B. BLUEFISH ASSESSMENT SUMMARY

State of Stock: The bluefish biological reference points (BRP) listed in Amendment 1 to the Bluefish Fishery Management Plan, implemented in 2000, are $\frac{1}{2}B_{MSY}$ = 53,751 mt (118.5 million lbs) and F_{MSY} = 0.40. The updated estimates of these reference points, from the present assessment, are $\frac{1}{2}B_{MSY}$ = 73,526 mt (162.1 million lbs) and F_{MSY} = 0.19. Based on the present assessment's ASAP model, bluefish biomass in 2004 was estimated to be 104,136 mt (229.6 million lbs) (Figure B3) and fishing mortality rate in 2004 was estimated to be F = 0.15.

Based on the Amendment 1 BRPs, the bluefish stock is considered overfished but overfishing is not occurring. Based on the new biological reference point estimates, the bluefish resource is not considered overfished and overfishing is not occurring.

Fishing mortality rates show a decreasing trend in F, an increasing trend in population biomass, and an increasing trend in population numbers. Population abundance estimates have increased since 1997 (Figure B2). Abundance peaked in 1982 at 176 million fish, declined to 57 million in the mid-1990s and has since increased to 92 million fish (Figure B2).

Forecast for 2005: No forecast was made.

Catch and Status Table (weights in '000 mt): Bluefish

Year	1998	1999	2000	2001	2002	2003	2004	Max	Min	Mean
USA Commercial landings[1]	3.7	3.3	3.7	3.9	3.1	3.4	3.8	7.5	0.8	3.7
USA Recreational landings[2]	6.6	5.4	6.2	7.5	6.6	8.0	6.9	43.6	5.4	16.7
USA Recreational discards[2]	1.2	1.7	2.2	2.3	1.9	1.8	1.7	2.3	0.6	1.4
Total Catch[2]	11.5	10.4	12.0	13.8	11.6	13.1	12.4	51.9	10.4	23.1
Total Stock Biomass[2]	70.6	72.9	80.3	87.7	88.2	92.2	104.1	229.1	64.7	109.4
F[2]	0.23	0.20	0.20	0.22	0.18	0.19	0.15	0.46	0.15	0.29

[1] Min, max and mean since 1950.

[2] Min, max and mean since 1982.

Stock Distribution and Identification: Bluefish is a highly migratory, pelagic species found along the U.S. Atlantic coast from Maine to Florida, but generally are found north of the Carolinas only in warmer months (Beaumariage 1969; Lund and Maltezos 1970). Bluefish in the western North Atlantic are managed as a single stock (NEFSC 1997; Fahay et al. 1999). Genetic data support a unit stock hypothesis (Graves et al. 1992; Goodbred and Graves 1996; Davidson 2002). For management purposes, the ASMFC and MAFMC define the management unit as the portion of the stock occurring along the Atlantic Coast from Maine to the east coast of Florida.

Catches: Bluefish are one of the most sought after species by recreational fishers along the Atlantic Coast. In 2004, recreational anglers along the Atlantic Coast harvested over 6,900 mt of bluefish (Figure B1). Recreational landings have ranged from a low of 5,379 mt in 1999 to a high of 43,607 mt in 1986 (Figure B1). Landings from the commercial fishery have been consistently lower than in the recreational fishery. Regional variations in commercial fishing activity are linked to the seasonal migration of bluefish. Commercial landings decreased from 7,500 mt in 1981 to 3,100 mt in 2002. Commercial landings have been regulated by quota since the implementation of Amendment 1 in 2000. In 2004, commercial landings were 3,800 mt

(Figure B1). Gill nets are the dominant commercial gear used to target bluefish and account for over 40% of the bluefish commercial landings from 1950 to 2003. Other commercial gears including hook and line, pound nets, seines, and trawls, which collectively account for about 50% of the commercial landings.

Data and Assessment: The Bluefish Technical Committee evaluated the quality of the commercial, recreational data, and aging information for use in an analytical model. Most of the commercial sampling since 1997 has occurred in North Carolina and Virginia, where a large proportion of the landings is taken. The committee determined that the amount of sampling by gear and market grade adequately represented the length distribution of Atlantic coast bluefish landings. Recreational landings data, length data, and discard estimates were obtained from the MRFSS survey. Age data were used from Virginia's cooperative aging program and North Carolina age data were available from 1983 to 1996. Most state agencies between Massachusetts and Florida conduct annual marine finfish surveys. These survey indices were evaluated for their appropriateness in the bluefish assessment. The approach was to evaluate the utility of each survey index based on their performance within the modeling framework.

The Bluefish Technical Committee decided that an age-based model such as a catch-at-age model or VPA model was appropriate for a bluefish assessment. The bluefish data were truncated to an age-6+ category to reduce the influence of ageing error and to reduce the bimodality of catch-at-age distributions. The NFT ADAPT version of VPA was used as an initial model. The Committee concluded that although the VPA produced satisfactory results, the assumption of no error in the catch-at-age matrix and the way ADAPT handles selectivity may produce misleading results. Therefore, a catch-at-age model, ASAP from the NFT models, was chosen as the primary assessment tool. The ASAP model allows error in the catch-at-age as well as the assumption of separability into year and age components making it better at handling the selectivity patterns and catch data from the bluefish fishery.

Biological Reference Points: The biological reference points in the FMP for Atlantic coast bluefish, $\frac{1}{2}B_{MSY}$ = 53,751 mt (118.5 million lbs) and F_{MSY} = 0.4, were based on a surplus production model that was rejected at the SAW-39 review in 2004. New biological reference points developed for the present assessment using an ASAP model are $\frac{1}{2}B_{MSY}$ = 73,526 mt (162.1 million lbs), F_{MSY} = 0.19, F_{MAX} = 0.28, $F_{0.1}$ = 0.18 and $F_{30\%}$ = 0.28.

Alternative reference point values were also calculated using an age-based Thompson-Bell yield-per-recruit model and gave estimates of F_{MAX} = 0.25, $F_{0.1}$ = 0.17 and $F_{30\%}$ = 0.26. In the Y/R model, partial recruitment values were based on the average 1982-2003 ASAP selectivity estimates. The model was extended to age-7+ with a selectivity of 1.0.

The estimated F in 2004 of 0.15 is below both the old and new estimates of F_{MSY} and below the alternative F reference points. Therefore, it is concluded that bluefish is not experiencing overfishing.

Recruitment and spawning stock biomass were estimated in the ASAP model and these values were used to fit a Beverton-Holt S/R relationship. The parameters for bluefish were alpha = 35426.6 and beta = 41159.4 with a steepness of 0.74 (Figure B4). Spawning stock biomass (SSB) at MSY was estimated equal to be 142,104 mt (313.3 million lbs). Using the SSB/R and

B/R estimates from the Thompson-Bell model, the Shepherd/Sissenwine approach estimated B_{MSY} = 147,052 mt (324.2 million lbs).

The current FMP defines overfished condition as a biomass level below ½ B_{MSY}. The biomass reference point (½ B_{MSY}) in the current FMP equals 53,751 mt (118.5 million lbs) whereas the new proposed estimate is 73,526 mt (162.1 million lbs). The current estimate of biomass, B_{2004}, is 104,136 mt (229.6 million lbs), which would be considered not overfished under the FMP definition and according to the new proposed value of ½B_{MSY}.

Fishing Mortality: Fishing mortality estimates in ASAP are based on a separability assumption involving year and age. The 2004 F_{MULT} value equals 0.15, which is the estimate of full F. F has steadily declined since 1991 when F reached 0.41 (Figure B2).

Total Stock Biomass: Biomass estimates peaked in 1982 at 229,120 mt (505.1 million lbs), declined to 64,727 mt (142.7 million lbs) in 1997, and has since increased to 104,136 mt (229.6 million lbs) in 2004.

Recruitment & Spawning Stock Biomass: Between 1982 and 2004, the number of age 0 recruits ranged from about 10,000,000 to 70,000,000 per year. During the same period, annual spawning stock biomass ranged from about 68,000 – 225,000 mt. Recruitment and spawning stock biomass, both estimated in the ASAP model, were positively related and were fit to a Beverton-Holt S/R relationship (Figure B4).

Special Comments:
1) All of the SARC-41 external reviewers expressed the view that this bluefish assessment had several significant weaknesses. For more details, see the "Introduction" of this report and see the external reviewers' reports at website: http://www.nefsc.noaa.gov/nefsc/saw/ under the heading "Recent Reports".

2) The highly migratory nature of bluefish populations and the recruitment dynamics of the species create a challenging modelling situation. Migration creates seasonal fisheries with unique selectivity patterns which a bimodal partial recruitment pattern.

3) The migratory pattern of bluefish results in several recruitment events. A spring cohort, originating south of Cape Hatteras, NC during spring migrations, and a summer cohort originating in the offshore Mid-Atlantic Bight together generate a bimodal age-0 size distribution. It has been hypothesized that the success of the spring cohort controls the abundance of adult bluefish. The variable intra-annual recruitment pattern is a source of uncertainty in the assessment.

Sources of Information:
Beaumariage, D.S. 1969. Returns from the 1965 Schlitz tagging program including a cumulative analysis of previous results. Florida Dept. of Natural Resources, Marine Research Lab Technical Series No. 59:1-38.

Davidson, W.R. 2002. Population structure of western Atlantic bluefish (*Pomatomus saltatrix*). Master's Thesis. Thesis. University of Delaware., Wilmington, DE.

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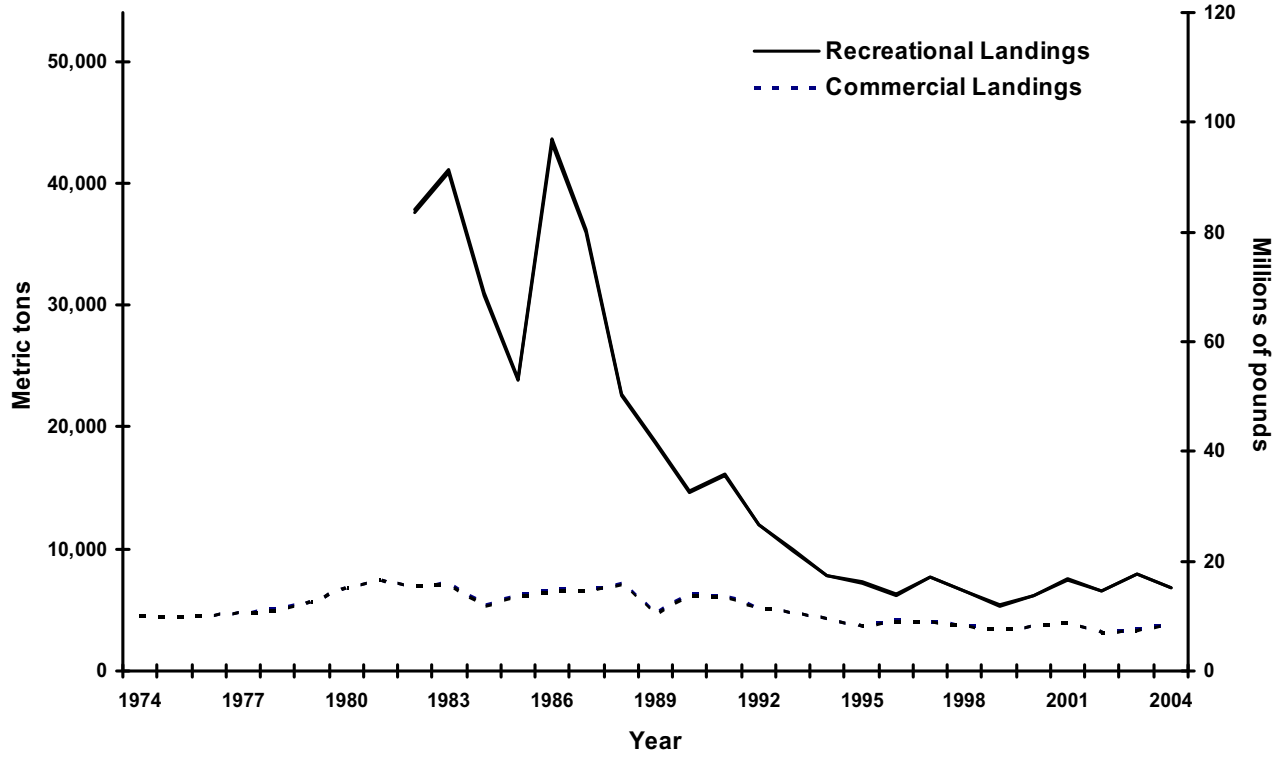
Goodbred, C.O. and J.E. Graves. 1996. Genetic relationships among geographically isolated populations of bluefish (*Pomatomus saltatrix*). Marine and Freshwater Research 47:347-355.

Graves, J.E., J.R. McDowell, A.M. Beardsley and D.R. Scoles. 1992. Stock structure of the bluefish *Pomatomus saltatrix* along the Mid-Atlantic coast. Fishery Bulletin 90:703-710.

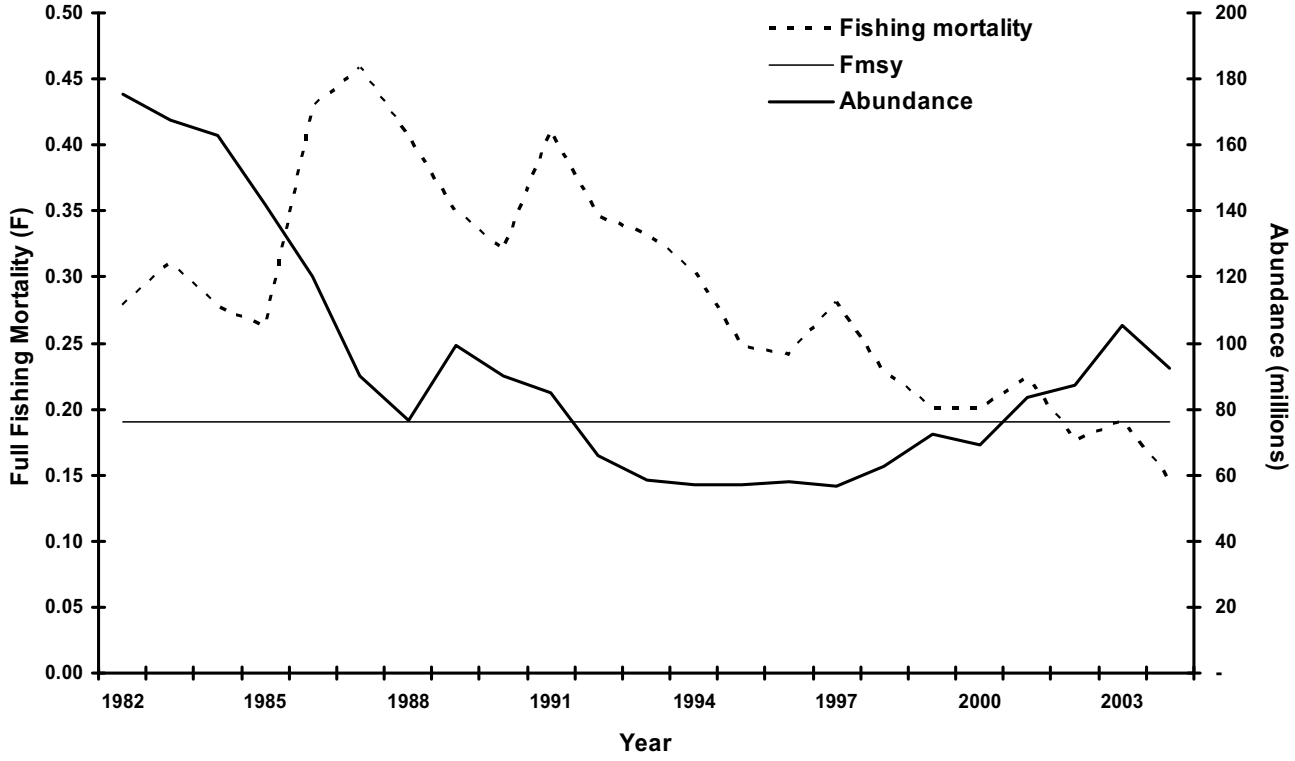
Lund, W.A. and G.C. Maltezos. 1970. Movements and migrations of the bluefish, *Pomatomus saltatrix*, tagged in waters of New York and Southern New England. Transactions of the American Fisheries Society 99:719-725.

Northeast Fisheries Science Center. 1997. Report of the 23rd Northeast Regional Stock Assessment Workshop (23rd SAW): Stock Assessment Review Committee (SARC) consensus summary of assessments. NEFSC Reference Document 97-05.

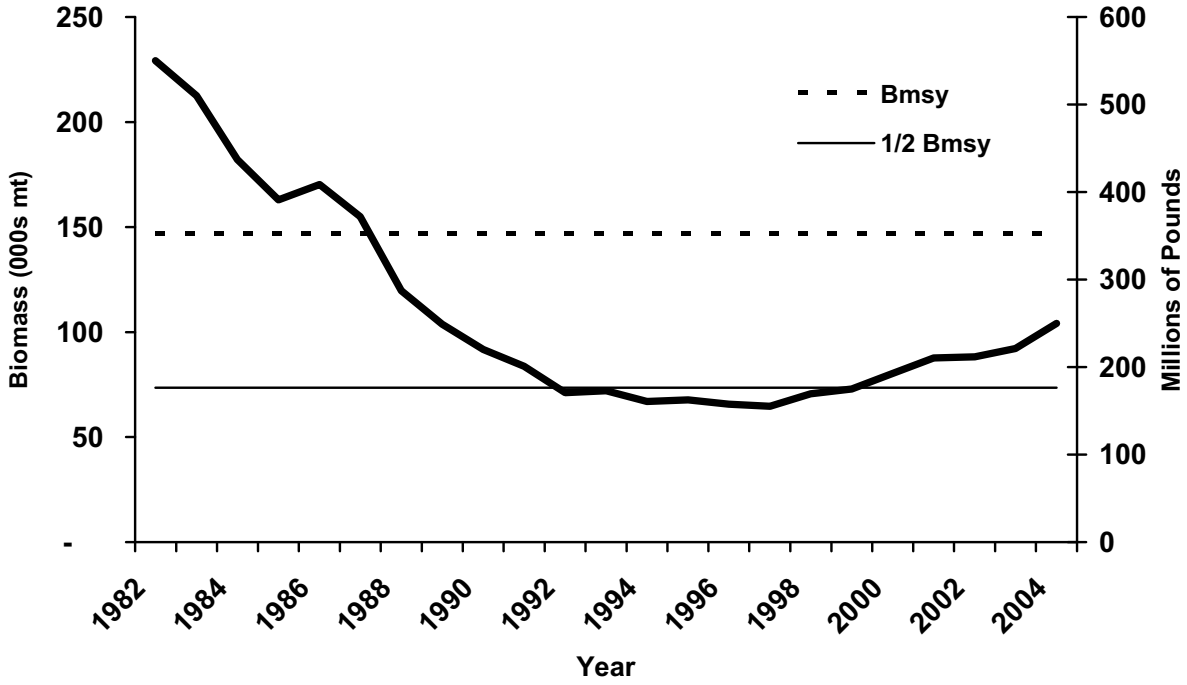
B1. Recreational and commercial landings of bluefish, Maine to Florida. Recreational series begins in 1982.



B2. Fishing mortality and total stock abundance estimates of bluefish along the Atlantic coast estimated from the ASAP model. Proposed F_{msy} reference point also from the ASAP results.



B3. Atlantic coast bluefish biomass and proposed biological reference points from ASAP model.



B4. Bluefish stock-recruitment relationship from data estimated in ASAP model.