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Report on Studies of Streams in the Iowa Driftless Region

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The streams of the Iowa Driftless Area occupy old entrenched valleys, have high gradients, and transport cool waters flowing rapidly over rocky substrates. Water quality, overall, is relatively high when judged by either physio-chemical characteristics or stream communities. Distribution of aquatic biota largely reflects the habitats provided by spring-fed streams.
INDEX DESCRIPTORS: Stream limnology, rivers, stream fauna

Iowa has an area of about 9,000 km^2 (3,475 mi^2) in its northeastern corner which is drained by relatively old entrenched meandering streams. Streams of this driftless region of Iowa are largely within the drainage basins of three rivers (Upper Iowa River, Yellow River, Turkey River) which drain towards the east, where they join the Upper Mississippi River. The history of these streams touches many phases of human life. They have served as temporary political boundaries, as namesakes for prehistoric cultures and geological formations, as the inspiration to a world-famous composer, and as the site of the first water mill in Iowa (Petersen, 1941). In this report we call attention to studies which have been conducted on these streams and briefly describe some of their abiotic and biotic characteristics.

The Upper Iowa River and the Turkey River are the longest streams with the largest drainage basins of the Iowa driftless area (Table 1). Although the western portions of both basins lie outside the driftless area, but within the Paleozoic Plateau (Prior, 1976), we have included the entire drainage basin for consideration in this paper. Several small basins (e.g. Village Creek and Paint Creek) whose streams drain directly into the Upper Mississippi River are also included.

UPPER IOWA RIVER DRAINAGE BASIN

The Upper Iowa River (Fig. 1) drains an area of approximately 2736 km^2. Originating in the glacial drift plains of Mower County, Minnesota, it falls about 222 m during its 217 km journey. The Upper Iowa flows in a southeasterly direction, dropping 152 m in elevation to Decorah, Iowa, and then angles to the northeast for the last 80 km before discharging into the Mississippi River just south of New Albin, Iowa. The lower 11 km have been channelized as part of a 1958 flood control project by the U.S. Army Corps of Engineers. Dams impound the streams' water at Lime Springs, Iowa, and about 6.5 km and 11.3 km downstream from Decorah. Numerous springs in the drainage basin emerge from limestone or sandstone formations, providing water at a temperature of about 9° C throughout the year; 12 tributary streams are included in the Iowa Conservation Commission's trout stocking program.

In 1972 the U.S. Congress designated the Upper Iowa as one of 27 rivers for inclusion in the National Wild and Scenic River System. Subsequently, the Upper Iowa has been the subject of more research

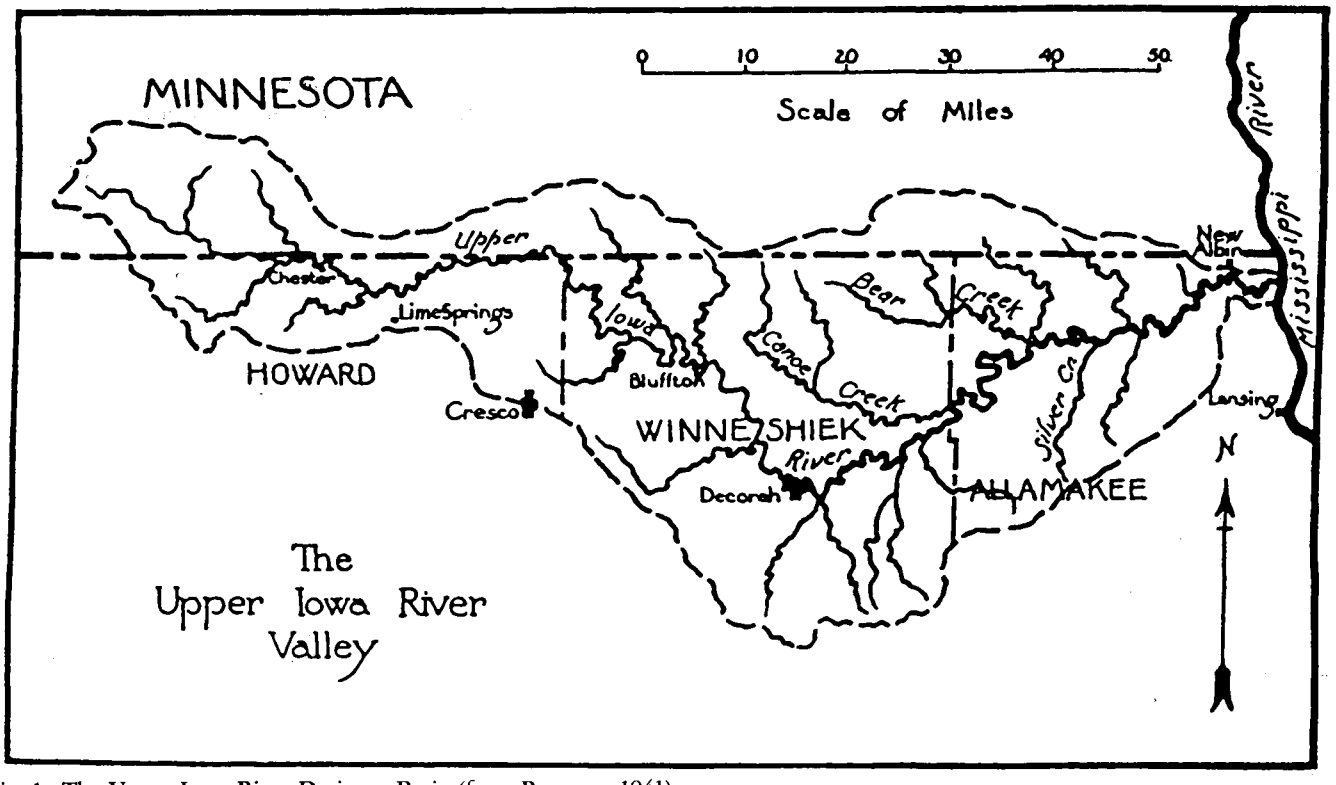

Fig. 1. The Upper Iowa River Drainage Basin (from Petersen, 1941).

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Table 1. Major Drainage basins of the Iowa Driftless region*.

Drainage Basin	Stream length (km)	Area (km^2)	Stream Gradient (m/km)
Upper Iowa	217	2736	0.98
Village Creek	24	197	4.79
Paint Creek	34	186	3.50
Yellow River	56	624	3.12
Bloody Run Creek	19	97	6.19
Sny Magill Creek	11	92	5.30
Turkey River	217	4391	0.89
Little Turkey	56	920	0.76
Volga River	53	1056	1.27
Crane Creek	70	550	1.17

* Physical details for many smaller trout streams of the Iowa Driftless area are presented by Paragamian (1981).

studies than other streams of the Iowa driftless area (Table 2). The studies have ranged from those conducted over 12 months (McMullen, 1972) to those of only brief sampling periods (Meierhoff and Prill, 1982). In addition to the Upper Iowa River, a variety of tributary streams within the drainage basin have been included in these studies (e.g. Sherpelz and Eckblad, 1974). There is a relatively high water quality within this basin (USEPA, 1979), but localized areas, especially immediately downstream from Decorah, have excessive organic loading (Eckblad, 1974; Meierhoff and Prill, 1982).

Many people use this river for fishing, tubing, and canoeing. For example, recreational use of the Upper Iowa River by canoeists was 6,529 canoeist-days during a 101-day period beginning May 27, 1973. About 83 percent of this canoeing took place on the river reach from Kendallville to Decorah, Iowa (Seitz, 1974).

YELLOW RIVER DRAINAGE BASIN

The Yellow River arises in southeastern Winneshiek County from a series of springs between Ossian and Frankville, Iowa (Fig. 2). It has developed as a widely branching dendritic waterway through a relatively narrow and steep-sided valley with a stream gradient averaging three times that of the Upper Iowa River. The stream is thought to have received its name from the yellow-colored suspended sediment noted at its mouth during high flow conditions, and its name appears on maps from the late 1700's. Samuel Lewis included the Yellow River on his map of Louisiana in 1804, but he misjudged its origin as being a lake in the vicinity of present-day Marshalltown, Iowa. It is of some historical interest that the first water mill in Iowa was built on this river in 1831 and the earliest settlements in Allamakee County were in the valley of the Yellow River (Petersen, 1941).

Had the early explorers ascended the river any distance, they might have given the Yellow River a different name. Few Iowa streams have clearer water during most of the year than the Yellow River. It occupies one of the few valleys of the state which was never developed with either a railroad or primary highway. This steeply inclined valley is potentially subject to high rates of soil erosion, and recent studies have shown that BOD, organic nitrogen, total phosphate, metals, and pesticides increased immediately following rainfalls (Kennedy and Splinter, 1983). In general, these elevated levels were of short duration, and biological indicators like benthic macroinvertebrates suggest the presence of relatively high water quality for the Yellow River (Prill et al, 1982). We found no recent studies of stream algae for the Yellow River (Table 2).

Table 2. Summary of references to studies of the Iowa driftless streams.

Drainage Basin	Features	References
Upper Iowa	Abiotic	Knudson, 1971; Eckblad, 1974; Geary and Morris, 1975; McMullen, 1972; Sherpelz and Eckblad, 1974; USEPA, 1979; IDEQ, 1975.
	Algae	Sherpelz and Eckblad, 1974; Eckblad, 1974.
	Invertebrates	Eckblad, 1974; Geary and Morris, 1975; Meierhoff and Prill, 1982; Phillips, 1980; USEPA, 1979; Scherpelz and Eckblad, 1974.
	Fish	Cleary, 1951; Craft, 1974.
Yellow	Abiotic	Kennedy and Meierhoff, 1978; Kennedy and Splinter, 1983.
	Algae	None found
	Invertebrates	Kennedy and Meierhoff, 1978; Phillips, 1980; Prill et al., 1982; Kennedy and Splinter, 1983.
	Fish	Cleary, 1951.
Turkey	Abiotic	Gakstatter, 1972; Geary and Morris, 1976; Geary, 1977; Kennedy, 1978; Meierhoff and Prill, 1980; USEPA, 1979.
	Algae	USEPA, 1979.
	Invertebrates	Geary and Morris, 1976; Geary, 1977; Meierhoff and Prill, 1980; Phillips, 1980; USEPA, 1979.
	Fish	Cleary, 1951.
Little Turkey	Abiotic	Meierhoff and Prill, 1980.
	Algae	None found
	Invertebrates	Meierhoff and Prill, 1980; Phillips, 1980.
	Fish	Cleary, 1951.
Volga	Abiotic	Kennedy, 1978; Prill and Meierhoff, 1978; Eckblad, 1979; Reis, 1980; Koster and Thein, 1980.
	Algae	None found
	Invertebrates	Eckblad, 1979; Reis, 1980.
	Fish	Cleary, 1951; Eckblad, 1979; Reis, 1980.
Crane Creek	Abiotic	Prill and Meierhoff, 1980.
	Algae	None found
	Invertebrates	Prill and Meierhoff, 1980.
	Fish	None found
Misc. other	Abiotic	Cawley, 1973; Eckblad, 1973; Prill and Meierhoff, 1979; Heitmann, 1980.
	Algae	None found
	Invertebrates	Prill and Meierhoff, 1978.
	Fish	None found

TURKEY RIVER DRAINAGE BASIN

The river known by the Sauk and Fox Indians as the "Penakunsebo", apparently for the large number of wild turkeys in its valley, flows through some of the most fertile agricultural land of northeast Iowa (Petersen, 1941). Its three large tributary streams (Crane Creek, Little Turkey River, Volga River) give the Turkey River drainage basin an area that is seven and one-half times that of the Yellow River and twice as large as that portion of the Upper Iowa basin lying within Iowa (Fig. 3).

Crane Creek originates in the glacial plain region of northern Howard County and flows southeasterly, almost paralleling the Wapsipinicon River to its west, for approximately 70 km until its junction with the Little Turkey River in Fayette County. Chemical and biological evidence, thus far, indicate a relatively unpolluted, stable stream environment for Crane Creek (Prill and Meierhoff, 1980). The Little Turkey River flows southeast about 56 km through Chickasaw and Fayette counties to its confluence with the Turkey River upstream from Eldorado. Water quality studies have indicated diverse and healthy stream communities for the Little Turkey River (Meierhoff and Prill, 1980).

The Volga River originates in Fayette County, on the glacial plain of the Iowan Surface landform, and flows to the southeast for its first 27 km, where it then intersects the Paleozoic Plateau landform (Prior, 1976). A 12.4 km reach of this stream flows through the Volga River State Recreation Area (VRSRA) east of Fayette. The Volga River has a high water quality (Kennedy, 1978; Prill and Meierhoff, 1978), with a rich diversity of aquatic biota (Eckblad, 1979; Reis, 1980). We found no recent studies of algae within the Turkey River drainage (Table 2).

MISSISSIPPI TRIBUTARY DRAINAGE BASINS

We have not attempted to identify literature dealing with the Mississippi River reach passing through the Iowa driftless area, but some background to this large river system is provided by Cawley (1973) and Eckblad (1973). Four smaller drainage basins of the Iowa driftless area discharge directly into the Mississippi River. These are, beginning with the most northern, Village Creek, Paint Creek, Bloody Run Creek, and Sny Magill Creek. These relatively short, widely branching dendritic waterways have high stream gradients with steep-sided wooded valleys. The water quality of these streams has usually been judged to be quite high and they provide a suitable habitat for trout (Prill and Meierhoff, 1978).

STREAM FAUNA FOR THE IOWA DRIFTLESS REGION

The characteristic karst topography of the Iowa Driftless Area results in a very limited amount of pond or lake habitat. As a result, aquatic organisms may have distribution patterns reflecting, in part at least, the absence of standing waters. This may be the case for a variety of Iowa's aquatic biota (e.g. the plant distributions given by Lammers and Van der Valk, 1977 & 1978), but we will focus on distributions of selected fish and crayfish of the driftless streams.

The fathead minnow, fantail darter, green sunfish, and the common crayfish *Orconectes virilis* are among those river species found throughout Iowa, including the driftless area (Cleary, 1951; Phillips, 1980). On the other hand, several species of fish (longnose dace, slimy sculpin, mottled sculpin, and brook charr) and the crayfish *Orconectes propinquus* appear to have their Iowa distributions restricted to the streams of the driftless area. Some species within the driftless area are restricted to the Upper Mississippi River and the mouths of its tributaries (e.g. silver chub, bigmouth buffalo, gars, sturgeons, and crayfish species *Procambarus acutus* and *Procambarus gracilis).* A few species reported from streams just west of the driftless area (e.g. golden shiner, tadpole madtom, bullhead minnow, northern pike, and *Orconectes immunis, Orconectes rusticus)* have not been reported from stream reaches running through the Driftless Area (Phillips, 1980).

Most fish species restricted to the Driftless Area of Iowa are

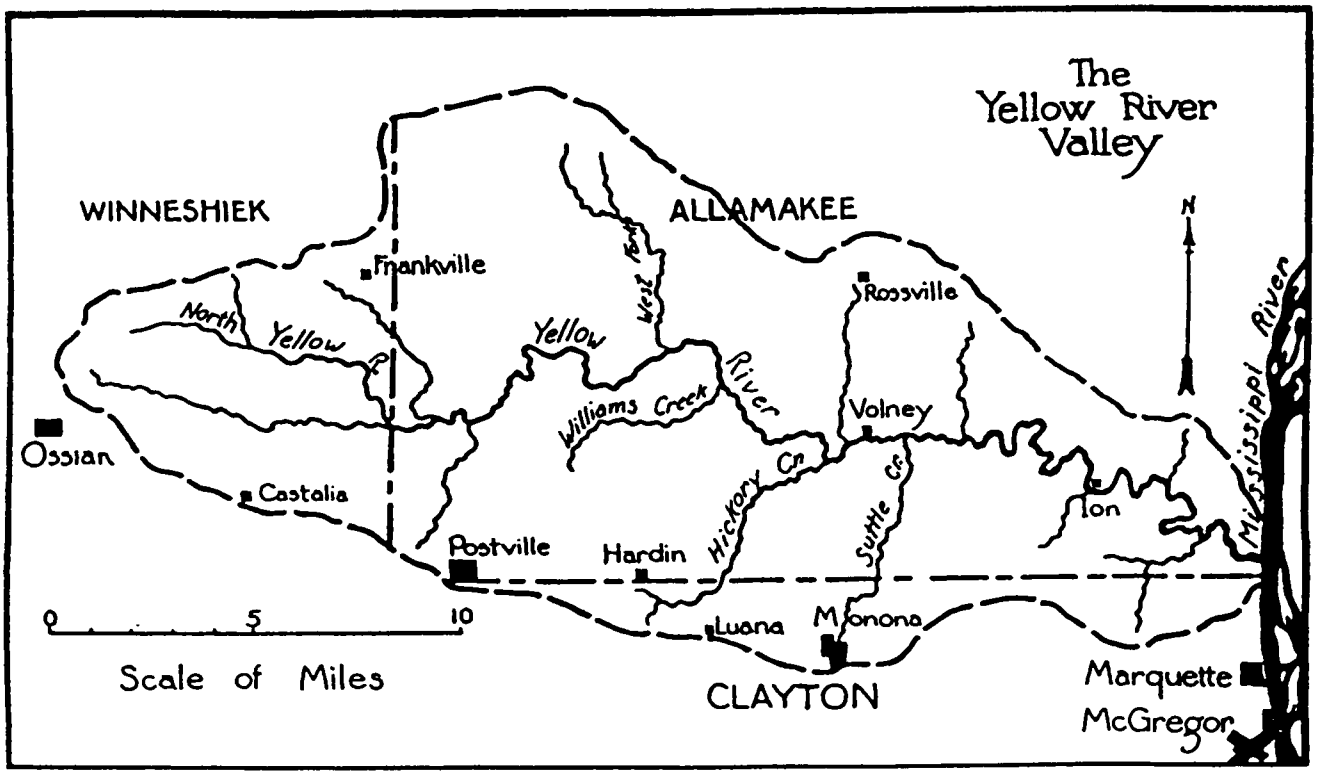

Fig. 2. The Yellow River Drainage Basin (from Petersen, 1941).

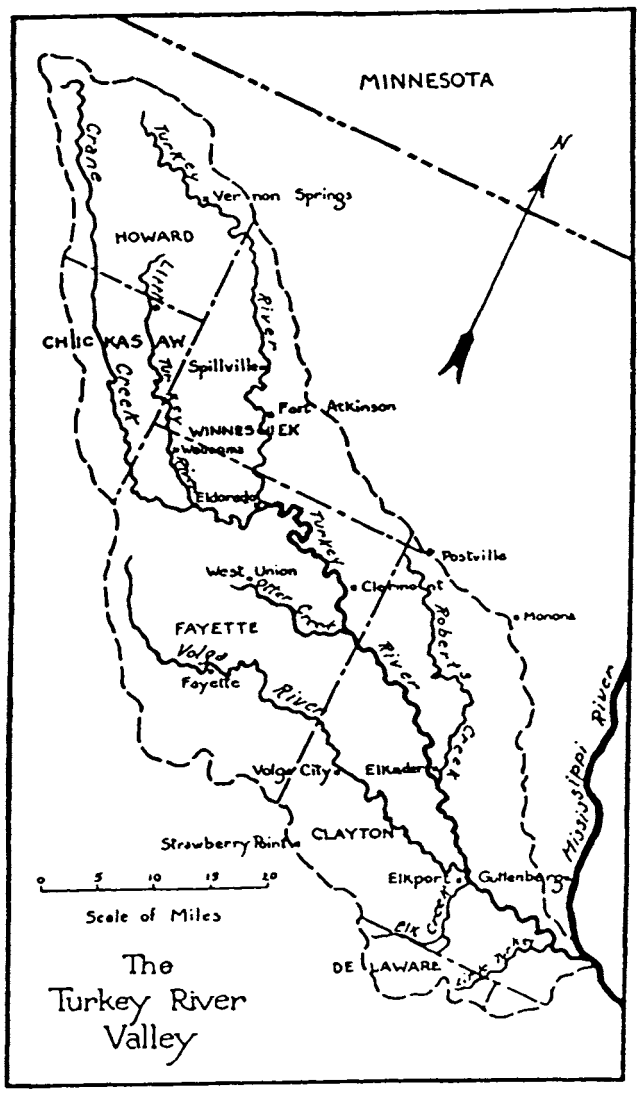

Fig. 3. The Turkey River Drainage Basin (from Petersen, 1941).

probably limited by requirements for cool water and/or rocky bottoms. Species such as the brook charr and sculpins, sometimes referred to as glacial relicts (Bailey, 1956), may have persisted in the streams of northeastern Iowa which served as a refuge from nearby glaciation. However, the current interpretaton of Pleistocene events in northeastern Iowa assumes that the area was covered by glaciers as recently as 500,000 years ago (Prior, pers. comm.). It seems likely that the ranges of stream organisms moved south and north with the advance and retreat of glaciers. Following the last glacial retreat and a warmer climate, species better adapted to cool water habitats persisted in spring-fed streams of the Driftless Area. Their present occurrence is probably due to the numerous coldwater springs, rather than being directly traced to the absence of glaciation in the area.

Species absent from the Iowa Driftless Area streams have habitat requirements not provided by these river systems. Some are species found only in large rivers, while others prefer either slower flowing streams or small ponds and lakes. The drainage systems west of the Iowa Driftless Area, such as the Wapsipinicon and Cedar Rivers, originate in the glacial plains and provide a variety of stream habitats with usually more sand than rocky substrates. This difference may account for the presence of golden shiners, pumpkinseed sunfish, and tadpole madtoms in these streams, while they are not commonly reported for streams of the Iowa Driftless Area.

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