

Appendix C: Habitat Analysis

HABITAT ANALYSIS

Both the quality and quantity of available habitat affects the macroinvertebrate community. A healthy biological community not only requires good water quality, but also a supporting habitat. The effect of habitat can be minimized by sampling in areas where habitats are similar. This way, impacts to the biological community can be attributed to water quality.

When sampling station habitats are not comparable, it is important to consider the differences when interpreting the bio-survey results.

Beginning with the 1993 study, each sampling station's habitat has been rated. There are two types of rating systems. One is for a riffle/run prevalent stream, like most of the streams in Monroe County. The other is for glide/pool prevalence. Only a few stations in this study were rated using the latter system. The rating system incorporates three categories for a total of twelve parameters. The following is an explanation of the habitat parameters:

Habitat Parameter Descriptions

RIFFLE/RUN COMMUNITY

Substrate/Instream Cover

1. **Instream Cover:**

This is a measure of quantity and variety of natural structures in the stream that will provide a habitat for fish. This would include fallen trees, logs, and branches, undercut banks and large rocks. A wide variety of substrate will support greater diversity.

2. **Substrate for Benthic Macroinvertebrates:**

This measures the amount of hard substrate available for insects and snail habitat. Many insect larvae attach themselves to submerged substrate. Areas with rocky bottoms are critical for maintaining a healthy variety of insects.

3. **Embeddedness:**

This refers to the degree to which rocks are covered or sunken into the silt, sand or mud. As substrate becomes embedded in the stream bottom, the amount of surface space for insects to attach themselves decreases. As substrate becomes embedded, the quantity and quality of the macroinvertebrate community will decrease.

4. **Velocity/Depth Regime:**

There are four basic velocity/depth combinations:

- (1) Slow-deep
- (2) Slow-shallow
- (3) Fast-deep
- (4) Fast-shallow

General guidelines are as follows: 0.5m separates deep from shallow: 0.3m/s separates fast from slow. Streams that contain all four regimes are considered optimal.

Channel Morphology (form and structure)

5. **Channel Alteration:**

This parameter is a measure of changes to the shape of the stream channel. Streams that run through agricultural or urban areas may have been altered many times. When streams have been changed in any way (i.e., straightened, deepened, diverted, concrete channelized, artificial embankments or stabilization, dams or bridges) it can affect the macroinvertebrate community. Streams that have been altered have fewer natural habitats for fish, macroinvertebrates and plants.

6. **Sediment Deposition:**

This parameter measures the sediment, which has accumulated on the stream bottom as a result of deposition. Deposition occurs as a result of large-scale movement of sediment caused by watershed erosion. This deposition may cause the formation of islands or point bars in the stream, which decreases the available habitat for macroinvertebrates.

7. **Frequency of Riffles:**

This parameter assumes that a stream with riffles or bends provides more diverse habitat than any straight or uniform depth stream. The ratio is calculated by dividing the average distance between riffles or bends by the average depth. The smaller ratio is an indicator of good habitat.

8. **Channel Flow Status:**

This is a measure of the degree to which the channel is filled with water. When the water reaches the base of both banks and a minimal amount of channel substrate is exposed, optimal conditions exist.

Riparian and Bank Structures

9. **Condition of Banks:**

This parameter addresses stream bank erosion (or potential for erosion). Steep banks are generally more subject to erosion and failure. Signs of erosion include crumbling and unvegetated banks and exposed tree roots and soil.

10. **Bank Vegetative Protection:**

This measures the amount of stream bank, which is covered by vegetation. Plant root systems on stream banks help to hold the soil in place. This reduces the stream bank erosion. This parameter also provides information such as stream shading and nutrient uptake. Banks with full natural plant growth are better for macroinvertebrates and fish.

11. **Grazing Disruptive Pressure:**

This parameter measures the impact to the riparian zone due to livestock grazing or human activities such as urbanization, golf courses and residential development.

12. **Riparian Zone Width:**

This is a measure of the width of the natural vegetation from the edge of the stream bank. This zone serves as a buffer to pollutants entering the stream from run off and erosion. It also provides nutrients to the stream. An undisturbed riparian zone is reflective of a healthy stream, while a narrow riparian zone is not as healthy for a stream. Roads, parking lots, fields, lawns, rocks, bare soil or buildings near a stream bank have a detrimental effect on habitat.

GLIDE/POOL COMMUNITY

Substrate/Instream Cover

1. **Instream cover:**

This is a measure of quantity and variety of natural structures of the stream that provides a habitat for fish. This would include fallen trees, logs and branches, undercut banks, and large rocks. A wide variety of substrate will support greater diversity.

2. **Substrate for Macroinvertebrates:**

The substrate in muddy bottom streams consists mostly of submerged logs, snags and aquatic vegetation.

3. **Pool Substrate Composition:**

This is an evaluation of the type and condition of bottom substrates found in pools. Firm sediment types such as gravel and sand as well as rooted aquatic plants support a wider variety of organisms. A pool substrate dominated by mud or bedrock will not support a diverse community. A variety of substrate is needed for a diverse community.

4. **Pool Variability:**

This parameter rates the overall mixture of pool types found in the streams. The four basic types of pools are:

- (1) Large-shallow
- (2) Large-deep
- (3) Small-shallow
- (4) Small-deep

General guidelines are as follows: greater than one half the cross-section to separate large from small and one meter separating shallow and deep.

Channel Morphology (form and structure)

5. **Channel Alteration:**

This parameter is a measure of changes to the shape of the stream channel. Streams that run through agricultural or urban areas may have been altered many times. When streams have been changed in any way (i.e., straightened, deepened, diverted, concrete channelized, artificial embankments or stabilization, dams or bridges) it can affect the macroinvertebrate community. Streams that have been altered have fewer natural habitats for fish, macroinvertebrates and plants.

6. **Sediment Deposition:**

This parameter measures the sediment, which has accumulated on the bottom as a result of deposition. Deposition occurs as a result of large-scale movement of sediment caused by watershed erosion. This deposition may cause the formation of islands or point bars in the stream, which decreases the available habitat for macroinvertebrates.

7. **Channel Sinuosity:**

This is an evaluation of the frequency of bends in a stream. Streams that meander provide a variety of habitat for macroinvertebrates. Straight stream segments provide for monotonous habitats and are prone to flooding. The bends in the stream also protect the banks from erosion.

8. **Channel Flow Status:**

This is a determination of the percent of the channel that is filled with water. The flow status changes as the channel enlarges or as flow is decreased as a result of dams or obstructions, diversions for irrigation, or drought. When water does not cover as much of the streambed the available habitat is decreased.

Riparian and Bank Structure

9. **Condition of Bank:**

Refer to riffle/run definition.

10. **Bank Vegetative Protection:**

Refer to riffle/run definition.

11. **Grazing Disruptive Pressure:**

Refer to riffle/run definition.

12. **Riparian Vegetative Zone Width:**

Refer to riffle/run definition.

Each sampling station's habitat is rated using the previously discussed parameters. Each parameter is scored from 0-20 as follows:

<u>Score</u>	<u>Category</u>
0-5	Poor
6-10	Marginal
11-15	Suboptimal
16-20	Optimal

Each parameter is added for a final habitat score for a particular station.

<u>Score</u>	<u>Category</u>
0-71	Poor
72-131	Marginal
132-191	Suboptimal
192-240	Optimal

The habitat is a major factor in determining the potential of the aquatic community. A marginal or poor habitat is not expected to support the quantity and quality of macroinvertebrates that an optimal habitat will.

Similar streams may have differing aquatic communities due to differing habitat. The effect of habitat can be minimized by sampling in areas where habitats are similar. In these areas, the impacts on the aquatic community can be attributed to water quality.

HABITAT RESULTS

<u>Site Number</u>	<u>Score</u>	<u>Category</u>	<u>Influences</u>
PARACR03	201	Optimal	Well developed riffle and run. Gravel, cobble and boulder particles are 25-50% surrounded by fine sediment. Riparian vegetation width impacted due to highway.
BUTZRU01	158	Suboptimal	Unstable banks, raw areas frequent. Moderate deposition of new gravel. Only 2 of the 4 velocity/depth regimes present.
CRCRPA01	182	Suboptimal	Occurrence of riffles relatively frequent. Streambank moderately stable.
DEHOCR04	173	Suboptimal	Gravel, cobble and boulder particles are 25-50% surrounded by fine sediment. 70-90% of streambank surface covered by vegetation. Width of riparian zone 6 - 12 meters.
PARACR04	163	Suboptimal	Occurrence of riffles relatively frequent. Water fills > 75% of the available channel. Width of riparian zone 6 - 12 meters.
INDIRU01	212	Optimal	Greater than 50% mix of boulder, cobble, or other stable habitat. Well developed riffle and run. Streambank moderately stable.
FOHIRU01	181	Suboptimal	Some channelized areas present, new island bar formation. 70 – 90% of streambank surfaces vegetated. Width of riparian zone 6 - 12 meters.
SWIFCR06	203	Optimal	Streambank stable with small areas of erosion. Occurrence of riffles relatively frequent. Water reaches base of both lower banks.
SWIFCR02	154	Suboptimal	Streambanks unstable, frequent raw areas. Width of riparian zone 6 - 12 meters. 50 – 70% of streambank surfaces vegetated.

<u>Site Number</u>	<u>Score</u>	<u>Category</u>	<u>Influences</u>
PARACR01	169	Suboptimal	30-50% mix of boulder, cobble, or other stable habitat. Streambank moderately stable with small areas of erosion. Width of riparian zone 12 - 18 meters. Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.
FOHIRU09	181	Suboptimal	Streambank moderately stable with small areas of erosion. Width of riparian zone 12 - 18 meters.
FOHIRU06	182	Suboptimal	Well developed riffle and run. Grazing or other disruptive pressure evident but not affecting full plant growth potential to any great extent. Width of riparian zone < 6 meters.
POCOCR18	185	Suboptimal	Streambank moderately stable with small areas of erosion. 70 - 90% of the streambank surfaces covered by vegetation. Water reaches both lower banks with minimal amount of substrate exposed.
SCOTCR04	156	Suboptimal	Moderate deposition of coarse sand. 70 - 90% of the streambank surfaces covered by vegetation. Width of riparian zone 6-12 meters.
POCOCR15	188	Suboptimal	Greater than 50% mix of boulder, cobble, submerged logs or other stable habitat. Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment. Width of riparian zone 6-12 meters.
SWIFCR07	195	Optimal	Greater than 50% mix of boulder, cobble, and submerged logs. All four velocity/depth regimes present. Streambank moderately unstable with up to 60% of banks have erosion.
SWIFCR05	196	Suboptimal	Moderately stable banks, small areas of erosion. All four velocity/depth regimes present.

<u>Site Number</u>	<u>Score</u>	<u>Category</u>	<u>Influences</u>
SWIFCR03	195	Optimal	Moderately stable banks or other habitat. Occurrence of riffles relatively frequent. Width of riparian zone < 6 meters.
POCOCR20	209	Optimal	Occurrence of riffles relatively frequent. Excellent mix of boulder, cobble, submerged logs, undercut banks or other stable habitat. Width of riparian zone >18 meters.
POCOCR16	185	Suboptimal	Some channelization present with an increase in bar formation. Width of riparian zone < 6 meters.
POCOCR17	174	Suboptimal	New increase in bar formation. Streambank stable. Vegetative disruption evident. Width of riparian zone <6 meters.
PINEMTRU01	210	Optimal	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. More than 90% of the streambank surfaces covered with vegetation. Width of riparian zone 12-18 meters.
MIDDBR01	198	Optimal	More than 90% of the streambank surfaces covered with vegetation. Width of riparian zone 6-12 meters.
BRODCR01	194	Optimal	Evidence of past channelization and gravel bar creation. Excellent mix of boulder, cobble, submerged logs, undercut banks or other stable habitat. Width of riparian zone 6 - 12 meters.
REDRU03	152	Suboptimal	Width of riparian zone >18 meters. Banks stable, more than 90% of streambank surfaces covered by vegetation.
HAWKRU01	162	Suboptimal	Gravel, cobble, and boulder particles are 25 – 50% surrounded by fine sediment. Occurrence of riffles infrequent. Width of riparian zone <6 meters. Evidence of past channelization and vegetation disruption present.

<u>Site Number</u>	<u>Score</u>	<u>Category</u>	<u>Influences</u>
TUNKCR07	177	Suboptimal	Glide/Pool prevalence Streambank stable. More then 90% of the surfaces covered by vegetation. Width of riparian zone 6-12 meters.
TOBYCR14	186	Suboptimal	Streambank stable, 90% vegetated surfaces. Evidence of past channelization present. Width of riparian zone 12 – 18 meters.
TUNKCR03	208	Optimal	All four of the velocity/depth regimes present. Greater than 50% mix of boulder, cobble, undercut banks, or other stable habitat. 90% of streambank surfaces covered by vegetation.
JONASCR01	195	Optimal	Well developed riffle and run. Streambank stable, vegetative disruption evident due to mowing. Width of riparian zone <6 meters.
SHAWCR05	196	Optimal	Greater than 50% mix of boulder, cobble, or other stable habitat. Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediments. Width of riparian zone <6 meters due to residential structure.
MARSCR08	192	Optimal	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediments. Streambank moderately stable. Width of riparian zone 6 - 12 meters.
MARSCR09	193	Optimal	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediments. Width of riparian zone <6 meters. Streambank stable, vegetative disruption evident due to mowing.
BRODCR14	196	Optimal	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediments. All 4 velocity/depth regimes present. Width of riparian zone 6 -12 meters.
BRODCR15	164	Suboptimal	Some new increase in bar formation. Width of riparian zone 6 -12 meters. (D/S) Left bank armored, right bank very unstable, many raw areas

<u>Site Number</u>	<u>Score</u>	<u>Category</u>	<u>Influences</u>
POCOCR14	192	Optimal	Some new increase in bar formation. Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.
MCMICR21	174	Suboptimal	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment. Width of riparian zone 6-12 meters. <25% of channel substrate is exposed.
POHOCR08	164	Suboptimal	Width of riparian zone <6 meters. Occurrence of riffles infrequent. Disruption of streambank vegetation obvious. Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.
WEIRCR02	178	Suboptimal	Only 3 of the 4 velocity/depth regimes present. Gravel, cobble, and boulders particles are 25-50% surrounded by fine sediment. 90% of the streambank surfaces covered by vegetation; Width of riparian zone <6 meters.
POHOCR06	212	Optimal	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediments. Banks stable, 90% of the streambank surfaces covered by vegetation.
BUCKCR01	168	Suboptimal	Some new increase in bar formation. Width of riparian zone 6-12 meters. Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediments.
AQUACR09	204	Optimal	Greater than 50% mix of boulder, cobble, undercut banks, or other stable habitat. Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediments. Width of riparian zone 12 -18 meters.
AQUACR10	192	Optimal	All 4 velocity/depth regimes present. Vegetative disruption cropped to less than one-half of potential plant stubble height. Width of riparian zone <6 meters.
BRODCR12	190	Suboptimal	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediments. Width of riparian zone 6 - 12 meters.

<u>Site Number</u>	<u>Score</u>	<u>Category</u>	<u>Influences</u>
CRCRST02	168	Suboptimal	Only 3 of the 4 velocity/depth regimes present. Width of riparian zone 6-12 meters. Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediments.
BUSHCR07	216	Optimal	Occurrence of riffles relatively frequent. Width of riparian zone >18 meters. Some new increase in bar formation. Streambanks stable, 90% covered by vegetation.
BRODCR13	151	Suboptimal	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediments. Riffle not as wide as stream and length is less than 2 times stream width. Some new increase in bar formation.
CHERCR11	189	Suboptimal	Gravel, cobble, and boulder particles are 0 -25% surrounded by fine sediments. Well developed riffle and run. All 4 velocity/depth regimes present
MCMICR30	177	Suboptimal	Width of riparian zone 6-12 meters. 30 - 50% mix of boulder, cobble, or other stable habitat. Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediments.
LEHIRI01	209	Optimal	Width of riparian zone 12-18 meters. 90% of streambank covered by vegetation. All four velocity/depth regimes present.
LEHIRI02	183	Suboptimal	All four velocity/depth regimes present. Some new increase in bar formation. Width of riparian zone 6-12 meters.
TOBYCR01	182	Suboptimal	Well developed riffle and run. 90% of streambank covered by vegetation. Width of riparian zone 6-12 meters.