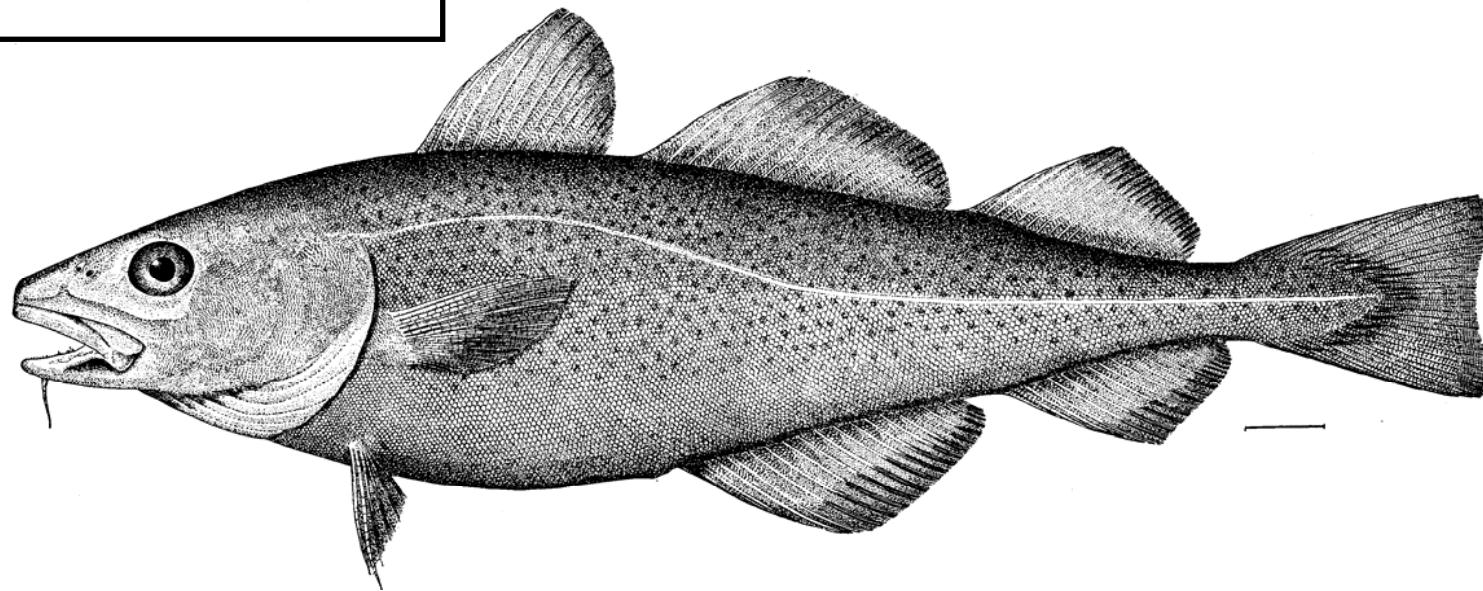


Draft Presentation
For Peer Review Only.
Does not represent
final NOAA Decision/Policy.
4/29/08

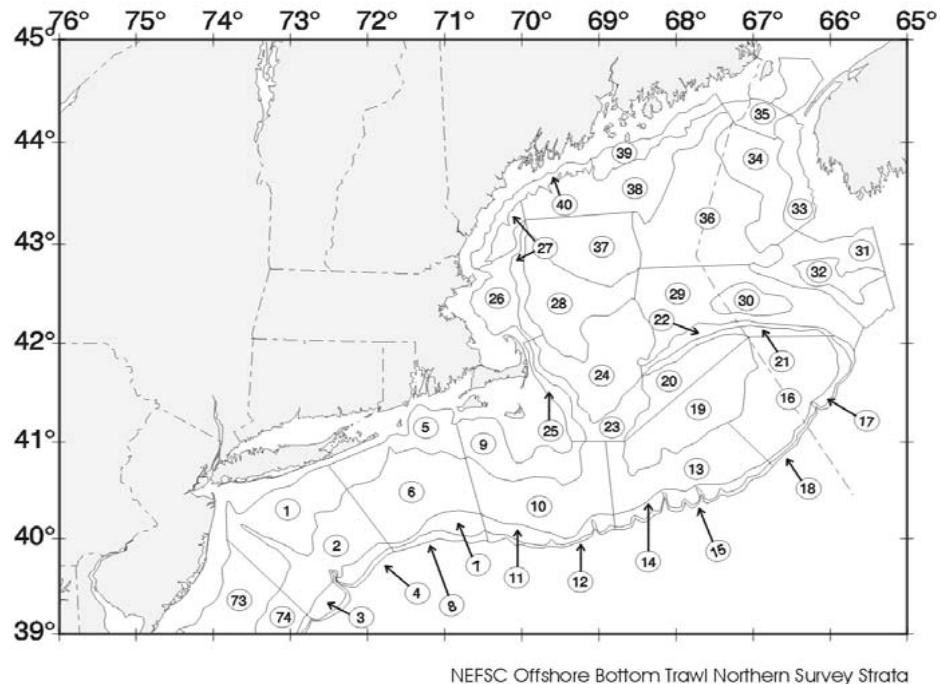
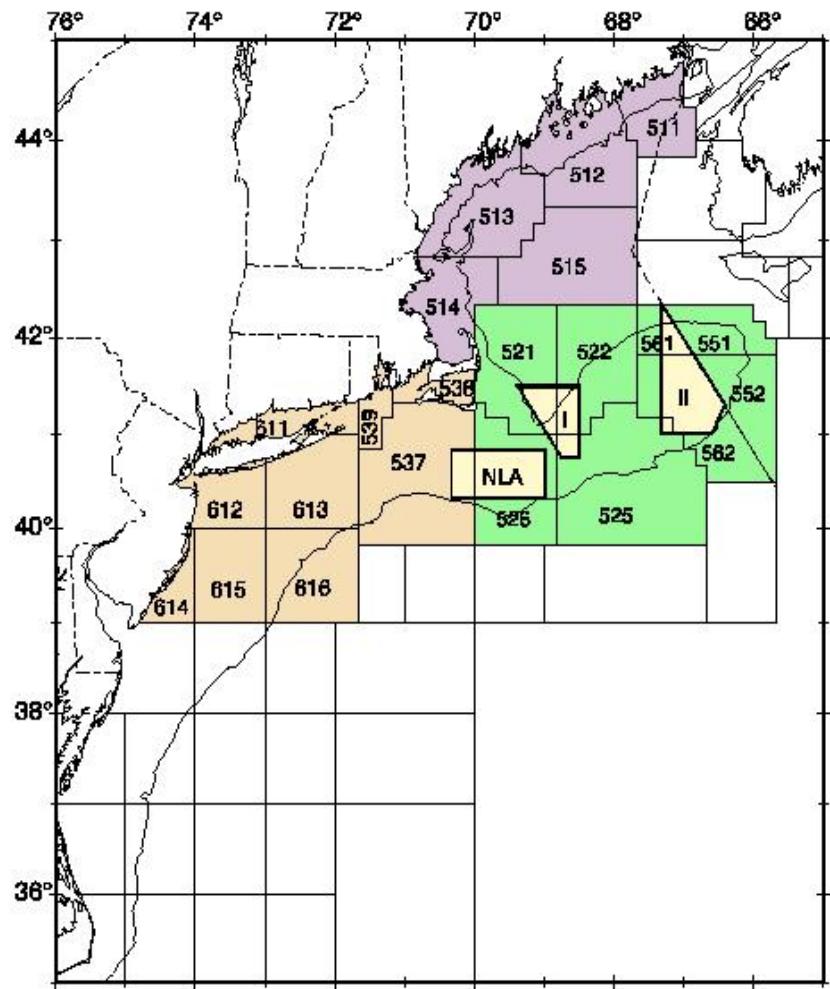
Georges Bank Atlantic Cod



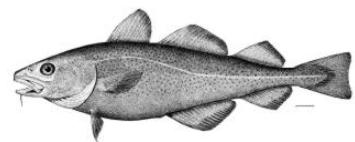
Gadus morhua

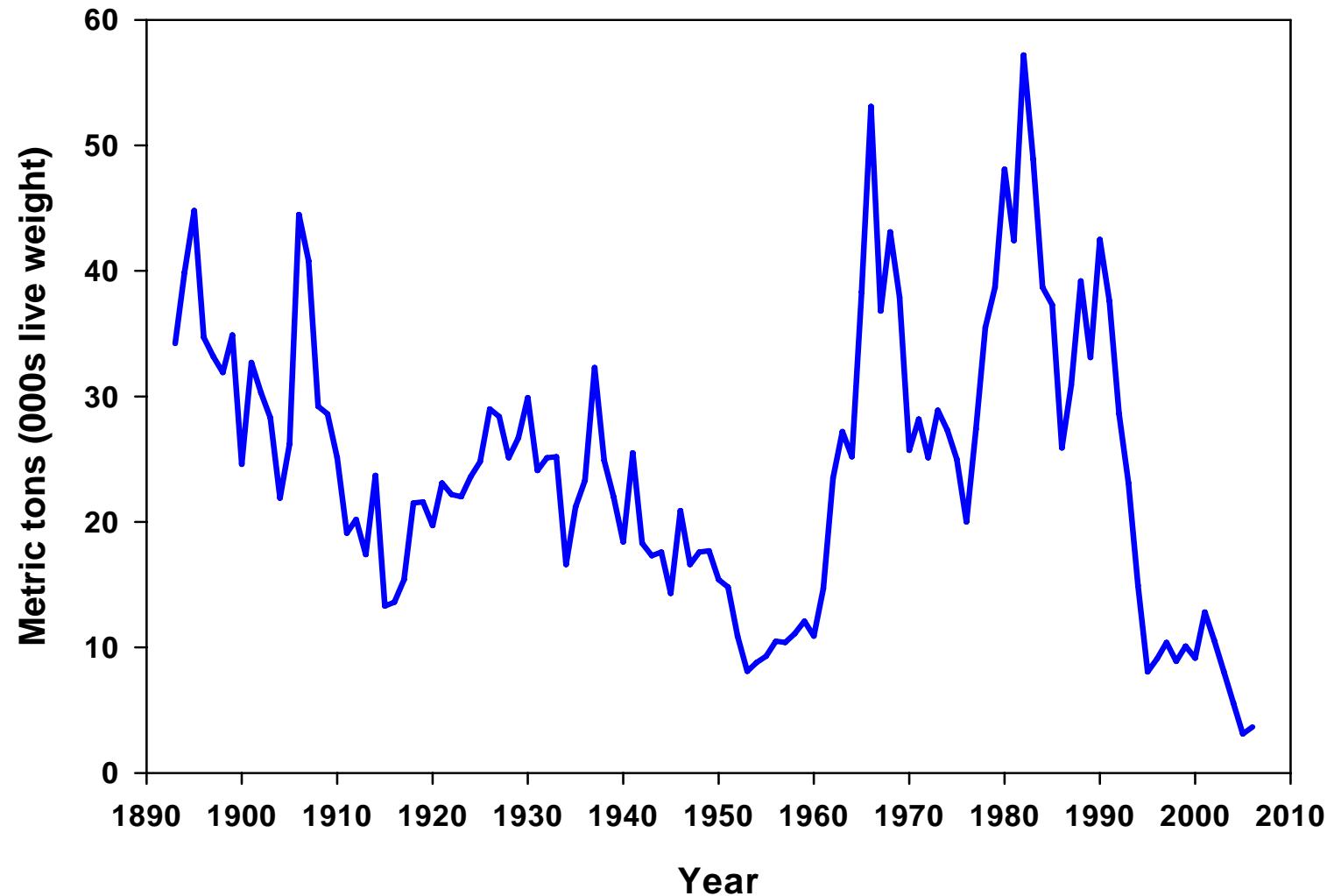
Loretta O'Brien
GARM III BRP Meeting April 28-May 2, 2008
Woods Hole, Ma.

Atlantic Cod Assessment Area

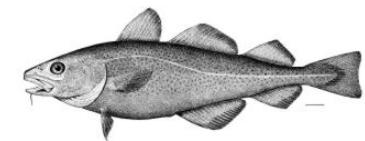


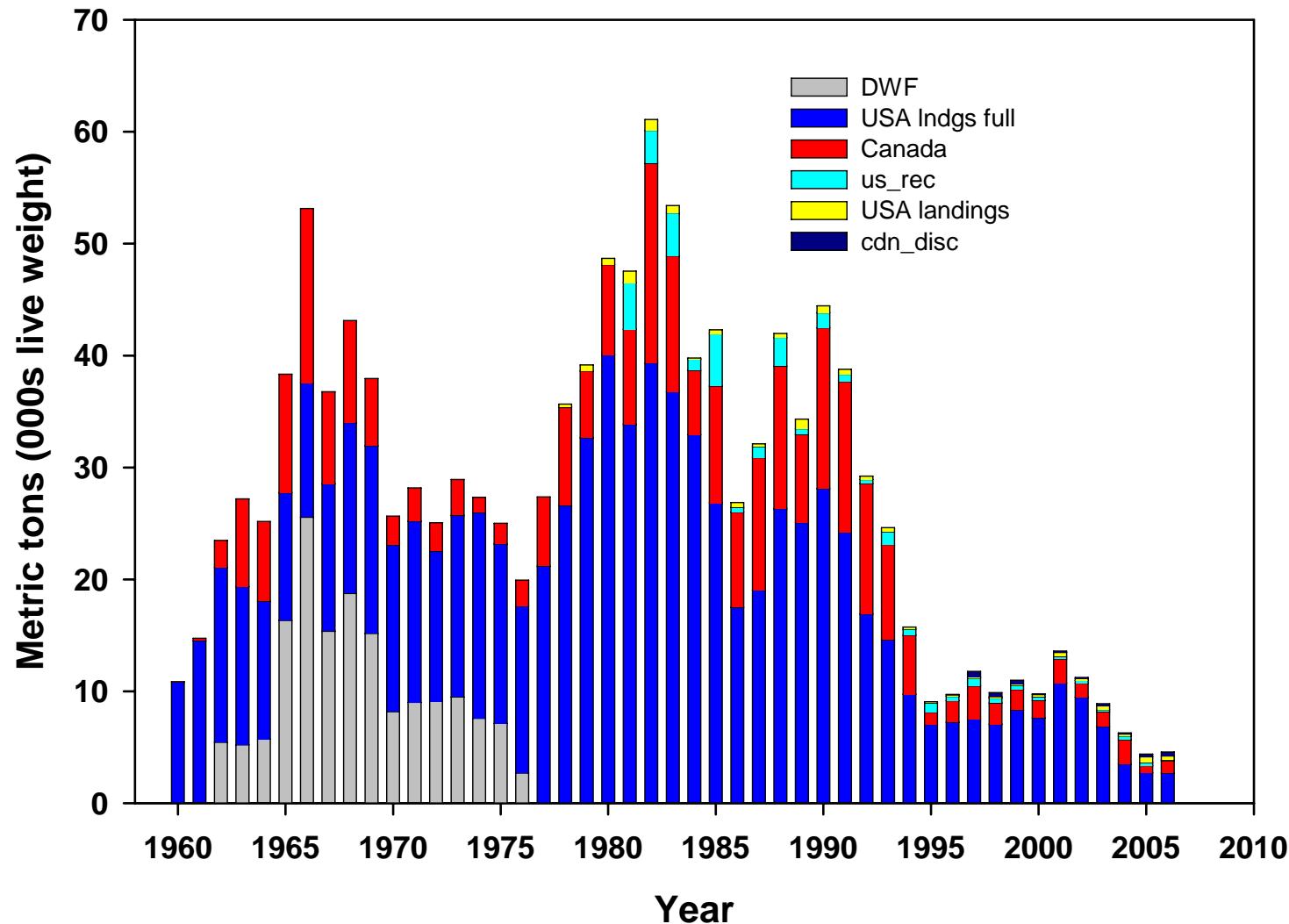
NEFSC Offshore Bottom Trawl Northern Survey Strata

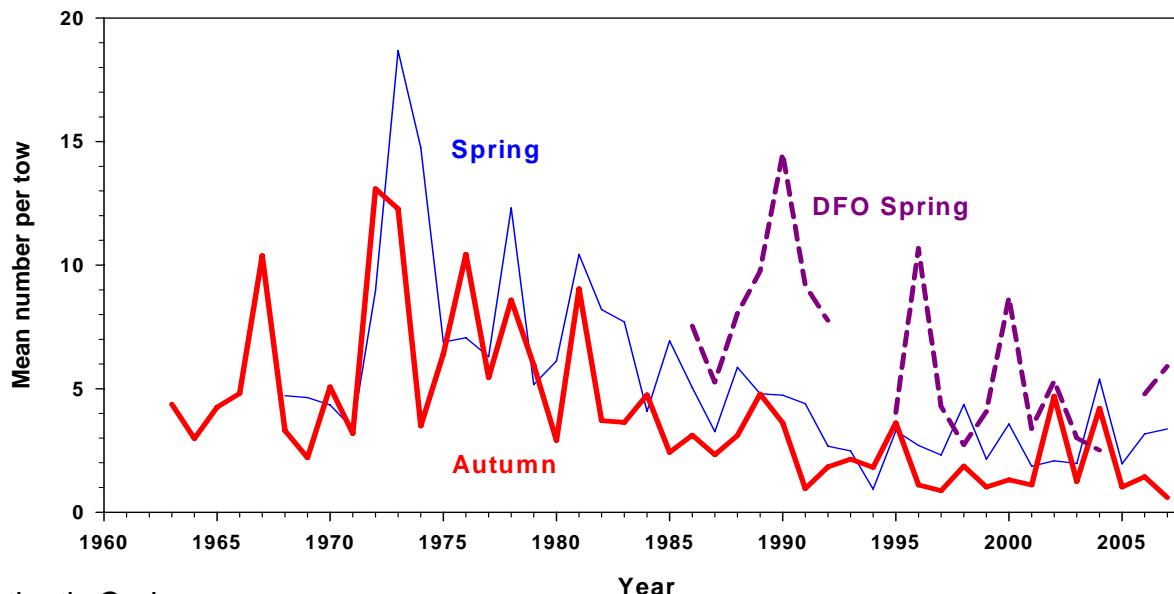
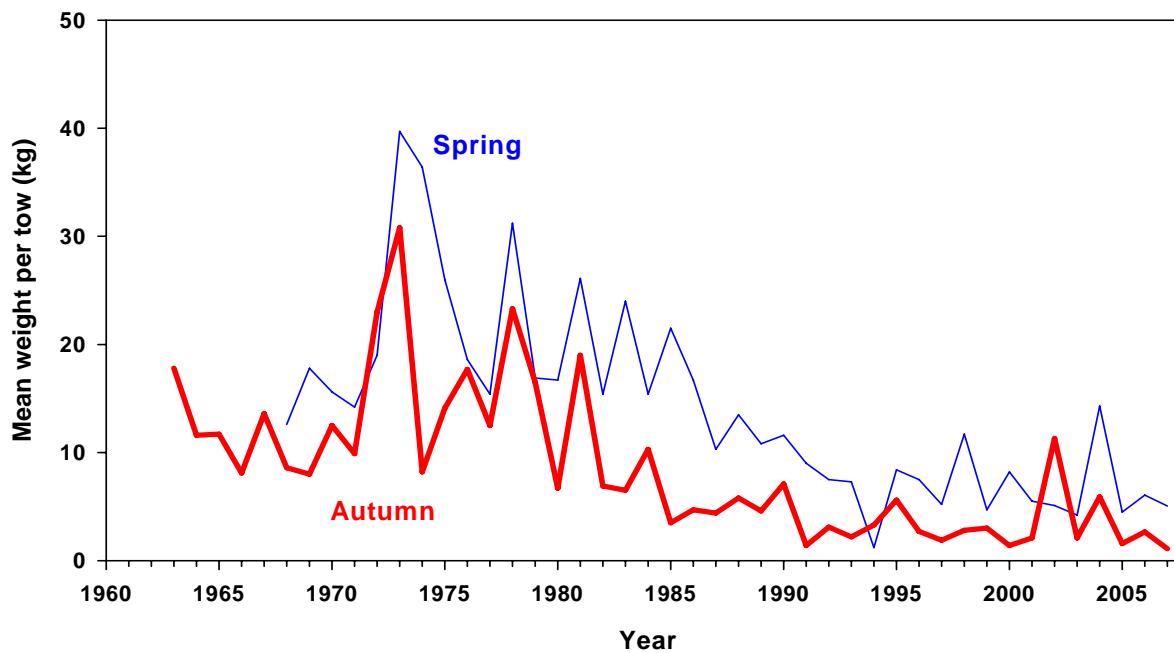




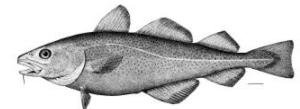
Georges Bank Atlantic Cod

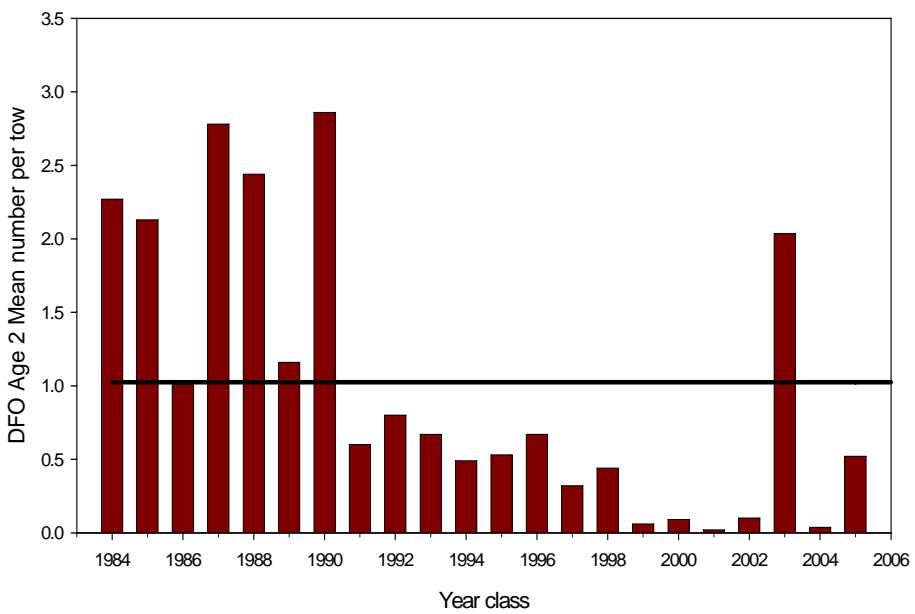
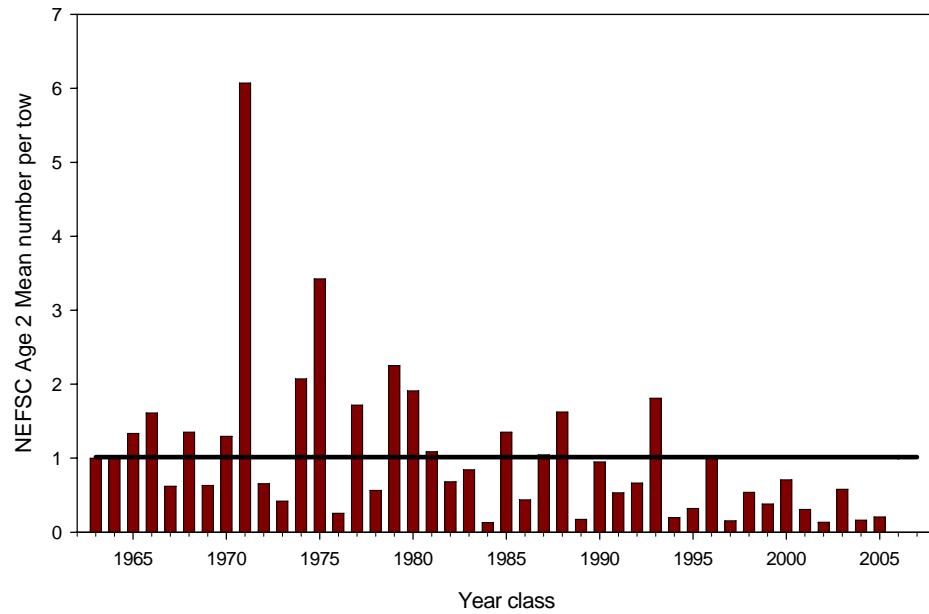
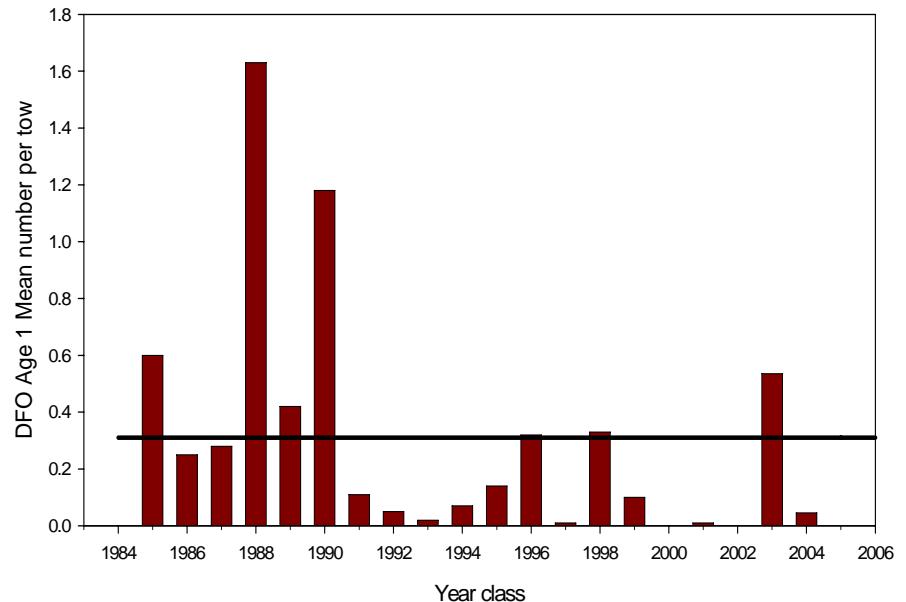
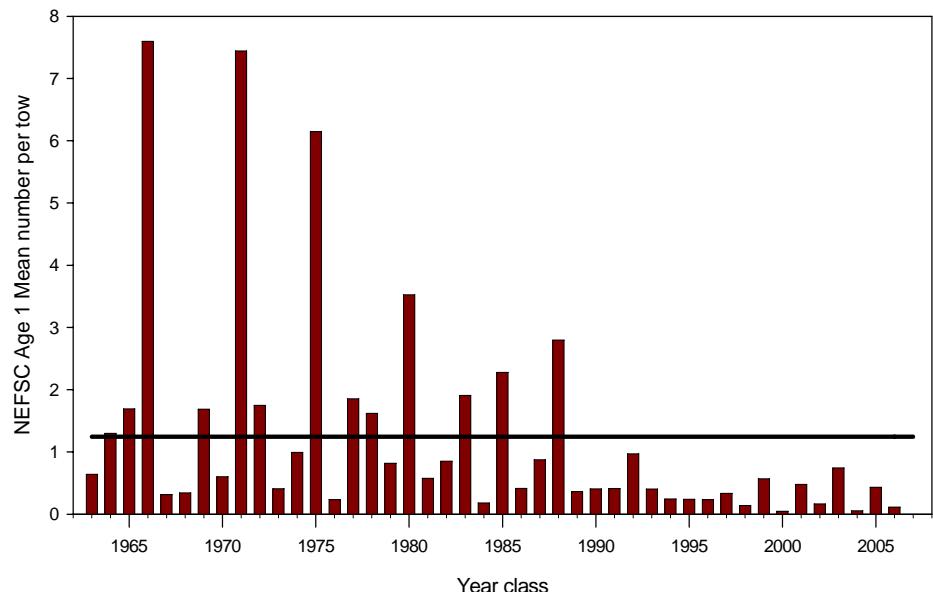




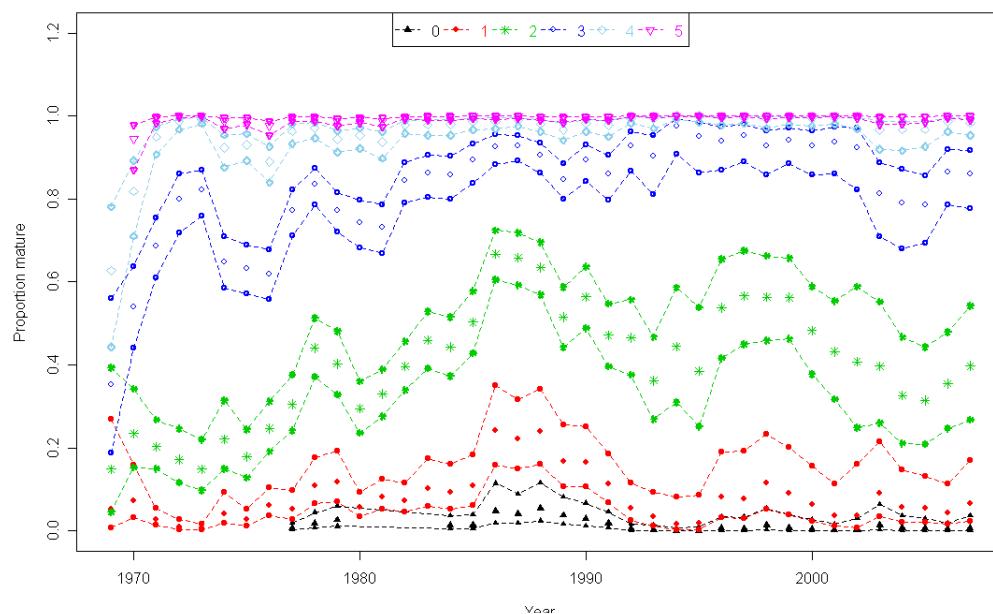


Georges Bank Atlantic Cod

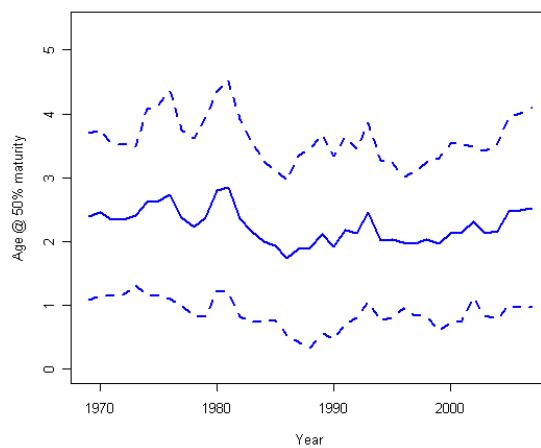




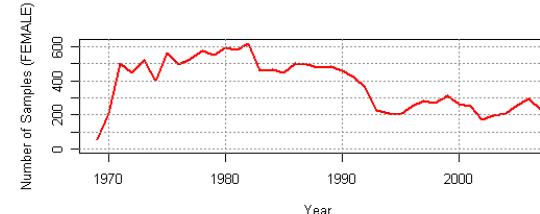
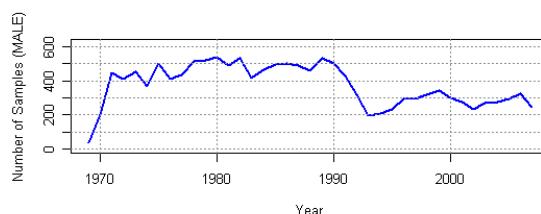
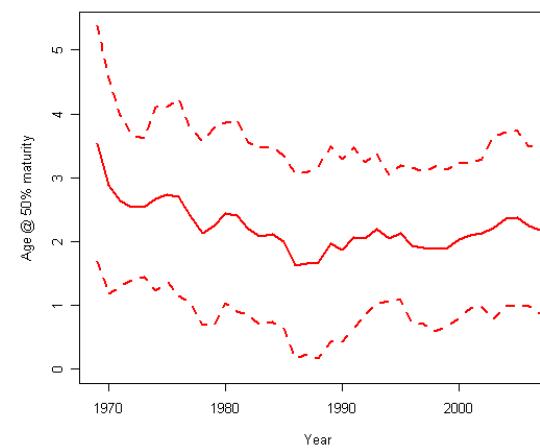
FEMALE Cod maturity at age w/ 95% CI



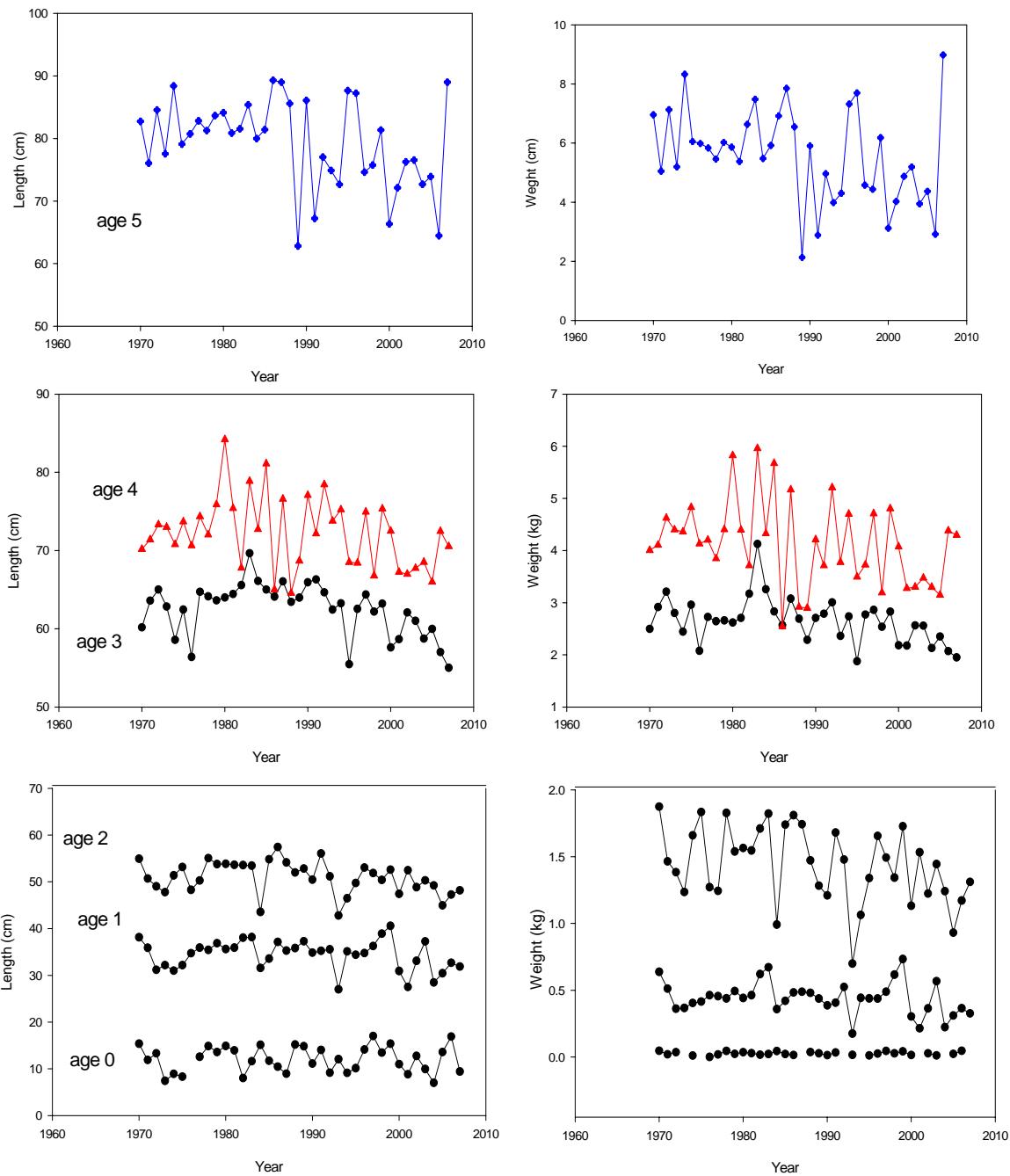
MALE Cod at 50% maturity (3 yr window)



FEMALE Cod at 50% maturity (3 yr window)



NEFSC Autumn Surveys



2004 Assessment: VPA with LAA 10+
1978-2004
Foldest : 4-9

Initial bridge runs:

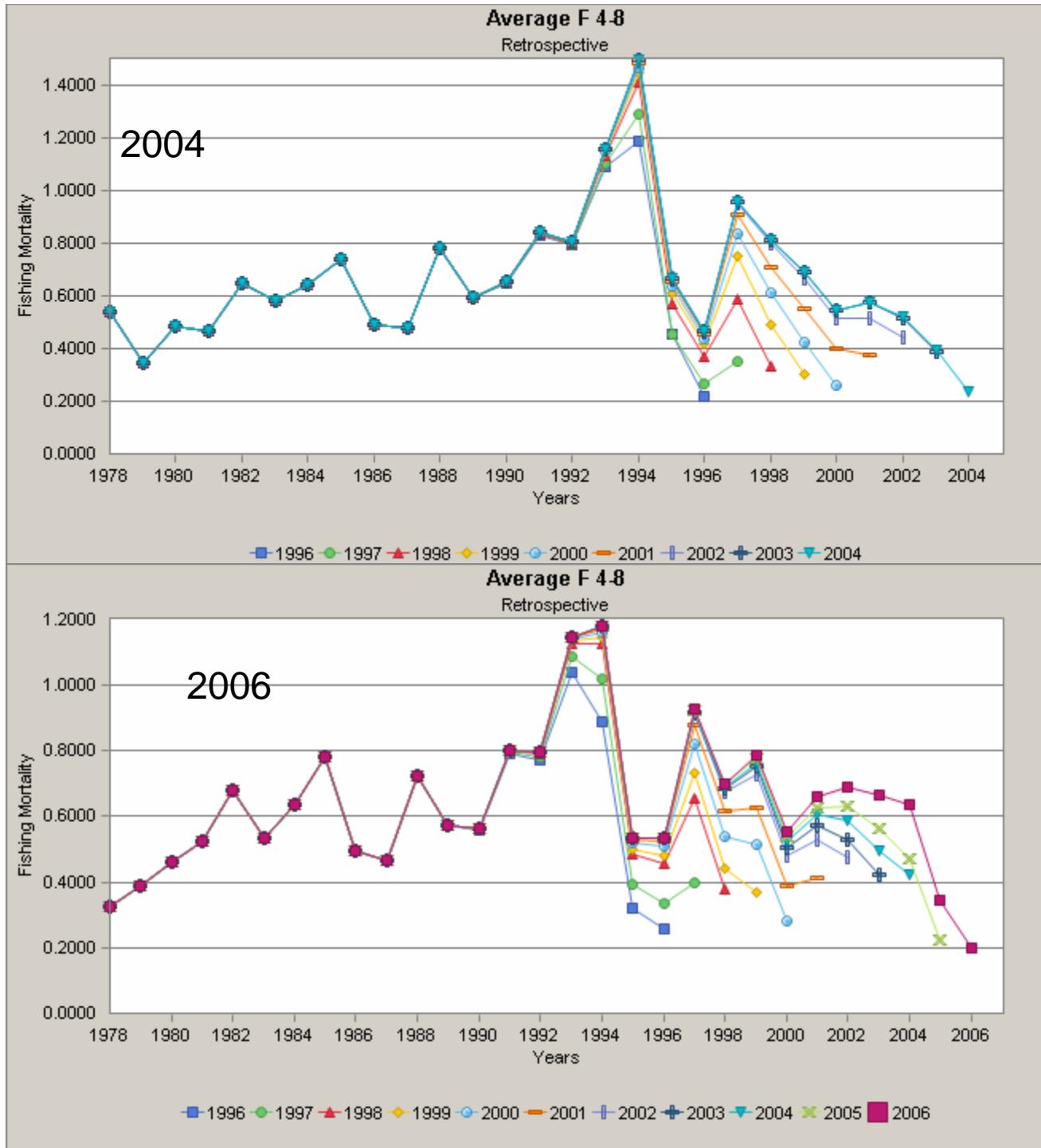
2006 Assessment: VPA with LAA 10+
1978-2006
Foldest : 4-9

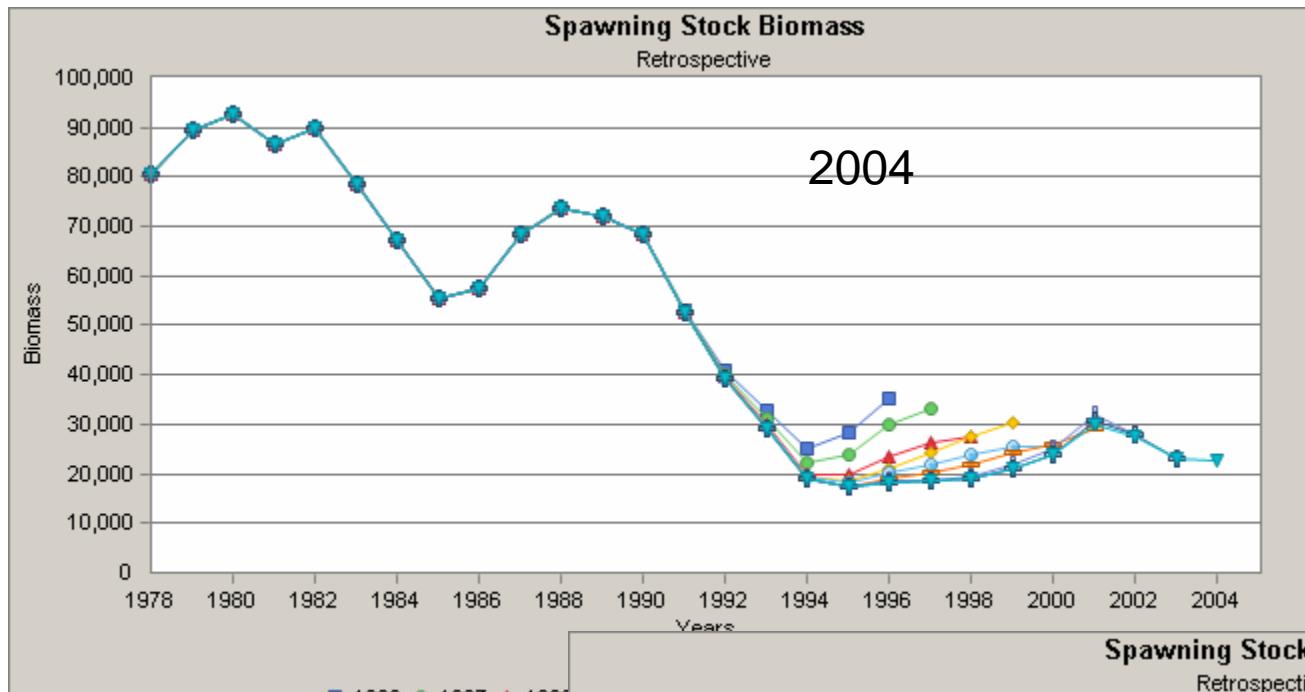
2006 Assessment: VPA with CAA 10+
1978-2006
Foldest : 4-9

2006 BRP Assessment : Explore VPA and ASAP models

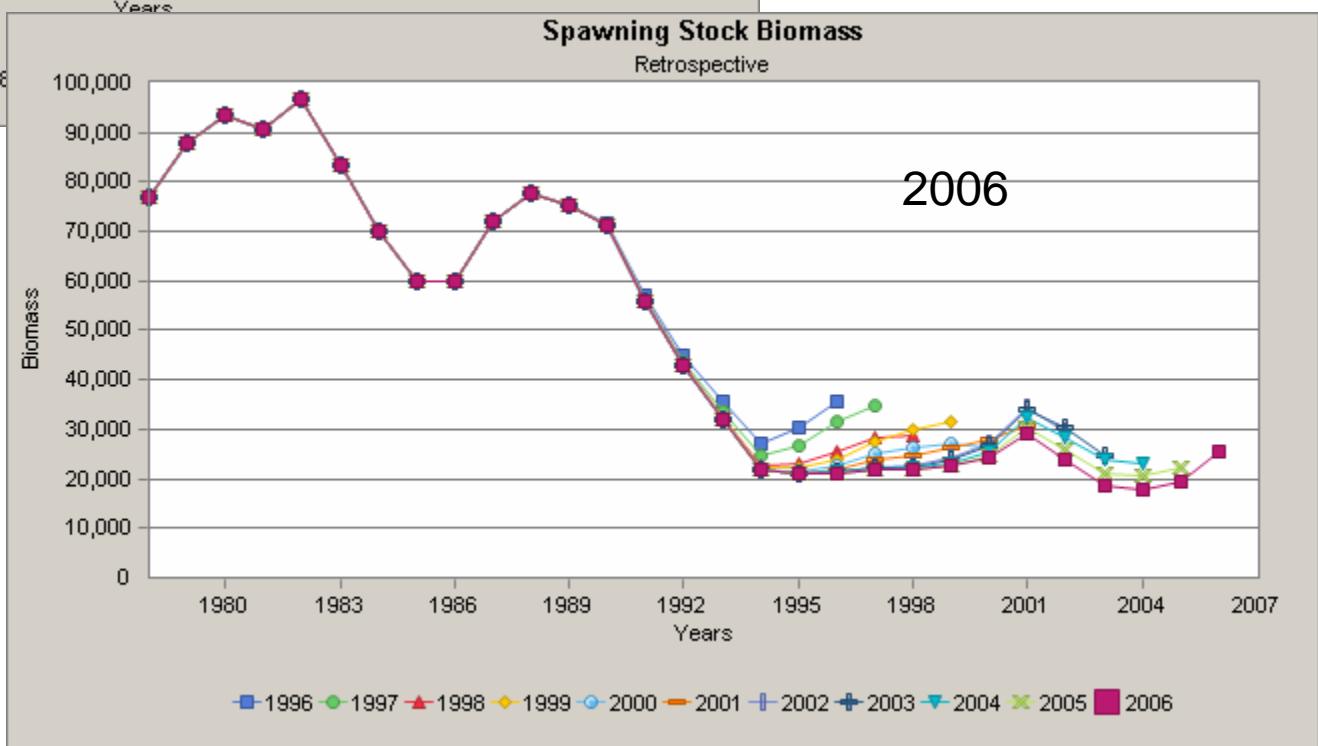
VPA COMPARE OLD/NEW

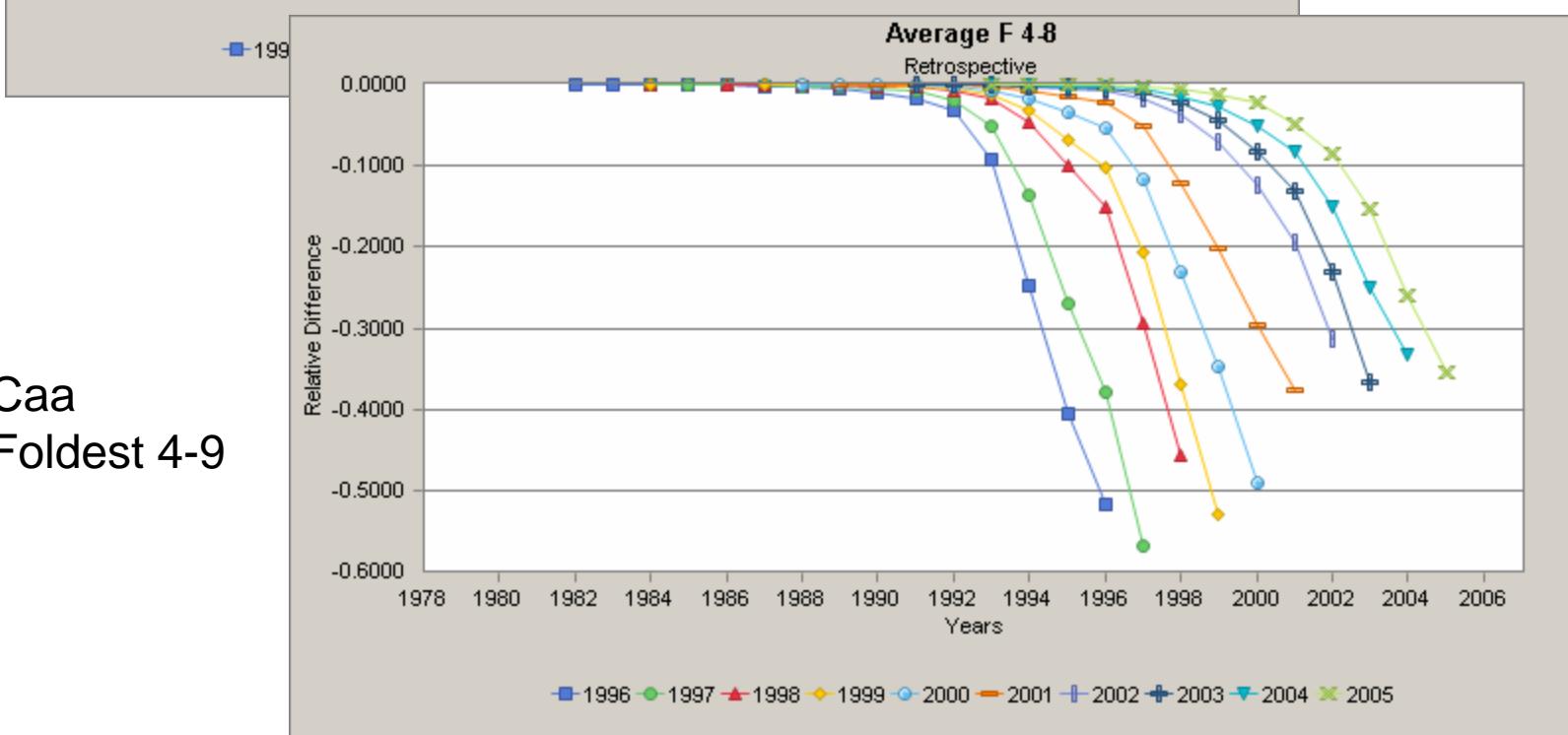
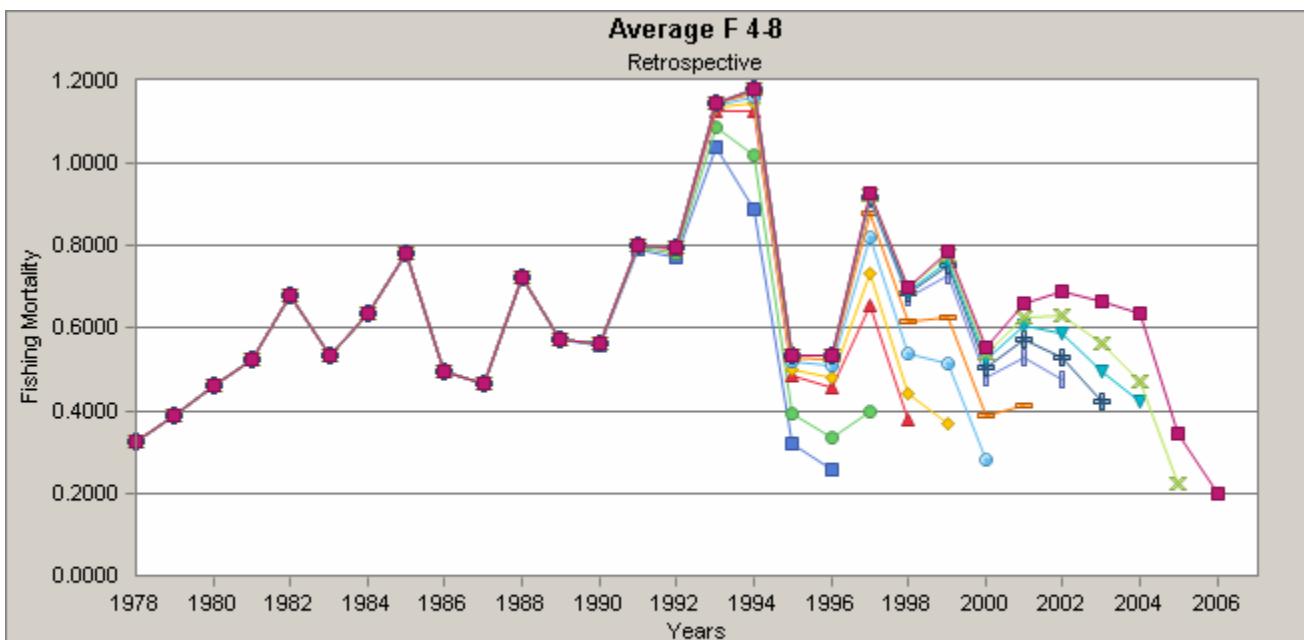
LAA





LAA





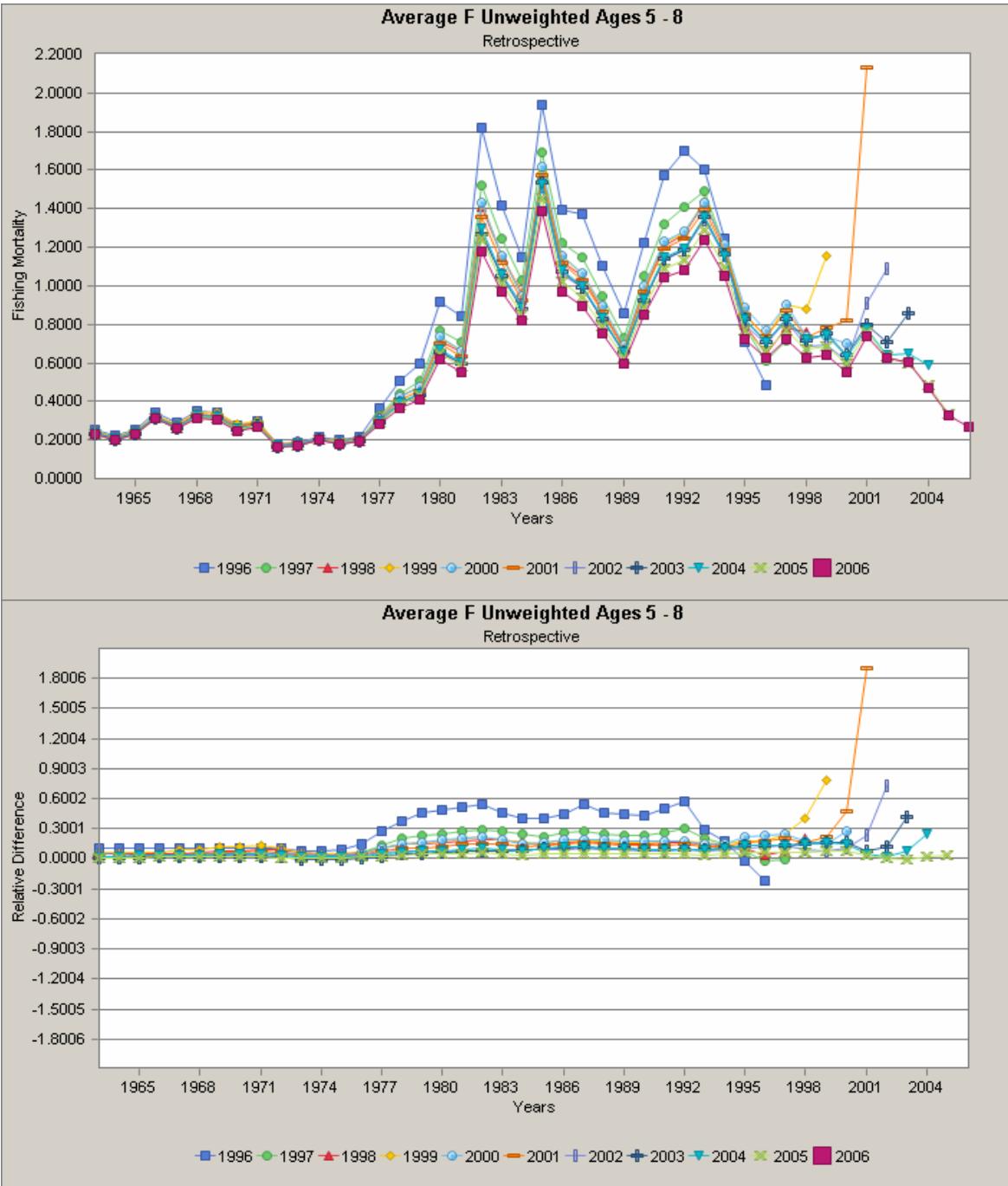
Caa
Foldest 4-9

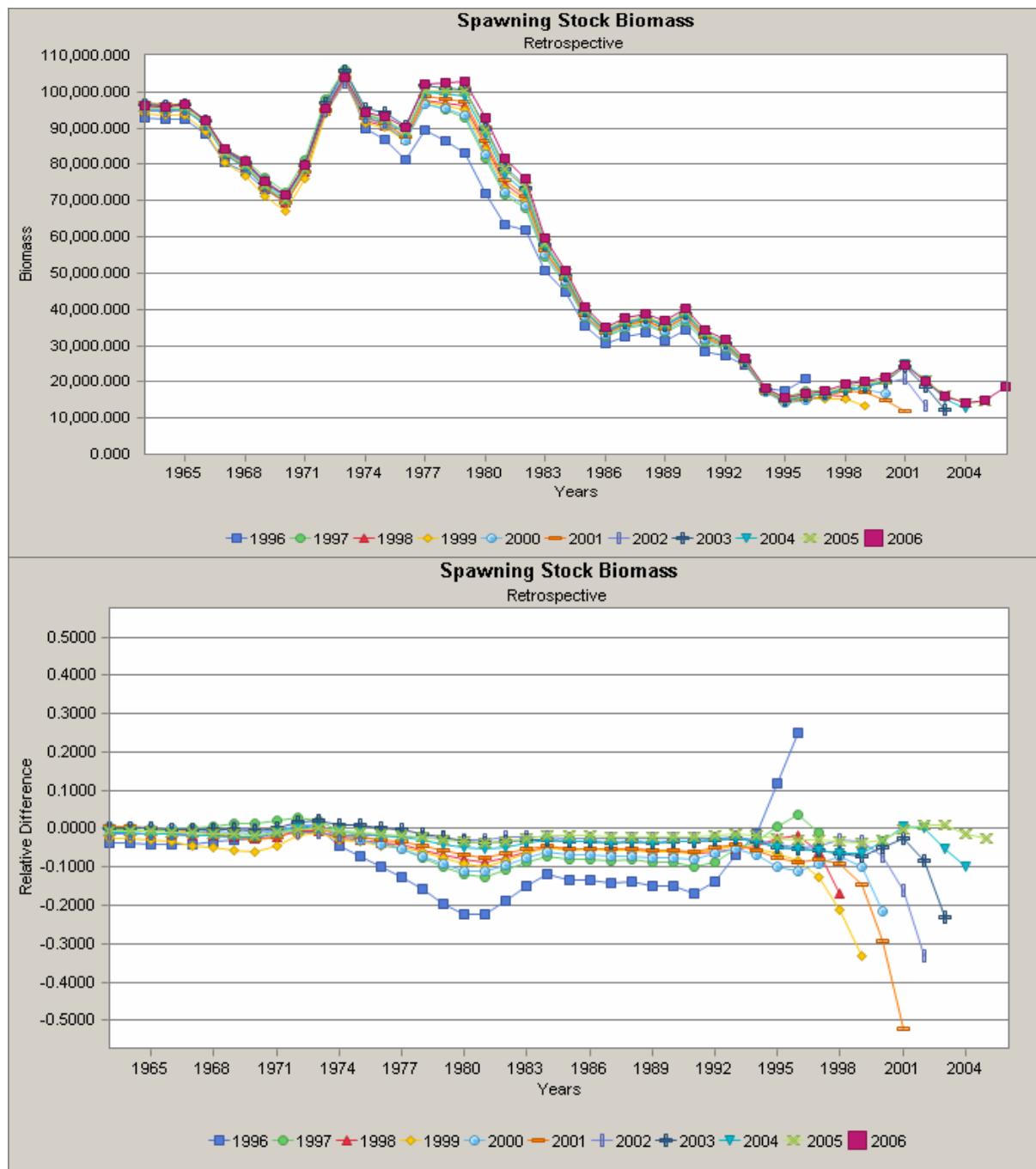
ASAP

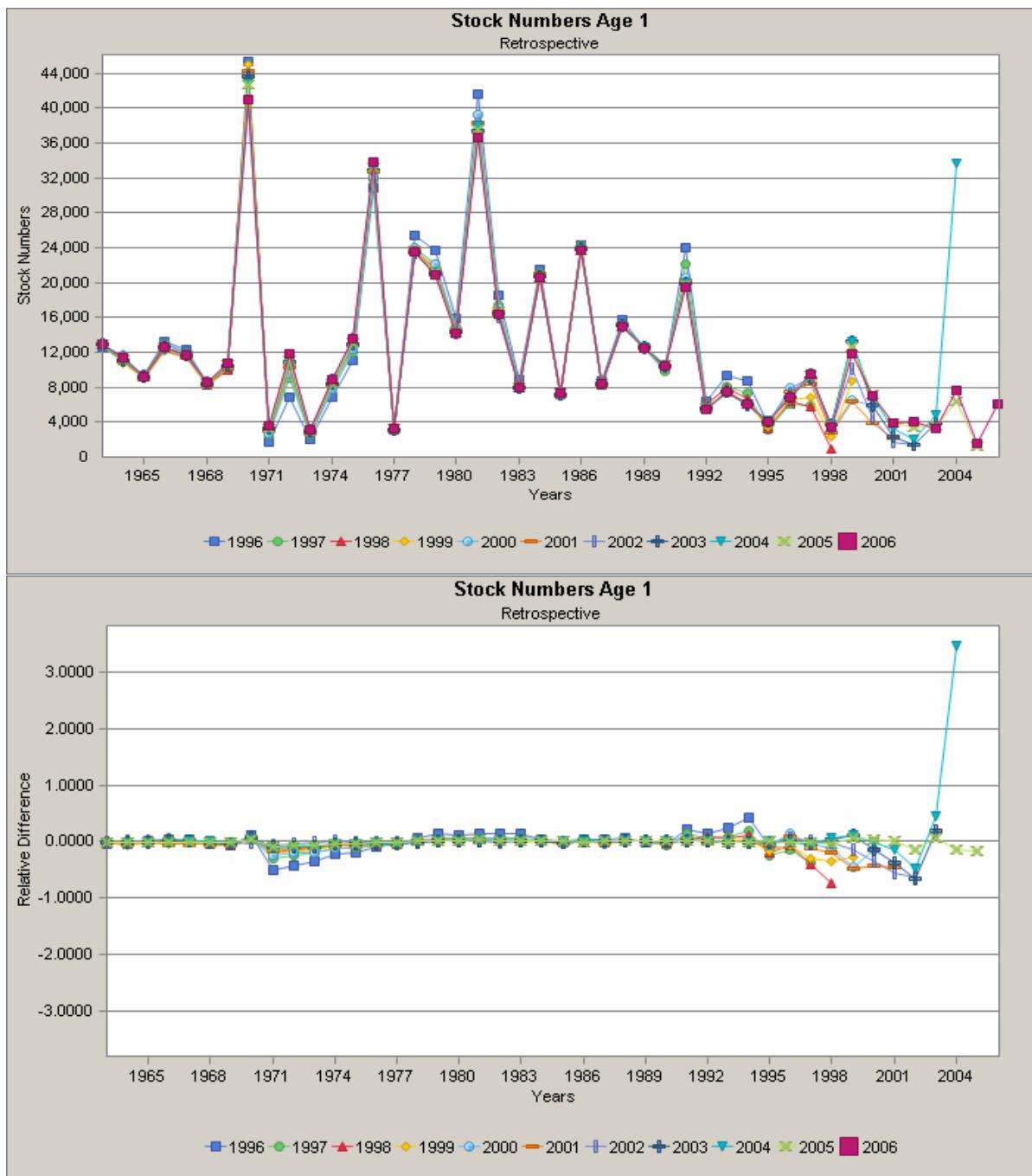
**model 2 fleets CAA 10+,
landings 1930+,
landings 1963-1977, catch 1978+
survey catch biomass 1963+
explore selectivity by age and w/ logistic
4 surveys
splitting surveys or not ~ minimal difference
retrospective similar to unsplit VPA**

ASAP : Final model

**model 2 fleets CAA 10+
landings 1963 +
Age selectivity
F average 5-8
survey catch biomass 1963+
4 surveys
surveys not split
retrospective similar to unsplit VPA**







VPA

Exploratory models

catch 1978+, single CAA

10+, 9+

4 surveys, split at 1994 and not split

Foldest 5-9, 5-6,5-7,6-8

Final model

single CAA 10+, catch 1978+

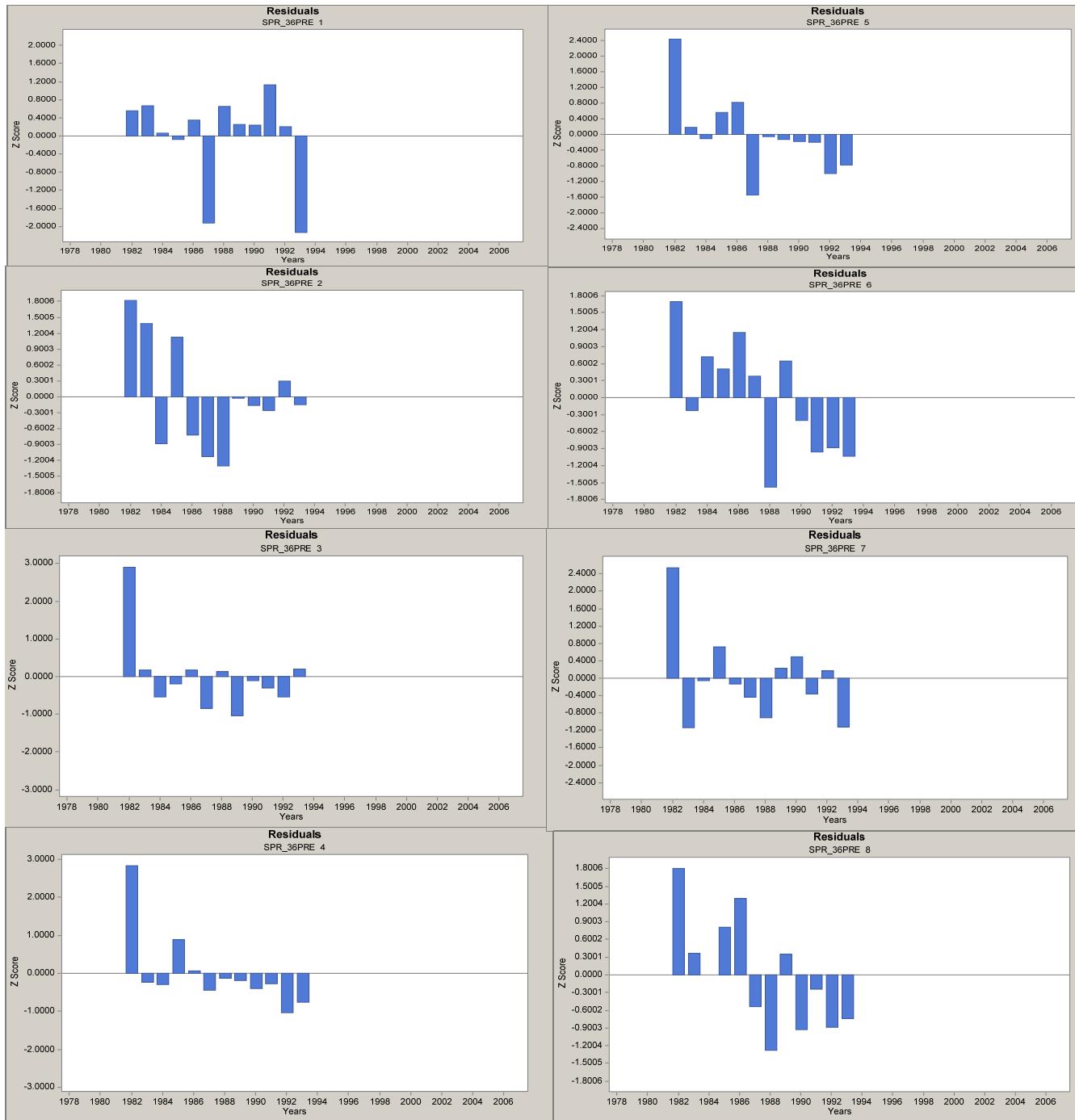
4 surveys

Foldest 5-9

split survey at 1994

less retrospective than unsplit

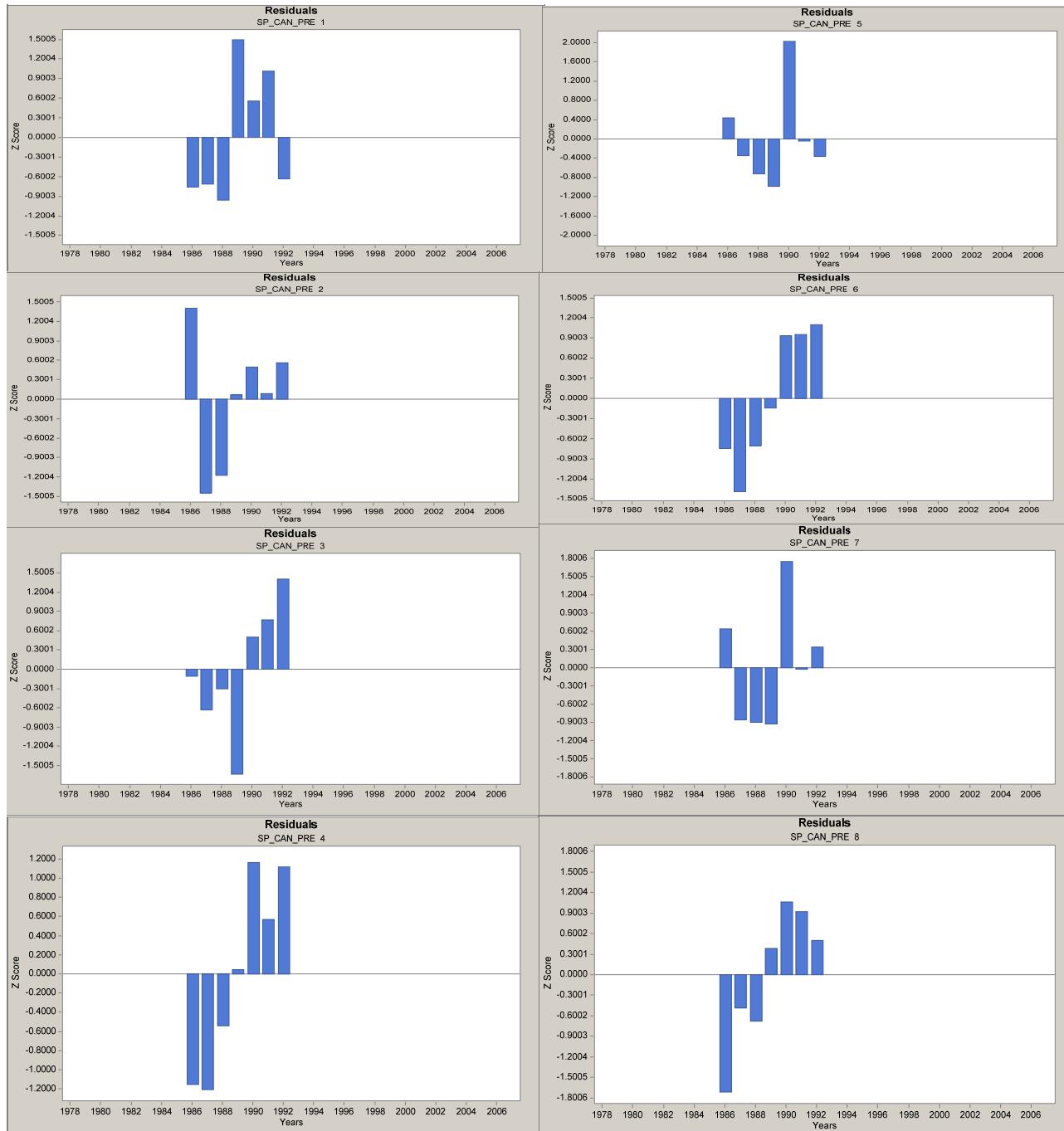
Spring NEFSC pre split



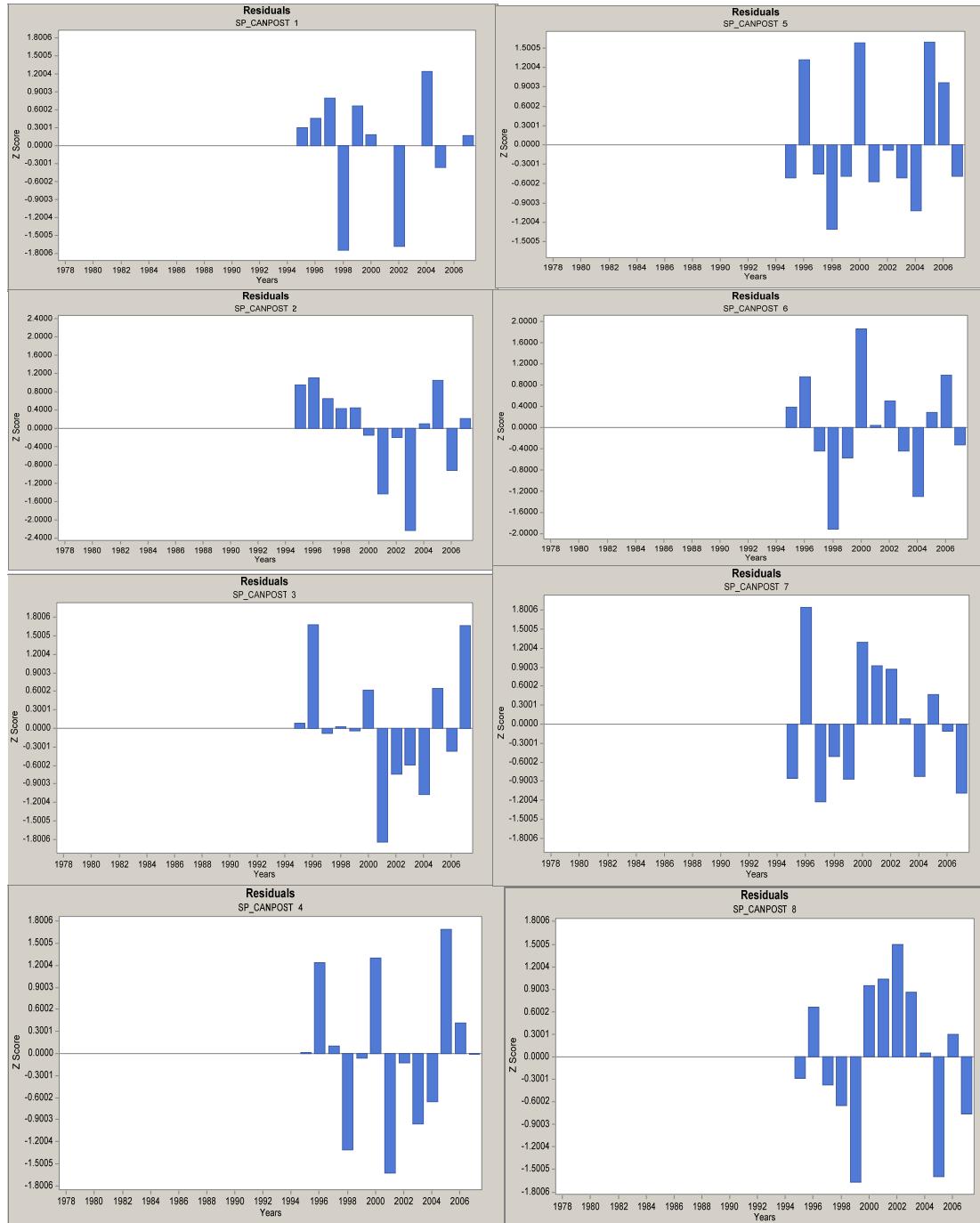
Spring NEFSC post-split

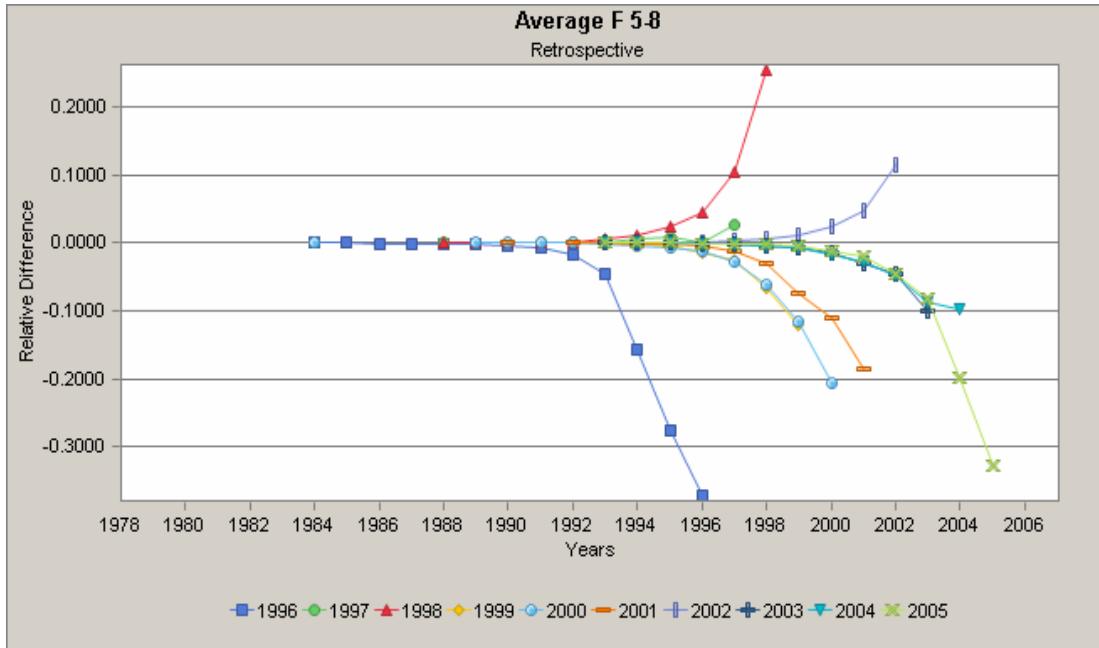
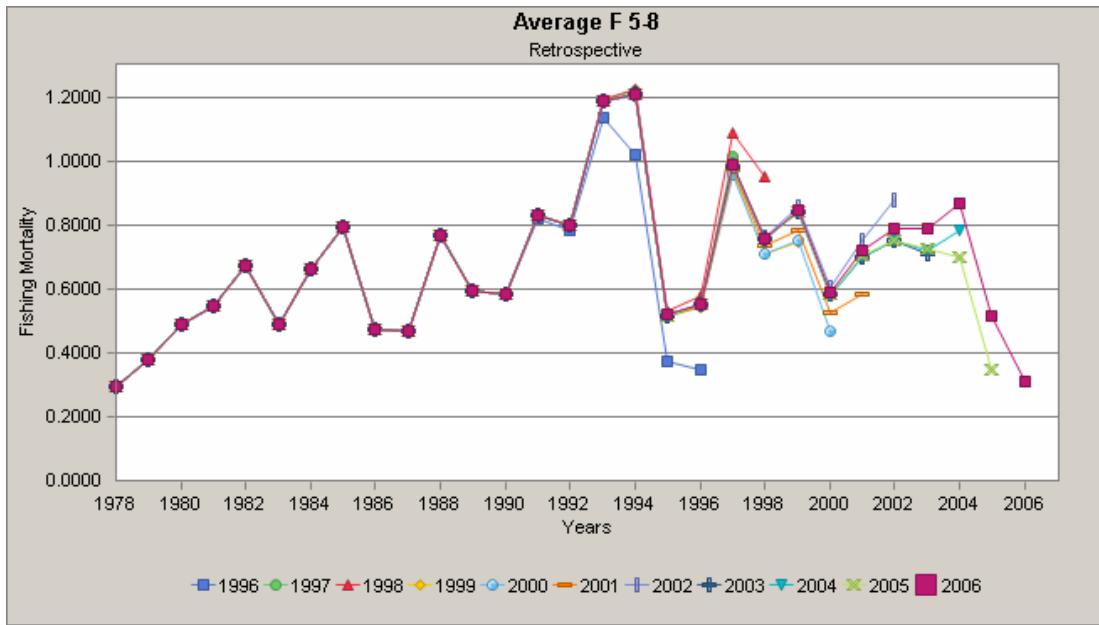


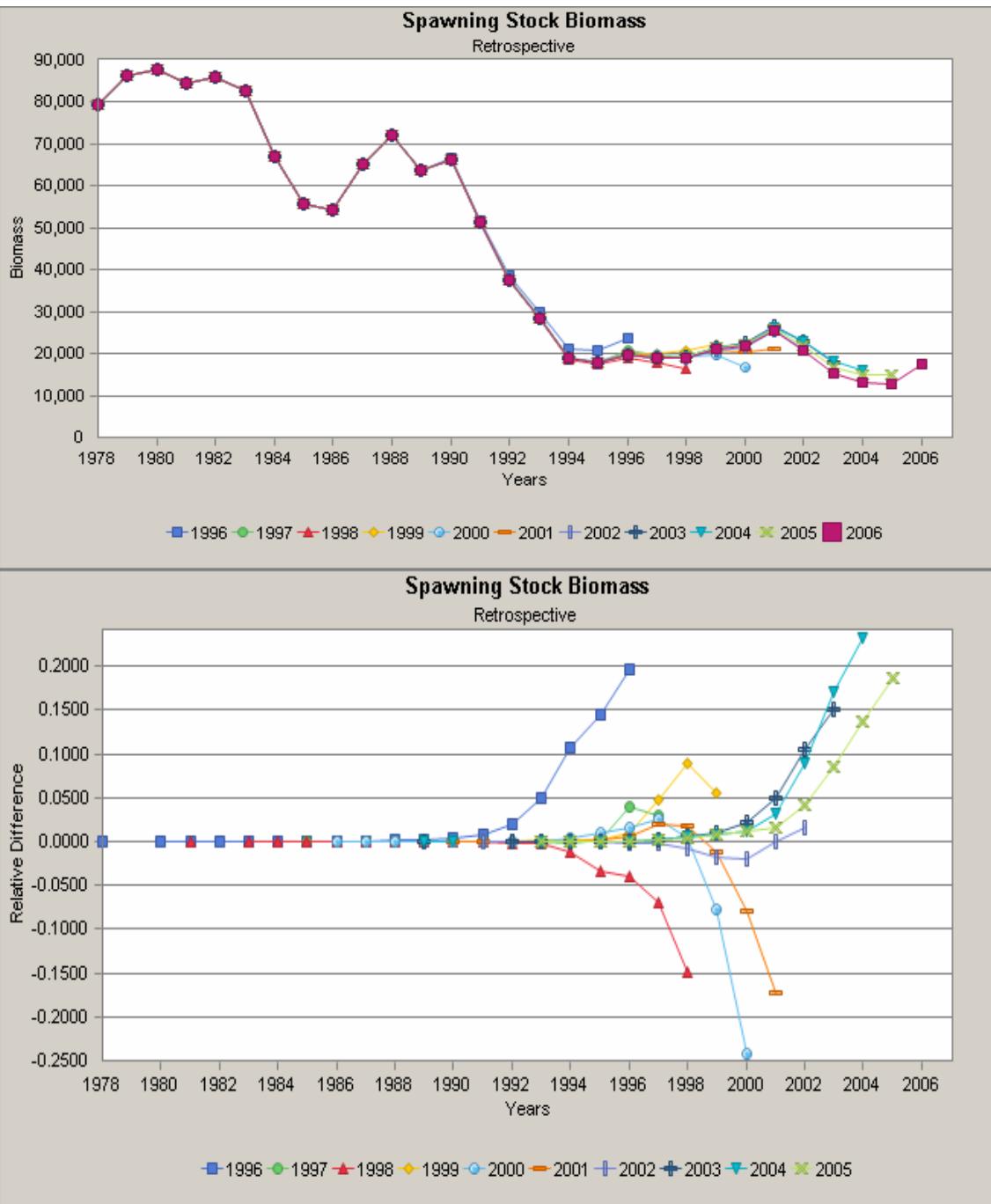
Spring DFO pre-split

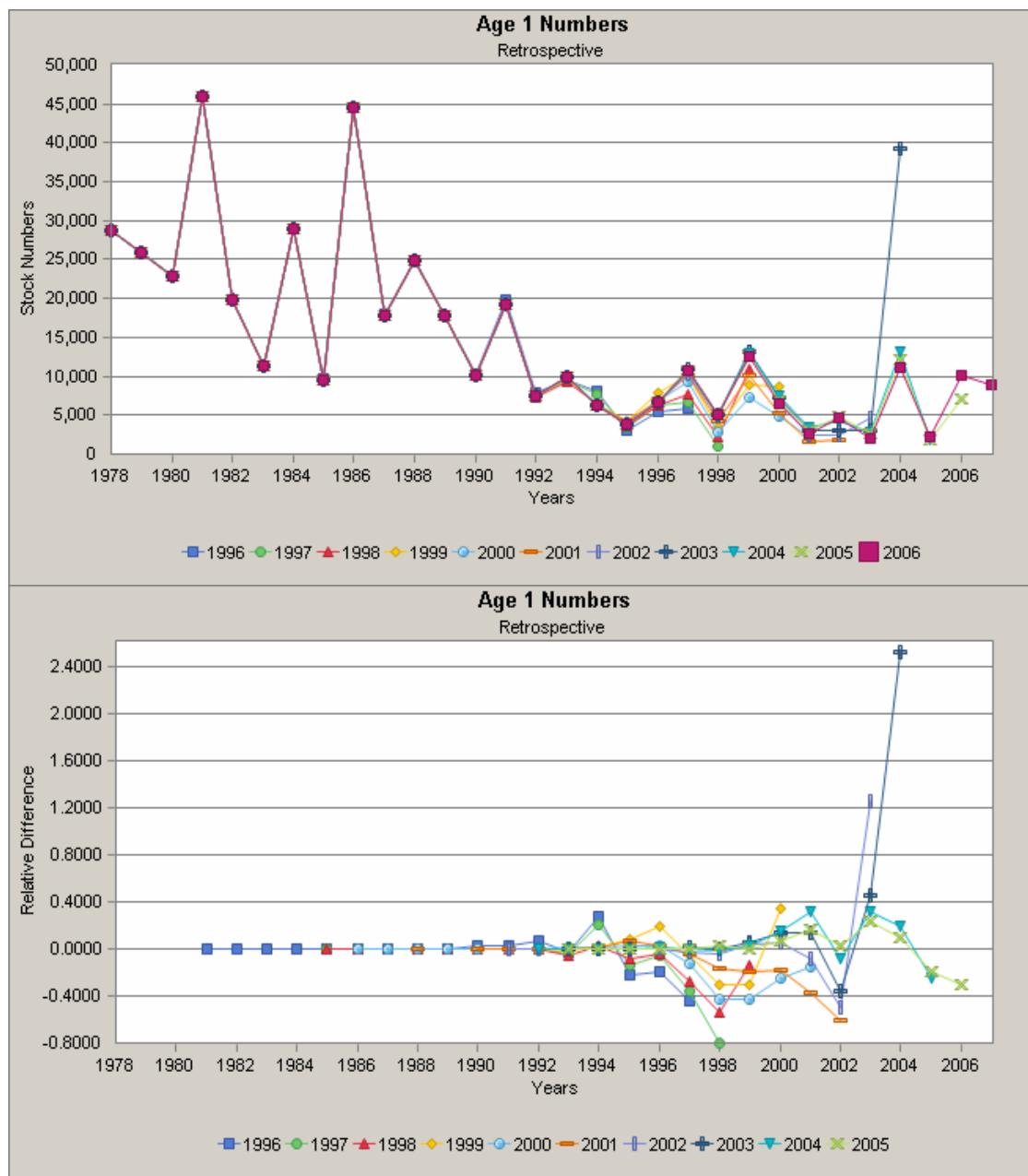


Spring DFO post-split









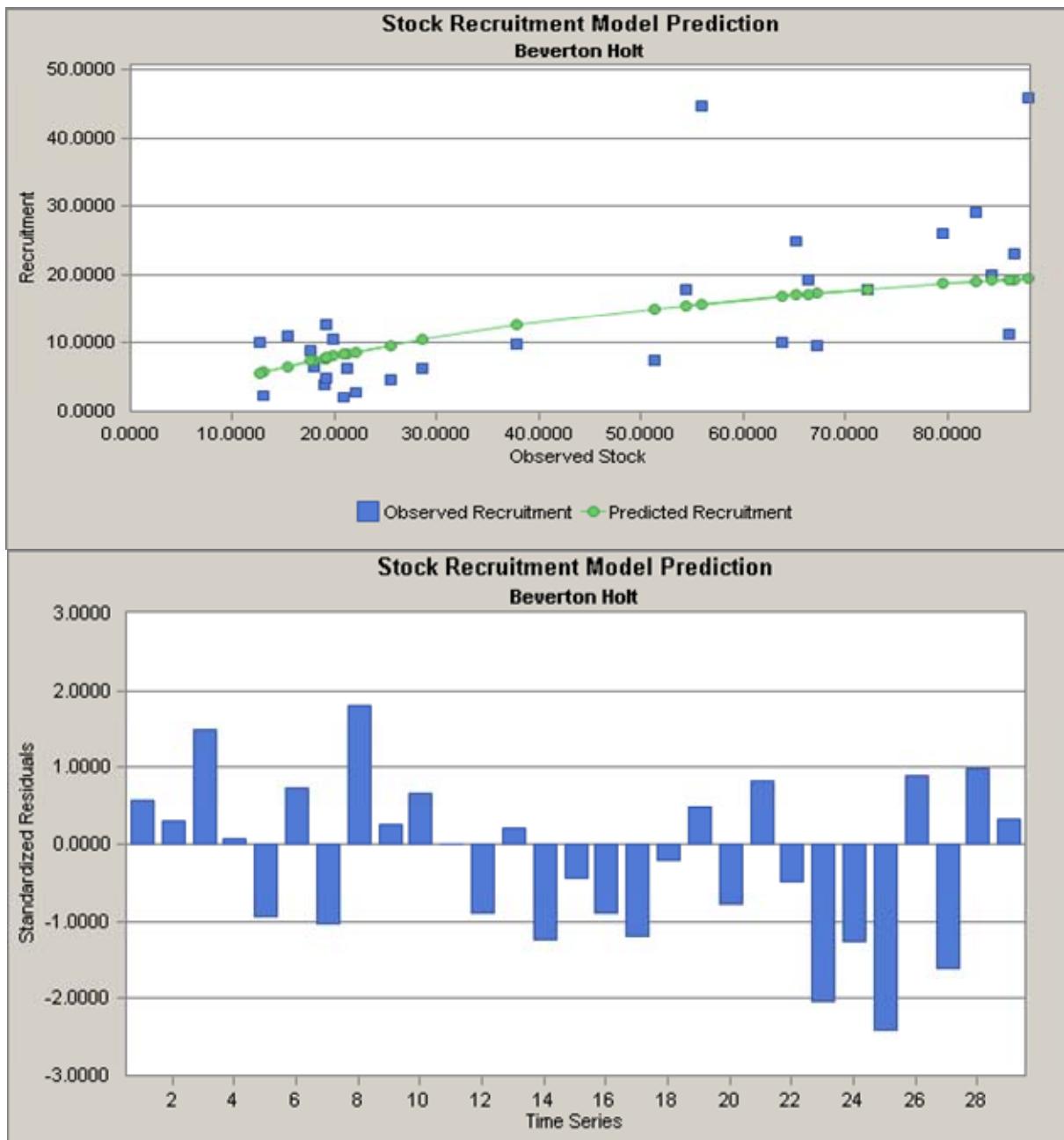
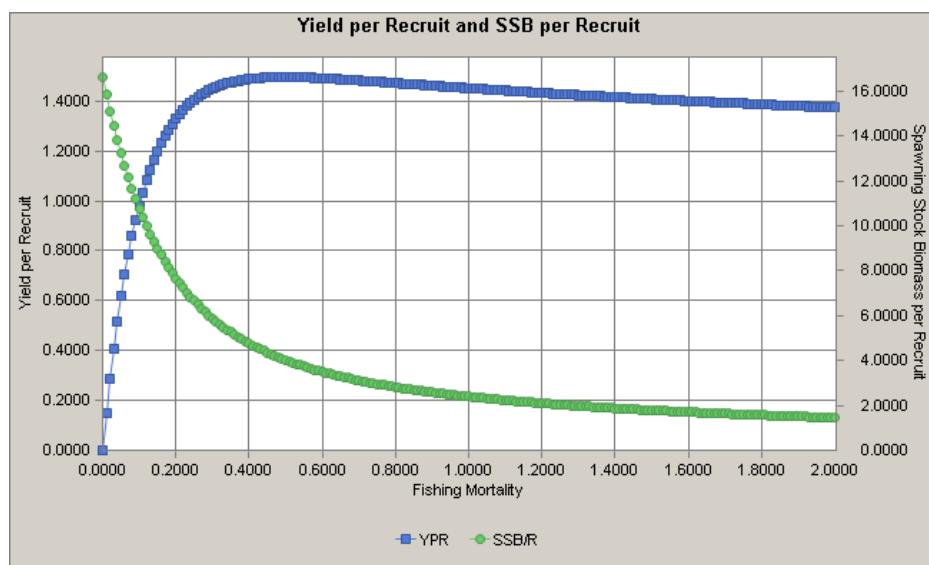


Table A12. Input data for yield-per-recruit and projection analysis. Selectivity and mean weight estimated as an average of 2002-2006 data, and proportion mature estimated from a five-year moving average, 2002-2006.

Age	VPA selectivity	ASAP selectivity	Stock weight	Catch weight	Spawning stock weight	Proportion mature
1	0.00	0.01	0.266	0.447	0.266	0.06
2	0.08	0.13	0.774	1.300	0.774	0.36
3	0.38	0.73	1.721	2.185	1.721	0.83
4	0.74	1.00	2.583	3.016	2.583	0.98
5	1.00	1.00	3.390	3.864	3.390	1
6	1.00	1.00	4.314	4.822	4.314	1
7	1.00	1.00	5.360	5.962	5.360	1
8	1.00	1.00	6.426	7.235	6.426	1
9	1.00	1.00	7.866	8.472	7.866	1
10	1.00	1.00	10.514	10.713	10.514	1



$$F_0.1 = 0.22 \\ F_{max} = 0.5$$

$$F_{40\%} = 0.25$$

Table A13. Biological reference points as esimated by YPR, VPA, ASAP, and projection analysis from the current assessment, 1978-2006 ,and the BRPs derived by BRP working group (NEFSC 2002).

Model	F40%	Fmsy	SSBmsy	MSY	alpha	beta steepness
YPR						
Proj. (emp)	0.251		93,723	19,836		
VPA						
B-H		0.225	174,292	33,983	32.982	60.9238
Proj.(B-H)		0.225	274,211	52,714	32.982	60.9238
ASAP						
internal		0.17	107,622	17,428	20286	48833
Proj.		0.17	187,510	30,962	20286	48833
BRP WG 2002						
		0.18	217,000	35,200	28.2855	77.6945

Summary

- Preferred model is VPA with split survey based on retro
- Range of MSY from VPA S/R within historical landings

Current Status:

GB Atlantic cod are overfished and overfishing is occurring

Landings: 3,663 mt in 2006 (2,566 mt US, 1,097 mt Canada)

As of GARM II

Landings in 2004: 5,563 mt

F (ages 4-8) = 0.24

SSB= 22,564 mt

Reference Points

Yield and SSB/R

$$F_{0.1} = 0.17$$

$$F_{\max} = 0.33$$

$$F_{40\%} = 0.17$$

MSY-based Reference Points

$$\text{MSY} = 35,200 \text{ mt}$$

$$\text{SSB}_{\text{MSY}} = 217,000 \text{ mt}$$

$$\text{FMSY} = 0.18$$

GB cod biomass sv indices remain below the long term average (43 yrs)

Fishing mortality declining since 1997 currently at the lowest level.

SSB reached record low in 1995, SSB in 2004 was 22,600 mt ,10% of SSB_{MSY}.

Current Model Approach

- **Age-structured model : VPA**

1st assessed with VPA in 1986

Prior to 1994, CPUE and survey tuning indices, w/ moderate retrospective

Post 1994, retro flipped, and retro stronger for F (no CPUE, sampling/management changes)

Recent retro may be due to changes in selectivity -gear changes/closed areas

Strengths:

Applicable to available data:

Landings at age - USA and Canada

Discards at age - USA and Canada

3 surveys for calibration -NEFSC spr,fall, DFO spr

Moderate retro in recruits (age 1 and SSB)

Tracks fleet and stock dynamics, trends in SSB, year class strength

Same model as used by DFO for 5Zjm cod in TRAC

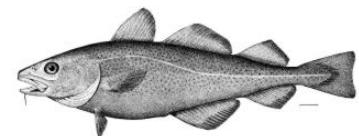
Weaknesses:

Stronger retrospective in F in recent years

Changes in selectivity can not be parameterized in VPA

Does not utilize removals not characterized by age, i.e. historical landings, recreational data

Georges Bank Atlantic Cod



Feasibility of changing models

Forward projecting model

feasible alternative to VPA, based on comparison of SS2 and VPA results

Software and data both available

Proposed Model

ASAP – local technical and software support

but.. Transboundary stock, need to consider implications re:TMGC

...ability to

