

SEDAR 94: Florida Hogfish

WFS Base Model Configuration



WFS Base Model Configuration

Assessment Model

- Stock Synthesis v.3.30.24.1
 - SCA in the integrated analysis class
- Fair to moderate complexity

Spatio-temporal

- Years: 1986 – 2024
- 1 season (annual), 1 area (stock)
- Spawning: January 1
 - Core season: Dec - Apr
- Settlement: one event on Feb 1 at age-0
 - Pelagic larval period ca. 34 days
- Time-blocks: follow min size/bag limits
 - 1986-1999, 2000-2017, 2018-2024

Life History

- VB growth **estimated** internally
 - ***Linf*: 82.3 cm FL; *k* = 0.112**
 - Platoons: 3,
 - Dist: 0.15, 0.70, 0.15
- Ages: 0 – 23
- $M = 0.235$ for **ages 3 -23** using Lorenzen
- Length-weight: fixed params
- Female maturity: fixed age-logistic
- Fecundity: spawning biomass at length
- Two-sex model:
 - Female to male hermaphroditism based on stock-specific functions
 - Management quantities based on combined SSB

WFS Base Model Configuration

Fishing Fleets

- Commercial
 - Combined gear: SP, HL, TR
 - Landings (mt)
 - Fit exactly
 - No discards
- Recreational SP
 - Landings (000s)
 - Fit exactly
 - No discards
- Recreational HL
 - Landings and discards (000s)
 - Discard mortality: 41.4%
 - Fit exactly

Surveys

- FWRI Seagrass TW
- SEAMAP TW
- Combined Video

WFS Base Model Configuration

- Length Compositions

- COM, REChl (landings and discards), RECsp
 - **Super periods** applied following regulatory time blocks to boost sample sizes and reduce noise
- SEAMAP and COMB_VIDEO
 - Annual compositions retained

- Conditional Age at Length (CAAL)

- SEAMAP Trawl
- FI_LHR_SP



WFS Base Model Configuration

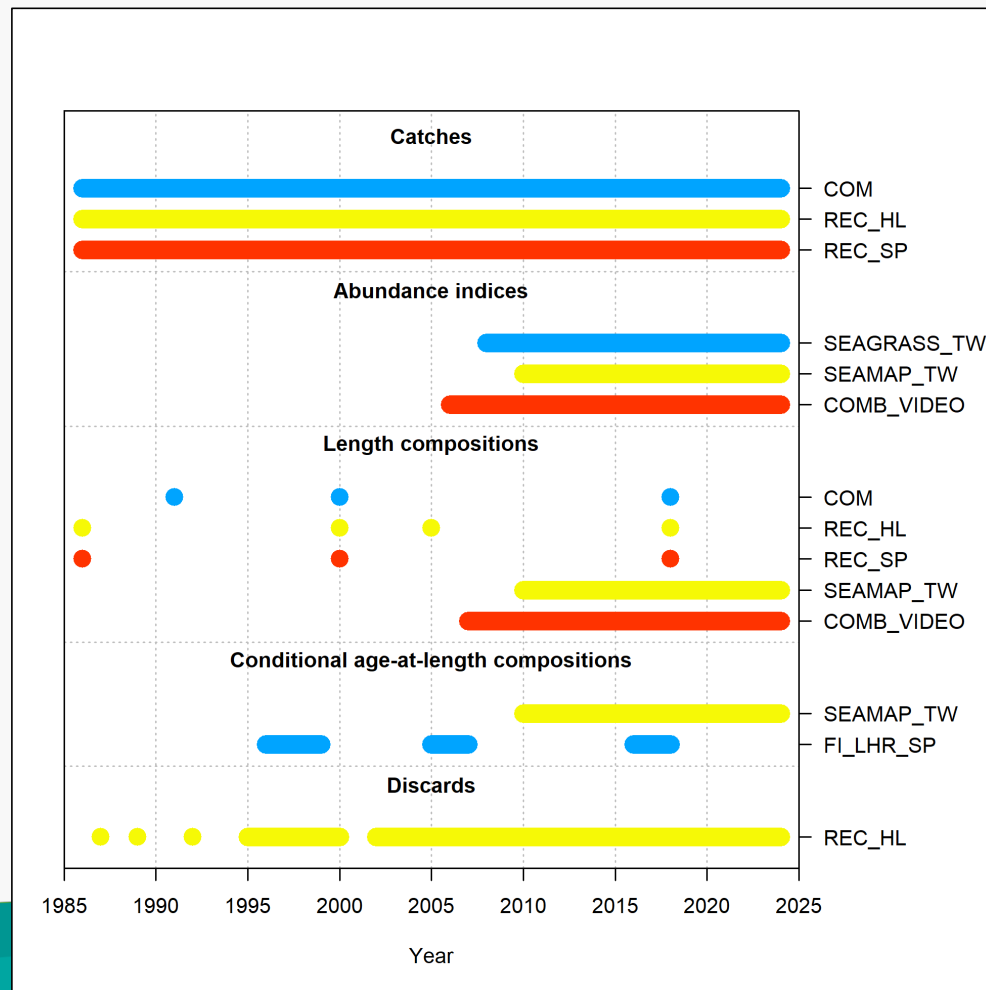


Figure 4.1

WFS Base Model Configuration

Fleet Selectivity

- Commercial Combined – double normal (domed w/ flexibility)
 - No discards
- Recreational SP – double normal (domed w/ flexibility)
 - No discards
- Recreational HL – double normal (domed w/ flexibility)

Index Selectivity

- FWRI Seagrass TW
 - Constant age-0
- SEAMAP TW
 - Double normal (domed w/ flexibility)
 - Constant catchability
- Combined Video
 - Single logistic (flat-topped)

WFS Base Model Configuration

Stock-recruitment Dynamics

- Beverton-Holt stock-recruitment model
 - Virgin recruitment in log-space ($\ln(R_0)$) – estimated
 - Steepness –**fixed (0.99)**
 - Lack of contrast in catch timeseries prevent steepness from being estimated (i.e., no historical catch causing decline in SSB and R, followed by reduction in catch, causing recovery of SSB and R).
 - Standard deviation of log of recruitment (σ_R) – estimated but checked against alternative value following tuning by Methot and Taylor (2011) via r4ss
 - **SR_regime offset applied to 1985** (before start year)
 - Assumes population is not in equilibrium at model start year
- Simple recruitment deviations
 - Sum-to-zero constraint
- Main recruitment deviations
 - 1986 – 2024 (period of higher data-richness)
 - No early rec devs to influence initial population structure
- Bias adjustments (following Methot and Taylor 2011)



WFS Base Model Configuration

Parameters

- 87 out of 124 parameters estimated
 - *Life history*: 26
 - *S-R*: 6
 - *Annual recruitment deviations*: 40
 - *Catchability*: 3
 - *Selectivity*: 50

Reported Fishing Mortality Rates

- Exploitation rate
 - Dead biomass/total age_1+ biomass
 - Accounts for females and males
 - Consistent with tracking M/F SSB
 - Utilized in SEDAR 37 and cited for multiple fleet selectivities



WFS Base Model Configuration

Model Convergence Criteria

- Total likelihood (sum of individual data components)
- Invertible Hessian matrix
- Maximum gradient < 0.0001

Error Structure

- Assumes log-normal for all landings, indices, and discard data

Data Weighting

- Francis weighting applied to all length and age comp data
 - Most components down-weighted
 - Upweight REChl lengths (2.5) and RECsp lengths (1.3)
- Improved fits to all indices and length/age data via LL



SEDAR 94: Florida Hogfish

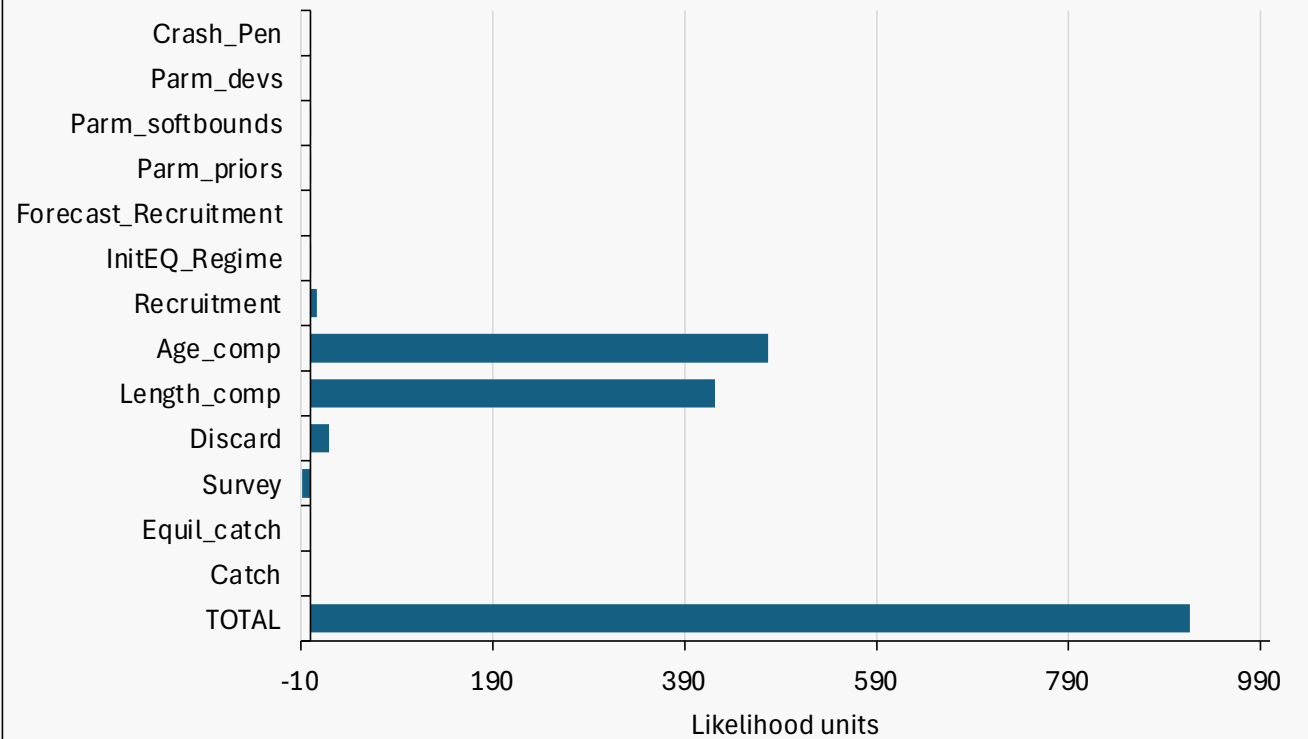
WFS Base Model Fits



Model Likelihood Components

Total negative log-likelihood = 916.605

Log Likelihood Components



Internal Estimation of Growth

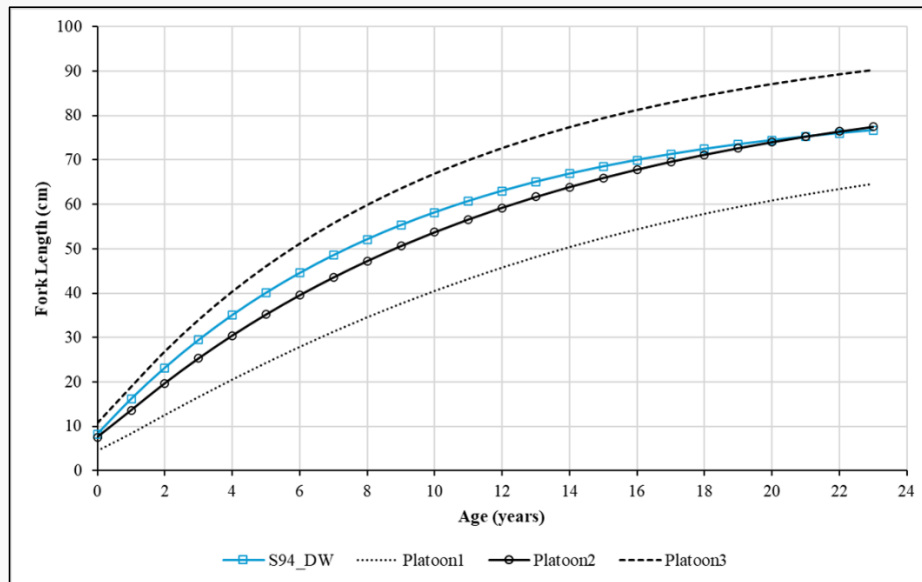


Figure 4.11

- Von Bertalanffy
 - $L_{inf} = 89.6$ cm FL
 - $k = 0.083$
- 3 platoons
 - 0.15, 0.7, 0.15
 - $Platoon_sd_ratio = 0.85$

Data

Config

Results

Landings

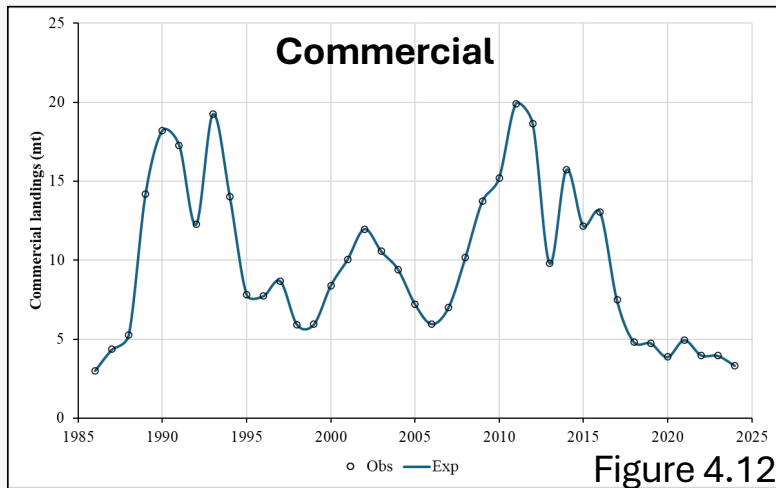


Figure 4.12

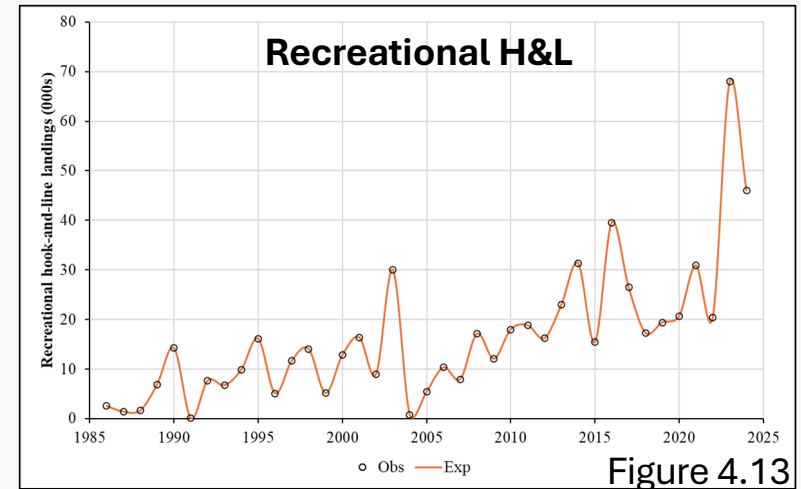


Figure 4.13

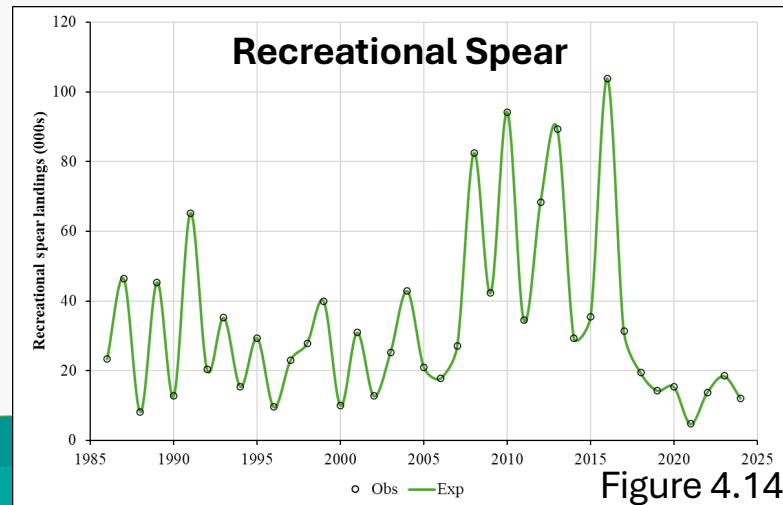


Figure 4.14



Landings

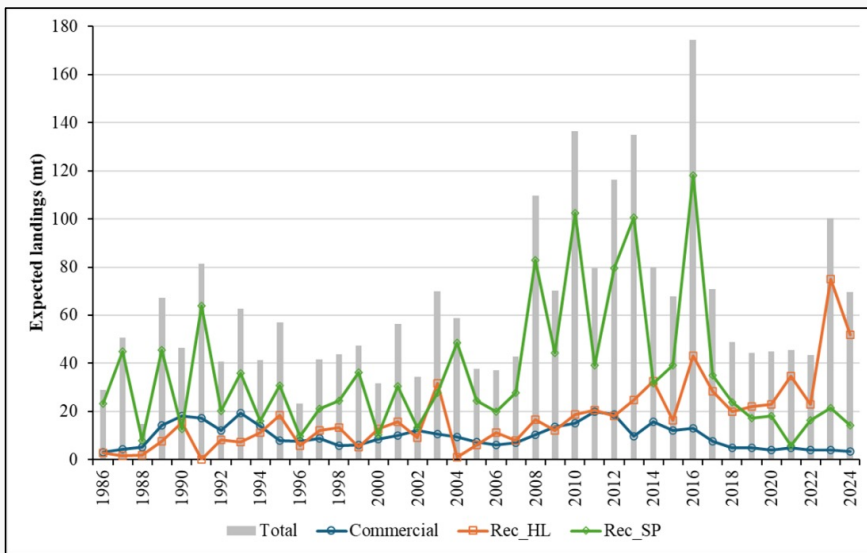


Figure 4.15

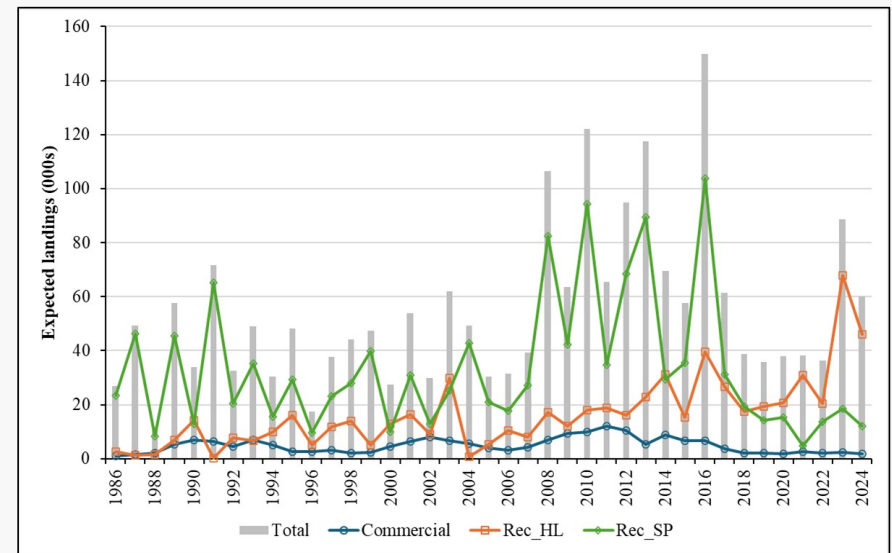
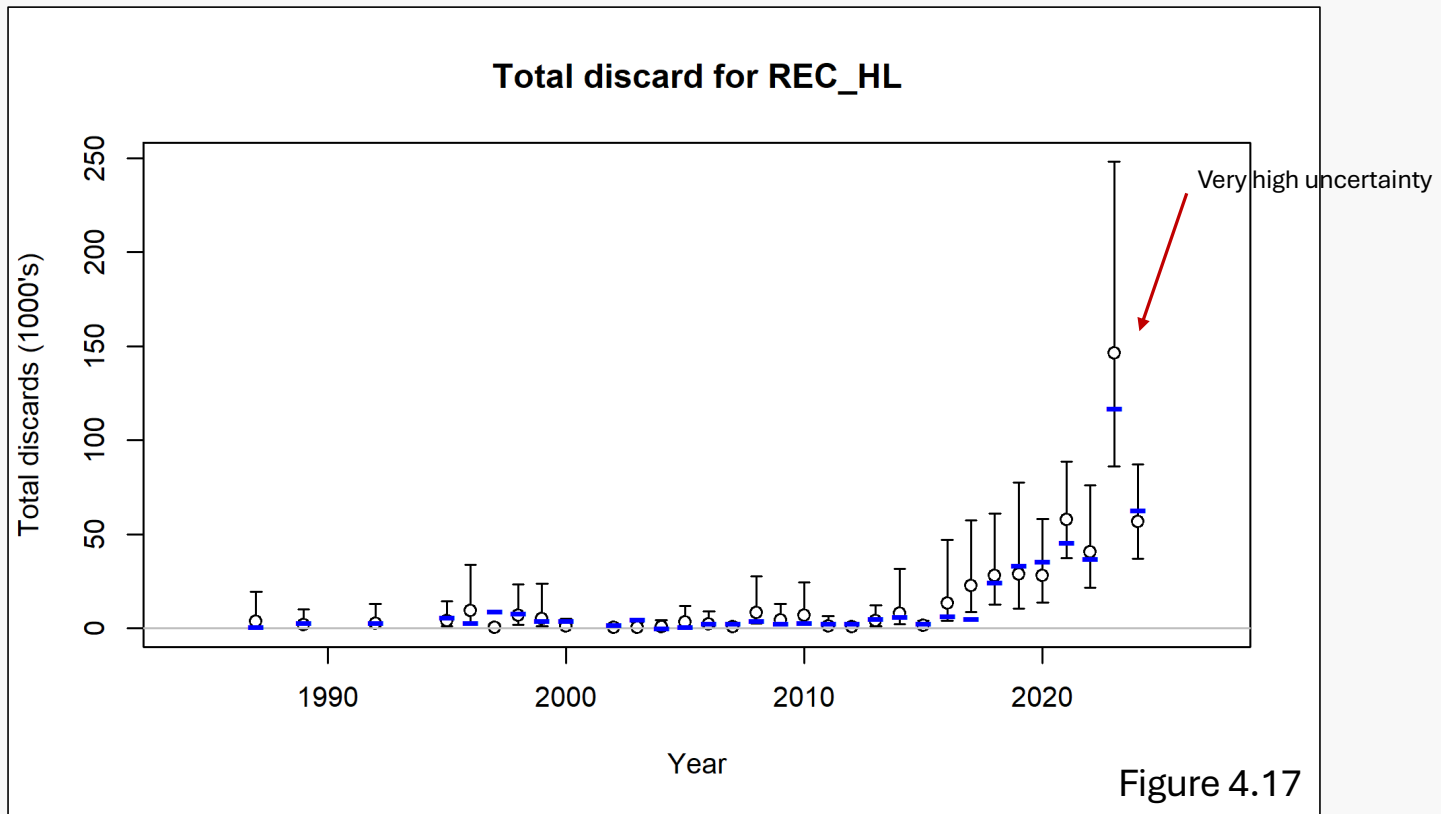


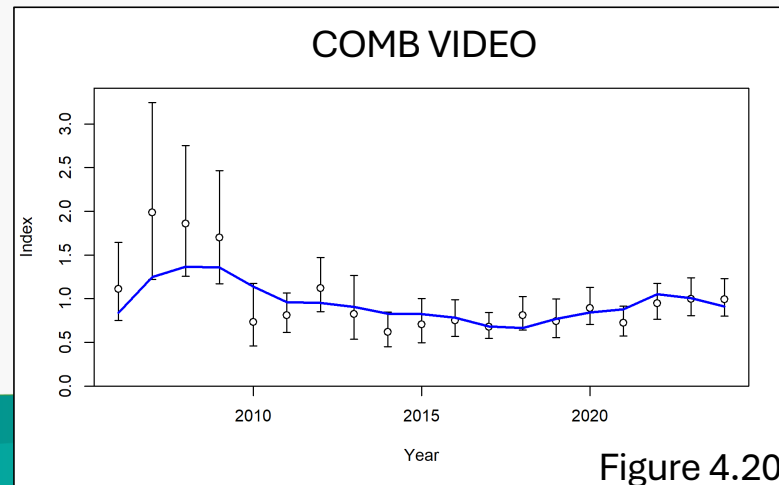
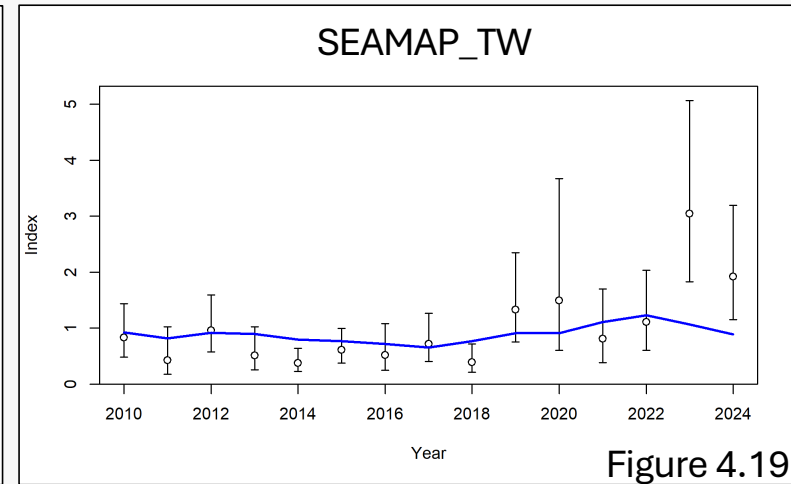
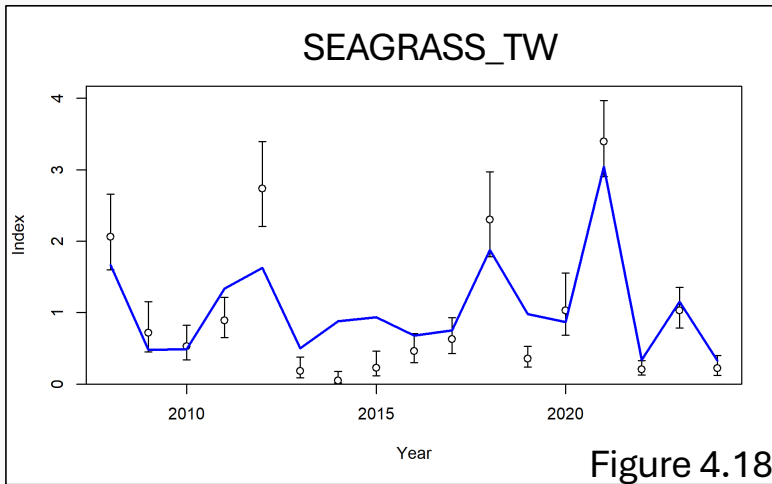
Figure 4.16



Discards



Indices of Abundance



Index residuals

INDEX	RUNS.P	TEST	SIGMA3.LO	SIGMA3.HI	TYPE
SEAGRASS_TW	0.261	Passed	-1.33151	1.331509	CPUE
SEAMAP_TW	0.155	Passed	-1.43683	1.43683	CPUE
COMB_VIDEO	0.243	Passed	-0.58245	0.582452	CPUE

INDICES	RMSE %	nobs
SEAGRASS_TW	67.2	17
SEAMAP_TW	52.8	15
COMB_VIDEO	22.2	19
Combined	50.1	51

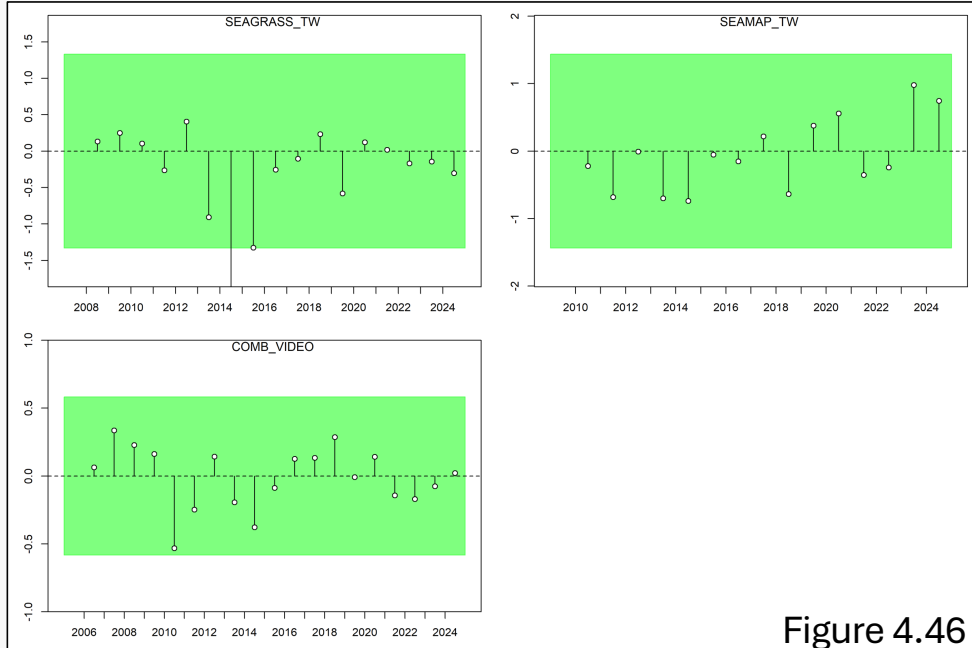


Figure 4.46

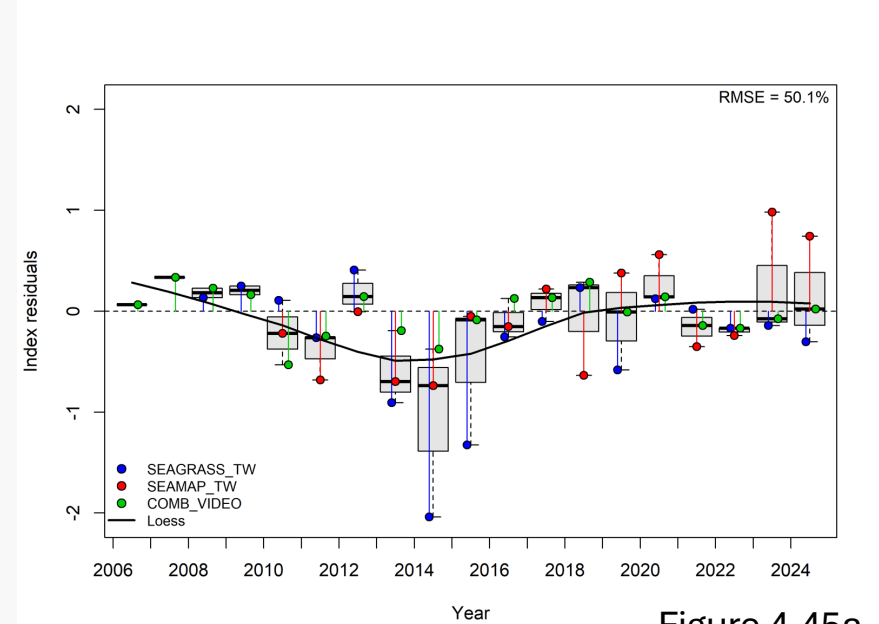


Figure 4.45a

Length Composition

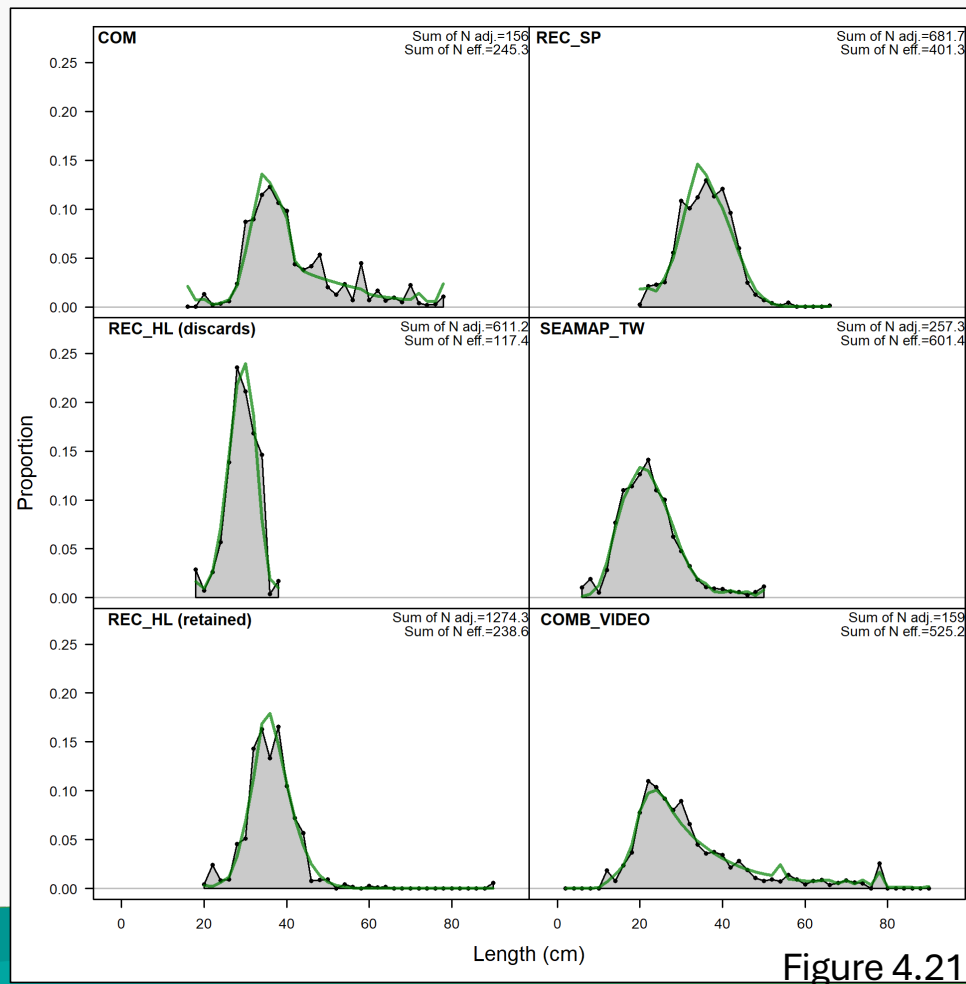


Figure 4.21

Length Composition

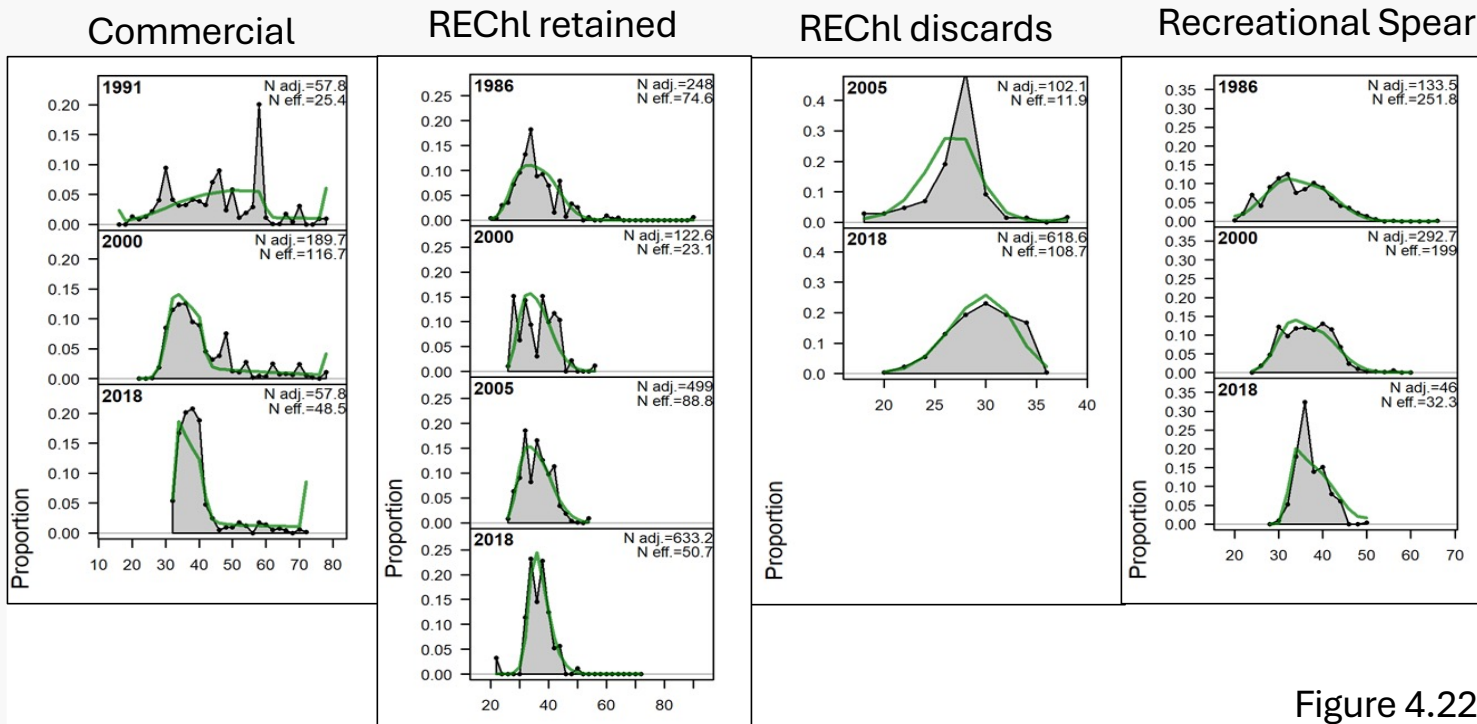


Figure 4.22

SEAMAP Trawl Length Composition

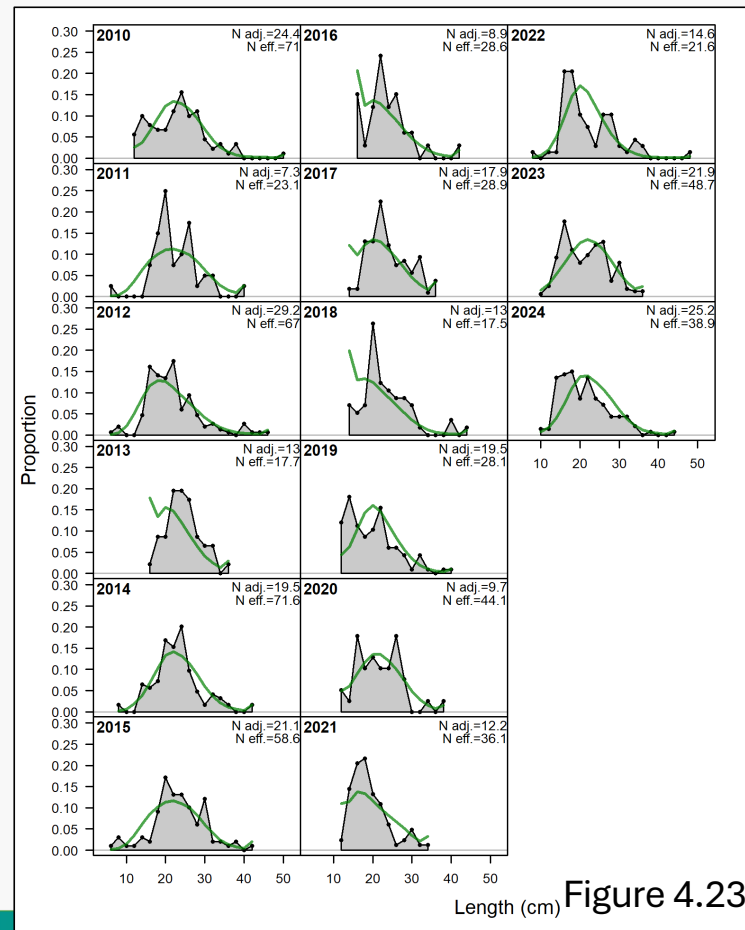


Figure 4.23

Data

Config

Results

Combined Video Length Composition

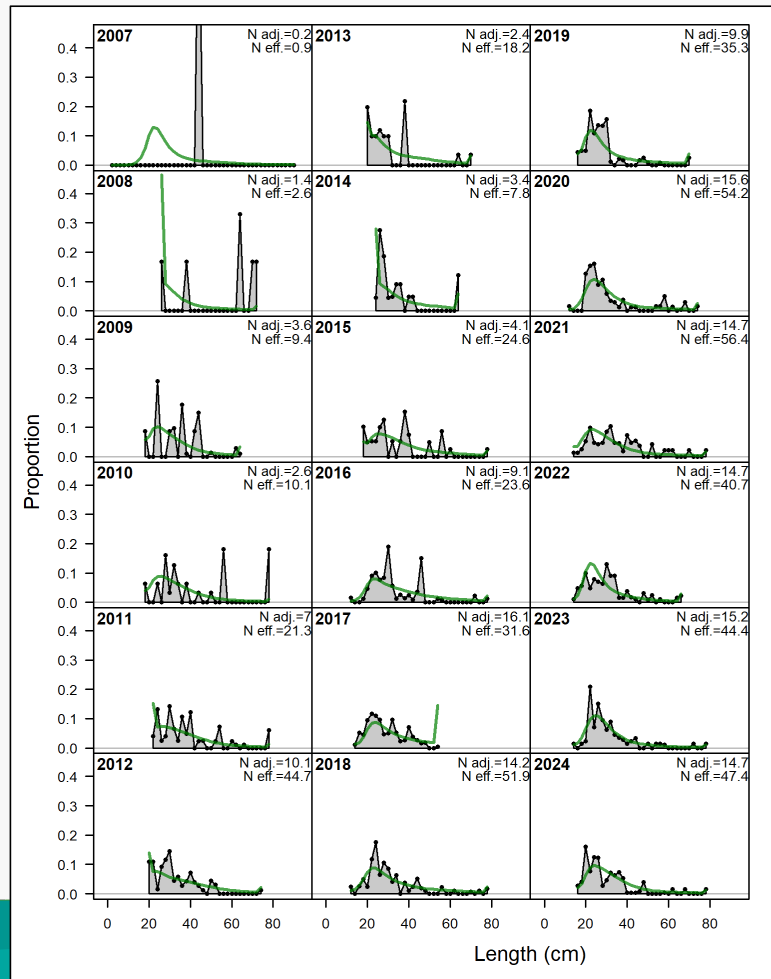


Figure 4.24



Length Composition Residuals

INDEX	RUNS.P	TEST	SIGMA3.LO	SIGMA3.HI	TYPE
REC_HL	0.159	Passed	-0.02522	0.025217	length
SEAMAP_TW	0.215	Passed	-0.12992	0.12992	length
COMB_VIDEO	0.002	Failed	-0.25396	0.253958	length

INDICES	RMSE %	nobs
COM	4.2	3
SEAMAP_TW	6	15
COMB_VIDEO	18.4	18
REC_HL	1	4
REC_SP	1	3
Combined	12.5	43

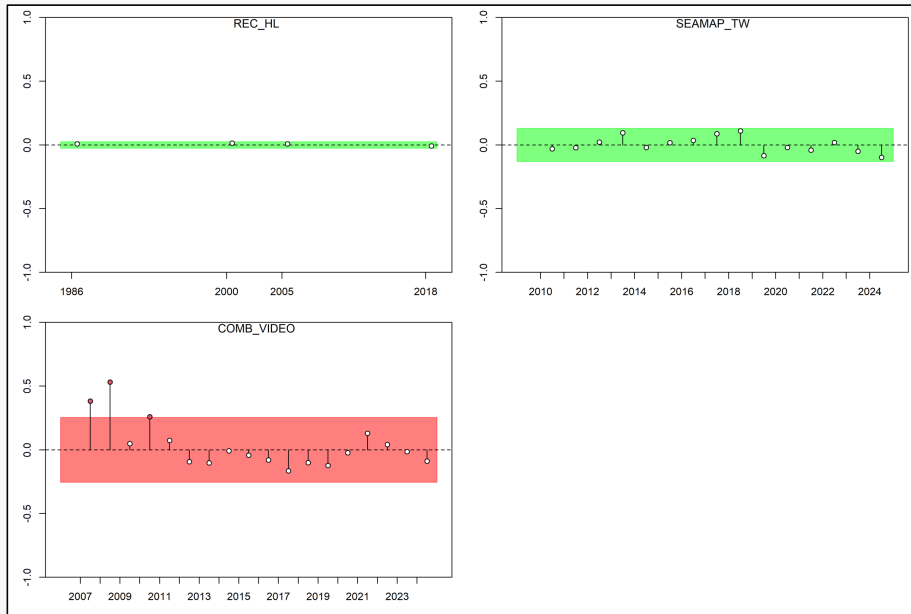


Figure 4.47

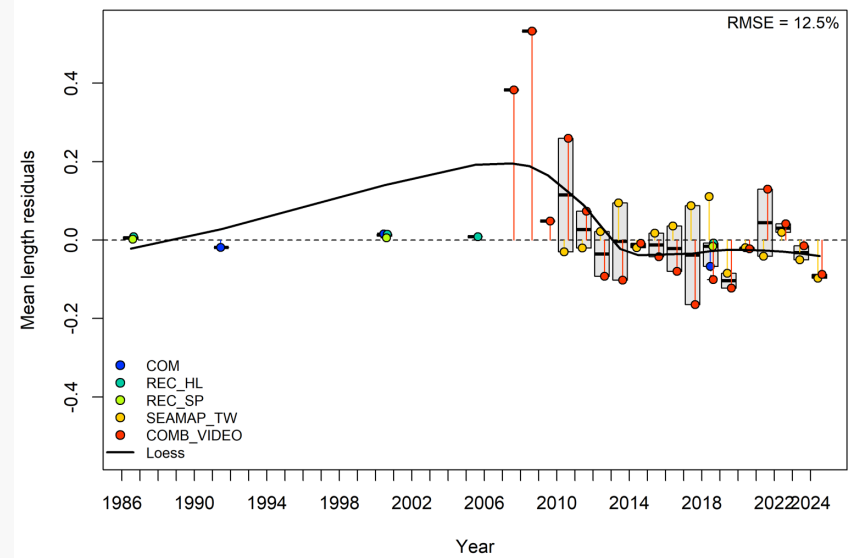


Figure 4.45



Conditional Age-at-Length

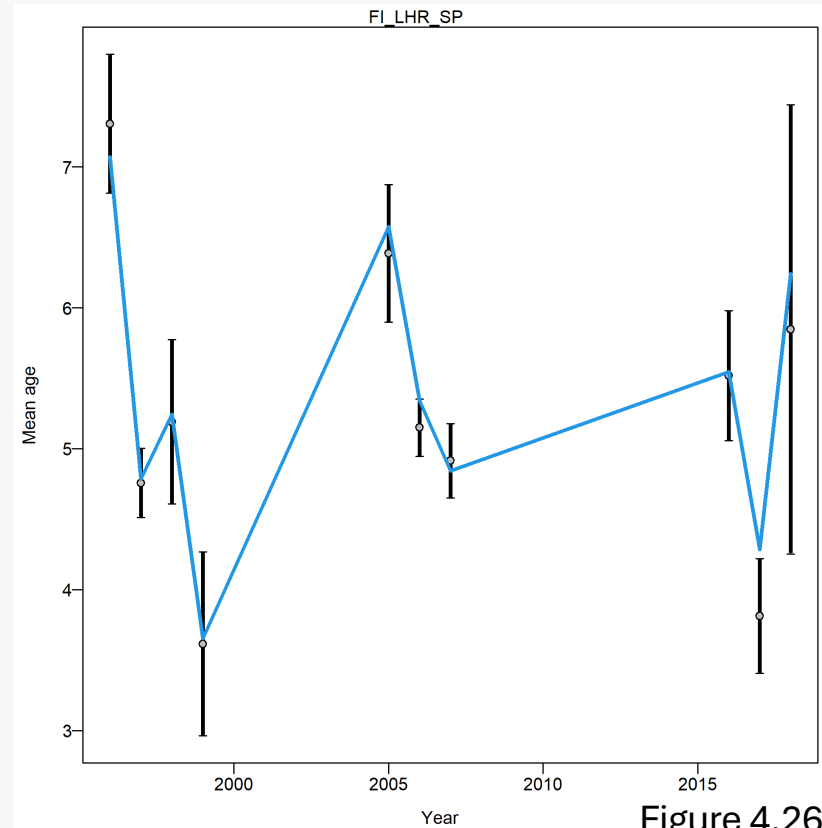
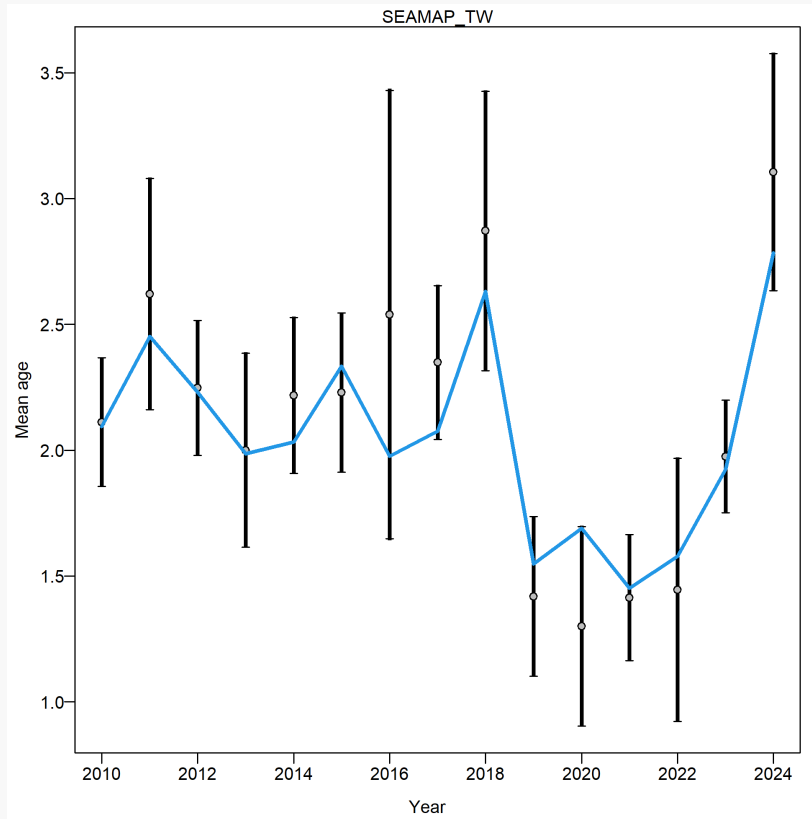


Figure 4.26



Data

Config

Results

Conditional Age-at-Length

INDEX	RUNS.P	TEST	SIGMA3.LO	SIGMA3.HI	TYPE
SEAMAP_TW	0.052	Passed	-0.31034	0.31034	Con
FI_LHR_SP	0.411	Passed	-0.06378	0.063777	Con

INDICES	RMSE %	nobs
FI_LHR_SP	4.7	10
SEAMAP_TW	11.5	15
Combined	9.4	25

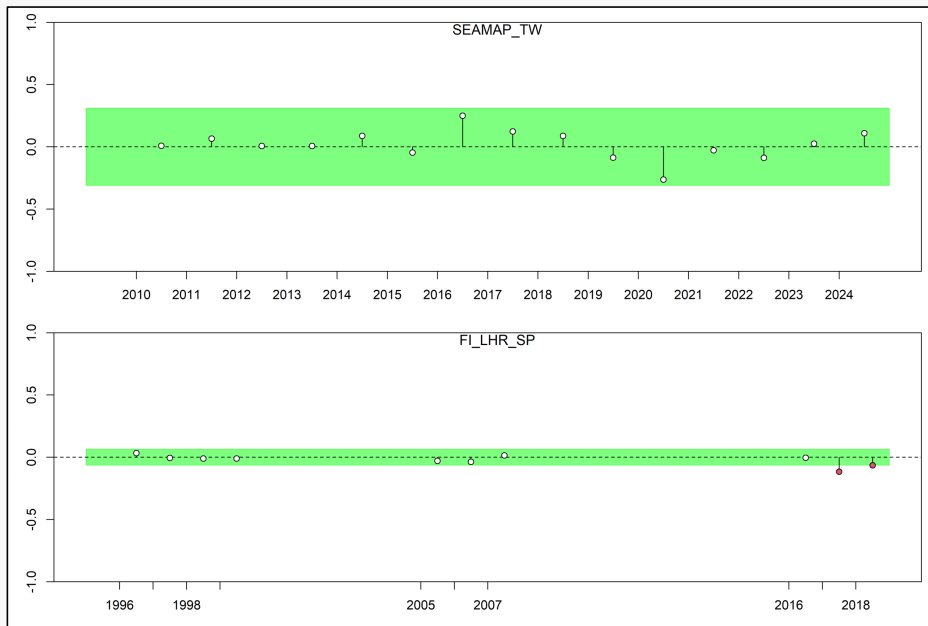


Figure 4.47

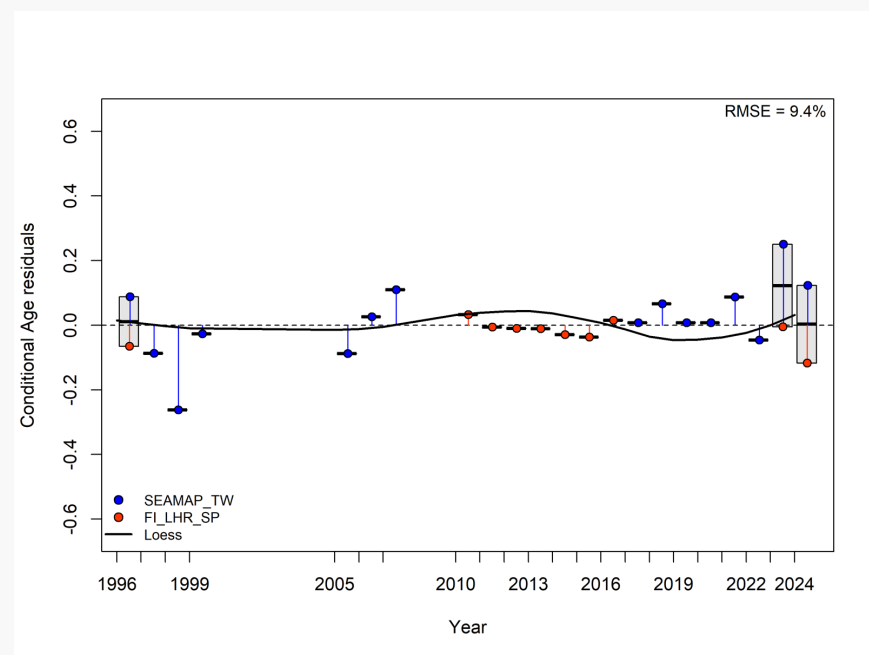


Figure 4.45



Spawning Stock Biomass (male and female)

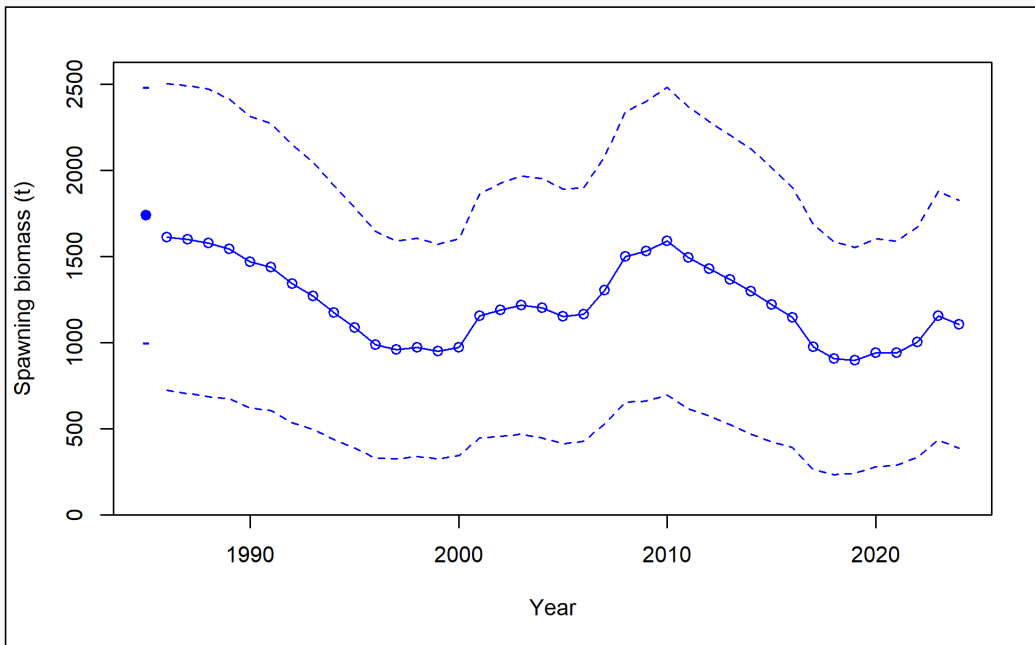


Figure 4.30a

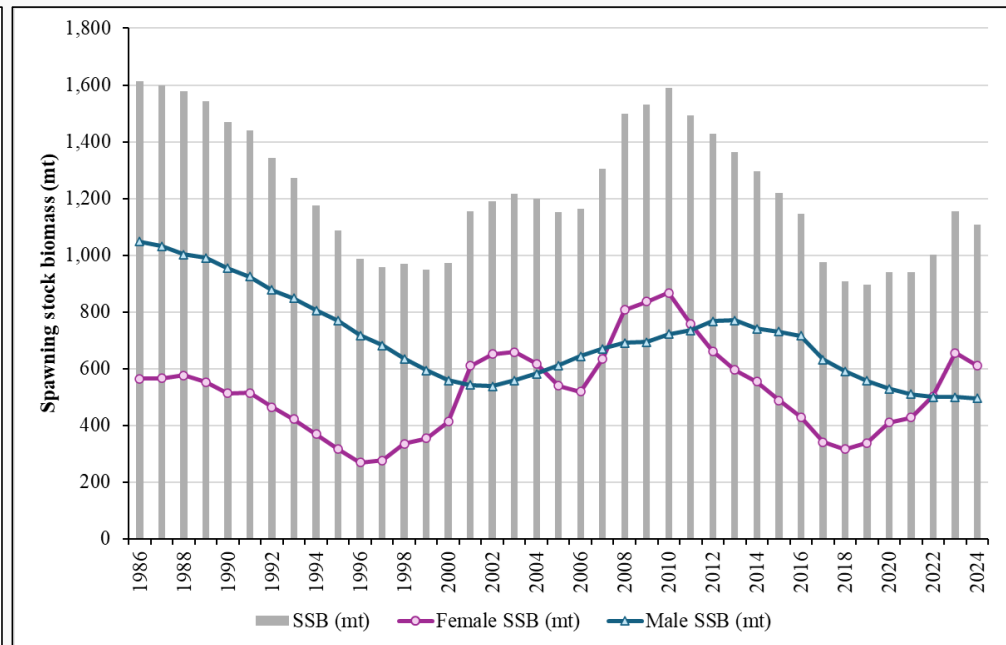


Figure 4.30b



Stock-Recruitment Dynamics

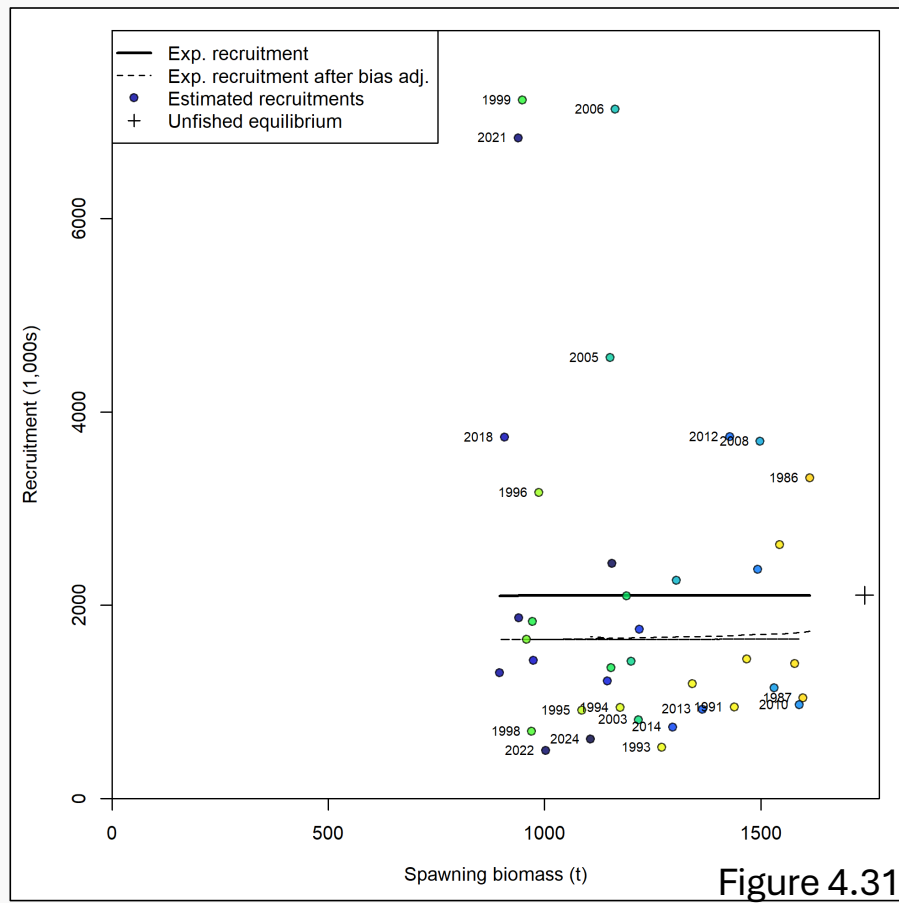


Figure 4.31

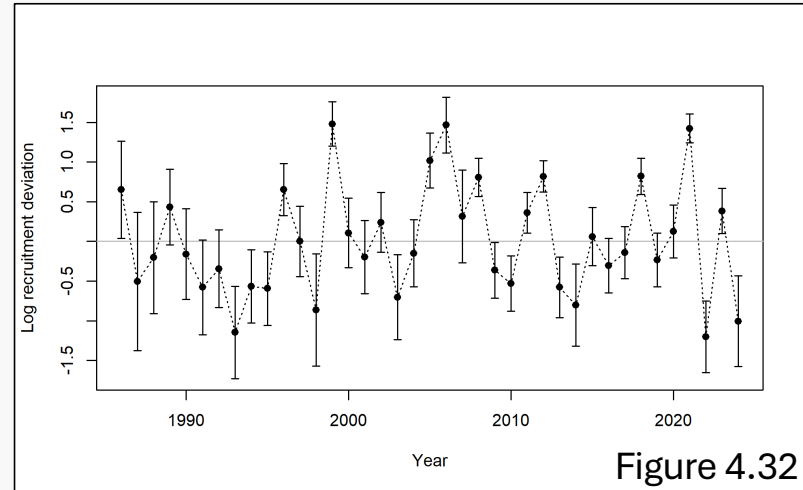


Figure 4.32

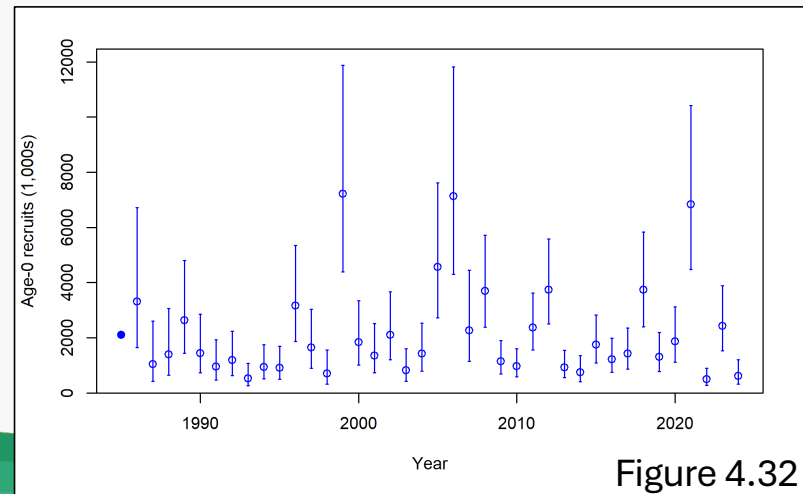


Figure 4.32



Fishing Mortality Rates

Exploitation rates

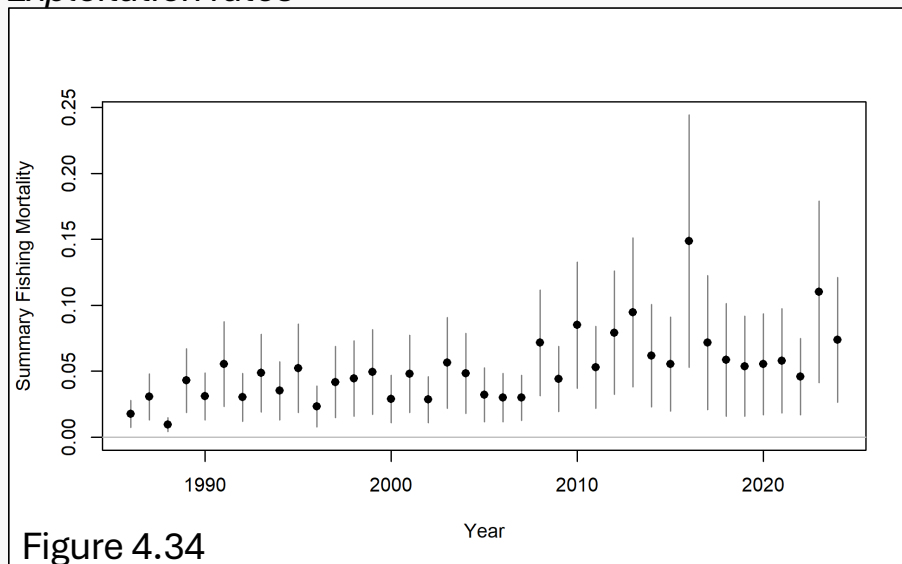


Figure 4.34

Apical fishing mortality rates

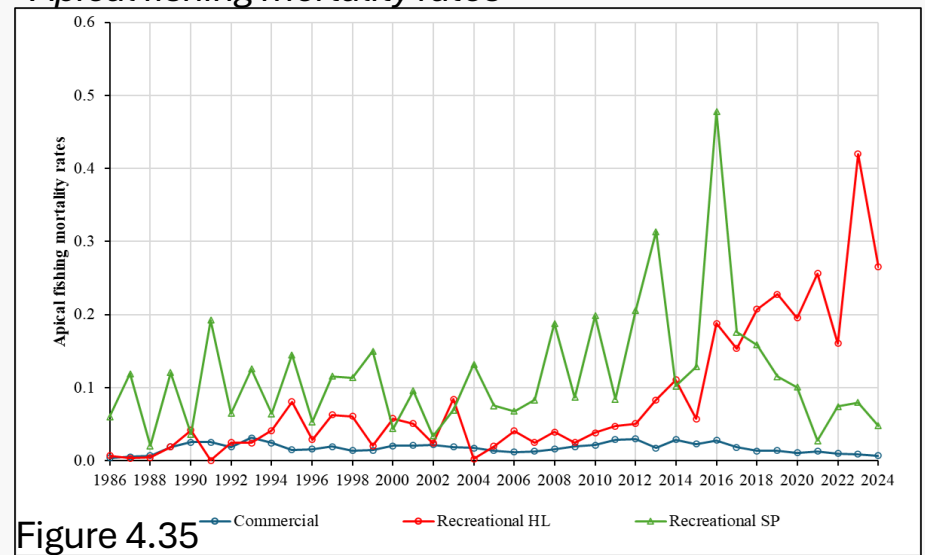
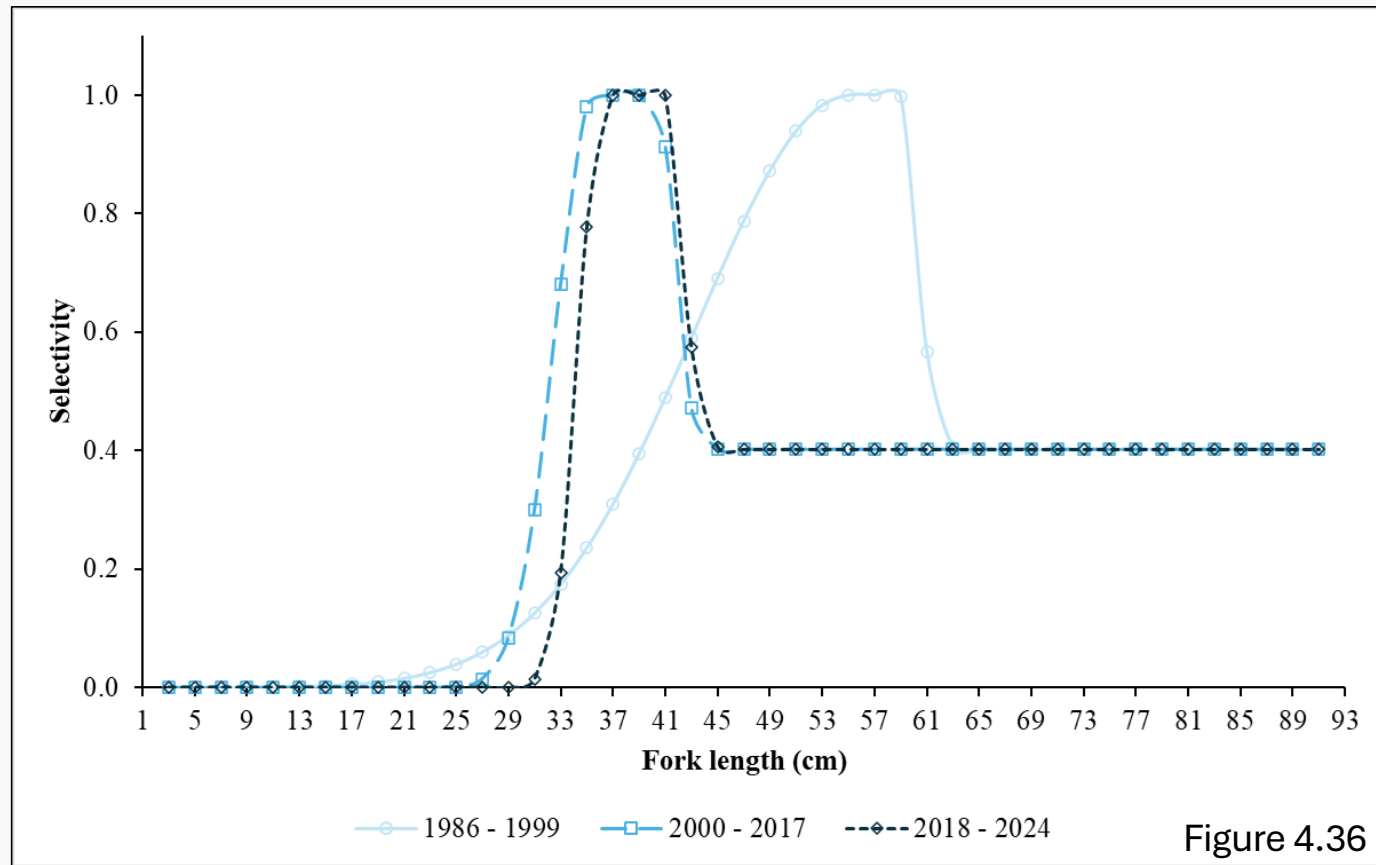


Figure 4.35

Selectivity- Commercial



1986 – 1998: No minimum size limits

1999 – 2017: 12" (305 mm) FL minimum size,

2018 – 2024: 14" (356 mm) FL minimum size,



Selectivity – Rec SP

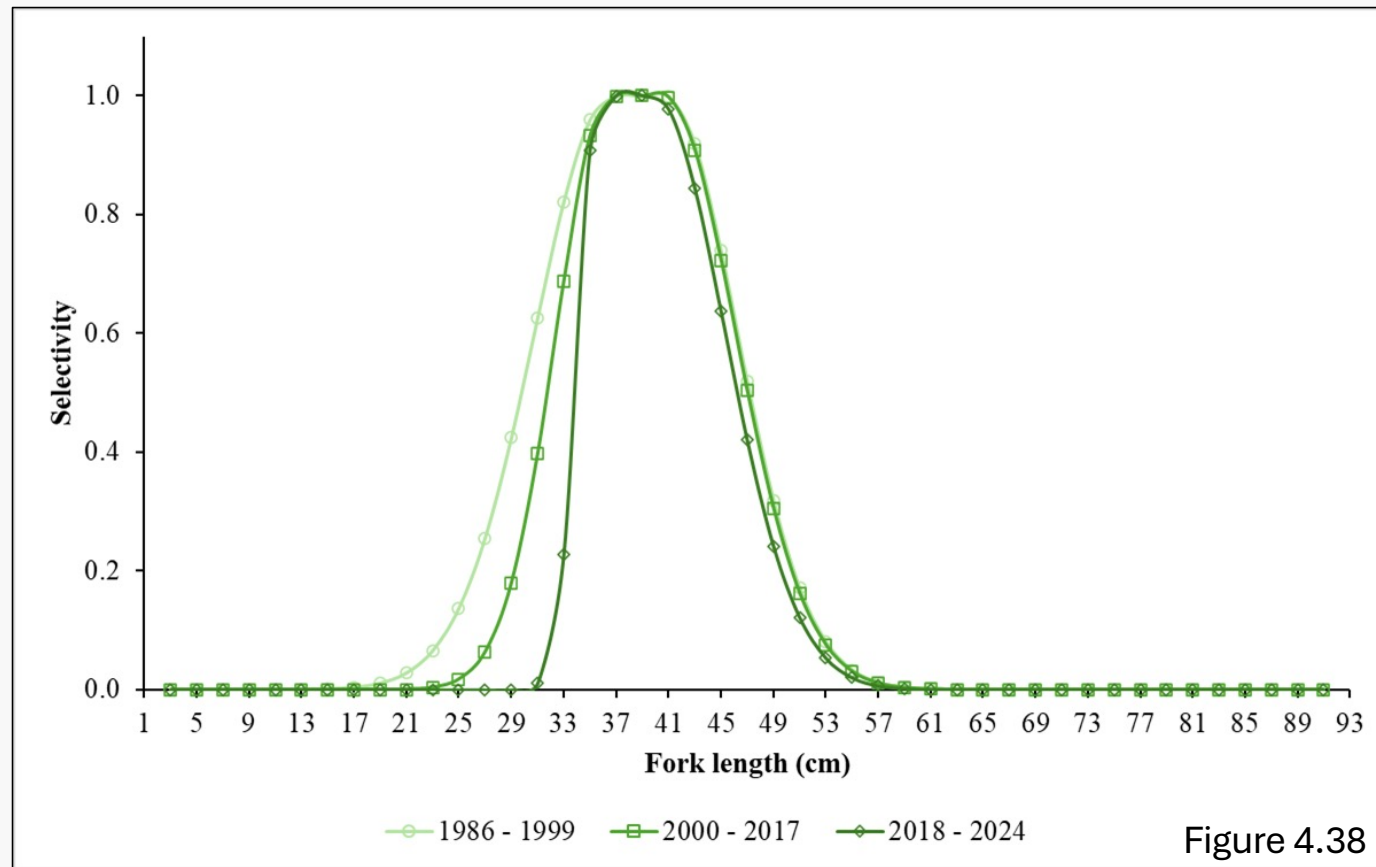


Figure 4.38

1986 – 1998: No minimum size limits

1999 – 2017: 12" (305 mm) FL minimum size,

2018 – 2024: 14" (356 mm) FL minimum size,

Selectivity- Rec HL

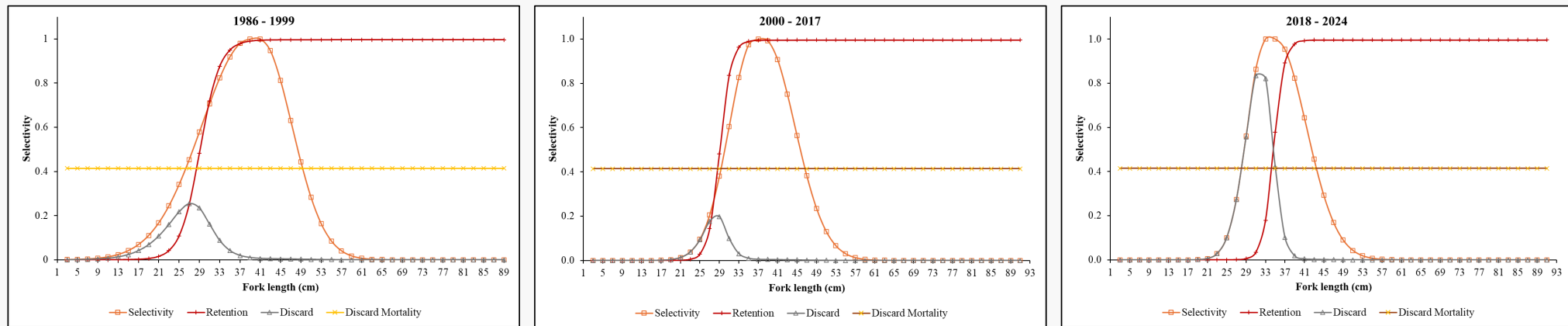


Figure 4.37

1986 – 1998: No minimum size limits

1999 – 2017: 12" (305 mm) FL minimum size

2018 – 2024: 14" (356 mm) FL minimum size



Selectivity - Indices

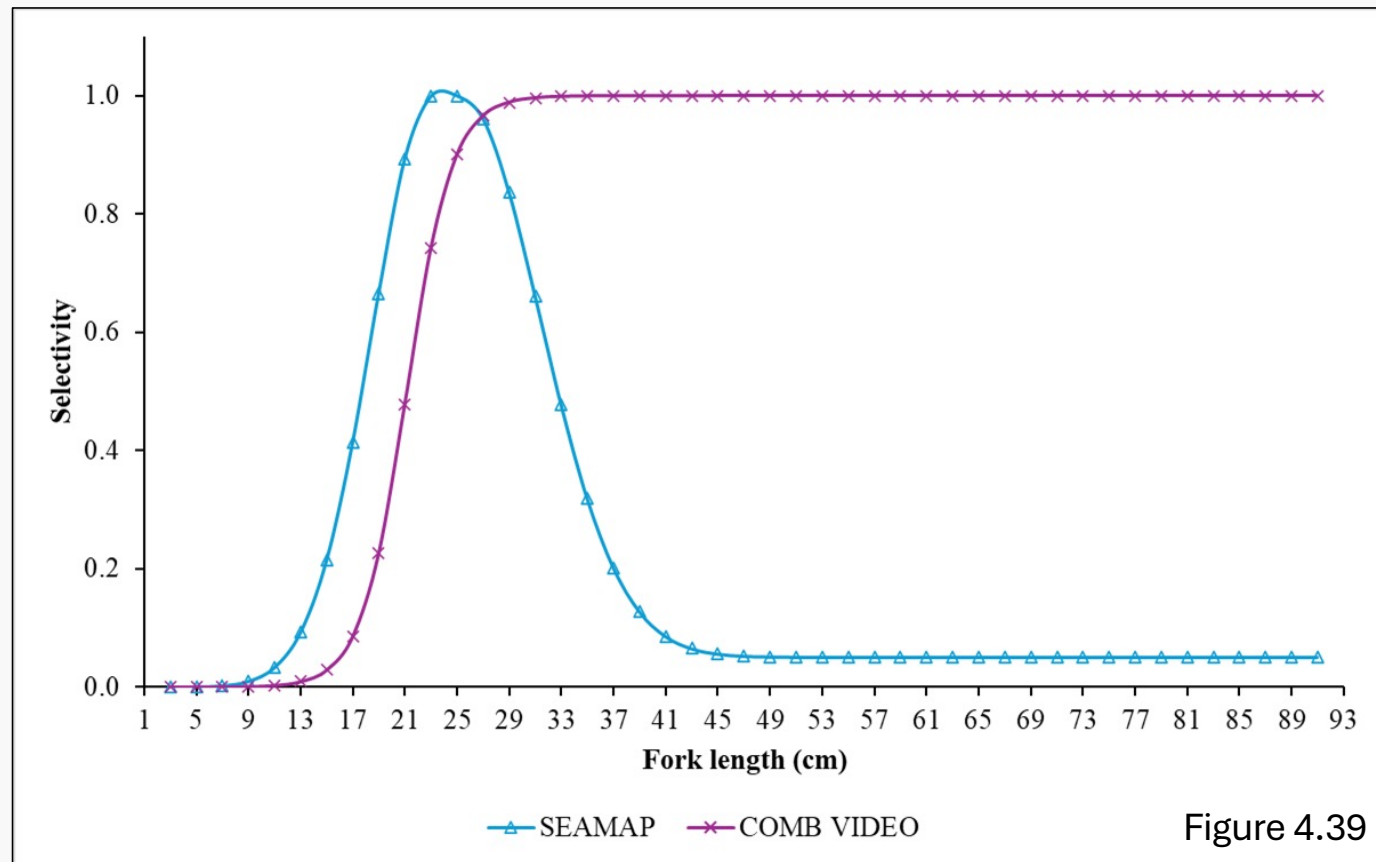


Figure 4.39

Thank You!



Landings Comparison

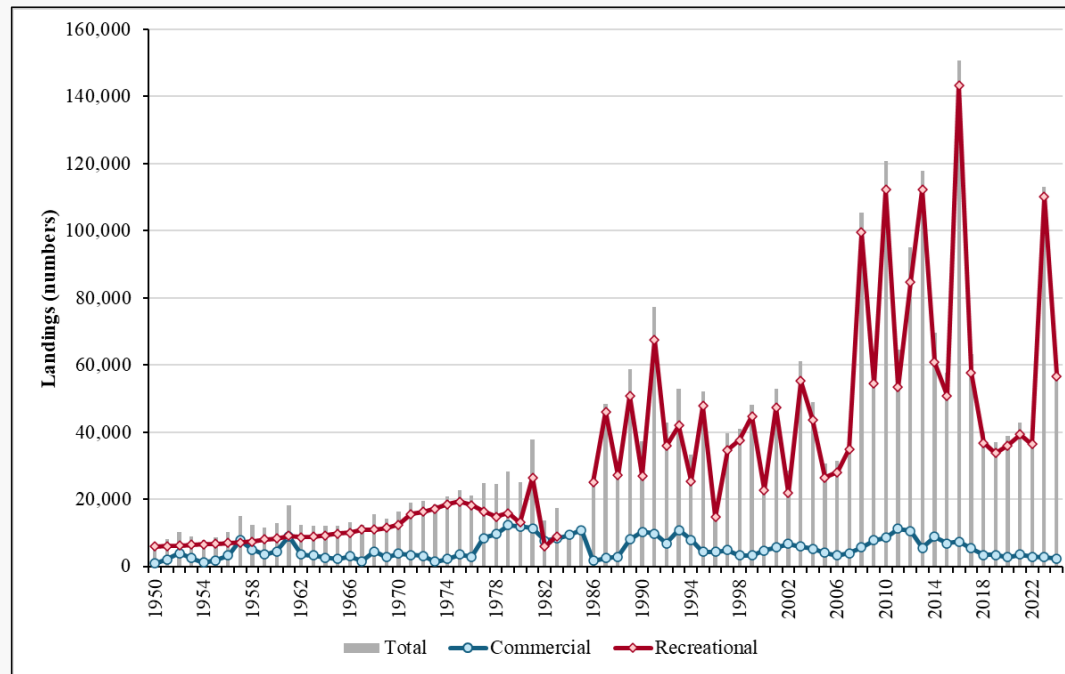


Figure 4.6

Life History Overview

- Tropical reef species associated with coral reef areas in the western north Atlantic Ocean, Gulf of America, and Caribbean Sea
 - From the Carolinas south to northern coast of Brazil. In U.S. continental waters, most abundant in the eastern Gulf of America and FL Keys
 - Populations from U.S. waters are currently believed to belong to three stocks
- Juveniles settle nearshore in seagrass beds or shallow reefs with ontogenetic migration to nearshore/offshore hard-bottom habitats and reef habitats
- Protogynous hermaphrodites that form harems. Protracted spawning with peaks from December through April
- Feeds during day for benthic invertebrates, such as crabs and mollusks



History

Data

Config

Results

Stock	Region	FL Counties	MRIP	NMFS Stat	SRHS
-	West of FL	-	-	11 – 21	24 – 29
WFS	NW FL	Escambia to Dixie	1	7 – 10	23
WFS	SW FL	Levy to Collier	2	3 – 6	21, 22
Keys/EFL	FL Keys	Monroe	3	1, 2, 2479 - 2482	12, 17, 18*
Keys/EFL	SE FL	Indian River to Miami-Dade	4	2580, 2680, 2780, 2579, 2679, 2779	11
Keys/EFL	NE FL	Nassau to Brevard	5	2880, 2980, 3080, 2879, 2979, 3079	7, 8
-	North of FL	-	-	North of 31°	1 – 6, 9, 10



SEDAR 94: Florida Hogfish



Fishery/Spatial Closures

Gulf

- Madison-Swanson (6/2004 – present)
 - Fishing prohibited
- Steamboat Lumps (6/2004 – present)
 - Fishing prohibited
- The Edges (7/2009 – present)
 - Fishing prohibited Jan 1 – Apr 30
- Flower Garden (01/1992- present)
 - Bottom gears prohibited

- Riley's Hump (2/1994 - 8/2002)
 - Fishing prohibited May 1 – Jun 30
- Tortugas Reserves (8/2002 – present)
 - Fishing prohibited
- Pulley Ridge (1/2006 – present)
 - Bottom gears prohibited

FL State Waters – Western Dry Rocks

- April 1 – July 31 (4/2021 – present)



Size Limit History

Federal (10 – 200 Miles)

- 12" (305 mm) FL (11/1999 – 08/2017)
- 14" (356 mm) FL (08/2017 – present)

FL State Waters (0 – 10 Miles)

- 12" (305mm) FL (07/1994 – 08/2017)
- 14" FL in Gulf (08/2017 – present)

Trip Limit History

Commercial

- None

Recreational

- 5 fish per person per day (11/1999 – present)



Assessment History

SEDAR 37

Stock Synthesis v3.24

1986 – 2012, SEFL/Keys, WFS, GA-NC Stocks, Ages 0 – 18+

SEDAR 37 Update

Stock Synthesis v3.24

1986 – 2016, WFS Stock, Ages 0 – 18+

WFS (Update)

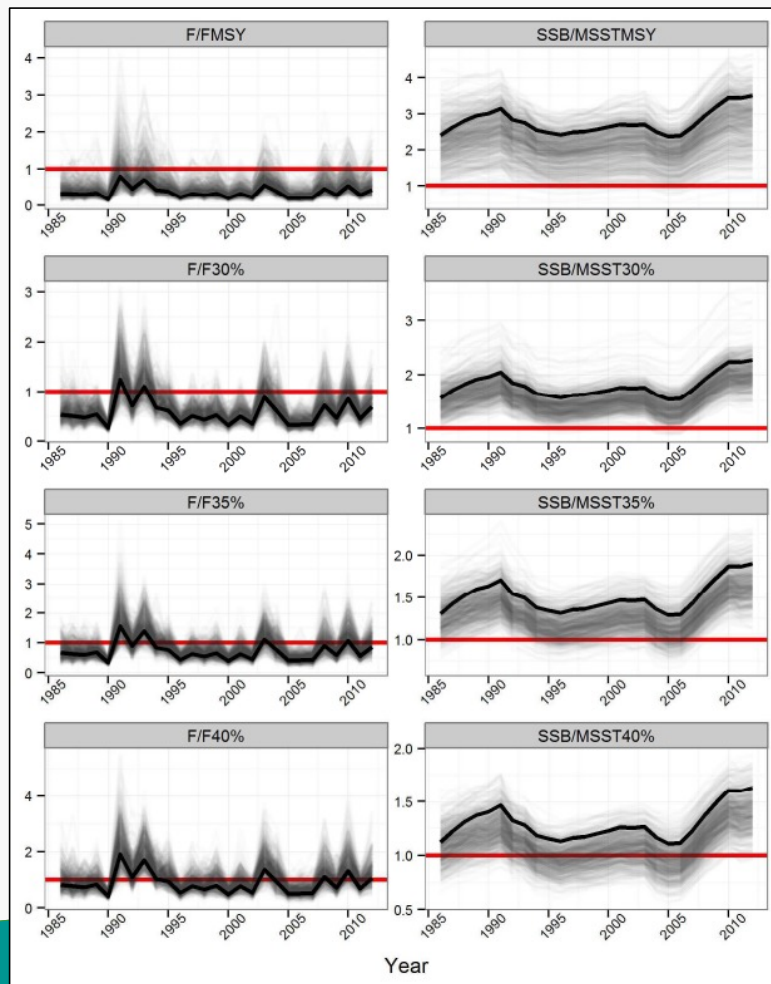
5 Fleets

- Dome shaped: commercial trap, recreational spear, recreational hook and line
- Asymptotic: commercial hook and line
- Freely estimated (domed): commercial spear

8 IOAs

- 4 FD – Selectivity linked to fleets: Comm Spear, Comm HL, Rec Spear, Rec HL
- 4 FI – Dome shaped selectivity: Combined Video Survey (NMFS/FWRI), FWRI Seagrass Trawl, FWRI Baitfish Trawl, SEAMAP Trawl

S37 Stock Status



SEDAR 37 (2014)

West Florida Shelf

Not overfished

Not undergoing overfishing for all
MFMTs except $F_{40\%SPR}$

S37U Stock Status

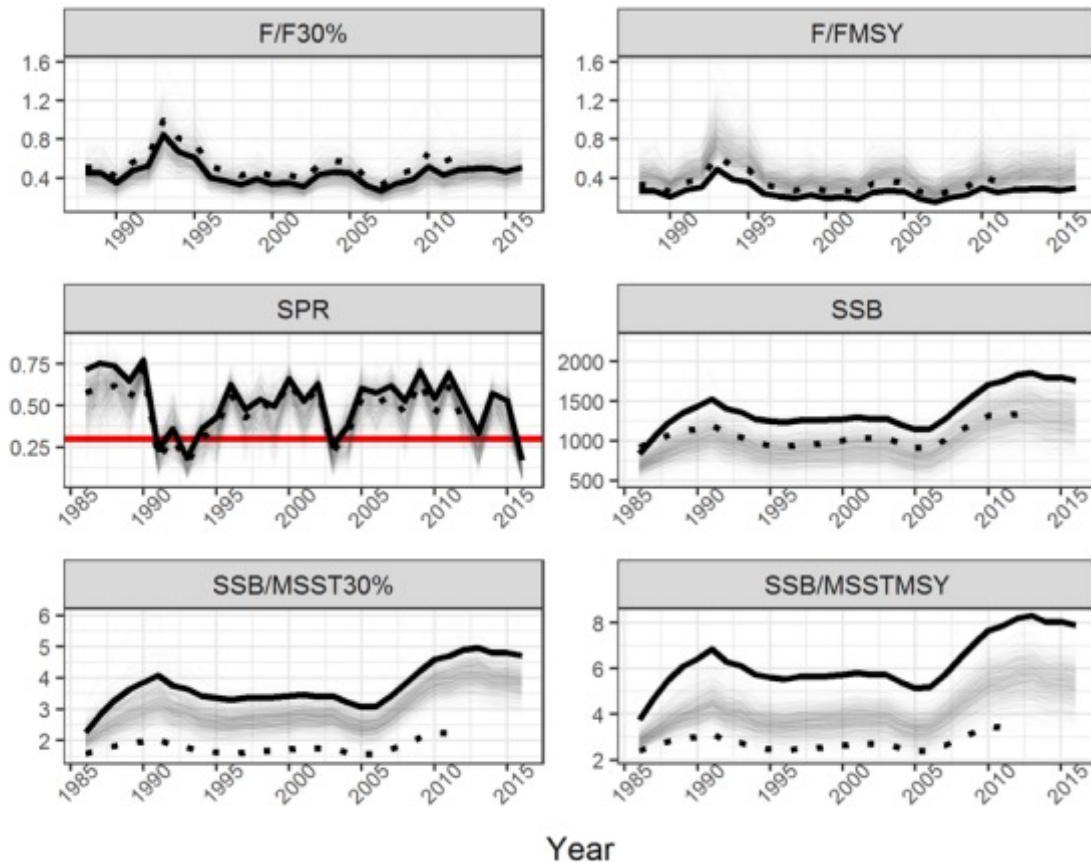


SEDAR 37U (2017)

West Florida Shelf

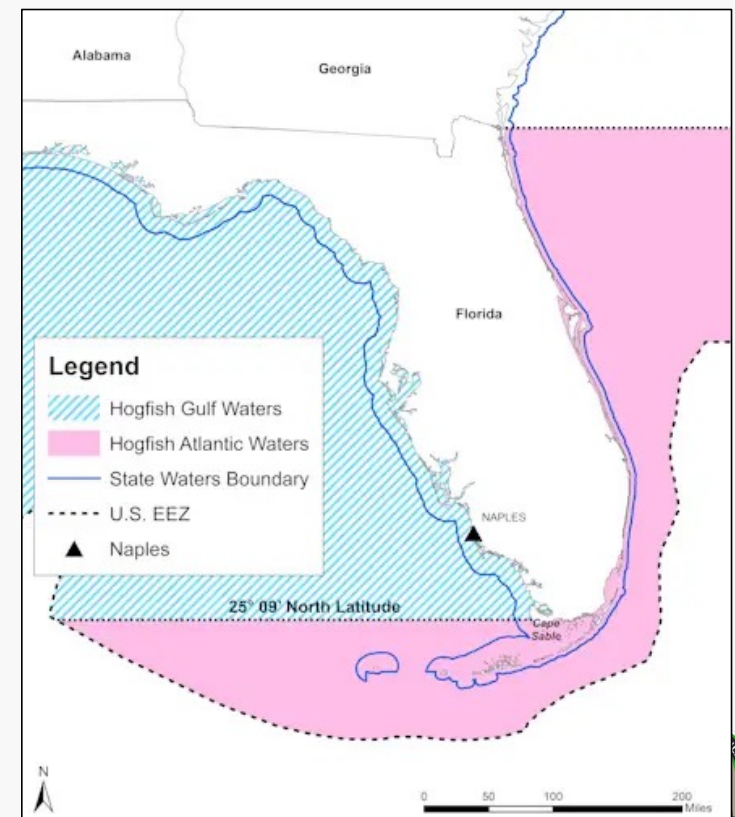
Not overfished

Not undergoing overfishing



SAFMC Snapper Grouper Amendment 37

- Implemented Aug 14, 2017
- **Stock boundary for Gulf/Atl** (Fishery Mgmt. Unit)
 - 25 degrees 9 min N Lat (Cape Sable).
- Set $MSY = F_{30\%SPR}$ and $MSST = 75\%$ of SSB_{MSY}
- Increased the min. size from 12" FL to 16" FL
 - 14" FL in Gulf (RF Amend. 43; 8/24/17)
- Established OY, ACL, and **10 yr rebuild plan**
- Modified Rec bag limit: 1/p/d.
- Established a Rec season: May-Oct.



Parameter Correlation

Highly correlated Parameter pairs (>0.7)

Parameter a	Parameter b	corr
VonBert_K_Fem_GP_1	L_at_Amax_Fem_GP_1	-0.958579
Size_DblN_ascend_se_COM(1)_BLK1repl_2000	Size_DblN_peak_COM(1)_BLK1repl_2000	0.952415
Size_DblN_ascend_se_REC_SP(3)_BLK1repl_2000	Size_DblN_peak_REC_SP(3)_BLK1repl_2000	0.941951
Size_DblN_ascend_se_COM(1)_BLK1repl_2018	Size_DblN_peak_COM(1)_BLK1repl_2018	0.919888
Size_DblN_ascend_se_SEAMAP_TW(5)	Size_DblN_peak_SEAMAP_TW(5)	0.901953
Size_DblN_ascend_se_REC_SP(3)_BLK1repl_2018	Size_DblN_peak_REC_SP(3)_BLK1repl_2018	0.888827
Size_DblN_ascend_se_REC_SP(3)	Size_DblN_peak_REC_SP(3)	0.885616
Size_DblN_ascend_se_REC_HL(2)_BLK1repl_2018	Size_DblN_peak_REC_HL(2)_BLK1repl_2018	0.873457
Platoon_SD_Ratio	CV_young_Fem_GP_1	-0.857999
Size_DblN_top_logit_COM(1)	Size_DblN_peak_COM(1)	-0.856136
Size_DblN_peak_COM(1)_BLK1repl_2018	Size_DblN_top_logit_COM(1)	-0.854836
Size_DblN_ascend_se_REC_HL(2)	Size_DblN_peak_REC_HL(2)	0.794191
Size_DblN_ascend_se_REC_HL(2)_BLK1repl_2000	Size_DblN_peak_REC_HL(2)_BLK1repl_2000	0.787968
Size_DblN_ascend_se_COM(1)_BLK1repl_2018	Size_DblN_top_logit_COM(1)	-0.776796
Size_DblN_peak_REC_SP(3)_BLK1repl_2000	Size_DblN_top_logit_REC_SP(3)	-0.765402
Size_DblN_peak_COM(1)_BLK1repl_2018	Size_DblN_peak_COM(1)	0.755851
Size_DblN_peak_COM(1)_BLK1repl_2000	Size_DblN_top_logit_COM(1)	-0.735689
Size_DblN_ascend_se_REC_SP(3)_BLK1repl_2000	Size_DblN_top_logit_REC_SP(3)	-0.711789