Research to Enhance Oil and Gas Development and Environmental Protection on Federal Lands

DE-AI26-06NT15467/Task 6: Data Collection for the Assessment of Aquatic Communities in Northeastern Wyoming and Southeastern Montana

Goal

The goals of this monitoring plan are to 1) establish current conditions for aquatic biota and their habitat and 2) determine existing and potential effects of coalbed natural gas (CBNG) discharge waters on aquatic life. Although it is too late to establish a true baseline of conditions before CBNG development, the current condition of aquatic communities and habitat can be assessed.

Performers

Bureau of Land Management (BLM), Miles City, MT
US Geological Survey (USGS), Denver, CO

Results

Information about the project, including the data collected to date, is available at http://wy.water.usgs.gov/projects/atg/. Data currently available include chlorophyll-a and ash-free dry mass concentrations in algae samples and major-ion concentrations in water samples collected in conjunction with ecology samples. Water-quality samples were collected only at sites where water quality is not currently monitored as part of the Water Task Group's surface-water monitoring program. All water-quality data collected by the USGS, including major-ion data collected as part of the monitoring plan, are stored electronically in the USGS National Water Information System and are available at http://waterdata.usgs.gov/nwis.

Benefits

The results of this project will help support development of natural gas resources while protecting the cultural and natural resources of the Powder River Basin (PRB). The project will 1) provide for environmentally sound energy development; 2) develop coordinated and complementary best management practices, guidelines, and programs related to CBNG activities to conserve and protect resources; 3) monitor the impact of CBNG activities and assess the effectiveness of mitigating measures; 4) develop and integrate databases and scientific studies needed for effective resource management and planning; and 5) promote compatibility in the application of each agency's mission.

Background

This assessment was conducted in 2005 in cooperation with BLM, Montana Department of Environmental Quality (MDEQ), Montana Fish, Wildlife, and Parks (MFWP), U.S. Environmental Protection Agency (EPA), Wyoming Department of Environmental Quality (WDEQ), and Wyoming Game and Fish Department (WGFD). This summary also describes groups with interests or responsibilities in monitoring the effects of PRB CBNG development.

The PRB in northeastern Wyoming and southeastern Montana is an important source of energy resource for the United States. Resources produced from the basin include coal, oil, uranium, conventional natural gas, and, within the last decade, CBNG—often also referred to as coalbed methane. As of 2004, more than 10,000 CBNG wells had been drilled in northeastern Wyoming. An estimated 50,000-60,000 CBNG wells could be drilled and put into production in the PRB by 2012. Throughout the PRB large volumes of ground water are removed from coalbed aquifers and discharged on the surface in order to recover CBNG. This ground water, which can be slightly to moderately saline, is discharged to perennial, intermittent, and ephemeral streams and to surface impoundments. It is currently unknown what potential effects these discharges will have on aquatic communities (fish, macroinvertebrates, and algae) and their habitats.

Summary

Data collected for the assessment of aquatic communities included measurements for habitat, fish community, algae, and benthic macroinvertebrates. Sampling and measurement techniques were derived from EPA

Environmental Monitoring and Assessment Program (EMAP) protocols for habitat and fish community (with some modifications) and the USGS National Water-Quality Assessment (NAWQA) Program protocols for algae and benthic macroinvertebrates.

Habitat transects were established at all 47 sites sampled in Montana and Wyoming. Reach lengths in all streams except the main stem Powder River, were defined as 40 wetted channel widths, with a minimum reach length of 200 meters and a maximum reach length of 1,000 meters. Eleven transects, equally spaced along the reach, were established for measurement of variables such as wetted and bankfull width, bank and streambed substrate, embeddedness, bank angle, canopy cover, and fish cover. At Wyoming sites, a longitudinal profile of the streambed, water surface, bankfull stage, and low terraces, if any, were surveyed. Within each reach, two to four cross sections were monumented with rebar when possible for long-term reference. A 100-particle pebble count was completed in at least one riffle cross section and one pool cross section. At Montana sites, two to four cross sections were monumented and surveyed when possible; however, longitudinal profiles and pebble counts were not done.

Habitat data collection varied between the main stem Powder River and all other streams sampled. The Powder River was sampled differently from the other streams due to its continuously shifting sand habitats. The WGFD established 2-mile study reaches on the main stem Powder River in Wyoming during 2004. WGFD and USGS personnel coordinated field efforts and jointly sampled sites on the main stem Powder River in Wyoming in 2005. Fish community and mesohabitat mapping was conducted in the spring of the year (pre-runoff) and during low-flow conditions in July. WGFD personnel collected fish samples and made warm-water stream assessments during both sampling periods following WGFD protocols. USGS personnel provided high-resolution global-positioning system mapping of mesohabitat types (riffle, run, shoal, pool, and isolated backwater) for both periods. During low-flow sampling of Powder River sites in Wyoming, habitat sampling was performed by USGS personnel, who also collected samples for algae and benthic macroinvertebrates. Along the main stem Powder River in Montana, USGS personnel used WGFD protocols to determine sampling reaches and assess fish populations. Stream-habitat transects along the main stem Powder River were sampled in the same manner in both Wyoming and Montana. A transect was set across each habitat sampled for fish, and applicable features along each of these transects were recorded following the EMAP protocol.

Benthic macroinvertebrates were collected at each of the 47 sites following NAWQA protocols. At sites where riffles were available in the stream reach, riffles were sampled as the richest targeted habitat (RTH). Each RTH sample was a composite, semi-quantitative sample from five points, with a total sampled area of 1.25 square meters. About 75 percent of the project sites sampled in 2005 had riffles and RTH samples. A qualitative multi-habitat (QMH) sample of macroinvertebrates was collected at all sites and functioned as the primary sample at sites where riffles were absent. The QMH sample was a timed collection (1 hour) of macroinvertebrates from the various microhabitats in the reach, such as logs, macrophytes, and soft substrates. The macroinvertebrate samples were sent to Utah State University for taxonomic analysis.

Algae samples were collected at 24 sites in Wyoming and 2 sites in Montana near the State line. At each site where riffles were available, semi-quantitative samples of periphytic algae were scraped from 25 rocks and composited into a RTH sample following NAWQA protocols. At sites without riffles, periphyton samples were collected from depositional targeted habitat (DTH) in the euphotic zone of pools. A subsample of the RTH algae samples was frozen on dry ice and sent to the USGS National Water Quality Laboratory for analysis of chlorophyll-a and ash-free dry mass. The RTH and DTH algae samples were sent to a laboratory for taxonomic analysis following procedures described by Charles and others (2002).

Current Status (July 2007)
Project terminated due to budget shortfall.

Project Start: November 30, 2005
Project End: November 30, 2008

Anticipated DOE Contribution: $34,000
Performer Contribution: $129,000

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Publications
A final report with data from 2005 and 2006 will be completed in winter of 2008.