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Too many people assume, generally without having given any serious thought to its character or its history, that international law is and always has been a sham. Others seem to think that it is a force with inherent strength of its own. . . . Whether the cynic or sciolist is the less helpful is hard to say, but both of them make the same mistake. They both assume that international law is a subject on which anyone can form his opinions intuitively, without taking the trouble, as one has to do with other subjects, to inquire into the relevant facts.

—J. L. Brierly

Regime design matters.¹ International treaties and regimes have value if and only if they cause people to do things they would not otherwise do. Governments spend considerable resources and effort drafting and refining treaty language with the (at least nominal) aim of making treaty compliance and effectiveness more likely. This article demonstrates that whether a treaty elicits compliance or other desired behavioral changes depends upon identifiable characteristics of the regime's compliance systems.² As negotiators incorporate certain rules into a regime and exclude others, they are making choices that have crucial implications for whether or not actors will comply.

For decades, nations have negotiated treaties with simultaneous hope that those treaties would produce better collective outcomes and skepticism about

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1. This article summarizes the arguments made in Ronald B. Mitchell, *Intentional Oil Pollution at Sea: Environmental Policy and Treaty Compliance* (Cambridge, Mass.: MIT Press, forthcoming).

2. The term “compliance system” comes from Oran Young, *Compliance and Public Authority: A Theory with International Applications* (Baltimore, Md.: Johns Hopkins University Press, 1979), p. 3.

the ability to influence the way governments or individuals act. Both lawyers and political scientists have theorized about how international legal regimes can influence behavior and why they often do not.³ Interest in issues of compliance and verification has a long history in the field of nuclear arms control.⁴ More recently, this interest in empirically evaluating how international institutions, regimes, and treaties induce compliance and influence behavior has broadened to include other security areas as well as international trade and finance.⁵ Concern over the fate of the earth's environment recently has prompted a further extension into questions of whether and how environmental treaties can be made more effective at eliciting compliance and achieving their goals.⁶

Researchers in all these issue-areas face two critical questions. First, given that power and interests play important roles in determining behavior at the international level, is any of the compliance we observe with international treaties the result of the treaty's influence? Second, if treaties and regimes can alter behavior, what strategies can those who negotiate and design regimes use to elicit the greatest possible compliance? This article addresses both these questions by empirically evaluating the international regime controlling intentional oil pollution. Numerous efforts to increase the regime's initially low levels of compliance provide data for comparing the different strategies for eliciting compliance within a common context that holds many important

3. See, for example, Abram Chayes and Antonia Handler Chayes, "On Compliance," *International Organization* 47 (Spring 1993), pp. 175-205; Young, *Compliance and Public Authority*; Roger Fisher, *Improving Compliance with International Law* (Charlottesville: University Press of Virginia, 1981); and W. E. Butler, ed., *Control over Compliance with International Law* (Boston: Kluwer Academic Publishers, 1991).

4. See, for example, Abram Chayes, "An Inquiry into the Workings of Arms Control Agreements," *Harvard Law Review* 85 (March 1972), pp. 905-69; Coit D. Blacker and Gloria Duffy, eds., *International Arms Control: Issues and Agreements*, 2d ed. (Stanford, Calif.: Stanford University Press, 1984); and Antonia Handler Chayes and Paul Doty, *Defending Deterrence: Managing the ABM Treaty into the Twenty-first Century* (Washington, D.C.: Pergamon-Brassey's International Defense Publishers, 1989).

5. See, for example, John S. Duffield, "International Regimes and Alliance Behavior: Explaining NATO Conventional Force Levels," *International Organization* 46 (Autumn 1992), pp. 819-55; Ethan Kapstein, *Governing the Global Economy: International Finance and the State* (Cambridge, Mass.: Harvard University Press, 1994); and Joseph M. Grieco, *Cooperation Among Nations: Europe, America, and Non-tariff Barriers to Trade* (Ithaca, N.Y.: Cornell University Press, 1990).

6. For example, see Peter Haas, Robert Keohane, and Marc Levy, eds., *Institutions for the Earth: Sources of Effective International Environmental Protection* (Cambridge, Mass.: MIT Press, 1993); Peter H. Sand, *Lessons Learned in Global Environmental Governance* (Washington, D.C.: World Resources Institute, 1990); and Peter M. Haas, "Do Regimes Matter? Epistemic Communities and Mediterranean Pollution Control," *International Organization* 43 (Summer 1989), pp. 377-403. Current projects that deal with questions of regime compliance and effectiveness (and their principal investigators) include those being conducted at, or with funding from, Dartmouth College (Oran Young and Marc Levy); the European Science Foundation (Kenneth Hanf and Arild Underdal); the Foundation for International Environmental Law and Diplomacy (James Cameron); the Fridtjof Nansen Institute (Steinar Andresen); Harvard University (Abram Chayes and Antonia Chayes); Harvard University (William Clark, Robert Keohane, and Marc Levy); the International Institute for Applied Systems Analysis (David Victor and Eugene Skolnikoff); and the Social Science Research Council (Edith Brown Weiss and Harold Jacobson).

explanatory variables constant. The goal of the treaties underlying this regime has been to reduce intentional discharges of waste oil by tankers after they deliver their cargoes. Since the late 1970s, these treaties have established two quite different compliance systems, or “subregimes,” to accomplish this goal. One has prohibited tanker operators from discharging oil in excess of specified limits. The other has required tanker owners to install expensive pollution-reduction equipment by specified dates. Treaty parties viewed both subregimes as equally legitimate and equally binding.⁷ The two subregimes regulated similar behavior by the same nations and tankers over the same time period. The absence of differences in power and interests would suggest that compliance levels with the two subregimes would be quite similar.⁸ According to collective action theory, these cases are among the least likely to provide support for the hypothesis that regime design matters: subregime provisions required the powerful and concentrated oil industry to incur large pollution control costs to provide diffuse benefits to the public at large.⁹ Indeed, the lower cost of complying with discharge limits would suggest that compliance would be higher with those limits than with equipment requirements.

Not surprisingly, violations of the limits on discharges have occurred frequently, attesting to the ongoing incentives to violate the agreement and confirming the characterization of oil pollution as a difficult collaboration problem.¹⁰ A puzzle arises, however, from the fact that contrary to expectation compliance has been all but universal with requirements to install expensive equipment that provided no economic benefits. The following analysis clearly demonstrates that the significant variance across subregimes can only be explained by specific differences in subregime design. Comparing the two compliance systems shows that the equipment subregime succeeded by ensuring that actors with incentives to comply with, monitor, and enforce the treaty were provided with the practical ability and legal authority to conduct

7. Thomas M. Franck, *The Power of Legitimacy Among Nations* (New York: Oxford University Press, 1990).

8. Case selection that holds these other factors constant avoids the notorious difficulties of measuring power and interests and allows us to “attribute variance in collective outcomes to the impact of institutional arrangements with some degree of confidence”; see Oran Young, *International Cooperation: Building Regimes for Natural Resources and the Environment* (Ithaca, N.Y.: Cornell University Press, 1989), p. 208. On difficulties in measuring power, see David A. Baldwin, “Power Analysis and World Politics: New Trends Versus Old Tendencies,” *World Politics* 31 (January 1979), pp. 161–93.

9. Michael McGinnis and Elinor Ostrom, “Design Principles for Local and Global Commons,” Workshop in Political Theory and Policy Analysis, Bloomington, Ind., March 1992, p. 21. Olson’s argument that small groups supply public goods more often than large groups assumes that group members benefit from providing the good, which is not true in the oil pollution case; see Mancur Olson, *The Logic of Collective Action: Public Goods and the Theory of Groups* (Cambridge, Mass.: Harvard University Press, 1965), p. 34.

10. See Arthur A. Stein, *Why Nations Cooperate: Circumstance and Choice in International Relations* (Ithaca, N.Y.: Cornell University Press, 1990); and Robert Axelrod and Robert O. Keohane, “Achieving Cooperation Under Anarchy: Strategies and Institutions,” in Kenneth Oye, ed., *Cooperation Under Anarchy* (Princeton, N.J.: Princeton University Press, 1986).

those key implementation tasks. Specifically, the regime elicited compliance when it developed integrated compliance systems that succeeded in increasing transparency, providing for potent and credible sanctions, reducing implementation costs to governments by building on existing infrastructures, and preventing violations rather than merely deterring them.

Compliance theory and definitions

Explaining the puzzle of greater compliance with a more expensive and economically inefficient international regulation demands an understanding of existing theories about the sources of compliance in international affairs. Realists have inferred a general inability of international regimes to influence behavior from the fact that the international system is characterized by anarchy and an inability to organize centralized enforcement. In what has been the dominant theoretical view, “considerations of power rather than of law determine compliance.”¹¹ To explain variance in treaty compliance, look for variance in the power of those with incentives to violate it or in the interests of those with the power to violate it. Treaties are epiphenomenal: they reflect power and interests but do not shape behavior.

This view does not imply that noncompliance is rare in international affairs. Although nations will violate rules whenever they have both the incentives and ability to do so, as Hans Morgenthau notes, “the great majority of the rules of international law are generally observed by all nations.”¹² For the realist, behavior frequently conforms to treaty rules because both the behavior and the rules reflect the interests of powerful states. More specifically, compliance is an artifact of one of three situations: (1) a hegemonic state forces or induces other states to comply; (2) the treaty rules merely codify the parties’ existing behavior or expected future behavior; or (3) the treaty resolves a coordination game in which no party has any incentive to violate the rules once a stable equilibrium has been achieved.¹³

Treaty rules correlate with but do not cause compliance. Therefore, efforts to improve treaty rules to increase compliance reflect either the changed interests of powerful states or are misguided exercises in futility. The strength of this view has led to considerable attention being paid to whether rules influence behavior and far less being paid to design features that explain why one rule influences behavior and another does not.

11. The quotation is from Hans Joachim Morgenthau, *Politics Among Nations: The Struggle for Power and Peace*, 5th ed. (New York: Alfred A. Knopf, 1978), p. 299. See also Kenneth Waltz, *Theory of International Politics* (Reading, Mass.: Addison-Wesley Publishing Co., 1979), p. 204; and Susan Strange, “Cave! Hic Dragones: A Critique of Regime Analysis,” in Stephen D. Krasner, ed., *International Regimes* (Ithaca, N.Y.: Cornell University Press, 1983), pp. 337–54 at p. 338. For a contrasting view, see Young, *International Cooperation*, p. 62.

12. Morgenthau, *Politics Among Nations*, p. 267.

13. On this distinction, see Stein, *Why Nations Cooperate*.

In contrast, international lawyers and institutionalists contend that the anarchic international order need not lead inexorably to nations violating agreements whenever doing so suits them. Other forces—such as transparency, reciprocity, accountability, and regime-mindedness—allow regimes to impose significant constraints on international behavior under the right conditions.¹⁴ Implicit in the institutionalist view is the assumption that power and interests alone cannot explain behavior: a given constellation of power and interests leaves room for nations to choose among treaty rules that will elicit significantly different levels of compliance. High compliance levels can be achieved even in difficult collaboration problems in which incentives to violate are large and ongoing. Treaties can become more effective over time, and regimes may even learn.¹⁵ Agreeing with Morgenthau that compliance will be quite common, institutionalists do not exclude the possibility that the regime, rather than mere considerations of power, causes some of that compliance.¹⁶

In essence, this debate revolves around whether in a realm of behavior covered by an international agreement, that behavior is ever any different than it would have been without the agreement. If we define “treaty-induced compliance” as behavior that conforms to a treaty’s rules because of the treaty’s compliance system, institutionalists view treaty-induced compliance as possible. In contrast, realists see all compliance as “coincidental compliance,” that is, behavior that would have occurred even without the treaty rules.

The debate between these theories highlights the demands placed on research that seeks to identify those design characteristics of a regime, if any, that are responsible for observed levels of compliance. I define compliance, the dependent variable, as an actor’s behavior that conforms with an explicit treaty provision. Speaking of compliance with treaty provisions rather than with a treaty captures the fact that parties may well comply with some treaty provisions while violating others. A study of “treaty compliance” would aggregate violation of one provision with compliance with another, losing valuable empirical information.¹⁷ Restricting study to the explicit rules in a treaty-based regime allows the analyst to distinguish compliance from noncompliance in clear and replicable ways. Obviously, a focus on explicit rules ignores other potential mechanisms of regime influence, such as norms, principles, and

14. See, for example, Abram Chayes and Antonia Chayes, “Compliance Without Enforcement: State Behavior Under Regulatory Treaties,” *Negotiation Journal* 7 (July 1991), pp. 311–30; Young, *International Cooperation*; Robert O. Keohane, “Reciprocity in International Relations,” *International Organization* 40 (Winter 1986), pp. 1–27; and Krasner, *International Regimes*.

15. Joseph S. Nye, Jr., “Nuclear Learning and U.S.–Soviet Security Regimes,” *International Organization* 41 (Summer 1987), pp. 371–402.

16. See, for example, Louis Henkin, *How Nations Behave: Law and Foreign Policy* (New York: Columbia University Press, 1979), p. 47; Young, *International Cooperation*, p. 62; and Chayes and Chayes, “Compliance Without Enforcement,” p. 31.

17. At the extreme, if all parties violated treaty provision A and complied with treaty provision B, they could all be classified as in partial compliance, ignoring the important variance in compliance rates.

processes of knowledge creation.¹⁸ However, this restrictive definition has the virtue of bringing the debate to a level at which research on actual treaties and actual compliance can contribute to the intellectual and policy debates.

This article evaluates the features of a regime that may determine compliance by differentiating among three parts of any compliance system: a primary rule system, a compliance information system, and a noncompliance response system. The primary rule system consists of the actors, rules, and processes related to the behavior that is the substantive target of the regime. In the choice of who gets regulated and how, the primary rule system determines the pressures and incentives for compliance and violation. The compliance information system consists of the actors, rules, and processes that collect, analyze, and disseminate information on instances of violations and compliance. Self-reporting, independent monitoring, data analysis, and publishing comprise the compliance information system that determines the amount, quality, and uses made of data on compliance and enforcement. The noncompliance response system consists of the actors, rules, and processes governing the formal and informal responses—the inducements and sanctions—employed to induce those in noncompliance to comply. The noncompliance response system determines the type, likelihood, magnitude, and appropriateness of responses to noncompliance. These categories provide the framework used in the remainder of this article to evaluate the oil pollution regime's sources of success and failure in its attempt to elicit compliance.

Two subregimes for international oil pollution control

For most people, oil pollution conjures up images of tanker accidents such as that of the *Exxon Valdez*.¹⁹ While oil from such accidents poses a concentrated but localized hazard to the marine environment, the waste oil traditionally generated during normal oil transport has posed a more diffuse but ubiquitous threat. After a tanker delivers its cargo, a small fraction of oil remains onboard, adhering to cargo tank walls. Ballasting and tank-cleaning procedures mixed this oil—averaging about 300 tons per voyage—with seawater, creating slops. These in turn were most easily and cheaply disposed of by discharging them overboard while at sea.²⁰ By the 1970s, the intentional discharges made on thousands of tanker voyages were putting an estimated million tons of oil into the oceans annually.²¹ While scientific uncertainty remains regarding the extent

18. See Haas, Keohane, and Levy, *Institutions for the Earth*; George W. Downs and David M. Rocke, *Tacit Bargaining, Arms Races, and Arms Control* (Ann Arbor: University of Michigan Press, 1990); Charles Lipson, "Why Are Some International Agreements Informal?" *International Organization* 45 (Autumn 1991), pp. 495–538; and Chayes and Chayes, "On Compliance," pp. 188–92.

19. The *Exxon Valdez* wrecked in Prince William Sound, Alaska, on 24 March 1989.

20. For comparison, the *Exxon Valdez* spilled thirty-five thousand tons.

21. National Academy of Sciences, *Petroleum in the Marine Environment* (Washington, D.C.: National Academy of Sciences, 1975). See also National Academy of Sciences and National Research Council, *Oil in the Sea: Inputs, Fates, and Effects* (Washington, D.C.: National Academy Press, 1985).

of damage to marine life caused by such chronic but low-concentration discharges, their impact and that of accidents on seabirds and resort beaches have produced regular international efforts at regulation.²²

Intentional oil discharges were one of the first pollutants to become the subject of an international regulatory regime.²³ In the International Convention for the Prevention of Pollution of the Seas by Oil (OILPOL) of 1954, nations addressed the coastal oil pollution problem by limiting the oil content of discharges made near shore.²⁴ In what has been a regime largely focused on regulation,²⁵ numerous revisions were negotiated within diplomatic conferences sponsored by the Intergovernmental Maritime Consultative Organization (IMCO) or within its committees and those of its successor, the International Maritime Organization (IMO). By the late 1970s, the regime's major provisions, now contained in the International Convention for the Prevention of Pollution from Ships (MARPOL), consisted of restrictions on both tanker operations and tanker equipment that relied on quite different compliance systems.²⁶ Although rule-making has remained consistently international, governments and nonstate actors have played crucial roles in the implementation and enforcement of the regime: tanker owners and operators have been the targets of the regulations while maritime authorities, classification societies, insurers, and shipbuilders have monitored and enforced the regulations.

The discharge subregime

The discharge subregime of the last fifteen years evolved from the initial regulations of 1954. That agreement constituted a compromise between the United Kingdom—which wielded strong power in oil markets but had strong

22. See, for example, National Academy of Sciences and National Research Council, *Oil in the Sea*; and Joint Group of Experts on the Scientific Aspects of Marine Pollution (GESAMP), *The State of the Marine Environment*, Reports and Studies no. 39 (New York: United Nations, 1990).

23. For the history of oil pollution control from the 1920s through the 1970s, see Sonia Zaide Pritchard, *Oil Pollution Control* (London: Croom Helm, 1987); for a history from the 1950s through the 1970s, see R. Michael M'Gonigle and Mark W. Zacher, *Pollution, Politics, and International Law: Tankers at Sea* (Berkeley: University of California Press, 1979).

24. "International Convention for the Prevention of Pollution of the Sea by Oil," 12 May 1954, *Treaties and Other International Agreements Series (TIAS)*, no. 4900 (Washington, D.C.: U.S. Department of State, 1954).

25. For an excellent description of a regime more focused on developing scientific understanding of an environmental problem, see Levy's description of the regime on European acid precipitation in Marc Levy, "European Acid Rain: The Power of Tote-board Diplomacy," in Haas, Keohane, and Levy, *Institutions for the Earth*, pp. 75–132.

26. See *International Convention for the Prevention of Pollution from Ships (MARPOL)*, 2 November 1973, reprinted in *International Legal Materials (ILM)*, vol. 12 (Washington, D.C.: American Society of International Law, 1973), p. 1319 (hereafter cited by abbreviation, volume, and year); and *Protocol of 1978 Relating to the International Convention for the Prevention of Pollution from Ships*, 17 February 1978, reprinted in *ILM*, vol. 17, 1978, p. 1546 (hereafter cited together as *MARPOL 73/78*).

environmental nongovernmental organizations pushing it to reduce coastal pollution—and Germany, the Netherlands, the United States, and other major states that viewed any regulation as either environmentally unnecessary or as harmful to their own shipping interests. Although the United Kingdom had sought to restrict tanker discharges throughout the ocean, the final agreement limited the oil content of discharges made within fifty miles of any coastline to 100 parts oil per million parts water (100 ppm). In 1962, the British pushed through an amendment applying this 100 ppm standard to discharges made by new tankers regardless of their distance from shore.

The principle underlying the 1962 amendment—that crude oil could float far enough that discharge zones would not effectively protect coastlines—had gained sufficient support by 1969 that nations agreed to limit discharges by all tankers throughout the ocean. The pressure to amend the 1954/62 agreement came from two different sources. On one side, the thirty-five million gallons of oil spilled by the grounding of the *Torrey Canyon* off Britain and France on 18 March 1967 and growing environmentalism, especially in the United States, supported a push for stronger regulations.²⁷ The previously resistant United States replaced the United Kingdom as the leading activist state and especially sought to ensure that amendments would address the growing evidence of enforcement problems with existing regulations.

On the other side, oil companies rightly interpreted the 1962 amendments as a wake-up call that discharge standards would soon be replaced by expensive equipment requirements. In response, Shell Marine International developed and promoted an operational means by which tankers could reduce oil discharges without any new equipment.²⁸ The load-on-top procedure (LOT) involved consolidating ballast and cleaning slops in a single tank, letting gravity separate out the water so it could be decanted from beneath the oil, and loading the next cargo on top of the remaining slops. The beauty of LOT was that it ensured that less cargo was wasted, thereby advancing both the environmental goal of reducing intentional oil pollution and the economic goal of reducing the amount of valuable oil discharged overboard. LOT even improved on the regime's existing standards, since its use reduced rather than merely redistributed intentional discharges. The problem was that normal operation of LOT produced discharges that exceeded the 100 ppm standard. If this criterion had remained in effect, tankers would have had to install expensive new equipment to comply with OILPOL, defeating LOT's major economic virtue. With the support of France, the Netherlands, Norway, and the now less-activist United Kingdom, oil and shipping companies therefore also sought to amend the treaty. Oil companies considered LOT so effective that they wanted diplomats to scrap the 1954/62 zonal approach altogether.

27. M'Gonigle and Zacher, *Pollution, Politics, and International Law*, p. 100.

28. J. H. Kirby, "The Clean Seas Code: A Practical Cure of Operation Pollution," in *Third International Conference on Oil Pollution of the Sea: Report of Proceedings, Rome 7–9 October 1968* (Winchester, England: Warren and Son, 1968), pp. 201–19.

The pressures for greater environmental protection, however, led them to support the more limited objective of redefining the limits on discharges from the 100 ppm “content” criterion to one that could be monitored using existing on-board equipment.²⁹

In a unanimously accepted compromise in 1969, more stringent and enforceable regulations were framed in terms that averted equipment requirements. Within the fifty-mile near-shore zones, discharges could now only involve “clean ballast” that left no visible trace; outside the fifty-mile zones, discharges could not exceed 60 liters of oil per mile (60 l/m). Proponents argued that the clean ballast provision would improve enforcement by transforming any sighting of a discharge into evidence of a violation.³⁰ The more crucial change involved a new limit that total discharges not exceed one fifteen-thousandth of a tanker’s capacity.³¹ Although compliance with this standard required a tanker to reduce its average discharges by almost 98 percent, Shell’s J. H. Kirby claimed that “any responsibly run ship, no matter how big, could operate” within these standards if it used LOT.³² The low total discharge limit also allowed port authorities to assume that any tanker with completely clean tanks had blatantly violated the agreement.³³ These standards took effect in 1978 and remain in force today through their incorporation into the 1973 MARPOL agreement.

The equipment subregime

By the early 1970s, public concern was pushing environmental issues onto the international political scene with increasing frequency. The United Nations Conference on the Human Environment and negotiation of the London Dumping Convention in 1972 set the stage for a major overhaul of the OILPOL agreement. IMCO hosted a major conference in 1973 to negotiate the MARPOL treaty. Its goal was the replacement of OILPOL’s rules with rules that would cover all major types of vessel-source marine pollution.

29. Kirby, “The Clean Seas Code,” p. 206.

30. Assembly resolution 391, IMCO/IMO doc. resolution A.391(X), 1 December 1977, Annex, par. 5. All document citations herein refer to IMCO/IMO documents housed in the IMO Secretariat library. They are numbered similarly: according to issuing committee (abbreviated), meeting number, agenda item, and document number. Information documents are designated by “Inf.” prior to the document number. Circulars are designated by “Circ.,” issuing committee, and circular number only. Resolutions are designated by adopting body, resolution number, and meeting number. Conference documents are cited by abbreviated conference title, preparatory meeting number, agenda item, and document number. Hence the above resolution citation would be interpreted as the 391st resolution adopted by the 10th meeting of the (IMCO) assembly.

31. *1969 Amendments to the International Convention for the Prevention of Pollution of the Sea by Oil*, 21 October 1969, reprinted in Bernd Ruster and Bruno Simma, eds., *International Protection of the Environment: Treaties and Related Documents* (Dobbs Ferry, N.Y.: Oceana Publications, 1975).

32. Kirby, “The Clean Seas Code,” p. 208.

33. See Kirby, “The Clean Seas Code,” pp. 200 and 209; and William T. Burke, Richard Legatski, and William W. Woodhead, *National and International Law Enforcement in the Ocean* (Seattle: University of Washington Press, 1975), p. 129.

The U.S. government had become increasingly concerned that the ease with which tanker crews could violate discharge standards and the massive resources and diligence needed to detect violations were preventing effective mitigation of the growing oil pollution problem.³⁴ By 1972, Congress had adopted legislation that threatened to require all American tankers as well as all tankers entering U.S. ports to install expensive pollution-reducing equipment. The legislation included a proposal to require all large tankers to install double hulls to address accidental spills and segregated ballast tanks (SBT) to address intentional discharges. The SBT system involved arranging ballast tanks and associated piping such that ballast water could not come into contact with oil being carried as cargo. The system was expensive both in terms of capital and the reduction to cargo-carrying capacity. The United States sought international agreement to require SBT but threatened to require it unilaterally if necessary. Discharge requirements clearly were cheaper, more economically efficient, and “in theory . . . a good idea.”³⁵ However, environmental pressures and growing evidence that LOT was neither as widespread nor as effective as had been hoped led the United States and the United Kingdom to support rules that offered easier and more effective enforcement.

The largely U.S.-based oil companies initially opposed SBT requirements but eventually supported them as preferable to threatened U.S. unilateral rules. Many shipping states also reluctantly supported SBT requirements. They believed such requirements would avert an even more costly double bottom requirement. It was also fiscally acceptable: the combination of a recent building boom and the proposed language of the requirements meant that tanker owners would only have to incur the additional costs of SBT many years in the future and then only for large tankers. However, governments representing shipbuilding interests (France and Japan) and those representing independent tanker owners (Denmark, Germany, Greece, Norway, and Sweden) opposed the requirement.³⁶ By a vote of thirty to seven, the conference adopted a requirement for tankers over 70,000 tons built in 1980 and later to install SBT.

By 1977, a spate of accidents in the United States and continuing enforcement concerns led President Jimmy Carter to propose that SBT requirements be applied to all tankers, not just large new tankers.³⁷ Given (1) that the United States was again explicitly threatening unilateral action and (2) that the 1973

34. M'Gonigle and Zacher, *Pollution, Politics, and International Law*, p. 108.

35. See statements submitted by the U.S. delegation to the 13th Preparatory Session for an International Conference on Marine Pollution in 1973: IMCO/IMO doc. MP XIII/2(c)/5, 23 May 1972. (Using note 30 as a guide, this would be the 5th document issued relating to agenda item 2[c]). See also doc. MP XIII/2(a)/5, 1 June 1972; G. Victory, “Avoidance of Accidental and Deliberate Pollution,” in *Coastal Water Pollution: Pollution of the Sea by Oil Spills* (Brussels: North Atlantic Treaty Organization [NATO], 2–6 November 1970), p. 2.3.

36. M'Gonigle and Zacher, *Pollution, Politics, and International Law*, p. 114.

37. Jacob W. Ulvila, “Decisions with Multiple Objectives in Integrative Bargaining,” Ph.D. diss., Harvard University, 1979, appendix A1.1.

MARPOL agreement still had been ratified by only three states, IMCO called a second major conference in 1978.³⁸ State positions reflected the fact that retrofitting existing tankers with SBT would reduce each tanker's (and the fleet's) cargo capacity by some 15 percent.³⁹ Greece, Norway, and Sweden saw this as a means to put scores of their laid up independent tankers back to work. However, most states saw SBT retrofitting as extremely expensive.⁴⁰ Just as the 1962 amendments had prompted LOT development, the 1973 MARPOL agreement prompted oil companies to perfect a technique known as crude oil washing (COW), which entailed spraying down cargo tanks with the cargo itself rather than with seawater. Operating COW equipment during cargo delivery transformed oil that otherwise would have been discharged as slops into usable delivered cargo, simultaneously reducing oil pollution and increasing cargo owner revenues. The industry proposal for COW as an alternative to SBT produced a compromise in which tankers built after 1982 had to install both SBT and COW, while existing tankers had to be retrofitted with either SBT or COW by 1985. The 1978 Protocol Relating to the International Convention for the Prevention of Pollution from ships was made an integral part of the 1973 MARPOL agreement. While MARPOL and its protocol, known collectively as MARPOL 73/78, did not enter into force until 1983, their standards regulated all new construction after 1979.

Observed compliance levels

Available evidence demonstrates a wide divergence in levels of compliance under these two subregimes. During the same time period in which almost every tanker owner was retrofitting existing tankers and buying new tankers to conform with MARPOL's requirements for SBT and COW, large numbers of tanker operators continued to discharge oil well in excess of legal limits. The variance between the observed compliance rates with the two subregimes is quite marked.

Violations of the clean ballast, 60 l/m, and total discharge standards in place since 1978 have been common. Oil company surveys from the 1970s show that neither oil company nor independent tankers reduced average discharge levels to the one fifteen-thousandth limit in any year between 1972 and 1977 (see Figure 1). Although oil company tankers dramatically reduced average discharges in the early 1970s, discharges remained at three times the legal limit. The two-thirds of the fleet operated by independent oil transporters did far worse, with discharges that were thirty times the legal limit and that were not

38. M'Gonigle and Zacher, *Pollution, Politics, and International Law*, pp. 122 and 130.

39. See Sonia Z. Pritchard, "Load on Top: From the Sublime to the Absurd," *Journal of Maritime Law and Commerce* 9 (April 1978), pp. 185–224 at p. 194.

40. For an excellent discussion of state positions during both the 1973 and 1978 conferences, see M'Gonigle and Zacher, *Pollution, Politics, and International Law*, pp. 107–42.

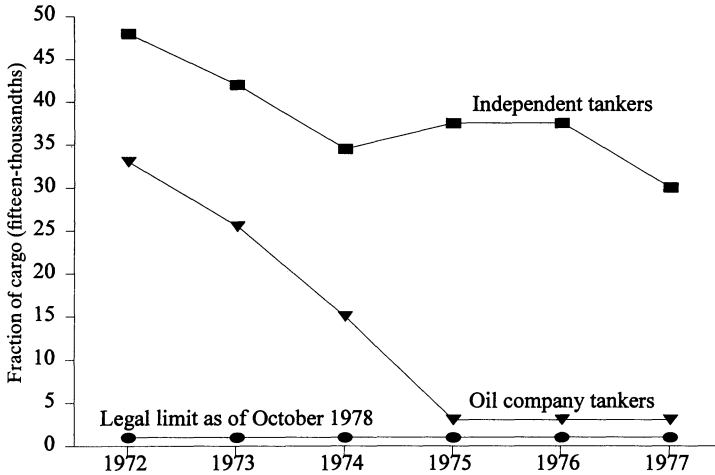


FIGURE 1. Average tanker discharges, 1972–77

Source. U.S. Congress, House Committee on Government Operations, *Oil Tanker Pollution: Hearings Before the Subcommittee on Government Activities and Transportation*, 18 and 19 July 1978, 95th Congress, 2d sess., p. 322.

much below levels that a tanker practicing no pollution control would have produced.⁴¹ The trends in these discharges suggest that few tankers complied with the limit after it took legal effect in 1978.⁴²

Other evidence confirms the frequency of discharge violations. A 1981 National Academy of Sciences estimate of oil pollution relied on an assumption that 50 percent of the world's tanker fleet was violating the total discharge limit.⁴³ A 1989 revision of that study assumed 15–20 percent of tankers were still violating this limit, although it provided no evidence to support the dramatic improvement.⁴⁴ Representatives of independent transporters admit that tankers often violate discharge limits to comply with their contracts: some charter arrangements require ships to arrive with clean tanks but many ports lack facilities to receive the slops they generate by cleaning.⁴⁵ Studies of

41. See, for example, the estimate of 0.3 percent in James E. Moss, *Character and Control of Sea Pollution by Oil* (Washington, D.C.: American Petroleum Institute, 1963), p. 47, and the estimate of 0.4 percent in IMCO/IMO doc. OP I/21, 15 January 1965, of the Oil Pollution subcommittee. (Using note 30 as a guide, this indicates the only document issued relating to agenda item 21 at the 1st meeting of the subcommittee.)

42. Unfortunately, oil companies discontinued the surveys after 1977. Personal communication from Arthur McKenzie, Tanker Advisory Center, New York, 1992.

43. Informational document of the Marine Environment Protection Committee: IMCO/IMO doc. MEPC XVI/Inf.2, 4 November 1981.

44. IMCO/IMO doc. MEPC 30/Inf.13, 19 September 1990, p. 15.

45. For example, "IMO, Tanker Owners Urge Increase in Facilities Accepting Oily Wastes," *International Environment Reporter*, 8 March 1989, p. 130.

detected oil slicks and dead seabirds as well as violation reports provided to IMO confirm that many tankers continue to discharge their slops at sea.⁴⁶

The variety of sources pointing to violation of the discharge standards contrasts sharply with the uniformity of evidence that compliance with the equipment standards has been exceptionally high. By 1981, one shipping research firm already had evidence that new tankers were being built with SBT and existing tankers were being retrofitted with SBT and/or COW.⁴⁷ Recent national and international studies as well as industry experts reveal a common assumption that all tankers comply with the equipment standards although none provides empirical support for this assumption.⁴⁸

Analysis of previously unavailable data on equipment installed on large tankers supports these perceptions (see Table 1).⁴⁹ Among large tankers in the fleet at the end of 1991, 94 percent of tankers built in 1979 or earlier had installed SBT or COW as required, 98 percent of those built between 1980 and 1982 had installed SBT as required, and 98 percent of those built after 1982 had installed both SBT and COW as required. The figures not only confirm remarkably high compliance rates but also document that tankers of all nations, not merely those that supported the equipment requirements during negotiation, have complied.

The variance between the subregimes is more remarkable when one considers that both international politics and private economics would lead us to expect higher compliance with the discharge standards, not the equipment standards. The discharge standards had been adopted unanimously. In contrast, several powerful nations opposed the equipment standards in both 1973 and 1978. Tankers seeking the economic benefits of conserving oil could have done so most cheaply by using the equipment-free option of LOT, not by installing COW or the even more expensive SBT. Indeed, in 1978, one

46. See, for example, C. J. Camphuysen, *Beached Bird Surveys in the Netherlands 1915–1988: Seabird Mortality in the Southern North Sea Since the Early Days of Oil Pollution* (Amsterdam: Werkgroep Noordzee, 1989); United States Coast Guard, *Polluting Incidents In and Around U.S. Waters* (Washington, D.C.: U.S. Department of Commerce, 1973 and 1975–86); N. Smit-Kroes, *Harmonisatie Noordzeebeleid: Brief van de Minister van Verkeer en Waterstaat* (Tweede Kamer der Staten-Generaal: 17-408) (Harmonization of North Sea policy: Letter from the Minister of Transport and Waterways; Lower House of Parliament) (The Hague: Government Printing Office of the Netherlands, 1988); IMCO/IMO doc. MEPC 21/Inf. 8, 21 March 1985; and Second International Conference on the Protection of the North Sea, *Quality Status of the North Sea: A Report by the Scientific and Technical Working Group* (London: Her Majesty's Stationery Office, 1987), p. 14.

47. Drewry Shipping Consultants, Ltd., *The Impact of New Tanker Regulations*, Drewry publication no. 94 (London: Drewry Shipping Consultants, Ltd., 1981), p. 25.

48. See IMCO/IMO doc. MEPC 30/Inf.13, 19 September 1990, p. 8; Second International Conference on the Protection of the North Sea, *Quality Status of the North Sea*, p. 57; Pieter Bergmeijer, "The International Convention for the Prevention of Pollution from Ships," paper presented at the 17th Pacem in Maribus conference, Rotterdam, August 1990, p. 12; and personal interview with E. J. M. Ball, Oil Companies International Marine Forum, London, 26 June 1991;

49. The detailed statistics in Table 1 and Figure 2 were developed from an electronic version of Clarkson Research Studies, Ltd., *The Tanker Register* (London: Clarkson Research Studies, Ltd., 1991) generously provided by Clarkson Research Studies, Ltd.

TABLE 1. *Percentage of crude oil tankers weighing over 70,000 deadweight tons with segregated ballast tanks (SBT) and/or crude oil washing equipment (COW) onboard^a*

<i>Equipment onboard</i>	<i>Tanker construction date (and MARPOL requirement)^b</i>		
	<i>1979 and earlier (SBT or COW)</i>	<i>1980–82 (SBT only)</i>	<i>Post 1982 (SBT and COW)</i>
SBT and COW	32%	94%	98%
SBT or COW	94%	99%	100%
Total SBT (alone and with COW)	36%	98%	99%
Total COW (alone and with SBT)	89%	95%	99%
SBT alone	4%	4%	1%
COW alone	58%	1%	1%
Neither SBT nor COW	6%	1%	0%
<i>MARPOL compliance level</i>	94%	98%	98%

^aData reflect tankers in the fleet as of 31 December 1991.

^bMARPOL = International Convention for the Prevention of Pollution from Ships.

Source. Electronic version of Clarkson Research Studies, Ltd., *The Tanker Register* (London: Clarkson Research Studies, Ltd., 1991).

academic analyst, Charles Okidi, predicted that the enormous costs of SBT would make compliance “negligible.”⁵⁰

In short, the empirical evidence of higher compliance levels with the equipment subregime runs contrary to predictions based on a simple analysis of exogenous power and interests. How do we explain what appears to be a significant divergence between theory and observed outcomes? Was any of the observed compliance treaty-induced? If so, what elements of the equipment standards compliance system explain its greater success at eliciting compliance? The rest of this article answers these questions.

Was compliance treaty-induced?

Before we can explain how one subregime produced such dramatically higher compliance levels than another within the same issue-area, we need to assure ourselves that we can accurately attribute this variance to features of the

50. Charles Odidi Okidi, *Regional Control of Ocean Pollution: Legal and Institutional Problems and Prospects* (Alphen aan den Rijn, The Netherlands: Sijthoff and Noordhoff, 1978), p. 34.

regime. Taking realist analysis seriously requires that we avoid attributing causation where only spurious correlation exists. Factors other than variation in the compliance systems of the two subregimes may explain the observed behaviors. Did tanker owners and operators act any differently than they would have in the absence of international regulations? The following accounting of incentives to comply with regulations from both within and outside of the regime strongly suggests (1) that increased use of LOT owes more to economics than to international law, (2) that increased installation of COW equipment owes much to economics but also reflects the MARPOL regime's influences, and (3) that increased installation of SBT largely is due to MARPOL influences.

LOT

Several pieces of evidence indicate that the 1969 rules had little to do with the observed increase in the use of LOT by tanker operators. A large share of tankers simply did not use LOT or comply with the discharge standards. The continuing noncompliance with discharge standards did not result from an inability to use LOT—a noncomplex procedure that required no new equipment—but from insufficient incentives to use it.

The subregime itself produced few effective mechanisms for inducing operators to adopt LOT. While I discuss these failures more fully below, the discharge subregime's compliance system failed to induce the monitoring and enforcement necessary to deter violations. The subregime's failure effectively to detect, identify, prosecute, and penalize violators left tanker operators' incentives to comply with it largely uninfluenced. As the official IMO newsletter put it, "Little has changed in the three decades since [1962]. The problem is detecting a violation in the first place (which is difficult) and then collecting sufficient evidence to prove the case in court (which has all too often proved to be impossible)."⁵¹

Given the absence of these pathways for regime influence, it is not surprising to find that economic influences readily explain the pattern of LOT usage. A tanker operator's first-order incentives to use LOT depended on the costs of recovering waste oil, the value of that oil, and the ownership of the oil being transported. This last factor meant that oil companies had far greater incentives to adopt LOT than did independent transporters. The latter carry oil on charter to cargo owners and are paid for the amount of oil initially loaded, known as the bill-of-lading weight, not for the amount delivered. Therefore, discharging waste oil at sea costs the independent transporter nothing. Indeed, using LOT reduces the bill-of-lading weight in subsequent cargo by the amount of remaining slops, thereby reducing the payment that the independent transporter receives. In contrast, operators that own their cargoes, as oil

51. See p. 9 of "Cleaner Oceans: The Role of the IMO in the 1990s," *IMO News*, no. 3, 1990, pp. 6–12.

companies usually do, can offset a LOT tanker's slightly smaller cargo capacity with the benefit of having all the oil it paid for delivered. At 1976 prices, the lower bill-of-lading weight cost the tanker owner some \$700, while the value of oil recovered benefited the cargo owner some \$16,000.⁵²

The decrease in average discharges of oil company tankers in the 1970s and the absence of a similar decrease in discharges of independent tankers correlate more with these divergent incentives and with rising oil prices than with any treaty proscription. Oil companies' greater incentives to conserve oil explain why their average discharges were lower than those of independent tankers in 1972 and why they decreased discharges more rapidly after the 1973 oil price hikes (see Figure 1). If the regime, rather than economics, were influencing oil company behavior, these decreases should have occurred only after the total discharge limits took legal effect in 1978, not after 1973. The far smaller decrease in average discharge among independents reflects the fact that conserved oil had little value to them.

Nevertheless, the OILPOL regime does appear to have been responsible for the timing of LOT development in the early 1960s and to have at least contributed to some adoption of LOT. Oil company representatives noted at the time that they had developed LOT in response to the increasing pressures for equipment requirements that were evident at the 1962 conference. The facts that (1) oil prices remained constant throughout the 1960s and (2) LOT involved a procedural—not a technological—breakthrough support this more limited claim of regime influence. Declines in discharges by both oil company and independent tankers before the oil price increases of 1973 and declines in independent tankers' discharges after 1973 also prove difficult to attribute exclusively to economic factors. Having said this, however, it remains clear that economic factors rather than the features of the subregime were the dominant factors influencing tanker operators' behavior.

COW

The almost universal installation of COW equipment initially tempts one to conclude that compliance was treaty-induced. The contrast in rates of use of LOT and COW suggest that differences in the designs of the corresponding subregimes may be responsible, given that both methods allowed a tanker operator to reduce waste oil. However, closer evaluation reveals that here, too, economic factors played an important role, although not an exclusive one.

Like LOT, COW has economic as well as environmental benefits. COW's costs include those for the washing machines and the additional time and labor needed to wash tanks in port during delivery rather than during the ballast

52. The following discussion of the costs of LOT, COW, and SBT draws heavily on William G. Waters, Trevor D. Heaver, and T. Verrier, *Oil Pollution from Tanker Operations: Causes, Costs, Controls* (Vancouver, B.C.: Center for Transportation Studies, 1980).

voyage.⁵³ As with LOT, the offsetting benefit of more delivered cargo accrues to the cargo owner. However, the tanker operator also benefits: the decrease in oil left on board increases the tanker's effective cargo capacity and reduces sludge buildup, which can lead to large repair and maintenance costs. Compared with a tanker that was not practicing pollution control, using COW produced a net savings per voyage of \$9,000.

These economic incentives to adopt COW are borne out by the evidence of the timing of its adoption. In many instances, tankers adopted COW before required to do so by MARPOL. Recall that negotiators only incorporated COW requirements into MARPOL in 1978 and only made them applicable to tankers built after 1982. Yet by the mid-1970s, many oil companies had already incorporated COW as a standard operational procedure.⁵⁴ This timing does not correspond with the development of COW technology in the late 1960s or with the deadline set by MARPOL. Instead, like LOT, it corresponds with the rising oil prices of the 1970s.

The contrast to the SBT requirements also confirms the role of economics. The higher capital costs of SBT and the significant reduction to cargo-carrying capacity that SBT involved imposed a net cost per voyage on a tanker with SBT of \$1,500 relative to a tanker with no pollution-control equipment. A new tanker installing both COW and SBT, as required by MARPOL, faced costs of almost \$8,000 per voyage. Owners of large tankers built before 1980, who were allowed to choose between SBT and COW, installed COW equipment on 89 percent of their tankers and SBT on only 36 percent (see Table 1). Owners also installed COW equipment on 95 percent of large tankers built between 1980 and 1982, even though MARPOL only required them to install SBT. COW's economic benefits certainly appear to be a major influence on COW installations.

Several details suggest that economics were not the sole influence on behavior, however. If they were, we should expect companies to achieve the economic goal of conserving oil by the cheapest and most cost-effective means possible, that is, by LOT, not COW. We should also expect to see the same divergence between the behavior of independent carriers and oil companies as we observed in the LOT case. Yet the 99 percent compliance rate attests to the fact that all tanker owners were installing COW. The adoption of COW more frequently than SBT does not imply that the subregime was ineffective, only that when the subregime left owners with alternatives, their choices were driven by costs. In contrast to clear flaws in the compliance system supporting

53. Drewry Shipping Consultants, Ltd., *Tanker Regulations: Enforcement and Effect*, Drewry publication no. 135 (London: Drewry Shipping Consultants, Ltd., 1985), p. 25.

54. See M. G. Osborne and J. M. Ferguson, "Technology, MARPOL, and Tankers: Successes and Failures," *IMAS 90: Maritime Technology and the Environment* (London: Institute of Marine Engineers, 1990), p. 6-2; Testimony of William Gray, in U.S. Congress, House Committee on Government Operations, *Oil Tanker Pollution: Hearings Before the Subcommittee on Government Activities and Transportation, 18 and 19 July 1978*, 95th Congress, 2d sess., 1978, p. 92; and IMCO/IMO doc. MEPC V/Inf.A, 27 April 1976.

discharge standards, as I detail below, the design of the compliance system supporting equipment requirements provided several means of successfully reducing both the incentives and ability of tanker owners to violate COW requirements. Thus, an interplay among economics and subregime characteristics appears to have been the source of widespread COW adoption.

SBT

Adoption of the SBT standard provides an unambiguous example of subregime influence on behavior. Unlike COW or LOT, tanker owners had no economic incentives to install this technology. SBT's additional piping and equipment added several million dollars to the cost of a new tanker, representing almost 5 percent of total cost.⁵⁵ Installing SBT also reduced cargo capacity, especially when installed on an existing tanker. Yet these costs provided no offsetting benefits in the form of reduced cargo wastage. Even those governments that had supported the 1978 proposal that all tankers be retrofitted with SBT admitted that SBT would increase the cost of carrying oil by 15 percent; some oil company estimates ran up to 50 percent.⁵⁶ As late as 1991, oil and shipping interests opposed mandatory SBT retrofitting as being too expensive.⁵⁷

The pattern of observed SBT installation follows that which one would predict for behavior driven by effective treaty rules rather than economics. Among tankers currently in the fleet, more than 98 percent of those required to install SBT have done so despite the significant costs involved. Compliance has been elicited even among those required to install both SBT and COW. Rates of SBT installation among older tankers bolster the argument: among tankers built before 1980, which MARPOL allowed to choose between SBT and COW, only 36 percent have installed SBT. Indeed, owners installed SBT alone on only 4 percent of older tankers but installed COW alone on 58 percent, suggesting that owners installed SBT only when a tanker was already in dock to be retrofitted with COW. Figure 2 graphs the percentages of current tankers using SBT and COW by year of construction. The timing of the increase in the number of tankers installing SBT seen in the figure reinforces the conclusion that owners installed SBT only under the regulatory threat posed by the subregime's compliance system. In short, owners have installed SBT only when MARPOL required them to do so. As one analyst noted, "If there were not a

55. See Philip A. Cummins, Dennis E. Logue, Robert D. Tollison, and Thomas D. Willett, "Oil Tanker Pollution Control: Design Criteria Versus Effective Liability Assessment," *Journal of Maritime Law and Commerce* 7 (October 1975), pp. 181-82; and Charles S. Pearson, *International Marine Environmental Policy: The Economic Dimension* (Baltimore, Md.: The Johns Hopkins University Press, 1975), p. 98.

56. See IMCO/IMO doc. MEPC V/Inf. 4, 8 March 1976, p. A18; and M'Gonigle and Zacher, *Pollution, Politics, and International Law*, p. 134.

57. See IMCO/IMO doc. MEPC 31/8/5, 4 April 1991; and Osborne and Ferguson, "Technology, MARPOL, and Tankers," p. 6-2.

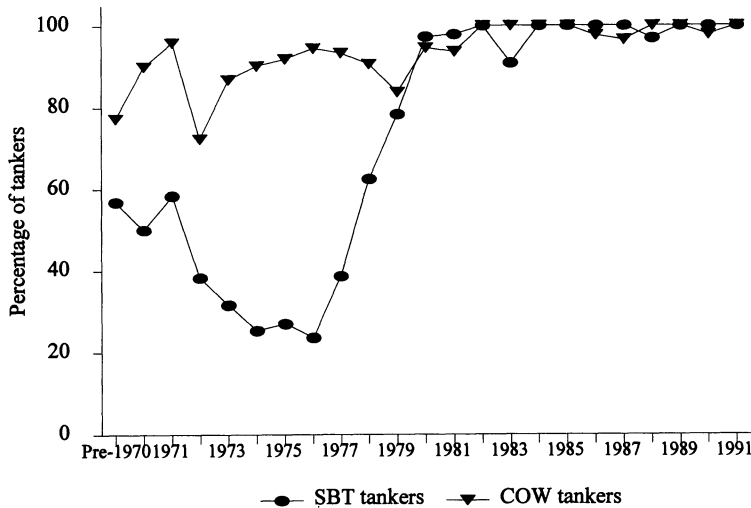


FIGURE 2. *Percentage of tankers with segregated ballast tanks (SBT) and/or crude oil washing equipment (COW) on board in 1991, by year of tanker construction*

Source. Electronic version of Clarkson Research Studies, Ltd., *The Tanker Register* (London: Clarkson Research Studies, Ltd., 1991), provided to the author.

regulatory requirement, there would not be SBT.”⁵⁸ Within several years, the subregime had caused a radical change in tanker owner behavior.

One alternative explanation of SBT adoption deserves special attention. At least one analyst has claimed that hegemonic pressures exerted by the United States explain the success of MARPOL.⁵⁹ Certainly the negotiation history demonstrates that the SBT requirements of 1973 and 1978 resulted directly from threats of unilateral U.S. regulation. Indeed, the United States is the only state that adopted national legislation containing a faster schedule and broader application of equipment requirements than MARPOL.⁶⁰ Admitting that MARPOL’s rules resulted from hegemonic pressures, however, does not imply that subsequent behaviors result from that same pressure. As international diplomats are all too well aware, resources adequate to elicit votes for a resolution during a conference may prove inadequate to cause corresponding changes in behavior. The relevant question is, “Could the United States,

58. Personal interview with Sean Connaughton, marine transportation analyst, American Petroleum Institute, Washington, D.C., 8 April 1992.

59. Jesper Grolin, “Environmental Hegemony, Maritime Community, and the Problem of Oil Tanker Pollution,” in Michael A. Morris, ed., *North-South Perspectives on Marine Policy* (Boulder, Colo.: Westview Press, 1988).

60. Drewry Shipping Consultants, Ltd., *Tanker Regulations*, p. 11.

through unilateral measures, have induced so many tanker owners to install SBT?" Available evidence suggests not.

While the United States wields tremendous diplomatic leverage, it wields nothing near hegemonic power in oil transportation markets. Since the United States became concerned about oil pollution in the late 1960s, it has been responsible for less than 5 percent of new tankers built, less than 7 percent of tanker registrations, and less than 20 percent of world oil imports.⁶¹ Given SBT's high costs, oil transportation companies would have been more likely to respond to unilateral U.S. equipment requirements by installing SBT on a sufficient number of tankers to service the U.S. market than by installing it on all tankers. Nor has the United States sought to link MARPOL enforcement with other issues through threats of sanctions or through side-payments.⁶² Indeed, in terms of power to control oil tankers, Japan—which opposed SBT requirements in both 1973 and 1978—consistently has controlled larger shares of tanker construction, tanker registration, and oil imports than the United States. Thus, while the nation most strongly supporting universal installation of SBT could not have imposed its preferences on its own, the nation most capable of doing so consistently opposed such measures.

Mechanisms of influence

Compliance with discharge standards via the use of LOT was largely an artifact of economic factors. Compliance with requirements for SBT and COW has been both higher and more clearly the result of the treaty. Rival explanations of economic influences and international political hegemony prove incapable of adequately explaining the observed outcomes and behaviors. The equipment subregime succeeded at inducing reluctant tanker owners to spend considerable money on additional equipment that provided them with no economic benefit. The following assessment of the exact means by which it did so simultaneously reinforces the conclusion that the regime caused the change in behavior and identifies design features that might be used to improve the effectiveness of other regimes.

Which of the many differences between the two subregimes best explain the different levels of observed compliance? In what ways did the equipment subregime “get it right” where the discharge standards failed? In subsequent portions of this article, I shall show how the design of the equipment regime

61. See Lloyd's Register of Shipping, *Annual Summary of Merchant Ships Completed* (London: Lloyd's Register of Shipping, various years); Lloyd's Register of Shipping, *Statistical Tables* (London: Lloyd's Register of Shipping, various years); and United Nations, *Statistical Yearbook* (New York: United Nations, various years).

62. For examples of U.S. sanctions to enforce the International Convention for the Regulation of Whaling, see Gene S. Martin, Jr., and James W. Brennan, “Enforcing the International Convention for the Regulation of Whaling: The Pelly and Packwood–Magnuson Amendments,” *Denver Journal of International Law and Policy* 17 (Winter 1989), pp. 271–92.

induced compliance by (1) eliciting monitoring and enforcement and (2) reducing opportunities for violation.

Enhancing transparency

The equipment subregime had one major advantage over the discharge subregime in its significantly higher transparency level. Violations of the SBT and COW requirements simply were far easier to observe than violations of any discharge standard.

Consider the two compliance information systems. Both OILPOL and MARPOL required tanker captains to note discharges in record books and to make those books available to port authorities for inspection. This obvious reliance on self-incrimination made naval and aerial surveillance programs the more common means of detecting illegal discharges. The total discharge standard of one fifteen-thousandth of cargo capacity improved on this system by providing a criterion that could be monitored by tank inspections in port without relying on information supplied by the tanker captain. Practically speaking, these inspections were restricted to ports in oil-exporting states, since discharges occurred after delivery, on a tanker's return to port to load more cargo.

In contrast, the compliance information system for equipment standards relied on the fact that buying or retrofitting a tanker requires the knowledge and consent of at least three other actors: a builder, a classification society, and an insurance company. Agents in each of these industries would know of a violation even before it was committed. MARPOL also required flag state governments, or classification societies nominated by them, to survey all tankers to ensure compliance before issuing the required International Oil Pollution Prevention (IOPP) certificate and to conduct periodic inspections thereafter.⁶³ As part of the process of evaluating tankers to provide insurers with the information needed to set rates, classification societies regularly monitor compliance with international construction requirements through representatives stationed in shipyards.⁶⁴ Finally, MARPOL gave all port states the legal authority to inspect a tanker's IOPP certificate and its equipment to ensure compliance with the equipment requirements.

The equipment standards subregime made violations more transparent than violations in the discharge standards subregime in several ways. To begin with, regulating the tanker builder-tanker buyer transaction yielded a drastically reduced number of events to be monitored. While several thousand tankers ply the world's oceans, they are owned, built, and classified by only a few owners, shipyards, and classification societies. A tanker making ten trips per year could

63. MARPOL 73/78, Annex I, Regulations 4 and 5.

64. Personal interview with John Foxwell, Shell International Marine, London, 27 June 1991.

violate the total discharge standard three hundred times in its thirty-year life but could only violate the equipment requirements once.

Equipment standards also required authorities to monitor far fewer locations to detect violations. The discharge process standards—100 ppm, clean ballast, and 60 l/m—required patrols of wide areas of ocean to detect slicks that often could not be linked with the responsible tanker. As early as the 1920s, experts had noted the difficulties of such a monitoring system.⁶⁵ The addition of total discharge limits allowed detection of violations while a tanker was in an oil port, a procedure involving far fewer resources. Unfortunately, most oil-exporting states had exhibited little interest in preventing marine pollution; many such states were not even parties to MARPOL.⁶⁶ Inspections to verify compliance with equipment standards could occur in developed oil-importing states, which had shown far more interest in enforcement. The shift from the 100 ppm and 60 l/m limits to total discharge limits improved dramatically the practical ability to detect violations. The shift from total discharge limits to equipment standards improved the regime further by increasing incentives for monitoring among those who already had the practical ability to monitor.

Equipment standards dramatically eased the problem of obtaining evidence needed to sanction a violator. The standards eliminated any reliance on self-incrimination by the perpetrator of a violation. Detecting an equipment violation and identifying its perpetrator also were not time-sensitive. Successful detection and identification of a violation had to occur within hours for violations of the initial standards and within days for total discharge violations but could wait for years for equipment violations. Authorities also faced several difficulties in transforming detection of a discharge at sea into a case worthy of prosecution. In what can be called “passive voice” violations, often a tanker could not be identified as responsible for a detected slick: authorities could only say a violation “had been committed.” Even if a responsible tanker could be identified, determining whether the 100 ppm or 60 l/m criterion had been exceeded generally was difficult. The total discharge standard could have eliminated this problem, but oil-exporting states never established inspection programs. These flaws in the design of the discharge standards compliance system were not necessarily inherent or insurmountable. For example, some analysts proposed placing observers on all tankers to verify compliance with discharge standards.⁶⁷ Even without such a system, governments could have established enough ocean patrol and in-port inspection programs to make detection of discharge violations likely. However, such programs would have

65. Charles Hipwood, United Kingdom Marine Department, cited in Pritchard, *Oil Pollution Control*, p. 23.

66. While Iran and Iraq never have signed either agreement, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, the United Arab Emirates, and Venezuela have never signed MARPOL.

67. Cummins et al., “Oil Tanker Pollution Control,” p. 171.

involved huge expenditures of resources to produce only a low probability of successful deterrence.

In the first years after OILPOL was signed, evidence quickly demonstrated that only the Federal Republic of Germany and the United Kingdom were making any significant efforts to monitor compliance with discharge standards.⁶⁸ By the late 1970s, the Americans, British, Dutch, and French had instituted aerial surveillance programs.⁶⁹ Many other countries used aerial surveillance during the 1980s.⁷⁰ However, these programs were most often small and nonsystematic. The Dutch program flew more surveillance flights per year in the late 1970s than at any time in the 1980s, and the United States discontinued its program in the 1980s due to budgetary pressures.⁷¹ Reports to IMO from 1983 to 1990 show that only one-quarter of the sixty-seven MARPOL signatories had any programs to detect discharges at sea.⁷² British and Dutch data confirm the problems of identifying perpetrators: the British could link detected spills to tankers in only 22 percent of cases and the Dutch, in only 14 percent.⁷³

The entry into force of total discharge standards in 1978 allowed inspectors in oil-loading ports to assume that any incoming tanker with all tanks free of slops had violated the very low limit placed on total discharges. However, even those oil-exporting states that were party to MARPOL had strong disincentives to inspect ships in their ports: ports that were conducting inspections were less attractive loading sites than neighboring ports that were not conducting inspections. Not surprisingly, most governments did not alter their enforcement strategies in response to the greater potential for enforcement provided by the promulgation of total discharge standards. In contrast, considerable evidence confirms that the equipment regime significantly changed the ways in which nations and classification societies conducted tanker inspections. Many of the states that originally had opposed the 1973 and 1978 U.S. proposals for equipment regulations subsequently have conducted the in-port inspections needed to detect violations. In 1982, the maritime authorities of fourteen European states signed a Memorandum of Understanding on Port State Control, committing themselves annually to inspect 25 percent of ships

68. IMCO/IMO doc. OP/CONF/2, 1 September 1961.

69. See James Cowley, "IMO and National Administrations," *IMO News*, no. 4, 1988, pp. 6-11; Smit-Kroes, *Harmonisatie Noordzeebeleid*; and IMCO/IMO doc. MEPC 21/Inf.9, 25 March 1985.

70. James McLoughlin and M. J. Forster, *The Law and Practice Relating to Pollution Control in the Member States of the European Communities: A Comparative Survey* (London: Graham and Trotman, 1982).

71. Personal interview with Daniel Sheehan, U.S. Coast Guard, Washington, D.C., 9 April 1992.

72. Gerard Peet, *Operational Discharges from Ships: An Evaluation of the Application of the Discharge Provisions of the MARPOL Convention by Its Contracting Parties* (Amsterdam: AIDEnvironment, 1992), annexes 5 and 10.

73. See United Kingdom Royal Commission on Environmental Pollution, *Eighth Report: Oil Pollution of the Sea* (London: Her Majesty's Stationery Office, 1981), p. 195; and Smit-Kroes, *Harmonisatie Noordzeebeleid*.

entering their ports for violations of maritime treaties, including MARPOL.⁷⁴ Notably, until 1992, the memorandum of understanding explicitly excluded inspections for discharge violations from its mandate, limiting cooperation to inspection for equipment violations. Even though several member states had voted against SBT, all fourteen have included checks of IOPP certificates in the thousands of inspections they conduct each year. In reports to the IMO secretariat, five additional countries and the United States have reported finding discrepancies in tankers' oil pollution certificates. Canada, Japan, Poland, and Russia have major port inspection programs, and ten Latin American states have recently signed an agreement similar to the European memorandum.⁷⁵ While these countries undoubtedly vary widely in how frequently and carefully they conduct inspections, all have made inspections for MARPOL-required equipment a standard element of their inspection programs.

The effectiveness of these governmental inspections depends at least in part on the initial issue of accurate IOPP certificates by flag states or classification societies designated by them. Reports to IMO for 1984 to 1990 show that missing and inaccurate pollution certificates declined steadily from 9 percent to 1 percent; the memorandum of understanding secretariat reports similar declines—from 11 percent to 3 percent.⁷⁶ These trends suggest that after an initial period of learning how to issue and inspect certificates, classification societies and governments both now issue thorough and accurate certifications. Like port state governments, flag states and classification societies appear to have altered their behavior to become active participants in the equipment subregime's compliance information system. It would seem unlikely that classification societies and flag states would have responded in the same fashion to U.S.-only legislation.

The greater transparency of violations of equipment requirements served perhaps most importantly to reassure other tanker owners that their own compliance would not place them at a competitive disadvantage in the marketplace. An environmentally concerned tanker operator inclined to comply with the discharge standards could not escape the knowledge that others probably would not comply. The economic incentives to discharge oil at sea, the absence of transparency about who was and who was not complying, and the attendant inability of enforcement efforts to effectively deter dis-

74. "Memorandum of Understanding on Port State Control," reprinted in *ILM*, vol. 21, 1982, p. 1.

75. *Acuerdo de Viña del Mar: Acuerdo Latinoamericano Sobre Control de Buques por el Estado Rector Del Puerto* (Viña del Mar Accord: Latin American Accord on Port State Control of Vessels), 5 November 1992. The text of the agreement is almost identical to the text of the "Memorandum of Understanding on Port State Control," cited above. Reference to the agreement can be found in Secretariat of the Memorandum of Understanding on Port State Control, *Annual Report* (The Hague: The Netherlands Government Printing Office, 1992).

76. Secretariat of the Memorandum of Understanding on Port State Control, *Annual Report* (The Hague: The Netherlands Government Printing Office, various years).

charges precluded any assumption other than that many competitors would violate the discharge standards to reduce their costs. The greater transparency of equipment requirements assured a tanker owner installing SBT and COW that all other owners also were doing so. Each company could rest assured that its competitors also would have to incur equipment costs or be sanctioned for not doing so.

The equipment standards provided the foundation for a compliance information system far more transparent than was possible under the discharge subregime. In response, even governments that had opposed the adoption of the requirements conducted inspections for compliance. The subregime's compliance information system channeled the behavior of both governments and classification societies into monitoring activities that supported the regime. It did so by ensuring that those actors with incentives to monitor compliance also had the practical ability and legal authority to do so. The transparency of the system improved the ability to deter violations and simultaneously reassured tanker owners that their own compliance would not place them at a competitive disadvantage with respect to other owners.

Facilitating potent but low-cost sanctions

Greater transparency translated into higher levels of compliance with equipment standards only because the compliance system also induced likely and potent sanctions. The noncompliance response system of the discharge subregime failed to do the same. Even after a violation was detected, tanker operators were unlikely to be successfully prosecuted and equally unlikely to receive a stiff penalty. In contrast, the equipment subregime authorized governments to use the administrative sanction of detention, which made both the likelihood and the cost of being penalized far higher for the equipment standards than for discharge standards. The incentives and abilities of governments to prosecute and to impose large penalties for violation were far lower under the discharge standards than under the equipment standards.

Detected discharge violations frequently remained unprosecuted because the subregime relied on customary international law with its deference to enforcement by flag states. Both OILPOL and MARPOL required a government that detected a discharge violation at sea to forward all evidence to the flag state for prosecution. Only if a tanker discharged illegally within a state's twelve-mile territorial sea and then entered a port of that state could that state prosecute a tanker registered elsewhere. Flag states have generally been less than aggressive in following up on evidence referred to them.⁷⁷ Flag states often lack the ability to prosecute, since tankers flying their flag may rarely enter their ports. They also have few incentives to prosecute because vigorous enforcement on their part would induce owners to take their registrations, and the

77. See Organization for Economic Cooperation and Development (OECD), "OECD Study on Flags of Convenience," *Journal of Maritime Law and Commerce* 4 (January 1973), pp. 231-54.

large associated fees, to a less scrupulous state.⁷⁸ The fact that pollution occurred off another state's coastline and that many developing flag states lack vocal environmental constituencies only reinforced these disincentives to prosecute. In short, the flag states with the authority to prosecute lacked incentives to do so, and the coastal states with the incentives to prosecute lacked the authority to do so.

Under the discharge standards, even states sincerely seeking to prosecute and convict a violator faced major obstacles to success. As already noted, evidence of a violation often failed to produce a violator, and otherwise convincing evidence often failed to meet the legal standards of proof needed for conviction. Evidentiary hurdles should have decreased with the prohibition of discharges that produced visible traces. However, even with aerial photographs of discharges, tankers frequently avoid conviction.⁷⁹ Between 1983 and 1990, port and coastal states discarded for lack of evidence an average of 36 percent of cases occurring in territorial seas and successfully convicted and fined less than 33 percent of all detected violators.⁸⁰ An additional 20 percent of high-seas cases referred to flag states were not prosecuted for the same reason, and less than 15 percent of all referrals resulted in fines being imposed.⁸¹ Indeed, according to Paul Dempsey, from 1975 through 1982 "ninety-two percent of all fines were imposed through port state enforcement."⁸² Many experts had hoped that the clearer evidence from inspections for total discharge violations would overcome these problems, but, according to E. J. M. Ball, there is no record "of a single case where the one fifteen-thousandth rule was used for prosecution."⁸³

When conviction was successful, governments rarely imposed penalties adequate to deter future discharge violations as required by MARPOL.⁸⁴ Although governments have the ability and legal authority to impose high fines, the conflicting goals of the judiciary often inhibit them from doing so. Most states' courts are reluctant to impose fines disproportionate to the offense to compensate for low detection and conviction rates. The principle that "the punishment should fit the crime" places an upper bound on fines that may be too low to successfully deter violation, if detection and prosecution is difficult.

78. Paul Stephen Dempsey, "Compliance and Enforcement in International Law—Oil Pollution of the Marine Environment by Ocean Vessels," *Northwestern Journal of International Law and Business* 6 (Summer 1984), pp. 459–561 and p. 576 in particular.

79. See *ibid.*, p. 526; and personal interview with Ronald Carly, Ministry of Transportation, Brussels, 10 June 1991.

80. Peet, *Operational Discharges from Ships*, pp. 17–18, Tables 11 and 12; and Marie-Jose Stoop, *Olieverontreiniging door schepen op de noordzee over de periode 1982–1987: opsporing en vervolging* (Oil pollution by ships on the North Sea 1982–1987: Investigations and prosecution) (Amsterdam: Werkgroep Noordzee, July 1989).

81. Ronald Bruce Mitchell, "From Paper to Practice: Improving Environmental Treaty Compliance," Ph.D. diss., Harvard University, Cambridge, Mass., 1992, Table 5-1.

82. Dempsey, "Compliance and Enforcement in International Law," p. 537.

83. Personal interview with E. J. M. Ball.

84. MARPOL 73/78, Article 4(4).

Since 1975, the average fine imposed by states never has exceeded \$7,000 and actually has decreased over time.⁸⁵ A Friends of the Earth International study concluded that fines have remained “very low in comparison to the price the vessel would have to pay for using port reception facilities.”⁸⁶ Even when a large penalty is assessed, the delays between initial violation and final sentencing and the reluctance of most states to detain tankers for minor discharge violations often mean that the responsible tanker and crew have long since left the state’s jurisdiction, making fine collection difficult. Owen Lomas points out that the problem is further exacerbated by the fact that “shipowners and their insurers routinely indemnify the masters of their ships against fines imposed upon them for oil pollution.”⁸⁷

In place of the discharge subregime’s legal system of prosecution, conviction, and fines, the equipment subregime relied on quite different responses to noncompliance. The most immediate sanctions involved the ability of classification societies, insurers, and flag state governments to withhold the classification, insurance, and pollution prevention certificates that a tanker needed to conduct international trade. As John Foxwell put it, tankers “cannot get insurance without certification, and can’t get certification without compliance.”⁸⁸ These sanctions amounted to preventing any illegally equipped tanker from doing business. Even if an owner could devise a means to avoid these direct economic effects, a noncompliant tanker that could not trade to all ports would still bring a far lower price in the large tanker resale market.⁸⁹

Besides these market-based sanctions, the equipment subregime obligated port states either to detain tankers with false pollution prevention certificates or inadequate equipment or to bar them from port.⁹⁰ As administrative sanctions, these responses skirted both flag state and port state legal systems—and the associated sensitivities regarding legal sovereignty. Paradoxically, this strategy made port states more likely to use detention and flag states more willing to accept it. Detention also had the virtue that even low usage by a few major oil-importing states forced tanker owners to choose between risking detention and the more costly option of not trading to those lucrative markets. Authorizing developed states to detain violating tankers effectively moved the right to sanction to countries that had far greater domestic political pressures to use it.

Coupling the equipment requirements themselves with these administrative sanctions completely eliminated the legal and evidentiary problems that make

85. Mitchell, “From Paper to Practice,” Table 4–5.

86. IMCO/IMO doc. MEPC 29/10/3, 15 January 1990.

87. Owen Lomas, “The Prosecution of Marine Oil Pollution Offences and the Practice of Insuring Against Fines,” *Journal of Environmental Law*, vol. 1, no. 1, 1989, p. 54. See also IMCO/IMO doc. MEPC 32/14/3, 17 January 1992.

88. Personal interview with John Foxwell, Shell International Marine, London, 27 June 1991.

89. Bergmeijer, “The International Convention for the Prevention of Pollution from Ships,” p. 12.

90. *MARPOL 73/78*, Articles 5(2) and 5(3).

even clear violations of discharge standards difficult to prosecute successfully. Detention imposed opportunity costs on a tanker operator of several thousand dollars per day, and forced retrofitting could cost millions of dollars—far exceeding the fines for discharge violations.⁹¹ Detention had the positive quality that it was not so costly as to be considered a disproportionate response to the crime but was costly enough to deter other violations. In short, detention was simultaneously more likely and more costly.

While many states inspected tankers for compliance with equipment requirements, most have not detained noncompliant ships frequently. IMO records from 1984 to 1990 reveal that seven of fifteen states, including Japan, have detained ships at least once. Only Germany, the United Kingdom, and the United States have detained ships often. This undoubtedly reflects a reluctance on the parts of some states to detain foreign tankers as well as the fact that most tankers were equipped appropriately in the first place.

Although few states detained ships, available evidence supports the conclusion that the subregime altered enforcement behavior. Not one of the states that detained ships began to do so until after MARPOL took effect in 1983.⁹² Even the United States waited until that year—ten years after the detention provision had been accepted. Consider the counterfactual: it is unlikely that the United States would have detained tankers for breaching U.S.-only requirements for SBT, even though it had the practical ability to do so. Without MARPOL, such detentions would have constituted a major infringement of flag state sovereignty. If the use of the more costly detention sanction had reflected an exogenous increase in the interests of states in environmental enforcement, fines for discharge violations should have increased at the same time. Yet, as states began to use detention, fines did not increase dramatically.⁹³ Finally, public goods theory predicts that actors will tend not to enforce rules that supply benefits to other parties.⁹⁴ Contrary to theory, however, European states and the United States spend far more on enforcing equipment standards—a public good that improves the global ocean environment—than on enforcing discharge standards off their own coastlines—the benefits of which would be more “private.”

The equipment subregime operated not by convincing reluctant actors to enforce rules with which they disagreed but by removing the legal barriers that inhibited effective enforcement by those states and nonstate actors willing to enforce them. Classification societies had interests in ensuring that the tankers they classified were able to trade without fear of detention. The incorporation of equipment requirements into their classification criteria provided the

91. Personal interviews with John Foxwell; and with Richard Schiferli, Memorandum of Understanding Secretariat, Rijswijk, The Netherlands, 17 July 1991.

92. Personal interview with Daniel Sheehan.

93. See Peet, *Operational Discharges from Ships*, annex 15; and Dempsey, “Compliance and Enforcement in International Law.”

94. Axelrod and Keohane, “Achieving Cooperation Under Anarchy.”

foundation for insurers to penalize noncompliant tankers. The willingness of a few environmentally concerned oil-importing states to inhibit tankers that lacked the required equipment from trading freely posed an extremely potent threat to a tanker owner. However, the ability and willingness of these states to threaten this sanction depended on removing international legal barriers to its use. Once these barriers were removed, imposing sanctions involved few costs to those imposing them, whether classification societies, insurers, or port state authorities. It thereby made detention more likely, even though it created no new incentives for states to impose sanctions. In a case of “nothing succeeds like success,” the various threats of the equipment subregime’s noncompliance system led to initial compliance by almost all tankers, making it rare that sanctions ever needed to be imposed.

Building on existing institutions

The oil pollution control regime induced implementation of those provisions that involved few direct costs to governments. Monitoring and enforcement proved especially likely when their costs were pushed “off-budget” by deputizing private, nonstate actors to issue certificates and conduct inspections. Piggy backing monitoring and enforcement efforts onto existing government programs also has been successful in accomplishing the regime’s objectives with only minor program modifications and minimal cost. Governments have tended to ignore or put little effort into those stipulations that require significant new expenditure of government resources.

MARPOL’s equipment subregime fostered monitoring by allowing governments to delegate responsibility for surveys to classification societies. This in turn increased the likelihood that tankers would be initially surveyed and subsequently inspected; additionally, the quality of inspections increased. Delegation also helps developing flag states, many of which lack the resources, the practical ability, and the incentives to conduct such inspections. MARPOL allowed such states to fulfill their treaty commitments by assigning classification and inspection responsibilities to actors who often had greater access to and more resources with which to conduct such inspections. Classification societies also had strong incentives to conduct accurate surveys as a means of protecting their business reputations and avoiding problems with insurance companies. The strategy thus simultaneously removed these tasks and the resources they required from the hands of governments and placed them in the hands of actors who could more easily accomplish them. Classification societies already had infrastructures to monitor tanker purchases for safety, financing, and insurance purposes. Adding pollution control to their long inspection checklists required only marginal changes to existing procedures.

The many inspection programs operated by developed port states parallel this pattern. Like classification societies, the maritime authorities of the European memorandum of understanding states, the United States, and other states interested in enforcing the equipment requirements could make simple,

low-cost alterations to port state inspections already being conducted for safety, customs, and other purposes. The recent establishment of a Latin American memorandum and current negotiations for an Asian-Pacific memorandum suggest that the equipment subregime has provided states with a low-cost means to implement their international commitments as their interests in enforcement increase. In contrast, where states have had to incur significant new costs to implement treaty provisions, they have proved highly unlikely to do so. Detection of discharge violations required development of completely new surveillance programs. Most developed states have not established large, ongoing surveillance programs. Even in environmentally concerned states, aerial surveillance programs have tended to be relatively small and subject to the vagaries of domestic budget battles.

In the realm of compliance, the tendency for governments to push implementation costs onto nonstate actors is obvious. Compliance with the equipment standards has involved significant costs to tanker owners and no direct costs to governments. Yet, the treaty also required member states to ensure that their ports had facilities to receive the slops that tankers traditionally had discharged overboard. Although developed states have built more reception facilities, ports in the oil-loading states where they are most needed still largely lack any facilities. IMO participants consistently have failed to adopt proposals for developed states to fund reception facilities in developing states. Even in many developed states, facilities are sorely inadequate relative to the demands of their tanker traffic.⁹⁵ Additionally, the task of determining which ports have adequate facilities and which do not largely has fallen on the shoulders of nonstate actors.⁹⁶ National governments consistently have argued that providing reception facilities is the responsibility of either the ports themselves or of the oil industry.

Coercing compliance rather than deterring violation

The compliance systems of the two subregimes differ most strikingly in the fundamental model underlying their regulatory strategies. The equipment standards subregime relied on a "coerced compliance" strategy, which sought to monitor behavior to prevent violations from occurring in the first place. The discharge standards subregime was deterrence-oriented, attempting to detect, prosecute, and sanction violations after they occurred to deter future violations.⁹⁷ This basic difference in orientation made the compliance task facing the

95. IMCO/IMO doc. MEPC 30/Inf.32, 12 October 1990.

96. See IMCO/IMO docs. MEPC 19/5/2, 21 October 1983; MEPC 22/8/2, 8 October 1985; and MEPC 30/Inf.30, 15 October 1990.

97. Neither strategy was incentive-based, as was the funding of compliance under the Montreal Protocol and Framework Convention on Climate Change. For development of the distinction between these three strategies, see Albert J. Reiss, Jr., "Consequences of Compliance and Deterrence Models of Law Enforcement for the Exercise of Police Discretion," *Law and Contemporary Problems* 47 (Fall 1984), pp. 83-122; and Keith Hawkins, *Environment and Enforcement: Regulation and the Social Definition of Pollution* (Oxford: Clarendon Press, 1984).

equipment standards subregime more manageable than that facing the discharge standards subregime. The underlying strategy choice had important consequences for the level of compliance achieved: inhibiting the ability to violate treaty provisions proved far more effective than increasing the disincentives for violating them.

MARPOL's equipment standards created a remarkably effective system for detecting and sanctioning violations. Even if this compliance system had relied exclusively on the threat of oil-importing states detecting and detaining noncompliant tankers, most tankers would have installed COW and SBT. However, the equipment subregime's strength really came from the fact that it rarely had to use the more potent sanctions it made possible. Involving shipbuilders, classification societies, and insurers in the regulatory process could well have produced the same outcome even without the additional threat of detention. The subregime relied on surveying behavior and preventing violations rather than detecting and investigating them afterwards.⁹⁸ By regulating the business transaction of a tanker purchase rather than the autonomous action of a discharge, the equipment rules allowed identification of potential violators and made it harder to actually commit a violation. Tanker captains faced many regular autonomous decisions about whether to violate discharge standards. In contrast, tanker owners only had to decide once between violating or complying with equipment standards, and their decision required cooperation from other actors and involved major economic consequences. Even before construction began, classification societies and insurance companies were pressing for and monitoring compliance with international standards, helping avert violations before they occurred. Classification societies, insurance companies, and flag state inspectors could withhold the papers necessary to conduct business in international oil markets, thereby frustrating any tanker owner's attempt to reap the benefits of sidestepping these standards.

Experience with the discharge standards had shown that many states would not enforce pollution standards; indeed, even detention was used regularly by only a few states. Given the costs of SBT, if deterrence had been the major source of compliance, one would expect some tankers initially to have violated the equipment standards in an attempt to identify which and how many states actually would enforce the rules. Especially in light of their votes against the requirements, owners might well have assumed less than rigorous enforcement in places like France and Japan. Yet, compliance levels did not follow a pattern of initial noncompliance followed by stiff sanctions and subsequent compliance. The compliance system of the equipment subregime succeeded by effectively restricting the opportunities to violate it rather than making the

98. Reiss, "Consequences of Compliance and Deterrence Models of Law Enforcement for the Exercise of Police Discretion."

choice of violation less attractive. The very low noncompliance levels suggest that in most cases an owner simply decided it would be impossible to convince a tanker builder, a classification society, and an insurer to allow the purchase of a tanker without COW and SBT. Likewise, tankers coming in for repairs and maintenance undoubtedly would have found it difficult to explain why they were not planning on installing SBT or COW, as required. The low levels of detected violations of the equipment standards reveal that obstacles to committing a violation played a major role in preventing such violations. New tankers have been built initially to MARPOL standards, not retrofitted later in response to deterrence threats. Even before MARPOL's equipment deadlines passed, owners were building new and retrofitting older tankers to meet the requirements.

The equipment subregime may have been as successful as it was precisely because it produced a redundant regulatory system. It established compliance information and noncompliance response systems that prevented most violations but could successfully deter any actors who might otherwise have considered violating it. As the experience with discharge standards clarifies, deterrence-based strategies often require the successful completion of a complex chain of actions to be effective. The initial discharge standards subregime faced problems at almost every step of the process: detecting violations, identifying violators, prosecuting violators, and imposing potent sanctions. The shift to total discharge standards eliminated or mitigated some of these problems, but the problems remaining left overall deterrent levels essentially unchanged. A tanker captain evaluating the expected costs of violating OILPOL's or MARPOL's discharge standards could only conclude that the magnitude and likelihood of a penalty were quite small. Successful deterrence strategies must ensure that the whole legal chain operates smoothly, since the breakdown of any link can significantly impair its effectiveness.

Conclusions

Nations can design regime rules to improve compliance. This article has demonstrated that, even within a single issue-area, reference to design features of compliance systems surrounding particular provisions is necessary to explain observed variance in compliance. In the regime regulating intentional oil pollution, the same governments and corporations with the same interests during the same time period complied far more frequently with rules requiring installation of expensive equipment than they did with rules limiting total discharges of oil. Where theories of hegemonic power and economic interests fail to explain this variance, differences in the subregime's compliance systems readily explain why the former subregime led powerful actors to comply with it while the latter did not.

The equipment standards elicited significantly higher compliance because they selected a point for regulatory intervention that allowed for greater transparency, increased the likelihood of forceful responses to detected

violations, built on existing institutions, and coerced compliance by preventing actors from violating them rather than merely deterring actors from doing so. In any regime, the distribution of state power and interests and the traits of relevant economic sectors constrain, but fail to fully explain, the regulations to which states will agree and the degree of possible compliance. By acknowledging these limits and realizing that the same goal often may be achieved by regulating quite different activities, policymakers can improve compliance by regulating those sectors more vulnerable to pressures for compliance and by facilitating the efforts of those governments and nonstate actors more likely to implement and enforce such regulations. This matching of regulatory burdens to expected behavior places the careful choice of the regime's primary rules at the center of any effective compliance system.

Once such primary rules have been established, careful crafting of the compliance information system and the noncompliance response system can further increase the likelihood of compliance. Oil pollution regulations succeeded by facilitating the goals of, placing responsibilities on, and removing the legal and practical barriers limiting those governments and private actors predisposed to monitor and enforce agreements, not by imposing obligations on recalcitrant actors. Inducing compliance required an integrated system of rules and processes that placed actors within a strategic triangle of compliance so that they had the political and economic incentives, practical ability, and legal authority to perform the tasks necessary to implement the treaty.⁹⁹ When such efforts succeeded, governments and private actors acted differently than they would have in the absence of the regime. When such efforts failed, opportunities to increase compliance were missed. We should not expect treaties to achieve perfect compliance.¹⁰⁰ Nevertheless, negotiators can and should design and redesign them to maximize compliance within the constraints that power and interests impose.

Eliciting compliance is only one of the criteria on which we would want to judge a regime's rules. Indeed, the value of compliance itself rests on the assumption that more compliance makes the treaty itself more effective. In the oil pollution case, compliance with the equipment rules involved at least as great a reduction in intentional discharges as did compliance with the discharge standards. Thus, we can safely infer that the higher compliance levels under the former rules also led to increased treaty effectiveness, a fact confirmed by a consensus among most experts that intentional oil discharges have declined since MARPOL took effect.¹⁰¹ However, I am not arguing here for "command and control" regulations but for considering compliance levels—along with efficiency, cost, and equity—as an important evaluative criteria in regime design. The cheaper, more flexible, and more efficient discharge standards simply failed to induce the level of compliance needed to achieve a socially

99. I am indebted to Robert O. Keohane for the notion of a strategic triangle of compliance.

100. Chayes and Chayes, "On Compliance."

101. See Ronald B. Mitchell, "Intentional Oil Pollution of the Oceans," in Haas, Keohane, and Levy, *Institutions for the Earth*, pp. 183–248.

desired outcome; yet the costs of the equipment standards may have exceeded the benefits of that outcome. In cases in which more efficient solutions elicit compliance sufficient to achieve a policy goal, they are clearly preferable. If expected compliance with such solutions appears low, effective regime design requires evaluating whether the benefits of higher compliance outweigh the expense and inefficiency of alternative solutions.

Can we apply the findings developed from studying these two oil pollution cases to other issue-areas? Initial selection of a difficult collaborative problem with characteristics common to many international collaboration problems provides some confidence that we can do so. Other treaties provide anecdotal support for some of the findings reported herein. Nuclear powers consistently have sought to increase the transparency of arms control treaties through progressively tighter provisions for data exchange and on-site inspections. Although the experience with Iraq provides a dramatic example of failure, the nuclear materials and missile technology control regimes rely primarily on coerced compliance models of regulation, seeking to prevent countries from violation in the first instance. Human rights regimes frequently have used information from nongovernmental organizations to monitor compliance with their provisions. These design features seem likely to be the source of some regime compliance, but confirming that conclusion requires considerably more research. The solutions adopted in the oil pollution regime also undoubtedly cannot be applied to all regimes or even to all environmental regimes. Wildlife and habitat protection, for example, can rarely be achieved through technological solutions or quantitative requirements that can be easily monitored. In other instances, the solutions to new problems will not be able to build on existing infrastructures and institutions. The strategies available to international regulators will depend at least in part on features unique to the problem being addressed. Analysts have already shown how regimes influence behavior in realms involving security.¹⁰² How the impacts of similar compliance systems vary across security, economic, human rights, or environmental regimes remains one of many important future questions.

Whether the nations of the world can collaborate to resolve the many international problems, both environmental and otherwise, that face them will depend not on merely negotiating agreements requiring new behaviors but on ensuring that those agreements succeed in inducing governments, industry, and individuals to adopt those new behaviors. We can hope and work for a day when all nations and their citizens are sufficiently concerned about peace, economic well-being, human rights, and the environment that we will not need international law to criminalize the behavior threatening those values and to dictate more benign behaviors. Until then, however, careful crafting and recrafting of international treaties provides one valuable means of managing the various problems facing the nations of the world.

102. See Robert Jervis, "Security Regimes," in Krasner, *International Regimes*, pp. 173–94; and Duffield, "International Regimes and Alliance Behavior."