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CHAPTER VII.

PROPOSED PLAN FOR MONITORING SPECIES OF GREATEST CONSERVATION NEED AND HABITATS

Barn Owl, *Tyto alba*

FISH AND WILDLIFE CONSERVATION AND MANAGEMENT IS INTENDED TO PROVIDE STABLE, SELF-SUSTAINING POPULATIONS OF NATIVE SPECIES.

Therefore, species and habitat monitoring efforts contribute to two important aspects of the planning cycle: the inventory stage that assesses the status of the state's natural resources and the evaluation stage that measures the success of conservation efforts.

SPECIES MONITORING

The DFW has operated under a planned management system for over 30 years and conducts a wide variety of survey and monitoring activities (Table 7-1). The public expects the state to have knowledge of the distribution and relative abundance of fish and wildlife. Federal support for survey and monitoring of game and sport fish species has been established in Indiana since 1937.

Additionally, readily observable bird species have benefited from long standing surveys that provide standardized population trend data. Distribution and abundance surveys for other nongame species have increased in Indiana in the last three decades. Records for SGCN are entered into the Heritage Database, which is maintained by the Division of Nature Preserves (DNP). The Heritage Database represents one of the oldest and most complete repositories of SGCN occurrence data available.

Element five of the Congressional guidelines for the SWAP revision requires that species monitoring needs be identified. A review of current monitoring efforts was an important component in the identification of additional monitoring needs. Specific questions were included in the Species Survey (Appendix O) to determine the level of awareness of species monitoring efforts conducted by the state and other entities. In the CWS Technical Expert Survey, in all species groups, except amphibians, those surveyed were more aware of species monitoring by the state than monitoring by other organizations (Table 7-2). In the recent Species Survey, awareness of species monitoring by the state was greater in all species groups (Table 7-3).

State monitoring efforts are used to determine the status of species, set harvest regulations, and prioritize conservation efforts. Historically, the majority of these surveys have been aimed at game or commercially valuable species. In addition to species status information, collectively, these surveys have provided some insight into habitat and environmental health changes in Indiana. More recently, monitoring efforts conducted or supported by the Nongame and Endangered Wildlife Program (formerly the Wildlife Diversity Section, now the Wildlife Science Unit of the Wildlife Section), have provided population status information for a majority of SGCN. Implementing conservation actions needed to prevent species from declining to the point of being endangered requires early detection and intervention. Therefore, four distinct levels of species monitoring are essential for comprehensive conservation:

1. Monitoring of game, commercial, or common species
2. Monitoring of species in declining or at-risk habitats
3. Monitoring of suspected at-risk species
4. Monitoring of known SGCN

As long as appropriate, the DFW will continue the monitoring efforts in Table 7-1, which are the focus of the SWAP and are directly related to the detection (determining the conservation status of a species) or monitoring of SGCN.

The DFW does not have statutory authority for insects and invertebrates, other than mollusks. A list of rare insects has been developed based on the recommendation of insect experts working in Indiana (Appendix E). As a general trend, rare insects occur in rare habitats. Correspondingly, staff to address the needs of federally endangered insects in Indiana has come from the DNP. In Indiana, the DNP has responsibility for rare plants and plant communities. The DFW works with the DNP to protect and manage rare habitats and the species, including insects that depend upon them. As resources (funds, expertise, etc.) allow, a more comprehensive insect inventory should be pursued.

In response to element five of the Congressional guidelines for the SWAP revision, DFW sought to identify gaps in species monitoring coverage. This included consideration of monitoring technique development. In 2005, only bird and fish survey efforts seemed to have achieved some measure of standardization. Bird monitoring efforts have benefited from the unifying influence of federal control under the Migratory Bird Treaty Act (MBTA). Fish monitoring efforts are often related to game fish management needs or environmental monitoring. Considerable effort has been expended to establish standardized fish sampling and analysis protocols relative to water and environmental quality monitoring. Undoubtedly, the use of fish in environmental monitoring has contributed to a better understanding of species abundance and distribution.

Since 2005, a greater level of standardization of monitoring efforts has been achieved for amphibians, especially frogs as a result of the North American Amphibian Monitoring Program (NAAMP), and mammals, especially summer bat populations as a result of statewide mobile and fixed acoustic bat surveys. In 2005, it was indicated that monitoring efforts for amphibians, especially salamanders, all reptiles, and freshwater mussels needed to be increased. In the 2005 CWS, reptiles were identified as the most under-monitored species group by both the state and non-state agencies (Table 7-2). The awareness of species monitoring has increased for all species groups since 2005 (Table 7-4), except for reptiles. All species monitoring would benefit from standardized efforts that would facilitate inter-state or regional comparisons; standardized protocols that allow comparison of population trends between state, regions and sample areas is desirable. Indiana does participate in national and regional efforts to develop effective, efficient and standardized protocols for species or species groups as identified in Table 7-1.

Table 7-5 provides a list of anticipated survey and monitoring needs, derived from expert comments provided in the Species Survey and from DFW biologists. The degree to which these survey and monitoring efforts are implemented and the scheduled plan for implementation depend upon a variety of factors, including funding and available expertise. In response to new information, regional or

national priorities, or efficient inventory opportunities, this list may be amended to provide for efficient, effective conservation. Given the magnitude of the inventory needs, use of properly trained citizen scientists is an option for certain species. Efforts should be applied to determining techniques and protocols that can be successfully conducted by volunteers provided limited training. Method of data verification and volunteer recruitment and retention also need to be explored. A successful volunteer program is expected to require the full-time attention of one or more volunteer coordinators, provided either by the state or a conservation partner.

Table 7-1. Current species monitoring efforts conducted by the DFW.

Species Group	Survey Name	Schedule	Area
Game Mammals and Game Birds	Archers Index - Beaver, Bobcat, Northern Bobwhite, Coyote, Deer, Fox Squirrel, Gray Fox, Gray Squirrel, Ruffed Grouse, Muskrat, Opossum, rabbit, Raccoon, Red Fox, River Otter, Skunk, and Turkey	Annual	Statewide
	Dove - banding	Annual[1]	Statewide
	Duck - breeding	Annual	Statewide
	Goose - breeding survey	Annual	Statewide
	Landowner survey - similar to the small game license survey below but for the 'unlicensed' sportsperson – also includes Deer, Turkey, Coyote, Crow, and Ruffed Grouse	Biennial	Statewide
	Northern Bobwhite - breeding	Annual	Statewide
	Pheasant - breeding	Annual	Northern Indiana
	Pheasant broods/Winter Sex Ratio	Periodic	Northern Indiana
	Small game license holder survey - Northern Bobwhite, Cottontail Rabbit, Fox Squirrel, Gray Squirrel, Mourning Dove, Pheasant, and Woodcock	Biennial	Statewide
	Turkey - harvest	Annual	Statewide
	Woodcock - breeding	Annual[1]	Statewide
	Wood duck - banding	Annual[1]	Statewide
	Canada Goose - banding	Annual	Statewide

Species Group	Survey Name	Schedule	Area
	Waterfowl - weekly inventory	Annual – August through January	Statewide at select state and federal properties
	Waterfowl - riverine surveys	Annual – November through January	Lower Wabash River and portions of the West Fork White River
	Fur Buyer Survey	Annual	Statewide
	Trapper Survey	Biennial	Statewide
	Citizen Science Trail Cam Survey	Annual	Statewide
	Scent Station Survey	Annual	Southern Indiana
	River Otter Harvest Survey	Annual	Statewide
	River Otter - occurrences	Annual – as reported	Statewide
	Bobcat - occurrences	Annual – as reported	Statewide
	Large Mammal Report Form	Annual	Statewide
	Deer - Mandatory Harvest Check	Annual	Statewide
	Deer - Hunter Survey	Every 3 years	Statewide

Species Group	Survey Name	Schedule	Area
Nongame Birds	Bald Eagle - wintering*	Annual	Statewide
	Bald Eagle - nesting*	Annual	Statewide
	Barn Owl*	Periodic (< 5 yr interval)	Statewide
	Breeding birds - atlas*	20 year cycle	Statewide
	Breeding birds - summer counts*	Annual with volunteers	Statewide
	Breeding birds - survey*	Annual[1]	Statewide – random routes
	Colonial waterbird survey*	Periodic (< 5 yr interval)	Statewide
	Least Tern*	Annual	Southwestern Indiana
	Osprey *	Annual	Statewide
	Peregrine Falcon*	Annual	Statewide
	Loggerhead Shrike*	Annual	Statewide
	Sandhill Crane*	Annual	Statewide
	Secretive marsh birds*	Annual	Selected properties
Nongame Mammals	Allegheny Woodrat*	Periodic	Southern Indiana
	Archer Index – Badger*	Annual	Statewide
	Badger* - occurrences	Annual – as reported	Statewide
	Franklin Ground Squirrel*	Periodic (≤ 10 year intervals)	Northwestern Indiana
	Indiana Bat* - winter hibernacula census	Biennial	Caves in southern Indiana
	Summer bat populations*	Annual[1]	Statewide
	Swamp Rabbit*	Periodic (≤ 10 year intervals)	Southwestern Indiana

Species Group	Survey Name	Schedule	Area
Amphibians	Anurans - calling frogs and toads*	Annual[1]	Statewide
	Crawfish Frog*	Periodic (< 5 yr interval)	Southern Indiana
	Green Tree Frog*	Periodic (< 5 yr interval)	Southern Indiana (as range expands)
	General Salamander*	Annual	Statewide
	Green Salamander*	Annual	Southern Indiana
	Hellbender*	Annual	Southern Indiana
	Streamside Salamander*	Periodic (< 5 yr interval)	Southeastern Indiana
	Mole Salamander*	Periodic (< 5 yr interval)	Southwestern Indiana
	Spadefoot Toad*	Periodic (< 5 yr interval)	Southern Indiana
Fish	Game and commercially valuable species	Annual	Statewide in selected streams and reservoirs on a rotating schedule
	Glacial Lakes Status and Trends	Annual	Northern Indiana Glacial Lakes – regional stratified random assessment on a rotating schedule
	Largemouth Bass survey	Annual	Statewide in selected streams, lakes, and reservoirs on a rotating schedule
	Percidae sport fish survey	Annual	Statewide where Percidae are stocked
	Moronidae sport fish survey	Annual	Statewide where Moronidae are stocked
	Commercial fish harvest reporting	Annual	Ohio, Wabash, East Fork White, West Fork White, and Patoka rivers
	Paddlefish and Paddlefish roe survey	Annual	Ohio River
	Shovelnose Sturgeon survey	Annual	Wabash River
	Channel Catfish, Blue Catfish, and Flathead Catfish survey	Annual	Big Rivers in Southern Indiana
	Lake sturgeon*	Annual	Big rivers in Southern Indiana
	Nongame Fish*	Continuous	Statewide

Species Group	Survey Name	Schedule	Area
Freshwater Mussels	Freshwater Mussels (focus on former commercial species)*	10-12 year interval	Big rivers in central and southern Indiana
	Freshwater Mussels*	Continuous	Statewide
Reptiles	Box Turtle*	Periodic (< 5 yr interval)	Statewide with emphasis on south central Indiana
	Ornate Box Turtle*	Periodic (< 5 yr interval)	Northwestern and one location southwestern Indiana
	Kirtland Snake*	Annually	Statewide
	Timber Rattlesnake*	Periodic (< 10 yr interval)	South central Indiana
	Cottonmouth*	Periodic (< 5 yr interval)	Southern Indiana
	Wall lizard*	Periodic as reported	Potentially statewide
	General reptile*	Annual	Statewide

** Efforts include SGCN*
[1] Conducted under a national or regional protocol

Table 7-2. Percentage of respondents from the 2005 CWS Technical Expert Survey that were aware of species monitoring efforts by state agencies and other organizations statewide.

Species Group	State Efforts	Other Organization Efforts
Amphibians	12.5	15.6
Birds	28.3	22.2
Fish	30.2	10.1
Mammals	18.5	7.4
Mussels	15.0	12.5
Reptiles	12.5	4.9

Table 7-3. Percentage of respondents from the 2015 SWAP Species Survey that are aware of which agencies and organizations monitor species groups in Indiana.

	Federal agencies (e.g., USDA Forest Service)		**State agencies** (e.g., Indiana Department of Natural Resources)		**Local agencies** (e.g., County Parks & Recreation Department)		**Non-profit organizations**		**For-profit entities**		**Research entities** (e.g., universities)		**I don't know**		**Total Responses**
	%	N	%	N	%	N	%	N	%	N	%	N	%	N	
Amphibians	29.4	5	82.4	14	0.0	0	5.9	1	0.0	0	70.6	12	0.0	0	17
Birds	53.1	17	84.4	27	3.1	1	28.1	9	3.1	1	18.8	6	0.0	0	32
Fish	4.5	1	90.9	20	4.5	1	0.0	0	0.0	0	36.4	8	0.0	0	22
Mammals	51.5	34	98.5	65	13.6	9	27.3	18	42.4	28	86.4	57	0.0	0	66
Mollusks	0.0	0	81.3	13	6.3	1	0.0	0	0.0	0	12.5	2	12.5	2	16
Reptiles	14.3	1	100.0	7	14.3	1	0.0	0	0.0	0	71.4	5	0.0	0	7
Total	36.3	58	91.3	146	8.1	13	17.5	28	18.1	29	56.3	90	1.3	2	160

Table 7-4. Percentage of respondents from the 2015 SWAP Species Survey that are aware of current monitoring efforts with respect to species groups in Indiana.

Species Group	Yes	No
Amphibians	38.5	61.5
Birds	46.1	53.9
Fish	51.7	48.3
Mammals	62.3	37.7
Mussels	63.0	37.0
Reptiles	12.9	87.1

Table 7-5. Suggested survey, monitoring, survey technique, survey protocol, and database needs for species in Indiana from 2015 SWAP Species Survey.

Species Group	Species	Schedule	Area	Associated Database Needs
Amphibians	Plains leopard frog	Annual	Northern Indiana	Yes
Birds	Migratory stopover sites	Annual	Selected migratory stopover sites	Yes
	Nesting habitat searches	Annual	Selected habitats	Yes – part of Statewide bird DB
	Owls and Nightjars	Annual	Statewide in suitable habitat	Yes – part of Statewide bird DB
	Rails, Bitterns, and shorebirds	Annual	Statewide in appropriate wetland habitat on a regular cycle	Yes – part of Statewide bird DB
	Gallinaceous game birds (spring)	Annual	Statewide (random)	Yes – part of Statewide bird DB
	Bird Sighting Database	Continuous	Statewide	Yes – part of a statewide bird DB
Freshwater Mussels	Freshwater Mussels	Annual	A subset of Indiana's small steams on a 5-10 year rotation	Yes
Insects	General insect survey	Continuous	Selected rare habitats on a regular cycle	Yes
Invertebrates	Cave invertebrates	Continuous	Selected cave systems on a regular cycle	Yes

Species Group	Species	Schedule	Area	Associated Database Needs
Mammals	Bats (summer)	Annual	Portions of the state on a regular cycle	Yes
	Bats (winter)	Annual	Known or suspected bat caves on a regular cycle (except Myotis sodalist caves)	Yes
	Bat Band Database	Continuous	Statewide	Yes
	Small mammals (shrews, mice and voles)	Annual	Statewide - representative habitats, by county on a regular cycle	Yes
	River Otter – Statistical Population Reconstruction	Annual	Statewide	Yes
	Bobcat – Statistical Population Reconstruction	Annual	Statewide	Yes
Reptiles	Massasauga	Annual	Northern Indiana	Yes
	Blandings turtle	Annual	Northern Indiana	Yes
	Spotted turtle	Annual	Northern Indiana	Yes
	Lizards	Annual	Statewide or by county on a regular cycle	Yes – part of statewide reptile DB
	Snakes	Annual	Statewide or by county on a regular cycle	Yes – part of statewide reptile DB
	Turtles	Annual	Statewide or by county on a regular cycle	Yes – part of statewide reptile DB
General surveys	Surveys of SGCN, especially in certain habitats.	Annual	Statewide in appropriate habitats on a regular cycle	Yes – part of the Heritage Database
	General Prey Inventories - insect, small mammals, amphibians, etc.	As needed	Specific study sites	No – include in study report

Species Group	Species	Schedule	Area	Associated Database Needs
State Land Surveys	General Nongame survey - All nongame wildlife and insects	Annual	DNR properties	Yes – could be part of each area's database and the Heritage Database
Additional Database Needs	Pit Tag database	Continuous	Statewide	Yes
	Road Kill database (all vertebrate species)	Annual	Statewide - selected roadways on a regular cycle	Yes
	Wildlife disease	Continuous	Statewide	Yes
	Wildlife rehabilitation	Annual	Statewide	Yes
	Window, cell tower and windmill bird and bat kill database	Annual	Statewide	Yes – could be part of a statewide bird DB

HABITAT MONITORING

Habitat inventory and monitoring has been less deliberate and frequent than species monitoring.

In the past, the DNR and the public have depended upon a disjunct collection of separate inventories (e.g., the 10-year USDA Forest Service Forest Inventory and Analysis, National Wetland Inventory, rare community entries in the Heritage Database and others), and specific habitat measures collected in association with specific species inventory surveys. In aquatic systems, collection of corresponding habitat data has been an important component of sampling protocols aimed at aquatic community assessment such as the Index of Biotic Integrity (IBI), which classifies species in part by their habitat requirements, and the Qualitative Habitat Evaluation Index (QHEI) which directly describes habitat characteristics. More recently, bathymetric, vegetation, and bottom hardness mapping has been incorporated as a habitat component of the DNR's Glacial Lakes Status and Trends Monitoring. However, most of these efforts collect data on a limited number of indicator parameters, in selected portions of streams, lakes, or reservoirs. Even the systematic efforts of the EPA and USGS in Indiana fail to provide a complete picture of aquatic system habitat in Indiana.

Monitoring plans for habitats required by SGCN as required by Element three of the SWAP revision have been hampered by an inability to precisely define the habitat type or component upon which the SGCN depends. Monitoring distribution and abundance of major habitat types to provide baseline data for future comparisons provides a critical foundation.

The CWS initiated the first comprehensive inventory of statewide habitat data. A team of specialists, led by four scientists at Indiana State University (ISU), provided a quantitative measure of over 80 habitat features. Measures for major habitat features were based on analysis of Landsat 7 Enhanced Thermal Mapper plus (ETM+) or Terra's Advanced Space-borne Thermal Emissions Reflection Radiometer (ASTER) digital data projects for Indiana. Additionally, ISU provided a historic overview of the changes in the eight major habitat categories in Indiana, as outlined in the CWS, from pre-European settlement to present, in hundred-year intervals, with associated changes in fauna. The results of the habitat analysis and historic overview were published in 2012 by Whitaker and Amlaner – '*Habitats and Ecological Communities of Indiana Presettlement to Present*'.

For the SWAP revision, rather than using a customized habitat classification system that was used in the CWS, the NLCD was utilized. NLCD data was compared from 2001 and 2011 to assess changes in habitats (see Chapter VI for results of this analysis). The land cover classification scheme of the NLCD was adapted to fit the eight major habitat types (Appendix B). This change in analysis was encouraged by the Teaming with Wildlife Best Practices Guide (2012) and should provide a well-accepted standardized classification scheme to allow consistency across state plans and improve the chances for collaborative efforts.

Factors affecting habitats and our understanding of species and habitat interactions change. As an understanding of these factors develops, so does the need to measure specific habitat characteristics. DFW biologists, species experts and conservation partners identified additional habitat survey and monitoring needs. Table 7-6 provides a list of additional habitat monitoring needs as required by Element five of the SWAP revision. The degree to which these monitoring efforts are implemented and the implementation scheduled plan depends upon a variety factors including funding and available technology and expertise. In response to new information, regional or national priorities, or availability of inventory opportunities, this list may be amended to provide for efficient, effective conservation. To accommodate adaptive management, additional habitat characteristics may need to be inventoried.

Table 7-6. Habitat monitoring and associated database needs.

Habitat Type	Habitat Feature	Schedule	Area	Associated Database Needs
All Habitats	Quantitative or index information on the total acreage, geographic distribution, patch size, native vs. non-native, vegetation diversity and relative abundance, ownership, and relative condition of the habitats.	Once per decade	Statewide	Yes
All Habitats	Invasive animals and plants	Continuous	Statewide	Yes – including treatment information and results
All Habitats	Soil maps	Continuous	Statewide	Yes
All Habitats	Land cover/land use	As available	Statewide	Yes
Agricultural Lands	Agricultural statistics	Annual	Statewide	Yes
Aquatic Systems	Aquatic systems - bottom substrate and contour	Continuous	Statewide	Yes

Habitat Type	Habitat Feature	Schedule	Area	Associated Database Needs
Aquatic Systems	Environmental contaminants in waterways	Some streams should be monitored annually others on a rotating schedule	Statewide	Yes
Barren Lands	Rock outcrops	Continuous	Statewide	Yes
Forests	Forest statistics	As available, large public landholding should be monitored annually	Statewide	Yes
Forests	Deer browse impact	Every few years	Statewide	No
Subterranean Systems	Cave locations, cave recharge areas, and general karst feature inventory	Continuous	Southern Indiana	Yes
Wetlands	Restored Wetlands	Continuous	Statewide	Yes

THE EFFECTIVENESS OF THE CONSERVATION ACTIONS TAKEN

Conservation actions should be based on the best available science. Element five of the Congressional guidelines for the SWAP revision address the need for adapting conservation actions in response to new information or changing conditions. To allow for adaptive management, successful survey and monitoring efforts have two necessary components: the technically proficient implementation of survey and monitoring protocols and the effective dissemination of results. Both steps are necessary to direct and evaluate the effectiveness of the conservations actions undertaken. The survey and monitoring efforts proposed by the SWAP relate to the identification of SGCN (especially early identification), identification of threats to these species and their habitats, monitoring known SGCN, and evaluation of conservation actions. The purpose of survey and monitoring activities is to detect population or habitat change. All partners, including the DFW, are expected to respond appropriately to detected change and adapt their conservation activities. Therefore, all partners involved in the implementation of the SWAP have the same responsibility—to conduct well-designed inventory protocols in a technically proficient manner and to make the results of the survey and monitoring efforts available to other partners and interested parties.

The DNR will conduct species and habitat survey and monitoring efforts as resources allow (including, but not necessarily limited to those identified in Tables 7-1, 7-5, and 7-6) and to participate, as appropriate, in regional or national monitoring programs. Along with the results, all aspects of the inventory necessary to the responsible interpretation of the effort will be made available to the partners and other interested parties. Partners are urged to provide their survey and monitoring efforts in a similar manner. Additionally, the DFW will continue to provide relevant data to the Heritage Database. Easily accessed, timely inventory information will allow conservation partners and other interested parties to track progress towards conservation goals and to apply adaptive management where appropriate. Information sharing by all partners will facilitate the application of accurate, timely information to the environmental review process.

Individual conservation goals set by partners may have specific timelines. The success of these efforts may be evaluated by the available monitoring efforts as appropriate to their specific timeline. The effectiveness of the entire SWAP will be evaluated and addressed in subsequent reviews of this document (not to exceed ten years as delineated in Element six).