

GOA Pacific cod stock assessment models for 2015

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Overview

- Comments
- Data
- Models
- Results

Joint Plan Team meeting - May

For the GOA, the subcommittee recommended that the following models be developed for this year's preliminary assessment:

- Model 0: Final model from 2014
- Model 2: Final model from 2011

Joint Plan Team meeting - May

For the GOA, the subcommittee recommended that the following non-model analyses be conducted for this year's preliminary assessment:

- Analysis 1: Examine the longline survey RPN and length frequency data for use within the model

Joint Plan Team meeting - May

For the GOA, the discretionary model was as follows:

- Final model from 2014, but with an exploration of initial conditions

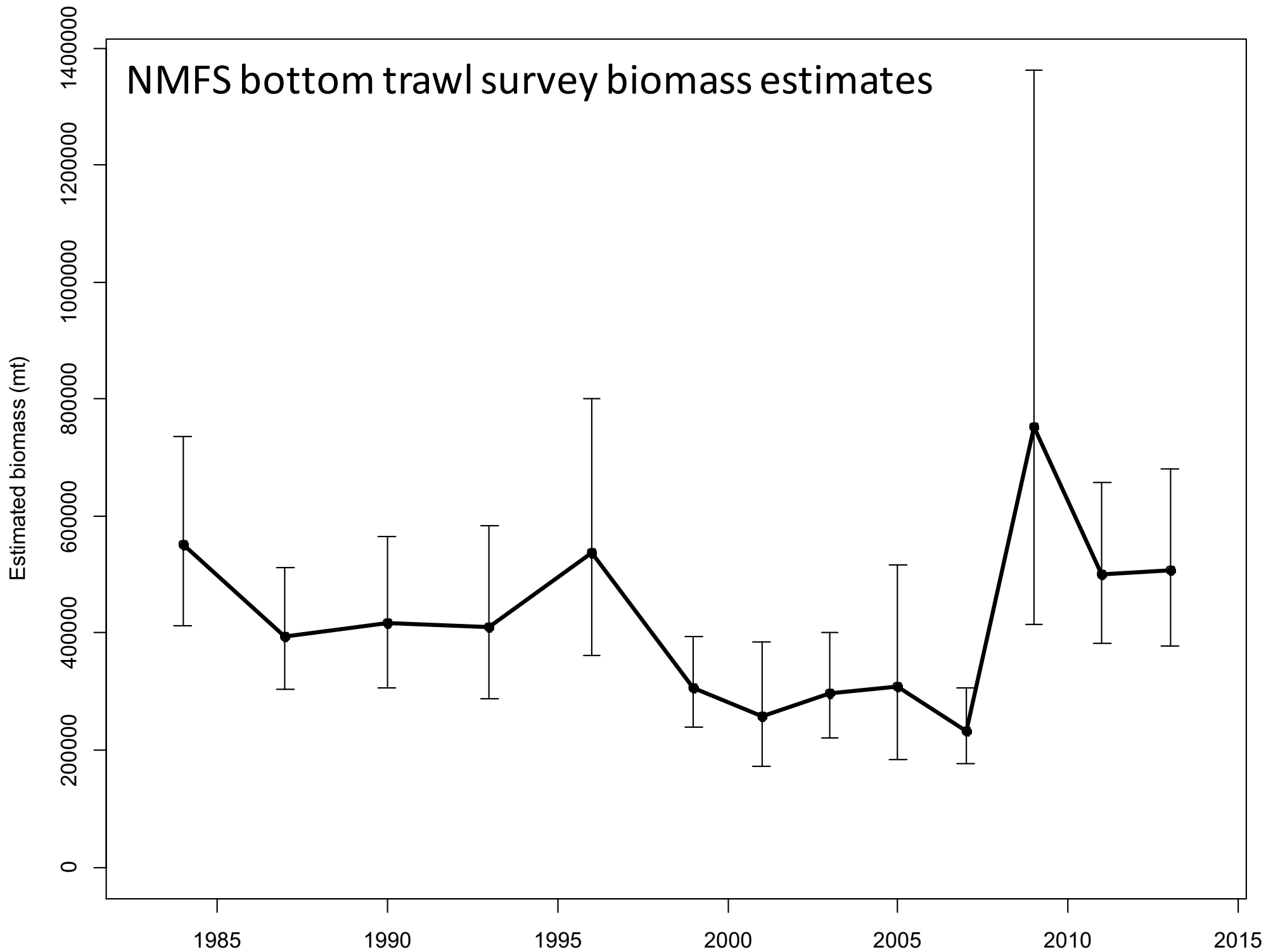
Responses

- Model 0 is the final model from 2014
- Model 2 is the final model from 2011
- Model 3 is the final model from 2014 with an exploration of initial conditions
- Analysis 1: Steve Barbeaux is looking at the NMFS longline survey data; analyses are ongoing

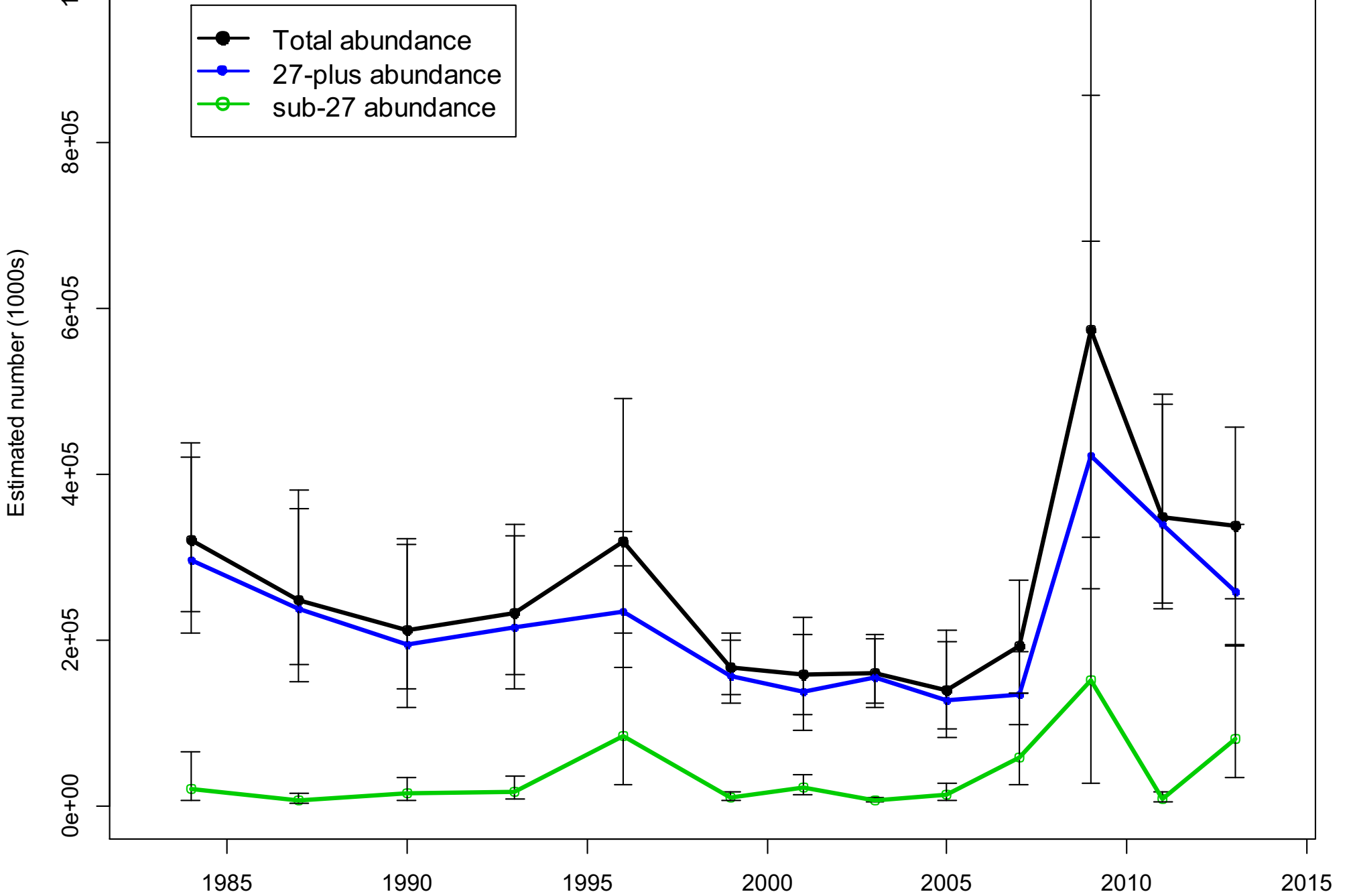
Data

- Fishery catch and length composition data through 2014
- Survey abundance and length composition data through 2013
- Survey age composition and conditional age-at-length data through 2013

NMFS bottom trawl survey biomass estimates

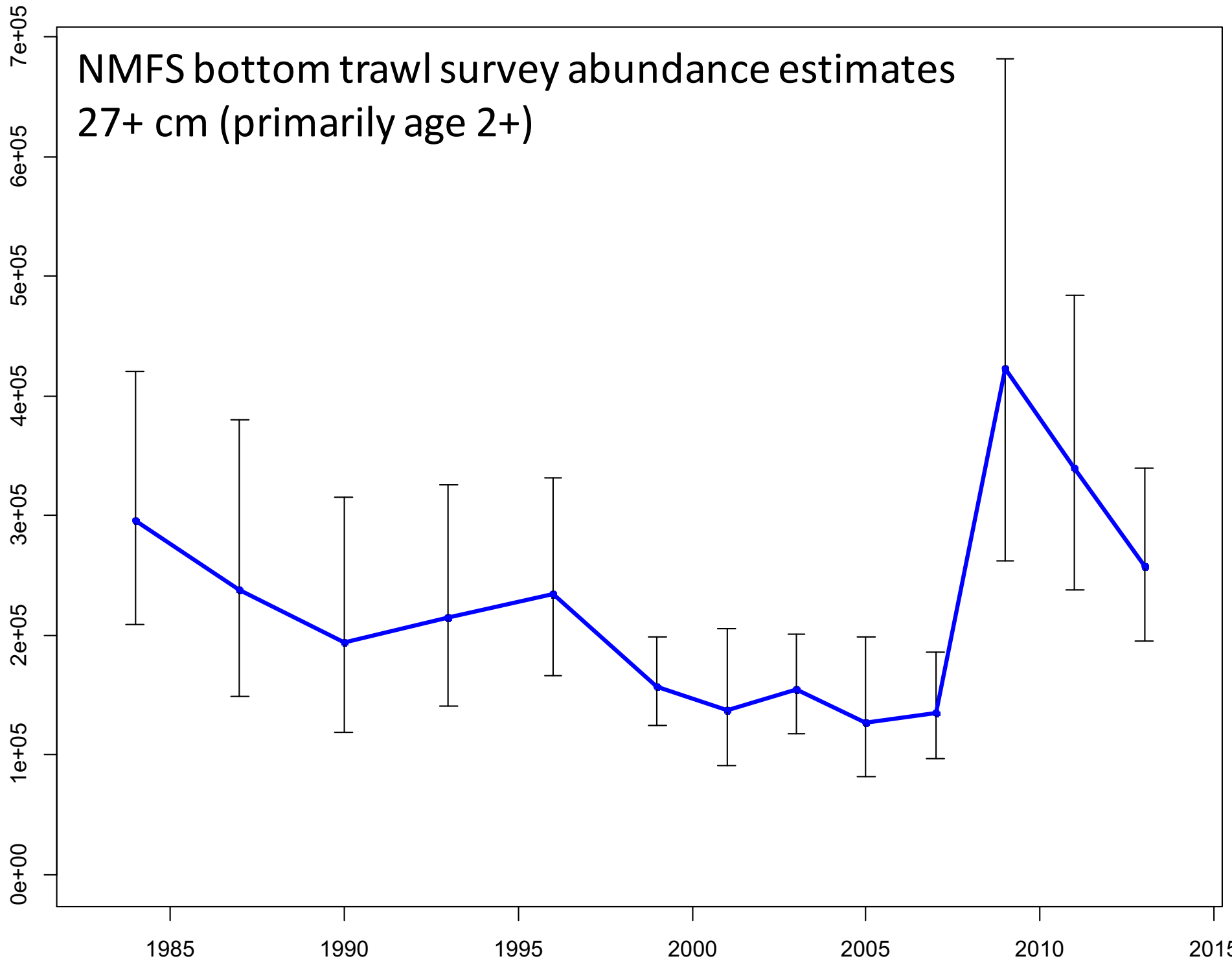


NMFS bottom trawl survey abundance estimates



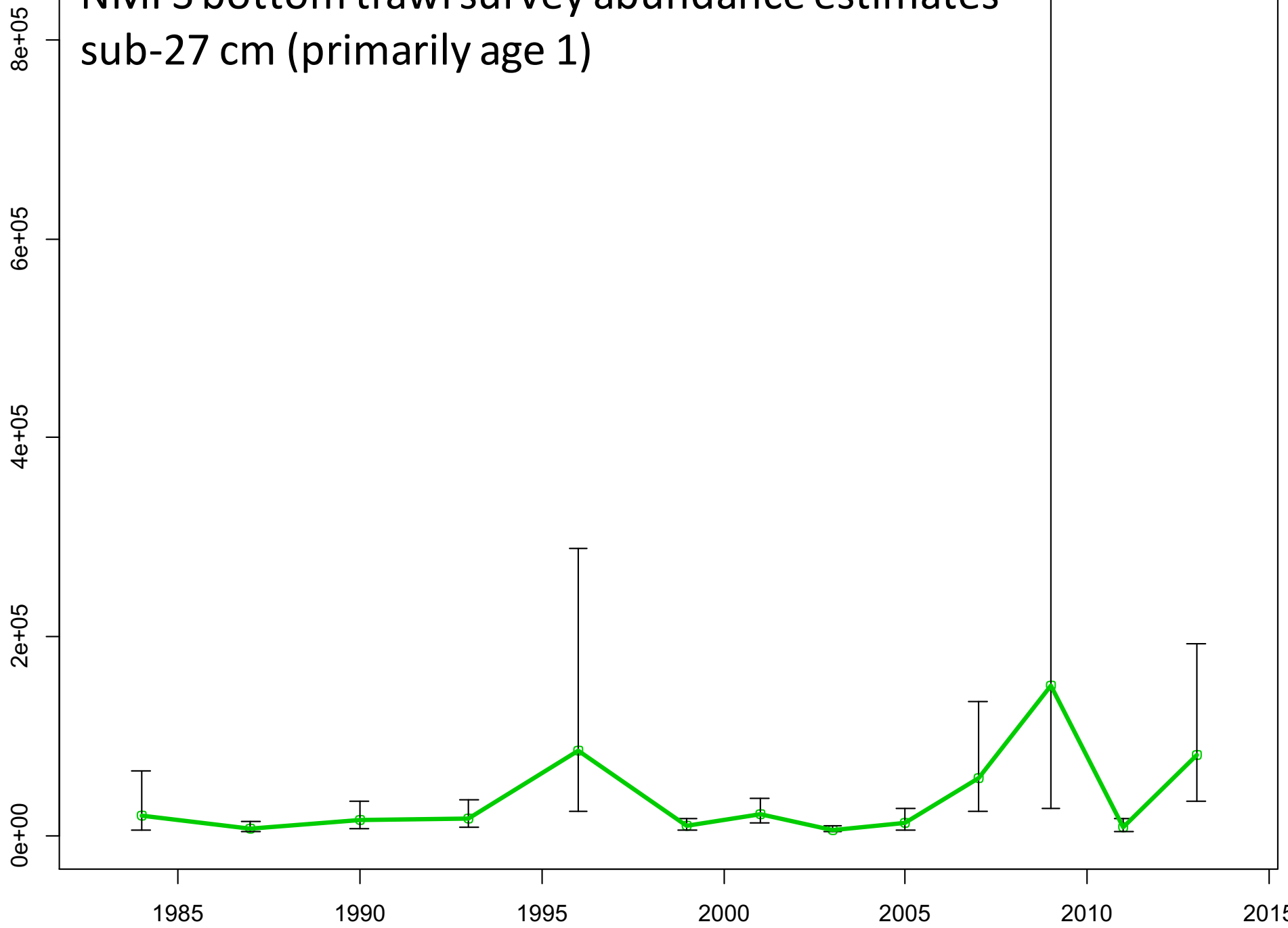
NMFS bottom trawl survey abundance estimates 27+ cm (primarily age 2+)

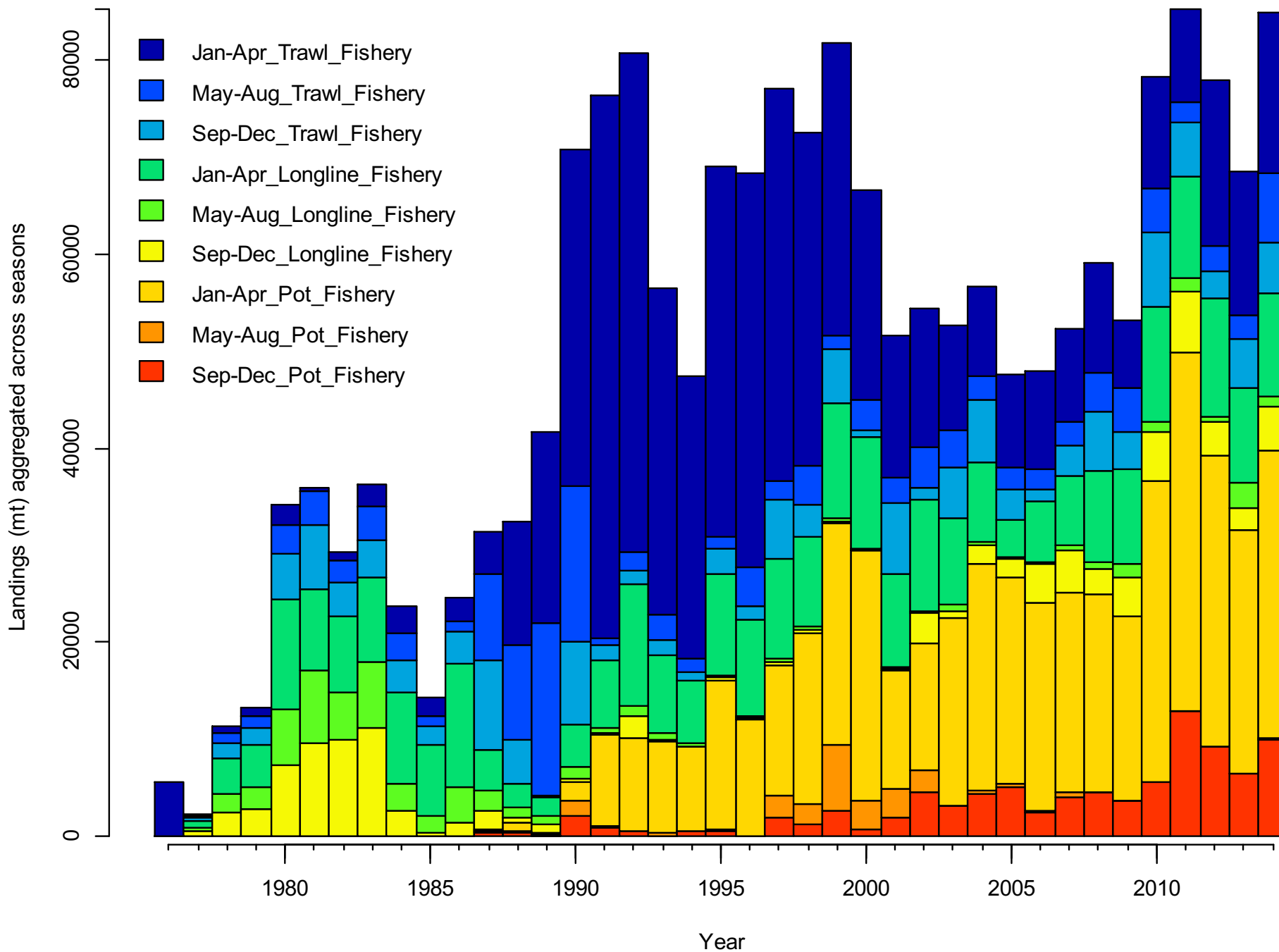
Estimated number (1000s)



NMFS bottom trawl survey abundance estimates sub-27 cm (primarily age 1)

Estimated number (1000s)





Models

- Model 0 – final model from 2014
- Model 2 – final model from 2011
- Model 3 – final model from 2014 with an unsuccessful exploration of initial conditions

Model 0 – 2014 final model

- Three gear types (trawl, longline, and pot), 5 seasons (Jan-Feb, Mar-Apr, May-Aug, Sept-Oct, and Nov-Dec), and three fishery selectivity “seasons” (Jan-Apr, May-Aug, and Sept-Dec);
- Time-varying fishery selectivity-at-length for all gears and seasons (3 – 7 blocks);
- Two blocks for catchability for the survey, 1984 – 1993 and 1996 – 2013, with the catchability for the latter period fixed at 1.0;
- The bottom trawl survey is treated as one data source, not two, i.e., not split into sub-27 and 27-plus surveys;
- Two blocks of non-parametric survey selectivity-at-age, 1984 – 1993 and 1996 – 2013;
- Conditional age-at-length survey data for 1987 – 2013; and
- The use of the SS “multiplier” on \bar{R} instead of setting recent recruitments equal to the mean

Model 2 – 2011 final model

- Three gear types (trawl, longline, and pot), 5 seasons (Jan-Feb, Mar-Apr, May-Aug, Sept-Oct, and Nov-Dec), and three fishery selectivity “seasons” (Jan-Apr, May-Aug, and Sept-Dec);
- Time-varying fishery selectivity-at-length for all gears and seasons (3 – 7 blocks);
- Two blocks for catchability for the 27-plus survey, 1984 – 1993 and 1996 – 2013, with the catchability for the latter period set to 1.04;
- The bottom trawl survey is **split into a sub-27 and 27-plus survey**;
- Time-varying double normal **survey selectivity-at-age** for the 27-plus survey (12 blocks);
- Time-varying **catchability** for the sub-27 survey;
- Constant non-parametric **survey selectivity-at-age** for the sub-27 survey; and
- Median recruitment before 1977 restricted to be less than the post-1976 median recruitment

Model 4 – adjusted 2014 final model

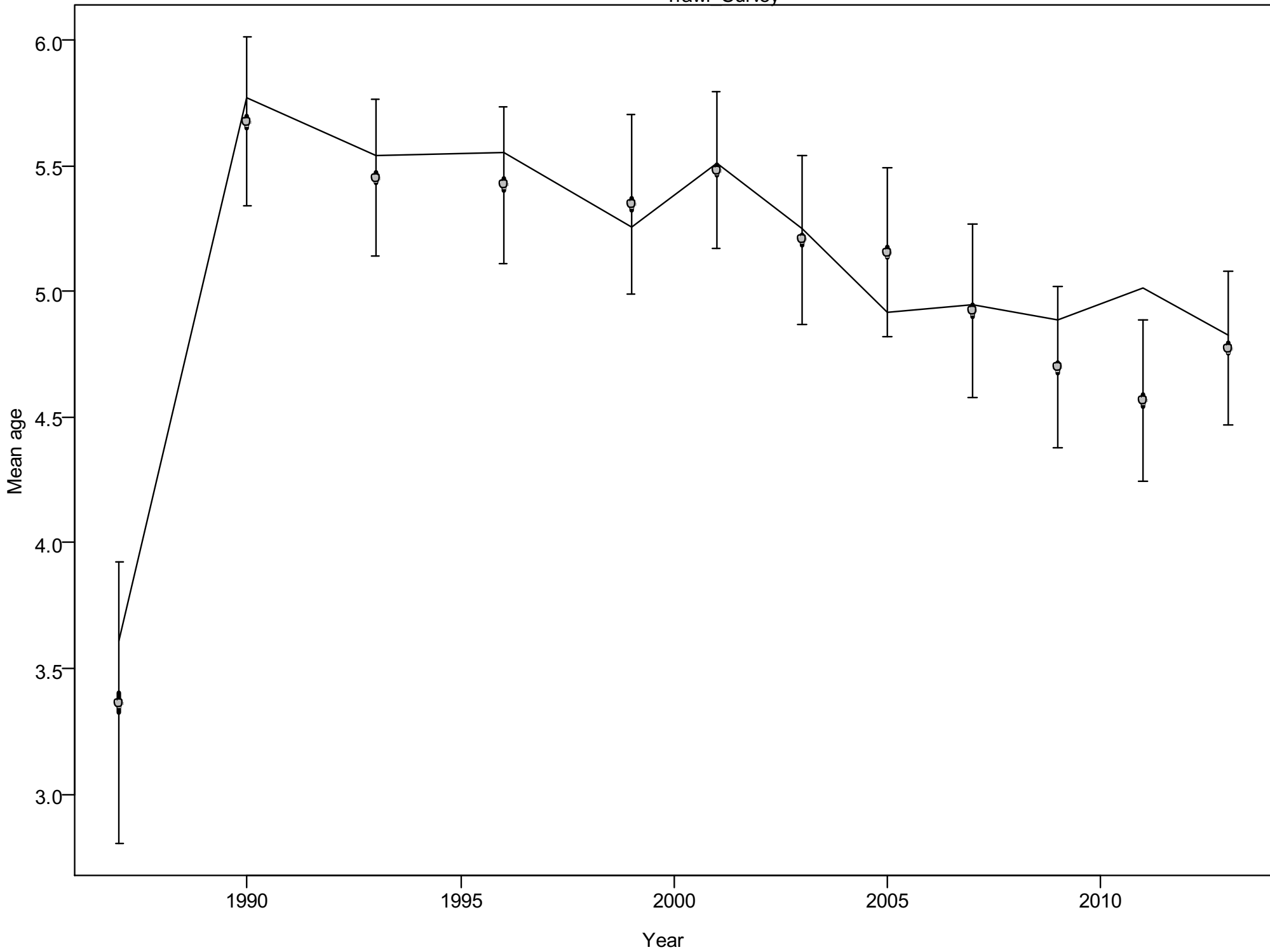
Model 4 is the final model from 2014 with the omission of all age-1 survey data for 1990 on, and other adjustments, including

- A_{\min} increased from 1 to 2;
- Early recruits increased from 13 to 16;
- Survey selectivity is 0 for age 1 for 1990 on;
- 3 or 4 blocks of survey selectivity; and
- Non-parametric or double-normal survey selectivity-at-age

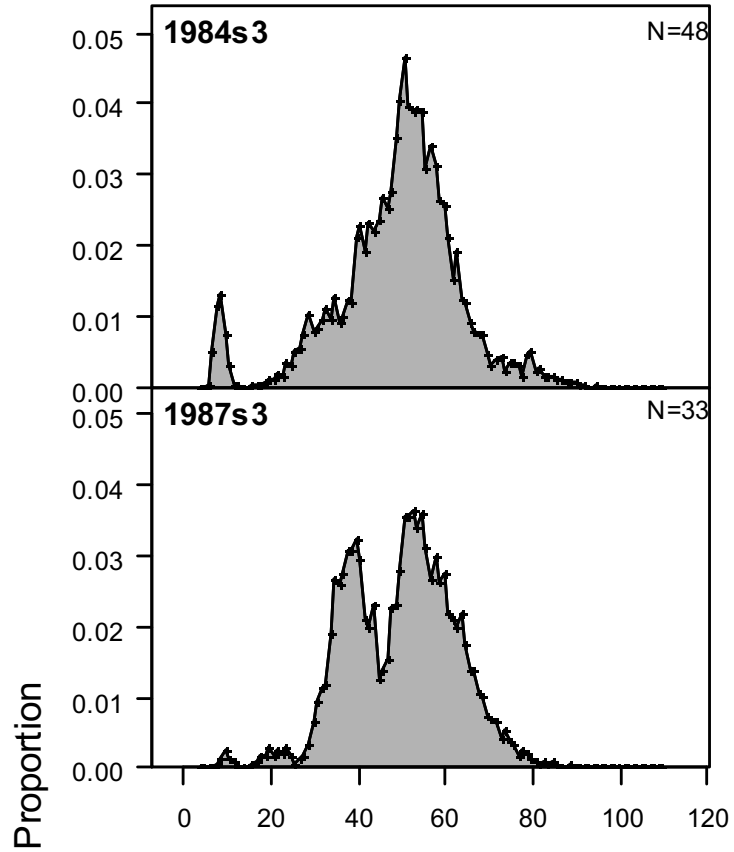
Why only 1990 on?

- Smaller, younger fish were caught in the survey in 1984 and 1987
- There are no age data for 1984, so the models are fit to length composition data for 1984 and 1987
- These early data could be omitted

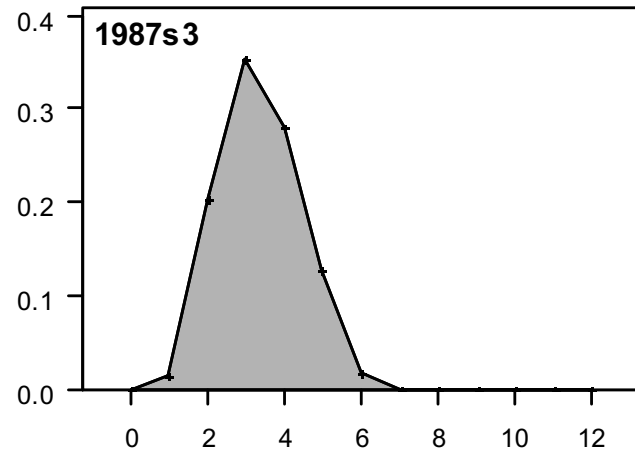
Trawl Survey



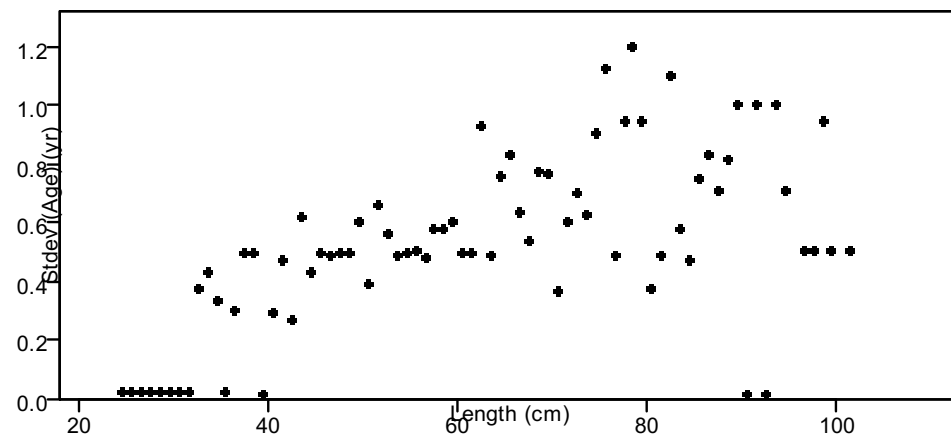
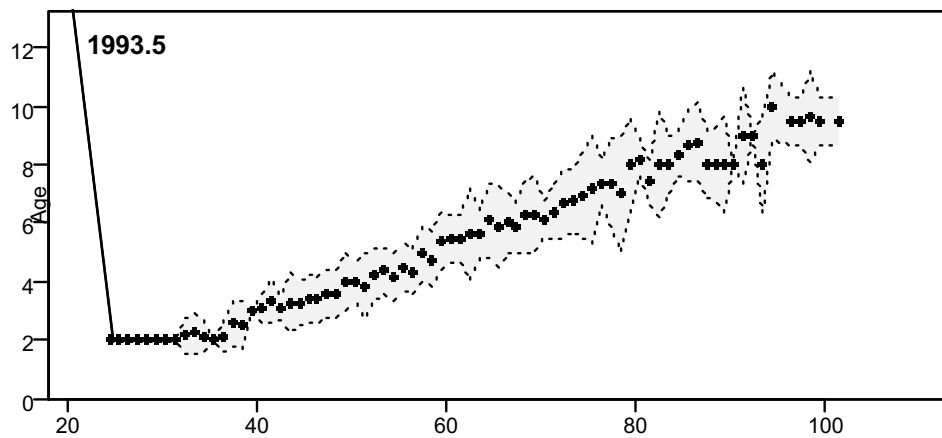
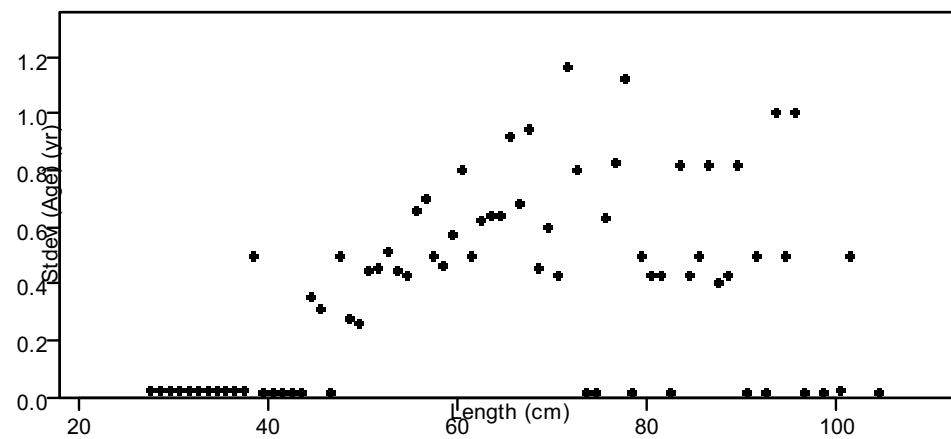
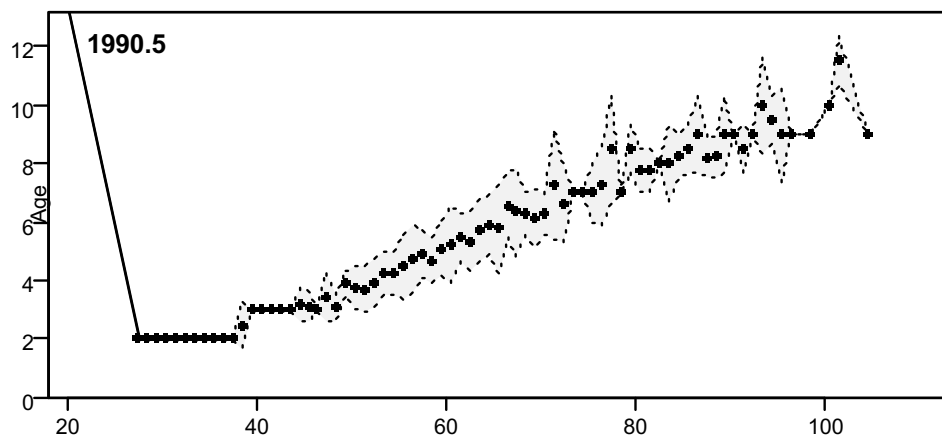
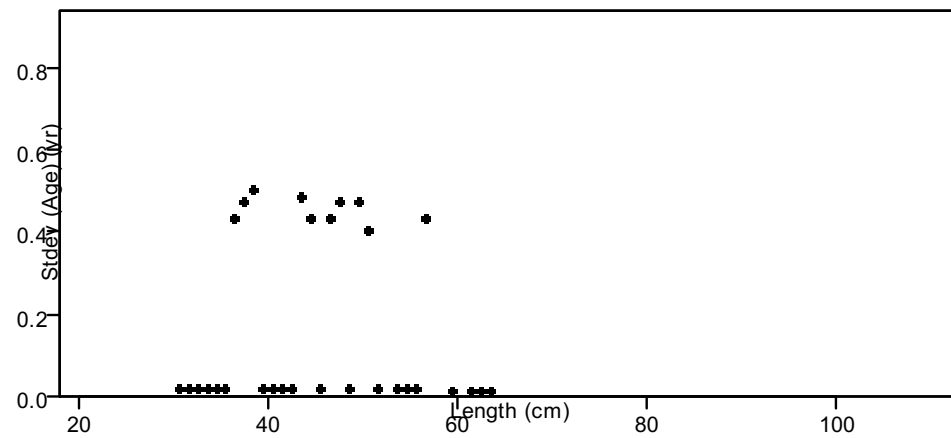
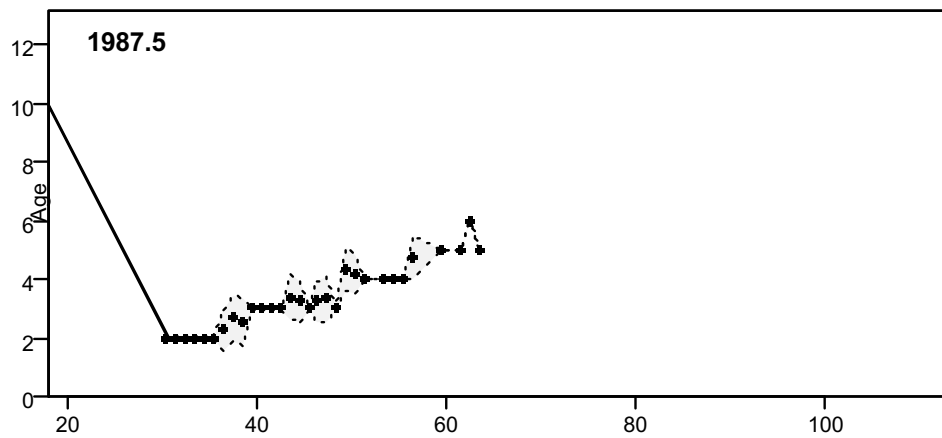
Length composition data



Age composition data



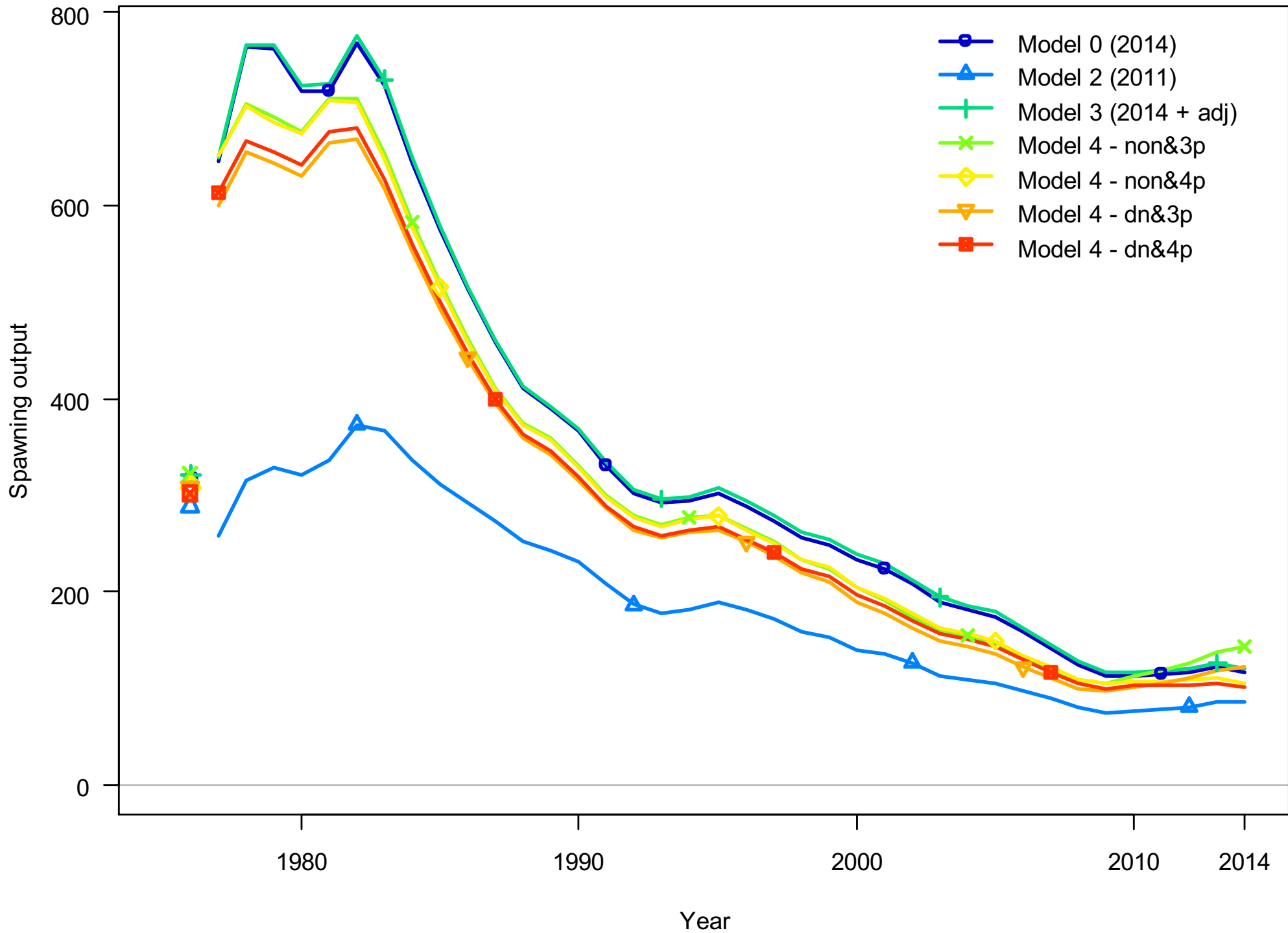
Conditional AAL plot, whole catch, Trawl_Survey

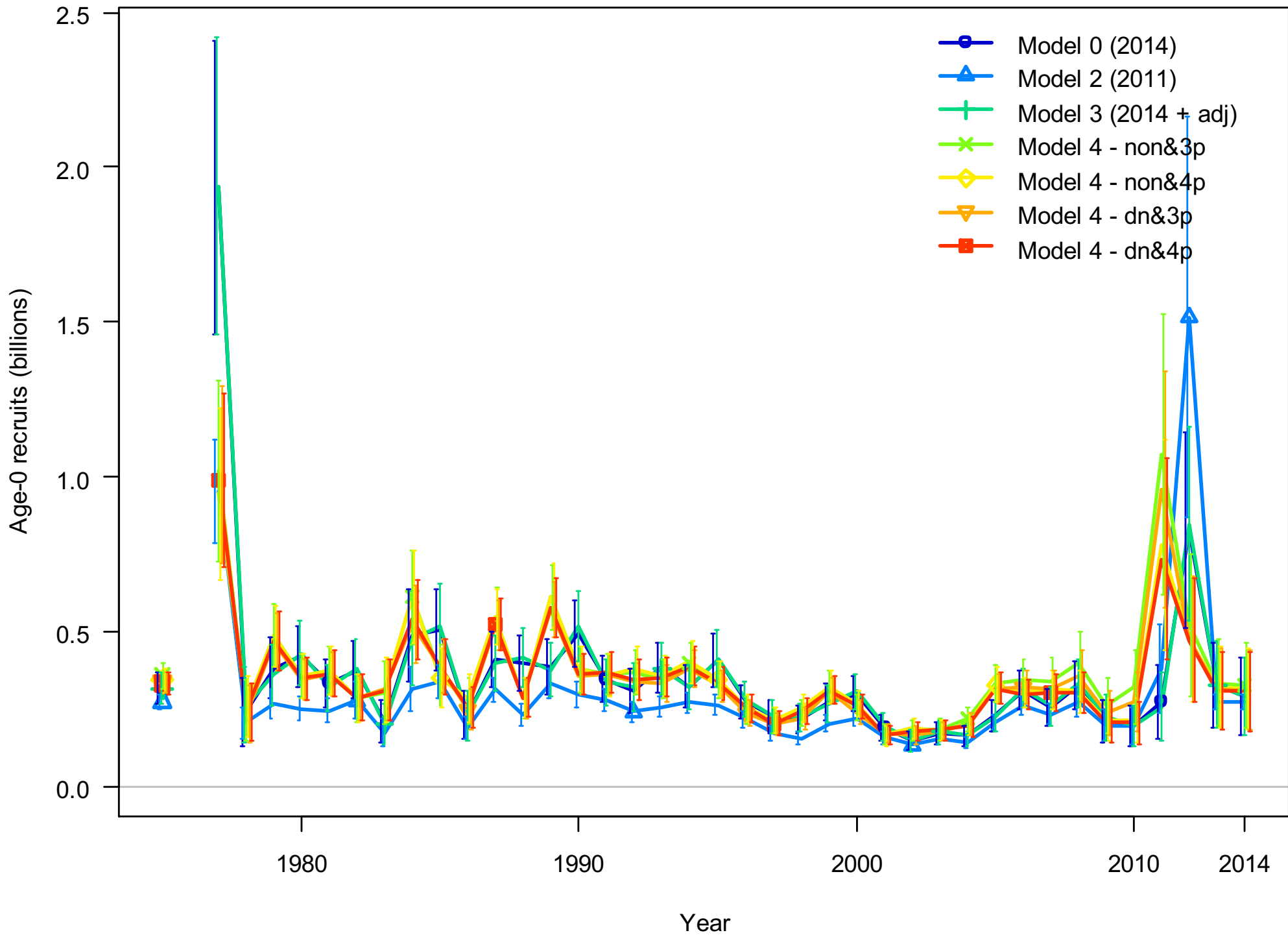


Length (cm)

Results

- Spawning biomass
- Age-0 recruits
- Fits to survey abundance indices
- Selectivity curves





Survey abundance indices

- Model 2
 - 27-plus and sub-27 survey indices
- Model 0 and Model 3
 - No split in survey data
- Model 4
 - Age-1 data omitted from survey data

27-plus survey abundance

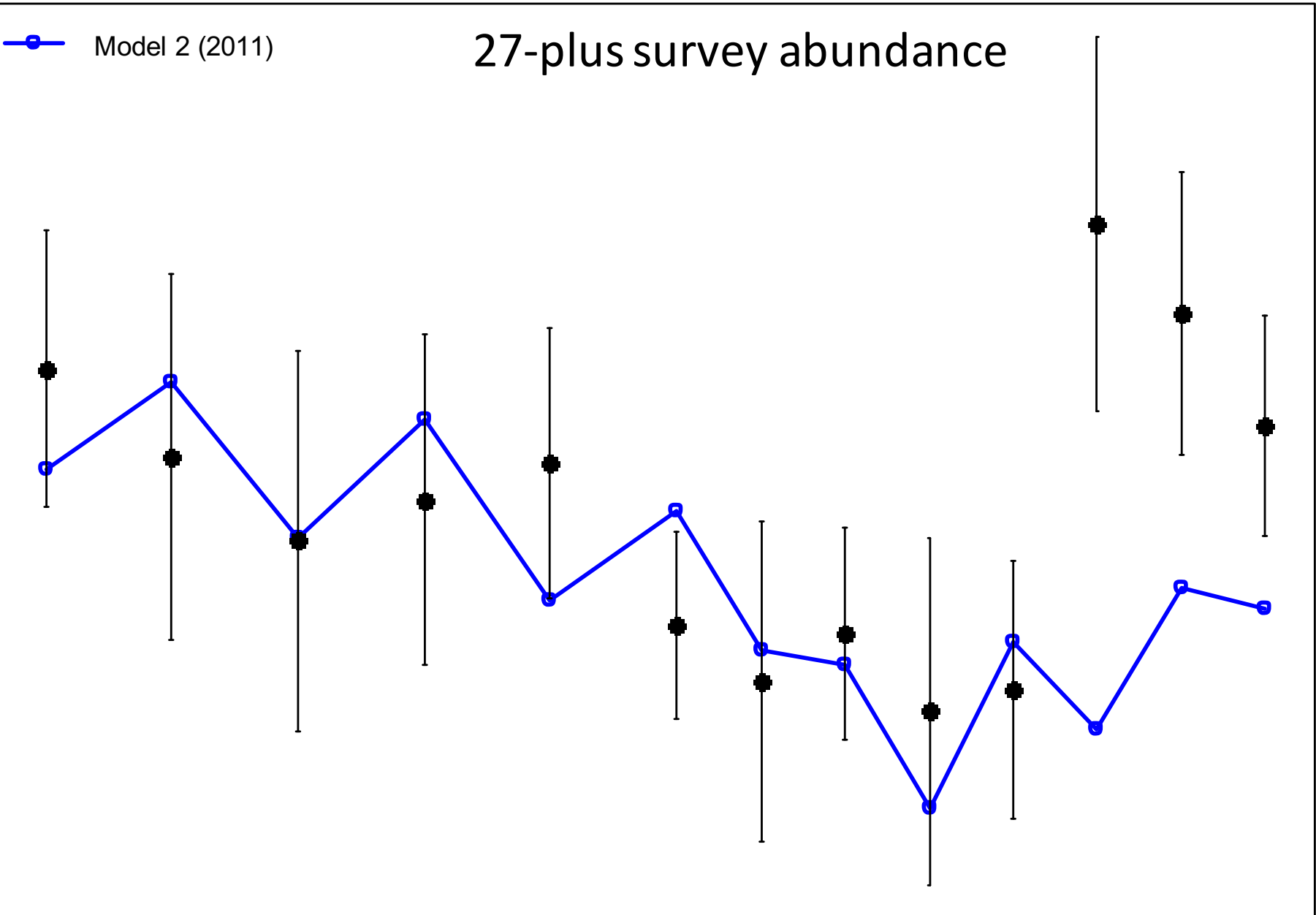
Model 2 (2011)

Log index

13.0
12.5
12.0
11.5

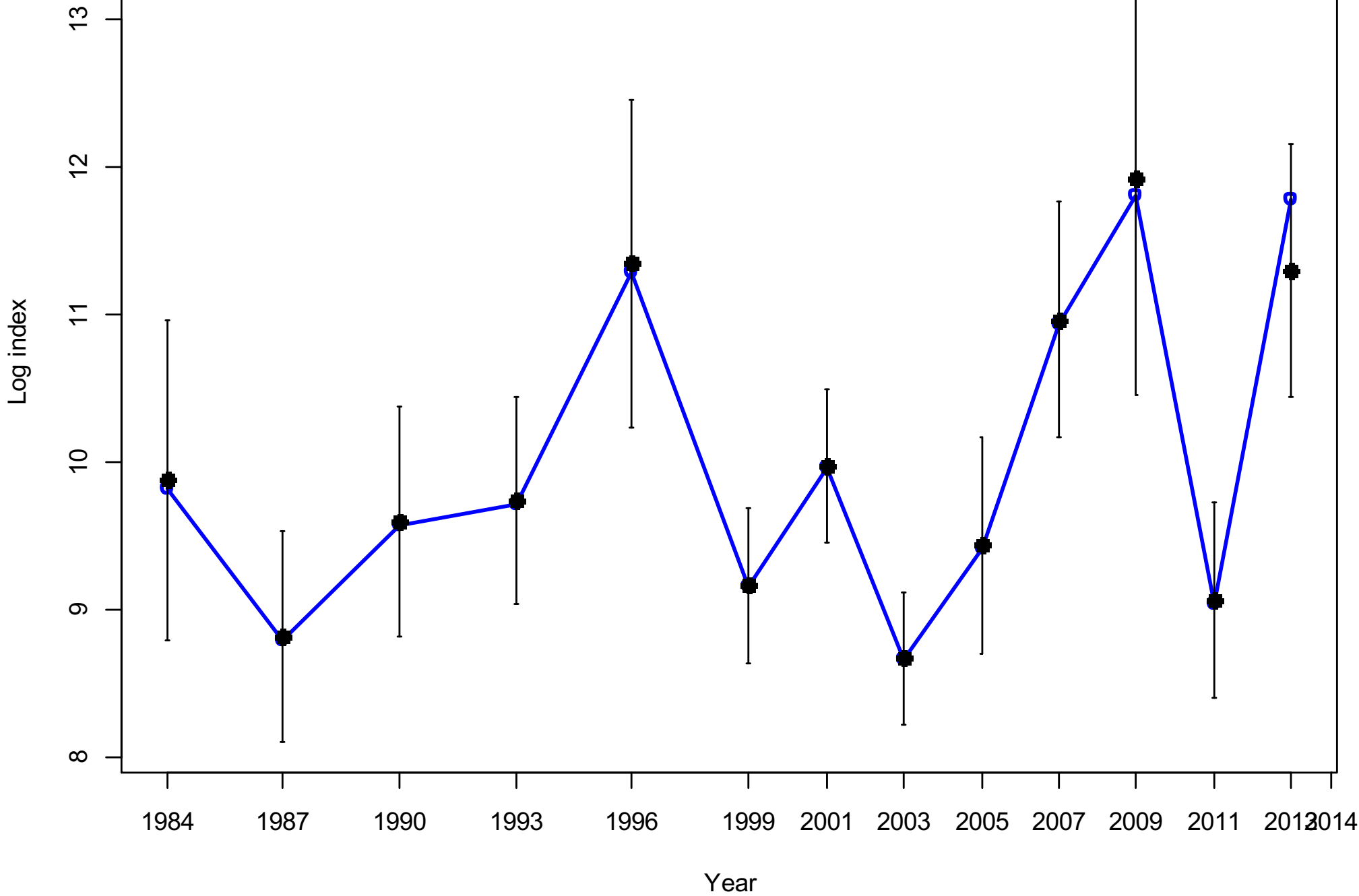
1984 1987 1990 1993 1996 1999 2001 2003 2005 2007 2009 2011 2013 2014

Year



Sub-27 survey abundance

Model 2 (2011)



Total survey abundance

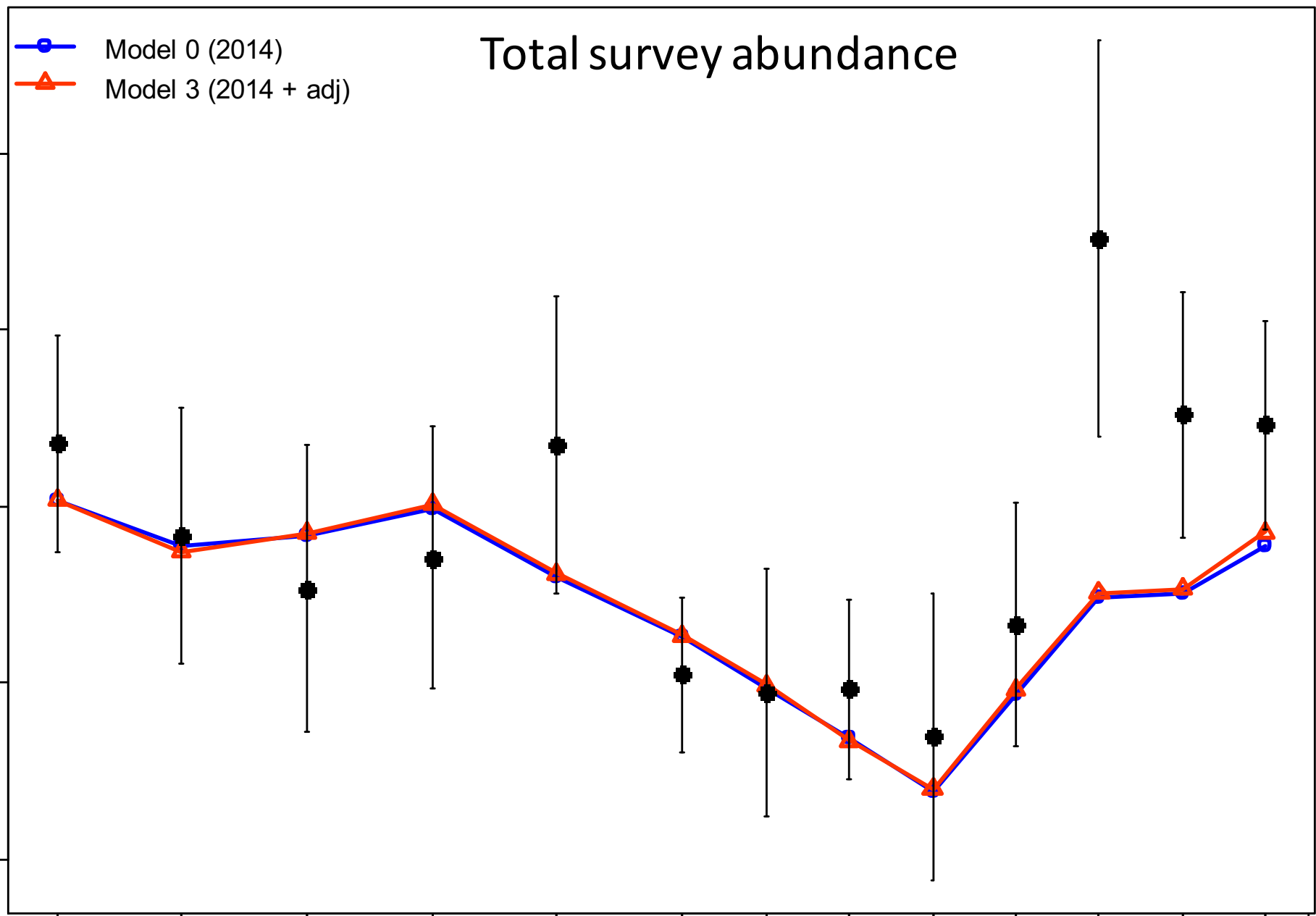
- Model 0 (2014)
- Model 3 (2014 + adj)

Log index

13.5
13.0
12.5
12.0
11.5

1984 1987 1990 1993 1996 1999 2001 2003 2005 2007 2009 2011 2012 2014

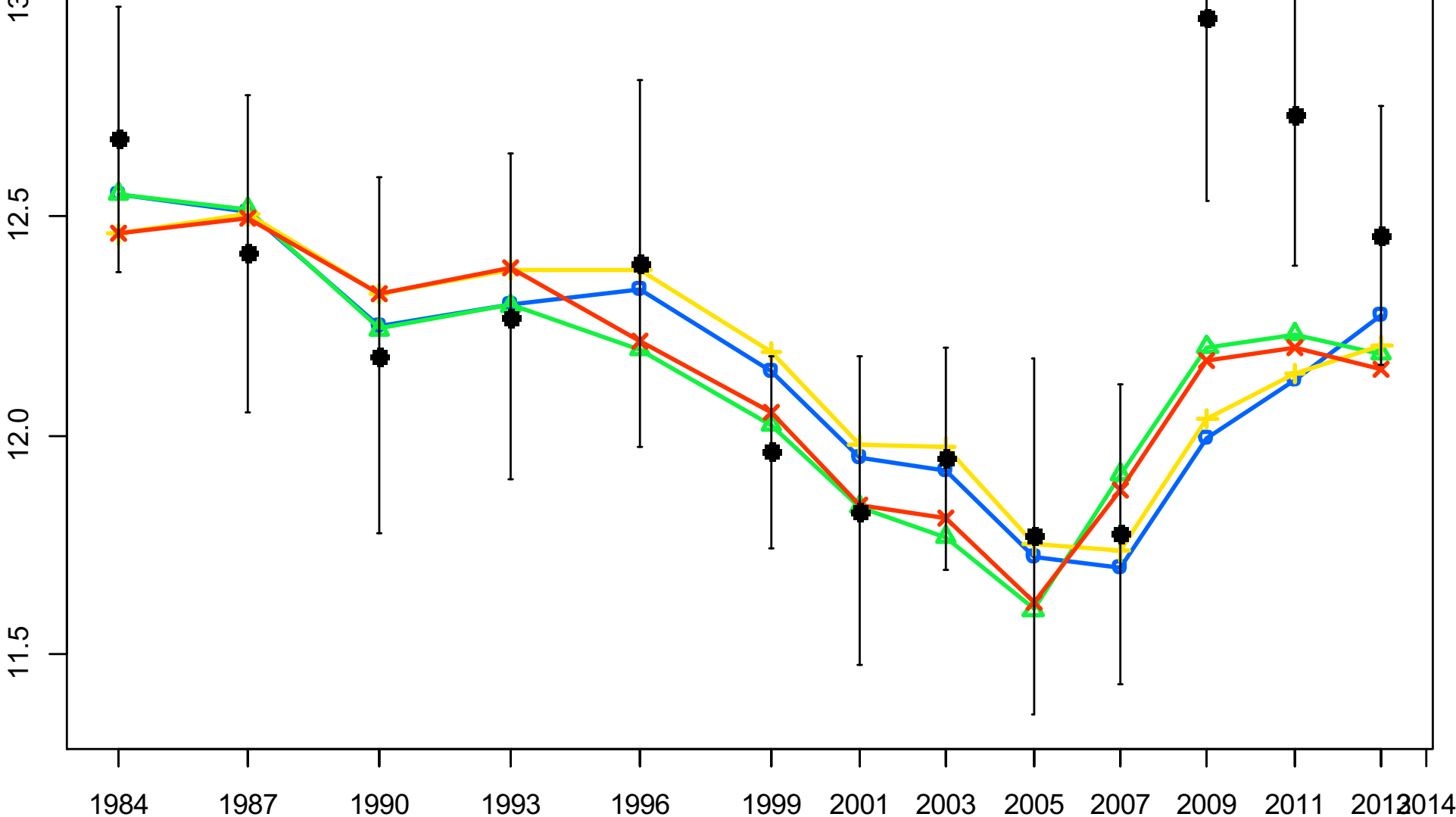
Year



No age-1 survey abundance

- Model 4 - non&3p
- Model 4 - non&4p
- Model 4 - dn&3p
- Model 4 - dn&4p

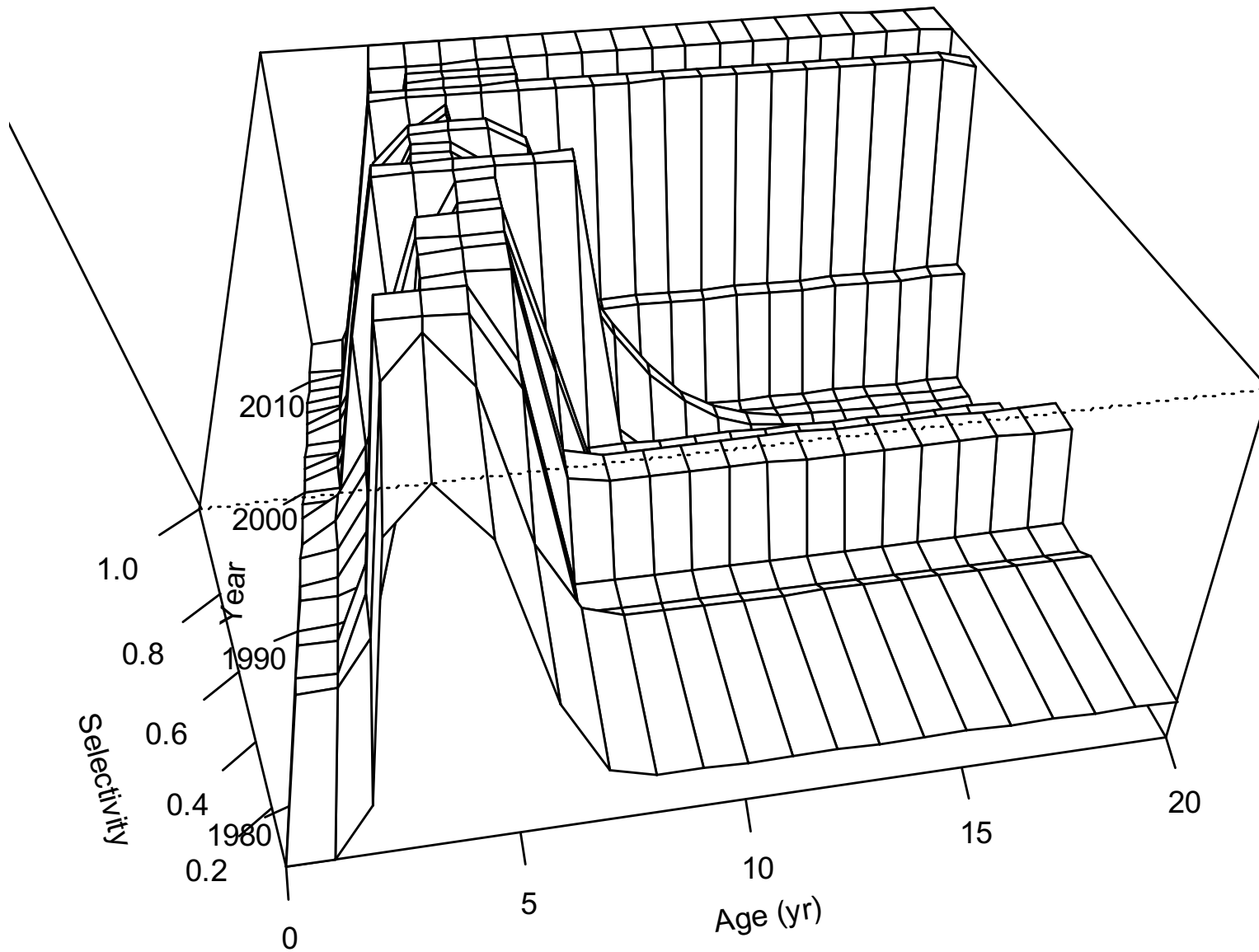
Log index



Year

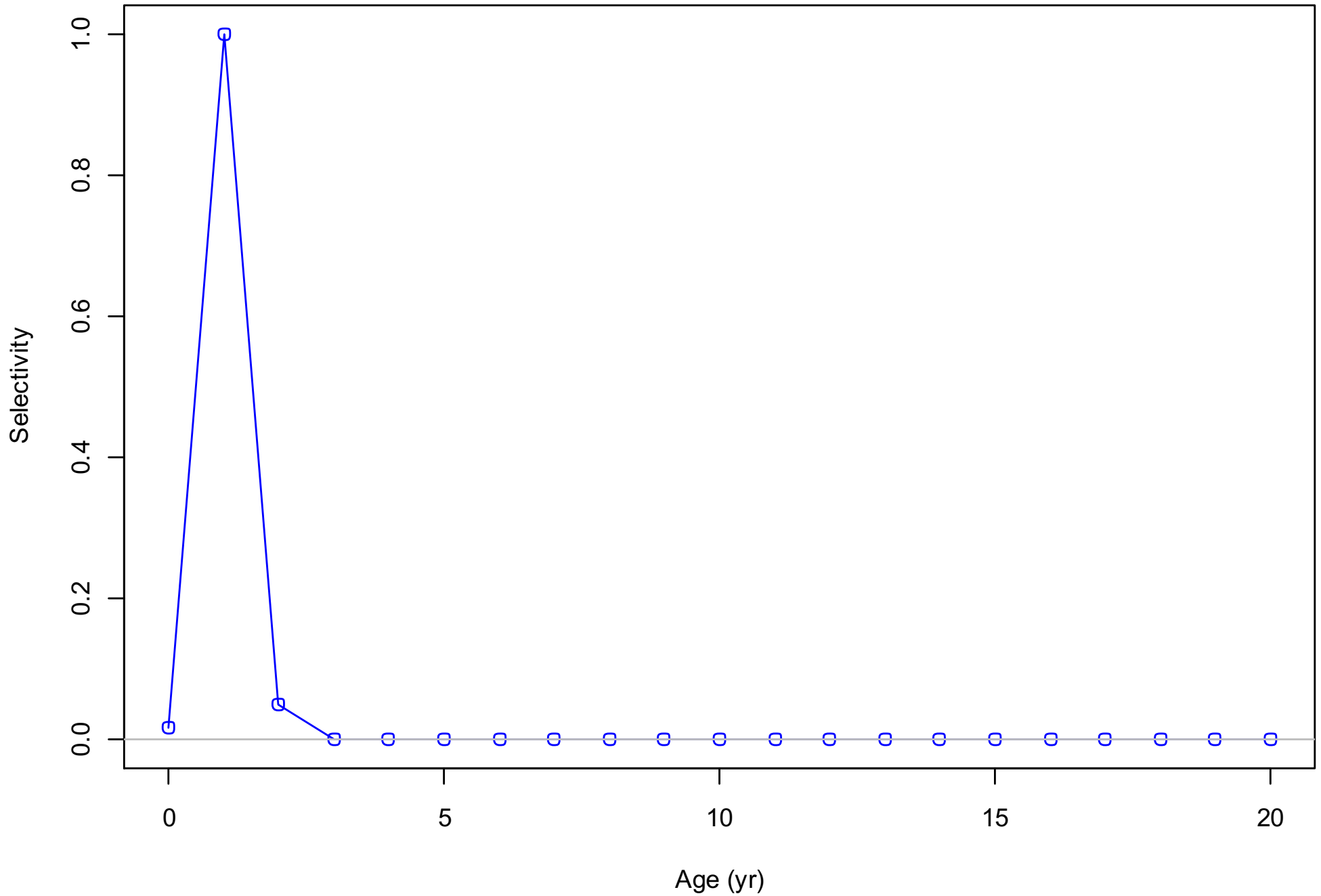
Model 2

Time-varying selectivity for 27plus_Trawl_Survey



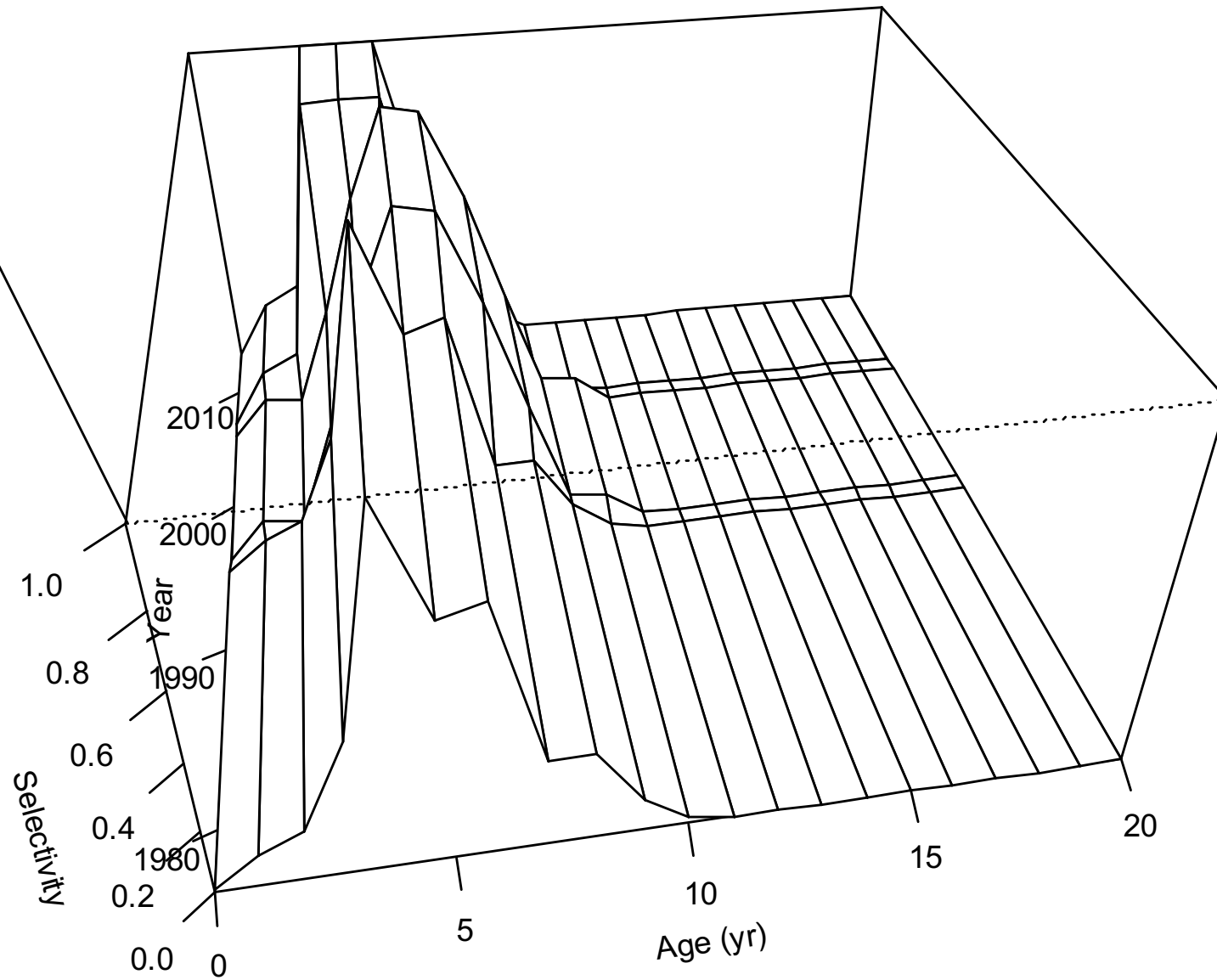
Model 2

Ending year selectivity for Sub27_Trawl_Survey



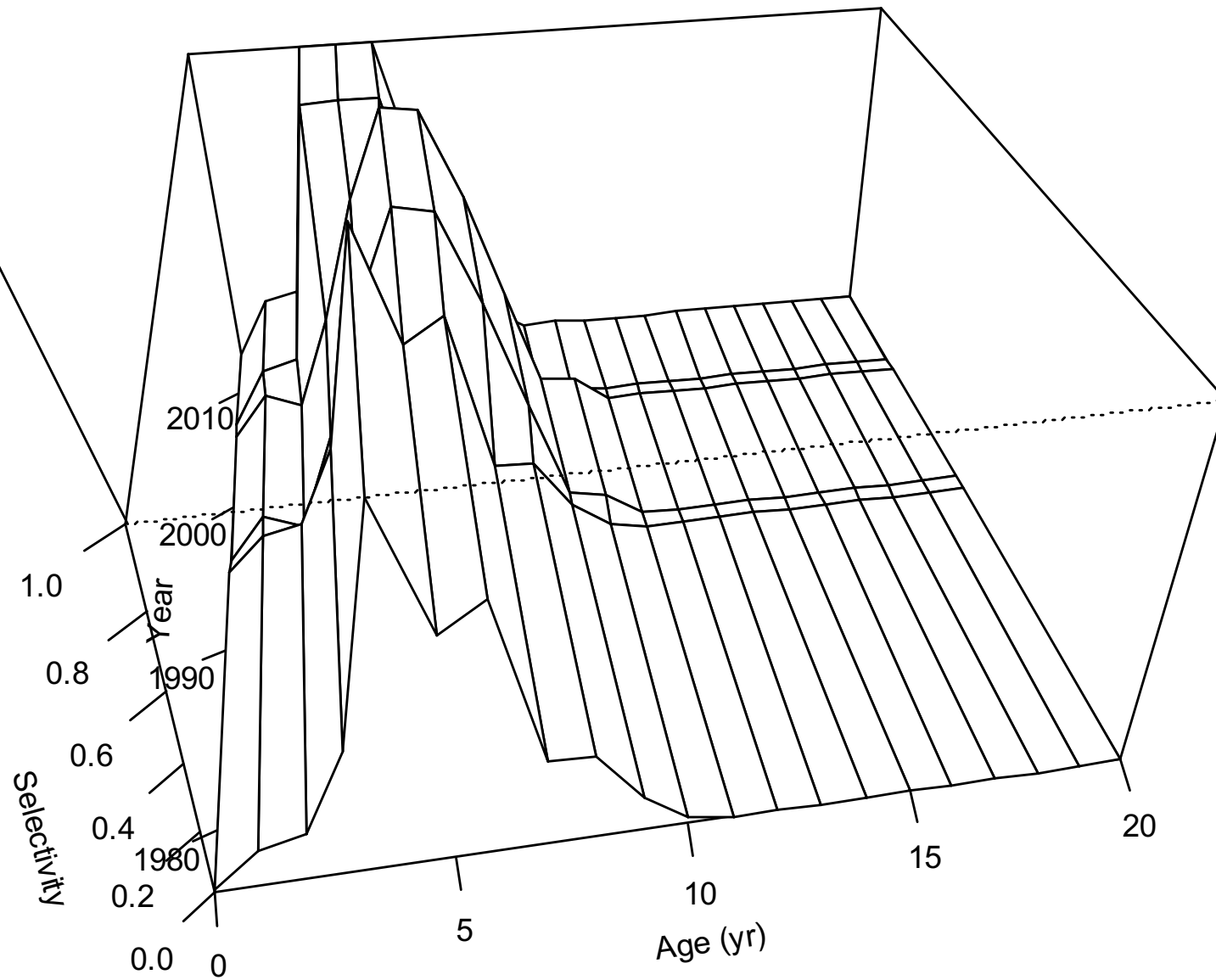
Model 0

Time-varying selectivity for Trawl_Survey



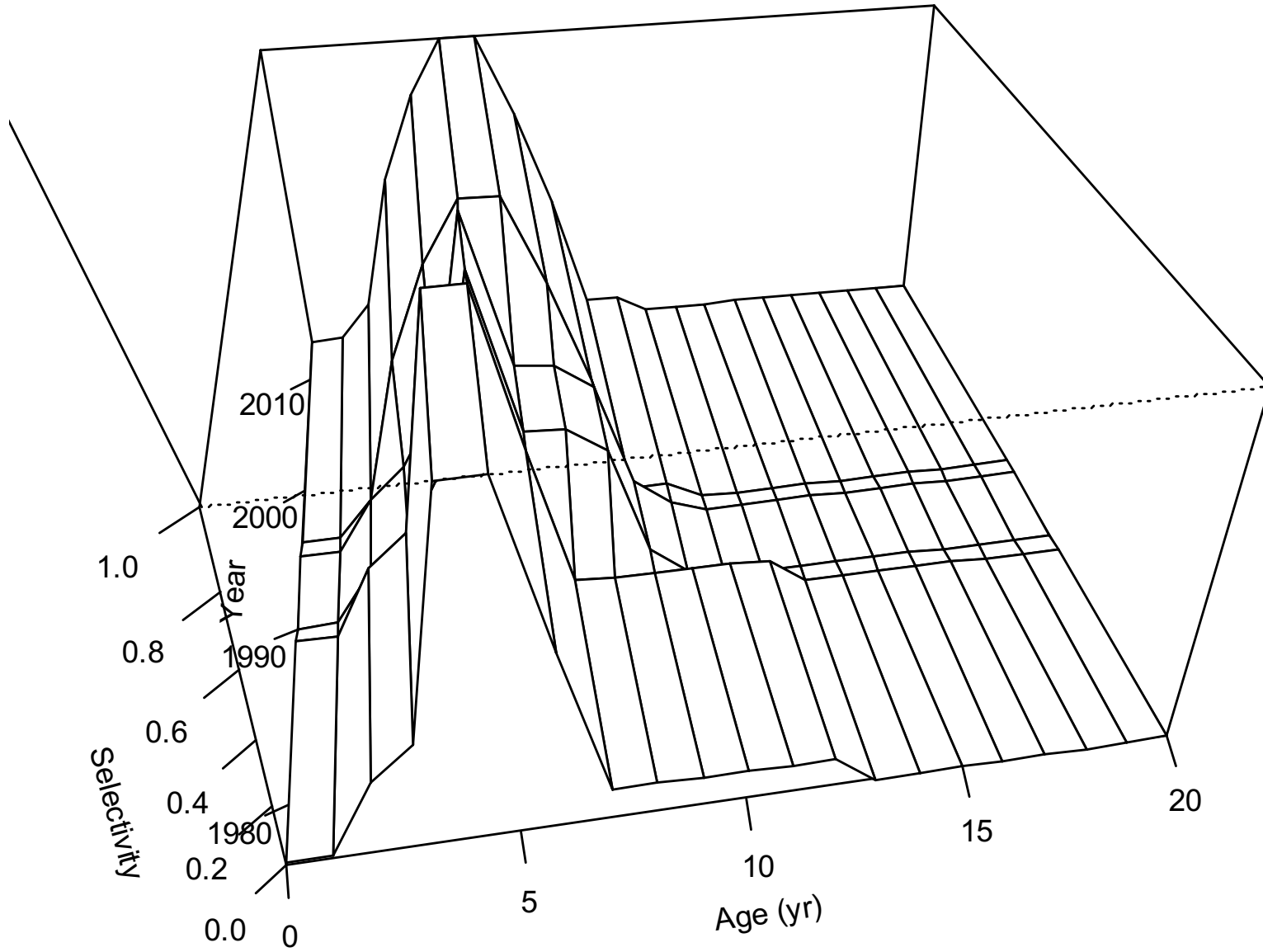
Model 3

Time-varying selectivity for Trawl_Survey



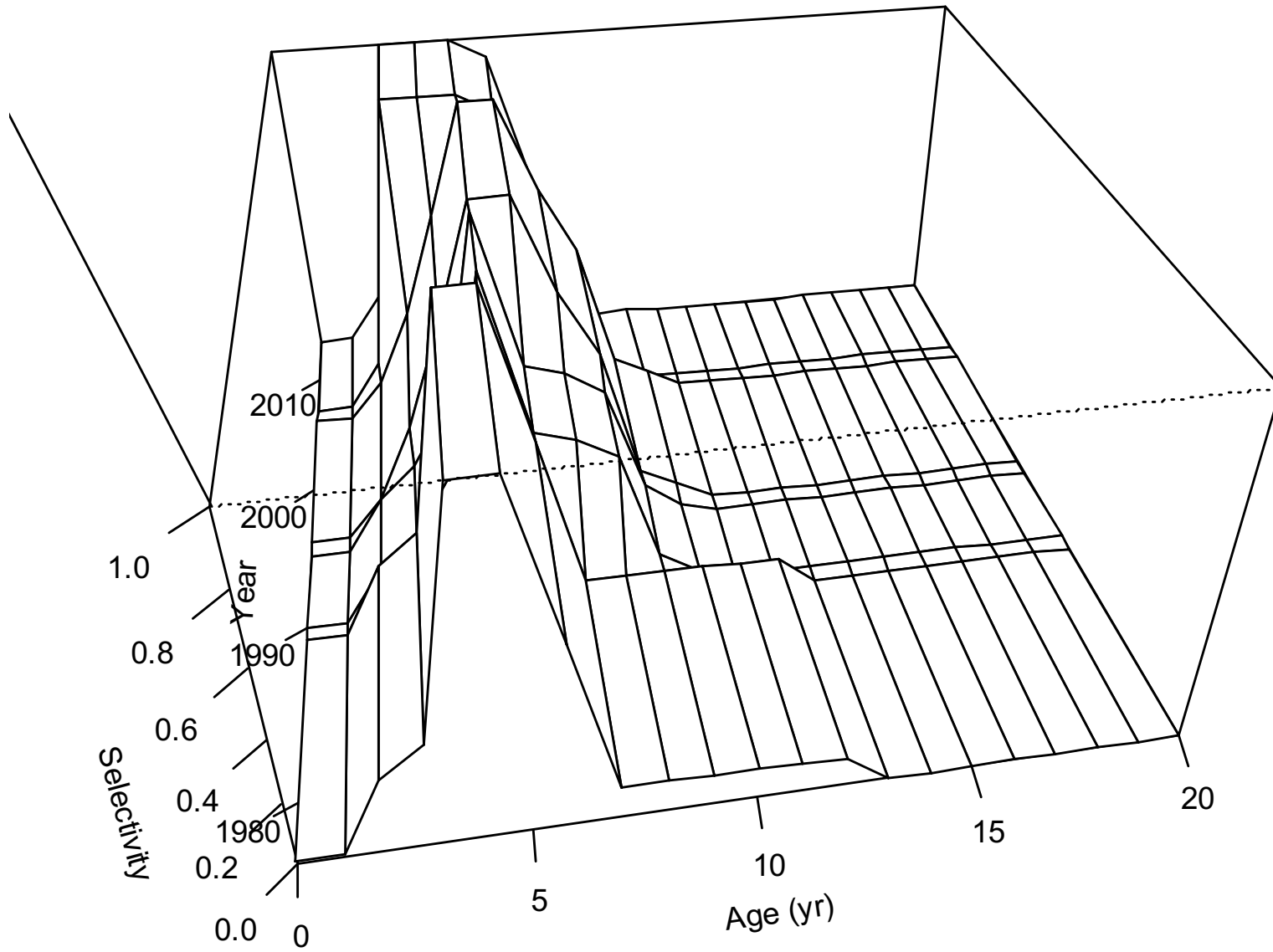
Model 4 – non-parametric and 3 periods

Time-varying selectivity for Trawl_Survey



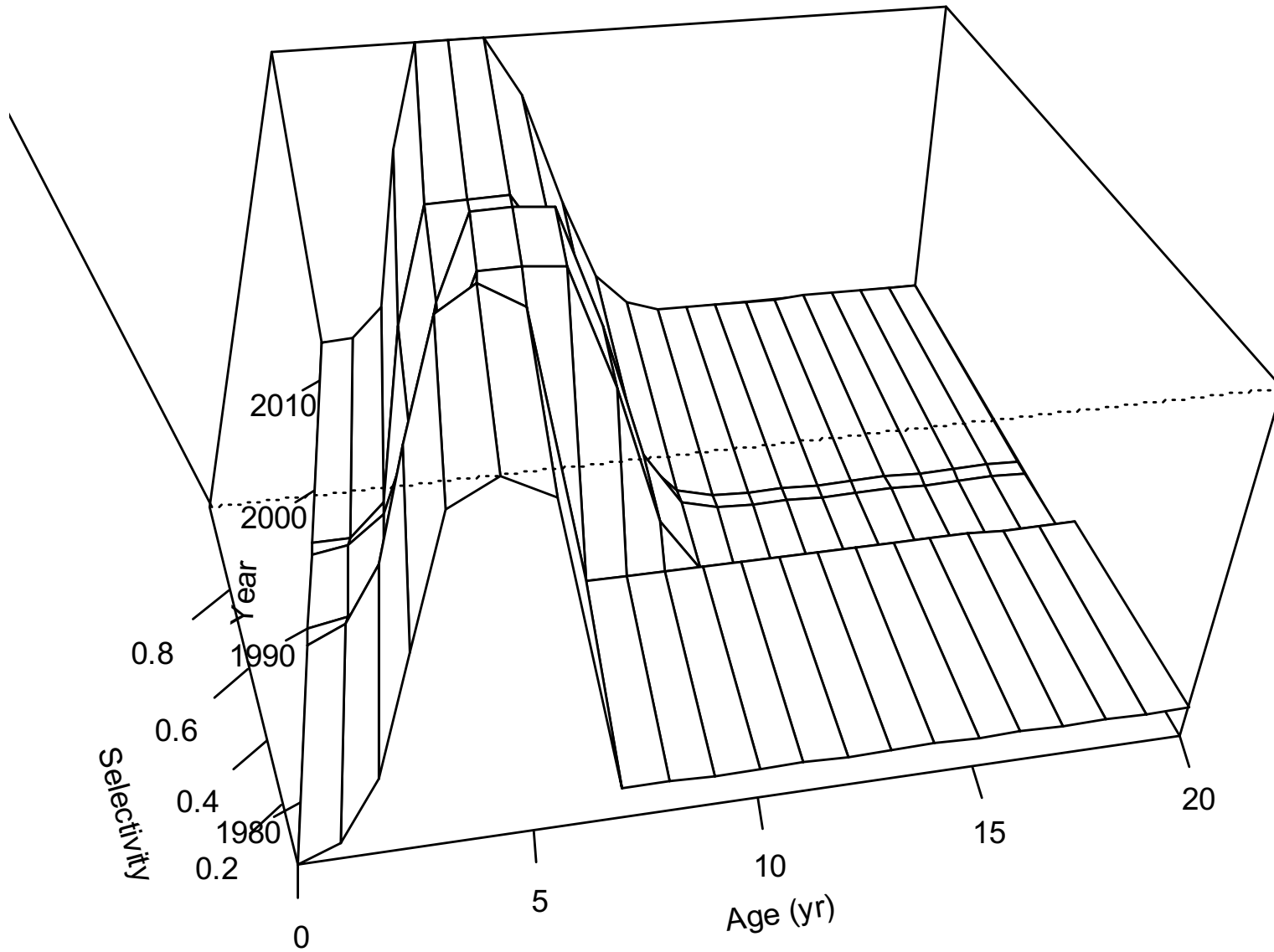
Model 4 – non-parametric and 4 periods

Time-varying selectivity for Trawl_Survey



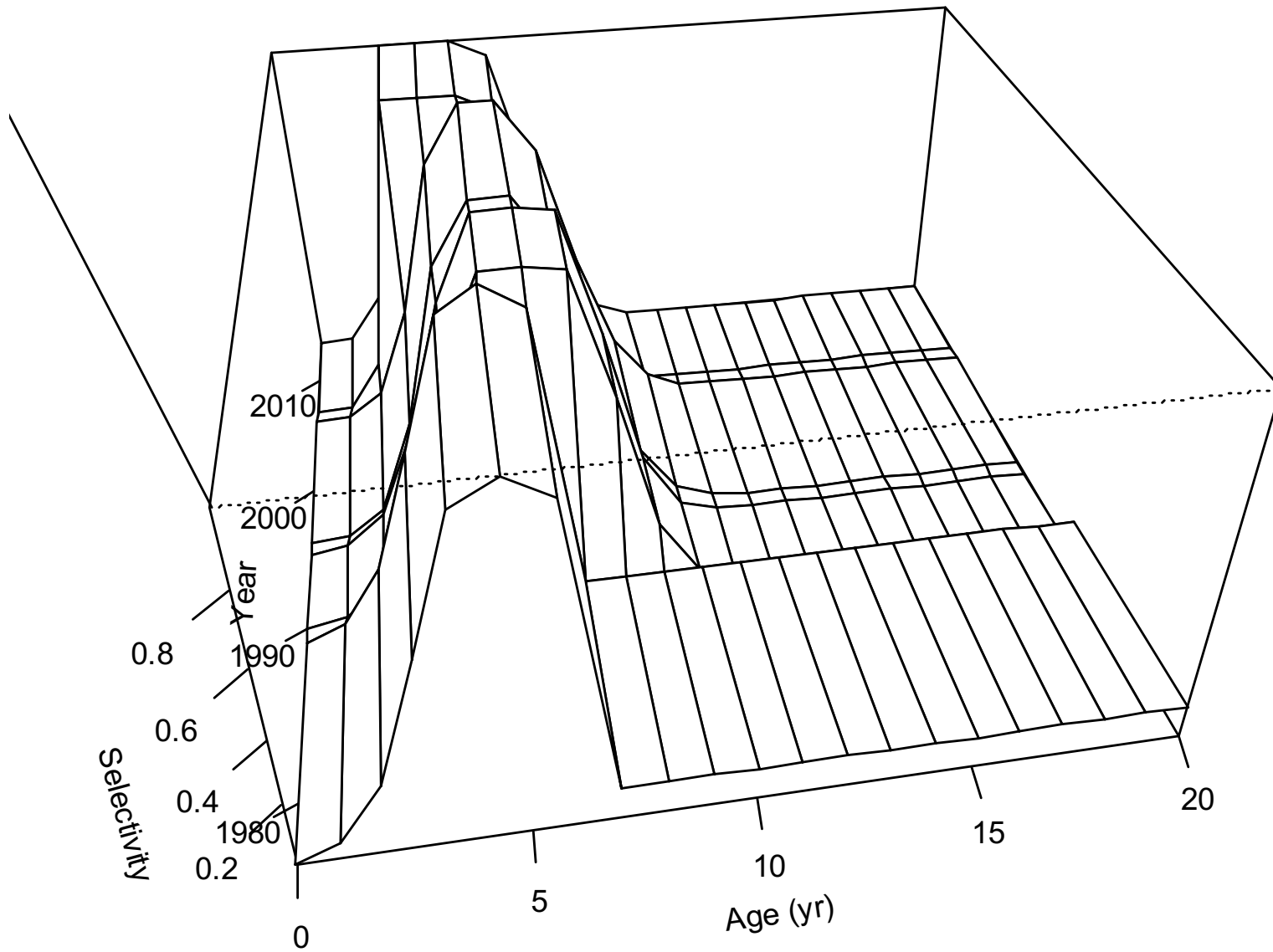
Model 4 – double normal and 3 periods

Time-varying selectivity for Trawl_Survey



Model 4 – double normal and 4 periods

Time-varying selectivity for Trawl_Survey



Negative log likelihood

	Model 2	Model 0	Model 3	Model 4 – non&3p	Model 4 – non&4p	Model 4 – dn&3p	Model 4 – dn&4p
Total NLL	2841.10	2609.42	2657.50	2566.73	2534.78	2591.00	2561.57
Parameters	260	229	232	230	240	210	215
Survey	0.45	-4.86	-5.85	-3.77	-8.27	-2.66	-6.37
Fsh len comp	2197.71	2139.37	2157.60	2172.10	2164.75	2170.75	2166.75
Srv len comp	41.02	10.32	13.85	7.30	7.27	11.00	8.86
Srv age comp	73.65	471.94	491.46	403.211	384.45	425.18	406.33
Srv size-at- age	540.89	-	-	-	-	-	-
Recr	-12.69	-10.74	-13.40	-14.79	-15.51	-15.51	-16.16

Growth parameter estimates

	Model 2	Model 0	Model 3	Model 4 - non 3p	Model 4 - non 4p	Model 4 - dn 3p	Model 4 - dn 4p
Amin	1	1	2	2	2	2	2
L at Amin	20.48	26.47	38.70	30.57	30.60	30.57	30.62
L_{∞}	97.11	93.75	94.31	94.16	94.60	94.32	94.39
k	0.197	0.188	0.183	0.193	0.189	0.194	0.192
CV for L at Amin	3.13	3.39	4.42	3.88	3.86	3.90	3.87
CV for L at A_{∞}	6.55	7.38	7.16	7.17	7.09	7.13	7.11

Discussion