# Guide to Appropriate Metric Selection for Calculating the Index of Biotic Integrity (IBI) for Indiana Rivers and Streams

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Assessment Branch
Biological Studies Section

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# Guide to Appropriate Metric Selection for Calculating the Index of Biotic Integrity (IBI) for Indiana Rivers and Streams

Sample collections for all ecoregions, and large and great rivers were conducted by Dr. Thomas P. Simon (formerly with U.S. EPA) with support from the Indiana Department of Environmental Management (IDEM) for the development of biological criteria on behalf of the U.S. EPA, Region 5. Collection procedures follow the U. S. Environmental Protection Agency (USEPA) Standard Operating Procedures for conducting rapid assessment of ambient surface water quality using fish (1988). For a detailed list of documents used to create this guide, please refer to the reference section of this paper.

1. Determine drainage area (sq mi)

    a. Less than 1000 square miles*…….…… step 2
    b. Greater than or equal to 1000 square miles ..……..……. step 3

* If you are sampling a location that is categorized as a large river (greater than or equal to 1000 square miles) on the St. Joseph River, St. Mary's River, and Maumee River (Huron Erie Lake Plain), or the St. Joseph River, Pigeon River, and Elkhart River (Northern Indiana Till Plain) use this option.

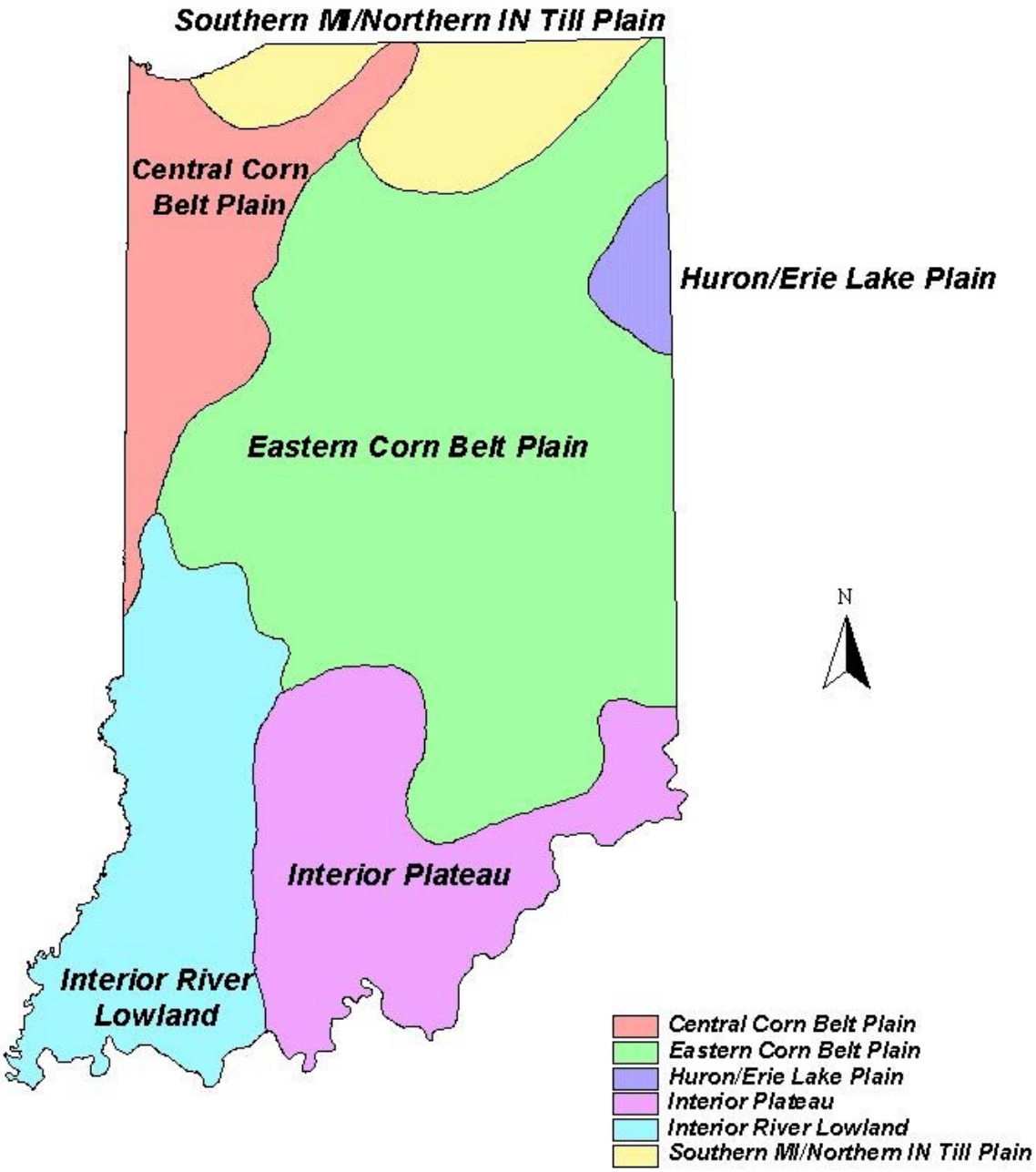
2. Determine which ecoregion your stream is located in, or drains into. If your sampling location lands on or near an ecoregion boundary line, place it in the ecoregion that the stream drains into, see map next page.

    a. Central Corn Belt Plain…….…… page 3
    b. Eastern Corn Belt Plain …...…….……..…. page 14
    c. Northern Indiana Till Plain…….…….……. page 18
    d. Huron Erie Lake Plain ……... ……. page 23
    e. Interior River Lowland ……..…….. page 28
    f. Interior Plateau …… page 31

3. Determine which category best fits

    a. Drainage area (sq mi) is greater than or equal to 1000, not mainstem Wabash River……. ……..…….. page 32
    b. Drainage area (sq mi) is greater than or equal to 2000 (sq. mi), mainstem Wabash River…… page 35

**Ecoregions of Indiana (Omernik and Gallant 1988)**



# Central Corn Belt Plain

Determine which basin your site is located in

a. Kankakee River and Iroquois River basins……..…… Table 1
b. Lake Michigan Basin……...…….Table 2, page 5

**Table 1**

Determine what stream category your site belongs in

a. Less than or equal to 20 (sq mi), Headwater site…… use metrics B, and H
b. Greater than 20, but less than 1000 (sq mi), Wadable site.…… use metrics B, and W

| Stream Category | Metric | Metric Score 5 | 3 | 1 |
|---|---|---|---|---|
| B | Total number of species (app. A) | Page 5, Fig. 1 or 2 | | |
| H | Number of darter, madtom and sculpin species (app. B) | Page 6 Fig. 4, or Page 7 Fig. 5 | | |
| W | Number of darter species (app. B) | Page 6 Fig. 4, or Page 7 Fig. 5 | | |
| H | Percent headwater species (app. D) | ≥26.5 | 13.3-26.6 | ≤13.3 |
| W | Number of sunfish species (app. E) | >3 | 2-3 | <2 |
| H | Number of minnow species (app. H) | Page 8, Fig. 7 or 8 | | |
| W | Number of sucker species (app. I) | Page 10, Fig. 11 | | |
| B | Number of sensitive species (app. K) | Page 10, Fig. 12, or Page 11, Fig. 13 | | |
| B | Percent tolerant species (app. L) | ≤25 | 25.1-49.9 | ≥50 |
| H | Percent omnivore species (app. M) | Page 11, Fig. 14 | | |
| W | Percent omnivore species (app. M) | <19.3 | 19.3-38.7 | >38.7 |
| H | Percent insectivore species (app. N) | Page 12, Fig. 15 | | |
| W | Percent insectivore species (app. N) | ≥50 | 25.1-49.9 | ≤25 |
| H | Percent pioneer species (app. O) | <24.7 | 24.7-49.4 | >49.4 |
| W | Percent carnivore species (app. P) | >5 | 2.0-5 | <2 |
| B | Catch Per Unit Effort (= number of individuals) | Page 13, Fig. 17 | | |
| B | Percent simple lithophilic species (app. Q) | ≥34 | 16.5-33.9 | <16.5 |
| B | Percent DELT anomalies (app.R) | <0.1 | 0.1-1.3 | >1.3 |

Scoring modification needs to occur when less than **25** (headwater) or **50** (wadeable) individuals are collected, see appendix S.

# Central Corn Belt Plain

**Table 2**

Determine what stream category your site belongs in

a. Less than or equal to 20 (sq mi),
   Headwater site……use stream category B, and H
b. Greater than 20, but
   less than 1000 (sq mi),
   Wadable site.……..……use stream category B, and W

Determine which "sub-basin" your site is in

a. East Branch Little Calumet…… define further using EBLC
b. Lake Michigan Division……..…… define further using LMD

| Stream Category | Metric | Metric Score 5 | 3 | 1 |
|---|---|---|---|---|
| B | Total number of species (app. A) | Page 6, Fig. 3 | | |
| H | Number of darter, madtom and sculpin species (app. B) | Page 7, Fig. 6 | | |
| W | Number of darter species (app. B) | Page 7, Fig. 6 | | |
| B | Number of sunfish species (app. E) | >3 | 2-3 | <2 |
| H (LMD) | Number of minnow species (app. H) | Page 9, Fig. 9 | | |
| H(EBLC) W | Number of Salmonid species (app. G) | Page 9, Fig. 10 | | |
| B | Number of sensitive species (app. K) | Page 11, Fig. 13 | | |
| B | Percent tolerant species (app. L) | ≤25 | 25.1-49.9 | ≥50 |
| H | Percent omnivore species (app. M) | Page 11, Fig. 14 | | |
| W | Percent omnivore species (app. M) | <19.3 | 19.3-38.7 | >38.7 |
| H | Percent insectivore species (app. N) | Page 12, Fig. 15 | | |
| W | Percent insectivore species (app. N) | ≥50 | 25.1-49.9 | ≤25 |
| H (LMD) | Percent pioneer species (app. O) | <24.7 | 24.7-49.4 | >49.4 |
| H(EBLC) | Percent carnivore species (app. P) | Page 12, Fig. 16 | | |
| W | Percent carnivore species (app. P) | >25 | 12.5-25 | <12.5 |
| B | Catch Per Unit Effort (= number of individuals) | Page 13, Fig. 17 | | |
| B | Percent simple lithophilic species (app. Q) | ≥34 | 16.5-33.9 | <16.5 |
| B | Percent DELT anomalies (app. R) | <0.1 | 0.1-1.3 | >1.3 |

Scoring modification needs to occur when less than **25** (headwater) or **50** (wadeable) individuals are collected, see appendix S.

Figure 1. Kankakee River Basin

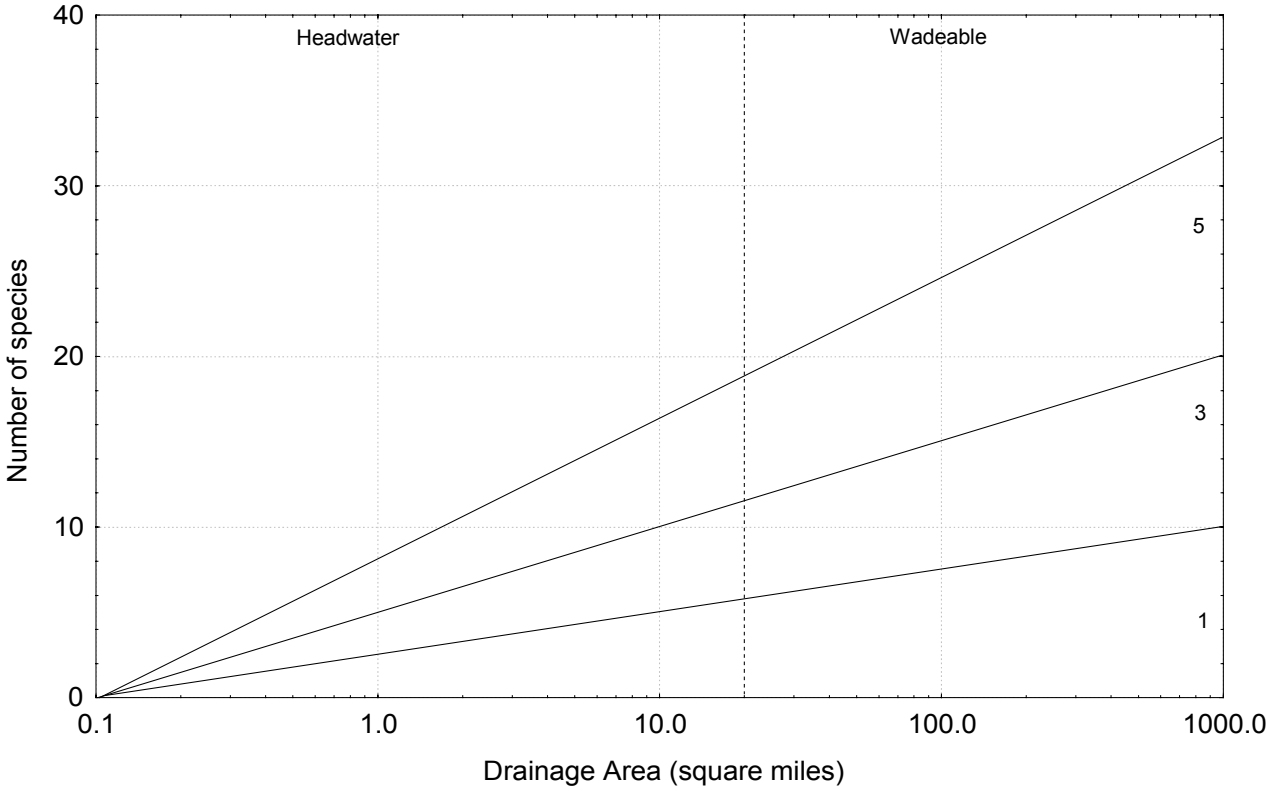



Figure 2. Iroquois River Basin

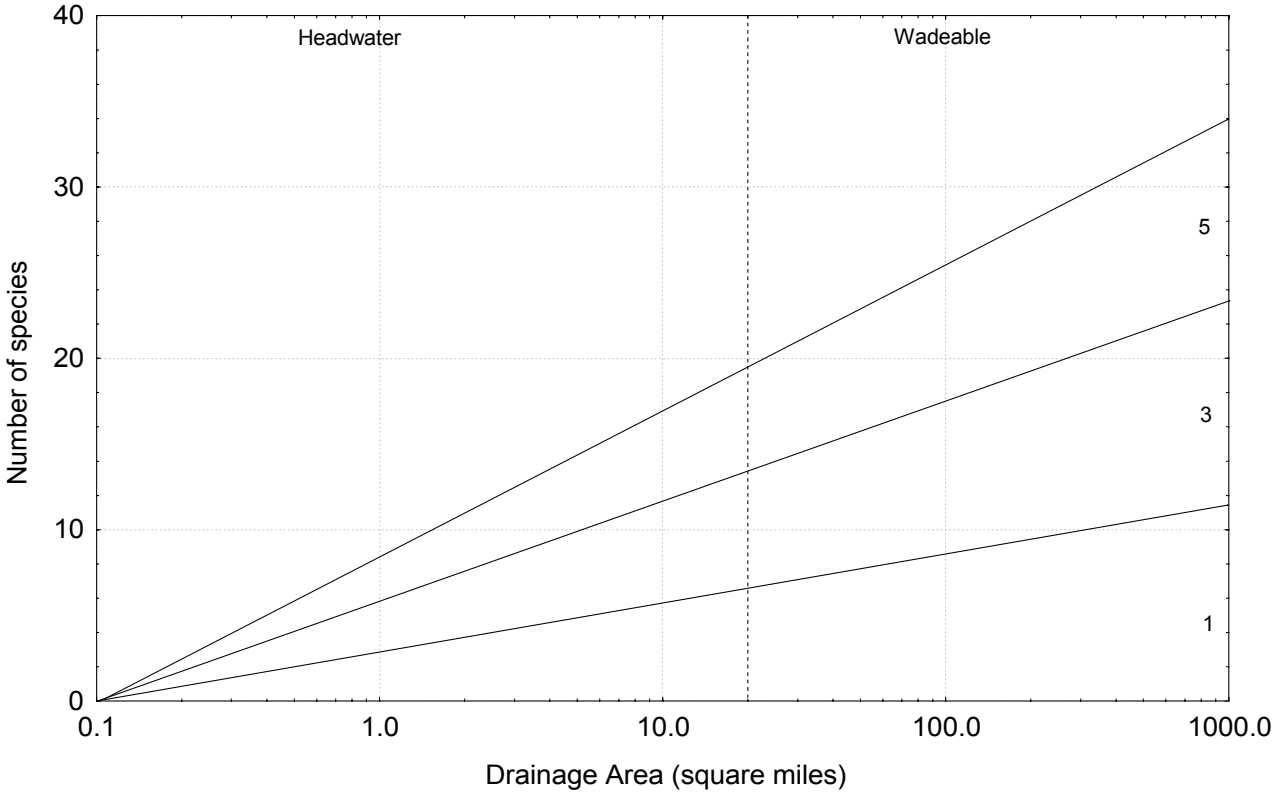


Figure 3. Lake Michigan River Basin

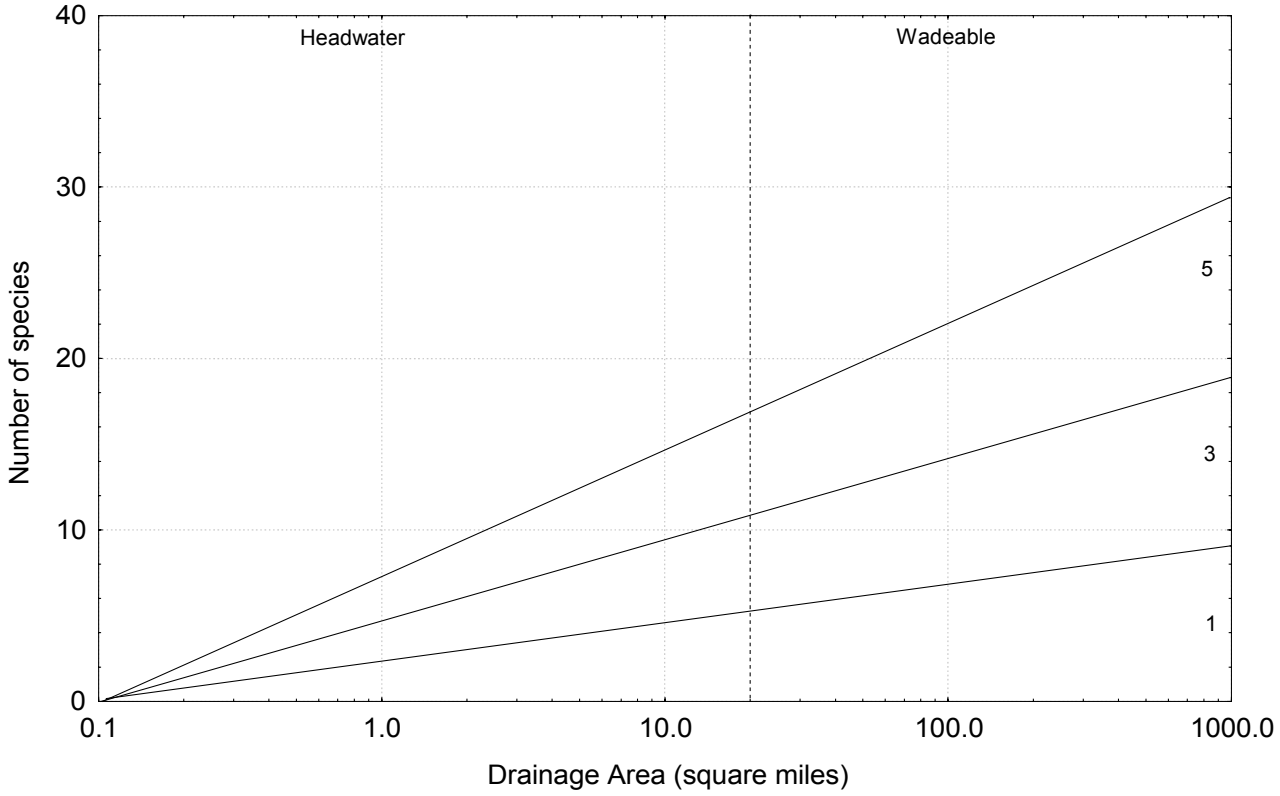



Figure 4. Kankakee River Basin

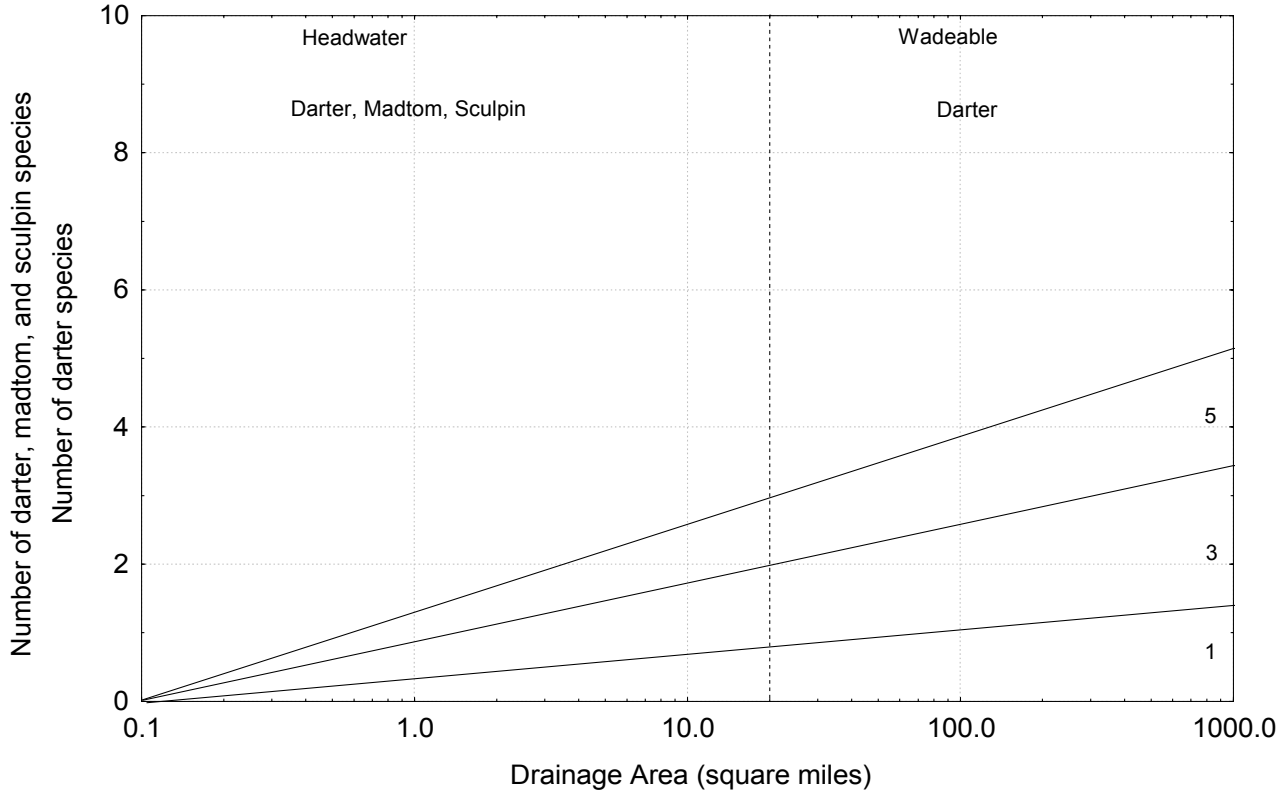


Figure 5. Iroquois River Basin

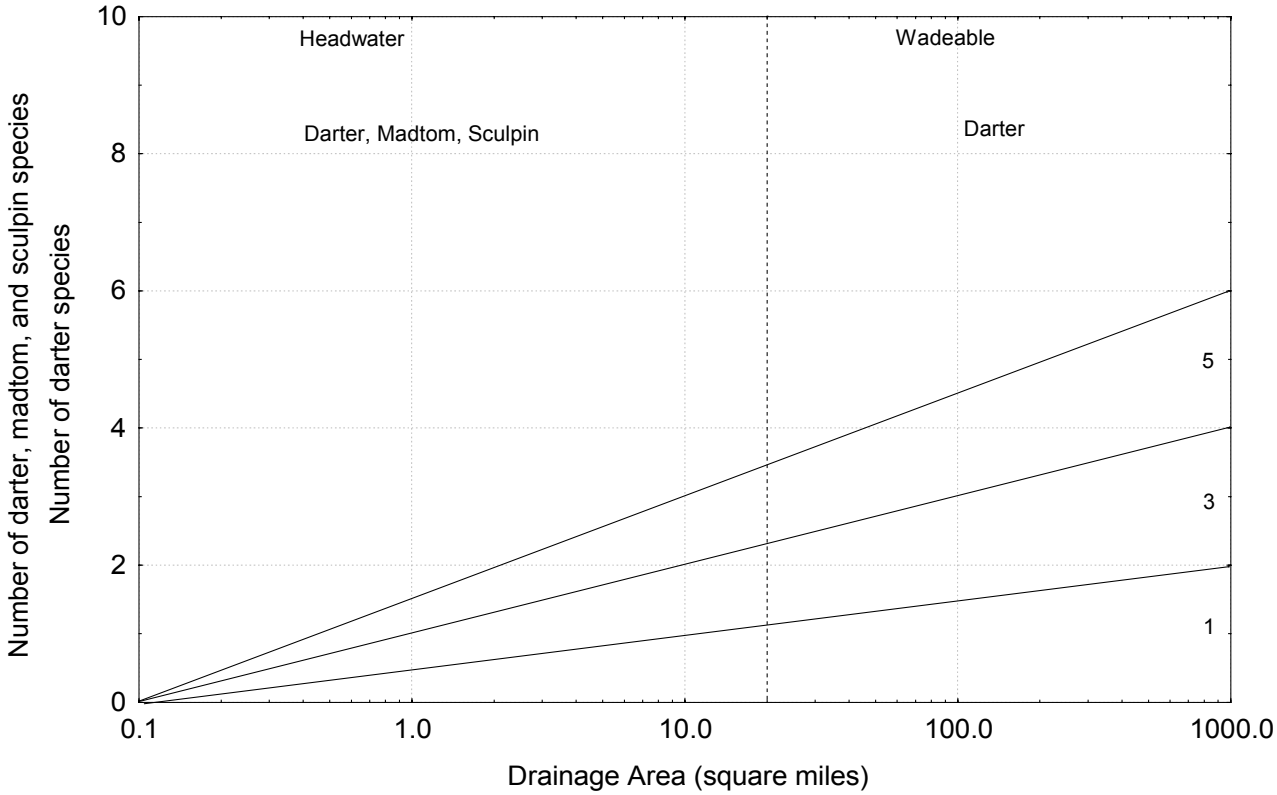



Figure 6. Lake Michigan River Basin

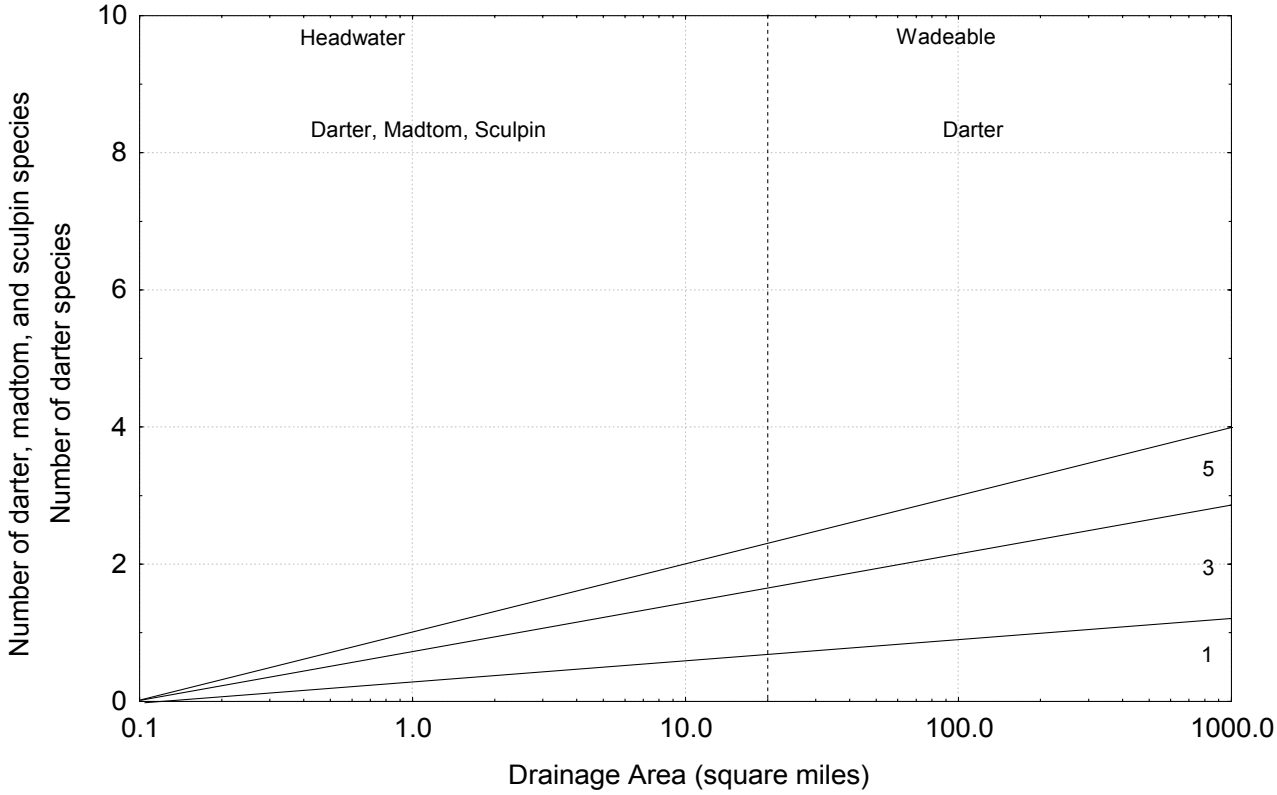


Figure 7. Kankakee River Basin

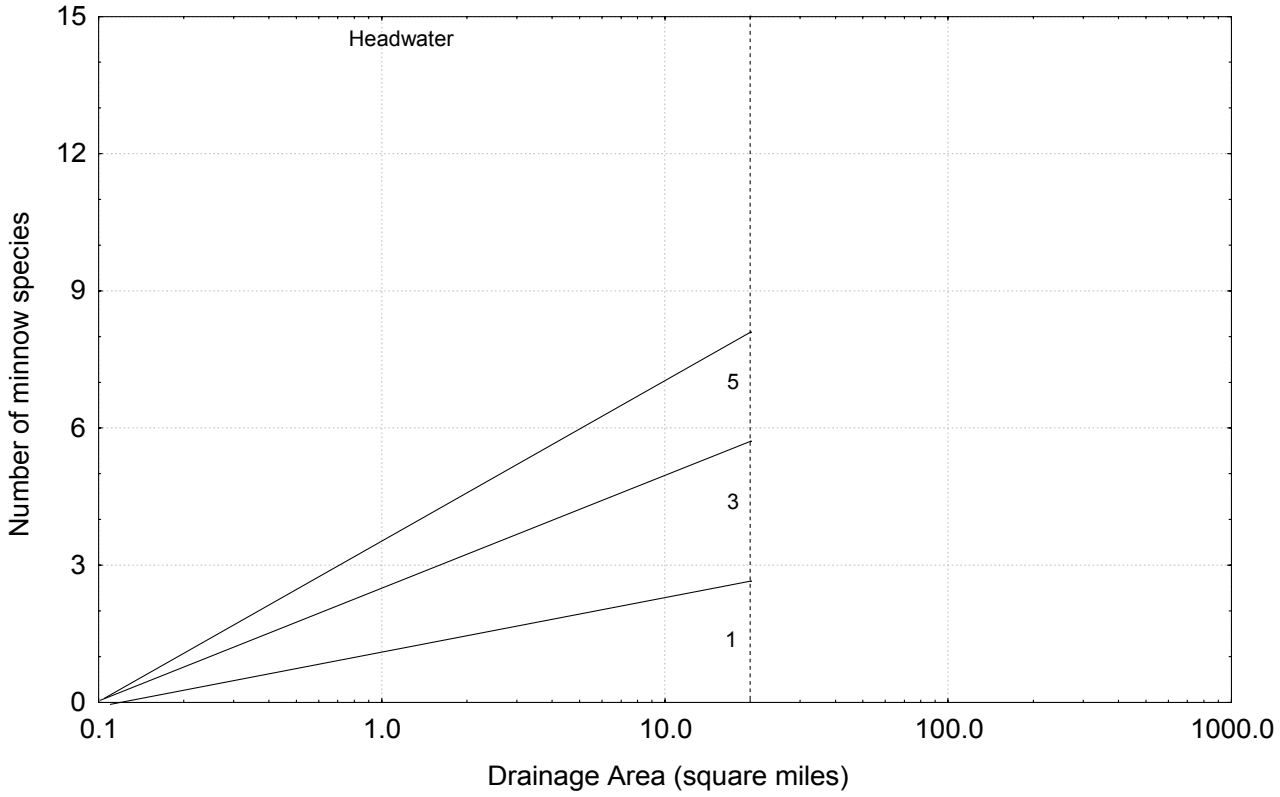



Figure 8. Iroquois River Basin

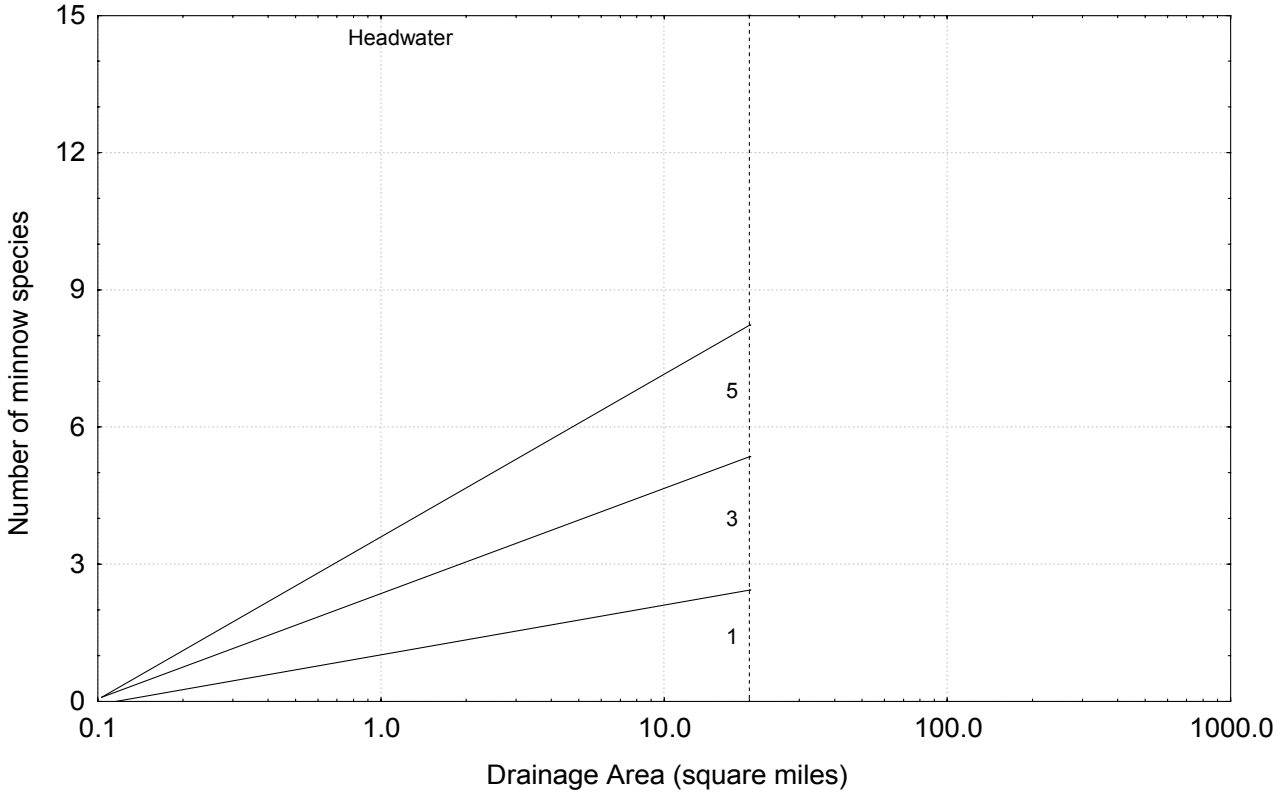


Figure 9. Lake Michigan River Basin

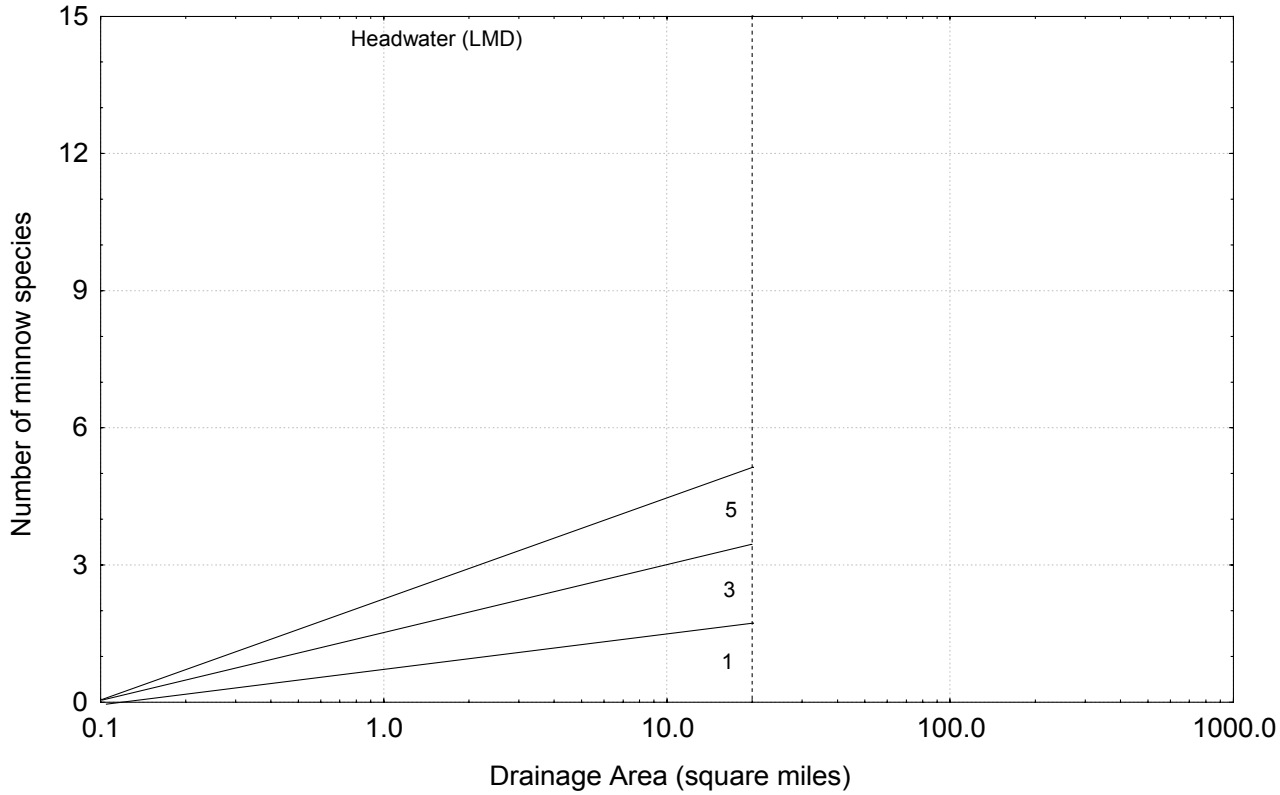



Figure 10. Lake Michigan River Basin

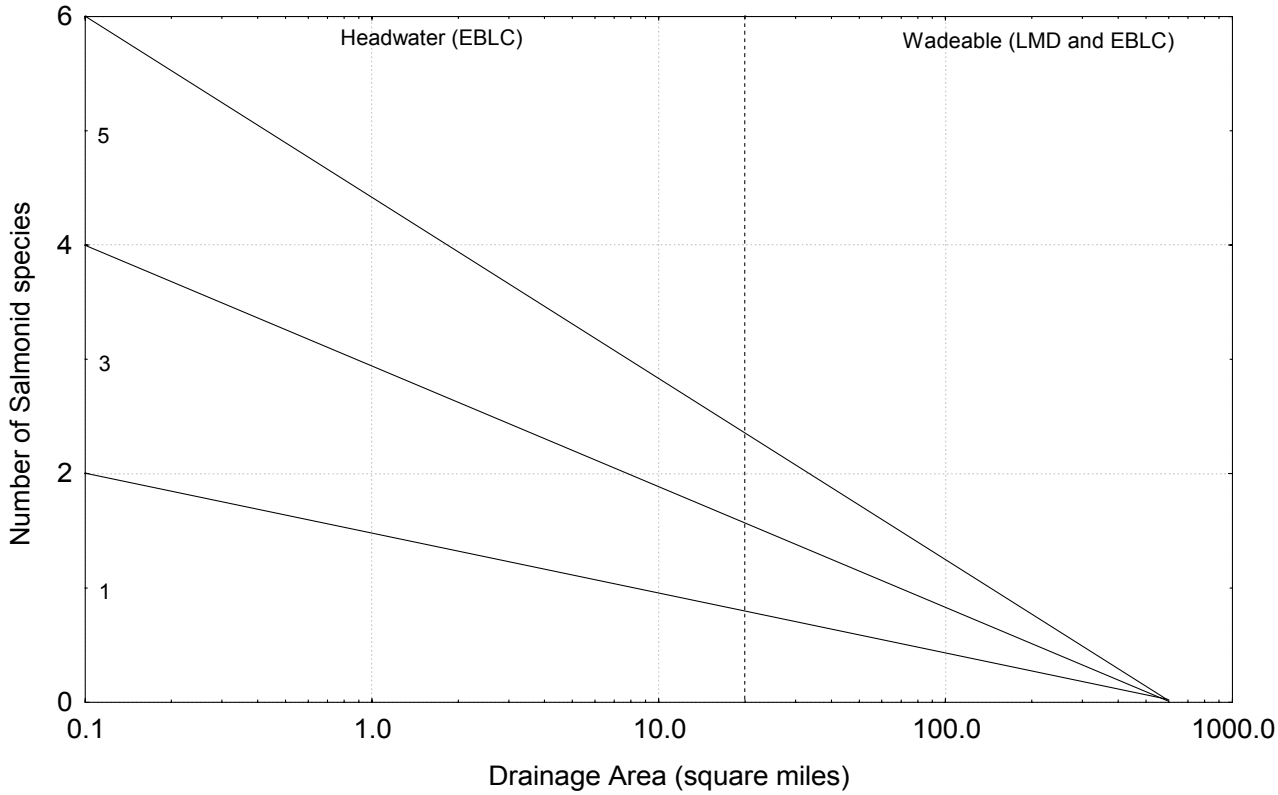


Figure 11. Kankakee and Iroquois River Basin

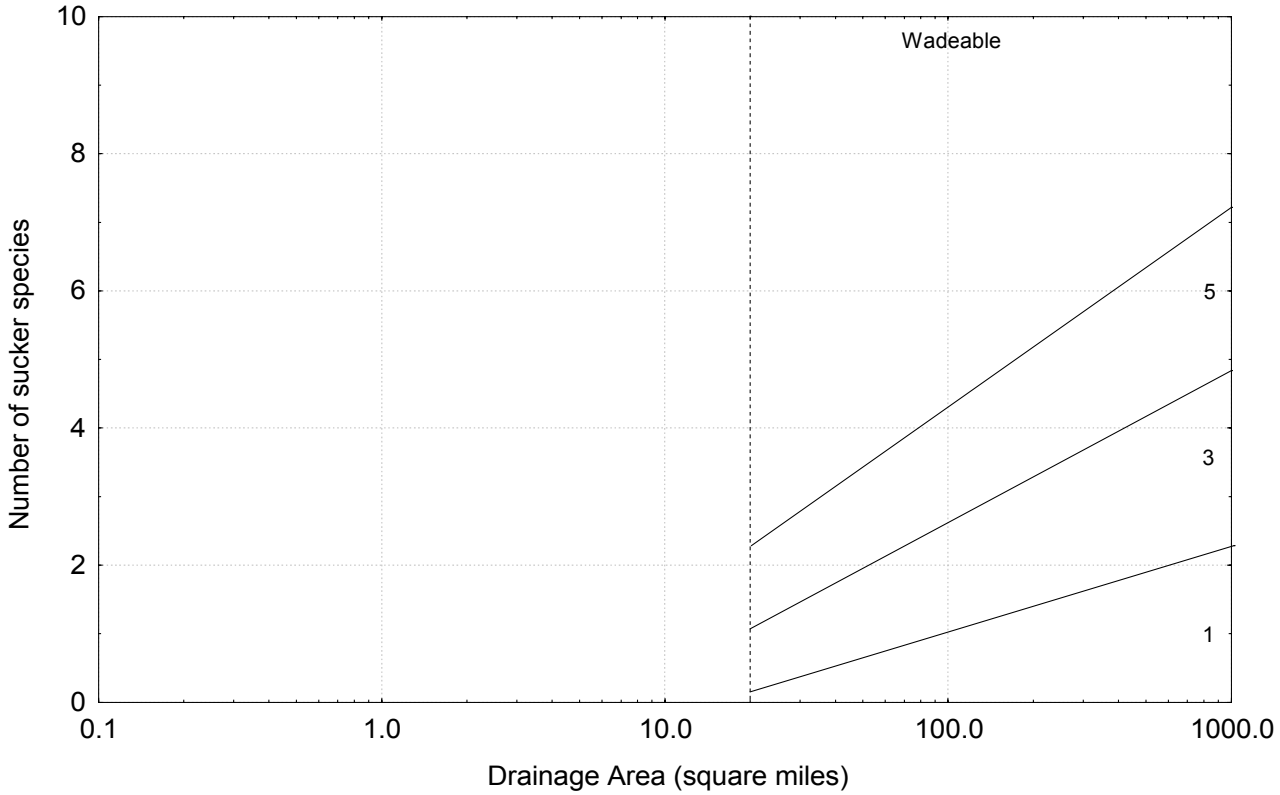



Figure 12. Kankakee River Basin

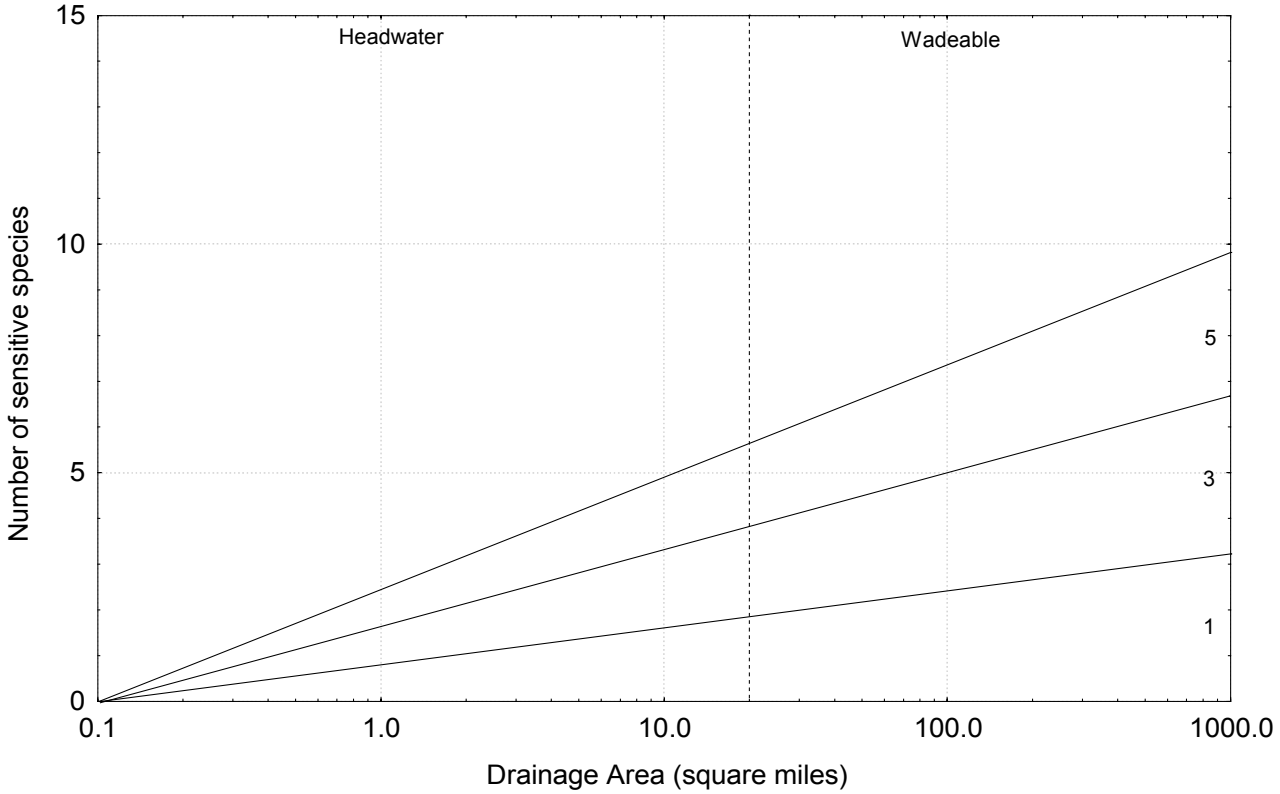


Figure 13. Iroquois and Lake Michigan River Basin

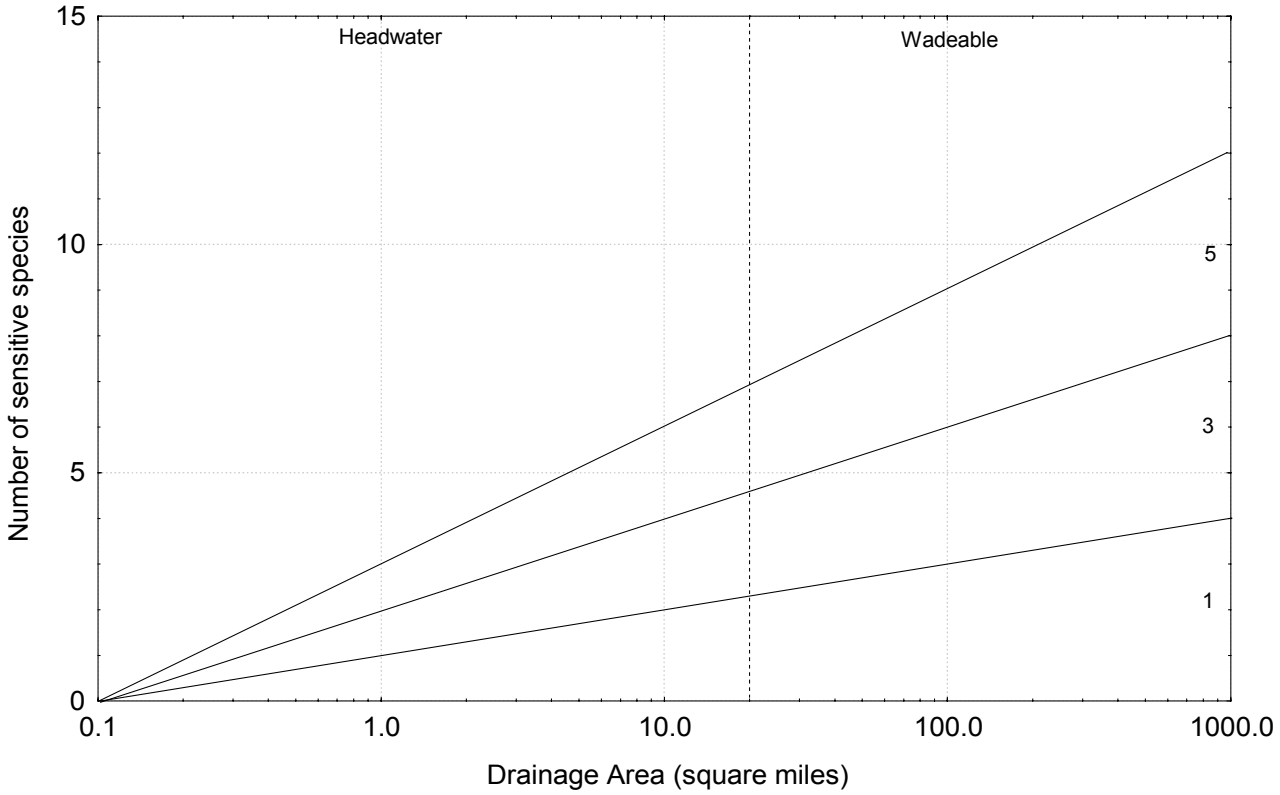



Figure 14. Kankakee, Iroquois and Lake Michigan River Basin

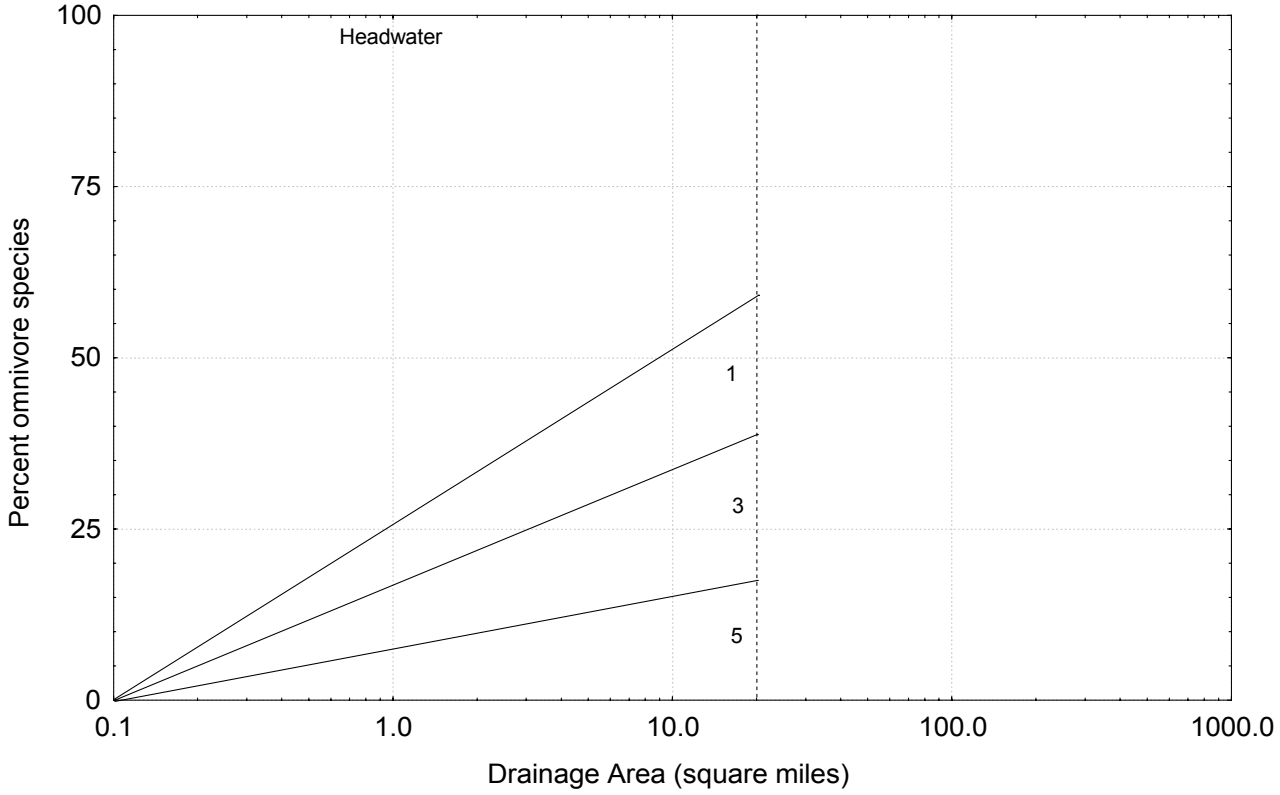


Figure 15. Kankakee, Iroquois and Lake Michigan River Basin

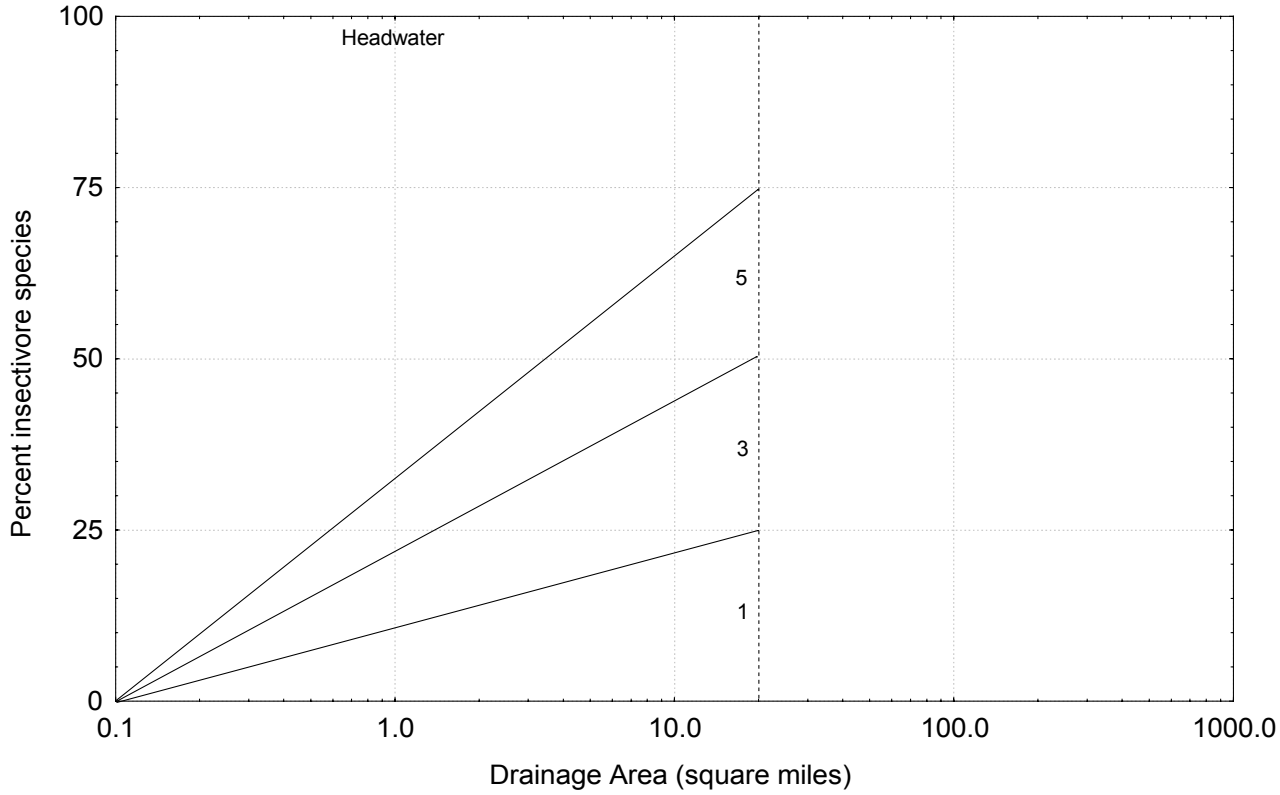



Figure 16. Lake Michigan River Basin

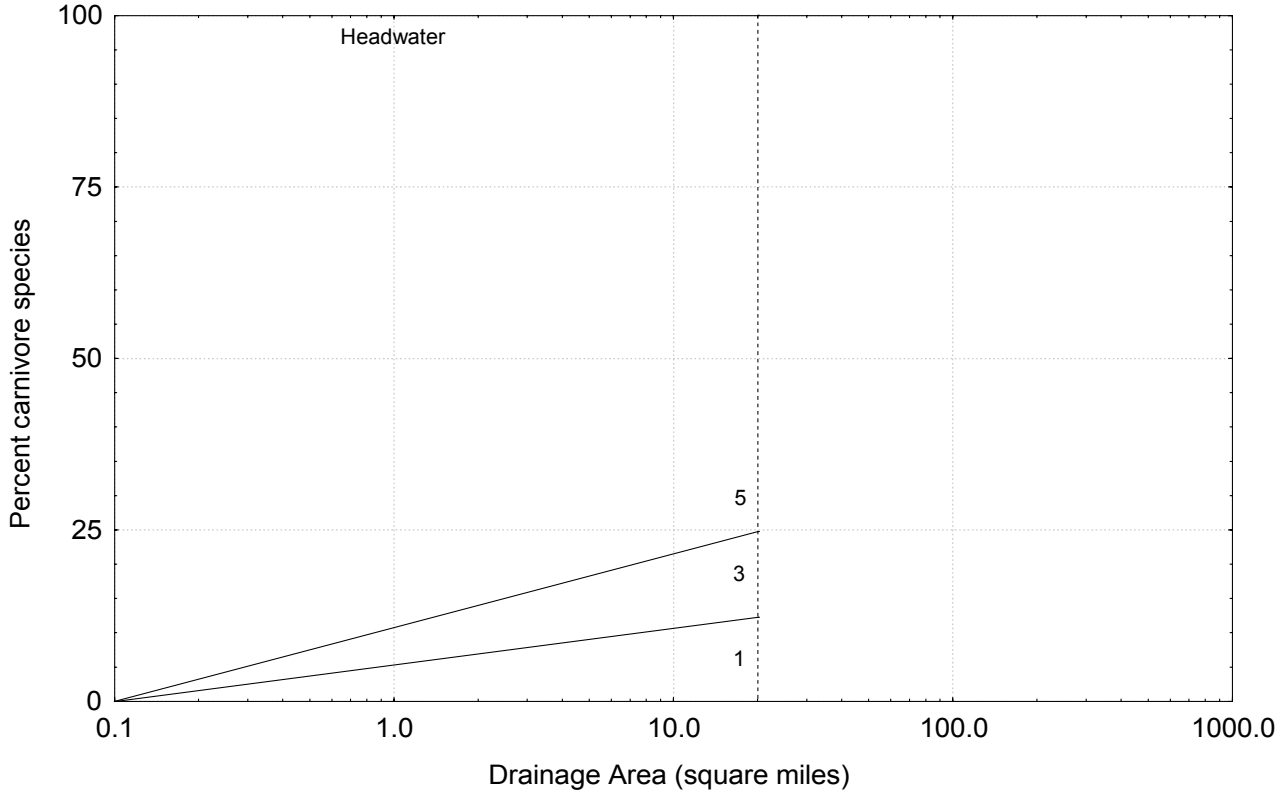
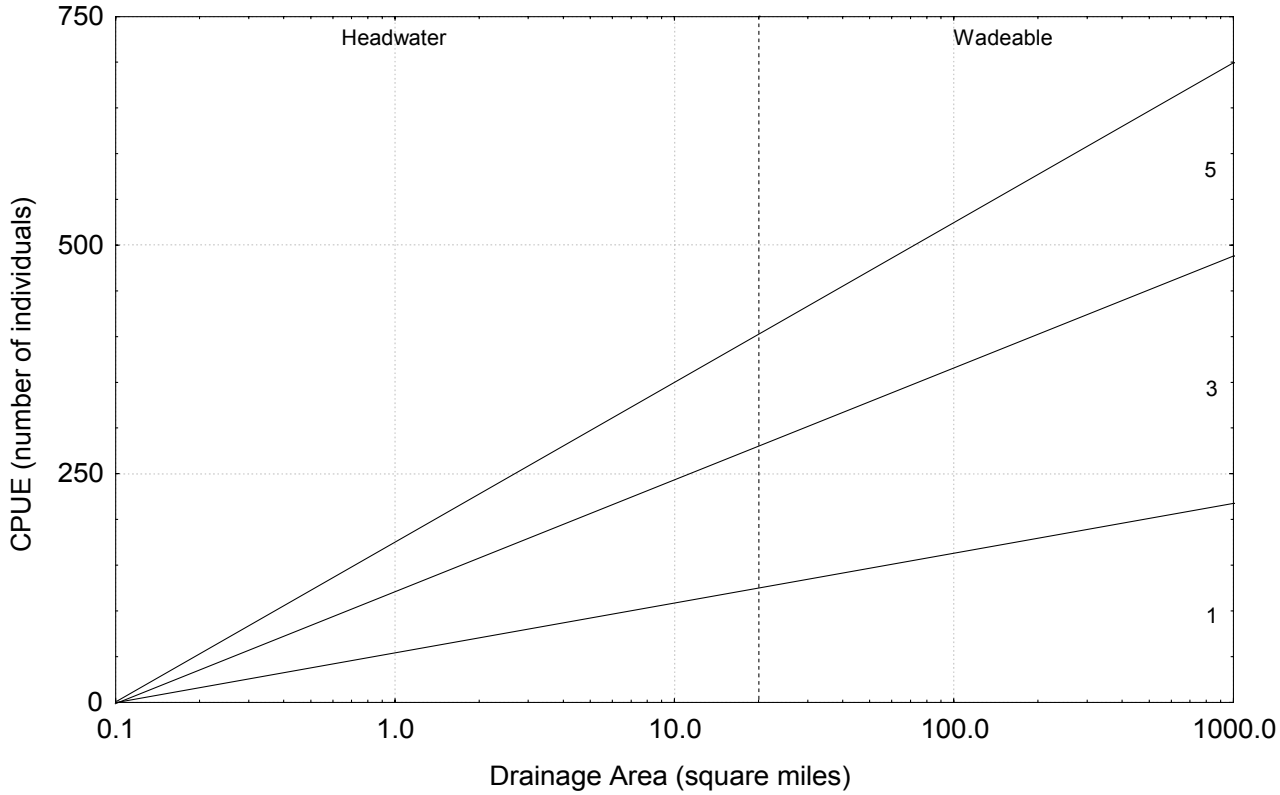


Figure 17. Kankakee, Iroquois and Lake Michigan River Basin



## Eastern Corn Belt Plain

Determine what stream category your site belongs in

a. Less than or equal to 20 (sq mi),
   Headwater site……..…… use stream category B, and H
b. Greater than 20, but less than 1000 (sq mi),
   Wadable site.……...…… use stream category B, and W

| Stream Category | Metric | Metric Score 5 | 3 | 1 |
|---|---|---|---|---|
| B | Total number of species (app. A) | Page 15, Fig. 1a | | |
| H | Number of darter, madtom and sculpin species (app. B) | Page 15, Fig. 2a | | |
| W | Number of darter species (app. B) | Page 15, Fig. 2a | | |
| H | Percent headwater species (app. D) | Page 16, Fig. 3a | | |
| W | Number of sunfish species (app. E) | >3 | 2-3 | <2 |
| H | Number of minnow species (app. H) | Page 16, Fig. 4a | | |
| W | Number of sucker species (app. I) | >3 | 2-3 | <2 |
| B | Number of sensitive species (app. K) | Page 17, Fig. 5a | | |
| B | Percent tolerant species (app. L) | <25 | 25-50 | >50 |
| B | Percent omnivore species (app. M) | <25 | 25-50 | >50 |
| B | Percent insectivore species (app. N) | >50 | 25-50 | <25 |
| H | Percent pioneer species (app. O) | <25 | 25-50 | >50 |
| W | Percent carnivore species (app. P) | >10-25 | >25-50<br>5-10 | >50<br><5 |
| B | Catch Per Unit Effort (= number of individuals) | Page 17, Fig. 6a | | |
| B | Percent simple lithophilic species (app. Q) | >40 | 20-40 | <20 |
| B | Percent DELT anomalies (app. R) | <0.1 | 0.1-1.3 | >1.3 |

Scoring modification needs to occur when less than **50** (headwater) or **100** (wadeable) individuals are collected, see appendix S.

Figure 1a. ECBP

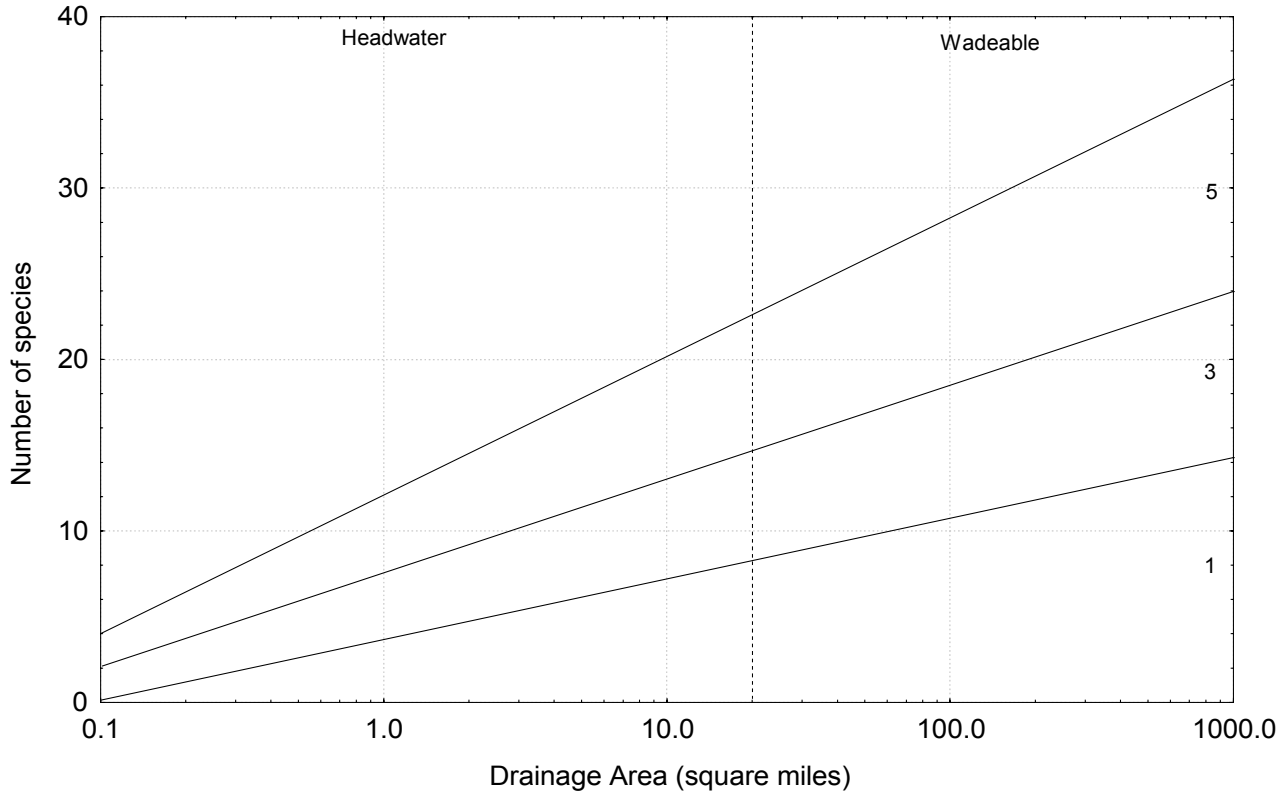



Figure 2a. ECBP

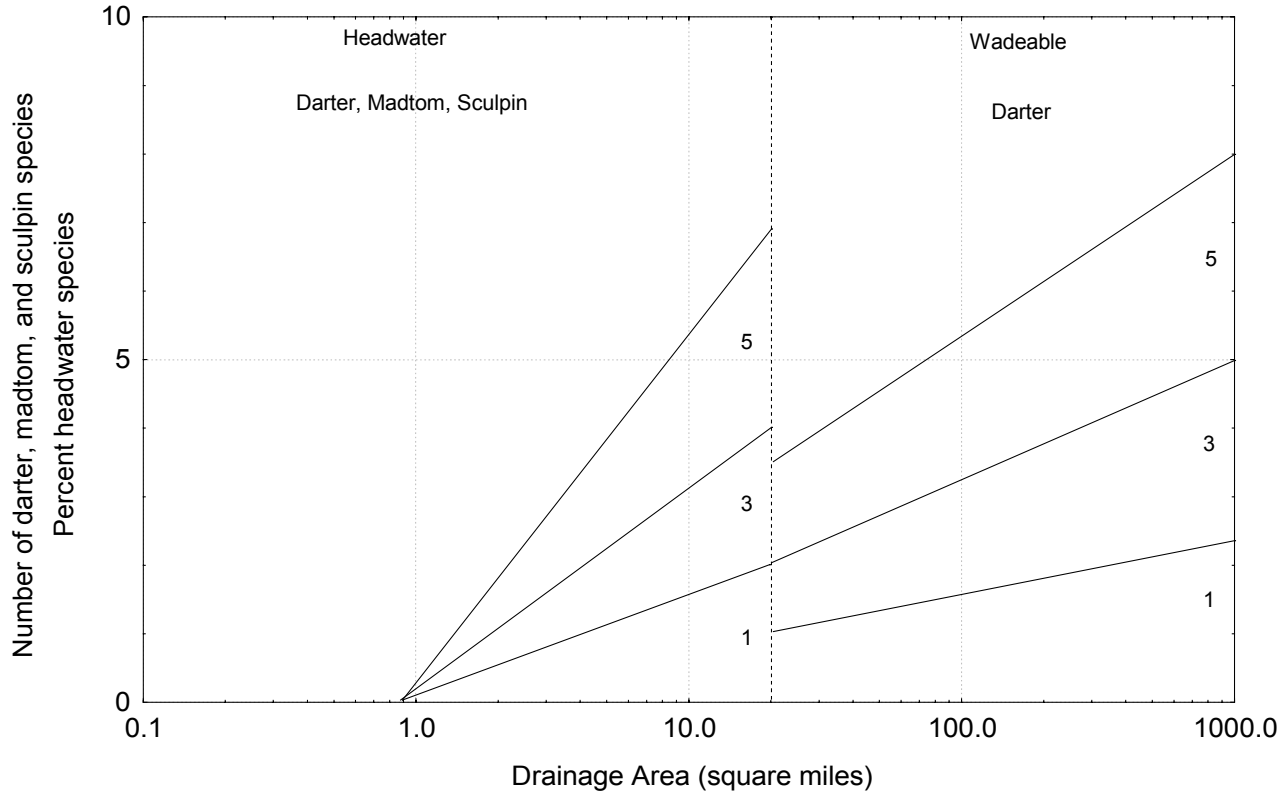


Figure 3a. ECBP

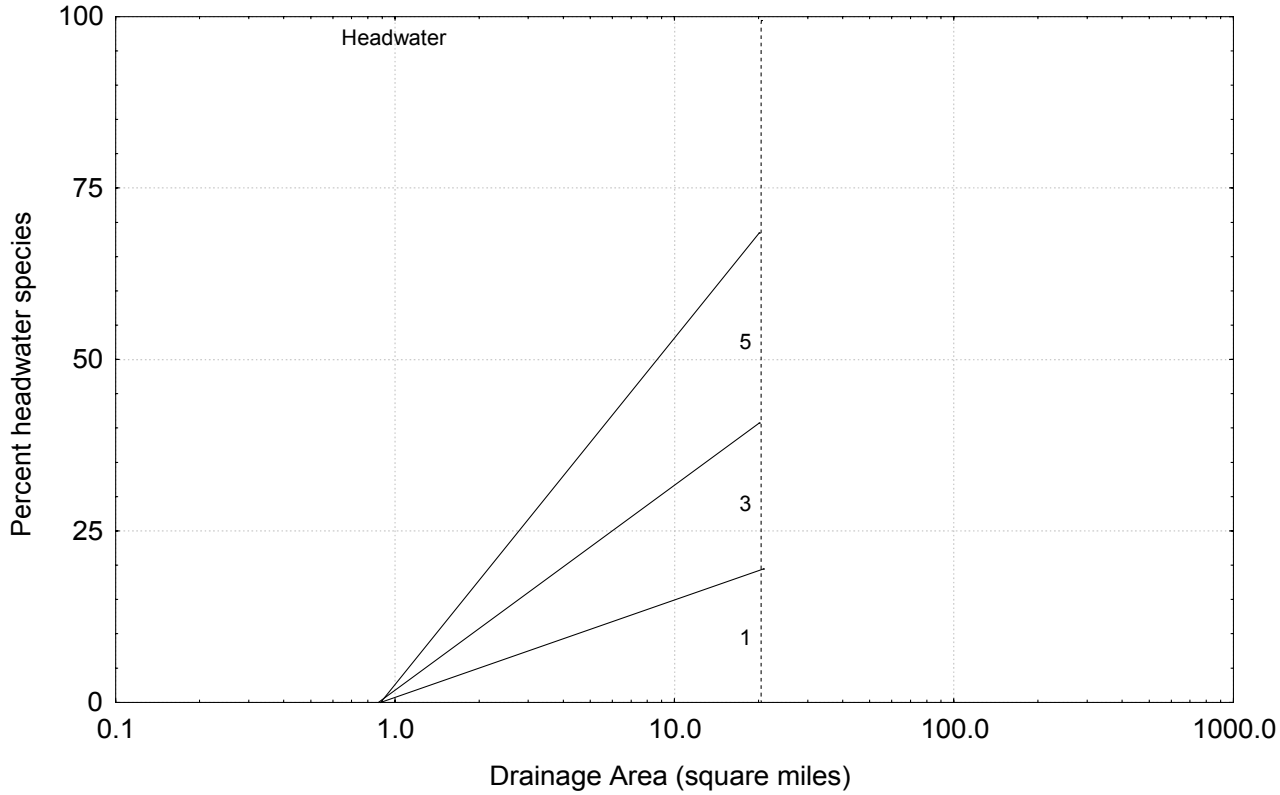



Figure 4a. ECBP

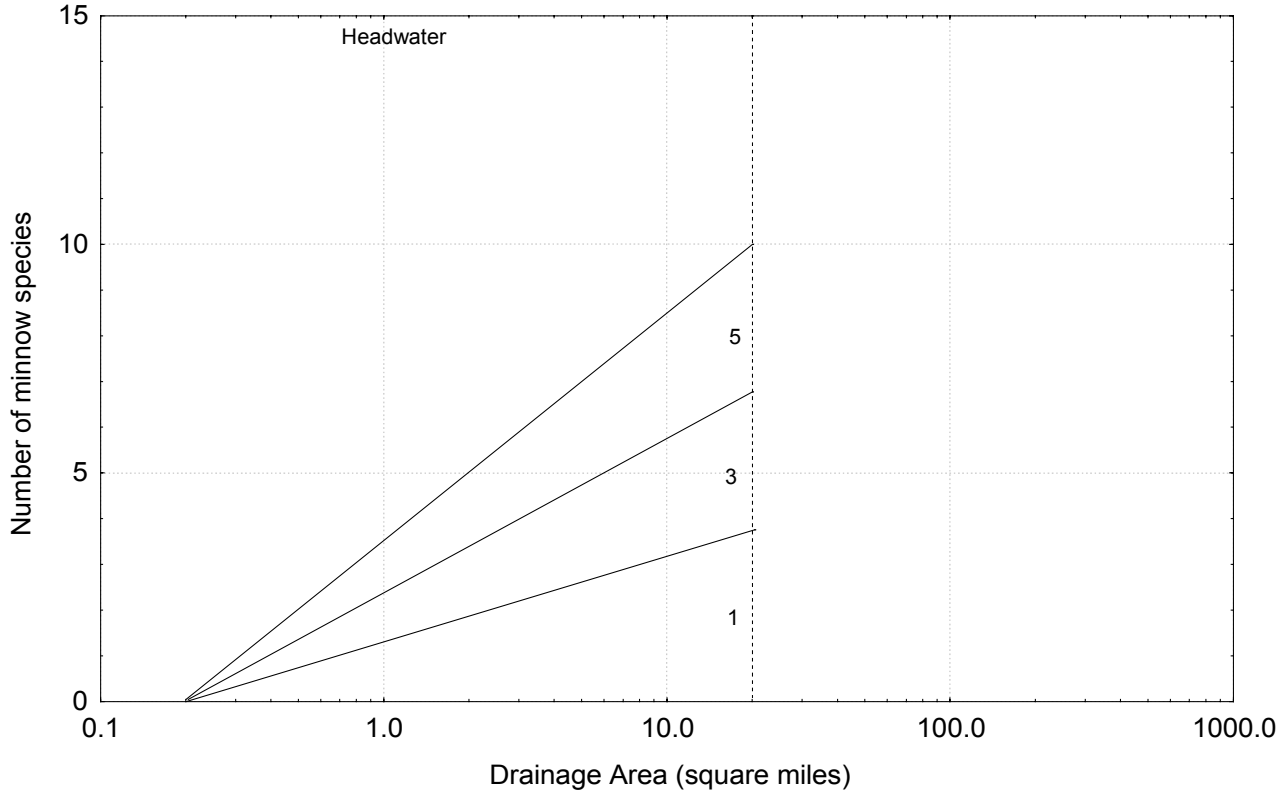


Figure 5a. ECBP

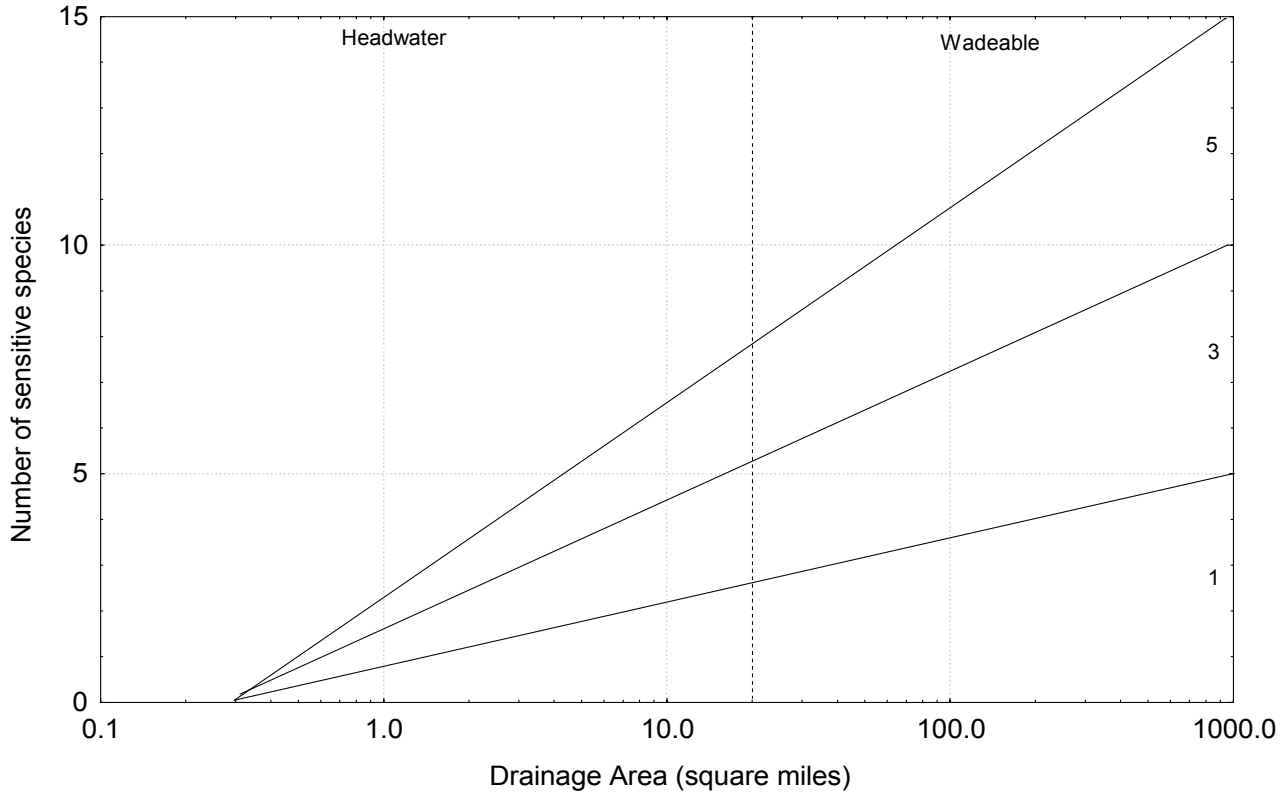
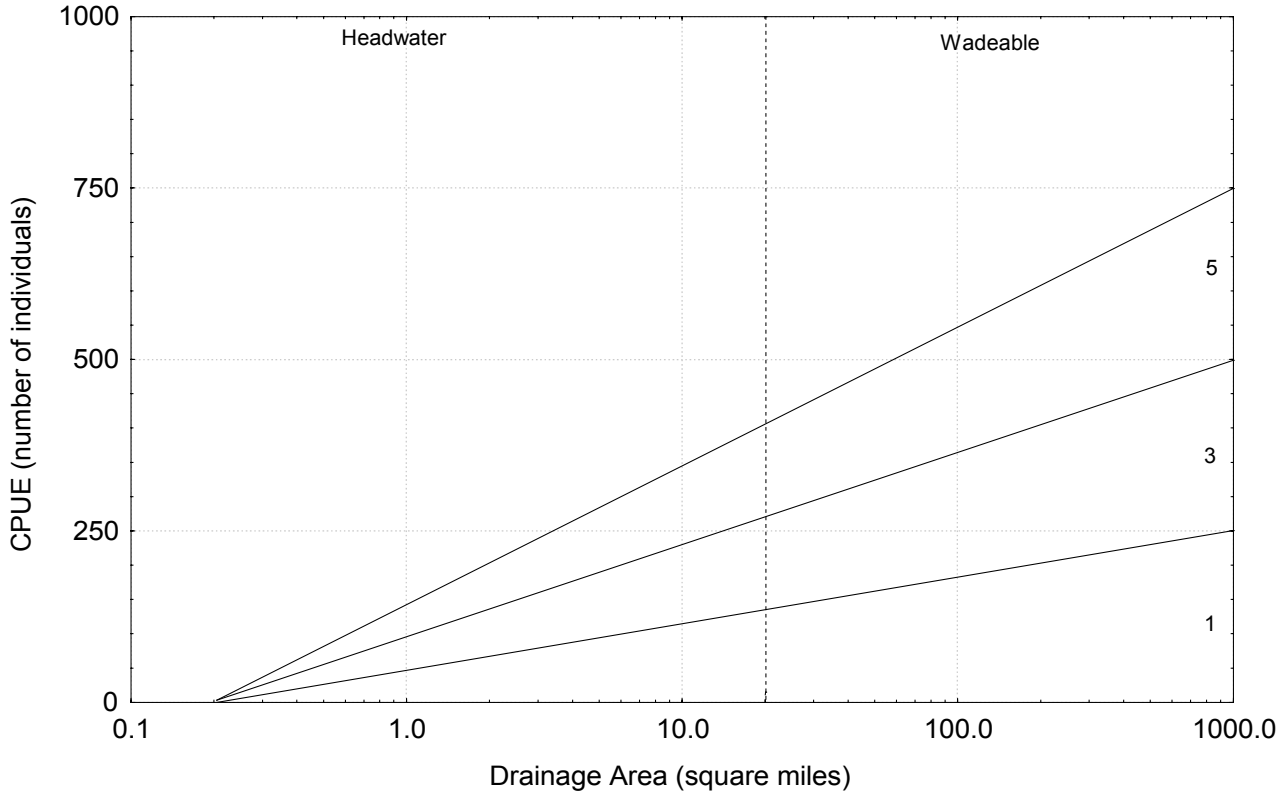



Figure 6a. ECBP



## Northern Indiana Till Plain

Determine what stream category your site belongs in

a. Less than or equal to 20 (sq mi),
   Headwater site……..…… use stream category B, and H
b. Greater than 20, but less than 1000 (sq mi),
   Wadable site*……..…… use stream category B, and W

* Note, the largest size streams (e.g. St. Joseph River, Pigeon River, and Elkhart River) were included in the calibration. The criteria should work for all drainage areas in this ecoregion (Dr. Thomas P. Simon, personal communication).

| **Stream Category** | **Metric** | **Metric Score** | | |
|---|---|---|---|---|
| | | **5** | **3** | **1** |
| B | Total number of species (app. A) | Page 19, Fig. 1b | | |
| H | Number of darter, madtom and sculpin species (app. B) | Page 19, Fig 2b | | |
| W | Number of darter species (app. B) | ≥3 | 2 | <2 |
| H | Percent headwater species (app. D) | >50 | 25-50 | <25 |
| W | Number of sunfish species (app. E) | Page 20, Fig. 3b | | |
| H | Number of minnow species (app. H) | Page 20, Fig. 4b | | |
| W | Number of sucker species (app. I) | Page 21, Fig. 5b | | |
| B | Number of sensitive species (app. K) | Page 21, Fig. 6b | | |
| B | Percent tolerant species (app. L) | <31 | 31-64 | >64 |
| B | Percent omnivore species (app. M) | <31 | 31-60 | >60 |
| B | Percent insectivore species (app. N) | >60 | 30-60 | <30 |
| H | Percent pioneer species (app. O) | <33 | 33-66 | >66 |
| W | Percent carnivore species (app. P) | >16 | 8-16 | <8 |
| B | Catch Per Unit Effort (= number of individuals) | Page 22, Fig. 7b | | |
| B | Percent simple lithophilic species (app. Q) | >45 | 15-45 | <15 |
| B | Percent DELT anomalies (app. R) | <0.1 | 0.1-1.3 | >1.3 |

Scoring modification needs to occur when less than **50** (headwater) or **100** (wadeable) individuals are collected, see appendix S.

Figure 1b. NITP

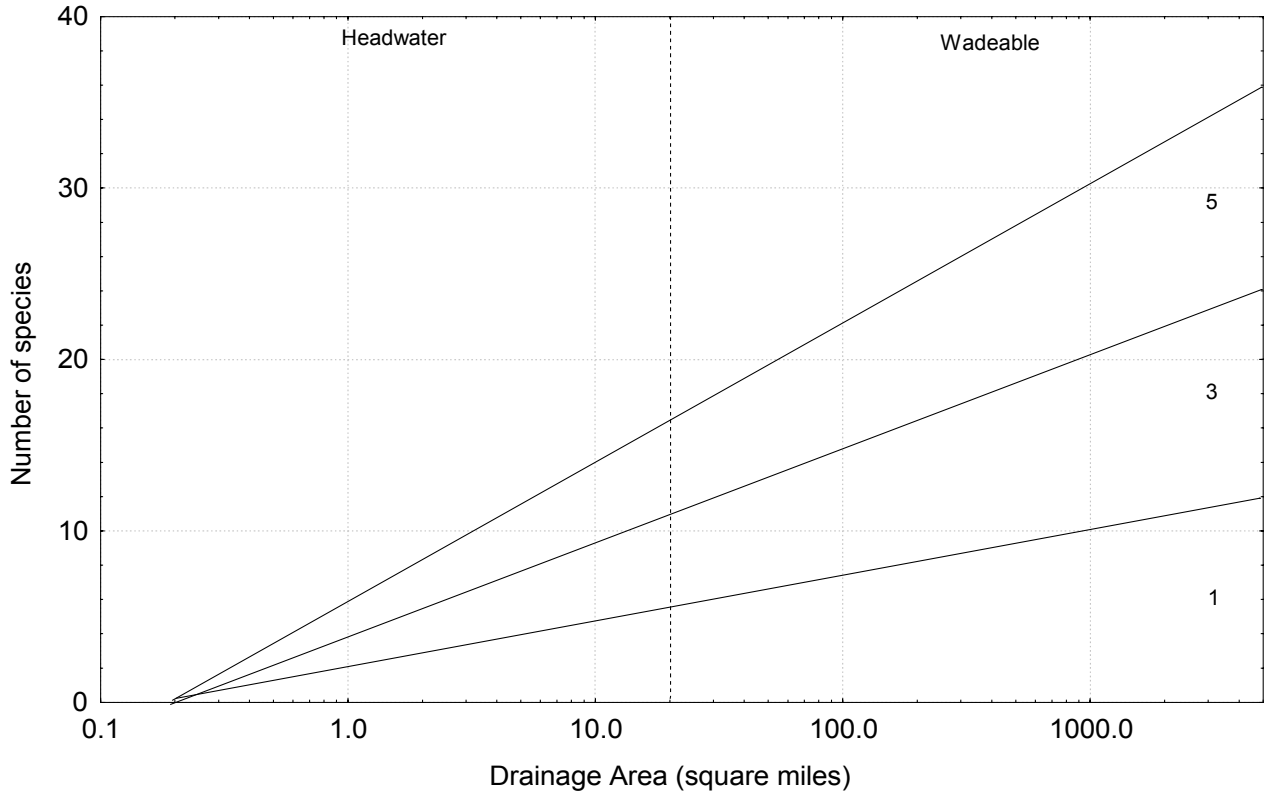



Figure 2b. NITP

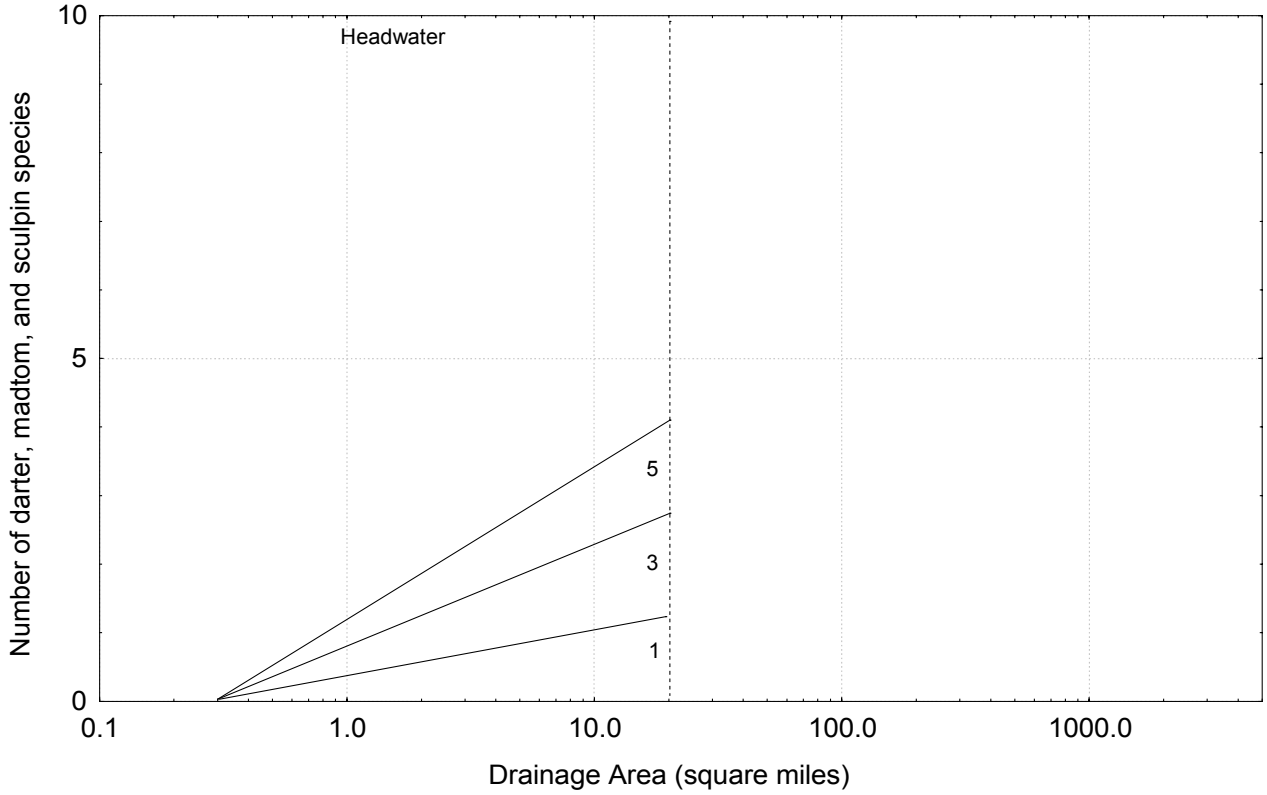


Figure 3b. NITP

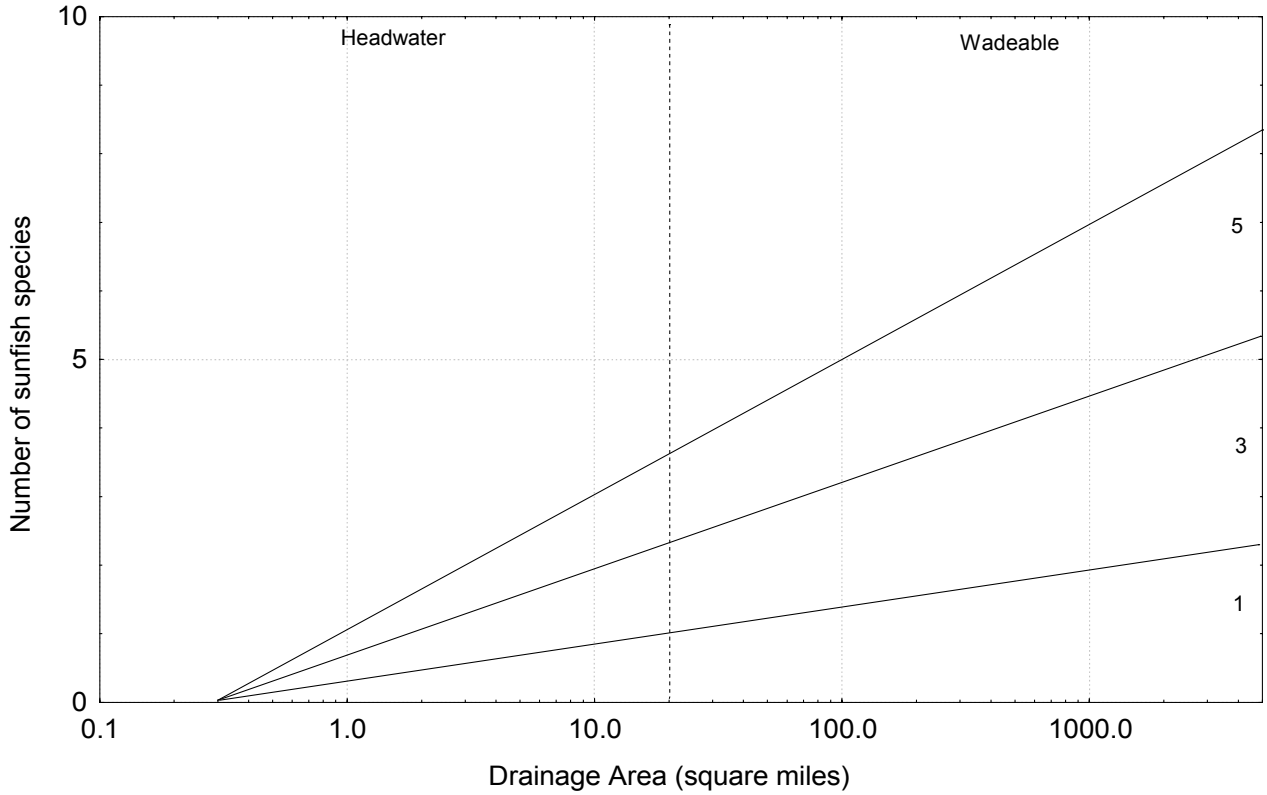



Figure 4b. NITP

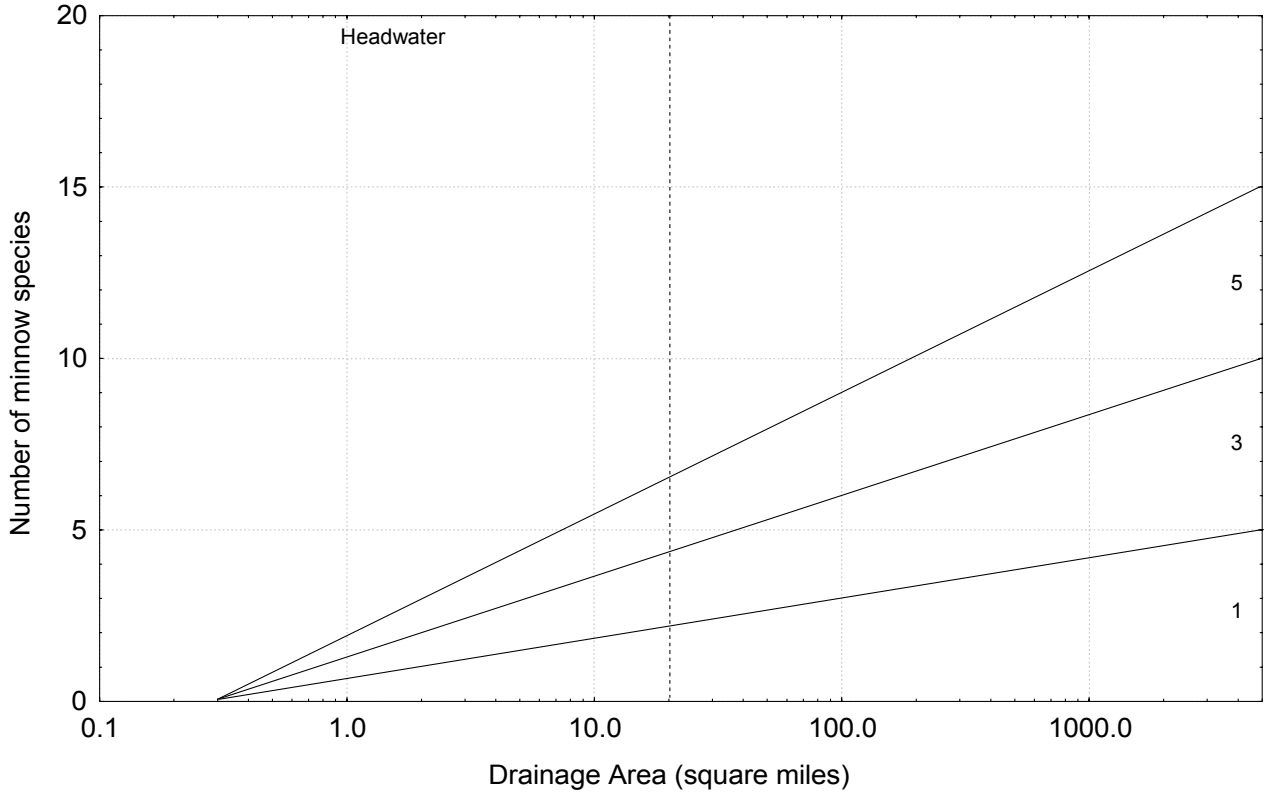


Figure 5b. NITP

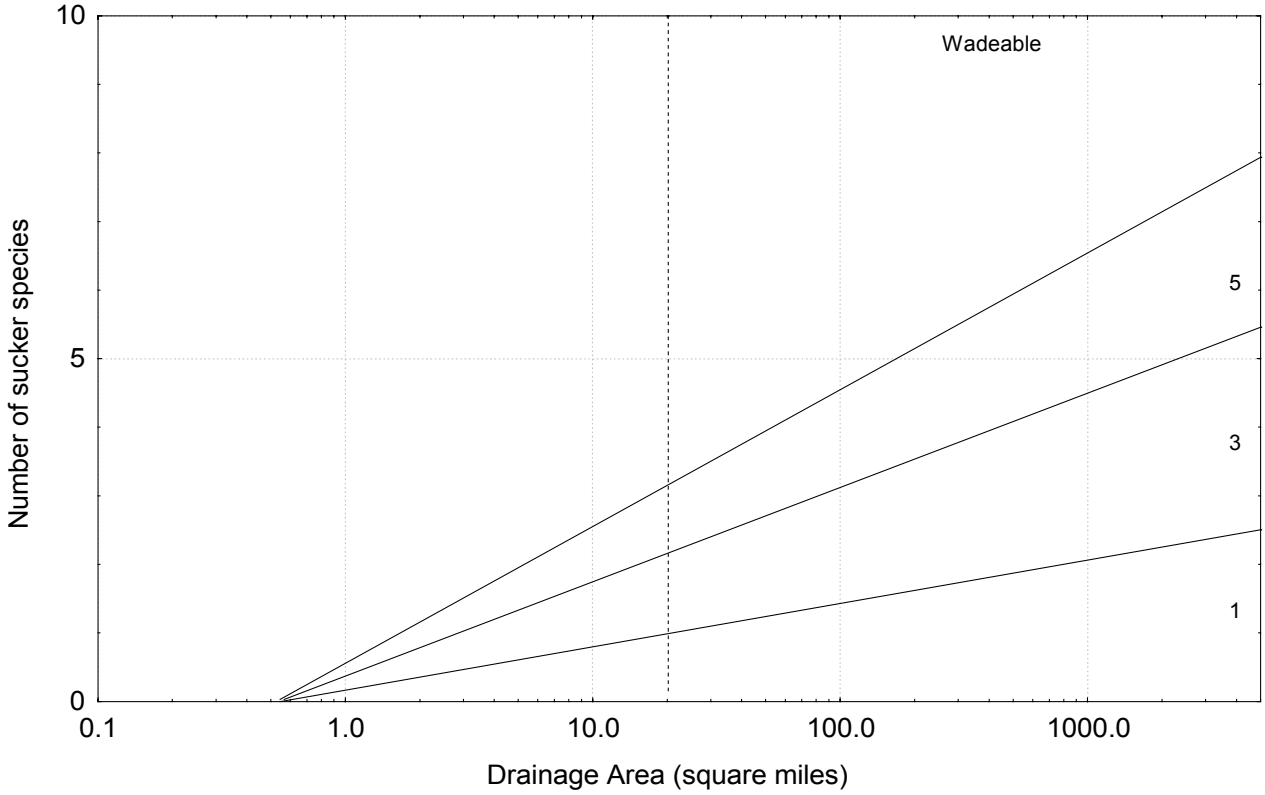



Figure 6b. NITP

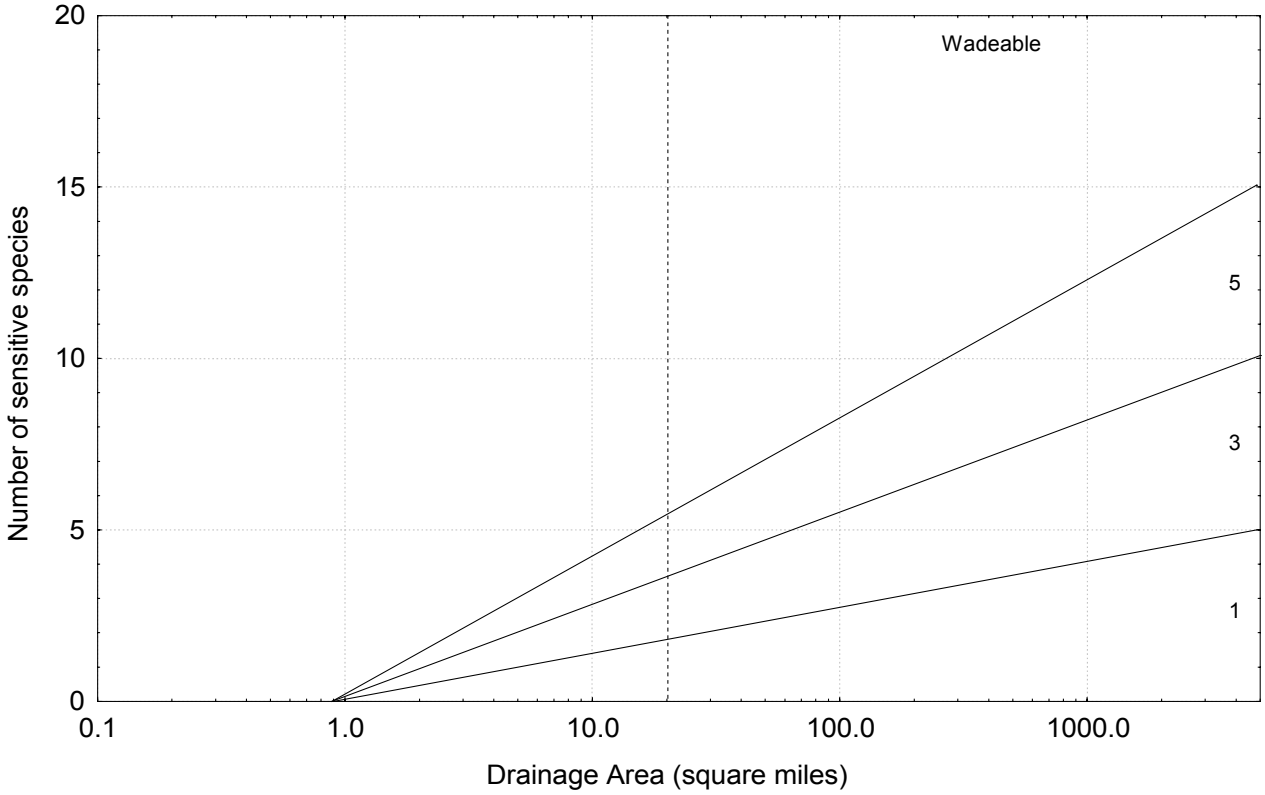
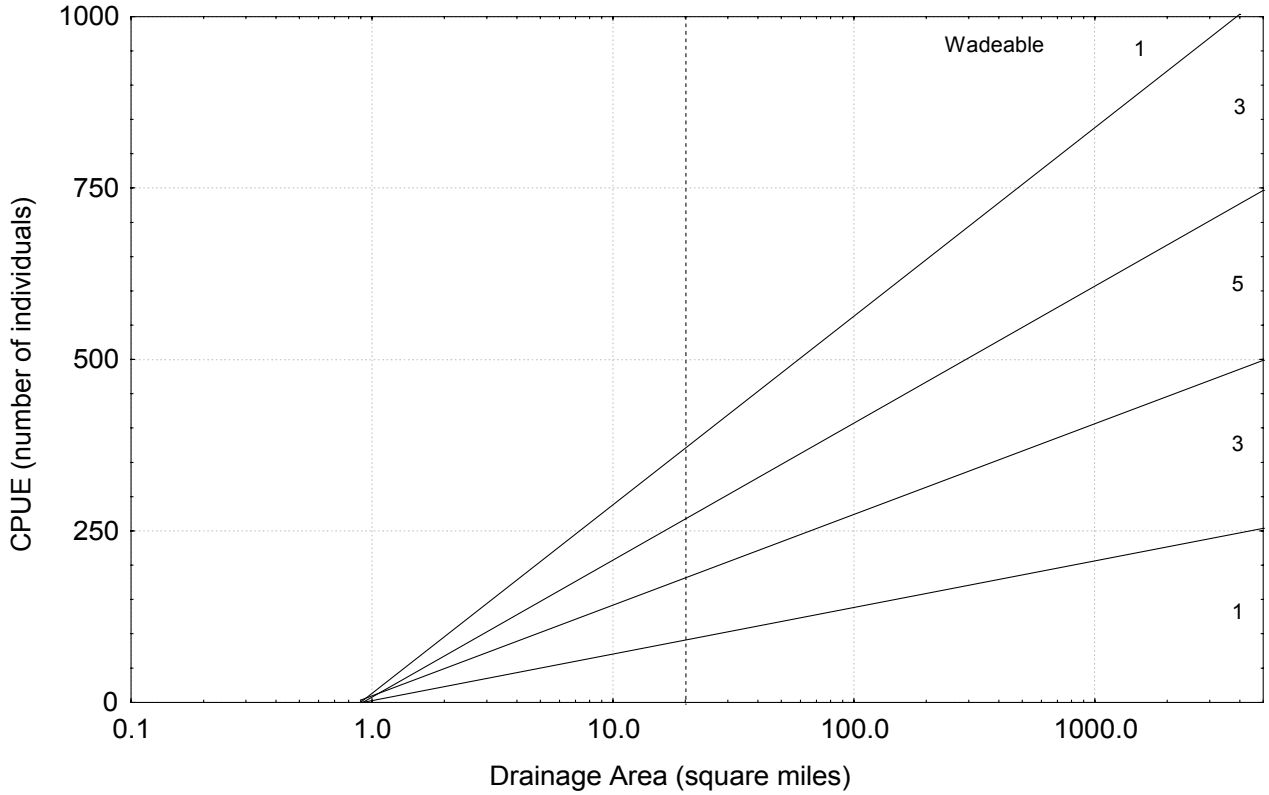


Figure 7b. NITP



## Huron Erie Lake Plain

Determine what stream category your site belongs in

a. Less than or equal to 20 (sq mi),
   Headwater site…….…… use stream category B, and H
b. Greater than 20, but less than 1000 (sq mi),
   Wadable site*...…...…… use stream category B, and W

* The largest size streams (e.g. St. Joseph River, St. Mary's River, and Maumee River) were included in the calibration. The criteria should work for all drainage areas in this ecoregion (Dr. Thomas P. Simon, personal communication).

| Stream Category | Metric | Metric Score 5 | 3 | 1 |
|---|---|---|---|---|
| B | Total number of species (app. A) | Page 24, Fig. 1c | | |
| H | Number of darter, madtom and sculpin species (app. B) | Page 24, Fig. 2c | | |
| W | Number of darter species (app. B) | Page 24, Fig. 2c | | |
| B | Number of sunfish species (app. E) | >3 | 2-3 | <2 |
| H | Number of minnow species (app. H) | >6 | 4-6 | <4 |
| W | Number of sucker species (app. I) | Page 25, Fig. 3c | | |
| B | Number of sensitive species (app. K) | Page 25, Fig. 4c | | |
| B | Percent tolerant species (app. L) | <31 | 31-64 | >64 |
| B | Percent omnivore species (app. M) | <25 | 25-50 | >50 |
| B | Percent insectivore species (app. N) | >50 | 25-50 | <25 |
| H | Percent pioneer species (app. O) | Page 26, Fig. 5c | | |
| W | Percent carnivore species (app. P) | >7 | 4-7 | <4 |
| B | Catch Per Unit Effort (= number of individuals) | Page 26, Fig 6c | | |
| B | Percent simple lithophilic species (app. Q) | Page 27, Fig. 7c | | |
| B | Percent DELT anomalies (app. R) | <0.9 | 0.9-3 | >3 |

Scoring modification needs to occur when less than **50** (headwater) or **100** (wadeable) individuals are collected, see appendix S.

Figure 1c. HELP

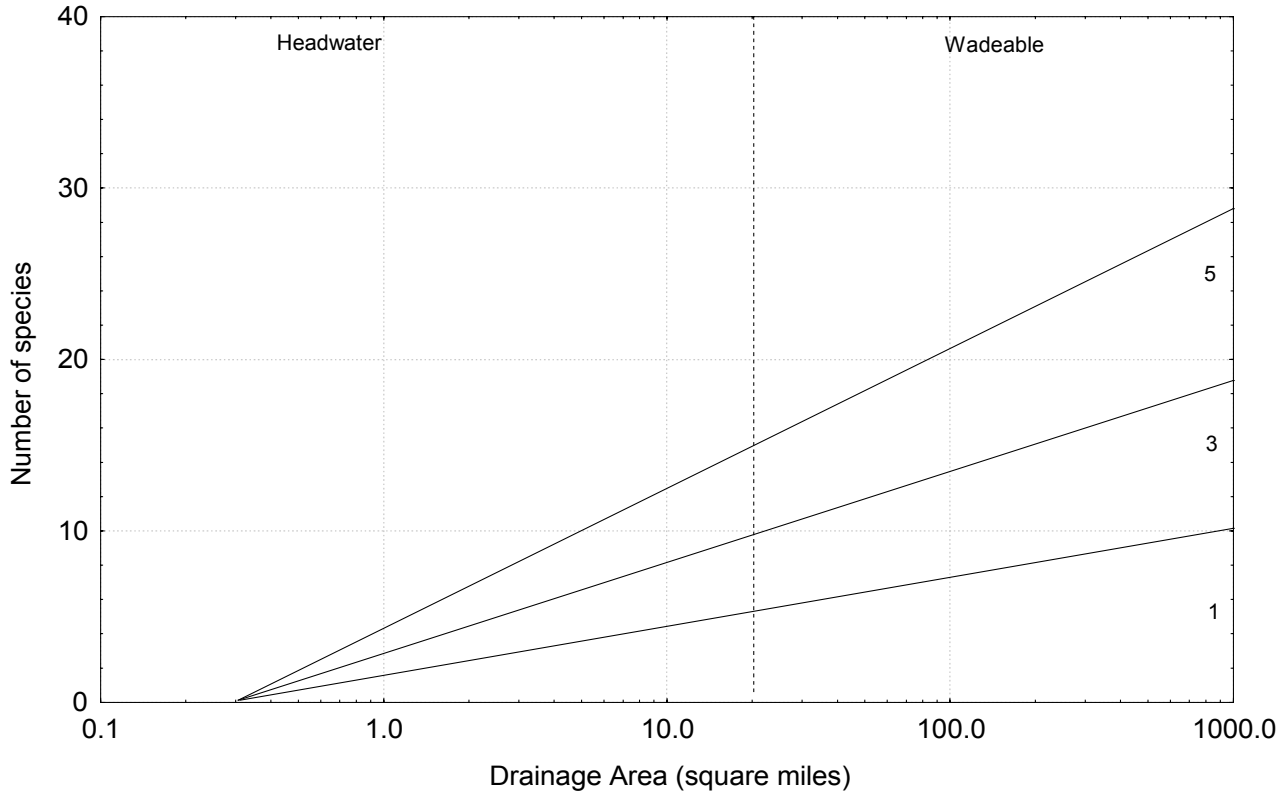



Figure 2c. HELP

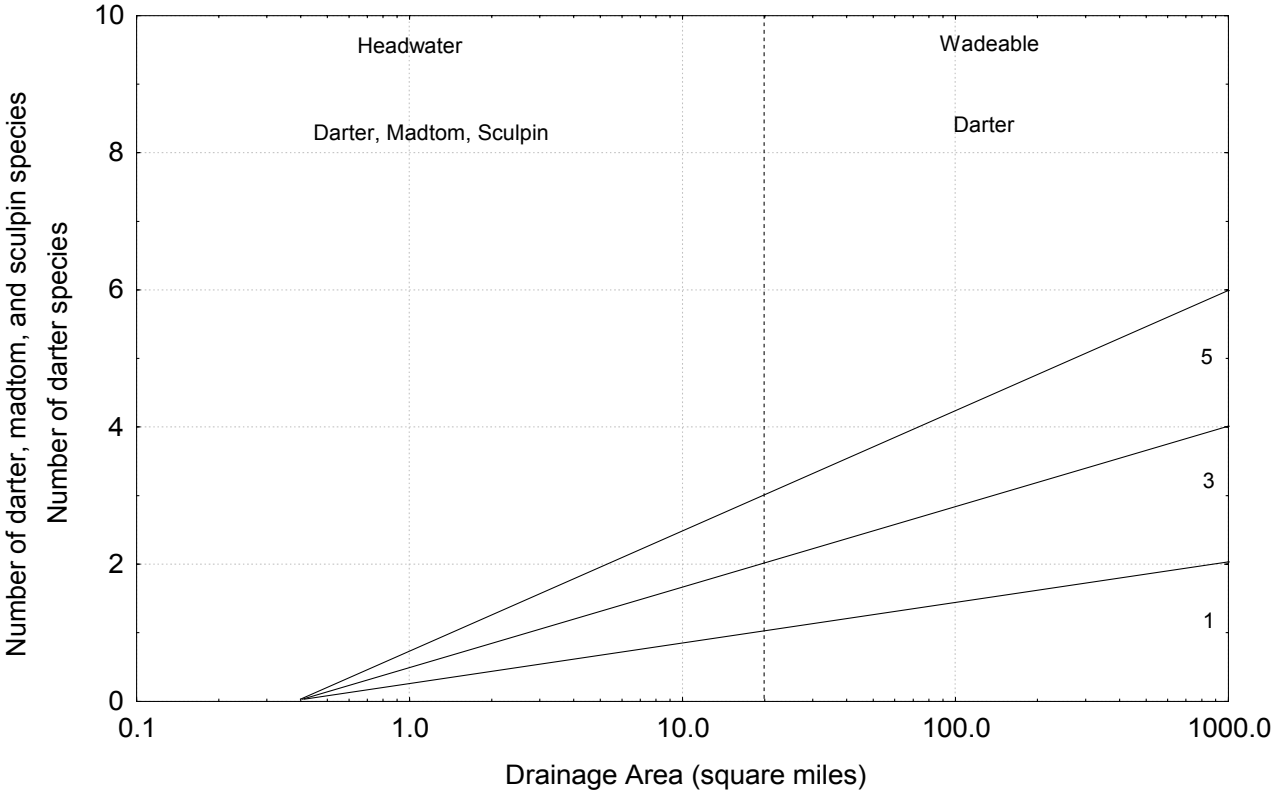


Figure 3c. HELP

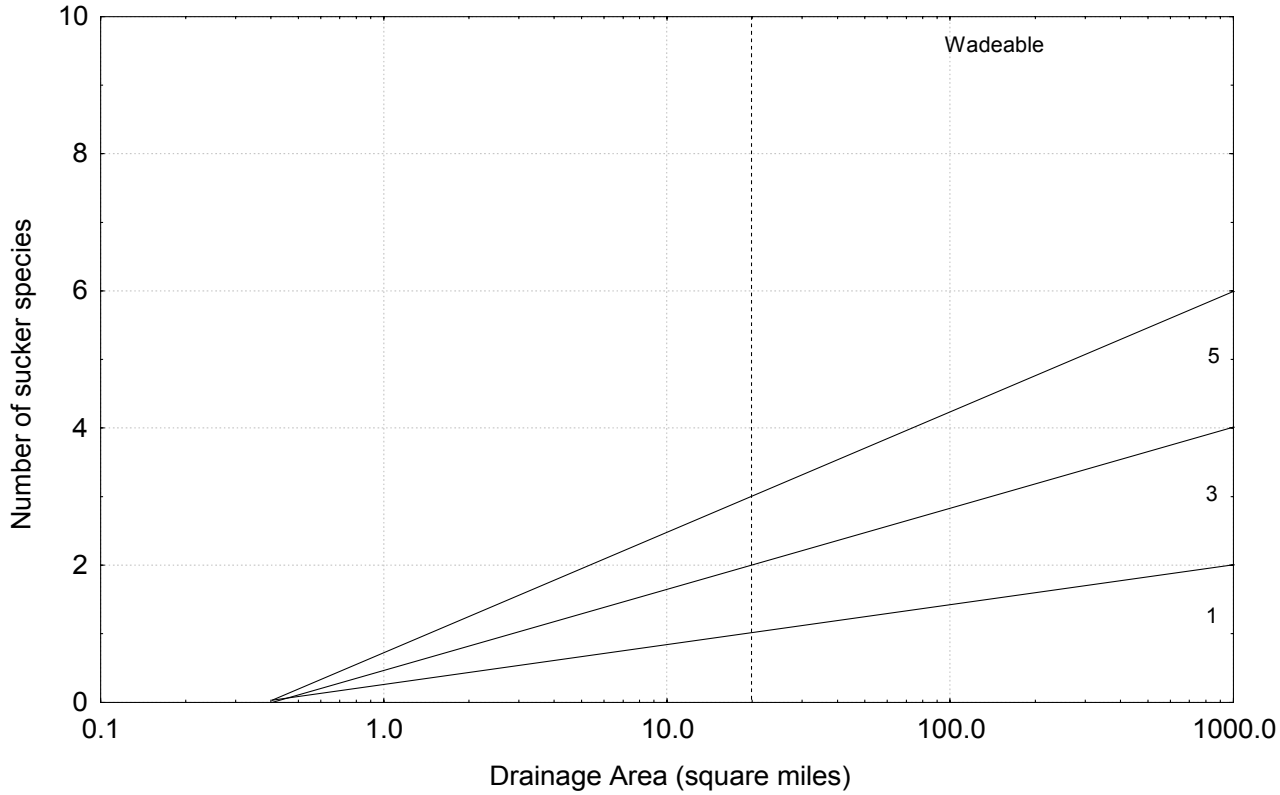



Figure 4c. HELP

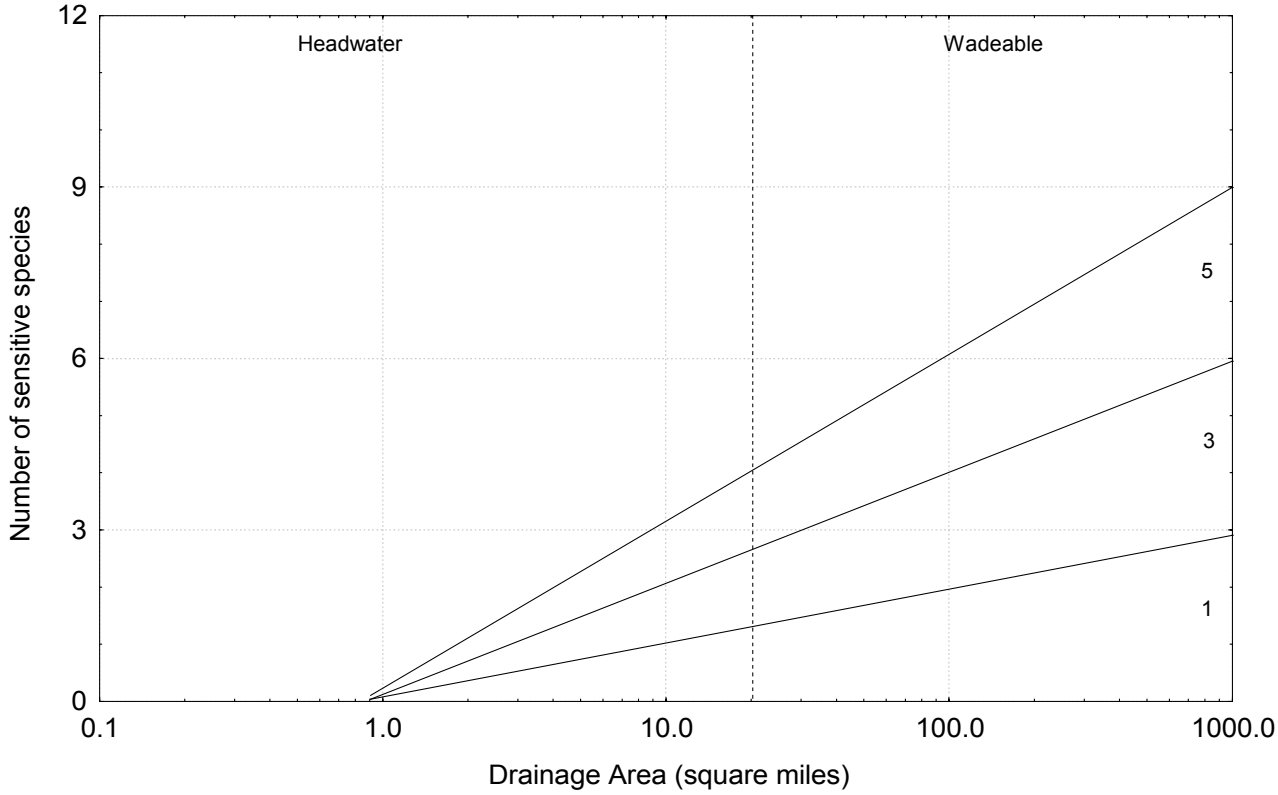


Figure 5c. HELP

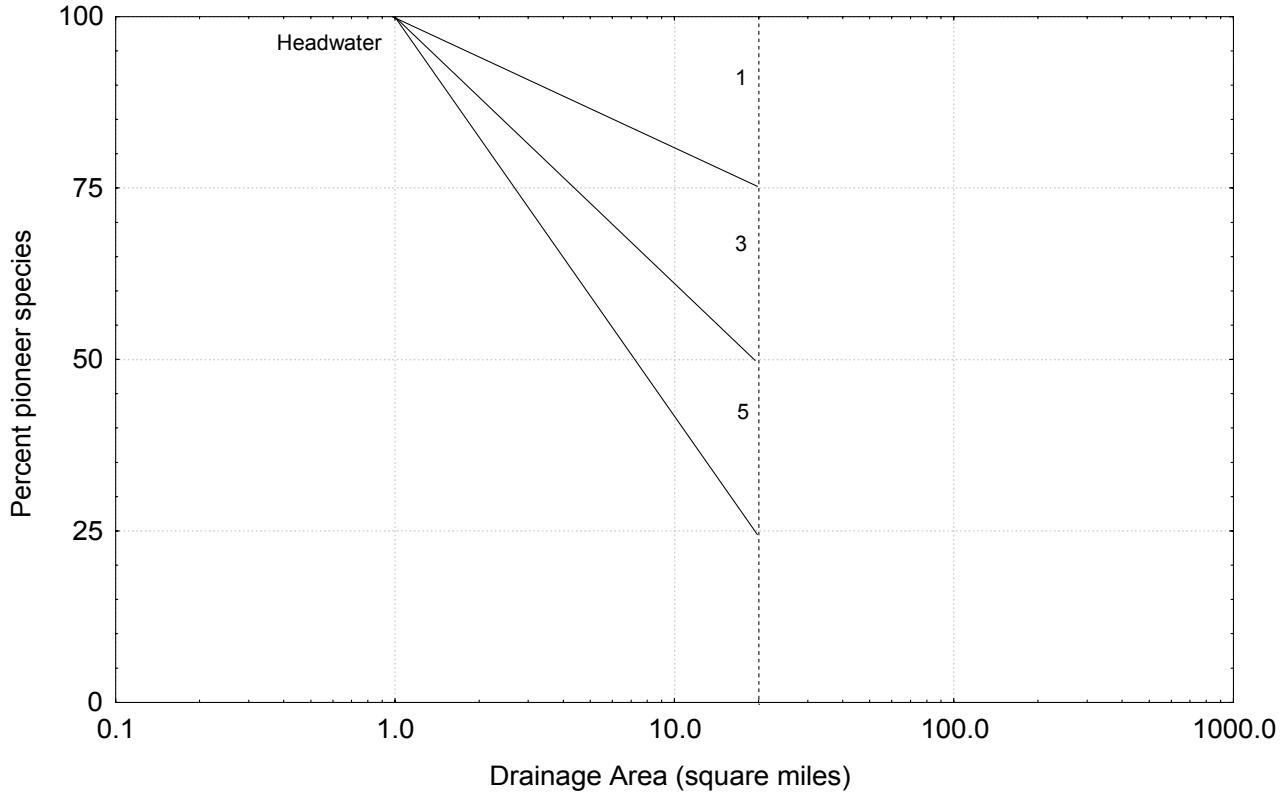



Figure 6c. HELP

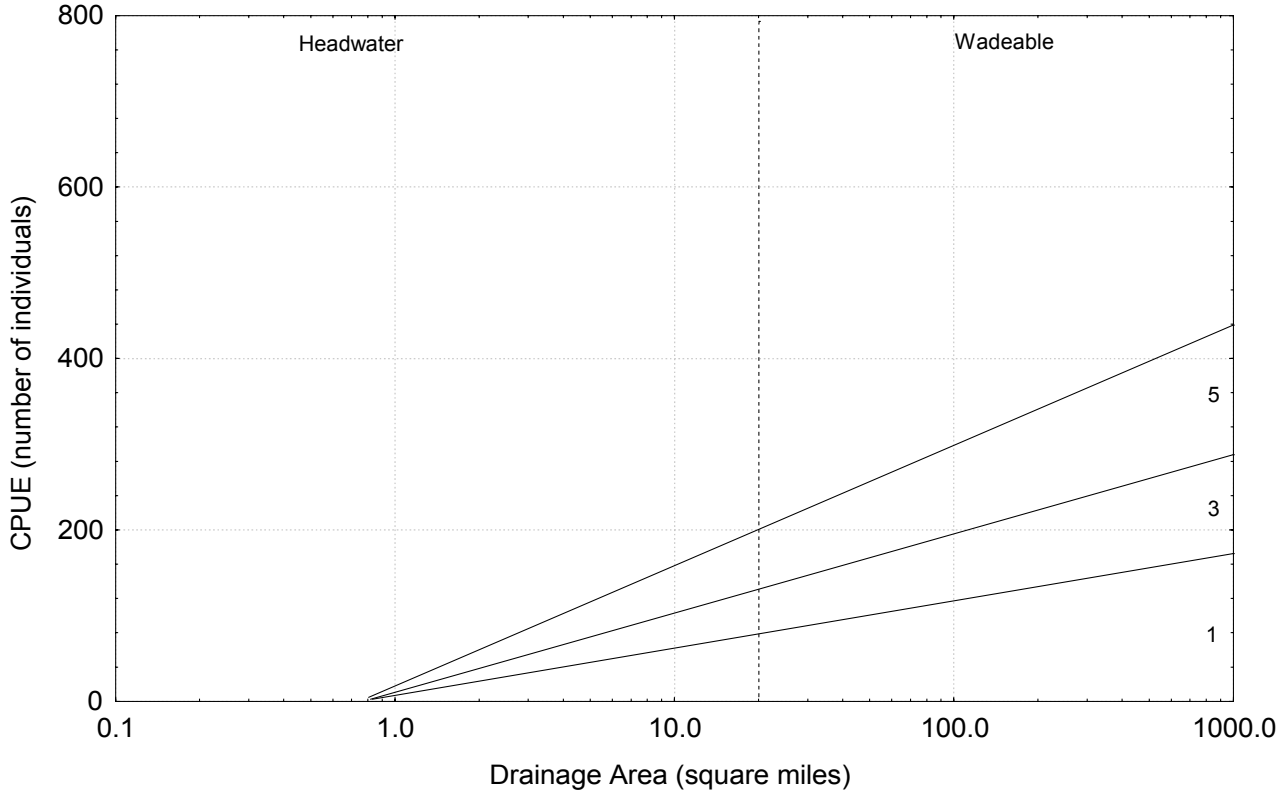
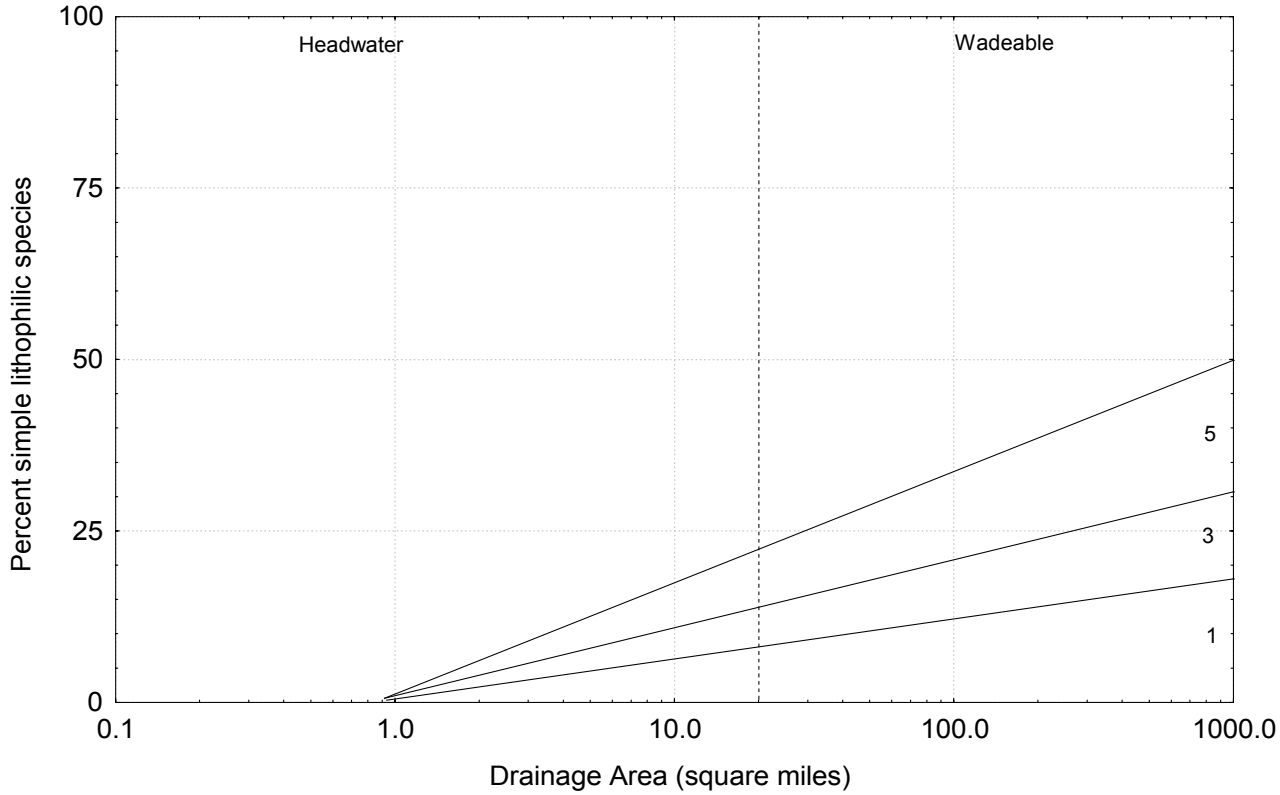


Figure 7c. HELP



# Interior River Lowland

Determine what stream category your site belongs in

a. Less than or equal to 20 (sq mi),
   Headwater site……..…… use stream category B, and H
b. Greater than 20, but less than 1000 (sq mi),
   Wadable site.……...…… use stream category B, and W

| Stream Category | Metric | Metric Score 5 | 3 | 1 |
|---|---|---|---|---|
| B | Total number of species (app. A) | Page 29, Fig. 1d | | |
| B | Number of minnow species (app. H) | Page 29, Fig. 2d | | |
| B | Number of sunfish species (app. E) | >3 | 2-3 | <2 |
| B | Number of sucker species (app. I) | >3 | 2-3 | <2 |
| B | Number of sensitive species (app. K) | Page 30, Fig. 3d | | |
| B | Percent tolerant species (app. L) | <25 | 25-50 | >50 |
| B | Percent omnivore species (app. M) | ≤15 | 16-29 | ≥30 |
| B | Percent insectivore species (app. N) | >50 | 25-50 | <25 |
| H | Percent pioneer species (app. O) | <32 | 32-66 | >66 |
| W | Percent carnivore species (app. P) | 15-21 | 7-15<br>21-29 | <7<br>>29 |
| B | Catch Per Unit Effort (= number of individuals) | >200 | 100-200 | <100 |
| B | Percent simple lithophilic species (app. Q) | >20 | 10-20 | <10 |
| B | Percent DELT anomalies (app. R) | <1 | 1-2 | >2 |

Scoring modification needs to occur when less than **50** (headwater) or **100** (wadeable) individuals are collected, see appendix S.

Figure 1d. IRL

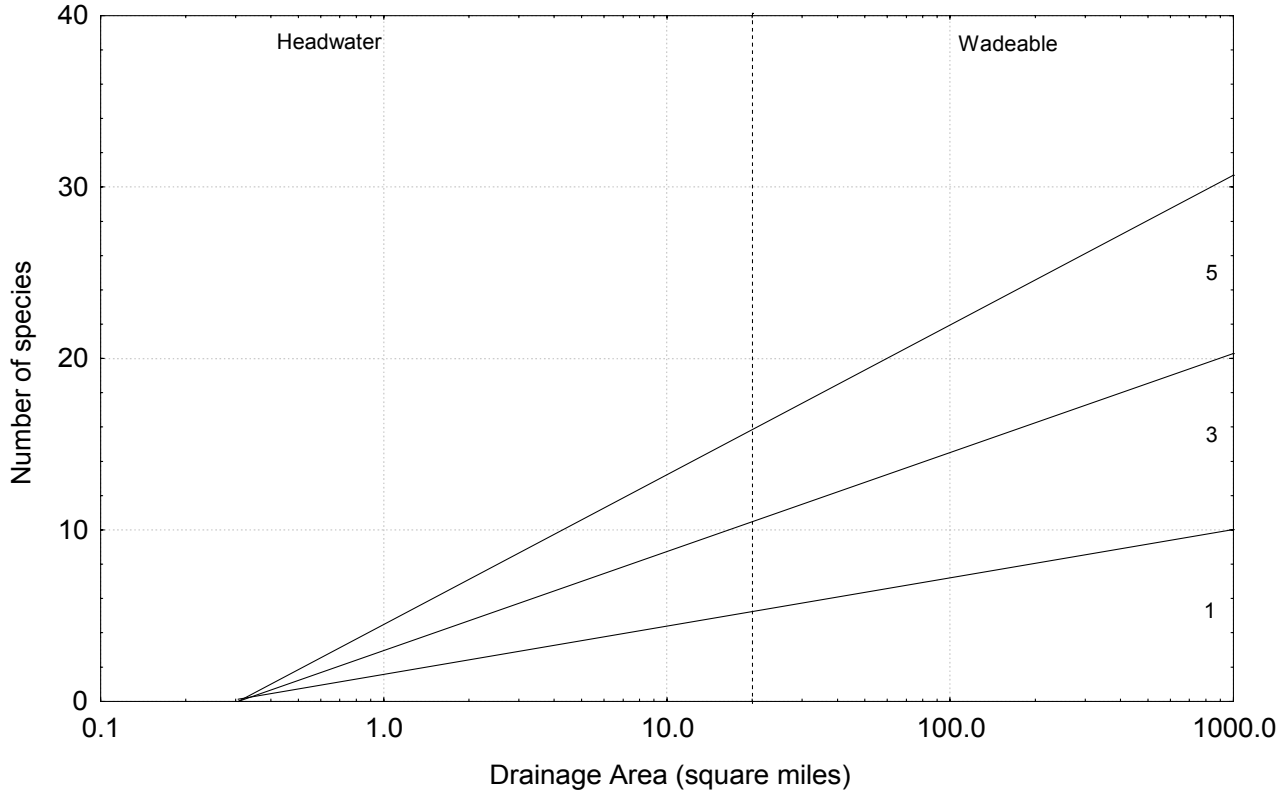



Figure 2d. IRL

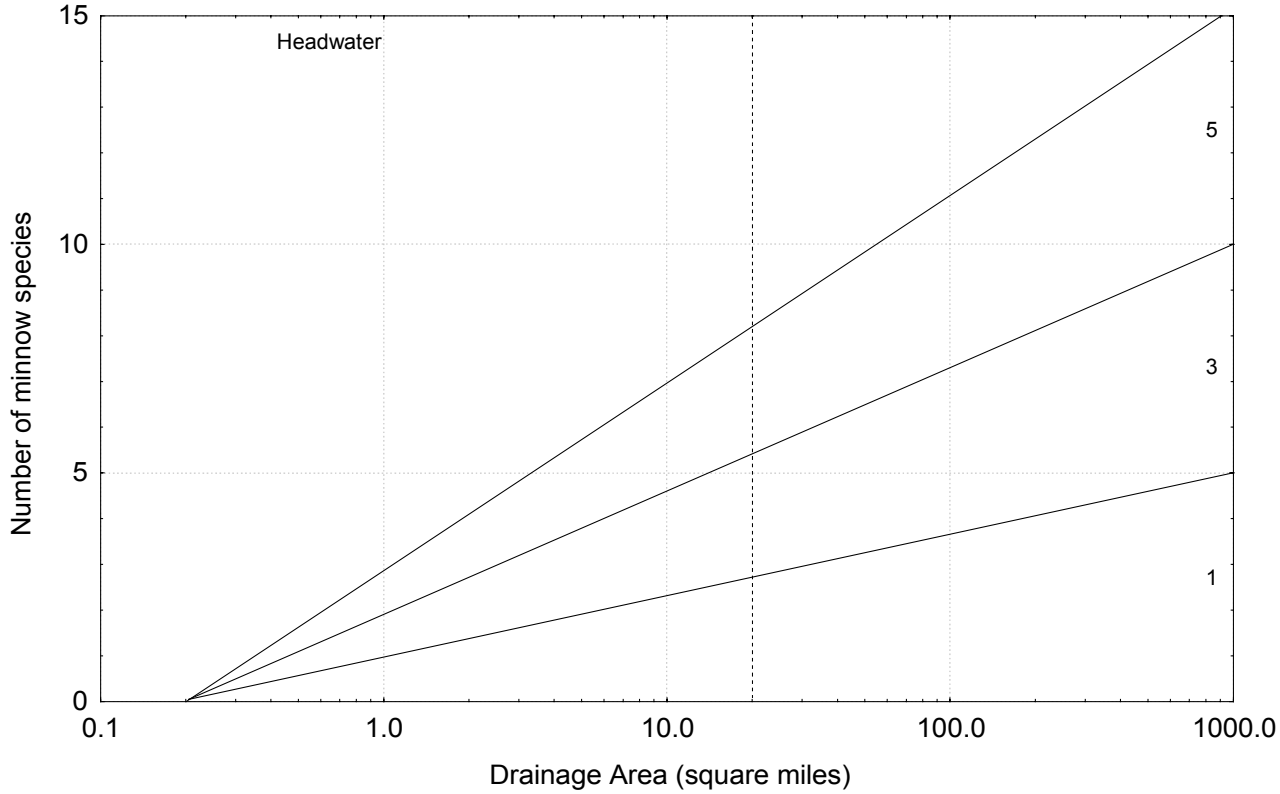
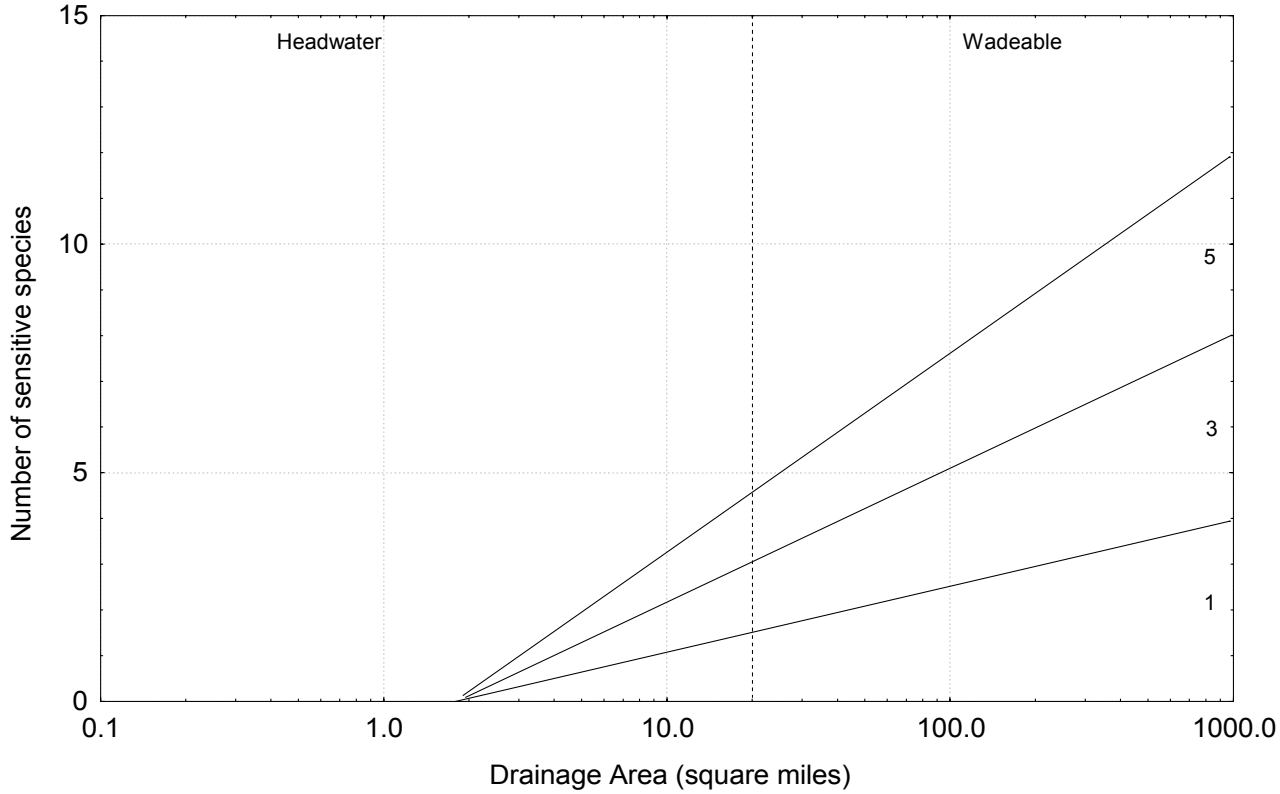


Figure 3d. IRL



## Interior Plateau

At this time metric calibration for this particular ecoregion has not been accomplished. However, if your stream falls in this category it is recommended that you use metrics calibrated for the Middle Anderson River Basin (Dr. Thomas P. Simon, personal communication).

1. Determine which set of metrics to use

    a. Drainage area is less than
    or equal to 100 square miles…….…….…… step 2
    b. Drainage area is greater than
    100 (sq mi) and less than 1000 (sq mi)……... use ECBP metrics, page 14

2. Determine what stream category your site belongs in

    a. Less than or equal to 20 (sq mi),
    Headwater site……..…… use stream category B, and H
    b. Greater than 20, but less than 100 (sq mi),
    Wadable site.……...…… use stream category B, and W

| Stream Category | Metric | Metric Score 5 | 3 | 1 |
|---|---|---|---|---|
| H | Total number of species (app. A) | >12 | 6-12 | <6 |
| W | Total number of species (app. A) | >16 | 7-16 | <7 |
| H | Number of darter, madtom and sculpin species (app. B) | >2 | 1-2 | 0 |
| W | Number of darter species (app. B) | >3 | 1-3 | 0 |
| H | Percent headwater species (app. D) | >26 | 13-26 | <13 |
| W | Number of sunfish species (app. E) | >3 | 2-3 | <2 |
| H | Number of minnow species (app. H) | >6 | 3-6 | <3 |
| W | Number of sucker species (app. I) | >3 | 1-3 | 0 |
| H | Number of sensitive species (app. K) | >4 | 2-4 | <2 |
| W | Number of sensitive species (app. K) | >5 | 3-5 | <3 |
| B | Percent tolerant species (app. L) | <25 | 25-50 | >50 |
| B | Percent omnivore species (app. M) | <18 | 18-33 | >33 |
| B | Percent insectivore species (app. N) | >50 | 25-50 | <25 |
| H | Percent pioneer species (app. O) | <22 | 22-48 | >48 |
| W | Percent carnivore species (app. P) | >5 | 2-5 | <2 |
| H | Catch Per Unit Effort (= number of individuals) | >275 | 125-275 | <125 |
| W | Catch Per Unit Effort (= number of individuals) | >300 | 150-300 | <150 |
| B | Percent simple lithophilic species (app. Q) | >34 | 16-34 | <16 |
| B | Percent DELT anomalies (app. R) | <0.1 | 0.1-1.3 | >1.3 |

Scoring modification needs to occur when less than **25** (headwater) or 5**0** (wadeable) individuals are collected, see appendix S.

## Large River Metrics

Determine which stream category to use

a. Greater than or equal to 1000 (sq. mi)
but less than 2000 (sq mi)……...…….. use B, and LR
b. Great river (greater than
or equal to 2000 square miles) sites……. use B, and GR

| Stream Category | Metric | Metric Score 5 | 3 | 1 |
|---|---|---|---|---|
| B | Total number of species (app. A) | ≥23 | 17-22 | ≤16 |
| LR | Number of darter, madtom and sculpin species (app. B) | >4 | 2-4 | <2 |
| GR | Percent large river species (app. C) | >27 | 13-27 | <13 |
| B | Number of Centrarchid species (app. F) | >5 | 3-5 | <3 |
| B | Number round-bodied sucker species (app. J) | >4 | 2-4 | <2 |
| B | Number of sensitive species (app. K) | >7 | 4-7 | <4 |
| B | Percent tolerant species (app. L) | <10 | 10-25 | >25 |
| B | Percent omnivore species (app. M) | <15 | 15-30 | >30 |
| B | Percent insectivore species (app. N) | >65 | 40-65 | <40 |
| B | Percent carnivore species (app. O) | Page 33, Fig. 1e | | |
| B | Catch Per Unit Effort (= number of individuals) | Page 33, Fig. 2e | | |
| B | Percent simple lithophilic species (app. Q) | Page 34, Fig. 3e | | |
| B | Percent DELT anomalies (app. R) | <1 | 1-2 | >2 |

Scoring modification needs to occur when less than **100** (large and great river) individuals are collected, see appendix S.

Figure 1e. IRL

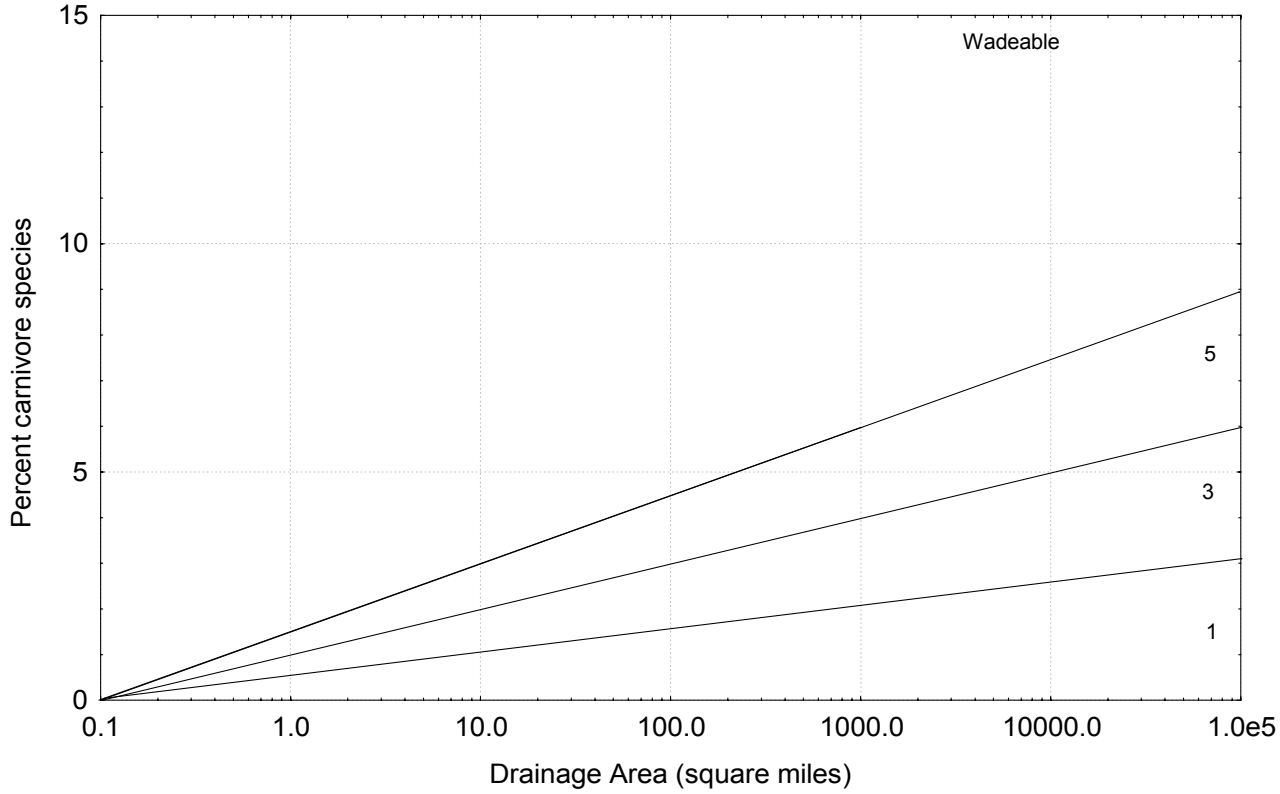



Figure 2e. Large Rivers

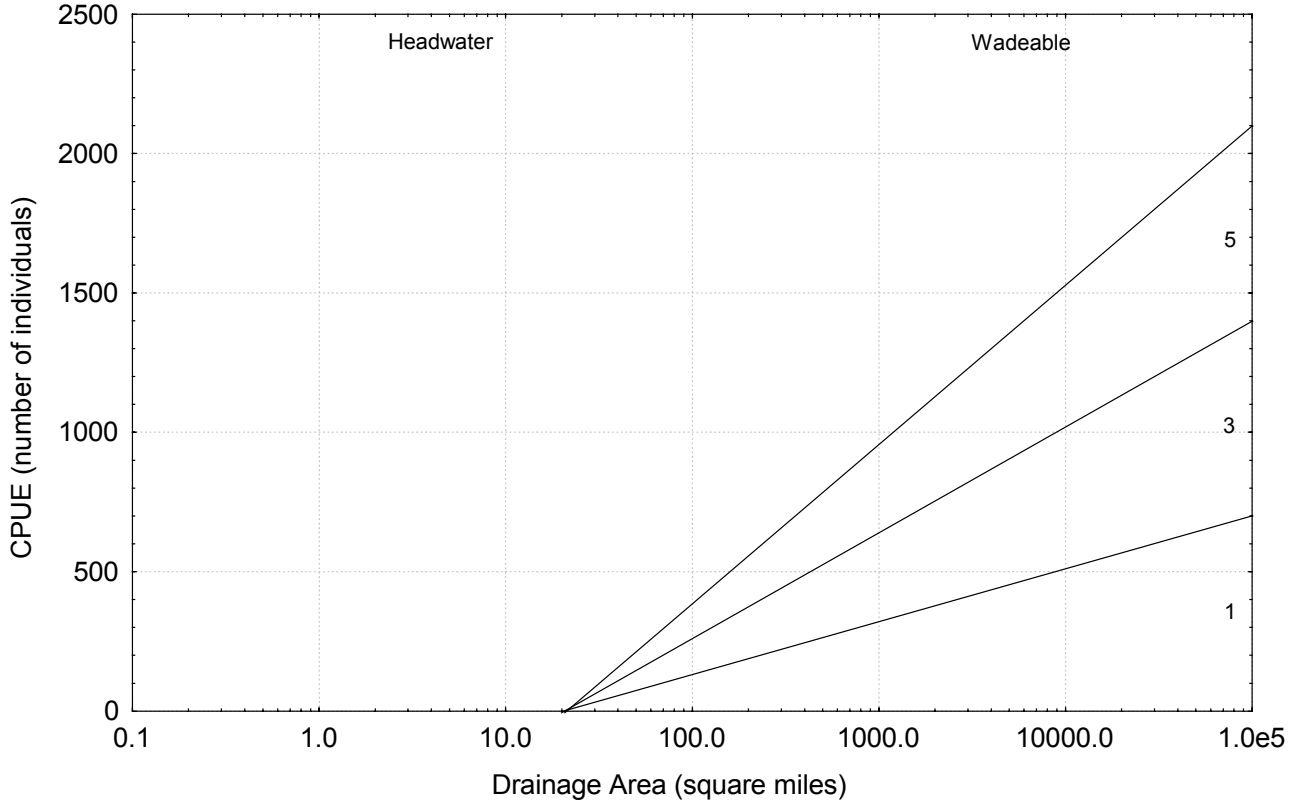
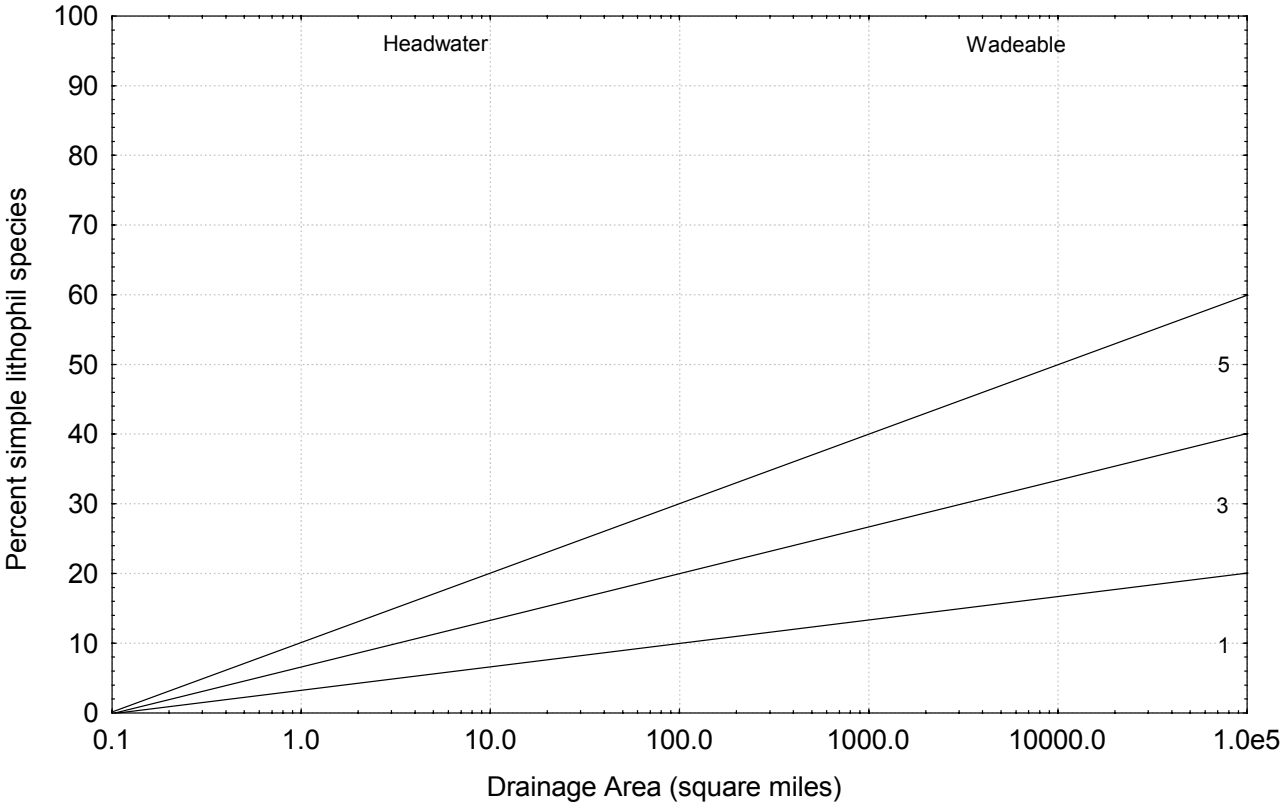


Figure 3e. Large Rivers



## Lower Wabash River Basin Metrics

Developed for use on great rivers (drainage area greater than or equal to 2000 square miles) in the Lower Wabash River Basin.

Note: Large numbers of one species often "swamp" certain metrics making it difficult to assess site status. Therfore, it was essential to remove *Dorosoma cepedianum* (gizzard shad) from this particular set of data prior to IBI calculation (see metric Catch Per Unit Effort – gizzard shad).

| **Stream Category** | **Metric** | **Metric Score** | | |
|---|---|---|---|---|
| | | **5** | **3** | **1** |
| | Total number of species (app. A) | >20 | 10-20 | <10 |
| | Percent large river species (app. C) | >50 | 25-50 | <25 |
| | Number of Centrarchid species (app. F) | >4 | 2-4 | <2 |
| | Number round-bodied sucker species (app. J) | >4 | 2-4 | <2 |
| | Number of sensitive species (app. K) | >6 | 3-6 | <3 |
| | Percent tolerant species (app. L) | <25 | 25-50 | >50 |
| | Percent omnivore species (app. M) | <15 | 15-30 | >30 |
| | Percent insectivore species (app.N) | >50 | 25-50 | <25 |
| | Percent carnivore species (app. P) | 20-30 | 10-20<br>30-40 | <10<br>>40 |
| | Catch Per Unit Effort – gizzard shad (= number of individuals) | >300 | 150-300 | <150 |
| | Percent simple lithophilic species (app. Q) | >30 | 15-30 | <15 |
| | Percent DELT anomalies (app. R) | <0.1 | 0.1-1.3 | >1.3 |

Scoring modification needs to occur when less than **50** (without gizzard shad) or **100** (with gizzard shad) individuals are collected, see appendix S.

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# Appendices

A. Total number of species…….… 38
B. Total number of darter, madtom, and sculpin species, or
Total number of darter species……..… 39
C. Percent large river species……...…….. 40
D. Percent headwater species……. 41
E. Total number of sunfish species……. 42
F. Total number of Centrarchid species…….…… 43
G. Total number of Salmonid species……..…….. 44
H. Total number of minnow species…….. 45
I. Total number of sucker species…….…… 47
J. Total number of round-bodied sucker species……..……. 48
K. Total number of sensitive species……. 49
L. Percent tolerant species……. 51
M. Percent omnivore species…….. 52
N. Percent insectivore species…… 53
O. Percent pioneer species……. 56
P. Percent carnivore species……...……... 57
Q. Percent simple lithophil species…… 58
R. Percent DELT anomalies…….. 59
S. Scoring Modifications……... 59

**Please note, there are some species listed in the following appendicies that are not currently encountered in Indiana (for example; *Hypophthalmichthys molitrix*, silver carp, *Proterorhinus marmoratus*, tube nose goby etc.). Species that are "hypothetical" (*Fundulus olivaceus*, blackspotted topminnow, *Percina vigil*, saddleback darter etc.), or "extirpated" (*Crystallaria asprella*, crystal darter, *Percina uranidea*, stargazing darter etc.) in Indiana are also included.**

**Appendix A. Total number of species**

*This metric only includes" non-hybrid" species. Some common species considered as hybrids (listed below) are not included in the total number of species metric. However, they "may" be included in the following proportional metrics: Percent headwater species, Percent Tolerant species, Percent omnivore species, Percent insectivore species, Percent Pioneer, Percent carnivore species, Percent simple lithophil species, and Percent DELT Anomalies.*

Common hybrid species not included in metric calculation:

| Genus | Species | Common Name |
|---|---|---|
| *Esox* | *lucius x masquinongy* | tiger muskie |
| *Morone* | *chrysops x saxatilis* | wiper |
| *Stizostedion* | *canadense x vitreum* | saugeye |
| *Lepomis* | *x-hybrid* | sunfish hybrid |
| *Etheostoma* | *spectabile x caerule* | orangethroat x rainbow hybrid |
| *Cyprinus* | *auratus x carpio* | goldfish x carp hybrid |
| *Cyprinidae* | *hybrid* | Cyprinidae hybrid |

Note, you may encounter other hybrid species, or parental combinations that are not be listed here.

**Appendix B. Total number of darter, madtom, sculpin species, or Total number of darter species**

Darter species:

| Genus | Species | Common Name |
|---|---|---|
| *Etheostoma* | *chlorosomum* | bluntnose darter |
| *Etheostoma* | *gracile* | slough darter |
| *Etheostoma* | *spectabile* | orangethroat darter |
| *Etheostoma* | *nigrum* | johnny darter |
| *Etheostoma* | *asprigene* | mud darter |
| *Etheostoma* | *blennioides* | greenside darter |
| *Etheostoma* | *caeruleum* | rainbow darter |
| *Etheostoma* | *camurum* | bluebreast darter |
| *Etheostoma* | *exile* | Iowa darter |
| *Etheostoma* | *flabellare* | fantail darter |
| *Etheostoma* | *histrio* | harlequin darter |
| *Etheostoma* | *maculatum* | spotted darter |
| *Etheostoma* | *microperca* | least darter |
| *Etheostoma* | *squamiceps* | spottail darter |
| *Etheostoma* | *tippecanoe* | Tippecanoe darter |
| *Etheostoma* | *variatum* | variegate darter |
| *Etheostoma* | *zonale* | banded darter |
| *Percina* | *caprodes* | logperch |
| *Percina* | *sciera* | dusky darter |
| *Percina* | *evides* | gilt darter |
| *Percina* | *maculata* | blackside darter |
| *Percina* | *phoxocephala* | slenderhead darter |
| *Percina* | *shumardi* | river darter |
| *Percina* | *uranidea* | stargazing darter |
| *Percina* | *vigil* | saddleback darter |
| *Percina* | *copelandi* | channel darter |
| *Ammocrypta* | *clara* | western sand darter |
| *Ammocrypta* | *pellucida* | eastern sand darter |
| *Crystallaria* | *asprella* | crystal darter |

Madtom species:

| Genus | Species | Common Name |
|---|---|---|
| *Noturus* | *gyrinus* | tadpole madtom |
| *Noturus* | *nocturnus* | freckled madtom |
| *Noturus* | *eleutherus* | mountain madtom |
| *Noturus* | *exilis* | slender madtom |
| *Noturus* | *flavus* | stonecat |
| *Noturus* | *miurus* | brindled madtom |
| *Noturus* | *stigmosus* | northern madtom |

Sculpin species:

| Genus | Species | Common Name |
|---|---|---|
| *Cottus* | *cognatus* | slimy sculpin |
| *Cottus* | *bairdi* | mottled sculpin |
| *Cottus* | *carolinae* | banded sculpin |
| *Cottus* | *ricei* | spoonhead sculpin |
| *Myoxocephalus* | *thompsoni* | deepwater sculpin |

## Appendix C. Percent large river species

| Genus | Species | Common Name |
|---|---|---|
| *Ichthyomyzon* | *castaneus* | chestnut lamprey |
| *Ichthyomyzon* | *unicuspis* | silver lamprey |
| *Acipenser* | *fulvescens* | lake sturgeon |
| *Scaphirhynchus* | *platorynchus* | shovelnose sturgeon |
| *Polyodon* | *spathula* | paddlefish |
| *Lepisosteus* | *platostomus* | shortnose gar |
| *Atractosteus* | *spatula* | alligator gar |
| *Anguilla* | *rostrata* | American eel |
| *Alosa* | *chrysochloris* | skipjack herring |
| *Dorosoma* | *petenense* | threadfin shad |
| *Hiodon* | *alosoides* | goldeye |
| *Hiodon* | *tergisus* | mooneye |
| *Hybognathus* | *nuchalis* | Mississippi silvery minnow |
| *Nocomis* | *micropogon* | river chub |
| *Notropis* | *hudsonius* | spottail shiner |
| *Notropis* | *atherinoides* | emerald shiner |
| *Notropis* | *shumardi* | silverband shiner |
| *Notropis* | *volucellus* | mimic shiner |
| *Pimephales* | *vigilax* | bullhead minnow |
| *Erimystax* | *x-punctatus* | gravel chub |
| *Macrhybopsis* | *storeriana* | silver chub |
| *Extrarius* | *aestivalis* | speckled chub |
| *Cycleptus* | *elongatus* | blue sucker |
| *Ictiobus* | *bubalus* | smallmouth buffalo |
| *Ictiobus* | *cyprinellus* | bigmouth buffalo |
| *Ictiobus* | *niger* | black buffalo |
| *Ictalurus* | *furcatus* | blue catfish |
| *Ictalurus* | *punctatus* | channel catfish |
| *Pylodictis* | *olivaris* | flathead catfish |
| *Lota* | *lota* | burbot |
| *Morone* | *chrysops* | white bass |
| *Morone* | *mississippiensis* | yellow bass |
| *Percina* | *shumardi* | river darter |
| *Stizostedion* | *vitreum* | walleye |
| *Stizostedion* | *canadense* | sauger |
| *Percina* | *copelandi* | channel darter |
| *Ammocrypta* | *clara* | western sand darter |
| *Ammocrypta* | *pellucida* | eastern sand darter |
| *Crystallaria* | *asprella* | crystal darter |
| *Aplodinotus* | *grunniens* | freshwater drum |
| *Notropis* | *wickliffi* | channel shiner |
| *Morone* | *chrysops x saxatilis* | wiper |
| *Stizostedion* | *canadense x vitreum* | saugeye |
| *Moxostoma* | *m. breviceps* | Ohio redhorse |

## Appendix D. Percent headwater species

| Genus | Species | Common Name |
|---|---|---|
| *Lampetra* | *aepyptera* | least brook lamprey |
| *Lampetra* | *appendix* | American brook lamprey |
| *Clinostomus* | *elongatus* | redside dace |
| *Rhinichthys* | *atratulus* | blacknose dace |
| *Phoxinus* | *erythrogaster* | southern redbelly dace |
| *Culaea* | *inconstans* | brook stickleback |
| *Cottus* | *bairdi* | mottled sculpin |
| *Cottus* | *carolinae* | banded sculpin |
| *Etheostoma* | *flabellare* | fantail darter |

## Appendix E. Total number of sunfish species

*This metric is used specifically on headwater and wadable streams, with drainage areas less than 1000 square miles. It does NOT include the black bass (Micropterus sp.).*

| Genus | Species | Common Name |
|---|---|---|
| *Ambloplites* | *rupestris* | rock bass |
| *Centrarchus* | *macropterus* | flier |
| *Lepomis* | *cyanellus* | green sunfish |
| *Lepomis* | *gulosus* | warmouth |
| *Lepomis* | *macrochirus* | bluegill |
| *Lepomis* | *gibbosus* | pumpkinseed |
| *Lepomis* | *humilis* | orangespotted sunfish |
| *Lepomis* | *megalotis* | longear sunfish |
| *Lepomis* | *microlophus* | redear sunfish |
| *Lepomis* | *punctatus* | spotted sunfish |
| *Lepomis* | *symmetricus* | bantam sunfish |
| *Pomoxis* | *annularis* | white crappie |
| *Pomoxis* | *nigromaculatus* | black crappie |
| *Elassoma* | *zonatum* | banded pygmy sunfish |

## Appendix F. Total number of Centrarchid species

| Genus | Species | Common Name |
|---|---|---|
| *Ambloplites* | *rupestris* | rock bass |
| *Centrarchus* | *macropterus* | flier |
| *Lepomis* | *cyanellus* | green sunfish |
| *Lepomis* | *gulosus* | warmouth |
| *Lepomis* | *macrochirus* | bluegill |
| *Lepomis* | *gibbosus* | pumpkinseed |
| *Lepomis* | *humilis* | orangespotted sunfish |
| *Lepomis* | *megalotis* | longear sunfish |
| *Lepomis* | *microlophus* | redear sunfish |
| *Lepomis* | *punctatus* | spotted sunfish |
| *Lepomis* | *symmetricus* | bantam sunfish |
| *Micropterus* | *dolomieu* | smallmouth bass |
| *Micropterus* | *salmoides* | largemouth bass |
| *Micropterus* | *punctulatus* | spotted bass |
| *Pomoxis* | *annularis* | white crappie |
| *Pomoxis* | *nigromaculatus* | black crappie |
| *Elassoma* | *zonatum* | banded pygmy sunfish |

## Appendix G. Total number of Salmonid species

| Genus | Species | Common Name |
|---|---|---|
| *Coregonus* | *clupeaformis* | lake whitefish |
| *Coregonus* | *artedi* | cisco or lake herring |
| *Coregonus* | *hoyi* | bloater |
| *Coregonus* | *nigripinnis* | blackfin cisco |
| *Coregonus* | *reighardi* | shortnose cisco |
| *Coregonus* | *zenithicus* | shortjaw cisco |
| *Oncorhynchus* | *kisutch* | coho salmon |
| *Oncorhynchus* | *tshawytscha* | chinook salmon |
| *Oncorhynchus* | *mykiss* | rainbow trout |
| *Salmo* | *salar* | Atlantic salmon |
| *Salmo* | *trutta* | brown trout |
| *Salvelinus* | *namaycush* | lake trout |
| *Salvelinus* | *fontinalis* | brook trout |
| *Coregonus* | *kiyi* | kiyi |

## Appendix H. Total number of minnow species

| Genus | Species | Common Name |
|---|---|---|
| *Cyprinus* | *carpio* | carp |
| *Carassius* | *auratus* | goldfish |
| *Hybognathus* | *nuchalis* | Mississippi silvery minnow |
| *Hybognathus* | *hankinsoni* | brassy minnow |
| *Hybognathus* | *hayi* | cypress minnow |
| *Notemigonus* | *crysoleucas* | golden shiner |
| *Clinostomus* | *elongatus* | redside dace |
| *Semotilus* | *atromaculatus* | creek chub |
| *Rhinichthys* | *atratulus* | blacknose dace |
| *Rhinichthys* | *cataractae* | longnose dace |
| *Nocomis* | *micropogon* | river chub |
| *Nocomis* | *biguttatus* | hornyhead chub |
| *Notropis* | *chalybaeus* | ironcolor shiner |
| *Notropis* | *hudsonius* | spottail shiner |
| *Notropis* | *rubellus* | rosyface shiner |
| *Notropis* | *atherinoides* | emerald shiner |
| *Notropis* | *buchanani* | ghost shiner |
| *Notropis* | *shumardi* | silverband shiner |
| *Notropis* | *ludibundus* | sand shiner |
| *Notropis* | *texanus* | weed shiner |
| *Notropis* | *volucellus* | mimic shiner |
| *Notropis* | *anogenus* | pugnose shiner |
| *Notropis* | *ariommus* | popeye shiner |
| *Notropis* | *blennius* | river shiner |
| *Notropis* | *boops* | bigeye shiner |
| *Notropis* | *dorsalis* | bigmouth shiner |
| *Notropis* | *heterodon* | blackchin shiner |
| *Notropis* | *heterolepis* | blacknose shiner |
| *Notropis* | *photogenis* | silver shiner |
| *Ericymba* | *buccata* | silverjaw minnow |
| *Hybopsis* | *amblops* | bigeye chub |
| *Hybopsis* | *amnis* | pallid shiner |
| *Phenacobius* | *mirabilis* | suckermouth minnow |
| *Campostoma* | *anomalum* | central stoneroller |
| *Campostoma* | *oligolepis* | largescale stoneroller |
| *Pimephales* | *notatus* | bluntnose minnow |
| *Pimephales* | *promelas* | fathead minnow |
| *Pimephales* | *vigilax* | bullhead minnow |
| *Couesius* | *plumbeus* | lake chub |
| *Ctenopharyngodon* | *idella* | grass carp |
| *Phoxinus* | *erythrogaster* | southern redbelly dace |
| *Scardinius* | *erythrophthalmus* | rudd |
| *Hypophthalmichthys* | *molitrix* | silver carp |
| *Cyprinella* | *lutrensis* | red shiner |
| *Cyprinella* | *spiloptera* | spotfin shiner |
| *Cyprinella* | *whipplei* | steelcolor shiner |
| *Erimystax* | *dissimilis* | streamline chub |
| *Erimystax* | *x-punctatus* | gravel chub |
| *Luxilus* | *chrysocephalus* | striped shiner |
| *Luxilus* | *cornutus* | common shiner |
| *Lythrurus* | *ardens* | rosefin shiner |
| *Lythrurus* | *fumeus* | ribbon shiner |
| *Lythrurus* | *umbratilis* | redfin shiner |

Appendix H continued

| Genus | Species | Common Name |
|---|---|---|
| *Macrhybopsis* | *storeriana* | silver chub |
| *Opsopoeodus* | *emiliae* | pugnose minnow |
| *Extrarius* | *aestivalis* | speckled chub |
| *Notropis* | *wickliffi* | channel shiner |
| *Mylopharyngodon* | *piceus* | black carp |
| *Hypophthalmichthys* | *noblis* | bighead carp |

## Appendix I. Total number of sucker species

| Genus | Species | Common Name |
|---|---|---|
| *Catostomus* | *catostomus* | longnose sucker |
| *Catostomus* | *commersoni* | white sucker |
| *Carpiodes* | *cyprinus* | quillback |
| *Carpiodes* | *carpio* | river carpsucker |
| *Carpiodes* | *velifer* | highfin carpsucker |
| *Erimyzon* | *sucetta* | lake chubsucker |
| *Erimyzon* | *oblongus* | creek chubsucker |
| *Moxostoma* | *macrolepidotum* | shorthead redhorse |
| *Moxostoma* | *anisurum* | silver redhorse |
| *Moxostoma* | *carinatum* | river redhorse |
| *Moxostoma* | *duquesnei* | black redhorse |
| *Moxostoma* | *erythrurum* | golden redhorse |
| *Moxostoma* | *valenciennesi* | greater redhorse |
| *Hypentelium* | *nigricans* | northern hogsucker |
| *Cycleptus* | *elongatus* | blue sucker |
| *Ictiobus* | *bubalus* | smallmouth buffalo |
| *Ictiobus* | *cyprinellus* | bigmouth buffalo |
| *Ictiobus* | *niger* | black buffalo |
| *Minytrema* | *melanops* | spotted sucker |
| *Lagochila* | *lacera* | harelip sucker |
| *Moxostoma* | *breviceps* | Ohio redhorse |

## Appendix J. Total number of round-bodied sucker species

| Genus | Species | Common Name |
|---|---|---|
| *Erimyzon* | *sucetta* | lake chubsucker |
| *Erimyzon* | *oblongus* | creek chubsucker |
| *Moxostoma* | *macrolepidotum* | shorthead redhorse |
| *Moxostoma* | *anisurum* | silver redhorse |
| *Moxostoma* | *carinatum* | river redhorse |
| *Moxostoma* | *duquesnei* | black redhorse |
| *Moxostoma* | *erythrurum* | golden redhorse |
| *Moxostoma* | *valenciennesi* | greater redhorse |
| *Hypentelium* | *nigricans* | northern hogsucker |
| *Cycleptus* | *elongatus* | blue sucker |
| *Minytrema* | *melanops* | spotted sucker |
| *Moxostoma* | *m. breviceps* | Ohio redhorse |

## Appendix K. Total number of sensitive species

| Genus | Species | Common Name |
|---|---|---|
| *Lampetra* | *aepyptera* | least brook lamprey |
| *Lampetra* | *appendix* | American brook lamprey |
| *Ichthyomyzon* | *bdellium* | Ohio lamprey |
| *Ichthyomyzon* | *fossor* | northern brook lamprey |
| *Polyodon* | *spathula* | paddlefish |
| *Hiodon* | *alosoides* | goldeye |
| *Hiodon* | *tergisus* | mooneye |
| *Clinostomus* | *elongatus* | redside dace |
| *Rhinichthys* | *cataractae* | longnose dace |
| *Nocomis* | *micropogon* | river chub |
| *Nocomis* | *biguttatus* | hornyhead chub |
| *Notropis* | *chalybaeus* | ironcolor shiner |
| *Notropis* | *rubellus* | rosyface shiner |
| *Notropis* | *shumardi* | silverband shiner |
| *Notropis* | *ludibundus* | sand shiner |
| *Notropis* | *texanus* | weed shiner |
| *Notropis* | *volucellus* | mimic shiner |
| *Notropis* | *anogenus* | pugnose shiner |
| *Notropis* | *ariommus* | popeye shiner |
| *Notropis* | *boops* | bigeye shiner |
| *Notropis* | *heterodon* | blackchin shiner |
| *Notropis* | *heterolepis* | blacknose shiner |
| *Notropis* | *photogenis* | silver shiner |
| *Notropis* | *wickliffi* | channel shiner |
| *Hybopsis* | *amblops* | bigeye chub |
| *Hybopsis* | *amnis* | pallid shiner |
| *Erimystax* | *dissimilis* | streamline chub |
| *Erimystax* | *x-punctatus* | gravel chub |
| *Lythrurus* | *ardens* | rosefin shiner |
| *Opsopoeodus* | *emiliae* | pugnose minnow |
| *Extrarius* | *aestivalis* | speckled chub |
| *Carpiodes* | *velifer* | highfin carpsucker |
| *Moxostoma* | *macrolepidotum* | shorthead redhorse |
| *Moxostoma* | *anisurum* | silver redhorse |
| *Moxostoma* | *carinatum* | river redhorse |
| *Moxostoma* | *duquesnei* | black redhorse |
| *Moxostoma* | *erythrurum* | golden redhorse |
| *Moxostoma* | *valenciennesi* | greater redhorse |
| *Moxostoma* | *breviceps* | Ohio redhorse |
| *Hypentelium* | *nigricans* | northern hogsucker |
| *Cycleptus* | *elongatus* | blue sucker |
| *Noturus* | *nocturnus* | freckled madtom |
| *Noturus* | *eleutherus* | mountain madtom |
| *Noturus* | *exilis* | slender madtom |
| *Noturus* | *flavus* | stonecat |
| *Noturus* | *miurus* | brindled madtom |
| *Noturus* | *stigmosus* | northern madtom |
| *Amblyopsis* | *spelaea* | northern cavefish |
| *Typhlichthys* | *subterraneus* | southern cavefish |
| *Fundulus* | *catenatus* | northern studfish |
| *Fundulus* | *dispar* | starhead topminnow |
| *Labidesthes* | *sicculus* | brook silverside |
| *Ambloplites* | *rupestris* | rock bass |

Appendix K continued

| Genus | Species | Common Name |
|---|---|---|
| *Lepomis* | *megalotis* | longear sunfish |
| *Micropterus* | *dolomieu* | smallmouth bass |
| *Etheostoma* | *blennioides* | greenside darter |
| *Etheostoma* | *caeruleum* | rainbow darter |
| *Etheostoma* | *camurum* | bluebreast darter |
| *Etheostoma* | *histrio* | harlequin darter |
| *Etheostoma* | *maculatum* | spotted darter |
| *Etheostoma* | *squamiceps* | spottail darter |
| *Etheostoma* | *tippecanoe* | Tippecanoe darter |
| *Etheostoma* | *variatum* | variegate darter |
| *Etheostoma* | *zonale* | banded darter |
| *Percina* | *caprodes* | logperch |
| *Percina* | *sciera* | dusky darter |
| *Percina* | *evides* | gilt darter |
| *Percina* | *phoxocephala* | slenderhead darter |
| *Percina* | *uranidea* | stargazing darter |
| *Percina* | *vigil* | saddleback darter |
| *Percina* | *copelandi* | channel darter |
| *Ammocrypta* | *clara* | western sand darter |
| *Ammocrypta* | *pellucida* | eastern sand darter |
| *Crystallaria* | *asprella* | crystal darter |

## Appendix L. Percent tolerant species

| Genus | Species | Common Name |
|---|---|---|
| *Lepisosteus* | *osseus* | longnose gar |
| *Lepisosteus* | *platostomus* | shortnose gar |
| *Dorosoma* | *cepedianum* | gizzard shad |
| *Umbra* | *limi* | central mudminnow |
| *Cyprinus* | *carpio* | carp |
| *Carassius* | *auratus* | goldfish |
| *Notemigonus* | *crysoleucas* | golden shiner |
| *Semotilus* | *atromaculatus* | creek chub |
| *Rhinichthys* | *atratulus* | blacknose dace |
| *Pimephales* | *notatus* | bluntnose minnow |
| *Pimephales* | *promelas* | fathead minnow |
| *Ctenopharyngodon* | *idella* | grass carp |
| *Scardinius* | *erythrophthalmus* | rudd |
| *Hypophthalmichthys* | *molitrix* | silver carp |
| *Cyprinella* | *lutrensis* | red shiner |
| *Catostomus* | *commersoni* | white sucker |
| *Carpiodes* | *cyprinus* | quillback |
| *Carpiodes* | *carpio* | river carpsucker |
| *Ictiobus* | *bubalus* | smallmouth buffalo |
| *Ictiobus* | *cyprinellus* | bigmouth buffalo |
| *Ictalurus* | *punctatus* | channel catfish |
| *Pylodictis* | *olivaris* | flathead catfish |
| *Ameiurus* | *melas* | black bullhead |
| *Ameiurus* | *natalis* | yellow bullhead |
| *Fundulus* | *diaphanus* | banded killifish |
| *Morone* | *chrysops* | white bass |
| *Lepomis* | *cyanellus* | green sunfish |
| *Aplodinotus* | *grunniens* | freshwater drum |
| *Mylopharyngodon* | *piceus* | black carp |
| *Hypophthalmichthys* | *noblis* | bighead carp |
| *Morone* | *americana* | white perch |
| *Cyprinus* | *auratus x carpio* | goldfish carp hybrid |

## Appendix M. Percent omnivore species

| Genus | Species | Common Name |
|---|---|---|
| *Dorosoma* | *cepedianum* | gizzard shad |
| *Dorosoma* | *petenense* | threadfin shad |
| *Umbra* | *limi* | central mudminnow |
| *Cyprinus* | *carpio* | carp |
| *Carassius* | *auratus* | goldfish |
| *Cyprinus* | *auratus x carpio* | goldfish carp hybrid |
| *Hybognathus* | *nuchalis* | Mississippi silvery minnow |
| *Hybognathus* | *hankinsoni* | brassy minnow |
| *Hybognathus* | *hayi* | cypress minnow |
| *Pimephales* | *notatus* | bluntnose minnow |
| *Pimephales* | *promelas* | fathead minnow |
| *Pimephales* | *vigilax* | bullhead minnow |
| *Ctenopharyngodon* | *idella* | grass carp |
| *Scardinius* | *erythrophthalmus* | rudd |
| *Hypophthalmichthys* | *molitrix* | silver carp |
| *Catostomus* | *commersoni* | white sucker |
| *Carpiodes* | *cyprinus* | quillback |
| *Carpiodes* | *carpio* | river carpsucker |
| *Carpiodes* | *velifer* | highfin carpsucker |
| *Mylopharyngodon* | *piceus* | black carp |

## Appendix N. Percent insectivore species

*Species that are "invertivore" feeders are also included in this metric.*

| Genus | Species | Common Name |
|---|---|---|
| *Acipenser* | *fulvescens* | lake sturgeon |
| *Scaphirhynchus* | *platorynchus* | shovelnose sturgeon |
| *Hiodon* | *alosoides* | goldeye |
| *Hiodon* | *tergisus* | mooneye |
| *Coregonus* | *clupeaformis* | lake whitefish |
| *Osmerus* | *mordax* | rainbow smelt |
| *Notemigonus* | *crysoleucas* | golden shiner |
| *Clinostomus* | *elongatus* | redside dace |
| *Rhinichthys* | *cataractae* | longnose dace |
| *Nocomis* | *micropogon* | river chub |
| *Nocomis* | *biguttatus* | hornyhead chub |
| *Notropis* | *chalybaeus* | ironcolor shiner |
| *Notropis* | *hudsonius* | spottail shiner |
| *Notropis* | *rubellus* | rosyface shiner |
| *Notropis* | *atherinoides* | emerald shiner |
| *Notropis* | *buchanani* | ghost shiner |
| *Notropis* | *shumardi* | silverband shiner |
| *Notropis* | *ludibundus* | sand shiner |
| *Notropis* | *texanus* | weed shiner |
| *Notropis* | *volucellus* | mimic shiner |
| *Notropis* | *anogenus* | pugnose shiner |
| *Notropis* | *ariommus* | popeye shiner |
| *Notropis* | *blennius* | river shiner |
| *Notropis* | *boops* | bigeye shiner |
| *Notropis* | *dorsalis* | bigmouth shiner |
| *Notropis* | *heterodon* | blackchin shiner |
| *Notropis* | *heterolepis* | blacknose shiner |
| *Notropis* | *photogenis* | silver shiner |
| *Cyprinidae hybrid* | | cyprinidae hybrid |
| *Ericymba* | *buccata* | silverjaw minnow |
| *Hybopsis* | *amblops* | bigeye chub |
| *Hybopsis* | *amnis* | pallid shiner |
| *Phenacobius* | *mirabilis* | suckermouth minnow |
| *Couesius* | *plumbeus* | lake chub |
| *Cyprinella* | *lutrensis* | red shiner |
| *Cyprinella* | *spiloptera* | spotfin shiner |
| *Cyprinella* | *whipplei* | steelcolor shiner |
| *Erimystax* | *dissimilis* | streamline chub |
| *Erimystax* | *x-punctatus* | gravel chub |
| *Luxilus* | *chrysocephalus* | striped shiner |
| *Luxilus* | *cornutus* | common shiner |
| *Lythrurus* | *ardens* | rosefin shiner |
| *Lythrurus* | *fumeus* | ribbon shiner |
| *Lythrurus* | *umbratilis* | redfin shiner |
| *Macrhybopsis* | *storeriana* | silver chub |
| *Opsopoeodus* | *emiliae* | pugnose minnow |
| *Extrarius* | *aestivalis* | speckled chub |
| *Catostomus* | *catostomus* | longnose sucker |
| *Erimyzon* | *sucetta* | lake chubsucker |
| *Erimyzon* | *oblongus* | creek chubsucker |

Appendix N continued

| Genus | Species | Commno Name |
|---|---|---|
| *Moxostoma* | *macrolepidotum* | shorthead redhorse |
| *Moxostoma* | *anisurum* | silver redhorse |
| *Moxostoma* | *carinatum* | river redhorse |
| *Moxostoma* | *duquesnei* | black redhorse |
| *Moxostoma* | *erythrurum* | golden redhorse |
| *Moxostoma* | *valenciennesi* | greater redhorse |
| *Hypentelium* | *nigricans* | northern hogsucker |
| *Cycleptus* | *elongatus* | blue sucker |
| *Catostomidae sp.* | | catostomidae sp |
| *Ictiobus* | *bubalus* | smallmouth buffalo |
| *Ictiobus* | *cyprinellus* | bigmouth buffalo |
| *Ictiobus* | *niger* | black buffalo |
| *Minytrema* | *melanops* | spotted sucker |
| *Noturus* | *gyrinus* | tadpole madtom |
| *Noturus* | *nocturnus* | freckled madtom |
| *Noturus* | *eleutherus* | mountain madtom |
| *Noturus* | *exilis* | slender madtom |
| *Noturus* | *flavus* | stonecat |
| *Noturus* | *miurus* | brindled madtom |
| *Noturus* | *stigmosus* | northern madtom |
| *Ameiurus* | *melas* | black bullhead |
| *Ameiurus* | *natalis* | yellow bullhead |
| *Ameiurus* | *nebulosus* | brown bullhead |
| *Aphredoderus* | *sayanus* | pirate perch |
| *Percopsis* | *omiscomaycus* | trout-perch |
| *Fundulus* | *diaphanus* | banded killifish |
| *Fundulus* | *olivaceus* | blackspotted topminnow |
| *Fundulus* | *catenatus* | northern studfish |
| *Fundulus* | *notatus* | blackstripe topminnow |
| *Fundulus* | *dispar* | starhead topminnow |
| *Gambusia* | *affinis* | western mosquitofish |
| *Labidesthes* | *sicculus* | brook silverside |
| *Pungitius* | *pungitius* | ninespine stickleback |
| *Culaea* | *inconstans* | brook stickleback |
| *Cottus* | *bairdi* | mottled sculpin |
| *Cottus* | *carolinae* | banded sculpin |
| *Cottus* | *ricei* | spoonhead sculpin |
| *Centrarchus* | *macropterus* | flier |
| *Lepomis* | *cyanellus* | green sunfish |
| *Lepomis* | *macrochirus* | bluegill |
| *Lepomis* | *gibbosus* | pumpkinseed |
| *Lepomis* | *humilis* | orangespotted sunfish |
| *Lepomis* | *megalotis* | longear sunfish |
| *Lepomis* | *microlophus* | redear sunfish |
| *Lepomis* | *punctatus* | spotted sunfish |
| *Lepomis* | *symmetricus* | bantam sunfish |
| *Etheostoma* | *chlorosomum* | bluntnose darter |
| *Etheostoma* | *gracile* | slough darter |
| *Etheostoma* | *spectabile* | orangethroat darter |
| *Etheostoma* | *nigrum* | johnny darter |
| *Etheostoma* | *asprigene* | mud darter |
| *Etheostoma* | *blennioides* | greenside darter |
| *Etheostoma* | *caeruleum* | rainbow darter |

Appendix N continued

| Genus | Species | Commno Name |
|---|---|---|
| *Etheostoma* | *camurum* | bluebreast darter |
| *Etheostoma* | *exile* | Iowa darter |
| *Etheostoma* | *flabellare* | fantail darter |
| *Etheostoma* | *histrio* | harlequin darter |
| *Etheostoma* | *maculatum* | spotted darter |
| *Etheostoma* | *microperca* | least darter |
| *Etheostoma* | *squamiceps* | spottail darter |
| *Etheostoma* | *tippecanoe* | Tippecanoe darter |
| *Etheostoma* | *variatum* | variegate darter |
| *Etheostoma* | *zonale* | banded darter |
| *Etheostoma* | *spectabile x caerule* | orangethroat rainbow hybrid |
| *Percina* | *caprodes* | logperch |
| *Percina* | *sciera* | dusky darter |
| *Percina* | *evides* | gilt darter |
| *Percina* | *maculata* | blackside darter |
| *Percina* | *phoxocephala* | slenderhead darter |
| *Percina* | *shumardi* | river darter |
| *Percina* | *uranidea* | stargazing darter |
| *Percina* | *vigil* | saddleback darter |
| *Percina* | *copelandi* | channel darter |
| *Ammocrypta* | *clara* | western sand darter |
| *Ammocrypta* | *pellucida* | eastern sand darter |
| *Crystallaria* | *asprella* | crystal darter |
| *Elassoma* | *zonatum* | banded pygmy sunfish |
| *Notropis* | *wickliffi* | channel shiner |
| *Lepomis* | *x-hybrid* | sunfish hybrid |
| *Neogobius* | *malanostomus* | round goby |
| *Moxostoma* | *m. breviceps* | Ohio redhorse |
| *Menidia* | *beryllina* | inland silverside |
| *Gasterosteus* | *aculeatus* | threespine stickleback |

Appendix O. Percent pioneer species

| Genus | Species | Common Name |
|---|---|---|
| *Semotilus* | *atromaculatus* | creek chub |
| *Ericymba* | *buccata* | silverjaw minnow |
| *Campostoma* | *anomalum* | central stoneroller |
| *Campostoma* | *oligolepis* | largescale stoneroller |
| *Pimephales* | *notatus* | bluntnose minnow |
| *Pimephales* | *promelas* | fathead minnow |
| *Erimyzon* | *sucetta* | lake chubsucker |
| *Erimyzon* | *oblongus* | creek chubsucker |
| *Lepomis* | *cyanellus* | green sunfish |
| *Etheostoma* | *spectabile* | orangethroat darter |
| *Etheostoma* | *nigrum* | Johnny darter |

## Appendix P. Percent carnivore species

*Species that are "piscivores" are also included in this metric.*

| Genus | Species | Common Name |
|---|---|---|
| *Petromyzon* | *marinus* | sea lamprey |
| *Ichthyomyzon* | *bdellium* | Ohio lamprey |
| *Ichthyomyzon* | *castaneus* | chestnut lamprey |
| *Ichthyomyzon* | *unicuspis* | silver lamprey |
| *Lepisosteus* | *osseus* | longnose gar |
| *Lepisosteus* | *oculatus* | spotted gar |
| *Lepisosteus* | *platostomus* | shortnose gar |
| *Atractosteus* | *spatula* | alligator gar |
| *Amia* | *calva* | bowfin |
| *Anguilla* | *rostrata* | American eel |
| *Alosa* | *chrysochloris* | skipjack herring |
| *Oncorhynchus* | *kisutch* | coho salmon |
| *Oncorhynchus* | *tshawytscha* | chinook salmon |
| *Oncorhynchus* | *mykiss* | rainbow trout |
| *Salmo* | *salar* | Atlantic salmon |
| *Salmo* | *trutta* | brown trout |
| *Salvelinus* | *namaycush* | lake trout |
| *Salvelinus* | *fontinalis* | brook trout |
| *Esox* | *lucius* | northern pike |
| *Esox* | *americanus* | grass pickerel |
| *Esox* | *ohioensis* | muskellunge |
| *Esox* | *masquinongy* | Great Lakes muskellunge |
| *Esox* | *lucius x masquinongy* | tiger muskie |
| *Ictalurus* | *furcatus* | blue catfish |
| *Pylodictis* | *olivaris* | flathead catfish |
| *Morone* | *saxatilis* | striped bass |
| *Morone* | *chrysops* | white bass |
| *Morone* | *mississippiensis* | yellow bass |
| *Morone* | *americana* | white perch |
| *Morone* | *chrysops x saxatilis* | wiper |
| *Ambloplites* | *rupestris* | rock bass |
| *Lepomis* | *gulosus* | warmouth |
| *Micropterus* | *dolomieu* | smallmouth bass |
| *Micropterus* | *salmoides* | largemouth bass |
| *Micropterus* | *punctulatus* | spotted bass |
| *Stizostedion* | *vitreum* | walleye |
| *Stizostedion* | *canadense* | sauger |
| *Stizostedion* | *canadense x vitreum* | saugeye |
| *Gymnocephalus* | *cernuus* | ruffe |

## Appendix Q. Percent simple lithophilic species

| Genus | Species | Common Name |
|---|---|---|
| *Acipenser* | *fulvescens* | lake sturgeon |
| *Scaphirhynchus* | *platorynchus* | shovelnose sturgeon |
| *Polyodon* | *spathula* | paddlefish |
| *Hybognathus* | *nuchalis* | Mississippi silvery minnow |
| *Clinostomus* | *elongatus* | redside dace |
| *Rhinichthys* | *atratulus* | blacknose dace |
| *Rhinichthys* | *cataractae* | longnose dace |
| *Notropis* | *rubellus* | rosyface shiner |
| *Notropis* | *shumardi* | silverband shiner |
| *Notropis* | *ariommus* | popeye shiner |
| *Notropis* | *blennius* | river shiner |
| *Notropis* | *boops* | bigeye shiner |
| *Notropis* | *photogenis* | silver shiner |
| *Hybopsis* | *amblops* | bigeye chub |
| *Hybopsis* | *amnis* | pallid shiner |
| *Phenacobius* | *mirabilis* | suckermouth minnow |
| *Couesius* | *plumbeus* | lake chub |
| *Phoxinus* | *erythrogaster* | southern redbelly dace |
| *Erimystax* | *dissimilis* | streamline chub |
| *Erimystax* | *x-punctatus* | gravel chub |
| *Luxilus* | *chrysocephalus* | striped shiner |
| *Luxilus* | *cornutus* | common shiner |
| *Lythrurus* | *ardens* | rosefin shiner |
| *Catostomus* | *catostomus* | longnose sucker |
| *Catostomus* | *commersoni* | white sucker |
| *Moxostoma* | *macrolepidotum* | shorthead redhorse |
| *Moxostoma* | *anisurum* | silver redhorse |
| *Moxostoma* | *carinatum* | river redhorse |
| *Moxostoma* | *duquesnei* | black redhorse |
| *Moxostoma* | *erythrurum* | golden redhorse |
| *Moxostoma* | *valenciennesi* | greater redhorse |
| *Moxostoma* | *m. breviceps* | Ohio redhorse |
| *Hypentelium* | *nigricans* | northern hogsucker |
| *Cycleptus* | *elongatus* | blue sucker |
| *Minytrema* | *melanops* | spotted sucker |
| *Lota* | *lota* | burbot |
| *Etheostoma* | *spectabile* | orangethroat darter |
| *Etheostoma* | *caeruleum* | rainbow darter |
| *Etheostoma* | *camurum* | bluebreast darter |
| *Etheostoma* | *maculatum* | spotted darter |
| *Etheostoma* | *tippecanoe* | Tippecanoe darter |
| *Etheostoma* | *variatum* | variegate darter |
| *Etheostoma* | *spectabile x caerule* | orangethroat rainbow hybrid |
| *Percina* | *caprodes* | logperch |
| *Percina* | *sciera* | dusky darter |
| *Percina* | *evides* | gilt darter |
| *Percina* | *maculata* | blackside darter |
| *Percina* | *phoxocephala* | slenderhead darter |
| *Percina* | *shumardi* | river darter |
| *Percina* | *uranidea* | stargazing darter |
| *Percina* | *vigil* | saddleback darter |
| *Stizostedion* | *vitreum* | walleye |
| *Stizostedion* | *canadense* | sauger |

Appendix Q continued

| Genus | Species | Common Name |
|---|---|---|
| *Percina* | *copelandi* | channel darter |
| *Ammocrypta* | *clara* | western sand darter |
| *Ammocrypta* | *pellucida* | eastern sand darter |
| *Crystallaria* | *asprella* | crystal darter |
| *Stizostedion* | *canadense x vitreum* | saugeye |
| *Gymnocephalus* | *cernuus* | ruffe |

## Appendix R. Percent DELT anomalies

*This metric only includes external anomalies in the form of deformity, erosion, lesion, tumor, (DELT) or multiple (which is a combination of two or more of the DELT anomalies). Other external anomalies such as parasites or black spot should not be included when calculating this metric.*

## Appendix S. Scoring modifications

| | |
|---|---|
| Score the following metrics as 1: | Percent omnivore species<br>Percent insectivore species<br>Percent simple lithophil species<br>Percent DELT anomalies<br>Percent pioneer species |
| Score the following metric as 1: | Percent carnivore species, when dominated (>50 %) by grass pickerel |

**Note**, additional scoring modifications may occur when less than **150** individuals are collected (Headwater, Wadeable, Large and Great River stream categories).

| | |
|---|---|
| Score the following metrics as 1: | Percent omnivore species, when dominated (>50%) by creek chub and blacknose dace |
| | Percent insectivore species, when dominated (>50%) by either striped shiner, common shiner or spotfin shiner |