

FOR RELEASE: October 19, 1993

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### MMS STUDY HELPS TRACK OCEAN EFFECTS OF RECORD MISSISSIPPI FLOODING (#30049)

This summer's disastrous flooding on the Mississippi River loosed a huge plume of fresh, muddy water into the Gulf of Mexico and beyond. The unusual ocean currents unleashed by the flood are providing a wealth of rare natural experiments for oceanographers and could even result in good news for shrimp lovers, some scientists say.

This is the worst summertime Mississippi flooding since modern ocean observation techniques have been in use, so observers aren't sure of possible short-term or long-term environmental effects. But new monitoring systems are allowing accurate tracking of the plume for the first time. The high-tech current tracking techniques, sponsored by the U.S. Minerals Management Service (MMS) to provide data for its physical oceanography studies and those of other agencies, are detailing the Mississippi plume's effects through the Gulf, around the Florida Peninsula and as far north as the coast of North Carolina.

Normally, most of the river's flow of fresh water moves west along the Gulf Coast, according to Dr. Ken Turgeon, head of MMS's Environmental Studies Program. But 1993's flooding vastly expanded the plume and unusual wind patterns pushed much of the water toward the east. The influx of fresh water lowers the water's salt content, endangering some marine life. Salinity--normally around 3.6 percent--has recently been measured as low as 3.0 - 3.1 percent as far east as the Florida Keys and beyond. "In oceanographic terms, that's a significant difference," Turgeon said.

In addition to the water's reduced salinity, "the flooding may have introduced high levels of other chemicals, including nitrates and phosphates from agricultural runoff and industrial and urban pollutants," Turgeon said.

MMS, the Interior Department agency charged with administering the nation's natural gas and oil development programs on the Outer Continental Shelf (OCS), has studied the movement of the river's plume in the Gulf since April of 1992. The study is part of an attempt to help develop models which can forecast the movement of any future oil spills and differentiate between those spills and materials coming into the Gulf from the river.

This isn't the first time the Mississippi's waters have reached the east coast, according to Dr. Murray Brown of MMS's Louisiana-Texas Shelf Physical Oceanography Program (LATEX). Twenty years ago, Dr. Larry Atkinson--now of Old Dominion University--noticed lowered salinity in water samples he'd taken off the North Carolina coast. The Mississippi flooded that year, too, and the river was the only possible source of the volumes of fresh water required for such a change in water quality.

In 1993, scientists have more numerous and vastly improved observation equipment and techniques, said Brown. Drifting buoys follow the ocean current patterns, transmitting data continuously by satellite. An electronic bulletin board sponsored by MMS allows scientists from all federal agencies along with contractors, private scientists, and observers from State laboratories to share data from their observations, test their results, and distribute information. Extra manpower helps with the high-tech collecting techniques: "We have a special team of scientists at Louisiana State University to interpret satellite images, with a particular emphasis on the Mississippi River plume," said Brown.

The analysis of the Mississippi plume is one of a dozen studies of the Gulf's currents, chemistry and physics under the LATEX program. MMS scientists cooperate with scientists from the National Oceanographic and Atmospheric Administration (NOAA), who are also studying the river's plume. NOAA operates several automated oceanographic and weather stations, including some near the Florida Keys, known as C:MAN stations.

This complicated network of data-gathering instruments and scientists first noticed changes in the area of the Florida Keys several weeks ago, said Brown. At about that time, NOAA's C:MAN stations in the Florida Keys began recording significant drops in ocean salt content, far greater changes than could be accounted for by rainfall or any other usual occurrence. "This is the first time we've ever seen such a big drop in ocean salinity far from fresh water sources," Brown said.

About the same time, a group of four drifting buoys that normally would have been expected to travel west through the Gulf suddenly went east instead. "This behavior of so many drifters at the same time was unique in our experience," Brown said. "They went right past the mouth of the Mississippi and turned the corner at Florida." One got caught in an eddy near Key West, while two others were hung up west of Tampa. A fourth went around the tip of

Florida and up the East Coast.

And Dr. Atkinson, who had first observed the freshwater phenomenon twenty years ago, again took to the ocean to make some comparative observations. "While he was out there off the North Carolina coast," Brown said, "one drifting buoy we'd put out three months before off the Texas coast went right past him." The plume moved relatively fast as it traveled up the coast--about 4 to 5 knots, Brown said--and hung close to the landward edge of the Gulf Stream.

The rare incursion of Mississippi river water into the Atlantic is "...an interesting oceanographic curiosity," said Brown, but its environmental effects are not especially worrisome. Of somewhat greater concern is what's happening west of the river's mouth, where much of the plume's waters flow. There, the warm, fresh water forms a thin cap over the colder salt water below, locking oxygen out. The resulting hypoxia starves sea life at the bottom. "We haven't seen any fish kills in the open water yet," said Brown. "The things that are dying are those that can't get away.

"This is one of the most severe hypoxia episodes we've recorded down here," he added. But that might not be all bad...especially if you like seafood. The dying organisms on the ocean floor, he explained, all become food for organisms further up the food chain. One NOAA scientist has speculated that this huge addition to the food supply--the "carbon pool" as the scientists call it--could result in a bumper crop for shrimp fisherman.

Regardless of the phenomenon's effect on the seafood market, however, this year's record Mississippi floods--together with a wealth of new techniques for observing and measuring their effects--are providing MMS and other ocean scientists around the Gulf of Mexico with a rare chance to study a range of highly unusual events...and they're taking advantage of it.

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SUBJECT: PR-10/19/93 Ocean effects...MS Flood(#30049)