Section 5 Summary of Assessment Advice and Management Implications

5.1 Summary of Assessments

The 20 assessment updates indicate improved biomass and landings and generally lower fishing mortality rates since the mid-1990s (Table 5.1; Figures 5.1.1-5.1.3). The biomass of eight of the stocks was at or above ½ B-MSY in 2001, while 12 stocks were below the threshold. Stock biomasses have improved in 19 of the 20 stocks since 1995 (Figure 5.1.2; the exception being Mid-Atlantic yellowtail), with a median percent increase in biomass for all stocks of 177% (range: -33 to 2430 percent). Fishing mortality (F) rates declined for 15 of 19 stocks between 1994 and 2001 (Figure 5.1.3). In the case of Georges Bank yellowtail flounder, F has declined by about 90% since the mid-1990s. Numerous other stocks have experienced reductions in F of 20-50%, including Georges Bank and Gulf of Maine cod, Georges Bank haddock, witch flounder and American plaice. For several of the stocks where harvest rates are measured by landings to survey biomass ratios (exploitation index methods), relative Fs have been reduced by 50% or more (e.g., Gulf of Maine haddock, pollock and windowpane flounder). The four stocks showing increases in F since 1994 were Cape Cod and Mid-Atlantic yellowtail, white hake and Southern New England/Mid-Atlantic winter flounder. Of the 19 stocks for which 2001 fishing mortality (or its proxy) can be estimated, 10 were fished below F-MSY in 2001, and 9 above (Table 5.1; Figure 5.1.1).

Overall landings for the 20 stocks (USA and Canada combined) increased from 49,700 mt in 1995 to 69,400 mt in 2001 (a 40% increase). The primary stocks contributing to increased groundfish landings were Georges Bank haddock, Georges Bank yellowtail flounder, Georges Bank cod, and Georges Bank winter flounder. Together, these four stocks accounted for a combined increase in landings of 21,700 mt; greater than the cumulative 20 stock total increase of 19,700 mt between 1995 and 2001. Stocks declining in landings since 1995 were primarily pollock, Gulf of Maine cod and white hake.

Trends in biomasses for the various stocks since 1990 are summarized in Figure 5.1.2. The various stocks are grouped by assessment area, based on where the stock distributions and landings are predominant (since some stocks occur in more than one of the areas). Biomasses generally declined in all regions from 1990 to 1995. Increases since have been most rapid on Georges Bank and the Gulf of Maine, with biomass increases for four of the five Southern New England-Mid-Atlantic stocks more modest.

Two stocks continue to have extremely high fishing mortality rates - Mid-Atlantic yellowtail flounder and Cape Cod yellowtail flounder (Figure 5.1.1). In the former case, assessment scientists will present analyses to SARC 36 recommending that the Mid-Atlantic and Southern New England yellowtail resources be combined. The case of Cape Cod yellowtail remains enigmatic, in that the apparent mortality rates on the stock remain exceptionally high despite the reductions in F seen in co-occurring stocks (e.g., Gulf of Maine cod, and winter flounder). The GARM recommended additional biological studies, including tagging, to better understand the relationships between Cape Cod yellowtail and adjacent stocks of the same species.

For the remaining seven stocks where fishing mortality exceeded F-MSY, the average reduction necessary to reach that level was 52% (range: 37% for Southern New England/Mid-Atlantic winter flounder to 64%, witch flounder).

In order to achieve biomass targets by appropriate dates, F-rebuild was computed for each stock using stochastic medium-term projection methodologies. The F reductions required to achieve the biomass goals by the target dates are greater than the F reductions required to achieve F-MSY on a stock-by-stock basis (Table 5.1).

Table 5.1. Summary of fishing mortality rate and biomass status for 20 Northeast groundfish stocks in 2001. Projections of maximum F to achieve B-MSY (F-Rebuild) assume F in 2002 = 0.85 * F in 2001, and stocks should be rebuilt by 2009, unless otherwise noted.

Species	Stock	F-MSY	F-2001	% F Reduction to achieve F-MSY	F-Rebuild	% F Reduction to achieve F-Rebuild	B-MSY ('000 mt)	B-2001 ('000 mt)	B-2001 % of B-MSY
Cod	GM	0.23	0.47	51	0.11	76	82.8	22.0	27
	GB	0.18	0.38	53	0.15*	61	216.8	29.2	14
Haddock	GM	0.23+	0.12	none	0.20	none	22.17#	10.31	47
	GB	0.26	0.22	none	0.20	10	250.3	74.4	30
Yellowtail	CC	0.21	1.97	89	0.12	94	8.4	1.9	23
	GB	0.25	0.13	none	0.22	none	58.8	38.9	66
	SNE	0.27	0.46	41	0.10**	78	45.2	1.9	4
	MA	0.33+	2.17	85	0.30	86	12.91#	0.21	2
Witch Flounder		0.16	0.45	64	-	none	19.9	11.3	57
American Plaice		0.17	0.43	60	0.10	77	28.6	13.8	48
Winter Flounder	GM	0.26	0.14	none	-	none	5.4	5.37	99
	GB	0.32	0.25	none	-	none	9.4	9.8	104
	SNE-MA	0.32	0.51	37	0.12	76	30.1	7.6	25
White Hake		0.55+	1.36	60	0.50	63	7.70#	2.35	31
Pollock		5.88+	3.55	none	4.83	none	3.0#	1.60	53
Redfish		0.04	0.01	none	0.01***	none	236.7	119.6	51
Ocean Pout		0.31+	0.007	none	n/a	n/a	4.90#	2.46	50
Windowpane	Northern	1.11+	0.1	none	-	none	0.94#	0.79	84
	Southern	0.98+	0.69	none	0.73	none	0.92#	0.21	23
Atlantic Halibut		0.06	unknown	unknown	unknown	unknown	5.4	0.2	4

+ = fishing mortality rate proxy is catch divided by the survey abundance index
# = biomass target based on survey abundance index
* = rebuilding period is 2019 for GB cod
** = the SNE YT stock cannot be rebuilt to long-term biomass target by 2009 even if F=0.0 (using recruitment from last 10 years)
*** = rebuilding period is 2041 for redfish

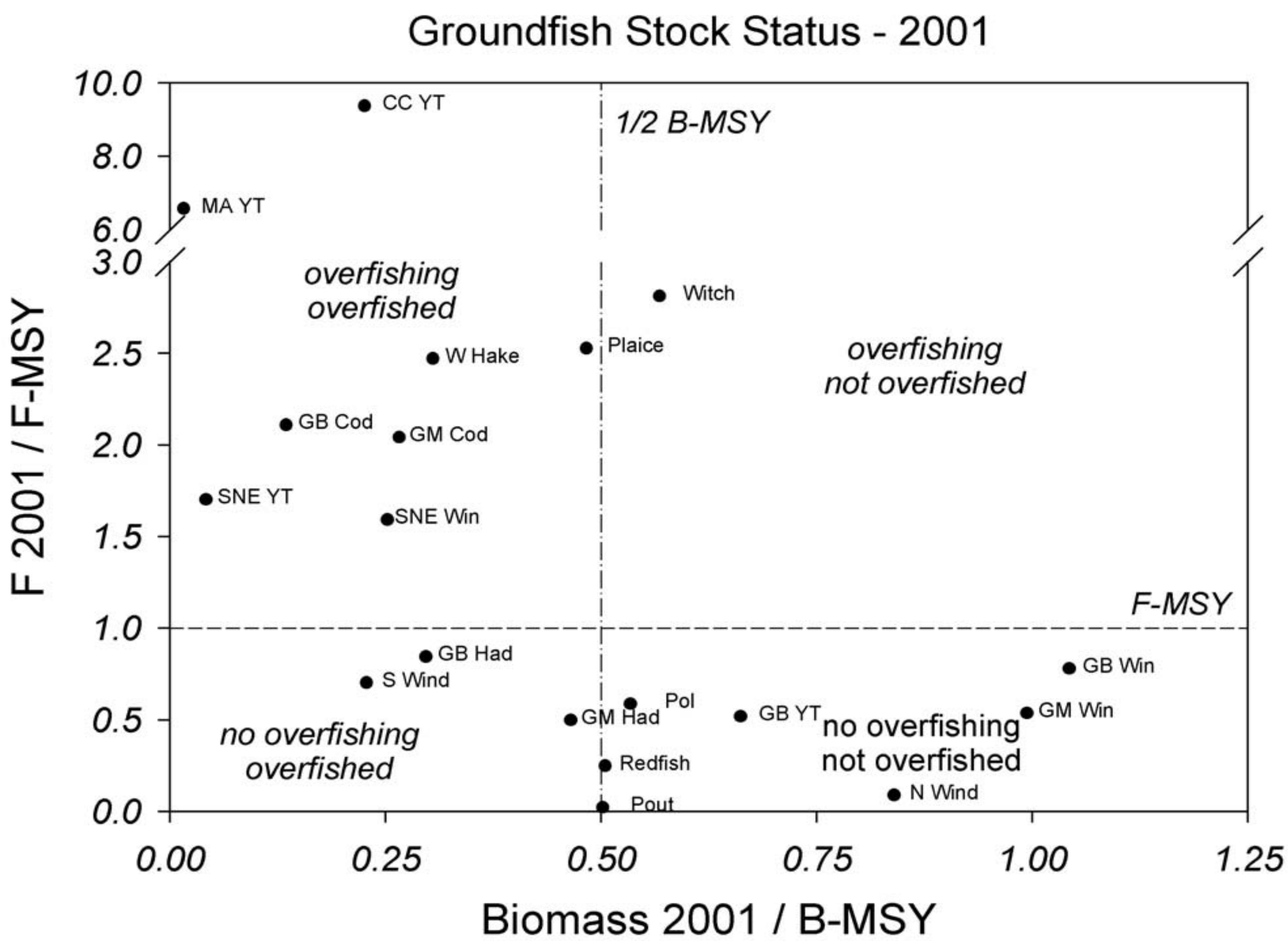

Figure 5.1.1. Status of 19 Northeast groundfish stocks relative to status determination criteria of fishing mortality and stock biomass. The data are expressed as ratios of the 2001 F and biomass to the F-MSY and B-MSY values for each stock. Halibut status not plotted

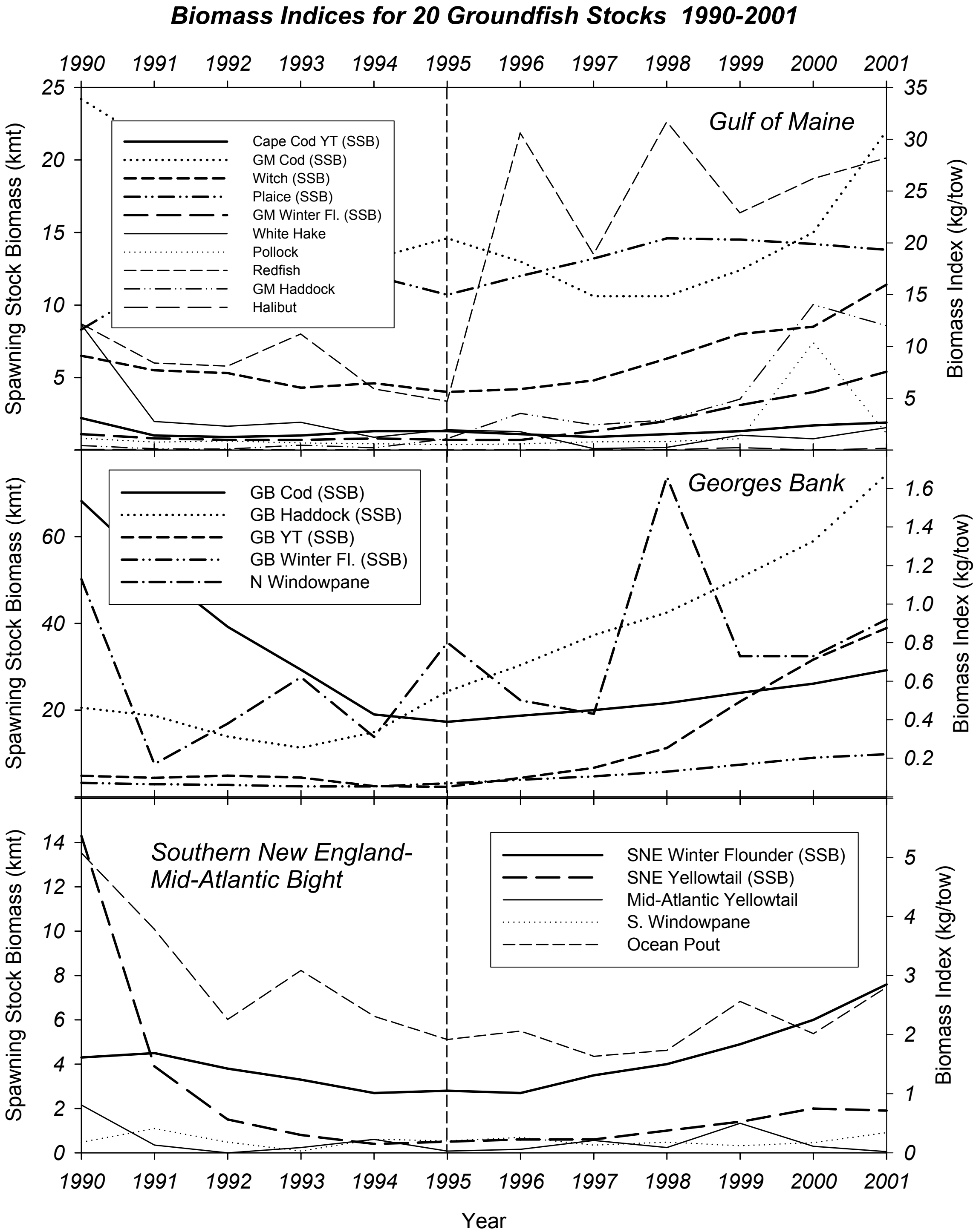

Figure 5.1.2. Changes in stock biomass (spawning biomass or total biomass survey index) for 20 Northeast groundfish stocks, 1990-2001. The biomass index plotted for each stock is noted. Stocks are grouped by the area of predominant concentration (Gulf of Maine, Georges Bank, Southern New England – Mid-Atlantic Bight).

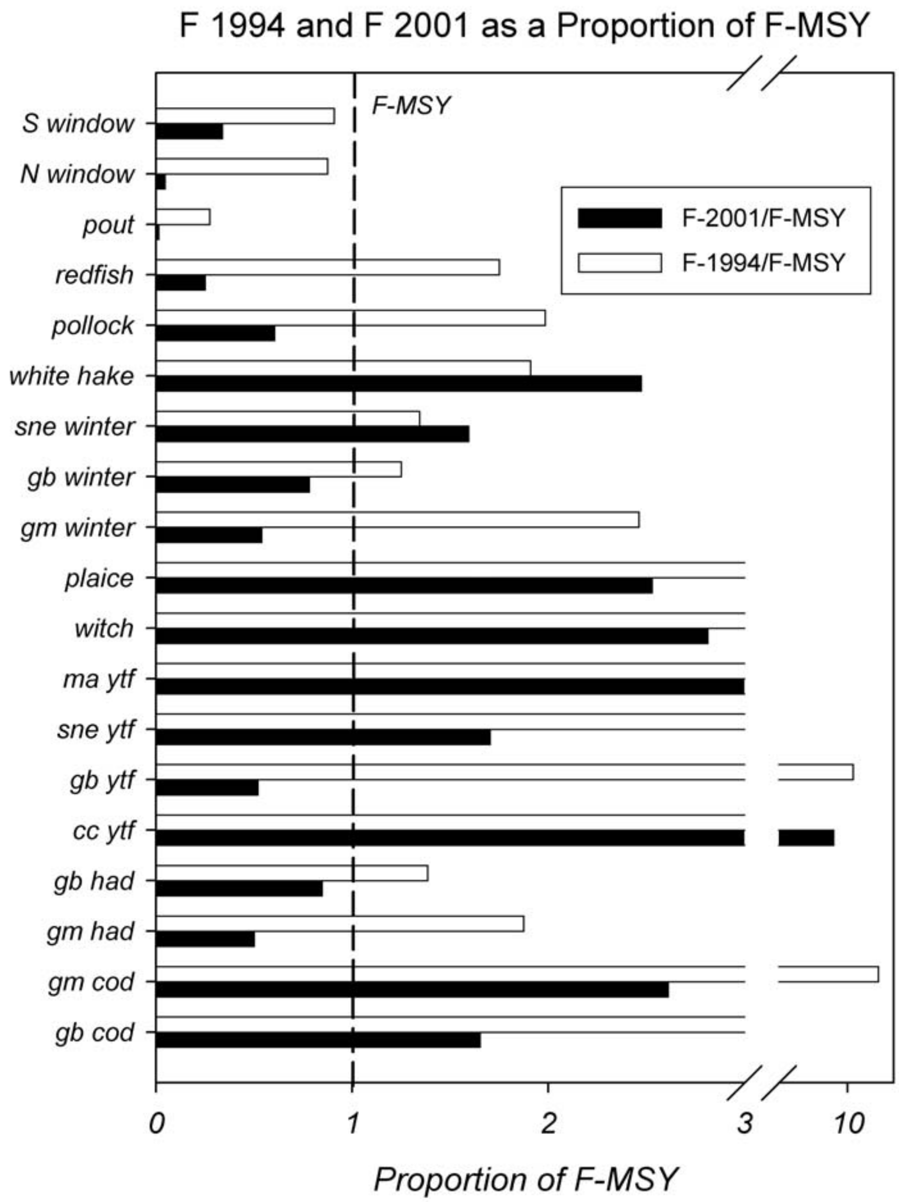

Figure 5.1.3. Changes in fishing mortality rate or exploitation rate indices for 19 stocks of Northeast groundfish between 1994 and 2001. The fishing mortality rate in each year is expressed as a ratio of the F-MSY value for each stock (a ratio of 1 means the stock is fished at F-MSY).

5.2 Sensitivity of Stock Assessment Calculations to Potential Warp Offsets

Given the absence of measurable intervention effects associated with the warp offsets, the GARM endorsed the nominal assessment calculations as the basis for management decision-making. However, in order to examine the robustness of the management advice to potential variations in the survey catches, the GARM carried out a series of sensitivity analyses. These analyses are reflected in each of the stock assessments presented in section 2 of this report, and specifically as the "cross" plots of sensitivity of assessment calculations to arbitrary increases in survey indices in years influenced by the warp offsets.

Sensitivity runs conducted for the various assessments included arbitrary increases in trawl survey catches for affected surveys of 10%, 25% and 100%. The first two scenarios consider decreases in survey catch rates that are at or below the limits of detection of the analyses of offset effects carried out at the GARM. The 100% increase is not supported by analyses carried out at the meeting, the increase is only included for illustrative purposes. An effect of this magnitude would likely have been detectable in the various exploratory data analyses. It should be noted that these arbitrary increases in survey catches were used in assessment calculations across all species, including those found in shallow depths (and thus less likely to be negatively influenced by warp offsets, e.g., yellowtail flounder, winter flounder, windowpane).

The confidence intervals from the +10% and +25% sensitivity runs overlapped the nominal assessment results for all stocks therefore changes of this magnitude have no significant impact on estimates of F and SSB (Table 5.2). The stock assessment models integrate unaffected catch information from commercial and recreational fisheries and the full time series from the research vessel surveys, reducing the influence of variations in recent survey indices.

In only three of 20 stocks did the qualitative status determination for overfished (e.g., <1/2 BMSY) change by adding arbitrary increases in survey abundance indices (Table 5.2). In two cases (American plaice, and Gulf of Maine haddock), the stocks were near ½ BMSY based on nominal assessment results. In these cases the 10% increases in surveys were sufficient to change biomass status determination. Of the 18 other cases, arbitrary increases in recent surveys of 100% changed only the biomass status for white hake.

In only one case (Southern New England yellowtail flounder) did the status determination regarding the overfishing criterion (fishing mortality rate) change with arbitrary increases in survey catches up to 100%.

The overall management advice is robust to variations in recent survey catch rates.

Table 5.2. Summary of status determinations for 20 New England groundfish stocks. Sensitivity of status determination to arbitrary increases in trawl survey abundance indices for 2000 to spring 2002 are given for three levels of increase (+10%, +25% and +100%). Overfishing refers to the current fishing mortality rate relative to F-MSY. Overfished refers to the current biomass relative to B-MSY. Asterisks (*) indicate cases where the 80% bootstrap confidence interval for a particular criterion does not overlap that from the nominal assessment run. Shaded cells are where status determination changes from the nominal assessment when survey catch data are increased. SSB is spawning stock biomass, TSB is total stock biomass.

Species	Stock	Status Criterion	Nominal Status	Status +10%	Status +25%	Status +100%
Atlantic Cod	Gulf of Maine	F	overfishing	overfishing	overfishing	overfishing
		SSB	overfished	overfished	overfished	overfished *
	Georges Bank	F	overfishing	overfishing	overfishing	overfishing *
		SSB	overfished	overfished	overfished	overfished *
Haddock	Gulf of Maine	F	no overfishing	no overfishing	no overfishing	no overfishing
		TSB	overfished	not overfished	not overfished	not overfished
	Georges Bank	F	no overfishing	no overfishing	no overfishing	no overfishing
		SSB	overfished	overfished	overfished	overfished *
Yellowtail Flounder	Cape Cod	F	overfishing	overfishing	overfishing	overfishing
		SSB	overfished	overfished	overfished	overfished
	Georges Bank	F	no overfishing	no overfishing	no overfishing	no overfishing *
		SSB	not overfished	not overfished	not overfished	not overfished *
	S. New England	F	overfishing	overfishing	overfishing	no overfishing *
		SSB	overfished	overfished	overfished	overfished *
	Mid-Atlantic	F	overfishing	overfishing	overfishing	overfishing
		TSB	overfished	overfished	overfished	overfished
Witch Flounder		F	overfishing	overfishing	overfishing	overfishing *
		SSB	not overfished	not overfished	not overfished	not overfished *
American Plaice		F	overfishing	overfishing	overfishing	overfishing
		SSB	overfished	not overfished	not overfished	not overfished *

Table 5.2 (continued).

Species	Stock	Criterion	Nominal	+10%	+25%	+100%
Winter Flounder	Gulf of Maine	F	no overfishing	no overfishing	no overfishing	no overfishing
		SSB	not overfished	not overfished	not overfished	not overfished
	Georges Bank	F	no overfishing	no overfishing	no overfishing	no overfishing
		TSB	not overfished	not overfished	not overfished	not overfished
	S. New England-Mid-Atlantic	F	overfishing	overfishing	overfishing	overfishing *
		SSB	overfished	overfished	overfished	overfished *
White Hake		F	overfishing	overfishing	overfishing	overfishing
		SSB	overfished	overfished	overfished	not overfished
Pollock		F	no overfishing	no overfishing	no overfishing	no overfishing
		TSB	not overfished	not overfished	not overfished	not overfished
Acadian Redfish+		F	no overfishing	no overfishing	no overfishing	no overfishing
		SSB	not overfished	not overfished	not overfished	not overfished
Ocean Pout		F	no overfishing	no overfishing	no overfishing	no overfishing
		TSB	Not overfished	not overfished	not overfished	not overfished
Windowpane Flounder	Northern	F	no overfishing	no overfishing	no overfishing	no overfishing
		TSB	not overfished	not overfished	not overfished	not overfished
	Southern	F	no overfishing	no overfishing	no overfishing	no overfishing
		TSB	overfished	overfished	overfished	overfished
Atlantic Halibut		F	unknown	unknown	unknown	unknown
		SSB	overfished	overfished	overfished	overfished

+ = Assessment models were not updated for Acadian redfish
unknown = estimates of F or proxy are not available for Atlantic halibut

5.3 Consistency of NMFS Bottom Trawl Survey Data

Evidence for a postulated decrease in catch efficiency due to trawl warp offsets during 2000 – 2002 spring NMFS bottom trawl surveys is reviewed and summarized in sections 3 and 4 of this report. Given the interest in this topic and other issues that were raised concerning the catch efficiency of the fishing system in recent years (NEFSC 2002), it is useful to consider long term trends in the indices and how they relate to other measures of abundance. The total, multispecies abundance index (kg/tow, all species combined) was computed for all offshore survey strata consistently sampled in the NMFS fall survey during 1963-2001 (Figure 5.3a). This series showed initial high abundance of all species, followed by a precipitous decline in the mid-1960s to a low in the mid-1970s. The index increased in the late 1970s-early 1980s, then declined to a time series low in the early 1990s. Recent indices have increased steadily to a level similar to those in the early 1980s. The 2001 index was 141 kg/tow - about 67% of the time series high in 1964 (209 kg/tow).

The second index is that from the Massachusetts Division of Marine Fisheries, fall bottom trawl survey (Figure 5.3b). This series uses a different vessel and trawl gear and fishes at generally shallower depths (primarily within 3 miles of the Massachusetts coastline) than the NMFS survey. This series began in 1978, and its all time high value (311 kg/tow) occurred in that year. The 2001 fall Massachusetts index was 257 kg, or 83% of the 1978 value. The series also shows a declining trend in the early 1990s, followed by an increase in the past several years.

The third survey series (Figure 5.3c) is a subset of the NMFS fall trawl series only for those offshore survey strata near the Massachusetts coast. The NMFS survey generally samples deeper waters than the Massachusetts survey, but the species mix of the reduced NMFS survey set is more similar to that sampled inshore than the NMFS survey as a whole. This series shows trends in abundance similar to the NMFS series and the Massachusetts Division of Marine Fisheries Series. The time-series high index was in 1983 at 301 kg/tow, and the 2001 index was 215 kg/tow, or 71% of the maximum.

The fourth series displayed (Figure 5.3d) is the "principal groundfish and flounders" index computed from the fall survey series. The index includes 12 groundfish and flatfish species, and all offshore survey strata, and is smoothed with an autoregressive moving average model. This index peaked in 1963 at 72 kg/tow, and the 2001 value was 36 kg/tow (50% of the maximum).

The overall trends in these indices and the general comportment of the NMFS and Mass-DMF surveys do not support the hypothesis of highly reduced catch efficiency in the NMFS surveys during the period of warp offsets or in the recent past (as compared with earlier periods of the time series). The Massachusetts and NMFS series do not necessarily index the same things (i.e., the MA-DMF inshore survey catches a higher proportion of juvenile fish than does the offshore NMFS survey), but the trends and scale of indices in these series are comparable. If the NMFS survey has become 1/10th as efficient as it used to be (as was proposed at the Trawl Warp Workshop, NEFSC 2002), then the 2001 index for the full NMFS trawl survey would be 1.41 metric tons per tow, roughly 6.8 times the maximum (1964) value. Even if the recent catch efficiency were reduced by a factor of two as compared with earlier years, this would generate indices inconsistent with the trends in other survey series, and at levels that are inconsistent with population sizes of fished resources or landings patterns. For example, the 1964 survey index for all species was 209 kg. The maximum groundfish catch ever taken off the Northeast USA was in 1965 (766,000 metric tons), and the index declined steeply by the fall of 1965 (Figure 5.3a). By comparison, landings of groundfish in 2001 were about 80,000 metric tons, and the index of abundance increased modestly from 2000. Doubling of the 2001 trawl survey catch would produce an value equivalent to the highest value ever seen in the principal groundfish and flounders index (1963), and 36% higher than the maximum value of the fall survey series for all species (Figure 5.3a).

Information from the NEFSC, Massachusetts DMF, and other applicable fishery-independent surveys are consistent in that they show a strong and continuing recovery of the groundfish complex in recent years, roughly to levels last seen in the early 1980s.

Reference

NEFSC 2002. Report of the Workshop on Trawl Warp Effects on Fishing Gear Performance, 2-3 October, 2002, Woods Hole, MA. Northeast Fisheries Science Center Reference Document 00-15. 80 pp.

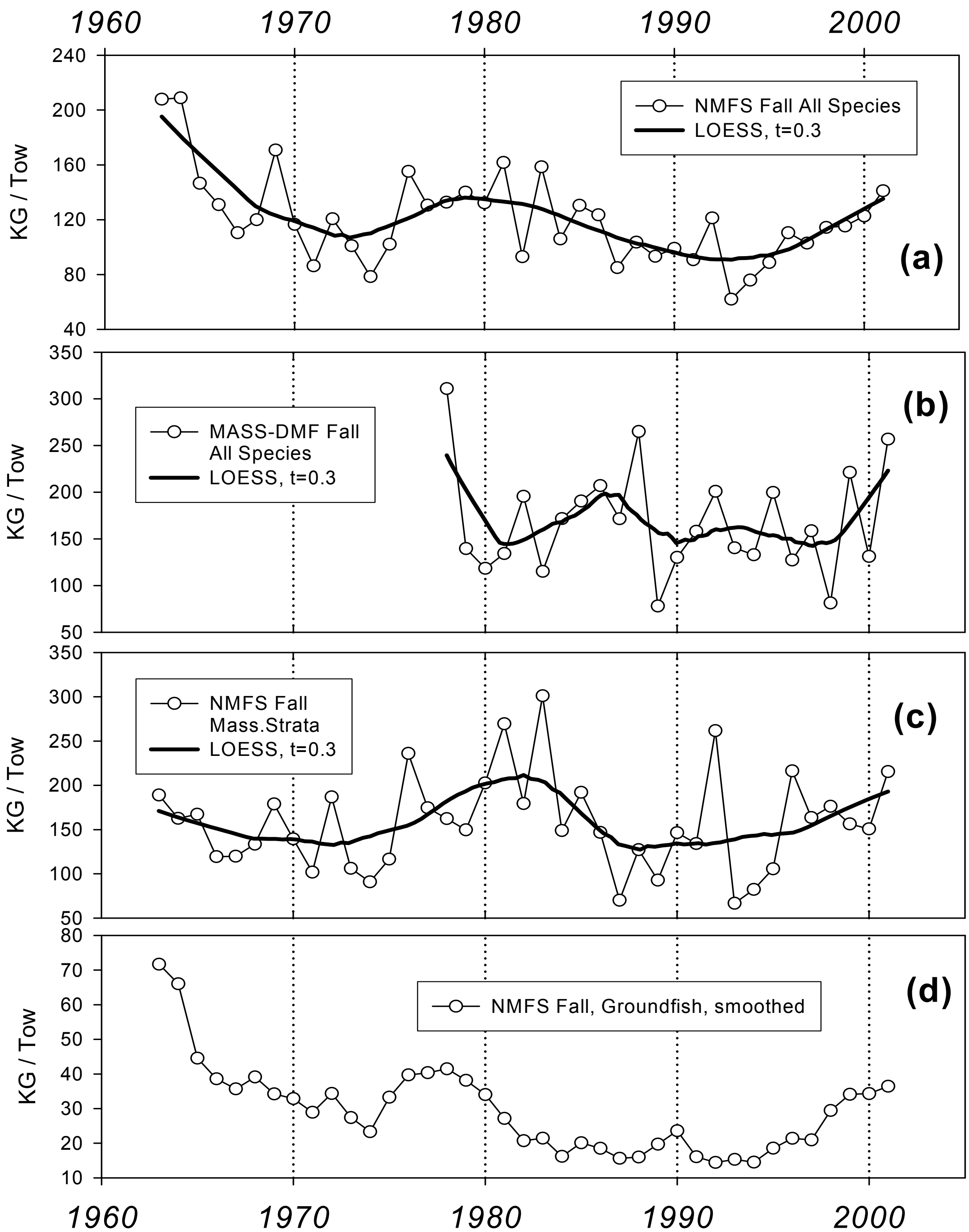

Figure 5.3. Trends in bottom trawl survey abundance indices, 1963-2001. The panels display observed and smoothed (bold lines) indices for: (a) the NMFS Fall survey (kg/tow) for all species, (b) the Massachusetts Division of Marine Fisheries Fall, (c) the NMFS Fall offshore survey for strata near the Massachusetts coast, and (d) the principal groundfish and flounders abundance index for the NMFS fall bottom trawl survey (smoothed series).