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Environmentally-driven fluctuations in condition factor of adult Gulf Menhaden (*Brevoortia patronus*) in the northern Gulf of Mexico.

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We evaluated the effects of a suite of environmental predictors on the relative condition (the relationship between individual weight and length) of adult Gulf Menhaden *Brevoortia patronus* sampled from the commercial fishery, from 1964 to 2011. A hierarchical linear model (HLM) was used to examine the association between relative condition and Mississippi River discharge. Generalized Additive Models (GAMs) were constructed to determine the impact on relative condition by El Niño Southern Oscillation (ENSO) and the spatially-variant influence of sea surface temperature (SST°C), chlorophyll *a* concentration (mg m^{-3}) and wind vector components. The HLM revealed a positive correlation between Mississippi River discharge and relative condition that was consistent throughout the fishing season (April to October). Comparisons of spatially–variant and –invariant GAMs indicated that the effects of SST was consistent in the northern Gulf of Mexico (NGOM) and that the greatest relative condition was at temperatures associated with the Mississippi River plume front. The effect of wind vector components was spatially-variable, likely due to geographic differences in wind-related transport of productive plume waters across the NGOM. Relative condition was greatest during positive ENSO anomalies. Relative condition exhibited intra-annual variability with a small peak during April and May and increasing condition from August until November, likely caused by increased food availability and provisioning by individuals for spawning. We show that multiple bottom-up processes impact the individual dynamics of Gulf Menhaden in the NGOM and these results can be used to predict their impacts on the fisheries and ecology of the NGOM.

Keywords: Gulf Menhaden · *Brevoortia patronus* · Relative condition factor · Environmental drivers · Mississippi River discharge · El Niño Southern Oscillation · Generalized Additive Model · Hierarchical Linear Model

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