Assessment of Lake Sturgeon Habitat in Lake Ontario and St. Lawrence River Tributaries.

Dawn E. Dittman[1], Emily C. Zollweg[2], Marc A. Chalupnicki[1], James H. Johnson[1], and James Snyder[3]

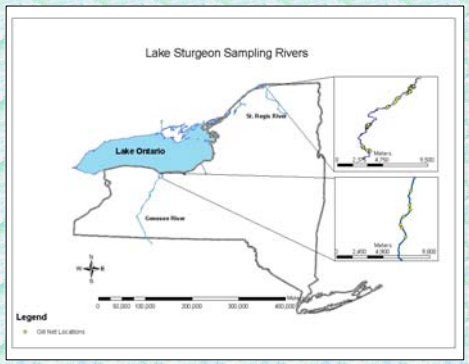
[1]Tunison Laboratory of Aquatic Science, U.S. Geological Survey Great Lakes Science Center, 3075 Gracie Rd., Cortland, NY 13045.

[2]Lower Great Lakes Fishery Resources Office, U.S. Fish and Wildlife Service, 405 North French Road, Suite 120A, Amherst, NY 14228.

[3]St Regis Mohawk Tribe Environment Office, 412 State Rt. 37, Hogansburg, NY 13655

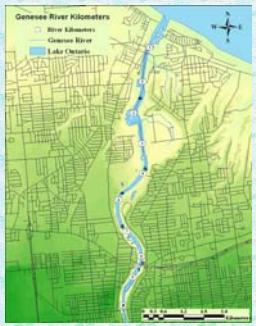
ABSTRACT

One of the top priorities in restoration of native fish communities is the assessment of the current available habitat quality in the target ecosystem. In response to the imperiled status of one key native species, the lake sturgeon (*Acipenser fulvescens*), the New York State Department of Environmental Conservation formulated a recovery plan to maintain and establish lake sturgeon populations in at least eight separate locations. As part of the implementation of the recovery plan, pre and post stocking assessments of sturgeon habitat quality and use by the released sturgeon have been conducted in two North flowing but quite different rivers. These rivers were the Genesee River - a major tributary to Lake Ontario (9 km of accessible habitat - low gradient, 1,900 fingerlings), and the St. Regis River – a tributary to the St. Lawrence River, (32 km of accessible habitat – higher gradient, 5,000 fingerlings). A habitat suitability index (HSI) for lake sturgeon and an index of biotic integrity (IBI) were applied to each river. Released juvenile sturgeon are successfully using both rivers in habitat that is predominantly consistent with the HSI and IBI evaluations. Contrasts in sturgeon habitat use and the HSI and IBI values for these rivers give insights into the status, process, and next steps in the recovery plan for lake sturgeon and the native fish community of Lake Ontario and St. Lawrence River tributaries.



METHODS: Sturgeon Assessment

Experimental gill nets were used to capture fish in various habitats. Each monofilament net was 38 m long, 2.4 m deep, ranging in size from 5 cm to 15 cm stretched mesh . The nets were set at a 45º angle to the shore for 20 to 24hrs. Fish caught in each gill net were measured and identified, lake sturgeon which were also weighed and tagged with a floy tag. All fish were released back into the river. GPS capture locations were recorded. Assessments were done monthly May to October for 2 years in each river.



2003 900 stocked
2004 1000 stocked

Estimate of the Sturgeon # in the Genesee

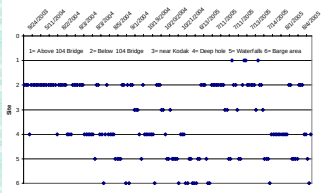
August	2005	1,045	CI 817-1433
May	2006	1,365	
October	2006	1,385	

609 Total Marked

		03YC	04YC
August	2005	437 mm & 338 g	298 mm & 113 g
May	2006	489 mm & 513 g	359 mm & 199 g
October	2006	527 mm & 657 g	452 mm & 113 g

- **Juvenile sturgeon are staying the river in excellent numbers.**
- **The habitat in which the fish were captured was gravelly to sandy.**
- **Most captures were in the deepest sections of a given river reach.**
- **Growth was similar to growth in other systems.**

90 to 154 mm average / yr



Genesee River capture locations of 03YC sturgeon

Largest Sturgeon 03 YC: 589 mm & 1,250 g

Thanks for invaluable assistance with field work and laboratory work and analysis go to D. Carlson, K. Douglas, R. McDonald, P. Randall, R. Reese, T. Wallbridge, USGS seasonal personnel, and NYSDEC field and hatchery personnel. Major funding was provided by the USEPA.

METHODS:IBI FISH COMMUNITY

A fish biotic index was calculated for gill net catches at each site using a biotic program following the original method of Karr (1981). Fourteen of the eighteen metrics; Native species, Species of Cyprinidae, Intolerant species, Nonindigenous species, Species of native Percidae, Number of individuals, Proportion as nonindigenous, Proportion as top carnivores, Proportion as benthic insectivores, Proportion as general feeders, Proportion as water column insectivores, Proportion as Logperch, Species of Centrarchidae, Proportion as Catastomidae, were selected to have a positive or negative effect on the community structure. Following selection, IBI scores were calculated by the program based on life history information of fish collected in rivers and the Finger Lakes in New York. The final standardized values summed from the fourteen metrics were categorized into three health ranges; Poor, Fair, Good.

GENESEE FISH IBI RESULTS

Example Fish IBI Scores- Gill Nets
Genesee October 04

Below 104	Site #2	40.58	Fair
LAS Tree	Site #2a	54.27	Fair
Kodak1	Site # 3	20.11	Poor
Kodak 2	Site # 3	24.15	Poor
30"Hole	Site # 4	42.02	Fair
Falls	Site # 5	50.03	Fair
Barge	Site # 6	61.61	Good

Example Fish IBI Scores- Gill Nets
Genesee June 05

Above 104	Site # 1	37.06	Poor
LAS Tree	Site #2a	53.03	Fair
Kodak1	Site # 3	31.44	Poor
Kodak 2	Site # 3	50.08	Fair
30"Hole	Site # 4	41.13	Fair
Falls	Site # 5	35.30	Poor
Barge	Site # 6	48.87	Fair

Example Fish IBI Scores- Gill Nets
Genesee October 06

Below 104	Site #2	30.57	Poor
LAS Tree	Site #2a	33.10	Poor
Kodak1	Site # 3	54.10	Fair
Kodak 2	Site # 3a	22.57	Poor
30"Hole	Site # 4	40.02	Fair
Falls	Site # 5	48.72	Fair
Barge	Site # 6	34.13	Fair

DISSCUSSION: IBI FISH METRICS

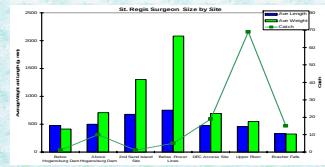
Gill net samples in the lower 9 km of the Genesee River were rated mostly fair to poor. In many cases only few species were caught, often only sturgeon

Seine and gill net samples were recorded to comprise the fish community structure of the lower 32km of the St. Regis River, and used in the construction of the biotic indices. Two threatened species, lake sturgeon and eastern sand darter were caught in the gill nets and seine pulls respectively. rock bass and lake sturgeon were caught the most in the gill nets while cyprinids were rarely caught. emerald shiner and pumpkinseed were caught the most in the seine pulls with rosyface shiner, tadpole madtom, muskellunge, and brook silverside being caught the least.

750 released in 98
1,200 released in 99
1,027 released in 00
800 released in 03
1,200 released in 04

Sturgeon Average Size:
August and September 2005

98YC	790 mm	&	2,450 g
99-00	641 mm	&	1,089 g
03YC	397 mm	&	242 g
04YC	316 mm	&	115 g



- **Juvenile sturgeon are using the St. Regis river. Individuals of all 5 year classes were captured**
- **The habitat in which the fish were captured was gravelly to sandy**
- **Most captures were in the deepest sections of the given river reach.**

References

Hilsenhoff, W. L. 1975. Aquatic Insects of Wisconsin. Tech. Bull. 89. Department of Natural Resources. Madison Wisconsin. 52pp.

Karr, J. R. 1981. Assessment of biotic integrity using fish communities. *Fisheries*. 6(6):21-27.

Shannon, C.E. 1948. A mathematical theory of communication. *Bell System Technical Journal*. 27:379-423, 623-56.

Sharpe, W.E., W. G. Kimmel and A. R. Buda.

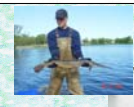
ST. REGIS FISH IBI RESULTS

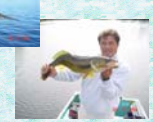
Example St Regis IBI Scores-Gill Nets:
Below Hogansburg Dam to St. Lawrence

Below_Dam	64.04	GOOD
Below_Dam	47.41	FAIR
Sand Island	49.38	FAIR
Below_Dam	49.19	FAIR
Down_River	54.25	FAIR
By_Stream	50.17	FAIR
Below_Dam	44.57	FAIR
Mouth_of_River	44.03	FAIR

Example Fish IBI Scores-Gill nets

Below Brasher Falls	60.34	GOOD
Below Brasher Falls	56.65	FAIR
Below Brasher Falls	55.43	FAIR
Below Brasher Falls	60.34	GOOD
Site #2 Deep Hole	57.98	FAIR
Site #2 Deep Hole	48.86	FAIR
Site 2 Net 2	65.49	GOOD
Upper River Net 3	46.74	FAIR
DEC Access Net 2	61.36	GOOD
DEC Access Net 1	57.76	FAIR
DEC Site Downstream	46.26	FAIR
DEC Site Upstream	41.41	FAIR





Introduction: The process of successful species restoration/recovery requires a thorough assessment of the health of the system in the areas targeted for restoration. A more general method of evaluation of freshwater systems is the Index of Biotic Integrity (IBI). An IBI is a synthesis of diverse biological information which numerically depicts associations between human influence and biological attributes. It is composed of several biological attributes or 'metrics' that are sensitive to changes in biological integrity caused by human activities. The multi-metric (a compilation of metrics) approach compares what is found at a monitoring site to what is expected using a regional baseline condition that reflects little or no human impact (Karr 1981). General fish community and invertebrate community sampling was conducted to provide data for development of IBI metrics and the application of the IBI to the lower Genesee River and the lower St. Regis River for the evaluation of the general health of the river.

METHODS: BENTHIC IBI

Macroinvertebrate samples were collected with a petit ponar grab at net (seine and gill) locations. A benthic biotic index was calculated for each site following the method of Sharp (2005), which follows the original method of Hilsenhoff (1975). The index is based on dividing selected Orders of aquatic invertebrates into three classes based on their sensitivity to pollution. Class I organisms are most sensitive; these include mayflies (Ephemeroptera), stoneflies (Plecoptera), and some caddisflies (Trichoptera). Class II organisms are moderately tolerant to stream pollution; these include water beetles (Coleoptera), amphipods (Amphipoda), sow bugs (Isopoda), and some caddisflies. Class III organisms are pollution tolerant; these include aquatic earthworms (Oligochaeta), leeches (Hirudinea), and true flies (Diptera). The index is calculated by the number of Orders in Classes 1 and II [2*(n*Class I)+(n*Class II); n = number of taxa in each Order]. Sites are rated as indications of Gross pollution, Moderate pollution, or Clean stream. The rating may reflect habitat type, not strictly pollution.

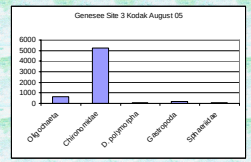
BENTHIC IBI RESULTS

Example Benthic IBI Scores
Genesee June 05

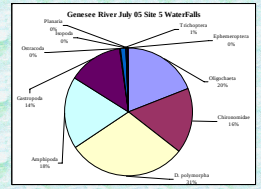
Above 104	Site #1	2	Gross Pollution
Below 104	Site #2	4	Moderate Pollution
Kodak	Site # 3	3	Moderate Pollution
30"Hole	Site # 4	2	Gross Pollution
Falls	Site # 5	8	Moderate Pollution
Barge	Site # 6	5	Moderate Pollution

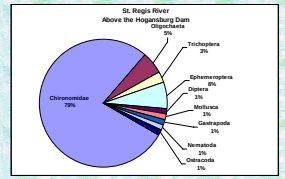
Example Benthic IBI Scores
Genesee July 05

Above 104	Site #1	7	Moderate Pollution
Below 104	Site #2	11	Clean
Kodak	Site # 3	11	Clean
30"Hole	Site # 4	4	Moderate Pollution
Falls	Site # 5	11	Clean
Barge	Site # 6	5	Moderate Pollution



Rated as Gross Pollution by B-IBI





Example Macroinvertebrate Communities rated as Clean by B-IBI

A total of 19 taxa were identified during the study and 18 families were used in the construction of the biotic indices. Due to the variation in composition and abundance of invertebrates, the indices used various combinations of the collected taxa to determine health of the rivers.

St. Regis River: The benthic invertebrate IBI rated most sites fair to poor, a few were clean. Predominance of shallow sandy habitats contributed to the poor ratings for the benthic invertebrate community.

Genesee River: Sites were rated severe pollution to clean stream. Ratings were not consistent among sites between months. Sediment type on the spectrum of gravel to silt were strongly influences the ratings .