Sea Duck Joint Venture
Annual Project Summary for Endorsed Projects
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Diet of Surf Scoters Molting in Eastern North America (SDJV#92)

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Project Description: The diet of molting Surf Scoters has not been previously described, and there is no information on the contributions of diet vs. endogenous reserves to the overall energy budget of Surf Scoters during molt. Documenting the contributions that diet and nutrient reserves play in the energy budget will increase our understanding of the importance of local food sources as one of the factors responsible for habitat selection in Surf Scoters.

Objectives: The first objective of this study was to document the fatty acid composition and stable-isotope (carbon and nitrogen) signatures of various tissue of molting Surf Scoters (adipose, liver, breast muscle and feathers) and their potential prey items. The second objective was to assess the feasibility of using these data to delineate the origin (terrestrial vs. marine) of nutrient reserves upon arrival of Surf Scoters to molting areas. The final objective was to compare stable-isotope levels in growing feathers to levels in muscle tissue and prey items to evaluate the potential use of feathers for identifying affiliations with the molting area.

Preliminary Results*:*

Stable Isotopes--. Figure 1 shows the stable carbon and nitrogen signatures of breast muscle sampled from juvenile and adult Surf Scoters either early or late in the molt. The $\delta^{15}N$ did not change significantly over the course of the molt in either age class (data not shown) but the $\delta^{13}C$ was significantly enriched later in the molt for both juveniles and adults ($p<0.001$). Marine preys are typically enriched in $\delta^{13}C$ relative to terrestrial diets; thus, the results here are consistent with a shift from a terrestrial-based diet during inland breeding to a marine-based diet during the molt. The $\delta^{13}C$ did not differ between juveniles and adults at either stage of the molt. Figure 2 shows the stable isotope signatures from the base and tip of the first primary of juvenile and adult Surf Scoters sampled late in the molt. $\delta^{15}N$ did not differ between the base and tip of the feather in either age group. In both juveniles and adults, the $\delta^{13}C$ was significantly enriched in the base of the feather, which was synthesized later in the molt, relative to the tip of the feather ($p<0.001$). These results in the feather are consistent with that of the breast-tissue, indicating a shift in carbon source prior to the molt.

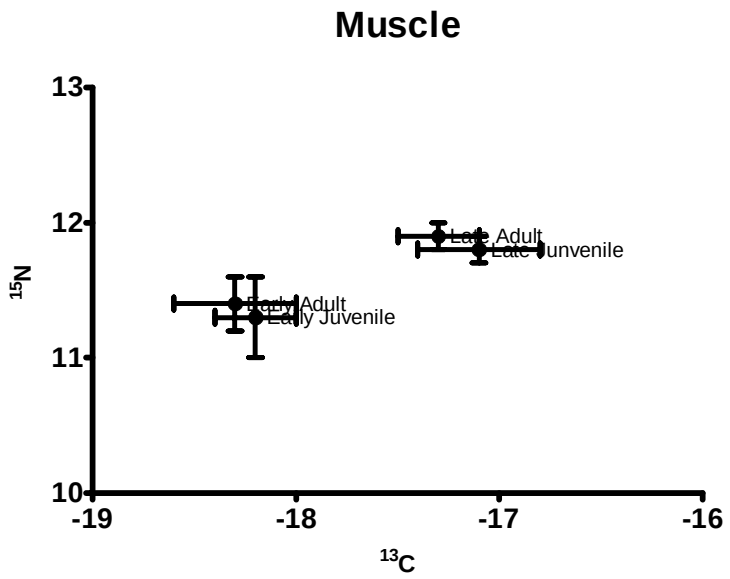

Figure 1: $\delta^{15}N$ and $\delta^{13}C$ values for adult and juvenile Surf Scoter breast muscle tissue.

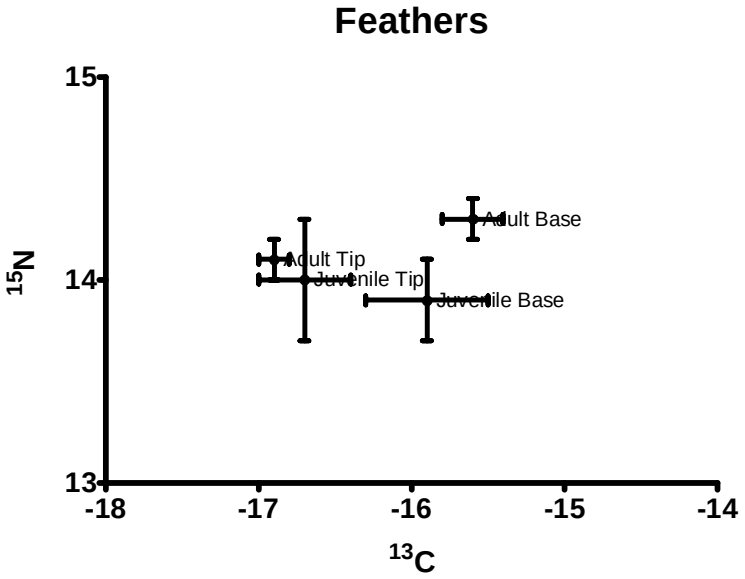

Figure 2: $\delta^{15}N$ and $\delta^{13}C$ values for base and tip of adult and juvenile Surf Scoter first primary.

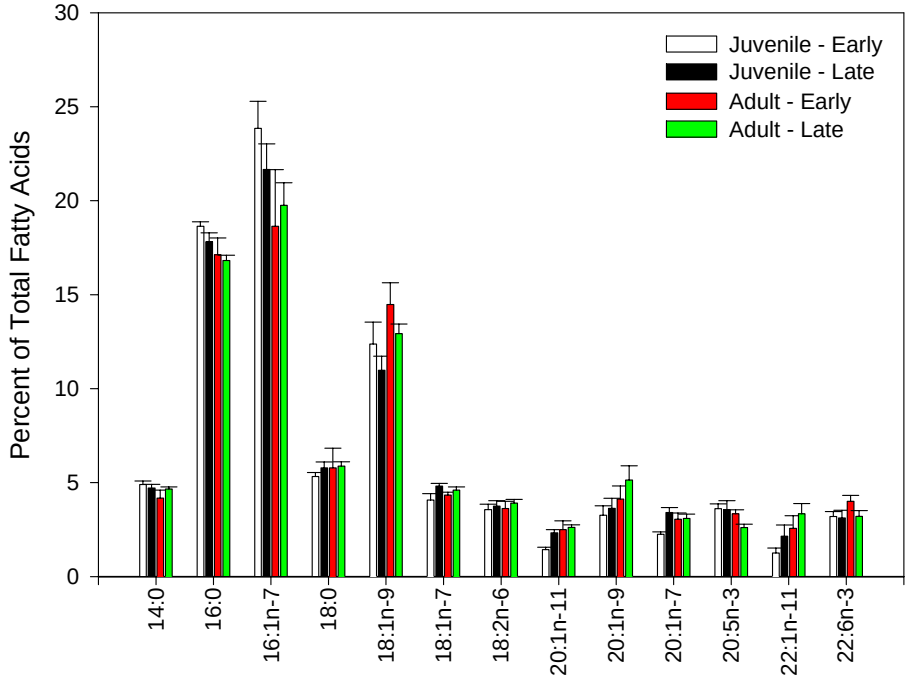

Figure 3. Fatty acid composition (mean ± S.E.) in adipose tissue of juvenile and adult surf scoters early and late in the molt.

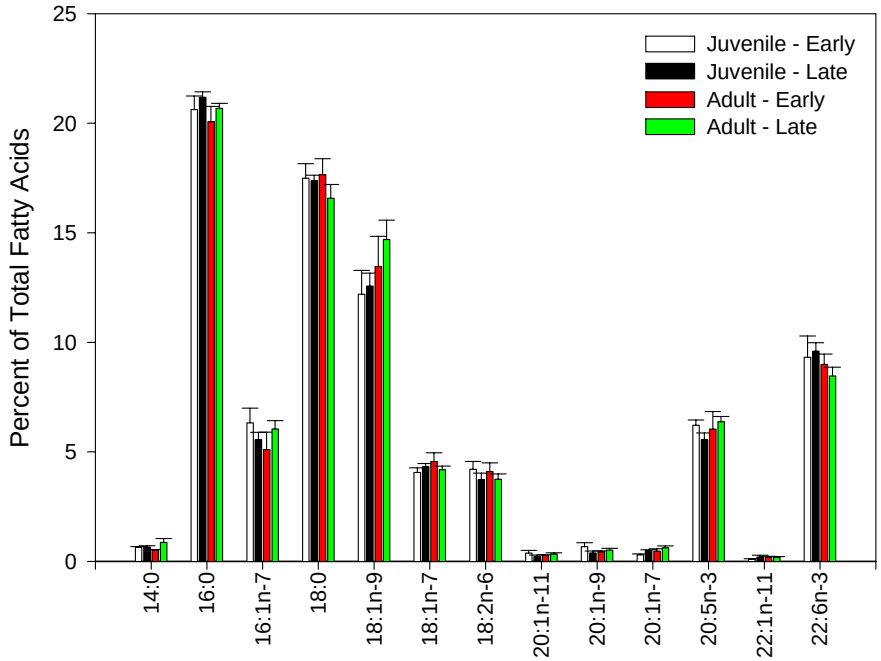

Figure 4. Fatty acid composition (mean ± S.E.) in liver tissue of juvenile and adult surf scoters early and late in the molt.

Fatty Acids--. Results of ANOSIM on Bray-Curtis similarity matrices generated from adipose and liver FA composition data did not show a significant differences between adult and juvenile surf scoters at either an early or late molt stage (Figs 3 and 4). Lipids of

adipose tissue are thought to reflect diet over a range of weeks to potentially months (Budge et al., 2006) while liver lipids turnover at a much faster rate and likely provide information about very recent diet, on the order of days to a week. The results here suggest a uniform diet in both age classes both prior to and during the molt, suggesting that both adults and juveniles forage on similar prey during this time. This further supports the stable isotope data and suggests that both age classes are foraging in similar niches before and during the molt. The clear difference in fatty acid composition between adipose and liver data likely occurs because of the time-frame each represents; the higher levels of marine fatty acids, such as 20:5n-3 and 22:6n-3, in the liver tissues clearly illustrates the shift from a terrestrial-based diet with a signal preserved in the adipose, to a marine based and more recent diet evident in the liver samples.

Project Status:

The FA composition of adipose and liver tissue, sampled from juvenile and adult male Surf Scoters over the molting period, have been analyzed. The $\delta^{15}N$ and $\delta^{13}C$ signatures of breast muscle, sampled over the period of the molt, and of the base and tip of the first primary, taken late in the molt, have been determined. Information from both data sets indicates that both age classes forage in similar areas prior to and during the molt. We had anticipated acquiring sufficient prey samples to compare chemical markers in potential prey to the ducks. Unfortunately, very few prey items were available, effectively preventing such comparisons at this time.

Literature Cited

Budge, S.M., S.J. Iverson and K.N. Koopman. 2006. Studying trophic ecology in marine ecosystems using fatty acids: A primer on analysis and interpretation. Marine Mammal Science 22: 759-801.