Macroinvertebrate Communities of the Great Swamp Watershed

2013

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Drew University
Northern New Jersey
Average Monthly Temperature (°F) preceding sampling date

Source: http://climate.rutgers.edu/stateclim_v1/data/north_njhisttemp.html

Northern New Jersey
Monthly Precipitation (inches) - preceding sample date

Source: http://climate.rutgers.edu/stateclim_v1/data/north_njhistprecip.html
Northern New Jersey
Annual Climate Values

“Isabel”

“Irene”

Annual Precipitation (in/yr)

Mean Annual Temperature (°F)


Annual Precipitation (in/yr)

Mean Annual Temperature

Blue: Annual Precipitation (in/yr)
Red: Mean Annual Temperature

Isabel

Irene
Great Swamp Watershed, May 16, 2013. Habitat Assessment
* Average, 2000-2008 ** Determined once

<table>
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<tr>
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<th>temp</th>
<th>TDS</th>
<th>DO</th>
<th>pH</th>
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• Macroinvertebrates (MIVs)

  • Direct, integrative measure of water quality
  
  • Provide historical information
  
  • Can be used to identify impairment sources
  
  • Both broad dispersal as adults and limited mobility as nymphs/larvae
  
  • Normally abundant
  
  • Easy & inexpensive to sample and identify
Calculating the Benthic Index of Biological Integrity  B-IBI

### B-IBI Scores

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<th>BB1</th>
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<th>RB1</th>
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<td>3</td>
<td>3</td>
<td>6</td>
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<td>#Trich</td>
<td>6</td>
<td>4</td>
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<tr>
<td>B-IBI Total</td>
<td>28</td>
<td>22</td>
<td>32</td>
<td>30</td>
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The graph illustrates the performance of various entities labeled as BB1, BB2, LB1, LB2, LB3, LB4, GB2, GB3, GB4, GB5, PB1, PB2, PB3, PR1, PR2, PR4, and IG1 over the years 2012 and 2013. The Y-axis represents the B-IBI metric, which ranges from 7 to 39. The graph is color-coded to distinguish between the years, with black dots representing 2012 and red dots representing 2013. Entities are distributed across four categories: very poor, poor, fair, and good, indicating their performance levels.
Southern Boulevard, Chatham Township
Golf course; heavily traveled roadway

*BB 1*
**BB 1**

Small, slow flow
High temperature, oil films
2013 – high TDS (>NJS);
hydropsychid dominance down
Drainage channel, STP
BB2

Sandy, poor substrate
2013 - high pH
To be dropped?
GSWA monitoring site

*LB1*
Limited substrate
High turbidity, sediments
Diluted but high TDS (>NJS)
2013 higher TAXA, esp chironomids
Bank erosion, eutrophication
Good
Fair
Poor
Very Poor

LB 2

Higher temperature
low DO, detritus
High TDS >NJS, chemical smell
Morris Township STP
Seaton Hackney Stables
Morristownship Pool
Strong chemical smell

LB3

L84
**LB3**

Very limited substrate - shifting sands

TDS = 752 mg/L; >>NJS

2013: Taxa up; oligochaete dominance down
Fanok Road municipal pool
Channelized ditch
Little MIV substrate

TDS = 1013 mg/L, >>NJS

2013: Taxa doubled, 13 chironomid types
GSWA monitoring site
Sedimentation – but mussels
GB2

Poor substrate diversity

High turbidity – silt bar expanding

Mussel bed
GB3

Good substrate

High temperature
Very high turbidity – silt & debris

2013 – TAXA, mayflies higher, dominance down
Office complex
Parking lots, retention ponds
I-287
GB 4

Poor substrate, High TDS & silt

2013: TAXA up, Blackflies down
GB 5

Temperature high, Low DO, Thick silt & algae cover substrate

2013 – TAXA up Blackflies down
PB 1

Good substrate
Some sedimentation

2013 – stoneflies & caddisflies down
Opposite Youngs Road
Good canopy cover
Mt Kemble influences?
PB 2

2013 – higher TAXA, more caddisflies
Tempe Wick Road
Small impoundment upstream
Ideal MIV habitat - Despite heavily traveled roadway

2013 - TAXA drop
Fewer E, P, Ts ... why??
Below Osborn Pond
High temperature, eutrophication products from pond
Limited substrate

2013 – TAXA up esp. mayflies, hydropsychid dominance down

PR1
Below I-287
Flooding, sediments, highway debris
Original PR2 site
Destroyed by Hurricane Irene
New, much poorer site downstream. Fewer mayflies and caddisflies.

2012+13 vs 2011: fewer mayflies, caddisflies
Hardscrabble Road
Ideal habitat – close to roadway
**PR3**

High MIV diversity; low density

2013: mayflies up
Upper Passaic tributary
“Reference” site
IG 1

Great habitat

**IG1**

![Graph showing B-IBI Value (m) from 2000 to 2013 with points marked for Good, Fair, Poor, and Very Poor categories. The trend line indicates a decreasing value over the years.]

![Images of a clear, flowing stream and a stone bridge in a forested area, indicating a great habitat for wildlife.]
Highlights for 2014 sampling:

1. High TDS levels (>NJS): new at BB1, continuing at GB4, GB5 and LB5
2. High pH: BB1, BB2, GB2
3. Continued decline especially at Primrose Brook: PB1, PB3
Northern New Jersey
Annual Climate Values

"Isabel"

"Irene"

Annual Precipitation (in/yr)

Mean Annual Temperature (°F)


Annual Precipitation (in/yr)  Mean Annual Temperature

- Blue line: Annual Precipitation (in/yr)
- Red line: Mean Annual Temperature

Legend:
Great Brook (GB2, GB3, GB4, GB5), Primrose Brook (PB1, PB2, PB3)

Black Brook (BB1, BB2), Loantaka Brook (LB1, LB2, LB3, LB4),
Passaic River (PR1, PR2, PR3)

Same pattern, all sites, both GS & RR watersheds: regional cause?
Both Groups Increase in B-IIBI score, 2001-2007

Northern New Jersey
Annual Precipitation (in)

- "Blizzard of 1996"
- Hurricane Isabel
- Hurricane Irene
- This Study
Increased Precipitation

- Less danger of stagnation or drying up during low-water periods
- More water, faster flow, lower temperature, higher DO levels
- More water, faster flow, better flushing of sediment-space-clogging silt
- More water, better dilution of potentially stress-producing contaminants
- More precipitation through surroundings, more allochthonous organic detritus rinsed in for MIV food
- More precipitation, perhaps improving survival/reproduction of terrestrial life history stages?
Community Quality (B-IBI) Patterns

Group I Pattern: Great Brook (GB2, GB3, GB4, GB5), Primrose Brook (PB1, PB2, PB3)

Group II Pattern: Black Brook (BB1, BB2), Loantaka Brook (LB1, LB2, LB3, LB4), Passaic River (PR1, PR2, PR3)

Patterns differ within each watershed: stream-based cause(s)?
Northern New Jersey
Annual Climate Values

- Declining precipitation: more stress, lower B-IBI (Group I?)
- Increasing temperature, lower DO: more stress, lower B-IBI (Group I?)
Earlier sampling dates, lower temperature

- Lower temperatures, higher DO: less stress, higher B-IBI (Group II?)
- earlier dates, catch different points in life cycle timing
  - pre-emergence “sample flooding”/ post-emergence diversity “expansion”
    - especially problematic with blackflies
2000-2007: increasing community quality – all sites, both watersheds
Regional influence: increasing post-drought precipitation?

2008-2013: Group I decreasing; Group II increasing – streamwide not regional? a mix?
Climate influences:
- decreasing precipitation – negative effect?
- increasing temperatures – negative effect?
- yet Group II community scores increase?

Earlier sample date influences:
- earlier sample dates – pre- or post-emergence “boom or bust”
- earlier sample dates - colder temperatures – positive?
- colder temperatures – higher DO – positive

Watershed influences:
- Group types differ in adjacent subwatersheds (GSwamp)?
- Group I (declines) – less stress, GS; more stress, RR?
- Group II (increases) – more stress, GS; less stress, RR?

On-going concern:
Are Group I 2008-2013 declines by larger-scale (e.g., climate) or by local-scale issues?
Highlights for 2014 sampling:

1. Settle on fixed sampling date – late May/early June
2. High TDS levels (>NJS): new at BB1, continuing at GB4, GB5 and LB5
3. High pH: BB1, BB2, GB2
4. Continued decline at Group I streams – Great & Primrose Brooks
   what underlies this pattern – large-scale or local?