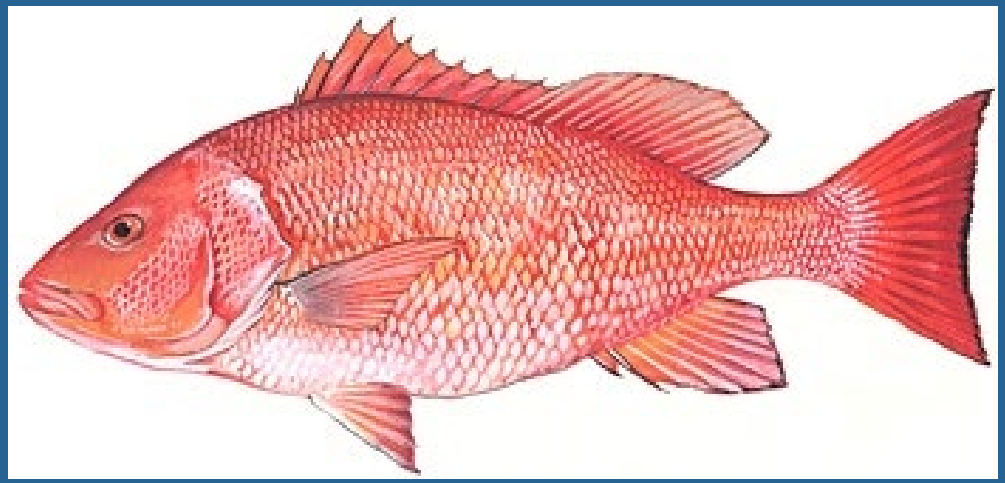
SEDAR 73
South Atlantic Red Snapper

SSC Discussion

NOAA FISHERIES
Sustainable Fisheries Branch, Beaufort, NC



11 January 2021

Topics

- Review of S41 data
- New data considerations for S73
- Model modifications

Topics

- **Review of S41 data**
- New data considerations for S73
- Model modifications

Life history

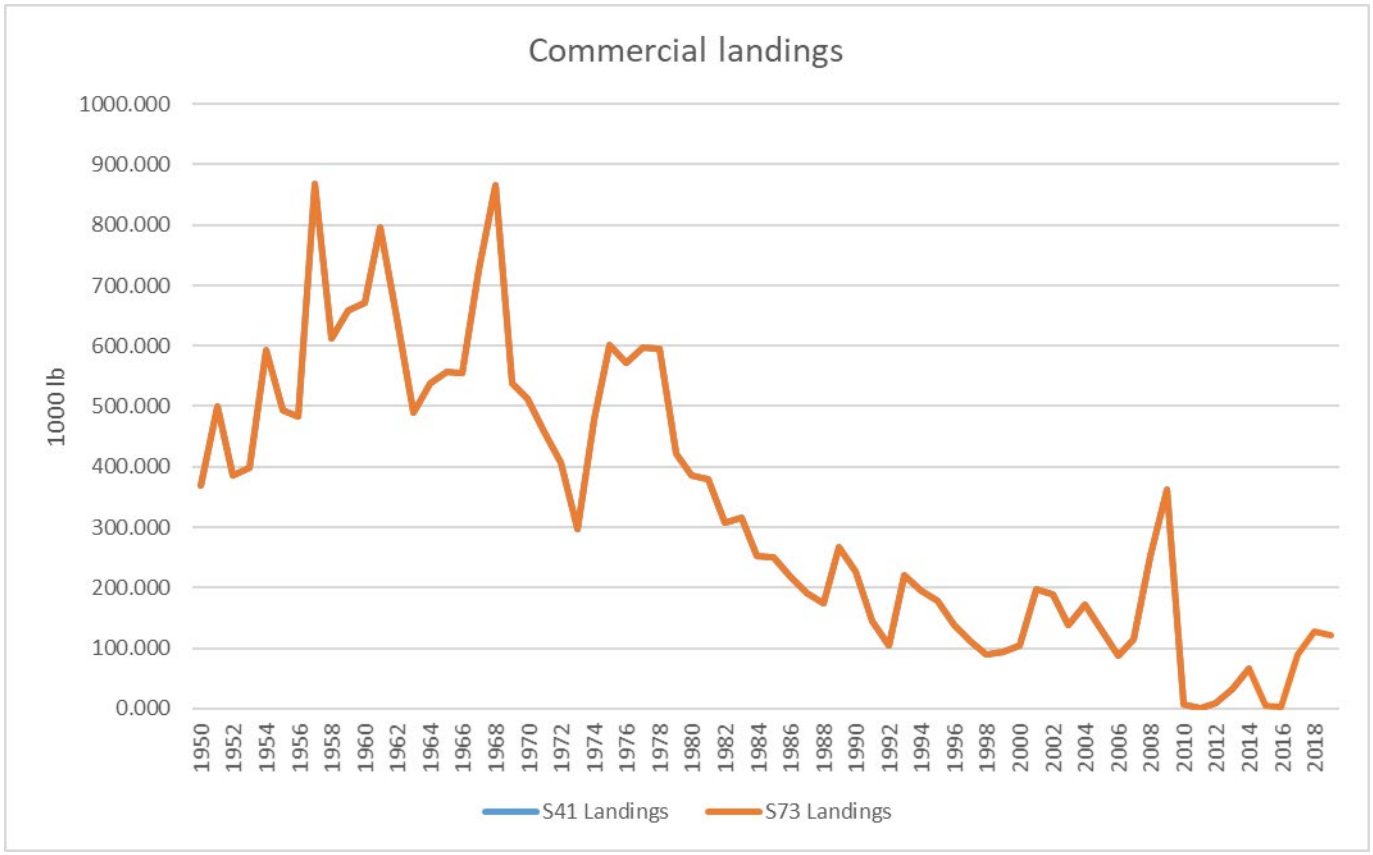
- Von Bertalanffy growth
  - Population growth curve – all data
  - Fishery growth curve1 – fishery samples taken during 20” minimum size limit
  - Fishery growth curve 2 – fishery samples taken outside of the 20” minimum size limit
- Age-based natural mortality
- Spawning biomass modeled as population fecundity
  - Spawning occurs in mid-summer
  - 50:50 sex ratio
  - Logistic model of female maturity
  - Batch size is a function of body size
  - Age-specific number of batches

Fleet structure

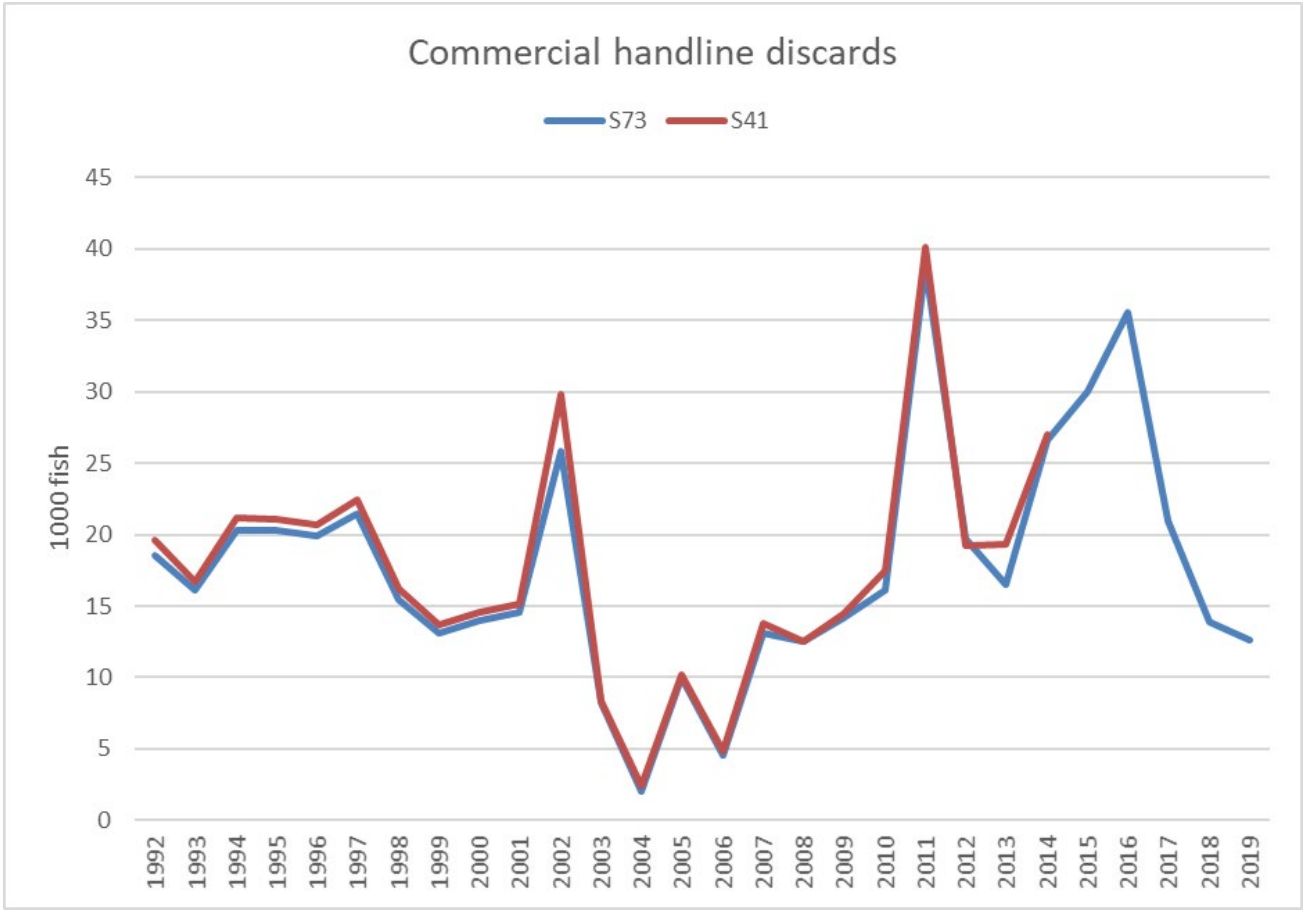
- Commercial handline (pooled with other gears)
- Recreational headboats
- General recreational (private + charterboats)

- Landings and dead discards modeled separately for each fleet

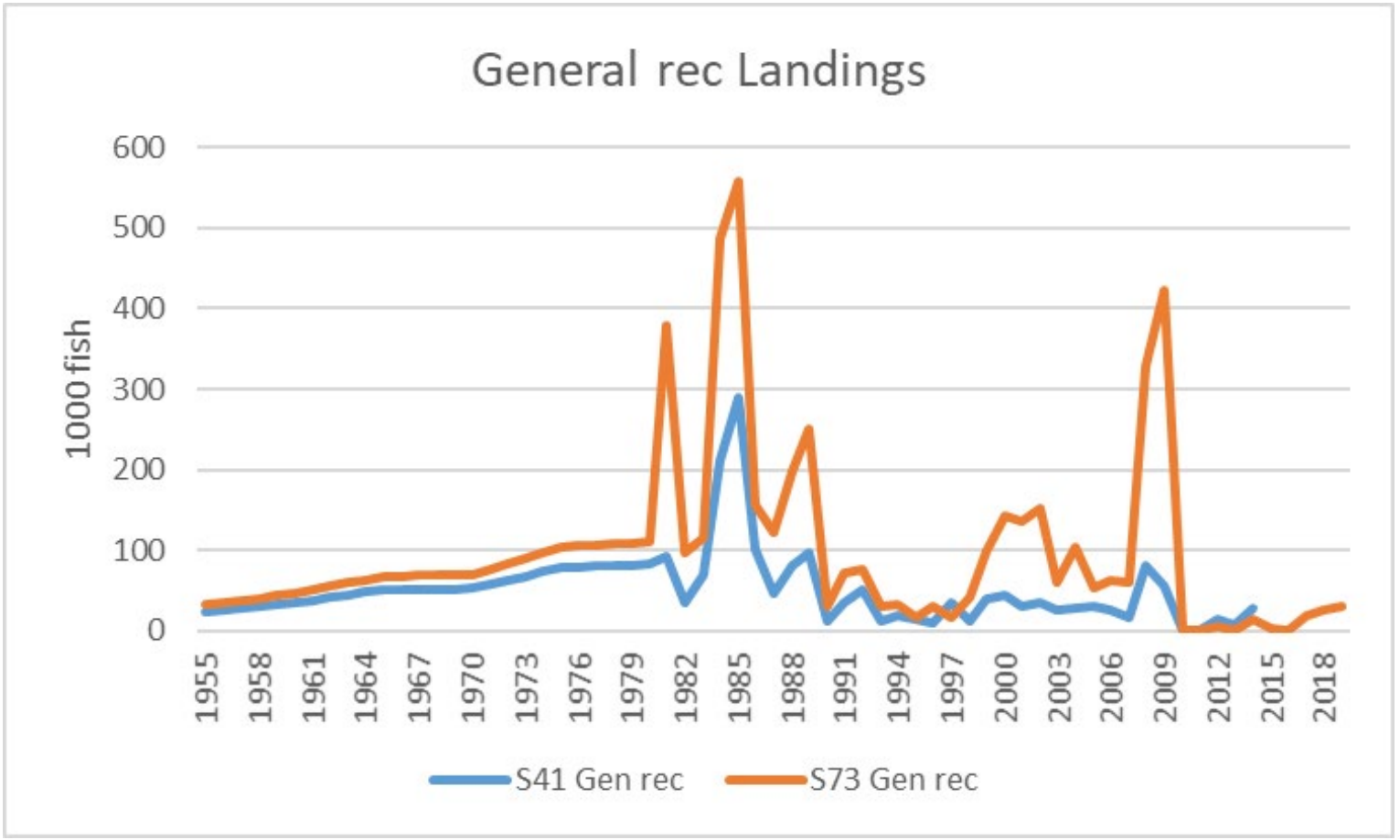
Commercial Landings



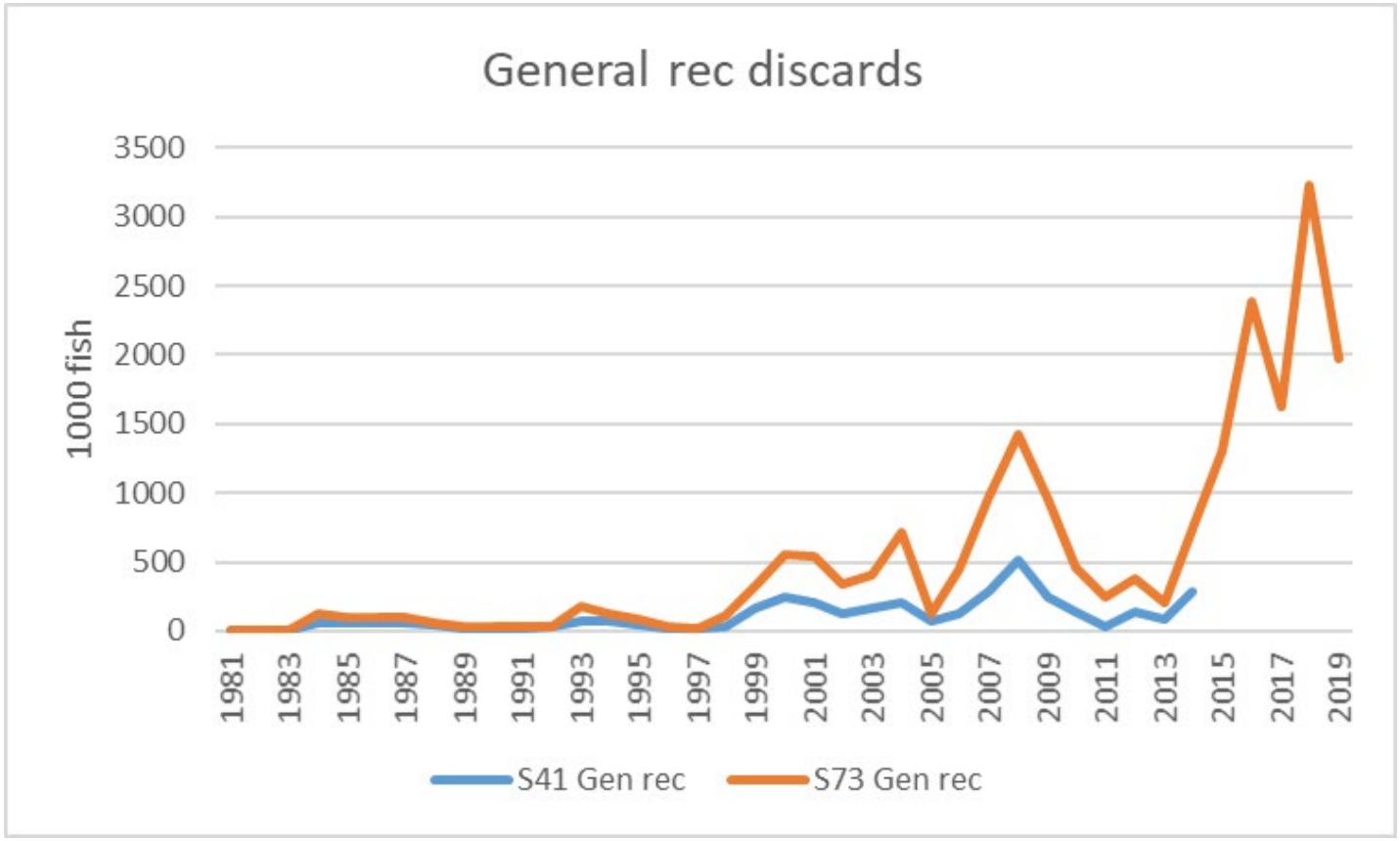
Commercial Discards



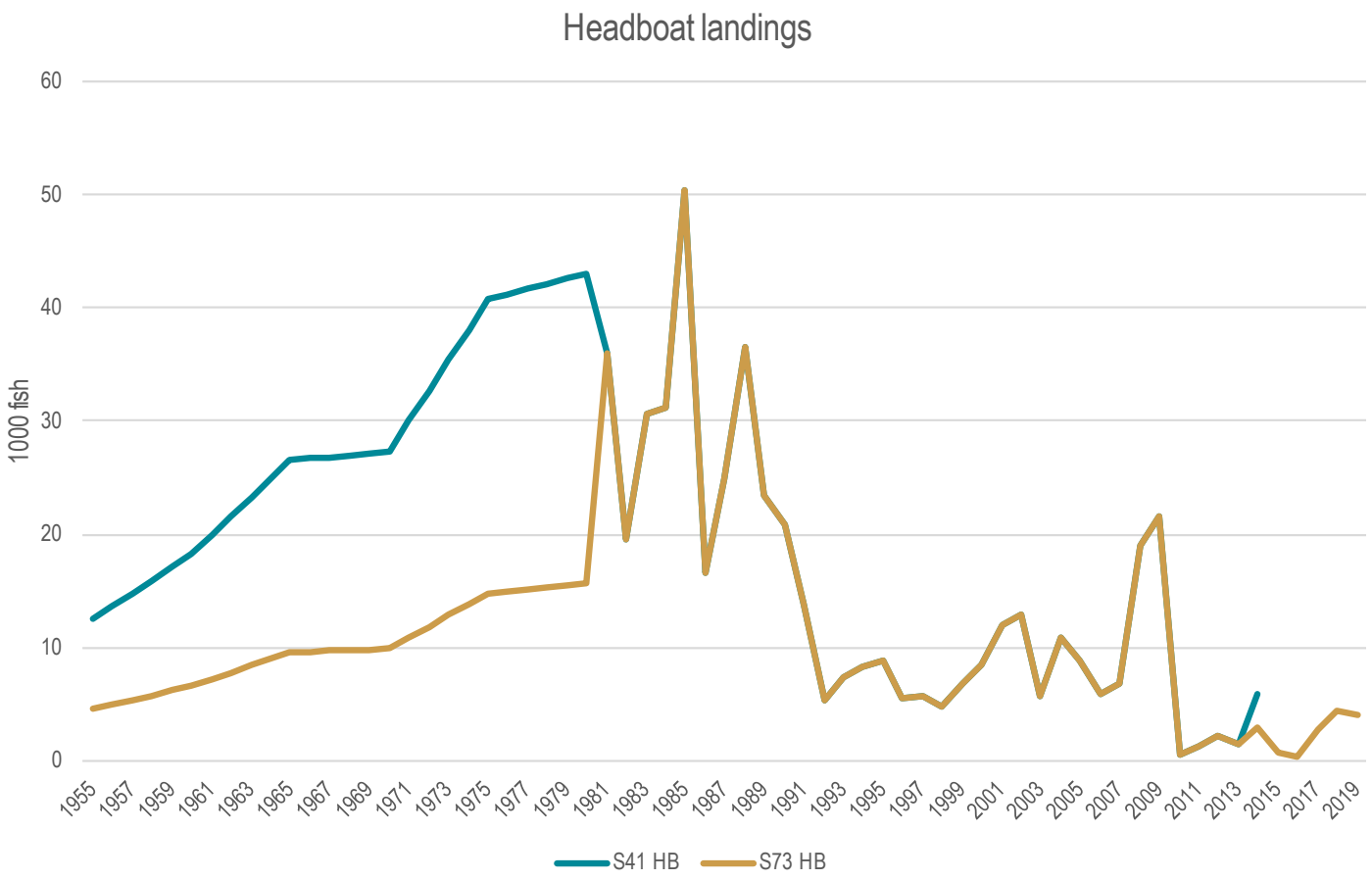
General Recreational Landings



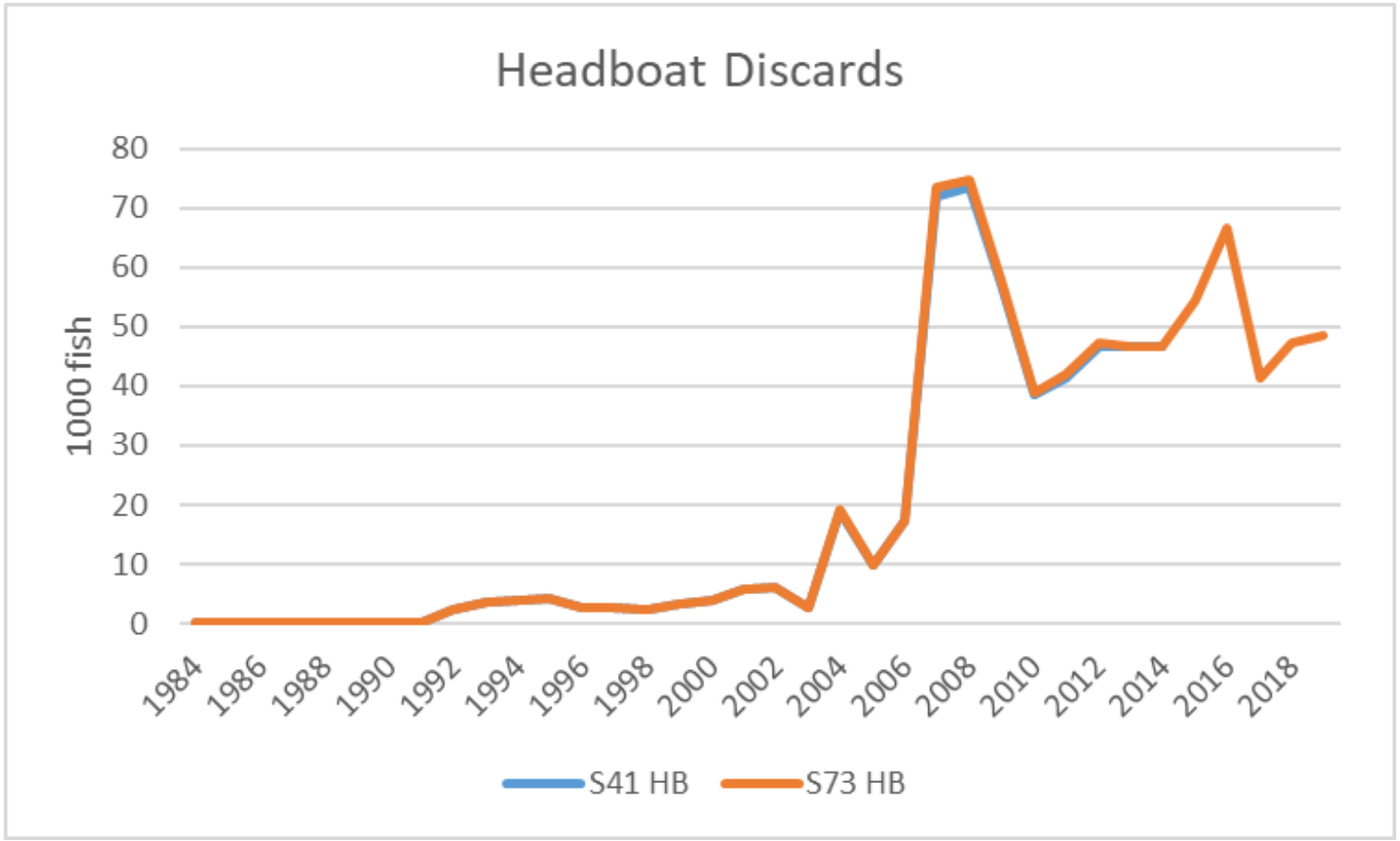
General Recreational Discards



Headboat Landings



Headboat Discards



Discard Mortality

Sector	Pre-Regulation	Range	Post-Regulation	Range
Recreational	37%	(27%-45%)	28.50%	(20%-36%)
Commercial	48%	(38%-58%)	38%	(28%-38%)

- Two time blocks based on hook type (J vs circle)
  - Recreational: pre-2011 and 2011-current
  - Commercial: pre-2007 and 2007-current

- *Update to discard mortality rates, given new data*

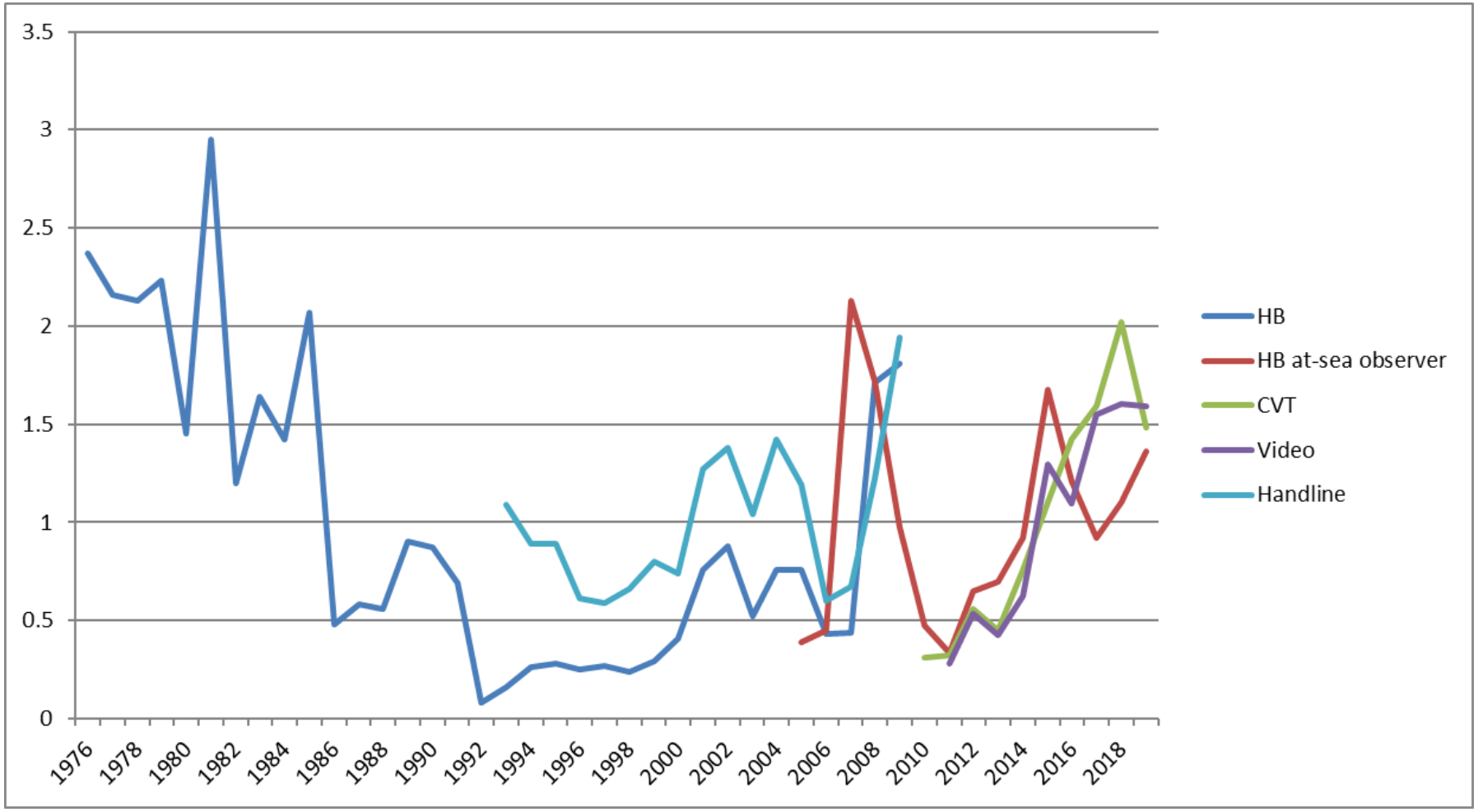
Comps available for S73

- Lengths
  - Commercial landings 1984–1992
  - Commercial discards; pooled into <2010 and ≥2010
  - Headboat discards 2005–2019
  - Gen rec discards (*new data source, more detail later*)
- Ages
  - Commercial landings 1990–2019
  - Headboat landings 1978–2019
  - General rec landings 2001–2019
  - SERFS chevron trap 2010–2019

Indices of Abundance

- Three fishery dependent indices of abundance
  - Headboat logbooks (1976–2009)
  - Commercial handline logbooks (1993–2009)
  - Headboat discards, only fish <20” (2005–2019)
- Logbook indices (landings per effort) were truncated at 2009, because of the regulations starting in 2010
- Two fishery independent index of abundance from SERFS
  - S41 combined the two indices, because of non-independence
  - Chevron traps (2010–2019)
  - Videos (2011*–2019)

All Indices


3.5
3
2.5
2
1.5
1
0.5
0
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
HB
HB at-sea observer
CVT
Video
Handline

Topics

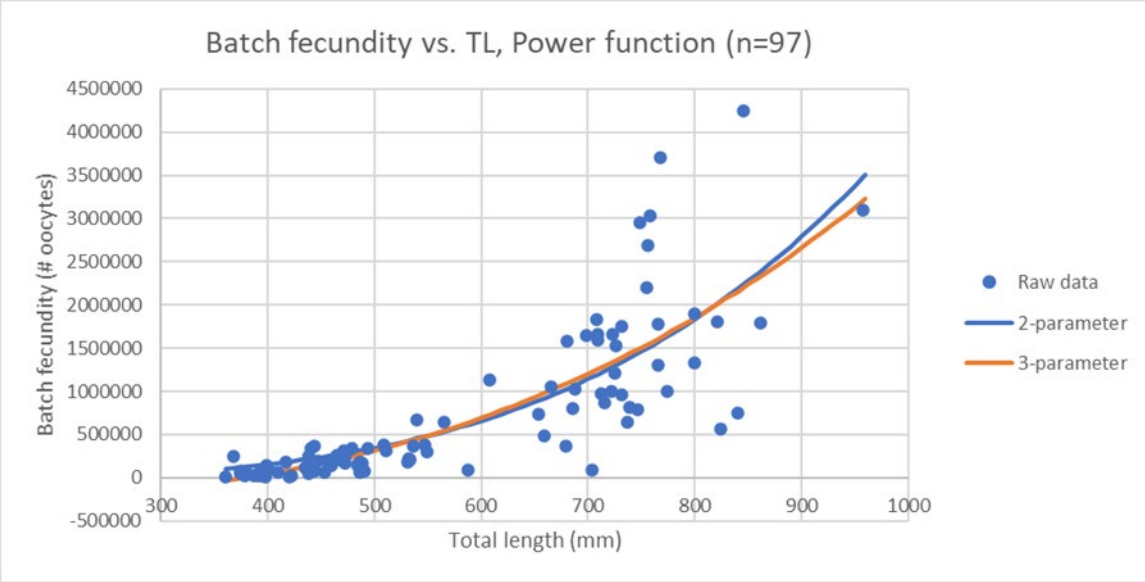
- Review of S41 data
- **New data considerations for S73**
- Model modifications

New data considerations

- Life history
  - Batch fecundity, natural mortality
- Indices of abundance
  - Trap and video as separate time series, video start year
  - FWRI repetitive timed drop survey (hook-and-line)
- Discard length comps
  - Commercial: short bottom longline observer program
  - Headboats: Captain Steve Amick measurements
  - Gen rec: FWRI charterboat observers, MyFishCount
- Discard mortality and use of descender devices

Batch fecundity (S73-DW07)

- Additional specimens (28) added to the S41 data set
- S41 fecundity model was a 2-parameter power function of mean length at age
- Updated model is a 3-parameter power function of length



Batch fecundity

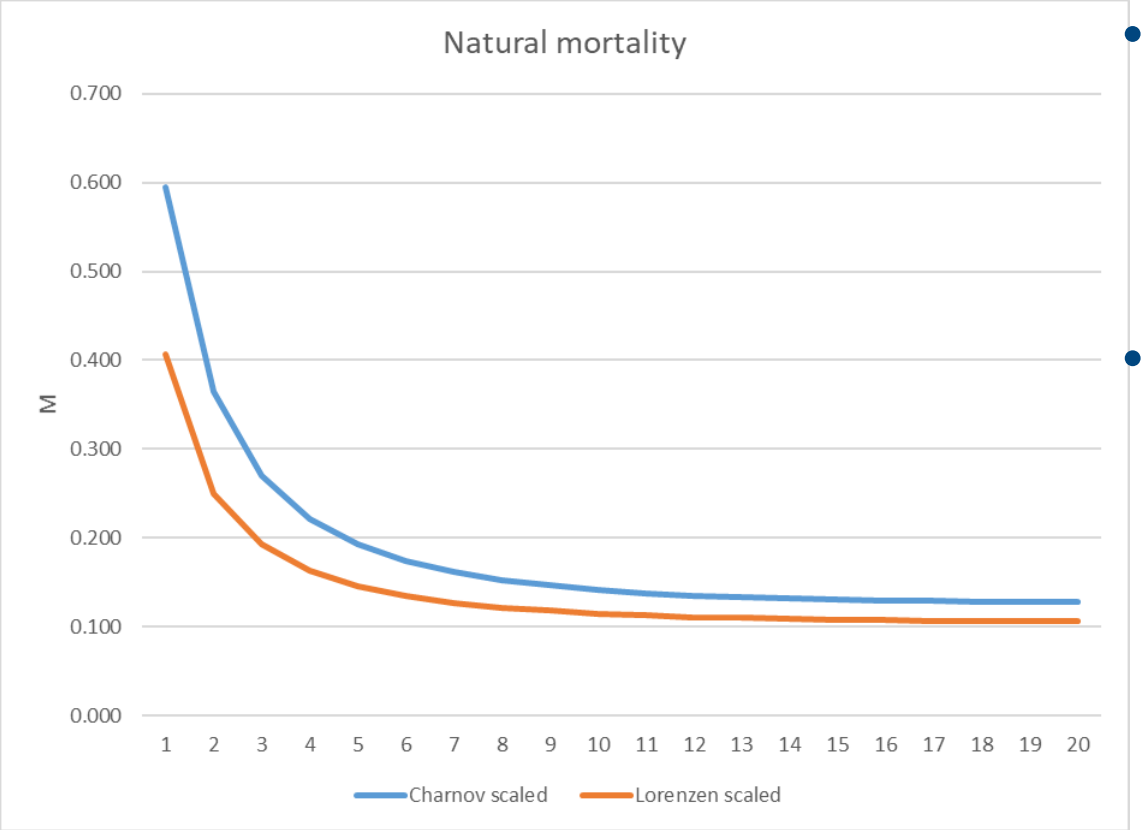
- Working paper recommends the 3-parameter function for length or weight, or the 2-parameter function for age
  - BF=a+(b*X^z) or BF=a*X^b
- Further recommends using mean observed batch fecundity (55523 eggs) for sizes<400mm, to avoid negative fecundity values from the model
  - Given growth of red snapper, this would apply to age-1 fish

- Panel decision: 3-parameter function of mean total length at age (ages 2+), with mean observed BF applied to age-1 fish

Natural mortality

- S41 scaled the Charnov curve to Then et al. M=0.13, which was based on all fishes
  - Scales to provide same cumulative survival of ages 4+
- Panel decision: scale the Lorenzen curve to Then et al. M=0.11, which is based only on Lutjanidae
  - Also scales to provide same cumulative survival of ages 4+
- This approach is the same as that taken in the S68 research track assessment of scamp

Natural mortality



- Shallower slope (younger fish) results primarily from change to Lorenzen
- Lower saturation value (older fish) results primarily from scaling to Lutjanidae data

Video index start year

- S41 started in 2010
  - Given the terminal year of 2014 (originally 2013), strong desire to keep all possible years
  - In SEDAR assessments, red snapper is the only species where this index was started in 2010
- S73-WP05 recommends starting in 2011, because:
  - Camera change in 2011
  - Restricted spatial coverage in 2010
  - Longer time series now, so incentive to include first year of SEFIS is diminished, especially given the differences in sampling then
- Panel decision: Start the video index in 2011

SERFS trap and video indices

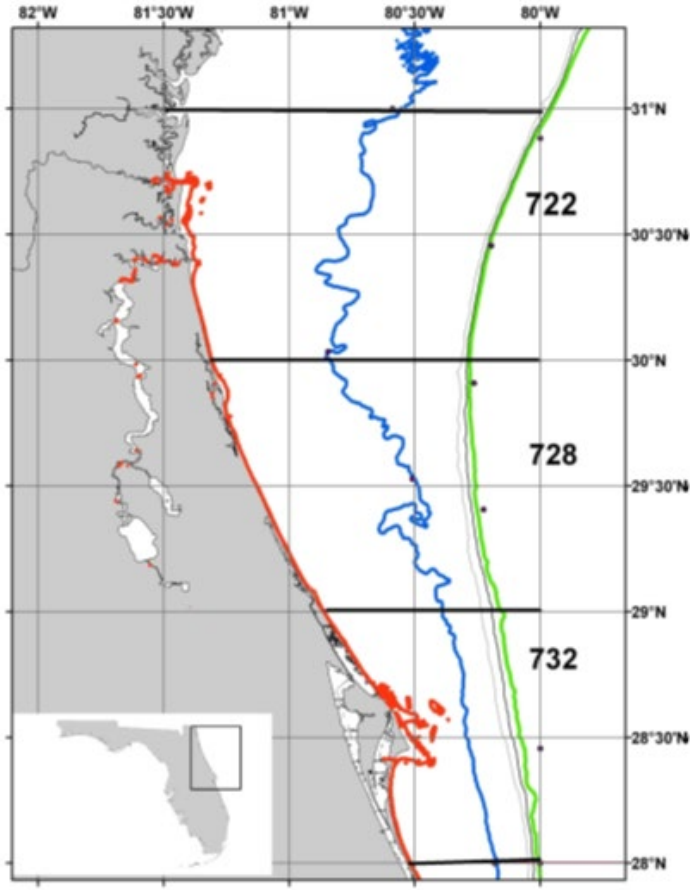
- S41 combined the indices prior to fitting in the assessment, to account for non-independence of sampling
- Selectivity Working Group (S73-WP14) findings:
  - Trap gear is dome-shaped, video gear is believed to be flat-topped
  - Ascending limb appears to be similar for the two gears
- Panel decisions:
  - Keep the indices separate in the assessment, but multiply each likelihood component by 0.5
  - Consider a joint likelihood if time allows

SERFS trap and video selectivities

- Trap is dome-shaped, and can be estimated by fitting to the trap age comp data
- Video is flat-topped, with ascending limb to mirror that of the trap selectivity

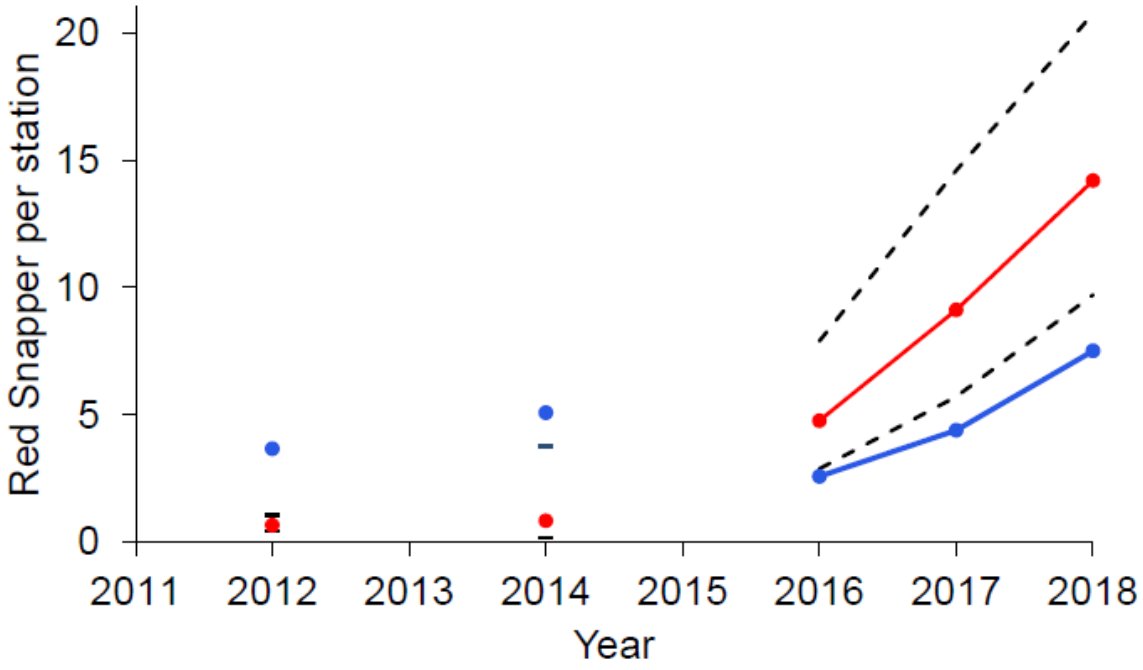
FWRI RTD survey (S73-WP06)

- Stratified random design using NMFS zones 722, 728, 732 and two depth strata, <30 m and >30m
- Conducted in 2012, 2014, 2016, 2017, and 2018
- Hook gear
- Associated age compositions available
- Index was standardized using a GLM assuming a negative binomial distribution



FWRI RTD survey

- Panel decision: Use this index and corresponding age comps in a sensitivity run
  - Exclude 2014 age comps because sampling targeted fish in deeper water for a special study on spawning



Commercial discard lengths

- S41 data were from the South Atlantic Fisheries Foundations Reef Fish Observer Program
- New data source: Shark Bottom Longline Observer Program (includes reef fishes and vertical line gear)
- Panel decision: Use all observer data available for vertical line gear to supplement the S41 data

	n.fish	n.trip
2007-2009	146	13
2010-2019	598	52

Recreational discard lengths

- S41 only had recreational discard lengths from headboat observers
  - No discard lengths for gen rec fleet, assumed its selectivity mirrored the headboat discard selectivity
- New data sources for S73
  - Captain Steve Amick's headboat records, to supplement the headboat observer data
  - Gen rec lengths from charterboat observers and from MyFishCount

Captain Steve Amick's discard lengths (S73-WP04)

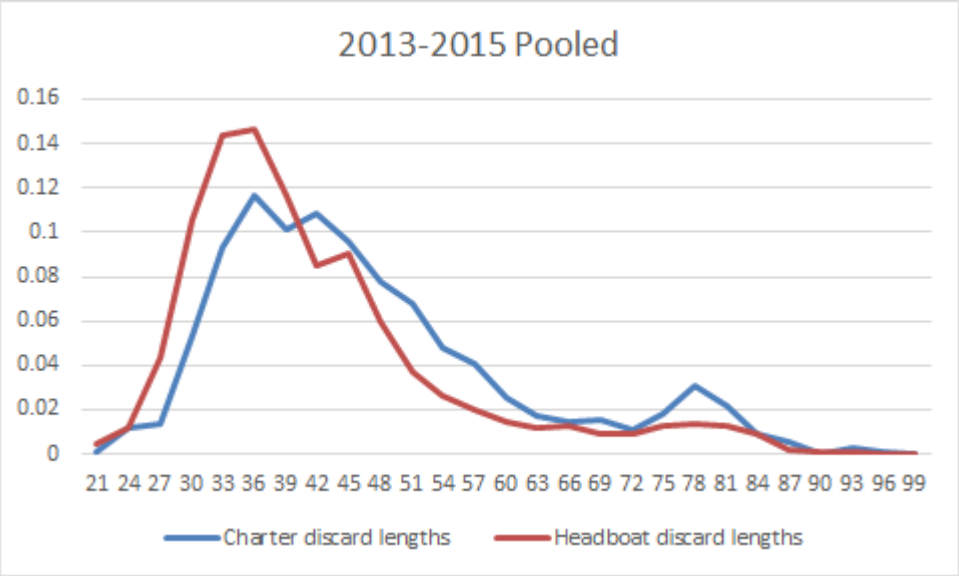
- Headboat out of Savannah, GA
- Lengths of most discarded red snapper were recorded, 2010-2013

Year	# lengths
2010	455
2011	455
2012	263
2013	240
Total	1413

- Panel decision: pool these data with the Headboat observer data from the states, weighted by state-specific discard estimates

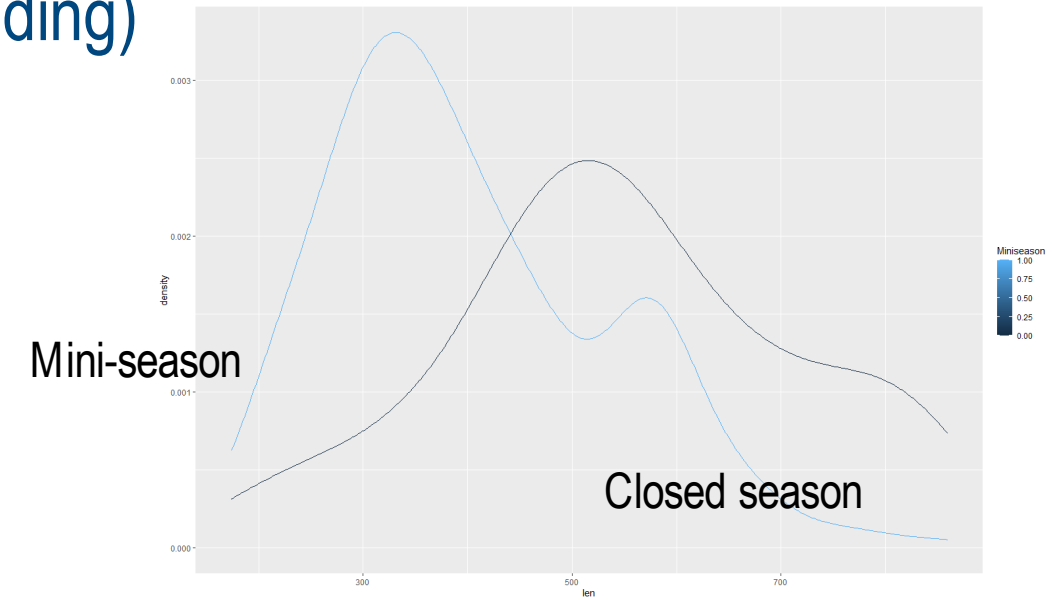
Charterboat discard lengths

- FWRI MARFIN project, 2013-2015 (S73-WP12)
- At-sea observers on charterboats
- Panel decision: Use these annual length comps to estimate discard selectivity of the gen rec fleet



MyFishCount length comps

- 85% of data from during mini-seasons
- S73 panel and observers believe discarding behavior during mini-season to be different from the rest of the year (e.g., high-grading)

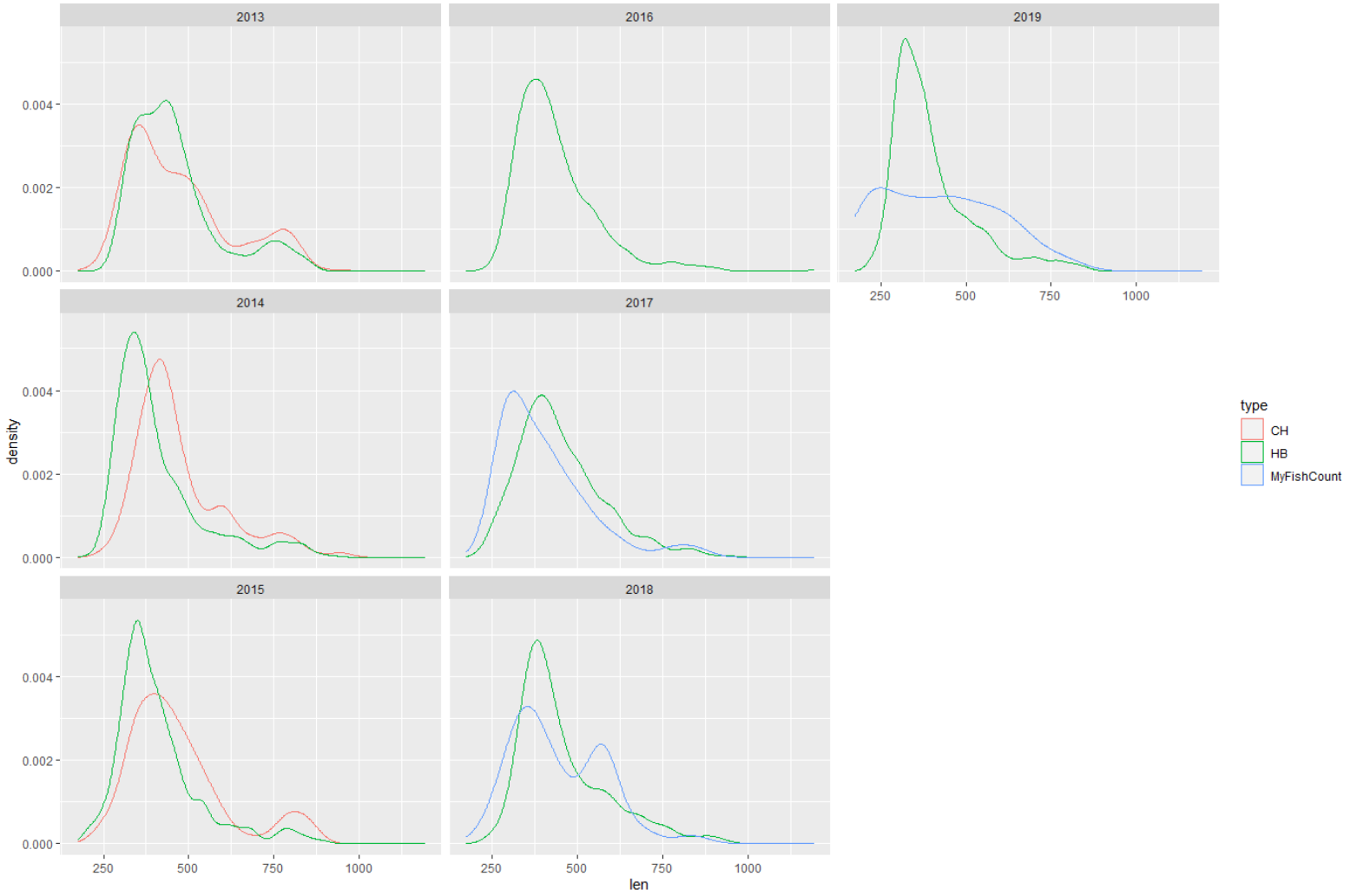


- Panel decision: Use these data in a sensitivity run, along with the FWRI charterboat observer data, to estimate discard selectivity of the gen rec fleet

Summary of recreational discard lengths

	Headboat at-sea			MARFIN Charter observer			Headboat (Steve Amick)			MyFishCount		
Year	N.fish	N.trips	Coverage	N.fish	N.trips	Coverage	N.fish	N.trips	Coverage	N.fish	N.trips	Coverage
2005	494	57	NC - FL									
2006	680	38	NC - FL									
2007	1522	78	NC - FL									
2008	1740	82	NC - FL									
2009	470	71	NC - FL									
2010	369	60	NC - FL				440	70	Savannah, GA			
2011	331	55	NC - FL				447	67	Savannah, GA			
2012	725	80	NC - FL				211	41	Savannah, GA			
2013	574	96	NC - FL	425	50	Florida	213	50	Savannah, GA			
2014	643	74	NC - FL	351	41	Florida						
2015	882	71	NC - FL	210	28	Florida						
2016	815	78	NC - FL									
2017	764	78	NC - FL							82	49	GA-nFL
2018	951	84	NC - FL							76	44	GA-nFL
2019	918	92	NC - FL							93	45	GA-nFL

Discard length comps by fleet



Discard mortality

- S41 had two time blocks (J hook v circle hook), values differed for commercial and recreational (same value for headboats and gen rec)
  - recreational: pre-2011 and 2011-2014
  - commercial: pre-2007 and 2007-2014
- S73-WP15 summarized new information on discard mortality and utility of descender devices
- S73 panel decisions:
  - Three time blocks for the assessment period and a fourth for forecasts
  - Separate estimates for headboats and gen rec, starting with block two
  - Apply same proportional reductions in discard mortality from charterboat to commercial (25% descender usage for block 3, 75% usage for block 4)
  - Assume same level of uncertainty from S41

Discard mortality

S41

Sector	Pre-Regulation	Range	Post-Regulation	Range
Recreational	37%	(27%-45%)	28.50%	(20%-36%)
Commercial	48%	(38%-58%)	38%	(28%-38%)

S73

	Block 1	Block 2	Block 3 (2017-2020)	Block 4 (post 2020)
Headboats	0.37 (0.27-0.45)	0.26 (0.18-0.34)	0.25 (0.17-0.33)	0.22 (0.14-0.3)
Gen rec	0.37 (0.27-0.45)	0.28 (0.2-0.36)	0.26 (0.18-0.34)	0.23 (0.15-0.31)
Commercial	0.48 (0.38-0.58)	0.38 (0.28-0.48)	0.36 (0.26-0.46)	0.32 (0.22-0.42)

Topics

- Review of S41 data
- New data considerations for S73
- **Model modifications**

Model modifications (to date)

- Pool historical recreational fleet (headboat + gen rec)
- Mean recruitment model
- Dirichlet-multinomial likelihood

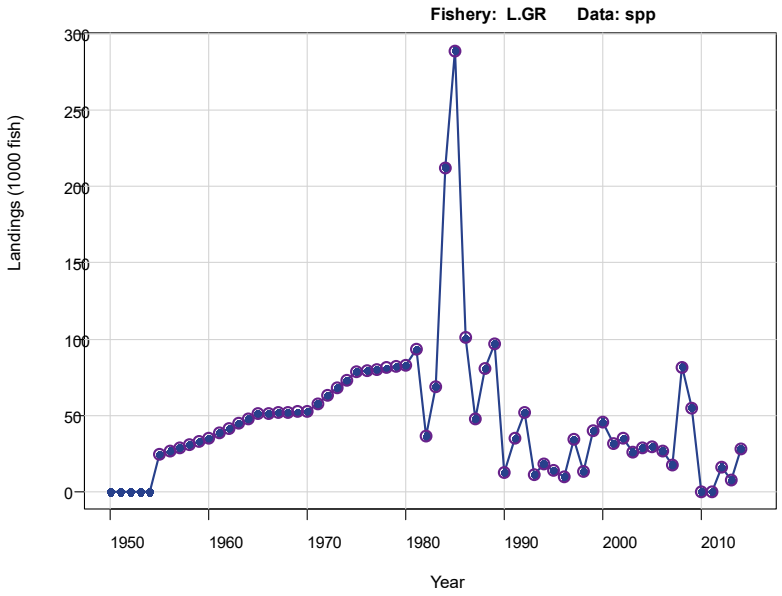
Pool historical recreational fleets

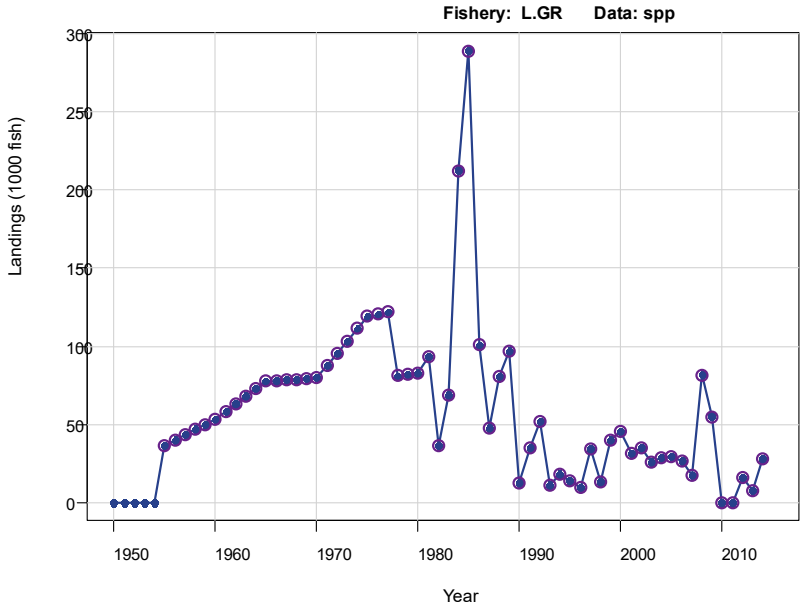
- Headboat and gen rec share a selectivity curve in block 1 (1955-1992)
- Pooled landings were estimated prior to 1981, then split between headboat and gen rec using a constant ratio
- However, nothing is gained by separating them prior to 1978, the first year of headboat length comps
- Separating headboat in 1978 saves 23 parameters (annual estimates of headboat F, 1955-1977)

S41

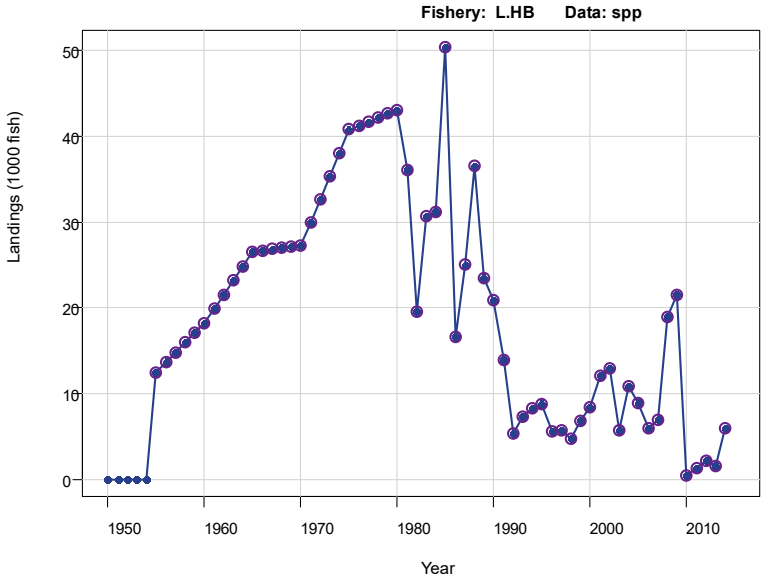
S41 alternative

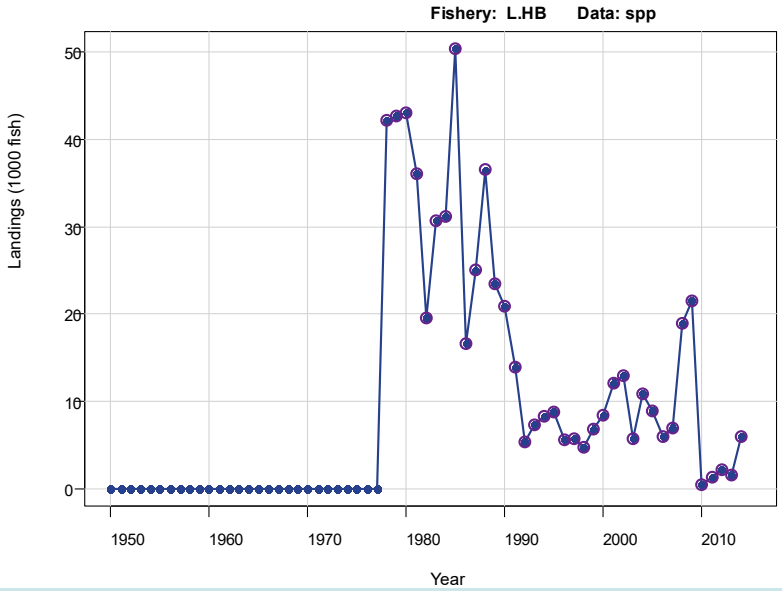
Gen Rec



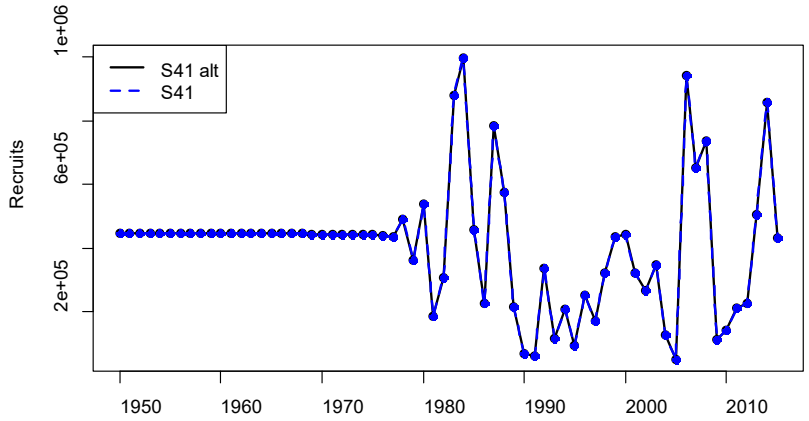


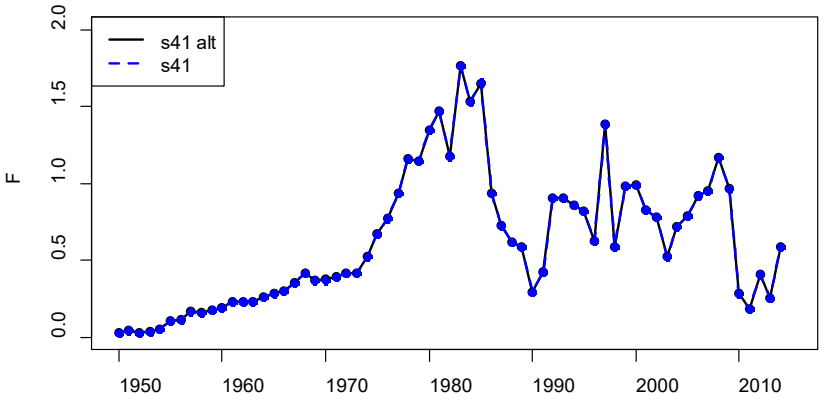
Headboat

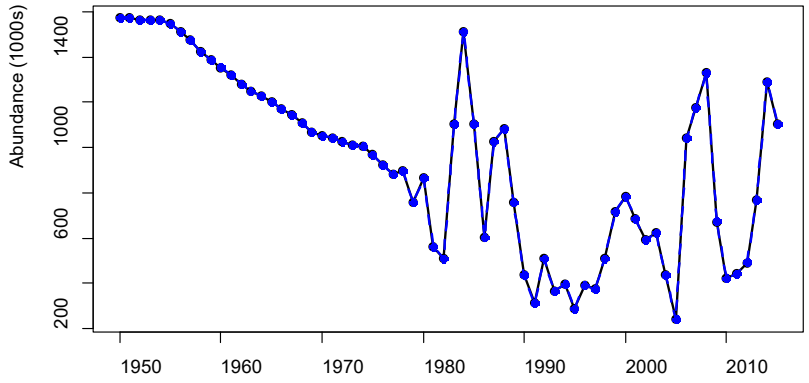


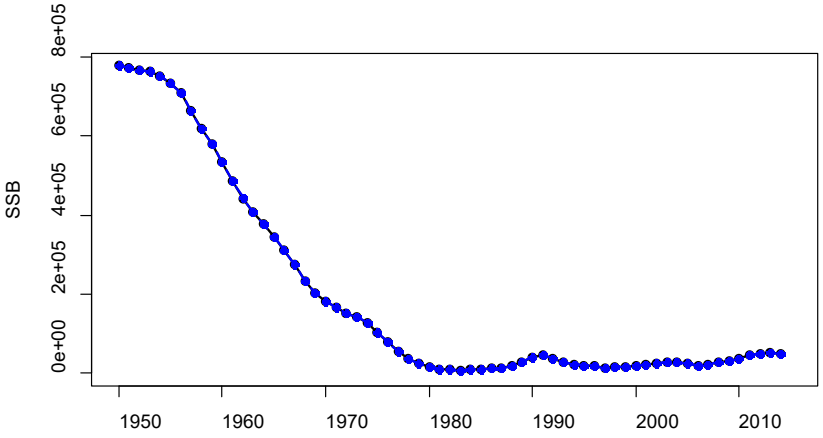


Pooled historical recreational landings







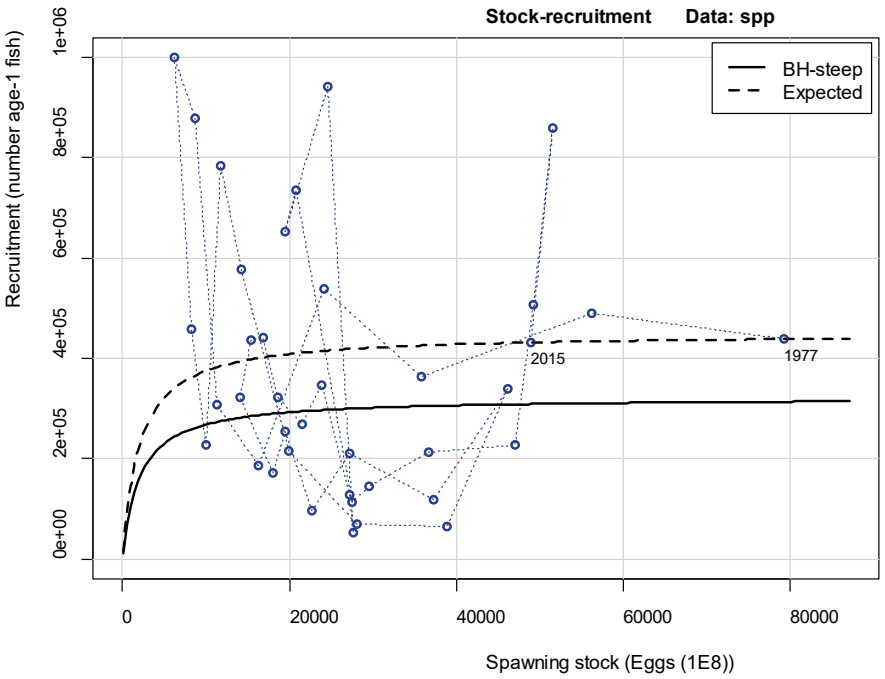


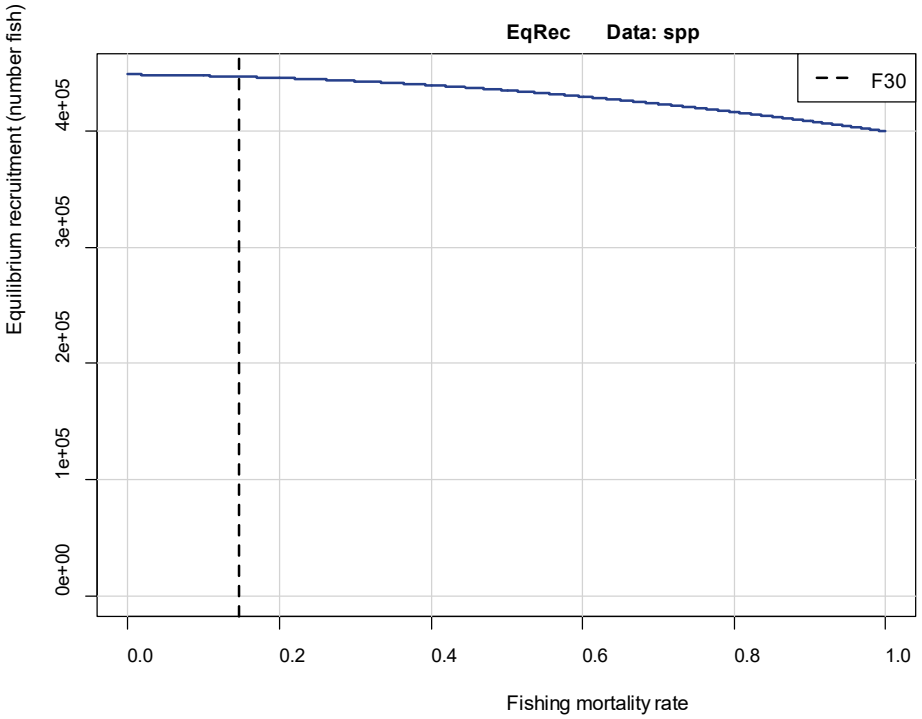
- Panel decision:
  - Pool headboat with general recreational landings for historic period
  - Separate headboat fleet starting in 1978, first year of headboat length comps

Spawner-recruit function

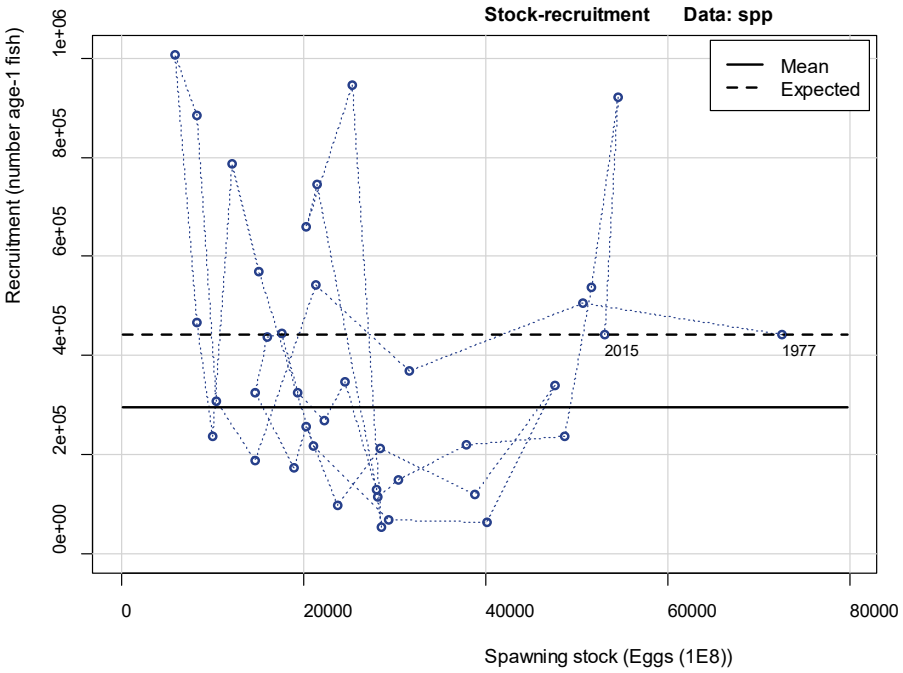
- Steepness could not be estimated in S15, S24, or S41
- S41 used the Beverton-Holt recruitment model with fixed steepness=0.99, to approximate the mean recruitment model
- Current version of BAM has an option for the mean recruitment model

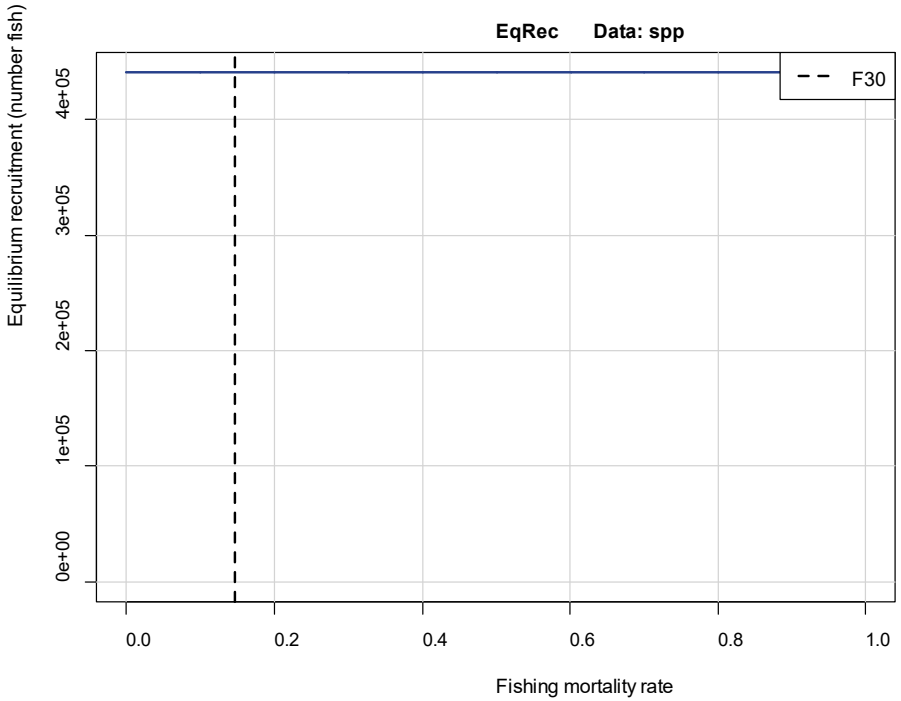
S41 with Beverton-Holt model (h=0.99)



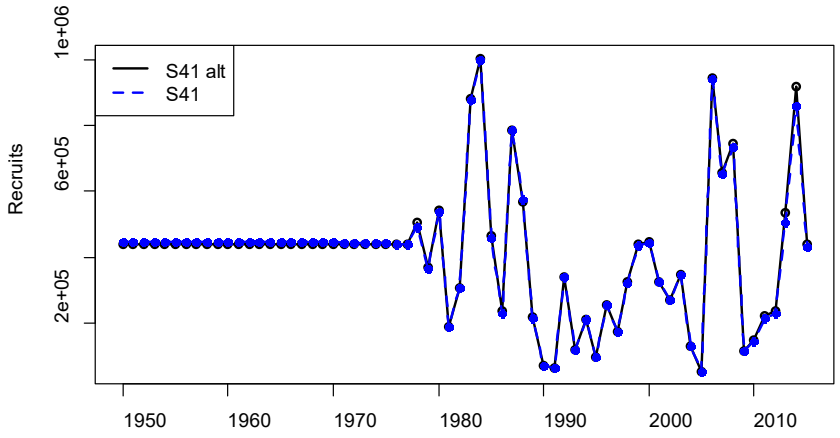


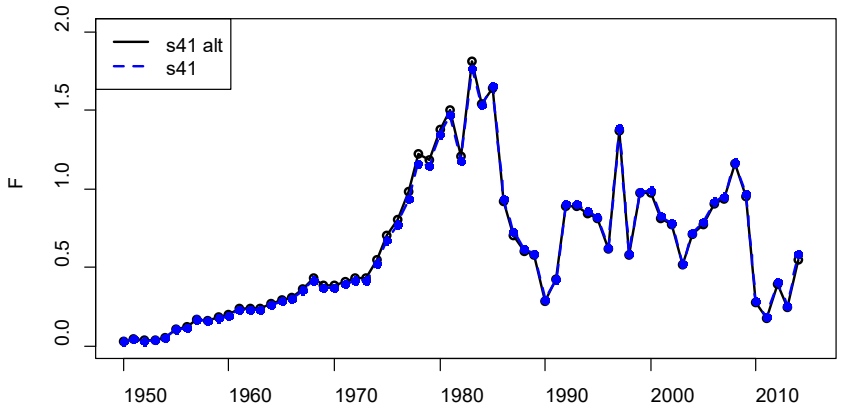
S41 with mean recruitment model

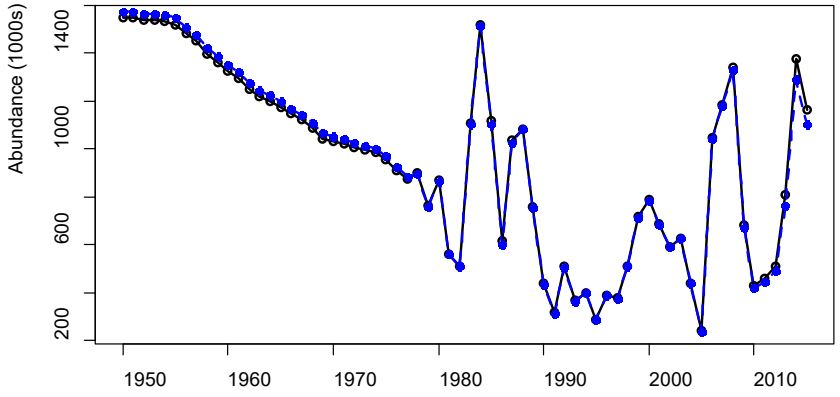


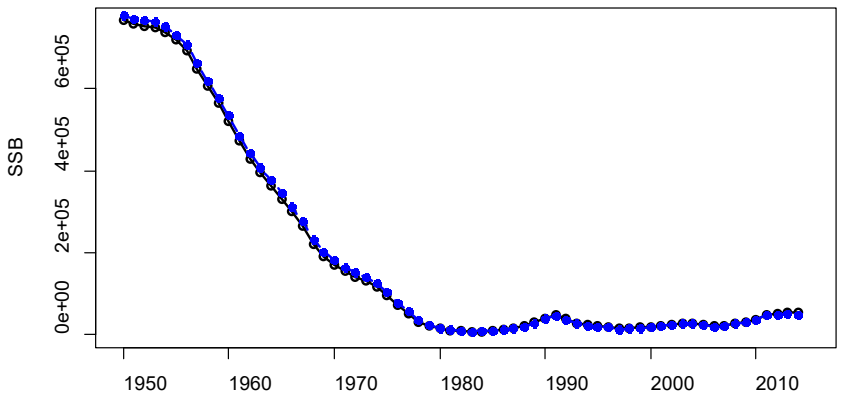


Bev Holt (h=0.99) v. mean recruitment model









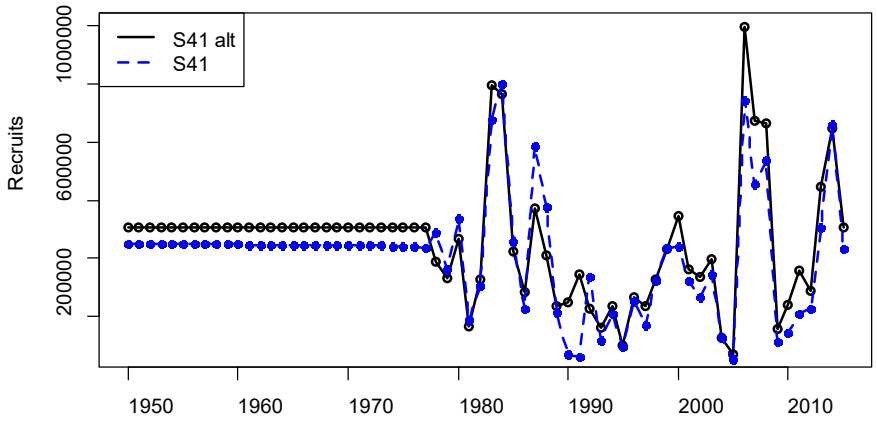
- Panel decision
  - Use the “mean recruitment” model in S73, if steepness cannot be estimated

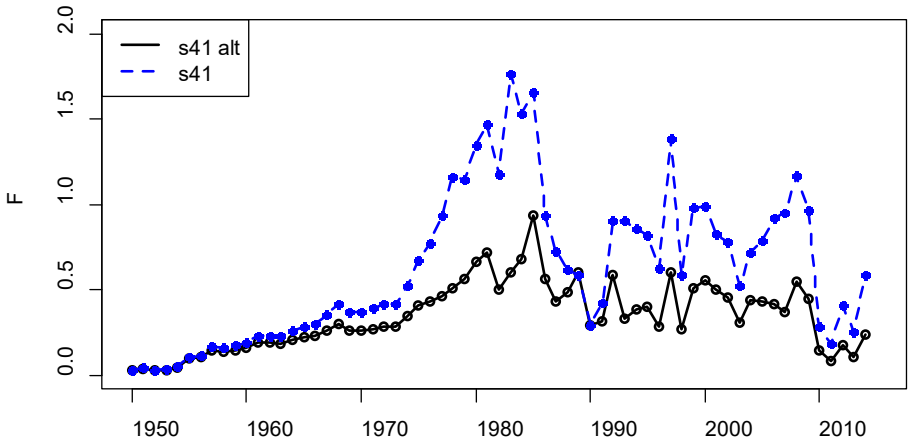
Dirichlet-multinomial

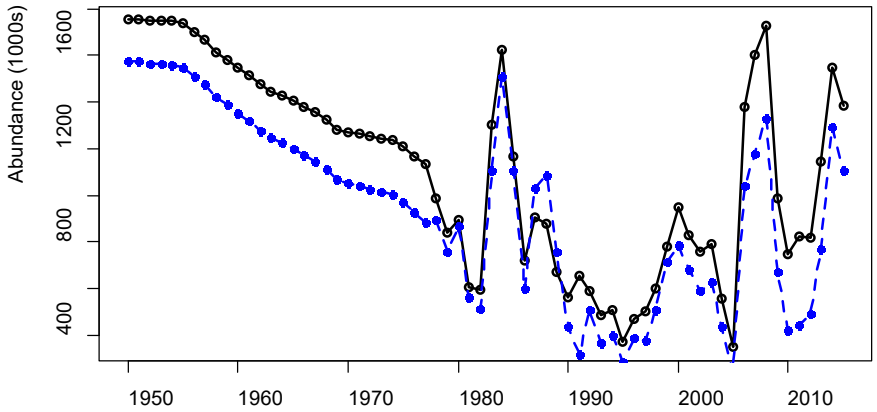
- S41 fit comp data using the robust multinomial likelihood
- Current version of BAM has option for Dirichlet-multinomial likelihood for fitting comp data
- Recent SA assessments have used this option
    - Better accounts for correlation in sampling
    - Self-weighting (no need for iterative reweighting of comp data)
    - Allows for zeros in the observations

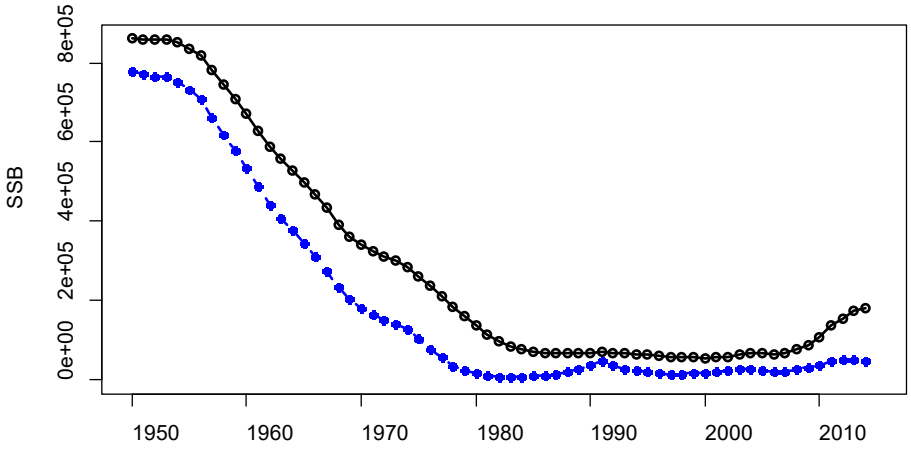
Robust multinomial v Dirichlet-multinomial

(Note: This shows a simple replacement. I did not explore likelihood profiles of DM parameters or re-weighting of indices.)









- Panel decision:
  - Replace robust multinomial with Dirichlet multinomial for fitting age and length comps

Next steps

- Incorporate new data into the updated model
- Examine behavior of the S73 model