G5 Determining a Postmortem Submersion Interval (PMSI) Based on Algal/Diatom Diversity on Decomposing Mammalian Carcasses in Brackish Ponds in Delaware

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The goal of this presentation is to share a new technique to utilize a much-neglected biological evidence (aquatic plants) to determine a postmortem submersion interval. The authors intend to demonstrate how algae and diatoms can be used in medicolegal investigations involving brackish or saline aquatic systems. The attendee will learn how to sample, photograph and identify algae and diatoms useful in forensic science.

Because very little is known on how bodies decompose in freshwater, brackish, and marine environments, and much less is known on how to determine a postmortem submersion interval (PMSI) (i.e., determine the time a body has been submerged in an aquatic environment until the point of discovery), this presentation will impact the forensic community and/or humanity by adding to a much neglected but growing database on decomposition in aquatic environments. The authors hope to provide the first analysis of mammalian decomposition in brackish ponds using botanical evidence to determine a PMSI. This approach has been used in freshwater systems but not in saline environments such as brackish ponds. It is hoped using this technique and type of plant evidence will shed new light in determining how long a body may have been submerged in these types of aquatic systems.

Algae and diatoms have been employed to estimate the location of drowning victims as well as link criminal suspects to specific aquatic crime scenes. However, little or no evidence exists on documenting algal colonization and succession on mammalian carcasses in brackish or marine environments. The purpose of this presentation is to document how saline environments influence not only the rate that pig carcasses decompose, but also characterize the algal/diatom community at each stage of decomposition in order to use species diversity and composition indices to estimate a PMSI. The objectives of this study include: 1) characterize the physical changes and rate of pig decomposition in saline aquatic systems; 2) compare algal diversity on pigs to a natural substrate such as ceramic tiles and; 3) determine if species richness or diversity differs among stages of decomposition. This study was conducted in two slightly brackish water (brackish is defined as salinity levels between 5-18% parts per thousand-ppt) ponds near Smyrna, Delaware. The stages of decomposition were identified and characterized by physical changes. The duration of each stage was estimated in degree days. Water temperature was recorded for the duration of each trial. Salinity measurements were determined using a refractometer. To examine algal diversity on pig carcasses vs. a natural substrate, samples were collected every 3 days (trial one) and every 2 days (trial two) for approximately 20 days. Algal samples were preserved in Lugoli solution and glacial acetic acid and stored in dark conditions until analysis. Algae and diatom species were identified using a light microscope and photographed with a Nikon Digital Camera. Species diversity and evenness among stages of decomposition were determined using Shannon and Simpson's diversity indices. The mean diversity indices for pig carcasses and ceramic tiles were compared using a t-test. Previous studies have revised or suggested that five (not six) stages of decomposition have been identified for mammalian carcasses in freshwater aquatic systems. Five stages are described in this study: Submerged Fresh, Early Floating, Advanced Floating Decay, Floating Remains, and Sunken Remains. Ponds in this study maintained a salinity value of 2-4 ppt. Accumulated degree days for trial one of this study was 893 degree days. Pigs began to float within three days, the duration of the Early Floating stage ranged from 3-9 days; Floating Decay stage ranged from 6-12 days; Advanced Floating Decay stage ranged from 9-21 days, and pigs sank within 15 – 24 days. The submerged fresh stage was characterized as the time the body initially entered the water until it floated to the water surface. Few physical changes were observed during this stage. The Early Floating stage was identified as when the pigs floated and began to bloat, forming indentations from the cage on their skin and with some algal growth. Little to significant disarticulation of limbs was observed on floating pig carcasses. The Advanced Floating Decay stage was characterized as much of the carcass having been removed, with the skull exposed and the loss of limb bones. The Sunken Remains stage was identified when the remains sank to the pond bottom with only bits of bones remaining. Algal diversity was significantly greater on pig carcasses than ceramic tiles. Diversity increased significantly as decomposition progressed until pig carcasses had reached the advanced floating decay stage. Mammalian carcasses will support algal/diatom communities and that these communities experience plant succession similar to terrestrial habitats. However, in terrestrial systems, plant succession/diversity increases over time; in aquatic systems, plant succession/diversity will increase and eventually decrease as the substrate (mammalian carcass) decomposes. This study shows how algal/diatom

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diversity and taxonomy can be used to determine the duration a submerged victim has been under water.

Brackish Ponds, Diatoms, Postmortem Submerged Interval

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