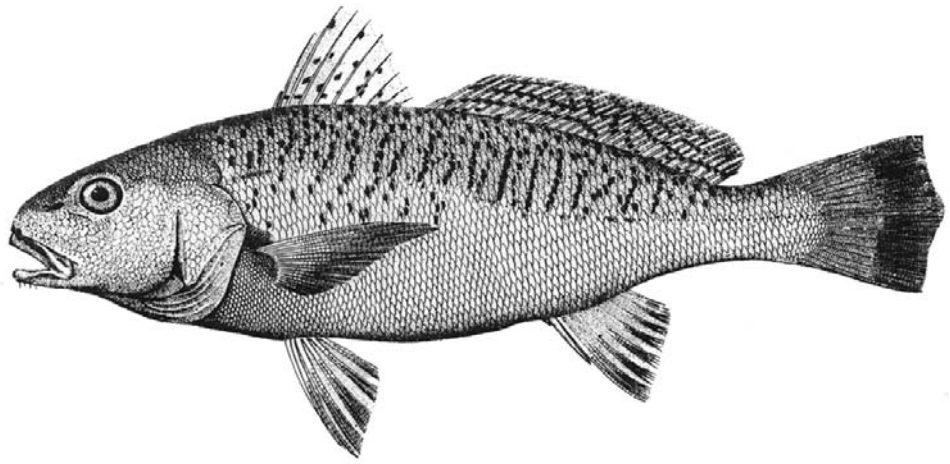
REVIEW OF THE INTERSTATE FISHERY MANAGEMENT PLAN FOR ATLANTIC CROAKER
(Micropogonias undulatus)

2002 FISHING YEAR



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I. Status of the Fishery Management Plan

The *Fishery Management Plan (FMP) for Atlantic Croaker* was adopted in 1987 and includes the states from Maryland through Florida. In reviewing the early plans created under the Interstate Fisheries Management Plan process, the Atlantic croaker plan was seen by the Atlantic States Marine Fisheries Commission (ASMFC) as in need of review and possible revision. A Wallop-Breaux grant from U.S. Fish and Wildlife Service was provided to conduct a comprehensive data collection workshop for croaker and spot. The October 1993 workshop at the Virginia Institute of Marine Science was attended by university and state agency representatives from six states. Presentations on fishery-dependent and fishery-independent data, population dynamics and bycatch reduction devices were made and discussed. All state reports and a set of recommendations were included in the workshop report (ASMFC 1993).

Subsequent to the workshop and independent of it, the South Atlantic State/Federal Fisheries Management Board of ASMFC reviewed the status of several plans in order to define the compliance issues to be enforced under the Atlantic Coastal Fisheries Cooperative Management Act (ACFCMA). The Board found recommendations in the Atlantic Croaker FMP to be vague and no longer valid. The Board recommended that an amendment be prepared to the Atlantic Croaker FMP to define management measures necessary to achieve the goals of the FMP. In their final schedule for compliance under the ACFCMA, the Interstate Fisheries Management Program (ISFMP) Policy Board adopted the finding that the current Atlantic Croaker FMP does not contain any management measures that states are required to implement.

In 2003 the Atlantic croaker Stock Assessment Sub-Committee developed an updated stock assessment through the Southeast Data Assessment and Review (SEDAR) process. This assessment was peer reviewed by a SEDAR panel in the fall of 2003. This panel recommended that further work be done on this assessment and at this time it should not be used for management decisions. It is anticipated that this assessment will be peer reviewed again in 2004 and the South Atlantic Board will initiate an Amendment to the Atlantic croaker FMP at that time. A Plan Development Team will also need to be appointed by the South Atlantic Board in order to begin preparation of the amendment.

II. Status of the Stock

The area of greatest abundance on the Atlantic Coast extends from Chesapeake Bay to Florida, although significant catches are made in some years as far north as New York. The species is a major component in generalized fishery-independent trawl and seine surveys in several states. Annual recruitment is highly variable and dependent on natural environmental conditions. Mean density of croaker from the Southeast Area Monitoring and Assessment Program's (SEAMAP) spring shallow water trawl survey in the South Atlantic Bight averaged 71.6 individuals per hectare from 1989-1994. The mean density decreased to a time-series low in 1997, 18.9 individuals/ha. In recent years, the mean density fluctuated around 60 individuals per hectare (61.1 individuals/ha in 2001). The North Carolina estuarine trawl survey indices were low in the late 1980s and early 1990s, with an all time low in 1991. Several good yearclasses were sampled in the mid to late 1990s and 2000. Recruitment was not as high in 2001 and 2002, with the indices below the 15-year average. Virginia surveys indicate high juvenile abundance in the mid-70's with good year-classes in 1984 and 1985. Juvenile abundance was low in Virginia rivers during 1991 and 1993 but was high in 1996. Juvenile surveys in Maryland's portion of Chesapeake Bay indicated large year-classes during 1993-2002, with the exception of poor year-class in 1995, and an exceptionally large year-class in 1998. Juvenile surveys in Maryland's coastal bays indicated an increasing trend of Atlantic croaker abundance from the mid-1980s through 1999, with weaker year-classes in 2000 and 2001. However, the 2002 year-class appeared stronger. Pound net surveys in Maryland's Chesapeake Bay and Potomac River indicated increasing mean length during 1993-98, consistent with the notion of an expanding stock. Mean length increased to a time series (1993-2002) high during 2001. A total mortality rate of 55-60% has been calculated for Chesapeake Bay stocks. Analyses done at Virginia Institute of Marine Science (VIMS) indicate that croaker sampled in Chesapeake Bay may have a biological capacity to resist growth overfishing.

North Carolina declared croaker to be "of concern". A "concern" stock status is defined as those stocks for which an assessment is incomplete or unavailable but show increased effort and landings. Species designated "concern" may be a reasonable candidate for FMP development if the concern is well documented and justified. Increased commercial CPUE's, landings, and age structure suggest the stock is in recovery but the annual juvenile abundance index is below average and landings in inside waters show no improvement. There have been socioeconomic changes within the inside fisheries that may attribute to the declines in commercial landings from inside waters. Recreational landings have increased by weight in inside waters but the actual number of fish are below the MRFSS 10-year average which indicates people are catching bigger fish but fewer than in previous years.

The latest stock assessment was completed in 2003, however the peer review panel has recommended additional work on the assessment before the stock status can be determined. It is anticipated that the stock assessment will be updated and peer reviewed again in 2004.

III. Status of the Fishery

Atlantic coast commercial landings of croaker have varied from one million pounds in 1970 to 64 million pounds in 1945. Commercial landings increased steadily each year from a low of 3.7 million pounds in 1991 to more than 28 million pounds in 2001 (Table 1). North Carolina landings have continued to grow since 1993, with the highest landings in 2001. However, the largest increase in landings has occurred in Virginia, where only 164,000 pounds were reported in 1991, but 12.8 million pounds were landed in 1997 and Virginia's commercial landings have remained at 12-13 million pounds since. Coastwide landings of Atlantic croaker have remained steady at 25 to 28 million pounds from 1997 to 2002. Croaker remain a major component of the seine, trawl, gill net and pound net fisheries in Virginia, North Carolina and Maryland.

Atlantic croaker is the major component of the North Carolina "scrap fishery". A number of regulations instituted by North Carolina, such as banned flynet fishing south of Cape Hatteras, the introduction of BRDs in shrimp trawls, incidental finfish limits taken by shrimp and crab trawls in inside waters, minimum mesh size restrictions in trawls and culling panels in long hauls may have indirectly reduced catches of juvenile croaker and changed the size and age distributions of the harvest. In Georgia, trawl-caught croaker is sold as unsorted mixed fish along with spot, whiting, and small flounder, therefore, commercial landings are a tenuous measurement there. Small croaker were previously a major part of the bycatch of the south Atlantic shrimp trawl fishery, however the use of TED's and BRD's has reduced this bycatch.

Recreational landings of croaker from Massachusetts through the Atlantic coast of Florida have varied from 2.8 million to a high of 13.2 million fish during 1981-2002 (Table 2). Recreational landings remained steady at 9-10 million fish each year from 1997-2000. Landings increased to 13.2 million fish in 2001 and then decreased again to 11.5 million fish in 2002. The recent high level of overall recreational landings are reflected in major increases in the recreational fisheries in the mid-Atlantic region, particularly New Jersey, Delaware, Maryland and Virginia.

IV. Status of Assessment Advice

In 2003 the Atlantic croaker Stock Assessment Subcommittee conducted a stock assessment for Atlantic croaker. This assessment was reviewed by the SEDAR Peer Review Panel in October, 2003. The panel recommended additional data be added to the assessment and for the Technical Committee to evaluate the use of other types of models. It is anticipated that the Atlantic croaker Stock Assessment Subcommittee will perform this additional analysis and the assessment will be reviewed again in 2004.

V. Status of Research and Monitoring

Catch and effort data are collected by state commercial and recreational statistics programs. More complete and timely data should be available as the Atlantic Coastal Cooperative Statistics Program is further developed and implemented. Fishery-independent data, from Cape Hatteras to Cape Canaveral, are collected in the SEAMAP program. Recruitment indices are available from ongoing juvenile surveys in Delaware, Maryland, Virginia, North Carolina, Florida and through the SEAMAP program. Researchers at VIMS have conducted studies on temperature tolerance, developed a juvenile recruitment model based on the effect of winter water temperature and offshore wind velocities, and developed population dynamics parameters to evaluate growth overfishing potential. The Virginia Marine Resources Commission and state of North Carolina have evaluated the use of culling panels in pound nets for the release of small spot and croaker. North Carolina also conducted a study to evaluate the use of culling panels in long hauls and swipe nets (Gearhart 2000). The study proved that shifts occurred in the length frequency distribution of many species including croaker, which resulted in rule changes to begin the use of culling panels in some areas of North Carolina since 1999. A flynet characterization study was concluded in April 2003 in North Carolina. A total of 3 trips out of a permitted 18 trips were completed during the study period (January 15 – April 1, 2003. The purpose of the experiment was to test flynet gear in the closed area using the tailbag mesh size (3 ¾" diamond mesh) required by the ASMFC Weakfish Plan to assess the size and species composition of the catches. The results were to be used by the ASMFC and NMFS to determine whether it would be reasonable to consider partial or seasonal reopening of the area south of Cape Hatteras to harvest legal-sized weakfish without an excessive amount of discards. Because only a limited number of tows in the 2002-03 season were conducted, meaningful tow data could not be obtained in the first year of testing. NCDMF is currently in the process of re-applying for another permit for the next two consecutive fishing seasons (2003-04 and 2004-05) to continue this study.

The Potomac River Fisheries Commission has implemented the use of culling panels for pound nets on a voluntary basis, which allows escapement of smaller fish (100% <9"). Gear research for bycatch reduction in shrimp trawls may continue in the future under interstate and federal sponsorship. A number of studies from the University of Delaware were published which investigated the link between recruitment and low temperatures, genetic stock identification, and geographic variation in life history traits/population dynamics. A scale-otolith comparison study for aging croaker was recently completed by NCDMF (NCDMC 2001). NCDMF also initiated a fishery-independent gill net study in Pamlico Sound in 2001 to examine species abundance and gather age/length data (NCDMF 2002 and 2003).

VI. Status of Management Measures and Issues

The FMP for Atlantic croaker identifies the following management measures for implementation:

1. Promote the development and use of bycatch reduction devices through demonstration and application in trawl fisheries.

2. Promote increases in yield per recruit through delaying entry to croaker fisheries to age one and older.

Although the ISFMP Policy Board judged that the FMP management recommendations were too vague and did not furnish objective compliance criteria, progress has been made on developing bycatch reduction devices (BRD's). The October 1993 spot and croaker workshop proceedings summarized experimental bycatch reduction work and examined the population implications of bycatch reduction (ASMFC 1993). It was clear that there were economically viable shrimp gears that reduce finfish bycatch. North Carolina has implemented minimum mesh size restrictions in shrimp trawls (1 ½" tailbag) since 1991, flynets (4" main body, 3" extension, and 1 3/4" tail bag) in 1997, and the closure of ocean waters south of Cape Hatteras to the South Carolina state line for flynets in 1994, all of which may indirectly affect the fishing impact on croaker.

Currently no regulations directly govern fishing practices for Atlantic croaker in North Carolina. However, the regulation limiting the scrapfish catch to 5,000 pounds per vessel per day has an indirect effect since croaker comprise a large percentage by weight of the scrapfish landed by NC commercial fishing gears. BRDs were required in all North Carolina shrimp trawls in the fall of 1992 by proclamation. Flynet fishery restrictions such as a minimum mesh size (3" square or 3.5" diamond) in 1992 and the closure of ocean waters south of Cape Hatteras to flynets in 1994, also affected the fishing impact on croaker. A reduction in the average catch of the scrapfish species occurred in the 1996 haul seine fishery when several crews began to consistently use escape panels in their nets. Rule changes including culling panels in some areas for long haul seines of North Carolina have been in effect since 1999. Reducing the quantity of sub-adult croaker harvested should increase spawning stock biomass and yield per recruit. The Potomac River Fisheries Commission requires large mesh bycatch reduction panels in all pound nets. It is estimated that the panels allow the release of 100% of captured croaker below the minimum legal size of nine (9) inches.

The states of Florida through North Carolina have promoted and require the use of TED's (turtle excluder devices) and BRD's in state waters. North Carolina has implemented minimum mesh size restrictions in shrimp trawls (1 ½" tail bag) since 1991 and flynets (4" main body, 3" extension, and 1 ¾" tail bag) in 1997. Florida has a maximum shrimp trawl size. Evaluation of the beneficial effects of BRD's to the croaker population, which is a component of a mixed species fishery, may be available from work conducted on weakfish during preparation of Amendment 3 to that FMP and should be compiled. A target reduction in bycatch of croaker may be a suitable objective criteria in an amended plan. Size limits that are in place in the states have been there for several years and do not represent a response to the FMP. In order to minimize recreational discard mortality, a new amendment may evaluate the concept of encouraging the use of circle hooks, which minimize such mortality.

VII. Implementation of FMP Compliance Requirements as of October 1, 2003

There are no regulatory compliance requirements in the 1987 Atlantic Croaker FMP.

VIII. Recommendations of FMP Review Team

Management and Regulatory Recommendations

Management recommendations in the 1987 Croaker FMP should be adopted and implemented by appropriate regulations or legislation. They are as follows:

- Promote the development and use of Turtle Excluder Devices(TED's) and Bycatch Reduction Devices (BRD's) through demonstration in the southern shrimp fishery, and fish separators in the finfish trawl fishery; and
- Promote increases in yield per recruit through delaying entry to croaker fisheries to age one or older.

Amendments

- Develop an amended Atlantic Croaker FMP with objective compliance criteria.

Research and Monitoring Recommendations

<u>High Priority</u>

- Determine migratory patterns and mixing rates through cooperative, multi-jurisdictional tagging studies, including tagging information from Cape Fear south. Examine otolith microchemistry data available and continue research in this area.
- Conduct an aging workshop to develop criteria for aging croaker otoliths, comparison study of scales vs. otoliths.
- Studies of croaker growth rates and age structure need to be conducted throughout the species range.
- Age-size data that are representative of all gear types in the fisheries should be developed on an annual basis.
- Fishery-independent size, age and sex specific relative abundance estimates should be developed to monitor long term changes in croaker abundance.
- Improve catch and effort statistics from the commercial and recreational fisheries.
- Examine reproductive biology of croaker with emphasis on developing maturity schedules and estimates of fecundity across the management unit (partially met: Barbieri et al. 1994).
- Evaluate bycatch and discard estimates from the commercial and recreational fisheries (i.e. shrimp fishery). Characterization of the scrap fishery.
- Produce a general fishery independent index using state survey information. Develop a coast wide and or regional CPUE index.
- Examine socio-economic aspects of the fishery.

<u>Medium Priority</u>

- Conduct stock identification research on croaker (partially met: Lankford et al. 1999).
- Evaluate hook and release mortality under varying environmental factors and fishery practices and include in updated assessment.
- The effects of mandated bycatch reduction devices (BRD's) on croaker catch should be evaluated and compiled.

- In trawl fisheries or other fisheries that historically take significant numbers of croaker, states should monitor and report on the extent of unutilized bycatch and fishing mortality on fish less than age-1.
- The optimum utilization (economic and biological) of a long term fluctuating population such as croaker should be evaluated.
- Continue monitoring of juvenile croaker populations through fishery-independent surveys.
- Identify essential habitat requirements.

Low Priority
- Determine species interactions and predator/prey relationships for croaker (prey) and other more highly valued fisheries (predators).
- Determine the impacts of any dredging activity (i.e. for beach re-nourishment) on all life history stages of croaker.

Identified Management Issues
- Develop appropriate management goals, objectives and biological reference points.

Research needs identified as being met
- Cooperative coastwide croaker juvenile indices should be developed and validated to clarify stock status. (Lee et al. 2001)
- Cooperatively develop a yield per recruit analysis to establish a minimum size that maximizes YPR (Barbieri et al. 1997, Lee et al. 2001)

List of References

Atlantic States Marine Fisheries Commission (ASMFC). 1993. Proceedings of a Workshop on Spot (*Leiostomus xanthurus*) and Atlantic Croaker (*Micropogonias undulatus*), L.Kline and H. Speir, eds. ASMFC, Washington, DC. 160 pp.

Barbieri, L.R., M.E. Chittenden, Jr. and S.K. Lowerre-Barbieri. 1994. Maturity, spawning, and ovarian cycle of Atlantic croaker, *Micropogonias undulatus*, in the Chesapeake Bay and adjacent coastal waters. Fish. Bull. 92: 671-685.

Barbieri, L.R., M.E. Chittenden, Jr. and C.M. Jones. 1997. Yield-per-recruit analysis and management strategies for Atlantic croaker, *Micropogonias undulatus*, in the Middle Atlantic Bight. Fish. Bull. 95: 637-645.

Gearhart, Jeff. 2000. Study II. Documentation and reduction of bycatch in North Carolina Fisheries. Job 1-Long Haul Seine Escape Panel Evaluation. Interstate Fisheries Management Program Implementation for North Carolina. Completion Report for Cooperative Agreement No. NA 57FG0171 /1-3. Department of Environment and Natural Resources. Division of Marine Fisheries. 29.pp.

Lankford, T.E., Jr., T.E. Targett and P.M Gaffney. 1999. Mitochondrial DNA analysis of population structure in the Atlantic croaker, *Micropogonias undulatus* (Perciformes: Sciaenidae). Fish. Bull. 97: 884-890.

Lee, Laura M., J.E. Hightower and P.S. Rand. 2001. Population dynamics of Atlantic croaker occurring along the U.S. east coast, 1981-1998.

North Carolina Division of Marine Fisheries (NCDMF).2003. Pamlico Sound Independent Gill Net Survey. Annual Progress Report Grant F-70. March 1, 2002 - June 30, 2003. Segment 2. North Carolina Department of Environment and Natural Resources. Division of Marine Fisheries. 34 pp.

NCDMF. 2002. Pamlico Sound Independent Gill Net Survey. Annual Progress Report Grant F-70. March 1, 2001 - June 30, 2002. Segment 1. North Carolina Department of Environment and Natural Resources. Division of Marine Fisheries. 32 pp.

NCDMF. 2001. Survey of population parameters of marine recreational fishes in North Carolina. Annual Progress Report Grant F-42. January – December 2000. Segment 10. North Carolina Department of Environment and Natural Resources. Division of Marine Fisheries. 46 pp.

Table 1. Commercial landings (in pounds) of Atlantic croaker by state, 1960-2002 (source: pers. comm. NMFS Fish. Stats. & Econ. Div.).

Year	NH	MA	RI	NY	NJ	DE	MD	VA	NC	SC	GA	FLEC	Total
1950					37,900	6,100	2,517,900	6,673,900	2,095,800	29,100	1,000	60,400	11,422,100
1951					50,000	4,900	1,850,600	4,223,400	2,102,100	22,000		121,300	8,374,300
1952					82,700	8,300	850,300	3,641,200	1,346,300	23,000		151,200	6,103,000
1953					156,700	43,300	462,400	4,060,100	1,433,900	6,900		94,000	6,257,300
1954					369,200	60,100	912,900	5,124,500	1,015,500	5,100		124,700	7,612,000
1955					741,300	667,200	1,704,600	9,752,100	992,600	32,200		201,600	14,091,600
1956					76,800	27,200	1,748,700	9,667,900	4,828,800	73,500		138,400	16,561,300
1957					103,500	166,900	1,400,000	14,197,600	2,915,900	1,700		131,200	18,916,800
1958					400	3,200	658,500	11,856,000	6,920,600	9,700	100	157,600	19,606,100
1959					1,800	8,700	838,300	7,655,400	3,056,600	9,000		85,500	11,655,300
1960					8,100	200	586,000	3,932,700	2,092,800	20,500	300	140,700	6,781,300
1961					56,900		48,900	3,082,300	1,753,500	13,300		142,700	5,097,600
1962					4,300		11,100	1,293,700	1,662,800	33,300	600	161,300	3,167,100
1963							1,500	122,400	2,275,700	36,200	700	113,700	2,550,200
1964							2,400	394,200	1,866,900	10,400	400	101,200	2,375,500
1965							400	1,531,700	1,753,400	3,400	2,100	106,800	3,397,800
1966							800	1,463,200	1,267,000	1,300	5,100	330,700	3,068,100
1967							1,200	323,500	1,282,800		6,000	143,800	1,757,300
1968							100	6,200	1,200,800			70,000	1,277,100
1969							400	63,200	1,368,700	200	1,800	49,900	1,484,200
1970					200		100	127,900	806,800	2,700	9,400	66,900	1,014,000
1971					100		200	264,900	948,200	1,500	500	89,800	1,305,200
1972	17,700				400		500	484,100	4,108,600	400	2,400	101,100	4,715,200
1973				100	37,100		37,300	1,358,300	4,324,100	3,100	14,900	102,900	5,877,800
1974					45,100		120,300	1,501,700	6,081,700	39,900	8,500	65,100	7,862,300
1975					885,100	1,300	639,700	4,721,300	10,251,700	3,500	4,000	61,500	16,568,100
1976		100			700,600	2,600	1,069,100	5,897,600	15,038,000	1,300	13,600	78,400	22,801,300
1977			400		1,478,600	8,900	692,300	8,600,600	18,994,800	600	7,000	49,500	29,832,700
1978			100		654,900	7,300	597,000	8,099,100	19,945,471	730	563	39,470	29,344,634
1979			2,600	6,200	91,000	3,700	97,400	2,136,600	20,558,193	7,082	19,137	38,646	22,960,558
1980				900	12,000		7,100	711,600	21,146,798	5,438	4,721	50,911	21,939,468
1981				200	23,500		2,100	429,800	11,205,342	2,441	1,038	72,112	11,736,533
1982					100		7,000	119,300	10,824,953	386	2,177	95,357	11,049,273
1983		200			200		500	150,400	7,249,680	3,200	1,097	81,737	7,487,014
1984			100	3,000	57,700		27,100	817,700	9,170,160	3,793		131,375	10,210,928
1985		400			48,800	100	9,500	2,171,821	8,695,544	1,256		115,641	11,043,062
1986					106,000	500	137,500	2,367,000	9,424,828	924		177,414	12,214,166
1987					357,600	800	119,300	2,719,500	7,289,191	698	553	217,932	10,705,574
1988					30,100	200	98,700	1,749,200	8,434,415	2,614	304	140,011	10,455,775
1989					137,100		89,500	947,300	6,824,088	1,950		94,909	8,096,472
1990			20		644		3,584	198,195	5,769,512	1,190	32	104,402	6,077,579
1991			10		31,292	700	6,183	164,126	3,436,960			56,761	3,696,032
1992					51,600	800	10,685	1,339,388	2,796,612		210	73,369	4,272,664
1993					183,414	2,500	158,062	5,264,974	3,267,652			51,465	8,928,067
1994					117,256	3,000	218,744	5,773,430	4,615,793			96,018	10,824,241
1995					334,654	13,000	549,716	6,991,044	6,021,332			22,879	13,932,625
1996				1	621,889		810,435	9,442,959	9,961,862			26,045	20,863,191
1997				1,309	1,994,446	10,509	1,455,707	12,790,922	10,711,704			36,572	27,001,169
1998				31	1,029,332	10,368	1,375,646	12,006,988	10,865,928			26,418	25,314,711
1999			4	2	2,071,046	14,729	1,584,412	12,849,954	10,185,535			26,441	26,732,123
2000			40	285	2,130,465	11,121	1,501,655	12,889,406	10,122,634			34,441	26,690,047
2001				315	1,389,837	22,736	2,233,160	12,929,191	12,017,459			14,857	28,607,555
2002			67	224	1,828,615	10,732	1,513,025	12,447,795	10,030,747			17,205	25,848,410
Total	17,700	700	3,341	12,567	18,140,290	1,121,695	28,770,214	239,529,293	344,358,793	415,502	108,232	5,084,288	637,564,471

Table 2. Atlantic croaker recreational landings (numbers of A + B1 fish) by state, 1981-2002 (source: pers. comm. NMFS Fish. Stats. & Econ. Div.).

Year	MA	NJ	DE	MD	VA	NC	SC	GA	FLEC	Total
1981		1,054	3,003	0	964,013	1,043,240	165,742	35,591	598,896	2,811,539
1982				10,452	273,039	596,493	193,554	169,749	1,682,619	2,925,906
1983				108,355	2,154,133	1,620,909	60,811	75,173	1,148,227	5,167,608
1984				211,035	2,047,720	2,147,871	588,114	202,364	2,781,742	7,978,846
1985				21,276	2,284,334	723,933	260,265	144,341	1,306,955	4,741,104
1986			4,694	123,578	6,384,966	356,742	599,442	69,887	5,118,552	12,657,861
1987		0	0	208,488	3,234,224	904,030	166,978	44,783	2,580,727	7,139,230
1988			1,186	1,005,452	4,048,690	2,256,128	144,057	64,093	685,778	8,205,384
1989			478	22,871	2,203,504	2,131,763	217,023	72,598	359,417	5,007,654
1990			281	100,673	2,374,679	1,063,452	346,631	585,380	304,064	4,775,160
1991		16,235	37,500	288,471	4,298,542	434,067	100,816	184,435	1,030,115	6,390,181
1992		0	9,854	117,427	4,524,040	723,823	74,051	440,185	754,595	6,643,975
1993		2,552	19,352	805,560	4,990,098	755,998	32,700	89,734	304,067	7,000,061
1994		1,567	5,718	1,633,581	6,494,691	1,179,735	188,520	102,974	599,032	10,205,818
1995		15,184	136,865	827,183	5,029,708	850,606	75,422	100,826	438,076	7,473,870
1996		35,037	235,389	775,115	4,997,021	662,240	37,464	61,957	116,575	6,920,798
1997		342,089	385,586	1,053,232	8,066,926	661,116	118,428	64,050	235,430	10,926,857
1998	1,477	143,404	391,231	1,126,058	6,730,181	387,427	170,528	64,953	234,360	9,249,619
1999		357,261	662,724	1,209,572	5,881,671	442,185	54,761	104,438	403,982	9,116,594
2000		1,023,442	517,886	2,674,880	5,486,159	391,056	32,332	128,922	455,870	10,710,547
2001		1,177,813	312,005	1,319,928	9,335,313	635,552	19,802	21,503	426,264	13,248,180
2002		253,472	261,634	1,223,385	9,129,060	408,944	66,409	36,497	177,751	11,557,152
Total	1,477	3,369,110	2,985,386	14,866,572	100,932,712	20,377,310	3,713,850	2,864,433	21,743,094	170,853,944

Table 3. Atlantic croaker recreational landings (pounds of A + B1 fish) by state, 1981-2002 (source: pers. comm. NMFS Fish. Stats. & Econ. Div.).

Year	MA	NJ	DE	MD	VA	NC	SC	GA	FLEC	Total
1981		582	2,317	0	535,297	426,240	67,284	9,665	305,547	1,346,932
1982				70,276	455,250	264,607	67,015	45,161	754,956	1,657,265
1983				32,053	486,006	395,402	14,158	25,412	510,599	1,463,630
1984				86,462	634,870	584,660	161,661	80,684	1,856,599	3,404,936
1985				17,169	843,414	278,214	72,780	40,421	684,449	1,936,447
1986			2,595	116,542	2,034,337	126,888	173,028	21,504	2,783,651	5,258,545
1987		0	0	191,628	1,306,814	352,346	64,696	14,947	1,005,053	2,935,484
1988			827	926,399	2,390,573	935,460	54,313	20,313	316,900	4,644,785
1989			284	19,189	1,329,680	658,567	80,580	21,138	268,335	2,377,773
1990			112	37,873	875,427	347,183	123,795	205,352	127,525	1,717,267
1991		4,264	10,972	117,210	1,728,021	157,660	16,173	54,116	460,453	2,548,869
1992		0	3,291	53,556	1,768,962	233,533	28,512	132,596	407,672	2,628,122
1993		844	9,641	476,866	1,993,915	282,910	18,005	55,604	180,517	3,018,302
1994		818	2,892	991,166	3,024,118	351,230	128,306	34,048	337,474	4,870,052
1995		9,515	82,864	567,149	2,675,381	326,135	25,386	20,862	301,918	4,009,210
1996		39,099	205,526	702,037	2,716,759	346,501	14,480	21,797	50,038	4,096,237
1997		278,758	340,198	1,117,999	5,522,195	309,457	53,863	26,272	113,096	7,761,838
1998	1,790	135,733	293,560	1,150,459	5,920,436	161,117	76,821	30,966	141,756	7,912,638
1999		301,957	522,201	1,024,398	4,969,283	212,991	26,356	32,375	231,692	7,321,253
2000		1,125,730	483,963	2,672,996	4,888,910	201,306	13,457	62,390	242,912	9,691,664
2001		1,132,214	304,127	1,278,699	7,674,759	355,009	10,750	7,844	320,487	11,083,889
2002		268,423	250,899	1,162,278	7,075,130	242,184	29,343	10,622	117,880	9,156,759
Total	1,790	3,297,937	2,516,269	12,812,404	60,849,537	7,549,600	1,320,762	974,089	11,519,509	100,841,897

Table 4. Summary of current state and federal regulations for Atlantic croaker.

State/Agency	Recreational	Commercial	Other
New York	none	none	
New Jersey	none	none	trawling prohibited from 0-2 miles from shore
Delaware	8"	none	
Maryland	9"; 25 fish limit	9"	trawling restricted in Ches. Bay; closed 1/1-3/15
PRFC	25 per person/day		
Virginia	none	none	trawling prohibited in state waters
North Carolina	none	none	Flynets excluded south of C. Hatteras and mesh size restrictions; culling panels required in long haul seines/pound nets; TEDs required in flounder trawls in most state waters; TED/BRD requirements and min. mesh restrictions in shrimp trawls
South Carolina	none	none	gear-related restrictions; TED/BRD requirements; license to land/sell
Georgia	8"; 25 fish limit	8"; 25 fish limit	BRD requirement; no trawling in sounds
Florida	none	none	net ban in state waters
Federal (EEZ waters)			

Table 5. Numbers of recreational releases (B2 fish) of Atlantic croaker by state, 1981-2002 (source: pers. comm. NMFS, Fish. Stats. and Econ. Div.).

Year	MA	RI	NY	NJ	DE	MD	VA	NC	SC	GA	FLEC	Total
1981		246	4,369	0	0	16,233	324,238	704,259	128,192	13,481	85,740	1,276,758
1982						0	77,756	641,327	107,340	111,630	188,277	1,126,330
1983						1,507,184	1,410,151	424,562	119,036	70,499	379,021	3,910,453
1984						70,192	673,080	1,701,418	746,905	37,573	236,432	3,465,600
1985						13,132	1,616,052	1,596,901	238,678	66,649	1,146,582	4,677,994
1986					1,757	43,399	2,578,268	137,841	84,335	40,623	318,511	3,204,734
1987				1,374	861	32,074	2,056,580	560,853	108,366	76,908	1,770,697	4,607,713
1988					582	273,231	832,284	984,219	112,271	20,021	200,630	2,423,238
1989					1,307	41,822	1,342,169	891,926	58,642	17,632	72,822	2,426,320
1990					1,268	88,688	3,922,564	1,351,152	111,085	317,497	168,144	5,960,398
1991				91,633	75,319	3,352,190	7,418,045	669,385	25,168	140,402	647,824	12,419,966
1992				4,103	43,583	856,292	4,167,137	954,494	26,729	178,267	251,343	6,481,948
1993				5,799	13,194	2,504,362	5,795,479	1,499,217	16,949	83,203	138,875	10,057,078
1994				17,253	14,069	1,628,824	7,676,780	3,110,528	141,513	99,026	331,736	13,019,729
1995				31,019	41,574	496,046	5,494,289	1,172,716	108,345	89,609	141,732	7,575,330
1996				17,585	76,851	403,776	5,151,206	1,218,799	64,494	60,282	126,300	7,119,293
1997				111,468	384,233	1,497,670	7,275,160	1,443,568	138,107	25,630	116,276	10,992,112
1998	10,422			221,324	839,932	3,021,780	4,990,541	1,060,928	266,068	159,928	152,744	10,723,667
1999				860,325	1,017,499	2,483,800	5,668,925	1,368,478	116,826	57,567	967,894	12,541,314
2000				688,746	694,813	4,967,856	7,811,048	1,569,385	96,402	169,903	428,131	16,426,284
2001				853,621	285,123	1,585,806	7,086,706	1,256,807	115,284	192,362	282,461	11,658,170
2002				369,003	361,355	2,523,276	7,107,656	925,806	92,498	194,474	217,054	11,791,122
Total	10,422	246	4,369	3,273,253	3,853,320	27,407,633	90,476,114	25,244,569	3,023,233	2,223,166	8,369,226	163,885,551