

# Seasonal and size-specific variation of total mercury content in large pelagic fishes off North Carolina

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## Introduction

Human exposure through the consumption of fishes contaminated with mercury is a public health concern and consumption advisories are already in place for several upper trophic level species

Mercury enters the marine food web through bacterial methylation and bioaccumulates at higher trophic levels

Methylation of mercury can vary spatially and seasonally, due to fluctuations in anthropogenic inputs, and cause variation in tissue mercury concentrations of migratory fishes

National and regional federal guidelines for consumption are based on averages of mercury content over broad geographic areas and may not be representative of levels that North Carolina anglers encounter<sup>1</sup>

## Objectives

1. Estimate muscle tissue mercury concentrations in dolphinfish, wahoo, blue marlin, blackfin and yellowfin tuna from North Carolina waters
2. Quantify variability in total mercury concentration as a function of fish size, season, and trophic level

## Methods

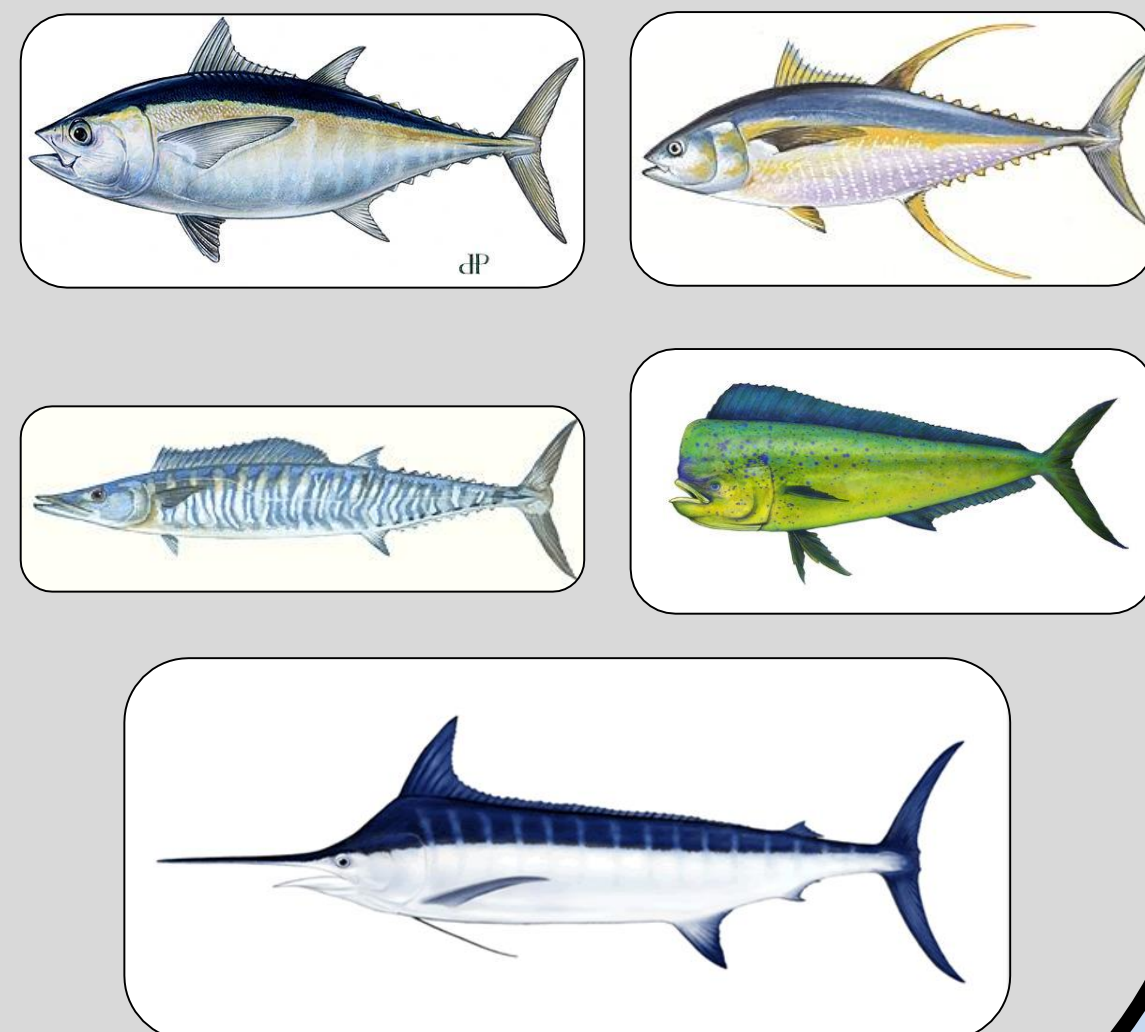
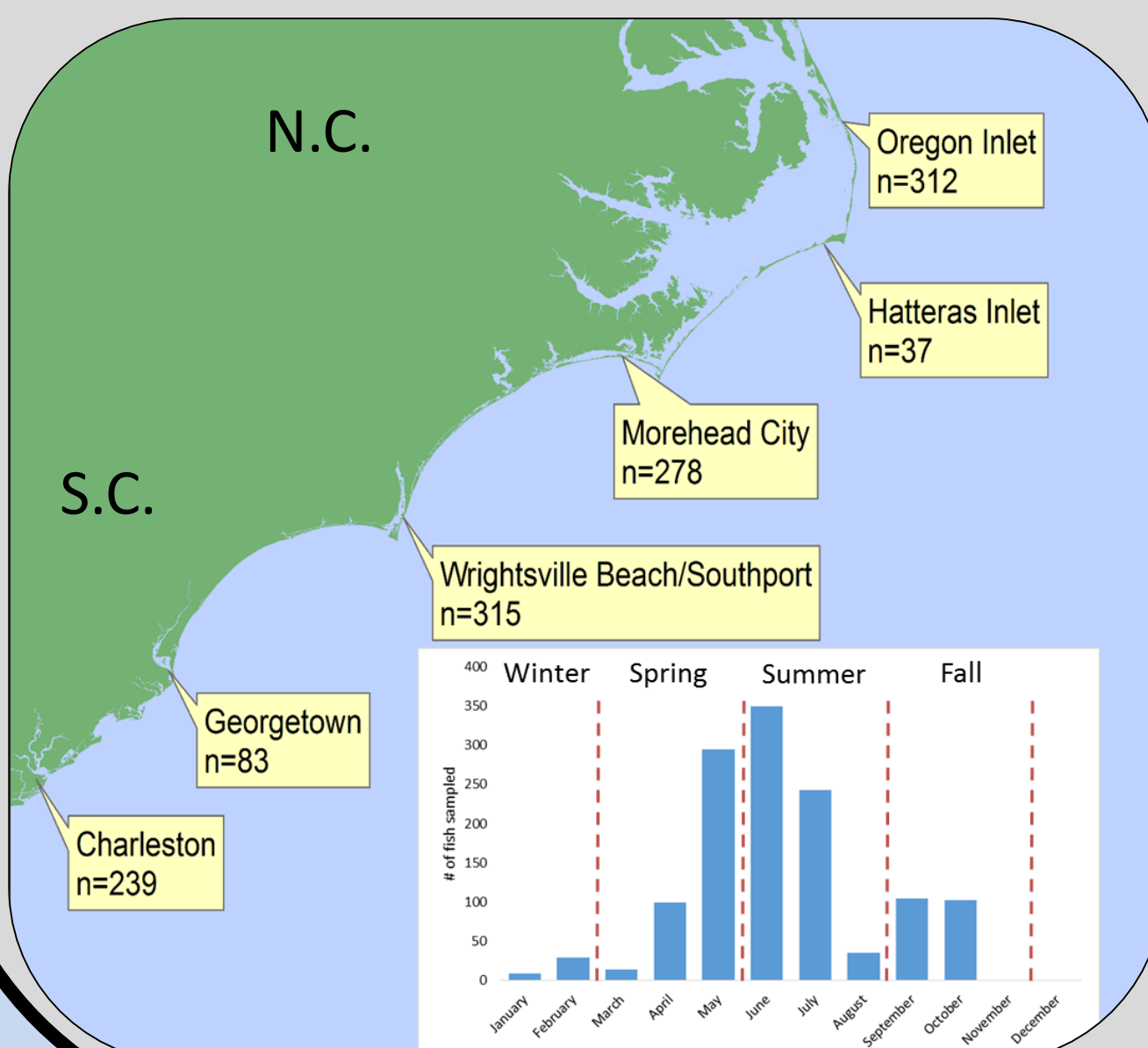
Fish were collected from state fishing tournaments and charter boat operations from spring 2012 – winter 2014

Fork length (cm), weight (kg), and sex was recorded for each fish

~20g of dorsal muscle tissue removed and dried at 60°C for 48 hours

Total mercury content was estimated using a Tri-Cell Direct Mercury Analyzer with values converted to wet weight concentration

Diet information was collected during a separate study investigating the trophic ecology of large pelagic marine fishes



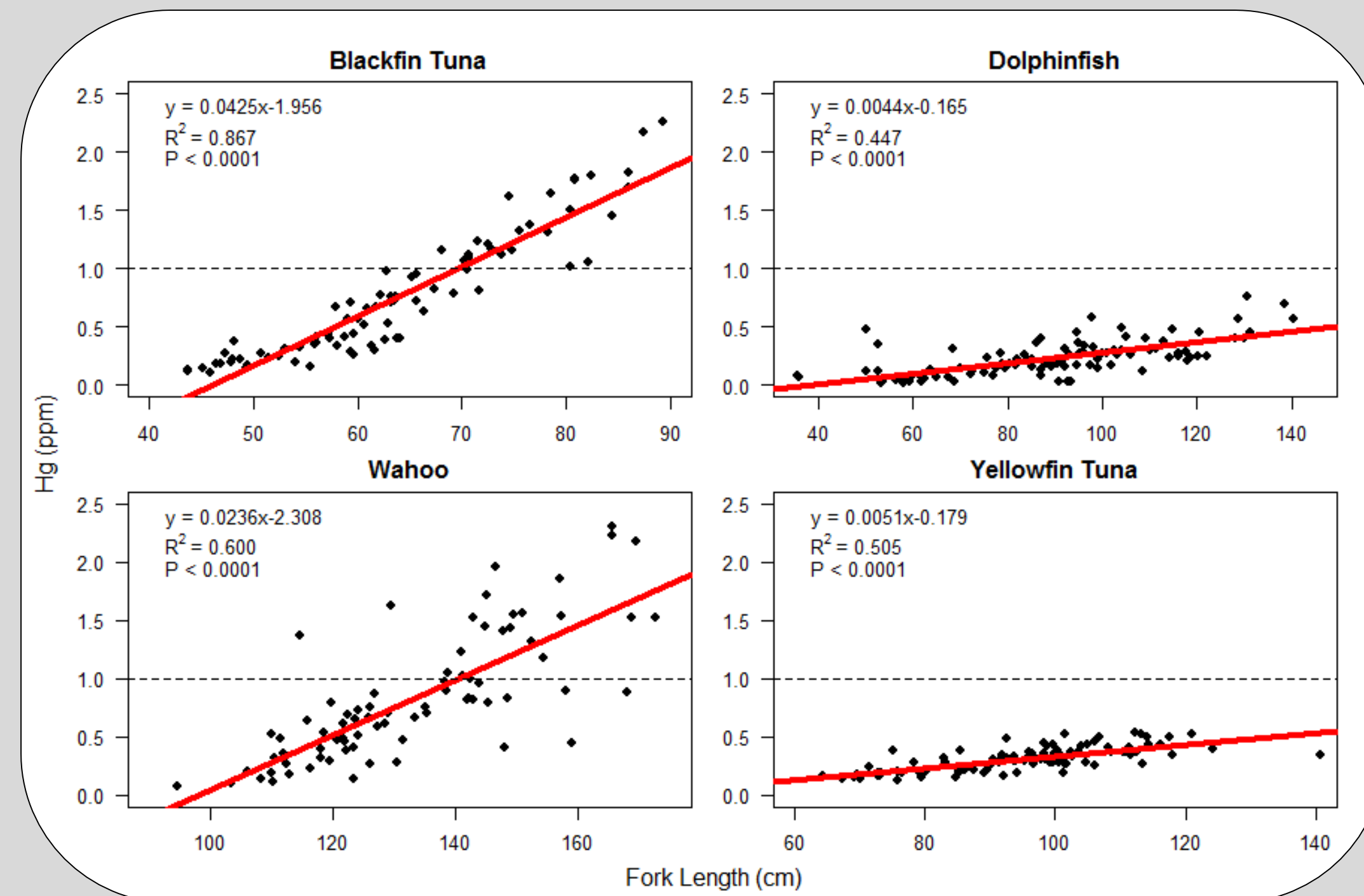
## Results

### 1) Estimated muscle tissue mercury concentrations

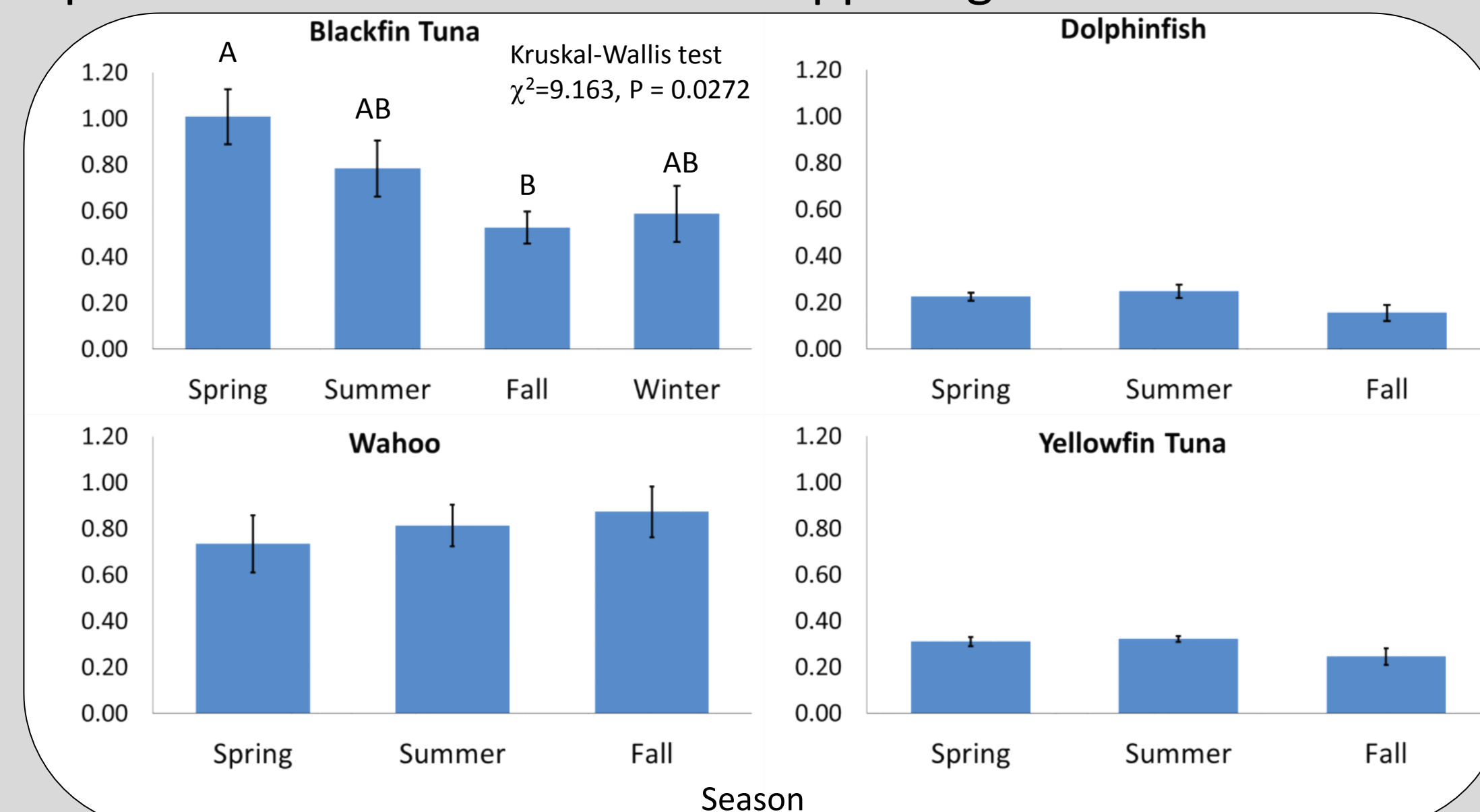
Summary of fish size range and mercury content for five marine fish species common in pelagic waters off North Carolina

| Species               | Count | Fork Length (cm) |       |       | Mercury (ppm) |      |       |
|-----------------------|-------|------------------|-------|-------|---------------|------|-------|
|                       |       | Min              | Mean  | Max   | Min           | Mean | Max   |
| <b>Blackfin Tuna</b>  | 82    | 43.7             | 63.7  | 89.4  | 0.11          | 0.75 | 2.26  |
| <b>Dolphinfish</b>    | 96    | 35.6             | 89.4  | 140.4 | 0.02          | 0.23 | 0.75  |
| <b>Wahoo</b>          | 78    | 94.6             | 133.1 | 172.7 | 0.08          | 0.82 | 2.29  |
| <b>Yellowfin Tuna</b> | 97    | 64.3             | 95.6  | 140.7 | 0.13          | 0.31 | 0.54  |
| <b>Blue Marlin</b>    | 6     | 262.3            | 269.9 | 277.5 | 1.833         | 4.74 | 12.99 |

### 2) Effects of size, season, and diet on mercury content

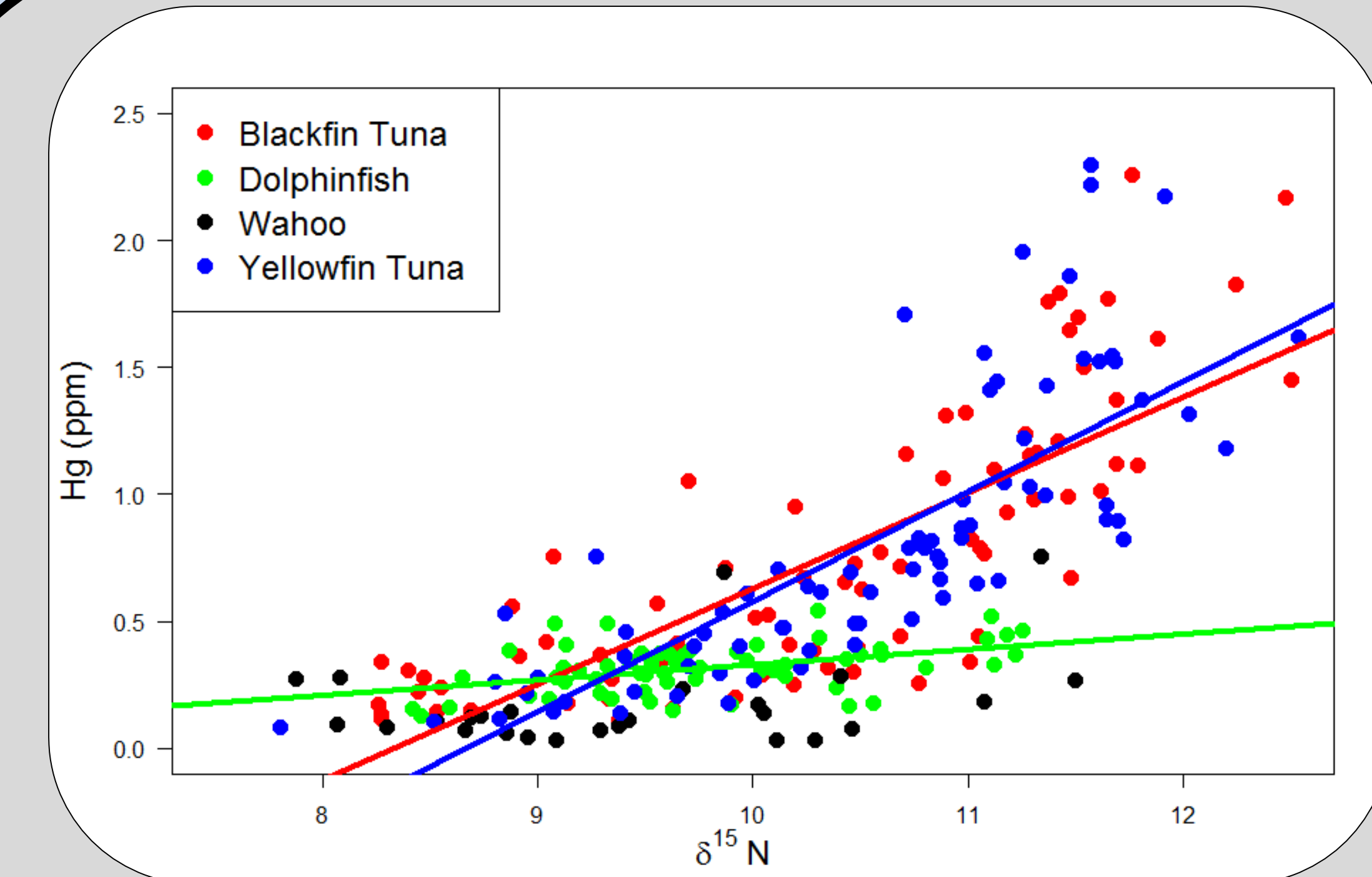


Mercury content (ppm) vs. fork length (cm); dashed line represents FDA action level of 1.0 ppm Hg

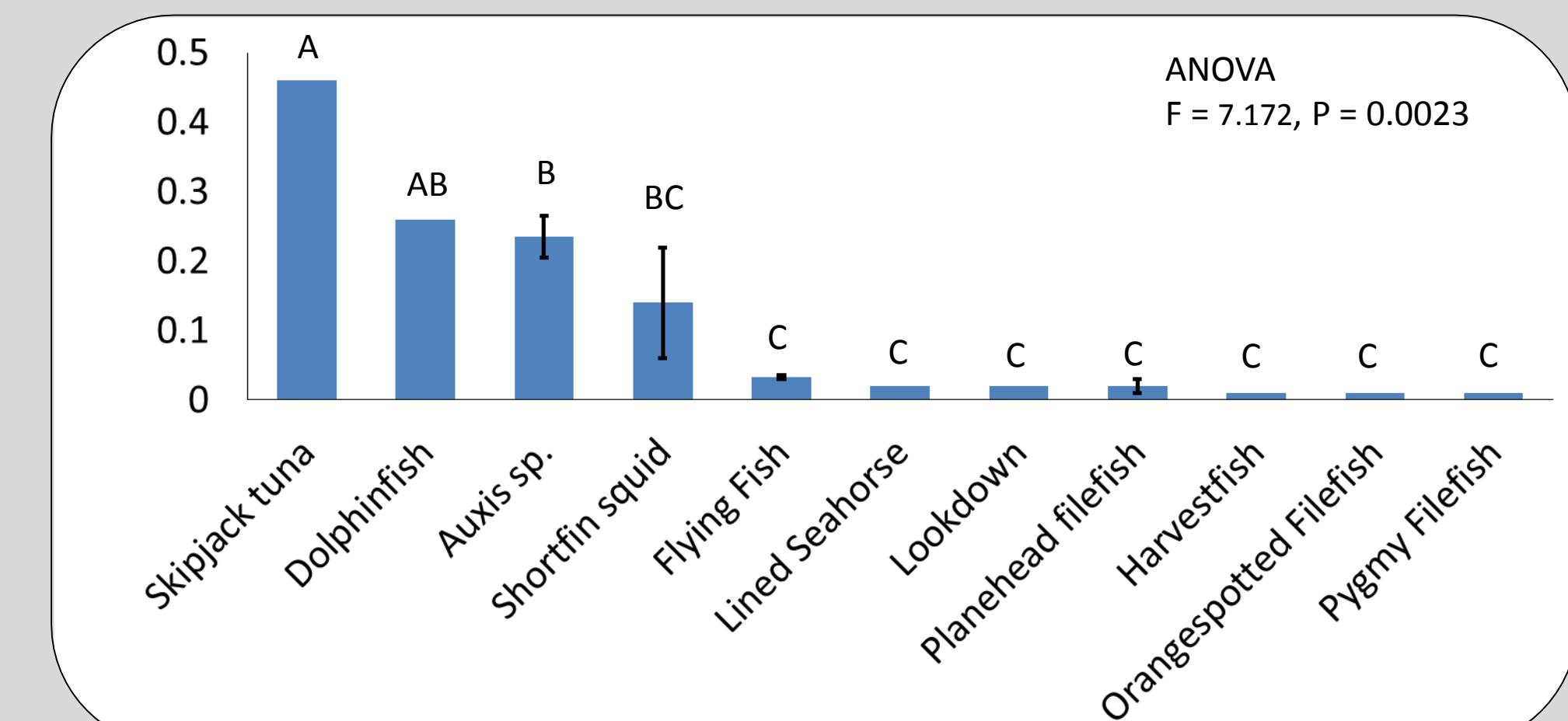


Mean (±SE) mercury concentration by season; means with different letters are significantly different

## Results



Mercury content (ppm) vs. stable isotope concentrations of nitrogen ( $\delta^{15}N$ ); regression lines indicate significant relationships



Common prey taxa recovered from diets and their mercury content

## Conclusions

Mercury concentrations varied widely among species with some upper ranges exceeding the FDA action level

Mercury burden increased with increasing fish size and trophic position indicating that diet changes likely contribute to bioaccumulation

A diet shift in blackfin tuna from winter to spring was observed and could explain the seasonal difference in mercury burden

Trends in Hg concentration are similar to those in Petre et al (2012)<sup>2</sup> for NC landed fish, identifying fish size and trophic level as a good predictor of Hg and expanding the size ranges of fish sampled for NC

We observed high Hg in blackfin tuna which is not covered by the FDA advisories, but occur frequently in the landings of NC anglers

## Acknowledgements

R. Crosson, J. Vanderfleet, K. Newtoff, S. Emslie, T. Bradshaw  
References: 1) Williams, L. K. 2006. Health effects of methylmercury and North Carolina's advice on eating fish. North Carolina Occupational and Environmental Epidemiology Branch, North Carolina Department of Health and Human Services. 2) Petre, S. J., D. K. Sackett, and D. D. Aday. 2012. Do national advisories serve local consumers: an assessment of mercury in economically important North Carolina fish. Journal of Environmental Monitoring.

