UNITED STATES DEPARTMENT OF COMMERCE
The Inspector General
Washington, D.C. 20230

February 26, 2009

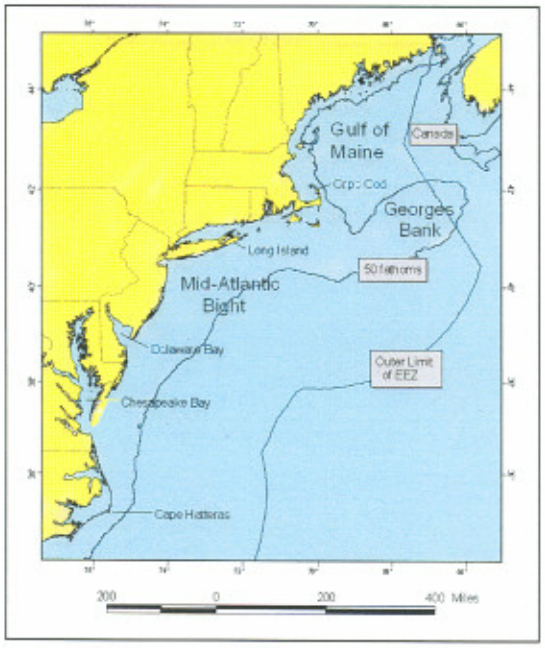
The Honorable Edward M. Kennedy
United States Senate
Washington, DC 20510-2101

Dear Senator Kennedy:

This responds to your letter of August 28, 2008, requesting that we investigate a series of issues regarding the work and scientific methods of the National Marine Fisheries Service's (NMFS') Northeast Fisheries Science Center. We investigated your specific concerns about "the quality of the science used to determine catch limits for New England commercial fisheries" and related allegations from the fishing industry and non-NOAA scientists, as well as with NMFS' implementation of National Standard 2 of the Magnuson-Stevens Fishery Conservation and Management Act.

National Standard 2 requires that conservation and management measures in fishery management plans be based on the best scientific information available. Your staff had shared with us a number of allegations and concerns from the fishing industry and several independent researchers that raised questions about whether the Northeast Fisheries Science Center had used the best available science in the recent Groundfish Assessment Review Meeting (GARM III), which sought to evaluate fundamental scientific information for all 19 groundfish stocks. We focused our review on the two fisheries that generated the most concerns—northeast groundfish (specifically, Atlantic cod, haddock, pollock, and yellowtail flounder) and Atlantic sea scallops. Figure 1 shows the area covered by the Northeast Science Center.

Figure 1. Northeast U.S. Shelf Ecosystem



Source: Environmental Assessment Regulatory Impact Review, Initial Regulatory Flexibility Analysis for Northeast Multispecies Fishery Management Plan, National Marine Fisheries Service, Gloucester, Massachusetts, January 16, 2009

We also addressed concerns that NMFS has denied the fishing industry access to underlying scientific data. We examined one particular data access issue that arose from a request under the Freedom of Information Act, including the transparency of NMFS' procedures for responding to data requests, the timeliness of its response, and the appropriateness of the fees it charged to process the request.

Although we found merit with several of the specific allegations, overall we found the Science Center meets the "best available science" requirements of National Standard 2. We also found systemic issues with NMFS' management of FOIA that are beyond the scope of this review. As detailed below, we identified several issues with respect to the relationship between NOAA in the Northeast region and the groundfish industry and NOAA's progress in using ecosystem approaches to fisheries management that NOAA should promptly address. We will be sharing our observations with NOAA. Our findings with respect to the specific allegations we were asked to review are detailed in attachment A.

Summary of Findings

The history of contention between the groundfish industry and NOAA in the Northeast Region, where industry is suspicious of the science and sees NOAA as biased toward conservation goals, provides the backdrop for the decisions made by NOAA that impact the groundfish industry. We found the relationship between the northeast groundfish industry and NMFS is characterized by a lack of confidence and trust and by poor communication, which colors how individuals view NOAA's management of fisheries. For example, NOAA's poor handling of a 2008 FOIA request contributes to its reputation in the Northeast Region as an agency that is unconcerned with transparency.

While NOAA has made limited progress in the Northeast Region improving the transparency of its fishery management process since 2004, when these issues were most recently addressed by an external review,[1] more work needs to be done to rebuild the relationships with industry, particularly the groundfish industry. Additionally, several issues arose during the course of our review that reinforce the need for NOAA to more aggressively pursue ecosystem approaches to fisheries management, which will require additional data and new models.

As a result of our work, we will make recommendations to NOAA related to enhancing the participation of the northeast groundfish industry in the fisheries management process, clarifying NOAA's policy on the multispecies exemption, more aggressively pursuing ecosystem approaches to fisheries management, and ensuring NOAA meets its statutory FOIA requirements.

Methodology

During the course of the review, we met with or spoke to government officials and fisheries scientists from the Massachusetts, New Hampshire, and Maine departments of fish and wildlife, industry associations, fishermen, environmental groups, researchers involved in assessments and peer reviews, and researchers not involved in the process, including international scientists.

We attended a U.S. Senate field hearing before the Subcommittee on Oceans, Atmosphere, Fisheries, and Coast Guard, Committee on Commerce, Science, and Transportation, in Portland, Maine, on October 14, 2008. We conducted interviews at the Northeast Fisheries Science Center

[1] National Research Council. 2004. *Improving the Use of the "Best Scientific Information Available" Standard in Fisheries Management*.

in Woods Hole, Massachusetts, on November 16, 2008, and from November 17-20, 2008, we attended the New England Fishery Management Council meeting in Danvers, Massachusetts, and met with staff at the Northeast Regional Office in Gloucester, Massachusetts. We traveled to Maine again in January 2009 to conduct additional interviews. Our scope and methodology are more fully described in attachment E.

Background

The Magnuson-Stevens Act requires that fishery management councils make use of the "best scientific information available" to manage stocks via fishery management plans.[2] Generally, if science indicates that a stock is overfished or subject to overfishing, the act requires regulations, such as catch limits, gear restrictions, and/or area closures, to allow the stock to recover. NMFS uses its own scientists and contracts with outside experts to conduct stock assessments. These assessments form the scientific basis used to (1) determine biologically sustainable harvests by fishery management councils, (2) guide the monitoring and rebuilding of overfished and threatened stocks, and (3) set maximum, or total allowable, catch in each fishery.

Since 1985 the Science Center has used a two-part system to ensure adequate peer reviews of its stock assessments: a Stock Assessment Workshop, which is where the stock assessment is made, followed by an independent, external peer review conducted by the Stock Assessment Review Committee to ensure compliance with the "best available science" requirement.[3]

NMFS' Overfished and Overfishing Definitions

Overfished: "A stock or stock complex is considered overfished when its population size falls below the minimum stock size threshold. A rebuilding plan is required for stocks that are deemed overfished."

Overfishing: "According to the National Standard Guidelines, 'overfishing occurs whenever a stock or stock complex is subjected to a rate or level of fishing mortality that jeopardizes the capacity of a stock or stock complex to produce maximum sustainable yield on a continuing basis.' Overfishing is occurring if the maximum fishing mortality threshold is exceeded for 1 year or more."

A stock can be subject to overfishing but not overfished (i.e., fish are being removed at a high rate that will eventually lead to the stock's depletion, but the current stock population is not below the minimum threshold). A stock can also be overfished, but not subject to overfishing (i.e., the stock population is at a low level, but fishing rates are at a level such that the stock is expected to rebuild.

See attachment C for a graph of how the GARM III Assessment illustrated these definitions.

Source: http://www.nmfs.noaa.gov/fishwatch/glossary.htm

NMFS' use of best available science both nationally and at the Northeast Science Center has been the subject of seven separate reviews conducted over the past decade, by the National Research Council of the National Academy of Sciences, the Government Accountability Office, and the National Academy of Public Administration. (Attachment B contains a brief description of each study.)

[2] Magnuson-Stevens Fishery Conservation and Management Act, Section 301.
[3] National Research Council. 2004. *Improving the Use of the "Best Scientific Information Available" Standard in Fisheries Management*, p.13.

The growing number of fishery management actions challenged in federal courts demonstrates that the scientific information that informs the development of fishery management plans is the subject of substantial scrutiny from all parties, including environmental groups, recreational and commercial fishers, and other members of the fishing industry. According to a 2004 National Research Council report, "to avoid being subject to sometimes severe reductions in allowable catch, the [fishing] industry has often challenged the scientific information underlying the finding that the stock is overfished."[4] Conservation-minded plaintiffs also challenge the science, alleging it is inadequate. Our review found that alleged violations of National Standard 2 have been among the most frequently stated causes of action in complaints filed under the Magnuson-Stevens Act. In a report requested by Congress and NMFS, the National Academy of Public Administration found in 2002 that "courts are deferential to NMFS' scientific expertise; when experts disagree, the court will not second-guess the agency's judgment as long as it is reasonable."[5] The National Academy of Public Administration found that challenges to National Standard 2 failed in 80 percent of the cases it reviewed from 1977-2001.

Figure 2. Select U.S. Commercial Landings in the Northeast

	Quantity		Value	
	2006	2007	2006	2007
	Millions Pounds		Million Dollars	
Massachusetts				
New Bedford	168.3	149.5	281.4	268.0
Gloucester	117.4	94.4	47.3	46.8
Maine				
Portland	58.2	34.6	27.8	24.1
Stonington	23.4	12.3	34.3	23.5
Rhode Island				
Newport	9.9	8.5	20.8	12.4
Point Judith	46.0	37.6	46.8	36.7

Source: Data from NMFS; photo from NEFSC

Commercial landings at Gloucester Fishing Pier, circa 1950. Gloucester is one of the most lucrative commercial ports in the Northeast.

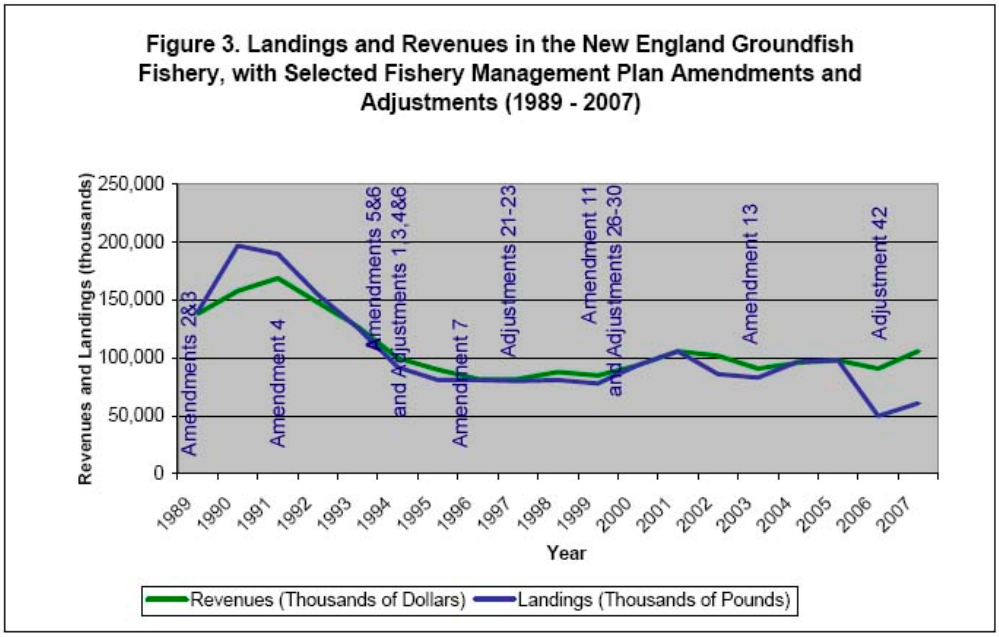
In 2007, the value of commercial landings of all species in New England was $875 million dollars and 573 million pounds. In 2006, the value of commercial landings of all species in New England was $953 million dollars and 700 million pounds. Figure 2 lists the quantity and value of commercial landings at important ports in New England in 2006 and 2007. For example, New Bedford, Massachusetts, had the highest value of commercial landings in the U.S. in 2006 and 2007, and the ninth and seventh highest landings in pounds in 2006 and 2007, respectively.

[4] National Research Council of the National Academy of Science, *Improving the Use of the "Best Scientific Information Available" Standard in Fisheries Management*, 2004, p.13. One outcome of this report was NMFS' restructuring of the lines of supervision between regional directors. To avoid undue influence, or the appearance thereof, following this report NMFS' national science and technology office director supervises the regional science center directors instead of the regional office directors.

[5] See National Academy of Public Administration, 2002. *Courts, Congress, and Constituencies: Managing Fisheries by Default*, 2002, p. 21.

Historical Context of Northeast Multispecies/Groundfish Allegation

The Northeast Multispecies fishery management plan was implemented in 1986 to reduce fishing mortality of heavily fished groundfish stocks. This plan specifies the management measures for 12 species in federal waters off the New England and Mid-Atlantic coasts, comprising a total of 19 individual stocks. While these 12 species exhibit unique body types, behaviors and habitat preferences, all live near the bottom and feed on bottom-dwelling organisms and, consequently, are often caught together. Figure 3 shows landings and revenues in this fishery from 1989 to 2007.



In 1994, Amendment 5 to the fishery management plan capped fishery participation (number of fishing days) and established measures to reduce fishing effort. In 2004, implementation of Amendment 13 overhauled this plan and established rebuilding programs for all stocks that were either overfished or subject to overfishing. The rebuilding period for all but three stocks under this plan ends in 2014, 10 years after Amendment 13 was developed,[6] and at which time the stock can be reclassified if it has been rebuilt.

Amendment 13 also specified a benchmark stock assessment and review of criteria used to determine stock status in 2008, halfway through the rebuilding period for most stocks. This assessment, now known as the GARM III, sought to evaluate fundamental scientific information for all 19 groundfish stocks and was completed in August 2008. GARM III evaluated the data and models used for assessing the stocks, evaluated the biological reference points, established new reference points, assessed the biomass (i.e., quantity of fish) and fishing mortality status of

[6] The rebuilding period for Georges Bank cod is 2026, for Cape Cod /Gulf of Maine yellowtail flounder it is 2023, and for redfish it is 2051.

the groundfish stocks in 2007, and provided examples of fishing mortality rates that would be expected to rebuild overfished stocks.[7]

Table 1. GARM III 2007 Stock Status [a]

Species	Stock[b]	2007 Overfishing is occurring	2007 Stock is overfished
Cod	GB	+	+
	GOM	+	
Haddock	GB		
	GOM		
Yellowtail flounder	GB	+	+
	SNE/MA	+	+
	CC/GOM	+	+
American plaice			
Witch flounder		+	+
Winter flounder	GB	+	+
	GOM	+	+
	SNE/MA	+	+
Redfish			
White hake		+	
Pollock		+	
Windowpane	North	+	+
	South	+	
Ocean pout			+
Atlantic halibut			+

[a]The pollock and windowpane flounder information in this table was revised subsequent to GARM III in order to use 3-year averages, instead of 2-year averages, as used in GARM III. The 2-year average was the basis for one of the allegations we investigated during this review.

[b]GB – Georges Bank, GOM – Gulf of Maine, SNE/MA – Southern New England/Mid-Atlantic, CC – Cape Cod

Source: NMFS' Proposed Interim Secretarial Action to immediately reduce overfishing in the Northeast multispecies fishery, December 2008

Table 1, which summarizes the results of GARM III, shows that 15 of 19 stocks in this fishery management plan are characterized as overfished or subject to overfishing. Eight stocks are both overfished and subject to overfishing. NMFS defines a stock of concern as one that is in an overfished condition or subject to overfishing. To rebuild these stocks of concern within statutory timelines, NMFS must calculate the percentages of required reductions in fishing mortality for each stock in the plan.

In other words, NMFS must limit the amount of targeted and incidental catch of stocks of concern by a certain amount via a host of management measures intended to achieve required reductions in fishing mortality. Government, industry, and academic researchers and fisheries managers described this work as complicated, predictive, and reliant on estimates, models, and projections. NMFS has determined that all stocks except one should rebuild with a 50 percent probability by the end of their respective rebuilding periods (2014 except for three stocks). Fifty percent probability of success has become the standard for fisheries management plans in the northeast region due to the uncertainty associated with recruitment[8] of a stock and biomass trends, coupled with the variable effectiveness of management measures in place.

[7]As required by Amendment 13, the GARM III assessment dealt with all 19 species at the same time. This was different than the process used by the Science Center in the past. Generally, Stock Assessment Workshops assess fewer stocks (between 1 and 5) at one time. Also, the external, independent peer review conducted by the Stock Assessment Review Committee generally follows the Stock Assessment Workshop. For the GARM III assessment, however, independent peer reviewers were present at the stock assessment meetings, and peer reviewers drafted their independent reports from these meetings.

[8] Recruitment is an important component of fish stock population dynamics that refers to the survival of juveniles. It plays an essential role in the life history of marine organisms, because the survival of juveniles is linked to adult populations.

Table 2 summarizes NMFS' proposed reductions to fishing mortality rates to meet the rate goals resulting from GARM III. For example, the most severe reduction in fishing mortality is for Southern New England/Mid-Atlantic stock of winter flounder, described as severely depleted; the proposed reduction in fishing mortality rate from 2008 is by 100 percent. As a result, no catch of this stock is envisioned in 2009.

Even though there is scientific uncertainty associated with these estimates, NOAA's data indicates that 15 of 19 groundfish stocks are overfished or subject to overfishing under the MSA. This requires prudent, conservative, or stringent management measures to rebuild the stocks by an end date. In other words, once a stock is determined to be overfished and subject to overfishing, NMFS must cut fishing mortality and rebuild the stock. This puts the already struggling groundfish industry under considerably more pressure.

Table 2.
Proposed Reductions to Fishing Mortality Rates for 2009

Species	Stock	Proposed Reductions to Fishing Mortality Rates (%)
Cod	GB	- 40
	GOM	-21
Haddock	GB	322
	GOM	72
Yellowtail flounder	GB	- 16
	SNE/MA	- 38
	CC/GOM	- 18
American plaice		92
Witch flounder		- 32
Winter flounder	GB	98
	GOM	- 11
	SNE/MA	- 100
Redfish		375
White hake		29
Pollock		- 48
Windowpane	North	- 74
	South	- 21
Ocean pout		NA
Atlantic halibut		- 27

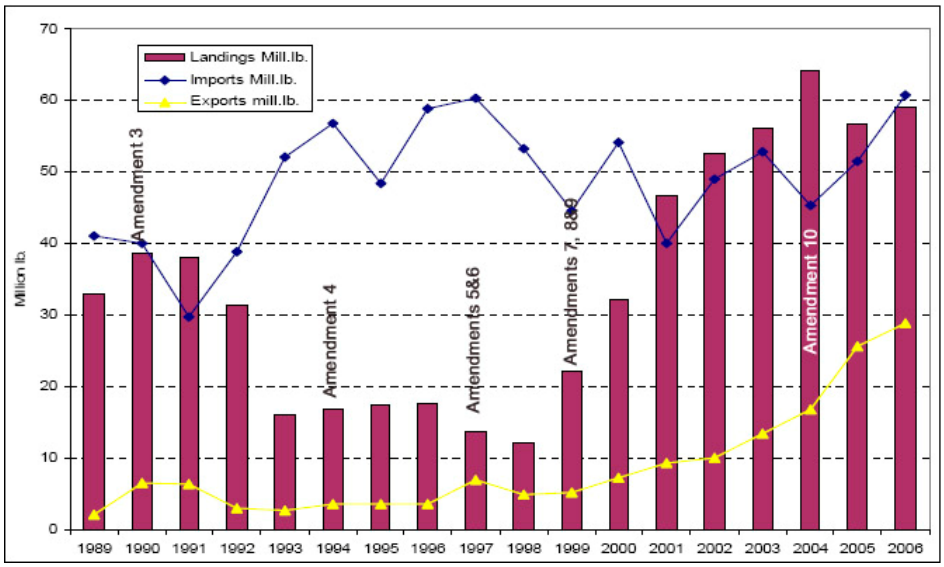
NA - not available.
Source: NMFS' Proposed Interim Secretarial Action to immediately reduce overfishing in the Northeast multispecies fishery, December 2008

Historical Context of Atlantic Sea Scallops Allegation

The Atlantic Sea Scallop fishery management plan was implemented in 1982 to restore adult scallop stocks and reduce year-to-year fluctuations in stock abundance. Early plan amendments significantly reduced fishing effort by limiting access to the resource, allocating days at sea (number of days a vessel is allowed to fish for scallops each year), implementing gear restrictions to improve the escape of small scallops and finfish, and limiting crew size. Area closures in New England and the Mid-Atlantic and possibly other environmental factors have resulted in increased scallop biomass both within and outside of the closed areas. The scallop plan has been further developed over the years by adjusting the annual day-at-sea allocation to achieve optimum yield in the scallop fishery, controlling access in several closed areas, and introducing area-based management strategies, reducing bycatch, and protecting essential fish habitat.

Over the past 10 years, management of sea scallops has resulted in a dramatic increase in abundance (see figure 3) and the development of a highly profitable commercial Atlantic sea scallop fishery, reported at $385 million total revenue in 2007.

Figure 3. Atlantic Sea Scallop Fishery Management Plan Amendments, with Landings, Exports, and Imports



Source: Framework 19 to the Scallop Fishery Management Plan, April 29, 2008

In 2001, a formal consultation, as required by Section 7(a)(2) of the Endangered Species Act (ESA), sought to determine whether the scallop fishery would jeopardize the continued existence of the loggerhead, leatherback, Kemp's ridley, green sea turtles, or any other ESA-listed species under NMFS jurisdiction. The resulting biological opinion concluded that the scallop fishery did not jeopardize the existence of the turtles. To date, the consultation has been reinitiated four times, each time based on new information. And in each case the determination was made that the fishery does not jeopardize the existence of the turtles. Each time, the biological opinion contained "Reasonable and Prudent Measures" to reduce incidental turtle takes. The most recent opinion was initiated on April 3, 2007, based on new information regarding the capture of sea turtles in scallop trawl gear published by the Science Center.

We were asked to investigate the allegation that NMFS did not use the best available scientific evidence when it reduced the scallop fishery harvest during the 2008 summer and fall seasons. However, we found that on October 1, 2008, the Fisheries Survival Fund filed suit against the Secretary of Commerce alleging that the Department of Commerce, NOAA, and NMFS violated an ESA regulation concerning the scope of the Reasonable and Prudent Measures and associated Terms and Conditions presented in the biological opinion, and that these measures were implemented in an arbitrary and capricious manner.[9] Due to the pending litigation, we stopped investigating this allegation.

[9] Fisheries Survival Fund v. Gutierrez (1:08cv01679, D.D.C). See also Oceana v. Gutierrez (1:08cv01881, D.D.C), also related to this issue.

ISSUES FOR NOAA TO ADDRESS

I. A History of Poor Communication and Mistrust in the Northeast Region Colors How Individuals View NOAA's Management of Fisheries

Our examination of the allegations identified weak points in NOAA's interactions with the fishing industry with respect to its Magnuson-Stevens responsibilities. As detailed below, we believe these weaknesses are at the core of several of the allegations.

The Relationship Between the Northeast Groundfish Industry and NMFS Is Characterized by a Lack of Confidence and Trust

We found generally that the northeast region's groundfish industry lacks confidence in the fishery management process. Some interviewees impugned the science, but many more impugned the management decisions made with the science. This is based on a long history of sparring between the groundfish industry and NOAA regulators over limits to the amount of days that fishing vessels can spend at sea, regulating certain types of gear, or closing some traditional fishing grounds to fishing. The challenges inherent to balancing a sustainable fishery with industry's interests, coupled with ineffective efforts to rebuild stocks, have also contributed to this unproductive relationship. In our view, a general lack of confidence and trust in NMFS is at the core of many of the current allegations made about the science. Out of the nine allegations we examined, we concluded that six are the result of ineffective communications and ongoing tension between the groundfish industry and NOAA.

Most interviewees acknowledge that fisheries science is complicated, predictive, and characterized by uncertainty, and one senior NMFS official stated that "best available science," as required by the Magnuson-Stevens Act, does not always mean "good science." Very few interviewees told us that they think NMFS scientists are deceiving fishermen or acting with malice. We heard from many stakeholders external to NOAA, even from several fishermen and external fisheries science researchers, that that Science Center's research is as good as it gets, even world-class, and that the scientists do the best they can with what they know.[10] Scientists we interviewed accept that science is about hypothesis testing—disproving and refuting hypotheses—and acknowledge that fisheries science can and should be continuously improved.

[10] Following the presentation of the GARM III assessments, the New England Fishery Management Council sent two official letters to the Science Center expressing appreciation for the science used in these assessments and citing their "outstanding contributions to the process." See correspondence from Paul Howard, executive director of the New England Fishery Management Council, to Nancy Thompson, science and research director of the Northeast Fisheries Science Center, dated September 8, 2008. See also correspondence from Howard to Thompson, dated October 24, 2008. The letter dated October 24, 2008, acknowledged "recent criticisms concerning the quality of the work" regarding the GARM III process and explicitly recognized the "competence, hard work and high level of integrity" of the Science Center staff. According to NMFS officials, it is not typical for fishery management councils to expressly thank science centers for assessment work in formal correspondence. The fact that the council, comprised of many current and former fishing industry members, expressly praised the Science Center demonstrates a level of confidence in the science, which directly opposes the allegations we were asked to investigate.

Ineffective Communication and Misunderstandings Between NMFS and Industry Erode Trust

In our view, many of the allegations we investigated stem not from questionable scientific methods, but rather from unclear communication and misunderstandings between NMFS and the fishing industry that have the effect of eroding the industry's trust in NMFS. Despite the limitations of stock assessment science, we found that NMFS considered and adequately accounted for competing scientific considerations, and its conclusions drawn from the data were reasonable, even to external scientists. Following are several examples of insufficient communication from NMFS to the groundfish industry, or misunderstandings by the groundfish industry based on incomplete information.

Time Series Allegation Reflects an Inadequate Explanation of a Weakness in NMFS' Data and How NMFS Corrected for It

One of the allegations we were asked to investigate involves whether NOAA was justified in "splitting the time series" of its trawl survey data to correct for a bias in the modeled data. Upon investigation, we found a clear lack of understanding on this issue among members of the industry and the Fishery Management Council.

NOAA Trawl Surveys

NOAA monitors the status of a wide variety of marine finfish and shellfish populations through bottom trawl survey programs.

In conducting the surveys, a trawl net is towed for a specified time at a number of statistically sampled sites. Upon completion of a tow, the net is hauled up and emptied on the deck. The sample is sorted by species, measured and weighed. Data from trawl surveys are used to generate indices of relative abundance so that fisheries managers can monitor population trends. In the northeast region, the indices are used, in conjunction with data from state, Canadian, and a few industry-based surveys, to develop stock assessments and fishery management plans.

The northeast region's autumn bottom trawl surveys began in 1963. These are the source of the longest continuous time series of marine research vessel sampling data in the world. For the finfish survey, about 300 sites are randomly chosen in waters 2 to 200 fathoms deep off the northeast U.S., from the Gulf of Maine to Cape Hatteras. Spring surveys were added in 1968.

Source: NOAA web site

The specific allegation from several members of the industry and the Fishery Management Council is that NMFS arbitrarily chose the year 1994 for the split in time series. As a result, industry felt that the GARM III results made "progress look worse" in rebuilding some groundfish stocks. At the root of the allegation is a very technical statistical problem whose exact cause and solution have not yet been determined by scientists in the U.S. or anywhere in the world.

Generally, stock assessments rely on models that use historical and current survey data ("time series" data) to estimate the stock population. These models are predictive in nature and seek to forecast the stock population under certain levels of fishing mortality. One way to examine the predictive validity of these models is to conduct retrospective analyses to determine the accuracy of a particular model. Researchers look back at the prediction of the model for a particular year and compare it with the historical data actually collected for that year to see if there is bias in the data or the models used to make the predictions that inform fishery management measures. Retrospective patterns, or bias, result when the model produces a consistent over- or underestimation when compared against the historical data. For example, in many of the northeast stocks, scientists have found a retrospective pattern (bias) that results in stock assessment models estimating a higher stock

biomass and a lower fishing mortality than what actually happened according to the historical data. These biases can be due to either bias in the data that goes into the model (e.g., unrecorded landings) or incorrectly specified variables in the model (e.g., assuming a constant natural mortality rate across ages).

Scientists at NMFS have led a working group devoted to researching causes and solutions to this retrospective problem for at least 2 years. The International Council on Exploration of the Seas (ICES), a group of international researchers that includes representatives from NMFS, has been researching this problem for at least 15 years. Though the exact causes of this retrospective pattern bias is yet undetermined, we found no evidence that NMFS is failing to use the best scientific data available. In contrast, we found that NMFS is actively working toward determining a cause and finding a solution to this problem. Several external researchers agreed that splitting the time series was a reasonable alternative to use during the GARM III assessments, given the currently available scientific data. One international scientist noted that in some other countries, time series data are split with less scientific rigor and scrutiny than in the U.S. Splitting the time series allows researchers to produce the best (i.e., least biased) catch advice moving forward. It is an imperfect technical fix to a data problem, akin to rebaselining, but some kind of adjustment was necessary according to many of the researchers with whom we spoke. Also, a 2008 study from ICES supports splitting the time series as a plausible measure for this type of data problem. [11]

Some members of the industry and the Fishery Management Council do not seem to have a clear understanding of why NOAA researchers have split the time series. We heard from a few industry members that splitting the time series would result in fewer fish to catch, but several were not clear about the reasons supporting this. Allegations that NOAA is doing this in an arbitrary way indicate a lack of clear communication by NOAA to industry members. Based on our discussions with NOAA scientists and external, independent scientists, we do not believe the decisions were arbitrary or misguided. We do believe, however, it is NOAA's responsibility to clearly communicate its scientific decisions to constituents, even more so when the science is complex.

With regard to the specific allegation, our discussions with NOAA scientists and several external researchers revealed that two significant events occurred in 1994 that could have led to a change in the fishery and, thus, the data:

1. NMFS changed the way landings data was collected in the United States in an effort to make it more objective and valid. Prior to 1994, landings data was collected via self-reports from vessels; after 1994, vessel trip reports verified by vessel observers and dealer reports were the sources of the data. If self-reported landings had been underreported, the change in methodology could result in an increase in reported landings.

[11] International Council on Exploration of the Seas, 2008. *Report of the Working Group on Methods of Fish Stock Assessments*, 7-16 October 2008,Woods Hole, Massachusetts, USA. ICES CM 2008/RMC, p. 1.

2. NMFS made significant management changes to the fishery in 1994. Amendment 5, for example, put a cap on groundfishery participation and developed measures to reduce fishing effort for the first time.

We found that even though these significant changes to the fishery occurred in 1994, most industry representatives with whom we spoke did not consider the impact of the changes in the management of the fishery, which could have led to a change in the fishery data. This indicates to us that in this instance there was a lack of clear communication between the Science Center and the industry, or unwillingness on behalf of the fishing industry to listen, or both, contributing to the lack of confidence in the science.

Poor Communication by NOAA about the Multispecies Exemption

The "multispecies exemption" to Magnuson-Stevens' requirement to prevent overfishing while achieving optimum yield from each fishery is another area where confusion could be clarified by NOAA. During conversations with members of the fishing industry, as well as with researchers external to NOAA, we heard that NMFS should use this exemption to allow more fishing of the recently abundant haddock stock despite the depleted cod stock. This exemption has never been employed, though the law allows for it under certain circumstances. The law allows one or more stocks to experience overfishing, but not be overfished, only if it can be demonstrated that (1) the action will result in long-term net benefits to the nation; (2) the action would not cause a stock to be driven to a dangerously low level; and (3) analysis showed there were no reasonable alternatives.[12]

Several Fishery Management Council members stated that whenever the possibility of the exemption is raised, the Northeast Regional Office denies its use without any public discussion, or dismisses it by saying it will be considered, but then never revisits it. According to several NMFS senior officials, it would be virtually impossible to show that increased fishing of haddock was in the best long-term interest of the nation, for example, or that there are no other reasonable options. We found no evidence indicating that NMFS has discussed its policy about the multispecies exemption with industry or provided guidance to industry on its possible use. NMFS officials also told us they suspect that people who urge consideration of this exemption do not understand it. Nonetheless, it remains NMFS' responsibility to educate the Fishery Management Council and the industry about this exemption and its very strict guidelines given the evident confusion that surrounds both. We will recommend to NOAA that it should clarify its policy on the multispecies exemption.

Perception that NOAA Sets Conservative Catch Limits

We also heard allegations from several industry representatives that NMFS always sets management measures in a conservative way, ignoring the Magnuson-Stevens Act requirement to obtain optimum yield from the fisheries. From industry representatives, we heard that according to NMFS, Georges Bank yellowtail flounder in 2002-2003 was totally rebuilt and was

[12] Code of Federal Regulations Title 50: Wildlife and Fisheries, Part 600—Magnuson-Stevens Act Provisions, Section 600 Section 310. See also MSA, Section 301.

heralded by the agency as a success.[13] Fishermen caught all their allowable harvest in 2004, but at the end of the fishing year NMFS reported that the stock had "collapsed." To the fisherman, this demonstrated that NMFS' science was unreliable.

We learned, however, that the Science Center in 2002 and 2003 offered the scientific advice to fishery managers that although the stock population was at a good level, other variables did not look as positive. For example, the stock was concentrated in a small area, the age structure was not ideal, and the models were exhibiting early symptoms of the retrospective patterns, or bias, described earlier. These were reasons to use caution when managing the fishery and setting quotas, but catch rates were set by the Fishery Management Council and the Northeast Regional Office to the maximum point in the range recommended by the Science Center. As it turned out, the catch rate was too high and fish were harvested from a smaller population than initially estimated, resulting in the stock's decline. In this example, NMFS management set liberal—not conservative—catch limits, but industry blamed the science for the resulting decline in stock. Industry representatives and state officials described this as "whipsaw" management—going from one extreme to the other in a short time period—which further erodes confidence in the process.

[13] See also Stone, H.H., Gavaris, S., Legault, C.M., Neilson, J.D. and Cadrin, S.X. 2004. "Collapse and recovery of the yellowtail flounder (*Limanda ferruginea*) fishery on Georges Bank." *Journal of Sea Research*, Volume 51, Issues 3-4, May 2004, pp. 261-270.

II. NOAA Has Made Limited Progress in the Northeast Region Improving the Transparency of its Fishery Management Process Since 2004

While NOAA has taken some steps to improve the transparency of its fishery management process, we found several examples of NOAA actions that have contributed to the breakdown in the relationship between NMFS in the Northeast Region and the fishing industry, as it relates to managing fisheries.

NOAA's Poor Handling of a 2008 FOIA Request Contributes to its Reputation in the Northeast Region as an Agency That Is Unconcerned with Transparency

We were asked to investigate concerns related to a FOIA request made by the sea scallop industry. While the act provides for enforcement by the requester, we did review NOAA's compliance with Department of Commerce policy as it relates to the handling of FOIA requests. We found that in this case NOAA did not meet required FOIA deadlines and overestimated the fees associated with the FOIA request. Though we have seen no evidence of a deliberate attempt to conceal information, industry members view such exchanges with NOAA as indications that NOAA is not being transparent and open—characteristics highlighted by the National Research Council as needing improvement in its 2004 report.[14]

We heard from several sea scallop industry representatives that NOAA's mishandling of this FOIA request was frustrating to them, yet not surprising given previous exchanges with the agency. Interactions like this will only serve to further erode the industry's confidence in NOAA. For each interaction with the industry, NOAA would benefit by emphasizing transparency and openness. This allegation is discussed more fully in attachment A, pages 33-35.

Understandable and Straightforward Presentation of Scientific Information by NOAA Is Fundamental to a More Transparent Process

In its 2004 review,[15] the National Research Council recommended to NOAA that "the presentation of scientific information at regional fishery management council meetings should be concise and as free of scientific jargon as possible." This is worth reiterating, given the current lack of confidence in NOAA's science, as articulated by representatives of the groundfish industry. Effective communication between NMFS scientists and stakeholder groups remains challenging. For example, NMFS scientists must be effective spokespeople and have the ability to engage with nonscientific audiences or, at a minimum, the Science Center needs to have staff that can serve in this function. The Science Center must continually improve its ability to communicate scientific results to the Fishery Management Council in a meaningful way. Several

[14] National Research Council, 2004. *Improving the Use of the "Best Scientific Information Available" Standard in Fisheries Management*. NOAA Fisheries asked the National Research Council's Ocean Studies Board to examine the application of the term "best scientific information available" as the basis for fishery conservation and management measures required under National Standard 2 of the Magnuson-Stevens Act. National Standard 2 was under scrutiny as Congress developed legislation for an upcoming reauthorization of the Magnuson-Stevens Act, which occurred in 2006.

[15] National Research Council, 2004. *Improving the Use of the "Best Scientific Information Available" Standard in Fisheries Management*, pp. 2 and 60.

industry representatives told us of their confusion with Science Center explanations of scientific results, which they said further undermines their confidence in the fishery management process.

The Gulf of Maine Research Institute's Marine Resource Education Program is one example of efforts to teach industry members about science, the legal framework, and fisheries management. This program, which consists of a 3-day seminar on fisheries science and a 3-day seminar on the management process, both educates industry members and brings them together with NOAA staff in a nonconfrontational arena. We heard from industry members and researchers that relationships formed during these seminars provide a foundation that continually supports the ongoing interactions between NOAA and the industry during the fisheries management process. According to those with whom we spoke, these relationships help break down barriers and eliminate preconceptions that each party has of the other.

We reviewed materials from a recent session and found agenda items that address many of the concerns and allegations we heard from industry members during this investigation. For example, if more industry members participated in such forums, confidence in fisheries science, understanding of management processes, and relationships with NOAA could improve. However, as the science and modeling procedures become more complex, it will take greater effort to provide the management councils with understandable and straightforward explanations of the procedures and the results. We think this is a particularly important challenge that NOAA faces regarding these allegations.

Table 3:
Gulf of Maine Marine Resource Education Program

Years MREP has been offered:	6
Number of participants:	303
Number of current New England FMC members who have attended:	8
Number of members of other FMCs:	3

Source: Marine Resource Education Program, as of January 1, 2009

In a related issue of transparency, as we investigated the incorporation of environmental influences into stock assessment models, we learned of much research under way at the Science Center in this regard. However, members of the industry we spoke with were largely unaware of these studies.

While the Science Center's initiative to make its research papers available online is commendable, NOAA could take additional steps to make these papers more accessible to the general public. Navigating the Science Center's web site is not very easy or intuitive, and if interested users do not know exactly what to search for, they may not come across the relevant research. We think confidence could be increased if the industry were aware of the quantity of research that has been conducted or is in progress. On this front, we will recommend that NOAA improve the usability of the Science Center web site such that users can search by species or type of research to find relevant articles. We think this would improve the relationship between NOAA and the industry and be another step to improve confidence.

We acknowledge several steps that NMFS' Northeast Regional Office has taken in an attempt to improve communication and be more transparent. These include providing information to the publication *Commercial Fisheries News*, producing publications and informational guides on regulations, creating public meeting space in the design of the new NOAA building in

Gloucester for fishers to meet with NMFS staff, and working to get the Days at Sea system online so that fishermen can check their days-at-sea balance on the Internet. However, the Northeast Regional Office web site—a critical communications tool—was not functioning during the majority of our 4-month investigation. This does not contribute to a public image of openness and transparency.

Increased Industry Involvement in Research Efforts Builds Confidence with NMFS

We heard from several NOAA officials, Fishery Management Council members, and industry representatives that involving fisherman in research is an excellent way to increase confidence in NOAA research. Collaboration between NMFS and the sea scallop, surf clam/quahog, and monkfish industries was offered as positive examples of cooperative research. While the groundfish industry already collaborates with several universities and states, it desires more than the current level of participation in NMFS research, and urges consideration and use of industry data in NMFS stock assessments. We heard from several stakeholders that when funding levels for cooperative research were higher for the northeastern groundfish industry, relationships between NOAA and the industry were noticeably better than they are now.

Cooperative Research Partners Program (CRPP)

"In FY 1999, the Northeast Regional Office of the National Marine Fisheries Service (NMFS) developed the Cooperative Research Partners Program (CRPP) … to formalize and expand collaborative research among New England's commercial fishing industry, marine science and fishery management communities. The goal of this initiative is to enhance the data upon which fishery management decisions are made as well as to facilitate communication and collaboration among New England commercial fishermen, scientists, and fishery managers. Through this initiative, CRPP partners are collaborating with the New England Fishery Management Council in setting research priorities to meet management and fishing industry needs."

Funding for cooperative research in this region has fluctuated since 2000, with a high of $9.8 million in 2002 and a low of $3.2 million in 2005. Funding for 2008 was $4.2 million

Source: http://www.nero.noaa.gov/StateFedOff/coopresearch/crpp.html; NEFSC data.

The GARM III assessments made use of several sources of industry- and state-based data collections. The Maine-New Hampshire inshore groundfish survey, which began in 2000 and has over 5 years of data, is a good example of state and industry cooperation on research that influences NMFS science. The Massachusetts survey was also considered for several stocks in the GARM III assessments, including Gulf of Maine cod and Cape Cod/Gulf of Maine yellowtail flounder.[16] The GARM III reports provide indications of how industry-based surveys are being used successfully and recommendations for using these surveys in the future:

- Industry-based surveys are "generally set up to address issues that may not be answered well by traditional, long-running scientific surveys."[17]

[16] Northeast Fisheries Science Center, 2008. *Assessment of 19 Northeast Groundfish Stocks through 2007: Report of the 3rd Groundfish Assessment Review Meeting (GARM III)*, Northeast Fisheries Science Center, Woods Hole, Massachusetts, August 4-8, 2008, pp. 236, 268.
[17] Northeast Fisheries Science Center, 2008. *Appendix to the Report of the 3rd Groundfish Assessment Review Meeting (GARM III): Assessment of 19 Northeast Groundfish Stocks through 2007*, Northeast Fisheries Science Cent Ref Doc. 08-16; p. 882.

- Industry-based surveys "are exceptional at providing . . . fish distributions, spawning areas, age-length keys, maturity and maturation rates and other biological characteristics on a finer scale (in many cases) than that provided by more general NMFS surveys. The review panel encourages the further development of these surveys and considers further studies on their applicability to be valuable."[18]

Based on our work, we believe that additional cooperative research involving the groundfish industry could assist NOAA with biological data (including size, composition, age, weight and stomach content data), ecological data, and habitat research. Additionally, involving the industry in calibrating the new NMFS research vessel might be a way of increasing the industry's confidence in its findings.

Side-by-side research survey trawls—with an industry vessel trawling next to the NOAA vessel—were advocated by many members of the industry and some in the academic community. There is a widely held perception by fishermen that NOAA's survey trawl does not catch as many fish as industry does, so industry has little trust in it. Memories of "Trawlgate" in 2002—when the Science Center publically admitted it made calibration errors in its research survey vessel—exacerbate this concern. In that case, acting on the advice of industry members, NOAA inspected the trawl cables on the NOAA Ship Albatross IV's sampling equipment and found that the cable attaching scientific survey gear to the vessel was inaccurately calibrated. That meant that the vessel could be dragging its nets through the water lopsided, catching fewer fish, and leading scientists to conclude there were fewer fish in the sea. NOAA ultimately took measures to remedy the errors that occurred on the vessel and worked to make the survey data comparable to those of previous surveys. Nevertheless, this increased suspicion among the groundfish industry.

Inherent Conflict Between Scientific Surveys and Commercial Fishing

"There is always disagreement between fishermen and government scientists... Imagine an overfished area of the sea in the shape of a hockey field with nets at either end. The few fish left therein would gather around the goals because fish like structured habitat. Scientists would survey the entire field, make lots of unsuccessful hauls, and conclude that it contains few fish. The fishermen would make a beeline to the goals, catch the fish around them, and say the scientists do not know what they are talking about. The subjective impression the fishermen get is always that there's lots of fish - because they only go to places that still have them... fisheries scientists survey and compare entire areas, not only the productive fishing spots."
- *Fisheries scientist Daniel Pauly*

Source:
http://www.seaaroundus.org/magazines/2008/FishermanLife_AnInterviewWithDanielPauly.pdf

We did hear a counterargument from researchers both internal and external to NOAA that industry-based surveys do not have the same standards of scientific rigor as NOAA trawl surveys. One reason provided was that members of the industry often have the goal of maximizing their catch while at sea, even while doing research, which affects the comparability of these surveys to NOAA's. Industry-based surveys are also less likely to employ random sampling techniques (as required by statistical modeling for sample surveys) and more likely to fish in areas where they know there are fish (identified by their on-board technology, knowledge

[18] Ibid., p 889.

of where fish can usually be found, or through contact with other fishing boats in the area). Nonetheless, side-by-side trawls could be used to test the validity of the NOAA surveys and thus improve confidence and relationships with the fishing industry.

When examining the issue of rebuilt haddock and depleted cod, we learned of cooperative research with the industry to design separator trawls that work on the basis of differing behaviors between the species upon encountering a trawl. This type of cooperative research is a positive step forward, and we recommend that NOAA continue these types of ventures that can lead to increased participation of the industry in management measures. This has been successful in the scallop fishery where the industry has participated in gear innovations that have allowed this fishery to again become productive and lucrative.

Finally, a community-supported fishery developed by the fishermen's cooperative exists in Port Clyde, Maine. The fishery is modeled after the community-supported agriculture concept. Community-supported fishery members pay for shares at the beginning of the season and pick up their shares of locally caught fresh seafood (including groundfish) each week. Fishermen commit to not catching juveniles and to taking measures beyond those required to ensure sustainable fishing practices. According to the program director, this program gives both fishermen and community members a sense that they are participating in the recovery of the fishery. We think that NMFS, in the northeast specifically, should encourage this type of creative effort, and publically provide positive feedback for industry members who are working toward a sustainable, profitable fishery. Such recognition could be modeled after the national NOAA Sustainable Fisheries Leadership Awards, but focused specifically on the struggling northeastern groundfishery.[19]

[19]The Sustainable Fisheries Leadership Awards were created to recognize outstanding performance, achievements, and leadership by industries, organizations, and individuals whose contributions to science and management have promoted best stewardship practices for the sustained use of the nation's living marine resources. The Sustainable Fisheries Leadership Awards were initiated in June 2005. See http://www.nmfs.noaa.gov/awards/index.htm for details on the NOAA Sustainable Fisheries Leadership Awards.

III. Several Issues Reinforce the Need for NOAA to More Aggressively Pursue Ecosystem Approaches to Fisheries Management, Which Require Additional Data and New Models

While examining the allegations regarding yellowtail flounder and haddock, we encountered several issues that demonstrate the need for NOAA to more aggressively pursue ecosystem approaches to fisheries management. For a more detailed discussion about the yellowtail flounder and haddock allegations, see attachment A, pages 29-31.

Stock Assessments and the Ecosystem – Not Quite There Yet

Three tiers of stock assessments exist. The first and most basic assessment is the single-stock assessment. The next level is a multispecies assessment that examines how species interaction affects growth and mortality. The top tier is an ecosystem assessment that would include single and multispecies effects as well as environmental factors. At each stage, the goal is to forecast relative stock populations based on current data. NOAA scientists have been and are currently working within the first tier of single stock assessments, but are working toward multispecies and ecosystem approaches. Using data currently available, during the GARM III assessment, the Science Center conducted an ecosystem assessment and determined that the biomass management targets used in the GARM were reasonable.

Although scientists are admittedly not to a point where they can build predictive ecosystem models, they have been able to note signals and symptoms of ecosystem changes in the current single stock assessments.

Sources: GARM III Report and Appendices

NOAA Scientists Are Beginning to Investigate the Impact of Ecosystem Changes on Stock Assessments

We learned that the Science Center has made some advances in conducting ecosystem impact studies, but most current stock assessments do not produce data detailing those impacts. Most people we interviewed, from NOAA, the Fishery Management Council and the fishing industry, were anxiously awaiting more research on ecosystem effects, but we heard from NOAA and external researchers that ecosystem models are not currently used to predict trends in stocks. Several scientists mentioned that ecosystem models require more data then can currently be collected with current funding levels, and that the newly developed ecosystem models are still unproven.[20]

Senior management at the Science Center agreed that it is "absolutely important" to look at environmental impacts on stocks, and noted that the Science Center has been collecting some environmental/ecosystem data since the 1960s (for example, salinity, PH levels, temperatures). In August 2008, the Science Center created an Ecosystem Assessment Program with the goal of having a "core capacity" to conduct ecosystem research. This is an important organizational step that should help focus the Science Center to more aggressively plan, coordinate, conduct, and review research that can inform ecosystem management decisions for fisheries.

In the most recent groundfish stock assessments, NOAA took another step forward and used terms of reference focused on ecosystem factors. In response to this, 12 working papers were presented regarding ecosystem data at the GARM III meetings.[21] These papers indicate that

[20] The fisheries management plan for sardines developed by NMFS' Pacific Fishery Management Council was cited by one NOAA official as a best practice for how to incorporate ecosystem effects into stock assessment models. This could be used as a general model of how to move forward in the northeast.

[21] Northeast Fisheries Science Center, 2008. A*ppendix to the Report of the 3rd Groundfish Assessment Review Meeting (GARM III)*, see pp. 862-869 and 975.

environmental or ecological changes can be taken into account during single stock assessments without a full ecosystem model, and that several factors that can be observed in the fish population are suspected to have bases in ecosystem changes. For example, in the yellowtail flounder assessment, scientists decided to focus on data from the most recent decade because of changes observed in the stock during the last few decades. This resulted in a lower target stock biomass because of the realization that the stock is growing more slowly than in the past. The scientists report they are still testing hypotheses to find out why this is happening, but environmental or ecological changes could have been an influence. This is a promising example of NOAA's advancement in pursuing ecosystem approaches to fisheries management,[22] but more needs to be done.

NOAA fisheries scientists and other researchers also told us that they strive to better understand how ecosystems affect, and are affected by, human activities and management action. We also learned that more understanding about human and environmental impacts on the marine environment is needed to further develop NOAA researchers' understanding of the physical, chemical and biological processes in marine ecosystems, and their interrelationships with human activity. During our interviews, scientists told us that the impacts on fisheries of contaminants from the mainland that end up in the seas, such as pollutants, medical waste, or agricultural fertilizers, remain largely unknown.

NOAA Lacks Research on Interactions within Ecosystems

We heard from many NOAA and external researchers that it is difficult to study groups of organisms that occupy complex systems, such as the marine ecosystems relevant to the allegations we were asked to examine related to sea scallops and groundfish. The scientists we interviewed agreed that most fisheries research still focuses on only one or two species at a time, out of the dozens or hundreds that might occupy a typical habitat. Fisheries researchers with whom we spoke also acknowledged that although the fate of each fish stock is determined by the actions of other species that occupy the same habitat, scientists are still unable to adequately describe the interactions between species in underwater habitats, and do not have enough data about these interactions.

During our review, the question was often raised by industry members as to how much NMFS knows about stocks' competition for space and resources on the ocean bottom. NMFS researchers confirmed to us that while single species stock assessments are the norm, NOAA is slowly moving toward more ecosystem-based assessments. Some NMFS researchers acknowledged that ecosystem carrying capacity—the capacity of an ecosystem to support healthy organisms while maintaining its productivity, adaptability, and capability for renewal—is not taken into account in most stock assessments, mostly due to a lack of data on these interactions. So while we heard from fisherman that as cod has declined over the past few

[22] As an example of modest progress in this arena, in 2008 an attorney from NOAA's General Counsel presented, to new fishery management council members, several provisions in the Magnuson-Stevens Act, including National Standard 2 (best available science), identified as contemplating a role for the consideration of climate-change related impacts on fishery management decision-making.

decades, dogfish and skates have filled that ecological niche, this is an intuitive effect not yet verified by research.

Nevertheless, many in the industry and on the Fishery Management Council noted that it is not realistic to build every stock to sustainable biomass levels simultaneously. Likewise, several researchers who participated in GARM III acknowledged that not all species could be maintained at historically high biomass levels, and the new assessments have lowered target biomass levels for several species. New data, which reflects the new best available science, substantiates this.

Additionally, several scientists emphasized that climate research is required to understand and predict the effects of climate change on species, ecosystems, and humans. We believe that NOAA scientists should more aggressively pursue studies of the response of fish populations to climate change and changes in ocean circulation, and work with their partners to develop models that can predict climate effects on fisheries.[23] Speaking with NOAA scientists, officials, and attorneys, we note the incorporation of ecosystem factors, including possible impacts from climate change, into stock assessments as a "work in progress."[24] We will recommend to NOAA that it should more aggressively pursue ecosystem approaches to fisheries management, which will require additional data, new models, and analysis.

Conclusion

Our investigation of the allegations concerning the groundfish industry found an underlying lack of confidence in NOAA among industry members in this region that continues to erode confidence in NOAA's fishery management and science. This finding is reminiscent of a conclusion from a 1998 National Research Council review of the Northeast Fishery Stock Assessments: "stock assessment science is not the real source of contention in the management of New England Groundfish fisheries … the social and economic concerns created by strong management measures and lack of participation in the management process were the more important concerns."[25]

The history of contention between the groundfish industry and NOAA in the northeast, where industry is suspicious of the science and views NOAA as biased in favor of conservation goals, provides the backdrop for the decisions made by NOAA that impact the groundfish industry. Out of the nine allegations we examined, six appear to be the result of ineffective communications and ongoing tension between the groundfish industry and NOAA. The challenges inherent in

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[23] As we began to investigate the allegation related to interactions between sea turtles and sea scallop gear, we learned that NOAA has limited data on sea turtles in the northeast. Several researchers and fishermen noted that the appearance of sea turtles in the northeast was a relatively new phenomenon, perhaps a result of warming oceans. We found no data to support or refute these claims.

[24] See GAO-07-863, *Agencies Should Develop Guidance for Addressing the Effects on Federal Land and Water Resources*, an August 2007 report to congressional requesters that found that federal resource managers, including at NOAA, face challenges in addressing the observed and potential effects of climate change in management and planning efforts. GAO recommended the Secretaries of Agriculture, Commerce, and the Interior develop guidance incorporating agencies' best practices that advises managers how to address climate change effects. Though the report focused on land management rather than living resources management, it is instructive of the need for agencies generally to develop policies for taking climate change into account.

[25] National Research Council,1998b. *Review of Northeast Fishery Stock Assessments*, p. 7.

balancing a sustainable fishery with industry's interests, coupled with limited success in rebuilding stocks, have contributed to this unproductive relationship.

Our findings show that the pervasive lack of trust and confidence the groundfish industry has in NOAA manifests itself as doubt in the science. And our investigation ultimately turned its focus on what NOAA is doing and can do to improve its relationship with the groundfish industry. Without an improved relationship, we believe the science will continue to be questioned.

If you have any questions, or if we can be of further assistance, please do not hesitate to contact me at (202) 482-4661.

We have sent identical letters to Senator John Kerry, Senator Olympia Snowe, and Senator Susan Collins.

Sincerely,

Todd J. Zinser
Inspector General

cc. Otto Wolff, Chief Financial Officer and Assistant Secretary for Administration
Dr. James W. Balsiger, Acting Assistant Administrator for Fisheries

Attachment A

Details Regarding the Specific Allegations and/or Concerns

This section outlines each allegation we investigated in detail, starting with the basis for the concern, and then describes our findings.

1) *The GARM III report incorrectly used the single fall survey biomass index from 2007 as a basis for determining whether the pollock stock is overfished.*

An overfished determination would necessitate a rebuilding plan under the Magnuson-Stevens Act, thereby restricting the amount of pollock that fishermen are allowed to catch. We confirmed that the GARM III report incorrectly used the single fall survey biomass index from 2007 as the basis for determining that the pollock stock was overfished. The explanation given by Science Center officials and scientists was that the single value point was mistakenly inserted into the report a rush to finalize the GARM III process.

NMFS officials stated that to be consistent with prior approaches used by the New England Fishery Management Council's Plan Development Team, the appropriate method for determining the 2007 stock status is to take the average of recent fall survey biomass indices. There are several ways to compute the average (e.g., lagged versus centered; latest 3 years versus latest 2 years) and different formulas for the average lead to different conclusions about whether the stock is overfished. According to the Science Center's lead pollock researcher, it was determined that for the 2007 index a centered approach (average of data from 3 years including, prior year, index year, and current year—in this case the average of data for 2006-2008) should be used. However, this was not possible since the 2008 fall trawl survey had not been completed in time for the last GARM III meeting in August 2008.

Therefore, the GARM III participants agreed to use a lagged approach (average of index year plus previous years). According to Science Center officials, there were two alternatives for computing the lagged average biomass index:

1. a 2-year lagged approach (using data from 2006-2007), or

2. a 3-year lagged approach (using data from 2005-2007).

Each of these formulas leads to different conclusions about whether the stock is overfished (see figure 5). The choice of which formula to use is especially important because the value from 2005 was the highest in 25 years. Given the signs in the recent fall survey indices and in the annual landings that indicated the average biomass of the stock would decline to a level approaching overfished and that the threshold would be breached within 2 years, the

Figure 5.

$B_{THRESHOLD}$ = 1.0 Kg/tow
(Anything below this number indicates the stock is overfished)

2-year Lagged Average = 0.856 Kg/tow
(2006-2007) ***Overfished***

3-year Lagged Average = 1.42 Kg/tow
(2005-2007) ***Not Overfished***

Source: Northeast Fisheries Science Center

GARM III participants chose the 2-year lagged approach.

However, the number reflected in the GARM III report was the single 2007 data point—not the lagged average. Regardless, both conclusions showed that the pollock stock was overfished. After the New England Fishery Management Council notified NMFS of the error in using the 2007 number to make the overfished determination and its concerns about the exclusion of the 2005 data point in the lagged approach, NMFS officials determined that the "… high sensitivity to the inclusion of a particular data point suggests that it is uncertain whether the stock is currently overfished." As a result and until the 2008 fall survey index could be calculated, NMFS revised its findings to include the 3-year lagged average and notified the New England Fishery Management Council in October 2008 that the status determination for pollock stock has been changed to "*approaching* an overfished condition and overfishing is occurring."

Retrospective Patterns in Data

Generally, stock assessments rely on a model that uses historical and current survey data (i.e., time series data) to estimate a stock's population. These models seek to predict what the stock population will be under certain levels of mortality due to fishing. One way to examine the predictive validity of these models is to conduct retrospective analyses that investigate how accurate a particular model is using historical data to "predict" historical trends. By comparing the prediction to the actual historical data, scientists can see if there is bias in the data they are using to make predictions and management measures. Retrospective pattern bias results when the model produces a consistent over- or underestimation based on a comparison to the historical data. For example, a biased retrospective pattern occurs when a stock assessment model estimates a higher stock biomass and a lower fishing mortality than what actually happened according to the historical data. Attachment D provides a demonstration of retrospective pattern analysis.

These biases can be due to either bias in the data that goes into the model (e.g., unrecorded landings) or incorrectly specifying the variables for a model (e.g., assuming a constant natural mortality rate across ages).

The consequences of failing to correct a predictive model that has these biases could be to consistently overestimate the stock population and/or underestimate fishing mortality, and thus continually decrease stock size rather than allowing it to rebuild.

***Source:* National Research Council, 1998. *Improving Fish Stock Assessments*, National Academy Press, Washington, DC.**

Subsequently, in January 2009, NMFS notified the council that based on the 2008 fall survey index, the 3-year centered average for pollock is below the biomass threshold and, therefore, that the species is overfished. In addition, overfishing is occurring for this species. A letter highlighting this finding was sent to the New England Fishery Management Council on February 6, 2009. The Council must develop a rebuilding program for this species within 1 year of notice of overfished status. The Council intends to include a rebuilding program for pollock in Amendment 16 to the NE Multispecies FMP, which is currently being developed by the Council for implementation in May 2010.

Based on our work, the error related to pollock does not appear to stem from bias or lack of best science on the part of NOAA, but from the rush to conduct 19 benchmark stock assessments at the same time. However, this mistake had a much more harmful impact by providing the groundfish industry with an example where the industry thought NMFS was leaning toward conservation over allowing maximum optimal yield. This reinforces the mistrust the industry has for NMFS—with industry suggesting that NMFS "cherry picks" the data to enforce conservation measures.

We found no evidence to support this contention on the part of NMFS, but note that it is an area of serious concern for the industry.

2) *The 2008 joint assessment of Georges Bank cod by researchers from Canada and the U.S. estimated higher biomass levels than did NMFS' 2008 GARM III assessment of the same stock.*

This allegation involved two assessments of the Georges Bank cod – one from a joint U.S./Canada group—the Transboundary Resources Assessment Committee (TRAC),[26] which assessed the eastern portion of the stock, and one from the GARM III, which assessed the entire Georges Bank cod stock. The U.S./Canada assessment found, proportionally, a much higher biomass than the GARM III assessment. The fact that the GARM III assessment estimated a smaller stock would mean that fishermen in the U.S. could catch proportionally fewer fish than Canadian fishermen.

When TRAC was initially formed in 1998 the goal was to ensure consistency in methodology and data used to assess the U.S. and Canada stocks that share Georges Bank and Gulf of Maine, particularly for cod, haddock, and yellowtail flounder. Therefore, since its inception, TRAC had assessed both the eastern portion of Georges Bank cod and haddock stocks (both of which are fished by Canada as well as the U.S.) and the entire Georges Bank cod and haddock stocks. When the GARM process was initiated, the entire Georges Bank cod and haddock stock assessments fell under its purview rather than TRAC. The TRAC assessment is still conducted on the eastern portion of the stock (i.e., the portion shared between the U.S. and Canada) to allocate proportions of stock to each country, but TRAC could not assess the entire stock under requirements for the GARM III assessment. This opened the door for potential inconsistencies between the two groups tasked with assessing portions of the same stock.

The 2008 TRAC assessment was Canada's update of a 2002 benchmark assessment of the eastern portion of Georges Bank cod. The 2008 GARM was a benchmark assessment of the entire Georges Bank stock, led by NMFS researchers. We learned that both assessments are based on the same data but they used different predictive models, which resulted in the difference in estimates that form the basis of this allegation. Specifically, in 2002, the TRAC benchmark assessment chose a model that differed from previously used models to correct for a newly identified retrospective pattern, or bias, in the data. Using input from a peer review panel, TRAC chose a particular model formulation that NMFS scientists did not agree with based on their own simulation.

At the 2008 GARM III benchmark assessment, a NMFS researcher presented three models for examination to address the retrospective patterns in data:

1. Base model (which had been used in prior assessments),
2. Split model (splitting the time series),

[26] TRAC is the scientific arm of the Transboundary Management Guidance Committee, a government—industry committee comprised of representatives from Canada and the United States. TRAC reviews stock assessments and projections necessary to support management activities for shared resources across the U.S.-Canada boundary in the Gulf of Maine-Georges Bank region.

3. TRAC model (primarily as a comparison, as it was not deemed appropriate by Science Center researchers).

The GARM panel chose to use the split model because it demonstrated less bias in retrospective analysis.[27] Again, NMFS scientists were not satisfied with how the TRAC model performed—it was presented at the GARM III meeting only as an indication of how the chosen assessment model would differ from that of the TRAC. Even TRAC scientists reported that they were not satisfied with how the model had performed in the most recent update assessment and called for a new benchmark assessment, which will begin early in 2009. This assessment will address the question of how to correct for retrospective patterns in data, including model selection. According to TRAC researchers, the split model the GARM III used is a "prime candidate" for the upcoming TRAC benchmark. Even if this model is not chosen, it is worth noting that the several international researchers with whom we spoke did not think that NMFS' choice of models was either irrational or unsupported by the data.

The U.S./Canada TRAC and GARM III assessments were conducted at approximately the same time, yet ended up with vastly different results. One can easily understand why this is of concern to the industry—it seems as though the joint TRAC assessment "found more fish" than the U.S. GARM III assessment—again appearing to support the allegation that NMFS "cherry picks" data to support conservation. Yet upon careful consideration of this allegation and discussion with scientists both internal and external to NOAA, including from Canada, we believe that NMFS has considered other competing models, adequately articulated plausible distinctions, used intelligible standards, and made readings of the data that were reasonable. We do not believe that NMFS is basing its determination on anything but what it has determined to be the best available science. The benchmark GARM III assessment used a different predictive model than the joint U.S./Canada TRAC assessment (whose benchmark was 6 years old at this point). The new GARM III benchmark led to different estimates than the old TRAC benchmark assessment, which is due for benchmarking again early next year.

We do want to point out that when the stocks were being jointly assessed by TRAC alone (which did include U.S. scientists and peer reviewers), there was less risk of using discrepant models and producing discrepant results. Moving the entire Georges Bank cod assessment into the GARM III and assessing it as a whole instead of as a separate benchmarking for the eastern portion opened the door for possible inconsistencies – which will continue to erode the industry's confidence in the science.

3) "*The GARM [made] progress look worse by splitting the trawl survey time series" and "somewhat arbitrary decisions were made … looking at all NMFS data prior to 1994 through one lens, and all data after 1994 through a different lens in order to make the outcomes of the stock assessment models arrive at conclusions that were expected by scientists in their previous biomass estimates.* [28]

[27] Northeast Fisheries Science Center, 2008. *Assessment of 19 Northeast Groundfish Stocks through 2007*, pp. 2-11.
[28] September 10, 2008, correspondence from Senate committee staffers detailing allegations.

The basis for the allegation is the accusation that splitting the time series resulted in unnecessarily low catch limits for fishermen. We earlier described this particular allegation as it relates to the lack of clear communication and understanding between the Science Center and the Fishery Management Council and groundfish industry (see pages 9-13). Here we discuss in greater detail what we learned about this allegation.

The GARM III assessment report notes that "almost all the assessments of the GARM III stocks considered at the current review exhibited a pattern with an over-estimation of SSB [spawning stock biomass] and an under-estimation of fishing mortality (F) in the last, current, year of the analysis. . . Of the 14 GARM III stocks that were assessed using an age-based assessment model, seven of these had retrospective patterns severe enough that an adjustment was deemed necessary."[29] This means that, upon examining historical data using the current predictive models, the models have in the past overestimated and can be expected to continue to overestimate the stock population and underestimate the fishing mortality rate. Not correcting these assessments at all would ultimately lead to erroneously high catch limits and a decrease in stock size. The GARM III panels used two types of adjustments, or corrections, for the retrospective pattern problem. The one most relevant to our inquiry is splitting the time series, which was used in five of these stock assessments.[30]

We learned that when estimating population sizes from survey and catch data, it is important to understand the relationship between the survey observations and estimated population sizes. This relationship, called *catchability*, is typically assumed to be linear and unchanging over time. At some point, the assumption of constant catchability may no longer be valid because of changes in the fishery, biology, or data collection, for example,

1. changes in accuracy of reported landings could appear to increase the catchability of fish within the surveys;
2. changes in the natural mortality rate of the fish that are not accounted for in the model could appear to increase the catchability of fish within the surveys; and
3. management measures or environmental changes could change the distribution of fish causing a change in the catchability of fish within the surveys.

The time series split for the five stocks occurred around the years 1994 or 1995, as a result of statistical analyses showing "something changed" in the data during this time frame, and it corresponds with two important changes in the fishing industry:

1. NMFS changed the way it collected data in the United States. Prior to 1994, vessels self-reported landings data; after 1994, this data came from reports filed by vessel trip observers and fish dealers in an effort to improve data validity.

[29] Northeast Fisheries Science Center, 2008. *Assessment of 19 Northeast Groundfish Stocks through 2007*, pp. 2-11.
[30] Based on interviews with participants in GARM III, we learned that a "Rho adjustment" was used in two other stock assessments because the split in time series was ineffective at controlling the retrospective pattern bias. The GARM report expresses a clear preference for the split in time series over the Rho adjustment because the latter complicates the calculations of stock projections.

2. NMFS made significant management changes to the fishery in 1994. Amendment 5, for example, put a cap on groundfishery participation and developed measures to reduce fishing effort for the first time.

Both of these factors could have impacted estimates of landings, and both could have affected the stock biomass, which could have differentially affected survey estimates before and after the change to the fishery.

Science Center scientists admit they do not know exactly why the retrospective patterns are appearing, but because they are appearing and because they indicate a bias in the resulting projections, scientists want to inform managers of the expected effects of the bias. One way scientists do this is by splitting the time series. This conveys an explicit, public recognition that since 1994 there is a problem when historical data is compared to projections from the models. NOAA researchers think that the change could have resulted from (1) a change in natural mortality rate; (2) unrecorded landings; (3) unobserved discards (fish caught in nets, for example, that are not the intended catch); and/or (4) mobility of the species. Though the cause has not been determined, scientists at the Science Center believe that splitting the time series is one way to inform managers of the change. Because scientists cannot determine a specific cause for the change, however, and the variable for "catchability" is the one affected by this split in time series, several industry representatives told us that this contributes to their lack of confidence in the science, generally.

In October 2008, the International Council on Exploration of the Seas evaluated the effect of splitting the survey time series even if the true source of the change in the stock was not catchability, the variable that is assumed to change in this model, but rather a change in reported catch or natural mortality. The council found that splitting survey series produced better management advice than not splitting it. This finding demonstrates that splitting the time series is both reasonable and desirable in the absence of any further scientific evidence for explaining the cause of the problem.[31]

During interviews, we heard from several industry and Fishery Management Council members that the Science Center is not looking into the retrospective pattern problem. To the contrary, we found that the Science Center has spent considerable time researching retrospective patterns and alternative ways to correct for them. Science Center researchers report that they have studied the topic at some length in a working group for the past two years.[32] They also note participating in the ICES Working Group on Methods of Fish Stock Assessments, which has been examining the problem of retrospective patterns since 1991.[33] And contrary to allegations we heard, the retrospective pattern is not restricted to models used in the Northeastern U.S.—it is a problem seen all over the world, hence the international working group.[34]

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[31] International Council on Exploration of the Seas, 2008. R*eport of the Working Group on Methods of Fish Stock Assessments*, p. 1.
[32] See Working Paper 4.1: Legault C et al. 2008. *Report of the Retrospective Working Group* (referenced in Northeast Fisheries Science Center, 2008. *Appendix to the Report of the 3rd Groundfish Assessment Review Meeting (GARM III)*: p. 929).
[33] Ibid.
[34] ICES, 2008. *Report of the Working Group on Methods of Fish Stock Assessments*.

An international researcher told us that the U.S. more carefully and methodologically examines splitting the time series before actually making the split than do other countries. There are other models used throughout the world to correct for this pattern, but according to the international researchers with whom we spoke, there is no known "best" model, and circumstances of the particular fishery often inform model selection. In the GARM III assessment, other models were considered to correct the biased retrospective pattern without splitting the time series. However, the peer-reviewed GARM assessments chose the split option for the stocks for which it corrected the retrospective pattern.

At the root of this allegation is a very technical statistical problem concerning retrospective bias that as of yet has no statistical solution. Though the exact causes of this bias in the data—the retrospective pattern—remain unknown, NMFS is actively working toward finding a solution to the problem. In the interim splitting the time series was the best alternative. We found no evidence that NMFS is failing to use the best scientific data available. We believe the underlying problem here, again, is the industry's lack of confidence in NMFS' motives. These topics—retrospective patterns, time series splits, and the statistical models under discussion—are highly complex. As more is learned, more complex models can be built that better explain the conditions at work and better predict their impact on stock levels. As the models become more complex, they become even more difficult for the layperson to understand. The burden will continue to fall on NOAA to improve its ability to communicate these matters to the Fishery Management Council and the industry.

4) *The failure to rebuild yellowtail flounder is not the result of fishing mortality but is due to global warming and other environmental factors. Warming waters are prompting the southern stock of yellowtail flounder to move north.*

Yellowtail flounder in this region has been struggling for many years and shows little or no signs of rebuilding, especially in the southernmost stock. Behind this allegation is the hypothesis that biomass targets should not be set according to historical expectations, but should be lowered because of climate change. Lower targets would be easier to reach and might allow the industry to fish more.

We investigated two aspects of this allegation. First, was warming coastal waters incorporated into GARM III? And second, how do NOAA scientists investigate the impact of ecosystem changes on stock assessments?

Was the warming of coastal waters incorporated into the GARM III assessment of the yellowtail flounder stocks?

Several members of the groundfish industry and some Fishery Management Council members told us they believe the yellowtail flounder now live in deeper waters than previously. They suspect the fish have moved to deeper waters to escape warming waters and to follow their food source, which is also migrating because of warming water. According to NOAA researchers, however, no data exists to support these contentions. NOAA scientists acknowledge and agree that the southern stock of yellowtail flounder is in very poor condition, but science does not

support the hypothesis that this is due to climate change as evidenced by water temperature change or northern migration of the stocks.

We found that NOAA researchers have investigated migration patterns of yellowtail flounder stocks and have not found evidence of their moving northward.[35] We also heard from several researchers that yellowtail flounder is not a coastal species, but lives offshore, where waters show a warming trend in the summer and a cooling trend in the winter.[36] Researchers believe the winter's cold water trends improve the condition of the stock and may have led to recent, noticeable improvements.[37] Where the stock has been suffering most, in the Southern New England/Mid-Atlantic, NOAA scientists report that water temperature is no different than in Georges Bank, where the stock has been doing better.[38] NOAA researchers have investigated possible effects of changing water temperature, but have seen no links to changes in the stock productivity. Therefore, this variable has not been incorporated into the models.[39] These issues were discussed and documented at the recent GARM III.[40]

See pages 19-21 for additional discussion of the second aspect of this allegation related to how NOAA scientists investigate the impact of ecosystem changes on stock assessments.

5) *NMFS consistently sets conservative catch limits, ignoring the MSA requirement to obtain optimum yield.*

This allegation and the next involve a recent success story and the associated tension that even success brings in this environment of harsh criticism. Haddock is one of the few stocks in the northeastern groundfishery that has been rebuilt ahead of schedule. The problem is that haddock live and are caught with cod, a stock that is still in a severely declined state. Theoretically, haddock could be caught at much higher levels, but because cod is a very common bycatch when fishing for haddock, as much as 90 percent of the available catch of haddock is allegedly left in the ocean. This allegation speaks to the frustration of U.S. fisherman leaving up to 90 percent of the total allowable catch of rebuilt haddock stocks in the ocean in 2008. The question we investigated is: if haddock is already rebuilt, why it must remain part of the multispecies complex?

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[35] See Working Papers C5, C6, C7 and C8 in Northeast Fisheries Science Center. 2008. *Appendix to the Report of the 3rd Groundfish Assessment Review Meeting (GARM III)*, pp. 853-855.

[36] Friedland, K.D. and J.A. Hare, 2007. Long-term trends and regime shifts in sea surface temperature on the continental shelf of the northeast United States. *Continental Shelf Research*. 27: 2313-2328. Specifically, see figure 12.

[37] See Sissenwine, M.P. 1974. Variability in recruitment and equilibrium catch of the Southern New England yellowtail flounder fishery. *J. Cons. Int. Explor*. Mer. 36:15–26. However, a more recent study has cast some doubt on this relatively simplistic relationship. (Sullivan M.C., R.K. Cowen, and B.P. Steves. 2005. Evidence for atmosphere-ocean forcing of yellowtail flounder [Limanda ferruginea] recruitment in the Middle Atlantic Bight. *Fisheries Oceanography*. 14:386-399.) According to NMFS researchers, this is one of the major difficulties when trying to include environmental variables, simple relationships often do not stand the test of time because the fish are living in a highly complex environment with multiple interacting factors.

[38] See Friedland, K.D. and J.A. Hare, 2007. Long-term trends and regime shifts in sea surface temperature on the continental shelf of the northeast United States. Specifically, see figures 9 and 10.

[39] See Sullivan M.C., R.K. Cowen, and B.P. Steves, 2005. Evidence for atmosphere-ocean forcing of yellowtail flounder (Limanda ferruginea) recruitment in the Middle Atlantic Bight. *Fisheries Oceanography*. 14:386-399. Also see notes from correspondence from NEFSC.

[40] See reference #34.

The answer we heard to this question—both internal and external to NOAA—was nearly unanimous: since the 19 stocks live together and are caught together on the bottom of the ocean, they must be managed together in a multispecies complex. As such, it appears that higher harvests of haddock must be forgone to assist the rebuilding of all stocks in the multispecies plan.

In the 2008 GARM III stock assessments, haddock was determined as not overfished, with no overfishing occurring. This is one of the few rebuilding success stories in the northeast since aggressive regulations began in 1994. Haddock lives and is caught on the ocean bottom together with cod and yellowtail flounder—both struggling species within the multispecies complex. The Magnuson-Stevens Act requires all overfished stocks to be rebuilt in 10 years, so even if a stock is doing well, the fishery is closed if the bycatch limit of a struggling species is reached. Traditional groundfish trawl gear catches weaker stocks as bycatch, such as cod, and the haddock fishery closes once the small limit on cod (or flounder) bycatch is reached.

Given the abundance of haddock, NMFS and the industry are working to develop, test, and improve gear to target this population, yet exclude the more vulnerable species from the trawl net. One example is the Ruhle trawl, a type of separator trawl being tested in certain areas to determine the extent to which overfished stocks such as cod and flounder escape out the bottom.

The Canadians also catch haddock, and allegedly catch almost their entire haddock quota, as negotiated with the United States. The Canadians allow a smaller mesh size in their trawl nets, use separator gear, and only catch haddock as bycatch, not as part of a fishery management plan. Canada's national fisheries law does not require rebuilding in 10 years, as does the Magnuson-Stevens Act, so we heard that Canadian managers have more flexibility in setting catch limits.

6) *The multispecies fishery management plan unduly restricts fishing of abundant groundfish stocks.*

This allegation follows directly from the previous one. With some stocks rebuilding quicker than other stocks, we investigated whether rebuilding 19 stocks in one fishery management plan is effective. Theoretically, stocks with higher biomass levels could be fished at a much higher rate than stocks with low biomass levels. We investigated the question: why can't individual groundfish species (or stocks) have their own management plan?

Since 1996, the Magnuson-Stevens Act has required that each stock defined as overfished be rebuilt in 10 years. Many people we interviewed stated that this congressionally mandated time period was unreasonable, not based on science, and unattainable in many cases. This 10-year period was cited most often as the problem in rebuilding stocks of concern, not the multispecies fisheries management plan or the science used to inform management decisions.

Many in the industry and on the Fishery Management Council noted that it is not realistic to build every stock to sustainable biomass levels simultaneously. Likewise, several researchers who participated in GARM III acknowledged that not all species could be maintained at historically high biomass levels, and the new assessments have lowered target biomass levels for several species. New data, which would reflect the new best available science, substantiates this.

The question was often raised as to how much NMFS knows about stocks' competition for space and resources on the ocean bottom. Researchers do single species stock assessments and are slowly moving toward more ecosystem-based assessments. Some researchers acknowledge that ecosystem carrying capacity—the capacity of an ecosystem to support healthy organisms while maintaining its productivity, adaptability, and capability for renewal—is not taken into account in most stock assessments, mostly due to a lack of data on these interactions. So while we heard from fisherman that as cod has declined over the past few decades, dogfish and skates have filled that ecological niche, this is an intuitive effect not yet verified by research.

The GARM III assessment did provide an "Ecosystem Considerations" section that attempted to assess the ecosystem carrying capacity within the context of the 19 stock assessments. This assessment concluded that the GARM III biomass targets were adequate.

Additionally, we heard from a broad range of stakeholders that if separate management plans were drafted for certain species, any amendment to one plan would necessitate amendments to every other plan pulled out of the multispecies plan, since the species must be managed together. This idea was described as potentially very inefficient and time-consuming.

7) *NMFS sets the natural mortality rate at 0.2 for all species and this is not specific enough. If a different natural mortality rate was used, a greater percentage of fish mortality might be attributed to natural causes and less to commercial or recreational fishing, and fishermen could catch more fish.*

Our review found that NMFS did not set the natural mortality rate at 0.2 for *all* of the species in the groundfish multispecies complex, but it did so for the majority of them. Specifically, the Science Center used different natural mortality rates in only 2 of the 19 species—Gulf of Maine-Georges Bank Acadian redfish (0.05) and Atlantic halibut (0.15).

The natural mortality rate is the rate at which fish are removed from the population for reasons other than fishing activity (e.g., predation, disease, and age). In general, the natural mortality rate is assumed to be the difference between total mortality and fishing mortality. When the fishing mortality rate is low (because of management measures or lower demand for the stock), a greater portion of mortality is due to natural causes, thus more weight falls on the natural morality rate estimate. This rate can therefore play a key role in fish stock assessments, but many interviewees believe its influence on fish population dynamics is one of the most difficult to determine. As a result, the Science Center defers to the commonly used (by the fisheries science community) natural mortality rate of 0.2 for most species.

Many interviewees agreed that the natural mortality rate can have a noticeable impact on stock assessments. Industry believes this impact is oftentimes negative. For instance, if the natural mortality rate is underestimated then the fishing mortality rate will be overestimated and the fishing mortality rate for future catches will be set lower than it should be. A 1998 NRC review of northeast stock assessments recommended that "A variety of assessment models should be used, and independent estimates of mortality (M) should be considered."[41] To date, the Science

[41] National Academy of Science, 1998. *Review of Northeast Fishery Stock Assessments.*

Center has done little to implement this recommendation. Therefore, the Fishery Management Council and industry representatives want the Science Center to place a priority on determining more accurate natural mortality rates for the remaining 17 species in the northeast multispecies complex. Science Center officials acknowledged to us that they need to do more work in this area but do not know how much the center can or will do based on current resources.

8) *NMFS did not provide evidence to support cutting the fishery during the summer and fall in the Mid-Atlantic; estimates of turtle takes were left out of previous assessments; and improvements based on rotational management were not considered. The industry also alleges it should be allowed to harvest more scallops than permitted by the actions recommended in the scallop biological opinion.*

This allegation is intrinsically related to the scallop biological opinion. We will comment on this allegation to the point at which it may relate to the pending litigation.

A law firm representing the sea scallop industry submitted a request dated March 24, 2008, to the NOAA FOIA officer for all materials related to the scallop biological opinion. NMFS prepared a "FOIA Request and Action Record," dated March 25, 2008. The receipt of the request established the start of the 20 work-day limit for delivery of responsive documents. The requester agreed to pay all reasonable fees and costs necessary to fulfill the request provided the fees did not exceed $300.

As shown in table 3, below, NMFS did not comply with its own procedures.[42] NOAA did not meet the deadline to respond to the requestor, nor did it immediately contact the requestor to negotiate an extension to respond, as required. Several NOAA researchers commented that this particular FOIA request had been confusing and even "chaotic." The requestor was given at first a seemingly high cost of $7,943 for the materials. In a later letter, this cost was revised to $1,680. We discovered that at the time the revised cost estimate was submitted, the FOIA officer contacted the requestor to informally convey that most documents would be held as privileged (predecisional), thus the requestor would not receive many (if any) documents in return for the payment. Upon hearing this, the requestor did not make payment and filed suit against the Department citing "arbitrary and capricious" decisions contained in the biological opinion.[43]

We discussed NMFS' FOIA response with the FOIA coordinator, who said that he endeavors to comply with the handbook and does the best he can. Although several NOAA officials who respond to FOIA requests acknowledged that deadlines were missed, it is apparent to us that the responsible officials were not held accountable for following FOIA procedures for this particular request. In our opinion, NMFS' failure to actively manage the FOIA process in this instance resulted in wasted effort and expense in identifying, duplicating hard copy and electronic records, and providing administrative review of those records. We suspect there may be further problems with the FOIA process at NOAA, but those issues are beyond the scope of this review.

[42] We used NMFS' FOIA policy directive and handbook as the criteria in evaluating NMFS' response. The documents describe the procedures and timeline for NMFS' response to FOIA requests. The handbook requires FOIA officers to take specific proactive steps to ensure that FOIA responsibilities are met in a timely manner.
[43] Fisheries Survival Fund v. Gutierrez (1:08cv01679, D.D.C).

Interactions like this will only further erode the industry's confidence in NOAA. For each interaction with the industry, NOAA must keep transparency and openness in mind. In this particular case, the FOIA deadline was exceeded and it appears the fees associated with the request were overestimated. Though we have seen no evidence of a deliberate attempt to conceal information, industry members view such exchanges with NOAA as indications that NOAA is not being transparent and open—characteristics highlighted by the National Research Council as needing improvement in its 2004 report.[44]

Table 4. NMFS Response to a FOIA Request dated March 24, 2008

NMFS action required per the FOIA handbook	Date of NMFS' Action	NMFS Action
Prepare CD-244: FOIA Request and Action Record	March 25, 2008	The CD-244 was completed. This established April 22, 2008, as the 20 working day deadline to provide responsive documents.
Immediately, contact requester regarding scope, fee issues or responsive documents	June 30, 2008	Referenced in the June 30, 2008, letter below, a May 14, 2008 telephone conversation between FOIA coordinator and the requester, modifying the request to exclude anything that would be included in the administrative record for the 2008 BiOp for Atlantic Sea Scallops.
Immediately provide requester an opportunity to modify the request in order to meet the 20 working-day time limit	June 30, 2008	FOIA coordinator letter to requester modifying request to exclude anything that would be in the administrative record.
ASAP and no later than 20 working days after the receipt of a request inform requester of the estimated fee in writing and request advance payment	June 30, 2008	Same letter as above and requests payment of $7,943.
Immediately respond to requester regarding scope, fee issues or responsive documents	July 15, 2008	Letter from FOIA coordinator to the requester reiterating the scope of the information requested and reducing the cost estimate of the search to be conducted to $1,680.
Immediately respond to requester regarding scope, fee issues or responsive documents	July 21, 2008	Letter from requester referencing a "conversation last week regarding the National Marine Fisheries Service's 'NMFS' apparent preliminary determination that perhaps the overwhelming majority of the documents … are privileged." FOIA coordinator said he called the requester and conveyed the message that documents may be withheld. The conversation occurred immediately followed the revised fee letter [assumed to be 7/16/08].

9) *The 2008 FOIA request for documents related to the scallop biological opinion was poorly handled.*

We fully discuss our findings regarding this allegation above, but reiterate that the poor handling of this FOIA request further eroded the industry's confidence in NOAA. At each interaction with the industry, NOAA must keep in mind its goals for transparency and openness. In this particular

[44] National Research Council, 2004. *Improving the Use of the "Best Scientific Information Available" Standard in Fisheries Management*.

case, NOAA did not meet the FOIA deadline and overestimated the fees associated with the request. Although we did not find evidence to suggest a deliberate attempt to delay the release of information, the handling of the request suggests to industry members that NOAA is not being transparent and open—characteristics noted as needing NOAA's attention by the National Research Council in 2004.

Attachment B

Previous External Reviews Dealing with NMFS' Use of Science (1998–2005)

Since 1998, the National Research Council of the National Academy of Science, GAO, and the National Academy of Public Administration (NAPA) have examined NMFS' use of best available science nationally, and at NMFS' Northeast Fisheries Science Center.

- The National Research Council's 1998 *Review of Northeast Fishery Stock Assessments*, required by Congress in the 1996 Magnuson-Stevens Act reauthorization, found that the stock assessment process in the Northeast region, despite the need for improvements, "appears to provide a valid scientific context for evaluating the status of fish populations and the effects of fishery management." The National Research Council also found that the Northeast region's stock assessment process is analogous to processes and standards used in jurisdictions elsewhere in the world. The National Research Council recommended improvements in NMFS' collection, analysis, and modeling of stock assessment data, although it noted that the strict regulations in question "might have been avoided if fishing mortality in the New England groundfisheries had been effectively controlled from the mid-1980s (p. 2)."

- In a 2002 report requested by Congress and NMFS, the National Academy of Public Administration stated in a chapter devoted to NMFS' use of science that NMFS should "maintain and advance its tradition of excellence in fisheries science." A 2005 follow-up report stated that with respect to the use of science, overall progress is being made but the size and nature of NMFS' scientific mission continues to present significant challenges.[45]

- A 2002 report by the National Research Council studied the scientific foundation, data, models, and processes used by NMFS to meet it regulatory requirements and respond to litigation. In *Science and Its Role in the National Marine Fisheries Service*, NRC referenced several instances in which solid scientific advice was ignored by the councils, and subsequently by NMFS in approving the council action. NRC recommended that NOAA create standard review procedures and guidelines to increase the efficient use of the best available scientific information for management considerations, and review regional governance systems.

- A 2004 GAO report, prompted by concerns about the accuracy of NMFS stock assessments on the west coast,[46] found that NMFS lacked a standard approach for ensuring the reliability of non-NMFS data used in stock assessments. GAO also found that NMFS had taken steps to implement some of the recommendations contained in a 2001 internal NMFS stock assessment improvement plan, but because of staffing and funding limitations, NMFS had not yet implemented many of the recommendations

[45] See National Academy of Public Administration, 2005. *Improving Fisheries Management: Actions Taken in Response to the Academy's 2002 Report*.
[46] See GAO-04-606, *Pacific Groundfish: Continued Efforts Needed to Improve Reliability of Stock Assessment*.

aimed at obtaining more types of data and improving data quality. GAO recommended standardizing the processes and continuing to work to improve data quality. As part of a comprehensive review of Magnuson-Stevens Act implementation, GAO also assessed the best available science issue in 2000. It found that NMFS appeared to be using the best available scientific information to determine the condition and abundance of fish and other marine species, but improvements to include more current and complete data could be made. See *Fishery Management: Problems Remain With National Marine Fisheries Service's Implementation of the Magnuson-Stevens Act* (RCED-00-69).

- The National Research Council's 2004 report, *Improving the Use of the "Best Scientific Information Available" Standard in Fisheries Management,* opined that Congress's "best scientific information available" language "acknowledges the existence of scientific uncertainty, a feature of even the most robust biological population assessments, and dictates that prudent management be consistent with the scientific information that is available even though data gaps exist" (p.42). Its major recommendation was that NMFS should implement guidelines that more uniformly address issues of relevance, inclusiveness, objectivity, transparency, timeliness, and peer review to govern the production and use of scientific information in the preparation of fishery management plans and supporting documents**.** It noted as a positive development the Northeast Fisheries Science Center's 20 years of experience using "a two-part system consisting of stock assessment development conducted by the Stock Assessment Workshop and external peer review conducted by the Stock Assessment Review Committee" (page 29).

1) **National Academy of Science, 1998**
Review of Northeast Fishery Stock Assessments
http://books.nap.edu/openbook.php?record_id=6067&page=1 (summary)

2) **GAO RCED-00-69**, **2000**
Fishery Management**:** Problems Remain With National Marine Fisheries Service's Implementation of the Magnuson-Stevens Act
http://www.gao.gov/archive/2000/rc00069.pdf

3) **National Academy of Science, 2002**
Science and Its Role in the National Marine Fisheries Service
http://www.nap.edu/openbook.php?isbn=0309084628

4) **National Academy of Public Administration, 2002**
Courts, Congress, and Constituencies: Managing Fisheries By Default
http://71.4.192.38/NAPA/NAPAPubs.nsf/17bc036fe939efd685256951004e37f4/a04705cd1a32a13c85256c0200653434?OpenDocument

5) **GAO-04-606, 2004**
Pacific Groundfish: Continued Efforts Needed to Improve Reliability of Stock Assessments

http://www.gao.gov/docsearch/locate?to=http%3A%2F%2Fwww.gao.gov%2Fnew.items%2Fd04606.pdf

6) **National Academy of Science, 2004**
Improving the Use of the "Best Scientific Information Available" Standard in Fisheries Management
http://books.nap.edu/catalog.php?record_id=11045

7) **National Academy of Public Administration, 2005 follow-up report**
Improving Fisheries Management: Actions Taken in Response to the Academy's 2002 Report
http://71.4.192.38/NAPA/NAPAPubs.nsf/5053746074da45db85256968006aa88f/5e571c8d54a25dbb85256fba007645b7?OpenDocument

Attachment C: GARM III Assessment of Stocks in Status-Defining Quadrants[47]

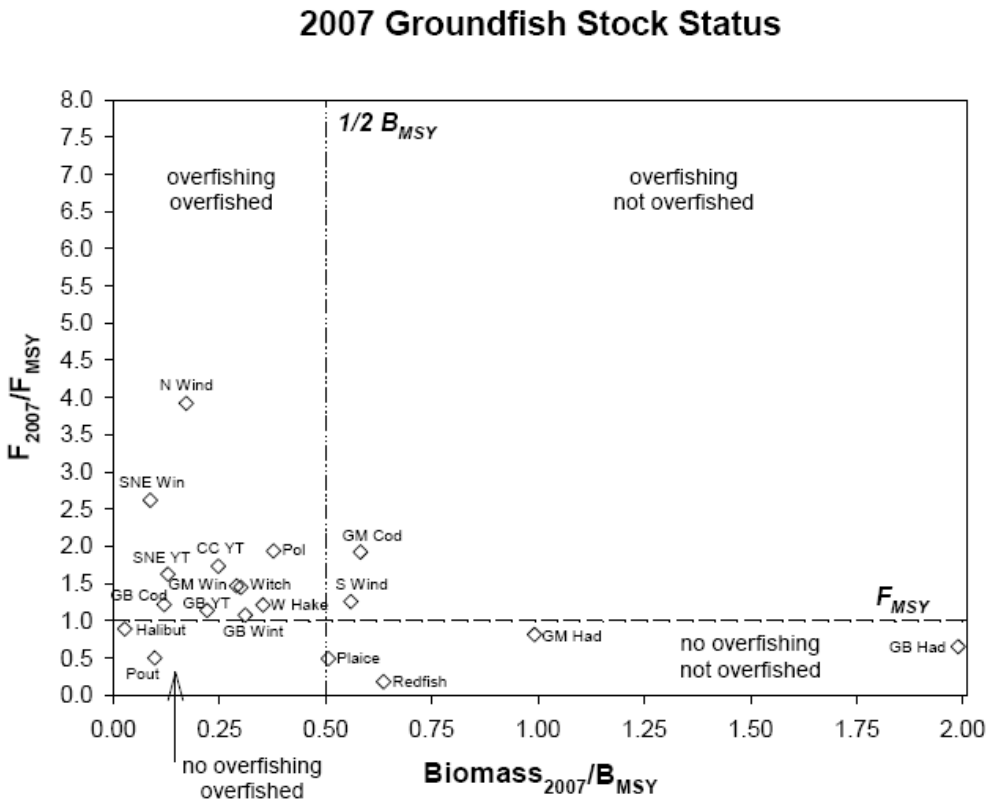
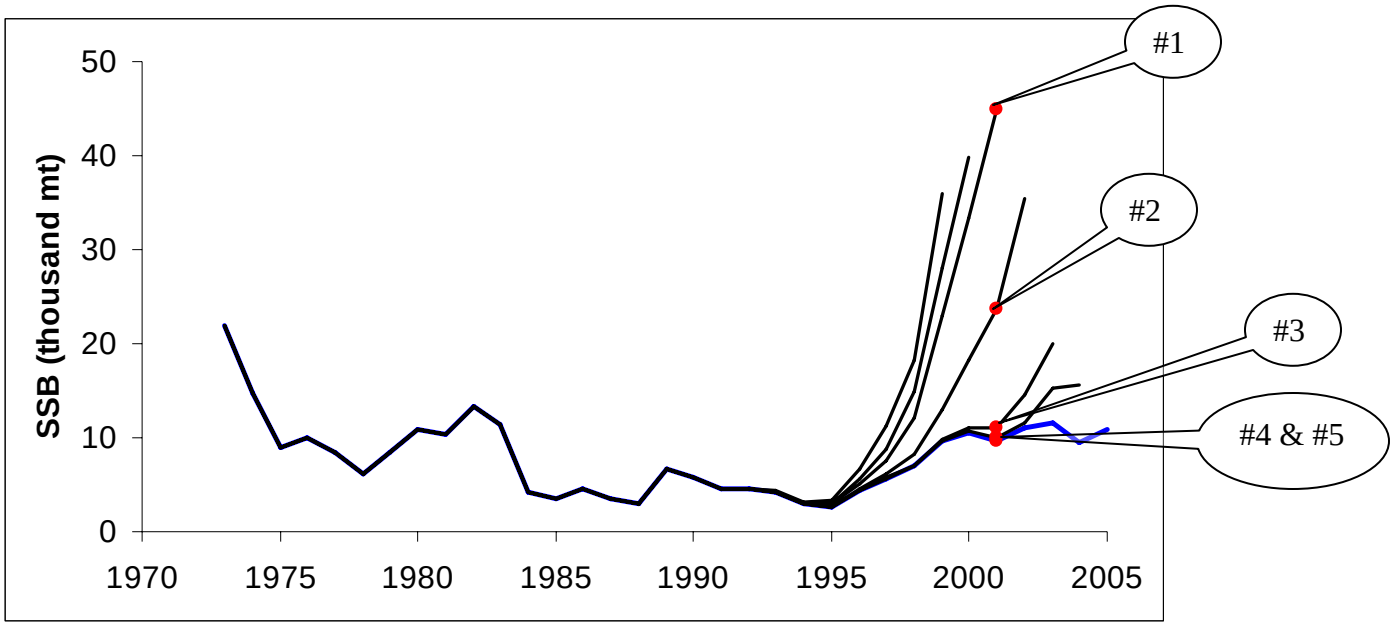


Figure 2. Status of 19 groundfish stocks in 2007 with respect to F_{MSY} and B_{MSY} or their proxies based on the GARM III review

[47] Northeast Fisheries Science Center, 2008. *Assessment of 19 Northeast Groundfish Stocks through 2007*; Executive Summary.

Attachment D: Retrospective Pattern Bias



Source: E-mail communication with Science Center staff, dated 1/26/09.

This figure illustrates a retrospective pattern, or bias, in the data. The pattern is developed by taking a particular year in the past (2001, in this case) and looking at how the stock biomass would have been estimated given data that was gathered in subsequent years.

The graph shows that the spawning stock biomass (SSB, which is one of the primary measures of the stock population) was first estimated at 45 thousand metric tons (kt) in 2001 (see #1). The next year, the estimate for 2001 dropped almost in half to 24 kt (see #2), and then dropped by more than half the following year to 11 kt (see #3). By 2004, the estimate for the 2001 SSB had dropped to 10 kt and stayed at this value for 2005 (see #4 and #5). The implication is that the original assessment in 2001 had vastly overestimated the population abundance and thus managers would have set catch advice much too high relative to the advice that would have been provided had the 2001 estimate from the 2005 assessment been used, by almost fivefold. This high catch advice would then translate into a higher fishing mortality rate than desired and either slow rebuilding or cause the population to decline. The assumption that the 2005 estimate of 2001 SSB is better than the 2001 estimate of 2001 SSB is based on the additional years of information about the cohorts that occurred from 2002 to 2005.

Attachment E

Scope and Methodology:

Objective 1 -
Focusing on specific complaints listed in the "Areas of Inquiry" document provided to OIG by Senate staff, for each targeted species we reviewed the following:

- Key laws and agency reports.
- The relevant management plan and recent management measures, including amendments and frameworks.
- Relevant meeting agendas and summaries from
    - the New England Fishery Management Council (NEFMC)
    - NEFMC advisory teams, science and statistical committee, and plan development teams.
- GARM III assessment report and appendixes.
- Certain recent stock assessment and fishery evaluation reports.
- Peer reviews of these stock assessments.

We also reviewed external evaluations drafted since 1998 of NMFS' use of science by the National Academy of Public Administration, the National Research Council of the National Academy of Science, and the Government Accountability Office. (See attachment B.)

We interviewed the following agency and industry representatives:

- Officials from NMFS' Northeast Regional Office; the Northeast Fisheries Science Center, which has lead responsibility for conducting stock assessments for the northeast; and the New England Fishery Management Council, which has responsibility for developing and implementing fishery management measures.
- Government officials and fisheries experts from the Massachusetts, New Hampshire, and Maine departments of fish and wildlife, the Atlantic States Marine Fisheries Commission, environmental groups, and industry associations, as well as fishermen.
- Certain researchers involved in assessments and peer reviews.
- Officials and certain researchers not involved in the process, including international researchers.

We did not simulate NMFS' stock assessment models, review NMFS' algorithms, or evaluate the mathematical and statistical methodologies used in the models.

We traveled to the Northeast Regional Office in Gloucester, Massachusetts, and the Northeast Fisheries Science Center in Woods Hole, Massachusetts; we attended the New England Fishery Management Council meeting in Danvers, Massachusetts, from November 17-20, 2008. We attended a field hearing in Portland, Maine, on October 14, 2008, and traveled to Maine again in January 2009 to conduct additional interviews.

Objective 2 - To address concerns that NMFS has denied the fishing industry access to underlying scientific data, we examined data access issues, including the transparency of NMFS'

procedures for responding to data requests, the timeliness of its responses, and the appropriateness of costs it charges to process requests.

We reviewed the following:

- Freedom of Information Act (5 USC 552)
- FOIA exemptions
- Electronic Freedom of Information Act Amendments of 1996
- NOAA's Guide for Submitting FOIA Requests
- NOAA's Guide for Submitting FOIA Appeals
- Department Administrative Order 205-12, Public Information
- Department Administrative Order 205-14, Processing Requests Under the Freedom of Information Act
- NOAA Administrative Order 205-14, Processing Requests Under the Freedom of Information Act
- Privacy Act of 1974 (and amendments)
- Department of Commerce FOIA regulations that implement the FOIA statute, 15 CFR §§ 4.1~4.11

We spoke with individuals alleging problems with the NMFS data access procedures, and with NOAA and NMFS FOIA officers in Silver Spring, Maryland, and in the Northeast Regional Office in Gloucester, Massachusetts.

We conducted our review from October 2008 through February 2009.