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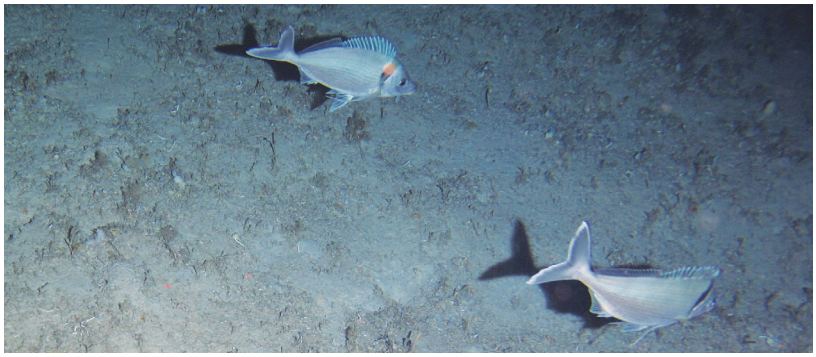
Australian Government
Australian Fisheries Management Authority

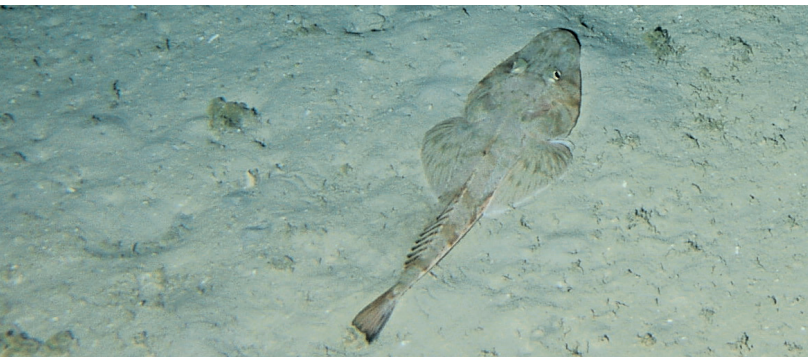
2015/0817 June 2018

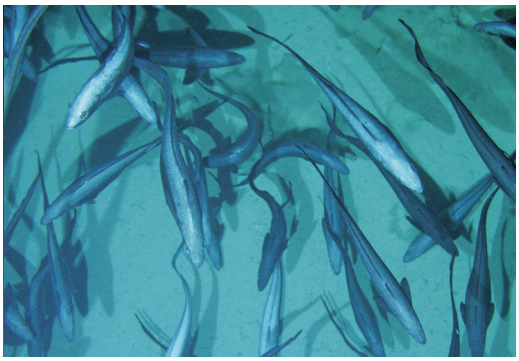
Stock Assessment for the Southern and Eastern Scalefish and Shark Fishery: 2016 and 2017

PART 1

2016







Principal investigator **G.N. Tuck**

CSIRO

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Acknowledgements

All authors wish to thank the science, management and industry members of the south east, GAB and shark resource assessment groups for their contributions to the work presented in this report. Authors also acknowledge support from Fish Ageing Services (for fish ageing data) and AFMA (for the on-board and port length-frequencies, and in particular John Garvey, for the log book data). Toni Cracknell is greatly thanked for her assistance with the production of this report.

Cover photographs

Front cover, jackass morwong, orange roughy, blue grenadier, and flathead.

Report structure

Parts 1 and 2 of this report describe the assessments of 2016 and 2017 respectively.

Stock Assessment for the Southern and Eastern Scalefish and Shark Fishery 2016 and 2017

Part 1: 2016

G.N. Tuck
June 2018
Report 2015/0817

Australian Fisheries Management Authority

Stock Assessment for the Southern and Eastern Scalefish and Shark Fishery: 2016

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13. Tiger flathead (*Neoplatycephalus richardsoni*) stock assessment based on data up to 2015 – development of a preliminary base case

Jemery Day

CSIRO Oceans and Atmosphere, Castray Esplanade, Hobart 7000, Australia

13.1 Executive Summary

This document presents a suggested base case for an updated quantitative Tier 1 tiger flathead (*Neoplatycephalus richardsoni*) assessment for presentation at the first SERAG meeting in 2016. The last full assessment was presented in Day and Klaer (2013). The preliminary base case has been updated by the inclusion of data up to the end of 2015, which entails an additional 3 years of catch, discard, CPUE, length and age data and ageing error updates since the 2013 assessment and incorporation of survey results from the Fishery Independent Survey from 2008-2014. This document describes the process used to develop a preliminary base case for tiger flathead through the sequential updating of recent data to the stock assessment, using the stock assessment package Stock Synthesis (SS-V3.24Z).

Changes to the last stock assessment include: separating length frequencies into onboard and port collected components, with a joint selectivity pattern estimated; including FIS abundance indices separated into Eastern (SESSF Zones 10 and 20) and Tasmanian (SESSF Zone 30) fleets; weighting length frequencies by shots and trips rather than fish measured; and using a new tuning method.

Results show reasonably good fits to the catch rate data, length data and conditional age-at-length data. This assessment estimates that the projected 2017 spawning stock biomass will be 43% of virgin stock biomass (projected assuming 2015 catches in 2016), compared to 50% at the start of 2014 from the last assessment (Day and Klaer 2013).

13.2 Introduction

13.2.1 *Bridging from 2013 to 2016 assessments*

The previous full quantitative assessment for tiger flathead was performed in 2013 (Day and Klaer, 2013) using Stock Synthesis (version SS-V3.24f, Methot, August 2012). The 2016 assessment uses the current version of Stock Synthesis (version SS-V3.24Z, Methot, 2015), which has few changes to SS_V3.24f.

As a first step in the process of bridging to a new model, the data used in the 2013 assessment was used in the new software (SS-V3.24Z) and minor updates were made to the 2001-2012 catch history. This was followed by including the data from 2013-2015 into the model. This additional data included new catch, discard, CPUE, length frequency and age-at-length data for 2013, 2014 and 2015 and FIS for 2014. The last year of recruitment estimation was extended to 2012 (2009 in the 2013 assessment). The use of updated software and the inclusion of additional data resulted in some differences in the fits to CPUE, age and length data. The usual process of bridging to a new model by adding new data

piecewise and analysing which components of the data could be attributed to changes in the assessment outcome was conducted with the details outlined below.

13.2.2 *Update to Stock Synthesis SSV-3.24Z and updated catch history*

The 2013 tiger flathead assessment (2013BaseCase) was initially converted to the most recent version of the software, Stock Synthesis version SS-V3.24Z (Base2013NoHessian).

The next step included updated catch history in the 2013 assessment, which involved minor revisions to the catch history from 2001-2011 and using updated data for 2012 and 2013 to replace the preliminary 2012 and 2013 data used in the 2013 assessment. This includes some corrections to allocations of catches between fleets before 2011 and updates to recent state catches, and replacing the estimated 2013 catch with actual catches. These changes in catch history (B2UpdateCatch01-11) were included after the transition to SS-V3.24Z. There were negligible changes to the spawning biomass and recruitment time series for any of these steps. When these time series are plotted together, it is very difficult to see any difference between them (Figure 13.1and Figure 13.2).

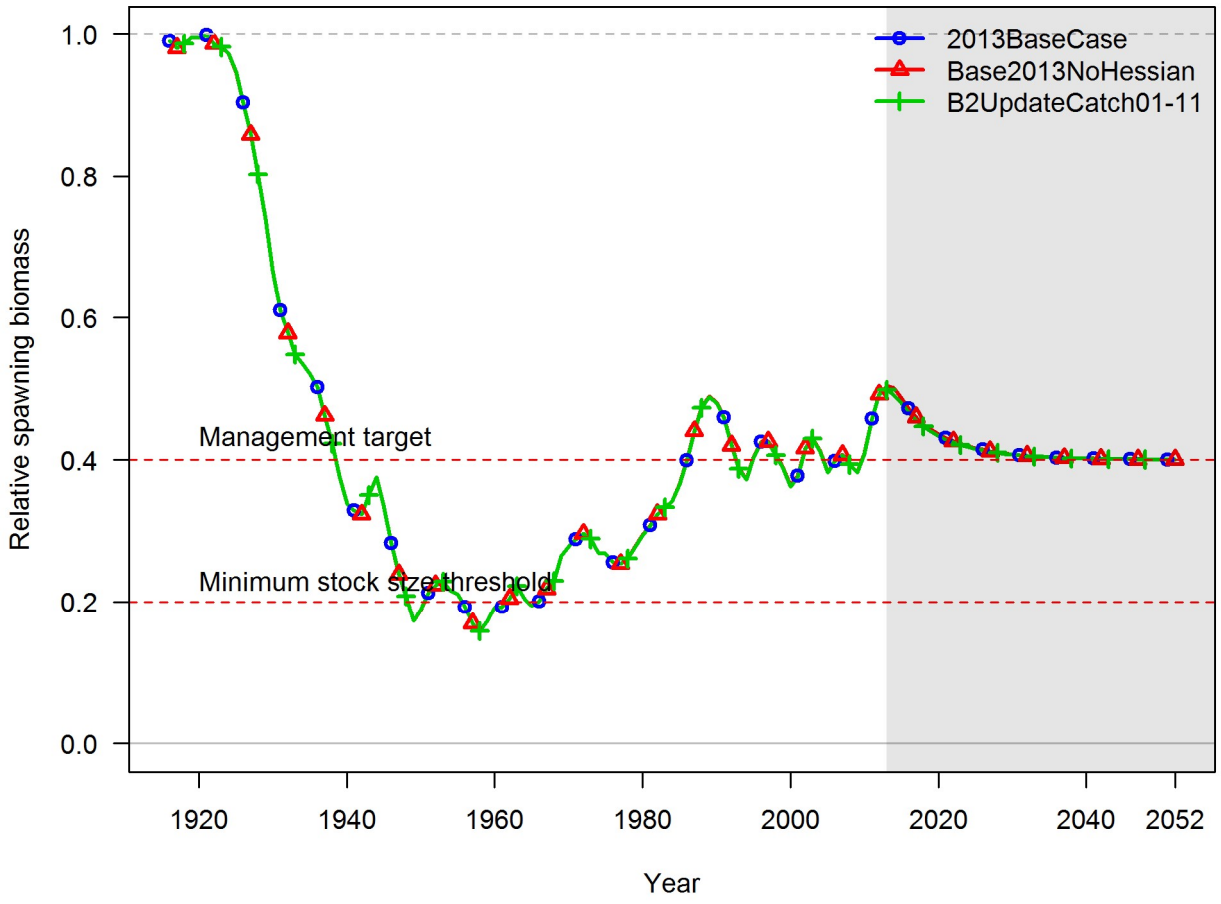

Figure 13.1. Comparison of the spawning biomass time series for the 2013 assessment (2013BaseCase) and a model converted to SS-V3.24Z (Base2013NoHessian) and updates to the 2001-2013 catches to include data which was unavailable to the 2013 assessment (B2UpdateCatch01-11).

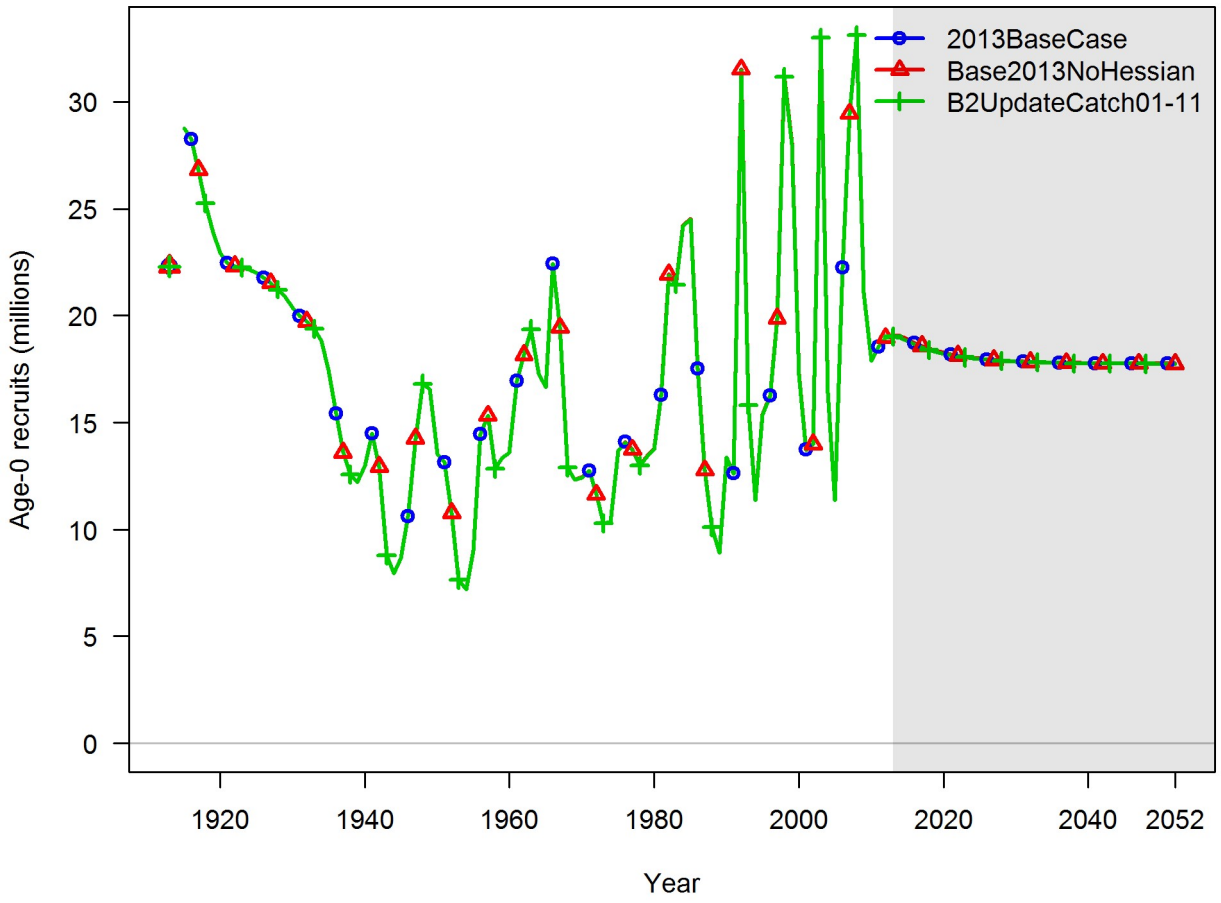

Figure 13.2. Comparison of the recruitment time series for the 2013 assessment (2013BaseCase) and a model converted to SS-V3.24Z (Base2013NoHessian) and updates to the 2001-2013 catches to include data which was unavailable to the 2013 assessment (B2UpdateCatch01-11).

13.2.3 *Inclusion of new data: 2013-2015*

Starting from the converted 2013 base case model with updated catch history, (B2UpdateCatch01-11), additional data from 2013-2015 were added sequentially to develop a preliminary base case for the 2016 assessment:

1. Change final assessment year to 2015, add catch to 2015 (B3).
2. Add CPUE to 2015 (from Sporcic and Haddon (2016)) (B4).
3. Add FIS indices for 2014, with the FIS abundance index split into two indices to match the spatial zones corresponding to the Eastern trawl and Tasmanian trawl fleets (B6).
4. Add updated discard fraction estimates to 2015 (B7).
5. Update length frequency data, this time including both port and onboard length frequencies for historical data and weighting these length frequencies by number of shots or trips, rather than number of fish (B12).
6. Add updated age error matrix and age-at-length data to 2015 (B13).

7. Change the final year for which recruitments are estimated from 2009 to 2012 (B15).
8. Retune using latest tuning protocols, including Francis weighting on lengths and ages, and without using lambda=0.1 to down weight the age and length likelihood (T7_2016Base).

Inclusion of the new data resulted in gradual changes to the estimates of recruitment and the relative spawning biomass time series. Including the new CPUE data resulted in reduced recent recruitment estimates and reduced 2017 relative spawning biomass, with further reductions due to the length and age data. Estimating an additional three years of recruitments (to 2012) resulted in three years of above average recruitment producing a slight increase to the relative spawning biomass in 2017, although at a level below that predicted by the 2013 assessment.

The final tuned model produced changes to the relative spawning biomass from around 1940 onwards, with a reduction in the earlier years, from around 1940-1990, but with an increase to the relative spawning biomass from 1990 onwards. Tuning also resulted in considerable changes to the recruitment time series from around 1940 onwards.

Since the 2013 assessment, standard changes to the procedures used in the Stock Synthesis assessments in the SESSF include:

1. Including both port and onboard length frequency data.
2. Weighting length frequency data by shot or trip numbers rather than fish measured.
3. Modification to the tuning procedures including use of Francis weighting for length and age data.
4. separating the FIS data into areas to match fleets used in the assessments, so in this case separating to an eastern trawl FIS (Zones 10 and 20) and a Tasmanian trawl FIS (Zone 30).

These are considerable changes to the tuning procedures used in the 2013 assessment, so it is not surprising that tuning resulted in considerable changes. Previous tiger flathead assessments have applied a lambda of 0.1 to length and age frequency data to down weight the likelihood from these sources relative to the likelihood from the CPUE and survey data. Weighting these frequencies by shot rather than numbers of fish measured, and using the latest tuning protocols including Francis weighting has allowed these lambdas to be returned to 1. If it can be avoided, it is preferable to set the lambdas at 1, rather than make somewhat adhoc decision to balance the likelihood from different data sources and somewhat arbitrarily down weight length and age data.

Inclusion of the new data had relatively minor impacts on the estimates of recruitment and the spawning biomass time series. With recruitment estimated up until 2012, this resulted in the recruitments estimated from 2007-2009 to be revised down, compared to the 2013 assessment. However, the three new years of estimated recruitment (2010, 2011 and 2012) are all above average. These recruitment events appear to be supported by the recent length data and have resulted in an estimate of the depletion at the start of 2017 of 43% of unexploited stock biomass, SSB_0. While the most recent recruitments are well estimated, they should be treated with some caution as it is possible for future data to result in modifications to estimates of recent recruitment events, as occurred with the 2007-2009 recruitment estimates from the 2013 assessment. In that assessment, when recruitment was only estimated to 2007, excluding the above average recruitment estimates in 2008 and 2009, the spawning biomass was estimated to be 40% of SSB_0. Since 2005 various values have been used for the target and the breakpoint in the Tier 1 harvest control rule. In 2009, AFMA directed that the 20:35:40 (B_{lim}: B_{MSY}: F_{targ}) form of the harvest control rule is used for tiger flathead.

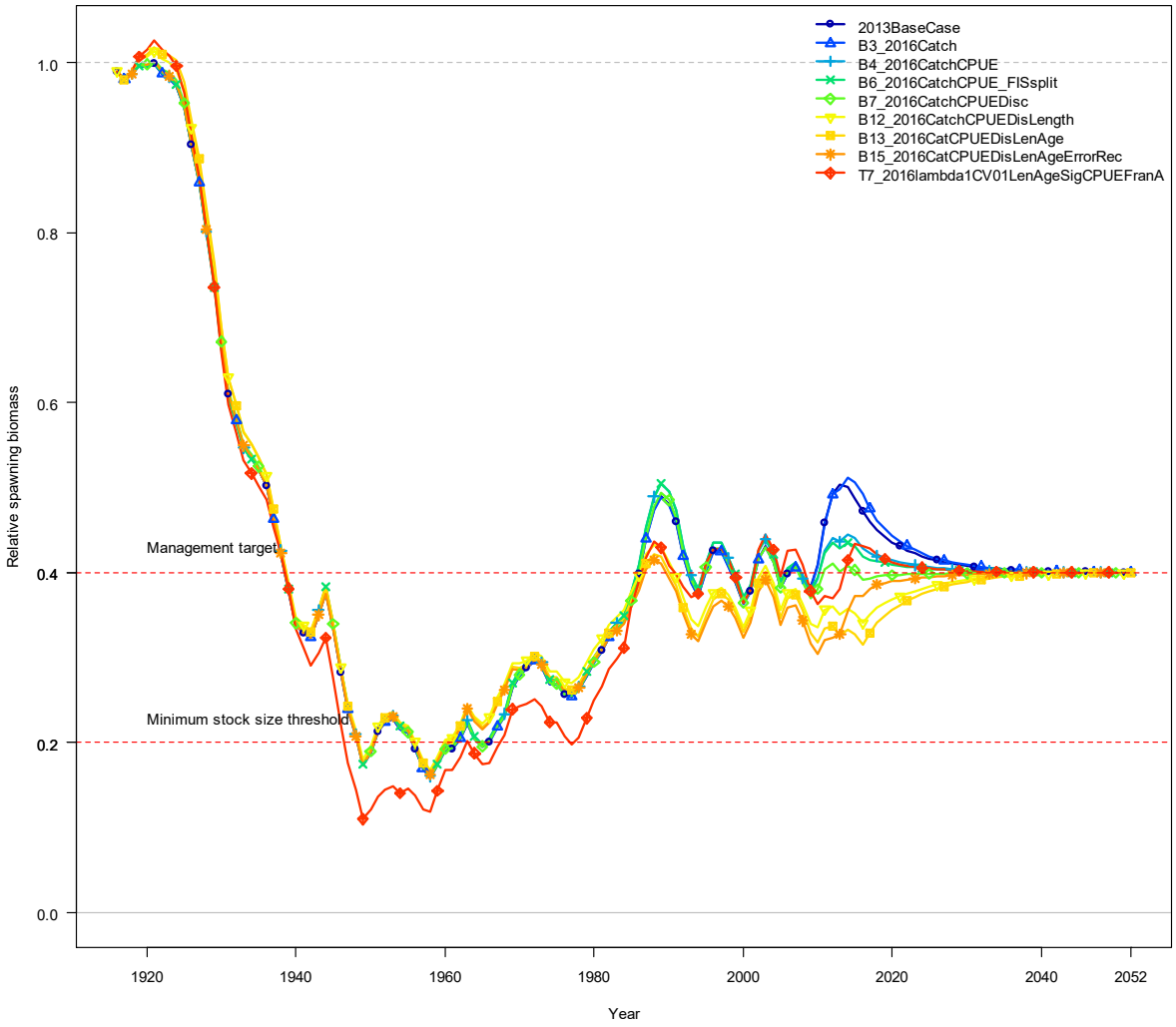

Figure 13.3. Comparison of the spawning biomass time series for the 2013 assessment model converted to SS-V3.24Z (2013BaseCase) and various bridging models leading to a proposed 2016 tuned base case model (T7).

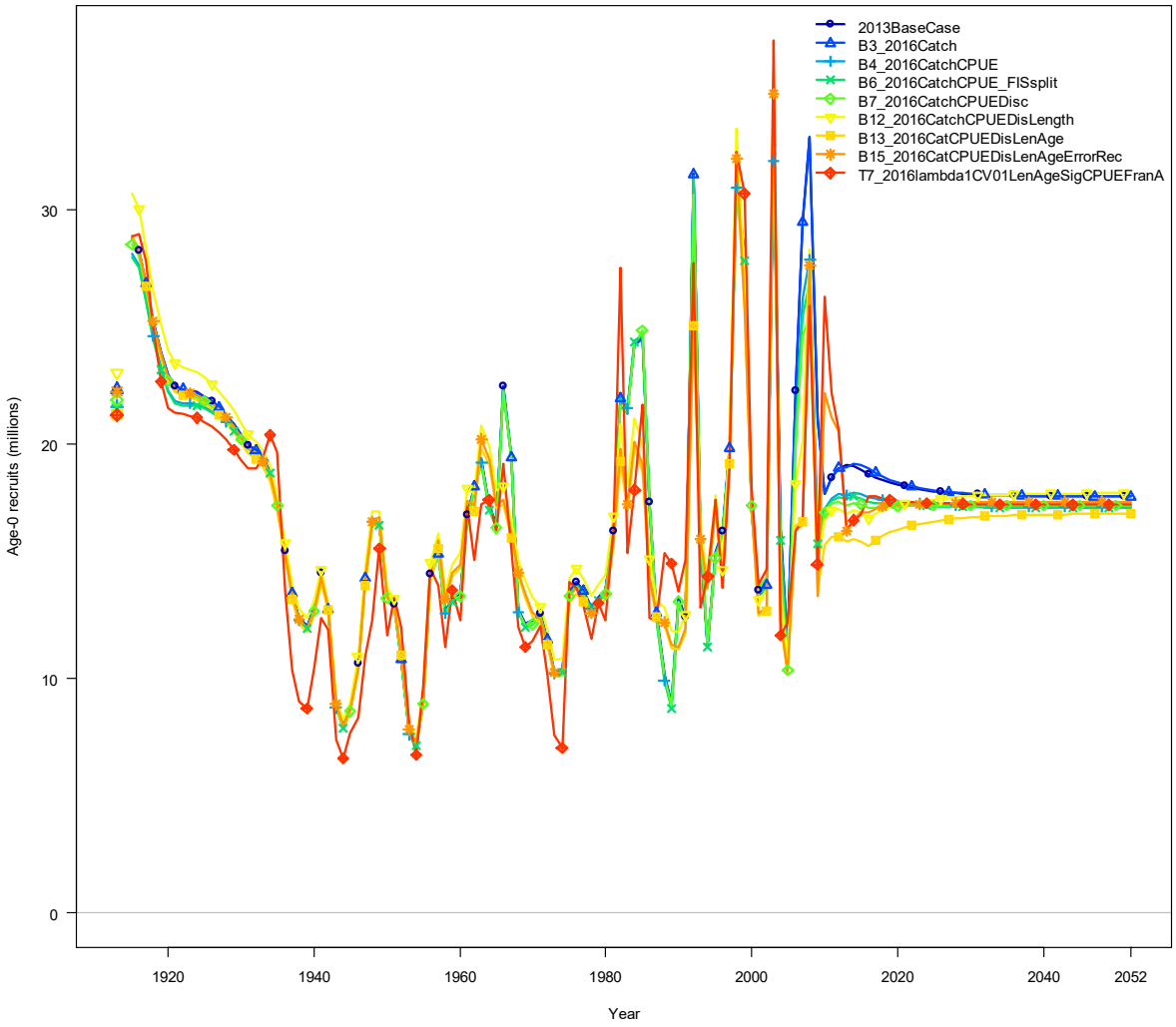

Figure 13.4. Comparison of the recruitment time series for the 2013 assessment model converted to SS-V3.24Z (2013BaseCase) and various bridging models leading to a proposed 2016 tuned base case model (T7).

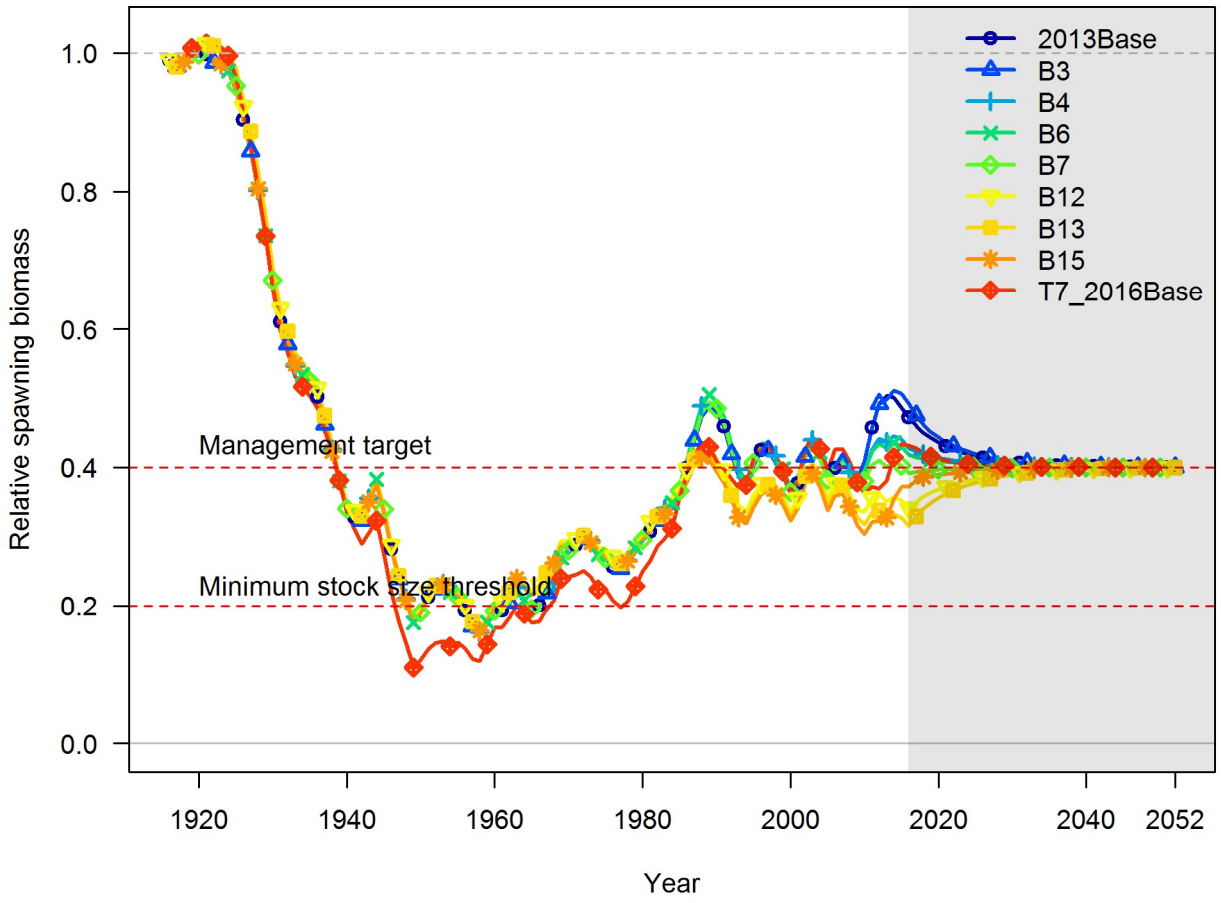

Figure 13.5. Comparison of the spawning biomass time series for the 2013 assessment model converted to SS-V3.24Z (2013Base) and various bridging models leading to a proposed 2016 tuned base case model (T7).

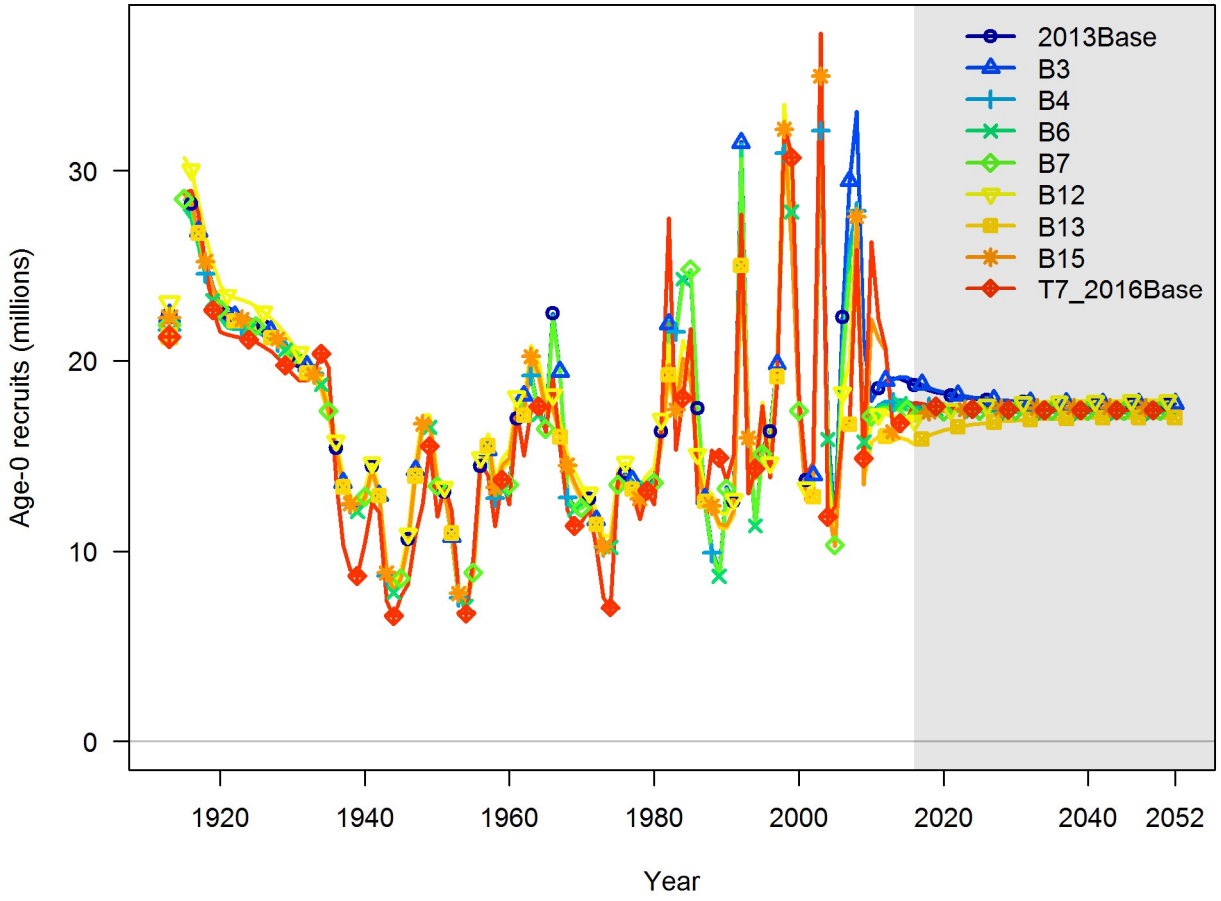

Figure 13.6. Comparison of the recruitment time series for the 2013 assessment model converted to SS-V3.24Z (2013Base) and various bridging models leading to a proposed 2016 tuned base case model (T7).

13.3 Acknowledgements

Age data was provided by Kyne Krusic-Golub (Fish Ageing Services), ISMP and AFMA logbook and CDR data were provided by John Garvey (AFMA). Mike Fuller, Roy Deng and Franzis Althaus (CSIRO) pre-processed the data. Athol Whitten provided very useful R code for organising plots. Robin Thomson, Geoff Tuck, Rich Little, Miriana Sporcic, Malcolm Haddon and Judy Upston are thanked for helpful discussions on this work.

13.4 References

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Sporcic M and Haddon M (2016). Catch rate standardizations for selected SESSF Species (data to 2015). Unpublished report to SERAG Data, 11-13 October 2015, Hobart. 214 p.

13.5 Appendix: Preliminary base case diagnostics

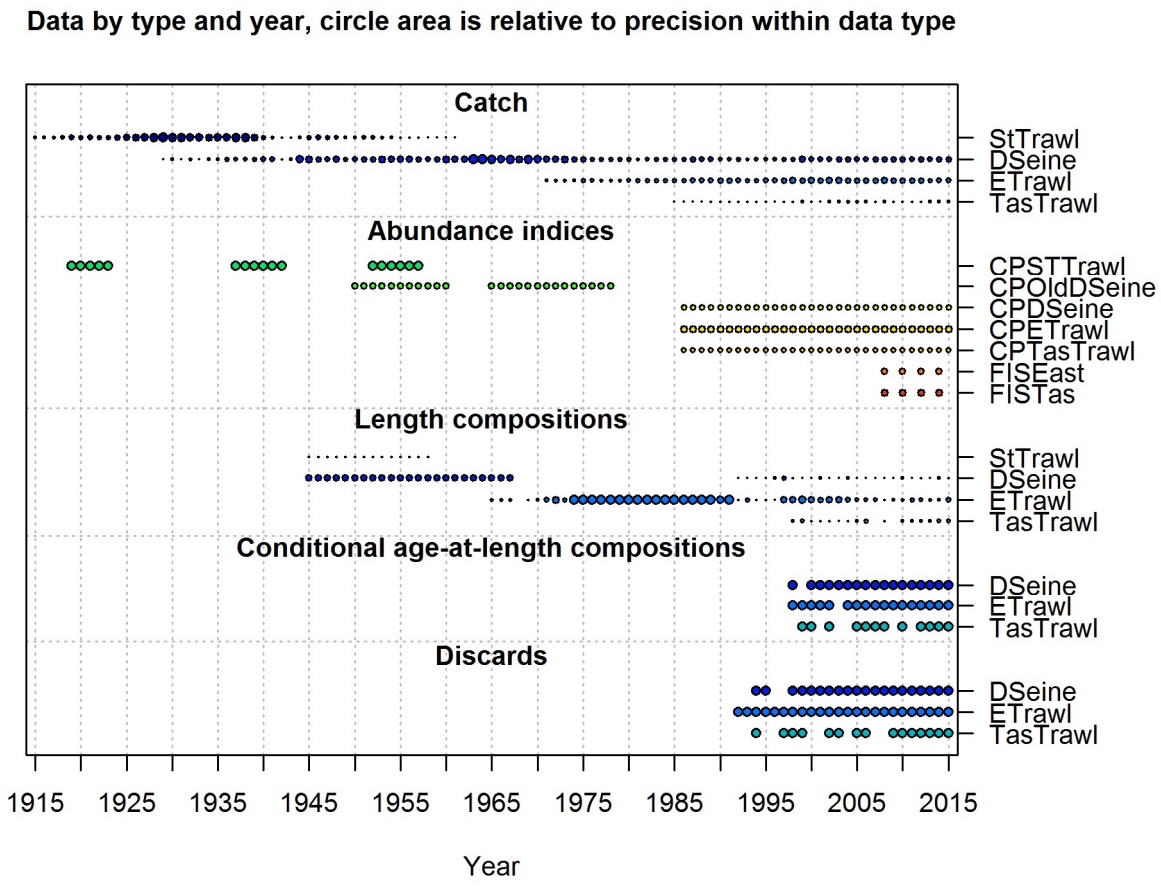

Figure A 13.1. Summary of data sources for tiger flathead stock assessment.

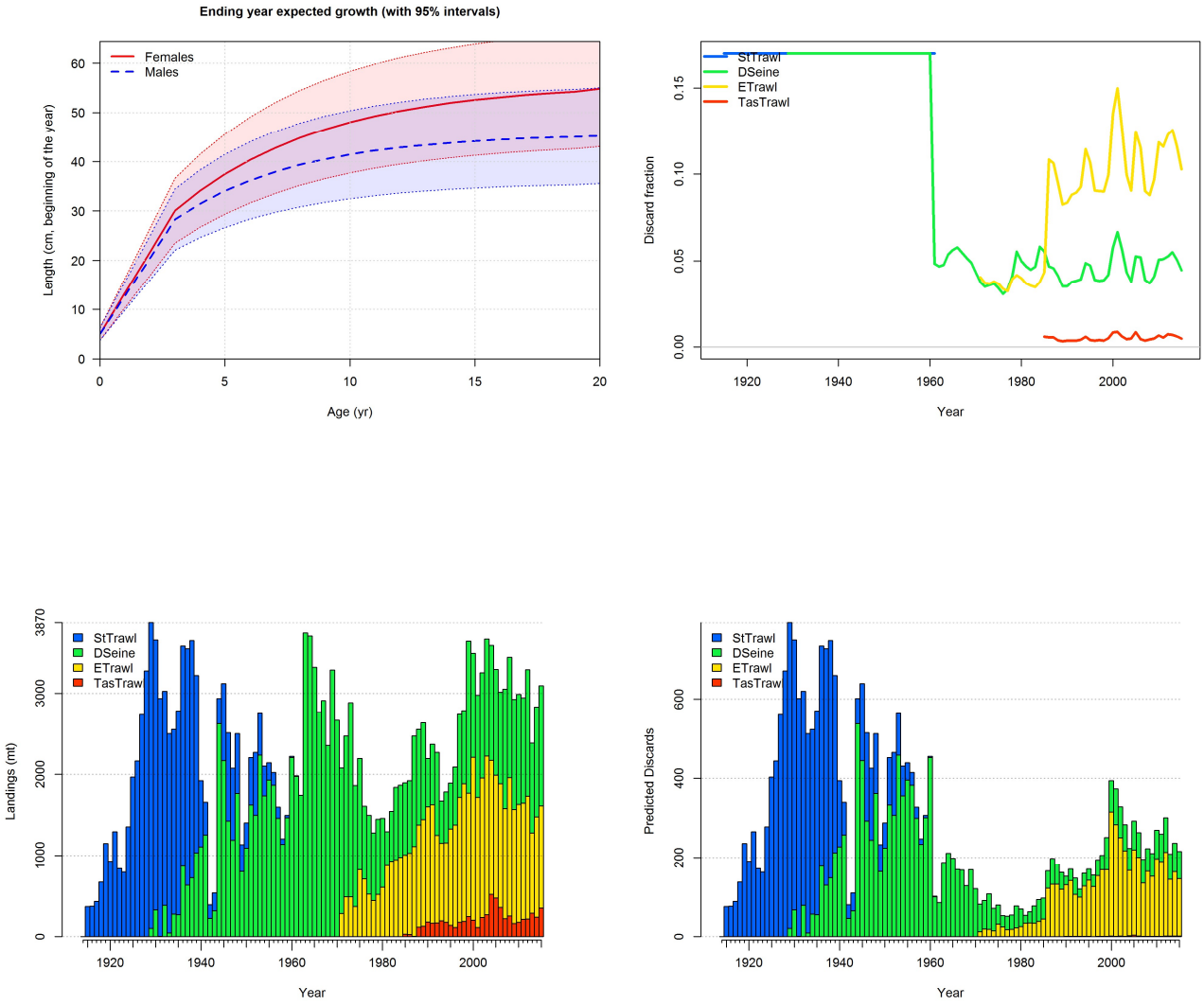

Figure A 13.2. Growth, discard fraction estimates, landings by fleet and predicted discards by fleet for tiger flathead.

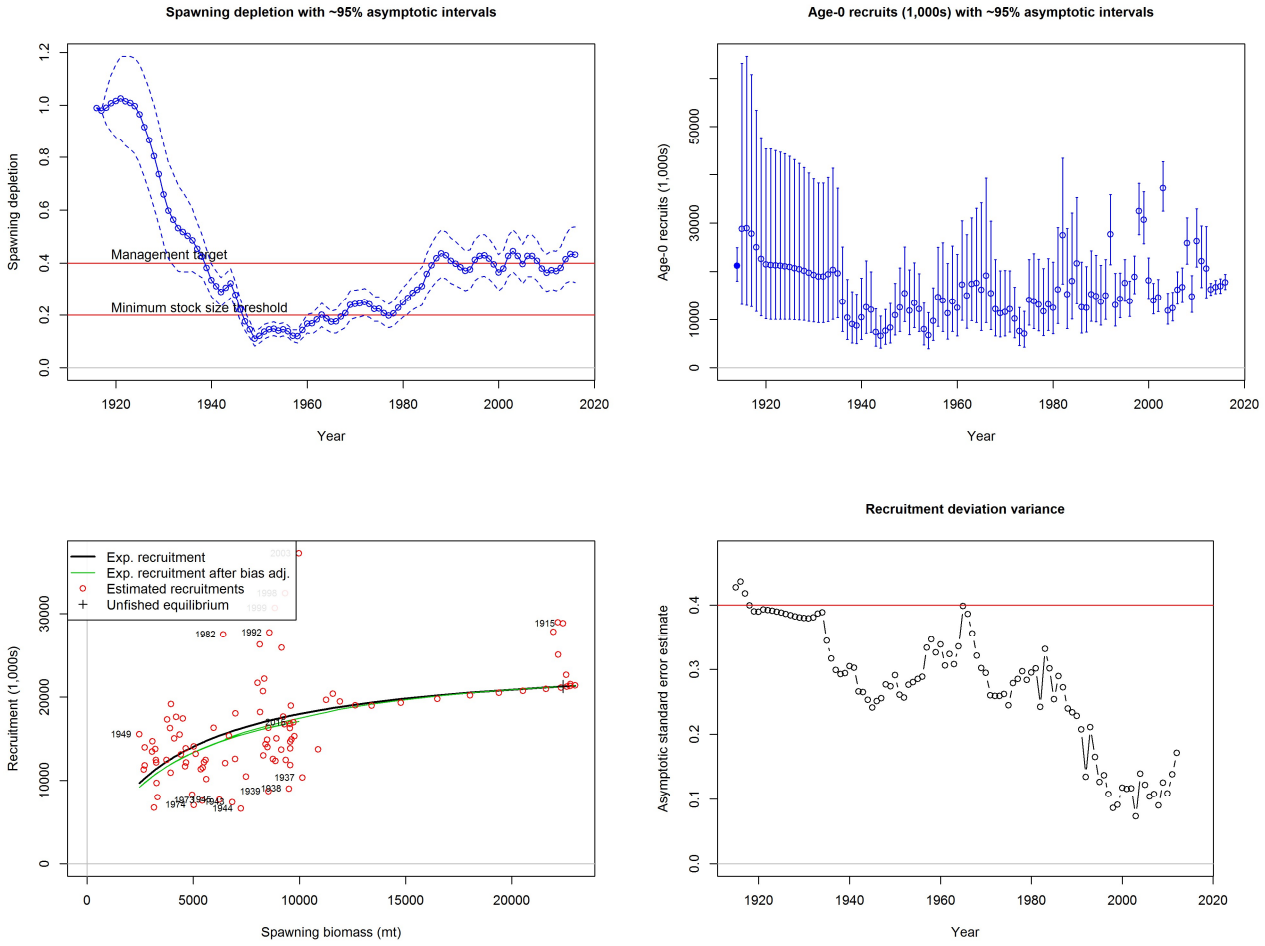

Figure A 13.3. Time series showing depletion of spawning biomass with confidence intervals, recruitment estimates with confidence intervals, stock recruitment curve and recruitment deviation variance check for tiger flathead.

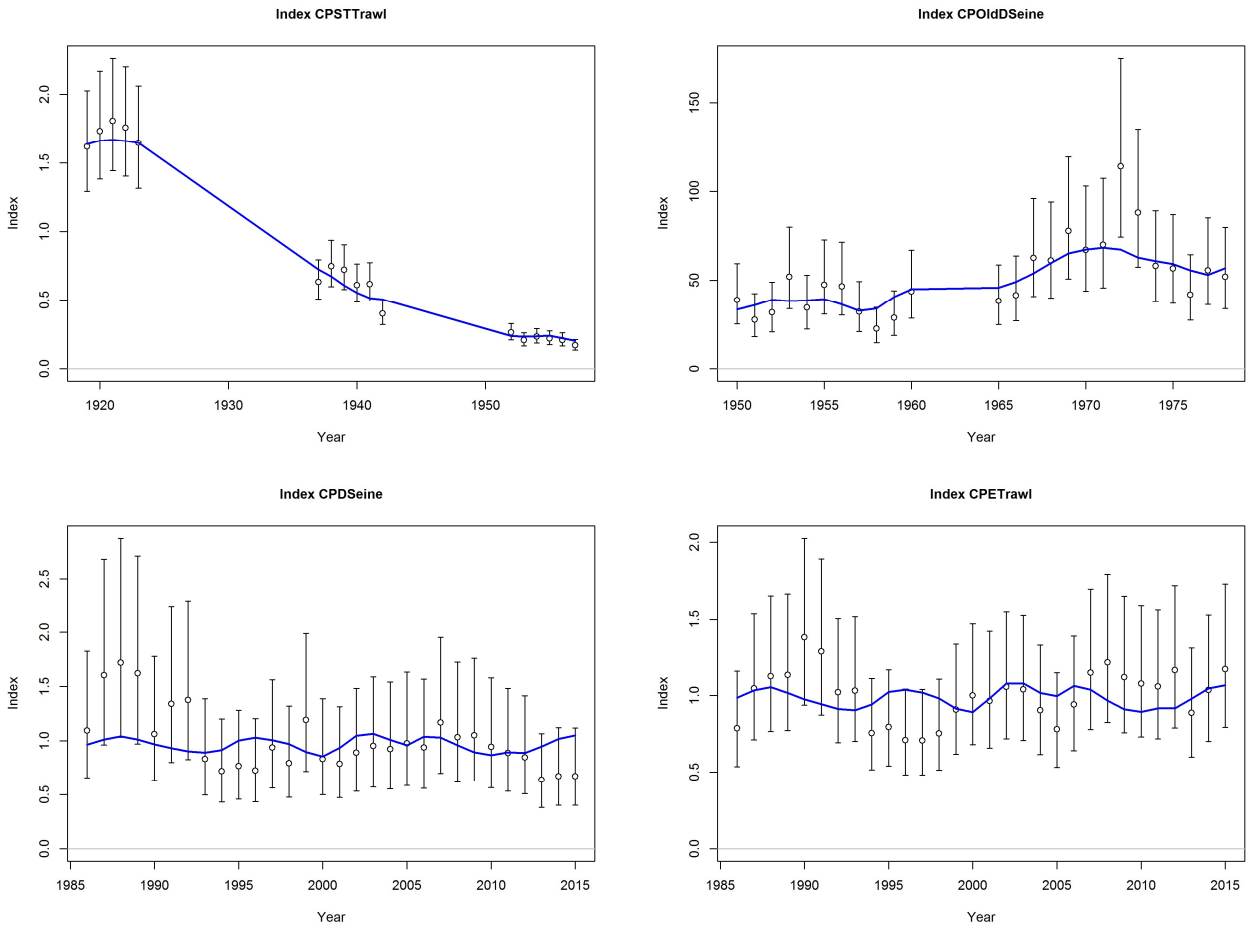

Figure A 13.4. Fits to CPUE by fleet for tiger flathead: steam trawl, old Danish seine, Danish seine, eastern trawl.

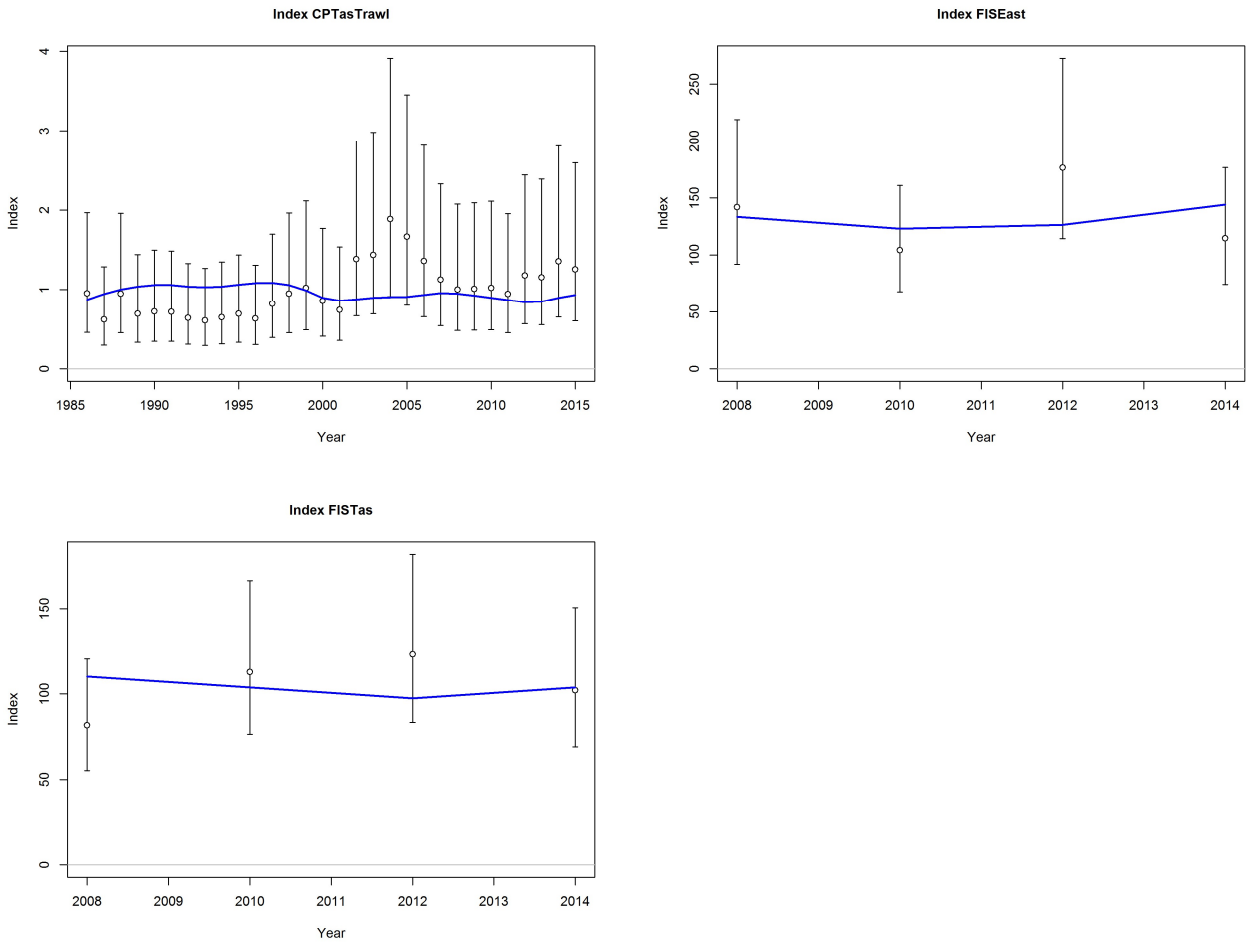

Figure A 13.5. Fits to CPUE by fleet for tiger flathead: Tasmanian trawl and the Fishery Independent Survey.

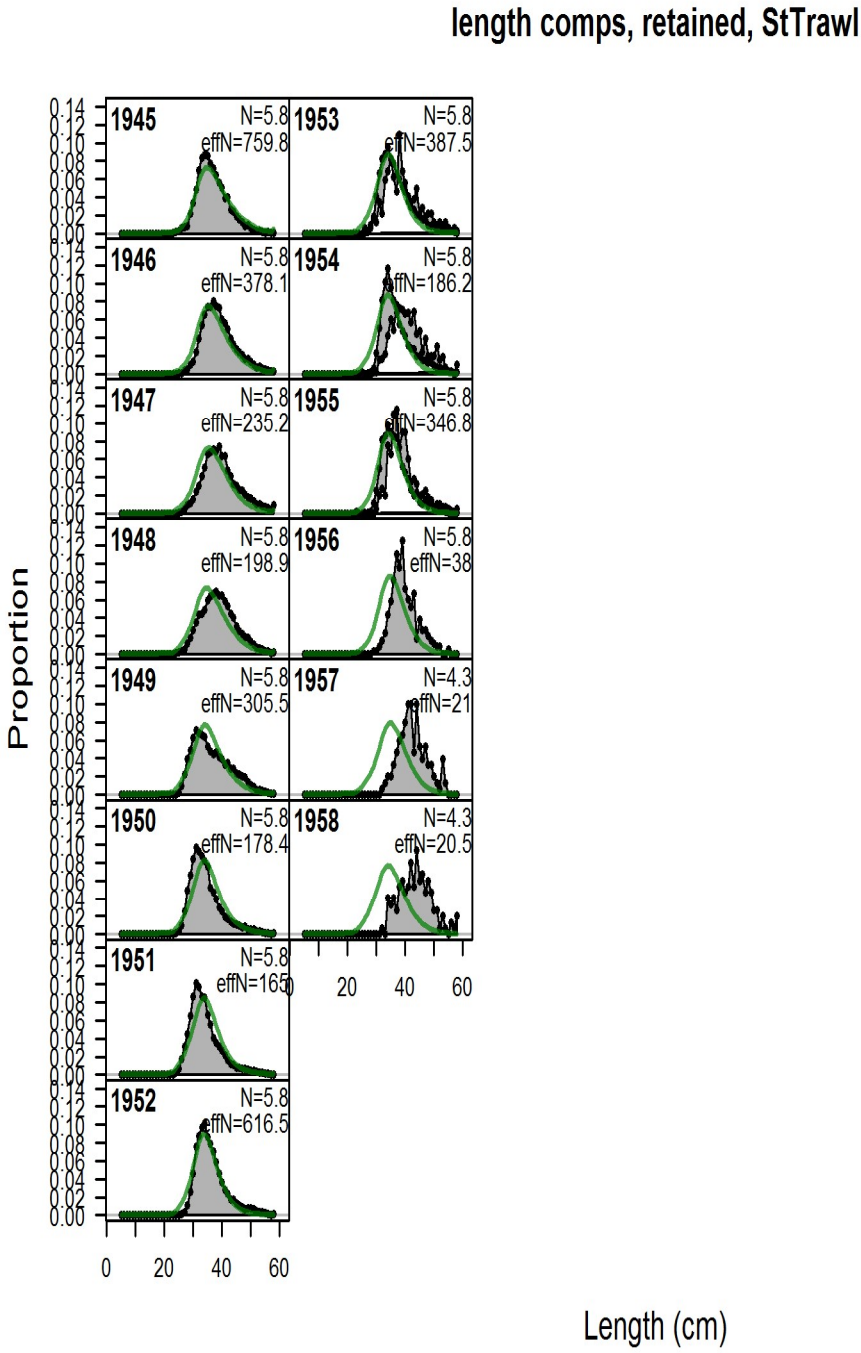

Figure A 13.6. Tiger flathead length composition fits: steam trawl retained.

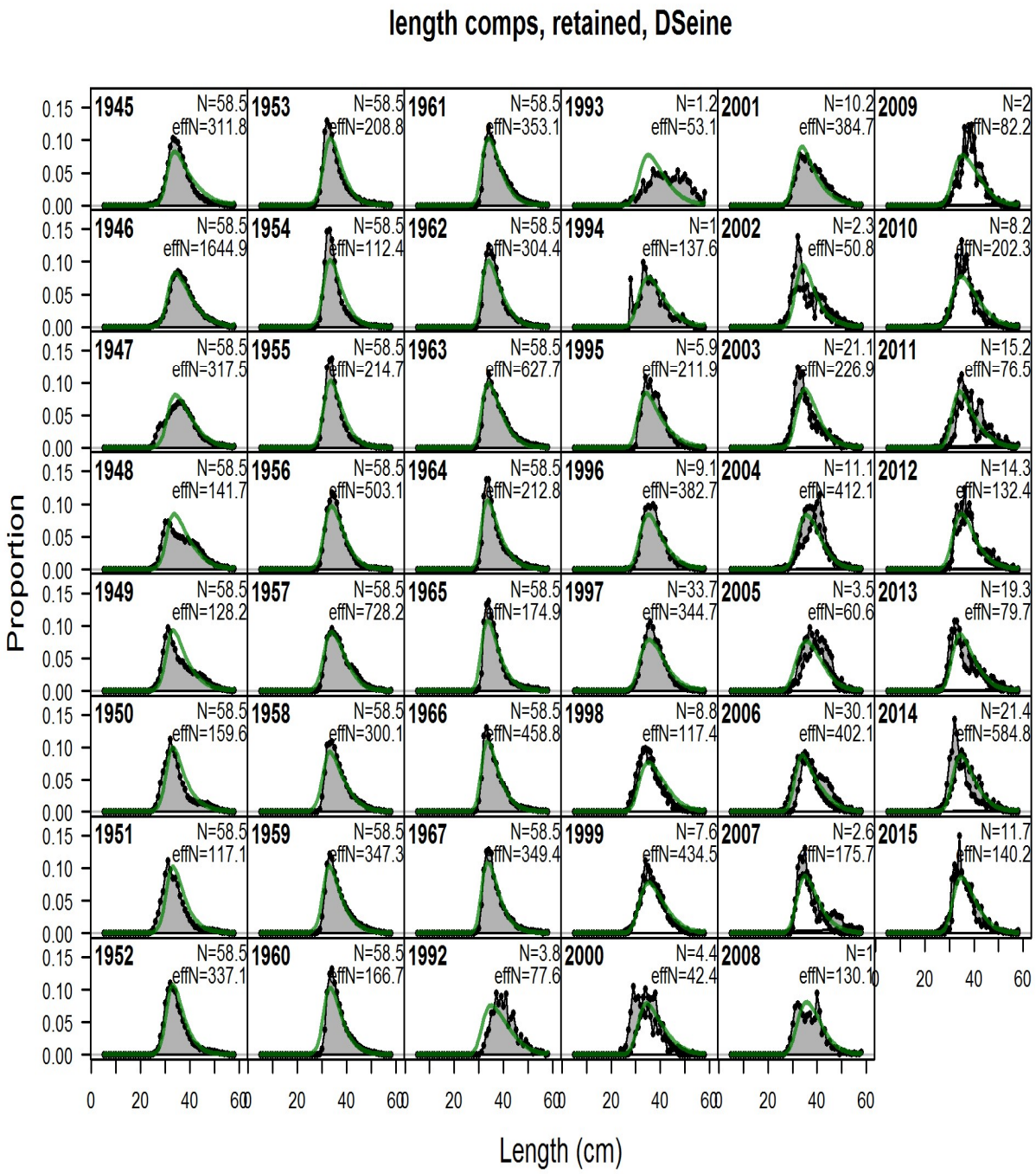

Figure A 13.7. Tiger flathead length composition fits: Danish seine retained.

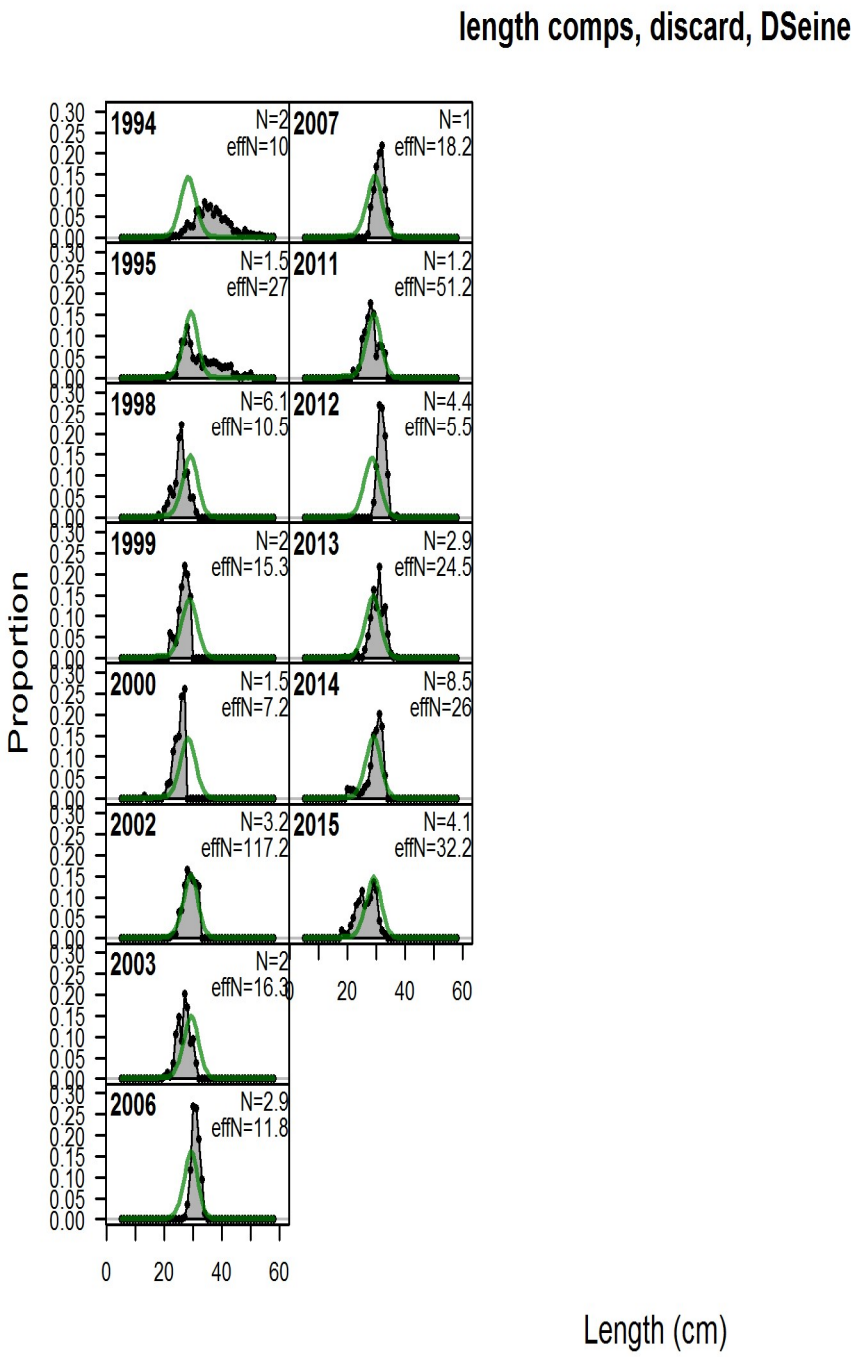

Figure A 13.8. Tiger flathead length composition fits: Danish seine discarded.

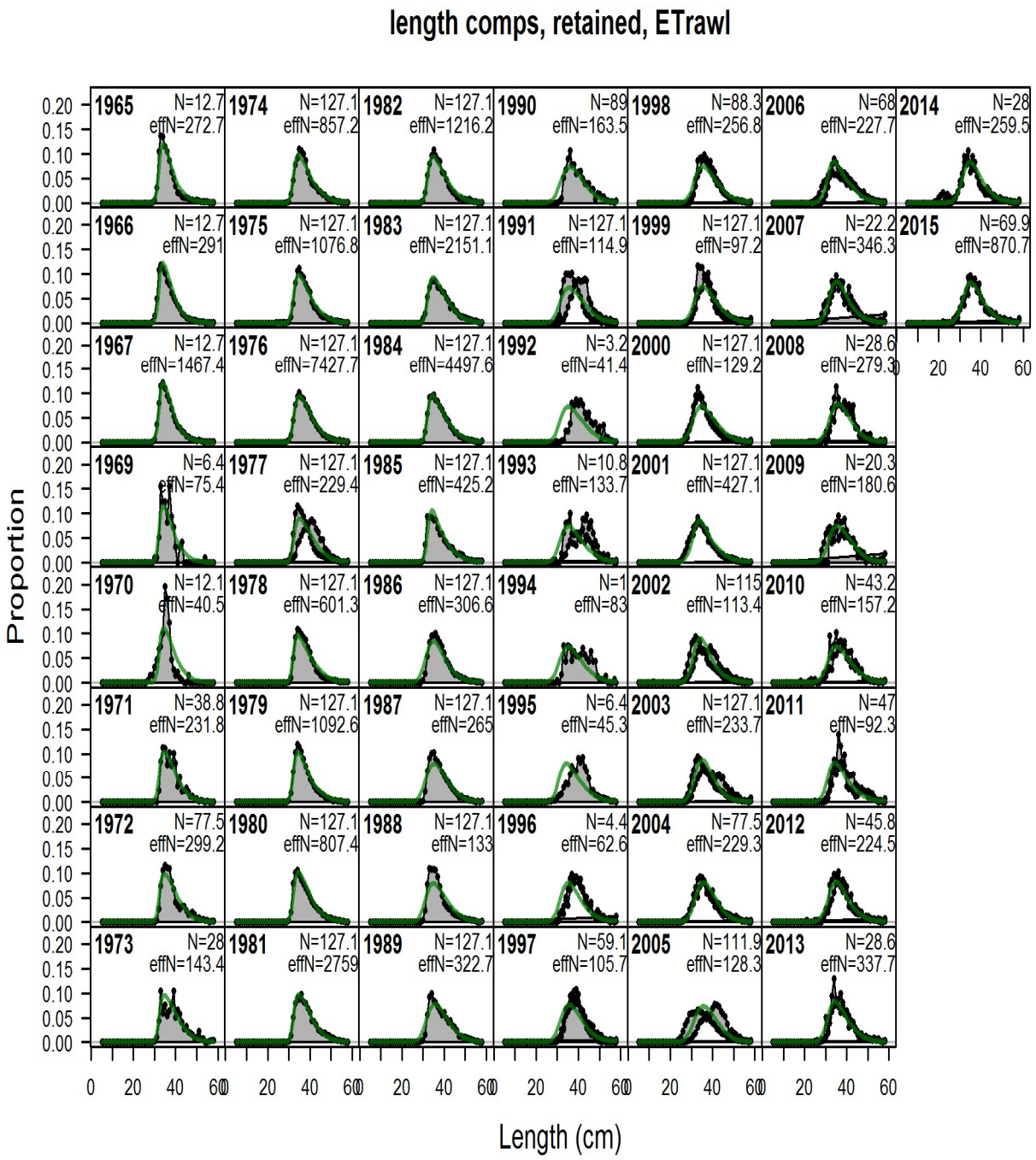

Figure A 13.9. Tiger flathead length composition fits: eastern trawl retained.

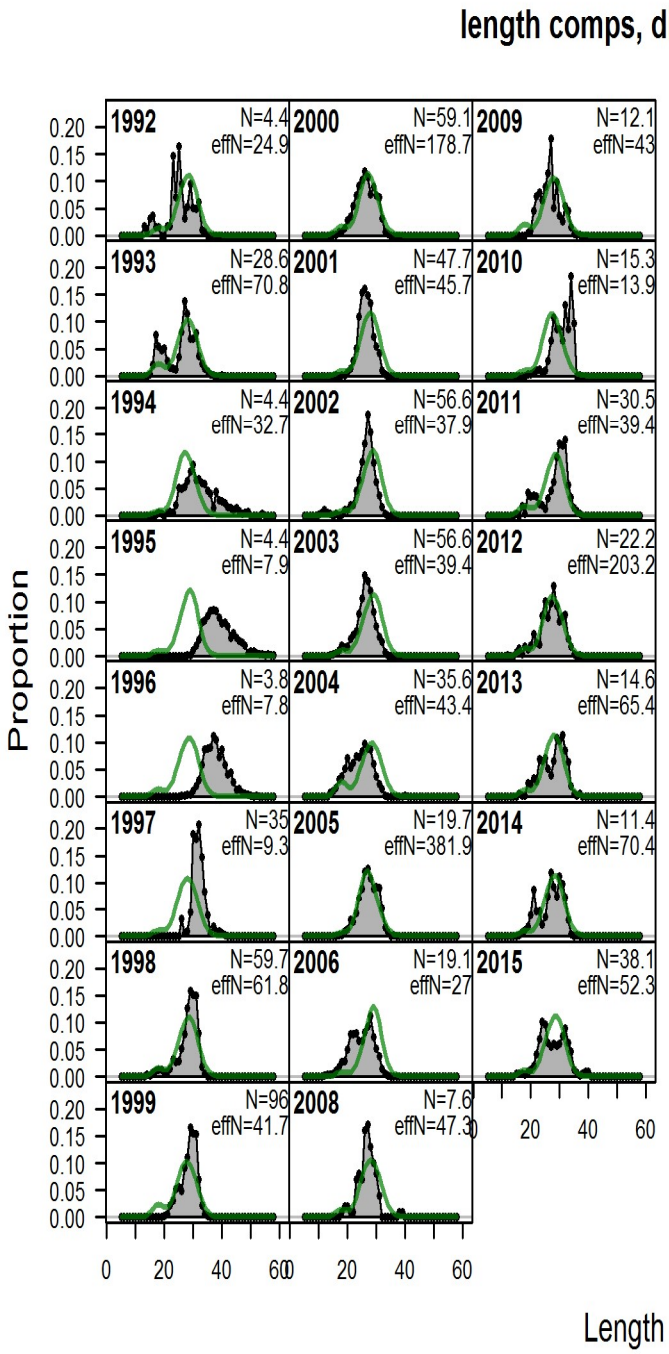

Figure A 13.10. Tiger flathead length composition fits: eastern trawl discarded.

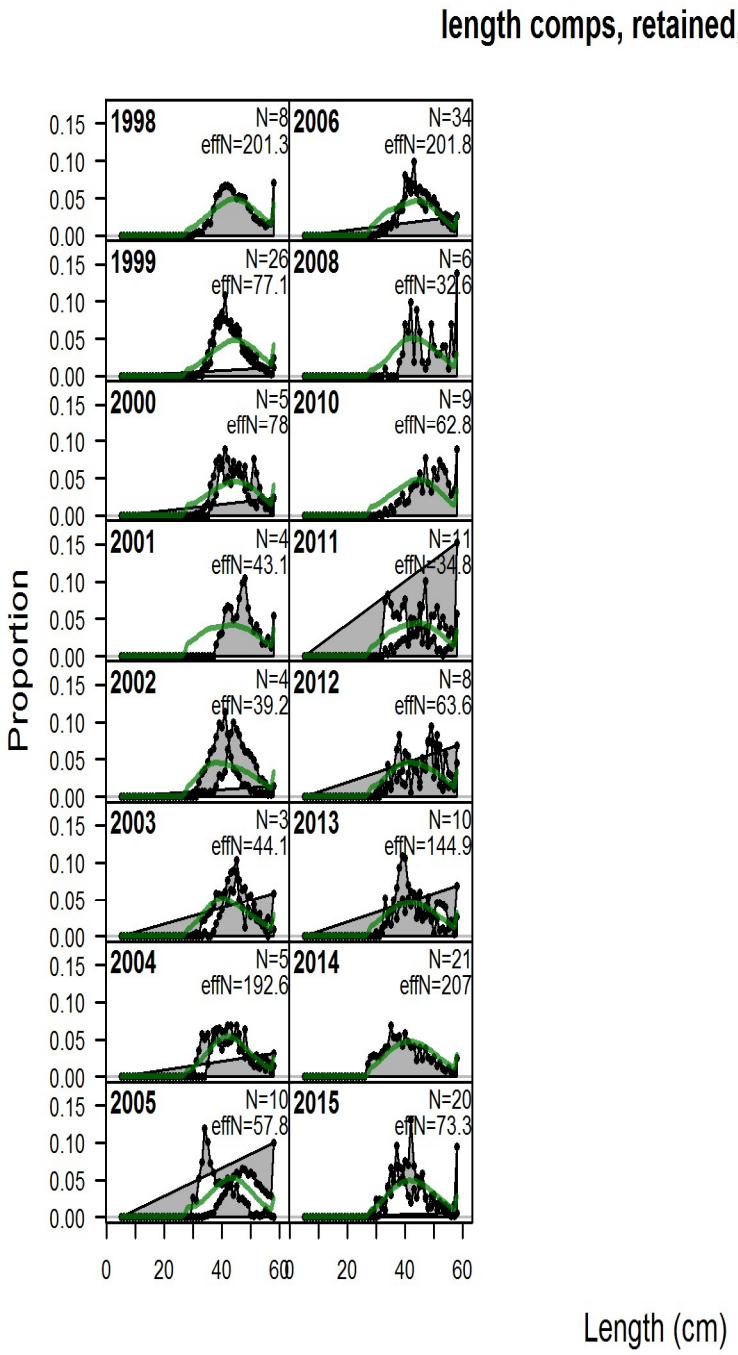

Figure A 13.11. Tiger flathead length composition fits: Tasmanian trawl retained.

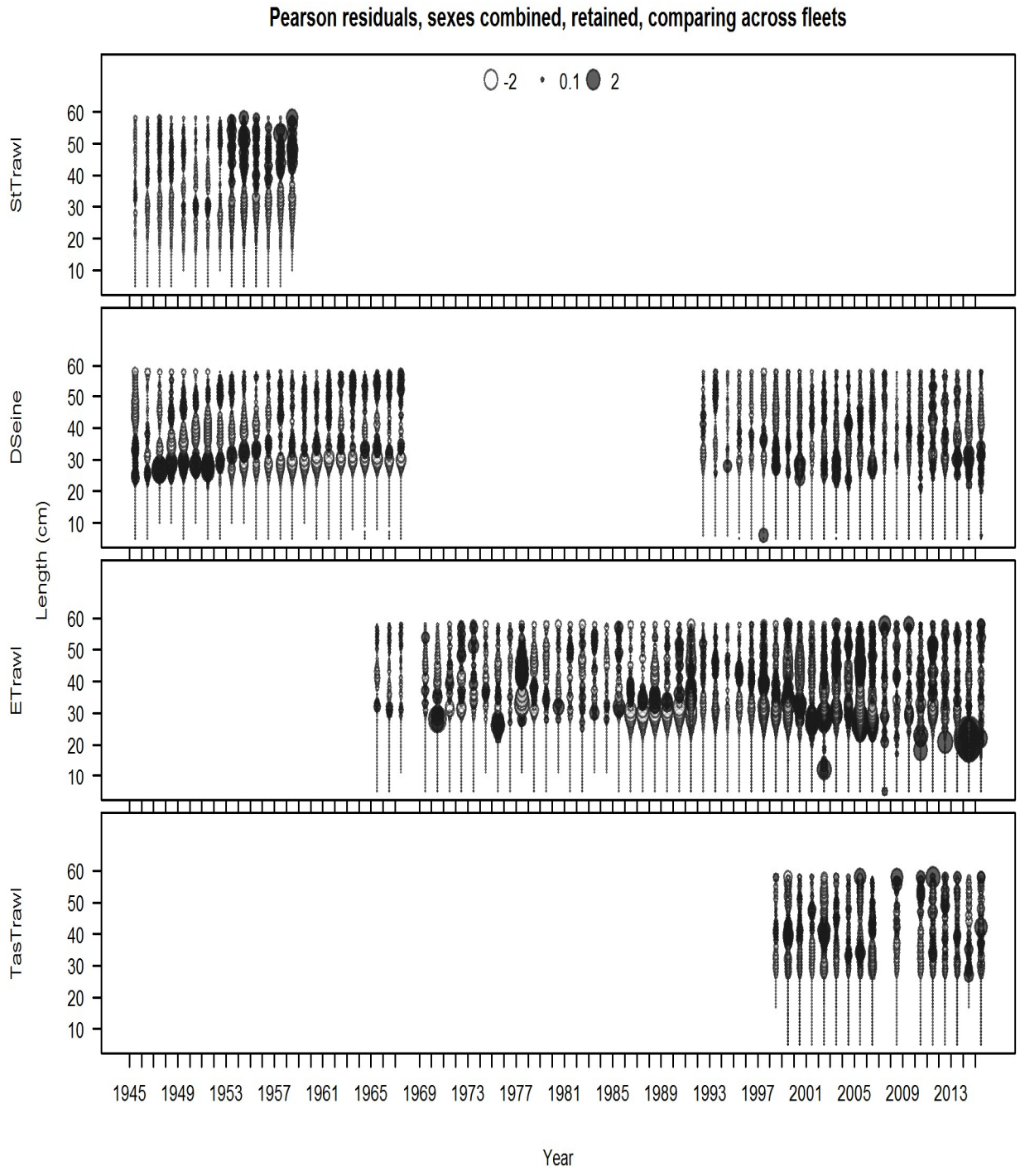

Figure A 13.12. Residuals from the annual length compositions (retained) for tiger flathead displayed by year and fleet.

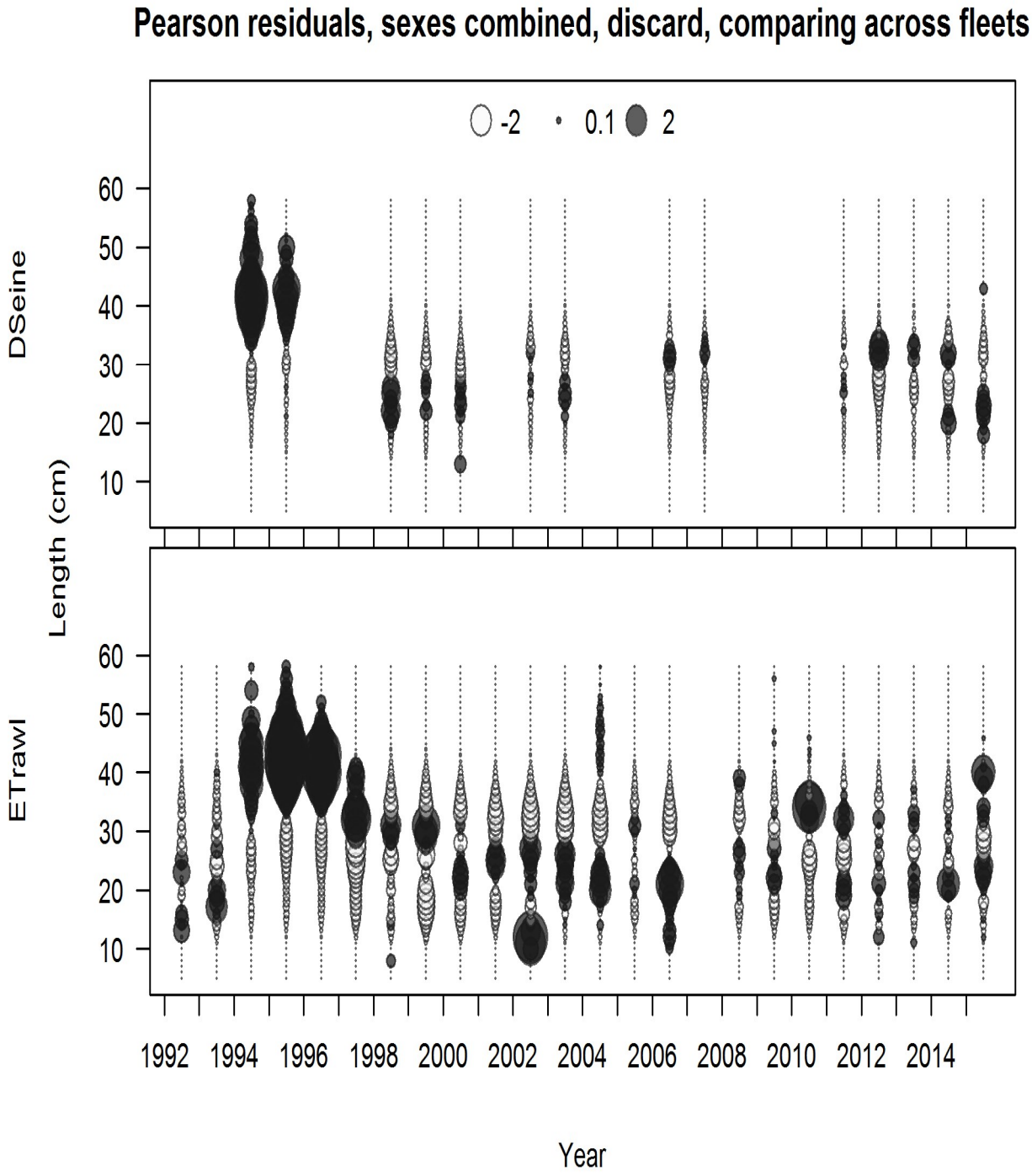

Figure A 13.13. Residuals from the annual length compositions (discarded) for tiger flathead displayed by year and fleet.

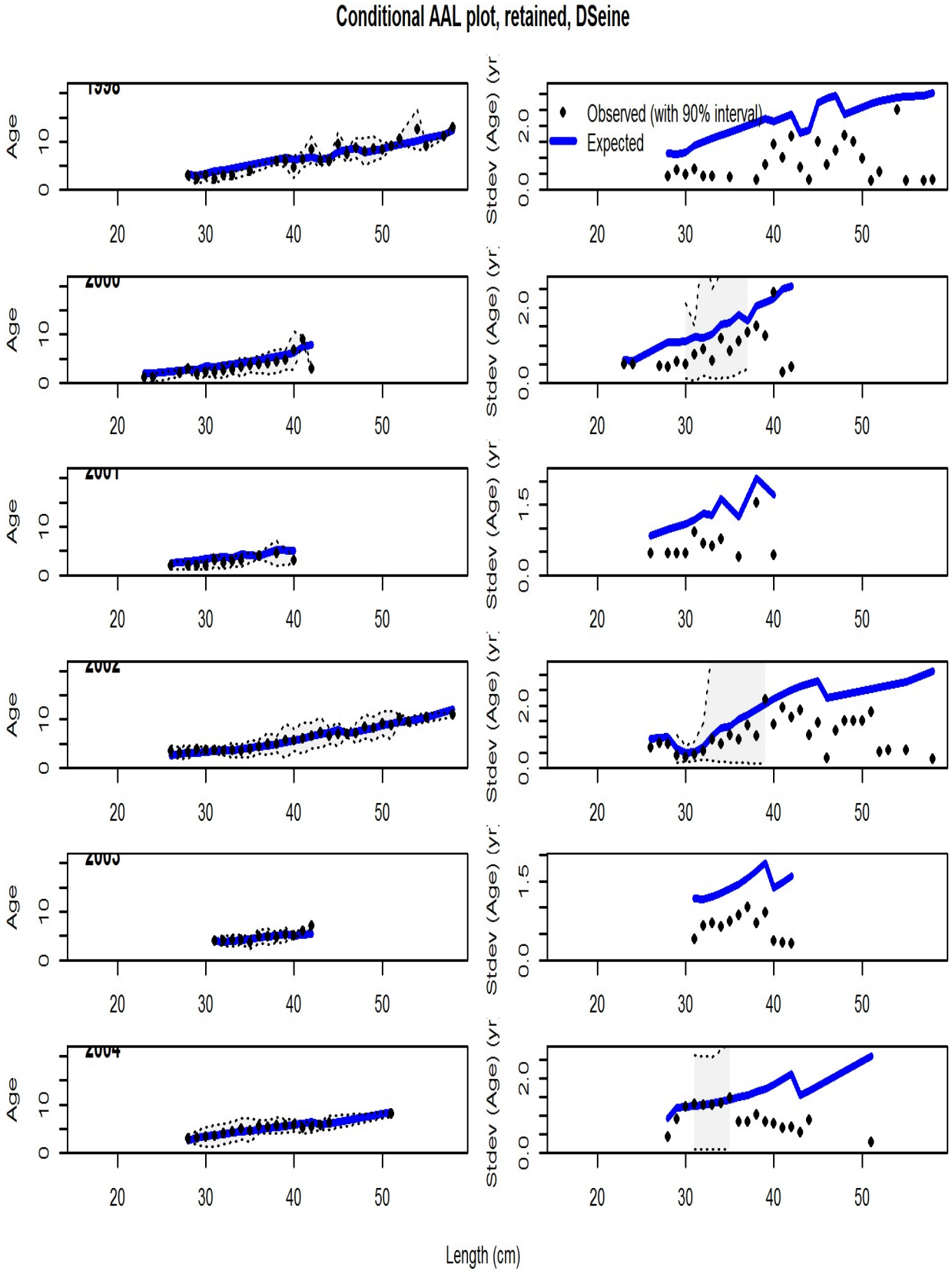

Figure A 13.14. Tiger flathead conditional age-at-length fits: Danish seine part 1.

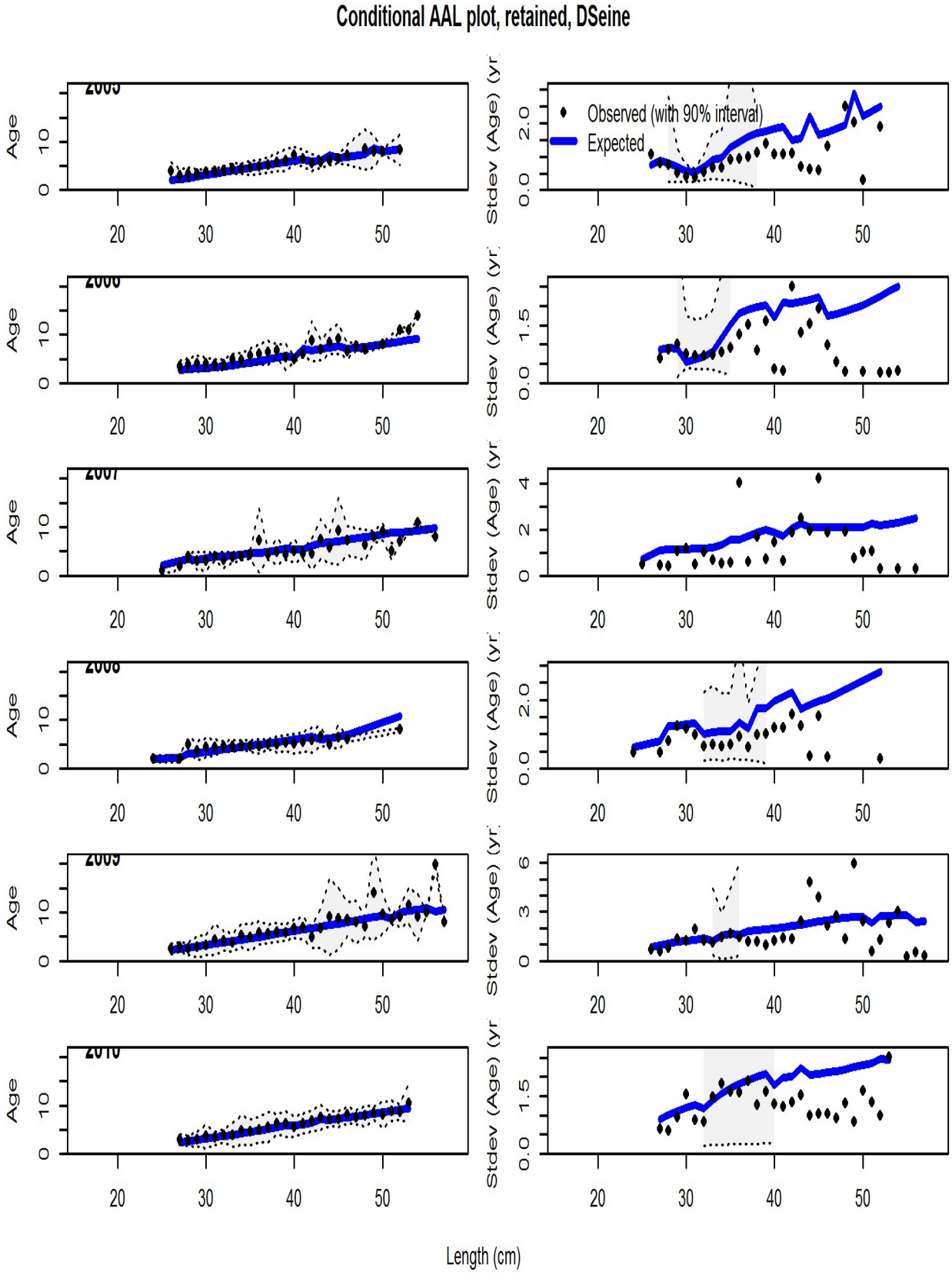

Figure A 13.15. Tiger flathead conditional age-at-length fits: Danish seine part 2.

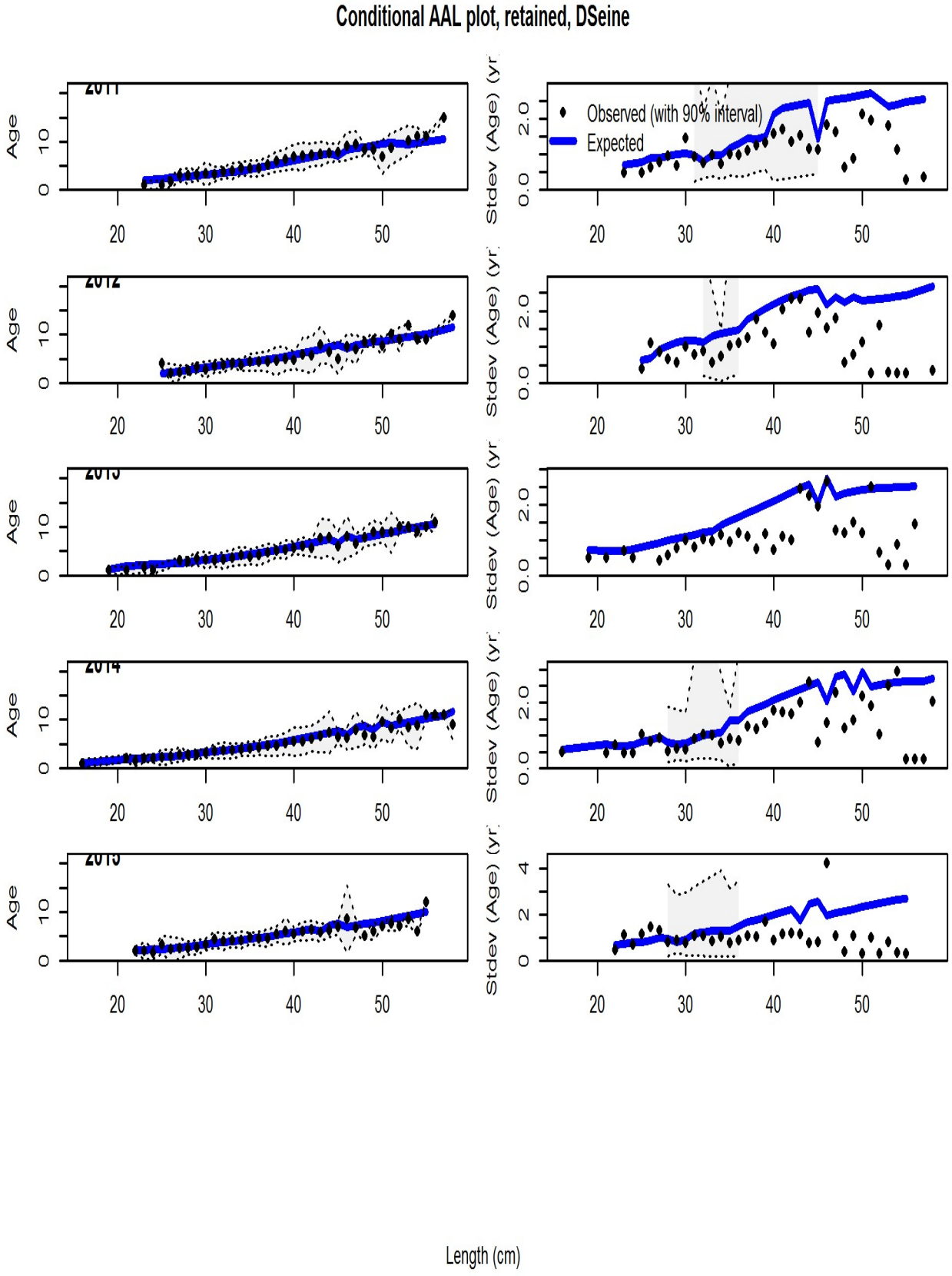

Figure A 13.16. Tiger flathead conditional age-at-length fits: Danish seine part 3.

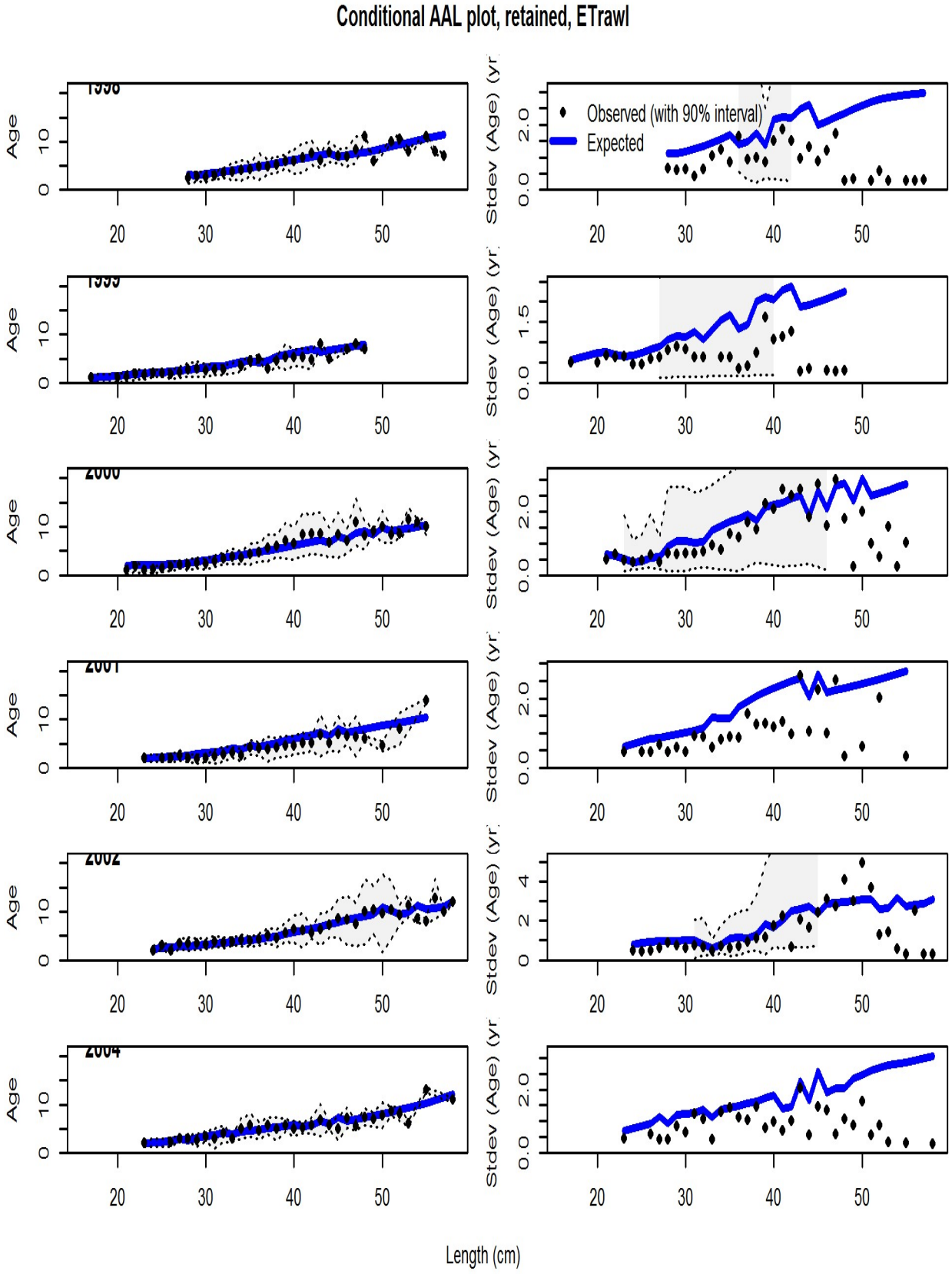

Figure A 13.17. Tiger flathead conditional age-at-length fits: eastern trawl part 1.

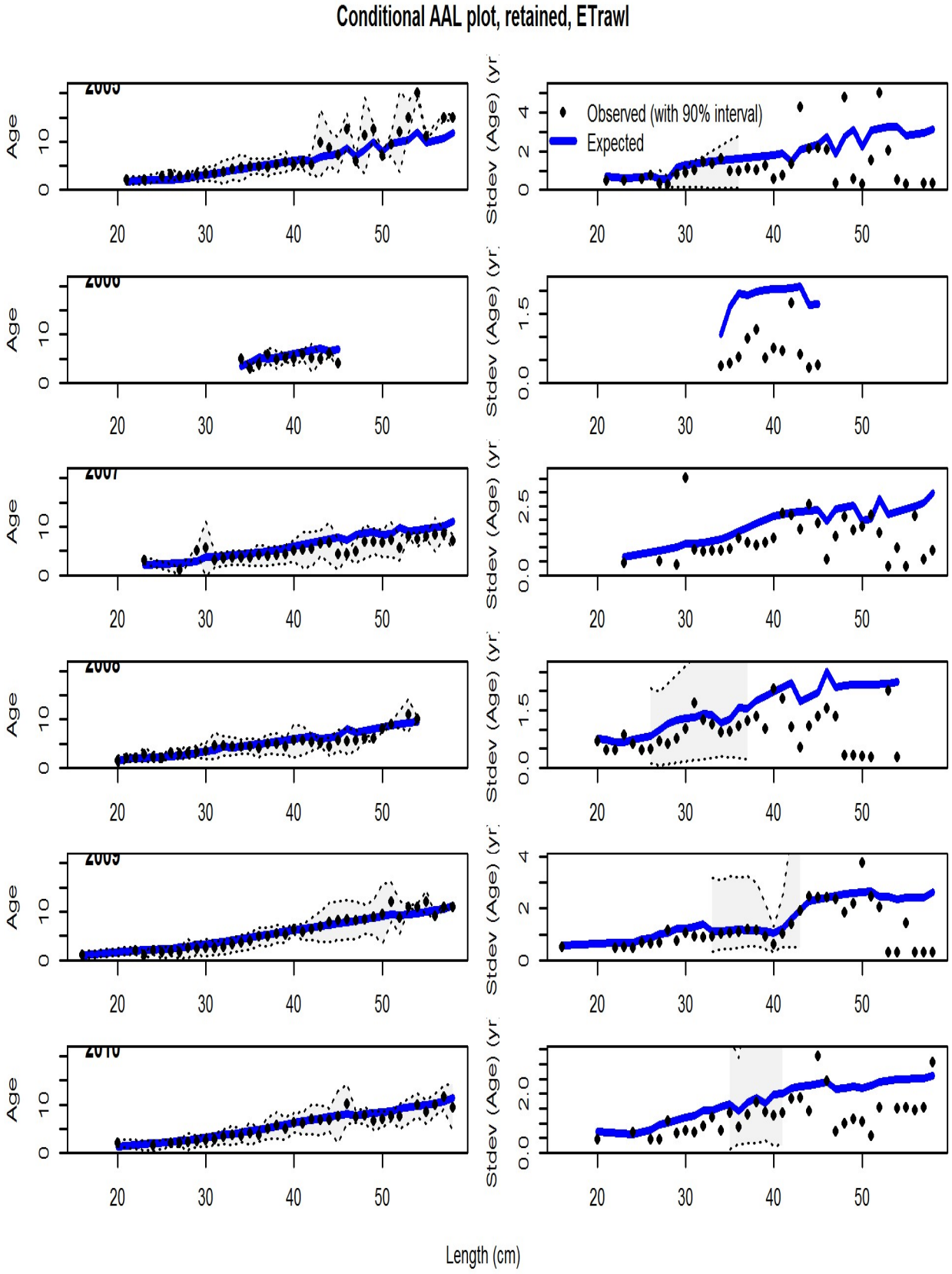

Figure A 13.18. Tiger flathead conditional age-at-length fits: eastern trawl part 2.

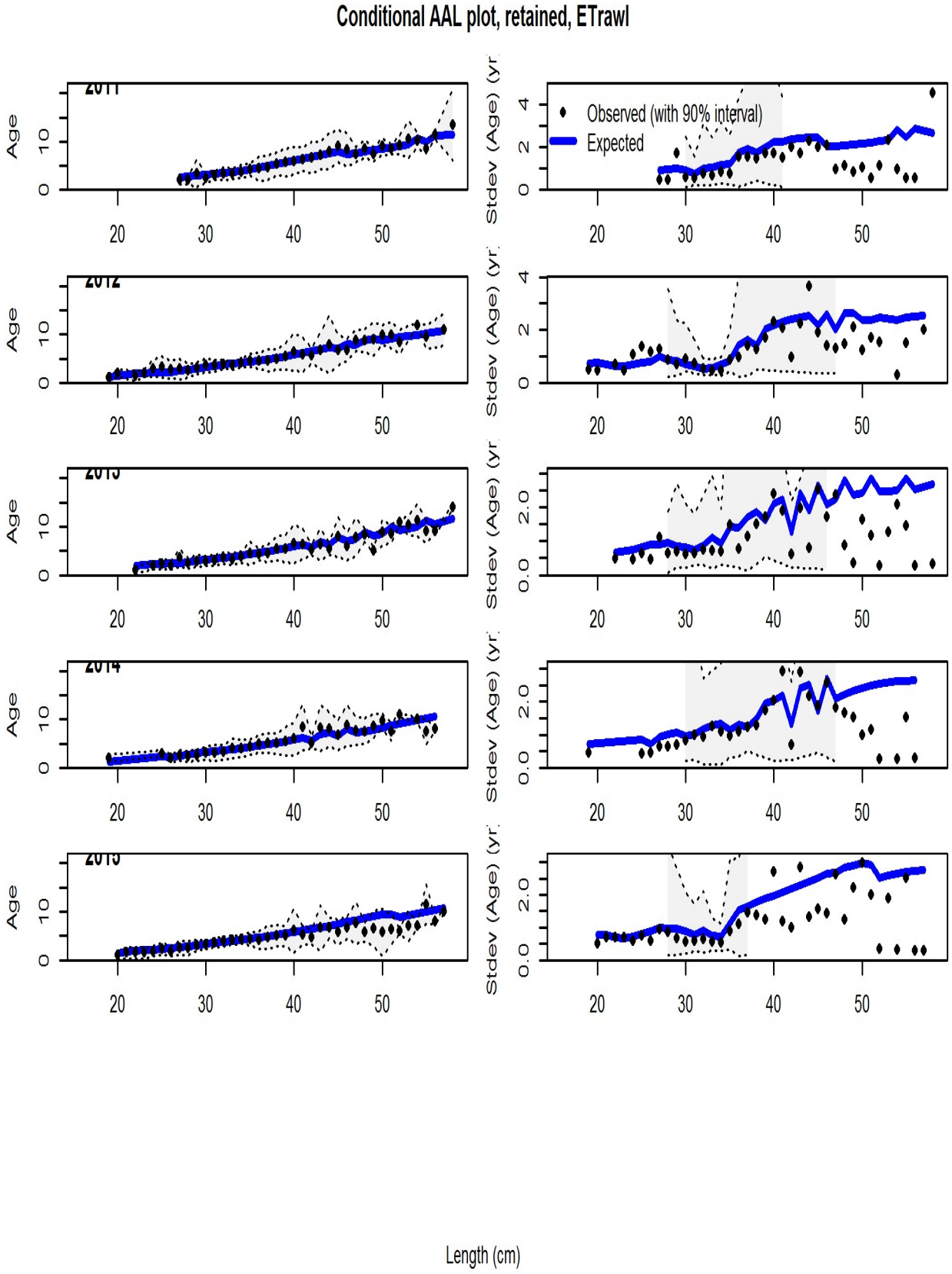

Figure A 13.19. Tiger flathead conditional age-at-length fits: eastern trawl part 3.

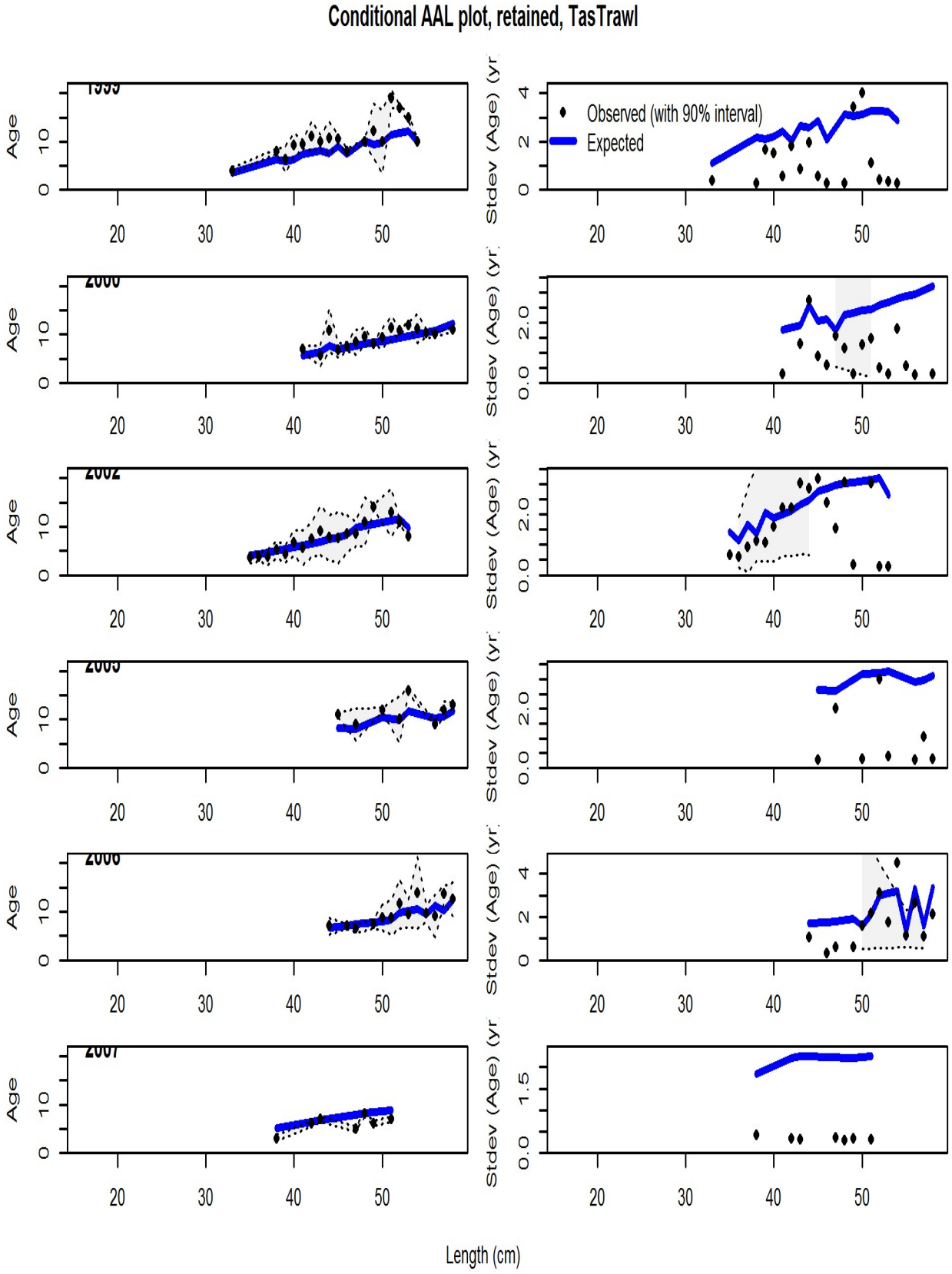

Figure A 13.20. Tiger flathead conditional age-at-length fits: Tasmanian trawl part 1.

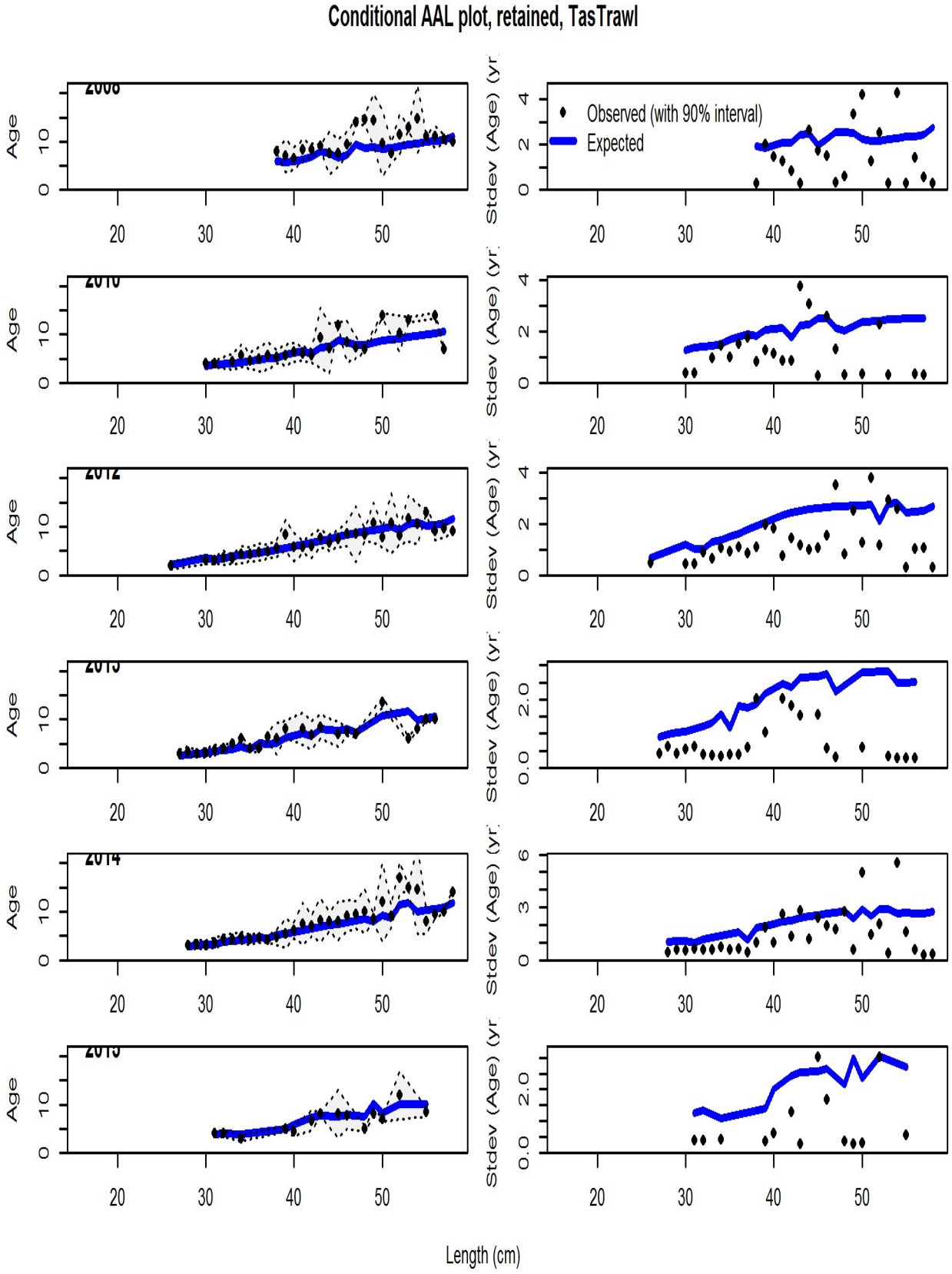

Figure A 13.21. Tiger flathead conditional age-at-length fits: Tasmanian trawl part 2.