SEDAR 92 Atlantic Blueline Tilefish: North of Cape Hatteras Data Limited Methods (DLM)

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Introduction

SEDAR 50 benchmark assessment

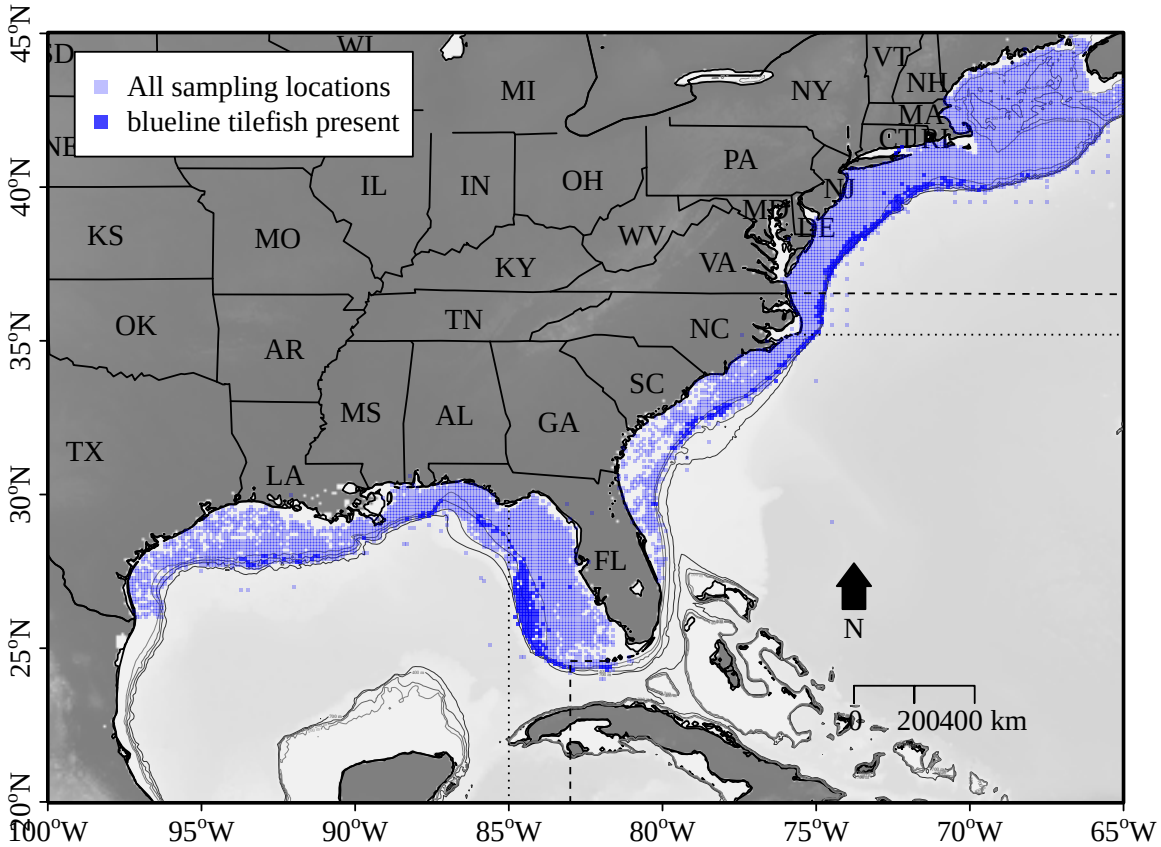
- The SEDAR 50 assessment of Atlantic Blueline Tilefish initially focused on data from the Atlantic GMFMC/SAFMC boundary in the Florida Keys northward
- Problems with early models led the Assessment Panel to reconsider the spatial ranges of the landings data and indices of abundance
- Because the data used to develop the indices of abundance did not adequately characterize fisheries north of Cape Hatteras, the Assessment Panel decided to also restrict landings data used in the Atlantic assessment to the area south of Cape Hatteras
- This decision resulted in more appropriate model of population dynamic south of Cape Hatteras, but required the area north of Cape Hatteras to be assessed in separate analyses

Introduction

SEDAR 50 benchmark assessment

Separate analyses were developed for:

1. Atlantic south of Cape Hatteras
2. Atlantic north of Cape Hatteras



Introduction

SEDAR 50 benchmark assessment

What data were available in SEDAR 50 DLMtool analysis for north of Cape Hatteras?

1. Age data: NO
2. Length data: YES, commercial longline were recommended
3. Indices of abundance: NO
4. Removals (landings and dead discards): YES
5. Life history parameters: YES, some based on meta-analysis from SEDAR 50. Growth and maturity based on blueline tilefish.

Introduction

SEDAR 50 benchmark assessment

- Data inputs were provided to the DLMtool input object
- DLMtool then determines what approaches (a.k.a. management procedures, MPs) can be applied, runs them and reports distributions of TACs (total allowable catch)
- A subset of these MPs were selected by the SEDAR 50 Assessment and Review Panels, documented in the SEDAR 50 report
- The analysis conducted by the SEFSC for SEDAR 50 was provided to the MAFMC-SAFMC SSC Joint Blueline Tilefish Subcommittee
- A further subset of these MPs was selected by the MAFMC-SAFMC SSC Joint Blueline Tilefish Subcommittee

Introduction

SEDAR 92 operational assessment

- Used the most up to date version of DLMtool
- Considered the DLMtool MPs selected by the MAFMC-SAFMC SSC Joint Blueline Tilefish Subcommittee to be the "approved..models" for the area north of Cape Hatteras
- Identified data sets used by those approaches and personnel who could provide them
- Convened a Landings Stream Topical Working Group (Apr-Sep 2024) to "Review and recommend catch and landing streams for North of Cape Hatteras." as per ToR 5
- An additional Life History Topical Working Group (Oct-Dec 2024) was later convened per request of SAFMC to review SCNDR blueline tilefish age data with the limited goal of updating growth model parameters

Introduction

SEDAR 92 operational assessment

- Final data inputs were available to the analyst in January 2025
- After early runs of selected DLMtool MPs using updated inputs failed, all additional MPs reported in the SEDAR 50 report were added to the analysis
- SEDAR 92 Report submitted in March 2025
- Joint Mid- and South Atlantic SSC meeting April 2025

Methods

Data

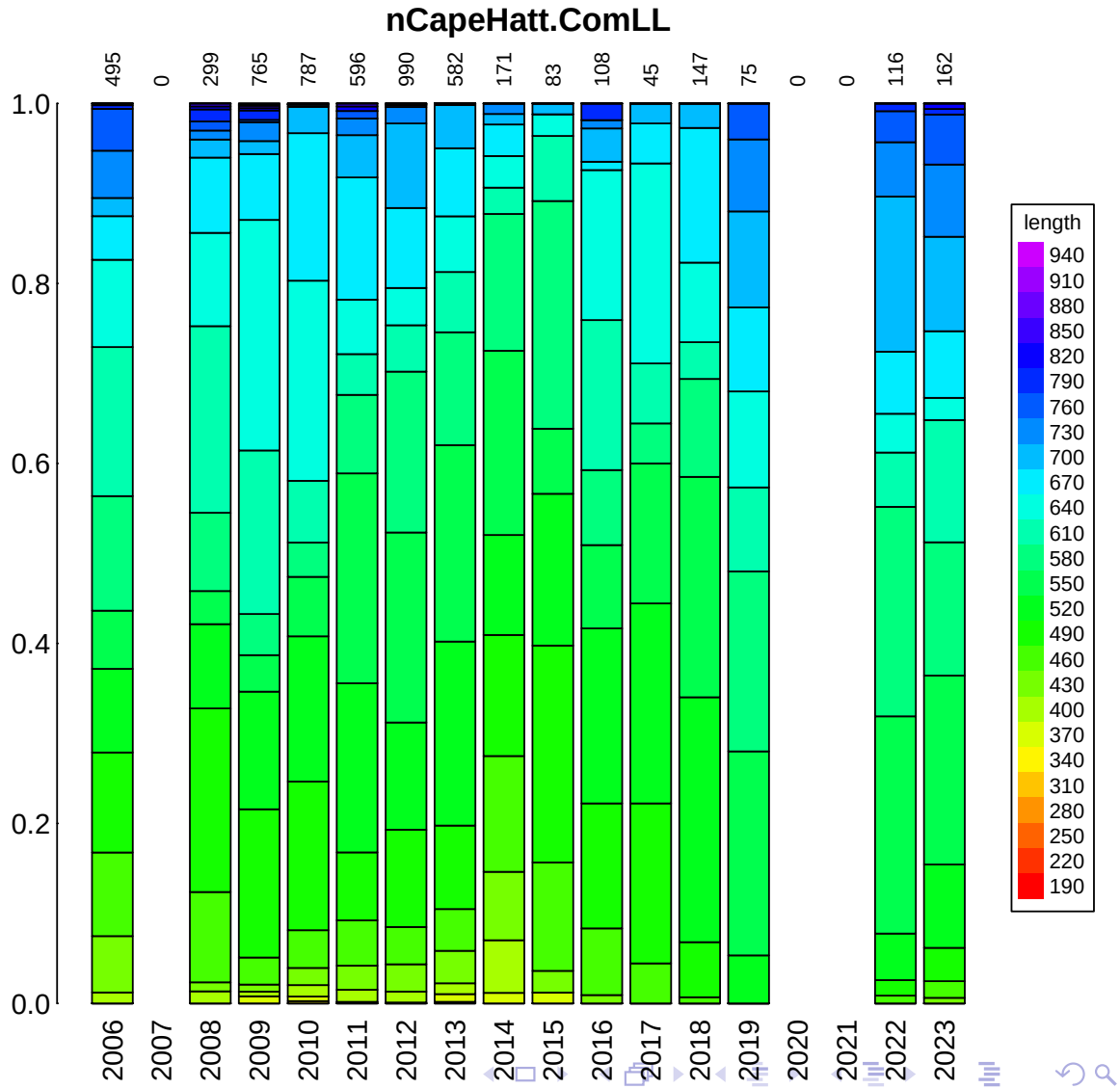
- Input data for DLMtool functions are listed below and plotted thereafter where appropriate
- Data supplied to DLMtool are presented here by type:
  - Matrices
  - Vectors
  - Points

Methods

Data

Matrices

- Catch-at-length (`CAL`): a single matrix of numbers-at-length by year
- Data used for `CAL` were longline length compositions (2006-2023)
- Numbers of trips < 10 per year since 2013
- See Pawluk (2024) SEDAR92-WP-05



Methods

Data

Vectors

1. catch (`Cat`): time series of removals in pounds. Also used to calculate a CV of catches (`CV_Cat` = 0.67)
2. years (`Year`): years associated with catch data 2002 to 2023

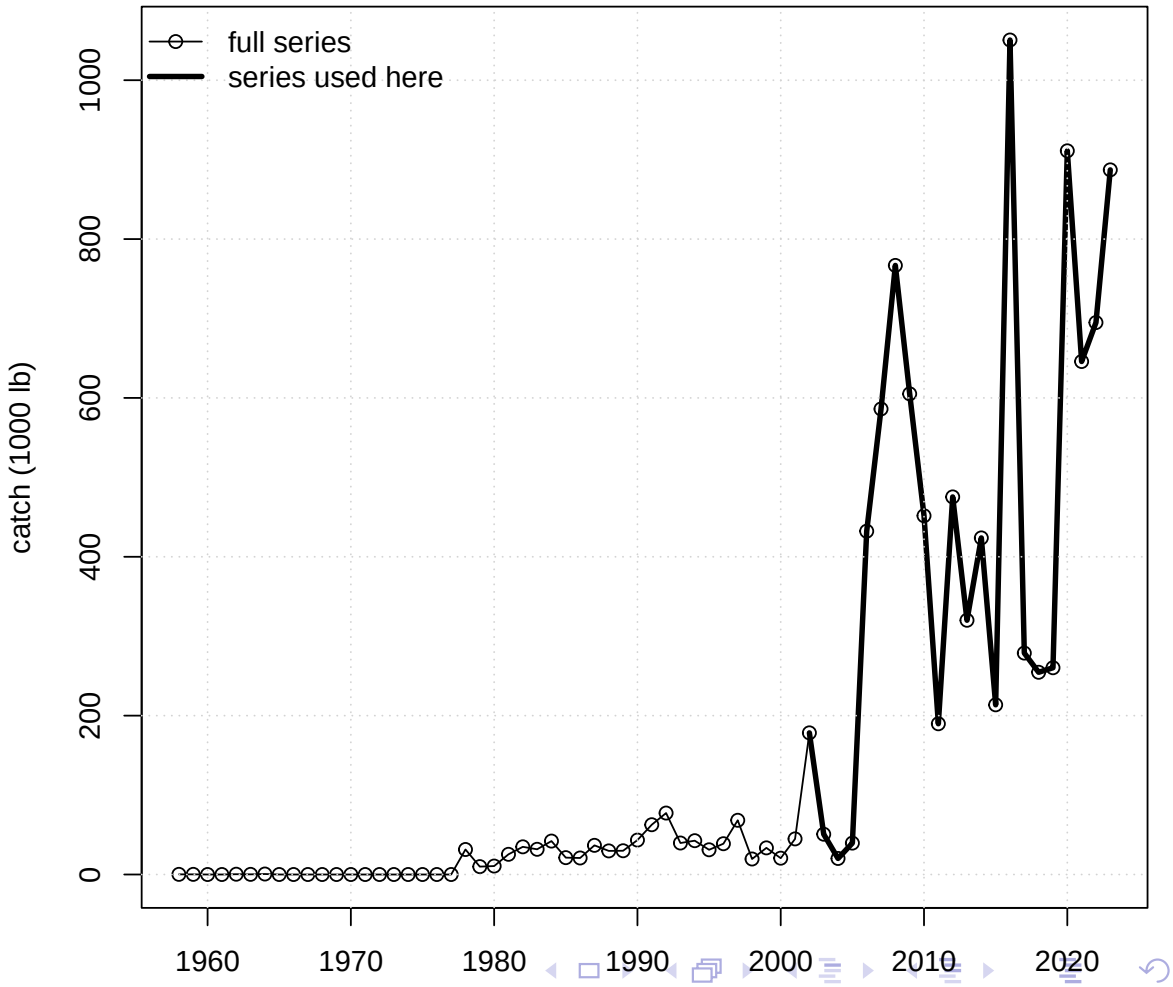
Methods

Data

Vectors

Catch data used in north of Cape Hatteras DLM analysis

- Full series (thin solid line) includes all removals for all years available
- A truncated series of years (thick solid line) since landings were first substantial (2002-2023) was used for `Cat`



Methods

Data

Points

1. natural mortality (M; `Mort`)
   - Estimate of M based on $t_{\max} = 40$ and the Then et al (2014) equation:
     $\texttt{Mort} = 4.899 * 40^{-0.916} = 0.17$
   - An upper estimate of $M = 0.25$ was computed from a minimum $t_{\max} = 26$ using the Then et al (2014) equation. A normal distribution was assumed around M, for which 0.25 represented the 97.5th percentile. The CV of this distribution was then determined (`CV_Mort` $= 0.24$)

Methods

Data

Points

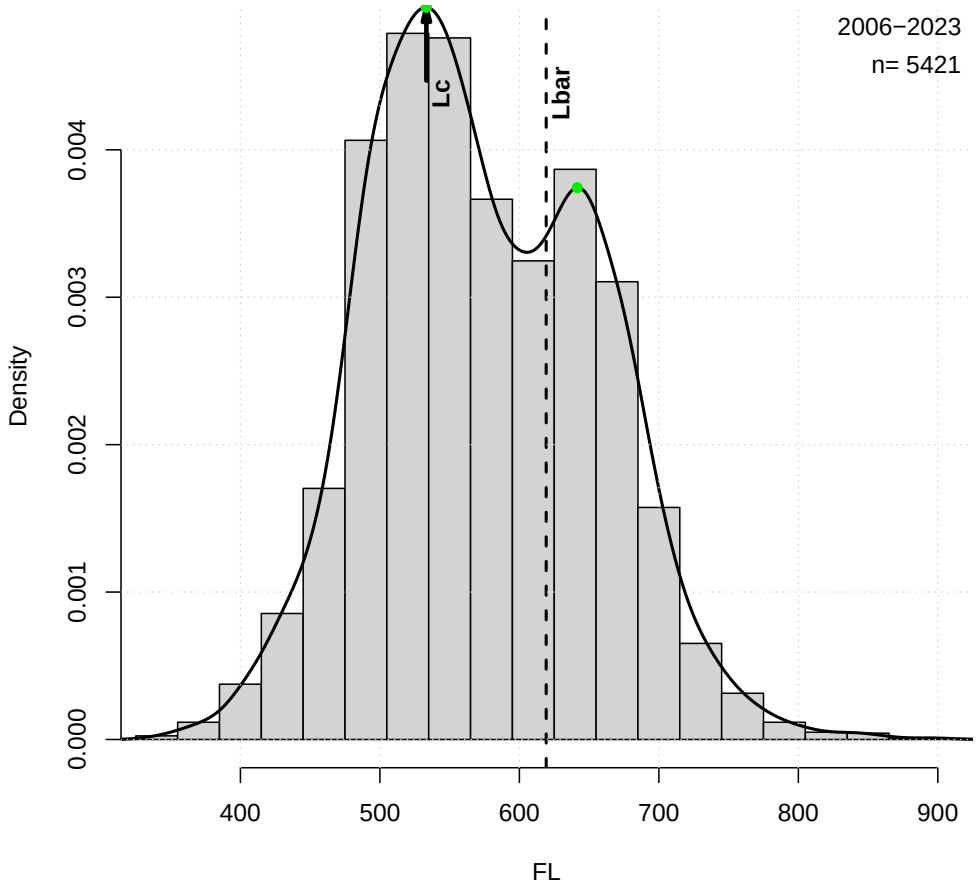
2. L_{50} (`L50`): length at 50% maturity = 305 mm. Very few immature fish observed in data. (`CV_L50` = 0.45)

Methods

Data

Points

3. Modal length of catches: Size of fish in first length mode in catch length composition (`Lc` = 533 mm.).
4. Length at full selection (`LFS`): Set equal to `Lc`. The CV was also calculated directly from the first size mode in the catch length composition (`CV_LFS` = 0.1)
5. Mean length of catch larger than `Lc` (`Lbar` = 619 mm.).



Methods

Data

Points

Growth parameters from growth model fit to SCDNR blueline tilefish age data recommended by SEDAR 92 Life History Topical Working Group (LH TWG)

6. von Bertalanffy K:
   `vbK` $= 0.16$
   `CV_vbK` $= 0.141$
7. von Bertalanffy L_∞:
   `vbLinf` $= 679.01$
   `CV_vbLinf` $= 0.014$
8. von Bertalanffy t_0:
   `vbt0` $= -6.16$
   `CV_vbt0` $= -0.19$

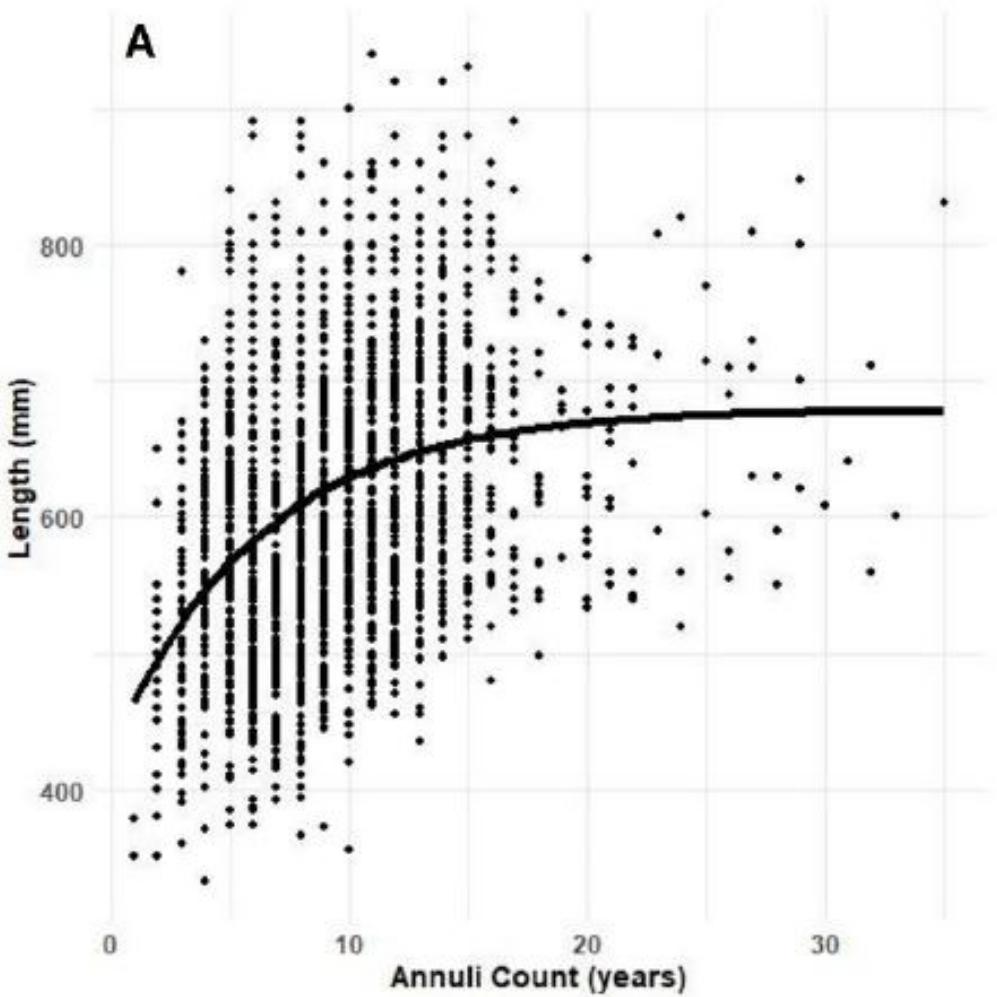


Figure 1 from Bubley (2024) SEDAR92-WP-06

Methods

Data

Points

10. weight length equation parameter a: SEDAR 50 blueline tilefish $W = aL^b$ fit (`wla` = 0.0000178, `CV_wla` = 0.08; units: mm and g)
11. weight length equation parameter b: SEDAR 50 blueline tilefish $W = aL^b$ fit (`wlb` = 2.94, `CV_wlb` = 0.004; units: mm and g)

Methods

Data

Points

12. Beverton-Holt steepness parameter: Based on a meta-analysis of marine demersal teleost fishes by Shertzer and Conn (2012)
    `steep` = 0.836
    `CV_steep` = 0.24
13. maximum age: Estimate from SEDAR 50 (SEDAR 92 LH TWG did not recommend a change)
    `MaxAge` = 40 years.

Methods

Analysis

1. `AvC`: Average catch over entire `Cat` time series (2002 – 2023)
2. `CC1`: Average catch over most recent 5 years of `Cat` time series
3. `CC4`: 70% of average catch over most recent 5 years of `Cat` time series

Methods

Analysis

4. `Fdem_ML`
   - Uses Beverton-Holt equilibrium mean length method to estimate recent Z and current biomass (B_{current})
   - Uses life history data, solves the Euler-Lotka equation for r and computes $r/2 = F_{\text{MSY}}$
   - $F_{\text{MSY}} B_{\text{current}} = \text{TAC}$

Methods

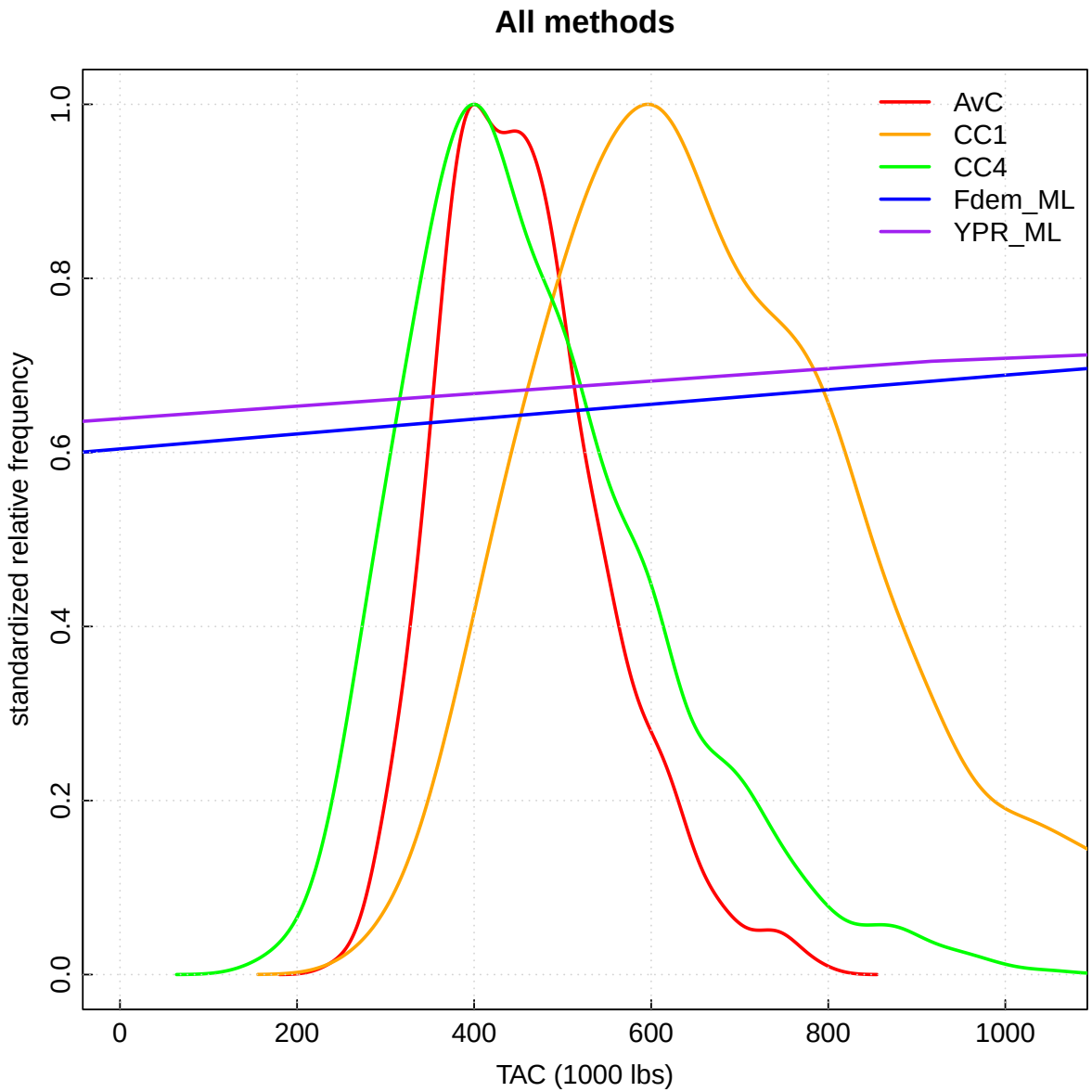
Analysis

5. `YPR_ML`
   - Uses Beverton-Holt equilibrium mean length method to estimate recent Z and current biomass (B_{current})
   - Conducts a yield-per-recruit analysis to estimate a proxy for F_{MSY}
   - $F_{\text{MSY}} B_{\text{current}} = \text{TAC}$

Results

Distributions of TACs from north of Cape Hatteras DLM analysis

- Catch based methods produce TACs in a similar range
- mean length (ML) methods produce extremely high and uncertain TACs



Results

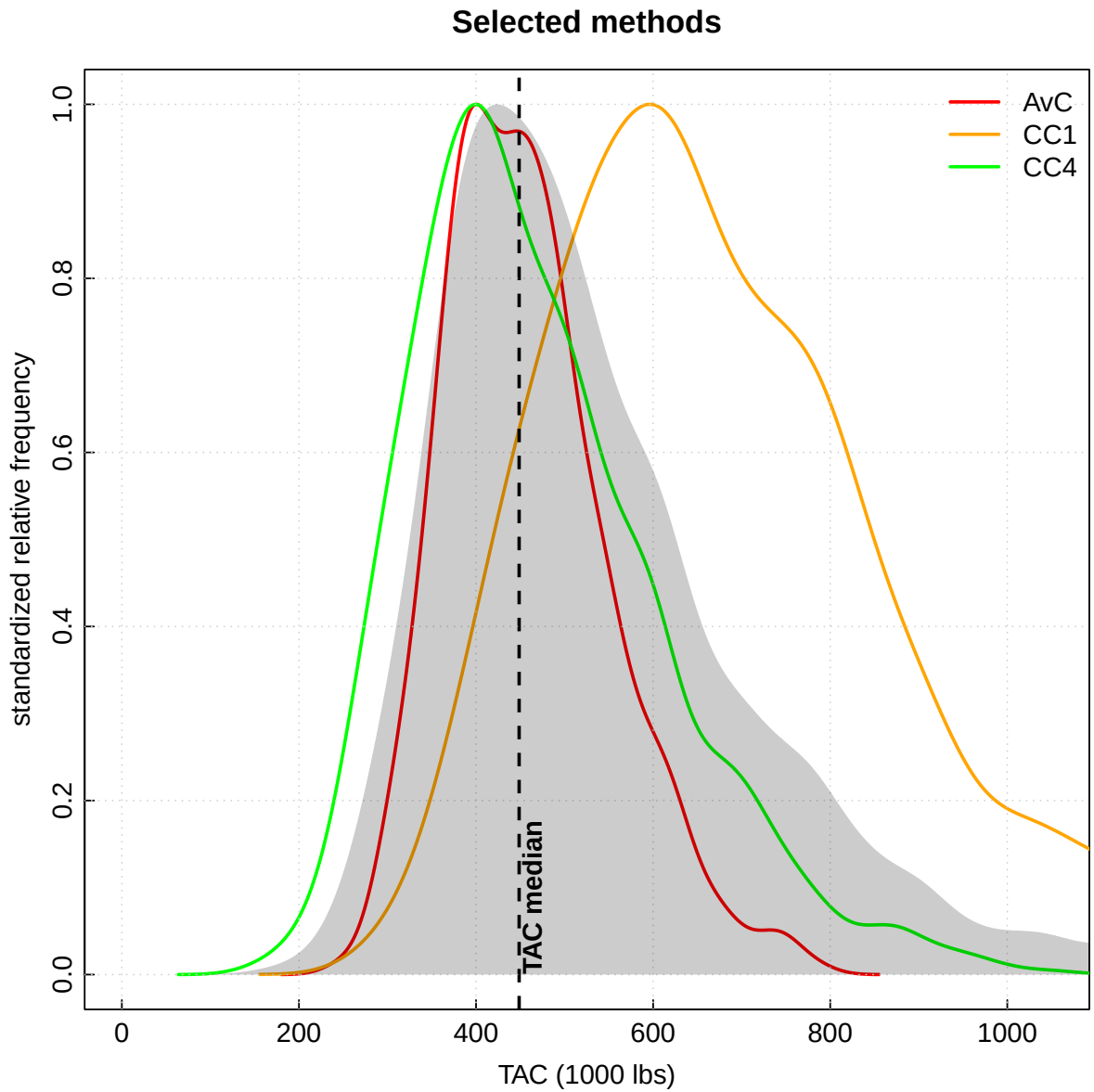
Table: Quantiles of TAC (total allowable catch) distributions from all `DLMtool` management procedures applied north of Cape Hatteras. Column names AvC, CC1, CC4, Fdem_ML, and YPR_ML are abbreviations for management procedures defined in the main text

Quantile	AvC	CC1	CC4	Fdem_ML	YPR_ML
2.5%	309	380	260	983	1941
5%	327	406	277	1649	2549
10%	353	448	307	2713	3507
25%	390	535	365	6890	6162
50%	449	646	443	16010	13099
75%	511	794	549	37087	33267
90%	584	963	672	69270	92846
95%	628	1099	739	90836	179223
97.5%	674	1216	810	119478	312380

Results

Distributions of selected TACs from north of Cape Hatteras DLM analysis

- Dashed vertical line is the median of all MP medians
- Shaded area represents distribution of all TAC combined



Results

Table: Quantiles of TAC (total allowable catch) distributions from select `DLMtool` management procedures applied north of Cape Hatteras. Column names AvC, CC1, and CC4 are abbreviations for management procedures defined in the main text. Values in the TOTAL column are computed from a distribution combining the results of all management procedures in this table.

Quantile	AvC	CC1	CC4	TOTAL
2.5%	309	380	260	290
5%	327	406	277	315
10%	353	448	307	350
25%	390	535	365	405
50%	449	646	443	495
75%	511	794	549	622
90%	584	963	672	785
95%	628	1099	739	898
97.5%	674	1216	810	1033

Discussion

What happened with the ML methods in SEDAR 92?

- Apparent problem is (too many) negative estimates of F_{recent} using the Beverton-Holt equilibrium mean length equation

$$Z = K(L_\infty - Lbar)/(Lbar - Lc)$$
$$Z = 0.16(679.01 - 619)/(619 - 533) = 0.11$$

$$Z - M = F_{recent}$$
$$0.11 - 0.17 = -0.06$$

- The MPs filter out runs with negative F_{recent} but the distribution of F_{recent} in the remaining runs has a peak near zero, ranging to ≈ 0.05
- The resulting B_{current} estimates range widely and are very large
- Median TACs from these MPs were many times higher than the highest observed catches (removals)

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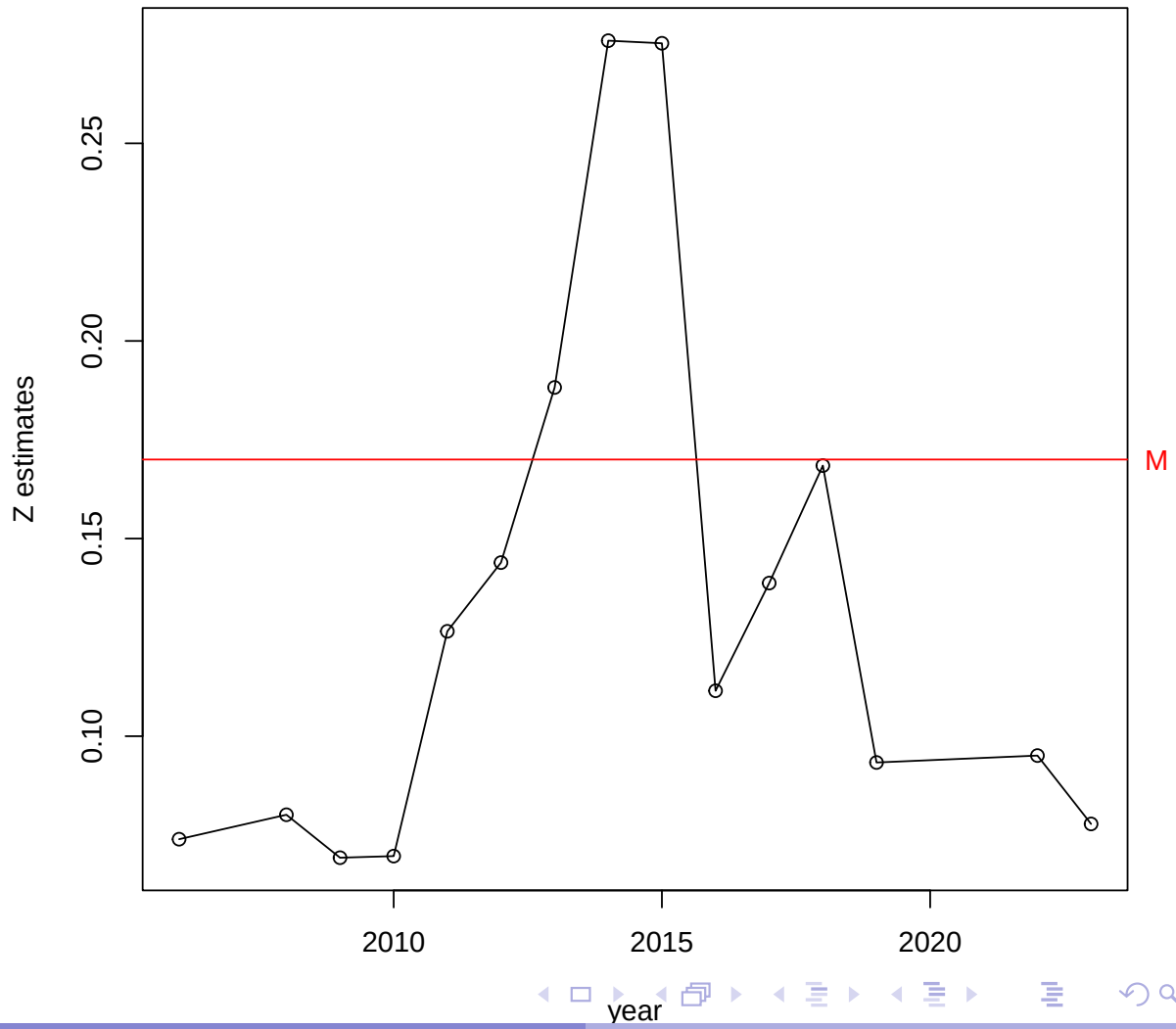
Discussion

Why did the ML methods produce reasonable results in SEDAR 50?

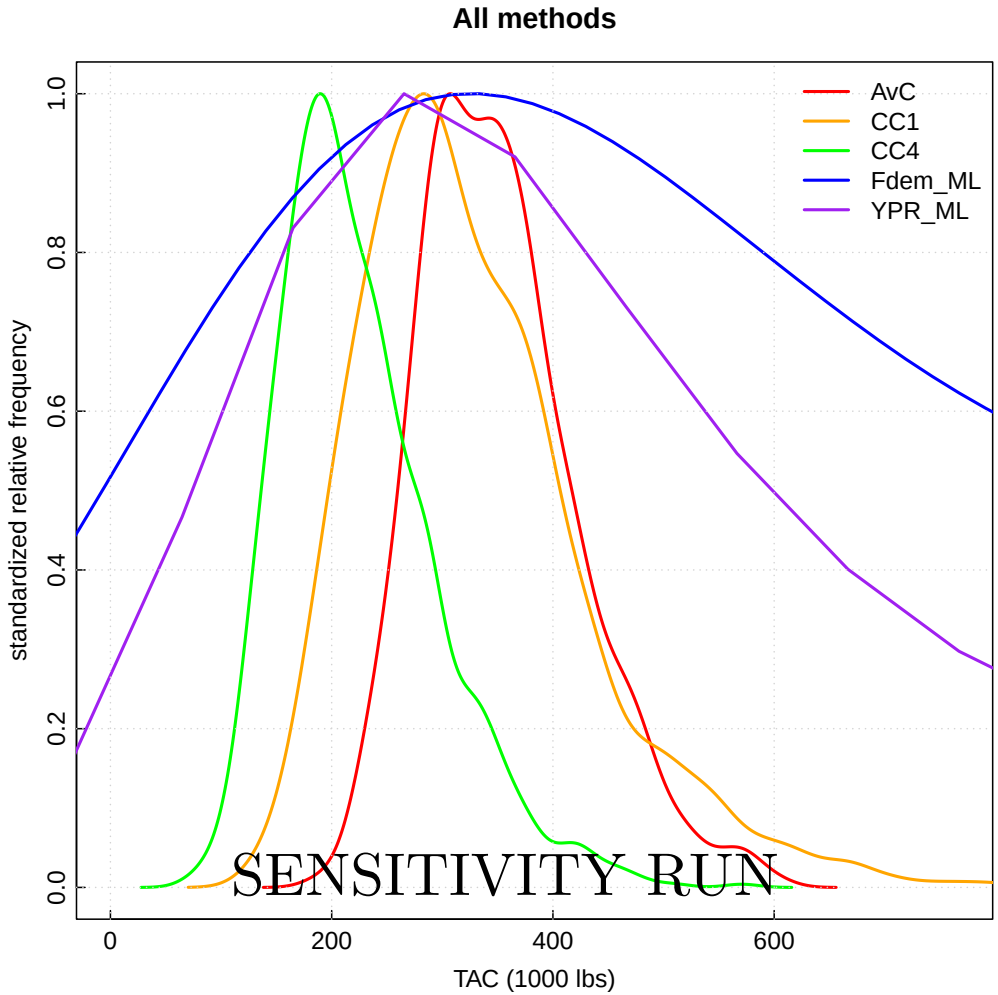
- Changing L_c and L_{bar} to values from most years would also result in negative $F_{current}$
- Changing L_c and L_{bar} to 2015 values result in larger Z and positive $F_{current}$



Discussion

Why did the ML methods produce reasonable results in SEDAR 50?

- Changing L_c and L_{bar} to 2015 values result in larger Z and positive $F_{current}$
- If we also limit the catch series to 2015, as a sensitivity run, results of the ML methods are much more consistent with other methods



Conclusions

- `ML` methods which were used in SEDAR 50 did not provide reasonable results in SEDAR 92
- The remaining MPs are solely catch-based
- Median TACs from these methods range from 443 to 646 klb with an overall median of 495 klb

Questions