



Paul J. Diodati
Director

Commonwealth of Massachusetts

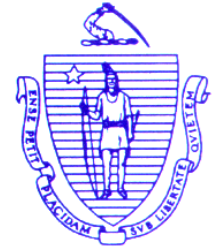
Division of Marine Fisheries

251 Causeway Street, Suite 400

Boston, Massachusetts 02114

(617)626-1520

fax (617)626-1509



Deval Patrick
Governor

Richard K. Sullivan, Jr.
Secretary

Mary B. Griffin
Commissioner

TO: Marine Fisheries Advisory Commission
FROM: David E. Pierce
DATE: January 11, 2012
RE: Gulf of Maine Cod: SARC 53 Assessment & Its Implications

The Council must deal with a potentially devastating blow to the vitality of the New England groundfish fishery and an unplanned and unacceptable restructuring of the fishery. We are in the second fishing year of Amendment 16 implementation with the experience of large-scale groundfish sector management superimposed on hard quotas for every groundfish stock with discards (real and assumed) tallied against those quotas. The



Council faces a dramatic reversal of the status of Gulf of Maine (GOM) cod [Note: cartoon does not reflect my opinion, but was offered recently to readers of Cape Cod Times.]

Expecting 2012 to mark further substantial progress towards rebuilding GOM cod to the Council's spawning stock biomass (SSB) target with fishing mortality below the overfishing level, the November 2011 SARC revealed a nightmare scenario that if played out could remove GOM cod from

commercial and recreational fishermen's allocation portfolios. The result: a crippling of the GOM groundfish fleet and far fewer recreational fishing opportunities for cod.

The Council's Executive Committee has instructed its SSC to take a fresh look at the assessment and scientific information not considered – or at least not emphasized – at SARC 53. The Council will use this information and SSC conclusions to revise downwards the GOM cod acceptable biological catch (ABC) and annual catch limit (ACL) for fishing year 2012 beginning May 1. Apart from the obvious and alarming socioeconomic impacts of the GOM cod assessment (see below), DMF questions whether reducing the severity of the cut in GOM cod catch for 2012 – prescribed through SARC 53 – will jeopardize the stock especially if current fishing patterns continue, i.e., fishing on pre-spawning and spawning aggregations with no restriction on catch except for sectors' GOM cod ACEs that may not be effectively monitored at sea, or even in port.

Problem Statement:

Assessments

- (1) The 2011 Gulf of Maine cod assessment (SARC 53) revealed that the 2005 year-class strength was overestimated by an astonishing amount. Thought to be strong when last assessed at GARM III (Groundfish Assessment Review Committee) in 2007 (24 million age 1 fish), this year-class now appears to have been about 5 million fish. Year-class strengths are almost exclusively derived from bottom trawl surveys.
- (2) According to SARC 53, other factors contributing to an overestimation of stock size in 2007 (such as new values for weight-at-age, use of Bigelow for surveys, and high 2010 recreational catch) have had far less influence than the strength of the 2005 year-class.
- (3) In 2007 (GARM III) the Council was informed that SSB was at 33,877 metric tons and fishing mortality on ages 5-7 (reference ages) was 0.46 (about 33% removal of stock). Now, through SARC 53 the Council learns that looking back in time SSB in 2007 actually was 10,714 mt and fishing mortality was 0.68 (45%). Therefore, the Council acted on too-optimistic assessment information.
- (4) Using another assessment technique (ASAP, not VPA), NEFSC has informed us that in 2010 SSB was just 11,868 mt. A new SARC 53 target SSB is 54,247 mt, and the threshold defining overfished is 27,124 mt. Therefore, we are far below the threshold and cannot rebuild to the target before the deadline of 2014.
- (5) F (ages 5-7) in 2010 was estimated to be 1.11 (62% annual removal of GOM cod stock). F now appears to be historic highs. $F = 0.23(18\%) = \text{overfishing}$
- (6) The assessment concluded that there are two recognized stocks: Gulf of Maine and Georges Bank with “limited” mixing. The GOM stock complex extends from the northern tip of Cape Cod east to the US/Canadian border and north to the coast of Maine.

Management implications

- (1) SARC 53 spawning stock biomass (SSB) projections run with three different assumptions for fishing mortality: $F_{\text{MSY}(F_{35\%})} = 0.23$, $F_{75\%F_{\text{MSY}}} = 0.17$, and $F = 0.0$ indicated that under even the most optimistic scenario for rebuilding ($F = 0.0$ with no adjustment for retrospective patterns), GOM cod cannot rebuild to SSB_{MSY} by the current rebuilding date of 2014.
- (2) In hindsight, allowable catches in fishing year 2011 were too high and will not be reduced for the remainder of fishing year 2011 (i.e., January - April 30, 2012).
- (3) Sector GOM cod Sub-ACL for FY 2010 is 4,327 mt, but could be as low as 401 mt in FY 2012. Common Pool Sub-ACL could be reduced from 240 mt to 9 mt.
- (4) Recreational Sub-ACL could be reduced from 2,673 mt to 314 mt.
- (5) State waters (non-federal permit holders) catch could be set at 66 mt (reduced from 566 mt).

Economic impacts

- (1) At a minimum (NEFMC preliminary analyses) change in groundfish revenue by state relative to FY 2010 would be -91% (NH), -54% (ME), and -21% (MA) although impacts to specific ports would be more severe (e.g., Gloucester -60%).
- (2) Vessels most affected would be 30-50 feet.

- (3) Impacts to the following sectors would be significant and severe judging from GOM cod revenues as a percent of total revenues (groundfish trips only): Port Clyde (36%), NEFS 2 (30%), NEFS 3 (60%), NEFS 10 (35%), NEFS 11 (46%), NEFS 12 (77%), and NCCS (40%).
- (4) Sixty-three (63%) percent of GOM party/charter vessels earn nearly all (greater 90%) of revenue on groundfish trips with private recreational vessels accounting for 60-80% of recreational catch.

Moving forward:

- (1) In an October 14, 2010 letter from Secretary of Commerce Gary Locke to Congressman Barney Frank the Secretary said: *“You asked if I had emergency authority to increase catch limits due to economic conditions. Section 305(c)(1) of the Act grants the Secretary of Commerce the authority to ‘issue an emergency regulation or take interim measures to address an emergency or overfishing...’ Under the NOAA policy applying this authority, I may take economic factors into account in determining whether to promulgate an emergency rule so long as those factors are based on ‘recent, unforeseen events or recently discovered circumstances’ (emphasis added). In addition, pursuant to the Act, any exercise of the authority must be based on the best scientific evidence available that indicates doing so will not undermine the conservation mandates of the Act and any action must give priority to conservation measures. See NRDC v. Daley, 209 F.3d 747 (D.C. Cir. 2000)”* This letter with its reference to NRDC v. Daley indicates that the Secretary can act by considering economic factors relevant to the expected precipitous drop in the GOM cod ACL for May 1, 2012 because SARC 33 results were completely **“unforeseen” and “recently discovered.”** However, “new” science must be available enabling the Secretary to adequately deal with Act “conservation mandates.” Of importance, according to Secretary Locke, “I am prepared to issue an emergency regulation to revise catch limits whenever there is both sufficient economic and sound scientific data available to meet these requirements...” (emphasis added).
- (2) Current economic performance and economic outlook for the multispecies fishery are both poor. Primary sources of economic data and insights making this case are:
 - a. “Break-Even Analysis of New England Groundfish Fishery for Fishing Years 2009 and 2010,” November 14, 2011 [Collaborative work between the Commonwealth’s Division of Marine Fisheries, NOAA Fisheries, and the University of Massachusetts School for Marine Science and Technology (SMAST)]:
 - i. This collaboration to evaluate the financial performance of the multispecies fishery revealed that fewer vessels (289 v. 374) participated in the groundfish fishery in FY 2010 than in 2009, and large numbers and percentages of those vessels in both years did not break even. For example, out of 289 vessels in FY 2010 only 167 vessels (58%) were above break-even (including sector costs but excluding consideration of all overhead costs such as costs of leasing ACE).

- ii. In FY 2010 break-even differences between vessel categories revealed: for trawlers less than 50 feet (58 vessels), 50% broke even; for trawlers greater than 50 feet but less than 65 feet (63 vessels), 54% broke even; and for trawlers greater than 65 feet (111 vessels), 56% broke even. Therefore, large percentages of large and small vessels of all gear types did not break-even meaning vessels costs exceeded revenues. These percentages are conservative estimates because all overhead costs couldn't be included. Moreover, although vessels may have broken even, they may not have been profitable. Absent necessary data, profitability could not be determined in this break-even analysis.
- iii. Of note, Dr. Jane Lubchenco in her October 3, 2011 written testimony on New England groundfish management provided to the U.S. Senate's Committee on Commerce, Science, and Transportation, that the break-even analysis revealed "*while a number of fleet segments performed better in 2010 relative to 2009, some segments did perform worse, including some of the smaller boat segments. NMFS is concerned about the impacts on these small boats and will continue to work with the Council to understand the root causes of the negative outcomes and identify corrective actions.*" Unknown to her at the time, the final analyses revealed an "across-the-board" inability of about 50% of all vessels to break-even in 2009 or 2010 with perhaps far more than 50% likely not being profitable and viable unless capable of entering or intensifying their effort in other fisheries
- b. "Comparative Economic Survey and Analysis of Northeast Fishery Sector 10 (South Shore, Massachusetts)," November 2011 [DMF analysis in collaboration with SMAST, NOAA Fisheries, and Sector 10 fishermen]:
 - i. Severe economic losses occurred in this sector largely due to transition to catch shares. From 2009 to 2010 this sector's groundfish landings declined 61%, and groundfish net revenue declined by 52%. Thirty percent (30%) of Sector 10 permit holders lost at least 80% of their net groundfish revenue, totaling \$301,000. Fifty-two percent (52%) lost at least half of their revenue as compared to 2009 totaling \$667,000.
 - ii. Crew pay decreased by 33% with 22% less crew members
 - iii. Five (5) permit holders lost 90% or more of their net revenue from groundfish trips; 5 permit holders lost 70-90%; 4 permit holders lost 50-70%.
- c. "2010 Final Report on the Performance of the Northeast Groundfish Fishery (May 2010 – April 2011)," October 27, 2011 [NOAA Fisheries Social Sciences Branch, NEFSC]:
 - i. Concluded that "*groundfish industry obtained more value from fewer fish landed and less fishing effort expended...Estimates of the average vessel owners' net and gross revenues increased for groundfish vessels in all size classes, owing largely to higher*

prices for fish...study also showed the continuation of trends begun during the last decade of fewer, more efficient fishing operations and declining number of active boats.” NEFSC found higher average owners’ net revenue per day on groundfish trips [Note: authors did not consider the shift from days-at-sea management in FY 2009 with restrictive trip limits to sector management in FY 2010 with no trip limits. A lack of limits [and higher prices for fish] is *expected* to increase average revenue per day on groundfish trips (i.e., misleading “per day” reference).

- ii. Concluded that in 2007-2009 20% of vessels captured about 68% of groundfish gross revenues, but in 2010, 20% of vessels captured nearly 80% of groundfish gross revenues.
 - iii. The groundfish fleet caught just 38% of fish allocated for 2010 catch. Sixty-two percent (62%) was left uncaught due to unavailability of fish in certain local areas, fishermen’s difficulties in balancing annual catch allocations, lack of capital to purchase annual catch allocations, and inability to target certain species while avoiding others.
 - d. “Preliminary Potential Sector Contribution Ownership (emphasis added) Data,” June 7, 2011 [Complied by NMFS with summary of PSC prepared by NEFMC staff]: The manner in which ACLs were allocated to fishermen (e.g., catch history from 1996-2006 excluding recent years of 2007-2009) “permanently” gave ownership of many stocks to relatively few individuals and “business entities.” For example, *before* considering leasing outcomes and resulting in-year PSC redistribution, we find that the top three “business entities” (more than one individual with an ownership interest in a single permit) have PSC ownership of 23.8% of Georges Bank cod, 31.3% of Georges Bank haddock, and 36.5% of Georges Bank winter flounder. The top 10 “entities” own 27% of GOM cod, 45% of GOM haddock, 29.5% of CC/GOM yellowtail flounder, and 28.6% of GOM winter flounder. Giving ownership of large quantities of groundfish stocks to relatively few individuals means economic opportunities for other fishermen with lesser allocations are much reduced (especially with low ACLs and “choke” stocks) and only can be increased through quota leasing from the “haves” and at a price.
- (3) The Commonwealth’s Marine Fisheries Institute (MFI) produced a November 1, 2010 report entitled: “A Report on Scientific and Economic Information that Supports Increases in Multispecies Groundfish Annual Catch Limits.” The MFI’s conclusions at the direction of the NEFMC were reviewed by the Council’s Scientific and Statistical Committee (SSC). The SSC recognized the MFI Report raised issues in need of additional scientific work. The SSC recommended: “*The Council should consider additional social and economic information in the development of ABC control rules and in setting ABCs (rather than relegated to secondary impact analyses). Such an evaluation would also identify potential problems of misspecification or inconsistencies in the Guidelines [for National*

- Standards]. While this is a significant research undertaking, it is both critically important and achievable (emphasis added).”*
- (4) The need for additional “sound scientific data” identified by the Secretary of Commerce (see #1 above) must be satisfied. To that end we have the MFI being asked by Senator John Kerry and Governor Deval Patrick to contribute towards a new assessment or understanding of the status of GOM cod.
 - (5) Likely outcomes of the requested GOM cod assessment triggered by SARC 53 results that were completely **“unforeseen” and “recently discovered:”**
 - a. Models – ASPIC versus ASAP: We have the paper, “The End of Overfishing?” by Rothschild and Jiao (Draft November 22, 2011) in which the authors conclude – using an ASPIC assessment approach (having fewer parameters than the SARC 53 approach) – that GOM cod is not overfished and is at a relatively high level of abundance. These authors compute F_{MSY}/B_{MSY} compared to $F_{40\%}/B_{40\%}$ (GARM III Report) and conclude the latter proxy statistic is biased relative to the former and ASPIC statistics. They conclude that the ASPIC statistics are better than the proxy statistics. Are the authors’ correct? Is ASPIC a suitable alternative of equal value to ASAP? According to the GARM III proxy, the GOM stock is overfished and overfishing is occurring while the reverse is true for ASPIC calculations.
 - b. Stock structure and intermixing:
 - i. We should focus on stock structure and the current assumption that exchange between stocks is limited. The SSC recommended at its April 12, 2011 meeting: *“There should be a comprehensive evaluation of scientific information on cod population structure and its management implications, including the possibility of revising management units...”* Although the SSC recommended this topic be a priority for the NEFMC “research track” and be taken into account in the next management cycle beginning with the 2014 fishing year, the frenetic debate about GOM cod dictates its immediate consideration.
 - ii. Does the Working Paper written by Loehrke and Cadrin in 2007 for GARM III stand or does new tagging information question some of their results and conclusions (A review of tagging information for stock identification of cod off New England).
 - iii. How can the tagging and movement results reported to the NEFMC Research Steering Committee on October 25, 2006 (i.e., cooperative work with fishermen Goethel, Bouchard, Mirarchi, Balzano, and Ford) be reconciled with the SARC 53 assumption about “limited exchange?” These tagging results (including those from the NE Regional Cod Tagging Program) don’t appear to have been used to support or refute the claim of “limited exchange.”
 - iv. There is a need to consider the paper “Atlantic Cod Stock Structure in the Gulf of Maine” by Ted Ames [Fisheries (29:1) January 2004] who characterizes GOM historical cod grounds, identifies essential habitat for cod, determines long-term productivity on

- historical cod fishing grounds, evaluates 1920s seasonal distribution, identifies seasonal movements of 1920s cod, the separation of inshore and offshore populations, and describes historical cod migrations in the GOM.
- v. Consideration of the 2010 paper “Fine-scale spatial and temporal genetic structure of Atlantic cod off the Atlantic coast of the USA” by Kovach, Breton, Berlinsky, Maceda, and Wirgin in *Marine Ecology Progress Series* (410:177-195) is warranted.
 1. With “GOM” cod possibly being a southern complex consisting of a winter-spawning inshore GOM, offshore GOM, and sites south of Cape Cod (all genetically differentiated from a Georges Bank population), have years of less-restrictive regulations affecting fisheries east and south of Cape Cod inadvertently impacted “GOM” cod contributing to recent high fishing mortality (2010 F_{ages 5-7} = 1.11)?
 2. These authors concluded: “...*the Georges Bank population is divergent from the southern New England and perhaps New York Bight populations, with which it currently is grouped for management purposes. The southern New England populations maintain connectivity with the winter-spawning inshore GOM population and both spring- and winter-spawning offshore populations of the GOM...*”
 3. Once NOAA Fisheries “assesses” the “Georges Bank” stock in January, if we discover that stock also is in poorer shape than expected and F is high, what will be implications of that determination on “GOM” cod if the Kovach et al. conclusions are accepted? Will it support the argument of “**unforeseen and recently discovered?**”
 4. Importantly, according to Ruzzante, Taggart, and Cook in their 1998 paper “A nuclear DNA basis for shelf and bank-scale population structure in northwest Atlantic cod (*Gadus morhua*): Labrador to Georges Bank (Molecular Ecology 7:1663-1680), “...*incorrect assumptions regarding genetic structure, or exploitation patterns that ignore structure can easily lead to overexploitation patterns and erosion of genetic resources via depletion of the constituent spawning components...*”
 - vi. Consideration also is warranted for the paper, “Ecological and management consequences of a mismatch between biological and management units of Atlantic cod in U.S. waters” by Kerr, Cadrin, and Kovach.
 1. These authors contend: “...*Monitoring of both the northern and southern spawning groups would be necessary to ensure maintenance of biocomplexity and a conservative harvest approach would be needed to account for the*

apparent lower productivity of the northern spawning group.”

2. *“Restricting fishing on spawning grounds during the spawning season would be a useful management tool to ensure there is not depletion of unique spawning components...”*
 3. Quoting other authors, they say: *“Reduction in biomass of spawning groups can reduce connectivity, and potentially destabilize local and regional populations. In extreme cases, overfishing may lead to local extirpation of a spawning group and loss of diversity within the regional population. On ecological time-scales, the loss of diversity of spawning groups can result in less stable regional population dynamics, and on evolutionary time-scales it can limit the ability of a species to adapt to changing environmental conditions...”*
- vii. Changing environmental conditions may have influenced stock structure and intermixing including overall distribution patterns. What has changed and to what extent? Do we have North Atlantic Oscillation (NAO) considerations regarding stock movement and status relative to established targets?
1. Is there any relevance to GOM cod of findings from the paper, “Impacts of interannual environmental forcing and climate change on the distribution of Atlantic mackerel on the U.S. Northeast Continental Shelf” (2011) by Overholtz, Hare, and Keith (*Marine and Coastal Fisheries* 3:1).
 2. Similarly, relevance of “Long-term trends and regime shifts in sea surface temperatures on the continental shelf of the northeast United States” (2007) by Friedland and Hare (*Continental Shelf Research* 27).
 3. Then there’s “Do environmental factors affect recruits per spawner anomalies of New England groundfish” (2005) by Brodziak and O’Brien (*ICES Journal of Marine Science* 62) in which the authors estimated effects of the NAO on recruits per spawner for GOM cod and other stocks.
 4. Also, there’s “Cod recruitment is strongly affected by climate when stock biomass is low” (2005) by Brander (*ICES Journal of Marine Science* 62) who focused on European cod stocks and NAO effects. He concluded that environmental variability represented by the NAO only has a significant effect on recruitment when spawning stock is low.
 5. Moreover, there’s “Changing spatial patterns of fish stocks in relation to climate and population size on the Northeast United States continental shelf” (2009) by Nye, Link, Hare, and Overholtz (*Marine Ecology Progress Series* 393).

- a. They described the influence of the NAO (and AMO index) and concluded that GOM cod increased its depth of occurrence in the Gulf of Maine.
- b. They believed, “...*deep-water sedentary fish, particularly those in the Gulf of Maine, may not adjust their spatial distribution in response to warming, but may experience greater changes in **growth, reproduction, and recruitment** (emphasis added) than those fish that have shifted their distribution.*”
- c. 2005 year-class: SARC 53 results indicated the 2005 year-class re-estimation was the primary cause for the very pessimistic GOM cod status and projections, and almost all the information available on this year class was from survey data. Of note, according to Dr. Chris Legault (NEFSC scientist and SSC Chairman), “*a single [two], anomalous large tow in two consecutive years contributed towards the perception (emphasis added) that the 2005 year class was substantial. Subsequent survey and fishery observations during 2008-2010 indicated that the 2005 year class was far less abundant than estimated, and is only of average size (Table A.59). This outcome suggests great care should be used in biomass projections. It should cause us to question assumed strengths of other year-classes subsequent to 2005. For example, do recreational catches in recent years suggest greater year-class strengths than cited at SARC 53 (Tables A35 and 37). Furthermore, why in 2007 were the Council and SSC confident about the 2005 year-class despite its strength being based on two “anomalous tows.”*”

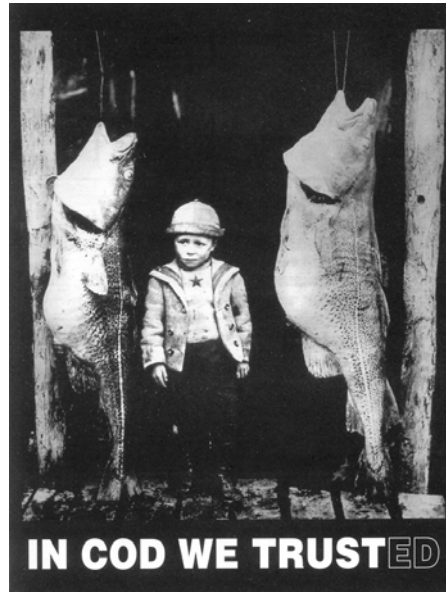
(6) Reasons for caution.

- a. Stock status history: GOM cod SSB has fluctuated around 10,000 mt since 1980, only being slightly about 20,000 mt in 1980 and 1990 with the 1990 “peak” being caused primarily by the strong 1987 year-class. Fishing mortality is now as high as it was from 1981-1984 although lower than F from 1992-1994. With this past history (last 30 years) of SSBs and Fs, what is the real potential for achieving the SSB target of 54,257 mt and/or F_{MSY} of 0.23 shy of prohibiting cod catch/landing for many years? This question is particularly relevant with confidence in our ability to accurately assess year-class strengths now appears to be very low (i.e., 2005 year-class prediction snafu). SSB in 2010 has been assessed at 11,868 mt.
- b. Shock and Aw(e)ful: Even though earlier projections had GOM cod SSB at the target by 2014, perhaps the awful shock of SARC 53 is simply a revisiting of stock conditions experienced in 2000 and a “wake-up” call for the Council. Recall that in December 2001 the Council on a vote of 9:8 rejected Framework 36 that would have dramatically cut F on GOM cod. For GOM cod a 63% reduction in F would have been required meaning a 24% reduction in catch (commercial and recreational landings

and commercial discards). The needed F reduction was revised to 79% (55% reduction in catch) relative to 2000 when total catch was about 5,877 mt: 3,730 mt commercial landings, 11,147 mt recreational landings, and 1,000 mt commercial discards). FW 36 likely target 2002 landings were about 3,062 mt. Recreational landings were to be restrained to only 673 mt. Does this repeat of 2000-like stock condition suggest that 2010 stock status should have been expected?

- c. Judge Kessler 12/28/2001 decision: Recall that Judge Gladys Kessler (U.S. District Court for the District of Columbia) decided that “*Plaintiffs [Conservation Law Foundation, Center for Marine Conservation, National Audubon Society, and National Resources Defense Council] have shown that Defendants [Secretary of Commerce, NOAA, and NMFS] have not complied with the Sustainable Fisheries Act. Specifically Framework 33 violates overfishing, rebuilding, and bycatch provisions of the SFA, while Amendment 9 violates bycatch provisions of SFA...*” She stated: “*Given their record of inaction and delay, Defendants have not carried out their burden of showing that they will remedy their ongoing violations of SFA... Defendants had a statutory duty to come into compliance with the SFA by February 1999. It is now almost three years later, and defendants have yet to comply with the statute... In its Opposition, Defendants had indicated to the Court that Amendment 13 would be implemented by fall 2002. However, on November 30, 2001, Defendants advised the Court that their timetable had fallen yet another year behind schedule...*” Is this 2001 Kessler decision and Council decisions leading up to it, relevant to how the Council must reduce GOM cod fishing mortality and allowable catch? Judge Kessler’s decision would have resulted in allowable commercial landings of just 1,789 mt and recreational landings of only 393 mt.
- d. Inshore versus offshore distribution: SARC 33 (July 2001) had an important conclusion to consider in any determination about whether the GOM cod SARC 53 conclusions were unexpected and unforeseen. SARC 33 determined that GOM cod inshore/offshore biomass proportions based on fall NEFSC bottom trawl surveys (4-yr running average) was 70% offshore (strata 28-30 and 36-40) versus 30% inshore (strata 26 and 27). SARC 53 indicated that GOM cod is now concentrated in the western portion of the GOM (presumably strata 26 and 27). To what extent are cod now concentrated in the western GOM and what are the implications of this distribution for the future of the GOM cod stock?
- e. Cod collapses.
- i. On September 26 and 27, 2005 DMF held a workshop entitled: “MassBay Cod Project: A vital remnant of the Gulf of Maine cod stock?” Director Diodati said to participants, “*Gulf of Maine cod need the largest reduction in fishing mortality. In recent years, seasonal abundance of cod near-shore has been attracting increased numbers of commercial and recreational fishermen...*” In background material for the Workshop it was noted: “*Consider*

that not too long ago stock collapse appeared imminent. The 27th SAW (June 1998) recommended an immediate reduction in fishing mortality to near zero and that all directed fishing for cod should be ended. It concluded that the combined effects of low spawning stock biomass (6,600 mt in 1998 versus 26,000 mt in 1989), high fishing mortality (0.75 in 1997), record low recruitment, and record low survival of pre-recruit fish indicated the stock was



collapsing (projected 5,700 mt in 1999)... (emphasis added). It continued, "...we continue to reflect on the consequences of a collapse as evidenced by the Canadian experience with northern cod ..."

- ii. The Council should reflect on the following most recent status of cod stocks in the North Atlantic:
 1. Labrador cod (2GH) with no reported landings since 1980 and no recovery since 1993.
 2. Northern cod (2J 3KL) under a moratorium (some fishing allowed) with recovery stalled in recent year.
 3. Grand Banks cod (3NO) with no directed fishing since 1994.
 4. Flemish Cap cod (3M) with small increase in 2010 based on some recruitment and projected to rise above critical biomass level.
 5. Northern Gulf of St. Lawrence cod (3Pn 4RS) remains critically low.
 6. Southern Newfoundland cod (3Ps) with 4-year moratorium and biomass close to limit reference points.
 7. Southern Gulf of St. Lawrence cod (4TVn) has collapsed and continues to decline.
 8. Eastern Scotian Shelf cod (4VW) increased rapidly in recent years but after an 18-year closure; projected to decline below current limit reference points even under no fishing.
 9. Gulf of Maine cod (4XY) at low biomass with recruitment trending down.

10. Eastern Greenland cod with no offshore fishery for 15 years; recommended no fishing in 2011.
11. Western Greenland cod closed to cod fishing.
- iii. In other words, what's up with cod just about everywhere in the NW Atlantic? Can GOM cod (5Y) and Georges Bank cod (5Z) be far behind? Are we finally facing a collapse of GOM cod and perhaps Georges Bank cod as well thereby justifying very little to no cod catch in 2012 and beyond? Are we in the midst of cognitive dissonance?
- f. Protection of spawning aggregations: DMF research pertaining to cod spawning aggregations and their protection (i.e., Cod Conservation Zones) culminated in the paper "Disruption of an Atlantic cod spawning aggregation resulting from the opening of a directed gillnet fishery" by Dean, Hoffman, and Armstrong (to be published in North American Journal of Fisheries Management 2012).
- i. These authors concluded: *"This study [using acoustic receivers to record transmissions from acoustically tagged cod] clearly demonstrates the adverse effect of gillnetting within an Atlantic cod aggregation."*
 - ii. Commenting on the Amendment 16 catch-share system, they indicated: *"...fishing efforts controls such as daily possession limits and rolling closures have been lifted for most fishermen. While this new system may provide a more direct method of controlling fishing mortality for the cod stock as a whole, it also greatly increases the potential for overexploitation of individual spawning groups. The Cod Conservation Zones enacted by Massachusetts have extended the spawning protection once offered by rolling closures in the immediate vicinity of the aggregations. Yet, other cod spawning aggregations exist in the Gulf of Maine that will likely face the brunt of relatively unrestricted fishing pressure, unless similar conservation zones are established... Fishery managers attempting to achieve spawning protections need to consider that fishing on spawning aggregations may have adverse effects that go beyond simple removal of biomass."*
 - iii. Buttrressing their conclusions and concerns are numerous papers such as:
 1. "Mating systems and the conservation of commercially exploited marine fish" (2003) by Rowe and Hutchings (Trends in Ecology and Evolution 18:11);
 2. "Extreme spawning site fidelity in Atlantic cod" (2011) by Skjaeraasen, Meager, Karlsen, Hutchings, and Ferno (ICES Journal of Marine Science 68:7);
 - a. Of note: *"...we are unaware of such fidelity on as small a geographic scale as documented here. Almost all recaptures of wild cod in the present study were within a few kilometers of the release*

- site, and cod continued to be recaptured there 3 years after initial release at or about the time of spawning.*
- b. *Notwithstanding the likely spatial biased fishing effort (on the spawning aggregation), the large proportional representation of recaptured cod at or near the spawning grounds and the large proportion of acoustically tagged wild fish present at the spawning ground in both 2008 and 2009 are consistent with the hypothesis that cod in the area exhibit homing and fidelity to these spawning grounds (emphasis added)...”*
3. “The illusion of plenty: hyperstability masks collapses in two recreational fisheries that target spawning aggregations” (2011) by Erisman, Allen, Claisse, Pondella, Miller, and Murray (Can.J. Fish. Aquat. Sci. 68)
- a. These authors found for southern California barred sand bass and kelp bass that “*aggregating behavior of fish and persistent targeting of spawning aggregations by recreational fisheries combined to produce a hyperstable relationship between CPUE and stock abundance in both species with created the illusion that population levels were stable and masked fishery collapses.*”
- b. Referencing other researchers’ findings, they concluded: “...*The importance of effective monitoring for aggregating fishes cannot be overstated, given that few aggregations are managed worldwide and most have either declined or disappeared altogether.*”
4. “Spawning behavior of Atlantic cod, *Gadus morhua*: evidence of mate competition and mate choice in a broadcast spawner” (1999) by Hutchings, Bishop, and McGregor-Shaw (Can. J. Fish. Aquat. Sci. 56);
5. “Multiyear homing of Atlantic cod to a spawning ground” (2001) by Robichaud and Rose (Can, J. Fish. Aquat. Sci. 58);
6. “An observation on the reaction of Atlantic cod (*Gadus morhua*) in a spawning shoal to bottom trawling” (1997) by Morgan, DeBois, and Rose (Can. J. Fish. Aquat. Sci. 54);
7. “Cod spawning on a migration highway in the north-west Atlantic” (1993) by Rose (Nature 366);
- g. No-trip-limit fishery: Heretofore the GOM cod fishery (and Georges Bank) were managed with restrictive trip limits (in some cases too restrictive promoting large discarding). Now there are no trip limits for sector fishermen.

- i. Sector management with sector ACEs for GOM cod results in an individual fisherman's GOM cod percent sector contribution or PSC being caught or leased by that fisherman with a trip's catch (landings and discards) only being constrained by that fisherman's PSC, i.e., thousands instead of previous hundreds of pounds.
 - ii. GOM cod landings through trips greater than 800 pounds (dressed weight) was 2,500 mt; less than 800 pounds accounted for 590 mt in fishing year 2010.
 - iii. These data should be examined by gear, time and area within the GOM to determine the range and frequency of catches to provide insights into the effects of a no-trip-limit fishery especially in areas and at times when GOM cod are aggregated for spawning.
- h. Actual GOM cod catch (calendar year) versus target TACs (fishing year): In past years under days-at-sea (DAS) restriction GOM cod catch greatly exceeded target TACs. For example in 1996 the target TAC was 2,762 mt versus 7,650 mt (commercial landings and discard plus recreational harvest). Comparisons were: 2,605 vs 5,731 mt (1997); 1,783 vs. 4,515 mt (1998); 782 vs. 4,769 mt (1999); 1,118 vs. 5,939 (2000); 1,918 [interpolated] vs. 8,400 mt (2001); 1,918 [interpolated] vs. 7,286 mt (2002); 2,675 [interpolated] vs. 7,537 mt (2003); 4,850 vs. 5,817 mt (2004) – *note following reversal*: 6,372 vs. 5,635 mt (2005); 5,146 vs. 5,536 mt (2006); 10,020 vs. 5,268 mt (2007); 10,491 vs. 8,499 mt (2008); 10,724 vs. 8,775 mt (2009). For nine consecutive years commercial and recreational catches greatly exceeded target TACs, then collective catch began to drop below the TACs. This reversal of fortune needs to be explained (i.e., more effective regulations, fewer fishermen, GOM cod unavailable, TACs derived from too optimistic assessments...).

Management requirements

- (1) Rebuilding deadline: GOM cod is scheduled to rebuild to the biomass target by 2012. With the “loss” of the 2005 year-class that is no longer possible even if F is reduced to zero – another impossible task.
- a. Magnuson-Stevens considerations:
 - i. Magnuson-Stevens Reauthorization (May 2007) pages 92 & 93 regarding “Rebuilding overfished fisheries,” i.e., “...if the Secretary [Commerce] discovers at any time that a fishery is overfished, the Secretary shall immediately notify the appropriate Council and request that action be taken to end overfishing in the fishery... Within 2 years after an identification [i.e., fishery is overfished] ...the appropriate Council...shall prepare and implement a fishery management plan, plan amendment or proposed regulations for the fishery **to end overfishing immediately** (emphasis added) in the fishery and to rebuild affected stocks of fish...”
 - ii. Contents of Fishery Management Plans page 76: “Any fishery management plan which is prepared by any Council, or by the

Secretary, with respect to any fishery, shall...establish a mechanism for specifying annual catch limits in the plan...or annual specifications, at a level ***such that overfishing does not occur in the fishery*** (emphasis added)..."

- iii. Effective Dates page 79: Regarding ii above, "*shall...take effect in fishing year 2010 for fisheries determined by the Secretary to be subject to overfishing and in **fishing year 2011** (emphasis added) for all other fisheries...*"

(2) NOAA Fisheries advice on "flexibility"

- a. We've been advised that NOAA Fisheries will provide advice on this important issue tomorrow, Friday the 13th (oops, bad omen?)
- b. Depending on that advice the Groundfish Committee (January 18 meeting) will have recommendations for the Council's consideration beginning on January 31 (3-day Council meeting).

(3) MFI involvement

- a. See letter from Diodati and Rothschild to Eric Schwaab.
- b. Met on Monday (9th) to review DMF/SMAST research relevant to GOM cod and to plan for constructive input consistent with newly developed understanding between the MFI and the Northeast Fisheries Science Center.