2000 REVIEW OF THE FISHERY MANAGEMENT PLAN FOR ATLANTIC CROAKER
(Micropogonias undulatus)

Prepared by:

The Atlantic Croaker Plan Review Team

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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 which would lay the groundwork for a major amendment to the 1987 FMP. 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.

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 The Board found recommendations in the croaker plan to be vague and no longer valid. The Board recommended that an amendment be prepared to the 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 croaker FMP does not contain any management measures that states are required to implement.

A Technical Committee was appointed in 1997 and will begin compiling data during the summer of 1998, the first step in preparing a stock assessment. The 1993 workshop proceedings will provide the basis for a plan revision along with data collected by the states and federal agencies since then. The Technical Committee met in September, 1998 to review the available data and began preparing an assessment. A stock assessment subcommittee has also been appointed and will be responsible for preparing the actual assessment. 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 39.9 individuals/ha in 1995, and then to 18.9 individuals/ha in 1997. North Carolina Estuarine Trawl Survey juvenile indices were low during the mid-80's with a 14 year low in 1991, followed by several good yearclasses in 1993, 1995 and 1997. Virginia surveys indicate high juvenile abundance in the mid-70's with good yearclasses in 1984 and 1985. Juvenile abundance was low in Virginia rivers during 1991 and 1993 but was high in 1996. Maryland surveys indicate large yearclasses in 1993, 1996 and 1997. 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 recently declared croaker to be "of concern," due to a lack of fish in the sounds and uncontrolled catches in ocean waters. "Of concern" stock status is defined as those stocks that were once considered to be declining or depressed which have shown measurable and consistent improvement.

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 have increased steadily each year from a recent low of 3.7 million pounds in 1991 to 27 million pounds in 1997 (Table 1). North Carolina landings have continued to grow after experiencing steady catches in 1991-1994; 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. Croaker remain a major component of the seine, fish trawl, and pound net fisheries in Virginia, North Carolina and Maryland. Croaker is the major component of the North Carolina "scrap fishery" and is the primary bait in the blue crab fishery. 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, 1981-98, from Massachusetts through the Atlantic coast of Florida have varied from 2.8 to a high of 12.6 million fish in 1986 (Table 2). 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.

Table 1. Commercial landings (in pounds) of Atlantic croaker by state, 1960-99 (source: NMFS commercial landings data).

Year	MA	RI	NY	NJ	DE	MD	VA	NC	SC	GA	FLEC	Total
1960				8100	200	586000	3932700	2092800	20500	300	140700	6781300
1961				56900		48900	3082300	1753500	13300		142700	5097600
1962				4300		11100	1293700	1662800	33300	600	161300	3167100
1963						1500	122400	2275700	36200	700	113700	2550200
1964						2400	394200	1866900	10400	400	101200	2375500
1965						400	1531700	1753400	3400	2100	106800	3397800
1966						800	1463200	1267000	1300	5100	330700	3068100
1967						1200	323500	1282800		6000	143800	1757300
1968						100	6200	1200800			70000	1277100
1969						400	63200	1368700	200	1800	49900	1484200
1970				200		100	127900	806800	2700	9400	66900	1014000
1971				100		200	264900	948200	1500	500	89800	1305200
1972				400		500	484100	4108600	400	2400	101100	4697500
1973			100	37100		37300	1358300	4324100	3100	14900	102900	5877800
1974				45100		120300	1501700	6081700	39900	8500	65100	7862300
1975				885100	1300	639700	4721300	10251700	3500	4000	61500	16568100
1976	100			700600	2600	1069100	5897600	15038000	1300	13600	78400	22801300
1977		400		1478600	8900	692300	8600600	18994800	600	7000	49500	29832700
1978		100		654900	7300	597000	8099100	19945471	730	563	39470	29344634
1979		2600	6200	91000	3700	97400	2136600	20558193	7082	19137	38646	22960558
1980			900	12000		7100	711600	21144152	5107	4721	50911	21936491
1981			200	23500		2100	429800	11204580	2441	1038	72112	11735771
1982				100		7000	119300	10824762	318	2163	95357	11049000
1983	200			200		500	150400	7249496	3150		81737	7485683
1984		100	3000	57700		27100	817700	9170110	3068		131375	10210153
1985	400			48800	100	9500	2171821	8693528	1177		115641	11040967
1986				106000	500	137500	2367000	9424706	558		177414	12213678
1987				357600	800	119300	2719500	7287920	618		217932	10703670
1988				30100	200	98700	1749200	8434415	1614		140011	10454240
1989				137100		89500	947300	6823939	1950		94909	8094698
1990		20		644		3584	193844	5769512	1190	32	104402	6073228
1991		10		31292	700	6183	164126	3436960	480	59	56761	3696571
1992				51600	800	10685	1339388	2796612		210	73369	4272664
1993				183414	2500	158062	5260137	3267652			51465	8923230
1994				117256	3000	218744	5773430	4615791			96018	10824239
1995				334654	13000	549716	6991044	6021326			22879	13932619
1996			1	621889		810435	9442959	9961860			26045	20863189
1997			1309	2032365	10509	1455707	12790922	10711705			36572	27039089
1998				1029000	10000	1376000	12007000	10783000			26000	25231000

Table 2. Atlantic croaker recreational landings (numbers A + B1 fish) by state, 1981-99 (source: pers. comm. NMFS Fish. Stats. & Econ. Div.).

Year	MA	NJ	DE	MD	VA	NC	SC	GA	FLEC	Total
1981		1054	3003	0	964013	1043240	165742	35591	598896	2811539
1982				10452	273039	596493	193554	169749	1682619	2925906
1983				108355	2154133	1620909	60811	75173	1148227	5167608
1984				211035	2047720	2147871	588114	202364	2781742	7978846
1985				21276	2284334	723933	260265	144341	1306955	4741104
1986			4694	123578	6384966	356742	599442	69887	5118552	12657861
1987				208488	3234224	904030	166978	44783	2580727	7139230
1988			1186	1005452	4048690	2256128	144057	64093	685778	8205384
1989			478	22871	2203504	2131763	217023	72598	359417	5007654
1990			281	100673	2374679	1063452	346631	585380	304064	4775160
1991		16235	37500	288471	4298542	434067	100816	184435	1030115	6390181
1992			9854	117427	4524040	723823	74051	440185	754595	6643975
1993		2552	19352	805560	4990098	755998	32700	89734	304067	7000061
1994		1567	5718	1633581	6494691	1179735	188520	102974	599032	10205818
1995		15714	139324	800463	5129268	853425	75514	104418	418986	7537112
1996		33917	268320	818597	5188429	629579	36517	58169	113576	7147104
1997		342088	385586	1053232	8065644	645131	116383	63152	230350	10901566
1998	1477	143404	391231	1126058	6730181	387427	170528	64953	234360	9249619
1999		357261	662724	1209572	5881671	442185	54761	104438	403982	9116594

Table 3. Atlantic croaker recreational landings (pounds A + B1 fish) by state, 1981-99 (source: pers. comm. NMFS Fish. Stats. & Econ. Div.).

Year	MA	NJ	DE	MD	VA	NC	SC	GA	FLEC	Total
1981		582	2317	0	535297	426240	67284	9665	305547	1346932
1982				70276	455250	264607	67015	45161	754956	1657265
1983				32053	486006	395402	14158	25412	510599	1463630
1984				86462	634870	584660	161661	80684	1856599	3404936
1985				17169	843414	278214	72780	40421	684449	1939447
1986			2595	116542	2034337	126888	173028	21504	2783651	5258545
1987				191628	1306814	352346	64696	14947	1005053	2935484
1988			827	926399	2390573	935460	54313	20313	316900	4644785
1989			284	19189	1329680	658567	80580	21138	268335	2377773
1990			112	37873	875427	347183	123795	205352	127525	1717267
1991		4264	10972	117210	1728021	157660	16173	54116	460453	2548869
1992			3291	53556	1768962	233533	28512	132596	407672	2628122
1993		844	9641	476866	1993915	282910	18005	55604	180517	3018302
1994		818	2892	991166	3024118	351230	128306	34048	337474	4870052
1995		9874	84218	551432	2728523	325267	25463	21512	288514	4034803
1996		37849	232446	737348	2807267	329544	14116	20675	48391	4227636
1997		278759	340199	1117998	5520859	302583	52928	25902	110678	7749906
1998	1790	135733	293500	1150459	5920436	161117	76821	30966	141756	7912578
1999		301957	522201	1024398	4969283	212991	26356	32375	231692	7321253

IV. Status of Assessment Advice

A quantitative stock assessment of Atlantic croaker has not been conducted. The current management plan (1987) identified the lack of data needed for a stock assessment as one of the major problems facing management of this species. The current effort to compile and analyze available data should lead to a formal assessment sometime in 2000. The ISFMP Policy Board has recommended that the croaker assessment be peer reviewed as soon as an assessment is complete.

V. Status of Research and Monitoring

Catch and effort data are collected by state commercial and recreational statistics programs. 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 began to evaluate the use of culling panels in pound nets for the release of small spot and croaker. The Maryland Department of Natural Resources conducted a hook and line release mortality study. Gear research for bycatch reduction in shrimp trawls may continue in the future under interstate and federal sponsorship.

VI. Status of Management Measures and Issues

The FMP for Atlantic croaker identifies the following management measures (recommendation 1 as amended) 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 summarizes experimental bycatch reduction work and examines the population implications of bycatch reduction. It is clear that there are economically viable shrimp gears that reduce finfish bycatch. At the state level, North Carolina has been testing bycatch reduction devices in the shrimp trawl fishery and has achieved finfish reductions of 50-70% with little loss of shrimp. North Carolina requires fish excluder devices in every trawl (except try nets) in the shrimp fishery (commercial and recreational). In the North Carolina flynet fishery, where a large portion of the croaker catch occurs, there is a requirement for a minimum tail-bag mesh of 3.5-

inch diamond or 3-inch square mesh. Also, North Carolina banned flynet fishing in waters south of Cape Hatteras. This requirement should reduce the catch of small croaker.

The states of Florida through North Carolina have promoted and require the use of TED's (turtle excluder devices) and BRD's (bycatch reduction devices) in state waters. None of the states have minimum trawl mesh sizes or culling panels in directed gears. Evaluation of the beneficial effects of BRD's to croaker stocks which are 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.

Table 4. Current state and federal Atlantic croaker regulations.

State/Agency	Recreational	Commercial	Other
New Jersey		trawling prohibited from 0-2 miles from shore	
Delaware	8"	8"	
Maryland	9"; 25 fish limit	9", trawling restricted in Chesapeake Bay	
PRFC	10"; 20 fish limit	10"	
Virginia		trawling prohibited in state waters	
North Carolina		gear-related restrictions; TED/BRD requirements	
South Carolina		gear-related restrictions; TED/BRD requirements	
Georgia	8"; 25 fish limit	8"; 25 fish limit; BRD requirement; no trawling in sounds	
Florida		net ban in state waters	
Federal (EEZ waters)			

VII. Current State-by-State Implementation of FMP Compliance Requirements as of June 1, 1998

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

VIII. Recommendations of FMP Review Team

General

- Compile and analyze existing data in preparation for a quantitative stock assessment.

Regulatory Recommendations

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

- 1. Promote the development and use of trawl efficiency devices (TED's and BRD's) through demonstration in the southern shrimp fishery, and fish separators in the finfish trawl fishery; and

- 2. 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>

- Criteria should be cooperatively developed for aging croaker otoliths **(partially met: Barbieri et al. 1994a)**.

- Studies of croaker growth rates and age structure need to be conducted throughout the species range **(partially met: Barbieri et al. 1994a)**.

- Age-length keys that are representative of all gear types in the fishery should be developed **(partially met: Barbieri et al. 1994a)**.

- Fishery dependent and 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, along with size and age structure of the catch **(partially met: Barbieri et al. 1994a)**.

- Examine reproductive biology of croaker with emphasis on developing maturity schedules and estimates of fecundity **(partially met: Barbieri et al. 1994b)**.

<u>Medium Priority</u>

- Conduct stock identification research on croaker.

- Cooperative coastwide croaker juvenile indices should be developed and validated to clarify stock status.

- Evaluate hook and release mortality under varying environmental factors and fishery practices.

- 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 in major nursery areas.

- Cooperatively develop a yield per recruit analysis to establish a minimum size that maximizes YPR **(partially met: Barbieri et al. 1997)**.

- Determine the onshore vs. offshore components of the croaker fishery.

- Identify essential habitat requirements.

<u>Low Priority</u>

- Determine migratory patterns and mixing rates through cooperative, multi-jurisdictional tagging studies.

- 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.

<u>Identified Management Issues</u>

- There are none listed for this species at this time.

List of References

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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.

Table 5. Numbers of recreational releases (B2 fish) of Atlantic croaker by state, 1981-99 (source: pers. comm. NMFS, Fish. Stats. and Econ. Div.).

Year	MA	RI	NY	NJ	DE	MD	VA	NC	SC	GA	FLEC	Total
1981		246	4369	0	0	16233	324238	704259	128192	13481	85740	1276758
1982						0	77756	641327	107340	111630	188277	1126330
1983						1507184	1410151	424562	119036	70499	379021	3910453
1984						70192	673080	1701418	746905	37573	236432	3465600
1985						13132	1616052	1596901	238678	66649	1146582	4677994
1986					1757	43399	2578268	137841	84335	40623	318511	3204734
1987				1374	861	32074	2056580	560853	108366	76908	1770697	4607713
1988					582	273231	832284	984219	112271	20021	200630	2423238
1989					1307	41822	1342169	891926	58642	17632	72822	2426320
1990					1268	88688	3922564	1351152	111085	317497	168144	5960398
1991				91633	75319	3352190	7418045	669385	25168	140402	647824	12419966
1992				4103	43583	856292	4167137	954494	26729	178267	251343	6481948
1993				5799	13194	2504362	5795479	1499217	16949	83203	138875	10057078
1994				17253	14069	1628824	7676780	3110528	141513	99026	331736	13019729
1995				29976	41387	478421	5611653	1181356	106541	91474	138013	7678821
1996				17023	82132	418084	5255144	1165365	62900	57005	122338	7179991
1997				111468	384233	1497670	7274948	1407197	135691	25294	113633	10950134
1998	10422			221324	839932	3021780	4990541	1060928	266068	159928	152744	12713667
1999				860325	1017499	2483800	5668925	1368478	116826	57567	967894	12541314