HINKSON CREEK COLLABORATIVE ADAPTIVE MANAGEMENT RESEARCH PROPOSAL: FY2015

Total Budget (Not to Exceed):
$186,000.00

Submitted To:
Hinkson Creek Watershed Collaborative Adaptive Management
Stakeholders, Actions and Science Teams

Date:
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Project Title:
Improving Understanding of Fish Community Relationships
to Physical Habitat Conditions in Hinkson Creek

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Background and Justification

Hinkson Creeks listing on the Clean Water Act (CWA) 303(d) list as impaired due to unknown pollutants in 1998 (MDNR, 2011; USEPA, 2011) came about due to many problems suspected by State and Federal agencies, and local residents including (but not limited to) water quality and hydrologic alteration. Suspected problems included (1) larger and more frequent floods, (2) lower base flows; (3) increased soil erosion in construction and development areas with subsequent transport of the soil to streams (i.e. altered suspended sediment regimes); (4) water contamination from urban storm water flows; (5) degradation of habitat for aquatic organisms due to the concerns listed above; and (6) degradation of aquatic habitat due to the physical alteration of stream channels and adjacent streamside (riparian) corridors (MDNR, 2009). In late November of 2008 a nested-scale experimental watershed design was implemented on Hinkson Creek (Hubbart et al. 2010) to investigate the suspected problems that led to the 1998 listing and improve understanding of contemporary land-use and urbanization effects on hydrologic processes, water quality, and biological community health. Nested watershed study designs use a series of sub-basins inside a larger watershed to examine environmental variables. Sub-basins are often determined based on dominant land use and characteristics of the hydrologic system. A nested watershed study design enables quantitative characterization of influencing patterns and processes observed at each location (Hubbart et al., 2010). Each nested monitoring site of Hinkson Creek is designed to monitor water stage and a complete suite of climate variables. Multiple additional water quality variables (e.g. suspended sediment, nitrogen, phosphorus, chloride, pH, and other constituents) have been monitored at the nested sites since shortly after implementation of the study. A United States Geological Survey gauging station (USGS-06910230) has collected stage data intermittently since 1966 and provides flow data for site 4 (Figure 1).

Stream and river restoration projects intended to improve water quality are more likely to be successful if conducted with knowledge of current and past hydrologic, geomorphological, and biological conditions in the watershed (see discussion and review in Wohl et al. 2005). It is proposed that current research efforts in Hinkson Creek, including those of the Missouri Department of Natural Resources lead macro-invertebrate monitoring, should be complemented by an improved understanding of other components of the biological community, particularly fish.

Objectives

The goal of this proposed project will be to explore how fish communities may act as indicators of types and locations of stressors affecting Hinkson Creek. We propose to collect fish community data longitudinally along the stream length of Hinkson Creek and compare that information to habitat features, physical conditions, and potential sources of impairment presently understood and quantified for the basin. In addition, indicators of poor fish health will be collected from individuals captured, including deformities, erosion of fins, lesions, and tumors along the length of study stream. Data will be collected that are consistent with and therefore comparable to existing fish data sets collected in Missouri as indicators of stream biological integrity (Doisy et al. 2008). Finally, we will collect information on growth, length frequencies,

and relative abundance of sportfish targeted by local anglers; Hinkson Creek is an important local fishing destination for residents in the Columbia, Missouri region. Improved understanding of the overall status of fish in Hinkson Creek and comparisons between Hinkson Creek fish assemblage characteristics and appropriate reference streams will provide baseline information and context from which management and restoration goals can be realistically set.

Methods

Sampling Frame: At least *N = 30* representative reaches will be selected for fish sampling in a stratified-random manner. The length of Hinkson Creek corresponding to the current Physical Habitat Assessment work (approximately 52km) will be stratified into major segments based on tributary connections entering the system or abrupt changes in landscape features, including human impact or underlying geology. Within those segments, representative reaches for sampling will be selected in a random manner, or based on access, if time does not allow a completely randomized design. In addition to fish sampling, temperature data loggers will be placed adjacent to sampling sites and physical data will be collected. Spring (May-June) and summer (July-September) sampling will be conducted in each site to capture likely seasonal changes in fish assemblage characteristics.

Sampling methods: Crews will collect fish community and associated water quality and physical habitat data in a standardized manner based on ongoing work by the Missouri Department of Conservation (MDC) Resources Assessment and Monitoring Program (RAM). All of the data available through the RAM program have been accumulated using standardized procedures (developed by EMAP) for collecting fish assemblage information in a range of wadeable streams and rivers throughout Missouri. This will be paired with standardized methods developed by the RAM program for assessing physical habitat characteristics. In all cases, existing data will be used to its greatest capacity for relating to fish community characteristics.

Study Outcomes: Product(s) and Recommendations for CAM Process

Worthwhile questions that may be asked with this type of data set include:

1) *Can the fish assemblage provide additional diagnostic insight into the causes or nature of alterations to Hinkson Creek?*
2) Given their mobile nature and reliance on a complement of habitats over the landscape to complete their life history, are fish more or less sensitive than other biological measures (e.g., invertebrates) to changes in the landscape and human impacts?
3) Do populations of local sportfish show signs of decreased growth, population size, or low recruitment in affected areas?
4) How does Hinkson Creek biological integrity, according to the fish community, compare to other systems around Missouri of similar size and closer to ‘reference’ conditions?
5) Do fish in the system follow longitudinal patterns expected in a riverine landscape? Can hotspots of diversity and abundance be identified based on tributary connections or other

landscape factors that may provide water quality refugia for fish if degradation occurs in the mainstem creek, either through human impact or drought? Conversely, can localized depauperate assemblages be diagnostic of specific water-quality effects?

6) Do faunal changes occur in the system throughout the growing season? Does reduction of flow to baseline or drought conditions result in concentration of fish to pool habitats, loss of less tolerant sportfish, faunal attenuation, an increase in incidence of fish disease or malformities, or a decrease in IBI indices through time?

Products will include improved understanding of fish species distribution and demographics of sportfish in Hinkson Creek in relation to physical habitat attributes and potential sources of stress. This information will inform the CAM process by identifying whether or not fish population problems, which are often associated with physical habitat degradation and water quality issues, exist in Hinkson Creek, and whether they can be associated with specific stressors. That information will help guide decision makers in terms of management plans to mitigate any detected fish population alterations. Study outcomes may identify land-use related impacts to fish populations that will help target most effective locations for BMP implementation projects to improve habitat for given species or species assemblages. Products will include at least one project report to CAM teams at the end of the 3 or 4 year project, a Ph.D. dissertation and at least 3 publications in the peer reviewed literature addressing the bulleted questions above.

Not to Exceed Budget

	Year 1	Year 2	Year 3	Year 4	Total
Salary - 2 Part Time Field Assist	$ 11,520.00	$12,096.00	$ 6,350.40	$ 3,333.96	$ 33,300.36
Salary, Tuition, Fringe - GRA (PhD)	$ 30,000.00	$31,500.00	$33,075.00	$34,728.75	$129,303.75
Supplies	$ 10,000.00	$ 5,000.00	$ 2,000.00	$ -	$ 17,000.00
Local Travel	$ 1,500.00	$ 1,500.00	$ 1,500.00	$ 1,500.00	$ 6,000.00
Total Direct Costs	$ 53,020.00	$50,096.00	$42,925.40	$39,562.71	$185,604.11
					$185,604.11

The U.S. Fish and Wildlife Cooperative unit is able to donate in-kind materials including lab, materials, electrofisher and a barge shocker, and a boat shocker, which is the equivalent of many thousands of dollars' worth of equipment.

Tentative Schedule

Tasks/Accomplishments	Year 1				Year 2				Year 3				Year 4			
	F	W	Sp	Su	F	W	Sp	Su	F	W	Sp	Su	F	W	Sp	Su
Student Secured for Project	X															
Field Work / Sampling			X	X			X	X								
Data Analysis					X	X	X	X	X	X	X	X	X	X		
Report #1 to CAM Teams				X	X											
Report #2, Article (s) Submitted								X	X							
Report #3, Article (s) Submitted										X	X	X	X			
Dissertation Completed															X	
Student Graduates															X	
Work Completed															X	

Reports are distributed to CAM teams. Timeline assumes Ph.D. student matriculation at noted date (could be delayed depending on qualified applicants)

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