**6.** Please rank the following threats to ALL fish in ALL habitats in Indiana.

| | Critical threat | Serious threat | Somewhat of a threat | Slight threat | No threat | Unknown | Response Total |
|---|---|---|---|---|---|---|---|
| Invasive/non-native species | 7% (3) | 14% (6) | 28% (12) | 26% (11) | 9% (4) | 16% (7) | **43** |
| High sensitivity to pollution | 18% (8) | 34% (15) | 34% (15) | 7% (3) | 0% (0) | 7% (3) | **44** |
| Bioaccumulation of contaminants | 2% (1) | 9% (4) | 32% (14) | 34% (15) | 7% (3) | 16% (7) | **44** |
| Predators (native or domesticated) | 0% (0) | 7% (3) | 26% (11) | 35% (15) | 26% (11) | 7% (3) | **43** |
| Dependence on other species (mutualism, pollinators) | 0% (0) | 0% (0) | 17% (7) | 7% (3) | 45% (19) | 31% (13) | **42** |
| Diseases/parasites (of the species itself) | 0% (0) | 0% (0) | 12% (5) | 39% (16) | 7% (3) | 41% (17) | **41** |
| Regulated hunting/fishing pressure (too much) | 2% (1) | 2% (1) | 19% (8) | 23% (10) | 47% (20) | 7% (3) | **43** |
| Species over population | 2% (1) | 2% (1) | 7% (3) | 5% (2) | 81% (35) | 2% (1) | **43** |
| Unintentional take/ direct mortality (e.g., vehicle collisions, power line collisions, by-catch, harvesting equipment, land preparation machinery) | 0% (0) | 0% (0) | 5% (2) | 28% (12) | 63% (27) | 5% (2) | **43** |
| Unregulated collection pressure | 0% (0) | 0% (0) | 5% (2) | 21% (9) | 70% (30) | 5% (2) | **43** |
| Dependence on irregular resources (cyclical annual variations) (e.g., food, water, habitat limited due to annual variations in availability) | 19% (8) | 7% (3) | 23% (10) | 19% (8) | 16% (7) | 16% (7) | **43** |
| | | | | | **Total Respondents** | | **472** |

**7.** Please also rank these threats to ALL fish in ALL habitats in Indiana.

| | Critical threat | Serious threat | Somewhat of a threat | Slight threat | No threat | Unknown | Response Total |
|---|---|---|---|---|---|---|---|
| Habitat loss (breeding range) | 21% (9) | 23% (10) | 26% (11) | 14% (6) | 7% (3) | 9% (4) | **43** |
| Habitat loss (feeding/foraging areas) | 21% (9) | 26% (11) | 23% (10) | 16% (7) | 7% (3) | 7% (3) | **43** |
| Small native range (high endemism) | 2% (1) | 10% (4) | 7% (3) | 14% (6) | 60% (25) | 7% (3) | **42** |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Near limits of natural geographic range | 9% (4) | 2% (1) | 9% (4) | 7% (3) | 72% (31) | 0% (0) | **43** |
| Large home range requirements | 0% (0) | 0% (0) | 0% (0) | 7% (3) | 74% (31) | 19% (8) | **42** |
| Viable reproductive population size or availability | 9% (4) | 9% (4) | 21% (9) | 21% (9) | 37% (16) | 2% (1) | **43** |
| Specialized reproductive behavior or low reproductive rates | 16% (7) | 7% (3) | 21% (9) | 16% (7) | 30% (13) | 9% (4) | **43** |
| Degradation of movement/migration routes (overwintering habitats, nesting and staging sites) | 16% (7) | 14% (6) | 23% (10) | 14% (6) | 19% (8) | 14% (6) | **43** |
| Genetic pollution (hybridization) | 0% (0) | 0% (0) | 0% (0) | 21% (9) | 60% (26) | 19% (8) | **43** |
| Unknown | 0% (0) | 0% (0) | 18% (3) | 0% (0) | 12% (2) | 71% (12) | **17** |
| Other (please specify below) | 0% (0) | 20% (3) | 0% (0) | 0% (0) | 7% (1) | 73% (11) | **15** |
| | | | | | **Total Respondents** | | **417** |

**8.** Other threats to ALL fish in ALL habitats in Indiana.

1. Stream channelizing
2. High stream flows following spawning can seriouslyh reduce year class strength. This threat can be reduced by reducing ditching in headwaters, installing grass waterways and WASCOBS, maintaining riparian corridors. All of these measures will slow stream flows and reduce siltation.
3. High stream flows for a few months following spawning can seriously reduce year class strength.
4. Egg predators predation, nutritional requirements, early mortality syndrome
5. My area of expertise is effects of contamination on biological organisms, especially aquatic. This makes filling out he survey difficult. My knowleldge is applicable to aquatic habitatis rather than specific fish species in this survey.
6. Commercial over exploitation resulting in low spawner stock abundance.
7. commercial fishing
8. Threats to the Orangethroat Darter are related to threats to the habitat. It prefers high-functioning, high quality riffle habitat in headwater streams. Headwater streams, are not always given as much protection or value as larger rivers downstream. Threats to the species colonization, such as aquatic passage problems through culverts are one threat. Threats to the species watersheds, such as pollution, clearing of the riparian vegetation, creek gravel mining, and channelization are also threats to the habitat of this species.; Threats to the Orangethroat Darter are related to threats to the habitat. It prefers high-functioning, high quality riffle habitat in headwater streams. Headwater streams, are not always given as much protection or value as larger rivers downstream. Threats to the species colonization, such as aquatic passage problems through culverts are one threat. Threats

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| | |
|---|---|
| **Total Respondents** | **8** |
| (skipped this question) | 33 |

**9.** Please briefly describe the top two threats to ALL fish in ALL habitats in Indiana identified above.

1. 1. Pollution
2. sediment deposition
3. Pollution
4. over population
5. (1) Habitat loss - siltation which reduces wpawning areas and fills pools, loss of instrream cover (snagging and log removal), riparian destruction which allows water to warm and will reduce opportunity for logs and woody debris to enter stream, channelization.
(2) Pollution which triggers fish kills or repels smallmouth from the area.
6. (1) Habitat loss - siltation of spawning areas and pools, loss of instream cover, reparian destruction, channelization
(2) Point source pollution which triggers fish kills or repels rock bass from the area.
7. (1) habitat loss (feeding areas) - many reservoirs are getting very old and the once abundant standing timber is now diminishing which is reducing cover for white crappie.
(2) dependence on irregular sources - in many reservoirs, shad is the dominant forage base for crappie. If shad are growing extremely fast, crappie can only utilize shad for a short period of time before the shad outgrow the size crapie can consume.
8. Loss of undisturbed natural lake habitat.
9. Long-term declines in water quality associated with lake eutrophication.
Annual and seasonal variations in habitat availability.
10. Habitat loss and degredation are serios threats to rock bass. They prefer silt free streams to reproduce and thrive. They also relate closely to structure/cover therefore any habitat loss is a threat.

11. -Cold, clear water is critical for cisco survival; increased runoff and nutrient loading have degraded the habitat for this species in many of the 50+ lakes it once occurred in. Few lakes still have the species, and there is apparently little to no reproduction.
-The deliberate stocking of predator fish in cisco lakes has been a threat to this species for years; if this hasn't been stopped, it needs to.

12. 1) competition with invasives, namely gizzard shad
2) water level control regimes at impoundments

13. Lack of successful spawning, possibly related to bioenergetics. Too much egg predation.

14. The acute effects a of toxicants are recognized as a threat to organisms, but there is little knowledge on ecosystems or regional effects on chronic insults. Toxicants are more destructive to the embrolarva stages, but these are poorly documented. Pollution controls do not have definite focus on chronic effects.

15. Habitat loss and pollution

16. 1. Possible lack of reproductive success as indicated by poor length frequency distribution.
2. Possible sensitivity to pollution as indicated by its rarity in the Ohio River reach in Indiana.

17. Pike have suffered a major loss of spawning habitat due to the prevalence of dredging within the watershed. This practice along with levee construction has resulted in the near elimination of instream an emaergent wetland vegetation throughout the majority of the watershed.

18. Overharvest by commercial fishers
Mortality immature or male fish as commercial bycatch

19. Year class failure related to low spawner stock abundance. Competition with non native species for limited available food resources.

20. Habitat degredation, non-point sources runoff resulting from loss of riparian buffers due to developement.

21. Exotic species competition, specifically the round goby.

22. 1. Past pollution problems
2. Dams on rivers block migration

23. High sediment loads during spring rains

24. potential habitat loss

25. habitat loss and pollution

26. 1. Loss of habitat (reproductive/feeding) that is essential for northern pike survival
2. Over harvest and illegal harvest (This doesn't seem to be a major threat as of now)

27. 1)habitat loss/pollution, 2) commercial fishing

| | |
|---|---|
| 28. | 1. Non-point sources of pollution, especially sediments and pesticides<br><br>2. Point sources of pollution particularly sewage and spills of chemicals being transported along roads and railroads |
| 29. | Habitat Loss - The Eastern Sand darter requires sandy bottoms in fast flowing streams to bury eggs, hide from predators, ambush prey, conserve energy, and maintain position in unstable/shifting sandbars. Low reproductive rates/small populations - reach maturity at age 1, but only lives a few years. |
| 30. | Siltation- hornyhead chub are sight-feeders and mound builders for spawning;thus, muddy water will hamper their chances of survival and if the silt covers gravel and their nest, chances for successful reproduction will be limited.<br>Competition from other species better adapted to muddy and silty stream conditions |
| 31. | Habitat loss - requires shallow clear water with little current in weedy areas over gravel, sand, and silt to feed on insects and lay reproduce<br>Dredging (removal of aquatic vegetation and incresing depth of ditch)<br>Runoff (increases flow of stream, turbidity, and siltation of needed substrates) |
| 32. | Habitat loss (breeding & feeding)- the tadpole madtom feeds in dense vegetation and hides from predators in the leaf litter, dead wood, and other cover. By removing vegetation and cover in the stream, the tadpole madtom also loses spawning areas (tadpole madtoms typically lay eggs under submerged objects).<br>Degradation of the stream channel will also increase the velocity of the current (if straightened or cleared of debris) which will remove the tadpole madtom's preferred current-free, quiet habitat. |
| 33. | breeding and feeding/foraging habitat loss due to sedimentation from farm fields and stream banks as well as the removal of natural riparian vegetation; breeding and feeding/foraging habitat loss due to sedimentation from farm fields and stream banks as well as the removal of natural riparian vegetation |
| 34. | Habitat loss for both breeding and feeding/foraging areas. The slough darter prefers a mud or silt bottom with little current velocity and vegetation to deposit eggs on. They also spawn few eggs so reproduction is lower in places where vegetation is lacking. They also compete with other darters for insects and have a high mortality due to stagnation and freezing in the pools they desire to live in. |
| 35. | Habitat loss (breeding and foraging/feeding areas): Siltation of small headwater streams is limiting the population of southern redbelly dace because the species spawn over gravel substrates. Also, the removal of vegetation could decrease food availablity to the herbivorous species. They occupy streams that have a permanent flow of clear water; thus siltation or alterations in flow regimes could also affect the species. |
| 36. | Degradation of nesting and staging sites- pools or riffles with slow current beneath flat rocks<br>Low reproductive rates-Males reach sexual maturity at 2 while females can reproduce at 1 and they only have a life span of about 3 years. |
| 37. | The top two threats for the species are threats to migration (aquatic passage problems through stream crossing structures) and threats to the breeding habitat (high quality riffles). Threats to riffle habitat result from water quality degradation and loss of stream channel stability due to land management activities such as dredging, channelization, roads, and clearing of riparian vegetation.;<br>The top two threats for the species are threats to migration (aquatic passage problems through stream crossing structures) and threats to the breeding habitat (high quality riffles). Threats to riffle habitat result from water quality degradation and loss of stream channel stability due to land management activities such as dredging, channelization, roads, and clearing of riparian vegetation.;<br>The top two threats for the species are threats to migration (aquatic passage problems through |

The top two threats for the species are threats to migration (aquatic passage problems through stream crossing structures) and threats to the breeding habitat (high quality riffles). Threats to riffle habitat result from water quality degradation and loss of stream channel stability due to land management activities such as dredging, channelization, roads, and clearing of riparian vegetation.

| | |
|---|---|
| **Total Respondents** | **37** |
| (skipped this question) | 3 |

**10.** Please rank the following threats to the HABITAT of ALL fish in ALL habitats in Indiana.

| | Critical threat | Serious threat | Somewhat of a threat | Slight threat | No threat | Unknown | Response Total |
|---|---|---|---|---|---|---|---|
| Commercial or residential development (sprawl) | 12% (5) | 38% (15) | 22% (9) | 10% (4) | 18% (7) | 0% (0) | **40** |
| Counterproductive financial incentives or regulations | 0% (0) | 5% (2) | 8% (3) | 5% (2) | 32% (13) | 50% (20) | **40** |
| Invasive/non-native species | 10% (4) | 8% (3) | 28% (11) | 30% (12) | 10% (4) | 15% (6) | **40** |
| Nonpoint source pollution (sedimentation and nutrients) | 29% (12) | 37% (15) | 29% (12) | 5% (2) | 0% (0) | 0% (0) | **41** |
| Habitat fragmentation | 8% (3) | 25% (10) | 28% (11) | 10% (4) | 15% (6) | 15% (6) | **40** |
| Successional change | 2% (1) | 8% (3) | 15% (6) | 15% (6) | 35% (14) | 25% (10) | **40** |
| Diseases (of plants that create habitat) | 0% (0) | 0% (0) | 2% (1) | 12% (5) | 38% (15) | 48% (19) | **40** |
| Habitat degradation | 29% (12) | 29% (12) | 32% (13) | 7% (3) | 0% (0) | 2% (1) | **41** |
| Climate change | 2% (1) | 0% (0) | 18% (7) | 15% (6) | 28% (11) | 38% (15) | **40** |
| Stream channelization | 38% (15) | 25% (10) | 20% (8) | 10% (4) | 5% (2) | 2% (1) | **40** |
| Impoundment of water/flow regulation | 10% (4) | 28% (11) | 30% (12) | 10% (4) | 15% (6) | 8% (3) | **40** |
| Agricultural/forestry practices | 10% (4) | 39% (16) | 29% (12) | 15% (6) | 7% (3) | 0% (0) | **41** |
| Residual contamination (persistent toxins) | 0% (0) | 20% (8) | 32% (13) | 27% (11) | 2% (1) | 20% (8) | **41** |
| Point source pollution (continuing) | 15% (6) | 22% (9) | 27% (11) | 22% (9) | 0% (0) | 15% (6) | **41** |
| Mining/acidification | 0% (0) | 15% (6) | 25% (10) | 12% (5) | 28% (11) | 20% (8) | **40** |
| Drainage practices (stormwater runoff) | 5% (2) | 34% (14) | 29% (12) | 22% (9) | 2% (1) | 7% (3) | **41** |
| Unknown | 0% (0) | 0% (0) | 0% (0) | 0% (0) | 0% (0) | 100% (12) | **12** |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Other (please specify below) | 0% (0) | 8% (1) | 0% (0) | 0% (0) | 8% (1) | 85% (11) | **13** |
| | | | | | | **Total Respondents** | **671** |

**11.** Other HABITAT threats to ALL fish in ALL habitats in Indiana.

1. Riparian cooridor destruction. Loss of shading and sedimentation
2. Sand and gravel operations could destroy preferred habitat
3. Competition with round goby for nearshore habitat.
4. Dumping of refuse in sinkholes, these often contain persistent toxins associated with transformers, tires, appliances, pesticide containers, and electronic devices.

**Total Respondents** **4**

(skipped this question) 39

**12.** Please briefly describe the top two HABITAT threats to ALL fish in ALL habitats in Indiana identified above.

1. (1) Habitat degradation by sedimentation, channelization, cover removal, riparian removal. (2) Point source pollution - These ecoregions have major threats from large cities causing fish kills from waste water treatment plans. Also, confined feeding operations in the rural areas are a major threat to the stream fish communities.
2. (1) Habitat degradation - sedimentation, channelization, cover removal, riparian removal (2) Point source pollution - waste water treatment plants and confined feeding operations.
3. (1) regulation of impounded water - extreme water fluctuations in mainly the Army Corps reservoirs can negatively effect crappie populations especially if the water fluctuations occur during spawning (2) habitat degradation - the natural decomposition of flooded timber and woody debris is lessening the available cover for crappie. Also, siltation covers root wads left in the bottom of an impoundment which eliminates useable crappie cover.
4. Shoreline and labebed alterations
5. Habitat degradation
   Successional change
6. Any practices that create more erosion/sediment depostion and eliminates instream cover is a serious threat. Therefore, I'd have to say nonpoint source pollution and habitat degredation are the most serious threats.
7. Water quality degradation that leads to cloudy water is the key threat.
8. habitat loss/degredation due to a variety of circumstances
9. Identification of habitat along Indiana's nearshore area.

10. Habitat Degradation and Nonpoint source pollution

11. 1. Stream channelization
2. Non-point source pollution

12. The channelization of many streams in the upper Kankakee watershed and the associated fragmentation of wetland habitat has severely altered the state of the aquatic habitat in general.

13. Habitat Fragmentation
Water Level Variability

14. Competition with non native species for habitat. Need a quality place to live that is not in competiton with round goby.

15. Invasive species, non-point source pollution

16. Invasive species competition, specifically round goby interactions. Stream channelazation resulting in loss of habitat.

17. 1. Sedimentation
2. Dams fragmenting habitat

18. Sedimentation
Loss of habitat due to development in headwater areas

19. loss of riparian zone and siltation

20. loss of high quality riffles and outside bend deep fast runs

21. 1. Emergent bulrush and wetland habitat loss. It has been well documented in northern states that northern pike prefer flooded vegetation for spawning during the spring. Loss of this habitat from boating and wildlife (waterfowl and muskrat feeding) may reduce reproductive habitat for northern pike in some natural lakes.
2. Bulkhead seawall development reduces emergent vegetation used by northern pike for reproduction and for cover during feeding.

22. Both non-point and point sources of pollution associated with the increasing human population of Southern Indiana and the development of the area.

23. Habitat Degradation and stream channelization because this will directly affect the sediment transfer within the stream and microhabitat of the Eastern Sand Darter.

24. Nonpoint source pollution- sedimentation
Agricultural practices- again sedimentation

25. Non-point source pollution (sedimentation resulting in smothering of substrates and turbidity)
Habitat degradation (removal of vegetation and shallow water)

26. Stream channelization (straighting the channels to move water faster) and Habitat degradation (removal of debris in the stream to speed up the transfer of water off of the land and into the recieving stream)

27. breeding and feeding/foraging habitat loss due to sedimentation from farm fields and stream banks as well as the removal of natural riparian vegetation especially thru drainage maintenance activities

| | |
|---|---|
| | as well as the removal of natural riparian vegetation especially thru drainage maintenance activities |
| 28. | Habitat degradation and stream channelization as development continues in the Ohio River Drainage Habitat. |
| 29. | Non-point source pollution in the form of sedimentation<br>Destruction of clear shaded waters by forestry/agricultural practices or stream channelization. |
| 30. | Habitat degradation in terms of removal of substrate for spawning and sedimentation for covering the substrate needed to spawn. |
| 31. | Top two threats from the list up above are habitat degradation and stream channelization |

| | |
|---|---|
| **Total Respondents** | **31** |
| (skipped this question) | 12 |

**13.** What current monitoring efforts by state agencies are you aware of for ALL fish in ALL habitats in Indiana?

| | Yes, these efforts occur | Not aware of these efforts occuring | Response Total |
|---|---|---|---|
| Statewide year-round monitoring conducted by state agencies | 3% (1) | 97% (38) | **39** |
| Statewide once a year monitoring conducted by state agencies | 5% (2) | 95% (37) | **39** |
| Periodic statewide (less than once a year but still regularly scheduled) monitoring conducted by state agencies | 18% (7) | 82% (32) | **39** |
| Occasional statewide (less than once a year and not regularly scheduled) monitoring conducted by state agencies | 28% (11) | 72% (28) | **39** |
| Regional or local year-round monitoring conducted by state agencies | 8% (3) | 92% (37) | **40** |
| Regional or local once a year monitoring conducted by state agencies | 25% (10) | 75% (30) | **40** |
| Periodic regional or local (less than once a year but still regularly scheduled) monitoring conducted by state agencies | 74% (29) | 26% (10) | **39** |
| Occasional regional or local (less than once a year and not regularly scheduled) monitoring conducted by state agencies | 82% (32) | 18% (7) | **39** |
| | | **Total Respondents** | **314** |

**14.** What current monitoring efforts by other organizations are you aware of for ALL fish in ALL habitats in Indiana?

| | Yes, these efforts occur | Not aware of these efforts occuring | Response Total |
|---|---|---|---|
| Statewide year-round monitoring conducted by other organizations | 0% (0) | 100% (39) | **39** |
| Statewide once a year monitoring conducted by other organizations | 0% (0) | 100% (39) | **39** |
| Periodic statewide (less than once a year but still regularly scheduled) monitoring conducted by other organizations | 0% (0) | 100% (39) | **39** |
| Occasional statewide (less than once a year and not regularly scheduled) monitoring conducted by other organizations | 0% (0) | 100% (39) | **39** |
| Regional or local year-round monitoring conducted by other organizations | 8% (3) | 92% (37) | **40** |
| Regional or local once a year monitoring conducted by other organizations | 25% (10) | 75% (30) | **40** |
| Periodic regional or local (less than once a year but still regularly scheduled) monitoring conducted by other organizations | 20% (8) | 80% (32) | **40** |
| Occasional regional or local (less than once a year and not regularly scheduled) monitoring conducted by other organizations | 28% (11) | 72% (29) | **40** |
| | | **Total Respondents** | **316** |

**15.** How crucial are these monitoring efforts by state agencies for the conservation of ALL fish in ALL habitats in Indiana?

| | Very crucial | Somewhat crucial | Slightly crucial | Not crucial | Unknown | Response Total |
|---|---|---|---|---|---|---|
| Statewide year-round monitoring conducted by state agencies | 3% (1) | 5% (2) | 5% (2) | 62% (24) | 26% (10) | **39** |
| Statewide once a year monitoring conducted by state agencies | 10% (4) | 0% (0) | 3% (1) | 62% (24) | 26% (10) | **39** |
| Periodic statewide (less than once a year but still regularly scheduled) monitoring conducted by state agencies | 8% (3) | 8% (3) | 10% (4) | 49% (19) | 26% (10) | **39** |
| Occasional statewide (less than once a year and not regularly scheduled) monitoring conducted by state agencies | 5% (2) | 13% (5) | 10% (4) | 46% (18) | 26% (10) | **39** |
| Regional or local year-round monitoring conducted by state agencies | 2% (1) | 12% (5) | 8% (3) | 55% (22) | 22% (9) | **40** |
| Regional or local once a year monitoring conducted by state agencies | 13% (5) | 23% (9) | 23% (9) | 21% (8) | 21% (8) | **39** |

| | | | | | | |
|---|---|---|---|---|---|---|
| Periodic regional or local (less than once a year but still regularly scheduled) monitoring conducted by state agencies | 28% (11) | 40% (16) | 20% (8) | 8% (3) | 5% (2) | **40** |
| Occasional regional or local (less than once a year and not regularly scheduled) monitoring conducted by state agencies | 32% (13) | 24% (10) | 15% (6) | 12% (5) | 17% (7) | **41** |
| | | | | | **Total Respondents** | **316** |

**16.** How crucial are these monitoring efforts by other organizations for the conservation of ALL fish in ALL habitats in Indiana?

| | Very crucial | Somewhat crucial | Slightly crucial | Not crucial | Unknown | Response Total |
|---|---|---|---|---|---|---|
| Statewide year-round monitoring conducted by other organizations | 0% (0) | 8% (3) | 3% (1) | 56% (22) | 33% (13) | **39** |
| Statewide once a year monitoring conducted by other organizations | 5% (2) | 3% (1) | 5% (2) | 54% (21) | 33% (13) | **39** |
| Periodic statewide (less than once a year but still regularly scheduled) monitoring conducted by other organizations | 5% (2) | 5% (2) | 5% (2) | 51% (20) | 33% (13) | **39** |
| Occasional statewide (less than once a year and not regularly scheduled) monitoring conducted by other organizations | 5% (2) | 3% (1) | 3% (1) | 55% (21) | 34% (13) | **38** |
| Regional or local year-round monitoring conducted by other organizations | 0% (0) | 8% (3) | 5% (2) | 54% (21) | 33% (13) | **39** |
| Regional or local once a year monitoring conducted by other organizations | 8% (3) | 12% (5) | 15% (6) | 40% (16) | 25% (10) | **40** |
| Periodic regional or local (less than once a year but still regularly scheduled) monitoring conducted by other organizations | 10% (4) | 8% (3) | 10% (4) | 41% (16) | 31% (12) | **39** |
| Occasional regional or local (less than once a year and not regularly scheduled) monitoring conducted by other organizations | 8% (3) | 8% (3) | 15% (6) | 38% (15) | 32% (13) | **40** |
| | | | | | **Total Respondents** | **313** |

**17.** Regional or local state agency monitoring for ALL fish in ALL habitats in Indiana.

# Appendix E-75: Fish

1. Wabash River
West Fork White River
East Fork White River
Ohio River

2. Patoka River watershed

3. Blue River (Harrison County)
Sugar Creek (Shelby County)
Indian Creek (Greene County)

4. Blue River (Harrison County)

5. Blue River (Harrison County)
East Fork White River
West Fork White River

6. Patoka Lake
Hovey Lake
Dogwood Lake
Lake Sullivan
Many other lakes

7. (1) In early to mid 1990's the Division of Fish and Wildlife conducted a smallmouth bass inventory.
(2) 5 streasm have been sampled every other year from 1998 to 2004 to estimate smallmouth bass populations to determine the effect of smallmouth bass population changes due to the imposition of a 12 inch black bass size limit in 1998.

8. (1) IN early to mid 1990's, Division of Fish and Wildlife conducted fish community inventories on the major streams throughout the state.
(2) Game fish population estimates (including rock bass) have been conducted on 5 streams every other year from 1998 through 2004.

9. IDNR - Division of Fish and Wildlife

10. Division of Fish and Wildlife standardized largemouth bass sampling protocols
Tournament fishing monitoring by the Division of Fish and Wildlife

11. Division of Fish and Wildlife at cisco lakes
Department of Environmental Management water quality monitoring

12. various streams throughout the region, some are sampled more regularly than others

13. NE Indiana by DFW (Jed Pearson)

14. many impoundments throughout the state have general fisheries survey conducted on them and crappie are caught during these

15. Spring assessment out of Michigan City. Fall spawning assessment, Indiana waters of Lake Michigan. 9 month creel survey for harvest information. These efforts are conducted by the IDNR-Fish and Wildlife division.

16. IDNR periodically conducts fish stream surveys. IDEM conducts stream health surveys using fish and invertebrates

and invertebrates.

17. Ohio, White and Wabash rivers

18. DNR fishery surveys are occasionally conducted on the Iroquois River, the Yellow River, and the Kankakee River.

IDEM occasionally samples fish for contaminants analysis for the annual Fish Consumption Advisory.

19. White River
Wabash River

20. Lake Michigan proper out of Michigan City.

21. Headwater streams surveys were conducted in 2001 through 2004 by IDNR-Fish and Wildife, Lake Michigan Fisheries Office.

22. IDNR-Fish and Wildlife, Lake Michigan Fisheries office

23. IDEM annual ecoregion sampling

24. IDEM ecoregion sampling

25. INDFW, 1999 Wabash River, 2003 East Fork White River, 2004 West Fork White River, 2004 Main Stem White River, 1993 Patoka River, 2004 Ohio River Cannelton Pool, annual commercial fish harvest monitoring.

26. Ohio River, Newburgh and McApline Tailwater fall/winter annual monitoring, ocassional stream surveys

27. ocassional stream surveys

28. 1. Northern Pike are monitored via general fish surveys conducted to update lake status. There is now monitoring of northern pike on a general schedule.
2. There was a tracking study conducted in two Indaia natural lakes in the late 1990's by the IDNR to better understand reproductive habitat of northern pike.

29. Wabash River, Lafayette area, annual spring monitoring; occasional stream surveys

30. unkown

31. IDEM Probabilistic sampling

32. Indiana DNR Special Studies on T&E species- IDNR, Brant Fisher, did a study on the population of Eastern Sand Darters in Indiana over the past five years. IDNR- regional fish collection surveys may have collected some specimens of the Eastern Sand Darter. Indiana Department of Environmental Management (IDEM) occasionally collected Eastern Sand Darters as part of their Surface Water Quality Monitoring Strategy evaluating fish community structure in certain watersheds every 5 years.

33. IDEM monitors the Great Lakes Drainage once every five years; thus, they may have data available for hornyhead chub captured in the basin as part of the fish community assessments. IDNR may also sample fish communities in this area and have data on the hornyhead chub.

34. IDEM and IDNR collect fish community samples in this area; thus, they may have data on the distribution of Least darters.

35. IDEM monitors the Kankakee River basin once every five years to determine if the stream are supporting a well-balanced warmwater aquatic community. Tadpole madtoms may have been captured while sampling headwater streams.

36. See IDEM OWQ's Surface Water Qaulity Monitoring Strategy and project work plans and IDNR Fisheries Section Work Plans

37. IDEM monitors the health of major river basins every 5 years by looking at chemical, physical, and biological data collected at random locations within the watershed. Southern redbelly dace have been captured in the Ohio River Drainage Habitat; however, specific monitoring for the species has not occured to my knowledge by anyone state or other organization.

38. IDNR I believe has conducted special studies on some species. IDEM has record of some species being caught in that area.

39. IDEM and the DNR Nongame program also conduct fish monitoring during the field season. These above fish surveys are not specific to the Orangethroat Darter, but would include the Orangethroat Darter.; IDEM and the DNR Nongame program also conduct monitoring during the field season, once a year for fish. These above fish surveys are not specific to the Orangethroat Darter, but would include the Orangethroat Darter.

| | |
|---|---|
| **Total Respondents** | **39** |
| (skipped this question) | 3 |

## 18. Regional or local monitoring by other organizations for ALL fish in ALL habitats in Indiana.

1. none
2. none
3. None known to occur that specifically target smallmouth bass.
4. None known to occur that specifically target rock bass.
5. none known
6. West Fork White River & tributaries(Muncie area)
7. not aware of any
8. USFWS and Illinois natural history survey egg and fry assessments at the Port of Indiana. THis is part of a Fish and Wildlife Restoration Grant.
9. In some cities stream health is also assessed by fish and invertebrate surveys.
10. Ohio, White and Wabash rivers

11. Wabash River

12. Out of Michgian City and near Gary by Ball State University.

13. City of Elkhart-Elkhart & St. Joseph counties

14. University of Louisville has been monitoring the Northern Cavefish at irregular intervals and locations in southern Indiana since 1994

15. Ball State University fish sampling

16. While collecting fish community samples to evaluate the community structure and ability of the stream to support a healthy fish community, these organizations may have collected Eastern Sand Darters: Soil and Water Conservation Districts within those Ecoregions, Purdue University, Wildcat Creek Watershed Alliance? I would check with the Scientific Collectors Permit office for a list of organizations collecting in those ecoregions and also check with the IDEM Section 319 webpage for project summaries where fish or habitat in those ecoregions were studied.

17. Elkhart Public Works and Utilities has a fisheries biologist on staff that actively collects fish community samples from the Great Lakes Basin (1-2 times in the summer). He may have data on the hornyhead chub as well.

18. US Environmental Protection Agency; USGS Water Resources Division; Ohio River Valley Water Sanitation Commission; Midwest Biodiversity Institute, US Army Corps of Engineers; Muncie Bureau of Water Quality; City of Elkhart Water Quality; various universities; various consulting firms

19. The Hoosier National Forest conducts yearly fish surveys within two or more 5th level HUCs that encompass the Hoosier National Forest, which includes the Ohio River Drainage, Eastern Corn Belt/Interior Plateau Ecoregions. These above fish surveys are not specific to the Orangethroat Darter, but would include the Orangethroat Darter.; The Hoosier National Forest conducts yearly fish surveys within two or more 5th level HUCs that encompass the Hoosier National Forest, which includes the Ohio River Drainage, Eastern Corn Belt/Interior Plateau Ecoregions. These above fish surveys are not specific to the Orangethroat Darter, but would include the Orangethroat Darter.

| | |
|---|---|
| **Total Respondents** | **19** |
| (skipped this question) | 23 |

**19.** Please list organizations that are monitoring ALL fish in ALL habitats in Indiana.

1. DNR/DFW

2. DNR/DFW

3. DNR/DFW

4. DNR/DFW

5. DNR/DFW

6. DNR/DFW

7. None known that are specifically targeting smallmouth bass.

8. None known that specifically target rock bass.

9. none known

10. Bass fishing clubs who hold tournaments on Lake Wawasee and Syracuse Lake.

11. Muncie Bureau of Water Quality

12. NA

13. Indiana DNR, Division of Fish and Wildlife. Illinois Natural History Survey, USFWS>

14. IDNR, IDEM, City of Elkhart and South Bend.

15. Electric utilities, Ball State University, Purdue University

16. DNR and IDEM

17. Indiana and Illinois DNR
Purdue University
Ball State University
Southern Illinois University
Cinergy

18. IDNR-Fish and Wildlife, Ball State University, University of Michigan through a coastal program grant. USFWS

19. IDNR-Fish and Wildlife.

20. City of Elkhart - Elkhart and St. Joseph counties

21. University of Louisville, Biology Department

22. See 17 & 18

23. IDEM monitors fish communities not particular species; however, the Slough darter has been captured by electrofishing in the Ohio River Drainage Habitat.

24. USDA Forest Service, Hoosier National Forest; USDI Fish and Wildlife Service; IDEM; IDNR; USDA Forest Service, Hoosier National Forest; USDI Fish and Wildlife Service; IDEM; IDNR

| | |
|---|---|
| **Total Respondents** | **24** |
| (skipped this question) | 18 |

**20.** What are the current monitoring techniques for ALL fish in ALL habitats in Indiana?

| | Not used but | Not used and not |
|---|---|---|

| | | | possible with existing technology and data | possible with existing technology and data | feasible | | |
|---|---|---|---|---|---|---|---|
| Radio telemetry and tracking | 0% (0) | 12% (4) | 53% (18) | 6% (2) | 12% (4) | 18% (6) | **34** |
| Modeling | 6% (2) | 17% (6) | 36% (13) | 8% (3) | 6% (2) | 28% (10) | **36** |
| Coverboard routes | 0% (0) | 0% (0) | 0% (0) | 0% (0) | 10% (2) | 90% (19) | **21** |
| Spot mapping | 5% (1) | 10% (2) | 29% (6) | 0% (0) | 5% (1) | 52% (11) | **21** |
| Driving a survey route | 0% (0) | 5% (1) | 0% (0) | 26% (5) | 21% (4) | 47% (9) | **19** |
| Reporting from harvest, depredation, or unintentional take (road kill, bycatch) | 17% (5) | 28% (8) | 10% (3) | 17% (5) | 10% (3) | 17% (5) | **29** |
| Mark and recapture | 22% (8) | 30% (11) | 24% (9) | 3% (1) | 8% (3) | 14% (5) | **37** |
| Professional survey/census | 57% (23) | 30% (12) | 5% (2) | 0% (0) | 0% (0) | 8% (3) | **40** |
| Volunteer survey/census | 0% (0) | 31% (8) | 19% (5) | 0% (0) | 4% (1) | 46% (12) | **26** |
| Trapping (by any technique) | 31% (9) | 14% (4) | 14% (4) | 3% (1) | 7% (2) | 31% (9) | **29** |
| Representative sites | 37% (13) | 37% (13) | 11% (4) | 0% (0) | 0% (0) | 14% (5) | **35** |
| Probabilistic sites | 16% (5) | 19% (6) | 29% (9) | 0% (0) | 0% (0) | 35% (11) | **31** |
| Other (please specify below) | 21% (3) | 7% (1) | 0% (0) | 0% (0) | 0% (0) | 71% (10) | **14** |
| | | | | | | **Total Respondents** | **372** |

**21.** Other monitoring techniques for ALL fish in ALL habitats in Indiana.

1. 1. Larval sampling to check for reporduction
2. Long term monitoring through gillnets, trawling has been conducted at 3 sites along the lake michigan lakefront since the mid 70's by Ball State University during the summer season. Creel census has been conducted by IDNR-Fish and Wildlife division for approximately 20 years. Commerical monitoring was conducted until the halt of the commercial fishing industry in 1996.

| | |
|---|---|
| 3. | Delury or Survey/Removal techniques have been used at Donaldson Cave in the 1990's |
| 4. | Unintentional take could be monitored from fish kill cadaver counts if the officers could be trained to identify norther hog suckers instead of not counting them or just lumping them into the generic class of "round bodied suckers" |
| 5. | Electro-fishing and seining are appropriate methods for monitoring the Orangethroat darter.;<br>Electro-fishing and seining are appropriate monitoring techniques for the Orangethroat Darter.;<br>Electro-fishing and seining are appropriate methods for monitoring the Orangethroat darter. |

**Total Respondents** **5**

(skipped this question) 36

**22.** What one or two monitoring techniques would you recommend for effective conservation of ALL fish in ALL habitats in Indiana?

| | |
|---|---|
| 1. | Electrofishing swift water habitats<br>Hoop nets |
| 2. | Electrofishing<br>Trap nets |
| 3. | Electrofishing catch rate data<br>Population estimates<br>Angler creel surveys |
| 4. | ELECTROFISHING CATCH RATES<br>POPULATION ESTIMATES |
| 5. | Electrofishing surveys<br>Trap netting surveys<br>Gill netting surveys<br>Angler creel surveys<br>Population estimates |
| 6. | (1) Stream fish community surveys - To determine smallmouth bass distribution and abundance. There may be a correlation of smallmouth abundance to the species richness to the overall fish community.<br>(2) Smallmouth bass population estimates. |
| 7. | Stream fish community surveys.<br>Rock bass population estimates. |
| 8. | (1) Reporting from harvest(angler creel surveys) - This survey will show angler exploitation.<br>(2) Professional survey (fish management surveys) - This survey will show size structure, relative abundance, and provide age and growth information. |
| 9. | Springtime dc electrofishing according to DFW standard protocol<br>Standard DFW creel survey procedures<br>Tournament monitoing by the DFW and bass clubs |

10. Occasional gill-netting to verify presence followed by intensive netting to confirm low levels or absence

11. electrofishing surveys

12. I would like to see all the lake trout stocked in Lake Michigan to be coded wire tagged. That will allow for better understanding of survival after stocking and movement of the fish. It will also allow for better understanding of spawning site fidelity.

13. Professional Fish Surveys and Creel Surveys

14. 1. Electrofishing river wide
2. Hoop-netting by scientists and commercial fishermen

15. Periodic electrofishing surveys and mark recapture techniques probably provide the best information about the pike populations.

16. Electrofishing, trap net, and gill nets surveys (intensive); monitoring of commercial catch (less intensive).

Quist, M.C., C.S. Guy, P.J. Braaten, C.L. Pierce, and V.H. Travnichek. 2002. Potential influence of harvest on shovelnose sturgeon populations in the Missouri River system. North American Journal of Fisheries Management 22:537-549.

17. Fall trawl sampling for young of the year production. Possible incorporation of hydracoustic models for the near shore area.

18. Rotational sampling at reference sites along the headwaters. Historical comparisons from the early 80's will be compared with the sampling that was completed 2001-2004.

19. Stream sampling using electrofishing techniques and seining. This should be done every 5 years to get a clear picture of changes that occur to habitat, water quality and invasive species introductions and distribution.

20. Radio telemetry or mark & recapture

21. fall/winter Ohio River tailwater sampling and ocassional stream surveys

22. periodic stream surveys

23. Large fyke-nets are used in Lake Webster (Kosicusko Co.) to collected brood stock for muskellunge. These nets would be useful in capturing northern pike as well. This would allow bioligist to capture enough fish to get a represetative sample of adult fish. There is still no effective method of sampling young esocids without mortality.

24. transect electrofishing sampling, hoop nets where feasible

25. Development of an index of biotic integrity (IBI) for vertebrate cave communities in southern Indiana.
Selection of 5-10 locations for survey/counts every2-5 years. A similar survey schedule has been established for cavefish populations in Mammoth Cave National Park and could be used as a model (both IBI and survey).

| | |
|---|---|
| 26. | See where populations of the darter have been captured in the past and then with sienes or electrofishing equipment mark and recapture the darter to document habitat characteristics, water quality information, and land use characterization where the darters occur. You will need to target the habitat and not the exact location since the sandbars will probably shift over time. Look on the web for mark and recapture surveys as well as other eastern sand darter publications. I found many by just searching the web for Eastern Sand Darter. |
| 27. | IDEM, IDNR, and Elkhart use electrofishing equipment to sample fish communities; however, a seine could probably be used as well as tagging and radio telemetry to track the species movement. |
| 28. | Representative sites or look for sites where the habitat is suitable for the least darter and seine in the vegetation over rocky substrate. |
| 29. | seining or kick net<br>electrofishing |
| 30. | electrofishing results from probabilistic and representative sites |
| 31. | Seining or electrofishing representative sites using professionals. |
| 32. | Target the habitat with seining equipment or electrofishing. |
| 33. | Seining at representative sites |
| 34. | Electro-fishing streams..take a random sampling of streams within a watershed (5th or 6th level HUC)and standardize the stream reach length for the survey...usually 15 times the stream width. Seining is also an appropriate method for sampling, especially in the riffle habitats.; Electro-fishing can be used to sample stream habitats. I suggest designing a random sample of all streams within a watershed (5th or 6th level HUC). The size of the stream reach sampled would be 15 times the stream width. Seining would also be an appropriate method for sampling.; Electro-fishing streams..take a random sampling of streams within a watershed (5th or 6th level HUC)and standardize the stream reach length for the survey...usually 15 times the stream width. Seining is also an appropriate method for sampling, especially in the riffle habitats. |

| | |
|---|---|
| **Total Respondents** | **34** |
| (skipped this question) | 7 |

**23.** What current HABITAT inventory and assessment efforts or activities by state agencies are you aware of for ALL fish in ALL habitats in Indiana?

| | Yes, these efforts occur | No effort that I'm aware of | Response Total |
|---|---|---|---|
| Statewide annual inventory and assessment conducted by state agencies | 3% (1) | 97% (38) | **39** |
| Statewide once a year inventory and assessment conducted by state agencies | 3% (1) | 97% (38) | **39** |
| Periodic statewide (less than once a year but still regularly scheduled) inventory and assessment conducted by state agencies | 8% (3) | 92% (36) | **39** |

| | | | |
|---|---|---|---|
| Occasional statewide (less than once a year and not regularly scheduled) inventory and assessment conducted by state agencies | 15% (6) | 85% (33) | **39** |
| Regional or local year-round inventory and assessment conducted by state agencies | 3% (1) | 97% (38) | **39** |
| Regional or local once a year inventory and assessment conducted by state agencies | 15% (6) | 85% (33) | **39** |
| Periodic regional or local (less than once a year but still regularly scheduled) inventory and assessment conducted by state agencies | 48% (19) | 52% (21) | **40** |
| Occasional regional or local (less than once a year and not regularly scheduled) inventory and assessment conducted by state agencies | 49% (19) | 51% (20) | **39** |
| | | **Total Respondents** | **313** |

**24.** What current HABITAT inventory and assessment efforts or activities by other organizations are you aware of for ALL fish in ALL habitats in Indiana?

| | **Yes, these efforts occur** | **No effort that I'm aware of** | **Response Total** |
|---|---|---|---|
| Statewide year-round inventory and assessment conducted by other organizations | 0% (0) | 100% (38) | **38** |
| Statewide once a year inventory and assessment conducted by other organizations | 3% (1) | 97% (37) | **38** |
| Periodic statewide (less than once a year but still regularly scheduled) inventory and assessment conducted by other organizations | 5% (2) | 95% (36) | **38** |
| Occasional statewide (less than once a year and not regularly scheduled) inventory and assessment conducted by other organizations | 5% (2) | 95% (36) | **38** |
| Regional or local year-round inventory and assessment conducted by other organizations | 8% (3) | 92% (35) | **38** |
| Regional or local once a year inventory and assessment conducted by other organizations | 18% (7) | 82% (31) | **38** |
| Periodic regional or local (less than once a year but still regularly scheduled) inventory and assessment conducted by other organizations | 24% (9) | 76% (29) | **38** |
| Occasional regional or local (less than once a year and not regularly scheduled) inventory and assessment conducted by other organizations | 30% (12) | 70% (28) | **40** |
| | | **Total Respondents** | **306** |

**25.** How crucial are these HABITAT efforts by state agencies for the conservation of ALL fish in ALL habitats in Indiana?

| | These efforts are very crucial for this HABITAT | These efforts are somewhat crucial for this HABITAT | These efforts are slightly crucial for this HABITAT | These efforts are not crucial for this HABITAT | Unknown | Response Total |
|---|---|---|---|---|---|---|
| Statewide annual inventory and assessment conducted by state agencies | 3% (1) | 5% (2) | 3% (1) | 47% (18) | 42% (16) | **38** |
| Statewide once a year inventory and assessment conducted by state agencies | 5% (2) | 0% (0) | 8% (3) | 45% (17) | 42% (16) | **38** |
| Periodic statewide (less than once a year but still regularly scheduled) inventory and assessment conducted by state agencies | 5% (2) | 11% (4) | 5% (2) | 39% (15) | 39% (15) | **38** |
| Occasional statewide (less than once a year and not regularly scheduled) inventory and assessment conducted by state agencies | 5% (2) | 13% (5) | 5% (2) | 37% (14) | 39% (15) | **38** |
| Regional or local year-round inventory and assessment conducted by state agencies | 0% (0) | 5% (2) | 13% (5) | 45% (17) | 37% (14) | **38** |
| Regional or local once a year inventory and assessment conducted by state agencies | 3% (1) | 8% (3) | 28% (11) | 31% (12) | 31% (12) | **39** |
| Periodic regional or local (less than once a year but still regularly scheduled) inventory and assessment conducted by state agencies | 16% (6) | 37% (14) | 11% (4) | 13% (5) | 24% (9) | **38** |
| Occasional regional or local (less than once a year and not regularly scheduled) inventory and assessment conducted by state agencies | 18% (7) | 18% (7) | 13% (5) | 21% (8) | 29% (11) | **38** |
| | | | | **Total Respondents** | | **305** |

**26.** How crucial are these HABITAT efforts by other organizations for the conservation of ALL fish in ALL habitats in Indiana?

| | These efforts are very crucial | These efforts are somewhat crucial for | These efforts are slightly | These efforts are not crucial | Unknown | Response Total |
|---|---|---|---|---|---|---|

| | for this HABITAT | this HABITAT | crucial for this HABITAT | for this HABITAT | | |
|---|---|---|---|---|---|---|
| Statewide year-round inventory and assessment conducted by other organizations | 0% (0) | 3% (1) | 5% (2) | 39% (15) | 53% (20) | **38** |
| Statewide once a year inventory and assessment conducted by other organizations | 3% (1) | 0% (0) | 5% (2) | 37% (14) | 55% (21) | **38** |
| Periodic statewide (less than once a year but still regularly scheduled) inventory and assessment conducted by other organizations | 3% (1) | 3% (1) | 11% (4) | 32% (12) | 53% (20) | **38** |
| Occasional statewide (less than once a year and not regularly scheduled) inventory and assessment conducted by other organizations | 3% (1) | 0% (0) | 11% (4) | 34% (13) | 53% (20) | **38** |
| Regional or local year-round inventory and assessment conducted by other organizations | 0% (0) | 8% (3) | 8% (3) | 34% (13) | 50% (19) | **38** |
| Regional or local once a year inventory and assessment conducted by other organizations | 3% (1) | 5% (2) | 13% (5) | 29% (11) | 50% (19) | **38** |
| Periodic regional or local (less than once a year but still regularly scheduled) inventory and assessment conducted by other organizations | 11% (4) | 8% (3) | 18% (7) | 18% (7) | 45% (17) | **38** |
| Occasional regional or local (less than once a year and not regularly scheduled) inventory and assessment conducted by other organizations | 5% (2) | 8% (3) | 15% (6) | 26% (10) | 46% (18) | **39** |
| | | | | | **Total Respondents** | **305** |

**27.** Regional or local state agency HABITAT inventory and assessment for ALL fish in ALL habitats in Indiana.

1. West Fork White River
   East Fork White River
   Wabash River
2. None
3. Blue River (Harrison County)
   Sugar Creek (Shelby County)
   Indian Creek (Greene County)
4. Blue River (Harrison County)

5. BLUE RIVER (HARRISON COUNTY)

6. none

7. Indiana Dept of Natural Resources - Divison of Fish and Wildlife
Indiana Departement of Environmental Management

8. Indiana Department of Natural Resources - Divison of Fish and Widlife
Indiana Department of Environmental Management

9. None known to occur.

10. Not aware of any

11. IDEM - statewide QHEI
IDNR F&W - regional QHEI

12. NE IN, DFW, Jed Pearson.

13. not familiar with habitat assessments that occur on impoundments

14. Habitat mapping and shoreline aerial imagery.

15. In all major tributaries of Lake Michigan

16. Unknown

17. Habitat evaluations are conducted as part of general stream surveys by DNR biologists. Such surveys have been conducted on the Iroquois River, the Yellow River, and the Kankakee River.

18. Lake Michigan proper along the shoreline in nearshore area less than 30 feet in depth.

19. Trail Creek, East Branch of Little Calumet river, Reynolds Creek, Salt Creek, West Branch of Little Calument River, Deep River.

20. IDEM ecoregion surveys

21. Recently the IDNR has began sampling/mapping emergent plant species in some Indiana natural lakes. These plants may be used as reproductive habiatat for northern pike.

22. I don't know of any Habitat Inventory or Assessment done specifically for the Eastern Sand Darter in the habitat you list; however, I do know that IDEM as well as IDNR and other organizations use the Qualitative Habitat Evaluation Index to document the habitat quality of the streams sampled for aquatic communities.

23. Like I mentioned in my survey for the Eastern Sand Darter, IDEM, IDNR, and Elkhart use the QHEI (Qualitative Habitat Evaluation Index) to assess habitat in streams.

24. As I stated in previous surveys, the QHEI would provide a habitat assessment for sites where least darters were collected.

25. IDEM conducts a habitat assessment while sampling stream for fish community assessments using the QHEI (Qualitative Habitat Evaluation Index)

the QHEI (Qualitative Habitat Evaluation Index).

26. IDEM/OWQ/BSS; IDNR/FWD/FS; ORSANCO;

| | |
|---|---|
| **Total Respondents** | **26** |
| (skipped this question) | 17 |

**28.** Regional or local HABITAT inventory and assessment by other organizations for ALL fish in ALL habitats in Indiana.

1. West Fork White River
East Fork White River
Wabash River
2. none
3. NONE
4. none
5. None known.
6. none known
7. none known
8. Not aware of any
9. Muncie BWQ - WFWR and and tributaries in the Muncie area
10. St. Joseph River
11. Unknown
12. Lake Michigan proper along the shoreline in nearshore area less than 30 feet in depth.
13. City of Elkhart
14. USACOE Ohio River
15. USACOE Ohio River
16. Hoosier National Forest
Harrison/Crawford State Forest
Spring Mill State Park
Caves of south/central Indiana
17. Muncie; Elkhart; USGS/WRD

| | | |
|---|---|---|
| 18. | Two or more 5th level HUC watersheds a year that encompass the Hoosier National Forest are sampled; a random sampling of streams found within these 5th level HUCs occurs. | |
| | **Total Respondents** | **18** |
| | (skipped this question) | 25 |

**29.** Please list organizations that are monitoring this HABITAT for ALL fish in ALL habitats in Indiana.

1. DNR/DFW
2. None that I am aware of
3. DNR/DFW
4. DNR/DFW
5. DNR/DFW
6. none
7. None known.
8. none known
9. none known
10. Not aware of any
11. Indiana DNR- FIsh and Wildlife division. USFWS/GLFC
12. IDNR, IDEM, City of Elkhart and South Bend
13. Unknown
14. DNR division of Fish and Wildlife
15. IDNR, USFSW, Ball State, University of Michigan
16. IDNR-Fish and Wildlife, Lake Michigan Fisheries Office
17. IDNR-Fish and Wildlife, USFWS
18. USACOE Ohio River
19. USACOE Ohio River
20. U.S. Forest Service
    Indiana DNR
    University of Louisville

University of Louisville

21. IDEM makes assessments of the habitat while doing fish community surveys in the Ohio River Drainage Habitat.

22. IDEM- Qualitative Habitat Evaluations completed at sites where southern redbelly dace may have been captured as part of the fish community sampling program.

23. IDEM performs habitat assessments in this area

24. IDEM, IDNR, USDA Forest Service, USDI Fish and Wildlife Service

| | |
|---|---|
| **Total Respondents** | **24** |
| (skipped this question) | 19 |

**30.** What are the current HABITAT inventory and/or assessment techniques for ALL fish in ALL habitats in Indiana?

| | Frequently used | Occasionally used | Not used but possible with existing technology and data | Not used and not possible with existing technology and data | Not economically feasible | Unknown | Response Total |
|---|---|---|---|---|---|---|---|
| GIS mapping | 9% (3) | 26% (9) | 37% (13) | 0% (0) | 0% (0) | 29% (10) | **35** |
| Aerial photography and analysis | 3% (1) | 24% (8) | 18% (6) | 3% (1) | 0% (0) | 52% (17) | **33** |
| Systematic sampling | 26% (8) | 29% (9) | 16% (5) | 0% (0) | 0% (0) | 29% (9) | **31** |
| Property tax estimates | 0% (0) | 0% (0) | 0% (0) | 24% (6) | 12% (3) | 64% (16) | **25** |
| State revenue data | 0% (0) | 0% (0) | 0% (0) | 24% (6) | 12% (3) | 64% (16) | **25** |
| Regulatory information | 0% (0) | 15% (4) | 0% (0) | 11% (3) | 11% (3) | 63% (17) | **27** |
| Participation in landuse programs | 0% (0) | 11% (3) | 15% (4) | 4% (1) | 11% (3) | 59% (16) | **27** |
| Modeling | 3% (1) | 26% (8) | 19% (6) | 0% (0) | 6% (2) | 45% (14) | **31** |
| Voluntary landowner reporting | 0% (0) | 4% (1) | 8% (2) | 4% (1) | 12% (3) | 72% (18) | **25** |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Other (please specify below) | 13% (2) | 13% (2) | 0% (0) | 0% (0) | 0% (0) | 73% (11) | **15** |
| | | | | | | **Total Respondents** | **274** |

**31.** Other HABITAT inventory and assessment techniques for ALL fish in ALL habitats in Indiana.

1. QHEI
2. QHEI
3. QHEI
4. QHEI
5. none
6. QHEI
7. Bottom mapping of habitat.
8. IBI, and QHEI for representative sites.
9. Qualitative Habitat Evaluation Index(QHEI); REMAP protocols for Northern Forested Streams; stream channel cross-sections and longitudinal profiles; substrate analysis; descriptions of riparian vegetation; water quality parameters are measured using probes and Hydro-labs

| | |
|---|---|
| **Total Respondents** | **9** |
| (skipped this question) | 34 |

**32.** What one or two HABITAT inventory and assessment techniques would you recommend for effective conservation of ALL fish in ALL habitats in Indiana?

1. QHEI
2. QHEI
   GIS
3. QHEI
   GIS
4. QHEI
5. Qualitative Habitat Evaluation Index (QHEI) in conjunction with a stream community survey or sampling specifically for smallmouth bass. This can show which habitat components most strongly correlate with smallmouth bass abundance and or size structure.

6. Qualitative Habitat Evaluation Index (QHEI) in conjunction with at stream fish community survey or sampling specifically for rock bass. This can show which habitat components most strongly correlate with rock bass abundance and/or size structure.

7. Systematic sampling would probably be best to determine the abundance of cover that is available, but could be very difficult as most of the habitat is hidden under the surface of the water.

8. Unknown

9. I'm not very familiar with the habitat sampling outside of QHEI. Any assessment of this habitat though should look at both riparian and instream habitat.

10. Digital satellite imagery to conduct bottom contour mapping in nearshore spawning areas.

11. Assessment using the Qualitative Habitat Evaluation Index.

12. 1. Recording GIS information
2. Record habitat when the fish species is collected during a survey.

13. Systematic sampling of the habitat along the length of the stream to provide baseline data for comparison across time.

GIS mapping of restored, fully connected wetland to provide an inventory of available spawning habitat.

14. Systematic Sampling
Telemetry Surveys

15. Lidar mapping would help identify spawning areas within the nearshore zone along Indiana's coastline.

16. Sampling using electrofishing and seining in headwater areas. Completing IBI and QHEI and water quality analysis for these sites.

17. Sampling.

18. GIS mapping and aerial photography

19. GIS mapping and aerial photography and analysis

20. GIS mapping and aerial photography and analysis

21. 1. Emergent bulrush and wetland monitoring and protection via ecozones
2. Evaluate land and water use practices to reduce in lake and upstream degradation of vegetation and shoreline.

22. Population surveys every five years and development of an IBI to be applied at 5-10 critical locations. These to include Blue Spring Caverns, Spring Mill State Park, and Harrison/Crawford State Forest.

23. more habitat inventories and assessments

Two protocols that I recommend for reference include the following:

1. Harrelson, C.C., C.L. Rawlins, and J.P. Potyondy. 1994. Stream Channel Reference Sites: An Illustrated Guide to Field Technique. USDA Forest Service. General Technical Report RM-245. The above reference offers useful guidance on measuring stream channel cross-sections and substrate within the stream. This information can be used to determine if a stream channel is stable and if the substrate is available within riffle habitats, which are the preferred habitat of the Orangethroat Darter.

2. Simon, T. P. and P.M. Stewart. 1998. Standard Operating Procedures For Development of Watershed Indicators In REMAP: Northern Lakes and Forest Streams.

The above reference is very useful for developing a watershed level sampling design and includes useful methods for measuring stream channel and stream habitat parameters.

3. The Qualitative Habitat Evaluation Index (QHEI) developed by the Ohio EPA is a useful qualitative field method that can be used to prioritize sites within a watershed for stream habitat or water quality improvement.

| | |
|---|---|
| **Total Respondents** | **24** |
| (skipped this question) | 19 |

**33.** What is the current body of science for ALL fish in ALL habitats in Indiana?

| | Response Total | Response Percent |
|---|---|---|
| Complete, up to date and extensive | **0** | **0%** |
| Adequate | **15** | **38%** |
| Inadequate | **19** | **49%** |
| Nonexistent | **3** | **8%** |
| Other (please explain below) | **2** | **5%** |

1. Under development. Survey completed but data not processed yet.
2. Unknown in the larger scale

| | |
|---|---|
| | **39** |
| **Total Respondents** | |
| (skipped this question) | 4 |

**34.** Please provide a citation (title, author, date, publisher) that would give the best overview of ALL fish in ALL habitats in Indiana, if available. This resource may be used if further detail is needed.

| Response Total | Response Percent |
|---|---|

Title = A survey of fish communities and aquatic habitats at Indiana's major steams with emphasis on smallmouth bass distribution and abundance;
Author = Stuart T. Shipman;
Date = 12/1997;
Publisher = DNR fisheries section

Title = Many in AFS journal of fish management and transactions of AFS

Title = Impoundments Strategic Plan;
Author = IDNR - Fish and Wildlife;
Date = 1997;
Publisher = IDNR - Fish and Wildlife

Title = DFW largemouth bass database;
Author = Jed Pearson;
Date = unpublished;
Publisher = unpublished

Title = Cisco population status and management in Indiana;
Author = Jed Pearson;
Date = 2001;
Publisher = Division of Fish and Wildlife

Title = The Fishes of Missouri;
Author = William L. Plieger;
Date = 1997;
Publisher = Missouri Conservation Commission

Title = Lake Trout Restoration Plan;
Date = In progress

Title = Fishery, Habitat, and Recreational Use Surveys for the Kankakee River;
Author = Price and Robertson;
Date = 2005;
Publisher = DNR - Division of Fish and Wildlife (in review)

Title = Preliminary Results of 2004 Ball State University Yellow Perch Research in Indiana Waters of Lake Michigan;
Author = Paul Allen and Thomas Lauer;
Date = Cctober 2004;
Publisher = Ball State University

Title = Fisheries Survey of the East Branch of the Little Calumet River Watershed;
Author = Neil Ledet;
Date = 1978;
Publisher = IDNR Fisheries Section

Title = Wabash River Catfish Reports;
Author = Rob Columbo;
Date = 2002,2003,2004,2005;
Publisher = SIU/INDFW

Title = annual Ohio River sauger reports;
Author = ORFMT;
Date = annually since 1999;
Publisher = ORFMT

Title = Northern Pike Spawning Habitat Investigations At Two Narural Lake In Indiana;
Author = Cwalinski, Tim A.;
Date = September 2001;
Publisher = Indiana Department of Natural Resources

Title = Distribution and status of the northern cavefish;
Author = Pearson, W. D. and C. Boston;
Date = 1995;
Publisher = Final report to IN Department of Nat. Res.Div. of F&W

Title = Handbook of freshwater fishery biology;
Author = Kenneth D. Carlander;
Date = 1997;
Publisher = Iowa University Press

Title = Fishes of Ohio;
Author = Milt Troutman;
Publisher = OSU Press

**35.** If possible, please provide a second citation (title, author, date, publisher) that would give another good overview of ALL fish in ALL habitats in Indiana. This resource may also be used if further detail is needed.

Title = Surveys of the fish communties and aquatic habitats in 16 small streams in Indiana from 1996 through 1997.;
Author = Douglas C. Keller;
Date = 1999;
Publisher = IDNR

Title = Largemouth bass size limits at Indiana natural lakes - a 30-year history;
Author = Jed Pearson;
Date = 2003;
Publisher = unpublished

Title = Lake Trout Impediments Docuement;
Author = Numerous,;
Date = 2003;
Publisher = Lake Trout Task group/LMTC

Title = A fishery survey of the Kankakee River in Indiana;
Author = Robertson and Ledet;
Date = 1981;
Publisher = DNR - Division of Fish and Wildlife

Title = Yellow Perch Research and Management in Lake Michgian, Evaluating Progress in a Cooperative Effort, 1997-2001;
Author = David Clapp and John Dettmers;
Date = November 2004;
Publisher = American Fisheries Society, Fisheries

Title = Stream Survey of the East Arm of the Little Calumet River;

Author = Edward Braun;
Date = 1974;
Publisher = IDNR Division of Fish and Wildlife

Title = numerous INDFW FMR's;
Author = numerous;
Date = numerous;
Publisher = INDFW

Title = Age, growth and fin erosion of the northern cavefish, Amblyopsis spelaea, in KY and IN;
Author = Louis, M.;
Date = 1999;
Publisher = Unpubl. M.S. Thesis, University of Louisville

Title = fishes of Tennessee;
Author = Etnire and Starnes

Title = FW fishes of Canada;
Author = Scott & Crossman

**36.** What is the current HABITAT body of science for ALL fish in ALL habitats in Indiana?

| | Response Total | Response Percent |
|---|---|---|
| Complete, up to date and extensive | 0 | 0% |
| Adequate | 5 | 13% |
| Inadequate | 24 | 62% |
| Nonexistent | 8 | 21% |
| Other (please explain below) 1. Under development. Survey completed but data not processed yet. | 2 | 5% |
| 2. Unknown in the larger scale | | |
| **Total Respondents** | **39** | |
| (skipped this question) | 4 | |

**37.** Please provide a citation (title, author, date, publisher) that would give the best HABITAT overview of ALL fish in ALL habitats in Indiana, if available. This resource may be used if further detail is needed.

Title = A survey of fish communities and aquatic habitats at Indiana's major streams with emphasis on smallmouth bass distribution and abundance;
Author = Stuart Shipman;
Date = 12/1997;
Publisher = DNR/Fisheries section

Title = Cisco population status and management in Indiana;
Author = Jed Pearson;
Date = 2001;
Publisher = Division of Fish and Wildlife

Title = Fishery, Habitat, and Recreational Use Surveys for the Kankakee River;
Author = Price and Robertson;
Date = 2005;
Publisher = DNR - Div. of F & W

Title = Fisheries Survey of the East Branch of the Little Calumet River Watershed;
Author = Neil Ledet;
Date = 1978;
Publisher = IDNR-Fish and Wildlife

Title = Ohio River Mainstem Study;
Author = USACOE;
Date = 2000?;
Publisher = USACOE

Title = Cave adaptation in Amblyopsid  fishes;
Author = Poulson, T.;
Date = 1963;
Publisher = Amer. Midl. Nat. 70(2):257-290

**38.** If possible, please provide a second citation (title, author, date, publisher) that would give another good HABITAT overview of ALL fish in ALL habitats in Indiana. This resource may also be used if further detail is needed.

Title = Surveys of the fish communities and aquatic habitats in 16 small streams in Indiana from 1996 through 1997.;
Author = Douglas C. Keller;
Date = 1999;
Publisher = IDNR

Title = A Fishery survey of the Kankakee River in Indiana;
Author = Robertson and Ledet;
Date = 1981;
Publisher = DNR - Div. of F & W

Title = Stream Survey-Little Calument River East Arm;
Author = Edward Braun;
Date = 1974;
Publisher = IDNR-Fish and Wildlife

Title = A faunal inventory of subterranean streams using a modified index of biotic integrity;
Author = Jones, T.G.;
Date = 1997;
Publisher = Unpubl. Ph.D. Disst. University of Louisville

**39.** What are the research needs for ALL fish in ALL habitats in Indiana?

| | Urgently needed | Greatly needed | Needed | Slightly needed | Not needed | Unknown | Response Total |
|---|---|---|---|---|---|---|---|
| Life cycle | 5% (2) | 2% (1) | 40% (16) | 25% (10) | 28% (11) | 0% (0) | **40** |
| Distribution and abundance | 3% (1) | 26% (10) | 38% (15) | 21% (8) | 13% (5) | 0% (0) | **39** |
| Limiting factors (food, shelter, water, breeding sites) | 15% (6) | 30% (12) | 32% (13) | 12% (5) | 10% (4) | 0% (0) | **40** |
| Threats (predators/competition, contamination) | 15% (6) | 30% (12) | 22% (9) | 18% (7) | 15% (6) | 0% (0) | **40** |
| Relationship/dependence on specific habitats | 15% (6) | 25% (10) | 35% (14) | 10% (4) | 15% (6) | 0% (0) | **40** |
| Population health (genetic and physical) | 2% (1) | 8% (3) | 22% (9) | 48% (19) | 20% (8) | 0% (0) | **40** |
| Other (please specify below) | 10% (1) | 10% (1) | 0% (0) | 0% (0) | 20% (2) | 60% (6) | **10** |
| | | | | | **Total Respondents** | | **249** |

**40.** Other research needs for ALL fish in ALL habitats in Indiana.

1. How to produce more, larger crappie
2. Limiting factors and impacts of competition and predation

| | |
|---|---|
| 3. | Continued research on movement and survival as part of the rehabilitation strategy. |
| 4. | Determine population limiting factors in the Ohio River. |
| 5. | Population Persistence<br>Impact of Commercial Harvest |
| 6. | 1. Metapopulation dynamics<br>2. Extent of populations in subterranean systems which annot be entered by humans |

**Total Respondents** **6**

(skipped this question) 37

## 41. What are the HABITAT research needs for ALL fish in ALL habitats in Indiana?

| | Urgently needed | Greatly needed | Needed | Slightly needed | Not needed | Unknown | Response Total |
|---|---|---|---|---|---|---|---|
| Successional changes | 0% (0) | 8% (3) | 15% (6) | 18% (7) | 38% (15) | 21% (8) | **39** |
| Distribution and abundance (fragmentation) | 8% (3) | 18% (7) | 31% (12) | 21% (8) | 18% (7) | 5% (2) | **39** |
| Threats (land use change/competition, contamination/global warming) | 23% (9) | 23% (9) | 26% (10) | 21% (8) | 5% (2) | 3% (1) | **39** |
| Relationship/dependence on specific site conditions | 18% (7) | 28% (11) | 18% (7) | 18% (7) | 13% (5) | 5% (2) | **39** |
| Growth and development of individual components of the habitat | 19% (7) | 8% (3) | 27% (10) | 16% (6) | 16% (6) | 14% (5) | **37** |
| Other (please specify below) | 6% (1) | 6% (1) | 6% (1) | 6% (1) | 12% (2) | 65% (11) | **17** |
| | | | | | | **Total Respondents** | **210** |

## 42. Other HABITAT research needs for ALL fish in ALL habitats in Indiana.

| | |
|---|---|
| 1. | Water quality variations and impacts of land us and shoreline alterations |
| 2. | Water quality requirements. |
| 3. | 1. Assessment of the physical dimensions of the phreatic environment available to cavefishes, and the connections between known windows into the system.<br>2. Toxin concentrations in cave sediments and their recruitment rates into undergroud waters. |
| 4. | Effects of roads and stream crossings on the fish species; Is aquatic passage through culverts and other stream crossing structures adequate or are these crossings causing aquatic habitat |

other stream crossing structures adequate or are these crossings causing aquatic habitat fragmentation?

| | |
|---|---|
| **Total Respondents** | **4** |
| (skipped this question) | 39 |

**43.** How well do the following conservation efforts address the threats to ALL fish in ALL habitats in Indiana?

| | Very well | Somewhat | Not at all | Not used | Unknown | Response Total |
|---|---|---|---|---|---|---|
| Habitat protection (use below for details) | 21% (7) | 62% (21) | 3% (1) | 9% (3) | 6% (2) | **34** |
| Population management (hunting, trapping) | 18% (6) | 32% (11) | 3% (1) | 44% (15) | 3% (1) | **34** |
| Population enhancement (captive breeding and release) | 0% (0) | 15% (5) | 3% (1) | 82% (28) | 0% (0) | **34** |
| Reintroduction (restoration) | 12% (4) | 24% (8) | 6% (2) | 59% (20) | 0% (0) | **34** |
| Food plots | 0% (0) | 0% (0) | 3% (1) | 97% (32) | 0% (0) | **33** |
| Threats reduction | 6% (2) | 21% (7) | 6% (2) | 62% (21) | 6% (2) | **34** |
| Native predator control | 0% (0) | 0% (0) | 6% (2) | 94% (32) | 0% (0) | **34** |
| Exotic/invasive species control | 0% (0) | 15% (5) | 21% (7) | 38% (13) | 26% (9) | **34** |
| Regulation of collecting | 9% (3) | 44% (15) | 15% (5) | 29% (10) | 3% (1) | **34** |
| Disease/parasite management | 0% (0) | 12% (4) | 0% (0) | 65% (22) | 24% (8) | **34** |
| Translocation to new geographic range | 6% (2) | 15% (5) | 3% (1) | 68% (23) | 9% (3) | **34** |
| Protection of migration routes | 0% (0) | 6% (2) | 3% (1) | 74% (25) | 18% (6) | **34** |
| Limiting contact with pollutants/contaminants | 17% (6) | 46% (16) | 6% (2) | 31% (11) | 0% (0) | **35** |
| Public education to reduce human disturbance | 3% (1) | 32% (11) | 9% (3) | 44% (15) | 12% (4) | **34** |
| Culling/selective removal | 0% (0) | 18% (6) | 3% (1) | 71% (24) | 9% (3) | **34** |
| Stocking | 12% (4) | 18% (6) | 6% (2) | 62% (21) | 3% (1) | **34** |
| Other (please specify below) | 0% (0) | 0% (0) | 0% (0) | 8% (1) | 92% (11) | **12** |
| | | | | | **Total Respondents** | **556** |

**44.** Other current conservation practices for ALL fish in ALL habitats in Indiana.

1. Regulation of sport harvest. Closure of commercial fishery to allow spawning stock biomass to increase, thus allowing for the production of offspring that can eventually add to the spawning stock biomass.

2. Habitat protection if it greatly reduced the turbidity in streams for hornyhead chub feeding and breeding behaviors. Also, exotic/invasive species control would help the hornyhead population. The hornyhead chub is sensitive to pollution so limiting contact with pollutants/contaminants would benefit the species. The hornyhead chub is also a popular bait fish, so regulation of collecting would be beneficial to the species.

3. Habitat protection occurs in the form of the Clean Water Act, National Forest Management Act and other state and federal regulations that protect aquatic habitat and aquatic species. These regulations may or may not be enough for the sake of Orangethroat Darter conservation.

| | |
|---|---|
| **Total Respondents** | **3** |
| (skipped this question) | 40 |

**45.** What one or two specific practices would you recommend for more effective conservation of ALL fish in ALL habitats in Indiana?

1. does not need conserving

2. Pollution control - from waste water treatment plants and confined feeding operations.
Habitat protection and enhancement.

3. Pollution control.
Habitat protection or enhancement.

4. Habitat protection - Actually, I mean habitat enhancement by adding more woody cover to the old impoundments where the former woody cover has decomposed.

5. Habitat management and harvest management

6. Habitat protection and education to reduce habitat disturbance

7. Rock bass appear to be doing very well with little to no intensive management in streams where there is ample instream cover and good water quality. Therefore, habitat protection and contaminant reduction would be my recommendations.

8. -Assure there is no stocking of predator fish in cisco lakes
-Greatly limit/mitigate any new development on cisco lakes, particularly addressing runoff from lawns and other water quality issues
-Work to get any farmlands adjacent to cisco lakes into no-till

9. continued stocking for rehabilitation efforts. Change of the genetic suite of strains to be stocked. Utilize at least one deepwater strain.

10. Habitat protection and Public Education

11. 1. Public education
2. Regulation of collecting

12. Restoring the connection between the streams and the wetlands that were formerly associated with them to allow pike access to spawning areas. Current water management regimes often rely on pumping to fill restored wetlands, thus, fish passage is still restricted.

13. Commercial Harvest Regulation
Habitat Protection

14. Completely eliminate commercial fishing. This appears to have reduced the spawning stock to a level that could not maintain a fishery.

15. Habitat protection through landuse regulation. Agricultural runoff protection through education and landuse planning.

16. Land use planning and education.

17. Protection of migration routes

18. habitat protection/restoration and pollution control

19. 1. Implementation of ecozones in undeveloped areas to conserve that vegetation present.
2. Implement a catch and release only regulation in lakes with low densities.

20. 1. Acqusition and protection of a reserve at Blue Spring Caverns

2. Limit public access to population concentrations already under agency control at Harrison/Crawford State Forest and Spring Mill State Park

21. I am not sure what you are asking in this question. The best way to conserve the eastern sand darter would be to reduce sedimentation covering the sand substrate which the darter needs to survive and reproduce. Current efforts to reduce sedimentation in streams is somewhat effective, but I'm not sure if it is enough to keep the eastern sand darter from disappearing.

22. Habitat protection - erosion controls
Exotic species - possession of exotic species illegal (must dispose of fish properly and not release back to stream)

23. Habitat protection and the possible reintroduction of the least darter into suitable habitats that have been restored.

24. Habitat protection

25. declare moratorium on channel/drainage "improvement" projects that do not mitigate losses;

26. Habitat protection
Threats Reduction

27. Habitat protection

28. Habitat protection and threats reduction

29. 1.Restoration of stream channels..restoring or protecting stream channel function so that riffle habitats are enhanced or protected.
2.Restoration or enhancement of riparian vegetation to enhance or protect stream channels from runoff or impacts to the channel.
3. Maintenance of roads and stream crossings so that stream channel function and aquatic passage are maintained.

| | |
|---|---|
| **Total Respondents** | **29** |
| (skipped this question) | 14 |

**46.** How well do the following conservation efforts address the HABITAT threats to ALL fish in ALL habitats in Indiana?

| | Very well | Somewhat | Not at all | Not used | Unknown | Response Total |
|---|---|---|---|---|---|---|
| Habitat protection through regulation | 12% (4) | 62% (21) | 12% (4) | 6% (2) | 9% (3) | **34** |
| Habitat protection on public lands | 9% (3) | 62% (21) | 6% (2) | 21% (7) | 3% (1) | **34** |
| Habitat protection incentives (financial) | 18% (6) | 35% (12) | 12% (4) | 24% (8) | 12% (4) | **34** |
| Habitat restoration through regulation | 12% (4) | 33% (11) | 6% (2) | 30% (10) | 18% (6) | **33** |
| Habitat restoration on public lands | 9% (3) | 50% (17) | 12% (4) | 24% (8) | 6% (2) | **34** |
| Habitat restoration incentives (financial) | 18% (6) | 32% (11) | 9% (3) | 29% (10) | 12% (4) | **34** |
| Artificial habitat creation (artificial reefs, nesting platforms) | 0% (0) | 26% (9) | 12% (4) | 50% (17) | 12% (4) | **34** |
| Selective use of functionally equivalent exotic species in place of extirpated natives | 0% (0) | 0% (0) | 9% (3) | 83% (29) | 9% (3) | **35** |
| Succession control (fire, mowing) | 0% (0) | 3% (1) | 9% (3) | 79% (26) | 9% (3) | **33** |
| Corridor development/protection | 15% (5) | 26% (9) | 6% (2) | 44% (15) | 9% (3) | **34** |
| Managing water regimes | 12% (4) | 35% (12) | 6% (2) | 32% (11) | 15% (5) | **34** |
| Pollution reduction | 34% (12) | 51% (18) | 3% (1) | 9% (3) | 3% (1) | **35** |
| Protection of adjacent buffer zone | 31% (11) | 49% (17) | 3% (1) | 11% (4) | 6% (2) | **35** |
| Restrict public access and disturbance | 3% (1) | 15% (5) | 26% (9) | 50% (17) | 6% (2) | **34** |
| Land use planning | 12% (4) | 68% (23) | 6% (2) | 12% (4) | 3% (1) | **34** |
| Technical assistance | 0% (0) | 41% (14) | 3% (1) | 32% (11) | 24% (8) | **34** |
| Cooperative land management agreements (conservation easements) | 18% (6) | 47% (16) | 6% (2) | 21% (7) | 9% (3) | **34** |
| Other (please specify below) | 0% (0) | 8% (1) | 0% (0) | 0% (0) | 92% (11) | **12** |

**Total Respondents** **591**

**47.** Other current HABITAT conservation practices for ALL fish in ALL habitats in Indiana.

1. Limiting disturbance through the construction(DOW) permit process.

2. 1. Closing and/or year around gating of caves with large populations of hibernating or reproducing bats will ensure normal trophic cascades for those systems.
2. Restricting recreational caving in some caves might reduce periodic disturbances, increases in turbidity, and remobilization of toxins in sediments.

3. Again, I don't know if these practices are working well in Indiana, but the best way to conserve the critical habitat for the eastern sand darter would be habitat protection on all lands through whatever means necessary, habitat restoration of the floodplain would also be critical to the amount of sedimentation reaching the stream bed, managing water regimes may also impact the settling of sediments in stream (thus dam removal may be appropriate), protection of adjacent buffer zone is key to stopping deleterious effects of erosion and sedimentation in the stream, land use planning and conservation easements would also keep the runoff to a minimum.

4. Habitat protection and restoration on all lands by any means necessary would benefit all fish species (except those that are exotic and more tolerant than others) not just the hornyhead chub. Pollution reduction, protection of adjacent buffer zone, land use planning, and conservation easements would all be beneficial practices to the Hornyhead chub.

5. I am not aware of any of the above for which I marked "not used."

**Total Respondents** **5**

(skipped this question) 38

**48.** What one or two specific HABITAT practices would you recommend for more effective conservation of ALL fish in ALL habitats in Indiana?

1. Buffer strips
Bank stabilization

2. Corridor protection

3. Protection of adjacent buffer zones (riparian corridor). More participation would likely occur with financial incentives.

4. Protection of adjacent buffer zones (riparian corridor).

5. (1) Improve land use practices in watershed will reduce sedimentation in impoundments and reduce nutrient inputs. Reducing nutrient inputs will allow a deeper thermocline which is important for crappie growth. Crappie growth suffers when water temperatures become too high.
(2) Habitat restoration in the form of woody debris.

6. Habitat protection and restoration through regulation.

7. Pollution reduction and land-use zoning

8. 1) buffer/riparian zone protection - leads to improved water quality and more instream cover
2) pollution reduction - improved water quality and fewer fish kills

9. in Army Corps of Engineers impoundments alterations in water level control would likely benefit crappie

10. Determine critical habitat then create same.

11. Protection and restoration of Buffer Zones

12. 1. Non-point source pollution reduction
2. 2. riparian conservation easements

13. Wetland restoration projects with connectivity to the stream or "corridor" development that allows passage to wetlands already restored. We need to move toward natural regulation of water levels instead of artificial means.

14. Habitat Protection (minimizing fragmentation)
Managing Water Regimes

15. Habitat creation, ie. artificial structures during lake construction projects

16. Protection of habitat through land use planning. Currently most of the headwaters areas run through agricultural areas and need to maintain riparian buffer strips.

17. restoration of riparian zones, riffle protection/restoration

18. 1. Implementation of ecozones in undeveloped areas to conserve that vegetation present.
2. Reduce inlet and upstream degradation. Increase awareness and cooperation of landowners to create better shoreline and tributary habitat.

19. 1. Establishment of reserve at Blue pring Cavern
2. Restricted entry to selected caves in the Harrison/Crawford State Forest
3. Obtaining conservation easements/agreements with selected cave owners in Orange, Washington, Lawrence, and Harrison Counties.

20. Habitat protection
Land use planning

21. Protection of adjacent buffer zone
Nonpoint Source Pollution reduction

22. Habitat protection through regulation
Protection of adjacent buffer zone

23. Habitat protection
Restrict disturbance to habitat (dredging, removal of debris)

24. Habitat protection

25. Habitat protection and Protection of adjacent buffer zone

| | | |
|---|---|---|
| 26. | Habitat restoration and protection | |
| 27. | 1.Streambank stabilization or stream restoration (reconstructing the channel to reconnect it to its natural floodplain elevation).<br>2. Culvert or stream crossing structure improvement (replace non-functioning culverts or other crossing structures and replace with ones that function and are at the right elevation/location within the stream's longitudinal profile).<br>3. Restoration of riparian vegetative communities through tree planting, etc. | |
| | **Total Respondents** | **27** |
| | (skipped this question) | 16 |

**49.** Do you have any additional comments or information on ALL fish in ALL habitats that you feel would be useful in the development of the Indiana Comprehensive Wildlife Strategy?

| | |
|---|---|
| 1. | no |
| 2. | no |
| 3. | no |
| 4. | no |
| 5. | The overall smallmouth bass population in this area is somewhat poor aside from the St. Joseph River. I believe this is mostly due to the lack of habitat and loss of buffer zones. Buffer zones are vital to the health of smallmouth bass populations. They supply and protect habitat that is vital to the survival of the smallmouth bass. |
| 6. | The blue sucker population is doing well in the Wabash River and parts of the White River. Reintroduction into additional waterbodies is a possible option, but research is needed to determine why the population is heaklthy in the Wabash/White and not other Great Rivers. |
| 7. | Need annual assessments of population abundance and trends, as well as commercial harvest of females for the roe fishery |
| 8. | Much research work has been done on the the yellow perch by Ball State University since the mid 1970's. This works serves as the framework for the management of the population in Indiana's waters of Lake Michigan. It is critical that funding for this project continue to maintain the dataset. It is the largest and longest dataset for yellow perch on all of Lake Michigan and has served as the foundation for many management decisions on sport and commerical harvest decisions. |
| 9. | It has been over 20 years since the surverys were conducted, prior to the 2001-2004 surverys. It is important that surveys be conducted every 5 years or so to document changes to water quality, habitat and riparian zone protection. |
| 10. | A map of all known sightings of cavefishes, and dye-traced and probable connections between these known locations should be produced. Such a compilation would be invaluable in assessing the potential impacts of proposed projects, spills, and other landscape events within the limited range of the northern cavefish in Indiana. |
| | I would definetly search the internet for more information on specific studies done on the Eastern Sand Darter; however, I could not find much on the habitat itself in the Eastern Corn Belt/Interior |

| | | |
|---|---|---|
| | Sand Darter; however, I could not find much on the habitat itself in the Eastern Corn Belt/Interior Plateau Ecoregions of the Ohio River Drainage. IDEM has a list of sites of where Eastern Sand Darters have been collected with water chemistry and habitat (QHEI) assessments if interested. | |
| 12. | IDEM has collected hornyhead chubs from the Elkhart River (Elkhart & Noble counties), St. Joseph River (Dekalb County), Cedar Creek (Allen Co.), Yellow Creek (Elkhart Co.), and Pigeon River (Lagrange Co.). If you would like the data, we can provide water chemistry, biological, and habitat data assessments. | |
| 13. | IDEM has captured least darters at the following locations: Ringeisen Ditch, Trib of Carpenter Cr, Keefe Ditch, Claude May Ditch, and Howe Ditch in Jasper County, Singleton Ditch in Lake Co., Weiss Ditch in Newton Co., and Minier Lateral in Benton Co. | |
| 14. | IDEM has collected tadpole madtoms on the following streams: West Creek and Singleton Ditch in Lake County, Dausman Ditch in Kosciusko Co., Bogus Run in Starke Co., and Slough Creek in Jasper Co. | |
| 15. | The length of this survey possibly destroys its usefulness as many/most experts will not have the time and or patience to do this for very many fish species; some may not even do it al all. | |
| 16. | IDEM has captured slough darters on the following streams: Turkey Cr (Clay Co.), Patoka R and N Fk Little Pigeon Cr (Dubois Co.), Patoka R and Yellow Cr as well as Smith Fk Pigeon Cr (Gibson Co.), Bruster Br and Flat Cr (Pike Co.), E Fk Crooked Cr (Spencer Co.), Busseron Cr (Sullivan Co.), and Lost Cr, Otter Cr, N Br Otter Cr in Vigo Co. | |
| 17. | IDEM has captured many southern redbelly dace in their random fish sampling program. Most of these specimens came from the Whitewater Basin in headwater streams <20 sq. miles with high gradient and high biological integrity. | |
| 18. | IDEM has collected spottail darters in Posey Co. on a trib of Black River and Hawthorne Creek. | |
| | **Total Respondents** | **18** |
| | (skipped this question) | 25 |