Elemental Distribution in the Mineral Layer of Atlantic Tarpon Scales

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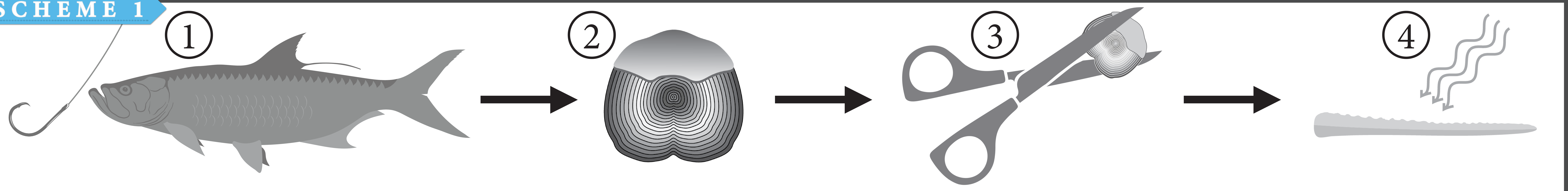
SCHEME 1



INTRODUCTION

Fish migration patterns, natal origins, and ontogeny can be inferred from the ear bone (otolith) chemistry of fish. However, otolith collection requires destructive sampling. Fish scales grow as two layers (mineralized and organic) in annual rings. The chemistry of those rings may also be used for ecological inferences over the lifespan of individual fishes but without destructive sampling like is required with otoliths (Fig. 1).

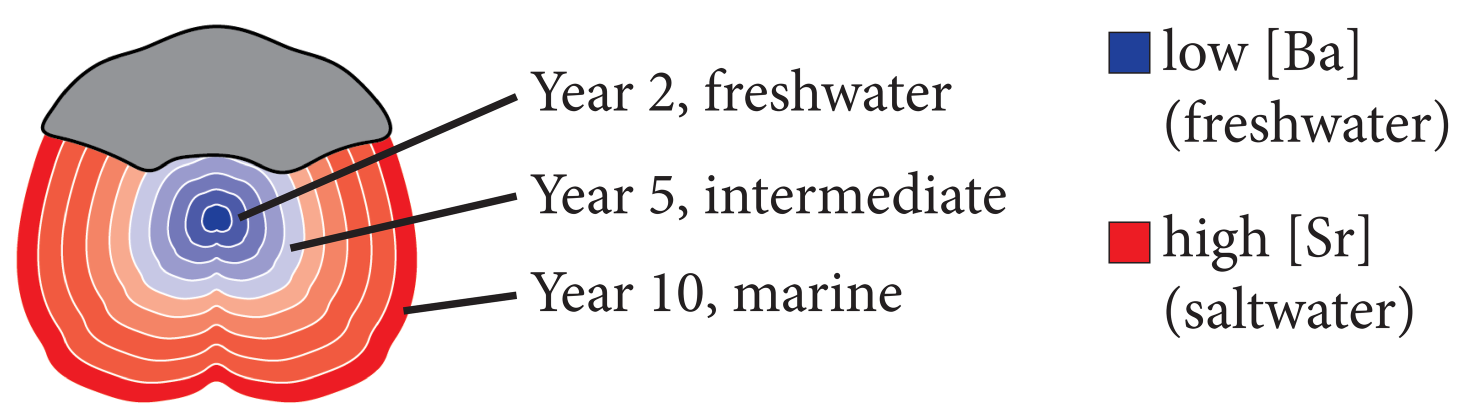


Figure 1. Scale chemistry and ring number are correlated to make inferences of habitat movement over the lifespan of the fish from which the scale was collected.

Laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS) is commonly used for collecting scale chemistry data. In using this technique it is assumed calcium and phosphorus are distributed homogenously throughout the calcified layer of fish scales, acting as an internal standard. This project aims to validate those assumptions by conducting energy dispersive X-ray linescans (EDS) on Atlantic tarpon scales (*Megalops atlanticus*) in a scanning electron microscope (SEM) perpendicular to the region scanned by LA-ICP-MS (Fig. 2).

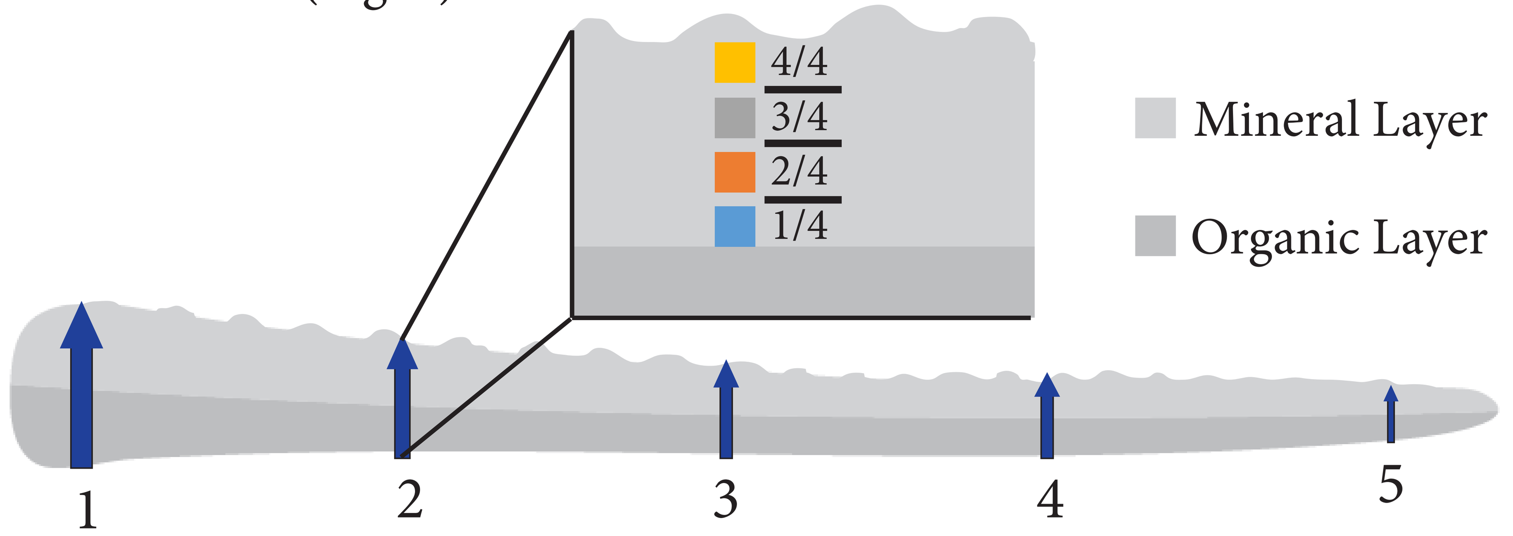


Figure 2. Cross-sectional view of fish scale. Blue arrows indicate direction of x-ray linescan conducted in this study to test for homogeneity. Mineral layer was subdivided into quarters to determine averages for comparison (Fig. 4).

METHODS

1. Atlantic tarpon were caught by local fisherman in the Port Aransas and Matagorda Bay regions (Fig. 3).
2. Scales collected from these tarpon were cleaned, air-dried, and shipped to NAU.
3. Scales (n = 8) were sectioned along their axis of symmetry with scissors and the resulting trans-section was polished with sandpaper to 2,000 grit.
4. Sections were mounted on aluminum scanning electron microscopy (SEM) stubs and sputter-coated with Au-Pd for 20 seconds before being placed in the SEM for EDS linescan analysis.

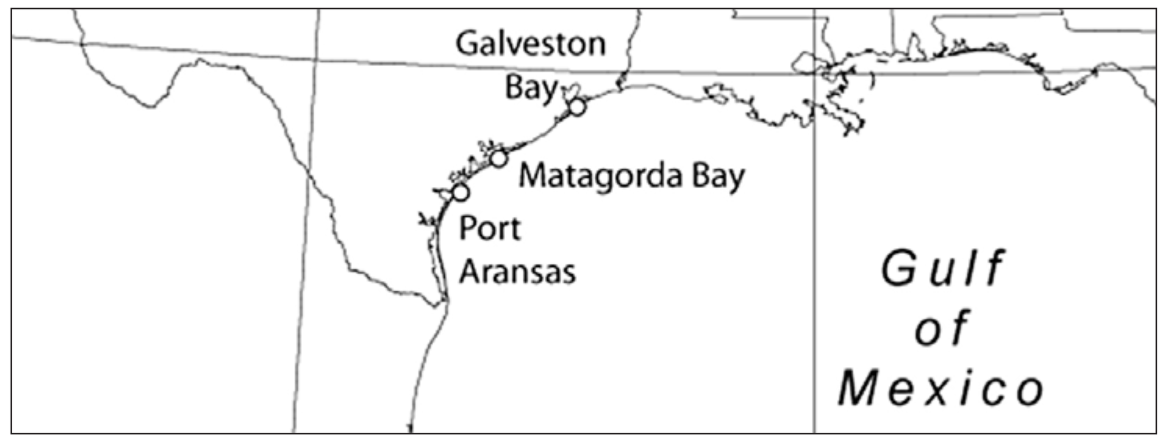


Figure 3. Scale collection region.

RESULTS and DISCUSSION

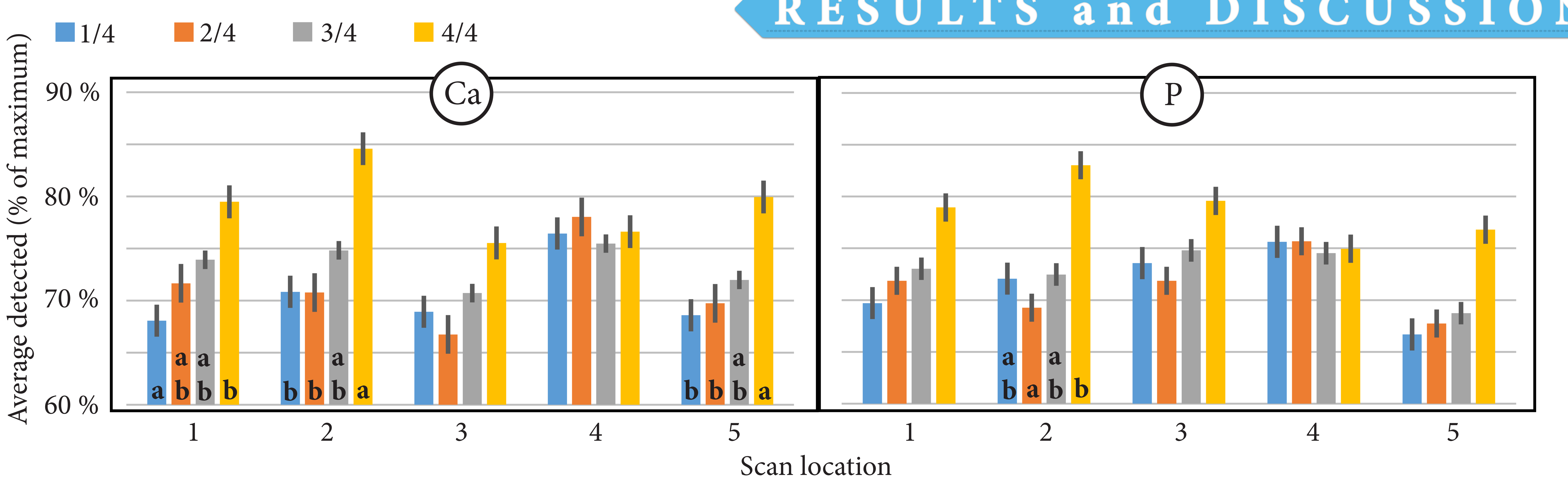


Figure 4. Distribution of Ca (left) and P (right) in the mineral layer (n = 8) across scan locations (Fig. 2). Overall, minerals increase toward the last quarter. The dependent axis shows the average value for each quarter normalized to the maximum detected. Significant differences exist between groups not sharing a letter as determined by a Tukey HSD test ($P < 0.05$). Error bars are +/- 1 standard error (SEM).

- No significant differences existed in the first three quarters of the mineral layer, thus these were the most homogeneous.
- Length-wise scans should be conducted along the center of the mineral layer.
- Conclusion: we did not find evidence to support the hypothesis that calcium and phosphorus are distributed homogenously throughout the entire calcified layer of fish scales.

ACKNOWLEDGEMENTS

We acknowledge the Henry Hooper Undergraduate Research Award (HURA) provided by Northern Arizona University for funding of this work.