Atlantic Sharpnose Shark Assessment
State-space, Age-structured Production Model (SPASM)

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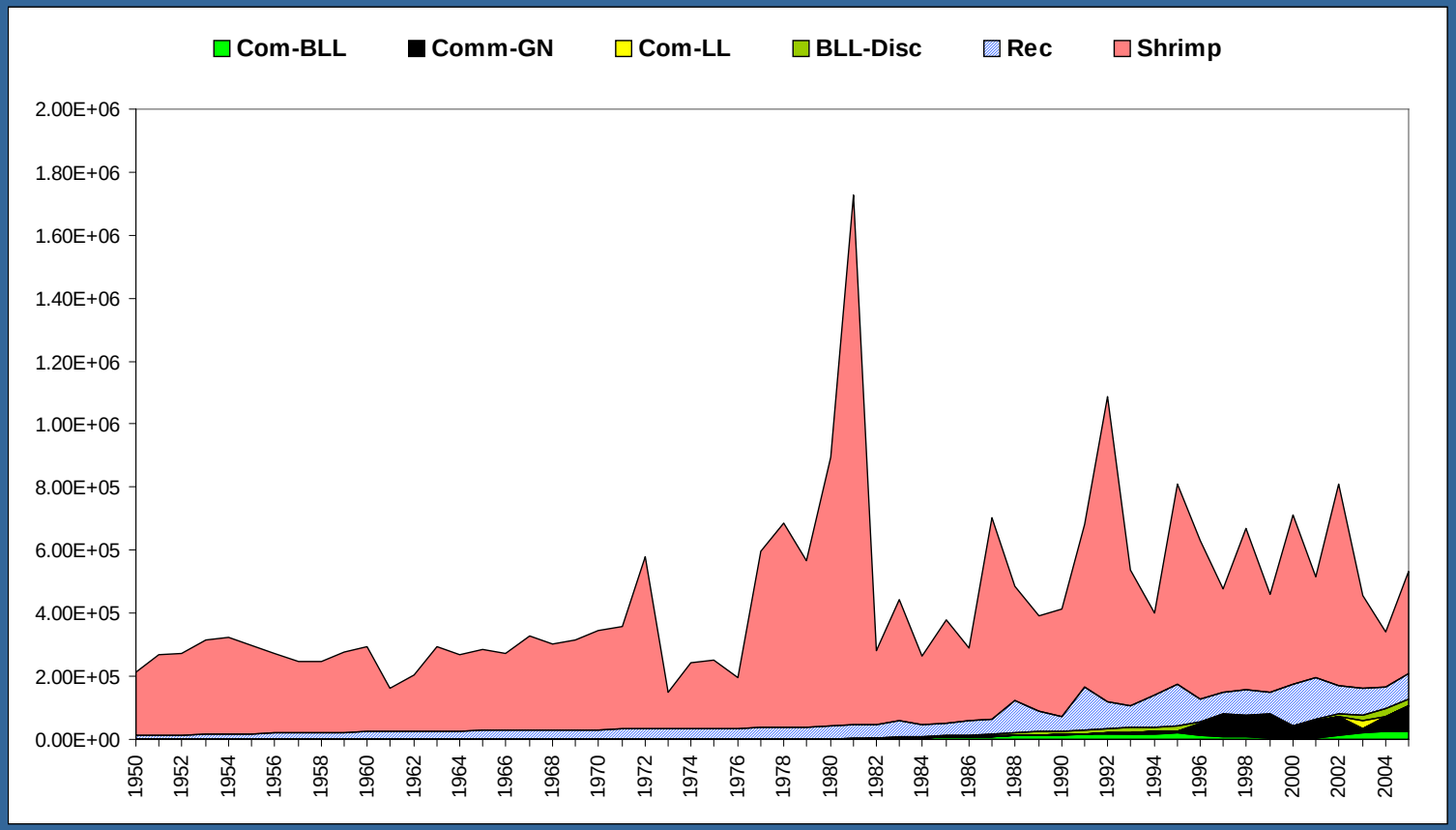
OUTLINE

1. Data Inputs
   a. Fishery
   b. Biology
2. Model Description
3. Base Model and Results
4. Sensitivity Cases

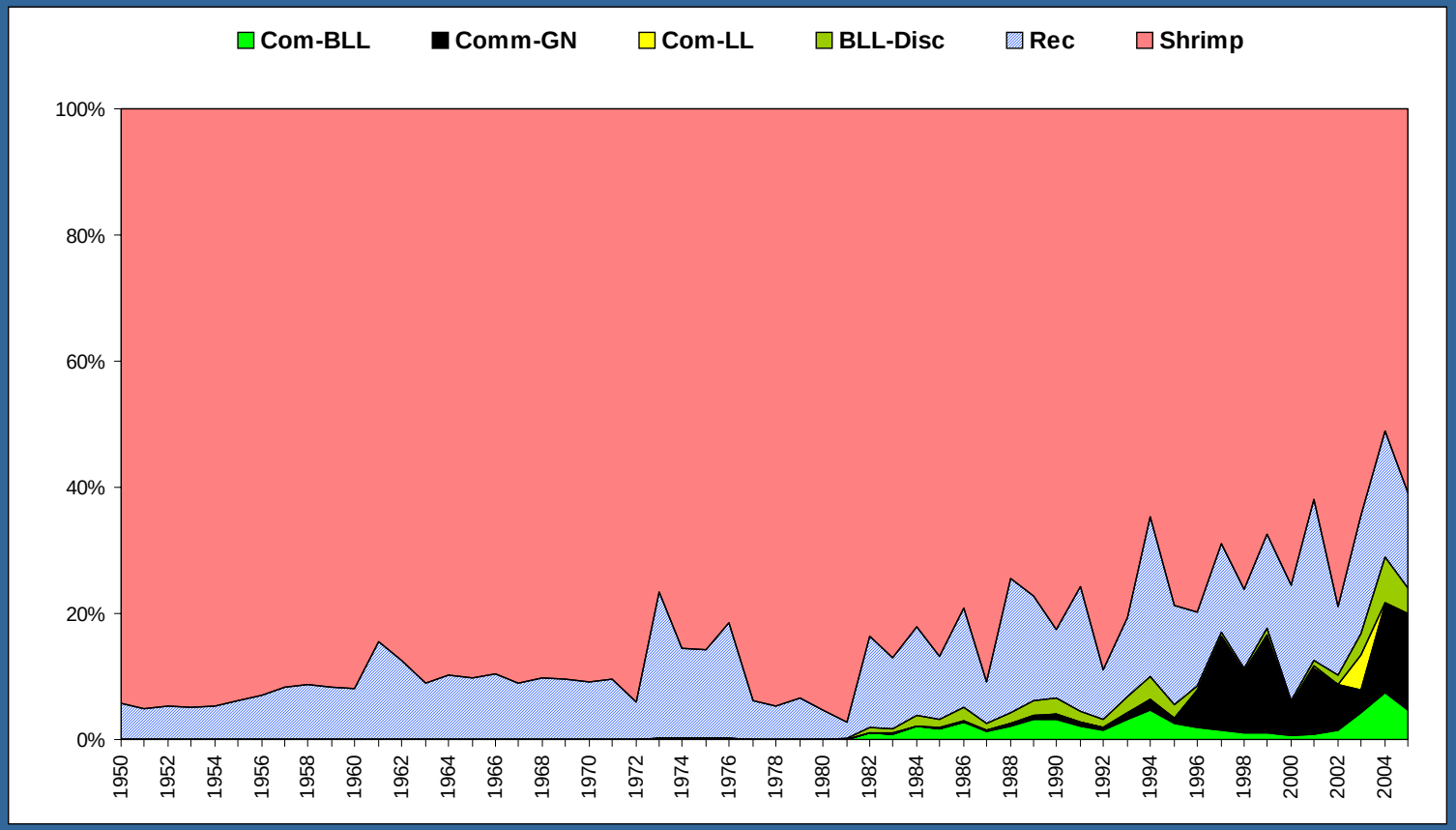
1a. Fishery Inputs

- Catch Series:
  - Commercial Lines
  - Commercial Gillnets
  - Commercial Bottom Longlines
  - Commercial Bottom Longline discards
  - Recreational
  - Shrimp Fishery discard

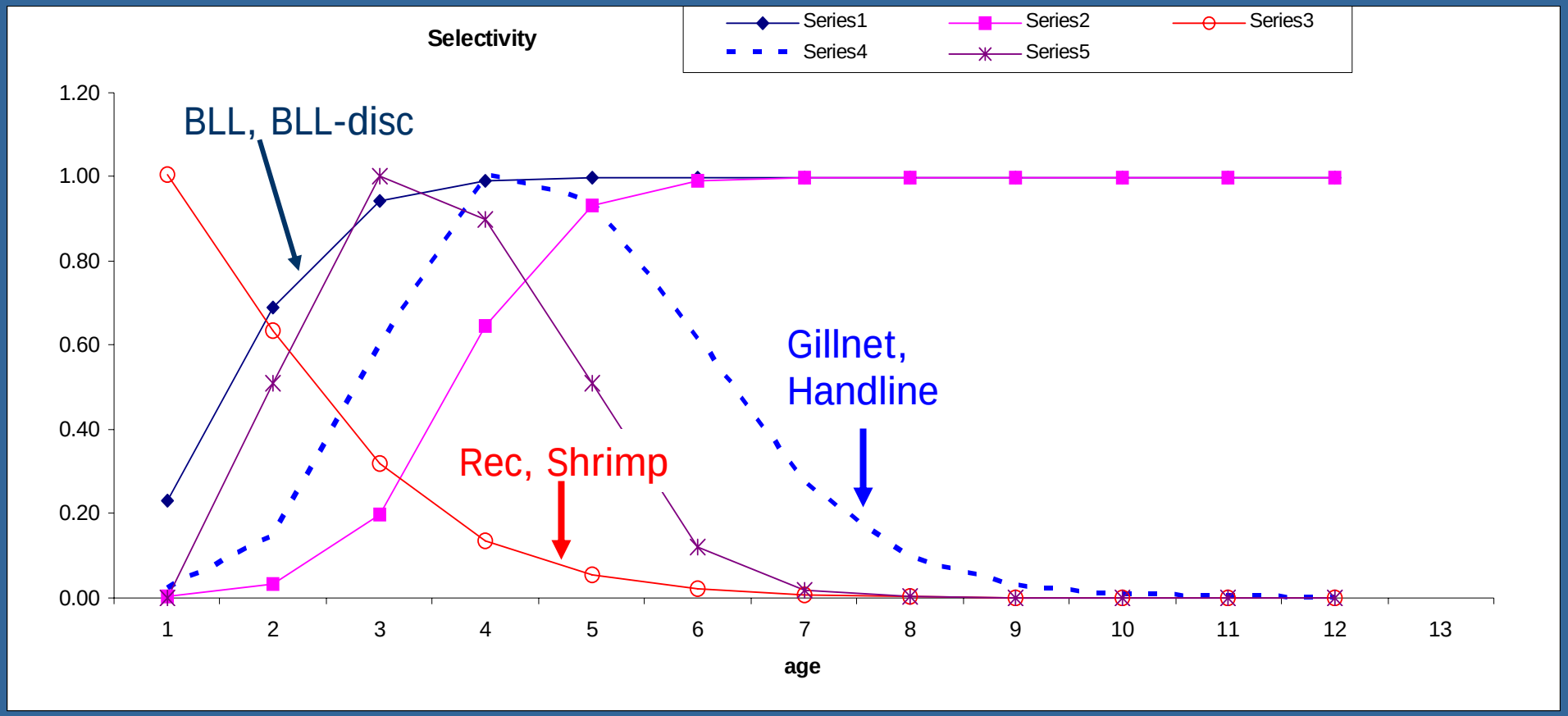
Catches


Com-BLL
Comm-GN
Com-LL
BLL-Disc
Rec
Shrimp
2.00E+06
1.80E+06
1.60E+06
1.40E+06
1.20E+06
1.00E+06
8.00E+05
6.00E+05
4.00E+05
2.00E+05
0.00E+00
1950
1952
1954
1956
1958
1960
1962
1964
1966
1968
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004

Catches


Com-BLL
Comm-GN
Com-LL
BLL-Disc
Rec
Shrimp
100%
80%
60%
40%
20%
0%
1950
1952
1954
1956
1958
1960
1962
1964
1966
1968
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004

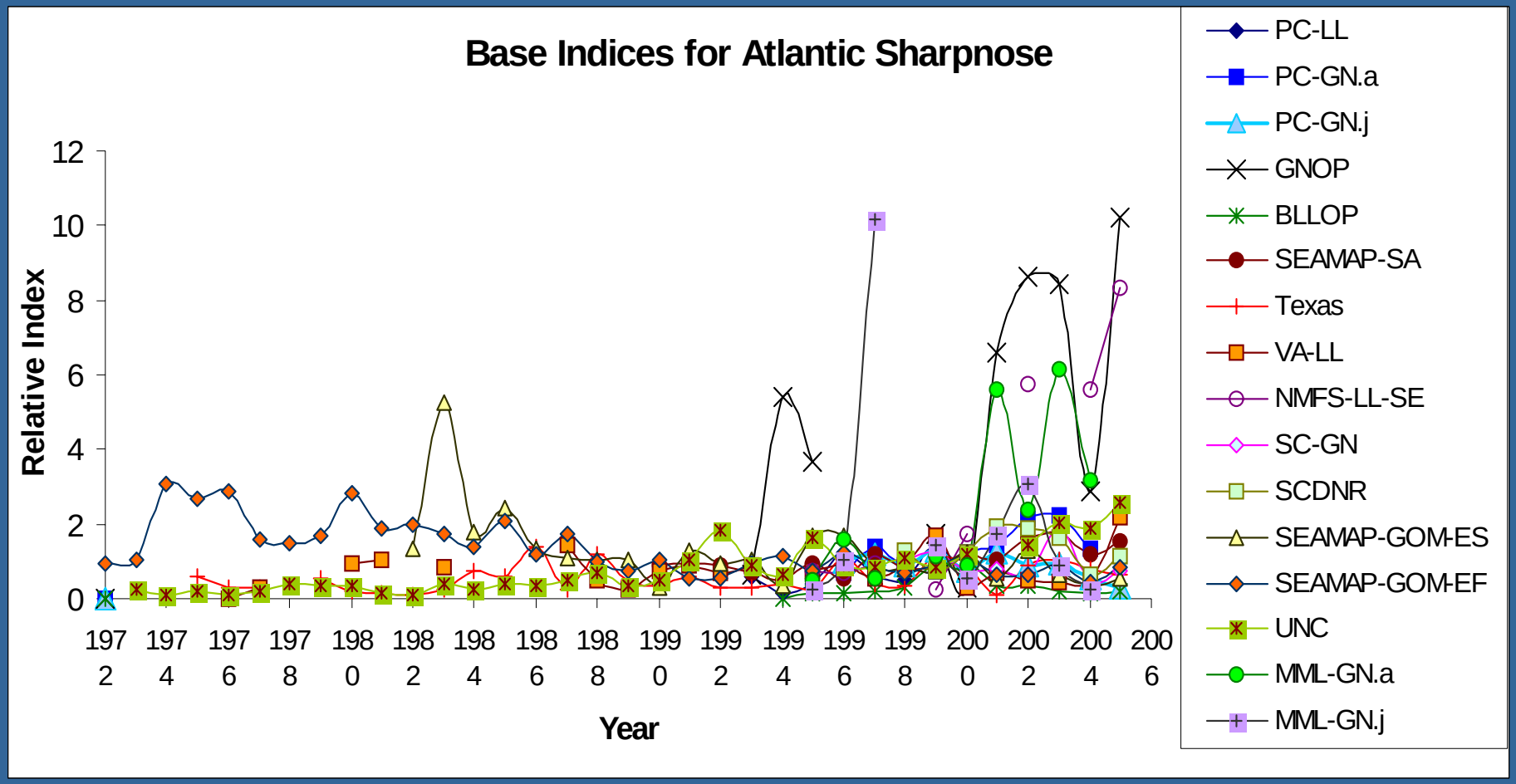
Selectivity - Catch



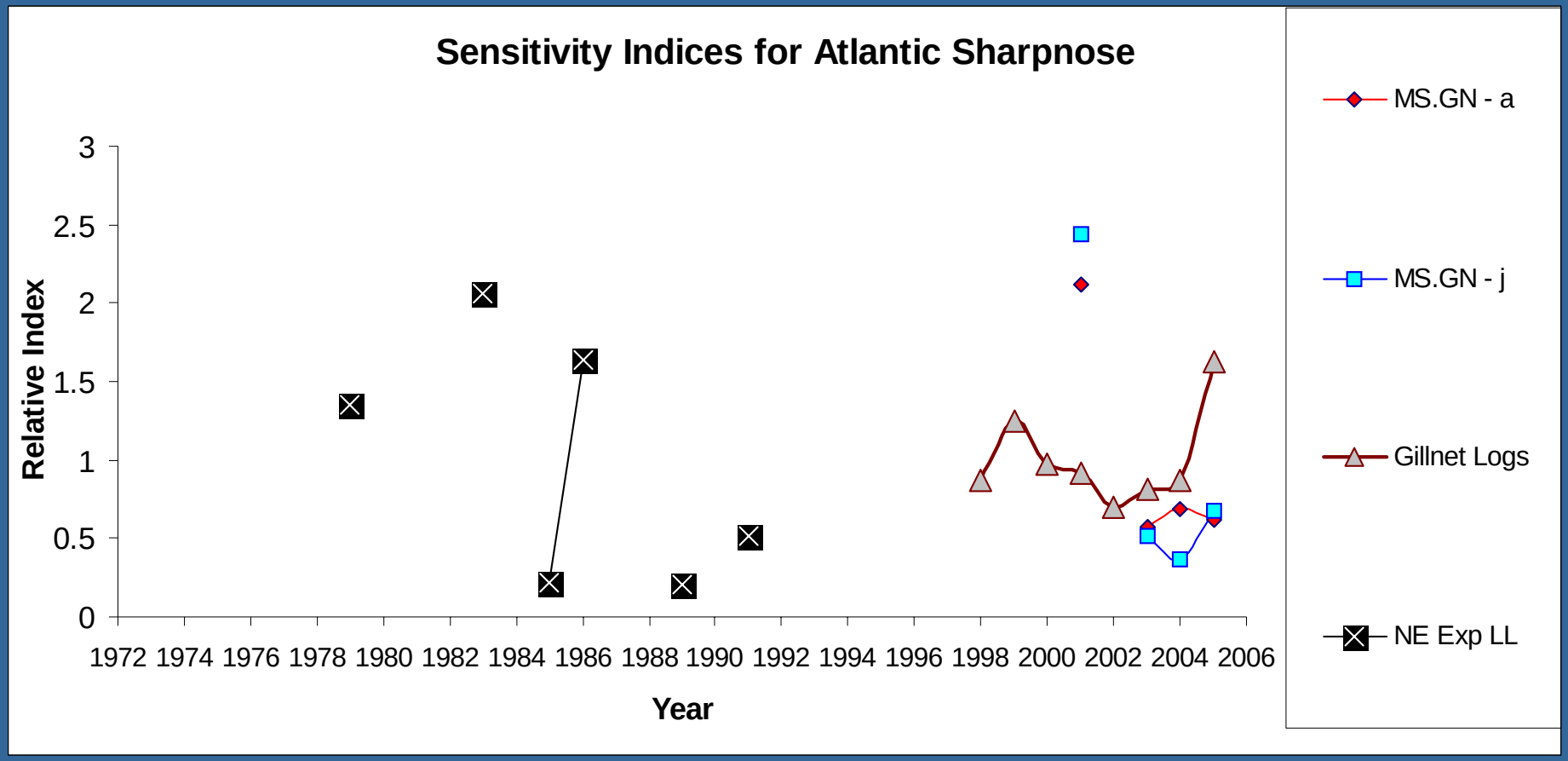
1a. Fishery Inputs

- Indices of Abundance:
  - BLLOP, NMFS-LL-SE
  - VA-LL, SCDNR, UNC
  - PC-LL, PC-GN.j, SEAMAP-SA, Texas, SC-GN, SEAMAP-GOM-ES, SEAMAP-GOM-EF, MML-GN.j
  - GNOP
  - PC-GN.a, MML-GN.a

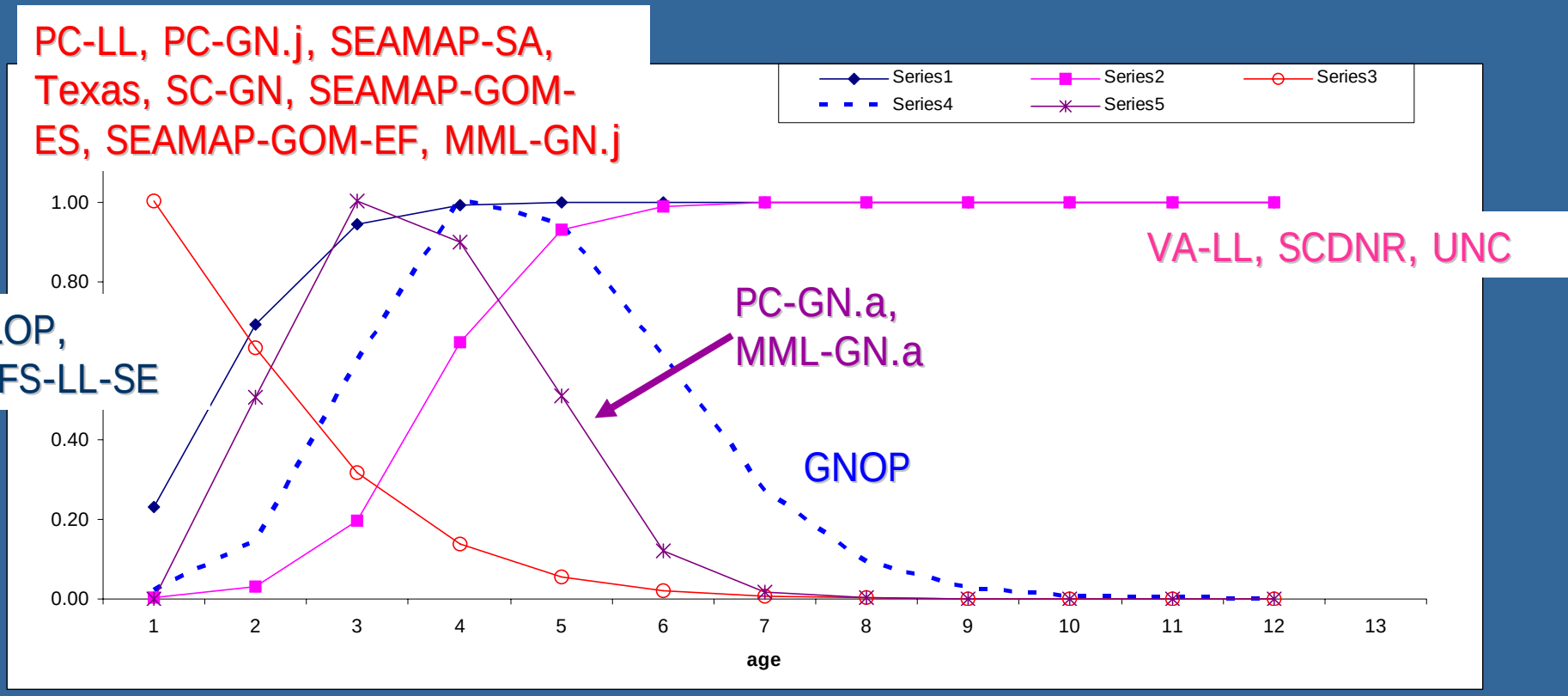
INDICES


Base Indices for Atlantic Sharpnose
Relative Index
Year
0
2
4
6
8
10
12
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
PC-LL
PC-GN.a
PC-GN.j
GNOP
BLLOP
SEAMAP-SA
Texas
VA-LL
NMFS-LL-SE
SC-GN
SCDNR
SEAMAP-GOM-ES
SEAMAP-GOM-EF
UNC
MML-GN.a
MML-GN.j

INDICES


Sensitivity Indices for Atlantic Sharpnose
Relative Index
3
2.5
2
1.5
1
0.5
0
1972 1974 1976 1978 1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006
Year
MS.GN - a
MS.GN - j
Gillnet Logs
NE Exp LL

Selectivity - Indices



Biological Inputs – DW values

- Pup-production: 4.1
- Natural Mortality: 0.24 → 0.36
- Pup-Survival: mode 0.70
- Maturity: ~ (between 2 and 3)
- Steepness: ~ 0.3

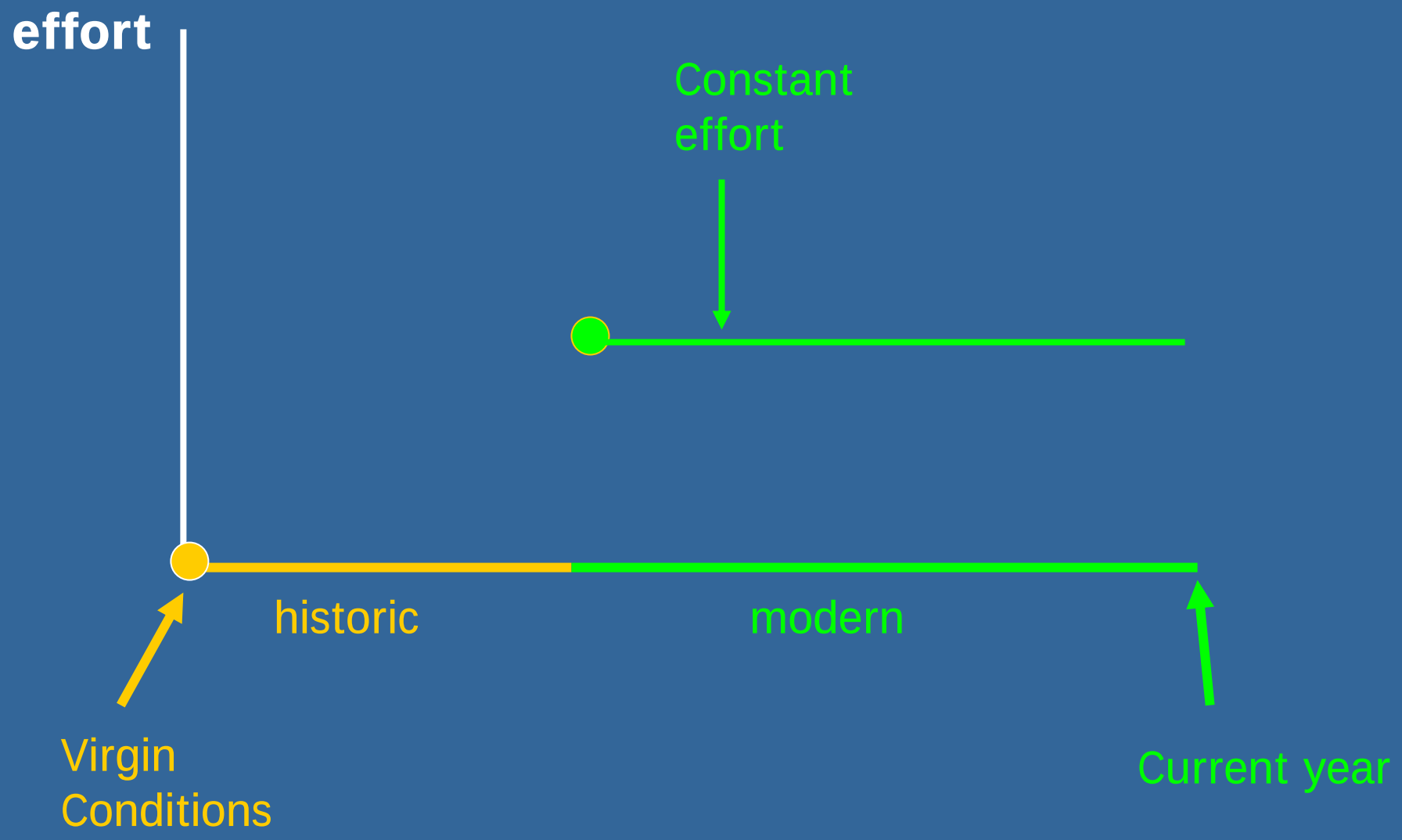
Model Description

- State-space Age-structured Production model
- Process error in reproduction (pup-survival and virgin number pups), fishing effort
- Observation error in catches and indices
- Recruitment at age 1; ages 1-12 modeled, age 12 is a plus group

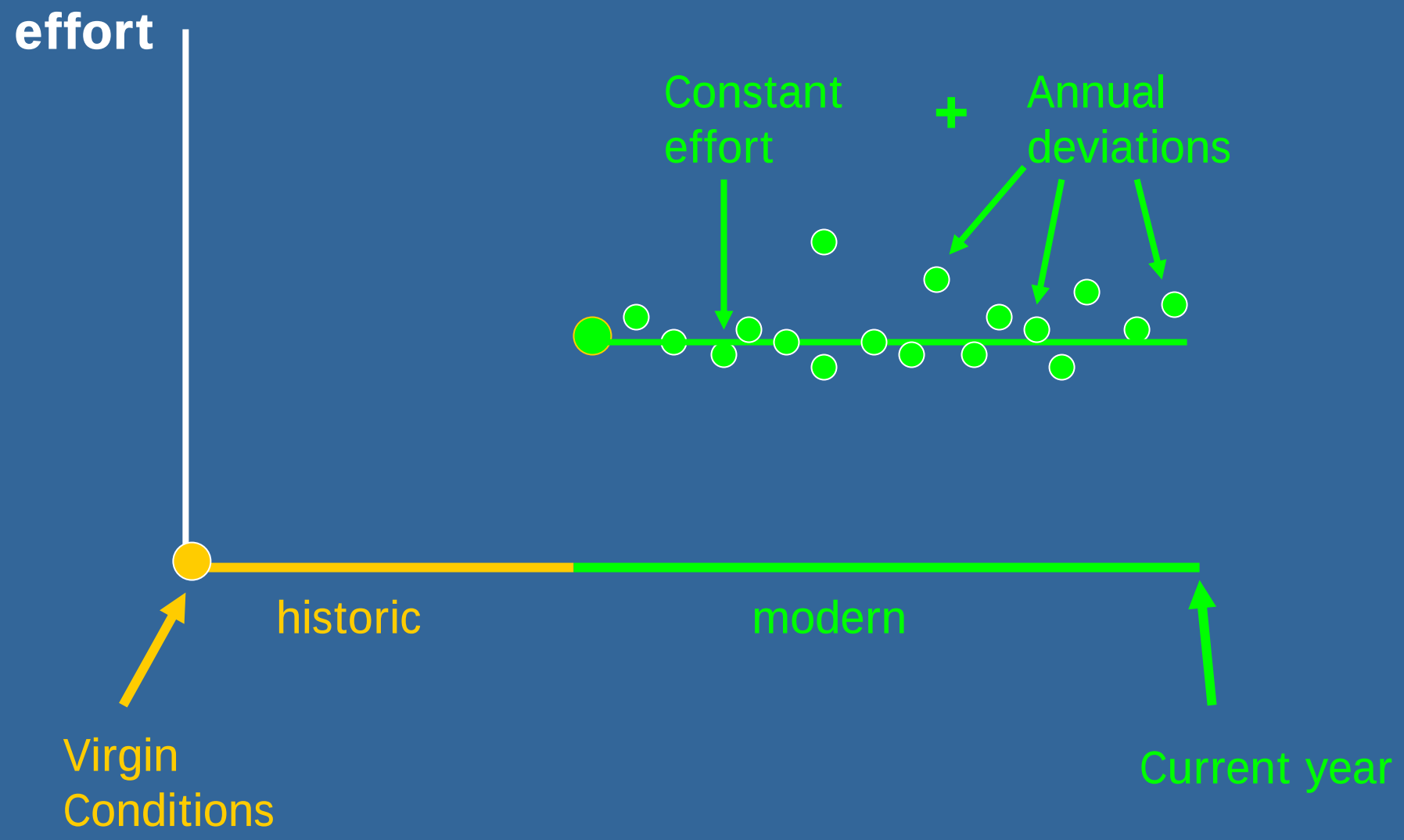
2. Model Description

- Time series split into historic and modern period
- Historic period begins in year when virgin conditions can be assumed; spans years where data are very sparse
- Modern period spans recent years, when data are presumed to be more abundant

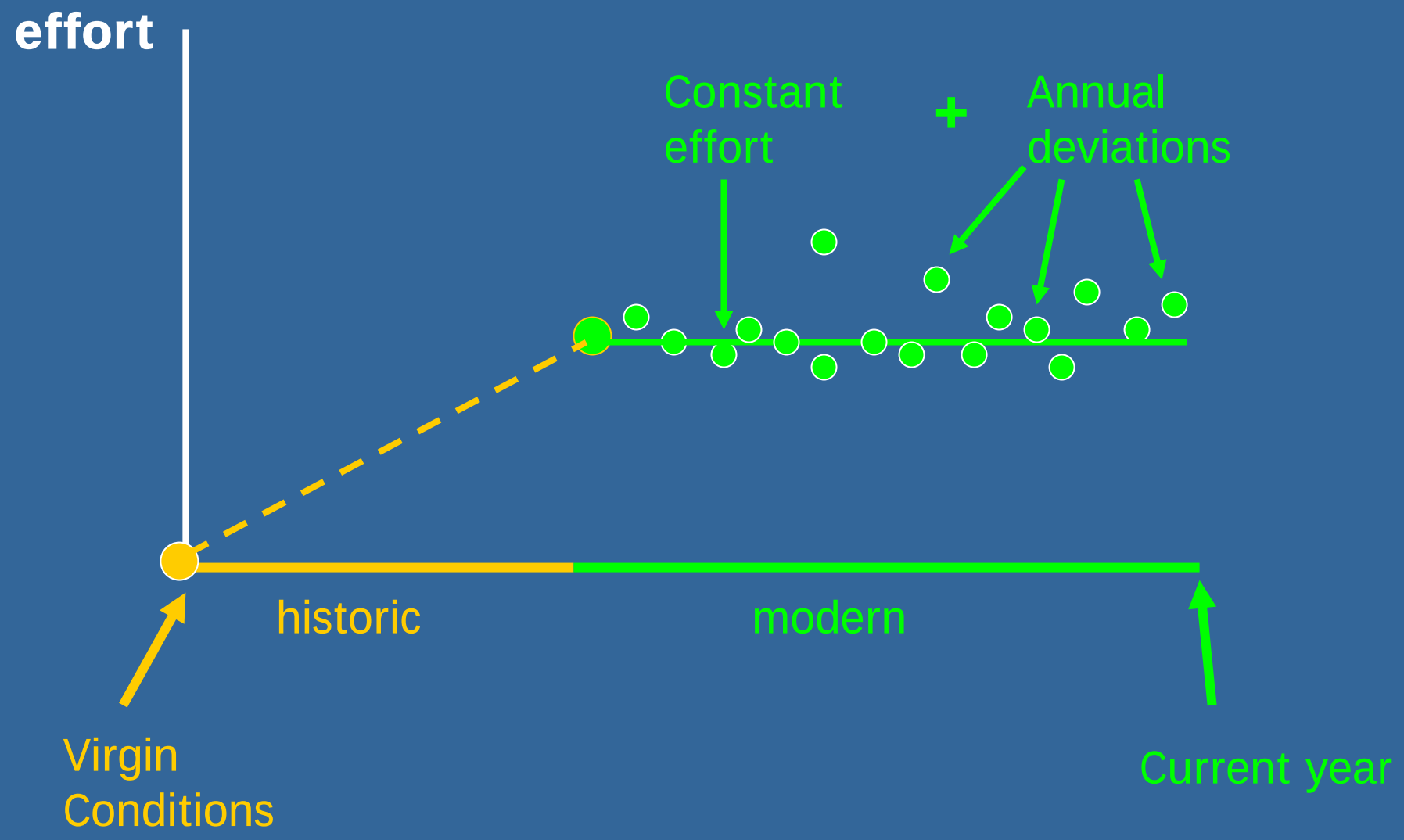
2. Model Description



2. Model Description



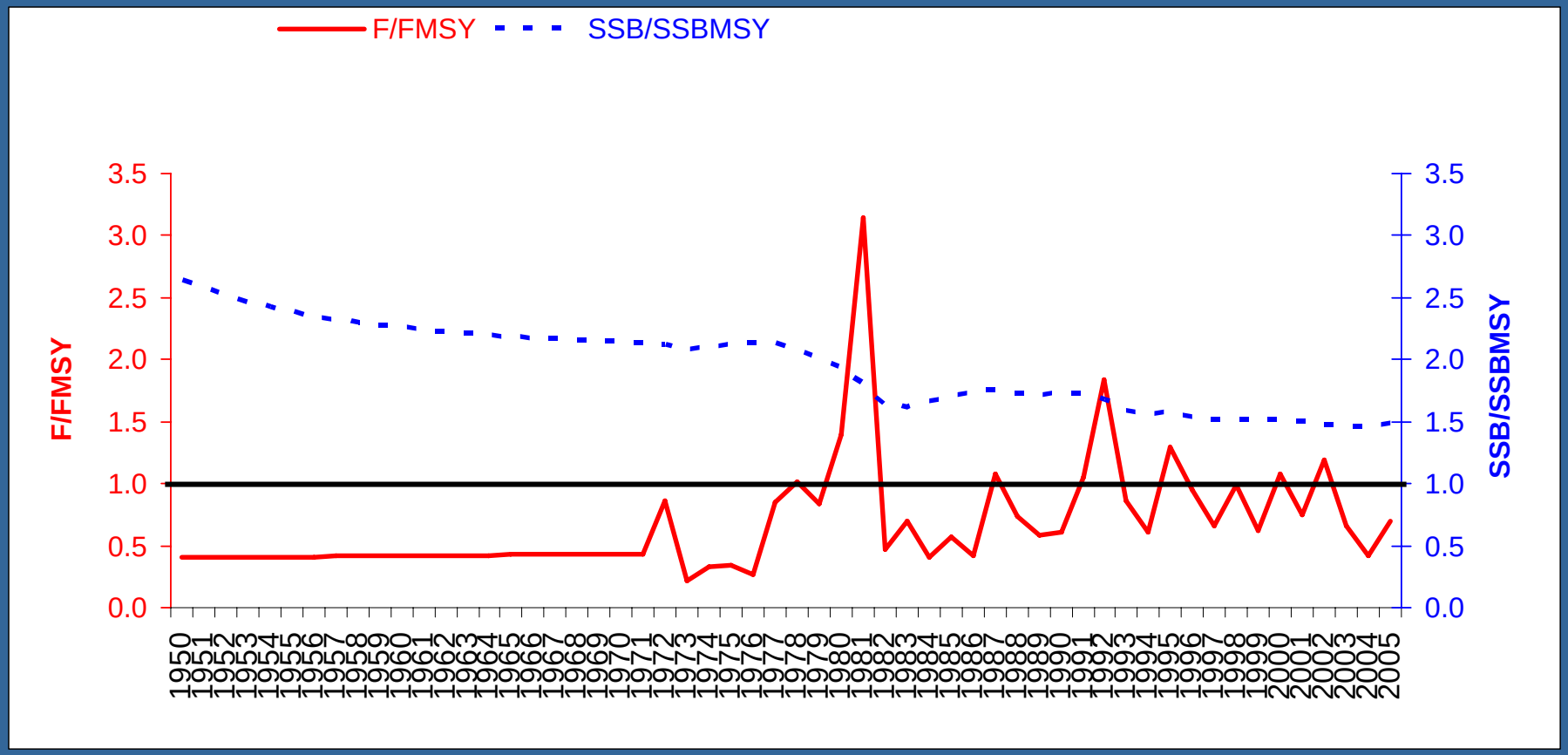
2. Model Description

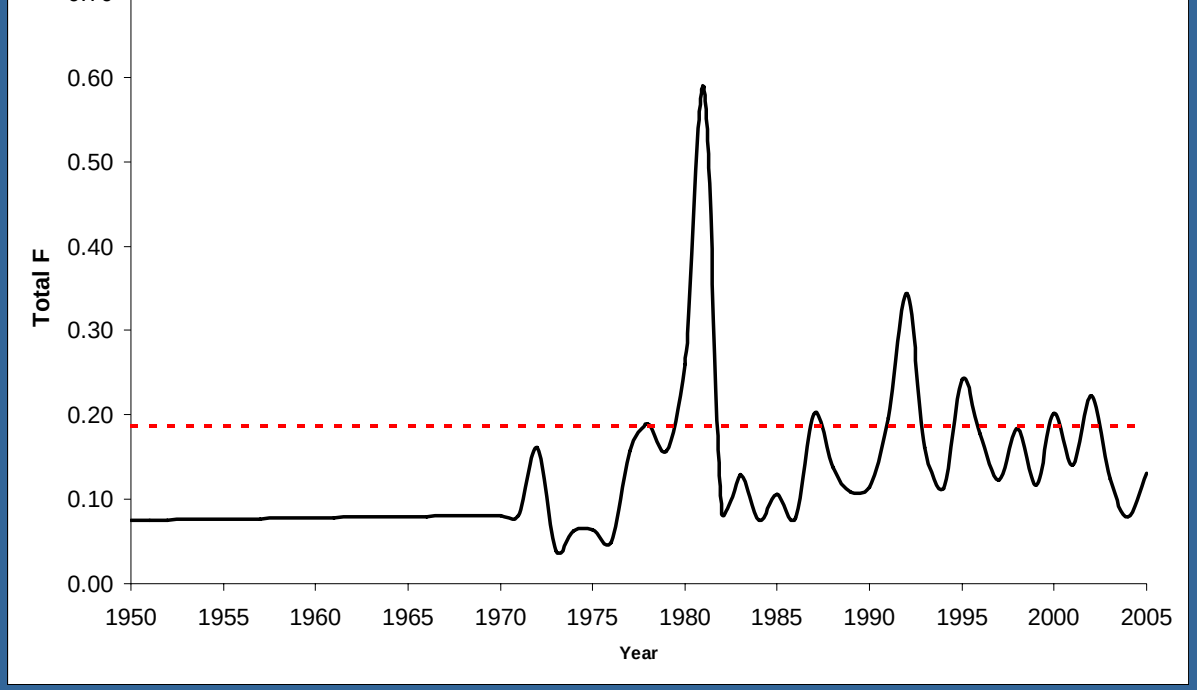


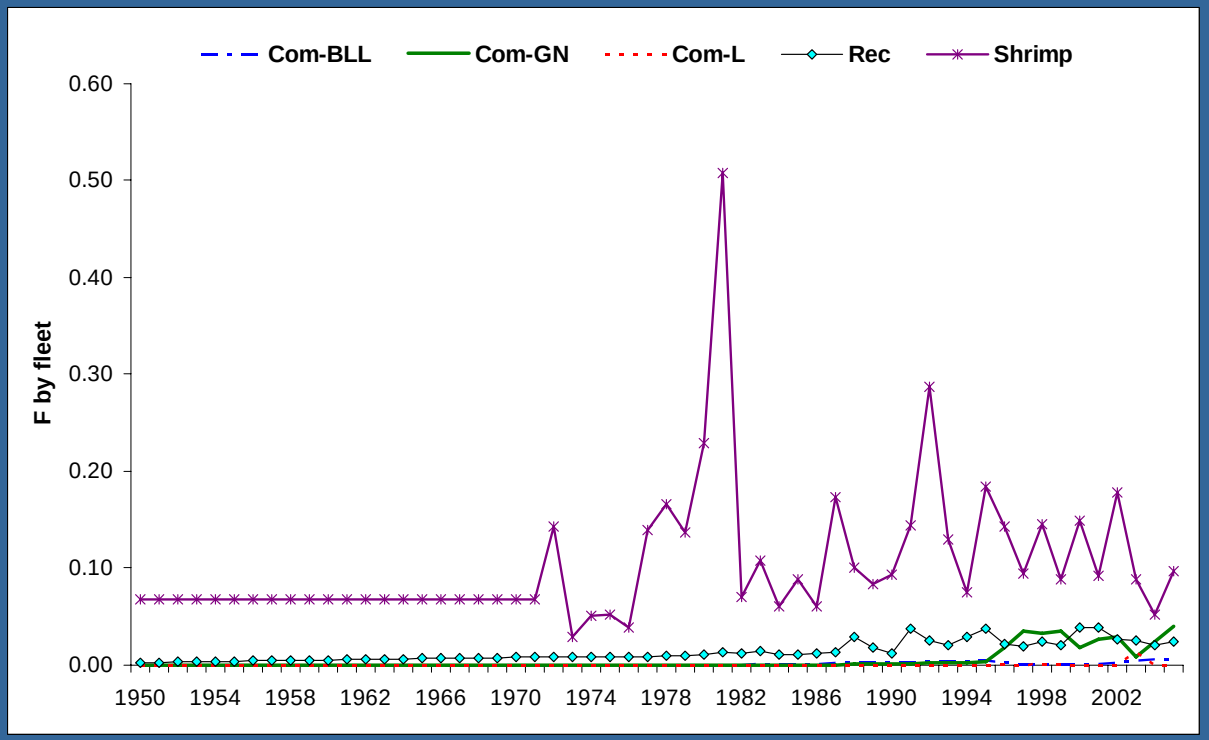
2. Model Description

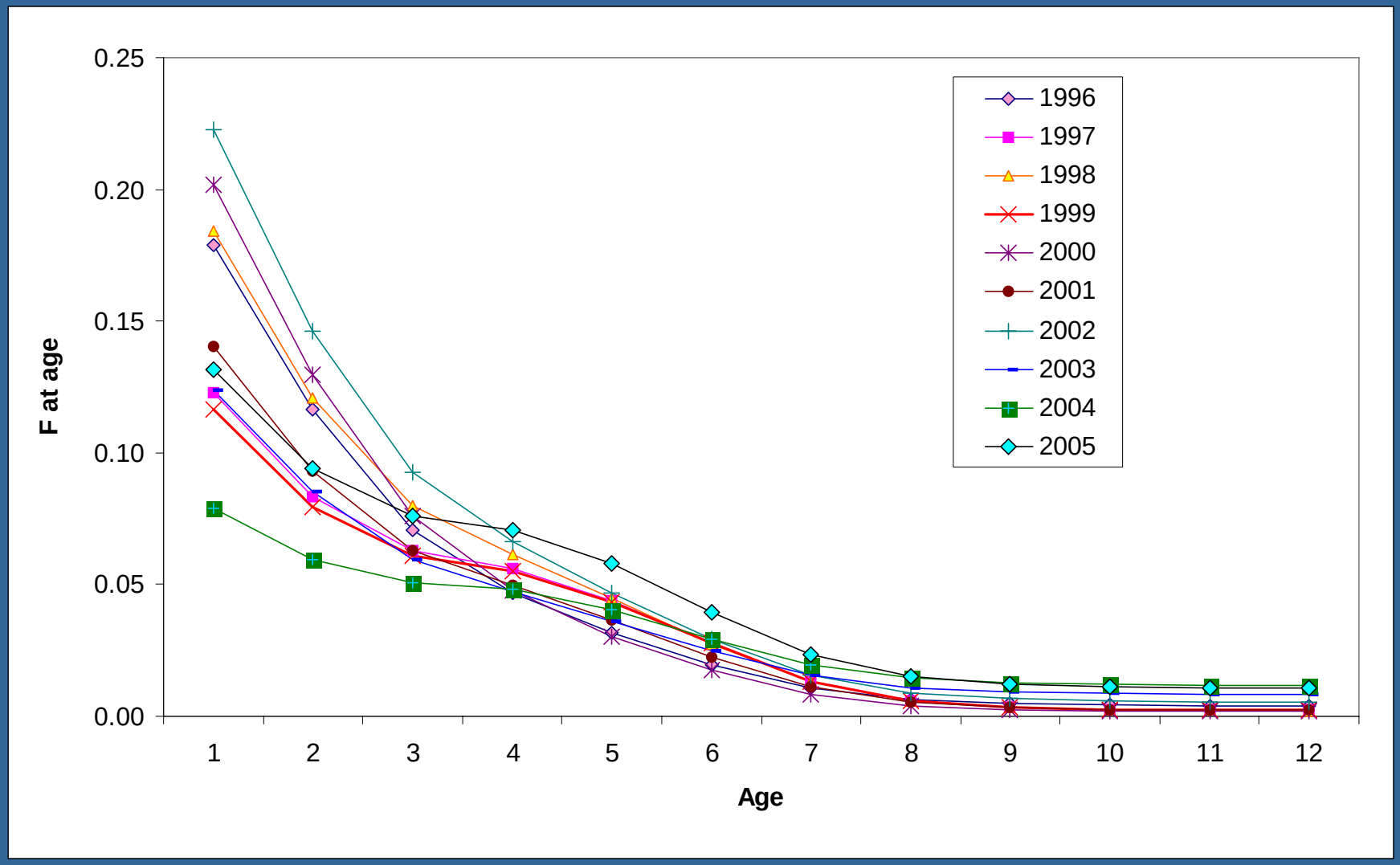
- Estimated catch series begin in 1972; earliest index (SEAMAP) begins in 1972
- Historic Catches followed DW recommendations for each series

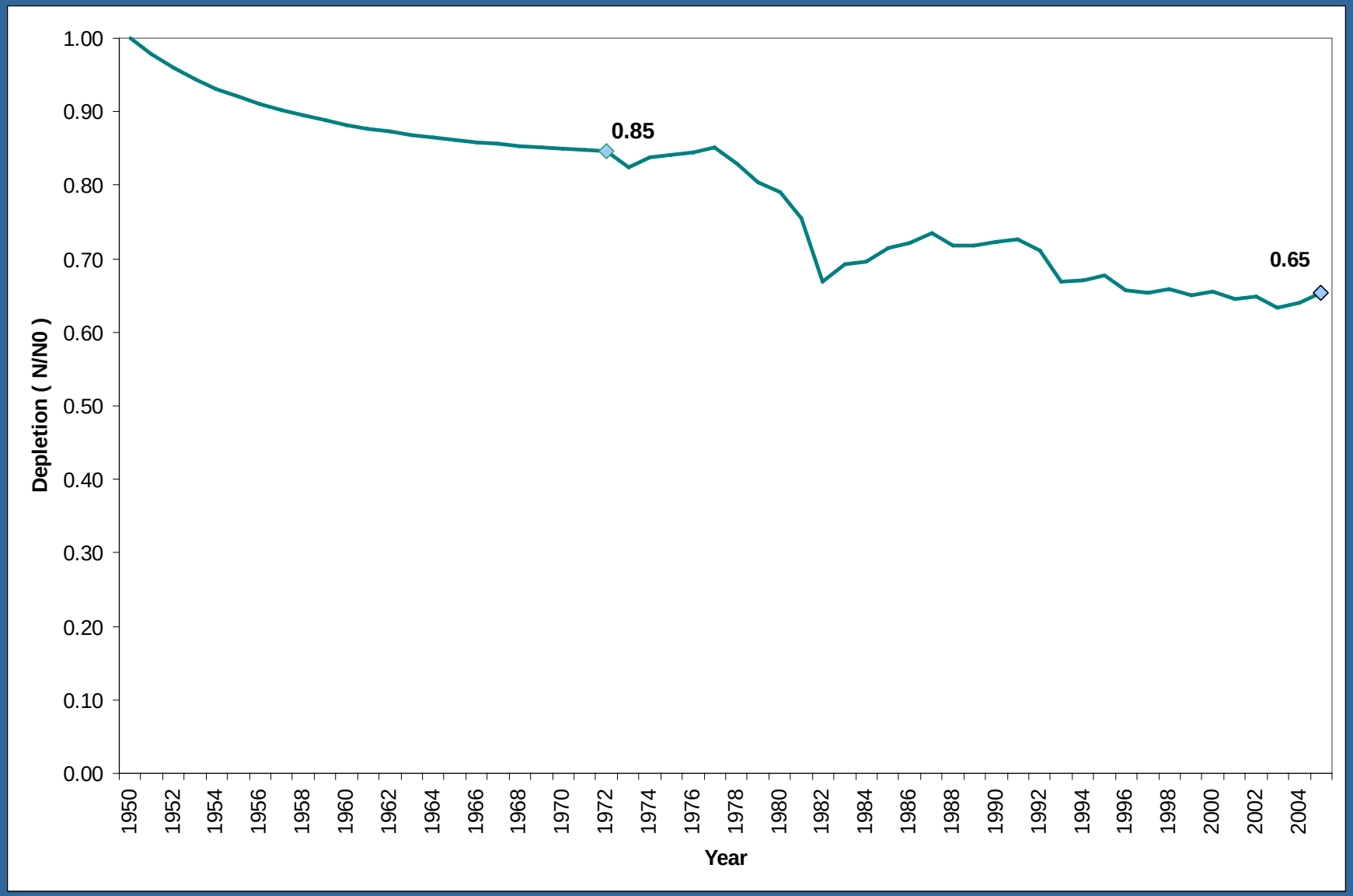
Base Results

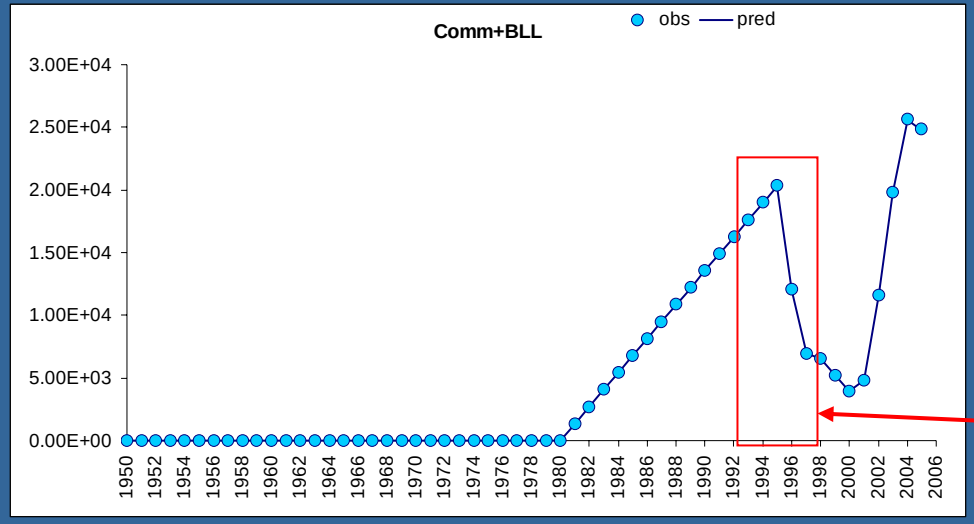



Total F
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
Year


Com-BLL
Com-GN
Com-L
Rec
Shrimp
F by fleet
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1950
1954
1958
1962
1966
1970
1974
1978
1982
1986
1990
1994
1998
2002

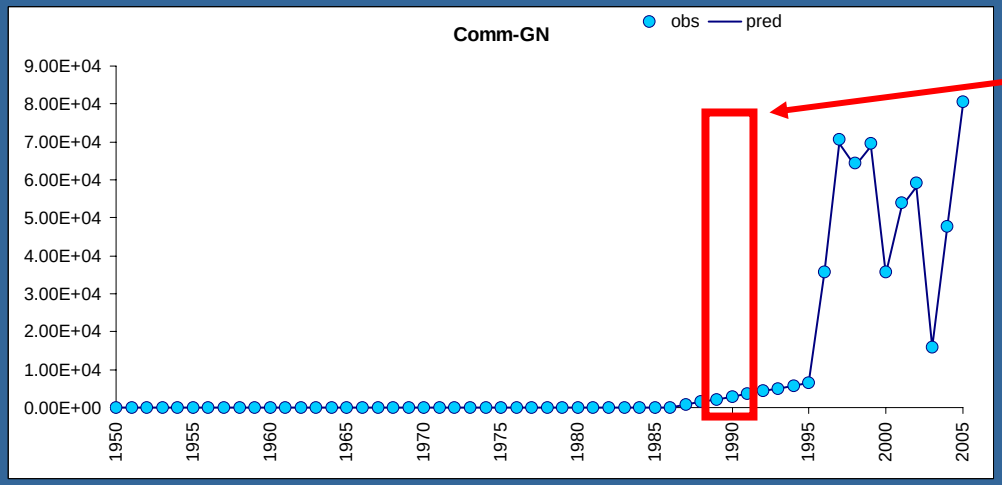

0.25
0.20
0.15
0.10
0.05
0.00
F at age
1
2
3
4
5
6
7
8
9
10
11
12
Age
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005


1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
Depletion (N/N0)
0.85
0.65
1950
1952
1954
1956
1958
1960
1962
1964
1966
1968
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
Year

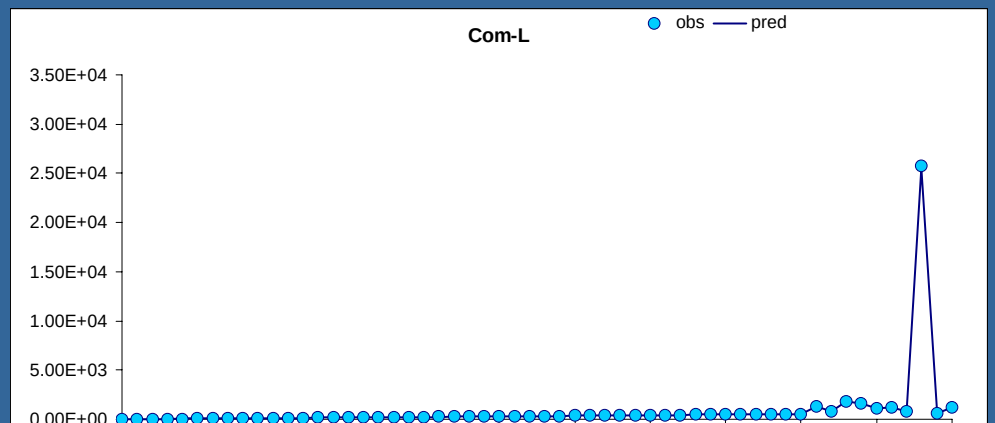


Should historic catches (pre '95) build up to 1995 or build up to ave. landings 1995-??; decision: fit exponential from point 0 in 1980 to data in 1995

Sander brothers



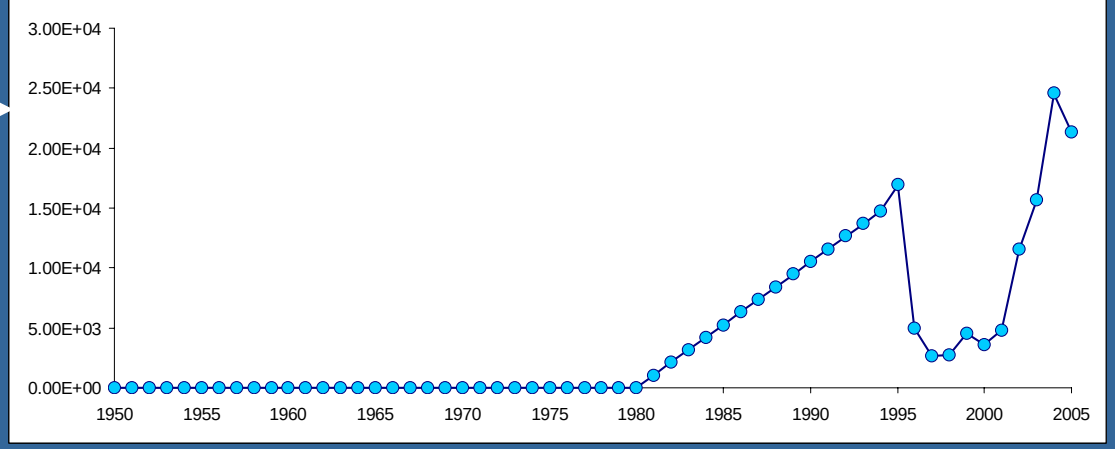
Fishery started up; targeting ramped in '92-'93; jump in landings reflects target shift from closure of LCS; OK as is

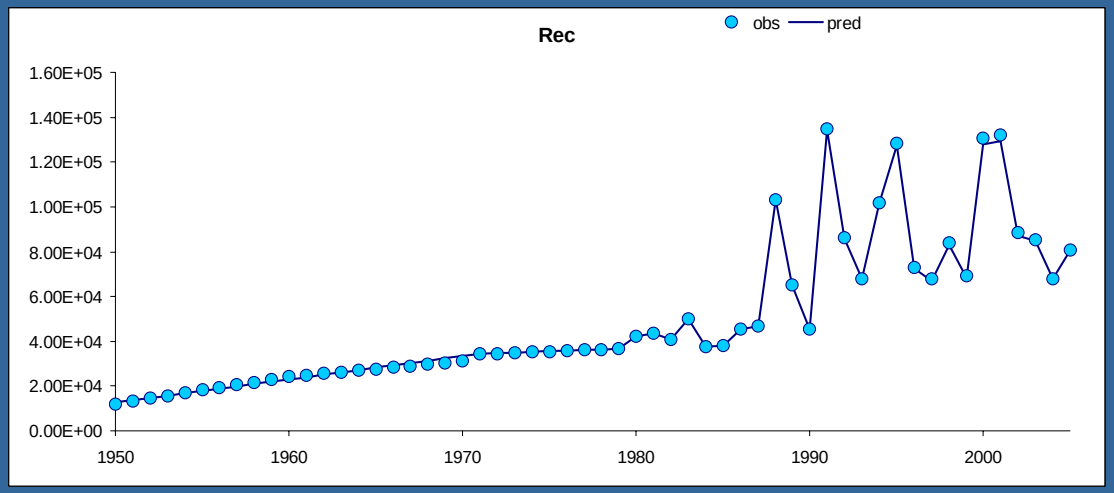


Explanation: DW-15, trolling off ALABAMA; pre-2003, almost no landings for that region/gear; 2 hypotheses:

1. mis-id gear (move to GN)
2. Number mis-reported

BLL-disc: new values will come from ave ’95-’05 discard rate applied to get discards from 1980-2005

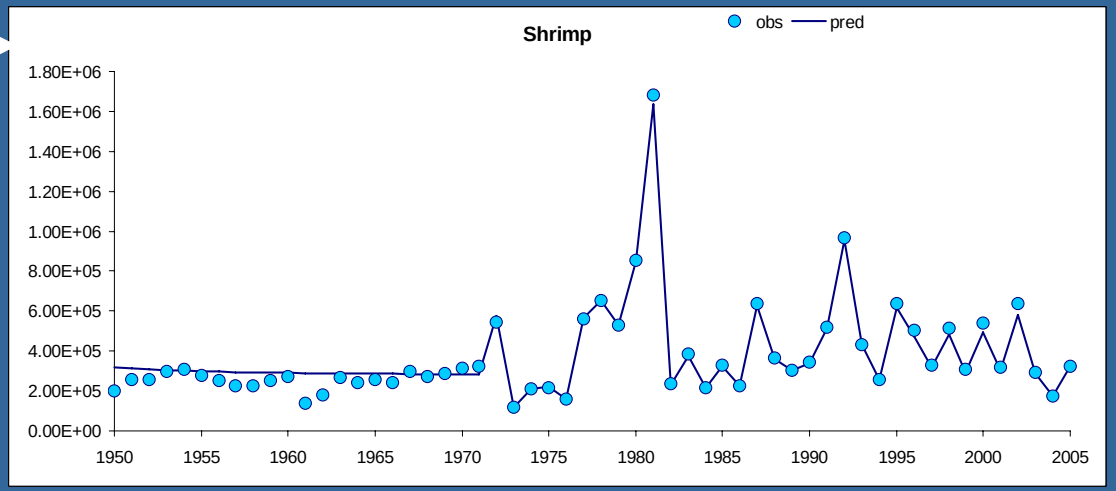




Nichols: anomalies... emailed Scott; try geomean of year before/after

... in limbo

Decision: smooth it with +/- 3 yrs observed data

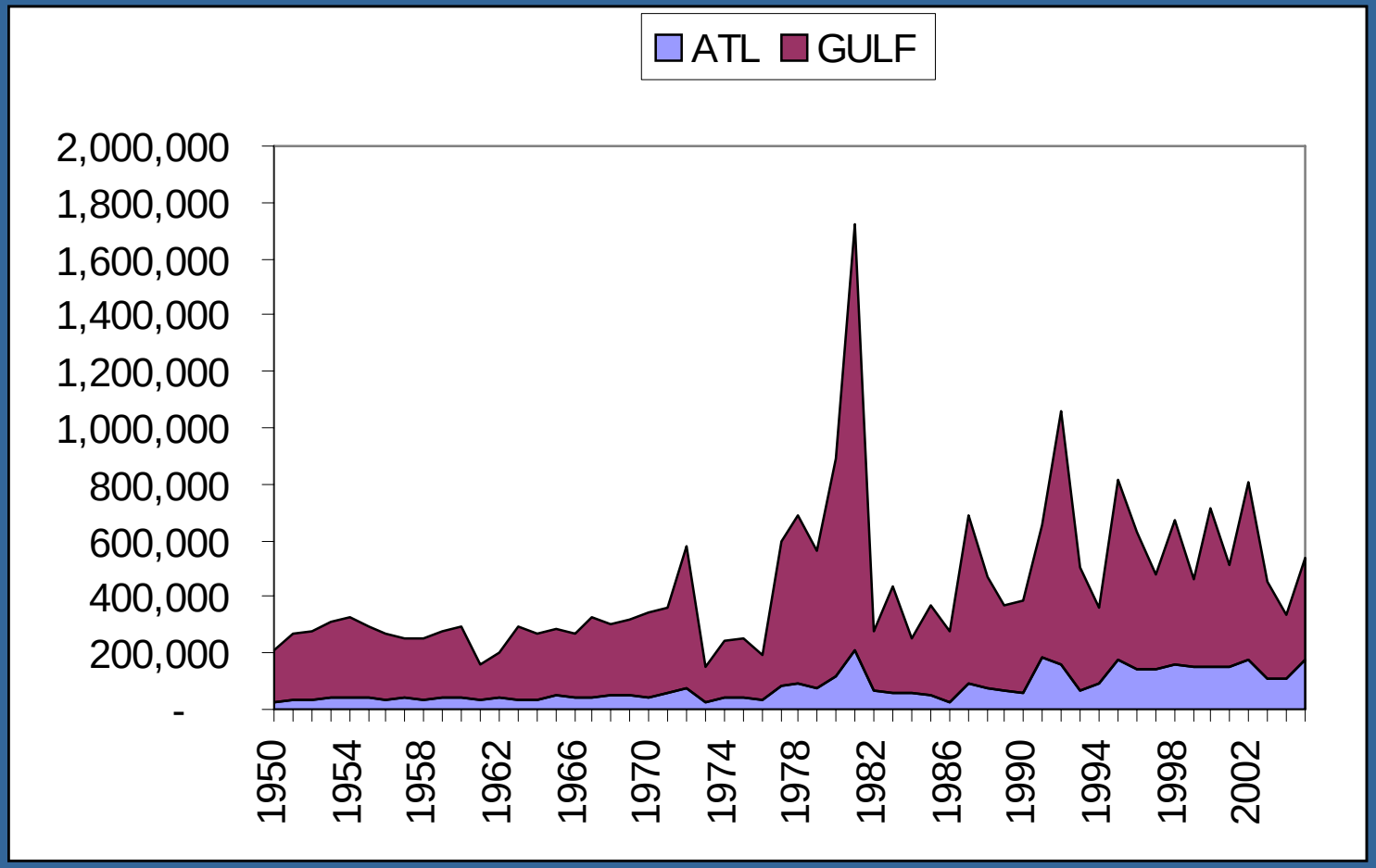


	Equal weight		Inverse CV weight	
	BASE	**BASE**	**S-1**	**S-1**
Parameter	Estimate	CV	Estimate	CV
SSF_{2005}/SSF_{MSY}	1.49	0.45	1.54	0.42
F_{2005}/F_{MSY}	0.70	0.78	0.66	0.76
N_{2005}/N_{MSY}	1.35	--	1.39	
MSY	1.27E+06	--	1.32E+06	
SPR_{MSY}	0.59	0.11	0.59	0.11
F_{MSY}	0.19	0.00	0.19	0.00
SSF_{MSY}	4.59E+06	--	4.77E+06	
N_{MSY}	4.62E+06	--	4.80E+06	
F_{2005}	0.13	0.78	0.12	0.76
SSF_{2005}	6.81E+06	0.65	7.35E+06	0.61
N_{2005}	6.22E+06	--	6.67E+06	
SSF_{2005}/SSF_0	0.56	0.32	0.59	0.29
B_{2005}/B_0	0.49	0.31	0.50	0.27
R0	3.24E+06	0.35	3.36E+06	0.35
Pup-survival	0.76	0.28	0.76	0.28
alpha	2.85	--	2.87	
steepness	0.42	--	0.42	

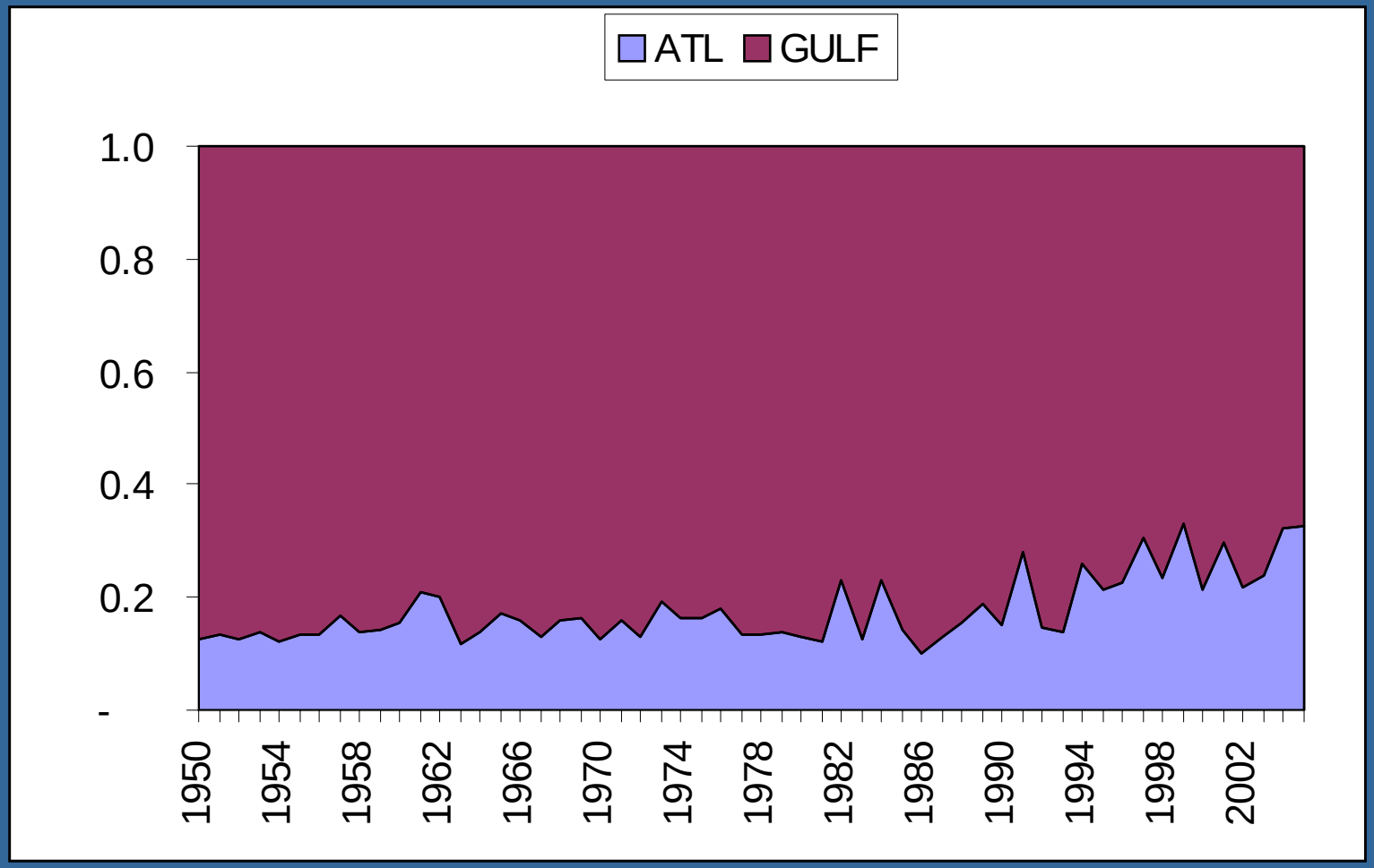
Additional Sensitivity Runs

- S-2 : separate assessment for Gulf and Atlantic
- S-3 : using base <u>and</u> sensitivity indices

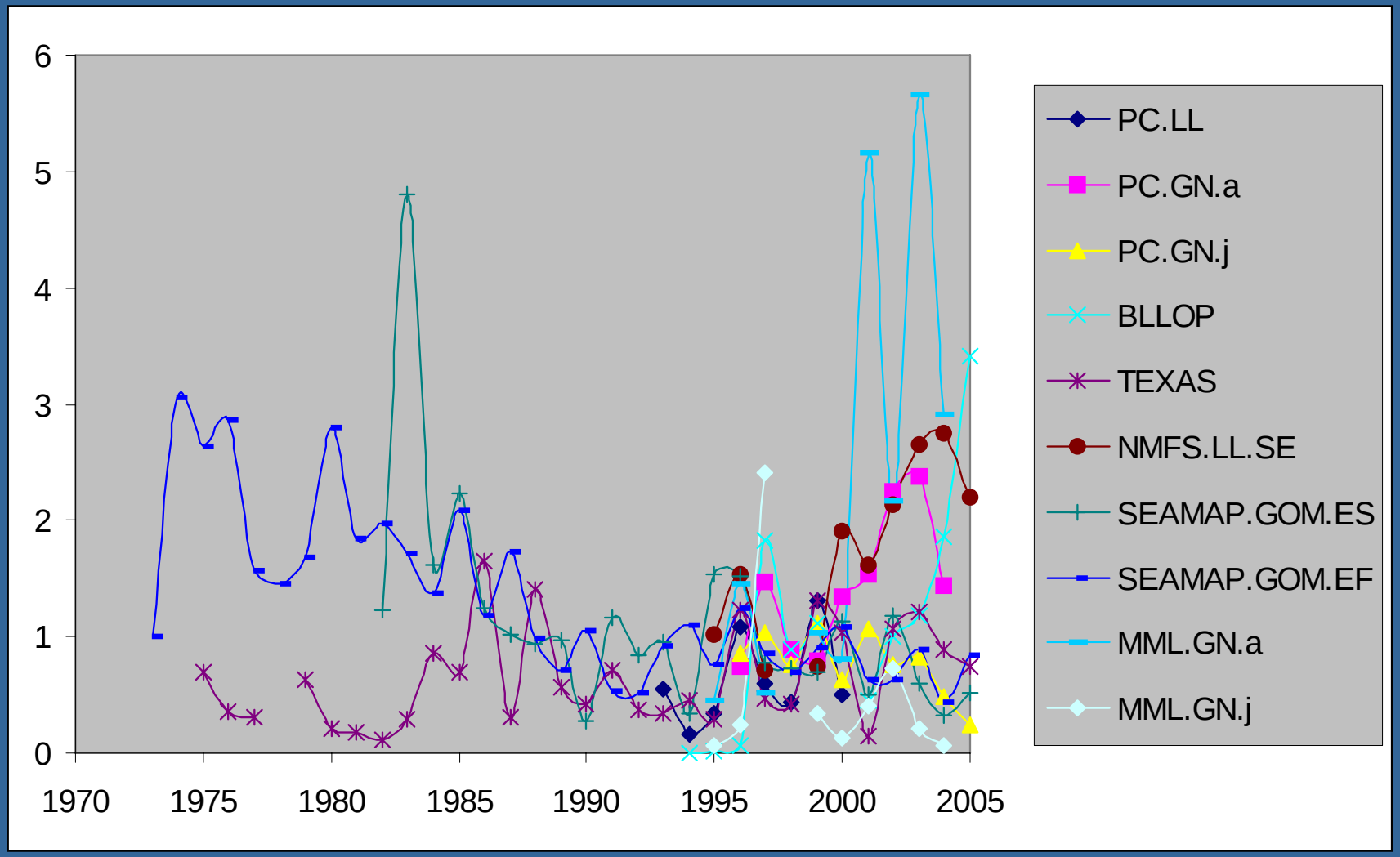
S-2 Landings


ATL
GULF
2,000,000
1,800,000
1,600,000
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
-
1950
1954
1958
1962
1966
1970
1974
1978
1982
1986
1990
1994
1998
2002

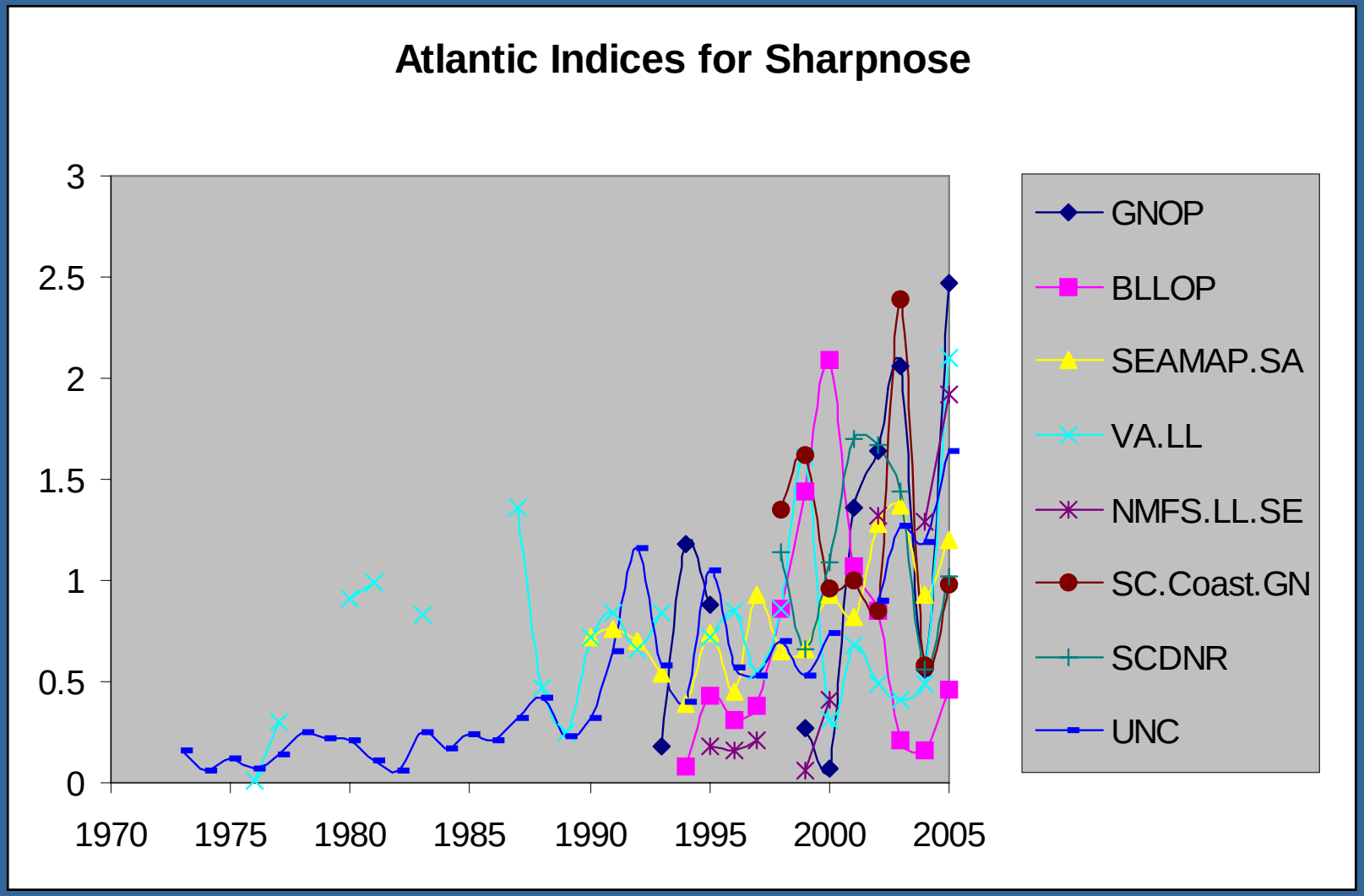
S-2 Landings


ATL
GULF
1.0
0.8
0.6
0.4
0.2
-
1950
1954
1958
1962
1966
1970
1974
1978
1982
1986
1990
1994
1998
2002

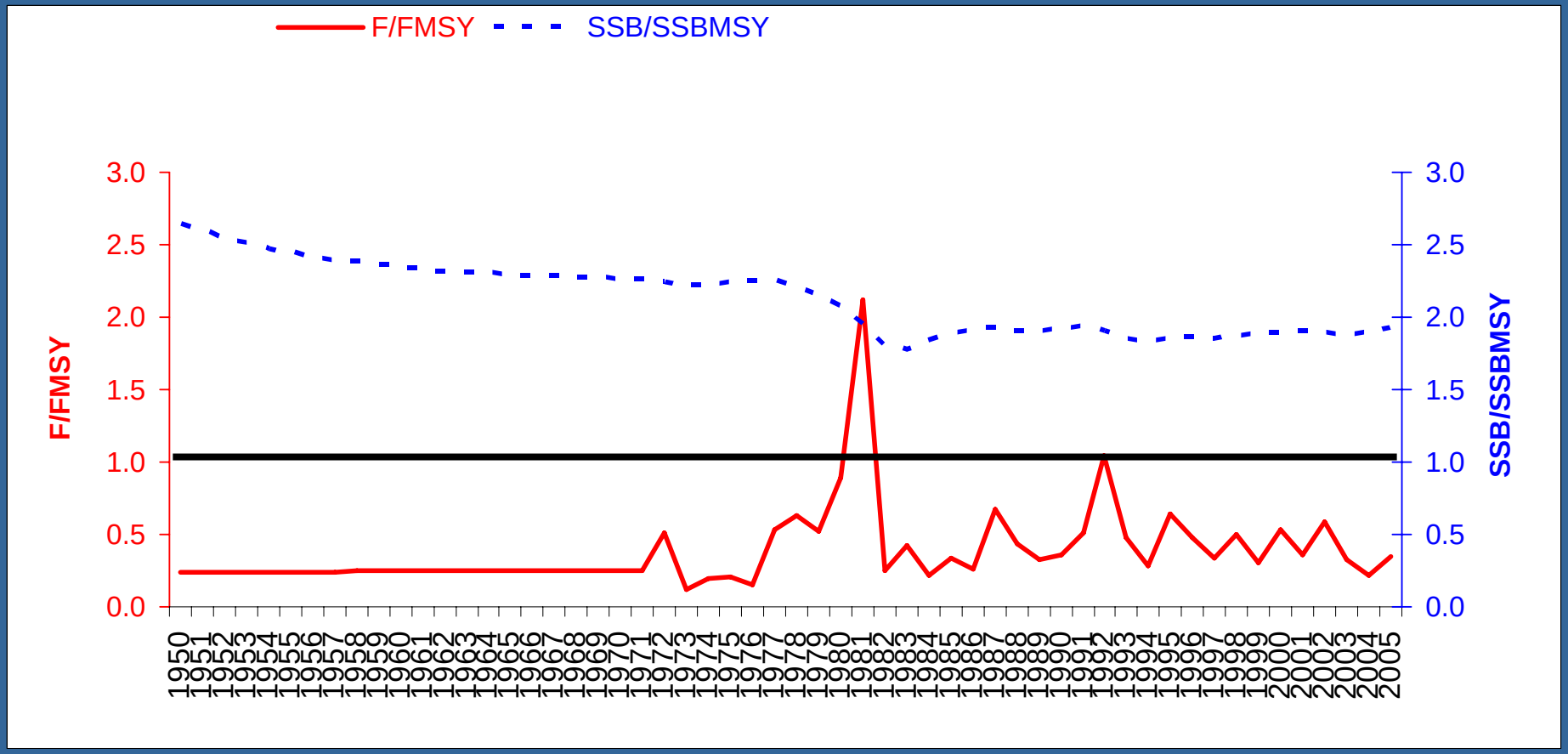
S-2: Gulf Indices



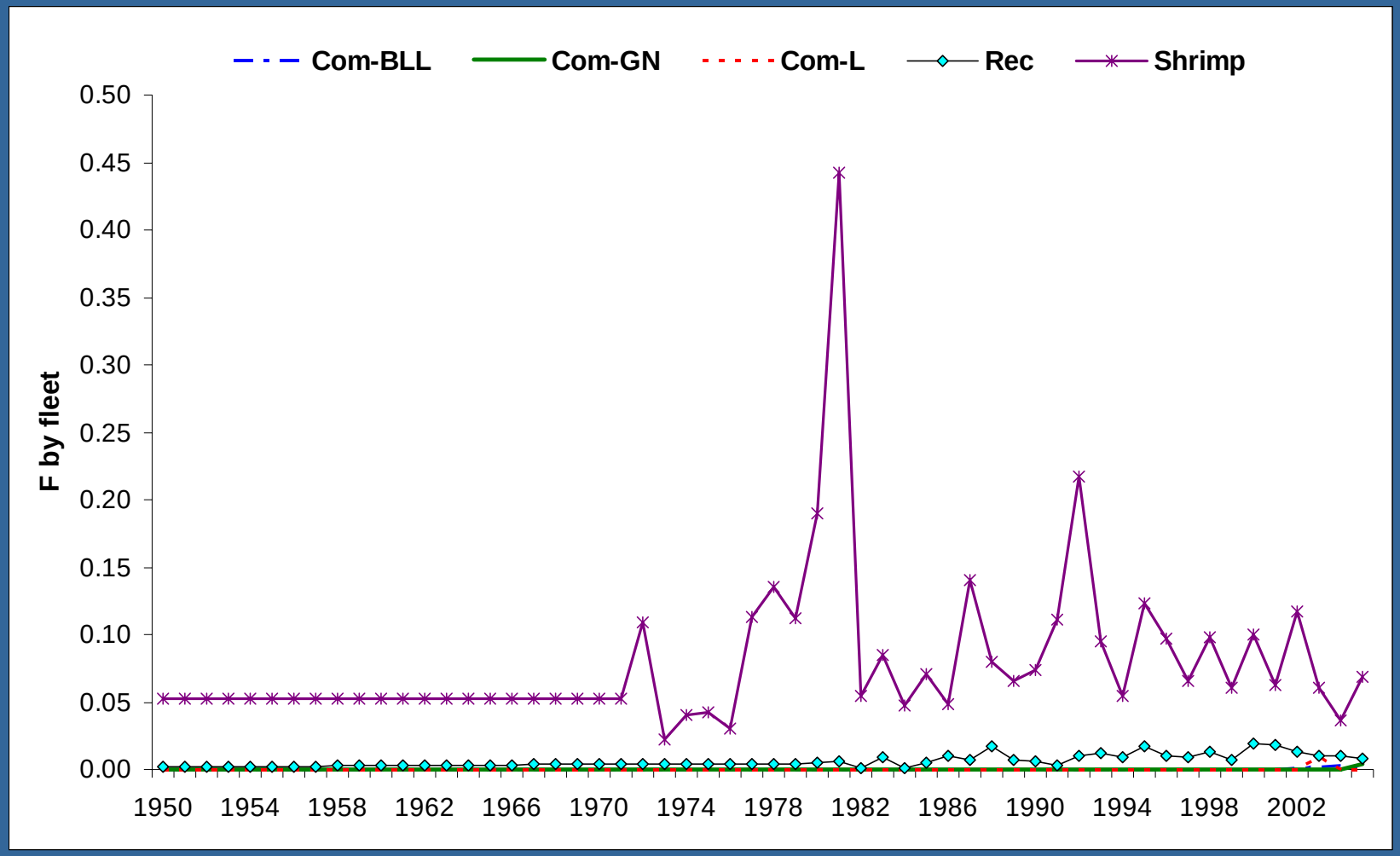
S-2: Atlantic Indices



S-2 : Results (Gulf)



S-2 : Results (Gulf)



S-2 : Results (Atlantic)

- No convergence

S-3: All indices

- Catches were for the whole stock
- All inputs same as base model plus the additional 4 sensitivity indices
- Equal weighting applied

S-3: Results

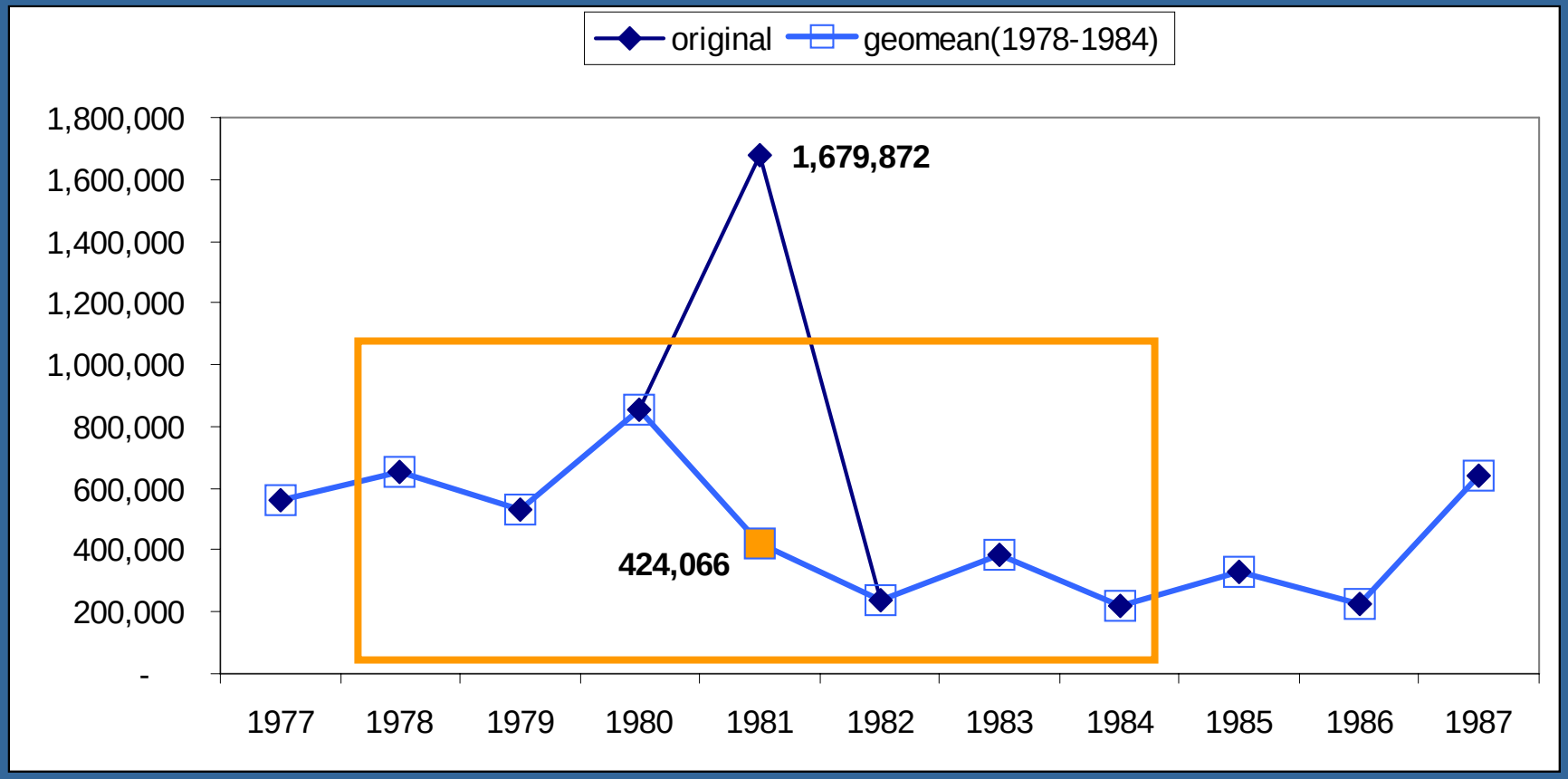
- No model convergence

Results for all converged models

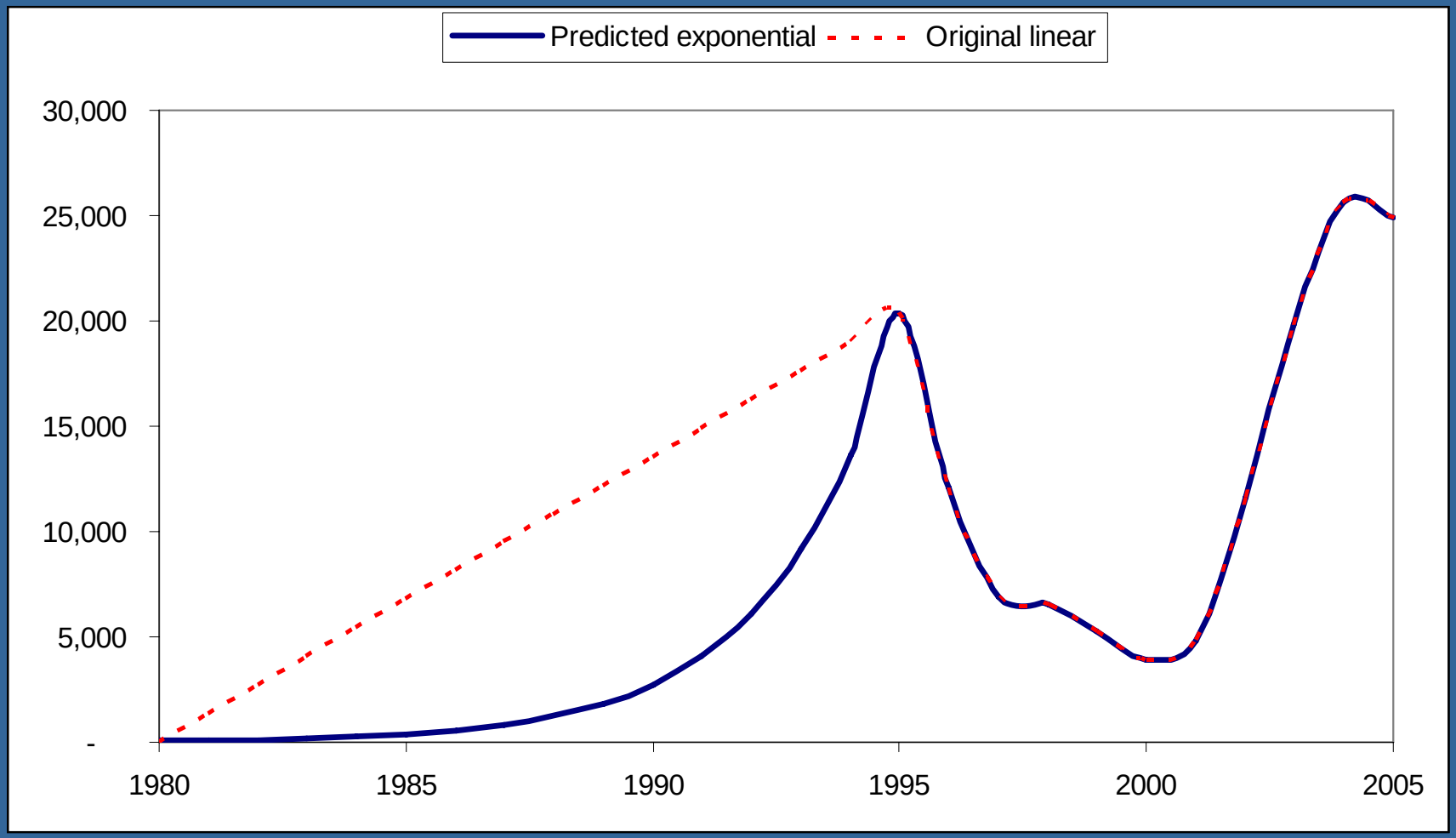
- Base
- S-1 : inverse CV weights for base indices
- S-2 : Gulf of Mexico Stock

	Equal weights		Inverse CV weight		Gulf Results	
	Base		S-1		S-2	
Parameter	**Estimate**	**CV**	Estimate	CV	Estimate	CV
SSF2005/SSFMSY	**1.49**	**0.45**	1.54	0.42	1.92	0.45
F2005/FMSY	**0.7**	**0.78**	0.66	0.76	0.35	0.78
N2005/NMSY	**1.35**	**--**	1.39	--	1.69	--
MSY	**1.27E+06**	**--**	1.32E+06	--	1.47E+06	--
SPRMSY	**0.59**	**0.11**	0.59	0.11	0.60	0.11
FMSY	**0.19**	**--**	0.19	--	0.24	--
SSFMSY	**4.59E+06**	**--**	4.77E+06	--	4.96E+06	--
NMSY	**4.62E+06**	**--**	4.80E+06	--	4.89E+06	--
F2005	**0.13**	**0.78**	0.12	0.76	0.08	0.78
SSF2005	**6.81E+06**	**0.65**	7.35E+06	0.61	9.54E+06	0.65
N2005	**6.22E+06**	**--**	6.67E+06	--	8.27E+06	--
SSF2005/SSF0	**0.56**	**0.32**	0.59	0.29	0.73	0.32
B2005/B0	**0.49**	**0.31**	0.5	0.27	0.61	0.31
R0	**3.24E+06**	**0.35**	3.36E+06	0.35	3.50E+06	0.35
Pup-survival	**0.76**	**0.28**	0.76	0.28	0.74	0.28
alpha	**2.85**	**--**	2.87	--	2.80	--
steepness	**0.42**	**--**	0.42	--	0.41	--

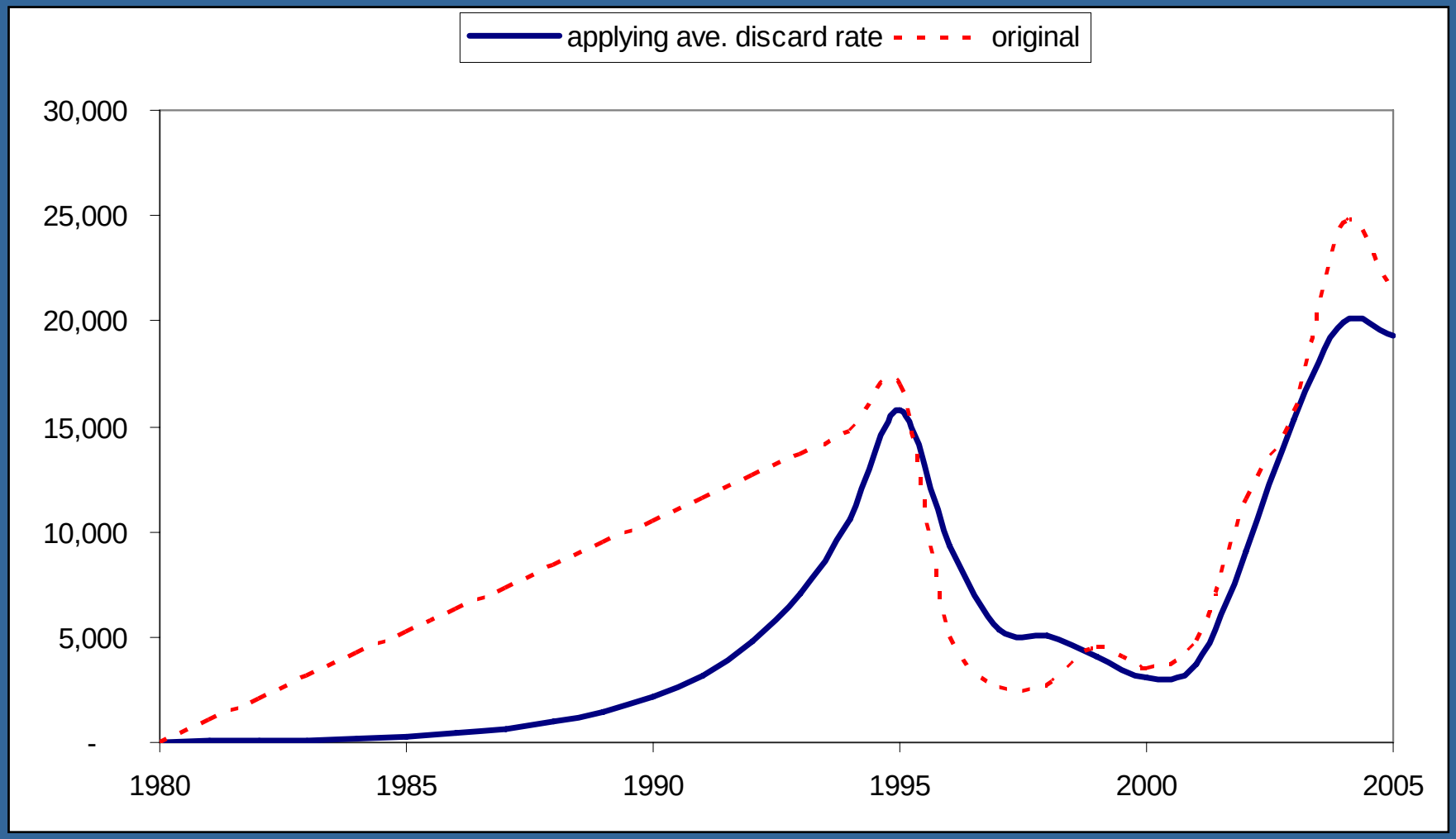
Updated Catches - Shrimp



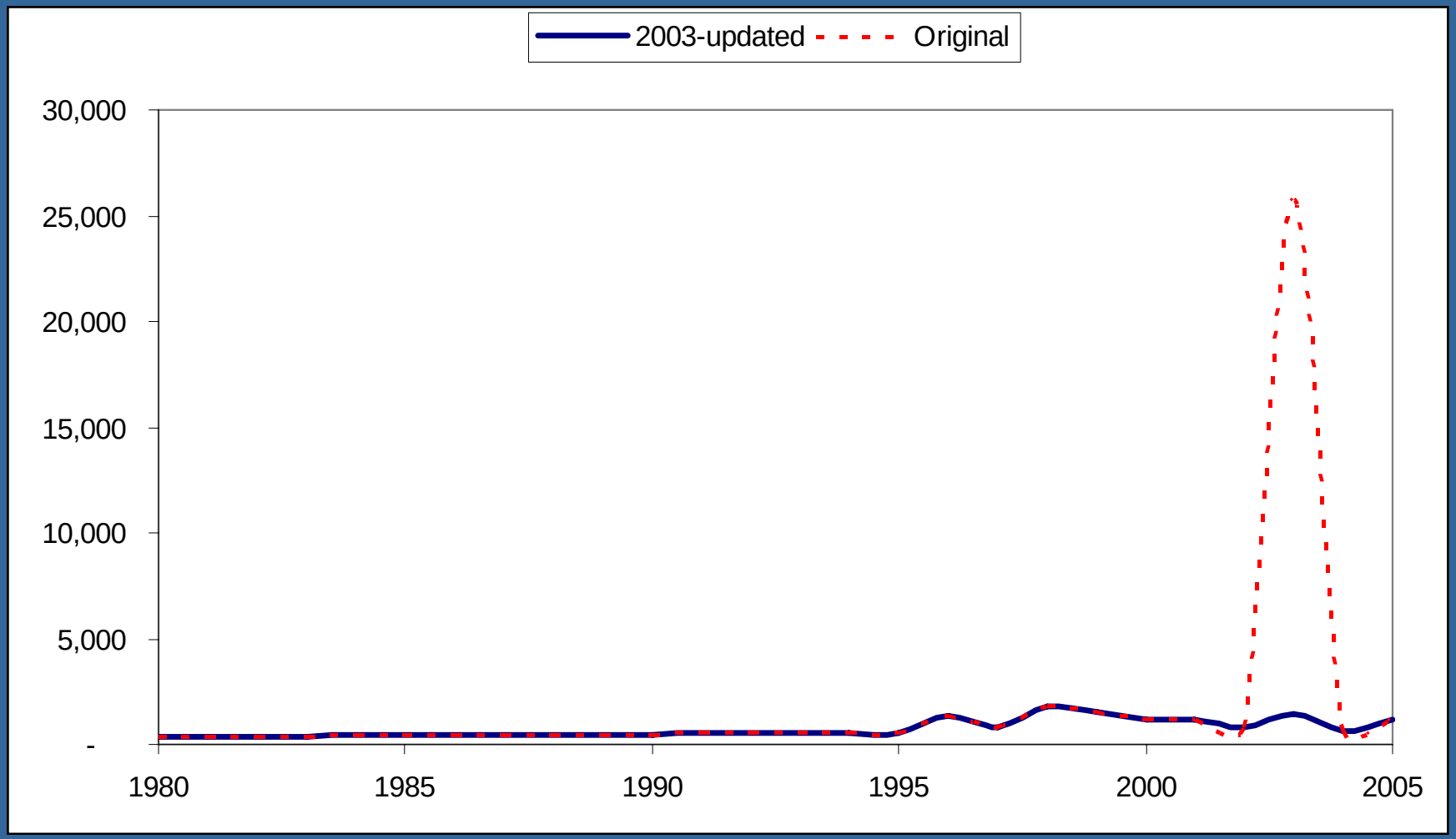
Updated Catches - BLL



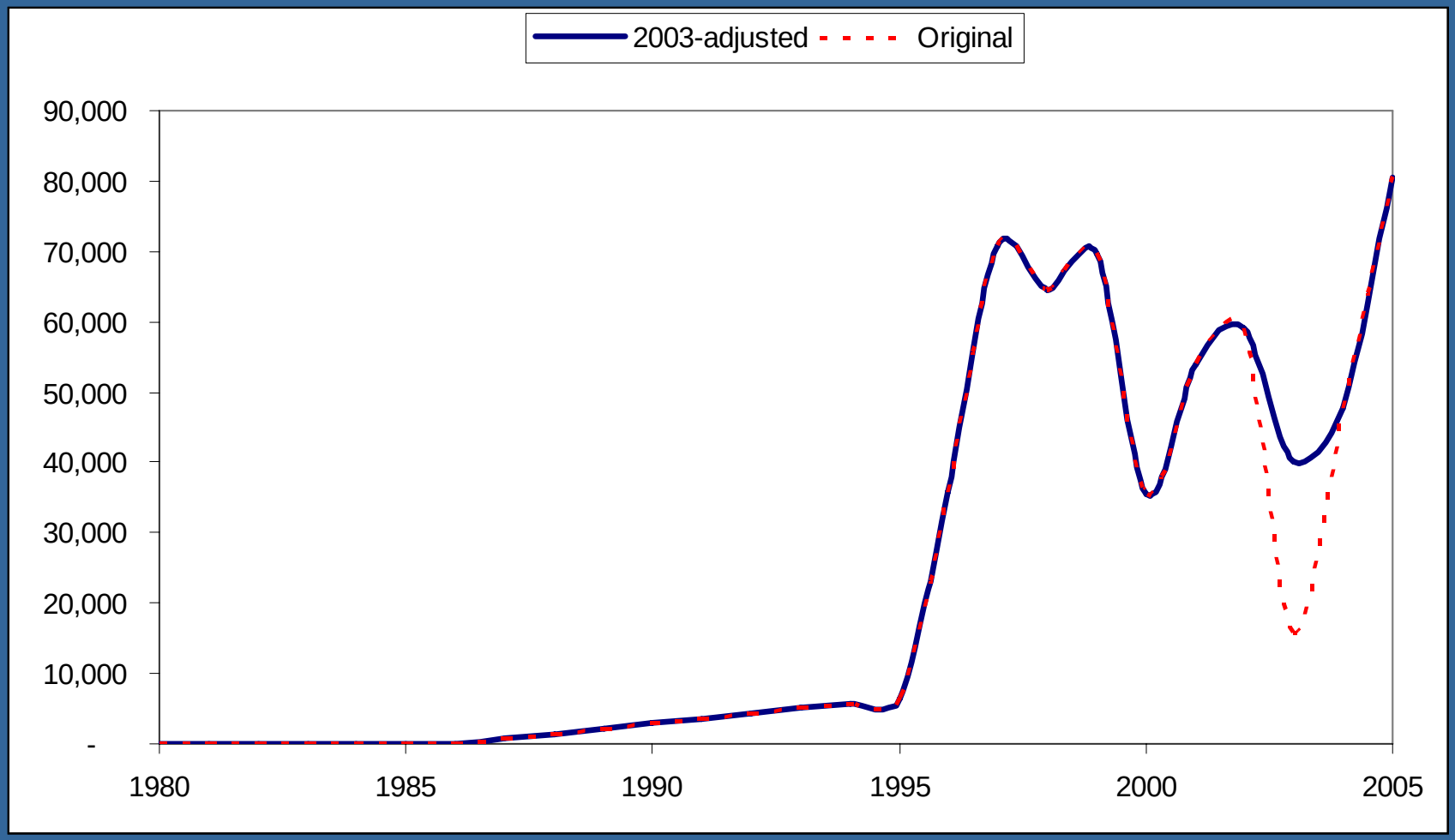
Updated Catches – BLL discards



Updated Catches - Lines



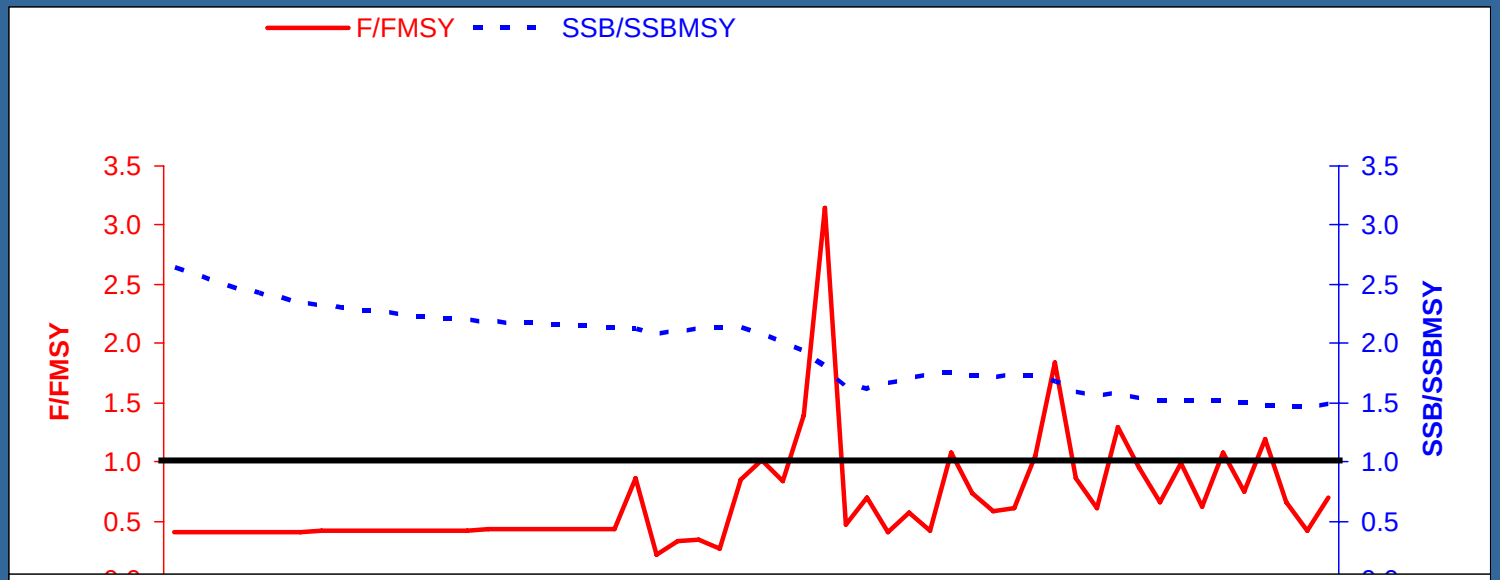
Updated Catches - GN



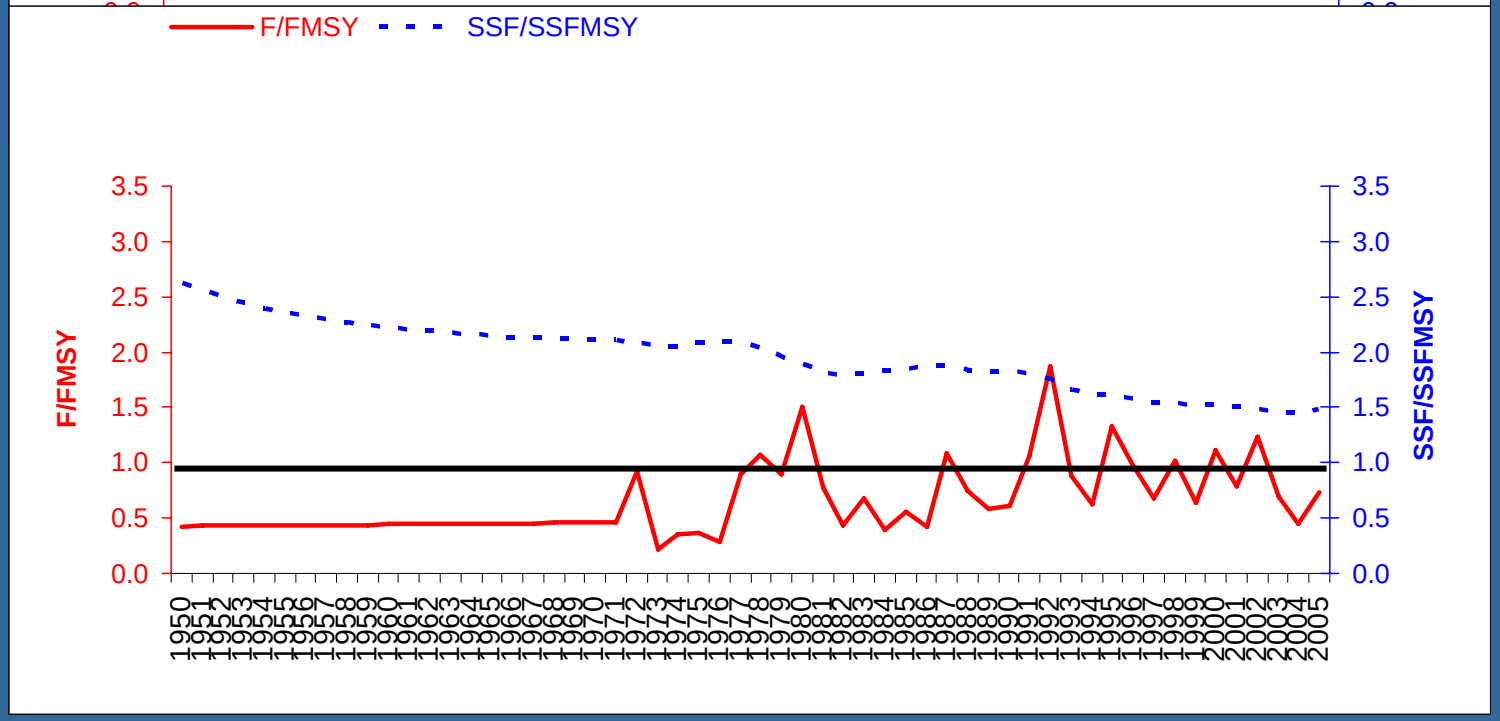
Re-running models after adjusting catches

Base model

DW catches

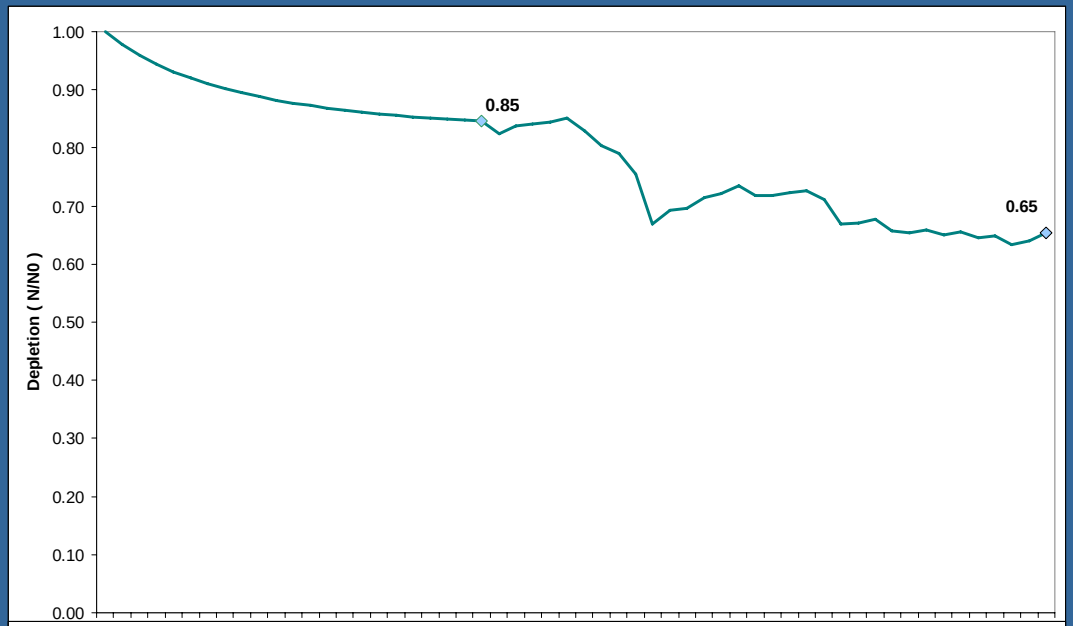


AW catches

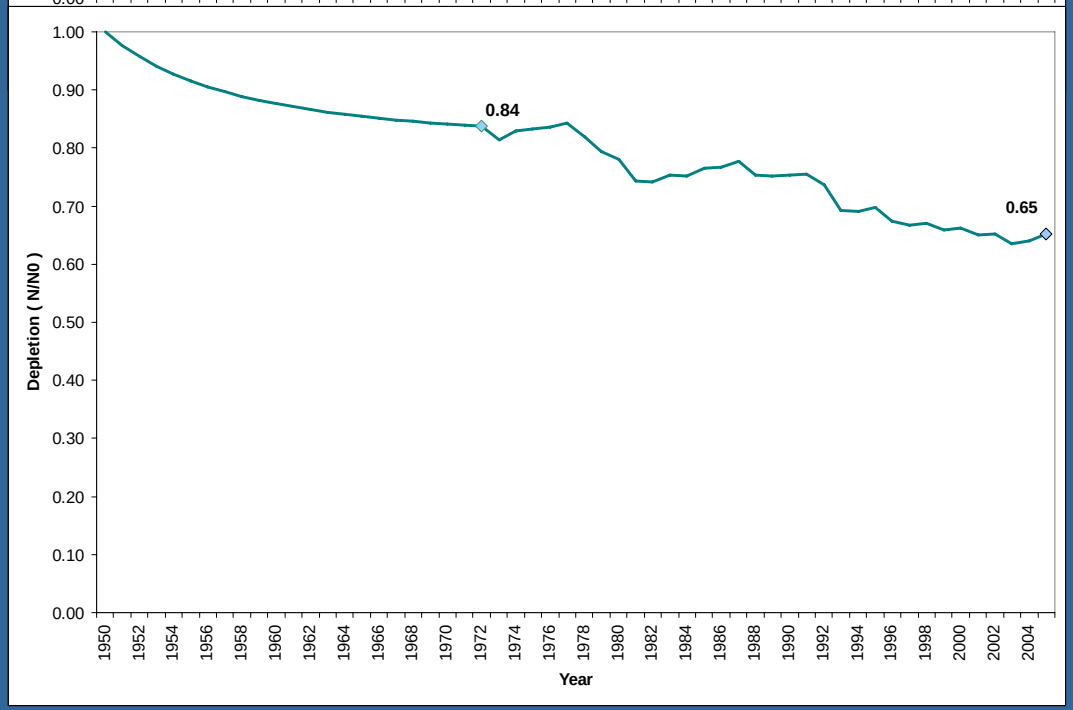


Base model

DW catches



AW catches

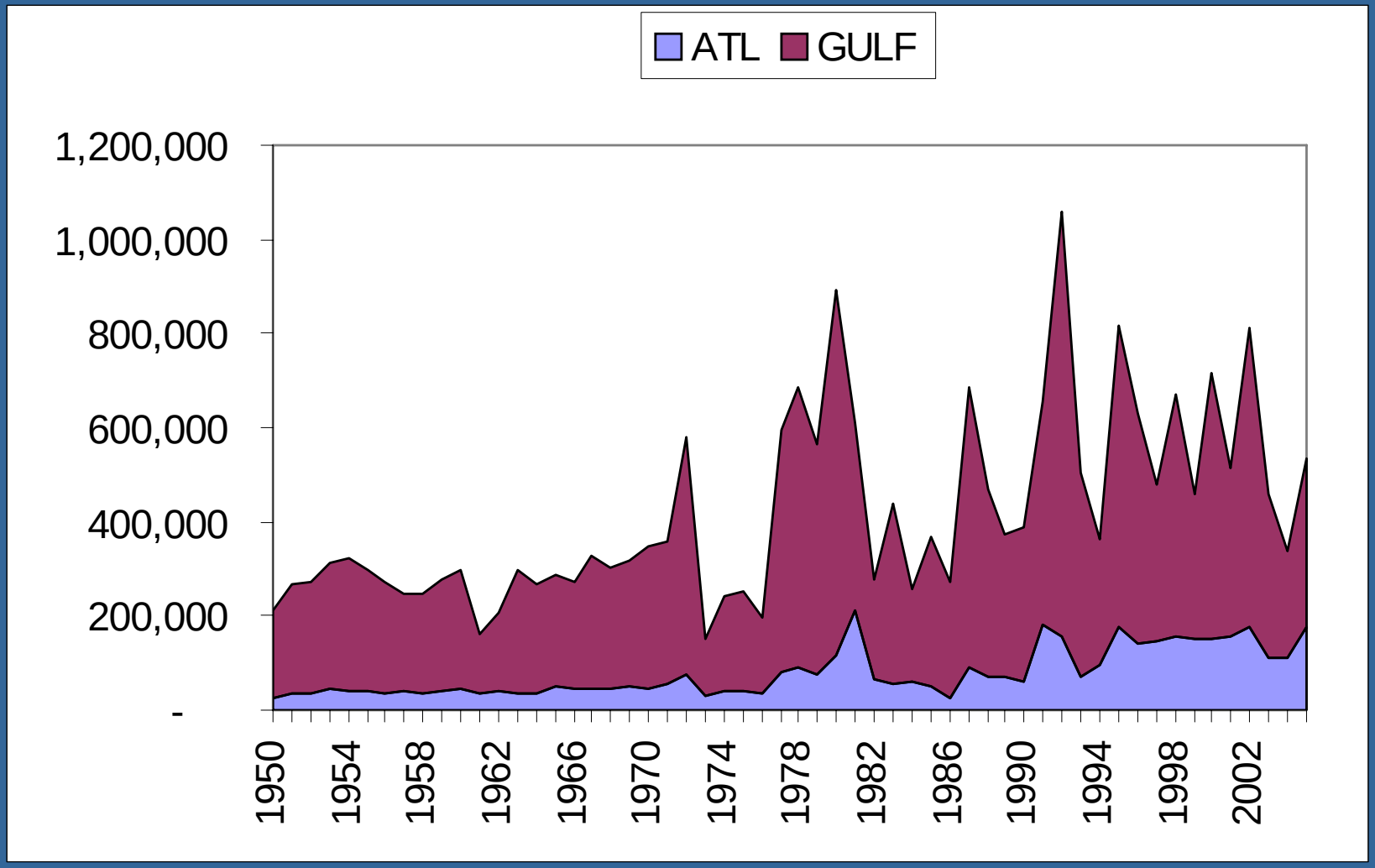


	DW Catches		AW Catches	
Parameter	Base Estimate	CV	Base Estimate	CV
SSF2005/SSFMSY	1.49	0.45	1.47	0.45
F2005/FMSY	0.70	0.78	0.74	0.79
N2005/NMSY	1.35	--	1.34	--
MSY	1.27E+06	--	1.21E+06	--
SPRMSY	0.59	0.11	0.60	0.11
FMSY	0.19	--	0.19	--
SSFMSY	4.59E+06	--	4.43E+06	--
NMSY	4.62E+06	--	4.45E+06	--
F2005	0.13	0.78	0.14	0.79
SSF2005	6.81E+06	0.65	6.53E+06	0.66
N2005	6.22E+06	--	5.96E+06	--
SSF2005/SSF0	0.56	0.32	0.56	0.32
B2005/B0	0.49	0.31	0.48	0.31
R0	3.24E+06	0.35	3.11E+06	0.36
Pup-survival	0.76	0.28	0.75	0.28
alpha	2.85	--	2.84	--
steepness	0.42	--	0.41	--

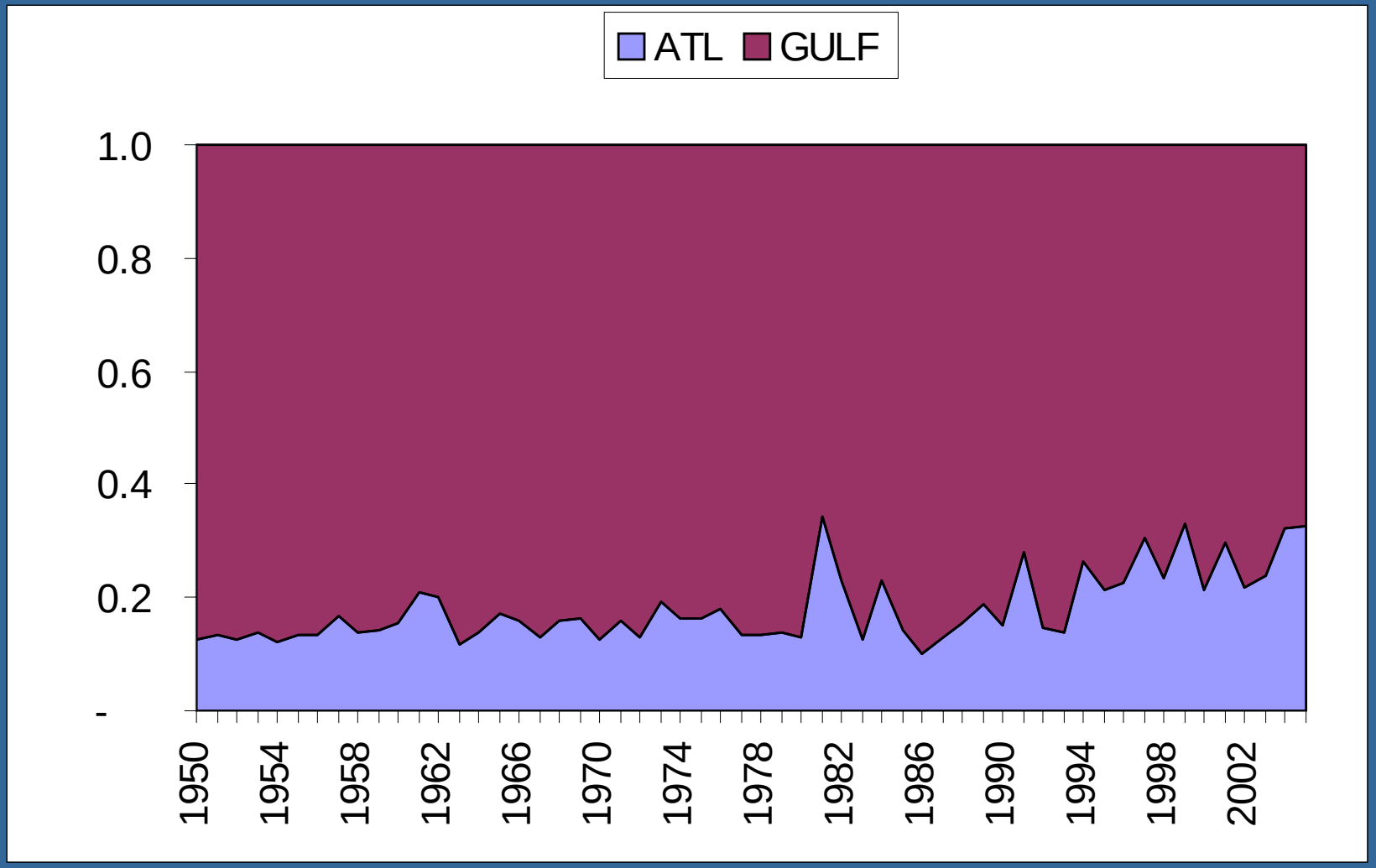
Sensitivity Runs

- S-1 : base inputs with inverse CV weights
- S-2 : separate assessment for Gulf and Atlantic (assumes 2 stocks)
- S-3 : using base <u>and</u> sensitivity indices

Gulf + Atlantic Landings



Gulf + Atlantic Landings



Sensitivity Results

- S-1 : base inputs with inverse CV weights
- S-2 : separate assessment for Gulf and Atlantic (assumes 2 stocks)
- S-3 : using base <u>and</u> sensitivity indices

= converged

= no convergence

	AW Catches		Inverse CV		Gulf Stock	
	Base		S-1		S-2	
Parameter	Estimate	CV	Estimate	CV	Estimate	CV
SSF2005/SSFMSY	1.47	0.45	1.56	0.42	1.26	0.45
F2005/FMSY	0.74	0.79	0.66	0.76	0.81	0.78
N2005/NMSY	1.34	--	1.41	--	1.18	--
MSY	1.21E+06	--	1.28E+06	--	8.60E+05	--
SPRMSY	0.60	0.11	0.60	0.11	0.58	0.11
FMSY	0.19	--	0.19	--	0.25	--
SSFMSY	4.43E+06	--	4.67E+06	--	2.63E+06	--
NMSY	4.45E+06	--	4.69E+06	--	2.65E+06	--
F2005	0.14	0.79	0.12	0.76	0.20	0.23
SSF2005	6.53E+06	0.66	7.30E+06	0.61	3.33E+06	0.29
N2005	5.96E+06	--	6.59E+06	--	3.12E+06	--
SSF2005/SSF0	0.56	0.32	0.59	0.29	0.47	0.68
B2005/B0	0.48	0.31	0.51	0.27	0.40	0.26
R0	3.11E+06	0.36	3.29E+06	0.35	1.91E+06	0.16
Pup-survival	0.75	0.28	0.76	0.28	0.81	0.16
alpha	2.84	--	2.85	--	3.03	--
steepness	0.41	--	0.42	--	0.43	--

Sharpnose Conclusions

- Updated catches (“AW Catches”) resulted in same status conclusion
- Not overfished
- No overfishing
- AW catches somewhat smaller overall than DW catches
- Slightly smaller point estimate for abundance levels (R0, N0, MSY)

Additional Sensitivity Request

- S-4 : Split SEAMAP into 2 separate indices

	AW Catches		Inverse CV		Gulf Stock		Seamap Split	
	Base		S-1		S-2		S-4	
Parameter	Estimate	CV	Estimate	CV	Estimate	CV	Estimate	CV
SSF2005/SSFMSY	1.47	0.45	1.56	0.42	1.26	0.45	1.52	0.44
F2005/FMSY	0.74	0.79	0.66	0.76	0.81	0.78	0.71	0.78
N2005/NMSY	1.34	--	1.41	--	1.18	--	1.37	--
MSY	1.21E+06	--	1.28E+06	--	8.60E+05	--	1.24E+06	--
SPRMSY	0.60	0.11	0.60	0.11	0.58	0.11	0.59	0.11
FMSY	0.19	--	0.19	--	0.25	--	0.19	--
SSFMSY	4.43E+06	--	4.67E+06	--	2.63E+06	--	4.43E+06	--
NMSY	4.45E+06	--	4.69E+06	--	2.65E+06	--	4.47E+06	--
F2005	0.14	0.79	0.12	0.76	0.20	0.23	0.13	0.78
SSF2005	6.53E+06	0.66	7.30E+06	0.61	3.33E+06	0.29	6.72E+06	0.65
N2005	5.96E+06	--	6.59E+06	--	3.12E+06	--	6.11E+06	--
SSF2005/SSF0	0.56	0.32	0.59	0.29	0.47	0.68	0.57	0.31
B2005/B0	0.48	0.31	0.51	0.27	0.40	0.26	0.49	0.29
R0	3.11E+06	0.36	3.29E+06	0.35	1.91E+06	0.16	3.13E+06	0.36
Pup-survival	0.75	0.28	0.76	0.28	0.81	0.16	0.77	0.28
alpha	2.84	--	2.85	--	3.03	--	2.88	--
steepness	0.41	--	0.42	--	0.43	--	0.42	--