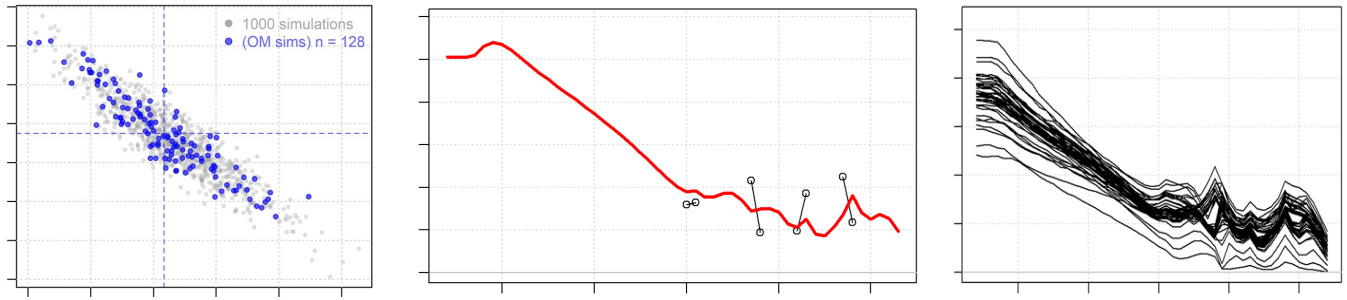
Developing A Framework for Management Decision Making for the Tasmanian Sand Flathead Fishery

Deliverable 1: Straw dog operating models

Tom Carruthers



29th March 2024, Online, Blue Matter - UT

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- Example code
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http://sandflathead.bluematterscience.com

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09 May, 2024

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UNIVERSITY of TASMANIA
IMAS
Institute for Marine and Antarctic Studies

Disclaimer

The following work is preliminary and intended only as tool for eliciting feedback on data, modelling and other aspects of these fisheries.

None of these results are final.

These analyses do not necessarily reflect the point of view of IMAS or other funders and in no way anticipate future policy in this area.

Objective

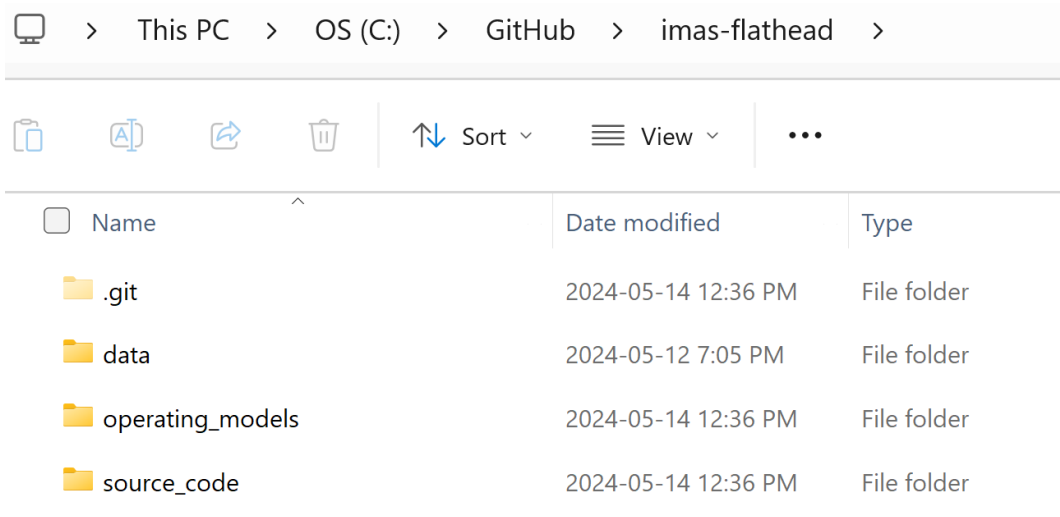
1. Resources: GitHub repository

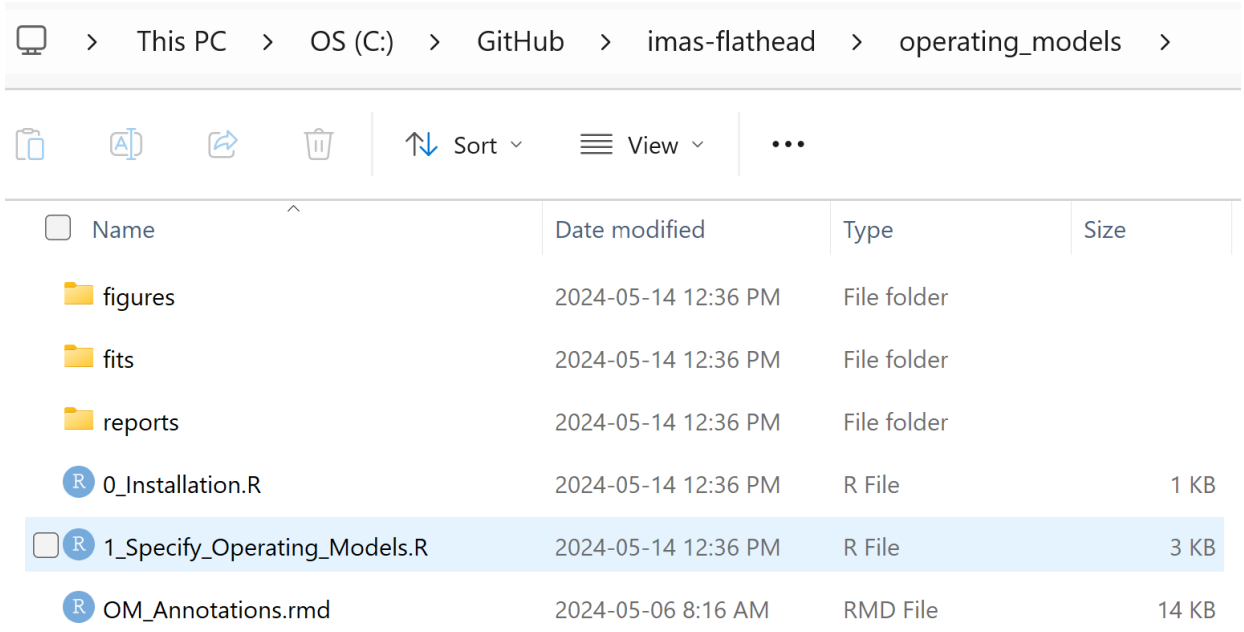
https://github.com/bwwolfe/imas-flathead

/source_code has all the nasty internal functions.

/operating_models has the higher level scripts for installation and OM construction (i.e., the ones you would look at first before delving into the source code).

The first place to go would be the ordered scripts in this directory.





2. Input data: Spatial definitions

Used the lowest common denominator across data-sets (‘Large region’):

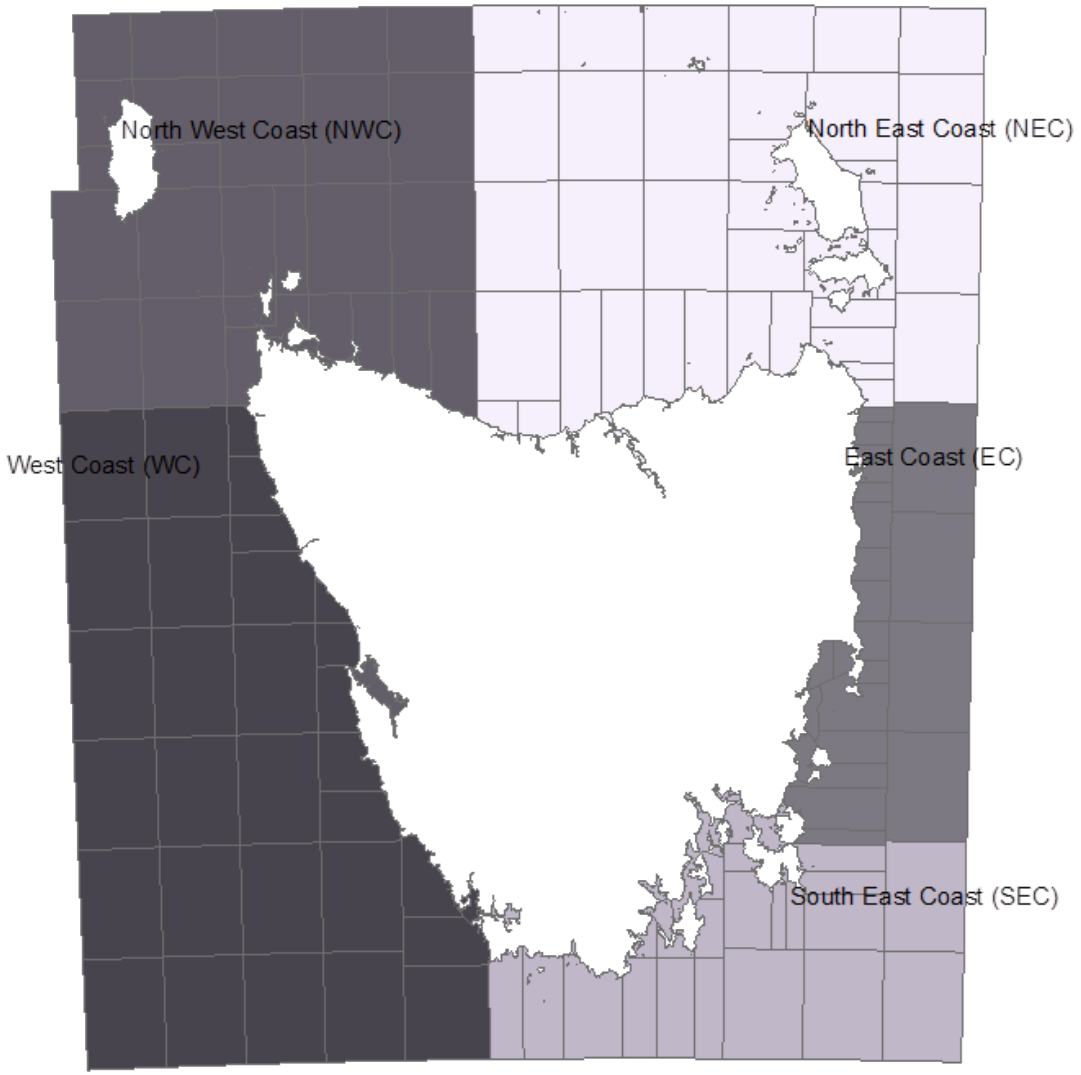
SEC: Derwent Estuary, Tasman, Frederick Henry/Norfolk Bay, South-eastern coast, D’entrecasteaux Channel, South, Northwest Bay, SECest, SEC

EC: Great Oyster Bay, Central-eastern coast, Eastern coast, Coles Bay, Georges Bay, EC

NWC: North-western coast, King Island, rocky cape, NWC

NEC: Tamar River, North-eastern coast, Flinders Island, Spring Bay, Flinders/Eastcoast, NC, EC, Deal island, Hogan group, NEC, FI

WC: Central-western coast, Western coast, South-western coast, unknown EAT, ECS, ET, SET, CBS, no sample



2. Input data

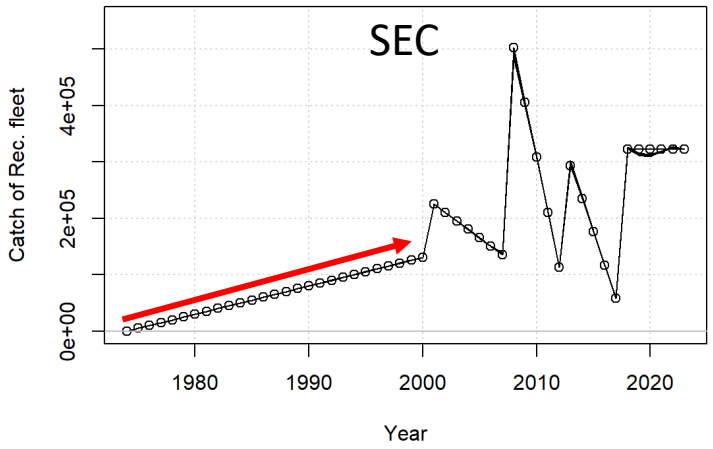
- Recreational catch (patchy)
- Recreational effort (patchy)

Model needs either complete (all years) catch or complete effort time series (can assume mean ‘spool-up’ catch)

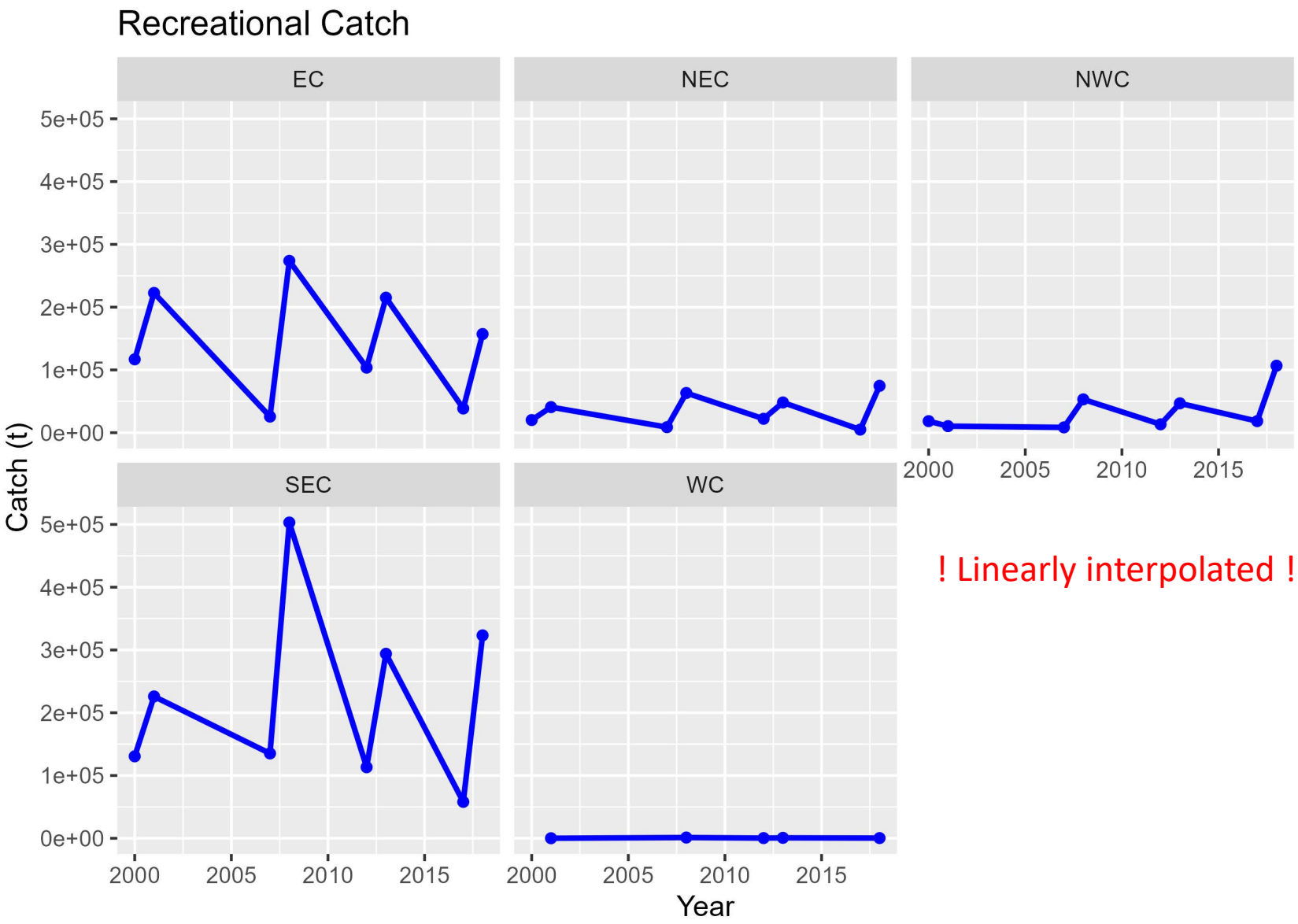
- Standardized recreational CPUE index
- Historical survey age / length composition
- Recreational survey age / length composition
- Commercial catch (not WC)
- Commercial effort (not WC)
- Nominal commercial CPUE

2. Input data: Recreational catch

! Linearly ramped to first observation !



- Annual data available?
- Start date for OM spool up – or mean catch prior to 2001?



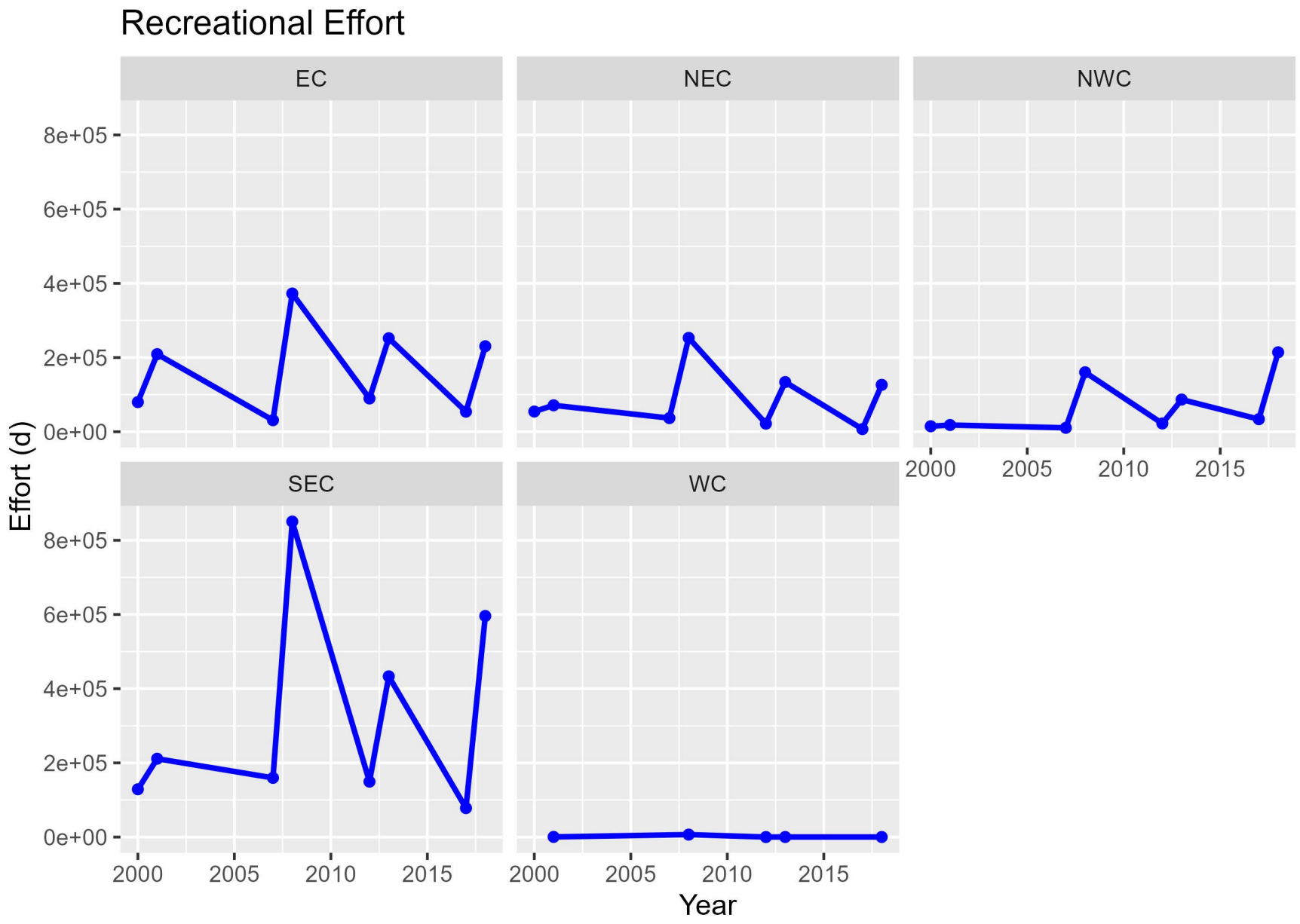
! Linearly interpolated !

2. Input data: Recreational effort

Not currently used - the standardized CPUE is used instead.

! Linearly interpolated !

Conditional on effort approach??

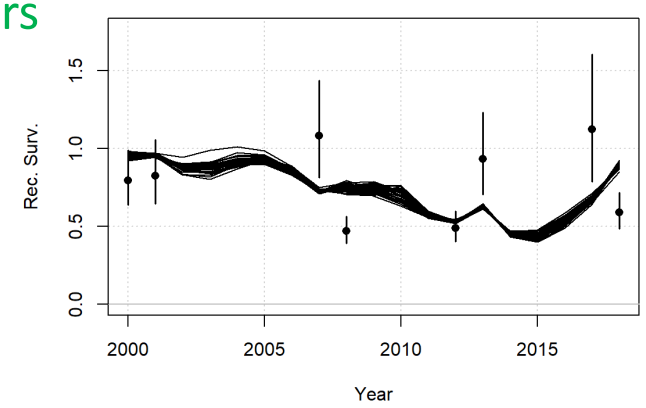


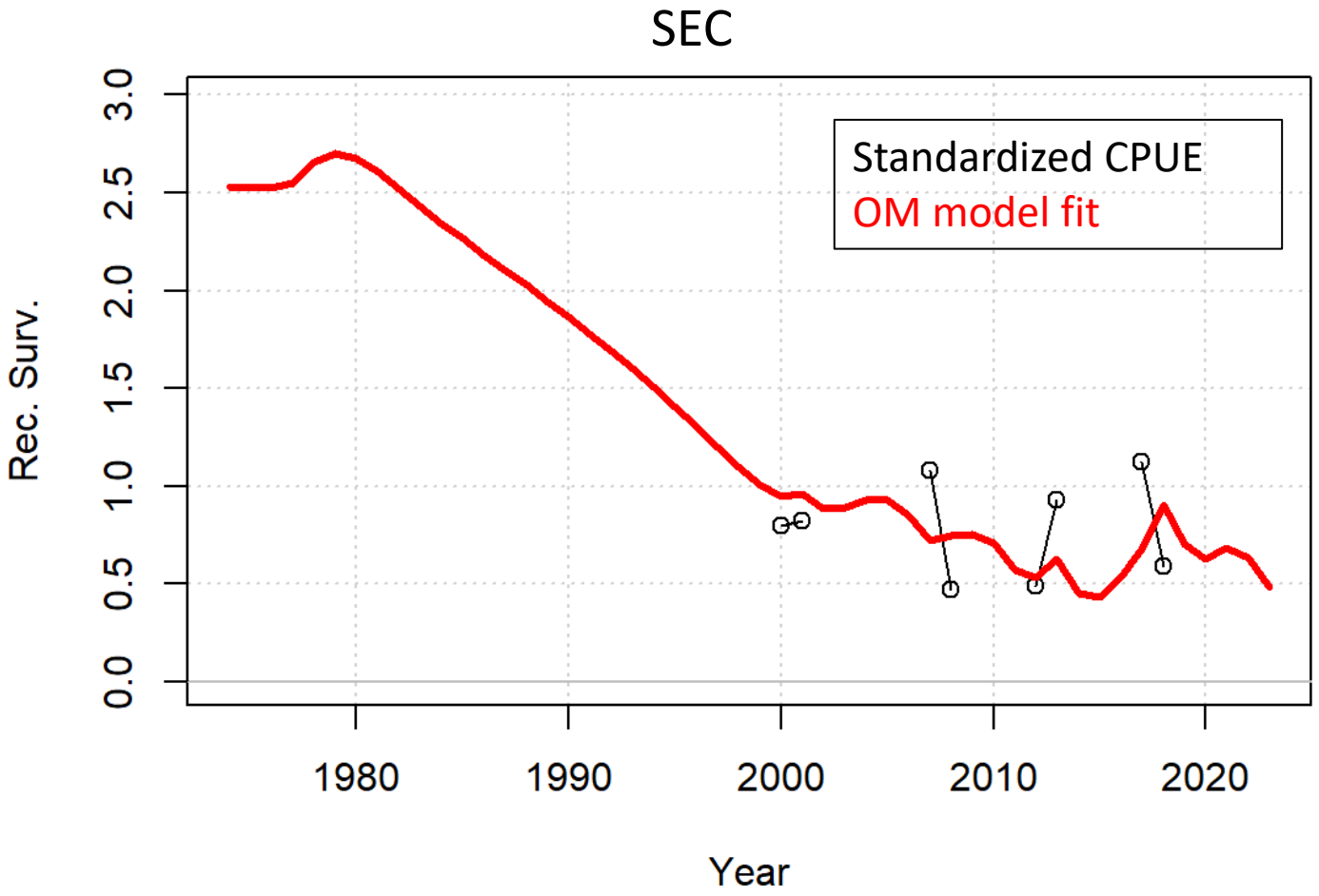
2. Input data: Standardized CPUE indices

log(CPUE) ~ Yr + Quarter + Region + WaterBody + Type

'Region' is something like Tasman, Derwent Estuary etc.

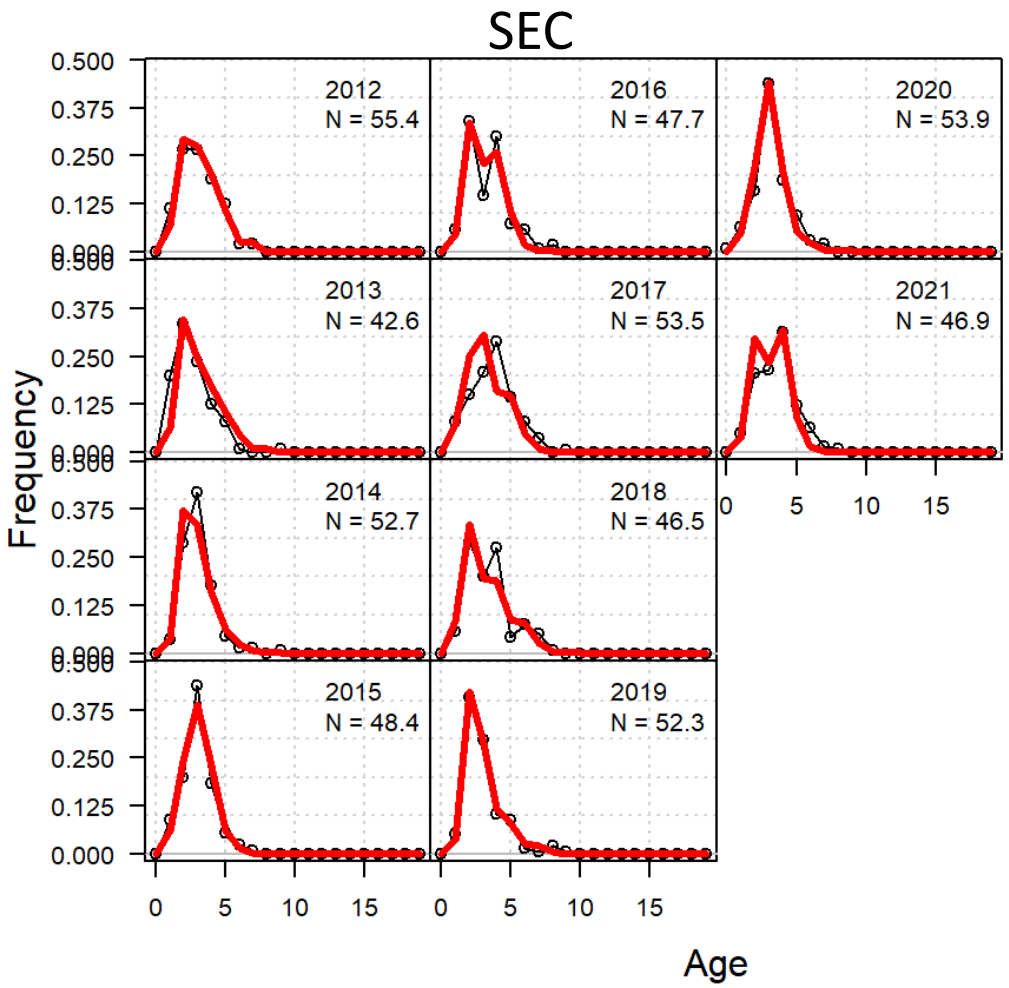
Note that most of these indices still include apparent discontinuity in adjacent 'observations' both nominal and standardized. The model can't get through these even with substantial error bars

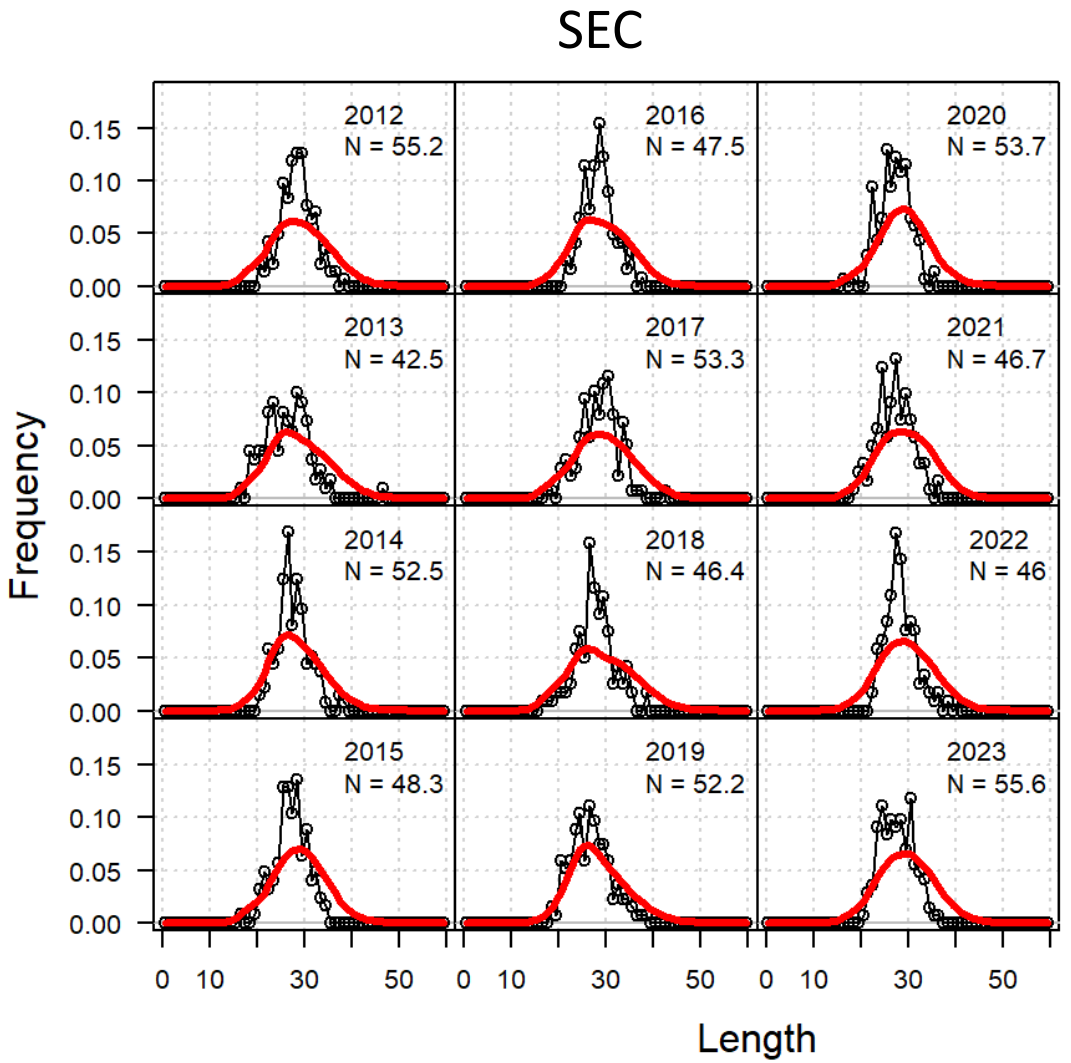




2. Input data: Recreational Survey (length and age)

Observed data
OM model fit





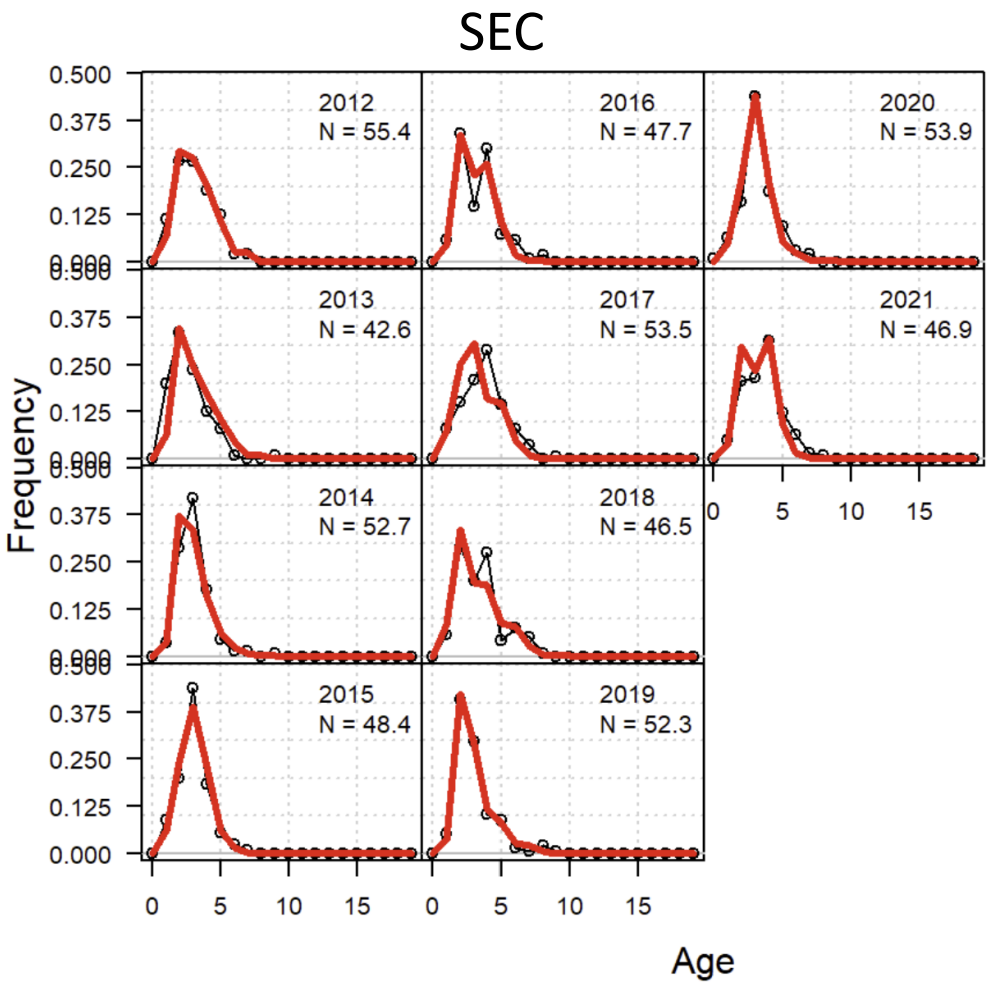
Is this indicative of recreational fishery selectivity?

rec_survey_data_20231215.xlsx

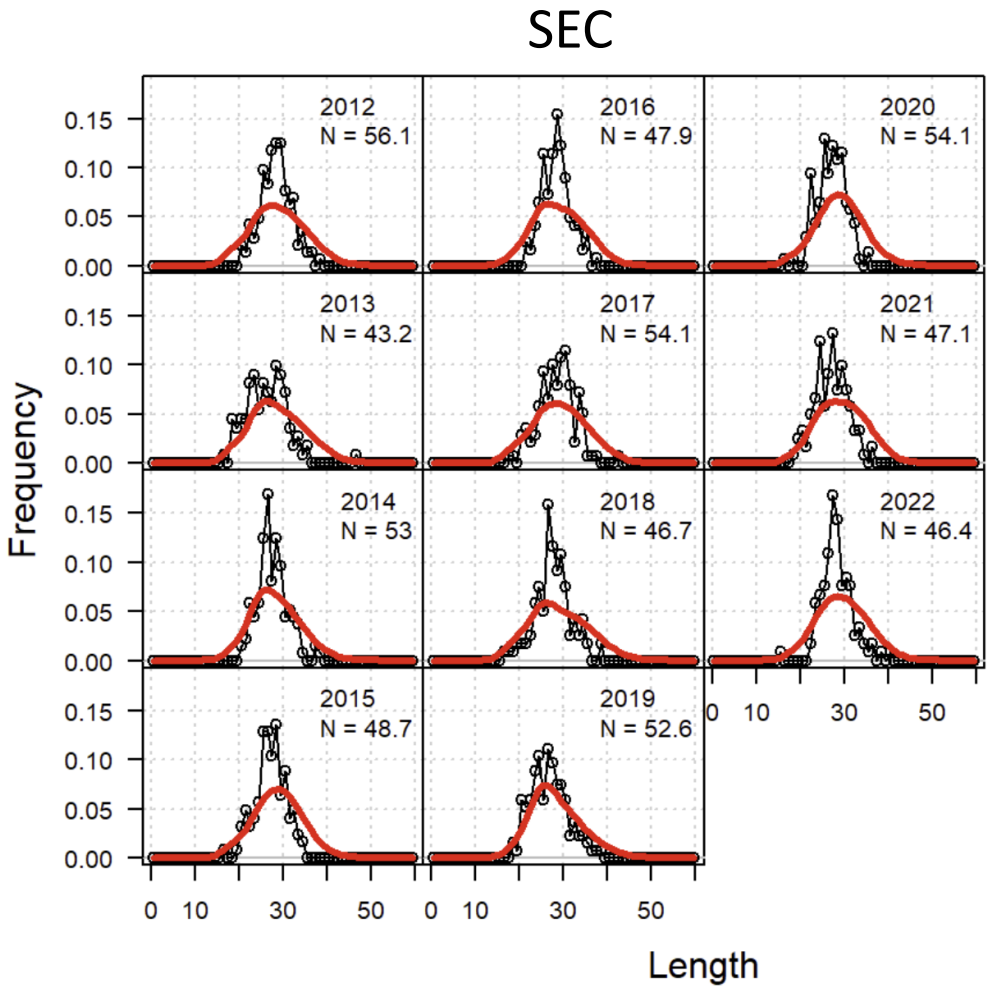
2. Input data: Historical Survey (length and age)

Observed data
OM model fit

Is this indicative of recreational fishery selectivity?



Observed (black) and predicted (red) age composition from Hist. Surv..

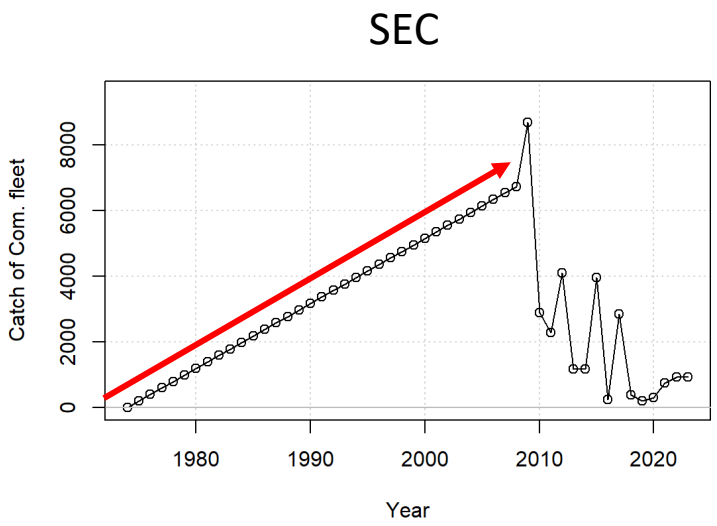


Observed (black) and predicted (red) length composition from Hist. Surv..

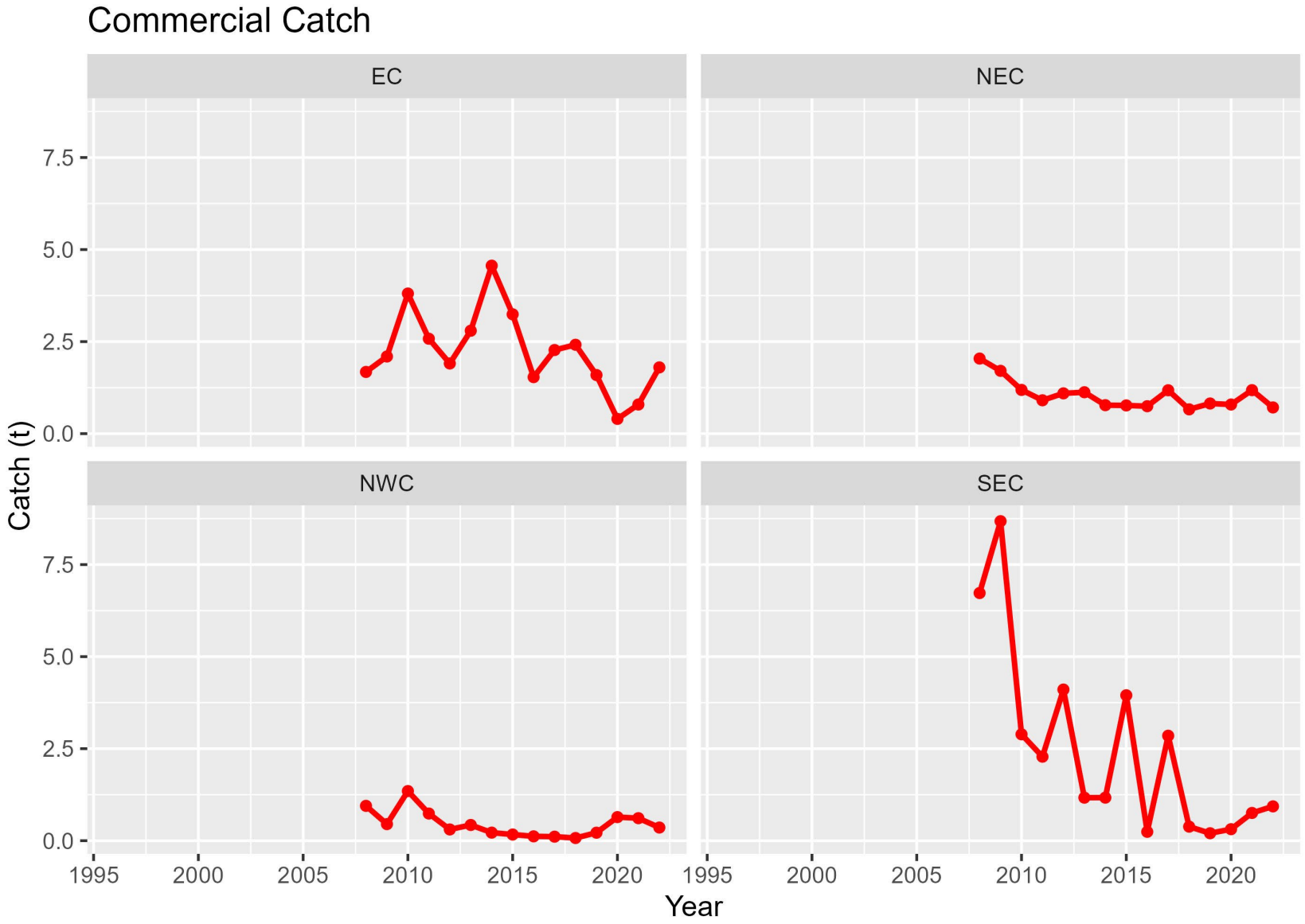
historical_data.xlsx

2. Input data: Commercial catch

! Linearly ramped to first observation !



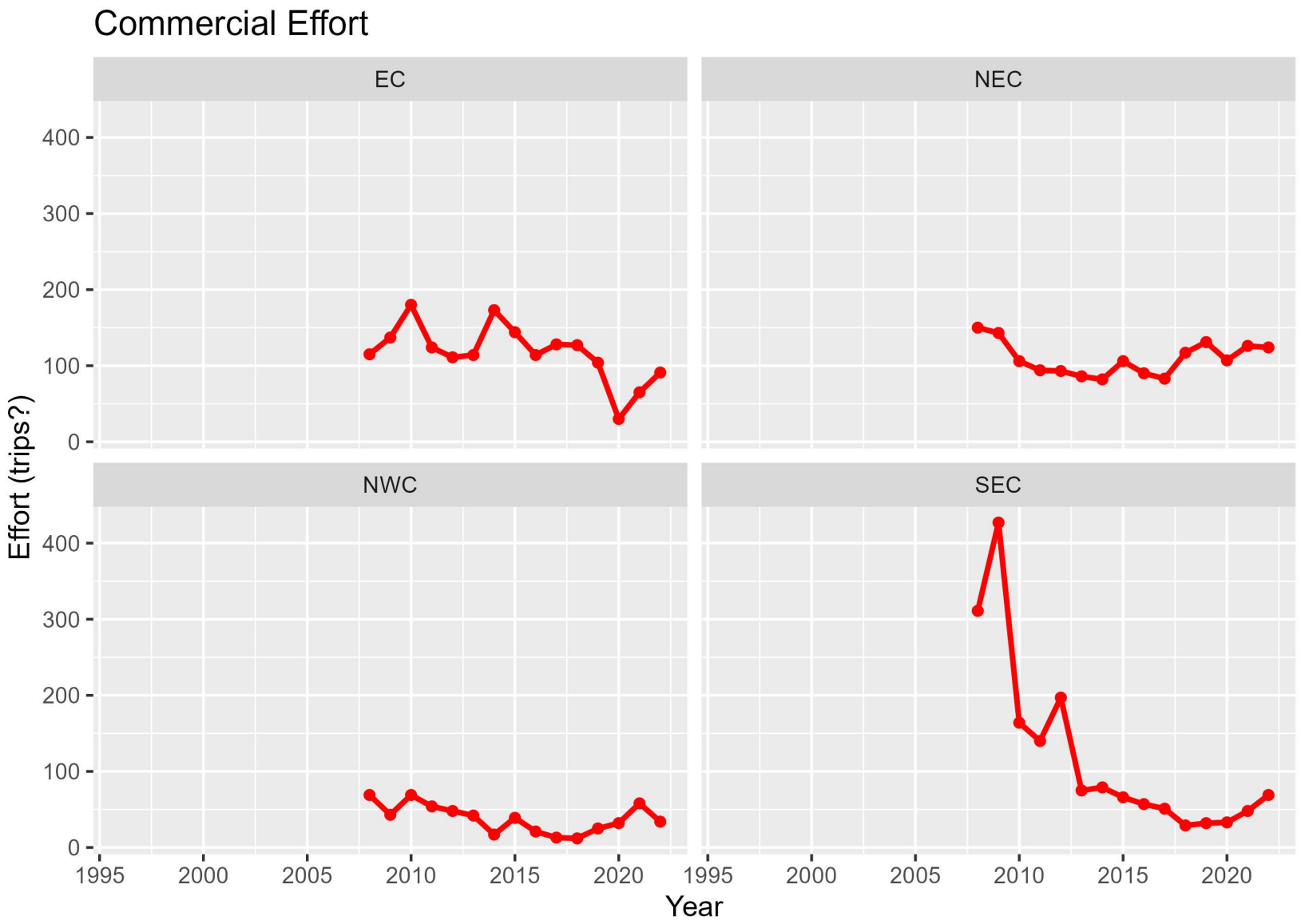
- Start date for OM spool up – or mean catch prior to 2008?



southern_sand_flathead_catch_tonnes_by_region_BMS.csv

2. Input data: Commercial effort

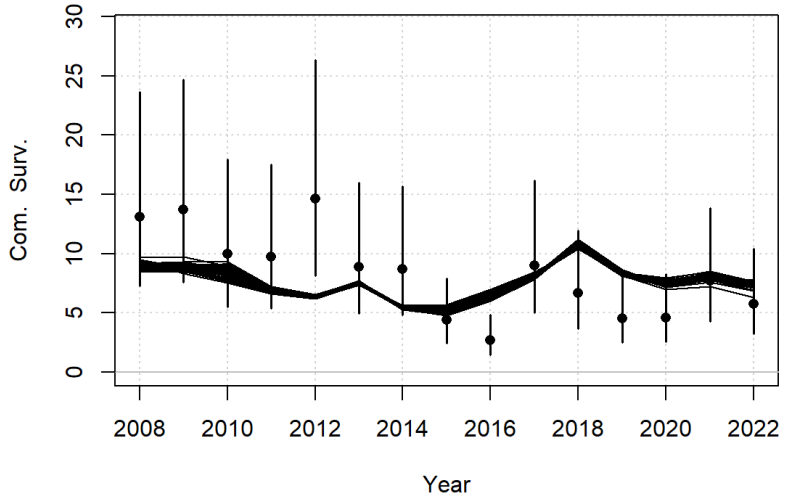
Not currently used – nominal CPUE index used instead.

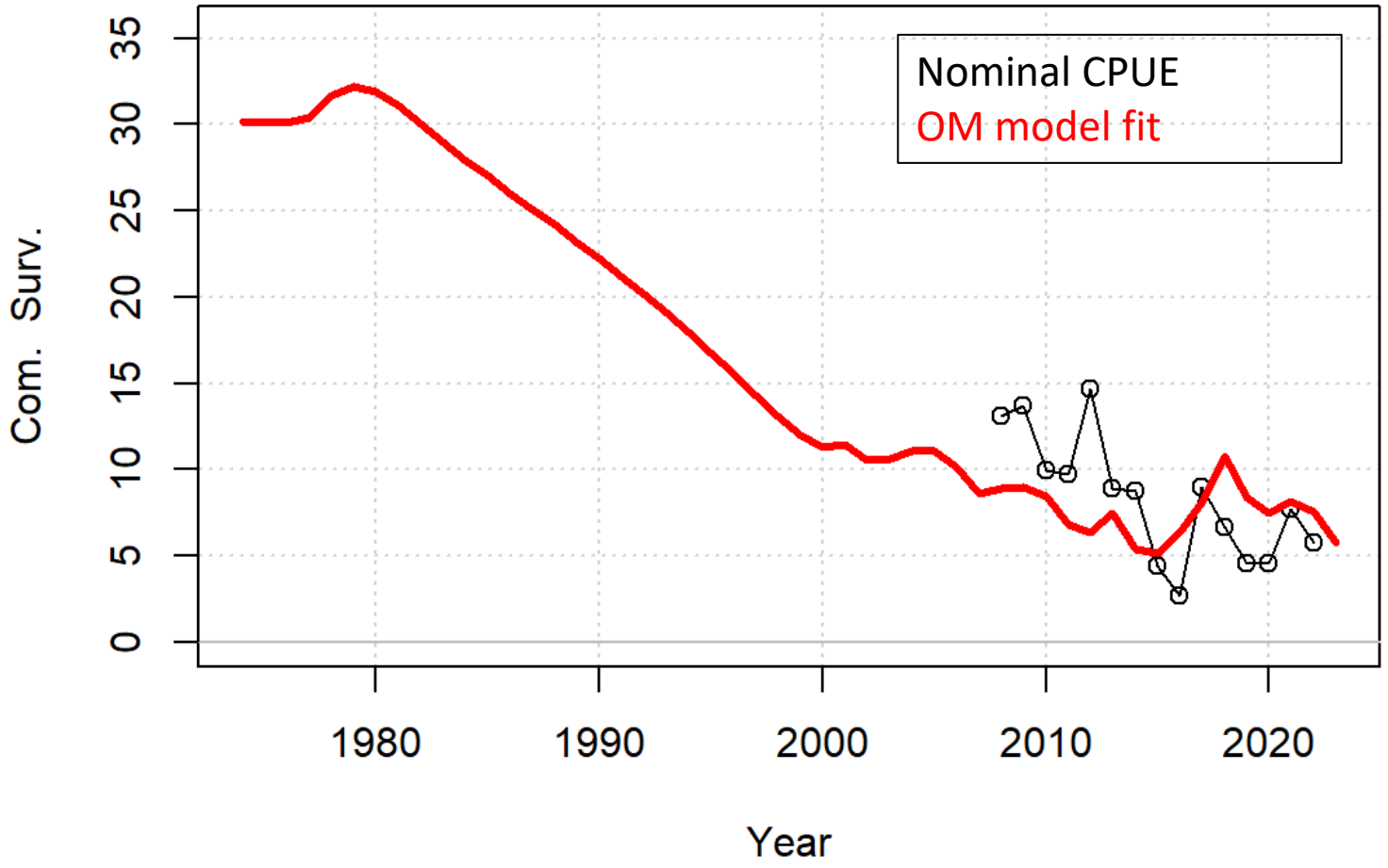


southern_sand_flathead_vessel_days_by_region_BMS.csv

2. Input data: Commercial nominal CPUE

Vague – high observation error assumed (40% CV)





southern_sand_flathead_cpue_kgperday_by_region_BMS.csv

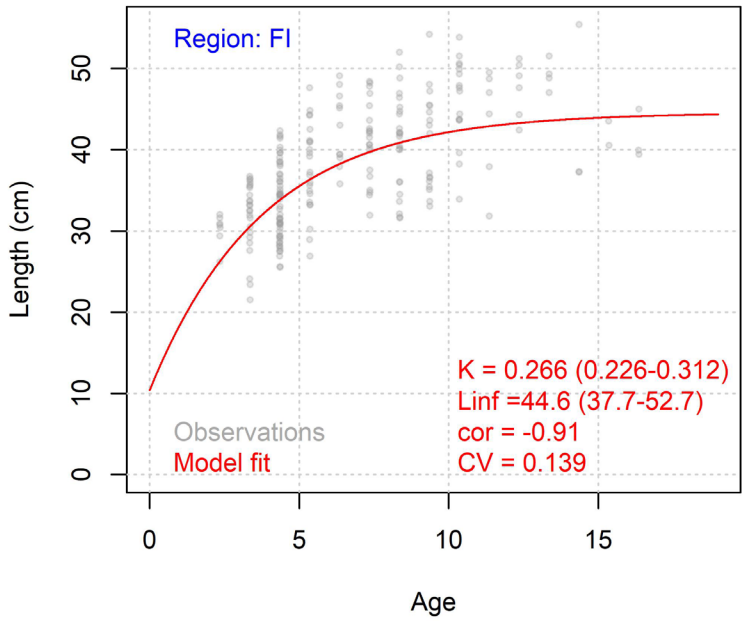
3. Model input parameters: Somatic growth

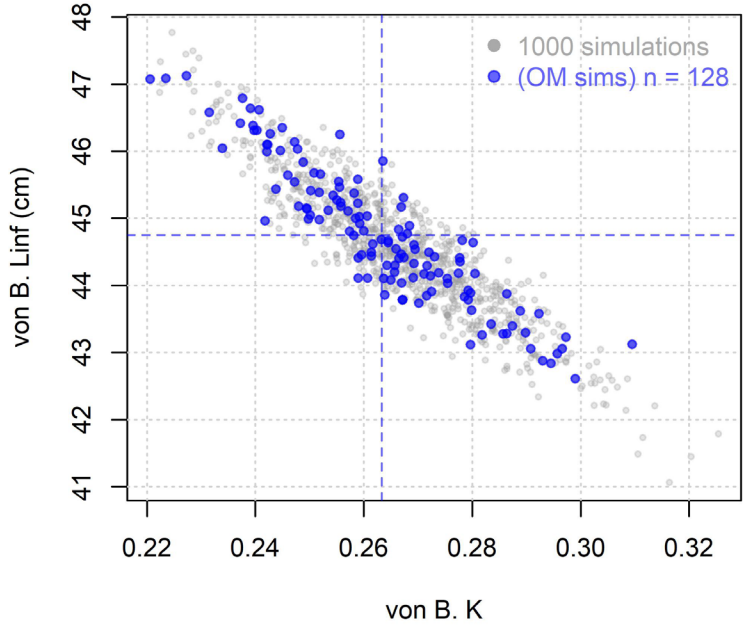
Used Flinders Island data as the ‘unfished’ level for K, Linf parameters.

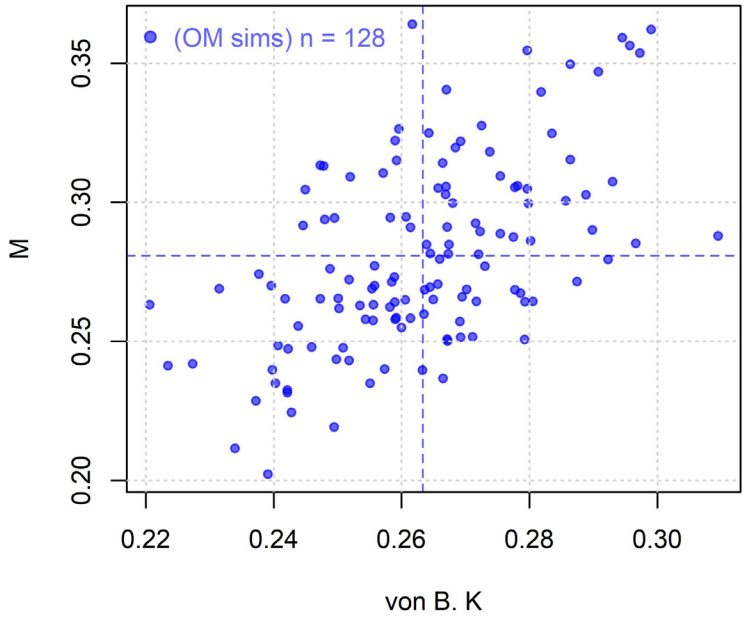
Maintained correlation in estimates, used FishLife meta analysis to preserve correlation in sampled natural mortality rate and length at 50% fraction mature.

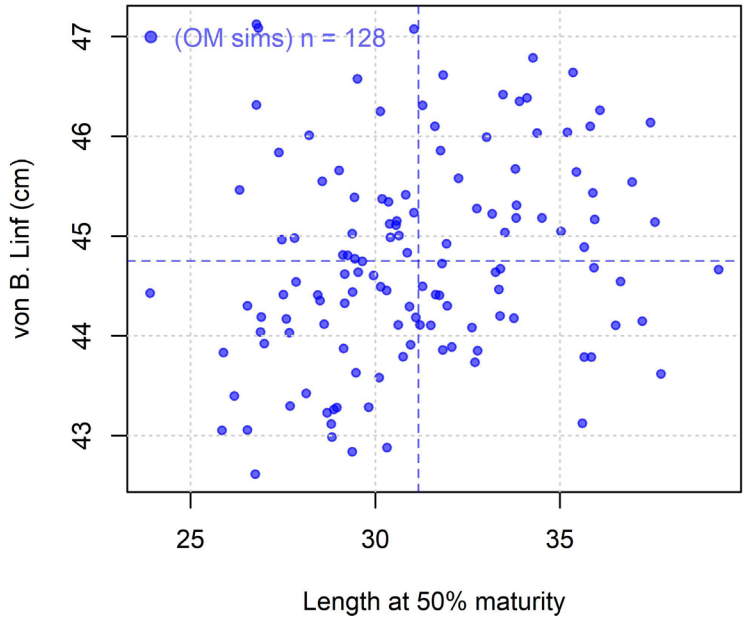
Should we be using Flinders’ data for this in all regions?

Estimated asymptotic length (Linf) lower than that used in other analyses.



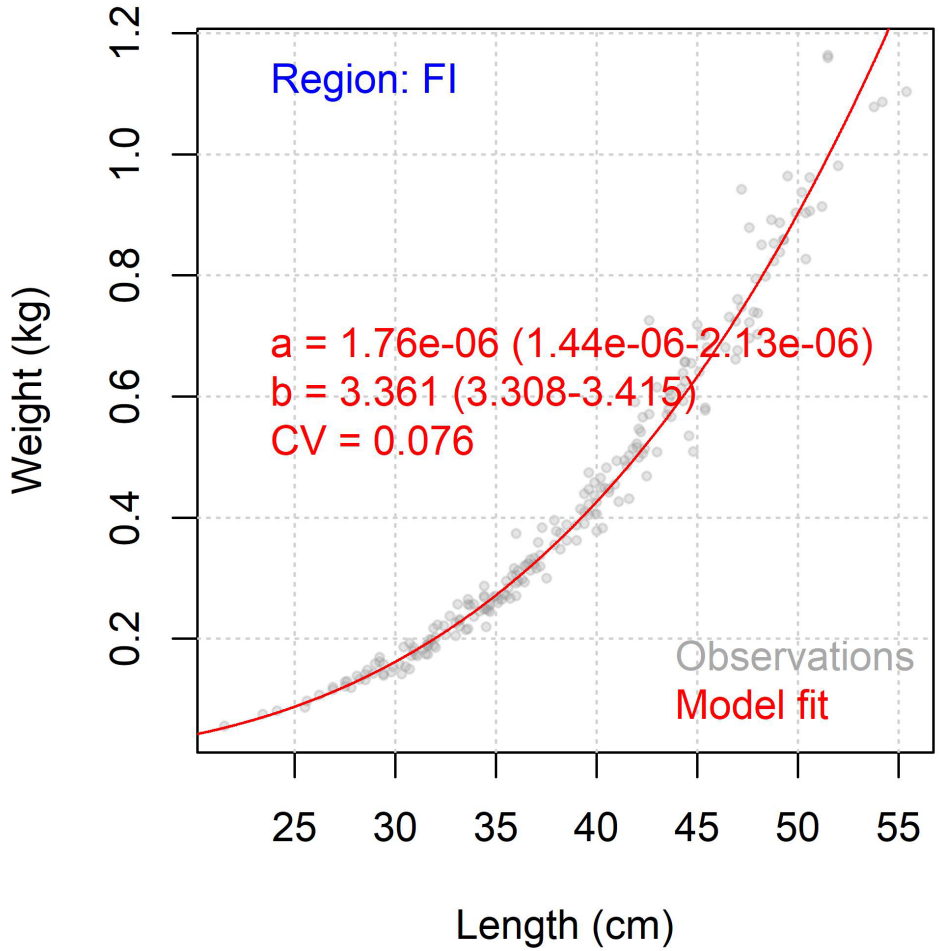


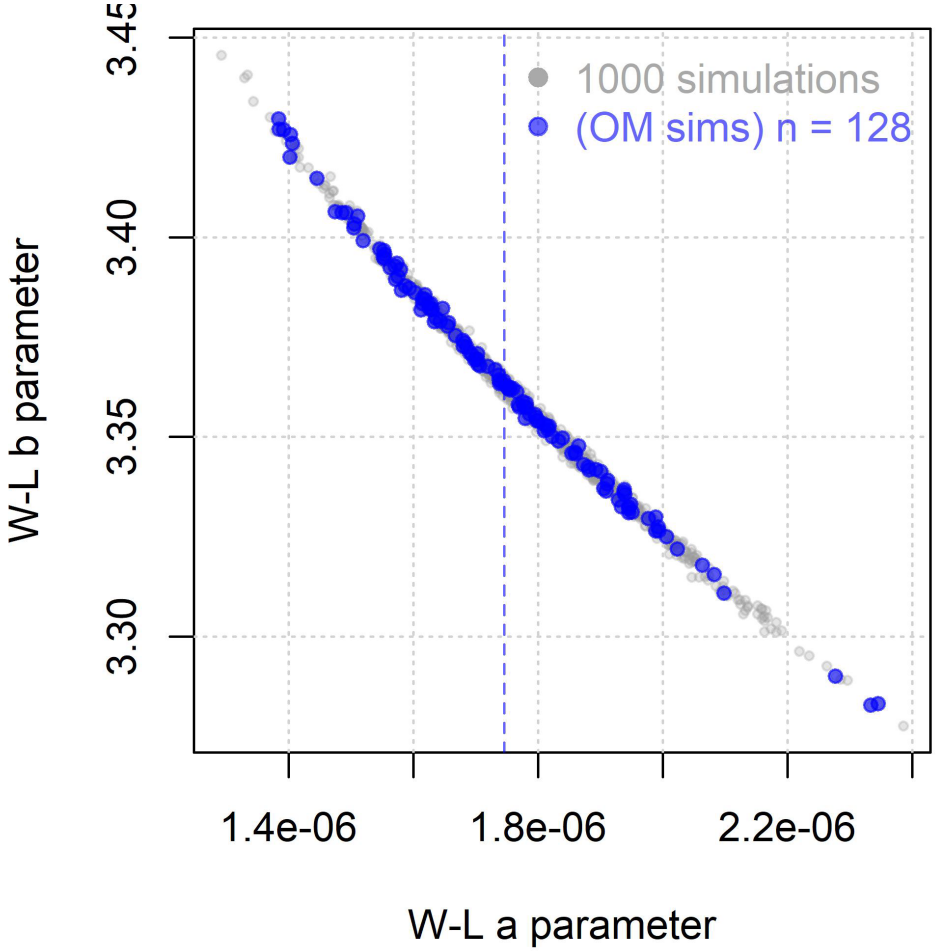




sfh_fishery_independent_data.xlsx

3. Model input parameters: weight at length





Used Flinder's data – is that correct?

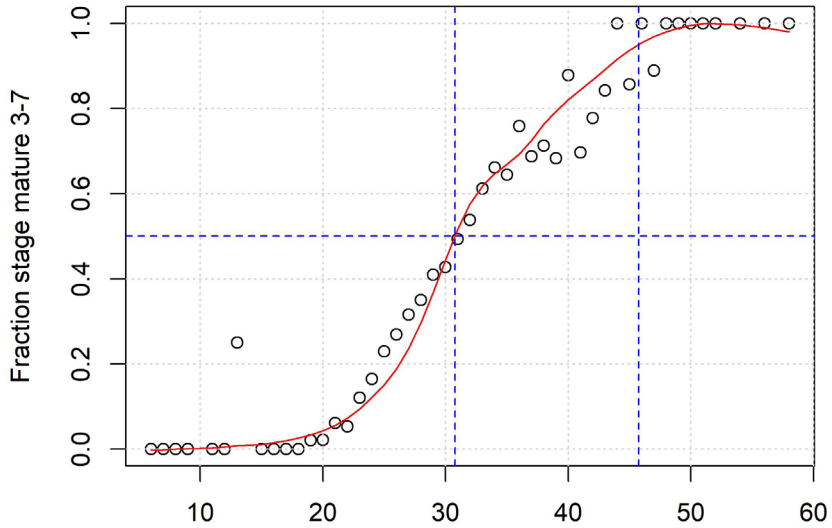
sfh_fishery_independent_data.xlsx

3. Model input parameters: maturity

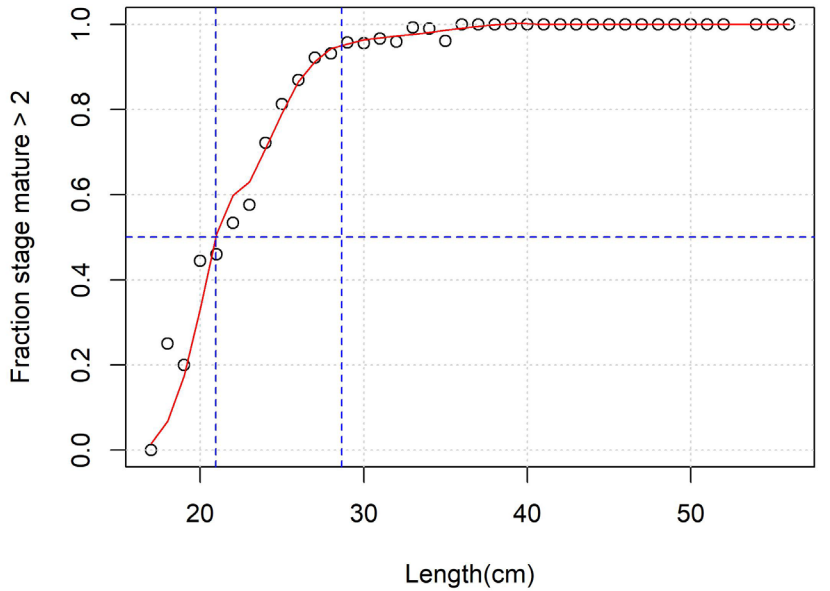
Rather different maturity ogives depending on data source!

What maturity data / ogive to use?

historical_data.xlsx



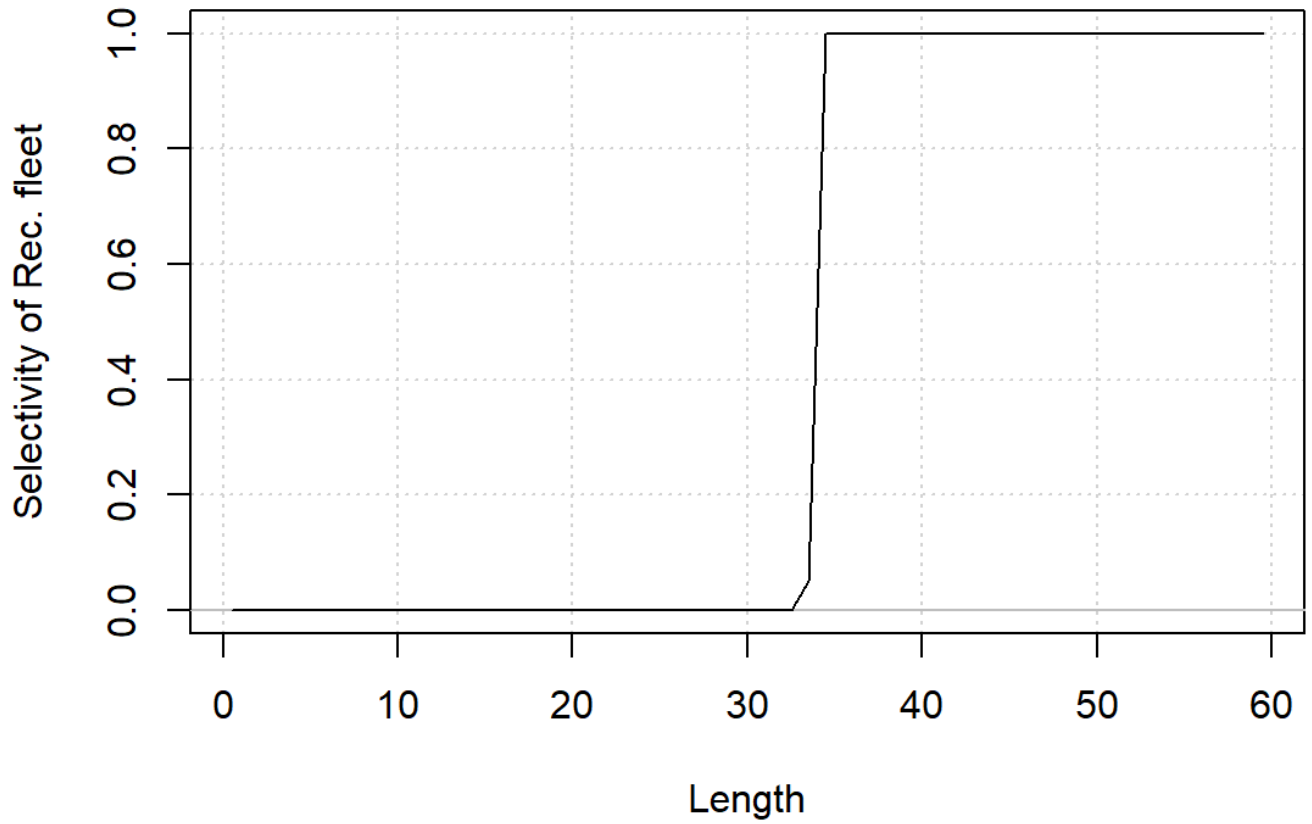
sfh_fishery_independent_data.xlsx



3. Model input parameters: recreational / commercial selectivity

Currently knife edge at ~34cm

Should this mirror the selectivity estimated for the historical or recreational survey?



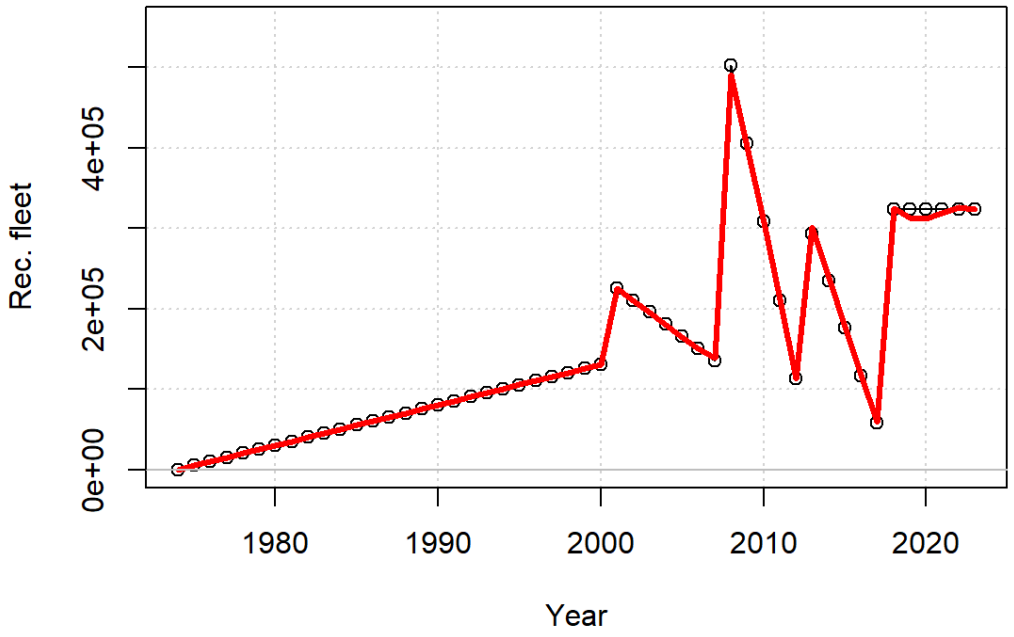
4. Assumptions

- Interpolation / ramping of catches (models conditioned on catch)
- Rec survey / hist survey not connected to rec selectivity
- Rec selectivity eyeballed currently and assumed asymptotic (flat topped)
- FI life-history parameters are appropriate for other regions
- M is 0.28 with CV of 0.15
- No background rate of discarding
- Models arbitrarily started in 1974
- No uncertainty in catches which are calculated from point values of expansion factors
- Discard mortality rate is 9% (Lyle et al 2006)
- Year vs season – calendar year is later half (Season 2022/23 is assigned year 2023)
- Commercial selectivity / retention at age / length is same as rec fleet
- Composition data assumed to have mean effective sample size of 50 per year.

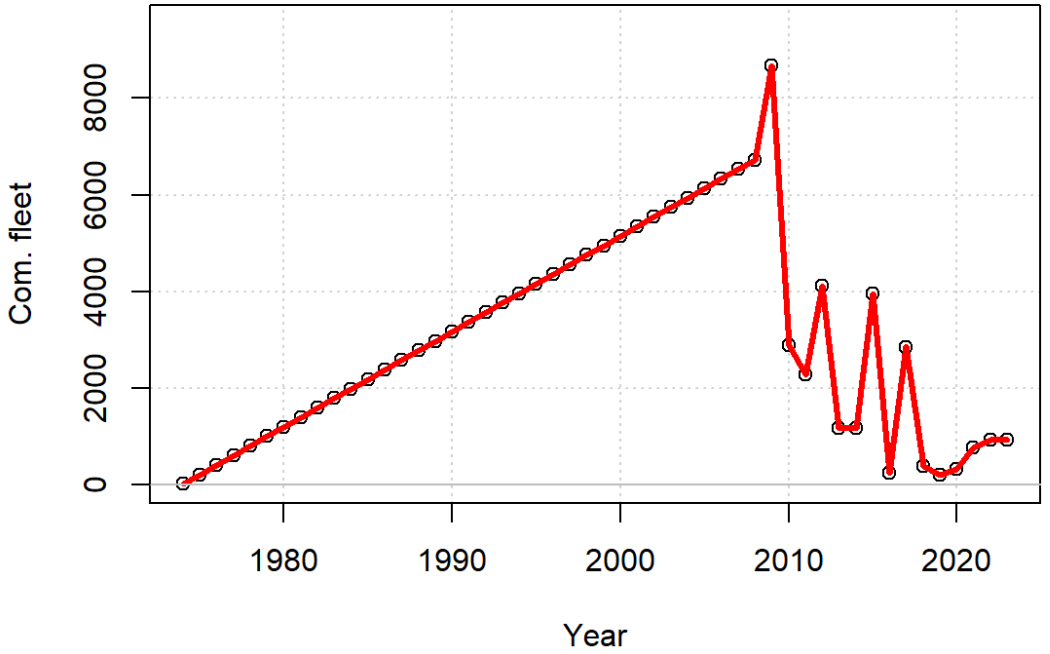
5. Model fit (SEC): Catches

Observations
OM model fit

Recreational



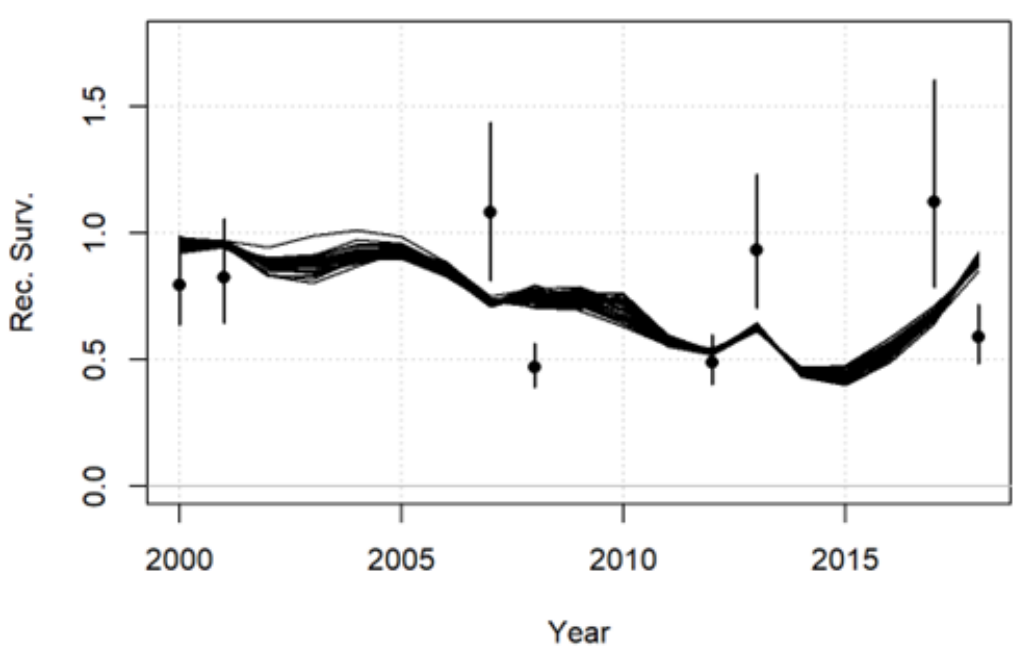
Commercial



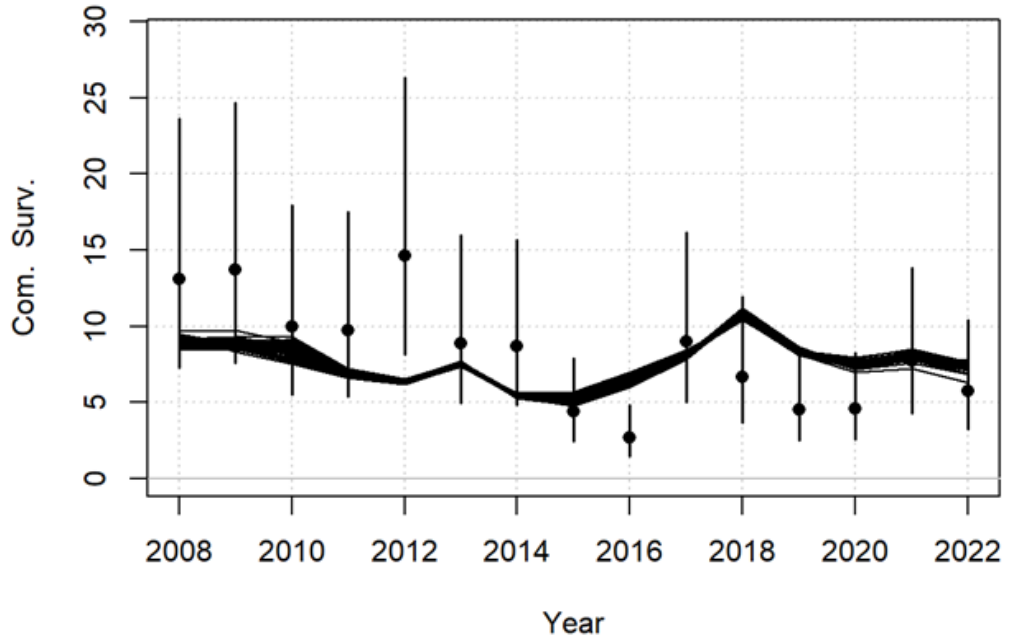
- How can historical catches be reconstructed?
- How can recent catches be interpolated?
- Can uncertainty in historical catches be estimated?
- Model conditional on effort?

5. Model fit (SEC): Indices

Recreational standardized CPUE



Commercial nominal CPUE

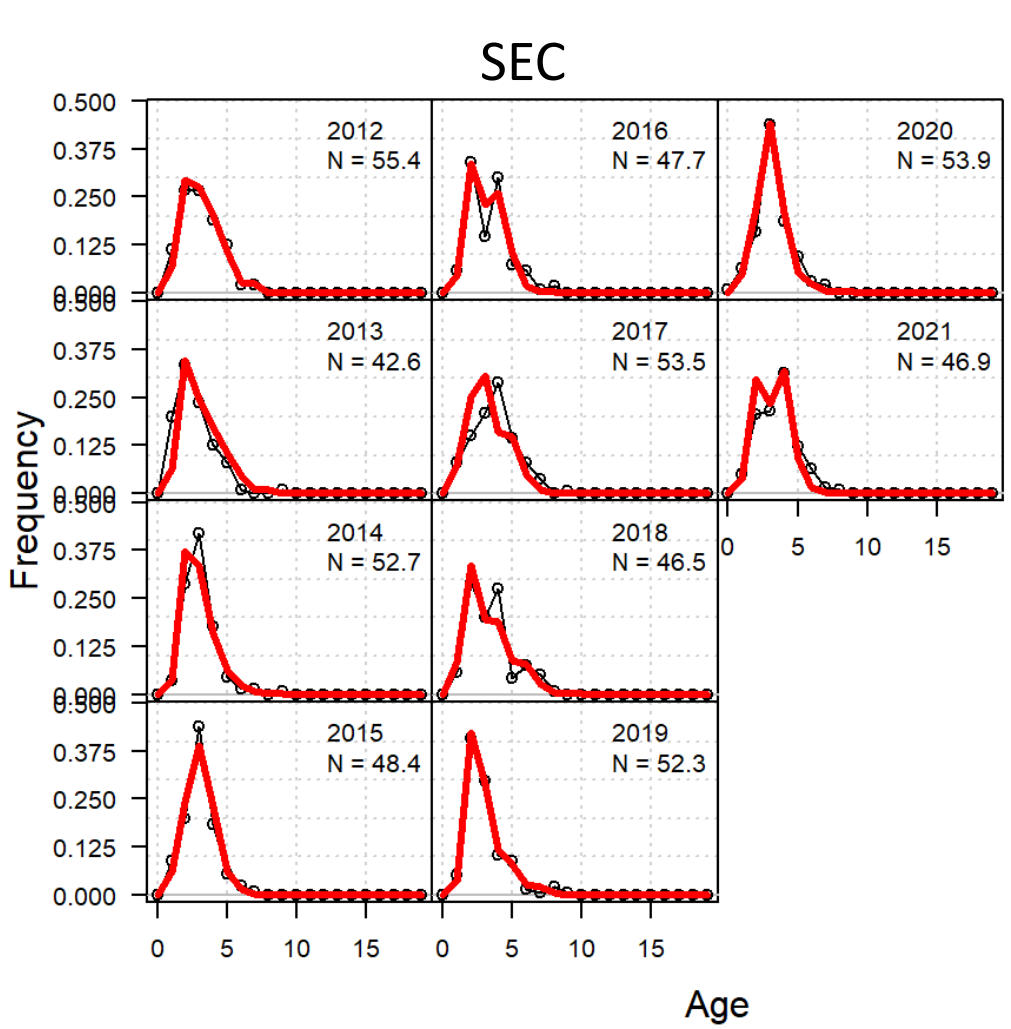


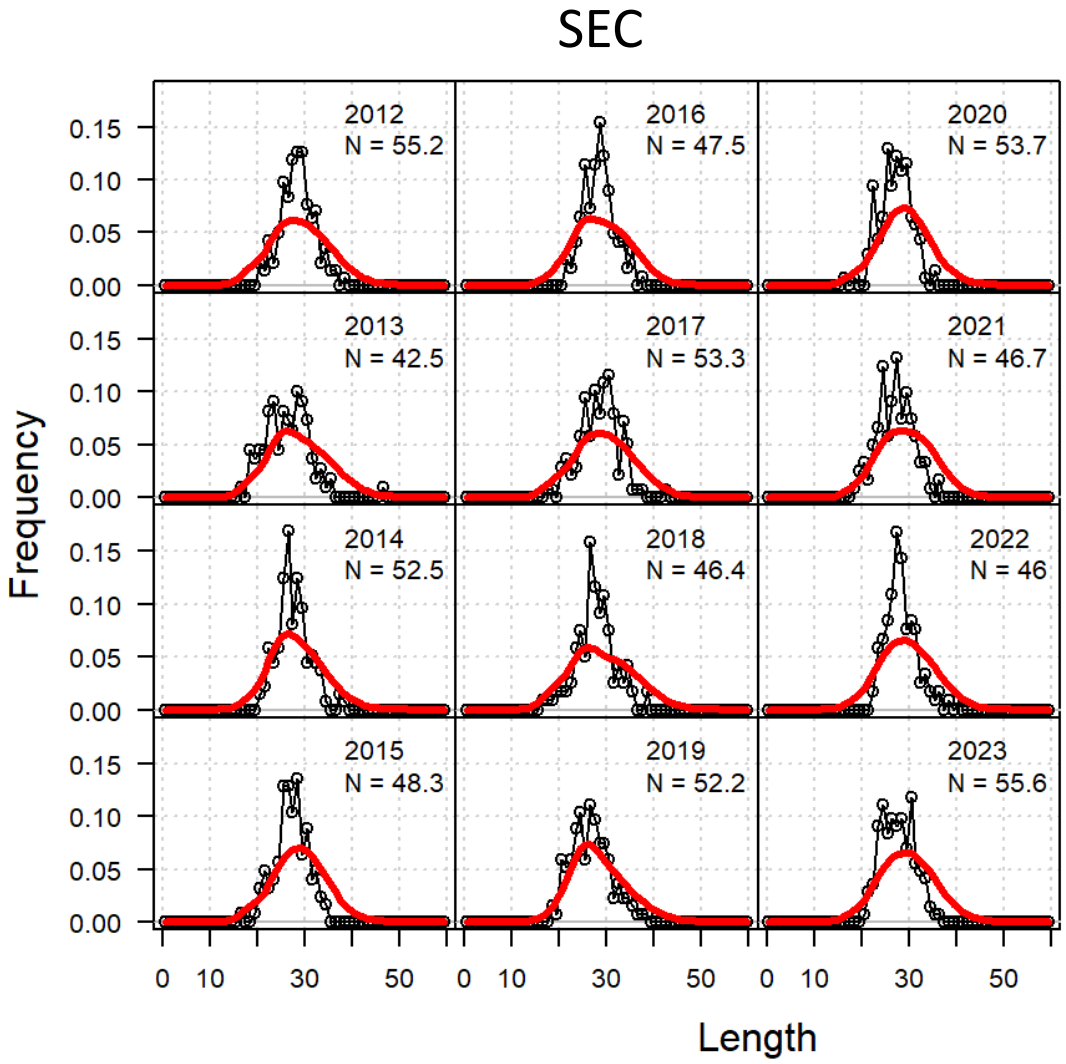
- How can Rec CPUE and Com. CPUE be improved?
- Is there a proxy for F – e.g. days per habitat area?

5. Model fit (SEC): Recreational Survey (length and age)

Observed data
OM model fit

Is this indicative of recreational fishery selectivity?

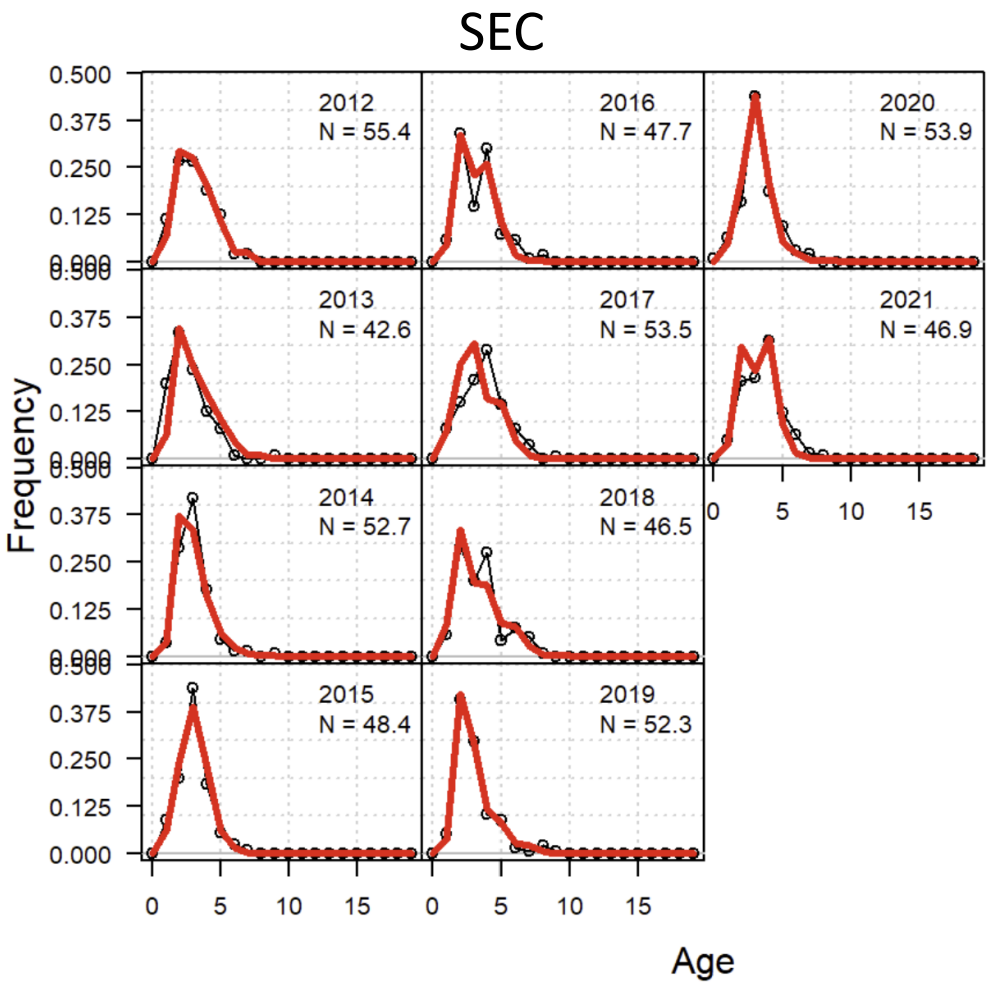




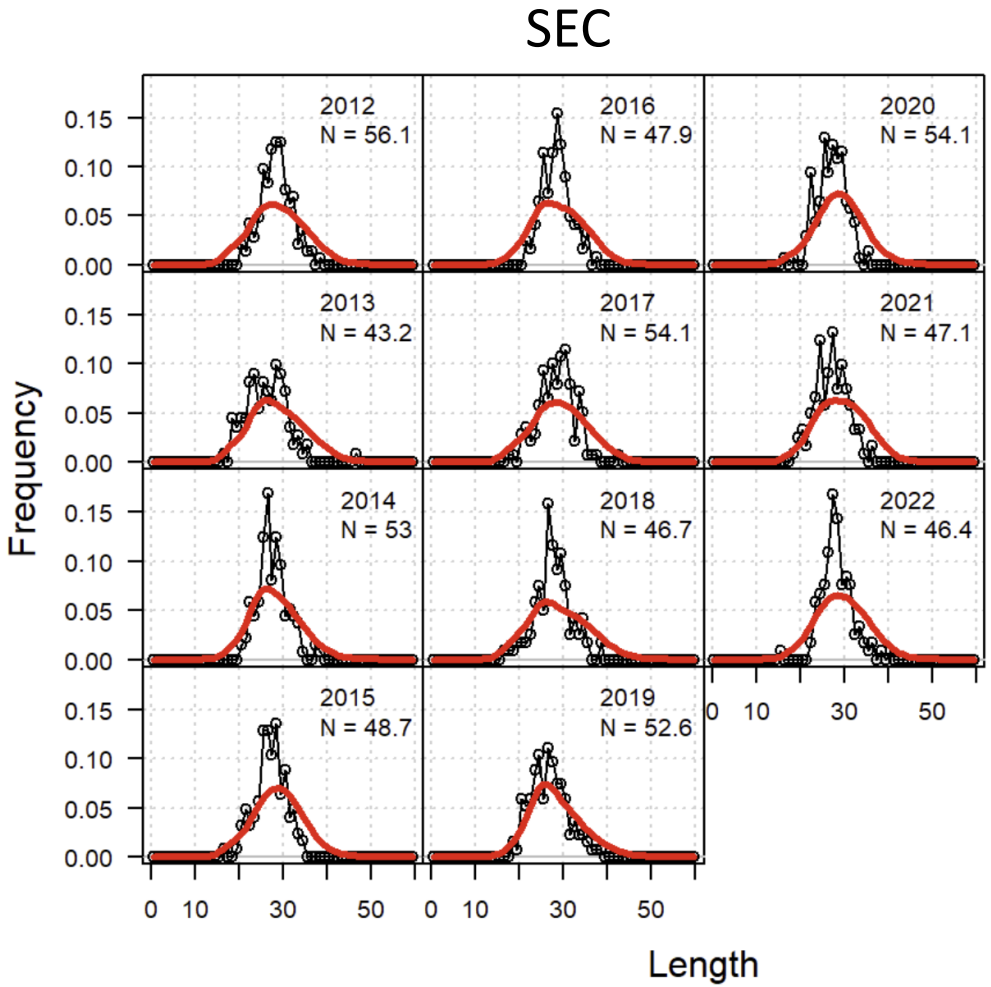
5. Model fit (SEC): Historical Survey (length and age)

Observed data
OM model fit

Is this indicative of recreational fishery selectivity?



Observed (black) and predicted (red) age composition from Hist. Surv..

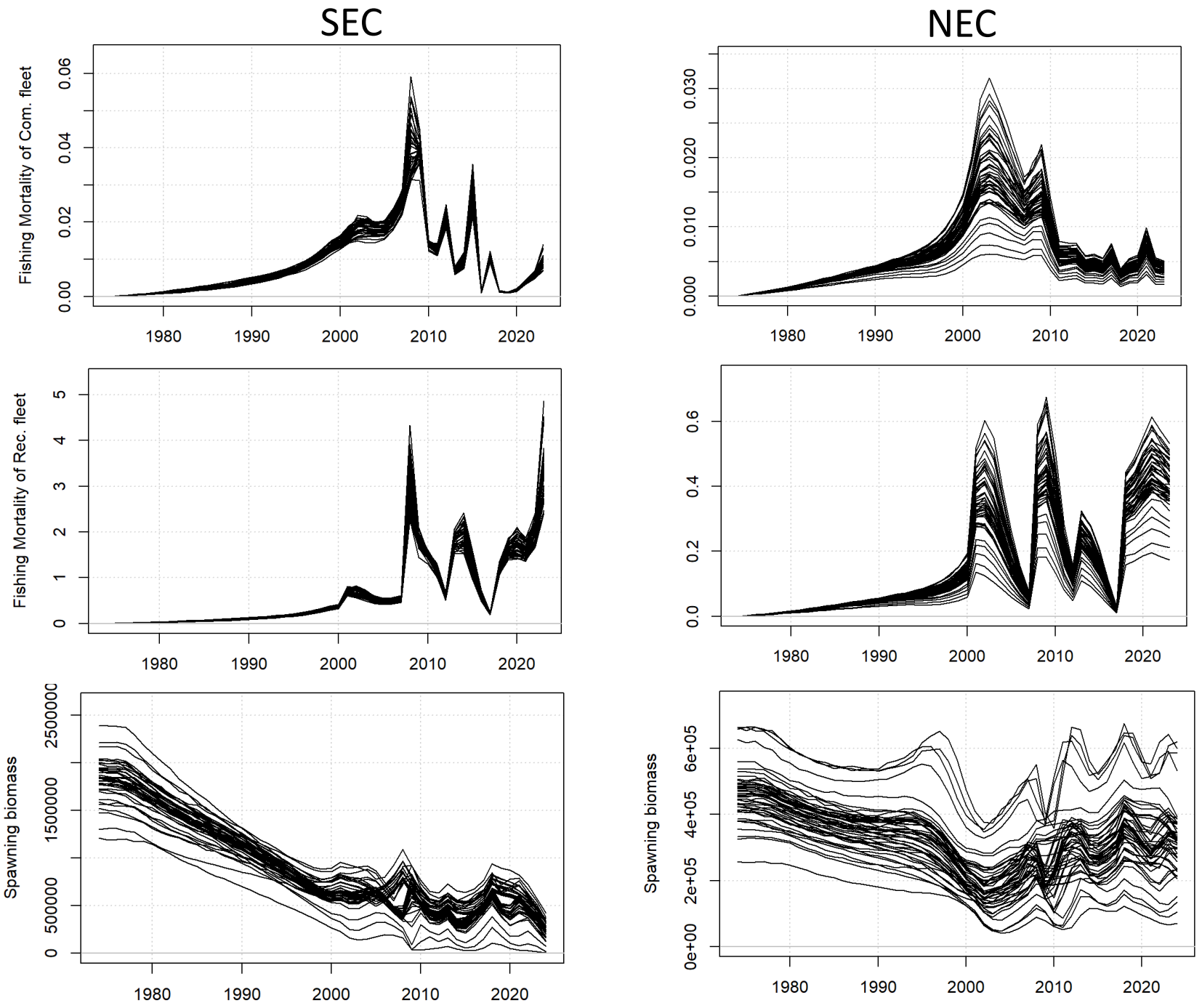


Observed (black) and predicted (red) length composition from Hist. Surv..

5. Model fit: Conclusions

- CPUE Indices are preliminary and have issues
- Catch fit is perfect (conditioned on catch) but perhaps should include uncertainty.
- Fit to age composition data is excellent
- Fit to length composition cannot approximate the width of the distribution (CV of length at age?).

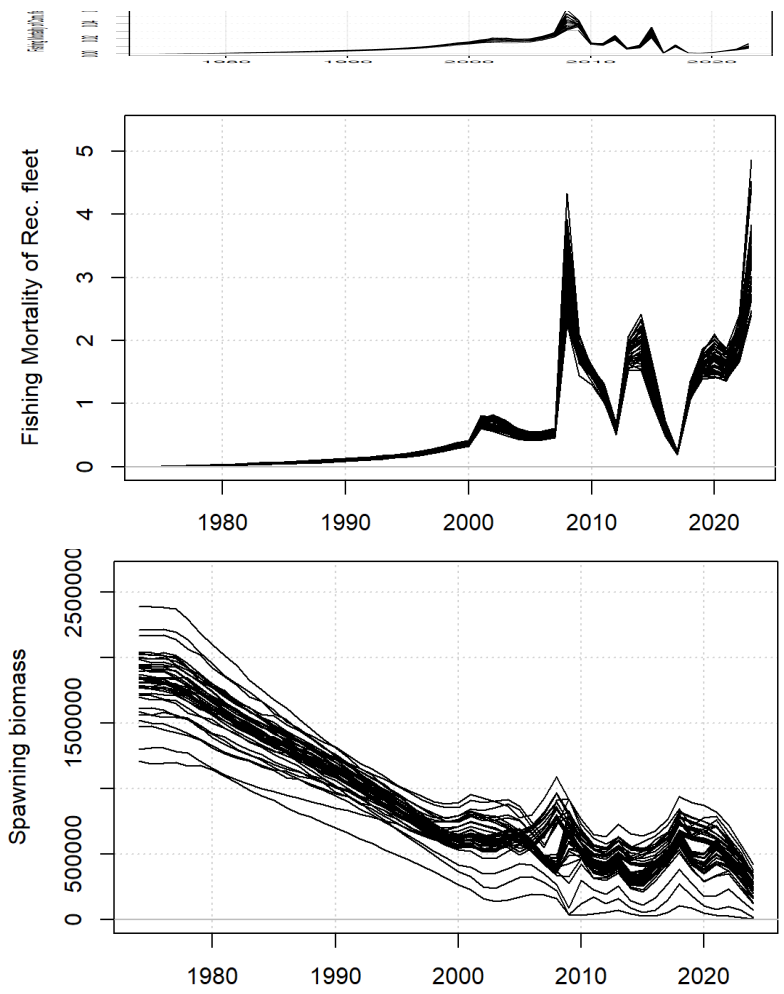
6. Model estimates: SSB & F



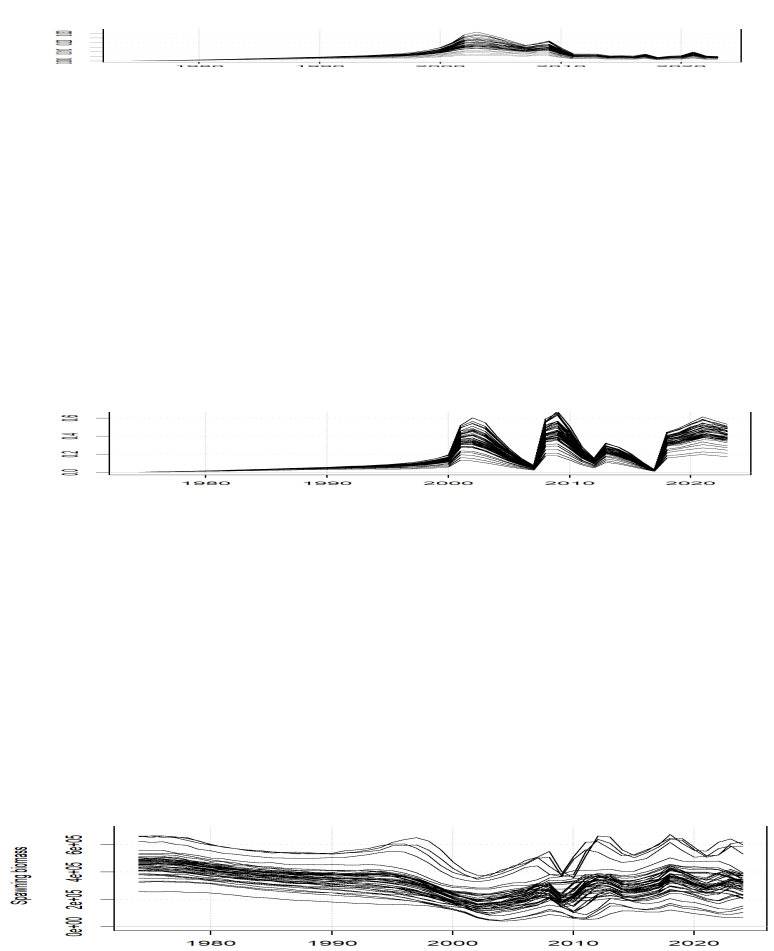
6. Model estimates: SSB & F

- Very large differences in estimated recreational exploitation rate among SEC and NEC areas
- Extremely high estimated exploitation rate of the recreational fleet in SEC
- Exploitation rate more comparable among recreational and commercial fleets in the NEC
- NEC a much smaller stock (unfished)
- What outputs do you need (quantities, reference points)?

SEC



NEC



6. Next steps

- Revise following feedback
- Document assessment results
- Include assessment diagnostics such as sensitivities, parameter profiles and retrospective analysis.
- Develop example management procedures
- Present preliminary closed-loop MSE-style simulation results

Acknowledgements

Thanks all for help getting to grips with this case study:

Sean Tracey, Nils Krueck, Kate Stark, Alyssa Marshall, Peter Coulson, Barrett Wolfe, Katie Cresswell, Ruth Sharples.