



**ILLINOIS NATURAL
HISTORY SURVEY**
PRAIRIE RESEARCH INSTITUTE

**Monitoring and Assessment of Aquatic Life in the Kaskaskia River for
Evaluating IDNR Private Lands Programs: Phase II**

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PROJECT TITLE:

Monitoring and Assessment of Aquatic Life in the Kaskaskia River for Evaluating IDNR Private Lands Programs: Phase II.

PROJECT OBJECTIVES:

(1) Continue established monitoring program that provides a basin-wide assessment of status and trends for aquatic life in wadeable streams of the Kaskaskia River basin; (2) expand sampling efforts in focal reaches to better characterize biological assemblages and physiochemical habitats in each of the four subbasins of the Kaskaskia River; (3) conduct additional monitoring of key populations within the Kaskaskia River; (4) provide technical support for IDNR's Private Lands Programs.

SUMMARY OF WORK COMPLETED IN PHASE I (2013-2015):

Phase I of this project (Monitoring and Assessing Aquatic Life in the Kaskaskia River) is summarized in Metzke and Hinz (2017). These efforts focused on a basin-wide assessment of wadeable stream reaches, stream segments which contain species having conservation status (i.e., focal reaches), and surveys at Illinois State Water Survey CREP study reaches. Additional survey effort was expended to support graduate student research relevant to study objectives. Both graduate students investigated the relationship between CRP density and stream assemblages; one focusing on aquatic insects and the other on fish. Both studies found a weak relationship between CRP density and species richness. In Phase I, 144 reaches were surveyed and 824 collection events (e.g., electrofishing survey, habitat evaluation, water chemistry measure) were completed (Table 1, Figure 1).

SUMMARY OF WORK COMPLETED IN PHASE II (2016-2017):**Work Completed in 2016**

Phase II of monitoring continued the basin-wide assessment of wadeable streams of Phase I, but shifted remaining effort to assessing focal stream segments using more intensive sampling and assessing stream segments with fish species that may respond to CREP activities. Spring EPT macroinvertebrate surveys have been eliminated, but mussel and black light surveys for adult aquatic insect surveys were added.

Basin-wide assessment reaches were selected using a stratified random technique where reaches were distributed within size categories, CRP density categories and HUC8 subbasins. Fish, benthic macroinvertebrate, habitat and water quality were surveyed at 21 basin-wide assessment reaches (Table 1, Figure 1). Continuous temperature recorders were placed and retrieved from five basin-wide assessment reaches. Focal assessment reaches were selected using a paired design where one reach with high CRP density (>10% in the local catchment) and one with low (<10%) were selected from neighboring tributaries. This paired design was employed to control for differences in geology, land use and potential species pool to assess observed physicochemical and biotic patterns associated with level of participation in conservation programs. Fish, benthic macroinvertebrates, habitat and water quality were surveyed at sixteen paired (i.e., eight pairs) reaches. Water quality was also measured at four to

five pairs of reaches during four high flow events. Two mussel and fifteen backlight surveys were conducted at paired reaches. Eleven temperature loggers were retrieved at paired reaches (loggers were placed at each reach, but five were lost). The recorded distributions of eleven species that may be intolerant of sedimentation (Table 2), and therefore may respond to CREP practices, were used to identify sensitive species reaches. Fifteen reaches with recent records of multiple sensitive species were selected and fish and habitat were surveyed at each reach. Length and weight of individuals from fish species sensitive to sedimentation were recorded at all surveyed sensitive species and paired reaches.

Work Completed During the 2017 Reporting Period

Sixty-five reaches were surveyed during summer 2017 (Table 3, Figure 2), bringing the total reaches over five survey seasons to 240 (Table 1). Several of these reaches have been surveyed in multiple years to allow for the evaluation of interannual variation or to compliment concurrent studies, and therefore the total number of monitoring events throughout the entire survey (i.e., efforts to characterize the physiochemical and biological attributes of a stream reach) is 1300.

Water quality (temperature, dissolved oxygen, specific conductivity, pH, total reactive phosphorus, ammonia nitrogen, nitrate nitrogen and turbidity) was assessed at basin-wide assessment and paired reaches during the low flow index period. Water quality (temperature, dissolved oxygen, specific conductivity, pH, nitrate nitrogen, nitrite nitrogen, total Kjeldahl nitrogen, total nitrogen, phosphorus and total suspended solids) was assessed during three high flow events at a subset of paired reaches (between four and eight reaches assessed during each event).

Forty continuous temperature recorders were deployed at basin-wide assessment and paired reaches in spring 2017 and will be retrieved in winter 2017-2018. Data from these recorders will be used to evaluate the thermal regime.

Habitat evaluations were completed at each surveyed reach using the Qualitative Habitat Evaluation Index (QHEI; OEPA 2006) and the Illinois Habitat Index (IHI; Sass, et al. 2010). The QHEI provides a qualitative index of habitat characteristics and can be viewed as a measure of biological potential. The IHI indexes landscape disturbance by qualifying relevant stream characteristics.

Benthic macroinvertebrates were surveyed at basin-wide assessment reaches twenty times, paired reaches nine times and at student research reaches seventeen times using a standard rapid assessment method (IEPA 2011). Collected organisms were preserved in ethanol for processing at a later date. Benthic samples collected during the 2015 and 2016 surveys were sorted during calendar year 2017 and 300-count subsamples were shipped to EcoAnalysts, Inc. (Moscow, IA) for identification.

Fish were surveyed using IDNR Basin Survey procedures (IDOC 1994) at all reaches. Length and weight of individuals from fish species identified as sensitive to sedimentation (Table 2) were measured at paired and sensitive species reaches.

Mussels were surveyed at fourteen paired and two sensitive species reaches. Surveys employed tactile and visual techniques to locate mussels. Eight person-hours were expended at each reach, although

each hour was recorded separately to facilitate comparisons with previous IDNR and INHS surveys which use four person-hours.

Progress towards a fish stock index occurred during the reporting period. IDNR electrofishing data (survey location, date, length and weight of individual fish) from non-wadeable streams of the Kaskaskia River basin were acquired, sorted and filtered in preparation for constructing this index.

One full-time professional worked on objectives 1-3, while one part-time professional provided assistance completing field work. Four student technicians aided field work. One full-time professional staff member provided GIS support to the IDNR CREP (objective 4).

Objective 1 – Basin-Wide Status and Assessment

Twenty basin-wide assessment reaches were surveyed in 2017, five in each of the four HUC8 subbasins (Table 3, Figure 2). In each subbasin surveys were completed at one large stream (link number ≥ 11) with a high density ($\geq 5\%$) of CRP in the local catchment, one large stream with a low density of CRP ($< 5\%$), two small streams (link number 2-10) with a high density of CRP and one small stream with a low density of CRP. These surveys will be used to evaluate physicochemical and biological status and temporal trends of wadeable stream in the Kaskaskia River basin. A total of 144 basin-wide assessment reaches have been surveyed since 2013 (Table 1).

Objective 2 – Intensive Evaluation of Physicochemical and Biotic Characteristics (Paired Streams)

Surveys were completed at eight of the paired reaches in 2017 (i.e., four pairs; Table 3, Figure 2). All paired reaches were surveyed in 2016 so those completed during this reporting period will aid evaluations of temporal variability. Mussel surveys have also been conducted at all paired reaches (two in 2016 and 14 in 2017). High flow event water quality samples were collected at least once at all pairs during Phase II.

Objective 3 – Monitoring of Focal Species (Sensitive Species and Fish Stock Index)

Length and weight of fish species sensitive to sedimentation (Table 2) were recorded at 15 reaches selected for sensitive species monitoring and at eight paired reaches in 2017 (Table 3, Figure 2). More than 1200 individuals from eleven sensitive species were measured in 2017, bringing the two-year total to 3057 individuals. Species-specific length to weight relationships will be used to provide a baseline species' condition and to evaluate condition in relation to stream characteristics or over time.

Work towards constructing a fish stock index for large bodied species (e.g., suckers, catfish, gar) in non-wadeable streams of the Kaskaskia River basin included acquiring length and weight information for fish collected during IDNR surveys and creating a database of relevant records. This stock index will use length to weight relationships to evaluate condition of large bodied species. Sufficient records (≥ 20 individuals) were available for seven species (Table 4) and work towards completing the index is ongoing.

Objective 4 - GIS Technical Support to IDNR CREP

Current GIS data infrastructure was updated by integrating other existing Private Lands and Watersheds (PLW) Program geospatial data and identifying overlap with CREP properties. In addition to ongoing quality control and maintenance of these PLW geodatabases, the spatial relationship of these data were examined in relationship to sources within IDNR and outside resources to produce maps showing the patterns and results required for PLW core activities and decision making.

One of the major efforts during the reporting period was to create priority areas for Private Lands work. This effort was greatly influenced by the Illinois Wildlife Action Plan (IWAP) to target priority areas for Private Lands conservation work that would maximize the benefit to the resources and to the landowner. The PLW division worked with USDA's Farm Service Agency (FSA) to map multiple scenarios influencing statewide CRP signups and worked to determine a proposal of HUC12 watersheds for their new Conservation Priority Areas (CPAs). Equitable distribution of HUC's comprising the CPA was a challenge given the guidelines provided in the 2014 Farm Bill, namely being limited to not more than 25% of the available remaining acres of state cropland. Major factors in the determination included; available state cropland identified as Highly Erodible Land, available state cropland (not already in CRP, CREP or WRP), areas with a high interest in CRP (based on CRP accepted/rejected reports), areas with low CRP contracts, areas of overlap between the IWAP and the Illinois Nutrient Loss Reduction Strategy (NLRS) Priority watersheds. Lastly, large corridors or identified areas in the IWAP received preference over small areas/sites with less connectivity.

A number of CREP practices have been identified by the NLRS as measures that would help reach the goal of reducing nutrient runoff into the Gulf of Mississippi. Over the last year, CREP has been part of discussions in the Agricultural Water Quality Technical Group working together with other members to establish baseline numbers/acreages to monitor progress towards reduction goals. All data was given a spatial component and reported by HUC12, HUC10, HUC8, County and NLRS Priority Watersheds.

Student Research/Special Questions Surveys

Nineteen reaches were surveyed in 2017 to support research relevant to understanding patterns of biotic assemblage composition or for filling data gaps (Table 3, Figure 2). Emphasis was placed on surveying reaches upstream of reservoirs to investigate the impacts of connectivity loss on fish and benthic macroinvertebrate assemblage composition. Fish, benthic macroinvertebrates, water quality and habitat were surveyed at each reach.

Reporting

One presentation at a scientific conference (Metzke 2017) was given during the reporting period. This presentation evaluated patterns of fish assemblage heterogeneity over space and time. The final project report for Phase II is in preparation.

LITERATURE CITED:

- Illinois Department of Conservation. 1994. Manual of Operations. Illinois Department of Conservation, Division of Fisheries, Springfield, IL. October 1994.
- Illinois Environmental Protection Agency. 2011. Standard operating procedure for method to collect aquatic macroinvertebrates from wadeable streams for biotic integrity assessments. IEPA Bureau of Water, Document Control Number 168.
- Metzke, B.A. 2017. In search of the elusive community boundary: Evaluating spatial and temporal heterogeneity of stream fish assemblages. Illinois Chapter of the American Fisheries Society, Moline, IL.
- Metzke, B.A. and L.C. Hinz, Jr. 2017. Establishing an aquatic monitoring program to assess the goals of the Illinois Conservation Reserve Enhancement Program in the Kaskaskia River Basin. Illinois Natural History Survey Technical Report 2017(4).
- Ohio Environmental Protection Agency. 2006. Methods for Assessing Habitat in Flowing Waters: Using the Qualitative Habitat Evaluation Index (QHEI). Ohio EPA Technical Bulletin EAS/2006-06-1. State of Ohio Environmental Protection Agency, Division of Surface Water, June 2006.
- Sass, L., L.C. Hinz, Jr., J. Epifanio and A.M. Holtrop. 2010. Developing a multi-metric index for wadeable streams in Illinois. Final Report to the Illinois Department of Natural Resources. Illinois Natural History Survey Technical Report 2010/21.

Table 1. Number of survey events and locations between 2013 and 2017.

<u>Evaluated Characteristic</u>	<u>Number of Events</u>						<u>Total Events</u>	<u>Total Reaches</u>
	<u>Basin Wide Status</u>	<u>Focal</u>	<u>ISWS</u>	<u>Student Research/ Special Questions</u>	<u>Paired</u>	<u>Sensitive Species</u>		
Fish Assemblage	124	0	6	50	24	30	234	197
Mussel Assemblage	0	0	0	6	16	2	24	24
Benthic Macroinvertebrate Assemblage	118	42	8	43	24	0	235	181
Spring EPT Macroinvertebrate Assemblage	68	30	3	0	0	0	101	86
Black Light Macroinvertebrate Assemblage	0	0	0	0	15	0	15	15
Water Quality	157	66	11	18	44	30	326	193
Temperature Regime	52	18	2	1	11	0	84	74
Habitat	127	42	8	50	24	30	281	240
Total Locations:	144	15	4	46	16	15		

Table 2. Focal species, or those sensitive to sedimentation, used to select reaches for sensitive species monitoring.

<u>Common Name</u>	<u>Scientific Name</u>
Horneyhead chub	<i>Nocomis biguttatus</i>
Bigmouth shiner	<i>Notropis dorsalis</i>
Central stoneroller	<i>Campostoma anomalum</i>
Creek chub	<i>Semotilus atromaculatus</i>
Orangethroat darter	<i>Etheostoma spectabile</i>
Red shiner	<i>Cyprinella lutensis</i>
Stonecat	<i>Noturus flavus</i>
Striped shiner	<i>Luxilus chrysocephalus</i>
Silverjaw minnow	<i>Ericymba buccata</i>
Sand shiner	<i>Notropis stramineus</i>
Redfin shiner	<i>Lythrurus umbratilis</i>

Table 3. Number of survey events and locations in 2017.

<u>Evaluated Characteristic</u>	<u>Number of Events</u>				<u>Total Events</u>	<u>Total Reaches</u>
	<u>Basin Wide Status</u>	<u>Paired</u>	<u>Sensitive Species</u>	<u>Student Research/ Special Questions</u>		
Fish Assemblage	20	8	15	14	57	57
Mussel Assemblage	0	14	2	0	16	16
Benthic Macroinvertebrate Assemblage	20	8	0	19	47	47
Water Quality	20	28	15	1	64	50
Habitat	20	8	15	14	57	57
Total Locations:	20	16	15	19		

Table 4. Large-bodied species from non-wadeable streams of the Kaskaskia River basin with at least 20 individuals recorded since 2000 with length and weight measures. These species will be used to complete a fish stock index.

<u>Common Name</u>	<u>Scientific Name</u>	Number of Records <u>Since 2000</u>
Common carp	<i>Cyprinus carpio</i>	545
Channel catfish	<i>Ictalurus punctatus</i>	789
Golden redhorse	<i>Moxostoma erythrurum</i>	144
Longnose gar	<i>Lepisosteus osseus</i>	38
Shortnose gar	<i>Lepisosteus platostomus</i>	109
Shorthead redhorse	<i>Moxostoma macrolepidotum</i>	245
Spotted gar	<i>Lepisosteus oculatus</i>	40

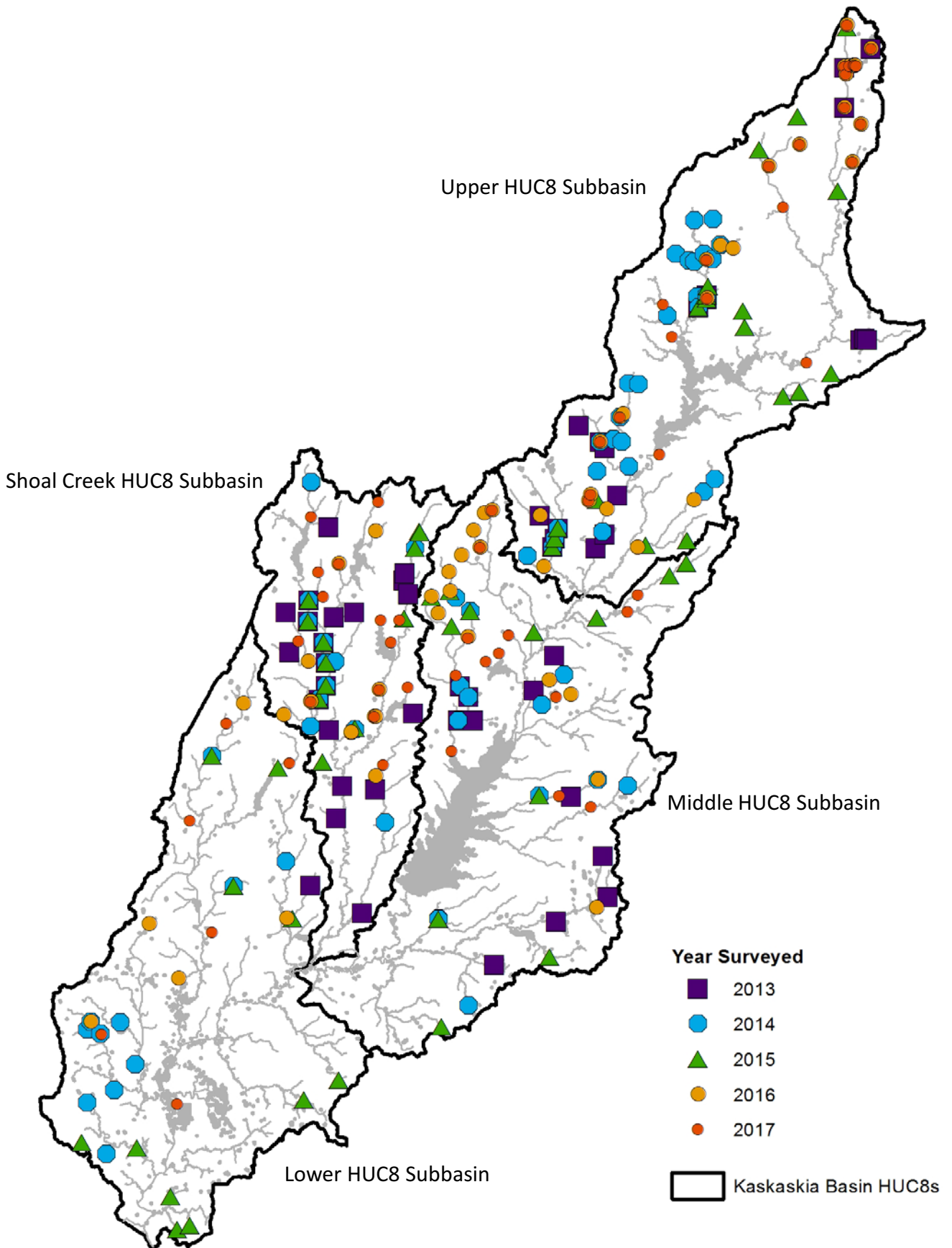


Figure 1. CREP stream bioassessment survey locations between 2013 and 2017.

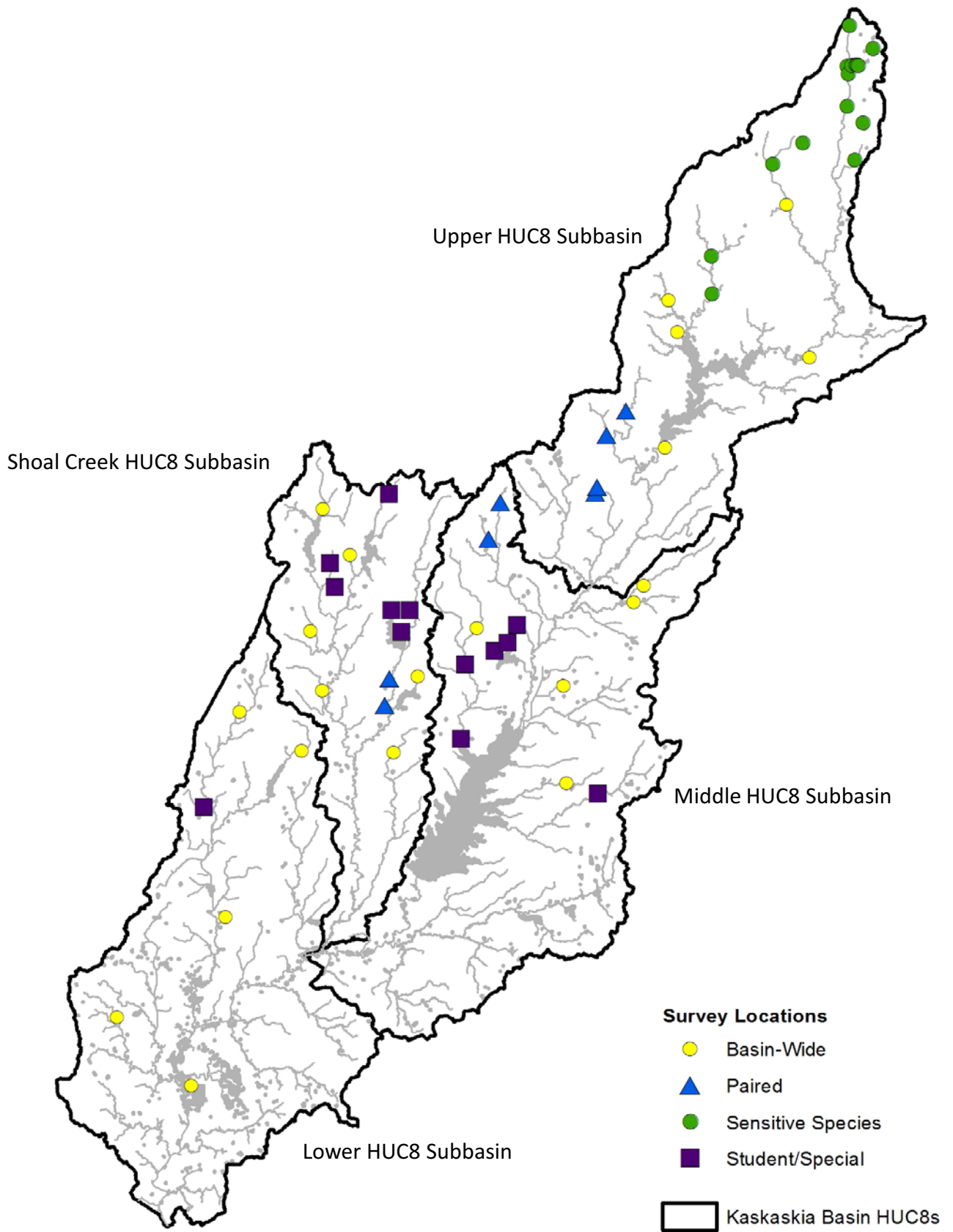


Figure 2. CREP stream bioassessment survey locations in 2017.