6. Please rank the following threats to the Wildlife in All subterranean systems Habitat in Indiana.

	Critical threat	Serious threat	Somewhat of a threat	Slight threat	No threat	Unknown	Response Total
Invasive/non-native species	0% (0)	14% (1)	0% (0)	29% (2)	57% (4)	0% (0)	**7**
High sensitivity to pollution	14% (1)	14% (1)	14% (1)	14% (1)	0% (0)	43% (3)	**7**
Bioaccumulation of contaminants	0% (0)	43% (3)	0% (0)	14% (1)	0% (0)	43% (3)	**7**
Predators (native or domesticated)	0% (0)	0% (0)	29% (2)	57% (4)	0% (0)	14% (1)	**7**
Dependence on other species (mutualism, pollinators)	0% (0)	0% (0)	0% (0)	0% (0)	71% (5)	29% (2)	**7**
Diseases/parasites (of the species itself)	0% (0)	0% (0)	14% (1)	14% (1)	29% (2)	43% (3)	**7**
Regulated hunting/fishing pressure (too much)	0% (0)	0% (0)	0% (0)	0% (0)	100% (7)	0% (0)	**7**
Species over population	0% (0)	0% (0)	0% (0)	0% (0)	100% (7)	0% (0)	**7**
Unintentional take/ direct mortality (e.g., vehicle collisions, power line collisions, by-catch, harvesting equipment, land preparation machinery)	0% (0)	29% (2)	0% (0)	57% (4)	0% (0)	14% (1)	**7**
Unregulated collection pressure	0% (0)	0% (0)	14% (1)	29% (2)	43% (3)	14% (1)	**7**
Dependence on irregular resources (cyclical annual variations) (e.g., food, water, habitat limited due to annual variations in availability)	0% (0)	0% (0)	29% (2)	43% (3)	14% (1)	14% (1)	**7**
					Total Respondents		**77**

7. Please also rank these threats to the Wildlife in All subterranean systems Habitat in Indiana.

	Critical threat	Serious threat	Somewhat of a threat	Slight threat	No threat	Unknown	Response Total
Habitat loss (breeding range)	29% (2)	29% (2)	43% (3)	0% (0)	0% (0)	0% (0)	**7**
Habitat loss (feeding/foraging areas)	14% (1)	43% (3)	43% (3)	0% (0)	0% (0)	0% (0)	**7**
Small native range (high endemism)	14% (1)	14% (1)	0% (0)	43% (3)	29% (2)	0% (0)	**7**
Near limits of natural geographic range	14% (1)	0% (0)	14% (1)	0% (0)	71% (5)	0% (0)	**7**
Large home range requirements	0% (0)	0% (0)	14% (1)	14% (1)	71% (5)	0% (0)	**7**
Viable reproductive population size or availability	0% (0)	0% (0)	29% (2)	29% (2)	14% (1)	29% (2)	**7**
Specialized reproductive behavior or low reproductive rates	14% (1)	29% (2)	43% (3)	0% (0)	0% (0)	14% (1)	**7**
Degradation of movement/migration routes (overwintering habitats, nesting and staging sites)	14% (1)	43% (3)	0% (0)	14% (1)	14% (1)	14% (1)	**7**

Genetic pollution (hybridization)	0% (0)	0% (0)	0% (0)	0% (0)	29% (2)	71% (5)	**7**
Unknown	0% (0)	33% (1)	0% (0)	0% (0)	0% (0)	66% (2)	**3**
Other (please specify below)	50% (1)	0% (0)	50% (1)	0% (0)	0% (0)	0% (0)	**2**
					Total Respondents		**68**

8. Other threats to the Wildlife in All subterranean systems Habitat in Indiana.

1. Loss of forest habitat surrounding winter hibernacula/caves.

2. With reference to "unregulated collection pressure," I included disturbance related to research/monitoring.

3. Unregulated Human Activity in Hibernacula

4. needs caves or mines for hibernationwithin probably 60 miles of its summering ground

Total Respondents **4**

9. Please briefly describe the top two threats to the Wildlife in All subterranean systems Habitat in Indiana identified above.

1. Human disturbance of hibernating bats (e.g., Ray's Cave in Greene Co.)
Alterations to microclimate within hibernacula

2. -Some traditional hibernacula have been rendered unsuitable or degraded due to cave development/commercialization (including disturbance of hibernating bats by human visitation), modication of the cave environment, or alternation of surface features.
-Threats also occur on summer habitat (not addressed here because it is not captured within the "cave habitat" category).

3. Human disturbance of active hibernacula

Loss of typical maternal roosting structures (large snags with sloughing bark)

4. The major two threats are loss of summer and winter (caves) habitat. In addition, education of cavers and continued improvments to cave gates are important to the Indiana bat survival

5. 1. Non-point sources of pollution, especially sediments and pesticides
2. Point sources of pollution particularly sewage and spills of chemicals being transported along roads and railroads

6. Oxidus gracilis is a non-native carnivorous millipede invading caves in the east; it is now in several Indiana caves and is preying on the food base for cave salamanders. Further east, reports of greatly decreased insect diversity in caves invaded by this millipide have been reported. Potential impact is unknown, but could be significant.

Total Respondents **6**

10. Please rank the following threats to the HABITAT of the Wildlife in All subterranean systems Habitat in Indiana.

	Critical threat	Serious threat	Somewhat of a threat	Slight threat	No threat	Unknown	Response Total
Commercial or residential development (sprawl)	14% (1)	43% (3)	43% (3)	0% (0)	0% (0)	0% (0)	**7**
Counterproductive financial incentives or regulations	0% (0)	0% (0)	0% (0)	29% (2)	43% (3)	29% (2)	**7**
Invasive/non-native species	0% (0)	0% (0)	29% (2)	14% (1)	57% (4)	0% (0)	**7**
Nonpoint source pollution (sedimentation and nutrients)	17% (1)	0% (0)	50% (3)	0% (0)	17% (1)	17% (1)	**6**
Habitat fragmentation	14% (1)	14% (1)	43% (3)	29% (2)	0% (0)	0% (0)	**7**
Successional change	0% (0)	0% (0)	14% (1)	29% (2)	57% (4)	0% (0)	**7**
Diseases (of plants that create habitat)	0% (0)	0% (0)	0% (0)	14% (1)	57% (4)	29% (2)	**7**
Habitat degradation	29% (2)	29% (2)	43% (3)	0% (0)	0% (0)	0% (0)	**7**
Climate change	14% (1)	14% (1)	29% (2)	14% (1)	0% (0)	29% (2)	**7**
Stream channelization	0% (0)	14% (1)	14% (1)	29% (2)	29% (2)	14% (1)	**7**
Impoundment of water/flow regulation	0% (0)	14% (1)	14% (1)	29% (2)	29% (2)	14% (1)	**7**
Agricultural/forestry practices	0% (0)	43% (3)	43% (3)	14% (1)	0% (0)	0% (0)	**7**
Residual contamination (persistent toxins)	0% (0)	14% (1)	57% (4)	0% (0)	0% (0)	29% (2)	**7**
Point source pollution (continuing)	0% (0)	29% (2)	29% (2)	14% (1)	0% (0)	29% (2)	**7**
Mining/acidification	0% (0)	0% (0)	57% (4)	0% (0)	29% (2)	14% (1)	**7**
Drainage practices (stormwater runoff)	0% (0)	0% (0)	14% (1)	57% (4)	14% (1)	14% (1)	**7**
Unknown	0% (0)	0% (0)	33% (1)	0% (0)	33% (1)	33% (1)	**3**
Other (please specify below)	0% (0)	100% (1)	0% (0)	0% (0)	0% (0)	0% (0)	**1**
					Total Respondents		**114**

11. Other HABITAT threats to the Wildlife in All subterranean systems Habitat in Indiana.

1. Dumping of refuse in sinkholes, these often contain persistent toxins associated with transformers, tires, appliances, pesticide containers, and electronic devices.

2. needs caves or mines as indicated above; Pesticides could be a major threat, for this onther bats, but unknown for sure

Total Respondents **2**

12. Please briefly describe the top two HABITAT threats to the Wildlife in All subterranean systems Habitat in Indiana identified above.

1. Adverse modifications to cave entrances (e.g., poorly designed bat gates), which cause a change in interior microclimates/temperatures.

Loss/degradation/fragmentation of forested areas surrounding caves used by bats during the fall swarming period.

2. Loss/degradation of traditional hibernacula.

loss, fragmentation and degradation of breeding habitat (note that breeding habitat also occurs in areas of the state not associated with caves)

3. The top two threats are habitat degradation of caves by potential migration of chemicals which alter the cave ecosystem, and the loss of roost trees via a number of man-related activities (commercial, agricultural, etc.)

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

5. habitat disappearing to development
needs caves and mines for hibernation

6. Forestry practices that open the forest canopy around cave entrances can greatly impact the habitat for some wildlife species, drying out the entrance to the point it is not useable habitat by the salamanders.

Total Respondents **6**

13. What current monitoring efforts by state agencies are you aware of for the Wildlife in All subterranean systems Habitat in Indiana?

	Yes, these efforts occur	Not aware of these efforts occuring	Response Total
Statewide year-round monitoring conducted by state agencies	0% (0)	100% (7)	**7**
Statewide once a year monitoring conducted by state agencies	0% (0)	100% (7)	**7**
Periodic statewide (less than once a year but still regularly scheduled) monitoring conducted by state agencies	71% (5)	29% (2)	**7**
Occasional statewide (less than once a year and not regularly scheduled) monitoring conducted by state agencies	14% (1)	86% (6)	**7**
Regional or local year-round monitoring conducted by state agencies	0% (0)	100% (7)	**7**
Regional or local once a year monitoring conducted by state agencies	0% (0)	100% (7)	**7**
Periodic regional or local (less than once a year but still regularly scheduled) monitoring conducted by state agencies	29% (2)	71% (5)	**7**
Occasional regional or local (less than once a year and not regularly scheduled) monitoring conducted by state agencies	14% (1)	86% (6)	**7**
		Total Respondents	**56**

14. What current monitoring efforts by other organizations are you aware of for the Wildlife in All subterranean systems Habitat in Indiana?

Appendix E-60: Aggregated Subterranean Systems

	Yes, these efforts occur	Not aware of these efforts occuring	Response Total
Statewide year-round monitoring conducted by other organizations	0% (0)	100% (7)	**7**
Statewide once a year monitoring conducted by other organizations	14% (1)	86% (6)	**7**
Periodic statewide (less than once a year but still regularly scheduled) monitoring conducted by other organizations	29% (2)	71% (5)	**7**
Occasional statewide (less than once a year and not regularly scheduled) monitoring conducted by other organizations	14% (1)	86% (6)	**7**
Regional or local year-round monitoring conducted by other organizations	0% (0)	100% (7)	**7**
Regional or local once a year monitoring conducted by other organizations	0% (0)	100% (7)	**7**
Periodic regional or local (less than once a year but still regularly scheduled) monitoring conducted by other organizations	14% (1)	86% (6)	**7**
Occasional regional or local (less than once a year and not regularly scheduled) monitoring conducted by other organizations	29% (2)	71% (5)	**7**
		Total Respondents	**56**

15. How crucial are these monitoring efforts by state agencies for the conservation of the Wildlife in All subterranean systems Habitat in Indiana?

	Very crucial	Somewhat crucial	Slightly crucial	Not crucial	Unknown	Response Total
Statewide year-round monitoring conducted by state agencies	0% (0)	0% (0)	0% (0)	80% (4)	20% (1)	**5**
Statewide once a year monitoring conducted by state agencies	0% (0)	20% (1)	0% (0)	60% (3)	20% (1)	**5**
Periodic statewide (less than once a year but still regularly scheduled) monitoring conducted by state agencies	43% (3)	14% (1)	14% (1)	14% (1)	14% (1)	**7**
Occasional statewide (less than once a year and not regularly scheduled) monitoring conducted by state agencies	0% (0)	17% (1)	0% (0)	50% (3)	33% (2)	**6**
Regional or local year-round monitoring conducted by state agencies	0% (0)	0% (0)	0% (0)	100% (5)	0% (0)	**5**
Regional or local once a year monitoring conducted by state agencies	0% (0)	20% (1)	0% (0)	80% (4)	0% (0)	**5**
Periodic regional or local (less than once a year but still regularly scheduled) monitoring conducted by state agencies	60% (3)	0% (0)	0% (0)	40% (2)	0% (0)	**5**
Occasional regional or local (less than once a year and not regularly scheduled) monitoring conducted by state agencies	17% (1)	17% (1)	0% (0)	67% (4)	0% (0)	**6**

Total Respondents	**44**

16. How crucial are these monitoring efforts by other organizations for the conservation of the Wildlife in All subterranean systems Habitat in Indiana?

	Very crucial	Somewhat crucial	Slightly crucial	Not crucial	Unknown	Response Total
Statewide year-round monitoring conducted by other organizations	0% (0)	0% (0)	0% (0)	80% (4)	20% (1)	**5**
Statewide once a year monitoring conducted by other organizations	0% (0)	17% (1)	0% (0)	67% (4)	17% (1)	**6**
Periodic statewide (less than once a year but still regularly scheduled) monitoring conducted by other organizations	33% (2)	33% (2)	17% (1)	0% (0)	17% (1)	**6**
Occasional statewide (less than once a year and not regularly scheduled) monitoring conducted by other organizations	0% (0)	17% (1)	0% (0)	67% (4)	17% (1)	**6**
Regional or local year-round monitoring conducted by other organizations	0% (0)	0% (0)	0% (0)	100% (5)	0% (0)	**5**
Regional or local once a year monitoring conducted by other organizations	0% (0)	20% (1)	0% (0)	80% (4)	0% (0)	**5**
Periodic regional or local (less than once a year but still regularly scheduled) monitoring conducted by other organizations	60% (3)	0% (0)	0% (0)	40% (2)	0% (0)	**5**
Occasional regional or local (less than once a year and not regularly scheduled) monitoring conducted by other organizations	17% (1)	17% (1)	0% (0)	67% (4)	0% (0)	**6**
				Total Respondents		**44**

17. Regional or local state agency monitoring for the Wildlife in All subterranean systems Habitat in Indiana.

1. All known I-bat hibernacula

2. -The IDNR conducts biennial hibernacula surveys in all known Indiana bat hibernacula in the state (except Batwing and Twin Domes Caves, which are surveyed under a separate Federal contract).
-Occassional monitoring/research is conducted in cave habitats on a localized basis by State agencies for specific purposes (such as the swarming habitat study at Wyandotte cave).
-Monitoring is also occasionally conducted in summer habitat (not included in this survey).

3. Caves in southern Indiana are monitored. Currently there are 33 hibernacula reported for the Indiana bat in southern Indiana. This confidential information is available upon request.

4. unkown

Total Respondents	**4**

18. Regional or local monitoring by other organizations for the Wildlife in All subterranean systems Habitat in Indiana.

1. Rick Clawson, Missouri DOC, conducts the bienniel winter surveys at Twin Domes and Batwing caves. The Indiana Karst Conservancy (Keith Dunlap) also assists with monitoring efforts, especially at hibernacula that they own or oversee. I have monitored the I-bat population in Reeves Cave in Monroe County.

2. There are surveys conducted at localized locations throughout the State of Indiana, primarily in summer habitat but also some cave habitat work, to address specific management or research needs. For example, surveys are conducted at all Department of Defense properties in the State.

3. See #17.

4. University of Louisville has been monitoring some wildlife species at irregular intervals and locations in southern Indiana since 1994

5. Biyearly monitoring for cave bats in about 18 caves in which Indiana myotis is known to hibernate.

Total Respondents **5**

19. Please list organizations that are monitoring the Wildlife in All subterranean systems Habitat in Indiana.

1. Indiana DNR(Dr. Virgil Brack/ESI, Keith Dunlap, Scott Johnson), Indiana Karst Conservancy, local NSS Grotto members, and U.S. Fish and Wildlife Service

2. Federal agencies (e.g., Forest Service, DoD, COE)
Educational institutions (e.g., Purdue, ISU)
Local/County agencies
Private Conservation Organizations (e.g., Indiana Karst Conservancy)

3. IDNR, USFWS, Indiana Karst Conservancy, Indiana Cave Survey, various ecological consultants and universities (federal permit holders)

4. University of Louisville, Biology Department

5. Virgil Brack and company.

Total Respondents **5**

20. What are the current monitoring techniques for the Wildlife in All subterranean systems Habitat 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
Radio telemetry and tracking	29% (2)	29% (2)	0% (0)	14% (1)	0% (0)	29% (2)	**7**
Modeling	0% (0)	33% (2)	33% (2)	0% (0)	0% (0)	33% (2)	**6**

Coverboard routes	0% (0)	0% (0)	0% (0)	50% (2)	0% (0)	50% (2)	**4**
Spot mapping	0% (0)	0% (0)	25% (1)	25% (1)	0% (0)	50% (2)	**4**
Driving a survey route	0% (0)	0% (0)	0% (0)	50% (2)	0% (0)	50% (2)	**4**
Reporting from harvest, depredation, or unintentional take (road kill, bycatch)	25% (1)	25% (1)	0% (0)	0% (0)	0% (0)	50% (2)	**4**
Mark and recapture	14% (1)	29% (2)	14% (1)	29% (2)	0% (0)	14% (1)	**7**
Professional survey/census	50% (3)	17% (1)	0% (0)	0% (0)	0% (0)	33% (2)	**6**
Volunteer survey/census	20% (1)	60% (3)	0% (0)	0% (0)	0% (0)	20% (1)	**5**
Trapping (by any technique)	71% (5)	0% (0)	0% (0)	0% (0)	0% (0)	29% (2)	**7**
Representative sites	33% (2)	17% (1)	17% (1)	0% (0)	0% (0)	33% (2)	**6**
Probabilistic sites	50% (2)	0% (0)	0% (0)	0% (0)	0% (0)	50% (2)	**4**
Other (please specify below)	0% (0)	50% (2)	25% (1)	0% (0)	0% (0)	25% (1)	**4**
					Total Respondents		**68**

21. Other monitoring techniques for the Wildlife in All subterranean systems Habitat in Indiana.

1. AnaBat/acoustic and/or video monitoring of cave entrances to assess bat presence/use.

2. Stable isotope analysis, genetic genotyping of individuals (through guano analysis), thermal imagery surveys, contaminant analysis/monitoring through guano and/or whole body analysis

3. The use of Anabat as appropriate. Anabat is a bat detector that uses vocalizations to identify species.

4. Delury or Survey/Removal techniques have been used at Donaldson Cave in the 1990's

5. mist-netting stream
cave counts
rabies lab bats
trapping cave and mine entrances

Total Respondents **5**

22. What one or two monitoring techniques would you recommend for effective conservation of the Wildlife in All subterranean systems Habitat in Indiana?

1. Continue ongoing bienniel winter surveys at all known hibernacula.

2. -Biennial hibernacula surveys (which I would classify as "professional survey/census"), are the only means currently available to track Indiana bat population trends on a statewide or rangewide basis. These surveys are conducted rangewide.
-Survey and monitoring activities conducted in summer habitat are used to: 1) evaluate summer distribution in the state, and 2) evaluate roosting and foraging habitat use/needs. These surveys are conducted in Indiana as well as other states throughout the range of the species.

3. 1) Hibernacula counts to track population levels (Already being done)
2) Intensive radiotelemetry that tracks roost and foraging movements of specific colonies in representative areas across the state.

4. Trapping for Indiana bat includes mist netting and harp trapping. Internal cave surveys are important and more emphasis should be placed on the use of Anabat.

5. 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).

6. the first 3 of the above.

Total Respondents **6**

23. What current HABITAT inventory and assessment efforts or activities by state agencies are you aware of for the Wildlife in All subterranean systems Habitat in Indiana?

	Yes, these efforts occur	No effort that I'm aware of	Response Total
Statewide annual inventory and assessment conducted by state agencies	0% (0)	100% (6)	**6**
Statewide once a year inventory and assessment conducted by state agencies	17% (1)	83% (5)	**6**
Periodic statewide (less than once a year but still regularly scheduled) inventory and assessment conducted by state agencies	67% (4)	33% (2)	**6**
Occasional statewide (less than once a year and not regularly scheduled) inventory and assessment conducted by state agencies	33% (2)	67% (4)	**6**
Regional or local year-round inventory and assessment conducted by state agencies	0% (0)	100% (6)	**6**
Regional or local once a year inventory and assessment conducted by state agencies	0% (0)	100% (6)	**6**
Periodic regional or local (less than once a year but still regularly scheduled) inventory and assessment conducted by state agencies	17% (1)	83% (5)	**6**
Occasional regional or local (less than once a year and not regularly scheduled) inventory and assessment conducted by state agencies	33% (2)	67% (4)	**6**
		Total Respondents	**48**

24. What current HABITAT inventory and assessment efforts or activities by other organizations are you aware of for the Wildlife in All subterranean systems Habitat 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% (6)	**6**
Statewide once a year inventory and assessment conducted by other organizations	0% (0)	100% (6)	**6**
Periodic statewide (less than once a year but still regularly scheduled) inventory and assessment conducted by other organizations	50% (3)	50% (3)	**6**
Occasional statewide (less than once a year and not regularly scheduled) inventory and assessment conducted by other organizations	17% (1)	83% (5)	**6**
Regional or local year-round inventory and assessment conducted by other organizations	0% (0)	100% (6)	**6**
Regional or local once a year inventory and assessment conducted by other organizations	0% (0)	100% (6)	**6**
Periodic regional or local (less than once a year but still regularly scheduled) inventory and assessment conducted by other organizations	17% (1)	83% (5)	**6**
Occasional regional or local (less than once a year and not regularly scheduled) inventory and assessment conducted by other organizations	33% (2)	67% (4)	**6**
	Total Respondents		**48**

25. How crucial are these HABITAT efforts by state agencies for the conservation of the Wildlife in All subterranean systems Habitat 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	0% (0)	0% (0)	0% (0)	33% (1)	66% (2)	**3**
Statewide once a year inventory and assessment conducted by state agencies	25% (1)	0% (0)	0% (0)	25% (1)	50% (2)	**4**
Periodic statewide (less than once a year but still regularly scheduled) inventory and assessment conducted by state agencies	67% (4)	0% (0)	0% (0)	0% (0)	33% (2)	**6**
Occasional statewide (less than once a year and not regularly scheduled) inventory and assessment conducted by state agencies	33% (2)	17% (1)	0% (0)	17% (1)	33% (2)	**6**
Regional or local year-round inventory and assessment conducted by state agencies	0% (0)	0% (0)	0% (0)	33% (1)	66% (2)	**3**
Regional or local once a year inventory and assessment conducted by state agencies	0% (0)	0% (0)	0% (0)	33% (1)	66% (2)	**3**
Periodic regional or local (less than once a year but still regularly scheduled) inventory and assessment conducted by state agencies	25% (1)	25% (1)	0% (0)	0% (0)	50% (2)	**4**

Occasional regional or local (less than once a year and not regularly scheduled) inventory and assessment conducted by state agencies	25% (1)	50% (2)	0% (0)	25% (1)	0% (0)	**4**
				Total Respondents		**33**

26. How crucial are these HABITAT efforts by other organizations for the conservation of the Wildlife in All subterranean systems Habitat 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 year-round inventory and assessment conducted by other organizations	0% (0)	0% (0)	0% (0)	33% (1)	66% (2)	**3**
Statewide once a year inventory and assessment conducted by other organizations	0% (0)	0% (0)	0% (0)	33% (1)	66% (2)	**3**
Periodic statewide (less than once a year but still regularly scheduled) inventory and assessment conducted by other organizations	60% (3)	0% (0)	0% (0)	0% (0)	40% (2)	**5**
Occasional statewide (less than once a year and not regularly scheduled) inventory and assessment conducted by other organizations	40% (2)	0% (0)	0% (0)	20% (1)	40% (2)	**5**
Regional or local year-round inventory and assessment conducted by other organizations	0% (0)	0% (0)	0% (0)	33% (1)	66% (2)	**3**
Regional or local once a year inventory and assessment conducted by other organizations	0% (0)	0% (0)	0% (0)	33% (1)	66% (2)	**3**
Periodic regional or local (less than once a year but still regularly scheduled) inventory and assessment conducted by other organizations	25% (1)	0% (0)	0% (0)	25% (1)	50% (2)	**4**
Occasional regional or local (less than once a year and not regularly scheduled) inventory and assessment conducted by other organizations	50% (2)	25% (1)	0% (0)	25% (1)	0% (0)	**4**
				Total Respondents		**30**

27. Regional or local state agency HABITAT inventory and assessment for the Wildlife in All subterranean systems Habitat in Indiana.

1. cave habitat is assessed when the winter surveys of hibernacula are conducted state-wide.

2. -State conducted annual monitoring of the cave environment in most major hibernacula. Human disturbance in key hibernacula is also monitored.
-The contractor who conducts the biennial hibernacula surveys also documents information on cave "condition" (e.g., breakdown) and makes management recommendations.

3. Karst regions and summer habitat in Indiana

4. south central part of state

5. DFW - nongame

Total Respondents 5

28. Regional or local HABITAT inventory and assessment by other organizations for the Wildlife in All subterranean systems Habitat in Indiana.

1. completed by Rick Clawson, Missouri DOC, for Twin Domes and Batwing caves. USFWS- Reeves Cave and others

2. Several organizations coollect information on the location and condition of caves, as well as the presence of bats in caves, which provides useful information.

3. Karst regions and summer habitat in Indiana

4. Hoosier National Forest
Harrison/Crawford State Forest
Spring Mill State Park
Caves of south/central Indiana

5. south central part of state

6. Indiana Karst Conservancy and local grottos

Total Respondents 6

29. Please list organizations that are monitoring this HABITAT for the Wildlife in All subterranean systems Habitat in Indiana.

1. Indiana Karst Conservancy, NSS Grottos, USFWS, I-69 bat consultants

2. IKC, TNC, USGS, Indiana Cave Survey, USFS

3. IDNR, USFWS, Indiana Karst Conservancy, Indiana Cave Survey, ecological consultants and universities (federal permit holders)

4. U.S. Forest Service
Indiana DNR
University of Louisville

5. Virgil Brack and his company

6. Indiana Karst Conservancy and local grottos

Total Respondents 6

30. What are the current monitoring techniques for the Wildlife in All subterranean systems Habitat in Indiana?

If a technique is not applicable to the Wildlife in All subterranean systems Habitat do not select a response in that row.

	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	14% (1)	43% (3)	0% (0)	14% (1)	0% (0)	29% (2)	**7**
Aerial photography and analysis	0% (0)	50% (3)	0% (0)	17% (1)	0% (0)	33% (2)	**6**
Systematic sampling	33% (2)	17% (1)	17% (1)	17% (1)	0% (0)	17% (1)	**6**
Property tax estimates	0% (0)	0% (0)	0% (0)	25% (1)	0% (0)	75% (3)	**4**
State revenue data	0% (0)	0% (0)	0% (0)	25% (1)	0% (0)	75% (3)	**4**
Regulatory information	40% (2)	0% (0)	0% (0)	20% (1)	0% (0)	40% (2)	**5**
Participation in landuse programs	0% (0)	0% (0)	20% (1)	20% (1)	0% (0)	60% (3)	**5**
Modeling	0% (0)	33% (2)	33% (2)	17% (1)	0% (0)	17% (1)	**6**
Voluntary landowner reporting	20% (1)	20% (1)	0% (0)	20% (1)	0% (0)	40% (2)	**5**
Other (please specify below)	50% (1)	0% (0)	0% (0)	0% (0)	0% (0)	50% (1)	**2**
					Total Respondents		**50**

31. Other HABITAT inventory and assessment techniques for the Wildlife in All subterranean systems Habitat in Indiana.

1. Temperature and Relative Humidity monitoring with remote dataloggers.

2. cave survey

3. Visual estimation - has the entrance been changed in anyway from its historical configuration (forest canopy opened up, entrance enlarged or blocked, etc.)

Total Respondents **3**

32. What one or two HABITAT inventory and assessment techniques would you recommend for effective conservation of the Wildlife in All subterranean systems Habitat in Indiana?

1. Cave microclimate monitoring with dataloggers should continue. A range-wide protocol for monitoring cave temperature and humidity has been developed by Bat Conservation International and is being widely used (contact Jim Kennedy or Merlin Tuttle at BCI). I believe Scott Johnson has been following this protocol in Indiana.

2. -Cave microclimate data used in conjunction with results of hibernacula surveys.
-Techniques to link summer/winter populations (new genetic techniques such as stable isotope analysis; pit tagging).
-Information on habitat use/needs in the vicinity of caves during swarming is a critical need. At present, radio telemetry represents the best potential to collect this information.

3. 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

4. cave survey in winter, and net survey in summer

Total Respondents **4**

33. What is the current body of science for the Wildlife in All subterranean systems Habitat in Indiana?

		Response Total	Response Percent
Complete, up to date and extensive		0	0%
Adequate		1	14%
Inadequate		4	57%
Nonexistent		0	0%
Other (please explain below)	1. There is lots of research, but also great need due to endangered status. 2. Somewhere between Adequate & Inadequate	2	29%
	Total Respondents		7

34. Please provide a citation (title, author, date, publisher) that would give the best overview of the Wildlife in All subterranean systems Habitat in Indiana, if available. This resource may be used if further detail is needed.

		Response Total	Response Percent
Title	1, Distribution and status of the northern cavefish 2. Wintering populations of bats in Indiana, with emphasis on the endangered Indiana Myotis, Myotis sodalist 3. Management of hibernacula in the state of Indiana 4. Home range near hibernacula in spring and autumn 5. Brack, Johnson and Dunlap, 2003. 1. Pearson, W. D. and C. Boston	5	100%

	2. Virgil Brack, Jr., Scott A. Johnson, and R. Keith Dunlap		
	3. Johnson, Brack, Dunlap		
	4. Russell C. Romme, Amy B. Henry, R. Andrew King, T. Glueck, and K. Tyrell		
Date	1. 1995 2. 2003 3. 2002 4. 2002	**4**	**80%**
Publisher	1. Final report to IN Department of Nat. Res.Div. of F&W 2. Proceedings of the IN Academy of Science 3. Bat Conservation International 4. The Indiana Bat: Biology and Management of an Endangered Species. Bat Conservation International 5. Proc. Ind. Acad, Sci. 112:-61-74.	**5**	**100%**
		Total Respondents	**5**

35. If possible, please provide a second citation (title, author, date, publisher) that would give another good overview of the Wildlife in All subterranean systems Habitat in Indiana. This resource may also be used if further detail is needed.

		Response Total	Response Percent
Title	1. Age, growth and fin erosion of the northern cavefish, Amblyopsis spelaea, in KY and IN 2. Biennial hibernacula survey reports 3. The nonhibernating ecology of bats in Indiana with emphasis on the endangered Indiana bat, Myotis sodalist 4. Mumford and Whitaker 1982	**4**	**100%**
Author	1. Louis, M. 2. Virgil Brack, Jr.	**2**	**50%**
Date	1. 1999 2. 1983	**2**	**50%**
Publisher	1. Unpubl. M.S. Thesis, University of Louisville 2. reports submitted to IDNR 3. Purdue University	**3**	**75%**
		Total Respondents	**4**

36. What is the current HABITAT body of science for the Wildlife in All subterranean systems Habitat in Indiana?

		Response Total	Response Percent
Complete, up to date and extensive		0	0%
Adequate		1	14%
Inadequate		5	71%
Nonexistent		0	0%
Other (please explain below)	Somewhere between Adequate and Inadequate	1	14%
	Total Respondents		7

37. Please provide a citation (title, author, date, publisher) that would give the best HABITAT overview of the Wildlife in All subterranean systems Habitat in Indiana, if available. This resource may be used if further detail is needed.

		Response Total	Response Percent
Title	1. Cave adaptation in Amblyopsid fishes 2. see previous reference 3. same as Q34 4. Hibernacula of the endangered Indiana bat in Indiana 5. Mumford and Whitaker 1982	5	100%
Author	1. Poulson, T. 2. Brack, Virgil Jr., A.M. Wilkenson, R.E. Mumford	2	40%
Date	1. 1963 2. 1984	2	40%
Publisher	1. Amer. Midl. Nat. 70(2):257-290 2. Proceedings of the Indiana Academy of Science, vol. 93:463-468	2	40%
	Total Respondents		5

38. If possible, please provide a second citation (title, author, date, publisher) that would give another good HABITAT overview of the Wildlife in All subterranean systems Habitat in Indiana. This resource may also be used if further detail is needed.

	Response Total	Response Percent
1. A faunal inventory of subterranean streams using a modified index of biotic integrity		

	2. same as Q35 3. Distribution and ecology in Indiana. Pp 48-54 in Indiana Bat: Biology and Management of an Endangered Species (A. Kurta and J. Kennedy, Eds.) 4. Veilleux et al. 2003.		
Author	1. Jones, T.G. 2. John Whitaker Jr. & Virgil Brack Jr.	**2**	**50%**
Date	1. 1997 2. 2002	**2**	**50%**
Publisher	1. Unpubl. Ph.D. Disst. University of Louisville 2. Bat Conservation International 3. J. Mamm, 841068-1075	**3**	**75%**
		Total Respondents	**4**

39. What are the research needs for the Wildlife in All subterranean systems Habitat in Indiana?

	Urgently needed	Greatly needed	Needed	Slightly needed	Not needed	Unknown	Response Total
Life cycle	0% (0)	14% (1)	57% (4)	29% (2)	0% (0)	0% (0)	**7**
Distribution and abundance	14% (1)	29% (2)	29% (2)	29% (2)	0% (0)	0% (0)	**7**
Limiting factors (food, shelter, water, breeding sites)	43% (3)	0% (0)	57% (4)	0% (0)	0% (0)	0% (0)	**7**
Threats (predators/competition, contamination)	29% (2)	43% (3)	29% (2)	0% (0)	0% (0)	0% (0)	**7**
Relationship/dependence on specific habitats	29% (2)	29% (2)	29% (2)	14% (1)	0% (0)	0% (0)	**7**
Population health (genetic and physical)	14% (1)	29% (2)	14% (1)	29% (2)	0% (0)	14% (1)	**7**
Other (please specify below)	25% (1)	50% (2)	0% (0)	0% (0)	0% (0)	25% (1)	**4**
					Total Respondents		**46**

40. Other research needs for the Wildlife in All subterranean systems Habitat in Indiana.

1. We need urgently need to determine the effects of the loss/fragmentation/timber management of summer habitat/forest on maternity colonies/reproductive success not just caves/winter habitat.

2. More information is needed on autumn swarming and spring staging. Similarly new hibernacula need to be recorded.

3. 1. Metapopulation dynamics
2. Extent of populations in subterranean systems which annot be entered by humans

4. need to know more about rabies in some wildlife species

Total Respondents 4

41. What are the HABITAT research needs for the Wildlife in All subterranean systems Habitat in Indiana?

	Urgently needed	Greatly needed	Needed	Slightly needed	Not needed	Unknown	Response Total
Successional changes	0% (0)	0% (0)	29% (2)	33% (2)	43% (3)	0% (0)	**7**
Distribution and abundance (fragmentation)	0% (0)	43% (3)	43% (3)	17% (1)	0% (0)	0% (0)	**7**
Threats (land use change/competition, contamination/global warming)	43% (3)	29% (2)	29% (2)	0% (0)	0% (0)	0% (0)	**7**
Relationship/dependence on specific site conditions	14% (1)	71% (5)	0% (0)	0% (0)	0% (0)	14% (1)	**7**
Growth and development of individual components of the habitat	0% (0)	33% (2)	33% (2)	0% (0)	17% (1)	17% (1)	**6**
Other (please specify below)	25% (1)	50% (2)	0% (0)	0% (0)	0% (0)	25% (1)	**4**
					Total Respondents		**38**

42. Other HABITAT research needs for the Wildlife in All subterranean systems Habitat in Indiana.

1. How much forest habitat needs to remain arround a hibernaculum to sustain a population of size x during the fall swarming period?

2. -How does cave environment, especially temperature and temperature stability, affect suitability and use of cave by Indiana bats
-What components of the habitat immediately surrounding the cave are most important to Indiana bats during fall swarming and spring staging. How is this habitat used.

3. Recommend a detailed analysis of forest canopy to openness ratio and habitat intricacies that provide preferred home range requirements, e.g. primary roosts, secondary roosts, water, night roosts, food.

4. 1. Assessment of the physical dimensions of the phreatic environment available to cavefishes, and the connections between known windows into the system.
2. Toxin concentrations in cave sediments and their recruitment rates into undergroud waters.

5. need to know more of the relationship between winter and summer habitat, and also of migration.

Total Respondents 5

43. How well do the following conservation efforts address the threats to the Wildlife in All subterranean systems Habitat in Indiana?

Appendix E-60: Aggregated Subterranean Systems

	Very well	Somewhat	Not at all	Not used	Unknown	Response Total
Habitat protection (use below for details)	50% (3)	50% (3)	0% (0)	0% (0)	0% (0)	**6**
Population management (hunting, trapping)	0% (0)	0% (0)	0% (0)	100% (6)	0% (0)	**6**
Population enhancement (captive breeding and release)	0% (0)	0% (0)	0% (0)	100% (6)	0% (0)	**6**
Reintroduction (restoration)	0% (0)	0% (0)	0% (0)	100% (6)	0% (0)	**6**
Food plots	0% (0)	0% (0)	0% (0)	100% (6)	0% (0)	**6**
Threats reduction	33% (2)	50% (3)	0% (0)	17% (1)	0% (0)	**6**
Native predator control	0% (0)	0% (0)	0% (0)	83% (5)	17% (1)	**6**
Exotic/invasive species control	0% (0)	0% (0)	17% (1)	83% (5)	0% (0)	**6**
Regulation of collecting	50% (3)	33% (2)	0% (0)	17% (1)	0% (0)	**6**
Disease/parasite management	0% (0)	0% (0)	0% (0)	100% (6)	0% (0)	**6**
Translocation to new geographic range	0% (0)	0% (0)	0% (0)	100% (6)	0% (0)	**6**
Protection of migration routes	0% (0)	0% (0)	0% (0)	67% (4)	33% (2)	**6**
Limiting contact with pollutants/contaminants	0% (0)	33% (2)	0% (0)	33% (2)	33% (2)	**6**
Public education to reduce human disturbance	33% (2)	67% (4)	0% (0)	0% (0)	0% (0)	**6**
Culling/selective removal	0% (0)	0% (0)	0% (0)	100% (6)	0% (0)	**6**
Stocking	0% (0)	0% (0)	0% (0)	100% (6)	0% (0)	**6**
Other (please specify below)	0% (0)	0% (0)	0% (0)	0% (0)	100% (1)	**1**
				Total Respondents		**80**

44. Other current conservation practices for the Wildlife in All subterranean systems Habitat in Indiana.

1. posting signs at caves, installing-bat friendly gates, land acquisition, installing fake video cameras to deter cave visits,using light-sensitve "speloggers" to monitor levels of human visitation

2. Note, I included regulation of research and research related disturbance under "regulation of collecting"

3. Protect ome caves and mines in which some wildlife species occurs.

Total Respondents **3**

45. What one or two specific practices would you recommend for more effective conservation of the Wildlife in All subterranean systems Habitat in Indiana?

1. Negotiate with the owner of Ray's Cave and other hibernacula to allow them to be gated or employ one or more of the other techniques above.

2. -Gating, securing conservation easements, or purchasing unprotected hibernacula (prioritizing based on current numbers or potential of hibernacula to harbor large numbers if disturbance is presently limiting numbers).
-Protecting surface features and forest cover surrounding hibernacula and manageing for high quality swarming habitat.

3. The purchasing and protection of recorded Indiana bat hibernacula and summer habitat. Similarly, public education is

needed on the importance of caves, snags, and the importance of this species to man.

4. 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

5. protect caves a and mines
continued education of people about bats.

6. Protect cave entrances from inappropriate management activities.

Total Respondents **6**

46. How well do the following conservation efforts address the HABITAT threats to the Wildlife in All subterranean systems Habitat in Indiana?

	Very well	Somewhat	Not at all	Not used	Unknown	Response Total
Habitat protection through regulation	17% (1)	83% (5)	0% (0)	0% (0)	0% (0)	**6**
Habitat protection on public lands	33% (2)	67% (4)	0% (0)	0% (0)	0% (0)	**6**
Habitat protection incentives (financial)	0% (0)	33% (2)	0% (0)	50% (3)	17% (1)	**6**
Habitat restoration through regulation	0% (0)	33% (2)	0% (0)	50% (3)	17% (1)	**6**
Habitat restoration on public lands	0% (0)	83% (5)	0% (0)	17% (1)	0% (0)	**6**
Habitat restoration incentives (financial)	0% (0)	33% (2)	0% (0)	50% (3)	17% (1)	**6**
Artificial habitat creation (artificial reefs, nesting platforms)	0% (0)	17% (1)	0% (0)	83% (5)	0% (0)	**6**
Selective use of functionally equivalent exotic species in place of extirpated natives	0% (0)	0% (0)	0% (0)	100% (6)	0% (0)	**6**
Succession control (fire, mowing)	0% (0)	0% (0)	17% (1)	83% (5)	0% (0)	**6**
Corridor development/protection	0% (0)	33% (2)	0% (0)	50% (3)	17% (1)	**6**
Managing water regimes	0% (0)	17% (1)	0% (0)	67% (4)	17% (1)	**6**
Pollution reduction	0% (0)	50% (3)	0% (0)	33% (2)	17% (1)	**6**
Protection of adjacent buffer zone	33% (2)	17% (1)	0% (0)	33% (2)	17% (1)	**6**
Restrict public access and disturbance	50% (3)	50% (3)	0% (0)	0% (0)	0% (0)	**6**
Land use planning	33% (2)	50% (3)	0% (0)	17% (1)	0% (0)	**6**
Technical assistance	50% (3)	0% (0)	0% (0)	33% (2)	17% (1)	**6**
Cooperative land management agreements (conservation easements)	50% (3)	33% (2)	0% (0)	17% (1)	0% (0)	**6**
Other (please specify below)	33% (1)	33% (1)	0% (0)	0% (0)	33% (1)	**3**
				Total Respondents		**105**

47. Other current HABITAT conservation practices for the Wildlife in All subterranean systems Habitat in Indiana.

1. Generally educate the public on retaining old, dead or dying trees that provide habitat for wildlife, including the Indiana bat.

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.

Total Respondents **2**

48. What one or two specific HABITAT practices would you recommend for more effective conservation of the Wildlife in All subterranean systems Habitat in Indiana?

1. Conservation easements on private property containing important swarming habitat and connected karst features around key hibernacula.

2. same as Q45

3. See #45.

4. 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.

5. Protect cave entrances from disturbance.

Total Respondents **5**

49. Do you have any additional comments or information on the Wildlife in All subterranean systems Habitat that you feel would be useful in the development of the Indiana Comprehensive Wildlife Strategy?

1. I am consulting with FHWA and INDOT on their proposed I-69 extention which is traversing karst terrain in Monroe and Greene counties. INDOT consultants are surveying many previously unsurveyed caves (n = 60 in 2004-05) that are potential Indiana bat hibernacula. New data will be available by March 2005.

The FWS is also currently revising the Indiana Bat Recovery Plan, which once completed will be an excellent source of information for this effort. Lori Pruitt is the best contact to keep up with the plan's status.

2. Maintain bat friendly human barriers at hibernacula
Research needs:
1) determine adequate levels of snag retention in managed forests
2) Include snag retention and snag decay rate in models of forest composition
3) estimate reproductive success or survival

3. Work closely with all appropriate federal and state environmental agencies in coordinating efforts on the Indiana bat.

4. 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

Total Respondents **4**