Appendix B8: Seasonal patterns in commercial meat weight and meat weight anomalies.

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This appendix describes updated estimates of seasonal patterns in mean commercial meat weights and updated annual commercial meat weight anomalies. The anomalies are used in the CASA model (Appendix 11) in calculating predicted catch weight to account for differences in shell-height meat weight relationships between the NEFSC scallop survey and commercial fishery. Relationships from the NEFSC scallop survey are used to calculate mid-year biomass for the population. Anomalies for the commercial fishery are calculated on an annual basis to account for overall and seasonal differences in survey and commercial meat weight, and changes over time in the seasonal distribution of catches.

Methods

The NMFS Observer program provided meat weight estimates from commercial catches that occurred throughout the year. These meat weights are for sea scallops in samples that are shucked by fishermen after the observer measures shell height. Meats from the observer program are not weighed individually. They are packed into a graduated cylinder and a volume for a sample (typically ~100 scallops) is recorded. The meat weight for a sample is calculated assuming a density estimate of 1.05 g/ml^3 (Caddy and Radley-Walters 1972; Smolowitz et al. 1989). Shell height data from the observer program for individual scallops are binned by 5 mm increments.

Predicted meat weights for the Mid-Atlantic Bight (MAB) and Georges Bank (GBK) were based on the models

$$W = e^{(\alpha+\beta \ln(H)+\gamma ln(D)+\rho(\ln(L)*\ln(D)))+\epsilon} \quad \text{(MAB)} \quad (1)$$

$$W = e^{(\alpha+\beta \ln(H)+\gamma ln(D)+\rho ln(L))+\epsilon} \quad \text{(GBK)} \quad (2)$$

where W is meat weight (g), H is shell height in mm, D is depth in m, and L is latitude measured in decimal degrees. This model was fit using NMFS scallop survey data from 2001 – 2008 (Appendix B7). As described in NEFSC (2007), the surveys for scallops occur in the summer when meat weights are typically high. The estimated coefficients from (1) and (2) were applied to the shell heights and depths recorded from observer samples from 2001 – 2009. Observer data for 2006 is incomplete and was not used in this analysis. Monthly anomalies were

computed using median predicted meat weights and median meat weights derived from observer data: $\frac{(pred.-obs.)}{pred.}$ (3)

Median meat weights were used instead of mean meat weights to reduce the influence of outliers in the data. In general, the observed meat weights (from observed volumes) should be less than the survey-based, predicted meat weights because the commercially shucked scallops leave some meat on the shell, and because the surveys occur in mid to late summer, a time of typically high meat weight. For both the Mid-Atlantic and Georges Bank, however, there were months of the year where the observed scallop meats were heavier than the predicted meats. In the Mid-Atlantic, peak meat weight occurred in April through August (Figure 1), while on Georges Bank peak meat weight occurred in June (Figure 2).

There are differences in the month in which peak meat weight occurs over the years of the study (Figures 3 and 4). Peak meat weight appears to have occurred earlier during recent years, though the time series is too short and there are too few observations to provide precise estimates of seasonal patterns on an annual basis. The typical seasonal pattern is therefore used in calculating anomalies for all years.

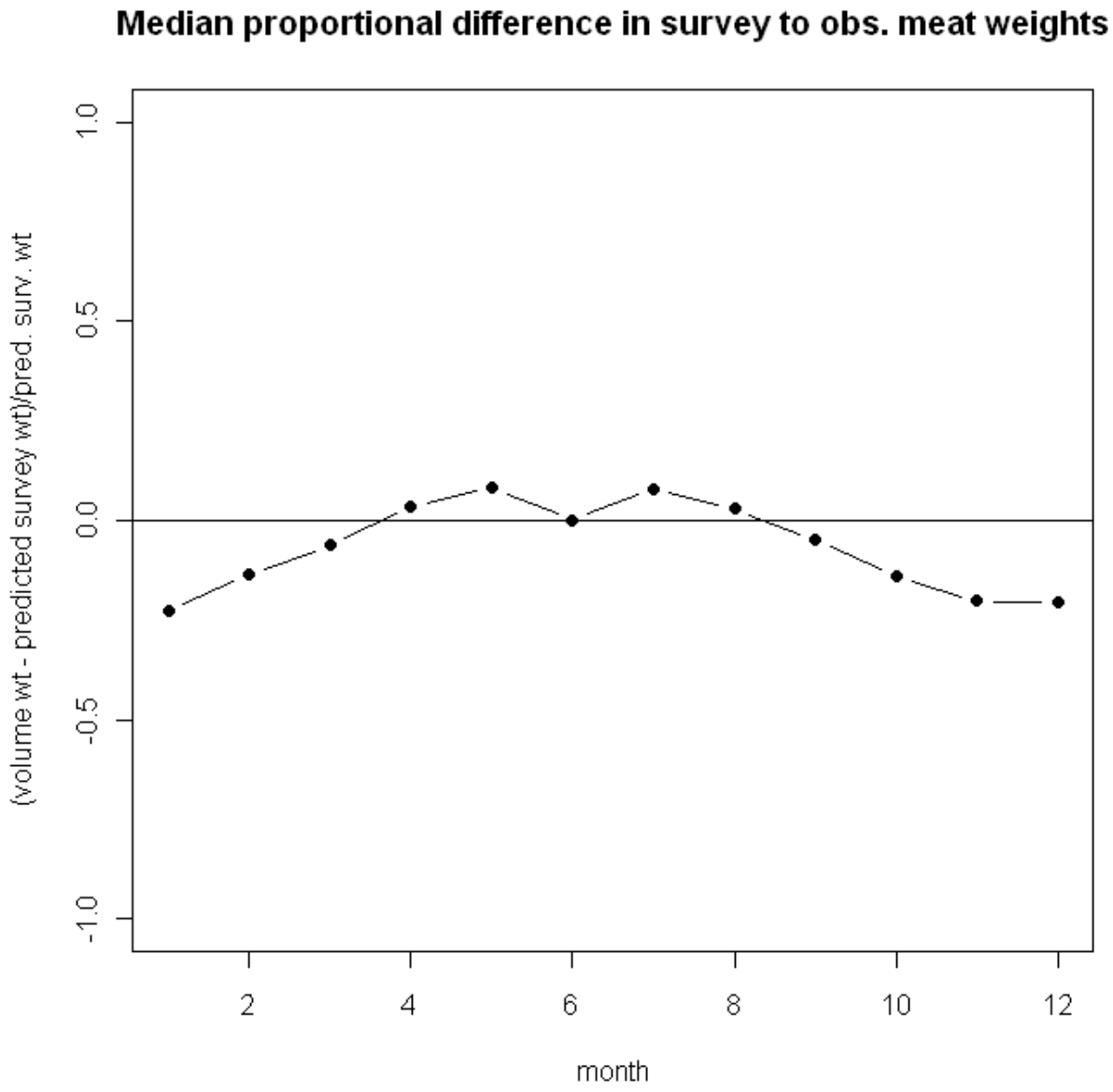
Median meat weight anomalies for 2003-2008 were smoothed by a second order polynomial loess function with a span of 0.25 (months). This short smoothing span provided a modest smooth that allowed the data to strongly influence the model fit (Figures 5 and 6). The smooth was applied to a duplicated annual cycle (i.e. 24 months were fit, using identical data in each 12 month period) and the middle 12 months were selected and reordered so that January was the first month in the resulting model fit. This manipulation guaranteed that December and January produced linking estimates. The smoothed monthly anomalies were then weighted by the landings in each month in each year for which we have landings data (1975 – 2008) and annual median values were calculated.

Updated annual meat weight anomalies differ from those in the last assessment (Figures 7 and 8). The updated anomalies are generally higher in the MAB (~7% higher on average) and lower in the GBK (~8% lower on average). In MAB the differences are due to new observer data which reflect an increase in meat weights during 2007-2008 (Figure 9). In GBK, 2007 and 2008 had relatively heavy survey meat weights (Figure 11). These two years are 40% of the years considered in this analysis. Therefore the meat weight trends in recent survey years are influential.

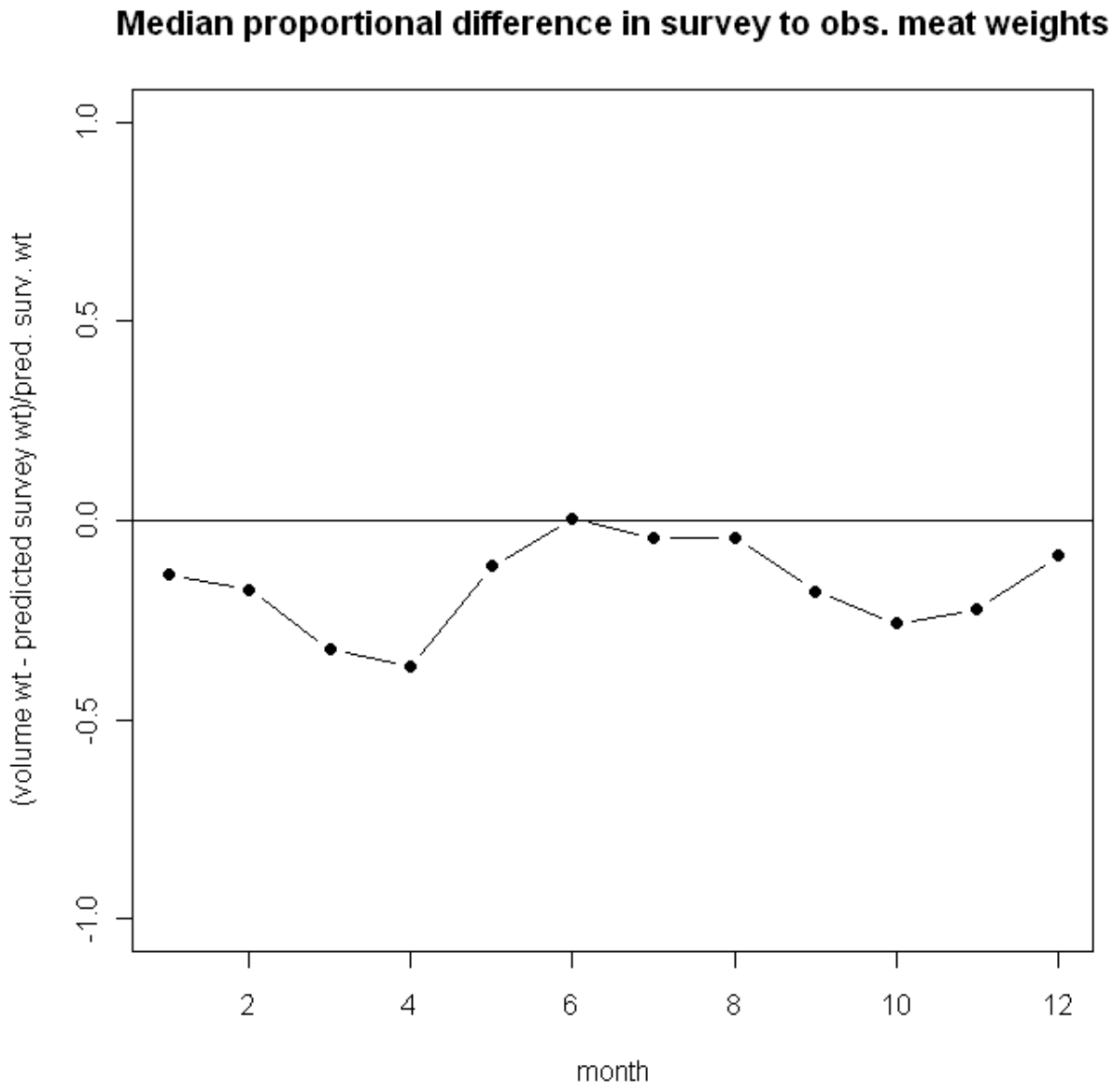
Literature Cited

Caddy, J.F. and C. Radley-Walters. 1972. Estimating count per pound of scallop meats by volumetric measurement. Fish. Res. Brd. Can. Man. Rep. Ser. 1202.

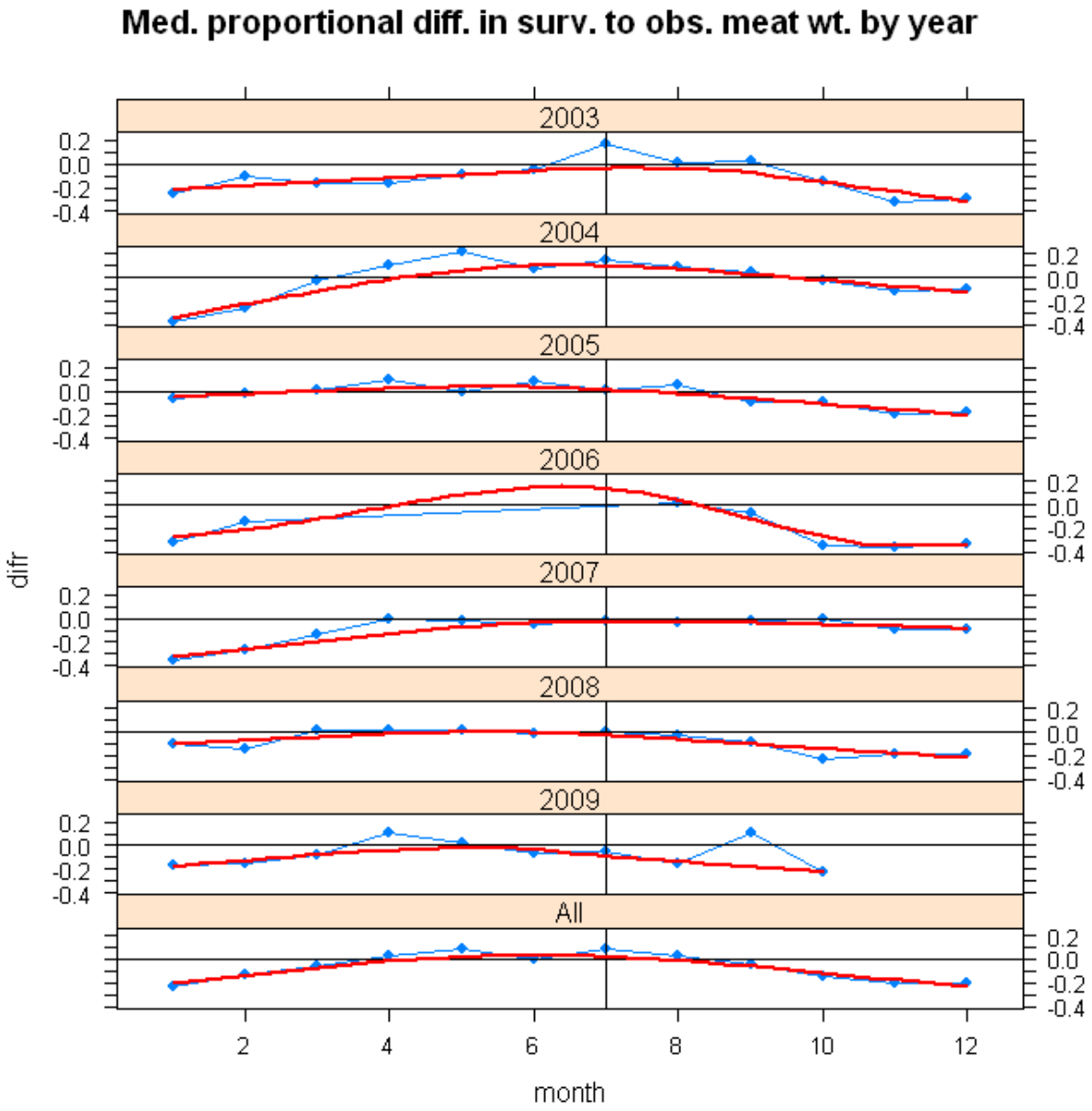
Smolowitz, R.J., F.M. Serchuk and R.J. Reidman. 1989. The use of a volumetric measure for determining sea scallop meat count. NOAA Tech. Mem. F/NER-1.



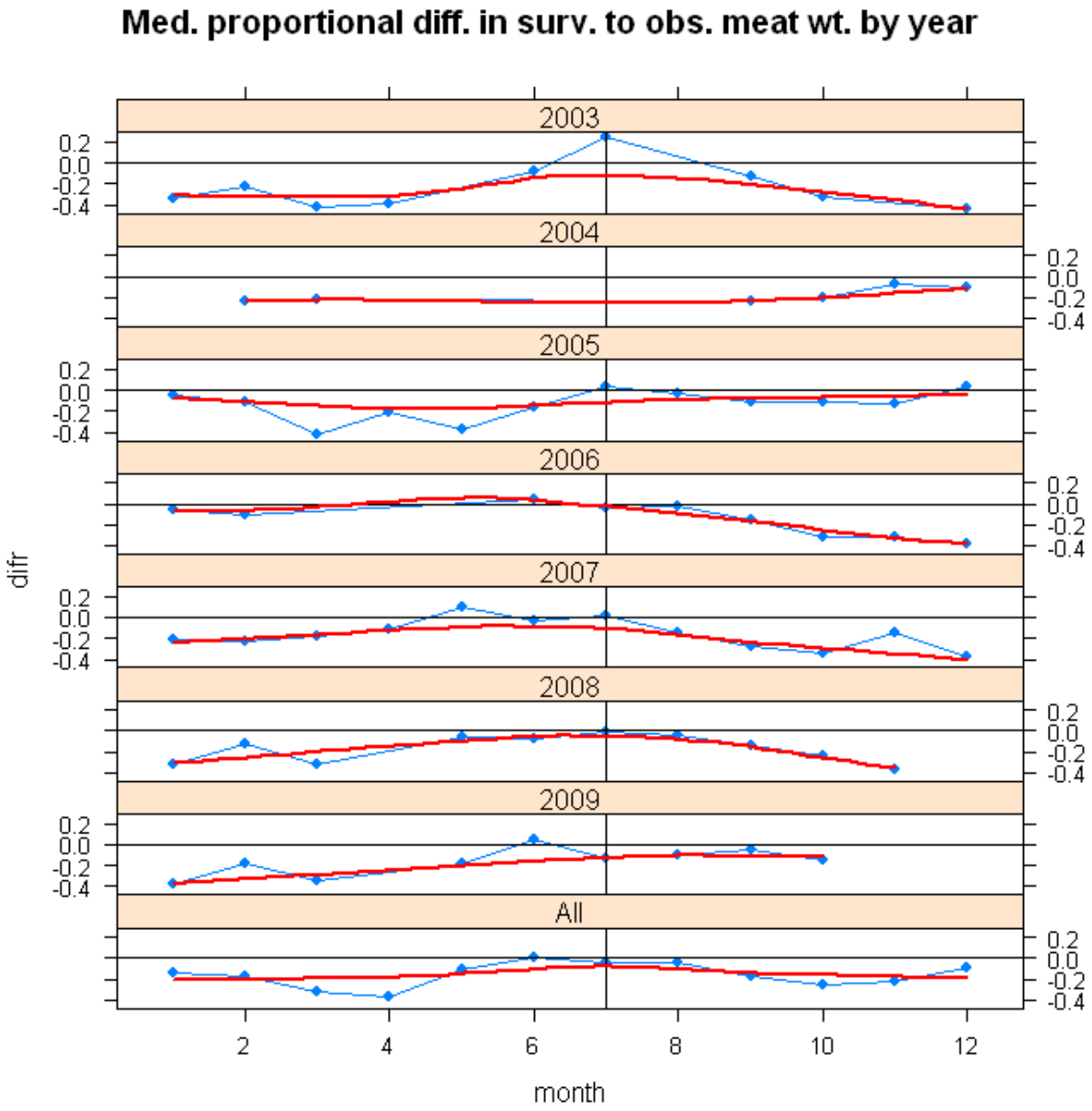
Appendix B8-Figure 1. Meat weight anomalies by month for the Mid-Atlantic Bight.



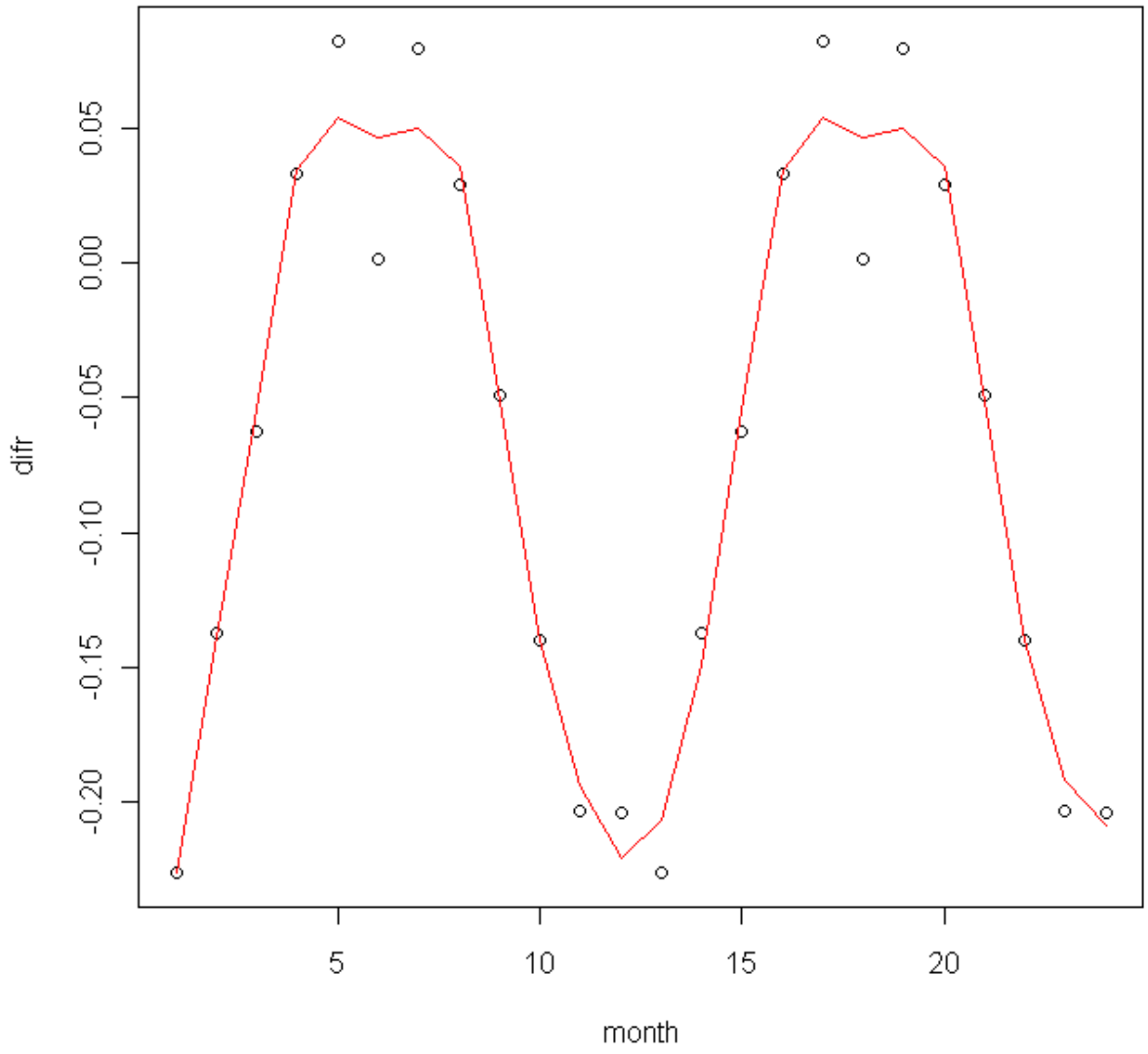
Appendix B8-Figure 2. Meat weight anomalies by month for Georges Bank.



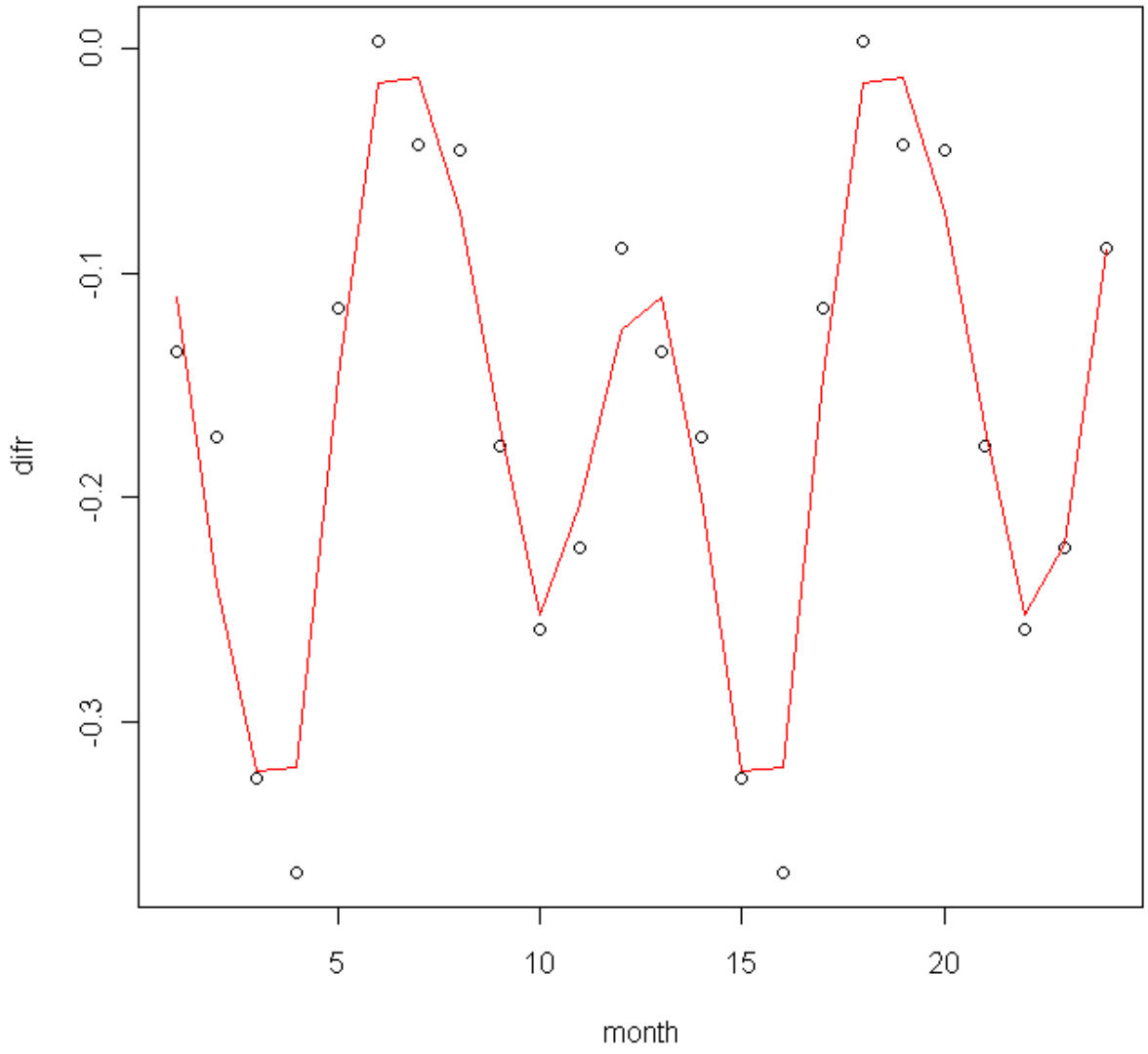
Appendix B8-Figure 3. Observer predicted meat weights (based on volume) compared to meat weights predicted by a model based survey data, by month, year, and overall, from the Mid-Atlantic. The red line is a loess regression and is used only to illustrate seasonal trends.



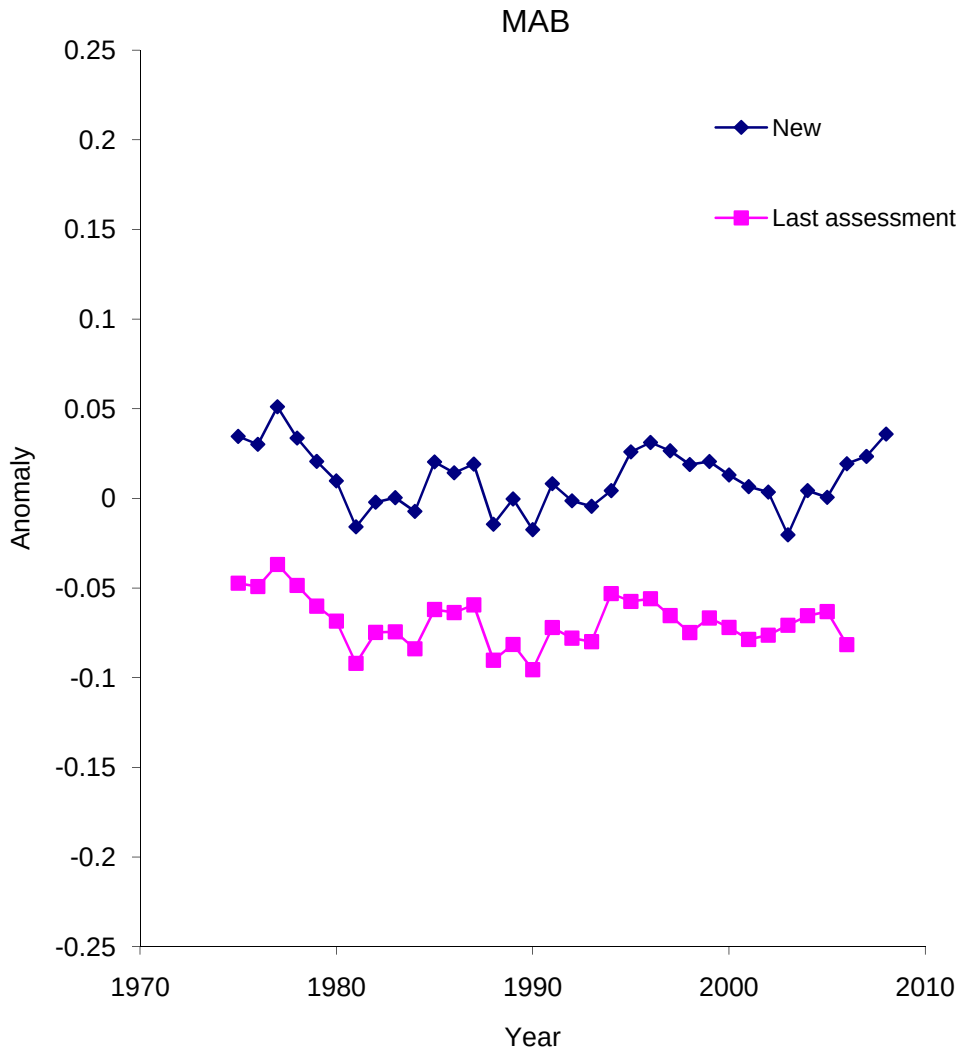
Appendix B8-Figure 4. Observer predicted meat weights (based on volume) compared to meat weights predicted by a model based on survey data, by month, in each year, and overall, from Georges Bank. The red line is a loess regression and is used only to illustrate seasonal trends.



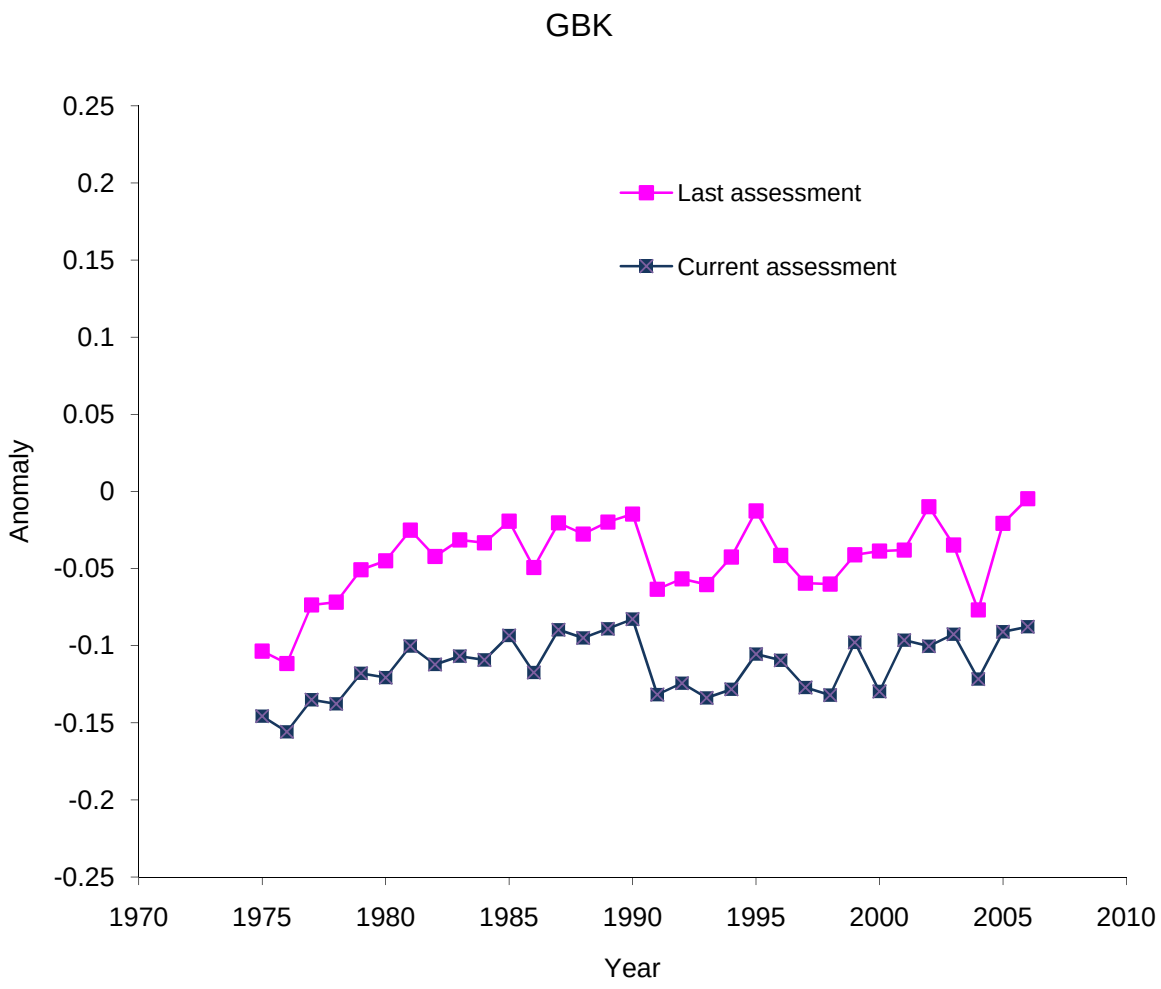
Appendix B8-Figure 5. Smoothed meat weight anomalies by month in the MAB.



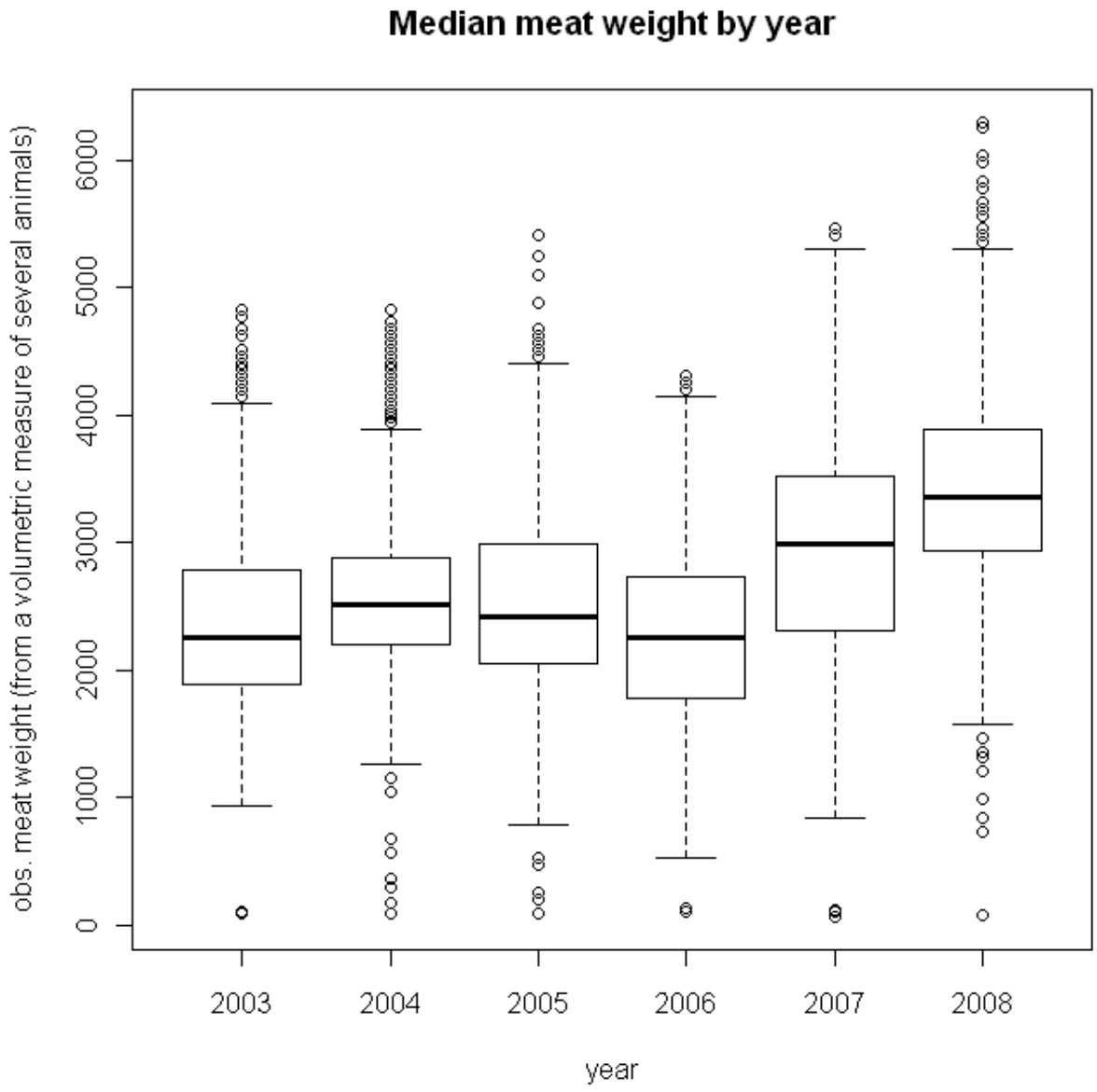
Appendix B8-Figure 6. Smoothed meat weight anomalies by month in the MAB.



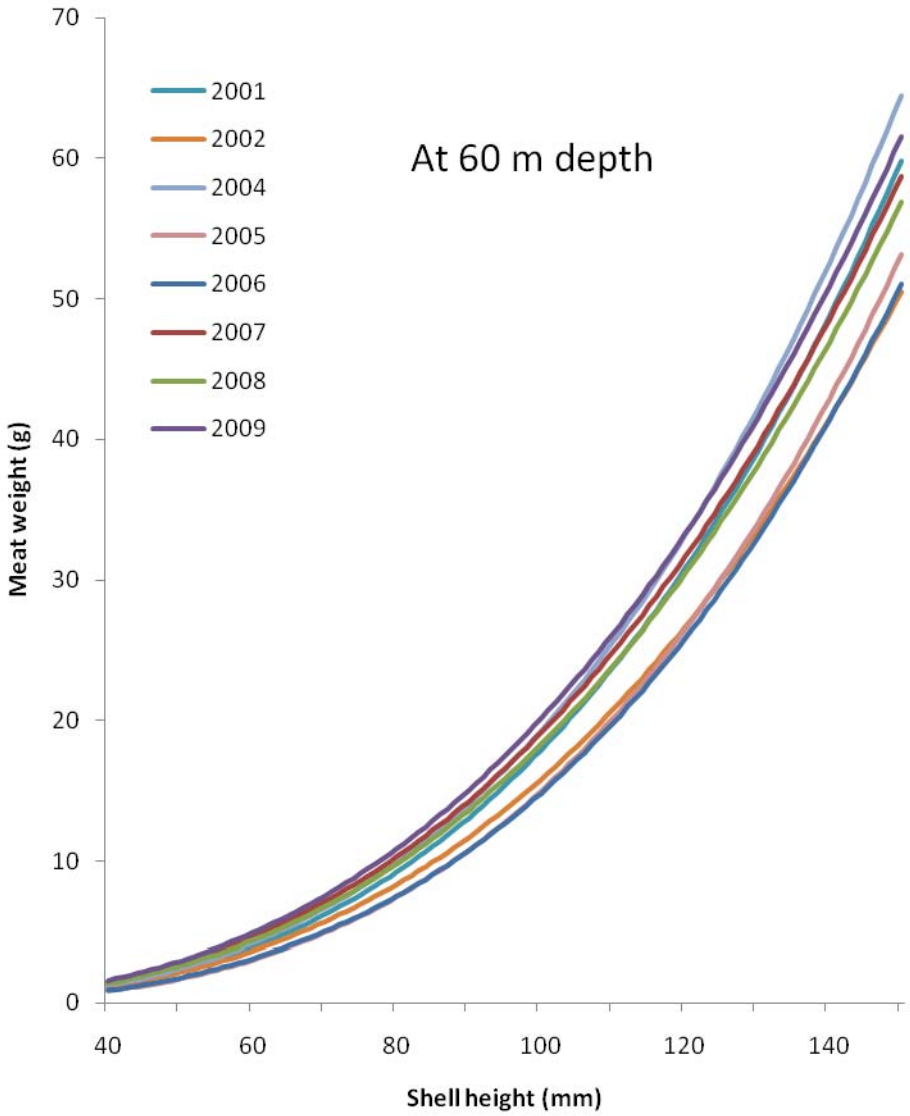
Appendix B8-Figure **7**. A comparison between the meat weight anomaly (smoothed and weighted by landings in each month) by year, as calculated in the last assessment and the current meat weight anomaly in the MAB.



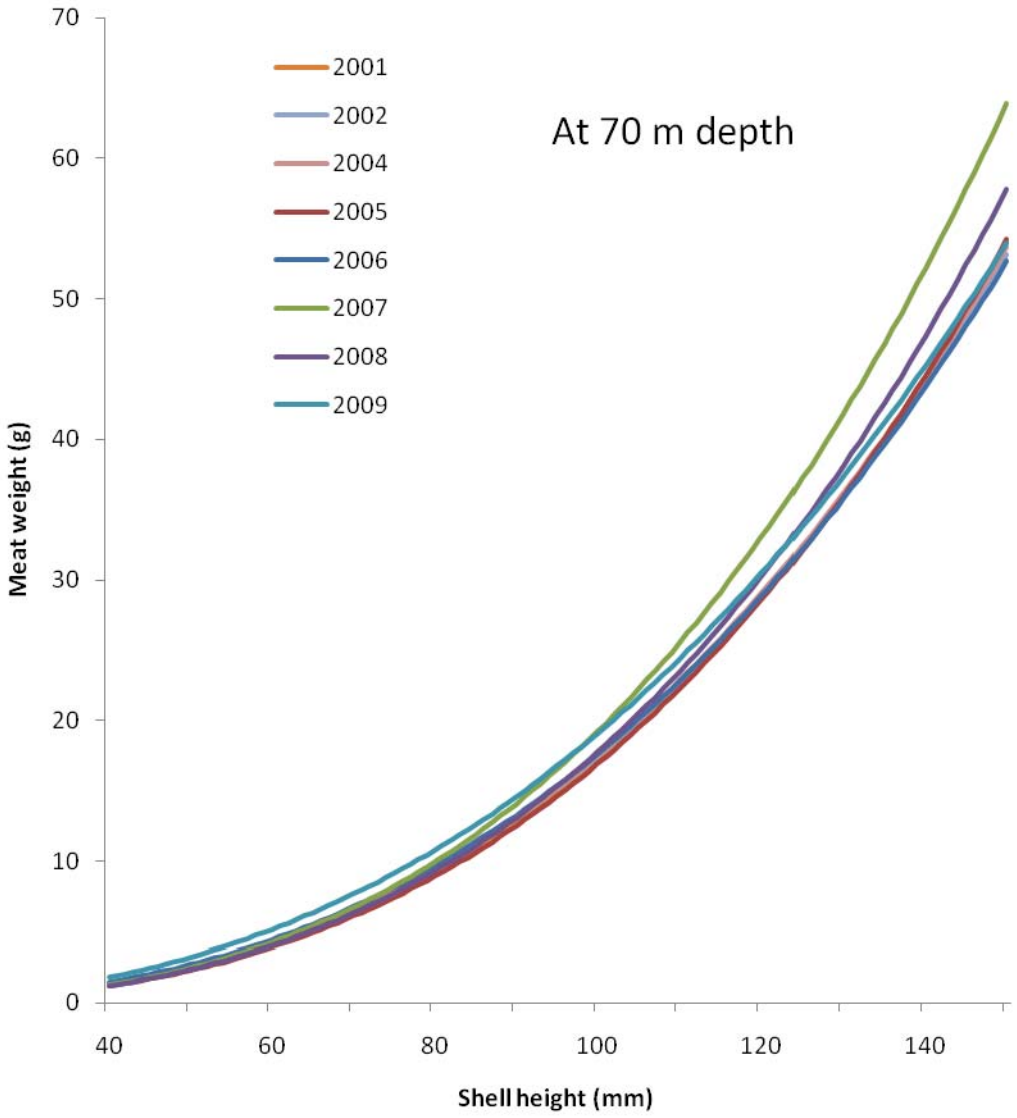
Appendix B8-Figure 8. A comparison between the meat weight anomaly (smoothed and weighted by landings in each month) by year, as calculated in the last assessment and the current meat weight anomaly in the GBK.



Appendix B8-Figure 9. The observed meat weight in the commercial catch by year. Observed meat weights are based on a simple density conversion of the volume of approximately 100 commercially shucked meats.



Appendix B8-Figure 10. Shell height/meat weight relationships for each survey year at 60 m depth in the Mid-Atlantic Bight ($W = e^{(\alpha + a(St) + \beta\, ln(L) + \gamma ln(D)) + \epsilon}$).



Appendix B8-Figure 11. Shell height-meat weight relationships by survey year at 70 m depth on Georges Bank ($W=e^{(\alpha+a(St)+\beta \ln(L)+\gamma \ln(D)+b(L_{St}))+\epsilon}$).