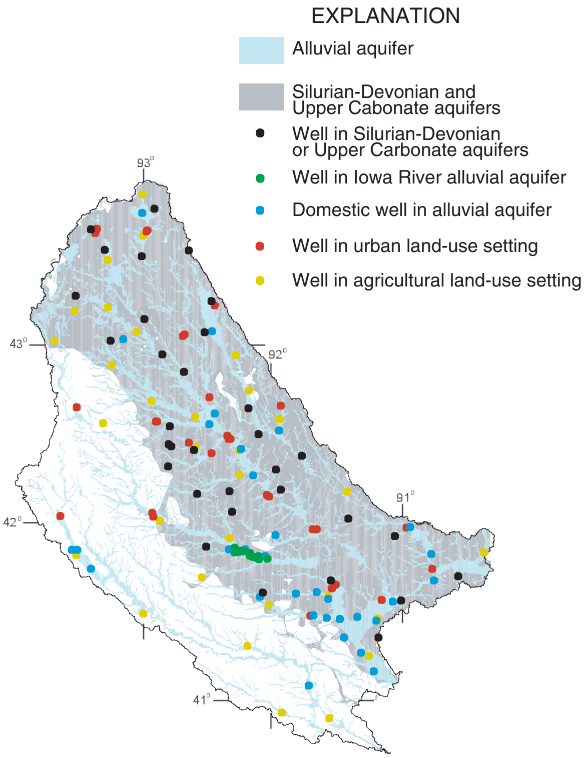
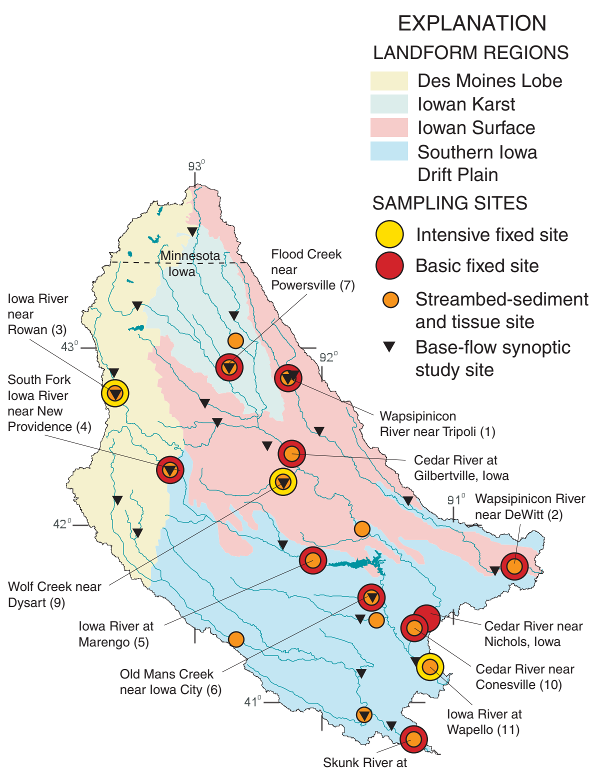
The objective of the Eastern Iowa Basins NAWQA study was to assess the water-quality conditions in streams and ground water in the Study Unit. The study design is based on a nationally consistent structure that incorporates an interdisciplinary approach (Gilliom and others, 1995). Stream-water quality was assessed using three interrelated components: stream chemistry, streambed-sediment chemistry, and stream ecology. Ground-water quality of the alluvial aquifers was selected for assessment because these aquifers are the major source of water for municipal and domestic supplies and they provide flow to streams. Water quality in the Silurian-Devonian and Upper Carbonate aquifers also was investigated.

Stream Chemistry

The Basic Fixed Site sampling network was designed to characterize the effects of physiographic differences on water quality in the primarily agricultural Study Unit. Water-chemistry, bed-sediment, and reservoir-core data were collected. Sites were selected on large rivers and smaller streams. Fixed sites on large rivers were located near the mouth of the four major rivers to characterize the integrated effects of differing land use and environmental setting on stream quality. Two additional large river sites were chosen to assess the upper part of the Cedar River and the Iowa River, before it flows into Coralville Reservoir. Fixed sites on streams were selected to characterize each of the physiographic areas. A reference site was selected on a watershed that retains a large amount of bottomland wetlands. Another site was selected to assess the effects of concentrated animal feeding operations on stream quality. A subset of the Basic Fixed Site network was intensively sampled (weekly to biweekly) through the spring and summer of 1997. Two synoptic studies were conducted during base-flow conditions (high and low base flow) to improve the spatial resolution and to better evaluate the effects of soil type and riparian buffers on stream-water quality and biological communities.





Stream Ecology

Ecological data including fish-tissue chemistry and fish, macroinvertebrate, and algal community structure were collected to provide better understanding of the relations among physical, chemical, and biological characteristics of a stream. Data were collected at the Basic Fixed Site sampling network plus four additional sites to provide better spatial coverage.

Ground-Water Chemistry

The ground-water network was designed to characterize water quality in the most heavily used aquifers in the Study Unit. A Study Unit survey characterized the water quality in the Silurian-Devonian and Upper Carbonate bedrock aquifers, the second greatest source of municipal and domestic supplies in the Study Unit. Another Study Unit survey characterized the water quality of the alluvial aquifers using domestic wells. Land-use studies assessed the occurrence and distribution of water-quality constituents in recently recharged water in the alluvial aquifers. Agricultural and urban land-use effects on quality of shallow ground water was characterized by sampling two networks of monitoring wells constructed at randomly selected sites.

SUMMARY OF DATA COLLECTION IN THE EASTERN IOWA BASINS, 1996–98

Study component	What data were collected and why	Types of sites sampled	Number of sites	Sampling frequency and period
Stream chemistry				
Basic Fixed Sites—large rivers	Major ions, organic carbon, suspended sediment, nutrients, pesticides, and streamflow were determined to describe concentrations and the amount of selected constituents transported from the study area	Streams draining basins from about 2,300 to more than 12,000 square miles that integrate the effects of urban and agricultural land use and physiographic regions	6 in 1996, 5 in 1997–98	Monthly beginning in March 1996 and during selected flood events
Basic Fixed Sites—streams	Major ions, organic carbon, suspended sediment, nutrients, pesticides, and streamflow were determined to evaluate physiographic effects on stream-water quality	Streams draining basins from 120 to 418 square miles of homogeneous land use and physiography	6	Monthly beginning in March 1996 and during selected flood events
Intensive Fixed Sites	Major ions, organic carbon, suspended sediment, nutrients, pesticides, and streamflow were determined to define short-term temporal variability	One large river and two stream Basic Fixed Sites	3	Weekly during 1997 growing season; biweekly for remainder of the year
Base-flow synoptic study	Nutrients, pesticides, organic carbon, and streamflow were determined to refine spatial variability during both low and high base-flow conditions	Streams draining basins ranging from 120 to 530 square miles representing greater than 90 percent agricultural land use	25	August 1997 and May 1998
Bed-sediment chemistry				
Bed sediment and tissue	Trace elements, organochlorine, and semivolatile organic compounds in streambed sediment to determine presence of these potentially toxic, hydrophobic compounds	Ecological sites—Large river and tributary/headwater fixed sites plus four additional sites for better spatial coverage	16	September 1995
Reservoir core study	Trace elements and organochlorine compounds in sediment to determine the historical occurrence (from filling in 1958 to 1993)	Site in a deep depositional zone of the Coralville Reservoir about 1.5 miles upstream from the dam	1	November 1993
Stream ecology				
Bed sediment and tissue	Trace elements and organochlorine compounds in fish tissue to determine occurrence	Ecological sites	16	September 1995
Intensive assessments	Fish, benthic invertebrates, algae, and aquatic and riparian habitat were sampled and described to assess community structure and to document within stream and annual variation	Ecological sites	12	All fixed sites in 1996 and intensive sites in 1997–98
Ecological synoptic survey	Benthic invertebrates, algae, and aquatic and riparian habitat were sampled to assess biological responses in relation to water quality and hydrologic variability	Streams draining basins ranging from 120 to 530 square miles representing greater than 90 percent agricultural land use	25	August 1997
Ground-water chemistry				
Bedrock aquifer survey	Major ions, nutrients, pesticides, pesticide degradates, VOCs, and tritium were determined to assess quality in second most-used aquifer in Study Unit	Existing domestic wells completed in the Silurian-Devonian aquifer (32–700 feet deep)	33	June–July 1996
Alluvial aquifer survey	The same constituents as in bedrock aquifer survey were determined to assess quality in most-used aquifer in the Study Unit	Existing domestic wells completed in unconsolidated alluvial deposits	32	June–July 1998
Land-use effects study—agricultural and urban	The same constituents as in bedrock aquifer survey were determined to assess water-quality differences due to agricultural and urban land use	Newly constructed monitoring wells at sites randomly selected on alluvial deposits and completed at the water table (31 agricultural and 30 urban wells)	61	June–August 1997
Ground-water chemistry special study				
Changing land-use study	The same constituents as in bedrock aquifer survey were determined to assess changes in water-quality due to conversion of row crops to wetlands and prairie	Existing monitoring wells plus three new monitoring wells completed at various depths in the Iowa River alluvial aquifer	28	August 1996 and 1998

Acre-foot—A volume of water equal to 1 foot in depth and covering 1 acre; equivalent to 43,560 cubic feet or 325,851 gallons.

Algae—Chlorophyll-bearing nonvascular, primarily aquatic species that have no true roots, stems, or leaves; most algae are microscopic, but some species can be as large as vascular plants.

Alluvial aquifer—A water-bearing deposit of unconsolidated material (sand and gravel) left behind by a river or other flowing water.

Alluvium—A general term for clay, silt, sand, and gravel deposited by a river or stream in the bed of the stream or on its flood plain.

Ammonia—A compound of nitrogen and hydrogen (NH_3) that is a common by-product of animal waste. Ammonia readily converts to nitrate in soils and streams.

Aquatic guidelines—Specific levels of water quality which, if reached, may adversely affect aquatic life. These are nonenforceable guidelines issued by a governmental agency or other institution.

Aquifer—A water-bearing layer of soil, sand, gravel, or rock that will yield usable quantities of water to a well.

Base flow—Sustained, low flow in a stream; ground-water discharge is the source of base flow in most places.

Basic Fixed Sites—Sites on streams at which streamflow is measured and samples are collected for temperature, salinity, suspended sediment, major ions, nutrients, and organic carbon to assess the broad-scale spatial and temporal character and transport of inorganic constituents of streamwater in relation to hydrologic conditions and environmental settings.

Breakdown product—A compound derived by chemical, biological, or physical action upon a pesticide. The breakdown is a natural process which may result in a more toxic or a less toxic compound and a more or less persistent compound.

Concentration—The amount or mass of a substance present in a given volume or mass of sample. Usually expressed as micrograms per liter (water sample) or micrograms per kilogram (sediment or tissue sample).

Constituent—A chemical or biological substance in water, sediment, or biota that can be measured by an analytical method.

Contamination—Degradation of water quality compared to original or natural conditions due to human activity.

Cubic foot per second (ft^3/s, or cfs)—Rate of water discharge representing a volume of 1 cubic foot passing a given point during 1 second, equivalent to approximately 7.48 gallons per second or 448.8 gallons per minute or 0.02832 cubic meter per second.

Degradate—See Breakdown product.

Detection limit—The minimum concentration of a substance that can be identified, measured, and reported within 99 percent confidence that the analyte concentration is greater than zero; determined from analysis of a sample in a given matrix containing the analyte.

Discharge—Rate of fluid flow passing a given point at a given moment in time, expressed as volume per unit of time.

Drainage basin—The portion of the surface of the Earth that contributes water to a stream through overland run-off, including tributaries and impoundments.

Drinking-water standard or guideline—A threshold concentration in a public drinking-water supply, designed to protect human health. As defined here, standards are U.S. Environmental Protection Agency regulations that specify the maximum contamination levels for public water systems required to protect the public welfare; guidelines have no regulatory status and are issued in an advisory capacity.

Ecoregion—An area of similar climate, landform, soil, potential natural vegetation, hydrology, or other ecologically relevant variables.

EPT richness index—An index based on the sum of the number of taxa in three insect orders, Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies), that are composed primarily of species considered to be relatively intolerant to environmental alterations.

Eutrophication—The process by which water becomes enriched with plant nutrients, most commonly phosphorus and nitrogen.

Ground water—In general, any water that exists beneath the land surface, but more commonly applied to water in fully saturated soils and geologic formations.

Habitat—The part of the physical environment where plants and animals live.

Hypoxia—Seasonally depleted dissolved oxygen concentrations (less than 2 milligrams per liter) in a water body

Index of Biotic Integrity (IBI)—An aggregated number, or index, based on several attributes or metrics of a fish community that provides an assessment of biological conditions.

Indicator sites—Stream sampling sites located at outlets of drainage basins with relatively homogeneous land use and physiographic conditions; most indicator-site basins have drainage areas ranging from 100 to about 400 square miles.

Integrator or Mixed-use site—Stream sampling site located at an outlet of a drainage basin that contains multiple environmental settings. Most integrator sites are on major streams with relatively large drainage areas.

Intolerant organisms—Organisms that are not adaptable to human alterations to the environment and thus decline in numbers where human alterations occur. See also Tolerant species.

Karst—A type of topography that results from dissolution and collapse of carbonate rocks such as limestone and dolomite, and characterized by closed depressions or sinkholes, caves, and underground drainage.

Leaching—Refers to movement of pesticides or nutrients from land surface to ground water.

Load—General term that refers to a material or constituent in solution, in suspension, or in transport; usually expressed in terms of mass or volume.

Loess—Homogeneous, fine-grained sediment made up primarily of silt and clay, and deposited over a wide area (probably by wind).

Maximum contaminant level (MCL)—Maximum permissible level of a contaminant in water that is delivered to any user of a public water system. MCLs are enforceable standards established by the U.S. Environmental Protection Agency.

Median—The middle or central value in a distribution of data ranked in order of magnitude. The median is also known as the 50th percentile.

Monitoring well—A well designed for measuring water levels and testing ground-water quality.

Mouth—The place where a stream discharges to a larger stream, a lake, or the sea.

Nutrient—Element or compound essential for animal and plant growth. Common nutrients in fertilizer include nitrogen, phosphorus, and potassium.

Overland flow—The part of surface runoff flowing over land surfaces toward stream channels.

Periphyton—Organisms that grow on underwater surfaces; periphyton include algae, bacteria, fungi, protozoa, and other organisms.

Pesticide—A chemical applied to crops, rights-of-way, lawns, or residences to control weeds, insects, fungi, nematodes, rodents or other "pests."

Physiography—A description of the surface features of the Earth, with an emphasis on the origin of landforms.

Plankton—Floating or weakly swimming organisms at the mercy of the waves and currents. Animals of the group are called zooplankton and the plants are called phytoplankton.

Radon—A naturally occurring, colorless, odorless, radioactive gas formed by the disintegration of the element radium; damaging to human lungs when inhaled.

Recharge—Water that infiltrates the ground and reaches the saturated zone.

Reference site—A NAWQA sampling site selected for its relatively undisturbed conditions.

Riparian zone—Pertaining to or located on the bank of a body of water, especially a stream.

Runoff—Excess rainwater or snowmelt that is transported to streams by overland flow, tile drains, or ground water.

Species diversity—An ecological concept that incorporates both the number of species in a particular sampling area and the evenness with which individuals are distributed among the various species.

Species (taxa) richness—The number of species (taxa) present in a defined area or sampling unit.

Study Unit—A major hydrologic system of the United States in which NAWQA studies are focused. Study Units are geographically defined by a combination of ground- and surface-water features and generally encompass more than 4,000 square miles of land area.

Tile drain—A buried perforated pipe designed to remove excess water from soils.

Tolerant species—Those species that are adaptable to (tolerant of) human alterations to the environment and often increase in number when human alterations occur.

Total concentration— Refers to the concentration of a constituent regardless of its form (dissolved or bound) in a sample.

Triazine herbicide—A class of herbicides containing a symmetrical triazine ring (a nitrogen-heterocyclic ring composed of three nitrogens and three carbons in an alternating sequence). Examples include atrazine, propazine, and simazine.

Tritium—A radioactive form of hydrogen with atoms of three times the mass of ordinary hydrogen; can be used to determine the age of water.

Unconsolidated deposit—Deposit of loosely bound sediment that typically fills topographically low areas.

Urban site—A site that has greater than 50 percent urbanized and less than 25 percent agricultural area.

Volatile organic compounds (VOCs)—Organic chemicals that have a high vapor pressure relative to their water solubility. VOCs include components of gasoline, fuel oils, and lubricants, as well as organic solvents, fumigants, some inert ingredients in pesticides, and some by-products of chlorine disinfection.

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APPENDIX—WATER-QUALITY DATA FROM THE EASTERN IOWA BASINS IN A NATIONAL CONTEXT

For a complete view of Eastern Iowa Basins data and for additional information about specific benchmarks used, visit our Web site at http://water.usgs.gov/nawqa/. Also visit the NAWQA Data Warehouse for access to NAWQA data sets at http://water.usgs.gov/nawqa/data.

This appendix is a summary of chemical concentrations and biological indicators assessed in the Eastern Iowa Basins. Selected results for this Study Unit are graphically compared to results from as many as 36 NAWQA Study Units investigated from 1991 to 1998 and to national water-quality benchmarks for human health, aquatic life, or fish-eating wildlife. The chemical and biological indicators shown were selected on the basis of frequent detection, detection at concentrations above a national benchmark, or regulatory or scientific importance. The graphs illustrate how conditions associated with each land use sampled in the Eastern Iowa Basins compare to results from across the Nation, and how conditions compare among the several land uses. Graphs for chemicals show only detected concentrations and, thus, care must be taken to evaluate detection frequencies in addition to concentrations when comparing study-unit and national results. For example, acetochlor concentrations in Eastern Iowa Basins agricultural streams were similar to the national distribution, but the detection frequency was much higher (79 percent compared to 33 percent).

CHEMICALS IN WATER

Concentrations and detection frequencies, Eastern Iowa Basins, 1996–98—Detection sensitivity varies among chemicals and, thus, frequencies are not directly comparable among chemicals

◆ Detected concentration in Study Unit

66 38 Frequencies of detection, in percent. Detection frequencies were not censored at any common reporting limit. The left-hand column is the study-unit frequency and the right-hand column is the national frequency

-- Not measured or sample size less than two

12 Study-unit sample size. For ground water, the number of samples is equal to the number of wells sampled

National ranges of detected concentrations, by land use, in 36 NAWQA Study Units, 1991–98—Ranges include only samples in which a chemical was detected

- Streams in agricultural areas
- Streams in urban areas
- Streams and rivers draining mixed land uses
- Shallow ground water in agricultural areas
- Shallow ground water in urban areas
- Major aquifers

Lowest 25 percent | Middle 50 percent | Highest 25 percent

National water-quality benchmarks

National benchmarks include standards and guidelines related to drinking-water quality, criteria for protecting the health of aquatic life, and a goal for preventing stream eutrophication due to phosphorus. Sources include the U.S. Environmental Protection Agency and the Canadian Council of Ministers of the Environment

| Drinking-water quality (applies to ground water and surface water)

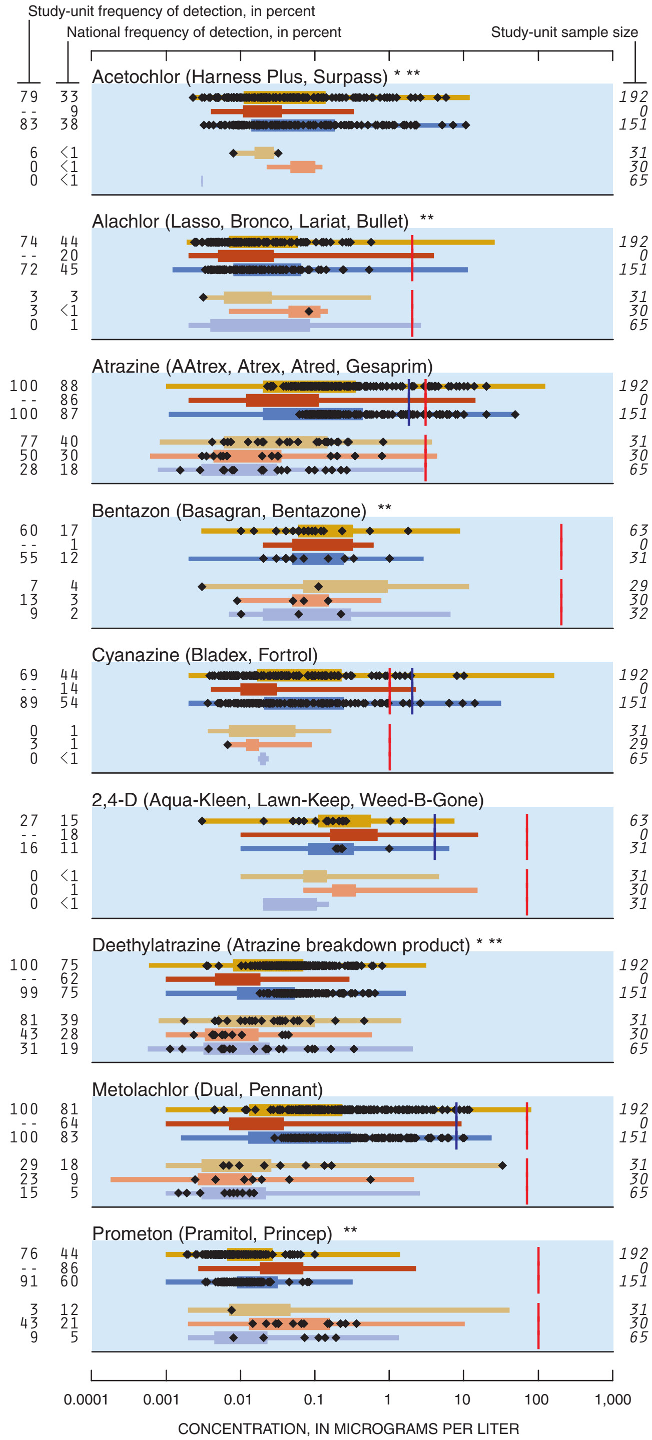
| Protection of aquatic life (applies to surface water only)

| Prevention of eutrophication in streams not flowing directly into lakes or impoundments

* No benchmark for drinking-water quality

** No benchmark for protection of aquatic life

Pesticides in water—Herbicides



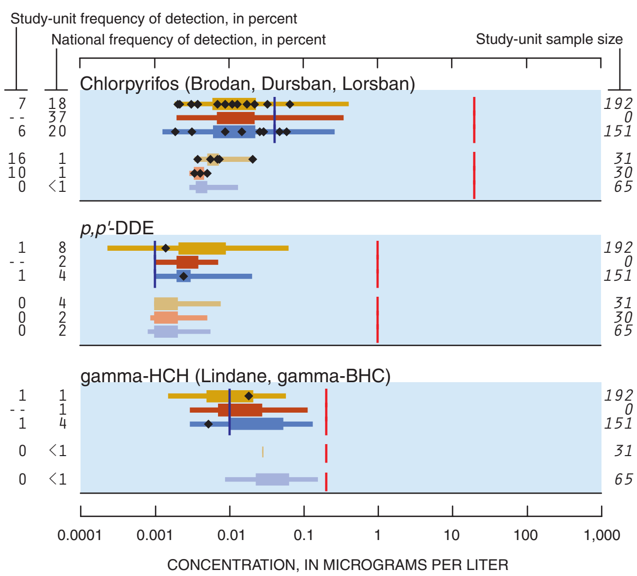
Other herbicides detected

Acifluorfen (Blazer, Tackle 2S) **
Bromacil (Hyvar X, Urox B, Bromax)
Bromoxynil (Buctril, Brominal) *
Butylate (Sutan +, Genate Plus, Butilate) **
DCPA (Dacthal, chlorthal-dimethyl) * **
Dicamba (Banvel, Dianat, Scotts Proturf)

Dichlorprop (2,4-DP, Seritox 50, Lentemul) * **
2,6-Diethylaniline (Alachlor breakdown product) * **
Diuron (Crisuron, Karmex, Diurex) **
EPTC (Eptam, Farmarox, Alirox) * **
Metribuzin (Lexone, Sencor)
Molinate (Ordram) * **
Napropamide (Devrinol) * **
Pendimethalin (Pre-M, Prowl, Stomp) * **
Picloram (Grazon, Tordon)
Pronamide (Kerb, Propyzamid) **
Propachlor (Ramrod, Satecid) **
Simazine (Princep, Caliber 90)
Tebuthiuron (Spike, Tebusan)
Triclopyr (Garlon, Grandstand, Redeem, Remedy) * **
Trifluralin (Treflan, Gowan, Tri-4, Trific)

Herbicides not detected
Benfluralin (Balan, Benefin, Bonalan) * **
Chloramben (Amiben, Amilon-WP, Vegiben) **
Clopyralid (Stinger, Lontrel, Transline) * **
2,4-DB (Butyrac, Butoxone, Embutox Plus, Embutone) * **
Dacthal mono-acid (Dacthal breakdown product) * **
Dinoseb (Dinosebe)
Ethalfluralin (Sonalan, Curbit) * **
Fenuron (Fenulon, Fenidim) * **
Fluometuron (Flo-Met, Cotoran) **
Linuron (Lorox, Linex, Sarclex, Linurex, Afalon) *
MCPA (Rhomene, Rhonox, Chiptox)
MCPB (Thistrol) * **
Neburon (Neburea, Neburyl, Noruben) * **
Norflurazon (Evital, Predict, Solicam, Zorial) * **
Oryzalin (Surflan, Dirimal) * **
Pebulate (Tillam, PEBC) * **
Propanil (Stam, Stampede, Wham) * **
Propham (Tuberite) **
2,4,5-T **
2,4,5-TP (Silvex, Fenoprop) **
Terbacil (Sinbar) **
Thiobencarb (Bolero, Saturn, Benthiocarb) * **
Triallate (Far-Go, Avadex BW, Tri-allate) *

Pesticides in water—Insecticides

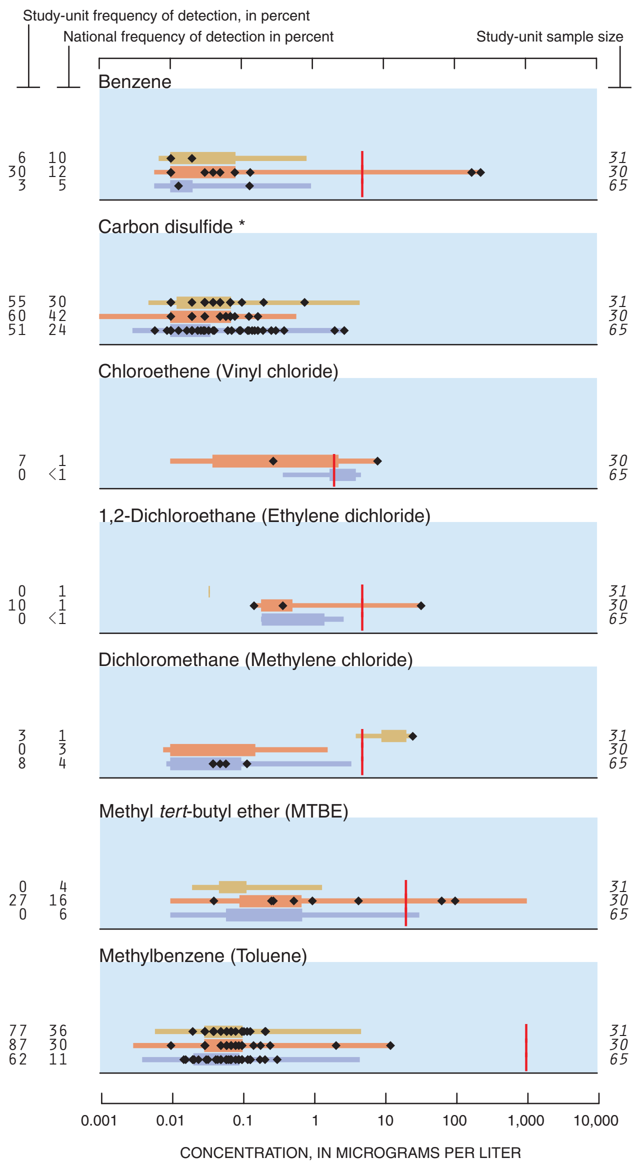


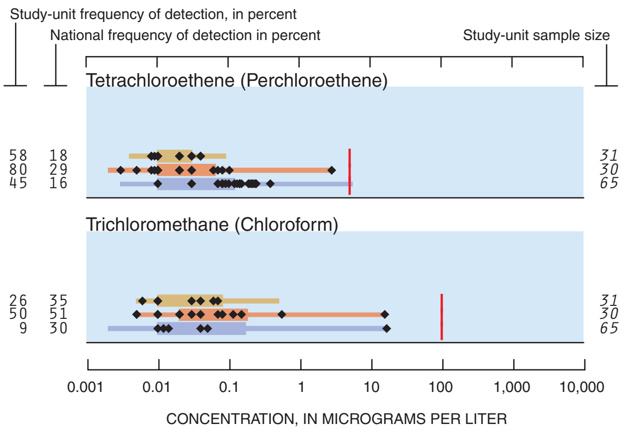
Other insecticides detected
Carbaryl (Carbamine, Denapon, Sevin)
Carbofuran (Furadan, Curaterr, Yaltox)
Diazinon (Basudin, Diazatol, Neocidol, Knox Out)
Dieldrin (Panoram D-31, Octalox, Compound 497)
Fonofos (Dyfonate, Capfos, Cudgel, Tycap) **
3-Hydroxycarbofuran (Carbofuran breakdown product) * **
Malathion (Malathion)

Insecticides not detected
Aldicarb (Temik, Ambush, Pounce)
Aldicarb sulfone (Standak, aldoxycarb)
Aldicarb sulfoxide (Aldicarb breakdown product)
Azinphos-methyl (Guthion, Gusathion M) *
Disulfoton (Disyston, Di-Syston) **
Ethoprop (Mocap, Ethoprophos) * **
alpha-HCH (alpha-BHC, alpha-lindane) **
Methiocarb (Slug-Geta, Grandslam, Mesurol) * **
Methomyl (Lanox, Lannate, Acinate) **
Methyl parathion (Penncap-M, Folidol-M) **
Oxamyl (Vydate L, Pratt) **
Parathion (Roethyl-P, Alkron, Panthion, Phoskil) *
cis-Permethrin (Ambush, Astro, Pounce) * **
Phorate (Thimet, Granutox, Geomet, Rampart) * **
Propargite (Comite, Omite, Ornamite) * **
Propoxur (Baygon, Blattanex, Unden, Proprotox) * **
Terbufos (Contraven, Counter, Pilarfox) **

Volatile organic compounds (VOCs) in ground water

These graphs represent data from 16 Study Units, sampled from 1996 to 1998

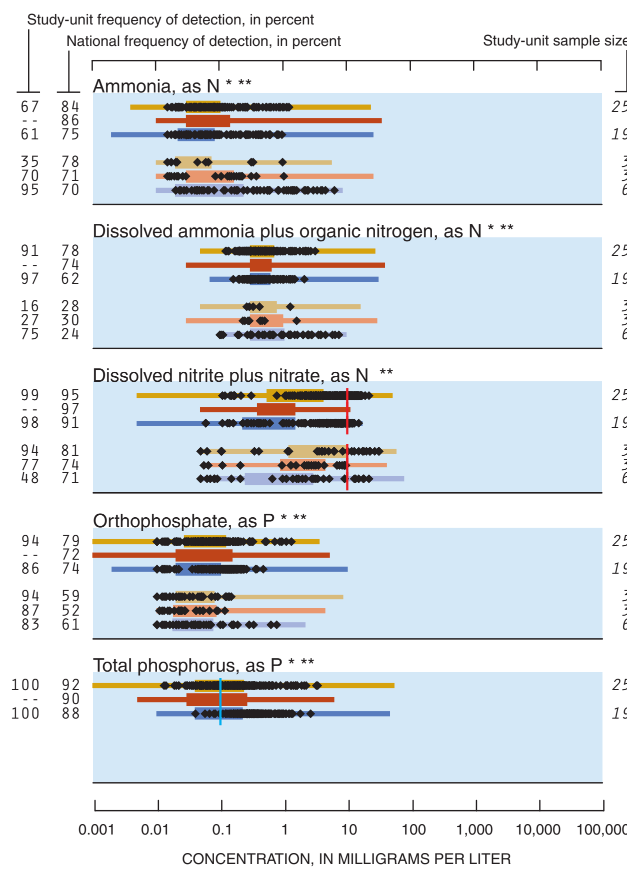




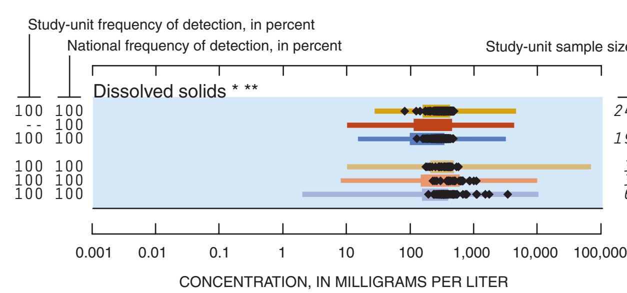
Other VOCs detected
tert-Amylmethylether (*tert*-amyl methyl ether (TAME)) *
Bromodichloromethane (Dichlorobromomethane)
Bromomethane (Methyl bromide)
2-Butanone (Methyl ethyl ketone (MEK)) *
n-Butylbenzene (1-Phenylbutane) *
sec-Butylbenzene *
tert-Butylbenzene *
Chlorobenzene (Monochlorobenzene)
Chlorodibromomethane (Dibromochloromethane)
Chloroethane (Ethyl chloride) *
Chloromethane (Methyl chloride)
1,3-Dichlorobenzene (*m*-Dichlorobenzene)
1,4-Dichlorobenzene (*p*-Dichlorobenzene)
Dichlorodifluoromethane (CFC 12, Freon 12)
1,1-Dichloroethane (Ethylidene dichloride) *
1,1-Dichloroethene (Vinylidene chloride)
trans-1,2-Dichloroethene ((E)-1,2-Dichlorothene)
cis-1,2-Dichloroethene ((Z)-1,2-Dichloroethene)
1,2-Dichloropropane (Propylene dichloride)
Diethyl ether (Ethyl ether) *
Diisopropyl ether (Diisopropylether (DIPE)) *
1,2-Dimethylbenzene (*o*-Xylene)
1,3 & 1,4-Dimethylbenzene (*m*-&*p*-Xylene)
1-4-Epoxy butane (Tetrahydrofuran, Diethylene oxide) *
Ethyl *tert*-butyl ether (Ethyl-*t*-butyl ether (ETBE)) *
1-Ethyl-2-methylbenzene (2-Ethyltoluene) *
Ethylbenzene (Phenylethane)
Iodomethane (Methyl iodide) *
Isopropylbenzene (Cumene) *
p-Isopropyltoluene (*p*-Cymene) *
Naphthalene
2-Propanone (Acetone) *
n-Propylbenzene (Isocumene) *
1,2,3,5-Tetramethylbenzene (Isodurene) *
Tribromomethane (Bromoform)
1,2,3-Trichlorobenzene *
1,1,1-Trichloroethane (Methylchloroform)
Trichloroethene (TCE)
1,2,3-Trichloropropane (Allyl trichloride)
1,2,3-Trimethylbenzene (Hemimellitene) *
1,2,4-Trimethylbenzene (Pseudocumene) *
1,3,5-Trimethylbenzene (Mesitylene) *

VOCs not detected
Bromobenzene (Phenyl bromide) *
Bromochloromethane (Methylene chlorobromide)
Bromoethene (Vinyl bromide) *
3-Chloro-1-propene (3-Chloropropene) *
1-Chloro-2-methylbenzene (*o*-Chlorotoluene)
1-Chloro-4-methylbenzene (*p*-Chlorotoluene)
1,2-Dibromo-3-chloropropane (DBCP, Nemagon)
1,2-Dibromoethane (Ethylene dibromide, EDB)
Dibromomethane (Methylene dibromide) *
trans-1,4-Dichloro-2-butene ((Z)-1,4-Dichloro-2-butene) *
1,2-Dichlorobenzene (*o*-Dichlorobenzene)
2,2-Dichloropropane *
1,3-Dichloropropane (Trimethylene dichloride) *
trans-1,3-Dichloropropene ((E)-1,3-Dichloropropene)
cis-1,3-Dichloropropene ((Z)-1,3-Dichloropropene)
1,1-Dichloropropene *
Ethenylbenzene (Styrene)
Ethyl methacrylate *
Hexachlorobutadiene
1,1,1,2,2,2-Hexachloroethane (Hexachloroethane)
2-Hexanone (Methyl butyl ketone (MBK)) *
Methyl acrylonitrile *
Methyl-2-methacrylate (Methyl methacrylate) *
4-Methyl-2-pentanone (Methyl isobutyl ketone (MIBK)) *
Methyl-2-propenoate (Methyl acrylate) *
2-Propenenitrile (Acrylonitrile)
1,1,2,2-Tetrachloroethane *
1,1,1,2-Tetrachloroethane
Tetrachloromethane (Carbon tetrachloride)
1,2,3,4-Tetramethylbenzene (Prehnitene) *
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113) *
1,2,4-Trichlorobenzene
1,1,2-Trichloroethane (Vinyl trichloride)
Trichlorofluoromethane (CFC 11, Freon 11)

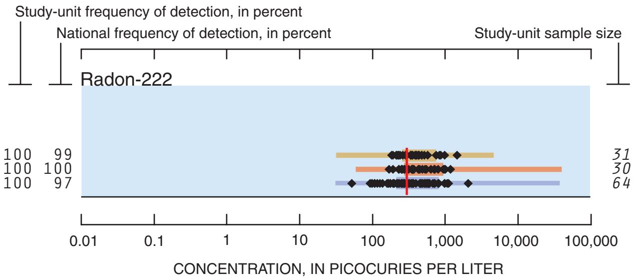
Nutrients in water



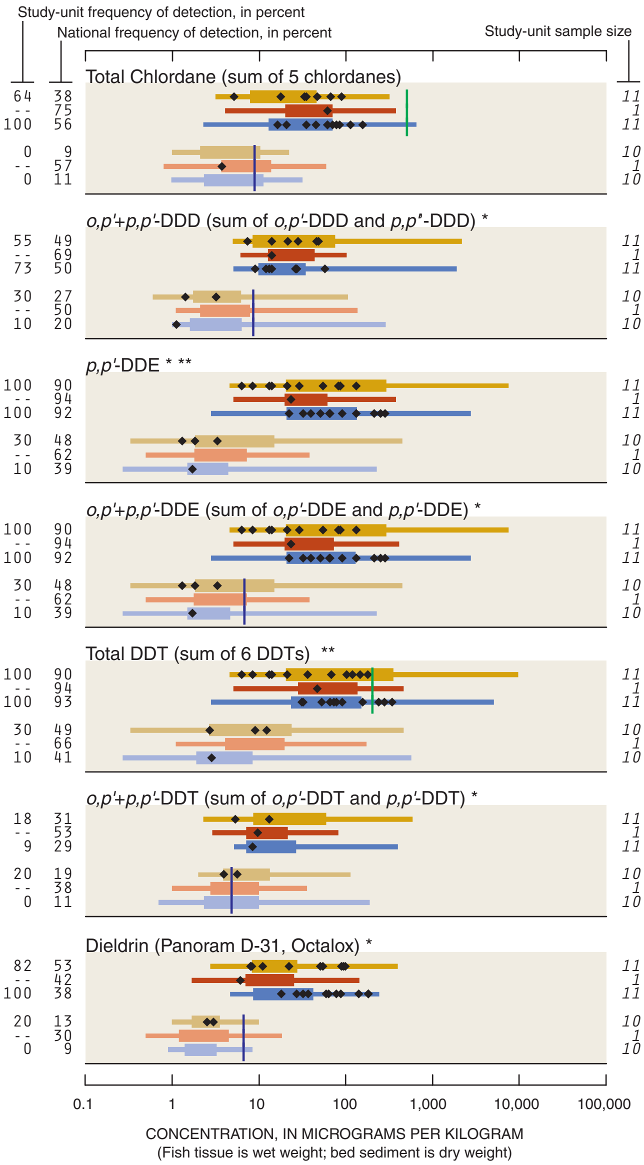
Dissolved solids in water



Trace elements in ground water



Organochlorines in fish tissue (whole body) and bed sediment



CHEMICALS IN FISH TISSUE AND BED SEDIMENT

Concentrations and detection frequencies, Eastern Iowa Basins, 1996–98—Detection sensitivity varies among chemicals and, thus, frequencies are not directly comparable among chemicals. Study-unit frequencies of detection are based on small sample sizes; the applicable sample size is specified in each graph

◆ Detected concentration in Study Unit

66 38 Frequencies of detection, in percent. Detection frequencies were not censored at any common reporting limit. The left-hand column is the study-unit frequency and the right-hand column is the national frequency

-- Not measured or sample size less than two

12 Study-unit sample size

National ranges of concentrations detected, by land use, in 36 NAWQA Study Units, 1991–98—Ranges include only samples in which a chemical was detected

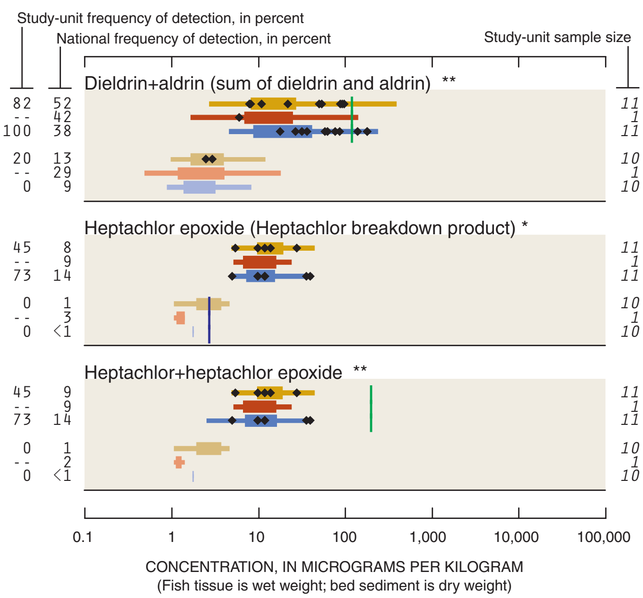
Fish tissue from streams in agricultural areas
Fish tissue from streams in urban areas
Fish tissue from streams draining mixed land uses
Sediment from streams in agricultural areas
Sediment from streams in urban areas
Sediment from streams draining mixed land uses

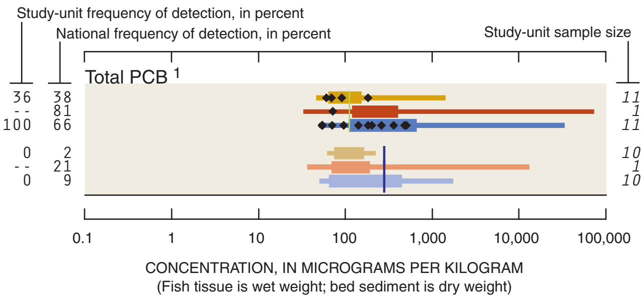
Lowest 25 percent | Middle 50 percent | Highest 25 percent

National benchmarks for fish tissue and bed sediment

National benchmarks include standards and guidelines related to criteria for protection of the health of fish-eating wildlife and aquatic organisms. Sources include the U.S. Environmental Protection Agency, other Federal and State agencies, and the Canadian Council of Ministers of the Environment

Protection of fish-eating wildlife (applies to fish tissue)
Protection of aquatic life (applies to bed sediment)
* No benchmark for protection of fish-eating wildlife
** No benchmark for protection of aquatic life



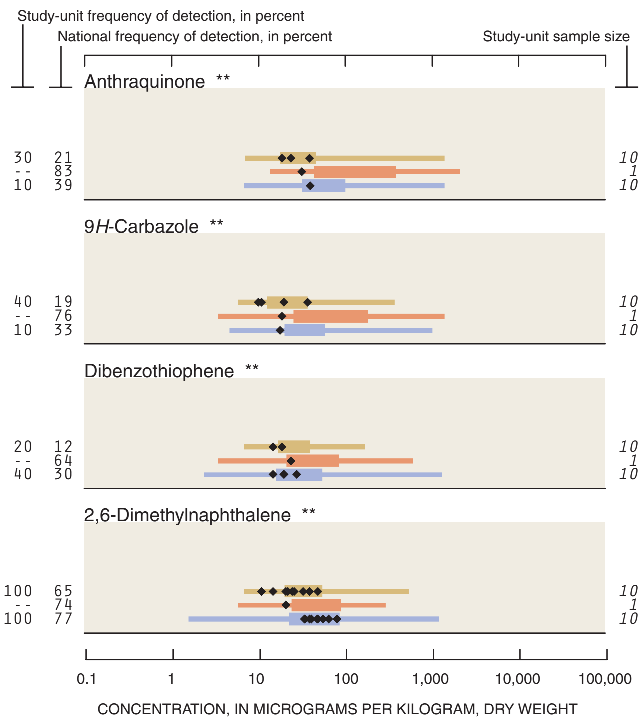


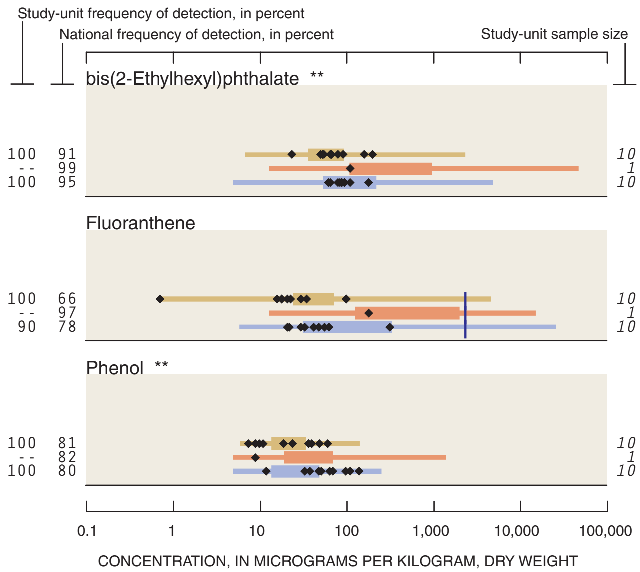
[1] The national detection frequencies for total PCB in sediment are biased low because about 30 percent of samples nationally had elevated detection levels compared to this Study Unit. See http://water.usgs.gov/nawqa/ for additional information.

Other organochlorines detected
DCPA (Dacthal, chlorthal-dimethyl) * **
Total-HCH (sum of alpha-HCH, beta-HCH, gamma-HCH, and delta-HCH) **
Mirex (Dechlorane) **
Pentachloroanisole (PCA) * **

Organochlorines not detected
Chloroneb (Chloronebe, Demosan) * **
Endosulfan I (alpha-Endosulfan, Thiodan) * **
Endrin (Endrine)
gamma-HCH (Lindane, gamma-BHC, Gammexane) *
Hexachlorobenzene (HCB) **
Isodrin (Isodrine, Compound 711) * **
p,p'-Methoxychlor (Marlate, methoxychlore) * **
o,p'-Methoxychlor * **
cis-Permethrin (Ambush, Astro, Pounce) * **
trans-Permethrin (Ambush, Astro, Pounce) * **
Toxaphene (Camphechlor, Hercules 3956) * **

Semivolatile organic compounds (SVOCs) in bed sediment



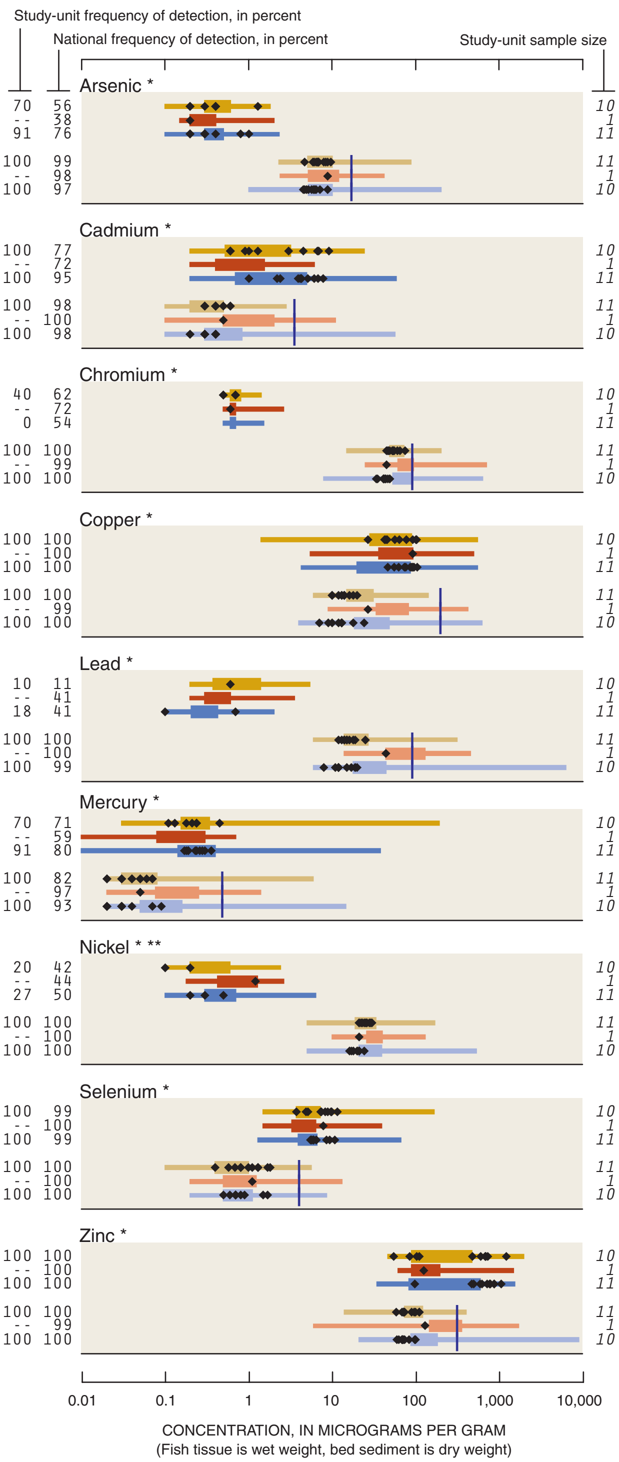


Other SVOCs detected
Acenaphthene
Acenaphthylene
Acridine **
Anthracene
Benz[*a*]anthracene
Benzo[*a*]pyrene
Benzo[*b*]fluoranthene **
Benzo[*ghi*]perylene **
Benzo[*k*]fluoranthene **
Butylbenzylphthalate **
Chrysene
p-Cresol **
Di-*n*-butylphthalate **
Di-*n*-octylphthalate **
Dibenz[*a,h*]anthracene
Diethylphthalate **
1,2-Dimethylnaphthalene **
1,6-Dimethylnaphthalene **
Dimethylphthalate **
2-Ethylnaphthalene **
9*H*-Fluorene (Fluorene)
Indeno[1,2,3-*cd*]pyrene **
Isoquinoline **
1-Methyl-9*H*-fluorene **
2-Methylanthracene **
4,5-Methylenephenanthrene **
1-Methylphenanthrene **
1-Methylpyrene **
Naphthalene
Phenanthrene
Pyrene
2,3,6-Trimethylnaphthalene **

SVOCs not detected
C8-Alkylphenol **
Azobenzene **
Benzo[*c*]cinnoline **
2,2-Biquinoline **
4-Bromophenyl-phenylether **
4-Chloro-3-methylphenol **
bis(2-Chloroethoxy)methane **
2-Chloronaphthalene **
2-Chlorophenol **
4-Chlorophenyl-phenylether **
1,2-Dichlorobenzene (*o*-Dichlorobenzene) **
1,3-Dichlorobenzene (*m*-Dichlorobenzene) **
1,4-Dichlorobenzene (*p*-Dichlorobenzene) **
3,5-Dimethylphenol **
2,4-Dinitrotoluene **
Isophorone **
Nitrobenzene **

N-Nitrosodi-*n*-propylamine **
N-Nitrosodiphenylamine **
Pentachloronitrobenzene **
Phenanthridine **
Quinoline **
1,2,4-Trichlorobenzene **

Trace elements in fish tissue (livers) and bed sediment



BIOLOGICAL INDICATORS

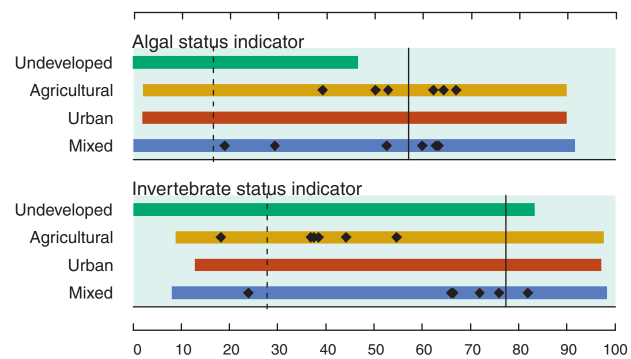
Higher national scores suggest habitat disturbance, water-quality degradation, or naturally harsh conditions. The status of algae, invertebrates (insects, worms, and clams), and fish provide a record of water-quality and stream conditions that water-chemistry indicators may not reveal. **Algal status** focuses on the changes in the percentage of certain algae in response to increasing siltation, and it often correlates with higher nutrient concentrations in some regions. **Invertebrate status** averages 11 metrics that summarize changes in richness, tolerance, trophic conditions, and dominance associated with water-quality degradation. **Fish status** sums the scores of four fish metrics (percent tolerant, omnivorous, non-native individuals, and percent individuals with external anomalies) that increase in association with water-quality degradation

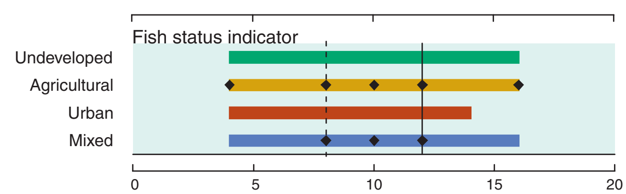
Biological indicator value, Eastern Iowa Basins, by land use, 1996–98

◆ Biological status assessed at a site

National ranges of biological indicators, in 16 NAWQA Study Units, 1994–98

- Streams in undeveloped areas
- Streams in agricultural areas
- Streams in urban areas
- Streams in mixed-land-use areas
- 75th percentile
- 25th percentile





A COORDINATED EFFORT

Coordination with agencies and organizations in the Eastern Iowa Basins was integral to the success of this water-quality assessment. We thank personnel from the following agencies and organizations who served as members of our liaison committee and participated in our liaison committee meetings.

- U.S. Department of Agriculture
  - Natural Resources Conservation Service
  - Agricultural Research Service
- U.S. Environmental Protection Agency, Region VII
- U.S. Fish and Wildlife Service
- U.S. Geological Survey
  - Biological Resources Division
- Iowa Department of Agriculture and Land Stewardship
  - Pesticide Bureau
- Iowa Department of Natural Resources
  - Environmental Protection Division
  - Geological Survey Bureau
  - Fisheries Bureau
- Minnesota Department of Natural Resources
  - Minnesota Pollution Control Agency
  - Minnesota Geological Survey
- Linn County Iowa REAP
- Linn County Iowa Conservation Board
- Johnson County Iowa Board of Supervisors
- Cedar Rapids Water Department
- Iowa City Public Works
- Iowa State University
  - Center for Sustainable Agriculture
  - Department of Botany
  - Extension Service
- University of Iowa
  - Hygienics Laboratory
    - Limnology Section
    - Environmental Research
  - Institute of Hydraulic Research
  - Center for Health Effects on the Environment
- University of Northern Iowa
  - College of Natural Sciences
- Wartburg College
  - Biology Department
- Iowa Farm Bureau Federation
- Iowa Environmental Council
- Iowa Ground Water Association
- Izaak Walton League
- Sierra Club
- Dow AgroSciences
- Dupont Agricultural Products
- Novartis Crop Protection
- Monsanto
- American Cyanamid Company
- American Corn Growers Association
- Johnson County Farm Bureau

We thank the following individuals for contributing to this effort.

James Cerveny, Jon Nania, Joel Galloway, Jennifer Tobias, and Matthew Bobier, the primary field personnel, who worked in all conditions to obtain a high-quality data set without which this report would not be possible.

Linda Roberts, the Study Unit biologist, who planned and supervised the collection of algae, macroinvertebrate, and fish samples.

The many U.S. Geological Survey personnel (too many to list) from the Iowa District and surrounding States that assisted in the collection of biological samples and in the construction of equipment shelters.

Scott Yess and Ann Rundstrom of the Fish and Wildlife Service and J. Kent Johnson University of Iowa Hydraulics Institute, who assisted in the collection of fish.

Technicians and chemists at the USGS National Water-Quality Laboratory in Denver, Colorado, who provided analysis of all water samples. Mike Thurman and Elizabeth Scribner and the staff of the U.S. Geological Survey Organic Geochemistry Research laboratory in Lawrence, Kansas, who analyzed all pesticide samples for degradates. Researchers and technicians at the USGS Isotope Tracers Laboratory and the USGS National Research Program Laboratory, who provided tritium and stable isotope analysis.

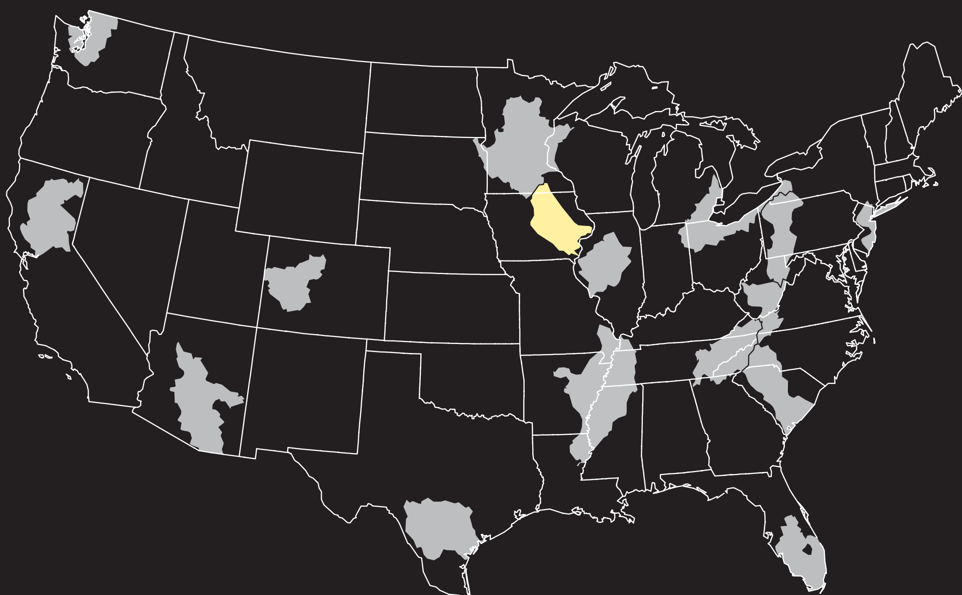
Tom Wilton of the Iowa Department of Natural Resources who provided a wealth of information, data, and advice that was invaluable in the completion of the water-chemistry and biological parts of the study.

Reviewers—Michael Burkhart, USDA Soil Tilth Laboratory; Susan Heathcote, Iowa Environmental Council; Jim Ellerhoff, Iowa Department of Agriculture and Land Stewardship; Richard Robinson, Iowa Farm Bureau Federation; Bernard Hoyer, Iowa Department of Natural Resources; Geological Survey Bureau. The many colleagues in the U.S. Geological Survey whose technical suggestions substantially improved this report. The editorial reviewers, Lanna Combs and Betty Palcsak.

Editors and publication preparation: Alene Brogan, Mary Kidd, Robert Olmstead, and Ed Swibas.

NAWQA

National Water-Quality Assessment (NAWQA) Program
Eastern Iowa Basins



Kalkhoff and others—Water Quality in the Eastern Iowa Basins
U.S. Geological Survey Circular 1210

ISBN 0-607-95415-9
9 780607 954159