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A FISHERIES MANAGEMENT PLAN FOR THE NEW YORK PORTION OF THE HOOSIC RIVER

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ABSTRACT

The 36 mile long New York reach of the Hoosic River contains 18.4 miles of trout water, 8.1 miles of warmwater stream fishing, and four instream impoundments ranging in size from 16 to 269 acres. Johnsonville Reservoir (269 acres) and Schaghticoke Reservoir (147 acres) are the third and sixth largest lakes in Rensselaer County, respectively.

The fisheries potential of the Hoosic River in New York and the four primary factors limiting the fishery (stream flow fluctuation, stream diversion, reservoir level fluctuation, and water quality/contaminants) are described. The fisheries goal and management objectives are defined. Twenty-one management recommendations that must be implemented to achieve the plan's objectives are presented.

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INTRODUCTION

The Hoosic River is a large river with the potential to support an important fishery, however, it has a history of water quality problems that have caused periodic fish kills and resulted in chemical contamination of fish. Fisherman utilization of the resource is low, averaging only 12 trips per acre in 1983 on the more accessible reaches of the trout inhabited section (Sanford 1984).

To better understand the river's fisheries potential and management needs, DEC's Region 4 Fisheries Office initiated a fisheries survey of the Hoosic River in 1986. Highlights of this survey, the river's management history, and resource management problems are summarized in this report and recommendations are made to develop the fishery.

DESCRIPTION

The Hoosic River originates in Massachusetts and flows through Vermont and New York before entering the Hudson River near Stillwater. Though largely rural in character, the river corridor upstream in Vermont and Massachusetts is fairly heavily industrialized. In northern Rensselaer County, it flows primarily through forested and agricultural lands.

The New York portion of the Hoosic River (Figure 1) is approximately 36 mi long with a drainage area of appproximately 730 mi^2. The 73 year average daily flow, measured at a gaging station near Eagle Bridge (Figure 1), is 945 cfs (Firda et al. 1986). Approximately 13 mi downstream at Schaghticoke Dam, the average daily flow was estimated at 1,182 cfs (NMPC 1986). In 1984, the minimum and maximum flows recorded at Eagle Bridge were 166 and 19,800 cfs, respectively (Firda et al. 1986).

The New York reach has a gradient of 11.1 ft/mi or 0.2% (Figure 2) and contains four dams and three hydropower facilities. A fourth hydroelectric facility is being reconstructed in Hoosick Falls at an existing dam. Hydropower operation may cause daily fluctuations in stream flows on 8.5 mi of river downstream of Johnsonville and Schaghticoke Reservoirs ranging from 30 to 1,760 cfs (NMPC 1986) and also results in a 1.9 mi bypassed reach between Schaghticoke Dam and the powerhouse.

There are 47 streams tributary to the New York portion of the Hoosic River (Table 1), and the largest are the Wallomsac River and the Little Hoosic River. The average daily flows in these two streams were 222 and 95 cfs, respectively (Firda et al. 1986). Combined, they represent 34% of the 945 cfs average daily flow of the Hoosic River at Eagle Bridge.

At least 16 tributaries support populations of brook[1/], brown, or rainbow trout (Table 1). These tributaries are probably important spawning and nursery areas for Hoosic River trout and at their confluence with the river serve as thermal refuge areas during periods of elevated water temperatures.

The Hoosic River can be subdivided into nine reaches as described below:

<u>Hudson River to Schaghticoke Dam</u>

This 7.2 mi reach of river supports a warmwater fish population with smallmouth bass and rock bass the most common sport fish (gamefish and panfish) species collected in 1986 (Table 3). Other game fish (largemouth bass, and walleye) and panfish (black crappie, bluegill, pumpkinseed, and yellow perch) collected in 1986 were less common and probably should be considered rare (Table 3). Observations during the 1986 sampling

1/See Table 2 for scientific names of species found in the watershed.

effort indicated that white sucker were the most abundant species in this reach followed by fallfish and common carp. Other species collected in 1986 or from earlier surveys included American eel, bluntnose minnow, common shiner, golden shiner, log perch, northern hog sucker, rosyface shiner, spotfin shiner, spottail shiner, and the tessellated darter. Blueback herring, an anadromous species, are present but the magnitude of the run is unknown. One dead and one dying adult blueback herring were observed in late June, 1986, by the author between the Schaghticoke powerhouse and the dam.

Stream flows in this reach of river are regulated by the Schaghticoke hydropower facility and may vary from around 28 to over 1,500 cfs daily in the 5.3 mi of river downstream of the powerhouse (NMPC 1986). Flows in the 1.9 mi reach bypassed by the penstock between the dam and powerhouse are dependent upon leakage from the dam during non-spillage periods. Habitat is poor in the lowermost 1.8 mi of river upstream from the mouth because of the bedrock (shale) bottom with few pools.

Schaghticoke Reservoir

This 147 acre impoundment, created in 1908, is the sixth largest lake in Rensselaer County and comprises 3.2% of the total ponded water in the county. Schaghticoke Reservoir is divided into four basins (Figure 3) ranging in size from 2.5 to 69.0 acres. Three of the four basins are connected but it appears that the smallest basin is isolated. The connection between the two large basins is navigable by boat.

The reservoir is homothermous with sufficient dissolved oxygen to support fish life to its 23 ft maximum depth (McBride 1988A). Physical and chemical parameters measured in June, 1986, were as follows: 86ppm total alkalinity, 212 mmhos conductivity, pH range from 7.9 on the bottom to 8.7 on the surface, and secchi disk transparencies ranging from 2.0 to 2.8 ft. Water levels may fluctuate from 1.0 to 3.5 ft daily because of hydropower generation (NMPC 1986).

Sixteen fish species were collected during the 1986 survey with largemouth bass and smallmouth bass the only gamefish collected (Table 3). Although northern pike were not collected in 1986, they were collected in a 1974 survey and were also collected upstream in 1983 and 1986. Northern pike should be considered rare in Schaghticoke Reservoir. The estimated density of bass $\geq$ 10 in was 13.0 largemouth bass and 1.2 smallmouth bass per acre, which is considered high and average for New York, respectively (McBride 1988A). Largemouth bass proportional stock density (PSD)[1/] and relative stock density[2/] of 15 in fish (RSD_{15}) was 53% and 29%, respectively. The electrofishing catch rate of 12.0 legal ($\geq$ 12 in) size largemouth bass per hour is considered very good. Panfish were abundant and included black crappie, bluegill, brown bullhead, channel catfish, pumpkinseed, rock bass, white crappie, and yellow perch. Approximately 45% of all panfish collected in 1986 were of a size[3/] considered desirable by anglers.

[1/]PSD is the porportion of fish of quality size (11 in for smallmouth bass and 12 in for largemouth bass) in a stock (7 in for smallmouth bass and 8 in largemouth bass) expressed as a percentage.
[2/]RSD is the proportion of fish of any designated size group in a stock and expressed as a percentage.
[3/]Crappie, yellow perch, bullhead, and catfish $\geq$ 8.0 in and bluegill, pumpkinseed, and rock bass $\geq$ 6.5 in are considered to be a size desirable to anglers.

Schaghticoke Reservoir to the James Thompson Dam

This 0.9 mile reach of river was first sampled in 1983 immediately below the dam and 19 fish species were collected (NMPC 1986). Game fish included brown trout, largemouth bass, northern pike, and smallmouth bass. Panfish included black crappie, bluegill, brown bullhead, pumpkinseed, rock bass, and yellow perch. Other species collected were bluntnose minnow, common carp, common shiner, golden shiner, longnose sucker, satinfin shiner, spottail shiner, tessellated darter, and white sucker. Stream flows are regulated by the Johnsonville hydropower facility 3.8 mi upstream and may fluctuate daily from 30 to 1,760 cfs. The James Thompson Dam hydropower facility operates in tandem with the upstream facility.

Valley Falls Reservoir

This 1.5 mi long, 59 acre run-of-river hydroelectric impoundment was created in 1927 by construction of the James Thompson Dam. The reservoir is homothermous with sufficient dissolved oxygen to support fish life to its 13.5 ft maximum depth (McBride in prep). Physical and chemical parameters measured in June, 1988, were as follows: 103 ppm total alkalinity, pH of 8.2, and a secchi disk transparency of 2.5 ft.

Fifteen fish species were collected during the 1988 fisheries survey with white sucker the most abundant species (McBride in prep). Fish collection data indicate sparse gamefish and panfish populations. Only seven largemouth bass and two smallmouth bass were collected and all were less than 6.0 in. Approximately 33% of the panfish (black crappie, bluegill, brown bullhead, pumpkinseed, rock bass, white crappie, and yellow perch) collected were of a size considered desirable by anglers with rock bass the most abundant panfish collected (McBride in prep). Other fish collected include bluntnose minnow, common carp, creek chub, golden shiner, and spottail shiner.

Valley Falls Reservoir to Johnsonville Reservoir

Fish populations in this 2.3 mi reach were sampled for the first time in 1986. Brown trout, largemouth bass, and rainbow trout were the only sport fish collected (Table 3). Other species collected and/or observed included common carp, longnose sucker, and white sucker. Trout were common and all were of wild origin with rainbow trout much more abundant than brown trout. Four year classes of trout from Age 0 - Age 3 were collected and several trout in the two to three pound category were observed but not collected. Trout abundance declined downriver with the lowest catches immediately upstream of the Valley Falls impoundment. It was surprising that no smallmouth bass or rock bass were collected or observed in this reach even though the habitat appears suitable. Their absence can not be explained. Only two largemouth bass were collected and both were young of year (Age 0) fish that probably either passed through the turbines or spilled over Johnsonville Dam. Stream flows in the reach are regulated by the Johnsonville hydroelectric facility and may range from 30 cfs to over 1,760 cfs daily (NMPC 1986).

Johnsonville Reservoir

This 6.4 mi long, 269 acre impoundment (Figure 4) was created in 1909. Johnsonville Reservoir is the third largest lake in Rensselaer County and comprises 5.9% of the total ponded water in the county. The head of the impoundment occurs about 1.5 mi upstream of the covered bridge at Buskirk (Figure 4).

The reservoir is homothermous with sufficient dissolved oxygen to support fish life to its 39 ft maximum depth (NMPC 1986). Chemical parameters measured in June, 1986, were: 86 ppm total alkalinity and pH ranging from 7.5 near the bottom to 7.9 at the surface (McBride 1988B). Water levels in the reservoir may fluctuate from 2.0 to 3.0 ft daily because of hydropower generation. In October, 1985, the reservoir was lowered 13.5 ft, which effectively dewatered the reservoir except for the river channel, to permit inspection of the dam.

Ten species of fish were collected in 1986 (Table 3) with white sucker the most abundant species. Largemouth bass and northern pike were the only game fish collected, however, northern pike should be considered rare since only two fish were collected. The estimated density of 8.8 largemouth bass $\geq$ 10 in per acre is average for New York (McBride 1988B), and the electrofishing catch of 11.8 legal ($\geq$12 in) bass per hour is considered very good. Largemouth bass PSD and RSD_{15} was 96% and 39%, respectively. The high PSD indicates a low abundance of bass $<$12 in. Few young fish were collected in 1981 or 1984. The scarcity of sublegal bass in this and earlier surveys suggest that water level fluctuation (up to 3.0 ft) may be adversely impacting largemouth bass populations during the May spawning period. The lake's poor access and abundance of large bass suggest that angler exploitation is low.

Panfish abundance is low but the quality of the population was good since approximately 66% of the panfish collected (black crappie, brown bullhead, pumpkinseed, rock bass, and yellow perch) were of a size considered desirable by anglers. Yellow perch were the most abundant panfish collected (Table 3). The low panfish abundance was most likely due to the 13.5 ft drawdown in 1985. However, centrarchid panfish spawning success may also be adversely affected by fluctuating water levels during the spawning season (McBride 1988B).

Johnsonville Reservoir to the Hoosick Falls Dam

Fish collections in 1974, 1982, and 1986 show that brown and rainbow trout are common throughout this 4.6 mi reach with rainbow trout the more abundant species (Table 3). Warmwater species include bluegill, brown bullhead, largemouth bass, northern pike, pumpkinseed, rock bass, smallmouth bass, and yellow perch. Warmwater species are localized in this reach with most collected within a mile of Johnsonville Reservoir or within 0.2 mi of the Hoosick Falls impoundment.

Hoosick Falls Impoundment

This 16 acre impoundment, created in the 1880's, has never been surveyed.

Hoosick Falls Impoundment to the New York - Vermont State Line

Fish collections made in 1974, 1975, 1982, 1983 and 1986 show that brown and rainbow trout are common in this 11.5 mi reach of river. In 1986, rainbow trout were clearly dominant (Table 3). All trout handled in 1986 were of wild origin but some stocked brown trout from the Vermont reach of the Hoosic River are probably occasionally present in the New York portion of the river. Warmwater sportfish in this reach are rare and include bluegill, brown bullhead, pumpkinseed, rock bass, and yellow perch. The absence of smallmouth is surprising and again, their absence can not be explained.

BACKGROUND

Water Quality

The Hoosic River has a long history of water quality problems. In 1934, the river was considered too warm for trout throughout its length and the stocking of warmwater fish above Eagle Bridge (Figure 1) was not recommended because of pollution (Greene and Senning 1935).

Recurrent fish kills have historically reduced fish populations. Studies from 1983 through 1986 show that water quality problems still exist in the Hoosic River. The reach from the Vermont-New York border to Hoosick Falls appeared moderately impacted by organic wastes in 1985 but not in 1983 or 1984 and there was no organic impact downsteam of Hoosick Falls (Robert Bode, DEC, personal communication). In his experience, no New York stream surveyed in consecutive years have exhibited the apparent variable water quality displayed in the Hoosic River. He theorized that these variations were related to 1) variable inputs from the many dischargers located along the river, and 2) the relatively small size of the river and accompanying low relative assimilative capacity.

Water samples collected June, 1985, from nine Hoosic River basin locations were tested for toxicity to *Ceriodaphnia dubia* and/or *C. affinis* (Dr. Edward Kuzia, DEC, personal communication). The impact on *Ceriodaphnia* reproduction caused by water samples near point source discharges in Massachusetts and Vermont suggest that toxic inputs are entering the Hoosic River in the vicinity of the sample stations in these states but that these sources were not affecting the New York section of the Hoosic River. A slight chronic toxicity problem was found in the Hoosick Falls area but the source of the problem was never identified (Dr. Edward Kuzia, DEC, personal communication).

No organic chemical contamination was found in 1983 but there were four distinct areas in the Hoosic River drainage basin that showed heavy metal concentrations not attributable to natural background sources as summarized in a 1984 report on a water quality survey by DEC (NYSDEC 1984):

1) At the New York-Vermont border, the Hoosic River sediments showed considerable chromium, lead, and zinc. Since the three metals are typical of tannery waste it could be assumed that the tannery at North Pownal, Vermont may make a significant contribution.

2) The sediments at Hoosick Falls showed copper, lead, and zinc contamination. The increases in copper are probably caused by the Oak Mitsui discharge while the lead and zinc may be partially attributable to Oak Mitsui.

3) Chromium, copper, lead, mercury, and zinc all showed rather dramatic increases in the sediments below Johnsonville. The sources or causes of these concentrations remains unknown.

4) The sediments of the lower Walloomsac River near North Hoosick showed significant levels of zinc, copper, and lead. These contaminants are probably related to the dumping of foundary sand on the river bank by Flowmatic Corporation in North Hoosick.

Recent studies have shown that the river's dissolved oxygen levels are satisfactory. The observed average dissolved oxygen concentration rarely dropped below the saturation value of 9.5 ppm at flows of approximately 420 cfs which makes it highly unlikely that dissolved oxygen problems would occur at lower flows (NYSDEC 1984).

Macroinvertebrate samples collected in July, 1983, from six locations showed good species richness (number of different kinds of organisms in the sample) and diversity (a value which combines species richness and community balance) values at all stations except at Hoosick Falls (NYSDEC 1984). The Hoosick Falls station had both low richness and diversity values along with the absence of mayflies.

There are five major discharges in New York which have impacted or may impact Hoosic River water quality. They include three on the Hoosic River (Hoosick Falls sewage treatment plant, Oak Mitsui Corporation, and Lydall Corporation), and two on the Walloomsac River (Flowmatic Corporation and Columbia Corporation). In recent years, these industries have upgraded their waste treatment facilities which should result in improved water quality. To evaluate the effectiveness of these improvements, biomonitoring of these discharges should be required by DEC to evaluate acute toxicity.

Fish Kills

Recurrent fish kills have historically reduced fish populations in the Hoosic River. From 1980 to 1983, there were seven reported fish kills of which five originated in Massachusetts, one in Vermont, and one in New York. The New York fish kill in July, 1983, killed approximately 100,000 fish. Probable causes have been determined for only three of the seven kills and include copper, sulfuric acid, and a lubricant. Since the fish kills almost always occurred on weekends or holidays, illegal dumping may have been a factor. There were no reported fish kills between 1983 and May, 1987, when a broken sewer line at North Adams killed an unknown number of fish in the Massachusetts reach. No fish were killed in New York.

During the 1970's and earlier, there were unconfirmed reports of fish kills; however, these kills were not reported to DEC until after the fact when it was too late for investigations to determine cause and assess damage. Because the Hoosic River had a history of pollution problems, the kills were apparently accepted as "normal" by residents in the area but as the public became more environmentally aware in the 1970's and the fishery potential in the Hoosic River became apparent, attitudes changed and fish kills were reported in a more timely fashion beginning in 1980. In December, 1982, officials from New York, Vermont, Massachusetts, and the Environmental Protection Agency met to coordinate fish mortality investigations in these interstate waters. As a result, a notification system was established for reporting and coordinating investigations of fish mortalities in the Hoosic River. Fish kills will probably remain an ever present threat because of industrial development along the river especially in Massachusetts and Vermont.

Contaminants

Fish in the Hoosic River contain excessive levels of PCB's which resulted in the issuance of a special health advisory in 1983. Initially, the advisory recommended eating no more than one meal per month of brown trout $\geq$ 12 in. In 1988, the meal a month advisory was extended to all trout of any size because of increased PCB levels in brown and rainbow trout. Sprague Electric Company in North Adams, Massachusetts, is considered the probable source of PCB's in the Hoosic River (Ward Stone, DEC, personal communication). Fishing has been prohibited in the 7.2 mi reach of Hoosic River downstream of the Schaghticoke Dam since 1976 as a result of the PCB related fishing ban on the Hudson River from the Troy Dam to Hudson Falls, which includes all tributaries to the first impassible barrier.

Fish from various Hoosic River locations have been collected for contaminant analysis since 1975. The results of these analyses are summarized in Tables 3 and 4.

PCB levels in Hoosic River fishes have generally declined since 1975 except for trout in the North Petersburg area (New York - Vermont border to the Little Hoosic River). Brown and rainbow trout from this reach averaged 4.3 and 2.8 ppm in 1986 compared to 2.4 and 1.8 ppm in 1983 (Table 4). Johnsonville Reservoir largemouth bass PCB levels have declined from 6.0 ppm in 1975 to 0.9 ppm in 1986 (Table 5). Hoosick Falls brown and rainbow trout PCB levels declined from 6.2 and 2.6 ppm to 2.3 and 1.2 ppm by 1986, respectively (Table 6). In the lowermost reach of the Hoosic River where fishing is prohibited, 1986 PCB levels in smallmouth bass and rock bass were 0.5 and 0.4 ppm, respectively (Table 6). The US Food and Drug Administration (FDA) tolerance level for PCB's is 2.0 ppm.

Mercury contamination was also a concern because largemouth bass from Johnsonville Reservoir in 1981 averaged 1.1 ppm (unpublished data, DEC's Bureau of Environmental Protection) which is above the 1.0 ppm FDA action level. However, results of the more extensive 1986 fish collections found that the average mercury levels were less than 1.0 ppm (Table 7). Yellow perch in Johnsonville Reservoir had the highest mercury level (0.9 ppm). The cause(s) of the elevated mercury concentrations are unknown.

Hydropower

New York's Hoosic River hydropower facilities include Schaghticoke, Valley Falls, and Johnsonville (Figure 1). A fourth facility which will utilize an existing dam is under construction at Hoosick Falls. There is one hydroelectric facility in Vermont at North Pownal and none in Massachusetts. The hydroelectric facilities are licensed by the Federal Energy Regulatory Commission (FERC) which is responsible for the license conditions under which these facilities operate. The FERC license for the Schaghticoke and Johnsonville hydropower facilities expires on December 31, 1993, and the relicensing application must be submitted to FERC between December 31, 1988 and December 31, 1990.

Schaghticoke and Johnsonville Reservoirs operate as storage reservoirs for hydropower generation which means that the instantaneous outflow from the impoundment (as discharge, spillage, directed releases, and/or leakage) is not always equal to the instantaneous inflow to the impoundent. The storage level of these impoundments will fluctuate on some temporal basis, e.g. hourly, daily, weekly, or monthly.

Water levels in Schaghticoke Reservoir may fluctuate from 1.0 to 3.5 ft daily depending on inflow and time of year (NMPC 1986).

The spillway crest elevation is 264.85 ft, however, 2.5 ft high flashboards are installed from June 1 through December 1 to increase the reservoir's storage capacity. Niagara Mohawk Power Corporation (NMPC) is permitted to lower the lake level to elevation 263.85 ft year round. At this elevation, water depths are less than two feet in most of the 28 acre basin west of Fishermans Lane (Figure 3).

Water levels in Johnsonville Reservoir can fluctuate from 2.0 to 3.0 ft daily (NMPC 1986). The spillway crest elevation is 343.5 ft; however, 2.5 ft high flashboards are generally installed from June 1 through December 1. NMPC is permitted to lower the lake level to elevation 344.0 ft when flashboards are in place and to elevation 340.5 ft for the remainder of the year.

The Valley Falls and Hoosick Falls hydroelectric facilities operate or will operate in a run-of-river mode, which means that the instantaneous outflow from the impoundment (as turbine discharge, spillage, directed releases, and/or leakage) is always equal to the instantaneous inflow into the impoundment. However, the Valley Falls facility is currently permitted to operate in tandem with the Johnsonville facility, located 3.8 mi upstream, which results in drastic stream flow fluctuations in the 0.9 mi reach of river downstream of the James Thompson Dam. The storage level of the Valley Falls and Hoosick Falls impoundments is not permitted to fall below the crest of the dam and/or flashboards except in case of emergencies.

Hydropower operations have a major impact on flows in the Hoosic River downstream of Johnsonville and Schaghticoke Dams. When Johnsonville and Schaghticoke Reservoirs are in a storage mode and not spilling, no water is discharged to the river except for leakage at the dams and/or through the turbines. Total leakage through the turbines at both Johnsonville and Schaghticoke is approximately 30 cfs (NMPC 1986). The amount of leakage through the dams is not known but presumed to be neglible. The duration of these minimal discharges, which are dependent upon stream flows, range from 4.2 to 19.9 hours. In the release mode, water is discharged to generate hydroelectric power and stream flows increase dramatically. Minimum and maximum generating flows at the Johnsonville hydroelectric project are 315 and 1,760 cfs, respectively (NMPC 1986). At Schaghticoke, minimum and maximum generating flows are 301 and 1,500 cfs, respectively (NMPC 1986). Spillage over Johnsonville and Schaghticoke Dams occurs 17.5 and 24.0% of the time, respectively (NMPC 1986).

Upstream from the hydropower facilities in New York, stream flow reductions as much as 50% in one day were observed in October, 1983, on the Hoosic River upstream of Hoosick Falls (Philip Hulbert, DEC, personal communication). The author observed a 6-8 inch drop in stream level during the 1986 survey. Correspondence with Vermont and Massachusetts officials provided no apparent reasons for the reduction in stream flows in the upper Hoosic River. The hydropower facility at North Pownal, Vermont, operates as a run-of-river facility. Changes in observed flows may have resulted from storm events in the watershed.

Hydropower operations have also resulted in two bypassed stream sections on the Hoosic River. There is a 1.9 mi bypass between Schaghticoke Dam and the powerhouse. Except during spillage events which occur about 24% of the time, flows in this reach are entirely dependent upon leakage from Schaghticoke Dam. There is no minimum flow requirement for this 1.9 mi reach. At the James Thompson Dam in Valley Falls, a minimum flow requirement of 120 cfs for the 300 ft long bypass reach will become effective upon resolution of the operational mode of the Johnsonville hydropower facility 3.8 mi upstream. In the interim, a 20 cfs conservation flow is required at all times in the bypassed reach.

Hydropower facilities provide a barrier to the upstream and downstream movement of fish. Upstream fish passage through the Hoosic River for anadromous species such as blueback herring is not a concern because of the impassible, natural barrier located approximately 0.1 to 0.2 mi downstream of Schaghticoke Dam. Although upstream fish passage of resident fish species is not a concern at the present time, fish moving downstream are subject to entrainment and impingement of unknown magnitude because stream flows are diverted through the turbines most of the time.

Changes in the Hoosic River Fishery

The first biological survey of the Hoosic River was in 1934 and resulted in the capture of 19 fish species (Table 2). Fish collections were made with 6 and 20 ft seines at four locations and did not include the instream impoundments. The Hoosic River was considered too warm for trout throughout its length (Greene and Senning 1935).

Forty years later in 1974 when the river was resurveyed, trout were found throughout the upper 16.1 mi from Eagle Bridge upstream to the New York - Vermont border. Brown trout were more abundant in this reach than rainbow trout. The next survey in 1982 found that rainbow trout were generally more abundant than brown trout. By 1986, fish collections showed that rainbow trout were clearly the dominant trout in the Hoosic River. The 1986 survey also found an additional 2.3 mi of trout water immediately downstream of Johnsonville Dam which brings the total trout inhabited reach to 18.4 mi or half of the river's New York length.

Thirty-two fish species were collected during the 1986 survey compared to 30 species recorded between 1974 and 1984 (Table 2). The small increase in species number from 1934 is probably mostly due to sampling methodology, frequency, and location rather than changes in the fish population.

Electrofishing collections in the south basin of Schaghticoke Reservoir in 1970, 1974, and 1986 show that composition of the sport fish population has remained relatively unchanged. However, sport fish were more abundant in 1986 than in 1970. Hourly electrofishing catch rates increased from 21.2 fish in 1970 to 138.9 in 1986 with individual catch rates higher for all species in 1986 than in 1970 (McBride 1988A). Game fish abundance increased from 8.4 fish per hour in 1970 to 58.8 in 1986; and panfish abundance increased from 12.8 to 80.2 fish per hour. Part of the increase was attributed to time of year sampled and increased electrofishing efficiency (McBride 1988A).

Interpretation of historical changes in species composition and relative abundance for Johnsonville Reservoir must be made with caution. Although the reservoir has been sampled six times since 1974, the entire impoundment was only surveyed in 1986. Bluegill appeared to be common in earlier surveys but absent in 1986.

Fish Stocking

Fish were first stocked in the Hoosic River in 1924. Stocking records show that at least 3.75 million walleye fry, 7100 fry and 200 fingerling smallmouth bass, 5250 brown trout and 750 rainbow trout fingerlings, 2500 fingerling and 30 adult yellow perch, 400 fingerling and 15 adult largemouth bass, 91 adult brown bullhead, and 30 adult chain pickerel were stocked between 1924 and 1933. Stocking locations could not be determined.

Following the 1934 biological survey of the Hoosic River, the 10.8 mi reach from Schaghticoke Reservoir to Buskirk was recommended for stocking with brown bullhead, smallmouth bass, and walleye (Greene and Senning 1935). From the available stocking records at least 17.7 million walleye, 1799 black crappie, 200 brown bullhead, 190 yellow perch, 72 rock bass, and 26 largemouth bass were stocked at unknown locations from 1947 to 1957. In addition, Johnsonville Reservoir was stocked with 5,400 black crappie and 960 brown bullhead between 1950 and 1953.

Brown trout were stocked from 1976 to 1983 in the 16 mi reach of river from Eagle Bridge upstream to the New York - Vermont state line. The recommended number was 21,000 brown trout yearlings or 1,400 fish per mile. However, only 9.6 mi of river was stocked because of the inaccessibility of 5.4 mi of river at scattered locations. Since the Hoosic River had a limited reputation as a fishery and poor access, it was stocked at only 50% of the recommended number. Thus, only 4,000 to 5,700 yearling brown trout were stocked annually. Trout stocking was terminated because of low angler use (12 trips/acre) and the poor (15%) return of stocked trout in 1983 (Sanford 1984).

Access

Access to the New York portion of the Hoosic River is informal and limited in many areas because of the distance from the road to the river. DEC has no public fishing rights easements on the Hoosic River. In addition, fishing is prohibited in the 7.2 mile reach from Schaghticoke Dam downstream to the Hudson River because of the fishing ban on the Hudson River between the Troy Dam and Hudson Falls which includes tributaries to the first impassible barrier. DEC's Region 4 Fisheries Office has been negotiating with NMPC unsuccessfully since 1981 for an easement right to the strip of land lakeward of the highwater mark at Buskirk for development of a light trailered boat launch on Johnsonville Reservoir. The hydropower developer at James Thompson dam is required to develop a fisherman access site to the Valley Falls impoundment as a condition of his FERC operators license.

Angling Use

In 1983, angler use averaged 12 trips/acre on the more accessible trout inhabited reaches of the Hoosic River (Sanford 1984) compared to the average 100 trips/acre for New York trout streams (Engstrom-Heg 1984). In Region 4 (east-central New York), coldwater streams support 12-82 angler trips per acre and averaged 47 trips per acre (Keller 1988). Low angler use on the Hoosic River was attributed to a combination of factors including low standing crops of trout, the river's reputation as a polluted water, lack of public awareness that the river supported a trout population, and the health advisory which recommended limiting fish consumption of brown trout $\geq$ 12 in to one meal per month (Sanford 1984). As access is improved and contaminant levels in trout are reduced to below FDA action levels, the trout inhabited reach of the Hoosic River should be able to support an estimated 50 trips per acre annually.

Angling use on the warmwater reach is unknown. However, fishing pressure on other Region 4 warmwater rivers and lakes averaged 12 and 20 trips/acre, respectively (Keller 1988). The Hoosic River certainly has the potential to support similar levels of angler use.

Angler Catch Rates

Trout anglers creeled 0.17 trout per hour during the 1983 Hoosic River creel census (Sanford 1984) but the catch and release rate was not determined. However, analysis of 25 stream sections censused during the 1978-80 evaluation of the statewide 9 in size limit on trout found that the average catch and release rate was 2.9 times higher (range was 0.3 to 7.0 X) than the creel rate (Engstrom-Heg and Hulbert 1982). Therefore, the 1983 Hoosic River catch rate (creeled plus released) was probably 0.7 trout per hour which was higher than the New York catch rate objective of 0.5 trout per hour (Engstrom-Heg 1984).

Bass catch rates on the Hoosic River impoundments and warmwater riverine reaches have never been determined. Angler cooperators participating in the 1978-80 New York statewide bass study (11 lakes and 1 river) averaged 0.51 largemouth and/or smallmouth bass per hour (Green et al 1986); however, cooperator catch rates may not be representative of the angling public. In 1982, Mohawk River cooperators averaged 1.32 smallmouth bass per hour (McBride 1989) compared to only 0.57 smallmouth bass per hour for the angling public (McBride 1983). The project leader of the New York statewide bass study suggests that bass catch rates in typical New York lakes by the general angling public will average 0.1 bass per hour or less but that skilled bass anglers can do much better (Dr. David Green, Cornell University, personal communication). Therefore, a catch rate of 0.1 bass per hour appears to be an appropriate target catch rate for Schaghticoke and Johnsonville Reservoirs.

Pending a definitive study of bass catch rates in New York's warmwater streams, a preliminary target catch rate (creeled and released) of 0.25 smallmouth bass per hour in the riverine reaches downstream of Valley Falls Reservoir appears appropriate. Anglers on New York's

Susquehanna and Unadilla Rivers (managed under a 10 in minimum size limit for bass) creeled 0.49 and 0.27 smallmouth bass per hour in 1966, respectively (NYSCD 1967). Smallmouth bass catch rates (creeled plus released) on three streams with a 12 in minimum size limit outside New York are as follows: Shenandoah River, Virginia, anglers averaged 0.32 fish per hour in 1974 and 1975 (Kauffman 1983); Huzzah Creek, Missouri, anglers averaged 0.19 fish per hour from 1969 to 1973 (Fleener 1974A); and Big Piney River, Missouri, anglers averaged 0.10 fish per hour from 1967 to 1972 (Fleener 1974B).

Fishing Regulations

Statewide angling regulations (Table 6) apply to the warmwater species throughout the New York reach of the Hoosic River and to trout in the four instream impoundments. In the riverine sections, there is a nine inch minimum size and five fish creel limit on trout. The intent of the nine inch size limit for trout was to take advantage of the growth potential inherent in large rivers such as the Hoosic River. Except for the Little Hoosic River where a 5 trout creel limit and 9 in size limit is also in effect, statewide trout regulations (10 fish, any size) apply to the Hoosic River tributary system.

LIMITS TO THE FISHERY

Although a number of factors limit the fishery on the Hoosic River, three primary problems (stream flow fluctuations, stream diversion, and reservoir level fluctuation) affect fish production and all are related to hydropower operations at Johnsonville and Schaghticoke. Resolution of the hydropower issues are now possible because the FERC license for these projects expire December 31, 1993 and the new license applications must be submitted between December 31, 1988 and December 31, 1990. The fourth issue is water quality, specifically the presence of PCB's. Elevated PCB levels in trout has resulted in health advisories on consumption of trout from the Hoosic River since 1983. Fishing has been prohibited in the 7.2 mi (217 acres) reach of Hoosic River below Schaghticoke Dam since 1976. Results of the 1986 contaminant analyses indicate that the fishing ban may not be necessary. These four issues are discussed in greater detail below.

Stream Flow Fluctuations

Stream flows in the 8.5 mi of river below the Johnsonville and Schaghticoke Reservoirs, excluding the 1.9 mi bypass reach below Schaghticoke Reservoir, may fluctuate daily from 30 to 1,760 cfs because of hydropower operation. Many riverine fish and invertebrate species have a limited range of conditions to which they are adapted and daily fluctuation in flows is not a condition to which most aquatic species are adapted (Cushman 1986). Such conditions can reduce the abundance, diversity, and productivity of these riverine organisms. Altering the volume of discharge changes the characteristics of a stream, including water depth, wetted perimeter, and current velocity. Hildebrand (1980) summarized the adverse impacts of water level fluctuations which are highlighted in the following paragraphs.

Current velocity is an important factor regulating the occurrence and microdistribution of stream dwelling invertebrates (Wright and Szluha 1980). Feeding adaptations and respiratory structures of stream invertebrates are specifically adapted for currents, and some species are confined to fairly definite ranges of current speed (Hynes 1970, Ward 1976). Thus one obvious effect of radically changing current velocities is that those species limited to narrow ranges will be unable to tolerate periods of unsuitable current velocity and only those organisms that can tolerate wide velocity variations will remain (Wright and Szluha 1980).

Reduced population numbers, biomass, and diversity of benthic organisms are often reported in streams where fluctuating conditions result in considerable habitat exposure (Wright and Szluha 1980). In circumstances of extremely rapid reductions, stranding and dessication of both invertebrates and fish may occur; and frequently, extreme fluctuations will prohibit development of an adapted community (Wright and Szluha 1980).

Downstream displacement via drift in response to low flows appears to be an important mechanism contributing to reductions of benthic fauna in fluctuating systems (Wright and Szluha 1980). Once in the drift, invertebrates are considerably more vulnerable to predation. MacPhee and Bruscen (1976) stated that extreme reductions in flow significantly increased the amount of insect drift and the rate of ingestion of drifting organisms by salmon in an experimental diversion channel. Minshall and Winger (1968), found that virtually all bottom dwelling forms were affected by the effects of reduction in stream discharge on benthic drift. They also noted that periodic reduction of water levels during daylight could increase the drift of invertebrates during periods when fish are actively feeding.

Fish populations in streams are also affected by fluctuating discharges. Experimental studies by MacPhee and Bruscen (1976) demonstrated that both decreases and rapid increases in flow displaced fish from test sections. Fish were displaced more rapidly at night than during the day. Such reductions in carrying capacity and resultant displacement of fish were caused by loss of shelter, food and available space. Habitat is assumed to be the primary factor limiting population size (Loar and Scale 1981) and each species has different habitat requirements for each life stage (spawning, incubation, fry, juvenile, and adult).

Frazer (1972) argues that although shelter is an important determinant of fish carrying capacity, carrying capacity can be affected by changes in current velocity alone. In support of his argument, Frazer (1972) cited studies by Kalleberg (1958) who reported a decrease in the size of territories for juvenile salmon and brown trout as a result of increased current velocity. Conversely, reduced velocities caused individuals to enlarge the area of their territories; and the smaller and less agressive fish were often displaced in the process. With reduced flows, more fish were forced to select less desirable feeding stations because of the expanded territories of the more agressive individuals. Thus, the competition for space becomes competition for food. The less agressive individuals remain in the smaller territories over longer periods of time and are thus exposed to more predators.

Warmwater sport fish abundance in the 5.3 mi reach of Hoosic River surveyed downstream of the Schaghticoke powerhouse appeared low (Table 3). Although quantitative data on medium size warmwater rivers in DEC's Region 4 is lacking, experience on Schoharie Creek, Susquehanna River, and Unadilla River suggest that sport fish are abundant in these waters and that Age 1 and older smallmouth bass appeared abundant. This was certainly not the case in the Hoosic River when only 21 smallmouth bass Age 1 and older were collected, and it appeared that bass abundance was low.

Based on the above discussions, it is likely that the drastic fluctuation in stream flows occurring on the New York portion of the Hoosic River downstream of Johnsonville and Schaghticoke Reservoirs are adversely impacting the aquatic community. The 30 cfs flows that may be present during the storage phase represents only about 2.5% of the 1,182 cfs average flow and is inadequate to provide good fishing. According to Tennant (1976), 30% of the average flow is recommended as a base flow to sustain good survival conditions for most aquatic life forms and general recreation. Thirty percent of the average stream flow at Schaghticoke Dam is 355 cfs. Elimination of these large daily fluctuations by changing the operational mode of the Schaghticoke and Johnsonville hydropower facilities to run of river should result in increased density and diversity of benthic invertebrates. Sport fish populations should also respond positively to a return of seasonal flow patterns.

Reservoir Water Level Fluctuation

Most reservoir sport fish are closely associated with the littoral and shore zones for some part of their life cycle. Specifically, spawning, incubation and hatching of eggs, and development of larvae, postlarvae, and juveniles occur in the shallow littoral and shore zone. The basic requirements for successful spawning, development, and growth are adequate spawning habitat, stable water level, and adequate food supply. Water level fluctuations can significantly affect all these requirements.

Water level elevations may fluctuate from 1.0-3.5 ft daily in Schaghticoke and Johnsonville Reservoirs because of hydropower operation. Prior to placement of flashboards around June 1, Schaghticoke Reservoir has a maximum daily 1.0 ft drawdown compared to 3.0 ft in Johnsonville Reservoir. This two foot difference in fluctuation between the two reservoirs may account for some of the observed differences in largemouth bass abundance and size structure in the two reservoirs.

In Johnsonville Reservoir, there were few Age 1-3 largemouth bass in 1986, as evidenced by the PSD of 96% (McBride 1988B). According to Anderson (1980), largemouth bass populations exhibit satisfactory or favorable size structure, ie. balance, when PSD is approximately 40-70%. Although the 13.5 ft drawdown in 1985 may have aggravated the situation, low numbers of sublegal bass were also observed in 1981 and 1984. McBride (1988B) suggested that the scarcity of bass <12 in may be due to the 3.0 ft water level fluctuation during the May spawning period since largemouth bass typically spawn in 1-4 ft of water (Scott and Crossman 1973). Thus, bass nests may be exposed and the eggs or fry killed when the water level is lowered 3.0 ft. Largemouth bass populations should benefit from stable water levels (McBride 1988B). The abundance and high size quality of the largemouth bass population that now exists with the 2.0-3.0 ft daily fluctuating water level is most likely due to low fishing pressure and low angler exploitation. Improved access, which is being recommended, will result in increased fishing pressure and exploitation of largemouth bass. Increased bass recruitment will be required to compensate for increased angler exploitation and to maintain the largemouth bass population in the desired PSD range of 40 - 70%.

In Schaghticoke Reservoir, there was no obvious drawdown impact on fish populations (McBride 1988A). Drawdown in May is limited to 1.0 ft compared to 3.0 ft in Johnsonville Reservoir. However, at maximum drawdown elevation, there was less than 2.0 ft of water in most of the 28 acre west basin (Figure 3) which represents 19% of the lake's surface area. This probably reduces the fisheries potential of Schaghticoke Reservoir.

Stream Diversion

Flows in the 1.9 mi reach between Schaghticoke Dam and the powerhouse are entirely dependent upon leakage and/or unregulated releases from Schaghticoke Dam. Spillage only occurs 24% of the time, whenever stream flows at the dam exceed 1,500 cfs. Fish populations in this reach are severely limited by these low flows because of the impact on one or more of their life stages (spawning, incubation, fry, juvenile, and adult) and the reduced carrying capacity of the stream. Fish populations could be enhanced by providing a minimum year round conservation flow release. According to Tennant (1976), 30% of the average flow is recommended as a base flow to sustain good survival conditions for most aquatic life forms and general recreation. The average stream flow at Schaghticoke Dam is 1,182 cfs (NMPC 1986). Thus, 30% of the average flow to the bypassed reach would be 355 cfs.

Water Quality/Contaminants

The Hoosic River has a long history of water quality problems including recurrent fish kills. Although overall water quality has greatly improved and fish kills are no longer chronic, the presence of PCB's and special health advisories on fish consumption will preclude attainment of angler use objectives. PCB's directly affect 26 mi or 72% of New York's Hoosic River reach and indirectly the remaining 10 mi because people probably assume that all fish in the river are contaminated.

Fishing has been prohibited in the 7.2 mi (217 acres) of Hoosic River downstream of the Schaghticoke Dam since 1976 but this closure is the result of the fishing ban on the Hudson River from the Troy Dam to Hudson Falls, which includes all tributaries to the first impassible barrier, because of high levels of PCB contamination in fish. Results of the 1986 contaminant analyses of fish from this reach demonstrates that the fishing ban on the lower Hoosic River may be unnecessary. PCB levels in the four fish species tested ranged from 0.4 to 1.1ppm (Table 6), which are well below the FDA tolerance level of 2.0 ppm. The highest levels were found in fallfish (1.1 ppm) and white sucker (0.9 ppm), species that are generally are not harvested by most anglers. Rock bass and smallmouth bass are the most abundant sport fish in this reach (Table 3) and they averaged 0.4 and 0.5 ppm of PCB's respectively (Table 6). PCB levels ranged from 0.1 to 1.2 ppm in rock bass and 0.2 to 1.1 ppm in smallmouth bass (Unpublished data, DEC's Bureau of Environmental Protection).

A health advisory on consumption of trout from the Hoosic River has been in effect since 1983 because of elevated PCB's. Initially, the advisory recommended eating no more than one meal per month of brown trout $\geq$ 12 in. In 1988, the meal a month advisory was extended to all trout of any size because of increased PCB levels in brown and rainbow trout from the North Petersburg area (New York - Vermont border to the Little Hoosic River). Brown and rainbow trout from this reach averaged 4.3 and 2.8 ppm in 1986 compared to 2.4 and 1.8 ppm in 1983 (Table 4).

MANAGEMENT GOAL AND OBJECTIVES

The Hoosic River offers a variety of fishing experiences ranging from stream fishing for trout and smallmouth bass to lake fishing for largemouth bass and a variety of panfish. This report identifies the fisheries potential for this river system and it is our intention to manage the resource so that it produces at or near that potential.

The goal of this plan is to:

DEVELOP AND MAINTAIN
DIVERSE AND HIGH QUALITY
WARMWATER AND TROUT FISHING
OPPORTUNITIES ON THE N.Y.
PORTION OF THE HOOSIC RIVER

Objectives

1. Provide smallmouth bass fishing opportunities in the riverine reaches downstream of the Valley Falls impoundment with mean angler catch rates (creeled plus released) of approximately 0.25 fish per hour.

2. Provide largemouth bass and/or smallmouth bass and panfish fisheries in Schaghticoke Reservoir with bass catch rates (creeled plus released) of approximately 0.1 fish per hour and a bass population PSD > 40% and with 50% of the panfish stock of desirable size.

3. Provide largemouth and panfish fisheries in Johnsonville Reservoir with bass catch rates (creeled plus released) of approximately 0.1 fish per hour and a bass population PSD > 40%. Provide a trophy fishery for tiger muskellunge.

4. Provide rainbow and brown trout fisheries in the Hoosic River upstream of Johnsonville Reservoir with trout catch rates (creeled plus released) of approximately 0.5 fish per hour.

5. Provide convenient fishermen access to all warmwater riverine reaches, coldwater riverine reaches, and impoundments to accommodate 12 angler trips/acre, 50 angler trips/acre, and 20 angler trips/acre, respectively.

Anticipated Problems

Major requirements needed to reach fisheries management objectives for the New York portion of the Hoosic River include:

1. Stabilization of stream flows in the Hoosic River downstream of Johnsonville and Schaghticoke Dams.

2. Stable water levels in Johnsonville Reservoir.

3. Provision for adequate flow in the 1.9 mi bypass reach from Schaghticoke Dam downstream to the powerhouse.

4. Adequate public access to the fishery resource.

5. Mitigation of the fishing ban on the lower 7.2 mi of Hoosic River.

6. Reduction of PCB contaminant levels in trout to less than 2.0 ppm.

FISHERIES MANAGEMENT STRATEGIES

To achieve the management goal, the following strategies should be implemented.

Hydropower Operation

The operating licenses for the NMPC hydropower generating facilities on the Hoosic River at Johnsonville and Schaghticoke expire December 31, 1993. NMPC intends to submit an application to FERC for authorization to continue operation of the two projects and the application must be submitted to FERC between December 31, 1988 and December 31, 1990. The relicensing process provides regulatory agencies the opportunity to make recommendations to FERC on mitigating existing adverse impacts to fisheries resulting from current permitted operational procedures.

Flows in the nearly nine miles of Hoosic River below the Johnsonville and Schaghticoke powerhouses must be stabilized. NMPC should be required by FERC to shift operation from the current storage and release mode at both impoundments to a run of river mode where the instantaneous outflow from the impoundment is always equal to the instantaneous inflow into the impoundment. This would provide more stable flows to the Hoosic River and result in a more productive fishery.

A variety of benefits would result from the change in operational mode. The dewatering impact downstream of the powerhouses which occurs whenever the hydroelectric facilities are non-operational and the reservoirs are not spilling would be eliminated. Second, daily fluctuating water levels in the reservoir would be eliminated which should benefit the fishery particularly in Johnsonville Reservoir. Third, there would be a 120 cfs conservation flow release at the James Thompson Dam to the 300 ft bypass reach instead of the interim 20 cfs which is now in effect pending resolution of the operational mode of the Johnsonville hydropower facility 3.8 mi upstream.

NMPC should be required by FERC to provide a minimum flow to the 1.9 mile bypassed reach between Schaghticoke Dam and the powerhouse. The quantity of the flow should be based on instream flow incremental methodology (IFIM) studies which should focus on optimizing habitat for juvenile and adult life stages of smallmouth bass and rock bass. This study should incorporate:

1. A sampling (transect) program in selected study sections that will obtain a representative assessment of each habitat type.

2. A statistically valid approach to expand results in study sections to the entire shunted reach.

3. A rationale for determining optimum flows for the target species in each habitat type based on measurements in the study sections and appropriate probability of use curves for all life stages of rock bass and smallmouth bass.

4. Discussion and literature citations that validate the probability of use curves used to determine the volume of the recommended release.

Fish Passage

Upstream fish passage on the Hoosic River is not a concern at this time. However, the entrainment and impingement impacts of hydroelectric plant operation on resident fish moving downstream is an ongoing DEC concern. In the absence of any quantitative data on the magnitude of the problem at Schaghticoke and Johnsonville, it will be DEC's interim position (Appendix A) that the following mitigative measures be implemented:

1. Angled trash racks will be installed in the forebay or intake area at an angle that is not less than 40° to the face of the intake structure or power plant.

2. The spacing between the bars shall be no greater than one inch.

3. The rack will be of sufficient depth or length to insure that the maximum velocity through the bars does not exceed 2.0 ft per second.

4. A bypass structure shall be installed on the downstream most end of the trash racks with sufficient flow for attraction and passage downstream.

Angler Access

Public access is limited on many Rensselaer County waters including the Hoosic River and its instream impoundments. Johnsonville and Schaghticoke Reservoirs are the third and sixth largest lakes in Rensselaer County, respectively. Improved access would benefit anglers.

As part of the Johnsonville and Schaghticoke hydropower relicensing efforts, NMPC should be required by FERC to develop and maintain the following public access:

1. On Schaghticoke Reservoir, a fishermen parking area should be developed along Fishermans Lane (Figure 3). It is recommended that a section of the road be widened to allow parking along one or both shoulders for eight cars. This roadside access would insure continued public access to Schaghticoke Reservoir and also permits the launching of car top boats.

2. A fishermen parking area for five cars and a car top boat access site should be constructed near the Schaghticoke powerhouse to provide shore and boat access to the tailwater discharge.

3. On Johnsonville Reservoir, a car top boat access site for eight cars should be developed at the lower end of the reservoir near the dam and a light trailered boat launch for 15 cars and trailer should be developed at the covered bridge in Buskirk (Figure 4).

4. A car top boat launch site should be developed below Johnsonville Dam with a capacity of five cars. This site in conjunction with another site to be constructed by the James Thompson Dam hydropower developer would provide float fishing opportunities on 3.8 mi of Hoosic River.

As part of the FERC exemption for hydropower development at the James Thompson Dam, DEC required the owner to develop a recreation area including a car-top launch facility. Work on the car-top launch facility began in the fall, 1988 and should be completed by spring, 1989.

DEC's Region 4 Fisheries Office will acquire public access for the remainder of the Hoosic River. Access points should be develoepd at two to three mile intervals and should include streamside parking areas at strategic locations which will be identified in 1989. Where terrain on other circumstances do not facilitate streamside parking, access should be acquired by combinations of roadside parking with footpaths to the river. Public fishing rights will be purchased upstream and downstream of each parking area or fisherman footpath.

Fishing Ban

Fishing is currently prohibited in the 7.2 mi reach of Hoosic River from the Hudson River to Schaghticoke Dam. Laboratory analyses of fish collected from this reach in 1986 for contaminant analysis found that average PCB levels ranged from 0.4 to 1.1 ppm (Table 6) and are well below the FDA tolerance level of 2.0 ppm. Smallmouth bass and rock bass, the primary sport fish in this reach, averaged 0.5 and 0.4 ppm of PCB's, respectively. The low PCB levels found in fish indicate that the ban on fishing may not be warranted and that fishing and/or fish consumption may not pose a health hazard. The appropriateness of the closure should be reviewed once a decision has been made on the proposed Hudson River PCB hot spot dredging program.

Fish Kills

Fish kills have been a chronic problem in the Hoosic River but they have become less prevalent in recent years. The last New York fish kill occurred in 1983. DEC's Region 4 fisheries staff in cooperation with DEC's Hale Creek Environmental Disturbances Unit at Johnstown will investigate promptly all fish kills originating in New York and assist to the extent possible with fish kill investigations occurring in Vermont and Massachusetts. A Hoosic River fish kill notification system for New York, Vermont, and Massachusetts officials responsible for fish kill investigations was established in 1981 to determine cause of the kills, assess damage and penalties. The 1981 list will be updated by the Region 4 Fisheries Office and maintained.

Water Quality

Water quality monitoring in the New York portion of the Hoosic River by DEC's Division of Water will continue through 1989. Studies include water column testing, toxicity testing, sediment testing, and macroinvertebrate sampling. Study objectives are to quantify the source(s) and magnitude of the problem(s) that may exist and to recommend corrective measures as needed. Coordination with Massachusetts and Vermont is needed for an interstate effort to identify and address chronic water quality issues. The PCB issue should be addressed first. To ensure that industrial dischargers in the New York reach are in conformance with their industrial discharge permits, the Region 4 Fisheries Office will request DEC's Region 4 Division of Water Office to make unannouced (notification the day of inspection only) inspections to collect effluent samples for analyses. This should be done at least once a year for three years. Industrial discharge permits are renewed every five years. At this time, the Region 4 Fisheries Office will request biomonitoring to evaluate the acute toxicity of the discharge to aquatic organisms.

Angler Use Survey

Angler use averaged 12 trips/acre on the more accessible trout inhabited reaches of the Hoosic River in 1983 (Sanford 1984) but is unknown on the warmwater reach. There is a need to determine current angling use and catch information to evaluate the effectiveness of fish management efforts. Fishing pressure will be determined on nine reaches of river through aerial angler counts over a three year period (1988-1990).

- DEC's Aviation Unit will make aerial counts of shore and boat anglers for each reach throughout the New York portion of the Hoosic River. Four flights will be made monthly (2 weekend days and 2 weekdays) from April through October.
- Region 4 Fisheries staff will complete data summary and analysis by January of the following year.

As fishing pressure approaches management objectives, a creel check will be conducted to assess angling quality.

Warmwater Fish Stocking

Johnsonville Reservoir has an abundant forage fish population. White sucker comprised 46% of all fish collected in 1986 (Table 3) and 34% of the biomass. Common carp were also quite common. The abundant carp and sucker population indicates that sufficient prey species are available to support another predator species. Tiger musky, a sterile hybrid between the muskellunge and northern pike, are recommended for stocking because white suckers are a preferred prey species (Engstrom-Heg et al. 1986). These fast growing fish require three to four years to attain the 30 in minimum size limit and have the potential to attain weights exceeding 15 lbs. Tiger muskies were stocked in Johnsonville Reservoir in September, 1988, at a stocking rate of 6 fish/acre or 1,614 tiger musky fingerlings annually.

Trout Stocking

Trout are profoundly affected by water temperatures. Brown and rainbow trout do best in waters where temperatures do not exceed 68°F and 70°F, respectively (Smith 1985). In the trout inhabited reach of the Hoosic River, maximum summer water temperatures as high as 80°F have been recorded. In 1975, the maximum weekly mean temperature was 75°F and 74°F at Eagle Bridge and North Petersburg (Figure 1), respectively (unpublished data, DEC's Region 4 Fisheries Office). The daily maximum temperature equalled or exceeded 75°F 18 times between June 27 and August 25 at Eagle Bridge and 16 times at North Petersburg (unpublished data, DEC Region 4 Fisheries data). These temperatures are well above the preferred range for trout.

Warm water temperatures in the Hoosic River tend to favor rainbow trout which tolerate somewhat higher temperatures than brown trout. During periods of elevated water temperatures, Hoosic River trout must seek thermal refuges to survive. During a hot, dry summer, trout populations will be reduced both in numbers and distribution because of the limited carrying capacity of thermal refuge areas. Wet and/or cool summers would reduce the frequency of high water temperatures, which should result in the Hoosic River sustaining larger trout populations under those conditions.

Under New York's trout management program, trout streams are assigned one of 14 management types (Engstrom-Heg 1984). The best fit of the management types suggested by Engstrom-Heg (1984) would be either Bw or Bs for the Hoosic River. Bw streams are generally infertile or habitat deficient wild trout streams lacking significant unused carrying capacity that are not stocked. Bs streams are generally infertile or habitat deficient streams, often small, with significant unused carrying capacity and a light to moderate fishery. Stocking of Bs streams provide for an early season fishery and some holdover. Both the Bw and Bs classifications are a poor fit because these categories are not sensitive to the trophy trout potential the river offers. Although, water temperatures in the Hoosic River commonly exceed the preferred temperature range, the river offers cold water refuge at tributary mouths and in areas of ground water recharge, which in combination with its overall productivity produces numbers of large trout. Rather than assign the Hoosic River a specific management type, the river will be designated "refuge restricted". Because the river is refuge restricted, and angling use is low in part because of the river's poor image and poor access, stocking is not recommended at the present time. An experimental trout stocking will be implemented when special health advisories on trout are removed and public access is improved. Until then, trout populations will be dependent upon natural recruitment, primarily from the tributary system.

Contaminants

Contaminants such as PCB's and mercury are present in Hoosic River fishes. Currently, there is a health advisory that recommends eating no more than one meal per month of trout from the Hoosic River. PCB levels have generally declined since 1975 except for trout in the North Petersburg area (Little Hoosic River to New York - Vermont border) which resulted in the imposition of the more restrictive health advisory on trout consumption in 1988. North Petersburg area brown trout PCB levels increased from 2.4 ppm in 1983 to 4.3 ppm in 1986 and rainbow trout increased from 1.6 ppm to 2.8 ppm during the same time period (Table 4). PCB levels were less than the FDA tolerance level (2.0 ppm) for all fish species tested at the other four collection sites. Mercury levels were less than the FDA tolerance level (1.0 ppm) for all fish species tested at the five collection sites. FDA tolerance levels were established to regulate commercial sale of fish.

The New York State Department of Health (DOH) has a general advisory that recreational anglers should eat no more than one meal (0.5 lb) per week of fish from any water in the state. Special restrictive advice for sport fishing are issued when contaminant analysis reveal levels which exceed FDA tolerance levels. For PCB's, the following guidelines are in effect (Dr. Ronald Sloan, DEC, personal communication):

$\geq$ 2.0 ppm - eat no more than one meal per month

$\geq$ 6.0 ppm - eat none

Additional trout collections will be required to monitor PCB levels to determine when health advisories on fish consumption are no longer warranted. Trout should be collected at five year intervals until PCB levels are less than 2.0 ppm. Since trout were last collected in 1986, the next collection should be scheduled for 1991. Trout should be collected from the New York - Vermont border downstream to the Little Hoosic River and downstream of Hoosick Falls. Additional collections of non-trout species from downstream areas are not warranted because PCB's levels are low and not a problem.

Fishing Regulations

Growth rates of warmwater sport fish in Schaghticoke and Johnsonville Reservoirs are generally average to fast compared to other waters in east-central New York (McBride 1988A; McBride 1988B). Even growth rates of smallmouth bass and rock bass from the river section below Schaghtiocke Reservoir are average (unpublished data, DEC Region 4). Since bass growth rates are good and fishing pressure is low, continuation of the statewide angling regulations for warmwater species (Table 7) should maintain the quality of the fisheries resource.

Trout growth rates are highly variable and dependent upon the age at which they enter the Hoosic River from a tributary. Rainbow trout generally enter the river at age 1 or 2 but some enter as young-of-year. Rainbow entering the river at age 0 can average 11 in as fall yearlings; and at the other extreme, rainbow trout entering the river at age 2 may only average about 7 in but grow 5 to 6 in during the following growing season (unpublished data, DEC Region 4). Rainbow trout entering as yearlings approximately 3.5 in long may range in size from 7 to 11 in by the following fall.

Brown trout generally enter the Hoosic River at Age 2 averaging about 7 in long and grow to 9 to 11 in long by the following fall. The slower growth rates for brown trout compared to rainbow trout is probably due to the warm summer water temperatures in the river.

The current nine inch size limit on trout in the Hoosic River appears to protect most trout through at least one growing season in the river. Although growth can be rapid, a higher size limit is not warranted at this time because of very warm summer water temperatures and low fishing pressure. The benefits of a higher size limit would be offset by the increased mortality rate that would occur during thermal stress periods. If fishing pressure approaches the 50 trips per acre objective described in this plan, a higher size limit may be necessary to maintain angling quality.

Fish Surveys

The 1985 drawdown in Johnsonville Reservoir adversely affected panfish populations. Another fisheries survey by DEC's Region 4 Fisheries Office should be scheduled for 1991 to determine if panfish populations have recovered and to reassess the largemouth bass population.

Publicity

Promotional efforts will be required to meet angler use objectives for the Hoosic River. Unfortunately, the health advisory on trout consumption preclude such efforts at the present time. Although the health advisory is limited to trout only, many people probably assume that all fish are contaminated. Once trout PCB levels decline to where special health advisories are no longer needed, promotional efforts will be warranted. The primary effort will be the development of a Hoosic River fishing brochure which shows the location of public fishing rights, boat launch sites, fisherman parking areas, and a description of the different fishing opportunities that are available.

MANAGEMENT RECOMMENDATIONS

The following recommendations should be implemented to help achieve the plan's objectives.

1. DEC will ask FERC to require that the operation of the Schaghticoke and Johnsonville hydropower facilities be changed from the current storage and release mode to a run-of-river mode. The change in operational mode will stabilize streamflows in 8.5 mi of river downstream of these two reservoirs and will also stabilize water levels in Schaghticoke and Johnsonville Reservoirs.

2. DEC will ask FERC to require the Schaghticoke hydropower operator to provide a minimum flow release to the 1.9 mi bypass reach from Schaghticoke Dam downstream to the powerhouse based on instream flow incremental studies. The fishery could be enhanced by providing a minimum year round flow.

3. DEC will ask FERC to require the Schaghticoke hydropower operator to provide and maintain the following fisherman access sites on Schaghticoke Reservoir:

a) a section of Fishermans Lane should be widened to provide and maintain road shoulder parking for eight cars and to facilitate the launching of car top boats.

b) a fisherman parking area (capacity for five cars) and a car top launch site should be developed near the powerhouse to provide access to the tailwater discharge area.

4. The James Thompson Dam hydropower operator is developing the recreation area, including the car top launch, on the Valley Falls impoundment as specified in the 1984 FERC hydropower license exemption. This project should be completed by spring 1989. If not, enforcement action against the developer should be initiated.

5. DEC will ask FERC to require the Johnsonville hydropower operator to provide and maintain the following fisherman access sites:

a) A car top boat launch site, with a capacity of eight cars, should be developed just upstream of the Johnsonville Dam along the south shore.

b) A light trailered boat launch, with a capacity of 15 cars and trailers, should be constructed on the southwest shore adjacent to the covered bridge at Buskirk.

c) A car top access site should be developed downstream of the dam. This five car site would provide float fishing access to the James Thompson Dam 3.8 mi downstream.

6. DEC will ask FERC to require the operator of the Schaghticoke and Johnsonville hydropower facilities to provide the following mitigative measures for downstream fish passage.

a) Angled trash racks will be installed in the forebay or intake area at an angle that is not less than 40° to the face of the intake structure or power plant.

b) The spacing between the bars shall be no greater than one inch.

c) The rack will be of sufficient depth or length to insure that the maximum velocity through the bars does not exceed 2.0 ft per second.

d) A bypass structure shall be installed on the downstream most end of the trash racks with sufficient flow for attraction and passage downstream.

7. The Region 4 Fisheries Office will purchase fisherman parking areas (FPA) and fishing rights easements at strategic locations approximately 2 to 3 mi apart throughout the 16.1 mi reach of river between Eagle Bridge and the New York - Vermont state line to facilitate angler access to the Hoosic River. The locations for access development will be identified and a timetable for implementation will be developed in 1989.

8. The Region 4 Fisheries Office will initiate a review of the ban on fishing in the 7.2 mi reach of the Hoosic River downstream of Schaghticoke Dam when a final decision on the proposed Hudson River PCB hot spot dredging program is reached.

9. The Region 4 Fisheries Office in cooperation with DEC's Hale Creek Laboratory will investigate all fish kills on the New York portion of the Hoosic River to determine cause and to assess damages and penalties.

10. The Region 4 Fisheries Office will maintain an updated list of contact persons in New York, Vermont, and Massachusetts who are responsible for investigating fish kills on the Hoosic River. This will allow NY officials to respond quickly to fish kills on the New York reach resulting from toxic spills or discharges in Vermont and

Massachusetts. The coordinated approach will also permit faster determination as to the cause of the fish kill, the seriousness of damages, and assessment of penalties.

11. The Region 4 Fisheries Office will review reports prepared by DEC's Division of Water on the results of ongoing studies on the Hoosic River to identify potential problem areas that may affect fisheries. It will also encourage the Division of Water to coordinate with Vermont and Massachusetts to initiate an interstate effort to identify and address chronic water quality problems. The PCB issue should be addressed first.

12. The Region 4 Fisheries Office will request biomonitoring of the five major industries to evaluate the acute toxicity of their discharge to the aquatic environment. This should be a condition when the discharge permit is renewed.

13. The Region 4 Fisheries Office will request DEC's Region 4 Division of Water to make unannounced inspections of the major industrial dischargers at least once a year for three years to collect effluent samples for analyses. This is needed to ensure that the industrial dischargers are in compliance with their discharge permit.

14. The Region 4 Fisheries Office will collect trout from the Vermont - New York border to the Little Hoosic River and downstream of Hoosick Falls for PCB analysis at five year intervals beginning in 1991. Trout collections will be continued until PCB levels decline to less than 2.0 ppm. Collections of non-trout species from downstream areas are not warranted because PCB levels are low and not a problem. DEC's Bureau of Environmental Protection will be responsible for laboratory analysis of the trout.

15. The Region 4 Fisheries Office will schedule aerial angler counts on the New York portion of the Hoosic River from 1988-90 to obtain baseline data on angler use. As fishing pressure approaches management objectives, a creel check will be conducted to assess angling quality.

16. DEC will stock Johnsonville Reservoir with 1,600 tiger musky fingerlings annually to help reduce the abundant sucker and common carp populations. The stocking should also result in the development of a trophy fishery for fish weighing eight pounds or better. Tiger musky stocking began in September, 1988.

17. Trout will be stocked experimentally when special health advisories on trout are removed and public access is improved. Until then, trout populations will be dependent upon natural recruitment.

18. The nine inch size limit on trout in the riverine reaches and the statewide angling regulations for warmwater species throughout the New York portion of the Hoosic River will be continued.

19. The Region 4 Fisheries Office will complete a final report on the 1988 fisheries survey of the 59 acre Valley Falls impoundment in 1989.

20. The Region 4 Fisheries Office will resurvey Johnsonville Reservoir in 1991 to determine if panfish populations have recovered from the 13.5 ft drawdown in 1985 and to reassess the largemouth bass population.

21. The Region 4 Fisheries Office will develop a Hoosic River fishing brochure which shows the location of public fishing rights, boat launch sites, fisherman parking areas, and a description of the different fishing opportunities that are available. Development of the brochure will be deferred pending a decline of trout PCB levels to less than 2.0 ppm.

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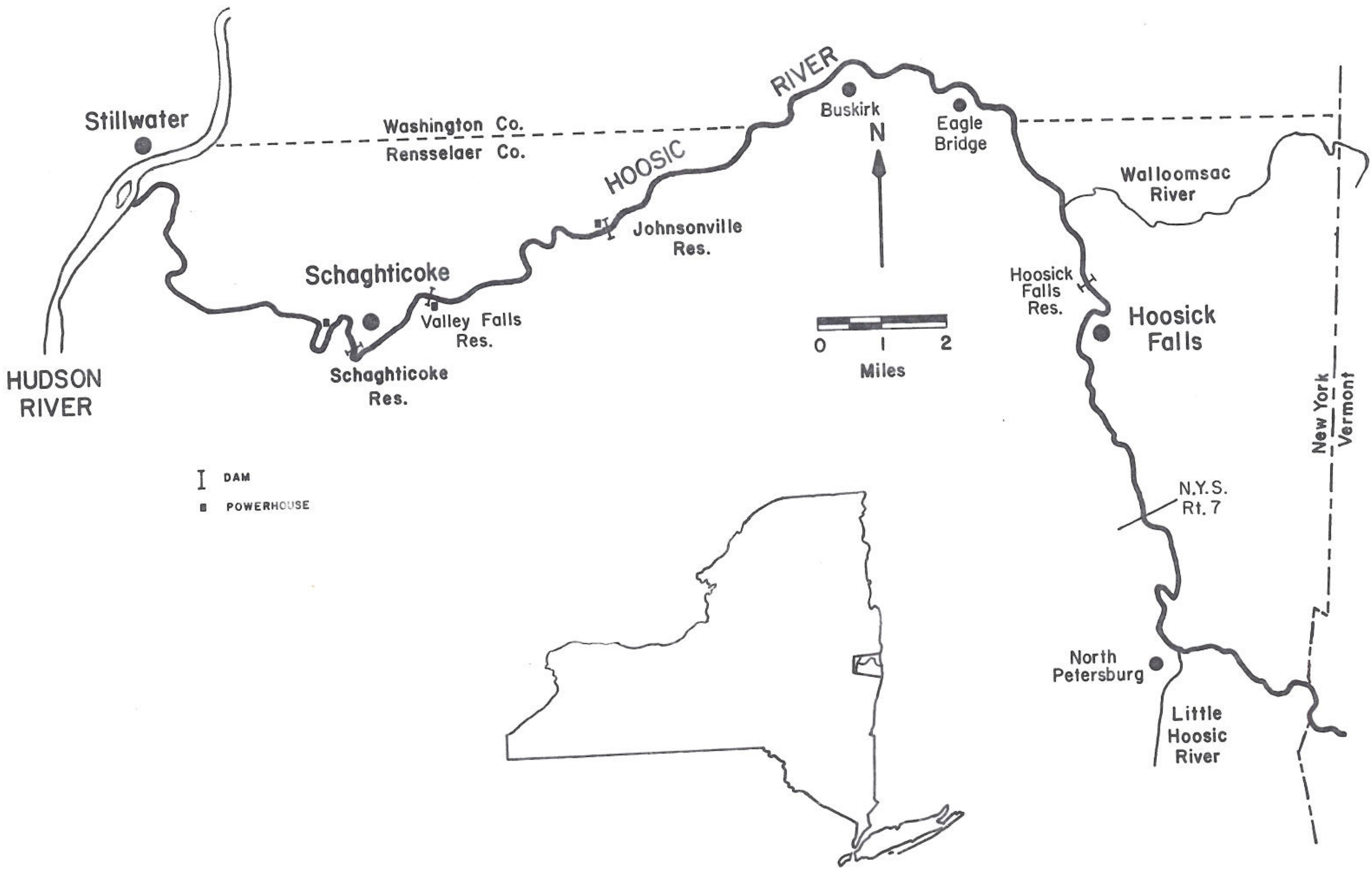


Figure 1: The Hoosic River from the Hudson River to the New York-Vermont state line.

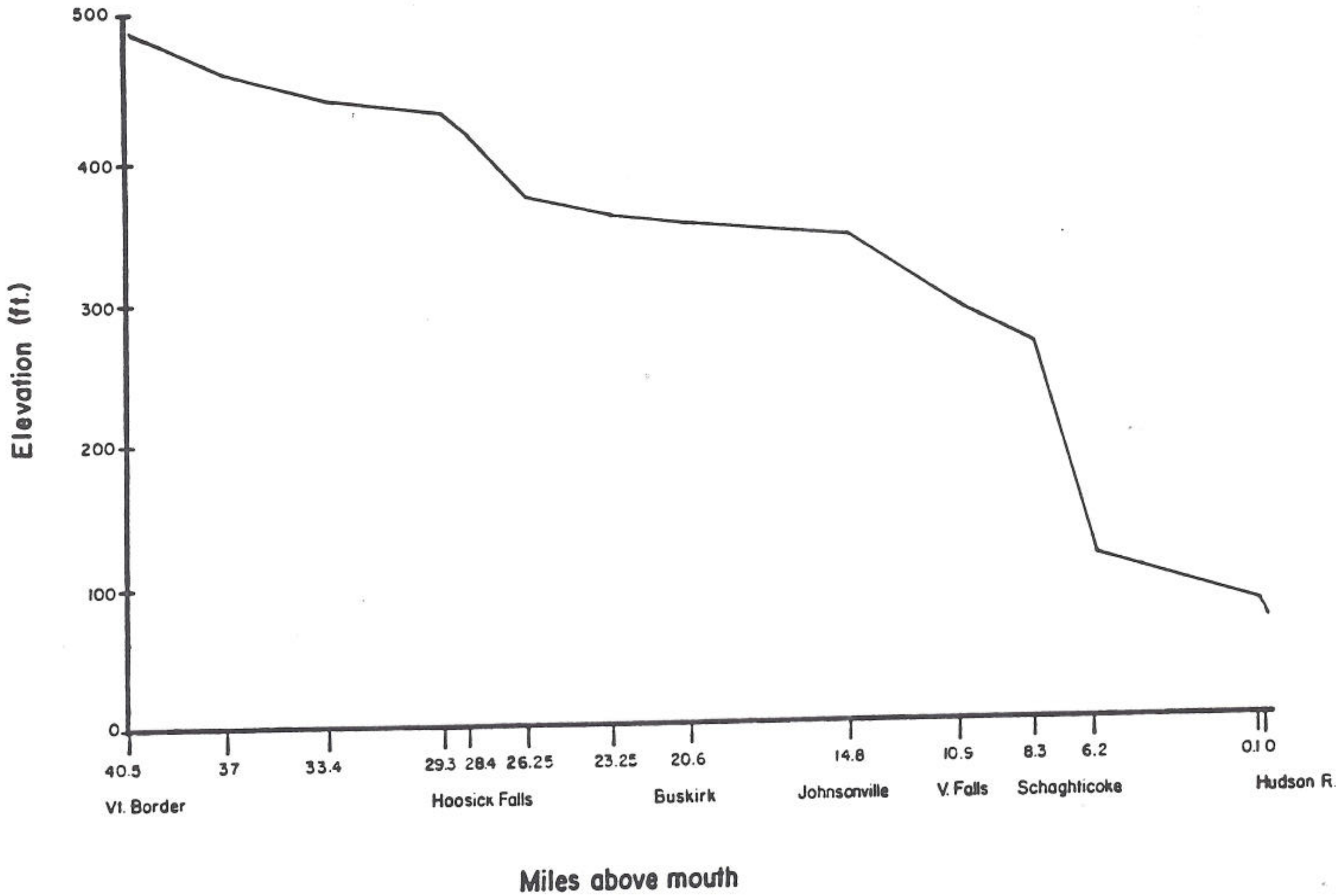
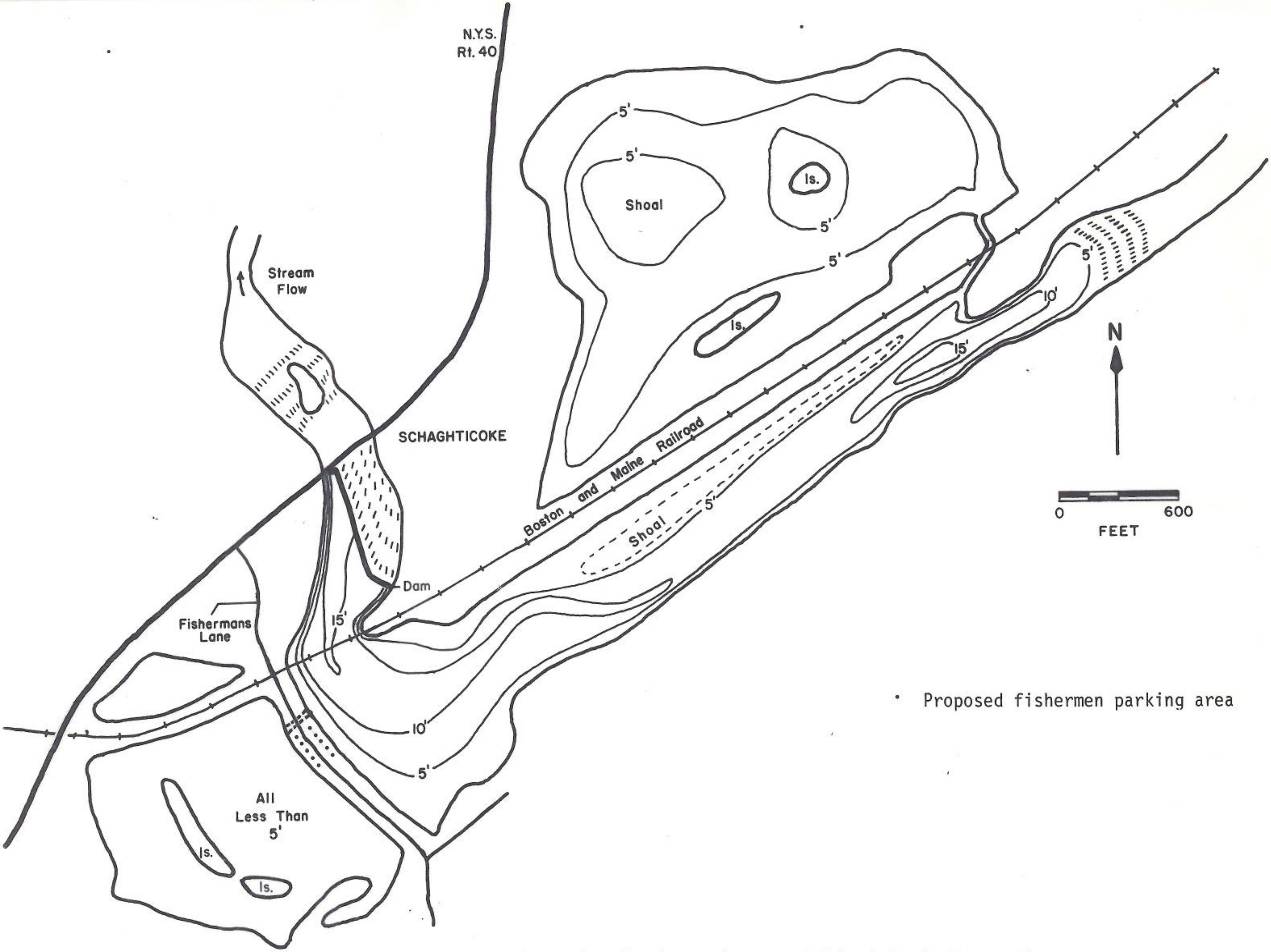


Figure 2: Stream gradient in the New York portion of the Hoosic River.



· Proposed fishermen parking area

Figure 3: Morphometric map of Schaghticoke Reservoir.

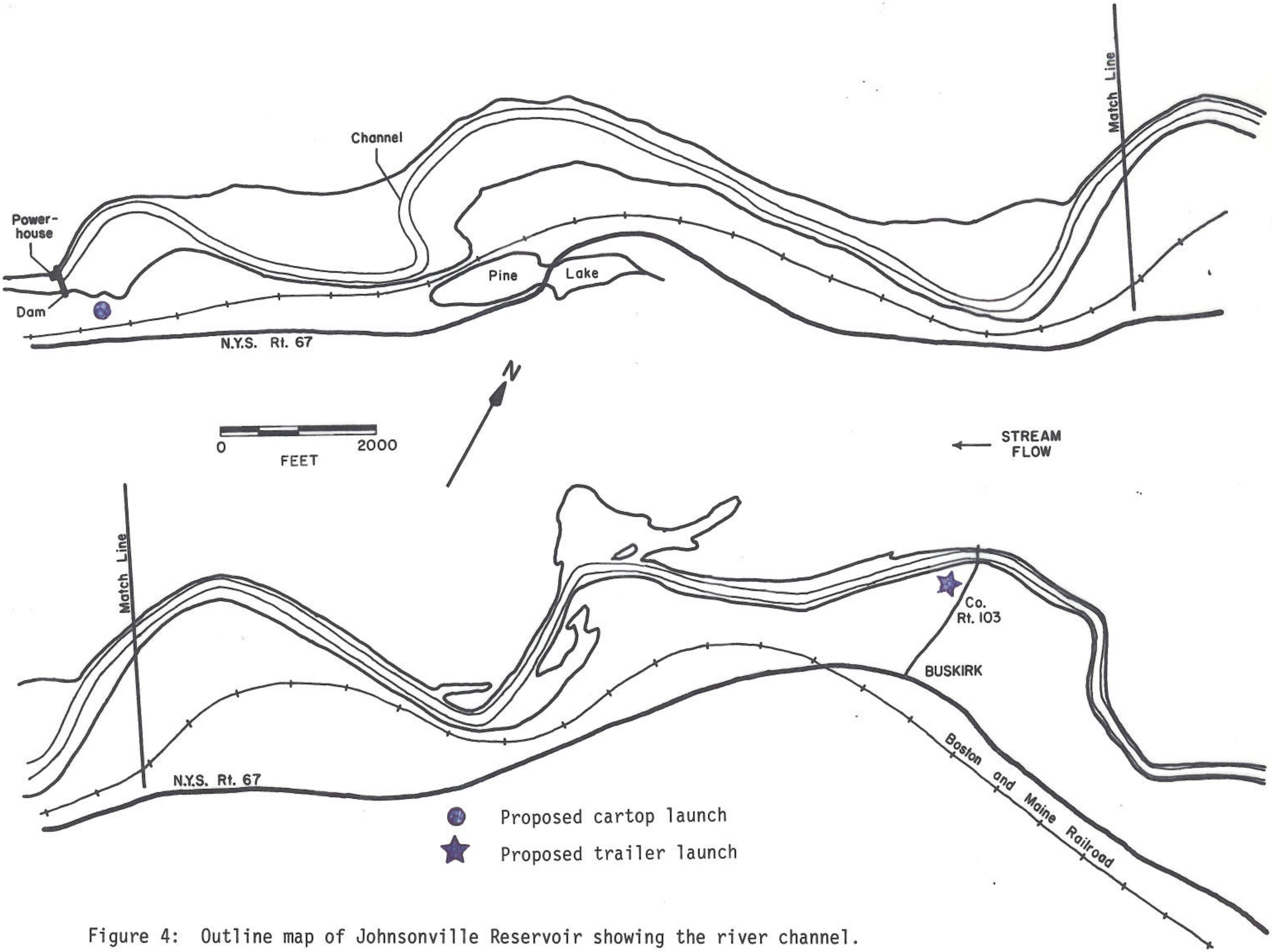


Figure 4: Outline map of Johnsonville Reservoir showing the river channel.

Table 1: Summary of trout inhabitated tributaries of the New York reach of the Hoosic River.

Tributary Number	Name	U.S.G.S. Quadrangle	Trout[1] Reproduction	Older Trout	No Data	Non Trout
1	-	Mechanicville			X	
2	-	Mechanicville			X	
3	-	Mechanicville			X	
4	Tomhannock Creek	Mechanicville				X
Unnumbered	-	Schaghticoke			X	
4A	-	Schaghticoke				X
5	-	Schaghticoke			X	
5A	-	Schaghticoke	RT, BT	BT		
6	-	Schaghticoke			X	
6A	-	Schaghticoke	RT	ST,BT		
7	-	Schaghticoke				X
8	Powamppokonk Creek	Schaghticoke				X
9	-	Schaghticoke	RT,BT	RT,BT		
10	Nipmoose Brook	Eagle Bridge		ST		
11	-	Eagle Bridge				X
12	-	Eagle Bridge				X
13	Center Cambridge Bk	Eagle Bridge		BT		
14	-	Eagle Bridge				X
15	Whipple Brook	Eagle Bridge	ST	ST		
15A	-	Eagle Bridge				X
16	-	Eagle Bridge	BT	BT		
17	-	Eagle Bridge				X
18	-	Eagle Bridge	ST,BT			
19	-	Eagle Bridge			X	
20	Owl Kill	Eagle Bridge		BT		
21	-	Eagle Bridge			X	
22	Case Brook	Eagle Bridge	ST	BT,ST		
23	Walloomsac River	Hoosick Falls	BT,RT	BT,RT		
24	-	Hoosick Falls			X	
25	-	Hoosick Falls			X	
26	Woods Brook	Hoosick Falls				X
27	-	Hoosick Falls				X
28	-	Hoosick Falls				X
29	-	Hoosick Falls				X
30	-	Hoosick Falls			X	
31	-	Hoosick Falls			X	
32	Browns Brook	North Pownal		BT		
33	-	North Pownal			X	
34	-	North Pownal				X
35	Shingle Hollow Brook	North Pownal	BT,RT	BT,RT,ST		
35A	-	North Pownal				X
36	Breese Hollow Brook	North Pownal	BT	BT		
37	-	North Pownal				X
38	Little Hoosic River	North Pownal	BT,RT	BT,RT		
39	-	North Pownal	ST	BT,ST		
40	-	North Pownal				X
41	-	North Pownal			X	

[1] BT - brown trout
RT - rainbow trout
ST - brook trout

Table 2: Common and scientific names of fishes collected in the Hoosic River and instream impoundments from its confluence with the Hudson River to the New York - Vermont state line.

		1934	1974-84	1986
FRESHWATER EELS				
American eel	*Anguilla rostrata*		X	X
HERRINGS				
Blueback herring	*Alosa aestivalis*			X[1/]
TROUTS				
Rainbow trout	*Oncorhynchus mykiss*		X	X
Brown trout	*Salmo trutta*		X	X
PIKES				
Northern pike	*Esox lucius*		X	X
MINNOWS AND CARP				
Goldfish	*Carassius auratus*		X	
Common carp	*Cyprinus carpio*	X	X	X
Golden shiner	*Notemigonus crysoleucas*		X	X
Satinfin shiner	*Notropis analostanus*		X[2/]	
Common shiner	*Notropis cornutus*	X	X	X
Spottail shiner	*Notropis hudsonius*	X	X	X
Rosyface shiner	*Notropis rubellus*	X	X	
Spotfin shiner	*Notropis spilopterus*			X
Bluntnose minnow	*Pimephales notatus*	X	X	X
Blacknose dace	*Rhinichthys atratulus*	X	X	X
Longnose dace	*Rhinichthys cataractae*		X	X
Creek chub	*Semotilus atromaculatus*	X	X	X
Fallfish	*Semotilus corporalis*	X	X	X
SUCKERS				
Longnose sucker	*Catostomus catostomus*		X	X
White sucker	*Catostomus commersoni*	X	X	X
Northern hog sucker	*Hypentilium nigricans*		X	X
FRESHWATER CATFISHES				
Yellow bullhead	*Ictalurus natalis*			X
Brown bullhead	*Ictalurus nebulosus*	X	X	X
Channel catfish	*Ictalurus punctatus*			X

Table 2: Con't.

TROUT-PERCHES				
Trout perch	*Percopsis omiscomaycus*		X	X
KILLIFISHES				
Banded killifish	*Fundulus diaphanus*	X		
SUNFISHES				
Rock bass	*Ambloplites rupestris*	X	X	X
Pumpkinseed	*Lepomis gibbosus*	X	X	X
Bluegill	*Lepomis macrochirus*		X	X
Smallmouth bass	*Micropterus dolomieui*	X	X	X
Largemouth bass	*Micropterus salmoides*	X	X	X
White crappie	*Pomoxis annularis*		X	X
Black crappie	*Pomoxis nigromaculatus*	X	X	X
PERCHES				
Tessellated darter	*Etheostoma olmstedi*	X	X	
Yellow perch	*Perca flavescens*	X	X	X
Log perch	*Percina caprodes*	X		X
Walleye	*Stizostedion vitreum vitreum*			X

1/Observed one dying and one dead adult blueback herring on 7/1/86 approximately 0.8 miles above Schaghticoke powerhouse.

2/Collected by non-DEC personnel.

Table 3: Total number of fishes[1/] collected by gill net and/or boat shocker from six locations on the New York portion of the Hoosic River in 1986.

	Hudson River to Schaghticoke Powerhouse	Schaghticoke Reservoir	Johnsonville Reservoir Dam to James Thompson Dam	Johnsonville Reservoir	Hoosick Falls to Walloomsac River	NY-Vermont State line to Little Hoosic River
Game Fishes						
Brown trout	-	-	5	-	2	10
Largemouth bass	4	53	2	23	1	-
Northern Pike	-	-	-	2	1	-
Rainbow trout	-	-	14	-	14	25
Smallmouth bass	34	25	-	-	1	-
Walleye	2	-	-	-	-	-
Pan Fishes						
Black crappie	2	42	-	8	-	-
Bluegill	5	51	-	-	6	-
Brown bullhead	-	3	-	11	1	-
Channel catfish	-	4	-	-	-	-
Pumpkinseed	4	18	-	3	-	-
Rock bass	14	18	-	10	8	-
White crappie	-	76	-	-	-	-
Yellow bullhead	-	1	-	-	-	-
Yellow perch	2	42	-	62	-	-
Other Fishes						
American eel	C[1/]	-	-	-	-	-
Blacknose dace	-	-	-	-	A	A
Bluntnose minnow	-	-	-	-	P	-
Common carp	A	75	C	49	3	-
Common shiner	P	-	C	-	P	P
Creek chub	-	-	-	-	-	P
Fallfish	A	-	-	-	C	-
Golden shiner	-	12	-	20	-	-
Log perch	P	-	-	-	-	-
Longnose dace	-	-	-	-	C	A
Longnose sucker	-	-	P	-	-	P
Northern hog sucker	P	-	-	-	-	-
Spotfin shiner	P	3	-	-	-	-

Table 3: Con't.

Spottail shiner	P	4	-	-	P	-
Trout perch	-	-	-	-	P	P
White sucker	A	32	A	157	A	C

1/ A = Abundant
C = Common
R = Rare
P = Present

Table 4: PCB concentrations in rainbow and brown trout collected from the North Petersburg area in 1979[1/], 1983[2/] and 1986[1/].

Species	Date	No Analyzed	Mean length (in)	Average PCB's (ppm)
Brown trout	6/79	11	10.4	4.4
Brown trout	7/83	3	9.8	1.4
Brown trout	10/83	10	12.4	2.4
Brown trout	9/86	10	9.0	4.3
Rainbow trout	6/79	5	8.6	1.8
Rainbow trout	7/83	2	9.7	0.8
Rainbow trout	10/83	4	10.7	1.6
Rainbow trout	9/86	9	10.1	2.8

[1/]NYSDEC. 1981. Toxic substances in fish and wildlife: 1979 and 1980 annual reports Volume 4, Number 1. New York State Department of Environmental Conservation. Bureau of Environmental Protection, Albany. 138pp.

[2/]Unpublished data, DEC's Bureau of Environmental Protection.

Table 5: PCB concentration in fishes collected from Johnsonville Reservoir in 1975[1/], 1978[2/], 1981[3/], 1984[3/], and 1986[1/].

Species	Date	No Analyzed	Mean Length(in)	Average PCB (ppm)
Largemouth bass	9/75	2	12.3	5.0
		3	15.7	6.0
Largemouth bass	6/78	19	13.3	4.2
Largemouth bass	6/81	12	15.8	2.6
Largemouth bass	6/84	9	15.6	1.3
Largemouth bass	6/86	16	15.0	0.9
White sucker	9/75	3	13.4	1.3
White sucker	6/78	10	11.0	0.2
Yellow perch	9/75	4	6.1	5.4
Yellow perch	6/86	10	10.9	0.5
Northern pike	6/86	2	24.0	0.6
Brown bullhead	6/86	3	11.9	0.2

1/ Unpublished data, DEC's Bureau of Environmental Protection.

2/ New York State Department of Enviornmental Conservation. 1979. Toxic substances in fish and wildlife: 1978 annual report. Volume 2. New York State Department of Environmental Conservation, Bureau of Environmental Protection, Albany.

3/ New York State Department of Environmental Conservation. 1987. Toxic substances in fish and wildlife: analyses since May 1, 1982 (Volume 6). New York State Department of Environmental Conservation, Bureau of Environmental Conservation Protection, Albany.

Table 6: PCB concentrations in fishes collected from the Hoosic Falls area, Schaghticoke Reservoir, and the lower Hoosic River in 1979[1/] and/or 1986[2/].

HOOSICK FALLS TO WALLOOMSAC RIVER

Species	Date	No Analyzed	Mean Length(in)	Average PCB's (ppm)
Brown trout	6/79	1	16.9	6.2
Brown trout	9/86	2	9.0	2.3
Rainbow trout	6/79	1	11.8	2.6
Rainbow trout	9/86	10	8.1	1.2
Bluegill	9/86	5	7.2	0.3
Rock bass	9/86	4	7.1	0.5
White sucker	9/86	5	14.0	0.7
SCHAGHTICOKE RESERVOIR				
Brown bullhead	6/86	3	9.5	0.1
Largemouth bass	6/86	15	15.5	0.9
White crappie	6/86	10	10.6	0.2
Yellow perch	6/86	10	9.7	0.4
SCHAGHTICOKE POWERHOUSE TO HUDSON RIVER				
Fallfish	9/86	5	10.4	1.1
Rock bass	9/86	11	7.3	0.4
Smallmouth bass	9/86	10	13.7	0.5
White sucker	9/86	5	16.7	0.9

1/ NYSDEC, 1981. Toxic substances in fish and wildlife. 1979 and 1980 annual reports. New York State Department of Environmental Conservation. Bureau of Environmental Protection, Albany. Volume 4(1):138pp.

2/ Unpublished data, DEC's Bureau of Enviornmental Protection.

Table 7: Mercury concentration[1/] in fishes collected in 1986 from five areas in the New York portion of the Hoosic River.

Species	Date	No Analyzed	Mean Length(in)	Average Mercury (ppm)
NY-VERMONT LINE TO LITTLE HOOSIC RIVER				
Brown trout	9/86	10	9.0	0.3
Rainbow trout	9/86	9	10.1	0.2
White sucker	9/86	4	16.0	0.4
HOOSICK FALLS TO WALLOOMSAC RIVER				
Brown trout	9/86	2	9.0	0.2
Rainbow trout	9/86	10	8.1	0.1
White sucker	9/86	5	14.0	0.5
Bluegill	9/86	5	7.2	0.2
Rock bass	9/86	4	7.1	0.4
JOHNSONVILLE RESERVOIR				
Largemouth bass	6/86	16	15.0	0.7
Brown bullhead	6/86	3	11.9	0.5
Northern pike	6/86	2	24.0	0.4
Yellow perch	6/86	10	10.9	0.9
SCHAGHTICOKE RESERVOIR				
Largemouth bass	6/86	15	15.5	0.7
Brown bullhead	6/86	3	9.5	0.2
Yellow perch	6/86	10	9.7	0.6
White crappie	6/86	10	10.6	0.4
SCHAGHTICOKE POWERHOUSE TO HUDSON RIVER				
White sucker	9/86	5	16.7	0.5
Rock bass	9/86	11	7.3	0.4
Smallmouth bass	9/86	10	13.7	0.7
Fallfish	9/86	5	10.4	0.2

1/Unpublished data, DEC's Bureau of Environmental Protection.

Table 8: Summary of 1987 angling regulations pertaining to the Hoosic River and its four instream impoundments.

STATEWIDE REGULATIONS[1/]

Species	Open Season	Minimum Length	Daily Limit
Trout (brook, brown and rainbow trout)	April 1 through September 30	Any Size	10
Largemouth and smallmouth bass	3rd Saturday in June through November 30	12"	5
Northern pike	1st Saturday in May through March 15	18"	5
Walleye		15"	5
Bullheads, carp, catfish, crappies, rock bass, suckers, sunfish, white bass, white perch and yellow perch	All Year	Any Size	Any Number

SPECIAL REGULATIONS[2/]

Species	Open Season	Minimum Length	Daily Limit
Trout	April 1 - Sept. 30	9"	5

[1/] Applies to all warmwater species in the Hoosic River and to trout in the four instream impoundments. For species not listed, see the current New York State fishing, small game hunting, and trapping regulations guide.

[2/] Applies to trout in the Hoosic River proper.

DOWNSTREAM MIGRANT FISH
MITIGATIVE RECOMMENDATIONS

BACKGROUND

During the early 1980's, a renewed interest in the development of hydropower projects in New York State created the need for the Division of Fish and Wildlife (DFW) to develop a set of generic concerns to ensure the protection, maintenance, restoration, and enhancement of fish and wildlife resources. These concerns included proposed operational modes, water-level fluctuations, fish passage, water quality, endangered species, wetlands significant habitats, public access (recreation), and construction activities. In the case of fish passage, the two principal areas of concern were the upstream passage of anadromous fish species and the downstream passage of both resident and anadromous fish species. In waters frequented by anadromous salmonids, such as Atlantic salmon, the DFW developed a requirement for one-inch angled trashracks with a maximum approach velocity of 2.0 feet per second for the protection of out migrating young and/or adult fish. However, in waters frequented by resident coldwater and warmwater species, the lack of knowledge on the timing and extent of their downstream movement initially resulted in a deferment of any mitigative measures until the DFW identified such a need. Subsequently, with the acquisition of additional insight on the potential for active and passive downstream movements by resident salmonids, centrachids and percids, the DFW began to prescribe the use of angled trashracks for certain projects where some adverse impacts are expected.

The following discussion addresses DEC's current position regarding the need to ascertain the significance of impacts due to entrainment and, the migration that should be provided to ensure an acceptable level of resources protection and/or enhancement.

DETAILED ASSESSMENT APPROACH

This approach requires prospective exemptee and licensees to conduct detailed pre and post project studies that provide sufficient data to facilitate a comparative analysis that evaluates the magnitude of annual entrainment and its effects on designated species of concern. It is recognized that a significant portion of this information must be collected after the project is operational. Developers/operators opting to assess the need for downstream passage migration should be prepared to provide the following:

-description of fish population and fish species distribution in impoundments above and below the project.
-the extent to which downstream migration of fish is occurring through the proposed project area including, but not limited to, the life stage(s) of each fish or other organism, the periodicity of their movements (e.g. continuous vs. episodic), and the type of downstream passage (active or passive).
-the extent to which the proposed project, new or existing, would result in a loss to some or all of the downstream migrant fish and the significance of this loss to downstream aquatic ecosystems.
-if it is deemed that the project will have a significant adverse impact, the type of mitigative measure(s) will have to be determined and implemented for their minimization or elimination.
-finally, the effectiveness of the mitigative measure(s) will have to be evaluated and, if necessary, any adjustments prescribed for improvement.

INTERIM MITIGATION

As an alternative, exemptees/licensees may opt for mitigative measures, such as angled trash racks, to ensure that the project is constructed in a timely and cost effective manner. Such racks shall be installed in the forebay or intake area at an angle that is not less than 40° to the face of the intake structure or power plant. The spacing between the bars shall be no greater than one inch. The rack shall be of sufficient depth or length to ensure that the maximum velocity through the bars does not exceed two feet per second.

In addition, a by-pass structure shall be installed on the downstream-most end of the trashracks with sufficient flow for attraction and passage downstream of the species of concern. Further, the DFW recommends that the trashracks be designed for interchangeability in the event that wider-spaced racks can be utilized at some further date (perhaps seasonally) if justified by results of adequate studies.

In summary, angled trashracks represent a current acceptable interim mitigative measure from the standpoint of both aquatic resource protection and hydropower project operation in most New York waters. This recommendation may be modified as new information on mitigative measures becomes available as impact studies are conducted and reported for hydropower facilities.

Division of Fish and Wildlife staff will participate in detailed scoping of site-specific studies if the project sponsor elects to pursue this option.