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**Monitoring and Assessment of Aquatic Life in the Illinois and Kaskaskia River Basins  
for Evaluating IDNR Private Lands Programs: Annual Report 2021**

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**INHS Technical Report 2021 (06)**

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## Annual Summary Report

**Project Title:**

Monitoring Aquatic Life in the Illinois and Kaskaskia River Basins for evaluating IDNR Private Lands Programs: Phase IV

**Project Number:**

IDNR CREP 22006

**Contractor Information:**

University of Illinois  
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1816 South Oak Street  
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**Reporting Period:**

January 1, 2021- December 31, 2021

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**Project Objectives:** (1) Monitor the status of aquatic communities and assess the progress toward the aquatic-life goals in randomly-selected stream sites associated with Conservation Reserve Enhanced Program (CREP) in the Illinois and Kaskaskia River basins; (2) survey a small number of least-disturbed stream sites to assist in establishing the best attainable goals for CREP; (3) improve our understanding on how and when CREP starts to benefit aquatic life by systematically tracking the long-term changes in aquatic life, water quality, and habitats at two new CREP sites selected based on the Before-After-Control-Impact design; (4) assess the importance of water quality improvement to aquatic life by monitoring aquatic life and their habitats at the CREP monitoring stations of the Illinois State Water Survey, and (5) provide technical and managing support for IDNR's Private Lands Programs.

**Project Title:** Monitoring Aquatic Life in the Illinois and Kaskaskia River Basins for evaluating IDNR Private Lands Programs: Phase IV (Progress Report for 1/1/2021-12/31/2021)

**Project Objectives:**

(1) Monitor the status of aquatic communities and assess the progress toward the aquatic-life goals in randomly-selected stream sites associated with Conservation Reserve Enhanced Program (CREP) in the Illinois and Kaskaskia River basins; (2) survey a small number of least-disturbed stream sites to assist in establishing the best attainable goals for CREP; 3) improve our understanding on how and when CREP starts to benefit aquatic life by systematically tracking the long-term changes in aquatic life, water quality, and habitats at two new CREP sites selected based on the Before-After-Control-Impact design; 4) assess the importance of water quality improvement to aquatic life by monitoring aquatic life and their habitats at the CREP monitoring stations of the Illinois State Water Survey, and (5) provide technical and managing support for IDNR's Private Lands Programs.

**Background:**

*Summary of Work in Phase I (2013-2015)*

A full account of the work completed in Phase I of this project can be seen in Metzke and Hinz (2017). The primary objectives of Phase I focused on establishing a basin-wide assessment of status and trends of aquatic life in wadeable stream reaches, surveys in targeted stream segments which contain species with conservation status (*i.e.* focal reaches), and surveys at the established Illinois State Water Survey CREP reaches (*i.e.* fixed-site monitoring). In addition to the primary objectives the project supported two graduate student research projects investigating the relationships between CRP density and aquatic assemblages for fish assemblages and macroinvertebrate assemblages, respectively. A total of 144 reaches were surveyed in Phase I.

*Summary of Work in Phase II (2016-2017)*

The aim of Phase II was to continue monitoring and assessing aquatic life in the Kaskaskia Basin while expanding on the goals of the first phase of the project (Metzke et al. 2017). The primary objectives of Phase II focused on continuing basin-wide assessment of status and trends of aquatic life in wadeable stream reaches, expand sampling efforts of focal stream reaches, and conduct additional monitoring of key populations in the basin. Key aquatic populations included adult aquatic insects, mussels, and fish species sensitive to sedimentation. During the reporting period of 2017, the total number of reaches over the five survey seasons (including Phase I and II) was 240 reaches (Metzke et al. 2019).

*Summary of Work in Phase III (2018-2020)*

The aim of Phase III was to continue monitoring and assessment of aquatic life in the Kaskaskia River Basin and build upon the knowledge gained in the first two phases of the project (Hostert et al. 2020). The primary objectives of this phase were to continue basin-wide assessments of aquatic life in wadeable stream reaches, resample fixed pairs of reaches, and expand our understanding of the best-attainable land-use conditions by sampling within less-disturbed watersheds. A total of 337 stream surveys were conducted over the eight survey seasons (Phases I-III) of the INHS aquatic life monitoring project (Hostert et al. 2020).

## Summary of Work Completed During Reporting Period (1/1/2021-12/31/2021):

Table 1. Phase IV Monitoring Program projected number of streams and sampling locations (in brackets) for each of the four survey components in the Illinois (IL) and Kaskaskia (Kask) River basins. Completed stream sites highlighted in grey. Adapted from IDNR CREP 22006 project proposal.

	Project Year	Aquatic-life Goal		ISWS Sites		Quality Sites		BACI	Total
		IL	Kask	IL	Kask	IL	Kask		
<i>Projected</i>	2021	-	12 (24)	5(5)	4(4)		3(6)		24 (39)
Completed	2021	-	11 (17)	5(5)	4(4)		3(3)		23 (29)
<i>Projected</i>	2022	16 (32)					4(8)		20 (40)
<i>Projected</i>	2023	-	12 (24)				3(6)	4 (10)	19 (40)

Throughout the reporting period, the Illinois Natural History Survey (INHS) has continued efforts to monitor the impacts of CREP on aquatic life in Illinois. A total of 29 wadeable stream sites were sampled during base-flow conditions to evaluate fish assemblages, benthic macroinvertebrate assemblages, stream habitat, and water chemistry in the Illinois and Kaskaskia River Basins (*Figures 1 & 2*). The length of each sampling site was standardized to a 100m reach for better comparability between sampling sites. The 29 completed sites for monitoring surveys fell into multiple categories that correspond with project objectives (17 Aquatic Life Goal Monitoring sites, 9 sites co-located with Illinois State Water Survey monitoring stations, and 3 less-disturbed sites – please see *Table 1*). With the addition of the sites sampled in 2021, a combined total of 366 streams monitoring surveys have been conducted since the onset of the aquatic life monitoring program (*Figure 3*.; Please note, *Figure 3* represents only sites within the Kaskaskia River Basin. The five stream sites sampled in the Illinois River Basin during the 2021 sampling season are depicted in *Figure 2*).

Fish community sampling using a single-pass electrofishing technique (e-seine or backpack) was conducted at each of the 29 monitoring sites. At each site, all fish were identified to species and the first 30 individuals of each species had additional metrics (length, weight, and condition) collected before releasing them back to the stream. Throughout the 29 sites over 8500 fish were identified and processed by our field crew in 2021. The maximum number of unique fish species identified at a single site was 23; the minimum number of unique species was 6 (*Table 3*). For a summary of the most common fish by total capture and by site frequency among our sites please see *Tables 1 & 2*.

Benthic macroinvertebrate sampling was conducted at each of the 29 sites using a standard multi-habitat, 20-jab sampling approach (Barbour et al. 1999, ILEPA 2011). Habitats for macroinvertebrate sampling were determined by the relative ratio of in-stream habitat (riffle, run, pool, or glide) within the established sampling site. The 2021 benthic macroinvertebrate samples are currently being sorted for a 300-organism fixed-count subsample to be sent to a certified external lab for taxonomic identification. Based on our current sorting progress, the taxonomy

samples will be ready for delivery to the taxonomy laboratory in February 2022. EcoAnalysts, Inc. has been identified to conduct the identification work for comparability to samples in the previous phases of the project. During the reporting period, we shipped the macroinvertebrate samples from the 2020 sampling season to EcoAnalysts Inc. for taxonomic identification. The resulting data have been received and are currently being incorporated into an analysis evaluating the variation in macroinvertebrate community within the Kaskaskia River Basin from 2013-2020.

Habitat assessments were conducted at each site during the 2021 sampling season using the Qualitative Habitat Evaluation Index (QHEI; Ohio EPA 2006) and the Illinois Habitat Index (IHI; Sass et al. 2010). The QHEI was developed by the Ohio EPA to provide a qualitative assessment of the habitat characteristics that are important for supporting fish communities. The IHI was developed to provide a qualitative evaluation of physical habitat and the response to human degradation in the upstream and local watershed, while also taking into account regional differences throughout Illinois. Both the IHI Score and the QHEI scores increase with better habitat quality. The maximum possible IHI score is 24, while the maximum QHEI score is 100. For the 2021 sampling season the minimum site score was 9 and maximum site score was 24 (mean = 19). The minimum QHEI score for all sampling sites was 30 and minimum was 67 (mean = 49.09). The combination of the QHEI and IHI assessments aids our understanding of the habitats available to aquatic life and how those habitats are changing through time (*Table 4*).

Water chemistry parameters (dissolved oxygen, specific conductance, turbidity, pH, nitrate-nitrogen, total reactive phosphorus, ammonia nitrogen, and temperature) were measured during base flow conditions at each of the 29 sites. These parameters were collected through a combination of Hach field test kits and a handheld water quality meter (Hach HQ 20d). In – stream continuous temperature loggers were deployed at 25 of the 29 stream sites. Temperature loggers were not deployed at 4 of the sites due to a combination of lack of permission for installation and uncertainty of equipment recovery. In addition, stream discharge was collected where water depth and flow conditions were appropriate for the threshold of our flowmeter. At sites where no flow could be detected a depth profile was taken.

### *Objective 1- Aquatic-life Goal Monitoring*

To evaluate progress towards the aquatic-life goals we set out to conduct stream surveys (sampling fish, benthic macroinvertebrates, habitat, and water chemistry parameters) at selected paired stream sites. Each pair consists of two sampling sites located along the same tributary with one stream site within a CREP parcel and an adjacent stream site in a location without CREP (typically agricultural land-use). Year one of the project is dedicated to conducting stream surveys at aquatic-life monitoring pairs in the Kaskaskia River Basin. During the 2021 sampling season, complete stream surveys were conducted at 14 aquatic-life monitoring sites (7 pairs) within the Kaskaskia River Basin (Figure 1.). Stream assessments were conducted on an additional 3 sites located on CREP easements however, a suitable agricultural site could not be sampled to complete the pair because we were unable to secure landowner permission for property access. With CREP enrollments opening in the near future we will likely be able to add additional pairs of aquatic-life monitoring sites in the Kaskaskia River Basin to get closer to our goal of sampling 12 pairs when we re-visit these aquatic-life monitoring pairs in 2023. Sampling

in streams directly connected to CREP easements gave us important connections to landowners enrolled in the program.

#### *Objective 2- Least-Disturbed Stream Monitoring*

To improve our understanding of the gradient of land-use within the CREP Basins, we identified least-disturbed stream segments with high (>50%) natural land-use types (e.g. woodland, wetland, or grassland) in the total upstream watershed. Land-use data from Great Lakes Regional Aquatic Gap Project (Holtrop et al. 2005) was used to compile a list of target stream segments in which total upstream watershed had 50% or more less-disturbed land-use types. Each least-disturbed stream segment was paired with an associated site surrounded by an agricultural setting but within the same tributary. A total of three least-disturbed sites were sampled during base-flow conditions of the reporting period (Figure 1). These three least-disturbed sites were surveyed for with the same methods as the aquatic-life monitoring sampling sites. We found trying to locate a pair of stream segments within the same tributary and size class which had high and low natural land-use in the total challenging. Stream segments within the Kaskaskia Basin which have high natural land cover tend to be closely clustered instead of sporadically distributed throughout the Basin. This resulted in pairs of sites that may visually differ in their local land-use (forested vs. agricultural) but both fall within the high natural land cover category for total upstream watershed. We will be re-evaluating the best way to choose pairs of sites with differing land-use in preparation for selecting least-disturbed sites in the Illinois River Basin for our 2022 sampling season.

#### *Objective 3- BACI-Based Monitoring*

Years one and two of Phase IV are dedicated to screening new CREP parcels for potential use in a BACI-based monitoring. Due to CREP enrollments remaining closed during 2021 we were unable to screen new parcels for use in the BACI monitoring. Our team is prepared to coordinate with CREP field specialists and the IDNR CREP team when enrollments are open.

#### *Objective 4- Biological Monitoring of ISWS Sites*

For the 2021 season we collaborated with the Illinois State Water Survey (ISWS) to conduct our biological stream monitoring sampling at sites co-located with nine ISWS nutrient monitoring stations (five in the Illinois River Basin and four in the Kaskaskia River Basin). Conducting stream biota sampling in the same locations as the established ISWS nutrient monitoring stations gives us access to a wider range of water chemistry data to help explain any variation we observe in the biotic community of sites with varying levels of local watershed CREP rates. It also gives a unique opportunity to bring together some of the Prairie Research Institute groups that are leading CREP monitoring programs in Illinois. The five ISWS sites located in the Illinois River Basin represent the first time that aquatic life surveys evaluating CREP have been conducted in the Illinois River Basin. The four sites located in the Kaskaskia River Basin have now been sampled more than once allowing us to investigate changes in the fish and macroinvertebrate communities throughout time.

*Objective 5- Technical support for IDNR's Private Lands Programs.*

The Technical Support component of this project is designed to assist with the spatial identification of critically necessary conservation easements and site design for practice information statewide, to interpret mapping information and identify priority areas for permanent easement acquisition by the Department of Natural Resources' (IDNR) Division of Private Lands and Watersheds (PLW). This GIS work falls into 3 main categories: maintain updated meta-data attributed GIS data; Develop GIS models to support PLW conservation goals; provide additional technical assistance and/or digital spatial solutions for PLW and agency partners.

In January of 2020, through a partnership with IDNR and INHS, 6 Conservation Resource Specialists (CRSs) were hired to provide “on the ground” promotion of conservation goals and develop relationships between partner agencies, landowners and the scientific community. The technical support for PLW also includes the role of supervising these new field staff through developing and implementing the following: responsive conservation easement project management; conservation easement stewardship and monitoring; conservation planning and implementation; research information collection - human dimensions; capacity-building efforts; CREP outreach and education.

**Presentations and Data Requests:**

A summary of the ongoing work of the monitoring project and preliminary results were presented at the 2021 IL American Fisheries Society Meeting. (Hostert et al. 2021, Lightning Talk Title: “Fish Community Trends in Tributaries of the Kaskaskia River”). In addition to the IL AFS meeting, data from the Aquatic Life Monitoring Program were requested and provided to Brian Metzke (State Aquatic Ecologist, IDNR) for two research projects.

**Tables:**

*Table 2. Top 10 most common fish species based on total number identified in INHS Aquatic Life Monitoring Field Surveys.*

<b>Fish Species</b>	<b>Total Number of Fish</b>
Bluntnose minnow	1553
Sand shiner	1553
Creek chub	764
Silverjaw minnow	682
Central stoneroller	568
Red shiner	487
Bigmouth shiner	440
Green sunfish	435
Johnny darter	281
Bluegill	245

*Table 3. Top 11 most common fish species based on site frequency in INHS Aquatic Life Monitoring Field Surveys. Total sites surveyed in 2021 was 29.*

<b>Fish Species</b>	<b>Total Number of Sites</b>
Creek chub	24
Green sunfish	23
Bluntnose minnow	22
Central stoneroller	22
Yellow bullhead	21
Bluegill	20
Blackstripe topminnow	20
White sucker	20
Johnny darter	19
Orangethroat darter	19
Sand shiner	19



Table 4. Summaries from the 29 sample sites in INHS Aquatic Life Monitoring field surveys during the 2021 sampling season. IHI metric is out of a possible 26, QHEI metric is out of a possible 100. Site Types include Aquatic Life-Goal Monitoring (ALM), Illinois State Water Survey co-located sites (ISWS), and Least-Disturbed (LD).

<b>Site</b>	<b>County</b>	<b>Stream Name</b>	<b>Site Type</b>	<b>Number of Fish Species</b>	<b>IHI</b>	<b>QHEI</b>
20111429_AG	Shelby	Sand Creek	ALM	6	22	52.5
20111429_CREP	Shelby	Sand Creek	ALM	13	23	59.25
20111495_AG	Shelby	Mud Creek	ALM	17	15	36
20111495_CREP	Shelby	Mud Creek	ALM	22	20	45.75
20121414_AG	Shelby	Jordan Creek	ALM	20	17	40
20121414_CREP	Shelby	Jordan Creek	ALM	23	15	41.75
20121457_AG	Fayette	Cemetery Branch to Ramsey Creek	ALM	5	22	42.5
20121457_CREP	Fayette	Cemetery Branch to Ramsey Creek	ALM	11	24	49
20131552_AG	Fayette	Lick Creek	ALM	13	18	62
20131552_CREP	Fayette	Lick Creek	ALM	15	24	67
20141557_AG	Fayette	Ash Creek	ALM	16	23	50.5
20141557_CREP	Fayette	Ash Creek	ALM	17	20	55
20141585_AG	Shelby	Robinson Creek	ALM	12	9	37
20141585_CREP	Shelby	Robinson Creek	ALM	12	16	54
20111452_CREP	Madison	East Fork Silver Creek	ALM	19	18	44.25
20131547_CREP	Fayette	Hurricane Creek	ALM	22	20	38
20141579_CREP	Fayette	Sandy Run	ALM	15	22	55.5
ISWS201	Cass	Panther Creek	ISWS	9	22	61
ISWS202	Cass	Cox Creek	ISWS	11	23	67
ISWS301	Knox	Court Creek	ISWS	17	17	47.75
ISWS302	Knox	North Creek	ISWS	20	22	52
ISWS303	Knox	Haw Creek	ISWS	19	22	63.25
ISWS402	Clinton	Lost Creek	ISWS	11	16	30
ISWS403	Marion	North Fork Kaskaskia River	ISWS	12	9	45.25
ISWS404	Fayette	Hurricane Creek	ISWS	15	22	38
ISWS405B	Montgomery	East Fork Shoal Creek	ISWS	16	9	42
KR_116101	Fayette	Big Creek	LD	21	16	36
KR_118900	Fayette	Gilham Creek	LD	11	16	48.5
KR_128082	Monroe	Horse Creek	LD	20	21	63

## References:

- Barbour, M.T., J. Gerritsen, B.D. Snyder, and J.B. Stribling. 1999. Rapid bioassessment protocols for use in streams and wadeable rivers: periphyton, benthic macroinvertebrates, and fish, Second Edition. EPA 841-B-99-002. U.S. Environmental Protection Agency; Office of Water; Washington, D.C.
- Holtrop, A. M., D. Day, C. Dolan, and J. Epifanio. 2005. Ecological classification of rivers for environmental assessment & management: stream attribution and model preparation. Champaign, IL.
- Hostert, L.E., L. Beja, and Y. Cao. 2020. Monitoring and assessment of aquatic life in the Kaskaskia River for evaluating IDNR private lands programs: phase III. INHS Technical Report 2021. University of Illinois, Champaign, IL.
- Hostert, L.E., and Y. Cao. 2021. Fish Community Trends in Tributaries of the Kaskaskia River. Lightening talk session at the 2021 IL Chapter of the American Fisheries Society Meeting. Champaign, IL.
- Illinois Environmental Protection Agency (ILEPA). 2011. Standard operating procedure for methods to collect aquatic macroinvertebrates from wadeable streams for biotic integrity assessments. Document Control Number 168. 8 pp.
- Metzke, B. A., L. C. Hinz Jr., and L. Beja. 2017. Monitoring and assessment of aquatic life in the Kaskaskia River for evaluating IDNR private lands programs: phase II. INHS Technical Report 2017 (34). University of Illinois, Champaign, IL.
- Metzke, B. A., and L. C. Hinz Jr. 2017. Establishing an aquatic monitoring program to assess the goals of the Illinois Conservation Reserve Program in the Kaskaskia River Basin. INHS Technical Report 2017 (4). University of Illinois, Champaign, IL.
- Metzke, B. A., L. C. Hinz Jr., L. Beja, L. E. Hostert, and Y. Cao. 2019. Monitoring and assessment of aquatic life in the Kaskaskia River for evaluating IDNR private lands programs: phase II final report. INHS Technical Report 2019 (26). University of Illinois, Champaign, IL.
- Ohio EPA. 2006. Methods for assessing habitat in flowing waters: using the Qualitative Habitat Evaluation Index (QHEI). Ohio EPA Technical Bulletin EAS/2006-06-1. Groveport, OH.
- Sass, L., L. C. J. Hinz, J. Epifanio, and A. M. Holtrop. 2010. Developing a multi-metric habitat index for wadeable streams in Illinois. Champaign, IL.

# INHS CREP Monitoring Sampling Sites 2021

## Kaskaskia Basin

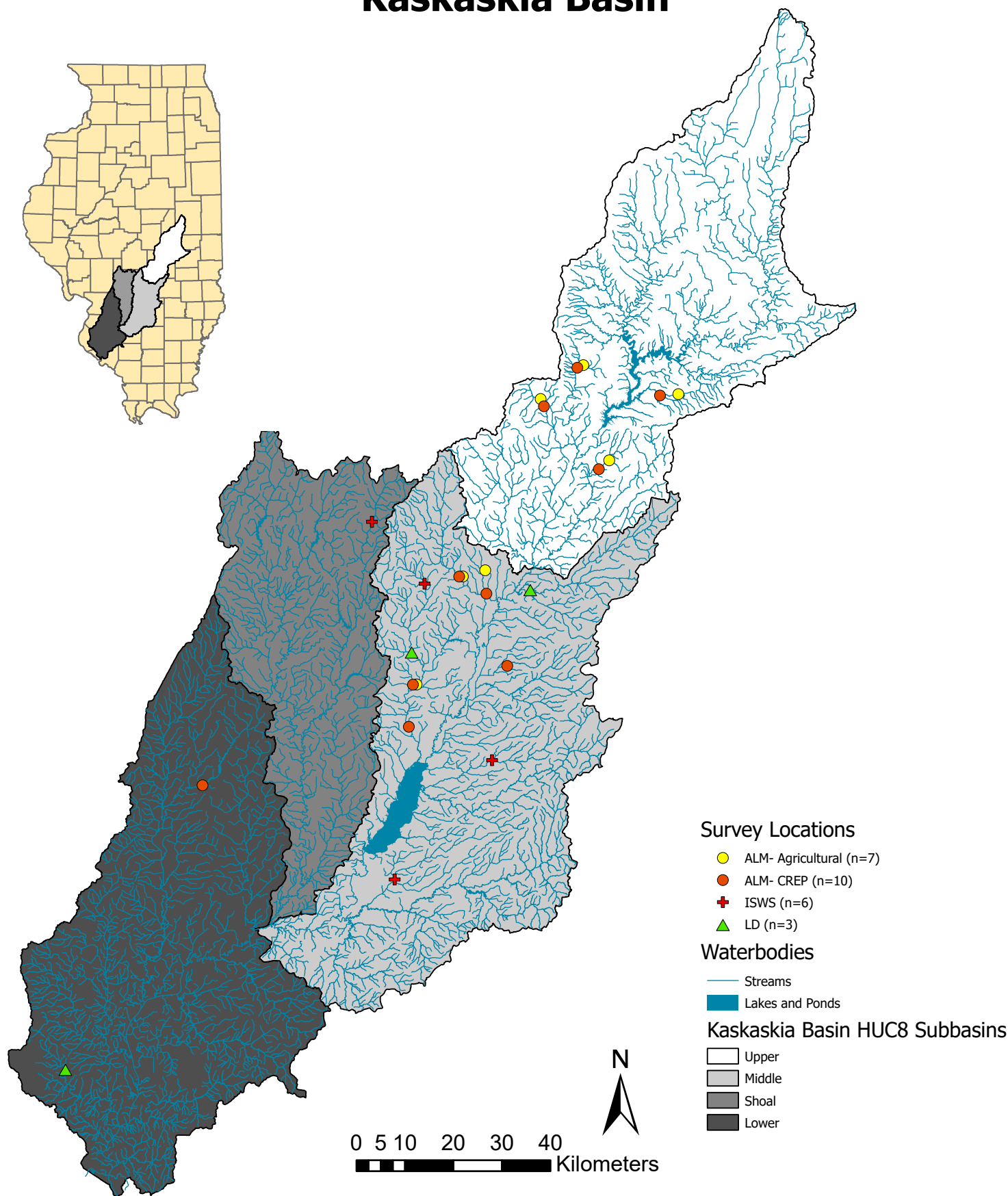


Figure 1. Locations of wadeable stream survey sites conducted in 2021 in the Kaskaskia River Basin of Illinois. Streams were sampled by the Illinois Natural History Survey (INHS) as part of the monitoring and assessment of aquatic life for the Conservation Reserve Enhancement Program (CREP). Sites are depicted with symbols that vary according to site type: ISWS in red crosses (n=4), least disturbed in green triangles (n=3), Aquatic Life Monitoring Agricultural in yellow circles (n=7), and Aquatic Life Monitoring CREP in orange circles (n=10). The basin is broken down to four United States Geological Survey (USGS) Hydrologic Unit Code 8 (HUC8) scale sub-basins Upper, Middle, Shoal, & Lower).

# INHS CREP Monitoring Sampling Sites 2021

## Lower Illinois Basin

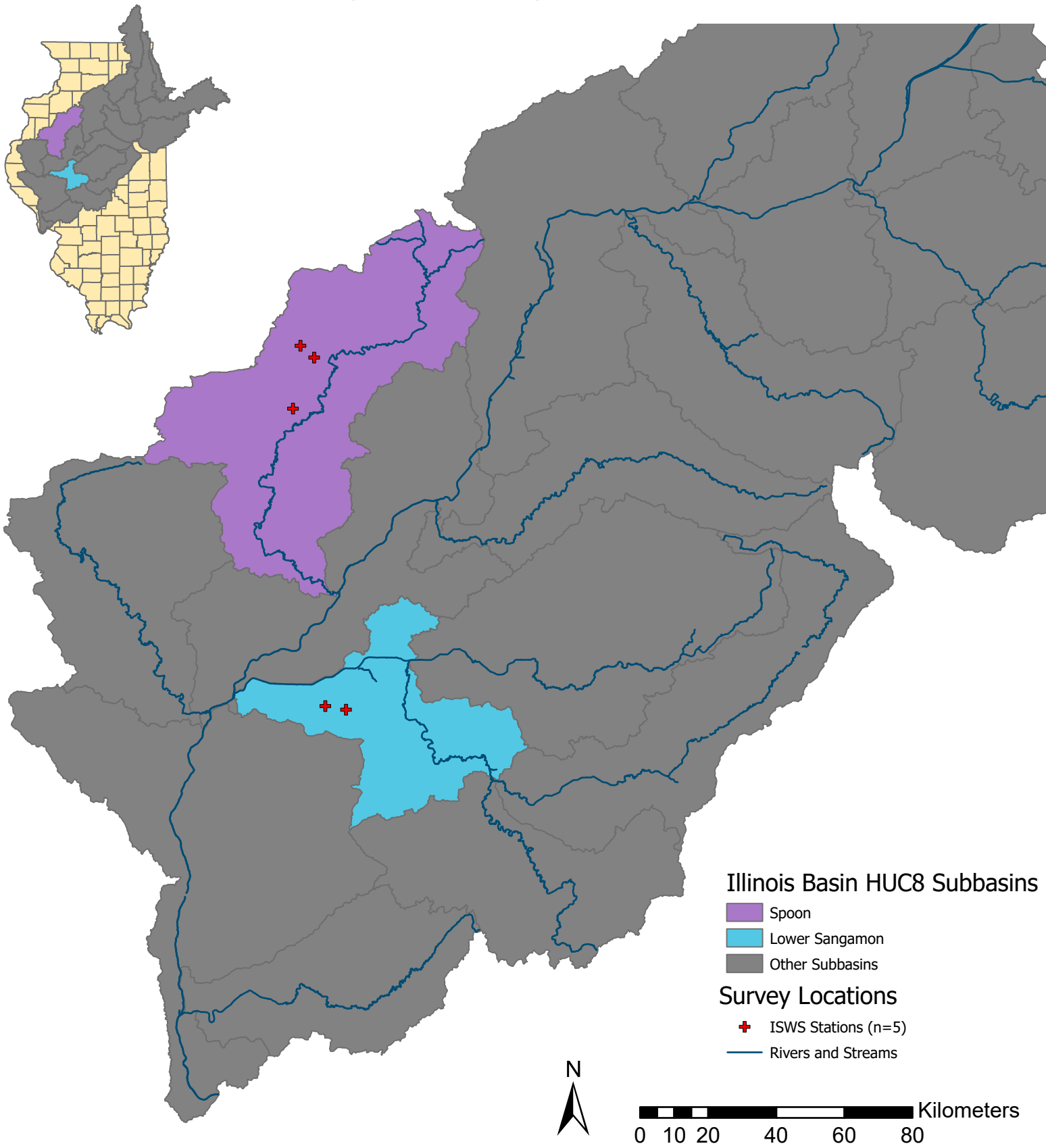


Figure 2. Locations of wadeable stream survey sites conducted in 2021 in the Lower Illinois River Basin of Illinois. Streams were sampled by the Illinois Natural History Survey (INHS) as part of the monitoring and assessment of aquatic life for the Conservation Reserve Enhancement Program (CREP). Survey sites co-located with Illinois State Water Survey (ISWS) monitoring stations are depicted with red crosses (n=5). All sampling sites were located in two United States Geological Survey (USGS) Hydrologic Unit Code 8 (HUC8) scale subbasins (Spoon and Lower Sangamon).

# INHS CREP Aquatic Life Monitoring Sampling Sites 2013-2021 Kaskaskia Basin

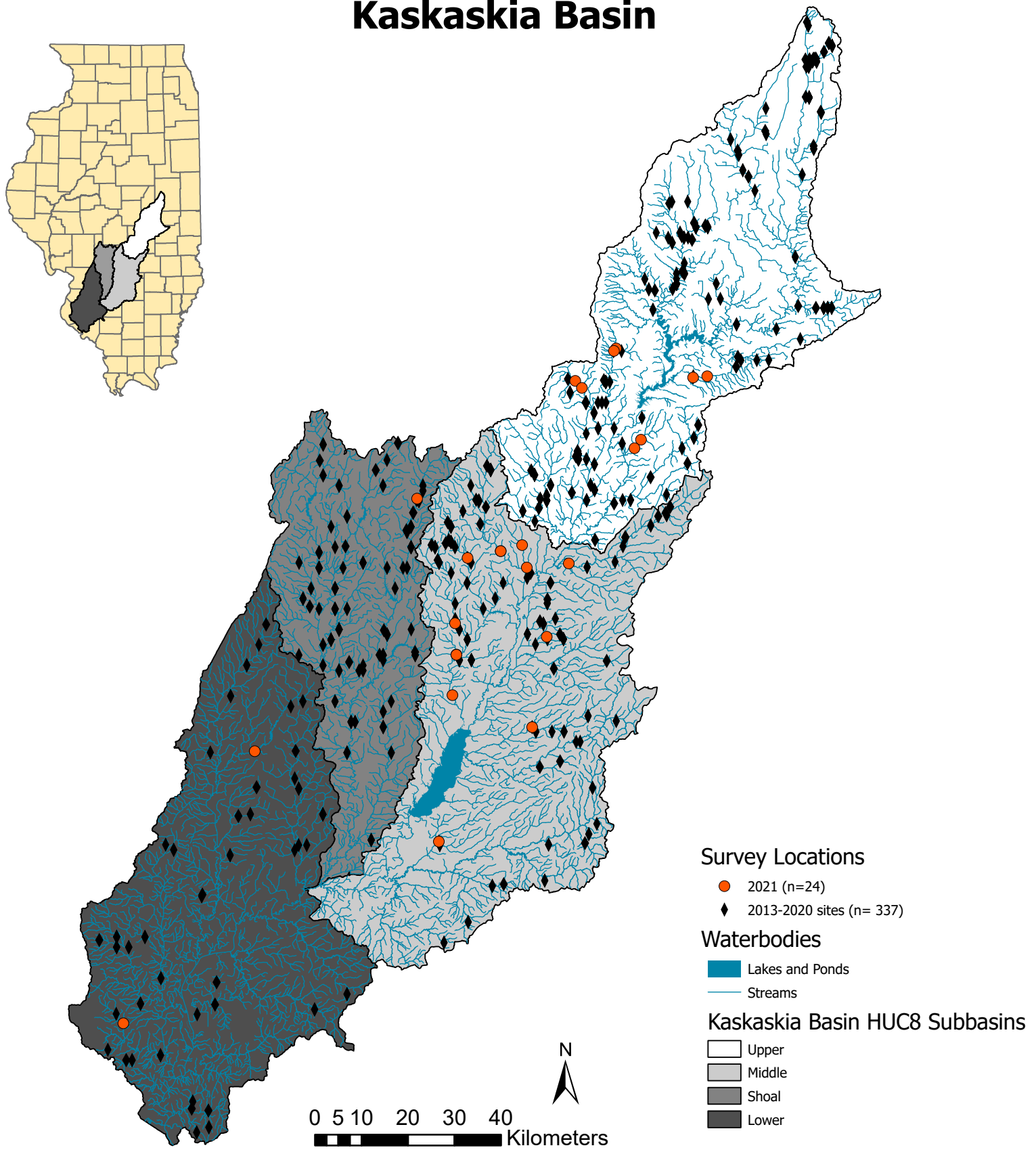


Figure 3. Locations of wadeable stream survey sites in the Kaskaskia River Basin of Illinois. Sites were sampled by the Illinois Natural History Survey as part of the monitoring and assessment of aquatic life for the Conservation Reserve Enhancement Program (CREP). Sampling locations from years 2013-2020 are symbolized with black diamonds (n=337) and year 2021 is symbolized with orange circles (n=29). The basin is broken down to four United States Geological Survey (USGS) Hydrologic Unit Code 8 (HUC8) scale sub-basins (Upper, Middle, Shoal, & Lower).