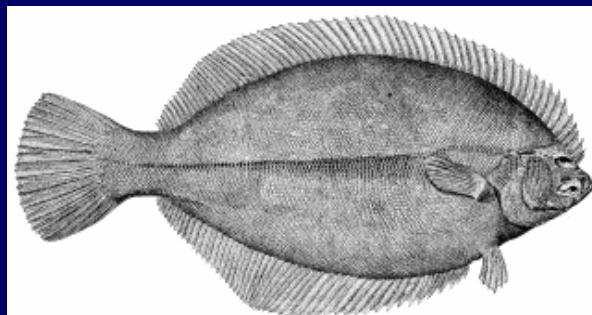
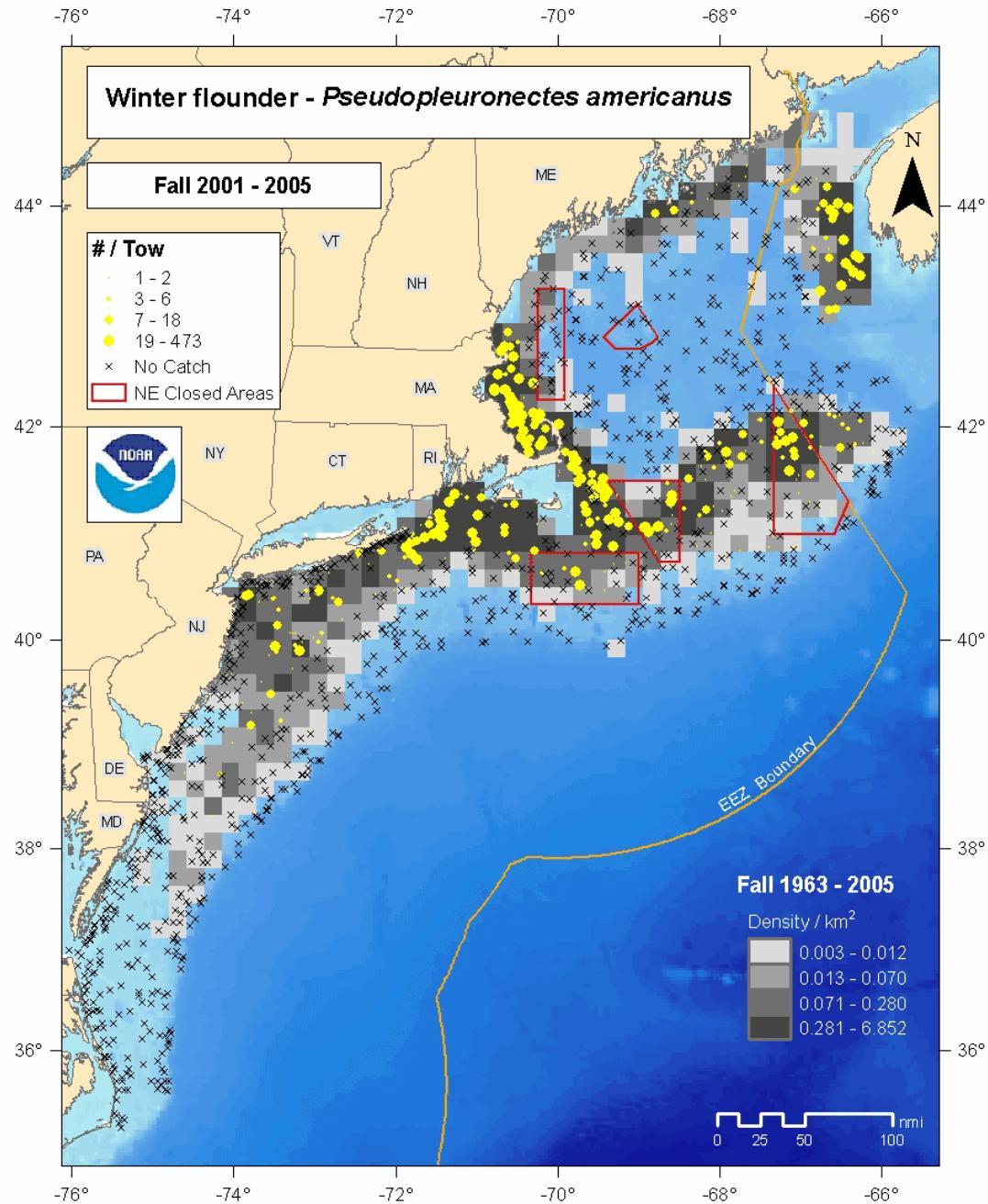
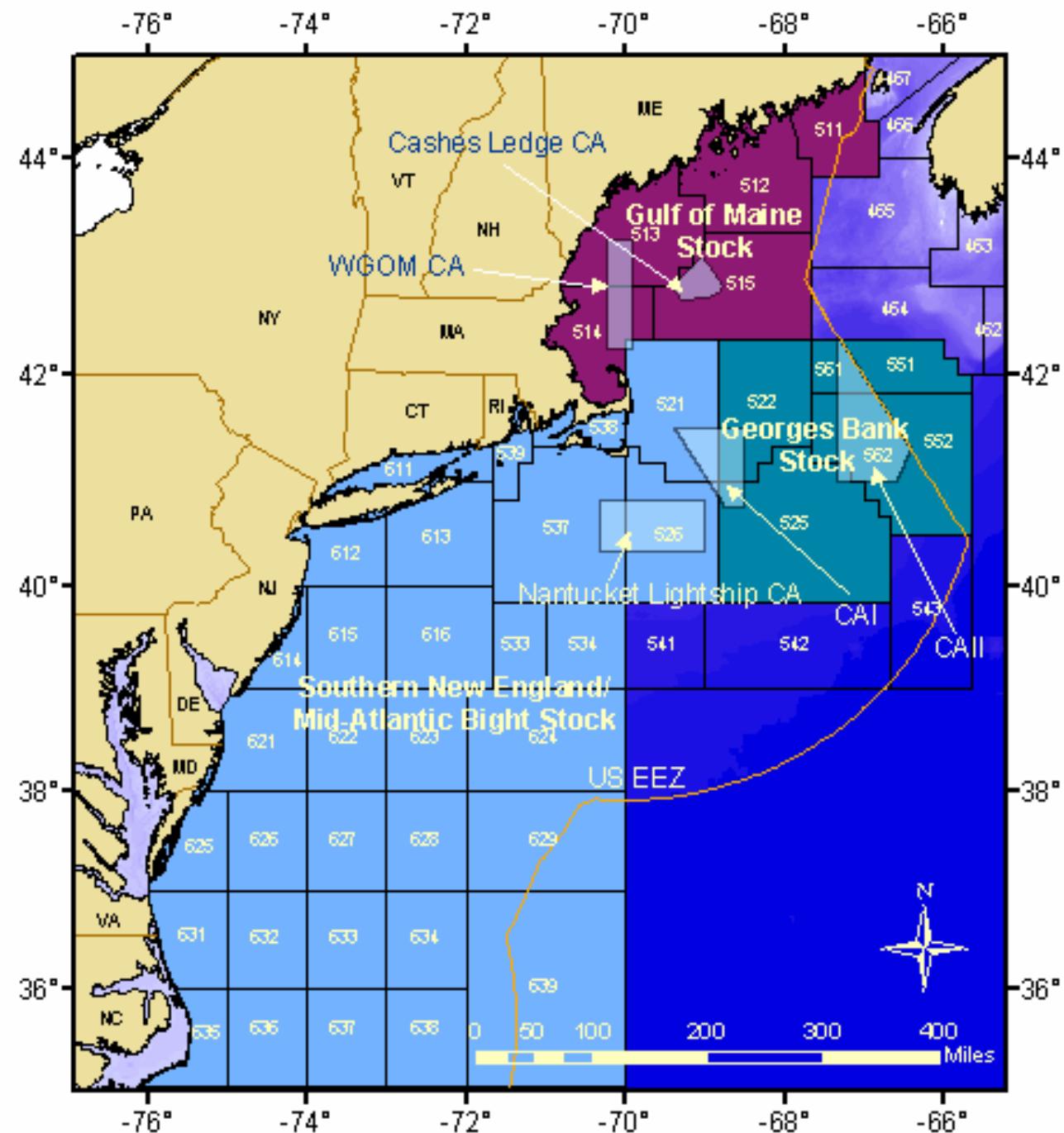


# GARM III



## Gulf of Maine Winter Flounder







## GARM II VPA



Wicked retrospective pattern

Models have difficulty with the apparent lack of a relationship between a large decrease in catch and little change in the indices and size & age distributions.

## GARM II STATUS

- SSB in 2004 was 3,400 mt or about 84% of BMSY = 4,100 mt (NOT overfished)
- Fishing mortality in 2004 was 0.13 or about 30% of FMSY = 0.43 (Overfishing is NOT occurring)





## GARM III



Investigation of the input data (surveys and catch). Why do we have mixed signals in the data?

Examine the updated VPA and try using some alternative models (SCALE and AIM).

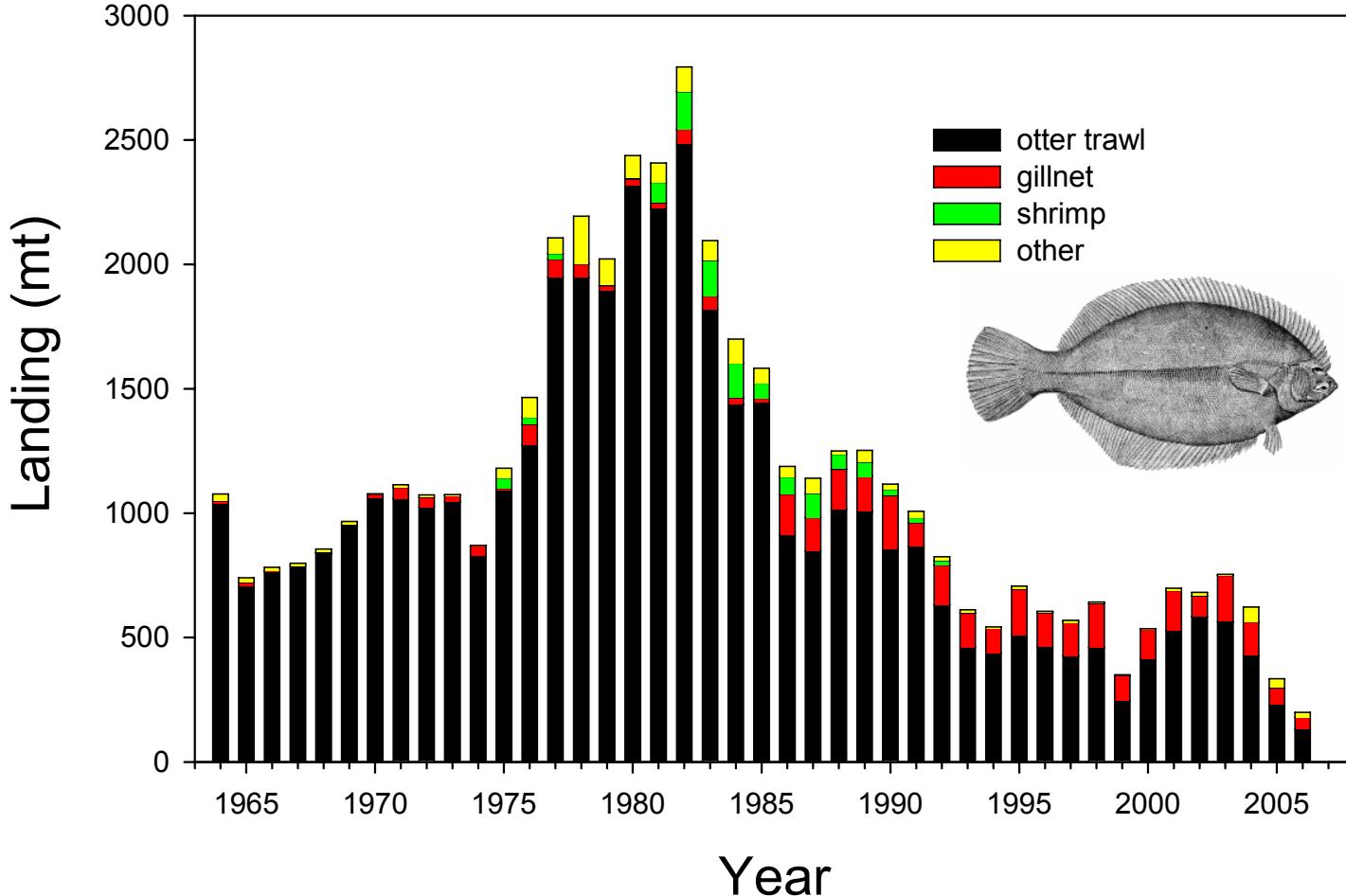


Figure Commercial landings by gear 1964-2006.

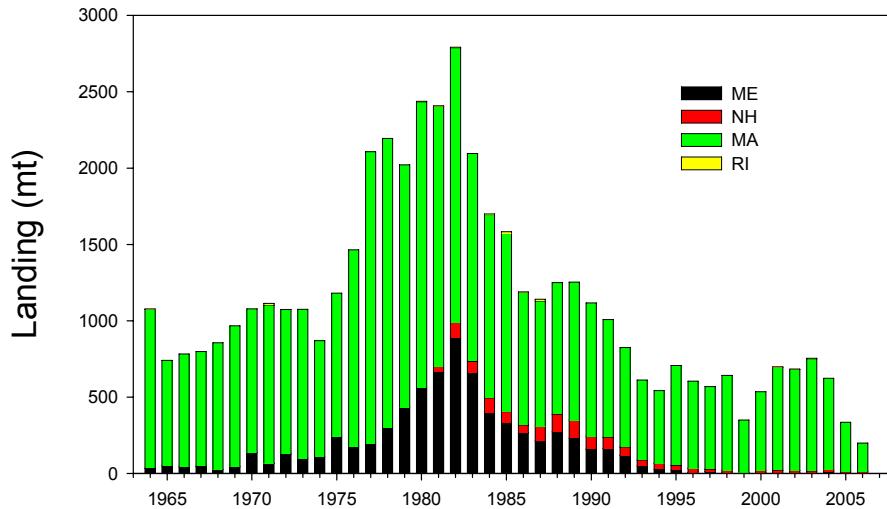


Figure Commercial landings by state from 1964-2006.

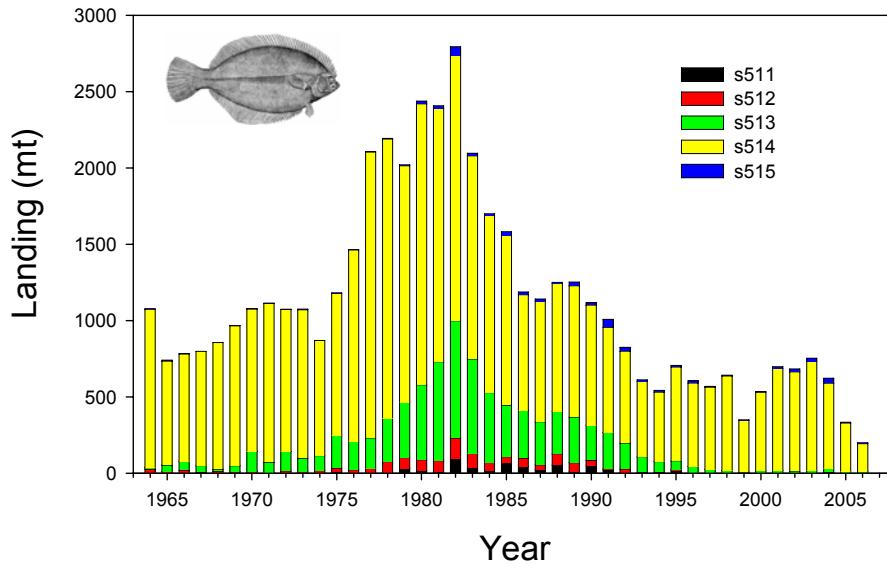


Figure Commercial landings by statistical area from 1964-2006.

# DATA UPDATE

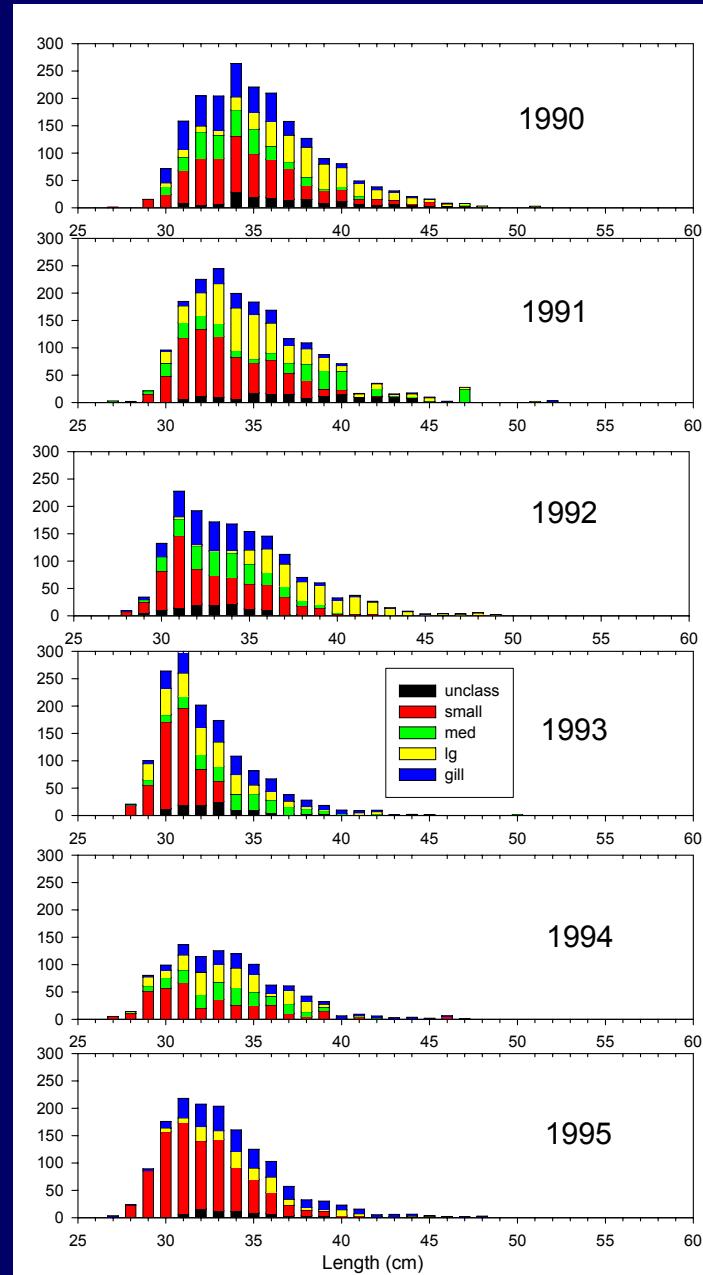
- Commercial and Recreational landings were re-estimated from 1990-2006.
- Large mesh trawl and gillnet discards were re-estimated (discard/keptall) from 1989-2006.
- Catch at age was re-estimated through 2004 and catch at length through 2006.

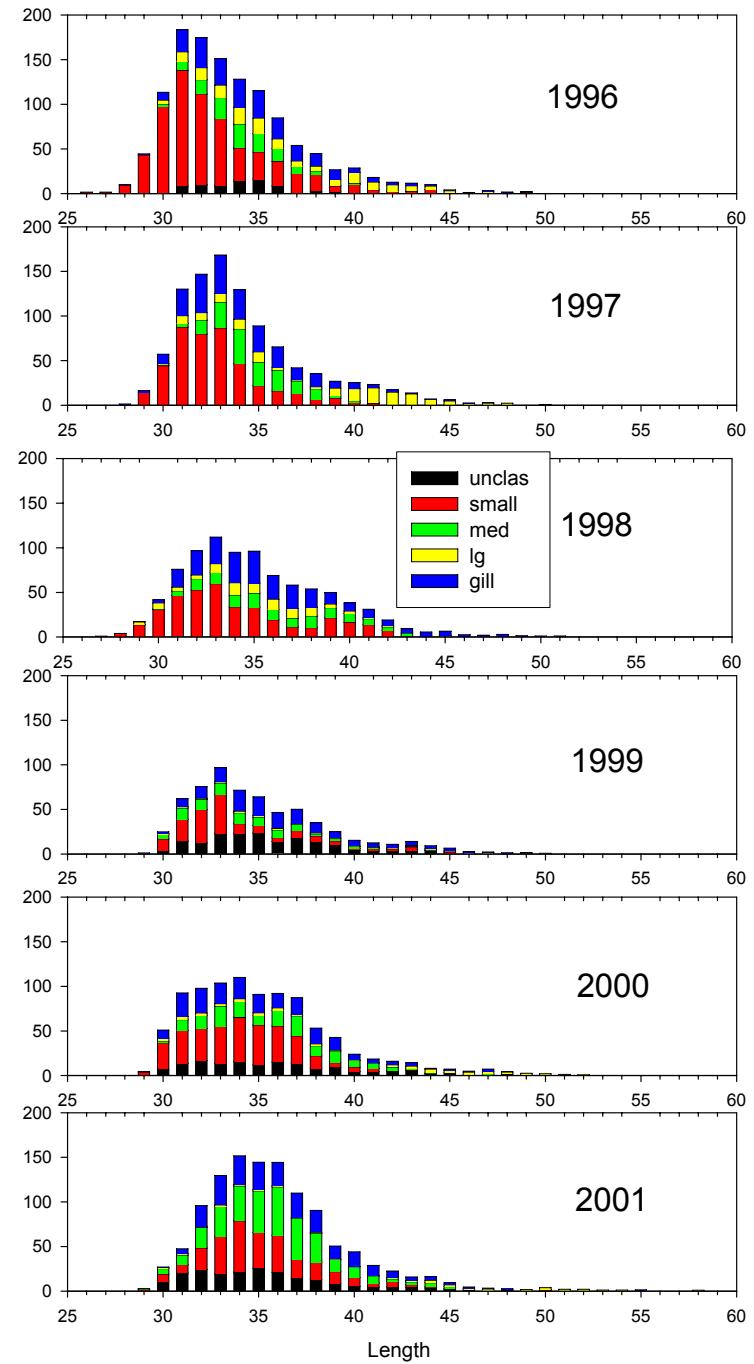
**Table I11.**

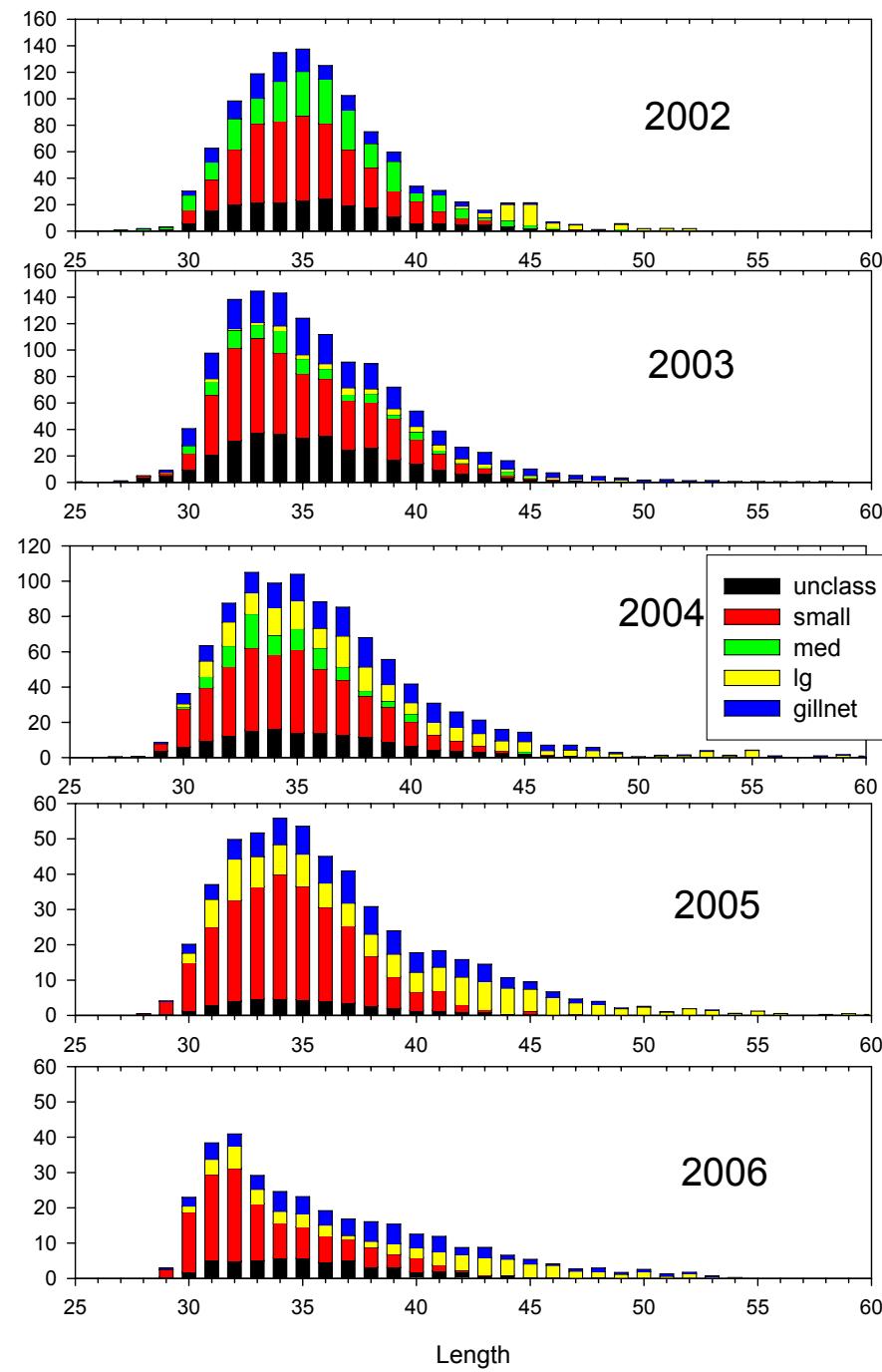
| Catch at age component                          | years        | halfyear         | length data                                 | age data                                  |
|---|--------------|------------------|---|---|
| trawl and other commercial landings             | 82-98        | mix              | commercial and observer (unclassified)      | commercial                                |
| trawl and other commercial landings             | <b>99-06</b> | whole & halfyear | <b>Observer (Trawl kept)</b>                | commercial                                |
| gillnet commercial Landings                     | 90-06        | whole & halfyear | observer (gillnet kept)                     | commercial                                |
| recreational Landings                           | 82-06        | halfyear         | MRFSS                                       | combine NEFSC and MA DMF ages by halfyear |
| recreational Discards                           | 82-06        | halfyear         | spr & fall MA DMF                           | combine NEFSC and MA DMF ages by halfyear |
| large mesh trawl discards (survey filter)       | 82-88        | whole year       | survey method (spr & fall MA DMF)           | combine NEFSC spr & fall survey           |
| large mesh trawl <b>disc (obs disc/keptall)</b> | <b>89-06</b> | whole year       | survey method (89-00) observer disc (01-06) | combine NEFSC spr & fall survey           |
| gillnet discards <b>(obs disc/keptall)</b>      | <b>86-06</b> | Whole & halfyear | observer discards                           | combine spr NEFSC and MA DMF ages         |
| shrimp discards (obs disc/days fished)          | 82-04        | shrimp season    | observer (discards)                         | combine spr NEFSC and MA DMF ages         |

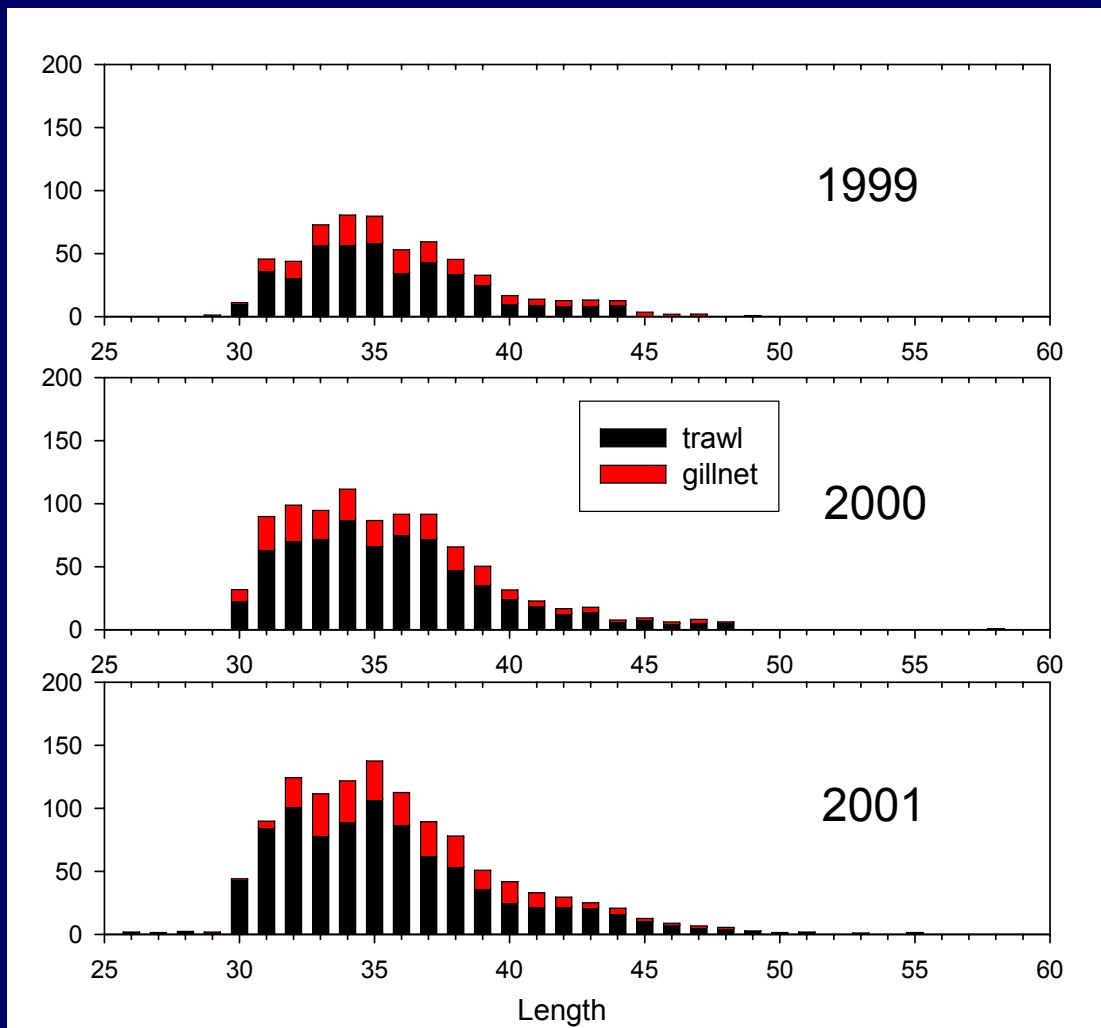
| year | Number of lengths. |     |      |     |     | Number of samples |      |    |    |     | mt/samples |       |      |     |     |     |     |       |
|------|--------------------|-----|------|-----|-----|-------------------|------|----|----|-----|------------|-------|------|-----|-----|-----|-----|-------|
|      | half               | lg  | sm   | med | un  | total             | half | lg | sm | med | un         | total | half | lg  | sm  | med | un  | total |
| 1982 | 1                  | 102 | 101  |     | 455 | 929               | 1    | 1  | 1  |     | 4          |       | 1    | 838 | 453 |     | 46  |       |
|      | 2                  | 84  | 81   |     | 106 |                   | 2    | 1  | 1  |     | 1          | 9     | 2    | 396 | 691 |     | 231 | 310   |
| 1983 | 1                  | 380 | 100  | 99  | 407 | 2551              | 1    | 4  | 1  |     | 1          | 24    | 1    | 120 | 510 |     | 53  |       |
|      | 2                  | 115 | 1344 |     | 106 |                   | 2    | 2  | 11 |     | 1          |       | 2    | 125 | 44  | 64  | 95  | 87    |
| 1984 | 1                  | 438 | 503  |     | 221 | 2201              | 1    | 5  | 4  |     | 2          | 19    | 1    | 74  | 95  |     |     |       |
|      | 2                  | 126 | 813  | 100 |     |                   | 2    | 1  | 6  | 1   |            |       | 2    | 189 | 67  | 114 | 124 | 89    |
| 1985 | 1                  | 665 | 735  |     |     | 1601              | 1    | 6  | 5  |     |            | 14    | 1    | 54  |     |     |     |       |
|      | 2                  | 121 |      |     | 80  |                   | 2    | 2  |    |     | 1          |       | 2    | 87  |     | 182 | 176 | 113   |
| 1986 | 1                  | 237 | 109  | 109 | 266 | 1503              | 1    | 3  | 1  | 1   | 3          | 17    | 1    |     | 242 | 126 | 48  |       |
|      | 2                  |     | 500  | 193 | 89  |                   | 2    |    | 6  | 2   | 1          |       | 2    | 113 | 37  | 31  | 56  | 70    |
| 1987 | 1                  |     |      |     | 113 | 683               | 1    |    |    |     | 1          | 8     | 1    |     |     |     |     |       |
|      | 2                  | 47  | 251  | 272 |     |                   | 2    | 1  | 3  | 3   |            |       | 2    | 257 | 137 | 75  | 249 | 143   |
| 1988 | 1                  | 102 | 258  | 706 | *   | 1342              | 1    | 1  | 3  | 7   | *          | 14    | 1    |     | 108 | 23  |     |       |
|      | 2                  |     | 169  | 107 | *   |                   | 2    |    | 2  | 1   | *          |       | 2    | 340 | 164 | 96  |     | 89    |
| 1989 | 1                  | 113 |      | 91  | 234 | 785               | 1    | 1  |    | 1   | 1          | 6     | 1    |     | 168 |     |     |       |
|      | 2                  |     | 95   | 220 | 32  |                   | 2    |    | 1  | 2   |            |       | 2    | 313 | 435 | 42  | 254 | 209   |
| 1990 | 1                  | 328 | 301  |     | 102 | 1142              | 1    | 3  | 4  |     | 1          | 12    | 1    | 64  | 48  |     |     |       |
|      | 2                  | 117 | 197  | 97  |     |                   | 2    | 1  | 2  | 1   |            |       | 2    | 83  | 90  | 144 | 111 | 75    |
| 1991 | 1                  | 188 | 254  | 205 | 143 | 1375              | 1    | 2  | 2  | 2   | 2          | 14    | 1    | 91  | 72  |     |     |       |
|      | 2                  | 236 | 349  |     |     |                   | 2    | 3  | 3  |     |            |       | 2    | 32  | 62  | 95  | 57  | 65    |
| 1992 | 1                  | 246 | 100  | 93  | 107 | 930               | 1    | 3  | 1  | 1   |            | 10    | 1    |     |     |     |     |       |
|      | 2                  | 57  | 74   | 253 |     |                   | 2    | 1  | 1  | 3   |            |       | 2    | 54  | 126 | 35  |     | 66    |
| 1993 | 1                  | 100 |      | 288 | 91  | 822               | 1    | 1  |    | 3   |            | 8     | 1    | 84  |     | 17  |     |       |
|      | 2                  | 80  | 55   | 157 | 51  |                   | 2    | 1  | 1  | 2   |            |       | 2    | 47  | 178 | 30  |     | 59    |

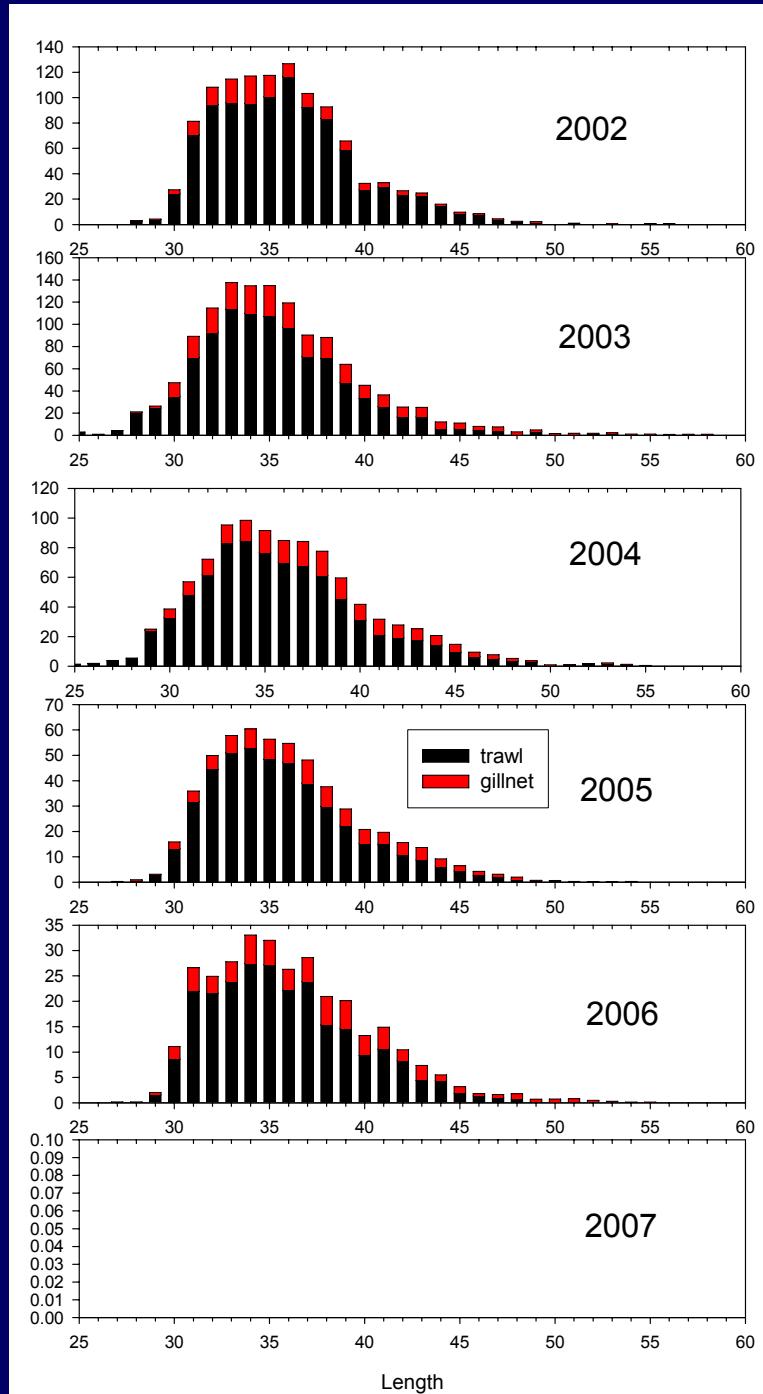
| year | Number of lengths. |     |      |      |      | Number of samples |      |    |    |     | mt/samples |       |      |      |      |      |      |       |
|------|--------------------|-----|------|------|------|-------------------|------|----|----|-----|------------|-------|------|------|------|------|------|-------|
|      | half               | lg  | sm   | med  | un   | total             | half | lg | sm | med | un         | total | half | lg   | sm   | med  | un   | total |
| 1994 | 1                  |     | 71   | 92   |      |                   | 1    |    | 1  | 1   |            |       | 1    |      | 57   |      |      | 64    |
|      | 2                  | 94  |      | 235* |      | 492               | 2    | 1  |    | 3   |            | 6     | 2    | 118  | 157  | 18   |      |       |
| 1995 | 1                  | 101 |      | 474  | 33   | 474               | 1    | 1  |    | 5   |            |       | 1    |      | 29   |      |      | 52    |
|      | 2                  |     | 414  | 609  |      | 1631              | 2    |    |    | 4   |            | 10    | 2    | 94   |      | 59   |      |       |
| 1996 | 1                  |     | 378  |      |      |                   | 1    |    | 4  |     |            |       | 1    |      | 29   |      |      | 31    |
|      | 2                  |     | 795  | 338  | 112  | 1623              | 2    |    | 7  | 4   |            | 15    | 2    | 23   | 16   |      |      |       |
| 1997 | 1                  |     | 127  | 75*  |      |                   | 1    |    | 2  | 1*  |            |       | 1    |      | 34   | 33   |      | 18    |
|      | 2                  | 407 | 1014 | 218* |      | 1841              | 2    | 5  | 11 | 3*  |            | 22    | 2    | 20   | 11   | 19   |      |       |
| 1998 | 1                  |     | 299  | 280* |      |                   | 1    |    | 5  | 3*  |            |       | 1    |      | 16   | 16   |      | 17    |
|      | 2                  | 69  | 746  | 110* |      | 1504              | 2    | 1  | 9  | 1*  |            | 19    | 2    | 51   | 12   | 32   |      |       |
| 1999 | 1                  |     |      | 275  | 122  |                   | 1    |    |    | 3   |            |       | 1    |      |      |      |      | 50    |
|      | 2                  |     | 80   |      | 430  | 907               | 2    |    | 2  |     |            | 5     | 2    |      | 42   | 15   |      |       |
| 2000 | 1                  | 104 | 4331 | 250  | 1046 |                   | 1    | 1  | 59 | 4   |            |       | 1    | 19   | 1    |      |      | 6     |
|      | 2                  | 244 | 344  |      | 130  | 6449              | 2    | 4  | 6  |     | 1          | 75    | 2    | 7    | 20   | 24   |      |       |
| 2001 | 1                  |     | 89   | 474  | 795  |                   | 1    |    | 1  | 6   |            |       | 1    |      | 66   | 10   |      | 41    |
|      | 2                  |     | 254  | 250  | 1756 | 3618              | 2    |    | 3  | 3   |            | 13    | 2    |      | 35   | 47   |      |       |
| 2002 | 1                  | 28  | 507  | 173  | 573  |                   | 1    | 1  | 7  | 2   | 1          |       | 1    |      | 7    | 34   | 59   | 21    |
|      | 2                  |     | 982  | 133  | 2734 | 5130              | 2    |    | 14 | 2   | 2          | 29    | 2    | 57   | 14   | 48   | 35   |       |
| 2003 | 1                  |     | 744  |      | 2410 |                   | 1    | 1  | 10 | 1   | 2          |       | 1    |      | 11   |      | 48   | 11    |
|      | 2                  | 384 | 818  | 110  | 914  | 5380              | 2    | 12 | 19 | 1   | 6          | 52    | 2    | 3    | 9    | 28   | 18   |       |
| 2004 | 1                  | 223 | 692  | 86   | 1915 |                   | 1    | 7  | 14 | 1   | 6          |       | 1    |      | 6    |      | 12   | 11    |
|      | 2                  | 7   | 706  |      | 2955 | 6584              | 2    | 1  | 12 |     | 4          | 45    | 2    | 18   | 9    | 48   | 6    |       |
| 2005 | 1                  |     |      |      |      | 0                 | 1    |    |    |     |            | 0     | 1    | #### | #### | #### | #### |       |
|      | 2                  |     |      |      |      |                   | 2    |    |    |     |            | 0     | 2    | #### | #### | #### | #### |       |
| 2006 | 1                  |     |      |      |      | 0                 | 1    |    |    |     |            | 0     | 1    | #### | #### | #### | #### |       |
|      | 2                  |     |      |      |      |                   | 2    |    |    |     |            | 0     | 2    | #### | #### | #### | #### |       |
| 2007 | 1                  |     |      |      |      | 0                 | 1    |    |    |     |            | 0     | 1    | #### | #### | #### | #### |       |
|      | 2                  |     |      |      |      |                   | 2    |    |    |     |            | 0     | 2    | #### | #### | #### | #### |       |

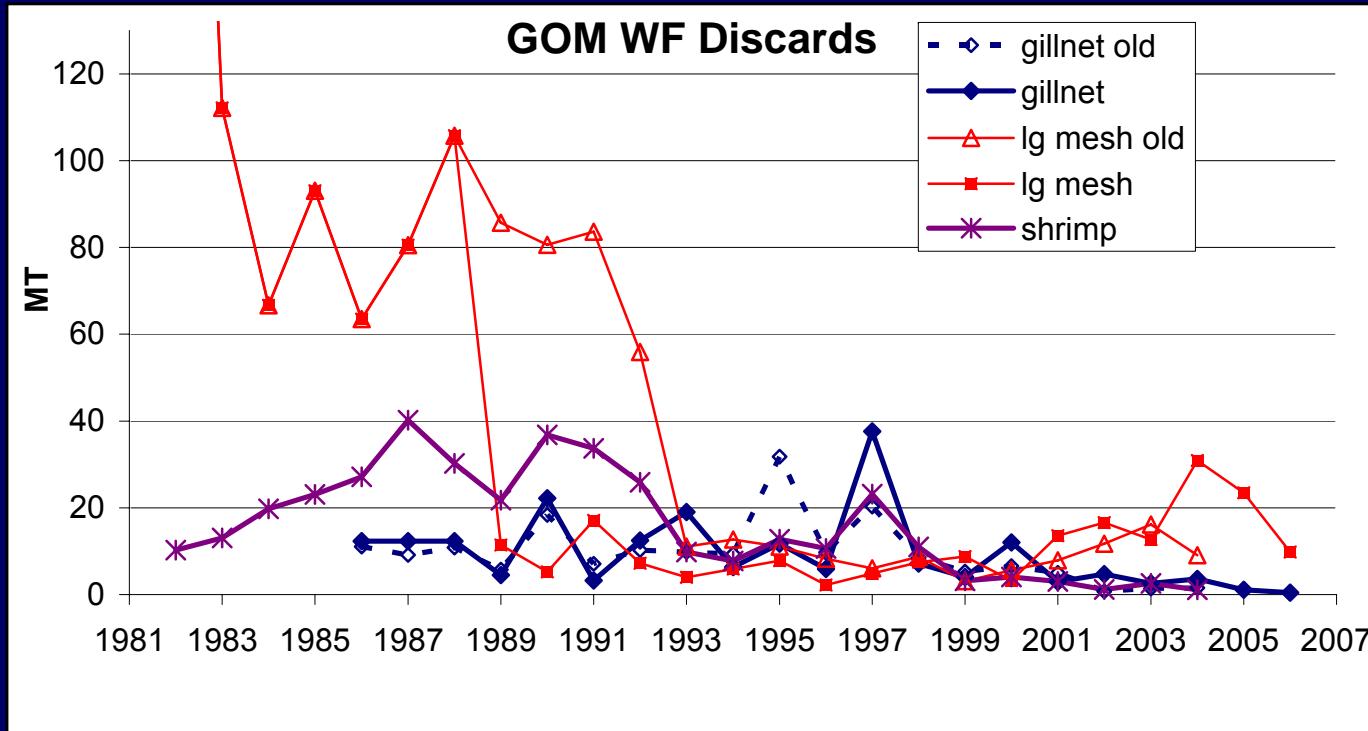


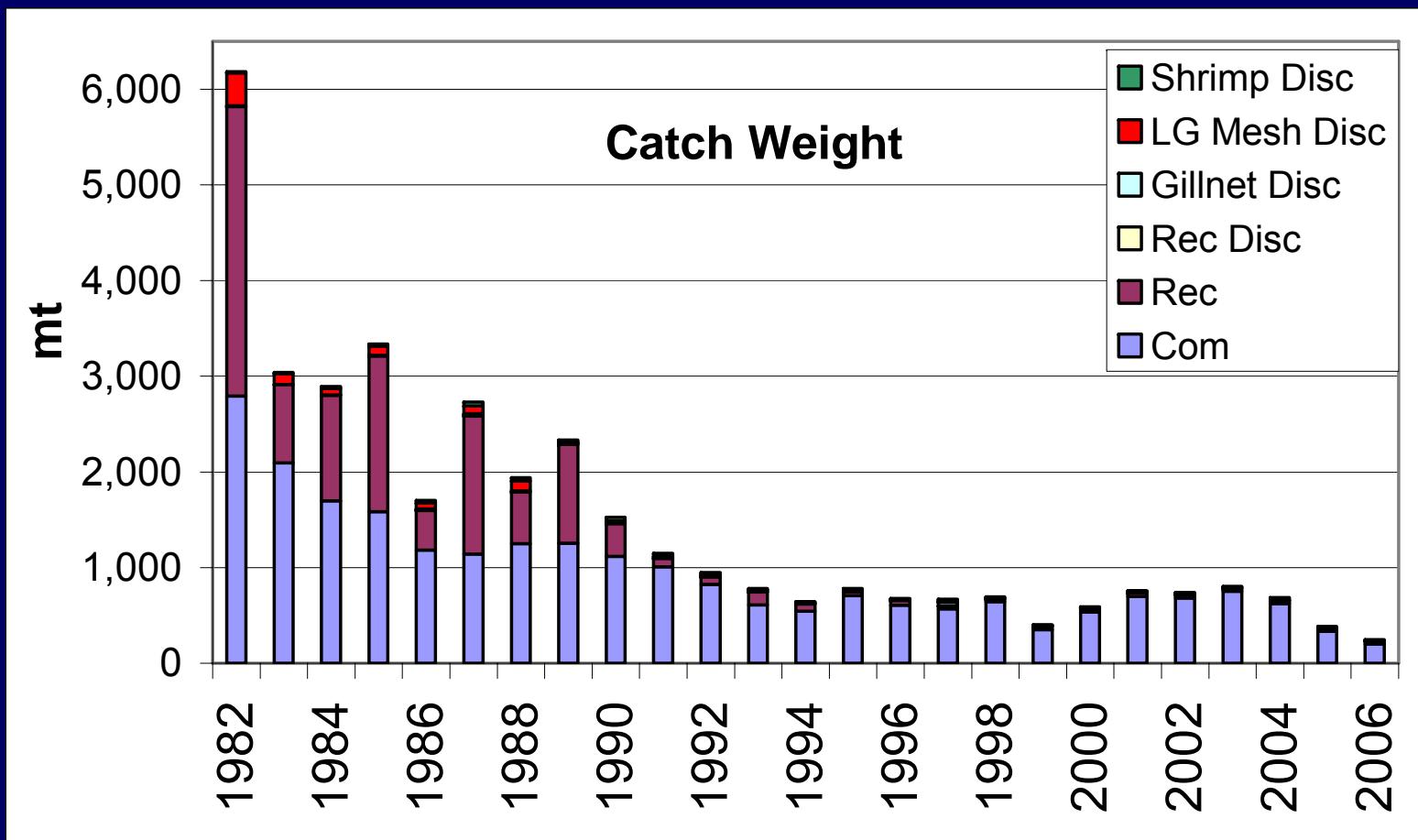




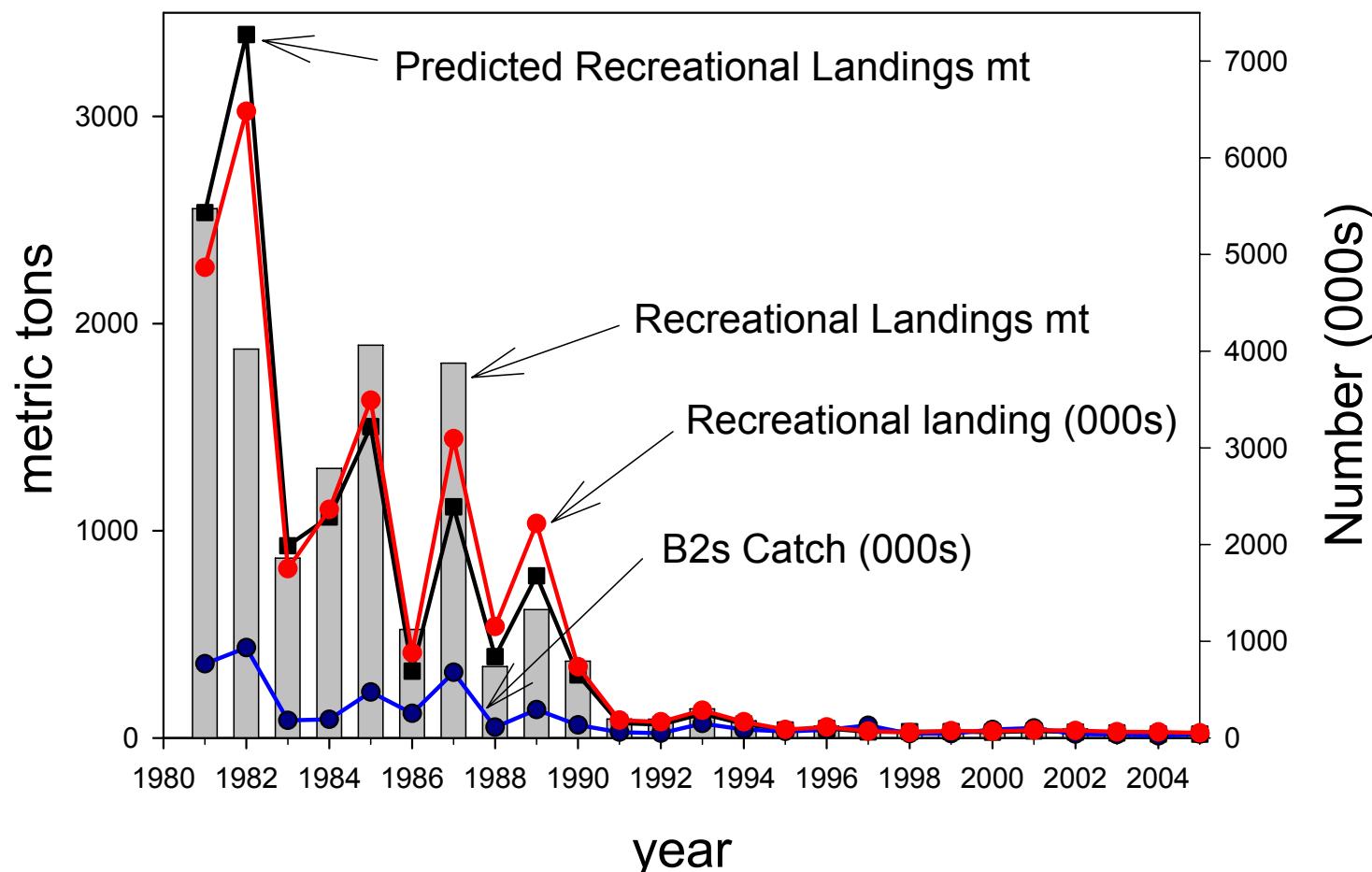


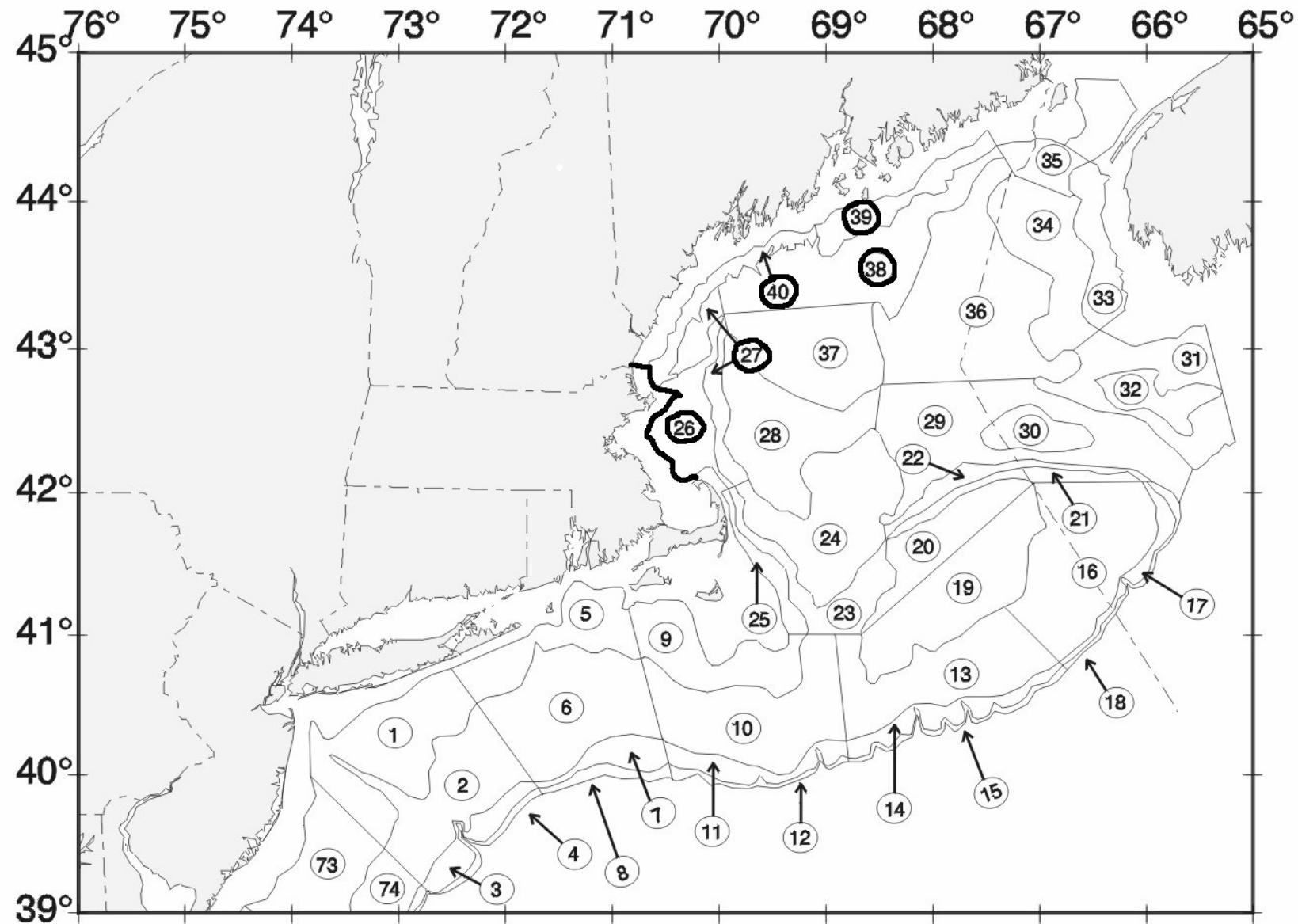


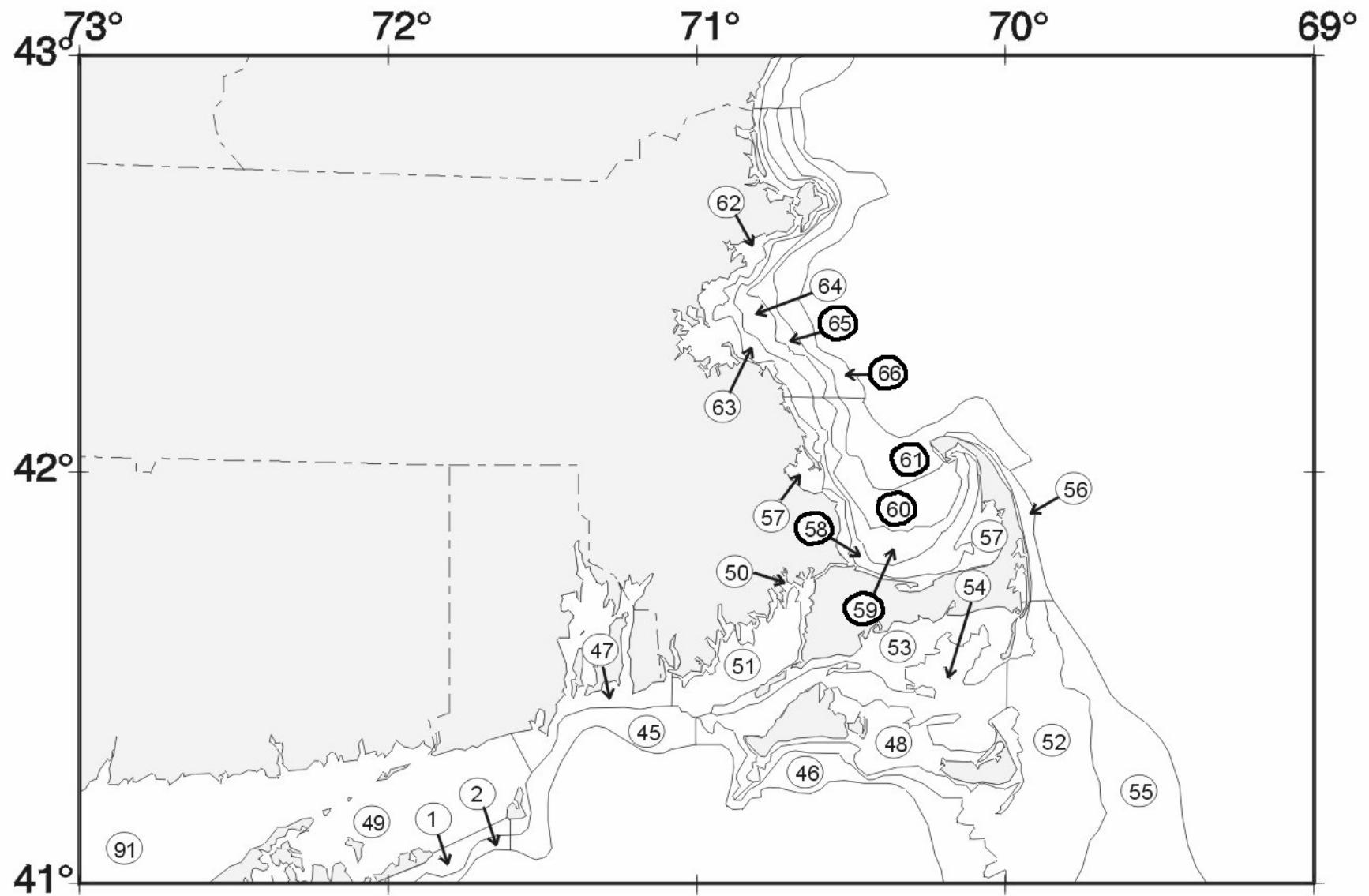




## Gulf of Maine Winter Flounder Recreational landings and b2 Catch







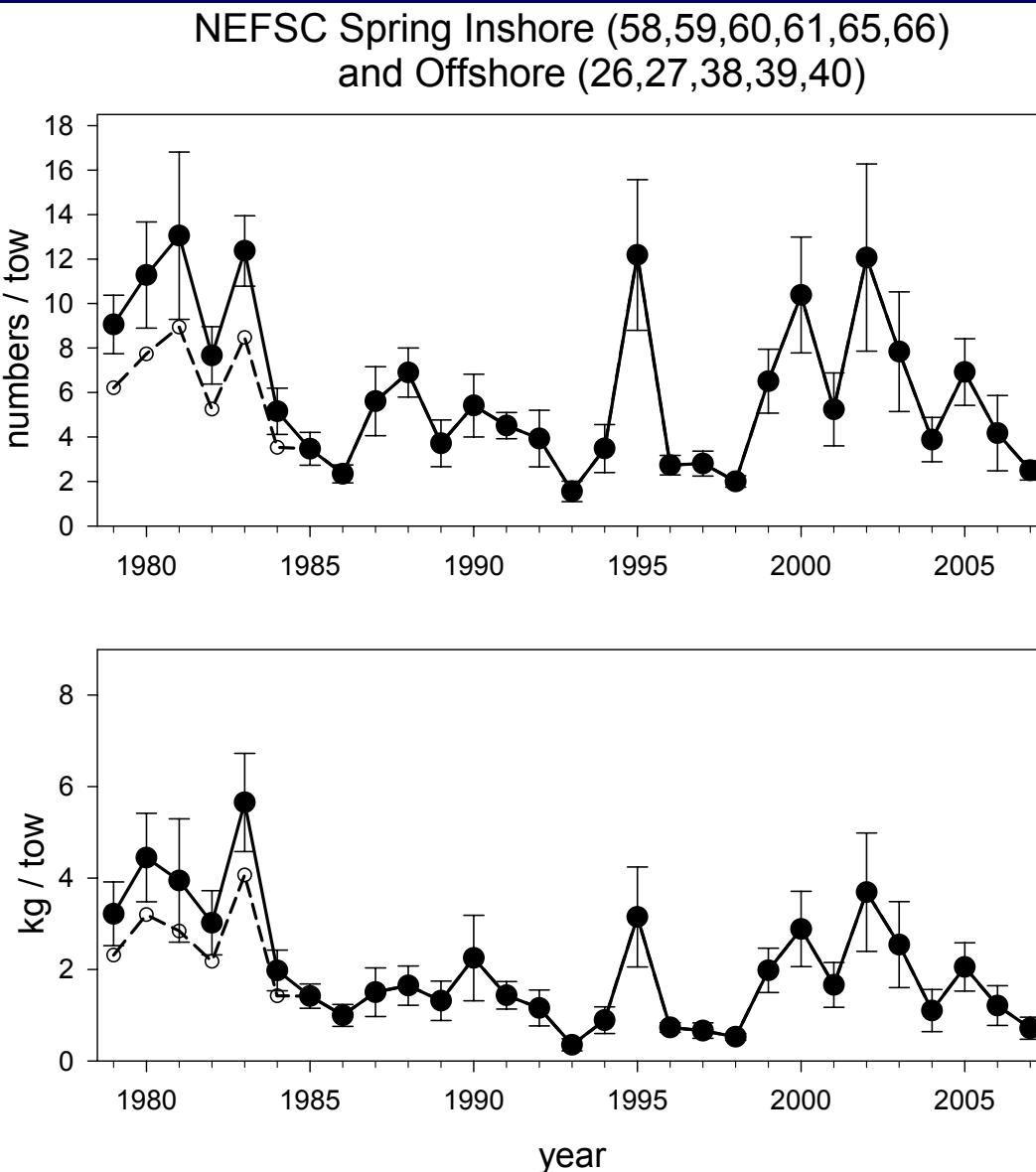


Figure . NEFSC Spring survey stratified mean numbers and mean weight (kg) per tow for Gulf of Maine winter flounder. Trawl door conversion factors are used where appropriate. Dotted lines are the unconverted indices.

NEFSC Fall Inshore (58,59,60,61,65,66)  
and Offshore (26,27,38,39,40)

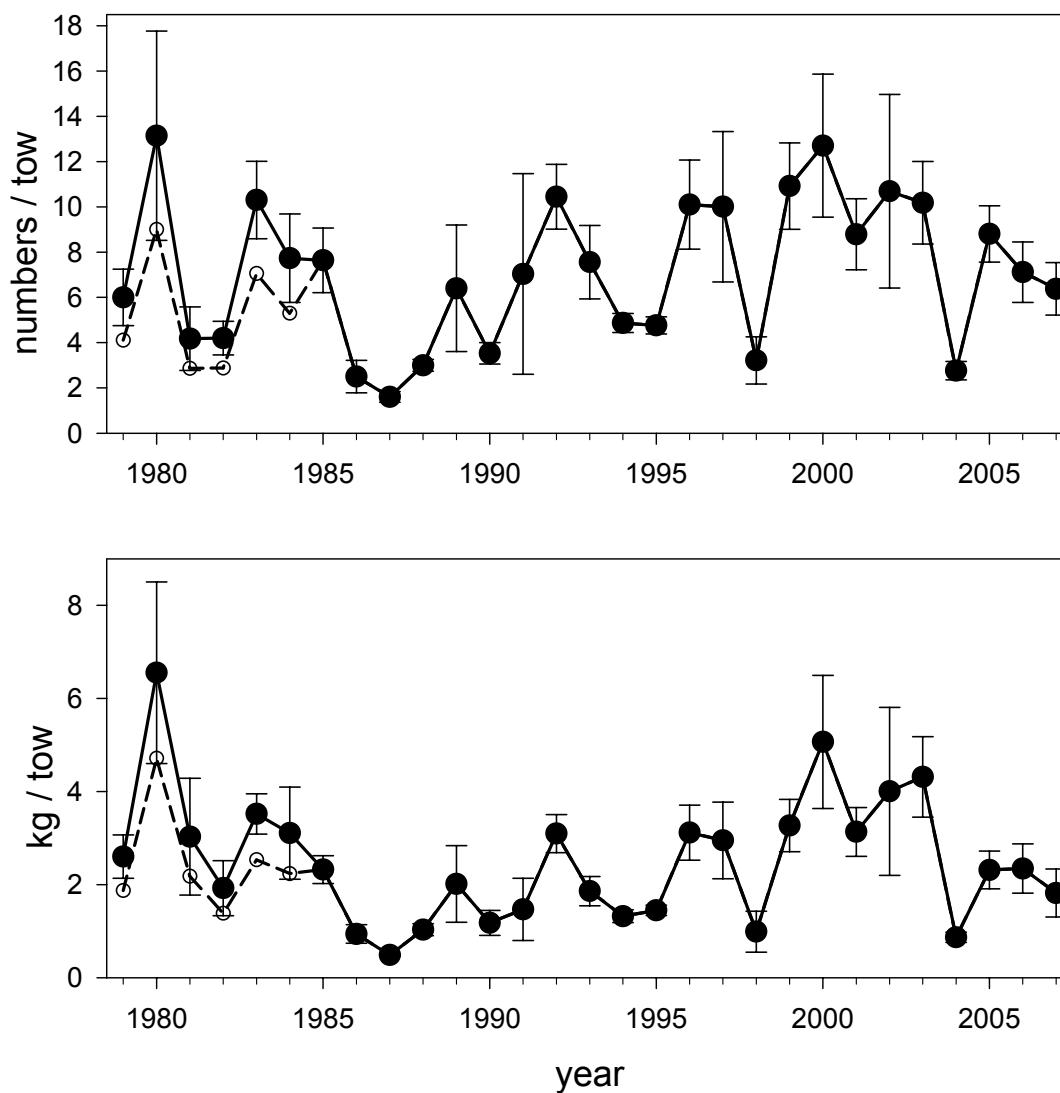
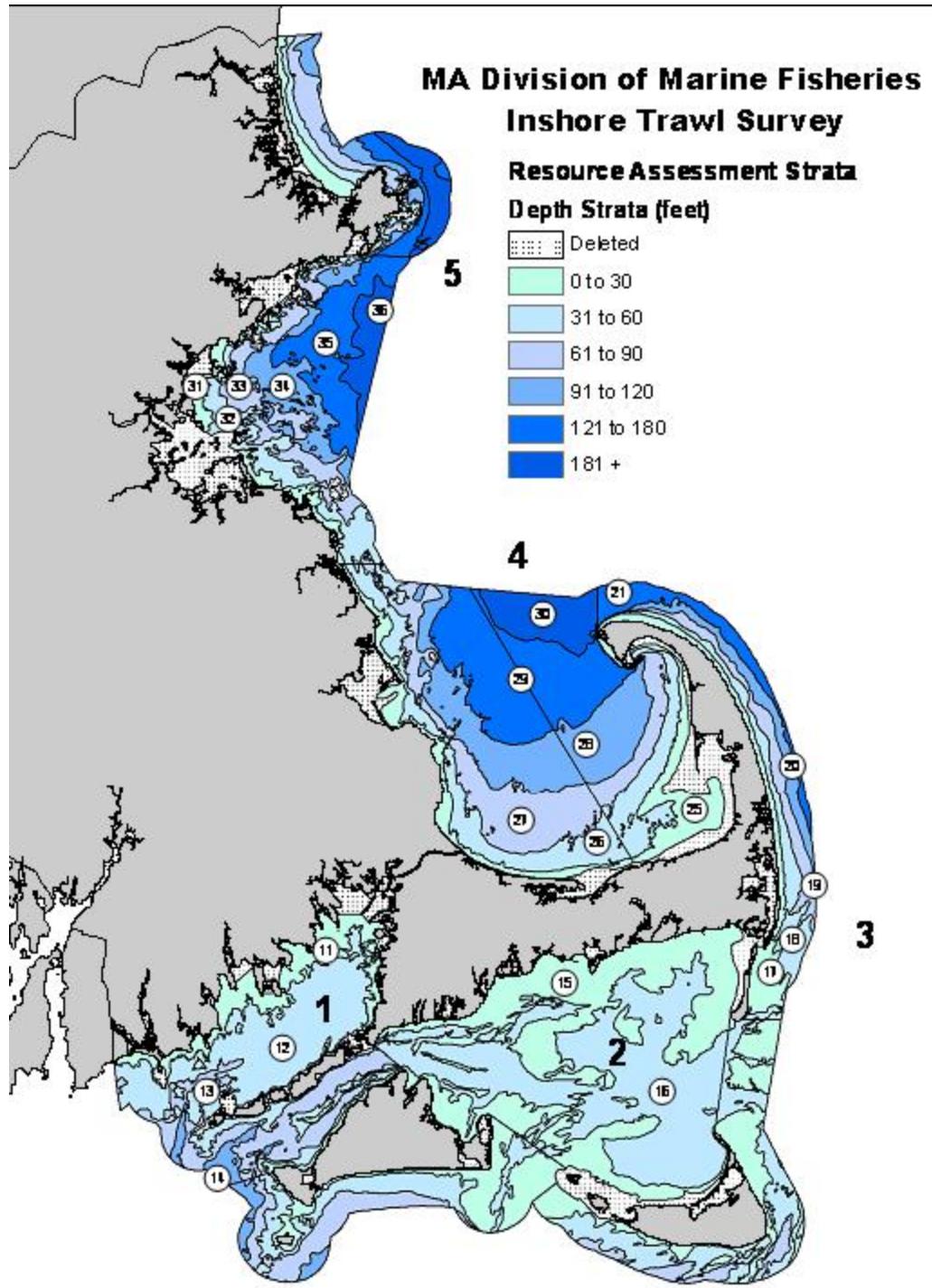


Figure . NEFSC Fall survey stratified mean numbers and mean weight (kg) per tow for Gulf of Maine winter flounder. Trawl door conversion factors are use where appropriate. Data for 2007 is preliminary. Dotted lines are the unconverted indices.



### MDMF Spring

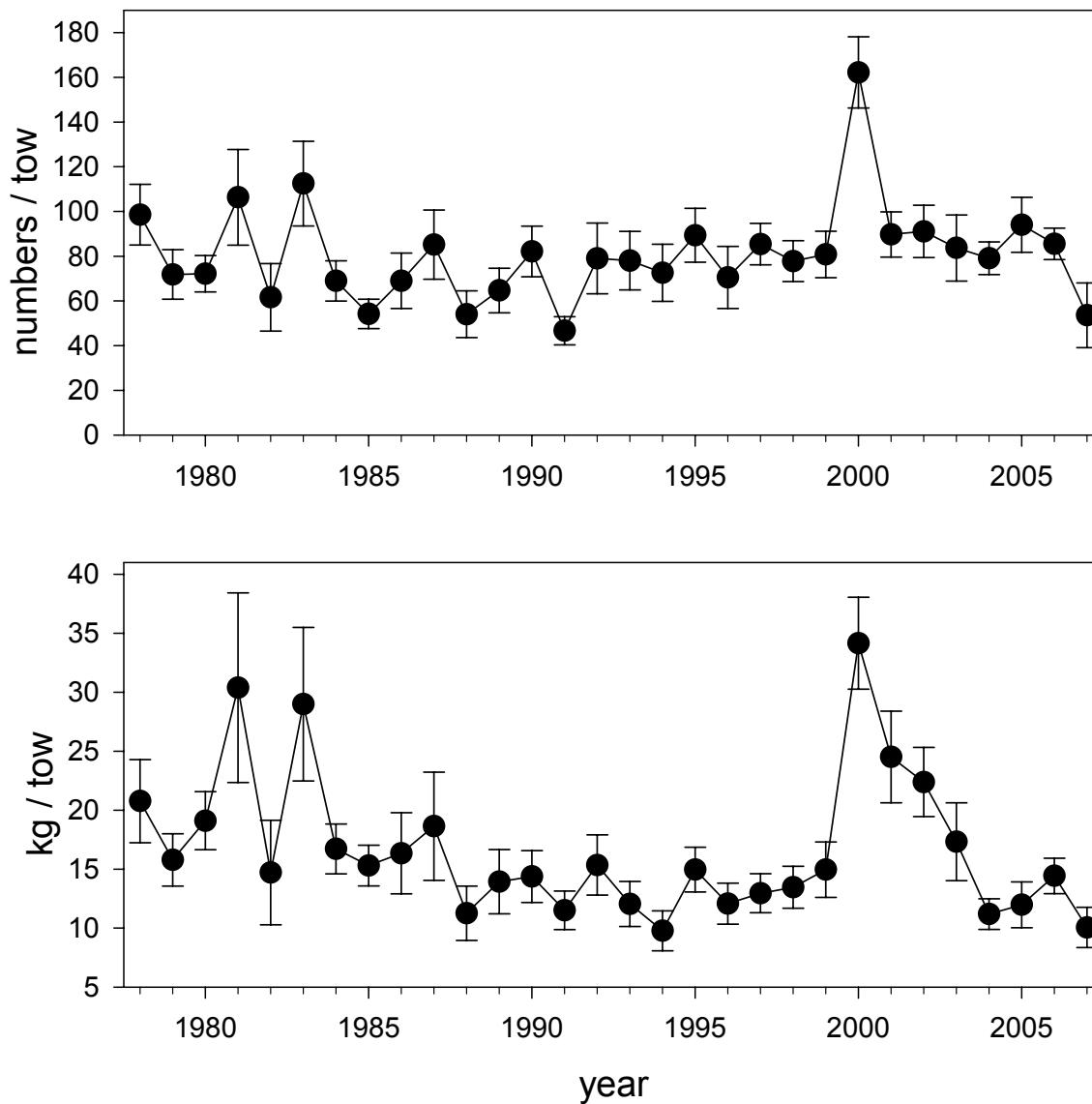


Figure . Massachusetts Division of Marine Fisheries (MDMF) Spring survey stratified mean numbers and mean weight (kg) per tow for Gulf of Maine winter flounder.

## MDMF Fall

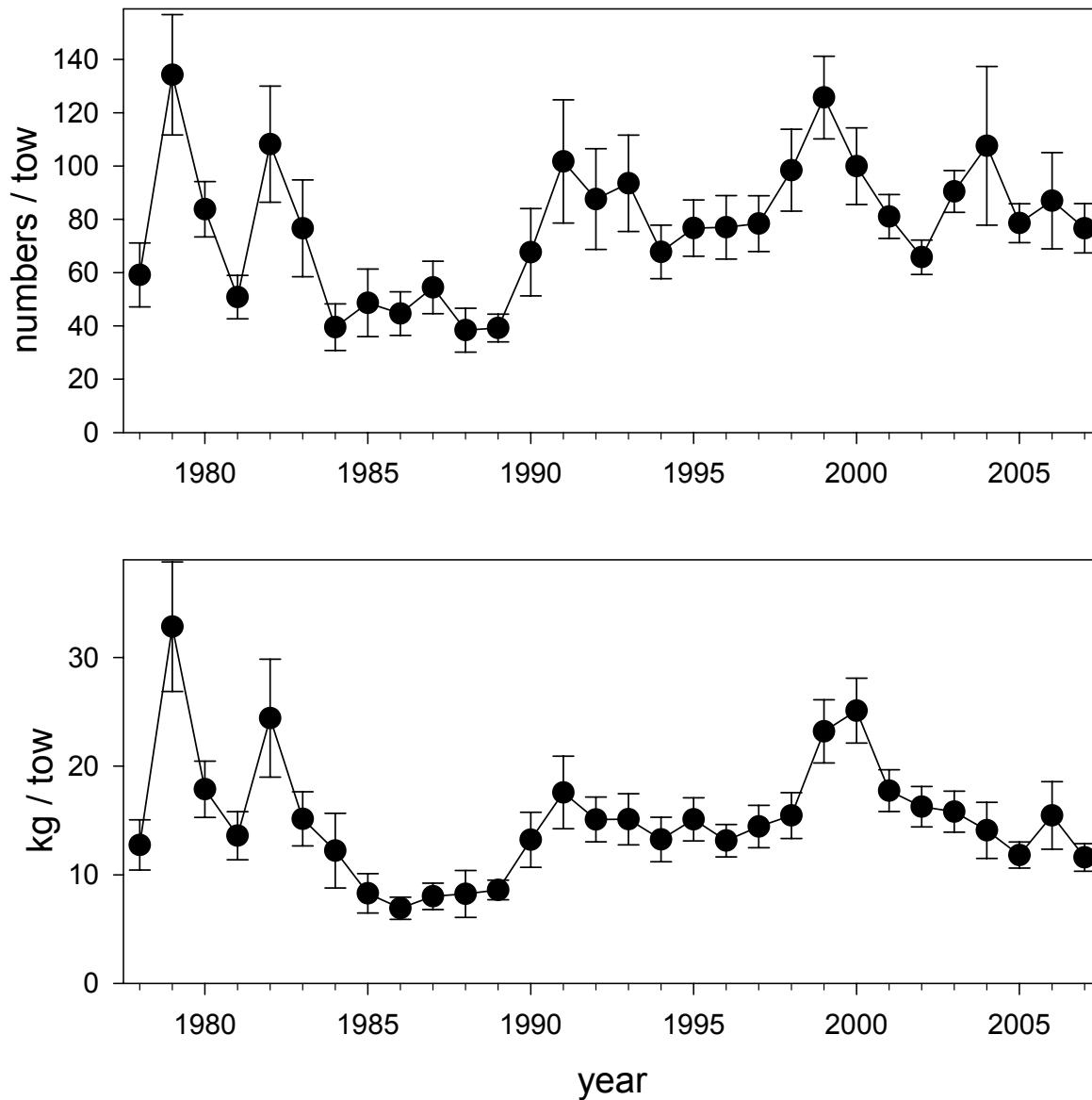
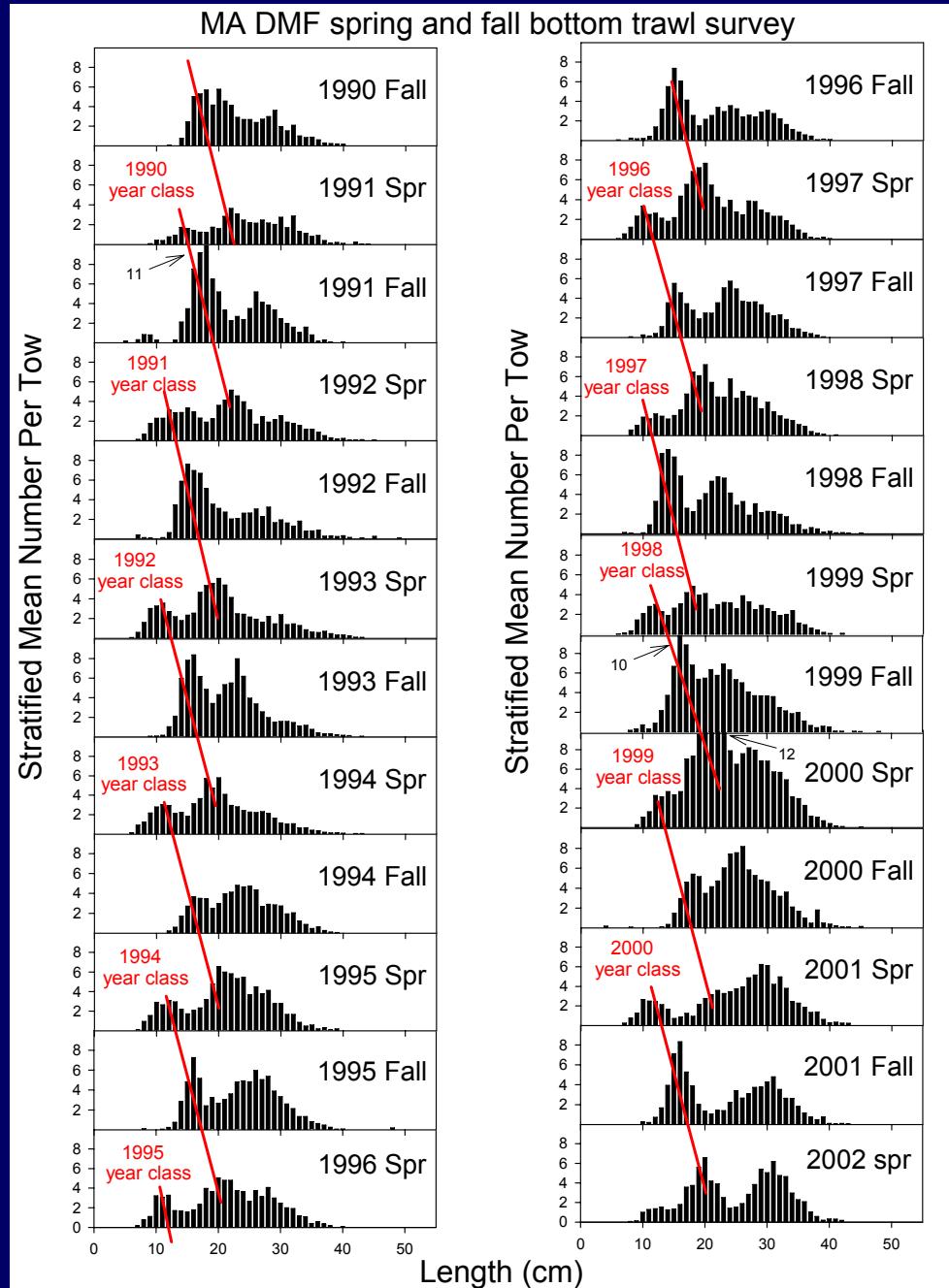
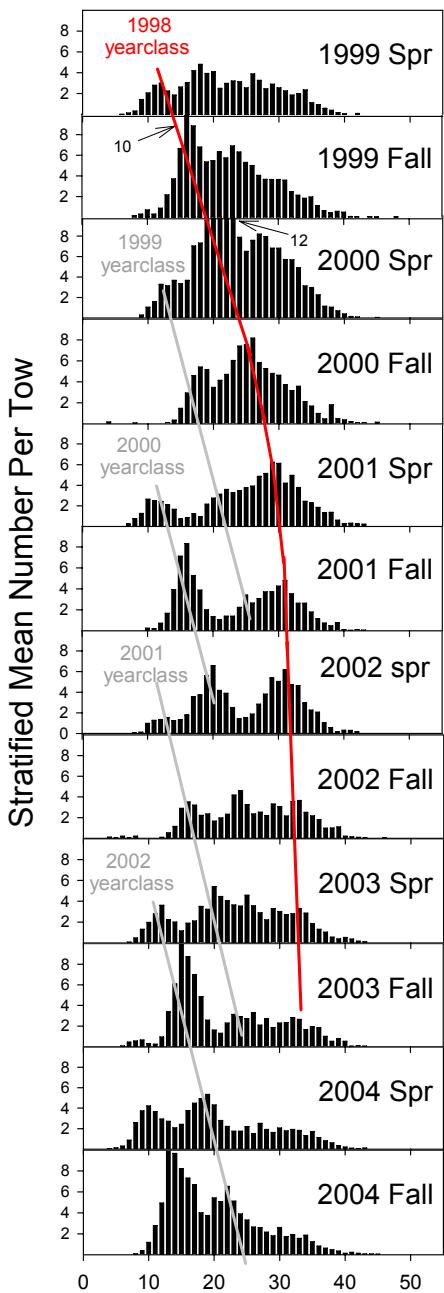


Figure . Massachusetts Division of Marine Fisheries (MDMF) Fall survey stratified mean numbers and mean weight (kg) per tow for Gulf of Maine winter flounder.



### 1998 yearclass in the MA DMF spring and fall bottom trawl survey



1998 yearclass  
Age 1

1998 yearclass  
Age 2

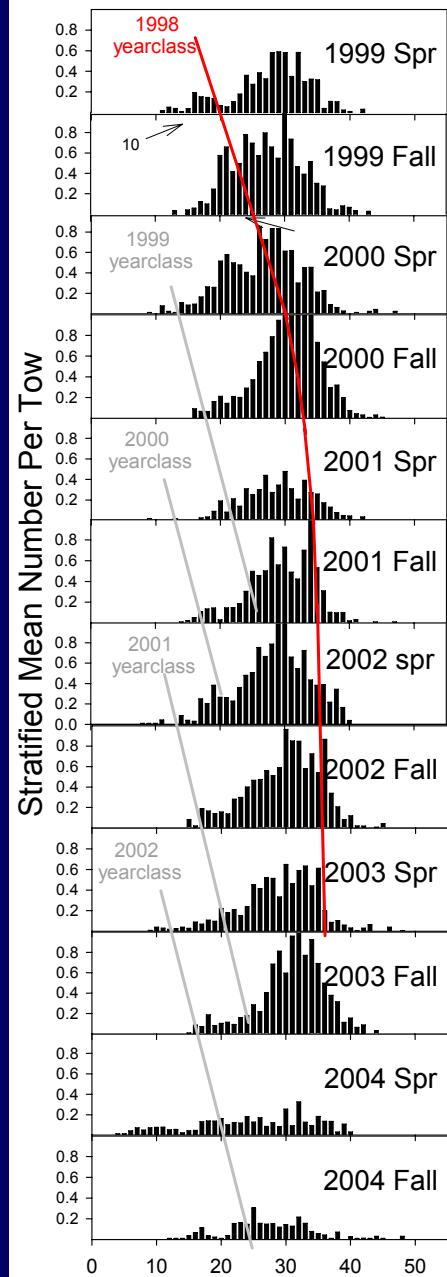
1998 yearclass  
Age 3

1998 yearclass  
Age 4

1998 yearclass  
Age 5

1998 yearclass  
Age 6

### 1998 yearclass in the NEFSC spring and fall bottom trawl survey



1998 yearclass  
Age 1

1998 yearclass  
Age 2

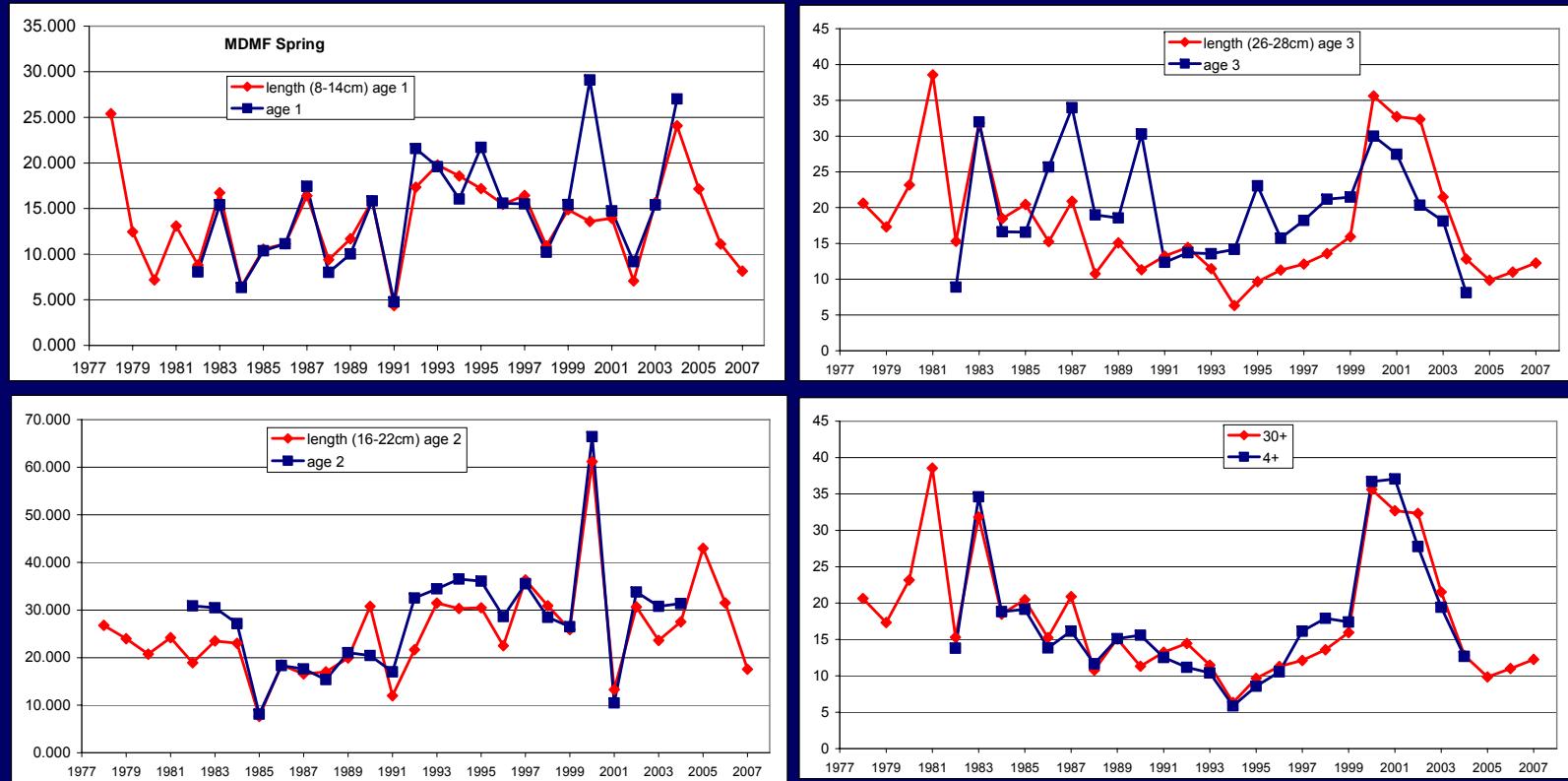
1998 yearclass  
Age 3

1998 yearclass  
Age 4

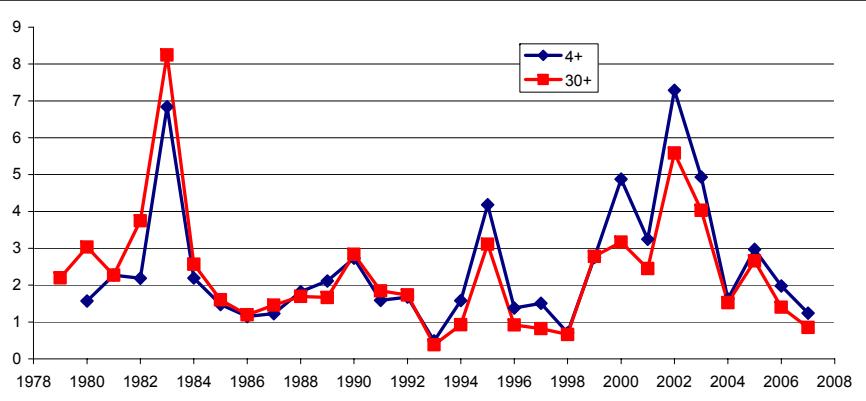
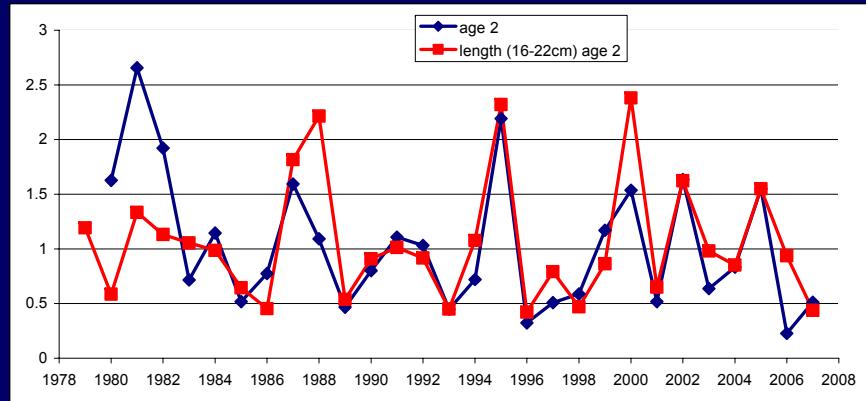
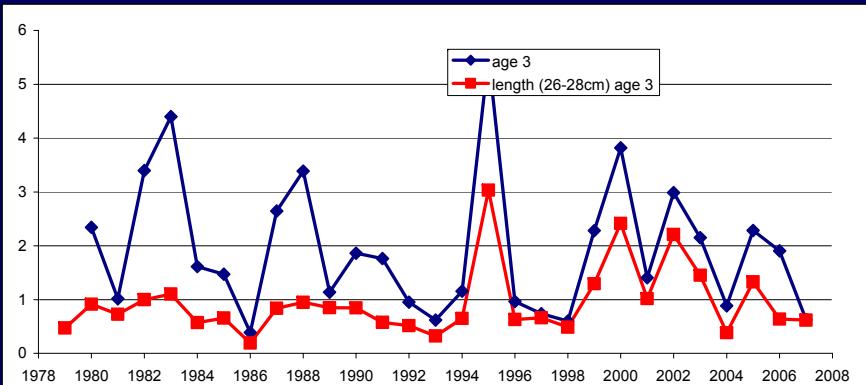
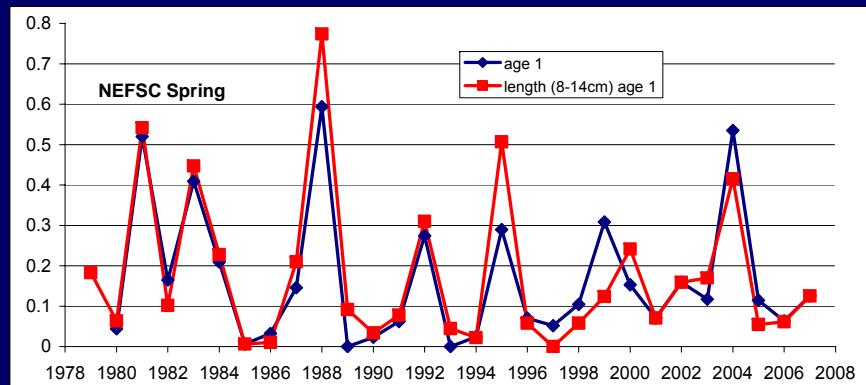
1998 yearclass  
Age 5

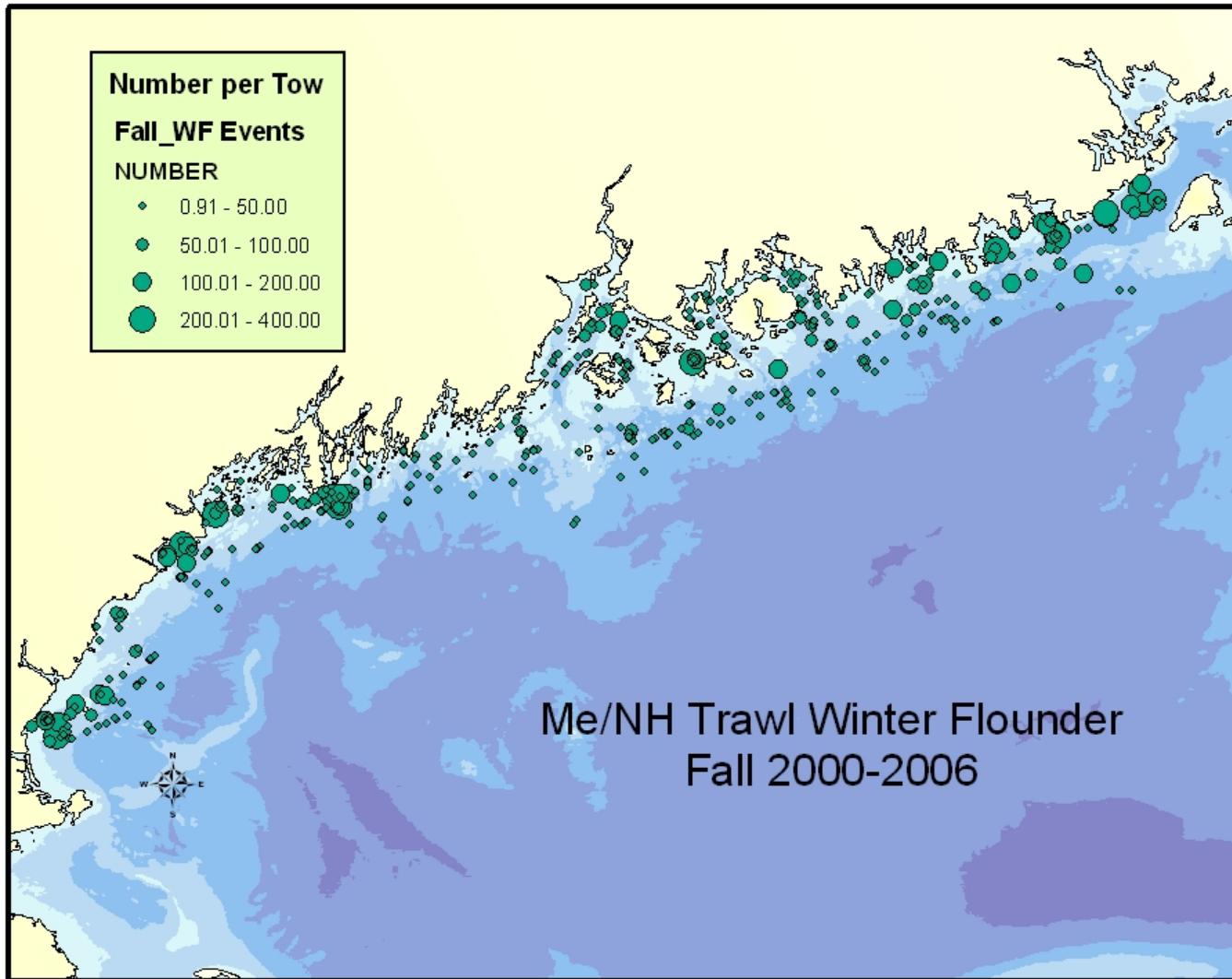
1998 yearclass  
Age 6

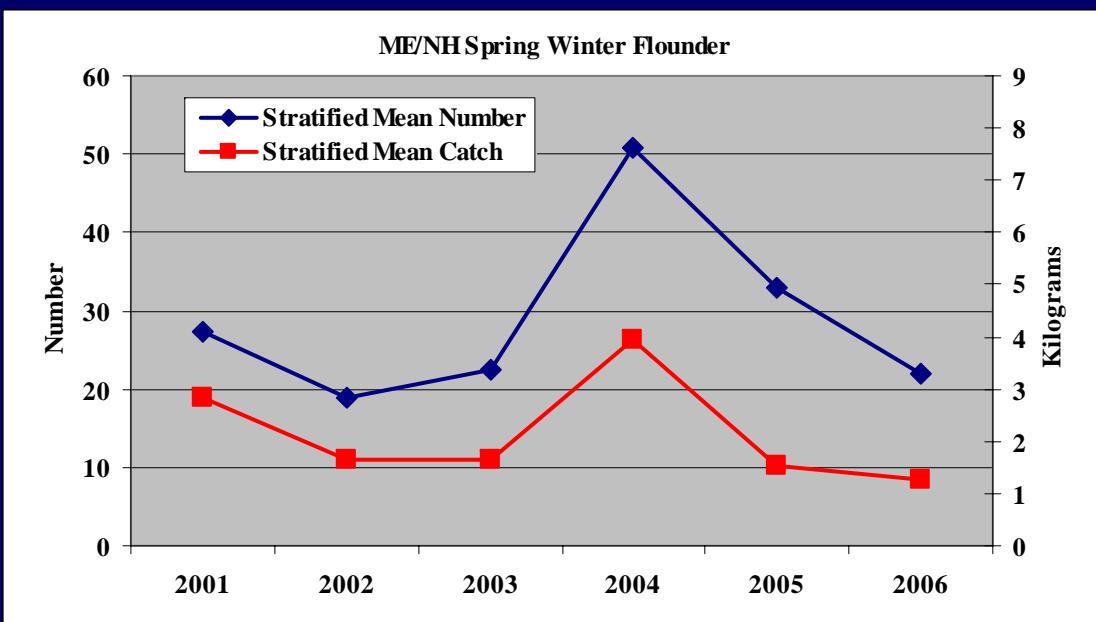
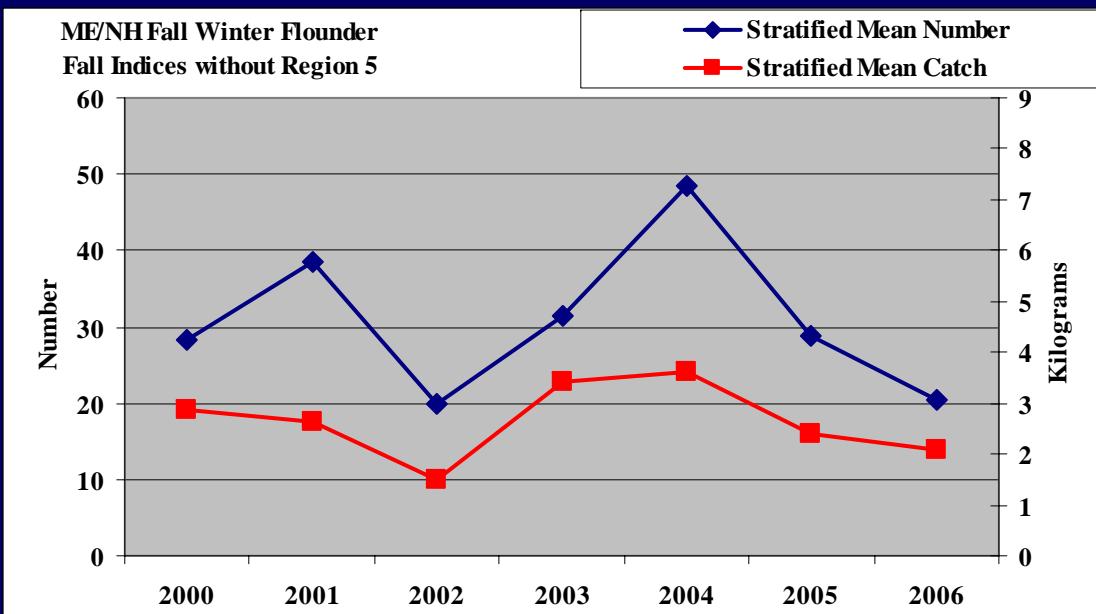
## MDMF Spring Survey



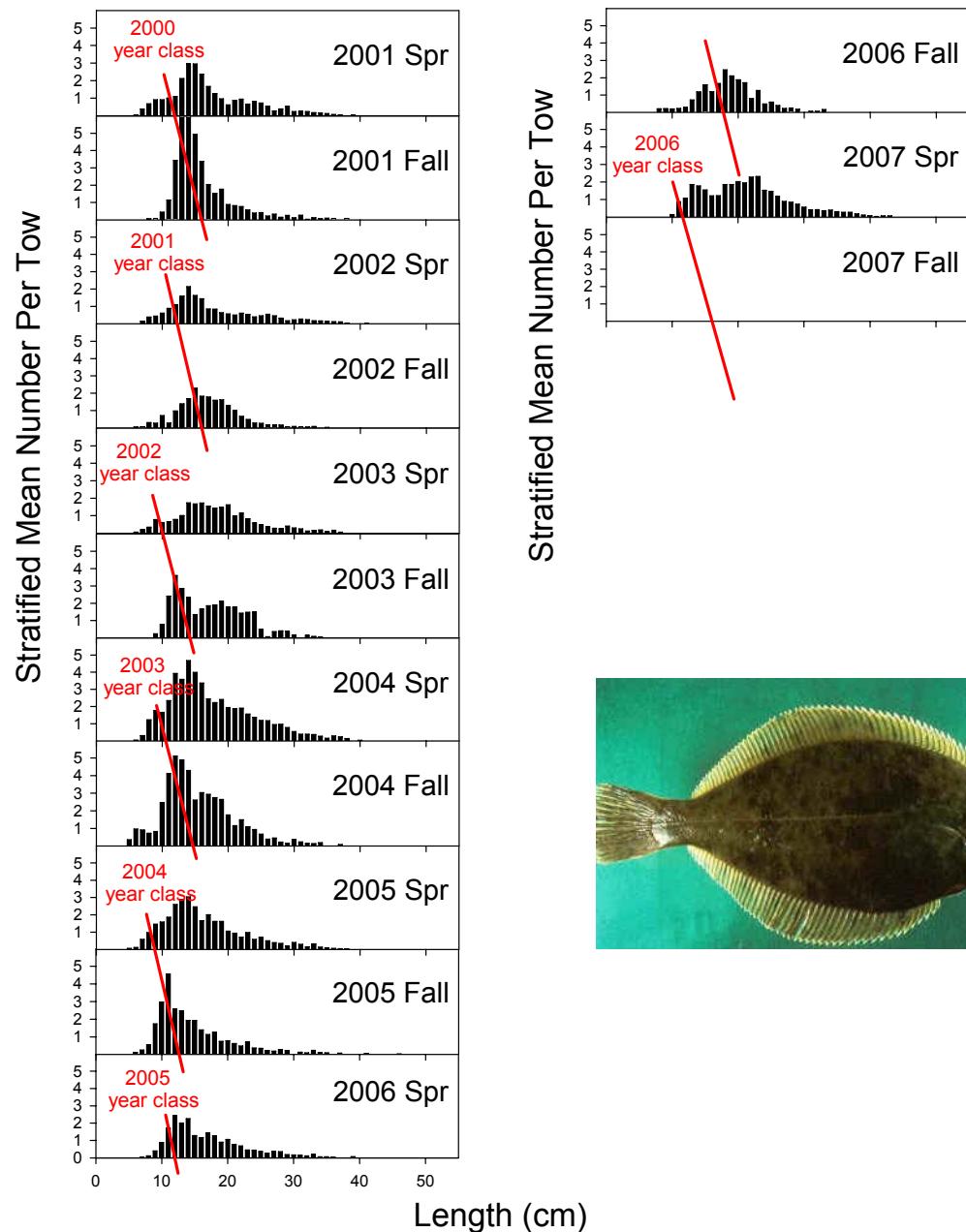
## NEFSC Spring Survey







### ME-NH spring and fall bottom trawl survey



## Gulf of Maine Winter Flounder Total Catch and VPA Fishing Mortality

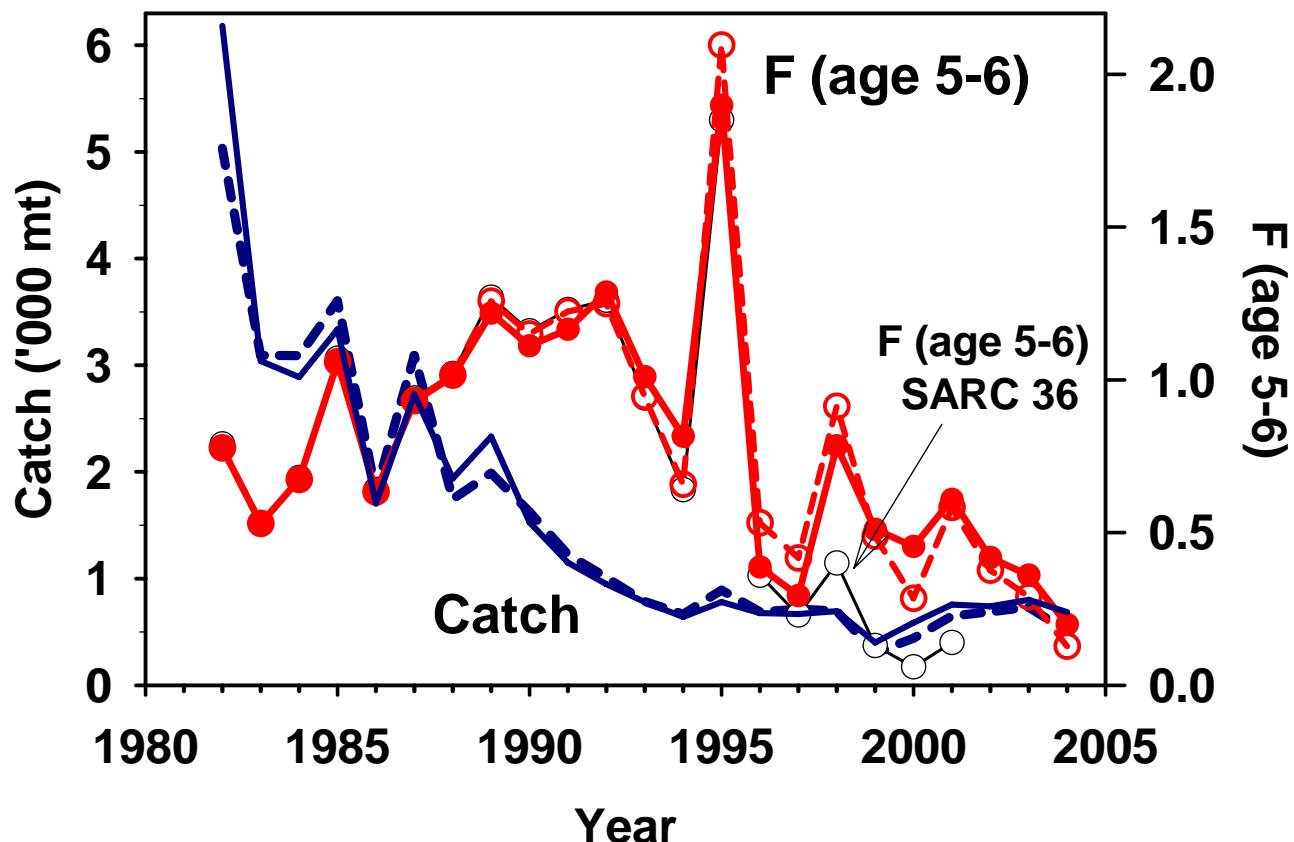


Figure 1. Updated (solid line) total catch (landings and discards, thousands of metric tons) and fishing mortality rate ( $F$ , ages 5-6) for Gulf of Maine winter flounder.

## Gulf of Maine Winter Flounder VPA SSB and Recruitment

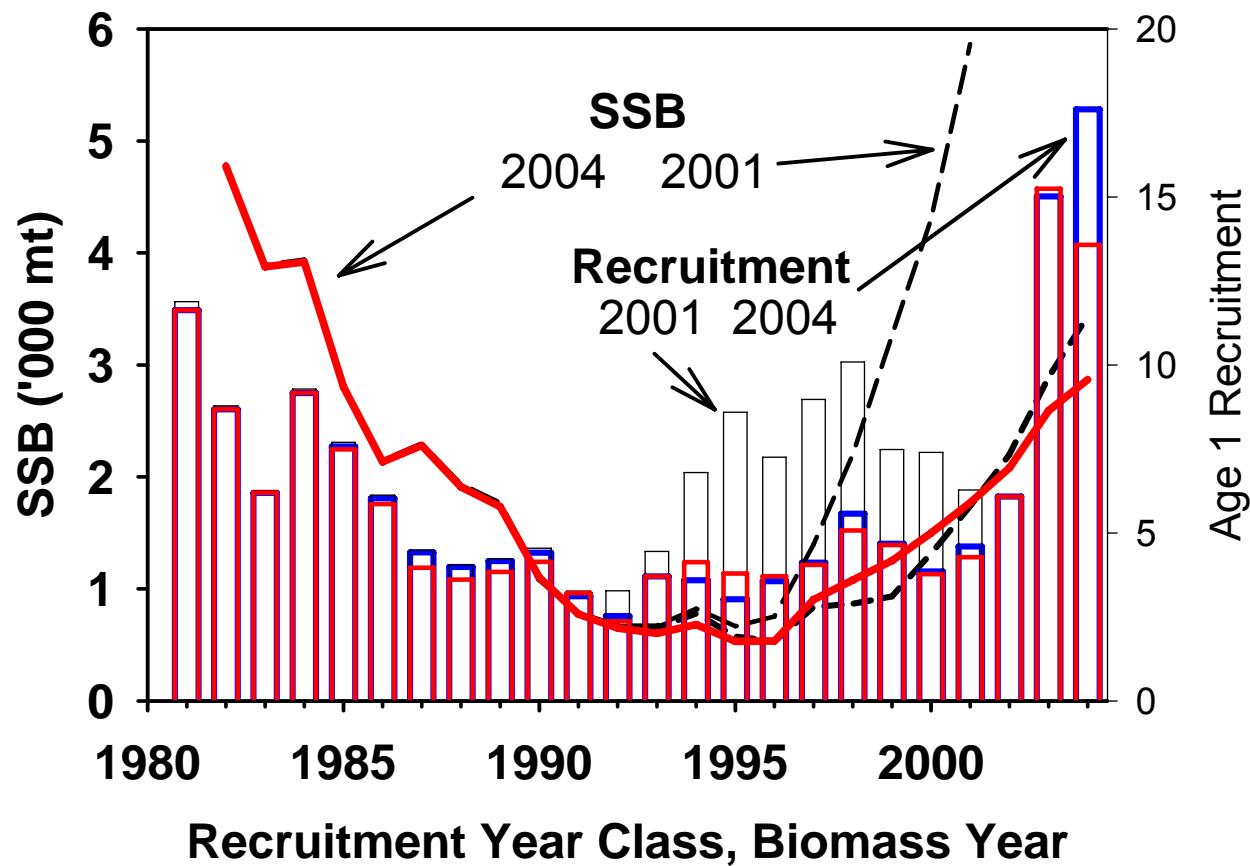


Figure I . Updated (red-solid line) VPA and SARC 36 (2001) spawning stock biomass (SSB, '000 mt) and recruitment (millions of fish at age-1) for Gulf of Maine winter flounder.

### Gulf of Maine winter flounder Updated VPA retrospective

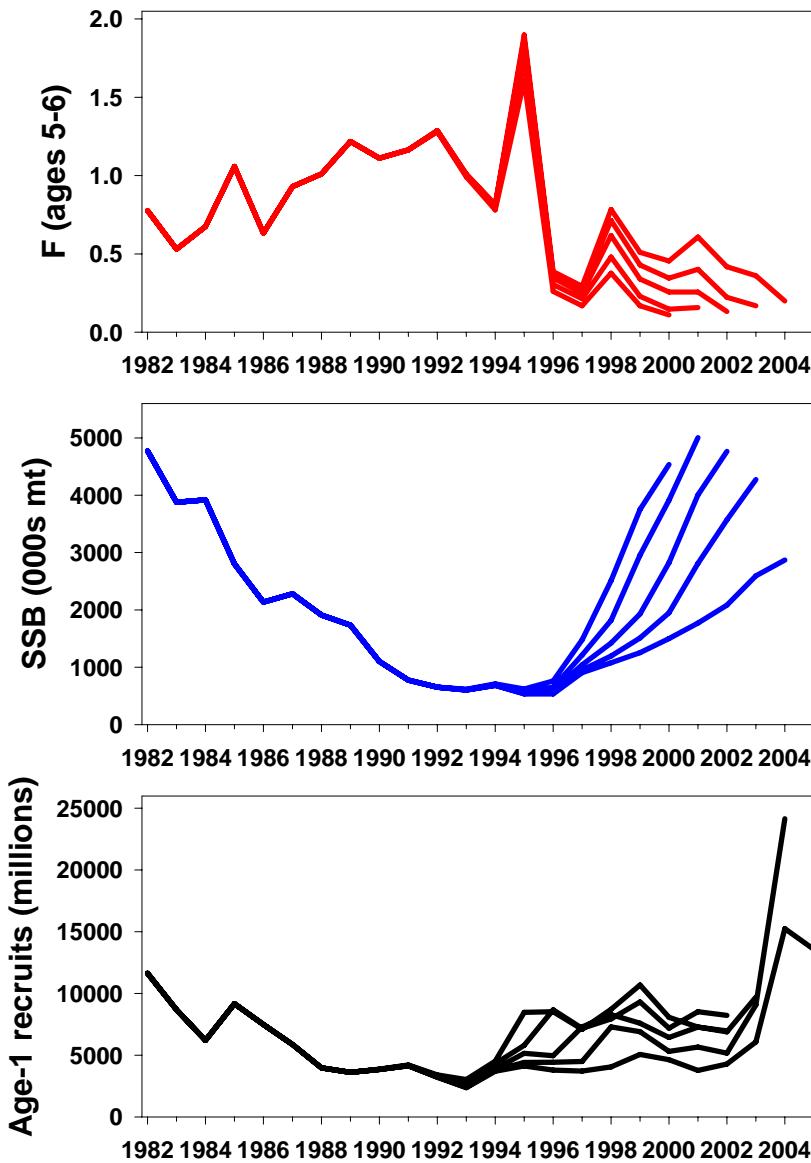


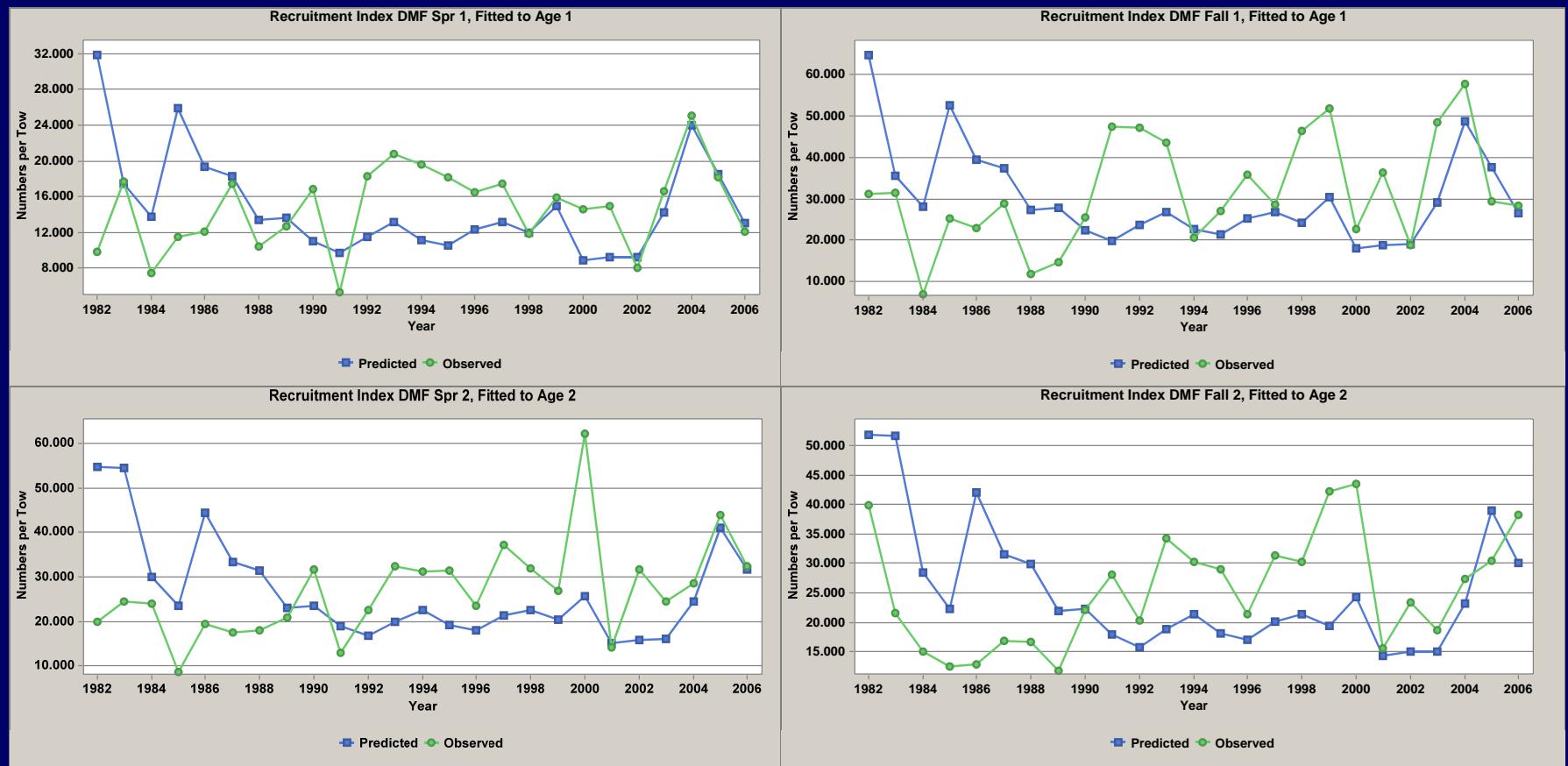
Figure I. Updated VPA retrospective for Gulf of Maine winter flounder.

## SCALE Model Issues

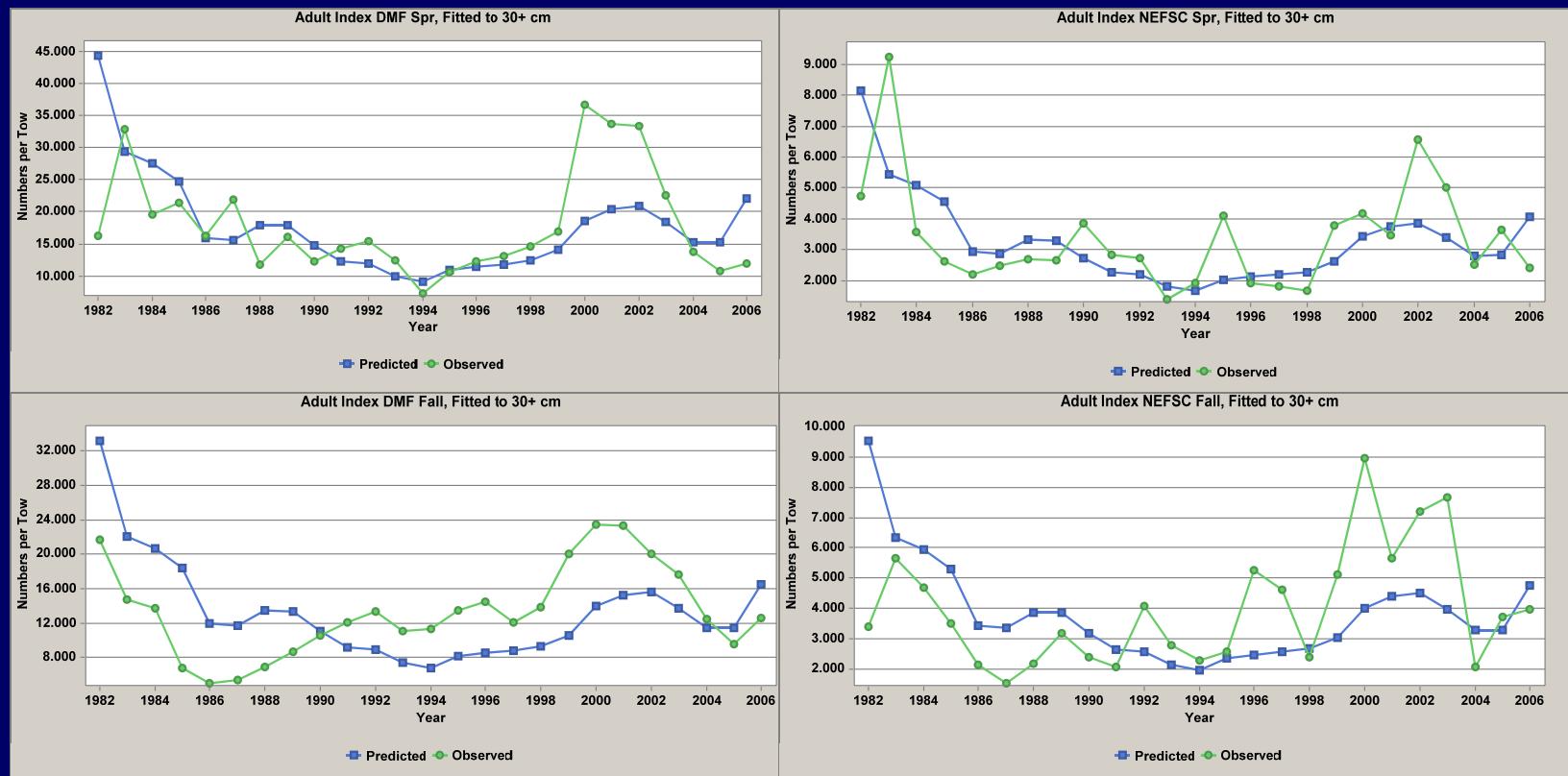
High weight on fitting the Catch was needed to help the model fit the catch and the recent decrease in the 30+ cm indices. This results in a lack of fit to the recruitment indices and produces a large initial population by increasing recruitment in the first year (1982).

## SCALE RUNS

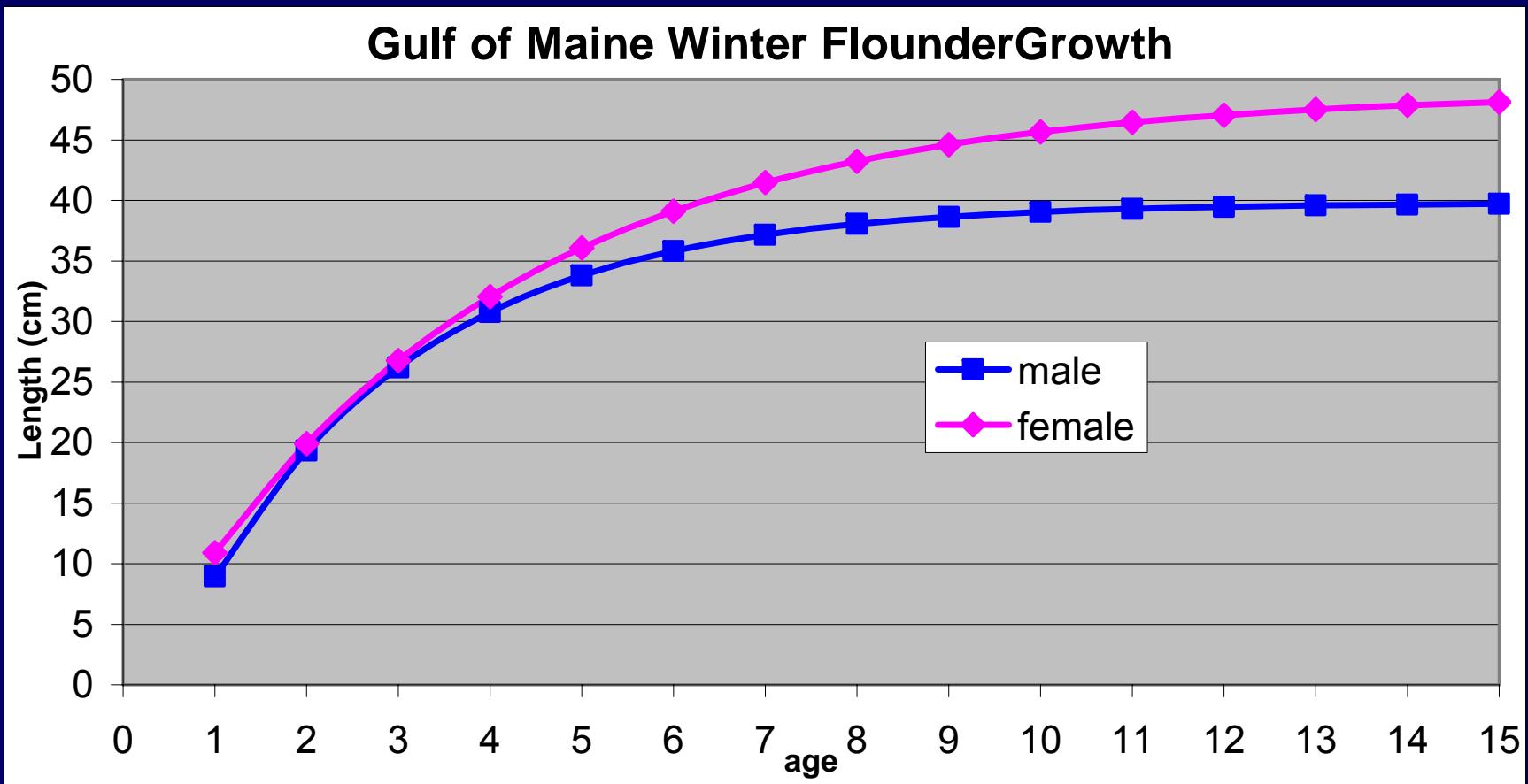
1. Single sex model,  $m=0.2$ , 30+ cm indices
2. Separate sexes, ♀  $m=0.2$ , ♂  $m=0.3$ , 30+ cm indices
3. Separate sexes, ♀  $m=0.2$ , ♂  $m=0.3$ , 35+ cm indices
4. Separate sexes, ♀  $m=0.2$ , ♂  $m=0.3$ , 35+ cm indices & age specific indices from the VPA
5. Separate sexes, ♀  $m=0.2$ , ♂  $m=0.3$ , 30+ cm indices & split abundance indices between 1994 & 1995



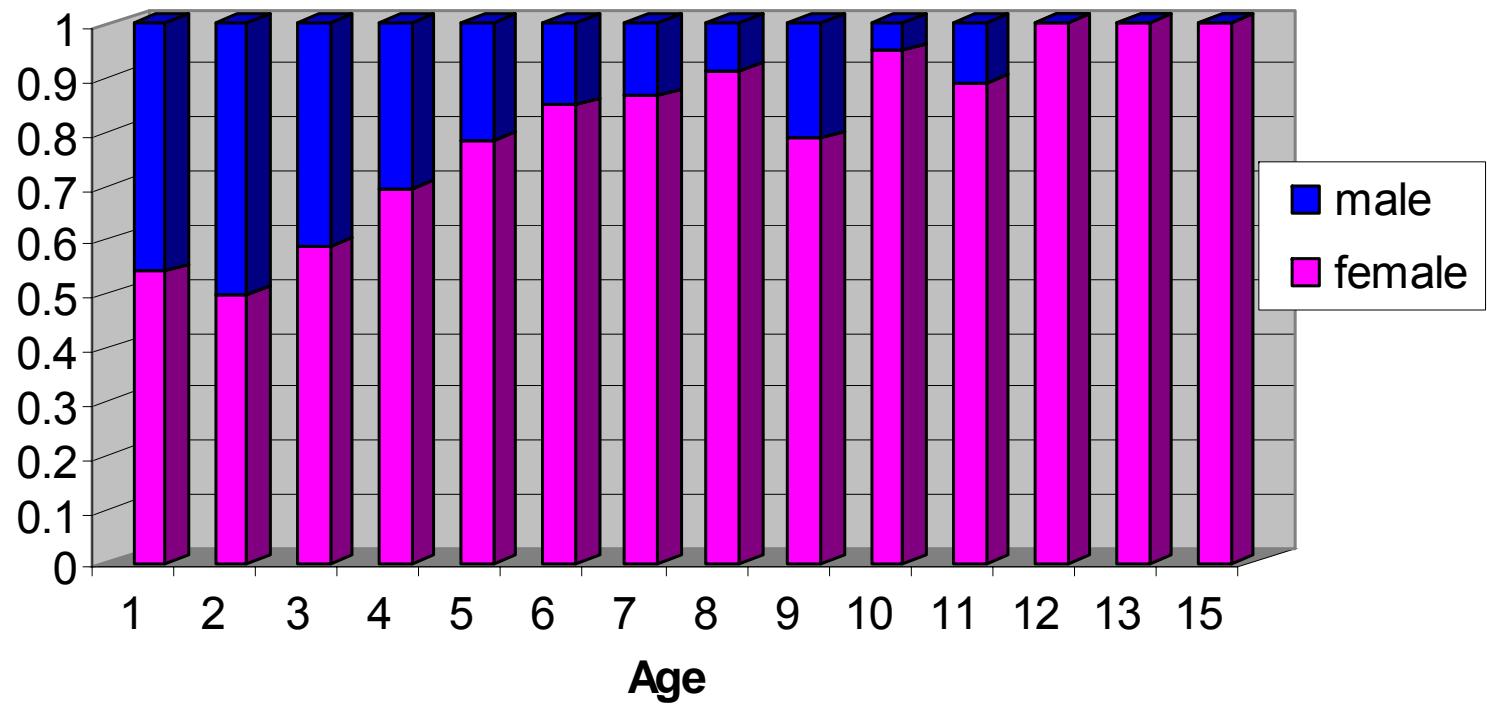
## RUN 2 Recruitment Indices



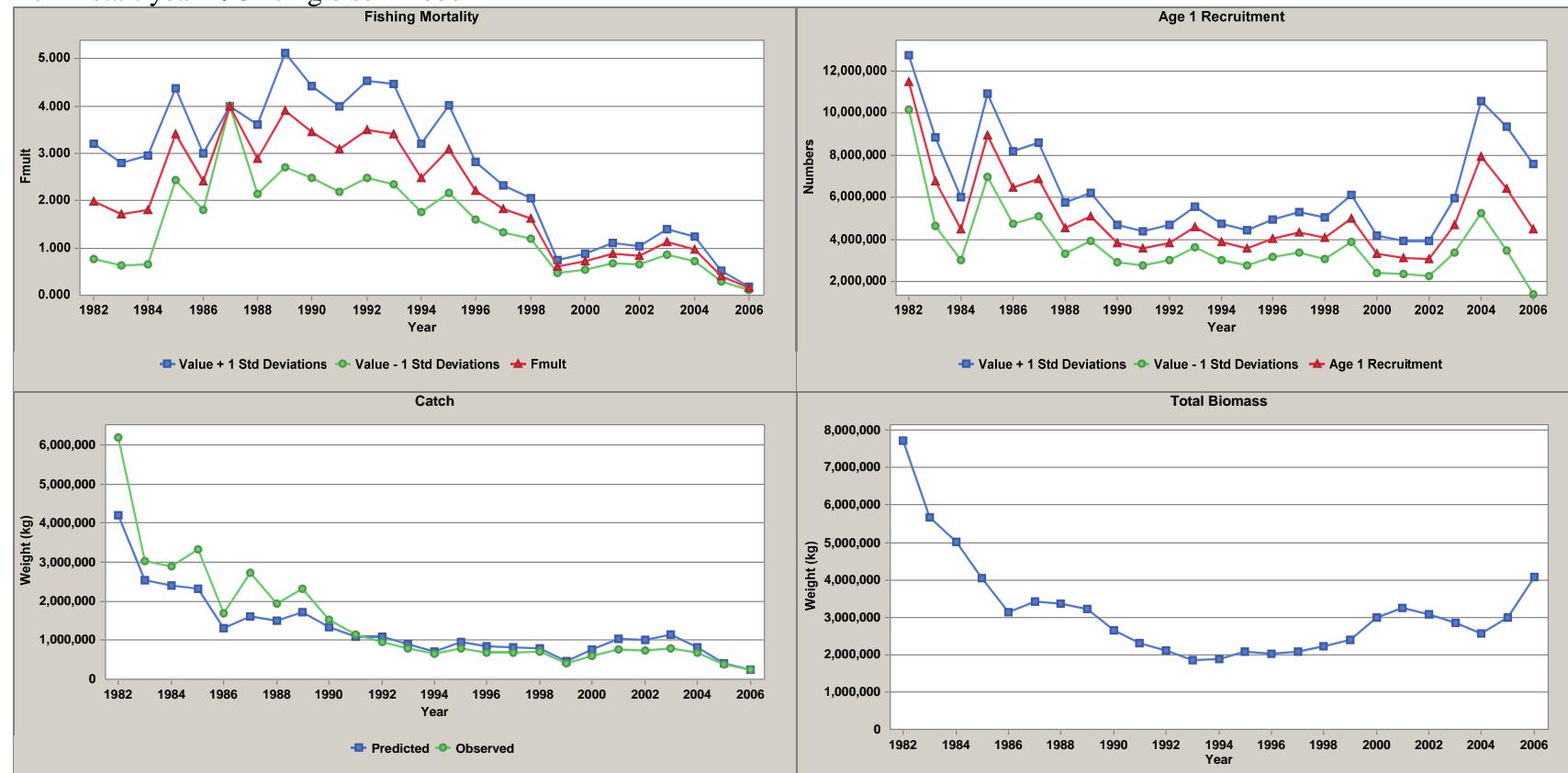
## RUN 2 30+ cm Indices



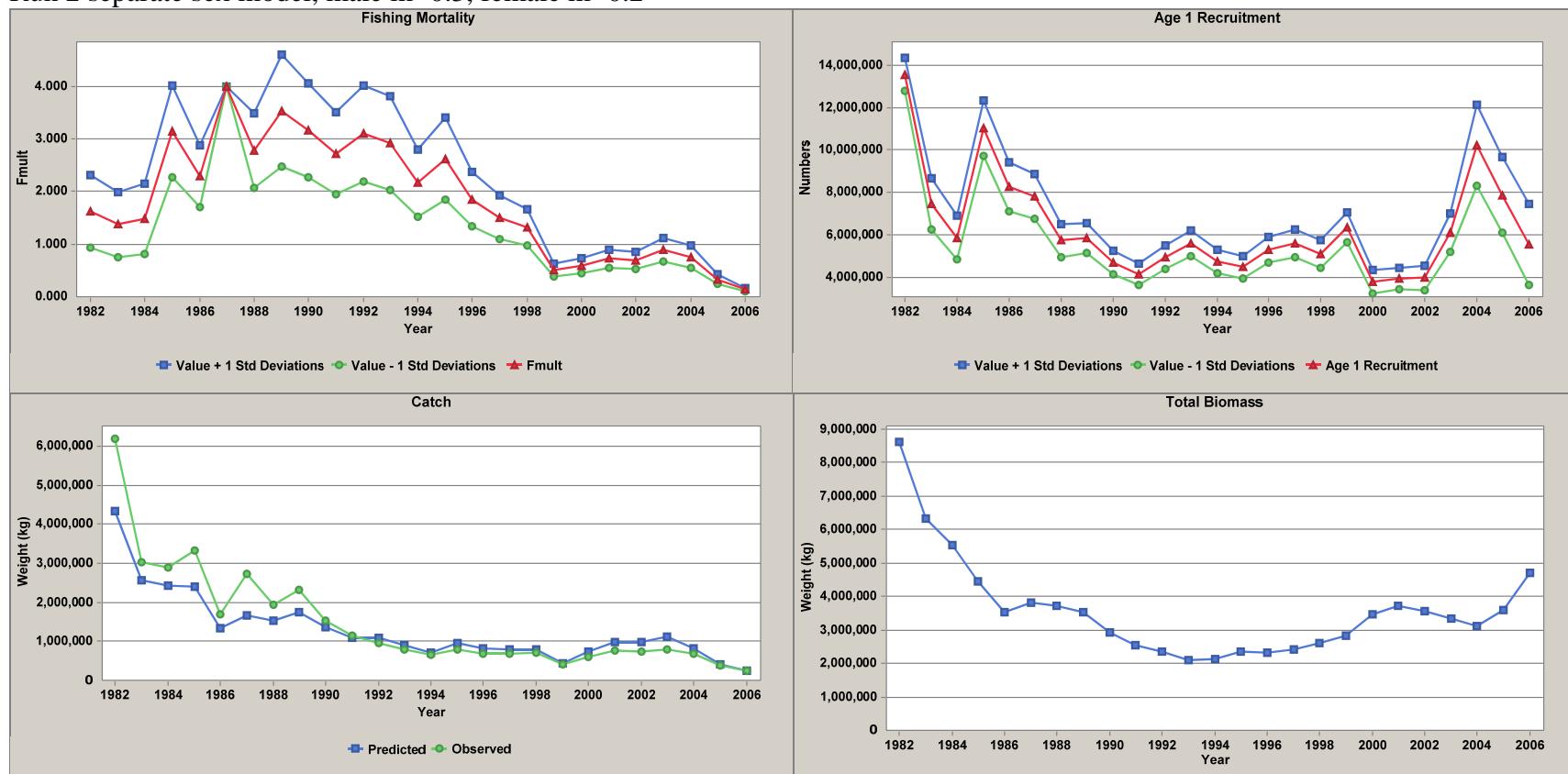
## NEFSC and DMF Survey Sex Ratio of sampled fish



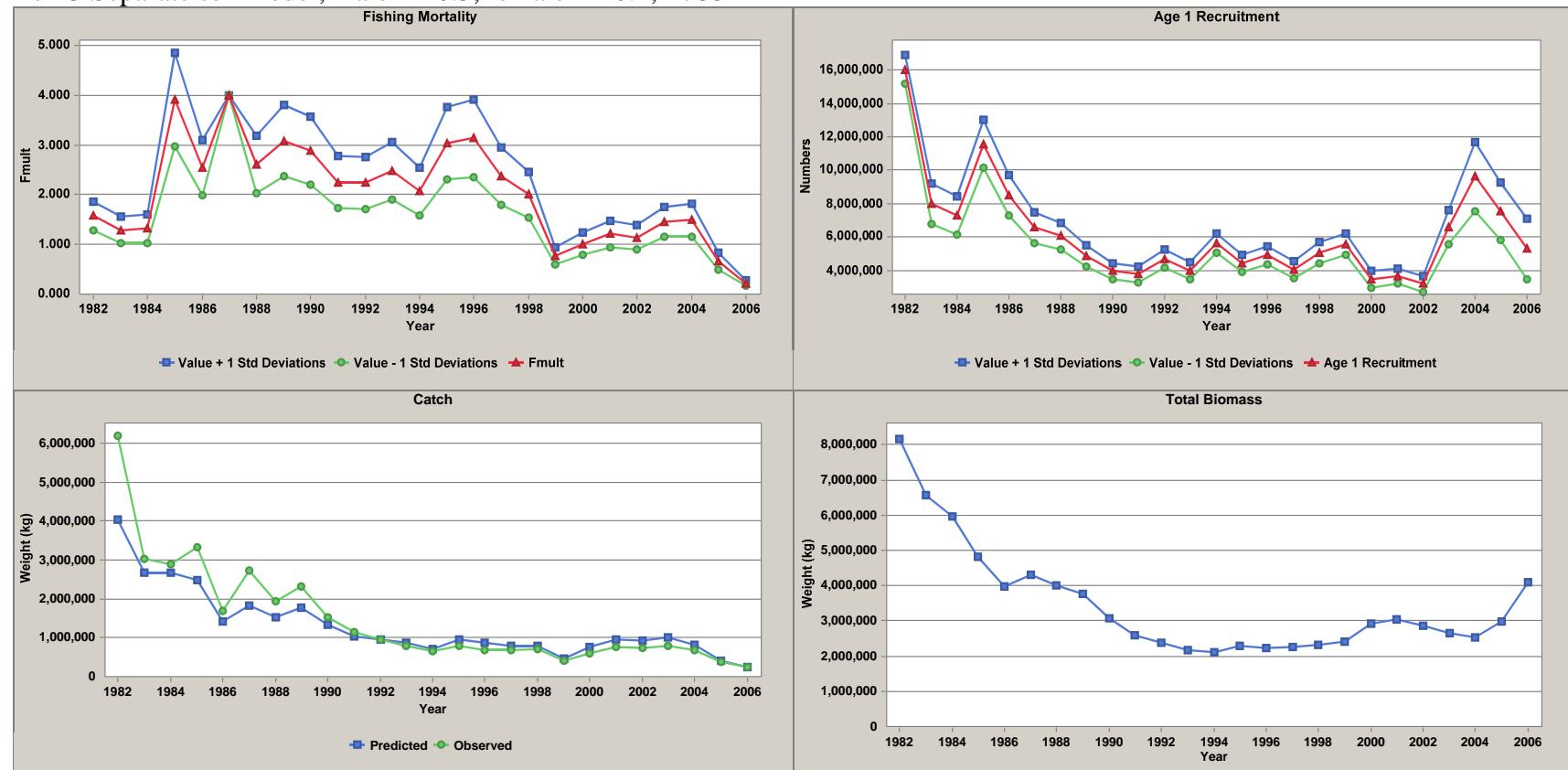
## Run 1 start year 1982 single sex model



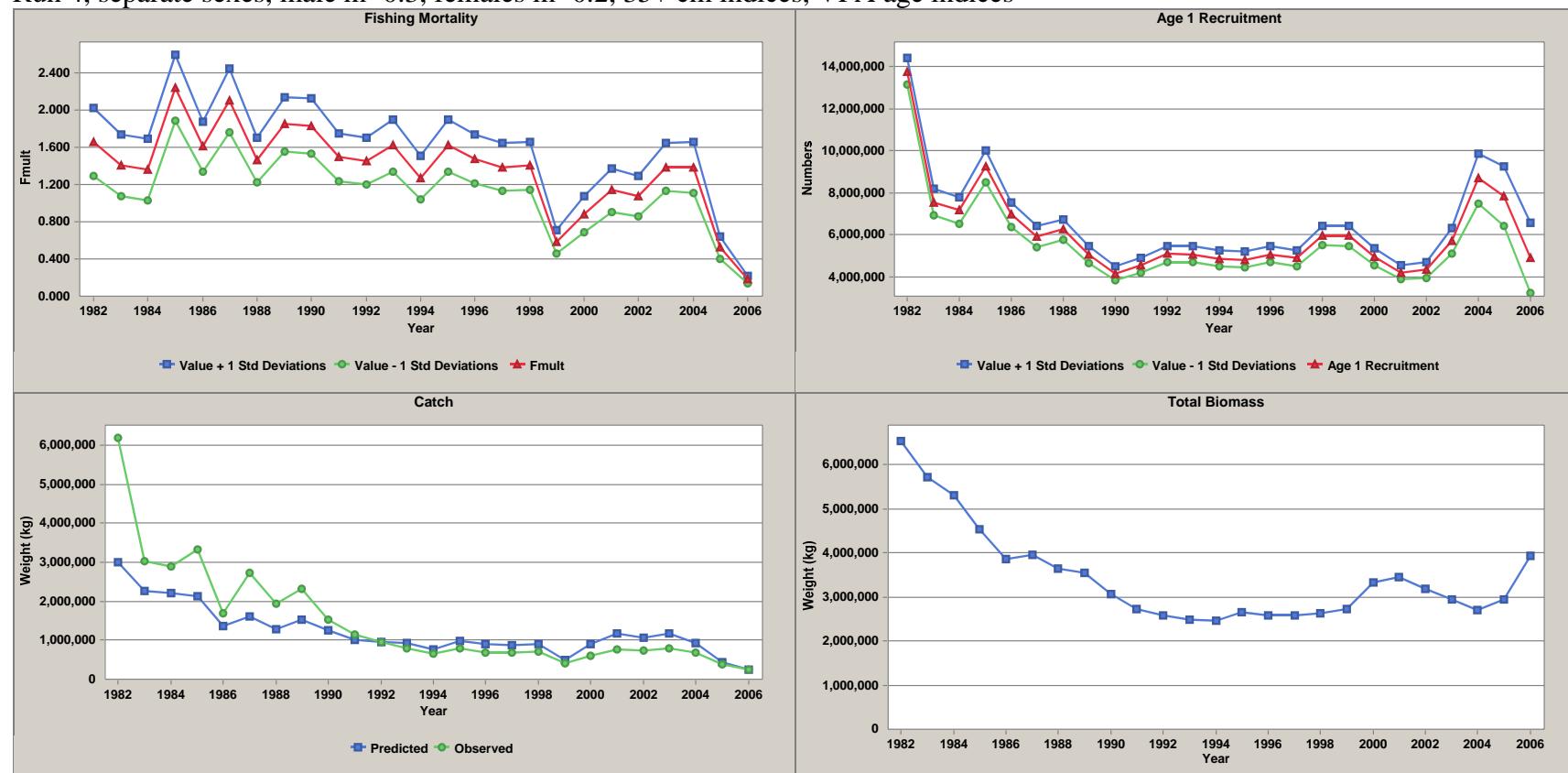
Run 2 separate sex model, male  $m=0.3$ , female  $m=0.2$



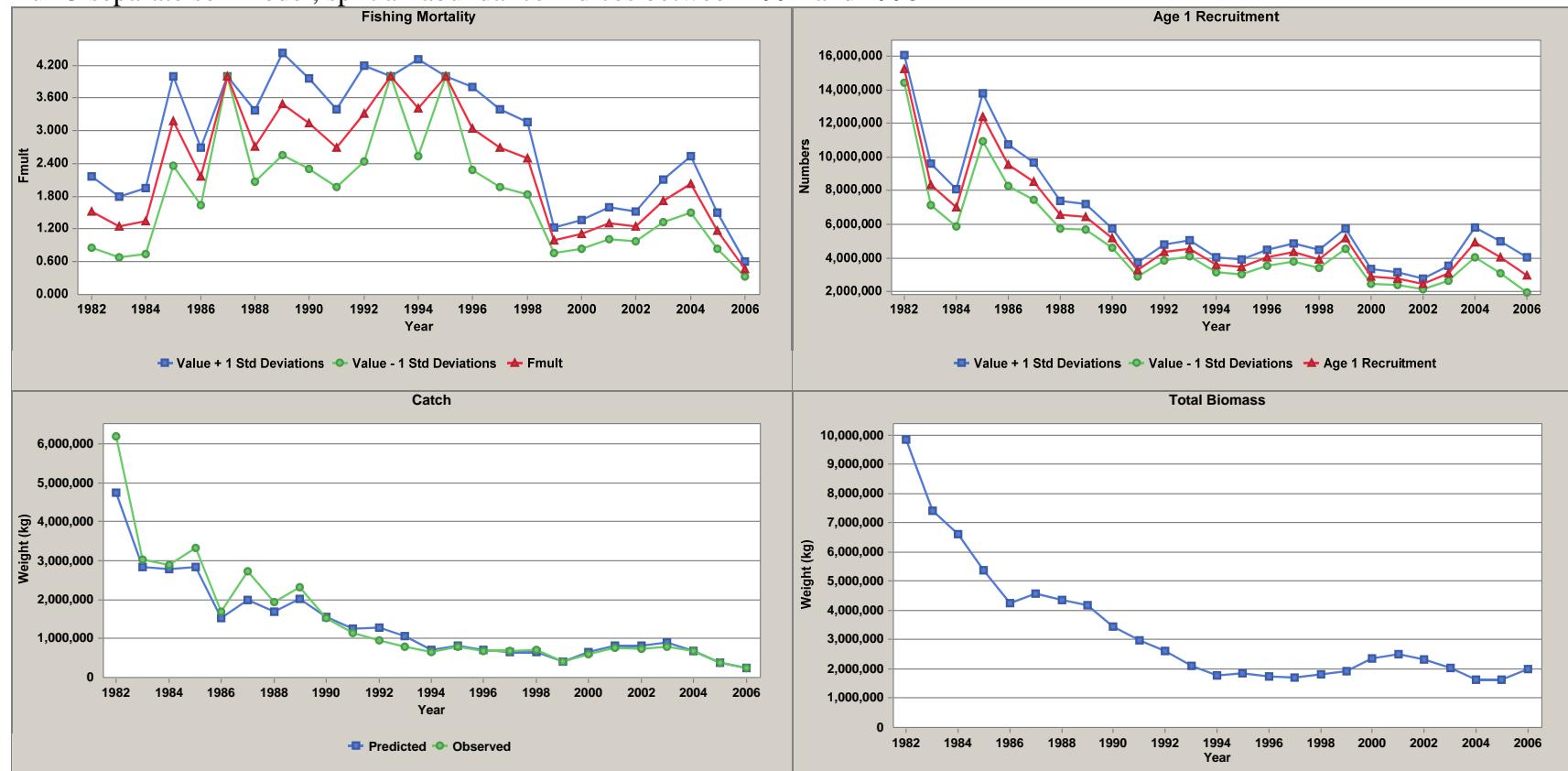
Run 3 Separate sex model, male  $m=0.3$ , female  $m=0.2$ , fit 35+



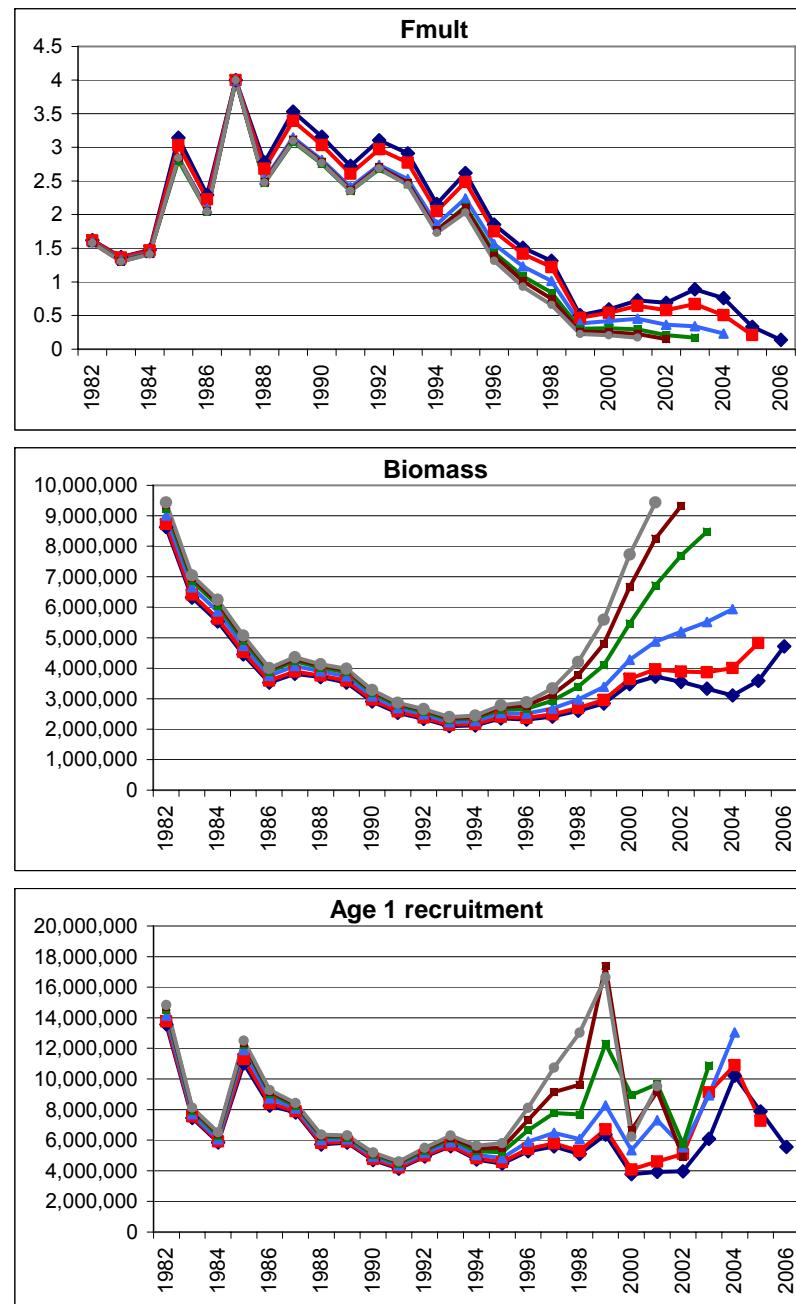
Run 4, separate sexes, male  $m=0.3$ , females  $m=0.2$ , 35+ cm indices, VPA age indices



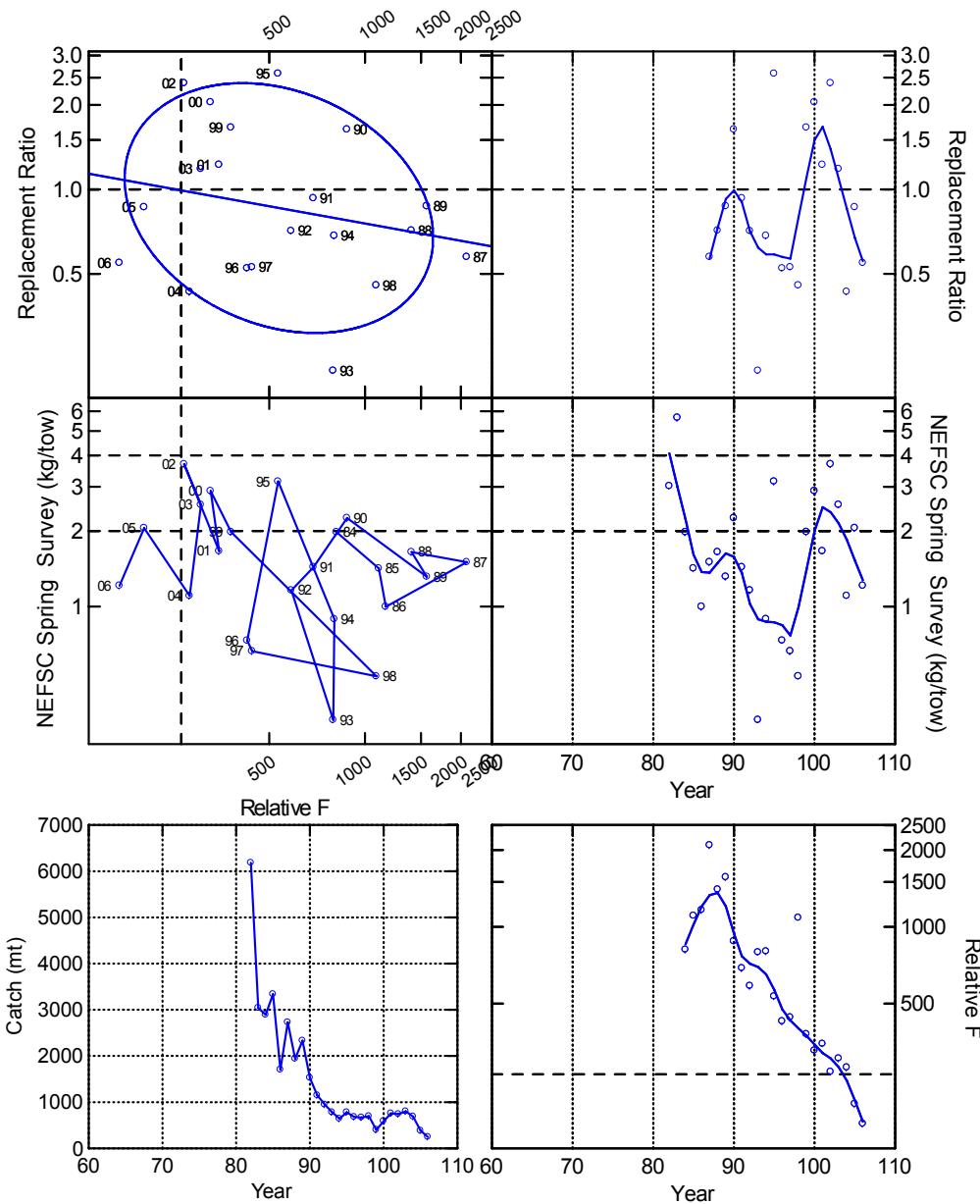
Run 5 separate sex model, spilt all abundance indices between 1994 and 1995



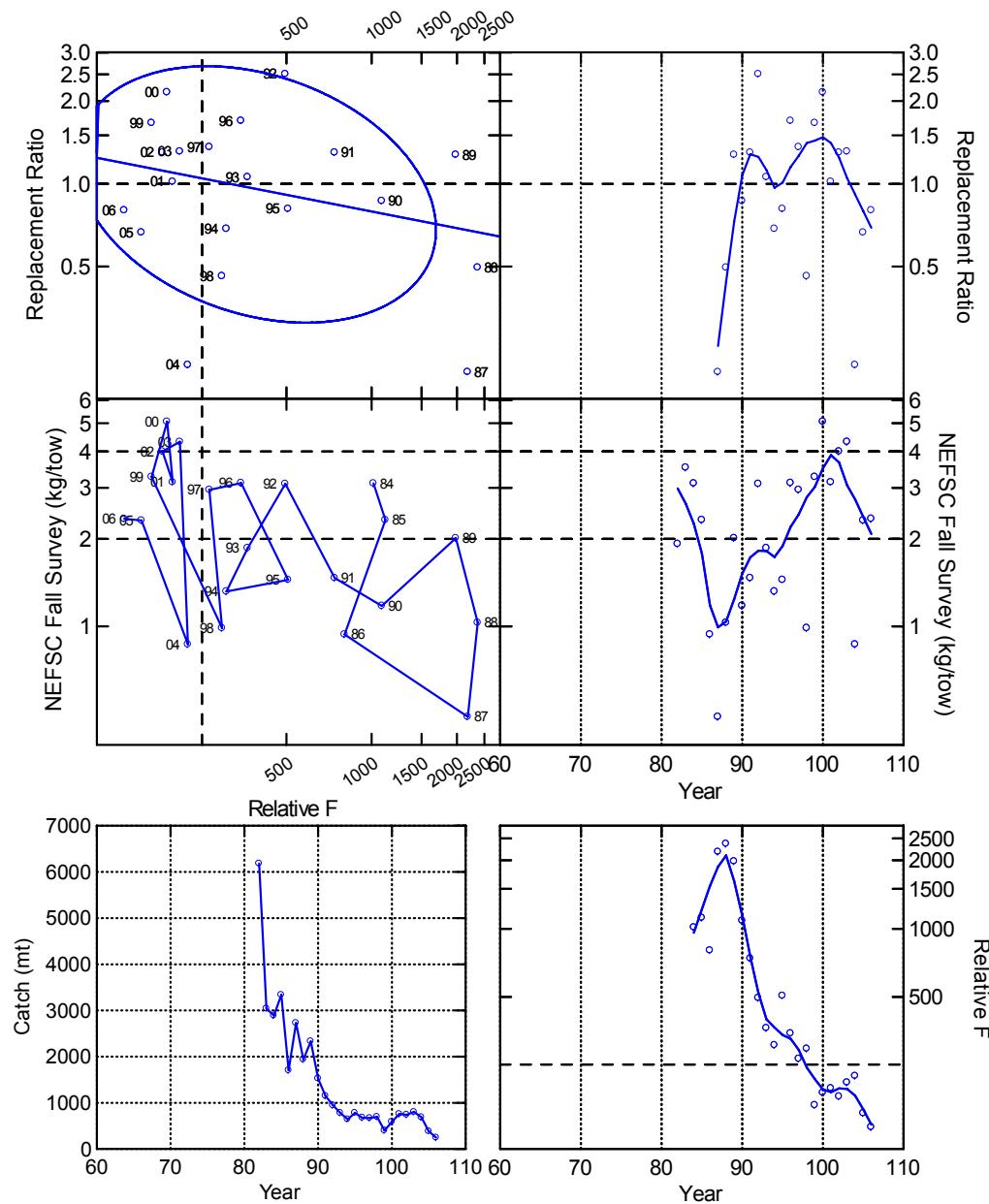
SCALE Run 2, Separate Sex model, Retro



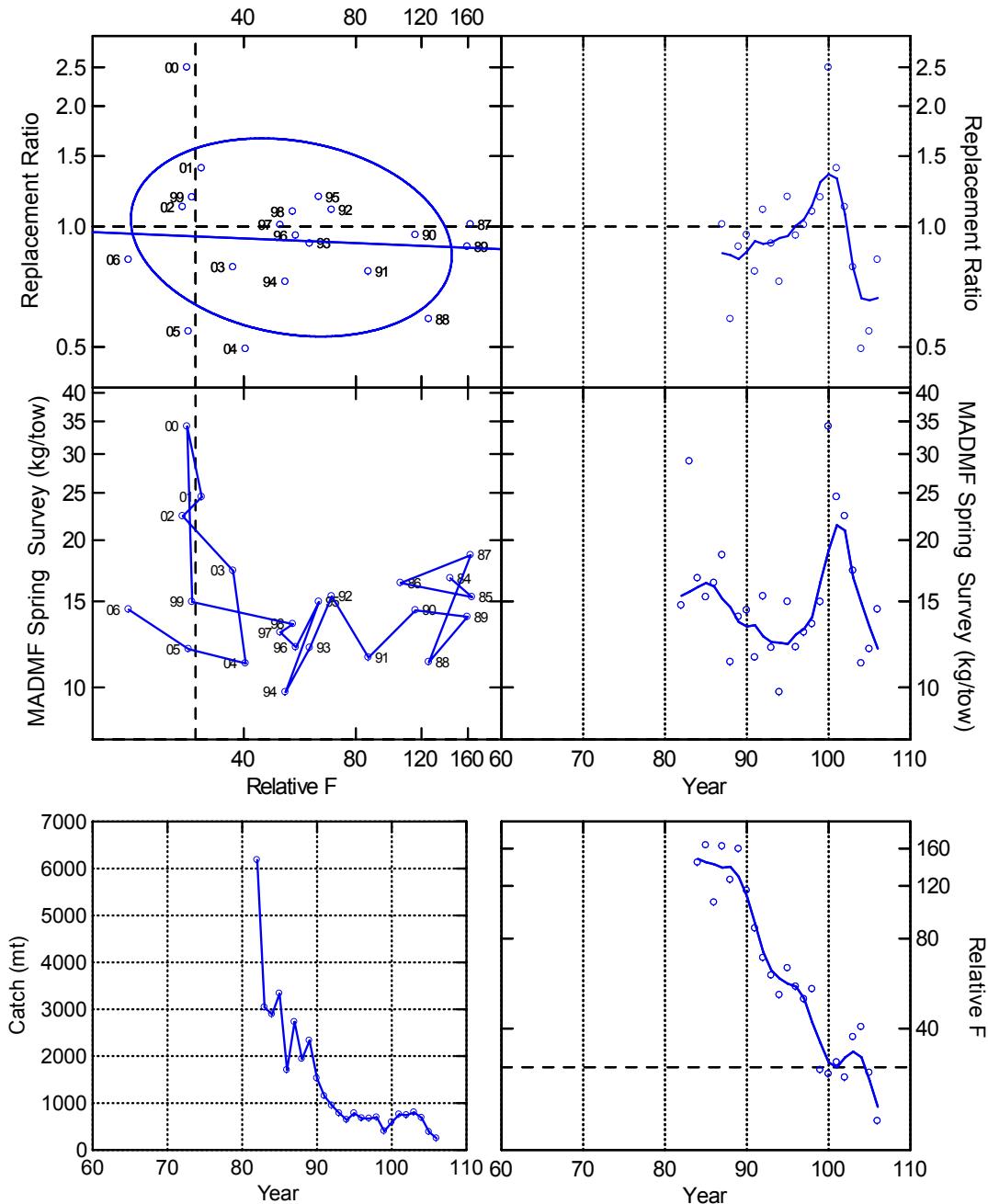
### GOM Winter Flounder, NEFSC Spring Survey



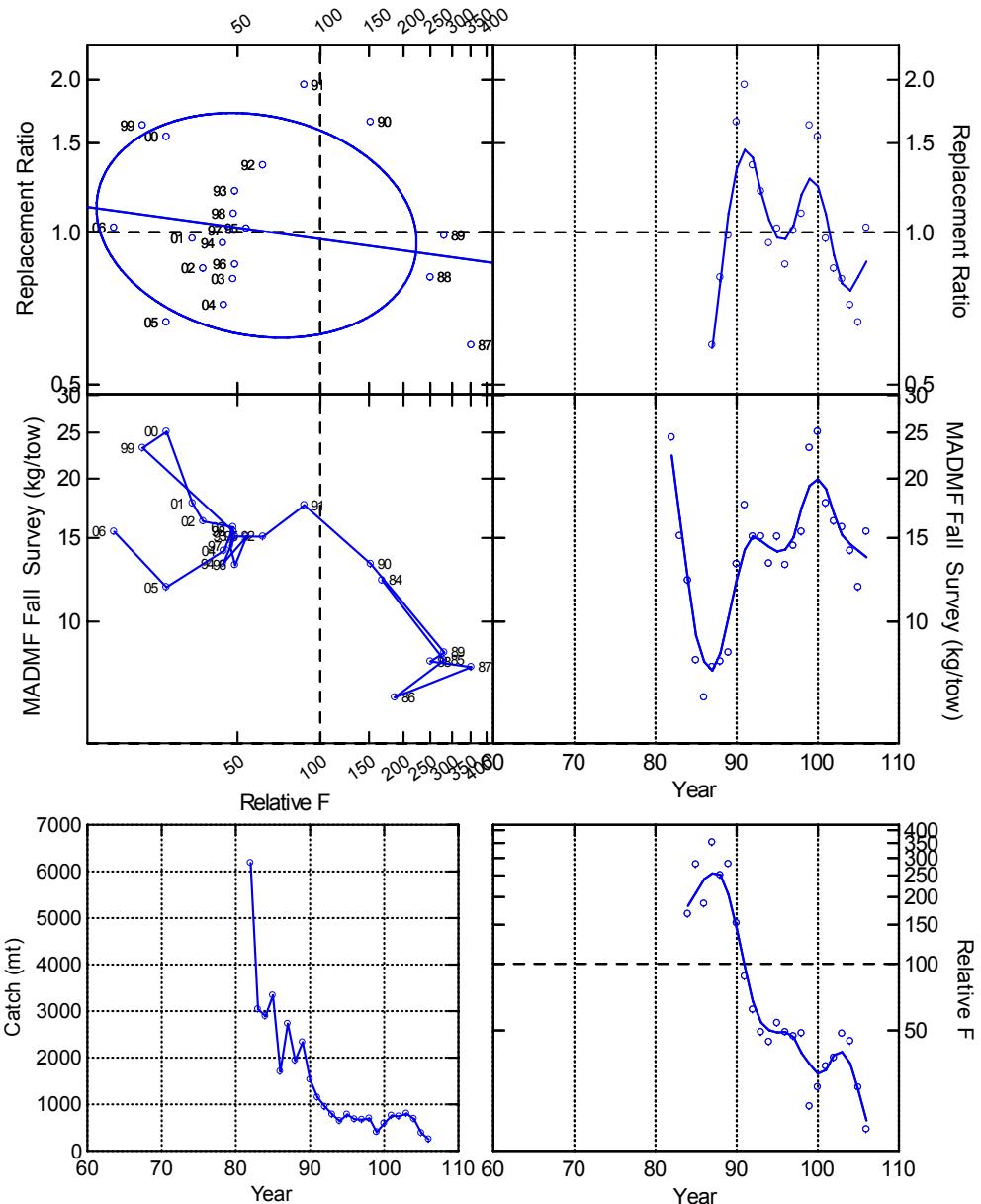
## Gulf of Maine Winter Flounder, NEFSC fall Survey



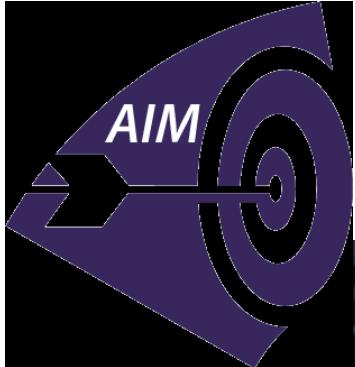
## GOM Winter Flounder, MADMF Spring Survey



### GOM Winter Flounder, MADMF Fall Survey



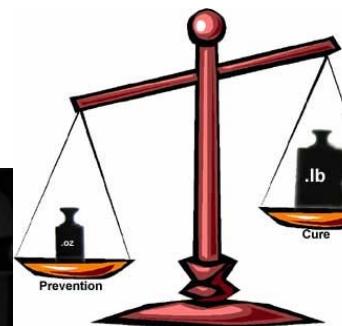
AIM



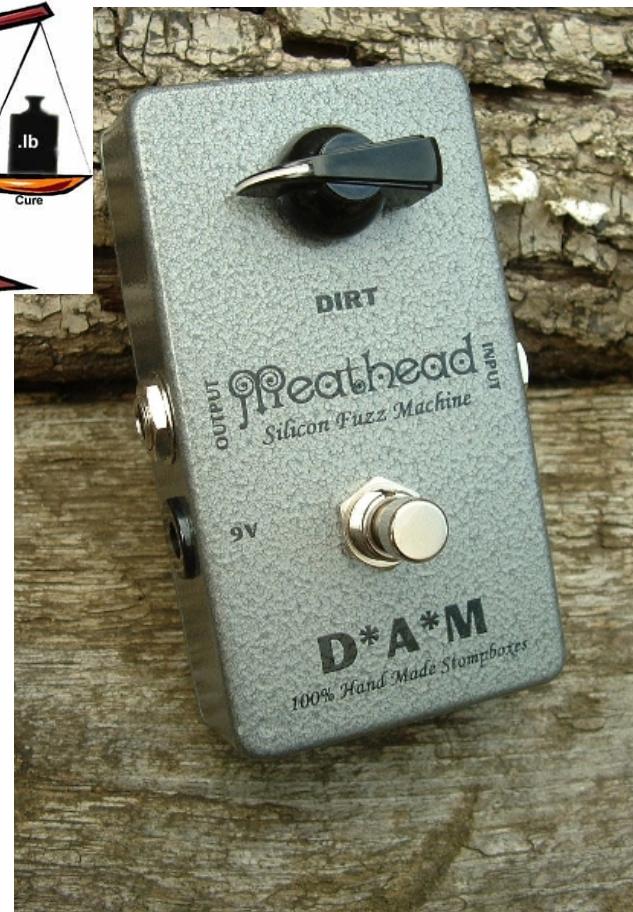
SS2



SCALE



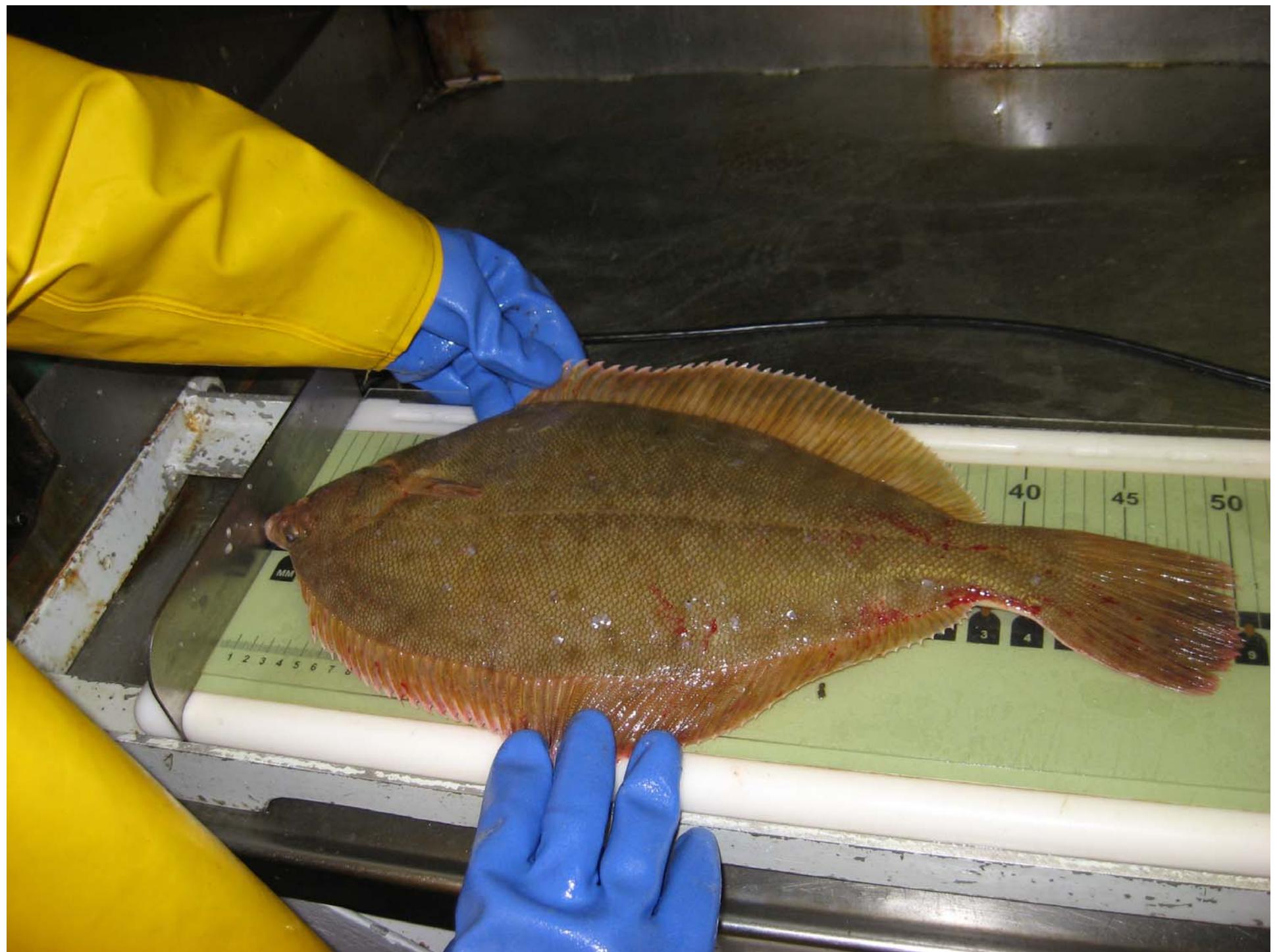
VPA

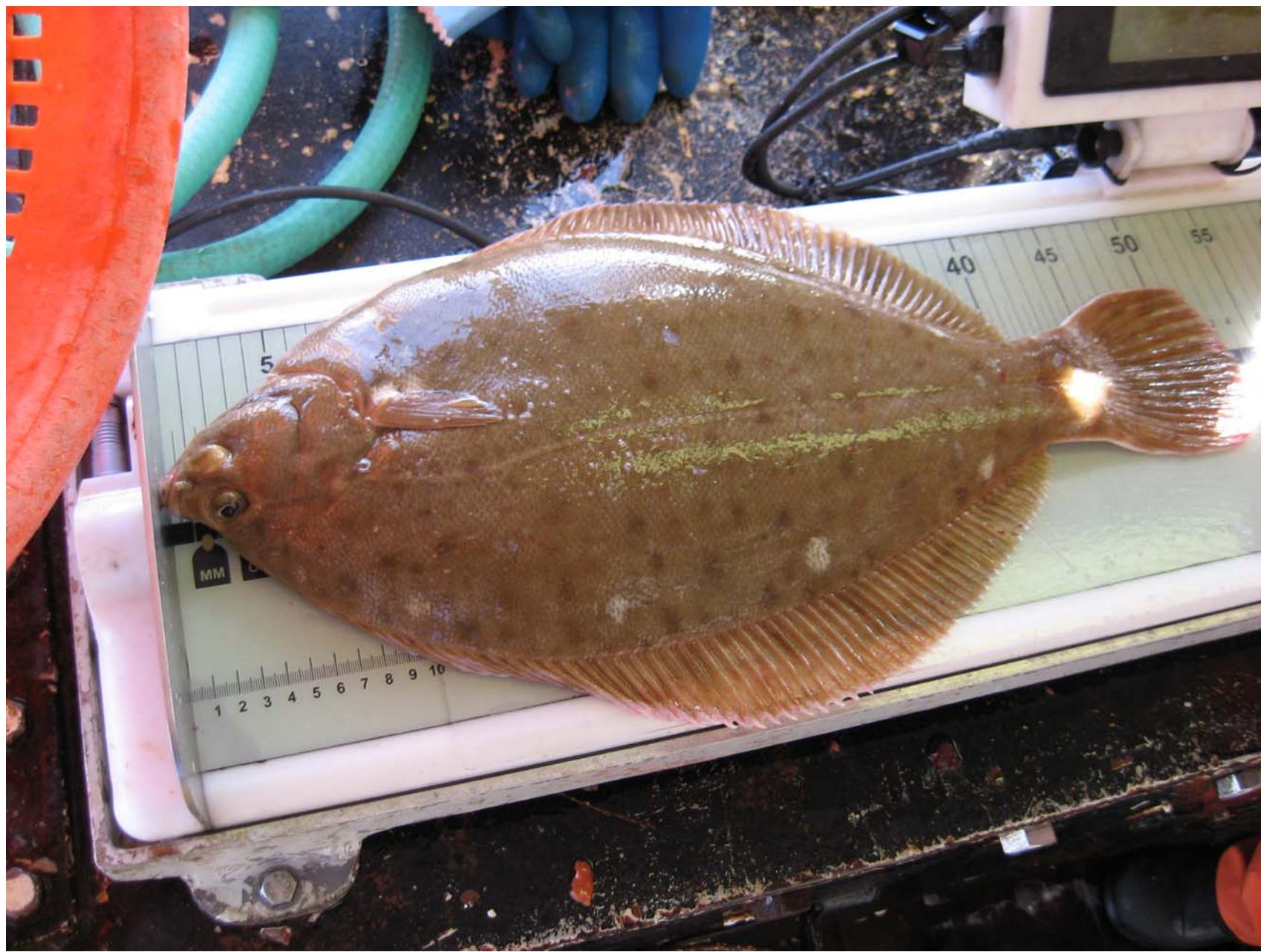


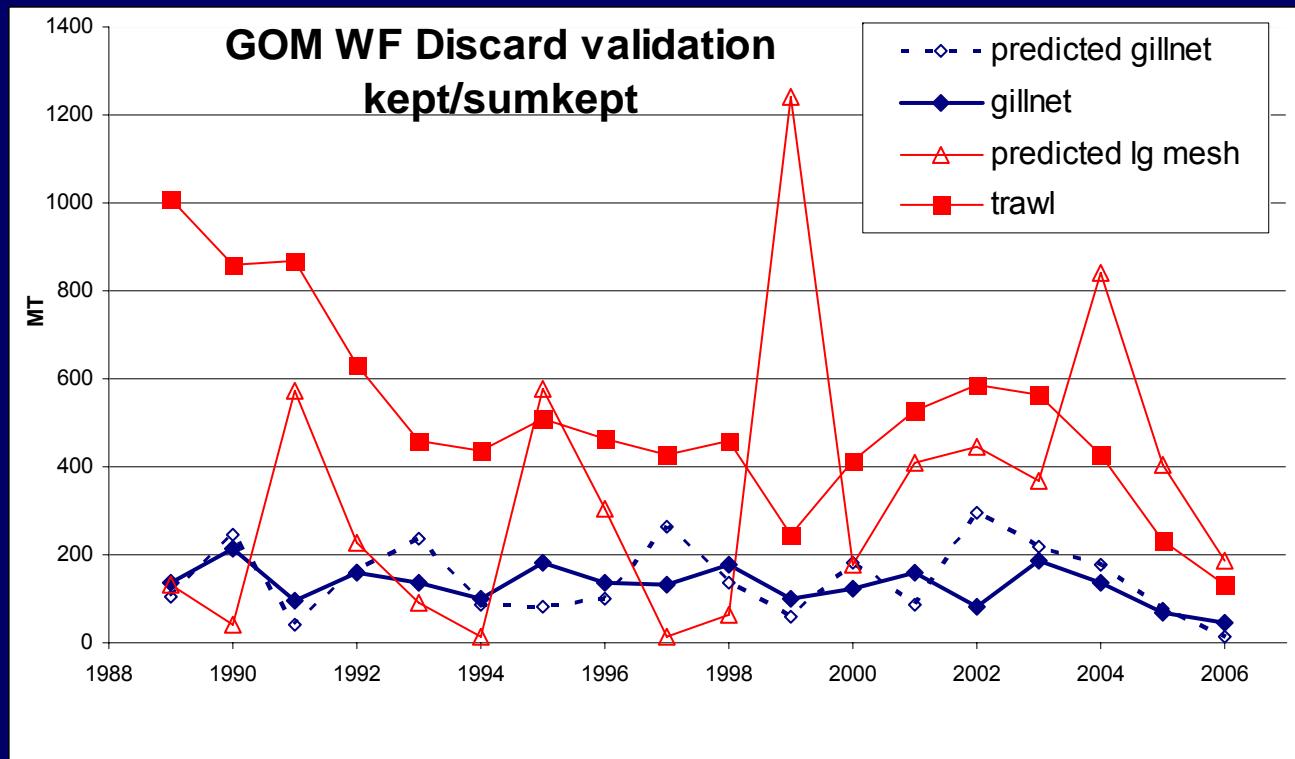
Model Selection ?

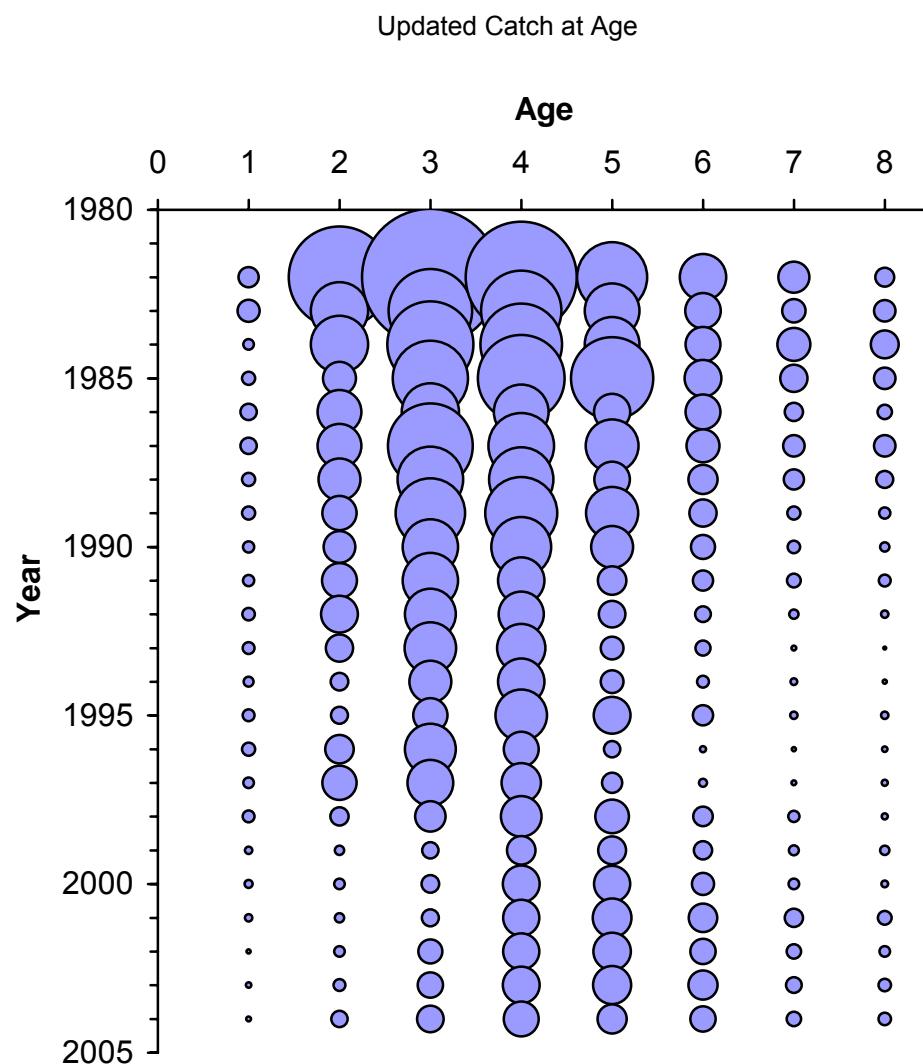


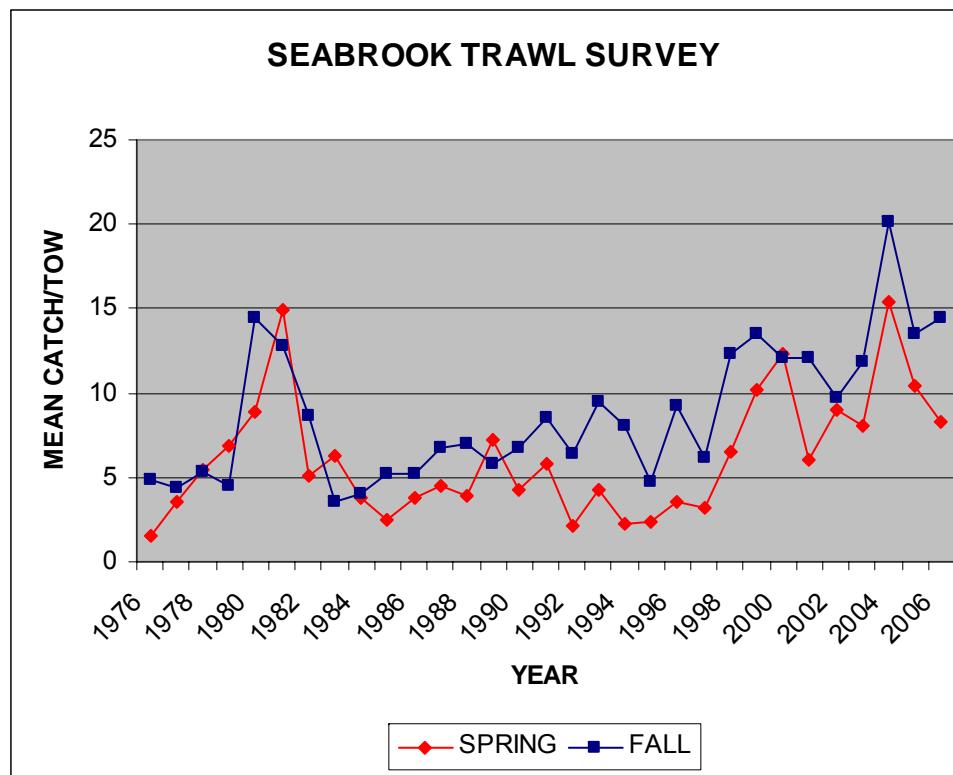




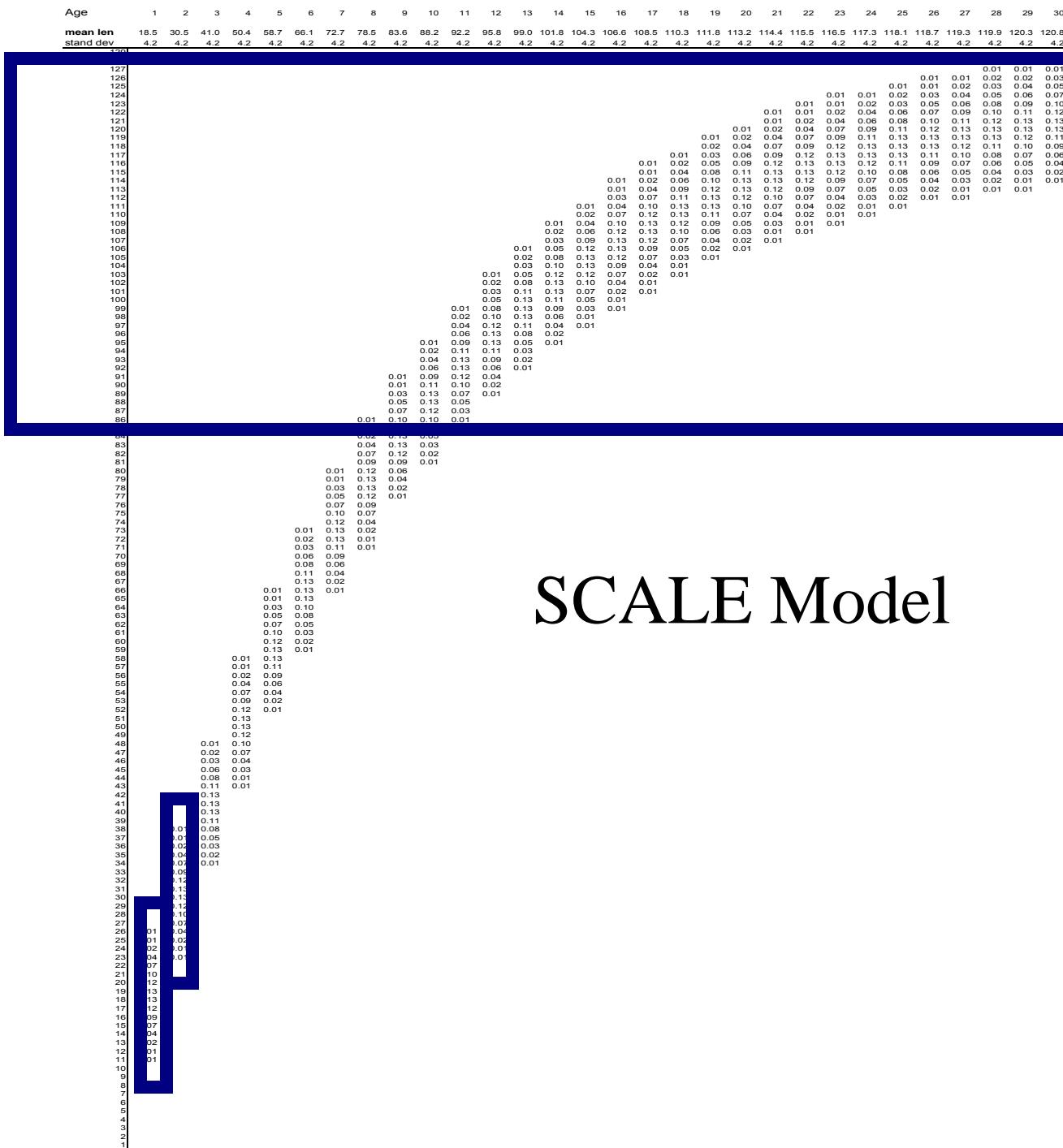




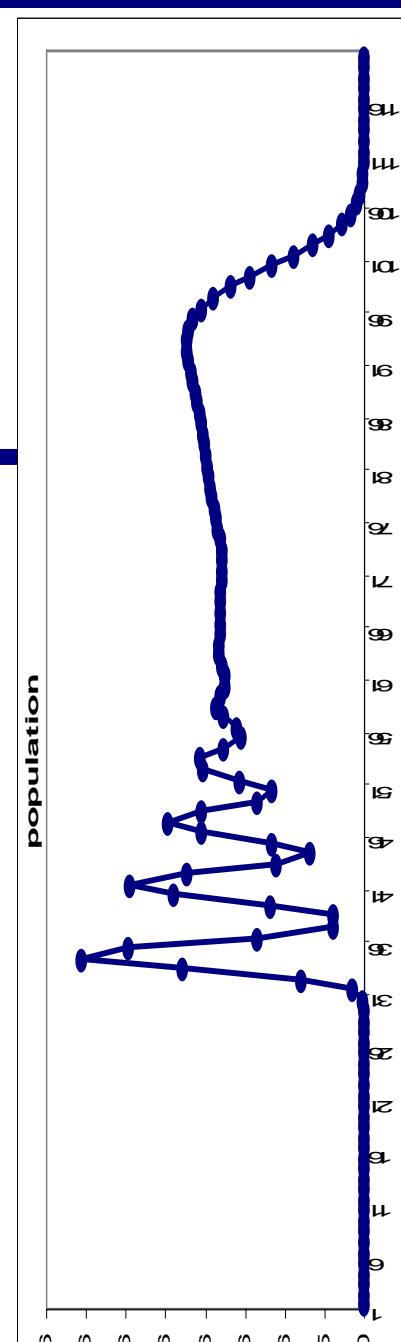




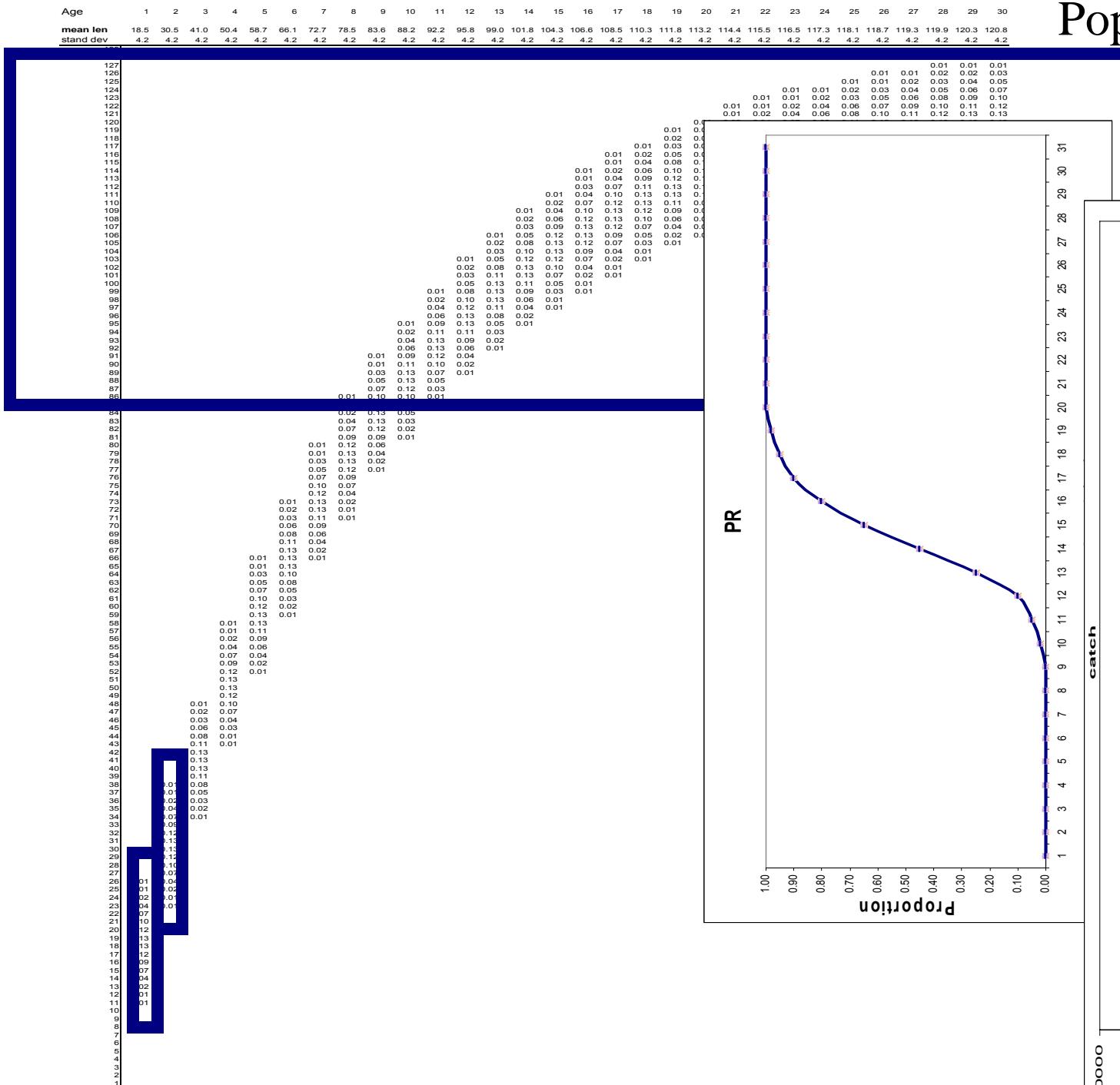
# Population



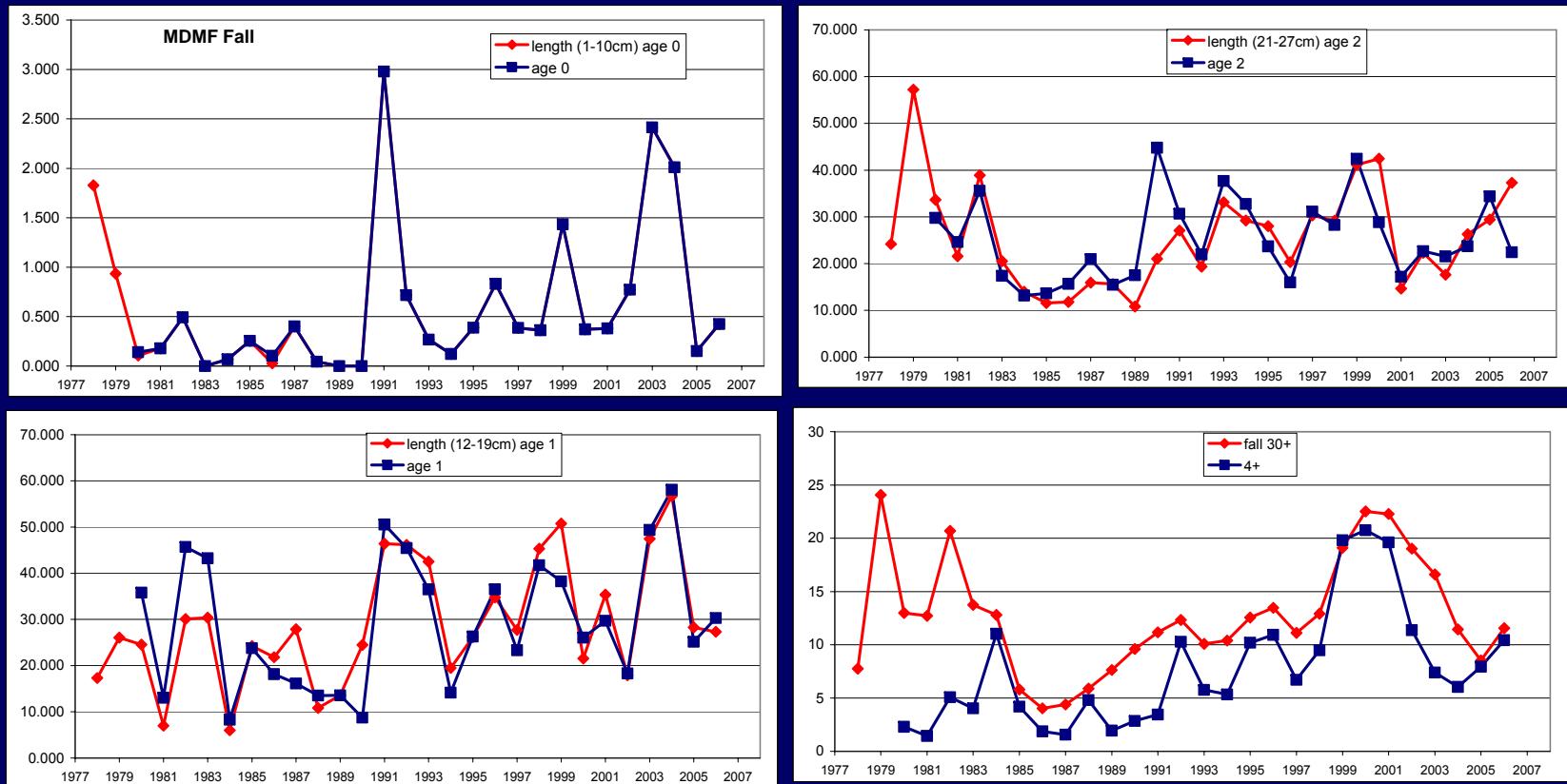
# SCALE Model



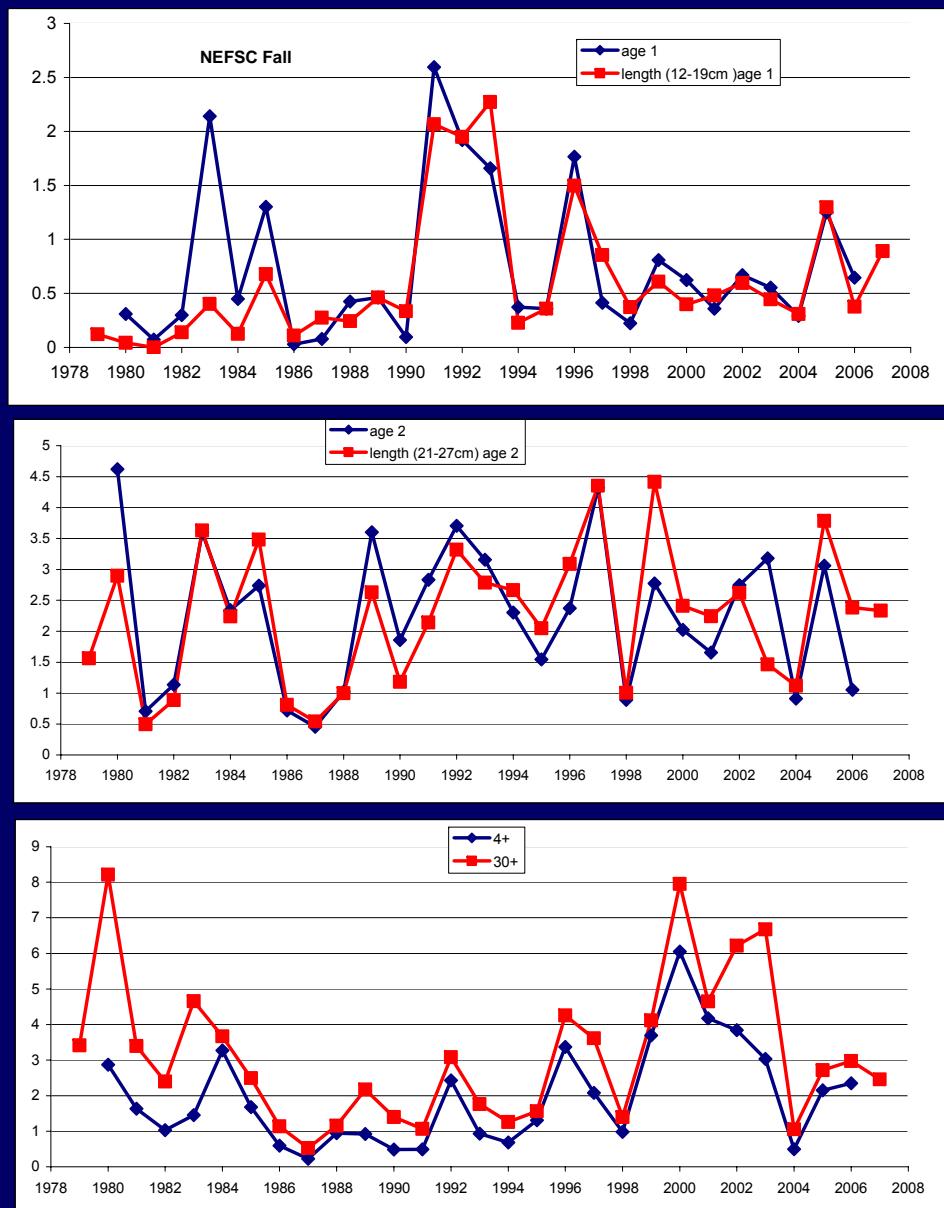
# Population



## MDMF Fall Survey



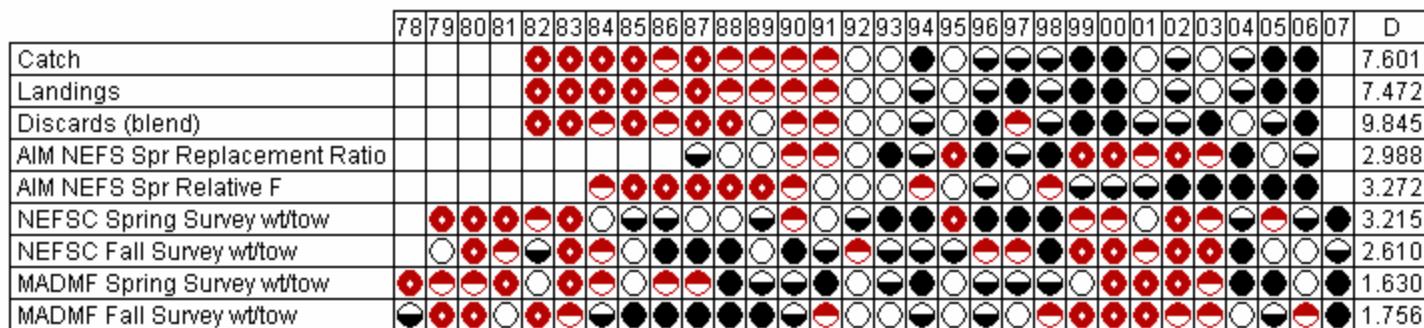
# NEFSC Fall Survey



## **SCALE RUNS 1982-2006**

1. Spring & Fall DMF age 1 & age 2 recruitment
2. Spring & Fall DMF & NEFSC 30 or 35 + cm indices
3. Spring & Fall DMF & NEFSC 30 or 35 + cm length frequencies
4. Catch at length 1982-2006
5. Total catch

### Gulf of Maine Winter Flounder



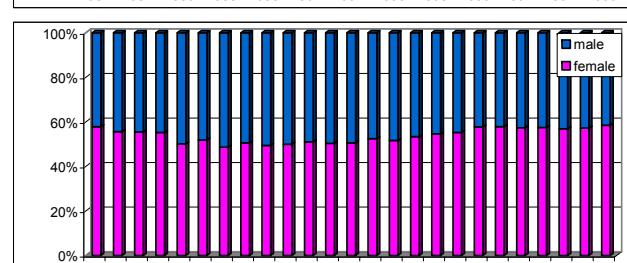
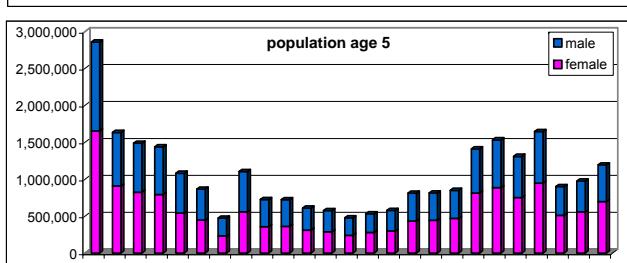
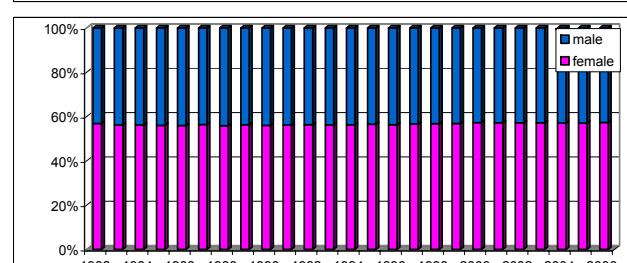
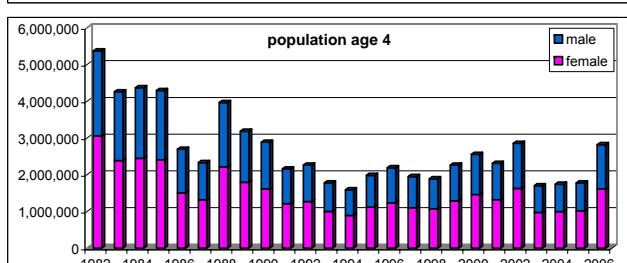
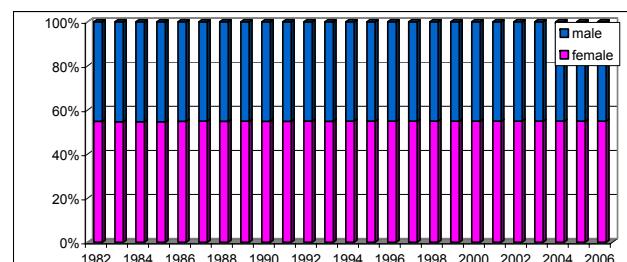
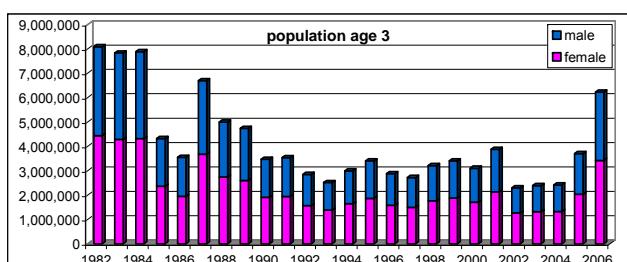
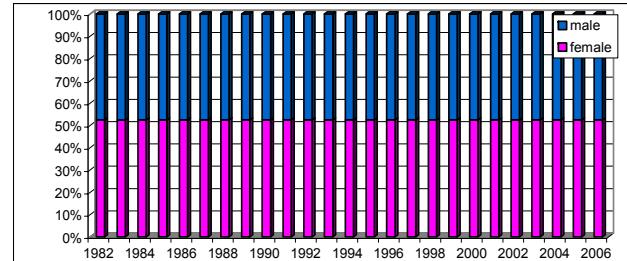
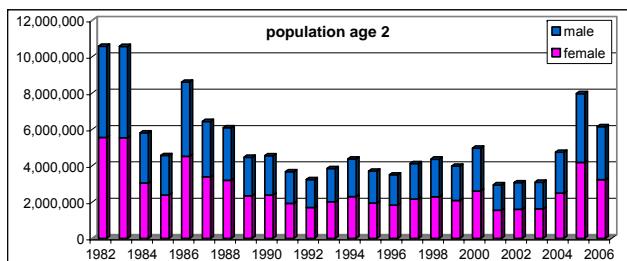
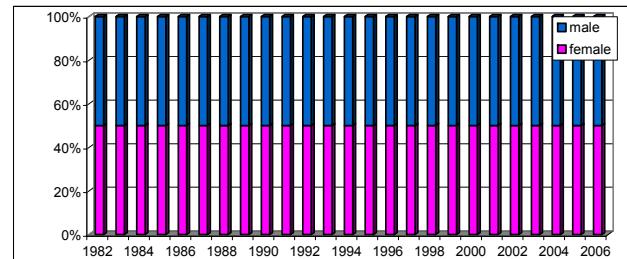
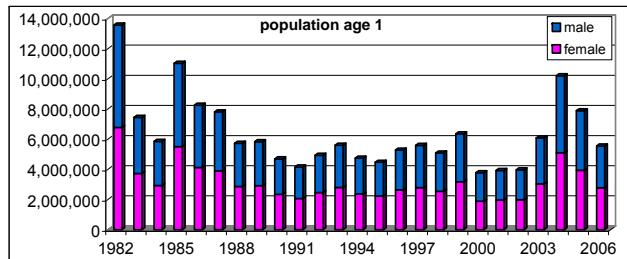
Legend



D = Measure of Dispersion: Range/Median

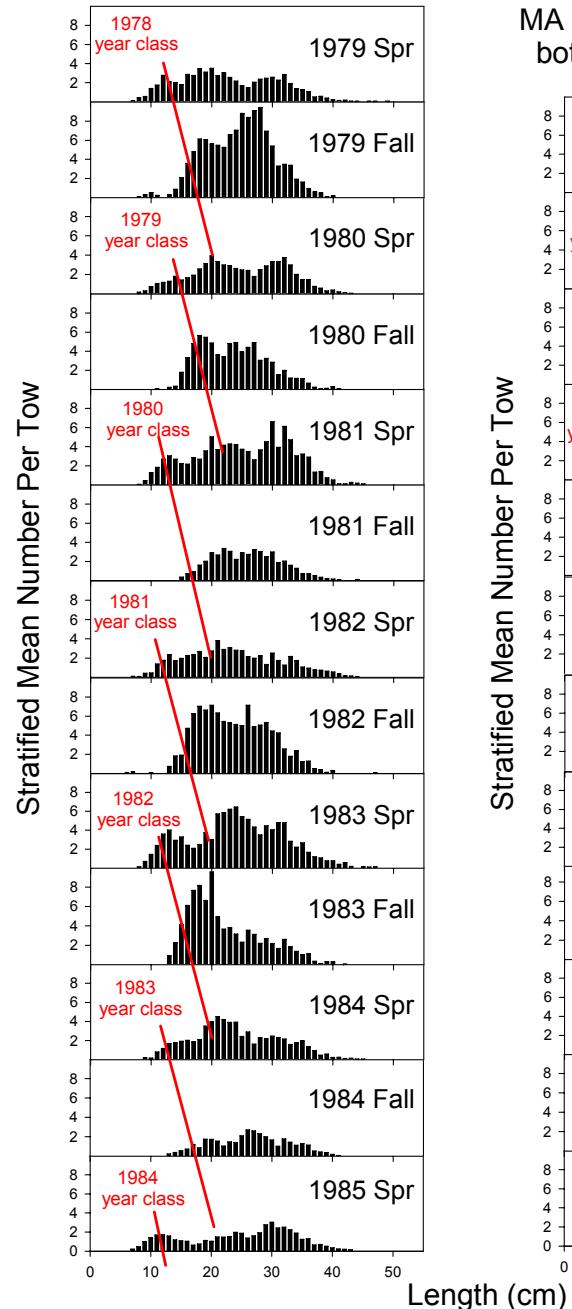
Gulf of Maine winter flounder sex ratio from the spring NEFSC and MADMF surveys.

| AGE |           | males | females | total |
|-----|-----------|-------|---------|-------|
| 1   | sex ratio | 0.43  | 0.57    | 1     |
|     | n         | 99    | 133     | 232   |
| 2   | sex ratio | 0.5   | 0.5     | 1     |
|     | n         | 265   | 269     | 534   |
| 3   | sex ratio | 0.46  | 0.54    | 1     |
|     | n         | 317   | 378     | 695   |
| 4   | sex ratio | 0.37  | 0.63    | 1     |
|     | n         | 227   | 391     | 618   |
| 5   | sex ratio | 0.27  | 0.73    | 1     |
|     | n         | 114   | 302     | 416   |
| 6   | sex ratio | 0.19  | 0.81    | 1     |
|     | n         | 41    | 176     | 217   |
| 7   | sex ratio | 0.19  | 0.81    | 1     |
|     | n         | 26    | 114     | 140   |
| 8   | sex ratio | 0.13  | 0.88    | 1     |
|     | n         | 8     | 56      | 64    |
| 9   | sex ratio | 0.23  | 0.77    | 1     |
|     | n         | 7     | 24      | 31    |
| 10  | sex ratio | 0.06  | 0.94    | 1     |
|     | n         | 1     | 16      | 17    |
| 11  | sex ratio |       | 1       | 1     |
|     | n         |       | 7       | 7     |
| 12  | sex ratio |       | 1       | 1     |
|     | n         |       | 1       | 1     |
| 13  | sex ratio |       | 1       | 1     |
|     | n         |       | 1       | 1     |
| 15  | sex ratio |       | 1       | 1     |
|     | n         |       | 1       | 1     |

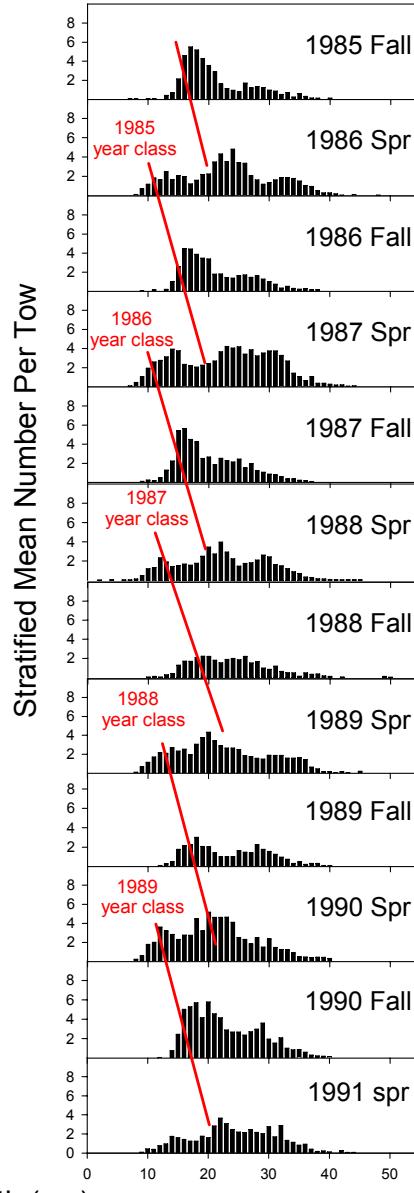


| year | Discard Ratio |         |         | CV      |         |         | Metric Tons |         |         |
|------|---------------|---------|---------|---------|---------|---------|-------------|---------|---------|
|      | trawl         |         |         | trawl   |         |         | trawl       |         |         |
|      | lg mesh       | sm mesh | gillnet | lg mesh | sm mesh | gillnet | lg mesh     | sm mesh | gillnet |
| 1989 | 0.0011        | 0.0032  | 0.0006  | 0.51    | 0.54    | 0.34    | 23          | 6       | 9       |
| 1990 | 0.0004        | 0.0001  | 0.0027  | 0.55    | 1.00    | 0.44    | 11          | 0       | 44      |
| 1991 | 0.0011        | 0.0010  | 0.0005  | 0.45    | 0.61    | 0.23    | 34          | 2       | 7       |
| 1992 | 0.0005        | 0.0002  | 0.0020  | 0.37    | 0.86    | 0.15    | 14          | 0       | 25      |
| 1993 | 0.0003        | 0.0042  | 0.0023  | 0.79    | 0.92    | 0.17    | 8           | 10      | 38      |
| 1994 | 0.0000        | 0.0000  | 0.0009  |         | 1.42    |         | 0           |         | 13      |
| 1995 | 0.0009        | 0.0091  | 0.0015  | 0.53    | 0.43    | 0.46    | 16          | 21      | 23      |
| 1996 | 0.0003        | 0.0008  | 0.0008  | 1.69    | 0.29    | 0.56    | 4           | 2       | 12      |
| 1997 | 0.0001        | 0.0098  | 0.0061  | 0.61    | 0.02    | 0.58    | 2           | 19      | 75      |
| 1998 | 0.0011        | 0.0000  | 0.0011  | 0.45    |         | 0.43    | 15          |         | 14      |
| 1999 | 0.0016        | 0.0081  | 0.0010  | 0.38    | 0.30    | 0.50    | 18          | 14      | 8       |
| 2000 | 0.0004        | 0.0000  | 0.0030  | 0.84    |         | 0.39    | 6           |         | 24      |
| 2001 | 0.0016        | 0.0017  | 0.0008  | 0.38    | 1.91    | 0.64    | 27          | 2       | 6       |
| 2002 | 0.0021        | 0.0077  | 0.0014  | 0.37    | 0.43    | 0.43    | 33          | 10      | 9       |
| 2003 | 0.0014        | 0.0016  | 0.0008  | 0.33    | 0.50    | 0.32    | 25          | 1       | 5       |
| 2004 | 0.0023        | 0.0064  | 0.0010  | 0.29    | 0.40    | 0.30    | 62          | 2       | 7       |
| 2005 | 0.0025        | 0.0072  | 0.0003  | 0.28    | 1.10    | 0.23    | 47          | 2       | 2       |
| 2006 | 0.0018        | 0.0038  | 0.0001  | 0.33    | 0.44    | 0.42    | 20          | 2       | 1       |

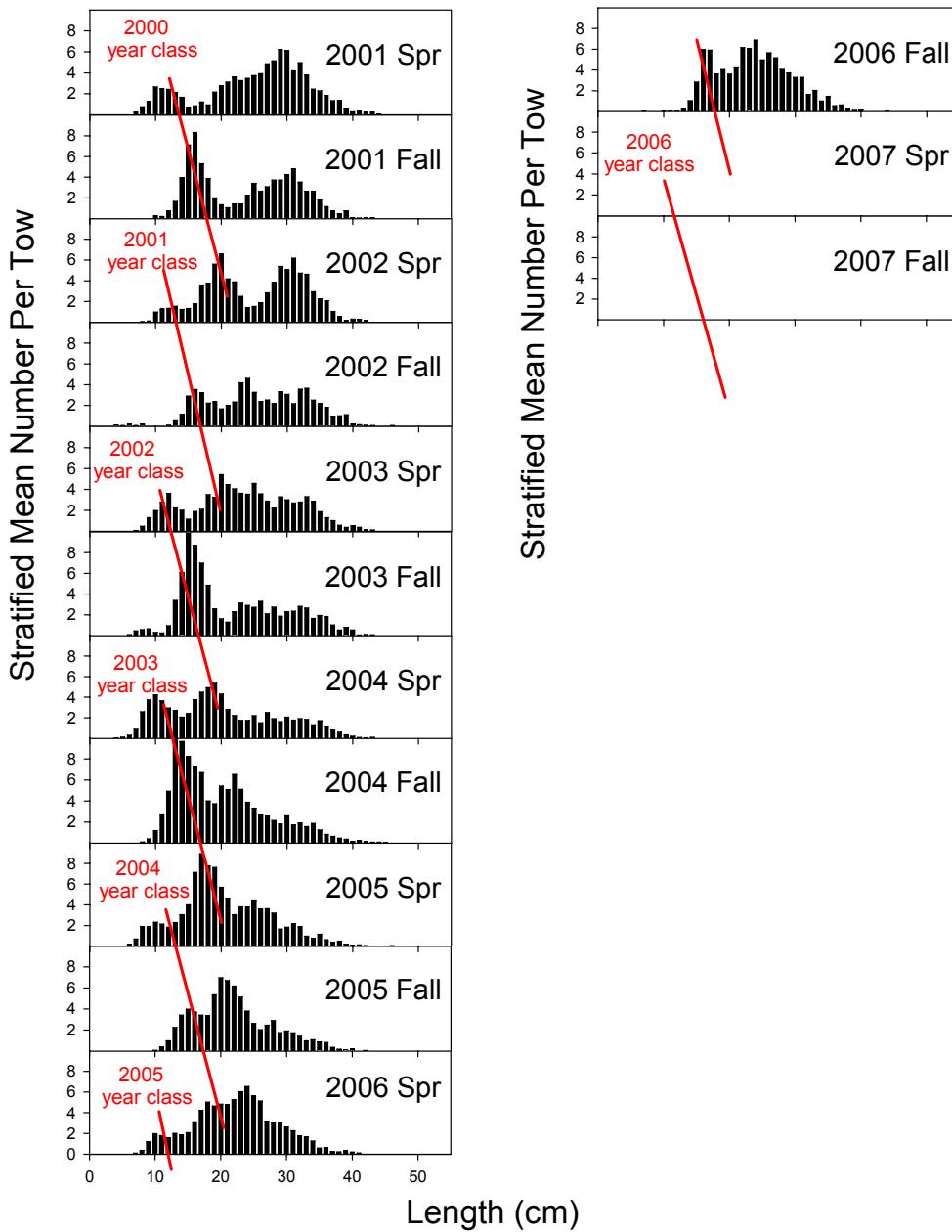
| Kept Ratio |         |         |         | CV      |         |         | Metric Tons |         |         |
|------------|---------|---------|---------|---------|---------|---------|-------------|---------|---------|
| year       | trawl   |         |         | trawl   |         |         | trawl       |         |         |
|            | lg mesh | sm mesh | gillnet | lg mesh | sm mesh | gillnet | lg mesh     | sm mesh | gillnet |
| 1989       | 0.006   | 0.015   | 0.007   | 0.38    | 0.45    | 0.58    | 131         | 27      | 107     |
| 1990       | 0.001   | 0.000   | 0.015   | 0.47    | 0.77    | 0.44    | 42          | 1       | 244     |
| 1991       | 0.019   | 0.001   | 0.003   | 0.44    | 0.54    | 0.22    | 572         | 2       | 43      |
| 1992       | 0.008   | 0.001   | 0.013   | 0.49    | 0.58    | 0.13    | 227         | 4       | 163     |
| 1993       | 0.004   | 0.027   | 0.014   | 0.76    | 0.53    | 0.14    | 93          | 68      | 236     |
| 1994       | 0.001   | 0.006   |         | 0.83    |         | 0.88    | 14          | 0       | 84      |
| 1995       | 0.032   | 0.000   | 0.005   | 1.03    |         | 0.28    | 575         | 0       | 83      |
| 1996       | 0.017   | 0.000   | 0.007   | 2.32    |         | 0.41    | 305         | 0       | 99      |
| 1997       | 0.001   | 0.040   | 0.021   | 2.01    | 0.33    | 0.51    | 12          | 76      | 262     |
| 1998       | 0.005   |         | 0.010   | 0.80    |         | 0.37    | 65          | 0       | 136     |
| 1999       | 0.110   | 0.000   | 0.007   | 0.66    |         | 0.45    | 1241        | 0       | 57      |
| 2000       | 0.012   |         | 0.023   | 0.40    |         | 0.39    | 179         | 0       | 183     |
| 2001       | 0.025   | 0.000   | 0.011   | 0.25    |         | 0.72    | 410         | 0       | 85      |
| 2002       | 0.028   | 0.005   | 0.045   | 0.29    | 0.51    | 0.40    | 446         | 7       | 295     |
| 2003       | 0.021   | 0.013   | 0.033   | 0.19    | 0.54    | 0.18    | 369         | 7       | 220     |
| 2004       | 0.031   | 0.034   | 0.025   | 0.21    | 0.72    | 0.13    | 841         | 13      | 176     |
| 2005       | 0.021   | 0.018   | 0.012   | 0.16    | 0.38    | 0.15    | 404         | 6       | 78      |
| 2006       | 0.017   | 0.003   | 0.002   | 0.27    | 0.39    | 0.41    | 189         | 1       | 12      |

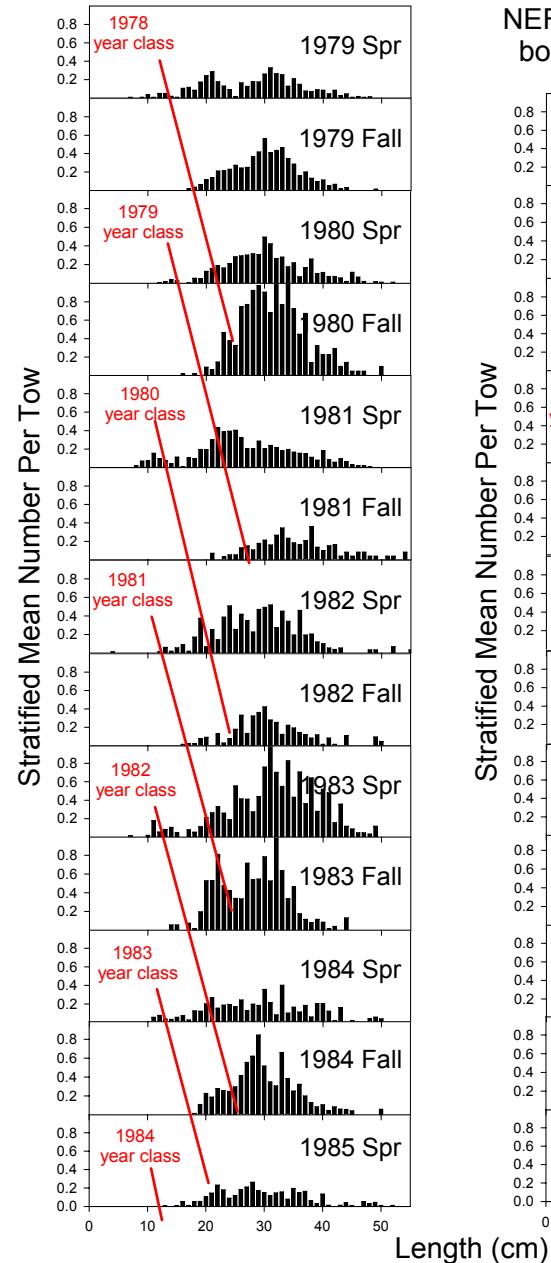


MA DMF spring and fall bottom trawl survey

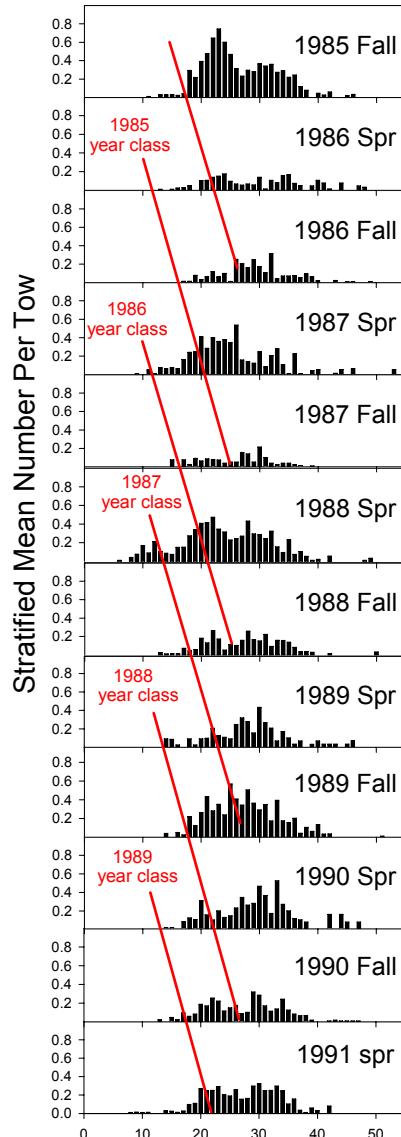


### MA DMF spring and fall bottom trawl survey

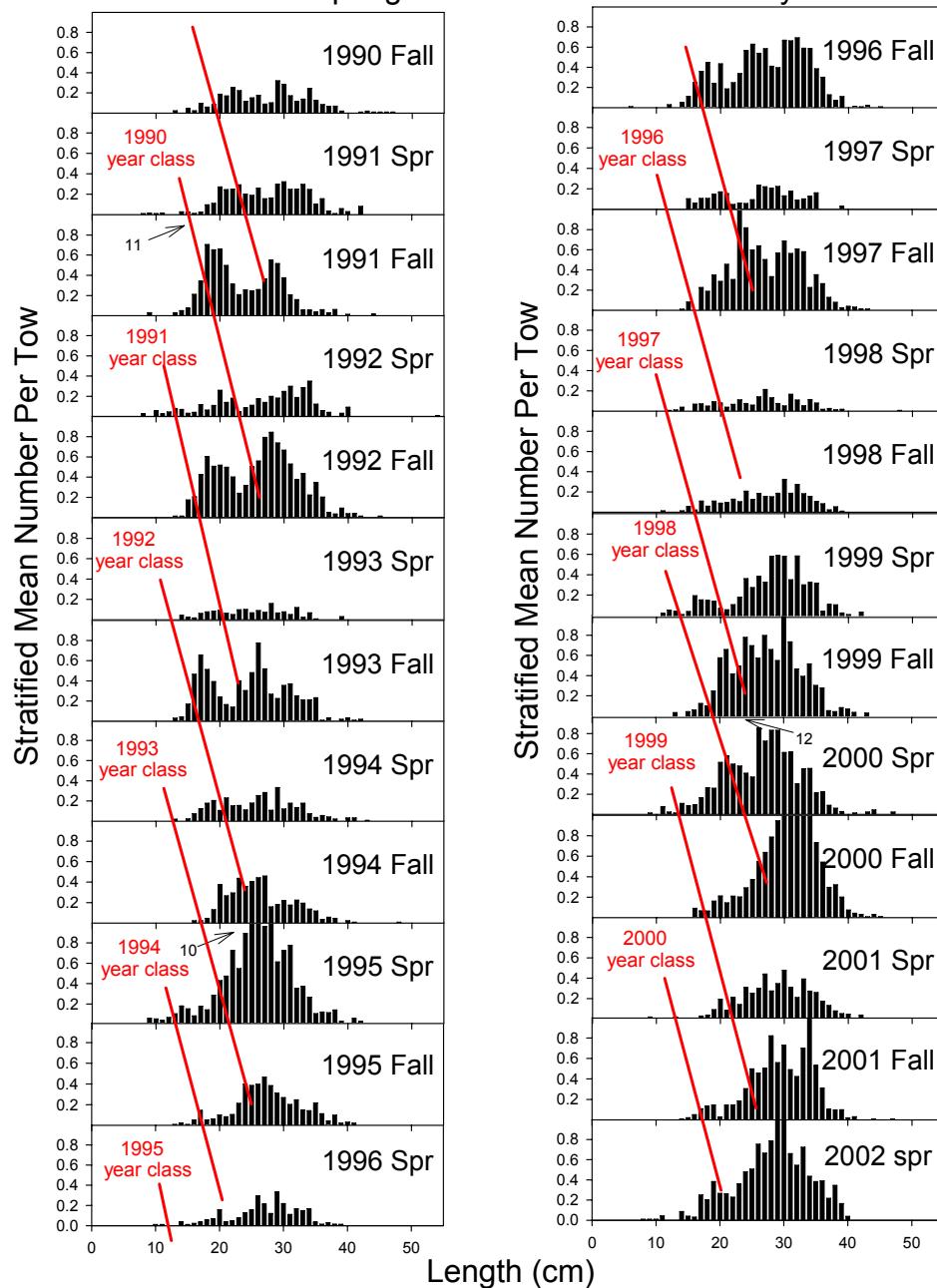




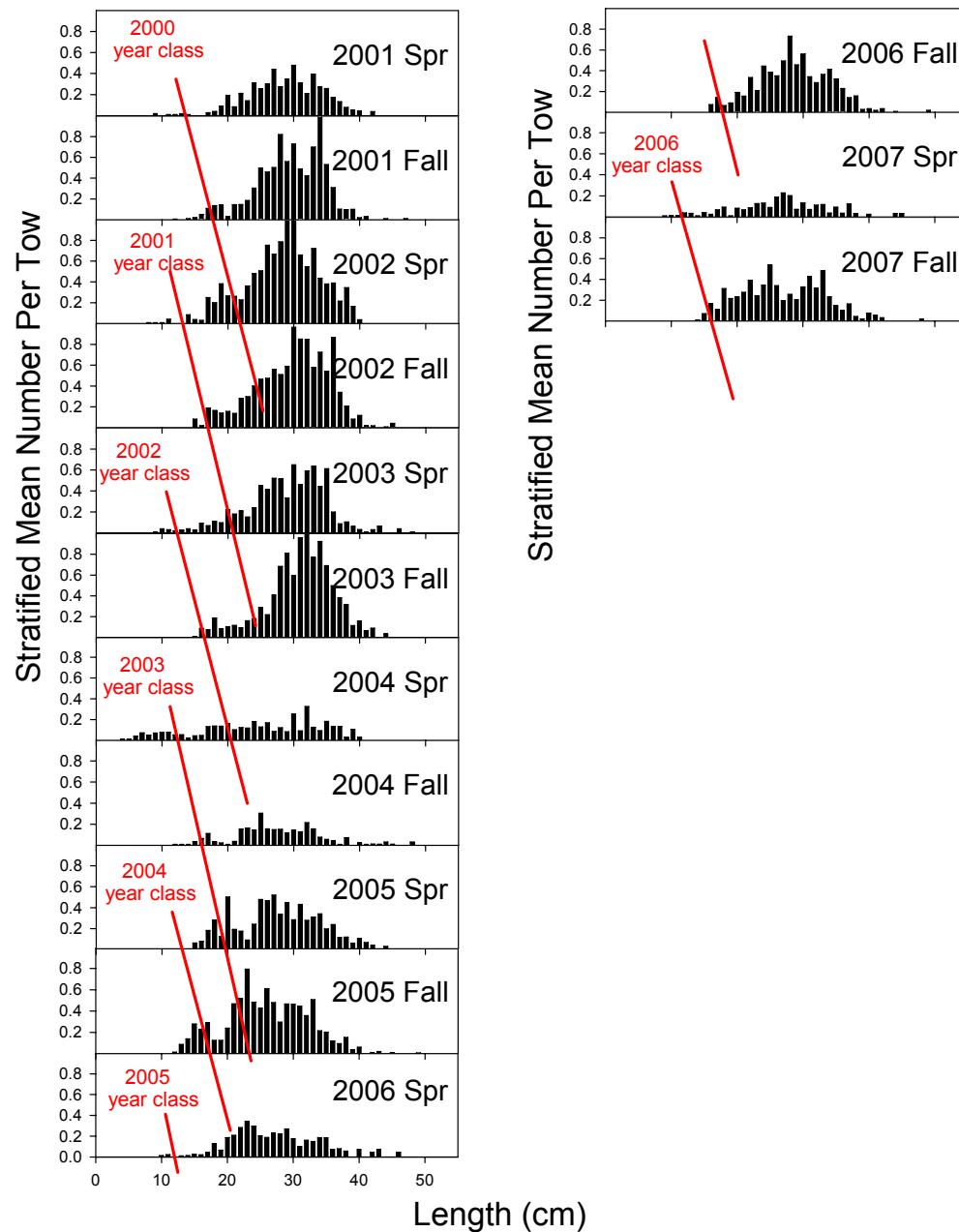
NEFSC spring and fall  
bottom trawl survey

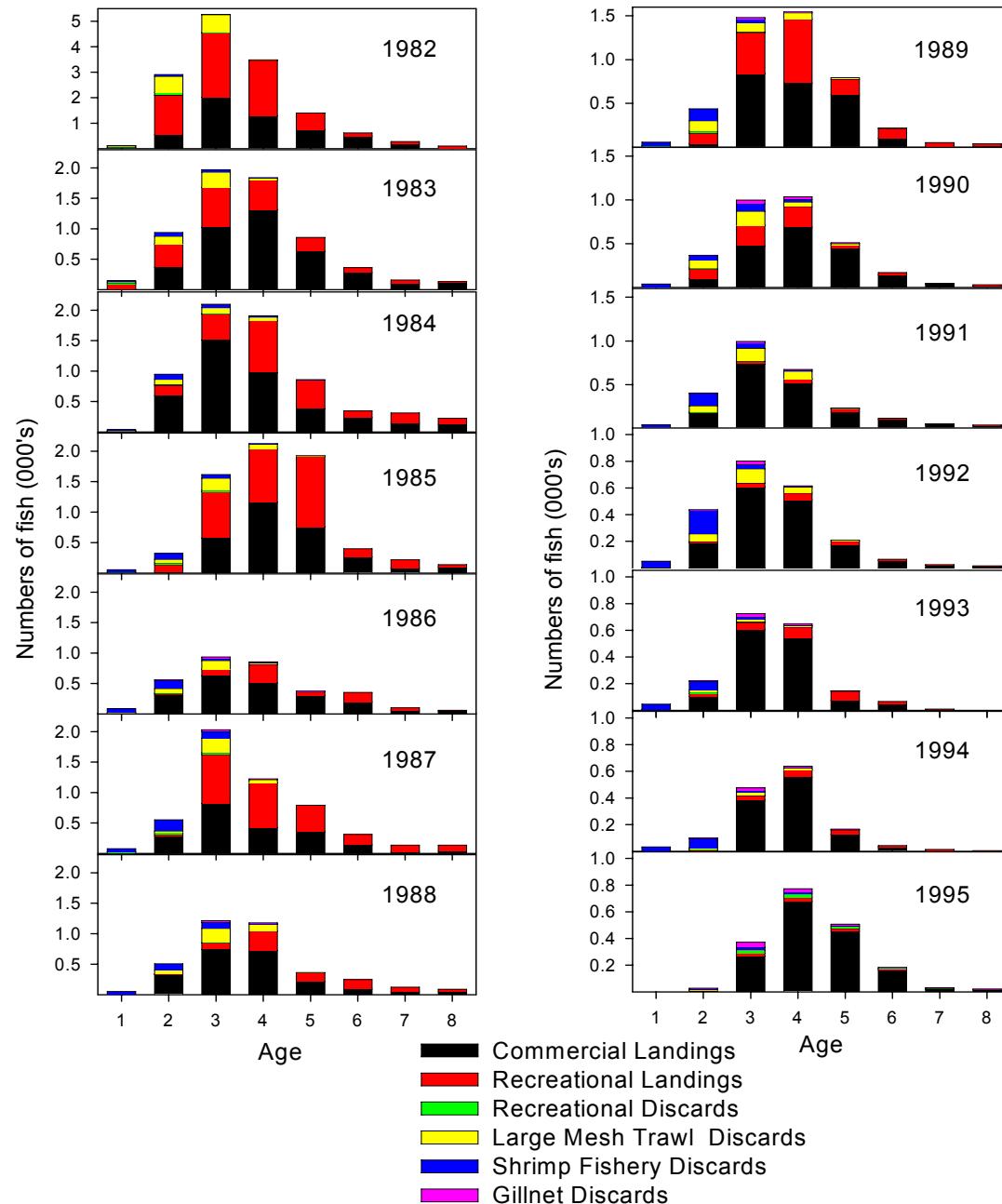


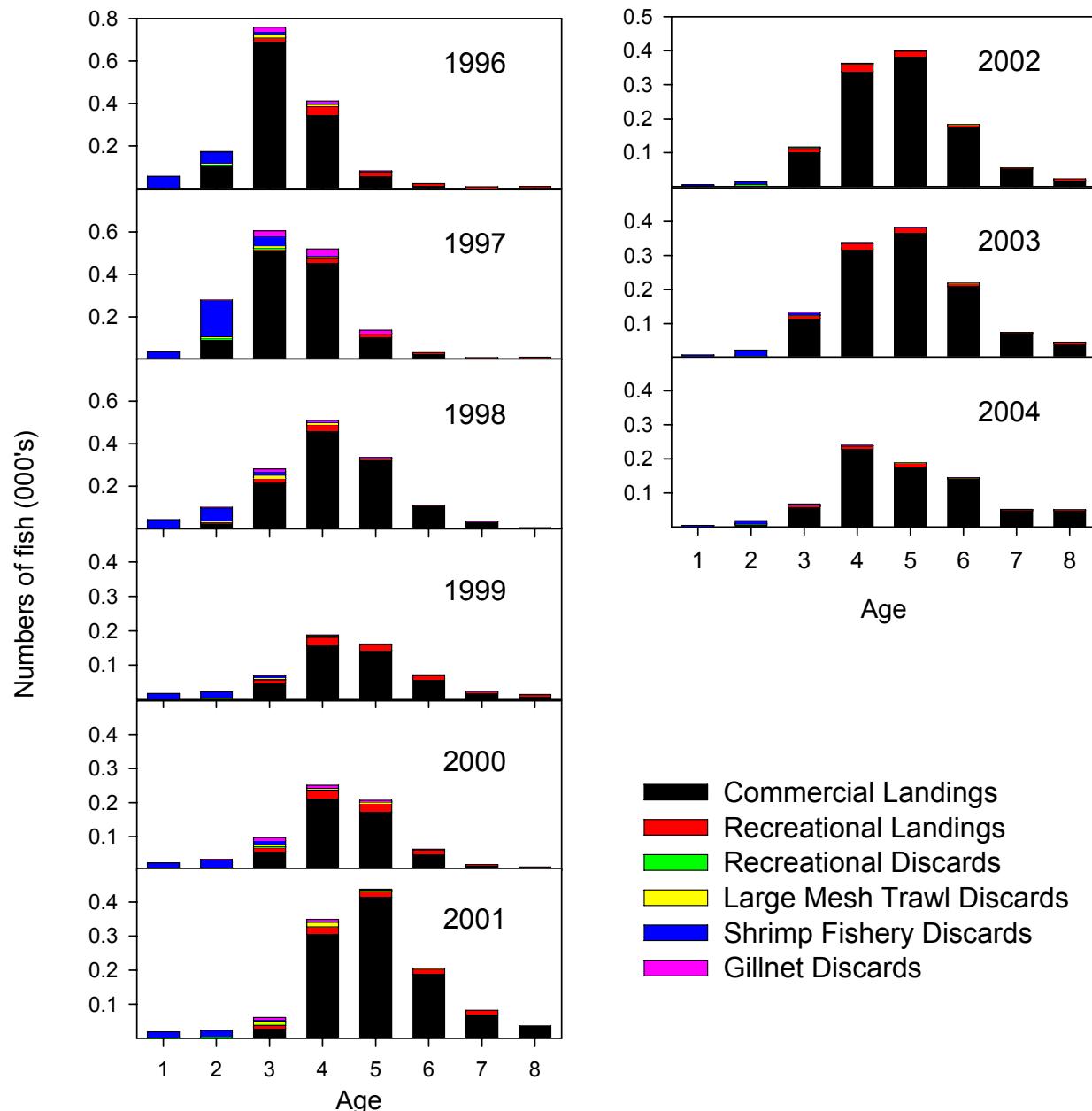
### NEFSC spring and fall bottom trawl survey

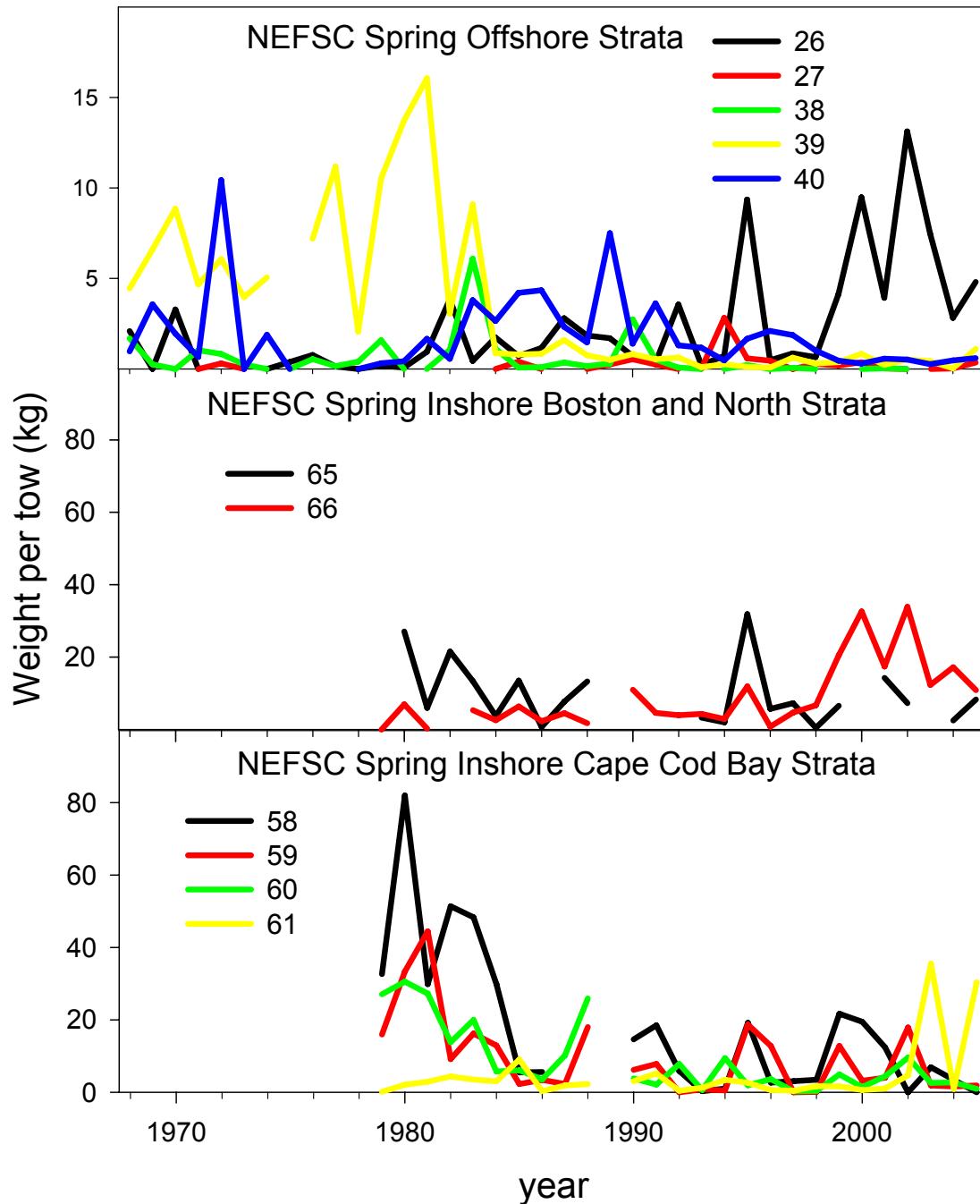


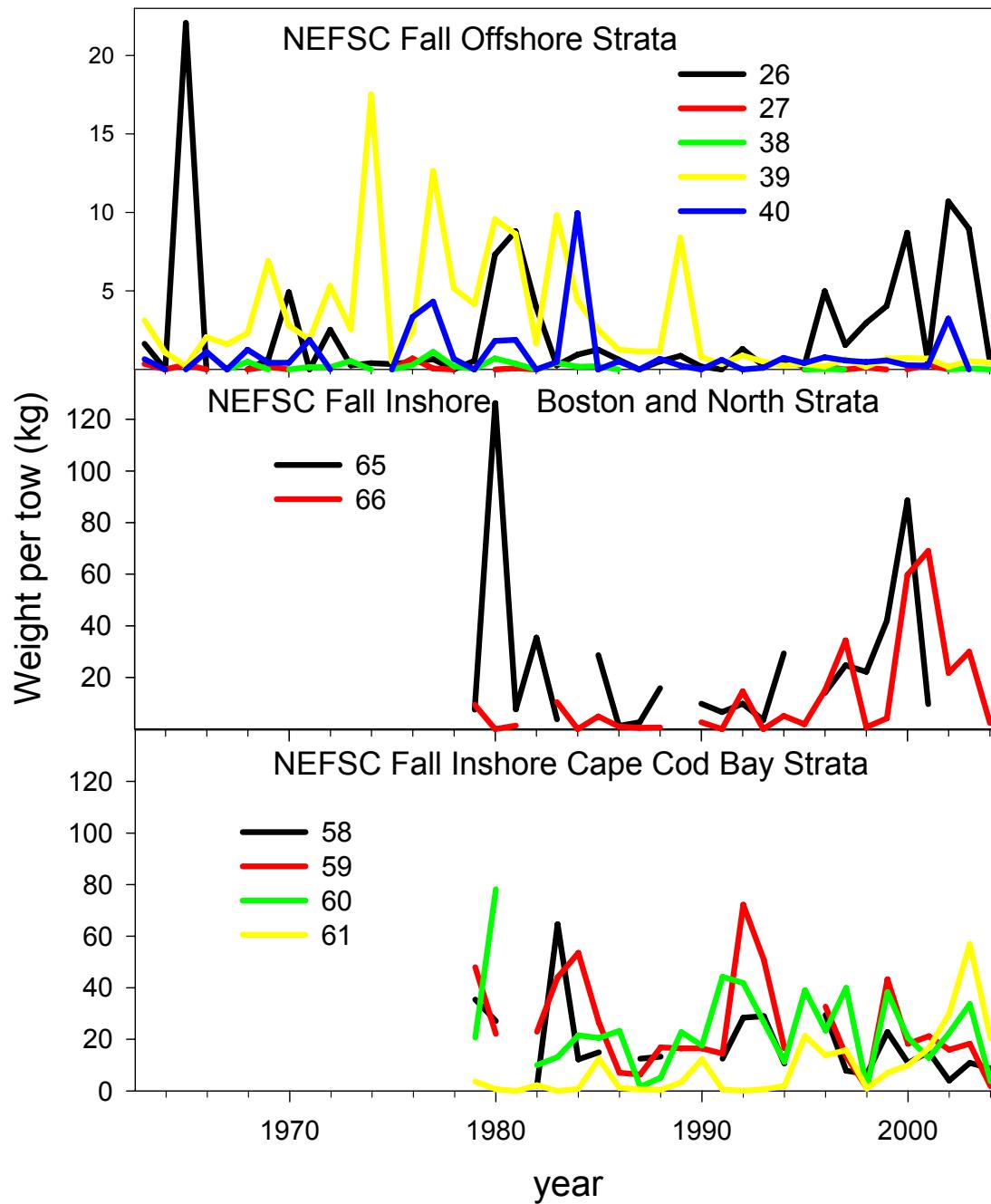
### NEFSC spring and fall bottom trawl survey

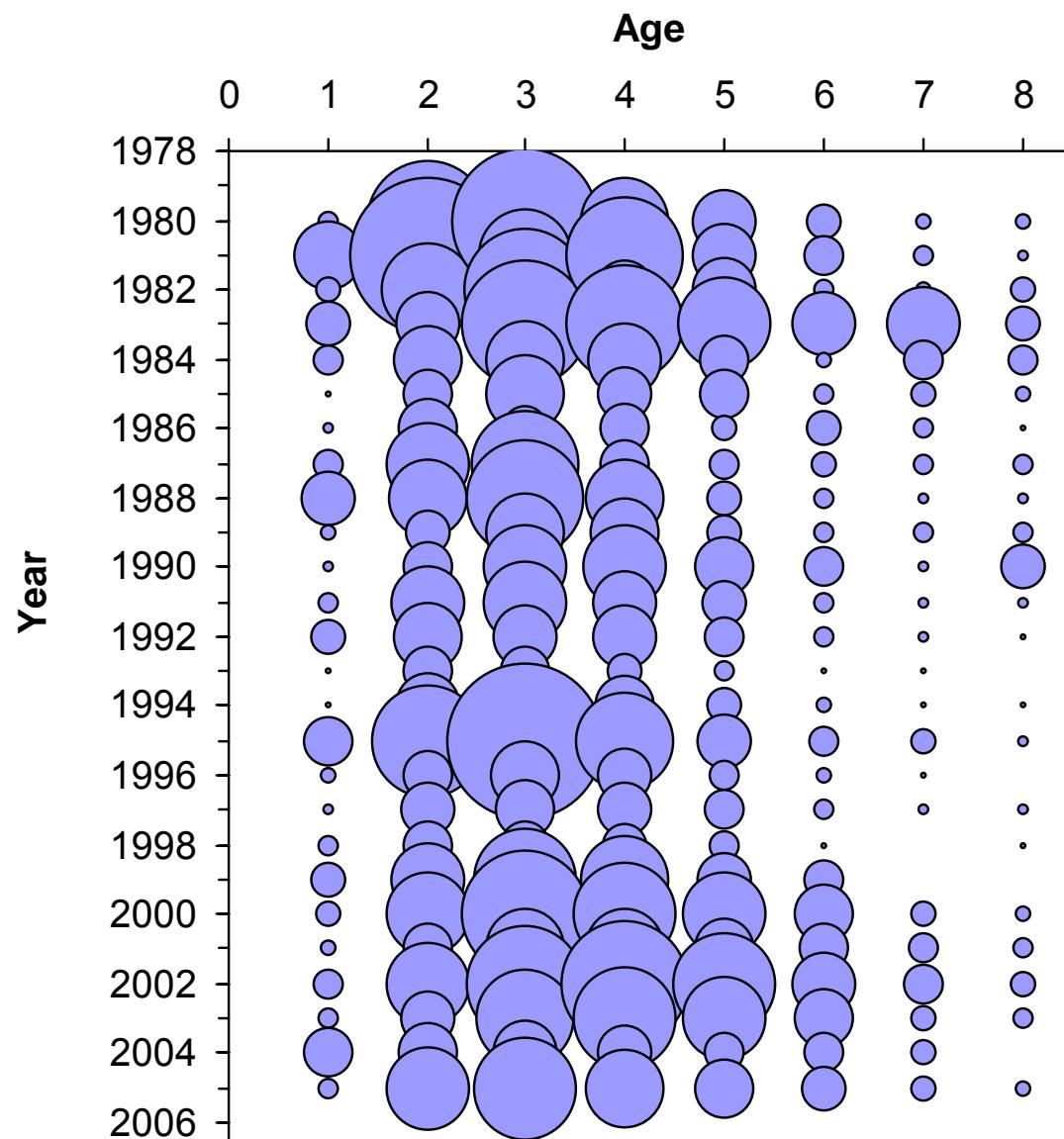




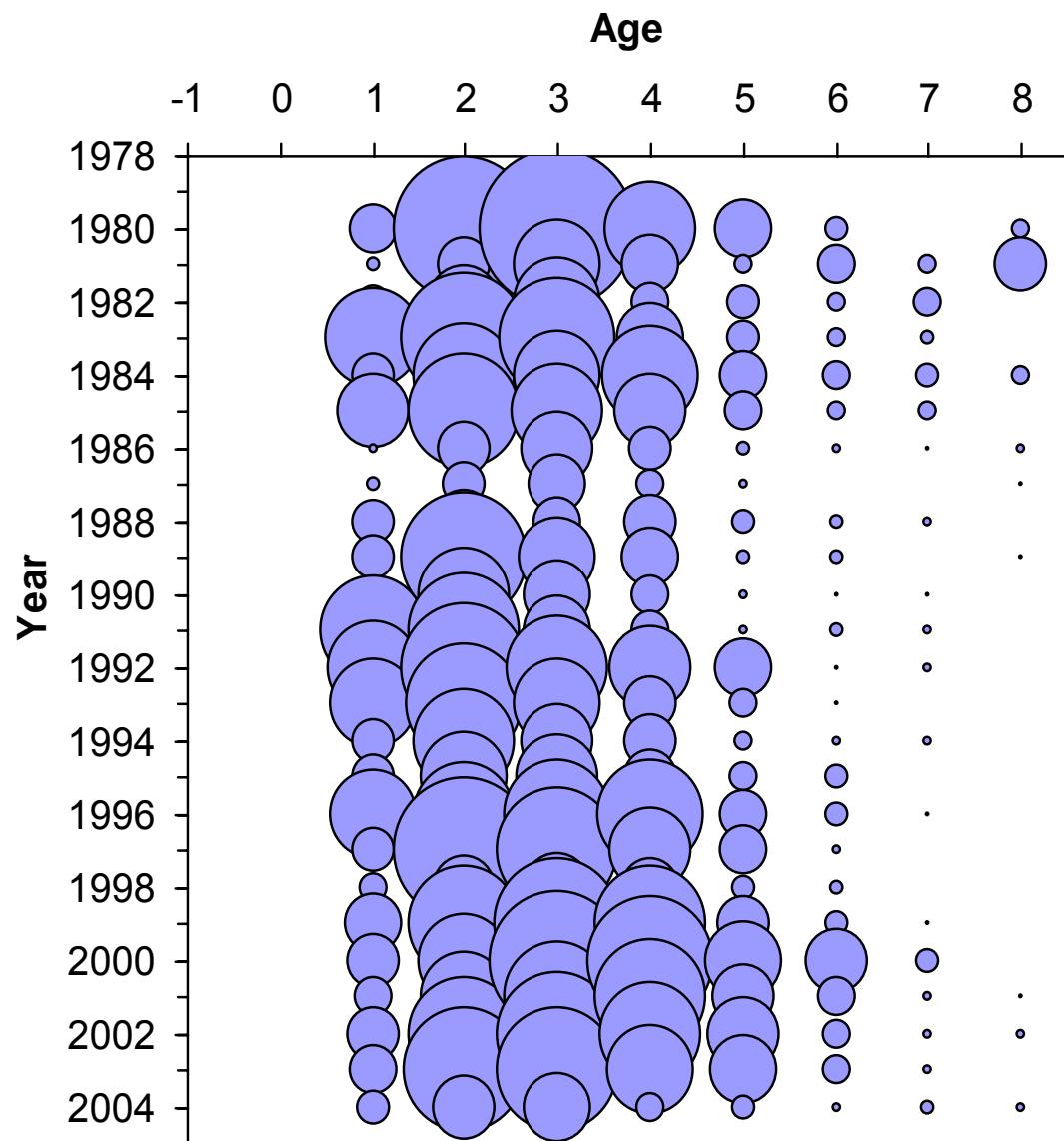




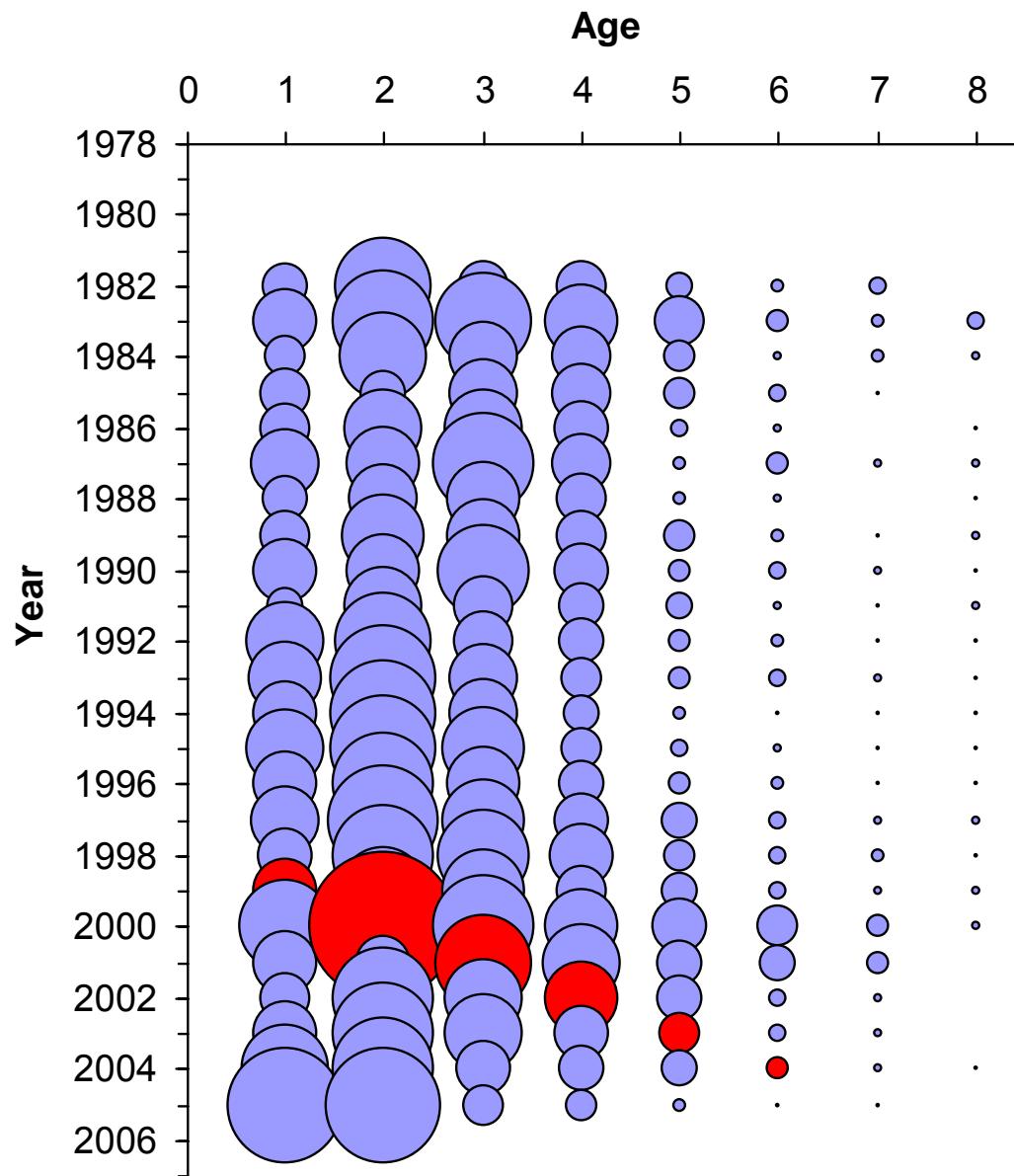




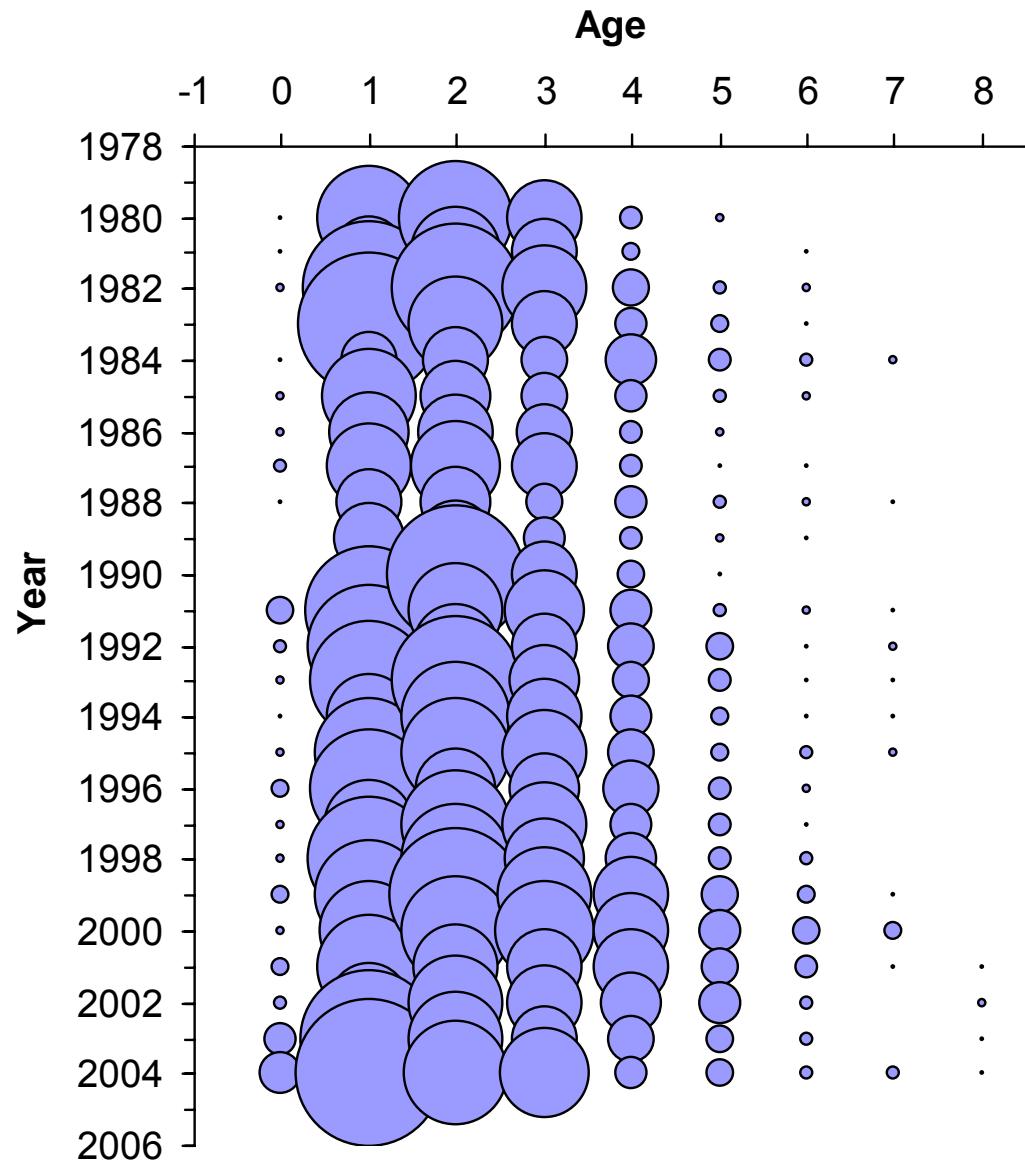
NEFSC Spring bubble plot by age.



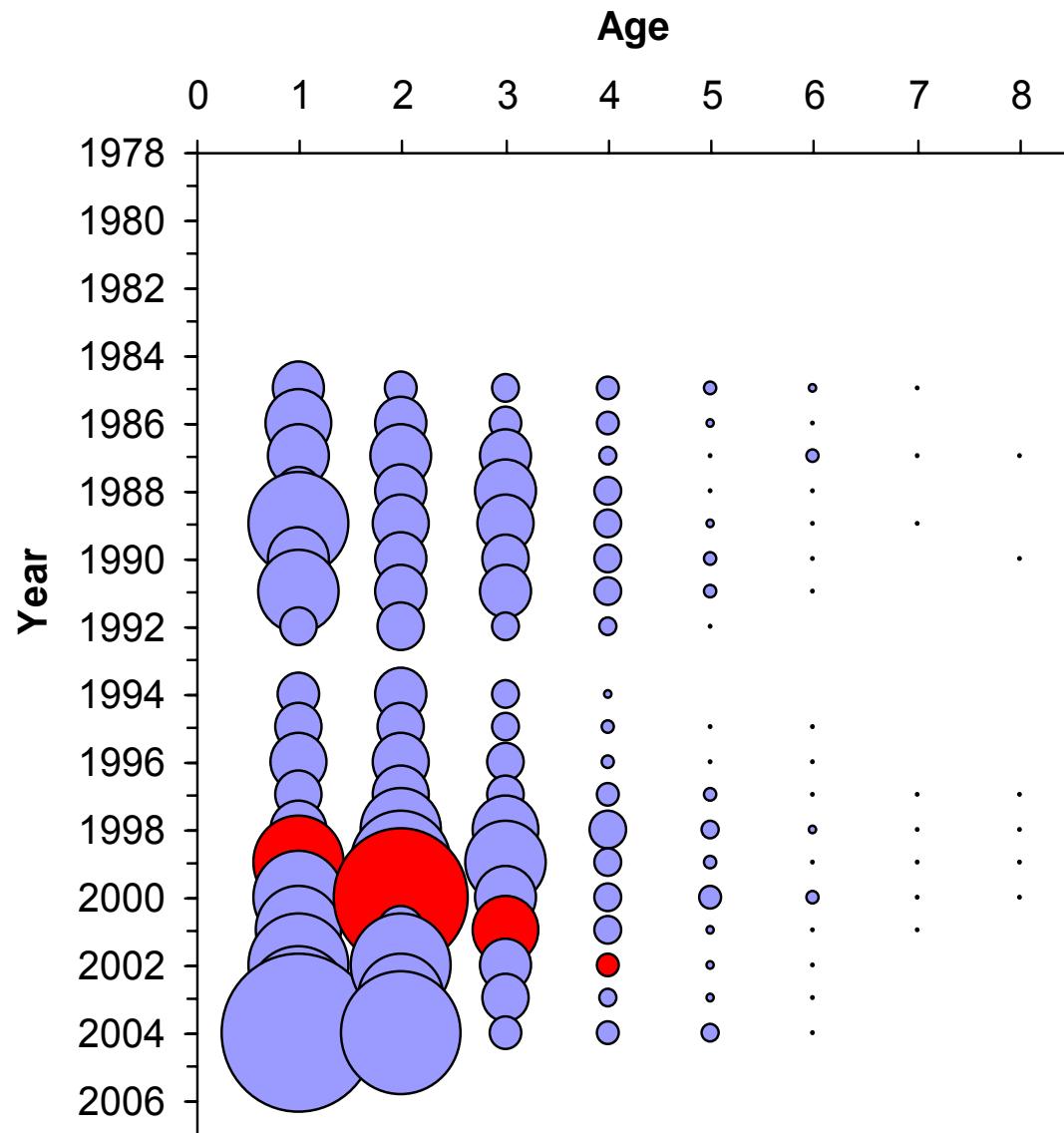
NEFSC Fall bubble plot by age.



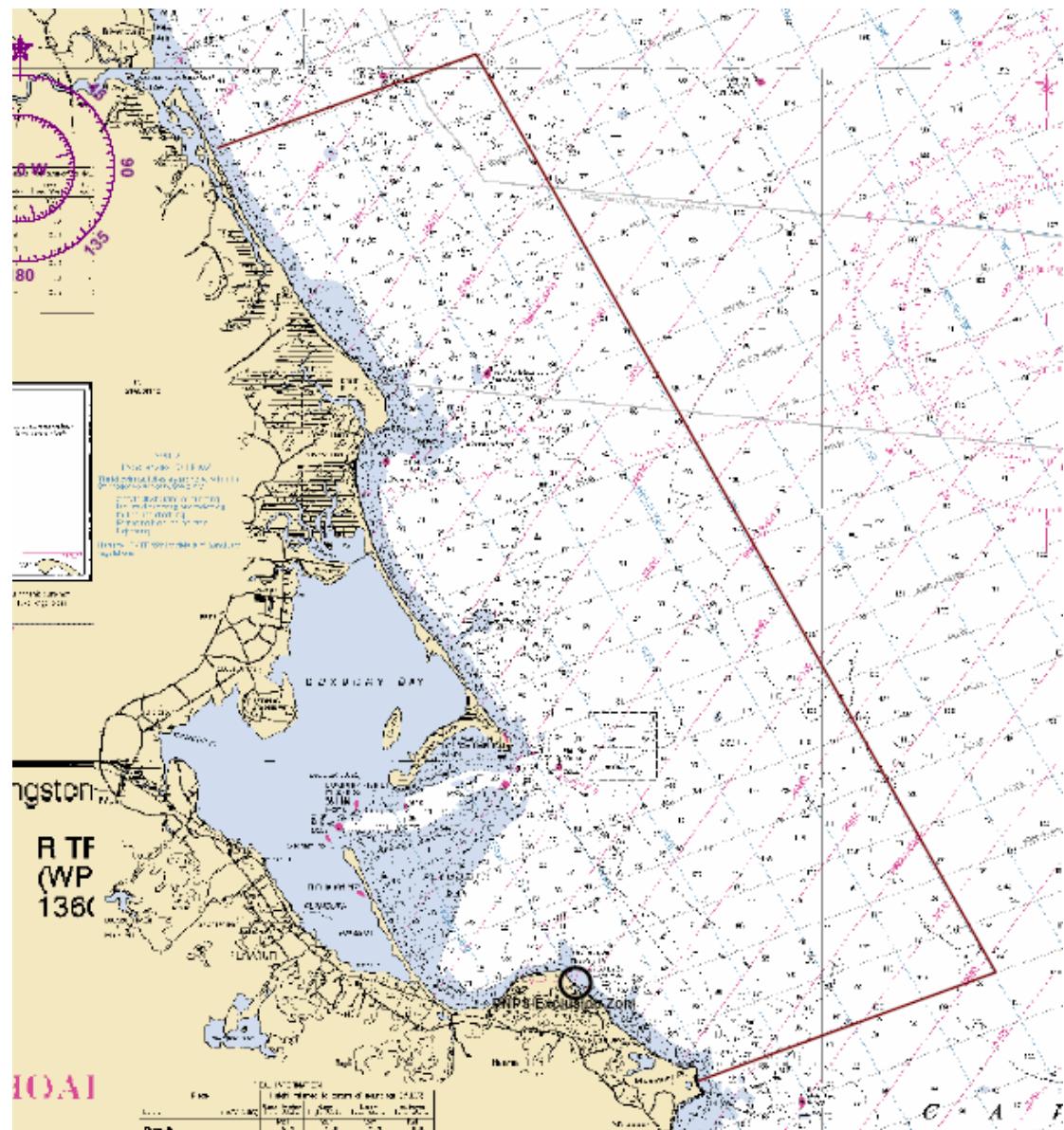
MDMF Spring bubble plot by age.



MDMF Fall bubble plot by age.

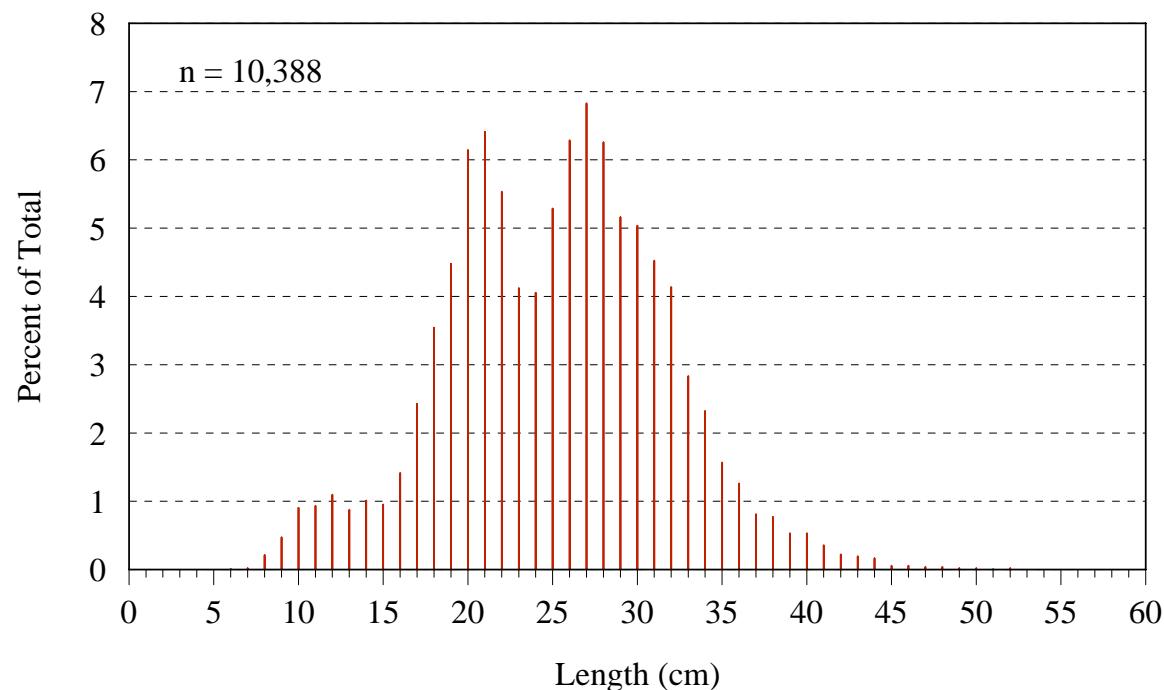


Seabrook Spring bubble plot by age.

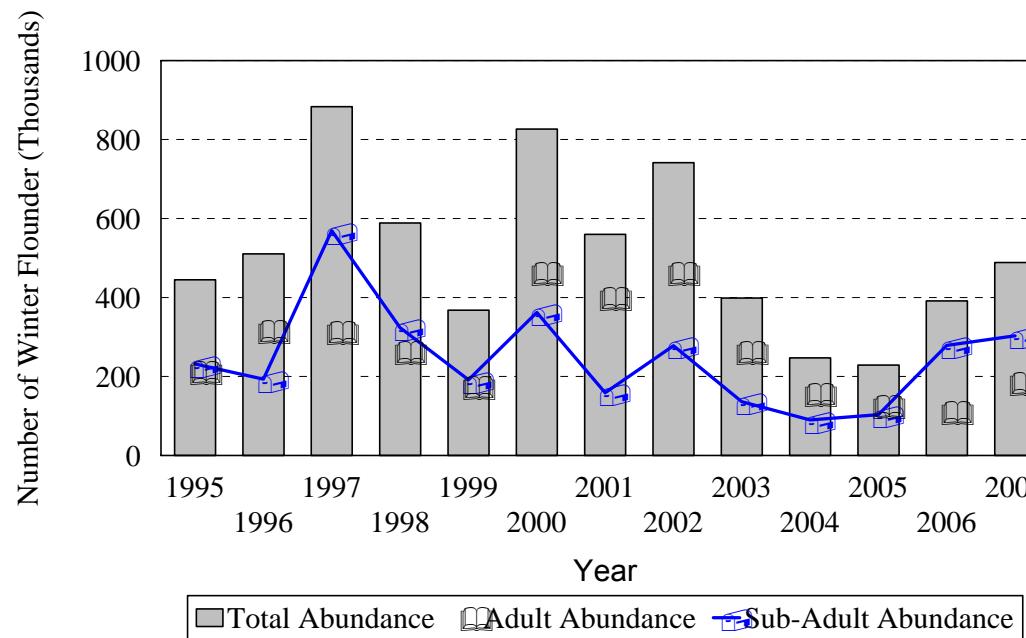


# Cape Cod Bay Area Swept 2007

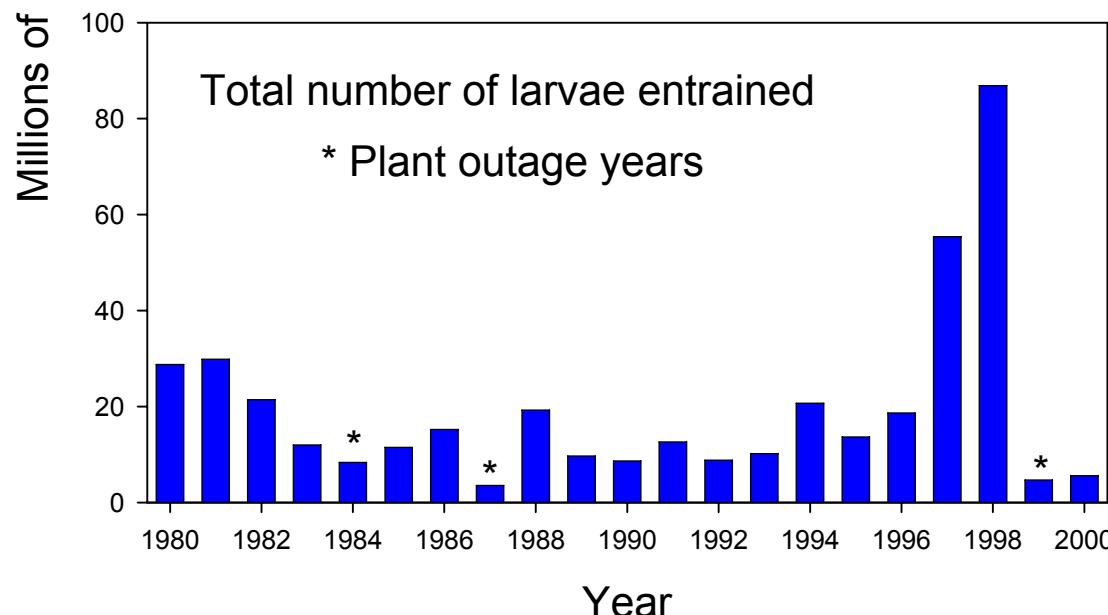
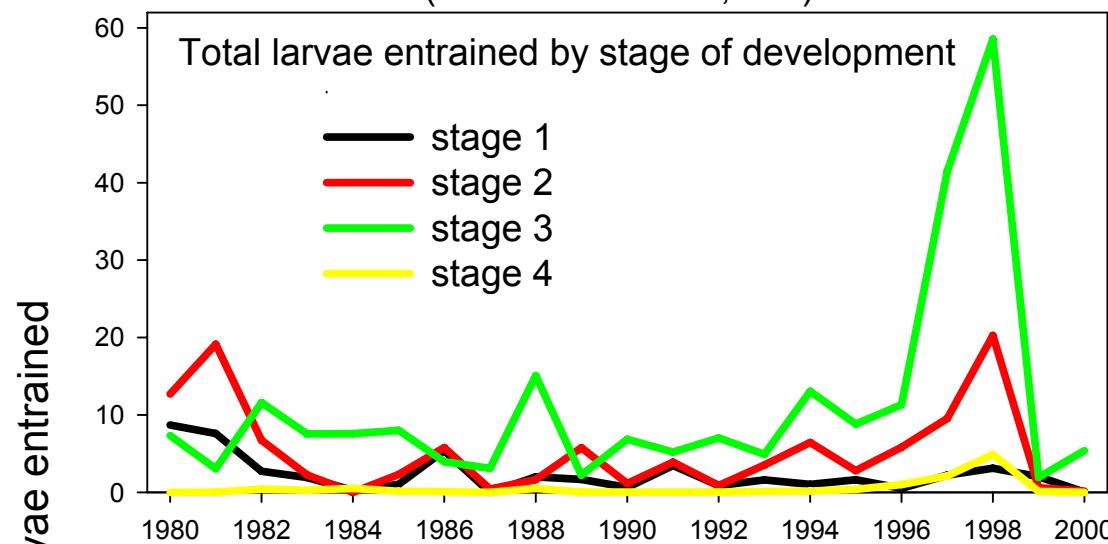
## Winter Flounder Length Frequency

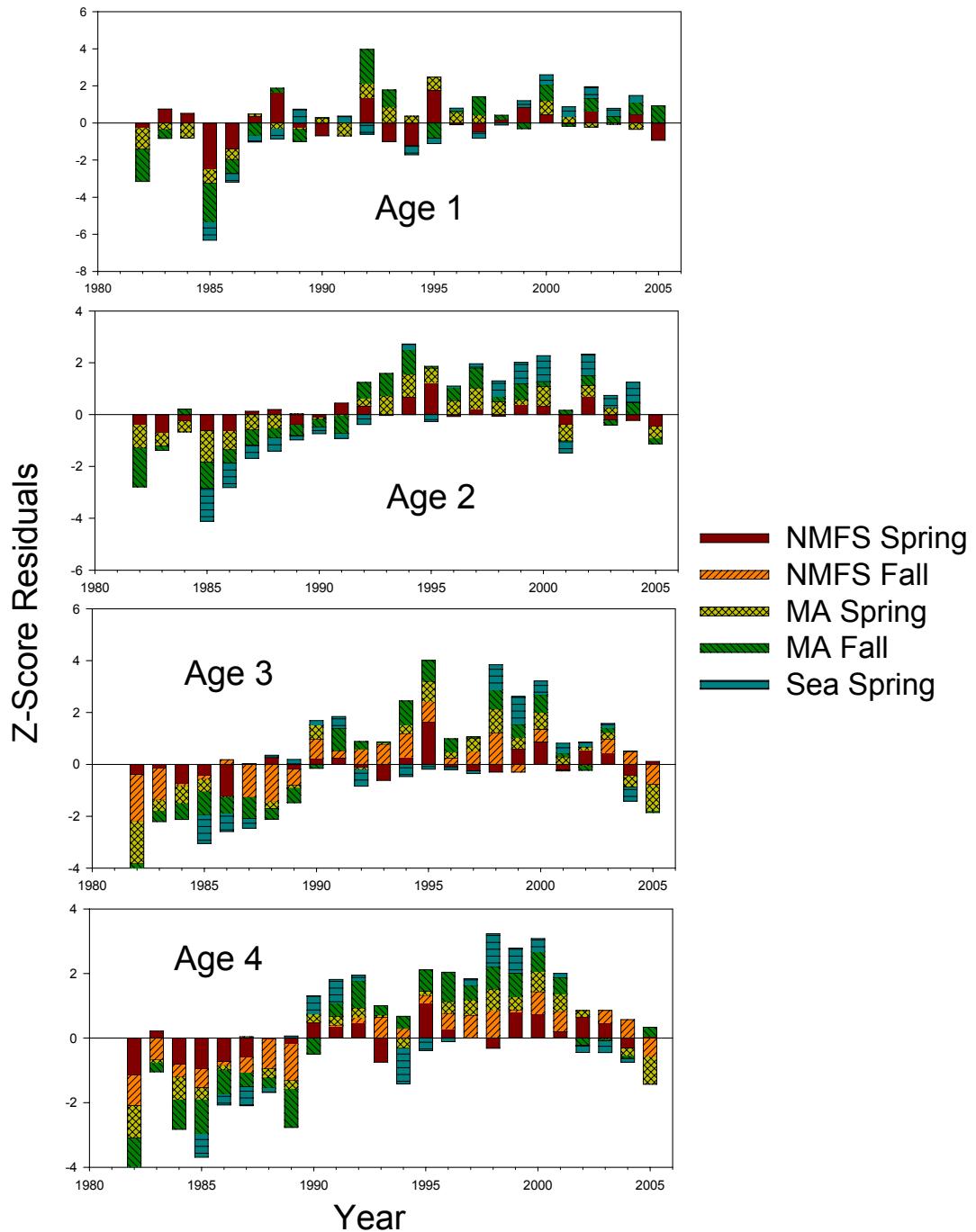


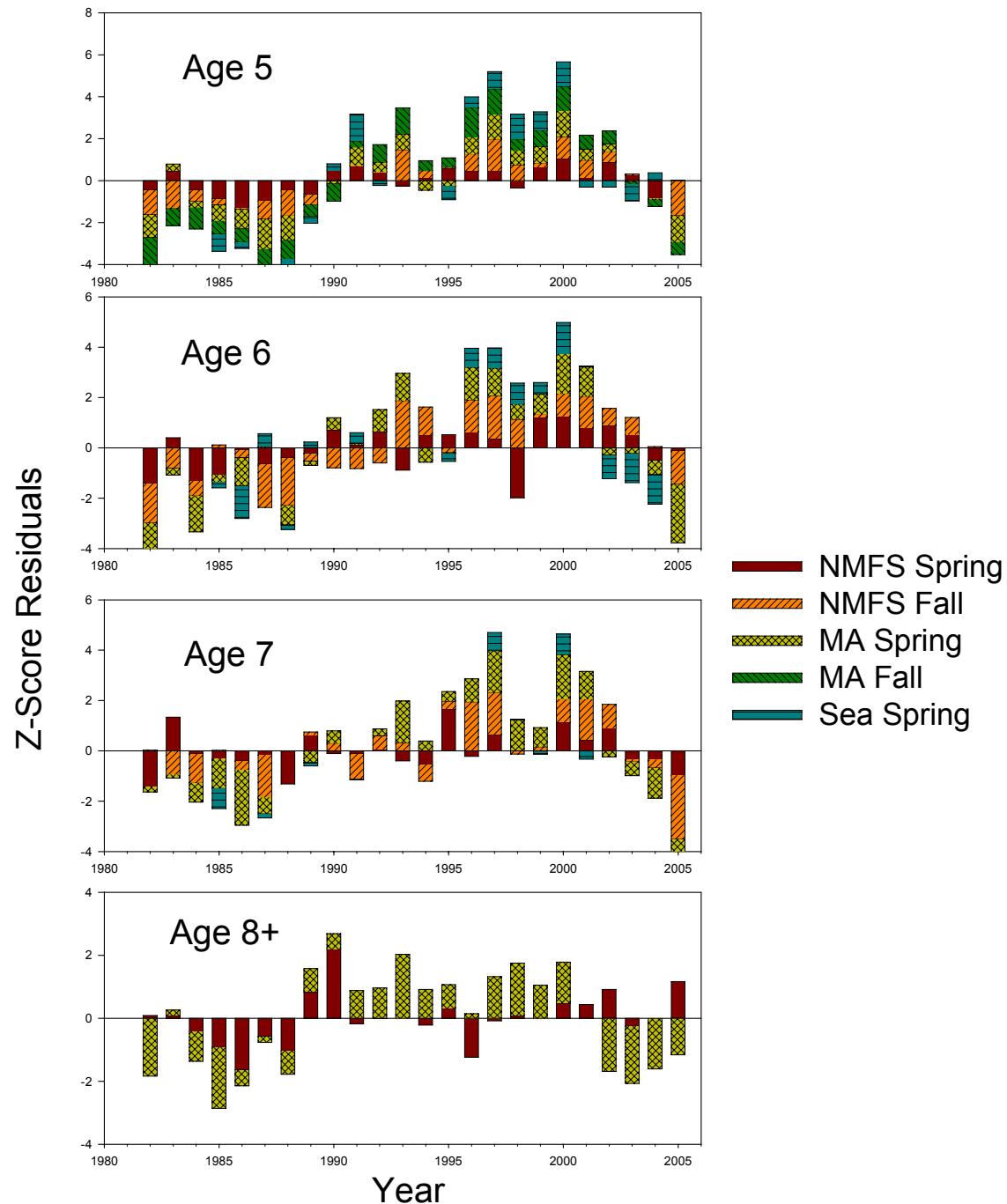
## Winter Flounder - Annual Abundance Estimates Spring 1995 - 2007



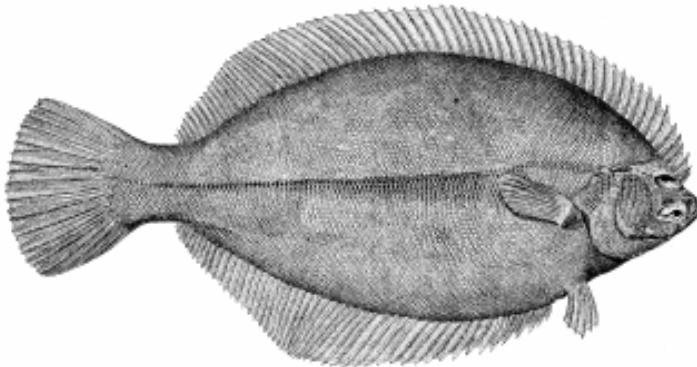
Winter Flounder larvae entrainment data  
at the Pilgrim Nuclear Power Plant in Plymouth, MA  
(Marine Research, Inc.)







# Winter Flounder biology



- Shoal-water flounder (<55 m)
- M = 0.2 (15 years is the oldest fish aged in NEFSC survey)
- 50% maturity is at age 3.5 for females
- Peak spawning occurs in March (estuaries)