Environmental Research and Education
Technology for Conservation

News from....

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Hudsonia

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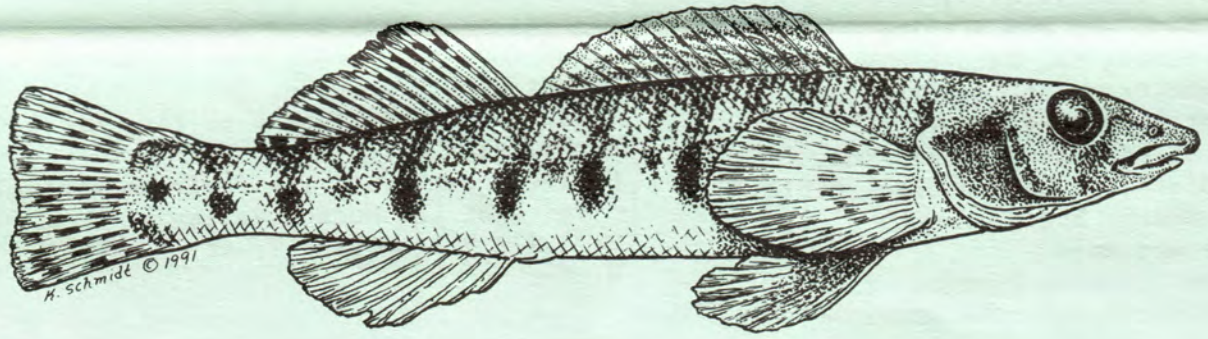
THE SHAWANGUNK KILL, HUDSON VALLEY NATURAL AREA

The Shawangunk Kill has great value as a relatively healthy Hudson River tributary with a unique and apparently natural assemblage of several aquatic plants and animals that are individually rare in New York. Furthermore, the Shawangunk Kill, from near Pine Bush north to the Wallkill River, has been designated under the New York State Wild, Scenic and Recreational Rivers Law.

Most Hudson Valley rivers and streams are damaged or on the brink of serious deterioration. The causes include siltation from soil erosion on construction sites; nutrient loading from soil erosion, treated sewage, and fertilizer runoff; salination from highway salting and chlorination of sewage; dams, channelization, removal of streamside trees and shrubs, bank stabilization, dredging, water withdrawals; and chemical pollution.

The results often include increased water temperatures, reduced transparency, lower flow rate and water level, higher nutrient loads, and deposition of fine, soft sediment. These reduce the quality of stream habitats for the more sensitive native plants and animals. Biological communities of coolwater, low nutrient, free-flowing streams are eventually replaced by communities of warmwater, eutrophic (high nutrient) streams with low, stabilized flows or flashy (rapidly fluctuating) flows. These altered communities contain a relatively few tolerant native species along with hardy, rapidly-repro-



Logperch (Percina caprodes). This 22 cm darter is primarily a Mississippi Valley species, and the eastern end of its range in the U.S. is the Hudson-Champlain corridor. Few logperch have been caught in the Shawangunk Kill and we do not know much about their abundance, distribution, or behavior in the river other than that they seem to occur in fast water in the springtime. Another rare fish, the shield darter (Percina peltata), is found in the upper Shawangunk Kill.

ducing, introduced plants and animals. There is nothing inherently undesirable about the organisms in damaged streams, but we can ill afford the loss of natural variety.

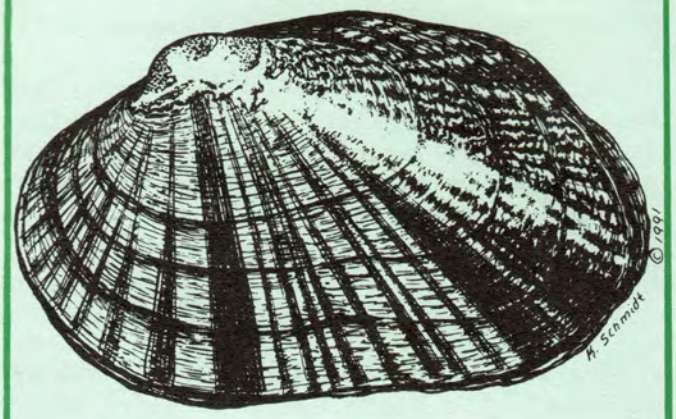
To better manage our environment and prevent unnecessary damage, planning for major alterations to streams and other habitats must include thorough and accurate biological surveys. The rarer elements of the environment, especially rare species and their habitats, are generally less easily replaced or substituted for, thus these elements must receive priority attention in environmental planning and impact analysis.

The Shawangunk Kill

Rising about 10 km (6 mi) southwest of Otisville in the Town of Greenville, the Shawangunk Kill flows northeast for 50 km straight-line (31 mi) along the base of the Shawangunk Mountains through New York's Orange and Ulster counties and into the Wallkill River. The local pronunciation of Shawangunk sounds like "Shongum".

The Shawangunk Kill crosses the shale and sandstone of the valley, but the river bed contains abundant cobbles and boulders of hard, whitish or reddish, conglomerate from the mountains. The bottom ranges from silt and sand in the backwaters and shoals to cobbles and rock rubble in the channel. There is extensive farm land near the river, but the banks and islands support forest or scrub containing many species of deciduous trees and shrubs. In the lower 29 river kilometers (18 mi) or so, from Pine Bush to the Wallkill, the river bed is about 15-50 m (50-160 ft) wide.

Hudsonia has studied portions of ten tributaries of the Hudson estuary. The Shawangunk Kill has escaped some of the environmental trauma to which other large streams have been subjected. Relatively low nutrient levels, cool water, and lack of major water control structures allow the lower Shawangunk Kill to support a biological community unlike any other known in our region. In two days of field work on the Shawangunk Kill, we discovered or verified the presence of a dozen rare species.



Brook floater (Alasmidonta varicosa). *This 8 cm long freshwater mussel is known historically from the Susquehanna River system but has not been found elsewhere in the Hudson Valley. The rare biota of the Shawangunk Kill do not share overall geographic ranges, suggesting that the co-occurrence of these species there is not due to human introduction or to postglacial drainage changes. Many freshwater mussels in the Appalachians are endangered due to pollution, siltation, dams, and collecting.*

Below Pine Bush, the river has yielded 28 species of fish, a very diverse fish community for a Hudson River tributary, including 4 species listed as rare statewide by the New York Natural Heritage Program. Rare mollusks and rare plants also occur in the lower Shawangunk Kill. Although many Heritage-listed species are more common outside New York, we need to preserve the genetic variation of these species within our state for potential utility to science, medicine, agriculture, and industry.

The Water Supply Proposal

The Orange County Water Authority 7(OCWA) evidently picked the Shawangunk Kill as a potential water source due to size and good water quality. OCWA proposes to divert up to 93 cubic feet per second (cfs) from the Shawangunk Kill at Pine Bush. A reservoir would be built on a small tributary of the Wallkill called Dwaar Kill, with a treatment plant and a pipeline system to distribute treated water through much of northern Orange County.

As part of the environmental impact analysis, OCWA's engineering consultants ran an "Instream Flow Incremental Methodology" (IFIM) computer model to estimate how much water should be left in the Shawangunk Kill after withdrawal in order to prevent serious damage to the biological community. Data from studies done in other regions on several common kinds of fishes and invertebrates were used as input for the model. The model output predicted that a flow of about 80 or more cfs would be adequate for the survival of four-fifths of the species considered. The OCWA then proposed a minimum instream flow of only 35-50 cfs. The agency's consultants did not do any biological field work on the Shawangunk Kill although they studied the proposed Dwaar Kill reservoir site.

Winged monkeyflower (Mimulus alatus). *This 65 cm tall, blue-flowering plant occurs in most of the eastern U.S. In the Mid-Hudson region, it has been found at only five other streamside locations, on muddy soils. We tentatively identified another Heritage-listed rare wildflower, wingstem (Verbesina alternifolia), in the Shawangunk Kill but were unable to find a mature individual for verification.*

Computer modelling can be a useful approach to environmental management questions. But the model must use accurate, relevant data, preferably from the ecosystem proposed for alteration, and must be validated by comparing the output with reality. That is, the model must start and end with the local environment in order to be a "model" of the system in question.

Potential Impacts

Water withdrawals would increase the duration of lower flows even if no water is diverted when the flow falls to a specified minimum. Longer low flow periods would mean increased warming of the water in summer and early fall, reduced dissolved oxygen, and increased concentration of nutrients and silt. Some crucial habitats would be altered by deposition of fine sediment or longer exposure to the air. Blooms of bluegreen algae that occur only locally now at low flows would be exacerbated and might become toxic or suffocating to other organisms as well as esthetically displeasing. The canoeing season would be shortened and recreational fishing could be affected.

Water withdrawals at high flows would have less obvious effects, but there would be some changes in erosion and deposition of sediments on the floodplain, with resulting changes in vegetation and its role in supporting stream invertebrates that feed on dead leaves. The habitat of the winged monkeyflower could be altered.

Because there has been no detailed study of the populations, habitat requirements, and environmental tolerances of the river's rare species, it is impossible to closely predict impacts of water withdrawal. A species' ecology varies geographically, thus information from another area can be misleading. Enough is known about the brook floater and riverweed to suspect negative impacts from the proposed alteration, and we think the logperch and sand shiner are also vulnerable. The riverweed beds would be partly exposed above water for longer periods and subjected to higher water temperatures; vigor of the colonies would be decreased. Some of the sandy habitat for the sand shiner could be

Photo by Judy Isacoff Thomas

covered with silt. Still pools would become warmer and more nutrient-rich, vulnerable to invasion by the introduced pest plant, water-chestnut *(Trapa natans)*, which we have observed spreading to ponds and streams from the Hudson River.

Other extant or potential problems on the Shawangunk Kill include pollution by landfill leachate, withdrawal of water for irrigation, and siltation from logging, construction, and agriculture. The water supply project would exacerbate existing impacts.

The water pipelines are proposed to cross several wetlands. It is difficult to prevent weeds like purple loosestrife *(Lythrum salicaria)*, common reed *(Phragmites australis)*, and multiflora rose *(Rosa multiflora)* from invading wetlands where soils and hydrology have been disturbed. We do not know whether endangered and threatened species such as the bog turtle, northern cricket frog, and red-shouldered hawk occur in the wetlands on the pipeline route. The extent and boundaries of these wetlands may not have been accurately determined, a common problem in the Hudson Valley.

Recommendations

The fish and aquatic macroinvertebrate communities and the aquatic and riparian vegetation of the Shawangunk Kill need thorough field study from above the proposed water intake down to the confluence with the Wallkill. Riparian breeding birds, reptiles, and amphibians should be surveyed. The Heritage-listed species, including those discussed here and the wood turtle, as well as any others discovered when thorough biological surveys are conducted, each need quantitative study of population size and structure, habitat requirements, and ecological tolerances. Regionally-rare species also deserve study, including green dragon *(Arisaema dracontium)* (a plant), the margined madtom *(Noturus insignis)* (a fish), and a species of fingernail clam *(Sphaerium fabale)*.

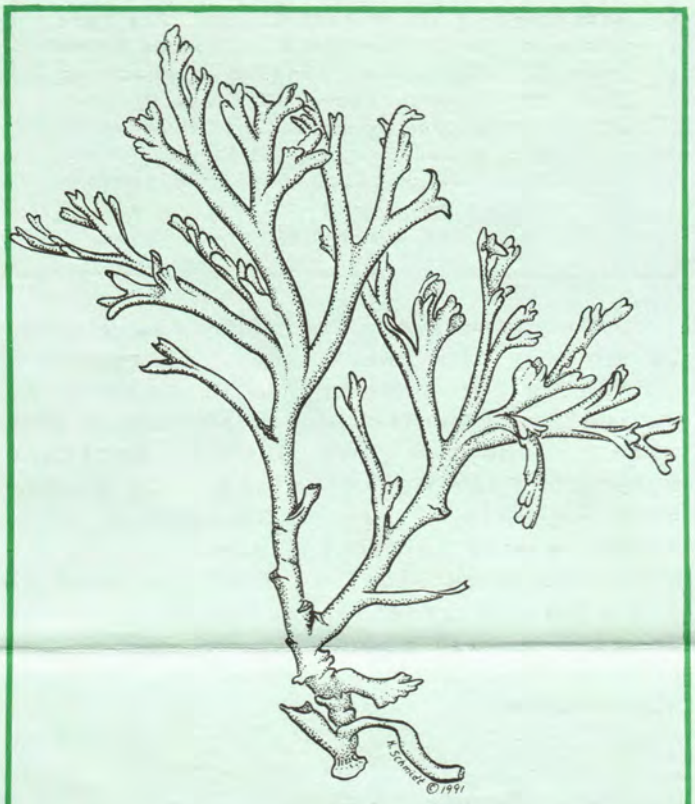
Observations of physicochemical and biological changes during natural low flows, especially in portions of the river affected by existing withdrawals and bypasses, would clarify some impacts of the proposed water supply diversion on the biota of the stream channel. Likewise, observations on sedimentation and plants of the floodplain during floods of different magnitudes could yield information on the response of the floodplain habitats to changes in high flows.

Water withdrawals from the Wallkill River and the Hudson, and high-flow skimming of the Shawangunk Kill without withdrawals at low flow, are alternatives to the proposed project that need serious ecological evaluation. More treatment would be needed for water from a source of lesser quality, and a larger reservoir

would be needed for high-flow skimming, but the added costs might be compensated by reducing damage to the Shawangunk Kill.

Wetlands of all sizes (whether or not they are state-regulated) should be skirted by the pipeline. Pipeline installation should not alter wetland topography, hydrology, or vegetation. Any disturbances should be replanted with species native to the local area, and monitored for invasion by introduced weeds.

The lower Shawangunk Kill is a "natural area", the biota and habitat of which are in a relatively natural condition and thus suitable for comparison in the study of more highly altered ecosystems. In order to preserve the Shawangunk Kill natural area and the other values of the river, including biodiversity, recreation, and water supply (with or without a major withdrawal), a broad buffer zone of natural soil and vegetation must be preserved along the river. The pressures of a growing population mean that stringent management of soil and water will be needed in the entire Shawangunk Kill watershed. Water quality and rare species in the river should be monitored, so deterioration can be avoided.



Riverweed or threadfoot (Podostemum ceratophyllum). *This peculiar stream plant has a compact, ca 7 cm long, moss-like form in faster water (illustrated) and a more delicate, longer form in slower water. Riverweed occurs primarily in the Appalachians and the Northeast, and is rare in the Shawangunk Kill; it has also been seen in Esopus Creek. Riverweed grows on normally-submerged bedrock ledges and is vulnerable to reduced flows, siltation, and other pollution.*

Water supply is the ultimate limitation on economic development and population expansion in many regions, perhaps worldwide. We are not used to thinking of the Northeast as a region where water is in short supply, but we must consider the environmental costs of pumping more and more surface water and groundwater, then putting the water back in different places and with deteriorated quality. Every region - perhaps county - should have a water plan that explicitly calculates environmental costs and regulates development appropriately. We should also invest in better pollution prevention and waste treatment to improve the quantity and quality of usable water resources. If we restored damaged rivers, we would have less need to alter and pollute watercourses like the Shawangunk Kill that are still in good condition.

Hudsonia does not take positions for or against economic development proposals. We conduct scientific studies and provide the resulting information, analysis, and recommendations to decision makers and the public. If you are interested in field biology or biological diversity, ask about Hudsonia field courses, back issues of *News from Hudsonia*, and a list of project reports. We are planning newsletters on ecological impacts of soil mining, and on techniques for identifying significant biological resources.

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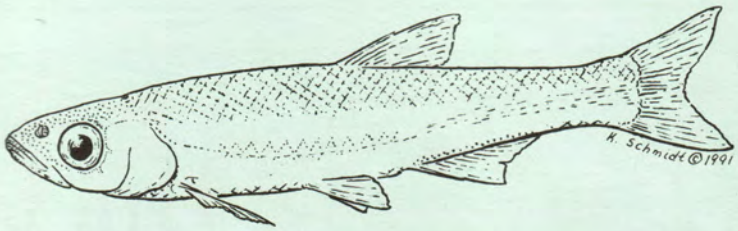
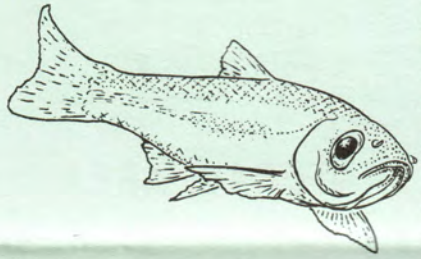


Comely shiner (Notropis amoenus). *The logperch, comely shiner, and sand shiner (Notropis stramineus) are not found in the Hudson Valley outside the Wallkill River watershed with the exception of a few Hudson River records for comely shiner and logperch probably due to individuals washed downstream by floods. Comely shiners, ca 12 cm long, range from North Carolina to western New York. Their habitat is the channels of medium to large streams irrespective of substrate. Unlike the comely shiner, the sand shiner is closely associated with sandy bottom in the Shawangunk Kill.*



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