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Randy Sauer is a Regional Fisheries Administrator (Regions III and IV) in Carlyle. He joined IDNR in 1982 and has been with the Fisheries Division since 1986, spending 30 years as a Stream Biologist prior to his current position. Randy has a B.S. in Natural Resources from Cornell University and M.A. in Zoology from Southern Illinois University-Carbondale.

@ORC is a weekly publication by the IL Department of Natural Resources Office of Resource Conservation about exciting and wonderful things ORC staff are doing throughout Illinois.

Tammy Miller, Editor
tammy.miller@Illinois.gov

Emily Brodt, Assistant Editor
emily.brodt@Illinois.gov

Stream Basin Sampling in Illinois

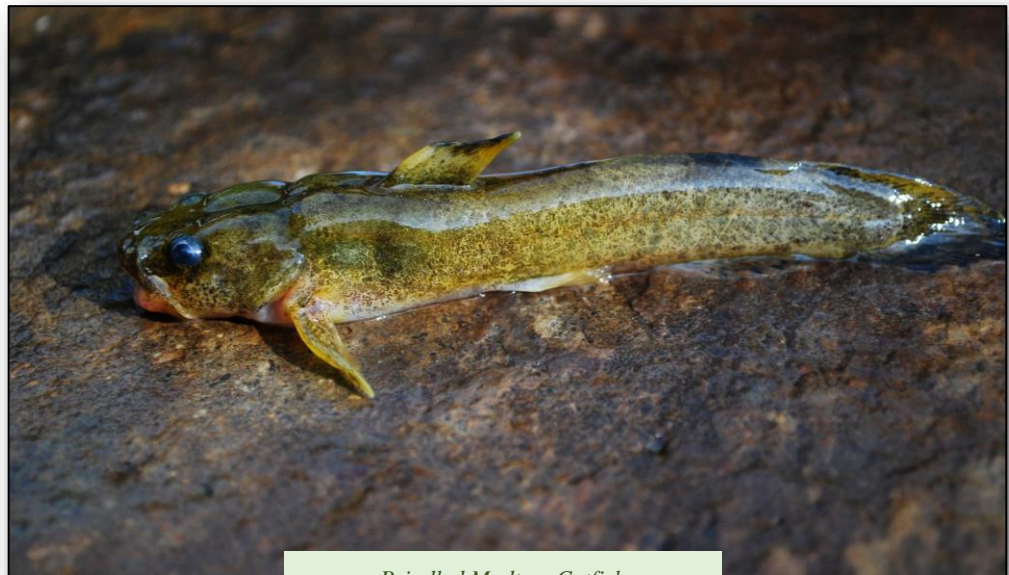
40 years of “Shocking” Developments

By Randy Sauer, Regional Fisheries Administrator

Illinois’ rivers and streams are the lifeblood of our state’s aquatic biodiversity. With over 100,000 miles of streams traversing the landscape, Illinois supports a diverse bounty of fish, mussels and other aquatic life. Over 150 species of fish dwell in our lotic habitats, ranging from diminutive darters (colorful, stream dwelling members of the perch family) to gargantuan catfish exceeding 100 pounds. What’s more, streams are a valuable indicator of what’s happening on the landscape as water quality and physical habitat are heavily influenced by human activities. Nowhere is this more apparent than in Illinois, where the effects of intensive agriculture, localized industry and other development have long compromised the integrity of our stream ecosystems.

Evaluation of all natural resources is a critical tool in their management and protection. To this end, the IL Dept of Natural Resources (IDNR) and IL Environmental Protection Agency (IEPA) embarked on a landmark partnership nearly 40 years ago. Our agencies’ Cooperative Basin Survey Program was launched in 1981 with the purpose of evaluating and periodically monitoring the biological health of Illinois streams based upon their aquatic communities. This information would be used to help manage, protect and restore stream ecosystems statewide.

Because of their relatively long life, mobility and response to environmental stresses on multiple fronts (water quality and physical habitat), fish are an ideal candidate to serve as indicators of overall stream health. Dr. James Karr, a University of Illinois ecologist at the time, espoused this in developing the “Index of Biotic Integrity (IBI)” in 1981. The IBI is a numerical yardstick which estimates the biotic integrity (or health) of a stream segment based upon a set of attributes from a fish



Brindled Madtom Catfish



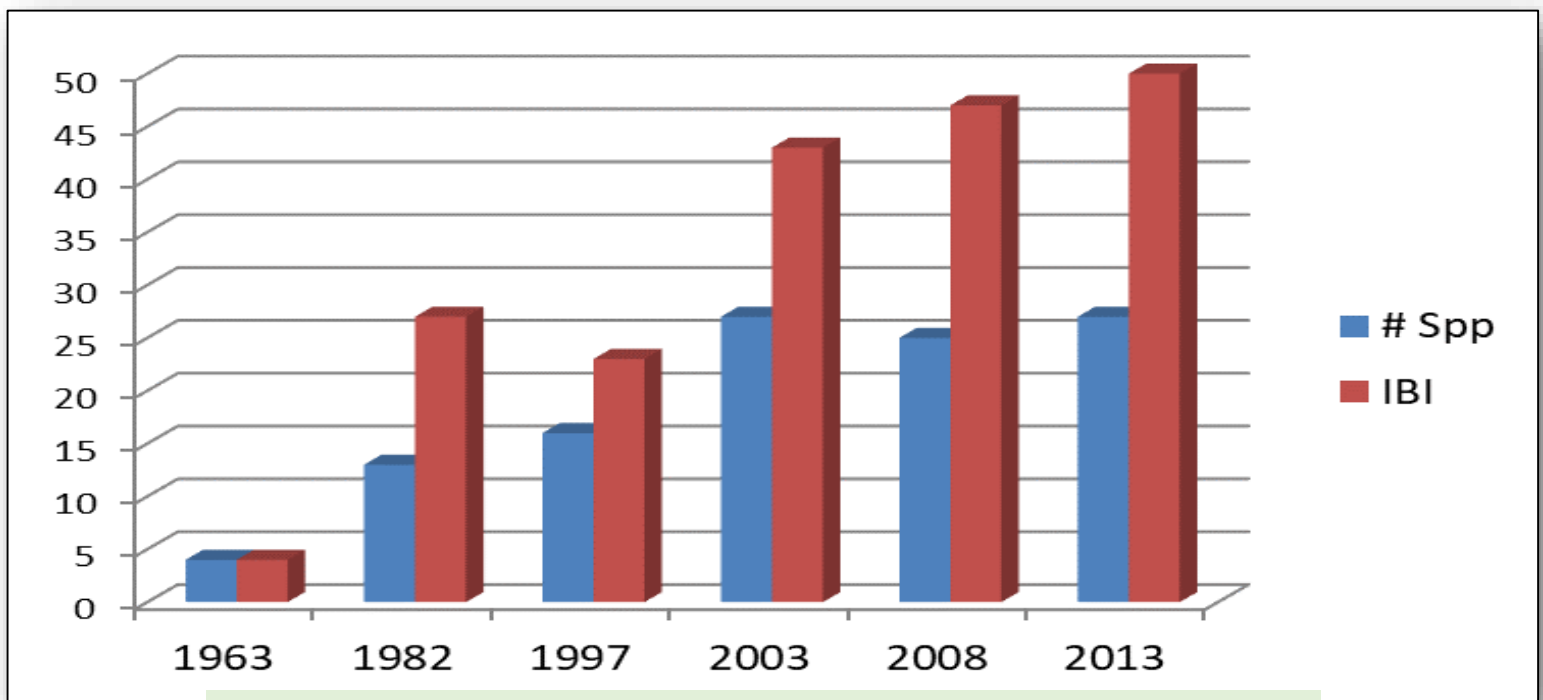
Hornyhead Chub

sample. Revised by IEPA in 2000, the IBI evaluates overall species richness (number of fish species), “intolerant” species (indicators of relatively undisturbed conditions), spawning and feeding specialists adapted to specific habitat conditions and several other metrics which are cumulatively totaled and result in an overall score ranging from zero to 60, with higher scores reflecting less environmental disturbance and thus, more natural conditions.

Another important ecological indicator is the community of benthic (bottom-dwelling) macroinvertebrates, i.e. animals lacking backbones but visible to the naked eye. These include early life stages of insects (e.g. mayfly nymphs and black fly larvae), other

arthropods (joint legged invertebrates), snails, worms etc. As gill breathers, macroinvertebrates are important trend indicators of water quality (especially dissolved oxygen). They are relatively easy to collect and sedentary, giving us clues to more localized stressors. They are an ideal complement to fishes as environmental indicators.

With this in mind, the IEPA/IDNR Work Group (which also included scientists from IL Natural History Survey at the time) developed a comprehensive, multi-pronged approach to evaluating streams in a highly integrated team approach. IDNR Fisheries personnel would be responsible for fish sampling, identification and subsequent fish data analysis. Meanwhile, IEPA would sample water quality (i.e. chemical constituents such as dissolved oxygen, total dissolved solids, coliform bacteria etc.), collect macroinvertebrates, measure stream flow and evaluate physical stream habitat characteristics (e.g. substrate composition, pool/riffle/run, instream cover). IEPA then uses this information to determine whether resource quality meets regulatory standards designed to protect for balanced aquatic life and to ensure that other beneficial aspects of streams are protected and maintained.



Number of fish species collected (# Spp) and Index of Biotic Integrity (IBI) from Sugar Creek downstream of Bloomington-Normal, 1963-2013

IDNR supports these goals and also has additional ones aimed at improving the quality of sport fishing opportunities in Illinois streams and rivers, documenting the need for added protection of our highest quality streams and for restoration of degraded stream habitats, and tracking the distribution of all fish species (including those on the state's threatened and endangered list) over time. Our predecessor agency, the IL Dept of Conservation (IDOC), had actually conducted statewide stream fish surveys throughout the 1960's across all of Illinois watersheds, providing valuable baseline information for what was to come.

The first major watershed sampled jointly between the two agencies was the Sangamon River basin during 1981-82. Additional basins were sampled in coming years (Kaskaskia, Fox etc.) until the entire state had been covered by 1995. Since then, each watershed has been surveyed on a five year rotation with 100-150 sites completed statewide each year. To date, over 5,000 samples have been collected from over 1500 stream sites across Illinois, providing one of the most robust biological databases of its kind in the nation.

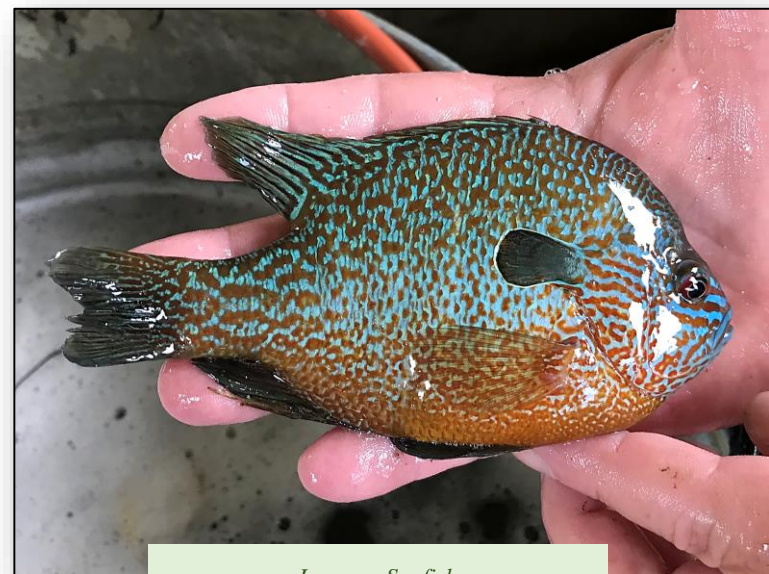
To allow effective comparison of these data over time, sampling methodologies have remained relatively constant. The 1960's IDOC surveys, along with the first few years of the cooperative IDOC/IEPA efforts, involved the use of a fish toxicant (rotenone) on wadeable sites. This method effectively "killed out" a section of stream which resulted in a very thorough sample but exerted a heavy toll on the affected fish community. By 1987, we had replaced rotenone sampling with the electric seine, a device developed in Illinois by Dr. R. Weldon Larimore of INHS some thirty years earlier. This method yields relatively complete samples with much less fish mortality.

On deeper, non-wadeable sites we employ an electrofishing boat similar to those used on lakes but somewhat smaller. Minnow seine hauls usually supplement our boat samples in shallower riffle habitats. Most macroinvertebrate sampling involves a "D-frame" aquatic dip net vigorously employed in the bottom substrate, debris jams, root wads and other likely habitats. Mussel sampling by INHS researchers occurred across all our major stream basins recently to yield an even more complete picture of our aquatic biota.

After almost four decades and upwards of a million fish collected, several positive trends appear when looking at our statewide data set. The most dramatic changes came



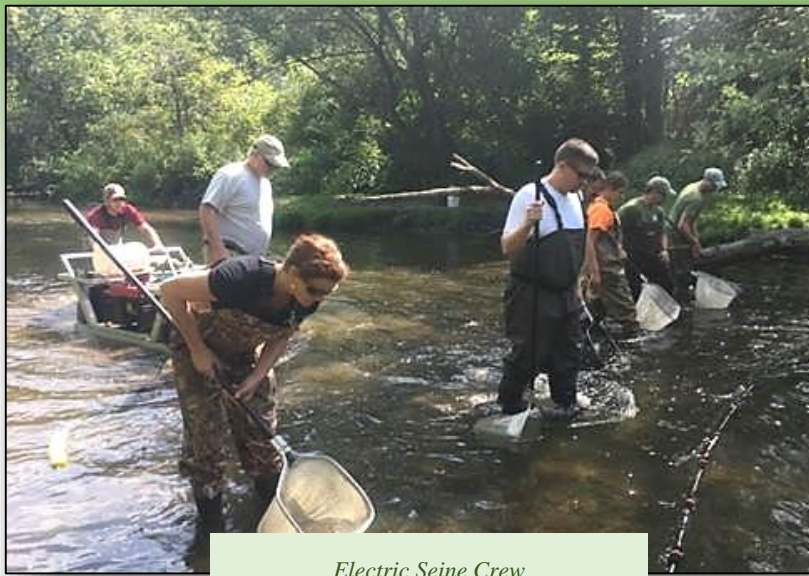
*IEPA Staff conducting
Macroinvertebrate Sampling*



Longear Sunfish



Stream Sampling from an Electrofishing Boat



Electric Seine Crew

in the wake of the 1972 passage of the Clean Water Act (CWA) which mandated, and subsequently funded, upgrades in municipal and industrial wastewater treatment. The vast improvements in water quality which accrued throughout implementation of CWA standards appeared most obvious in heavily urbanized Chicago area watersheds such as the Fox and DesPlaines, but were also apparent in more populated localities downstate (see Sugar Creek graph). Even relatively agricultural basins such as the Sangamon and Kaskaskia saw moderate gains in biological integrity throughout the 1980's and 1990's likely owing to increased use of conservation tillage, Farm Bill set-aside programs and other such initiatives.

On the flip side, the proliferation of aquatic nuisance species such as Asian carp and round goby have taken a toll on our native fish communities in waterways across the state. Often we see a sharp immediate expansion in their range (and numbers) followed by an eventual "plateau" with a more stable, yet altered, aquatic ecosystem. Other recent, troubling trends involve loss of aquatic vegetation due to improper herbicide use (and more locally, the invasive grass carp) along with waterborne pharmaceutical products which can disrupt fish health and reproduction.

As we complete our fourth decade of basin surveys this summer (work will occur in the Kankakee, Mackinaw and Saline/Ohio basins among others), IDNR Fisheries and IEPA Monitoring staff await the opportunity to put on chest waders and haul our equipment up and down steep streambanks in the heat of summer! The interagency camaraderie and thrill of scientific discovery seem to make up for a little discomfort. Hopefully, lessons learned from our work will continue to enable us all to be effective stewards of Illinois' amazingly resilient stream dwellers.



Fall Creek, Illinois