Tanner Crab Report

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Topics

- Impacts on assessment
  - potential loss of EBS shelf survey corner stations
  - changes in bycatch estimation in groundfish fisheries
  - revised input sample sizes for survey size compositions

- Model simplifications
  - fit to ADFG management area-specific directed fishery catch data rather than aggregated data
    - may simplify selectivity for the directed fishery
  - start in 1982 to avoid
    - uncertain foreign fleet catch data
    - major changes in survey gear, areal coverage
    - long initialization period

- Model additions
  - ability to estimate non-equilibrium initial numbers-at-XMSZ
  - multiyear projections with a range of potential F's

- Proposed models for September assessment

Model developments

- Revised management quantity calculations to allow uncertainty estimates assuming likelihood surface is MVN at the MLE (SSC request)
  - uses results from ADMB "std" file
  - approximation to MCMC
- Projections: added ability to
  - resample estimated recruitment
  - project under arbitrary F's for the directed fishery (SSC request)
- Started developing a GMACS model

Model developments

- Added ability to estimate initial population numbers-at-size by XMS as parameters (CPT suggestion to start model later) using
  - ln-scale base initial abundance + ln-scale deviations

$$n_{1,1,1,1} = \exp(\eta_1)$$
$$n_{x,m,s,z} = \exp(\eta_1 + \eta_{x,m,s,z}) \text{ for } x, m, s, z \neq 1,1,1,1$$

  - ln-scale total initial abundance and logistic-scale parameters

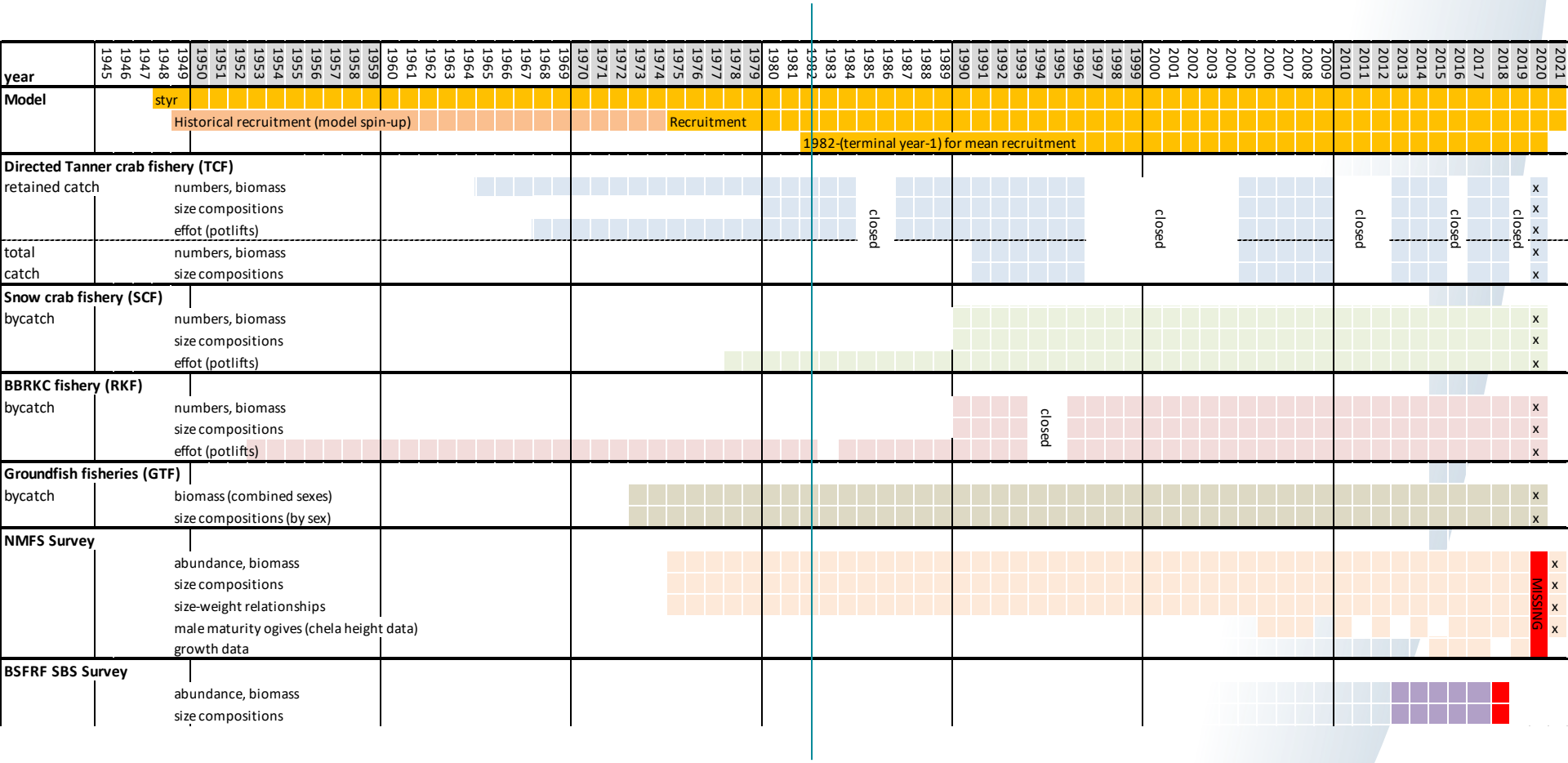
$$n_{x,m,s,z} = \exp(\eta_1) \cdot p_{x,m,s,z}$$
$$p_{x,m,s,z} = \frac{\tilde{p}_{x,m,s,z}}{\sum_{x,m,s,z} \tilde{p}_{x,m,s,z}}$$
$$\tilde{p}_{x,m,s,z} = \frac{1}{1 + e^{-\eta_{x,m,s,z}}}$$

  - smoothing penalties can be applied

Model Explorations

model configuration	parent	changes	number of parameters
21.22a	--	2021 assessment model	346
No Corner Stations	21.22a	survey biomass time series and size compositions calculated using NMFS trawl survey hauls with the "corner" stations removed for all years	346
22.01	21.22a	using updated bycatch estimates for the groundfish fisheries used in place of old versions	346
22.02	21.22a	using input sample sizes for survey size compositions based on effective sample sizes from bootstrapping in place of default value of 200	346
22.03	21.22a	fits to fishery catch data changed from sex-specific to aggregated, corresponding fits to size composition data changed to extended versions	346
22.04a	21.22a	using directed fishery data by ADFG management areas from 2005 on + changes to selectivity functions for directed fishery and snow crab fishery	350
22.04b	21.22a	fishery biomass likelihoods change from lognormal to normal	350
22.05a, b, c, d	21.22a	Starting model in 1982, all data prior to 1982 dropped, estimating initial population size using individual parameters on log scale, a-d: increased weights	403
22.06a, b, c, d	21.22a	Starting model in 1982, all data prior to 1982 dropped, estimating initial population size using individual parameters on logistic scale, a-d: increased weights	404

21.22a: time frames



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21.22a: fishery processes

Fishery/process	time blocks	21.22a description
TCF	directed Tanner crab fishery	
capture rates	pre-1965	male nominal rate
	1965+	male ln-scale mean + annual devs
	1949+	ln-scale female offset
male selectivity	1949-1990	ascending logistic
	1991-1996	annually-varying ascending logistic
	2005+	annually-varying ascending logistic
female selectivity	1949+	ascending logistic
male retention	1949-1990, 1991-1996, 2005-2009, 2013-2015, 2017, 2018	ascending logistic
% retained	pre-1988	fixed at 100%
	1991-1996	fixed at 100%
	2005-2009	fixed at 100%
	2013+	fixed at 100%
SCF	bycatch in snow crab fishery	
capture rates	pre-1978	nominal rate on males
	1979-1991	extrapolated from effort
	1992+	male ln-scale mean + annual devs
	1949+	ln-scale female offset
male selectivity	1949-1996	dome-shaped (double normal)
	1997-2004	dome-shaped (double normal)
	2005+	dome-shaped (double normal)
female selectivity	1949-1996	ascending logistic
	1997-2004	ascending logistic
	2005+	ascending logistic

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21.22a: fishery processes

Fishery/process	time blocks	21.22a description
RKF	bycatch in BBRKC fishery	
capture rates	pre-1952	nominal rate on males
	1953-1991	extrapolated from effort
	1992+	male ln-scale mean + annual devs
	1949+	ln-scale female offset
male selectivity	1949-1996	ascending normal, asymptote fixed
	1997-2004	ascending normal, asymptote fixed
	2005+	ascending normal, asymptote fixed
female selectivity	1949-1996	ascending normal
	1997-2004	ascending normal
	2005+	ascending normal
GTF	bycatch in groundfish fisheries	
capture rates	pre-1973	male ln-scale mean from 1973+
	1973+	male ln-scale mean + annual devs
	1973+	ln-scale female offset
male selectivity	1949-1986	ascending logistic
	1987-1996	ascending logistic
	1997+	ascending logistic
female selectivity	1949-1986	ascending logistic
	1987-1996	ascending logistic
	1997+	ascending logistic

21.22a: survey processes

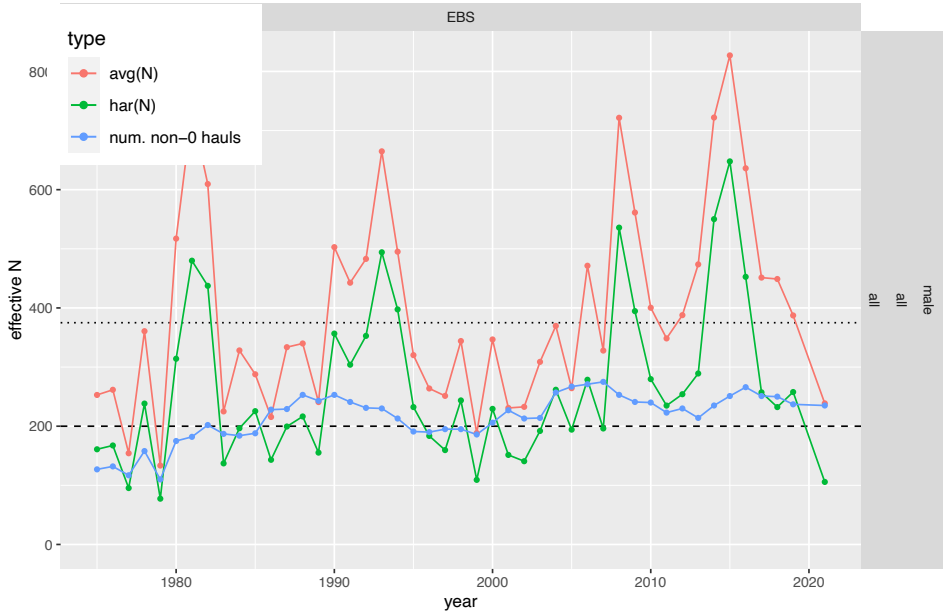
process	time blocks	21.22a description
Surveys		
NMFS EBS trawl survey		
male survey q	1975-1981	ln-scale
	1982+	ln-scale w/ prior based on Somerton's underbag experiment
female survey q	1975-1981	ln-scale
	1982+	ln-scale w/ prior based on Somerton's underbag experiment
male selectivity	1975-1981	ascending logistic
	1982+	ascending logistic
female selectivity	1975-1981	ascending normal, estimated fully-selected size
	1982+	ascending normal, fixed asymptote
BSFRF SBS trawl surveys		
male catchability	2016-2017	fixed at 1 for all sizes
male availability	2016-2017	empirically-determined outside the model
female catchability	2016-2017	fixed at 1 for all sizes
female availability	2016-2017	empirically-determined outside the model

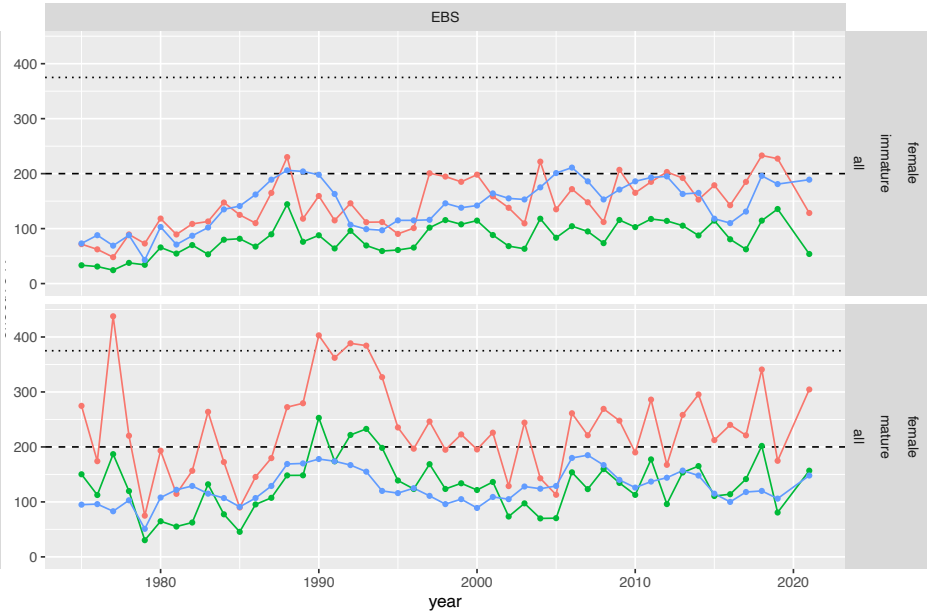
21.22a: population processes

process	time blocks	21.22a description
Population rates and quantities		
Population built from annual recruitment		
Recruitment	1949-1974	ln-scale mean + annual devs constrained as AR1 process
	1975+	ln-scale mean + annual devs
	1949+	sigma-R fixed
Growth	1949+	sex-specific
		mean post-molt size: power function of pre-molt size
		post-molt size: gamma distribution conditioned on pre-molt size
Maturity	1949+	sex-specific
		size-specific probability of terminal molt
		logit-scale parameterization
Natural mortalty	1949-1979,	estimated sex/maturity state-specific multipliers on base rate
	1985+	priors on multipliers based on uncertainty in max age
	1980-1984	estimated "enhanced mortality" period multipliers

Motivations: 22.02—revised survey sample sizes

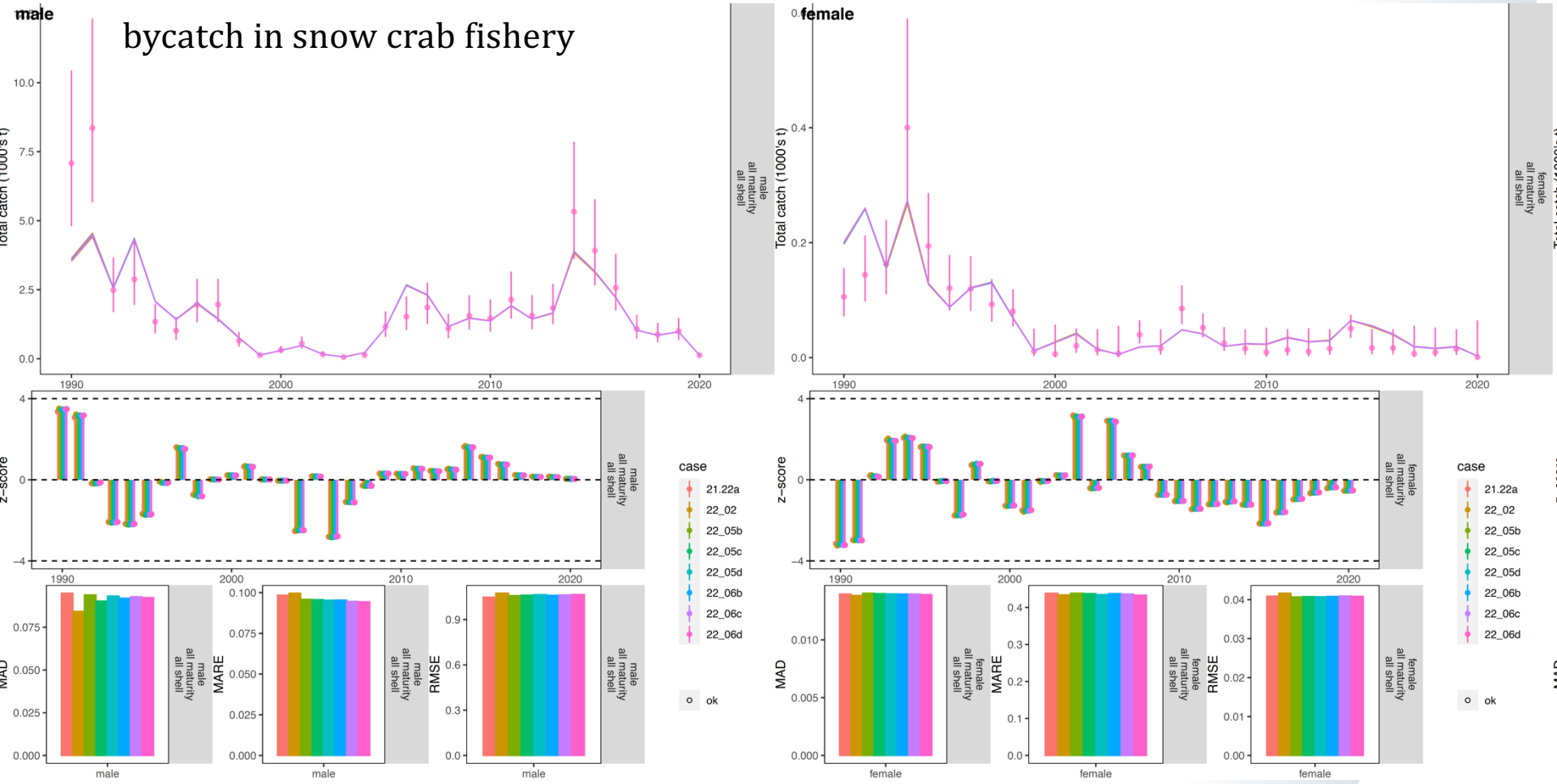
- 22.02: revised input sample sizes for survey size comps
  - current input sample sizes are fixed at 200
  - concerned that size comps may be overweighted
  - used bootstrapping to estimate effective sample sizes
    - effective sizes higher than current input sample sizes





FISHERIES

Motivations: 22.03--Fit to total catch biomass



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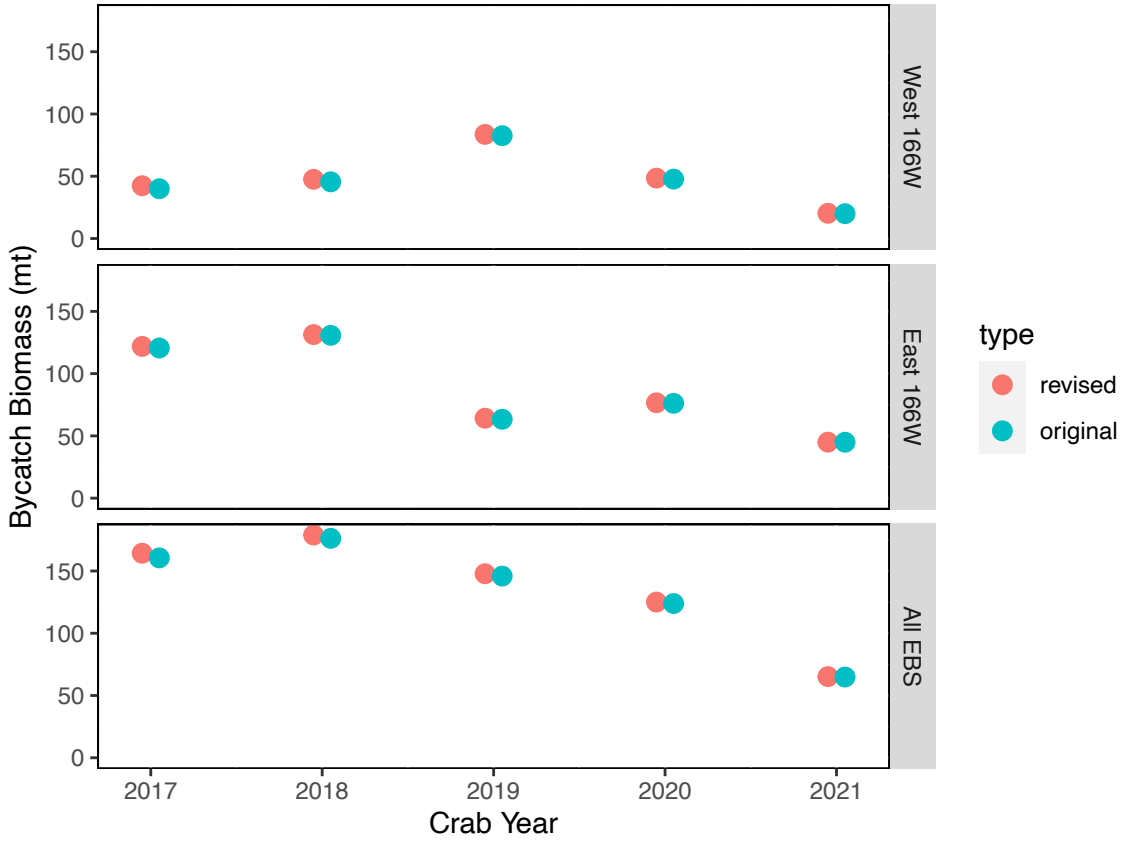
Motivations: 22.05's, 22.06's—start in 1982

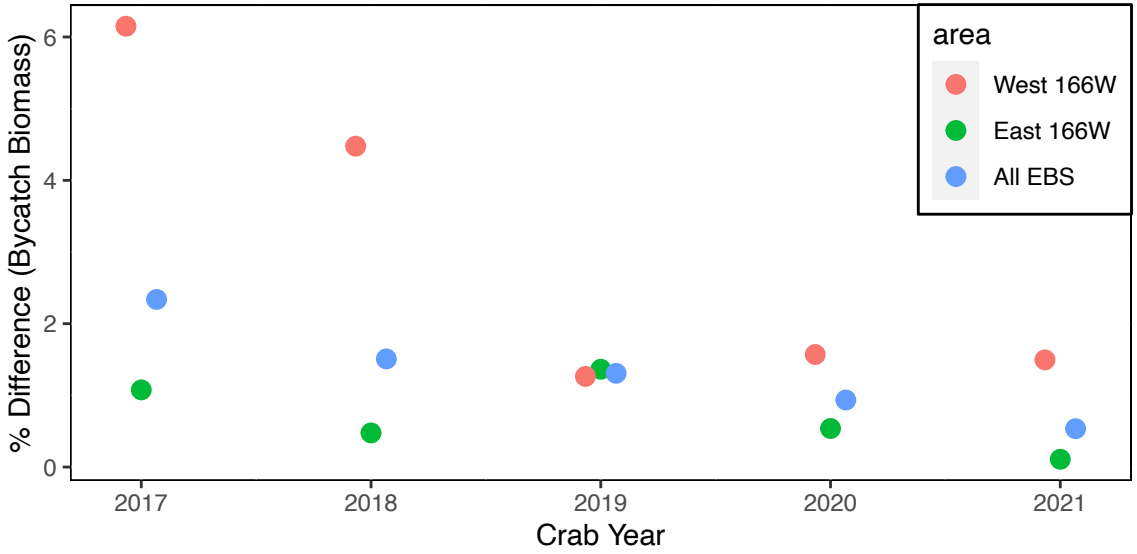
- 21.22a
  - starts in 1948, builds up population through recruitment
  - 1965-1979: retained catch data from foreign and domestic fleets of uncertain quality
  - effort data used to extrapolate bycatch in BBRKC, snow crab fisheries prior to 1990
  - NMFS trawl survey gear standardization in 1982
    - areal coverage varied annually prior to 1982
    - model uses multiple time blocks to model q, selectivity
  - Elevated mortality period 1980-1984
- 22.05's, 22.06's
  - start in 1982
  - estimate initial numbers-at-size as parameters
  - no elevated mortality period

Initial results

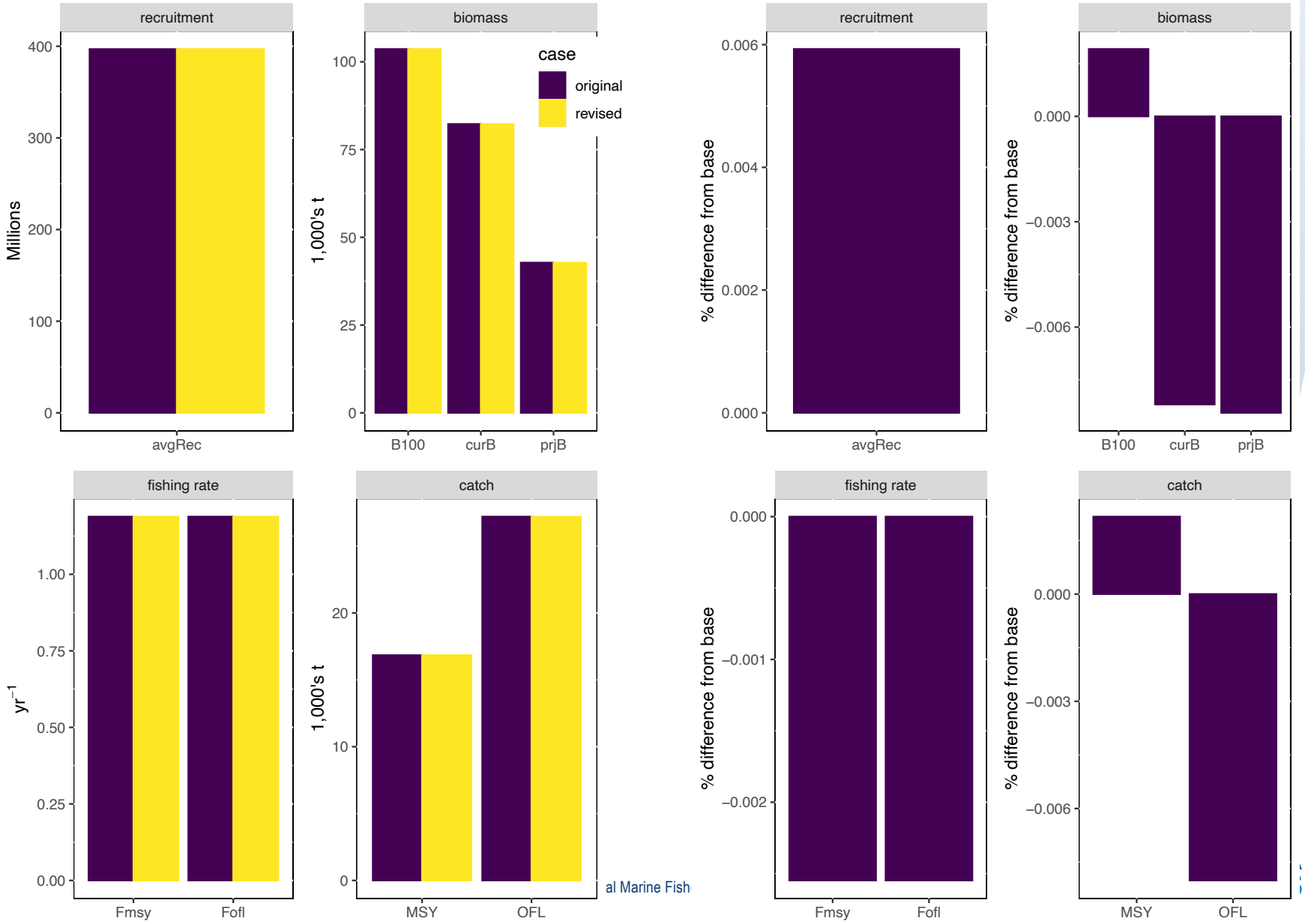
model configuration	parent	changes	number of parameters	jitter runs	number at bounds	objective function value	max gradient	invertible for std. devs?
21.22a	--	2021 assessment model	346	--	0	3014.12	5.92E-04	yes
No Corner Stations	21.22a	survey biomass time series and size compositions calculated using NMFS trawl survey hauls with the "corner" stations removed for all years	346	--	0	3023.45	7.58E-05	yes
22.01	21.22a	using updated bycatch estimates for the groundfish fisheries used in place of old versions	346	--	0	3014.11	5.83E-04	yes
22.02	21.22a	using input sample sizes for survey size compositions based on effective sample sizes from bootstrapping in place of default value of 200	346	--	2	3785.04	3.82E-04	yes
22.03	21.22a	fits to fishery catch data changed from sex-specific to aggregated, corresponding fits to size composition data changed to extended versions	346	--	0	2982.62	2.06E-05	yes
22.04a	21.22a	using directed fishery data by ADFG management areas from 2005 on + changes to selectivity functions for directed fishery and snow crab fishery	350	400		no converged runs		
22.04b	21.22a	fishery biomass likelihoods change from lognormal to normal	350	400		no converged runs		
22.05a	21.22a	Starting model in 1982, estimating initial population size using individual parameters on log scale, no smoothing on parameters, all data prior to 1982 dropped	403	--	3	2701.50	1.79E-03	no
22.05b	22.05a	smoothing weight = 0.1	403	--	2	2727.16	3.62E-04	yes
22.05c	22.05a	smoothing weight = 1.0	403	--	2	2899.22	5.41E-04	yes
22.05d	22.05a	smoothing weight = 10.0	403	--	2	4128.05	3.55E-04	yes
22.06a	21.22a	Starting model in 1982, estimating initial population size using individual parameters on logistic scale, no smoothing on parameters, all data prior to 1982 dropped	404	--	7	2719.84	1.59E-04	no
22.06b	22.06a	smoothing weight = 0.1	404	400	2	2766.73	1.04E-03	yes
22.06c	22.06a	smoothing weight = 1.0	404	--	3	3004.20	1.24E-03	yes
22.06d	22.06a	smoothing weight = 10.0	404	--	2	4216.40	1.00E-03	yes

Model 22.01: Changes to bycatch estimation for groundfish fisheries





Model 22.01


recruitment
Millions
400
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B100
curB
prjB
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recruitment
% difference from base
0.006
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0.000
avgRec
biomass
% difference from base
0.000
−0.003
−0.006
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curB
prjB
fishing rate
yr−1
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0.50
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fishing rate
% difference from base
0.000
−0.001
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% difference from base
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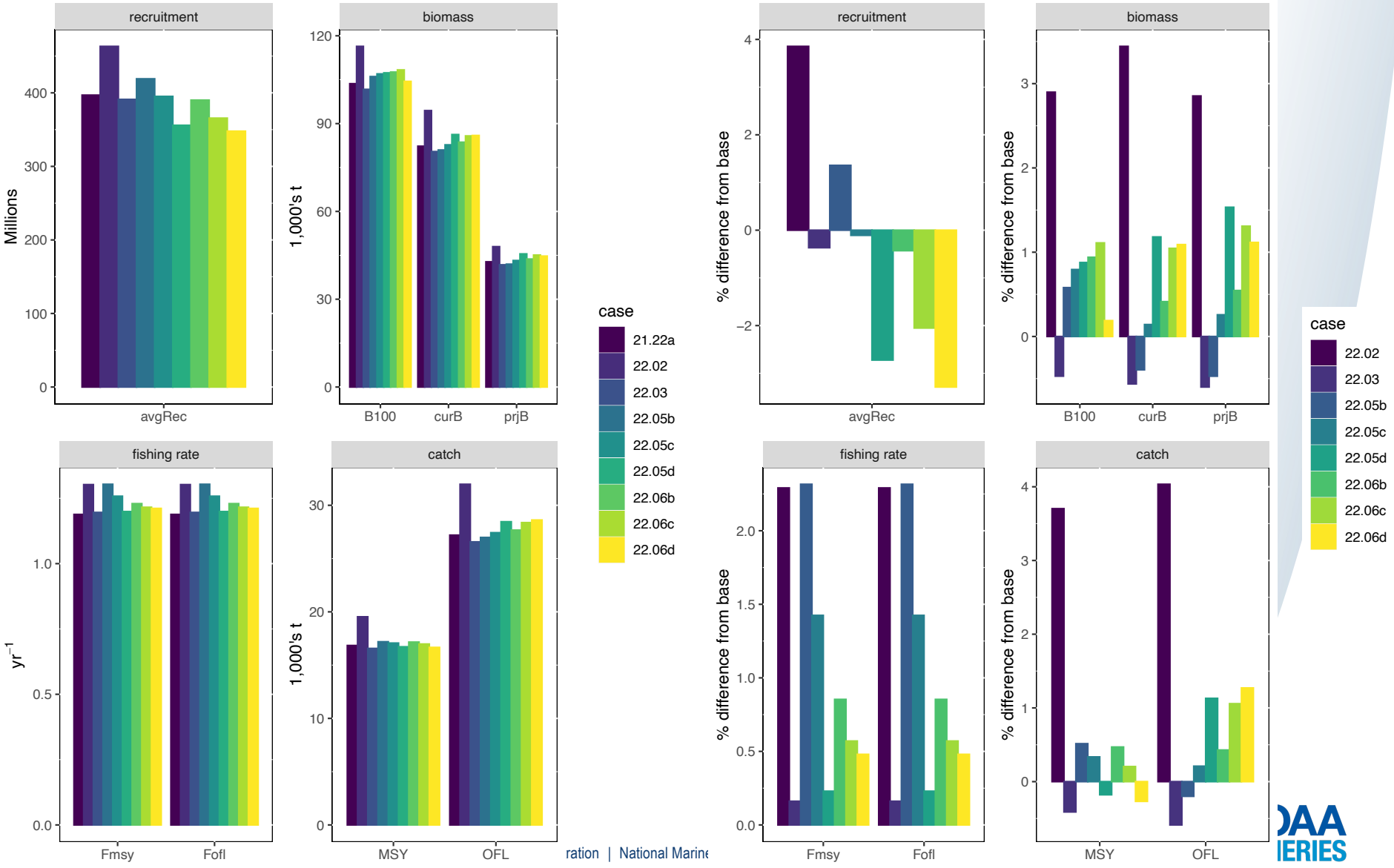
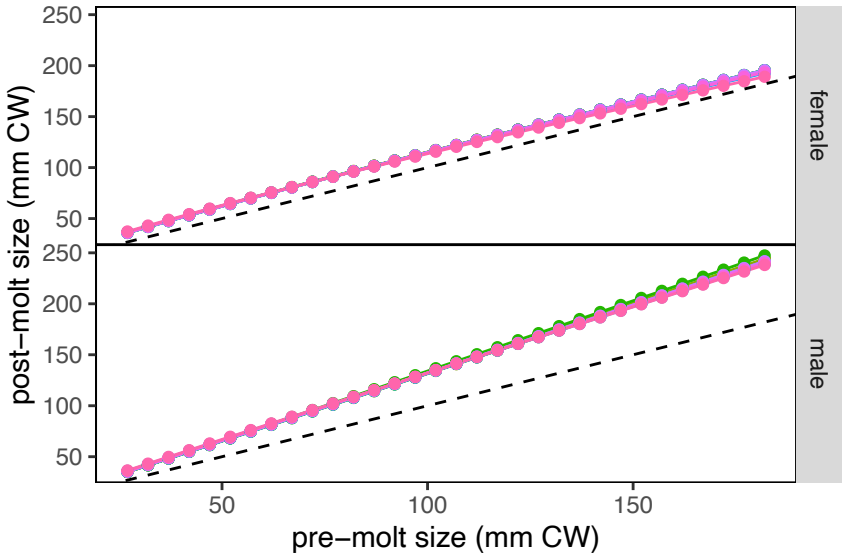
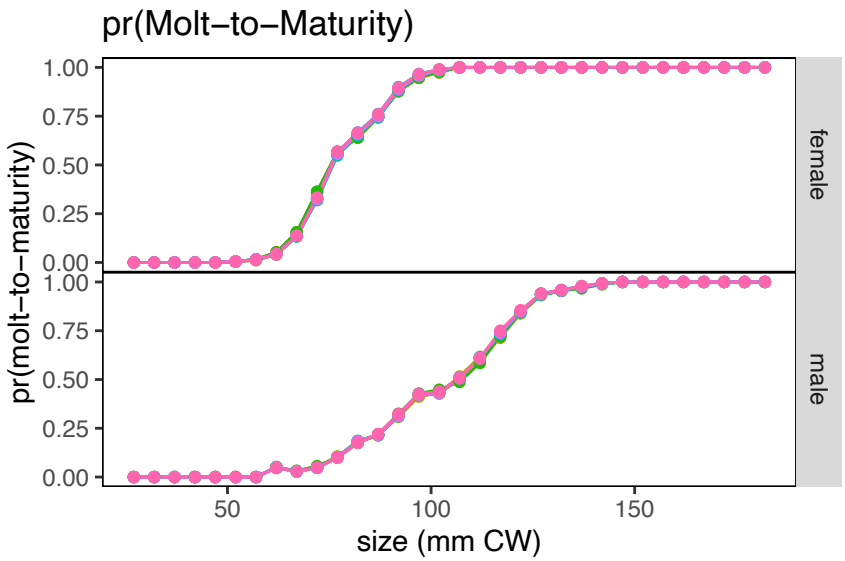
−0.006
MSY
OFL

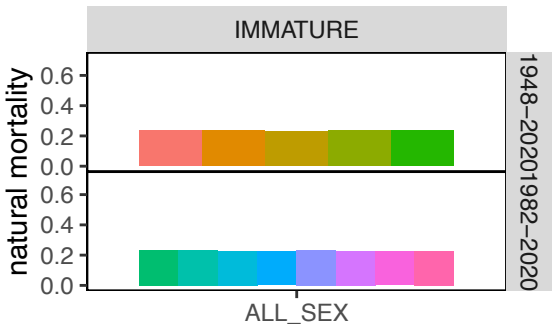
Management quantities

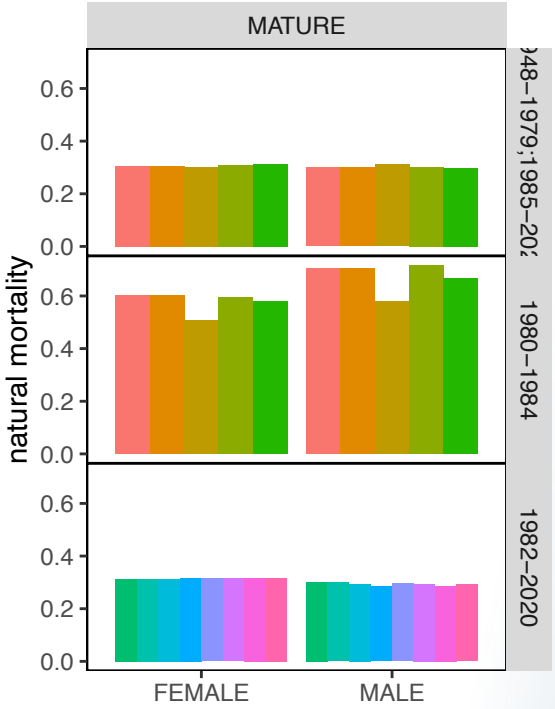


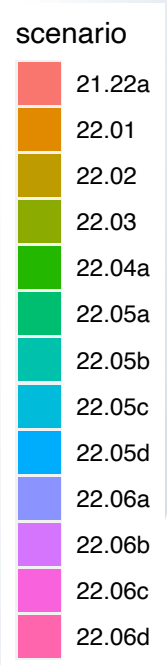
Population processes











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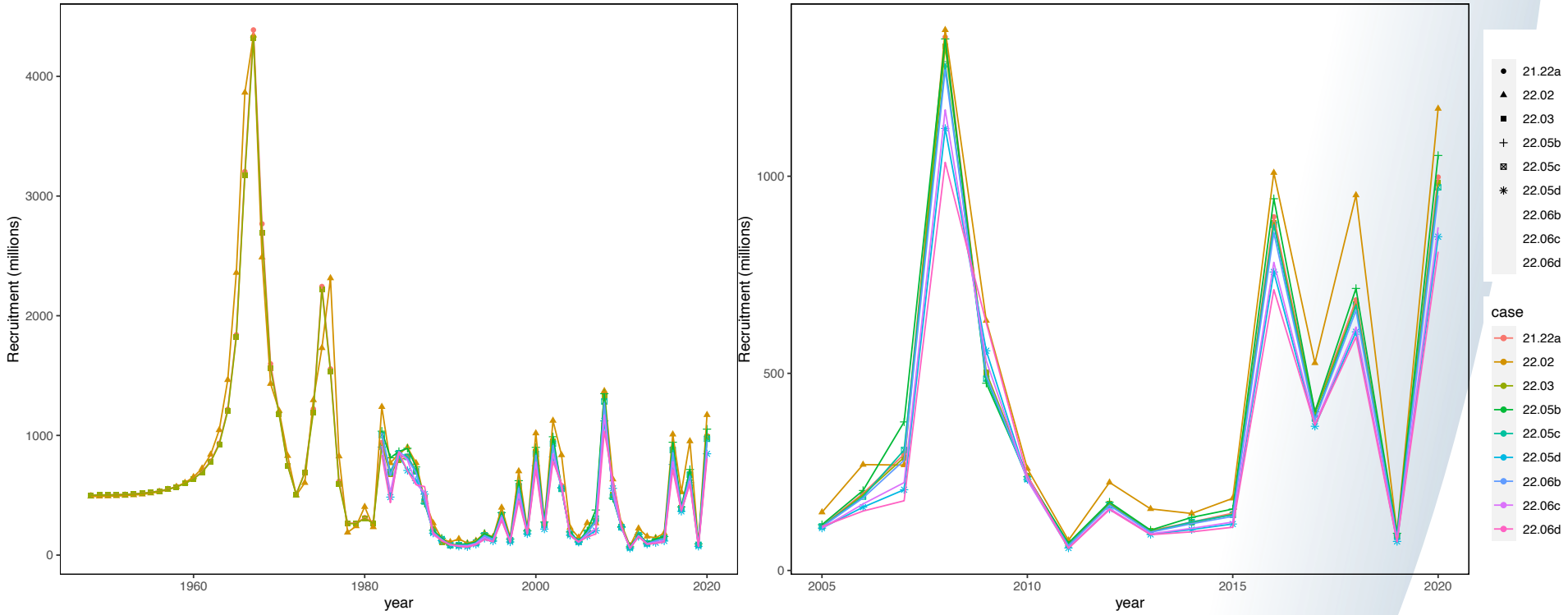
Recruitment



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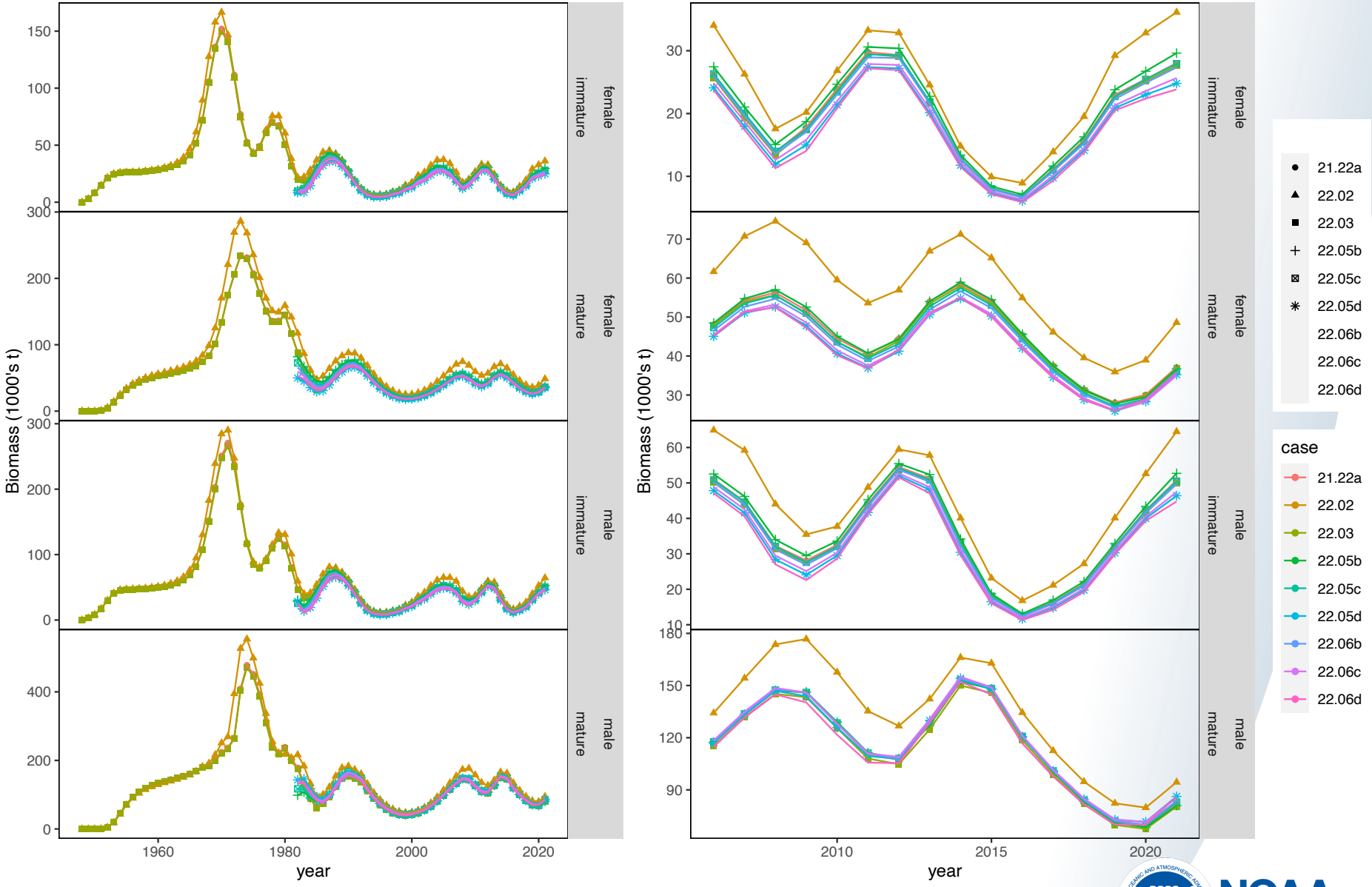
Population biomass



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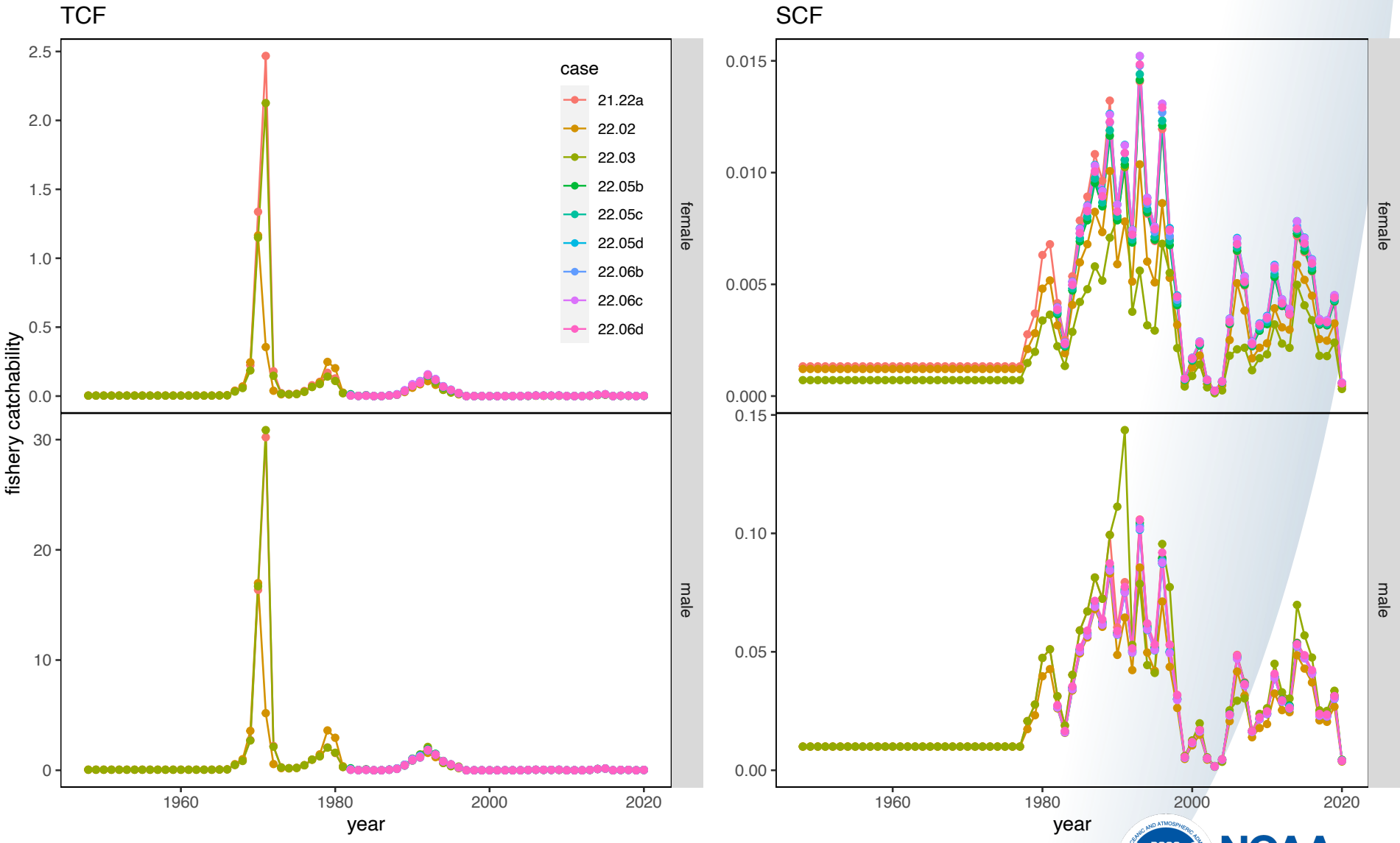
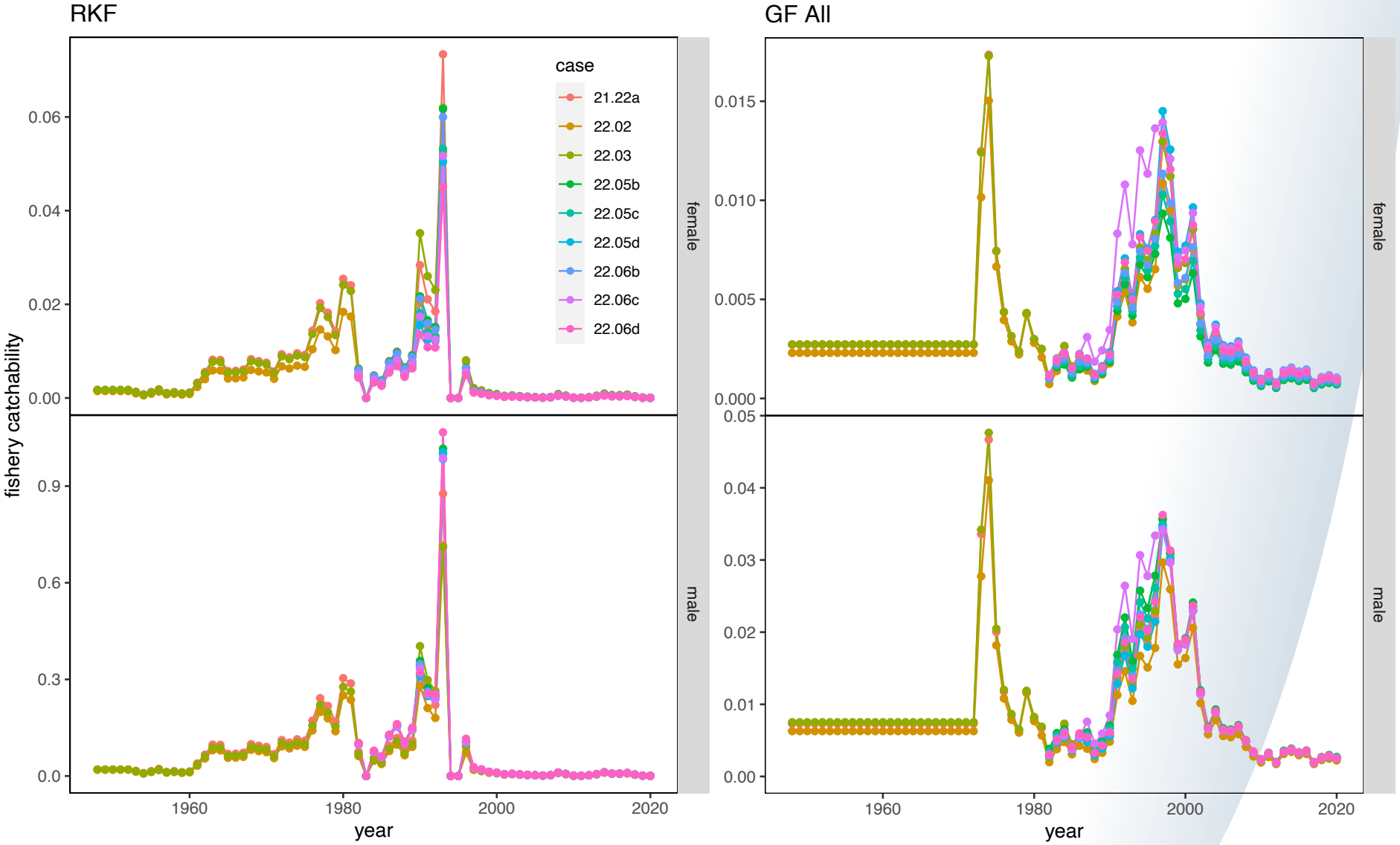
Fishery capture rates



Fishery capture rates



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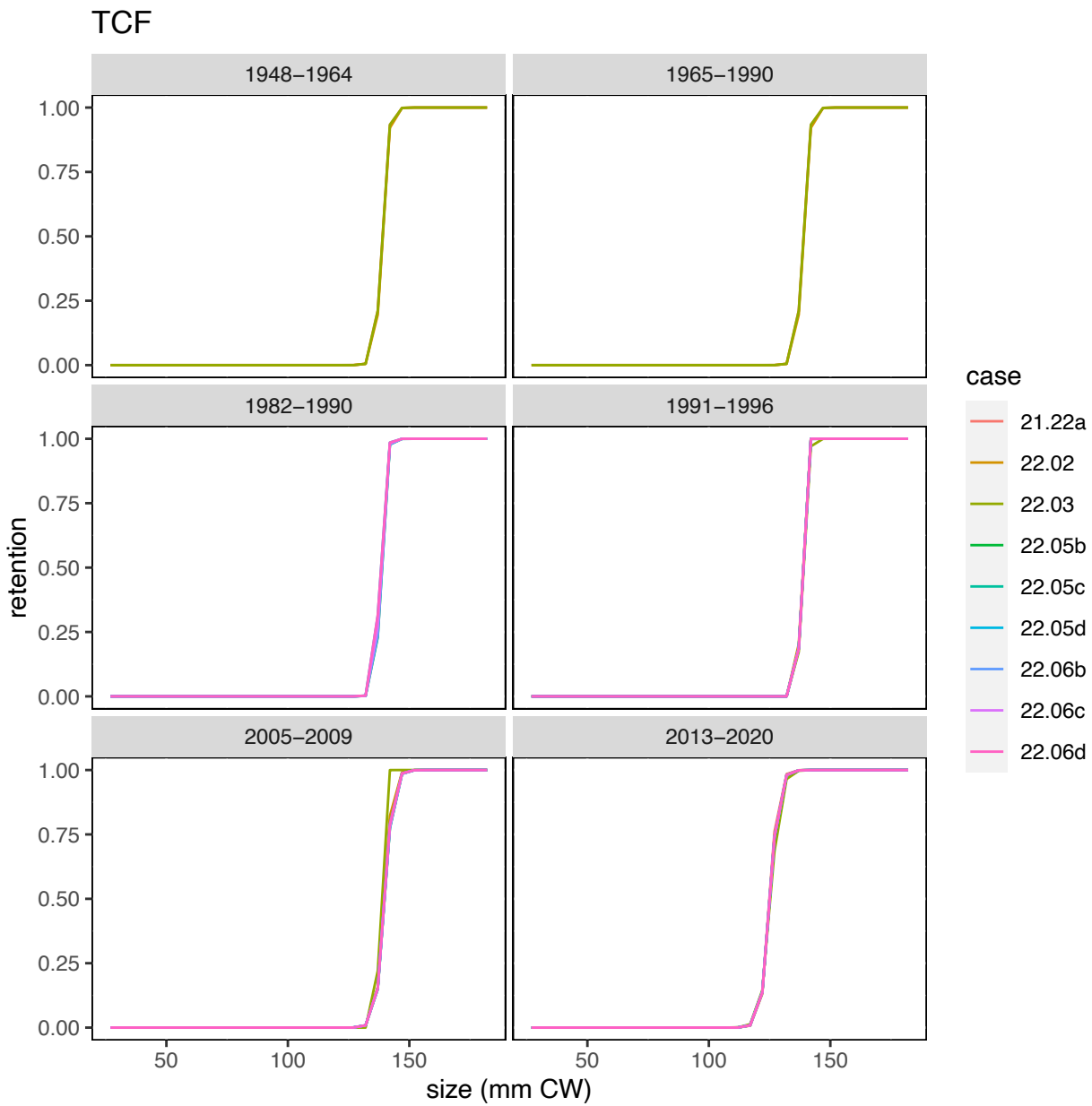
Directed fishery retention function



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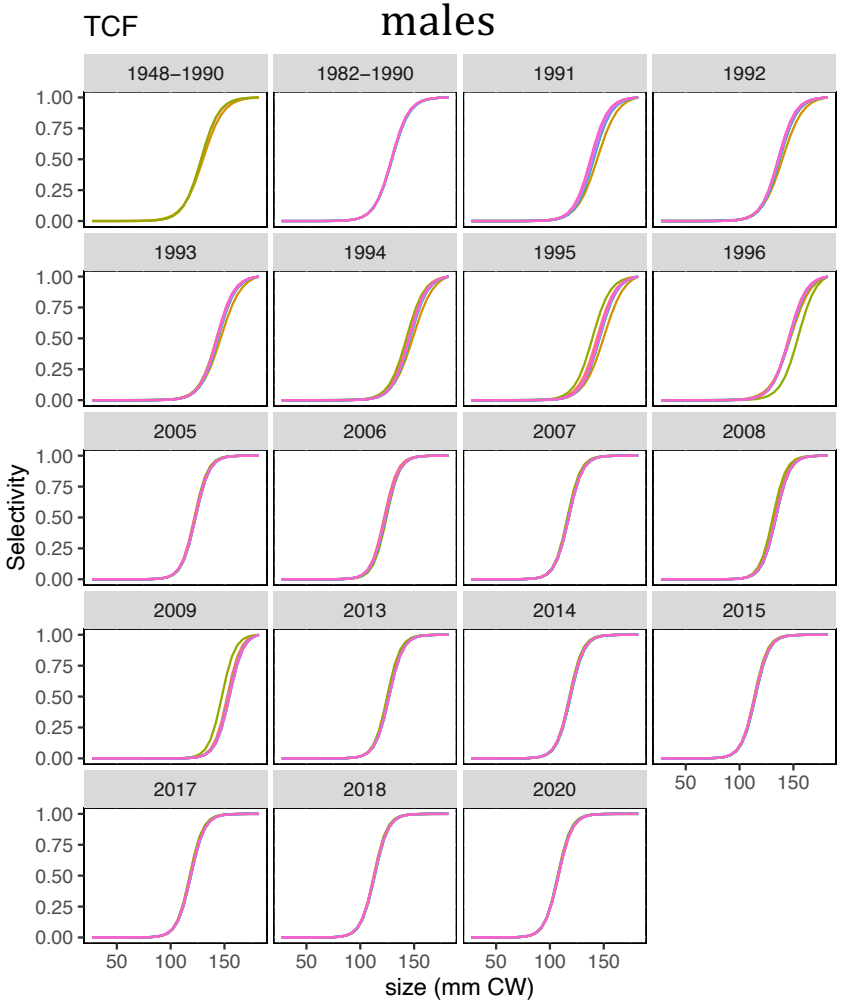
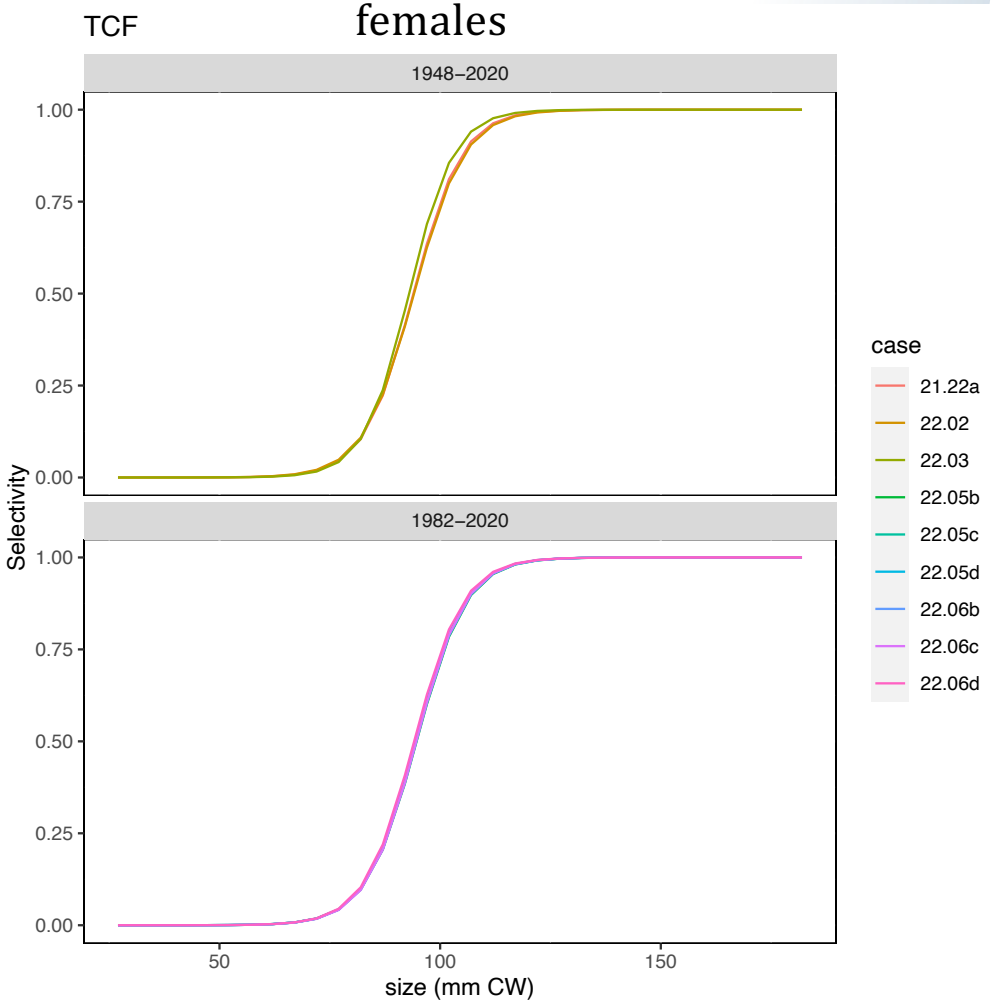
Directed fishery selectivity





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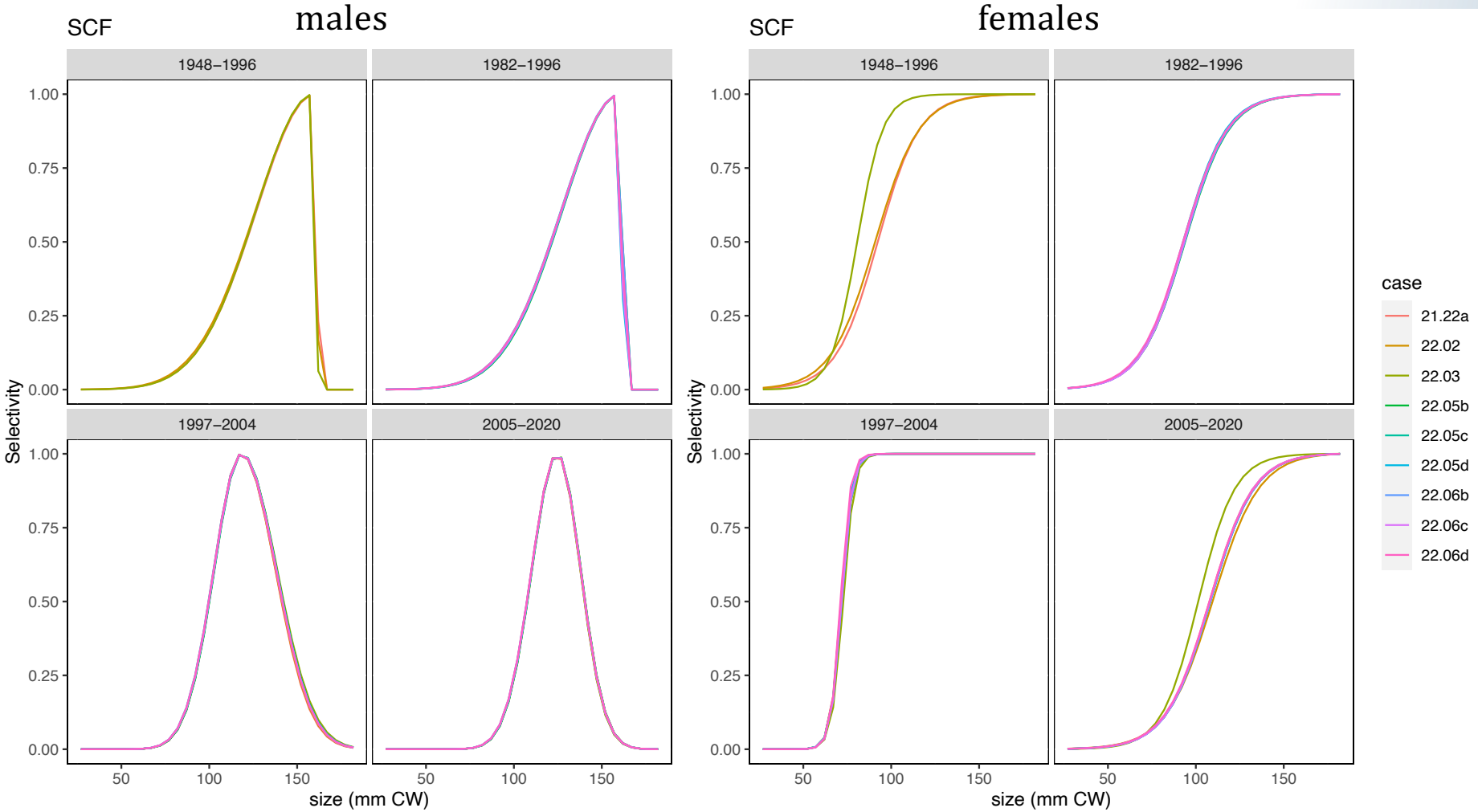
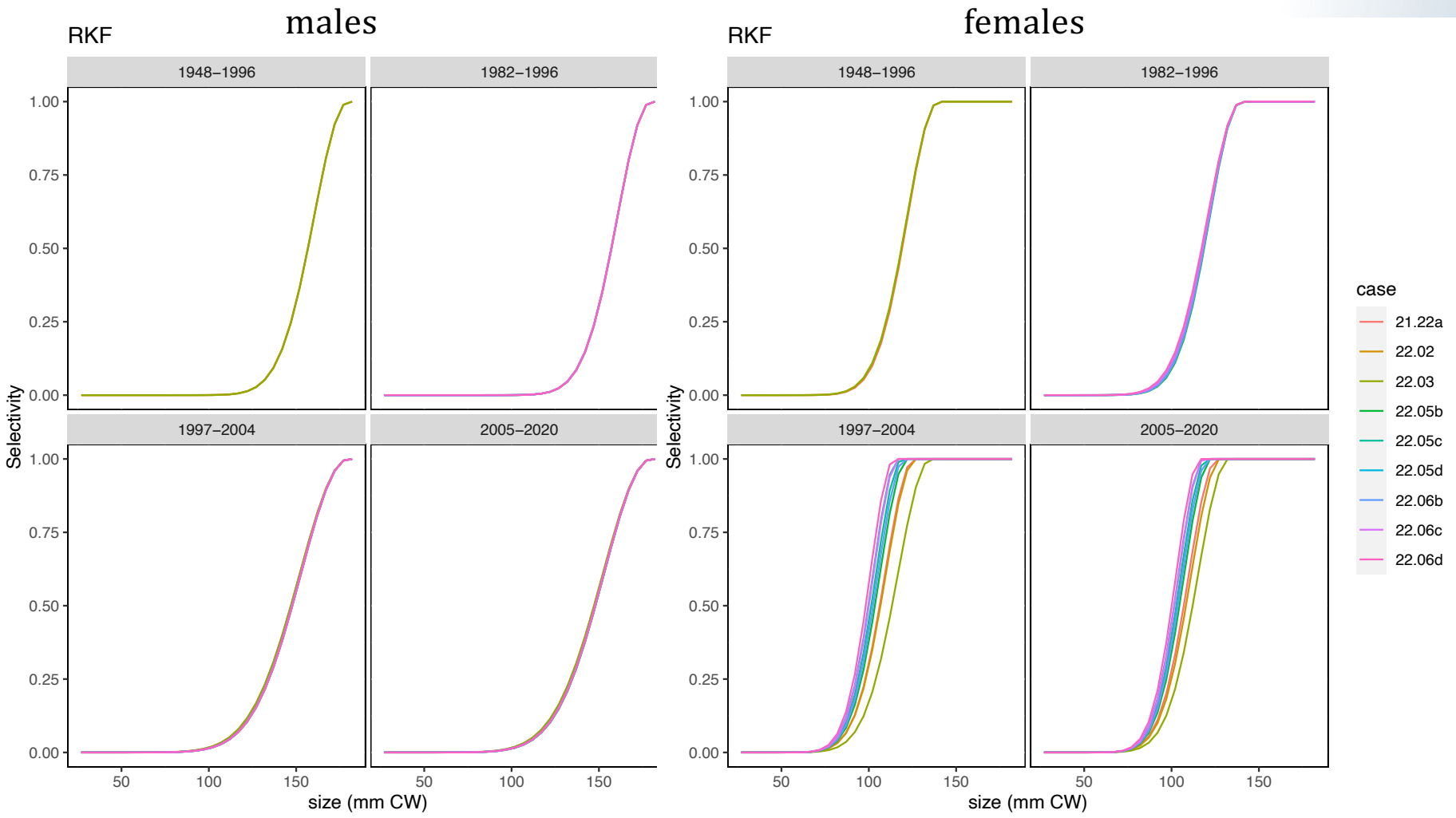
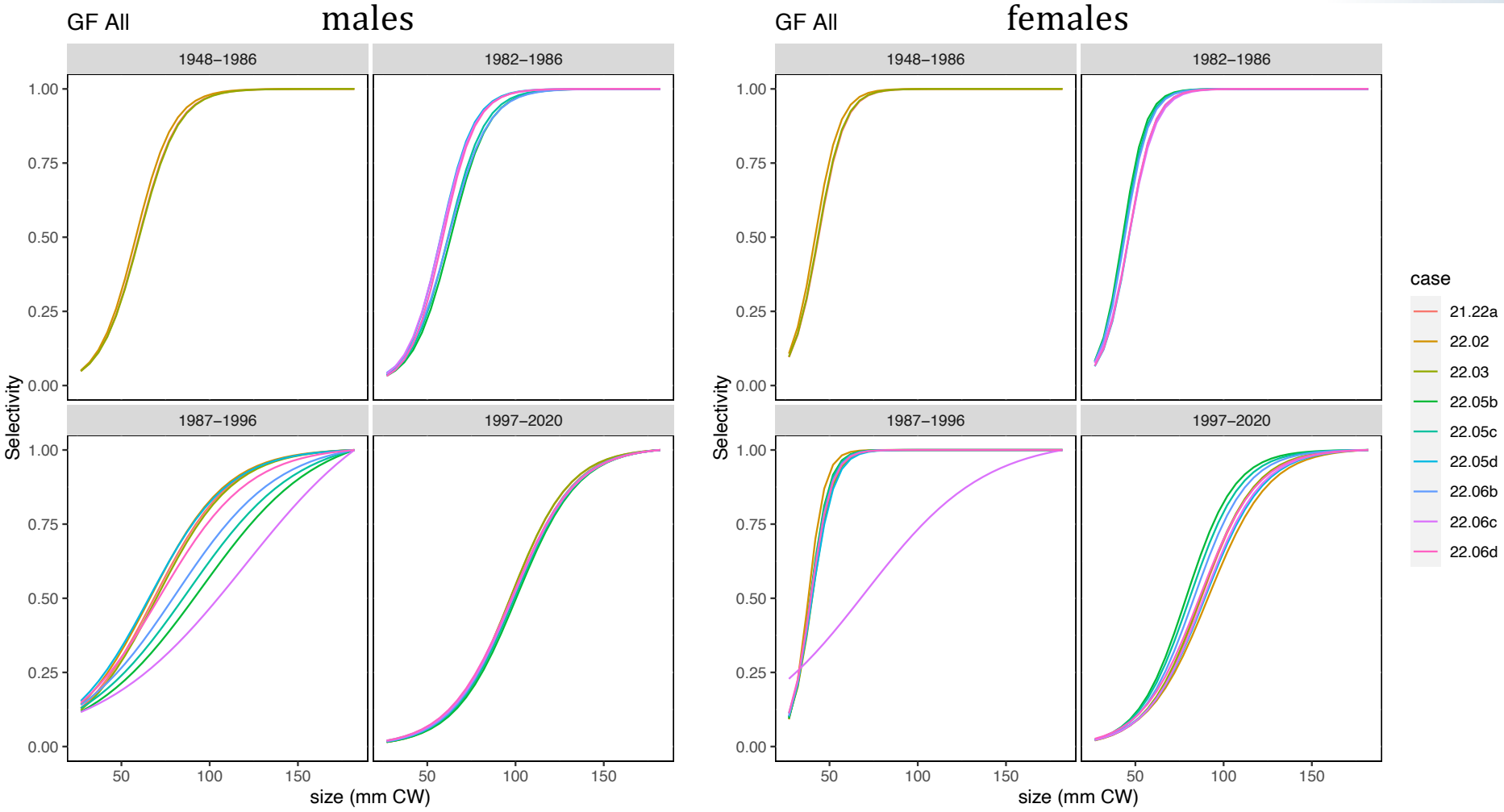
Bycatch selectivity in snow crab fishery



Bycatch selectivity in BBRKC fishery



Bycatch selectivity in groundfish fisheries



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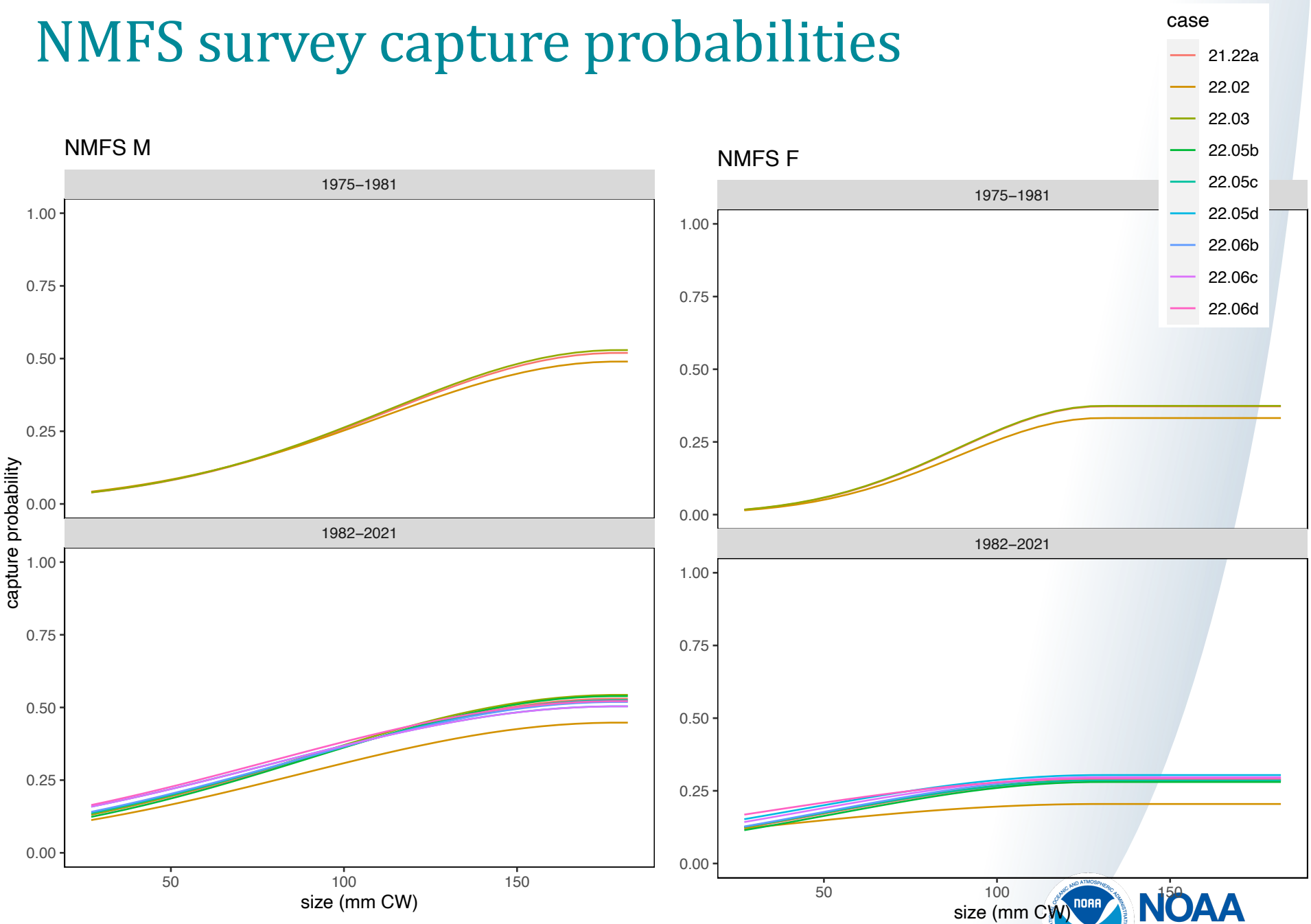
NMFS survey capture probabilities



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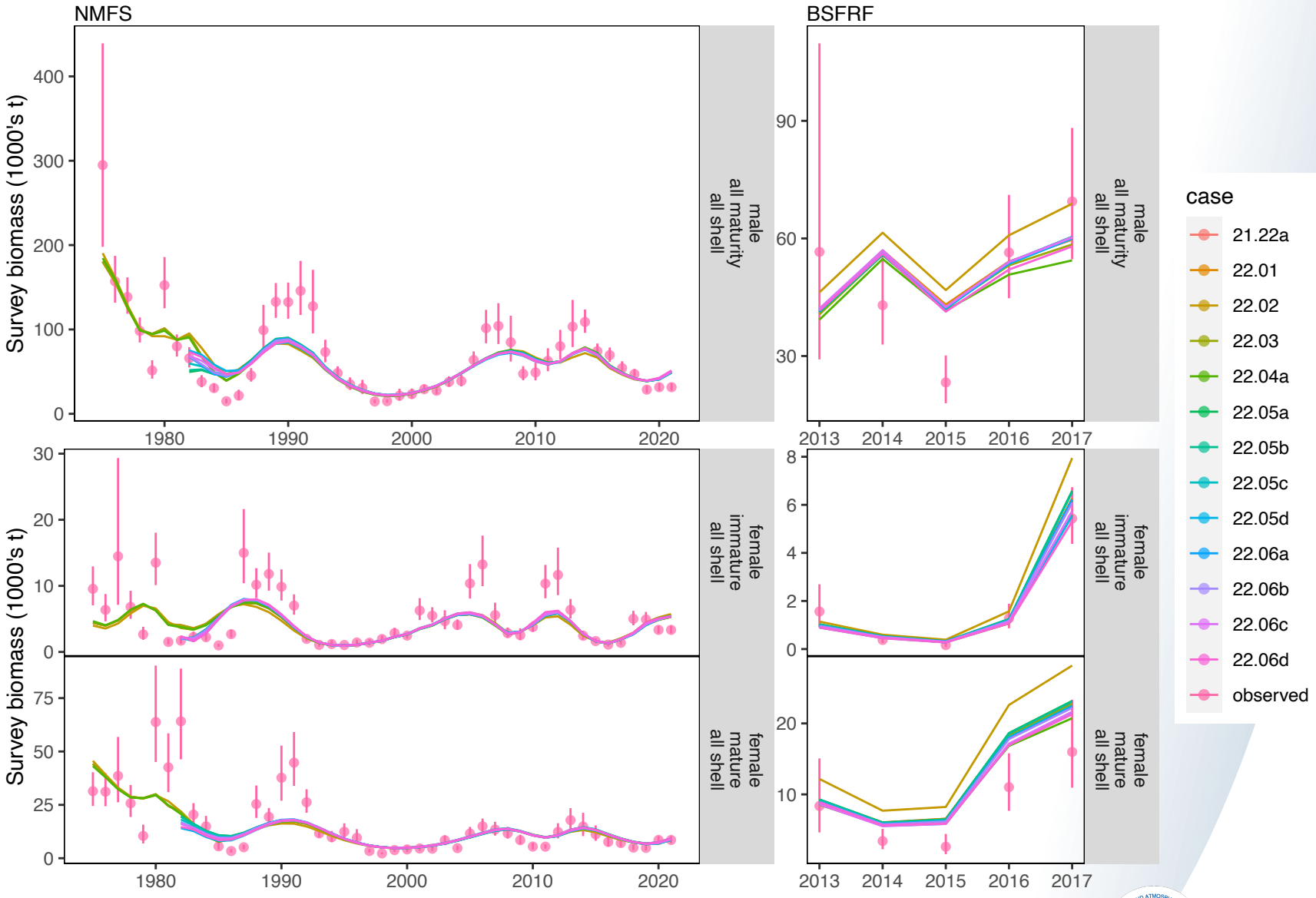
Fits to survey biomass



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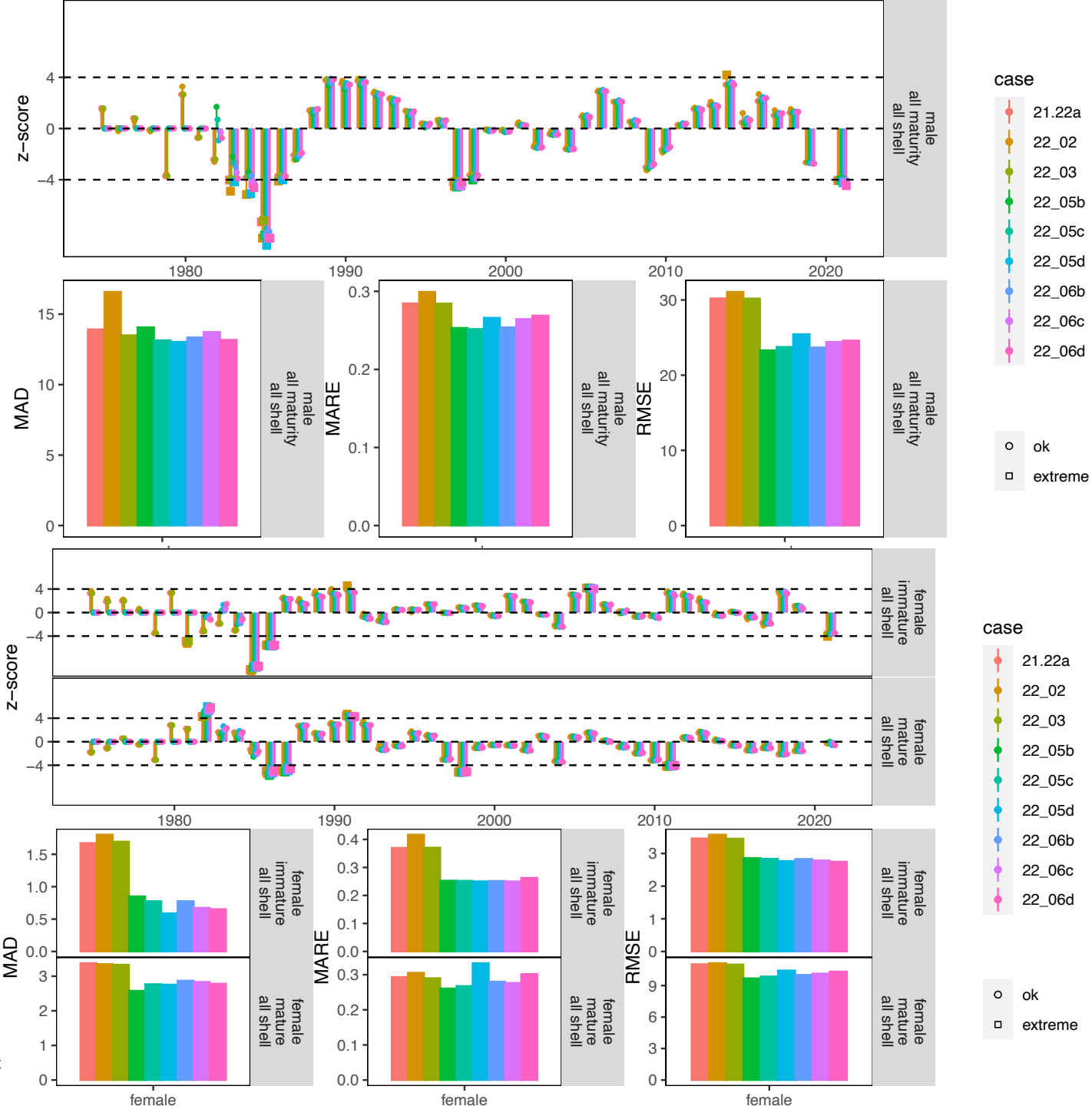
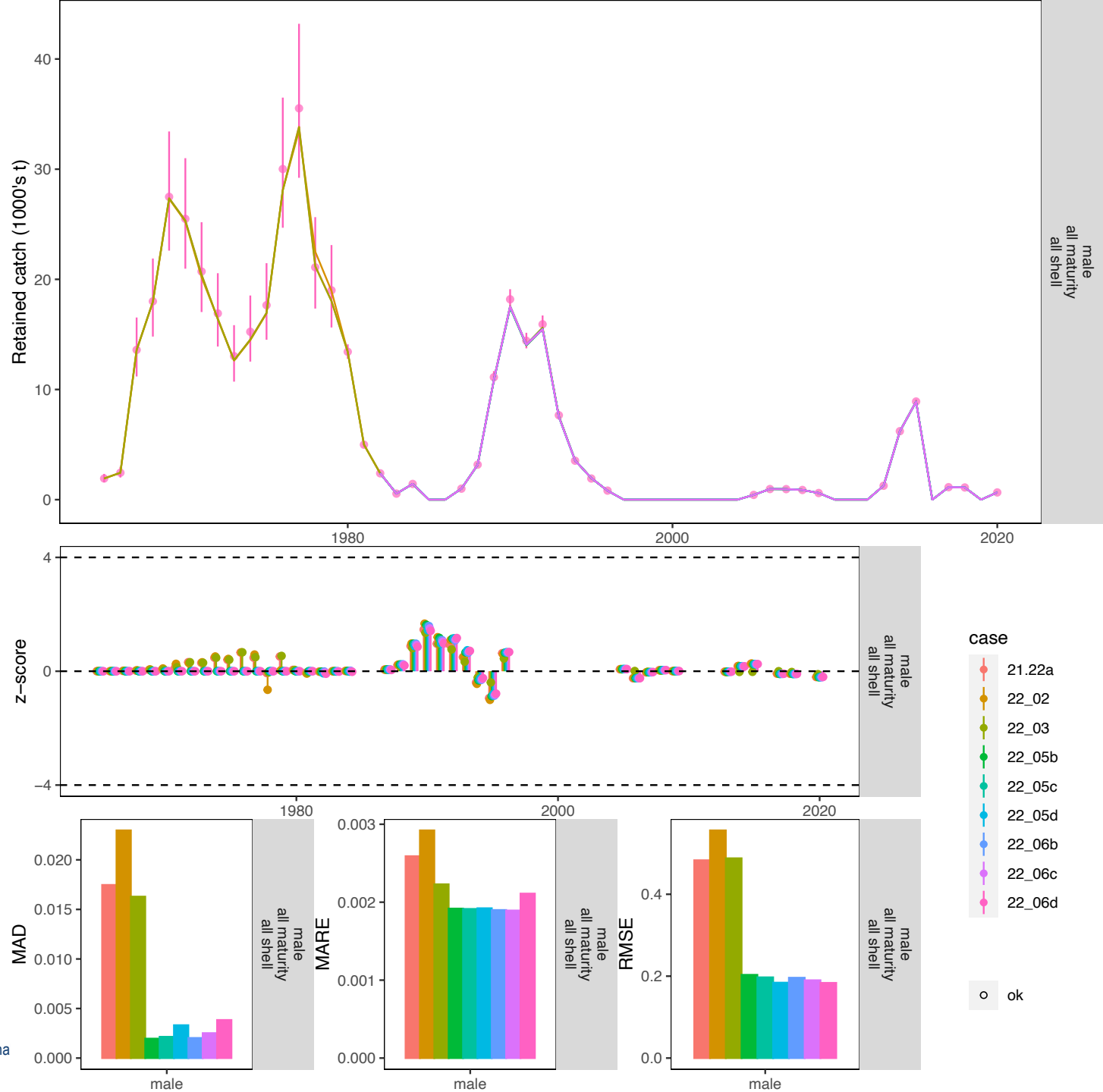
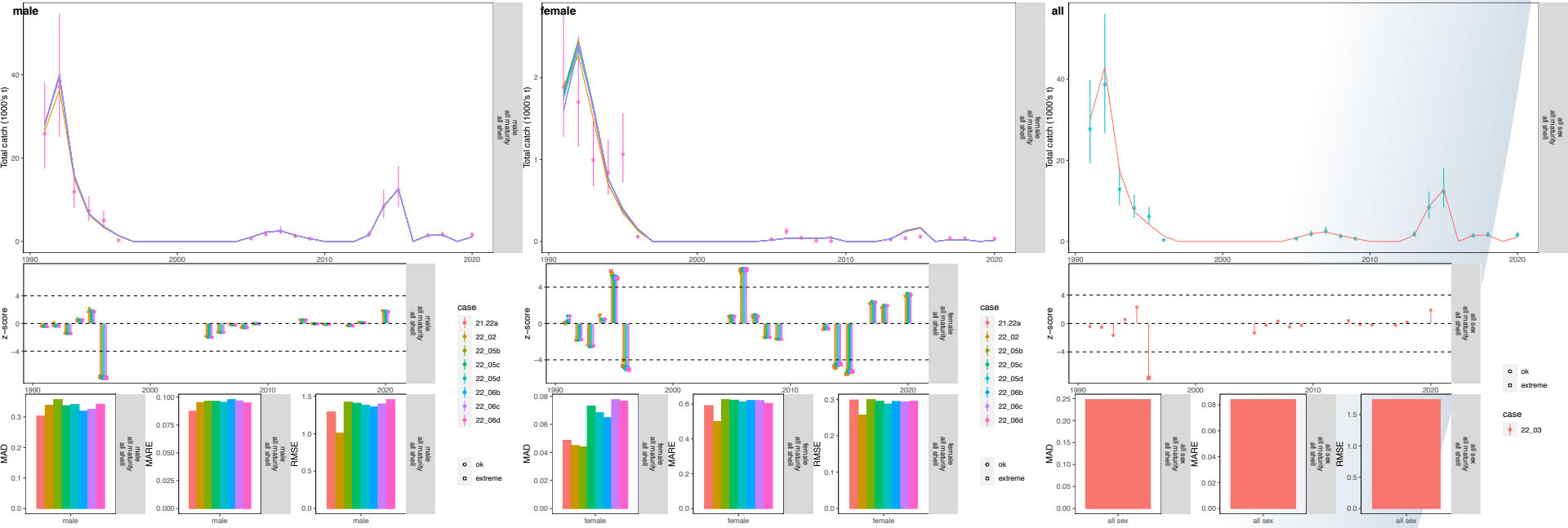
Fits to NMFS survey biomass



Fits to retained catch



Fits to total catch biomass in directed fishery



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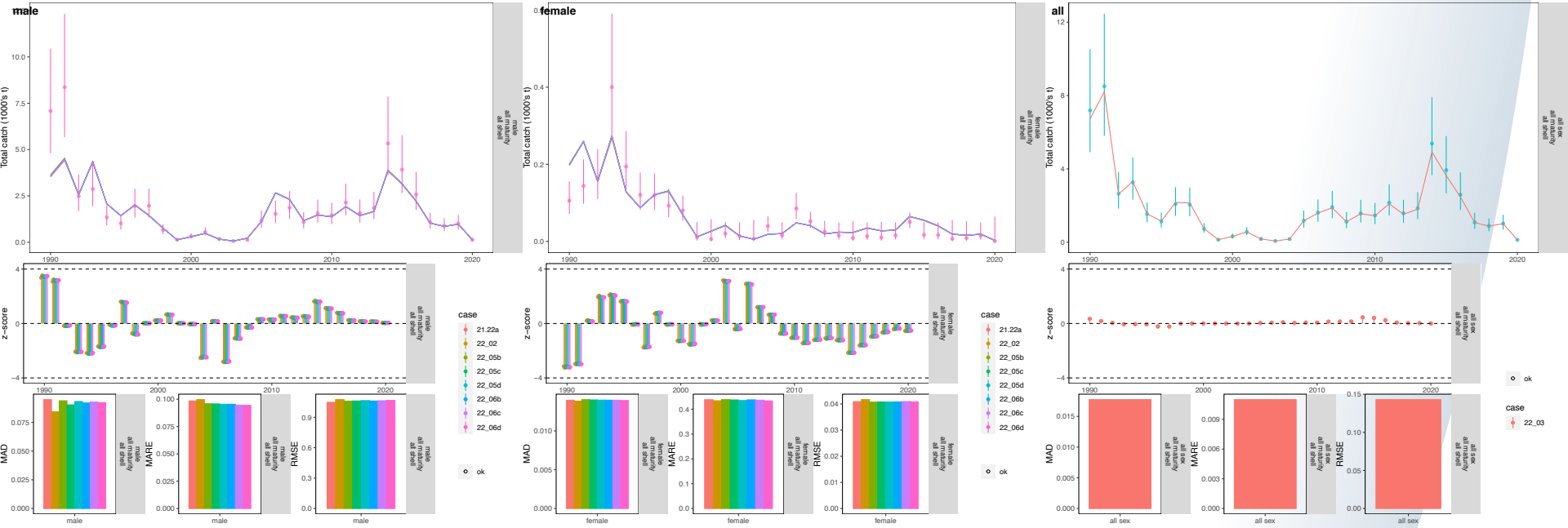
Fits to total catch biomass in snow crab fishery



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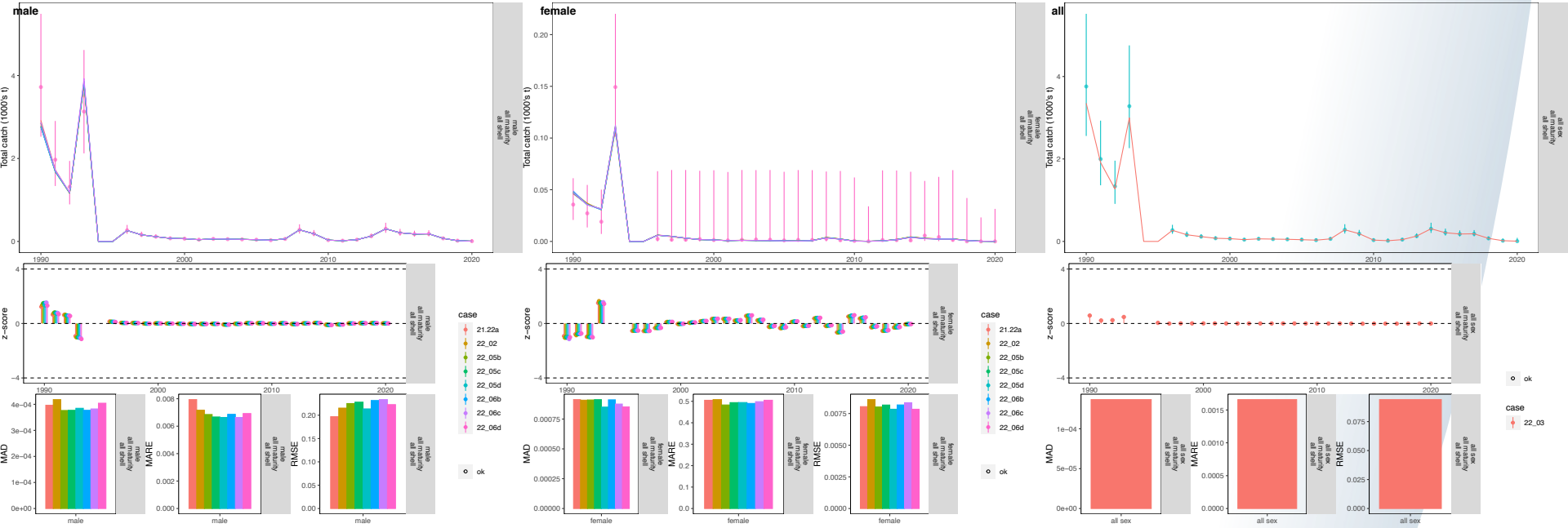
Fits to total catch biomass in the BBRKC fishery



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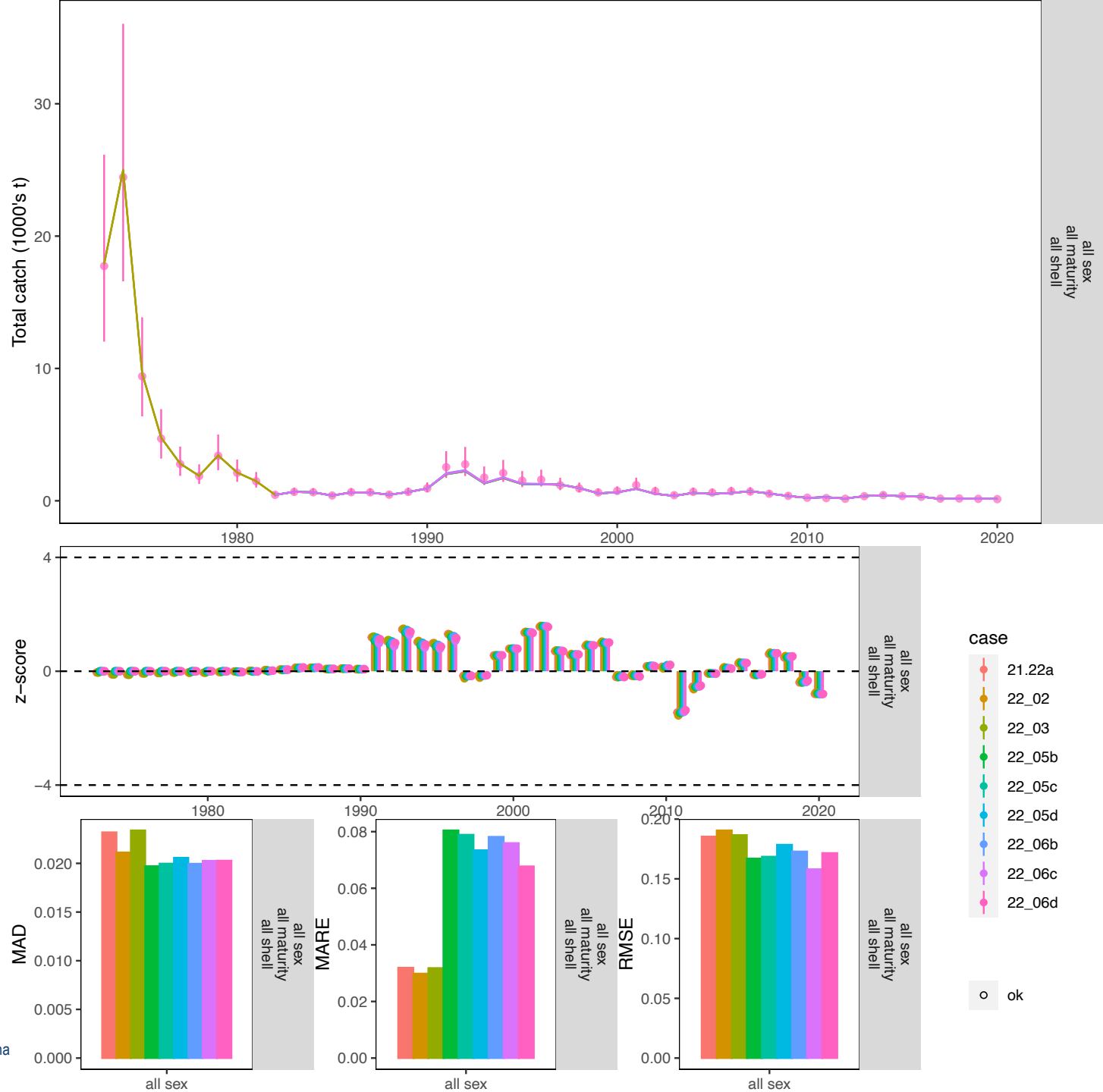
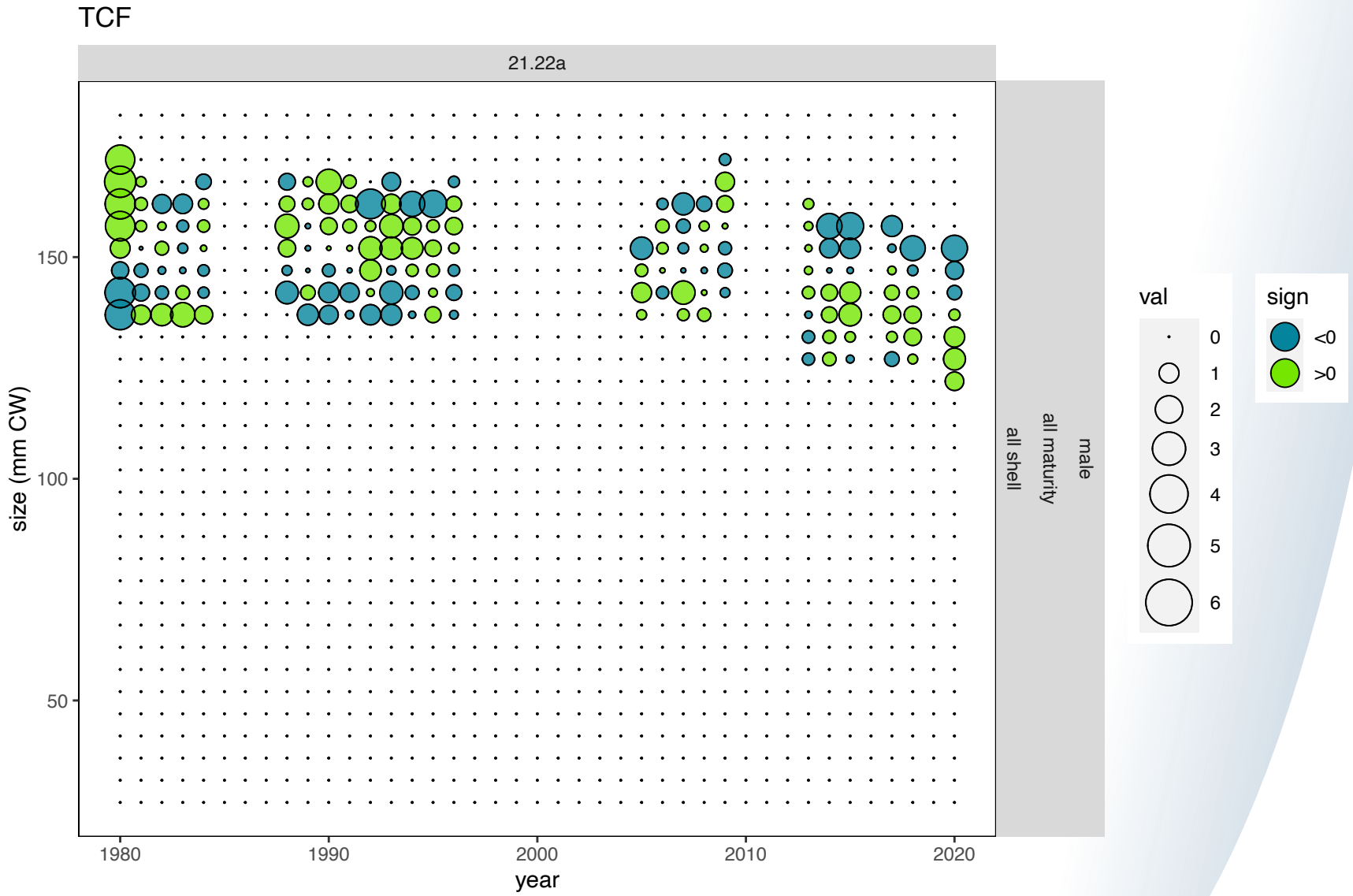
Fits to total catch biomass in the groundfish fisheries



Retained catch size comps



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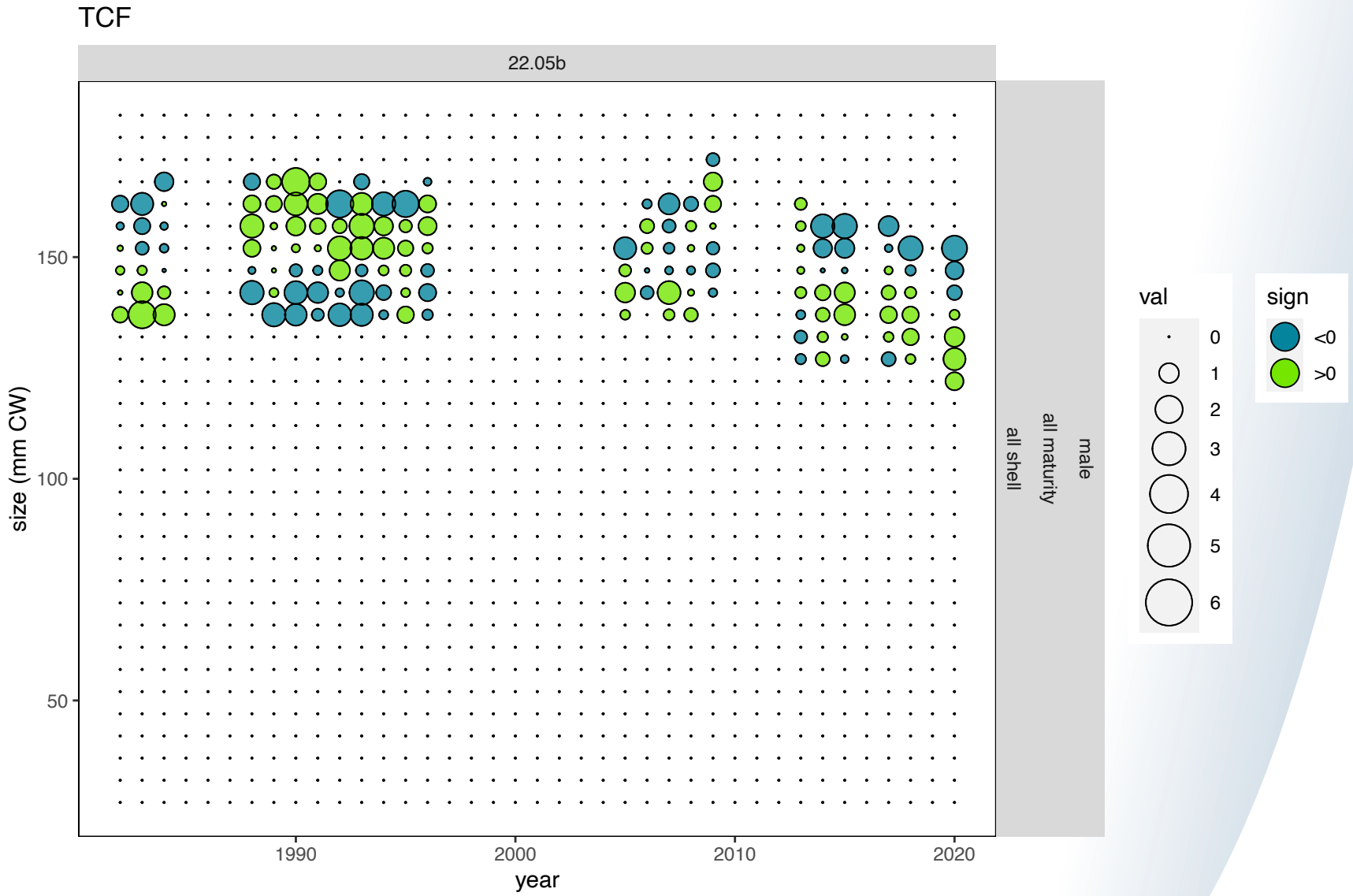
Retained catch size comps



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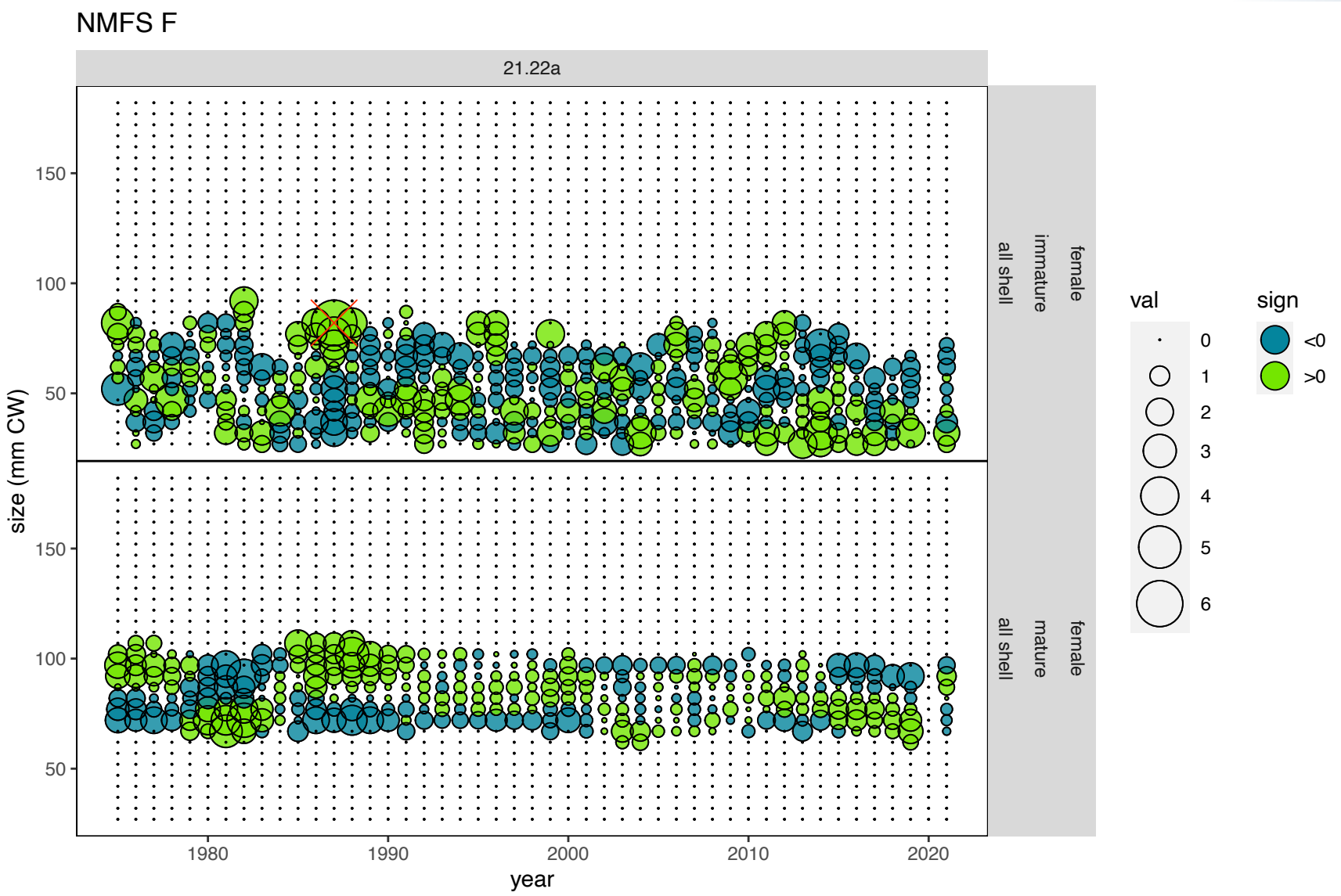
Survey Size Comps



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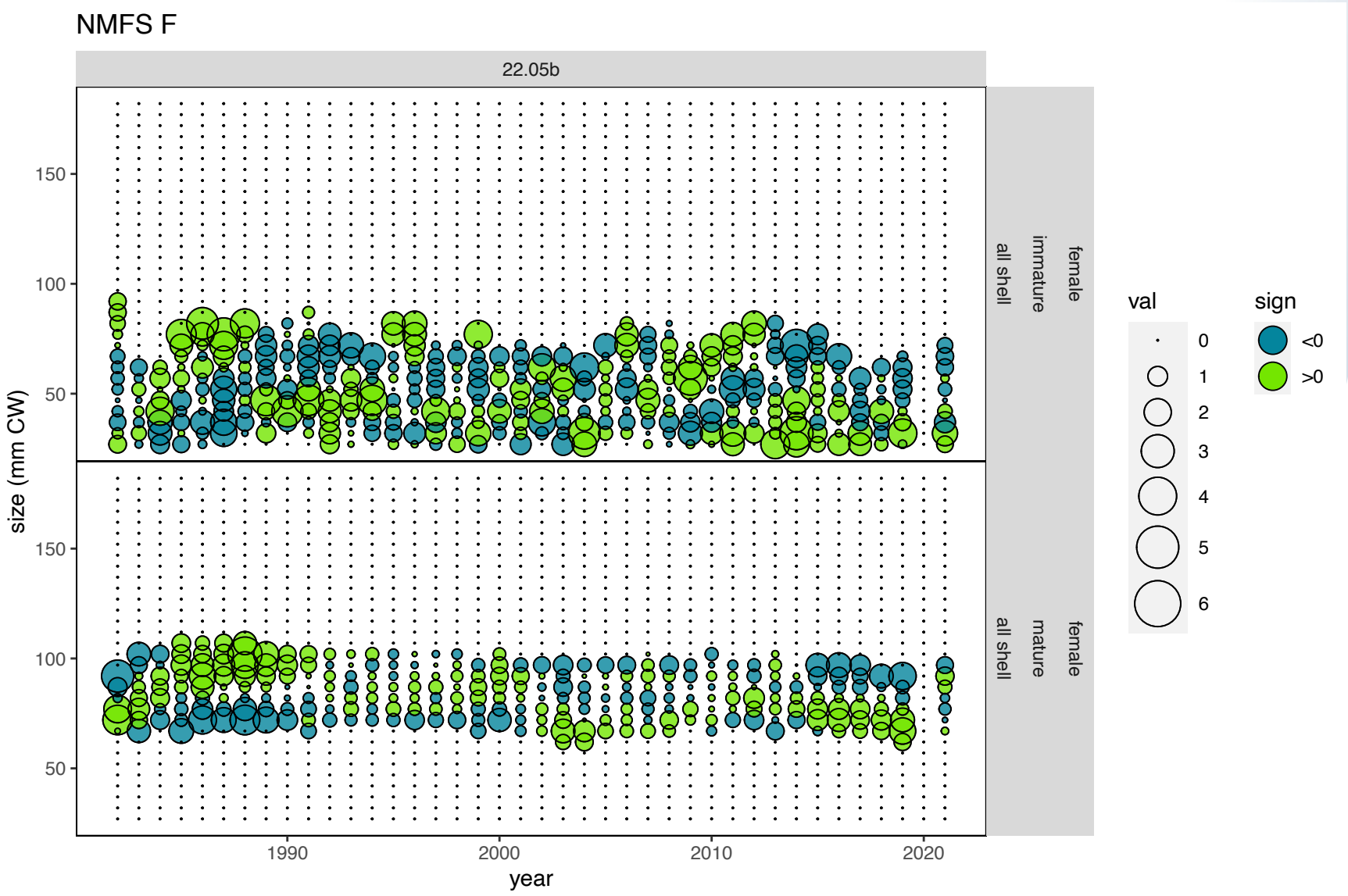
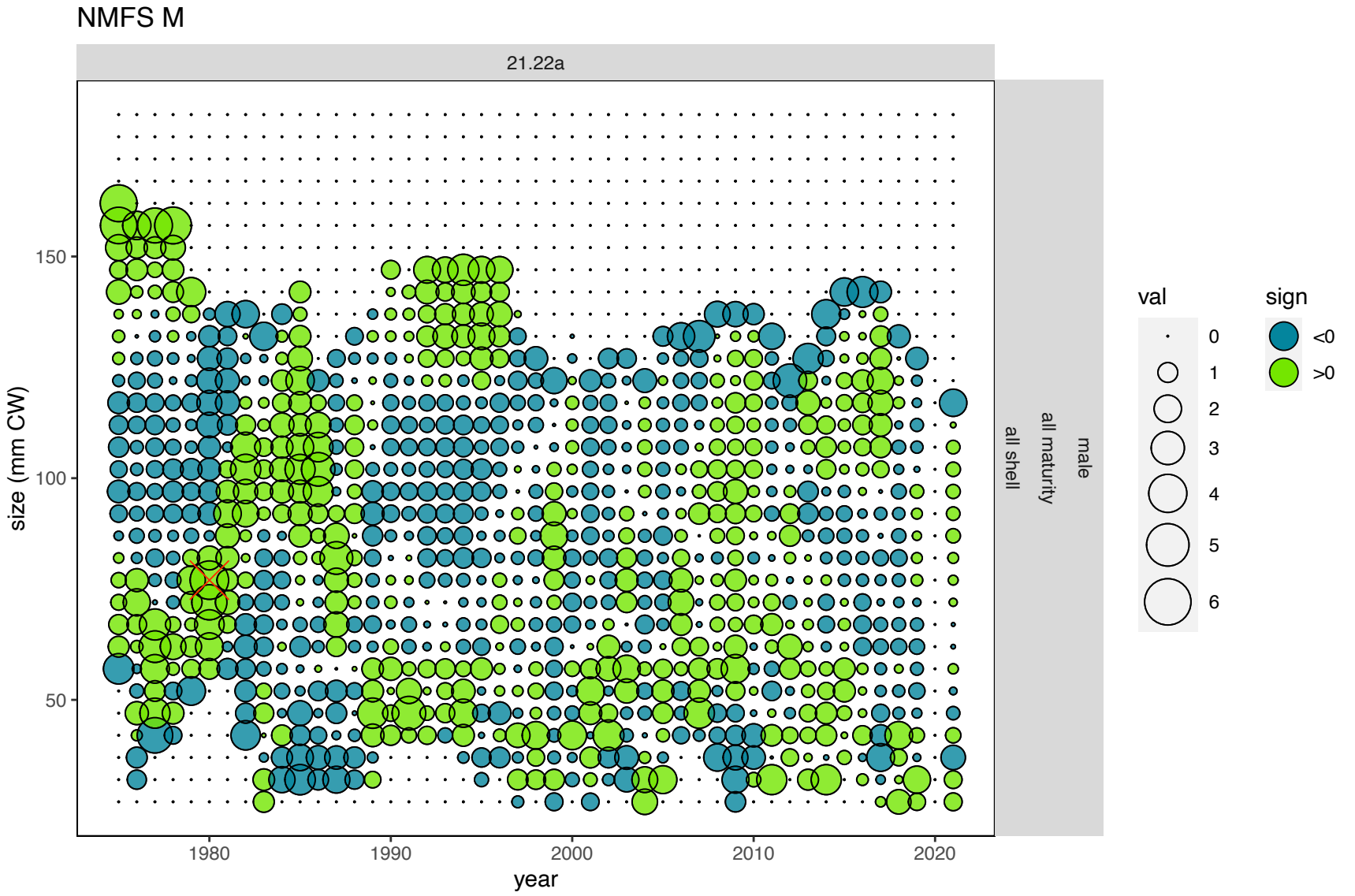
Survey Size Comps



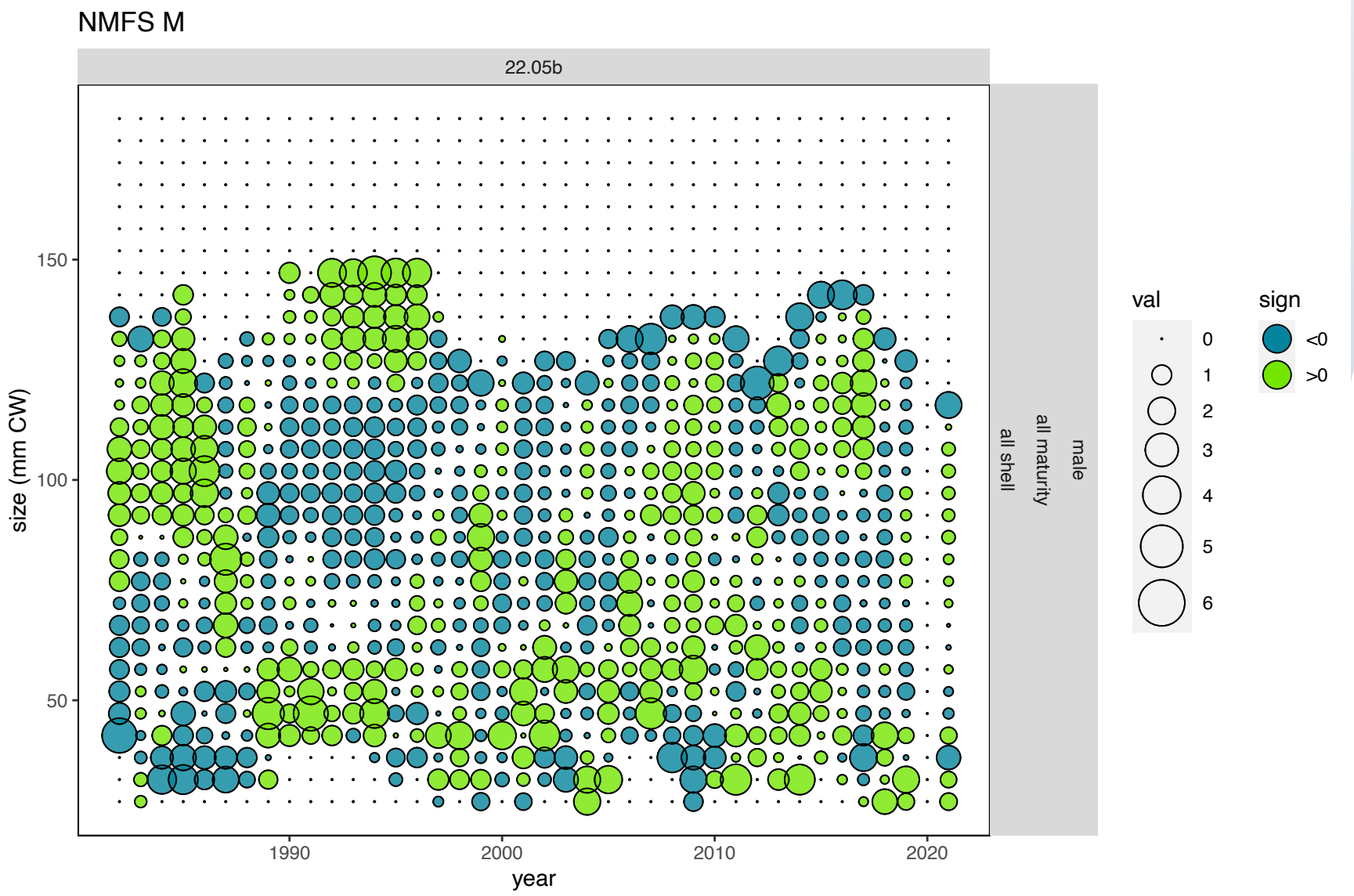
FISHERIES

Survey Size Comps



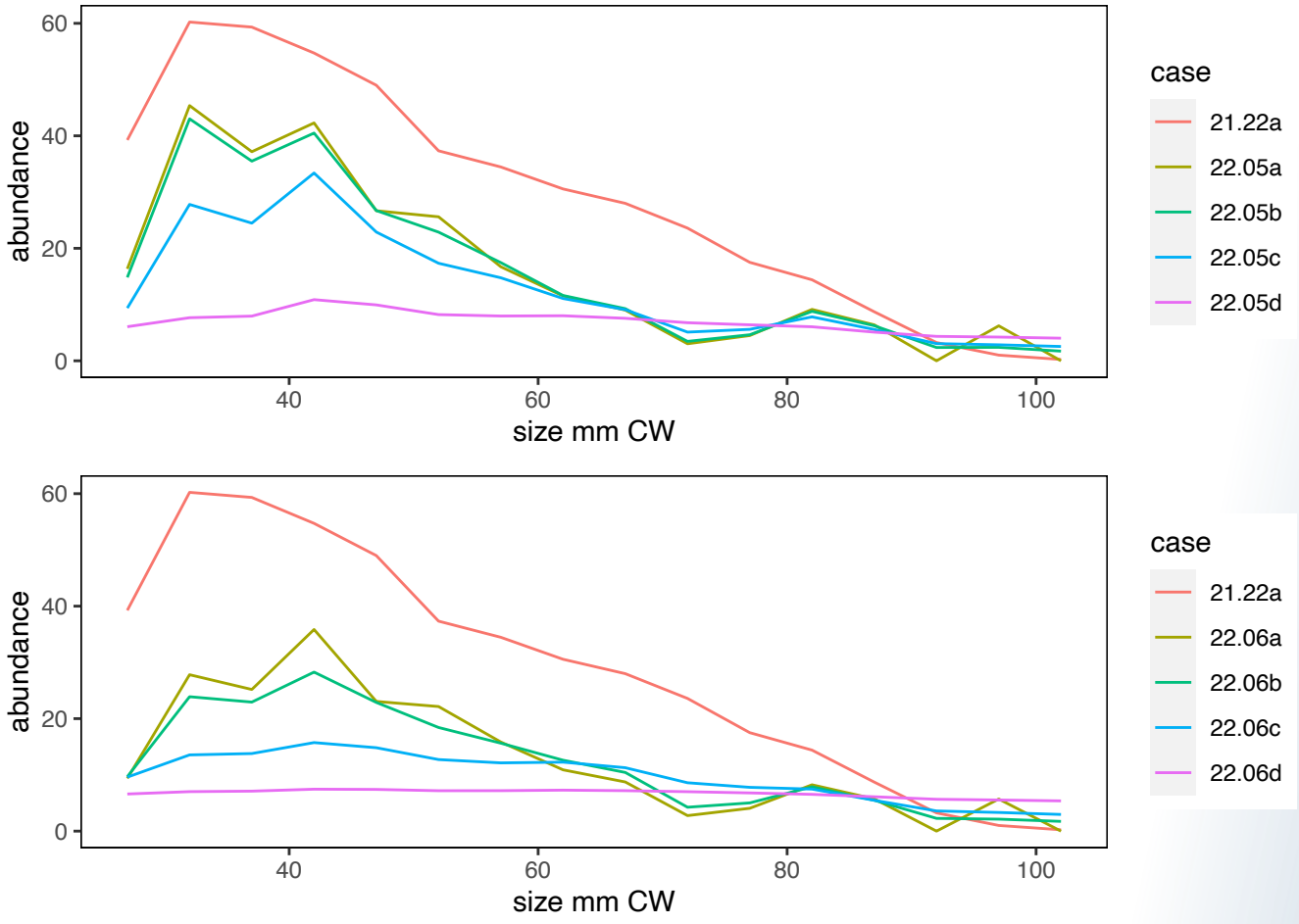
FISHERIES

Survey Size Comps



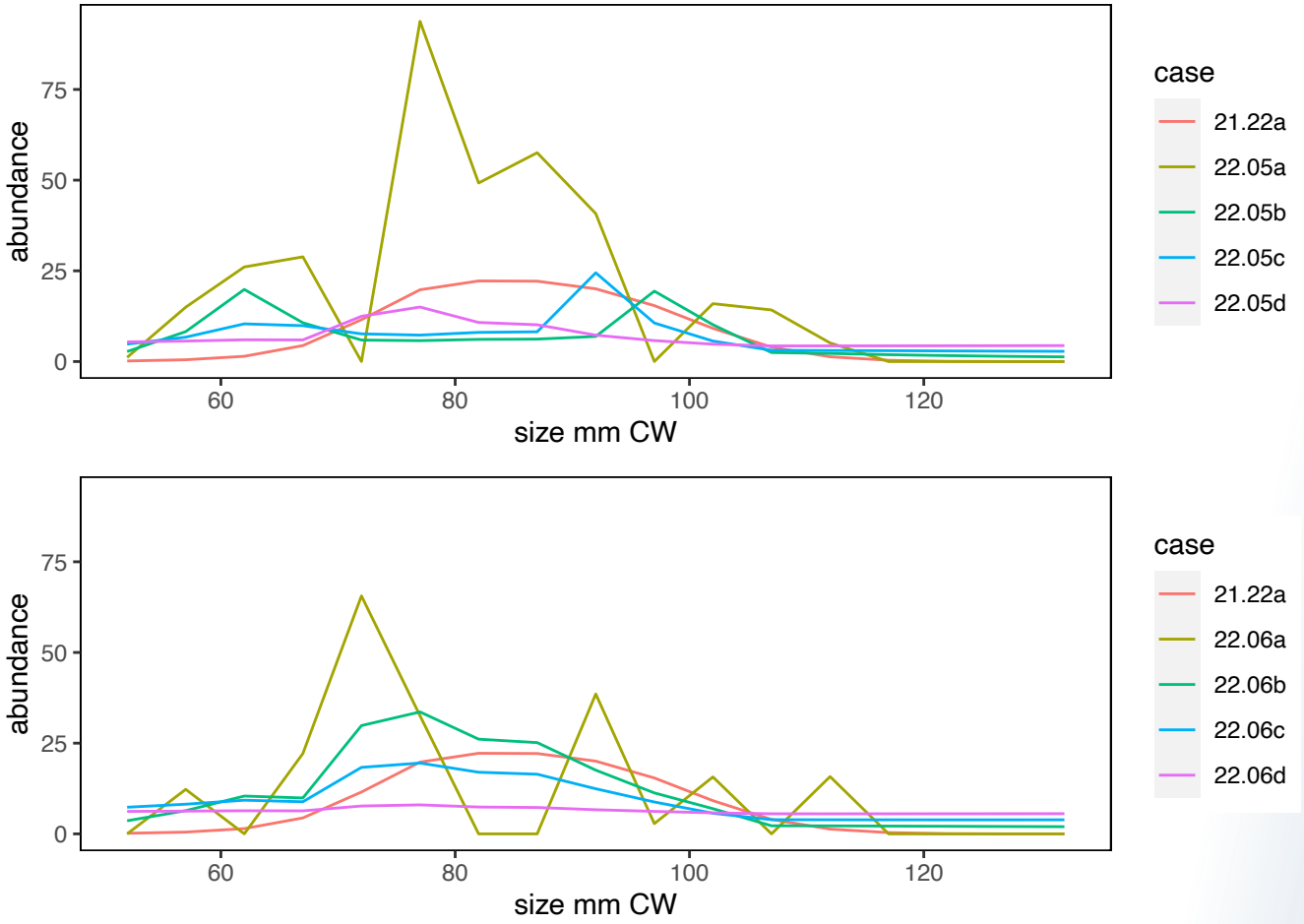
22.05's, 22.06's

Old-shell mature females



22.05's, 22.06's

Old-shell mature females



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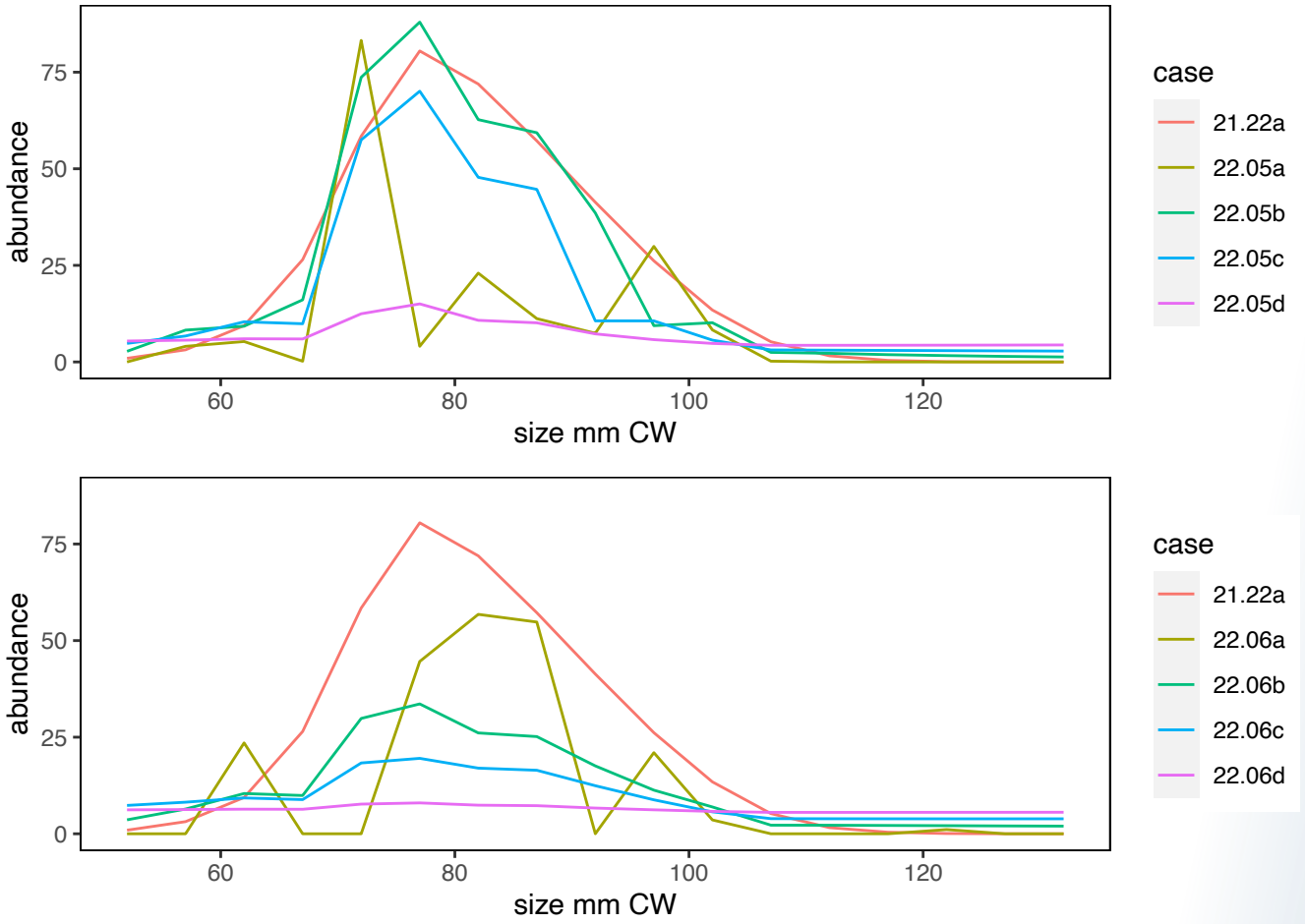
22.05's, 22.06's: Initial numbers-at-size

Old-shell mature females



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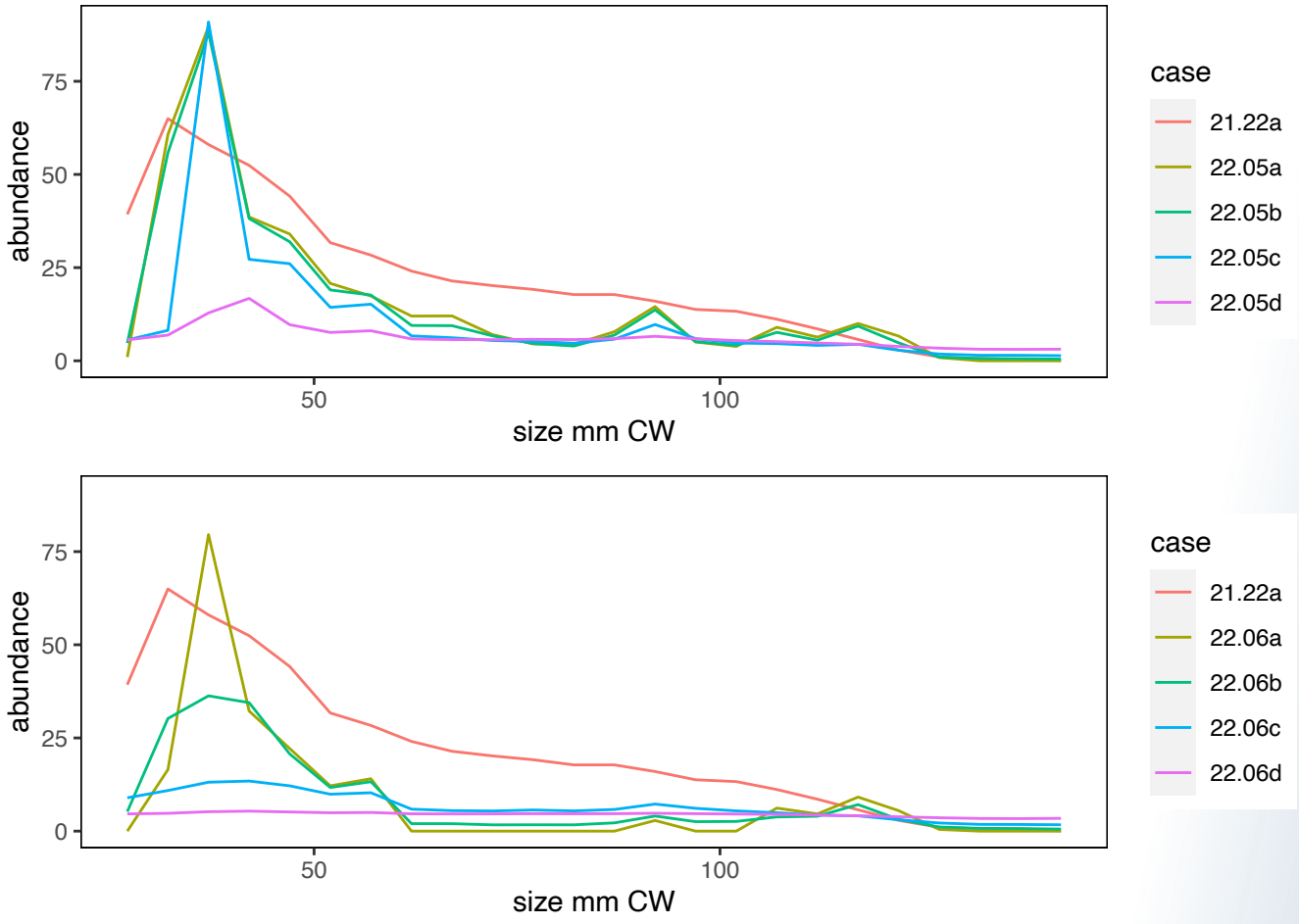
22.05's, 22.06's: Initial numbers-at-size

Immature males



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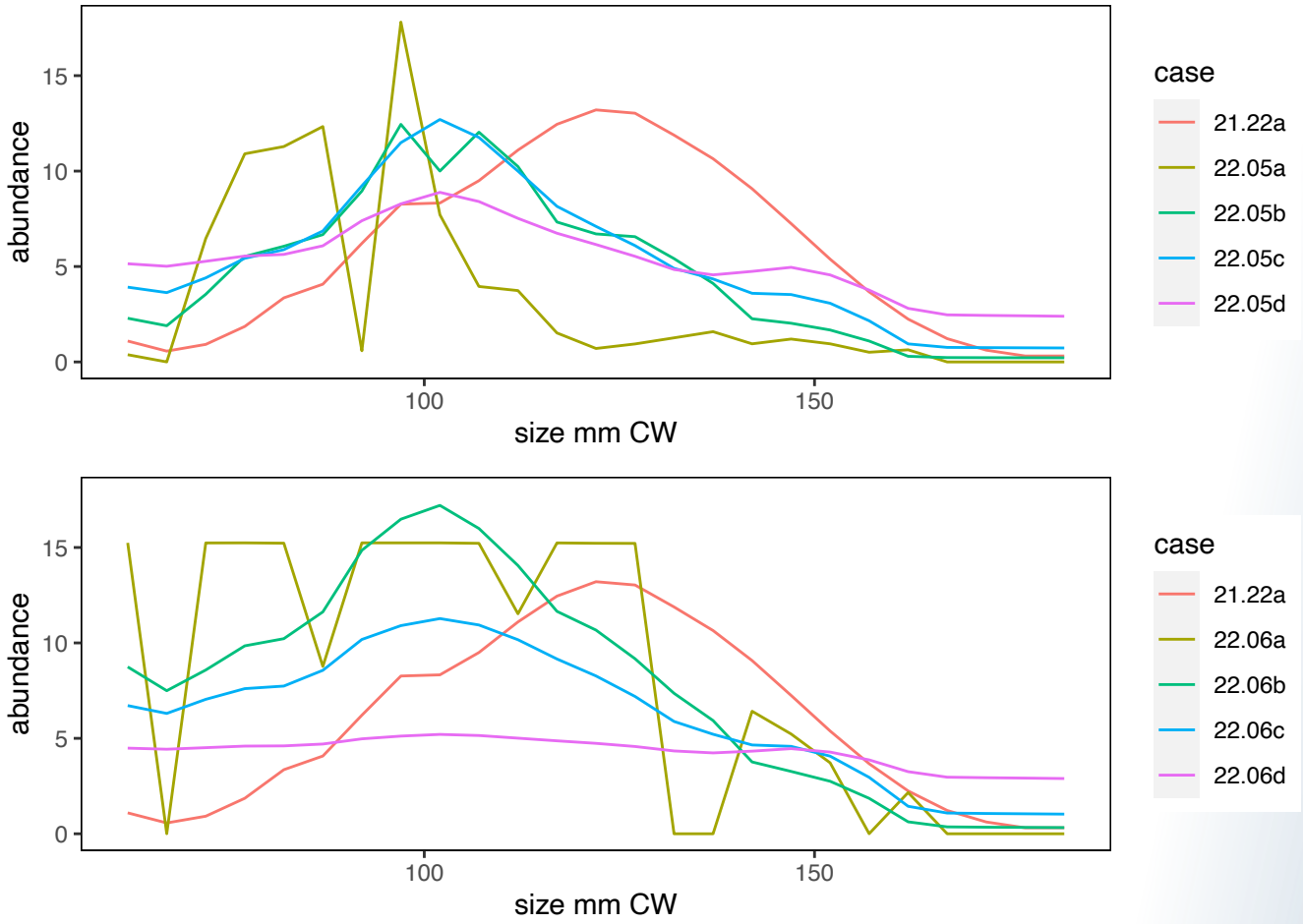
22.05's, 22.06's: Initial numbers-at-size

New-shell mature males



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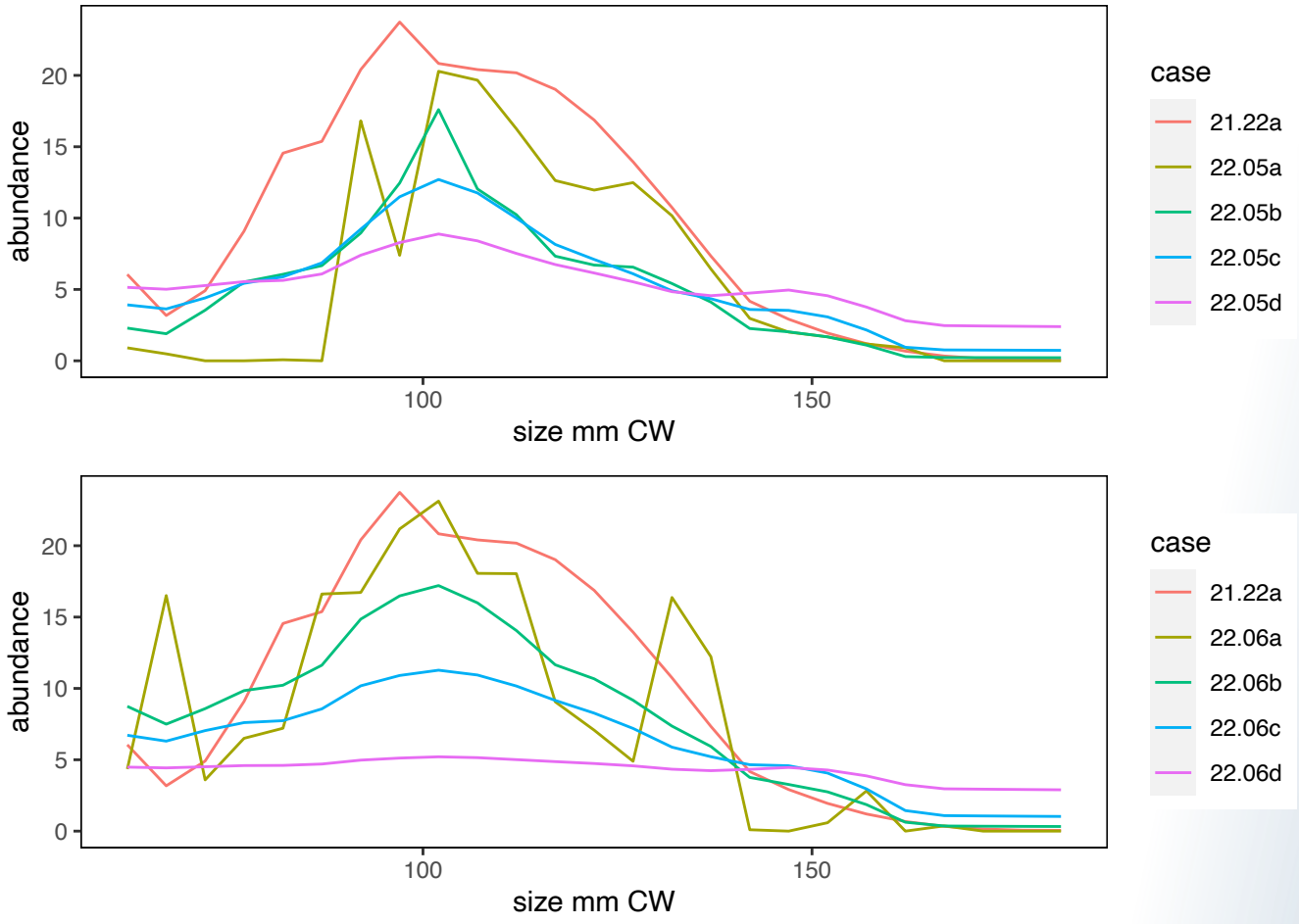
22.05's, 22.06's: Initial numbers-at-size

Old-shell mature males



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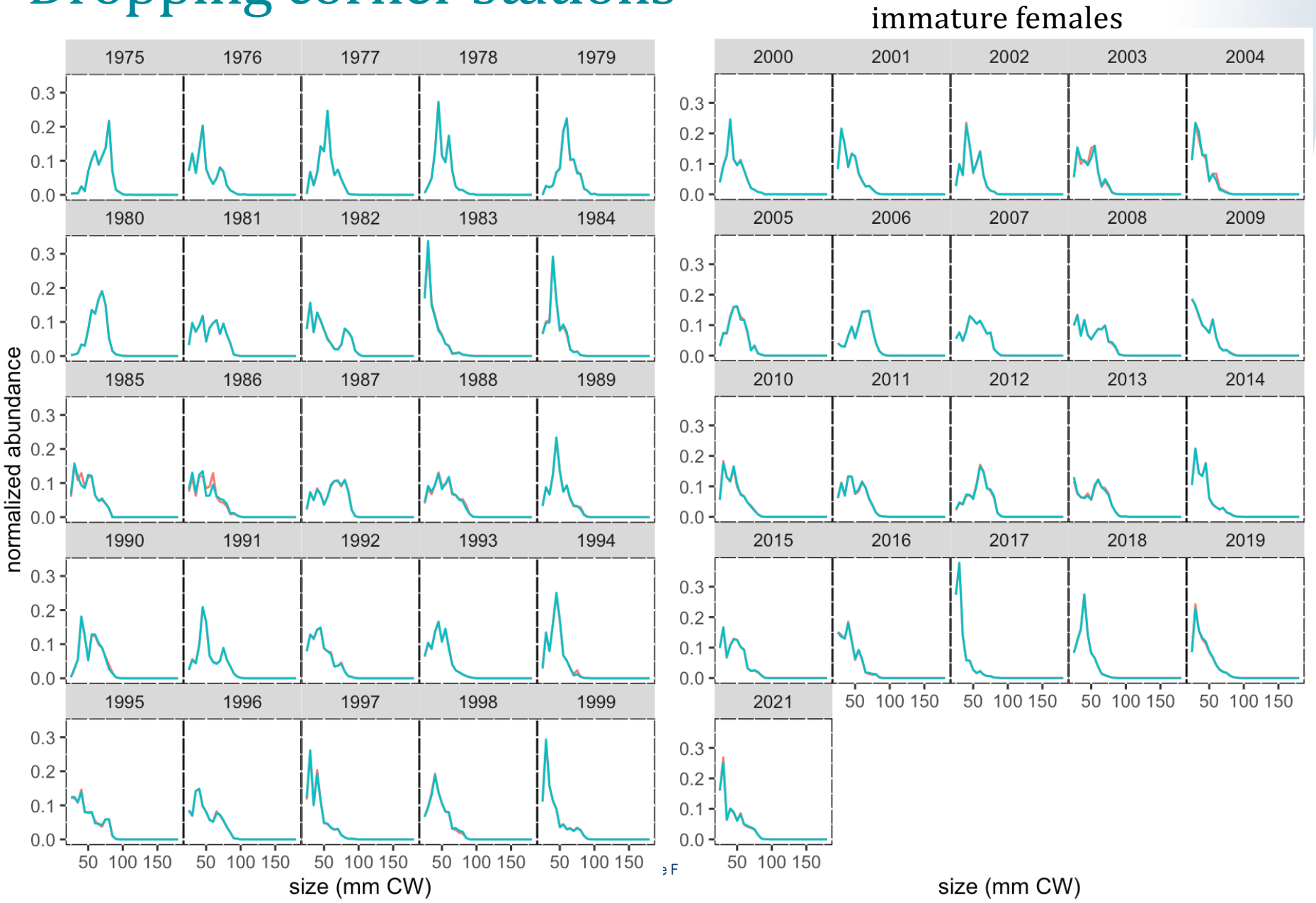
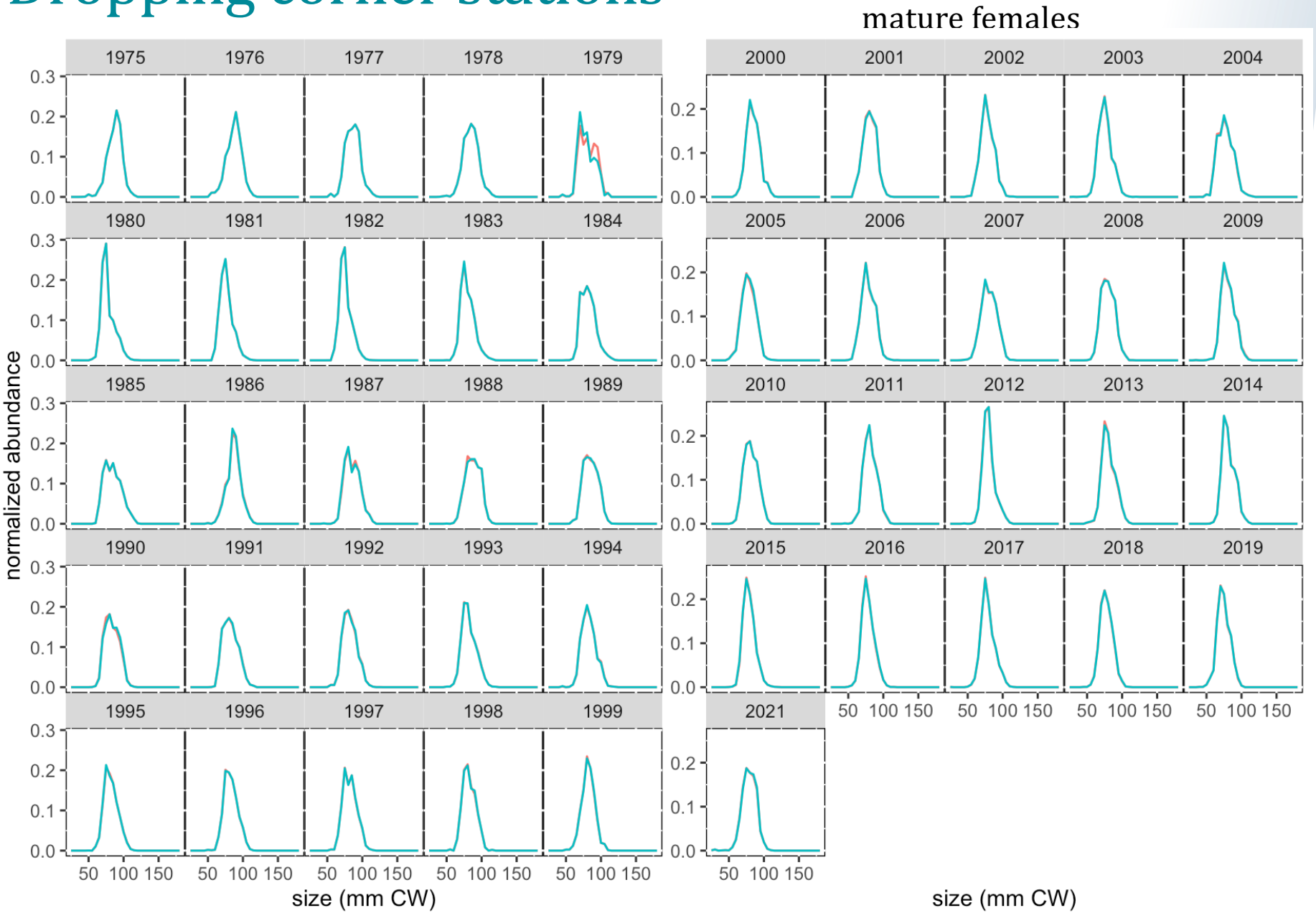
Recommended models for September

- 22.01: 2021 assessment model + revised bycatch in the groundfish fisheries
- 22.03: 22.01 + fits to total fishery catch biomass, rather than sex-specific fits
- 22.05b: 22.01 + start in 1982 estimating initial numbers-at-size using ln-scale parameters with minor smoothing
- 22.06b: 22.01 + start in 1982 estimating initial numbers-at-size using logistic-scale parameters with minor smoothing

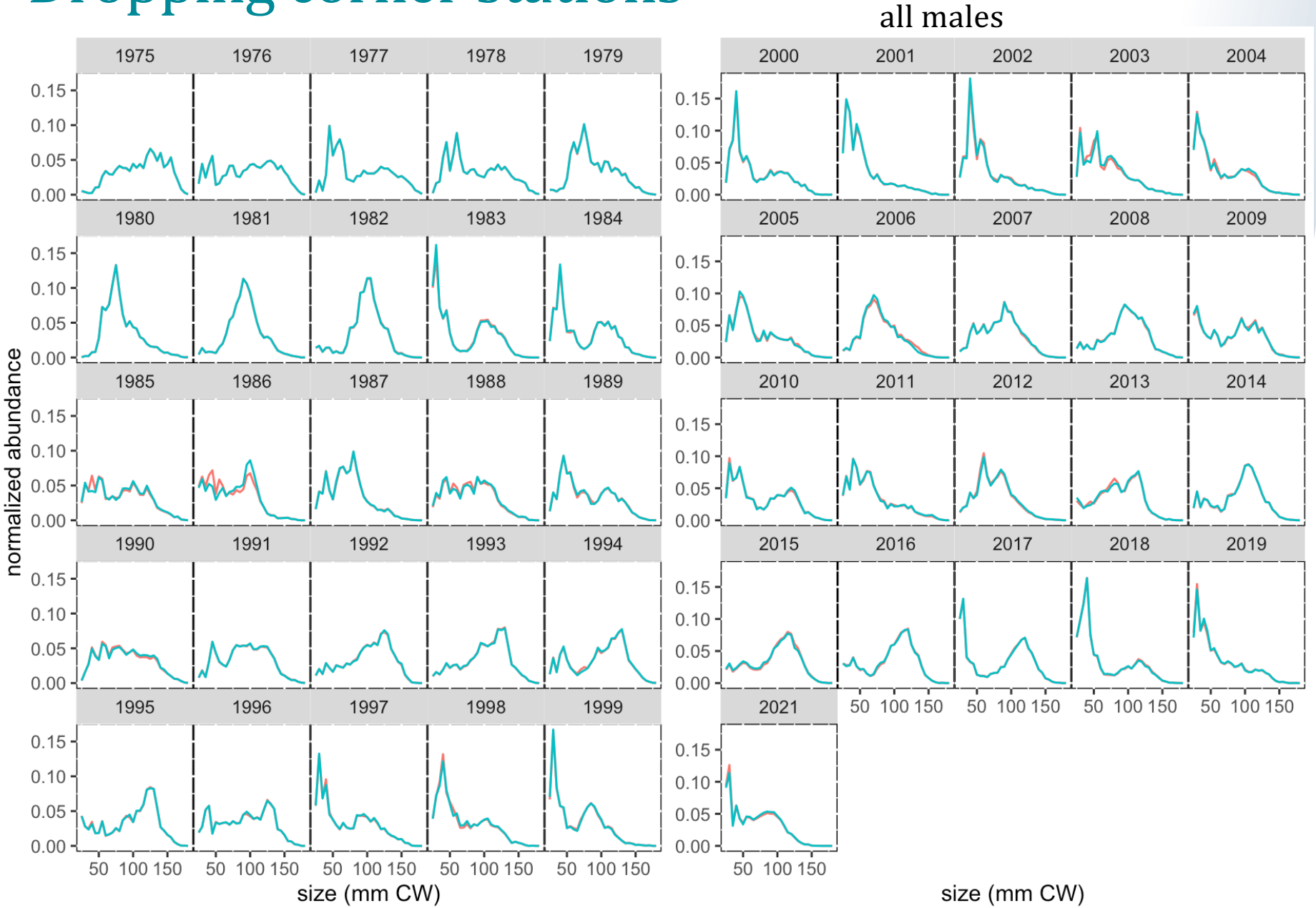
Dropping corner stations



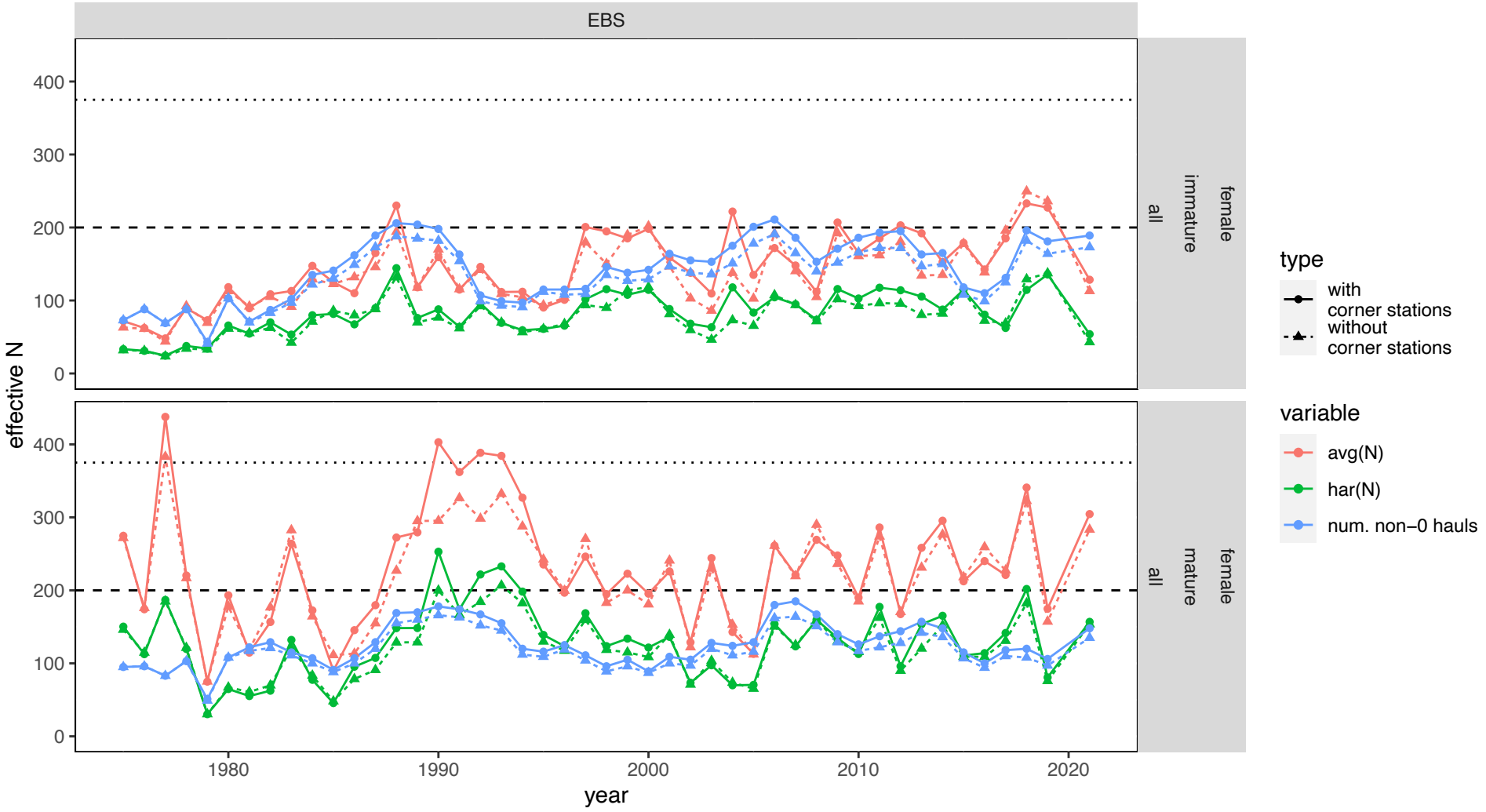
Dropping corner stations



Dropping corner stations



Dropping corner stations



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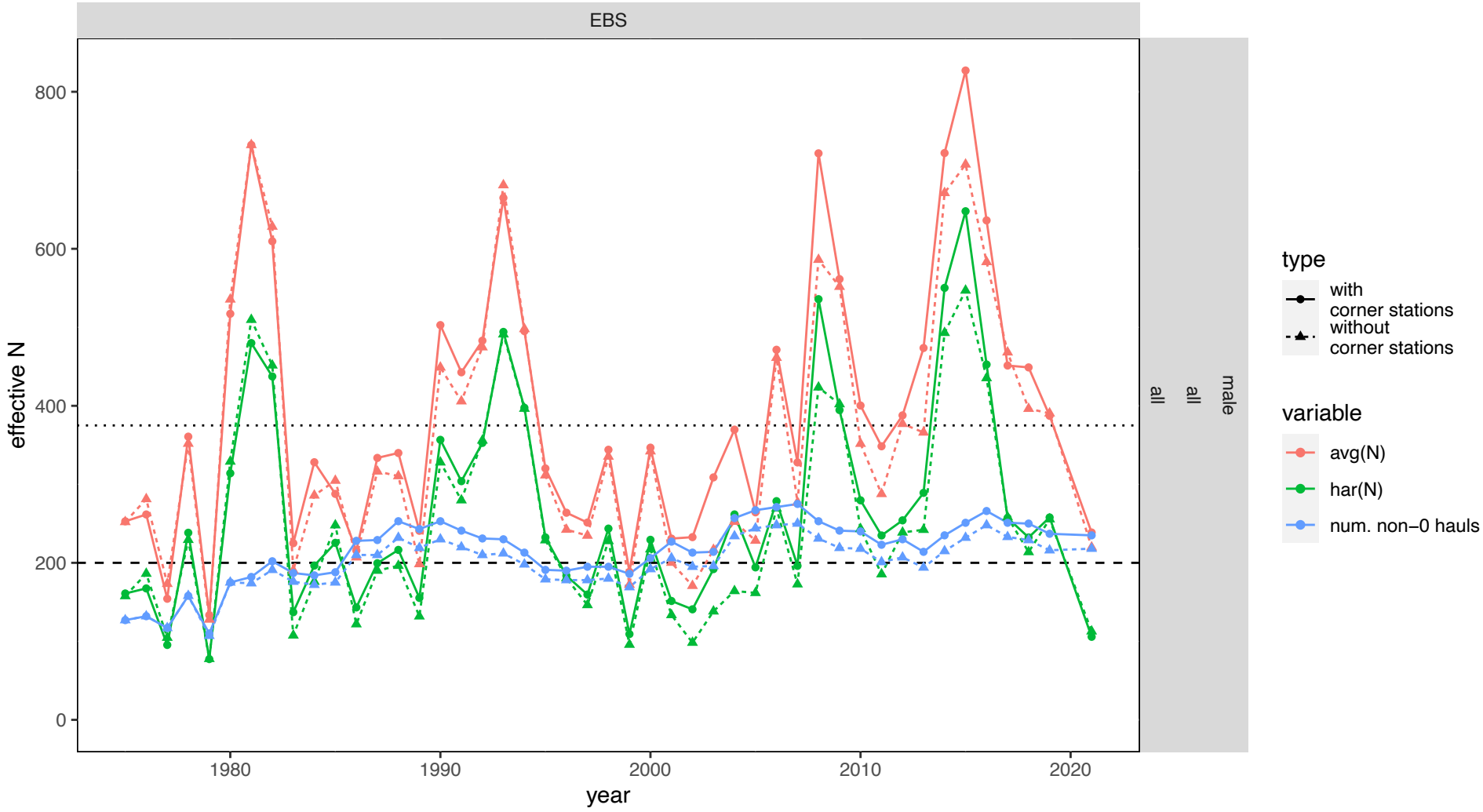
Dropping corner stations



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