SEDAR 68: Scamp and Yellowmouth Research Track assessment

Life History Group Plenary #2

May 26th, 2020

NOAA FISHERIES
Southeast Fisheries Science Center

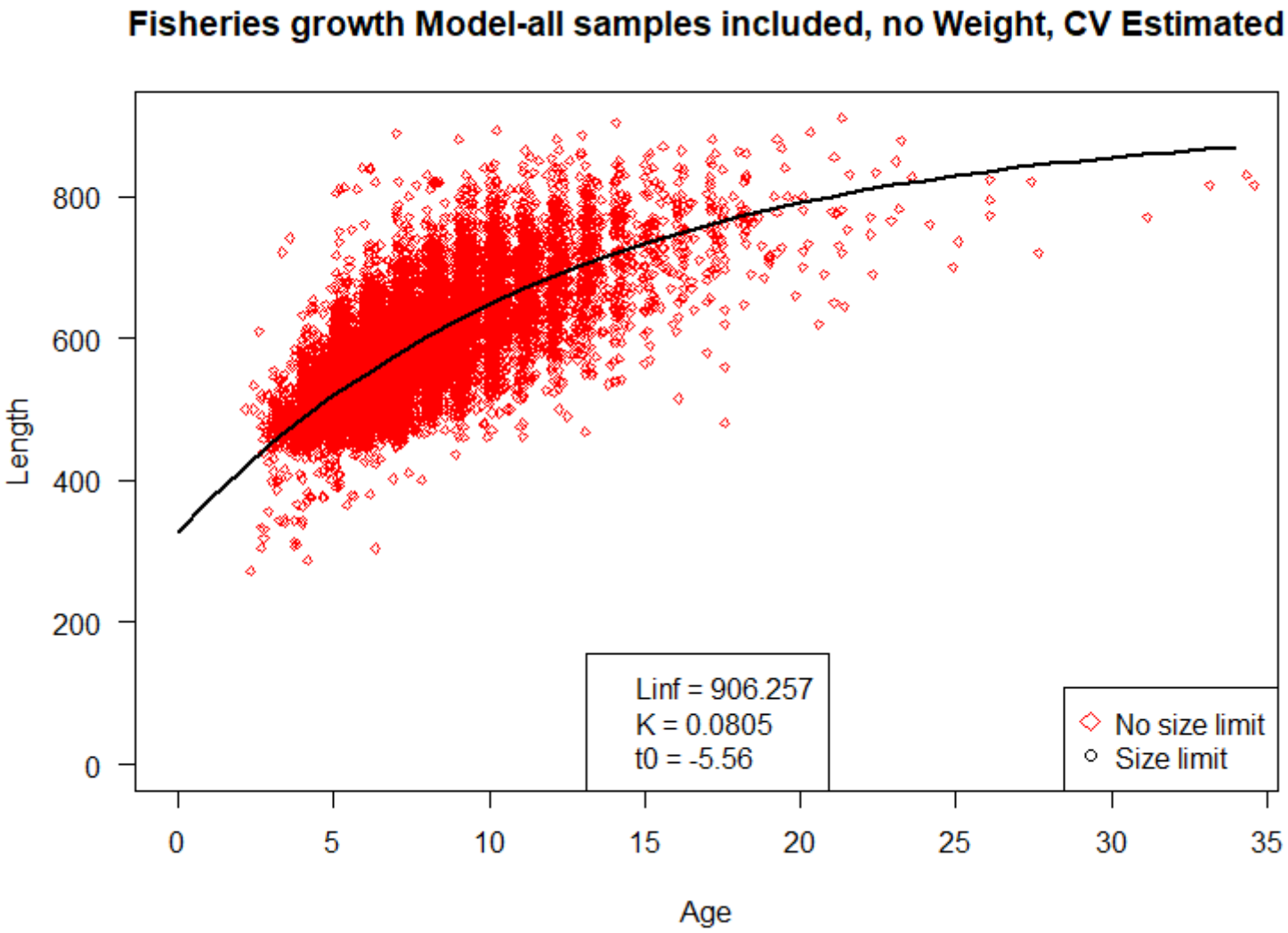
Recommendations already accepted

- Meristics Conversions-Both Regions
- South Atlantic Growth models: population and female

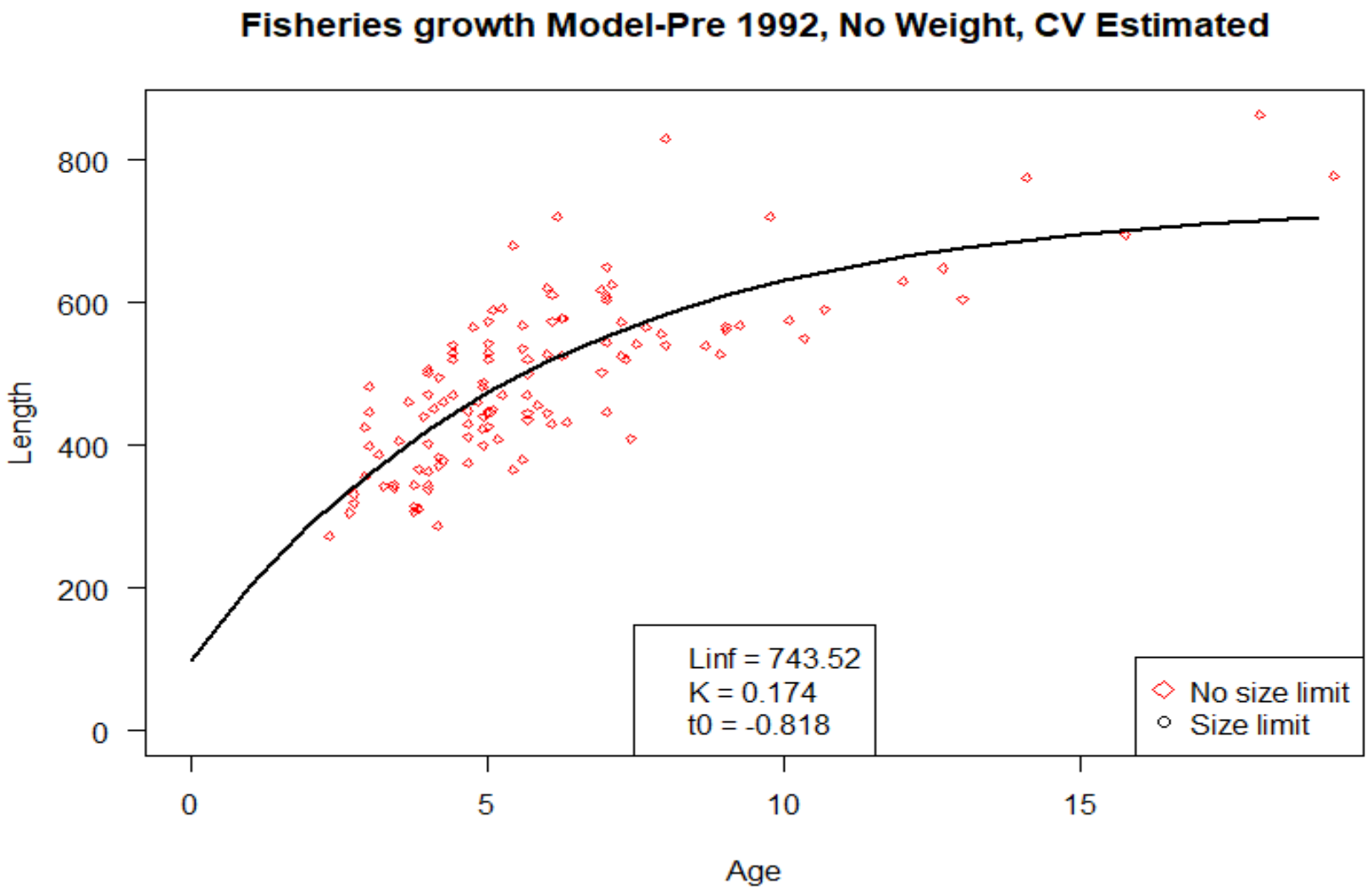
Recommendations to discuss

- South Atlantic Growth models: Fisheries
- GOM growth models
- Reproduction: South Atlantic and GOM

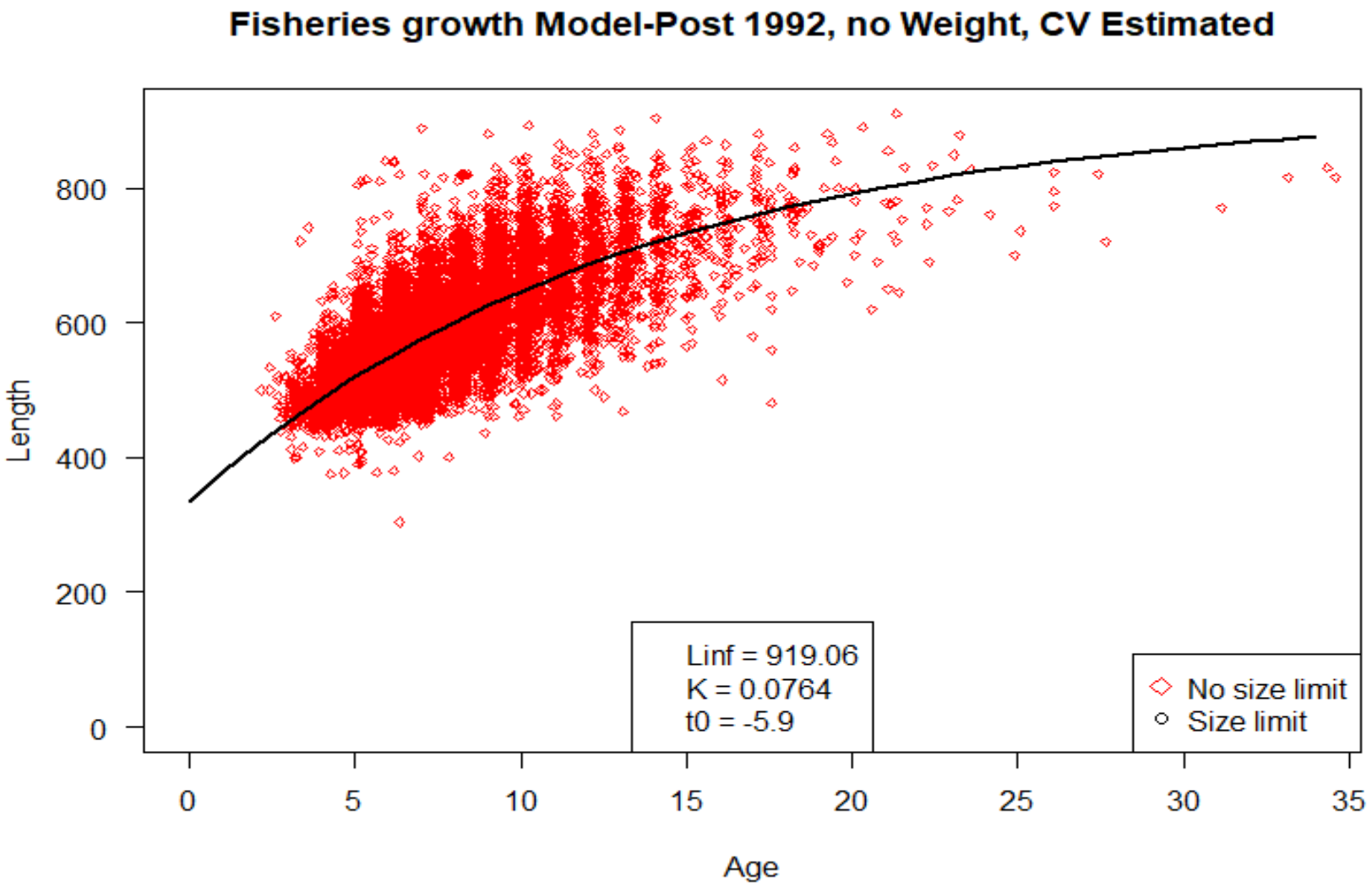
Growth Models: South Atlantic-Fisheries model



Growth Models: South Atlantic-Pre 1992



Growth Models: South Atlantic-Post 1992



Growth Models: South Atlantic fisheries models

- LHG Recommendations:
- Pre 92 growth models
  - Don’t recommend using to scale the fisheries landings prior to 1992
  - Use population growth model
- Post 92 growth models
  - To scale fisheries landings 1992-present

- ADT Recommendation:

NOAA FISHERIES
SEFSC
Panama City Laboratory

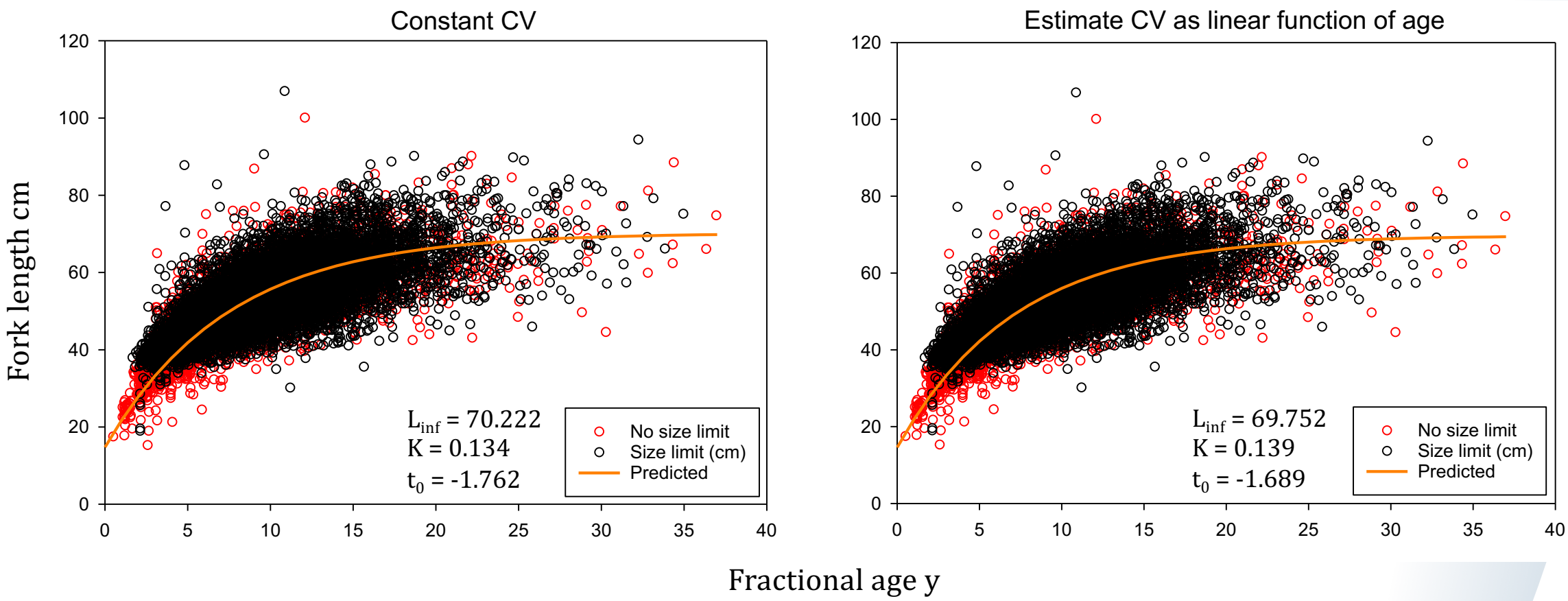
SEDAR 68
Gulf of Mexico
scamp and yellowmouth grouper
Growth Models

Beverly Barnett
Laura Thornton

GOM Population growth models

	# of observations	# of parameters	L_{inf}	K	t_0	AIC
Constant Sigma	13,233	4	71.800	0.112	-2.410	267.57
Constant CV	13,233	4	70.222	0.134	-1.762	262.42
Estimate CV as linear function of age	13,233	5	69.752	0.139	-1.689	264.29
Estimate CV as linear function of size at age	13,233	5	69.808	0.139	-1.675	264.29

GOM Population growth models



Growth Models: Gulf of Mexico population

- LHG Recommendations:
- Recommend these as the most appropriate growth models for Gulf of Mexico:
  - Inverse weighting
  - Constant CV
  - Estimate CV as linear function of age

- ADT Recommendation:

SEDAR 68 Scamp Reproduction – S. Atlantic

David Wyanski, Wally Bubley, Dawn Glasgow, Keilin Gamboa-Salazar

May 26, 2020

Scamp/Yellowmouth – reproductive parameters, S. Atlantic SouthEast Reef Fish Survey (SERFS)

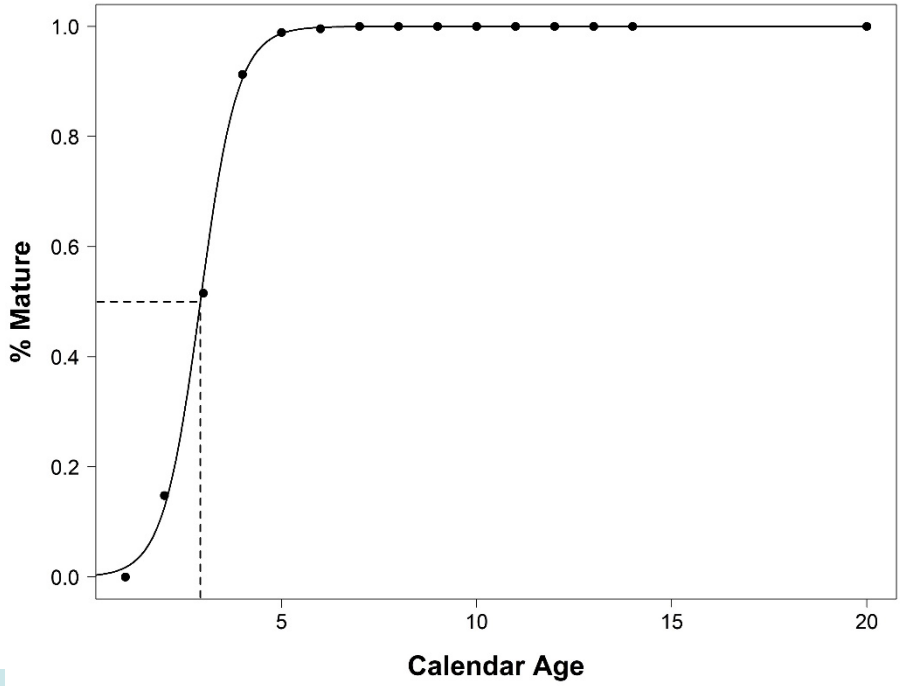
- Results presented in SEDAR68-DW-05
  - **Amended report and updated data input workbook to be submitted**
- Scamp (n=4,518) and Yellowmouth (n=28) with age and repro data
- Collection date: 1979-2017
- Sample composition
  - Fishery-independent (54%)
  - Fishery-dependent (45%)
    - Commercial (38%), Recreational (7%)
  - Snapper reel (48%), chevron trap (42%), short bottom longline (6%)
- Histological assessment

SAtl – female Scamp/Yellowmouth age at maturity

Period	Adult phases included	Distribution	N	A_{50} (yr)		Estimate	SE	Pr(>|z|)
1979-2017, all months	All	Logit	3515	2.3	(Intercept)	-3.71043	0.34738	<2e-16
					CalAge	1.63587	0.09939	<2e-16
1979-2017, Feb-Jul	**Dev. & Spawn. Capable**	Logit	1011	2.9	(Intercept)	-6.1129	0.7237	<2e-16
	(Vtg oocytes present)				CalAge	2.0936	0.1998	<2e-16

Shift in recommendation for SAtl to a functional maturity ogive

- A_{50} for GOM is 3.4 yr

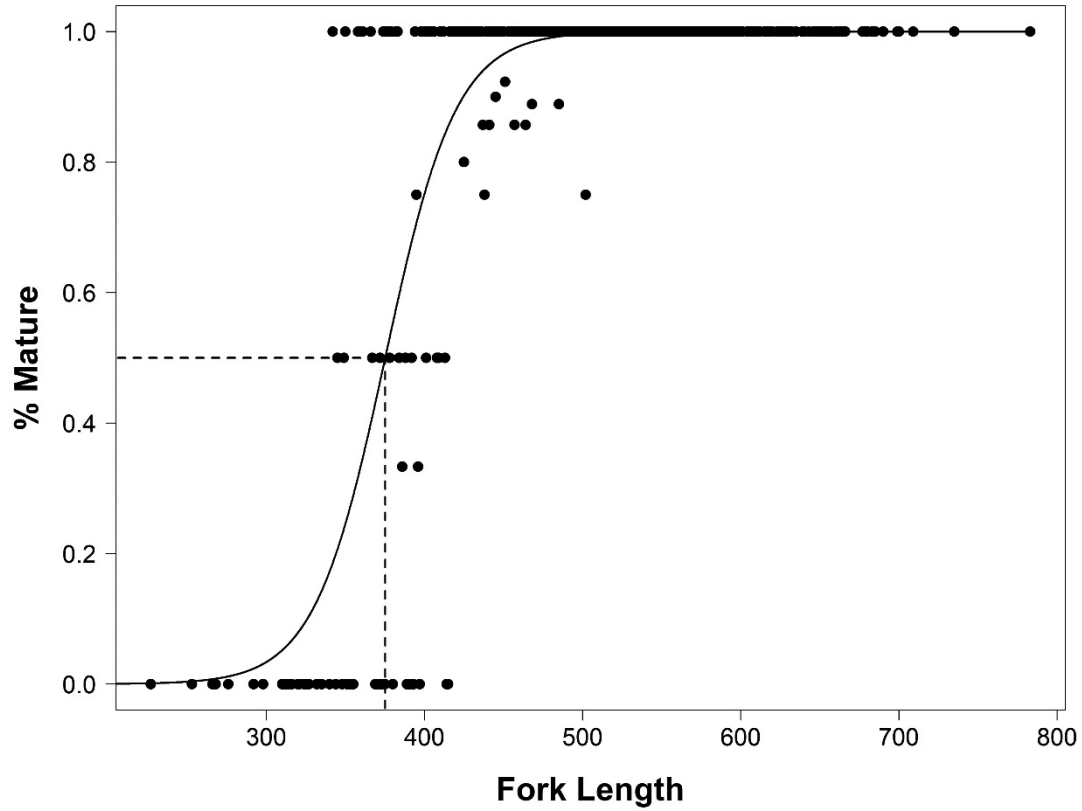


SAtl – female Scamp/Yellowmouth size at maturity

Period	Adult phases included	Distribution	N	L_{50} (mm)		Estimate	SE	Pr(>|z|)
1979-2017, all months	All	Probit	3673	343.8	(Intercept)	-6.0399	0.4375	<2e-16
					Fork length	0.0176	0.0011	<2e-16
1979-2017, Feb-Jul	**Dev. & Spawn. Capable**	Logit	1085	375.2	(Intercept)	-16.7155	1.6901	<2e-16
	(Vtg oocytes present)				Fork length	0.0446	0.0042	<2e-16

Shift in recommendation for SAtl to a functional maturity ogive

- L_{50} for GOM is 364 mm

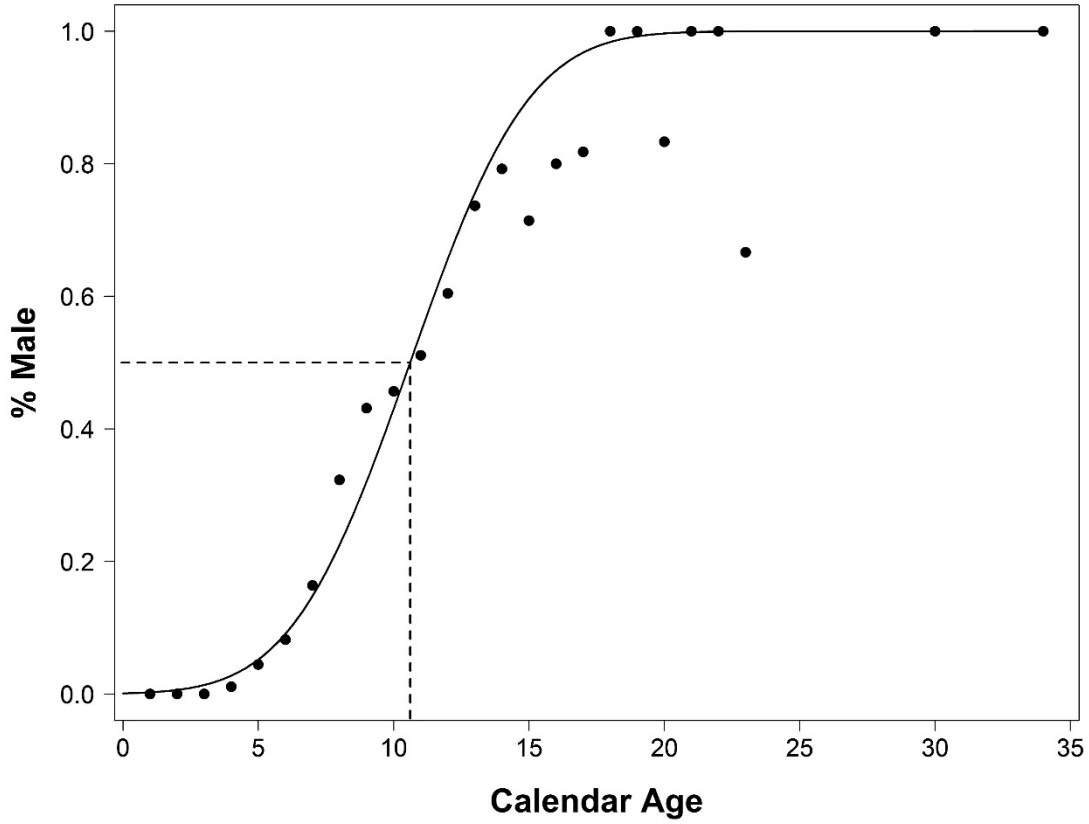


SAtl – Scamp/Yellowmouth age at sex transition

Period	Data	Distribution	N	A_{50} (yr)		Estimate	SE	Pr(>|z|)
1979-2017, all months	Adults only	Probit	4246	10.1	(Intercept)	-2.778163	0.0744	<2e-16
	Female, Trans., Male				CalAge	0.274544	0.009681	<2e-16
1979-2017, all months	**Immature & Adults**	Probit	4357	10.6	(Intercept)	-3.07207	0.07969	<2e-16
	Female and Male only				CalAge	0.28968	0.01014	<2e-16

New recommendation for SAtl:

- ogive based on all fish except transitionals
- A_{50} for GOM is 10.8 yr

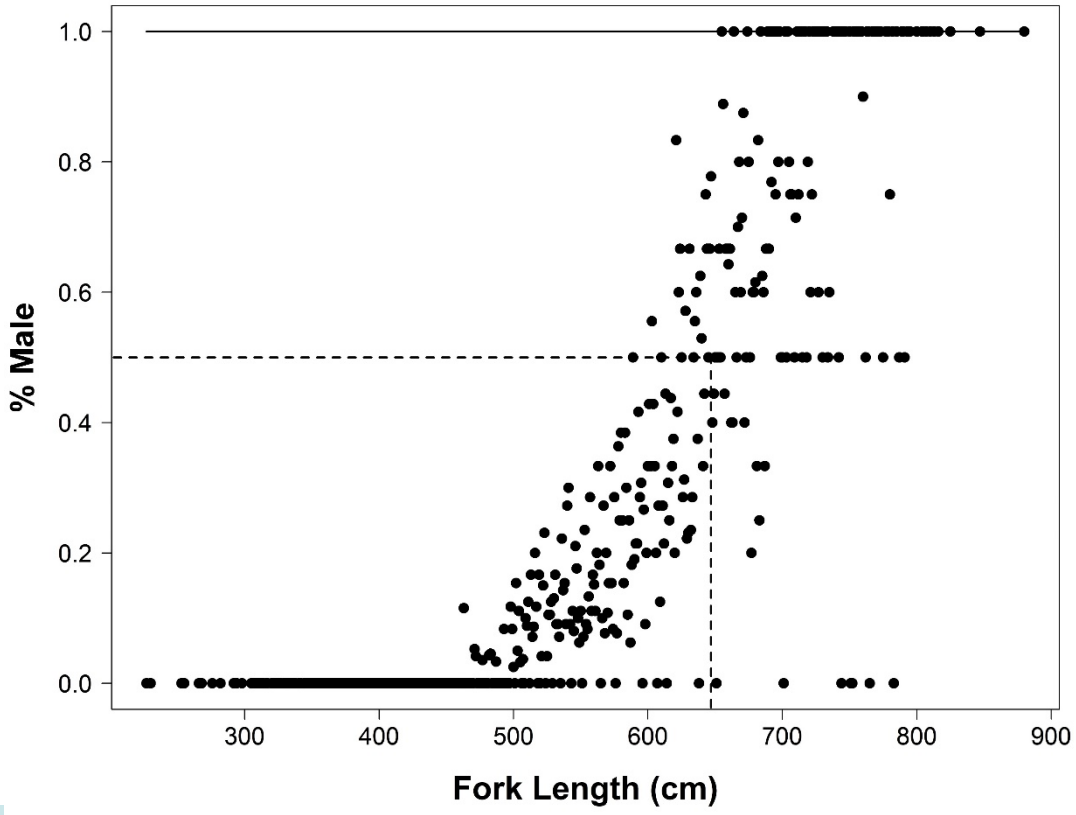


SAtl – Scamp/Yellowmouth size at sex transition

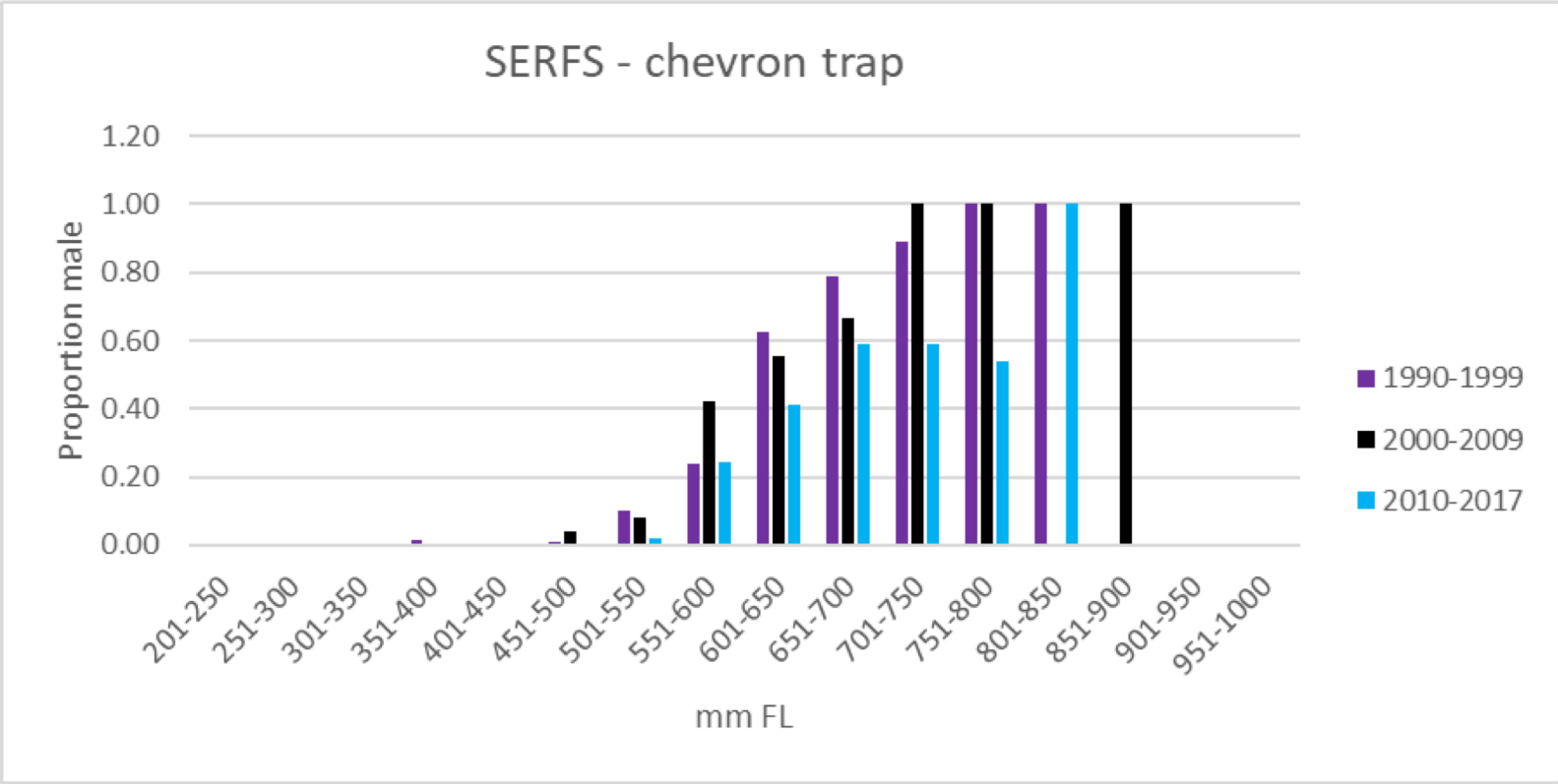
Period	Data	Distribution	N	L_{50} (mm)		Estimate	SE	Pr(>|z|)
1979-2017, all months	Adults only	Probit	4467	635.9	(Intercept)	-6.9406	0.1951	<2e-16
	Female, Trans., Male				CalAge	0.0109	0.0003	<2e-16
1979-2017, all months	**Immature & Adults**	Probit	4584	646.9	(Intercept)	-7.7646	0.2256	<2e-16
	Female and Male only				CalAge	0.0120	0.0004	<2e-16

New recommendation for SAtl:

- ogive based on all fish except transitionals
- L_{50} for GOM is 556 mm



Sex ratio – SERFS chevron trap



- 2010s - Only period with evidence of change (decrease) in prop. male within length interval
  - Further spatial analysis to be done

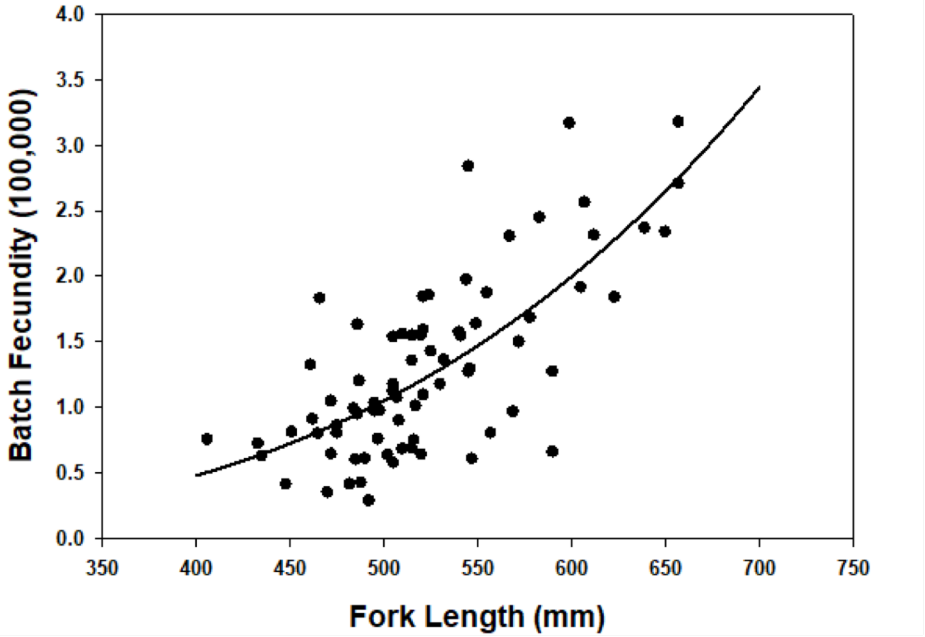
* No conclusive evidence of sperm limitation

S. Atlantic – reproductive potential

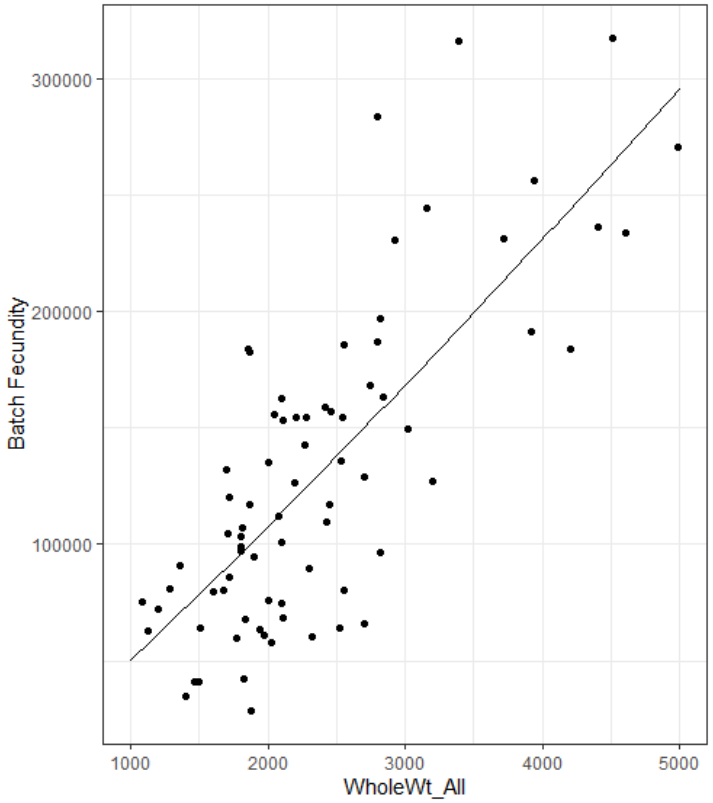
- LH workgroup shifted to recommendation of using total spawning biomass vs TEP (total egg production) in base model
  - Use of TEP would omit reproductive value of males
  - Precedence for use of total spawning biomass in previous SAtl assessments of grouper (Gag, Red Grouper, Snowy)
  - Brooks et al. (2008) – recommendation of total biomass for protogynous species
  - Limitations of batch fecundity data (lack of data for largest females)

  - Workgroup exploring with assessment team:
    - How to weight contributions of male and female biomass to reproductive success
    - TEP in combination with a measure of male reproductive value for sensitivity run

Scamp – batch fecundity at FL, S. Atlantic



- Data from Harris et al. (2002)
- Yr=1996 (n=72) and 1998 (n=4)
- Batch fecundity = b * FL^z



- b= 3.16 E^{-5} (SE 7.30 E^{-5}) and z= 3.53 (SE 0.36)
- Range of FL = 406-657 mm
- 3.0% of SERFS females > 657 mm
- **Recommended equation?**
  - **Decision delayed until August**

- b= 25.12 (SE 20.58) and z= 1.10 (SE 0.10)
- Range of whole wt = 1081-4990 g
- 1.2% of SERFS females > 4990 g

Reproduction: South Atlantic

- LHG Recommendations:
- Recommend these parameters as the most appropriate reproduction data for South Atlantic

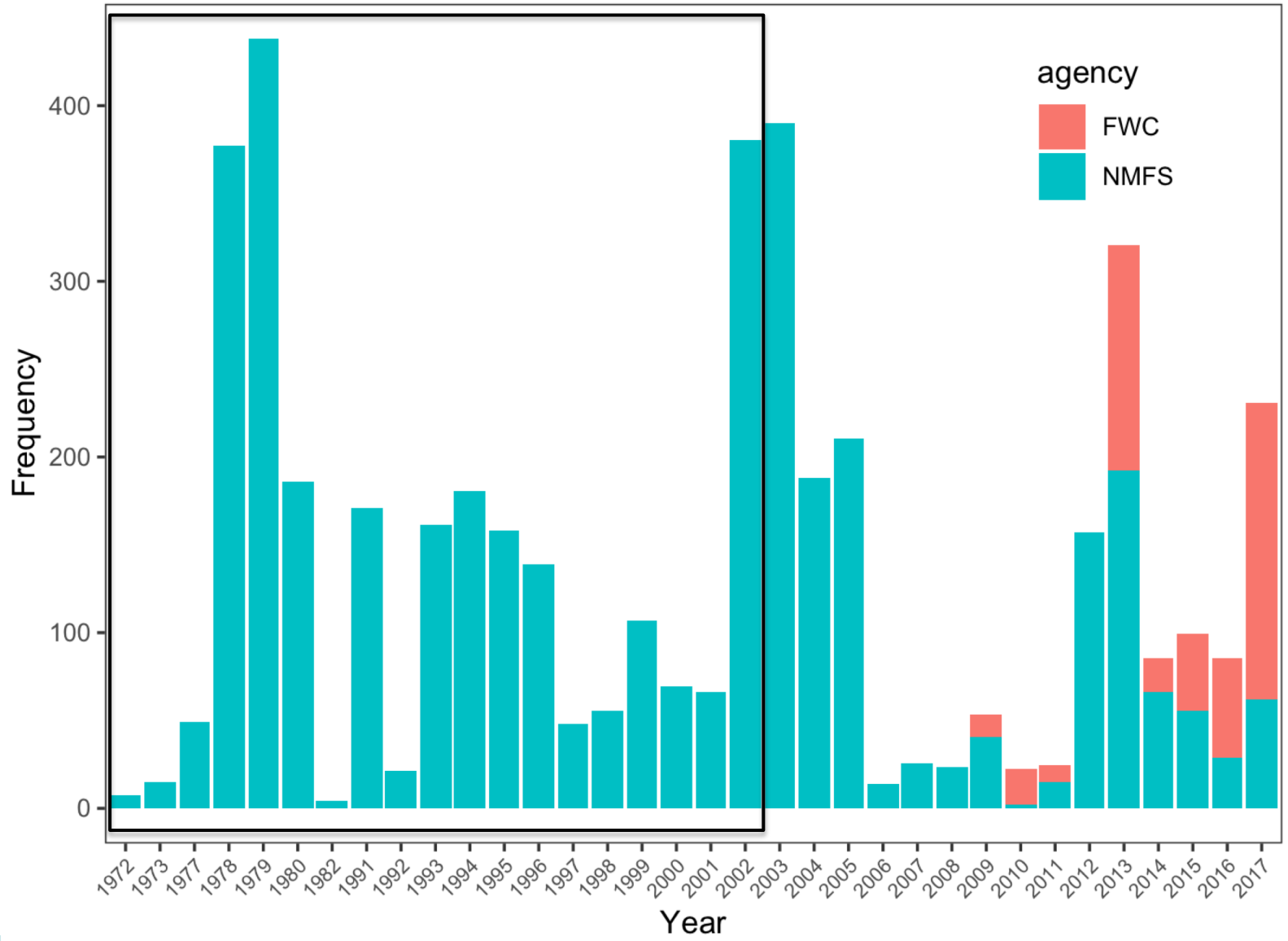
- ADT Recommendation:

SEDAR 68 Scamp Reproduction – Gulf of Mexico

Sue Lowerre-Barbieri, Veronica Beech, Claudia Friess

May 26, 2020

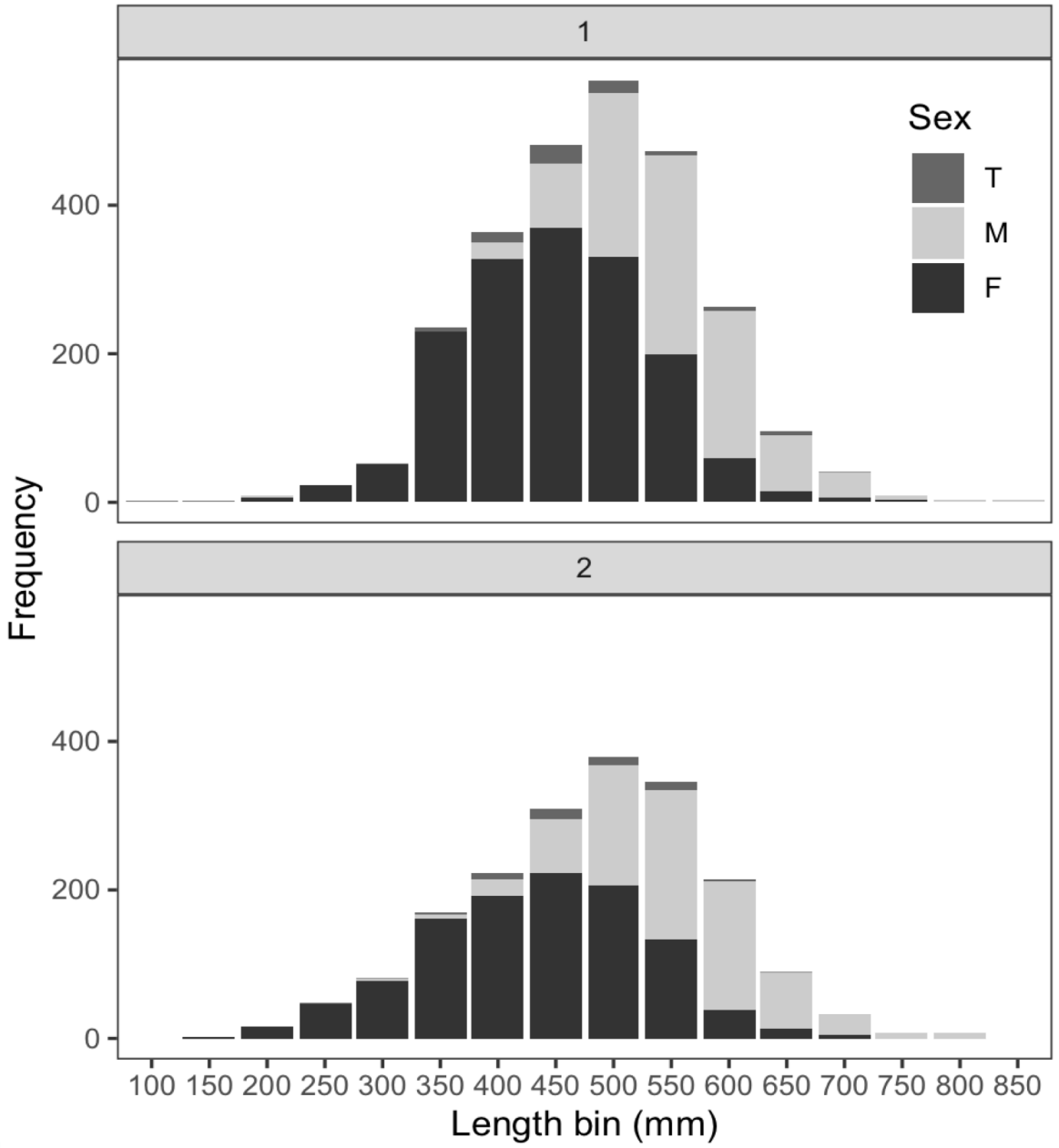
GOM Sample Availability



N = 4,564

N_{aged} = 2,001

GOM Sex ratio



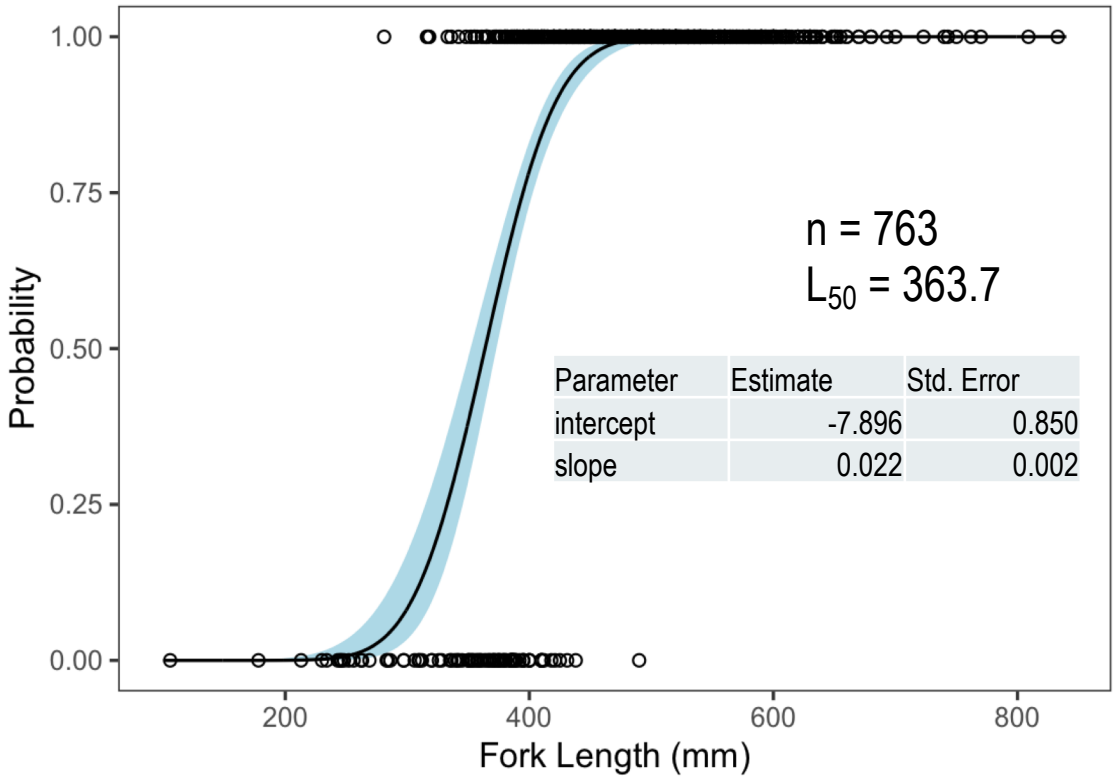
1972 - 2002

2002 - 2017

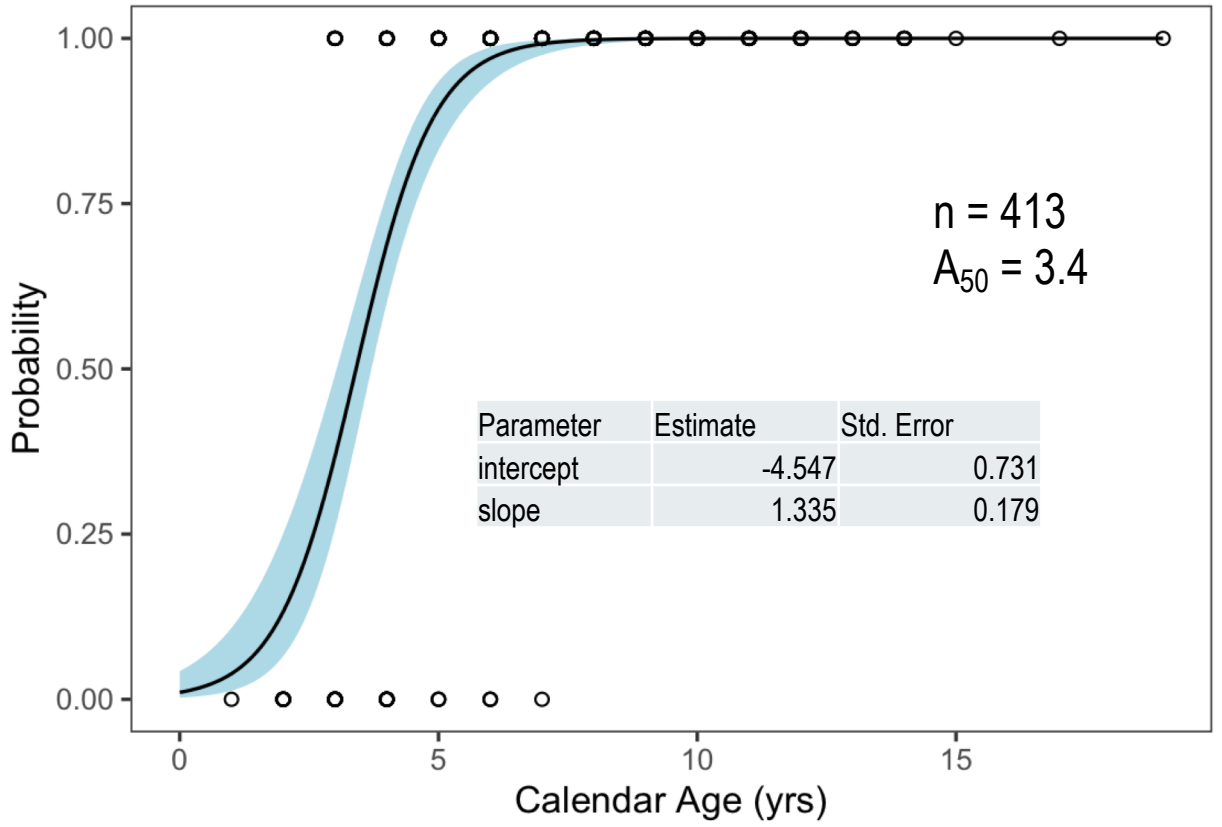
GOM Maturity at age and length

- Time period selected for maturity estimates: Feb 2 – July 25 (period from first to last date a female with spawning indicators was sampled)
- Reproductive stages included: spawning capable and immature

Length (GLM, probit fit)



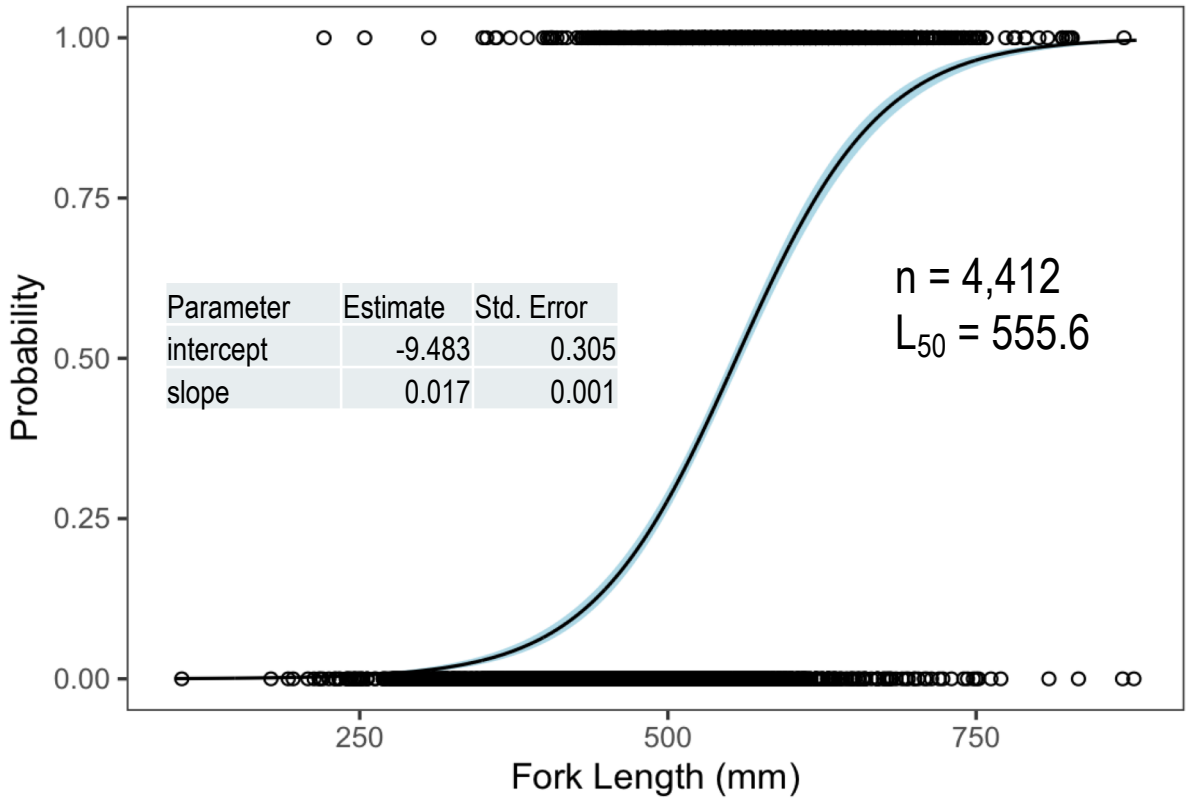
Age (GLM, logit fit)



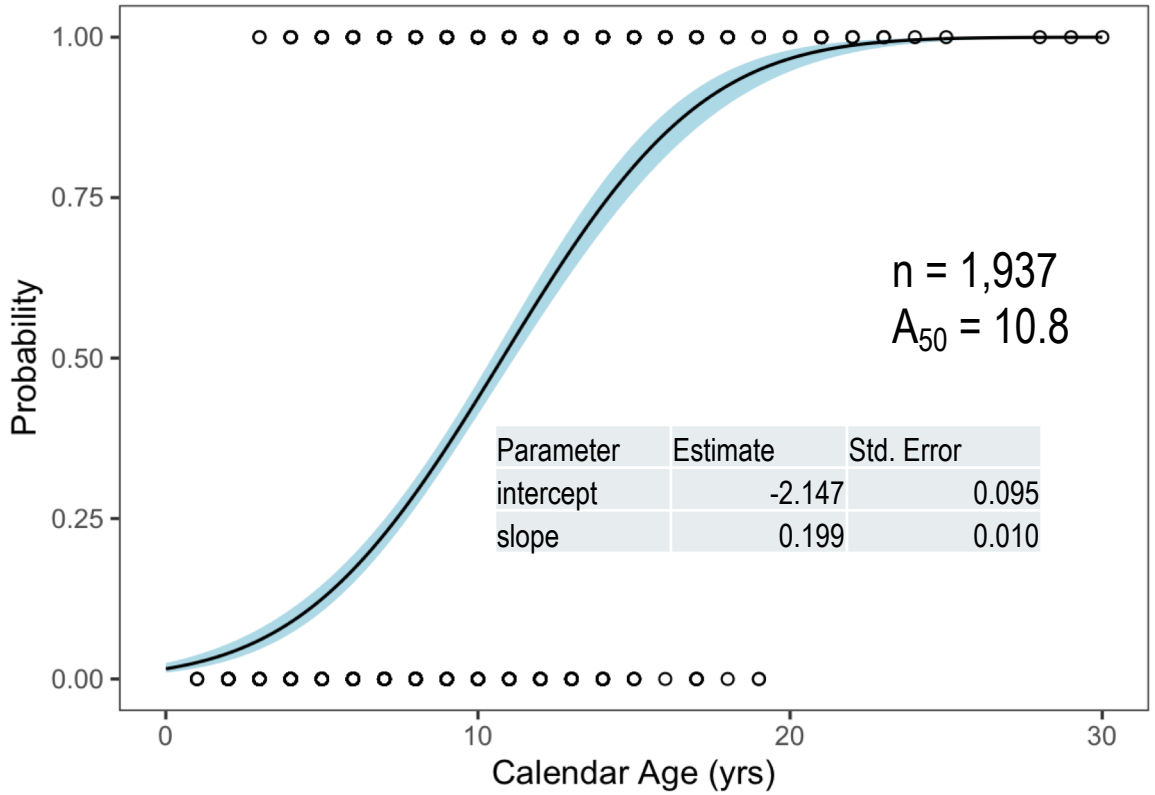
GOM Transition at age and length

- Time period: all months
- Males and Females only (transitionals were excluded)

Length (GLM logit fit)



Age (GLM probit fit)



GOM Spawning frequency

$$Spawning\ Fraction_{age} = \frac{\#\ Actively\ Spawning\ Females_{age}}{\#\ Females_{age}} / 2$$

$$Spawning\ Interval_{age} = \frac{1}{Spawning\ Fraction_{age}}$$

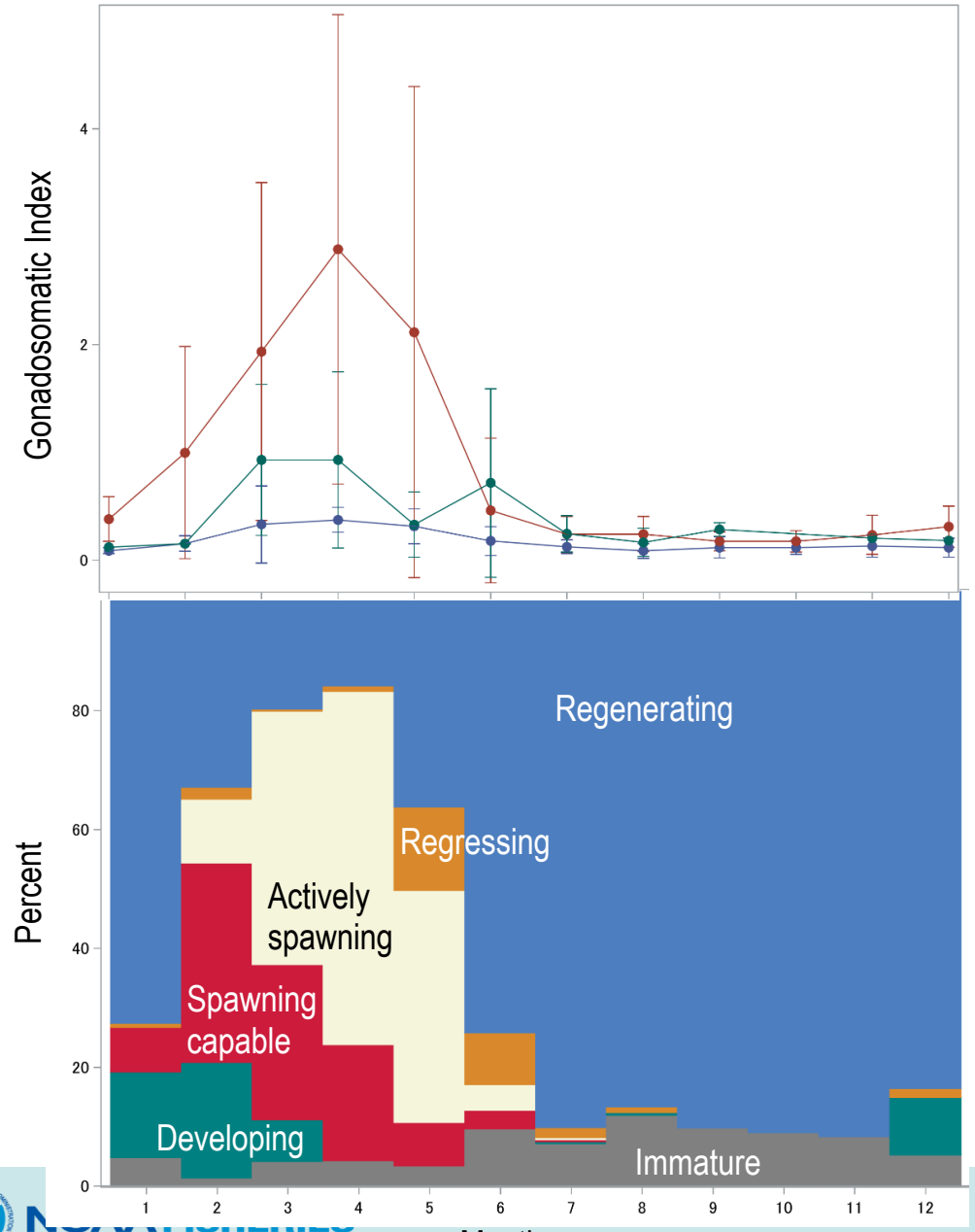
$$Spawning\ Frequency_{age} = SS_{pop} * Spawning\ Fraction_{age}$$

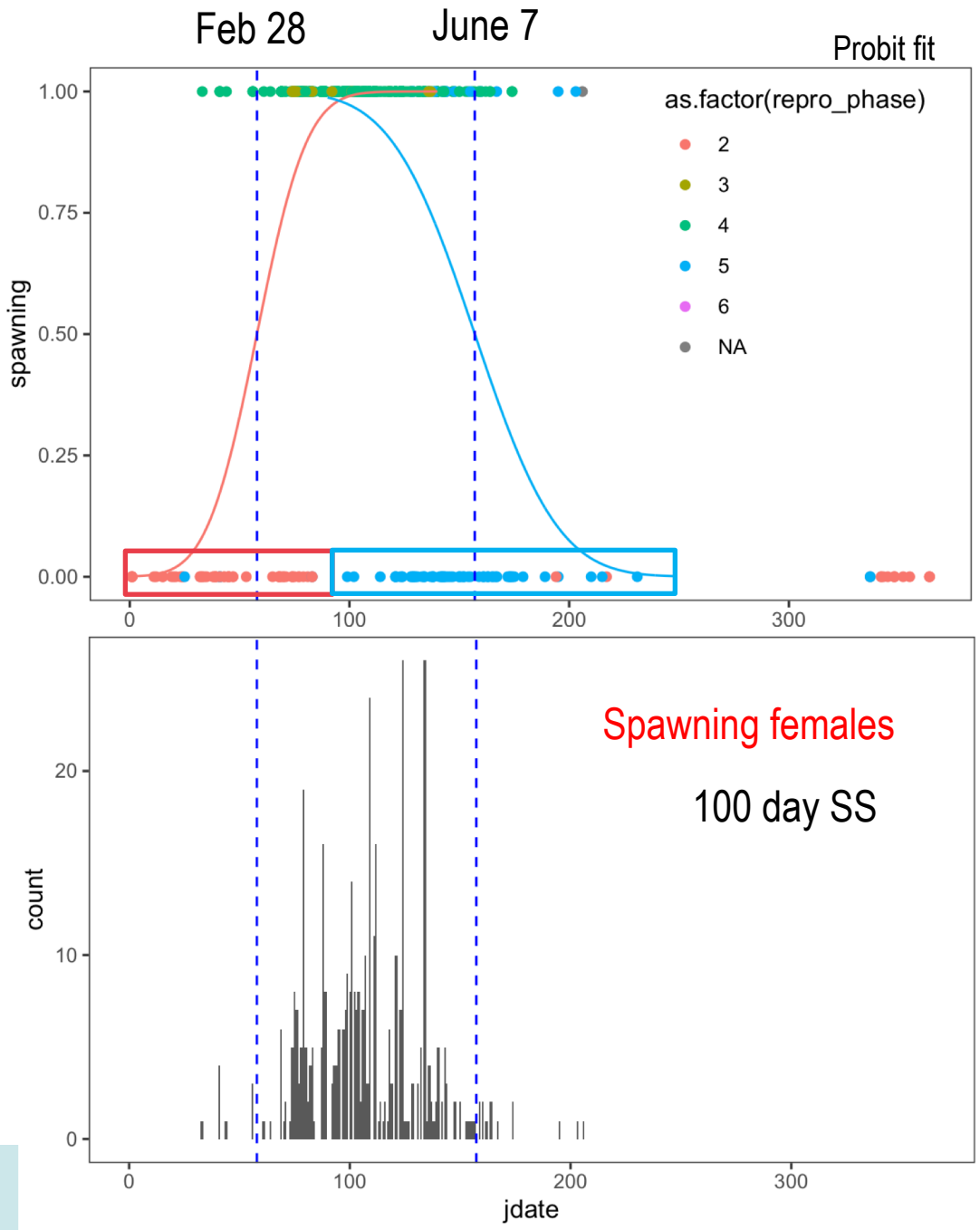
422 spawning capable females, 226 of which had age information

Spawning season length at age

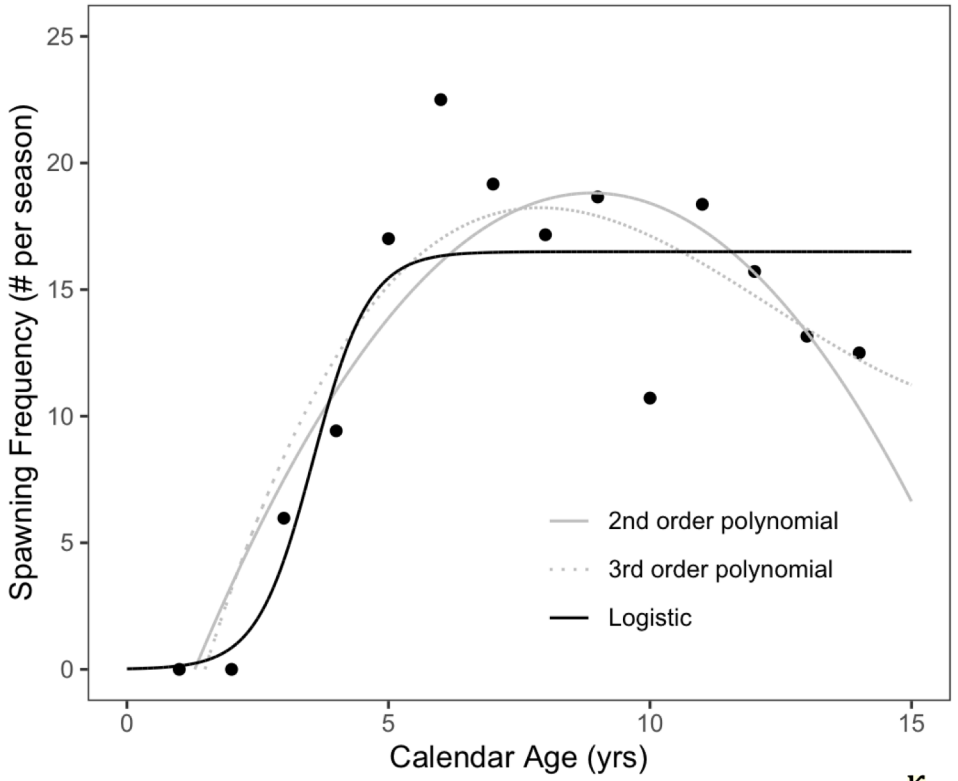
calendar_age	SS length	n
3	49	8
4	76	13
5	159	33
6	126	45
7	59	23
8	88	23
9	82	25
10	78	15
11	59	18
12	49	11
13	29	5
14	66	5
15	0	1
19	0	1
NA	173	196

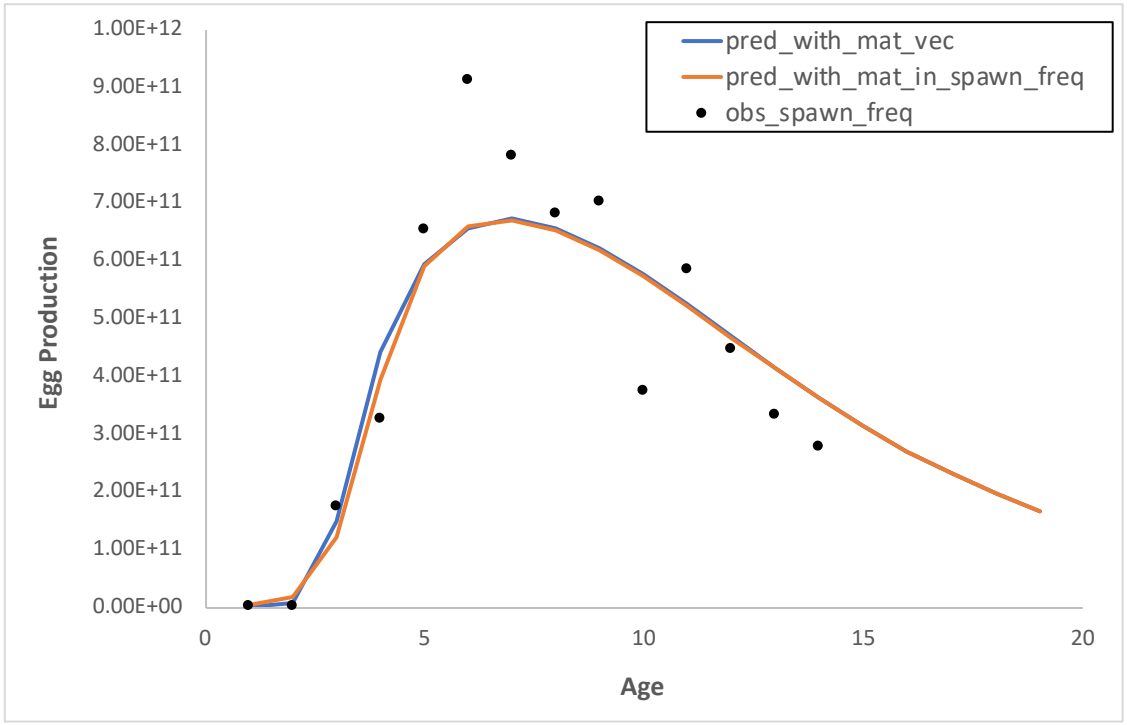
GOM Spawning season length estimation





GOM Spawning frequency estimates (100 day spawning season)





Model comparison

$$y = \frac{\kappa}{(1 + (e^{-a_1 * (x - a_0)})}$$

Model	AIC	delta
Logistic	74.41	0
2nd order poly	79.8	5.39
3rd order poly	79.9	5.49

Parameter	Estimate	St. Error
kappa	16.496	0.059
a1	1.867	0.373
a0	3.556	0.102
sig (for likelihood)	2.992	0.189

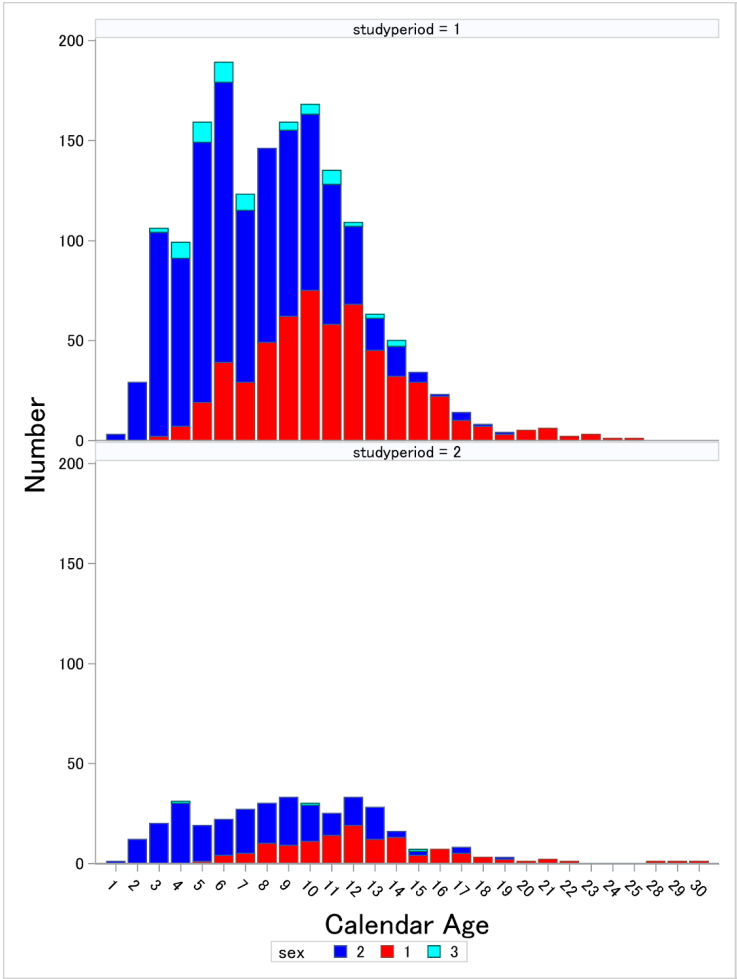
$$Eggs_a = N_a PropF_a SF_a BF_a$$
$$Eggs_a = N_a PropF_a mat_{age} SF_a BF_a$$
$$N_{a+1} = N_a e^{-M}$$

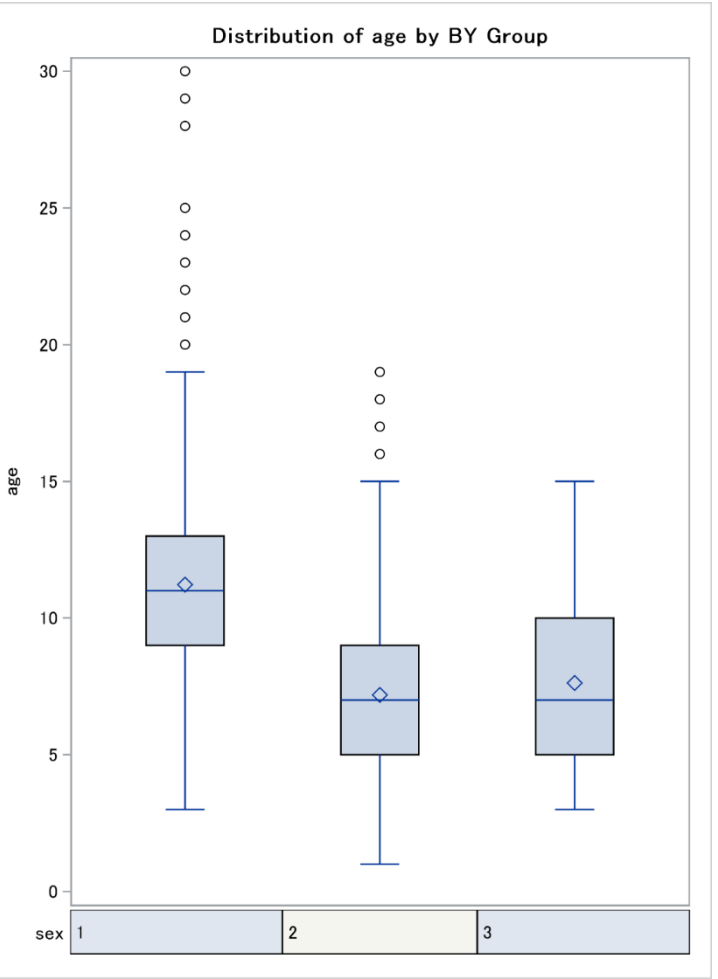
BF_a = South Atlantic batch fecundity at age
Obs SF = GOM observed spawning frequency with females included in denominator

Best measure of reproductive potential

- Issues with total egg production: batch fecundity sample size too small (n=9), would need to use the South Atlantic batch fecundity to size relationship; sample size of females with ages too small to estimate age-specific spawning season duration.

- Given significant differences in size/age distributions by sex and protogynous gender system, important to integrate a measure of male reproductive potential.
- We recommend using combined biomass, with additional measures to most accurately reflect sex-specific and demographic reproductive value (i.e., not assuming equal contributions of male and female biomass to reproductive success and exploring how best to weight age/size contributions for both sexes)





Reproduction: Gulf of Mexico

- LHG Recommendations:
- Recommend these parameters as the most appropriate reproduction data for Gulf of Mexico

- ADT Recommendation:

Reproduction comparison between regions

	South Atlantic	Gulf of Mexico
Length at Maturity (L_{50})	375.2 mm FL	363.7 mm FL
Age at Maturity (A_{50})	2.9 years	3.4 years
Length at Transition (L_{50})	647 mm FL	555.6 mm FL
Age at Transition (A_{50})	10.6 years	10.8 years

To present at next plenary

- SA Reproduction
  - Batch Fecundity
  - Spawning frequency
  - Sperm Limitation
- Natural mortality-Both Regions

ACCEPTED RECOMMENDATION SLIDES

Meristics data: Scamp and Yellowmouth Grouper

- Data from many sources:

Fishery-Dependent	Fishery-Independent
TIPS	SERFS
Headboat Survey	FWRI FIM
MRIP	Dauphin Island study
GulfFin	Gulf Trap Survey
Observer Program	Gulf Longline Survey

Meristics data: South Atlantic Length-Length Conversions

- Recommending Merisitic equations be used as presented

Model: $Y = a + bX$	n	a	SE	b	SE	r^2	Units	range of Independent variable
FL = TL	1999	19.72	1.31	0.89	0	0.99	mm. mm	267 - 1003
TL = FL	1999	-15.01	1.51	1.11	0	0.99	mm. mm	252 - 898
TL = maxTL	152	-0.30	3.34	0.98	0	0.99	mm. mm	457 - 922
maxTL = TL	152	2.95	3.37	1.01	0	0.99	mm. mm	453 - 916
FL = maxTL	5213	23.03	0.70	0.88	0	0.99	mm. mm	193 - 922
maxTL = FL	5213	-20.42	0.83	1.13	0	0.99	mm. mm	184 - 847
FL = SL	5111	25.38	0.90	1.12	0	0.98	mm. mm	149 - 720
SL = FL	5111	-15.46	0.83	0.88	0	0.98	mm. mm	184 - 847
TL = SL	183	17.00	10.57	1.14	0.02	0.95	mm. mm	374 - 695
SL = TL	183	11.97	8.34	0.77	0.01	0.95	mm. mm	453 - 916
maxTL = SL	5321	5.90	1.18	1.26	0	0.98	mm. mm	149 - 750
SL = maxTL	5321	5.07	0.92	0.78	0	0.98	mm. mm	193 - 925

Meristics data: South Atlantic Weight-Length Conversions

- Recommending Merisitic equations be used as presented

Model: $Y = a + bX$	n	Power Equation: $Y = a(X)^b$	r^2	Units	range of Independent variable
Ln(WW) = Ln(FL)	17614	$WW = 7.03E\text{-}08(FL)^{2.75}$	0.92	kg, mm	178 - 1130
Ln(FL) = Ln(WW)	17614	$FL = 417.54(WW)^{0.34}$	0.92	kg, mm	0.083 - 20.98
Ln(WW) = Ln(TL)	2847	$WW = 2.78E\text{-}08(TL)^{2.87}$	0.91	kg, mm	183 - 1003
Ln(TL) = Ln(WW)	2847	$TL = 443.31(WW)^{0.32}$	0.91	kg, mm	0.10 - 11.00
Ln(WW) = Ln(maxTL)	4805	$WW = 1.21E\text{-}08(maxTL)^{3.00}$	0.95	kg, mm	193 - 922
Ln(maxTL) = Ln(WW)	4805	$maxTL = 451.20(WW)^{0.32}$	0.95	kg, mm	0.083 - 15.50
Ln(WW) = Ln(SL)	4749	$WW = 2.92E\text{-}08(SL)^{2.97}$	0.94	kg, mm	149 - 750
Ln(SL) = Ln(WW)	4749	$SL = 351.46(WW)^{0.32}$	0.94	kg, mm	0.083 - 15.50

Meristics data: GOM Length-Length Conversions

- Recommending Merisitic equations be used as presented

Model: $Y = a + bX$	n	a	SE	b	SE	r^2	Units	range of Independent variable
FL = TL	3205	17.74	0.95	0.89	0.00	0.99	mm. mm	167 - 976
TL = FL	3205	-12.88	1.09	1.11	0.00	0.99	mm. mm	160 - 944
TL = maxTL	520	-2.78	1.35	0.99	0.00	0.996	mm. mm	325 - 1001
maxTL = TL	520	4.63	1.36	1.01	0.00	0.996	mm. mm	312 - 976
FL = maxTL	2994	23.01	0.71	0.87	0.00	0.99	mm. mm	187 - 1001
maxTL = FL	2994	-22.75	0.85	1.14	0.00	0.99	mm. mm	178 - 944
FL = SL	3042	19.53	0.84	1.12	0.00	0.99	mm. mm	146 - 798
SL = FL	3042	-13.37	0.77	0.88	0.00	0.99	mm. mm	178 - 944
TL = SL	606	3.57	3.42	1.25	0.00	0.97	mm. mm	247 - 798
SL = TL	606	7.58	2.68	0.78	0.00	0.97	mm. mm	260 - 976
maxTL = SL	3258	-0.53	1.00	1.28	0.00	0.99	mm. mm	139 - 798
SL = maxTL	3258	4.82	0.77	0.77	0.00	0.99	mm. mm	175 - 1001

Meristics data: GOM Weight-Length Conversions

- Recommending Merisitic equations be used as presented

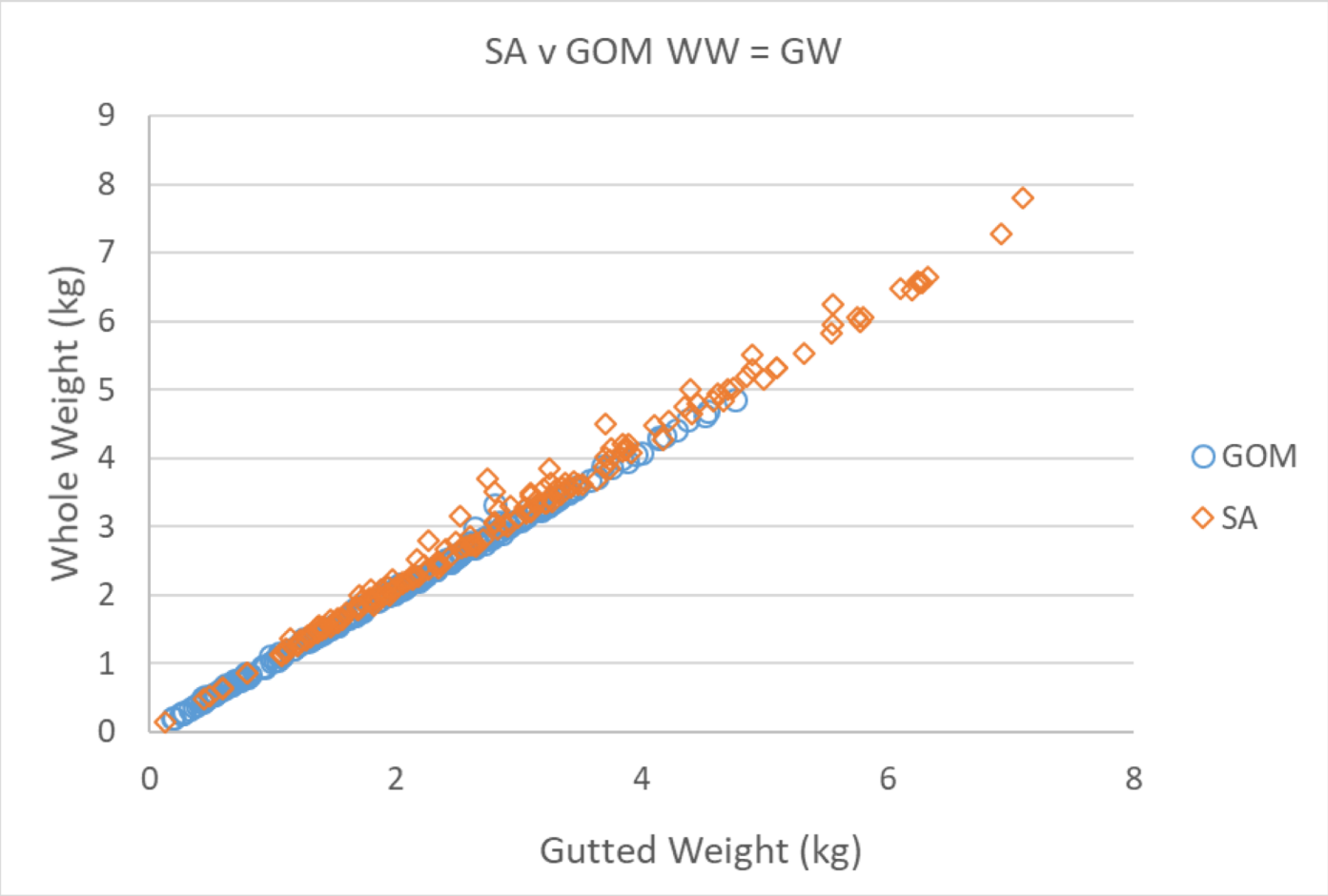
Model: $Y = a + bX$	n	Power Equation	r^2	Units	range of Independent variable
Ln(WW) = Ln(FL)	12660	$WW = 2.14E\text{-}08(FL)^{2.94}$	0.92	kg, mm	160 - 1240
Ln(FL) = Ln(WW)	12660	$FL = 417.17(WW)^{0.31}$	0.92	kg, mm	0.053 - 29.93
Ln(WW) = Ln(TL)	3059	$WW = 2.16E\text{-}08(TL)^{2.90}$	0.92	kg, mm	167 - 1176
Ln(TL) = Ln(WW)	3059	$TL = 447.87(WW)^{0.32}$	0.92	kg, mm	0.053 - 16.82
Ln(WW) = Ln(maxTL)	1972	$WW = 2.27E\text{-}08(maxTL)^{2.88}$	0.96	kg, mm	230 - 1001
Ln(maxTL) = Ln(WW)	1972	$maxTL = 455.54(WW)^{0.33}$	0.96	kg, mm	0.13 - 10.14
Ln(WW) = Ln(SL)	2092	$WW = 4.40E\text{-}08(SL)^{2.89}$	0.97	kg, mm	177 - 798
Ln(SL) = Ln(WW)	2092	$SL = 354.74(WW)^{0.33}$	0.97	kg, mm	0.13 - 10.14

Meristics data: South Atlantic and Gulf of Mexico

- Working group recommendation: Recommend using length-length and weight-Length Meristic conversions as presented

- ADT Recommendation:

South Atlantic and Gulf of Mexico
Whole Weight = Gutted Weight No intercept Relation



AREA	Slope	r^2
ALL N = 396	1.05	0.9987
SA N = 171	1.07	0.9985
GOM N = 225	1.03	0.9997

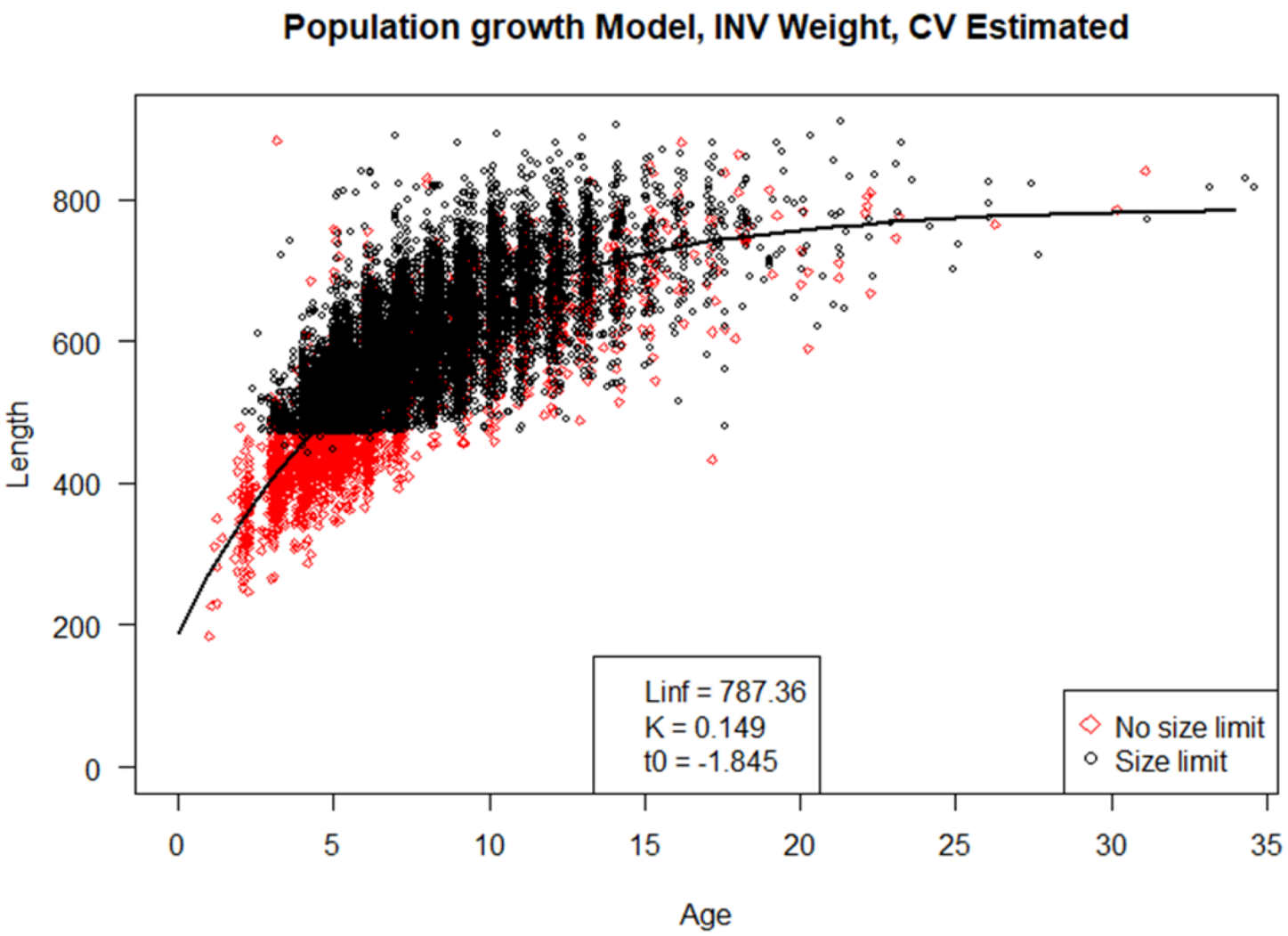
Meristics data: South Atlantic and Gulf of Mexico

- Whole Weight = Gutted Weight
  - SA - primarily fishery-independent data (few fishery-dependent)
  - GOM - fishery-dependent data
  - It's likely the fishery independent study was more thorough in extracting all of the guts, whereas fishery dependent likely left some remnants
  - Small sample sizes from both regions and SA had wider range of values.
  - **Working Group Recommend combining data to have one Whole Weight-Gutted Weight Conversion**
- **ADT Recommendation:**

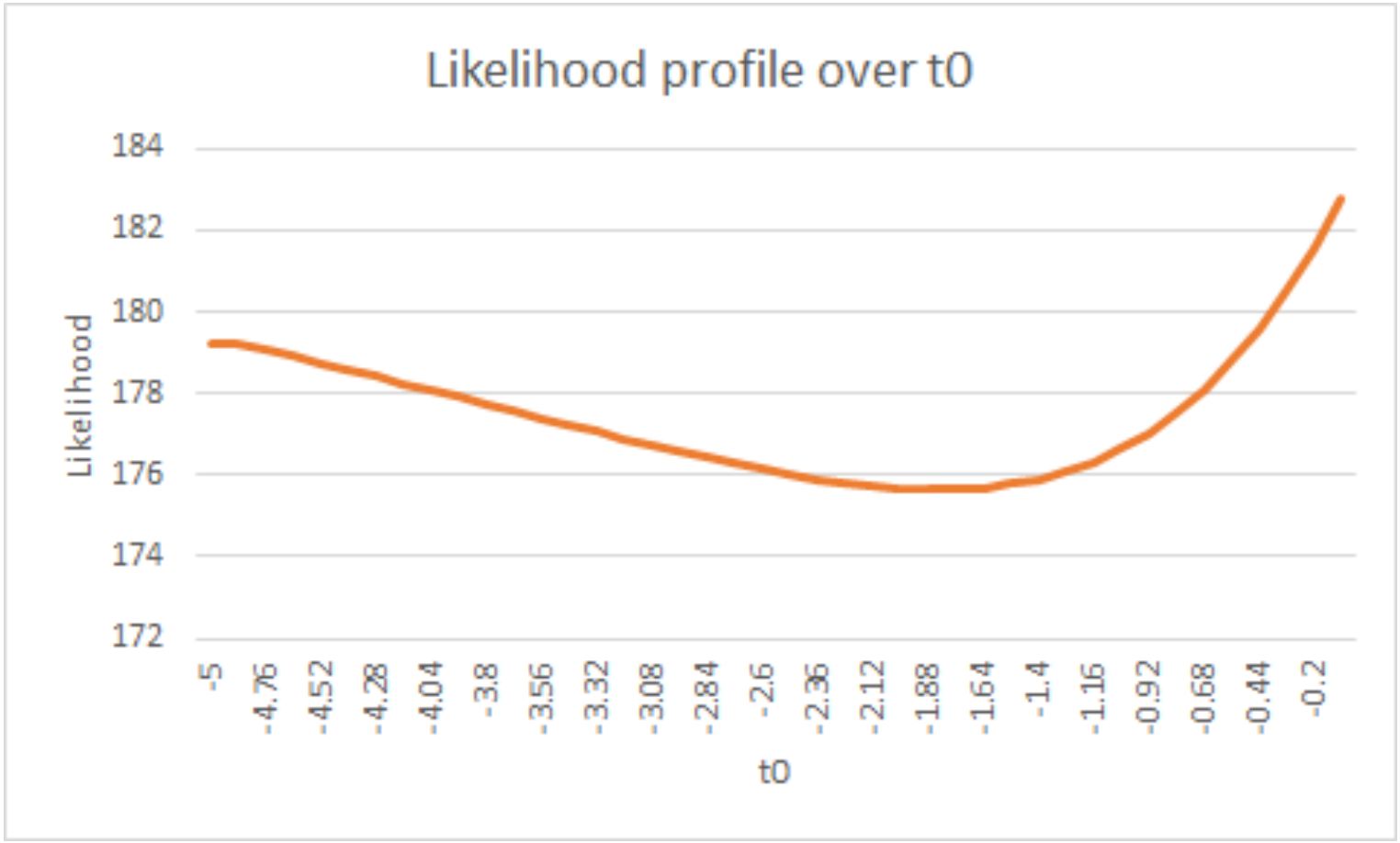
Growth Models: South Atlantic-Overview

	Linf	K	t0	C.V.
Population model (n= 16778)	787.36 ± 26.35	0.149 ± 0.027	-1.845 ± 0.711	0.1 ± 2.6815e-005
Fisheries model (n= 13811)	906.26 ± 15.81	0.0805 ± 0.00402	-5.56 ± 0.258	0.095 ± 5.7927e-004
Fisheries Pre 1992 model (n= 121)	743.52 ± 68.89	0.174 ± 0.0499	-0.817 ± 0.727	0.149 ± 9.7876e-003
Fisheries Post 1992 model (n= 13690)	819.06 ± 17.48	0.076 ± 0.0042	-5.19 ± 0.288	0.1 ± 7.1679e-008
Females only model (n= 3568)	761.51 ± 79.21	0.128 ± 0.051	-2.53 ± 1.42	0.118 ± 0.0199

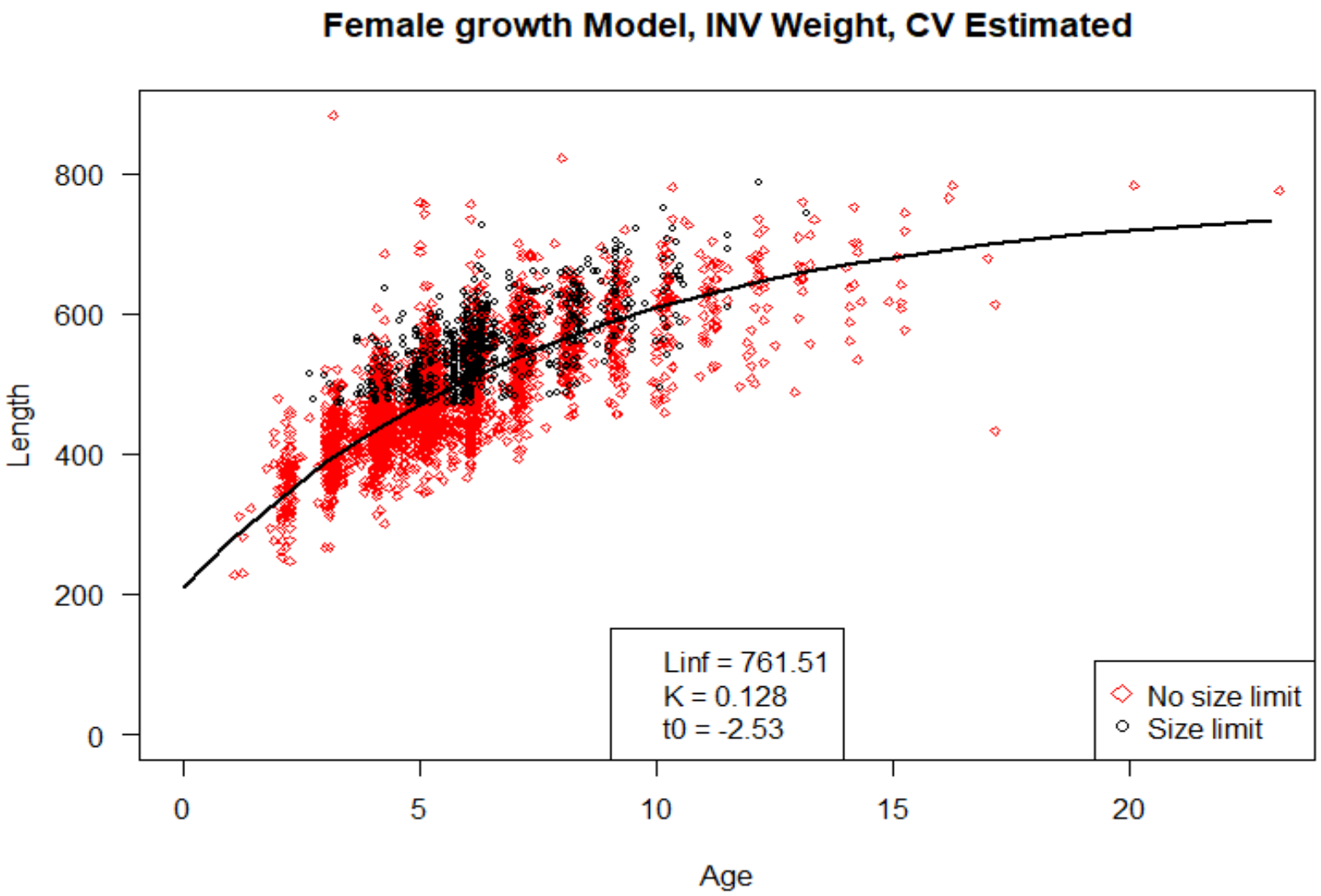
Growth Models: South Atlantic-Population Model



Population growth curve, model estimate is -1.84, which is the minimum of the likelihood.



Growth Models: South Atlantic-Females



Growth Models: South Atlantic

- LHG Recommendations: Recommend these as the best growth models for categories requested for South Atlantic

- ADT Recommendation: