Activities

2006 Research Highlights

December

USGS Science Policy In The News

Unit Cooperators may be reading news headlines such as "USGS Scientists Object to Stricter Review Rules; Pre-Publication Policy Seen as Cumbersome." (Washington Post, Thursday, December 14, 2006, A29). The USGS Scientists quoted in the article are not your friendly scientists (Chipps and Berry) at the South Dakota Coop Unit. We just follow orders. Here is what is going on in a nutshell. We have to get more peer review and we have to document the review in writing. We have always had a lot of peer review of proposals and papers that we (staff and students) write, beginning with agency review of proposals to journal editor review of manuscripts. And, because we are at a university, we have an extra level of review for student work, which is the student's Graduate Committee (3 Graduate Faculty for M.S., 5 for Ph.D.) that reviews proposals and theses.

Some major new steps that may involve you as a Cooperator are: (1) Two levels of USGS management now review our products whereas before there was only one level, which may mean delays of one week to six months (but who knows, it is a new process); (2) peer reviewers (possibly you) must write comments and we must write responses and the comment/response package is sent to USGS managers with the product; and (3) we now have to do this not only for manuscripts, but also for proposals, study plans, reports, abstracts, posters, and prepared talks.

This is being done for all Coop Units and USGS Science Centers (not just us) to ensure that our products meet the Agency's scientific standards and to determine whether the public relations staff should be notified.

November

Research Need: Status of South Dakota River fishes

Research Finding: Unit Leader Dr. Charles R. Berry, Jr., reported on the status of South Dakota fishes in the biomonitoring session of the South Dakota Water Conference held in Brookings on November 1-2. Fisheries data collected in the last 15 years in all major watersheds shows that South Dakota's river fish community is changing. The recent fish

SD Fishes By The Numbers
122 species historically
111 species recently
36 reduced range
23 new species
18 expanded range
8 missing
6 in only 1 drainage

fauna is different from the historical fauna because several species are now absent and species have been introduced. Some species are being reduced in their ranges, meaning that they are found in fewer basins than historically. More natives disappeared East River than West River and there were more introduced species West River than East River. This information justifies watershed management to conserve aquatic biodiversity and specific activities to conserve certain fishes. Data from the aquatic gap analysis project is available to help find river reaches where conservation measures will be most effective.

October

The Coop Unit is jointly supported by five agencies that appoint a representative to the Unit Coordinating Committee. Committee members are (L to R in picture) Greg Watson – Region 6, Fish and Wildlife Service (FWS), Pat Ruble – Wildlife Management Institute (WMI), Dr. Gary Lemme - South Dakota State University (SDSU), Dr. Bern Shanks – U.S. Geological Survey (USGS), and Doug Hansen – South Dakota Game, Fish and Parks (SDGFP). The Committee, and invited state and federal biologists, met on October 26 to review the Unit's activities.

September

Research Need: Information on mercury dynamics in South Dakota lakes.

Hg

Research Results: Atmospheric deposition of mercury across the landscape, combined with recent increases in water levels, are believed to contribute to elevated mercury concentrations in fishes. Ph.D. student Trevor Selch found that lakes that experienced the greatest change in surface area between wet (1999-2001) and dry (1975-1979) years contained walleye with the highest mercury concentrations. Walleye sampled in Bitter and Twin lakes in the spring contained significantly higher mercury concentrations than those collected during summer and fall. The effects of mercury on reproductive hormones (estradiol-17â and testosterone) are not well understood. Reduced hormone levels in Bitter may be linked to reduced gonad weight and fecundity (eggs/g). Selch is working with Assistant Unit leader Dr. Steven Chipps.

August

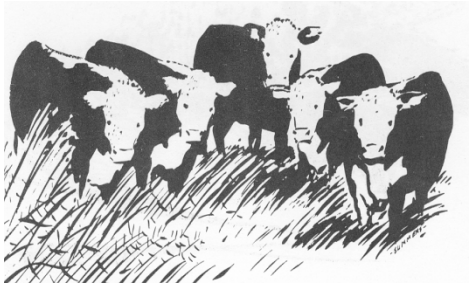
Research Need: Choosing the right spatial and temporal context.

Research Finding: A consortium of leading ecologists says that "ecological topology" is a frontier in ecological research (BioScience 2001:15). Ecological topology is a way of evaluating how scales of information affect ecological processes. The American Fisheries Society recently

published a symposium titled *Landscape influences on stream habitats and biological assemblages* (R. Hughes, et al. eds). Unit Leader Dr. Charles R. Berry Jr., and associates Christopher Hoagstrom and Steven Wall, published two papers about South Dakota fishes in the symposium. The first is from the temporal context, explaining how fish populated 22 tributaries in the upper Missouri River after glaciation. The fish assemblage in a basin today depends on basin size, basin habitat complexity, and basin location. The second is from the spatial context, dealing with the Topeka shiner. Topeka shiner presence depends on several key riparian zone features at the reach scale and at the valley segment scale. Associations with other fish species are also important.

July

Research Need: Livestock Grazing and Wildlife.



Research Finding: Livestock grazing rates of light (25 AUM) to moderate (37 AUM) intensity provide habitat for most species of non-game birds nesting in mixed-grass prairies and still enable ranchers to obtain a profit from livestock production. Livestock weight gain and bird nesting *declined* as livestock grazing intensity increased. In contrast, among the 19 species of non-game birds studied were some (longspurs, larks, sandpipers, dogwits, willets) that had highest densities where grazing was most intense. Some grazing practices, particularly rotational grazing, on native or seeded grassland habitats can be applied for long-periods of time (e.g., 19 years) without negative effects on certain species of grassland non-game birds. Studies were done in south-central North Dakota from 1989-2003. These were the essential conclusions of recent studies by former Assistant Unit Leader Dr. Kenneth F. Higgins and colleagues and students.

June

Research Need: Indicators of floodplain wetland health.

Research Finding: Agricultural activities influence macrophytes, algae, and macroinvertebrate communities in floodplain wetlands. Seasonally-flooded wetlands were characterized as low impact (non-disturbed) or high impact (disturbed) based on local land use. Fourteen additional wetlands were also sampled to evaluate the general condition of seasonally-flooded floodplain wetlands. A wetland condition index (WCI) used six biological metrics to discriminate between disturbed and non-disturbed wetlands: 1) biomass of Culicidae larvae, 2) abundance of Chironomidae larvae, 3) macroinvertebrate diversity, 4) total number of plant species, 5) the proportion of exotic plant species, and 6) total number of sensitive diatom species. Disturbed wetlands had less taxa richness and species diversity and more exotic and nuisance (e.g., mosquitoes) species. Environmental differences between low and high impact wetlands included measures of total potassium, total phosphorus, total nitrogen, alkalinity, conductance, and sediment phosphorus concentration. “Biological metrics are useful indicators of disturbance in floodplain wetlands,” says Assistant Unit Leader Dr. Steven R. Chipps, whose article on this subject is in the latest issue of *Wetlands*.

May

Research Need: Basic information on Bureau of Reclamation Reservoirs.

Research Accomplishment: Assistant Unit Leader Dr. Steven R. Chipps will be starting a new project on Belle Fourche and Keyhole reservoirs. The information will augment the data he and former Assistant Unit Leader Dr. Walter Duffy have collected on U.S. Bureau of Reclamation reservoirs since 1995. They obtained some of the first limnology data on these reservoirs – data that includes oxygen and temperature profiles, nutrient budgets, sediment data, and biota. Much data has been collected while focusing on factors controlling plankton populations. Chipps and students have built models to explain and predict many of the limnological changes. Some of the important findings have been:

- Nutrient budgets: Mass-balance models based on phosphorus inputs/outputs provided reasonable estimates of reservoir nutrient concentrations (r^2=0.76) for Angostura, Deerfield, Pactola, Sheridan, and Stockade reservoirs. These models can be used to predict changes in reservoir nutrient concentration resulting from increases (or decreases) in nutrient inputs from tributary inflows.
- Iron concentration: Naturally occurring bog-iron deposits are common in Black Hills watersheds. Studies in Pactola, Deerfield, Sheridan, and Stockade reservoirs showed that the ratio of P:Fe in reservoir sediments was a good predictor of mean summer water phosphorus concentration (r^2=0.96) in these reservoirs. Sediment P:Fe was lowest in Pactola Reservoir owing to an aerobic hypolimnion and high Fe inputs from Rapid Creek. However, sediment phosphorus concentration was relatively high in Pactola Reservoir, underscoring the importance of aerobic conditions in maintaining good water quality.
- Factors affecting water clarity: Chlorophyll a, detritus and inorganic suspended solid concentrations were used to build models for predicting Secchi depth in Angostura, Pactola, and Deerfield reservoirs. These models provided good fits to observed Secchi readings (r^2=0.72 to 0.94) and proved useful for assessing changes in water clarity owing to increased algal production (chlorophyll a) and/or sediment inputs (inorganic suspended solids).
- Shadehill: oxygen, temperature, hydrogen sulfide, and pH conditions were acceptable during 1994-1995; slow growth of walleye may have been due to prey base rather than limnological conditions.

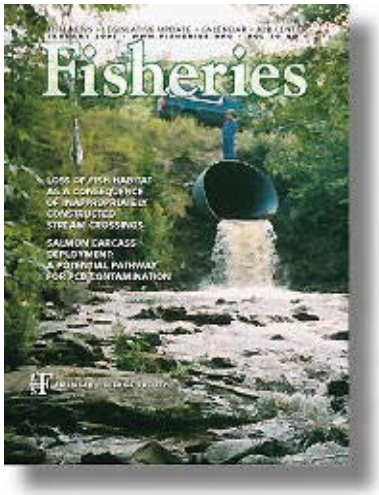
April

Research Need: Evaluate secondary effects of strobe lights as fish deterrents at Oahe Dam

Research Accomplishment: We assessed effects of strobe lights on stress response and avoidance behavior in largemouth bass, fathead minnow, channel catfish, yellow perch, and Chinook salmon. Plasma cortisol level for channel catfish (8.9), yellow perch (8.1), and Chinook salmon (17.3) increased significantly compared to controls (5.0, 0.3, and 10.2 μg/dL) after 1 hour (h) of exposure to strobe lights. After 7 h, plasma cortisol level was similar to controls for all fish taxa. Fathead minnows showed no response to strobe lights at either 1 or 7 h of exposure. Behavior experiments showed that mean distance moved from the strobe light varied significantly between test and control fish and was highest for largemouth bass (mean distance

after 1 h =8.2 m) followed by Chinook salmon (7.4), yellow perch (7.3), and channel catfish (4.9). In contrast, avoidance behavior by fathead minnows did not differ between fish exposed to strobe lights and those used in controls. Although elevated cortisol level was useful for predicting an avoidance response, stress response alone was a poor indicator of relative sensitivity of individual taxa to strobe lights. Direct observations of avoidance behavior revealed that largemouth bass, Chinook salmon, and yellow perch were more sensitive to strobe lights than channel catfish. Lack of both a stress response and avoidance behavior by fathead minnows indicates low sensitivity of this species to strobe lights and warrants further investigation into the effectiveness of strobe lights on cyprinid species.

March



Research Need: Effects of roads on fish and wildlife. South Dakota does not have problems as bad as that pictured on the cover of Fisheries, but interest in highways and wildlife is "getting traction." We got calls about culverts from two consulting firms this week.

Research Findings: The South Dakota Unit has worked on three issues related to roads and wildlife.

Culverts and endangered fish conservation: We used the GAP Analysis models of known and predicted presence of Topeka shiners to find 81 stream segments with road crossings. We found 7% of the 232 culverts were a high priority for restoration or maintenance for some reason (2004 SD Acad. Sci. 83:125-135). This information was given to J. Pickle of HRD, Inc. GAP Analysis information was also provided to a company in Sioux Falls that had to mitigate for filling a stream to build a parking lot.

Roads and wetlands: Assistant Unit Leader "Emeritus" Kenneth F. Higgins found that highways promote wetland drainage (Wetlands 9:27-39). Graduate student Ms. Sara Juni "asked the critters" how a mitigation wetland should be constructed and then provided data to the DOT in the form of a colorful brochure. She evaluated the biota in 17 created or restored wetlands by the DOT, City of Sioux Falls, City of Watertown, U.S. Fish and Wildlife Service, etc; the data indicate that created wetlands in South Dakota quickly attain biota similar to natural wetlands; however, our surveys were fairly superficial and short term.

Borrow pits and wildlife: Higgins surveyed the wildlife of 33 borrow pits that were older than 20 years (1989 SD Academy of Science 68:47-54); the borrow pit created on campus is a good place to find the endangered Topeka shiner.

February

Research Need: Information on South Dakota river fishes.

Research Finding: South Dakota's river fish assemblages changed in the 20th Century. We have moved fish around – 21 species were successfully introduced to the state and 22 East River species were successfully introduced to river drainages further west. The loss of natives has not been alarming, but the more restricted ranges of many may be an alarming trend. Only 9 natives were missing from recent collections and most of those were rare Missouri River fishes. However, 39 other species had declined in the number of drainages where they were formerly present. Most introduced species were in West River streams, but native species persisted best in West River streams despite the new species. Most native species declines were in East River streams where land use change and habitat modification may have been more of a factor than in West River streams. Fish faunas have not been *homogenized*. Homogenization is a buzz word in ecology these days meaning that communities become similar as the rare species that make communities unique disappear and introduced and common natives remain on the list. Soon the faunal lists from each drainage are similar because the faunas have been homogenized. These data were presented at the recent meeting of the Dakota Chapter of the American Fisheries Society by Unit Ph.D. student Chris Hoagstrom. Twelve other presentations were made by Unit staff and students. Hoagstrom's advisor is Unit Leader Dr. Charles R. Berry, Jr.

January

Research Need: High pH in South Dakota lakes?

Research Finding: The "research" cited here is "literature research" done by Assistant Unit Leader Dr. Steven R. Chipps in response to a question about South Dakota lakes. The pH measurement is a measure of hydrogen ion concentrations; pH above 7 is basic, pH below 7 is acidic. High pH levels (pH = 8-9) likely stem from plant production (specifically a reduction in CO_2 during algal blooms). One important aspect of pH with regard to lake production is its effect on sediment nutrient release. As pH increases, the capacity of iron (hydroxides) in sediments to bind P is reduced – so high pH can lead to increased nutrient loading. (This phenomenon was studied during the 10-year-long Poinsett-Oakwood Lakes study that the Coop Unit participated in a few years ago. The report stated that Oakwood was a sink for phosphorous runoff, but lake sediments contributed more phosphorous to the lake water than did tributaries.) In turn, this increased nutrient loading can enhance algal production, which may be a positive-feedback to maintaining elevated pH during summer. Most studies of effects of high lake pH are on plankton. Zooplankton (Daphnia) growth and survival can be negatively affected at pH>10 --- which is another positive feedback, since reduced grazing pressure by daphnia on algae can lead to increased algal densities. Chipps concluded, "All in all I think high pH values are worthy of attention because of the well-documented effects on nutrient release and subsequent potential for enhance eutrophication" (that causes our "green" lakes in summer).