

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>
0-60	Poor
72-120	Marginal
132-180	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	192	Optimal	Well developed riffle and run. All four velocity/depth regimes present. Riparian vegetation width impacted due to highway. Streambanks moderately stable.
BUTZRU01	150	Suboptimal	Unstable banks, apparent landslide. Moderate deposition of new gravel. Only 2 of the 4 velocity/depth regimes present.
CRCRPA01	185	Suboptimal- Optimal	Only 3 of the 4 velocity/depth regimes present. Streambank moderately stable.
DEHOCR04	176	Suboptimal	Gravel, cobble and boulder particles are 25-50% surrounded by fine sediment. Only 3 of the 4 velocity/depth regimes present. Width of riparian zone 6 - 12 meters.
PARACR04	191	Optimal	Occurrence of riffles relatively frequent. Water reaches both lower banks with minimal amount of channel substrate exposed. Width of riparian zone 6 - 12 meters.
INDIRU01	200	Optimal	Greater than 50% mix of boulder, cobble, or other stable habitat. Well developed riffle and run. Only 3 of the 4 velocity/depth regimes present. Width of riparian zone > 18 meters.
FOHIRU01	168	Suboptimal	Some channelized areas present, new island bar formation. 70 – 90% of streambank surfaces vegetated. Condition of banks moderately stable.

<u>Site Number</u>	<u>Score</u>	<u>Category</u>	<u>Influences</u>
SWIFCR06	195	Optimal	Greater than 50% mix of boulder, cobble, submerged logs or other stable habitat. Occurrence of riffles relatively frequent. Width of riparian zone 12 - 18 meters.
SWIFCR02	170	Suboptimal	Streambanks moderately unstable, new embankments. Width of riparian zone 6 - 12 meters.
PARACR01	179	Suboptimal	Greater than 50% mix of boulder, cobble, submerged logs or other stable habitat. Streambank stable with small areas of erosion. Width of riparian zone 12 - 18 meters.
FOHIRU09	173	Suboptimal	Streambank moderately stable with small areas of erosion. Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment. Only 3 of the 4 velocity/depth regimes present.
FOHIRU06	173	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.
LEHIRI01	215	Optimal	Greater than 50% mix of boulder, cobble, submerged logs or other stable habitat. Well developed riffle and run. All four velocity/depth regimes present. Water reaches base of both lower banks.
LEHIRI02	185	Suboptimal-Optimal	All four velocity/depth regimes present. Little or no enlargement of islands or point bars. Water reaches base of both lower banks.
TOBYCR01	192	Optimal	Well developed riffle and run. 90% of streambank covered by vegetation. Banks stable; no evidence of erosion or bank failure. Width of riparian zone 12 - 18 meters.

<u>Site Number</u>	<u>Score</u>	<u>Category</u>	<u>Influences</u>
SWIFCR07	192	Optimal	Greater than 50% mix of boulder, cobble, submerged logs or other stable habitat. All four velocity/depth regimes present. Vegetative disruption minimal; riparian zone >18 meters.
SWIFCR05	188	Suboptimal- Optimal	Occurrence of riffles relatively frequent All four velocity/depth regimes present. Width of riparian zone 12-18 meters.
SWIFCR03	183	Suboptimal- Optimal	Excellent mix of boulder, cobble, submerged logs, undercut banks or other stable habitat. Disruption of streambank vegetation is obvious. Width of riparian zone < 6 meters.
CRCRPA03	193	Optimal	Occurrence of riffles relatively frequent. Riparian zone >18 meters with minimal vegetation disruption. No channelization or dredging present.
DRSARU01	199	Optimal	Greater than 50% mix of boulder, cobble, submerged logs or other stable habitat. Occurrence of riffles relatively frequent. Width of riparian zone >18 meters.
POCOCR20	199	Optimal	Occurrence of riffles relatively frequent. < 25% of channel substrate exposed. Width of riparian zone >18 meters.
POCOCR16	151	Suboptimal	New embankments present on both banks and 40- 80% of stream reach channelized and disrupted. Width of riparian zone 6 - 12 meters.
POCOCR17	177	Suboptimal	New increase in bar formation. < 25% of channel substrate exposed. Gravel, cobble, and boulder particles are 25 – 50% surrounded by fine sediment. Width of riparian zone 6 – 12meters.
POCOCR19	144	Suboptimal	Some new increase in bar formation. Only 3 of the 4 velocity/depth regimes present.50 - 70% of the streambank surfaces covered by vegetation. Width of riparian zone <6 meters.

<u>Site Number</u>	<u>Score</u>	<u>Category</u>	<u>Influences</u>
SCOTCR04	150	Suboptimal	Water reaches both lower banks with minimal amount of substrate exposed. 70 - 90% of the streambank surfaces covered by vegetation. Width of riparian zone 12 - 18 meters.
POCOCR15	170	Suboptimal	Greater than 50% mix of boulder, cobble, submerged logs or other stable habitat. Gravel, cobble, and boulder particles are 0–25% surrounded by fine sediment.
POCOCR18	175	Suboptimal	Streambank moderately stable with small areas of erosion. 70 - 90% of the streambank surfaces covered by vegetation.
POCOCR22	187	Suboptimal- Optimal	Well developed riffle and run. Width of riparian zone > 18 meters.
POCOCR14	158	Suboptimal	30 - 50% mix of boulder, cobble, or other stable habitat. Water fills 25 – 75% of available channel. Width of riparian zone 12 - 18 meters.
MCMICR21	134	Suboptimal	New embankments present on both banks; 40 to 80% of stream reach channelized and disrupted. Gravel, cobble, and boulder particles are 50 – 75% surrounded by fine sediment.
REDRU03	166	Suboptimal	Glide/Pool prevalence. Shallow pools much more prevalent than deep pools. Banks stable, more then 90% of streambank surfaces covered by vegetation.
HAWKRU02	203	Optimal	Banks stable; 90% of streambank surfaces covered by vegetation. Little or no enlargement of islands or point bars; water reaches both lower banks.
TROUCR03	189	Suboptimal- Optimal	Greater than 50% mix of boulder, cobble, or other stable habitat. Occurrence of riffles relatively frequent. Water fills >75% of available channel.

<u>Site Number</u>	<u>Score</u>	<u>Category</u>	<u>Influences</u>
TOBYCR14	177	Suboptimal	Greater than 50% mix of boulder, cobble, undercut banks, or other stable habitat. Evidence of past channelization present. Width of riparian zone 12 – 18 meters.
TUNKCR03	200	Optimal	All four of the velocity/depth regimes present. Water reaches base of both lower banks. 90% of streambank surfaces covered by vegetation.
JONASCR01	191	Optimal	Greater than 50% mix of boulder, cobble, undercut banks, or other stable habitat. Well developed riffle and run. Streambank stable, 90% vegetated surfaces. Width of riparian zone <6 meters.
POHOCR08	149	Suboptimal	Width of riparian zone <6 meters. Occurrence of riffles infrequent. 70 - 90% of the streambank surfaces covered by vegetation, moderately stable.
WEIRCR02	170	Suboptimal	Only 3 of the 4 velocity/depth regimes present. Gravel, cobble, and boulders particles are 50-75% surrounded by fine sediment. 90% of the streambank surfaces covered by vegetation; width of riparian zone <6 meters.
POHOCR06	196	Optimal	Well developed riffle and run. All 4 velocity/depth regimes present. Banks stable, 90% of the streambank surfaces covered by vegetation.
BUCKCR01	162	Suboptimal	Disruption of streambank vegetation is evident, patches of bare soil and closely chopped vegetation common. Only 3 of the 4 velocity/depth regimes present. Width of riparian zone <6 meters.

<u>Site Number</u>	<u>Score</u>	<u>Category</u>	<u>Influences</u>
AQUACR09	209	Optimal	Greater than 50% mix of boulder, cobble, undercut banks, or other stable habitat. Water reaches base of both lower banks. More than 90% of the streambank surfaces covered by vegetation; width of riparian zone 12 -18 meters.
AQUACR10	182	Suboptimal-Optimal	All 4 velocity/depth regimes present. Water reaches base of both lower banks. Occurrence of riffles relatively frequent. Width of riparian zone <6 meters.
MARSCR08	175	Suboptimal	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediments. Occurrence of riffles infrequent. Width of riparian zone 6 - 12 meters.
MARSCR09	171	Suboptimal	Water reaches base of both lower banks. Occurrence of riffles infrequent. Width of riparian zone <6 meters.
SAMBCR10	156	Suboptimal	Only 3 of the 4 velocity/depth regimes present. Width of riparian zone <6 meters. Water fills 25 – 75% of available channel.
BRODCR14	169	Suboptimal	All 4 velocity/depth regimes present. Water fills 25 – 75% of available channel. Well developed riffle and run. Width of riparian zone 6 -12 meters.
BRODCR15	141	Suboptimal-	Gravel, cobble, and boulder particles are 0 – 25% surrounded by fine sediments. Occurrence of riffles relatively frequent. Unstable banks, many raw areas
CRANCR01	170	Suboptimal-	Only 3 of the 4 velocity/depth regimes present. Occurrence of riffles relatively frequent. Gravel, cobble, and boulder particles are 0 -25% surrounded by fine sediments.
MCMICR28	185	Suboptimal-Optimal	Greater than 50% mix of boulder, cobble, undercut banks, or other stable habitat. All 4 velocity/depth regimes present. Width of riparian zone <6 meters.

<u>Site Number</u>	<u>Score</u>	<u>Category</u>	<u>Influences</u>
BRODCR01	181	Suboptimal- Optimal	Evidence of past channelization present. Excellent mix of boulder, cobble, submerged logs, undercut banks or other stable habitat. Width of riparian zone 6 - 12 meters.
BRODCR12	183	Suboptimal- Optimal	Excellent mix of boulder, cobble, undercut banks, or other stable habitat. Width of riparian zone 6 - 12 meters.
BUSHCR07	193	Optimal	Well developed riffle and run. Water fills > 75% of the available channel. All 4 velocity/depth regimes present.
BRODCR13	151	Suboptimal	30 - 50% mix of boulder, cobble, or other stable habitat. Water fills > 75% of the available channel. Width of riparian zone >18 meters.
CHERCR11	175	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	157	Suboptimal	Streambank moderately stable, 70 - 90% of the surfaces covered by vegetation, Water fills > 75% of the available channel.
TUNKCR06	211	Optimal	Glide/Pool prevalence Streambank stable. More than 90% of the surfaces covered by vegetation. Width of riparian zone >18 meters.