

Seafood Watch

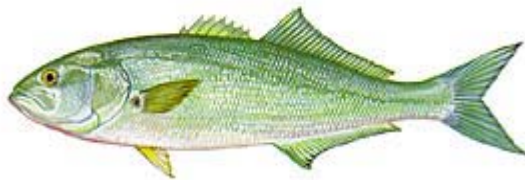
Seafood Report



MONTEREY BAY AQUARIUM®

Bluefish

Pomatomus saltatrix



(Image © Duane Raver, Jr.)

Northeast Region

Final Report

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About Seafood Watch® and the Seafood Reports

Monterey Bay Aquarium's Seafood Watch® program evaluates the ecological sustainability of wild-caught and farmed seafood commonly found in the United States marketplace. Seafood Watch® defines sustainable seafood as originating from sources, whether wild-caught or farmed, which can maintain or increase production in the long-term without jeopardizing the structure or function of affected ecosystems. Seafood Watch® makes its science-based recommendations available to the public in the form of regional pocket guides that can be downloaded from the Internet (seafoodwatch.org) or obtained from the Seafood Watch® program by emailing seafoodwatch@mbayaq.org. The program's goals are to raise awareness of important ocean conservation issues and empower seafood consumers and businesses to make choices for healthy oceans.

Each sustainability recommendation on the regional pocket guides is supported by a Seafood Report. Each report synthesizes and analyzes the most current ecological, fisheries and ecosystem science on a species, then evaluates this information against the program's conservation ethic to arrive at a recommendation of "Best Choices", "Good Alternatives" or "Avoid". The detailed evaluation methodology is available upon request. In producing the Seafood Reports, Seafood Watch® seeks out research published in academic, peer-reviewed journals whenever possible. Other sources of information include government technical publications, fishery management plans and supporting documents, and other scientific reviews of ecological sustainability. Seafood Watch® Fisheries Research Analysts also communicate regularly with ecologists, fisheries and aquaculture scientists, and members of industry and conservation organizations when evaluating fisheries and aquaculture practices. Capture fisheries and aquaculture practices are highly dynamic; as the scientific information on each species changes, Seafood Watch's sustainability recommendations and the underlying Seafood Reports will be updated to reflect these changes.

Parties interested in capture fisheries, aquaculture practices and the sustainability of ocean ecosystems are welcome to use Seafood Reports in any way they find useful. For more information about Seafood Watch® and Seafood Reports, please contact the Seafood Watch® program at Monterey Bay Aquarium by calling (831) 647-6873 or emailing seafoodwatch@mbayaq.org.

Disclaimer

Seafood Watch® strives to have all Seafood Reports reviewed for accuracy and completeness by external scientists with expertise in ecology, fisheries science and aquaculture. Scientific review, however, does not constitute an endorsement of the Seafood Watch® program or its recommendations on the part of the reviewing scientists. Seafood Watch® is solely responsible for the conclusions reached in this report.

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Executive Summary

Bluefish, *Pomatomus saltatrix*, is a migratory, pelagic species that is distributed worldwide. In the United States, bluefish are found along the entire East Coast and in the Gulf of Mexico. Bluefish is a fast growing, highly fecund fish with moderate longevity and a relatively young age at sexual maturity. These life history characteristics make bluefish inherently resilient to fishing pressure. Until the 1990s, bluefish were primarily a recreational fish species; in recent years recreational landings have declined while commercial landings have remained relatively stable. The Atlantic stock of bluefish is not overfished, and overfishing is not occurring. However, there is moderate uncertainty associated with the status of bluefish. The status of bluefish stocks in the Atlantic thus rates as a moderate conservation concern. The primary gears used to commercially harvest bluefish are sink gillnets, otter trawls, drift gillnets, and pound nets. Marine mammals are a primary bycatch concern associated with the Mid-Atlantic gillnet fishery; however, the gillnets used to target bluefish are generally small mesh gillnets, which have been shown to have the lowest marine mammal bycatch rates of all gillnet mesh sizes. Therefore, bycatch rates as a moderate conservation concern. Approximately 64% of the total bluefish catch is landed with gillnets. The habitat effects of bluefish fishing practices overall rate as a moderate conservation concern. Bluefish have been managed jointly by the Atlantic States Marine Fisheries Commission and the Mid-Atlantic Fishery Management Council under the Bluefish Fishery Management Plan since 1990. Although management measures are currently in place, management was not implemented until after significant declines in bluefish stocks, and is considered to be moderately effective for the bluefish fishery. The preceding suite of factors results in an overall recommendation of “Good Alternative” for bluefish.

This report was updated on September 19, 2005. Please see Appendix for a summary of the changes made at this time.

Table of Sustainability Ranks

Sustainability Criteria	Conservation Concern			
	Low	Moderate	High	Critical
Inherent Vulnerability	√			
Status of Stocks		√		
Nature of Bycatch		√		
Habitat Effects		√		
Management Effectiveness		√		

Overall Seafood Recommendation:

Best Choice 

Good Alternative 

Avoid 

Introduction

Bluefish are found in every ocean basin throughout the world, except for the eastern Pacific (Bigelow and Schroeder 1953). In the U.S., bluefish are found along the entire East Coast and in the Gulf of Mexico. Bluefish are a schooling, pelagic species, and seasonally migrate along the U.S. Atlantic Coast, moving into the Middle Atlantic Bight in the spring, and southward or offshore in the fall (Fahay et al. 1999). Larger bluefish are generally found further north during the summer (Wilk 1977). Juvenile bluefish are found in all of the estuaries surveyed by the Northeast Fisheries Science Center (NEFSC) from Cape Cod, Massachusetts to Cape Hatteras, North Carolina (Fahay et al. 1999), while eggs and larvae are only found in oceanic waters (Able and Fahay 1998).

North Carolina, New York, and New Jersey accounted for 73% of bluefish landings in the U.S. in 2002 (Figure 1) (NMFS 2004). The primary gears used to harvest bluefish are gillnets (sink and drift), otter trawls, and pound nets (NMFS 2004). The otter trawls used in the bluefish fishery are equipped with flynets, and differ from the otter trawls used to catch shrimp. In North Carolina in 2002, 77% of the bluefish landed were harvested with ocean sink nets, and 11% were harvested by estuarine gillnets (NCDMF in press). Sink nets are often referred to as “drop nets”, as the nets are set onto a school of fish, and are designed to be sinking gillnets that fish just above the ocean bottom (NCDMF in press).

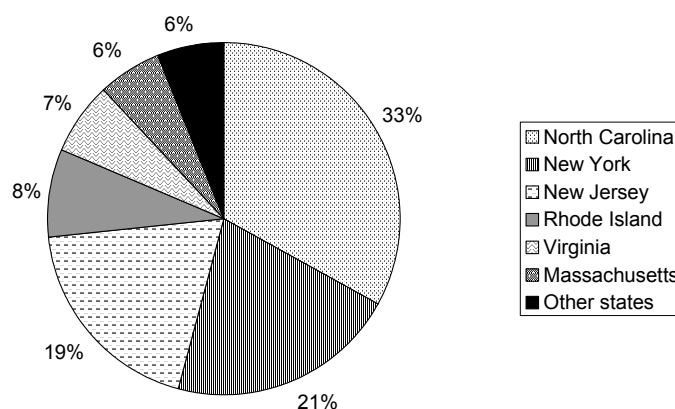


Figure 1. Bluefish landings by state, 2002 (NMFS 2004).

Until the 1990s, bluefish were primarily a recreational fish species; in recent years recreational landings have declined while commercial landings have remained relatively stable (Figure 2). In 1981, commercial landings of bluefish were 15% of the total U.S. landings, compared to 40% in 2001 (Lewis et al. 2002). From 1974 – 2002, commercial landings averaged approximately 5,000 metric tons (mt) per year (NMFS 2004), while recreational landings averaged 22,000 mt per year (Lazar and Gibson 2002). Total U.S. bluefish landings rose steeply during the 1970s, peaked in the 1980s, and began to decline in the 1990s. Bluefish are landed in state and federal waters, with an average of 63% of the commercial landings coming from state waters from 1985 – 1994 (MAFMC 1998).

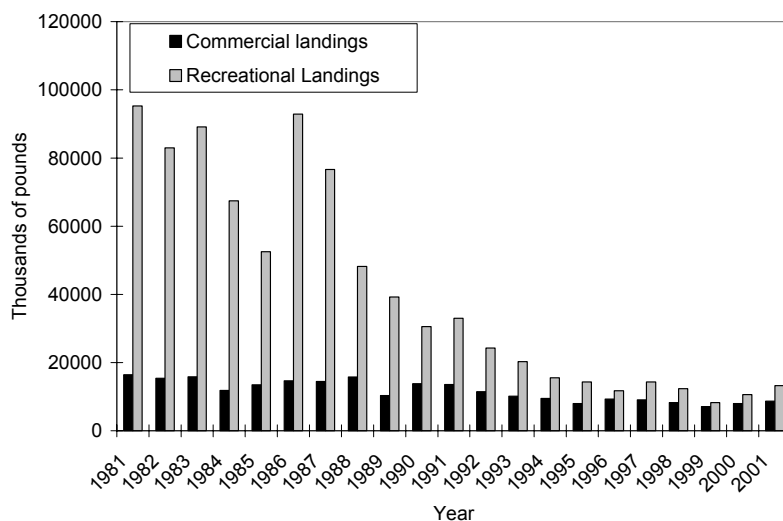


Figure 2. Commercial and recreational landings of bluefish in the U.S., 1981 – 2001 (Lewis et al. 2002).

Bluefish are managed under the Bluefish Fishery Management Plan (FMP), as a joint management effort by the Mid-Atlantic Fishery Management Council (MAFMC) and the Atlantic States Marine Fisheries Commission (ASMFC). The FMP was developed as a response to recreational fishers' concerns that foreign demand for bluefish would result in a commercial purse-seine fishery for bluefish (MAFMC 1998). The FMP was completed and approved in 1990, and included measures such as a license requirement to sell bluefish, and a possession limit for recreational fishers (MAFMC 1998). The fishery is allocated on a state-by-state quota (MAFMC 1998). According to the MAFMC (1998), additional measures for the recreational fishery should be considered, such as minimum fish size limits and seasons; potential additional measures for the commercial fishery include minimum fish size limits and mesh size restrictions. In 1998, Amendment 1 to the Bluefish FMP was approved to establish a rebuilding plan for the Atlantic stock of bluefish (MAFMC 1998).

Scope of the analysis and the ensuing recommendation:

This analysis encompasses bluefish caught in the commercial fishery on the U.S. East Coast. There is a small fishery for bluefish in the Gulf of Mexico, which is not included in this analysis, as landings from the Gulf of Mexico contributed less than 2% to total U.S. bluefish landings in 2002 (NMFS 2004). The recreational bluefish fishery is not evaluated in this recommendation.

Availability of Science

Life history data (e.g., age and growth data) are available for bluefish; however, there is limited information about the reproductive biology of bluefish. There are adequate data concerning the geographic distribution of bluefish, but little is known about the possible offshore distribution of bluefish due to sampling limitations. Stock assessments have been conducted on a somewhat regular basis since 1985. Management information such as FMPs, FMP amendments, and stock assessments are available as grey literature.

Market Availability

Common and market names:

Common names for bluefish include blue, chopper, elf, fatback, greenfish, Hatteras blue, horse mackerel, rock salmon, skipjack, slammer, snap mackerel, snapper (a small bluefish), and taylor (MAFMC 1998; MRFSS 2002).

Seasonal availability:

Bluefish are available year-round.

Product forms:

Bluefish are available fresh, frozen, salted, dried, smoked, or as a pate.

Import and export sources and statistics:

Although bluefish are harvested worldwide due to their widespread range, there are no data on the import and export of bluefish in the NMFS foreign trade database. Most international commercial landings of bluefish are from the Mediterranean and Black Seas, although their proportion to the worldwide landings declined from 1993 – 1995 (MAFMC 1998). In 1993, Turkey contributed 47% of the total world production of bluefish, while the U.S. contributed 14%; by 1995 Turkey was contributing only 25% while the U.S. contribution increased to 20% (MAFMC 1998).

Analysis of Seafood Watch® Criteria

Criterion 1: Inherent Vulnerability to Fishing Pressure

Growth & longevity

Bluefish is a fast growing species; young-of-year bluefish exhibit growth rates of 0.9-2.1 mm/day (McBride and Conover 1991), which is higher than other estuarine fish in the Mid-Atlantic Bight (0.3-1.1 mm/day) (Able and Fahay 1998). Bluefish may grow as large as 1.1 m and weigh as much as 12.3 kg (Bigelow and Schroeder 1953). Bluefish also mature quickly, reaching sexual maturity by age 2 (Wilk 1977). Chiarella and Conover (1990) found that bluefish in their sample reached an average of 26.5 cm fork length (FL) by age 1, and 43.5 cm FL by age 2. The oldest fish in their sample was an 88.0 cm, 12 year-old female (Table 1) Chiarella and Conover 1990). Since then, a 14 year-old fish has been aged by Sipe and Chittenden (2002).

Spawning

It was previously thought that there are two major spawning seasons for bluefish, one in the spring in the South Atlantic Bight (south of Cape Hatteras), and one in the summer in the Middle Atlantic Bight (between Cape Cod and Cape Hatteras) (Kendall and Walford 1979; Chiarella and Conover 1990). Recent studies suggest, however, the existence of a single, migratory spawning stock of bluefish for which spawning is a continuous event beginning in late winter in the southeastern U.S. (Hare and Cowen 1993; Smith et al. 1994). The spring-spawned cohort enters estuaries in late-May to mid-June (McBride and Conover 1991; Cowen et al. 1993), while the summer-spawned cohort either remains in coastal habitat (Able and Fahay 1998) or enters estuaries in mid to late August (McBride and Conover 1991). Both spring and summer-spawned cohorts also utilize oceanic habitats (Able et al. 2003).

The size structure of the bluefish stock is bimodal, with the spring-spawned cohort being more abundant (Chiarella and Conover 1990; McBride et al. 1993). Over a 20-year period, the summer cohort dominated in only one year (Munch and Conover 2000). It is important to consider the bimodal recruitment of the bluefish stock; if the summer-spawned fish are an important contribution to the population in some years, recruitment to the adult stock may be overestimated using the young-of-year (YOY) index (Munch and Conover 2000). Bluefish are highly fecund; one 58 cm female sampled contained 1.1 million developing eggs (Lassiter 1962).

Habitat use and feeding

Juvenile bluefish are thought to be estuarine dependent (Fahay et al. 1999), although they also utilize oceanic habitats (Able et al. 2003). Adult bluefish are pelagic and are not associated with a particular substrate (Fahay et al. 1999). Adult bluefish are found in bays, estuaries, nearshore oceanic waters, and offshore waters over the continental shelf (Bigelow and Schroeder 1953). Bluefish is a warm water species, and is usually found in water temperatures ranging from 14 – 16°C; although they can tolerate temperatures from 11.8 – 30.4°C, they are stressed at either extreme (Bigelow and Schroeder 1953). Bluefish are voracious predators, and consume more butterfish and squid than is harvested by commercial fisheries (Buckel et al. 1999). They also feed on species such as mackerel, menhaden, herring, alewives, scup, and hake (Bigelow and Schroeder 1953).

Table 1. Life history characteristics of bluefish.

Intrinsic Rate of Increase (r)	Growth Rate	Age at Maturity	Max Age	Fecundity	Species Range	Special Behaviors	Population Variability	Sources
Unknown	vBgf ¹ : L _∞ = 87.2 cm, k = 0.26	2 yrs	14 yrs	1.1 mil dev. eggs (58 cm female)	Ocean basins except the eastern Pacific	None	Not driven by physical environmental change	Bigelow and Schroeder 1953; Lassiter 1962; Salerno et al. 2001; Sipe and Chittenden 2002

Synthesis

Bluefish mature quickly, reaching sexual maturity by age 2, and are moderately long-lived, with a maximum age of 14 years. Bluefish have a broad range as they occur in every ocean basin except the eastern Pacific. There is no evidence that bluefish exhibit any special behaviors that increase ease of capture, and there is no evidence of high population variability driven by environmental change. These factors indicate that bluefish are inherently resilient to fishing pressure.

Inherent Vulnerability Rank:



Neutral 

Vulnerable 

Criterion 2: Status of Wild Stocks

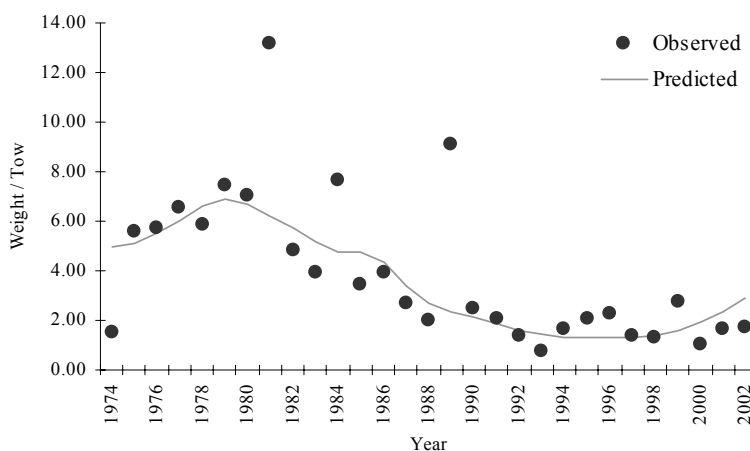
Overfishing occurs when the fishing mortality rate (F) exceeds the fishing mortality rate that produces maximum sustainable yield (F_{MSY}) (NMFS 2003a). The 2004 catch-at-age model stock assessment for bluefish estimated F_{MSY} = 0.19, with F₂₀₀₄ = 0.15, which is below the overfishing threshold (41st SAW 2005). The bluefish stock is considered overfished when the minimum biomass is less than ½ B_{MSY} (B_{MSY} is the biomass at which maximum sustainable yield is produced); the 2004 bluefish stock assessment estimated that ½ B_{MSY} = 33,351 mt while biomass at the beginning of 2004 was estimated at 47,235 mt (41st SAW 2005). The bluefish stock is therefore not considered overfished, with the current biomass estimated at 71% of B_{MSY} (Table 2).

¹ vBgf = a commonly used growth function in fisheries science to determine length as a function of age. L_∞ is maximum length, and k is body growth coefficient.

Table 2. Stock status of bluefish.

Classification Status	B/B _{MSY}	Occurrence of Overfishing	F/F _{MSY}	Abundance Trends/CPUE	Age/Size/Sex Distribution	Degree of Uncertainty in Stock Status	Sources
Not overfished	0.71	Not occurring	0.79	Declining long term trends, short term abundance increasing	Age distribution not skewed	Moderate	Lazar and Gibson 2002; NMFS 2003a; 41 st SAW 2005

Fishery independent research is conducted by NMFS, as well as individual states. Some states use trawls to monitor adults and juveniles, others use haul seine surveys or multiple mesh gillnets. Year class strength is monitored through the NMFS autumn trawl survey (Lewis et al. 2002). Fishery independent data show a decreasing long-term trend in population abundance, with an increasing trend in recent years (Figure 3). The NMFS/NEFSC fall inshore trawl survey is conducted from Cape Cod to Cape Hatteras, and was used in the 2002 stock assessment as an index of stock abundance (Lazar and Gibson 2002). The only catch per unit effort (CPUE) data included in the 2002 stock assessment were from the recreational fishery. These CPUE data show a decreasing long-term trend in population abundance from the early 1980s to the 1990s, but population abundance has been variable in recent years (Figure 4). Although spawning stock biomass has increased since 1996, recruitment has been below average since 1990 (Lazar and Gibson 2002). Despite a long term-trend of decreasing biomass, the age distribution of the population is not skewed (Lazar and Gibson 2002); that is, fishing pressure has not altered the age structure of the population in either direction.

**Figure 3.** Observed indices of relative biomass from the NEFSC autumn inshore bottom trawl survey with best-fit predicted index of relative biomass (Figure from Lee 2003).

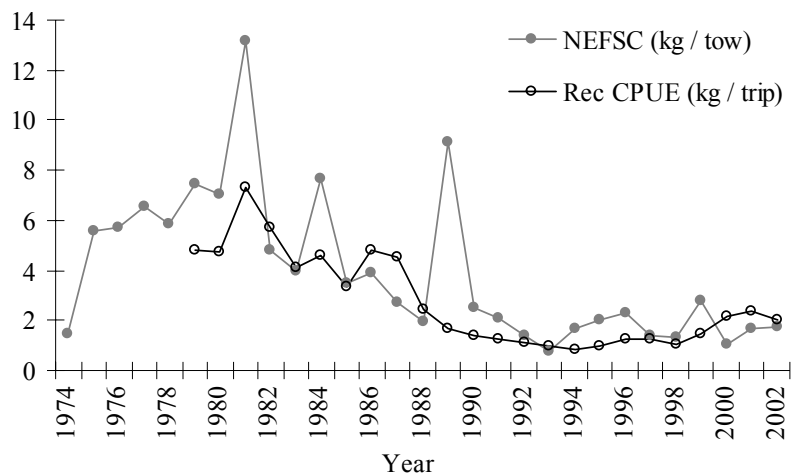


Figure 4. Calculated annual recreational CPUE of bluefish plotted with NEFSC autumn inshore bottom trawl survey annual indices of bluefish biomass, 1974 – 2002 (Figure from Lee 2003).

The 2004 model estimates indicate that F was above F_{MSY} until 2002 (Figure 5), while biomass estimates indicate that biomass was below the overfished threshold throughout the 1990s, but has been above $\frac{1}{2} B_{MSY}$ since 2000 (Figure 6) (41st SAW 2005). The 2004 stock assessment used a catch-at-age model to assess the Atlantic bluefish stock, and concluded that the stock is no longer overfished (41st SAW 2005). However, one stock assessment reviewer believes that caution is warranted regarding the ‘not overfished’ status of bluefish, and the other two reviewers remain concerned about the overall quality and use of the data in the assessment (Jones 2005). Model uncertainty includes the “dual use of data in constructing the CPUE by age and the lack of statistical diagnostics”; in addition, the reviewers felt that there was insufficient time to incorporate all the changes recommended by SARC-39 after the 2002 assessment (Jones 2005, p. 3).

In the 2002 assessment, fishery independent data were not able to determine the abundance of bluefish occurring offshore; concerns have been raised that recent inshore surveys and landings have declined due to the offshore migration of bluefish (Wilson 2000; Lee 2003). However, there are currently no data to support this theory (Lee 2003). Bigelow and Schroeder (1953) suggest that while some bluefish move offshore to the warm bottom waters of the continental shelf edge, some migrate southward.

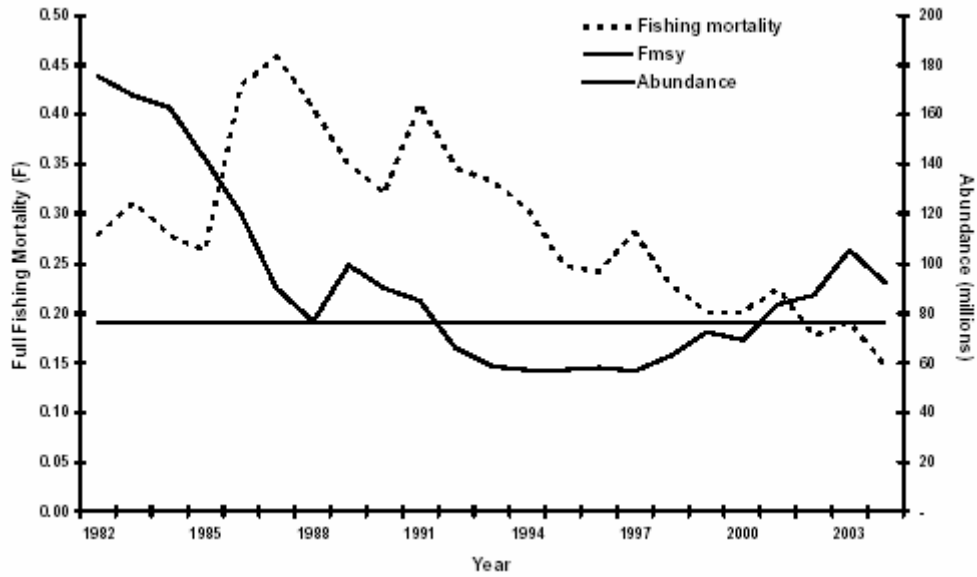


Figure 5. Fishing mortality and abundance relative to F_{MSY} , 1982 – 2004; the Atlantic bluefish stock is not experiencing overfishing (Figure from 41st SAW 2005).

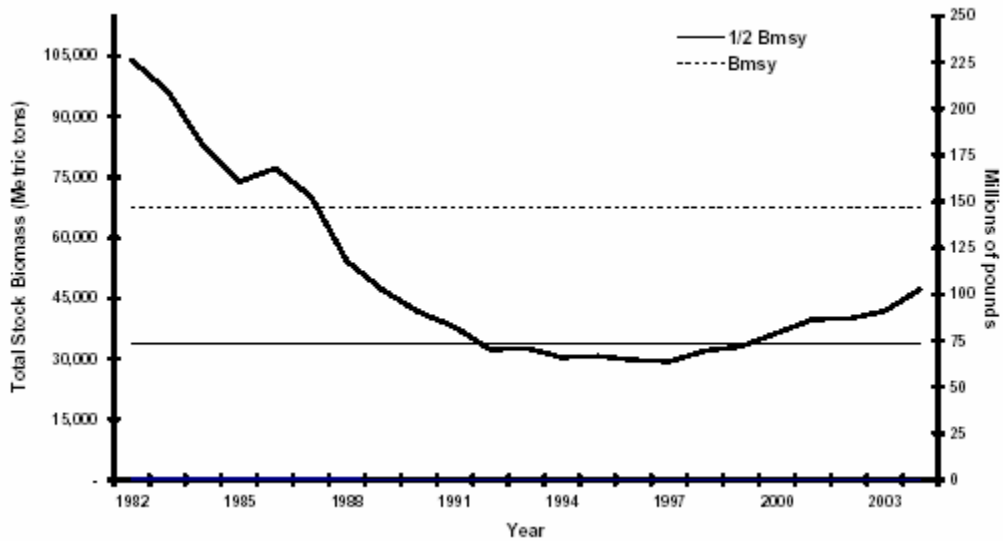


Figure 6. Biomass relative to B_{MSY} and the overfished threshold, $1/2 B_{MSY}$ from 1982 – 2004 (Figure from 41st SAW 2005).

Synthesis

Bluefish are not overfished, and biomass is currently 71% of B_{MSY} . Atlantic bluefish are not experiencing overfishing, but F has only been below F_{MSY} since 2002. Long-term abundance trends exhibit a declining trend, while short-term abundance trends are increasing. There is a moderate level of uncertainty associated with the status of the bluefish stock. The status of the bluefish stock rates as a moderate conservation concern, and stock status is considered moderate/rebuilding.

Status of the Stocks Rank:

Healthy  Moderate/Rebuilding  Poor  Critical 

Criterion 3: Nature of Bycatch

Seafood Watch® defines sustainable wild-caught seafood as marine life captured using fishing techniques that successfully minimize the catch of unwanted and/or unmarketable species (i.e., bycatch). Bycatch is defined as species that are caught but subsequently discarded (injured or dead) for any reason. Bycatch does not include incidental catch (non-targeted catch) if it is utilized, accounted for and/or managed in some way.

Sink gillnets, otter trawls, drift gillnets, and pound nets accounted for 89% (2801 mt) of the total U.S. commercial landings of bluefish in 2002 (Figure 7) (Table 3) (NMFS 2004). Otter trawls are modified with flynets in order to catch pelagic species such as bluefish. The observer programs for the North Carolina coastal gillnet and inshore gillnet fisheries are at the pilot level, while the program for the southeastern Atlantic flynet fisheries is at the baseline level (NMFS undated). Baseline level programs are those for which initial monitoring has been conducted to determine whether a systematic program is needed, and pilot level programs are those for which initial monitoring has been conducted to design a systematic program (NMFS undated). Marine mammals are the primary bycatch concern associated with the Mid-Atlantic gillnet fishery, and are protected under the Marine Mammal Protection Act (MMPA). As of 1998, NMFS was monitoring coastal gillnet fisheries in the Mid-Atlantic fishery for species such as bluefish to assess their potential impacts on marine mammals (NMFS 1998).

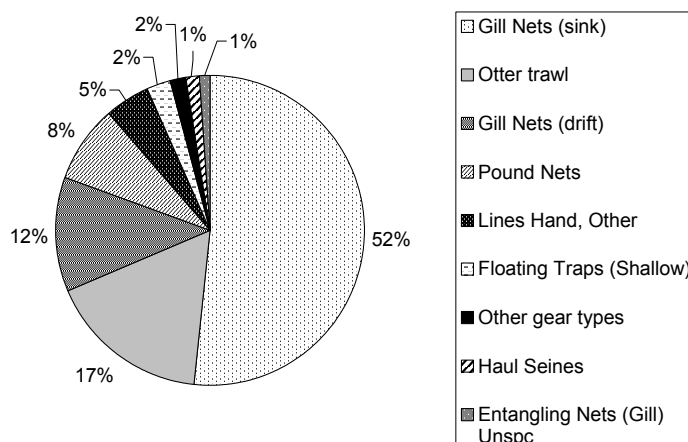


Figure 7. Commercial gear used to harvest bluefish in 2002 (NMFS 2004).

Table 3. Bycatch characteristics of the bluefish fishery.

Gear	Composition of Bycatch	Population Consequences of Bycatch	Bycatch/Target Species Ratio	Trend in Quality & Quantity of Bycatch	Ecosystem Effects	Sources
Gillnet	Likely includes marine mammals	Unknown	Unknown	Unknown	No evidence to date	West et al. 1994; NMFS 2001; Palka and Rossman 2001
Otter trawl modified with a flynet	High diversity of species	Unknown	Unknown	Unknown	No evidence to date	West et al. 1994; Chuenpagdee 2003

Gillnets

Gillnets set on the ocean bottom are also called sink nets, and account for 52% of bluefish landings in the U.S. (NMFS 2004). The majority of bluefish caught in North Carolina are caught in ocean sink nets set on the ocean side of the Outer Banks from Oregon Inlet to Drum Inlet (West et al. 1994). The mesh size of ocean sink nets varies with the size of the targeted bluefish; medium and large bluefish are targeted with 4.5 – 6.5 inch stretched mesh, and small bluefish are targeted with 3 – 3.5 inch stretched mesh (NCDMF in press). The North Carolina fishery is a winter fishery, and generally occurs from November to March (NCDMF in press). Anchors are not generally employed, as vessels remain in the general vicinity while the nets are fishing, and the nets are retrieved at the end of the day (Ross 1989).

In North Carolina, an estuarine gillnet fishery occurs year-round, and targets small to medium bluefish with small mesh (< 5 in) set nets (NCDMF in press). Three primary types of gillnets exist in the North Carolina estuarine gillnet fishery: set, runaround, and drift nets (NCDMF in press). Set nets are deployed and left from a few hours to a few days depending on water temperature and season, and can be further divided into float and sink categories, depending on how they fish within the water column (NCDMF in press). The average soak time for coastal gillnets in North Carolina ranges from 1 – 4 hours (Steve et al. 2001). Float nets fish the entire

height of the water column, while sink nets fish a fixed distance off the ocean bottom and do not extend into the upper portion of the water column if the water is deeper than the height of the net (NCDMF in press). While the winter fishery for bluefish is directed, the estuarine fishery is a mixed species fishery, targeting additional species such as Spanish mackerel and weakfish (F. Munden pers. comm.). Tie downs reduce the height of the net in the water column, and are used in some areas of North Carolina to minimize bycatch of non-target species (NCDMF in press).

Drift gillnets contributed 12% of the total U.S. commercial bluefish landings in 2002, and are the primary gear used to harvest bluefish in New Jersey (NMFS 2004). When appropriate mesh sizes are used, gillnets are generally more selective than trawls (NMFS 2003b). Gillnets select for the faster-growing young fish and the slower-growing older fish, while trawls select for smaller fish at all ages (Lucena and O'Brien 2001). A Southeast Fisheries Science Center (SEFSC) study using supplemental discard data forms from 2001 – 2003 found that gillnets in the South Atlantic had high discards of menhaden (21,122 individuals) and spiny dogfish sharks (7,871 individuals) (Poffenberger 2004). Compared to other gears in the study, the diversity of discards was not high; the report, however, does not include data such as the specific fisheries that were sampled or the mesh size used. The North Carolina coastal gillnet fishery has a “high potential” for bycatch of marine mammals and sea turtles, and a “moderate potential” for fish bycatch is (NMFS undated). However, stringent management measures for the Pamlico Sound gillnet fishery during the last three years have resulted in a successful reduction in sea turtle interactions in large mesh gillnets (Price 2004).

Palka and Rossman (2001) found that mesh size was a primary factor in the correlation of bycatch rates of bottlenose dolphins in the Mid-Atlantic coastal gillnet fishery. Estimated bycatch rates of bottlenose dolphins for small mesh fisheries targeting species such as croaker, weakfish, and bluefish were lower than the medium and large mesh fisheries from 1996 – 2000 (Palka and Rossman 2001). The highest bycatch rates were associated with the large mesh fisheries targeting monkfish, striped bass, and black drum (Palka and Rossman 2001). During 1996 – 2000 in the winter off North Carolina, when many bluefish are caught, approximately a quarter of the estimated bycatch of coastal bottlenose dolphins came from small mesh gillnet fisheries (≤ 5 in) and an additional half of the bycatch came from medium mesh gillnet fisheries (5-7 in) (Palka and Rossman 2001). Palka and Rossman (2001) did not indicate what proportion of the bycatch came from the bluefish fishery. As a result of these bycatch estimates, the winter North Carolina coastal bottlenose dolphin management unit was designated as “strategic”, that is, bycatch was above the Potential Biological Removal (PBR)² and thus unsustainable (Waring et al. 2002).

In 1997 the Mid-Atlantic Take Reduction Team was established to examine interactions between harbor porpoises and the Mid-Atlantic gillnet fishery. The large mesh fisheries targeting dogfish and monkfish were responsible for observed mortalities of harbor porpoises from 1995 – 1998; an average estimated 358 mortalities and serious injuries to harbor porpoises were due to interactions with the Mid-Atlantic gillnet fishery during that time period (NMFS 2001). Although large mesh fisheries were primarily observed, stranding and observer data suggest that small mesh fisheries also contribute to bycatch (NMFS 2001). Based on observer data from the

² The PBR level is the maximum number of animals that can be removed while allowing the stock to maintain its optimum sustainable population.

Mid-Atlantic gillnet fisheries, estimated bycatch of harbor porpoises were 103 in 1995, 311 in 1996, 572 in 1997, and 446 in 1998 (NMFS 2001). After the Harbor Porpoise Take Reduction Plan (Federal Register, Vol. 63, N. 231, December 2, 1998) and several FMPs were put into place, harbor porpoise bycatch in the Mid-Atlantic region was reduced to 53 in 1999 and 21 in 2000 (Waring et al. 2002). While marine mammal takes do occur in small mesh gillnets, the contribution of the bluefish fishery to these takes is unknown. The bycatch of similar or lower trophic level species relative to bluefish landed by gillnets is also unknown.

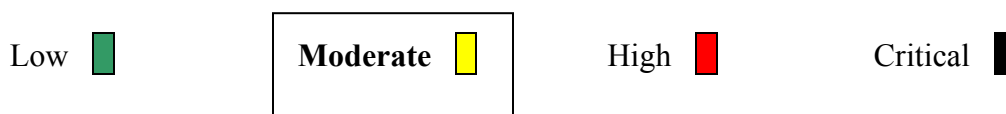
Otter trawls and pound nets

According to West et al. (1994), the winter trawl flynet fishery is one of the main contributors to fish bycatch in North Carolina. Flynets are modified trawls used to catch pelagic species, and the fishery occurs offshore; in North Carolina, bycatch in the trawl flynet fishery is similar to that of the long haul fishery and consists mainly of undersized spot, croaker, menhaden, and weakfish (West et al. 1994). Pound nets are stationary gear set in estuaries and sounds, and are nonselective once fish enter the gear (West et al. 1994). Pound nets are purported to contribute to declines of weakfish and Atlantic croaker in North Carolina (West et al. 1994). Sea turtles are also caught in pound nets; entanglement of sea turtles in pound nets depends on factors such as net location, mesh size, and tidal currents (Lutcavage and Musick 1985). The bycatch of similar or lower trophic level species relative to bluefish landed by otter trawls is unknown.

Synthesis

Although gillnets targeting bluefish are associated with marine mammals takes, the bluefish fishery is not thought to be contributing to the decline of any marine mammal species. The drop net method of harvesting bluefish, as well as the smaller mesh sizes used may reduce the number of marine mammal takes. Otter trawls modified with flynets likely have a high diversity of bycatch species, as do pound nets. It is unknown if bycatch in the bluefish fishery has any effect on population levels of the bycatch species, and the trends in bycatch composition and quantity are unknown. Bycatch rates as a moderate conservation concern in the bluefish fishery.

Nature of Bycatch Rank:



Criterion 4: Effect of Fishing Practices on Habitats and Ecosystems

The gears used to commercially harvest bluefish are gillnets, otter trawls, and pound nets (Table 4). In the Mid-Atlantic, sink gillnets targeting bluefish may be tended several times per day (NEFSC 2002). The anchors and leadlines have the most contact with the ocean bottom; the type of anchor used (e.g., a piece of railroad track, sash weights, or Danforth anchors) depends on the currents (NEFSC 2002). In the Mid-Atlantic, leadlines may be heavier than 65 lb/net (NEFSC 2002). Although sink gillnets are a stationary gear, they move around on the ocean bottom once the nets have been set, and they are dragged along the ocean bottom when they are retrieved (NEFSC 2002). The results of an expert panel workshop concluded that sink gillnets

have a low impact to biological structure in mud and sand habitats, a low impact to physical structure in mud, and a negligible impact to physical structure in sand habitats (NEFSC 2002). Auster and Langton (1999) suggest that the effects of dragging stationary gear such as gillnets along the ocean bottom when the nets are set and retrieved are similar to the effects of mobile gear, although the area impacted per unit area is smaller for stationary gear. An experts' impact rating study concluded that bottom gillnets have "low" biological impacts, and "medium" physical impacts (Chuenpagdee et al. 2003). However, Barnette (2001) suggests that there is no evidence that sink gillnets have a significant effect on bottom habitat. In North Carolina, bluefish are also targeted by the winter trawl fishery using flynets; flynets are used to catch pelagic schooling fish and do not likely affect marine habitat (West et al. 1994). A flynet differs from an otter trawl for shrimp in that it is constructed of larger mesh webbing, has a larger spread, and is towed along the bottom for a much shorter period of time (F. Munden, pers. comm.). Pound nets are a stationary gear and there is likely no habitat effect associated with the pound net fishery (West et al. 1994; Barnette 2001). Mobile fishing gear, such as trawls, are a cause for concern because of the size of the affected fishing grounds and modification of the substrate, although the effects of bottom trawling vary depending on the type of gear used and habitat trawled (NRC 2002). Some examples of mobile fishing gear effects on habitat include compression and suspension of sediments and reduction of epifaunal coverage (Thrush et al. 1998).

Table 4. Habitat effects of gear used to harvest bluefish.

Gear Type	Effect of Fishing Gear on Habitats	Habitat Resilience to Disturbance	Geographic Extent of Fishery Effects	Evidence of Food Web Disruption	Evidence of Ecosystem Changes	Sources
Gillnet	Moderate damage	Moderate	Medium area	None	None	Auster and Langton 1999; NEFSC 2002
Otter trawl modified with a flynet	Moderate damage	Moderate	Large area	None	None	West et al. 1994; NRC 2002; Chuenpagdee et al. 2003

Synthesis


Gillnets used to target bluefish affect a moderate geographical area, and have a moderate effect of bottom habitat. Sink gillnets can affect bottom habitat when the nets are both set and retrieved, and through movement of the net once it has been set. In general, otter trawls cause great damage to bottom habitat; however, otter trawls for bluefish are modified with a flynet, which reduces the habitat effects of this fishing gear. Pound nets are stationary gear, and have a minimal effect on the bottom habitat. Overall, the effects of bluefish fishing practices on habitats and ecosystems rates as a moderate conservation concern.

Effect of Fishing Practices Rank:

Benign 

Moderate 

Severe 

Critical 

Criterion 5: Effectiveness of the Management Regime

Bluefish are managed jointly by the MAFMC and ASMFC under the Bluefish FMP of 1990. The FMP included measures such as a license requirement to sell bluefish, and a possession limit for recreational fishers (MAFMC 1998). Amendment 1 to the FMP was implemented in 1999, as a result of the 18th Stock Assessment Workshop (SAW). The 18th SAW found that stock biomass and recruitment were low, while fishing mortality was twice as high as F_{MSY} (Wilson 2000). Current management measures include a quota, size limits, and gear restrictions (Table 5).

Management regularly collects fishery independent data, as well as recreational CPUE data. Stock assessment reviews were conducted in 1985, 1986, 1987, 1990, 1993, 1994, 1996, 2002, and 2004. Bycatch reduction efforts include gear restrictions implemented as a result of the Mid-Atlantic Harbor Porpoise Take Reduction Plan (Table 6). There have been no efforts to minimize habitat effects of fishing practices, as it rates as a low conservation concern. The commercial fishery is allocated 17% of the total allowable landings (TAL) of bluefish, while the recreational fishery is allocated 83% of the TAL; this allocation is based on the historic proportion of commercial and recreational landings of bluefish from 1981 – 1989 (MAFMC 1998). Total bluefish landings since 1974 were highest from 1981 – 1986 (Lazar and Gibson 2002). The recommended TAL for 2003 was 16,941 mt. According to Amendment 1, if 17% of the TAL is less than 4,763 mt, the commercial quota can be increased to 4,763 mt if the recreational fishery is anticipated to land less than their allocated 83% (MAFMC 1998). Individual state quotas are also allocated based on their percentage of landings from 1981 – 1989 (Table 7) (MAFMC 1998). The recreational fishery is managed by a bag limit, which varies by state (Table 8). Management has specified a nine-year rebuilding plan for bluefish through a gradual reduction in F . According to the rebuilding plan specified in Amendment 1, $F = 0.51$ for years one and two (1999 – 2000), $F = 0.41$ for years three through five (2001 – 2003), and $F = 0.31$ for years six through nine (2004 – 2007) (MAFMC 1998). However, during the rebuilding period, the target F for the following year will be set at either the level specified by the rebuilding plan, or the level estimated for the most recent year, whichever is less (MAFMC 1998). Using an F_{MSY} of 0.40, bluefish have been undergoing overfishing since 1979 (MAFMC 1998).

There are no issues associated with enforcement of the commercial bluefish fishery, and logbook reporting is mandatory. Management measures were not implemented until after significant declines; however, fishing mortality rates declined after the Bluefish FMP was adopted in 1990, and implemented in 1991 (Figure 8) (MAFMC 1998). With the adoption of Amendment 1 in 1999, annual biomass of the bluefish stock began to increase.

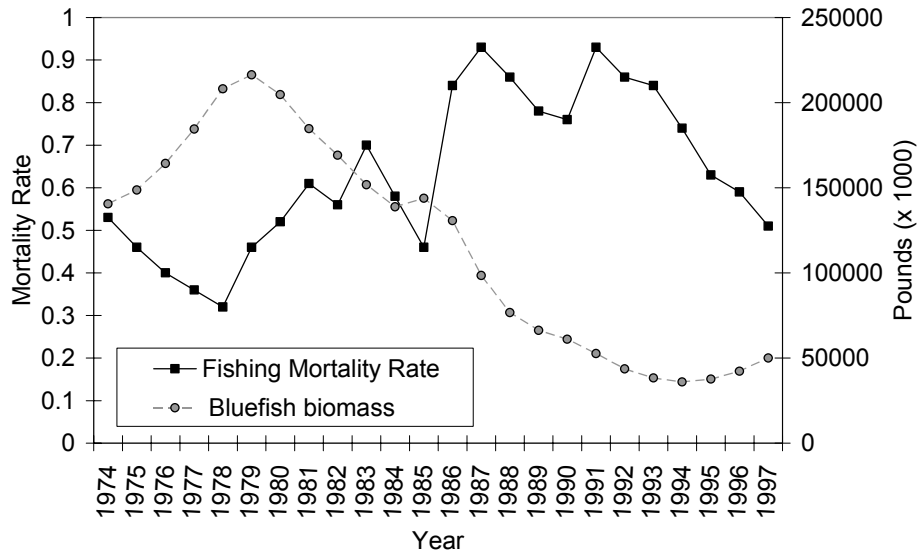


Figure 8. Decrease in Fishing Mortality Rate (F) after implementation of Bluefish FMP in 1991, and subsequent increase in biomass (MAFMC 1998).

Table 5. Commercial harvest management measures for the bluefish fishery.

Management Jurisdictions & Agencies	Total Allowable Landings	Size Limit	Gear Restrictions	Trip Limit	Area Closures	Sources
ASMFC, MAFMC	16,941 mt (17% allocated to comm., 83% allocated to rec.)	Varies by state	Varies by state; seasonal closures associated with specific gear types to minimize marine mammal interactions	None	None	MAFMC 1998; Lee 2003

Table 6. Gear requirements for the small mesh (5 – 7 in) gillnet fishery required by the Final Rule Implementing the Mid-Atlantic Harbor Porpoise Take Reduction Plan (Table from NMFS 2001).

Floatline length: NJ waters Southern Mid-Atlantic waters	Less than or equal to 914.1 m Less than or equal to 645.6 m
Twine size: All Mid-Atlantic waters	Greater than or equal to 0.81 mm
Net cap: All Mid-Atlantic waters	45 nets
Net size	A net must be no longer than 91.4 m
Net tagging	Requires all nets to be tagged by 01/01/00
Time/area closures: NJ mudhole	Closed from Feb 15 – Mar 15

Table 7. Commercial quotas for 2001 based on 1981 – 1989 landings (Table from Lewis et al. 2002).


State	Percent of quota	Quota (lbs)
ME	0.69	70,193
NH	0.41	43,523
MA	6.72	705,254
RI	6.81	714,851
CT	1.27	132,962
NY	10.39	1,090,436
NJ	14.82	1,555,701
DE	1.88	197,211
MD	3.00	315,189
VA	11.88	1,247,348
NC	32.06	3,366,384
SC	0.04	3,696
GA	0.01	998
FL	10.06	1,056,269
Total	100.00	10,500,011

Table 8. Status of Bluefish FMP implementation by states in 2002 (Table from Lewis et al. 2002).

State	Rec Limit	Rec Size Limit	Comm Trip Limit	Comm Open Season
ME	3			
NH	10			07/01 – 09/30
MA	10		2.3 mt/day	
RI	10			
CT	10		0.2 mt/day	04/15 – 12/31
NY	10			Gear specific
NJ	15			Gear specific
DE	10		Gear specific	Gear specific
MD	10	20.3 cm		
VA	10			
NC	15	Only 5 > 60 cm		
SC	10			
GA	15	30.5 cm FL		
FL	10	30.5 cm FL	3.4 mt/day	

Synthesis

A recent stock assessment has been completed for bluefish, and management regularly collects fishery independent and recreational CPUE data. Bycatch reduction efforts include seasonal closures for specific gear types to minimize bluefish fishery interactions with marine mammals, which are the primary bycatch concern. Management has not addressed the effect of fishing practices on bottom habitat due to the minimal effects of gillnets. The bluefish fishery is adequately enforced, as logbook reporting is legally mandated. However, management measures were implemented only after significant declines in stock abundance which occurred throughout the 1980s. Management of bluefish in the Atlantic is therefore considered moderately effective.

Effectiveness of Management Rank:Highly Effective **Moderately Effective** Ineffective Critical 

Overall Evaluation and Seafood Recommendation

Bluefish are inherently resilient to fishing pressure due to their low age at maturity, moderate longevity, and high fecundity. Stock status of bluefish is considered moderate/rebuilding, as the stock is at 71% of B_{MSY} and the stock has not been experiencing overfishing since 2002. Long-term trends in abundance exhibit a declining trend, while short-term trends are increasing. Bycatch rates as a moderate conservation concern, as there is some interaction with marine mammals such as harbor porpoises and bottlenose dolphins in the bluefish gillnet fisheries. The effect of fishing practices on habitats and ecosystems rates as a moderate conservation concern. Although bluefish have been managed since 1990, management measures were not implemented until after significant declines in bluefish stocks occurred. Management is therefore characterized as moderately effective. The preceding suite of factors results in an overall seafood recommendation of “Good Alternative” for bluefish.

Table of Sustainability Ranks

Sustainability Criteria	Conservation Concern			
	Low	Moderate	High	Critical
Inherent Vulnerability	√			
Status of Stocks		√		
Nature of Bycatch		√		
Habitat Effects		√		
Management Effectiveness		√		

Overall Seafood Recommendation:

Best Choice 

Good Alternative 

Avoid 

Supplemental Information

Although potential health effects are not a factor in the overall seafood recommendation, the consumption of bluefish may be a health concern for certain individuals. Polychlorinated biphenyl (PCB) contamination in bluefish has been a widespread issue since the 1970s (Eldridge and Meaburn 1992). Bluefish consumption advisories are currently in effect for New York, New Jersey, Delaware, Connecticut, Rhode Island, and Maine due to PCB levels in bluefish. The advisories vary by state; some suggest that bluefish should not be consumed, while others specify limited consumption for women of child-bearing age and children. More information is available at the EPA's Fish Advisories home page: <http://www.epa.gov/ost/fish/states.htm>. Deshpande et al. (2002) found that bluefish (compared to sea bass, flounder, and tautog) had the highest lipid content, as well as the highest mean PCB and pesticide concentrations. A 1985 study sampled bluefish from Massachusetts to North Carolina, and found that bluefish in the small or medium size category did not exceed the FDA tolerance level of 2 ppm, while PCB levels in some large fish at every sampling site exceeded the tolerance level (Eldridge and Meaburn 1992); it is therefore safer to eat the small and medium-sized bluefish.

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Appendix

In 2002 F_{MSY} for bluefish was estimated at 0.26 (Lazar and Gibson 2002), and F was estimated at 0.18, which was below the overfishing threshold (Lazar and Gibson 2002). The 2002 bluefish stock assessment estimated that $\frac{1}{2} B_{MSY} = 100,100$ mt while biomass at the beginning of 2003 was estimated at 58,680 mt (Lazar and Gibson 2002). Thus the bluefish stock was considered overfished, with the biomass estimates at 29% of B_{MSY} . According to Seafood Watch® criteria this resulted in a high conservation concern and a stock status ranking of “poor”.

In 2004, the Atlantic bluefish stock was assessed using a catch-at-age model, and the assessment concluded that bluefish are no longer overfished. Because current bluefish biomass is estimated at 71% of B_{MSY} , and the stock has not been experiencing overfishing since 2002, the stock is considered “moderate/rebuilding” according to Seafood Watch® criteria; there is no overall change, and bluefish continue to be recommended as a “Good Alternative”.