E57 Determining the Flow Rate Required to Move Submerged Human Remains

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After attending this presentation, attendees will understand some principles of how and under what conditions a deceased human body moves when submerged in a fluvial environment.

This presentation will impact the forensic science community by providing refined search and location strategies for investigations of bodies found in water. The results of this project can augment traditional means of investigation by improving references related to the orientation and velocity of a body on the bottom of a river. Understanding the movement of a body submerged in water can be useful for supporting or disputing witness statements and establishing a timeline of events in an investigation. Models and established patterns of the movement of human remains in water can be used to help determine either information on where a body entered the water once it has been recovered or to aid in searches for missing persons believed to be in the water. This will also be beneficial in stressing the importance of recording the position and orientation of a body found in a river as well as recording the river flow, which is often overlooked by investigators.

This research used two models with densities within the range of that of a healthy adult male: a 12” muslin figurine with water balloons and ¼” zinc nuts, and a 12” muslin figurine filled with silicone and copper rods. The models were submerged alternatively in a racetrack flume that had a one-centimeter layer of fine sand on the bottom and was filled with domestic tap water. Using a pygmy flow meter, the flume was set at a known speed and the model was added. Each model was submerged in four different orientations parallel to the flow of the water: face up with head upstream, face down with head upstream, face up with head downstream, and face down with head downstream. The time it took for the model to travel 100cm was recorded. Additional flow rates were used. The relationship between orientation, flow rate, density, and model velocity was analyzed. For the water balloon model, at the slowest flow rate, the face-up-with-head-downstream orientation moved almost four times faster than any other orientation. At the faster flow, the face-down-with-head-upstream orientation moved half as fast as the other three orientations. Faster flows decreased the significance of the orientation of the model and decreased the flume/model velocity ratio. The silicone model, which had a higher density, required faster flow to reach the same velocity as the water balloon model.

The controlled model was assessed using living human participants who are certified scuba divers. Each participant’s height and weight were measured and their density calculated. Each participant lay at the bottom of a river with a pony scuba tank and a dive belt for weight for 15 minutes. Involuntary forward movement and positional changes were observed and the flow of the river was measured with a Price AA flow meter. This was done in three rivers with various sediments on the riverbed.

Drowning, Investigation, Water

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