

## The Bender Board: A New Design for the Restraint and Measurement of Hellbenders

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The Eastern Hellbender (*Cryptobranchus alleganiensis alleganiensis*) is a large, aquatic salamander historically found throughout the eastern United States (Mayasich et al. 2003). Hellbender populations have experienced drastic declines in recent decades throughout their geographic distribution (Wheeler et al. 2003), which has created a critical need for widespread data collection of biological samples (e.g., blood or tissue samples for genetic analysis) and accurate growth data. However, acquiring biological samples and accurate morphological measurements of large salamanders in the field can be difficult.

Restraining and measuring hellbenders using existing restraint devices is problematic due to their large size, muscular body and tail, and the production of copious amounts of mucus (Wise and Buchanan 1992). To safely collect biological samples and obtain accurate measurements, it is necessary to restrain individuals to minimize handling time, stress, and the potential for injury to the animal and researchers. Traditional measuring techniques usually involve either restraining animals by hand or placing them on a standard fish measuring board (Herke 1977). However, measuring boards do not contain restraints to prevent individuals from struggling during measuring or blood and tissue collection which can increase the amount of handling time for more active individuals. Methods that have been developed to restrain and measure amphibians in the field include an anuran restraining device (Bourque 2007), a “mander masher” (Wise and Buchanan 1992), a modified clear plastic tube (Mathis 1991), and a PVC “salamander stick” (Walston and Mullin 2005). The anuran restraining device is designed specifically for a frog’s morphology and would not fit a large salamander, while the latter three devices do not provide adequate access to the salamander’s tail and stomach for sample collection. Squeezebox techniques have been utilized for handling venomous snakes (Quinn and Jones 1974), but to our knowledge few techniques have been specifically developed for restraining large salamanders. A technique which safely restrains individuals while allowing for consistent measurements can improve the accuracy and precision of morphological measurements in salamanders.

To resolve this issue, we have created the “bender board.” This device is a specialized squeezebox designed to prevent

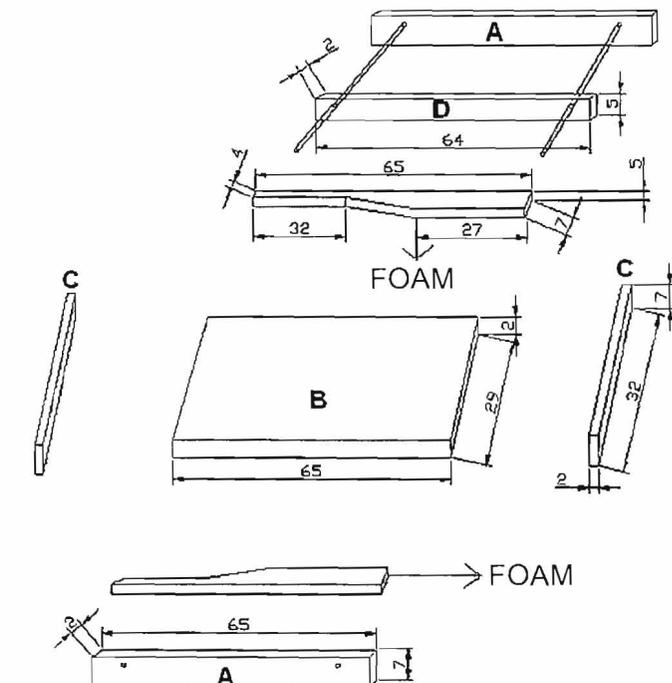


Fig. 1. Schematic of the components and construction of the bender board.

struggling by captured hellbenders and allow for quick, accurate measurements. The board is made from lightweight wood, wooden dowels, and polyfoam (Fig. 1). The box is assembled by nailing two 65 cm x 2 cm x 7 cm boards (A) to the long edge of a 65 cm x 2 cm x 29 cm baseboard (B). Next, two 32 cm x 2 cm x 7 cm boards (C) are nailed to the ends of the baseboard to create an open box. Four 1 cm holes are drilled 7.5 cm in and 1.5 cm down from each corner on the long edge of the box. Two additional holes are drilled 4.5 cm in and 1.5 cm down from two corners of a separate 64 cm x 2.5 cm x 5 cm board (D). The holes on the separate board should line up with the holes on the constructed box as this will form the sliding restrainer board. A firm, nonabrasive polyfoam is then glued to one inside edge of the box and one edge of the sliding board. The polyfoam should be cut to conform to directional placement of salamanders into the board to hold the tail in place. Small holes should be cut in the polyfoam to allow for insertion of the dowels in the following step. Finally, the restrainer board is connected to the box by 31.5 cm x 1 cm wooden dowels inserted through the holes across the



Fig. 2. Bender board shown holding an Eastern Hellbender.

board (Fig. 2). These dowels allow the animal to first be placed onto the board and then the restrainer board can be pressed against one side of the salamander. Large binder clips are placed behind the restrainer board on the dowels to hold it in place while in use. To use the bender board, the hellbender is placed onto the board with its head under the forward dowel, ventral or dorsal side up depending on the procedure and its legs are adhered laterally with tail and body straight by sliding the restrainer board closed and securing the binder clips. This allows for safe handling and measuring of total length and snout-vent length (SVL), drawing of blood, and marking individuals. This design is also ideal and efficient for use in the field when working alone. The approximate time to restrain hellbenders from the point of placement onto the board to securing the restraining board was under 10 seconds. Throughout the study 183 individuals ranging in size (SVL) from 26.2 cm to 38.3 cm were restrained using the board.

This design should increase the accuracy of measurements by eliminating the salamander's ability to struggle. The possibility of injury and stress are also reduced because researchers will not need to manually restrain individuals for longer than is necessary. The polyfoam padding creates a soft, non-abrasive cushion to securely restrain hellbenders without injury and it holds moisture which helps prevent desiccation and reduces the need to continually apply water during processing procedures. Although only tested on hellbenders, this design could easily be modified for use on other salamander species, particularly other large pedomorphic salamanders such as sirens (*Siren* spp.), amphiumas (*Amphiuma* spp.), and mudpuppies (*Necturus* spp.). Due to the polyfoam's ability to hold moisture, we recommend that researchers employ multiple boards as this would allow for adequate disinfection between sampling occasions and reduce the potential for disease transfer. This lightweight, relatively small "bender board" is portable, easy to use in the field, and can be modified to include carrying handles. Variations on the design could include replacing wooden materials with plastic to further decrease weight, improve durability, and increase the ease of cleaning. Although not illustrated, we recommend placing an additional nonabrasive restraint in the form of a small piece of plexiglass or similar material over the space between the anterior dowel to prevent individuals from sliding forward and under the dowel which could allow them to escape. The responsible use of this design could increase researcher sampling efficiency and measurement accuracy, while decreasing handling stress and the potential for injury. The use of the "bender board" also would reduce the need to anesthetize individuals using tricaine methane sulphonate (commercially available as MS-222) which has shown to produce adverse physiological effects and an alteration of behavior (Byram and Nickerson 2008; Fedewa and Lindell 2005).

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