Review of Available Length Composition Data Submitted for use in the SEDAR 65 Atlantic *Carcharhinus limbatus* Stock Assessment

Andrea Kroetz and Dean Courtney

SEDAR65-AW05

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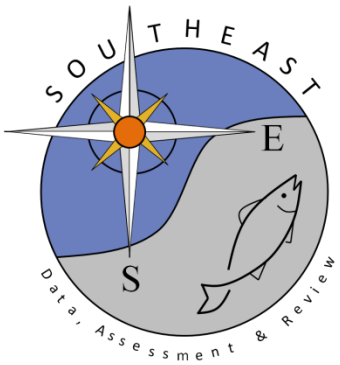

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SEDAR 65 ASSESSMENT WORKSHOP DOCUMENT

SEDAR65-AW05

Review of Available Length Composition Data Submitted for use in the SEDAR 65 Atlantic *Carcharhinus limbatus* Stock Assessment

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Summary

This document details length composition data for Atlantic *Carcharhinus limbatus* that were submitted during the SEDAR 65 Data Workshop for possible use in the SEDAR 65 Atlantic *C. limbatus* stock assessment. This working paper reviewed fisheries-independent and fisheries-dependent data that were submitted to the SEDAR 65 Data Workshop and were determined to be accepted or rejected from possible use in Stock Synthesis for the SEDAR 65 Assessment. A total of 10,945 Atlantic *C. limbatus* records were collected between 1974 and 2019. Fishery-dependent surveys contributed 6,585 specimens and fishery-independent surveys contributed 4,360 specimens. Atlantic *C. limbatus* ranged in size from 40 cm FL to 180 cm FL, covering a wide range of the species' size range from young-of-the-year to adult sharks. Variability in the size distribution and numbers of recorded specimens was present among the different surveys.

Introduction

The proposed analytical approach to be implemented in this assessment is a length-based age-structured statistical model (Stock Synthesis; Methot and Wetzel 2013; e.g., Wetzel and Punt 2011a, 2011b). Stock Synthesis utilizes an integrated modeling approach (Maunder and Punt 2013) to take advantage of the many data sources available, including length composition data. Once data are organized into 'fleets' based on similar length compositions, selectivity for each fleet can be estimated in the Stock Synthesis model from the time series of binned length data. Similarly, available length composition time series obtained for accepted CPUE indices will be reviewed during subsequent assessment webinars in order to determine if there are sufficient length data to represent the length composition distributions of each accepted CPUE index. Length based selectivity for CPUE indices with representative length composition distributions will be estimated in the Stock Synthesis model from the time series of binned length data. Length

based selectivity for CPUE indices without representative length composition distributions will be set equal to (mirror) CPUE indices with representative length composition distributions.

Methods and Data Analysis

Length composition data for Atlantic *C. limbatus* were submitted during the SEDAR 65 Data Workshop. The available length time series data were obtained from fisheries-independent scientific surveys as well as from recreational catch data and were available from 1974-2019 (n=17, Table 1). Data were recorded by fisheries research biologists, scientific observers, and recreational fishermen (e.g., logbook data). Length data used in analyses from fishery-dependent surveys were sourced from the Marine Recreational Information Program (MRIP), Southeast Region Head Boat Survey (SRHS), South Carolina Department of Natural Resources (SCDNR) shore-based fishing logbook data, Southeast Fisheries Science Center (SEFSC) Panama City Laboratory Shark Bottom Longline Observer Program (SBLOP), SEFSC Panama City Gillnet Observer Program (GNOP), and the University of Florida longline program (i.e., bottom longline program before it was taken over by SEFSC-SBLOP). Length data from fishery-independent surveys were sourced from the Virginia Shark Monitoring and Assessment Program (VASMAP), SEFSC Mississippi Lab bottom longline, Northeast Fishery Science Center (NEFSC) longline, Southeast Area Monitoring and Assessment Program (SEAMAP) Longline from Georgia-University of North Florida, SCDNR-SEAMAP longline, SCDNR drumline, SCDNR red drum longline, Cooperative Atlantic States Shark Pupping and Nursery (COASTSPAN) longline, COASTSPAN gillnet, Florida Atlantic University (FAU) drumline/longline, and SCDNR small gillnet survey.

Data on Atlantic *C. limbatus* size, sex, capture location, and date were recorded for each specimen. For analyses purposes, data were restricted to the western Atlantic. Fork length (FL) measurements in centimeters (cm) were used to create length compositions and data were filtered to include only true measurements (i.e., no estimated measurements). Length data were omitted from analyses if it exceeded biologically plausible measurements for this species; age-0 length is reported to be around 40 cm FL and maximum size was around 180 cm FL (S65-DW02). Data were binned into size classes of 5 cm FL increments and subset by sex. Data matrices were then created for each sex to include the proportion of animals in each size bin per year for input into Stock Synthesis. Length-frequency histograms were created for males, females, and combined sexes of Atlantic *C. limbatus*. Age at 50% maturity was indicated by vertical bars and was designated as 123.05 cm FL for females and 115.15 cm FL for males (S65-DW01). To aid in estimations of *C. limbatus* discards in commercial fisheries, length-frequency histograms were created for the fishery-dependent SEFSC-GNOP and SBLOP data based on whether *C. limbatus* were reported to have been kept, discarded dead, or released alive. Each survey used in this report were analyzed separately.

Results and Discussion

A total of 10,945 records of Atlantic *C. limbatus* specimens were considered within the scope of this study in the years of 1974-2019. Fishery-dependent surveys contributed 6,585 specimens and fishery-independent surveys contributed 4,360 specimens (Table 1). Atlantic *C.*

limbatus ranged in size from 40 cm FL to 180 cm FL, covering a wide range of the species' size range from young-of-the-year to adult sharks. Variability in the size distribution and numbers of recorded specimens was present among the different surveys. Length-frequency histograms indicate a wide range of sizes in *C. limbatus* captured in each survey (Appendix A). Within the SEFSC-GNOP data, 1,353 length measurements were taken on *C. limbatus* that were not specified as to whether these measurements were direct or estimated and thus were not included in the final sample size (n=124). Length-frequency histograms indicated that these 'unknown' measurements spanned a wide range of the species' size (Appendix B). Length-frequency histograms of *C. limbatus* discards from the SEFSC-SBLOP indicated that a large number were kept in the fishery (n=3,475) while fewer were discarded dead (n=108) and released alive (n=7) (Appendix C).

References

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Methot R. D. and C. R. Wetzel. 2013. Stock synthesis: A biological and statistical framework for fish stock assessment and fishery management. Fisheries Research 142:86–99.

Natanson L.J., B.M. Deacy, H.E. Moncrief-Cox, W.B. Driggers III. 2019. Reproductive parameters for blacktip sharks (Carcharhinus limbatus) from the western North Atlantic Ocean. SEDAR65-DW01. SEDAR, North Charleston, SC. 10 pp.

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Wetzel, C. R., and A. E. Punt. 2011a. Model performance for the determination of appropriate harvest levels in the case of data-poor stocks. Fisheries Research 110:342–355.

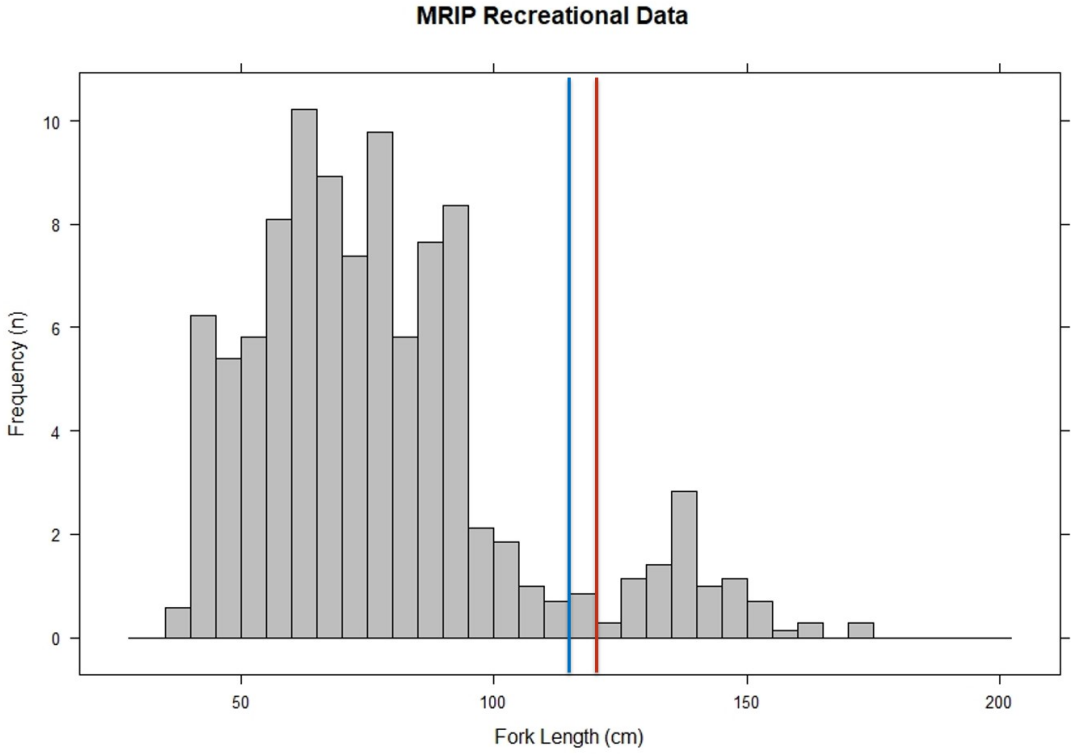
Wetzel, C. R., and A. E. Punt. 2011b. Performance of a fisheries catch-at-age model (Stock Synthesis) in data-limited situations. Marine and Freshwater Research 62: 927–936.

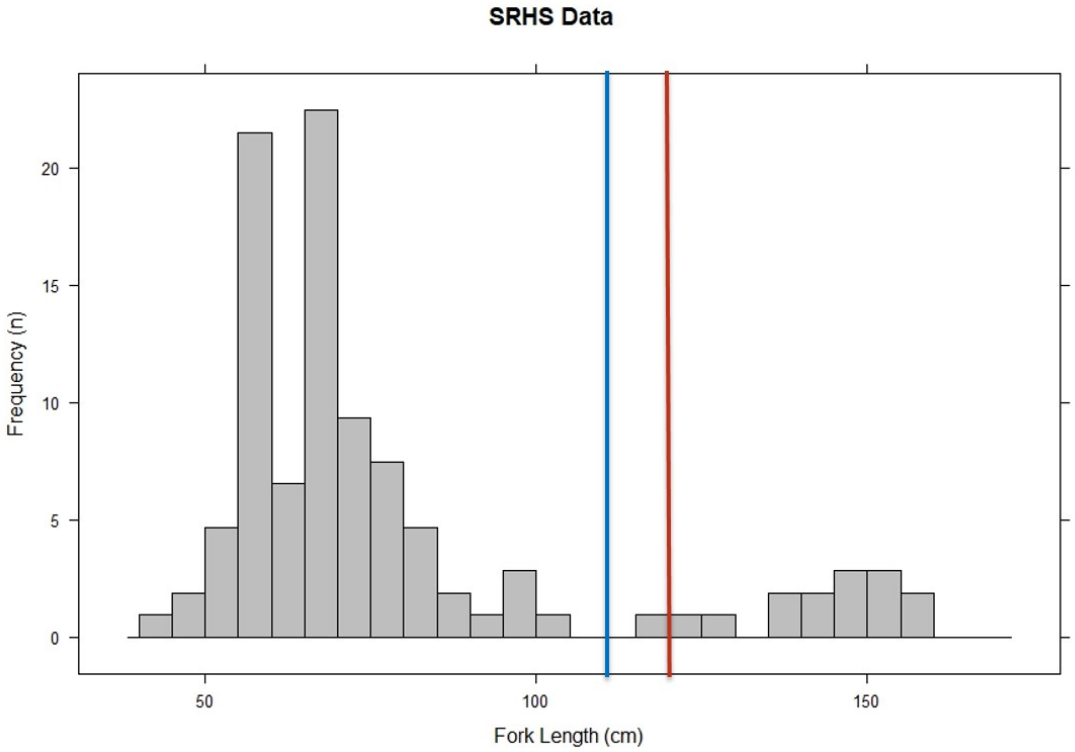
Table 1. Available length composition data for Atlantic *C. limbatus* obtained from fisheries-independent scientific surveys and from fisheries-dependent recreational catch for years 1974-2019.

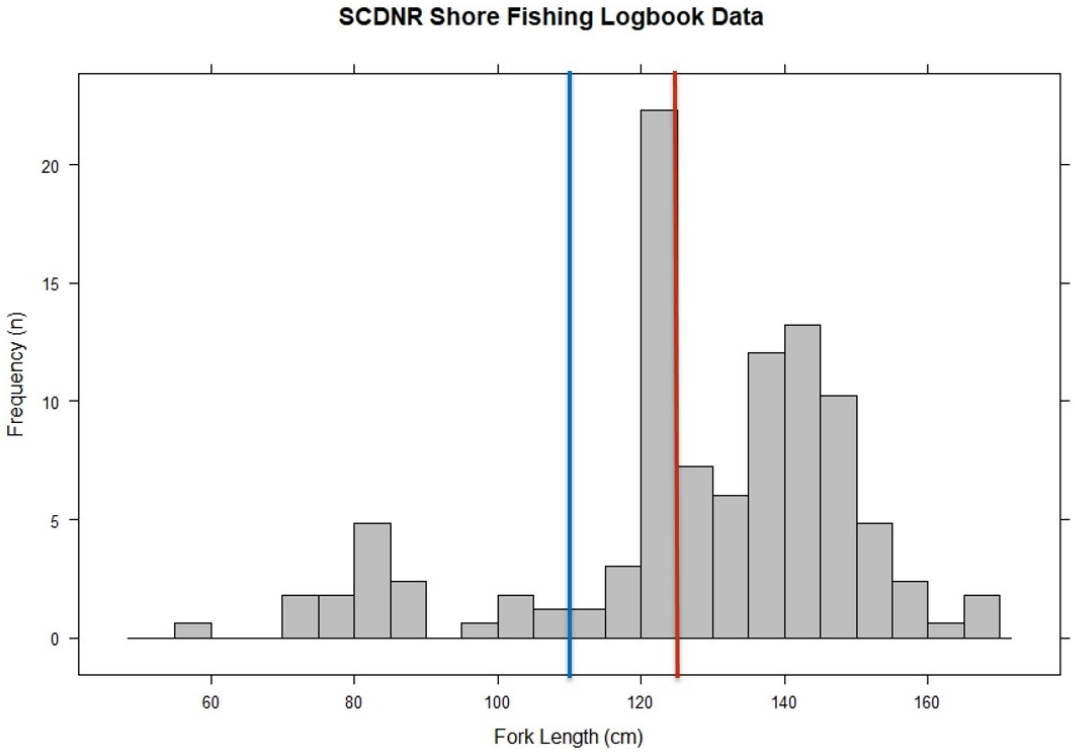
Data Source	Years of Coverage	Sample Size (number of sharks)
Fishery Dependent		
Marine Recreational Information Program (MRIP)	1981-2018	781
Southeast Region Head Boat Survey (SRHS)	1989-2018	107
South Carolina Department of Natural Resources (SCDNR) Shore Fishing	2013-2018	166
Southeast Fisheries Science Center (SEFSC) Panama City Lab Shark Bottom Longline Observer Program (SBLOP)	2005-2018	3,708
Southeast Fisheries Science Center (SEFSC) Panama City Lab Gillnet Observer Program (GNOP)	1999-2018	124
University of Florida Longline	1994-2005	1,699
	Total	**6, 585**
Fishery Independent		
Virginia Shark Monitoring and Assessment Program (VASMAP)	1974-2018	324
Southeast Fisheries Science Center (SEFSC) Mississippi Laboratory Bottom Longline	1996-2018	19
Northeast Fisheries Science Center (NEFSC) Bottom Longline	1996-2018	638
Southeast Area Monitoring and Assessment Program (SEAMAP) Longline (Georgia-University of North Florida)	2007-2018	218
South Carolina Department of Natural Resources (SCDNR) SEAMAP Longline	2007-2018	1,032
South Carolina Department of Natural Resources (SCDNR) Drumline	2013-2019	302
South Carolina Department of Natural Resources (SCDNR) Red Drum longline	1994-2008	301
Cooperative Atlantic States Shark Pupping and Nursery (COASTSPAN) Longline	1999-2019	641
Cooperative Atlantic States Shark Pupping and Nursery (COASTSPAN) Gillnet	1999-2019	487
Florida Atlantic University Drumline/Longline	2014-2019	123
South Carolina Department of Natural Resources (SCDNR) Small Gillnet Survey	2006-2019	275
	Total	**4, 360**

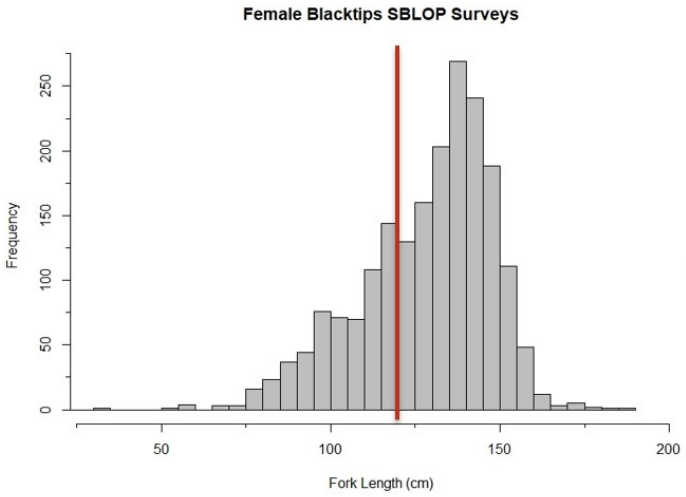
Appendix A – Length-Frequency Compositions for Atlantic *Carcharhinus limbatus* Submitted during the SEDAR 65 Data Workshop for Possible inclusion in the SEDAR 65 *Carcharhinus limbatus* Atlantic Stock Assessment

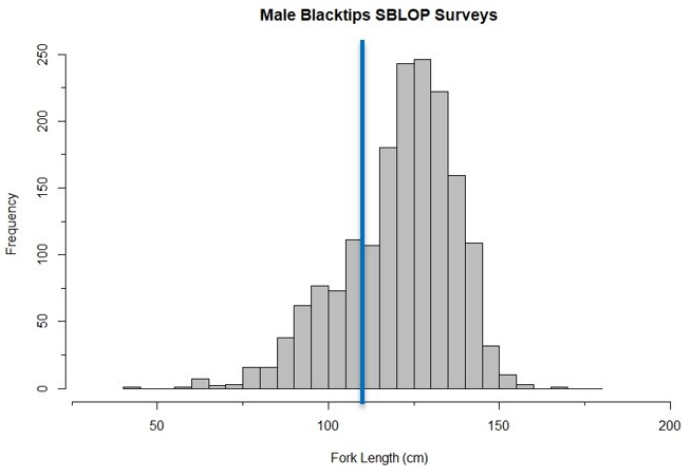
Length-frequency distributions of Atlantic *Carcharhinus limbatus* from fishery-dependent and fishery-independent surveys. Red vertical lines indicate 50% maturity for females (123 cm FL) and blue vertical lines indicate 50% maturity for males (115 cm FL).

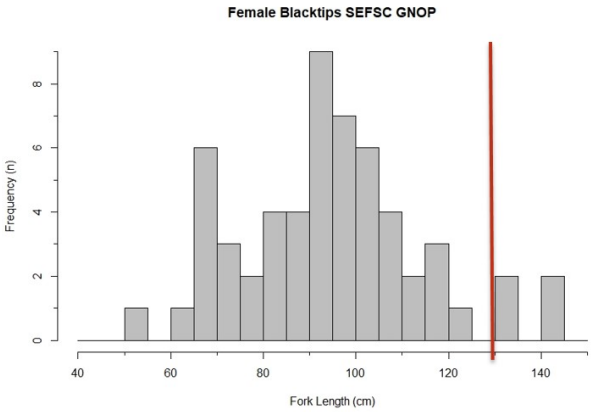


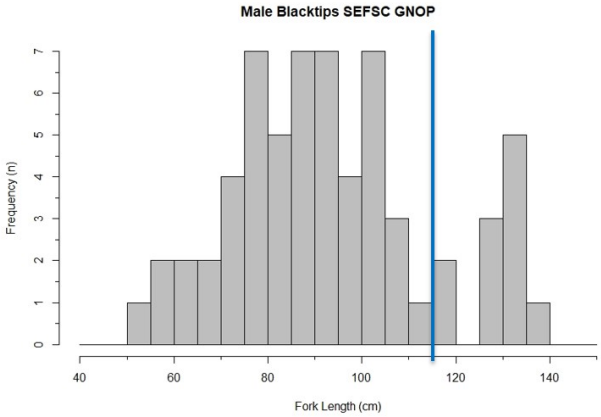

SRHS Data
Frequency (n)
0
5
10
15
20
50
100
150
Fork Length (cm)

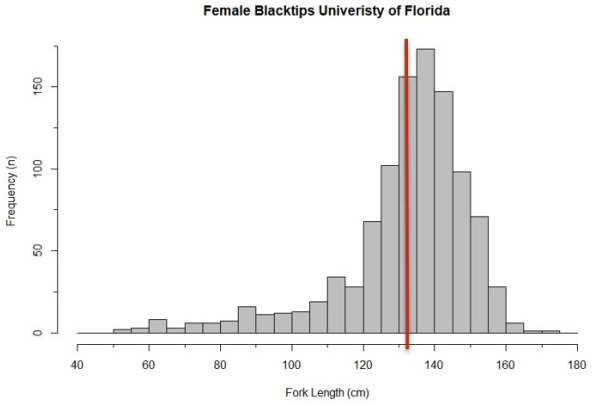

SCDNR Shore Fishing Logbook Data
Frequency (n)
0
5
10
15
20
60
80
100
120
140
160
Fork Length (cm)

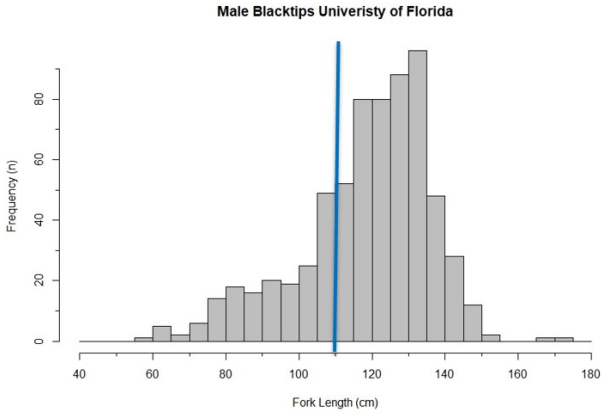

Female Blacktips SBLOP Surveys
Frequency
Fork Length (cm)

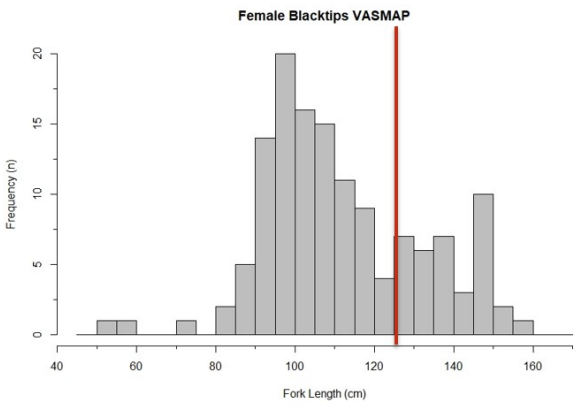

Male Blacktips SBLOP Surveys
Frequency
Fork Length (cm)

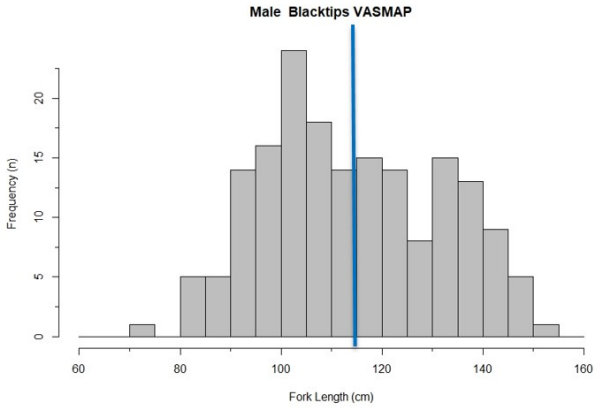

Female Blacktips SEFSC GNOP
Frequency (n)
Fork Length (cm)


Male Blacktips SEFSC GNOP
Frequency (n)
Fork Length (cm)


Female Blacktips Univeristy of Florida
Frequency (n)
Fork Length (cm)


Male Blacktips Univeristy of Florida
Frequency (n)
Fork Length (cm)


Female Blacktips VASMAP
Frequency (n)
Fork Length (cm)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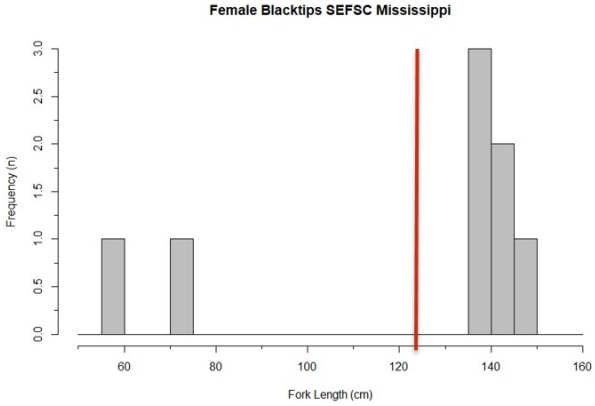
Fork Length (cm)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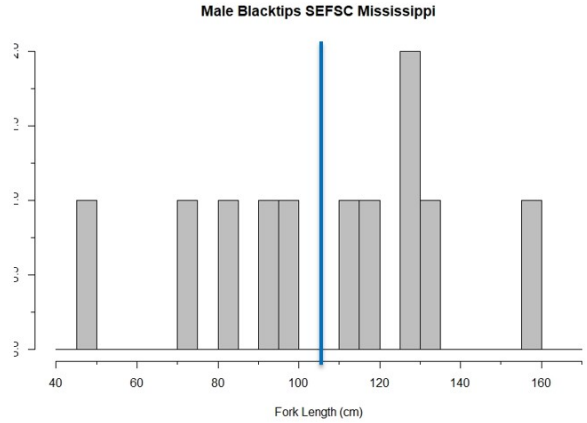
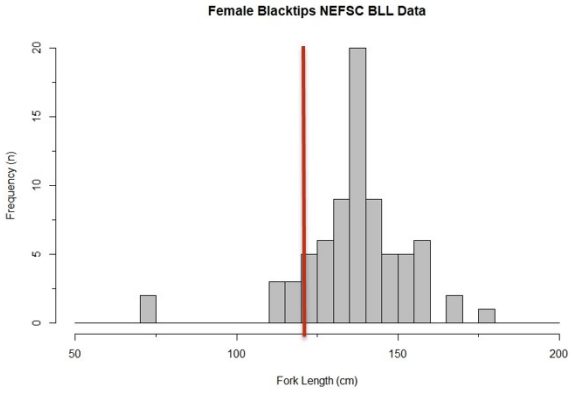
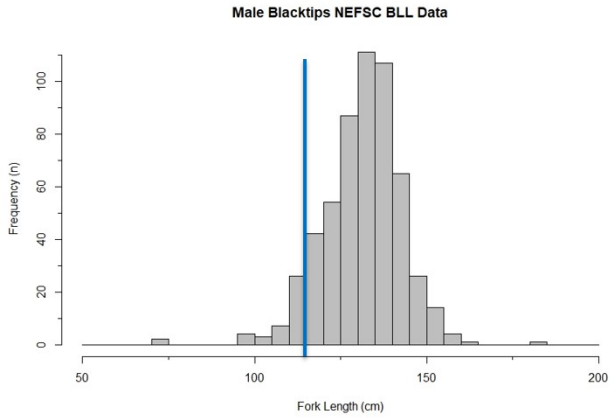
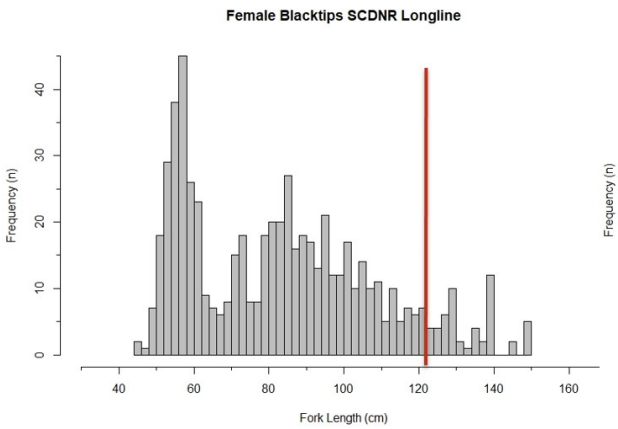
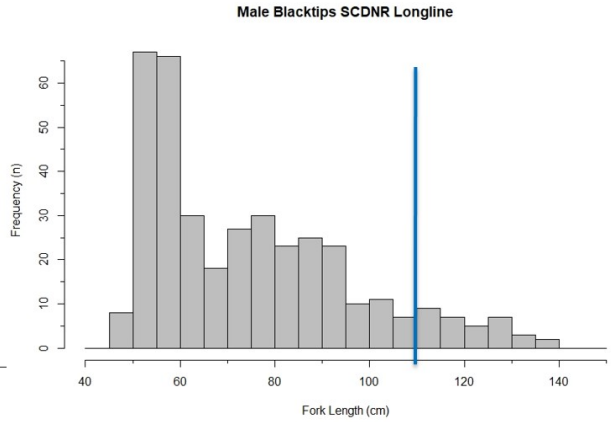
Frequency (n)
Fork Length (cm)


Male Blacktips SEFSC Mississippi
Fork Length (cm)


Female Blacktips NEFSC BLL Data
Frequency (n)
Fork Length (cm)


Male Blacktips NEFSC BLL Data
Frequency (n)
Fork Length (cm)


Female Blacktips SCDNR Longline
Frequency (n)
Fork Length (cm)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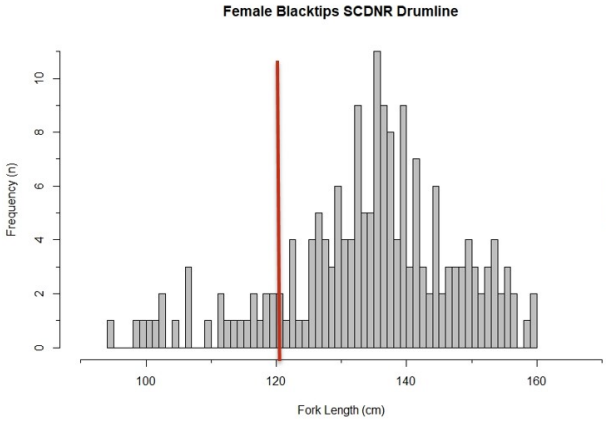
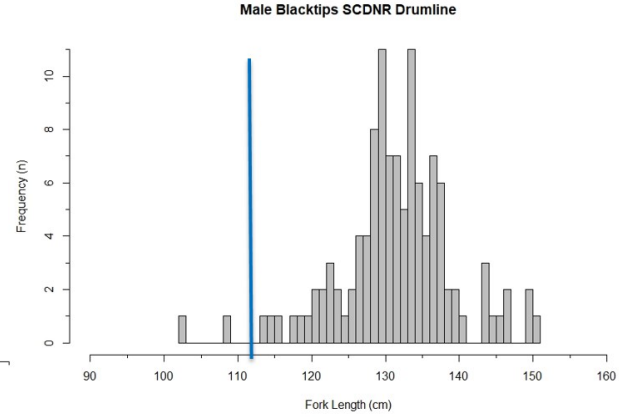
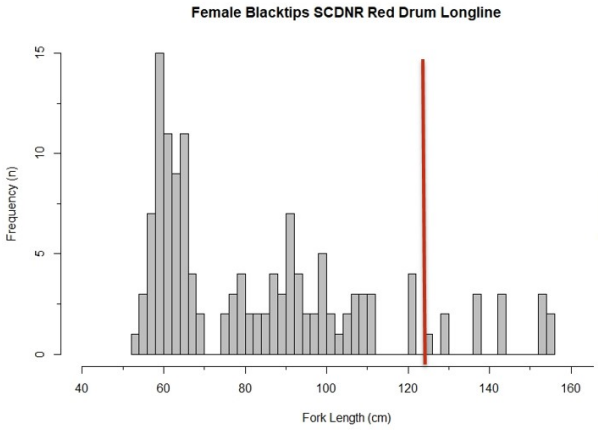
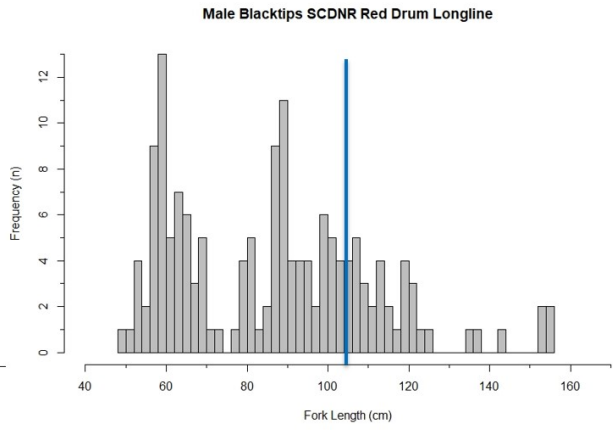
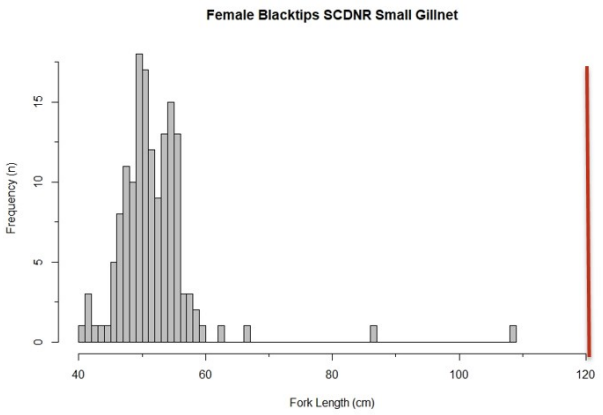
Frequency (n)
Fork Length (cm)

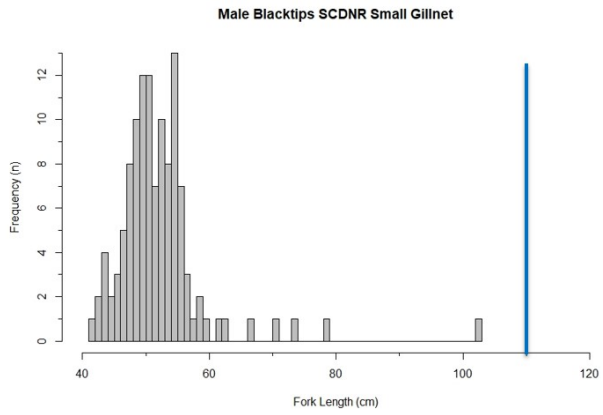

Female Blacktips SCDNR Drumline
Frequency (n)
Fork Length (cm)

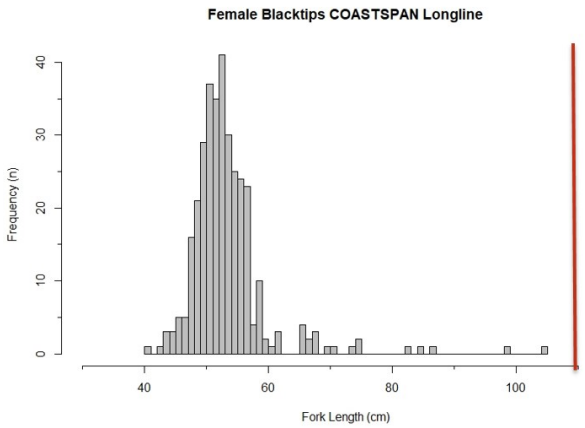

Male Blacktips SCDNR Drumline
Frequency (n)
Fork Length (cm)

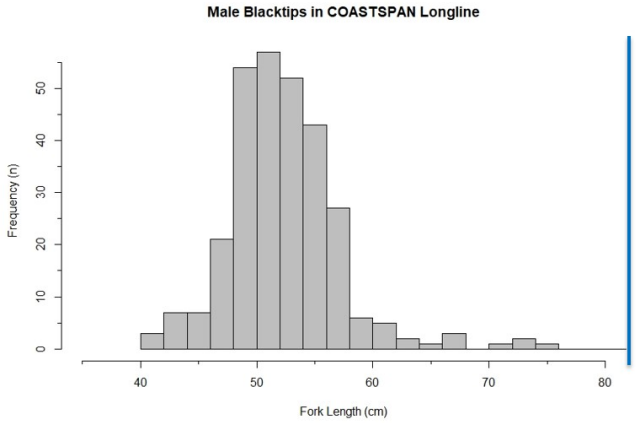

Female Blacktips SCDNR Red Drum Longline
Frequency (n)
Fork Length (cm)

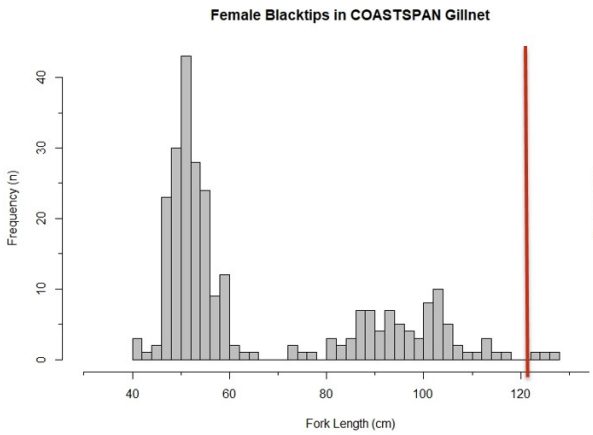

Male Blacktips SCDNR Red Drum Longline
Frequency (n)
Fork Length (cm)


Female Blacktips SCDNR Small Gillnet
Frequency (n)
Fork Length (cm)


Male Blacktips SCDNR Small Gillnet
Frequency (n)
Fork Length (cm)


Female Blacktips COASTSPAN Longline
Frequency (n)
Fork Length (cm)


Male Blacktips in COASTSPAN Longline
Frequency (n)
Fork Length (cm)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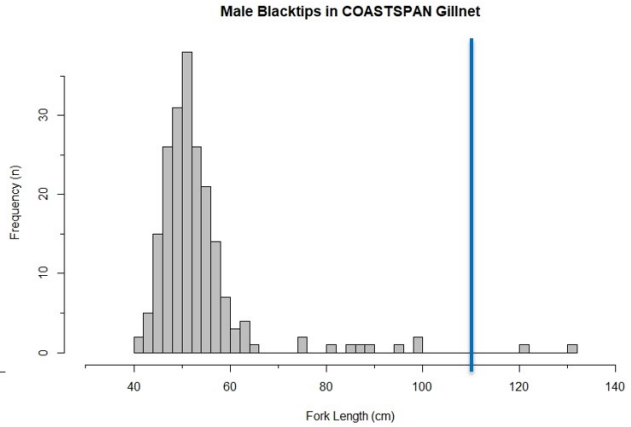
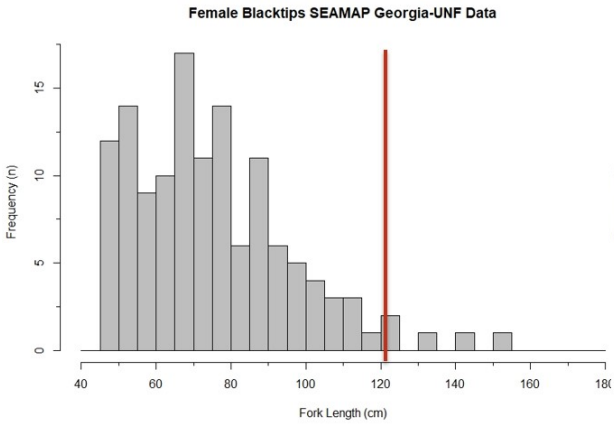
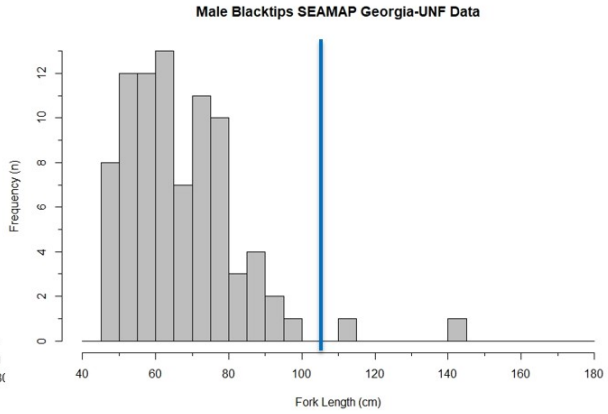
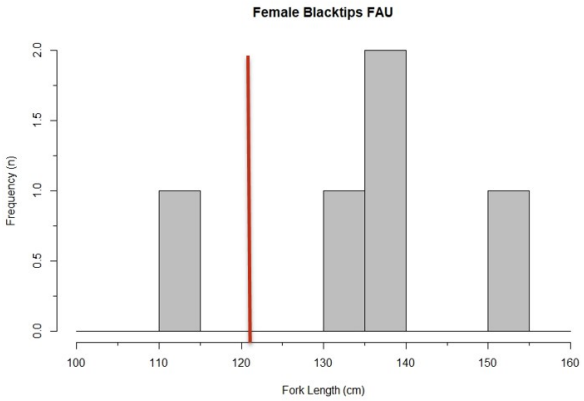
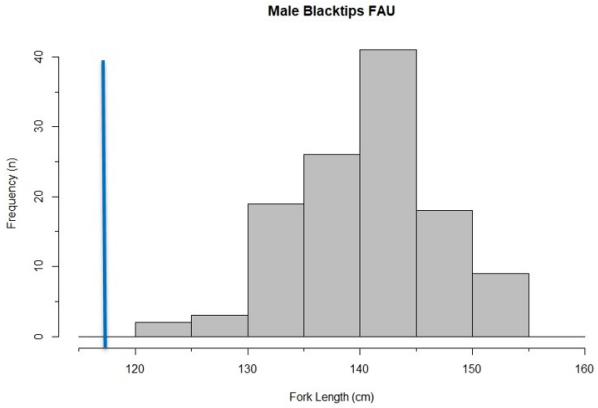
Frequency (n)
Fork Length (cm)


Male Blacktips in COASTSPAN Gillnet
Frequency (n)
Fork Length (cm)


Female Blacktips SEAMAP Georgia-UNF Data
Frequency (n)
Fork Length (cm)

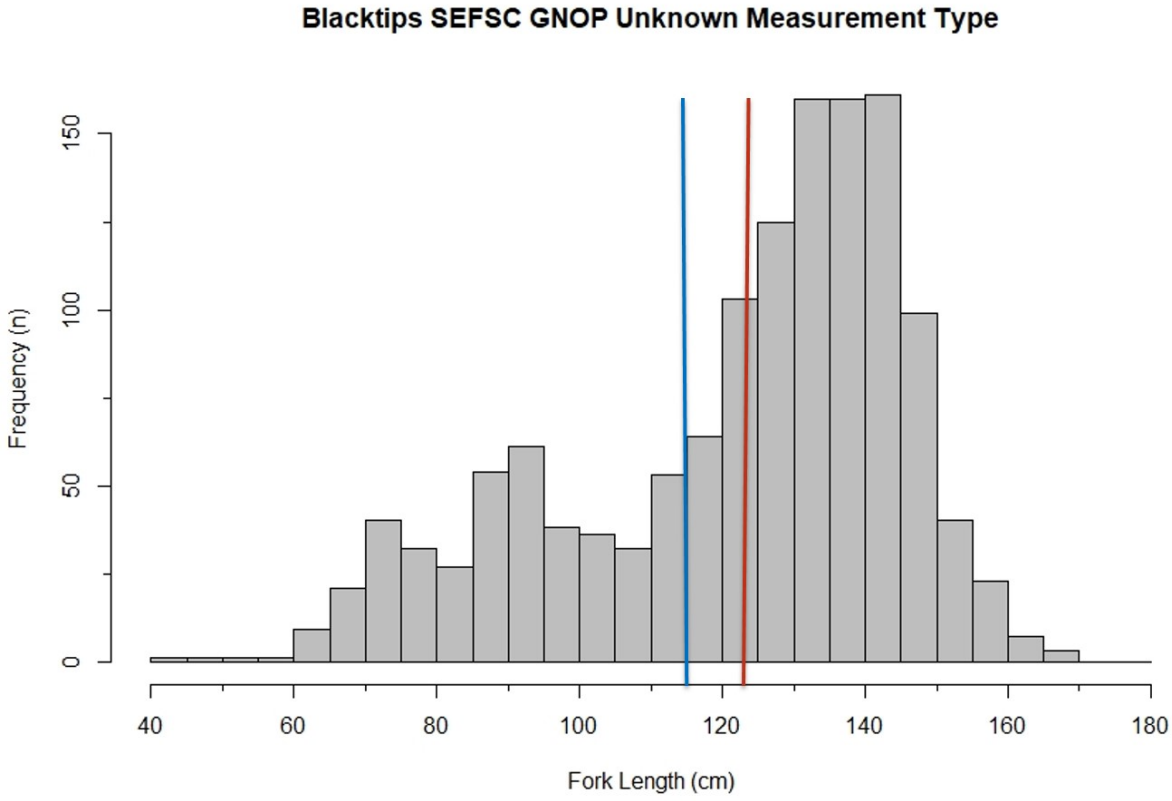

Male Blacktips SEAMAP Georgia-UNF Data
Frequency (n)
Fork Length (cm)

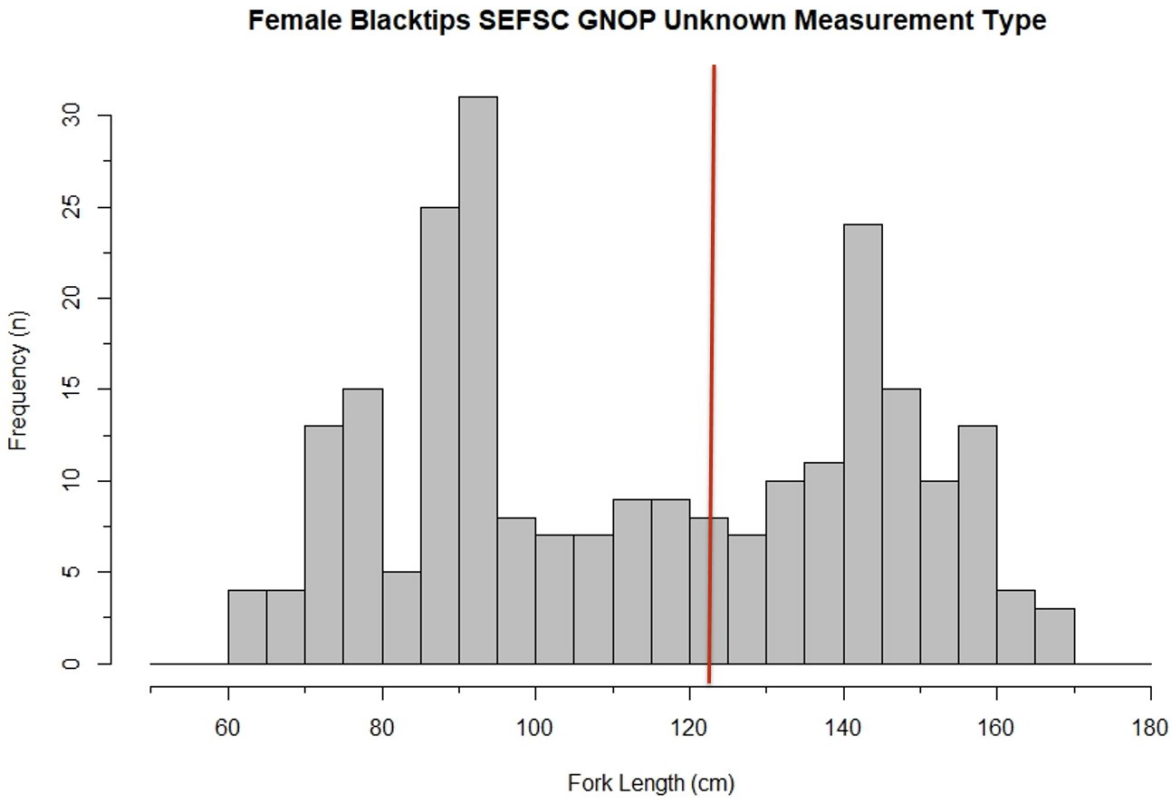

Female Blacktips FAU
Frequency (n)
Fork Length (cm)


Male Blacktips FAU
Frequency (n)
Fork Length (cm)

Appendix B – Length-Frequency Compositions of Unknown Measurement Type for Atlantic *Carcharhinus limbatus* from the Southeast Fisheries Science Center Gillnet Observer Program (SEFSC-GNOP)

Length-frequency distributions of Atlantic *Carcharhinus limbatus* from fishery-dependent data from the SEFSC-GNOP. Red vertical lines indicate 50% maturity for females (123 cm FL) and blue vertical lines indicate 50% maturity for males (115 cm FL).




Female Blacktips SEFSC GNOP Unknown Measurement Type
Frequency (n)
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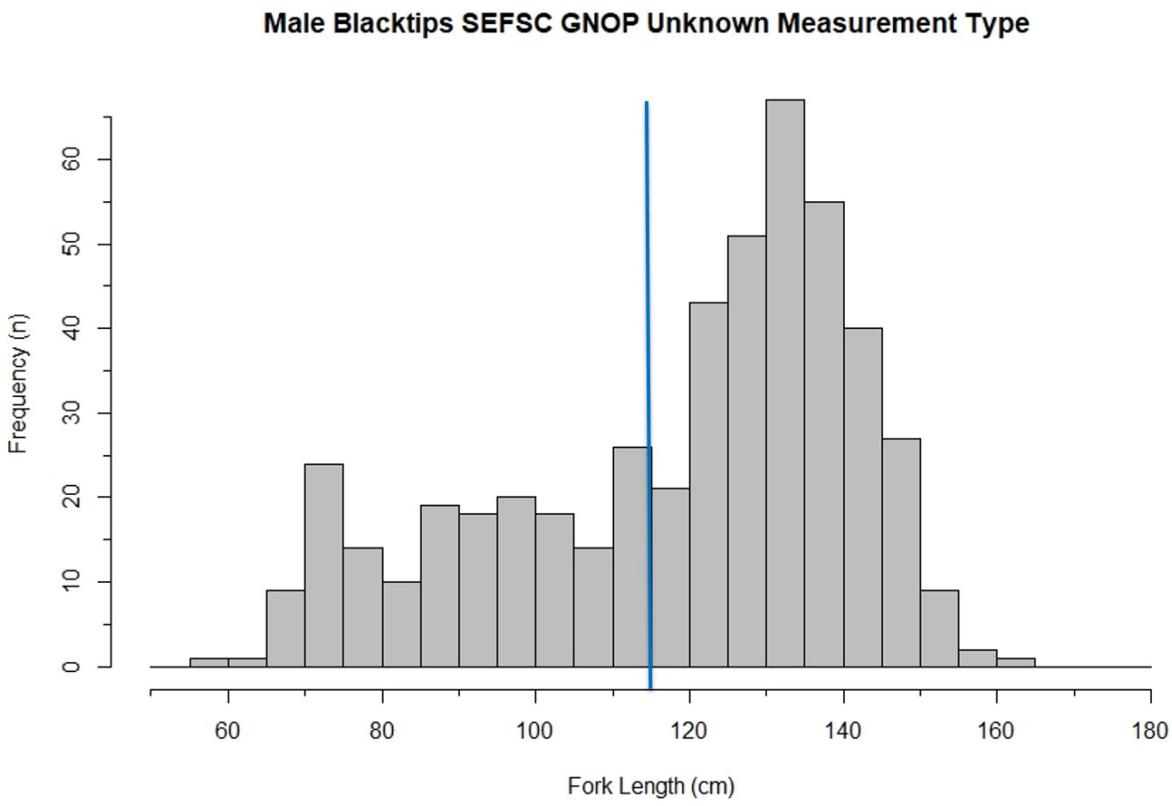
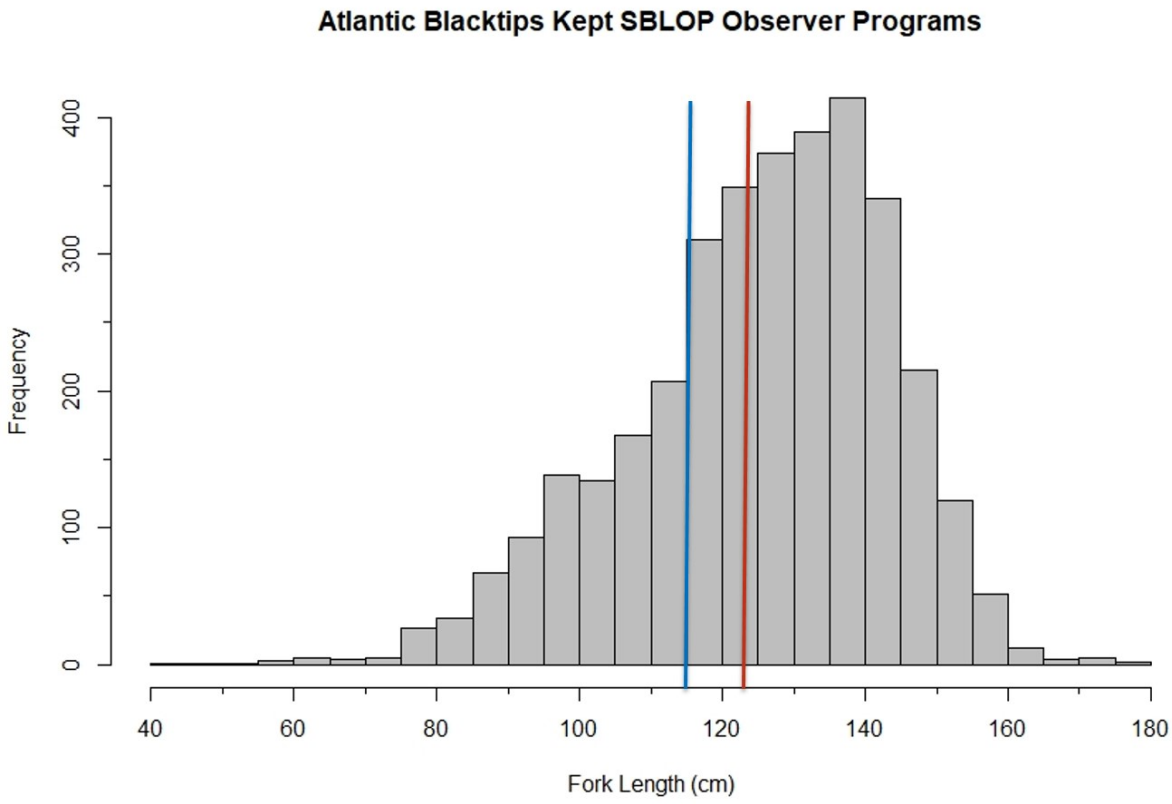
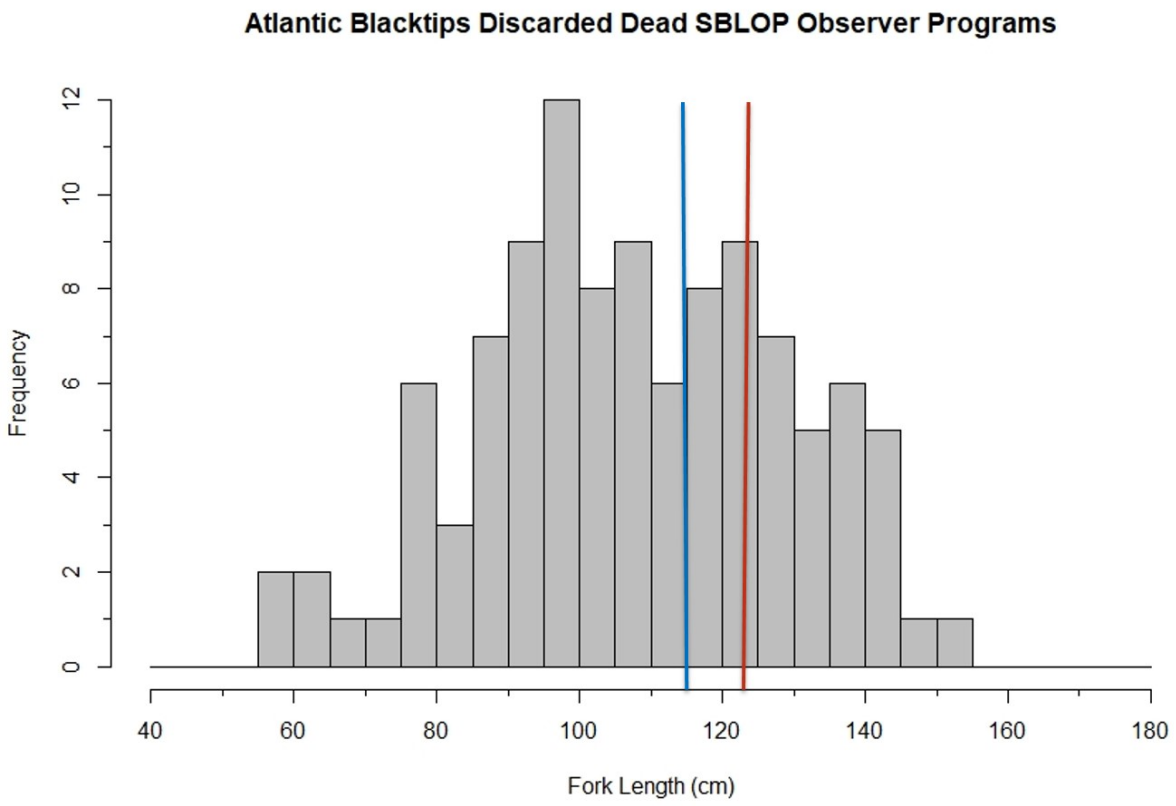
10
15
20
25
30
60
80
100
120
140
160
180
Fork Length (cm)

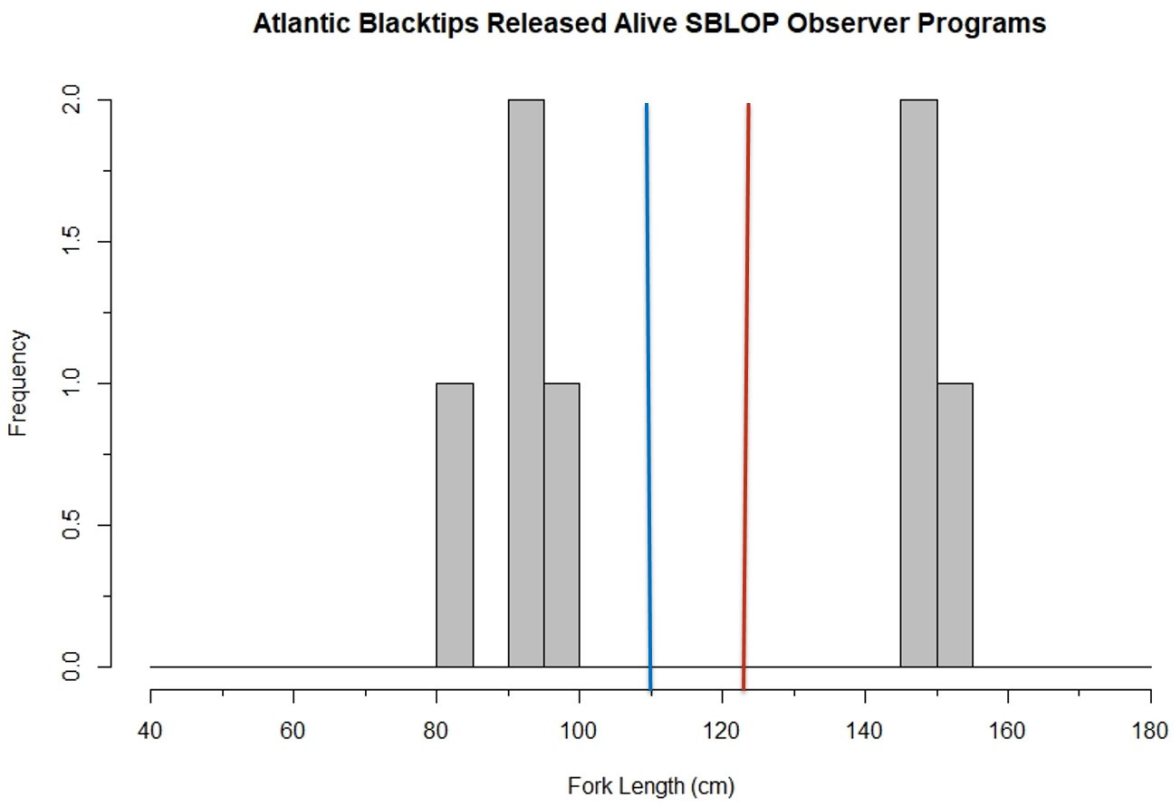

Male Blacktips SEFSC GNOP Unknown Measurement Type
Frequency (n)
0
10
20
30
40
50
60
60
80
100
120
140
160
180
Fork Length (cm)

Appendix C – Length-Frequency Compositions of Atlantic *Carcharhinus limbatus* Discards from the Southeast Fisheries Science Center Shark Bottom Longline Observer Program (SEFSC-SBLOP)

Length-frequency distributions of Atlantic *Carcharhinus limbatus* discards from fishery-dependent data from the SEFSC-SBLOP. Red vertical lines indicate 50% maturity for females (123 cm FL) and blue vertical lines indicate 50% maturity for males (115 cm FL).




Atlantic Blacktips Discarded Dead SBLOP Observer Programs
Frequency
0
2
4
6
8
10
12
40
60
80
100
120
140
160
180
Fork Length (cm)


Atlantic Blacktips Released Alive SBLOP Observer Programs
Frequency
0.0
0.5
1.0
1.5
2.0
40
60
80
100
120
140
160
180
Fork Length (cm)