GULF HYPOXIA: CAN A LEGAL REMEDY BREATHE LIFE INTO THE OXYGEN DEPLETED WATERS?

Sarah White

I. INTRODUCTION

"Never before has the interconnectedness of life in distant rural communities been so apparent."[1] A Louisiana shrimp trawler and Iowa farmer may have never met, but the two have a common enemy: an oxygen-starved, nearly lifeless ocean off the Louisiana coast, the "dead zone."[2] The shrimper fears that the hypoxic zone will eventually suffocate his livelihood, while the farmer worries that regulators will force he and other farmers to take costly and unproven steps to shrink the dead zone.[3] Various attempts have been taken to alleviate both fears. This Note will focus on the success and shortcomings of the plans, and the feasibility of a national approach to solving the problems in the Gulf of Mexico.

II. THE GULF HYPOXIC ZONE

The dead zone is nearly the size of the state of New Jersey and covers the area from the Mississippi River delta to the Texas-Louisiana border.[4] "The

1. David Malakoff, *Death by Suffocation in the Gulf of Mexico*, 281 SCIENCE 190, 192 (1998).
2. *See id*. at 190.
3 *See id*.
4. *See* Bill Hanna, *Scientists, Fishing Industry Worry about Barren Area in the Gulf of Mexico*, FORT-WORTH STAR TELEGRAM, Sept. 5, 1999, at 1A.

Mississippi River Basin covers 41% of the contiguous United States, is home to 47% of the nation's rural population, generates 52% of U.S. farm receipts, comprises 52% of U.S. farms, and creates 33% of all farm-related jobs."[5] As a result, a substantial number of the nation's most valuable fisheries are located in this area, which comprises approximately 40% of the total U.S. fishery landings.[6] The dead zone causes "reduced species richness, severely reduced abundances" of marine life and "limited recovery" of oxygen levels even after oxygen has been mixed back into the water.[7]

Louisiana produces and lands more commercial and recreational marine life than any other state bordering the Gulf of Mexico.[8] Gulf fisheries provide seventy-two percent of the nation's shrimp, sixty-six percent of total oyster production, and fifteen percent of the domestic harvest of commercial fish.[9] Commercial catches of fish and shellfish from the Gulf have an annual value of $1.4 billion when processed; recreational and commercial fisheries together generate around $2.8 billion in revenue per year.[10] Hypoxia affects all forms of marine habitat in some way, as well as the entire resource production base in the Gulf.[11] In the early 1980s, shrimp catch efficiencies declined dramatically in areas where bottom waters were hypoxic.[12] Shrimp landings in Louisiana and Texas have decreased approximately twenty-five percent since their peak in the mid 1980s.[13] As of yet, there has not been an overall decrease in fishery declines, which is likely due to adaptability and opportunism in commercial fisheries.[14] Nonetheless, a decline is expected in the future.

A. *Causes of Gulf Hypoxia*

"The Gulf of Mexico hypoxic zone, a bottom area with dissolved oxygen levels too low to sustain human life, is the largest zone of [anthropogenic, or] human

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5. *Gulf of Mexico Hypoxia: Land and Sea Interactions: Interpretive Summary* (visited Sept. 26, 2000) <http://www.cast-science.org/hypo/hypo_is.htm> [hereinafter *Interpretive Summary*].

6. *See Hypoxia in the Gulf of Mexico* (visited Sept. 26, 2000) <http://www.epa.gov/msbasin/backgrda.html>.

7. Mike Dunne, *Researchers Sharing Data on Dead Zones in Gulf*, THE ADVOCATE (Baton Rouge, La), Mar. 12, 1998, at 15A (quoting lectures given by Nancy Rablais of Louisiana University's Marine Consortium).

8. *See Gulf of Mexico Hypoxia: Land and Sea Interactions: Social and Economic Dimensions of Marine Hypoxia*, (visited Sept. 26, 2000) <http://www.cast-science.org/hypo/hypo_03.htm> [hereinafter *Social and Economic Dimensions*].

9. *See* FISHERIES & ECONOMICS DIVISION OF THE NATIONAL MARINE FISHERIES SERVICE, U.S. DEP'T OF COMMERCE, FISHERIES OF THE UNITED STATES 1995, at 1 (1996).

10. *See Social and Economic Dimensions, supra* note 8.

11. *See id.*

12. *See* M.L. Renaud, *Hypoxia in Louisiana Coastal Waters During 1983: Implications for Fisheries*, 84 FISHERY BULLETIN 19, 19 (1986).

13. *See Social and Economic Dimensions, supra* note 8.

14. *See id.*

caused, coastal hypoxia in the Western Hemisphere."[15] Gulf hypoxia results from decomposition of organic matter growth stimulated by Mississippi River nutrients and stratification of marine waters due to the Mississippi and Atchafalaya Rivers inflow.[16] "Nitrogen export from the Mississippi River Basin has increased 2-to-7 fold over the last century."[17] Excess nutrients lead to increased alga production and increased availability of organic carbon within the ecosystem.[18] This process is known as eutrophication.[19] The "over production" of algal often sinks to the bottom and decays, consuming most if not all of the available oxygen in the bottom waters.[20] Anoxia occurs when all of the oxygen has been depleted; when most of the oxygen has been depleted, the condition is known as hypoxia.[21] The effects of the increased nutrient enrichment can cause reduced sunlight, loss of aquatic habitat, a decrease in dissolved oxygen, and impacts on living resources.[22]

Oxygen depletion begins in the spring, reaches its maximum during the summer, and generally disappears in the fall.[23] The two principal factors that lead to the development of hypoxia are the decomposition of organic matter, which is formed in response to nutrient changes and water column freshwater/saltwater stratification.[24] Freshwater inputs to the sea float over dense salt water, therefore water column stratification is stronger in the spring when runoff and river water is high.[25] This continues into the summer when the water is warm—in fact, hypoxia is highest at these times.[26]

B. *Current Trends and Problems*

Hypoxia on the northern continental shelf in the Gulf of Mexico was first discovered in the 1970s.[27] However, since the Mississippi River flood of 1993, the hypoxic zone in the Gulf has doubled to over eighteen thousand square kilometers

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15. *Interpretive Summary, supra* note 5.

16. *See Gulf of Mexico Hypoxia: Land and Sea Interactions: Dimensions and Characteristics of Gulf of Mexico Hypoxia* (visited Sept. 26, 2000) <http://www.cast-science.org/hypo/hypo_02.htm> [hereinafter *Dimensions and Characteristics*].

17. *Interpretive Summary, supra* note 5.

18. *See Gulf of Mexico Hypoxia Assessment Plan* (visited Oct. 26, 2000) <http://www.cop.noaa.gov/HypoxiaPlan.htm> [hereinafter *Gulf of Mexico Hypoxia Assessment Plan*].

19. *See id*.

20. *See id*.

21. *See id*.

22. *See id.*

23. *See Gulf of Mexico Hypoxia Assessment Plan*, *supra* note 18.

24. *See Dimensions and Characteristics*, *supra* note 16.

25. *See* N.N. Rablais et al., *A Brief Summary of Hypoxia on the Northern Gulf of Mexico Continental Shelf: 1985-1988*, 58 MODERN & ANCIENT CONTINENTAL SHELF HYPOXIA 35, 35-37 (1991).

26. *See id.*

27. *See Dimensions and Characteristics*, *supra* note 16.

and has remained that size every year since mid-summer 1997.[28] Nutrient concentrations in the Mississippi River have increased dramatically during this century, but have accelerated since the 1950s, coincident with the increase in fertilizer usage.[29] This is because "nitrogen moves from agricultural land to surface waters by air, surface runoff, sediment transport, and subsurface drainage."[30] Freshwater discharge and nutrient flux from the Mississippi and Atchafalaya Rivers also influence the distribution and intensity of hypoxia.[31] In the 1970s, a number of systems reported hypoxia-related problems for the first time.[32] By the end of the 1980s, serious hypoxia-related environmental problems were reported primarily from coastal lands.[33] The problems with hypoxia continued throughout the 1990s.[34]

"Human activities produce 60% of all the fixed nitrogen deposited on land each year . . . ."[35] Cornell University biogeochemist Robert Howarth also points out that, "in recent years, the worldwide rate of fertilizer applications has risen exponentially and, in the northeastern United States, the nitrates produced from fossil fuel emissions have increased about 20% in just the last decade."[36] This is far more nitrogen than is necessary for use in crops or other land plants.[37] In fact, of all the nitrogen that humans are currently putting into watersheds, approximately twenty percent is consistently ending up in our rivers.[38]

The main contributor to recent increases in hypoxia is the fact that human-related inputs to coastal areas are also increasing.[39] The hypoxia problem also stems from a variety of sources, some of which are related to agriculture and some which may still be unknown.[40] According to Nancy Rabalais, a scientist who studies the hypoxic region, fifty-six percent of the influx comes from commercial fertilizer,

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28. *See Gulf of Mexico Hypoxia Assessment Plan*, *supra* note 18.

29. *See Gulf of Mexico Hypoxia: Land and Sea Interactions: Marine Hypoxia Worldwide*, (visited Sept. 26, 2000) <http://www.cast-science.org/hypo/hypo_01.html>.

30. *Interpretive Summary*, *supra* note 5.

31. *See* Rablais, *supra* note 25, at 35-36.

32. *See Interpretive Summary*, *supra* note 5.

33. *See* Rablais, *supra* note 25, at 35-36.

34. *See id.*

35. Anne Simon Moffat, *Global Nitrogen Overload Problem Grows Critical*, 279 SCIENCE 988, 988 (1998).

36. *Id*.

37. *See id*.

38. *See id*.

39. *See* Robert J. Diaz & Rutger Rosenberg, *Marine Benthic Hypoxia: A Review of its Ecological Effects and Behavioral Responses of Benthic Macrofauna*, 33 OCEANOGRAPHY & MARINE BIOLOGY: AN ANNOTATED REV. 245, 291 (1995).

40. *See Water Pollution: Clean Water Act Should be Strengthened to Address Nutrient Reduction, Group Says*, Daily Environment Report, Mar. 30, 1999, *available in* Westlaw, BNA-DEN database, 60 DEN A-10, 1999.

twenty-five percent from animal manure, six percent from municipal waste, four percent from atmospheric decomposition, and a small percent is still unknown. [41]

C. *Other Causes*

Although most of the recent debate has focused on nitrogen as the major nutrient involved in hypoxia, other nutrients and their various sources from the Mississippi River Basin are also involved.[42] For example, tile drainage, changes to agricultural land in the Midwest, atmospheric deposition of nutrient from inside and outside the Mississippi watershed, nonpoint discharges from suburban and urban areas, and point discharges from within the watershed have all been found to be contributors to increases in nutrients.[43] Other contributors are population growth; concentrated animal feeding operations; increased fertilizer application on crops, parks and lawns; manufacturing, mining and construction; and the increased use of fossil fuel for energy.[44] Point sources send about seventeen percent of the nitrogen into the Gulf.[45] One study, however, has indicated that perhaps farmers are not primarily to blame for this problem.[46] The "variation in the river's flow may also be an important factor in the control of hypoxia."[47] The study found that "physical, chemical, biological, hydrological and meteorological forces all play a role in creating a dead zone."[48]

Nonetheless, agriculture has been implicated in sixty percent of the problems of river quality degradation in the United States.[49] This is based on the fact that "over fifty-two percent of American farms are found in the Mississippi River basin" and the basin generates over $98 billion agricultural dollars annually.[50] The nitrogen lost from the Mississippi River basin amounts to nearly two thousand kilograms per year.[51] If fifty percent (a conservative estimate) of this nitrogen comes from

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41. *See id.*

42. *See Dimensions and Characteristics, supra* note 16.

43. *See Interpretive Summary, supra* note 5.

44. *See* Mary L. Belefski & Larinda Tervelt Norton, *Hypoxia in the Gulf of Mexico: A Historical and Policy Perspective*, 12 TUL. ENVTL. L.J. 331, 337 (1999).

45. *See id.* at 348.

46. *See Study Indicates Fewer Fish in Gulf Waters Because of Hypoxia,* THE ADVOCATE (Baton Rouge, La), June 16, 1999, at 4B (reporting on a recent study by hydrologist Anne Carey of the Alabama College of Engineering that indicates from farms may not be the bulk of the blame for hypoxia in the Gulf).

47. *Id*.

48. *Id*.

49. *See* ENVL. PROTECTION AGENCY, NATIONAL WATER QUALITY INVENTORY: 1994 REPORT TO CONGRESS ES-15 (1995).

50. *Gulf of Mexico Hypoxia*: *Land and Sea Interactions: Probable Source of Mississippi River Nitrogen* (visited Sept. 26, 2000) <http://www.cast-science.org/hypo/hypo_04.htm> [hereinafter *Probable Source*].

51. *See id.*

agricultural sources, this increased loading would amount to a loss rate of one thousand kilograms of nitrogen for each of the 1,087,500 farms in the region.[52] However, this estimate increases when we add discharge from drainage tiles or artificial subsurface drainage and fertilizer and manure applications.[53]

III. Practical Solutions

In addition to surface runoff water, air, sediment, and subsurface drainage water also transport nutrients from land to surface and coastal waters.[54] The type of chemicals applied as crop nutrients, as well as the rate and method of application will affect concentrations in drainage water.[55] Cropping, tillage, and weather affects runoff water and sediment transport.[56] In addition, farming practices such as tilling crops will affect the concentrations of dissolved or absorbed nutrients.[57] Wetlands and buffer or filter strips can also intercept nutrients.[58]

The size and complexity of the hypoxic zone and the Mississippi River basin pose challenges to both scientists and policy makers.[59] The basin covers thirty-one states making cooperation at a statewide level difficult, if not impossible.[60] Many agricultural lands have been saturated for years, meaning that the nitrogen will take years to cycle out, even with immediate changes to the rate of nitrogen application on agricultural fields.[61] Therefore, years may pass before any progress or improvement in this regard are noticeable.[62] "If we start reducing nutrients at the same rate that they were introduced, we may have to wait twenty to thirty years to see the benefit."[63]

Inexpensive management options can, however, reduce some nitrogen losses from agricultural lands.[64] The Council of Agriculture, Science, and Technology has suggested several inexpensive methods to reduce nitrogen flow. These include alterations of fertilizer application methods to decrease runoff losses, alterations of tillage regimes to decrease sediment bound nutrient transport, fine tuning application

52. *See id.*
53. *See id.*
54. *See Gulf of Mexico Hypoxia: Land and Sea Interactions*: *Nitrogen Export from Agricultural Landscapes* (visited Sept. 26, 2000) <http://www.cast-science.org/hypo/hypo_05.htm> [hereinafter *Nitrogen Export*].
55. *See id.*
56. *See id*.
57. *See id.*
58. *See id.*
59. *See* Beleski & Norton, *supra* note 44, at 345.
60. *See id*.
61. *See id.* at 346.
62. *See id*.
63. Dunne, *supra* note 7, at 15A (quoting Dubravko Justic of LSU's Coastal Ecology Institute).
64. *See Interpretive Summary, supra* note 5.

rates to decrease losses through subsurface drainage, and best management practices to reduce nitrogen flux.[65] Another effective method is using buffer strips, which decrease the ability to transport sediment over the land.[66] Wetlands, whether natural or constructed, have the potential to reduce nitrogen in flow through water.[67]

Management practices for decreasing agricultural runoff, however, can be quite expensive for farmers and have had varying effects.[68] Some of the most cost-effective techniques are to alter "fertilizer application methods to decrease surface runoff," alter "tillage regimes to decrease sediment" transport, and fine tune "[nitrogen] application rates to decrease" subsurface drainage loss.[69] The costs associated with decreasing nutrient losses, including materials, equipment and management, are necessary to decrease nutrient levels and are expensive.[70] In addition, testing and monitoring soils, plants, and crop yields are essential to determine the effectiveness of decreasing nutrient losses.[71] Other potential costs include decreased crop yields and removal of land from production.[72] Finally, precision fertilizer application and irrigation management require additional time and added costs.[73]

IV. PROBLEMS

"The size of the river basin and the complexity of its problems challenge, the traditional approaches to addressing water pollution" control and the only way to solve these problems is through nationwide action.[74] One of the largest causes of the problems in the basin is the series of structures, including levees, designed by the Army Corp of Engineers to control the Mississippi.[75] By controlling the flooding of the Mississippi River, the Corp has drastically altered the normal flow of the river along with its natural habitats along the rivers and the banks.[76] In addition to habitat destruction, the control structures have caused a gradual loss in the basin's wetlands.[77] Wetlands are a natural filter for surface water and allow settlement to

65. *See id.*
66. *See Nitrogen Export, supra* note 54.
67. *See id.*
68. *See id.*
69. *Id.*
70. *See id.*
71. *See Gulf of Mexico: Land and Sea Interactions: Costs and Benefits of Decreasing Agricultural Nutrient Transport* (visited Sept. 26, 2000) <http://www.cast-science.org/hypo/hypo_06.htm>.
72. *See id.*
73. *See id.*
74. Scott Siff & David Mears, *The Mississippi River Basin: A National Treasure, A National Challenge*, 12 TUL. ENVTL. L.J. 293, 295 (1999).
75. *See id.* at 299.
76. *See id.*
77. *See id.*

stay on the land rather than running into the river.[78] Without such a filter or buffer, sediment washout and nonpoint source pollution have become one of the largest threats to the river.[79] Furthermore, since the river channel is near such fertile agricultural land, the loss of the wetlands has allowed the nutrient and pesticide runoff from the farms to enter into the river.[80]

V. Policy and Legal Solutions

The goal of the Clean Water Act ("CWA") is the "restoration and maintenance of chemical, physical and biological integrity of the Nation's waters."[81] However, the focus of the CWA is on point source pollution.[82] Therefore, despite the great strides we have made in curbing point source pollution, many of our nation's waters remain impaired due to non-point source pollution. In fact, a 1995 report indicated that nonpoint source pollution impaired seventy-two percent of the miles of affected rivers and streams, fifty-six percent of affected lake areas, and forty-three percent of the square miles of affected estuaries.[83] Despite the large economic expenditures by industry and municipal wastewater systems to reduce point source pollution, forty percent of the nation's waterways do not meet federal guidelines.[84] Nonpoint source pollution (polluted runoff) remains one of the leading causes of pollution in both agricultural and urban areas.[85]

The CWA makes nonpoint source pollution a secondary consideration even though nonpoint source pollution is becoming the primary pollution source in the nation's waters.[86] However, the CWA does contain a few sections that were intended to curb nonpoint source pollution.

A. *Clean Water Act Sections 208 and 319*

Congress first attempted to deal with nonpoint source pollution by enacting section 208. The section was the first to distinguish between point and nonpoint sources.[87] In 1987, Congress added section 319 to help strengthen section 208.[88]

78. *See id.*
79. *See id.*
80. *See id.* at 299-300.
81. Federal Water Pollution Control Act, 33 U.S.C. §1251 (1994).
82. *See id.*
83. *See* Gen. Accounting Office, GAO/RCED-95-200BR, Animal Agriculture: Information on Waste Management and Water Quality Issues 8 (1995).
84. *See Farm, Urban Runoff, Municipal Sources Top Pollution Causes, EPA Tells Congress*, [1993-1994] Env't. Rep. (BNA) No. 24, at 2228-2229 (Apr. 24, 1994).
85. *See id.* at 2228.
86. *See* Jerry L. Anderson, *The Environmental Revolution at Twenty-Five*, 26 Rutgers L.J. 395, 399 (1995).
87. *See* S. Rep. No. 95-370, at 8 (1977), *reprinted in* 1977 U.S.C.C.A.N 4326, 4334.
88. *See* Federal Water Pollution Control Act § 208, 33 U.S.C. § 1288 (1994).

Section 319 of the CWA established a national policy for controlling nonpoint source pollution through nonpoint source management programs.[89] Included in the section was a process to identify agriculturally and silviculturally related nonpoint sources of pollution.[90] The section also sets forth procedures and methods to control such sources to the extent feasible.[91]

Section 319 requires all states to implement an assessment report which "identifies those navigable waters within the state which, without additional action to control nonpoint sources of pollution, cannot reasonably be expected to attain or maintain applicable water quality standards or the goals and requirements of this chapter."[92] The assessment should identify best management practices and measures to control each type of nonpoint source.[93] The section requests that each state reduce nonpoint source pollution to the "maximum extent practicable" which is a higher standard than section 208.[94] However, section 319 is a voluntary program, which does not require states to penalize individual polluters who do not attempt to follow best management procedures.[95] Hence, the section is not always followed or enforced.

Enforcement and compliance with the CWA on the state level is also a problem. The CWA is ineffective because political and state boundaries do not coincide to water resources problemsheds.[96] Most water problems are multistate or even multinational in nature. Generally there is not a competent government authority with legal jurisdiction over a regional watershed.[97] Hence, often one jurisdiction will solve its watershed problems without regard to the effects on neighboring jurisdictions. As a consequence, those jurisdictions located downstream frequently suffer the most.[98] This cost externalization has resulted in part to the tragedy of the commons currently being suffered in the Gulf of Mexico.

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89. *See id*. § 1329.
90. *See id*.
91. *See id.*
92. *Id*. § 1329(a)(1)(A).
93. *See id*. at § 1329(a)(1)(C).
94. *Id.*
95. *See* Natural Resources Defense Council v. EPA, 915 F.2d 1314, 1318 (9th Cir. 1990).
96. *See* William Goldfarb, *Watershed Management: Slogan or Solution?,* 21 B.C. ENVTL. AFF. L. REV. 483, 484-86 (1994) (discussing William B. Lord, *Unified River Basin Management in Retrospect and Prospect,* in UNIFIED RIVER BASIN MANAGEMENT—STAGE II 58-67 (David J. Allee et al. eds., 1981)).
97. *See id.* at 484 (discussing Helen M. Ingram, *The Political Economy of Regional Water Institutions*, 55 AMER. J. AGRI. ECON. 10 (1973)).
98. *See id.*

B. *Watersheds*

Nevertheless, the answer to nonpoint source pollution may not be further governmental regulation.[99] Watershed management projects represent one effort to reduce agricultural nonpoint source pollution. Because of the limitations of the CWA, watershed management should be considered a viable solution to address nonpoint pollution.[100]

A watershed is defined as "a geographic area in which water, sediments, and dissolved materials drain to a common outlet—a point on a larger stream, a lake, an underlying aquifer, and estuary, or an ocean."[101] On the federal level, however, watershed management has no "consistently accepted descriptive meaning, either conceptual or operational."[102] As such, federal watershed programs are varied and rather unsuccessful. In addition, interstate watershed-wide compacts are variable with regard to resources managed, purposes and organizational structure.[103] Furthermore, interstate compact commissions have only been established for a few watersheds and aquifers.[104]

Watershed management is a useful tool for measuring and controlling nonpoint source pollution as well.

> It is sensible and effective to view nonpoint source pollution from a watershed perspective because 1) nonpoint source pollution is caused by the effects of intermittent storm events on diffuse land use and management activities, 2) the water quality impacts of individual nonpoint sources are difficult, if not impossible to measure, and 3) a nonpoint source's location within a watershed is critical with regard to its contribution to nonpoint source waterbody pollutant loadings.[105]

The EPA has a program to deal with watersheds. This program consists of three elements "1) risk-based targeting of focus watersheds; 2) participation by all affected and interested stakeholders; and 3) integrated solutions established by stakeholder consensus."[106] However, the program is based on voluntary negotiation

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99. *See* Kristi Johnson, Note, *The Mythical Giant: Clean Water Act Section 401 and Nonpoint Source Pollution*, 29 ENVTL. L. 417, 459 (1999).

100. *See* Goldfarb, *supra* note 96, at 494.

101. *Id.* at 484 (citing U.S. ENVTL. PROTECTION AGENCY, THE WATERSHED PROTECTION APPROACH: AN OVERVIEW (1991)).

102. *Id*. at 488.

103. *See id.* at 493.

104. *See id.* at 494.

105. *Id.* at 494-495.

106. *Id.* at 501; U.S. Envtl. Protection Agency, *The Watershed Approach* (last modified June 22, 2000) <http://www.epagov/OWOW/watershed/wa1.html>.

and consensus; hence, watershed protection based on the EPA model will continue to be sporadic and ineffective.[107]

Congress has developed a different proposal for watershed management in the Senate Clean Water Act reauthorization bill.[108] The bill is an attempt to revive section 208 of the CWA by enabling a state's governor to designate areas within the state as watershed management units.[109] Unlike section 208, section 302 focuses on watersheds only, sets up a period for compliance, and covers interstate watersheds.[110]

Although realistically this program seems as destined for failure as the current CWA, state watershed initiatives may give hope. The best example is the Chesapeake Bay Program. The Chesapeake Bay agreements, in conjunction with section 117 of the CWA, created an interstate covenant outlining a series of goals to reduce nutrient inflows into the Chesapeake Bay by forty percent in the year 2000.[111] A multidisciplinary panel was organized to set forth management and sustainable development of the bay.[112] Nonetheless, the goals of this program have yet to be met because section 302, like 208 and the Chesapeake Bay program, has been unsuccessful in solving watershed pollution. This is due to the fact that section 302 is voluntary, relies on substate management and planning agencies, lacks enforcement and lacks sufficient funding.[113]

C. *Environmental Quality Initiatives Program*

Congress has also attempted to regulate nonpoint source pollution by other means than the typical environmental laws. One such approach to the agricultural nonpoint source pollution dilemma is the Environmental Quality Initiatives Program ("EQIP"), which was included in the 1996 Farm Bill.[114] The voluntary program is intended to provide technical and financial support to farmers and ranchers to assist them in reducing nonpoint source pollution.[115] The program calls for identifying priority areas for protecting aquatic resources and reducing water pollution from agriculture.[116] The over $2 billion annually available for this program can also be used to implement total maximum daily loads ("TMDLs").[117]

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107. *See* Goldfarb, *supra* note 96, at 502.

108. *See* Water Quality Act of 1987, 33 U.S.C. § 1251 (1994).

109. *See id.* § 1251(g).

110. *See* Goldfarb, *supra* note 96, at 503.

111. *See* Robert W. Adler, *Addressing the Barriers to Watershed Protection*, 25 ENVTL. L. 973, 1071 (1995).

112. *See id.*

113. *See* Goldfarb, *supra* note 96, at 504.

114. *See* 16 U.S.C. § 3839aa (Supp. IV 1998).

115. *See id*. § 3939aa.

116. *See Draft EPA Implementation Strategy on Total Maximum Daily Loads Program,* Daily Environment Report, *Nov. 18, 1996, available in* Westlaw, BNA-DEN database, 224 DEN E-1, 1996 [hereinafter *Draft EPA Implementation Strategy*].

117. *See id.*

D. *Total Maximum Daily Loads*

The CWA establishes a goal of fishable and swimmable waters.[118] Nonetheless, many waters have yet to meet that goal, and the Gulf of Mexico is perhaps one of the most extreme cases. Under CWA section 303, states are required to identify impaired waters and develop TMDLs for the waters, with oversight from the Environmental Protection Agency ("EPA").[119] A TMDL allocates pollution control responsibility among various pollution sources in a watershed and provides the basis for a program to eliminate excess pollution in the watershed.[120] The EPA's original emphasis was on point source pollution, and despite the fact that states had the authority to do more with nonpoint source pollution, it did nothing.[121] Through citizen suits in the mid-1990s, the EPA was forced to use its duty to act under section 303.[122] Since these suits, the EPA and the states have produced new guidance, new state lists of impaired waters, and a few TMDLs.[123]

Nonetheless, as of October 7, 1999, sixteen states had not completed a draft of their nonpoint source management programs.[124] Furthermore, the EPA has approved none of the states' upgraded programs.[125] Consequently, nonpoint source pollution remains a major cause of the hypoxia problem in the Gulf of Mexico.

In addition, TMDLs themselves are currently in controversy. The first issue is whether section 303 covers nonpoint pollution at all, as has been questioned by several suits filed by agribusinesses.[126] In their reading of the act, TMDLs are to be set only after emission limitations have been exhausted.[127] Emission limitations only apply to point sources.[128] The groups argue that because emissions limitations only apply to point source pollution, TMDLs are limited to point sources as well.[129] However, looking at both the legislative history of the CWA and its present state, this makes "no pollution control sense at all."[130]

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118. *See* Federal Water Pollution Control Act, 33 U.S.C. § 1251(a)(2) (1994).

119. *See id.* at § 1313(d)(1)(C).

120. *See id*. at § 1313(d).

121. *See* Oliver A. Houck, *TMDLs IV: The Final Frontier*, XXIX ENVTL. L. REP. 10,469, 10,473 (1999) [hereinafter *TMDLs IV*].

122. *See id.* at 10,474.

123. *See id*. at 10,476, 10,480-81.

124. *See State Territory Progress in Upgrading Their Nonpoint Source Management Plans*, (visited Sept. 26, 2000) <http://www.epa.gov/OWOW/NPS/npsus.html>. Included in these states are several important farming states whose agricultural runoff has been directly correlated to the Gulf of Mexico, including Arkansas, Illinois, Iowa, Kentucky, and Tennessee. *See id*.

125. *See id*.

126. *See TMDLs IV*, *supra* note 121, at 10,474.

127. *See* Oliver A. Houck, *TMDL, Are We There Yet?: The Long Road Toward Water Quality-Based Regulation Under the Clean Water Act*, XXVII ENVTL. L. REP. 10,391, 10,399 (1997).

128. *See id.*

129. *See id.*

130. *Id.* at 10,400.

The second question is whether TMDLs are simply a calculation, or whether the calculation of the TMDLs develops itself into a plan that the states must follow.[131] It is likely that the courts will follow the EPA's lead and includes nonpoint source pollution in section 303, and will require TMDLs to include a plan.[132]

Even if TMDLs pass these legal hurdles, they still may not be effective. One of the questions surrounding TMDLs is whether they are scientifically accurate.[133] The information used to create state assessments and impaired waters lists are often out of date and speculative because states do not have the resources to monitor all water bodies.[134] In 1998, only nineteen percent of the nation's waters were monitored for pollution.[135] Furthermore, the states are in need of assistance to monitor, assess, and enforce in order to meet the provisions of section 303.[136] In addition, the states and nonpoint source businesses have not been willing to cooperate.[137]

In order for the TMDL program to have a chance at success, the EPA needs the states to cooperate. This has proven to be almost impossible in states that have a large reliance on agribusiness and other nonpoint source business.[138] Unfortunately, some of these states are the largest contributors of the runoff that directly affects the hypoxia problem in the Gulf.[139] In order to deal with this problem, the EPA is considering an interstate TMDL for the Mississippi River watershed.[140]

Without changing the CWA the EPA's hands are virtually tied when trying to address nonpoint source pollution.[141] The "EPA can only go so far before the law ends."[142] The questions that remain are whether TMDLs will work and whether they are worth the time and expense. Unfortunately, the answer to that is unclear. On the one hand, ambient-based controls generally have not been successful in environmental law.[143] "TMDLs also contain the threat of eroding the significant

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131. *See TMDLs IV*, *supra* note 121, at 10,474.

132. *See id.*

133. *See id*. at 10,475.

134. *See id.* at 10,475-76.

135. *See id.* at 10,469-70.

136. *See id*. at 10,472-74.

137. *See generally id.* (discussing various state plans, or lack thereof, and the EPA's inability to enforce and require stricter and more accurate data).

138. *See, e.g*., *id.* at 10,480-81 (discussing state inaction in regard to implementing TMDLs). For example, Iowa is currently in stage two but contends that agriculture should not be blamed for nonpoint source pollution; West Virgina has defaulted and allocated no money to the TMDL process; Nebraska will complete no more than one TMDL per year due to finances; Kansas has backed off certain types of monitoring; North Carolina's TMDLs have yet to be approved on the state level; Wyoming has TMDL–limiting legislation pending. *See id*.

139. *See id*.

140. *See Draft EPA Implementation Strategy, supra* note 116.

141. *See id*.

142. *TMDLs IV*, *supra* note 121, at 10,482.

143. *See id*. at 10,482-83.

gains made in CWA point source controls by trading the certainty of point source permit emission limits for the amorphous and unenforceable content of state water quality and nonpoint source plans."[144] On the other hand, TMDLs provide a bottom line for environmental assessments and a reason to get there.[145]

E. *The Clean Water Action Plan*

The Clean Water Action Plan is an attempt to strengthen, enhance, and improve the CWA.[146] Issued in February 1998, it attempts to develop a new means for the federal government, in coordination with state and local areas, to address the problems associated with non-point source pollution.[147] The action plan has four main categories to address the problems in watersheds and in particular, the Mississippi River basin.[148] The first essential provisions of the plan change the way that water quality problems are addressed.[149] The plan focuses on watersheds and an overall water quality approach, rather than the technology-based standards used for point source pollution.[150] The plan calls for a unified approach that requires states, localities, and tribes to identify watersheds that need immediate assistance, pristine watersheds, and threatened watersheds.[151]

The plan also calls for enhanced standards on both the state and federal level.[152] These programs will address storm water runoff and concentrated animal feeding operations and the harm they continue to cause to the nation's waterways.[153] By providing a number of incentives for farmers and ranchers, the plan encourages good stewardship practices on farm and ranch lands.[154] Also, by 2002, the Department of Agriculture will establish two million miles of conservation buffers along the nation's waterways.[155]

Another theme of the plan is to provide more useful information.[156] By the year 2000, agencies were required to find sources of nonpoint source pollution and track their improvements through information available on the Internet.[157] The EPA has also established programs to improve Internet access to water quality

144. *Id*. at 10,485.
145. *See id*.
146. *See* U.S. ENVTL. PROTECTION AGENCY., CLEAN WATER ACTION PLAN: RESTORING AND PROTECTING AMERICA'S WATERS i-ii (1998).
147. *See id*. at 53. *See also* Siff & Mears, *supra* note 74, at 311-12.
148. *See id.* at ii-iii. *See also* Siff & Mears, *supra* note 74, at 312.
149. *See id.* at 10. *See also* Siff & Mears, *supra* note 74, at 312.
150. *See id.* at ii-iv. *See also* Siff & Mears, *supra* note 74, at 312.
151. *See id*. at 75-77.
152. *See id.* at v. *See also* Siff & Mears, *supra* note 74, at 313.
153. *See id.* at v-vi. *See also* Siff & Mears, *supra* note 74, at 313.
154. *See id.* at vi-vii. *See also* Siff & Mears, *supra* note 74, at 313-14.
155. *See id.* at vii. *See also* Siff & Mears, *supra* note 74, at 314.
156. *See id*. *See also* Siff & Mears, *supra* note 74, at 314.
157. *See id.* at 55, 70. *See also* Siff & Mears, *supra* note 74, at 314.

information.[158] These include Surf Your Watershed, Index of Watershed Indicators, and the Nonpoint Source Homepage.[159]

In particular, the plan directs the EPA to develop nutrient criteria by the end of the year 2000.[160] Farm groups argue that the best way to do this is through voluntary incentive-based approaches while environmental groups fear this may cause too much leniency.[161] Farm groups are also encouraging the use of local site-specific criteria for nutrient criteria and state autonomy and flexibility.[162] This, however, is likely to lead to the same state implementation problems that are faced in regard to TMDLs. Another problem with the nutrient levels is the fact that airborne nutrients may be a contributing factor to the hypoxia problem.[163] Furthermore, the effects of nutrient levels differ with varying temperature and weather conditions.[164] Accordingly, many are unsure of the practicality of nutrient criteria limitations.

With regard to hypoxia in the Gulf, the EPA has promulgated reports to address nutrient management and hypoxia in the Mississippi River basin and the Gulf of Mexico watersheds.[165] These reports address the causes and effects of hypoxia and will be used in developing an action plan.[166] The plan's comment stage ended in August of 1999.[167] In October of 1999, the EPA promulgated an integrated assessment of the reports.[168] The comment stage for these reports was extended to January 20, 2000, and a final draft is expected to be forthcoming at the time of publication.[169]

Here again, a controversy has developed between agribusiness and environmentalists. "The agricultural community is concerned about nonpoint source

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158. *See Draft EPA Implementation Strategy, supra* note 116.

159. *See Surf Your Watershed* (visited Dec. 9, 2000) <http://www.epa.gov/surfnewi/text.html>; *Index of Watershed Indicators* (visited Dec. 9, 2000) <http://www.epa.gov/iwi/index.html>; *Nonpoint Source Homepage* (visited Dec. 9, 2000) <http://www.epa.gov/OWOW/NPS/NPSUS.html>. The web pages are frequently updated and contain accurate information.

160. *See* Susan Bruninga, *Water Pollution: Regulating Nutrients, Implementing Controls Focus of EPA Meeting on Drafting Criteria*, Daily Environment Report, *available in* Westlaw, BNA-DEN database, 112 DEN A-9, 1999.

161. *See id*.

162. *See id*.

163. *See id*. Agricultural and environmental groups continue to argue over the effect of airborne nutrients. *See id*. Air decomposition contribution estimates range from negligible to 25%. *See id.* Agricultural groups would like to delay implementation of nutrient criteria until the effect of air pollution can is more adequately determined. *See id*.

164. *See id*.

165. *See* Notice of Availability of Topical Scientific Reports for an Integrated Assessment of the Causes and Consequences of Hypoxia in the Gulf of Mexico, 64 Fed. Reg. 23,834, 23,834 (1999).

166. *See id.*

167. *See id.*

168. *See* Notice of Availability of an Integrated Assessment of the Causes and Consequences of Hypoxia in the Gulf of Mexico, 64 Fed. Reg. 56,788, 56,788 (1999).

169. *See id*.

pollution" and would like to find ways to regulate the pollution.[170] The proposals by the Gulf group may not be the solution, however, environmentalists appear generally satisfied with the majority of the study and the work of the Gulf of Mexico Hypoxia Group.[171] Farm groups, on the other hand, are upset with the increased blame placed on farm practices for the hypoxic problem.[172] One group points out other causes such as the forced change in the flow of the river and asks that the Hypoxia Group consider these causes.[173] The group concludes that there is a limited knowledge base to the cause of the hypoxia, and asks that all potentially involved groups work together for a solution to the problem.[174]

In July of 2000, the final rule was promulgated.[175] The rule provides several key changes from the previous regulations. First, the rule provides that states should meet water quality standards within ten years from July or within ten years of the listing date, if the listing date is later.[176] This can be extended for five years if the state can show that earlier implementation is not practical.[177] States should meet these goals through recorded implementation plans.[178] The plans should include a list of necessary actions and a timeline for implementation; reasonable assurances that implementation will occur; a monitoring plan; a plan for revision of the TMDL if progress is not achieved; and the date to meet water quality standards.[179] The plans differ in some respects based on whether the water is impaired because of NPDES permits (point sources) or whether nonpoint sources alone are the contributing factors.[180] Most notably, runoff controls should be put in place within five years of the plan if practical.[181] This means that the effects of this regulation may hit the farming community sooner than some other areas.

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170. Johnson, *supra* note 99, at 459.

171. *See* Letter from Mona Shoup, et al, Galveston Bay Conservation and Preservation Association, to Gulf of Mexico Hypoxia Working Group, National Oceanic and Atmospheric Administration 1 (December 20, 1999) (on file with author) (letter from 34 environmental groups expressing general approval of the assessment and the suggestions for controlling nutrient loading, namely from agricultural sources).

172. *See* Letter from Richard W. Newpher, Executive Director, American Farm Bureau Federation to Gulf of Mexico Hypoxia Working Group 1 (December 17, 1999) (on file with author) (indicating that nitrogen fertilizer has become the focus of the evaluation).

173. *See id.* at 2.

174. *See id.*

175. *See* Revisions to the Water Quality Planning and Management Regulation and Revisions to the National Pollutant Discharge Elimination System Program in Support of Revisions to the Water Quality Planning and Management Regulation, 65 Fed. Reg. 43,586, 43,586 (2000) [hereinafter Revisions].

176. *See id.* at 43,613.

177. *See id.*

178. *See id.* at 43,625.

179. *See id.*

180. *See id.* at 43,625-26.

181. *See id.* at 43,626.

Further, the state should prioritize the TMDLs based in part on whether the polluted area affects drinking water supplies or an endangered species habitat.[182] Each state's list of impaired waters are now required to be submitted on a four-year, rather than a two-year cycle.[183] Although in theory this will give states more time to adequately review and revise the list, areas may be impaired without a state's knowledge.

Another noteworthy change in the TMDL program is the ability of the public to participate in the TMDL process. The state must provide a minimum of thirty days to allow the public to respond to the state list, and the state is required to comment on all "significant comments."[184] Further, the final rule does not contain the petition process allowing the public to request that the EPA perform the duties of the state when the state fails to do so.[185] The public's only recourse is through the judicial process.[186]

Although the new regulation does clarify the duties of the states in regard to developing and implementing TMDLs, the regulation is not nearly as effective as it could be. The final regulation attempts to appease many of the interested parties in the debate. For example, states are required to take into account weather conditions and seasonal variations when preparing the lists, which was a concern of some agricultural groups.[187] States are only required to provide lists every four years thereby saving time and money, but may allow impaired waters to go undetected.[188] Environmentalists are pleased that the new regulations require implementation plans, which were not necessary under previous regulations.[189] Nonetheless, the final rule is a starting point and a necessary attempt to implement the TMDL provisions of the CWA.

The Clean Water Action Plan and its programs can be particularly useful in the Mississippi River basin, because the river touches so many states and therefore needs to be monitored on a federal level.[190] The plan will make it easier to know whether the watersheds are securing clean water through its monitoring and tracking program.[191] In addition, the plan will enable citizens and the government to gauge the sources of pollution and levy appropriate remedies through legal and political resources.[192]

182. *See id.* at 43,614.
183. *See id.* at 43,617.
184. *See id.* at 43,634-35.
185. *See id.* at 43,637.
186. *See id.*
187. *See id.* at 43,668. *See also* Bruninga, *supra* note 160.
188. *See* Revisions, *supra* note 175, at 43,667.
189. *See id.* at 43,668.
190. *See* Siff & Mears, *supra* note 74, at 314.
191. *See id.* at 315.
192. *See id.*

VI. CONCLUSION

The looming question that remains is what can be done to solve the hypoxic condition in the Gulf of Mexico. Any solution is fraught with economic, social and policy implications. If the decision is left to the states the problem may never be solved. After all, how likely is it that the Iowa farmer will implement costly programs to help the Louisiana shrimp trawler?

Furthermore, states are unwilling to compromise their autonomy in this environmental field. States are not willing to forgo their political power to hand over control of nonpoint source pollution to the federal government. A local solution would be easier to reach, but the states tend to forget that in the Mississippi basin, all local decisions have regional and national effects.

The potential costs of solving the hypoxia problem are astronomical. A failure to take action may result in disastrous effects to the fishing industry, while forcing compliance with nonpoint source controls may have equally disastrous effects to the Midwestern farmer. In addition, the science and technology involved in the problem is not precise. Many states do not have the money or technology to conduct accurate TMDLs. Furthermore, the government has no proof that TMDLs actually work.

The solution to hypoxia in the Gulf has yet to fully develop. Nevertheless, states and the federal government must continue to forge alliances, increase technology and conduct scientific study. Furthermore, the states and federal government must continue to subsidize and educate all that are adversely affected. Only through education and cooperation can the problem truly be solved.