February 1, 2023

A PROPOSAL FOR

RUSH RIVER BIOTIC DATA COLLECTION AND ANALYSIS

Executive Summary

We will sample macroinvertebrate populations in the Rush River and its important tributaries and analyze the samples using various biotic indices requiring laboratory identification of insects to the species level. We have selected 16 sites for sampling, based on a number of factors, including: 1) coverage of the Rush River over the section considered the most productive trout fishery, 2) sampling at sites with historical Hilsenhoff Biotic Index (HBI) data, 3) sampling at selected stations used for Fisheries Surveys (electro-shocking) with high fish counts, 4) sampling in tributaries considered significant for the fishery and especially for brook trout.

Funding for the laboratory analysis is required, and we request that this be provided by local Trout Unlimited (TU) Chapters.

The use of biotic indices to evaluate water quality in Wisconsin streams has a long history beginning with the work of W.L. Hilsenhoff (1982,1987). Hilsenhoff assigned organic pollution tolerance values to various macroinvertebrates, initially 1-5 (1982) and later revised to 1-10 (1987) increasing with increasing levels of tolerance. He then calculated a weighted average of organic pollution tolerance from samples of macroinvertebrates collected at locations of interest. Many other indices are used for various purposes in the evaluation of stream health. Lillie et al. (2003) provides extensive guidelines for macroinvertebrate data interpretation, comparison of the different biotics indices, and the use of Wisconsin DNR (WDNR) electronic database.

The initial motivation for this effort was an evaluation of the WAV-II biotic index proposed by Michael Miller, Stream Ecologist at the WDNR. This new metric requires identification of invertebrates collected to the order or class level, which can be done by trained volunteers. However, an evaluation of the WAV-II index for a given site depends on the availability of metric data such as the HBI from lab analyzed samples (requiring species-level ID) for purposes of comparison. A review of these metrics for the Rush showed that few biotic surveys have been done since 2018, and only at a few locations. To keep the database current and useful, input of detailed biotic data (species ID) will be required over the next decade.

This proposal aims to leverage a volunteer-based effort to ensure that new data will be available on a timely basis. This data will be included and preserved within the Surface Water Integrated Monitoring System (SWIMS) database, for use in documenting and understanding the invertebrate community on the Rush and its tributaries. A volunteer-based effort can leverage the DNR's scientific expertise and experience to produce abundant, high-quality data for selected sites along the length of the river.

TU's Role

This project is an opportunity for TU to assume a more active role in the biotic monitoring of one of our most productive trout streams. Historically, this type of monitoring has been funded by the DNR and carried out by DNR scientists. Recently, however, the priority for data collection has shifted towards at-risk streams and those watersheds where detailed remediation/protection plans and actions are in place. Since the Rush does not fall into this category, data collection has been limited over the past five years.

Going forward, a new approach involving collaboration between DNR biologists and trained volunteers (drawn mostly from the local TU Chapters) might be useful in establishing a long-term biotic monitoring program for the Rush. Sampling will be done by volunteers following the same rigorous sampling protocols as used by the WDNR, and laboratory identification of macroinvertebrate species will be performed by scientists in the same laboratories as used in the past. Hence the results would be of the same quality as those contained in the historical database and, as mentioned above, will be entered into the SWIMS database alongside all historical data where they would be permanently available to researchers and interested citizens. Interpretation and presentation of the results to TU and other audiences is also envisioned as a valuable outcome of this project.

As mentioned above, we propose that funding for the laboratory analysis be provided by local TU Chapters.

Description of the Sampling Sites

The Rush River is more than 30 miles in length, with many more miles of Class I (self-sustaining wild trout populations) and Class II (some natural reproduction) tributaries. A total of 16 sampling sites are proposed, as follows:

1. 10 sites on the Rush River, beginning at the 385th St bridge, three miles north of Hwy 35, and ending at Pierce County Rd Y around 17 miles to the north.
2. Two sites each on the Class I tributaries Lost Creek and Cave Creek
3. Two sites on the Class II tributary Morgan Coulee Creek.

Figure 1 shows the location of the proposed sites. Table I shows the details of the sites, including latitude and longitude. Enlarged maps are shown in the Appendix.

The Wisconsin DNR's Surface Water Data Viewer (SWDV) (https://dnrmaps.wi.gov/H5/?Viewer=SWDV) was the primarily tool used to select these sites. This software contains the location of all sampling sites where any type of data has been collected going back as far as 1979, as well as links to the actual data sets, including water quality, invasive species observations, and invertebrate sampling and analysis. Of the 16 proposed sites, nine have existing macroinvertebrate data and associated metrics, including HBI, which can be found in the SWDV. The SWDV is linked to the Surface Water Integrated Monitoring System (SWIMS) – the DNR's system that holds chemistry (water, sediment, fish tissue) data, physical data, biological (macroinvertebrate, aquatic invasives) data and more. The 6–8-digit numbers shown in Table I and Figure 1 are SWIMS station numbers that have been assigned historically to all locations where data has been collected.

Figure 2 shows a small sample of invertebrate data collected by Michael Miller at Station 10029204, 2000 meters south of State Highway 10. This Station is of interest due to the high level of stream health as indicated by the calculated HBI for six samples collected in 2004. Note that a lower HBI indicates a higher score for stream health. The HBI values were close to 3.0 for all six samples, well below the "excellent" threshold. Figure 3 shows how this compares to historic HBI measurement for eight other sampling locations over the time period 1979-2018. Samples were collected by WDNR staff using the procedures described by Hilsenhoff (1987) and in the DNR guideline

(WDNR 2017). It is seen that Station 10029204 was found to have an excellent population of pollution intolerant insects, especially mayflies, when the sampling was done. Figure 3 hints at some other interesting trends in space and time, but more sampling is required to explore this – a goal of the study currently proposed. All the invertebrate counts (see Fig. 2) used to compute the HBI are available in the SWDV, as well as many other metrics used to measure stream biotic health that can be computed from this data.

The DNR's Fisheries Survey was another tool used to select the sites for this proposal. The Fisheries Surveys indicate the general health, species, and age classes of the trout population on the Rush and its tributaries and provide a useful context for evaluating the macroinvertebrate data and associated biotic metrics. The Station IDs historically used to identify the locations for the Fisheries Surveys are noted in square brackets []. Not all of these locations are currently active for surveys. Six of the proposed sites listed in Table I – identified as [8], [14]. [15]. [16], [17] and [18] – are included in the most recent 2021 Fisheries Survey of the Rush River (Yalally 2021). An additional two sites – [4] and [10] were included in past Fisheries Surveys. Additionally, five of the six sites proposed on the tributaries are Fisheries Survey locations. We note that Stations [8] (450th Av), [14] (Stonehammer), and [17] (Hwy 29) have been included in all Surveys dating back to 2000. These stations are included in the sites proposed under this proposal.

Resources Required and Schedule

Sample collection will be carried out by volunteers. Sample analysis using the WAV-II biotic index will also be done by volunteers. Species level identification of specimens will be performed by Kurt L. Schmude, PhD, Professor in the Department of Natural Sciences at UW-Superior and scientist at the Lake Superior Research Institute, who has been consulted in the preparation of this proposal. Michael Miller of the WDNR will serve as project consultant.

Samples will be collected at 16 sites. The following resources are required:

1. Collection equipment: D-frame nets, collection trays, etc. with be loaned to the project by Pierce County WAV Coordinator Retta Isaacson. DNR will provide 1-liter bottles.
2. Analysis will be provided by Kurt Schmude of UW-Superior for $225/sample. 250 specimens from each sample will be identified and entered into the WI DNR SWIMS database for generation of biotic metrics. A copy of the report that SWIMS generates for each site will be provided, along with a summary table of all invertebrates (and their numbers) separated by site. The data will also be available through the SWDV.
3. Cost for the laboratory analysis for 16 samples, will be approximately $3600. Transportation of samples, additional samples, and miscellaneous items may involve additional cost. Five gallons of ethyl alcohol (denatured) will cost approximately $200.
4. Volunteer hours: It is estimated that four teams of two volunteers each will be able to carry out the sampling, with each team sampling 4 sites. Assuming 3 hours for each site (including travel) plus some training, a total of 50-60 hours of volunteer time will be required.
5. Schedule: We will perform sampling during September and October 2023. Weather/human comfort and safety permitting, the sampling can extend into November. If samples are provided by mid-November, results will be available by the end of January 2024.

Sampling Method:

The sampling method is provided in the WDNR document "Guidelines for the Standard Collection of Macroinvertebrate Samples from Wadeable Streams v2.0," (WDNR 2017). A summary of the method, copied from this document, is as follows. (Note: mIBI refers to WDNR's macroinvertebrate Index of Biotic Integrity (mIBI, Weigel 2003,) but the same method will apply for this project.)

1. Macroinvertebrate sampling for calculation of the mIBI should occur one of two index periods, spring (March-May) or fall (September-November), with the fall index period being heavily preferred. Water levels should be near baseflow. Usually there will not be a long-term flow record for that site and staff will have to gauge bankfull height from riparian clues and determine if stream is at or below that level. Samples should be collected in riffle habitats. If no riffles are present, samples may be collected in runs provided there is at least 15% coarse benthic substrate (fine sand or larger, 0.64-2mm size class). Staff should review current data, historic data and field notes from any samples taken in the spring index period or from non-riffle habitats to ensure that the sample is representative of the likely assemblage and that the mIBI should be applied for water quality assessments.

2. Enter the stream working upstream approaching the target riffle being careful not to disturb the targeted sampling area. Sample the targeted riffle with a D-frame 500 or 600 micron mesh kick net (hereafter "kick net", see Section G for discussion of alternative mesh size) by holding the net frame firmly against the stream bottom and disturbing the substrate upstream of the kick net with your feet. Dig deeply into the substrate with the heel or toe to dislodge macroinvertebrates from the streambed. Avoid kicking course debris into the net such as rocks and woody debris. Make sure that the plume of silt that results from disturbing the substrate is flowing into the net, as this plume also contains the dislodged macroinvertebrates.

3. After the sample is collected, rinse fine sediment from the net by forcefully swishing the net through the water a few times, being careful not to lose the organisms captured. Removing fine sediment from the net makes laboratory analysis of the sample easier and helps insure adequate preservation of the sample. Discard large sticks, rocks, and leaves from the net after thoroughly rinsing debris to dislodge any clinging macroinvertebrates back into the net.

4. Transfer the debris and macroinvertebrates to a HDPE or glass wide-mouth jar of sufficient size. Inspect the net and transfer clinging macroinvertebrates into a properly labeled sample jar. The sample debris should occupy less than 1/2 the sample jar's volume. Initially, preserve the sample with 95% ethanol while in the field. There will be sufficient water in the sample to dilute the final concentration to ~75-80%. Within 48 hours pour-off the alcohol solution and refill with fresh 90-95% ethanol. Samples containing large amounts of organic materials should be preserved and re-preserved several times. Poorly preserved samples result in decayed or brittle organisms and make proper taxonomic identifications difficult or impossible.

The document referenced above (WDNR 2017) provides detailed descriptions of the collection method, sample preservation, and sample labelling requirements. Sampling labelling requires the use of two labels attached to each sample, one inside and one outside the sample jar. All macroinvertebrate samples also need to have a macroinvertebrate labslip generated from the SWIMS database before they can be submitted to a WDNR approved lab (UW-Superior) for taxonomic identification, which are associated with a new or existing SWIMS project. The project coordinator (Carl Nelson) will create a new SWIMS project entitled "Rush River Biotic Monitoring" and will arrange for labslip creation.

As noted above (see Table 1) all proposed sampling sites currently have an assigned SWIMS Station ID, with one exception – a proposed new station on upper Cave Creek. If a new SWIMS Station ID is needed, this can be created and must be approved by the SWIMS database manager.

WAV-II Sampling and Analysis:

Water Action Volunteer (WAV) and WAV-II sampling and analysis is a parallel effort that will be conducted alongside the main project described above. The WAV indices utilize Order and Class level identifications, e.g., Classes such as gastropods (snails) or bivalves (mussels and clams) or Orders such as *Ephemeropterans* (mayflies), *Trichopterans* (caddisflies), and *Plecopterans* (stoneflies). Class and Order level identifications can generally be made in the field by trained volunteers and the animals returned to the stream alive. The local WAV Coordinator will provide training to the volunteers as required to assist in identifications.

The specimens required for WAV and WAV-II sorting will be selected from the sample, with like specimens being placed in separate compartments of an ice cube or other compartmentalized tray, as described in Appendix B. This will be done by volunteers with the required taxonomic skills. After the results have been recorded, the tray contents will be recombined with the original sample, which will then be preserved and prepared for transportation to the lab as described in (4) above.

The WAV-II index is computed in the field as shown on the recording form in Appendix B. The WAV index is identical, except there is no +1 addition included for the "most common animal." This addition is the unique feature of the draft WAV-II index.

Summary:

This proposal aims to leverage a volunteer-based effort in collaboration with the Wisconsin DNR to ensure that new biotic data is available going forward for the Rush River and its tributaries. Based on October 2022 estimates, the total cost for sample collection and analysis for all 16 proposed sites is $3800-4000. Results will be available through the SWIMS database.

Work is planned for September-October 2023. For flexibility in funding, a two-year rotation with 8 sites per year, or a four-year rotation with four sites per year could also be considered.

Carl Nelson

Project Coordinator

REFERENCES:

Hilsenhoff, WL. 1982. Using a biotic index to evaluate water quality in streams. Technical Bulletin (132) 1-22, Wisconsin Department of Natural Resources, Madison, WI.

Hilsenhoff, WL. 1987. An improved biotic index of organic stream pollution. *The Great Lakes Entomologist*, 20(1) 31-39.

Lillie, RA, Szczytko, SW, Miller, MA. 2003. Macroinvertebrate Data Interpretation Guidance Manual. Wisconsin Department of Natural Resources, Bureau of Integrated Science Services. Madison, WI. PUB-SS-965-2003.

WDNR 2017. Guidelines for the Standard Collection of Macroinvertebrate Samples from Wadeable Streams v2.0. Wisconsin Dept. of Natural Resources, Madison, WI.

Weigel, B.M. 2003. Development of stream macroinvertebrate models that predict watershed and local stressors in Wisconsin. *Journal of the North American Benthological Society*, 22(1):123-142.

Yallaly, K. 2021. Fisheries survey report for Rush River, Pierce and St. Croix County, Wisconsin 2021, waterbody identification code 2440300. WDNR Fisheries Biologist, Baldwin, WI.

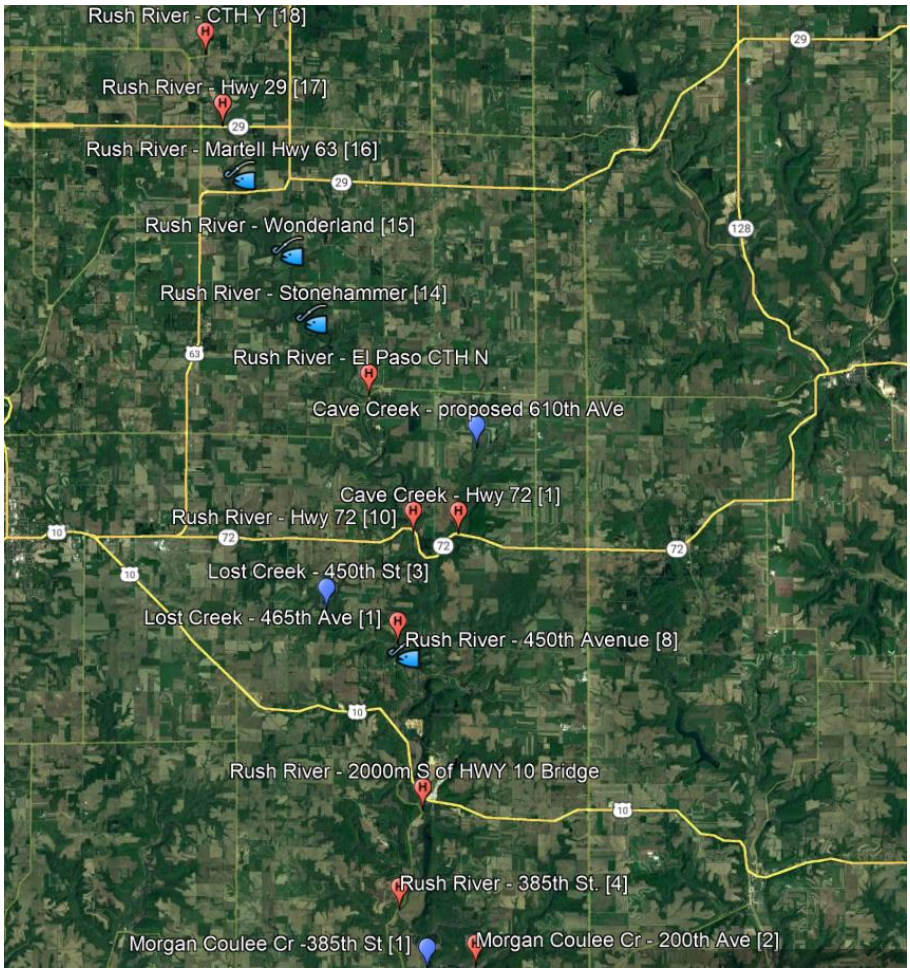


Figure 1. Proposed sampling sites.

H=HBI Measurements in database
Fish&Hook=Fisheries Survey Station (Active), no HBI in database
Blue=Not a Fisheries Survey Station, no HBI
Fisheries Survey Stations in square brackets []

Table 1. Proposed Sampling Sites (Sorted by Latitude)

	Site Description	Lat	Long	Station ID
1	Morgan Coulee Cr - 385th St [1] (Station 10008810)	44.61012	-92.32084	10008810
2	Morgan Coulee Cr - 200th Ave [2] (Station 10008820)	44.61120	-92.30159	10008820
3	Rush River - 385th St [4] (Station 10008903)	44.62715	-92.33187	10008903
4	Rush River - 2000m south of HWY 10 Bridge (Station 10029204)	44.65543	-92.32250	10029204
5	Rush River - 450th Avenue [8] (Station 10008913)	44.69480	-92.32975	10008913
6	Lost Creek - 465th Ave [1] (Station 483083)	44.70186	-92.33186	483083
7	Lost Creek - 450th St [3] (Station 10008892)	44.71173	-92.36058	10008892
8	Cave Creek - Hwy 72 [1] - 1 Mi East Of BB (Station 483037)	44.73325	-92.30824	483037
9	Rush River - Hwy 72 [10] - NRSA Site (Station 10051363)	44.73335	-92.32623	10051363
10	Cave Creek - 610th Ave - proposed	44.75741	-92.30092	NA
11	Rush River - Hwy N El Paso (Station 483078)	44.77197	-92.34397	483078
12	Rush River - Stonehammer [14] (Station 10008914)	44.78893	-92.36507	10008914
13	Rush River - Wonderland [15] - 50' below mouth of Gilman Cr (Station 10044498)	44.80801	-92.37564	10044498
14	Rush River - Hwy 63 Martell [16] (Station 10008924)	44.82940	-92.39471	10008924
15	Rush River - Hwy 29 [17] (Station 10008922)	44.84811	-92.40195	10008922
16	Rush River - CTH Y [18] (Station 10008918)	44.86821	-92.40884	10008918

Monitoring Station

Station ID 10029204
Station Name Rush River - 2000m south of HWY 10 Bridge

Show specific parameter: <Show All>

Sample Results

Project	Date/Time	DNR Parameter	Species	Result
UW Stevens Point Macroinvertebrate Analyses	10/07/2004 12:00 AM	PLECOPTERA PERLIDAE PARAGNETINA MEDIA		1
UW Stevens Point Macroinvertebrate Analyses	10/07/2004 12:00 AM	PLECOPTERA PERLODIDAE ISOPERLA SLOSSONAE		5
UW Stevens Point Macroinvertebrate Analyses	10/07/2004 12:00 AM	PLECOPTERA PERLODIDAE ISOPERLA SLOSSONAE		1
UW Stevens Point Macroinvertebrate Analyses	10/07/2004 12:00 AM	PLECOPTERA PERLODIDAE ISOPERLA SLOSSONAE		1
UW Stevens Point Macroinvertebrate Analyses	10/07/2004 12:00 AM	EPHEMEROPTERA BAETIDAE BAETIS BRUNNEICOLOR		1
UW Stevens Point Macroinvertebrate Analyses	10/07/2004 12:00 AM	EPHEMEROPTERA BAETIDAE BAETIS BRUNNEICOLOR		1
UW Stevens Point Macroinvertebrate Analyses	10/07/2004 12:00 AM	EPHEMEROPTERA BAETIDAE BAETIS BRUNNEICOLOR		1
UW Stevens Point Macroinvertebrate Analyses	10/07/2004 12:00 AM	EPHEMEROPTERA BAETIDAE BAETIS TRICAUDATUS		4
UW Stevens Point Macroinvertebrate Analyses	10/07/2004 12:00 AM	EPHEMEROPTERA BAETIDAE BAETIS TRICAUDATUS		4
UW Stevens Point Macroinvertebrate Analyses	10/07/2004 12:00 AM	EPHEMEROPTERA BAETIDAE BAETIS TRICAUDATUS		1
UW Stevens Point Macroinvertebrate Analyses	10/07/2004 12:00 AM	EPHEMEROPTERA BAETIDAE BAETIS TRICAUDATUS		5
UW Stevens Point Macroinvertebrate Analyses	10/07/2004 12:00 AM	EPHEMEROPTERA BAETIDAE BAETIS TRICAUDATUS		9
UW Stevens Point Macroinvertebrate Analyses	10/07/2004 12:00 AM	EPHEMEROPTERA BAETIDAE ACENTRELLA TURBIDA		6
UW Stevens Point Macroinvertebrate Analyses	10/07/2004 12:00 AM	EPHEMEROPTERA BAETIDAE ACENTRELLA TURBIDA		10
UW Stevens Point Macroinvertebrate Analyses	10/07/2004 12:00 AM	EPHEMEROPTERA BAETIDAE ACENTRELLA TURBIDA		2
UW Stevens Point Macroinvertebrate Analyses	10/07/2004 12:00 AM	EPHEMEROPTERA BAETIDAE ACENTRELLA TURBIDA		5
UW Stevens Point Macroinvertebrate Analyses	10/07/2004 12:00 AM	EPHEMEROPTERA BAETIDAE ACENTRELLA TURBIDA		20
UW Stevens Point Macroinvertebrate Analyses	10/07/2004 12:00 AM	EPHEMEROPTERA BAETIDAE ACENTRELLA TURBIDA		33
UW Stevens Point Macroinvertebrate Analyses	10/07/2004 12:00 AM	EPHEMEROPTERA BAETIDAE PLAUDITUS		1
UW Stevens Point Macroinvertebrate Analyses	10/07/2004 12:00 AM	EPHEMEROPTERA BAETIDAE PLAUDITUS		2
UW Stevens Point Macroinvertebrate Analyses	10/07/2004 12:00 AM	EPHEMEROPTERA BAETIDAE PLAUDITUS		5
UW Stevens Point Macroinvertebrate Analyses	10/07/2004 12:00 AM	EPHEMEROPTERA EPHEMERELLIDAE EPHEMERELLA EXCRUCIANS		22
UW Stevens Point Macroinvertebrate Analyses	10/07/2004 12:00 AM	EPHEMEROPTERA EPHEMERELLIDAE EPHEMERELLA EXCRUCIANS		57
UW Stevens Point Macroinvertebrate Analyses	10/07/2004 12:00 AM	EPHEMEROPTERA EPHEMERELLIDAE EPHEMERELLA EXCRUCIANS		100
UW Stevens Point Macroinvertebrate Analyses	10/07/2004 12:00 AM	EPHEMEROPTERA EPHEMERELLIDAE EPHEMERELLA EXCRUCIANS		51

Figure 2. Sample macroinvertebrate data from Surface Water Data Viewer. Note the large numbers of E. Excrucians (Pale Morning Dun) in the sample.

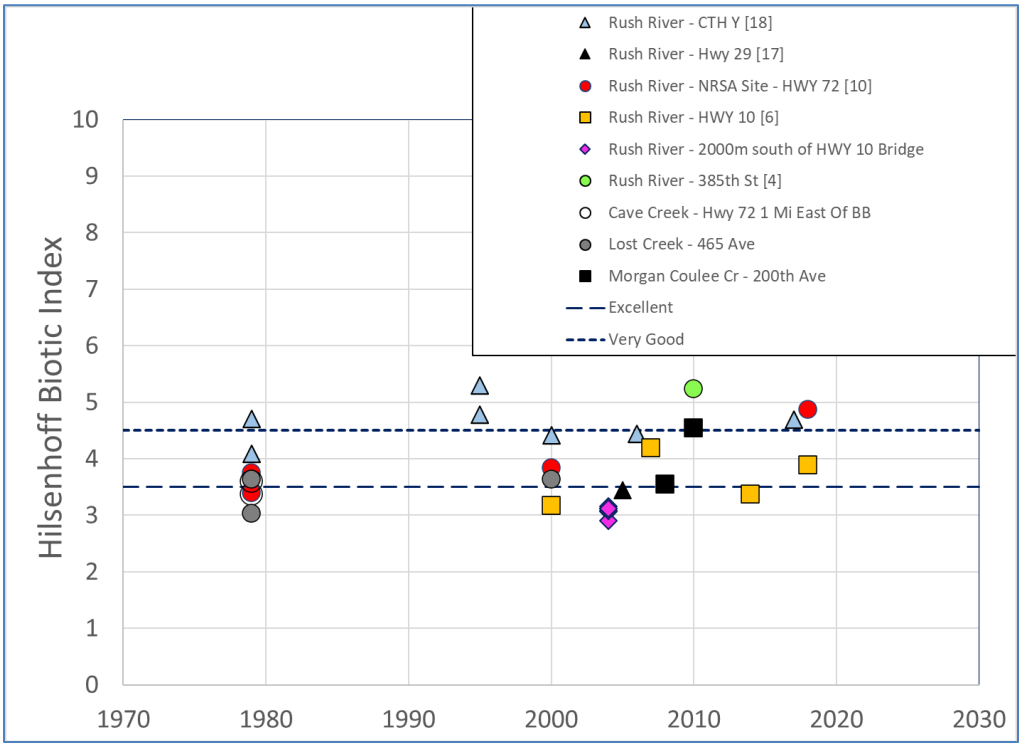
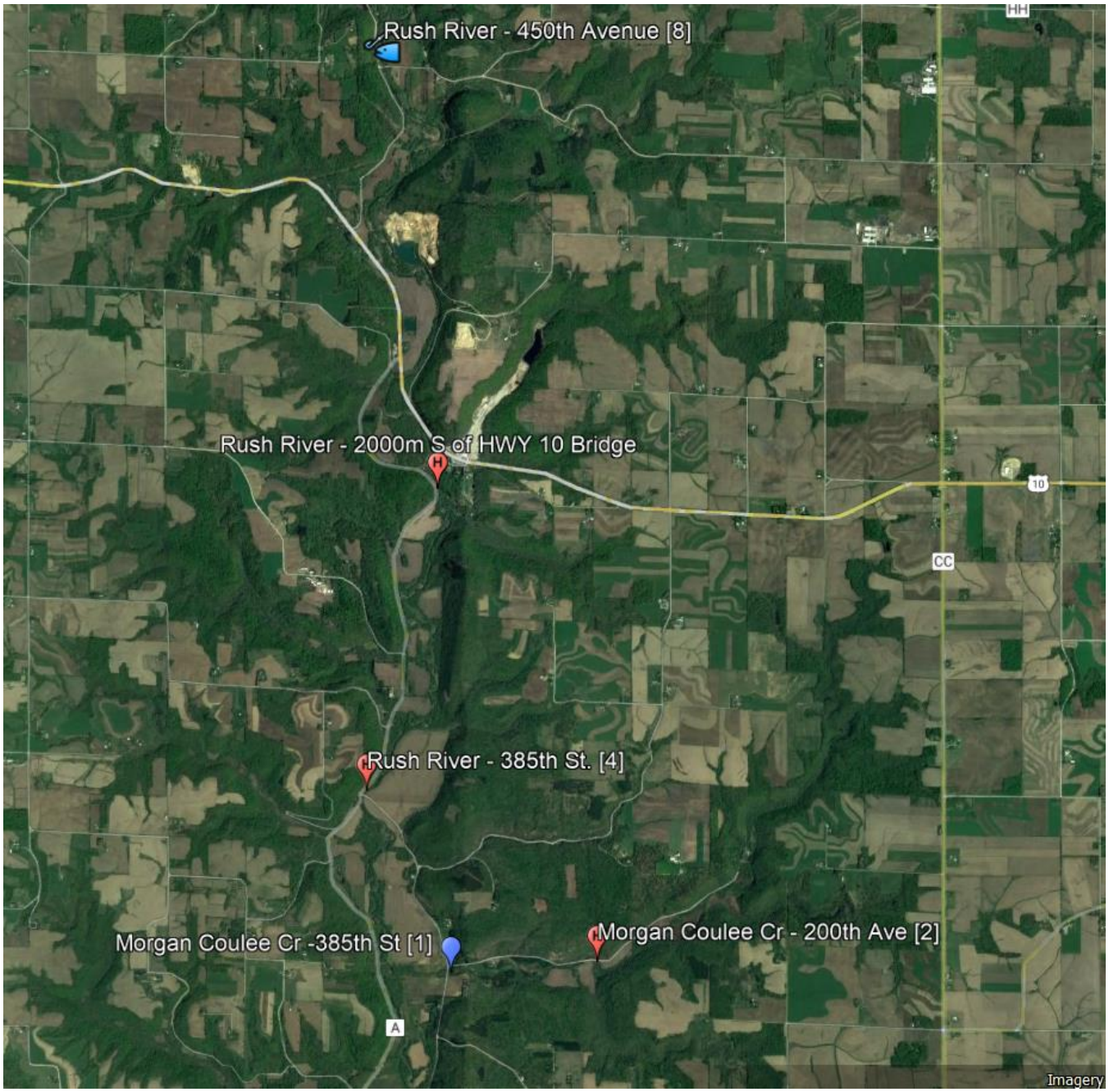


Figure 3. Hilsenhoff Biotic Index Data for nine sites, 1979-2018. Note that biotic health increases with decreasing HBI.

APPENDIX A – MAP ENLARGED VIEWS

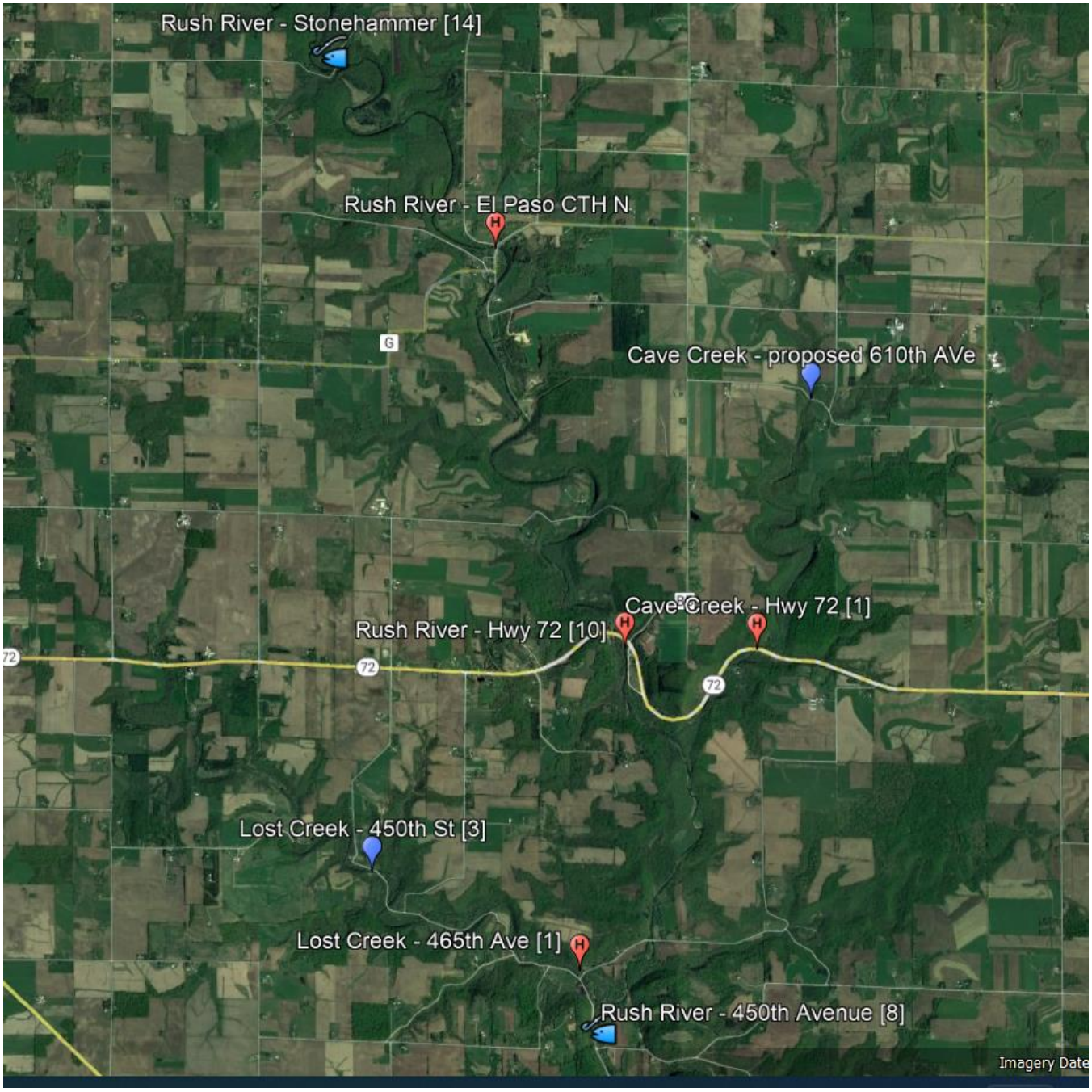


Lower Section

Key:

H=HBI Measurements in database
Fish&Hook=Fisheries Survey Station (Active), no HBI in database
Blue=Not a Fisheries Survey Station, no HBI
Fisheries Survey Stations in square brackets []

APPENDIX A – MAP ENLARGED VIEWS

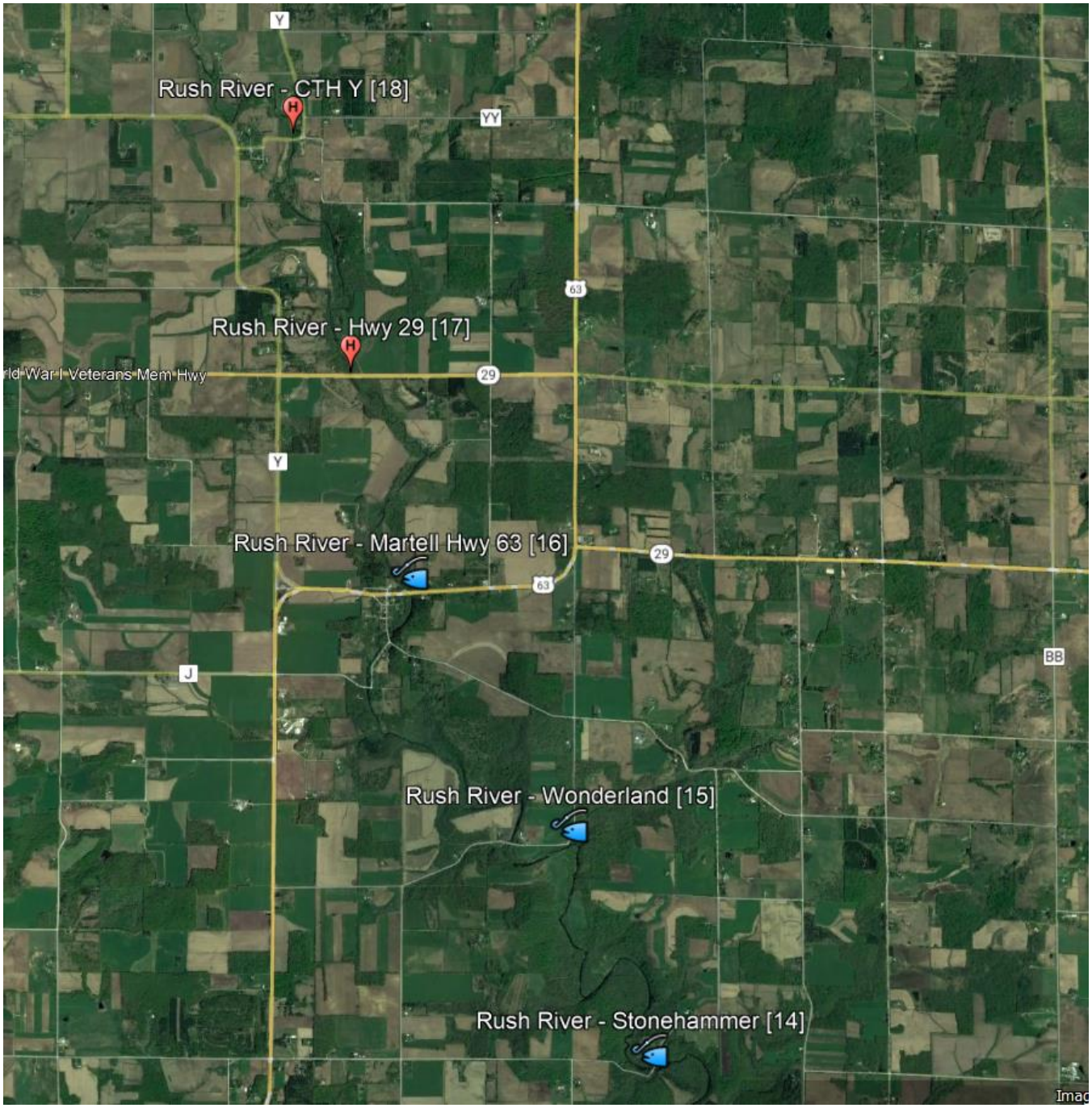


Middle Section

Key:

H=HBI Measurements in database
Fish&Hook=Fisheries Survey Station (Active), no HBI in database
Blue=Not a Fisheries Survey Station, no HBI
Fisheries Survey Stations in square brackets []

APPENDIX A – MAP ENLARGED VIEWS



Upper Section

Key:

H=HBI Measurements in database
Fish&Hook=Fisheries Survey Station (Active), no HBI in database
Blue=Not a Fisheries Survey Station, no HBI
Fisheries Survey Stations in square brackets [

Group 1. These animals are most sensitive to pollution. Circle the name of each animal found.


Mayfly


Stonefly

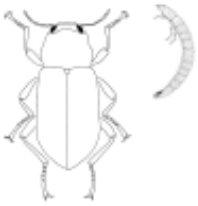

Dobsonfly



Caddisfly

No. of Group 1 animals found: ☐

Group 2. These animals are less sensitive to pollution than Group 1. Circle the name of each animal found.


Riffle Beetle


Freshwater Shrimp or Scud

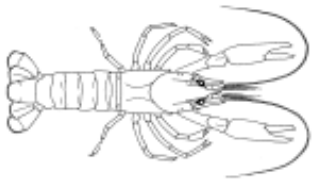

Dragonfly


Damselfly


Crane Fly

No. of Group 2 animals found: ☐

Group 3. These animals are more tolerant of pollution than Groups 1 or 2. Circle the name of each animal found.


Crayfish

Planaria


Mussel

No. of Group 3 animals found: ☐


Black Fly


Fingernail Clam


Water Mite

Group 4. These animals are most tolerant of pollution. Circle the name of each animal found.


Midge


Leech


Aquatic Worm


Sow Bug


Snail

No. of Group 4 animals found: ☐

Recording Form for the Citizen Monitoring Biotic Index

Name: _____ Date: _____ Watershed and Stream Names: _____ Time: _____ Location: _____ Site: _____ (County, Township, Range, Section, Road, Intersection, Other)

At this point, you should have collected a wide variety of aquatic macroinvertebrates from your three sites. You will now categorize your sample, using the *Key to Macroinvertebrate Life in the River* to help you identify the macroinvertebrates found. **The number of animals found is not important; rather, the variety of types of macroinvertebrates and their tolerance to pollution tells us the biotic index score**. Before you begin, check off the habitats from which you collected your sample (see right).

- ☐ Riffles
- ☐ Undercut banks
- ☐ Snag areas, tree roots, submerged logs
- ☐ Leaf packs

1. You should have removed large debris (e.g. leaves, rocks, sticks) from your sample and placed this material in a separate basin (after removing macroinvertebrates from it).

2. Check the basin with the debris to see if any aquatic macroinvertebrates crawled out. Add these animals to your sample.

3. Fill the ice cube tray half-full with water.

4. Using plastic spoons or tweezers, (be careful not to kill the critters – ideally, you want to put them back in their habitat after you're finished) sort out the macroinvertebrates and place ones that look alike together in their own ice cube tray compartments. Sorting and placing similar looking macroinvertebrates together will help insure that you find all varieties of species in the sample.

5. Refer to the *Key to Macroinvertebrate Life in the River* and the *Citizen Monitoring Biotic Index* to identify the aquatic macroinvertebrates:

A. On the back of this page, circle the animals on the index that match those found in your sample.

B. Count the number of types of animals that are circled in each group and write that number in the box provided. Do not count individual animals in your sample. Only count the number of types of animals circled in each group.

C. Enter each boxed number in the first space provided.

D. Decide which animal is the most common; add 1 for that animal's group in the second space provided (shaded area). Add zero for all other groups.

E. Multiply the entered sum by the group value.

F. Total the number of animals circled (a).

G. Total the calculated values for all groups (b).

H. Divide the total values by the total number of types of animals that were found: **TOTAL VALUES (b) / TOTAL ANIMALS (a).**

I. Record this number as the Index score. SHOW ALL MATH (Use space below to do your math computations)

		+1 for group with the most common animal (+0 for the other three groups)			
No. of animals circled from group 1	_____	+ ____ =	____	x 4 =	_____
No. of animals circled from group 2	_____	+ ____ =	____	x 3 =	_____
No. of animals circled from group 3	_____	+ ____ =	____	x 2 =	_____
No. of animals circled from group 4	_____	+ ____ =	____	x 1 =	_____
	Total animals (a)				**Total values (b)**

(b) total values _____ ÷
(a) total animals _____ =

Index score:

How healthy is the stream?

Excellent	3.6+
Good	2.6 - 3.5
Fair	2.1 - 2.5
Poor	1.0 - 2.0

Call your local Monitoring Coordinator if you have questions about sampling or determining the Biotic Index Score. ***Return form to:***