Addendum to Transition from TCSAM02 to GMACS: 1 function call

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0.0.0.1 Likelihood components

0.0.0.1.1 fishery and survey size composition data

Changes to GMACS

The comparison based on one function call between "equivalent" versions of the 2025 assessment model in GMACS and the bespoke model, TCSAM02, frameworks presented in Stockhausen 2026 demonstrated almost exact agreement between the two model frameworks for all quantities examined except some summary likelihood values, fits to fishery size composition data, and several management quantities, including the OFL. Differences between the summary likelihood values were expected because the two frameworks treated constants in those likelihoods differently. Differences in the management quantities were relatively small and result from the different approaches the frameworks take to determining equilibrium quantities.

The disagreement in the data and fits to the fishery size composition data, however, was not expected (Figures 102-105 in Stockhausen 2026) and suggested issues with how one of the frameworks handled "extended" size compositions: either how the input sex-specific size compositions were appended to create a single "extended" size composition or how the model calculated the corresponding predicted "extended" size composition prior to calculating the likelihood. Issues were subsequently identified with both possibilities in GMACS.

For the input size composition data, the assumption in GMACS was that individual compositions were normalized to sum to 1 by sex and thus the code scaled the individual components by their input sample sizes to maintain their relative sex-specific scaling before creating the "extended" composition. This was not, however, the appropriate course when the input compositions were scaled to total catch abundance, as was the case with the Tanner crab data. In this case, the relative scaling between the sex-specific compositions was already included in the expansions to total catch abundance. Consequently, logic was added to GMACS to distinguish these cases and handle them differently.

For the predicted size compositions, GMACS accounted for the possibility that fishery selectivity was sex-specific but assumed that fully-selected fishing mortality was not sex-specific. While this would not affect models that assumed fully-selected fishing mortality was identical for males and females or models that did not fit "extended" fishery size compositions, it would affect models like

the Tanner crab model that estimated sex-specific fishing mortality rates and fit "extended" size compositions in the likelihood.

Consequently, GMACS was updated to address both of these issues (May 7, 2026 on the branch "devel_202605" in the GMACS_tpl-cpp_code GitHub repository). Results comparing the fishery size compositions from the updated GMACS code at model initialization and the bespoke model are presented below. Other results presented in Stockhausen 2026 are unchanged, except for the summary size composition likelihoods which also changed but are not directly comparable because the two model frameworks treat the constants in the likelihood formula differently.

Model comparison at initialization using exactly equivalent parameter values

Figures 1-4 now illustrate the "exact equivalence" between the two modeling frameworks for "extended" fishery size compositions following the additions to GMACS to include sex-specific fully-selected fishing mortality rates in the predictions for the fishery size compositions. Similar agreement (not shown) was obtained for bycatch size compositions from the snow crab, BBRKC, and groundfish fisheries.

Figures

List of Figures

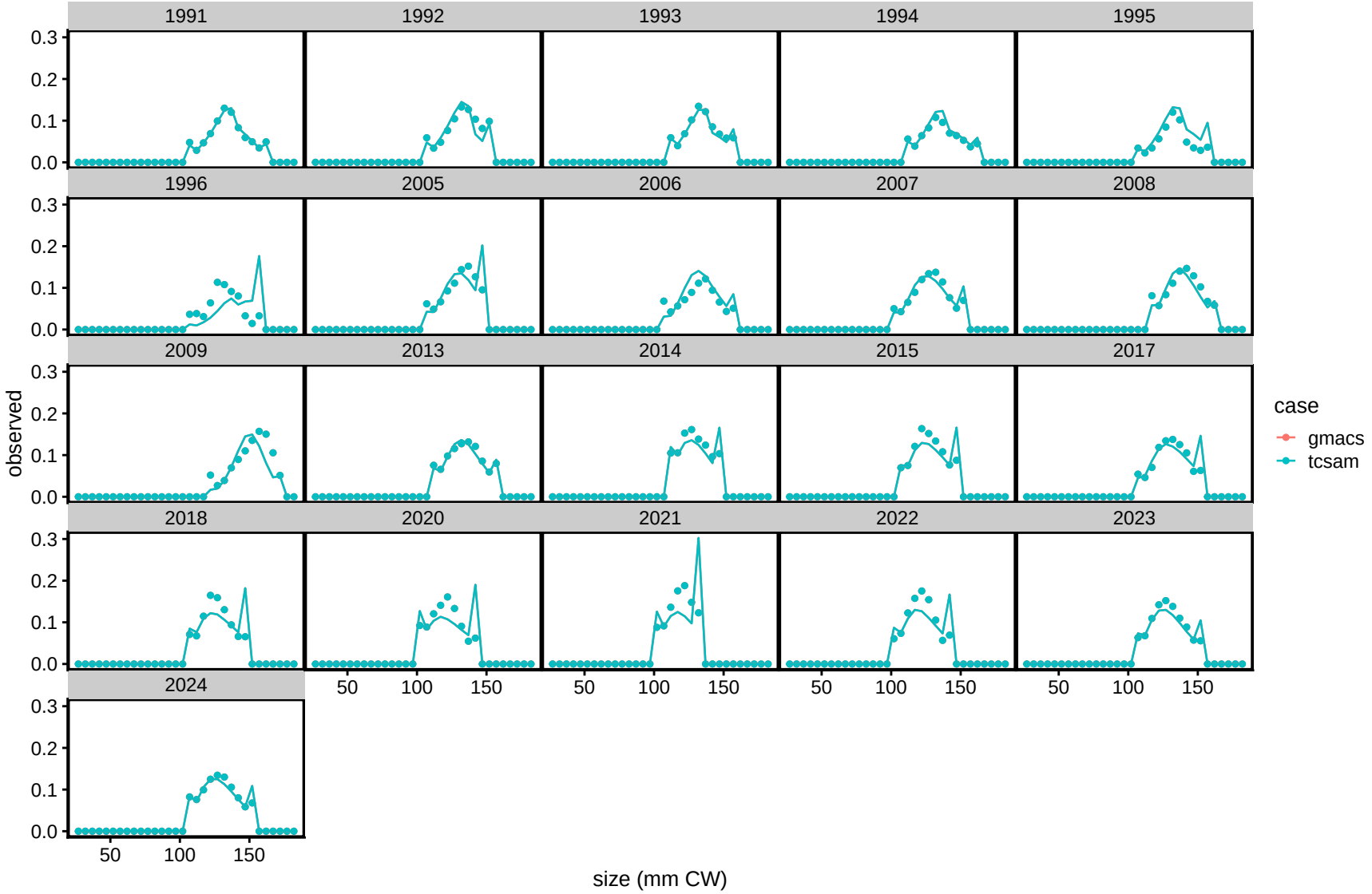

Figure 1. Comparison of fits to total catch size comps for males in the directed fishery. Points: data; lines: fit.

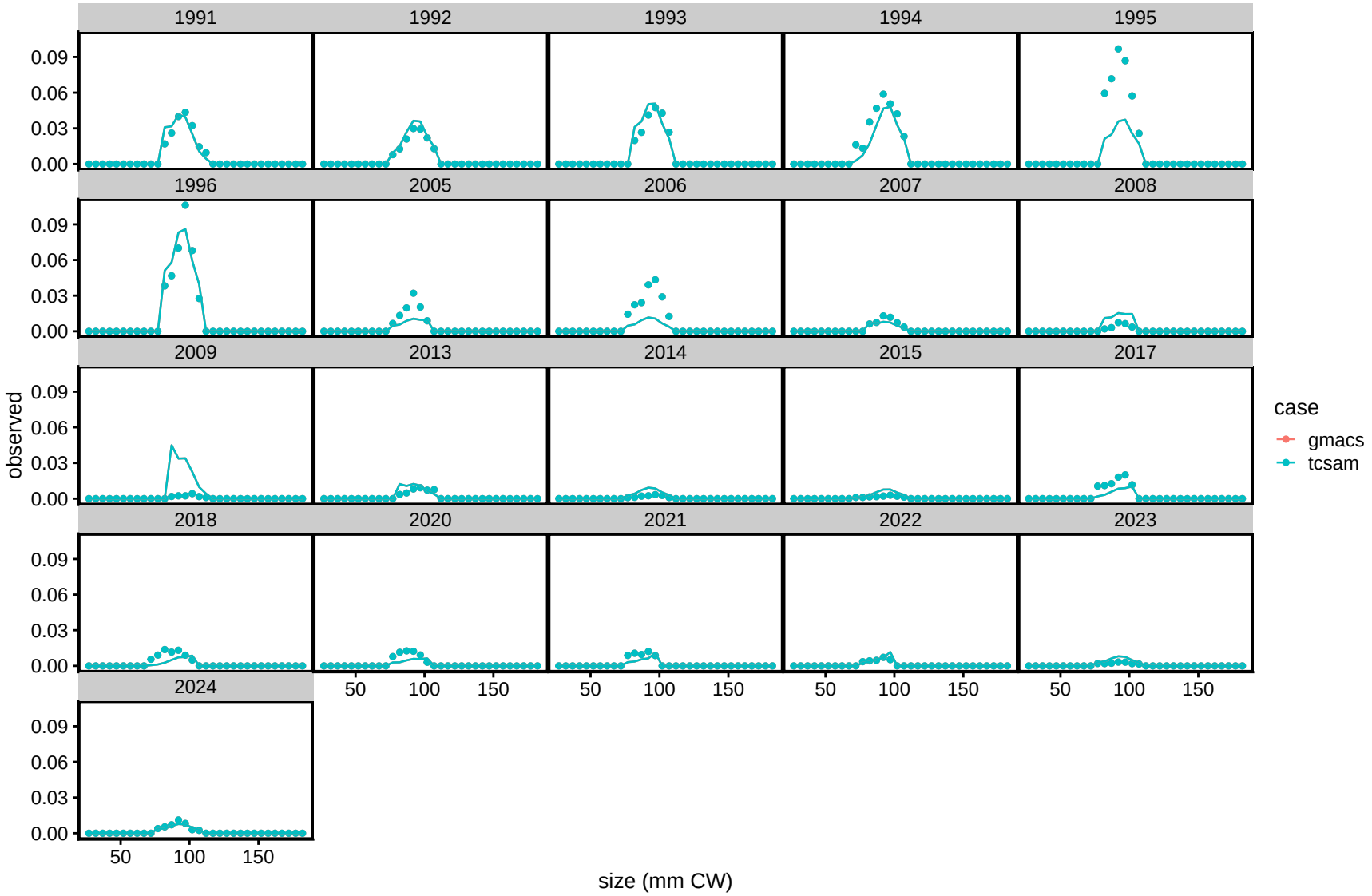

Figure 2. Comparison of fits to total catch size comps for females in the directed fishery. Points: data; lines: fit.

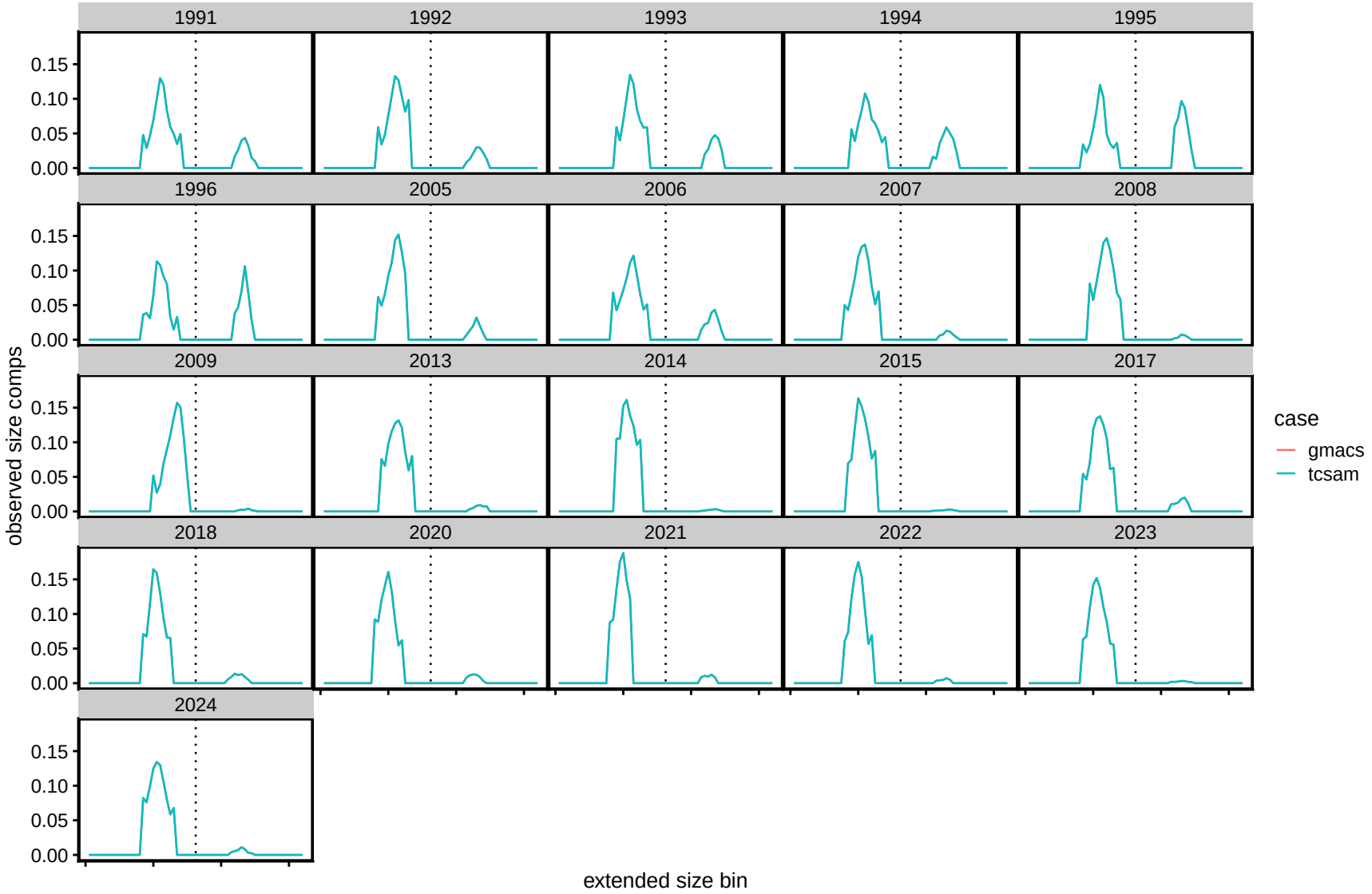

Figure 3. Comparison of "extended" observed total catch size comps for the directed fishery (TCF). In each panel, the vertical dashed line indicates the transition from males to females. A single likelihood valued is calculated for each "extended" size composition (rather than two likelihoods calculated by sex) based on the corresponding predicted size composition shown in the next figure.

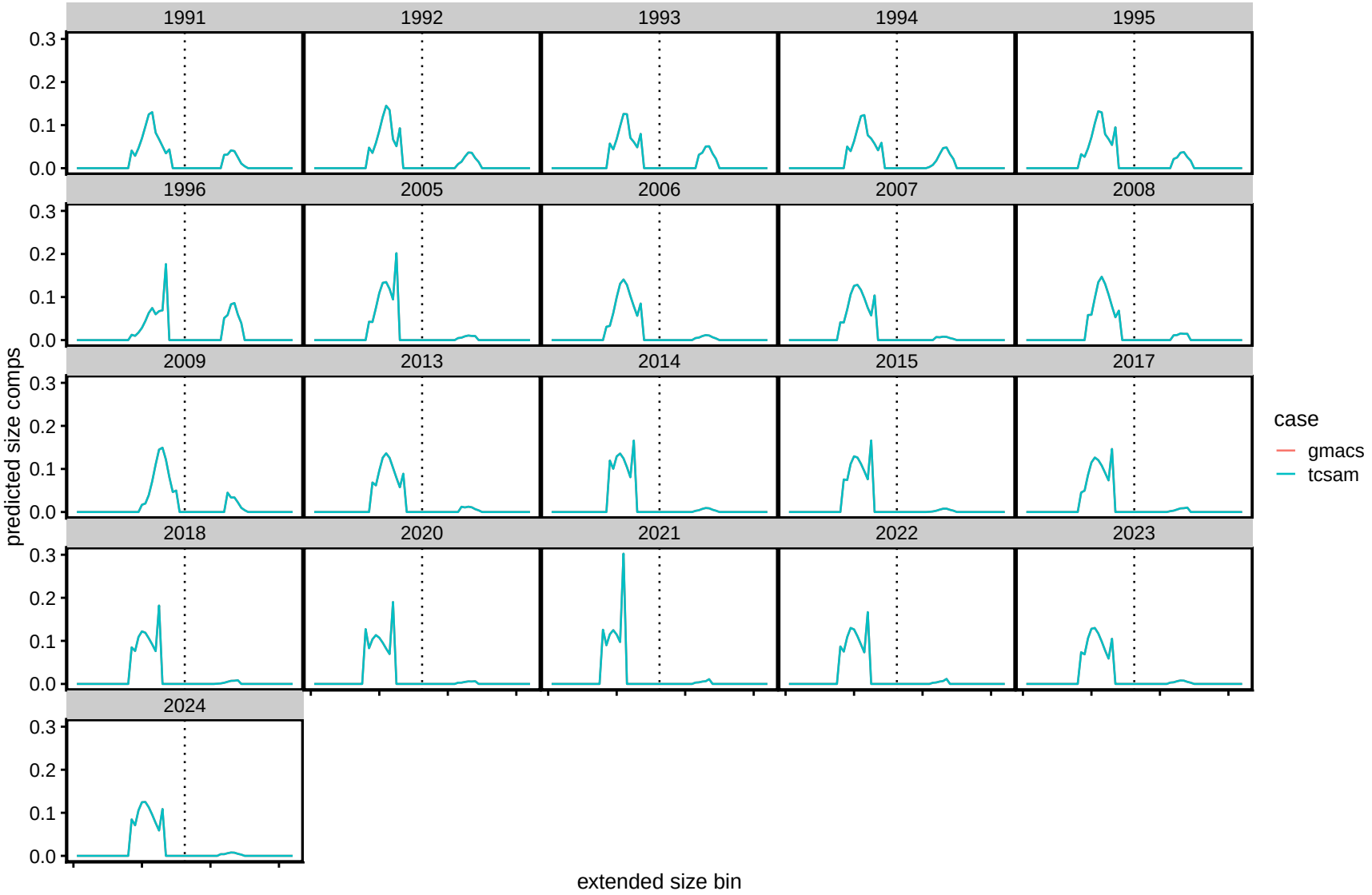

Figure 4. Comparison of "extended" predicted total catch size comps for the directed fishery (TCF). In each panel, the vertical dashed line indicates the transition from males to females. A single likelihood valued is calculated for each "extended" composition (rather than two likelihoods calculated by sex) based on the corresponding observed size composition shown in the previous figure.