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Division of Fisheries
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Effects of the Hofmann Dam on Local Fish Communities in the Des Plaines River

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Introduction

Dams cause dramatic changes in river environments and are a major factor contributing to the decline of fish biodiversity and sport fisheries in temperate rivers and streams (Kanehl et al. 1997). The most detrimental impacts of dams on fish communities are the loss of habitat and blockage of migration. Dams also effect water quality and flooding, and can be a significant safety hazard to boaters and anglers. In Northeastern Illinois alone, there are over 55 low head, or channel dams, many of which no longer serve their original purpose. Maintenance and replacement costs for dams can be excessive, leaving modification or removal as viable alternatives.

The Hofmann Dam, located between Lyons and Riverside on the Des Plaines River has recently drawn the attention of local residents due to concerns with flooding, safety and effects on fish and aquatic communities. In response to these concerns, the Army Corps of Engineers has agreed to fund a study under the Aquatic Ecosystem Restoration Program (Section 206) to examine the feasibility of modifying the Hofmann Dam, Fairbanks Road, and Armitage Avenue dams and restoring 20 miles of the Des Plaines River. The study is supported by the Illinois Department of Natural Resources, local communities, and citizens.

In order to provide information for the feasibility study, sampling was conducted on the fish communities in the areas of the Hofmann Dam to document the effects of the dam and to provide baseline data on aquatic resources.

Methods

Fish community samples were taken on September 30, 1998, immediately above the dam, and 0.5 miles downstream (Site 2, 3; Figure 1). Fish data from previous sampling efforts in 1995 and 1997 were also included in the analysis. Site 1, located about 1.5 miles upstream of the dam, was sampled in 1995 as part of routine monitoring. Site 4, located about 1.5 miles downstream of the dam, was sampled in 1997 as a part of the Des Plaines River Basin Survey.

All fish sampling was conducted using a boat-moated electrofishing unit (3 phase, 3500 watts). Each location was approximately 1000 feet in length and was sampled for 60 minutes. Larger specimens were identified to species, weighed, measured and returned to the river. Smaller individuals were preserved to insure proper identification in the laboratory.

The number of species, total abundance (number of fish per hour) and Index of Biotic Integrity (IBI; Karr et al. 1986) are given for each sampling site. The IBI is the sum of 12 metrics, or attributes, of the fish community, taking into consideration, species diversity, trophic condition (food habits), habitat requirements, and abundance and condition of the fish. The total of the 12 metrics yields a single numeric value ranging from 12 - 60 that indicates overall stream quality. A letter grade and an aquatic resource descriptor are assigned to a specific range of IBI as a part of Illinois Biological Stream Characterization or BSC (Hite and Bertrand 1995), as shown in Table 1.

Table 1. Biological Stream Characterization (BSC) ratings with IBI ranges and resource descriptors.

BSC Rating	IBI Range	Aquatic Resource Descriptor
A	51-60	Unique Aquatic Resource
B	41-50	Highly Valued Aquatic Resource
C	31-40	Moderate Aquatic Resource
D	21-30	Limited Aquatic Resource
E	<20	Restricted Aquatic Resource

Results and Discussion.

Sampling stations above the dam yielded a total of 9 species with an average abundance of 70 fish per hour of electrofishing. (Table 2). IBI values for the Stations 1 and 2, upstream of the dam resulted in BSC ratings in the D to E range (Table 2). Species found above the dam were generally more tolerant, typical of lake or slow water habitats (Table 3). The sportfish population upstream of the dam was very limited with only 5 young largemouth bass and 10 small bluegill.

In contrast, sampling stations below the dam had higher diversity, with 25 species represented. Stations downstream of the dam were also more productive, averaging 301 fish per hour of electrofishing; IBI values were in the C range for both samples (Table 2). A total of 4 intolerant species were found below the dam (Table 3) and the fish community was more characteristic of a riverine habitat. Sport fish were abundant including walleye, smallmouth bass, northern pike, largemouth bass, channel catfish, black crappie and bluegill (Table 3). Size distribution downstream of the dam was good for all sport species with many catchable-sized individuals present.

Table 2. Summary of fish sampling data above and below the Hofmann Dam.

Location	Parameter	1998	1995/97	Total No./ Average
Above Dam	No. Spp.	9	5	9
	No./Hour	107	33	70
	IBI	26	18	22
	BSC	D	E	D
Below Dam	No. Spp.	22	21	25
	No./Hour	236	365	301
	IBI	40	36	38
	BSC	C	C	C

Fish community data indicates that Hofmann Dam has a dramatic local effect on the aquatic community in the Des Plaines River. The fish population differences observed above and below the dam were primarily due to differences in habitat. Above the dam is deep and slow moving with more lake-like conditions and less habitat diversity. Below the dam, the habitat is more typical of a river environment, with greater depth and flow diversity. The Woolen Mills Dam on the Milwaukee River, Wisconsin, was also shown to have effects on upstream fish populations with few smallmouth bass, abundant common carp, and poor biotic integrity upstream of the dam (Kanehl et al. 1997).

Table 3. Comparison of fish species found above and below the Hofmann Dam, Des Plaines River.

Below Dam (Stations 3 and 4)			Above Dam (Stations 1 and 2)		
Walleye	Stizostedion vitreum	5	Largemouth bass	Micropterus salmoides	5
Northern pike*	Esox lucius	7	Orgspotted sunfish	Lepomis humilis	2
Smallmouth bass*	Micropterus dolomieui	61	Bluegill	Lepomis macrochirus	10
Largemouth bass	Micropterus salmoides	4	Green sunfish	Lepomis cyanellus	2
Black crappie	Pomoxis nigromaculatus	32	White sucker	Catostomus commersoni	8
Bluegill	Lepomis macrochirus	88	Fathead minnow	Pimephales promelas	1
Channel catfish	Ictalurus punctatus	27	Bluntnose minnow	Pimephales notatus	60
Orgspotted sunfish	Lepomis humilis	20	Goldfish	Carassius auratus	20
Green sunfish	Lepomis cyanellus	38	Carp	Cyprinus carpio	16
Silver redhorse*	Moxostoma anisurum	1			
White sucker	Catostomus commersoni	20			
Black bullhead	Ameiurus melas	1			
Yellow bullhead	Ameiurus natalis	3			
Carp	Cyprinus carpio	41			
Bowfin	Amia calva	2			
Spotfin shiner*	Cyprinella spiloptera	14			
Sand shiner	Notropis ludibundus	91			
Golden shiner	Notemigonus crysoleucas	2			
Creek chub	Semotilus atromaculatus	2			
Bluntnose minnow	Pimephales notatus	97			
Bigmouth shiner	Notropis dorsalis	6			
Fathead minnow	Pimephales promelas	1			
Gizzard shad	Dorosoma cepedianum	31			
Goldfish	Carassius auratus	11			
Yellow bass	Morone mississippiensis	1			

*** Intolerant species**

In nutrient enriched rivers, like the Des Plaines, oxygen demand is very high above dams due to increased algal and bacterial growth in the slow moving water (Singh et al 1995). Wide swings in dissolved oxygen can occur, with super-saturation during daylight hours (when algae are producing oxygen via photosynthesis), to total depletion during dark, early morning hours (when algae are only consuming oxygen). Butts and Evans (1978) found oxygen levels unfavorable for fish above the Hofmann Dam, particularly during the hot summer months. Temperature levels above dams are often elevated, which can contribute to less favorable conditions for fish and exacerbate oxygen problems. Although aeration does occur as water falls over the dam, there is a net loss in oxygen. High organic loads delivered from the upstream pool can cause oxygen reduction below the dam. Contrary to the popular notion, dams do not add oxygen to rivers.

Over the last 20 years, water quality has improved significantly in many Northeastern Illinois River systems, including the Des Plaines River. Although problems remain, fish and aquatic communities have responded positively to these improvements. However, many species of fish and mussels were lost during years of degraded conditions. Dams block migration routes from higher quality re-colonization sources and may limit the recovery of upstream areas, despite improved water quality. Mussels rely on fish for dispersion, therefore mussels are also effected by dams.

The Des Plaines River has 13 low head dams, most of which no longer serve their originally intended purpose. While dam removal has been shown to be one of the most cost-effective watershed improvement technique for restoring fish populations (Pajak 1992), other option are available. Ramping, bypass channels, and lowering have also been used to address dam issues. Re-connection of our highly fragmented urban rivers is critical to restoration efforts and making river ecosystems more resilient to both natural and man-made perturbations.

References

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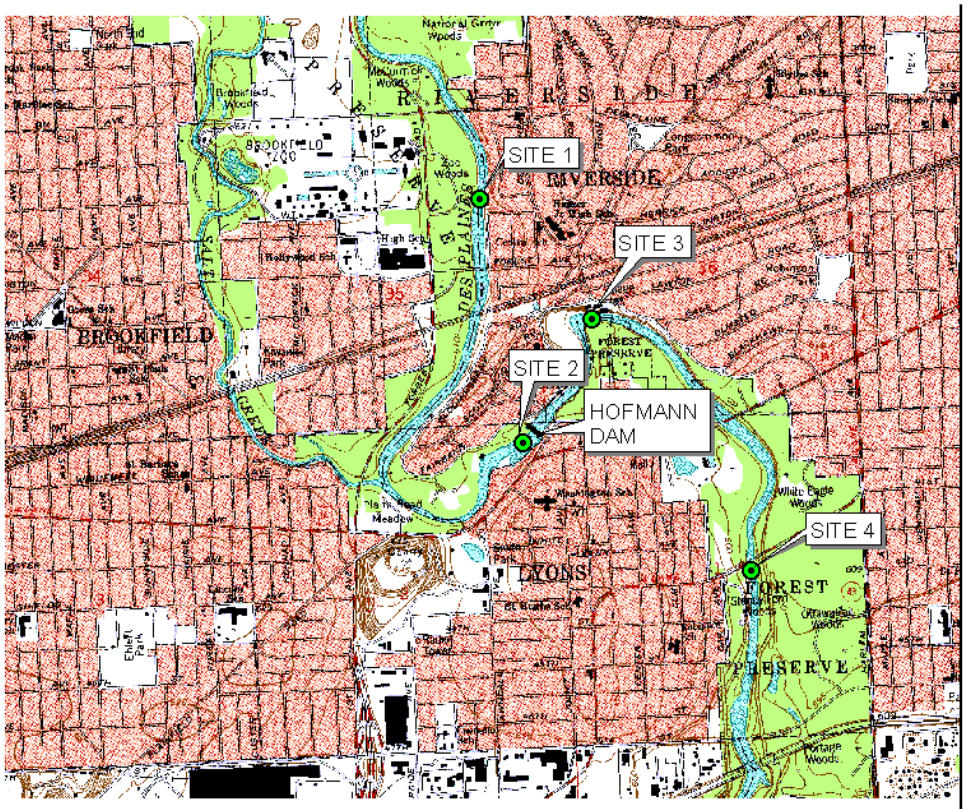

Figute 1. Location Hofmann Dam Study Fish Collection Site