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Administering the Clean Water Act: Do Regulators Have “Bigger Fish To Fry” When It Comes To Addressing the Practice of Chumming on the Chesapeake Bay?

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The Chesapeake Bay is one of the country’s most productive estuaries. However, for decades the health of the Bay has been declining due in large part to nutrification. Excessive nutrients encourage algal blooms, which lower dissolved oxygen and increase turbidity in the Bay’s waters. More than 40% of the Bay’s main stem is now dead largely as a result of this problem. The practice of chumming, the discarding of baitfish, usually menhaden, over the sides of fishing boats to attract game fish like striped bass, is contributing to the Bay’s nutrification problem because the decomposing chum raises the water’s biological oxygen demand, which lowers dissolved oxygen and increases water turbidity causing bay grasses to die and setting in motion destructive positive feedback loops. Chum may also be a source of disease in game fish, and the demand for chum is contributing to the decline of menhaden, an important food and filter fish, on the Atlantic Coast. Despite these problems, the practice of chumming is not regulated by either the federal government or the state of Maryland. This Article explores whether citizens can compel regulation by either jurisdiction and concludes that such initiatives would likely fail because of the absence of a duty to regulate. The Article examines why regulators decline to regulate and finds that the most likely reasons are an overdependence on economic approaches to environmental regulation, which drives regulators to choose the largest targets of opportunity, and a failure to understand how small disturbances in complex systems like estuaries can set off a cascade of potentially catastrophic and

* © 2007 Hope M. Babcock. Professor of Law, Georgetown University Law Center. The contents of this Article partially rely on a rulemaking petition students at the Institute of Public Representation, a public interest law clinic at Georgetown, submitted on behalf of Captain Norman W. Bartlett to the Maryland Department of the Environment in January 2007. Therefore, the author is especially indebted to IPR clinic students Bradford McLane and Jeremy Osborn, and IPR graduate teaching fellow and staff attorney Erik Bluemel, who contributed to the writing of that petition. An earlier, much-abbreviated version of the Article, entitled *Chumming on the Chesapeake Bay and Complexity Theory: Why the Precautionary Principle, Not Cost-Benefit Analysis, Makes More Sense as a Regulatory Approach*, appeared in a Symposium edition of the *Washington Law Review* and can be found at 82 WASH. L. REV. 505 (2007). I delivered a very preliminary think piece on the topic at the Symposium, which was held in honor of Professor William H. Rodgers at the law school on April 20-21, 2007.

irreversible consequences—here, the loss of the Bay’s biodiversity. The Article concludes by suggesting that the Precautionary Principle offers a much better approach to identifying regulatory targets in estuarine systems where much is scientifically uncertain; and exhorts citizens to spend time educating regulators of these facts rather than in fruitless and time-consuming litigation.

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I. INTRODUCTION

The Chesapeake Bay (Bay) is North America’s largest estuary and home to more than 3700 species of plants and animals, including 295 species of fish.¹ The Bay offers unique commercial and recreational opportunities; prime among these is fishing.² However, despite the investment of millions of dollars to improve the Bay’s water quality,³ the Bay suffers from severe environmental degradation that is impairing those uses.⁴ Since the release of the first congressionally funded comprehensive study of the Bay in the 1970s, scientists have known that among the most serious of the ills afflicting Bay water quality is eutrophication.⁵

This Article brings to the fore a largely overlooked source of the Bay’s eutrophication problem, the practice of chumming. Chumming involves dumping a slurry of decomposed or decomposing baitfish, usually menhaden, over the side of a boat to attract game species like striped bass. Striped bass are highly prized by both recreational fishers and consumers of fish. The practice is widely used by Maryland’s recreational fishing industry, which is an important contributor to the state’s economy.⁶ Chum contributes to the Bay’s nutrient enrichment,

1. Chesapeake Bay Program, Chesapeake Bay 2005 Health and Restoration Assessment, Part One: Ecosystem Health 2 (Mar. 2006), http://www.chesapeakebay.net/pubs/2007reports/EPA06_BagHealthReport.pdf [hereinafter Ecosystem Health].

2. MDE, Chesapeake Bay Restoration, <http://www.mde.state.md.us/water/bayrestoration.asp> (last visited Oct. 31, 2006); MD. CODE REGS. § 26.08.02.02(B)(1)(a)-(c) (2007) (describing designated uses).

3. In fact, federal and state officials estimate that the work that remains to restore the health of the Bay will cost approximately \$28 billion—the equivalent of purchasing six aircraft carriers. David A. Fehrenthold, *What Would It Take To Clean Up the Bay by 2010?*, WASH. POST, Jan. 29, 2007, at A01.

4. Ecosystem Health, *supra* note 1, at 3.

5. *Id.* at 2.

6. SUSAN MARIE STEDMAN & JEANNE HANSON, HABITAT CONNECTIONS, WETLANDS, FISHERIES AND ECONOMICS 4, available at <http://www.nmfsnoaa.gov/habitat/habitatconservation/publications/habitatconnections/num5.htm> (last visited Mar. 11, 2007).

which lowers dissolved oxygen levels in the water and increases water turbidity.⁷ Chum may also be a source of bacterial disease in game fish like striped bass,⁸ and the use of menhaden as baitfish is contributing to the decline in populations of that critically important fish.⁹ These adverse impacts threaten the Bay's biodiversity.¹⁰ Yet, chumming is not regulated by either the federal government or Maryland.¹¹ The problems created by this regulatory inertia and the reasons for it are the focus of this Article and what makes the chumming story relevant outside the Bay's watershed.

The reason that regulators have paid no attention to chumming in the Bay, even though it is of environmental concern, is the superficially rational decision to attend to larger targets of opportunity that are causing the Bay's enrichment problems, such as nutrient discharges from sewage treatment plants¹² and farm fields.¹³ Yet, the huge economic cost and political flashpoints of addressing those large sources have largely paralyzed legislators and regulators for nearly two decades.¹⁴ The result is that the Bay's nutrification problem is getting worse, and the bill for addressing the problem is getting bigger.¹⁵

Although the importance of the recreational fishing industry to the state may explain, in part, Maryland's reluctance to regulate chumming, this Article proposes that this failure is a surrogate for a more universal problem—the reluctance of regulators to address small sources of environmental problems or even small environmental problems

7. Sheila Murphy, General Information on Dissolved Oxygen, <http://bcn.boulder.co.us/basin/data/BACT/info/DO.html> (last visited Sept. 7, 2007).

8. Karl Blankenship, *Scientists Working To Unravel Mysteries of Rockfish Mycobacteriosis*, BAY J., June 2005, available at <http://www.bayjournal.com/article.cfm?article=2551>.

9. See Chesapeake Bay Ecological Found., Inc., Atlantic Menhaden, <http://www.chesbay.org/forageFish/menhaden.asp> (last visited Sept. 7, 2007).

10. Chesapeake Bay Ecological Found., Inc., Striped Bass Cooperative Study To Determine the Cause of Ulcerative Permatitis Syndrome (Dec. 10, 1997), http://www.chesbay.org/currentInvestigation/cr_12101997.asp.

11. 33 U.S.C. § 1311-1370 (2000); MD. CODE REGS. § 26 (2007).

12. ANN DORBIN ET AL., SAVING THE BAY: PEOPLE WORKING FOR THE FUTURE OF THE CHESAPEAKE 100 (1960).

13. *Id.* at 211.

14. Rodgers asks whether an agency's failure to achieve a primary objective with respect to solving "tough[er] resource commons disputes," here the Bay's overnutrification problems, can affect its resource allocation practices, and whether agencies are "inclined to preside over the extirpation of a resource caught up in the decline of the commons or do considerations of institutional self-interest dictate a fall-back strategy that at least slows down the decline?" William H. Rodgers, *Building Theories of Judicial Review in Natural Resource Law*, 53 U. COLO. L. REV. 213, 220 (1981-1982).

15. AMY GIMON ET AL., UNIVERSITY OF MIAMI, THE ROLE OF POLLUTION PREVENTION ON REDUCING NUTRIENT ENRICHMENT OF CHESAPEAKE BAY 7(1998).

themselves. The Article posits that the preoccupation of regulators with large sources of environmental problems reflects a misapprehension about how complex natural systems, like estuaries, behave, and how small harms to these systems can set off a cascade of problems, in some cases leading to systemic failure. The fact that regulators select major contributors to environmental problems as the prime targets of opportunity is a by-product of their overdependence on economic metrics, like cost-benefit analysis, which measure success based on the amount of pollutants removed from the waste stream and which undervalue broader, more difficult to quantify improvements in the receiving environment. Such measures are singularly ill-suited to complex natural systems. However, persuading a court that a regulatory agency has erred in its choice of targets and its allocation of resources is unlikely given the discretionary nature of those decisions.

This Article uses the story of chumming in the Chesapeake Bay to expose these broader flaws in regulatory approaches to solving environmental problems in complex natural systems. Part II of the Article presents background information on the Chesapeake Bay, especially the continuing problem of nutrient enrichment, which is still occurring despite nearly twenty years of effort to solve it. Part III introduces the reader to the practice of chumming, its adverse water quality impacts, and its importance to an economically powerful state industry. Part IV shows how even though chumming falls within the permitting provisions of the federal Clean Water Act (CWA) and Maryland's water quality standards, including its antidegradation policies, the discretionary nature of the government's regulatory responsibility creates an insurmountable barrier for citizens who want to compel government action. Part V explores how targeting larger sources of environmental problems in complex systems like estuaries misapprehends the capacity of smaller sources to affect those systems adversely and how the misguided reliance of regulators on choosing an economically rational target, instead of following the dictates of the Precautionary Principle, can adversely affect biodiversity. The Article concludes by proposing that, since wise regulatory action cannot be compelled, the only viable option left to citizens concerned about chumming, besides costly and inefficient litigation against individual anglers and charter boat captains, is to show regulators how small harms to complex systems can result in potentially irreversible and catastrophic positive feedback loops, which may lead to loss of biodiversity. Perhaps with that knowledge, regulators could see why chumming deserves their attention.

II. THE CHESAPEAKE BAY¹⁶

The country is not mountainous nor yet low, but such . . . pleasant plain hills and fertile valleys . . . rivers and brooks, all running most pleasantly into a fair Bay. Of fish we were best acquainted with herrings. Rockfish, shad, crabs, oysters . . . and mussels. In summer no place affordeth more plenty of sturgeon, nor winter more abundance of fowl.¹⁷

A. *Physical Features of the Bay*

The Chesapeake Bay is the largest bay in the United States, consisting of 2500 square miles. It is also the longest estuary in the country at 4000 miles, longer even than the “entire West Coast.”¹⁸ The Bay’s drainage area is 64,000 square miles, encompassing all or parts of six states and the District of Columbia.¹⁹ The Bay has been among the most productive of the country’s estuaries. For example, in 1986, 20% of the oysters harvested in the entire United States came from the Chesapeake Bay, as did over 50% of the blue crabs and soft-shelled clams.²⁰ Only the Atlantic and Pacific oceans rival the Chesapeake’s annual seafood output.²¹ Approximately 78% of Maryland’s commercial fisheries are estuarine, which means that they rely on the Bay for all or some part of their life cycle, as well as for food, migration, and shelter.²²

The Chesapeake Bay is different from the “glacier cut fjords” of the Pacific Northwest, like Puget Sound, or in the East, like Hudson Bay.²³ It is “more finely sloped” and shallower, giving wetlands “a foothold along the shores”²⁴ and “sunlight [an opportunity] to nurture aquatic plants.”²⁵ The Bay’s wide mouth allows for vigorous tidal flushing, as well as a net

16. The name Chesapeake comes from “Chesepiooc,” an Algonquin name meaning “great shellfish bay.” CHRISTOPHER P. WHITE, *CHESAPEAKE BAY: NATURE OF THE ESTUARY: A FIELD GUIDE* 3 (1990).

17. *Id.* (recounting a description of Virginia, attributed to Captain John Smith, from 1612).

18. *Id.*

19. *Id.* The Chesapeake Bay Program calculates that this creates “a watershed land to Bay water volume ratio seven times that of any other major estuary in the world.” Chesapeake Bay Program, *supra* note 1, at 2.

20. *Id.*

21. *Id.* at 3 (quoting Menken as referring to the Chesapeake Bay as an “immense protein factory”).

22. STEDMAN & HANSON, *supra* note 6 (discussing economic importance of both fishing industry to Maryland’s economy).

23. WHITE, *supra* note 16, at 4.

24. As of 1990, the Bay had 498,000 acres of emergent wetlands. *Id.* at 7. Wetlands filter pollutants, control floodwater surges, recharge groundwater, and provide nursery and spawning habitat as well as food for a wide variety of species. *Id.*

25. *Id.* at 4. The Bay’s average depth is 21 feet. *Id.*

outflow of water to the ocean; while its many tributaries contribute freshwater, nutrients, and other important material for plant growth.²⁶ The Bay's plant life provides oxygen, as well as critically important habitat and nursery areas²⁷ for aquatic species.²⁸ Submerged aquatic vegetation (SAV) plays an especially critical role for crabs and juvenile fish, providing "protective shelter for vulnerable fish stocks."²⁹

However, the Bay, like all estuaries, also presents a naturally "stressful environment" for many species because of temperature fluctuations and a salinity gradient, both of which create barriers that many species cannot cross.³⁰ In addition, the Bay's "circulatory system," in which "organic . . . and inorganic . . . compounds, dissolved gases, and nutrients" are suspended, "is governed by a dynamic interaction of freshwater inputs, the salinity structure, and tidal flow," each of which "is highly variable."³¹ "[T]his variability leads to an unstable environment for estuarine organisms and visiting species."³² "Turnover" of the Bay's water is slow. "On average, a parcel of water takes about two to three weeks to cycle along the Bay's 195-mile length."³³ The result is that the Bay's "few 'residents,' including larval fish, oysters, and crabs, have a permanent, if stressful home."³⁴

Six states and the District of Columbia comprise the Bay's watershed, from which 150 tributaries from a wide array of geophysical provinces drain into the Bay.³⁵ These tributaries supply the Chesapeake "with a mixture of 'fresh' waters with a broad geochemical range,"

26. *Id.* "On average, 70,000 cubic feet of water flow into the Bay each second from its tributary sources . . . barely one ninth the volume of sea water flowing into the Bay at any instant." *Id.* at 13.

27. Many anadromous species like striped bass spawn in the brackish waters of tributaries and the upper Bay, those areas where fresh and salt water mix, "where detritus, nutrients and phyton plankton are at a maximum." *Id.* at 7. While marine species like menhaden spawn in the Atlantic, their larvae get carried into the Bay by deepwater currents where they mature into juveniles and adults. These juvenile species, in turn, attract adult bluefish and other carnivorous fish into the Bay.

28. White stresses the importance of the bay's plants to the abundance of certain species like blue crabs, grass shrimp, and soft-shelled clams noting that the larger the plant base of the "food pyramid" is "the greater number of consumers . . . can be supported, or, . . . cultured and harvested for market." *Id.* at 5.

29. *Id.* at 7.

30. *Id.* at 5. White refers to the estuarine zone, the head of tidal mix, as a "no-man's land," accounting for the fact that estuaries have "comparatively few residents, mostly visitors, and these appear only at certain times of the year." *Id.*

31. *Id.* at 13.

32. *Id.*

33. *Id.* at 18.

34. *Id.* at 18.

35. *Id.* at 19.

“loaded with nutrients,” and create a multiplicity of distinct ecological zones in the Bay—what Christopher P. White, a former staff biologist with the Chesapeake Bay Foundation, calls “ecological partitions.”³⁶ “Since only a few species are tolerant of estuarine conditions, and because of the wide selection of habitats, . . . [t]he decrease in species diversity [in the estuarine zone] is accompanied by *niche expansion* in those species able to survive the stress.”³⁷ These factors, together with the lack of predators and availability of food, means that the Bay “supports enormous populations of a relatively small number of resident species.”³⁸

Chief among the limiting factors in this generally inhospitable natural environment is the level of dissolved oxygen in the water, which varies seasonally and is influenced by the amount of nutrients floating in the water.³⁹ While nutrients are important for growth and maintenance of plant life in the Bay, too much can cause algal blooms resulting in turbidity or “cloudy conditions” at the surface.⁴⁰ These blooms block sunlight, which is critical for photosynthesis and without which submerged aquatic vegetation cannot grow, lowering both dissolved oxygen levels and the productivity of those areas.⁴¹

Like a pyramid of stone, the animals on the top are dependent on the size of the plant base. Top carnivores such as crabs, bluefish, and ospreys are very abundant in the Chesapeake only because of the enormous plant productivity on the Bay. . . . The Bay’s various communities . . . sustain the nation’s most prolific estuarine fisheries.⁴²

36. *Id.* at 20.

37. *Id.* at 21; see also EDWARD O. WILSON, *THE DIVERSITY OF LIFE* 95, 112 (1992) (describing adaptive radiation as “the spread of species of common ancestry into different niches” and how vulnerable those radiated groups are to extinction); William H. Rodgers, Jr., *Where Environmental Law and Biology Meet: Of Pandas’ Thumbs, Statutory Sleepers, and Effective Law*, 65 U. COLO. L. REV. 25, 52 (1993) (discussing evolution and the process of natural selection and how species “can move . . . towards a specialized and adaptive peak . . . understood simply as a ‘position of high fitness associated with a specific environment’”).

38. WHITE, *supra* note 16, at 21. These species exhibit a high degree of adaption, “the process by which organic design and behavior is brought into close compatibility with the physical environment.” Rodgers, *supra* note 37, at 63.

39. WHITE, *supra* note 16, at 21. Dissolved oxygen is the amount of oxygen present in a given body of water measured in milligrams per liter (mg/l). Chesapeake Bay Program, *Dissolved Oxygen: Supporting Life in the Bay, Annual Assessment*, http://www.chesapeakebay.net/status_dev.cfm?sid=207&subjectarea=DOA (last visited Sept. 7, 2007). Fish need oxygen levels above 4 mg/l to survive; 6-9 mg/l is optimal. WHITE, *supra* note 16, at 21.

40. WHITE, *supra* note 16, at 21.

41. *Id.* at 21-22. “Species interactions” like “predation, parasitism, competition, and disease” also act as a regulator of population sizes. *Id.* at 23.

42. *Id.* at 251-58 (describing the land pyramid and the interdependence of the various layers which manifests itself in a tangle of food chains).

B. A Natural System in Trouble

“High quality waters are the foundation of a healthy Chesapeake Bay.” To support a vibrant Bay ecosystem, waters must become clear, oxygen levels higher, and the amount of algae and chemical contaminants in its waters must be reduced.”⁴³ Individuals, organizations, and government agencies have spent both human capital and dollars⁴⁴ on improving the health of the Bay.⁴⁵ However, in spite of some successes,⁴⁶ the quality of the Bay’s waters and aquatic-based habitat continues to decline.⁴⁷ According to a recent report by the Chesapeake Bay Program, “the overall ecosystem health of the Chesapeake Bay remains degraded Major pollution reduction, habitat restoration, fisheries management and watershed protection actions taken to date have not yet been sufficient to restore the health of the Bay.”⁴⁸

Nutrient enrichment due to human activities is one of the leading problems facing estuaries in the mid-Atlantic region, including the

43. Ecosystem Health, *supra* note 1, at 5.

44. For example from 1995-2004, the signatories of the Chesapeake Bay Agreement, plus the headwater states of West Virginia, Delaware, and New York have invested \$2.5 billion in efforts to reduce nutrient and sediment loadings to the Bay. Chesapeake Bay Program, *Chesapeake Bay 2005, Health and Restoration Assessment, Part One: Ecosystem Health 3*, CBP/TRS 279/06, EPA 903-R06001A (Mar. 2006). Nearly another \$8 billion has been spent during the same time period to restore critical Bay habitats, including restoring underwater grasses and wetlands, managing fisheries such as striped bass and menhaden more effectively, and protecting watersheds. *Id.* at 5-9.

45. These efforts began in earnest in 1983 with an agreement between the states of Maryland, Virginia, and Pennsylvania, the District of Columbia and the EPA to clean up the Bay. Overview of the Bay Program, <http://chesapeakebay.net/info/overview.cfm> (last visited Sept. 2, 2007). Optimistically, the signatories promised that the Bay would be clean by 2000. Fehrenthold, *supra* note 3. That agreement was modified shortly after the deadline was missed, and the parties again pledged to fix the Bay’s problems, improve its oyster production, and restore SAV by 2010. *Id.*

46. For example, Maryland’s “flush tax” places a surcharge on water bills to fund cleaning up discharges for sewage treatment plants and farm fields, the planting of small strips of forest along 5000 miles of streams to filter runoff, and the resurgence of the Bay’s striped bass population from severely depressed class year levels. Fehrenthold, *supra* note 3.

47. *Id.* To illustrate the enormity of the remaining challenge, Bay area states have indicated that they will need “at least \$2 billion” to implement agricultural measures to control runoff. *Id.* It will cost \$6 billion and many, many years to upgrade hundreds of antiquated sewage treatment plants. *Id.* For example, the chief engineer at the District of Columbia’s Blue Plains facility, one of the most modern facilities in the country, said even with “all the money in the world,” it would take him at least until 2014 to complete the job. Maryland has only replaced or brought up to code 11,000 of the 360,000 systems that need to be replaced or fixed—at current funding levels it would take 580 years to complete the inventory of repairs. The plan’s goal of increasing the Bay’s oyster population by ten times its size in 1987 has not “produced any breakthroughs.” *Id.*

48. Ecosystem Health, *supra* note 1, at 1. The Chesapeake bay Program is a regional partnership between Maryland, Virginia, Pennsylvania, the District of Columbia, and the EPA dedicated to restoring the health of the Bay.

Chesapeake Bay, because it causes algal blooms that lower dissolved oxygen levels below those supportive of healthy aquatic life.⁴⁹ All creatures in the Bay require dissolved oxygen to survive, with the exception of one anaerobic bacterium.⁵⁰ Without sufficient dissolved oxygen many Bay species, such as underwater grasses, clams, and fish, cannot survive. The entire Maryland portion of the Bay has been impaired by excess nutrient pollution since 1996.⁵¹

Algal blooms are rapid increases in the phytoplankton algae population of a water body. They have detrimental effects on dissolved oxygen levels.⁵² Higher and more concentrated amounts of algae lead to increased absorption of dissolved oxygen during the organisms' respiration period.⁵³ During respiration, algae use, rather than produce, oxygen and thereby contribute to the high biological oxygen demand (BOD) in the affected water body.⁵⁴ This high BOD makes less dissolved oxygen available for other aquatic life. The most significant source of oxygen in the Bay is the exchange of oxygen at the surface of the water where algal blooms occur.⁵⁵

Algal blooms also block sunlight from submerged aquatic vegetation. This blockage inhibits photosynthesis and oxygen production, causing the algae, as well as the SAV, to die, fall to the Bay floor, and decompose.⁵⁶ As the SAV and algae decompose, they use

49. Donald F. Boesch, Russell B. Brinsfield & Robert Magnien, *Chesapeake Bay Eutrophication: Scientific Understanding, Ecosystem Restoration, and Challenges for Agriculture* (July 14, 2000), available at <http://jeq.scijournal.org/cgi/content/full/30/2/303#BDY> (“[T]he most severe consequence of eutrophication is the depletion of dissolved oxygen by the decomposition of organic matter, either added to the ecosystem or produced within the ecosystem as a result of the stimulating effects of nutrient inputs. Anoxia (lack of oxygen) or hypoxia (dissolved oxygen concentrations lower than required by indigenous organisms) is a particular concern in coastal marine and freshwater bodies that exhibit density stratification permanently, seasonally, or periodically. Organic matter produced in lighted surface waters sinks to bottom waters where it decomposes, consuming oxygen inventories that are not replenished by photosynthesis or mixing with oxygen-rich surface waters.”).

50. Chesapeake Bay Program, Chesapeake Bay: Dissolved Oxygen Criteria, <http://www.chesapeakebay.net/wqcoxygen.htm> (last visited Sept. 7, 2007).

51. See EPA, Chesapeake Bay UAAs (Mar. 2006), http://www.epa.gov/waterscience/standards/uaa/pdf/cs_chesapeake.pdf.

52. Murphy, *supra* note 7.

53. *Id.*

54. Chesapeake Bay Program, Dissolved Oxygen: Supporting Life in the Bay, <http://www.chesapeakebay.net/do.htm> (last visited July 23, 2007).

55. See MD. DEP'T OF NAT. RES., MARYLAND CLEAN MARINA GUIDEBOOK 35 (1998), available at <http://www.p2pays.org/ref/06/05841.pdf> (noting the importance of the microlayer (floating water surface) and how pollution in the microlayer can affect the aquatic food web); Chesapeake Bay Program, *supra* note 50.

56. Chesapeake Bay Program, Nutrient Pollution, <http://www.chesapeakebay.net/nutr1.htm> (last visited Sept. 7, 2007).

dissolved oxygen that would otherwise be available to living organisms and further lower dissolved oxygen levels, creating a positive feedback loop that reinforces the original cycle.⁵⁷ Decomposition of organic matter robs living organisms of the oxygen they need to survive. This oxygen use further contributes to the water's BOD level.⁵⁸ The higher the BOD level of water, the less dissolved oxygen is available for living organisms.⁵⁹ Decomposing algae also contribute to the water's turbidity, blocking sunlight and creating another destructive positive feedback loop.⁶⁰

Little progress has been made on improving the Bay's low dissolved oxygen levels from nutrient enrichment.⁶¹ In March 2004, for example, the Maryland Department of Natural Resources recorded thirteen record-low dissolved oxygen readings.⁶² The Chesapeake Bay Program reported that 2005 had the lowest readings of dissolved oxygen since 1993, with approximately 10% of the Bay recording dissolved oxygen levels approaching zero.⁶³ Such low dissolved oxygen levels cannot sustain most aquatic life;⁶⁴ indeed, areas in the Bay with hypoxic and anoxic

57. Positive feedback, the original process whereby the consequences of an ongoing process become factors in modifying or changing that process—here, the cycle set in motion by low dissolved oxygen levels—is reinforced. PETER COVENEY & ROGER HIGHFIELD, *FRONTIERS OF COMPLEXITY: THE SEARCH FOR ORDER IN A CHAOTIC WORLD* 427 (1995). Ilya Prigogine, who believed that “all systems contain subsystems, which are constantly ‘fluctuating,’” any one or combination of which fluctuations “may become so powerful, as a result of positive feedback, that it shatters the preexisting organization,” at which point “it is inherently impossible to determine in advance which direction change will take: whether the system will disintegrate into ‘chaos’ or leap to a new, more differentiated, higher level of ‘order’ or organization.” Alvin Toffler, *Introduction* to ILYA PRIGOGINE & ISABELLE STENGERS, *ORDER OUT OF CHAOS: MAN’S NEW DIALOGUE WITH NATURE*, at xv (1984).

58. BOD measures the amount of oxygen consumed by microorganisms in decomposing organic matter in a body of water. EPA, *MONITORING AND ASSESSING WATER QUALITY: DISSOLVED OXYGEN AND BIOCHEMICAL OXYGEN DEMAND*, <http://www.epa.gov/volunteer/stream/vms52.html> (last visited Dec. 8, 2006).

59. *Id.*

60. Although water clarity was better in 2005, according to the Chesapeake Bay Program, “the long-term trend is downward. Chesapeake Bay Program, *supra* note 1, at 6.

61. According to the Chesapeake Bay Foundation's 2006 State of the Bay Report, the Bay received failing scores for nitrogen levels, dissolved oxygen, and water clarity. CHESAPEAKE BAY FOUND., *STATE OF THE BAY REPORT* (2006), <http://www.cbf.org/site/DOCServer/SOTB2006.pdf?docID=6743>.

62. See Md. Dep't of Natural Res., *Eyes on the Bay*, <http://www.eyesonthebay.net> (last visited Nov. 11, 2007).

63. Chesapeake Bay Program, *supra* note 30; Chesapeake Bay Found., *Chesapeake Suffers Near-Record ‘Dead Zone,’* in *SAVE THE BAY* (2005). The Bay Program also reported, based on water quality data collected during 2003-2005, only 29% of the Bay's waters met dissolved oxygen standards during the summer. *Ecosystem Health*, *supra* note 1, at 13.

64. Chesapeake Bay Program, *Too Much of a Good Thing: Fish Kills Illustrate Harmful Effects of Excess Nutrients on Bay Ecosystem*, <http://www.chesapeakebay.net/newsfish/kills110906.htm> (last visited Sept. 7, 2007) (reporting depleted DO levels from excess nutrients

levels of dissolved oxygen are often referred to as “dead zones” because they are devoid of life.⁶⁵

Dead zones, first observed in the Chesapeake in the 1970s,⁶⁶ have been increasing.⁶⁷ Over the past forty years, the volume of hypoxic and anoxic water in the Bay “has more than tripled;” the deep water dead zone is even expanding into major Bay tributaries, including the Potomac and York Rivers, and the Eastern Bay.⁶⁸ In July of 2005, data from the Chesapeake Bay Program revealed that approximately 40% of the Bay’s main stem beginning nearly at Baltimore and extending 100 miles south to Hampton Roads, Virginia, is now dead—“the largest area of oxygen depleted water seen since monitoring began 20 years ago.”⁶⁹

Low dissolved oxygen levels and high turbidity harm the Bay and inhibit the achievement of its designated uses, such as protection of fish and aquatic life, as well as recreational fishing. Species adversely affected by low dissolved oxygen levels must relocate to areas with higher dissolved oxygen levels or perish. Low dissolved oxygen levels and increased turbidity also kill vital bay grasses that provide food and shelter for aquatic creatures, such as the blue crab and summer flounder.⁷⁰ When bay grasses die, spawning and nursery habitat is destroyed and fish

resulted in several fish kills in 2006). The Bay’s benthic community also has suffered from low dissolved oxygen levels during the summer, with only 41% considered healthy in 2005; while only 31% of the Bay’s phytoplankton were considered healthy. Ecosystem Health, *supra* note 1, at 7.

65. See Martin Freed, *Dead Zone: A Threat to the Chesapeake*, THE FISHERMAN, Jan. 20, 2005, at 11; EPA, Technical Support Document for Identification of Chesapeake Bay Designated Uses and Attainability 16 (Aug. 2003), <http://www.epa.gov/region3/chesapeake/uasupport.htm>.

66. John Heilprin, Number of Ocean ‘Dead Zones’ Rise, <http://www.livescience.com/environment/061019apdeadzones.html> (last visited Nov. 11, 2007).

67. According to Bay area scientists, low dissolved oxygen levels have become “dramatically more common and widespread since the 1950s,” and are “lasting longer, dropping lower, and spreading farther throughout the system, shrinking habitat for crabs, fish, and oysters, and stressing many organisms.” Chesapeake Bay Foundation Fact Sheet, The Chesapeake Bay’s Dead Zone: Increased Nutrient Runoff Leaves Too Little Oxygen in 40% of the Bay’s Mainstem in July, <http://www.cbf.org/site/PageServer?pagename=responsesfactsdeadzone> (last visited Sept. 7, 2007) [hereinafter Fact Sheet] (indicating low dissolved oxygen levels have become “dramatically more common and widespread since the 1950s” and are “lasting longer, dropping lower, and spreading further throughout the system, shrinking habitat for crabs, fish, and oysters, and stressing many organisms”).

68. *Id.* at 1. These dead zones can move into shallow water when winds of sufficient duration affect the Bay’s circulation patterns “degrading those valuable habitats as well.” *Id.* at 2.

69. *Id.* at 1. Things have improved slightly; the Chesapeake Bay Foundation reported that the size of this dead zone was slightly smaller and was only the fifth largest dead zone ever recorded. Alex MacLennan, *Bad Waters: Dead Zones, Algal Blooms, and Fish Kills in the Chesapeake Region in 2007*, Chesapeake Bay Found., *Save the Bay* (Fall 2007) at 25.

70. Chesapeake Bay Program, Dissolved Oxygen Backgrounder at 5, http://www.chesapeakebay.net/pubs/doc-do_101_backgrounder.pdf (last visited Dec. 8, 2006).

and waterfowl have less to eat.⁷¹ Species that can relocate move to a more hospitable environment, leaving behind a less diverse ecosystem—one more tolerant of low dissolved oxygen levels,⁷² but less commercially and recreationally valuable.

“Localized, short term dissolved oxygen concentrations” also occur in shallow water areas of the Bay, killing resident fish and crabs or forcing them to abandon their preferred habitat.⁷³ Nonmobile species, “like clams, worms, and other bottom dwelling organisms on which fish and crabs feed, become stressed or die.”⁷⁴ These shallow water areas are preferred by anglers and on a nice day are often crowded with charter boats and their customers.⁷⁵ These fishers often employ the detrimental practice of chumming, to which this Article now turns.

III. CHUMMING

Chum reduces dissolved oxygen levels and increases turbidity, and thus contributes to the positive feedback loops that are destroying the health of the Bay.⁷⁶ However, chumming is completely unregulated. The EPA has not established effluent limits for chumming, although it has done so for the fish processing industry, and Maryland has not sought to regulate chumming, even though it runs afoul of the state’s antidegradation policies.⁷⁷ Although the importance of recreational fishing to Maryland’s economy may explain some of the state’s reluctance, an equal source of regulatory inertia may be that chumming appears to be an insignificant part of the Bay’s eutrophication problem, especially when compared to nutrient contributions from sewage treatment plants and farm fields.⁷⁸ However, chumming’s contribution to

71. The Chesapeake Bay Program reports that data collected in 2004 show Bay grasses covering about 73,000 acres. *Ecosystem Health*, *supra* note 1, at 9. However, this number may actually drop in 2006 because many of these same areas suffered a die-off in 2005. *Id.*

72. Mich. Dep’t of Env’t. Quality (DEQ), Biochemical Oxygen Demand and NPDES Permitting, <http://www.deq.state.mi.us/documents/deq-swq-mpdes-BiochemicalOxygenDemand.pdf> (last visited Sept. 7, 2007).

73. Fact Sheet, *supra* note 67, at 1.

74. *Id.* at 2.

75. Md. Dep’t of Natural Res., Chesapeake Bay & Tributaries Fishing Report (July 7, 2004), <http://www.dnr.state.md.us/fisheries/fishingreport/fishingrptArchive/frarchives2004/0707>.

76. Sheila Murphy, BASIN, General Information on Turbidity, <http://bcn.boulder.co.us/basin/data/BACT/info/Turb.html> (last visited Sept. 7, 2007).

77. MD. CODE ANN., ENVIR. §§ 9-302 (1996).

78. Bay watershed states estimate that they will need at least \$2 billion dollars to design and get farmers to implement measures to prevent soil, manure and fertilizers washing off of farm fields into the Bay or its tributaries and another \$6 billion to upgrade sewage treatment plants. Fehrenthold, *supra* note 3.

the impairment of the Bay's waters and aquatic habitat is not as insignificant as the regulators make it out to be.

A. The Practice of Chumming

Chumming involves the discharge of a slurry of decomposed or decomposing baitfish, usually from a fishing vessel.⁷⁹ The slurry may contain whole fish, chunks of fish, or a ground mixture of fish and other aquatic organisms such as shellfish and worms. The goal of chumming is to attract game species like striped bass. Maryland's recreational fishing industry uses the practice extensively.⁸⁰

Atlantic menhaden is the most commonly used chumming material along the Atlantic seaboard.⁸¹ Anglers often purchase menhaden chum in blocks⁸² and grind the chum into a "soup" that they spoon into the water⁸³ at regular intervals as their vessels drift with the current.⁸⁴ This process allows pieces of chum, about the size of a thumbnail, to drift through the water creating a "chum line."⁸⁵ Sometimes anglers lower the entire chum block into the water in a chum bucket, pot, or bag.⁸⁶ Chum buckets are normally five-gallon plastic buckets perforated with one-inch holes.⁸⁷ Users of chum buckets then agitate their selected container in the water "so a nice cloud of chum flows out."⁸⁸ Both techniques allow copious amounts of chum pieces and fish oils to escape and float through the water column, creating a "slick."⁸⁹

Fishing experts recommend that anglers use fifty pounds of chum per day per vessel.⁹⁰ This amount is necessary because a chum slick is only effective for distances of up to 300 yards behind the boat.⁹¹ It is

79. See KEN SCHULTZ, KEN SCHULTZ'S FISHING ENCYCLOPEDIA 385 (1999).

80. *Id.*

81. *Id.*

82. *Id.*

83. *Id.*

84. *Id.*

85. *Id.*

86. *Id.*

87. *Id.*

88. Lenny Rudow, *Summer Chumming*, THE FISHERMAN, June 30, 2006, at 7; see LEFTY KREH, L.L. BEAN, SALTWATER FLY-FISHING HANDBOOK 145 (2001).

89. ED RUSSELL & BILL MAY, FLYFISHER'S GUIDE TO CHESAPEAKE BAY: INCLUDES LIGHT TACKLE 17 (2002). The combination of fish pieces and oil on the water's surface is referred to as a "slick" because "oils released from the pulverized fish will float and leave a fine film that flattens the water slightly." Sarah Gardner, *Fly Rod Rock: Slick Strippers*, THE FISHERMAN, Oct. 6, 1994, at 23.

90. Schultz *supra* note 79, at 382. Indeed, one commentator has noted that "[p]erhaps the most important aspect of chumming is that once you start chumming, don't stop." KREH, *supra* note 88, at 145.

91. Gardner, *supra* note 89, at 24.

common for several vessels—a “chum fleet”—to engage in chumming simultaneously in the same location.⁹² Many independent anglers and charter boats compete for catches simultaneously in locations known to produce large yields from chumming.⁹³ This competition often results in more than 100 fishing boats descending upon a single chumming location at the same time.⁹⁴

With fifty pounds of chum recommended per vessel and as many as 100 vessels present at a particular fishing location at one time, as much as or more than 5000 pounds of chum can conceivably be discharged at each discrete chumming location in the Bay. There are twenty of these prime chumming locations in the Bay, which means as much as or more than 100,000 pounds of chum may be discharged into the Bay in a single day.⁹⁵ As discussed below in greater detail, the discharge of chum adversely affects the health of the Bay and its species by reducing dissolved oxygen levels in the Bay and increasing water turbidity.

B. Chumming Adversely Affects the Bay’s Water Quality and the Health of Its Species

When compared to nutrient discharges from sewage treatment plants and farm fields, chumming is a relatively small, localized source of pollution to the Bay’s waters. However, the impact of chumming is both serious and far-reaching.⁹⁶ The practice contributes to the Bay’s eutrophication in near-shore areas already stressed by excess nutrient loadings from farm runoff, sewage treatment plants, and leaking septic

92. Rudow, *supra* note 88, at 6.

93. *Id.*

94. *Id.*

95. The chum locations include: Hickory Thicket, Swan Point, Love Point, Sandy Point Light, Gooses, Hill, Diamonds, Stone Rock, Podickory Point, Hackets Bar, Choptank River Mouth Point, Point No Point Light, Rock Hall, Rips, Sewer Pipe East, Middle Grounds, Buoy 72, Buoy 72A, Gas Docks, Triangle (Point Lookout to Smith Point to Buoy 68). The Maryland Fishing Report, Chesapeake Bay & Tributaries Report (July 16, 2003), <http://www.dnr.maryland.gov/fisheries/fishingrpt.Archive/frarchives2003/chesapeake071603.html> (last visited July 25, 2007) (listing popular chumming spots on the Bay). Although not every chumming location may be a destination for the chumming fleet, the number of chumming destinations and chumming fleet locations is significant. Even if each angler used less chum because of the density of anglers in a particular chumming fleet destination, inordinately large amounts of chum would still be dumped in small areas of the already-fragile Bay.

96. The impact of chumming on the greater Bay’s water quality is captured by the so-called “butterfly effect,” first identified by Massachusetts Institute of Technology meteorologist Edward Lorenz, and used to describe how “tiny differences in input might quickly become substantial differences in output”—i.e., “a butterfly wing stirring air today in a Chinese park can transform the storm systems appearing next month over a North American city.” DONALD WORSTER, *NATURE’S ECONOMY: A HISTORY OF ECOLOGICAL IDEAS* 407 (1994).

tanks.⁹⁷ In addition, chumming impairs the quality of the Bay's waters by increasing its turbidity and may also be a source of disease in game fish and an important contributor to the decline in menhaden populations on the mid-Atlantic seacoast.⁹⁸

1. Chumming Contributes to the Bay's Low Dissolved Oxygen Levels and High Water Turbidity

Chumming decreases the amount of dissolved oxygen available to aquatic life in the Bay by increasing BOD, the amount of oxygen consumed by microorganisms in decomposing organic matter in a body of water.⁹⁹ Low dissolved oxygen levels result in fish kills, stressed and unhealthy species, and a reduction in biological diversity.¹⁰⁰ Chumming contributes no dissolved oxygen to the water, because the added material is dead or decaying organic matter; instead, as the chum that is not consumed by fish decomposes, it increases BOD by using available dissolved oxygen.¹⁰¹ Decomposition of organic matter like chum robs living organisms of the oxygen they need to survive.¹⁰² This oxygen use contributes to the water's BOD level. The higher the water's BOD level, the less dissolved oxygen there is for living organisms.¹⁰³

Pristine waters typically have a five-day BOD level of no more than 1 mg/l.¹⁰⁴ Efficiently treated municipal wastewater has a BOD value of about 20 mg/l, and untreated, raw wastewater has a BOD of 200 mg/l.¹⁰⁵ Three separate tests of frozen and nonfrozen chum samples revealed BOD levels from 227,000 mg/l to 330,000 mg/l.¹⁰⁶ Therefore, adding 5000 pounds of chum to discrete fishing locations within the Chesapeake

97. GIMON ET AL., *supra* note 15.

98. Murphy, *supra* note 7.

99. EPA, *supra* note 58.

100. EPA, MONITORING AND ASSESSING WATER QUALITY: DISSOLVED OXYGEN AND BIOMEDICAL OXYGEN DEMAND, <http://www.epa.gov/volunteer/stream/vms52.html> (last visited Sept. 7, 2007).

101. *Id.*

102. *Id.*

103. *Id.*

104. Wilkes Univ. Ctr. for Env'tl. Quality, Environmental Engineering & Environmental Sciences, Water Quality Terms, Glossary, <http://www.water-research.net/glossary.htm> (last visited Sept. 14, 2007) ("[A] sample with a 5 day BOD between 1 and 2 mg O/L indicates a very clean water, 3.0 to 5.0 mg O/L indicates a moderately clean water and 5 mg O/L indicates a nearby pollution sources.").

105. GEORGE TCHOBANOGLIOUS, FRANKLIN L. BURTON, FRANKLIN BURTON, DAVID TENSEL, WASTEWATER ENGINEERING: TREATMENT AND REUSE 64 (2002).

106. See Martel Certificate of Analysis (app. B) (Apr. 15, 2004); see also Enviro-Chem Labs., Final Report of Analyses (app. C) (Feb. 28, 2004); see also Microbac Labs., Inc., Test Results (app. D) (Jan. 30, 2004). The independent labs sampled frozen, menhaden chum samples, similar to the chum used in commercial and recreational chumming on the Bay.

Bay can acutely deplete the dissolved oxygen levels necessary to support life in those areas by increasing BOD markedly.

Chum also functions as a nutrient-rich fertilizer for algal blooms, which increase water turbidity and have a detrimental effect on dissolved oxygen levels and BOD in discrete areas of the Bay.¹⁰⁷ The slick of fish oils and fish parts that collect on the surface of the water blocks sunlight from submerged aquatic vegetation, inhibiting photosynthesis and oxygen production in the water column, and hindering the exchange of oxygen at the water's surface, the most significant source of oxygen in the Bay.¹⁰⁸

Chumming also harms the Bay by increasing water turbidity. Turbidity is a measure of water quality and is affected by suspended solids such as clay, silt, and organic matter, including algae and other microscopic organisms that interfere with the passage of light through the water column.¹⁰⁹ When anglers spoon chum directly in the water or agitate blocks of chum, they create "chum clouds," frequently involving large quantities of chum.¹¹⁰ Five thousand pounds of chum of varying sizes raining down through the water column greatly reduces water clarity and prevents sunlight from reaching submerged aquatic vegetation. Increased turbidity kills these underwater grasses, which then decomposes and fuels harmful algal blooms that ultimately reduce dissolved oxygen levels and increase turbidity.¹¹¹ Each of these impacts contributes to the positive feedback loops that are sending the Bay's health into a downward spiral.

2. Reduced Dissolved Oxygen Levels and Increased Turbidity Harm the Bay

Low dissolved oxygen levels and high turbidity can kill and stress species, decreasing populations of fish, shellfish, and bay grasses. If dissolved oxygen levels fall below 2 mg/l (severely hypoxic, or anoxic, levels), most of the organisms in the affected area must relocate to areas with higher dissolved oxygen levels—otherwise they will suffocate and die.¹¹² Some species, such as clams and oysters, cannot relocate to escape

107. See *supra* note 52 and accompanying text.

108. See Md. Dep't of Nat. Res., *supra* note 55, at 35 (noting the importance of the microlayer (floating water surface) and how pollution in the microlayer can affect the aquatic food web); Chesapeake Bay Program, *supra* note 39.

109. Murphy, *supra* note 76.

110. Lenny Rudow, *Summer Chumming*, THE FISHERMAN, June 30, 2006, at 7.

111. Murphy, *supra* note 76.

112. Chesapeake Bay Prog., Dissolved Oxygen Backgrounder 2, http://www.chesapeakebay.net/pubs/doc-do_101_backgrounder.pdf (last visited Dec. 8, 2006).

low dissolved oxygen levels; instead they die when levels drop below 2 mg/l.¹¹³ Fish kills may result after only a few hours of dissolved oxygen levels below 2 mg/l and are increasingly a common occurrence in the Bay.¹¹⁴ Hypoxic dissolved oxygen levels (between 2 and 5 mg/l) stress species, making them more susceptible to injury and illness as a result of other environmental stressors in the water.¹¹⁵

Low dissolved oxygen levels and high turbidity also destroy habitat and kill vital Bay grasses that provide food and shelter for aquatic creatures, such as the blue crab and summer flounder. When Bay grasses die, spawning and nursery habitat is destroyed and fish and waterfowl have less to eat. They then relocate to more hospitable environments, leaving behind a less diverse estuarine system; one more tolerant of low dissolved oxygen levels,¹¹⁶ but less commercially and recreationally valuable.¹¹⁷

The effect of chumming is vividly illustrated by the sensational decline of one of the most popular chumming areas in the Bay, “the Hill.” Beginning in the 1990s, anglers flocked to the Hill as it produced large fishing yields from chumming. The trade press noted it was “one of the most popular and productive spots” for chumming in the Bay.¹¹⁸ In the Hill’s heyday, as many as 100 vessels might be anchored close together, giving the impression that the Hill was “stacked up with boats.”¹¹⁹ This excess patronage resulted in “untold gallons” of chum being poured into this location.¹²⁰ Chum’s effect on the Hill was dramatic.

In June 2003, the Hill was mentioned in every issue of the Maryland Department of Natural Resources’ weekly fishing reports during the summer season. For several years, the reports described the Hill as a “hotspot” and described the chumming there as “fantastic,” “excellent,” and “productive.”¹²¹ By 2004 and 2005, however, the reports

113. See EPA, *supra* note 58. Oysters, once considered one of the most important commercial fisheries in the Bay, have been decimated by overharvesting, pollution, and diseases resulting in a “severe decline in their number,” so that today their population stands at about 9% of the Bay Program’s restoration goal for the species. Ecosystem Health, *supra* note 1, at 12.

114. See Murphy, *supra* note 76; see Chesapeake Bay Found., *supra* note 63.

115. See MICHAEL J. CADUTO, POND AND BROOK: A GUIDE TO NATURE IN FRESHWATER ENVIRONMENTS 39 (1990).

116. DEQ, *supra* note 72.

117. See Murphy, *supra* note 76.; DEQ, *supra* note 72.

118. See, e.g., Lenny Rudow, *Chum the Hill for Rockfish Thrills*, THE FISHERMAN, Oct. 7, 1999, at 16.

119. Rudow, *supra* note 88, at 6.

120. Rudow, *supra* note 118, at 17.

121. MDNR, Chesapeake Bay & Tributaries Fishing Reports: June 4, 2003, <http://www.dnr.state.md.us/fisheries/fishingreport/fishingrptArchive/frarchives2003/chesapeake060403.html>; MDNR, Chesapeake Bay & Tributaries Fishing Reports: June 11, 2003, <http://www.dnr.state.md>.

commented that chumming at the Hill was “slim,” “sporadic,” and had “yet to turn on.”¹²² In the spring of 2006, the fishing report noted chumming was “limited” and “nothing like the nineties.”¹²³ The reports have not referenced the Hill since then.¹²⁴ In stark contrast to its celebrated past, the Hill is now devoid of fish and largely abandoned by anglers.¹²⁵

Data from the Choptank River-Outer Choptank (EE2.1) monitoring station, the monitoring station closest to the Hill, suggest that fish no longer occupy the Hill because of low dissolved oxygen levels.¹²⁶ The Choptank station recorded average minimum dissolved oxygen levels well below the 5 mg/l necessary for most species to survive¹²⁷ and, during seven months in 2005, recorded severely hypoxic dissolved oxygen levels ranging from 1.30 mg/l to 3.8 mg/l.¹²⁸ Maximum average dissolved oxygen levels during the summer, when they are at their lowest and chumming at its highest,¹²⁹ barely met the necessary 5 mg/l necessary to

us/fisheries/fishingreport/fishingrptArchive/frarchives2003/chesapeake061103.html; MDNR, Chesapeake Bay & Tributaries Fishing Report: June 18, 2003, <http://www.dnr.state.md.us/fisheries/fishingreport/fishingrptArchive/frarchives2003/chesapeake061803.html>.

122. MDNR, Chesapeake Bay & Tributaries Fishing Reports: June 9, 2004, <http://www.dnr.state.md.us/fisheries/fishingreport/fishingrptArchive/frarchives2004/0609chesapeake.html>; MDNR, Chesapeake Bay & Tributaries Fishing Reports: July 21, 2004, <http://www.dnr.state.md.us/fisheries/fishingreport/fishingrptArchive/frarchives2004/0721chesapeake.html>; Chesapeake Bay & Tributaries Fishing Reports: June 5, 2005, <http://www.dnr.state.md.us/fisheries/fishingreport/fishingrptArchive/frarchives2005/0608chesapeake.asp>.

123. Md. Dep’t of Natural Res., Chesapeake Bay & Tributaries Fishing Report (May 24, 2006), <http://www.dnr.state.md.us/fisheries/fishingreport/fishingrptArchive/frarchives2006/0524chesapeake.asp>.

124. See MDNR, Chesapeake Bay & Tributaries Fishing Reports: May 24, 2006, <http://www.dnr.state.md.us/fisheries/fishingreport/fishingrptArchive/frarchives2006/0524chesapeake.asp>.

125. *Id.*

126. Md. Dep’t of Natural Res., Fixed Station Monthly Monitoring, Choptank, http://www.mddnr.chesapeakebay.net/bay_cond/bay_cond.cfm?param=bdo&station=EE21 (last visited Sept. 7, 2007).

127. MDNR, Fixed Station Monthly Monitoring, Choptank River-Outer Choptank, http://mddnr.chesapeakebay.net/bay_cond/bay_cond.cfm?param=bdo&station=EE21 (last visited Dec. 8, 2006).

128. *Id.*

129. Warmer Bay water cannot hold as much oxygen as colder water. EPA, Technical Support Document (1991), <http://www.epa.gov/npdes/pubs/onmo264.pdf>. The shallow depth of the Bay contributes to significant temperature fluctuations from 24 to 84 degrees Fahrenheit. *Id.* Similarly, during the summer, the Bay is more saline than during other seasons. Nat’l Estuarine Research Reserve System, Systemwide Monitoring Program, <http://nerrs.noaa.gov/Monitoring/Synthesis5.html> (last visited Sept. 7, 2007). As the salinity of water increases, the ability of the water to hold dissolved oxygen decreases. EPA, *supra* note 129, at 15. Also, during the summer, due to the unique hydrology of the Bay, vertical mixing of water occurs with less intensity, and as a result, deeper waters do not receive needed DO from shallower waters. *Id.* at 16; see also Jay L.

support many species.¹³⁰ While many sources can contribute to low dissolved oxygen levels, the “untold gallons” of decomposing chum discharged into the area without doubt affected the Hill’s water quality.¹³¹

Chumming lowers dissolved oxygen levels by increasing BOD and turbidity. Low dissolved oxygen levels kill and stress fish, as the story of the Hill vividly illustrates. The loss of fish, crabs, shellfish, invertebrates, and underwater bay grasses reduces the Bay’s biological diversity and impairs its designated use as habitat for fish and other aquatic species.

C. *Chumming Is a Source of Other Problems for the Bay*

Not only does chumming impair the Bay’s water quality and cause additional systemic stress for Bay species, it may also be a source of bacterial disease among game fish and contributes to the decline in menhaden populations on the East Coast. While these latter two impacts are more difficult to establish than the effect of chumming on water quality, water-based habitat, and species diversity, nonetheless there is sufficient cause for concern to warrant the discussion of these effects here.

1. Chum May Be a Source of Disease in Fish

The biological material present in chum may serve as a vector for the transmittal of diseases and infections to game species.¹³² Because

Taft et al., *Seasonal Oxygen Depletion in Chesapeake Bay*, 3 ESTUARIES 242, 242 (Dec. 1980), available at http://www.estuariesandcoasts.org/cdrom/ESTU1980_3_4_242_247.pdf.

130. MDNR, *supra* note 127.

131. Rudow, *supra* note 118, at 17.

132. DICK RUSSELL, STRIPER WARS: AN AMERICAN FISH STORY 218 (2005) (noting that most of the literature describes the transmission of mycobacteriosis through feeding on contaminated material); Andrew S. Kane et al., *Mycobacteria as Environmental Portent in Chesapeake Bay Fish*, 13 EMERGING INFECTIOUS DISEASES DISPATCH (Feb. 2007), available at <http://www.cdc.gov/EID/content/13/2/06-0558.htm> (noting that menhaden “are an essential link in the food chain” and “[t]he prevalence of infection in Atlantic menhaden . . . may indicate the potential of this fish to amplify spread to other species”); Karl Blankenship, *Scientists Working To Unravel Mysteries of Rockfish Mycobacteriosis*, BAY J., June 2005, available at <http://www.bayjournal.com/article.cfm?article=2551> (“Kane’s finding of mycobacteria in menhaden is significant because it’s possible that striped bass, a major predator of menhaden, could get infections from their prey.”); Ellen K. Silbergeld, *Pfiesteria: Harmful Algal Blooms as Indicators of Human-Ecosystem Interactions*, 82 ENVTL. RES. SECTION A 97, 100 (2000); S.F. Snieszko, *Mycobacteriosis (Tuberculosis) of Fishes*, FISH DISEASE LEAFLET 55 (1978) (noting infection by oral transmission is well-established); Suppalak Puttinaowarat, *Mycobacteriosis: A Chronic Disease Threatening Fish and Man*, 8 AAHRI NEWSLETTER art. no. 2 (Dec. 1999), http://www.fisheries.go.th/aahri/Health_new/AAHRI/AAHRI/Topics/newsletter/art40.htm.

striped bass have historically fed on menhaden,¹³³ menhaden chum is used to attract them. With over 90% of young-of-the-year menhaden suffering from *Pfiesteria*-like dinoflagellates (mycobacteria) or fungal infections in some areas of the Bay,¹³⁴ the possibility of infecting game species through menhaden chum is significant. Indeed, nearly 70% of striped bass in the Chesapeake Bay suffer from mycobacteria or fungal infections.¹³⁵ The Maryland Fish and Wildlife Health Program reported in 2006 that the prevalence of disease in striped bass collected from pound nets increased from 25% in 1998 to 60% in 2005.¹³⁶ “Two recent

133. RUSSELL, *supra* note 132, at 214 (noting that in the early 1990s menhaden accounted for between 37 and 66% of the striped bass’s diet, but by 1998-99, menhaden accounted for only 12 to 27% of the diet); ANTHONY S. OVERTON ET AL., A BIOENERGETICS APPROACH FOR DETERMINING THE EFFECT OF INCREASED STRIPED BASS POPULATION ON ITS PREY AND HEALTH IN THE CHESAPEAKE BAY, REPORT TO MDNR (Apr. 1, 2000), *available at* <http://www.chesbay.org/articles/2.asp> (noting that menhaden is 33% of the diet of 1-year-old striped bass and 66% of the diet of 6-year-old striped bass).

134. See R. Reimschuessel et al., *Myxosporean Plasmodial Infection Associated with Ulcerative Lesions in Young-of-the-Year Atlantic Menhaden in a Tributary of the Chesapeake Bay, and Possible Links to Kudoa clupeiidae*, 53 DISEASES OF AQUATIC ORGANISMS 143, 151 (2003); see also Kane et al., *supra* note 132, tbl. 2 (noting up to 57% of menhaden were infected). Some experts attribute the lesions to *Pfiesteria* (mycobacteria), a bacterial infection, while others attribute the harmful lesions to an *Aphanomyces* fungus. M.J. Dykstra & A.S. Kane, *Pfiesteria Piscicida And Ulcerative Mycosis Of Atlantic Menhaden—Current Status Of Understanding*, 12 J. OF AQUATIC ANIMAL HEALTH 18 (2000); Press Release, United States Geologic Survey, USGS Find Fungus To Be a Cause of Fish Lesions in Chesapeake (Sept. 30, 1998). The cause is inconsequential, however, because both causes illustrate the frail health of Bay species and how poor water quality has compromised Bay species’ health.

135. RUSSELL, *supra* note 132, at 206 (noting that “70% of all 5-year-olds had [mycobacteriosis]”); see also Blankenship, *supra* note 132 (noting mycobacteriosis is suffered by nearly 70% of 4-to-5-year-old striped bass); Karl Blankenship, *Striped Bass Illness Baffles Bay Scientists*, BAY J., Apr. 2002, *available at* <http://www.bayjournal.com/article.cfm?article=2551> (finding 69% of striped bass with mycobacterial infections); J. Raloff, *Fish Epidemic Traces to Novel Germ—Mycobacterial Infection Affects Bass in Chesapeake Bay*, SCI. NEWS, Mar. 3, 2001, at 132 (noting that in the late 1990s, over 50% of striped bass suffered from mycobacterial infections); CHESAPEAKE BAY FOUND. ET AL., MENHADEN MATTER 11 (2006), <http://www.menhadenmatter.org>. Mycobacteriosis in striped bass can also affect fishers who come into contact with diseased fish, causing them to suffer from “fish handler’s disease,” characterized by “a sore that won’t heal or painful swelling of joints . . . that can be difficult to get rid of, particularly for individuals with compromised immune systems. . . . Without proper treatment, ‘fish handler’s disease’ can lead to bursitis, arthritis, or osteomyelitis and can require surgery to remove infected tissue.” RUSSELL, *supra* note 132, at 206.

136. MARYLAND DEP’T OF NATURAL RES., FISHERIES SERVICE, FISHING REPORT (Jan. 17, 2007), www.dnr.state.nd.us/fisheries/fishingreport/chesapeake.asp (last visited Sept. 7, 2007). Ongoing studies indicate that fish are exposed to Mycobacteria early on and disease is first evident in age-1 fish. Prevalence of disease increases in fish with age and in male and female fish until at least age-6, and appears to be lower in the migratory spawning stock. *Id.* Because young striped bass are found in near shore areas where chumming occurs, it may be here that they contract the disease. Handling diseased fish can also be cause for concern for anglers and commercial watermen. While the bacteria that cause disease in fish do not pose an unusual danger to humans, it is possible to contract an infection by handling sick fish, particularly if the

independent studies alarmingly reveal that ‘natural mortality’ in striped bass has been rising since 1998,” and in September 2003 had “*increased fivefold* over the previous five years.”¹³⁷ This increased mortality is particularly problematic for the Bay’s striped bass population, given below-average striped bass reproduction in 2006.¹³⁸ A similar increase in mortality is not occurring in striped bass populations outside the Chesapeake Bay.¹³⁹

Chumming also has the potential to increase indirectly the incidence of disease among game fish and other species by weakening the species’ immune systems, making them more susceptible to other stresses in the estuarine environment. “Water quality has strong spatial heterogeneity and temporal flux, and these conditions could exacerbate both bacterial proliferation and host susceptibility.”¹⁴⁰ Striped bass, for example, are often underweight and malnourished as a result of low dissolved oxygen levels in the Bay, poor water quality, and a lack of plentiful live menhaden, which provide them with much-needed fats.¹⁴¹ These

individual has an open cut on her hand or a fish spine penetrates your skin. Maryland Department of Fisheries Service, therefore, recommends handling fish with gloves, washing hands frequently, and having a bottle of the waterless antibacterial hand wash on hand. *Id.*

137. RUSSELL, *supra* note 132, at 208-09.

138. Md. Saltwater Sportfishermen’s Ass’n, Press Release, Maryland DNR 2006 Young-of-Year Striped Bass Survey Indicates Below-Average Reproduction (Oct. 2006), <http://www.mssa.net/subpages/news-102606yoy.html>. The Chesapeake Bay Program reports that while stripe bass population has “dramatically increased over the past decade,” data indicate a slight decline in biomass over the past three years. Ecosystem Health, *supra* note 1, at 11.

139. RUSSELL, *supra* note 132, at 209.

140. Kane et al., *supra* note 132; *see also* RUSSELL, *supra* note 132, at 194 (quoting Joe Boone, a former MDNR biologist and fish population surveyor); RUSSELL, *supra* note 132, at 205 (quoting Wolfgang Vogelbein of the Virginia Institute of Marine Science as stating, “in general, infectious diseases in cold-blooded animals like fishes are greatly influenced by the environment. These [pathogens] are always present out in the water. Fish always seem to be exposed to them, but become diseased only when they are stressed.”); RUSSELL, *supra* note 132, at 214 (“Transmission of disease would have been aided by high density of striped bass in poor nutritional condition residing in degraded habitat (Chesapeake Bay was the most hypoxic [oxygen-starved] estuary in the mid-Atlantic region in the late 1990s.” (quoting Jim Uphoff, a Maryland biologist)).

141. *See* Bill Goldsborough, *A Huge Step Forward: How the Menhaden Catch Was Capped*, SAVE THE BAY, Sept. 2006, at 4; A.S. Kane et al., *Etiologies, Observations and Reporting of Estuarine Finfish Lesions*, 50 MARINE ENVTL. RES. 473 (2000); Nat’l Coal. for Marine Conservation, *A Recommendation To Amend the Atlantic Menhaden Fishery Management Plan To Protect and Preserve Menhaden’s Ecological Role in Chesapeake Bay and Throughout Its Range*, Presented to the Atlantic States Marine Fisheries Commission, Dec. 17, 2003, http://www.savethefish.org/PDF_files/Menhaden_Proposal_to_ASMFC_1203.pdf; *see also* CHESAPEAKE BAY FOUND. ET AL., *supra* note 135, at 10 (noting that striped bass have between 10 and 25% the body fat of healthy fish and are consuming 4 times less menhaden than they did 50 years ago, with juvenile striped bass consuming almost 9 times less menhaden); RUSSELL, *supra* note 132, at 214 (noting that the menhaden population decreased 80% between 2000 and 1960 and that striped bass weighed, on average, about 40% less than fish of the same age in the late 1950s).

environmental stressors may increase the susceptibility of striped bass to opportunistic skin pathogens such as mycobacteria and fungi.¹⁴²

The presence of pathogens in estuarine fish species is an important indicator of water quality and suggests a need for improved estuarine management.¹⁴³ “[D]eclines in nutrient loading will reduce eutrophication, thereby improving water quality, and in this context will likely lower the risk of toxic outbreaks of *Pfiesteria*-like dinoflagellates and harmful algal blooms.”¹⁴⁴

2. Chumming Is Contributing to Declines in Menhaden Populations

Chumming is also putting additional pressure on menhaden, an important source of food for many larger species of fish, particularly game fish like striped bass, weakfish, and bluefish.¹⁴⁵ Menhaden, which are filter feeders who feed on plankton, including the Bay’s overabundant algae, also perform an important water quality function for the Bay.¹⁴⁶ However, their population is decreasing along the Atlantic seaboard, which has caused considerable concern among scientists.¹⁴⁷ In fact, the number of menhaden is currently near the population’s historical low levels in the 1960s when it was declared overfished.¹⁴⁸ Scientists are

142. Indeed, some have established that stress, such as that caused by low DO levels, may induce lesions on striped bass which can increase their susceptibility to opportunistic skin pathogens. See Mac Law, *Differential Diagnosis of Ulcerative Lesions in Fish*, 109 ENVTL. HEALTH PERSPECTIVES 618, 685 (2001); E.J. Noga et al., *Acute Stress Causes Skin Ulceration in Striped Bass and Hybrid Bass (Morone)*, 35 VETERINARIAN PATHOLOGY 102, 102 (1998).

143. See Dykstra & Kane, *supra* note 134, at 18.

144. R.E. Magnien, *The Dynamics of Science, Perception, and Policy During the Outbreak of Pfiesteria in the Chesapeake Bay*, 51 BIOSCIENCE 10 (2001).

145. Chesapeake Bay Found., *At Last, a Limit: Menhaden Industry Capped*, 32 SAVE THE BAY 5 (2006). Chesapeake Bay President William Baker called menhaden “the most ecologically valuable fish in the Bay.” *Id.* at 2.

146. Legend has it that Squanto first instructed the Pilgrims at Plymouth in 1621 on the art of fertilizing their cornfields with menhaden. RUSSELL, *supra* note 132, at 218.

147. See Chesapeake Bay Ecological Found., Inc., *supra* note 9. Menhaden are also a source of Omega fish oil, a popular food supplement, and chicken feed. H. Bruce Franklin, *Fishing for the Future*, AM. SCI. ONLINE, Sept.-Oct. 2005, <http://www.chesbay.org/articles/2.asp> (“Chickens are fed hundreds of thousands of tons of ground-up menhaden stripped from the bay. These runoffs produce deadly overgrowths of algae.” (reviewing RUSSELL, *supra* note 132)). Menhaden is the commercial species landed in greatest numbers in Maryland. STEDMAN & HANSON, *supra* note 6, at 4.

148. CHESAPEAKE BAY FOUND. ET AL., *supra* note 135, at 6; Coastal Conservation Ass’n Maryland, Position Papers, Atlantic Menhaden, <http://www.ccamd.org/Homepage/PositionPapers/PPatlanticmenhaden.htm> (last visited Nov. 11, 2007); see also RUSSELL, *supra* note 132, at 226 (describing how menhaden recruitment (the number of new menhaden) “has plummeted,” dropping from 4.4 billion fish per year between 1975-1991, to 500 million in 2001, “the lowest figure ever recorded”). Maryland has recognized the need to protect Atlantic menhaden and has both prohibited purse seining of Atlantic menhaden and implemented catch limits on menhaden. Chesapeake Bay Found., *supra* note 145, at 5. Virginia has recently proposed capping the

particularly concerned about “a possible ‘localized depletion’” of menhaden populations in the Bay, which is “one of the species’ key nursery areas.”¹⁴⁹ “The thing is, menhaden are like passenger pigeons. It could be over before you’d ever know they were overfished, because their populations are extremely volatile and very responsive to environmental flux. Their response to a profound change in the availability of food, or anything like that, is to crash.”¹⁵⁰

Menhaden are an important food source for game fish like striped bass. Historically menhaden comprised 70% to 80% of striped bass food.¹⁵¹ The problem is that the resurgent striped bass population has occurred at the same time that the menhaden population has plunged, leading to weight loss in striped bass, a higher incidence of disease in the fish, and possibly a shorter life span.¹⁵² The current amount of menhaden in the Bay is insufficient to support the nutritional needs of the striped bass population.¹⁵³ Some have even suggested that had the menhaden population been at its historical size, the striped bass population would not have suffered so greatly from the outbreak of *Pfisteria* in 1997.¹⁵⁴

Loons, who feed on menhaden, have also been adversely affected by the decline in the menhaden population.¹⁵⁵ During the 1990s, the size of a typical Bay flock of loons went from 750 to 1000 birds during a three-hour observation period to between 15 and 40.¹⁵⁶ The absence of menhaden schools has also caused a decrease in osprey chick survival as well as a decline in active osprey nests.¹⁵⁷

menhaden catch at current industrial harvest levels. Purse seine nets “encircle whole schools of fish under the direction of spotter planes.” *Id.* at 4.

149. Ecosystem Health, *supra* note 1, at 12. Another source of pressure on menhaden is the loss of wetlands in the Bay system. By the 1980s, Maryland had lost 73% of its original estimated wetland base. As menhaden has a particularly strong tie to coastal wetlands and their detrital food chain. It is not surprising, given continuing coastal wetland loss and fishing pressure, that the menhaden fishery has declined by about 26% (pounds landed) since 1983. STEDMAN & HANSON, *supra* note 6, at 4.

150. Boston University biologist Les Kaufman, *quoted in* RUSSELL, *supra* note 132, at 229-30.

151. CHESAPEAKE BAY FOUND., *supra* note 61, at 4.

152. *Id.* Because the number of juvenile fish has decreased, the menhaden fishing industry is taking older fish, the same fish the striped bass forage on, further depleting the menhaden’s “spawning biomass.” RUSSELL, *supra* note 132, at 226.

153. *See, e.g.*, RUSSELL & MAY, *supra* note 89, at 333-34. For a discussion of the health of striped bass, see John Jacobs et al., Striped Bass Health, <http://www.dnr.state.md.us/fisheries/oxford/stripedbass> (last updated Apr. 23, 2002).

154. RUSSELL & MAY, *supra* note 89, at 334.

155. RUSSELL, *supra* note 132, at 227.

156. *Id.*

157. *Id.* (noting that “a similar pattern” is being observed in other areas along the Eastern seaboard).

Reducing the catch of menhaden would have the added beneficial side effect of improving water quality. As Russell and May noted:

[M]enhaden swim in dense schools with their open mouths sucking up vast amounts of plankton along with all sorts of detritus—like giant vacuum cleaners. This filter feeding helps clear the water by purging suspended particulate matter, thus decreasing turbidity, which encourages filtering grasses to grow. In addition, the menhaden’s filter feeding greatly limits the spread of potentially deadly algae blooms responsible for oxygen-depleting “dead zones” and diseases.¹⁵⁸

Indeed, “menhaden are the only filtering agent of note in the Bay.”¹⁵⁹ This important filtering function has caused marine biologist Sara Gottlieb to equate overfishing menhaden to removing a human liver, stating, “[j]ust as your body needs its liver to filter out toxins, ecosystems also need those natural filters.”¹⁶⁰ Similarly, Jim Uphoff, Stock Assessment Coordinator for the Maryland Department of Natural Resources commented that “[t]here’s nothing in the Chesapeake Bay that can take the place of menhaden You have the potential to cause a major ecosystem problem [by overfishing menhaden].”¹⁶¹ Former EPA Director of the Chesapeake Bay Program Bill Matuszeski has also proclaimed that “[w]e need to start managing menhaden for their role in the overall ecological system.”¹⁶²

As the foregoing discussion demonstrates, chumming adversely affects the Chesapeake Bay’s water quality by lowering dissolved oxygen levels and increasing turbidity. The practice is contributing to eutrophication of the Bay and species loss. Chum is part of a positive feedback loop that is leading to the Bay’s decline—impaired water quality, loss of SAV, and declining fish and shellfish populations. Species that cannot tolerate low dissolved oxygen levels and increased turbidity are forced to relocate to areas of higher water quality, more

158. *Id.* at 333.

159. *Id.* Dick Russell describes menhaden “as a critical species in the flow of energy and nutrients, billions of silvery sea-strainers that improve water quality and hold down algae growth.” *Id.* at 219. Russell notes that “the capacity of menhaden to ‘filter’ phytoplankton is unmatched by any other fish species.” *Id.*

160. See H. Bruce Franklin, *Net Losses: Declaring War on the Menhaden*, MOTHER JONES, Mar./Apr. 2006, http://www.motherjones.com/news/feature/2006/03/net_losses.html.

161. Coastal Conservation Ass’n Va., News Item, http://www.ccavirginia.org/cca_va_html/MenhadenExperts.htm (last visited Jan. 16, 2007).

162. *Id.*; see also RUSSELL, *supra* note 132, at 234 (“You have the menhaden industry harvesting hundreds of millions of pounds out of the bay, of a filter feeder that should be eating algae. Then the menhaden are being ground up and processed into a feed that’s going to chickens. The chickens are producing all this manure and nitrogen that ends up back in the water, stimulating more algae growth. And that can stimulate disease outbreaks—the prime victim of which is menhaden!” (quoting Bill Goldsborough, a Chesapeake Bay Foundation scientist)).

abundant food, and better habitat; those that cannot move perish. The resultant stress on important game fish reduces the ability of their immune systems to fend off opportunistic infections and increases the likelihood that such species will become ill or die. The practice may also serve as a direct vector for the transmittal of disease to fish that consume chum and may well be one of the reasons the population of a vitally necessary food and filter-feeding fish, menhaden, is thought to be close to collapse.¹⁶³

Given that chumming has serious adverse impacts on the health of the Chesapeake Bay, is it within the regulatory jurisdiction of either federal or state clean water laws; and if it is, can citizens compel regulation?

IV. COMPELLING REGULATORY ACTION

A strong case can be made that chumming can be regulated under both federal and state water quality laws. However, this does not mean that citizens can compel its regulation.

A. *Authority To Regulate Chumming*

As is the case in many states, the EPA has delegated authority to implement the CWA in Maryland to the Maryland Department of the Environment (MDE).¹⁶⁴ This delegation of authority requires that MDE “not adopt or enforce any effluent limitation, or other limitation, effluent standard, prohibition, pretreatment standard, or standard of performance which is less stringent than the effluent limitation, or other limitation, effluent standard, prohibition, pretreatment standard, or standard of performance” established by the federal CWA.¹⁶⁵ Therefore, this Article examines federal and Maryland law in tandem, except where Maryland law contains additional authority.

163. Russell speaking of menhaden says that he can “think of no better definition for the phrase ‘vicious circle’ . . . [t]he intricate web that nature has woven into and around the Chesapeake Bay ecosystem—where what happens to algae, menhaden, striped bass, and chickens is all interrelated—human practices can rapidly rend asunder.” RUSSELL, *supra* note 132, at 234.

164. 33 U.S.C. § 1314(b) (2000); MD. CODE REGS. § 26.08.02.10(A)(2) (2007).

165. 33 U.S.C. § 1370; *see also* No. Plains Res. Council v. Fid. Exploration & Dev. Co., 325 F.3d 1155, 1164 (9th Cir. 2003) (“[A state] has no authority to create a permit exemption from the [Clean Water Act] for discharges that would otherwise be subject to the [National Pollutant Discharge Elimination System] permitting process.”); *Menzel v. County Utils. Corp.*, 712 F.2d 91, 93 n.3 (4th Cir. 1983); DANIEL P. SELMI & KENNETH A. MANASTER, STATE ENVIRONMENTAL LAW §§ 6:8, 11:3 (2006).

The federal CWA prohibits discharges of “any pollutant by any person” from a point source without a permit.¹⁶⁶ In implementing the requirements of the federal CWA, Maryland similarly requires a permit before pollutants can be discharged into its waters¹⁶⁷ and bars the release of wastes unless they have been pretreated or subject to “other corrective action to protect the legitimate beneficial uses” of the state’s waters.¹⁶⁸ In addition, Maryland water quality standards contain an antidegradation policy that protects existing beneficial uses of state waters.¹⁶⁹ Therefore, if chumming falls within the prohibitions of either federal or Maryland law, it can be prohibited unless specifically authorized pursuant to a discharge permit.

1. Chum Is a Pollutant Under Federal and Maryland Law

Chum fits the definition of “pollutant” under the federal CWA and Maryland law. The federal CWA includes within the definition of “pollutant” “biological materials,”¹⁷⁰ and federal courts have read this term to include substances such as dead fish and shellfish.¹⁷¹ Therefore, chum is a “pollutant” under the federal CWA.¹⁷²

166. 33 U.S.C. § 1311(a) (2000).

167. MD. CODE ANN., ENVIR. § 9-322 (2007); MD. CODE REGS. § 26.08.04.01(B).

168. MD. CODE REGS. §§ 9-302(b), 4-402.

169. *Id.* § 26.08.02.04.

170. 33 U.S.C. § 1362(6).

171. *See* Ass’n of Pac. Fisheries v. EPA, 615 F.2d 794, 802 (9th Cir. 1980) (affirming district court’s determination that discharged water mixed with unused fish residuals from processing is effluent); *see also* U.S. Pub. Interest Research Group v. Atl. Salmon of Me., 339 F.3d 23, 28 (1st Cir. 2003) (noting introduction of live, nonnative salmon to a body of water is a discharge of a pollutant). Thus, chum is a pollutant even where it is comprised of biological materials harvested from the Bay and discharged back to the same waters because chum is processed by people and have the potential to adversely affect water quality. Nat’l Wildlife Fed’n v. Consumers Power Co., 862 F.2d 580 (6th Cir. 1988) (“[W]hen fish are removed from the waters of the United States, and subsequently dead fish or fish parts are released into the waters, an ‘addition’ of pollution occurs.”); Ass’n To Protect Hammersley, Eld. & Totten Inlets v. Taylor Res., Inc., 299 F.3d 1007, 1017 (9th Cir. 2002) (finding that processed fish or shellfish and thus altered by human or industrial processes and then discharged in amounts that “might affect the biological composition of the water” might constitute a pollutant under the CWA even though lives mussels were not); *cf.* Rybachek v. EPA, 904 F.2d 1276, 1285 (9th Cir. 1990) (holding that a mining operation involving excavation of dirt and gravel near a waterway and the discharge of the same materials back into the water was an “addition” of pollutants). The fact that a substance is discharged for a useful purpose (i.e., as a fish attractant) does not alter its status as a pollutant. *See, e.g.*, Hudson River Fishermen’s Ass’n v. City of New York, 751 F. Supp. 1088, 1101 (S.D.N.Y. 1990), *aff’d*, 940 F.2d 649 (2d Cir. 1991) (“[A] pollutant is a pollutant no matter how useful it may earlier have been.”).

172. Under the federal CWA, chum is considered to be a “conventional pollutant” because it contributes to BOD, total suspended solids, and oil. 40 C.F.R. § 401.16 (2006).

Similarly, chum falls within Maryland's definition of "pollutant," which includes any "liquid, gaseous, solid or other substance that will pollute any waters of this state."¹⁷³ This definition clearly covers chum, which consists of both solids and liquids and will pollute the waters of the Chesapeake Bay where it is discharged by increasing BOD and turbidity. Chum also constitutes "pollution" under Maryland law because it results in

contamination or other alteration of the physical, chemical, or biological properties of any waters of this State, including a change in temperature, taste, color, turbidity, or odor of the waters or the discharge or deposit of any organic matter, harmful organism, or liquid, gaseous, solid, radioactive, or other substance into any waters of this State that will render the waters harmful, or detrimental, to:

- a. Public health, safety, or welfare;
- b. Domestic, commercial, industrial, agricultural, recreational, or other legitimate beneficial uses;
- c. Livestock, wild animals, birds; or
- d. Fish or other aquatic life.¹⁷⁴

Because chum is a pollutant, chumming, which involves the release of chum into the water, on its face appears to be a discharge of a pollutant. However, to be a discharge of a pollutant within the meaning of the CWA, the addition of chum to the waters of the Bay must be from a point source.¹⁷⁵ Maryland law defines "discharge" as "[t]he addition, introduction, leaking, spilling, or emitting of a pollutant into the waters of this State; or the placing of a pollutant in a location where the pollutant is likely to pollute,"¹⁷⁶ but does not confine the source of the discharge to a point source.

2. A Boat Is Arguably a Point Source Under the CWA and an Irrelevant Concern Under Maryland Law

Under the federal CWA and Maryland law, a "point source" is defined as "any discernible, confined and discrete conveyance, including . . . any . . . vessel or other floating craft, from which pollutants are or may be discharged."¹⁷⁷ The United States Supreme Court has read the statutory definition of "point source" broadly to include ships.¹⁷⁸ The

173. MD. CODE ANN., ENVIR. § 9-101(g); MD. CODE REGS. § 26.08.01.01B(66).

174. MD. CODE ANN., ENVIR. § 9-101(b); MD. CODE REGS. § 26.08.01.01B(67).

175. 33 U.S.C. § 1362(14) (2000).

176. MD. CODE ANN., ENVIR. § 9-101(b).

177. 33 U.S.C. § 1362(14) (emphasis added); MD. CODE REGS. § 26.08.01.01(B)(65).

178. See *Dague v. City of Burlington*, 935 F.2d 1343, 1354 (2d Cir. 1991) (stating the definition of point source is to be interpreted broadly); *Weinberger v. Romero-Barcelo*, 456 U.S.

question is whether the discharge of chum from a fishing boat is from a boat or from the person on the boat. If it is the latter, there may not be a jurisdictional point source under federal law.

According to the United States Court of Appeals for the Second Circuit, people cannot be point sources, at least for purposes of applying the CWA's criminal penalty provisions.¹⁷⁹ However, the Third and Sixth Circuits have found that pollution emitted by people while on boats constituted point source discharges.¹⁸⁰ Thus, the dumping of barrels containing bilge slop, ash, and unburned wastes from a tug boat¹⁸¹ and sandblasting residue from a floating craft¹⁸² have been actionable under the federal CWA.¹⁸³ Ladling chum over the side of a boat or agitating the water with porous buckets containing chum from the side of the boat is only different in degree from slops being tossed over the side of a boat and quite similar to sandblasting residue to the extent there is almost a

305, 309 (1982) (“[T]he release of ordnance. . . from ships into navigable waters is a discharge of pollutants, even though the EPA . . . had not promulgated any regulations setting effluent levels or providing for the issuance of an NPDES permit for this category of pollutants.”); *Avoyelles Sportsmen’s League, Inc. v. Marsh*, 715 F.2d 897, 922 (5th Cir. 1983) (finding that bulldozers and backhoes are point sources).

179. *United States v. Plaza Labs., Inc.*, 3 F.3d 643 (2d Cir. 1993) (holding that a person cannot be a point source, finding that an individual who placed vials of contaminated blood in a rocky area below the high tide of the Hudson River was not criminally liable under the CWA, and saying, “[w]e find no suggestion either in the act itself or in the history of its passage that Congress intended the Clean Water Act to impose criminal liability on an individual for the myriad, random acts of human waste disposal, for example, a passerby who flings a candy wrapper in the Hudson River, or a urinating swimmer”).

180. *United States v. W. Indies Transp. Inc.*, 127 F.3d 299, 308 (3d Cir. 1997); *United States v. M/G Transp. Serv.*, 173 F.3d 584, 586 (6th Cir. 1999).

181. *See M/G Transp. Servs., Inc.*, 173 F.3d at 586 (upholding a criminal conviction against individuals who dumped “bilge slop,” ash, and unburned waste residues from barrels while on a tug boat constituted point source discharges).

182. *W. Indies Transp.*, 127 F.3d at 308 (finding that sandblasting conducted on a floating craft that caused residue to fall into the water constituted a point source discharge); *see also League of Wilderness Defenders/Blue Mountains Biodiversity Project v. Forsgren*, 309 F.3d 1181, 1185 (9th Cir. 2002) (finding that the statutory definition of point source “clearly encompasses an aircraft equipped with tanks spraying pesticide from mechanical sprayers directly over covered waters”).

183. *See WILLIAM H. RODGERS, ENVIRONMENTAL LAW: AIR AND WATER* § 4.10, at 150-51 (1986) (offering the “controllability theory” as a way of explaining why courts treat as point sources those sources of pollution that can be identified controlled at their source); *Concerned Area Residents for the Env’t. v. Southview Farm*, 34 F.3d 114, 118 (2d Cir. 1994) (agreeing with appellants that even though liquid manure flowing from farm fields “could be characterized . . . as diffuse run-off, the manure pollutant was nevertheless thereafter channeled or collected sufficiently to constitute a discharge from a point source”); *Sierra Club v. Abston Constr. Co.*, 620 F.2d 41, 47 (5th Cir. 1990) (holding that surface water runoff from piles of dirt were point sources of pollution when they had been collected or channeled by miners in connection with the mining activity); *United States v. Earth Sciences, Inc.*, 599 F.2d 368, 373 (10th Cir. 1979) (holding that leachate that overflowed from a mine reserve sump was a point source); *U.S. Pub. Interest Research Group v. Atl. Salmon of Me., L.L.C.*, 215 F. Supp. 2d 239, 256 (D. Me. 2002).

continuous stream of pollutants that goes on during the fishing day. In addition, the fact that chumming is controlled at its source by humans provides a further basis to consider chumming to be a point source discharge of a pollutant.¹⁸⁴

Maryland law extends beyond federal law by prohibiting the discharge of a pollutant by any person, regardless of whether that person is at or on a point source.¹⁸⁵ So even though Maryland regulations contain the same definition of point source found in the CWA,¹⁸⁶ it has not applied that definition to limit the scope of the term “discharge.”¹⁸⁷ If the state was suddenly to do this, and if chumming qualifies as a prohibited unpermitted discharge from a point source under federal law, then Maryland must prohibit the practice of chumming in the Chesapeake Bay as well because Maryland law must be at least as stringent as federal law under its delegated authority.¹⁸⁸ Therefore, either

184. See RODGERS, *supra* note 183, § 4.10, at 150-51 (offering the “controllability theory” as a way of explaining why courts treat as point sources those sources of pollution that can be identified controlled at their source); *Concerned Area Residents for the Env’t v. Southview Farm*, 34 F.3d 114, 118 (2d Cir. 1994) (agreeing with appellants that even though liquid manure flowing from farm fields “could be characterized as diffuse run-off, the manure pollutant was nevertheless thereafter channeled or collected sufficiently to constitute a discharge from a point source”); *Sierra Club v. Abston Constr. Co.*, 620 F.2d 4, 47 (5th Cir. 1990) (holding that surface water runoff from piles of dirt were point sources of pollution when they had been collected or channeled by miners in connection with the mining activity); *United States v. Earth Sciences, Inc.*, 599 F.2d 368, 373 (10th Cir. 1979) (holding that leachate that overflowed from a mine reserve sump was a point source); *U.S. Pub. Interest Research Group v. Atl. Salmon of Me., L.L.C.*, 215 F. Supp. 2d 239, 256 (D. Me. 2002).

185. MD. CODE ANN., ENVIR. § 9-322 (1996).

186. MD. CODE REGS. 26.08.01.01(65) (defining point source as “any discernible, confined and discrete conveyance, including any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or floating craft, from which pollutants are, or may be discharged”).

187. Maryland law extends beyond federal law in protection of water quality by prohibiting the discharge of pollutants by any person, irrespective of whether that person is at or on a point source. MD. CODE ANN., ENVIR. § 9-322. Although Maryland has point source regulations related to effluent limitations, see MD. CODE REGS. § 26.08.01.01(B)(23) (defining “effluent” as “the outflow of treated or untreated waste from . . . [a] point source”), and its antidegradation policy, see MD. CODE REGS. § 26.08.02.04, these regulations should not be read to limit the Environment Code’s prohibition against discharge of pollutants to point sources.

Further, the Maryland rules are coterminous with the “point source” definition in the federal CWA and, therefore, are interpreted in a similar manner. See *Faulk v. State’s Attorney for Harford County*, 474 A.2d 880, 887 (Md. 1984) (“Where the purpose and language of a federal statute are substantially the same as that of a later state statute, interpretations of the federal statute are ordinarily persuasive.”). The federal definition is interpreted broadly. *Dague v. City of Burlington*, 935 F.2d 1343, 1354 (2d Cir. 1991).

188. Pursuant to its delegated authority under the federal CWA, MDE may “not adopt or enforce any effluent limitation, or other limitation, effluent standard, prohibition, pretreatment standard, or standard of performance which is less stringent than the effluent limitation, or other limitation, effluent standard, prohibition, pretreatment standard, or standard of performance” established by the federal CWA. 33 U.S.C. § 1370 (2000); *No. Plains Res. Council v. Fidelity*

by operation of its own law or by operation of federal law, assuming the practice of chumming triggers the CWA's permitting requirements, the state must prohibit chumming because it involves the unpermitted discharge of a pollutant into Maryland waters.

3. Maryland's Water Quality Standards and Antidegradation Policies Independently Require the State To Ban Chumming

Maryland has regulations establishing beneficial water use classifications, such as fishing and water contact sports, and water quality criteria for achieving those use classifications.¹⁸⁹ The use classifications and criteria for the Bay also require the protection of fish and aquatic life as a "beneficial use" of the waters.¹⁹⁰ The Bay, with the exception of its main stem and associated tributary subcategories, must meet the water quality criteria established for Use I water bodies.¹⁹¹ Chumming is taking place in areas protected by Use I criteria. Use I criteria prescribe a dissolved oxygen level of at least 5 mg/l at all times (the level necessary to support many species),¹⁹² and state that turbidity must not exceed levels detrimental to aquatic life.¹⁹³ As chumming reduces dissolved oxygen levels well below the prescribed criterion and causes turbidity to increase to levels that are detrimental to aquatic life, the practice violates the state's water quality standards.

As part of its water quality standards, Maryland must establish antidegradation policies that protect existing uses of water segments and prevent the quality of waters that exceed the statute's fishable/swimmable

Exploration & Dev. Co., 325 F.3d 1155, 1164 (9th Cir. 2003) ([A state] "has no authority to create a permit exemption from the [CWA] for discharges that would otherwise be subject to the [National Pollutant Discharge Elimination System] permitting process."); *see also* Faulk v. State's Attorney for Harford County, 474 A.2d 880, 887 (1984) ("Where the purpose and language of a federal statute are substantially the same as that of a later state statute, interpretations of the federal statute are ordinarily persuasive."); *cf.* Menzel v. County Utils. Corp., 712 F.2d 91, 93 n.3 (4th Cir. 1983) (noting that the Clean Water Act "vests the states with authority to impose more stringent effluent limitations than are required by federal standards").

189. MD. CODE REGS. § 26.08.02.02(B) (listing designated uses); COMAR § 26.08.02.03-3 (designating criteria for designated uses); *see also* EPA, WATER QUALITY STANDARDS HANDBOOK § 2.1.2, at 2-1 (1993), <http://www.epa.gov/waterscience/standards/handbook> (explaining that the protection of aquatic life is a recognized "use" of waters under the federal CWA).

190. *See, e.g.*, MD. CODE REGS. § 26.08.02.08 (listing stream segment designations); *see also* EPA WATER QUALITY STANDARDS HANDBOOK, *supra* note 189, § 2.1.2, at 2-1 (explaining that the protection of aquatic life is a recognized "use" of waters under the CWA).

191. MD. CODE REGS. §§ 26.08.02.03-3(C)(5), (8)(a).

192. *Id.*

193. *Id.* § 26.08.02.03-3(A)(5)(a)-(b) (finding no more than 150 units at once or fifty units as a monthly average (in Nephelometer Turbidity Units)).

goal from worsening.¹⁹⁴ Maryland's antidegradation policy provides that state waters "shall be protected and maintained for existing uses,"¹⁹⁵ and "[w]ater which does not meet the standards established for it shall be improved to meet the standards."¹⁹⁶ While no court has yet reviewed Maryland's antidegradation policies or their application, other state courts have interpreted their state antidegradation policies to impose an affirmative duty on agencies to apply sufficiently stringent pollution controls in discharge permits to protect existing water quality.¹⁹⁷ Other state courts have also held that state antidegradation policies must comply with the minimum requirements of the federal antidegradation policy.¹⁹⁸ Chumming clearly violates Maryland's antidegradation policy because the state cannot ensure that the water quality of the Bay is maintained at its current level, let alone improved, when chumming is permitted.

Therefore, it appears as though a strong case can be made that chumming falls within the permitting requirements of both federal and state law and, under Maryland's antidegradation policies, can be prohibited.

B. Barriers to the Prohibition or Strict Regulation of Chumming

Despite all of the environmental problems associated with chumming and that the CWA and Maryland's water quality laws more likely than not cover the practice, several factors conspire against its regulation, let alone its prohibition. One barrier is the lack of political support for any action that might inhibit the practice because of its

194. 40 C.F.R. § 131.12(a)(d) (2006) ("[Each s]tate shall develop and adopt a statewide antidegradation policy and identify the methods for implementing such policy pursuant to this subpart.").

195. MD. CODE REGS. § 26.08.02.04(A). The federal and Maryland antidegradation policies are comparable, with each having three tiers. Maryland's tier 1 antidegradation regulation, however, is the only tier applicable to the Chesapeake Bay.

196. *Id.* § 26.08.02.04(F).

197. *See, e.g., Ex parte Fowl River Prot. Ass'n, Inc.*, 572 So. 2d 446, 450 (Ala. 1990) (applying Alabama's tier 1 antidegradation policy to reverse the state agency's issuance of an NPDES permit that would degrade existing uses of Mobile Bay and noting that the "national antidegradation policy by its own terms, is . . . a mandatory provision"); *In re Issuance of a Permit by Dep't of Env'tl. Prot. to Ciba-Geigy Corp.*, 576 A.2d 784, 793 (N.J. 1990) (interpreting New Jersey's tier 2 antidegradation regulations as imposing mandatory duties on the state permitting agency as part of the NPDES permitting process).

198. *See, e.g., Ohio Valley Env'tl. Coal. v. Horinko*, 279 F. Supp. 2d 732 (S.D. W.Va. 2003) (finding EPA's approval of West Virginia's antidegradation policy inconsistent in part with federal requirements); *Rivers Unlimited, Inc. v. Schregardus*, 685 N.E.2d 603, 603 (Ohio Com. Pl. 1997) (invalidating Ohio's antidegradation policy under the Supremacy Clause because it was inconsistent with federal requirements).

importance to the recreational fishing industry, a vital part of Maryland's economy; the other is that citizens cannot compel governmental action in this situation.¹⁹⁹

1. Economic Importance of the Recreational Fishing Industry

The recreational fishing industry contributes more than \$31 billion dollars per year to the country's economy.²⁰⁰ Recreational fishing is a particularly important part of Maryland's economy. According to a 1998 survey by the National Oceanic and Atmospheric Administration, Maryland anglers who lived in the state spent approximately \$696 million; nonresident anglers spent an additional \$63 million.²⁰¹ In 1991, the National Marine Fisheries Service calculated that over 430,000 anglers spent in excess of \$275 million fishing in Maryland's waters, which produced nearly \$14 million in state sales tax.²⁰²

Over one-third of the recreational fishing in the state is saltwater sportfishing in the Chesapeake Bay.²⁰³ Saltwater recreational fishing in 1991 generated nearly 5000 jobs and resulted in more than \$103 million in earnings for people in Maryland's coastal communities.²⁰⁴ "Due to the quality and variety of recreational fishing opportunities, Maryland has the second highest level of expenditures by saltwater anglers in the Northeast Region."²⁰⁵ Anglers who seasonally flock to the Eastern Shore of Maryland from the mid-Atlantic states spend money not only on fishing, but also on lodging, food, fuel, bait, and tackle, bringing a welcome "economic shot in the arm" for many small coastal

199. Rodgers notes that when courts are asked to review agency action, judges are inclined "to accept the legislative judgment as dictating the ethical necessities of a particular judicial decision," courts have a harder time "deriving and defining the controlling legislative ethic," with the result that "they are deferring to administrative choice and reducing the hard look doctrine solely to a process right." Rodgers, *supra* note 14, at 225. The result is that agencies are "accorded considerable room to roam, constrained only by process protections for likely victims." *Id.* at 226.

200. Press Release, Md. Saltwater Sportfishermen's Ass'n, Congress Passes Magnuson-Stevens Act (Dec. 11, 2006), available at http://www.mssa.net/subpages/news_121106mag.html.

201. Scott Steinbeck & Brad Gentner, *Marine Angler Expenditures in the Northeast Region, 1998*, NOAA Technical Memorandum, NMFS-F/SPO-47, at 19 (May 2001), available at http://www.st.nmfs.gov/st5/RecEcon/Publications/NMFS_F_SPo_47rev.pdf.

202. STEDMAN & HANSON, *supra* note 6, at 5. In 1995, the dockside value of Maryland's commercial fisheries was more than \$60 million, which contributed substantially to the economics of communities such as Baltimore, Ocean City, St. Michaels, Tilghman, Cambridge, Easton, Chestertown, Aberdeen, Pocomoke City, Annapolis, and Solomons. *Id.*

203. STEDMAN & HANSON, *supra* note 6, at 4.

204. *Id.*

205. Charlie Petrocci, *The Deep Lines of Fishing—Part I an Economic Engine*, Skipjack Net, Rural Development Center at the University of Maryland Eastern Shore 2 (2004), available at <http://www.skipjack.net/article.asp?StoryID-33>.

communities.²⁰⁶ “As long as fish make their annual seasonal migration, then fishermen and women won’t be far behind, pumping dollars into the local economy.”²⁰⁷

Charter boats are an important part of Maryland’s recreational fishing industry.²⁰⁸ Over 200 charter boats ply the waters of the Bay.²⁰⁹ Charter boats have “deep cultural roots in recreational fishing.”²¹⁰ To the extent that prohibiting the practice of chumming would decrease the success of charter boat captains because fewer fish might be caught, the severe regulation, let alone prohibition, of the practice might provoke substantial resistance.

Political resistance to regulating an important element of Maryland’s economy, however, is not insurmountable. Since chumming is already leading to a decrease in fish because of its impact on water quality and the menhaden population, the livelihood of charter boat owners is even now on borrowed time. Thus, any action by the state’s regulators to improve Bay water quality, and thus assure the presence of fish, should be welcome.²¹¹

2. Discretionary Responsibilities

Presuming that a court agrees that the discharge of chum from the side of a boat without a permit triggers liability under federal and/or Maryland law, then there should be no barrier to bringing an action against an individual charter boat captain under the law of either jurisdiction. However, such a strategy is too piecemeal, attenuated, and resource-intensive to make much of a dent in the problem.²¹² More effective would be an action to compel either the EPA or Maryland to

206. *Id.*

207. *Id.*

208. *Id.* at 1.

209. *Id.* The advent of richer anglers who can buy their own boats has cut into the charter boat business. *Id.* Charter5 boats charge from \$55 to \$700 per trip. *Id.* at 2.

210. *Id.* at 1.

211. A recent survey reported that recreational boaters on the Chesapeake Bay were willing to pay \$7.3 million annually for improved water quality (the present value of the improved water quality was calculated at \$146 million using a 5% discount rate). Douglas Lipton, Univ. Md., Dep’t of Agric. & Res. Econ., *The Value of Improved Water Quality to Chesapeake Bay Boaters* 3 (2003); see also Rodgers, *supra* note 14, at 219 (observing that northwest fishermen “are more inclined to tolerate conservation closures for the benefit of future generations than allocation closures for the benefit of other users”).

212. Citizens can sue to stop unpermitted discharges even when the agency administering the permitting program has determined no permit is required. See *Ass’n To Protect Hammersley, Eld, & Totten Inlets v. Taylor Res., Inc.*, 299 F.3d 1007, 1011-13 (9th Cir. 2002) (rejecting contrary position “because it runs squarely against the plain words of the statute and would frustrate the purposes of the Clean Water Act’s empowerment of citizen suits”).

prohibit or strictly regulate the activity. But this approach, especially at the federal level, is fraught with problems.

a. **Compelling Federal Action To Regulate Chumming or Undertake Enforcement Action**

Under section 505(a)(2) of the CWA, citizens can only sue the EPA when the agency fails to perform a nondiscretionary duty or performs that duty in a way that violates the statute.²¹³ Here, the agency's omission would be the failure to promulgate effluent limitations for the category of chumming, which would find expression in a discharge permit.²¹⁴ However, the CWA does not compel the EPA to issue such limitations. Section 301(b) merely establishes a timetable for compliance with any limitations the EPA does establish, including those for conventional pollutants like BOD and turbidity, and while the Supreme Court has held that the agency had authority to regulate classes and categories of activities; it has not held that it must.²¹⁵ Nor does section 304(b), which requires the EPA to issue guidelines for effluent limitations, require their promulgation for all sources.²¹⁶ Thus, congressional authorization for the EPA to issue effluent limitations does not create an enforceable duty within the meaning of § 505(a)(2).

213. 33 U.S.C. § 1365(a)(2) (2000).

214. Effluent limitations establish the amount, concentration, rate of discharge of pollutants from a point source into navigable waters. *Id.* The Administrator, or state in the case of a delegated program, can condition discharge permits issued under section 402(a) to assure compliance with the applicable effluent limitations. *Id.*; *see also* *Natural Res. Def. Council v. Train*, 510 F.2d 692, 696 (D.C. Cir. 1974) (stating that the EPA's regulations implementing section 402 "require that each 'NPDES permit apply and insure compliance with . . . (e)ffluent limitations under sections 301 and 302 of the Act'").

215. *E.I. DuPont de Nemours v. Train*, 430 U.S. 112, 127-28 (1977). *But see* *Reynolds Metals Co. v. EPA*, 760 F.2d 549, 552 (4th Cir. 1985) (citing *DuPont* for the proposition that the CWA "directs the EPA to issue nationally applicable effluent limitations guidelines and standards"). In fact, EPA can develop and apply effluent limitations on a case-by-case basis under section 402(a) of the Act, authorizing the agency to issue permits based on its "best professional judgment" where no categorical effluent limitations exist. 33 U.S.C. § 1342(a); *see also* 40 C.F.R. § 125.3(c)(2) (2006) (authorizing application of effluent limitations on a "case-by-case basis . . . to the extent that EPA-promulgated effluent limitations are inapplicable").

216. *Natural Res. Def. Council*, 510 F.2d at 712 (holding that section 304(b)(1) does not require EPA to promulgate effluent limitations guidelines for all point sources, within one year of the CWA's enactment, but putting the agency on a compliance schedule for their publication, and rejecting the argument that section 304(b)(1)(A) requires that effluent limitations must cover all point sources because section 301(e) requires that effluent limitations be applied to all point sources). Section 304(m) requires agency to review guidelines for toxic and nonconventional pollutants biennially for the purpose of identifying new categories of sources for which there are no guidelines and establish a schedule for their promulgation, it pointedly does not do this for conventional pollutants like BD or turbidity. 33 U.S.C. § 1314(m).

Similarly, the EPA is under no duty to bring an enforcement action against individuals who chum for discharging a pollutant without a permit. Under section 309(a)(1), the Administrator of the EPA must first make a “finding” of violation before it can bring an action against any person, including a state, alleged to be in violation of the act.²¹⁷ The EPA has not made a finding that chumming violates the Act,²¹⁸ and cannot be compelled to.²¹⁹ Even if it were to make such a finding,²²⁰ the agency is under no compulsion to issue an enforcement order under 309(a)(3). The courts have been very clear that how an agency chooses to expend its enforcement resources is well within its discretion, and those decisions will not be reviewed by a court.²²¹ Indeed, the Fifth, Eighth, Ninth, and Tenth Circuits have all read section 309(a)(3) of the CWA as discretionary.²²²

Finally, the EPA is under no duty to force Maryland to ban or regulate chumming or enforce Maryland law against those who engage in the practice. There are several theories under which the EPA might proceed against Maryland; however, none of them holds out much

217. 33 U.S.C. § 1319(a)(1) (“Whenever on the basis of any information available to him, the Administrator *finds* that any person is in violation of . . . this title . . . [he] shall issue an order requiring such person to comply with such section or requirement, or he shall bring a civil action.” (emphasis added)).

218. In fact, the EPA has specifically declined to make such a finding. See Letter from Jon M. Capacasa, Director, Water Prot. Div., U.S. EPA, Region III, to Norman Bartlett (Oct. 14, 2005) (explaining that the EPA has not developed regulations to address chum in surface waters “due to a lack of data indicating that chumming adversely impacts water quality”); Letter from Benjamin H. Grumbles, EPA Assistant Administrator for Water, to U.S. Representative Wayne Gilchrest (Oct. 27, 2004) (“[T]he agency has not developed a position on the regulation of chum or other bait-like products under the Clean Water Act.”); Letter from Bradley M. Campbell, Reg’l Adm’r of EPA Region III, to Norman Bartlett (Feb. 24, 2000) (on file with author) (“EPA defines boating, including anchored boats, as sources of nonpoint pollution . . . because boats are mobile.”). It is also highly unlikely that EPA’s decision to refrain from making a predicate finding that chumming violates the CWA is challengeable under either the CWA or the APA, as a matter committed to agency discretion by law. 5 U.S.C. § 701(a)(2) (2000).

219. See 33 U.S.C. §§ 1300-1370 (2000).

220. Should the agency conclude some day that chumming does not violate the CWA, there is no reasonable likelihood of reversing such a finding. See *United States v. Mead Corp.*, 533 U.S. 218, 221 (2001) (finding that an informal agency interpretation of a statute not codified by rule in accordance with the requirements of the APA is entitled to some deference according to its degree of persuasiveness).

221. See *Heckler v. Chaney*, 470 U.S. 821, 832 (1985) (stating a presumption that enforcement actions are not justiciable under the Administrative Procedure Act).

222. See, e.g., *Sierra Club v. Train*, 557 F.2d 485, 489 (5th Cir. 1977) (predating *Heckler*, but reading CWA’s legislative history to find section 309(a)(3) discretionary); *Dubois v. Thomas*, 820 F.2d 943, 948 (8th Cir. 1987) (stating that the EPA is not compelled by section 309(a)(3) to “expend its limited resources on investigating multitudinous complaints, irrespective of the magnitude of their environmental significance”); *Sierra Club v. Whitman*, 268 F.3d 898 (9th Cir. 2001) (citing *Heckler* and other circuit court opinions to read section 309(a)(3) as discretionary); *Bravos v. EPA*, 324 F.3d 1166, 1171-73 (10th Cir. 2003) (finding similarly).

prospect for success. First, although a few district courts have held that the Administrator of the EPA has a nondiscretionary duty under section 402(c)(3) to withdraw delegated authority from a state when she determines after a public hearing that that state is not administering its program in accordance with the Act,²²³ the majority rule is that that duty is discretionary.²²⁴ Even if the duty was considered nondiscretionary, the obligation is only triggered when a state has violated some federal regulation.²²⁵ Here, where the EPA has issued no effluent limitations regulating the discharge of chum that Maryland is failing to implement or enforce, there would be no basis for a court to find that the EPA has violated a mandatory duty to withdraw its approval of Maryland's delegated authority to administer the Act.

An equally unavailing theory would be that section 309(a)(2) imposes a separate, mandatory duty on the EPA to enforce when the agency finds that violations of permit conditions or effluent limitations in a state are "so widespread" that they "appear to result from a failure of

223. See, e.g., *Save the Valley, Inc. v. EPA*, 99 F. Supp. 2d 981, 985 (S.D. Ind. 2000) (interpreting sections 309 (a)(2), (a)(3), and 402(c)(3) as imposing mandatory duties on the EPA because to rule otherwise would vitiate congressional intent); *Save the Valley v. EPA*, 223 F. Supp. 2d 997 (S.D. Ind. 2002) (affirming those interpretations by declining to order EPA either to withdraw program authority from the state or to assume enforcement of the state's permitting authority); *S.C. Wildlife Fed'n v. Alexander*, 457 F. Supp. 118, 133 (D.S.C. 1978) (finding EPA Administrator cannot ignore violation when brought to her attention, and that a district court can compel the Administrator to make a finding when one is warranted); *Illinois v. Hoffman*, 425 F. Supp. 71, 77 (S.D. Ill. 1977) (finding Administrator's duty to act triggered "[w]hen a violation is directed to the attention of the Administrator"); *Rivers Unlimited v. Costle*, 11 Env't Rep. Cas. (BNA) 1681 (S.D. Ohio 1978) (holding that section 309(a)(2) imposes a mandatory duty on the administration).

224. *Bravos v. EPA*, 324 F.3d 1166, 1171 (10th Cir. 2003) ("Despite the 'he shall' language, the weight of authority is that § 309(a)(3) does not impose a mandatory duty on the Administrator."); *Sierra Club v. Whitman*, 268 F.3d 898, 900-03 (9th Cir. 2001) (finding EPA not have mandatory duty to investigate and make findings, nor to take enforcement action once a finding is made); *DuBois v. Thomas*, 820 F.2d 943 (8th Cir. 1987) (finding that based on extensive study of 309(a)(3)'s legislative history and some deference to EPA's interpretation of its enabling legislation, CWA imposes only discretionary duty on EPA Administrator to investigate and make finding and take enforcement action whenever private citizen assert violation); *Johnson County Citizen Comm. for Clean Air & Water v. EPA*, No. 3:050222, slip op. at 4 (M.D. Tenn. Sept. 9, 2005) ("[A] majority of courts considering this issue have rejected the reasoning of *Save the Valley*, *South Carolina Wildlife Fed'n*, and *Hoffman* courts."); *Weatherby Lake Improvement Co. v. Browner*, No. 961155CVW8, slip op. at 1 (W.D. Mo. Apr. 17, 1997) ("To hold otherwise [EPA's duty under section 402(c)(3) is mandatory] would frustrate the purposes of the [CWA] by requiring EPA to alter its priorities and expend its limited resources to investigate citizen complaint, regardless of their relative importance.").

225. See *Sierra Club v. EPA*, 377 F. Supp. 2d 1205, 1207 (N.D. Fla. 2005) ("[A] mandatory duty to withdraw approval arises only 'whenever the Administrator determines after public hearing' that a state is not administering its NPDES program in accordance with federal standards.").

the State to enforce.”²²⁶ Once again, there is no predicate initiative to trigger the section’s application, as the state has not issued any permits for chumming. Thus, EPA cannot enforce compliance against Maryland under this section because there are no permits being violated and, therefore, no failure of Maryland to react to the situation.²²⁷

For the reasons stated above, it is difficult to conceive of any legal theory that would compel action by the EPA against either individuals who engage in chumming or against Maryland for failing to undertake such an initiative.

b. Compelling Action by Maryland Against Chumming

Maryland has declined to regulate chumming on two grounds: that “chumming is an acceptable fishing practice”;²²⁸ and that, like the EPA, “chum does not meet the definition of either a point source or a pollutant.”²²⁹ The most viable theory for compelling Maryland to regulate chumming lies under its antidegradation policies that impose a mandatory duty on the state to protect and maintain designated uses of its waters. Less promising is any theory based upon a requirement to enforce against violators of its laws, for many of the same reasons as would block an attempt to compel enforcement by the EPA.²³⁰

226. 33 U.S.C. § 1319(a)(2) (2000).

227. EPA could issue a total maximum daily load (TMDL) for those areas of the Bay that are not currently meeting Maryland’s water quality standards due to nutrient enrichment. *Id.* § 1313(d). Since the Bay has been listed as impaired due to nutrients since 1996, Maryland is under an affirmative obligation to complete a nutrient TMDL, which among other things must identify the sources contributing to the nonimpairment and allocate the loadings among those sources which would bring the Bay back into compliance with water quality standards. *Id.* § 1313(d)(1). Although EPA has an independent duty under section 303(d)(2), *id.* § 1313(d)(2), to develop a TMDL when a state has not acted, it is unlikely that a claim against EPA for failing to act would succeed because even though Maryland has failed to enact a nutrient TMDL for the Bay, it has issued dozens of TMDLs for other waters, unlike other states, and a court would be unlikely to compel EPA action in a matter that so clearly relates to its discretionary allocation of resources. *See* Richard Eskin, Tom Thornton & Anna Soehl, EPA Wins Defense of Maryland’s TMDL Program, *available at* <http://textonly.mde.state.md.us/ResearchCenter/Publications/General/eMDE/vol2no1/lawsuit.asp> (“As of September 2005, Maryland had completed a total of 176 TMDLs.”); *see also* Potomac Riverkeeper et al. v. U.S. EPA et al., 2006 WL 890755 (D. Md. Mar. 31, 2006) (sustaining Maryland’s TMDL program against a variety of legal challenges including the claim that the state’s implementation was too slow and that it improperly prioritized its TMDLs).

228. Letter from Kendl P. Philbrick, Sec’y, Md. Dep’t of the Env’t, to Captain Norman W. Bartlett (July 25, 2005) (on file with author).

229. Letter from J.L. Hearn, Dir., Water Mgmt. Admin., Md. Dep’t of the Env’t, to Captain Bartlett (Apr. 9, 1999) (on file with author).

230. Section 9-334 imposes an obligation on the Maryland Department of the Environment to issue a “written complaint” to “known violators” of its water pollution laws. Although no Maryland court has interpreted section 9-334, let alone answered the question

Contrary to most of the relevant sections of the Maryland Code that are written almost entirely in discretionary language,²³¹ Maryland's antidegradation regulations impose mandatory duties on the state regulatory agency.²³² Tier 1 of that policy applies to the Chesapeake Bay and requires that the waters covered by Tier 1 "shall be protected and maintained for existing uses."²³³ Maryland's antidegradation policy also requires the imposition of cost-effective, best-management practices on sources of nonpoint pollution,²³⁴ and that "water which does not meet the standards established for it shall be improved to meet [those] standards."²³⁵ The question is whether these regulations impose a duty on Maryland to regulate chumming.

Even though Maryland's water quality standards establish a use classification and criteria for the Chesapeake Bay that provide for the protection of fish and aquatic life as a "beneficial use" of those waters, it has not adopted an implementation procedure for these criteria.²³⁶ Thus, even though there is no question that the Bay is too impaired to support

whether it imposes a mandatory duty on the department, the use of the word "shall" could be read as doing that. *See State v. Green*, 785 A.2d 1275, 1287 (Md. 2001) ("[When legislature] commands that something be done, using words such as 'shall' or 'must' rather than 'may' or 'should,' the obligation to comply with the statute or rule is mandatory."). However, in all likelihood, a Maryland court, like its federal counterparts, would find a decision by the Maryland Department of the Environment to forego enforcement action not to be justiciable. *See Spencer v. Md. State Bd. of Pharmacy*, 846 A.2d 341, 351 (Md. 2004) (citing *Heckler*) ("It is most difficult to apply or even articulate a judicial standard by which the agency's discretionary decision might be deemed arbitrary or capricious."). Additionally, any Maryland court faced with this question as a matter of first impression would probably look at how the federal courts have interpreted EPA's enforcement duty and be guided by the many cases that hold it to be discretionary. *Id.* Any argument that Maryland's Environmental Standing Act, Maryland Code Annotated, Natural Resources § 1-503(b) creates an independent enforcement action by citizens, would fail because of the fact that there are no regulations that Maryland would be violating if it fails to enforce against individuals who chum, and is limited by § 1-504 of MESA which limits the effect of § 1-503 by stating that MESA does not authorize new substantive causes of action and "is for the sole purpose of providing standing to sue." *See Medical Waste Assocs., Inc. v. Md. Waste Coal.*, 612 A.2d 241, 253 (Md. 1990).

231. *See, e.g.*, MD. CODE ANN., ENVIR. § 9-313 (saying MDE *may* adopt rules and regulations to carry out the provisions of the environment code).

232. The CWA requires states to include as part of their state water quality standards an antidegradation policy. 33 U.S.C. § 1313(d)(4)(B) (2000); *see also* 40 C.F.R. § 131.12(a) (2000) (requiring that each state develop statewide antidegradation policies and identify the methods for implementing such policy).

233. MD. CODE REGS. § 26.08.02.04(A). Maryland, like EPA, has three tiers of protection in its antidegradation regulations. Tier 2 provides additional protection to so-called high quality waters, *id.* § 02.04(B), but this list does not include the waters of the Chesapeake Bay. Tier 3 covers Outstanding National Resource Waters, *id.* § 26.08.02.04-2, but again the Bay is not included.

234. *Id.* § 26.08.02.04(C).

235. *Id.* § 26.08.02.04(F).

236. *Id.* § 26.08.02.08.

aquatic life and that the discharge of chum contributes to that impairment and that the death of Bay species undermines the uses designated for the Bay by Maryland regulations,²³⁷ since the agency has not yet elected to make its antidegradation policies part of its permitting program, there may be no duty under them to regulate discharges to impaired waters.²³⁸ Whether a court would excuse Maryland from implementing its antidegradation policy because it has elected not to regulate a problematic source of pollution is an open question. But in the face of the EPA's steadfast refusal to regulate the practice of chumming and the reliance of the economically important fishing industry on chumming, it seems unlikely that a Maryland court would intervene to end the stalemate.

Finally, any action to compel Maryland to issue regulations governing chumming must be preceded by a rulemaking petition under the Maryland Administrative Procedure Act to exhaust administrative remedies.²³⁹ The state agency's decision not to respond affirmatively to such a petition is well within the agency's discretion and thus not reviewable by a court.²⁴⁰

Therefore, as bad as the practice of chumming is for the waters of the Chesapeake Bay, notwithstanding that there is a colorable argument

237. *See id.* § 26.08.02.02 (fishing and boating).

238. In this, Maryland is unlike other states, which have made these policies part of their permitting programs, and courts have found them enforceable. *See* Water Res. Division, Ass'n of Central Oklahoma Gov's, Grant Carryover Project #18—N. Canadian River Pathogens TMDL 104, available at www.acogok.org/newsroom/downloads06/tmdlappendixC.pdf (discussing Oklahoma's process for issuing permits for discharges to state waters); *Alabama v. Legal Environmental*, 922 So. 2d 101, 108 (Al. Civ. App. 2005) (affirming the discretion of the state to use the permitting process to achieve improvements in water quality).

239. *Harvey v. Marshall*, 884 A.2d 1171, 1191-93 (Md. 2005) (“[A] court's inherent power of judicial review may reach an administrative agency's inaction as well as its action.”); *Harvey v. Marshall*, A.2d 529, 548 (Md. 2004) (finding that Maryland courts lack authority to issue a declaratory judgment or an injunction requiring a state agency to issue regulations until a party has filed a rulemaking petition under section 10-123(a) of the Maryland APA).

240. Under Maryland law, discharge permits can only be issued for activities if those activities will not violate applicable effluent limitations and other state and federal standards. MD. CODE REGS. § 26.08.04.02. Therefore, several changes need to be made to Maryland's regulations to reach chumming. For example, Maryland might amend its regulations defining pollutant, *id.* § 26.08.01.01, to include chum, triggering the need for a discharge permit. The revised rule would read “(11-4) Chum is a pollutant that includes fish wastes, processed or altered fish and shellfish, fish oils and other organic substances and any inorganic substances discharged to attract fish.” Amending MD. CODE REGS. § 26.08.04.01(B) by adding a new subsection to list chumming as a prohibited activity without a permit, would further clarify this prohibition. (e.g., “(6) The discharge of chum, or other wastes or pollutants, in any quantity for purposes including, but not limited to, the attraction of fish for recreational or commercial fishing.”). Finally, amending MD. CODE REGS. § 26.08.03.01(A), by establishing an effluent limitation that prohibits chumming would complete the regulatory circle, by effectively banning chumming in the Chesapeake Bay.

that it violates the requirements of both federal and state law, there is simply no way of compelling regulatory action by either jurisdiction. The only way chumming on the Bay will be regulated is if either the EPA or Maryland decides that it wants to. That will require one of the regulatory jurisdictions to overcome not only inertia, but also the superficially appealing argument that its resources are better spent on larger targets of opportunity.²⁴¹ However, that argument assumes that larger targets are better, which the next section of the Article argues are not.

V. THE DISJUNCTURE BETWEEN ECONOMIC-DRIVEN SOLUTIONS AND THE BEHAVIOR OF NATURAL SYSTEMS

Big is not always better in an estuarine environment, in part because pollutants from smaller sources have a way of aggregating into larger problems and, in part, because they can set off cascades of problems that may be as, or more, damaging to the natural system as large slugs of pollution from larger contributors.²⁴² Yet, small sources of pollution, like chumming, rarely attract the regulator's attention out of the mistaken belief that correcting those problems will not bring the same rate of return as tackling larger ones. This type of thinking reflects an overreliance on economic metrics for choosing regulatory targets and evaluating the success of those efforts. It is also based on a mistaken apprehension of how complex systems like estuaries work and undervalues the importance of maintaining a healthy, biologically diverse environment.

A. *Some Shortcomings of Economic Approaches to Environmental Problems*

Economic analysis has been part of the thinking about the natural world for centuries.²⁴³ The 1950s "bioeconomics paradigm"²⁴⁴ and later

241. See, e.g., *Ass'n To Protect Hammersley, Eld, & Totten Inlets v. Taylor Res., Inc.*, 299 F.3d 1007, 1011 n.3 (9th Cir. 2002) (recounting the objections of various amicus curiae to extending NPDES permitting requirements to shellfish harvesting facilities because the requirement would "divert the agency's administrative and financial resources away from regulating activities that significantly impair water quality").

242. See, e.g., Toffler, *supra* note 57, at xvii (saying how Prigogine and Stengers show how the smallest of disturbances can create large perturbations in systems sometimes leading to their collapse or complete restructuring); see also WORSTER, *NATURE'S ECONOMY*, *supra* note 96, at 407 (discussing the butterfly wing effect).

243. According to Donald Worster, economics and nature were first joined in 1658, when Sir Kenelm Digby spoke about the "oeconomy of nature," a thought which carried through into the eighteenth century, in which "God was seen as the Supreme Economist who had designed the earth's household and as the housekeeper who kept it functioning productively." WORSTER, *supra* note 96, at 39. Worster goes on to explain that in the nineteenth century the word "ecology"

cost-benefit analysis typify that dialectical collaboration.²⁴⁵ However, economists and ecologists have not always seen eye to eye. For example, E.O. Wilson is highly critical of the way species are valued in the bioeconomics model.²⁴⁶ He asserts that the model's traditional econometric approach, which is based on "market price and tourist dollars," underestimates "the true value of wild species."²⁴⁷ He also disapproves of what he calls one "guideline of conservation," cost-benefit analysis, because "it consistently undervalues the net benefits conferrable by species since it is much easier to measure the costs of conservation than the ultimate gains."²⁴⁸ Wilson worries that "[i]f a price can be put on something, that something can be devalued, sold, and discarded."²⁴⁹ "It would be folly," he suggests, "to let any species die by the sole use of the criterion of economic return however potent, simply because the name of that species happens to be written in red ink."²⁵⁰

Lisa Heinzerling and Frank Ackerman condemn cost-benefit analysis for relying on "inaccurate and implausible" economic approaches to valuation, using discounting procedures that "trivializes future harms and the irreversibility of some environmental problems," relying on "aggregate; monetized benefits [that] excludes questions of

replaced "oecology," but true to its origins was still "imbued with a political and economic as well as Christian view of nature"—that the world must "be somehow managed for maximum output." *Id.* By the early twentieth century, a new term had emerged, "bioeconomics," in which nature is defined as an economic system, each unit of which is tasked with the job of producing, manufacturing, and consuming. *Id.* at 291. By mid-twentieth century, economic concepts, like "interdependence and cooperation," "the primacy of efficiency and productivity," and "a managerial ethos," had begun to creep into the vocabulary of ecologists. *Id.* at 293-94.

244. The term "bioeconomics" defined nature as an economic system, each unit of which is tasked with the job of producing, manufacturing, and consuming. *Id.* at 291, introduced economic concepts, like "interdependence and cooperation," "the primacy of efficiency and productivity," and "a managerial ethos" into the vocabulary of ecologists. *Id.* at 293-94. The bioeconomics model materialized as part of the "New Ecology," in which "ecology . . . emerged as a full blown science of natural economics." *Id.* at 311; *see also id.* at 313 (describing the model's flow charts as revealing "all the energy lines mov[ing] smartly along, converging here and shooting off there, looping back to where they began and following the thermodynamic arrows in a mannerly march toward exit points," all leading to a highly managed environment).

245. WORSTER, *supra* note 96, at 311; *see also id.* at 294-311 (describing how concepts like "food chain," "energy flow," "and "energy budget," among others were part of were part of "an energy-economic model of the environment" emerging in the 1920s and finding completion by the 1950s as the "New Ecology").

246. WILSON, *supra* note 37, at 308.

247. *Id.*

248. *Id.* at 310; *see also* Rodgers, *supra* note 14, at 214 (expressing "sympathy with the idea that nonmarket human preferences are presumptively as important as the dollar votes of economic theory").

249. WILSON, *supra* note 37, at 348.

250. *Id.* at 310.

fairness and morality,” and for being “neither objective or transparent.”²⁵¹ They also point out that “some environmental benefits never have been subjected to rigorous economic evaluation” and, as a result, “their importance is frequently ignored,” while “there is also a tendency . . . to overestimate the costs of regulation in advance of their implementation.”²⁵² Although not ecologists, Ackerman and Heinzerling find cost-benefit “fundamentally incapable of delivering on its promise of more economically efficient decisions about protecting human, life, health, and the environment,” calling it “inherently unreliable” because there is no “credible monetary metric for calculating the benefits of regulation.”²⁵³

These concerns find particular purchase in complex systems like estuaries.

B. A Natural World in Flux

The bioeconomics model is premised on a view that “the most natural state of nature was balance.”²⁵⁴ Eugene Odum, a leading ecologist of the last century who did much of his work on the Chesapeake Bay, was one of the most forceful proponents of this view and a supporter of the bioeconomics model precisely because it works in a stable, nonchanging environment.²⁵⁵ Odum’s view that ecosystems were constantly moving towards homeostasis, that point at which the system was in balance after waging an “endless, but successful struggle” against disturbing forces,²⁵⁶ led to a theory of ecosystem management, the

251. Frank Ackerman & Lisa Heinzerling, *Pricing the Priceless: Cost-Benefit Analysis of Environmental Protection*, 150 U. PA. L. REV. 1553, 1563 (2002).

252. *Id.*

253. *Id.*

254. WORSTER, *supra* note 96, at 389; *see also* WILSON, *supra* note 37, at 304 (advocating the use of bioeconomic assays for entire ecosystems).

255. Odum was a proponent of an economic model of the environment, a “bioeconomics paradigm,” in which phrases like the “energy budget,” “nutrient capital, and “energy income” were common, WORSTER, *supra* note 96, at 311, and whose flow charts, according to Worster, revealed “all the energy lines mov[ing] smartly along, converging here and shooting off there, looping back to where they began and following the thermodynamic arrows in a mannerly march toward exit points,” *id.* at 313, all leading to a highly managed environment, *id.* E.O Wilson also was a proponent of ecological equilibrium and believed that changes to the physical environment could be reversed and “held rock-steady in a state close to optimum for human welfare,” and that while losses to biological diversity “cannot be redeemed, its rate can be slowed to barely perceptible levels of prehistory,” achieving “at least an equilibrium . . . in the birth and death of species.” WILSON, *supra* note 37, at 280-81.

256. WORSTER, *supra* note 96, at 366.

principle goal of which was to achieve a “steady state,” or equilibrium, what Worster calls a “no growth economy.”²⁵⁷

While the bioeconomics model has endured,²⁵⁸ its foundational principle that nature is a “perfectly manageable system of simple, linear, rational order”²⁵⁹ has not. That premise has been replaced by a much messier picture—“instead of order happily emerging out of chaos, it was chaos that kept boiling up from the darkness, breaking down order.”²⁶⁰ Nature became “a world of unique and unpredictable individual events . . . making it difficult for physical scientists to understand biological phenomena,”²⁶¹ a place where there are “simply too many variables to plot all the lines of influence, of cause and effect,” and where nature revealed itself as “essentially non-linear in all its processes.”²⁶²

Complexity theory, which emerged out of chaos theory, views ecosystems “not as permanent entities engraved on the face of the earth but as shifting patterns in the endless flux, always new, always different.”²⁶³ Where the equilibrium ecologists believed they could determine what level of disturbance was safe for an ecosystem, today “the very concept of what was a normal [or even optimal] yield or output [has] become far more ambiguous.”²⁶⁴ “Each organic system is so rich in feedbacks, homeostatic devices, and potential multiple pathways that a complete description is quite impossible.”²⁶⁵

Chaos and complexity theory also teach that the smallest changes in the environment in any one place may have substantial impacts someplace else.²⁶⁶ Ilya Prigogine and Isabelle Stengers show how, in far-

257. *Id.* at 367. Showing how prescient he was, Odum worried that “man-generated CO₂ and dust pollution might be making this precarious balance more and more ‘unsteady.’” EUGENE ODUM, *FUNDAMENTALS OF ECOLOGY* 271-72 (1971), *quoted in* WORSTER, *supra* note 96, at 368.

258. WORSTER, *supra* note 96, at 311.

259. *Id.* at 406.

260. *Id.* at 407.

261. *Id.* at 400 (quoting Daniel Simberloff, *A Succession of Paradigms in Ecology: Essentialism. To Materialism and Probabilism*, 43 *SYNTHESE* 25-26 (1980)).

262. *Id.* at 404. E.O. Wilson also worried that no one knew the answer to the question if species that are part of an ecosystem “begin to go extinct, at what point will the whole machine sputter and destabilize. WILSON, *supra* note 37, at 309.

263. WORSTER, *supra* note 96, at 412. An exponent of such theories is Ilya Prigogine, who with Stenger argued that “[i]t is the processes associated with randomness, openness, that lead to higher levels of organization, such as dissipative structures.” Toffler, *supra* note 57, at xxi; *see also* Rodgers, *supra* note 37, at 47 (“The study of evolutionary biology is the study of systems that . . . display chaotic, nonlinear, and unpredictable characteristics.”).

264. WORSTER, *supra* note 96, at 416.

265. ERNST MAYR, *THE GROWTH OF BIOLOGICAL THOUGHT: DIVERSITY, EVOLUTION, AND INHERITANCE* 59 (1982).

266. WORSTER, *supra* note 96, at 407 (describing “the butterfly effect”); *see also* PRIGOGINE & STENGERS, *supra* note 57, at 188 (“[T]he more complex a system is, the more

from-equilibrium conditions, even the smallest “perturbations or fluctuations can become amplified into gigantic, structure-breaking waves.”²⁶⁷ A new truism emerged that “[n]o organism functions independently of its environment, and no environment can be changed without changing the organisms that are part of it.”²⁶⁸ These theories instruct that it is impossible to pick regulatory targets with any degree of certainty, even if the choice bears some economic sense, because too little is understood about the underlying ecosystem and how it reacts to disturbances, and because an economic management approach devalues the worth of the system’s various parts.²⁶⁹ With these new insights, how could a regulator manage an ecosystem to achieve maximum, or at least optimal, yield under the bioeconomics model when all was constantly changing about her?

In the face of all this stochastic uncertainty, the conservation of biological diversity has become the only ecological imperative and management goal upon which most ecologists can agree.²⁷⁰ But, even with respect to the biodiversity, there is disagreement over which are the “keystone species,” the extinction of which “would bring down other species with it, possibly so extensively as to alter the physical structure of the habitat itself.”²⁷¹ E.O. Wilson warns that scientists may be wrong in

numerous are the types of fluctuations that threaten its stability.”). Rodgers makes an interesting point about solving commons problems by the creation of tradable property rights and the effect of that approach on entitlements, like tribal fishing rights, noting that the concept of “efficiency” attacks on those entitlements “take the form of the desirability of repudiating the entitlement so that it can be placed in the hands of those who assign it a ‘higher’ value or who can produce ‘more’ with it.” Here, the narrow focus of Bay area regulators on large sources of pollution suffers from the same type of myopia, in which efficiency is elevated over what is here an entitlement to a biologically diverse ecosystem. Rodgers, *supra* note 14, at 221.

267. Prigogine and Stengers subdivided Odum’s equilibrium into “equilibrium,” “near equilibrium,” and “far from equilibrium” conditions. See Toffler, *supra* note 57, at xv-xvi.

268. Rodgers, *supra* note 37, at 53.

269. See WILSON, *supra* note 37, at 307-10 (critiquing cost/benefit analysis). Although Rodgers believes that “fruitful lines of inquiry could be developed along conventional efficiency lines” on the issue of how to allocate resources in the face of uncertainty, a more ethical approach to the problem of “speculative spillover effects,” one that is fair to “ourselves, future generations, and nonhuman residents of the planet” is to “discover and forewarn those subject to risk.” Rodgers, *supra* note 14, at 226. Although these comments were made in the context of the National Environmental Policy Act and procedural fairness, they appear equally relevant to the predominance of efficiency thinking in ecosystem management.

270. WORSTER, *supra* note 96, at 418-20. E.O. Wilson, remarking on how important biodiversity is, refers to it as “our most valuable but least appreciated resource. WILSON, *supra* note 37, at 281.

271. WILSON, *supra* note 37, at 309. Wilson describes “keystone species” as the “biggest players” in an ecosystem, the removal of which “causes a substantial part of the community to change drastically, *id.* at 164, and likens their loss to “a drill accidentally striking a powerline. It causes lights to go out all over,” *id.* at 348. Rodgers notes that in evolution “there is no turning back”; once a species is “eliminated by extinction [it] will be gone forever.” *Biology and the Law,*

thinking that these keystone species are necessarily large organisms “[like] sea otters, elephants, Douglas firs, coral heads—but they might as easily include any of the tiny invertebrates, algae, and microorganisms that teem in the substratum and that also possess most of its protoplasm and move the mass of nutrients.”²⁷²

Making regulatory decisions on the basis of a favorable cost-benefit analysis is equally problematic in an estuarine environment as relying on bioeconomic models to predict outcomes because this analysis would be based on the same flawed “world view [that] assumes stable problems, with control costs that are stable or declining over time, and thus finds precautionary investment in environmental protection to be a needless expense.”²⁷³ Such a view is counter-indicated when dealing with an inherently instable environment where predicting how that environment will respond to stress is almost certain to fail and where the consequences of doing nothing can be severe.²⁷⁴ A cost-benefit analysis approach “systematically downgrades the importance of the future . . . through predictive methodologies that take inadequate account of the possibility of catastrophic and irreversible events;”²⁷⁵ yet the possibility of such events occurring is a constant reality in complex systems like estuaries.

C. *The Precautionary Principle Should Guide Regulatory Decisions Affecting Estuaries*

The Precautionary Principle offers better guidance for regulators than economic approaches in complex natural systems like estuaries. A concept of international customary law, the Precautionary Principle states that if something is potentially dangerous, then, in the face of scientific uncertainty, the prudent thing to do is intervene and limit the risk.²⁷⁶

supra note 37, at 51. Rodgers quotes Stanley on the topic of evolution as saying that “[t]he principles of irreversibility and lack of momentum teach us something important about the nature of evolution. There are no definite directions, no strict causal determinism producing identical results in similar circumstances. The path of environmental change through time is tortuous and undirected. STEVEN M. STANLEY, *EARTH AND LIFE THROUGH TIME* 645 (2d ed. 1986), *quoted in* Rodgers, *supra* note 37, at 51, n. 162.

272. WILSON, *supra* note 37, at 309.

273. Ackerman & Heinzerling, *supra* note 251, at 1572.

274. An additional problem with relying on the artifact of cost-benefit analysis may be that regulators focus on the amount of pollution a given source contributes to the environment and ignore any benefit to the receiving environment, in part because those benefits are so difficult to calculate. This approach necessarily prejudices targets that offer less reduction but may have equal or even better environmental benefits.

275. Ackerman & Heinzerling, *supra* note 251, at 1570.

276. Sunstein notes that there are many different definitions of the Precautionary Principle, the weakest of which recommends that inadequate cause and effect information should not be a

Where the harm could be irreversible²⁷⁷ or catastrophic,²⁷⁸ Cass Sunstein advises that special precautions should be taken²⁷⁹ and that regulators should be willing “to invest resources to preserve flexibility for the future” when faced with an irreversible risk of environmental harm.²⁸⁰ Here, where there is much that is uncertain about how the Bay works and where the loss of the Bay’s diversity from eutrophication could be both catastrophic and irreversible, application of the Precautionary Principle suggests that the EPA and Maryland should invest resources to address the adverse impacts of chumming because of the practice’s contribution to potentially irreversible positive feedback loops that lessen the health of the Bay and could lead to its collapse.

Sunstein warns, however, that the public is likely to treat the risk of a catastrophic harm actually occurring “as essentially zero” and pay little to insure against such risk.²⁸¹ Under such circumstances, especially when “the costs of precaution are incurred immediately,” and its “benefits will not be enjoyed until decades later,”²⁸² “people are likely to be extremely adverse to precautionary steps, even if they are justified”²⁸³ This unwillingness is especially true for elected officials who will have every incentive to delay undertaking costly protective action where the popular

basis to decline to regulate, the stronger of which versions suggest either the inclusion of a “margin of safety into all decision making” or directs that “when there is a risk of significant health or environmental damage to others or to future generations, and when there is scientific uncertainty as to the nature of that damage or the likelihood of the risk, then decisions should be made so as to prevent such activities from being conducted unless and until scientific evidence shows that the damage will not occur.” Cass R. Sunstein, *Irreversible and Catastrophic*, 91 CORNELL L. REV. 841, 849 (2006) (discussing various permutations of the Precautionary Principle as applied to global warming, injunctions in environmental cases, genetic modification of food, protection of endangered species, and terrorism). *Id.* at 849-50. A similar expression of precaution can be found in American case law. *See, e.g., Ethyl Corp. v. EPA*, 541 F.2d 1, 28 (D.C. Cir. 1976) (en banc) (“Where a statute is precautionary in nature, the evidence difficult to come by, uncertain, or conflicting because it is on the frontiers of scientific knowledge, the regulations designed to protect the public health, and the decision that of an expert administrator, we will not demand rigorous step-by-step proof of cause and effect. Such proof may be impossible to obtain if the precautionary purpose of the statute is to be served.”).

277. Sunstein defines irreversibility in the context of an environmental effect as being when the “restoration of the status quo is impossible or at best extremely difficult.” Sunstein, *supra* note 276, at 860.

278. *See id.* at 869 (“A catastrophic harm rests on the magnitude of the adverse effects.”).

279. *Id.* at 855-66 (saying that in situations where there is a risk of irreversible losses “it makes sense to pay an option to avoid” that risk).

280. *Id.* at 896.

281. *Id.* at 870-71.

282. *Id.* at 875.

283. *Id.* (“[I]t is easy to imagine situations in which future harms are being treated as irrelevant, or nearly so, because of social myopia, wishful thinking, or simply a failure of imagination or empathy with those who will be at risk.”).

perceptive is that the risk of harm is extremely low.²⁸⁴ In such cases, Sunstein recommends that regulators “pay attention to low probability risks of catastrophe”²⁸⁵ and advocates the application of a Catastrophic Harm Precautionary Principle to “overcome the danger that future risks will receive less attention than they deserve.”²⁸⁶ This principle suggests a second rationale for regulatory intervention in the case of chumming,²⁸⁷ as well as an explanation for current regulatory inertia.

Precautionary principles, not economic metrics, should guide the choices of regulators in a stochastic environment when faced with a risk of irreversible and potentially catastrophic dimensions—here, further loss of the Bay’s biodiversity and the potential collapse of the entire system. Eliminating chumming could have a significant effect on the health of the Bay and its species. To forestall regulation of chumming because it may pose a low risk of harm to Bay water quality is to misapprehend the nature of the risk and resultant harm. Since chumming decreases biodiversity by adversely affecting both the striped bass and menhaden population, it should not be countenanced.

[H]istory reveals not merely that change is real but also that change is various. All change is not the same, nor are all changes equal. Some changes are cyclical, some are not. Some changes are linear, others are not. Some changes take an afternoon to accomplish, some a millennium. We can no more take any particular kind of change as absolutely normative than we can take any particular state of equilibrium as normative The challenge is to determine which changes are in our enlightened self-interest and are consistent with our most rigorous ethical reasoning, always remembering our inescapable dependency on other forms of life.²⁸⁸

E.O. Wilson would agree. He proposes “a practical ethic” consisting of “a set of rules invented to address problems so complex or stretching so far into the future as to place their solution beyond ordinary discourse.”²⁸⁹ He could as well have been talking about the Precautionary Principle. He finds environmental problems to be “innately ethical” . . .

284. *Id.*; see also Ackerman & Heinzerling, *supra* note 251, at 1571 (“Too many years of delay might mean that the polar ice cap melts, the spent uranium leaks out of the containment ponds, the hazardous waste seeps into groundwater and basements and backyards—at which point we cannot put the genie back in the bottle at any reasonable cost (or perhaps not at all).”).

285. Sunstein, *supra* note 276, at 874.

286. *Id.* at 875.

287. See Cass R. Sunstein, *Precaution Against What? The Availability Heuristic and Cross-Cultural Risk Perception*, 57 ALA. L. REV. 75, 891 (2005) (discussing the “availability heuristic” and how people’s perception of risks are influenced by whether the risk is “cognitively available”).

288. WORSTER, *supra* note 96, at 432.

289. WILSON, *supra* note 37, at 312.

“[t]o choose what is best for both the near and distant futures is a hard task, often seemingly contradictory and requiring knowledge and ethical codes which for the most part are still unwritten.”²⁹⁰ A believer in “the strong hand of protective law” to preserve biological wealth, he asserts that the government has a “moral responsibility in the conservation of biodiversity . . . similar to that in public health and military defense.”²⁹¹ Insofar as biological diversity is deemed an irreplaceable public resource, its protection should be bound into the legal canon because loss of biodiversity “is the folly . . . our descendents are least likely to forgive us [for].”²⁹²

VI. CONCLUSION

The Chesapeake Bay is an invaluable resource for Maryland as well as for the rest of the country. Despite efforts to repair extensive damage to the Bay’s ecology done over time, more than 90% of its waters remain impaired under Maryland’s water quality standards, largely due to nutrification. The practice of chumming contributes to the poor state of the Bay’s health because chum lowers dissolved oxygen that is critical to aquatic life and increases water turbidity, setting in motion destructive positive feedback loops. Chum may also serve as a vector for the transmittal of diseases to species that feed on it and may contribute to the decline of menhaden, a critical filter and food fish for the Bay. Although prohibiting chumming would reduce the Bay’s BOD, improve water clarity and the exchange of oxygen at the surface, lessen stress on striped bass and other Bay species, help achieve Maryland’s designated uses for those waters, and reduce pressure on menhaden stocks, neither the EPA nor Maryland has undertaken any initiative to stop the practice. Unfortunately, it does not look like they can be compelled to do so.²⁹³

The story of chumming, however, is bigger than a case study of regulatory inertia and the inability of citizens to compel action through litigation because it reveals serious flaws in how complex natural systems are understood and approached by regulators. Bay area regulators are stuck in an outdated view of ecology which presumes that a balance in nature can be achieved and disturbances managed or corrected based on

290. *Id.*

291. *Id.* at 342.

292. WORSTER, *supra* note 96, at 419 (quoting WILSON, *BIOPHILIA* at 121 (1986) (indicating the possible consequences of not preserving biodiversity).

293. Since writing this Article, the author has received a letter from the Maryland Department of the Environment informing IPR that the agency had denied its rulemaking petition. Letter from Shari T. Wilson, Sec’y, Md. Dep’t of the Env’t to Erik Bluemel, Staff Attorney for the Inst. For Pub. Representation (Oct. 26, 2007) (on file with author).

economic metrics. A more contemporary view would help them see that what appear to be small changes to complex natural systems may, in fact, be large ones, and that to ignore them is fraught with peril for maintaining the biological diversity of those systems. The task for citizens is not to engage in what may well be fruitless litigation, but to learn more about how these natural systems operate. They then must teach regulators that their reluctance to address small sources of environmental degradation, like chumming, is imprudent and that, when it comes to biodiversity, “[t]he ethical imperative should therefore be, first of all, prudence.”²⁹⁴

294. WILSON, *supra* note 37, at 351.