J. Southern New England-Mid-Atlantic Bight windowpane flounder
by Lisa Hendrickson

8.0 Background

Windowpane flounder (*Scophthalmus aquosus*) is a left-eyed, flatfish species which is primarily found between the high water mark and 50 m, but also inhabits depths of up to 200 m (Klein-MacPhee 2002). The Southern New England-Mid-Atlantic Bight (SNE-MAB) windowpane flounder stock was most recently assessed in 2008 at a Groundfish Assessment Review Meeting (GARM III) using An Index-based Model (AIM) for the period 1975-2007 (NEFSC 2008). Input data to the AIM model consisted of: discards, landings, and the NEFSC fall survey biomass indices.

The current biological reference points, adopted at the 2008 GARM and in Amendment 16 to the Northeast Multispecies Fishery Management Plan (NEFMC 2009), are: F_{MSY} proxy = 1.47 kt/kg per tow and B_{MSY} proxy = 0.34 kg per tow. The F_{MSY} proxy was estimated from the AIM model and represents the relative fishing mortality rate (catch in year *t* / average fall survey biomass index during years *t* through *t*-2) at which the stock can replace itself. The MSY proxy (= 500 mt) is the median catch during a period of time when the stock was assumed to have been replacing itself (1995-2001), and was divided by the F_{MSY} proxy to compute the B_{MSY} proxy. At the 2008 GARM, the stock was not deemed overfished but overfishing was occurring (NEFSC 2008). Rebuilding is required by 2014 (NEFMC 2003).The stock was not rebuilt in 2007.

The stock assessment provided herein does not represent a simple update of the 2008 assessment because the entire catch and survey biomass time series were revised. It was necessary to re-compute the relative biomass time series using catches from a different survey strata set which excludes depths that cannot be sampled by the FSV *H. B. Bigelow,* which replaced the RV*Albatross IV* in 2009. The depths which cannot be sampled by the Bigelow consist of the two shallowest series of inshore strata and the waters within these strata constitute important windowpane flounder habitat during the fall surveys (Figure J1). In addition, it was necessary to revise the entire discard time series to account for recent corrections made to the Northeast Fisheries Observer Program (NEFOP) Database regarding some windowpane flounder hail weights. The 2007 landings data were also updated. The same AIM model configuration from the 2008 assessment was utilized and the catch and relative biomass indices for 2008-2010 were added to the revised time series. It was necessary to re-estimate the BRPs, in order to be consistent with the revised data series used in AIM.

9.0 The Fishery

Landings

Statistical Areas used for reporting fishery data for the SNE-MAB windowpane flounder stock include: 526, 533-539, 541, and 611-639 (Figure J2). Commercial landings and fishery-related data for windowpane flounder are available beginning in 1975. Several different methods have been used to collect the landings, fishing area and effort data. During 1963 through April of 1994, such data were collected and entered into Northeast Region Commercial Fisheries

Database (CFDBS) by NMFS port agents, who entered landings data from all dealer purchase receipts and interviewed a subset of captains to obtain information about fishing location and effort (Burns *et al*. 1983). During May of 1994-2003, reporting of landings by vessel and trip was mandatory for dealers issued federal permits to purchase groundfish. The data were collected and entered into the CFDBS by NMFS port agents. Since 2004, such data have been self-reported, electronically, by federally permitted dealers. Beginning in May of 1994, mandatory reporting of fishing location and effort data, gear type, estimated kept and discarded catch, and other trip-based fishing data were self-reported by fishermen on logbooks (i.e., Vessel Trip Reports or VTRs) and the data were entered into the Vessel Trip Report Database. In order to integrate data from the VTR Database with data from the CFDBS, an "allocation" database was created using a trip-based allocation scheme (Wigley *et al*. 2008a). Data retrieved from the allocation database were used to assign landings, by Statistical Area, to each of the two windowpane flounder stocks.

Landings of SNE-MAB windowpane flounder were updated for 2007 and extended through 2010. During most years, at least 97% of the landings were taken with bottom trawls, but 3.0-12.5% of the landings were taken with scallop dredges during 1987-1994 (Table J1). Landings were highest during the directed fishery period (1984-1990) and averaged 1,204 mt with a peak of 1,967 mt in 1985 (Figure J1, Table J2). Thereafter, landings gradually declined to 120 mt in 1995 and remained at this low level until 2001. During 2002-2010, landings were at the lowest levels on record and ranged between 38 mt and 84 mt. Landings in 2010 totaled 53 mt. A moratorium on the possession of SNE-MAB windowpane flounder was implemented in May of 2010 (NEFSMC 2010) and will remain in effect through the 2012 fishing year (T. Nies pers. comm.).

Discards

Discards (mt) of SNE-MAB windowpane flounder and estimates of their precision were initially provided for 1975-2007 at the 2008 GARM (NEFSC 2008). The combined ratio method of Wigley *et al.* (2008b), which is based on a ratio estimate pooled across all strata and trips within each fleet, was used to estimate discards for 1989-2010. For each trip, a combined discard to kept (d/k) ratio was computed using NEFOP data, where d = discard weight of SNE-MAB windowpane flounder and k = kept weight of all species. The discard ratios were then expanded by the total weight of all species landed during a trip (using landings from the CFDBS) to estimate total discard weight.

Discards were estimated for the large mesh bottom trawl fleet (codend mesh size $\geq$ 5.5 inches), small mesh bottom trawl fleet (codend mesh size < 5.5 inches), and the sea scallop dredge fleet ("limited permits" only). Due to low numbers of trips sampled by quarter, the small mesh bottom trawl and scallop dredge fleets were binned by half year to derive discard estimates. For both fleets, imputations were necessary during years where fewer than two trips were available. There were no observed trips for the scallop fleet during 1989 and 1990 and only two trips in 1991. As a result, scallop fleet discards for 1989-1991 were estimated using the hindcast method described below. Discards from the large mesh bottom trawl fleet were estimated by quarter and cells with fewer than two trips were imputed using annual values. Discards were hindcast for the large

mesh bottom trawl fleet (1982-1988), small mesh bottom trawl fleet (1975-1988), and the scallop dredge fleet (1975-1991) based on the following equation:

(1) $$\hat{D}_{t,h} = \bar{r}_{c,1989-1991,h} * K_{t,h}$$

where:

$\hat{D}_{t,h}$ is the annual discarded pounds of windowpane flounder for fleet *h* in year *t*

$\bar{r}_{c,1989-1991,h}$ is an average combined D/K ratio (discarded pounds of windowpane flounder / total pounds of all species kept) for the fleet *h* during either 1989-1991 (for the trawl fleets) or 1992-1998 (for the scallop fleet)

$K_{t,h}$ is the total pounds of all species kept (landed) for fleet *h* in year *t*

For the subject stock assessment, the 1975-2007 discard time series was revised using the same methods that were used for the 2008 assessment (NEFSC 2008), in order to account for recent corrections made to the NEFOP Database. Discards were estimated anew for 2008-2010. The NEFOP database errors were discovered when NEFOP staffs were asked by New England Fishery Management Council staff to examine several scallop dredge hauls, conducted in the southern windowpane flounder stock area, with unusually large quantities of windowpane flounder discards during 2010. Following an audit of windowpane catches for these hauls, it was determined that the database errors were primarily related to incorrect assignments, by editors, of the windowpane species code. Some catches recorded by observers as "sand dollar" were incorrectly assigned the "sand dab" or windowpane flounder species code. Therefore, the NEFOP Database hail weights (discard plus kept weight) of both stocks of windowpane flounder, for all scallop dredge and scallop trawl hauls reviewed by the subject editors, were checked against the original haul logs to identify and correct windowpane species coding errors as well as any other errors associated with windowpane flounder hail weights. In addition, all database haul records with scallop dredge and scallop trawl hail weights of ≥ 50 lbs of windowpane flounder were compared with the original haul logs to identify and correct any hail weight errors pertaining to windowpane flounder.

NEFOP Database errors involving hail weights of SNE-MAB windowpane flounder occurred during a subset of years beginning in 1997. Sand dollar catches were first recorded in the database in 1994, for scallop dredges and finfish bottom trawls, and in 2004 for scallop trawls. Most (68%) of the total incorrect hail weight of SNE-MAB windowpane flounder was associated with scallop dredge hauls for which sand dollars were miscoded as windowpane flounder. When all gear types included in the NEFOP database were considered, scallop dredges accounted for most (99.8%) of all sand dollar catches that occurred in the SNE-MAB windowpane flounder stock area. The highest incidence of sand dollar catches also occurred in scallop dredges (30.5% of all hauls during 1994-2010) followed by scallop trawls (5.9% of all hauls during 2004-2010). The incidence of sand dollar catches in finfish bottom trawls was very low (0.4% of all hauls during 1994-2010) and the gear type accounted for only 0.03% of all sand dollar catches in the SNE-MAB stock area. Consequently, the aforementioned systematic species coding error for windowpane flounder was not expected for finfish bottom trawls. In addition to species

miscoding errors by some editors, some hail weight errors were also attributable to hail weight keypunch errors and observer miscalculations.

The audit results suggested that a hail weight cutoff of 50 lbs per haul of windowpane flounder was an appropriate auditing limit because the 2010 error incidence rate (the year with the highest error incidence rate for scallop dredges and trawls) decreased with windowpane hail weight, from 67% for hauls with greater than 100 lbs of catch to 13% for hauls with 50-100 lbs of catch. Following correction of the database errors, an examination of the distribution of hauls with windowpane flounder catches indicated that most of the hail weights for scallop dredges (1991-2010) and scallop trawls (2004-2010) were well under 50 lbs. Hauls with windowpane flounder hail weights of ≤ 20 lbs comprised 98% of all hauls with positive catches and 90% of the total hail weight of windowpane flounder in scallop dredges and comprised 92% of all hauls with positive catches and 53% of the total hail weight of windowpane flounder in scallop trawls.

Trends were different for hail weights of SNE-MAB windowpane flounder in finfish bottom trawls. Hauls with windowpane flounder hail weights of ≤ 20 lbs comprised most (68%) of all hauls with positive catches, but only 13% of the total hail weight of windowpane flounder from this gear type. Hauls with hail weights of 91-2,550 lbs of windowpane flounder also comprised a small percentage (7%) of all positive hauls, but a much larger percentage (57%) of the total windowpane flounder hail weight.

All of the database errors involved discards and the net effect of the corrections was a reduction in the database discard weights of SNE-MAB windowpane flounder. During most years, the discard reductions represented small percentages of the total database discards of windowpane flounder for each of the three gear types. Reductions in the database discards of SNE-MAB windowpane flounder were highest for scallop dredges, totaling 8,529 lbs (3.9 mt), and ranged from 0.7% of the scallop dredge discard total in 2005 to 37.9% in 2010 (Tables J3 and J4). Database reductions in windowpane flounder discards for scallop trawls totaled 2,681 lbs (1.2 mt) and ranged from 17% of the scallop trawl total in 2005 to 38.4% in 2010. Reductions in the database discards for finfish bottom trawls totaled 435 lbs (0.2 mt) and ranged from 1.1% of the finfish bottom trawl total in 2008 to 2.3% in 2007.

During most years since 1975, windowpane discards were primarily from the large mesh bottom trawl fleet (considered as the small mesh fleet prior to 1982 when the minimum codend mesh size was less than 5.5 inches, Table J5). However, a majority of the total discards occurred in the scallop dredge/trawl fleet during 1993 and 1996-1999, ranging between 43% and 66%, and in the small mesh groundfish trawl fleet during 1989, 1992, 1994 and 2001-2002 and ranged between 53% and 69%.

Even during the directed fishery period, landings were dwarfed by the high level of discards that occurred; generally 2-5 times the landings (Table J2, Figure J1). During 1982-1991, total discards ranged between 2,779 mt and 4,429 mt. Since 1992, total discards have been much lower and averaged 378 mt. Total discards increased from 246 mt in 2008 to 436 mt in 2010. CVs during 1992-2010 averaged 0.37 and ranged from 0.11-0.19 during 2004-2010 (Table J5).

Catch

Differences between the revised catch time series and that from the 2008 assessment, for 1975-2007, reflect not only the NEFOP database edits described above, but also reflect any other updates or changes which may have occurred to all three of the databases (i.e., NEFOP, VTR and CFDBS Databases) which were used to estimate discards. The revised catch time series ranged from a reduction of 16.6% to an increase of 38.0% (Table J2).
Catches increased gradually from 1,145 mt in 1975 to 1,748 in 1981, then doubled in 1982 and remained at the highest levels during 1982-1991, ranging between 3,524 mt and 5, 318 mt (Table J2, Figure J3). After 1991, catches declined rapidly to a time series low of 184 mt in 2001 then ranged between 321 mt and 522 mt during 2002-2009 and totaled 490 mt in 2010. Since 1994, most of the catch has been comprised of discards.

10.0 Research Survey Data

The Northeast Fisheries Science Center (NEFSC) conducts annual research bottom trawl surveys, between the Gulf of Maine and Cape Hatteras, North Carolina, during the spring and fall (Azarovitz 1981). Beginning in 2009, the FSV *Henry B. Bigelow* replaced the RV *Albatross IV* as the research vessel used to conduct the NEFSC surveys. The draft of the *Bigelow* is deeper than that of the RV *Albatross*, and as a result, inshore strata with depths ≤ 18 m can no longer be sampled. Windowpane flounder catches during NEFSC fall bottom trawl surveys conducted from 1975 onward were used to derive the relative biomass indices used in the stock assessment model. Therefore, the fall survey indices were recomputed for 1975-2010 without the inclusion of catches from inshore strata that cannot be sampled by the FSV *Bigelow*. Biomass indices from the 2008 assessment were derived using catches from offshore strata 1-12 and 61-76 and inshore strata 2-46 and 55. The revised indices were based on catches from offshore strata 1-12 and 61-76, and inshore strata 2, 5, 8, 11, 14, 17, 20, 23, 26, 29, 32, 35, 38, 41 and 44-46. Survey indices were standardized for changes in trawl doors (numbers = 1.54, weight = 1.67), gear (numbers = 1.67, weight = 1.37), and vessels (numbers = 0.82, weight = 0.80). Door conversion coefficients (Byrne and Forrester 1991a) were applied to the 1975-1984 catches and vessel conversion coefficients (Byrne and Forrester 1991b) were applied when the RV *Delaware II* was utilized instead of the RV *Albatross IV*.

A comparison of trends in the NEFSC fall relative abundance (stratified mean number per tow) and biomass (stratified mean kg per tow) indices from the 2008 assessment with indices derived using the revised survey strata set suggest that windowpane flounder catches in strata ≤ 18 m contributed small amounts, during most years, to the annual indices. The contribution was generally greater when stock sizes were highest, during 1979-1985 (Figure J4). The 1975-2008 biomass indices for the revised strata set were generally lower, but the 95% confidence intervals consistently overlapped (Figure J5). However, the exclusion of catches in strata ≤ 18 m reduced the precision of the biomass indices; CVs (%) increased by 4.3 on average, with a maximum increase of 10.4 (Figure J6).

In order to extend the NEFSC fall survey indices beyond 2008, catches of windowpane flounder by the SRV *H. B. Bigelow* were converted to RV *Albatross IV* equivalents to account for catchability differences between the vessels due to vessel, gear, and towing protocol differences.

Calibration coefficients were computed from paired-tow studies conducted during the spring and fall of 2008 (Miller *et al*. 2010). Since AIM relies on biomass indices for all sizes combined, the influence of length-specific calibration effects are relatively unimportant in the model. Therefore, *Bigelow* catches of windowpane flounder were divided by constant calibration coefficients for catch numbers (2.044, SE = 0.2004) and weight in kg (1.901, SE = 0.2091) using a ratio estimator based on data from the fall calibration study (Miller et al. 2010).

Biomass levels for the NEFSC fall bottom trawl surveys were much higher during 1976-1988 than during 1989-2008 (Figure J7, Table J6). Biomass indices then increased and were above the 1975-2009 median (0.32 kg per tow) during 2009 (0.36 kg per tow) and 2010 (0.49 kg per tow). CVs of the biomass indices from 2009 onward account for the variance associated with the *Bigelow* calibration factors. CVs (%) of the revised biomass time series averaged 30.0 and ranged between 16.4 and 80.3 (Table J6).

The Review Panel requested a review of several additional series of biomass indices which were not included in AIM, to determine whether such indices corroborate the high biomass indices observed for the NEFSC fall surveys during 2009-2010, because the 2009-2010 indices were dependent on the *Bigelow* calibration factor. The results indicated that the 2009-2011 biomass indices for the NEFSC spring surveys and the inshore fall surveys conducted by the MA Division of Marine Fisheries (MA DMF) showed an increase similar to the biomass indices for the NEFSC fall surveys (Figure A.J1).

11.0 Assessment

AIM (version 2.2.0) software provided in version 3.1 of the NOAA Fisheries Toolbox (http://nft.nefsc.noaa.gov/) was used to assess the stock. AIM was run using the model formulation from the 2008 assessment, but with the revised catch and biomass indices for 1975-2010 (Table J7). As was done for the 2008 GARM, stock replacement ratios were computed as the NEFSC fall survey biomass index in year *t* / average biomass index for the previous five years. Relative fishing mortality rates were computed as the catch in year *t* / average fall survey biomass index during years *t* through *t*-2.

As a means of evaluating the applicability of the index method calculation to the data, a randomization test was performed based on 2,000 realizations. The randomization test evaluated the correlation between the **ln(replacement ratio)** and **ln(relative F) time series.** The critical value for the randomization test is the estimated correlation coefficient for the original catch and biomass index data. The significance level is the cumulative distribution probability evaluated at the critical value.

The AIM input data and model results for 1975-2010 are shown in Figure J8. A randomization test indicated that the correlation between the **ln(replacement ratio)** and **ln(relative F) was highly significant (*p* = 0.006)**. Probability and cumulative distributions from the randomization test are shown in Figure J9. There was no trend in the standardized residuals from the model, but the 1983 value was -3.0 (Figure J10).

12.0 Biological Reference Points

The current BRPs were adopted at the 2008 GARM (NEFSC 2008) and are: F_{MSY} proxy = 1.47 kt/kg per tow and B_{MSY} proxy = 0.34 kg per tow. The F_{MSY} proxy was estimated from the AIM model and represents the relative fishing mortality rate (catch in year *t* / average of the NEFSC fall survey biomass index during years *t* through *t*-2, in kt/kg per tow) at which the stock can replace itself. Stock replacement ratios were computed as NEFSC fall survey biomass index in year *t* / average biomass index for the previous five years. Based on trends in stock replacement ratios, during a period when catches were most precisely estimated (1989-2007), the stock appeared to be able to sustain itself at the catch levels which occurred during 1995-2001 (i.e., replacement ratios were near or above 1.0 during this period). Therefore, the median catch during 1995-2001 (= 500 mt) was considered as an MSY proxy. The MSY proxy was divided by the F_{MSY} proxy to compute the B_{MSY} proxy.

The current BRPs cannot be used to determine the 2010 stock status because the current BRPs were computed using biomass indices for a different survey strata set and a different catch series. Therefore, the 2010 stock status was determined based on re-estimated BRPs and the 1975-2010 revised input data. The re-estimated F_{MSY} proxy is 2.09 kt/kg per tow (90% CI = 1.00, 3.03, Figure J11), and based on the MSY proxy of 500 mt, resulted in a new B_{MSY} proxy of 0.24 kg per tow and a $B_{threshold}$ proxy of 0.12 kg per tow.

13.0 Projections

Stochastic projections of catches during 2008 and 2009 were run for the 2008 GARM using AIM (NEFSC 2008). However, the results were not used by the Science and Statistical Committee (SSC) to set the 2009 Acceptable Biological Catches (ABCs) for either of the windowpane flounder stocks. Instead, the SSC used the target fishing mortality rate, 75% of the F_{MSY} proxy, applied to the most recent three-year average of the relative biomass index from the NEFSC fall surveys to calculate the ABC.

Projected catches and relative biomass indices for 2011-2014 were estimated for the subject assessment, using AIM, in order to be consistent with the assessment methods from the 2008 GARM. Projections were run assuming fishing at the re-estimated F_{MSY} proxy (= 2.09 kt/kg per tow) and 75%F_{MSY} proxy (= 1.57 kt/kg per tow). Catch was 490 mt in 2010. Under the 75%F_{MSY} proxy scenario, which is used to provide catch advice, catches would increase from 752 mt in 2013 to 835 mt in 2014 (Table J8, Figure J12).

14.0 Summary

Although the results are not presented herein, an AIM sensitivity run based on the revised biomass and catch series for 1975-2007 did not change the 2007 stock status determination (NEFSC 2008). The new 2007 relative F value of 1.82 kt/kg per tow was greater than the new F_{MSY} proxy of 1.69 kt/kg per tow and the new 2007 biomass index of 0.19 kg per tow was above the new $B_{Threshold}$ proxy (= 0.15 kg per tow). Therefore, overfishing was occurring but the stock was not overfished in 2007. The stock was also not rebuilt in 2007.

Relative F in 2010 (= 1.40 kt/kg per tow), for the AIM run that incorporated the revised input data for 1975-2010, was below the re-estimated F_{MSY} proxy (= 2.09 kt/kg per tow), indicating that overfishing was not occurring in 2010 (Table J9). The 2010 biomass index (= 0.35 kg per tow) was above the re-estimated $B_{threshold}$ (50% of B_{MSY} = 0.12 kg per tow) as well as the re-estimated B_{MSY} proxy (= 0.24 kg per tow), indicating that the stock was not overfished in 2010 and was rebuilt.

8.0 Panel Discussions/Conclusions

Status of Stock

The biomass in 2010 (i.e., 2008-2010 average index of the NEFSC fall survey) is estimated to be 0.35 kg per tow. Relative F in 2010 (i.e., catch in 2010/average biomass index during 2008-2010) is estimated to be 1.40 kt/kg per tow.

The Fmsy proxy was re-estimated in an AIM analysis that incorporated revised catch and relative biomass time series. The Bmsy proxy was also re-estimated based on the MSY value from GARM-III. Revised estimates of the biological reference points are:

Bmsy proxy= 0.24 kg per tow,
Fmsy proxy = 2.09 kt/kg per tow, and
MSY proxy= 500 mt.

Based on these results, the stock of SNE-MAB windowpane flounder is not overfished and overfishing is not occurring. The stock is above the biomass target and is therefore rebuilt. At GARM-III, the stock was not overfished, but overfishing was occurring in 2007.

The results are based on the same model used in GARM-III (NEFSC 2008, CRD#08-15), which includes the use of catch and NEFSC fall survey biomass indices, during 1975-2010, in AIM. However, the assessment is more than a simple update because the entire catch and biomass time series were re-estimated because of some NEFOP database corrections and the use of a different survey strata set to derive the biomass indices (i.e., the FSV *H. B. Bigelow* cannot sample strata ≤ 18 m deep), respectively.

The biological reference points are based on the following revisions: re-estimation of the F_{MSY} proxy using AIM and the MSY value from the 2008 GARM.

SNE-MAB Windowpane Flounder. Summary of Assessment Information

SNE-MAB Windowpane Flounder	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Avg	Min	Max	YrRange
Landings (mt)	135	84	47	60	38	57	83	74	53	53	505	38	1967	1975-2010
Discards (mt)	49	256	474	340	293	374	266	246	410	436	1255	49	4429	1975-2010
Catch (mt)	184	339	522	400	330	431	349	321	463	490	1760	184	5318	1975-2010
SSB Proxy (kg/tow)	0.347	0.176	0.336	0.129	0.154	0.228	0.192	0.191	0.3631	0.4941	0.415	0.039	1.733	1975-2010
F relative	0.86	1.47	1.82	1.87	1.6	2.53	1.82	1.58	1.86	1.4	4.728	0.86	22.89	1977-2010

Reviewer Comments

The work that is presented is accepted by the Review Panel for determining stock status and providing catch advice.

The revised discard estimates were considered to be an improvement, because they corrected the previous problem of miscoding of "sand dollars" as "sand dabs" for some NEFOP database discard records. Revisions to the NEFOP database discards were more substantial for the southern stock of windowpane flounder than for the northern stock and were associated primarily with scallop dredges. Catches were mostly discards. Annual CVs of discard estimates for recent years were low and ranged from 0.19 in 2004 to 0.11 in 2010. As a research recommendation, the Review Panel suggested that alternative stratification schemes (e.g., geographic regions and gear types within fisheries) be investigated to further improve the precision of discard estimates.

There was some ambiguity between the 2008 GARM and Amendment 16 (NEFMC 2009) in the Multispecies Fishery Management Plan regarding whether to use the terminal year biomass index (i.e., that used for stock status determination at the 2008 GARM) or a 3-year lagged biomass index for stock status determination. The Review Panel agreed to use the method in the Fishery Management Plan (i.e., relative biomass index during 2008-2010).

The status of the stock is based on an analysis that incorporates the NEFSC fall survey indices. The 2009 and 2010 survey values are driving the perception of recovery for this stock, which depends on the calibration of the SRV *Bigelow*. However, the fall survey biomass calibration coefficient was relatively well-estimated (10% CV) and the coefficient estimate was similar to other flatfishes. The recent increase in the NEFSC fall survey biomass indices was supported by the recent trend in the NEFSC spring surveys, as well as in the inshore fall surveys conducted by the Massachusetts Division of Marine Fisheries (MA DMF).

The 2008 GARM developed catch projections based on AIM. Even though the SSC did not use AIM projections in 2009, these projections were conducted for this assessment to be consistent with the 2008 GARM methods.

Validation of age determination and processing of archived age samples from NEFSC fall surveys would help to inform a more analytical assessment.

9.0 References

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Table J1. Landings (mt) of SNE-MAB windowpane flounder, by gear category, during 1975-2010.

	Landings (mt)					
	Bottom trawls	Sea scallop dredges/trawls	Gillnets	Other[1]	Total	Percent landed by bottom trawls
1975	678.068	0.000	0.000	0.090	678	100.0
1976	563.308	0.079	0.000	0.014	563	100.0
1977	646.205	0.395	0.000	0.169	647	99.9
1978	889.539	2.656	0.000	0.665	893	99.6
1979	630.296	1.209	0.000	1.628	633	99.6
1980	523.582	0.873	0.000	0.257	525	99.8
1981	862.567	0.494	0.000	2.906	866	99.6
1982	627.620	1.664	0.000	2.099	631	99.4
1983	768.423	3.556	0.000	2.711	775	99.2
1984	1,042.413	1.722	0.000	1.139	1,045	99.7
1985	1,964.659	0.695	0.034	1.481	1,967	99.9
1986	1,356.512	20.660	0.050	0.911	1,378	98.4
1987	853.239	26.552	0.370	1.284	881	96.8
1988	1,097.798	39.338	0.037	9.816	1,147	95.7
1989	1,077.836	40.874	0.000	2.659	1,121	96.1
1990	832.860	55.235	0.060	1.669	890	93.6
1991	712.090	101.696	0.074	2.733	817	87.2
1992	512.853	68.117	0.053	2.545	584	87.9
1993	444.910	23.028	0.210	1.163	469	94.8
1994	176.885	7.639	1.330	0.068	186	95.1
1995	111.969	0.970	0.818	5.795	120	93.7
1996	189.516	0.179	0.123	1.077	191	99.3
1997	114.631	0.347	0.250	0.797	116	98.8
1998	119.680	0.154	0.524	1.427	122	98.3
1999	115.848	0.128	0.123	1.588	118	98.4
2000	121.332	0.014	0.157	3.311	125	97.2
2001	132.908	0.118	0.381	1.294	135	98.7
2002	81.542	0.000	0.250	1.974	84	97.3
2003	45.928	0.018	0.139	1.235	47	97.1
2004	57.883	0.000	0.186	2.214	60	96.0
2005	36.673	0.000	0.116	1.016	38	97.0
2006	55.066	0.052	0.453	1.331	57	96.8
2007	81.573	0.000	0.932	0.495	83	98.3
2008	72.852	0.001	0.990	0.652	74	97.8
2009	49.397	0.000	0.595	2.978	53	93.3
2010	50.599	0.000	0.696	2.128	53	94.7

[1] Includes other gear types and unknown gear types.

Table J2. Landings, discards, and catches (mt) of SNE-MAB windowpane flounder during 1975-2010 and differences (%) between these catches and those used in the 2008 AIM run for 1975-2007.

	Landings (mt)	Discards (mt)	Catch (mt)	Catch difference (%)
1975	678	467	1,145	-1.8
1976	563	595	1,159	-2.4
1977	647	557	1,204	-2.2
1978	893	949	1,842	-2.5
1979	633	1,022	1,655	-2.8
1980	525	957	1,482	-2.3
1981	866	882	1,748	-2.2
1982	631	2,893	3,524	-2.0
1983	775	3,612	4,387	-1.5
1984	1,045	3,417	4,463	-1.5
1985	1,967	2,779	4,746	-1.2
1986	1,378	3,021	4,399	-3.0
1987	881	2,984	3,865	-3.1
1988	1,147	3,015	4,162	-3.2
1989	1,121	3,442	4,564	-1.3
1990	890	4,429	5,318	-1.5
1991	817	2,983	3,799	-3.8
1992	584	517	1,101	-2.9
1993	469	397	866	-0.7
1994	186	1,032	1,218	3.7
1995	120	375	494	1.6
1996	191	548	739	22.1
1997	116	213	329	-3.3
1998	122	363	485	-7.5
1999	118	470	588	11.7
2000	125	130	255	-3.0
2001	135	49	184	1.4
2002	84	256	339	38.0
2003	47	474	522	16.2
2004	60	340	400	5.2
2005	38	293	330	5.5
2006	57	374	431	-6.7
2007	83	266	349	-16.6
2008	74	246	321	
2009	53	410	463	

2010	53	436	490

Table J3. Discards (pounds) of SNE-MAB windowpane flounder, by year and gear type, which were incorrect in the NEFOP Database. All values were subtracted from the original discard amounts of SNE-MAB windowpane flounder recorded in the database. Most errors involved species miscoding, by editors, and data keypunch errors.

	Windowpane database discards, lbs, by gear type (negear code)			
Year	Scallop dredge (132)	Bottom trawl (050)	Scallop trawl (052)	Total
1997	150			150
1998	495			495
2002	100			100
2005	67		90	157
2006	75			75
2007		1,294		1,294
2008	131	490		621
2009	500			500
2010	7,011	897	345	8,253
Total	8,529	2,681	435	11,645

Table J4. Discards (%, in pounds) of SNE-MAB windowpane flounder, by year and gear type, which were incorrect in the NEFOP Database. Values are expressed as percentages of the total database discards of SNE-MAB windowpane flounder within each category. All values were subtracted from the original discard amounts of windowpane flounder recorded in the database. Most errors (in terms of discard weight) involved species miscoding, by editors, and data keypunch errors.

	Windowpane database discards, % of total, by gear type (negear code)			
Year	Scallop dredge (132)	Bottom trawl (050)	Scallop trawl (052)	Total
1997	4.9%			3.3%
1998	19.3%			13.6%
2002	3.5%			1.0%
2005	0.7%		17.0%	0.3%
2006				0.1%
2007		2.3%		2.1%
2008		1.1%		1.1%
2009	5.8%			0.9%
2010	37.9%	1.9%	38.4%	12.7%
Total	12.8%	0.9%	17.9%	3.1%

Table J5. SNE-MAB windowpane flounder discard estimates (mt) and CVs for large mesh bottom trawls (codend mesh size ≥ 5.5 in.), small mesh bottom trawls (codend mesh size < 5.5 in.), and scallop dredges (limited permits) during 1975-2010. Discards were hindcast for large mesh trawls (1982-1988), small mesh trawls (1975-1988), and scallop dredges (1975-1991) due to no sampling.

	Large Mesh Bottom Trawls			Small Mesh Bottom Trawls			Scallop Dredges/Trawls, Limited Permits			Total	
Year	N Observer trips	Discards (mt)	CV	N Observer trips	Discards (mt)	CV	N Observer trips	Discards (mt)	CV	Discards (mt)	CV
1989	10	1,342	0.54	75	1,814	0.54	0				
1990	22	3,827	0.27	63	346	0.39	0				
1991	21	1,871	1.04	118	817	0.63	2				
1992	25	80	0.44	67	299	0.41	12	139	0.52	517	0.28
1993	13	150	0.43	18	74	4.59	14	173	0.54	397	0.90
1994	17	196	0.54	17	698	0.56	20	138	0.79	1032	0.41
1995	71	211	0.31	70	108	0.55	22	56	0.51	375	0.25
1996	32	215	0.42	84	90	0.39	32	243	0.33	548	0.23
1997	11	44	1.29	61	27	0.81	19	142	0.56	213	0.47
1998	14	232	0.46	30	21	1.02	13	109	0.52	363	0.34
1999	8	244	0.55	40	71	0.62	8	155	1.08	470	0.47
2000	34	87	0.60	43	16	4.76	69	27	0.85	130	0.73
2001	55	17	0.21	61	26	0.95	93	7	0.71	49	0.51
2002	49	30	0.26	51	175	1.71	91	50	0.22	256	1.17
2003	50	299	0.38	93	102	0.43	103	73	0.27	474	0.26
2004	197	205	0.27	301	91	0.37	218	44	0.22	340	0.19
2005	364	126	0.20	257	63	0.28	120	103	0.34	293	0.16
2006	171	273	0.17	174	38	0.50	90	63	0.39	374	0.15
2007	263	162	0.17	252	62	0.31	185	41	0.25	266	0.13
2008	253	134	0.17	174	58	0.40	339	53	0.16	246	0.14
2009	293	295	0.15	403	61	0.23	250	55	0.14	410	0.11
2010	381	202	0.12	480	48	0.29	223	187	0.21	436	0.11

Table J6. Stratified mean number and weight tow indices for SNE-MAB windowpane flounder caught during NEFSC fall bottom trawl surveys, 1975-2010. Indices include catches from offshore strata 1-12 and 61-76 plus inshore strata 2, 5, 8, 11, 14, 17, 20, 23, 26, 29, 32, 35, 38, 41 and 44-46. Standardization coefficients were applied for trawl door changes which occurred in 1985 (numbers = 1.54, weight = 1.67) and for vessel changes which occurred during various years (numbers = 0.82, weight = 0.80). From 2009 onward, fall calibration factors were used to convert FSV *H. B. Bigelow* catches to RV *Albatross IV* catches (numbers = 2.04, weight = 1.90) and the associated CVs (%) account for the variances of the calibration factor estimates.

Year	Mean number per tow	CV (%)	Mean kg per tow	CV (%)
1975	2.00	27.1	0.33	27.9
1976	3.14	25.6	0.63	23.4
1977	3.93	26.7	0.87	33.4
1978	3.64	23.0	0.73	23.1
1979	5.88	16.8	1.18	16.4
1980	2.66	18.6	0.58	17.9
1981	3.77	23.6	0.86	21.0
1982	8.95	22.8	1.73	22.4
1983	3.05	21.0	0.70	18.8
1984	2.75	24.9	0.58	25.3
1985	3.34	17.8	0.54	20.0
1986	3.45	75.8	0.64	80.3
1987	2.61	35.6	0.41	32.9
1988	2.25	42.7	0.41	41.3
1989	0.98	31.3	0.14	31.5
1990	0.91	28.0	0.15	27.4
1991	1.63	39.2	0.30	42.3
1992	1.07	18.6	0.19	21.1
1993	0.24	29.1	0.04	35.1
1994	0.92	41.8	0.19	43.8
1995	1.51	26.3	0.25	23.4
1996	1.71	23.2	0.26	21.2
1997	0.62	23.3	0.13	24.2
1998	1.17	28.7	0.20	23.5
1999	0.82	26.4	0.13	22.4
2000	1.00	65.5	0.17	54.8
2001	1.52	49.8	0.35	47.9
2002	0.80	26.6	0.18	28.3
2003	1.82	30.0	0.34	21.5
2004	0.70	24.3	0.13	22.1
2005	0.72	33.2	0.15	34.4
2006	1.08	29.6	0.23	34.3
2007	1.20	27.7	0.19	30.7
2008	1.11	44.9	0.19	45.8
2009	2.89	24.5	0.36	22.1
2010	3.01	18.2	0.49	17.0

Table J7. Revised AIM model input data for the assessment of SNE-MAB windowpane flounder including: catch (000's mt); NEFSC fall survey relative biomass indices (stratified mean kg per tow); relative fishing mortality rates (catch in year *t* / average of the NEFSC fall survey biomass indices in year *t* through *t*-2); and stock replacement ratios (NEFSC fall survey biomass index in year *t* / average biomass index for the previous five years) during 1975-2010. Survey indices are based on offshore strata 1-12 and 61-76, and inshore strata 2, 5, 8, 11, 14, 17, 20, 23, 26, 29, 32, 35, 38, 41 and 44-46.

	Catch	NEFSC fall survey stratified mean			
Year	(000's mt)	Kg per tow	CV (%)	Relative F	Replacement Ratio
1975	1.145	0.328	27.9		
1976	1.159	0.630	23.4		
1977	1.204	0.870	33.4	1.98	
1978	1.842	0.731	23.1	2.48	
1979	1.655	1.177	16.4	1.79	
1980	1.482	0.581	17.9	1.79	0.778
1981	1.748	0.858	21.0	2.00	1.075
1982	3.524	1.733	22.4	3.33	2.055
1983	4.387	0.699	18.8	4.00	0.688
1984	4.463	0.580	25.3	4.45	0.574
1985	4.746	0.544	20.0	7.81	0.611
1986	4.399	0.636	80.3	7.50	0.720
1987	3.865	0.413	32.9	7.28	0.493
1988	4.162	0.406	41.3	8.58	0.707
1989	4.564	0.137	31.5	14.32	0.266
1990	5.318	0.154	27.4	22.89	0.360
1991	3.799	0.303	42.3	19.19	0.868
1992	1.101	0.186	21.1	5.14	0.658
1993	0.866	0.039	35.1	4.92	0.164
1994	1.218	0.192	43.8	8.76	1.172
1995	0.494	0.249	23.4	3.09	1.424
1996	0.739	0.264	21.2	3.14	1.362
1997	0.329	0.129	24.2	1.54	0.694
1998	0.485	0.195	23.5	2.47	1.117
1999	0.588	0.125	22.4	3.93	0.607
2000	0.255	0.169	54.8	1.56	0.878
2001	0.184	0.347	47.9	0.86	1.967
2002	0.339	0.176	28.3	1.47	0.912
2003	0.522	0.336	21.5	1.82	1.660
2004	0.400	0.129	22.1	1.87	0.559
2005	0.330	0.154	34.4	1.60	0.666
2006	0.431	0.228	34.3	2.53	0.998
2007	0.349	0.192	30.7	1.82	0.938
2008	0.321	0.191	45.8	1.58	0.919
2009	0.463	0.363[1]	32.3	1.86	2.030

2010	0.490	0.494[1]	29.2	1.40	2.190

[1] Indices for 2009 onward were adjusted from FSV *Henry B. Bigelow* units to RV *Albatross IV* equivalents and the associated CVs account for the variance associated with the *Bigelow* calibration factor.

Table J8. Stochastic projections of SNE-MAB windowpane flounder catches (kt) and NEFSC fall survey relative biomass indices (kg per tow), for 2011-2014, assuming fishing at the F_{MSY} proxy (= 2.09 kt/kg per tow) and 75%F_{MSY} proxy (= 1.57 kt/kg per tow).

	2011		2012		2013		2014	
	Catch (mt)	Relative Biomass Index (kg per tow)	Catch (mt)	Relative Biomass Index (kg per tow)	Catch (mt)	Relative Biomass Index (kg per tow)	Catch (mt)	Relative Biomass Index (kg per tow)
F_{MSY} proxy (= 2.09)	730	0.349	730	0.349	729	0.349	729	0.349
75%F_{MSY} proxy (= 1.57)	609	0.388	677	0.431	752	0.479	835	0.532

Table J9. Current (1975-2007) and re-estimated (1975-2010) biological reference points (BRPs) for SNE-MAB windowpane flounder and stock status during 2010. The 2010 B index is the average biomass index for 2008-2010 for NEFSC fall bottom trawl surveys and the 2010 relative F is the catch in 2010 / average biomass index for 2008-2010 for NEFSC fall bottom trawl surveys. Biomass indices from 2009 onward were converted from FSV *Henry B. Bigelow* units to RV *Albatross IV* equivalents.

	Current[1]	Re-estimated	Stock status in 2010
F_{MSY} proxy (kt/kg per tow)	1.47	2.09	
F_{Target} (= 75%F_{MSY} proxy, kt/kg per tow)	1.10	1.57	
B_{MSY} proxy (kg per tow)	0.34	0.24	
$B_{threshold}$ (50% of B_{MSY})	0.17	0.12	
2010 relative F (kt/kg per tow)		1.40	overfishing is not occurring
2010 B index (kg per tow)[1]		0.35	not overfished and is rebuilt

1 The current BRPs should not be compared with either the proposed BRPs or the 2010 biomass index and relative F value because the current BRPs were computed using biomass indices based on a different survey strata set and a different catch time series.

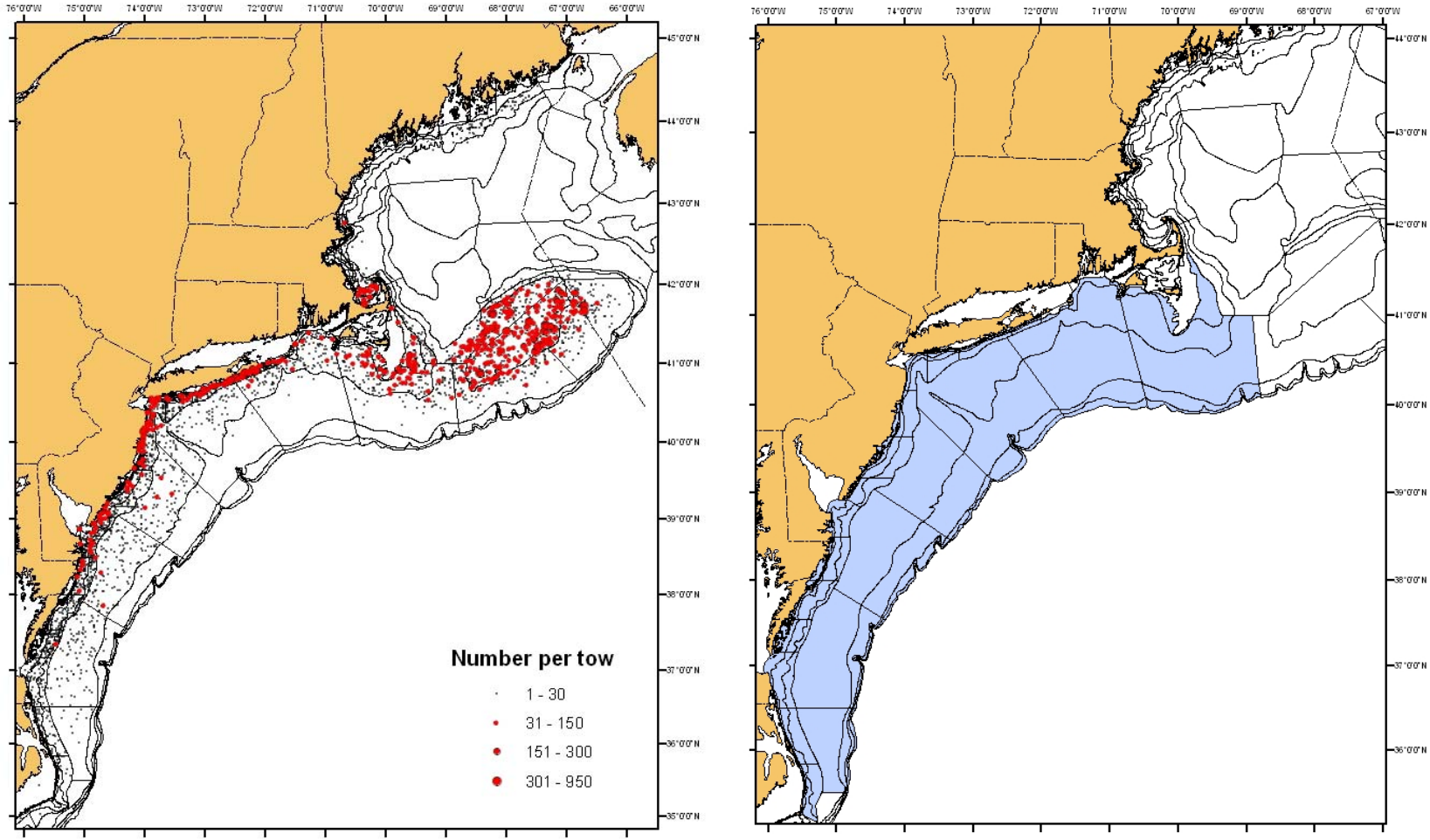

Figure J1. Distribution of windowpane flounder (number per tow) during NEFSC fall research bottom trawl surveys, 1968-2007 (left panel), and NEFSC survey depth strata, shaded blue (right panel), used to derive relative abundance and biomass indices for the SNE-MAB stock. As of 2009, abundance and biomass indices do not include catches from the two shallowest depth strata series (depths ≤ 18 m) because the strata cannot be sampled by the FSV *Henry B. Bigelow.*

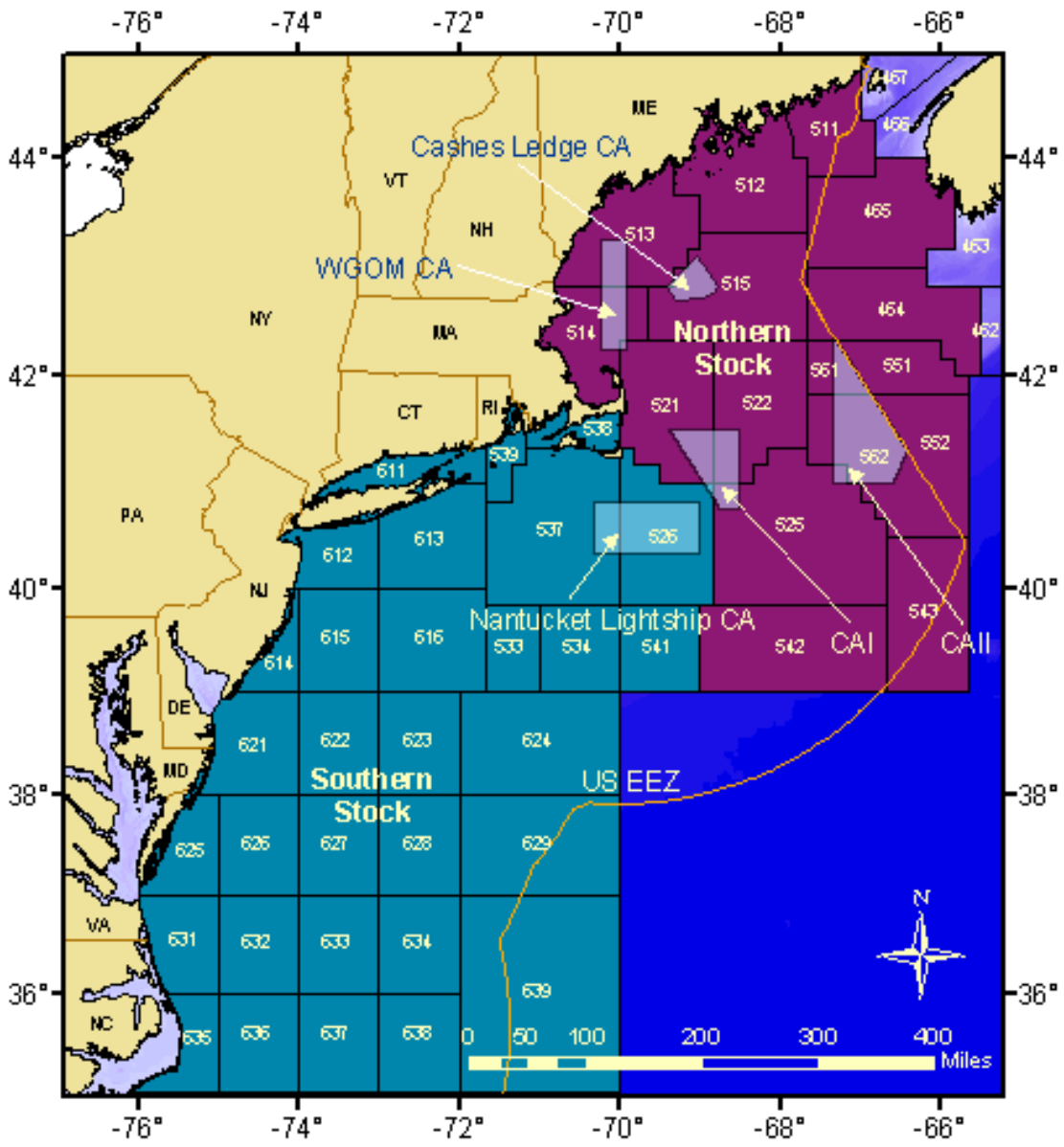

Figure J2. Statistical Areas used for reporting fishery data for the northern (Gulf of Maine-Georges Bank) and southern (Southern New England-Mid-Atlantic Bight) windowpane flounder stocks.

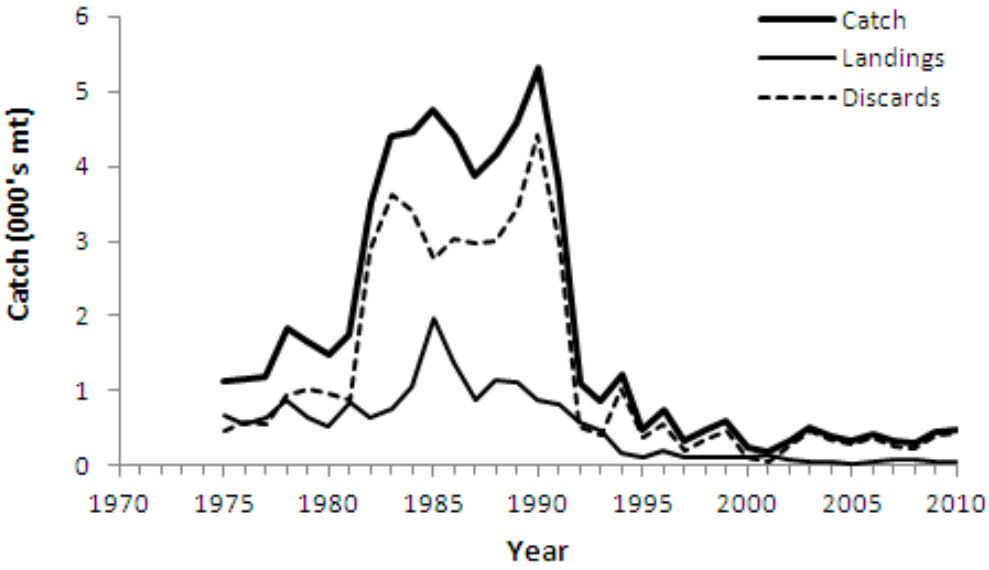

Figure J3. Landings, discards and catches (000's mt) of SNE-MAB windowpane flounder during 1975-2010.

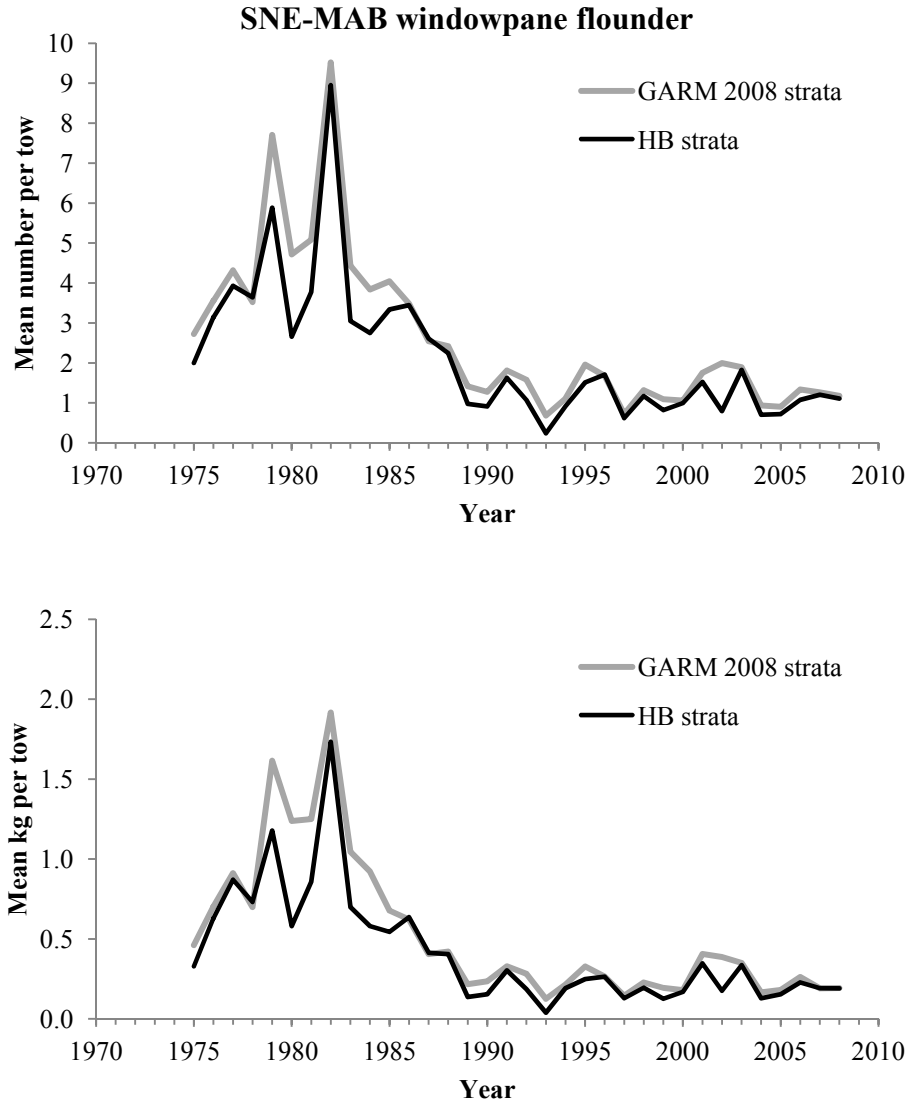

Figure J4. NEFSC fall survey relative abundance (top) and biomass (bottom) indices, during 1975-2008, for SNE-MAB windowpane flounder derived using catch data from two different strata sets. The grey line represents indices used in the 2008 stock assessment (NEFSC 2008) which included catches from strata ≤ 18 m (offshore strata 1-12 and 61-76 plus inshore strata 2-46 and 55). The black line represents the revised indices computed without including catches from strata ≤ 18 m (offshore strata 1-12 and 61-76 plus inshore strata 2, 5, 8, 11, 14, 17, 20, 23, 26, 29, 32, 35, 38, 41 and 44-46) which cannot be sampled by the FSV *Henry B. Bigelow* as of 2009.

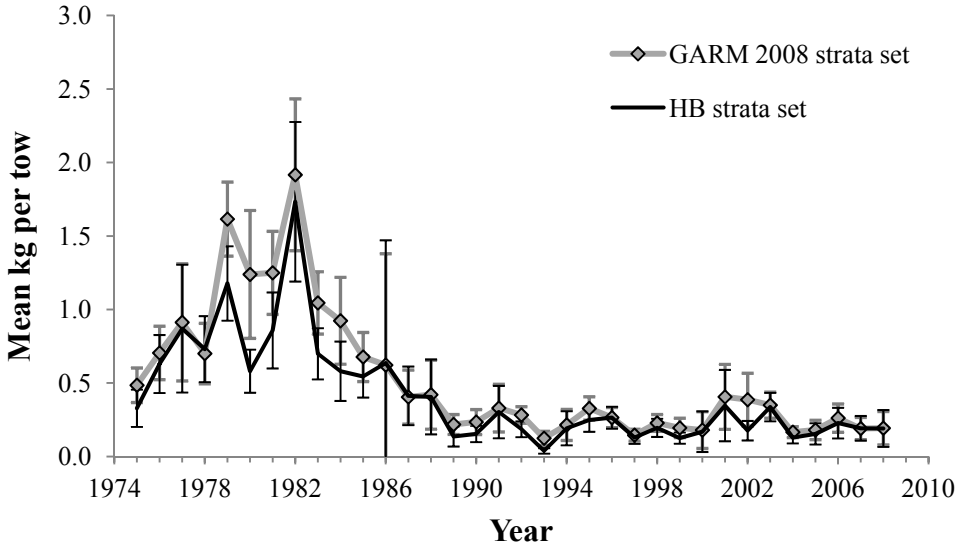

Figure J5. Comparison of NEFSC fall survey relative biomass indices (stratified mean kg per tow, +/- 2 SE), for SNE-MAB windowpane flounder, computed with (GARM 2008 strata set) and without catches from strata ≤ 18 m deep (HB strata set), 1975-2008. Strata ≤ 18 m deep cannot be sampled by the FSV *Henry B. Bigelow* as of 2009.

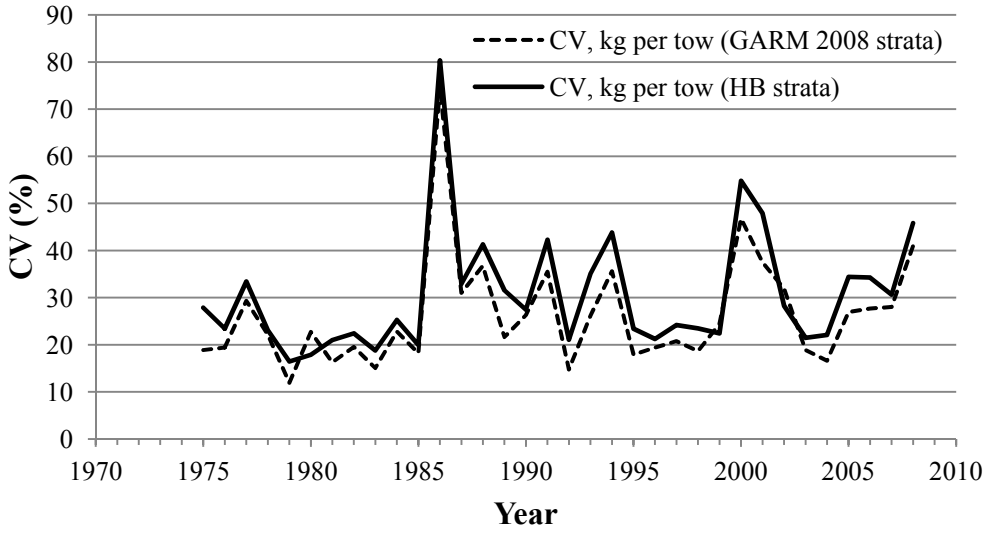

Figure J6. Comparison of CVs for NEFSC fall survey relative biomass indices (stratified mean kg per tow), for SNE-MAB windowpane flounder, computed with (GARM 2008 strata set) and without catches from strata ≤ 18 m deep (HB strata set) during 1975-2008. Strata ≤ 18 m deep cannot be sampled by the FSV *Henry B. Bigelow* as of 2009.

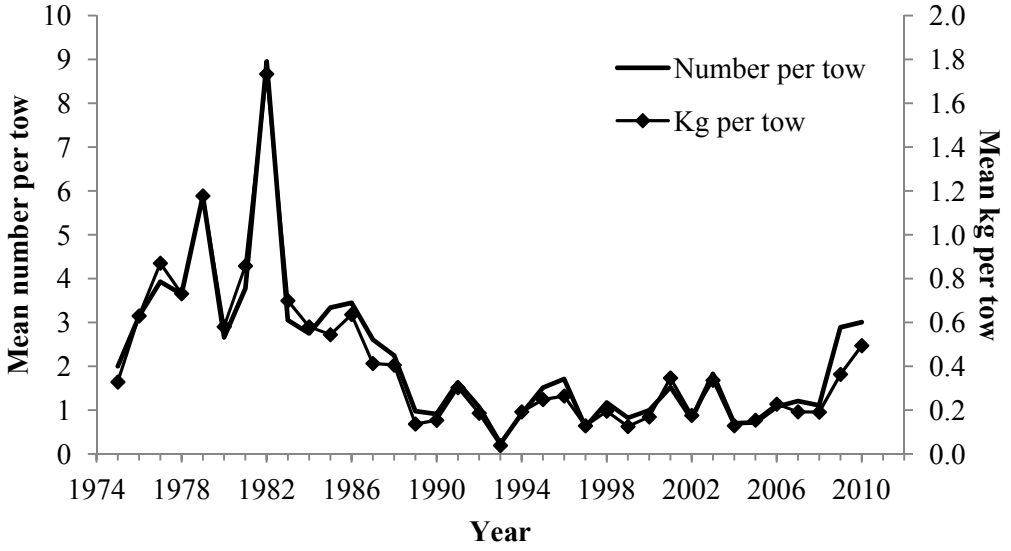

Figure J7. Revised NEFSC fall survey relative abundance and biomass indices, during 1975-2010, for SNE-MAB windowpane flounder. Survey indices were derived using catches from offshore strata 1-12 and 61-76 plus inshore strata 2, 5, 8, 11, 14, 17, 20, 23, 26, 29, 32, 35, 38, 41 and 44-46. Indices from 2009 onward represent SRV *H. B. Bigelow* catches adjusted to RV *Albatross IV* equivalents.

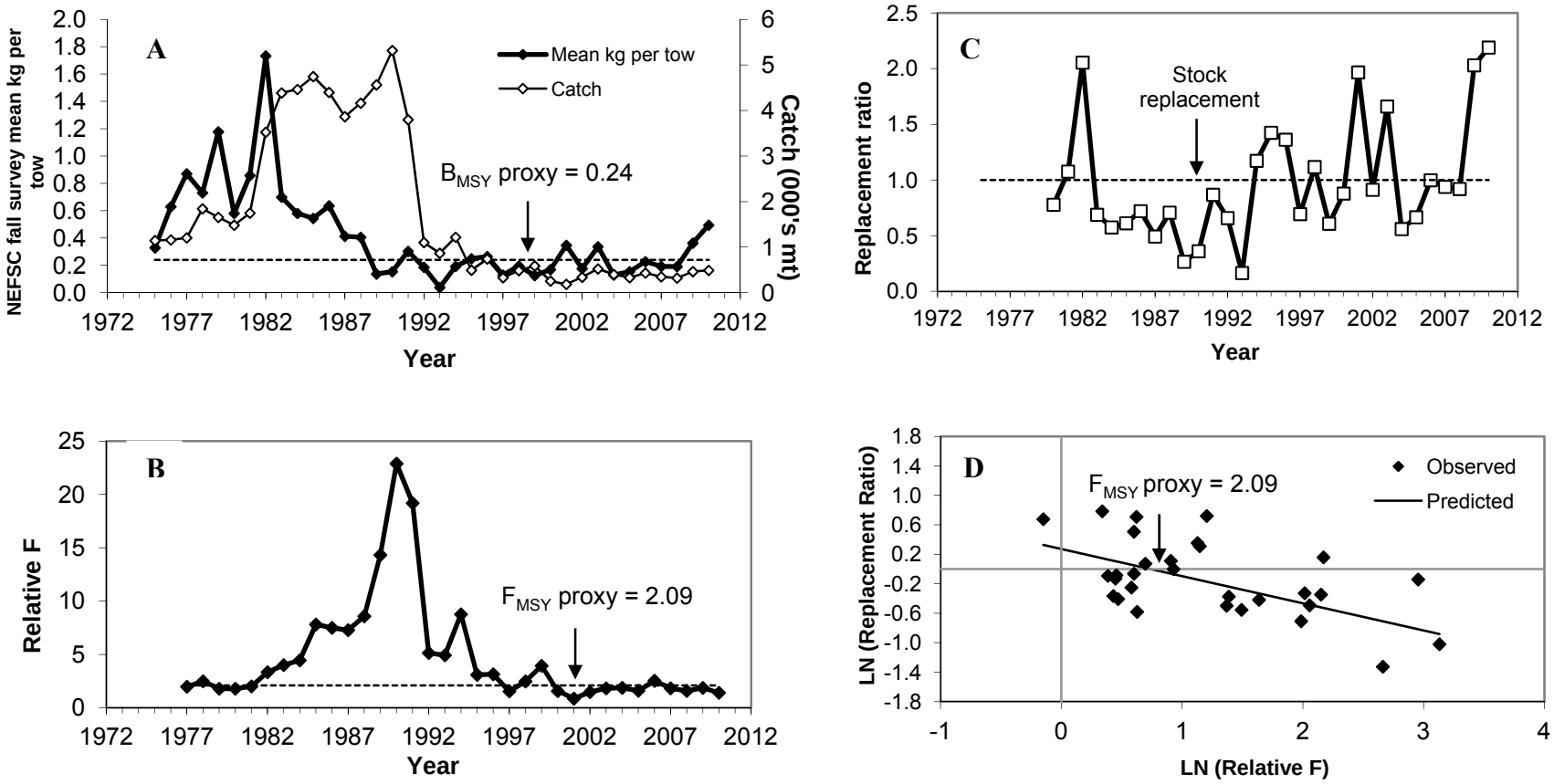

Figure J8. Trends in (A) the revised SNE-MAB windowpane flounder catches (000's mt) and revised NEFSC fall survey relative biomass indices (stratified mean kg per tow), (B) fishing mortality rates (catch in 2010 / 2008-2010 average of the NEFSC fall survey biomass indices), (C) stock replacement ratios, and (D) the regression of ln(relative F) against ln(replacement ratio) to calculate the relative F value where ln(replacement ratio) is equal to 0 (= F_{MSY} proxy of 2.09). Biomass indices were computed without the catches from NEFSC survey strata ≤ 18 m.

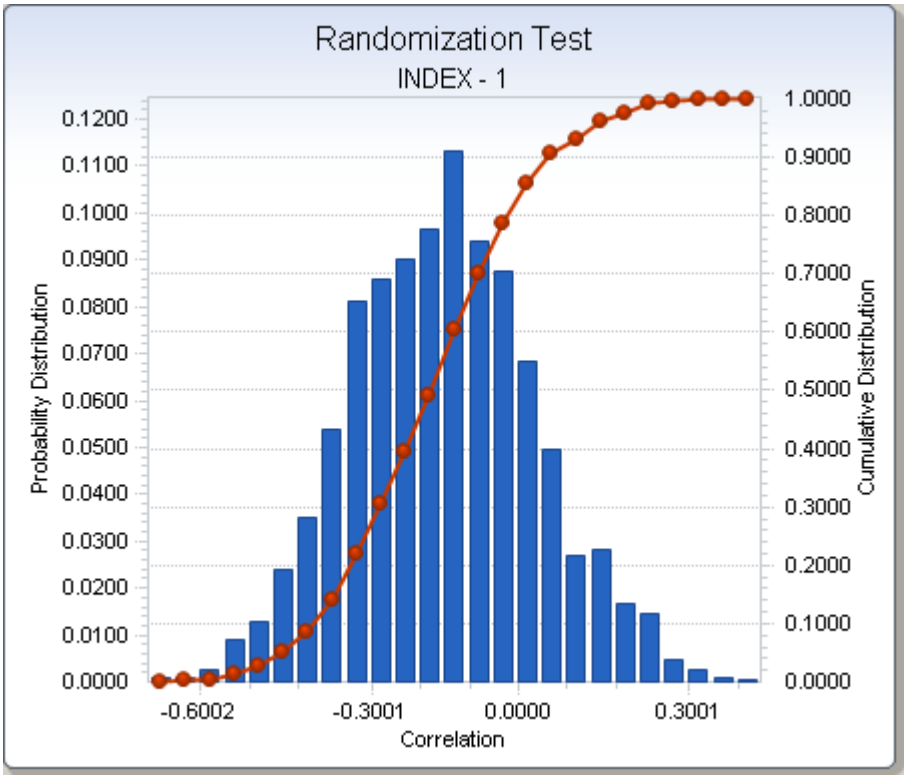

Figure J9. Probability and cumulative distributions from a randomization test, with 2,000 realizations, used to evaluate the correlation between the revised **ln(replacement ratio)** and **ln(relative F) time series (1975-2010)** for SNE-MAB windowpane flounder**.**

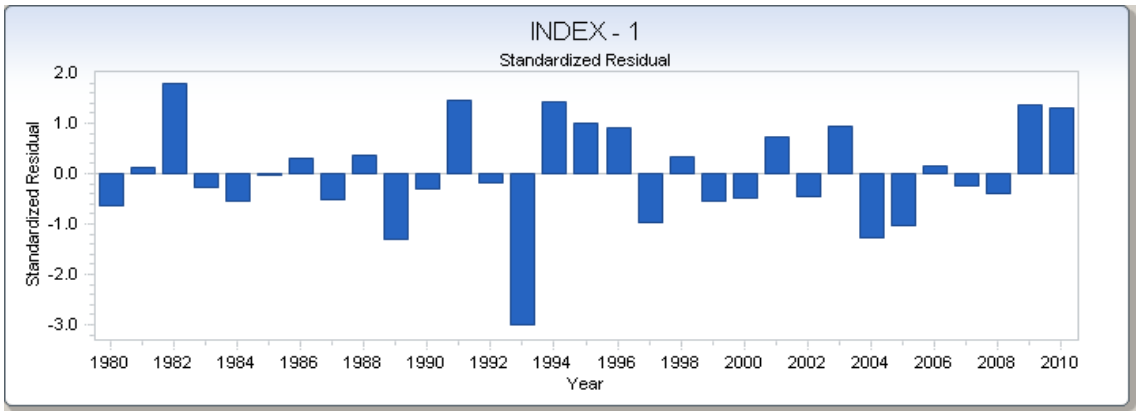

Figure J10. Standardized residuals from the AIM model run using the revised catches and biomass indices (1975-2010) for SNE-MAB windowpane flounder.

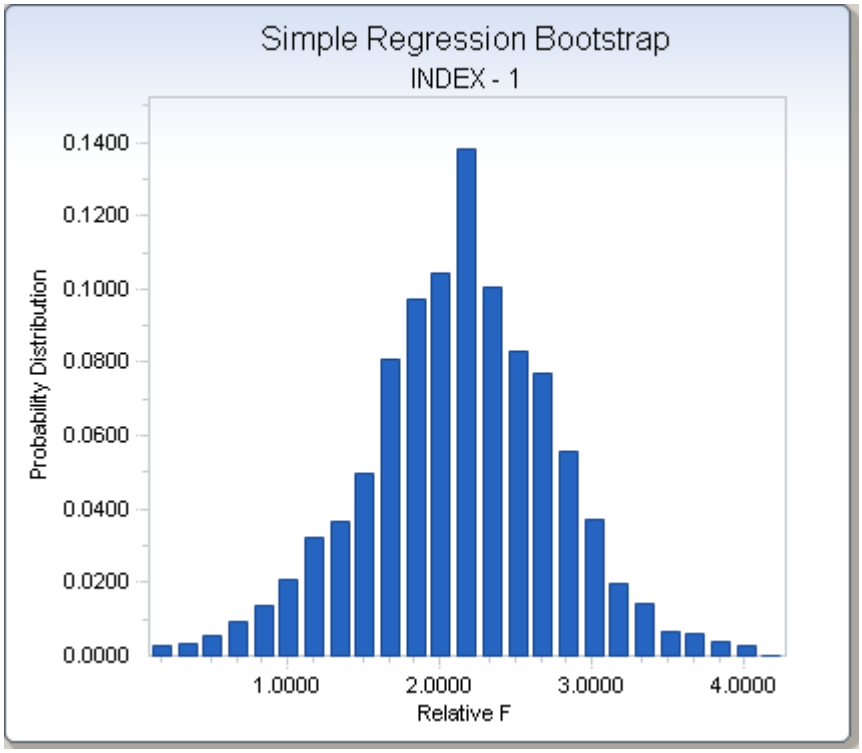

Figure J11. Probability distribution, based on 2,000 bootstrap realizations, of the estimate of relative F when the stock replacement ratio equals 1.0, which represents the re-estimated F_{MSY} proxy of 2.09 (90% CI = 1.00, 3.03), for the AIM run using the revised series of catches and biomass indices (i.e., where catches in strata ≤ 18 m were excluded) for 1975-2010.

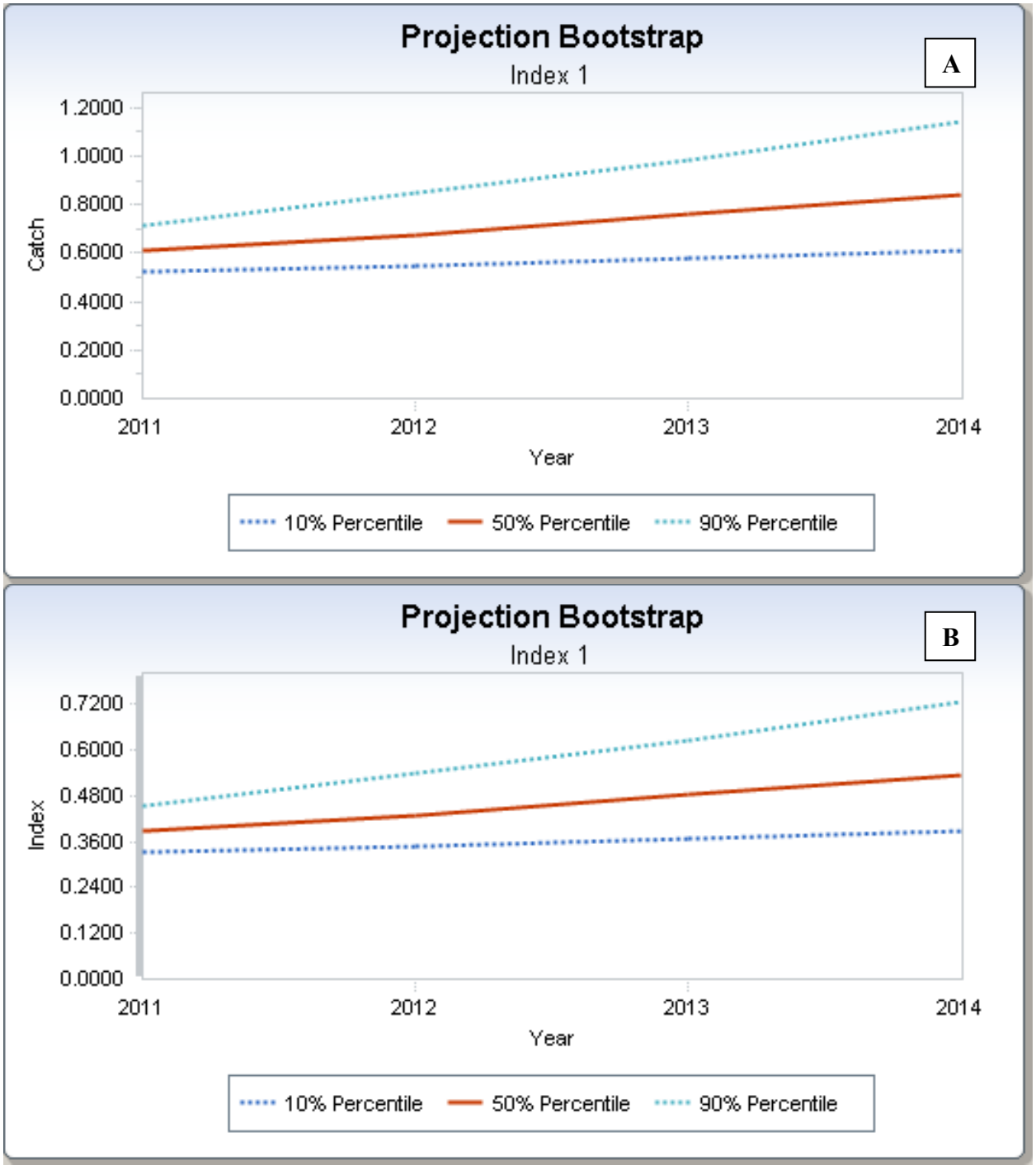

Figure J12. Stochastic projections of SNE-MAB windowpane flounder (A) catches (kt) and (B) NEFSC fall survey relative biomass indices (kg per tow), for 2011-2014, assuming fishing at 75% F_{MSY} proxy (= 1.57 kt/kg per tow).

10.0 Appendices

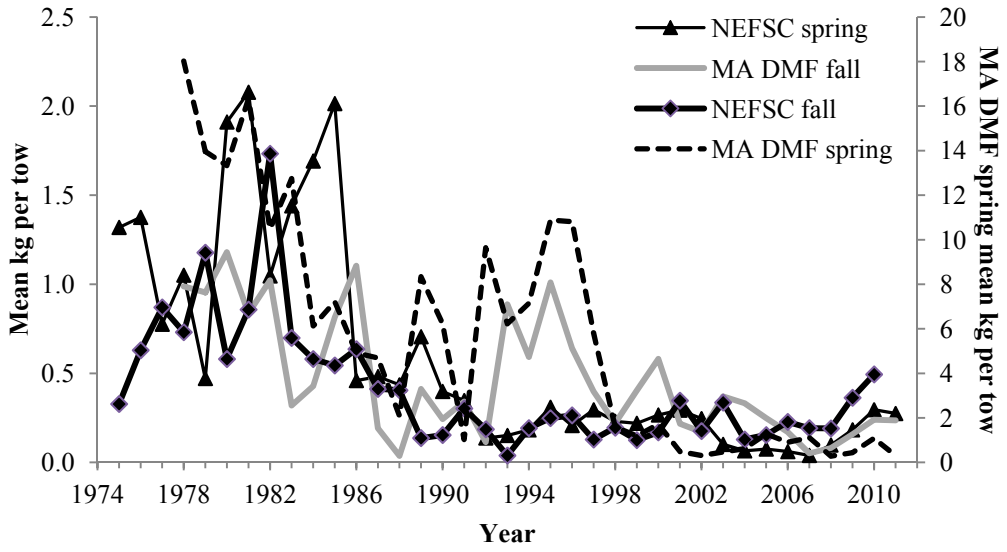

Figure A. J1. Relative biomass indices for the MA spring and fall bottom trawl surveys (1978-2011) and the NEFSC spring (1975-2011) and fall (1975-2010) bottom trawl surveys.

NEFSC indices from 2009 onward represent SRV *H. B. Bigelow* catches adjusted to RV *Albatross IV* equivalents.