THE RECOVERY IN U.S. FISHERIES

KATRINA M. WYMAN*

I. INTRODUCTION

Environmentalists often think of environmental problems as intractable, or, at the very least, difficult to fix. Perhaps for this reason, we commonly are regarded as pessimists, prone to seeing the negative rather than the positive.[1] This article is about a good news environmental story that has not received enough attention: the improving state of U.S. fisheries under federal control. These are generally the coastal fisheries located 3 to 200 miles from U.S. shores.[2]

---

* Sarah Herring Sorin Professor of Law, New York University School of Law. Thank you to Professor David Markell for inviting me to give the Distinguished Environmental Lecture at Florida State University College of Law for the *Journal of Land Use and Environmental Law*. Thank you also to the Journal editors for their patience and suggestions; to André Smith, Sarah Krame and Cory Conley for superb research assistance; and to Chris Costello and Brad Sewell for suggestions in conversation. The Filomen D'Agostino and Max E. Greenberg Research Fund at New York University School of Law provided generous financial assistance.

1. *See, e.g.,* Carol M. Rose, *Property and Emerging Environmental Issues – The Optimists vs. The Pessimists*, 1 BRIGHAM-KANNER PROPERTY RIGHTS CONF. J. 405, 406-07 (2012) (describing famous bet between the biologist Paul Ehrlich and the economist Julian Simon about whether resources would be exhausted).

2. Sarah Bittleman, *Toward More Cooperative Fisheries Management: Updating State and Federal Jurisdictional Issues*, 9 TULANE ENVTL. L.J. 349, 357 n.30 (1996) (citing Submerged Lands Act (codified as 43 U.S.C. § 1301-15 (1988))).

The news media are often reporting on overfished fisheries,[3] and many fisheries around the world are indeed overfished.[4] So it is not surprising that academics and others frequently discuss fisheries as a paradigmatic example of the tragedy of the commons.[5] This article emphasizes that it is a misnomer to apply that label to many federally managed fisheries in the U.S., and offers several hypotheses for why that is the case. I make two main points.

First, I emphasize that federally managed fisheries are not a commons and most importantly, for present purposes, that the state of U.S. fisheries has improved over roughly the past decade such that the vast majority of them are not tragic or trending toward tragedy.

Second, I elaborate three possible explanations for the impressive improvement in U.S. fisheries. The first is a legal hypothesis, which attributes the improvement to changes in the main federal statute governing the management of these fisheries: the Magnuson-Stevens Fishery Conservation and Management Act (the

---

3. *See, e.g.*, W. Jeffrey Bolster, *Where Have All the Cod Gone?*, N.Y. TIMES, Jan. 1, 2015, http://www.nytimes.com/2015/01/02/opinion/where-have-all-the-cod-gone.html?_r=0 (chronicling the decline in the historic Gulf of Maine cod fishery and closing of the fishery); Paul Greenberg & Boris Worm, *When Humans Declared War on Fish*, N.Y. TIMES, May 8, 2015, http://www.nytimes.com/2015/05/10/opinion/sunday/when-humans-declared-war-on-fish.html (describing post-World War II increase in "fishing power" and the impacts on fish catches, and referring to recent "reprieve" for fisheries); Patrick Whittle, *Scientists: Rapidly Warming Ocean is a Key Factor in Collapse of New England's Cod Fishery*, ASSOCIATED PRESS, Oct. 29, 2015, http://www.usnews.com/news/business/articles/2015/10/29/scientists-warming-ocean-factor-in-collapse-of-cod-fishery (reporting on recent scientific article attributing the collapse of New England cod fishery partly to warming of ocean waters).

4. FOOD & AGRIC. ORG. OF THE U.N., THE STATE OF WORLD FISHERIES AND AQUACULTURE: OPPORTUNITIES AND CHALLENGES 7 (2014), http://www.fao.org/3/a-i3720e.pdf (globally "28.8 percent" of fish stocks were overfished in 2011). Other studies suggest that the conditions of global fisheries are much worse than the FAO data implies. A 2009 article, based on an analysis of 166 global fish stocks, concluded that "[f]or about two-thirds of the examined stocks (63%), biomass (B) has dropped below the traditional single-species management target of MSY, that is, $B < B_{MSY}$." Boris Worm et al., *Rebuilding Global Fisheries*, 325 SCI. 578, 579 (2009). As Sewell et al. explain, this finding indicates that about "63%" of the worldwide fish stocks "need . . . rebuilding." BRAD SEWELL ET AL., NAT. RES. DEF. COUNCIL, BRINGING BACK THE FISH: AN EVALUATION OF U.S. FISHERIES REBUILDING UNDER THE MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT 16 (2013), http://www.nrdc.org/oceans/files/rebuilding-fisheries-report.pdf (citing Worm et al., *supra*). A 2016 article, based on an analysis of 4,713 fisheries from around the world, suggests that only "32% of fisheries are in good biological . . . condition." Christopher Costello et al., *Global Fishery Prospects Under Contrasting Management Approaches*, 113(18) Proceedings of the National Academy of Sciences 5125, 5125 (2016); *see also* Boris Worm, *Commentary: Averting A Global Fisheries Disaster*, 113(18) Proceedings of the National Academy of Sciences 4895 (2016) (commenting on the significance of Costello et al., *supra*).

5. *See, e.g.*, Holly Doremus, *Why International Catch Shares Won't Save Ocean Biodiversity*, 2 MICH. J. ENVTL. & ADMIN. L. 385, 387 (2013); Jonathan Adler & Nathaniel Stewart, *Learning How to Fish*, 31 UCLA J. ENVTL. L. & POL'Y 150, 157 (2013); Shi-Ling Hsu, *What is a Tragedy of the Commons? Overfishing and the Campaign Spending Problem*, 69 ALA. L. REV. 75 (2005). The phrase the "tragedy of the commons" is credited to Garrett Hardin, *The Tragedy of the Commons*, 102 SCI. 1243 (1968).

Magnuson-Stevens Act or MSA).[6] The second is an economic hypothesis. It ascribes the improvement to the spread of property rights in fisheries now known as catch shares. This is a policy change that economists have been advocating for decades. The third is the community hypothesis. It credits the improvement to fishing communities becoming engaged in more sustainable management of fisheries.

The bulk of this article is concerned with outlining these three hypotheses, which should be the subject of empirical testing. People familiar with fisheries are well aware of the improvement in U.S. fisheries.[7] But, to my knowledge, no one has as yet attempted to systematically explain the improvement, taking into account the various factors that may have contributed.[8]

The article briefly concludes by emphasizing that the legal, economic and community hypotheses all raise an underlying question that itself is worthy of further inquiry: what was the political confluence of interests that facilitated the changes in fisheries

---

6. 16 U.S.C. §§ 1801-1883 (2012). The federal fisheries statute bears the names of two U.S. senators who profoundly influenced U.S. fisheries policy, Senator Warren Magnuson and Senator Ted Stevens. James P. Walsh, *The Origins and Early Implementation of the Magnuson-Stevens Fishery Conservation and Management Act of 1976*, 42 COASTAL MGMT. 409, 410, 419, 422-23 (2014).

7. There are many references to the improvement in the status of U.S. fish stocks in the literature geared to fisheries specialists. *See, e.g.,* Allison K. Barner et al., *Solutions for Recovering and Sustaining the Bounty of the Ocean Combining Fishery Reforms, Rights-Based Fisheries Management, and Marine Reserves*, 28:2 OCEANOGRAPHY 252, 254-55 (2015); Robin A. Pelc et al., *Further Action on Bycatch Could Boost United States Fisheries Performance*, 56 MARINE POL'Y 56, 56 (2015); SEWELL ET AL., *supra* note 4; THE PEW CHARITABLE TR. & OCEAN CONSERVANCY, THE LAW THAT'S SAVING AMERICA'S FISHERIES: THE MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT (2013), http://www.oceanconservancy.org/our-work/fisheries/ff-msa-report-2013.pdf; Melissa S. Kearney et al., *What's the Catch? Challenges and Opportunities of the U.S. Fishing Industry*, THE HAMILTON PROJECT (2014), http://www.hamiltonproject.org/assets/legacy/files/downloads_and_links/Challenges_opportunities_fishing_industry_policybrief.pdf. There also has been some press coverage of the rebuilding of U.S. fish stocks. Wendy Koch, *U.S. Fish Stocks Rebound; Two-Third Back from Depletion*, USA TODAY (Mar. 13, 2013), http://www.usatoday.com/story/news/nation/2013/03/13/depleted-fisheries-rebound-nrdc/1983297/ (reporting on the report by SEWELL ET AL., *supra* note 4 on effectiveness of rebuilding provisions); Sylvia Rowley, *How Dwindling Fish Stocks Got a Reprieve*, N.Y. TIMES (Apr. 19, 2016), http://opinionator.blogs.nytimes.com/2016/04/19/how-dwindling-fish-stocks-got-a-reprieve/ (analyzing the reasons for the recovery of U.S. fisheries, including federal legislative amendments and greater use of catch shares).

8. There are recent empirical analyses of the effectiveness of the rebuilding requirements in the Magnuson-Stevens Act in rebuilding overfished fish stocks, which provide support for the idea that these requirements have contributed to the improvement in fish stocks. SEWELL ET AL., *supra* note 4; Kimberly Lai Oremus et al., *The Requirement to Rebuild US Fish Stocks: Is It Working?*, 47 MARINE POL'Y 71 (2014); COMM. ON EVALUATING THE EFFECTIVENESS OF STOCK REBUILDING PLANS OF THE 2006 FISHERY CONSERVATION AND MGMT. REAUTHORIZATION ACT, NATIONAL RESEARCH COUNCIL, EVALUATING THE EFFECTIVENESS OF FISH STOCK REBUILDING PLANS IN THE UNITED STATES (2014) [hereinafter "Fish Stock Rebuilding Plans"]. However, this pioneering research analyzing the impact of the rebuilding provisions likely explains only part of the improvement in fish stocks overall. This improvement is likely related to fewer stocks being added to the overfished list, as well to the rebuilding of overfished stocks. *See infra* note 46 and accompanying text.

management that appear to have benefited fish stocks? Today, many of the fisheries that are most in need of regulatory attention are likely in the developing world and on the high seas.[9] U.S.-based conservation groups and foundations are taking an interest in projects to improve fisheries management in these regions.[10] As environmentalists seek to improve fisheries abroad, we should better understand the political constellation of interests that has accompanied progress in the United States.

II. THE STATE OF U.S. FISHERIES

The ecologist Garrett Hardin is credited with coining the term the "tragedy of the commons" in a famous article in the 1960s to convey the idea that a resource that is open to everyone is prone to overuse, especially when the resource is in demand.[11] Hardin himself described the oceans – and ocean fisheries – as an instance of the tragedy of the commons in his famous 1968 article.[12] It is easy

9. Barner et al., *supra* note 7, at 253, 258-59 (Box 3: Fish Forever, A Collaborative TURF-Reserve Pilot Program); Tony J. Pitcher & William Cheung, *Fisheries: Hope or Despair?*, 74 MARINE POLLUTION BULL. 506 (2013); Crow White & Christopher Costello, *Close the High Seas to Fishing?*, 12 PLOS BIOLOGY 3 (2014). The U.S. is not alone among developed countries in witnessing an improvement in the biological health of its fish stocks. The status of fish stocks also appears to have improved in some developing countries. FOOD & AGRIC. ORG. OF THE U.N., *supra* note 4 (referring to improvements in the health of fish stocks in New Zealand, Australia, the European Union, Namibia and Mexico); Fish Stock Rebuilding Plans, *supra* note 8, at 5 (Australia, Canada and New Zealand have similar approaches to U.S. for rebuilding overfished fish stocks). *But see* SEWELL ET AL., *supra* note 4, at 16 (fisheries in "many developed nations, such as those in the European Union (EU), continue to lag in controlling overfishing and rebuilding fish populations"). According to the FAO, globally, the share of fisheries at "biologically unsustainable level[s]" "peaked at 32.5 percent in 2008 before declining slightly to 28.8 percent in 2011." FOOD & AGRIC. ORG. OF THE U.N., *supra* note 4, at 37.

10. *See, e.g.*, Barner et al., *supra* note 7, at 258; *Vibrant Oceans*, BLOOMBERG PHILANTHROPIES, http://www.bloomberg.org/program/environment/vibrant-oceans (last visited Mar. 13, 2016) (describing "the Vibrant Oceans Initiative, a $53 million, 5-year effort to boost fish populations in Brazil, the Philippines and Chile"); *Save the Oceans Feed the World*, OCEANA, http://oceana.org/our-campaigns/save_oceans_feed_world/campaign (last visited Mar. 13, 2016) ("Oceana focuses on countries that control the world's fish catch. . . . the United States, Europe, Belize, Brazil, Canada, Chile and Philippines."); *Oceans Policy and Resources*, ENVTL. DEF. FUND, https://www.edf.org/oceans/oceans-policy-and-resources (last visited Mar. 13, 2016) ("EDF is working . . . in places like the United States, European Union, Mexico and Belize, where reforms are taking hold, as well as in Indonesia, Philippines, Cuba and other countries."); *Marine Conservation*, WALTON FAMILY FOUND., http://www.waltonfamilyfoundation.org/our-impact/environment/marine-conservation (last visited Nov. 9, 2015) (describing work in "four priority ecosystems" around the world).

11. *See* John M. Grohl, *The Tragedy of the Commons*, WORLD OF PSYCHOLOGY (last visited Nov. 1, 2015), http://psychcentral.com/blog/archives/2009/07/29/the-tragedy-of-the-commons/ (discussing the origin of the term coined by Hardin and its significance). The phenomenon to which the tragedy refers was well known before Hardin. ELINOR OSTROM, GOVERNING THE COMMONS: THE EVOLUTION OF INSTITUTIONS FOR COLLECTIVE ACTION 2-3 (1990).

12. Hardin, *supra* note 5, at 1245 ("[T]he oceans of the world continue to suffer from the survival of the philosophy of the commons. Maritime nations still respond automatically to the shibboleth of the 'freedom of the seas.' Professing to believe in the 'inexhaustible re-

to understand why Hardin conceived of ocean fisheries in these terms. When he was writing in the late 1960s, it was a reasonable, although not entirely accurate, assumption that the oceans were open to anyone to fish, since the 1982 United Nations Convention on the Law of the Sea was yet to come.[13] When fisheries are indeed open to anyone each fisher likely will consider the costs and benefits only to him, or her, of taking fish from the sea in deciding how many fish to catch. [14] A fisher is not likely to give much, if any, weight to the costs that taking fish imposes on the fish population, the marine environment, or other fishers because these costs are largely external to the fisher. Even if the fisher did consider the social costs of the fisher's actions, it still might not make sense for the fisher to abstain from fishing, because the fisher has no right to exclude others from taking the fish that are left behind. Another fisher could come along at any point and take these fish because the oceans are open to everyone.[15]

A. Ocean Fisheries Are Not A Commons

It is no longer accurate to think of ocean fisheries as open to everyone. In the decades after World War II many ocean fisheries stopped being pure commons.[16] Many countries claimed control

---

sources of the oceans,' they bring species after species of fish and whales closer to extinction."). Hardin is criticized for wrongly equating a commons with open access, and implying that common grazing lands were overused. Rose, *supra* note 1, at 410; Robert Ellickson, *Property in Land*, 102 YALE L. J. 1315, 1381 (1993). In this article I am following Hardin in equating a commons with open access, though I recognize that Hardin is better described as referring to the difficulties created by open access.

13. Historically, states controlled a three-mile area on their shores. After World War II countries began making claims to control coastal fisheries in areas that historically had been beyond national control. For historical perspectives, see Katrina M. Wyman, *From Fur to Fish: Reconsidering the Evolution of Private Property*, 80 N.Y.U. L. REV. 117, 152-53, 152-53 nn.85-89 (2005); R.P. Anand, *Changing Concepts of Freedom of the Seas: A Historical Perspective*, *in* FREEDOM FOR THE SEAS IN THE 21ST CENTURY: OCEAN GOVERNANCE AND ENVIRONMENTAL HARMONY 72 (John M. Van Dyke et al. eds., 1993); Christopher J. Carr & Harry N. Scheiber, *Dealing with a Resource Crisis: Regulatory Regimes for Managing the World's Marine Fisheries*, 21 STAN. ENVTL. L.J. 45, 51-53 (2002).

14. I follow Barner et al. in using the gender neutral term "fisher." Barner et al, *supra* note 7, at 253 n.1.

15. *See also* Adler & Stewart, *supra* note 5, at 158. As discussed further below, the work of Elinor Ostrom and others has demonstrated that the tragedy of the commons is not inevitable and there are situations where individuals will consider the implications of their actions for others and sustainably manage resources. Elinor Ostrom, *Prize Lecture: Beyond Markets and States: Polycentric Governance of Complex Economic Systems*, LES PRIX NOBEL 408, 435 (2009) ("humans have a more complex motivational structure and more capability to solve social dilemmas than posited in earlier rational-choice theory"), http://www.nobelprize.org/nobel_prizes/economic-sciences/laureates/2009/ostrom_lecture.pdf; *see also id.* at 426, 432.

16. This discussion of the enclosure of ocean fisheries under national jurisdiction draws on Wyman, *supra* note 13, at 152-57. For another recent discussion of the same phenomenon, *see* Doremus, *supra* note 5, at 387-93.

over fisheries far from their shores.[17] The United States extended its control over ocean fisheries to 200 miles from its shores in 1976 by legislating a Fishery Conservation Zone that later became the U.S. Exclusive Economic Zone (EEZ).[18] The 1982 United Nations Convention on the Law of the Sea, which came into force in 1994, codified the right of countries to enclose fisheries within EEZs.[19] Today, there are very few ocean fisheries that truly are commons because there are few fisheries that are entirely located in the high seas — the area of the oceans beyond the EEZs under national control.[20]

The enclosure of ocean fisheries under national control meant that nation-states could now exclude foreigners from fishing in areas 200 miles from the shore. Indeed, keeping out foreign fleets and "Americanizing" fisheries off U.S. shores was a key reason that the United States extended its control over ocean fisheries to 200 miles from its shores in 1976.[21] The federal statute that created the Fishery Conservation Zone was very successful in driving out foreign fishers — the share of commercial fish catches in the U.S. EEZ caught by foreign fishers declined from 60% in 1981 to roughly "1% in 1991."[22]

However, once countries gained the ability to reserve the fisheries off their shores for their own nationals, they often did not move quickly to strictly regulate their own fishers. As a recent

---

17. Carr & Scheiber, *supra* note 13, at 52; Walsh, *supra* note 6, at 412-15, 420; Wyman, *supra* note 13, at 153 n.89.

18. Wyman, *supra* note 13, at 153-54 n.89; *see also* Fish Stock Rebuilding Plans, *supra* note 8, at 15-16.

19. U.N. Convention on the Law of the Sea, Dec. 10, 1982, 1833 U.N.T.S. 397; Wyman, *supra* note 13, 153 & n.89; *Status of the United Nations Convention on the Law of the Sea*, UNITED NATIONS, http://www.un.org/depts/los/reference_files/status2010.pdf (last visited Feb. 14, 2016). The United States has not ratified the Convention, though the United States complies with the terms of the Convention.

20. Katrina M. Wyman, *The Property Rights Challenge in Marine Fisheries*, 50 ARIZ. L. REV. 511, 519, 519 n.48 (2008). *See also* CHARLES S. PEARSON, ECONOMICS AND THE GLOBAL ENVIRONMENT 431 (2000) (stating that "over 90 percent of ocean fisheries [are] under national control"); Harry N. Scheiber, *Ocean Governance and the Marine Fisheries Crisis: Two Decades of Innovation – and Frustration*, 20 VA. ENVTL. L.J. 119, 126 (2001) (at the time of the United Nations Convention on the Law of the Sea, "an estimated 85% or more of commercially exploitable fish stocks and all then-known exploitable seabed mineral resources were located in the EEZ ocean areas"). Scholarship recently has focused attention on the significant extent to which fisheries occur in both the high seas and EEZs. Cassandra M. Brooks et al., *Challenging the 'Right to Fish' in a Fast-Changing Ocean*, 33 STAN. ENVTL. L.J. 289, 294 (2014); U. Rashid Sumaila et al., *Winners and Losers in a World Where the High Seas Is Closed to Fishing*, 5 SCI. REP. 1, 2 (2015).

21. Fish Stock Rebuilding Plans, *supra* note 8, at 15-16; Walsh, *supra* note 6, at 417, 422; Wyman, *supra* note 13, at 153-54 & n.89.

22. Fish Stock Rebuilding Plans, *supra* note 8, at 24 ("The FCMA effectively reduced foreign fishing within the United States' EEZ from approximately 60% of the commercial catch in 1981 to approximately 1% in 1991. Meanwhile, domestic fisheries grew. Foreign fishing in the U.S. EEZ is insignificant today although there is some foreign ownership of U.S. fishery enterprises.").

report from the National Academy of Sciences explained, when the U.S. asserted control over fisheries out to 200 miles in the 1970s, "[m]any stakeholders and members of Congress did not believe that it was necessary to regulate U.S. fisheries to any significant degree."[23] The result was that a variation on the tragedy of the commons played out in fisheries, now under national control, in what we might call a "tragedy of the national commons."[24] While ocean fisheries off U.S. shores were now controlled by the federal government, the federal government initially imposed few limitations on fish catches.[25] The consequences were predictable; by the early 1990s, many U.S. fish stocks were overfished — 43% according to a 1992 report from the National Marine Fisheries Service (NMFS).[26] Like global fish catches, U.S. catches peaked in the mid-1990s.[27]

---

23. Fish Stock Rebuilding Plans, *supra* note 8, at 22; *see also* Doremus., *supra* note 5, at 388-89.

24. *See* Bonnie J. McCay, *Enclosing the Fishery Commons: From Individuals to Communities*, *in* PROPERTY IN LAND AND OTHER RESOURCES 219, 220 (Daniel H. Cole & Elinor Ostrom eds., 2012) ("Tragedies of the fisheries commons continued, but within, rather than outside, national boundaries.").

25. MICHAEL L. WEBER, FROM ABUNDANCE TO SCARCITY: A HISTORY OF U.S. MARINE FISHERIES POLICY 174 (2002) ("The era of laissez-faire development of fisheries began closing in July 1989 when the NMFS issued revised guidelines for implementing the national standards of the Magnuson-Stevens Act."); *see also* Fish Stock Rebuilding Plans, *supra* note 8, at 24-25 (discussing "'602 guidelines'" issued in 1989). However, NMFS staff noted the need to contain pressure on fishery resources even before 1989. WEBER, *supra* at 178.

26. NAT'L OCEAN AND ATMOSPHERIC ADMIN., OUR LIVING OCEANS: REPORT ON THE STATUS OF U.S. LIVING MARINE RESOURCES 11 (1992) ("Across all regions combined, for those stocks where the status is known, . . . 43% are below the stock level necessary to support LTPY [long-term potential yield]."). A stock below LTPY is overfished. *Status of Fisheries of the United States 1997*, NAT'L MARINE FISHERIES SERV., http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/archive/1997-2002/status_of_fisheries_1997_report.pdf (last visited Mar. 3, 2016). ("Species that are listed in OLO [Our Living Oceans] as 'below' and 'far below' stock levels necessary to produce LTPY are considered 'overfished,' and those listed as 'near' and 'above' stock levels necessary to produce LTPY are considered 'not overfished.'"). *See also* Wyman, *supra* note 13, at 204 n.226 (comparing utilization rates and stock relative to long-term potential yield). The 43% percent refers to the percentage of federally managed fisheries that were overfished, not the percentage of federally and state managed fisheries combined that were overfished. *Our Living Oceans: Report on the Status of U.S. Living Marine Resources*, NAT'L MARINE FISHERIES SERV., http://www.st.nmfs.noaa.gov/LivingOceans.html (last visited June 15, 2016) ("Since 1991, [Our Living Oceans] . . . reports have presented an overview of the principal fishery resources, marine mammals, and sea turtles that are under the management jurisdiction of NOAA Fisheries").

A note is in order about the name of the agency. The National Marine Fisheries Service (NMFS) is also called NOAA Fisheries, as the agency is housed in the National Oceanic and Atmospheric Administration (NOAA) in the U.S. Department of Commerce. *Our Mission*, NAT'L MARINE FISHERIES SERV., http://www.nmfs.noaa.gov/aboutus/our_mission.html (last visited June 15, 2016).

27. CHRISTOPHER COSTELLO, THE HAMILTON PROJECT, TOMORROW'S CATCH: A PROPOSAL TO STRENGTHEN THE ECONOMIC SUSTAINABILITY OF U.S. FISHERIES 5-6 (Sept. 2014) ("[O]verall [U.S.] fish landings peaked in the mid-1990s at about 5 million metric tons . . . and revenue peaked in the late 1970s at almost $8 billion."); FOOD & AGRIC. ORG. OF THE U.N., *supra* note 4 at 37 ("The world's marine fisheries expanded continuously to a production peak of 86.4 million tonnes in 1996 but have since exhibited a general declining

B. U.S. Coastal Fisheries Are No Longer Tragic

Now consider the biological status of U.S. fisheries today. I rely on two sources to make the point that the health of U.S. fisheries has improved.

The first is a series of reports that NMFS has been statutorily required to prepare annually for Congress since the late 1990s on the biological status of U.S. fish stocks under federal jurisdiction.[28] There have been changes over time in these reports such that the status determinations in the early reports are not entirely comparable to the status determinations in the reports from after 2005.[29] But the reports are useful because they are a historical series that goes back nearly to the time when fish catches peaked along U.S. shores.[30] The first of these reports on the status of U.S. fish stocks was published in 1997, and the most recent covers 2014.[31]

---

trend."); *Id.* at 41 ("The declining trend in global marine catch has been seen since 1996, although with large fluctuations.").

28. Sustainable Fisheries Act of 1996, Pub. L. No. 104-297, § 109(e), 110 Stat. 3559, 3581 (amending 16 U.S.C. § 1854(e)); *see* 16 U.S.C. § 1854(e)(1) (2012).

29. *See* NAT'L MARINE FISHERIES SERV., ANNUAL REPORT TO CONGRESS ON THE STATUS OF U.S. FISHERIES – 2001 at 2 (2002), http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/archive/1997-2002/status_of_fisheries_report_congress_2001.pdf [hereinafter "NAT'L MARINE FISHERIES SERV. 2001"]; Email from Galen Tromble, Chief, Domestic Fisheries Division, Office of Sustainable Fisheries, National Marine Fisheries Service, to author (Oct. 30, 2015, 17:05 EST) (on file with author). For example, the reports from the late 1990s classified fish stocks as overfished based on mortality rates and/or biomass levels. Beginning in its 2000 report, NMFS applied the label overfished to fish stocks solely based on their biomass levels. NAT'L MARINE FISHERIES SERV., REPORT TO CONGRESS: STATUS OF FISHERIES OF THE UNITED STATES, App. 1 at 83 (2001), http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/archive/1997-2002/status_of_fisheries_report_congress_2000.pdf [hereinafter "NAT'L MARINE FISHERIES SERV. 2000"]. The changes between the 1999 and 2000 reports affected the number of overfished stocks, and resulted in NMFS offering a new number of overfished fish stocks (and new numbers of other categories of fish stocks) for 1999 in its 2000 report. *Id.* at 7-8, 83; NAT'L MARINE FISHERIES SERV., REPORT TO CONGRESS: STATUS OF FISHERIES OF THE UNITED STATES 1 (1999), http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/archive/1997-2002/status_of_fisheries_report_congress_1999.pdf. NMFS made a second important methodological change concerning the unit of analysis in 2005. "Before 2005, determinations for some stock complexes (groups of stocks) were applied to individual stocks - so one assessment could lead to many reported determinations. Starting in 2005, [NMFS] began reporting a single determination for each defined complex . . . . [T]he total number of reported stocks/stock complexes went down then as well. Now, determinations are made at the complex level, or at an indicator stock level." Email from Galen Tromble, Chief, Domestic Fisheries Division, Office of Sustainable Fisheries, National Marine Fisheries Service, to author (Oct. 30, 2015, 17:05 EST).

30. *See* NAT'L MARINE FISHERIES SERV., 2002 REPORT TO CONGRESS: THE STATUS OF U.S. FISHERIES at iv (2003), http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/archive/1997-2002/status_of_fisheries_report_congress_2002.pdf.

31. *Stock Status Archive*, NAT'L MARINE FISHERIES SERV., http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/archive/stock_status_archive.html (last visited Mar. 5, 2016).

The reports on the status of U.S. stocks provide one indication that U.S. fisheries are considerably healthier today than they were in the 1990s. The 1997 report indicates that 31% of U.S. fish stocks whose overfished status was known were overfished.[32] The 2014 report indicates that 16% are overfished — a 15 percentage point drop in overfished stocks in seventeen years.[33] The data do not suggest that there has been a straightforward decline in the share of overfished stocks since 1997. But since 2002, the percentage of overfished stocks has either dropped or stayed constant from year to year, except for once between 2005 and 2006 when there was a small increase. Figure 1 graphically illustrates the trend line. For each year between 1997 and 2014, it shows the percentage of overfished stocks. The numerator for each data point is the number of fish stocks NMFS classifies as overfished; the denominator is the total number of fish stocks whose overfished status was known that year.

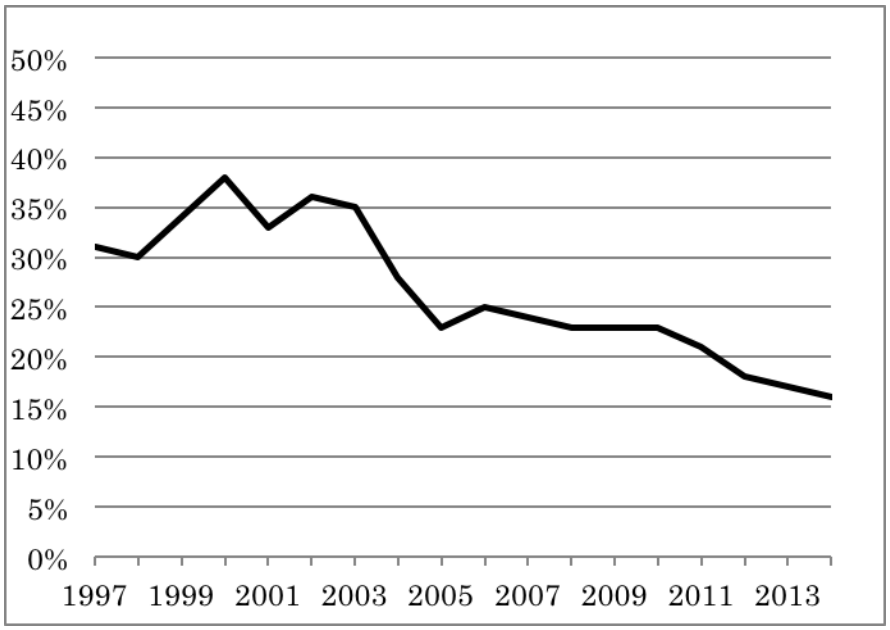
---

32. *See* NAT'L MARINE FISHERIES SERV., REPORT TO CONGRESS ON THE STATUS OF U.S. FISHERIES 3 (1997), http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/archive/1997-2002/status_of_fisheries_1997_report.pdf [hereinafter "NAT'L MARINE FISHERIES SERV. 1997"].

33. NAT'L MARINE FISHERIES SERV., 2014 ANNUAL REPORT TO CONGRESS ON THE STATUS OF U.S. FISHERIES at 1 (2015), http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/archive/2014/2014_status_of_stocks_final_web.pdf [hereinafter "NAT'L MARINE FISHERIES SERV. 2014"]. However, as noted above in the text, we should be cautious about directly comparing the numbers of overfished stocks in 1997 and 2014 because of changes in the reports over time. For example, before its 2000 report to Congress on the status of fish stocks, NMFS labeled fish stocks as overfished if their biomass levels were below a certain size or if the fishing mortality rate exceed a certain rate. After 2000, the overfished label was applied based only on biomass levels. NAT'L MARINE FISHERIES SERV. 2000, *supra* note 29, at App. 1 at 83; *see also* NAT'L MARINE FISHERIES SERV. 1997, *supra* note 32, at 3 (explaining how stock status was determined in the 1997 report); NAT'L MARINE FISHERIES SERV. 2014, *supra*, at 6 (explaining the terms "overfished" and "overfishing" in 2014 report).

Under NMFS's current approach, an overfished fish stock is essentially a stock whose biomass level is insufficient to achieve maximum sustainable yield. On the definition of overfished fish stocks, see 16 U.S.C. § 1802(34) (2012) ("The terms 'overfishing' and 'overfished' mean a rate or level of fishing mortality that jeopardizes the capacity of a fishery to produce the maximum sustainable yield [MSY] on a continuing basis."); 50 C.F.R. § 600.310(e)(2)(i)(E) (2016) ("A stock or stock complex is considered 'overfished' when its biomass has declined below MSST."). "Minimum stock size threshold (MSST) means the level of biomass below which the capacity of the stock or stock complex to produce MSY on a continuing basis has been jeopardized." 50 C.F.R. § 600.310(e)(2)(i)(F) (2016). Maximum Sustainable Yield "is the largest long-term average catch or yield that can be taken from a stock or stock complex under prevailing ecological, environmental conditions and fishery technological characteristics (e.g., gear selectivity), and the distribution of catch among fleets." 50 C.F.R. § 600.310(e)(1)(i)(A) (2016). On recent changes by NMFS to the guidelines for implementing the national standards in the Magnuson-Stevens Act, including changes to the definition of overfished, see U.S. Dept. of Commerce, Nat'l Oceanic and Atmospheric Admin., Magnuson-Stevens Act Provisions; National Standard Guidelines, Final Rule, 81 Fed. Reg. 71858 (Oct. 18, 2016).

Figure 1:
Percentage of U.S. Fish Stocks Classified as Overfished (1997-2014)[34]



The National Marine Fisheries Service's Fish Stock Sustainability Index (FSSI) is the second data source illustrating the improvement in the status of U.S. fish stocks. The FSSI, which was established by the NMFS in 2005, "currently" is based on data about "199 [federally managed] fish stocks . . . which represent 85 percent of total catch."[35] As a result of recent changes to the methodology for calculating the FSSI, the agency now calculates the FSSI "on a 1,000 point scale," in which 1,000 is the best score possible.[36] The agency awards fish stocks points based on whether their overfished and overfishing status are known, whether their stocks are subject to overfishing or above overfished levels, and close to maximum sustainable yield, as reflected in "stock assess-

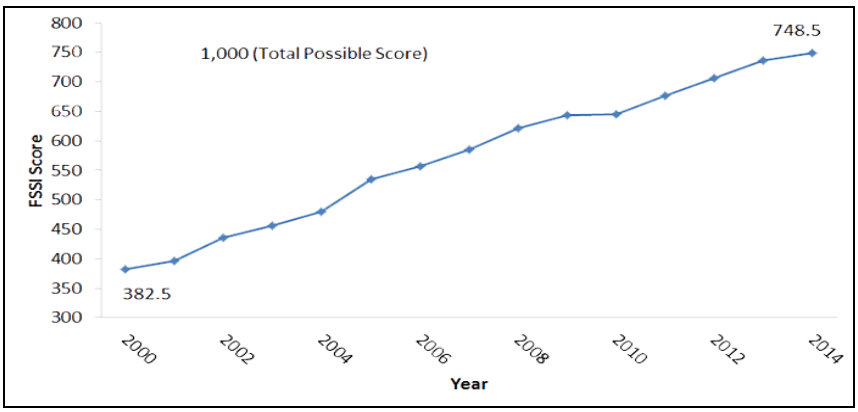
34. Figure 1 was prepared using data contained in NMFS's annual status of the stocks reports. Appendix 1 explains the data used, and choices made, in preparing Figure 1. For a similar graph, see THE PEW CHARITABLE TR. & OCEAN CONSERVANCY, *supra* note 7, at 13 (Status of U.S. fish stocks, 1997-2012).

35. *Fish Stock Sustainability Index*, NAT'L MARINE FISHERIES SERV., http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/fssi.html (last visited Feb. 16, 2016) [hereinafter "NOAA FISHERIES, *Fish Stock Sustainability Index*"].

36. *FSSI Scoring Methodology*, NAT'L MARINE FISHERIES SERV., http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/fssi_scoring.html (last visited Feb. 16, 2016) [hereinafter "NOAA FISHERIES, *FSSI Scoring Methodology*"]; *see also* NOAA FISHERIES, *Fish Stock Sustainability Index*, *supra* note 35.

ments and stock status determinations."[37] The status of the stocks reports used to prepare Figure 1, and the FSSI in Figure 2, are not completely independent sources of data about fisheries because NMFS relies on the same stock status assessments and determinations in preparing the status of the stocks reports and the FSSI.[38] As illustrated in Figure 2, NFMS calculates that the FSSI stood at 382.5 in 2000, and 748.5 in 2014.[39] In other words, the FSSI has increased by 366 points, or roughly 96%, in fourteen years.

Figure 2:
NOAA Fisheries' Fish Stock Sustainability Index[40]



The drop in the percentage of fish stocks classified as overfished and the increase in the FSSI provide strong evidence that the health of U.S. fish stocks has significantly improved in roughly the past decade. More refined analysis is necessary to pinpoint precisely the date that the recovery began. The data in Figure 1 about the percentage of overfished stocks suggest that fish stocks generally have been recovering since approximately 2002 because the percentage of stocks classified as overfished has fallen, or not increased, year-over-year since then — except for once in the mid-2000s. NMFS's FSSI in Figure 2 suggests that fish stocks have become steadily more sustainable since 2000, the first year of the index. Other sources, including environmental groups such as the

37. NOAA FISHERIES, *FSSI Scoring Methodology*, *supra* note 36.

38. *Status of U.S. Fisheries*, NAT'L MARINE FISHERIES SERV., http://www.fisheries.noaa.gov/sfa/fisheries_eco/status_of_fisheries/ [hereinafter "NOAA FISHERIES, *Status of U.S. Fisheries*"]; NOAA FISHERIES, *FSSI Scoring Methodology*, *supra* note 36.

39. NOAA FISHERIES, *Fish Stock Sustainability Index*, *supra* note 35.

40. *Id.* (*Fish Stock Sustainability Index* graph can be found at http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/fssi.html). NMFS has granted approval to republish the FSSI graph. Email from Laurel Bryant, Chief External Affairs, NOAA Fisheries Communications Office to author (Oct. 28, 2015, 1:31 EST).

Natural Resources Defense Council (NRDC), also acknowledge the improvement in the biological status of U.S. stocks.[41]

A few caveats are in order. Sixteen percent of fish stocks whose overfished status is known are overfished.[42] The NMFS data relate to fisheries under federal management only, as NMFS does not report on fisheries under state jurisdiction.[43] There are many fisheries under federal control whose overfished status is not known, although the overfished status of most of the most important fisheries is known.[44] The status of fisheries could deteriorate again, for example due to climate change, which is already affecting fisheries.[45]

Setting aside the caveats, the point is that there has been important progress in managing fisheries under federal jurisdiction since the early to mid-2000s. Before we turn to possible explanations for this progress, it is worth recognizing the complexity of what needs to be explained. What I am describing as the improvement in the status of federally managed fisheries likely is the product of two developments: overfished fish stocks are recovering and consequently being removed from the overfished fish list, and fish stocks are not being added to the overfished list in numbers that cancel out the recovery of fish stocks.[46] Explaining the improvement in U.S. fish stocks therefore requires explaining two phenomena: why overfished fish stocks are recovering, and why more fish stocks are not becoming overfished.

---

41. *See, e.g.*, SEWELL ET AL., *supra* note 4, at 17 ("as this evaluation shows, significant – indeed historic – progress has been made in rebuilding our nation's fisheries"); THE PEW CHARITABLE TR. & OCEAN CONSERVANCY, *supra* note 7, at 17 (citing sources).

42. NAT'L MARINE FISHERIES SERV. 2014, *supra* note 33, at 1.

43. *See* NOAA FISHERIES, *Status of U.S. Fisheries*, *supra* note 38; NOAA FISHERIES, *Fish Stock Sustainability Index*, *supra* note 35.

44. NAT'L MARINE FISHERIES SERV., NOAA FISHERIES 2013 REPORT TO CONGRESS ON THE STATUS OF U.S. FISHERIES 2 (2014), http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/archive/2013/status_of_stocks_2013_web.pdf (the overfished status of 248 stocks is unknown, while the overfished status of 230 stocks is known; the overfished status of "79 percent" of the "stocks that contribute approximately 90 percent of total fishery landings" "is known").

45. *Climate, Fisheries, and Protected Resources*, NAT'L MARINE FISHERIES SERV., http://www.fisheries.noaa.gov/stories/2014/03/climate_portal.html (last visited Mar. 22, 2016).

46. NMFS's 2014 status of the stocks report provides some basis for believing that this is what is occurring. It states that 37 stocks have been "rebuilt since 2000," and that the number of fish stocks on the overfished and overfishing lists "are at all-time lows." NAT'L MARINE FISHERIES SERV. 2014, *supra* note 33, at 1. It would be desirable to empirically examine the identity of the fish stocks categorized as overfished in the U.S., for example, to determine if the fish stocks categorized as overfished tend to remain categorized as such for long periods of time, or whether fish stocks are categorized as overfished for short periods of time, only to be replaced by other fish stocks on the overfished list.

III. THREE HYPOTHESES

When Hardin coined the term "the tragedy of the commons" to describe what can happen to resources when everyone has access to them, he emphasized that the tragedy "is not inevitable"[47] and that it can be overcome by restricting access to the resource.[48] Hardin essentially identified two ways of restricting access: the resource could remain publicly owned but governments could regulate access to it, for example by charging a fee to use it; or the resource could be sold off, and individuals could acquire private property rights that would allow them to exclude others from using the resource.[49] Political scientist Elinor Ostrom later identified a third option in addition to government regulation and private property: communities can avoid the tragedy of the commons by organizing themselves to manage resources.[50] In 2009 Ostrom won a Nobel Prize in economics for challenging the idea that the tragedy of the commons was inevitable without government regulation or private property.[51]

The three hypotheses that I offer for the improvement in U.S. fish stocks are inspired by these three options for avoiding the tragedy of the commons. They focus attention on the possibility that the improvement is due to government regulation, property rights in fisheries, or community management.[52]

---

47. Adler & Stewart, *supra* note 5, at 159.

48. *Id.* at 159-60 ("By restraining consumption and controlling access to a common resource, the commons can be conserved. This can be accomplished, in Hardin's formulation, either by private property or government regulation to restrict access and use of the underlying resource.").

49. *See, e.g.*, Hardin, *supra* note 5, at 1245. Hardin provocatively stated that he favored "mutual coercion, mutually agreed upon by the majority of people affected." *Id.* at 1247. As Shi-Ling Hsu argues, "the implications of Hardin's [narrative and this phrase] . . . are not" entirely "clear" and, as Hsu does, we could interpret Hardin as arguing "that something needed to be done, but [not] . . . distinguish[ing] between a governmental solution and a privatization solution, or the range of options in between." Hsu, *supra* note 5, at 79. This is why I say that Hardin "essentially" identified two ways of restricting resource access.

50. *See generally,* OSTROM, *supra* note 11.

51. Elinor Ostrom & Oliver E. Williamson, *The Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel 2009*, http://www.nobelprize.org/nobel_prizes/economic-sciences/laureates/2009/ostrom-facts.html (last visited Mar. 22, 2016).

52. My three hypotheses are not intended to be exhaustive, and there are other possible explanations for the improvement that also should be analyzed. For example, it is worth investigating if there has been a reduction in demand for wild fish caught off U.S. shores that has translated into less "fishing pressure." Even if demand for these fish has indeed fallen in recent years, however, this development might not be completely exogenous to the regulatory regime that is the focus of my first hypothesis, the legal hypothesis. By curtailing fish catches, the regulatory regime may have increased the price for U.S. wild caught fish, and contributed to the reduction in demand. Another variable that should be considered is whether the ecological conditions in which fisheries exist have changed in some ways that have enabled some fish populations to increase. The legal, economic and community hypotheses in this article all concern the human dimension of fisheries management, but the ecological dimension is also worth considering as an explanatory variable.

A. Legal Hypothesis

I begin with the legal hypothesis that changes in the main federal statute governing federal fisheries account for the recovery in fish stocks since the 2000s. I suspect that many of those familiar with the improvement in fish stocks would attribute it to legislative and regulatory changes to the federal fisheries management regime.[53]

1. Background

To understand the legal hypothesis, it is necessary to take a brief detour into the institutional structure for federal regulation of fisheries. The Magnuson-Stevens Act (MSA), the 1976 Congressional statute that extended U.S. jurisdiction over fisheries out to 200 miles, created an institutional apparatus for regulating the fisheries that came under federal control.[54] That structure, which largely persists to this day, is not the Washington D.C. agency-centric form of cooperative federalism in important pollution control statutes such as the Clean Air Act. Instead, it is a highly regionalized management structure in which a federal agency largely plays an oversight role. The MSA established eight regional fishery management councils and allocated to each council control over the fisheries in federal waters within a defined geographic area.[55] The councils are required to manage fisheries by preparing and amending fishery management plans. These plans and their amendments must comply with the requirements of the MSA, such as the Act's national standards.[56] The National Marine Fisheries Service, which is housed in the Department of Commerce, must approve the fishery management plans for them to take effect,[57] but the agency rarely disapproves management

53. There are many suggestions in the literature commenting on the improvement that attribute it to reforms to the Magnuson-Stevens Act. *See, e.g.*, Shaun M. Gehan & Michele Hallowell, *Battle to Determine the Meaning of the Magnuson-Stevens Fisheries Conservation and Management Reauthorization Act of 2006: A Survey of Judicial Decisions*, 18 OCEAN & COASTAL L.J. 1 (2012); Fish Stock Rebuilding Plans, *supra* note 8; NAT'L MARINE FISHERIES SERV. 2014, *supra* note 33; THE PEW CHARITABLE TR. & OCEAN CONSERVANCY, *supra* note 7, at 17.

54. Before 1976, the federal government played little role in managing fisheries. Eric Schwaab, *The Road to End Overfishing: 35 Years of the Magnuson Act* (Apr. 13, 2011), http://www.nmfs.noaa.gov/sfa/laws_policies/msa/documents/msa_35_years.pdf ("In 1976, federal management of marine fisheries was virtually non-existent.").

55. 16 U.S.C. § 1852(a)(1) (2012). Two councils are responsible for federal fisheries off the coast of Florida: the South Atlantic Council, and the Gulf Council. 16 U.S.C. § 1852(a)(1)(C) and (E) (2012).

56. 16 U.S.C. § 1851 (2012).

57. 16 U.S.C. § 1853(c) (2012); 16 U.S.C. §1854(a) (2012).

measures proposed by the councils.[58] NMFS has very limited authority to initiate management measures[59] except in the case of a relatively small number of highly migratory species for which it is directly responsible.[60]

The regional fishery management councils are the main drivers of policy under the MSA[61] — and these councils are dominated by fishing industry interests by statutory design.[62] Under the MSA, the majority of the voting members of each council are appointed by the Secretary of Commerce based on lists submitted by state governors.[63] Over half of Secretarial appointments are from the commercial and recreational fishing sectors, reflecting several statutorily prescribed features of the appointments process.[64] The

---

58. JOSH EAGLE ET AL., TAKING STOCK OF THE REGIONAL FISHERY MANAGEMENT COUNCILS 32 (2003).

59. *Id.* at 33; *see, e.g.*, 16 U.S.C. § 1854(c) (2012) (Secretary may prepare fishery management plan if council fails to prepare a plan if "fishery requires conservation and management"); 16 U.S.C. § 1854 (e)(5) (2012) (Secretary must prepare rebuilding plan if council does not prepare such a plan within 2 years of being notified by the Secretary that a fishery is overfished); 16 U.S.C. § 1855(c) (2012) (Secretary "may promulgate emergency regulations or interim measures … to address the emergency or overfishing").

60. 16 U.S.C. § 1852(a)(3) (2012); 16 U.S.C. § 1854(e) (2012); 16 U.S.C. § 1854(g) (2012); Fish Stock Rebuilding Plans, *supra* note 8, at 23. Email from Galen Tromble, Chief Domestic Fisheries Division, Office of Sustainable Fisheries, National Marine Fisheries Service to author (Nov. 4, 2015, 11:11 EST) (on file with author). "NMFS manages Atlantic HMS [highly migratory species] under a Secretarial FMP [fishery management plan]. In 2015, that FMP includes 31 stocks and stock complexes . . . . HMS in the Pacific and Western Pacific are managed in Council FMPs."

61. Craig W. Thomas et al., *Special Interest Capture of Regulatory Agencies: A Ten-Year Analysis of Voting Behavior on Regional Fishery Management Councils*, 38 POL'Y STUD. J. 447, 449 (2010); Robert Holahan, *Investigating Interest Group Representation on the Pacific Fisheries Management Council*, 36 MARINE POL'Y 782, 783 (2012).

62. On the intentions behind the original design of the MSA, see Wyman *supra* note 13, at 178 n.164 (citing sources).

63. 16 U.S.C. § 1852(a) (2012) (specifying the total number of voting council members, including the number appointed by Secretary of Commerce).

64. In 2014, across all councils, 72% of council members appointed by the Secretary represented commercial and recreational fishing sector interests; the remaining 18% were in an "other" category that NMFS defines as "members with knowledge of and experience in biological, economic, or social sciences; environmental or ecological matters; consumer affairs; and associated fields." NAT'L MARINE FISHERIES SERV. ET AL., 2014 REPORT TO CONGRESS ON THE DISCLOSURE OF FINANCIAL INTEREST AND RECUSAL REQUIREMENTS FOR REGIONAL FISHERY MANAGEMENT COUNCILS AND SCIENTIFIC AND STATISTICAL COMMITTEES AND ON APPORTIONMENT OF MEMBERSHIP FOR REGIONAL FISHERY MANAGEMENT COUNCILS 11, 14 (2015). Looking at the data on a council-by-council basis, there was only one council out of eight where "other" appointments equaled the number of fishing interest representatives; on the other seven councils, at least two-thirds of the appointed members were fishing sector representatives. *Id.* at 14 (providing raw data). For evidence that the 2014 numbers are not anomalous, see EAGLE ET AL., *supra* note 58 at 5; Thomas A. Okey, *Membership of the Eight Regional Fishery Management Councils in the United States: Are Special Interests Over-represented?*, 27 MARINE POL'Y 193 (2003). Several features of the appointments process lead to industry representatives dominating the appointments made by the Secretary of Commerce. As mentioned above, the Secretary appoints council members from lists of nominees submitted by state governors. In compiling lists of nominees, state governors are required to consult "with representatives of the commercial and recreational fishing interests of the State." 16 U.S.C § 1852(b)(2)(C) (2012). The council members appointed by the Secre-

remaining voting members are state and federal fisheries regulators,[65] and the state regulators also often reflect commercial and recreational fishing perspectives.[66] Historically, there have been very few environmentalists sitting on the councils.[67] Environmentalists only began taking an interest in fisheries management in the late 1980s or early 1990s, prompted by the abrupt decline in the historic New England groundfish fishery in the late 1980s.[68]

The legal hypothesis credits the improvement in U.S. fisheries to major Congressional amendments to the MSA in the 1990s and 2000s that sought to contain the influence of the industry-dominated councils over fisheries management. I highlight two sets of legislative amendments: the rebuilding requirements that Congress initially added in 1996 and then strengthened in 2006,[69] and the annual catch limit requirements that Congress inserted in 2006.[70] These amendments seek to limit the discretion of the councils in two ways: by increasing the influence of science and scientists in fishery management and by instituting binding legal requirements that environmentalists and others can use to sue NMFS if it approves inconsistent council proposals.

---

tary must be "knowledgeable regarding the conservation and management, or the commercial or recreational harvest, of the fishery resources of the geographical area concerned." 16 U.S.C. § 1852(b)(2)(A) (2012). The Secretary must, "to the extent practicable, . . . [ensure] a fair and balanced apportionment, on a rotating or other basis, of the active participants (or their representatives) in the commercial and recreational fisheries under the jurisdiction of [the] Council." 16 U.S.C. § 1852(b)(2)(B) (2012). Furthermore, the Secretary is required to report annually to House and Senate Committees on the implementation of the fair and balanced apportionment requirement. For these reports, see *Council Reports to Congress*, NAT'L MARINE FISHERIES SERV., http://www.nmfs.noaa.gov/sfa/management/councils/report_congress/reports.htm (last visited Mar. 22, 2016).

A recent article analyzing voting on the Pacific Fishery Management Council argues that the "coalitional structure on the [Council] . . . is best understood by the shared policy objectives of representatives from individual states, not by the broad interest groups these interests represent. While it may be the case that individuals view themselves as representatives of a particular interest group, this only appears to occur by state – a representative of the commercial fishing industry from California, for example, votes in tandem with other members of the California delegation more frequently than he votes with other commercial industry representatives from other states." Holahan, *supra* note 61, at 782.

65. 16 U.S.C. § 1852(b)(1) (2012) (remaining voting members).

66. EAGLE ET AL., *supra* note 58, at 26; Thomas et al., *supra* note 61, at 448, 461.

67. EAGLE ET AL., *supra* note 58, at 24, 26; *see also* Thomas et al., *supra* note 61, at 450 ("public interests are underrepresented on the councils").

68. Wyman, *supra* note 13, at 162 n.113 (citing WEBER, *supra* note 25, xxv, 173-95). Weber quotes Ken Hinman, a staff person at the National Coalition for Marine Conservation, as stating "[t]he collapse of the New England groundfish fishery brought environmental organizations in, raised public awareness, and was the impetus for most of the recent changes in policy we've seen." WEBER, *supra* note 25, at 182.

69. Sustainable Fisheries Act, Pub. L. No. 104-297 § 109(e), 110 Stat. 3559; Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006, Pub. L. No. 109-479 §104(c), 120 Stat. 3575 (amending 18 U.S.C. § 1854(e) (1996)).

70. Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006, Pub. L. No. 109-479 §104(a)(10), 120 Stat. 3575 (2007). I follow existing literature in highlighting these two sets of amendments, but recognize that the 1996 and 2007 reauthorizations of the Magnuson-Stevens Act introduced other amendments.

2. Two Sets of Legislative Amendments

a. 1996 Amendments

Let's start with the rebuilding requirements added in the Sustainable Fisheries Act of 1996, against the backdrop of "the collapse of groundfish populations in the New England region."[71] These amendments introduced the first legally binding requirements to rebuild overfished fish stocks.[72] Under the amendments, the Secretary of Commerce is required to "identify" overfished fisheries "within each Council's geographical area."[73] The amendments required the councils to prepare plans to rebuild overfished fisheries within a specified time frame from the designation of the fishery as overfished.[74] In addition, the amendments set a deadline

71. SEWELL ET AL., *supra* note 4, at 9; Sustainable Fisheries Act, Pub. L. No. 104-297, § 109(e), 110 Stat. 3559; the rebuilding provisions are now in 16 U.S.C. § 1854(e) (2012); *see also* 16 U.S.C. § 1853(a)(10) (2012) (plan for fishery approaching overfished status or overfished fishery must "contain conservation and management measures to prevent overfishing or end overfishing and rebuild the fishery"). For helpful overviews of the key provisions in the Sustainable Fisheries Act, *see, e.g.*, Andrew A. Rosenberg et al., *Rebuilding U.S Fisheries: Progress and Problems, Frontiers in Ecology and the Environment* 303, 304 (Aug. 2006) (identifying "four steps" that the Magnuson-Stevens Act required at that time for rebuilding fisheries); SEWELL ET AL., *supra* note 4, at 4; Fish Stock Rebuilding Plans, *supra* note 8, at 19-21; Gehan & Hallowell, *supra* note 53, at 2 (listing key provisions of SFA). The 2007 amendments made changes to the requirements originally introduced in 1996. *See* North Carolina Fisheries Ass'n v. Gutierrez, 518 F. Supp. 2d 62, 97-99 (2007) (describing 2007 changes to the rebuilding plan requirements).

72. H.R. REP. NO. 109-567 22 (2006) (describing "identifying overfished fisheries and requiring that they be rebuilt" as "something which had not been required previously"); SEWELL ET AL., *supra* note 4, at 4. Before the Sustainable Fisheries Act, the statute had "mandated that the councils prevent overfishing," though "neither the law nor agency guidelines" had effectively implemented this mandate. THE PEW CHARITABLE TR. & OCEAN CONSERVANCY, *supra* note 7, at 12. Nonetheless, litigation had established that the councils were under a legal obligation to end overfishing. Peter Shelley, *Have the Managers Finally Gotten It Right?: Federal Groundfish Management in New England*, 17 ROGER WILLIAMS U.L. REV. 21, 25 n.18 (2012) (citing Conservation Law Found. of New Eng. V. Franklin, 989 F.2d 54, 61 (1st Cir. 1993), which was the first case to directly enforce National Standard 1 under the Magnuson-Stevens Act). Also, there were rebuilding plans for fisheries even before the 1996 amendments. NAT'L MARINE FISHERIES SERV. 2000, *supra* note 29, at 5 (referring to 31 rebuilding plans from before 1996 Sustainable Fisheries Act), http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/archive/19972002/status_of_fisheries_report_congress_2000.pdf.

73. Sustainable Fisheries Act, Pub. L. No. 104-297, § 109(e), 110 Stat. 3559 (amending 16 U.S.C. § 1854(e)); *see* 16 U.S.C. § 1854 (e)(1) (2012).

74. Under the Sustainable Fisheries Act, the councils were required to prepare rebuilding plans within one year. Sustainable Fisheries Act, Pub. L. No. 104-297, § 109(e), 110 Stat. 3559 (amending 16 U.S.C. § 1854(e)). North Carolina Fisheries Ass'n v. Gutierrez, 518 F. Supp. 2d 62, 97-98 (D.D.C. 2007); Nat'l Audubon Soc'y v. Evans, Case No. Civ.A. 99-1707, 2003 WL 23147552, at *1 (D.D.C. 2003). The 2007 amendments to the Magnuson-Stevens Act extended the deadline to two years from the identification of the stock as overfished. Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006, Pub. L. No. 109-479, § 104(c)(1), 120 Stat. 3575 (2007) (codified as 16 U.S.C. § 1854(e)(3)). The Secretary of Commerce is now required to prepare a rebuilding plan if the council does

for actually rebuilding the overfished fisheries: "as short a time period as possible, not to exceed 10 years" except in a delimited range of circumstances.[75] In 2006, Congress further strengthened the rebuilding requirements by mandating "an immediate end to overfishing for stocks in rebuilding plans."[76] This amendment addressed the failure of the 1996 amendments to specifically require that overfishing end immediately in overfished fish stocks — a loophole which had permitted the continued overfishing of overfished fisheries.[77]

The rebuilding requirements, including the default legislated deadline of ten years, are controversial. The controversy reflects the fact that the requirements constrain the councils by mandating that they take measures to curtail harvest levels in overfished fisheries, and that such measures can significantly impact the livelihoods of fishers and fishing communities.[78] The stringency of the

---

not do so within 2 years of being notified that a fishery is overfished. 16 U.S.C. § 1854(e)(5) (2012).

75. SEWELL ET AL., *supra* note 4, at 3. Sustainable Fisheries Act, Pub. L. No. 104-297, § 109(e), 110 Stat. 3559 (1996) (amending 16. U.S.C. § 1854(e)) (codified as 16 U.S.C. § 1854(e)(4)(A) (2012)). "[H]alf of the current rebuilding plans for overfished populations exceed the statutory target period of 10 years." THE PEW CHARITABLE TR. & OCEAN CONSERVANCY, *supra* note 7, at 22.

76. SEWELL ET AL., *supra* note 4, at 16. Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006, Pub. L. No. 109-479, § 104(c)(3), 120 Stat. 3575 (2007) (amending 16 U.S.C. § 1854(e)) (adding "immediately" to the requirement that plans end overfishing) (codified as 16 U.S.C. § 1854(e)(3)(A)).

77. In the lead-up to the 2007 amendments, there was evidence that "[n]early half of the stocks for which there are rebuilding plans are still subjected to overfishing, so that fishing pressure is still too high to allow stock recovery." Rosenberg et al., *supra* note 71, at 303. Rosenberg et al. argued that "[e]nding overfishing immediately is fundamental to rebuilding these resources." *Id.* at 304. Also, environmentalists had lost a legal case, concerning the management of the New England groundfish fishery, in which they had argued that the council should be required to end overfishing immediately in an overfished stock. Shelley, *supra* note 72, at 27 (citing Oceana, Inc. v. Evans, Case No. Civ.A. 04-0811, 2005 W.L. 555416, at *12 (D.D.C. 2005)); *Id.* at 28, 31-32.

78. SEWELL ET AL., *supra* note 4, at 15; Fish Stock Rebuilding Plans, *supra* note 8 at 9; Shelley, *supra* note 72, at 29 n.42 (listing bills to increase the "'flexibility'" of the rebuilding provisions). For cases giving teeth to the rebuilding requirements, *see, e.g.*, Nat. Res. Def. Council v. Daley, 209 F.3d 747, 749, 756 (D.C. Cir. 2000) (1999 quota for overfished summer flounder fishery "is insufficient to meet Congress' mandate to the Service to prevent overfishing and to assure that specific conservation goals are met" because it has "only an 18% probability of achieving the principal conservation goal of the summer flounder fishery management plan"); A.M.L. Int'l, Inc. v. Daley, 107 F. Supp. 2d 90 (D. Mass. 2000) (rejecting fishing industry challenge to fishery management plan to rebuild the spiny dogfish fishery); Nat. Res. Def. Council, Inc. v. Nat'l Marine Fisheries Serv., 421 F.3d 872, 882, 876 (9th Cir. 2005) ("2002 darkblotched rockfish quota was based on an impermissible construction of the Act"; the fish was overfished, and NMFS "set a 'target' rebuilding time of 34 years [which was longer than the 14 years determined to be the biologically minimum period for rebuilding] and, in accordance with this target, *raised* the fishing harvest level for 2002" above the level for the previous year); Coastal Conservation Ass'n v. Gutierrez, 512 F. Supp. 2d 896, 900 (S.D. Texas 2007) (rebuilding plan for Gulf of Mexico red snapper fishery violates Magnuson-Stevens Act because it "is inconsistent with the scientific data and has a less than fifty percent chance of rebuilding red snapper stocks by 2032"); North Carolina Fisheries Ass'n v. Gutierrez, 518 F. Supp. 2d 62, 96-103 (D.D.C. 2007) (amendment to South Atlantic

requirements is an issue in the currently ongoing debate to reauthorize the MSA.[79] In 2015, NMFS proposed changes to its guidelines for implementing the rebuilding requirements to provide greater flexibility, presumably in part to forestall legislative changes.[80]

There is empirical evidence indicating that the rebuilding plan requirements added in 1996, and bolstered in the 2007 amendments, have helped to rebuild overfished stocks, and therefore have contributed to the overall improvements in U.S. fish stocks. In 2013, a Natural Resources Defense Council report "examined population trends" of "44 fish stocks" that have been subject to the rebuilding plan requirements.[81] The report found that "64%" of

---

Snapper-Grouper fishery management plan is invalid because it did not include rebuilding plans for the overfished snowy grouper and black sea bass fisheries); Nat. Res. Def. Council, et al. v. Locke, 771 F.Supp.2d 1203, 1207 (N.D. Cal. 2011) (referring to April 23, 2010 decision holding that NMFS "continued to give undue weight to short-term economic concerns in establishing rebuilding periods and harvest levels for several critically depleted Pacific Coast groundfish species, in contravention of the Magnuson-Stevens Act and binding Ninth Circuit precedent"); Lovgren v. Locke, 701 F.3d 5, 32 (1st Cir. 2012) (upholding "'stock-by-stock' approach" to rebuilding" New England groundfish stocks); Massachusetts v. Pritzker, 10 F. Supp. 3d 208, 214 (D. Mass. 2014) (rejecting challenge from Massachusetts and New Hampshire to annual catch limits for groundfish stocks that "significantly" reduced allowable catches "to prevent overfishing and rebuild overfished stocks"). Thank you to Brad Sewell and Dana Rubin for pointing me to these decisions.

79. *See, e.g.*, Strengthening Fishing Communities and Increasing Flexibility in Fisheries Management Act, H.R. 1335, 114th Congress § 4 (2015) (amending the rebuilding requirements in 16 U.S.C. § 1854(e) (2015)); H.R. REP. NO. 114-116, at 14 (2015) (describing the purpose of amending the rebuilding requirements in 16 U.S.C. § 1854(e) (2015)); *Reauthorization of the Magnuson-Stevens Fishery Conservation and Management Act: Oversight Hearing Before the H. Comm. on Nat. Res.*, 113th Cong. 53-63 (2013) (statements of Jeff Deem, Recreational Fishing Alliance and Vito Giacalone, Gloucester Fisherman & Policy Dir., Northeast. Seafood Coal).

80. U.S. Dept. of Commerce, Nat'l Oceanic and Atmospheric Admin., Magnuson-Stevens Act Provisions; National Standard Guidelines, Proposed Rules, 80 Fed. Reg. 2786 (Jan. 20, 2015); *see also* Executive Office of the President, Office of Management and Budget, Statement of Administration Policy on H.R. 1335 — Strengthening Fishing Communities and Increasing Flexibility in Fisheries Management Act (May 19, 2015), https://www.whitehouse.gov/sites/default/files/omb/legislative/sap/114/saphr1335r_20150519.pdf (indicating that senior advisers to the President oppose H.R. 1335 and that NMFS's proposal for "updating key guidelines for implementing the MSA [Magnuson-Stevens Fishery Conservation and Management Act] . . . would ameliorate many of the concerns that H.R. 1335 seeks to address without undermining the fundamental, science-based requirements of the MSA"); *National Standard 1 – Ongoing Revisions*, NAT'L MARINE FISHERIES SERV., http://www.nmfs.noaa.gov/sfa/laws_policies/national_standards/ns1_revisions.html (last visited Mar. 22, 2016) (comment period for the proposed revisions to the guidelines closed on June 30, 2015); Brad Sewell, *National Marine Fisheries Service Proposes Weakening Magnuson-Stevens Act Regulations*, NAT. RES. DEF. COUNCIL EXPERT BLOG (June 26, 2015), http://switchboard.nrdc.org/blogs/bsewell/national_marine_fisheries_serv.html (criticizing NMFS's proposed changes to NS1 guidelines).

Just before this article went to print, NMFS finalized its changes to the guidelines concerning rebuilding plans. *See* U.S. Dept. of Commerce, *supra* note 33. For criticism of the changes, see Brad Sewell, *U.S. Retreats on Fish Conservation for 1st Time in 40 Years*, NAT. RES. DEF. COUNCIL EXPERT BLOG (Oct. 14, 2016), https://www.nrdc.org/experts/brad-sewell/us-retreats-fish-conservation-1st-time-40-years.

81. SEWELL ET AL., *supra* note 4, at 3.

these stocks "can currently be considered a rebuilding success: 21 have been designated rebuilt . . . or have exceeded their rebuilding targets, and 7 have made significant rebuilding progress."[82] The NRDC report concluded that "[t]hese results show that the legal requirements have been a critical forcing mechanism for fisheries rebuilding in this country."[83] A report from the National Academy of Sciences, published later in 2013, examined the fate of a larger group of fish stocks – the universe of "85 stocks or stock complexes that were declared to be overfished or approaching an overfished state between 1997 and 2011," though the study "focused on a subset of 55 stocks that were assessed using quantitative methods." [84] Similar to the NRDC report, the National Academy of Sciences report found that rebuilding plans have had a positive effect in rebuilding stocks, but this report also had suggestions for change.[85]

b. 2007 Amendments

The second set of significant legal changes that I highlight are the catch limit requirements added in the 2007 amendments to the Magnuson-Stevens Act.[86] These amendments require legally binding limits on how many fish can be taken each year from a fishery,

---

82. *Id.*

83. *Id.* at 16. A 2014 academic article co-authored by two of the authors of the NRDC report and a third author examines "whether the implementation of the rebuilding policy is correlated with statistically significant changes in population trends of overfished fish stocks." Oremus et al., *supra* note 8, at 71. It finds that "19 of 44 stocks showed statistically significant positive slope changes (trend breaks) in biomass after rebuilding provisions were implemented." *Id.* at 72.

84. Fish Stock Rebuilding Plans, *supra* note 8, at 4.

85. *See, e.g.*, *id.* at 7 ("The legal and prescriptive nature of rebuilding mandates forces difficult management decisions, ensures a relatively high level of accountability, and can help to prevent protracted debate over whether and how stocks should be rebuilt."); *see also* Brad Sewell, *National Academy of Sciences Recognizes Success of U.S. Fisheries Rebuilding Law*, NAT. RES. DEF. COUNCIL EXPERT BLOG (Sept. 9, 2013), http://switchboard.nrdc.org/blogs/bsewell/national_academy_of_sciences_r.html (the National Academy of Sciences report finds that the rebuilding plan requirements have been successful, but paradoxically recommends changes that "could very quickly undermine that success").

86. *See* Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006, Pub. L. 109-479 § 104(a)(10), 120 Stat. 3575 (2007) (fishery management plans must "establish a mechanism for specifying annual catch limits in the plan (including a multiyear plan), implementing regulations, or annual specifications, at a level such that overfishing does not occur in the fishery, including measures to ensure accountability"); *see also* 16 U.S.C. § 1853(a)(15) (2012). For overviews of the 2007 amendments, see Gehan & Hallowell, *supra* note 53, at 4-9; Fish Stock Rebuilding Plans, *supra* note 8, at 21-22; *see also* Guindon v. Pritzker, 31 F. Supp. 3d 169, 197 (D.D.C. 2014) (noting that "[s]ection 303(a)(15) is phrased in terms of what an FMP [Fishery Management Plan] must contain, namely, 'measures to ensure accountability,' not in terms of what every regulation or proposed regulation must contain").

I refer to the amendments as the 2007 amendments because it was in 2007 that "President Bush signed into law the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006, Pub. L. No. 109-479, 120 Stat. 3575 (Jan. 12, 2007)." North Carolina Fisheries Ass'n v. Gutierrez, 518 F. Supp. 2d 62, 70 n.1 (D.D.C. 2007).

called catch limits. It is hard to believe, but before these amendments came into force, there were no binding limits on allowable catches in "the majority" of U.S. fisheries, even though such limits would seem to be a foundational conservation measure.[87]

The 2007 amendments also speak to the level at which these annual catch limits must be established. Catch limits must be set "at a level such that overfishing does not occur in the fishery."[88] In addition, in establishing the catch limits, the councils "may not exceed the fishing level recommendations of [their] . . . scientific and statistical committee or the peer review process."[89]

This latter provision is an example of what Professor Eric Biber describes as science being used as "an ex ante constraint on the implementation of an environmental statute."[90] The effort to use science to promote more conservationist policies is by no means unique to fisheries. Think of the requirement in the Endangered Species Act that species be listed based on "the best scientific and commercial data available."[91] In the fisheries context, the goal of environmentalists and others in expanding the reliance on science has been to reduce the influence of "politics" in fisheries decision-making, and to expand the influence of a methodology, science, that is often thought to promote a more precautionary approach to fisheries management.[92] The report of the House Committee on

87. U.S. Dep't of Commerce, Nat'l Oceanic and Atmospheric Admin., Magnuson-Stevens Act Provisions, 80 Fed. Reg. 2786 (January 20, 2015) ("before the ACL [Annual Catch Limit] requirement some U.S. fisheries were managed under a total allowable catch system, but the majority were managed through effort controls (e.g., days at sea, closures) or without explicit accountability"). Shelley refers to the impact of the absence of legally binding limits on catches in the New England groundfish fisheries before the 2007 amendments. Shelley, *supra* note 72, at 32 ("the practice of consequence-free annual quota overruns, which were a chronic outcome in New England, was eliminated by the AM [accountability measure] requirements [in the 2007 reauthorization]").

88. *See* Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006, Pub. L. No. 109-479 § 104(a)(10), 120 Stat. 3575 (2007); *see* now 16 U.S.C. § 1853(a)(15) (2012).

89. *See* Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006, Pub. L. No. 109-479, § 103(c)(3), 120 Stat. 3575 (2007); *see* now 16 U.S.C. § 1852(h)(6) (2012). On the peer review process that the councils can establish, *see* Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006 § 103(b)(1); *see now* 16 U.S.C. § 1852(g)(1)(E) (2012).

90. Eric Biber, *Which Science? Whose Science? How Scientific Disciplines Can Shape Environmental Law*, 79 U. CHI. L. REV. 471, 514 (2012).

91. Endangered Species Act §4(b)(1)(A), 16 U.S.C. § 1533(b)(1)(A) (2012). The Magnuson-Stevens Act similarly requires that "[c]onservation and management measures shall be based upon the best scientific information available." *See* 16 U.S.C. § 1851(a)(2) (2012).

92. Shelley, *supra* note 72, at 29 (referring to the goals of the "conservation community in New England" in the 2007 amendments to the Magnuson-Stevens Act, including requiring the councils to have Scientific and Statistical Committees, and "decreasing the latitude of [the] councils to ignore or modify the advice of these expert committees"); *Id.* at 32-34 (describing the reasons for legislative provisions concerning the Scientific and Statistical Committees). Shelley indicates that "the New England Council did not even have a functional SCC [Scientific and Statistical Committee] prior to the passage of the Magnuson Reauthorization Act." *Id.* at 33. Shelley acknowledges the limitations and evolving character

Natural Resources on the 2007 amendments described "the mandate that fishery managers base harvest levels on science" as "[t]he most important of the 'new tools for fishery managers'" in the amendments.[93]

In addition to requiring catch limits and setting standards for establishing them, the 2007 amendments also require that councils establish "accountability measures" to ensure that the annual catch limits are respected. [94] Accountability measures can include requirements that fishing be stopped inseason if the limit is exceeded.[95]

Annual catch limits were phased into fisheries management, and 2012 was "the first full year that all federal fisheries operated under annual catch limits."[96] There is a widespread sense that the requirements for catch limits and accountability measures to enforce them have been "game changers" in federal fisheries regulation.[97] NMFS touts the annual catch limit requirements as important to reducing overfishing and preventing fishery collapse.[98]

---

of fisheries science, even while endorsing a greater role for fisheries science in fisheries management and for cabining the discretion of the councils to ignore the advice of fisheries scientists. *Id*. at 66-69.

There is widespread recognition in legal scholarship that there are policy judgments embedded within the science used in environmental regulation. *See, e.g.*, Wendy E. Wagner, *The Science Charade in Toxic Risk Regulation*, 95 COLUM. L. REV. 1613 (1995); Holly Doremus, *Listing Decisions Under the Endangered Species Act: Why Better Science Isn't Always Better Policy*, 75 WASH. U. L. Q. 1029 (1997); Katrina M. Wyman, *Politics and Science in Endangered Species Act Listing Decisions*, *in* INSTITUTIONS AND INCENTIVES IN REGULATORY SCIENCE 99 (Jason Scott Johnson ed., 2012).

93. H.R. REP. NO. 109-567, at 23 (2006), *quoted in* Lovgren v. Locke, 701 F.3d 5, 17 n.10 (1st Cir. 2012); *see also* S. REP. NO. 109-229, at 6-7 (2006) ("Establishing a scientifically-based total allowable catch (TAC) for each managed fishery was a unanimous recommendation from all of the Council chairs, a recommendation of the Managing Our Nation's Fisheries Conference II final report, and a recommendation of the U.S. Ocean Commission . . . . The bill's catch limit provision works in concert with a number of provisions in the bill that respond to calls for strengthening the role of science in Council decision-making."); David Newman et al., *Current Methods for Setting Catch Limits for Data-Limited Fish Stocks in the United States*, 164 FISHERIES RESEARCH 86, 87 (2015) (describing broad support for "[t]he ACL [annual catch limit] mandate").

94. *See* Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006, Pub. L. No. 109-479 § 104(a)(10), 120 Stat. 3575 (2007); *see* now 16 U.S.C. § 1853(a)(15) (2012). Conservationists sought accountability measures. Shelley, *supra* note 72, at 29 (describing the objectives of "the conservation community in New England" in the reauthorization).

95. 50 C.F.R. § 600.310(g) (2016) (defining accountability measures); Gehan & Hallowell, *supra* note 53, at 8.

96. NAT. OCEANIC & ATMOSPHERIC ADMIN., NAT'L MARINE FISHERIES SERV., STATUS OF STOCKS 2012 ANNUAL REPORT TO CONGRESS ON THE STATUS OF U.S. FISHERIES 1 (2013) http://www.nmfs.noaa.gov/sfa/statusoffisheries/2012/2012_SOS_RTC.pdf.

97. NAT. OCEANIC & ATMOSPHERIC ADMIN., NAT'L MARINE FISHERIES SERV., THE ROAD TO END OVERFISHING: 35 YEARS OF THE MAGNUSON ACT, APRIL 13, 2011 2 (2011) http://www.nmfs.noaa.gov/sfa/laws_policies/msa/documents/msa_35_years.pdf.

98. NAT'L MARINE FISHERIES SERV., *supra* note 96, at 1 ("2012 is the first full year that all federal fisheries operated under annual catch limits to end and prevent overfishing. As additional stock assessments are completed, we expect the number of stocks on the overfishing list—now at an all-time low—to decrease further as a result of management under

A 2012 law review article analyzing the litigation since the 2007 amendments describes the legal requirements for annual catch limits, accountability measures, and the prohibitions on the councils setting limits above the recommendations of their Scientific and Statistical Committees as having "done more to put stocks on a sustainable footing than any other reform over the MSA's thirty-six year history."[99] It argues that "[a]nnual catch limits ("ACLs") and accountability measures ("AMs") have come to dominate the battlefield over fisheries management, both at the council level and in litigation."[100]

However, to my knowledge, there has been little systematic empirical analysis to date of the impact of the binding annual catch limits on U.S. fisheries, perhaps because it is only since 2012 that catch limits have been universally implemented.[101] It would be useful to attempt to link improvements in fisheries to the implementation of catch limits through event studies. One might also have the contrary hypothesis that improvements in fisheries facilitate the implementation of binding catch limits, because fishers may be less likely to object to catch limits if the fisheries are healthy, and the catch limits therefore will not significantly reduce the amounts that can be harvested. Empirical analysis also might shed light on the mechanism by which annual catch limits (and the rebuilding provisions) are improving fish stocks, assuming, as seems likely, that they are improving the status of the stocks. The

---

annual catch limits."); *Id.* at 2 ("Current management approaches, including annual catch limits and accountability measures to prevent overfishing, greatly reduce the likelihood that damaging levels of overfishing will occur."); *Id.* at 6 ("By 2012, all federal fisheries, including those for stocks on both the overfishing and overfished lists, were operating under ACLs [annual catch limits]. As of December 31, 2012, assessments demonstrated that overfishing ended for 58 percent of the domestic stocks that were subject to overfishing in 2007, when the requirement to implement ACLs was added to the MSA [Magnuson-Stevens Fishery Conservation and Management Act]."); *see also* NAT'L MARINE FISHERIES SERV., *supra* note 44, at 2 ("NOAA Fisheries and the Councils are actively monitoring how well ACLs [annual catch limits] control catch and are working to prevent further overfishing.").

99. Gehan & Hallowell, *supra* note 53, at 7.

100. *Id.* For early cases about the implementation of the accountability measures and catch limit requirements, see Oceana, Inc. v. Locke, 831 F. Supp. 2d 95 (D.D.C. 2011), appeal voluntarily dismissed in Oceana, Inc. v. Bryson, 2012 WL 2579364 (D.C. Cir. 2012); Flaherty v. Bryson, 850 F. Supp. 2d 38 (D.D.C. 2012). These two cases are helpfully discussed in Gehan & Hallowell, *supra* note 53, at 22-32. For more recent cases, see Guindon v. Pritzker, 31 F. Supp. 3d 169, 197-200 (D.D.C. 2014) (holding that NMFS's management of the recreational red snapper fishery violated the MSA because it did not include adequate accountability measures, among other reasons); Conservation Law Found. v. Pritzker, 37 F. Supp. 3d 254, 258 (D.D.C. 2014) (vacating part of rule "allowing bonus or 'carryover' catch in an amount that exceeds the SSC's [Scientific and Statistical Committee's] proposed ceiling").

101. Newman et al. state that "[i]t is well [established] that ACLs [annual catch limits] have been effective at preventing overfishing and rebuilding assessed and relatively data-rich stocks, which has resulted in significant economic and social benefits." Newman et al., *supra* note 93, at 86. But they cite NMFS reports for these propositions, not academic analysis.

rebuilding provisions may be functioning as an ex post remedy, to prompt the rebuilding of overfished fish stocks. The catch limit provisions might be acting prophylactically, to avoid the depletion of fisheries. But mandatory catch limits also seem to be functioning remedially in combination with the rebuilding provisions to spur improvements in overfished stocks.[102]

B. Economic Hypothesis

The second hypothesis that I elaborate for the improvement in U.S. fisheries focuses on the spread of property rights in these fisheries.

As I mentioned earlier, private property is another means of avoiding the tragedy of the commons, distinct from government regulation. This makes sense because the tragedy can be understood as arising from fishers not having property rights in fish while the fish are in the sea. Fishers usually acquire property rights in fish only once they catch the fish, but this incentivizes capturing fish, rather than leaving them in the ocean. Assigning a property right earlier in the lifecycle of the fish – while they are in the sea – might prompt fishers to leave the fish in the sea for longer, depending on the fisher's time horizon. Economists have been advocating for the creation of property rights in ocean fisheries since the 1970s, which is why I label the idea that property rights help explain the improvement in fish stocks the "economic hypothesis."[103]

1. Background

Today, property rights approaches to managing fisheries are generally described as "catch shares." As defined by NMFS, catch shares "is a general term for several fishery management strategies that allocate a specific portion of the total allowable fishery catch to individuals, cooperatives, communities or other entities, . . . [including] 'limited access privilege' (LAP) and 'individual fishing

---

102. *See, e.g.*, Massachusetts v. Pritzker, 10 F. Supp. 3d 208, 2014 (D. Mass. 2014) (rejecting challenges to annual catch limits that reduced allowable catches "to prevent overfishing and rebuild overfished stocks").

103. Wyman, *supra* note 13, at 155 n.94 (noting that the idea of establishing individual transferable quotas in fisheries is often credited to a 1973 paper by economist Francis Christy, although some sources suggest that there may have been proposals for something like individual transferable quotas before Christy's paper).

As my colleague Richard Stewart reminded me, implementing property rights in ocean fisheries requires legal changes and so this property rights hypothesis also could be labelled a legal hypothesis. As explained above, I label the property rights hypothesis the economic hypothesis because property rights have been championed by economists seeking to change the economic incentives of fishers.

quota' (IFQ) programs, and other exclusive allocative measures such as Territorial Use Rights Fisheries (TURFs) that grant an exclusive privilege to fish in a geographically designated fishing ground."[104] What unites these tools is that they grant "individual fishers or small groups of fishers . . . an exclusive privilege – either to harvest a given amount or to harvest within a given area – that persists over time."[105] As this last sentence underscores, though catch shares are commonly described as "property rights" approaches for managing fisheries, catch shares are technically offering fishers privileges, not property rights.[106]

The first major catch share program was implemented in a U.S. fishery in 1990, when the Mid-Atlantic surf clam and ocean quahog fisheries adopted individual transferable quotas (ITQs).[107] There are now 19 catch share programs in federal fisheries.[108] Over two-thirds of these programs (13 out of 19) have been implemented since 2000, in other words, roughly during the period in which the status of US fish stocks has improved.[109] The six remaining programs were implemented between 1990 and 1999.[110] Catch share programs are now a significant part of the toolkit in fisheries management, though there are different measures of their importance. On the high side, the Environmental Defense Fund, which advocates the introduction of catch shares, estimates that "65% of [the] fish caught in U.S. federal waters [are] under catch shares."[111] Kearney et al. indicate that "[t]oday, roughly half of the fish caught in the United States are harvested from a fishery un-

104. NAT'L MARINE FISHERIES SERV., NOAA CATCH SHARE POLICY 1, http://www.nmfs.noaa.gov/sfa/management/catch_shares/about/documents/noaa_cs_policy.pdf (last visited Mar. 17, 2016).

105. COSTELLO, *supra* note 27, at 8.

106. Indeed, these privileges "are not" property rights under the Magnuson-Stevens Act. Shannon Carroll, *Sector Allocation: A Misguided Solution*, 17 OCEAN & COASTAL L.J. 163, 185 (2011), at 177 (citing 16 U.S.C. § 1853a(b) (2006) and 16 U.S.C. § 1853a(b)(2) (2006)). My previous work may have gone too far in suggesting that individual fishing quotas are property rights. Wyman, *supra* note 13.

107. AYEISHA A. BRINSON & ERIC M. THUNBERG, NAT'L MARINE FISHERIES SERV., THE ECONOMIC PERFORMANCE OF U.S. CATCH SHARE PROGRAMS 11 (2013) https://www.st.nmfs.noaa.gov/Assets/economics/catch-shares/documents/Catch_Shares_Report_FINAL.pdf. For an interesting analysis of litigation involving catch share programs that distinguishes between early and later cases, see Suzanne Iudicello & Sherry Bosse Lueders, *A Survey of Litigation Over Catch Shares and Groundfish Management in the Pacific Coast and Northeast Multispecies Fisheries*, 46 ENVTL. L. 157 (2016).

108. Barner et al., *supra* note 7, fig. 1 at 254.

109. *Id.*

110. *Id.*

111. ENVTL. DEF. FUND, OCEANS REPORT 83, http://www.edf.org/sites/default/files/AR2013/ar2013_oceans_web.pdf (last visited Mar. 22, 2016). This statistic may be measuring the weight of federal fisheries caught under catch shares as compared with the weight of fish landings generally. If this is the case, the share of fisheries under catch shares may be affected by the heavy weight of Bering Sea pollock, which are caught under catch shares. Fish Stock Rebuilding Plans, *supra* note 8, at 14 ("The [Alaska] pollock fishery was and remains the largest volume fishery in the United States.").

der catch share management."[112] More modestly, economist Christopher Costello indicates in a recent paper that "about a third of total U.S. fish landings" are caught under catch shares, based on the weight of these fish landings.[113] Costello also has estimated "about 25 percent of species caught in U.S. fisheries are managed under catch shares."[114]

2. Two Possible Contributions of Catch Shares

I am not aware of empirical evidence establishing a correlation between the recent improvement in U.S. fisheries and the introduction of catch shares, let alone that catch shares have contributed to the improvement. But there are two reasons why we might think that their implementation has been a contributing factor.

First, catch shares may act prophylactically to prevent the deterioration of fisheries in which they are introduced by incentivizing fishers to favor policies to maintain and improve the health of fish stocks. One of the standard arguments for using catch shares to manage fisheries is that catch shares make fishers better stewards of the resource.[115] The idea is that fishers with shares now have a stake in preserving and enhancing the fish stock, because the fishers now have an asset that they can trade in addition to the fish that they catch, and the value of this asset depends on the status of the underlying fish stocks.

There is some empirical evidence that catch shares promote better stewardship of fisheries.[116] In a well-known article pub-

112. Kearney et al., *supra* note 7. The statistic is likely based on catch volumes, since other statistics referred to in the same paper are in terms of volume. *Id.* (Figure 2A. U.S. Catch Volume by Management System and Region, 2009).

113. COSTELLO, *supra* note 27, at 14, 17; *see also id.* fig. 2 at 14.

114. *Id.* at 17.

115. Wyman, *supra* note 13, at 159 (outlining the argument and citing sources for it); Barner et al., *supra* note 7, at 253, 255 (same). The stewardship argument for catch shares echoes an argument often made on behalf of private property that it encourages owners to take better care of resources and to avoid the tragedy of the commons. Harold Demsetz, *Toward a Theory of Property Rights*, 57 AM. ECON. REV. 347, 355 (1967). For a brief summary of the arguments for creating property rights in fisheries, see, e.g., Kearney et al., *supra* note 7.

116. For helpful overviews of the research suggesting that catch shares promote stewardship, see Adler & Stewart, *supra* note 5, at 176-88; Christopher Costello et al., *Economic Incentives and Global Fisheries Sustainability*, 2 ANN. REV. RESOURCE ECON. 299, 311-16 (2010). This paragraph draws on Adler & Stewart's discussion. For cautionary perspectives on the argument that catch shares promote stewardship, see Oliver Thébaud et al., *From Anecdotes to Scientific Evidence? A Review of Recent Literature on Catch Share Systems in Marine Fisheries*, 10 FRONTIERS ECOLOGICAL &. ENV'T 433, 433, 435 (2012) ("our review [of "peer-reviewed studies published in the past decade that looked at the impacts of adopting ITQs [individual transferable quotas] on individual marine fisheries"] shows that, over the period considered, peer-reviewed empirical research on the observed impacts of these management instruments remained limited"); McCay, *supra* note 24, at 224-25 (describing the idea that catch shares promote stewardship as "controversial" and reviewing scholarship

lished in 2008, Costello et al., found that "[i]mplement[ing] . . . catch shares . . . halts, and even reverses, the global trend toward widespread collapse."[117] The conclusion was based on analysis of "a global database of . . . 11,135 fisheries from 1950 to 2003," including "121 fisheries managed using catch shares – defined as variations on individual transferable quotas (ITQs) – by 2003."[118] In a subsequent article from 2010 responding to critiques of their earlier piece, Costello et al. also concluded that "ITQ fisheries are less likely to collapse than non-ITQ fisheries, and the magnitude of this effect increases the longer a fishery is managed by an ITQ."[119] A recent report from the National Academy of Sciences indicates that "no [U.S.] fish stocks were classified as overfished that were under an individual fishing quota management system at the time of classification."[120] This fact does not by itself prove that catch shares avoid overfishing, but it is suggestive.[121]

---

supportive and critical of this notion); Kearney et al., *supra* note 7 (referring to research suggesting "limited gains to ecological health owing to catch share adoption") (citing Jennifer F. Brewer, *Paper Fish and Policy Conflict: Catch Shares and Ecosystem-Based Management in Maine's Groundfishery*, 16(1) ECOLOGY & SOC'Y 15 (2011); Timothy Essington, *Ecological Indicators Display Reduced Variation in North American Catch Shares Fisheries*, 107(2) Proceedings of the National Academy of Sciences 754 (2010)); Timothy E. Essington et al., *Catch Shares, Fisheries, and Ecological Stewardship: A Comparative Analysis of Resource Responses to a Rights-Based Policy Instrument*, 5 CONSERVATION LETTERS 186 (2012) (based on analysis of over 150 global fisheries, catch shares "primarily act to dampen variability, but . . . variance dampening is only present when the access right is durable and secure").

117. Christopher Costello et al., *Can Catch Shares Prevent Fisheries Collapse?*, 321 SCI. 1678, 1678 (2008). The passage is quoted in Adler & Stewart, *supra* note 5, at 176. Costello et al. admit that it is easier to establish a correlation between catch shares and fishery sustainability, than that catch shares cause sustainable fisheries. Costello et al., *supra*, at 1680; Costello et al., *supra* note 116, at 305; Adler & Stewart, *supra* note 5, at 177.

118. Costello et al., *supra* note 117, at 1678, 1679. Similar passages are quoted in Adler & Stewart, *supra* note 5, at 176.

119. Costello et al., *supra* note 116, at 305. This passage is also excerpted in Adler & Stewart, *supra* note 5, at 178.

120. Fish Stock Rebuilding Plans, *supra* note 8, at 171 n.29.

121. However, it is important to note that it is difficult to be certain that the relative health of fish stocks under catch shares is attributable to catch shares. Catch shares may have been introduced in fisheries that already were relatively healthier than other fish stocks to start, because it might be easier to move to a new management regime when fish stocks are healthier. Costello et al., *supra* note 117, at 1680; Costello et al., *supra* note 116, at 301, 307-09 (describing "strategies" they used "to account for potential selection bias"); Adler & Stewart, *supra* note 5, at 177. In this regard, it is notable that six of the nineteen U.S. catch share programs are in Alaska fisheries, which historically have tended to be biologically healthy. BRINSON & THUNBERG, *supra* note 107, at 103; Kearney et al., *supra* note 7; Fish Stock Rebuilding Plans, *supra* note 8, at 18; SEWELL ET AL., *supra* note 4, at 11. Furthermore, it may not be catch shares per se, but predicates for introducing them, such as binding limits on allowable catches, which improve the health of fisheries. Adler & Stewart, *supra* note 5, at 50 (summarizing criticisms of Daniel W. Bromley, *Abdicating Responsibility: The Deceits of Fishery Policy*, 34 FISHERIES 280, 284 (2009)); Doremus, *supra* note 5, at 400; Costello et al., *supra* note 116, at 313-14 (presenting "simple analyses" that show that "some of the benefits" of ITQs are due to the cap, but arguing that "[t]here is a clear benefit to implementing an ITQ, whether or not the fishery has a TAC [total allowable catch]"). In a fishery with a binding catch limit, catch shares may promote "compliance with" the catch

A second way in which catch shares may be contributing to the overall improvement in U.S. fish stocks is they may be helping to ease the way toward rebuilding overfished fisheries. While the first reason focused on the potential benefits of catch shares in biologically healthy fisheries, this reason highlights the potential benefits in overfished fisheries. There is a theoretical basis for thinking that catch shares may help fishers deal with the reductions in fish catches often required to improve the status of fish stocks. A standard argument for catch shares is that they will increase the efficiency, and hence the profitability, of fishing.[122] Catch shares stand to do this by reducing the need for fishers to invest in boats, gear and labor to catch the fish. With a secure entitlement in a share of the catch, fishers no longer need to invest in lots of equipment and hire as many crewmembers because the fishers are no longer racing with each other to catch the fish before the regulator closes down fishing for the season. Fishers harvesting under catch shares also may spread out the harvest over a longer period of time; elongating the fishing season may allow them to command higher prices, by avoiding having to sell gluts of fish. The efficiency of fishing under catch shares may be especially helpful in overfished fisheries that are struggling to rebuild, and facing reductions in catch levels. Introducing catch shares when allowable catches are declining can help fishers harvest the lower catches more efficiently and profitably, with fewer boats and less gear.[123]

There is some empirical basis for thinking that catch shares may help overfished fisheries rebuild.[124] Recall that Costello et al.'s empirical work on global fisheries finds that the implementation of catch shares helps to "reverse[]" collapsed fisheries, not just to stop the decline of fisheries.[125]

Consider the use of sectors — which are a form of catch shares — in the New England groundfish fishery as an example of how

---

limits. Adler & Stewart, *supra* note 5, at 179 (citing Ragnar Arnason, *Property Rights in Fisheries: How Much Can Individual Transferable Quotas Accomplish?*, 6 REV. ENVTL. ECON. & POL'Y 217, 225 (2012)).

122. Wyman, *supra* note 13, at 157-158 (outlining the arguments that property rights in fisheries may help to reduce over-investment in fishing, and increase the value of output by spreading out the fishing season); Costello et al., *supra* note 116, at 300 (catch shares enable fishers to focus "on harvest efficiency" and to "increase profit by matching the time of catch with higher prices").

123. Fish Stock Rebuilding Plans, *supra* note 8, at 115 (referring to ways that individual transferable quota programs have been adapted to enable fishers to adjust to rebuilding programs). *But see id.* at 171 n.29 (noting that catch shares could promote the "specialization" that complicates adapting to the stringent limits imposed by rebuilding plans).

124. *But see* Thébaud et al., *supra* note 116 (citing source emphasizing the limited empirical evidence about the impacts of catch shares).

125. Costello et al., *supra* note 117, at 1678; *see also* Costello et al., *supra* note 116, at 310 ("fishery fixed effects results suggest that ITQs not only halt the trend in global collapse but may actually reverse it").

catch shares may be helping some U.S. fisheries adjust to the lower allowable catches necessary to rebuild depleted stocks. Under sectoral management, fishers are "encouraged" to group themselves into sectors,[126] which are "harvesting cooperatives,"[127] or as one observer pithily describes them, "a form of group fishing quota."[128] Regulators give each sector they approve a share of the total allowable catch for the entire fishery, based on the catch histories of the sector's members.[129] Each sector manages its share of the allowable catch, allocating it among its members, and ensuring that its members do not exceed the sector's allowable catch.[130] Many sectors grant their members individual shares of the sector's collective allowable catch, and members are allowed to trade or lease their shares with each other.[131] Sectors also are allowed to trade or lease catch shares with other sectors.[132] The ability to trade shares within and across sectors means that responsibility for catching the allowable catch can be consolidated onto a smaller number of vessels, as fishers can sell or lease their shares to others, and that the catch can be caught more efficiently. Allocating shares of the allowable catch to sectors ends the race for the fish among sectors because each sector has its own secure share. There also is no need for fishers within sectors to race with each other when sectors allocate their members individual shares.

The first two sectors were established in the New England groundfish fishery in the early 2000s, after the New England Fishery Management Council amended the management plan regulat-

---

126. Julia Olson & Patricia da Silva, *Changing Boundaries and Institutions in Environmental Governance: Perspectives on Sector Management of the Northeast US Groundfish Fishery*, 13 MARITIME STUD. 1, 5 (2014).

127. JONATHAN M. LABAREE, GULF OF MAINE RESEARCH INST., SECTOR MANAGEMENT IN NEW ENGLAND'S GROUNDFISH FISHERY: DRAMATIC CHANGE SPURS INNOVATION 1 (2012), https://www.gmri.org/sites/default/files/resource/sector_management_in_new_england.pdf.

128. Carroll, *supra* note 106, at 185. A sector is defined by regulation as follows: "Sector, with respect to the NE [Northeast] multispecies fishery, means a group of persons holding limited access NE multispecies permits who have voluntarily entered into a contract and agree to certain fishing restrictions for a specified period of time, and that have been allocated a portion of the TACs [Total Allowable Catch] of species managed under the NE Multispecies FMP [Fishery Management Plan] to achieve objectives consistent with the applicable goals and objectives of the FMP." 50 C.F.R. § 648.2 (2016); *see also* Carroll, *supra* note 106, at 185-86 n.176 (citing same definition).

129. Carroll, *supra* note 106, at 185-86.

130. *Greater Atlantic Region, Sector*, NAT'L MARINE FISHERIES SERV., http://www.greateratlantic.fisheries.noaa.gov/sustainable/species/multispecies/ (last visited Feb. 23, 2016) ("Several violations by sector members are specifically subject to joint and several liability, including: Sector quota overages, illegally discarding of legal-sized fish, and the misreporting of landings and discards.").

131. LABAREE, *supra* note 127, at 4; Carroll, *supra* note 106, at 188; Olson & da Silva, *supra* note 126, at 4.

132. LABAREE, *supra* note 127, at 1, 3-4, 6.

ing the catch of groundfish to allow for sectors.[133] Regulators introduced the option of establishing sectors to give "fishermen a degree of flexibility in adjusting to 'increasing restrictions imposed to rebuild groundfish stocks.'"[134] Sectors became an integral part of the New England groundfish fishery starting in 2010, after the Council was required by the 2007 amendments to the Magnuson-Stevens Act to establish stringent, legally binding catch limits to rebuild overfished groundfish stocks that significantly reduced catch levels for a number of stocks.[135] With the management changes introduced in 2010, regulators offered fishers a refurbished sectoral program,[136] in part because they believed that sectors could provide fishers with flexibility to adapt to more stringent catch limits.[137]

Many fishers have joined sectors. In the first year of the new program, 2010-2011, there were seventeen sectors[138] and vessels in the sectors "were responsible for 98% of the previous decade's catch."[139] In 2012, there were sixteen sectors in the New England groundfish fishery,[140] and the vessels in sectors had "approximately 99% of the sub-ACL [annual catch limit] . . . allocated to the commercial fishery."[141] Consistent with the idea that the sectors

---

133. Lovgren v. Locke, 701 F.3d 5, 15-16 (1st Cir. 2012). Amendment 13, which was partially approved by NMFS in 2004, "approved one sector, the Georges Bank Cod Hook Gear Sector, and a second, the Georges Bank Cod Fixed Gear Sector, was approved in 2006." *Id.* at 16 (internal citation committed); *see also id.* at 15 (timing of NMFS partial approval).

134. *Id.* at 16 (quoting 69 Fed. Reg. 22,906, 22,944 (Apr. 27, 2004)); *see also* Daniel S. Holland & Joshua Wiersma, *Free Form Property Rights For Fisheries: The Decentralized Design of Rights-Based Management Through Groundfish "Sectors" in New England*, 34 MARINE POL'Y 1076, 1077 (2010) (describing benefits of sectors).

135. For a concise description of the background to the implementation of sectors starting in 2010 in New England through Amendment 16, *see, e.g.*, Lovgren v. Locke, 701 F.3d 5, 17-19 (1st Cir. 2012); *see also* LAURA TAYLOR SINGER, GULF OF MAINE RESEARCH INST., THE DEVELOPMENT OF CATCH SHARES: LESSONS LEARNED FROM NEW ENGLAND (2011), https://www.gmri.org/sites/default/files/resource/the_development_of_catch_shares.pdf (comprehensive history). On the significance of the reduction in catch limits in several stocks, *see, e.g.*, *Lovgren*, 701 F.3d at 18 ("For certain stocks, A16's ACLs represented significant reductions from previous fishing levels."); *see also* LABAREE, *supra* note 127, at 10; Carroll, *supra* note 106, at 182-85, 189.

136. BRINSON & THUNBERG, *supra* note 107, at 50; *Lovgren*, 701 F.3d at 19.

137. *Lovgren*, 701 F.3d at 34; Carroll, *supra* note 106, at 183, 189.

138. BRINSON & THUNBERG, *supra* note 107, at 52.

139. *Lovgren*, 701 F.3d at 19 ("When the sector rosters were finalized, some 812 of the Fishery's 1477 eligible permit holders had chosen to join a sector. Although this sector choice represented only 55% of the Fishery's individual permits, these vessels were responsible for 98% of the previous decade's catch.") (citing 75 Fed. Reg. at 18,144, 18,115 tbl. 1).

140. LABAREE, *supra* note 127, at 3. Three of these sectors are comprised of fishers who do not fish and merely lease out their share of the allowable catch. *Id.*

141. BRINSON & THUNBERG, *supra* note 107, at 52. The sub-annual catch limit is the "percentage of an annual catch limit (ACL) allocated to a defined group of fishermen, such as a group of fishermen participating in the Northeast Multispecies Sector Program . . . . The sum of the sub-ACLs must not exceed the overall stock ACL." Measuring the Effects of Catch Shares, *Glossary*, http://www.catchshareindicators.org/glossary/#subacl (last visited Feb. 26, 2016).

may be helping the fishers to adjust to lower catch levels, sectors appear to be providing New England groundfish fishers with considerable flexibility to consolidate harvesting onto fewer vessels, and to thereby improve the efficiency of the fishery.[142] The consolidation is controversial though, in part, because it is causing a reduction in the number of "crew positions and crew share of the profits" from the fishery.[143] Fishers within sectors are also benefitting differentially from sectoral management.[144]

Although I have elaborated the economic hypothesis as if it is distinct from the legal hypothesis, it is important to recognize the role of the Magnuson-Stevens Act in promoting the introduction of catch shares. The evolution of property rights in ocean fisheries is endogenous to changes in the statute in a number of respects. First, the timing of the introduction of property rights has been affected by changes in the Act. After a number of catch share programs were introduced in 1990-1995, the implementation of catch shares stalled, although it did not end completely, between 1996 and 2002, because there was a Congressional moratorium on individual transferable quotas.[145] The moratorium initially lasted from 1996 to 2000, and Congress then extended it to 2002.[146] Second, the type of property rights introduced in ocean fisheries likely is affected by the provisions of the statute. When the Magnuson-Stevens Act was reauthorized in 2007, Congress legislated a series of "procedural and substantive" provisions[147] governing the introduction of catch shares (referred to as limited access privileges in

142. BRINSON & THUNBERG, *supra* note 107, at 55 ("On average 612 limited access vessels participated in the groundfish fishery . . . during the 2007-2009 Baseline Period . . . . The total number of participating vessels (i.e., sector plus common pool) declined to 445 vessels in 2010 and declined again in 2011 to 420 vessels. The number of active sector vessels was 303 in 2010, while the number of active sector vessels went down slightly to 301 in 2011."); *id.* at 59.

143. Shelley, *supra* note 72, at 57. *See also* Carroll, *supra* note 106; *Lovgren*, 701 F.3d at 5. For more thorough analysis of the social impacts of the sectors, see Measuring the Effects of Catch Shares, *Northeast Multispecies Sector Program, Economic Indicators*, http://www.catchshareindicators.org/results/northeast/social/ (last visited Mar. 22, 2016). This site points out that "[t]he total numbers of groundfish vessel crew positions and crew trips, by fishing year, for all home port states . . . decreased" before the widespread introduction of sectoral management in 2010 and "into the initial years of the catch share program." *Id*. It also reports that "[a]verage crew compensation in the groundfish fishery increased from 2009 to 2011 because of higher revenues in 2011 compared to other years, and then it declined in 2012 and 2013 as the number of active vessels decreased." *Id.*

144. Olson & da Silva, *supra* note 126, at 13 ("those with relatively larger and more diverse allocations, and who had a stronger capitalized base, could more easily buy fish from those with fewer options, driving consolidation").

145. Wyman, *supra* note 13, at 187-88; *see also* Michael De Alessi et al., *The Legal, Regulatory and Institutional Evolution of Fishing Cooperatives in Alaska and the West Coast of the United States*, 43 MARINE POL'Y 217, 218 (2014) (discussing the introduction of cooperatives during the period of the moratorium).

146. Carroll, *supra* note 106; Wyman, *supra* note 13, at 185-87; COSTELLO, *supra* note 27.

147. Carroll, *supra* note 106, at 180.

the Act).[148] These provisions affect the characteristics of the property rights regimes created under the Act, and may incentivize certain councils to favor certain types of rights over others. For example, the New England Fishery Management Council likely opted to promote the use of sectors in 2010 partly because the Council is precluded from recommending the introduction of individual fishing quotas without a referendum in which two-thirds of permit holders vote in support of the program.[149] Third, the statute, especially the gradual ratcheting up of standards in the 1996 and 2007 amendments, likely has increased the incentives to introduce property rights. As I explained above, property rights may have become more attractive tools for managing fisheries as the statute has been amended to require rebuilding and catch limits, because of the flexibility that property rights offer fishers to improve the efficiency of the harvest.

Overall, my point in setting out the economic hypothesis is that in thinking about why the state of U.S. fisheries has improved, we need to consider not only the changes to the Magnuson-Stevens Act, but also the proliferation of various forms of property rights in fisheries in recent decades under the auspices of the Act. Almost certainly, the economists who have advocated catch shares for decades would want to underscore the spread of catch shares as a potential contributor.

C. Community Hypothesis

The third hypothesis that I elaborate for the improvement in the status of U.S. fish stocks concerns community involvement in managing fisheries. The idea is that the status of the stocks has improved because fishing communities now are incentivized to sustainably manage fisheries in ways that communities were not before the early 2000s. I think of this hypothesis as the "Ostrom" hypothesis, because it is inspired by Ostrom's emphasis on the potential for communities to sustainably manage resources, at least under certain conditions.[150]

---

148. Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006, Pub. L. No. 109-479, § 106, 120 Stat. 3575 (codified as 16 U.S.C. § 1853a (2012)).

149. 16 U.S.C. § 1853a(c)(6)(D)(i) (2012); *see* Carroll, *supra* note 106, at 187 (describing sectors as "a cleverly crafted program designed to evade the referendum requirement and still comply with legal requirements"); Holland & Wiersma, *supra* note 134, at 1077 (referring to concerns at council level that an individual transferable quota program "might not pass a referendum").

150. OSTROM, *supra* note 11, at 15-21.

1. Background

To elaborate the community hypothesis, it is first necessary to define the term "community management," so that we can know what institutions we should look to for evidence that there is now more sustainable community management of U.S. fisheries.[151] I distinguish two understandings of community management. One, which I label the "user" understanding of community management, associates the term with management by actual resource users, as opposed to government. The other, which might be called the spectrum understanding, is more expansive and suggests that community management may exist when users and government are jointly managing a resource.

Ostrom presents communal "self-organization and self-governance"[152] of "common pool resources" such as fisheries as an alternative to centralized state regulation (and private property).[153] Ostrom associates self-governance with "institutional arrangements" in which resource users themselves "devise[], modif[y], monitor[], and sustain[] . . . [rules] to constrain individual behavior that would, if unconstrained, reduce joint returns to the community of users."[154] However, she suggests that government might be present even where "individuals . . . organize themselves." [155] Government might be in the background, establishing the framework in which self-governance occurs.[156] Governments might be lending "legitimacy" to the rules established by resource users, recognizing the rules in some way.[157] Under this under-

---

151. The text focuses on what counts as community management as opposed to state regulation. Another threshold question is what counts as a "community" for the purposes of community management. McCay has defined "community" for the purposes of community based fisheries management as "place-based fishery-dependent communities and . . . more or less discrete and localized groups of people with similar fishing technologies or interests." McCay, *supra* note 24, at 230.

152. OSTROM, *supra* note 11, at 29.

153. *Id.* at 15. Ostrom defines a "common-pool resource'" as a resource that "share[s] the attribute of subtractability with private goods and difficulty of exclusion with public goods." Ostrom, *supra* note 15, at 412.

154. OSTROM, *supra* note 11, at 20.

155. *Id.* at 25.

156. Ostrom emphasizes that "[a]ll legal rules are nested in another set of rules that define how the first set of rules can be changed." *Id.* at 51. *See also id.* at 146 ("In a political regime that does not provide arenas in which low-cost, enforceable agreements can be reached, it is very difficult to meet the potentially high costs of self-organization."); Robert S. Pomeroy & Fikret Berkes, *Two to Tango: The Role of Government in Fisheries Co-Management,* 21 MARINE POL'Y 465, 467 (1997) ("Strictly speaking, pure communal property systems and CBCRM [community-based coastal resource management] are always embedded in state property systems and derive their strength from them").

157. OSTROM, *supra* note 11, at 20. In one of Ostrom's examples of user self-governance, the inshore fishery in Alanya, Turkey, "[t]he list of fishing locations is endorsed by each fisher and deposited with the mayor and local gendarme once a year at the time of

standing of community management, users are the main managers but there is a residual role for government.

Instead of thinking of community management in oppositional terms as management by resource users rather than by government, the term can be understood as referring to a "spectrum" of approaches in which users and government interact to manage resources.[158] At one end of the spectrum are approaches in which government remains the decision-maker, while consulting with users; the other end is approaches where the users are the decision-maker, but government is in the background. In conceiving of community management as a spectrum of approaches in which users and government interact, we can take inspiration from Robert Pomeroy and Fikret Berkes's conceptualization of co-management.[159]

2. Two Versions of the Community Hypothesis

The user and the spectrum understandings of community management suggest two versions of a community hypothesis for the improvement in U.S. fish stocks. The first adopts the spectrum understanding and uses the term "community management" to refer to arrangements in which users and government are collaborating, although government might retain final decision-

---

the lottery." *Id.* at 19. Ostrom states that "[t]hat local officials accept the signed agreement each year also enhances legitimacy . . . ." *Id.* at 20.

158. COOP. RESEARCH & COOP. MGMT. WORKING GRP., NAT'L MARINE FISHERIES SERV., COOPERATIVE RESEARCH AND COOPERATIVE MANAGEMENT: A REVIEW WITH RECOMMENDATIONS 7 (2015) http://www.nmfs.noaa.gov/op/docs/cooperative_research_and_mgmt.pdf (referring to "cooperative management spectrums" in existing literature).

159. Pomeroy and Berkes explain that "co-management can . . . be viewed as a continuum, . . . based on the role(s) played by government and resource users," "where more power and authority is delegated to local-level institutions as one moves along the continuum." Pomeroy & Berkes, *supra* note 156, at 477; *see also* COOP. RESEARCH & COOP. MGMT. WORKING GRP., *supra* note 158, at 7 (referring to other scholarship discussing "cooperative management spectrums"). Pomeroy & Berkes also describe comanagement approaches in terms of a "hierarchy," not just a spectrum. Berkes & Pomeroy, *supra* note 156, at 466; *see also* COOP. RESEARCH & COOP. MGMT. WORKING GRP., *supra* note 158, at 7 (referring to spectrum and hierarchy conceptualizations of comanagement). Co-management is not "pure" community management, in which users control the resource, or "pure" state regulation, in which it is regulated by government. Pomeroy & Berkes, *supra* note 156, at 467. As Pomeroy and Berkes argue, co-management "is a middle course" in which the state is present, and there is "[a] certain degree of community-based resource management." *Id.*

Community management and co-management are likely best regarded as part of the same broad family of management approaches, which can be labeled community management. Indeed, Ostrom discusses "comanagement institutions" as a form of "community-based system." Thomas Dietz, Elinor Ostrom & Paul C. Stern, *The Struggle to Govern the Commons*, 302 SCI. 1907, 1909 (2003). For other suggestions that community-based management and co-management are part of the same category of approaches, see McCay, *supra* note 24, at 243; Evelyn Pinkerton et al., *Local and Regional Strategies for Rebuilding Fisheries Management Institutions in Coastal British Columbia: What Components of Comanagement Are Most Critical?*, 19 ECOLOGY AND SOC'Y 72, 72-73 (2014).

making authority. Under this understanding, the regional fishery management councils are instances of community management because many council members are from the commercial and recreational fisheries that the councils are overseeing, and the councils craft many of the important rules under which these fisheries occur, though the councils' rules must be approved by NMFS to take effect.[160] Focusing on the councils, we might hypothesize that the status of U.S. fish stocks has improved because the councils have been better incentivized in recent decades to sustainably manage fish stocks than the councils were in the 1980s and 1990s.

Why might the councils be managing fish stocks more sustainably in recent decades? One possibility is that the councils now have less discretion to manage fisheries unsustainably, partly because of the legislative amendments from 1996 and 2007 — that I described earlier — that require the rebuilding of overfished stocks and science-based catch limits. But focusing on the impact of these legislative changes on the councils makes the community hypothesis devolve into the legal hypothesis. A second possibility is that the councils are now managing fish stocks more sustainably because increasing numbers of council members are incentivized to be better ecological stewards because they have catch shares whose value grows with the increasing abundance of fisheries. But pointing to catch shares as the instigation for changing behavior at the council level suggests that it is the catch shares that are the focus of the economic hypothesis that have driven changes in fisheries management, not ultimately changes at the council level.

Evolutions in fishery science are a third possible explanation for changing behavior at the council level in recent times. The literature on community governance emphasizes that user knowledge of resources tends to promote community management, because it is easier for resource users to manage resources that

160. Pomeroy & Berkes suggest that the councils are a form of co-management. Pomeroy & Berkes, *supra* note 156, at 471-72. NMFS describes the councils as "on the spectrum of cooperative management" in a recent review of "the agency's co-management and cooperative research activities." COOP. RESEARCH & COOP. MGMT. WORKING GRP., *supra* note 158, at 1, 46. In conducting the review, agency staff interviewed NMFS staff and "external stakeholders," who had different views on whether the councils are a form of co-management. *Id.* at 18, 21, 26, 28.

It is difficult to treat the councils as communal management under Ostrom's presentation of communal self-governance as an arrangement where users, not governments, make the rules for governing resources. The councils are creatures of Congressional legislation, and the councils are bound by the legislated rules for fishery management. While many council members are from fishing communities, they are appointed by the Secretary of Commerce and not chosen by the communities themselves, and there are other council members who are state and federal government officials. In addition, the requirement for NMFS approval of council proposals means that NMFS is the formal decision-maker, not the councils. *See supra* notes 54 through 66, and accompanying text.

they understand.[161] There are indications that scientific understanding of U.S. fisheries has increased in recent years,[162] stimulated by legislative changes such as the requirement for science-based catch limits.[163] Anecdotal evidence suggests that council members, including at least some working in fishing, have absorbed the new information about fisheries, although NMFS science is still distrusted by the fishing industry.[164] An improved understanding of the fisheries at the council level could be one change in recent times that is promoting more sustainable management of fisheries by the councils. This hypothesis is not entirely distinct from the legal hypothesis focusing on changes in the MSA, because the improved scientific understanding of U.S. fish is linked with statutory amendments requiring science-based catch limits. But neither is the hypothesis totally reducible to the legal hypothesis, because the "information is affecting council behavior" hypothesis focuses on the possibility that the improved scientific understanding of fisheries by itself is contributing to improved community management of fisheries at the council level, regardless of why the improved scientific understanding arose.

The second version of the community hypothesis adopts the narrower "resource user"-focused understanding of community management, under which the term covers only initiatives by users to manage resources, not institutions such as the councils that involve active participation by users and government. There are long established examples of users organizing themselves to man-

161. Ostrom's work famously identifies a set of ten "variables . . . affecting the likelihood of users' self-organizing to manage a resource." Elinor Ostrom, *A General Framework for Analyzing Sustainability of Social-Ecological Systems*, 325 SCI. 419, 420 (2009). "Knowledge of the SES" [social-ecological system, which includes "resource units"] is among the ten variables. *Id*. at 421. Ostrom explains: "When users share common knowledge of relevant SES attributes, how their actions affect each other, and rules used in other SESs, they will perceive lower costs of organizing. If the resource system regenerates slowly while the population grows rapidly, such as on Easter Island, users may not understand the carrying capacity of the resource, fail to organize, and destroy the resource." *Id*. at 421.

162. *NOAA's Fishery Science: Is the Lack of Basic Science Costing Jobs?: Hearing Before the Subcomm. on Fisheries, Wildlife, Oceans and Insular Affairs of the H. Comm. on Nat. Res.*, 112th Cong. (2011) ("Today, we know more about our fish stocks than ever before, and it is vital that our science not regress, as this would inevitably lead to declines in our stocks and a loss in the economic and social values they provide.")(written testimony of Eric Schwaab, Assistant Administrator, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce) (2011); *see also* THE PEW CHARITABLE TR. & OCEAN CONSERVANCY, *supra* note 7, at 29-31.

163. *Strengthening Fishing Communities and Increasing Flexibility in Fisheries Management Act: Hearing Before the H. Comm. on Nat. Res.*, 113th Cong. 72-73 (2014) (statement of George J. Geiger, former Chairman, South Atlantic Fishery Management Council) ("The annual catch limit mandate has spurred a flurry of scientific advances in assessing and setting catch limits for stocks for which we have more limited data than we may have for stocks that have undergone more conventional assessment.").

164. *See, e.g., id*. (Geiger, a former chairman of the South Atlantic Fishery Management Council, is "also a recreational fisherman and fishing guide"); *see also* THE PEW CHARITABLE TR. & OCEAN CONSERVANCY, *supra* note 7, at 15-16, 31.

age U.S. fisheries, most prominently the lobster gangs of Maine made famous by James Acheson.[165] But more relevant for present purposes, several industry self-governance arrangements have developed in U.S. fisheries during the past two decades.[166] The emergence of these self-governance arrangements just before, and during, the period that the overall status of U.S. fish stocks has improved provides the basis for hypothesizing that the improvement might be attributable, in part, to more community management of fisheries by fishers themselves. Through these arrangements, commercial fishing interests may be helping to sustainably manage fisheries, or helping themselves to adjust to lower catch limits required to rebuild overfished fisheries.

Consider three examples. The Pacific Whiting Conservation Cooperative (PWCC) was established in 1997.[167] The four companies "licensed" by the Pacific Fishery Management Council to fish in the "catcher-processor sector" of the whiting fishery apportioned among themselves the sector's share of the total allowable catch established by the council.[168] They enforce the apportionment through "a contract signed by . . . each of the cooperative members."[169] PWCC members also "fund scientific research, including . . . stock assessment and bycatch avoidance programs."[170] The Alaska pollock cooperatives were established after Congress

165. For a recent discussion of the Maine lobster fishery by Acheson, see James Acheson & Roy Gardner, *Fishing Failure and Success in the Gulf of Maine: Lobster and Groundfish Management*, 13 MARITIME STUD. 1, 9-11 (2014). For references to other longstanding examples of fisheries self-governance, see McCay, *supra* note 24, at 231.

166. For discussion of recently established forms of user self-governance, *see, e.g.*, De Alessi et al., *supra* note 145; Gil Sylvia et al., *Fishery Cooperatives and the Pacific Whiting Conservation Cooperative: Lessons and Application to Non-Industrial Fisheries in the Western Pacific*, 44 MARINE POL'Y 65 (2014); COOP. RESEARCH & COOP. MGMT. WORKING GRP., *supra* note 158, at 11-12, 46. De Alessi et al. offer some striking statistics on the significance of recently established cooperatives in west coast fisheries. They state that "[s]ince 1997, the proportion of the total allowable catch (TAC) in the fisheries of the West Coast of the United States harvested by cooperatives and other catch share arrangements has risen from 0% to almost 60%." De Alessi et al., *supra* note 145, at 218. Moreover, "[f]ishery-wide revenues . . . show that cooperatives accounted for 28% of West Coast and Alaska commercial fisheries revenues in 2011. Adding the IFQ [individual fishing quota]-managed halibut and sablefish fisheries brings that number up to 43%." *Id.* at 222. User self-governance arrangements are a form of community management under the spectrum understanding of communal management, because it is a broader understanding that encompasses arrangements involving users and government. As I discuss below, government regulation has facilitated the establishment of these arrangements.

167. PACIFIC WHITING CONSERVATION COOP., http://www.pacificwhiting.org/ (last visited Mar. 22, 2016).

168. *Id.*; De Alessi et al., *supra* note 145, at 219 (referring to "four companies"). There are now three companies in the cooperative. *Id.* at 220.

169. PACIFIC WHITING CONSERVATION COOP., *supra* note 167.

170. *Id.*

passed the American Fisheries Act in 1998.[171] "The cooperatives use private contracts to establish rules and procedures for conducting their pollock fishery."[172] As mentioned above, sectors were established in the New England groundfish fishery beginning in the 2000s.[173] They are cooperatives that are formed through private contracts among their members.[174] Their operations plans include "harvesting rules, infraction measures, [and] a monitoring plan."[175]

Ostrom acknowledged that government might play a role in facilitating user self-organization, and government actions allocating shares of the whiting, pollock, and groundfish fisheries to delimited groups of resource users eased the creation of cooperatives in these fisheries.[176] For the whiting cooperative, "[t]he Pacific Fishery Management Council . . . provided the needed regulatory framework . . . when it formally divided the annual total allowable catch of Pacific whiting . . . among three fishery sectors" and "imposed a license limitation program for the West Coast groundfishery, which limited participation in the fishery to qualified vessels."[177] As for the pollock fishery, the North Pacific Fishery Management Council established "a moratorium on new entrants"

---

171. Wyman, *supra* note 13, at 170 n.139 & 217-18; *American Fisheries Act (AFA) Pollock Cooperatives*, N. PACIFIC FISHERY MGMT. COUNCIL, http://www.npfmc.org/american-fisheries-act-afa-pollock-cooperatives/ (last visited Mar. 22, 2016).

172. COOP. RESEARCH & COOP. MGMT. WORKING GRP., *supra* note 158, at 11.

173. *Supra* note 133. Shelley implicitly compares the sector management that Amendment 16 promotes to the community-based management of resources that Ostrom found could occur under certain circumstances. He argues that it is unclear whether the New England fishing industry is well-suited to sector-based management, though he is more optimistic about the potential for sectors "for the smaller scale day boats" than "[t]he larger offshore-capable trip boats [that] are already talking about continuing on to an IFQ system." Shelley, *supra* note 72, at 70 n.214. *See also* McCay, *supra* note 24, at 239-41 (arguing that "[c]ommunity-oriented sector management in New England has emerged mainly within . . . three very small sectors").

174. Carroll, *supra* note 106, at 188 (describing sectors as "voluntary contractual arrangement between fishers"); LABAREE, *supra* note 127.

175. LABAREE, *supra* note 127, at 3.

176. *See generally* Holland & Wiersma, *supra* note 134, at 1076 (indicating that the "formation of [various U.S. fishery] . . . cooperatives was enabled by regulatory actions that created an exclusive allocation of the TAC [total allowable catch] for a relatively small and cohesive group of permit holders who were able to agree on a system to ration the TAC among the members"); De Alessi et al., *supra* note 145, at 223 ("laws and regulations [can] reduce the transaction costs of cooperation by, for example, grouping similar operations within sector allocations or by only allowing quota transfers within cooperative structures"). Nicolás L. Gutiérrez et al. offer empirical evidence that it is helpful for the success of communal management for governments to allocate shares of the total allowable catch. Nicolás L. Gutiérrez et al., *Leadership, Social Capital and Incentives Promote Successful Fisheries*, 470 NATURE 386, 386 (2011) (after examining 130 co-managed fisheries, "[w]e identified strong leadership as the most important attribute contributing to success, followed by individual or community quotas, social cohesion and protected areas").

177. PACIFIC WHITING CONSERVATION COOP., *supra* note 167. *But see* Sylvia et al., *supra* note 166, at 66 (stating that "the industry negotiated" the allocation of the fishery among different sectors in 1996); *id.* at 67 (suggesting that limited entry was introduced after the cooperative was established).

in 1996.[178] The American Fisheries Act then "allocated" shares of the pollock catch among different sectors of the pollock fishery, and "identified ["by name"] all eligible vessels participating in" two sectors that formed cooperatives in 1999.[179] The New England Fishery Management Council established the regulatory framework that promoted the creation of sectors in the groundfishery; the council's framework assigns shares of the allowable catch levels to sectors based on the catch histories of their members.[180]

The role of legislative and regulatory actions in facilitating the creation of community management suggests that the spread of user self-governance is not entirely independent of legal changes in recent decades. As already mentioned, the requirements in the 2007 legislative amendments for legally binding catch limits provided a major impetus for the spread of sectors in New England, as the New England Fishery Management Council sought ways to ease the groundfish industry's adjustment to lower catch levels.[181] The three examples of community management also are examples of the spread of catch shares that is the focus of the economic hypothesis, because the examples involve regulators allocating privileges to harvest shares of allowable catches, in this instance to groups of users, rather than to individual users. So yet again, the community hypothesis, even when focused on the emergence of examples of user self-governance rather than the councils, is not completely separable from the legal and economic hypotheses.

Nonetheless, the community hypothesis is valuable, whether it is focused on changing behavior at the council level or the emergence of new forms of decentralized management in fisheries contemporaneous with the period of the recovery of U.S. fish stocks. The hypothesis suggests that changes within society attributable in some measure to resource users, not just changes from above in the statutory framework or property rights, may be partly responsible for the improvement in the status of the stocks.[182] As with the other hypotheses, empirical analysis is

178. Sylvia et al., *supra* note 166, at 69.

179. De Alessi et al., *supra* note 145, at 220. De Alessi et al. underscore the benefits of Congress defining the participants by noting that "cooperative formation" was "delay[ed]" by a year in other sectors where the Congressional legislation "only defined the qualifying criteria for" the sectors. *Id. But see* Sylvia et al., *supra* note 166, at 69 (the pollock industry "petitioned" for "conditions" that enabled it to develop cooperatives, while "the Pacific whiting fishery" benefitted from "conditions" that "support[ed] the *voluntary* agreement of the" cooperative).

180. *Supra* note 129 and accompanying text.

181. *Supra* note 135.

182. Admittedly, the role of legislation and regulation in facilitating and stimulating the spread of communal management regimes complicates characterizing self-governance efforts as entirely from within society. For example, while sectors were "first proposed and used by a local, community-based user group" in New England, "the general strategy soon became part of a wider government promotion to consider 'catch shares' as a management

needed to assess whether communal management is positively impacting the biological status of fisheries.[183]

IV. CONCLUSION

The improvement in the biological status of U.S. fisheries in roughly the past decade is a remarkable achievement that deserves broader attention. To be sure, there are still overfished fisheries in U.S. waters, and climate change and other phenomena create significant risks for the continued health of fish stocks and marine ecosystems. But it is nonetheless worth underscoring the good news story in U.S. fisheries, and analyzing the factors that have contributed to the progress in the status of the stocks. This article has sought to set the stage for further work by sketching three hypotheses for the improvement. These hypotheses should be subject to empirical inquiry, along with others.[184]

As I have emphasized throughout, the legal, economic and community hypotheses are not completely separable. Changes in the Magnuson-Stevens Act have affected the process and the impetus for establishing property rights and community management in fisheries. But there is another, more fundamental way in which the three hypotheses are linked: all of them point to political developments to explain the improvement in the fish stocks. Changing the Magnuson-Stevens Act by definition required Congressional action. Introducing catch shares generally requires action at the council level and by NMFS. The development of self-governance arrangements requires organizing components of the fishing industry and interacting with regulators and/or legislators.[185] Thus, even if one could establish empirically that there is a

---

tool more generally." Olson & da Silva, *supra* note 126, at 2; *see also id*. at 7 (sectors "became more top down . . . as sectors were soon perceived not as a choice but as the only viable option").

183. For some indications of the ecological effects of various forms of communal management, see *Northeast Multispecies Sector Program, Ecological Indicators*, MEASURING THE EFFECTS OF CATCH SHARES, http://www.catchshareindicators.org/results/northeast/ecological/ (last visited Mar. 22, 2016) (measuring the ecological and other effects of the New England groundfish sectors and the West Coast shore-based individual fishing quota program); Jennifer F. Brewer, *Hog Daddy and the Walls of Steel: Catch Shares and Ecosystem Change in the New England Groundfishery*, 27 SOC'Y & NAT. RES. 724, 725, 729 (2014) (suggesting, based on "[q]ualitative evidence," that the New England groundfish sectors are contributing to "ecosystem decline," as sector management shifts "from more direct and spatiotemporally specific regulatory controls on fishing effort to annual quotas on harvest outputs"); De Alessi et al., *supra* note 145, at 223 ("to date fishing cooperative have harvested the full amount of available catch limits").

184. *See supra* note 52 (identifying other hypotheses).

185. *See, e.g.*, Holland & Wiersma, *supra* note 134, at 1078 (referring to the role of "existing industrial organizations" and "nonprofit organizations" in organizing New England groundfish sectors); Olson & da Silva, *supra* note 126, at 5, 7 (referring to the role of the

relationship between the improvement in the status of the stocks and changes to the Magnuson-Stevens Act, the spread of catch shares or more sustainable communal management, one still would want to know what was the political constellation of interests that facilitated the changes in legislation, property rights and communal management themselves? The politics of U.S. fisheries regulation at the national, the regional and the local levels during the period of the recovery of the fish stocks is itself a topic worthy of further research, separate and apart from the reasons for the improvement in the fish stocks.[186] Understanding the political dimension of fisheries management is especially critical now, given the ongoing debate about reauthorizing the Magnuson-Stevens Act.[187]

V. APPENDIX

Explanation of the Data Used in Preparing Figure 1, Percentage of U.S. Fish Stocks Classified as Overfished 1997-2014

This Appendix provides information about the sources used, and choices made, in preparing Figure 1, which shows the percentage of U.S. fish stocks classified as overfished between 1997 and 2014.

I calculated the percentages that are graphed in Figure 1, using a series of reports that the National Marine Fisheries Service (NMFS) has prepared for Congress since 1997 on the status of U.S. fish stocks.[188] For each year's data point, the numerator is the number of overfished stocks, and the denominator is the total number of stocks whose overfished status NMFS identified.

The following table provides the raw data underlying the graph in Figure 1. Proceeding from left to right, it shows:

- The year.
- The number of fish stocks NMFS classified as overfished that year. This is the numerator for the year's data

---

Northeast Seafood Coalition, "key NGOs, philanthropic groups, and industry groups" in organizing sectors).

186. *See* Rowley, *supra* note 7 (quoting Margaret Spring, "who worked for Senator Daniel K. Inouye, a Democrat from Hawaii" at the time of the 2007 amendments as suggesting that bipartisanship was key to the reforms).

187. *Magnuson-Stevens Act, Ongoing Reauthorization Activities*, NAT'L MARINE FISHERIES SERV., http://www.nmfs.noaa.gov/sfa/laws_policies/msa/reauthorization_activities.html (last visited Mar. 22, 2016).

188. *Stock Status Archive*, NAT'L MARINE FISHERIES SERV., http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/archive/stock_status_archive.html (last visited June 20, 2016).

point. Before 2000, NMFS classified a fish stock as overfished based on biomass level, and/or fishing mortality levels. Beginning in its 2000 report, NMFS applied the label overfished to fish stocks solely based on their biomass levels.[189]

- The number of fish stocks NMFS classified as approaching overfished status that year. A fish stock is approaching an overfished condition "if, based on trends in fishing effort, fishery resource size, and other appropriate factors, the Secretary estimates that the fishery will become overfished within two years." 16 U.S.C § 1854(e)(1).
    - For 1997-2011, NMFS separately reported the number of fish stocks approaching overfished status, distinct from the number of not overfished stocks. For 2012, 2013 and 2014, NMFS did not separately report the number of stocks approaching overfished status and it was necessary to consult the supplemental tables accompanying NMFS reports to determine the number of fish stocks approaching overfished status, separate and apart from the number classified as not overfished. I consistently include the number of fish stocks approaching overfished in the total number of fish stocks whose status is known, which is the sum of overfished, approaching overfished and not overfished. NMFS is statutorily required to report the number of stocks approaching an overfished condition under 16 U.S.C. § 1854(e)(1).
- The number of fish stocks classified as not overfished that year.
- The total number of fish stocks that NMFS classified as overfished, approaching overfished and not overfished. This sum is the denominator for the year's data point in Figure 1.
- The number of overfished stocks, divided by the total number of stocks that NMFS classified as overfished, approaching overfished and not overfished, expressed as a percentage. The percentages are graphed in Figure 1.
- The number of fish stocks whose overfished status is unknown, not defined or N/A in the NMFS reports. This

189. On the current definition of overfished, see *supra* note 33. On methodological changes that NMFS made to the reports over time, see *supra* note 29.

data is not included in the graph in Figure 1. It is included in the table to illustrate the large number of stocks with unknown overfished status.

- The total number of stocks with known and unknown overfished status. This data is not included in the graph. It is included in the table to provide a perspective on the quantity of fish stocks under NMFS jurisdiction.

Trends in Overfished Fish Stocks in the United States: 1997-2014

Year	Known Overfished	Known Approaching Overfished	Known Not Overfished	Total Number of Fish Stocks With Overfished Status Known	Percentage of Known Overfished as Percentage of Total Known	Number of Fish Stocks With Unknown and Other Overfished Status	Total Number of Stocks (known and unknown)
1997	86	10	183	279	31%	448	727
1998	90	10	200	300	30%	544	844
1999	64	5	122	191	34%	716	907
2000	92	5	148	245	38%	660	905
2001	81	3	163	247	33%	712	959
2002	86	1	150	237	36%	695	932
2003	76	1	138	215	35%	694	909
2004	56	1	144	201	28%	487	688
2005	43	4	136	183	23%	347	530
2006	47	4	136	187	25%	343	530
2007	45	5	140	190	24%	338	528
2008	46	5	148	199	23%	332	531
2009	46	6	152	204	23%	319	523
2010	48	5	154	207	23%	321	528
2011	45	5	169	219	21%	318	537
2012	41	5	178	224	18%	230	454
2013	40	4	186	230	17%	248	478
2014	37	2	189	228	16%	241	469

Below I identify the sources of the data in the table, by year:

1997: NAT'L MARINE FISHERIES SERV., STATUS OF FISHERIES OF THE UNITED STATES, REPORT TO CONGRESS 3 (1997), http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/archive/1997-2002/status_of_fisheries_1997_report.pdf (279 is author's calculation based on total of known overfished, approaching overfished, and not overfished; 727 is author's calculation based on 279+448 unknown in table).

1998: NAT'L MARINE FISHERIES SERV., REPORT TO CONGRESS, STATUS OF FISHERIES OF THE UNITED STATES 1 (1998), http://

www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/archive/1997-2002/status_of_fisheries_report_congress_1998.pdf (300 is author's calculation based on total known overfished, approaching overfished, and not overfished; 844 is author's calculation based on 300+544 unknown in table).

1999 & 2000: NAT'L MARINE FISHERIES SERV., REPORT TO CONGRESS, STATUS OF FISHERIES OF THE UNITED STATES tbl. 1 at 14 (2001), http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/archive/1997-2002/status_of_fisheries_report_congress_2000.pdf (191 and 245 are author's calculations based on known overfished, approaching overfished and not overfished; 716 is author's calculation based on 390 unknown and 326 undefined in Table 1; 660 is author's calculation based on 619 unknown and 41 undefined in Table 1).

For 1999, the graph reflects the number of overfished stocks reported in NMFS's report to Congress for 2000, which is lower than the number for 1999 reported in the report for 1999, as changes were made to the reporting criteria between 1999 and 2000.[190]

2001: NAT'L MARINE FISHERIES SERV., ANNUAL REPORT TO CONGRESS ON THE STATUS OF U.S. FISHERIES – 2001 tbl. 1 at 12 (2002), http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/archive/1997-2002/status_of_fisheries_report_congress_2001.pdf (247 is author's calculation based on adding 81+3+163; 712 is author's calculation from adding 589 unknown, and 66 undefined and 57 N/A in Table 1); *id.* at iii (959 is author's calculation from 247+712).

2002: NAT'L MARINE FISHERIES SERV., ANNUAL REPORT TO CONGRESS ON THE STATUS OF U.S. FISHERIES—2002 tbl. 1 at 18 (2003), http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/archive/1997-2002/status_of_fisheries_report_congress_2002.pdf (237 is author's calculation based on 86+1+150; 695 is author's calculation based on 572 unknown, 70 not defined and 53 N/A in Table 1; 932 is author's calculation based on 237+695).

NMFS's report for 2002 indicates that there were 722 stocks in 2001 whose overfished status was unknown or whose fishing mortality rate threshold was undefined, but I calculated only 712 stocks in 2001 whose overfished status is unknown, undefined or N/A. I cannot reconcile the difference. NAT'L MARINE FISHERIES SERV., STATUS OF THE FISHERIES OF THE UNITED STATES 2002 9,

190. *See supra* note 29.

http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/archive/1997-2002/status_of_fisheries_report_congress_2002.pdf.

2003: NAT'L MARINE FISHERIES SERV., ANNUAL REPORT TO CONGRESS ON THE STATUS OF U.S. FISHERIES — 2003 tbl. 1 at 8 (2004), http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/archive/2003/status_of_fisheries_2003.pdf (215 is author's calculation based on total known overfished, not overfished and approaching overfished; 694 is author's calculation based on total not known, not defined and N/A); *id.* at 4 (909 stocks).

2004: NAT'L MARINE FISHERIES SERV., ANNUAL REPORT TO CONGRESS ON THE STATUS OF U.S. FISHERIES—2004 tbl. 2 at 10 (2005), http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/archive/2004/status_report_2004.pdf (201 is author's calculation based on total number of known overfished, not overfished and approaching overfished; 487 is author's calculation based on total not known, not defined and N/A/ in Table 2).

For 2004, the body of the report states that there are 200 stocks whose overfished status is known, but I calculate 201. The difference may be due to the fact that I include the stock known to be approaching overfished status. NAT'L MARINE FISHERIES SERV., ANNUAL REPORT TO CONGRESS ON THE STATUS OF U.S. FISHERIES—2004 7 (2005). I count this stock separately because Appendix 1 states that "the categories not overfished and approaching an overfished condition are mutually exclusive. Any stock listed as approaching an overfished condition (estimated to become overfished within 2 years) is not included in the not overfished category, even though it is currently not overfished, to eliminate double counting." *Id.* at app. 1, http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/archive/2004/2004_appendices.pdf.

2005: NAT'L MARINE FISHERIES SERV., REPORT ON THE STATUS OF U.S. FISHERIES FOR 2005 tbl. 2 at 10 (2005), http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/archive/2005/report_text_final_2005.pdf (the following data for 2005 are from this report: number of stocks approaching overfished status (4), and total number of stocks (530)); NAT'L MARINE FISHERIES SERV., REPORT ON THE STATUS OF U.S. FISHERIES FOR 2006 app. 1, tbl. 1 & 2, http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/archive/2006/2006_statusof_fisheries_appendix_1-2.pdf (this report is the source of the number of fish stocks reclassified as stocks with unknown status). The following numbers are the author's own calculations, based on using the numbers in the 2005 report as a

baseline and adjusting them to reflect the restatements in the 2006 report: number of stocks known to be overfished, number of stocks known to be not overfished, total number of stocks with known overfished status, percentage of stocks classified as overfished, number of stocks with unknown status, total number of stocks with known and unknown overfished status.

For 2005, I rely on the data in the 2005 report, as updated by the 2006 report. In the 2006 report, NMFS stated that 11 stocks classified as overfished in 2005, and 12 stocks classified as not overfished in 2005, should have been treated as stocks whose overfished status was unknown in 2005. The reason for reclassifying most of these 23 stocks was that the earlier stock status determination had been improperly based on the spawning potential ratio, which is not an appropriate basis for determining overfished status. REPORT ON THE STATUS U.S. FISHERIES 2006, *supra*, at 5 & 5 n.1 (number of overfished fish stocks for 2005 is 43, not 54 as reported in 2006 report); *id.* at app. 1, A-4 – A-5.

2006: NAT'L MARINE FISHERIES SERV., REPORT ON THE STATUS OF U.S. FISHERIES FOR 2006 tbl. 2 at 15 (2006), http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/archive/2006/2006_status_of_fisheries_report.pdf (187 is author's calculation based on total number of known overfished, not overfished and approaching overfished; 343 is author's calculation based on total not known, not defined, N/A in Table 2).

2007: NAT'L MARINE FISHERIES SERV., 2007 STATUS OF U.S. FISHERIES tbl. 1 at 6 (2008), http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/archive/2007/2007_status_of_fisheries.pdf (190 is author's calculation based on total number of known overfished, not overfished and approaching overfished; 338 is author's calculation based on total not known, not defined, N/A in Table 1).

2008: NAT'L MARINE FISHERIES SERV., 2008 STATUS OF U.S. FISHERIES tbl. 1 at 8 (2009), http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/archive/2008/status_of_fisheries_2008.pdf (199 is author's calculation based on total number of known overfished, not overfished and approaching overfished; 332 is author's calculation based on total not known, not defined and N/A in Table 1).

2009: NAT'L MARINE FISHERIES SERV., 2009 STATUS OF U.S. FISHERIES tbl. 1 at 7 (2010), http://www.nmfs.noaa.gov/sfa/fish

eries_eco/status_of_fisheries/archive/2009/2009_status_of_fisheries .pdf (204 is author's calculation based on total known overfished, not overfished and approaching overfished; 319 is author's calculation based on total not known, not defined and N/A in Table 1; 523 is author's own calculation based on total known overfished, known not overfished, overfished status not known, not defined, N/A and known approaching overfished in Table 1).

For 2009, I calculated that 523 stocks had known or unknown overfished status, not 522 as reported in the 2009 reports, Table 1. Description of FSSI and non-FSSI Stocks by Council, 2009. http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/archive/2009/2009_status_of_fisheries.pdf.

2010: NAT'L MARINE FISHERIES SERV., STATUS OF STOCKS: 2010 REPORT ON THE STATUS OF U.S. FISHERIES tbl. 1 at 5 (2011), http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/archive/2010/2010_status_of_fisheries.pdf (207 is author's calculation based on total known overfished, not overfished and approaching overfished; 321 is author's calculation based on total not known, not defined and N/A in Table 1).

2011: NAT'L MARINE FISHERIES SERV., STATUS OF STOCKS: REPORT ON THE STATUS OF U.S. FISHERIES FOR 2011 tbl. 1 at 6 (2012), http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/archive/2011/2011_sos_report.pdf (219 is author's calculation based on total known overfished, not overfished and approaching overfished; 318 is author's calculation based on total not known, not defined and N/A in Table 1).

2012: NAT'L MARINE FISHERIES SERV., STATUS OF STOCKS 2012: ANNUAL REPORT TO CONGRESS ON THE STATUS OF U.S. FISHERIES tbl. at 2 (2012), http://www.nmfs.noaa.gov/stories/2013/05/docs/2012_sos_rtc.pdf (2012 data, except for the number of approaching overfished and known not overfished; 454 is author's calculation based on total known and unknown); NAT'L MARINE FISHERIES SERV., STATUS OF STOCKS 2012: ANNUAL REPORT TO CONGRESS ON THE STATUS OF U.S. FISHERIES, Table A. Summary of Stock Status for FSSI Stocks & Table C. Summary of Stock Status for non-FSSI Stocks, http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/archive/2012/2012_tables_a_d.pdf (number of fish stocks approaching overfished status (5) and number of fish stocks known to be not overfished (178)).

2013: NAT'L MARINE FISHERIES SERV., STATUS OF STOCKS 2013: ANNUAL REPORT TO CONGRESS ON THE STATUS OF U.S. FISHERIES tbl. at 2 (2013), http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/archive/2013/status_of_stocks_2013_web.pdf (478 is author's calculation based on total known and unknown); NAT'L MARINE FISHERIES SERV., STATUS OF STOCKS 2013: ANNUAL REPORT TO CONGRESS ON THE STATUS OF U.S. FISHERIES (Table A. Summary of Stock Status for FSSI Stocks & Table C. Summary of Stock Status for non-FSSI Stocks), http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/archive/2013/2013_stock_status_tables.pdf (number of fish stocks approaching overfished status (4)).

2014: NAT'L MARINE FISHERIES SERV., STATUS OF STOCKS 2014: ANNUAL REPORT TO CONGRESS ON THE STATUS OF U.S. FISHERIES 1 & 2, http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/archive/2014/2014_status_of_stocks_final_web.pdf (241 is author's own calculation based on 469 (the number of stocks that NMFS "tracks") minus 228 (the number of stocks whose overfished status is known); NAT'L MARINE FISHERIES SERV., STATUS OF STOCKS 2014: ANNUAL REPORT TO CONGRESS ON THE STATUS OF U.S. FISHERIES, Table A. Summary of Stock Status for FSSI Stocks & Table C. Non-FSSI Stocks, http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/archive/2014/2014_stock_status_tables.pdf (number of fish stock approaching overfished status (2)).