

# FROM FEED COMPOSITION TO IMMUNE FUNCTION: EXPLORING MACRONUTRIENT RATIOS IN CATFISH AQUACULTURE

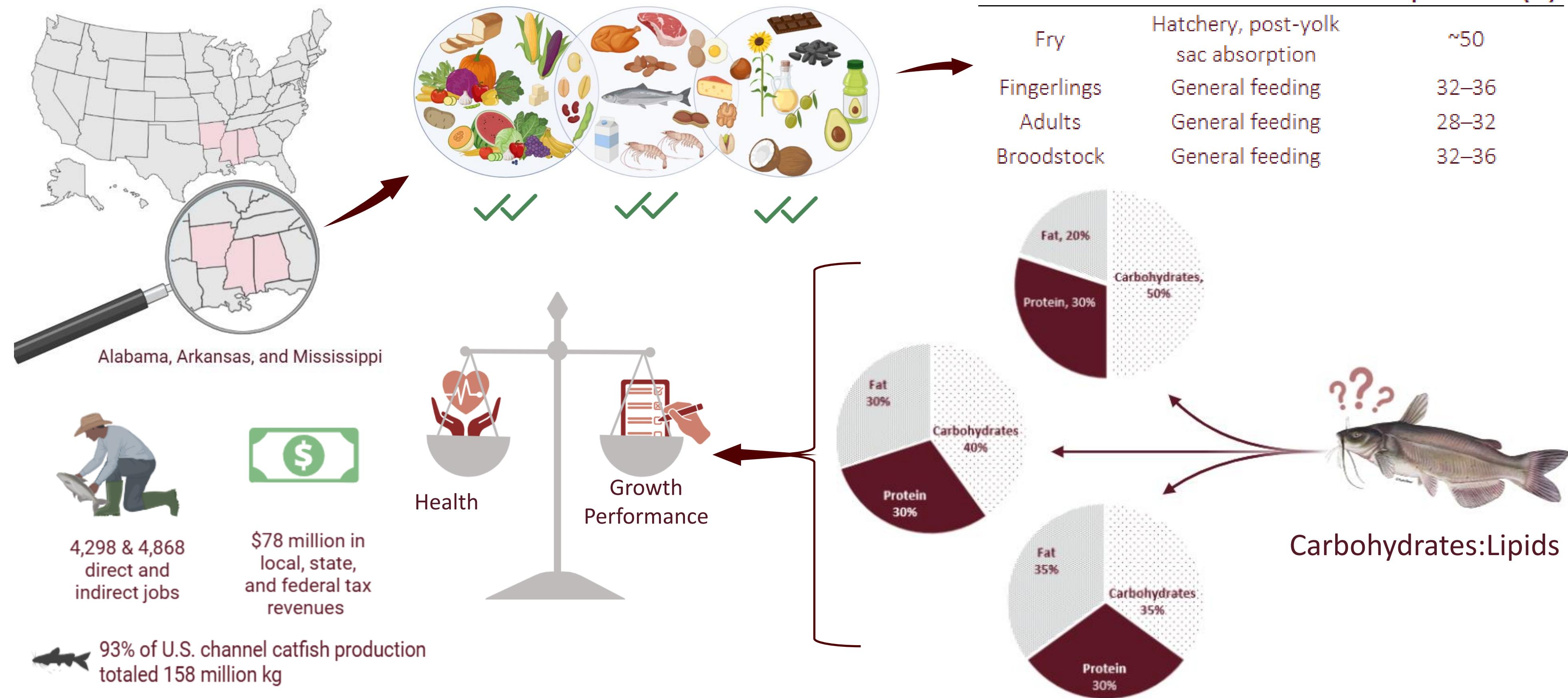


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## INTRODUCTION

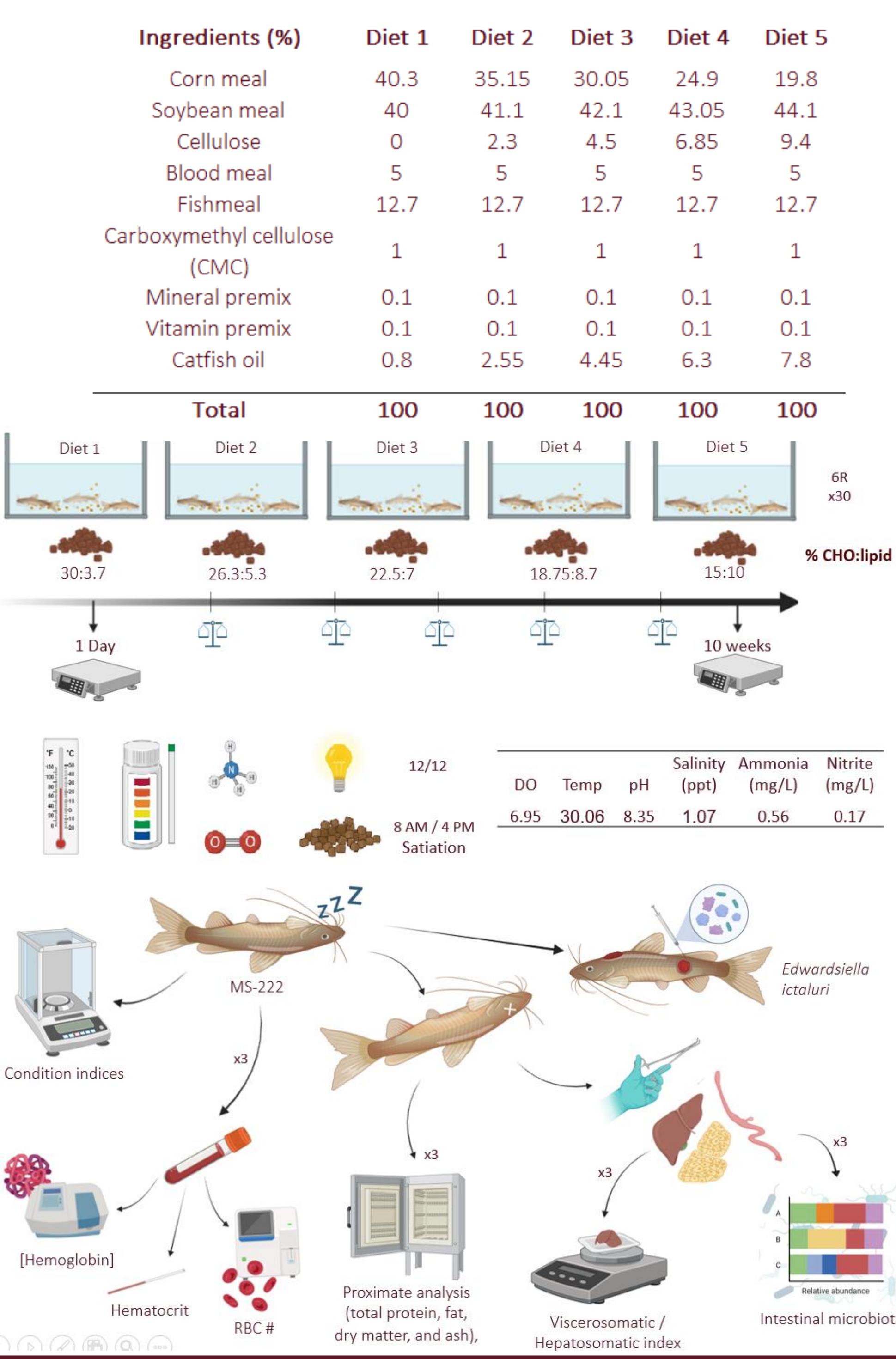
### Why catfish aquaculture?



## OBJECTIVES

This study evaluated how different carbohydrate-to-lipid ratios in isoenergetic diets affect growth, immunity, and disease resistance in channel catfish (*Ictalurus punctatus*), aiming to identify optimal macronutrient balances.

## METHODOLOGY



## CONCLUSIONS

Higher-lipid diets (diets 4 and 5) increased energy reserves without adverse effects on health or gut microbiota and were associated with improved response to bacterial challenge.

## RESULTS

