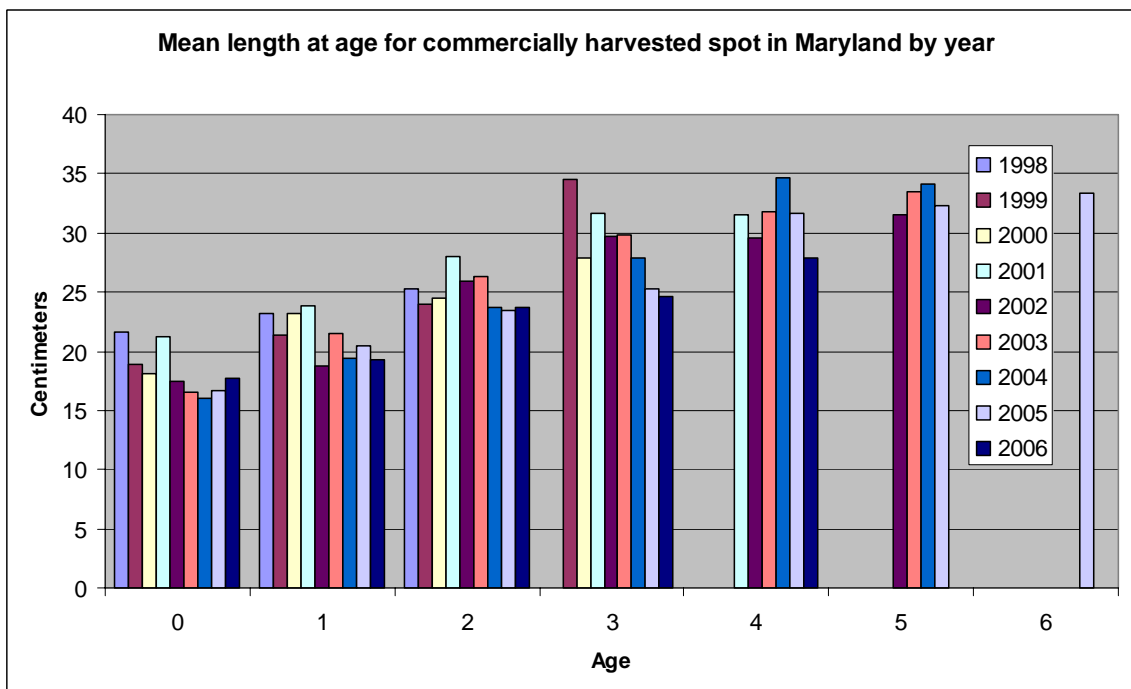
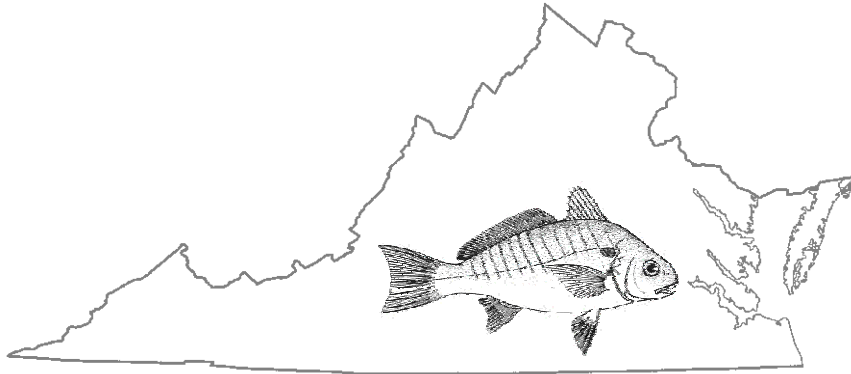


Figure 20. Spot mean length at age in numbers for Maryland’s commercial pound net fishery, 1998-2006.



**Update of Available Data for Spot, *Leiostomus xanthurus*,  
Occurring in Virginia Waters**



Report to the Atlantic States Marine Fisheries Commission

April 2008

Prepared by:

Laura M. Lee

Fisheries Management Division

Virginia Marine Resources Commission

2600 Washington Avenue

Newport News, VA 23607

## **Introduction**

The Atlantic States Marine Fisheries Commission's (ASMFC) South Atlantic Board requested that the Spot Plan Review Team (PRT) review and update available data relevant for the spot resource. This report summarizes data specific to the state of Virginia and includes data through 2007 where possible.

## **Management**

The Virginia Marine Resources Commission (VMRC) currently has no regulations governing commercial or recreational fisheries for spot in Virginia's marine waters.

## **Fisheries**

Commercial fisheries data were obtained from the VMRC's mandatory reporting database (VMRC, Newport News, VA, pers. comm.). Note that 2007 estimates of commercial harvest are considered preliminary and should be interpreted with caution.

Virginia's commercial fisheries have harvested an average of over 3.4 million pounds of spot from 1994 through 2007 (Table 1). Commercial harvest has ranged from a low of just under 2.0 million pounds in 2006 to a high of almost 4.5 million pounds in 1998 over this time period. Commercial harvest in 2005 and 2006 were the lowest on record for these years, though the estimate for 2007—while preliminary—was above the time series average. The majority of commercial harvest of spot has been taken by gill nets (including anchor, drift, and staked), accounting for 84% of the harvest between 1994 and 2007 (Table 2). Gill net harvest of spot ranged between 2.5 and 3.7 million pounds from 1994 through 2004, and then decreased to 2.1 and 1.6 million pounds in 2005 and 2006, respectively. Commercial harvest by gill nets in 2007 was similar to values prior to 2005, bringing in an estimated 2.9 million pounds of spot. Recall that 2007 estimates of commercial harvest are considered preliminary. From 1994 to 2007, haul seines accounted for 9.4% (0.3 million pounds per year) of the commercial harvest while pound nets accounted for 6.4 % (0.2 million pounds per year) of the commercial harvest. Commercial harvest of spot by all other gear types has been variable from 1994 through 2007, though the trend has been generally increasing since 1994. All other commercial gears accounted for less than 0.2% (< 5,000 pounds per year) of spot commercial harvest for this time period.

The age distribution of spot in Virginia's commercial catches was estimated based on samples collected by the VMRC's Biological Sampling Program (VMRC, pers. comm.). Age data are available from 1998 to 2007, though 2007 data are considered preliminary. Spot ranging in age from 0 to 6 have been observed in Virginia's commercial harvest during the available time series (Table 3; Figure 1). The commercial harvest has been dominated by age-1 spot for most of the time series.

Fishery-dependent indices of catch-per-unit-effort (CPUE) were developed for Virginia's commercial inshore gill net and haul seine fisheries. Directed trips for the commercial inshore gill net fishery were defined as those trips that harvested greater than or equal to 100 pounds of spot. The inshore gill net CPUE exhibited limited variability between 1994 and 1994, with the majority of values ranging between 600 and 1,000 pounds per directed trip (Figure 2). The haul seine CPUE has demonstrated more variability over this time series, with values ranging from 570 to just over 1,800 pounds per trip. There was a marked increase

in the haul seine CPUE observed in 2007, most of which can be attributed to the harvest by a traditional beach seine in September of 2007. The 2007 data are considered preliminary and subject to revision.

Recreational fisheries statistics for spot caught in Virginia waters were provided by the Marine Recreational Fisheries Statistics Survey (National Marine Fisheries Service, Fisheries Statistics Division, Silver Spring, MD, pers. comm.). Like the commercial data, recreational statistics for 2007 are considered preliminary and should be interpreted with caution.

Recreational fisheries have accounted for about 23% of the total harvest (commercial plus recreational Types A+B1) of spot in Virginia during 1994 to 2007 (Table 1). During this same time period, recreational harvest (Type A+B1) of spot averaged just over 1.0 million pounds. The lowest annual recreational harvest on record occurred in 1999, at just over 0.2 million pounds of spot. Since then, recreational harvest has been increasing, with an estimated 2.4 million pounds harvested in 2007 (note this estimate is preliminary).

Recreational indices of CPUE were developed by H. Rickabaugh (Maryland Department of Natural Resources, pers. comm.). The Virginia recreational CPUE series was calculated by dividing spot harvest (Type A+B1) in weight (pounds) by those trips targeting spot or trips that caught spot (Type A, B1, or B2). Only data collected from the private/rental and shore modes fishing in inland waters were used. Recreational harvest CPUE averaged 1.6 pounds of spot per trip between 1981 and 2007, ranging from a high of 3.2 pounds per trip in 1992 to a low of 0.6 pounds per trip in 1994 (Figure 3).

### **Fishery-Independent Surveys**

The Virginia Institute of Marine Science (VIMS) initiated a fishery-independent survey of the Chesapeake Bay estuary in 1955 (VIMS, Gloucester Point, VA, pers. comm.). The Juvenile Fish and Blue Crab Survey is a trawl survey intended to monitor the distribution and abundance of important finfish and invertebrate species occurring in the Chesapeake Bay. The VIMS develops annual indices of abundance for age-0 spot to provide a measure of relative year-class strength. The Random Stratified Converted Index (RSCI) is based on post-stratification of gear and/or vessel, using all spatially appropriate data (Montane and Fabrizio 2006). The RSCI index has been highly variable throughout much of the time series (Figure 4). The index suggests spot year-class strength was relatively low between 1958 and 1961 and from 1992 to the present. The VIMS also calculates indices based on fixed stations within the bay and rivers (Bay and Rivers index) and based on fixed stations within the rivers only (Rivers Only index). Both of these indices suggest relative abundance of age-0 spot has been variable over time (Figure 5). Similar to the RSCI index, the Bay and Rivers and Rivers Only indices provide evidence that relative year-class strength was generally higher prior to 1992.

## **References**

Montane, M.M., and M.C. Fabrizio. 2006. Estimating relative abundance of recreationally important finfish and crustaceans in the Virginia portion of Chesapeake Bay. Annual report to the Virginia Marine Resources Commission's Marine Recreational Fishing Advisory Board, Project No. RF 05-15, June 2005-May 2006. Virginia Institute of Marine Science, Gloucester Point, VA. 125 pp. (Revised December 7, 2006)

**Table 1.** Commercial and recreational harvest (pounds) of spot from Virginia waters, 1994–2007. Note: 2007 data are preliminary.

Year	Commercial	Recreational <sup>1</sup>	Total
	(lb)	(lb)	(lb)
1994	4,268,193	1,217,036	5,485,229
1995	3,603,408	1,067,637	4,671,045
1996	2,983,071	492,982	3,476,053
1997	3,493,774	1,263,447	4,757,221
1998	4,473,830	866,619	5,340,449
1999	3,041,923	244,499	3,286,422
2000	3,907,060	252,885	4,159,945
2001	3,355,974	523,202	3,879,176
2002	3,246,299	829,972	4,076,271
2003	3,712,212	875,729	4,587,941
2004	3,417,082	1,447,697	4,864,779
2005	2,486,389	1,434,965	3,921,354
2006	1,989,308	1,463,070	3,452,378
2007	3,871,406	2,385,326	6,256,732

**Table 2.** Commercial harvest (pounds) of spot from Virginia waters by major gear type, 1994–2007. Note: 2007 data are preliminary.

Year	Gill Net <sup>2</sup>	Haul Seine	Pound Net	Other	Total
	(lb)	(lb)	(lb)	(lb)	(lb)
1994	3,721,348	299,903	245,806	1,136	4,268,193
1995	3,016,095	176,098	409,242	1,973	3,603,408
1996	2,450,148	339,417	192,782	724	2,983,071
1997	3,006,742	271,308	214,435	1,289	3,493,774
1998	3,717,845	463,721	283,748	8,516	4,473,830
1999	2,581,139	327,491	131,200	2,093	3,041,923
2000	3,400,402	337,492	165,633	3,533	3,907,060
2001	2,878,385	222,321	246,327	8,941	3,355,974
2002	2,794,280	227,947	220,612	3,460	3,246,299
2003	3,042,109	350,436	312,536	7,131	3,712,212
2004	2,958,072	246,556	209,798	2,656	3,417,082
2005	2,056,145	248,244	172,675	9,325	2,486,389
2006	1,631,550	275,344	77,598	4,816	1,989,308
2007	2,930,018	734,123	193,205	14,059	3,871,406

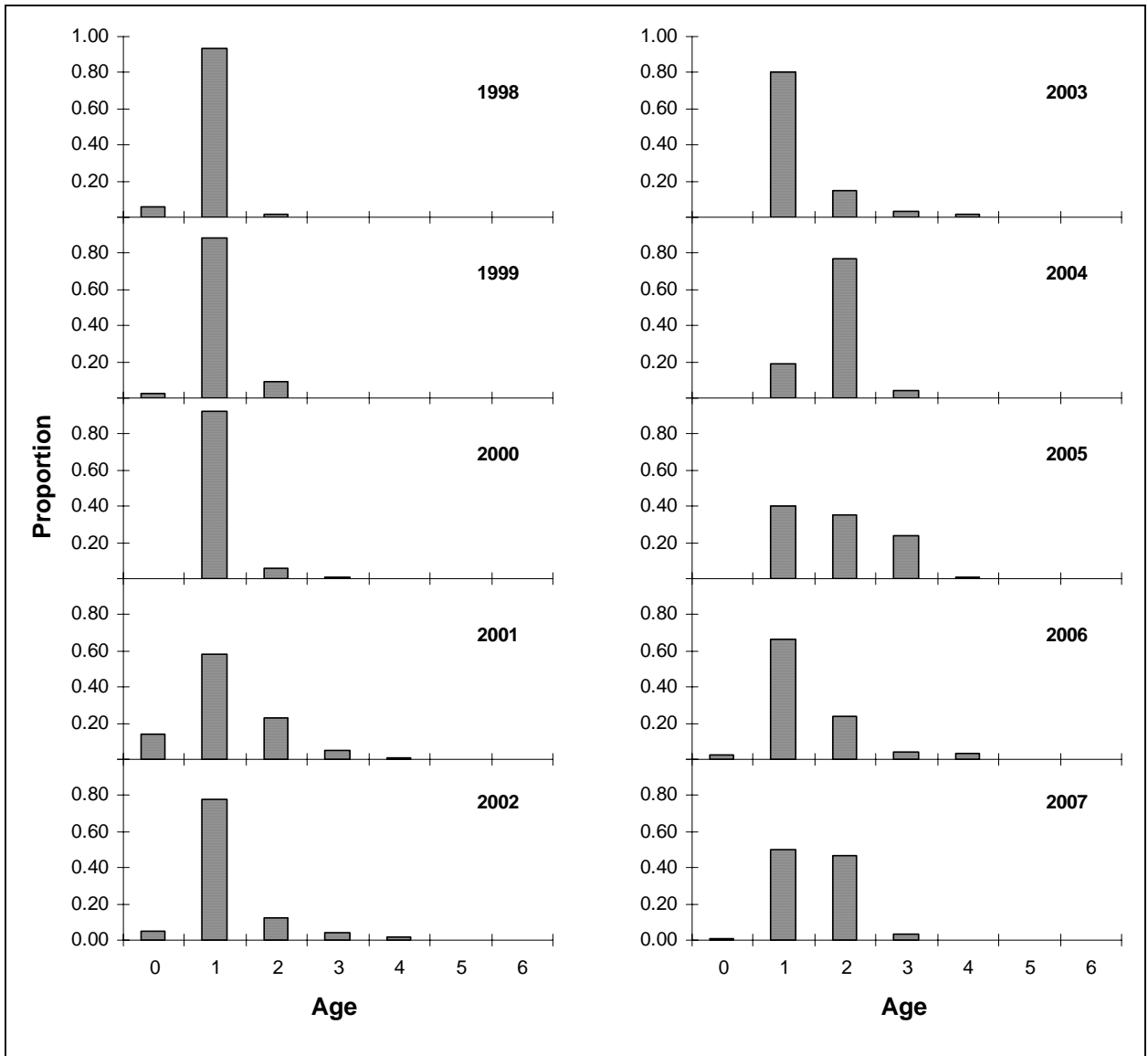
<sup>1</sup> Recreational harvest represents the sum of Type A and B1 catch, as defined by MRFSS (NMFS, pers. comm.)

<sup>2</sup> Gill nets include anchor, drift, and staked gill nets

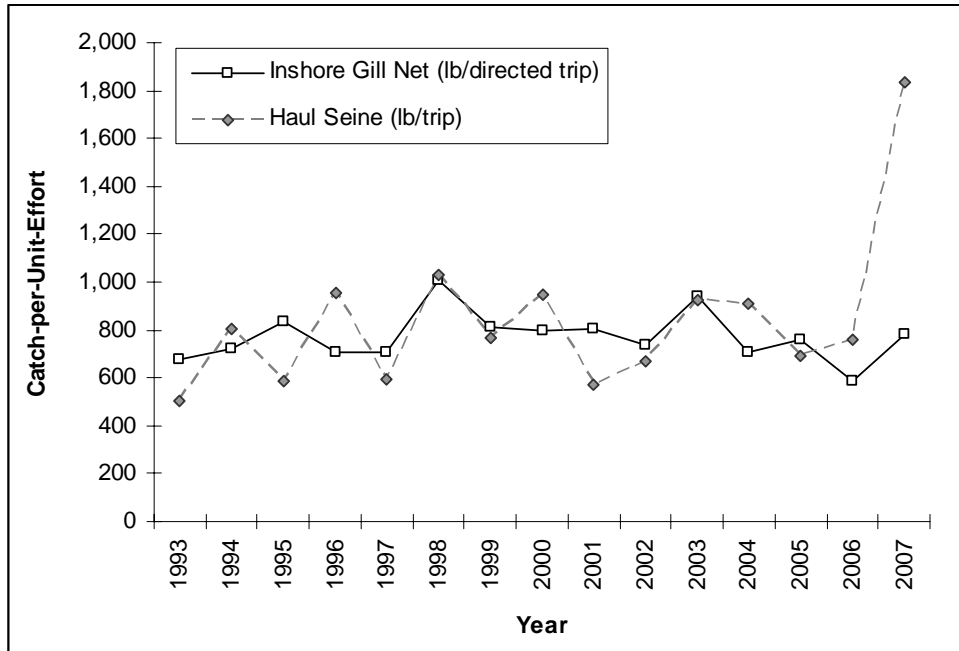
**Table 3.** Catch-at-age (numbers) of spot harvested by Virginia’s commercial fisheries, 1998–2007. Note: 2007 data are preliminary.

Year	Age						
	0	1	2	3	4	5	6
1998	619,301	10,327,949	142,636	0	0	0	0
1999	219,737	7,473,321	745,839	0	0	0	0
2000	24,130	8,428,794	510,445	92,598	9,701	0	0
2001	860,918	3,566,186	1,401,055	278,945	29,822	0	0
2002	338,330	5,718,447	907,798	309,968	99,873	7,318	0
2003	0	6,821,276	1,287,055	268,650	134,739	8,804	0
2004	0	1,357,226	5,544,717	271,558	11,499	12,695	454
2005	4,187	2,201,184	1,943,379	1,320,694	40,897	6,924	5,297
2006	139,433	3,506,582	1,245,756	210,478	154,119	0	0
2007	55,543	6,374,480	5,921,486	414,709	5,555	1,796	0

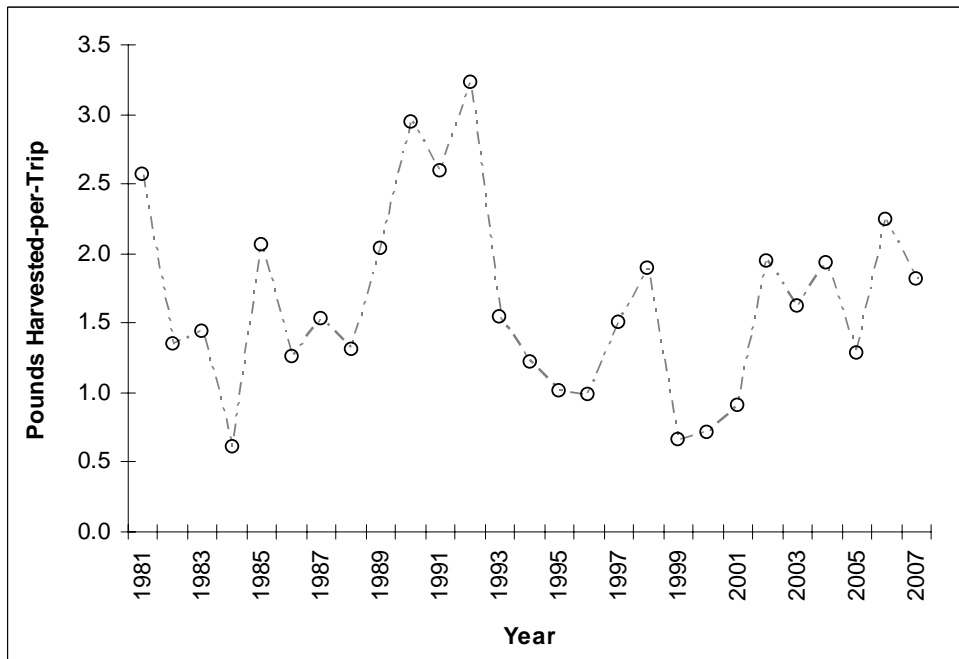




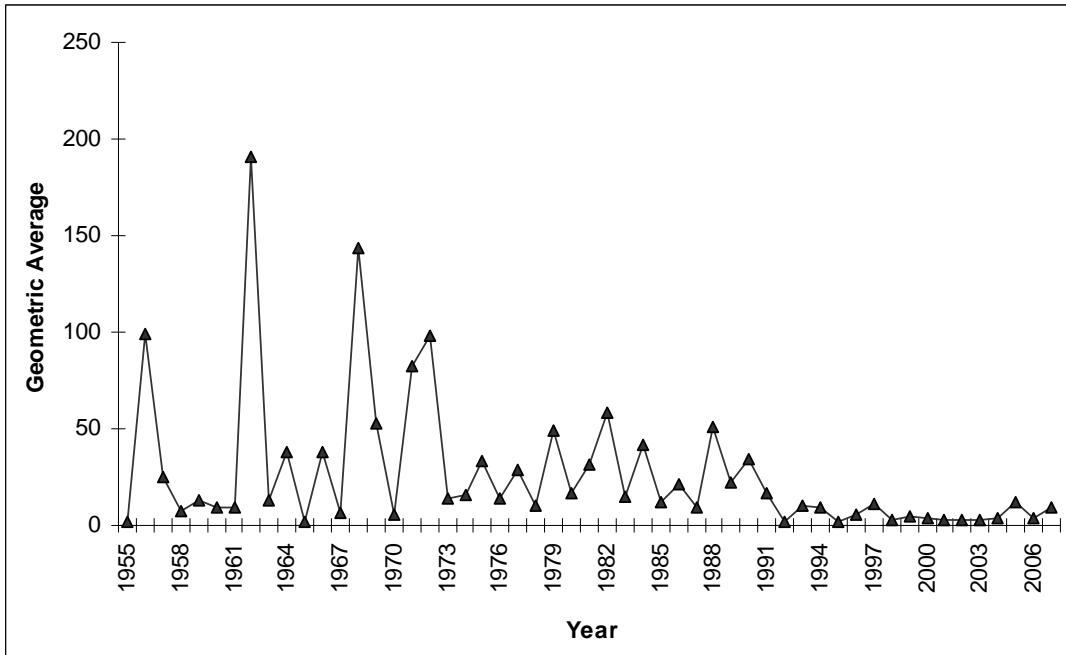
**Figure 1.** Proportion of spot harvested (numbers) at age observed in Virginia’s commercial fisheries, 1998–2007. Note: 2007 data are preliminary.



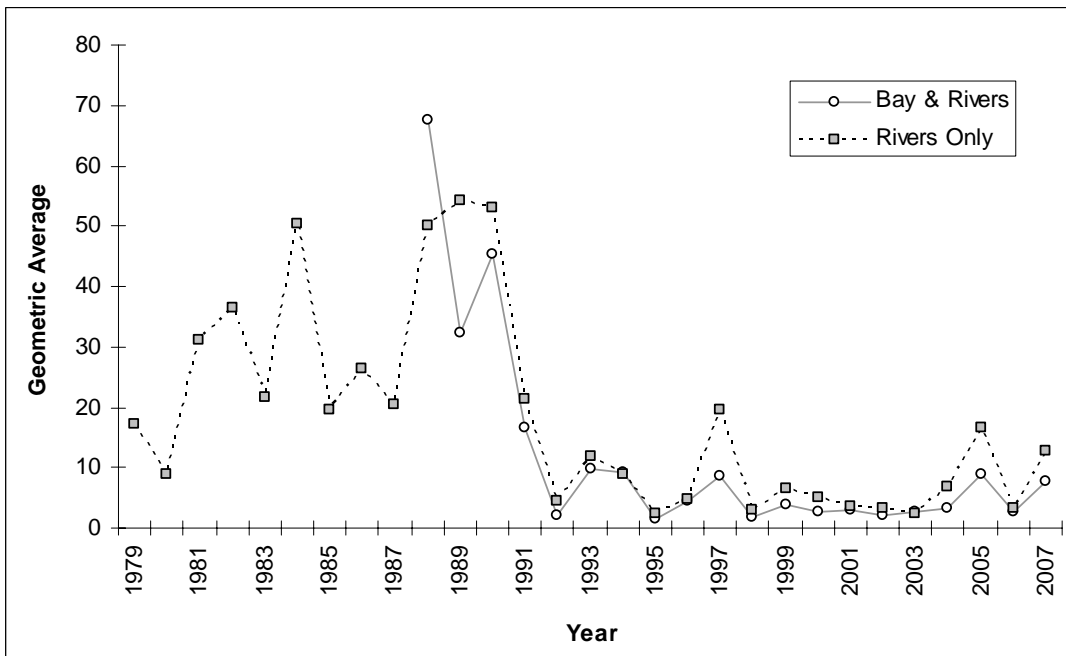
**Figure 2.** Catch-per-unit-effort (CPUE) of spot in Virginia’s commercial gill net and haul seine fisheries, 1994–2007. Directed trips for the commercial inshore gill net fishery were defined as those trips that harvested greater than or equal to 100 pounds of spot. Note: 2007 data are preliminary.



**Figure 3.** Catch-per-unit-effort (CPUE) of spot in Virginia’s recreational fishery, 1981–2007. Recreational catch includes harvest (Type A+B1) only. Recreational fishery effort was defined as those trips targeting spot or trips that caught spot (Type A, B1, or B2).



**Figure 4.** Annual index of juvenile spot relative abundance based on the VIMS Random-Stratified Converted Index (RSCI), 1955–2007. (Source: Montane and Fabrizio 2006)



**Figure 5.** Annual indices of juvenile spot relative abundance based on the VIMS Bay and Rivers index (1988–2007) and the VIMS Rivers Only index (1979–2007).

# DRAFT

## SPOT HARVEST AND INDEX REPORT For NORTH CAROLINA

### A Report to the Atlantic States Marine Fisheries Commission

April 09, 2008

#### North Carolina Division of Marine Fisheries

Recent (1994-2007) Trends in North Carolina Commercial, Recreational and Commercial Recreational Spot Fisheries

**Dependent Data:** (courtesy North Carolina Trip Ticket Program (NCTTP))

- Commercial Landings since 1994 have averaged 2.3 million pounds (Figure 1)
- Three major fisheries accounted for an average of 88.5% of landings, inshore gill net, ocean gill net and long haul (Figure 2)
- Since 1994 declines > than 20% year to year occurred 5 of the 14 years, most recently in 2007 when harvest decreased 36%.
- Since 1994, effort has been decreasing in the ocean gill net fishery, decreased slightly in the longhaul fishery and declined quickly over the last two years (2006, 2007) in the inshore gill net fishery (Figure 3)
- The number of longhaul trips has been consistent since 1999 but declined from 615 trips in 1994 to 327 trips in 2005, a decrease of 46.8%.
- Ocean gill net trips catching at least 100 lb steadily decreased from 952 trips in 1994 to 327 trips in 2005, a 64.3% decrease. Since 2001, the number of ocean gill net trips catching greater than 100 lb has been declining. There were 333 trips (> 100 lb) in 2007 (Figure 3)
- 2007 inshore gill net trips decreased 48.1% year to year, long haul trips decreased 17.2 % year to year, and ocean gill net trips increased 2.7% while total commercial landings hit 14-year and historical lows, down 35.6% year to year.
- CPUEs in the longhaul fishery were the lowest of the 14-year period and have decreased for 3 consecutive years. The CPUEs for the inshore gill net fishery were also the lowest of the 14-year period and have decreased for 3 consecutive years. The ocean gill net CPUEs have fluctuated the most, with CPUE values in 2007 close to the lowest of the 14-year period (Figures 4 and 5)

**Dependent Data:** Marine Recreational Fishery Statistics Survey (MRFSS) – Landings and Mean Catch Per Angler Trip

The mean catch per angler trip was examined from 1989 until 2007. It was calculated by summing Type A and Type B1 catch and divided by the number of contributing fishermen at the interview level. Mean catch is the mean of A + B1 at the interview/trip level.

# DRAFT

- Landings in the recreational fishery have averaged 1.2 million lb (Figure 1)
- Landings in 2007 were 11.7% above the 1994-2007 mean and increased 43.3% year to year
- Fluctuations have been common, landings up > 100% in 2001 relative to 2000, down 45% in 2002
- Mean catch per angler trip increased from 6.6 fish per trip in 2006 to 8.4 fish per trip in 2007. The average catch per angler trip from 1989-2007 was 7.3 fish per trip (Figure 6)
- Trend line has a positive slope since 1989 indicating a slight increase in CPUE during the 18 year period

**Dependent Data:** Recreational Commercial Gear License (RCGL). Catch data from NC Marine Fisheries License and Statistics section

RCGL allows licensee the right to catch spot with commercial gear (mostly gill nets) but license does not allow sale of these fish.

- NCDMF began to gather data in 2002 on RCGL license holders and spot landings have averaged 219,700 lb since 2002.
- Landings declined 46% from 2006 to 2007 (Figure 7), while trips declined 29.6%
- CPUEs also decreased in 2007 and were the lowest on record. CPUEs were consistent 2002-2005 but significantly decreased in 2006 and 2007 (Figure 8)

**Dependent Data:** North Carolina Citation Program

North Carolina awards a citation to any spot caught by hook and line if weight exceeds 1 lb.

- Low citation years, 1994-1999, year with highest number citations was 1999 with 10
- Beginning in 2000, many more citation sized fish applications were received, 19 in 2000, 249 in 2001, and 81 in 2005 but there were only two citations received in 2007 (Figure 9)

**Independent Data:** Program 195, Pamlico Sound Survey

Fifty-two randomly selected stations (grids) are sampled in June and again in September. Stations are randomly selected from strata based upon depth and geographic location. Randomly selected stations are optimally allocated among the strata based upon all previous sampling in order to provide the most accurate abundance estimates (PSE <20). Tow duration is 20 minutes; utilizing double

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rigged demersal mongoose trawls (9.1-m headrope, 1.0-m X 0.6 m doors, 2.2 cm bar mesh body, 1.9 cm bar mesh cod end and a 100-mesh tailbag extension.

- Data from this survey were used to produce juvenile abundance indices for spot (Figure 10)
- CPUEs have been extremely variable with no clear trend.
- Most recent year (2007) was showed a significant increase over 2006.

## **Independent Data:** Program 120 Estuarine Monitoring

One hundred five estuarine core stations along the coast are sampled each year without deviation to produce the JAI. Used is a two-seam 10.5 foot headrope trawl with a ¼ inch mesh in the body and 1/8 inch mesh in the tailbag. Tow duration is calibrated for 1 minute and a span of 75 yards.

- Data from this survey were used to produce JAIs for spot (Figure 11)
- These data also show wide fluctuations with no clear trend
- CPUE in 2007 also showed a significant increase over 2006 and reversed a two-year decline in juvenile CPUEs.

## **Independent Data:** Independent Gill Net Survey, Pamlico Sound

This study that began in 2001 employs a stratified-random sampling design based on area and water depth. An array of nets consisting of 30-yard segments of 3, 3½, 4, 4½, 5, 5½, 6, and 6½ inch stretched mesh webbing is set. Catches from an array of gill nets comprise a single sample and two samples (one shallow, one deep), totaling 480 yards of gill nets fished, were completed in a trip. Within a month, 32 core samples were completed (8 areas x twice a month x 2 samples). Data are used to calculate annual indices of abundance for Pamlico Sound for the following target species: Atlantic croaker (*Micropogonias undulatus*), bluefish (*Pomatomus saltatrix*), red drum (*Sciaenops ocellatus*), southern flounder (*Paralichthys lethostigma*), spot (*Leiostomus xanthurus*), weakfish (*Cynoscion regalis*), spotted seatrout (*Cynoscion nebulosus*), and striped bass (*Morone saxatilis*).

- Adult spot CPUE trends have decreased each of the last 3 years (Figure 12).
- CPUE highest in 2001, lowest in 2007
- Number of spot captured ranged from 2,108 in 2007 to 411 in 2007

## **Aging Data** Catch at Age for the Three Major Commercial Fisheries

- The dominant age classes in the ocean gill net, inshore gill net and the long haul fisheries are age 1 and age 2 (Figures 13,14 and 15)
- Very few age 0 fish are landed in these fisheries
- Proportion of older fish (3 and 4) showed little change

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## Discussion

Commercial landings in North Carolina's major fisheries (long haul, ocean gill net and inshore gill net) have declined significantly since 2004 and commercial landings in 2007 were a historical low. Effort, measured by trips has also decreased and part of this decrease is probably due to the lack of availability of the fish. The number of trips in the inshore gill net fishery during 2007 decreased approximately 50% in each of the last two years (2006, 2007). CPUEs in the gill net fisheries in 2007 were the lowest on record for inshore gill netting and approached 2006 lows in the ocean gill net fishery. Pounds landed in the long haul fishery were at a historical low and the number of trips in this fishery approached historical lows. However, it must be noted that CPUEs in the long haul fishery have been the most consistent of the major fisheries over the last ten years and decreases in landings are probably more a result of fewer long haul sets.

Both landings and CPUEs (mean catch/angler) increased in the recreational hook and line fishery in 2007. Preliminary data indicates the spot hook and line catch increased 43% in 2007 and was 8% above the 14-year average. Additionally, the mean catch per angler trip also increased in 2007 and was 15% above the 14-year average mean hook and line catch. These data are difficult to interpret relative to the apparent scarcity of fish available to the commercial fishers. The year 2007 marked the first year that the recreational harvest exceeded the commercial harvest.

Juvenile abundance indices fluctuated much over the study period, a trend that is not remarkable for short-lived species such as spot. CPUEs in the Pamlico Sound Survey and the Estuarine Trawl Survey decreased in 2005 and 2006, similar to JAI dips between 1996 and 1998. However, preliminary 2007 data indicated an increase in the juvenile indices in the Pamlico Sound and the coastwide estuarine trawl survey.

The CPUE values for the Pamlico Sound adult gill net survey have trended down since the highest value in the first year of the study (2001). The CPUE value in 2007 was the lowest since the survey began and confirms the lack of adult fish available during the fishing year. This survey will be expanded to the southern portion of the state in 2008 and these additional data will be used in the future to generate a more comprehensive adult index. Landings and trips in the Recreational Commercial Gear License fishery also decreased in 2007 reflecting the same theme of fewer adult fish available to fishers.

Recent decreases in most of the indices and in the commercial landings are concerning and seem to reflect a slow gradual decrease in abundance of spot that appears to have accelerated in 2006 and 2007. The life history of spot suggests that year class strength is often determined by environmental conditions that prevail on spawning grounds and nursery areas and fluctuations in year class strengths are to be expected. The catch at age in the major commercial fisheries indicate that landings in most years consist largely of only two age classes (Age 1 and 2). The strength of a given year class is most likely dependent on recruitment which is based on environmental factors. Since spot are such an estuarine dependent species, water quality/habitat degradation issues may be significantly impacting year class strengths. Coastwide development has placed many anthropogenic perturbations on their nursery areas including water quality stresses from both pollutants and freshwater runoff.

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Data indicate that spot are a large component in the total biomass of south Atlantic shrimp trawlers. Studies need to be conducted to determine what effect, if any these bycatch mortalities may be having on these short-lived, high natural mortality fish. The effect of spawning stock size on recruitment is still unknown. The increasing CPUEs in the juvenile indices for 2007 and the increases in the recreational mean catch per angler are encouraging. However, these increases were offset by another 2007 decrease in commercial landings, a decrease in the adult abundance index and a decrease in RCGL landings.



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## Commercial and Rec Spot Landings by Year

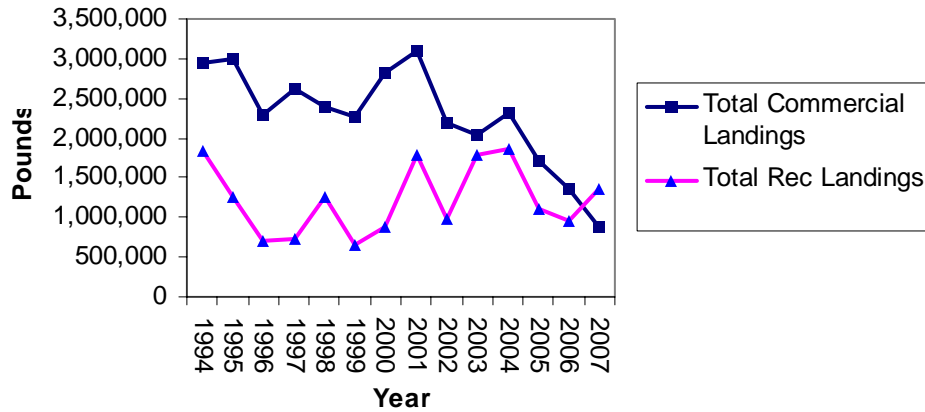


Figure 1. North Carolina commercial and recreational landings, 1994-2007.

## Major Commercial Fisheries, Spot

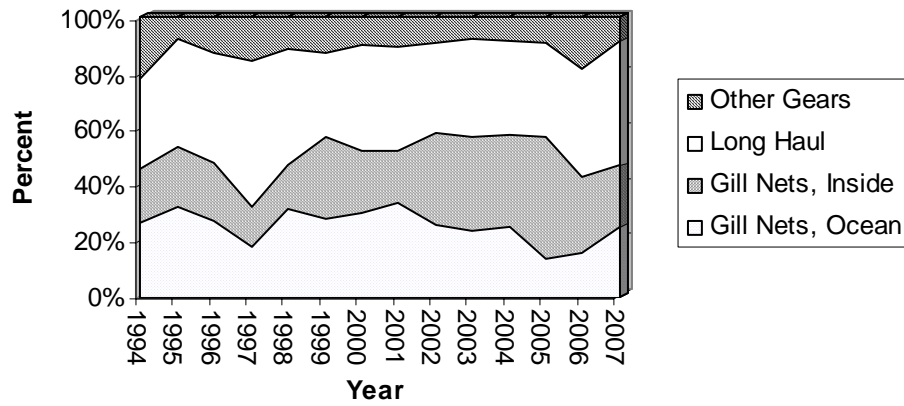


Figure 2. Major commercial gears capturing spot, 1994-2007.

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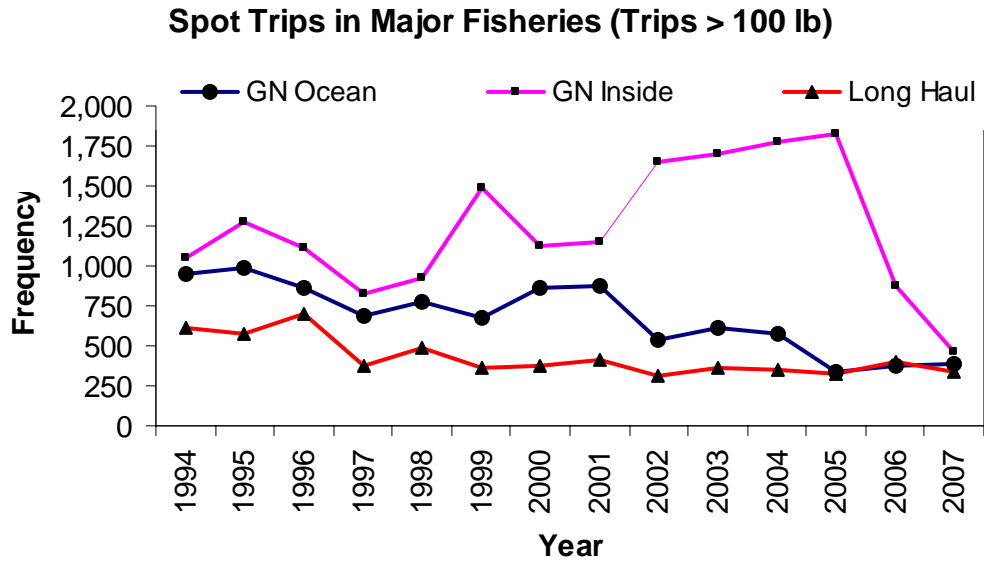


Figure 3. Spot trips in major North Carolina commercial fisheries, 1994-2007.

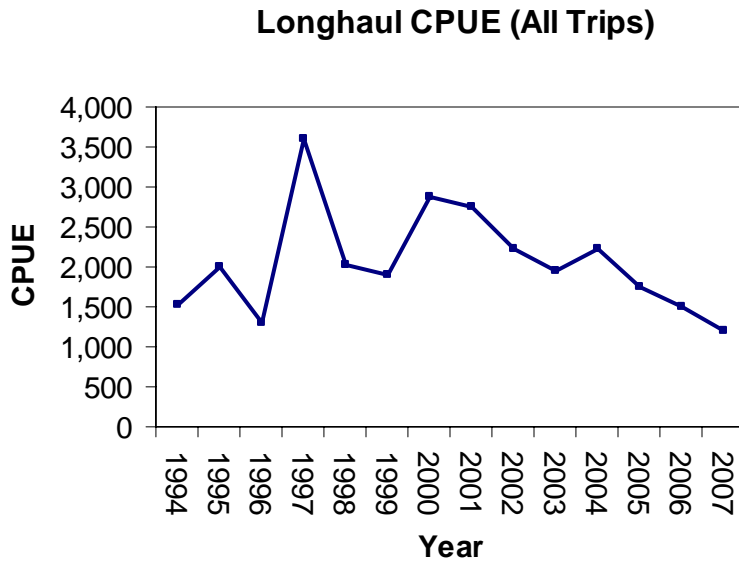


Figure 4. CPUE of longhaul fishery based on NCTTP trips and landings, 1994-2007.

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## CPUEs of Spot Inside & Ocean (Trips > 100 lb)

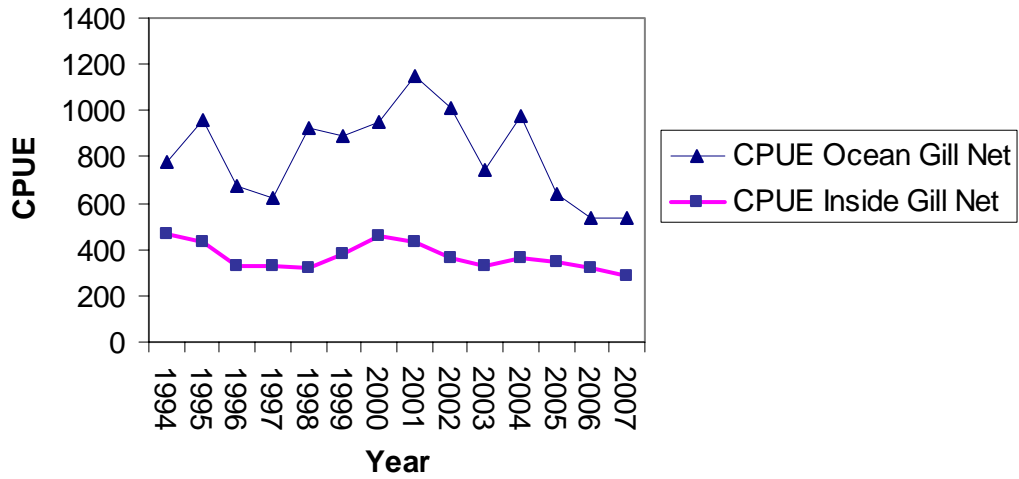


Figure 5. North Carolina ocean and inshore gill net spot CPUEs based on NCTTP, 1994–2007.

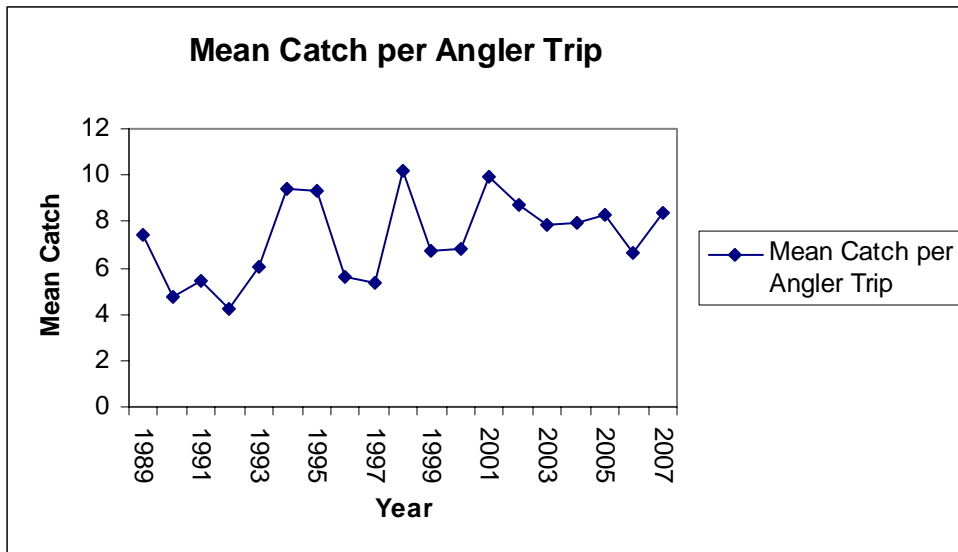


Figure 6. Spot mean catch per angler trip, 1989–2007 (from MRFSS).

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## RCGL Landings and Trips, Spot 2002-2007

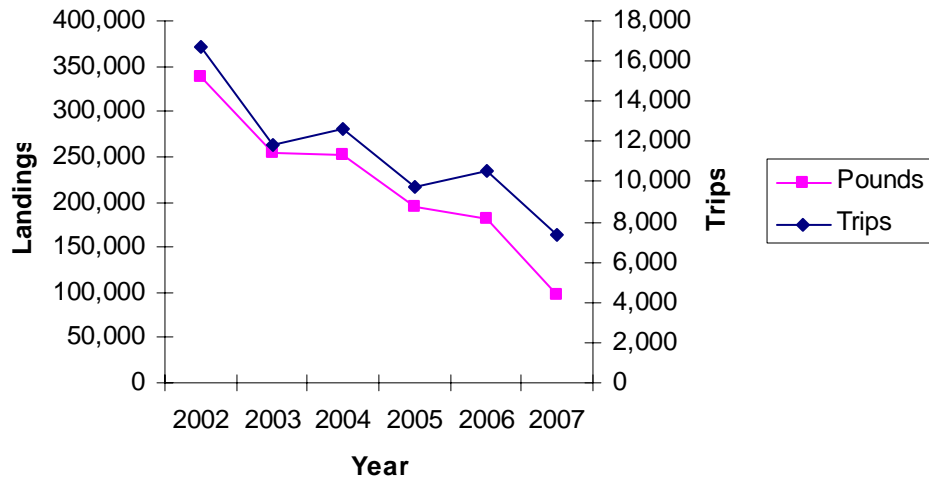


Figure 7. North Carolina spot landings and trips from RCGL license holders, 2002-2007.

## CPUE of Spot with RCGL

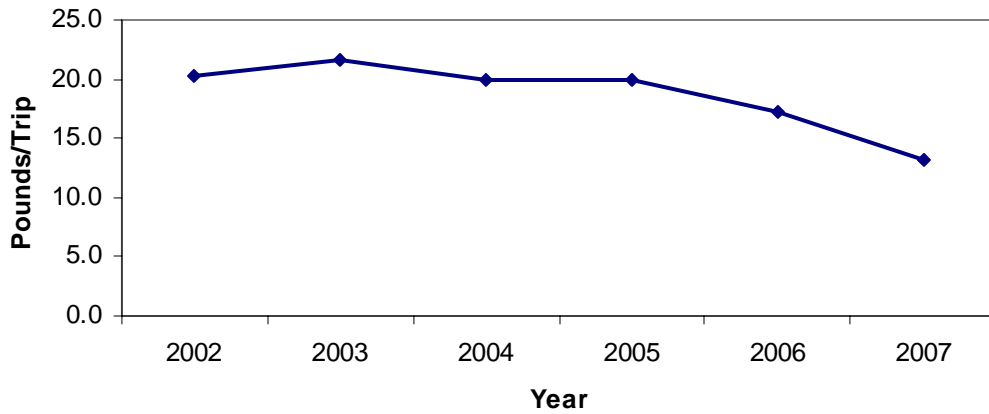


Figure 8. North Carolina spot CPUEs from RCGL license holders, 2002-2007.

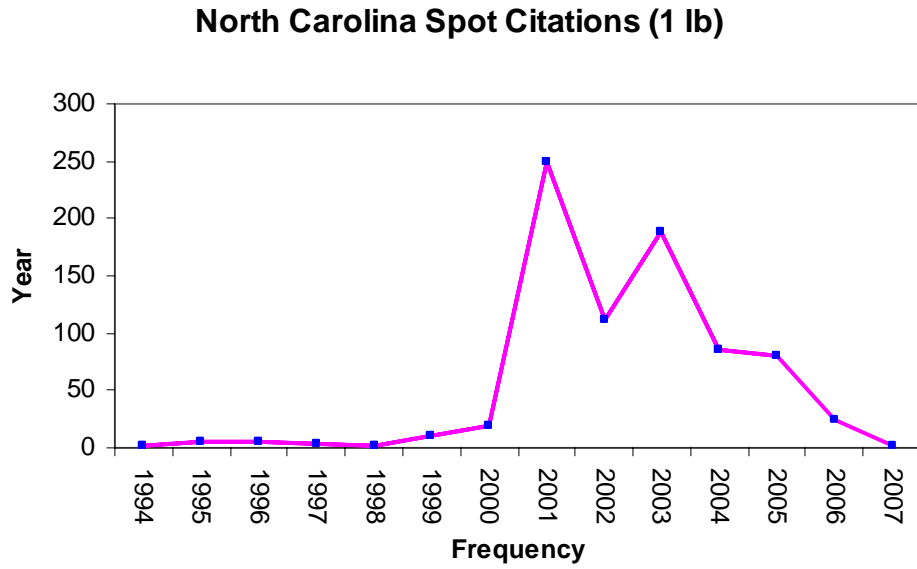


Figure 9. Number of spot citations (issued for hook and line catches > 1 lb) issued 1994-2007

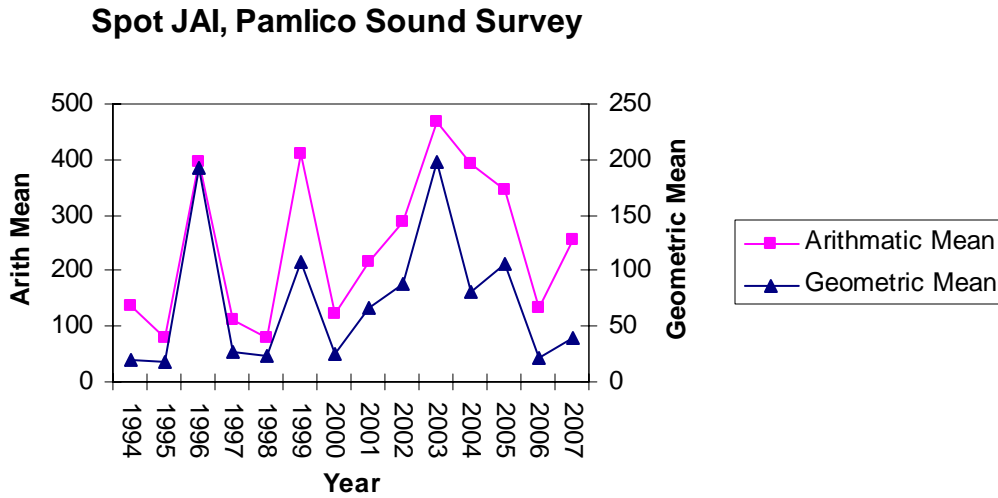


Figure 10. North Carolina Pamlico Sound Survey juvenile indices for spot 1994-2007.

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## Spot JAI, Estuarine Monitoring Program

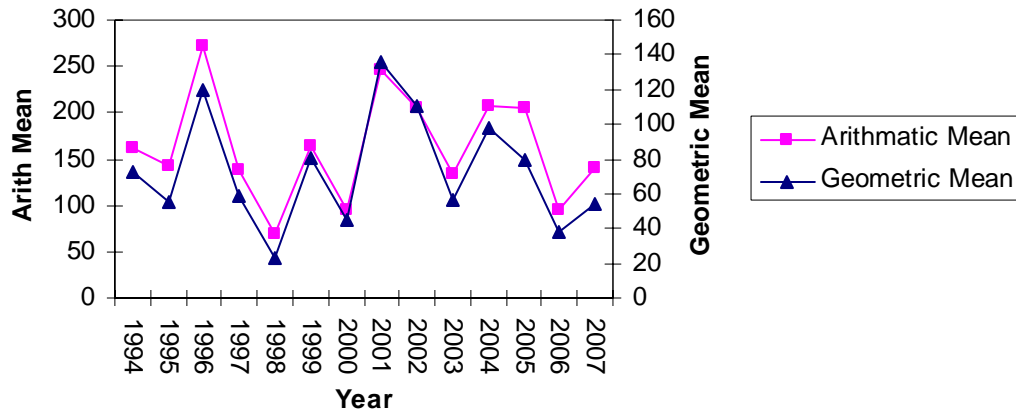


Figure 11. North Carolina Estuarine Trawl Survey juvenile indices for spot, 1994-2007.

## NC Spot CPUEs, Pamlico Sound, Adults

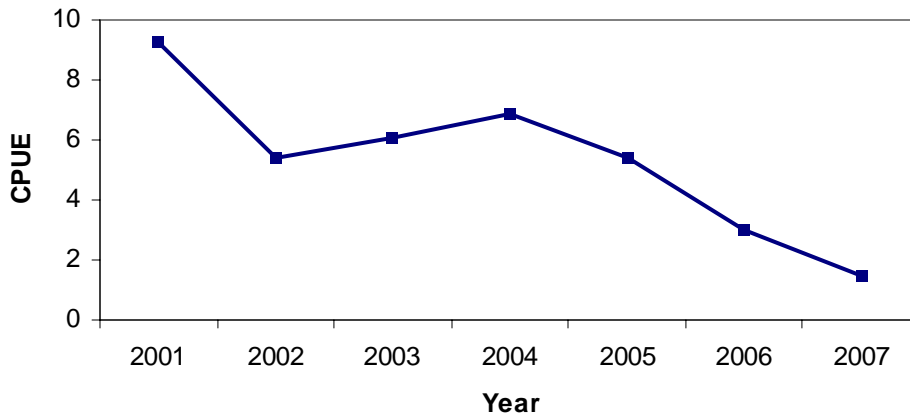


Figure 12. North Carolina spot annual weighted CPUE from Pamlico Sound Independent Gill Net Survey, 2001-2007.

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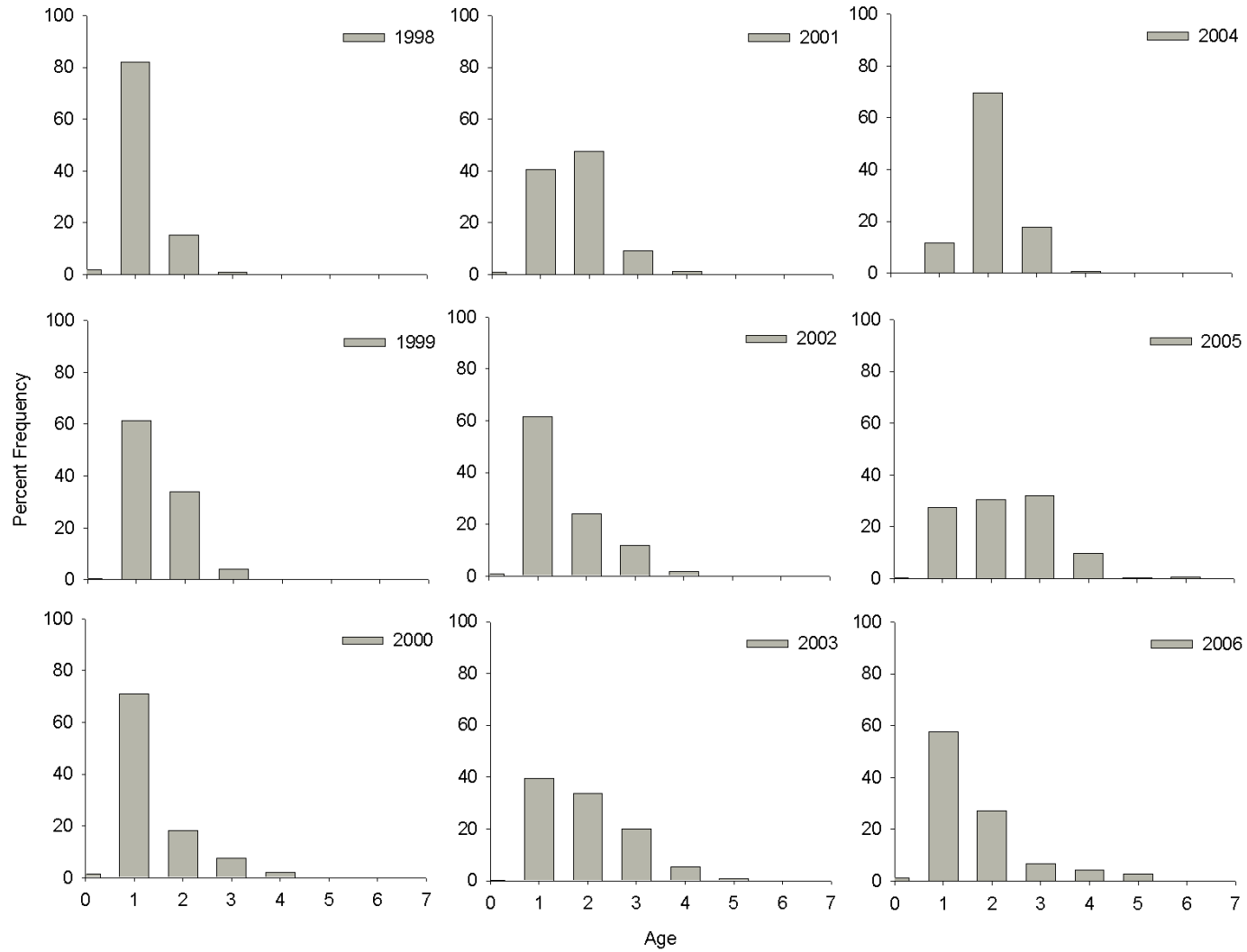


Figure 13. Age distribution of spot landed and sold in North Carolina inshore gill net fishery, 1998-2006.

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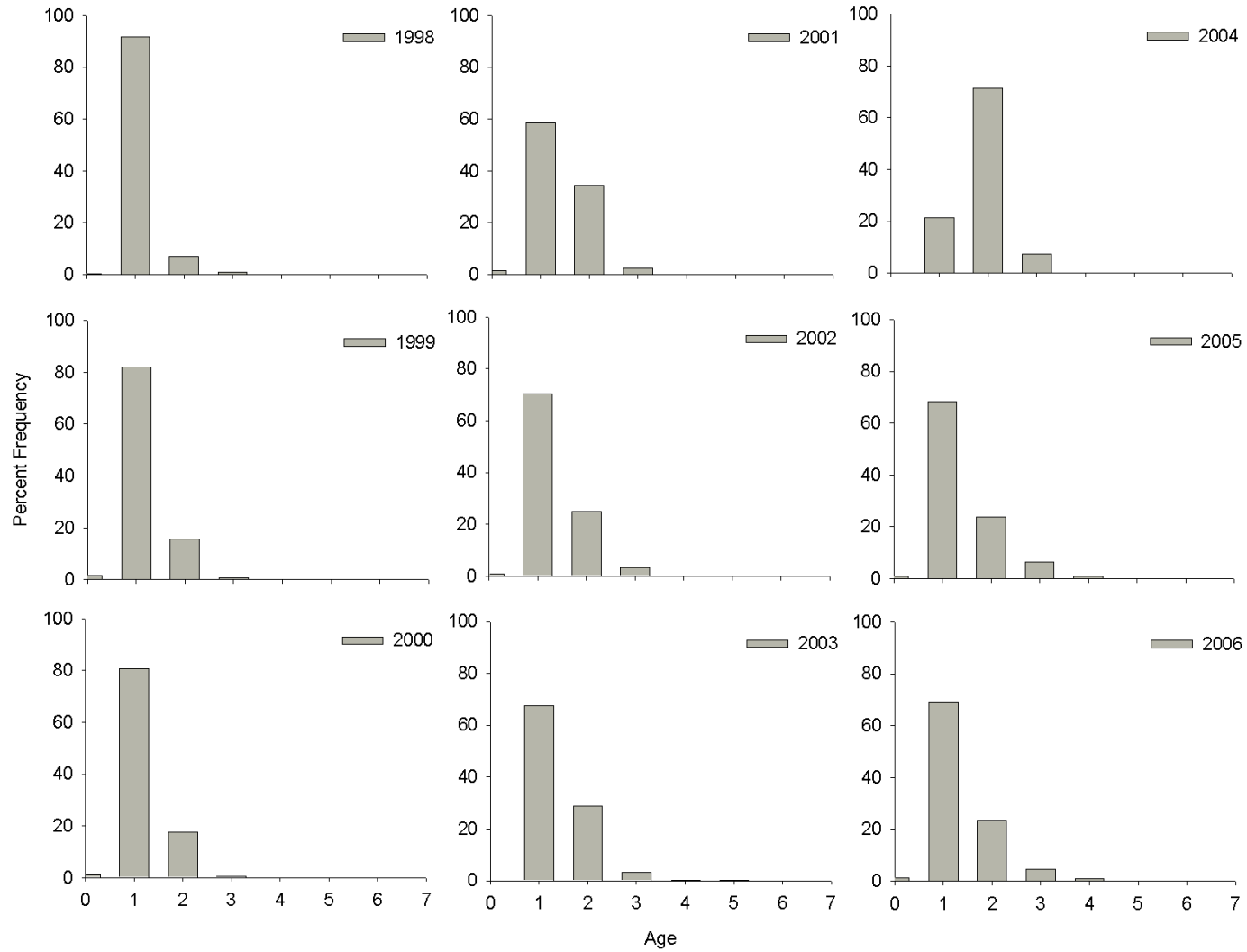


Figure 14. Age distribution of spot landed and sold in the North Carolina ocean gillnet fishery, 1998-2006.



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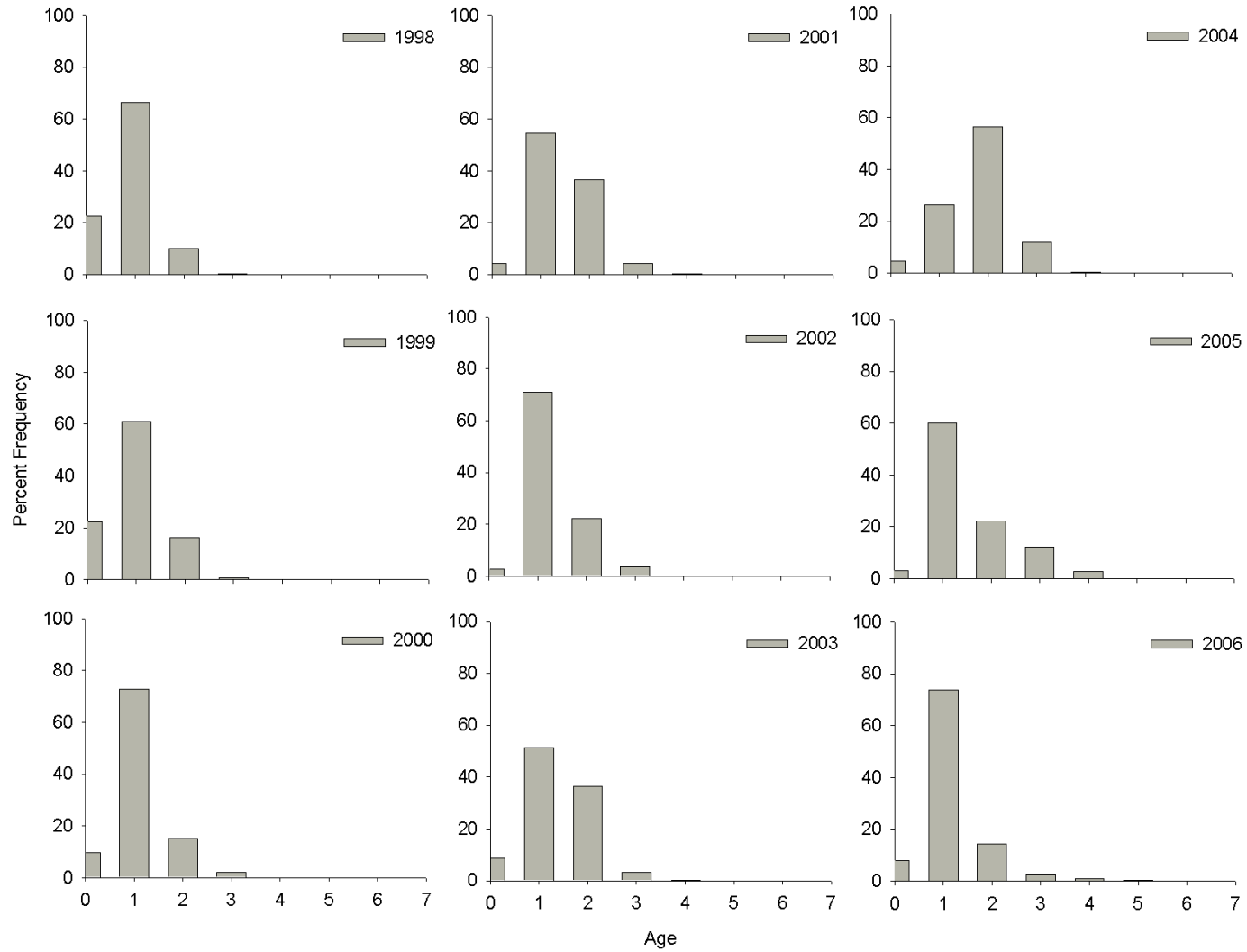


Figure 15. Age distribution of spot landed and sold in the North Carolina long haul fishery, 1998-2006.