SS3 Progress, Ideas and Plans (Thanks to Yijay, Jhen and Libin also to Shin and “Biologists”)

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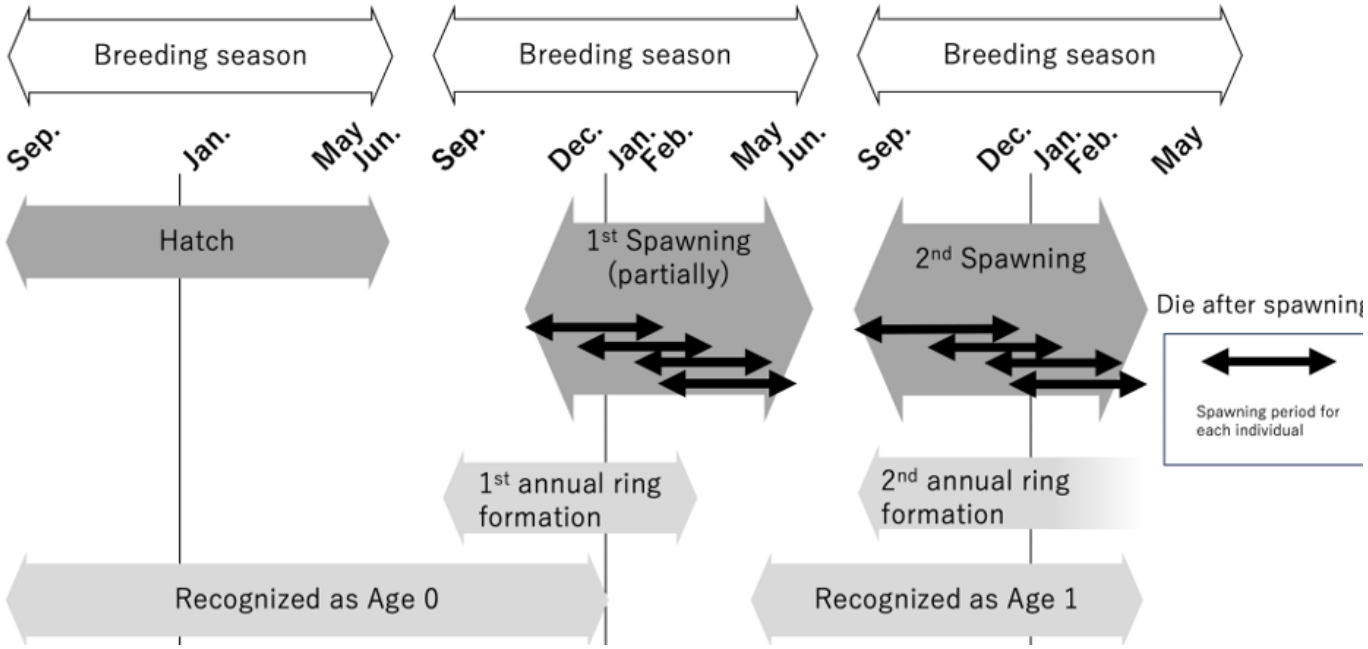
NPFC-2024-SSC PS14

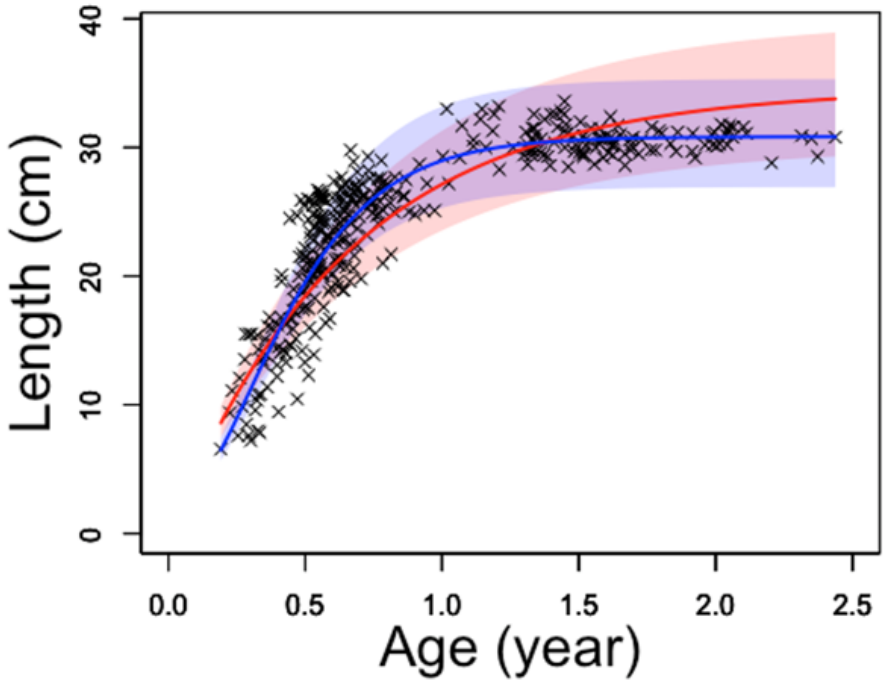
11–13, 16 December 2024

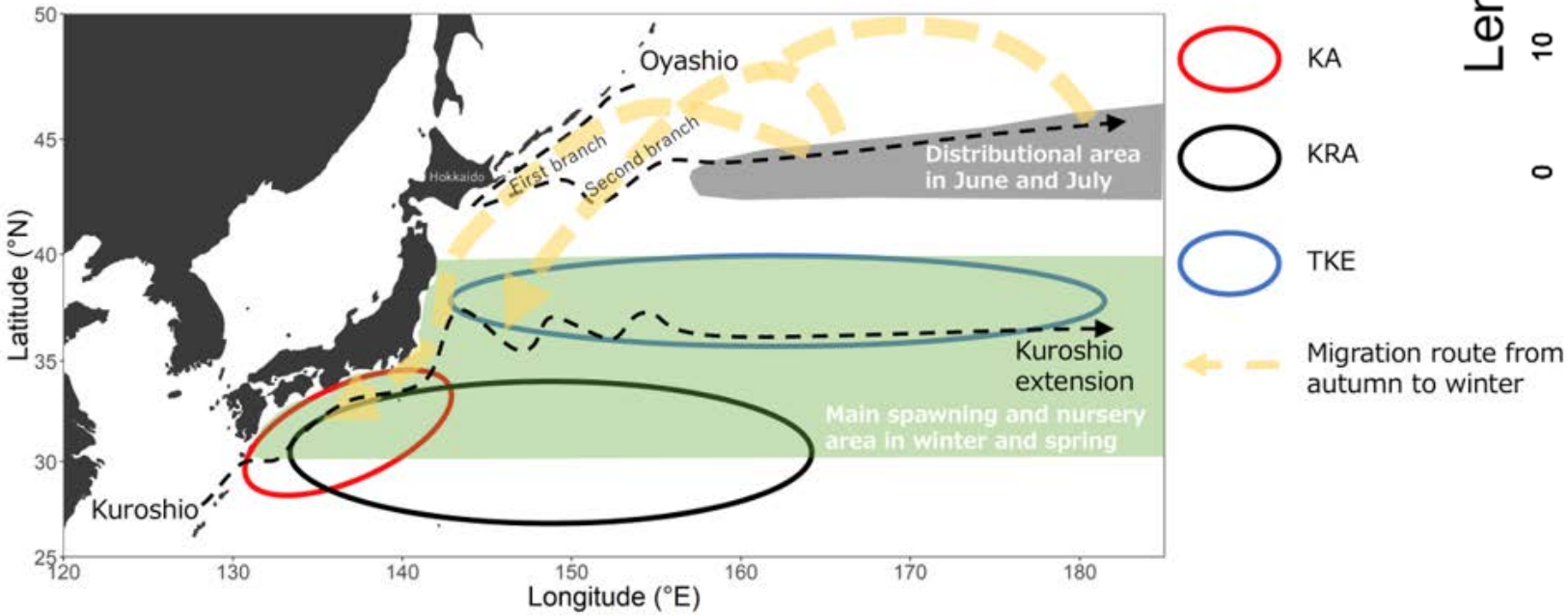
Conclusions

- Getting closer as biological assumptions refined (apologize, then listen to biologists)
- Future use as an operating model for MSE and/or assessment model
- Now see saury SS model as set of almost independent depletion study–one experiment for each annual cohort complicated by high/variable M and growth
- Tension between complexity and simplicity, which both seem important
- Do we have early life history (metamorphosis or “settlement” age and size right?
- Fit to length composition data probably crucial but depends on realistic assumptions about seasonal growth, natural mortality, recruitment and reproductive chronology
  - Recruitment over multiple seasons or subseasons may be necessary (next task)
  - Need to refine M-maturity/size assumptions (post-spawning mortality)
  - Consider using catch by month (available in catch at length data reports for all members?)
- Will soon need information about scale (prior for steepness, recruit variance or Q)
- Need environmental data to model recruitments (I will put them in as soon as you give them to me)
- Need to understand/adjust for differences in ageing criteria (based on daily rings in growth studies but incremented on Jan. 1 in SS3-see below advice from biologists)
- Consider shorter time steps to better estimate growth and catch data/fishing mortality
- Need permission to work with SS3 support staff on Pacific saury data files



Most of my modeling questions are biological and partially addressed in Q/A paper by these graphs





Steps after October meeting

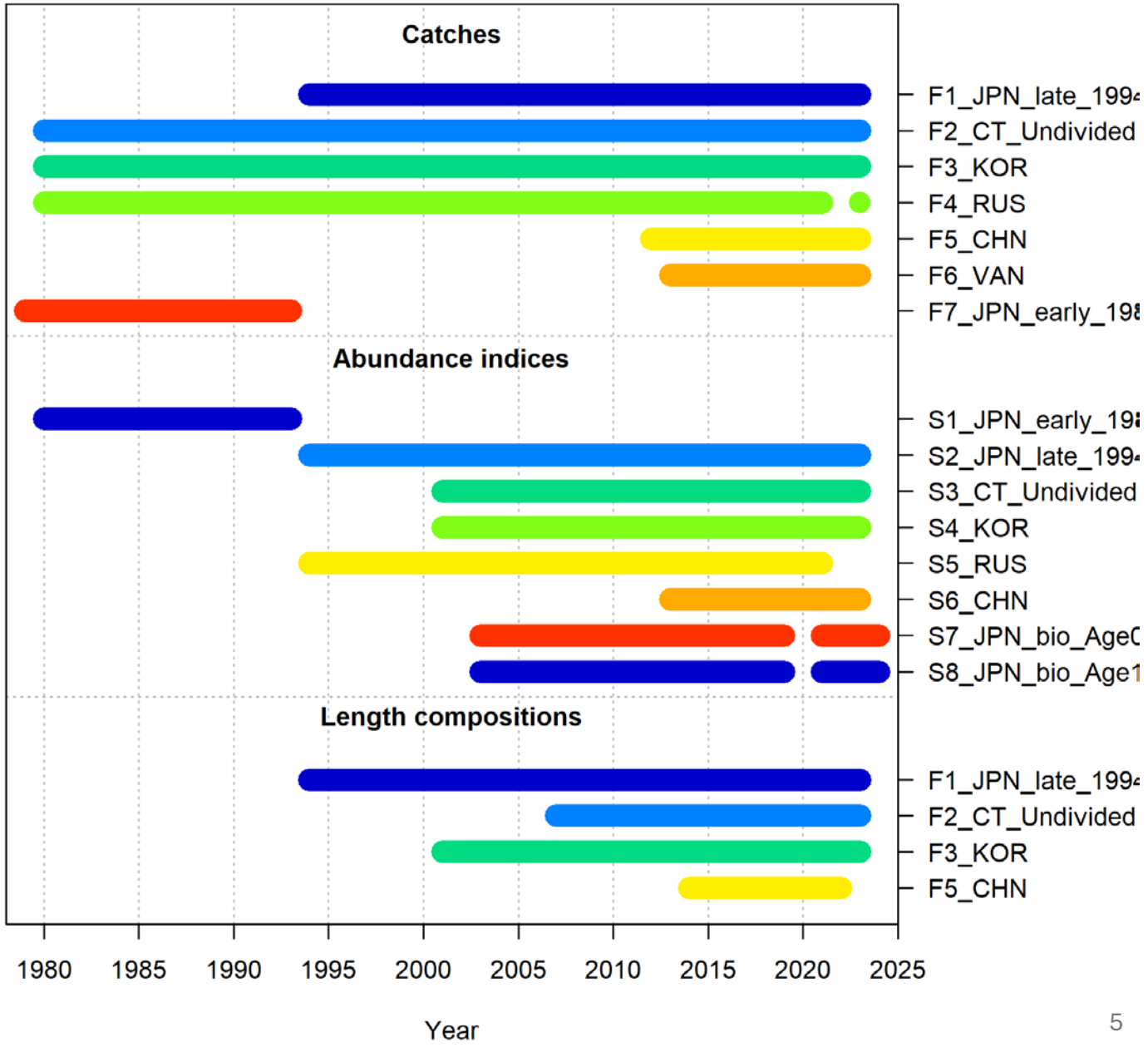
- Start with “Step 8” from October meeting (includes 2024 survey)
- Omit Step 9 with conditional catch at age
  - Ageing criteria and age-length key not clear or hard to work with
  - Already used to split Japanese survey
  - Revisit later?
- Steps taken based on October meeting (not in order)
  - Switch to new SS3 version (V3.30.23) and updated R4SS
    - R4SS may be harder but I can help
  - Estimate R0 (for better or worse)
  - All CPUE series nonlinear I=qB^x
  - “Undivided” CT CPUE back together random walk on Q
    - Note: random walk on Q for JPN early, random devs on Q for CT
  - Downweight CPUE to 1/5=0.2 (5 = JPN early, JPN late, CT, KOR, RUS)
  - **Asymptotic selex all fisheries and CPUE**
  - **Ages 0 and 1+**
  - **Published Gompertz growth curve**

Need JPN survey length data to estimate survey selx and growth! HIGH PRIORITY

Need to understand JPN age data better for conditional catch at age (maybe) and survey 0/1+ split

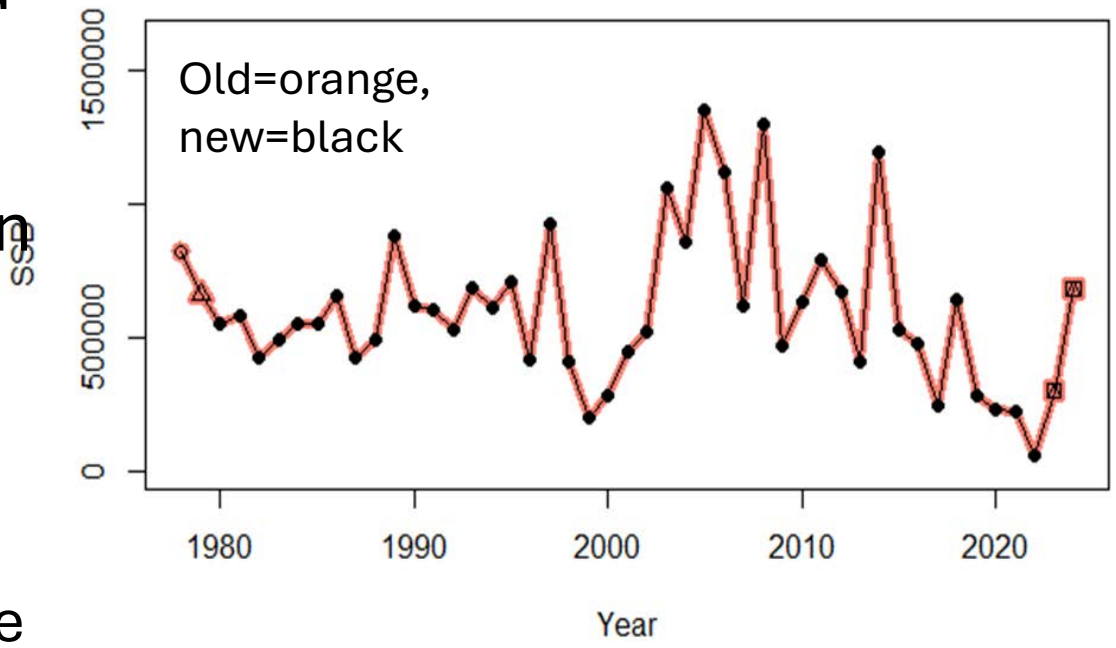
Add RUS (and VAN?) catch at length

Confirm decision to borrow selex curves for VAN from JPN late (if no length data)



Upgrade from SS Version 3.30.20 to 3.30.30

- Update to new version of ADMB and new r4ss
- Tested by running new and old versions with data files from Libin on 9/16/2024 (called “Step 1” previously)
- New SS runs original files with no problems
  - Results indistinguishable but objective function different (new=1096, old=1078)
- R4ss may be harder to update unless fixed now



Nakayama (2019) Gompertz growth curve

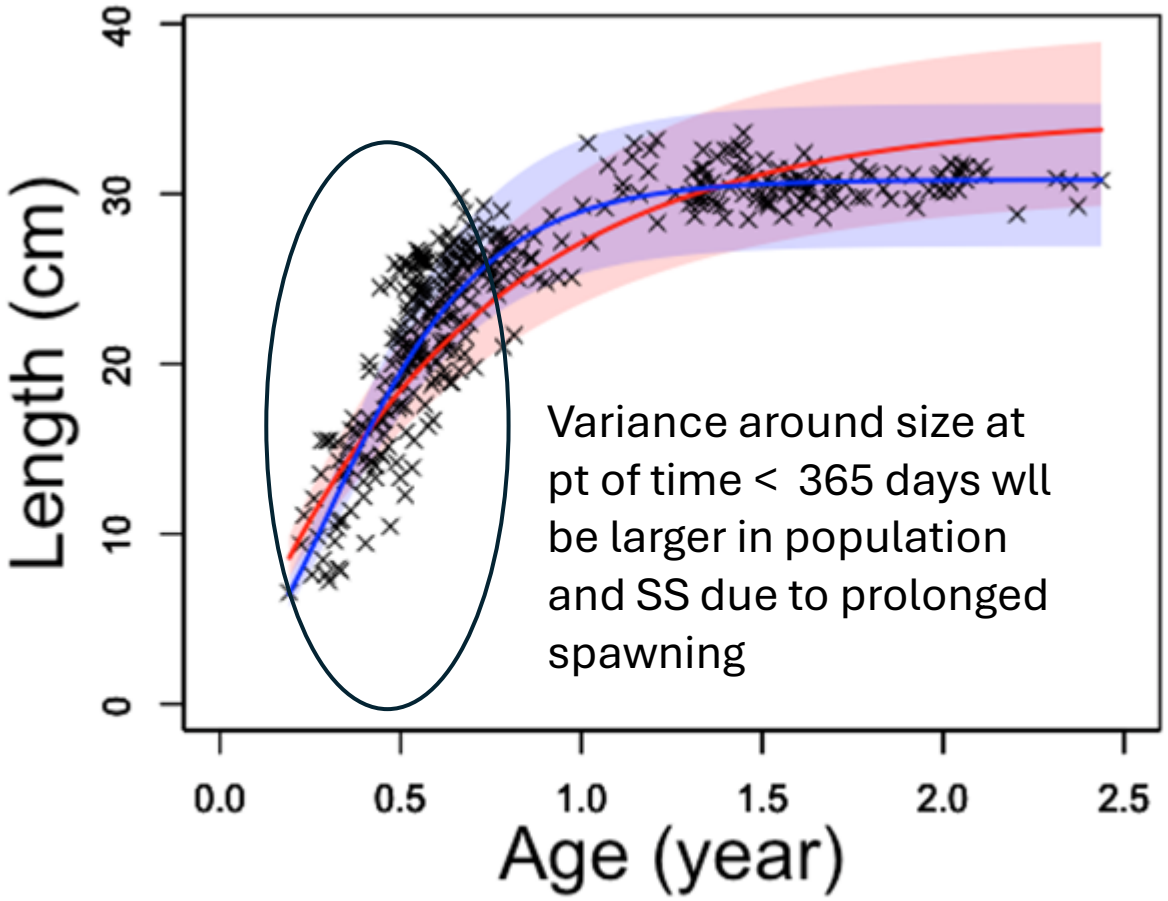


Figure. 5. von Bertalanffy (red) and Gompertz (blue) growth curve fi
data. Shadows around the curves are standard deviations.

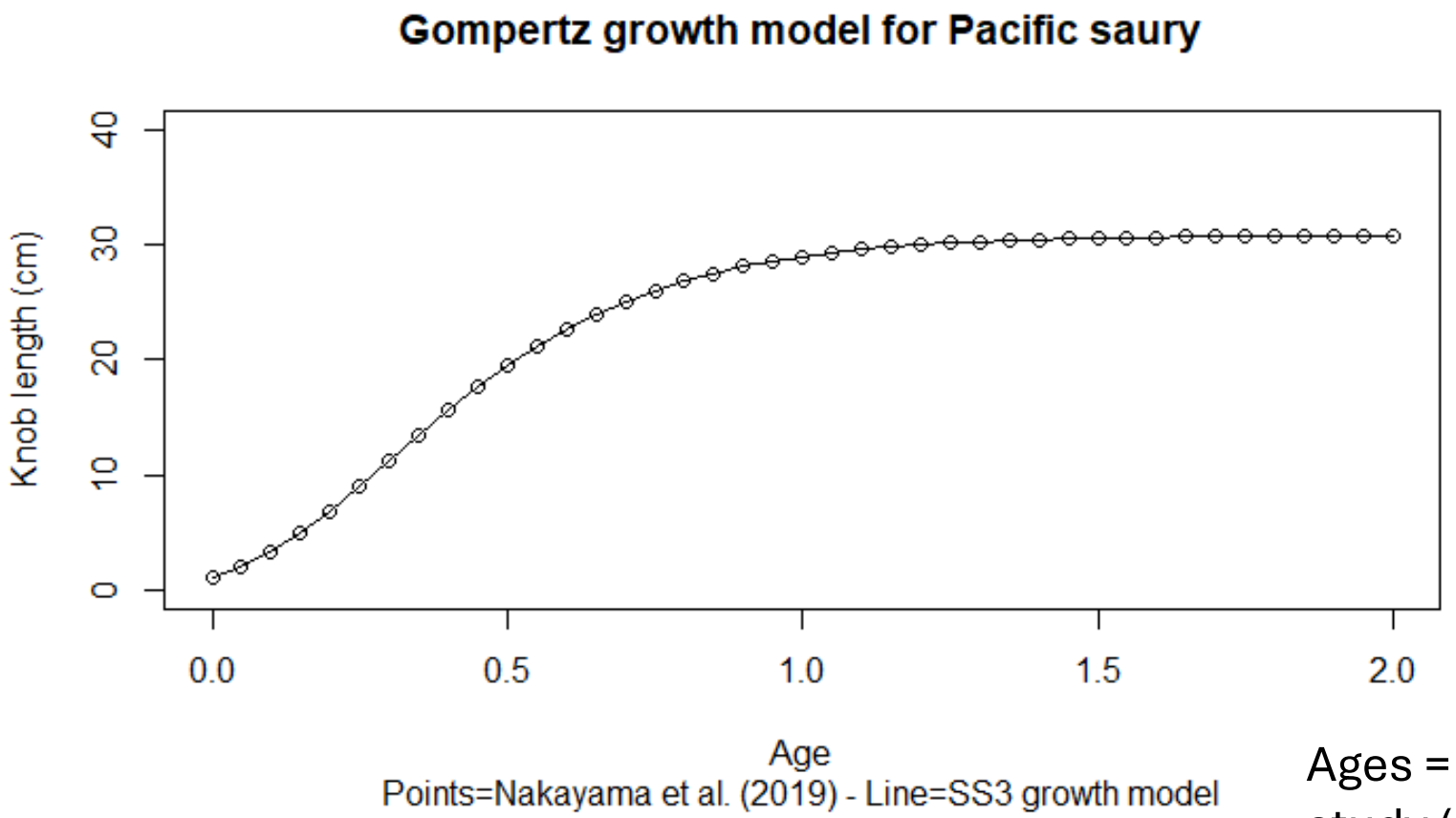
X axis is age but actually daily rings / 365?

Are these samples all pelagic?

How large are saury when they settle (metamorphose)? Less than 6 cm based on graph.

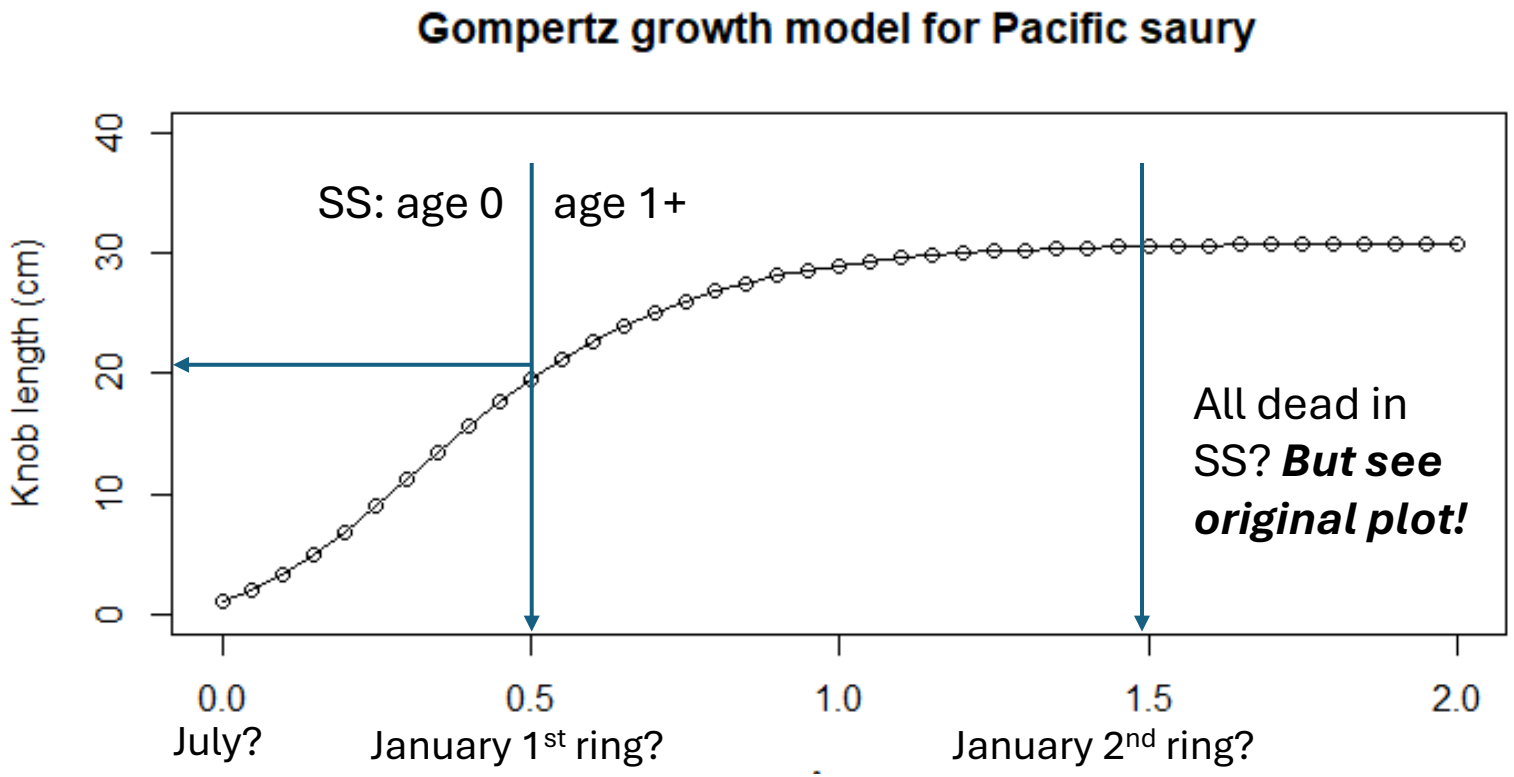
Biologists say few fish > 2 years *but they really mean few fish with 2 rings?*

Nakayama (2019) Gompertz as a Richards growth curve in SS3



Ages = daily ring counts / 365 in study (but SS increments age on January 1)

Current translation to Richards growth curve in SS3 – no parameters adjusted



For SS, should be years after settlement in July

Ages = daily ring counts / 365 in study but SS increments age on January 1

SS3 settlement at age 0 years or days assumed July 1

So, a fish age > 0.5 in this graph would be age 1 in SS?

Ring age - 0.5 ~ biological age in SS

Need to adjust growth curve parameters in SS? I don't think so, ***depends on settlement date assumptions.***

Hypothesis: fish older than 1.5 daily ring years when 2nd annulus forms in January are rare and mostly ageing error??

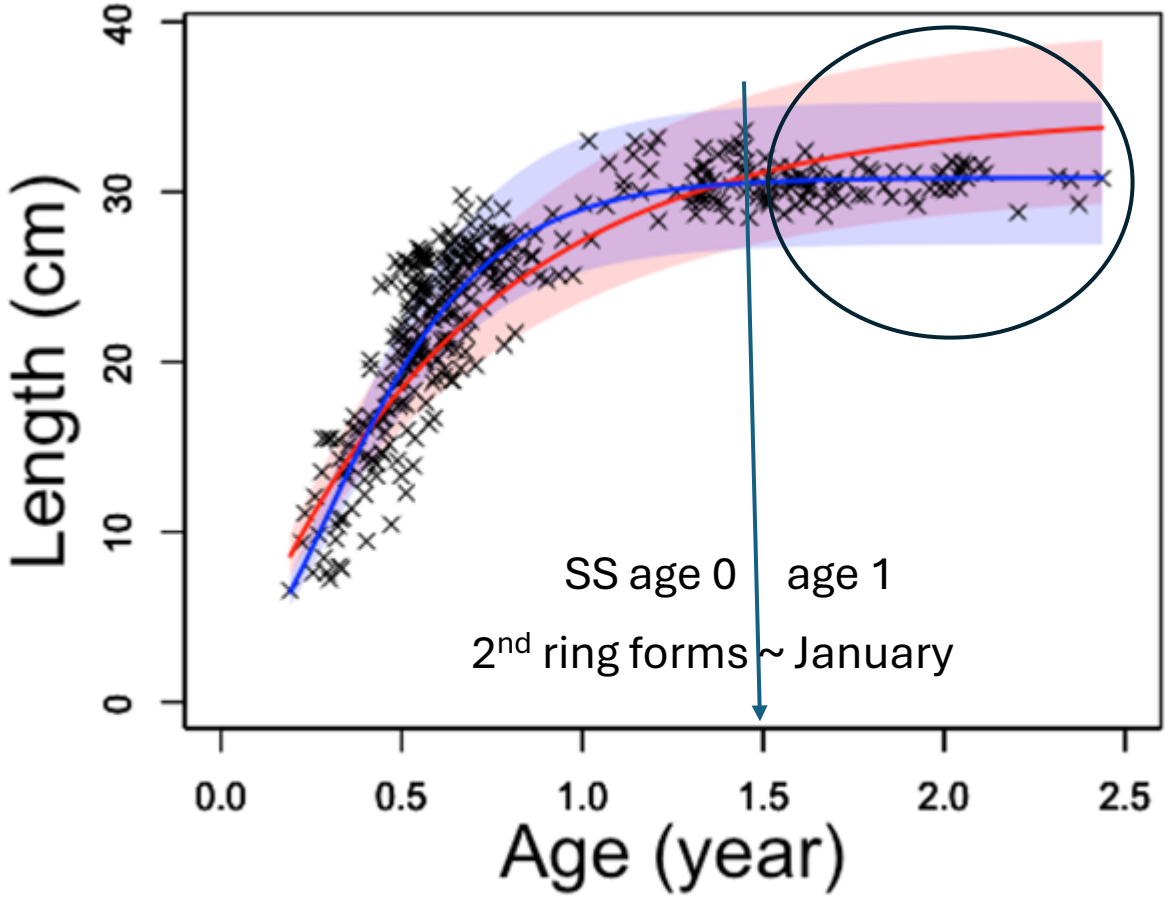


Figure. 5. von Bertalanffy (red) and Gompertz (blue) growth curve fi
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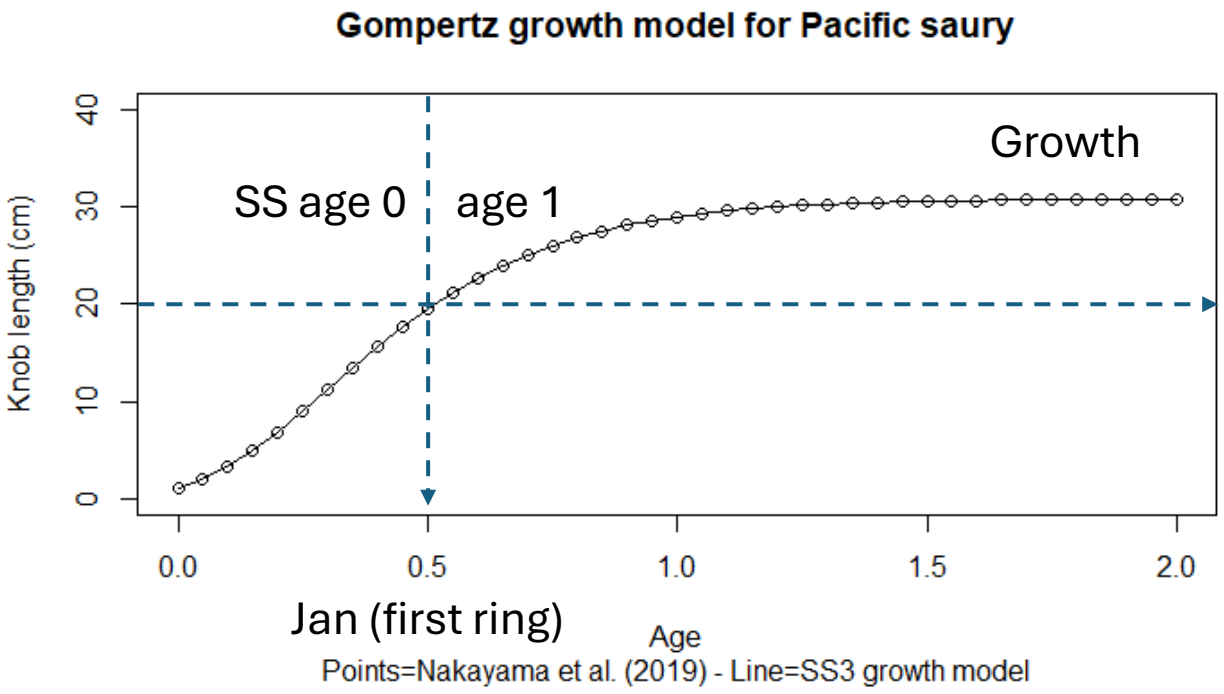
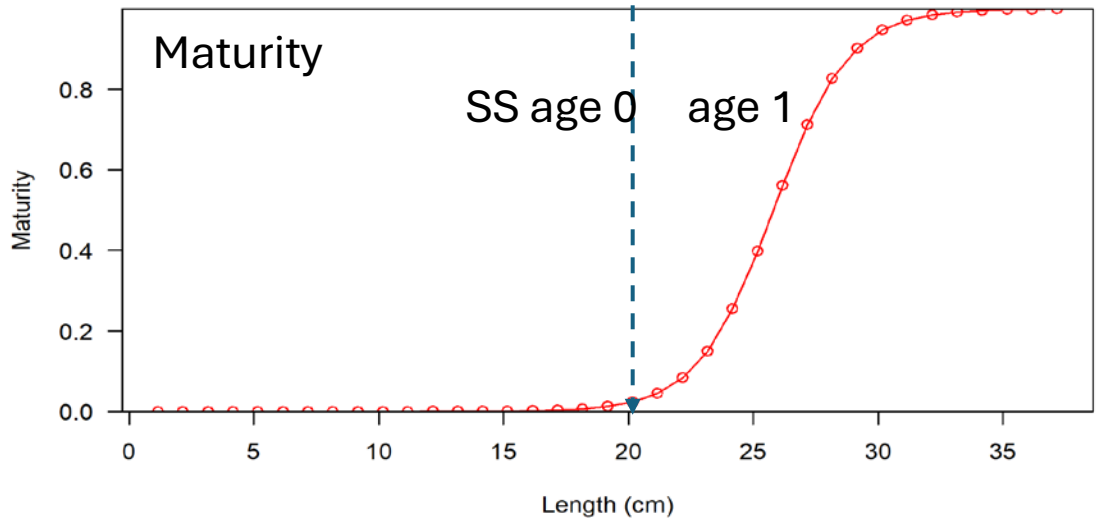
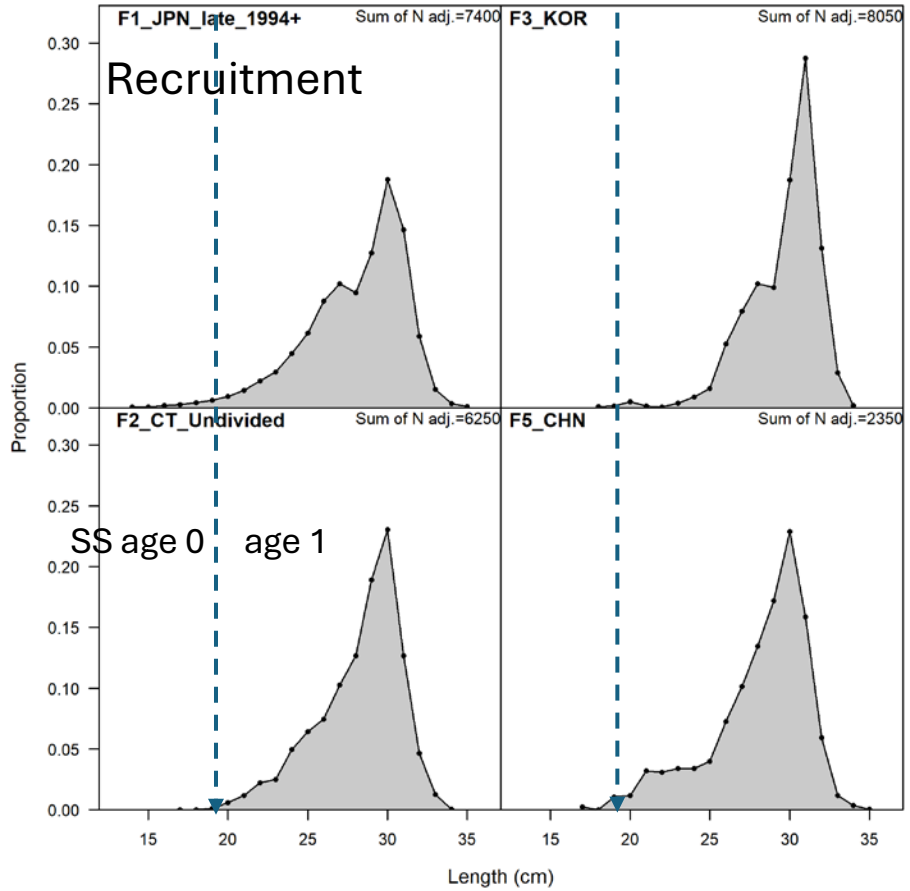
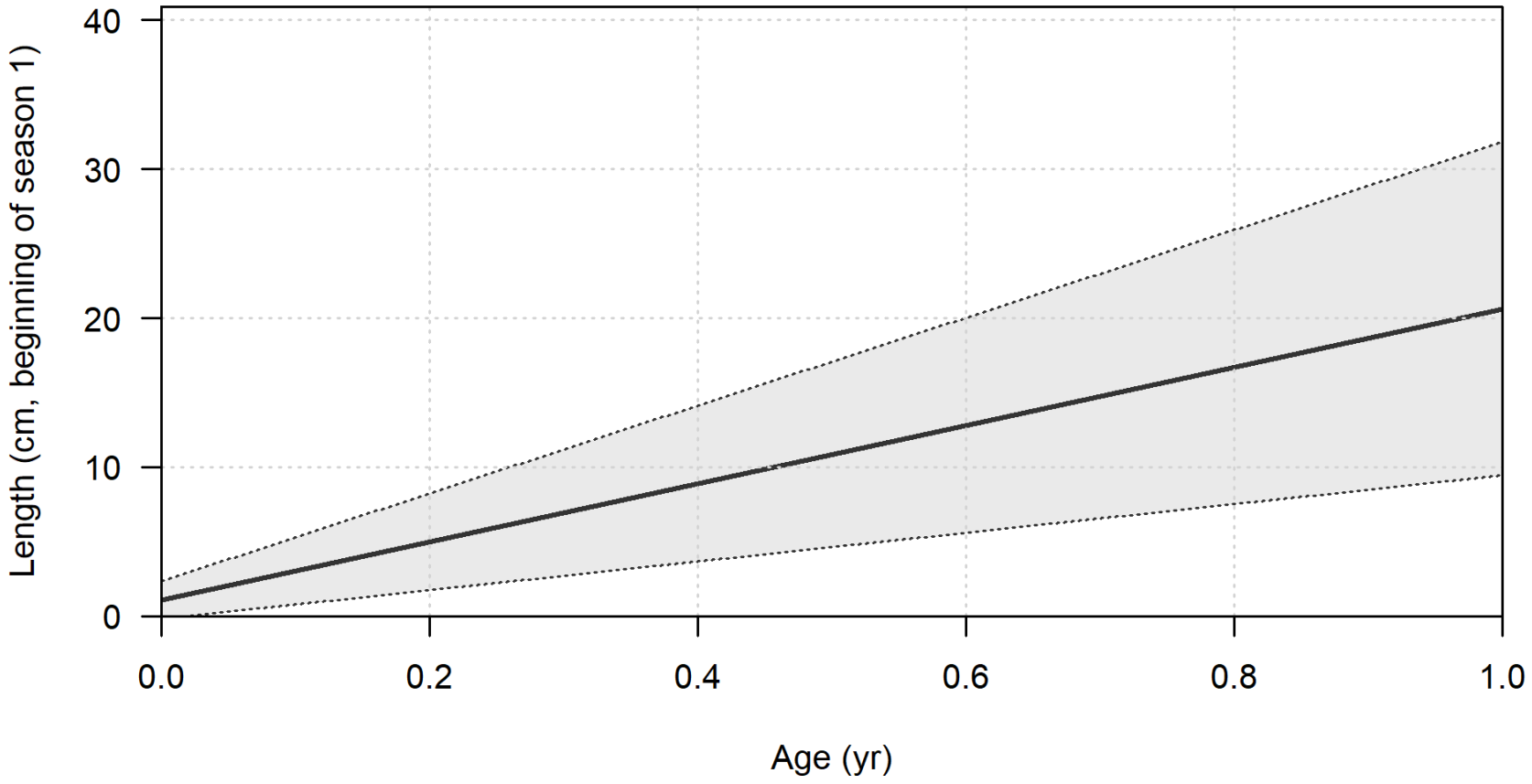




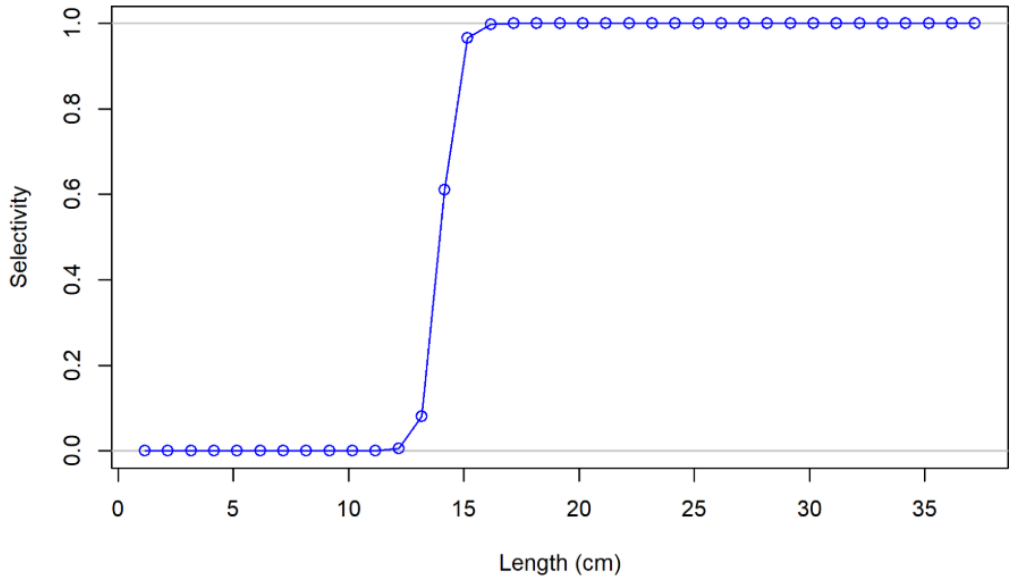


- Recruit at SS age 1 and about 20 cm
- Fishing starts when fish start maturing?
- Length peaks at 30 cm (~80% mature) in all cases
- All dead by 35 cm (~100% mature)
- So maturation and recruitment are simultaneous?

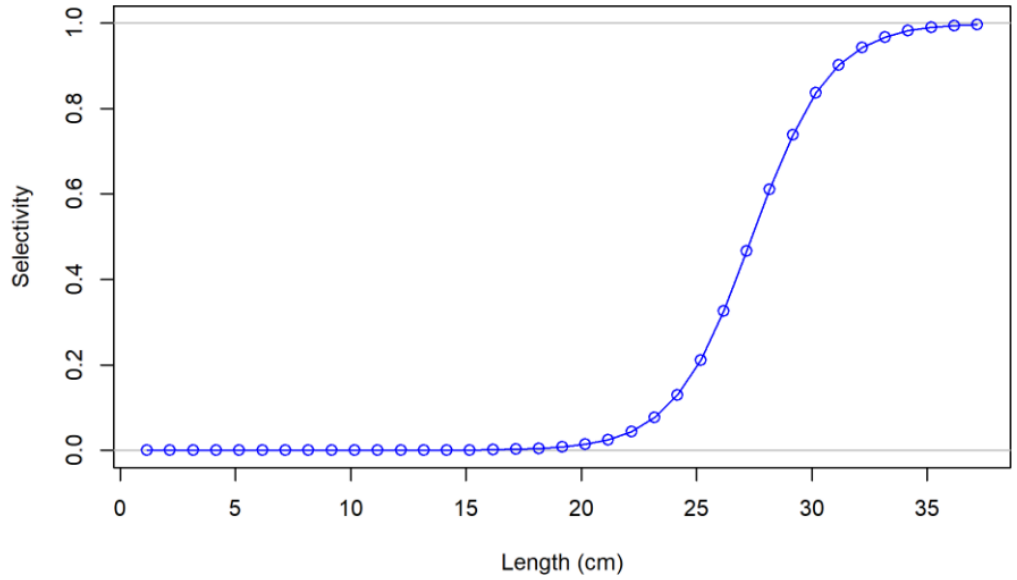
Updated Run16 (with all changes)



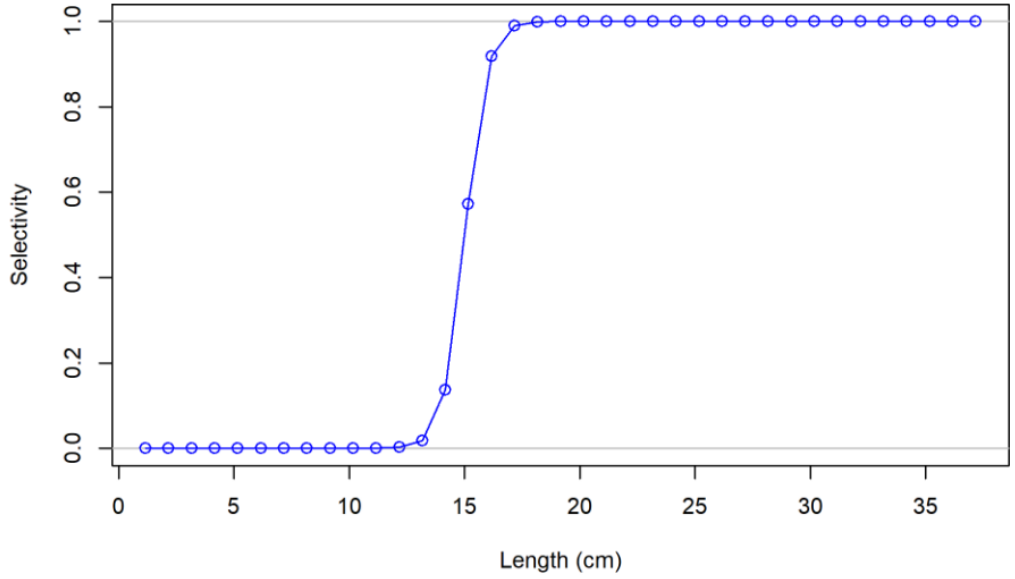
R4SS plot doesn't work well for saury due to different ageing criteria, omission of age 2, and calculation at whole ages only



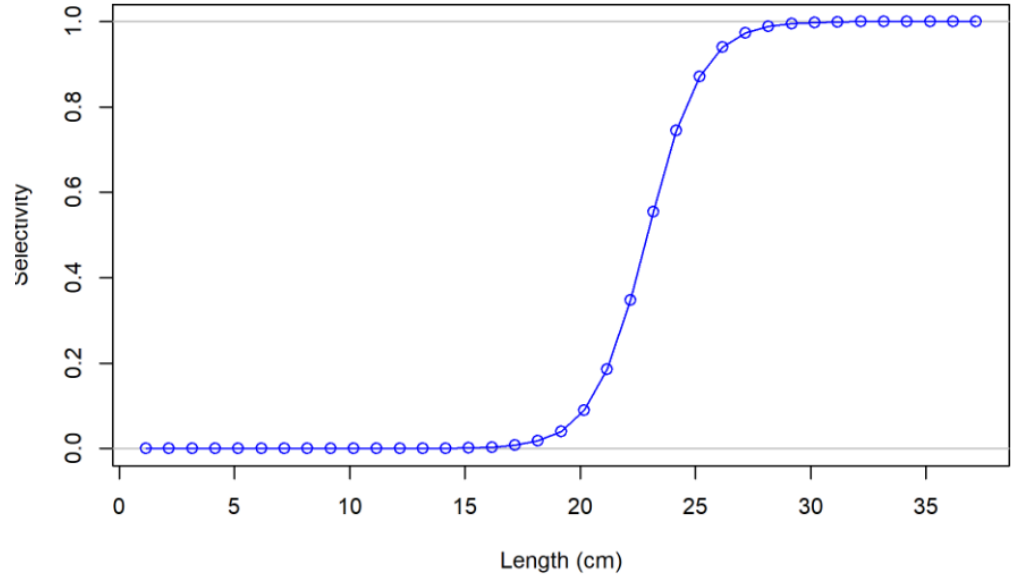
Ending year selectivity for F1_JPN_late_1994+



Ending year selectivity for F3_KOR



Ending year selectivity for F5_CHN



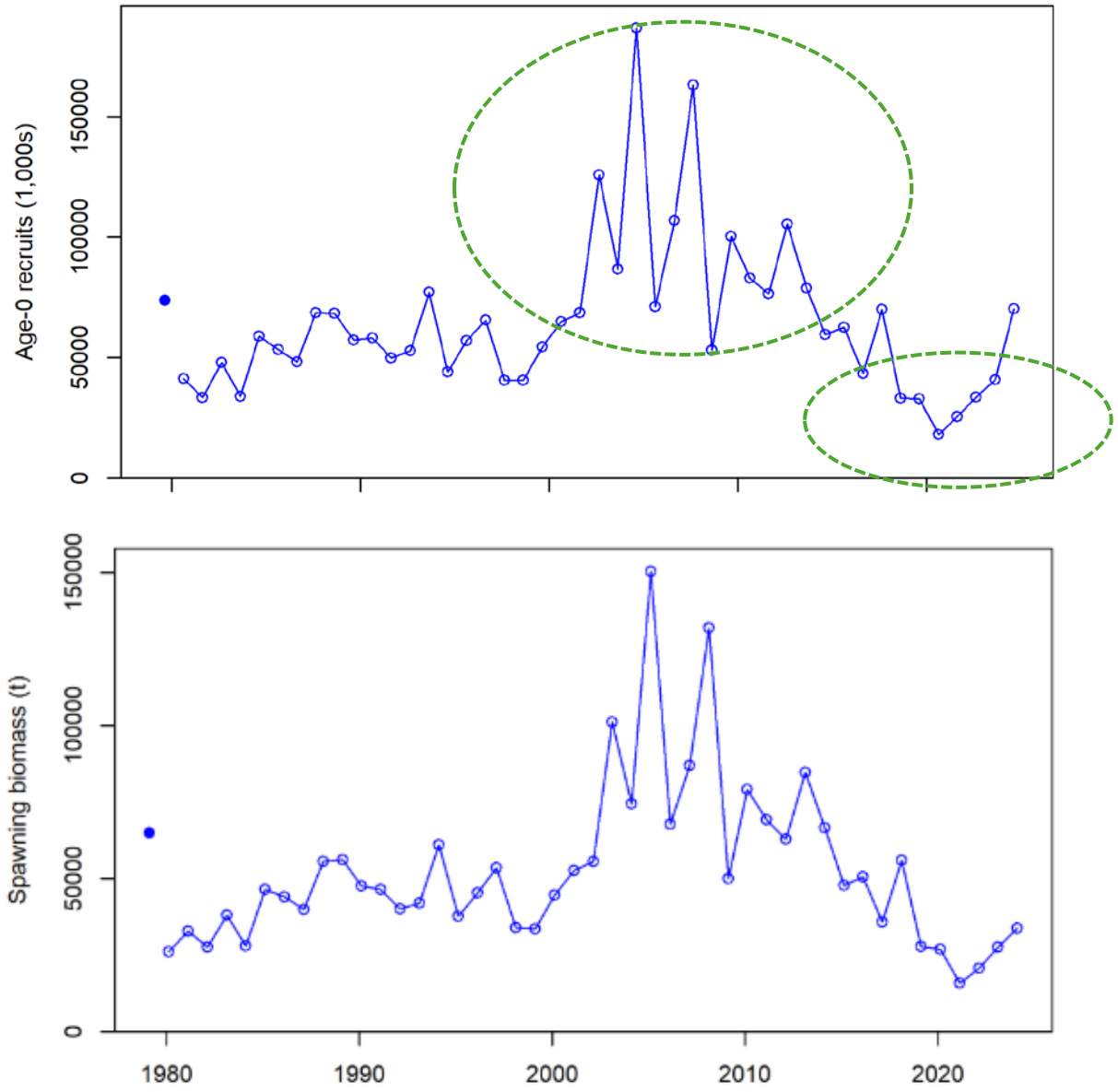
Ending year selectivity for F2_CT_Undivided

SSB and recruits

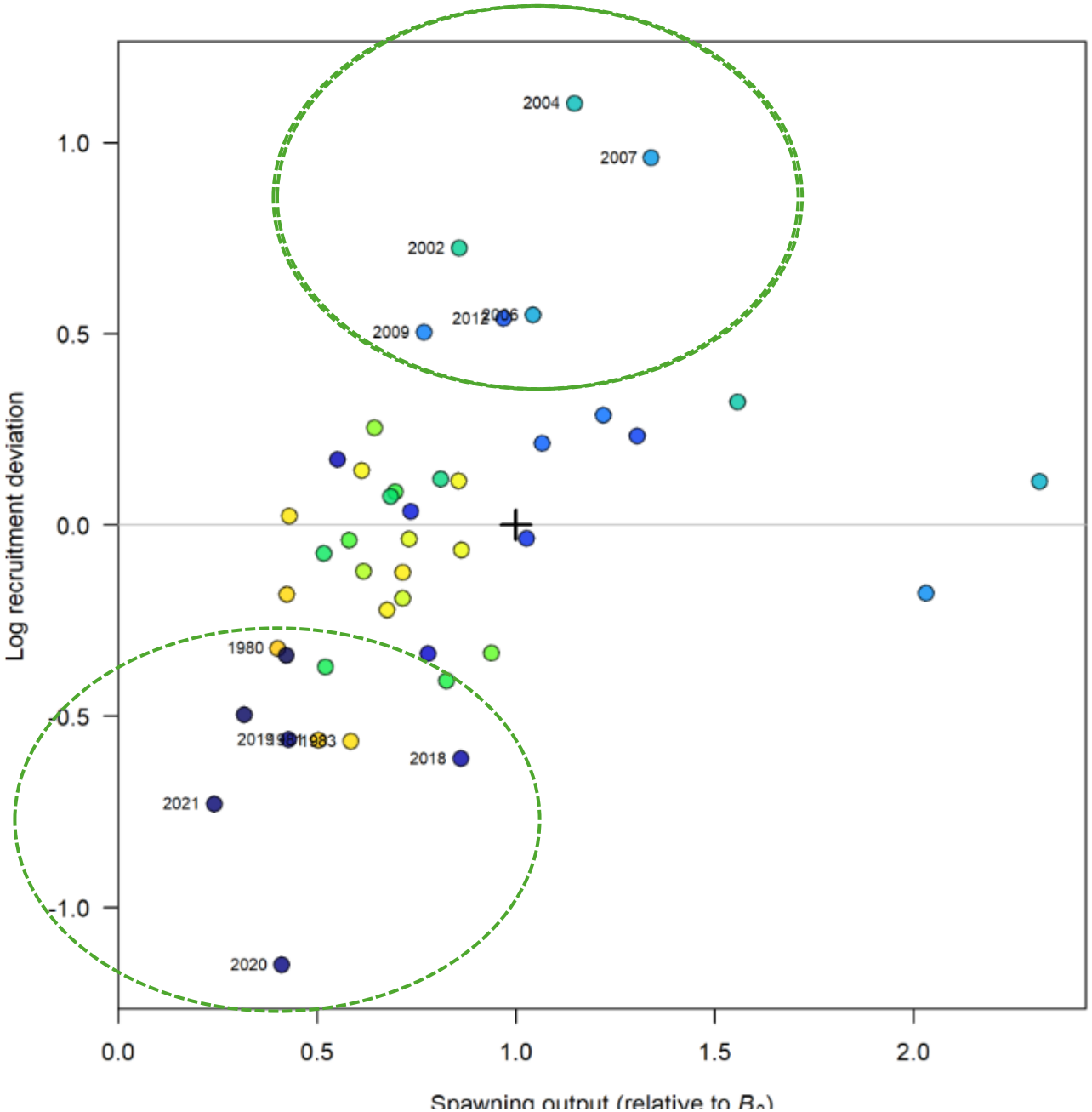
Some very high years and fewer very low years

2024 included

Don’t take scale or trend seriously yet

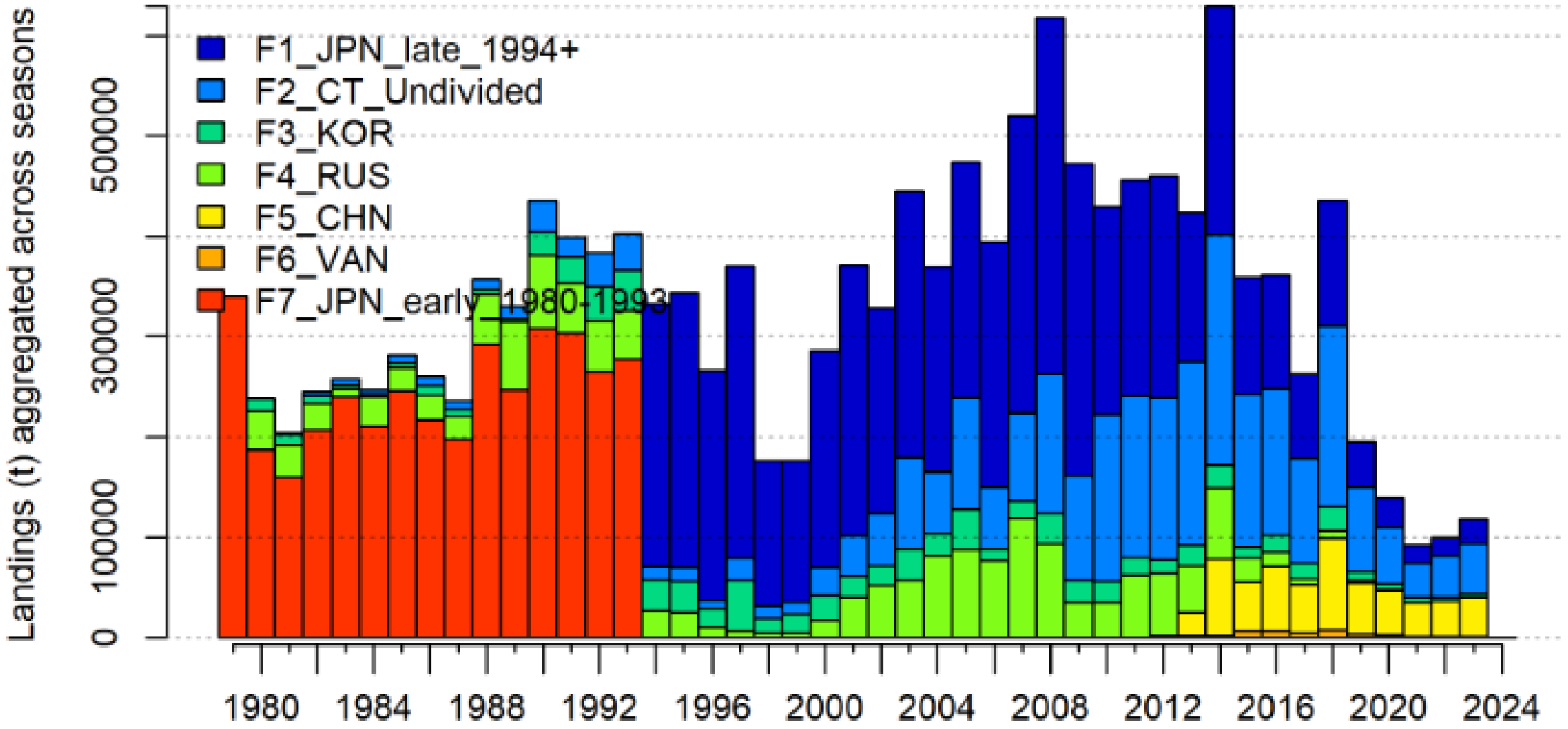


Spawner-recruit

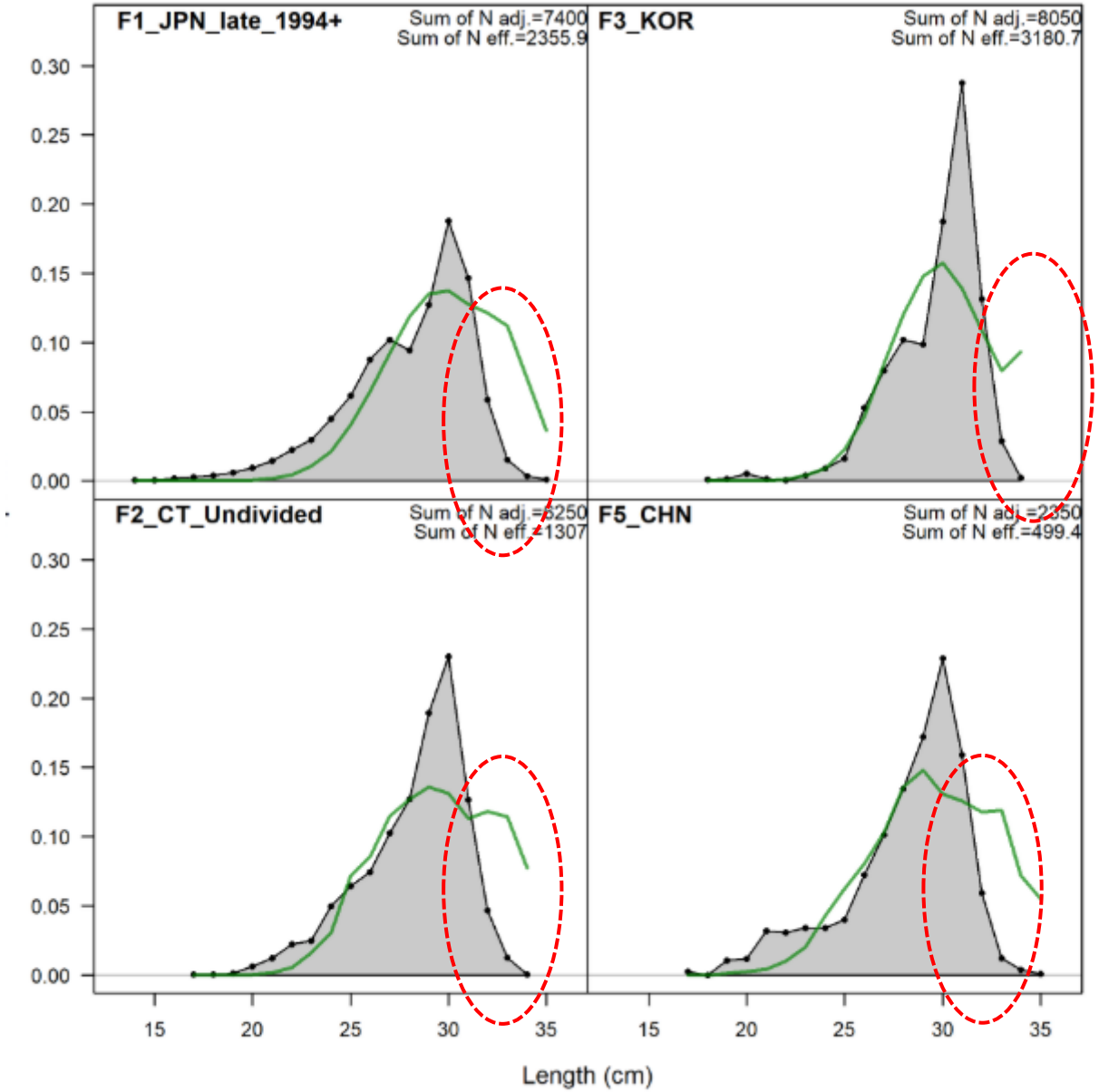


Need environmental variable (please?) or different steepness to explain recruitments

Give me one or two to try.


Landings (t) aggregated across seasons
0
100000
300000
500000
F1_JPN_late_1994+
F2_CT_Undivided
F3_KOR
F4_RUS
F5_CHN
F6_VAN
F7_JPN_early_1980-1993
1980
1984
1988
1992
1996
2000
2004
2008
2012
2016
2020
2024

Size comps (only data type with lack of fit issues)

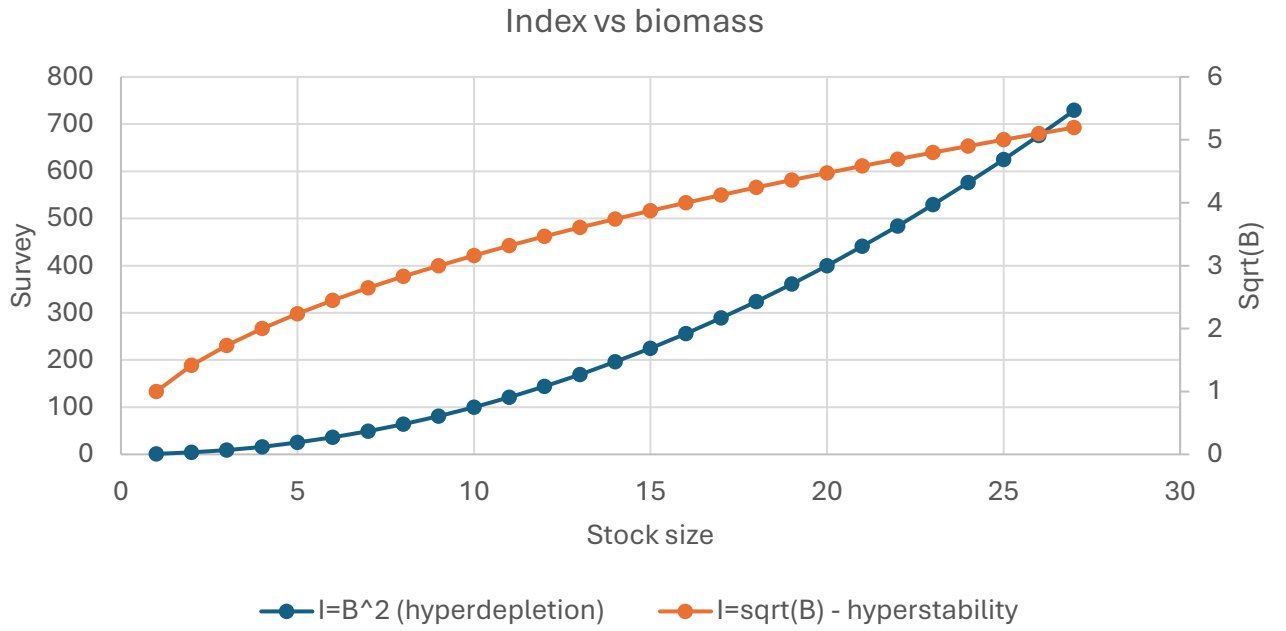


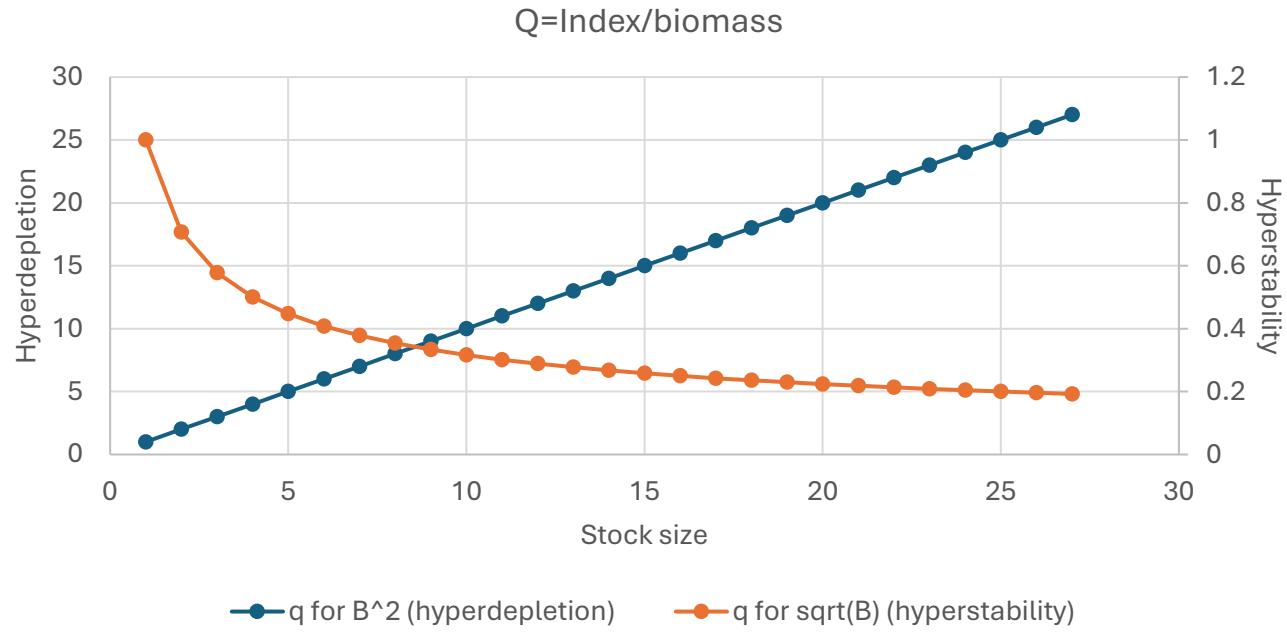
ength comps, aggregated across time by fleet.

Too many old post-spawning fish. They must die…

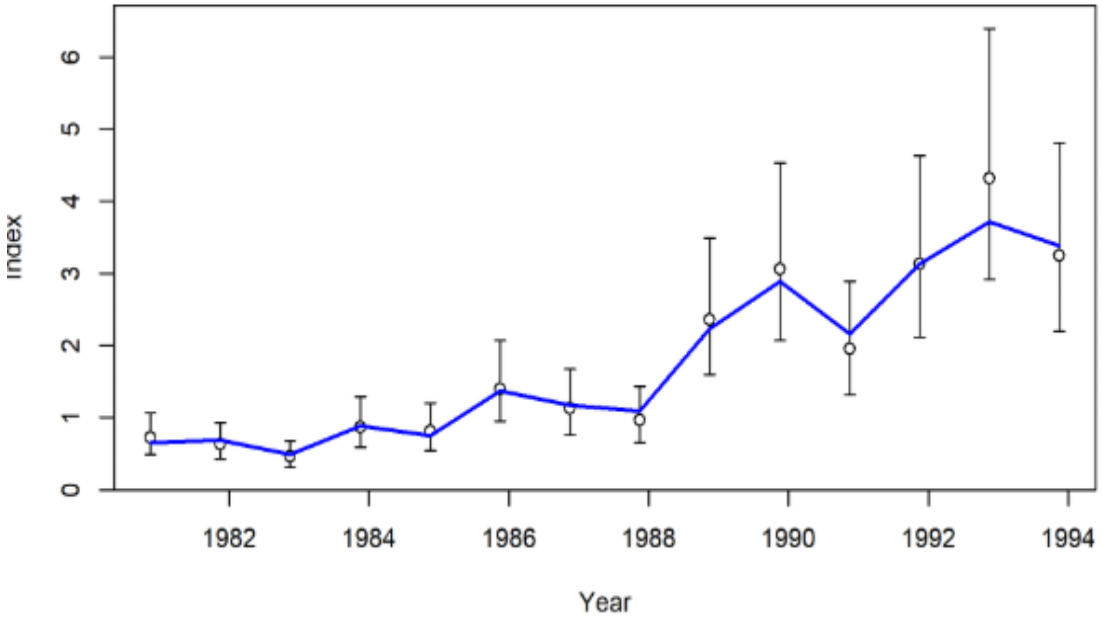
I will try SS options that increase M based on maturity and size

Q for nonlinear surveys (SS bug fix currently underway)

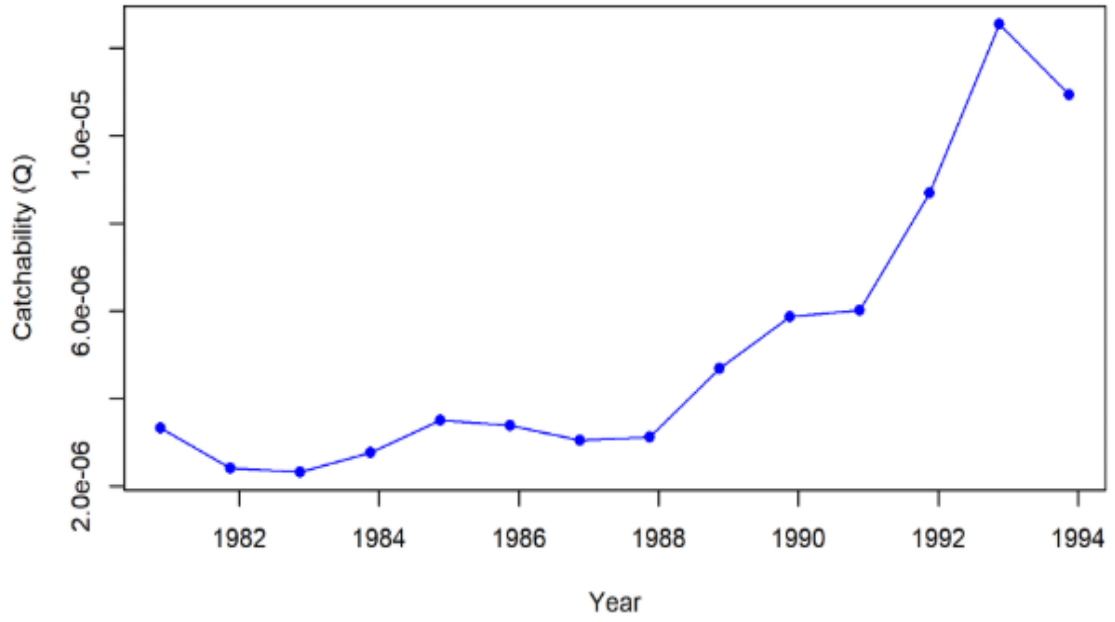




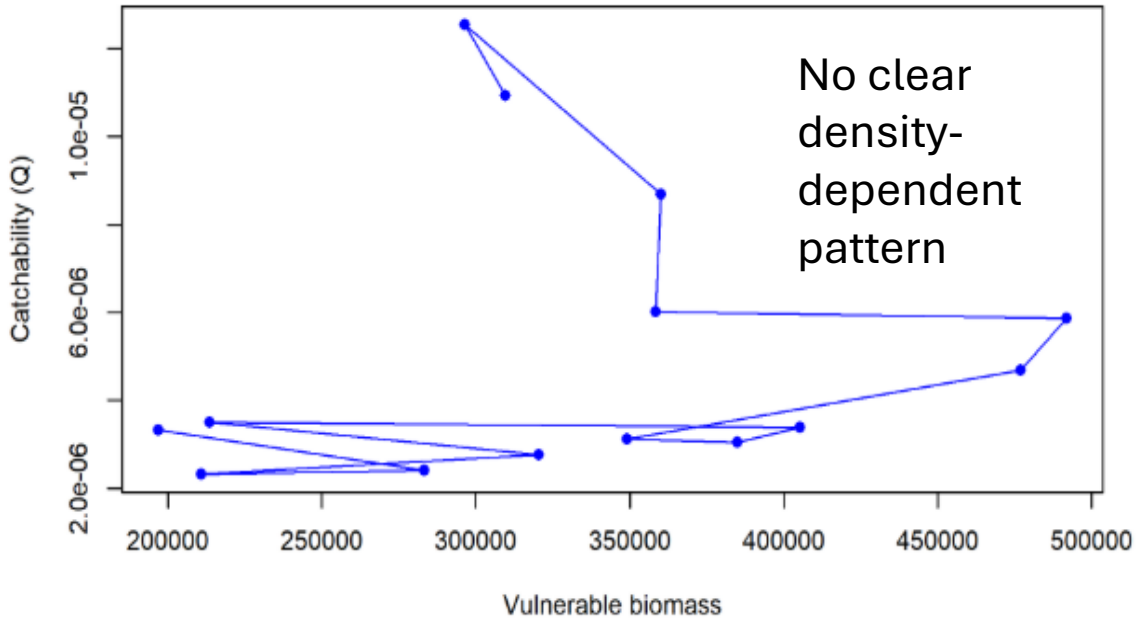
JPN early CPUE (devs)



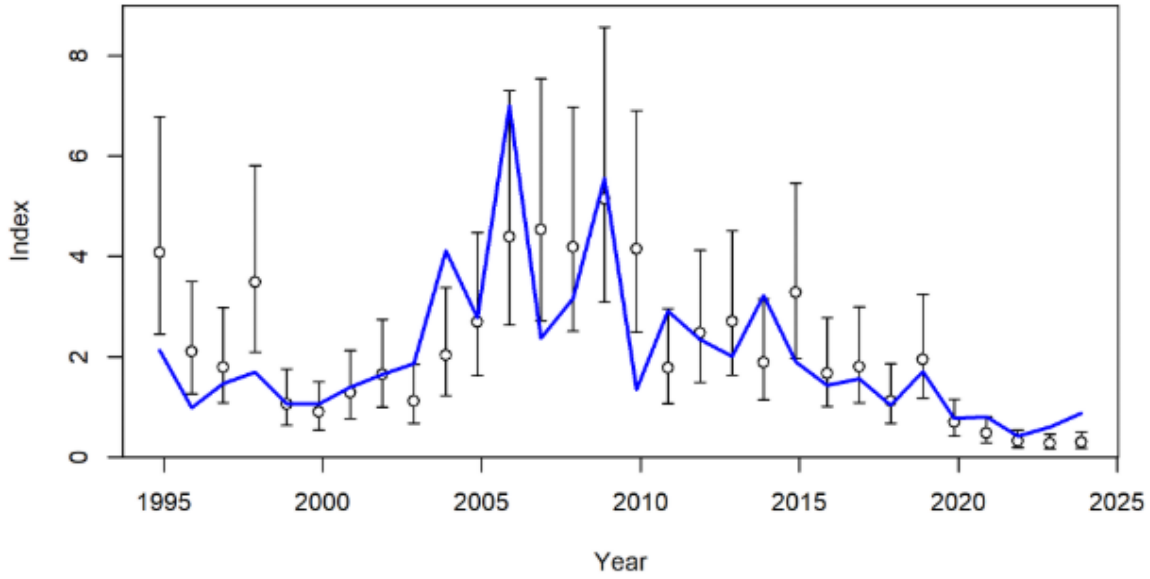
Fit to index data for S1_JPN_early_1980-1993. Lines indicat



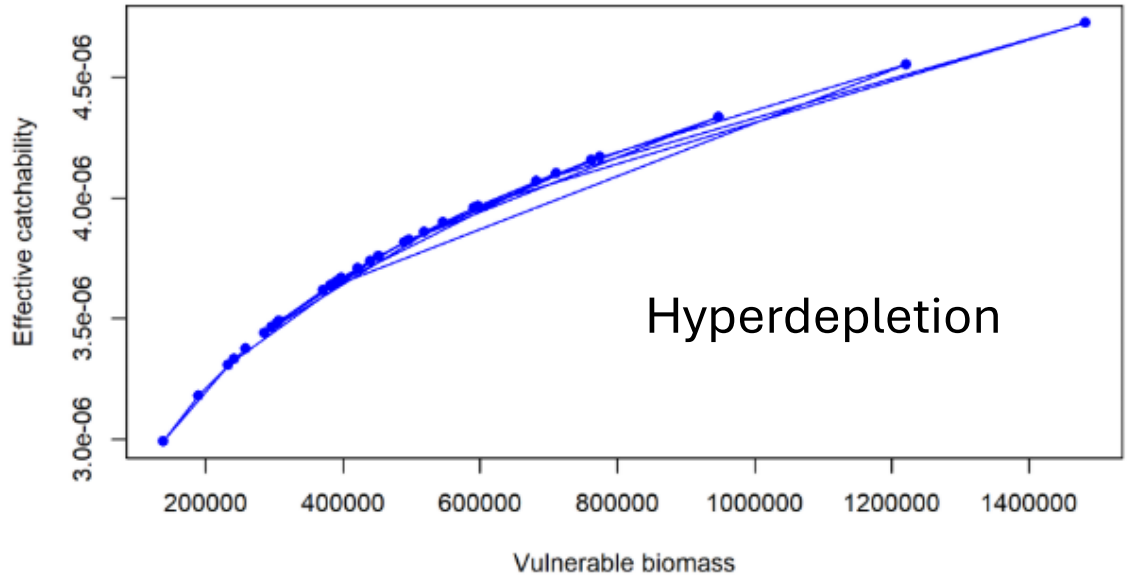
Timeseries of catchability for S1_JPN_early_1980-1993



JPN late CPUE (nonlinear)

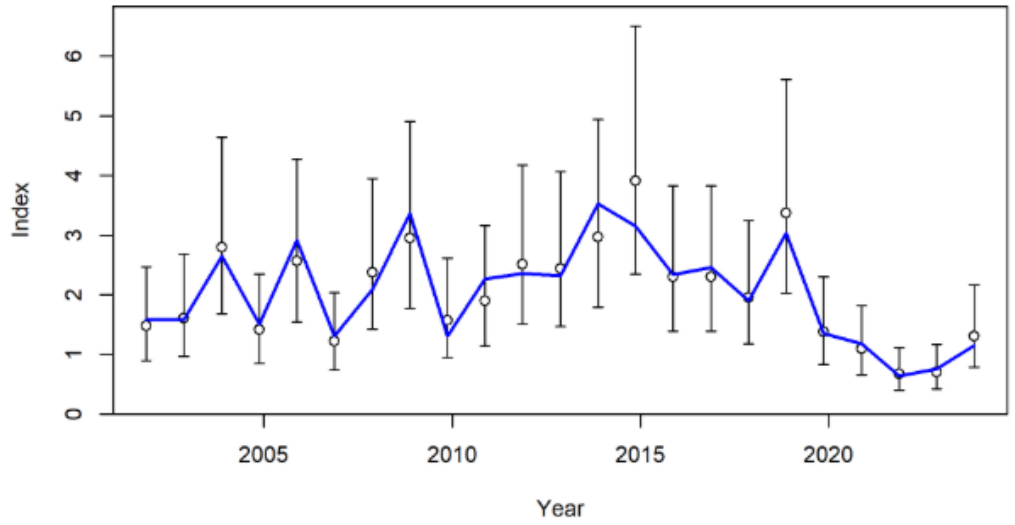


Fit to index data for S2_JPN_late_1994+. Lines indicate 95%

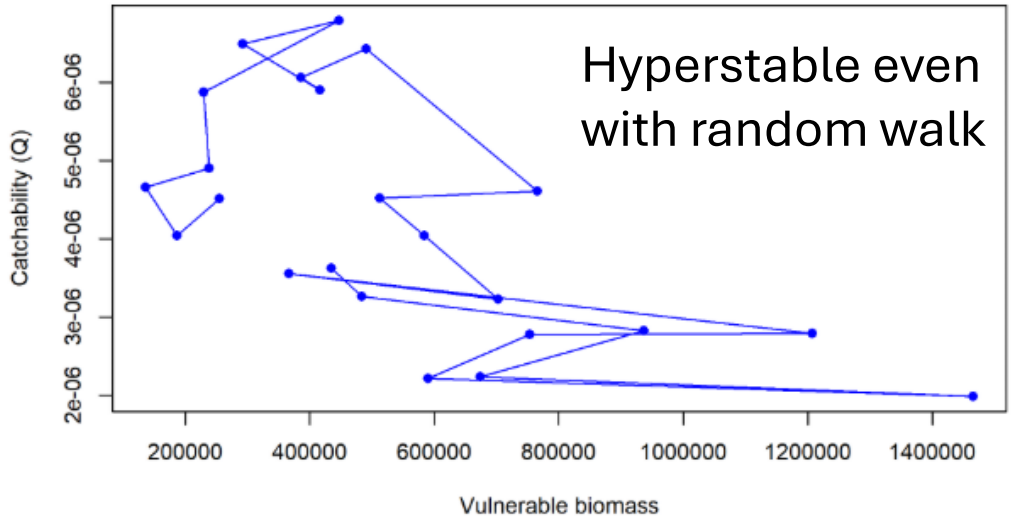


Catchability vs. vulnerable biomass for fleet S2_JPN_late_1994+

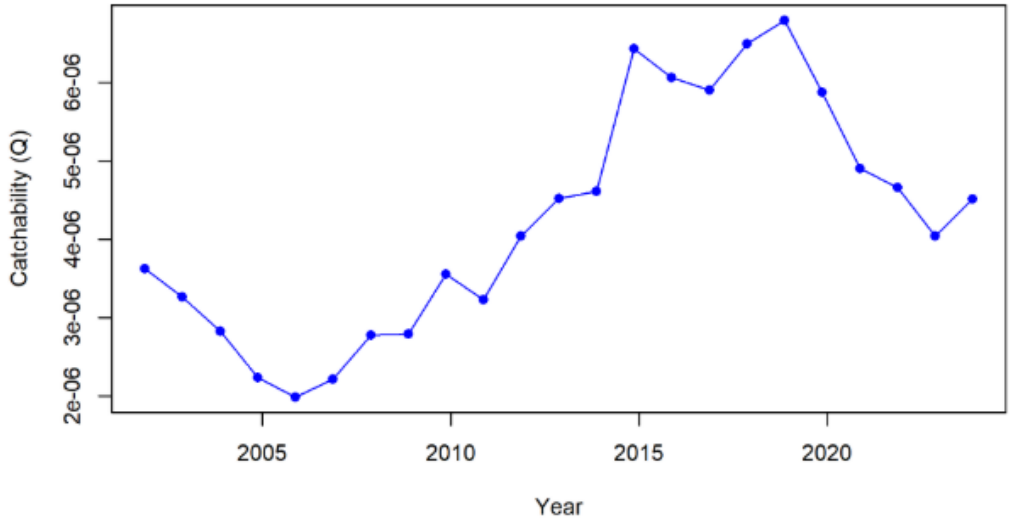
CT (linear with random walk)



Fit to index data for S3_CT_Undivided. Lines indicate 95% ur

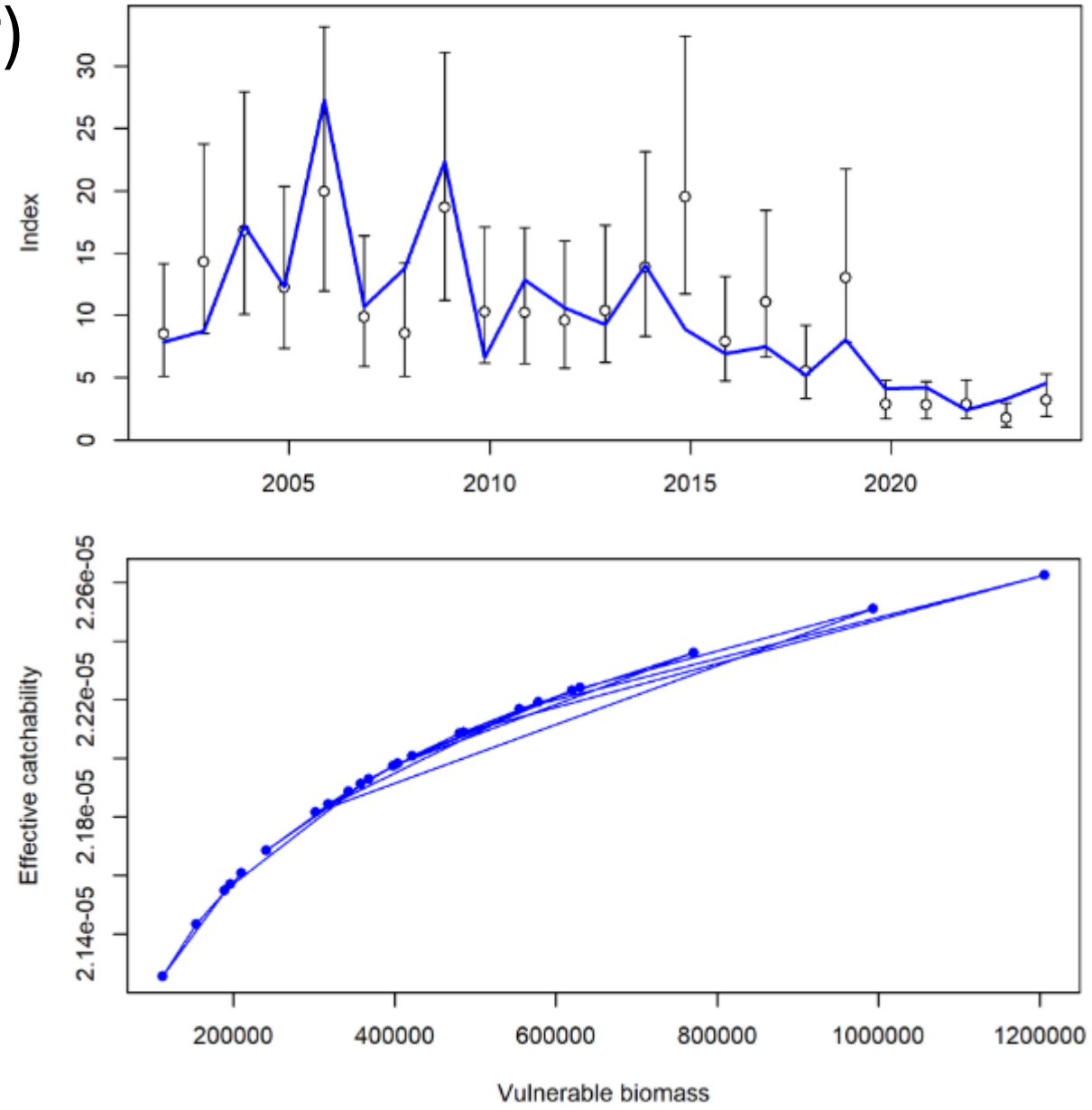


Catchability vs. vulnerable biomass for fleet S3_CT_Undivided



Timeseries of catchability for S3_CT_Undivided

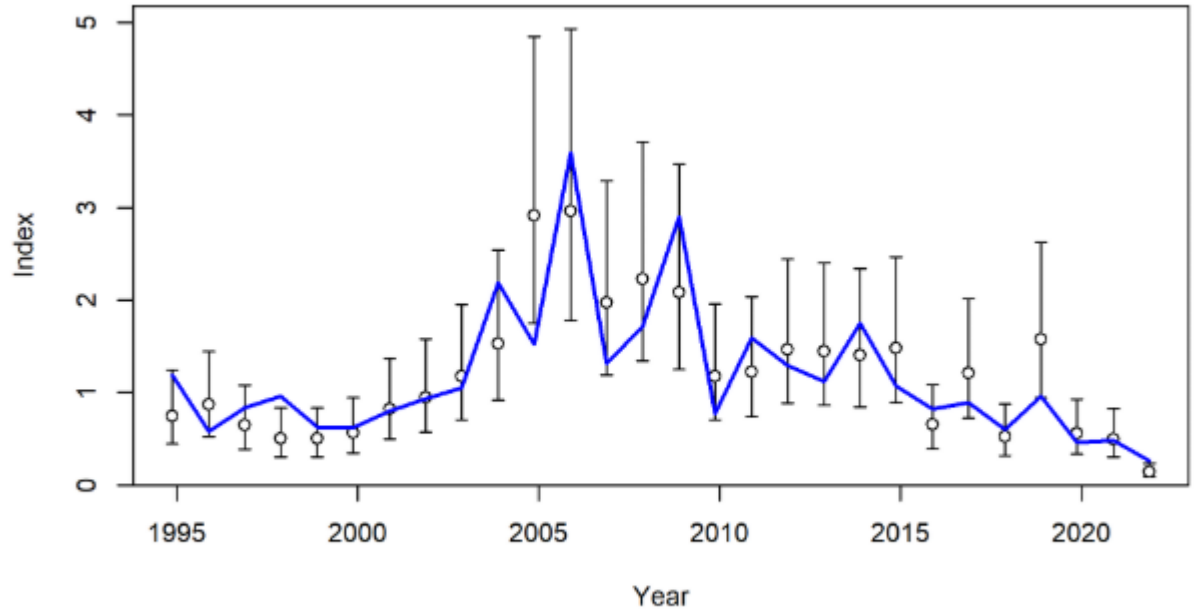
KOR (nonlinear)

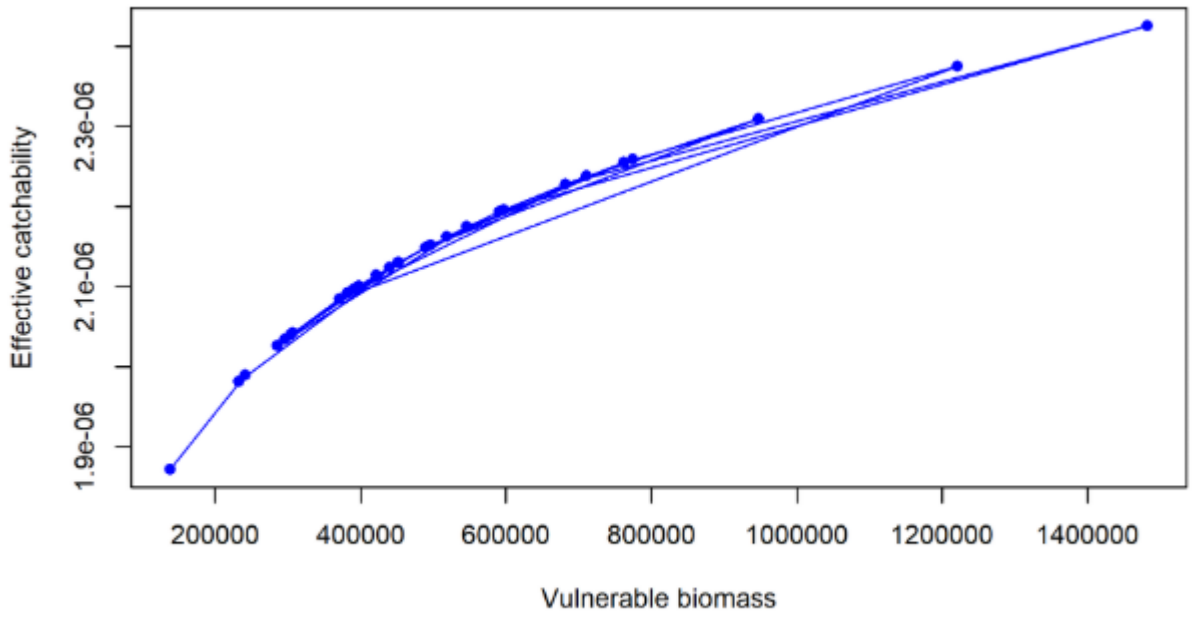


Catchability vs. vulnerable biomass for fleet S4_KOR

Hyperdepletion but magnitude small.

RUS (nonlinear, note last year is 2022)

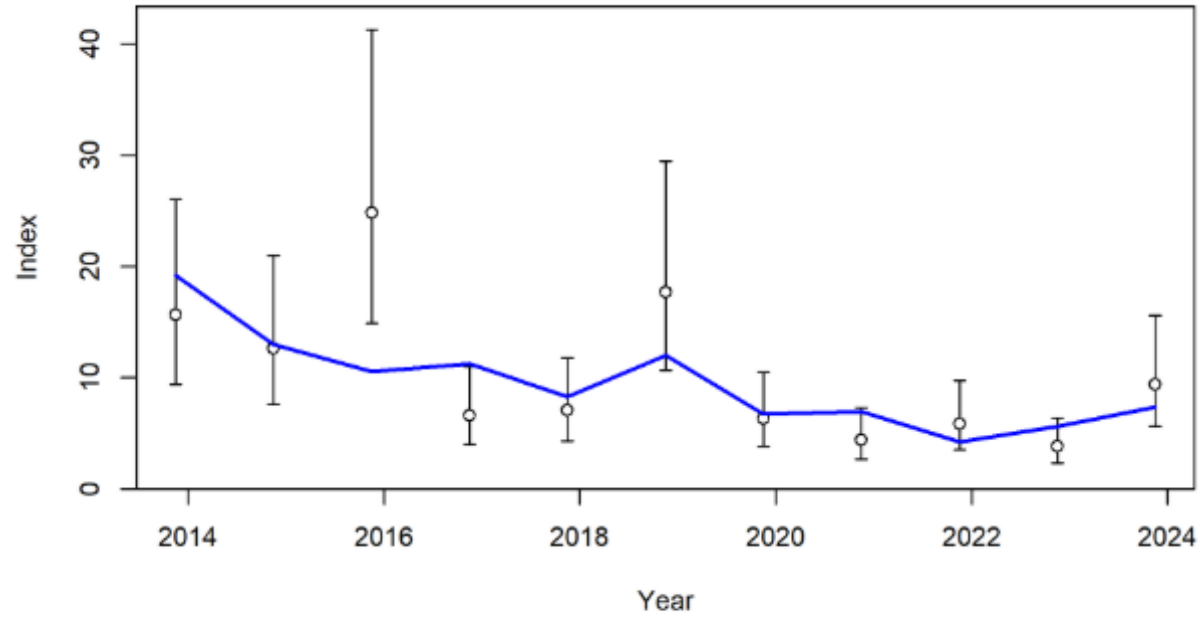




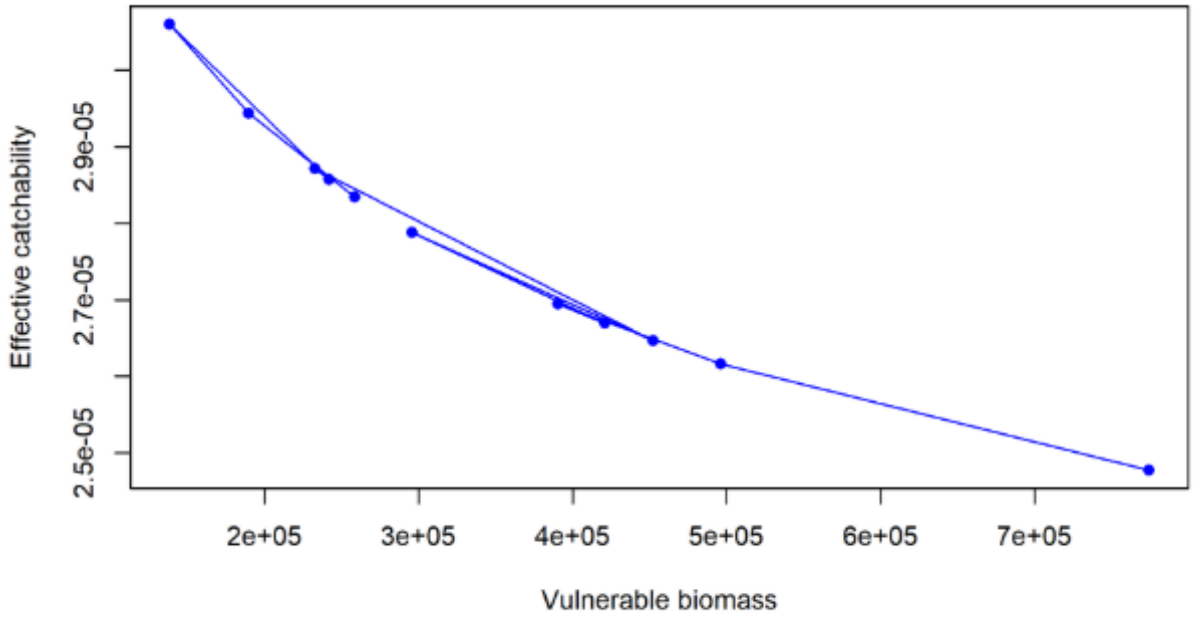
Catchability vs. vulnerable biomass for fleet S5_RUS

Hyperdepletion

China (nonlinear)

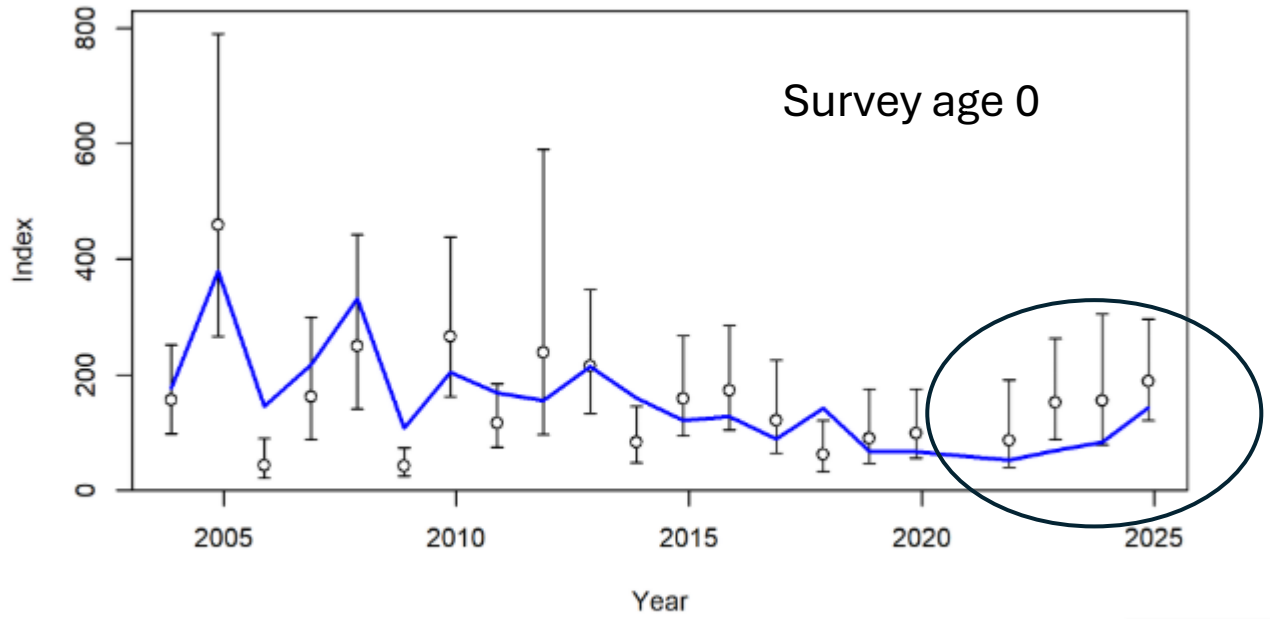


Fit to index data for S6_CHN. Lines indicate 95% uncertainty



Hyperstable

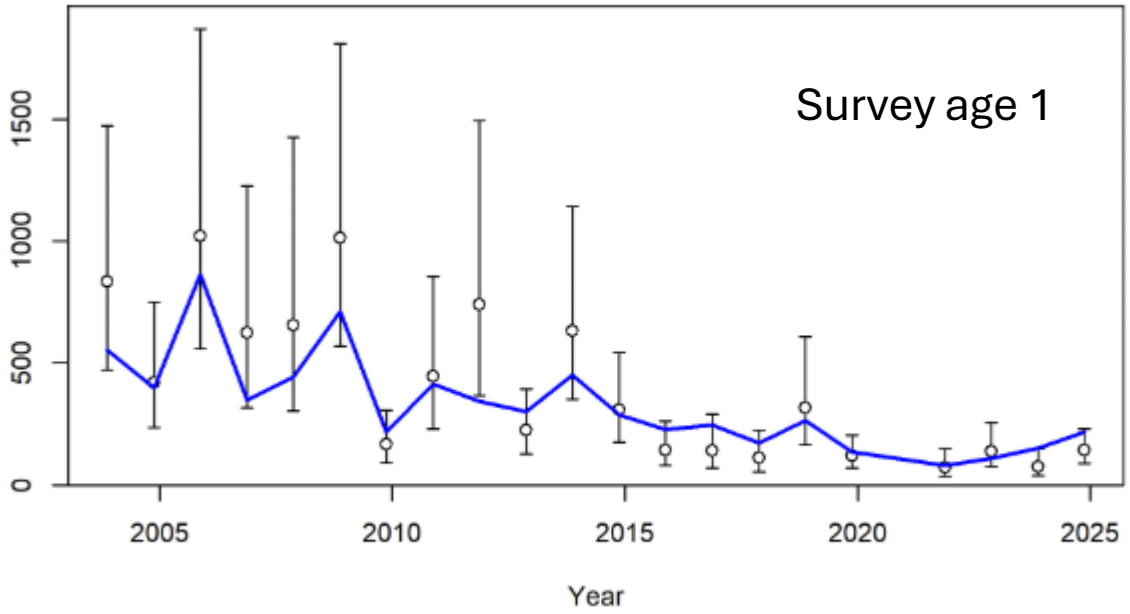
Catchability vs. vulnerable biomass for fleet S6_CHN



Not enough mortality on small fish

Fit to index data for S7 JPN bio Age0. Lines indica

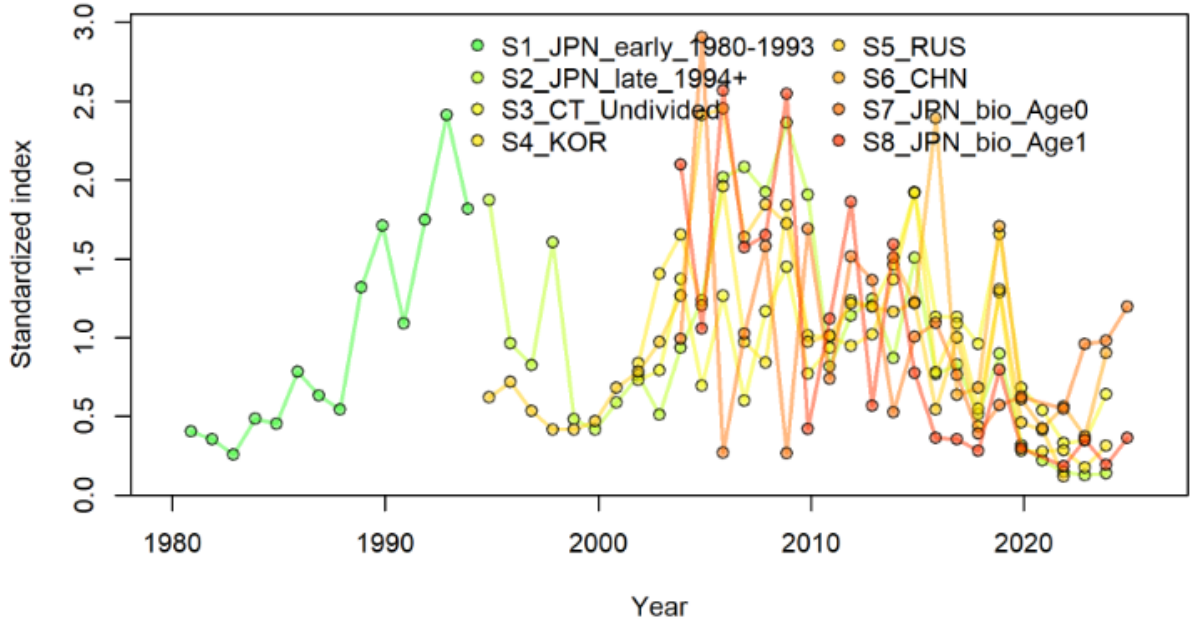
JPN survey (linear)



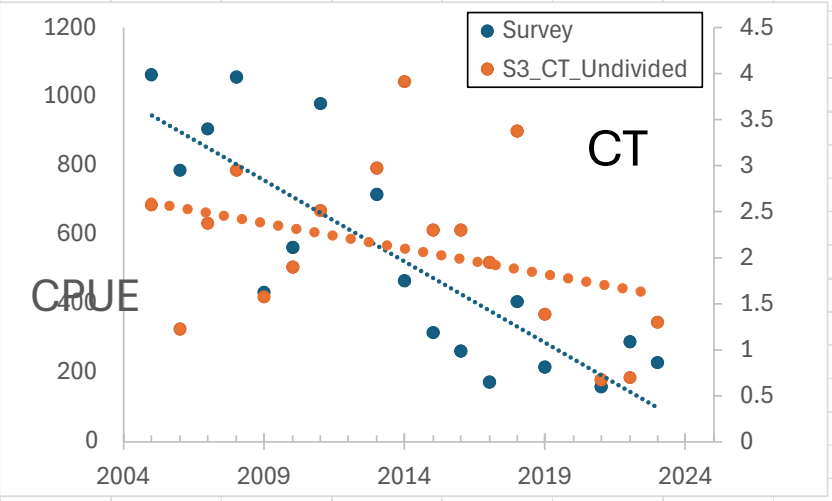
: to index data for S8 JPN bio Age1. Lines indicate 95% unce

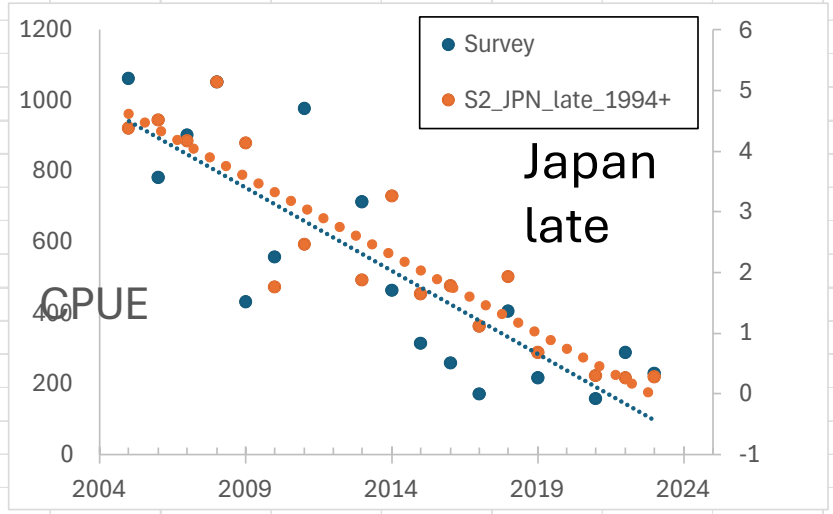
More on surprising hyperstability and hyperdepletion results

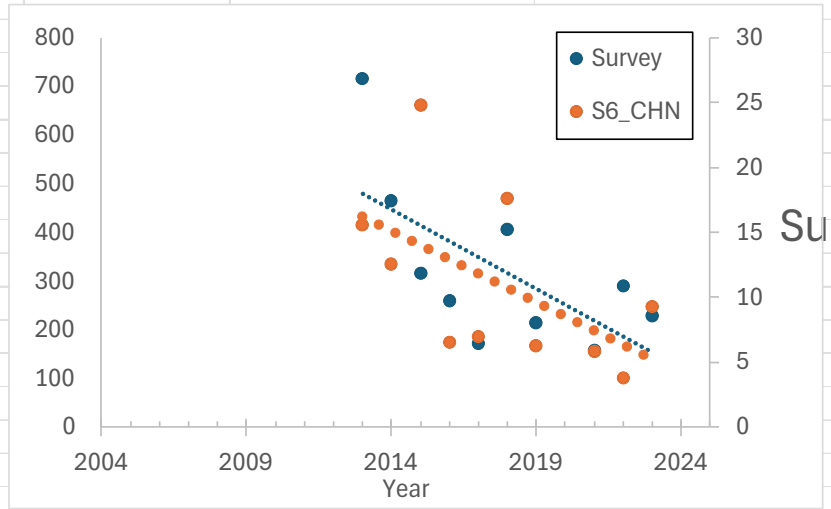
- If a CPUE series shows more (less) decline than survey then hyperdepletion (hyperstability)
- Model results suggest changes in Q for most or all CPUE series
- Compare trends in CPUE and survey since 2005 (omit years with no survey or CPUE data)
  - Should have started in 2004 = first year of survey)

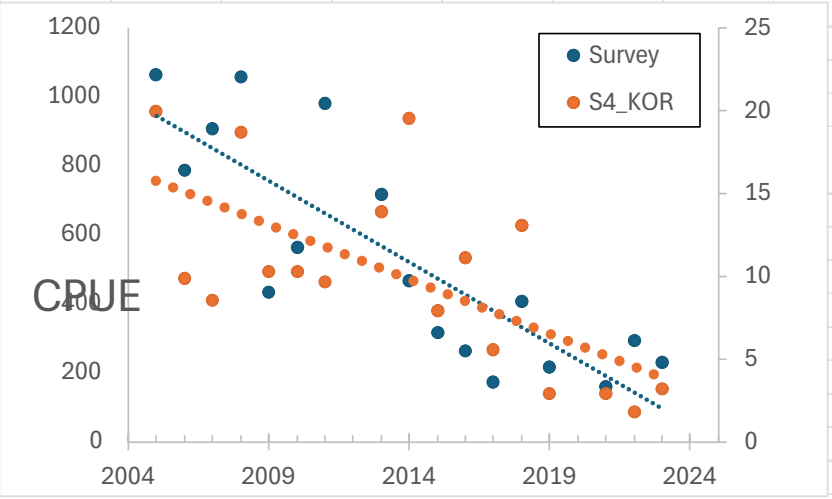


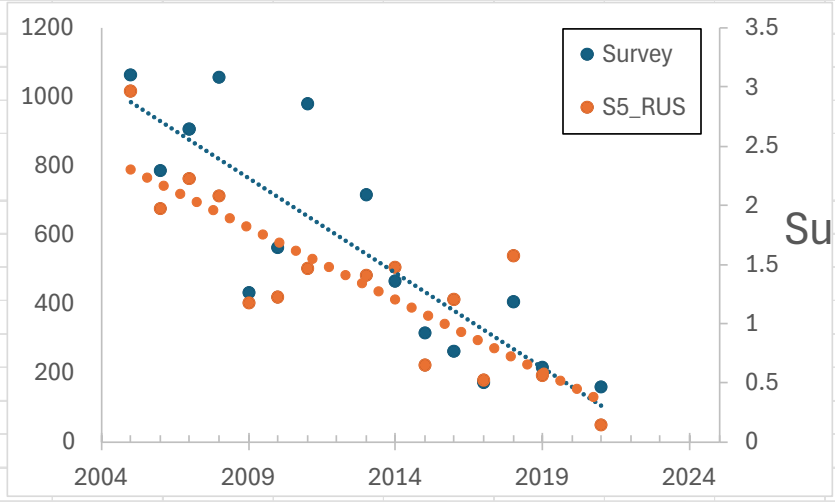
Standardized indices overlaid. Each index is rescaled to have











Fleet	Test result (data 2005-2024)	Model result (data 1994-2925)
S2_JPN_late_1994+	Hyperstable (slight)	Hyperdepletion
S3_CT_Undivided	Hyperstable	Hyperstable (with random walk)
S4_KOR	Hyperstable	Hyperdepletion (slight)
S5_RUS	Hyperstable	Hyperdepletion
S6_CHN	Hyperstable	Hyperstable

Data comparison suggests all CPUE are hyperstable but model sees 2 (or 3) cases of hyperdepletion. Is this a negative diagnostic??

Need to resolve hyper/hypo depletion patterns

- Some tension in model (e.g. poor fit to length comps?)
- Might be better to use fleet-specific random walks or dev pattern on Q
  - With or without the density effect
- Use joint CPUE to simplify

The end for now

Chronology for one cohort of Pacific saury in “reality” and assumed in SS