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Water protection in the Baltic Sea and the Chesapeake Bay: Institutions, policies and efficiency

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ABSTRACT

The Baltic Sea and the Chesapeake Bay share many characteristics. Both are shallow, brackish marine areas that suffer from eutrophication. Successful policies targeting point source pollution have lowered nutrient loads in both areas, but achieving the desired marine quality will require further abatement: efforts may be extended to more complicated and expensive pollution sources, notably agricultural nonpoint loads. Despite their ecological similarities, the two watersheds have different histories and institutional settings and have thus adopted different policies. Comparing and contrasting the policies reveal ways to improve the efficiency of each and ways to avoid the path of trial and error. No comparison of the parallel protection efforts, which involve expenditures of hundreds of millions of dollars annually, has been carried out to date. The present paper analyzes the policies applied in the two regions, distilling the results into six recommendations for future steps in preserving what are valuable sea areas.

1. Introduction

The Chesapeake Bay and the Baltic Sea have been the focus of intensive environmental protection during the past 40 years. The two areas have many similarities in terms of their environmental characteristics and pollution loads from anthropogenic sources. Both are shallow, brackish sea areas and both suffer from eutrophication in particular. The ratio of land area to water volume in them is high, making pollution loads particularly impactful. While both have managed to curtail pollution loads, neither has achieved the desired improvements in water quality. Future reductions will be sought from more expensive and complex sources of pollution. Tightening abatement requirements make careful policy design ever more important. A comparison of the two marine areas, which have parallel but independent protection histories, offers insights that can help improve the efficiency of protection in both.

The watersheds differ in several important respects as regards environmental institutions and policies. The Baltic Sea has nine independent littoral countries, whereas the Chesapeake Bay extends into six states within the United States. Initially, protection of the Baltic Sea relied on international agreements and protective measures taken independently by the littoral countries. Since 2004, eight of the countries have been members of the EU and protection of the Baltic is thus currently more strongly influenced by EU environmental policies. Protection of the Chesapeake Bay is governed by U.S. federal laws, with states being granted primacy in the case of some pollutants, particularly those causing nonpoint source (NPS) pollution.

The combination of similarities in ecological environment and differences in institutions allows us to compare and evaluate the policies chosen to address water quality problems in the two sea areas. Market-based instruments, for instance, are utilized only in the case of the Chesapeake Bay, but their potential might be greater in the Baltic Sea due to the higher heterogeneity in abatement costs between the polluters. How could the lessons learned in the United States be used when assessing the potential for adopting more flexible instruments for the Baltic Sea?

Underlying the design and effectiveness of policies in the different regions is the allocation of property rights to cleaner water. Where the 'polluter pays' principle is employed, the property rights to a clean environment belong to victims of pollution, and the responsibility for internalizing externality costs lies with the polluter. This has become a legal principle that is at the heart of many

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major environmental laws, where it calls for a "just" distribution of pollution costs (Grossman, 2007). On the other hand, satisfying such a principle may generate instabilities in international environmental agreements by imposing overly stringent (loose) policies on countries that benefit little (a lot) from the outcomes of the policies. Where the 'pay the polluter' principle is employed, property rights lie with the polluter and it is up to the public sector to pay the polluter to reduce its emissions. This has often been the practice in the U.S and EU when it comes to agricultural NPS pollution.

The literature provides surprisingly few comparisons of the Chesapeake Bay and the Baltic Sea despite the obvious analogies in the physical characteristics, environmental management and governance of the two water bodies. Wulff and Ulanowicz (1989) divided both ecosystems into 13 similar groups and described the cycling and flows of carbon between these groups to compare and analyze the two areas' susceptibility to pollution. To our knowledge, no similar comparison of the nutrient abatement policies has yet been conducted.[1]

The aim of this paper is to review recent trends in water protection and water policies in the Chesapeake Bay and Baltic Sea and to identify avenues for learning from the past experiences. We begin the paper by describing the economic, ecological and institutional features of environmental protection of the two areas, focusing on eutrophication. We then characterize what would be "ideal" environmental policies and instruments under the circumstances and compare the operative policies and institutions with each other and against the theoretical benchmark. Next, we outline the experiences of trading in the Chesapeake Bay and consider its suitability in the case of the Baltic. We summarize the paper with six theses that distil the main findings and recommendations of our study.

2. Description of the watersheds

2.1. Nutrient pollution in the Chesapeake Bay

The Chesapeake Bay watershed includes parts of six states—Delaware, Maryland, New York, Pennsylvania, Virginia and West Virginia—and the entire District of Columbia (collectively, the jurisdictions) (see Fig. 1). Runoff from the Bay's 166,000 km^2 watershed flows into an estuary with a surface area of 11,400 km^2, resulting in a land-to-water ratio of 15–1. This large ratio is one of the key factors in explaining why the drainage area has such a significant influence on water quality in the Bay.

Over the past 200 years, forest clearing and urban development have resulted in the following land use breakdown in the watershed: 69% wooded/open, 22% agriculture, 7% developed and 2% open water and extractive (National Research Council, 2011). Today, nearly 17 million people live in the watershed.

The pollutants of concern in the Bay are nutrients—nitrogen (N) and phosphorus (P)—and sediment. Excessive N and P in the Chesapeake Bay and its tidal tributaries promote a number of undesirable water quality conditions, such as excessive algal growth, low dissolved oxygen and reduced water clarity (Smith et al., 1992; Kemp et al., 2005). In 2010 only 18% of tidal waters met or exceeded guidelines for water clarity; only 38% of the Bay and its tidal tributaries met Clean Water Act standards for dissolved oxygen; and less than half of stream health scores at monitoring sites were fair, good, or excellent (Chesapeake Bay Program, 2011). An important consideration from a policy standpoint is that the Bay itself is bordered by only Maryland and Virginia, while the largest contributor of pollutants is Pennsylvania.

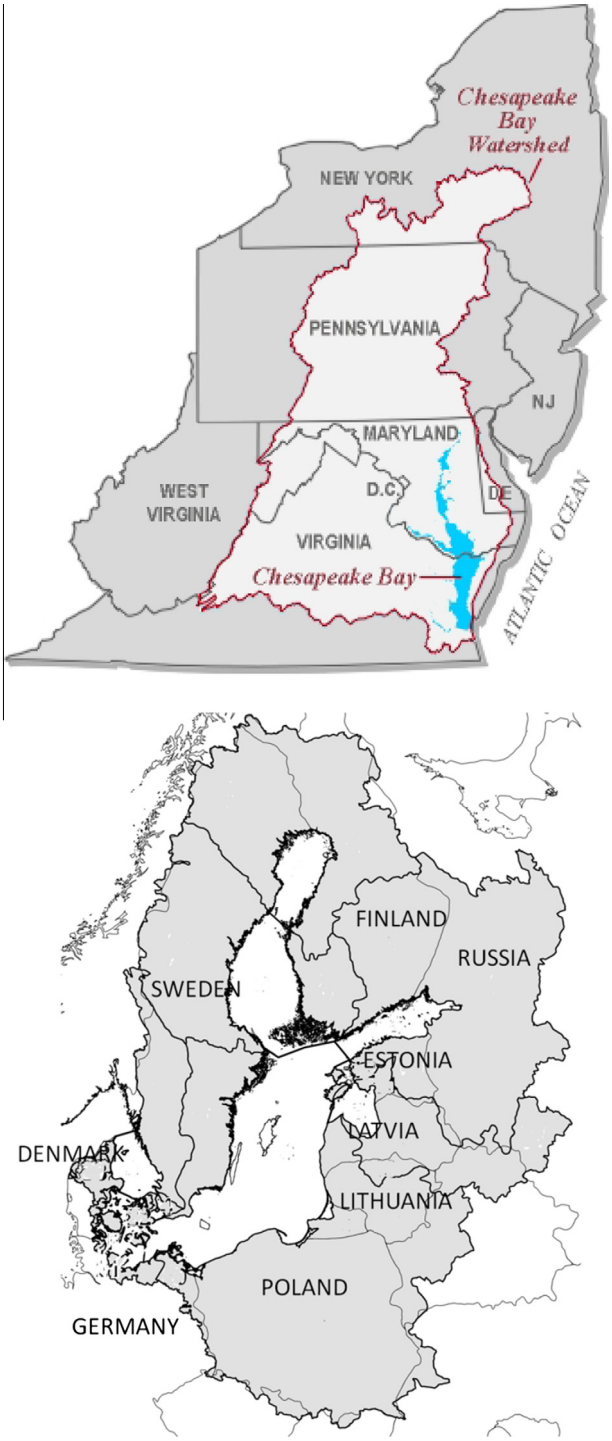

Fig. 1. Chesapeake Bay and Baltic Sea drainage basins.

Agriculture is the largest contributor of nutrients and sediment to the Bay. Crop production and animal operations contribute about 38% of total N loads, 45% of total P loads, and 60% of total sediment loads (National Research Council, 2011). Municipal and industrial point sources contribute 19% of N and 21% of P.

National water quality programs, such as a ban on phosphates in laundry detergent, and programs developed to specifically

[1] Agri-environmental policies in the EU and U.S. have been compared on a more general level by Baylis et al. (2008).