IN Cold-Water Project:

Macroinvertebrate and fish metrics discussion

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# Background

We will be building an R Shiny App for Indiana DEM to calculate their 2017 IBIs (fish and macroinvertebrates) as well as the cold-water IBIs we develop in the coming couple of years. I am currently putting together the app; however, need assistance dealing with the fish metrics as they are currently not in BioMonTools and are more complicated than our other metrics. I first highlight all of the unique metrics in the Macroinvertebrate IBI and then the Fish IBI. I split the information into site classes as well. I have annotated comments and questions and highlighted them.

# Macroinvertebrate IBIs

## New Metrics

Only one metric found in the macroinvertebrate IBIs is not currently in BioMonTools: the % Carnivore/omnivore individuals (pi\_ffg\_colomn).

## Unique Bug Metrics

|  |  |
| --- | --- |
| nt\_EPT | pi\_ffg\_pred |
| nt\_ffg\_scrap | pi\_ffg\_shred |
| nt\_habit\_cling | pi\_habit\_cling |
| nt\_tv\_intol | pi\_NonIns |
| pi\_Chiro | pi\_Odon |
| pi\_dom03 | pi\_tv\_intol |
| pi\_EPT | pt\_EPT |
| pi\_EPTNoBaeHydro | pt\_NonIns |
| pi\_ffg\_colomn | pt\_tv\_intol |
| pi\_ffg\_filt | pt\_tv\_toler |

## Northern Site Class

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Metric (abbrev)** | **Response to stress** | **Scoring formula** | **Thresh\_Lo** | **Thresh\_Hi** |
| % Non-insect taxa (pt\_NonIns) | Increase | 100\*(33.3-metric)/28.8 | 4.5 | 33.3 |
| % EPT individuals (pi\_EPT) | Decrease | 100\*(metric)/57.5 | 0 | 57.5 |
| % Predator individuals (pi\_ffg\_pred) | Increase | 100\*(56.9-metric)/53.6 | 3.3 | 56.9 |
| Number of clinger taxa (nt\_habit\_cling) | Decrease | 100\*(metric-1)/13 | 1 | 13 |
| Number of intolerant taxa (nt\_tv\_intol) | Decrease | 100\*(metric)/12 | 0 | 12 |
| % Tolerant taxa (pt\_tv\_toler) | Increase | 100\*(61.6-metric)/53.3 | 8.3 | 61.6 |

## North-Central Site Class

Note the highlighted scoring formula of the pi\_ffg\_shred metric. The 5th and 95th percentiles are identical – I could not find any information in the 2017 Indiana report to determine whether this is an error or correct.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Metric (abbrev)** | **Response to stress** | **Scoring formula** | **Thresh\_Lo** | **Thresh\_Hi** |
| % Non-insect taxa (pt\_NonIns) | Increase | 100\*(33.3-metric)/28.8 | 4.5 | 33.3 |
| % Three most dominant taxa (pi\_dom03) | Increase | 100\*(76.8-metric)/51.2 | 25.6 | 76.8 |
| % EPT individuals, excluding Caenidae and Baetidae (pi\_EPTNoBaeHydro) | Decrease | 100\*(metric)/40.2 | 0 | 40.2 |
| % Chironomidae individuals (pi\_Chiro) | Increase | 100\*(48.7-metric)/47.8 | 0.9 | 48.7 |
| % Predator individuals (pi\_ffg\_pred) | Decrease | 100\*(metric-3.3)/53.6 | 3.3 | 53.6 |
| % Shredder individuals (pi\_ffg\_shred) | Increase | 100\*(21.4-metric)/21.4 | 0 | 21.4 |
| Number of clinger taxa (nt\_habit\_cling) | Decrease | 100\*(metric-1)/13 | 1 | 13 |
| % Intolerant individuals (pi\_tv\_intol) | Decrease | 100\*(metric)/32.1 | 0 | 32.1 |

## Southwest Site Class

Note the highlighted scoring formula of the pi\_ffg\_filt metric. The 5th and 95th percentiles are identical – I could not find any information in the 2017 Indiana report to determine whether this is an error or correct.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Metric (abbrev)** | **Response to stress** | **Scoring formula** | **Thresh\_Lo** | **Thresh\_Hi** |
| Number of EPT taxa (nt\_EPT) | Decrease | 100\*(metric)/14 | 0 | 14 |
| % Non-insect individuals (pi\_NonIns) | Increase | 100\*(62.2-metric)/60.8 | 1.4 | 62.2 |
| % EPT individuals, excluding Caenidae and Baetidae (pi\_EPTNoBaeHydro) | Decrease | 100\*(metric)/40.2 | 0 | 40.2 |
| Number of scraper taxa (nt\_ffg\_scrap) | Decrease | 100\*(metric)/8 | 0 | 8 |
| % Collector-filterer individuals (pi\_ffg\_filt) | Increase | 100\*(36.1-metric)/36.1 | 0 | 36.1 |
| % Clinger individuals (pi\_habit\_cling) | Decrease | 100\*(metric-1)/48.5 | 1 | 48.5 |
| % Intolerant individuals (pi\_tv\_intol) | Decrease | 100\*(metric)/32.1 | 0 | 32.1 |

## Southeast Site Class

Note the highlighted metric needs to be added to BioMonTools.

Note the highlighted scoring formula of the pi\_Odon metric. The 5th and 95th percentiles are identical – I could not find any information in the 2017 Indiana report to determine whether this is an error or correct.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Metric (abbrev)** | **Response to stress** | **Scoring formula** | **Thresh\_Lo** | **Thresh\_Hi** |
| % Non-insect taxa (pt\_NonIns) | Increase | 100\*(33.3-metric)/28.8 | 4.5 | 33.3 |
| % EPT taxa (pt\_EPT) | Decrease | 100\*(metric)/35.2 | 0 | 35.2 |
| % EPT individuals, excluding Caenidae and Baetidae (pi\_EPTNoBaeHydro) | Decrease | 100\*(metric)/40.2 | 0 | 40.2 |
| % Odonata individuals (pi\_Odon) | Increase | 100\*(25.8-metric)/25.8 | 0 | 25.8 |
| % Carnivore/omnivore individuals (pi\_ffg\_colomn) | Increase | 100\*(23.9-metric)/23.9 | 0 | 23.9 |
| % Clinger individuals (pi\_habit\_cling) | Decrease | 100\*(metric-1)/48.5 | 1 | 48.5 |
| % Intolerant taxa (pt\_tv\_intol) | Decrease | 100\*(metric)/30.3 | 0 | 30.3 |

# Fish IBIs

## Unique Metrics

* BioNatNonTolnGS\_perdist
  + Requires biomass and distance fished estimate
* jni\_total
  + Requires estimate of drainage area (continuous – because of logDA calculation)
* jnt\_darter
  + Requires estimate of drainage area (continuous – because of logDA calculation)
* jnt\_dartmadsculp
  + Requires estimate of drainage area (continuous – because of logDA calculation)
* jnt\_natinvert
  + Requires estimate of drainage area (continuous – because of logDA calculation)
* jnt\_native
  + Requires estimate of drainage area (continuous – because of logDA calculation)
* jpi\_headwater
  + Requires estimate of drainage area (categorical – DA > or < 1 mi2)
* jpi\_toler
  + Requires estimate of drainage area (continuous – because of logDA calculation)
* jpt\_toler
  + Requires estimate of drainage area (continuous – because of logDA calculation)
* ni\_Total\_perdist
  + Requires estimate of distance fished
* nt\_Cent
* nt\_Cyprin
* nt\_darter
* nt\_natCypinvert
  + Couldn’t find definition – presumed to be: “Number of native Cyprinidae invertivore taxa”
* pb\_rbs
  + Requires biomass estimate
  + What is a “round-bodied sucker”?
* pb\_toler
  + Requires biomass estimate
* pi\_CyprinNoCarp
* pi\_delt
  + Requires estimate of the number of individuals with DELT anomalies; however, we currently set up our input file with the N\_TAXA per unique taxon; therefore, some of a given taxon could have DELT anomalies while others do not. Would likely need a N\_DELT column with the number of individuals of a given taxon that had DELT anomalies.
* pi\_dom01
* pi\_insinv
* pi\_intolerant
* pi\_omnivore
* pi\_os\_lithophil
  + Requires information on spawning habitat/habits
* pi\_osbh\_lithophil
  + Requires information on spawning habitat/habits
* pi\_pioneer
* pi\_rbs
  + What is a “round-bodied sucker”?
* pi\_sunfish
  + What is classified as a sunfish in Indiana?

## Small-Wadeable Streams Site Class

|  |  |  |
| --- | --- | --- |
| **Metric (abbrev)** | **Response to stress** | **Scoring formula** |
| Number of native taxa (jnt\_native) | Decrease | DA<1: 100\* MetVal / 9.75 OR DA>1:100\*MetVal/(9.71 \* logDA + 9.75) |
| Number of darter, madtom, or sculpin taxa (jnt\_dartmadsculp) | Decrease | 100\*MetVal/(2.42 \* logDA + 2.57) |
| Number of individuals (jni\_total) | Decrease | 100\*MetVal/(195 \* logDA + 459) |
| % Cyprinidae individuals (pi\_CyprinNoCarp) | Decrease | 100\*(MetVal)/94 |
| % Non-guarding, open-substrate + brood hiding lithophil individuals (pi\_osbh\_lithophil) | Decrease | 100\*(MetVal)/94 |
| % Headwater individuals (jpi\_headwater) | Decrease | DA<1: 100\* MetVal / 59 OR DA>1:100\*MetVal/(-23.4\*logDA+59) |
| % Pioneer individuals (pi\_pioneer) | Increase | 100\*(98-MetVal)/96 |
| Number of native invertivore taxa (jnt\_natinvert) | Decrease | DA<1: 100\* MetVal / 5.53 OR DA>1:100\*MetVal/7.48\*logDA+5.53) |
| % Tolerant taxa (jpt\_toler) | Increase | DA > 500: 100-(100\*MetVal/24.7) OR DA<500:100-(100\*MetVal/(-29.4\*logDA + 104)) |
| % individuals with DELT anomalies (pi\_delt) | Increase | 100\*(2-MetVal)/2 |

## 

## Large-Wadeable Streams Site Class

|  |  |  |
| --- | --- | --- |
| **Metric (abbrev)** | **Response to stress** | **Scoring formula** |
| Number of darter taxa (jnt\_darter) | Decrease | 100\*MetVal/(1.88 \* logDA + 2.47) |
| Number of Cyprinidae taxa (nt\_Cyprin) | Decrease | 100\*MetVal/10 |
| Number of individuals per distance fished (ni\_Total\_perdist) | Decrease | 100\*(MetVal-0.2)/7.6 |
| % Cyprinidae individuals no carp (pi\_CyprinNoCarp) | Decrease | 100\*(MetVal-4)/74 |
| % Sunfish individuals (pi\_sunfish) | Increase | 100\*(66.6-MetVal)/66.6 |
| % Omnivore individuals (pi\_omnivore) | Increase | 100\*(21.0-MetVal)/21.0 |
| % Tolerant individuals (jpi\_toler) | Increase | DA<500: 100-(100\*MetVal/(-21.2\*logDA+106)) OR DA>500:100\*(48.8-MetVal)/48.8 |
| % individuals with DELT anomalies (pi\_delt) | Increase | 100\*(2.0-MetVal)/2.0 |

## Low-Gradient Boatable Streams Site Class

|  |  |  |
| --- | --- | --- |
| **Metric (abbrev)** | **Response to stress** | **Scoring formula** |
| Number of native taxa (jnt\_native) | Decrease | DA<500: 100\*MetVal/(10.7 \*logDA + 4.44) OR DA>500: 100\*MetVal/33.3 |
| % Round-bodied sucker individuals (pi\_rbs) | Decrease | 100\*MetVal/29.8 |
| % Individuals of the most abundant taxon (pi\_dom01) | Increase | 100\*(61.2-MetVal)/45.3 |
| Biomass of Native Nontolerant minus Gizzard Shad per distance (BioNatNonTolnGS\_perdist) | Decrease | 100\*(MetVal-6.8)/171.1 |
| Number of native Cyprinidae invertivore taxa (nt\_natCypinvert) | Decrease | 100\*MetVal/6 |
| % Intolerant individuals (pi\_intolerant) | Decrease | 100\*(MetVal-1.6)/61.7 |
| % Biomass of tolerant taxa (pb\_toler) | Increase | 100\*(87.3-MetVal)/87.3 |
| % Non-guarding, open-substrate lithophil individuals (pi\_os\_lithophil) | Decrease | 100\*(MetVal-3.9)/48.5 |
| % individuals with DELT anomalies (pi\_delt) | Increase | 100\*(2-MetVal)/2 |

## High-Gradient Boatable Streams Site Class

|  |  |  |
| --- | --- | --- |
| **Metric (abbrev)** | **Response to stress** | **Scoring formula** |
| Number of native taxa (jnt\_native) | Decrease | DA<500:100\*MetVal/(10.7\*logDA+4.44) OR DA>500: 100\*MetVal/33.3 |
| Number of darter taxa (nt\_darter) | Decrease | 100\*MetVal/8 |
| Number of Centrarchidae taxa (nt\_Cent) | Decrease | 100\*(MetVal-2.9)/5.2 |
| % Biomass of round-bodied suckers (pb\_rbs) | Decrease | 100\*MetVal/77.1 |
| % Insectivore and invertivore individuals (pi\_insinv) | Decrease | 100\*(MetVal-22.5)/64.3 |
| % Omnivore individuals (pi\_omnivore) | Increase | 100\*(28.2-MetVal)/28.2 |
| % Intolerant individuals (pi\_intolerant) | Decrease | 100\*(MetVal-0.2)/70.1 |
| % Biomass of tolerant taxa (pb\_toler) | Increase | 100\*(96.1-MetVal)/96.1 |
| % Non-guarding, open-substrate lithophil individuals (pi\_os\_lithophil) | Decrease | 100\*(MetVal-6.1)/56.7 |
| % individuals with DELT anomalies (pi\_delt) | Increase | 100\*(2-MetVal)/2 |