Natural Resource Restoration in the Wabash and White Rivers Freshwater Mussel Augmentation Final Restoration Plan

August 2023

Department of the Interior
U.S. Fish and Wildlife Service

Indiana Department of Environmental Management

Indiana Department of Natural Resources

Co-Trustee concurrence on the Final Restoration Plan for:

Natural Resource Restoration in the Wabash

and White Rivers

Freshwater Mussel Augmentation

Final Restoration Plan

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Introduction

The U.S. Fish and Wildlife Service, the Indiana Department of Environmental Management, and the Indiana Department of Natural Resources, (the Trustees) have prepared a Restoration Plan (RP) to identify and analyze proposed projects that will restore natural resources injured and ecological services lost due to discharges of oil in the lower Wabash River watershed. Specifically, this RP proposes restoration projects to augment existing populations of rare, threatened and endangered freshwater mussels in or near areas where they still exist. The agencies, in their roles as Natural Resource Trustees (Trustees) solicited public input on the restoration projects proposed within this restoration plan. The public comment period for the RP was open for more than 30 days in June and July, 2023.

For decades, freshwater mussel populations in the lower Wabash River watershed have been adversely impacted by dams, dredging, sedimentation, and degraded water quality events (Jones and Neves 2002). Releases of hazardous substances into nearby soils, sediments, and surrounding waters, including tributaries within the Wabash River watersheds, have led to natural resource injuries. In addition, a number of natural resources, including surface water, sediments, fish, and migratory birds, have been exposed to and adversely affected by oil discharged from facilities in the WWR.

The Trustees developed this RP in accordance with applicable laws, including the Oil Pollution Act (OPA) and its implementing regulations applicable to the Natural Resource Damage Assessment (NRDA) process. 15 C.F.R. 990.10 *et seq*. To be sure, this RP will inform the public as to the types and scale of restoration to be undertaken towards compensating for injuries to natural resources as the result of a 2018 pipeline rupture which caused a release of oil into Big Creek, near Solitude, Indiana, a tributary of the Wabash River (the incident). The Trustees received no public comments on the draft RP and have selected Preferred Restoration Alternative(s) in the finalized RP.

Response actions implemented by the U.S. Environmental Protection Agency (EPA) related to the incident focused on the reduction of threats to human health and the environment but response actions did not address all ecological risks or to compensate the public for the ecological services lost in the interim under OPA. As a result, the Trustees undertook restoration planning activities described in this RP.

In sum, the purpose of this RP identifies and evaluates projects to restore injured natural resources and services lost due to releases of oil into Big Creek and the Wabash River associated with the incident in the Wabash River watershed. Specifically, the goal of this RP is to improve populations of rare freshwater mussel species.

Natural Resource Trustee Authority

Under federal law, the Trustees are authorized to act on behalf of the public to assess injuries to natural resources and services resulting from the release of hazardous substances and discharges of oil into the environment. The Trustees for the NRDA are the State of Indiana, represented by

the Indiana Departments of Natural Resources (IDNR) and Environmental Management (IDEM), and the Department of the Interior, represented by the U.S. Fish and Wildlife Service (USFWS). The NRDAR process allows Trustees to pursue claims against responsible parties for monetary damages based on these injuries in order to compensate the public. The work proposed in this restoration plan will compensate the public for the injury to the public resource as a result of releases of oil from the incident. This plan is written in accordance with the requirements of the OPA, 33 U.S.C. 2701 *et seq*., and its implementing regulations applicable to the NRDA process, 15 C.F.R. 990.10 *et seq.*

Summary of NRDAR Settlement

The natural resource Trustees recovered monetary damages from Marathon Pipe Line LLC in 2021 to settle legal claims concerning injuries to natural resources and their services associated with the incident which caused discharges of oil (diesel) into Big Creek near Solitude Indiana (USFWS 2019a). Currently there is approximately $370,504 to fund the restoration projects the Trustees propose in this RP.

Public Participation

Public participation and review is an integral part of the restoration planning process, and is specifically required in the OPA NRDA regulations [15 C.F.R. §990.55(c)]. This RP was open for public comment for more than 30 days in June and July 2023, available on the US Fish and Wildlife Service website at: https://www.fws.gov/library/collections/marathon-pipe-line-llc-diesel-spill-big-creek-nrdar-administrative-record-index, including several public notices published in several local newspapers. The Trustees received no comments from the public on the proposed RP. The Trustees will implement the preferred alternatives described herein. As always, the Trustees are interested in hearing from individuals, organizations, and agencies concerning these RP efforts. Comments can be shared with the Trustees by writing or emailing:

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As restoration progresses, the Trustees may amend the Final RP if significant changes are made to the types, scope, or impact of the projects. In the event of a significant modification to the Final RP, the Trustees will provide the public with an opportunity to comment, as appropriate.

Affected Environment and Summary of Injury to Natural Resources

The state of Indiana ranks 23rd in oil production nationally (Fig. 1), and there are many storage terminals and refineries in Indiana. Many crude oil and refined product pipelines crisscross rivers and streams throughout Indiana (Fig. 2) with generally speaking, few incidents.

The Trustees have had 9 occasions in the past 3 decades to initiate damage assessments related to oil production, refining and transport. In addition, dozens of other spills during this time frame were evaluated for potential damage assessments. This continuing threat of additional discharges of oil into the Wabash River and its tributaries makes restoration planning for mussel restoration all the more important.

As discussed herein, natural resource injuries occurred in Big Creek as a result of a diesel fuel pipeline rupture near Solitude, Indiana in 2018. The rupture occurred immediately upstream of a recent record of the federally endangered freshwater mussel, the fat pocketbook (*Potamilus capax*) (USFWS 2019). Records indicate fat pocketbook mussels are present at the confluence of Big Creek with the Wabash River (Cummings et al. 1992; Fisher 2006a, b), an area likely impacted by the diesel spill. Big Creek is an important resource, serving as a nursery area for a wide variety of mussel host fish. In 2008, Bandoli et al. found 40 different species of fish within Big Creek and its tributaries (Bandoli et al. 2010).

For more information on Trustee initiated Natural Resource Damage Assessments and other studies that have demonstrated injury to natural resources, please see our websites at:

https://www.fws.gov/project/marathon-pipe-line-llc-big-creek-and-knightsville-oil-spills-natural-resource-damage

The restoration projects in this RP are intended to augment the most imperiled aquatic natural resources that are within the Trustees current abilities to restore. The lower Wabash River historically contained 43 species of freshwater mussels in vast numbers. Armitage and Rankin (2008) completed an in-depth analysis of the imperiled aquatic resources in the Wabash and White Rivers. This RP considers restoration projects to restore and augment the most imperiled species using recovered NRDA funds. Although injuries occurred from this incident were located in Big Creek and at its confluence with the lower Wabash River, the restoration projects identified herein are intended to optimize Trustees' restoration efforts by focusing initial augmentation efforts in upstream areas near potential broodstock.

The proposed alternative in the draft RP was selected for implementation, the results of which we hope will increase populations of mussels in the middle and lower reaches of the Wabash River. The selected alternative within this RP, as depicted in Fig. 4, covers a portion of the White River, representing the Trustees' priority restoration area.

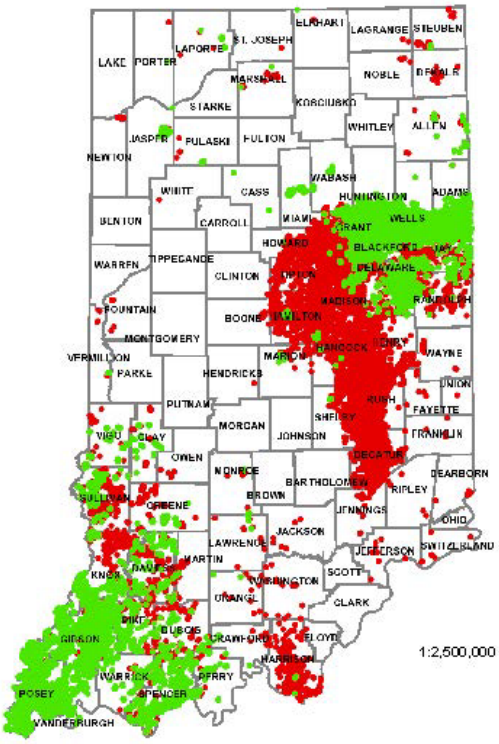

Fig. 1. Crude oil (green) and natural gas (red) production wells from 1889 to the present from the largely exhausted Trenton formation (east central Indiana) and the Illinois Basin (southwest Indiana) (IGS 2004).

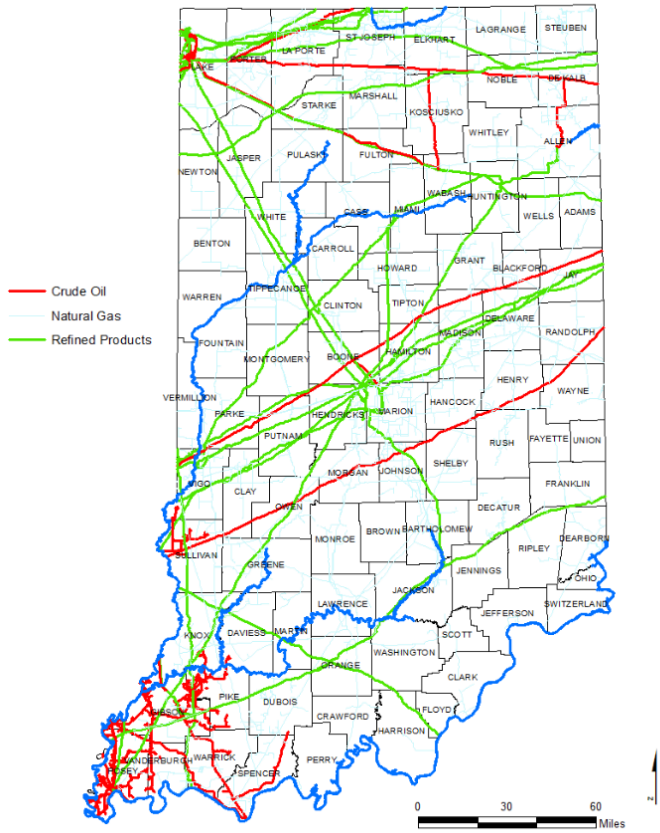

Fig. 2. Crude oil and refined product pipelines in Indiana (IGS 1988).

Project Coordination

The Natural Resource Trustees, collectively, will be responsible for overall project coordination and support. The Trustees will work to ensure that the projects meet the NRDA requirements and fulfill the goals of this restoration plan. The trustees will be responsible for identification and implementation of the chosen alternative, coordination with all stakeholders, and any other necessary restoration procedures. Approval of restoration projects, sites, activities, and fund allocation will be through unanimous agreement by the Natural Resource Trustees via Trustee Council Resolutions.

Proposed Restoration Alternatives

Restoration Alternatives Development and Evaluation

A reasonable range of restoration alternatives to address one or more specific injuries while making the environment and the public whole were considered, including natural recovery/no action. For each alternative, considerations were given to costs, benefits, likelihood of success, and effects on public health and safety. In the initial formulation of restoration options, the Trustees considered restoration projects for augmenting common mussels species. However, in evaluating current threats and the imperiled status of many species, the Trustees have chosen to emphasize working with rare, threatened and endangered species while we still can.

Alternative Comparison Criteria

As required by 15 CFR § 990.54 (a), the following criteria were used to compare restoration alternatives:

(1) The cost to carry out the alternative;
(2) The extent to which each alternative is expected to meet the trustees' goals and objectives in returning the injured natural resources and services to baseline and/or compensating for interim losses;
(3) The likelihood of success of each alternative;
(4) The extent to which each alternative will prevent future injury as a result of the incident, and avoid collateral injury as a result of implementing the alternative;
(5) The extent to which each alternative benefits more than one natural resource and/or service;
(6) The effect of each alternative on public health and safety.

In addition to the required criteria, the following criteria were also used to select the appropriate restoration alternatives:

- federal listing status
- the urgency to take actions for declining populations to address injuries
- challenges of working with the species
- hatchery experience with the species

- difficulty of collecting broodstock
- current presence of known host fish near current/historic mussel records for considered species

Alternative 1: No Action Alternative (no mussel augmentation efforts)

Due to current site conditions, native populations of many of these species may not recover without intervention. Modifications to the Wabash and White Rivers and their riparian corridors have reduced potential suitable habitat. Spills continue in the watersheds infrequently but do have an adverse impact to water quality. Many stream reaches have been channelized and banks have been denuded of vegetation. Although fat pocketbook can endure in ditched streams (Miller and Payne 2005), it is not optimum for most aquatic species. Eroding banks increase sediment loads in the watersheds which can negatively impact feeding clearance rates, fertilization success, glochidial development, and cause reproductive failure (Goldsmith et al. 2021). It currently is not feasible to locate and monitor remnant populations nor to expect natural recovery.

Alternative 2: Freshwater mussel augmentation in the lower Wabash River

The previously described site conditions are expected to decrease the likelihood of success for natural recovery and interfere with efforts to assist freshwater mussel recovery in the lower Wabash River. Increased sedimentation, poor bank stability, and water depth make mussel augmentation efforts in the lower Wabash River significantly more complicated at present. Water conditions at these locations increase the difficulty and costs of stocking and monitoring mussel populations in the lower Wabash River. USGS stream gauge data near these locations show annual average water depths of seven to ten feet. Such conditions limit monitoring to periods of low water, which can be of short duration and not always predictable, or require hiring qualified divers to conduct monitoring. Comprehensive monitoring efforts in the lower Wabash River would require significant level of biologist efforts and would not likely lead to large finds of broodstock. Attempting mussel augmentation efforts in closer proximity to known or potential sources of broodstock would enhance our chances of success.

Alternative 3: Freshwater mussel augmentation upstream near potential broodstock (Selected)

The preferred alternative consists of attempting to augment populations of sheepnose and fanshell mussels, to the extent we are able as we develop the tools and abilities in partnership with malacological experts. Augmentation of several mussel species was considered within this alternative, including: fat pocketbook (*Potamilus capax*), sheepnose (*Plethobasus cyphyus*), fanshell (*Cyprogenia stegaria*), round hickorynut (*Obovaria subrotunda*), scaleshell (*Leptodea leptodon*), and spectaclecase (*Cumberlandia monodonta*). Each of these species, with the exception of the scaleshell and spectacle case mussels, has historically been found in the Wabash River system. Scaleshell and spectacle case mussels were considered because of potentially having undiscovered populations within Indiana based on the presence of known populations in Illinois and Kentucky.

Table 1. Decision matrix

Species	Listing status	Record of presence in state	Recent records (< 20 years old)	Host fish present at record location	Potential for local brood stock	Estimated rearing cost	Challenges
fanshell *(Cyprogenia stegaria)*	E	Y	Y	Y	moderate with aggregation	$90,510	Collection of broodstock, new species to hatchery
fat pocketbook *(Potamilus capax)*	E	Y	Y	Y	low	$57,560	Collection of broodstock, new species to hatchery, mussel and host habitat characteristics
round hickory nut *(Obovaria subrotunda*	P, T	Y	N	Y	extremely low	$90,510	Collection of broodstock, source of host fish for hatchery brooding, transformation rates on host fish, new species to hatchery, low presence of host fish at site
scaleshell *(Leptodea leptodon)*	E	N	n/a	n/a	n/a	$56,140	Collection of broodstock, permission to produce, new species to hatchery, no records of presence in state
sheepnose *(Plethobasus cyphyus)*	E	Y	Y	Y	extremely low	$60,350	Short term brooder, low transformation rates on host fish, slow growing
spectaclecase *(Cumberlandia monodonta)*	E	N	n/a	n/a	n/a	$75,350	Collection of broodstock, timing of spawning, handling sensitivity of host fish, slow growing, no records of presence in state

E = endangered, T = threatened, P = proposed, N = no, Y = yes, n/a = not applicable

Fat Pocketbook

Populations of fat pocketbook are the nearest federally listed species to the Marathon pipeline rupture in Solitude, Indiana. There are multiple reproducing populations of fat pocketbook within Indiana. These populations occur in the Wabash River in Knox, Gibson, and Posey counties. Populations within the Wabash River appear to be doing well, with records as recent as 2016 and as many as 21 individuals being found at a single location. Individuals can also be found in tributaries of the lower Wabash River, the mainstem lower White River, and the mainstem Ohio River, although status of reproduction is unknown in these waterways. One site in the White River near Hazelton, Indiana could potentially serve as a restoration location (Fig. 3). It has nearby historical records of fat pocketbook. Mussel presence records for the location indicate that fat pocketbook were last observed at this location in 1976. Freshwater drum were collected at this location in 2020 by the Indiana Department of Environmental Management.

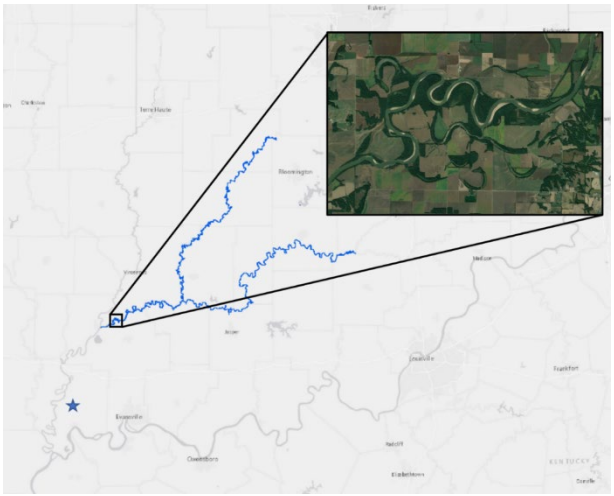

Fig. 3. Candidate location near Hazelton, Indiana for augmentation of fat pocketbook mussel populations.

Fanshell

Only two populations of fanshell are currently known to exist in Indiana: one in the East Fork White River in Martin County, and one in the Tippecanoe River in White, Carrol, and Tippecanoe counties. There is believed to be some natural recruitment occurring at these locations (USFWS 2019b). There is low likelihood of finding gravid females within the East Fork White River. Though gravid females may not be found under current conditions, it may be possible to aggregate fanshell located during searches to potentially cause gravid females to be present the following season. Host fish were captured at several locations in the East Fork White River (Table 2).

Table 2. Fanshell (*Cyprogenia stegaria*) host fish species

Common Name	**scientific name**	**Common Name**	**scientific name**
banded darter	*Etheostoma zonale*	greenside darter	*Etheostoma blennioides*
banded sculpin	*Cottus carolinae*	mottled sculpin	*Cottus bairdii*
blackside darter	*Percina maculata*	blotchside logperch	*Percina burtoni*
logperch	*Percina caprodes*	Roanoke darter	*Percina roanoka*
snubnose darter	*Etheostoma simoterum*	tangerine darter	*Percina aurantiaca*

Sheepnose

Records show that sheepnose mussels are present in healthy populations in the Tippecanoe and Ohio Rivers. Records show an additional presence of the species in the Wabash River, the Eel River, and the East Fork White River (USFWS 2020). A single live individual was collected from the East Fork White River in Martin County in 1992. With only a single live record of this species, distribution of the Sheepnose in the White River is expected to be sparse. Table 3 lists the host fish species for Sheepnose. Finding gravid females or enough individuals for aggregation from this location may not be successful. Gravid females for augmentation will likely have to be sourced from other locations in the Wabash River system.

Table 3. Sheepnose (*Plethobasus cyphyus*) host fish species.

Common Name	**scientific name**
Allegheny pearl dace	*Margariscus margarita*
banded killifish	*Fundulus diaphanus*
blackspotted topminnow	*Fundulus olivaceus*
blacktail shiner	*Cyprinella venusta*
bleeding shiner	*Luxilus zonatus*
bluntnose minnow	*Pimephales notatus*
brassy minnow	*Hybognathus hankinsoni*
bullhead minnow	*Pimephales vigilax*
central stoneroller	*Campostoma anomalum*
common shiner	*Luxilus cornutus*
creek chub	*Semotilus atromaculatus*
eastern blacknose dace	*Rhinichthys atratulus*
emerald shiner	*Notropis atherinoides*
fathead minnow	*Pimephales promelas*
golden shiner	*Notemigonus crysoleucas*
hornyhead chub	*Nocomis biguttatus*
largescale stoneroller	*Campostoma oligolepis*
longnose dace	*Rhinichthys cataractae*
mimic shiner	*Notropis volucellus*
Mississippi silvery minnow	*Hybognathus nuchalis*
Ozark minnow	*Notropis nubilus*
red shiner	*Cyprinella lutrensis*
river shiner	*Notropis blennius*
sauger	*Sander canadensis*
silver chub	*Macrhybopsis storeriana*
southern redbelly dace	*Chrosomus erythrogaster*
spotfin shiner	*Cyprinella spiloptera*
spottail shiner	*Notropis hudsonius*
steelcolor shiner	*Cyprinella whipplei*
striped shiner	*Luxilus chrysocephalus*
suckermouth minnow	*Phenacobius mirabilis*
Topeka shiner	*Notropis topeka*
western mosquitofish	*Gambusio affinis*
whitetail shiner	*Cyprinella galactosa*

Round Hickorynut
The round hickorynut, which has been recently listed, has several populations in the state including in the Tippecanoe River, the Eel River in Cass County, and the West Fork White River in Greene County. There are sparse records of the species being located in the East Fork White River and its tributaries. A specimen was found in 1992 in Martin County, in 1991 in Jackson County, and in 1990 in Johnson County. These records occur at a distance of over 30 linear miles between records. Natural recovery of this species in the East Fork White River system is not expected. Gravid females for augmentation will have to be sourced from another river.

Scaleshell and Spectacle Case
Although these two species have records in tributaries to the Wabash River on the Illinois side and the Ohio River on the Kentucky side, there are no known records of them occurring within the state of Indiana. The lack of local records currently precludes the ability to find suitable augmentation locations. It would also not be possible to locate gravid females from local genetic populations.

Based on the criteria described above, sheepnose and fanshell mussels were selected as the most appropriate candidate species for recovery (Fig. 4). Aside from other fat pocketbook populations, these two species were once prominent in the lower and middle Wabash River system. Populations of these mussels in the East Fork White River, in the vicinity of Shoals, Indiana, were selected as the best candidates for augmentation. This area of the river was historically known for vast mussel beds. The popularity of shell buttons during the early 20th Century led to the establishment of a button factory in Shoals, which produced the button blanks punched out from mussel shells. As demand for shell buttons diminished in the mid-20th Century, the local mussel beds got a reprieve until the 1960's. A demand for shells from freshwater mussels to be used as seed material for pearls from oysters restarted harvesting from the Shoals area. Unsustainable practices employed by these industries led to the overharvesting that depleted the populations of mussels in this area.

Summary of Environmental Consequences by Alternative

In this section, the Trustees analyzed the environmental consequences of Alternatives 1, 2, and 3 to determine whether implementation of any of these alternatives may significantly affect the quality of the human environment, particularly with respect to the physical, biological, socio-economic, or cultural environments. This section also identifies the Selected Alternative.

Alternative 1: No Action Alternative (no mussel augmentation efforts)

Under this Alternative, the Trustees would not initiate specific actions to restore injured natural resources and their services to baseline conditions or compensate the environment and the public for natural resource injuries caused by the discharges of oil into the environment.

Under this Alternative, the state and federal agencies and landowners would continue to manage, conserve and protect the sites within the WWR watersheds as outlined in current programs and

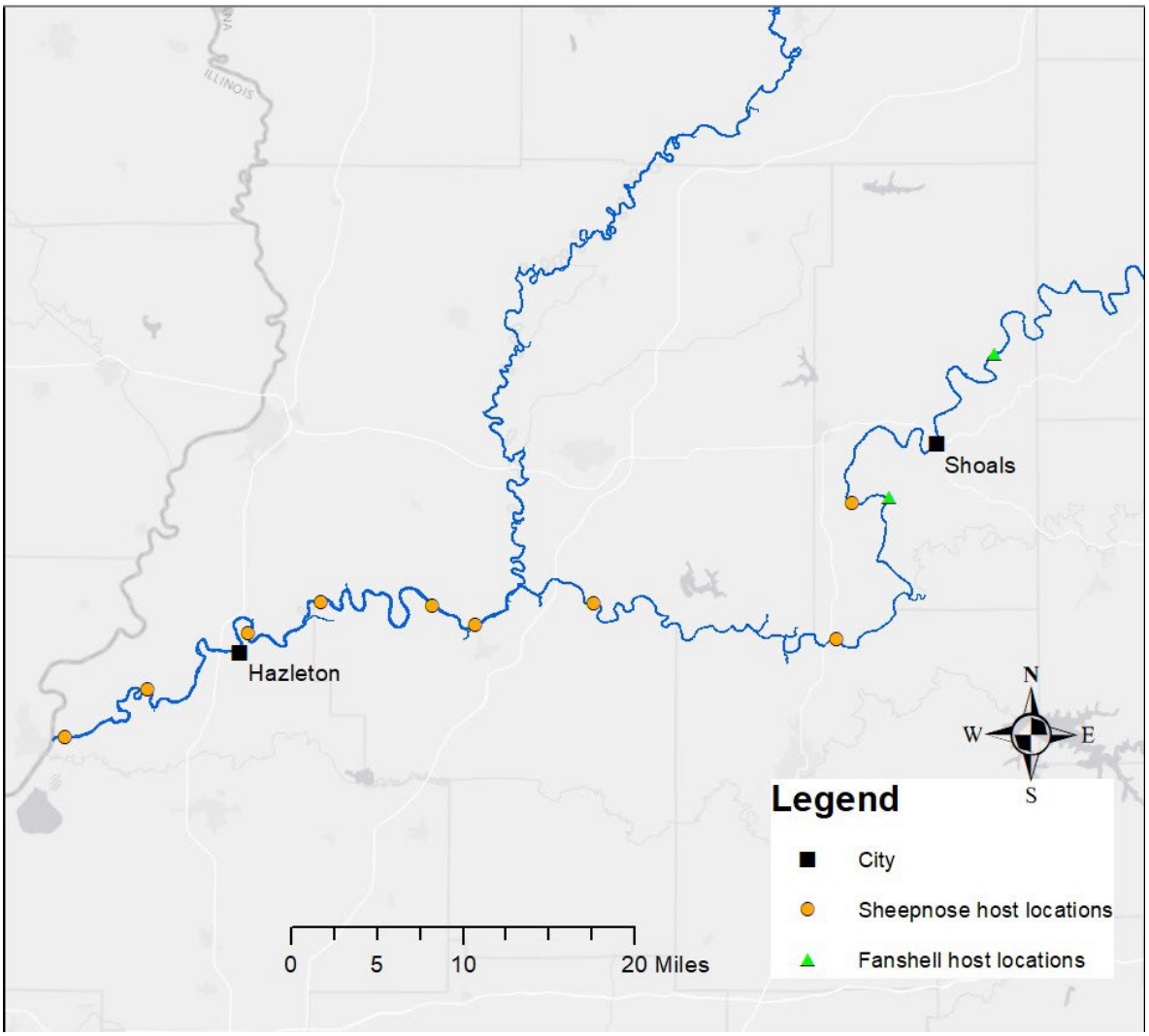

Fig. 4. IDEM fish community sampling locations in the White River and East Fork of the White River at which fanshell and sheepnose host fish were captured.

regulations and within applicable budget constraints. However, no additional action would be taken to compensate for injuries to natural resources or their services.

The goal of this restoration plan is to address the resource injuries resulting from discharges of oil to the lower Wabash River. This alternative does not allow for restoration replacement or acquisition of equivalent resources injured from spills. Without restoration, compensation for injury to natural resources would not occur. Rare species of mussels will likely continue to decline.

Alternative 2: Freshwater mussel augmentation in the lower Wabash River

The environmental consequences of implementing a freshwater mussel augmentation effort in the lower Wabash River would be a diminished chance of success, with a difficult and likely delayed ability to document restoration progress. Embarking on mussel augmentation efforts will be challenging as we work with rare species to develop successful culturing techniques. Success with culturing young mussels from gravid females (a precursor to augmenting in-stream populations) could potentially benefit management of these rare species. However, these gains in juvenile rare mussels may not be given a maximum chance at survival and reproduction due to the degree of difficulty working in the lower Wabash River currently presents.

Alternative 3: Freshwater mussel augmentation upstream near potential broodstock (Selected)

The environmental consequences of implementing a freshwater mussel augmentation effort areas upstream from the lower Wabash River near potential broodstock provide the greatest chances of a successful augmentation effort. Based on the criteria described previously, sheepnose and fanshell mussels were selected as the most appropriate species to work with for recovery. Initiating augmentation efforts with sheepnose and fanshell mussels to develop successful culturing techniques will greatly benefit species recovery. Augmenting populations of these mussels in the East Fork White River, in the vicinity of Shoals, Indiana, with these cultured juveniles will maximize chances for survival and reproduction. In addition, as we will be able to monitor success more easily which in turn may optimize restoration and recovery of these species. Beginning our work here might begin to rejuvenate these historically vast mussel beds.

Environmental Compliance

Actions undertaken by a federal trustee to restore natural resources or services under OPA are subject to the National Environmental Policy Act (NEPA) (42 U.S.C. § 4321 et seq.) and other federal laws. This plan meets the criteria for a categorical exclusion from a NEPA analysis under the Department of the Interior's Departmental Manual chapter on managing the NEPA Process for the U.S. Fish and Wildlife Service, 516 DM 8.5 (B)(6) and (11). A categorical exclusion from National Environmental Protection Act (NEPA) procedures is provided for actions implemented by the USFWS for:

> the reintroduction or supplementation (e.g., stocking) of native, formerly native, or established species into suitable habitat within their historic or established range, where no or negligible environmental disturbances are anticipated [516 DM 8.5 (B)(6)]; and
>
> Natural resource damage assessment restoration plans, prepared under sections 107, 111, and 122(j) of the Comprehensive Environmental Response Compensation and Liability Act (CERCLA); section 311(f)(4) of the Clean Water Act; and the Oil Pollution Act; when only minor or negligible change in the use of the affected areas is planned [516 DM 8.5 (B)(11)].

The completed Environmental Action Statement (EAS) is included at the end of this RP.

Any additional environmental compliance required, including compliance with Endangered Species Act (ESA) consultation and National Historic Preservation Act (NHPA), as appropriate, will occur prior to implementation of restoration.

Monitoring

The monitoring of this restoration plan will be conducted by the Natural Resource Trustees or their designated representatives. After a sufficient period of growing out juvenile mussels, an effort to tag mussels so that they can be monitored is important. This involves using adhesives and pit tags. Monitoring mussel augmentation sites should take place annually after river placement. Monitoring efforts will be documented to evaluate the success of our efforts.

Project Contacts

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