I. Gulf of Maine-Georges Bank windowpane flounder
by Lisa Hendrickson

1.0 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 in the Gulf of Maine (Klein-MacPhee 2002). The Gulf of Maine-Georges Bank (GOM-GB) 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 AIM consisted of U.S. discards, U.S. landings, and relative biomass indices derived from the fall surveys conducted by the Northeast Fisheries Science Center (NEFSC).

The current biological reference points (BRPs) were adopted at the 2008 GARM (NEFSC 2008) and promulgated via Amendment 16 to the Northeast Multispecies Fishery Management Plan (NEFMC 2009). The current BRPs are: F_{MSY} proxy = 0.50 kt/kg per tow and B_{MSY} proxy = 1.40 kg per tow. The F_{MSY} proxy was estimated from the AIM model and the MSY proxy was assumed as the median catch during 1995-2001, a period when the stock appeared to be able to replace itself based on the AIM replacement ratios. The MSY proxy was divided by the F_{MSY} proxy to compute the B_{MSY} proxy. Based on the results from the 2008 GARM, the stock was overfished and overfishing was occurring in 2007 (NEFSC 2008). Rebuilding is required by 2017 (NEFMC 2003).

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* (i.e., depths ≤ 18 m), which replaced the RV*Albatross IV* in 2009. 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 also necessary to re-estimate the BRPs, in order to be consistent with the revised data series used in AIM.

2.0 The Fishery

Landings

Statistical Areas used for reporting fishery data for the GOM-GB windowpane flounder stock include: 511-525, 542-543, 551-552, and 561-562 (Figure I1). U.S. 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 GOM-GB windowpane flounder were updated for 2007 and extended through 2010. During most years, at least 98% of the landings were taken with bottom trawls, but during 1987-1994, 2.8-6.0% of the landings were taken with scallop dredges (Table I1). Landings were highest (1,079 - 2,862 mt) during 1985-1993 when a directed fishery existed (Figure I2, I2). Since 1994, landings have occurred as a result of bycatch, primarily in the groundfish bottom trawl fleet. During 1994-2000, landings averaged 399 mt, but then declined further and averaged only 33 mt during 2001-2006. Landings increased to 117 mt in 2007, but then declined again and reached the lowest level on record in 2010 (0.4 mt) as a result of a prohibition on possession. Possession of GOM-GB windowpane flounder was initially prohibited by a NMFS interim action on May 1, 2009 and was extended through the 2010 fishing year via Amendment 16 (NEFMC 2010) and will remain in effect for fishing year 2012 (T. Nies pers. comm.).

Discards

Discards (mt) of GOM-GB 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 GOM-GB 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 one trip 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 GOM-GB windowpane flounder occurred during a subset of years beginning in 1995. For the SNE-MAB stock, most (68%) of the total incorrect hail weight of windowpane flounder involved scallop dredge hauls for which sand dollars were miscoded as windowpane flounder. However, most (67%) of the total incorrect hail weight of GOM-GB windowpane flounder was attributable to hail weight keypunch errors for bottom trawl hauls. Some hail weight errors were also attributable to observer miscalculations and species miscoding by editors.

Most of the NEFOP database errors involved discards, but two records (in 2000 and 2005) totaling 8,153 pounds (3.7 mt) were also erroneously entered as kept weights of GOM-GB windowpane flounder. The net effect of the corrections was a reduction in the database discard weights of GOM-GB windowpane flounder. During most years, the discard reductions represented small percentages of the total database discards of GOM-GB windowpane flounder for both gear groups. Reductions in the database discards of windowpane flounder for scallop dredges were minor, totaling 272 lbs. (0.123 mt) during all four years combined, and ranged

from 0.5% of the scallop dredge discard total in 2007 to 22.1% in 1995 (Tables I3 and I4). Database reductions in windowpane flounder discards for bottom trawls were also minor, totaling 9,259 lbs (4.2 mt) during all years combined, and ranged from 0.3% of the bottom trawl discard total in 2010 to 20.9% in 2000.

During most years, discards were primarily (> 70%) from the large mesh bottom trawl fleet (considered as the small mesh bottom trawl fleet prior to 1982 when the minimum codend mesh size was less than 5.5 inches). However, the scallop dredge fleet also contributed a substantial percentage (32%-57%) of the total discards during two time periods, 1977-1981 and 1987-1993 (Table I5). The small mesh bottom trawl fleet comprised a small percentage of the total discards, generally ≤ 7%, during most years. The CVs of the annual discard estimates for the small mesh fleet were the highest of all three fleets, and averaged 0.69 (Table I5). CVs for the scallop dredge and large mesh bottom trawl fleets averaged 0.42 and 0.38, respectively. Discard estimates for the large mesh bottom trawl fleet during 2002-2010 were more precisely estimated (CV range of 0.09-0.28) than during 1989-2001 (CV range of 0.32-0.92).

During the directed fishery period (1985-1993), windowpane flounder catches filled the market void left by depleted yellowtail flounder stocks, and landings exceeded discards (Figure I2). NEFOP data indicated that prior to the 2009 moratorium on possession; the primary reason for discarding was the lack of a market for this thin-bodied flatfish. There is no minimum size limit for landed fish, but the landings length composition data indicated that only the largest fish were retained (fish ≥ 29 cm) during 1994-2008. During the 1985-1993, discards averaged 27%, of the catch, but have since comprised a majority and averaged 92% during 2001-2010 (Figure I2, Table I2). In recent years, total discards (mostly from large mesh bottom trawls) increased from a record low of 58 mt in 1999 to 301 mt in 2004, and then increased further to 917 mt in 2007 (Table I2). During 2008-2010, discards were lower and ranged between 412 mt in 2009 and 235 mt in 2010. CVs of the total discard estimates averaged 0.30 and ranged between 0.09 and 0.69 during 1992-2010 (Table I5).

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 for 1975-2007 ranged from a reduction of 3.4% to an increase of 5.2%, with an average reduction of 2.0%, when compared with the 2008 GARM catch series (Table I2).

During 1975-2010, catches were highest during 1985-1991 and ranged between 2,000 mt and 3,657 mt (Table I2, Figure I2). Thereafter, catches declined to a time series low of 106 mt in 1999. During 2002-2007, catches generally increased due to increased discarding, primarily in the large mesh bottom trawl fleet (82-96% of the total discards). In 2007, catches reached the highest level (1,091 mt) since 1997. During 2008-2010, catches were lower and ranged between 440 mt in 2009 and 236 mt in 2010.

3.0 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. With respect to the GOM-GB windowpane flounder stock, the vessel change resulted in the exclusion of sampling in stratum 58 located in Cape Cod Bay. 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 stratum 58. The revised strata set included offshore strata 13-30 and 37-40 along with inshore strata 59-61 and 65-66. 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 the differences between the 1979-2007 relative biomass indices from the 2008 assessment with biomass indices derived using the revised survey strata set suggest that the omission of windowpane flounder catches from inshore stratum 58 had little effect on the annual biomass indices (Figure I3). Inshore stratum 58 was sampled beginning in 1979 and although windowpane flounder catches occurred in the stratum during most (69%) years, such catches were low (average = 19 fish per tow). Biomass indices derived using the revised strata set were generally lower than the indices from the 2008 GARM, but the amounts were small; < 0.01 kg per tow during most years (Figure I3). The precision of the biomass estimates was slightly lower for the revised biomass time series, but increases in the CVs were < 1% during most years. The greatest reduction in biomass indices (0.057 kg per tow) and their precision (CV increase of 3.7%) occurred in 1992 (Figure I3).

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).

Although annual relative abundance (stratified mean number per tow) and biomass (stratified mean kg per tow) indices were highly variable, some general trends were evident. Indices were consistently above the 1975-2009 median (= 0.732 kg per tow) during 1976-1986, but then declined to levels that were generally below the median during 1987-1997 (Figure I4 and Table I6). During 1998-2003, biomass indices increased to levels at or slightly above the median

during most years, but then fell below the median during 2004-2010 and ranged between 0.671 kg per tow in 2004 to 0.295 kg per tow in 2010.. CVs of the survey biomass indices from 2009 onward account for the variance associated with the *Bigelow* calibration factors. CVs (%) of the revised biomass time series averaged 29.7 and ranged between 16.6 and 55.9 (Table I6).

Relative abundance and biomass indices (stratified mean number and kg per tow, respectively) of windowpane flounder caught during Canadian (CA) spring (February) bottom trawl surveys (Georges Bank strata 5Z1-5Z4), during 1996-2011, were presented to the 2012 GARM Review Panel. Similar to the AIM run from the 2008 GARM, the CA spring survey indices were not included in the AIM run for the subject assessment. Relative biomass indices for the CA spring surveys were at their lowest levels during 2003-2011 (Figure A.I1), similar to the trend in biomass indices for the NEFSC fall surveys.

4.0 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 I7). 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 (trim factor = 200). 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 I5. A randomization test indicated that the correlation between the **ln(replacement ratio)** and **ln(relative F) was marginally significant (*p* = 0.090), similar to** the results from the 2008 AIM run ($p = 0.087$). Probability and cumulative distributions from the randomization test are shown in Figure I6. There was no trend in the standardized residuals from the model, but several values were greater than 2.0 (Figure I7).

5.0 Biological Reference Points

The current BRPs were adopted at the 2008 GARM (NEFSC 2008) and are: F_{MSY} proxy = 0.50 kt/kg per tow and B_{MSY} proxy = 1.40 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 (= 700 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 0.44 kt/kg per tow (90% CI = 0.24, 0.79, Figure I8), and based on the MSY proxy of 700 mt, resulted in a new B_{MSY} proxy of 1.60 kg per tow and a $B_{threshold}$ proxy of 0.80 kg per tow.

6.0 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 (= 0.44 kt/kg per tow) and 75%F_{MSY} proxy (= 0.33 kt/kg per tow). Catch was 236 mt in 2010. Under the 75%F_{MSY} proxy scenario, which is used to provide catch advice, catches would increase by a small amount between 2013 and 2014, from 180 mt to 190 mt, respectively (Table I8, Figure I9).

7.0 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 2.08 kt/kg per tow was greater than the new F_{MSY} proxy of 0.51 kt/kg per tow and the new 2007 biomass index of 0.24 kg per tow was below the new $B_{Threshold}$ proxy (= 0.68 kg per tow). Therefore, the stock was overfished and overfishing was occurring in 2007.

Relative F in 2010 (= 0.51 kt/kg per tow), for the AIM run that incorporated the revised input data for 1975-2010, was above the re-estimated F_{MSY} proxy (= 0.44 kt/kg per tow), indicating that overfishing was occurring in 2010 (Table I9). The 2010 biomass index (= 0.46 kg per tow, the average from 2008-2010) was below the re-estimated $B_{threshold}$ (50% of B_{MSY} = 0.80 kg per tow), indicating that the stock was also overfished in 2010.

Sources of uncertainty

Catches were underestimated because discards from the Canadian scallop dredge and groundfish bottom trawl fleets were not available for inclusion in the assessment. However, quarterly maps of VMS fishing location data for observer trips for the Canadian scallop fleet (Van Eeckhaute et al. 2010), when compared to distribution maps of windowpane flounder catches during NEFSC spring and fall bottom trawl surveys, suggested spatial overlap. In addition, effort by the Canadian scallop dredge fleet has increased since 2004 due to an increase in the number of freezer trawlers, which have larger dredges (Van Eeckhaute 2010). Landings of groundfish bycatch have been prohibited in the Canadian scallop fishery since 1996, so presumably there are no windowpane flounder landings included in the Canadian landings of "unspecified flounder".

8.0 Panel Discussions/Conclusions

Status of Stock

The biomass index in 2010 (i.e., 2008-2010 average of the NEFSC fall survey) is estimated to be 0.46 kg per tow. Relative F in 2010 (i.e., catch in 2010/average biomass index during 2008-2010) is estimated to be 0.51 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 the 2008 GARM. Revised estimates of the biological reference points are:

Bmsy proxy= 1.60 kg per tow,
Fmsy proxy = 0.44 kt/kg per tow, and
MSY proxy= 700 mt.

Based on these results, the stock of GOM-GB windowpane flounder is overfished and overfishing is occurring. The 2008 GARM determined that the stock was overfished and 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.

GOM-GB Windowpane Flounder. Summary of Assessment Information

GOM-GB Windowpane Flounder	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Avg	Min	Max	YrRange
Landings (mt)	42	14	16	27	51	46	117	46	28	0.4	730	0.4	2862	1975-2010
Discards (mt)	186	162	361	301	917	637	974	329	412	235	522	58	1115	1975-2010
Catch (mt)	229	176	377	328	968	683	1091	376	440	236	1252	106	3657	1975-2010
SSB Proxy (kg/tow)	0.894	0.858	0.742	0.671	0.677	0.653	0.242	0.447	0.633	0.295	0.851	0.183	3.313	1975-2010
F relative	0.294	0.214	0.453	0.433	1.389	1.024	2.082	0.841	0.998	0.515	1.719	0.116	7.667	1977-2010

Reviewer Comments

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

Changes in discard estimates were relatively minor for the northern windowpane stock, but were considered to be an improvement, because they corrected data entry errors regarding windowpane hail weights, which occurred primarily in bottom trawls.

There was some ambiguity between the 2008 GARM and Amendment 16 to 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 Amendment 16 (i.e., relative biomass index during 2008-2010).

Biomass indices from the NEFSC fall surveys were below the 1975-2009 median during 2004-2010. Biomass indices from a survey not used in the assessment, the February Canadian bottom trawl surveys on Georges Bank (i.e., 5Z1-5Z4), were also at their lowest levels during 2003-2011.

The 2008 GARM developed catch projections using 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.

Catches are under-estimated because discards of windowpane in the Canadian trawl and scallop dredge fisheries are not included in the assessment, but should be included in future assessments.

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

9.0 Acknowledgements

This assessment could not have been conducted without: data preparation and technical assistance provided by Susan Wigley; survey data collected and audited by ESB staffs; fishery data collected by NMFS port agents and REMSA staffs; observer data collected and audited by NEFOP and AIS staffs; and the database maintenance provided by DMS staffs.

10.0 References

Azarovitz, T.R. 1981. A brief historical review of the Woods Hole Laboratory trawl survey time series. pp. 62-67 *In* W.G. Doubleday and D. Rivard, Ed. Bottom trawl surveys. Canadian Special Publication of Fisheries and Aquatic Sciences 58.

Burns, T. S., R. Schultz, and B. E. Brown. 1983. The commercial catch sampling program in the northeastern United States. Can. Spec. Pub. Fish. Aquat. Sci. 66.

Byrne, C.J. and J.R.S. Forrester. 1991a. Relative fishing power of two types of trawl doors. Northeast Fish. Sci. Center Stock Assessment Workshop (SAW 12). 8 p.

Byrne, C.J., and J.R.S. Forrester. 1991b. Relative fishing power of NOAA R/Vs Albatross IV and Delaware II. Northeast Fish. Sci. Center Stock Assessment Workshop (SAW 12).8 p.

Klein-MacPhee, G. 2002. Lefteye Flounders. Family Scophthalmidae. Pages 547-550 *In* B. B. Collette and G. Klein-MacPhee, Ed. Bigelow and Schroeder's Fishes of the Gulf of Maine, 3rd Edition. Smithsonian Institution Press, Washington, D.C.

Miller T. J., C. Das, P. J. Politis, A. S. Miller, S. M. Lucey, C. M. Legault, R. W. Brown, and P. J. Rago. 2010. Estimation of Albatross IV to Henry B. Bigelow calibration factors. NEFSC Ref Doc. 10-05. 233 p.

NEFSC [Northeast Fisheries Science Center]. 2008. Assessment of 19 Northeast Groundfish Stocks through 2007: Report of the 3rd Groundfish Assessment Review Meeting (GARM III), Northeast Fisheries Science Center, Woods Hole, Massachusetts, August 4-8, 2008. US Dep Commer, NOAA Fisheries, Northeast Fish Sci Cent Ref Doc. 08-15; 884 p + xvii.

New England Fishery Management Council [NEFMC]. 2009. Amendment 16 to the Northeast Multispecies Fishery Management Plan. New England Fishery Management Council, Newburyport, MA.

New England Fishery Management Council [NEFMC]. 2003. Final Amendment 13 to the Northeast Multispecies Fishery Management Plan Including a Final Supplemental Environmental Impact Statement and an Initial Regulatory Flexibility Analysis. 1,660 p. plus Appendices.

Van Eeckhaute, L., Sameoto, J. and A. Glass. 2010. Discards of Atlantic cod, haddock and yellowtail flounder from the 2009 Canadian scallop fishery on Georges Bank. TRAC Ref. Doc. 2010/10. 7 p.

Wigley, SE, P. Hersey and J. E. Palmer. 2008a. A description of the allocation procedure applied to the 1994-2007 commercial landings data. NEFSC Ref. Doc 08-18. 61 p.

Wigley SE, Palmer MC, Blaylock J, Rago PJ. 2008b. A brief description of the discard estimation for the National Bycatch Report. NEFSC Ref. Doc. 08-02. 35 p.

Table I1. Landings (mt) of GOM-GB windowpane flounder, by gear category, during 1975-2010.

	Landings (mt)					
Year	Bottom trawls	Scallop dredges	Gillnets	Other[1]	Total	Percent landed by bottom trawls
1975	1298.910	0.000	0.000	0.850	1,300	99.9
1976	1513.695	0.000	0.141	2.257	1,516	99.8
1977	1096.110	0.000	0.560	1.874	1,099	99.8
1978	879.896	0.939	0.113	17.455	898	97.9
1979	848.462	2.869	0.041	3.588	855	99.2
1980	383.089	2.815	0.018	2.469	388	98.6
1981	410.149	1.143	0.068	1.173	413	99.4
1982	406.948	1.767	0.067	3.513	412	98.7
1983	456.079	0.647	0.000	2.454	459	99.3
1984	737.549	1.329	0.797	2.494	742	99.4
1985	2137.158	1.447	0.094	2.745	2,141	99.8
1986	1810.333	23.925	4.365	2.815	1,841	98.3
1987	1354.375	38.751	0.242	2.461	1,396	97.0
1988	1315.494	59.954	1.200	0.849	1,377	95.5
1989	1508.006	57.302	10.563	1.580	1,577	95.6
1990	1002.372	64.796	9.840	2.081	1,079	92.9
1991	2735.956	124.213	0.791	1.382	2,862	95.6
1992	1433.726	79.144	1.782	4.596	1,519	94.4
1993	1151.025	47.972	0.666	14.718	1,214	94.8
1994	321.646	12.840	3.637	0.865	339	94.9
1995	662.976	0.872	2.389	1.597	668	99.3
1996	771.241	0.390	0.800	0.719	773	99.8
1997	413.116	0.479	0.587	2.031	416	99.3
1998	395.215	0.440	1.004	1.287	398	99.3
1999	48.174	0.212	0.056	0.045	48	99.4
2000	146.855	0.238	0.234	0.057	147	99.6
2001	42.386	0.069	0.018	0.011	42	99.8
2002	13.637	0.002	0.075	0.062	14	99.0
2003	16.293	0.000	0.098	0.057	16	99.1
2004	26.270	0.000	0.511	0.035	27	98.0
2005	49.732	0.000	0.079	0.915	51	98.0
2006	43.652	0.696	0.156	1.462	46	95.0
2007	116.649	0.401	0.015	0.000	117	99.6
2008	46.156	0.032	0.040	0.005	46	99.8
2009	27.799	0.047	0.101	0.001	28	99.5
2010	0.427	0.000	0.010	0.000	0.4	97.7

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

Table I2. Landings, discards, and catches (mt) of GOM-GB windowpane flounder during 1975-2010 and differences (%) between these catches and those used in the 2008 AIM run for 1975-2007.

Year	Landings	Discards	Catch (mt)	Catch difference (%)
1975	1,300	251	1,551	-0.1
1976	1,516	275	1,791	-0.5
1977	1,099	404	1,502	-2.4
1978	898	454	1,352	-0.8
1979	855	516	1,370	-0.8
1980	388	570	958	-2.1
1981	413	626	1,039	-1.9
1982	412	802	1,214	-1.2
1983	459	881	1,340	-1.3
1984	742	801	1,544	-0.9
1985	2,141	680	2,821	-0.4
1986	1,841	614	2,456	-0.4
1987	1,396	605	2,000	-0.6
1988	1,377	677	2,055	-1.3
1989	1,577	457	2,034	-1.2
1990	1,079	1,031	2,110	-0.5
1991	2,862	794	3,657	0.3
1992	1,519	327	1,847	0.0
1993	1,214	383	1,597	1.1
1994	339	335	674	-1.1
1995	668	750	1,418	-3.4
1996	773	415	1,188	0.5
1997	416	1,115	1,531	-1.0
1998	398	271	669	-0.2
1999	48	58	106	1.7
2000	147	199	346	-1.0
2001	42	186	229	-1.8
2002	14	162	176	5.2
2003	16	361	377	1.8
2004	27	301	328	4.0
2005	51	917	968	1.2
2006	46	637	683	-0.5
2007	117	974	1,091	-0.7
2008	46	329	376	
2009	28	412	440	
2010	0.4	235	236	

Table I3. Discards (pounds) of GOM-GB windowpane flounder, by year and gear type, which were incorrect in the NEFOP Database. All values were subtracted from the original discard amounts of GOM-GB windowpane flounder recorded in the database. Most errors involved data keypunch errors.

	Windowpane database discards, lbs, by gear type (negear code)		
Year	Scallop dredge (132)	Bottom trawl (050)	Total
1995	81		81
2000		700	700
2004		210	210
2005	45	3,030	3,075
2006		2,130	2,130
2007	50	1,918	1,968
2008		1,051	1,051
2009	96		96
2010		220	220
Total	272	9,259	9,531

Table I4. Discards (%, in pounds) of GOM-GB 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 GOM-GB windowpane flounder within each category.
All values were subtracted from the original discard amounts of windowpane flounder recorded in the database. Most errors involved data keypunch errors.

	Windowpane database discards, % of total, by gear type (negear code)		
Year	Scallop dredge (132)	Bottom trawl (050)	Total
1995	22.1%		1.3%
2000		20.9%	7.8%
2004		0.7%	0.7%
2005	2.2%	0.9%	0.9%
2006		1.2%	1.2%
2007	0.5%	0.9%	0.9%
2008		1.2%	1.1%
2009	12.2%		0.1%
2010		0.3%	0.3%
Total	0.9%	0.9%	0.9%

Table I5. GOM-GB 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			Total	
Year	N Observer trips	Discards (mt)	CV	N Observer trips	Discards (mt)	CV	N Observer trips	Discards (mt)	CV	Discards (mt)	CV
1975					200.9			50		251	
1976					213.2			62		275	
1977					267.6			136		404	
1978					291.9			162		454	
1979					305.2			210		516	
1980					344.6			225		570	
1981					329.0			297		626	
1982		360			206.7			235		802	
1983		616			89.0			176		881	
1984		631			48.7			121		801	
1984		536			40.2			104		680	
1986		441			35.3			138		614	
1987		420			19.7			165		605	
1988		406			23.0			248		677	
1989	52	193	0.48	41	1.8	0.74	0	262		457	
1990	38	598	0.36	19	59.9	0.60	0	373		1,031	
1991	70	482	0.47	38	1.4	0.74	1	311		794	
1992	60	145	0.48	25	0.0		9	182	0.74	327	0.46
1993	29	254	0.96	9	5.6	0.82	11	123	0.82	383	0.69
1994	24	113	0.42	2	158.3	0.00	7	63	0.48	335	0.17
1995	48	713	0.59	31	8.4	0.39	6	28	0.28	750	0.56
1996	23	355	0.43	41	0.6	0.75	14	59	0.17	415	0.37
1997	17	818	0.92	4	27.1	1.39	11	270	0.42	1,115	0.68
1998	9	193	0.42	1	0.0		10	78	0.71	271	0.36
1999	31	35	0.58	12	1.1	0.32	60	22	0.23	58	0.36
2000	93	124	0.32	6	55.5	0.70	183	19	0.12	199	0.28
2001	138	164	0.38	12	0.2	1.07	17	22	0.23	186	0.34
2002	205	134	0.21	49	7.0	0.66	10	21	0.45	162	0.18

2003	372	347	0.28	39	1.4	0.47	10	13	0.44	361	0.27
2004	423	279	0.26	92	15.2	0.41	30	7	0.42	301	0.24
2005	1,080	629	0.10	145	271.6	0.25	71	17	0.31	917	0.10
2006	516	522	0.14	42	42.4	0.45	84	73	0.40	637	0.13
2007	523	873	0.15	31	3.5	0.84	80	98	0.45	974	0.14
2008	665	286	0.10	19	0.4	2.19	57	43	0.35	329	0.10
2009	740	395	0.09	46	0.7	0.47	67	15	0.45	412	0.09
2010	917	223	0.14	65	3.8	0.47	26	9	0.60	235	0.13

Table I6. Stratified mean number and weight tow indices for GOM-GB windowpane flounder caught during NEFSC fall bottom trawl surveys, 1975-2010. Indices include catches from offshore strata 13-30 and 37-40 and inshore strata 59-61 and 65-66. 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 (%) were adjusted to account for the variances of the calibration factor estimates.

Year	Mean number per tow	CV (%)	Mean kg per tow	CV (%)
1975	9.1	61.8	0.629	47.5
1976	8.7	30.3	1.910	23.6
1977	9.0	24.5	2.033	22.4
1978	10.2	38.3	1.505	18.9
1979	4.1	17.1	0.945	16.6
1980	2.7	28.2	0.867	29.3
1981	3.9	29.0	1.022	29.8
1982	3.4	30.5	0.808	33.6
1983	3.3	26.9	0.940	26.4
1984	18.5	25.2	3.313	26.4
1985	10.9	28.8	0.823	23.0
1986	5.2	20.7	1.143	24.4
1987	3.4	52.9	0.626	47.6
1988	4.5	28.0	0.677	27.9
1989	1.4	36.1	0.323	35.0
1990	5.2	47.0	0.925	45.2
1991	1.1	21.6	0.183	22.2
1992	1.8	22.8	0.372	27.6
1993	4.2	41.5	0.465	28.2
1994	1.4	34.6	0.262	40.9
1995	7.4	28.1	0.790	27.9
1996	3.1	25.5	0.510	25.6
1997	4.9	46.0	0.425	29.2
1998	12.5	16.1	1.590	22.2
1999	4.2	24.3	0.732	23.8
2000	3.8	60.6	0.710	55.9
2001	9.9	34.1	0.894	21.7
2002	5.5	28.1	0.858	27.7
2003	4.6	29.7	0.742	31.9
2004	7.4	33.3	0.671	36.3
2005	9.0	39.3	0.677	26.4
2006	5.9	48.5	0.653	33.6
2007	15.6	38.7	0.242	29.1
2008	2.6	35.0	0.447	35.9
2009	4.8	23.5	0.633	20.1
2010	6.3	32.4	0.295	23.7

Table I7. AIM input data for the assessment of the GOM-GB windowpane flounder stock 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, in kt/kg per tow); 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 were derived using catches from offshore strata 13-30 and 37-40 plus inshore strata 59-61 and 65-66.

	Catch	Relative biomass index		
Year	(000's mt)	(kg per tow)	Relative F	Replacement ratio
1975	1.551	0.629		
1976	1.791	1.910		
1977	1.502	2.033	0.986	
1978	1.352	1.505	0.744	
1979	1.370	0.945	0.917	
1980	0.958	0.867	0.866	0.617
1981	1.039	1.022	1.100	0.704
1982	1.214	0.808	1.350	0.634
1983	1.340	0.940	1.451	0.913
1984	1.544	3.313	0.915	3.615
1985	2.821	0.823	1.667	0.592
1986	2.456	1.143	1.396	0.828
1987	2.000	0.626	2.315	0.445
1988	2.055	0.677	2.520	0.495
1989	2.034	0.323	3.753	0.245
1990	2.110	0.925	3.288	1.288
1991	3.657	0.183	7.667	0.248
1992	1.847	0.372	3.744	0.680
1993	1.597	0.465	4.697	0.938
1994	0.674	0.262	1.840	0.578
1995	1.418	0.790	2.804	1.790
1996	1.188	0.510	2.282	1.231
1997	1.531	0.425	2.663	0.886
1998	0.669	1.590	0.795	3.242
1999	0.106	0.732	0.116	1.023
2000	0.346	0.710	0.342	0.877
2001	0.229	0.894	0.294	1.127
2002	0.176	0.858	0.214	0.986
2003	0.377	0.742	0.453	0.776
2004	0.328	0.671	0.433	0.852
2005	0.968	0.677	1.389	0.874
2006	0.683	0.653	1.024	0.850
2007	1.091	0.242	2.082	0.336
2008	0.376	0.447	0.841	0.749
2009	0.440	0.633	0.998	1.177
2010	0.236	0.295	0.515	0.556

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

Table I8. Stochastic projections of GOM-GB windowpane flounder catches (kt) and NEFSC fall survey relative biomass indices (kg per tow), for 2011-2014, assuming fishing at the F_{MSY} proxy (= 0.44 kt/kg per tow) and 75%F_{MSY} proxy (= 0.33 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 (= 0.44)	201	0.458	201	0.457	201	0.457	201	0.456
75%F_{MSY} proxy (= 0.33)	160	0.485	170	0.514	180	0.545	190	0.577

Table I9. Current (1975-2007) and re-estimated (1975-2010) biological reference points (BRPs) for GOM-GB 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)	0.50	0.44	
F_{Target} (= 75%F_{MSY} proxy, kt/kg per tow)	0.38	0.33	
B_{MSY} proxy (kg per tow)	1.40	1.60	
$B_{threshold}$ (50% of B_{MSY})	0.70	0.80	
2010 relative F (kt/kg per tow)		0.51	overfishing was occurring
2010 B index (kg per tow)		0.46	overfished

[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.

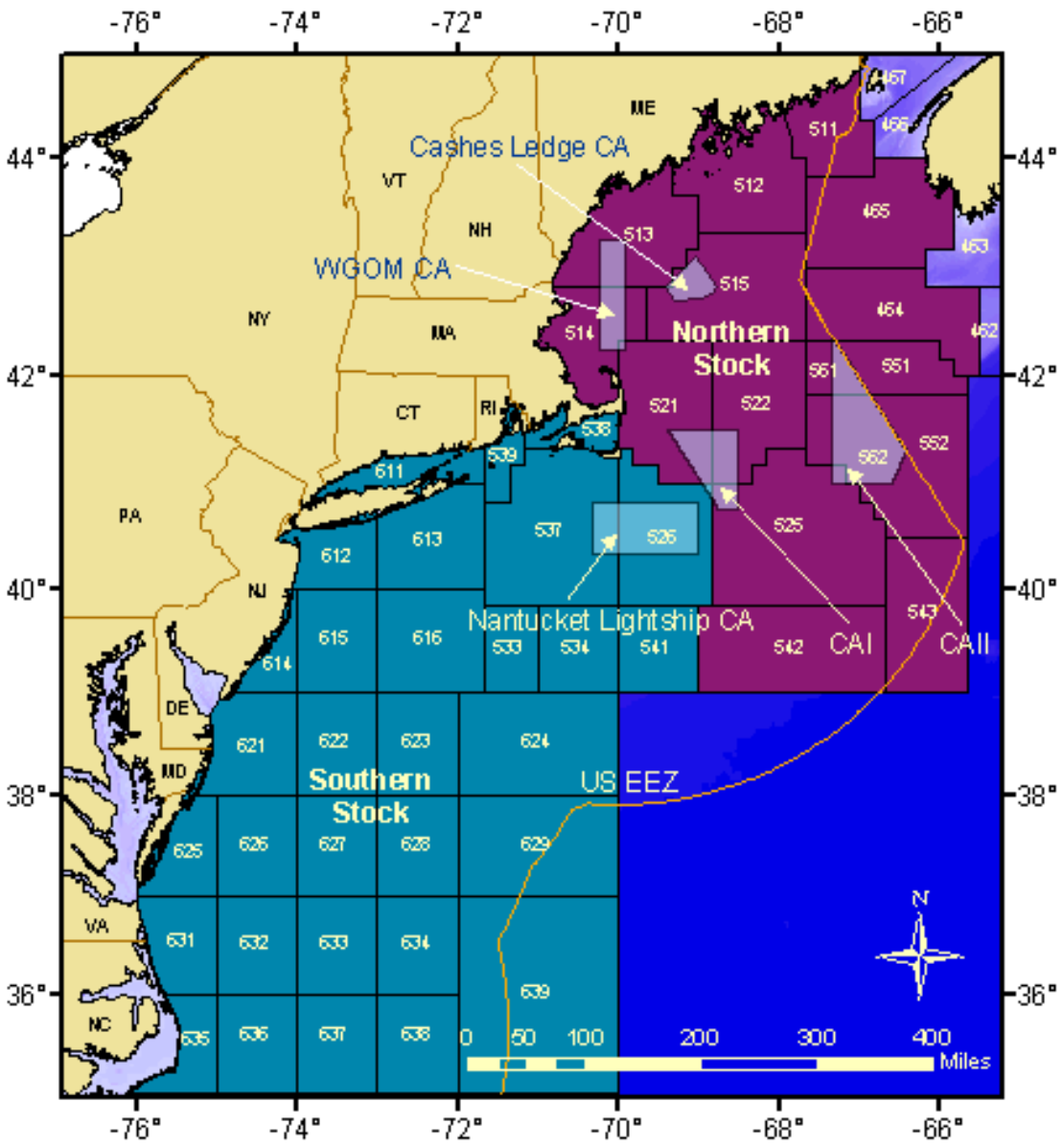

Figure I1. Statistical Areas used for reporting fishery data for the northern (Gulf of Maine-Georges Bank) and southern (Southern New England-Mid-Atlantic Bight) windowpane flounder stocks.

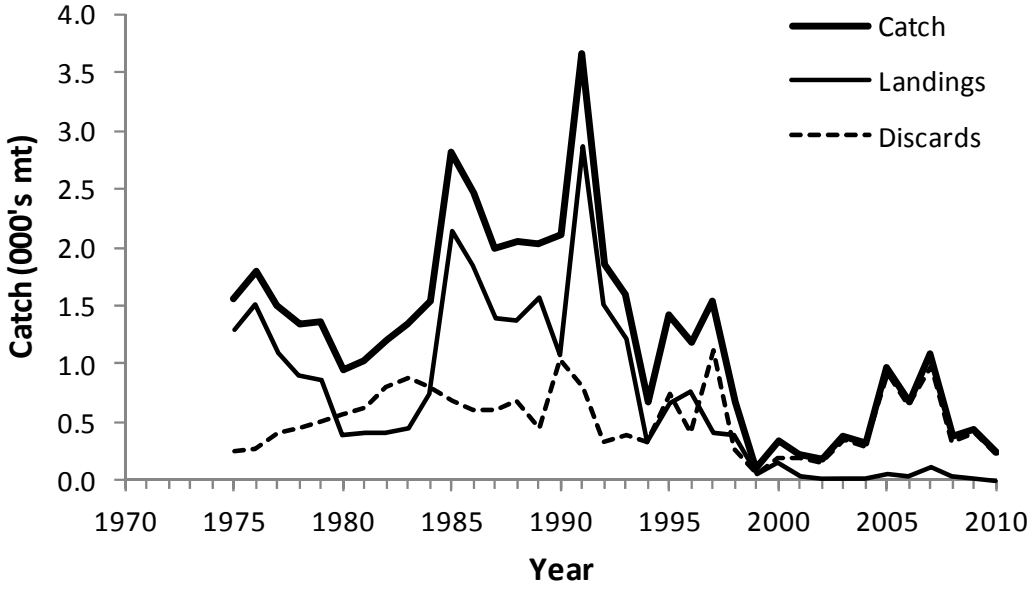

Figure I2. U.S. landings, discards and catches (000's mt) of GOM-GB windowpane flounder during 1975-2010.

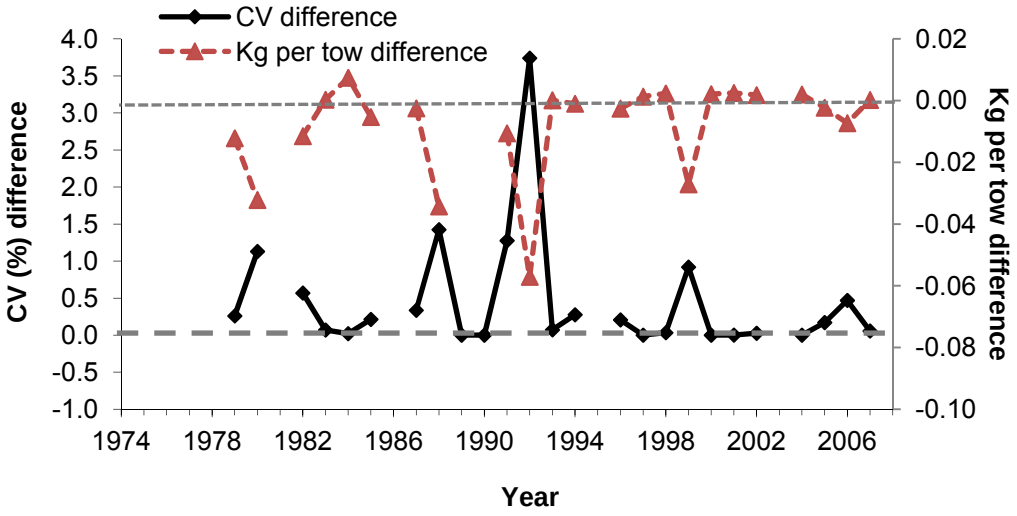

Figure I3. Effects of omitting windowpane flounder catches from inshore stratum 58 on the GOM-GB relative biomass indices (differences in stratified mean kg per tow) and their precision estimates (differences in CVs, %) for NEFSC fall research bottom trawl surveys, 1979-2007.

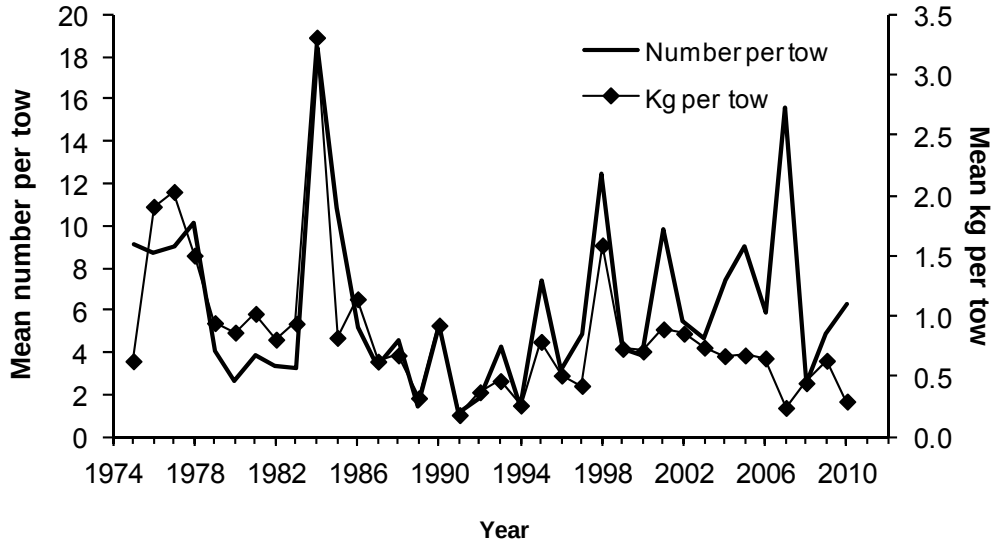

Figure I4. NEFSC fall survey relative abundance and biomass indices, during 1975-2010, for GOM-GB windowpane flounder. Survey indices were derived using catches from offshore strata 13-30 and 37-40 plus inshore strata 59-61 and 65-66. Indices from 2009 onward represent SRV *H. B. Bigelow* catches adjusted to RV *Albatross IV* equivalents.

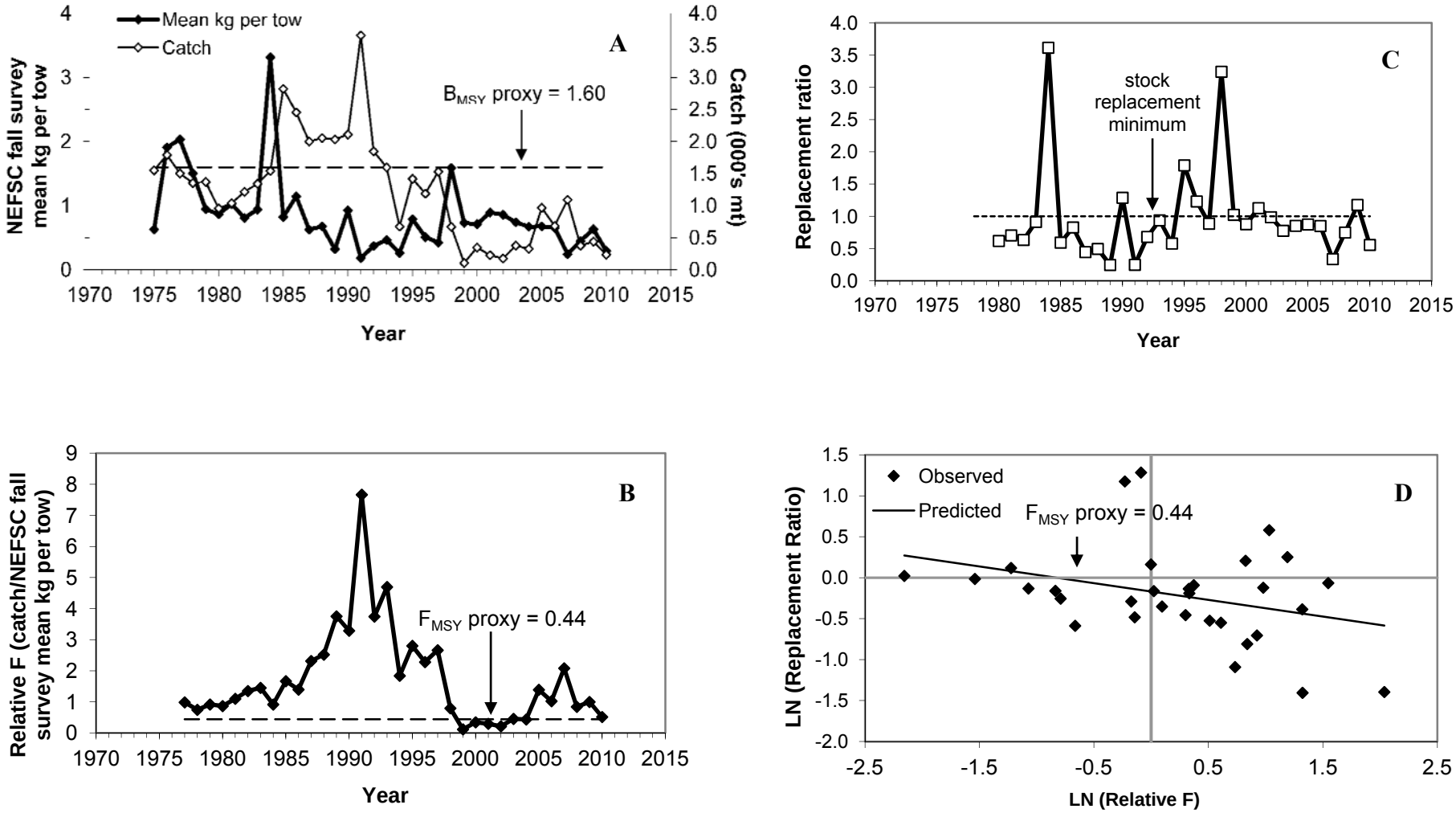

Figure I5. Trends in (A) GOM-GB windowpane flounder catches (000's mt) and NEFSC fall survey relative biomass indices (stratified mean kg per tow), (B) relative fishing mortality rates (catch in 2008 / 2008-2010 average of the NEFSC fall survey biomass indices), (C) stock replacement ratios, and (D) 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 0.44) during 1975-2010.

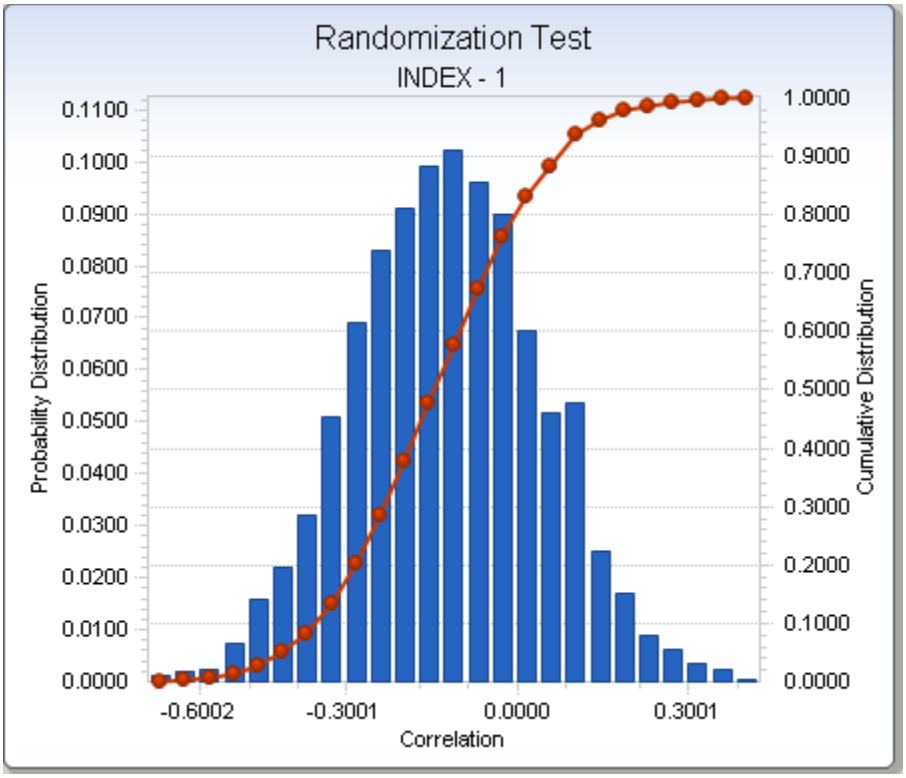

Figure I6. Probability and cumulative distributions from a randomization test, with 2,000 realizations, used to evaluate the correlation between the revised **ln(replacement ratio)** and **ln(relative F) time series (1975-2010)** for GOM-GB windowpane flounder**.** The critical value is -0.333 (p = 0.090).

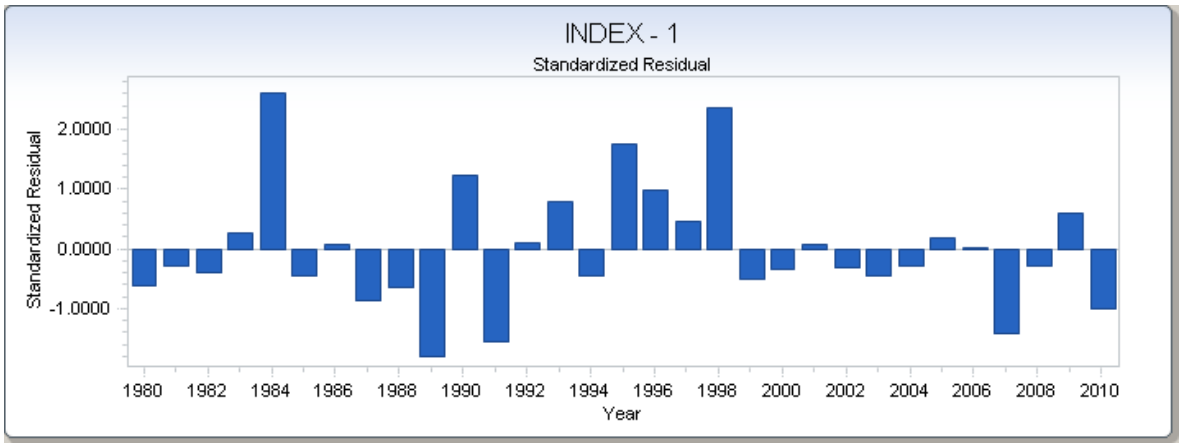

Figure I7. Standardized residuals from the AIM model run, 1975-2010, for GOM-GB windowpane flounder.

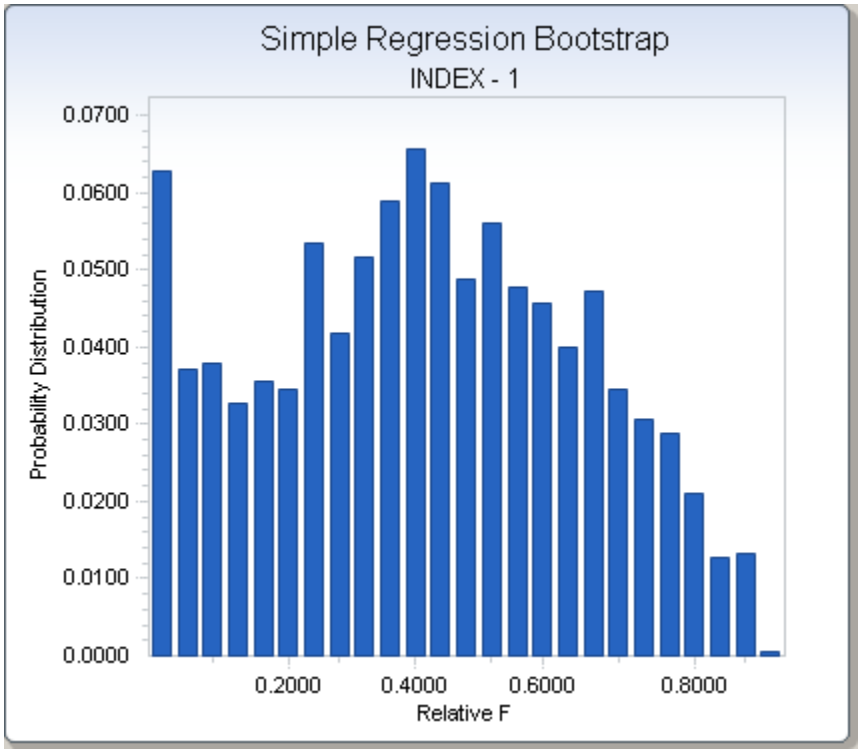

Figure I8. Probability distribution, based on 2,000 bootstrap realizations (trim factor = 200), of the estimate of relative F when the stock replacement ratio equals 1.0, which represents the F_{MSY} proxy estimate of 0.44 (90% CI = 0.24, 0.79) from the AIM run (1975-2010).

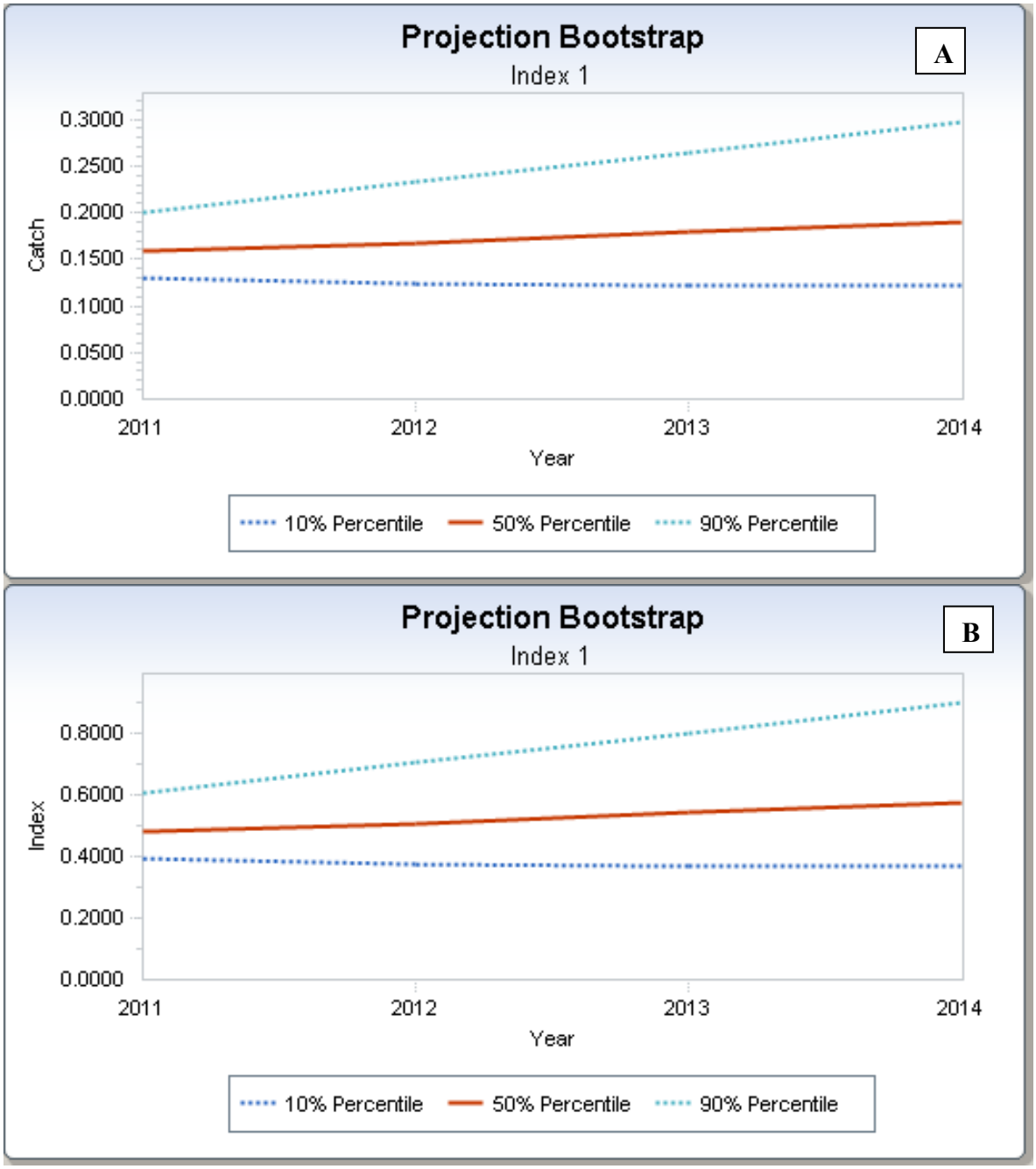

Figure I9. Stochastic projections of GOM-GB windowpane flounder (A) catches (kt) and (B) NEFSC fall survey relative biomass indices (kg per tow), for 2011-2014, assuming fishing at 75%F_{MSY} proxy (= 0.33 kt/kg per tow).

11.0 Appendices

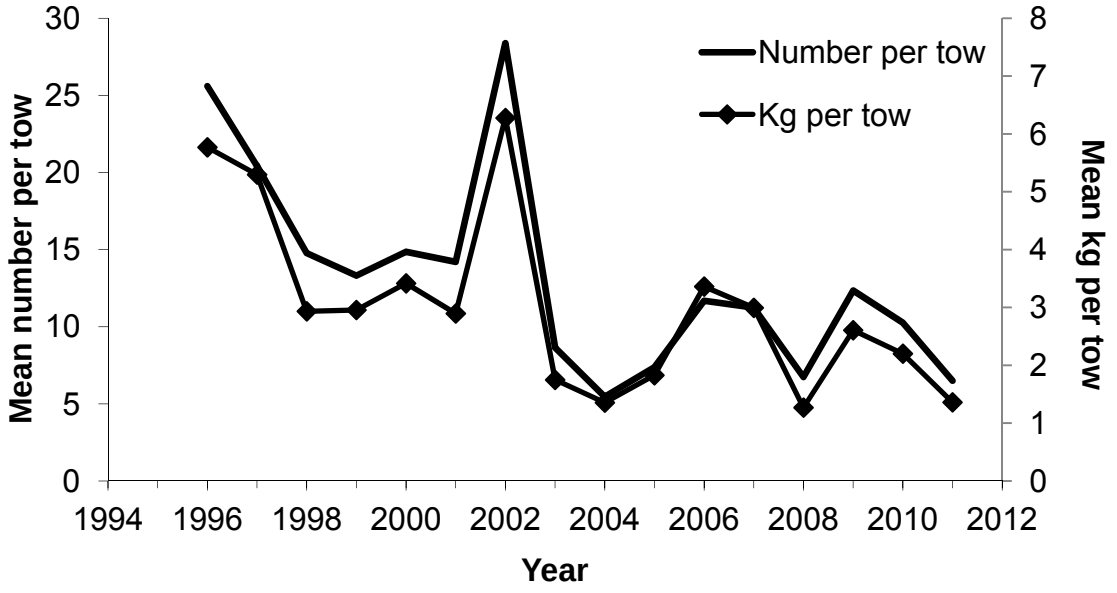

Figure A.I1. Relative abundance and biomass indices for GOM-GB windowpane flounder caught during Canadian spring (February) bottom trawl surveys conducted on Georges Bank (strata 5Z1-5Z4) during 1996-2011.