The Habitat Quality Index and Its Use in Texas

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Bioassessment in Texas

- Fish Indices of Biotic Integrity (IBI)
  - Statewide IBI
  - Regional IBIs
- Benthic Macroinvertebrate Indices
  - Benthic Rapid Bioassessment Index (BRBI)
  - Benthic Index of Biotic Integrity (BIBI)
- Habitat Quality Index
Types of Bioassessment in Texas

- **Receiving Water Assessment (RWA)**
  - Conducted in response to a permit action

- **Aquatic Life Assessment (ALA)**
  - Conducted to verify indications of impairment and to identify appropriate aquatic life use on unclassified segments

- **Aquatic Life Monitoring (ALM)**
  - Strictly routine monitoring

- **Use Attainability Analysis (UAA)**
  - Scientific study conducted to identify appropriate aquatic life use usually on water bodies where an aquatic life use has been designated in the TSWQS
Habitat Assessment in Texas

- A requirement of all bioassessment activities in Texas
- Follows the TNRCC’s RWA Protocols
- Provides quantifiable, reproducible data
- Involves moderate level of field effort
Texas Habitat Quality Index

Derived From Several Sources

- Maret, 1986. *Nebraska Stream Habitat Quality Index.*
How Big Is Texas Anyway?

- 5.5 x Louisiana
- 5.1 x Arkansas
- 3.8 x Oklahoma
- 2.2 x New Mexico
Unclassified Streams in Texas

- There are approximately 3,700 named streams, both perennial and intermittent, comprising about 191,228 stream miles.
- Approximately 151,034 miles, or 79%, are unclassified.
Default Aquatic Life Use For Unclassified Streams

- **Perennial**
  - Presumed ALU is high
  - Must maintain a 24-hour DO average of 5.0 mg/L

- **Intermittent with perennial pools**
  - Presumed ALU is limited
  - Must maintain a 24-hour DO average of 3.0 mg/L
Texas Ecoregions

- Texas has 12 ecoregions
  - 23 - Arizona/New Mexico Mountains
  - 24 - Southern Deserts
  - 25 - Western High Plains
  - 26 - Southwestern Tablelands
  - 27 - Central Great Plains
  - 29 - Central Oklahoma/Texas Plains
  - 30 - Central Texas Plateau
  - 31 - Southern Texas Plains
  - 32 - Texas Blackland Prairies
  - 33 - East Central Texas Plains
  - 34 - Western Gulf Coastal Plain
  - 35 - South Central Plains
Texas Ecoregion Map

Ecoregions of Texas

- 24 Southern Deserts
- 25 Western High Plains
- 26 Southwestern Tablelands
- 27 Central Great Plains
- 29 Central Oklahoma/Texas Plains
- 30 Central Texas Plateau
- 31 Southern Texas Plains
- 32 Texas Blackland Prairies
- 33 East Central Texas Plains
- 34 Western Gulf Coastal Plain
- 35 South Central Plains
Ecoregion Reference Site Criteria

- Stream must occur in “most typical” area of ecoregion based on Ecoregions of the South Central States (Omernik and Gallant, 1987)
- Watershed may not contain:
  - Urban Development
  - Point sources of pollution
  - Channelization
  - Atypical nonpoint sources of pollution
- Input from TNRCC regional staff based on best professional judgement is very important
Habitat Assessment Methods
Stream Reach Length

- **Wadeable Streams**
  - Based on 40x mean stream width
  - Minimum of 150m
  - Maximum of 500m
  - Usually is 200-300m

- **Non-wadeable Streams**
  - Based on one full meander of stream channel to include two examples of at least two types of geomorphic units
  - Minimum of 500m
  - Maximum of 1K
Transect Placement for Wadeable Streams

- For reach lengths 150-300m: 5 transects
  - Maximum distance between transects is 75m
- For reach lengths 301-500m: 6 transects
  - Maximum distance between transects is 100m
- Transect Area is defined as area 3m on each side of transect
Measuring Transect Distance With Laser Range Finder
Stream Physical Characteristics

- Primary Attributes (Substrate and Instream Cover)
  - Dominant Substrate Type (transect)
  - % Gravel or Larger (transect)
  - Algae and Macrophyte Abundance (transect)
  - Instream Cover Types (transect)
  - % Instream Cover (transect)
  - Dimensions of Largest Pool (reach)
Observing Substrate With The Aquascope
Measuring Dimensions of Largest Pool
Stream Physical Characteristics

- Secondary Attributes (Channel Morphology)
  - Number of Riffles (reach)
  - Habitat Type (transect)
  - Number of Stream Bends (reach)
  - Channel Obstructions and Modifications (reach)
  - Channel Flow Status (reach)
  - Stream Width (transect)
  - Stream Depths at Points Across the Transect (transect)
Depth Measurement
Depth Measurement
Flow status will change with changing flow regimes resulting in varying amounts of viable substrate for aquatic organisms.

Estimates the extent to which the channel is filled with water over the entire habitat reach.
Stream Physical Characteristics

- Tertiary Attributes (Riparian and Bank Structure)
  - Bank Slope (transect)
  - % Bank Erosion Potential (transect)
  - Aesthetics (reach)
  - % Tree Canopy (transect)
  - % Riparian Vegetation (reach)
  - Dominant Types of Riparian Vegetation (transect)
  - Width of Natural Buffer Vegetation (transect)
The Densimeter
Measuring Tree Canopy With A Densiometer
Measuring Bank Slope Using A Clinometer
Recording Qualitative Information
Width of Natural Buffer Vegetation

- TNRCC methods distinguish between “riparian zone” and “natural vegetative buffer”

- Riparian Zone - Exists whether man has encroached or not. What’s important is how the zone is functioning as a natural buffer for the stream

- Natural Vegetative Buffer - Defines the area of natural vegetation which buffers the stream from the activities of man. It is the lateral extent of natural vegetation until human activity or encroachment is observed.
Aesthetics of the Stream

- Wilderness
  - Outstanding natural beauty
  - No evidence of man’s alterations to landscape
  - Water clarity may be exceptional

- Natural Area
  - Native vegetation is common
  - Alterations to landscape by man are minimal (power lines, occasional fence)
Aesthetics of the Stream

- **Common Setting**
  - Landscape is fairly altered by man, but is not offensive
  - Could include an urban park setting

- **Offensive**
  - Stream does not enhance the aesthetics of the landscape
  - Littered with trash
  - Highly developed
Summary of Physical Characteristics of Water Body

- Field data is summarized
- Additional calculations are made from topographic maps or with mapping software such as Delorme’s Street Atlas USA
- This summary sheet is then used to score the metrics of the HQI
### Summary of Physical Characteristics Form

Using information from all of the transects and measurements in Part I and other sources, report the following general characteristics or averages for the entire reach:

<table>
<thead>
<tr>
<th>Stream Name</th>
<th>Date of Assessment</th>
</tr>
</thead>
</table>

Stream bed slope over evaluated reach (from USGS map; elevation change in meters/reach length in meters) ___________

Approximate drainage area above the transect furthest downstream (from USGS or county highway map in km²) ___________

Stream order ___________

Length of stream evaluated (in meters or kilometers) ___________

Number of lateral transects made ___________

Average stream width (in meters) ___________

Average stream depth (in meters) ___________

Instantaneous stream flow (in ft³/sec) ___________

Indicate flow measurement method ___________

Channel flow status (high, moderate, low, or no flow) ___________

Maximum pool width (in meters) ___________

Maximum pool depth (in meters) ___________
## Summary of Physical Characteristics Form

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of stream bends</td>
<td></td>
</tr>
<tr>
<td>Number of well defined bends</td>
<td></td>
</tr>
<tr>
<td>Number of moderately defined bends</td>
<td></td>
</tr>
<tr>
<td>Number of poorly defined bends</td>
<td></td>
</tr>
<tr>
<td>Total number of riffles</td>
<td></td>
</tr>
<tr>
<td>Dominant substrate type</td>
<td></td>
</tr>
<tr>
<td>Average percent of substrate gravel sized or larger</td>
<td></td>
</tr>
<tr>
<td>Average percent instream cover</td>
<td></td>
</tr>
<tr>
<td>Number of stream cover types</td>
<td></td>
</tr>
<tr>
<td>Average percent stream bank erosion potential</td>
<td></td>
</tr>
<tr>
<td>Average stream bank slope (in degrees)</td>
<td></td>
</tr>
<tr>
<td>Average width of natural buffer vegetation (in meters)</td>
<td></td>
</tr>
<tr>
<td>Average riparian vegetation percent composition by: (total to equal 100%)</td>
<td></td>
</tr>
<tr>
<td>Trees</td>
<td></td>
</tr>
<tr>
<td>Shrubs</td>
<td></td>
</tr>
<tr>
<td>Grasses and Forbes</td>
<td></td>
</tr>
<tr>
<td>Cultivated fields</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
</tr>
<tr>
<td>Average percent tree canopy coverage</td>
<td></td>
</tr>
<tr>
<td>Overall aesthetic appraisal of the stream</td>
<td></td>
</tr>
</tbody>
</table>
Habitat Quality Index

Scoring and Evaluation Criteria

- Primary Attributes
  - Available Instream Cover (1-4 score)
  - Bottom Substrate Stability (1-4 score)
  - Dimensions of Largest Pool (1-4 score)

- Secondary Attributes
  - Number of Riffles (1-4 score)
  - Channel Flow Status (0-3 score)
  - Channel Sinuosity (0-3 score)
Habitat Quality Index

Scoring and Evaluation Criteria

▶ Tertiary Attributes
  ▶ Bank Stability (0-3 score)
  ▶ Riparian Buffer Vegetation (0-3 score)
  ▶ Aesthetics of Reach (0-3 score)
Total Score for Aquatic Life Subcategories

- 26-31 Exceptional
- 20-25 High
- 14-19 Intermediate
- 8-13 Limited
- ≤ 7 Minimal
Typical Habitat Problems in Texas
Most Common Habitat Limitation
Instream Cover in Many Texas Streams
Major Riparian Buffer Problem
Even More Channelized
... And Even More Channelization
Tour of Texas Ecoregions
ER 24 - Southern Deserts
ER 25 - Western High Plains
ER 26 - Southwestern Tablelands
ER 30 - Central Texas Plateau
ER 31 - Southern Texas Plains
ER 32 - Texas Blackland Prairies