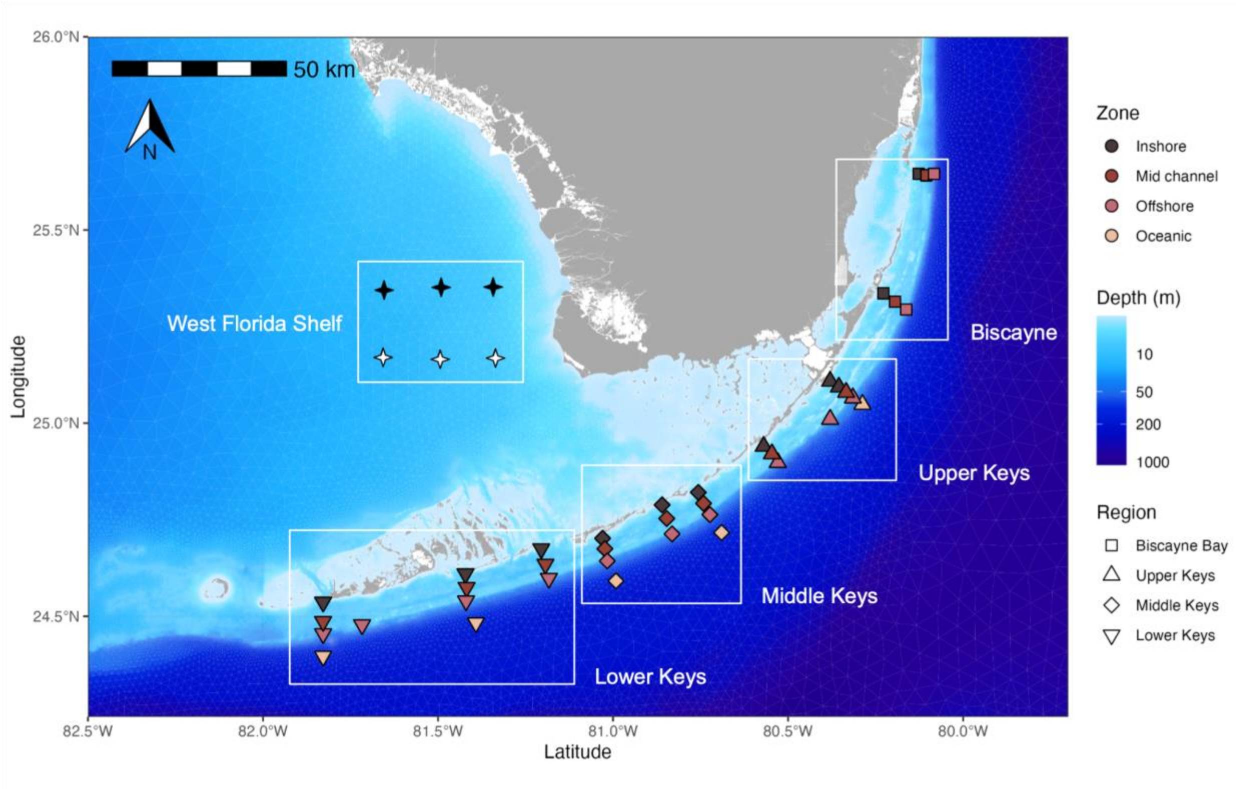

Figure 1. Locations of permanent sampling stations along the Florida Reef Tract and stations on the West Florida Shelf used for this study. Boxes delineate the biogeographical regions. For the points on the Florida Reef Tract, marker color indicates the position of the station along the shelf (coastal zone). The map is shaded by bathymetry (m) using the mesh grid resolution of the SLIM model.

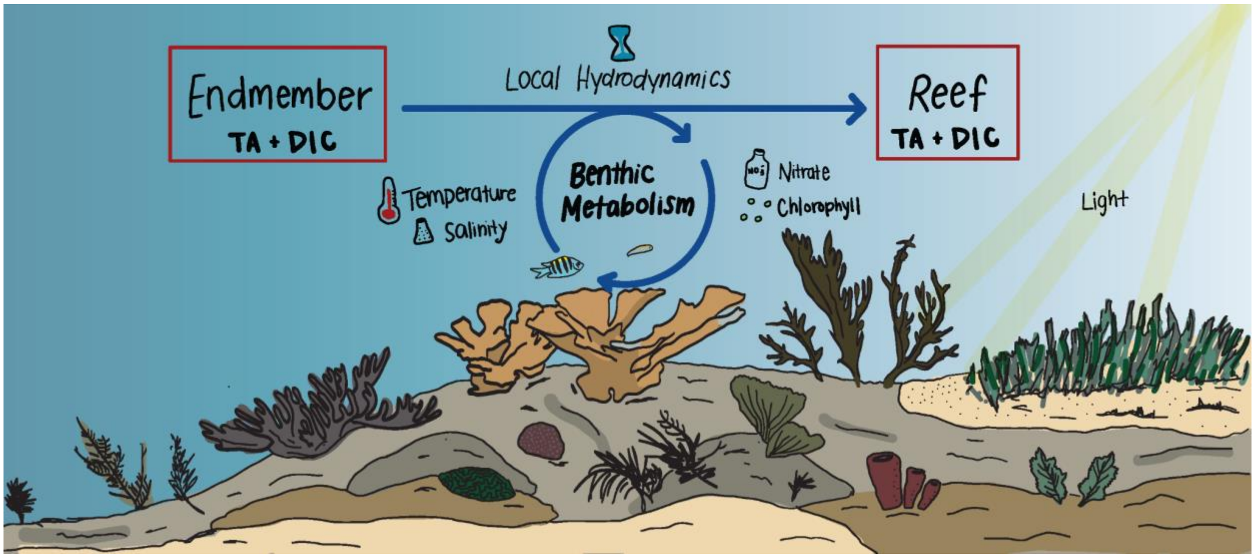

Figure 2. Conceptual model illustrating how onshore reef carbonate system dynamics (right) are driven by offshore endmember chemistry conditions (left) and the interaction between benthic metabolism and hydrodynamics. We can predict inshore (reef) carbonate chemistry (DIC, TA) given endmember chemistry (DIC, TA), local hydrodynamics (volume and water mass history, or "flowshed"), and benthic composition as well as other environmental drivers expected to modulate the metabolic signal from the benthos, including light, temperature, salinity, nitrate and chlorophyll-a. Illustration credit: Allyson DeMerlis.

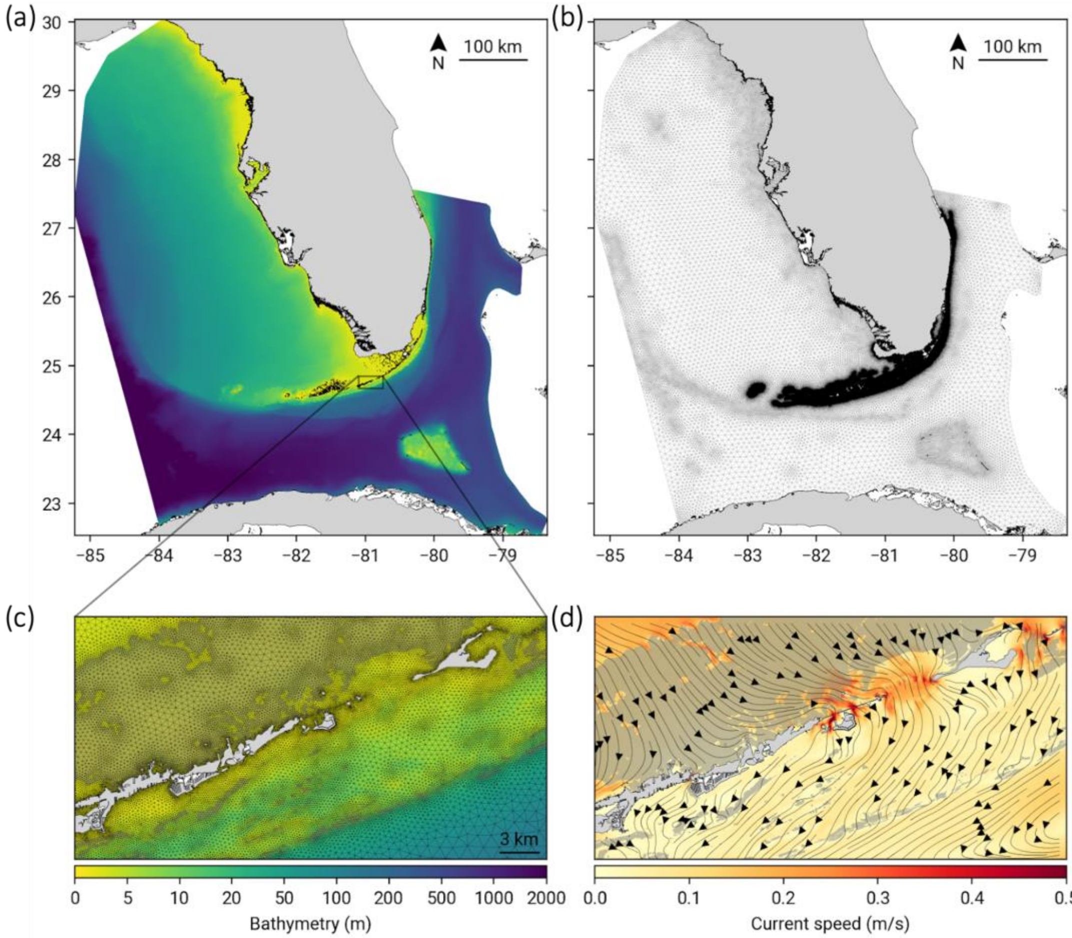

Figure 3. a) Bathymetry of South Florida and c) inset of Marathon and Long Key showing bathymetry of the mesh grid. b) Mesh grid resolution of the 2D SLIM model around South Florida. d) Example current velocity field around Marathon Key and Long Key (October 1st, 2017 at 03:00 UTC).

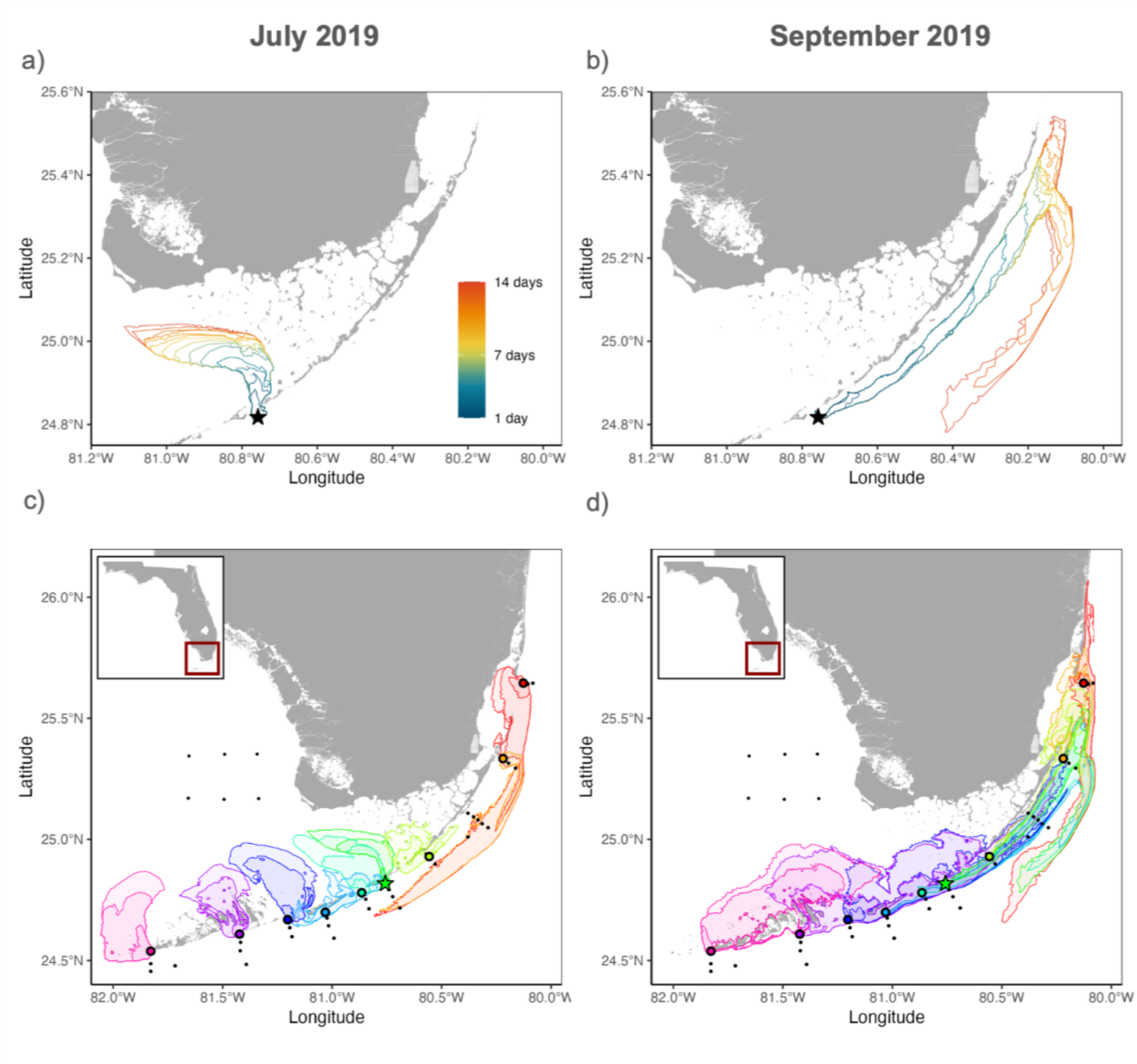

Figure 4. Upper panels: examples of 1-day to 14-day flowshed polygons tracking water back from the permanent inshore sampling station near Long Key in a) July 2019 and b) September 2019. Boundary color indicates the number of days represented by the water mass history polygon, or "flowshed". Lower panels: 1-day, 7-day, and 14-day flowsheds for inshore stations on the Florida Reef Tract on the same dates (a) July 2019 and b) September 2019). Green star indicates the station highlighted in a and b. Colors represent unique sampling stations and their respective water mass history. Note, opacity increases where polygons overlap. Smaller black points indicate the rest of the sampling stations used in this study (mid channel, offshore, and oceanic stations in the Florida Reef Tract and the 6 stations utilized on the West Florida Shelf.

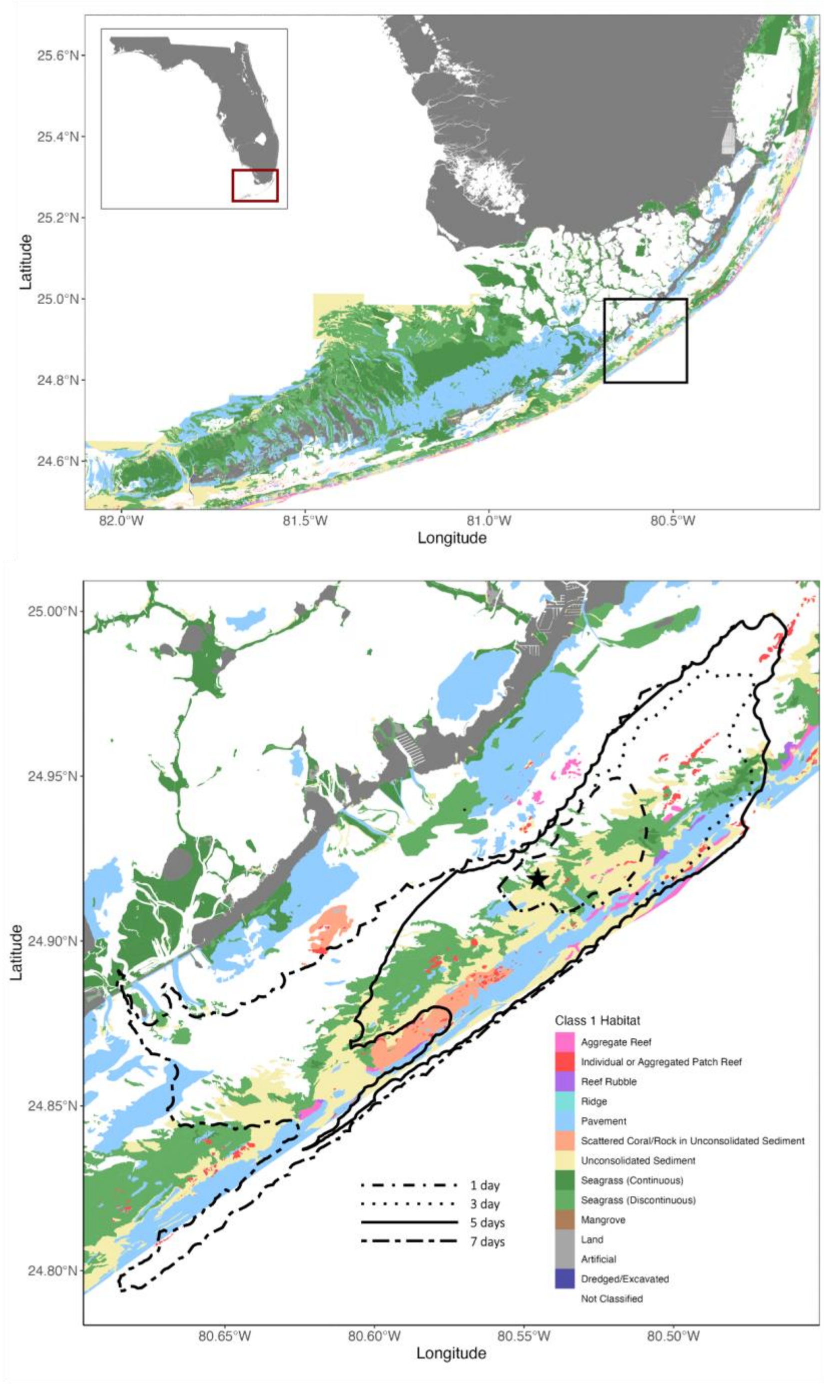

Figure 5. a) Benthic habitat composition in the Florida Keys as described by Florida's Unified Reef Map (Class 1 data shown). Box indicates the location of the zoomed in map shown in b. b) Habitat classification around Islamorada (Class 1 data) bounded by the 1-day (dashed), 3-day (solid), 5-day (dotted) and 7-day (dotdash) flowsheds for the station indicated by the star. These boundaries represent the water mass history extents for the water sampled the station in July 2019.

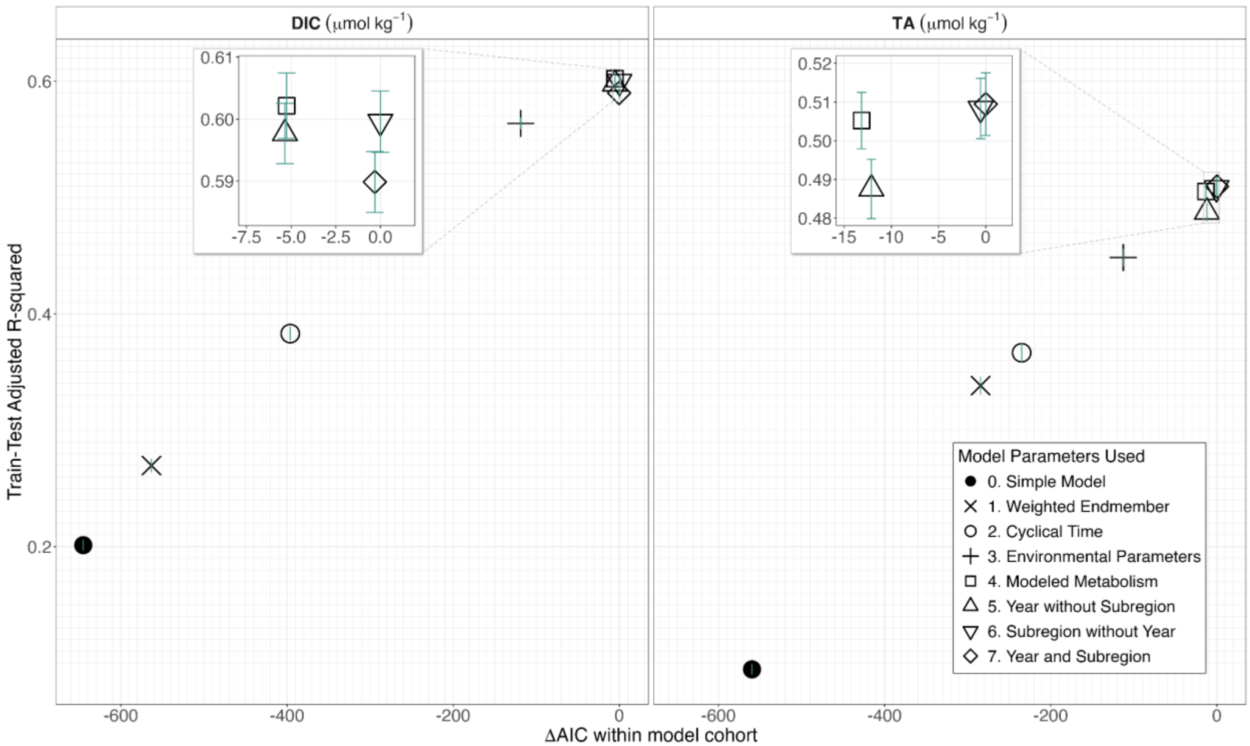

Figure 6. Model performance comparison for models with increasing complexity in the parameters included. Response variables are sample DIC (μmol kg^{-1}) (left) and sample TA (μmol kg^{-1}) (right). Plot is only inclusive of models run with 5 day flowshed polygons. Error bars represent standard error in train-test adjusted R-squared for each model.

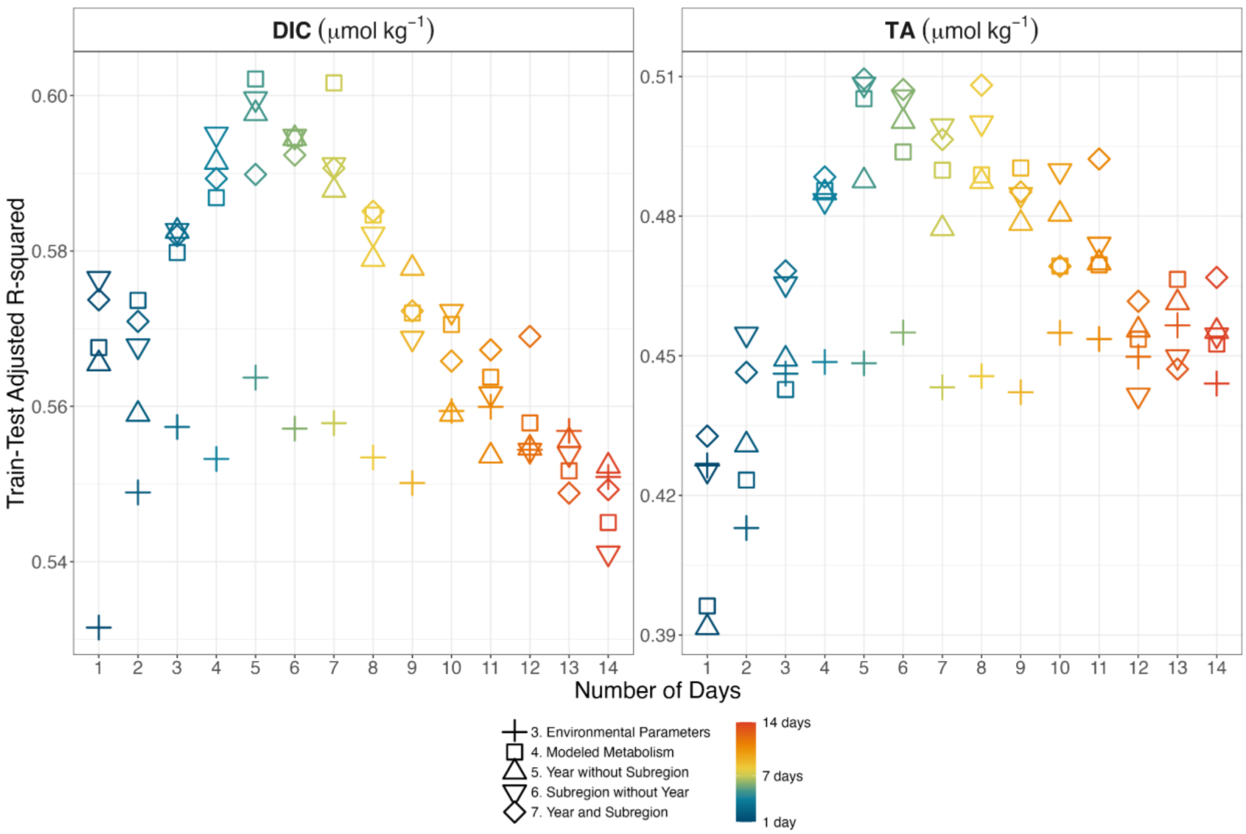

Figure 7. Comparison of linear model skill for the most complex models (Models 3-7) utilizing different water mass histories (flowshed polygons for 1 day up to 14 days). Model markers are consistent with Figure 6 and marker colors indicate the number of days (these colors are consistent with the flowshed boundary colors in Figure 4)