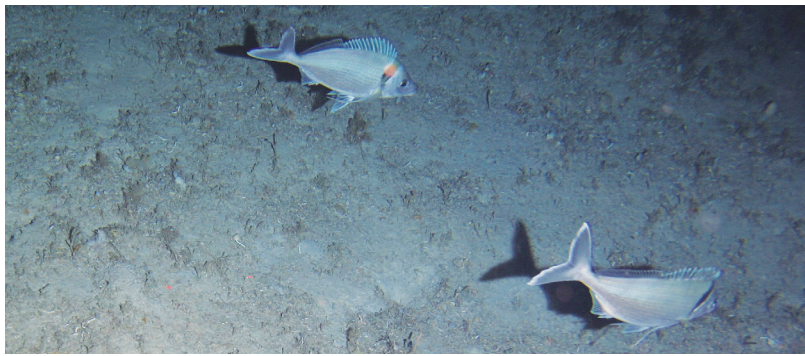


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Stock Assessment for the Southern and Eastern Scalefish and Shark Fishery: 2016 and 2017



PART
2

2017



Principal investigator **G.N. Tuck**



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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 2: 2017

G.N. Tuck
June 2018
Report 2015/0817

Australian Fisheries Management Authority

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

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14. School whiting (*Sillago flindersi*) stock assessment based on data up to 2016 – development of a preliminary base case

Jemery Day

CSIRO Oceans and Atmosphere, GPO Box 1538, Hobart, TAS 7001, Australia

14.1 Executive Summary

This document presents a suggested base case for an updated quantitative Tier 1 school whiting (*Sillago flindersi*) assessment for presentation at the first SERAG meeting in 2017. The last full assessment was presented in Day (2009). The preliminary base case has been updated by the inclusion of data up to the end of 2016, which entails an additional eight years of catch, discard, CPUE, length and age data and ageing error updates since the 2009 assessment and incorporation of an additional trawl CPUE index from 1995-2016. This document describes the process used to develop a preliminary base case for school whiting through the sequential updating of recent data to the stock assessment, using the stock assessment package Stock Synthesis (SS-V3.30).

Changes to the last stock assessment include: separating length frequencies into onboard and port collected components; weighting length frequencies by shots and trips rather than fish measured; and using a new balancing method.

Results show remarkably good fits to the catch rate data, length data and conditional age-at-length data. This assessment estimates that the projected 2018 spawning stock biomass will be 42% of virgin stock biomass (projected assuming 2016 catches in 2017), compared to 50% at the start of 2010 from the last assessment (Day 2009).

14.2 Introduction

14.2.1 Bridging from 2010 to 2017 assessments

The previous full quantitative assessment for school whiting was performed in 2009 (Day, 2009) using Stock Synthesis (version SS-V3.03a, Methot, 2009). The 2017 assessment uses the current version of Stock Synthesis (version SS-V3.30.07.01, Methot et al, 2016), which has many changes from SS_V3.03a.

As a first step in the process of bridging to a new model, the model was converted from version SS-V3.03a (Methot, 2009) to version SS-V3.24Q (Methot 2015) and then translated to version SS-V3.30.07.01, (Methot et al, 2016), using the data and model structure used in the 2009 assessment. One of the major changes to assessment procedures since 2009 is advances in model balancing, so after transferring to the most recent software, the current model balancing techniques were applied to the old model structure. This was followed by removing the rebalancing, and initially updating historical data (up to 2008). This was followed by including the data from 2009-2016 into the model. This additional data included new catch, discard, CPUE, length frequency, age-at-length data, an updated ageing error matrix and an additional CPUE index (trawl). The last year of recruitment estimation was extended to 2013 (2005 in the 2009 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.

14.2.2 Update to Stock Synthesis SSV-3.30.07.01 and updated catch history

The 2009 school whiting assessment was initially converted to a more recent version of the software, Stock Synthesis version SS-V3.24Q (base2009_3.24). The translation from version 3.24 to 3.30 is complex and involves many changes to the structure of input data files, so this interim step was used to make it easier to understand any changes to the assessment. The translation to version 3.30 (translated_3.30_3) was successful and this model was then balanced (translated_3.30_4).

The next step (from translated_3.30_3) included updated catch history used in the 2009 assessment, which involved significant revisions to both the state and Commonwealth catch histories to 2008 and replacing the estimated 2009 catch with the actual 2009 catch. These changes in catch history were included after the transition to SS-V3.30. There were negligible changes to the spawning biomass and recruitment time series for any of these additional steps. When these time series are plotted together, there are minimal relative changes in the translation to SS-V3.30 but more considerable changes when the model was balanced using current model balancing techniques (Figure 14.1 and Figure 14.2). However, the fit to the Danish seine CPUE is considerably improved simply by using the current model balancing techniques (Figure 14.3). There are changes to the absolute value of recruitment (Figure 14.4), although the relative changes are less significant (especially excluding the re-balancing step).

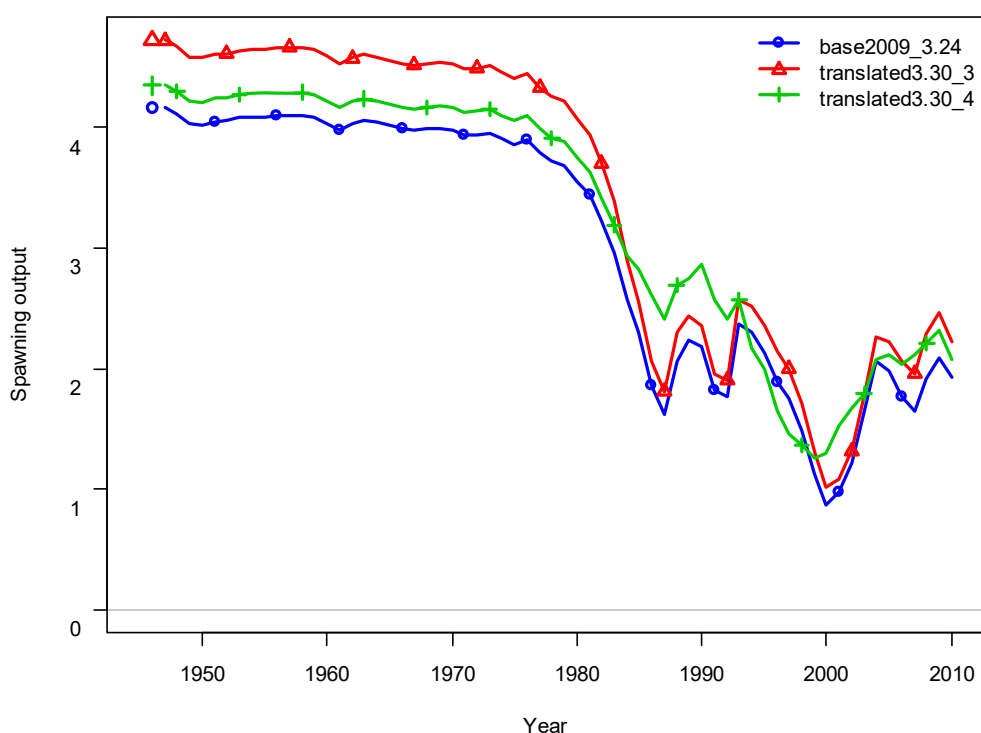


Figure 14.1. Comparison of the absolute spawning biomass time series for the 2010 assessment (base2009_3.24 – in blue), and a model converted to SS-V3.30 (translated3.30_3 in blue) and this same model balanced using the latest balancing procedures (translated3.30_4 – in green).

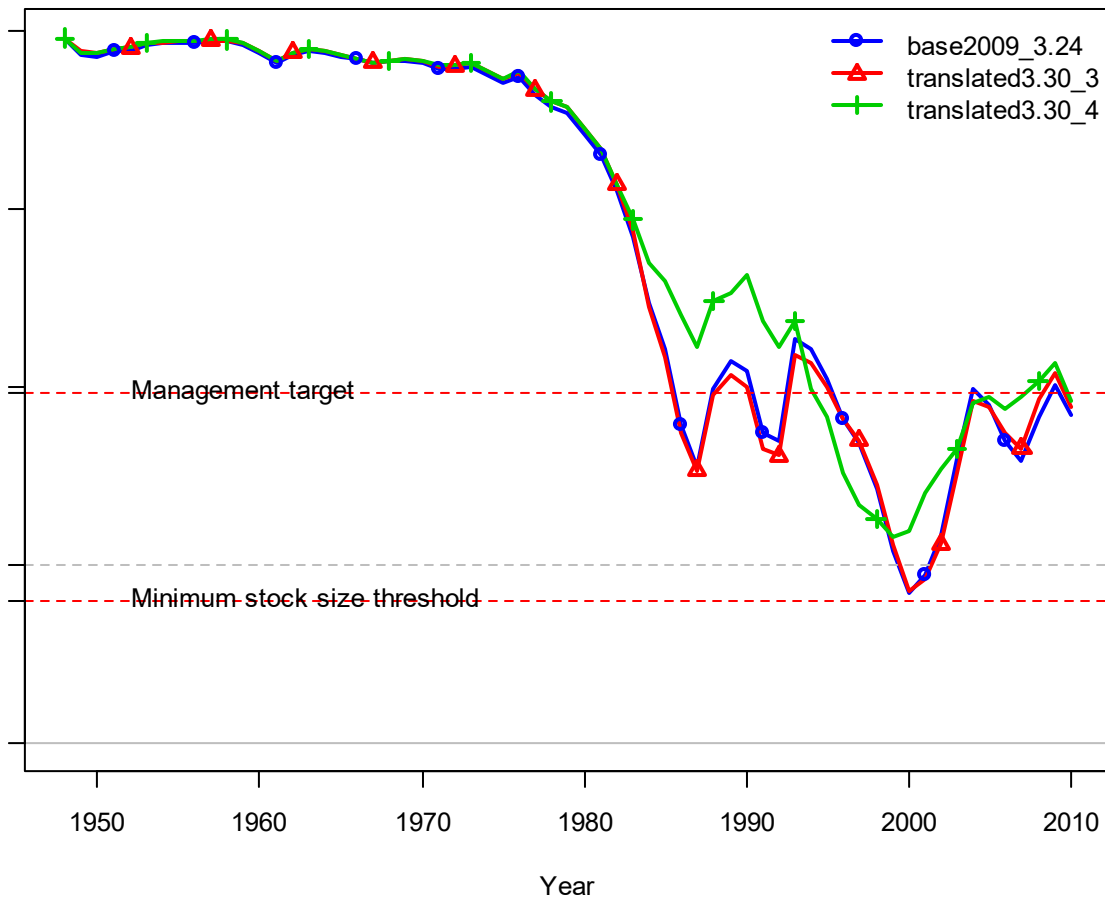


Figure 14.2. Comparison of the relative spawning biomass time series for the 2010 assessment (base2009_3.24 – in blue), and a model converted to SS-V3.30 (translated3.30_3 in blue) and this same model balanced using the latest balancing procedures (translated3.30_4 – in green).

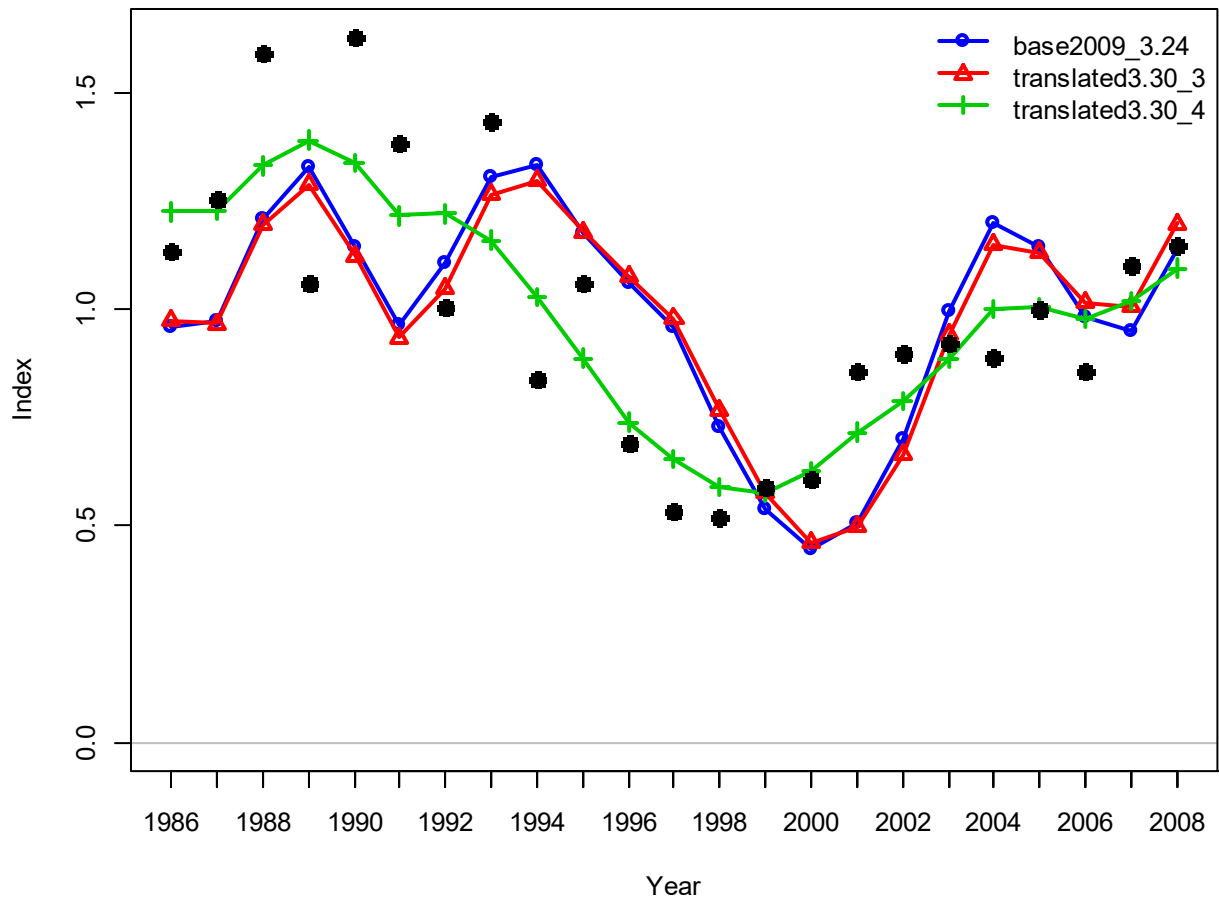


Figure 14.3. Comparison of the fit to the Danish seine CPUE index for the 2010 assessment (base2009_3.24 – in blue), and a model converted to SS-V3.30 (translated3.30_3 in blue) and this same model balanced using the latest balancing procedures (translated3.30_4 – in green).

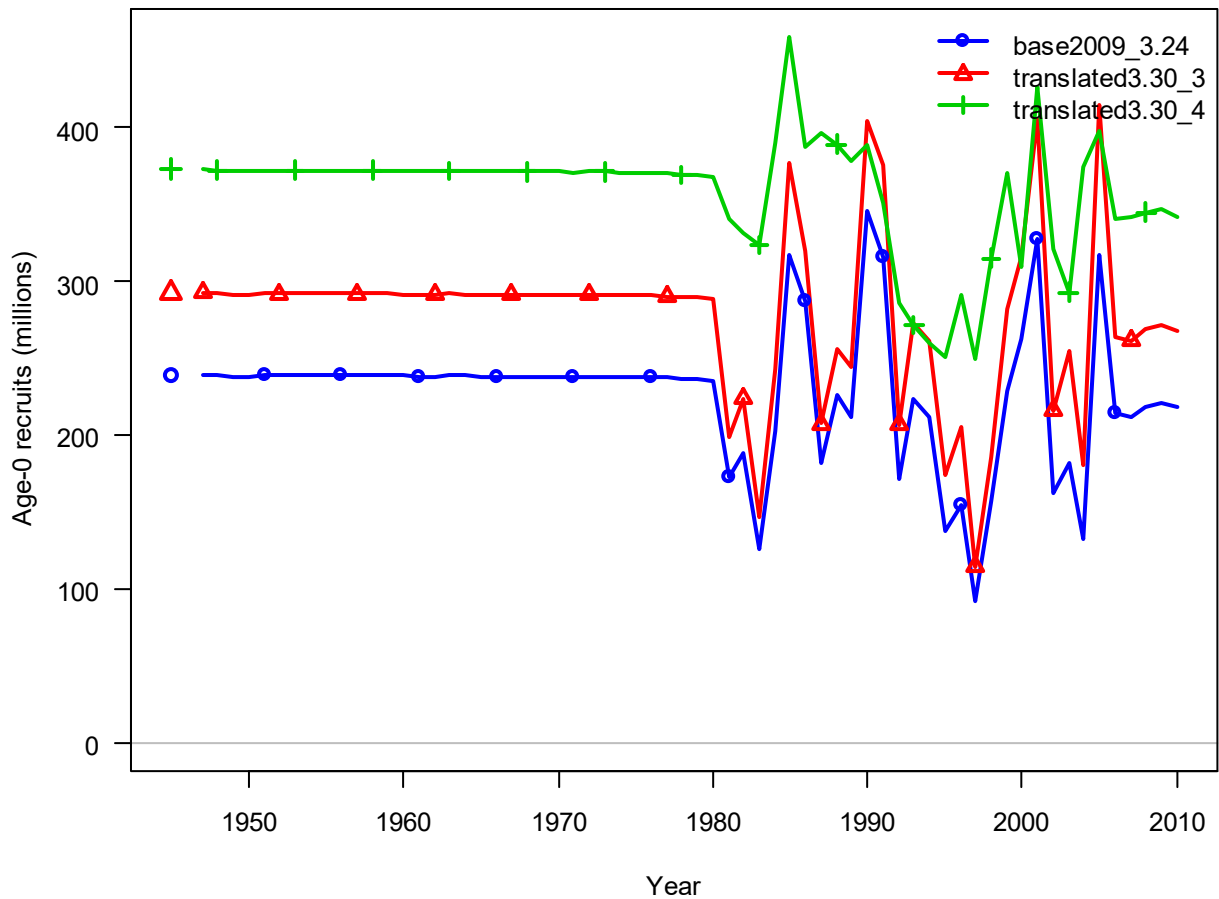


Figure 14.4. Comparison of the recruitment time series for the 2010 assessment (base2009_3.24 – in blue) and a model converted to SS-V3.30 (translated3.30_3 in blue) and this same model balanced using the latest balancing procedures (translated3.30_4 – in green).

14.2.3 Inclusion of new data: 2009-2016

Starting from the converted 2009 base case model with updated data to 2008, additional data from 2009-2016 were added sequentially to develop a preliminary base case for the 2016 assessment:

1. Change final assessment year to 2016, add catch to 2016 (addCatch2016).
2. Add CPUE to 2016 (from Haddon and Sporcic (2016)), including trawl CPUE from 1995 to 2016.
3. Add updated discard fraction estimates to 2016 (addDiscards2016).
4. Add updated length frequency data to 2016 (addLength2016).
5. Add length frequencies for onboard fleets and weighting all length frequencies by number of shots or trips, rather than number of fish (addOnbdLength2016).
6. Add updated age error matrix and age-at-length data to 2016 and change maximum age from six to nine years.
7. Change the final year for which recruitments are estimated from 2005 to 2013 (extendRec2013).

8. Rebalance using latest model balancing protocols, including Francis weighting on lengths and ages (baseBalance2017_2).

Inclusion of the new data resulted in a series of changes to the estimates of recruitment and the relative spawning biomass time series (Figure 14.5, Figure 14.6 and Figure 14.7), with perhaps the largest change resulting from the re-balancing of the model.

Since the 2009 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 balancing procedures including use of Francis weighting for length and age data, balancing the CPUE series within Stock Synthesis, and improvements to the recruitment bias ramp adjustment.

These are substantial changes to the balancing procedures used in the 2009 assessment, so it is not surprising that balancing resulted in considerable changes.

Inclusion of eight years of new data resulted in relatively large changes to estimates of recruitment and the spawning biomass time series. With recruitment estimated up until 2015, this resulted in seven out of eight years of new estimated recruitment residuals below average. This has resulted in an estimate of the depletion at the start of 2018 of 42% of unexploited stock biomass, SSB_0 .

There are some unresolved issues relating to anomalies in catch databases in the Victorian SEF2/VIT catches. These may result in minor changes to the catch history used in the assessment.

Recent NSW state data (age and length composition data and possibly some catch rate data) has not been made available for quality checking and potential use in this assessment. It would be useful to incorporate such data in this assessment in future.

NSW state catch has been separated north and south of the Barrenjoey line. It will be possible to exclude all NSW state waters catch north of Barrenjoey as a sensitivity to the base case (to be presented by the next RAG meeting), but not as an alternative base case.

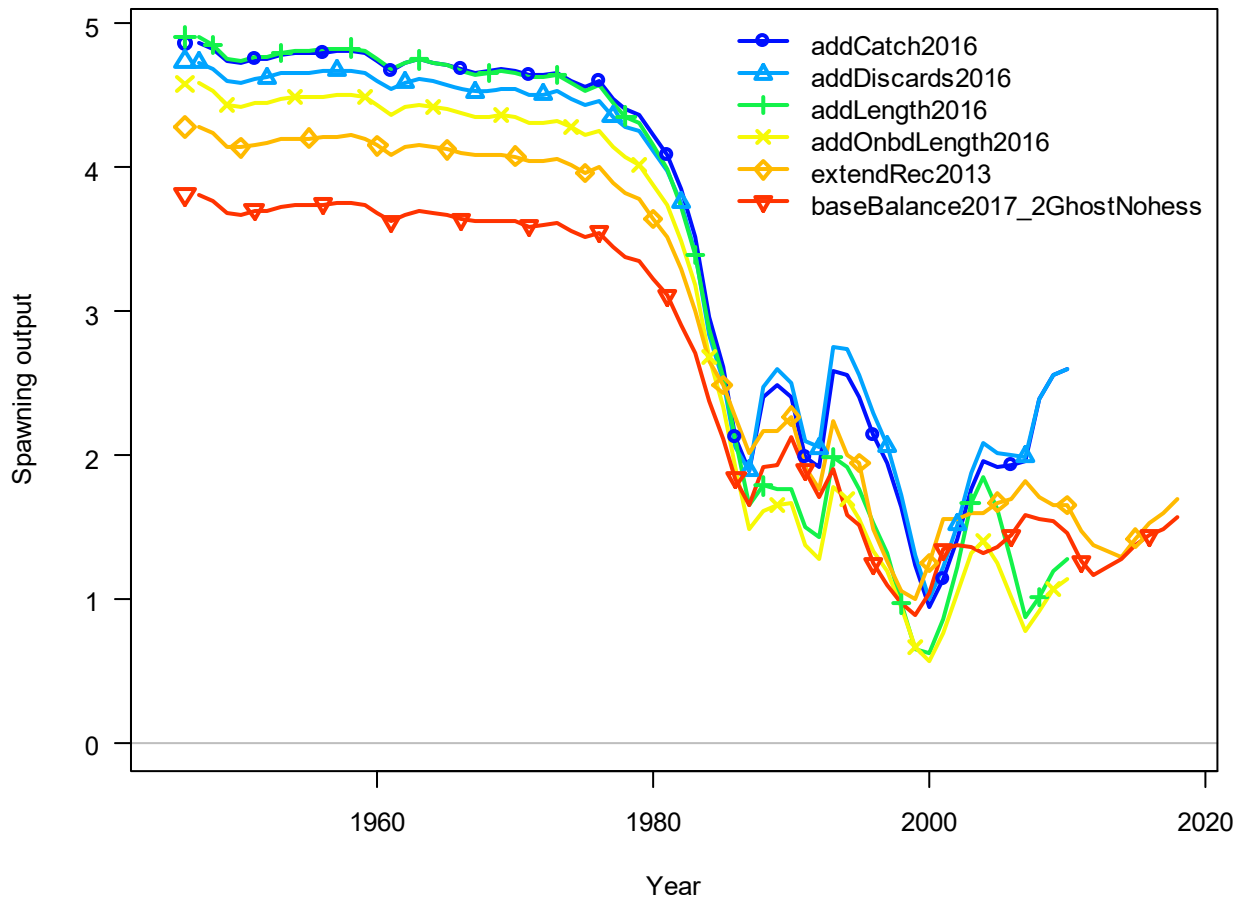


Figure 14.5. Comparison of the absolute spawning biomass time series for the 2010 assessment model converted to SS-V3.30 with various bridging models leading to a proposed 2017 balanced base case model (baseBalance2017_2).

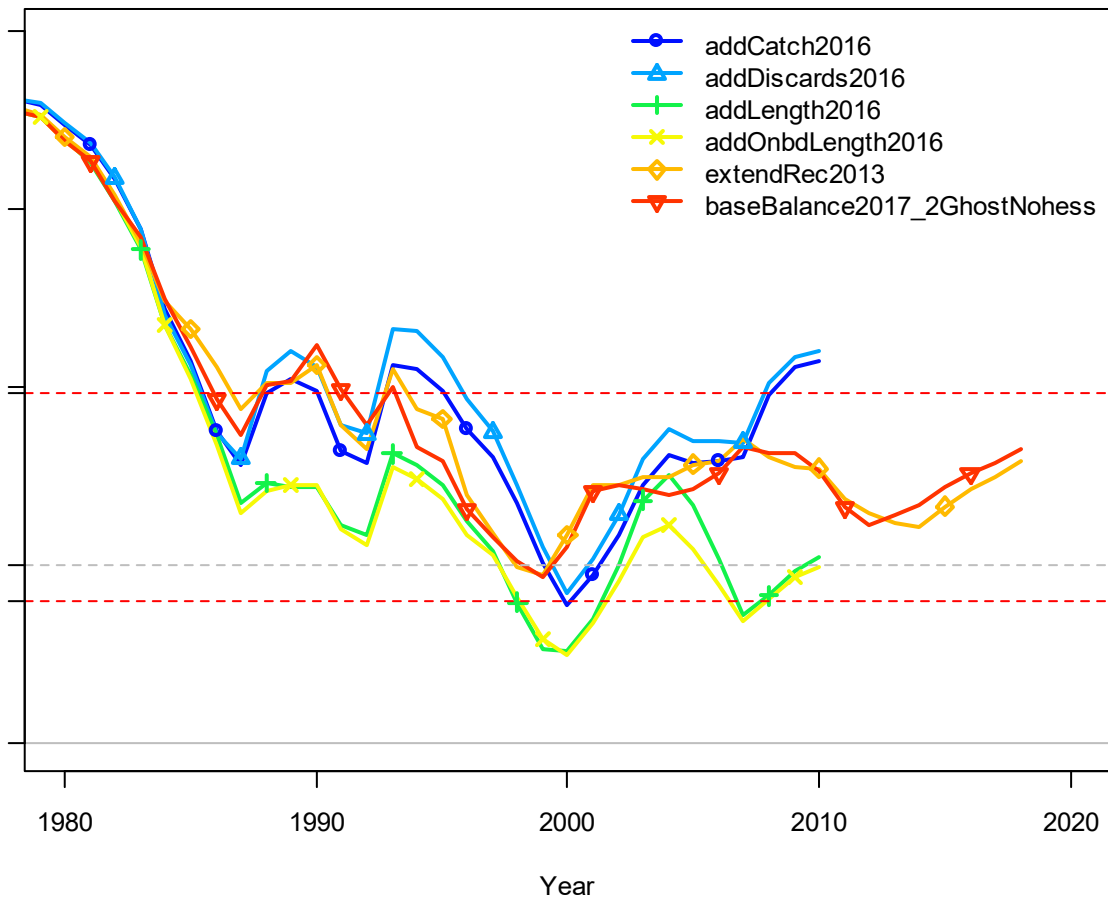


Figure 14.6. Comparison of the relative spawning biomass time series for the 2010 assessment model converted to SS-V3.30 with various bridging models leading to a proposed 2017 balanced base case model (baseBalance2017_2).

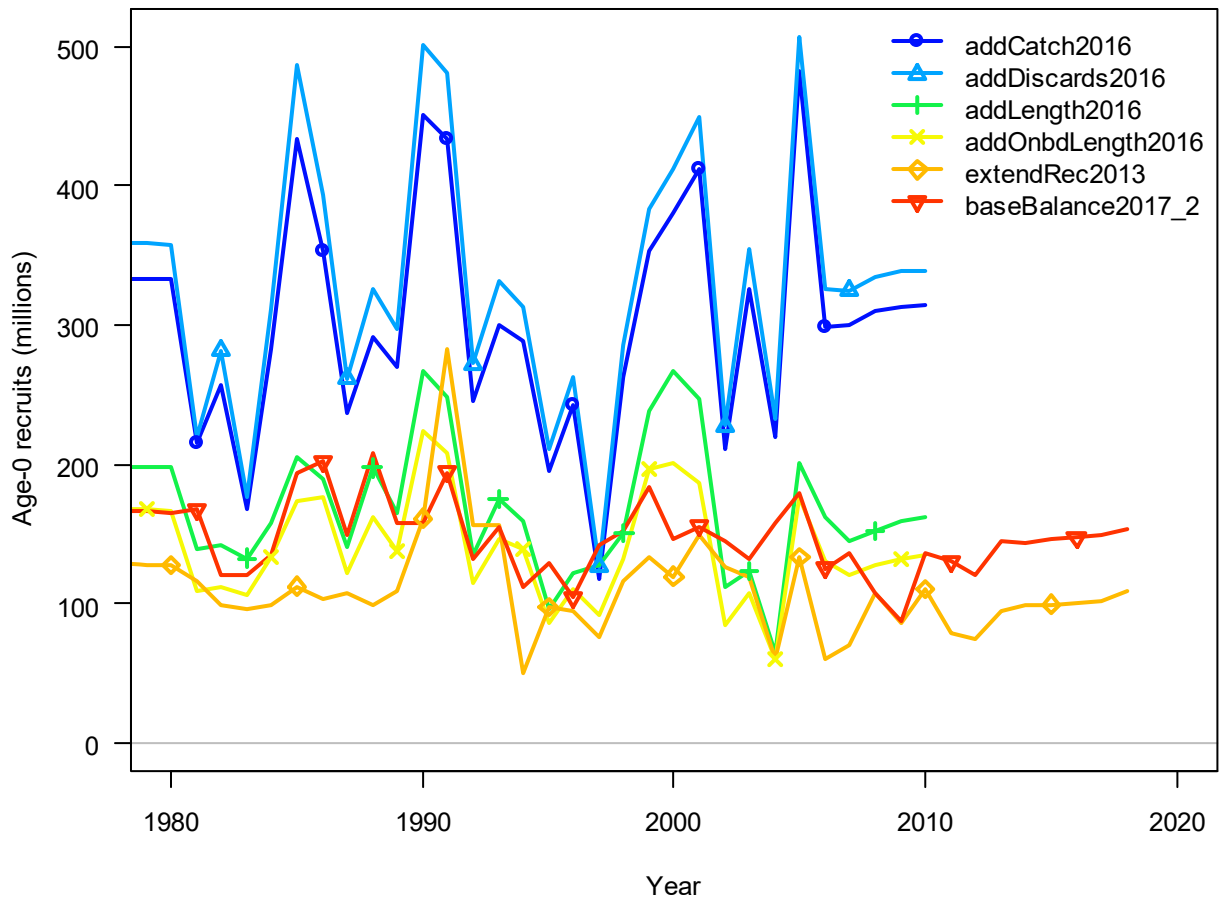


Figure 14.7. Comparison of the recruitment time series for the 2010 assessment model converted to SS-V3.30 with various bridging models leading to a proposed 2017 balanced base case model (baseBalance2017_2).

14.3 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. Karina Hall (NSW DPI) provided NSW catch data and advice on school whiting fisheries in NSW state waters. Malcolm Haddon provided useful code for auto-balancing, Athol Whitten provided useful R code for organising plots. Geoff Tuck, Malcolm Haddon, Andre Punt, Ian Taylor, Robin Thomson, Miriana Sporcic and Claudio Castillo-Jordán are thanked for helpful discussions on this work.

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14.5 Appendix A

14.5.1 Preliminary base case diagnostics

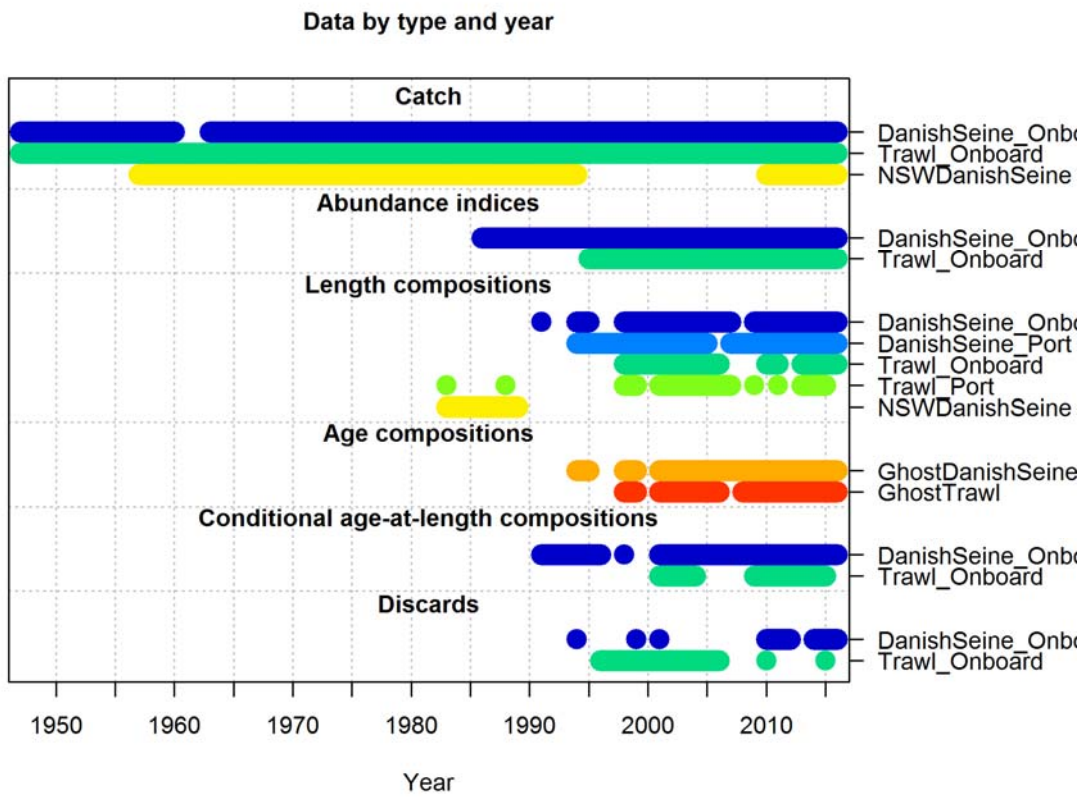


Figure A 14.1. Summary of data sources for school whiting stock assessment.

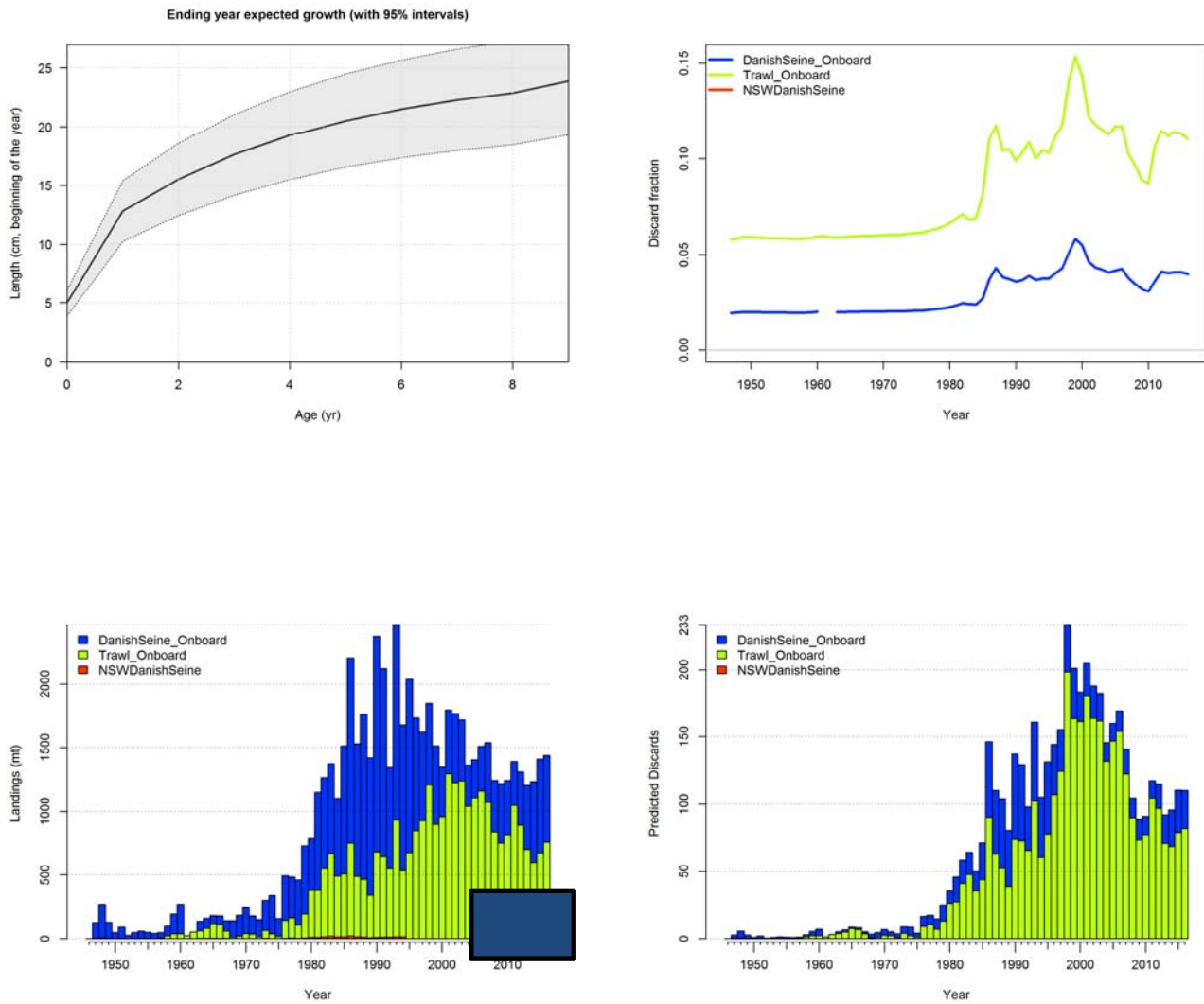


Figure A 14.2. Growth, discard fraction estimates, landings by fleet and predicted discards by fleet for school whiting.

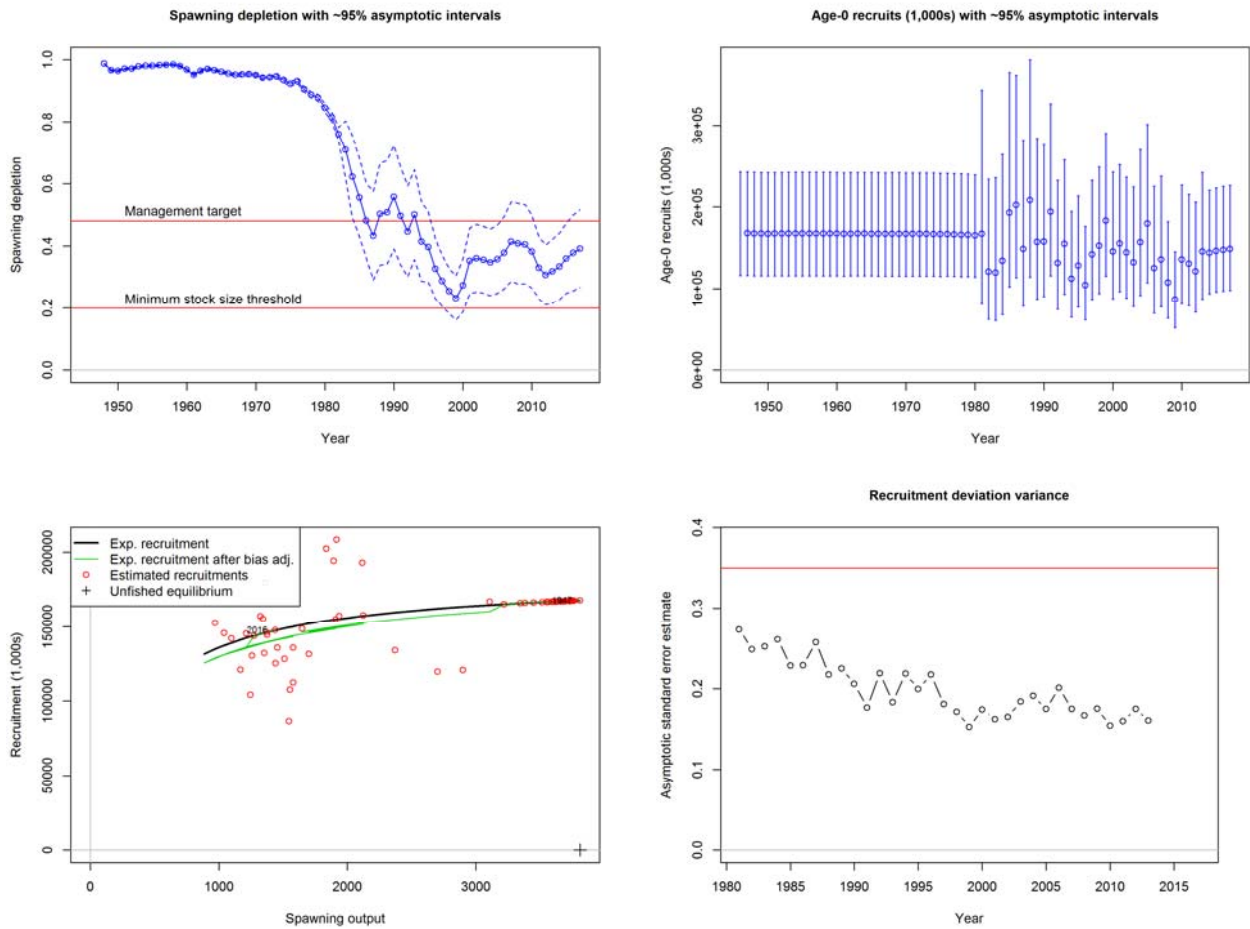


Figure A 14.3. Time series showing depletion of spawning biomass with confidence intervals, recruitment estimates with confidence intervals, stock recruitment curve and recruitment deviation variance check for school whiting.

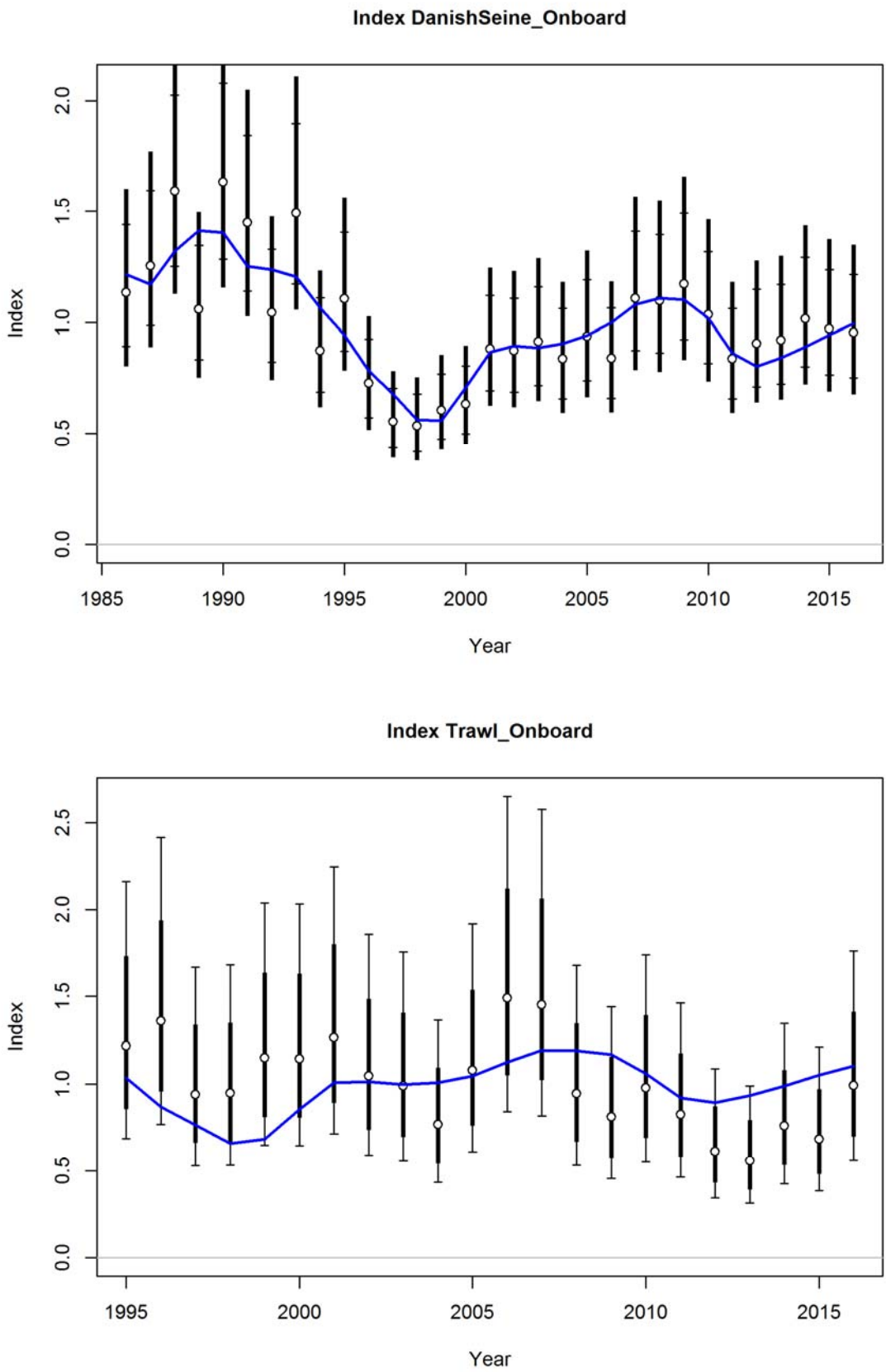


Figure A 14.4. Fits to CPUE by fleet for school whiting: Danish seine and trawl.

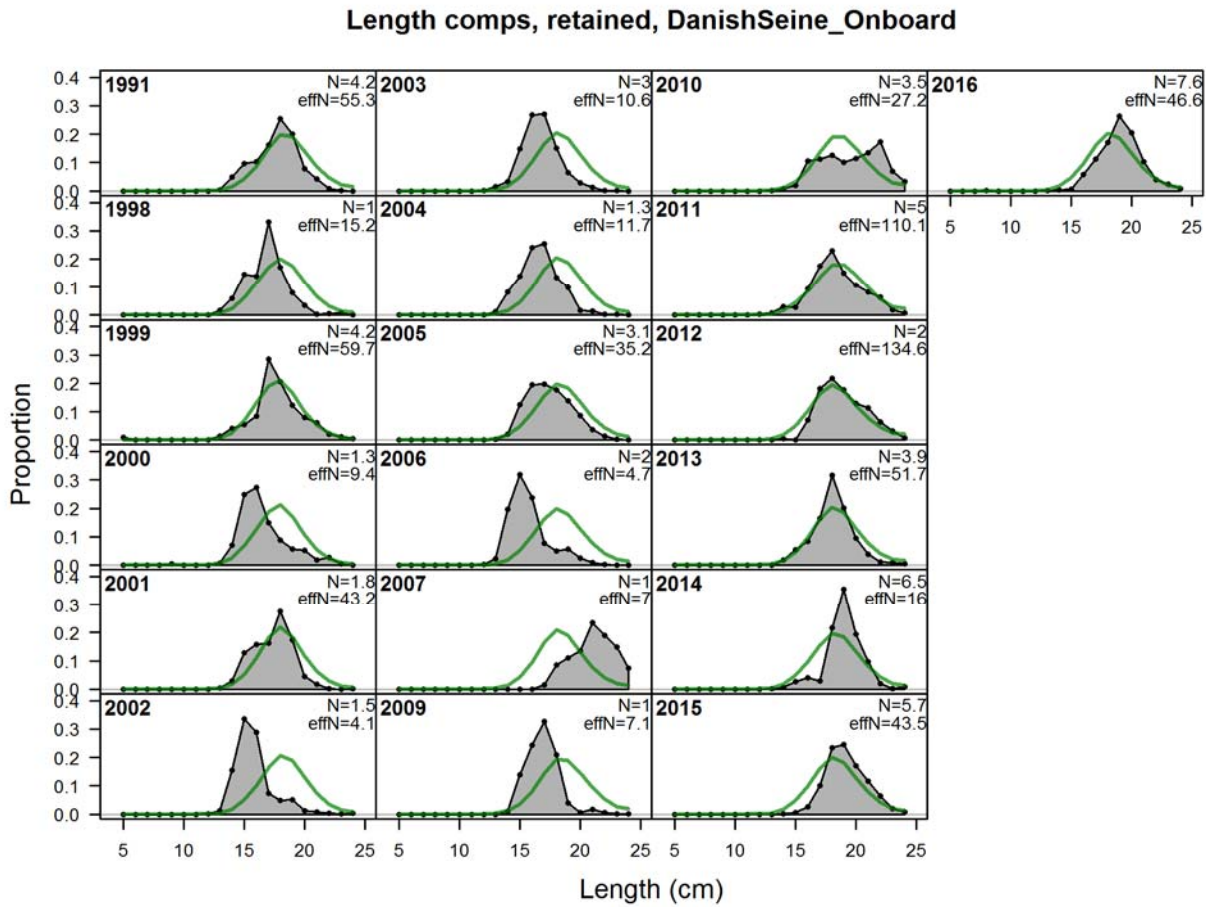


Figure A 14.5. School whiting length composition fits: Danish seine onboard retained.

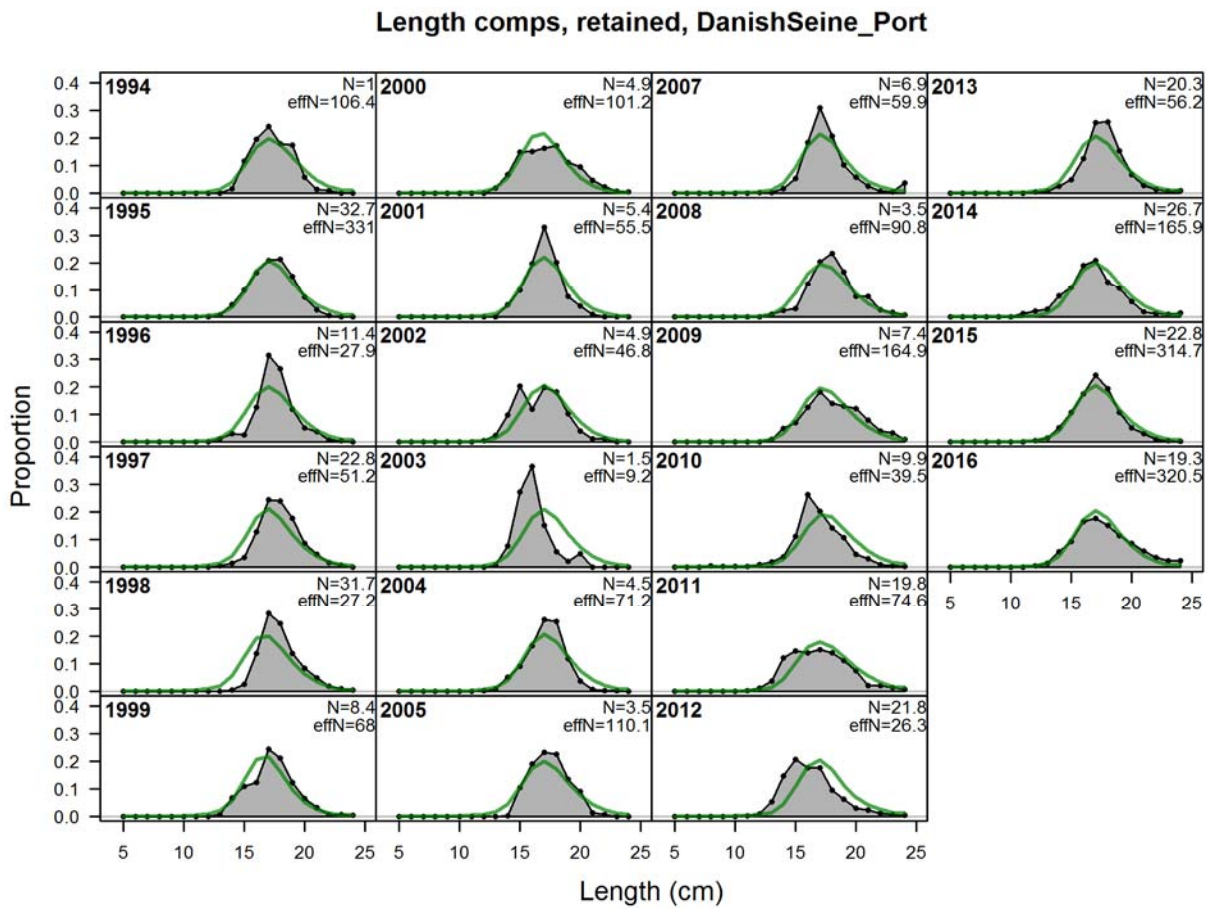


Figure A 14.6. School whiting length composition fits: Danish seine port retained.

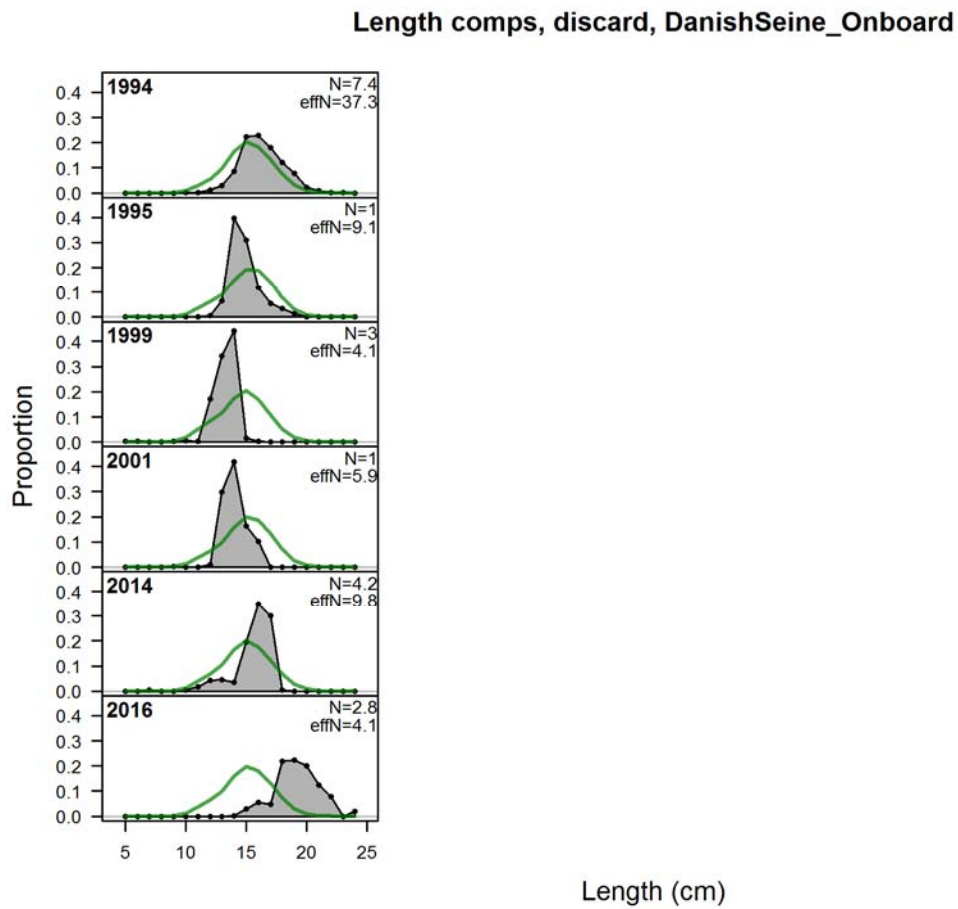


Figure A 14.7. School whiting length composition fits: Danish seine discarded.

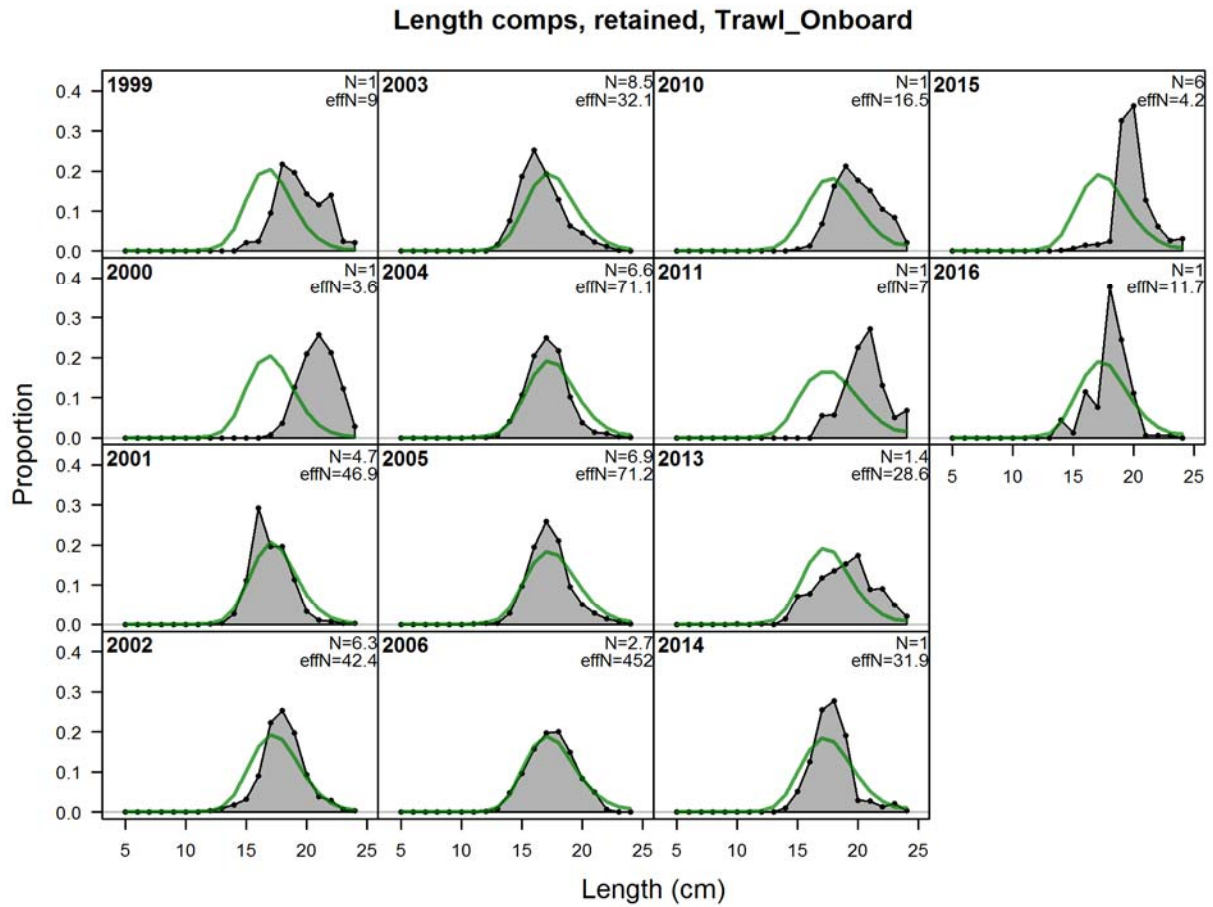


Figure A 14.8. School whiting length composition fits: trawl onboard retained.

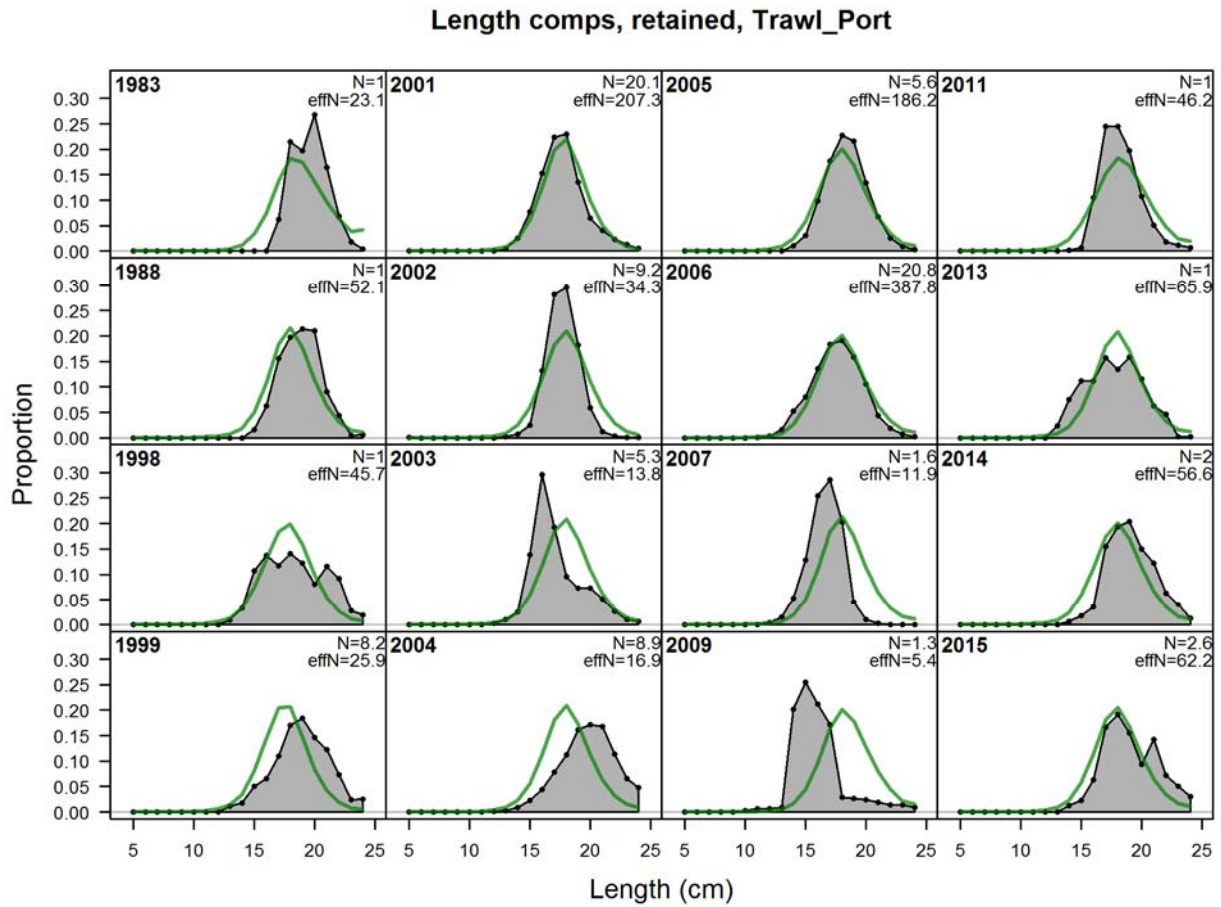


Figure A 14.9. School whiting length composition fits: trawl port retained.

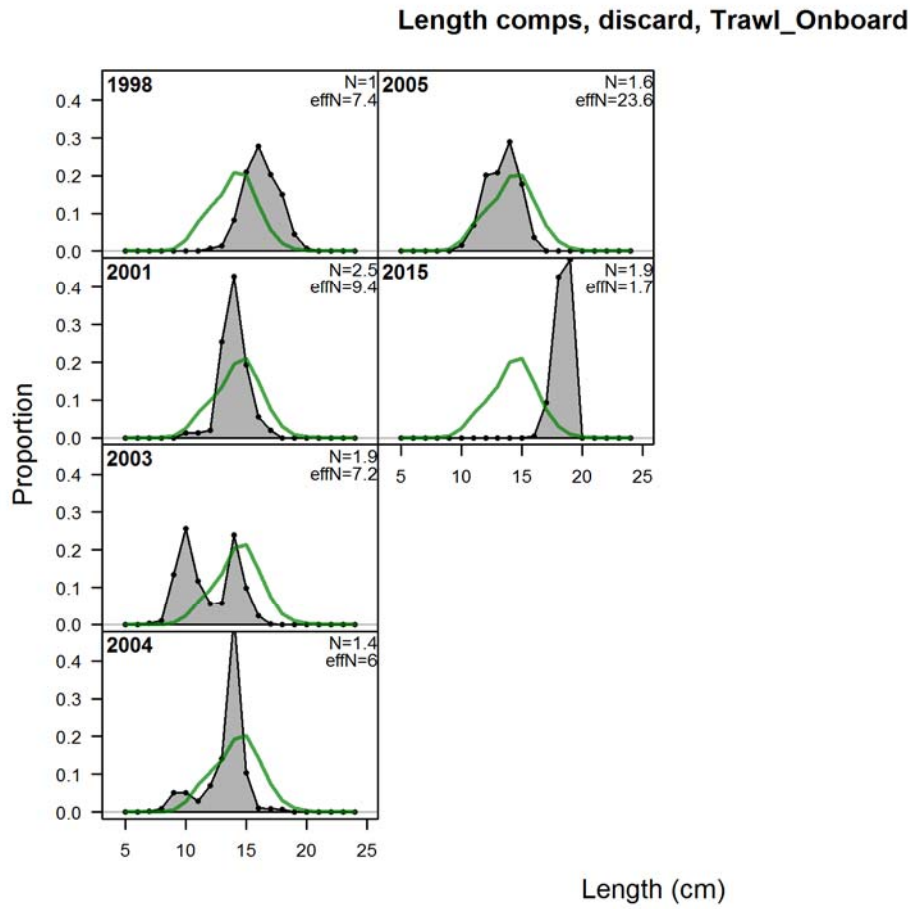


Figure A 14.10. School whiting length composition fits: trawl discarded.

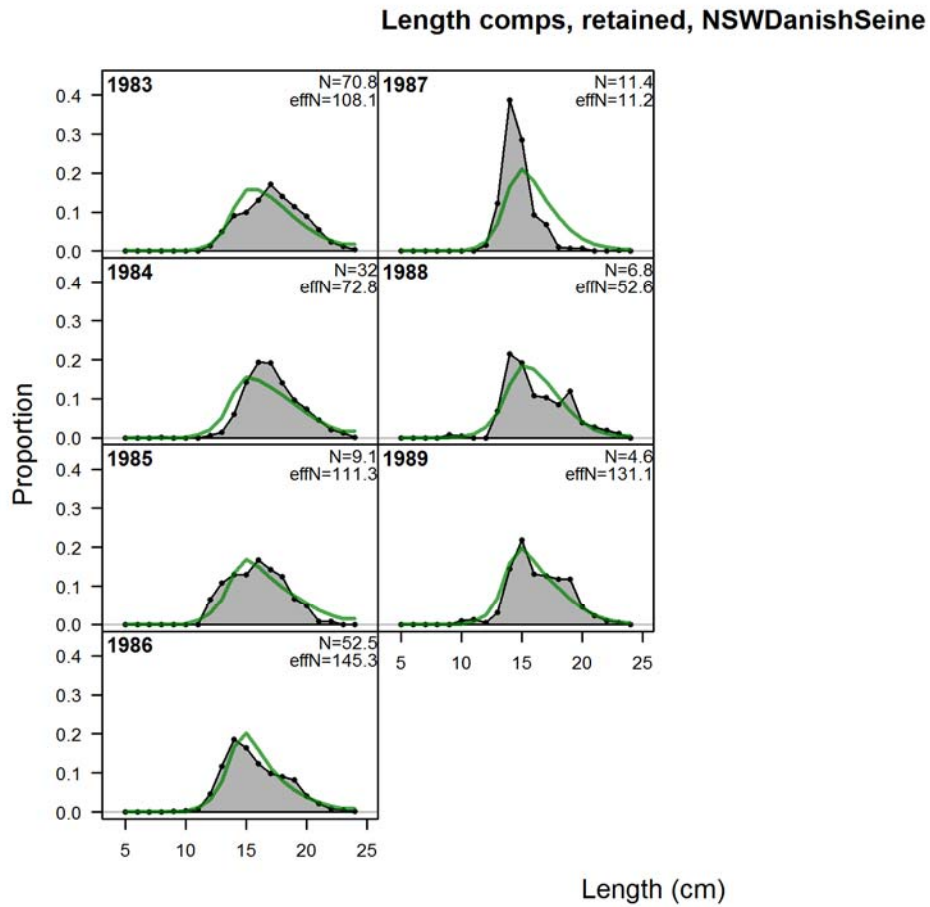


Figure A 14.11. School whiting length composition fits: NSW Danish seine retained.

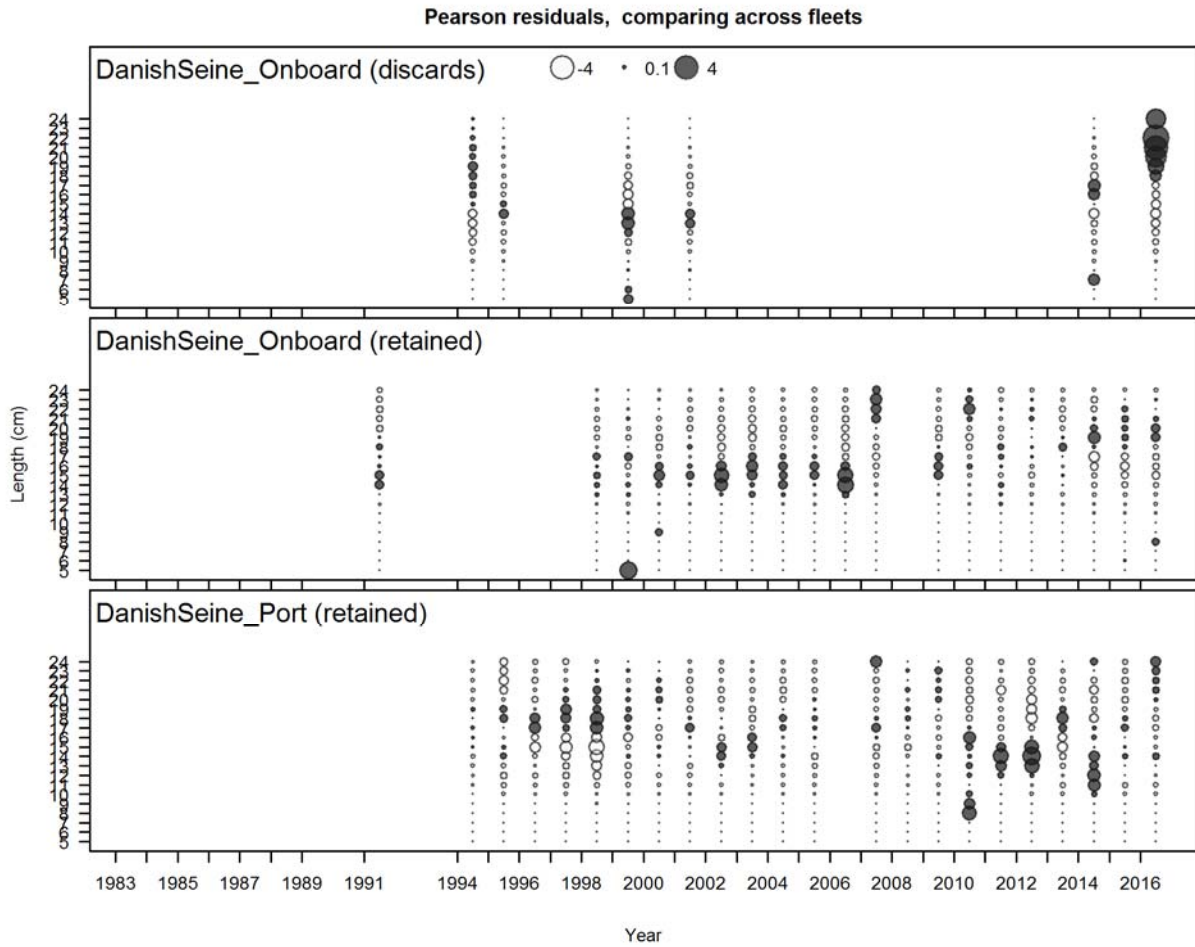


Figure A 14.12. Residuals from the annual length compositions (retained) for school whiting displayed by year for Danish seine fleets.

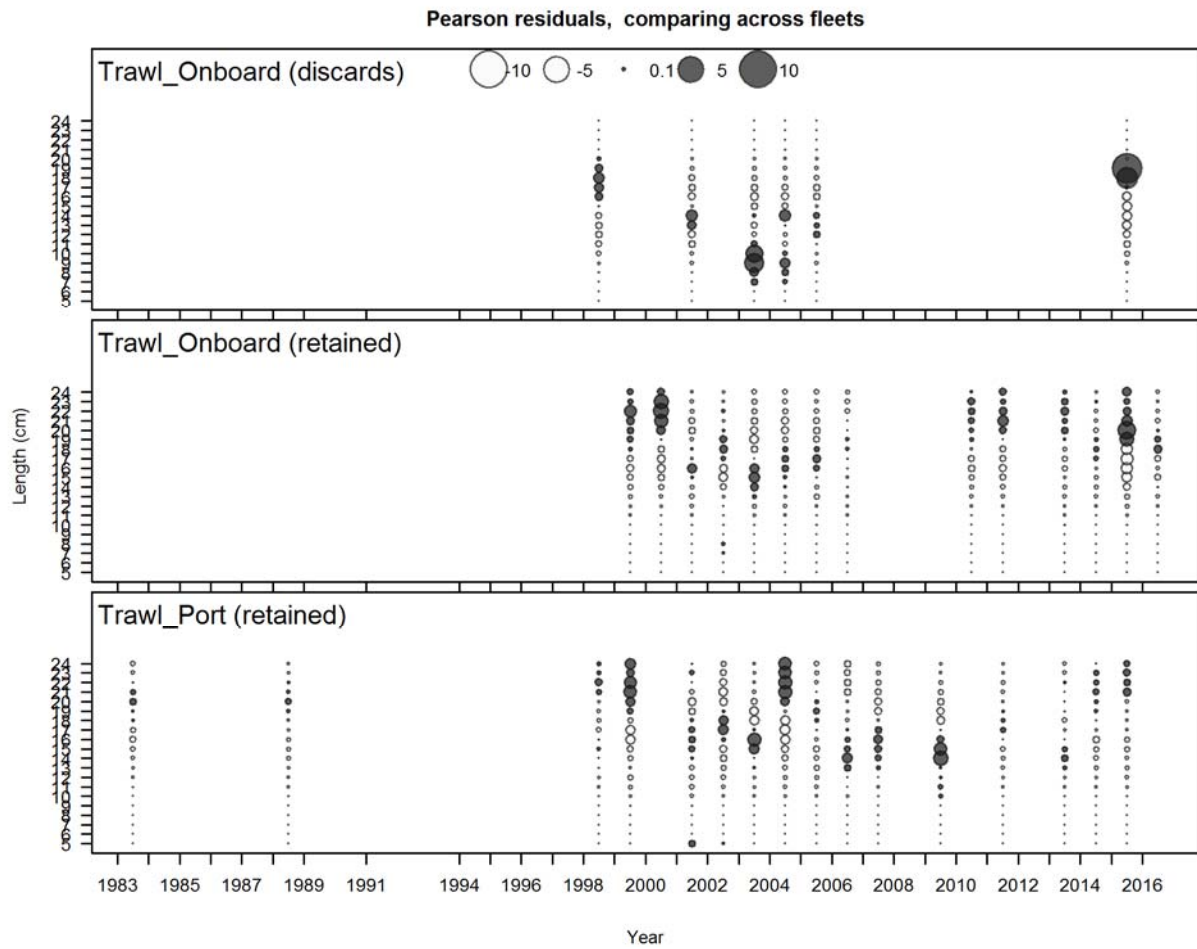


Figure A 14.13. Residuals from the annual length compositions (retained) for school whiting displayed by year for the trawl fleets.

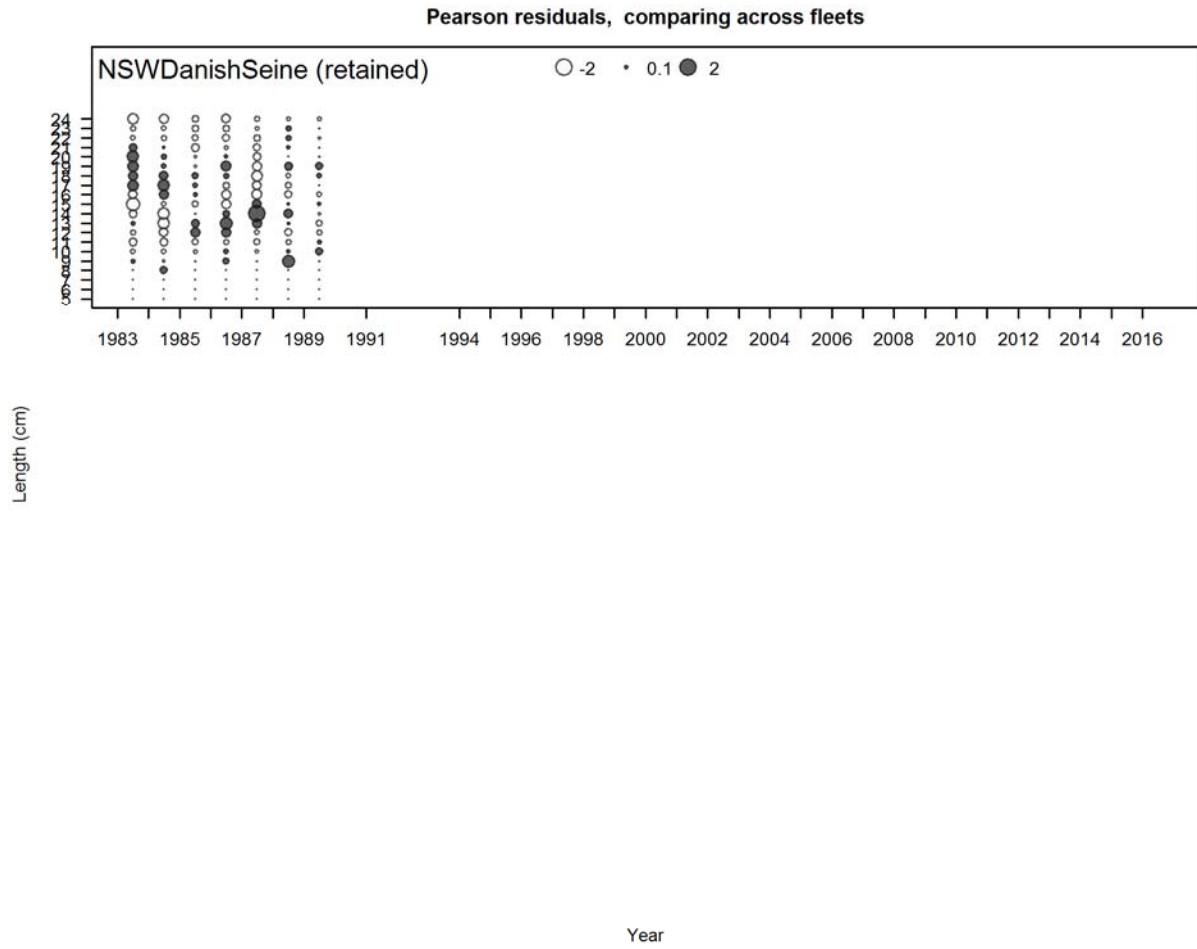


Figure A 14.14. Residuals from the annual length compositions (retained) for school whiting displayed by year for the NSW Danish seine fleet.

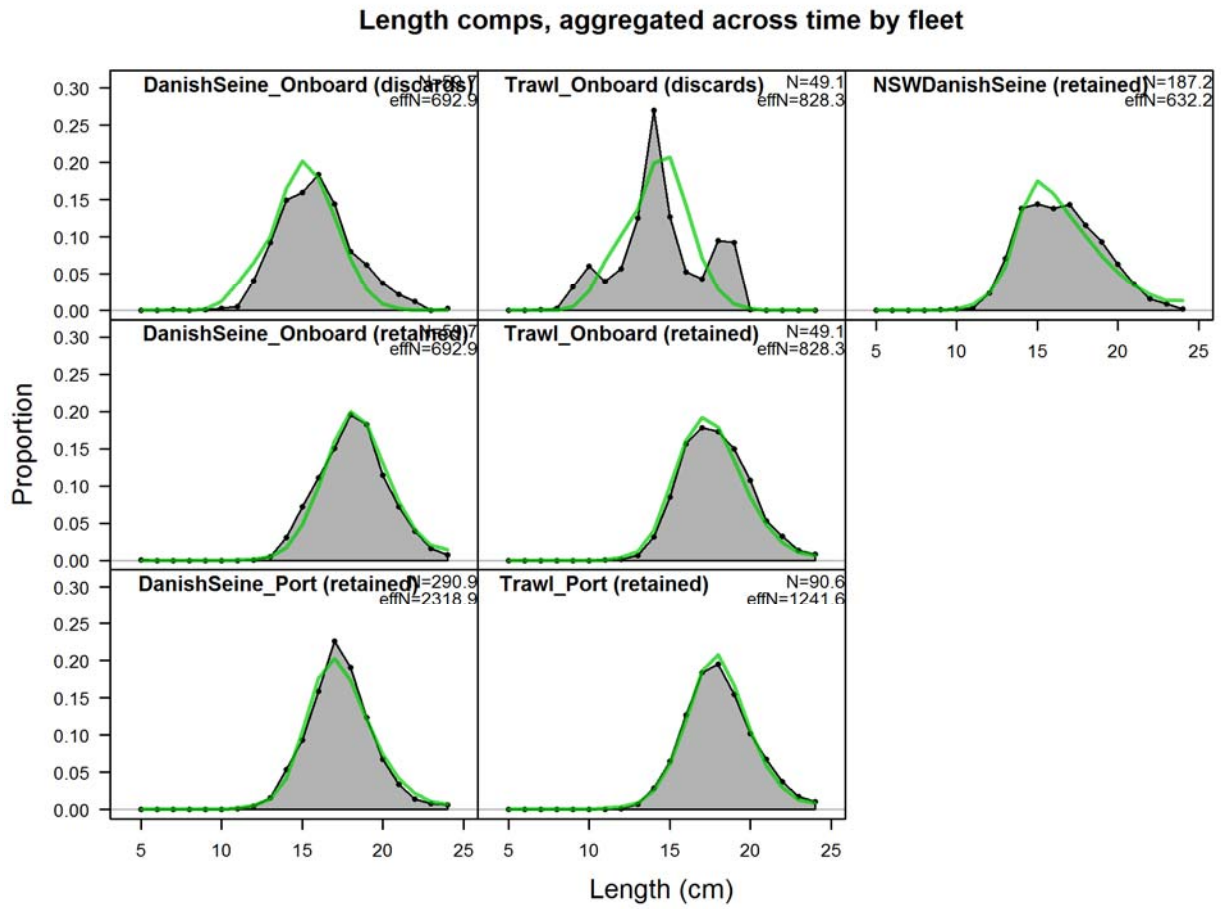


Figure A 14.15. Aggregated fits (over all years) to the length compositions for school whiting displayed by fleet.

Conditional AAL plot, retained, DanishSeine_Onboard

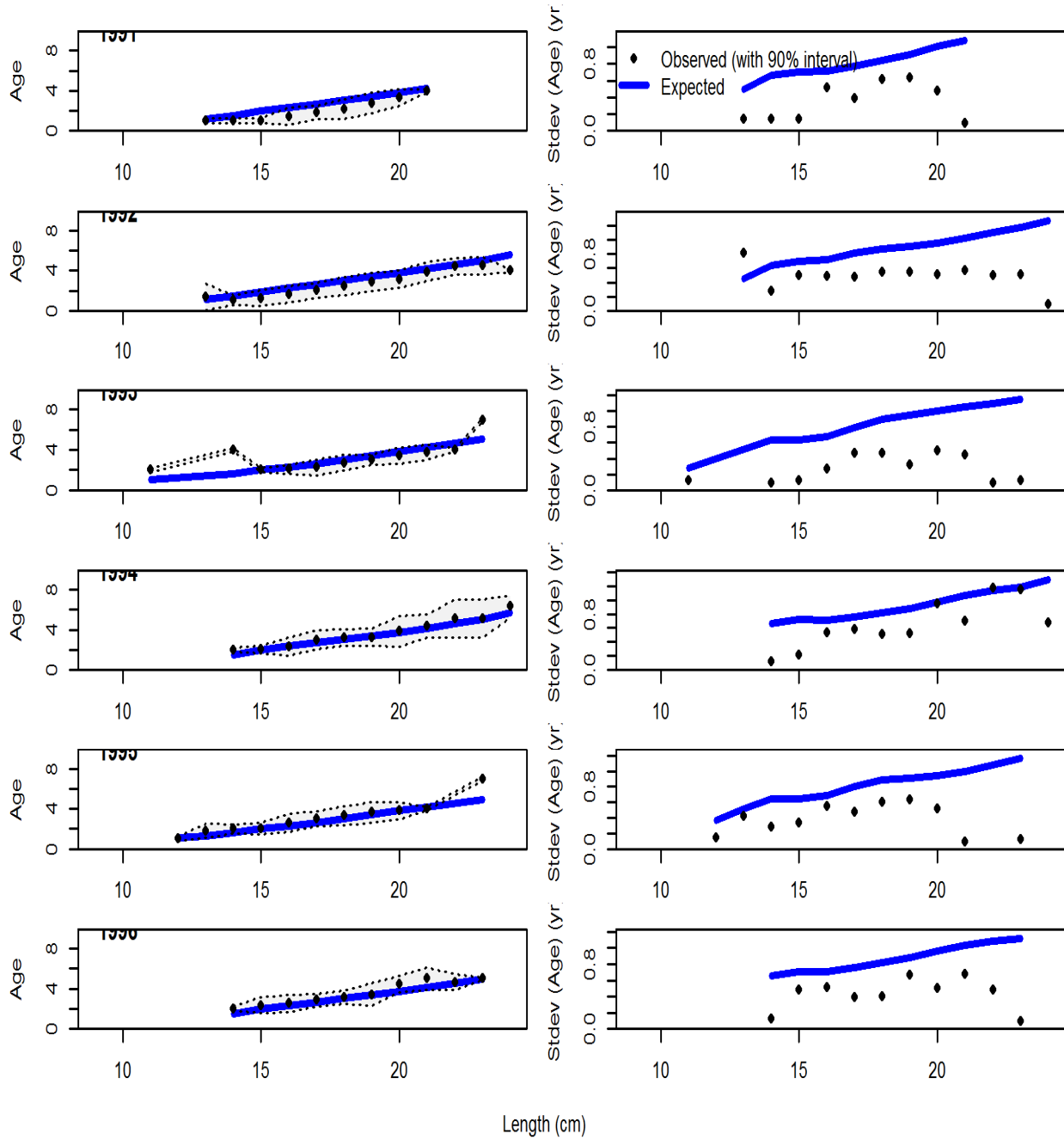


Figure A 14.16. School whiting conditional age-at-length fits: Danish seine part 1.

Conditional AAL plot, retained, DanishSeine_Onboard

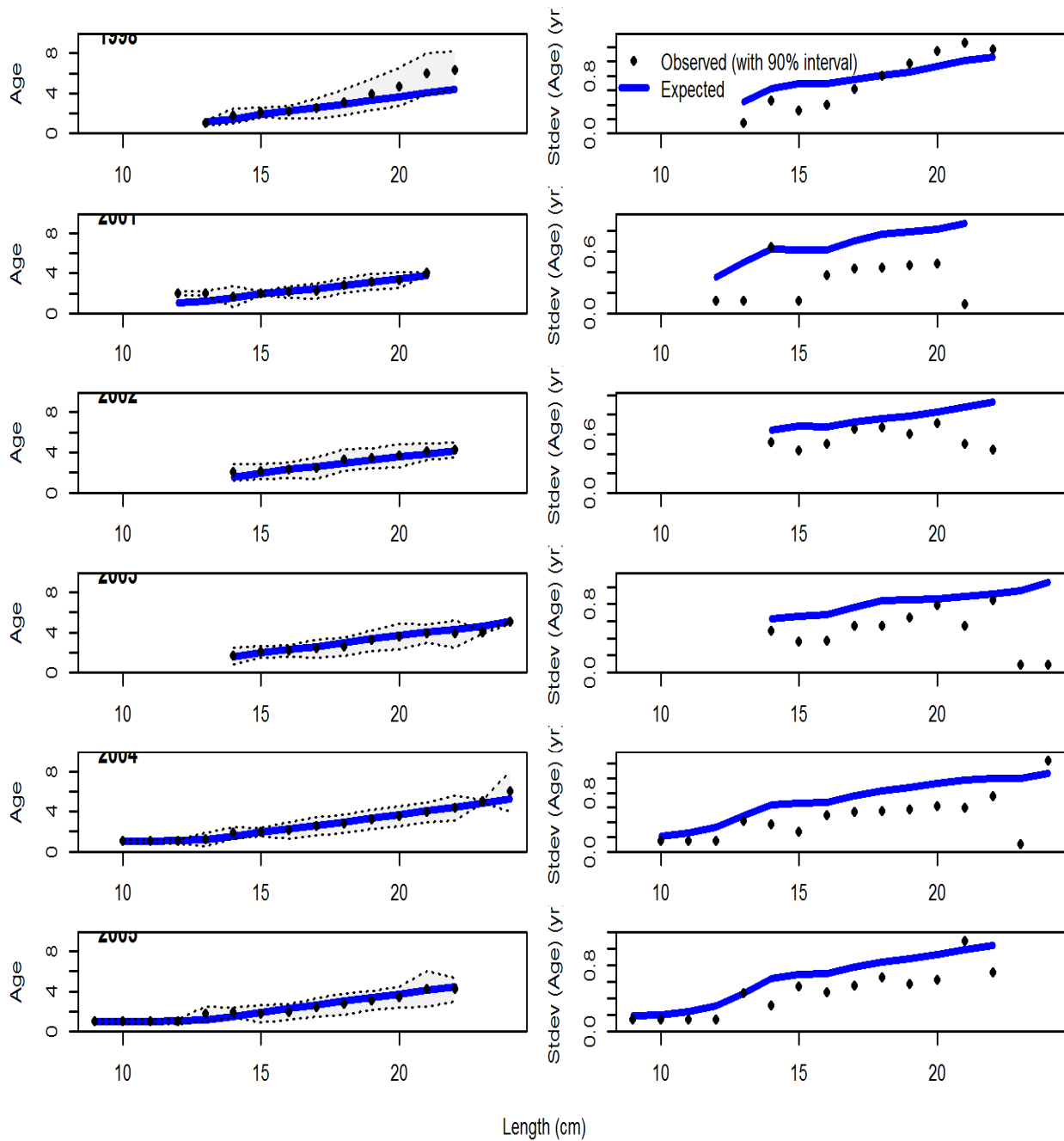


Figure A 14.17. School whiting conditional age-at-length fits: Danish seine part 2.

Conditional AAL plot, retained, DanishSeine_Onboard

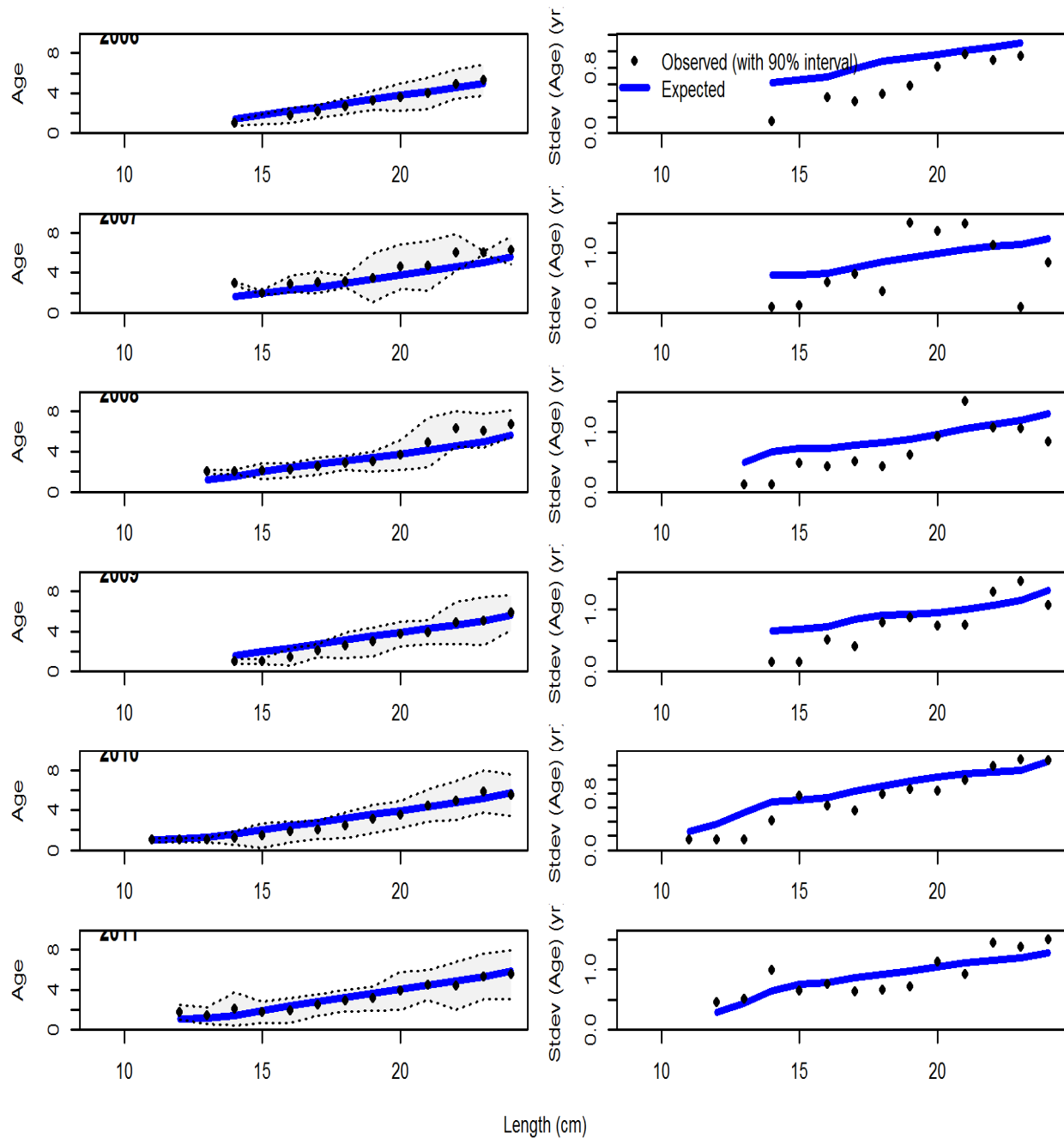


Figure A 14.18. School whiting conditional age-at-length fits: Danish seine part 3.

Conditional AAL plot, retained, DanishSeine_Onboard

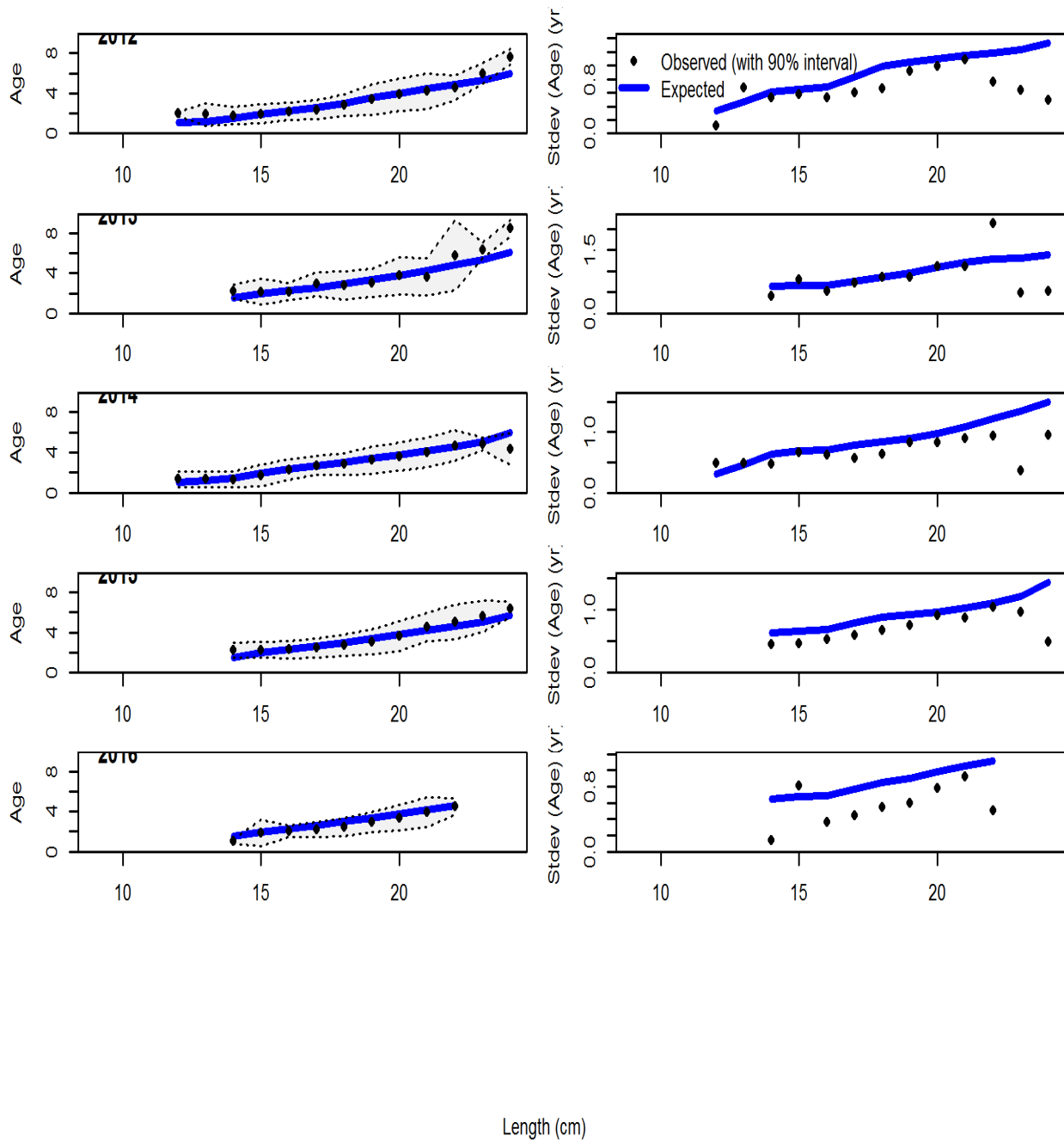


Figure A 14.19. School whiting conditional age-at-length fits: Danish seine part 4.

Conditional AAL plot, retained, Trawl_Onboard

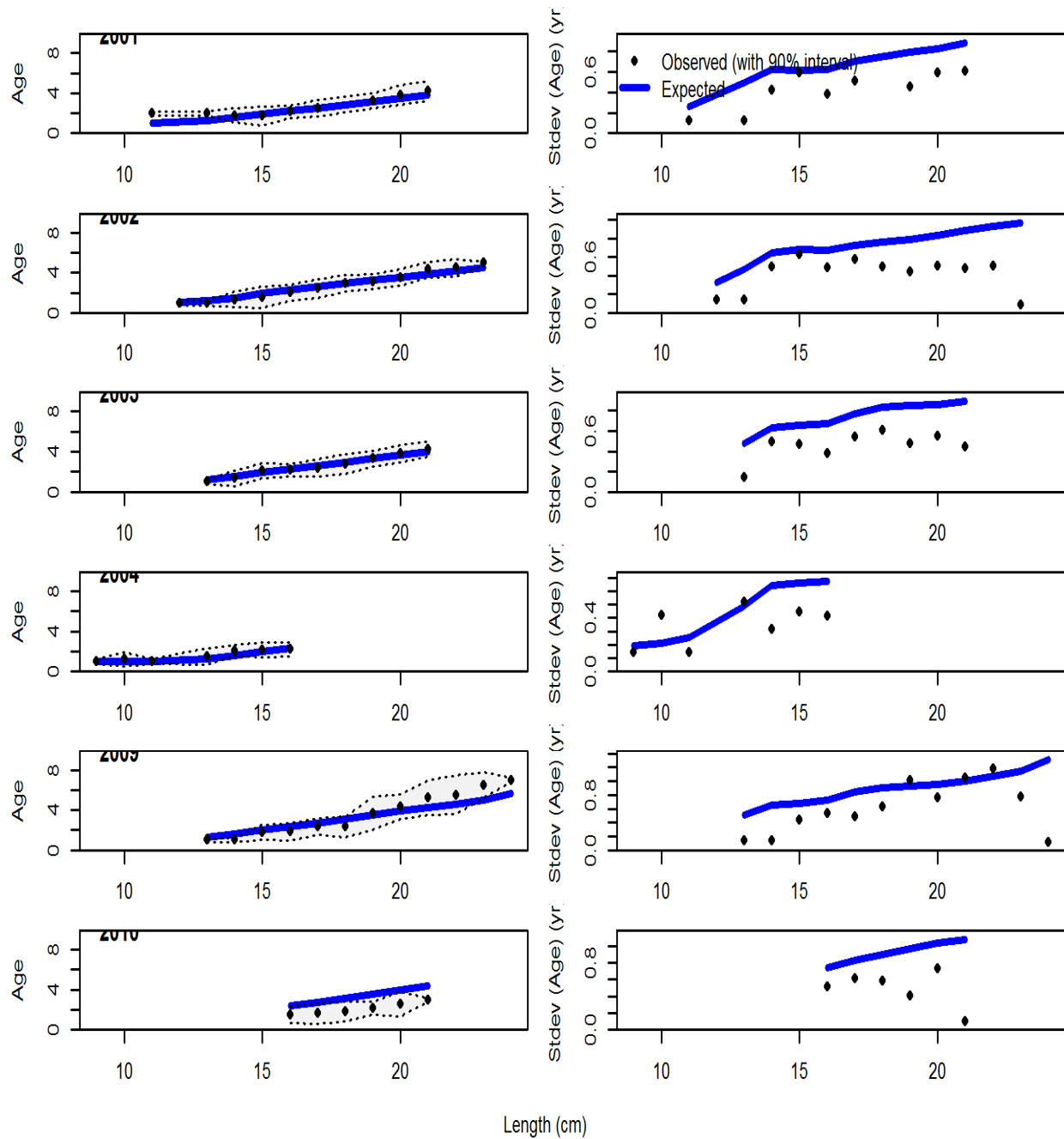


Figure A 14.20. School whiting conditional age-at-length fits: trawl part 1.

Conditional AAL plot, retained, Trawl_Onboard

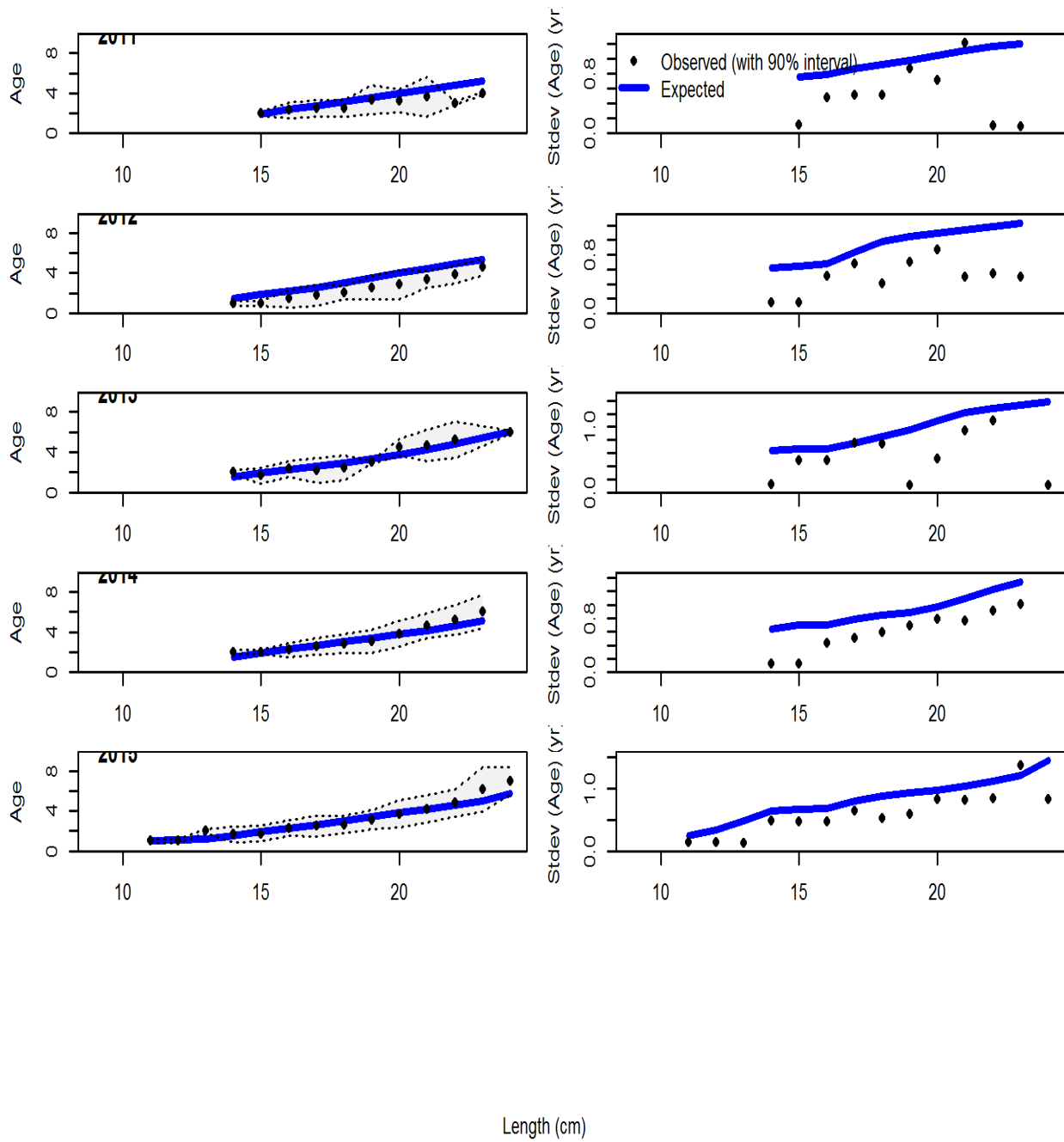


Figure A 14.21. School whiting conditional age-at-length fits: trawl part 2.

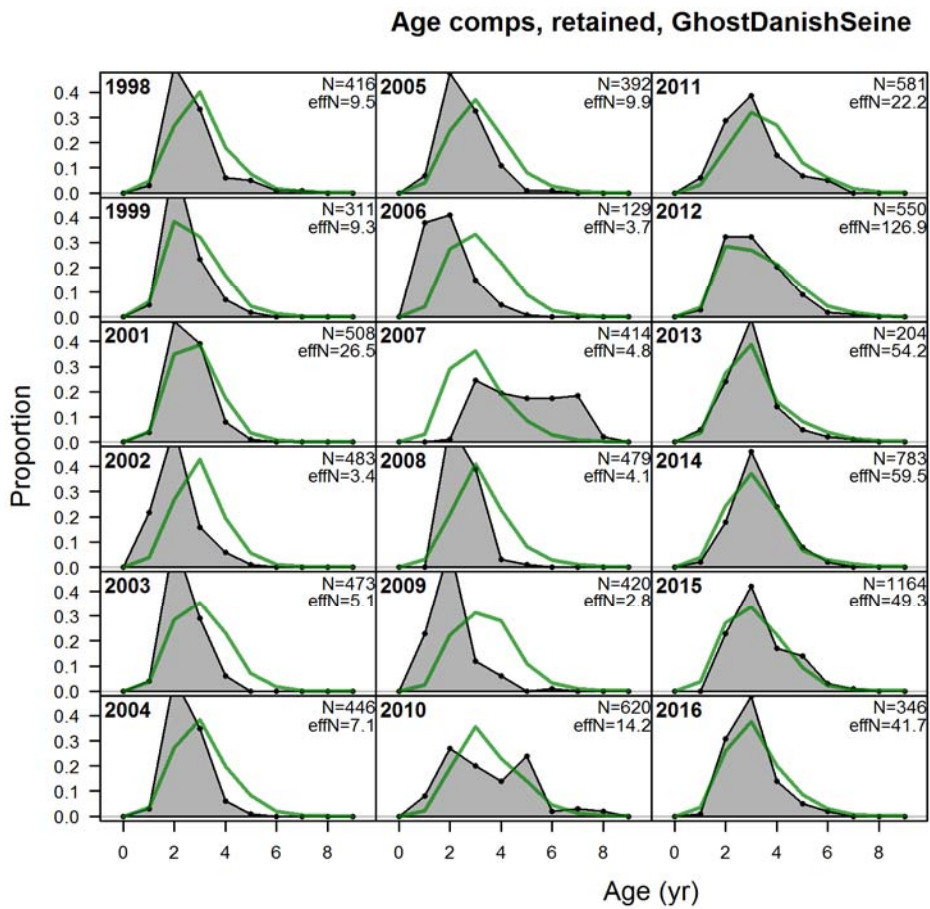


Figure A 14.22. School whiting implied fits to age: Danish seine retained.

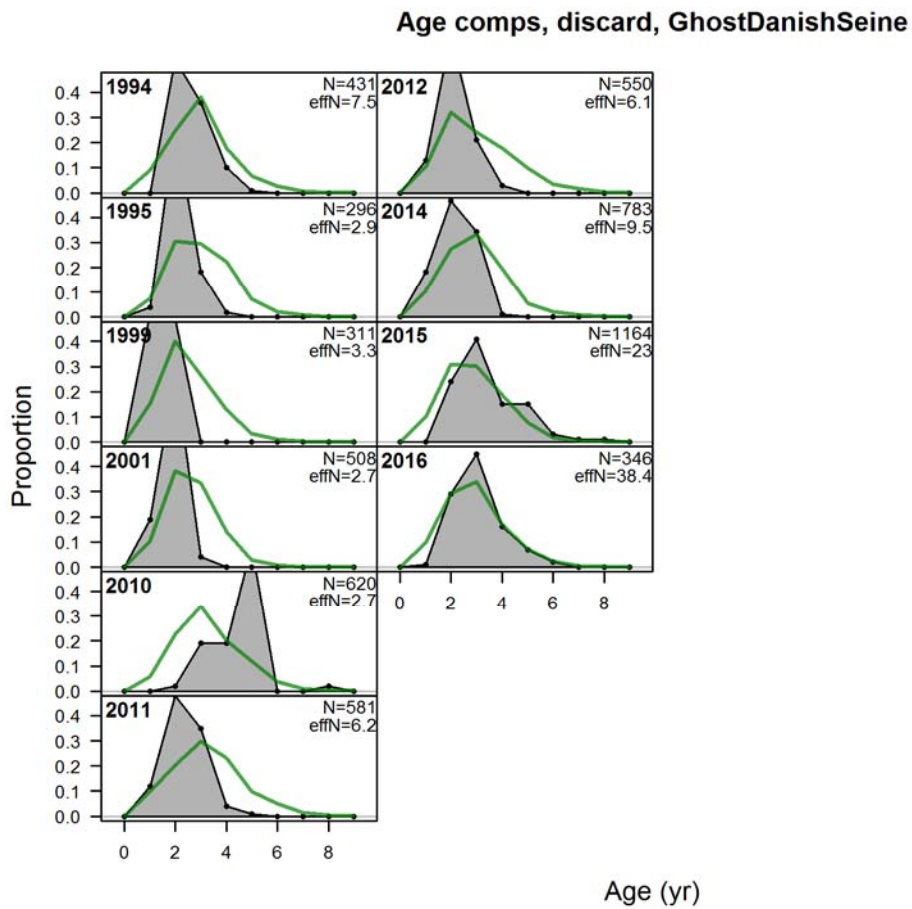


Figure A 14.23. School whiting implied fits to age: Danish seine discarded.

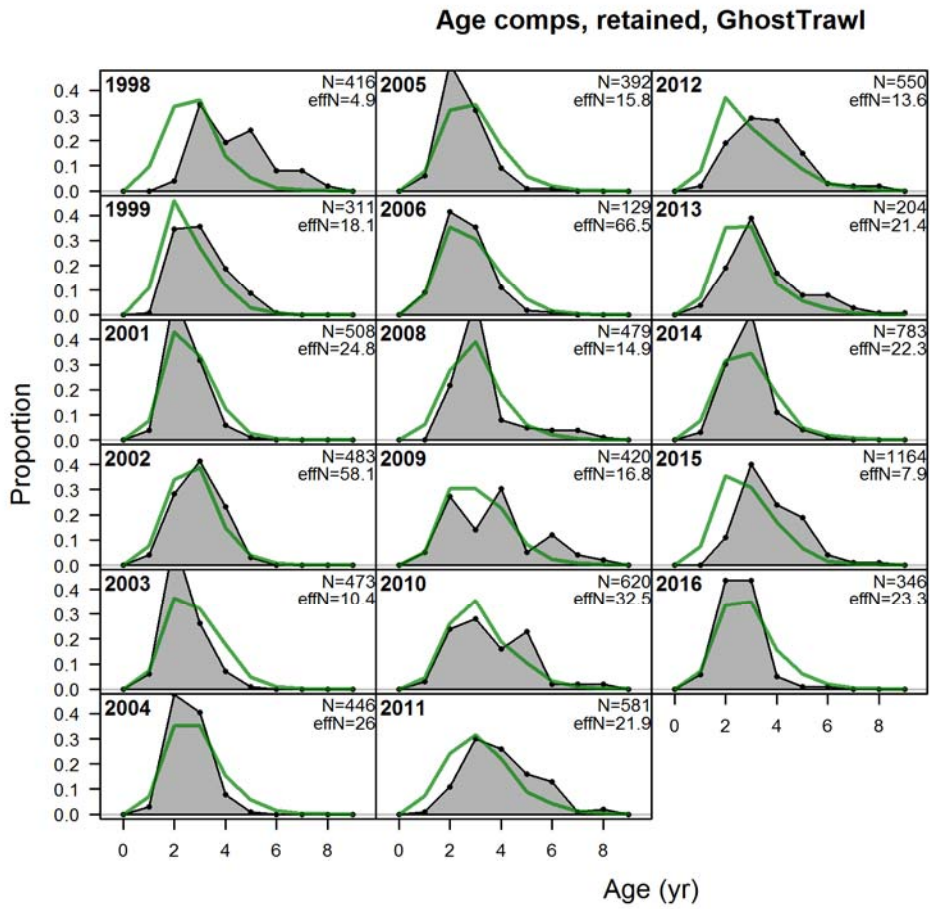


Figure A 14.24. School whiting implied fits to age: trawl retained.

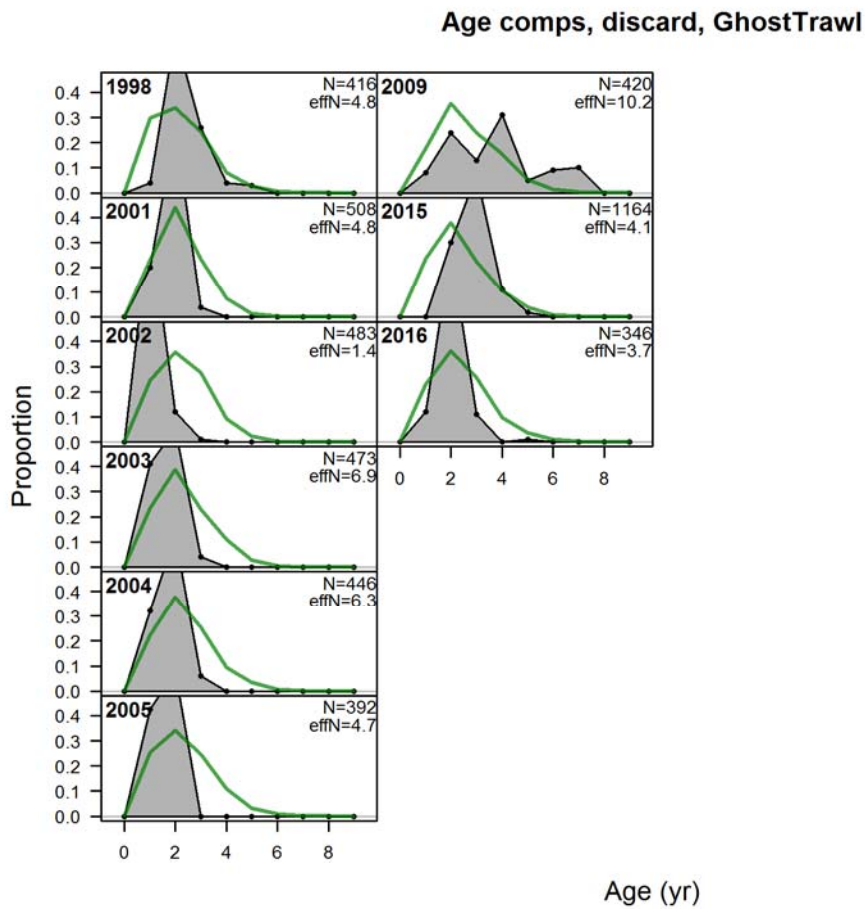


Figure A 14.25. School whiting implied fits to age: trawl discarded.

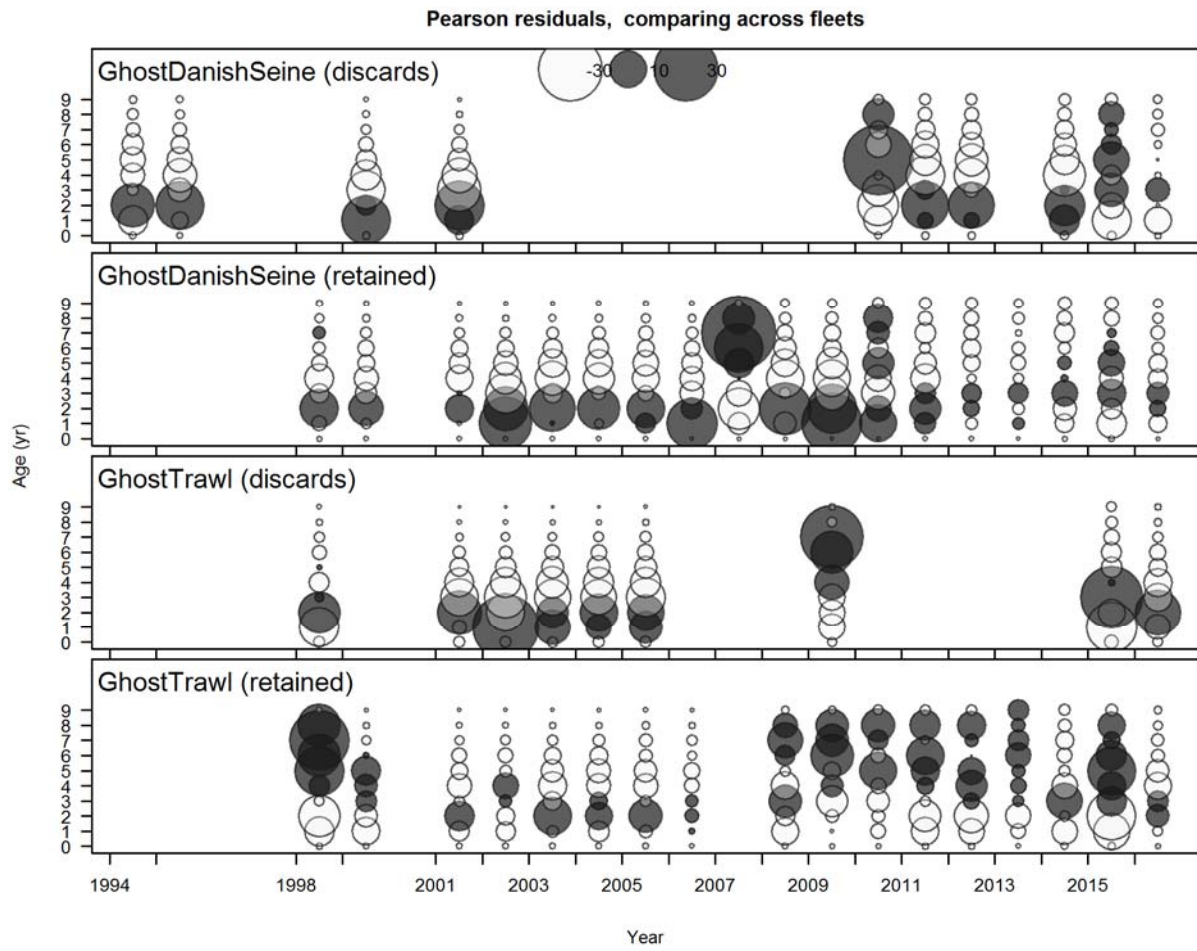


Figure A 14.26. Residuals from the annual implied fits to age compositions for school whiting displayed by year and fleet.

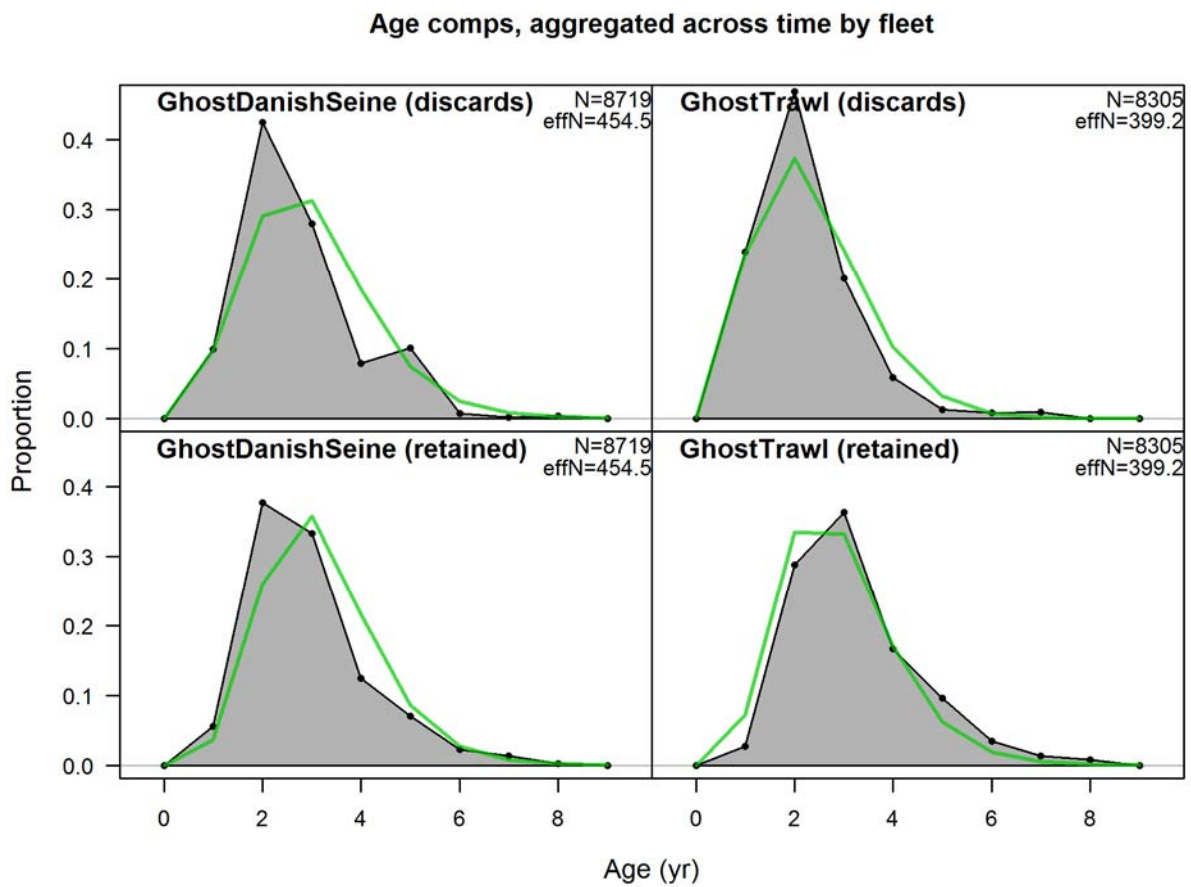


Figure A 14.27. Aggregated fits (over all years) to the implied age compositions for school whiting displayed by fleet.

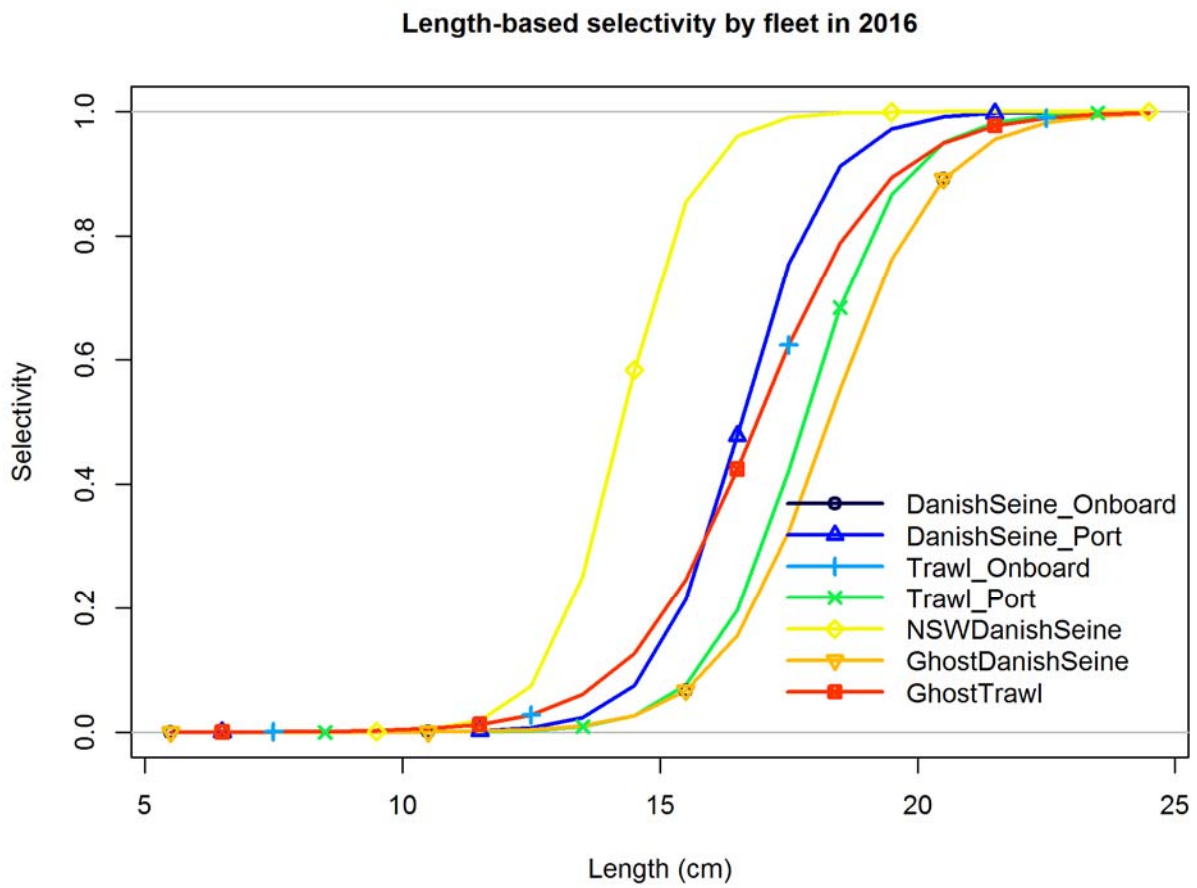


Figure A 14.28. Fits to selectivity for school whiting fleets.

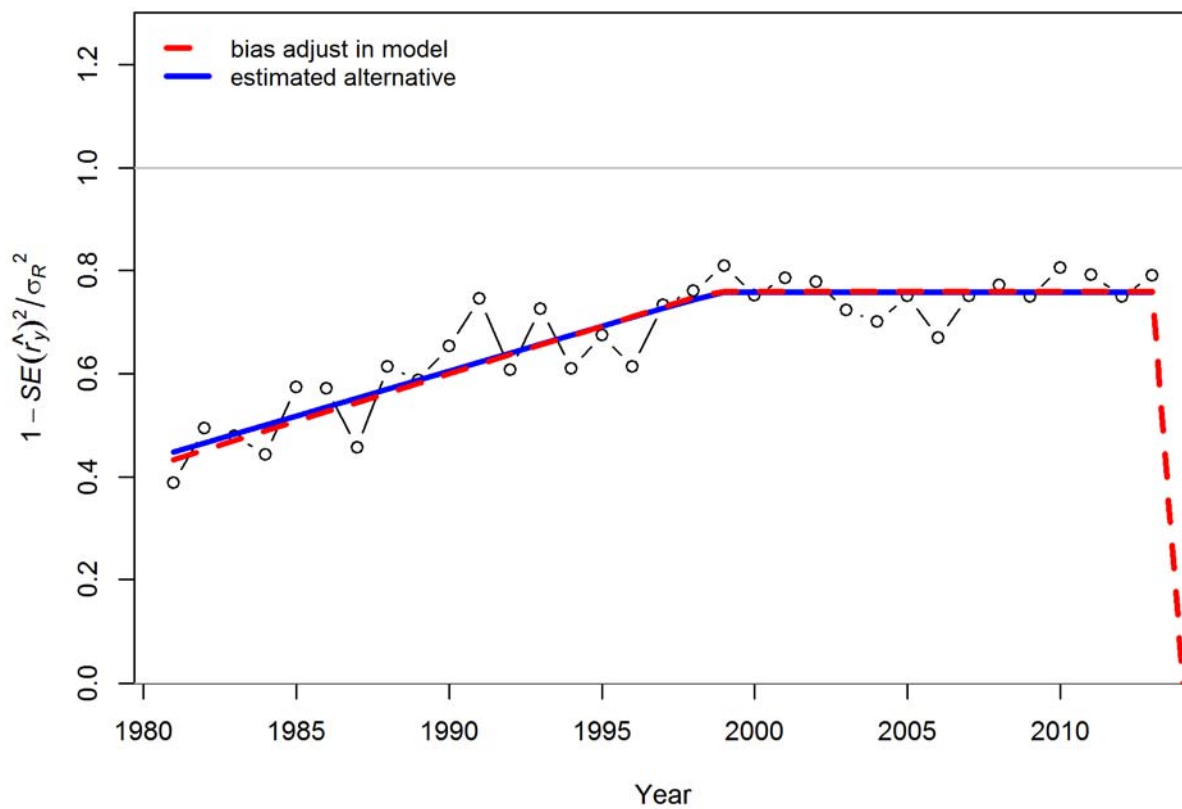


Figure A 14.29. Bias ramp adjustment for school whiting.

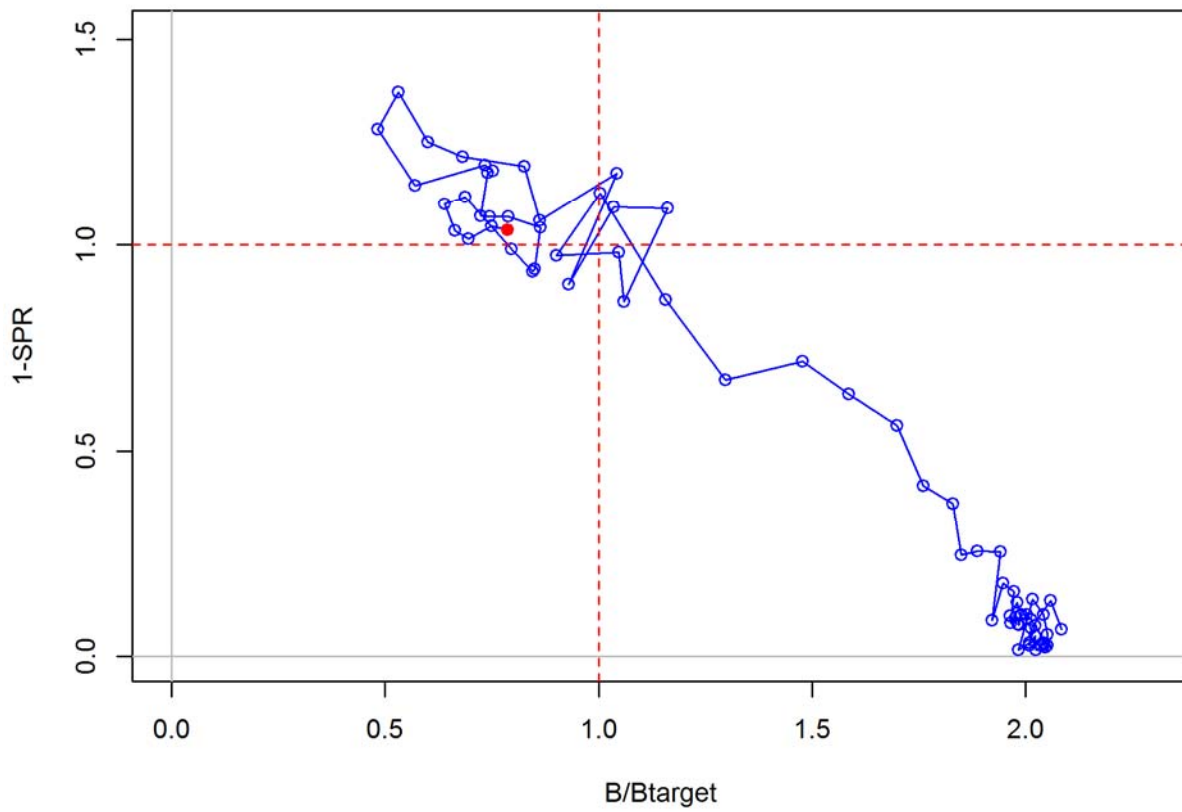


Figure A 14.30. Phase plot of biomass vs SPR ratio.