

A. Scope

This method pertains to the collection of large river (nonwadeable) macroinvertebrate sampling for the calculation of the Large River macroinvertebrate Index of Biotic Integrity (LR-mIBI, Weigel and Dimick 2011). This SOP will cover:

- a. Specifications for the Hester-Dendy (HD) artificial substrate samplers
- b. Sample deployments
- c. Sample retrievals
- d. Macroinvertebrate sample preservation
- e. Safety
- f. LR-mIBI Calculation

B. Summary of Method

Hester-Dendy (HD) artificial substrate samplers were selected as collection devices because they are uniformly applicable in a wide variety of rivers, including habitats where other methods will not work. The samplers are deployed and allowed to colonize for a 6-week duration between June and September. Sampler construction and deployment were based upon Ohio EPA (1987) protocols.

Three HD samplers are fastened to a cinder block and deployed between June and September. HDs should be either set directly on rocky substrate or attached to a snag to maintain 0.75 to 1.5 m of water above the sampler at low flow. Placement directly on fine sediment should be avoided where muck or shifting sand will bury the block and samplers. Sampler placement should be consistent with the recommended minimum velocity of 0.3 ft/sec (Ohio EPA 1987).

After 6 weeks, retrieve the samplers minimizing disturbance that may dislodge the invertebrates as the samplers are lifted to the surface. Without delay, set the block on the boat deck or shore, then quickly cut the HDs from the block and place the HDs in a large plastic pan. Remove from the pan any remaining rope or zip tie material along with their attached macroinvertebrates. Macroinvertebrates attached to zip ties, rope, cinder block or any material that is not the HD sampler should not be included in the sample. Finally, disassemble the HDs, scrape off the organisms, combine the sample contents, preserve them in ethanol, and deliver to Aquatic Biomonitoring Lab (ABL) at UW-Stevens Point. The ABL has a slightly different identification procedure for LR-mIBI samples where 500 individuals are targeted and often contain more Chironomidae individuals that take more time to identify. Because of this LR-mIBI samples are approximately ~3 times the cost of a wadeable mIBI sample.

1. Standard QA/QC practices

Standard field QA/QC procedures may include duplicate samples from a particular site. This would require two deployments in a similar location for an identical period of time. CO staff will notify field staff if any duplicates are required for the Large River Macroinvertebrate baseline monitoring program. As part of Local Needs or Targeted Watershed Assessments field staff may include duplicate samples in their project on an as needed basis.

C. Safety

Safety precautions of a general nature should be recognized. Life jackets should be worn if sampling from a boat or in areas of swift current. Collecting samples in cold weather, especially around cold waterbodies, carries the risk of hypothermia and collecting samples in extremely hot and humid

weather carries the risk of dehydration and heat stroke. Staff must have appropriate CPR training according to the current Bureau wide safety policies.

Secondarily, more dangerous conditions may exist when sampling in nonwadeable rivers. Staff should be trained in boat safety and operation if using one to reach a sampling site. Although the fringes of nonwadeable rivers may be wadeable and appear safe, strong currents and wading hazards may exist. PFDs must be worn if wading in the fringes of nonwadeable rivers and extreme caution should be exercised.

D. Equipment

1) Deployment

- a. 3 Hester-Dendy samplers (http://www.hesterdendy.com/8_plate.htm)
 - i. 8 – 3 inch x 3 inch plates of 1/8 inch Masonite hardboard
 - ii. 1/8 inch gap on top 3 spaces
 - iii. 1/4 inch gap in the middle 3 spaces
 - iv. 13/8 inch gap in bottom space
- b. 40 lb cinder block
- c. 3/8 inch by 24 inch length zip ties
- d. Small float and rope twine for sample retrieval (optional)
- e. Plastic coated wire or rope to attach to tree or logs (optional)
- f. GPS, camera
- g. Data sheets
- h. Waders
- i. Gloves
- j. PFD

2) Retrieval

- a. Plastic pan(s)
- b. Plastic putty knife, stiff bristle brush
- c. Scissors, wire snips
- d. Squirt bottle
- e. Large bug jar
- f. 500 micron mesh screen
- g. Ethanol
- h. GPS, camera
- i. Data sheets
- j. Waders
- k. Gloves
- l. PFD



Figure 1. Three Hester-Dendy samplers attached to cinder blocks.

E. General Deployment Procedures

1. Secure the 3 – HD samplers to the 40 lb cinder block (Fig 1). This can be done in advance of the deployment day.
2. Set the HD samplers on rocky substrate or attached to a snag to maintain 0.75 to 1.5 meters of water above the sampler at low flow.
 - a. Avoid areas with fine sediment (silt or sand) when possible as shifting substrate can bury HD samplers.
3. Samplers should be placed where a minimum water velocity of 0.3 ft/sec (0.09 m/sec).
 - a. In practice this amounts to placing the HD sampler in an area with some flow, i.e. not backwaters.
4. After placing the HD samplers attach optional retrieval gear such as floats, wire attached to logs/trees and/or flagging.
5. Take a GPS reading at deployment location and record all pertinent information on data sheets. Take pictures and/or draw maps of the deployment locations.

F. General Retrieval Procedures

1. Locate the HD deployment location using GPS coordinates, hand drawn maps or by locating flagging/floats. Approach the site from downstream until you locate the exact HD location.
2. Trying to minimize as much disturbance as possible as not to dislodge invertebrates lift the HD samplers to the surface.
3. Quickly set the HD samplers on a stable surface and cut the HD samplers free from the cinder blocks and place them in a large plastic pan.
4. Remove any remaining materials used to attach the HD samplers such as zip ties, twine or rope. Macroinvertebrates attached to these should not be included in the final sample.
5. Disassemble the HD samplers in the plastic pan.
6. Using a plastic putty knife, brush and/or squirt bottle remove all invertebrates and debris from the HD plates.
 - a. Small invertebrates may be living in small cases of mud so be sure to remove all debris from plates.
7. Pour the invertebrate/debris/water slurry through a 500 micron mesh (d-frame net or sieve bucket) to remove excess water and silt.
8. Transfer invertebrate and debris into a large, cleaned macroinvertebrate jar.
9. Preserve sample with 70% ethanol on site. Samples should be drained and re-preserved with 70% ethanol 1-2 days after collection to maintain appropriate preservation concentration.
10. Samples should be delivered to UW Stevens Point ABL in the late fall-early winter of the year the sample was collected.
11. The ABL will enter macroinvertebrate data into SWIMS and LR-mIBI will be automatically calculated.
 - a. As the LR-mIBI calculator is fairly new in SWIMS staff should be sure correct mIBI is calculated when evaluating the data.

G. Documentation

All data collection information should be tracked in the project in SWIMS and on the Non-wadeable Macroinvertebrate Field Data Report (3200-136), which can be found in the lab slip generator. Lab slips should be turned in to the UW-ABL along with the macroinvertebrate sample. Staff should scan or make photocopies of the macroinvertebrate lab slip for their own records. The UW Stevens Point will enter bug data into SWIMS where the LR-mIBI and component metrics will be calculated and stored. For the Large River Macroinvertebrate project site lists are stored on the Monitoring Activity Sheets (<http://intranet.dnr.state.wi.us/int/water/monitoring/regionalaccountability.htm>). Staff should record when samples are deployed and retrieved on the Monitoring Activity Sheets.

H. LR-mIBI Calculation

All individuals are identified by the UW Stevens Point ABL to the lowest practical level, usually species. The data are entered into the DNR BugProgram and migrated into SWIMS where the LR-mIBI and component metrics are calculated. The LR-mIBI is based upon 10 macroinvertebrate metrics that represent the assemblage structure, composition and function (Table 1). Qualitative ratings are assigned at 20-point increments where <20=Very Poor, 20-39=Poor, 40-59=Fair, 60-79=Good, and 80-100=Excellent.

Table 1. Taken from Table 3, Weigel and Dimick (2011)). Final IBI metrics and scoring criteria (suffix T=taxa, I=individuals).

Metric	Scoring criteria and rating (points)		
	Poor (0)	Fair (5)	Good (10)
Insect-T	0–21	22–31	>31
Insect-%I	0–89%	90–95%	>95%
EPT-T	0–6	7–15	>15
Dom ₃ -%I	>66%	41–66%	0–40%
MPTV	>6.440	5.875–6.440	0.000–5.875
IntolEPT ₂ -%I	0%	0.1–3%	>3%
TolChir ₈ -%I	>16.0%	2.5–16.0%	0.0–2.4%
EcoFTN	0–8	9–12	>12
Gath-%I	>54%	16–54%	0–15%
Scr-%I	0.0%	0.1–7.4%	>7.4%

I. References

Ohio EPA (Ohio Environmental Protection Agency). 1987. Biological criteria for the protection of aquatic life. Volume II: users manual for biological field assessment of Ohio surface waters. Ohio Environmental Protection Agency, Columbus, Ohio. (Available from: <http://www.epa.state.oh.us/dsw/bioassess/BioCriteriaProtAqLife.aspx>).

Weigel, B.M., and J.J. Dimick. 2011. Development, validation, and application of a macroinvertebrate-based index of biotic integrity for nonwadeable rivers of Wisconsin. *Journal of the North American Benthological Society*. 30:665-679.

K. DIY Hester-Dendy Sampler Construction

Each HD sampling costs ~\$13 a piece if purchased from http://www.hesterdendy.com/8_plate.htm. HDs can be made in house with minimal equipment using the following specifications. Each sampler consisted of a 4 inch eyebolt with a wingnut that held eight 7.6 × 7.6-cm (3 inch x 3 inch) plates made of 3.2-mm-thick (1/8 inch) masonite hardboard. Spacing between the plates was 3.2 mm (1/8 inch) between each of the first 3 plates, 6.4 mm (1/4 inch) between each of the next 3 plates, and 9.6 mm (3/8 inch) between the last 2 plates.

I have used washers to acquire the appropriate spacing between the hardboard plates, but since washer thickness varies among washers it can be time consuming to get accurate spacing. Others have used ½" square hardboard material for spacers, whereas others use bushings made of biologically inert plastic. Stainless steel hardware does not rust so it is easy to disassemble and reusable. HD samplers are available from several vendors, or you can make them yourself. I estimate one 4' x 8' hardboard sheet, after subtracting for all of the 1/8" saw cuts, yields 56 samplers. Three HD samplers constitute one sampling unit (i.e., for each site, 3 samplers are deployed and the inverts collected from those samplers are combined).

J. SOP updates tracking

Version #	Date	Sections	Name	Approval
1.0	June 2011	All	Weigel	
2.0	03/26/2015	All	Shupryt	Shupryt, 2015

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