Fish Habitat Assessment and Restoration in the Huron-Erie Corridor

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Introduction - The international Huron-Erie Corridor (HEC) includes southern Lake Huron, the St. Clair River, Lake St. Clair, the Detroit River, and western Lake Erie. Conflicting uses of HEC waters for waste disposal, water withdrawals, shoreline development, shipping, recreation, and fishing have resulted in a number of environmental changes to this system including loss and impairment of fish spawning and nursery habitat (Figure 1).

As part of the HEC Initiative developed in 2004, an international collaborative science-based adaptive management approach was developed that allows flexibility to address natural resource issues in the complex and ever-changing environments within the HEC.

Goals of the HEC Initiative include: 1) Restore/improve the ecological function and resilience of the HEC ecosystem, 2) Maintain healthy, diverse, and productive aquatic ecosystems throughout the HEC that will in turn provide societal, economic, and environmental benefits to the Great Lakes region and throughout the U.S. and Canada.

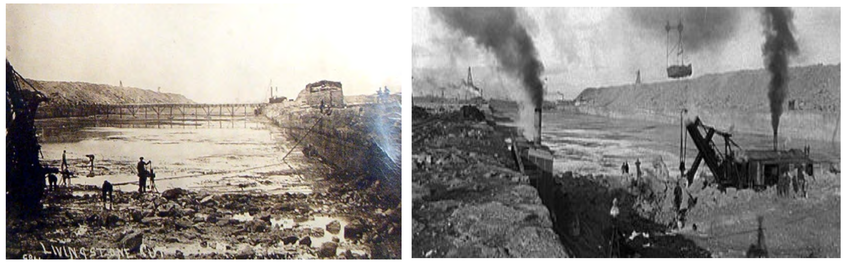
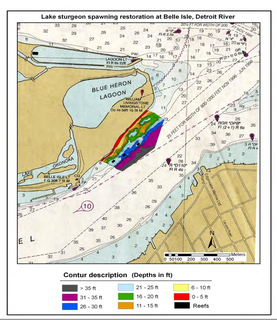


Figure 1. Construction of the Livingstone Channel in the lower Detroit River removed vast areas of spawning habitat.

Spawning Habitat – Interdisciplinary assessment of the extent of spawning habitat used by fish in the Detroit River identified two candidate sites where spawning habitat rehabilitation would be feasible and result in expanded opportunities for fish reproduction. Based on these findings, spawning reefs were constructed at Belle Isle in 2004 and Fighting Island in 2008 (Figure 2). Response by fishes was immediate and widespread (Table 1; Manny et al. 2007).

Table 1. Spawning adults and/or viable eggs found on constructed reefs at Belle Isle and Fighting Island, Detroit River 2005-2009.

Walleye	Emerald shiner
Northern hog sucker	Quillback
Shorthead redhorse	Lake whitefish
Silver redhorse	White bass
White sucker	Northern pike
Yellow perch	White perch
Round goby	Rock bass
Trout-perch	Lake sturgeon



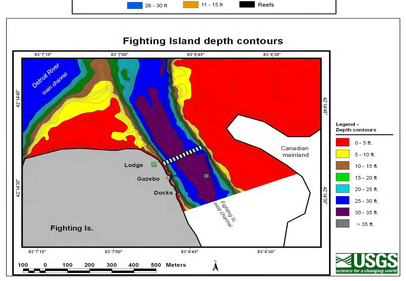


Figure 2. Locations of artificial fish spawning reefs constructed in the Detroit River.

Larval Fish Habitat – Intensive larval fish surveys conducted in the 1970s and 1980s in the main channels of the HEC found 25 species of larval fish with alewives, rainbow smelt, and gizzard shad in high abundance (Hatcher and Nester 1983). From 2006 through 2009, we sampled larval fish in the main channel and fringe habitats of the Detroit River finding 32 species (Table 2). Alewives and rainbow smelt were rare during 2006-2009, while yellow perch, white bass, gizzard shad, and spottail shiners were abundant. Notably, lake whitefish were found in relatively high abundance in the middle and lower sections of the river during 2006-2009 (Figure 3) near areas where spawning and egg incubation occurred (Roseman et al. 2007). Lake whitefish were rare in the 1970-80s study and their presence in recent surveys reflects improved spawning habitat conditions in the river. Also noteworthy, larval lake sturgeon were collected downstream of the newly constructed reef at Fighting Island in 2009. Lake sturgeon are listed as threatened in Michigan, Ohio, and Ontario.

Table 2. Representative larval fish collected in the Detroit River, 2006-2009.

Burbot	Longnose gar
Deepwater sculpin	Carp
Lake whitefish	Emerald shiner
Walleye	Gizzard shad
Yellow perch	Alewife
Rainbow smelt	White bass
Catastomus (suckers)	White perch
Moxostoma (redhorses)	Darters & logperch
	Troutperch
Muskellunge	Round goby
Smallmouth bass	Sand shiner
Bluegill	Common shiner
Black crappie	Spottail shiner
Pumpkinseed	Silver chub
Lake sturgeon	Bluntnose minnow

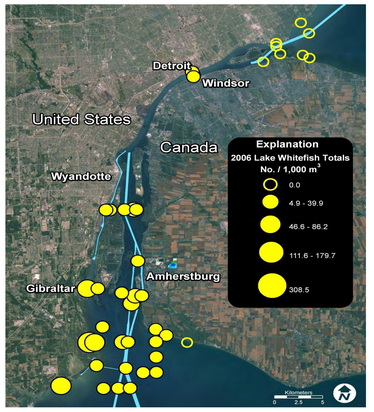


Figure 3. Distribution of larval lake whitefish in the Detroit River during 2006.

Juvenile Nursery Habitat in HEC Coastal Marshes - A multi-agency task force assessed the extent of juvenile fish use of HEC coastal marsh areas from 2004 – 2008 (Figure 4). Electrofishing, seining, and fyke netting showed these areas are important nurseries for juvenile fish (Table 3). While the spatial extent of these juvenile fish nursery habitats is limited, results indicate that some level of connectivity and retention exists between spawning, larval, and nursery habitats allowing fish access to areas where their early life history needs are adequately met. New research measuring the ecological relationships that structure these coastal marshes will guide development of future habitat rehabilitation strategies.

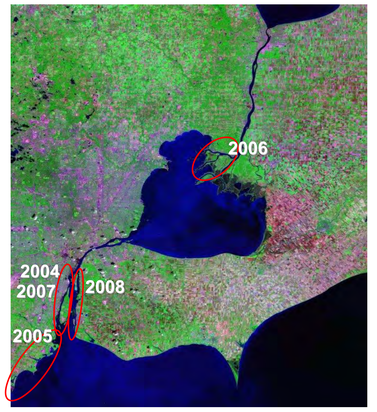


Figure 4. HEC coastal marsh areas sampled for fish use as nursery areas, 2004 – 2008.

Juvenile fishes collected from HEC coastal marshes.

Table 3. Examples of juvenile fish communities observed during assessments of HEC coastal marsh nursery areas.

Lake Erie 2005		Detroit R. 2006	
5,131 fish 47 species 15 families		13,103 fish 56 species 16 families	
Gizzard shad	15.8%	Bluntnose min.	33.3%
Bluegill	12.2%	L-mouth bass	18.5%
Pumpkinseed	10.0%	S-mouth bass	8.3%
Goldfish	7.4%	Bluegill	6.1%
L-mouth bass	3.9%	Rock bass	3.8%

2010 and Beyond – As part of the Great Lakes Restoration Initiative, we will expand research and management efforts to assess and rehabilitate fish spawning and nursery habitats in the HEC to enhance sustainable, native fish populations. To this end, our objectives include:

1) Use sound science to measure physical and biological habitat parameters within the HEC; identify locations where natural spawning and/or nursery habitat exists; and identify locations where habitat improvement projects would attract and enhance native fish populations.

2) Integrate geospatial and hydrodynamic models to estimate natural habitat attributes (geomorphology, flow regimes, depths, substrate characteristics, and bank slope; Holtschlag and Koschik 2002) as baseline parameters for fish habitat restoration by assisting an ongoing EPA funded project to meet AOC delisting goals by developing a "blueprint" for fish habitat restoration in the HEC.

3) Use information gleaned from objectives 1 and 2 to develop ecological process models that couple physical and biological fish habitat parameters and to identify sites where productive fish habitat can be restored.

4) Based on results of objectives 1-3, select candidate sites for construction of fish habitat (spawning reefs and nursery areas) to expand, improve, and restore habitats that produce native fishes;

5) Use accepted scientific methods and adaptive management principles to monitor the suitability of restored and constructed fish habitats to native fish populations and adjust research and management objectives accordingly.

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