QUIETING A NOISY OCEAN:

POLICY GUIDANCE FOR EFFECTIVE REGULATION OF UNDERWATER OCEAN SOUND

by

Jessalee Landfried

James Salzman, J.D., Adviser
May 2013

Masters project submitted in partial fulfillment of the
requirements for the Master of Environmental Management degree in
the Nicholas School of the Environment of
Duke University

2013

ABSTRACT

Anthropogenic ocean noise poses a serious threat to aquatic ecosystems, since marine species rely on their acoustic senses for many of their most essential biologic functions. However, although the potential harms of ocean noise are now well-known, quieting the oceans has proven to be a major challenge. In the United States, federal agencies and private actors operating in ocean environments rely on an outdated and patchy set of rules which, in practice, do little to actually reduce noise and protect animals. This paper offers guidance for improving the U.S. policy approach by examining the weaknesses of the current system and offering suggestions for possible paths forward. As a thought experiment, the paper concludes with a more detailed examination of a theoretical noise abatement licensing scheme.

ACKNOWLEDGMENTS

My deepest thanks to Prof. James Salzman and Dr. Linwood Pendleton, whose guidance and support were invaluable in producing this paper. I also leaned heavily on the expertise of many ocean sound experts, including Jaime Budzynkiewicz, Theresa Christopher, Chris Corvo, Brandon Southall, and Michael Weiss. They were all extremely generous with their time and knowledge, and their input was critical to my project. Of course, any errors or misconceptions are my own.

TABLE OF CONTENTS

INTRODUCTION

"A LONG TIME AGO, MY FATHER SAID THIS WAS A 'SILENT WORLD.'"

-JEAN-MICHEL COUSTEAU

Galveston Bay, a 600-square mile estuary off the coast of Texas, is a much busier place than it used to be. The Bay's rich estuarine environment has long supported large populations of shrimp, oysters, crabs, and fish, making it the second most productive estuary in the nation.[1] Bottlenose dolphins, who thrive on the abundant marine life, also call the Bay's deep waters home. But in the last few decades, the Bay's natural productivity has come in increasingly close contact with a number of major industrial activities. Galveston Bay is not only the site of the Port of Houston, a 25-mile long industrial complex that receives more than 200 million tons of cargo annually,[2] but it's also nestled behind dozens of offshore oil and gas rigs.[3] The Bay was not always a site of such intense industry: the Port's deepwater channel opened to much fanfare in 1914,[4] and offshore energy development only began in earnest in 1954.[5]

---

[1] Texas Environmental Commission, "Galveston Bay Estuary Program," http://www.tceq.texas.gov/publications/pd/020/10-03/galveston-bay-estuary-program (last updated Aug. 8, 2012).
[2] Port of Houston Authority, "Overview," http://www.portofhouston.com/about-us/overview/ (last visited March 12, 2013).
[3] *See* Energy Information Administration, "Gas Production in Offshore Fields, Lower 48" (April 2009), *available at* http://www.eia.gov/oil_gas/rpd/offshore_gas.pdf; National Geographic, "Gulf of Mexico: A Geography of Offshore Oil," *available at* http://education.nationalgeographic.com/media/file/A_Geography_of_Offshore_Oil-Map.pdf.
[4] Port of Houston Authority, "History," http://www.portofhouston.com/about-us/history/ (last visited March 12, 2013).
[5] National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling, "A Brief History of Offshore Oil Drilling" (Aug. 2010) at 3, *available at*

Galveston Bay's story is a common one. Similar expansions in industrial activity have taken place in waters across the globe[6] as humans relentlessly press the world's oceans for energy, food, transportation, and national security. This trend is especially marked in the Arctic, which is now more accessible than ever thanks to the warming global climate.[7] In some ways, intense ocean industrialization is highly visible: cargo ships have gotten bigger and bigger, coastal air has grown thicker with smog, and more and more smokestacks have popped up along shorelines.

But these changes have also sparked another shift more difficult for humans to perceive. Beneath the waves, our oceans have become very noisy places.[8]

The rapid increase in anthropogenic ocean noise poses a serious threat to aquatic ecosystems. Marine species rely on their acoustic senses for many of their most essential biologic functions. Whales, dolphins and fish alike depend on their hearing to mate, hunt, navigate, and more.[9] By muffling animal calls and producing noise loud enough to physically injure some species, human sound pollution may be hampering marine species' ability to survive and thrive in their

---

http://www.oilspillcommission.gov/sites/default/files/documents/A%20Brief%20History%20of%20Offshore%20Drilling%20Working%20Paper%208%2023%2010.pdf.

[6] *See, e.g.,* Richard Carter, "Life on the Edge: Industrialization of Our Oceans" (July 27, 2007), *available at* http://www.csc.noaa.gov/cz/CZ07_Proceedings/PDFs/Tuesday_Abstracts/3043.Charter.pdf.

[7] *See* POLAR ENVIRONMENTAL CENTER, "Melting Snow and Ice: A Call for Action," *available at* http://www.regjeringen.no/upload/UD/Vedlegg/klima/melting_ice_report.pdf (Dec. 2009).

[8] *See, e.g.,* N.Y. Times, *A Rising Tide of Noise is Now Easy to See* (Dec. 10, 2012), http://www.nytimes.com/2012/12/11/science/project-seeks-to-map-and-reduce-ocean-noise-pollution.html?pagewanted=all&_r=0; SCRIPPS INSTITUTE OF OCEANOGRAPHY, "Ocean Noise Has Increased Considerably Since 1960s," http://scrippsnews.ucsd.edu/Releases/?releaseID=744 (Aug. 18, 2006).

[9] "Taking and Importing Marine Mammals; Navy Training Activities Conducted Within the Northwest Training Range Complex," 74 Fed. Reg. 33828, 33846 (July 13, 2009).

underwater homes. Indeed, the consequences of underwater noise can be devastating. Military sonar testing in particular has been linked to mass whale deaths across the globe.[10]

Although the potential harms of ocean noise are now well-known, quieting the oceans has proven to be a major challenge. Anticipating and measuring adverse effects on marine life requires sophisticated analysis of dozens of factors: varying types of sound, different animals' auditory capacities, seasonal changes, migration patterns, and more. In the United States, federal agencies and private actors operating in ocean environments approach this complexity wielding only an outdated and patchy set of rules. Perhaps unsurprisingly, then, the level of sound in the ocean is still increasing.[11] In practice, U.S. policies impose costly analysis and reporting requirements – almost exclusively on federal agencies – but do little to actually reduce noise and protect animals.

Given this complexity and uncertainty, and the reality that we are failing to meaningfully reduce underwater sound, how should U.S. policy evolve? This paper seeks to help answer that question by examining the weaknesses of current policies and offering suggestions for possible paths forward. My analysis is based not only on standard legal and scientific research, but also on extensive interviews with scientists, government attorneys, academics and environmental activists who work in the field.

---

[10] *See, e.g.,* Navy, *Joint Interim Report: Bahamas Marine Mammal Stranding Event of 15-16 March 2000"* (Dec. 2001), *available at* http://www.nmfs.noaa.gov/pr/pdfs/health/stranding_bahamas2000.pdf; P.D. Jepson et al., "Gas-bubble lesions in stranded cetaceans,". (Oct. 9, 2003), 425 *Nature* 5756, *available at* http://www.nature.com/nature/journal/v425/n6958/full/425575a.html.

[11] *Supra* n. 8.

Sections I through III provide key background information on the complex nature of underwater ocean sound and the existing legal and policy context. Section I examines the types of anthropogenic sound introduced into marine environments, and describes what's known about how sound affects marine life. Section II outlines the current policy approach, including a brief description of international approaches and an examination of how litigation by environmental groups has impacted U.S. underwater sound regulation. Based on this scientific and legal background, Section III analyzes key failures of the current regulatory scheme. With an eye towards realistically addressing those failures, Section IV proposes several possible paths forward for U.S. policy. Section V elaborates on one of these, a licensing scheme, to explore the challenges and opportunities presented by policy innovation in this area.

I. A COMPLEX PROBLEM: SOUND IN THE MARINE ENVIRONMENT

Underwater ocean noise threatens some of the planet's most vulnerable species. Sound can directly cause physical injuries, and it can cause harmful behavioral changes that ultimately weaken the animal. In the most serious cases, underwater noise can cause mass marine animal fatalities. But what is "ocean noise" exactly? In reality, it is an extremely broad term encompassing a huge variety of noise producing events, whose sounds are received by scores of different creatures in a variety of underwater settings. Some noises are naturally present in the marine environment, but some are produced by humans. Anthropogenic sound in the oceans can come from sonar, weapons testing, vessel traffic, seismic tests, wind turbines, and drilling, among other sources. Noise can be chronic, like the engine noise from a ship, or sporadic, like an occasional boom from seismic testing. Some sources are stationary, while some are mobile.

Before examining policies that address underwater sound, it is helpful to understand sound itself, and how the array of anthropogenic noise produced in the oceans can impact marine ecosystems.

A. Sound's Basic Properties

In broad terms, ocean sound is a wave of pressure variations that travel through seawater.[12] The intensity of ocean sound is measured on the decibel (dB) scale, which is a logarithmic scale for sound intensity (like the Richter scale of earthquake intensity).[13] A unitary increase along the scale therefore indicates a multiple increase in intensity. A 10 dB increase produces a sound ten times louder, while a 20 dB increase will be one hundred times greater. Decibel levels cannot be directly compared between air and underwater environments because the differing pressure levels affect sound's transmission differently.[14] A sound, if produced with the same intensity in both air and water, would be approximately 63 dB quieter in the air.[15] Sound also travels more than four times farther in water than in air.[16] From the perspective of animal protection, the volume of a sound at its source matters less than the volume that reaches an animal. For example, a Navy study found that a humpback whale three kilometers away from a 230 dB airgun would actually be exposed to a 160 dB sound.[17] The water's characteristics (temperature, depth, salinity, and more) will also influence the extent of sound's propagation.[18]

[12] 74 Fed. Reg. 33828 at 33845.
[13] *Id.*
[14] *Id.*
[15] *Id.*
[16] NOAA, "How does sound travel in the ocean?" (last visited Feb. 1, 2013), http://oceanservice.noaa.gov/facts/sound.html.
[17] 74 Fed. Reg. 33828 at 33845.
[18] *Id.*

In addition to the decibel scale's measurement of intensity, sound is also measured in terms of frequency. Sound frequency is expressed in Hertz (Hz), which measure a sound wave's cycles per second. High-pitched sounds contain high frequencies, and low-pitched sounds contain low frequencies. A very low-frequency sound, typically below 5 Hz, is known as infrasonic sound. In contrast, ultrasonic sound is at a very high frequency, usually above 20,000 Hz. Humans cannot hear infrasonic or ultrasonic sounds, although both can be naturally found in the ocean environment. For example, harbor porpoise clicks have been measured at 150,000 Hz.[19] A single sound can contain different frequencies; 'narrowband' sounds are composed of a small range of frequencies, while 'broadband' sounds are composed of a broad range.

B. Potential Effects of Noise on Marine Life

Different types of marine animals are sensitive to different frequencies of sound. Just as dogs can hear sounds that humans cannot, different marine animals are capable of hearing – and being harmed by – different sound levels. In 2007, *Southall et al* completed the most comprehensive study of marine mammal hearing ranges to date. The Southall group estimated the hearing ranges for a variety of marine animals, and grouped them into "functional hearing groups."[20] These groups indicated the range of frequencies that different species were able to hear, and indicated sound levels that would harm each hearing group.[21] These estimated hearing ranges are considered the contemporary scientific gold standard, and are commonly referred to as the

[19] 74 Fed. Reg. 33828 at 33845.
[20] Brandon Southall et al., *Marine Mammal Noise Exposure Criteria: Initial Scientific Recommendations*, 33 AQUATIC MAMMALS 4 (2007), *available at* http://sea-inc.net/assets/pdf/mmnoise_aquaticmammals.pdf.
[21] *Id.*

"Southall criteria."[22] Functional hearing ranges for marine species vary widely. For example, baleen whales' functional hearing range is between 7 and 22 kHz, while harbor porpoises' range is from 200 Hz to 180 kHz.[23] Adding another layer of complexity, sound's effects on marine life are heavily context dependant. Much like the difference between hearing laughter in a library versus a crowded restaurant, the effect of noise on marine animals depends on the character of their environment at a given time.

The most common physical injury caused by underwater sound is threshold shift, which is noise-induced loss in hearing sensitivity.[24] Threshold shift can be temporary (TTS) or permanent (PTS). If temporary, it can last from minutes to days, and can cause varying levels of sensitivity reduction. PTS can also cause different levels of hearing loss.[25] In truth, no one knows exactly the point at which an animal's hearing might be permanently damaged. Only a handful of studies have provided empirical information on the levels at which threshold shift occurs in marine animals.[26]

Marine animals may also experience "acoustic masking," where anthropogenic noise drowns out the auditory signals that animals rely on for an array of tasks, such as communication,

---

[22] *See, e.g.,.* ENVIRONMENTAL RESOURCES MANAGEMENT, "Central Coastal California Seismic Imaging Project Underwater Noise Assessment" at 6, *available at* http://www.slc.ca.gov/division_pages/DEPM/DEPM_Programs_and_Reports/CCCSIP/FEIR_Appendices_Expanded/FEIR_Appendix_I_(02of15)_UNA_1Intro(1-8).pdf.
[23] *See* Southall et al. at 430.
[24] 74 Fed. Reg. 33828 at 338456-7.
[25] *Id.*
[26] *See* Finneran et al., 2000, 2002b, 2005a; Schlundt et al., 2000; Nachtigall et al., 2003, 2004; Kastak et al.

navigation, reproduction, and hunting.[27] When humans introduce loud noises of similar frequencies to those used by the animals, the anthropogenic noise can harm the animals by masking the sounds they need to hear to survive. As for vocal communications, many marine animals can adjust their calls to compensate for background noise introduced by humans. For example, some whale calls become louder in the presence of consistent sound.[28] But producing louder calls may divert the animals' precious energy from other important tasks.[29] Persistent increased sound has also been shown to reduce communications between north Atlantic right whales, one of the world's most critically endangered species.[30]

In the most dire instances, underwater noise can kill marine animals. Ocean sonar testing has been linked to gruesome mass strandings of whales and dolphins across the globe. In 1996, a mass stranding of Cuvier's beaked whales on the west coast of Greece was linked with a nearby NATO vessel's use of intense mid- and low-frequency active sonar.[31] In 2000, following a whale stranding in the Bahamas, National Marine Fisheries Service (NMFS) examinations showed hemorrhaging in deceased animals' ears consistent with acoustic damage. A NMFS and Navy joint task force concluded that the deaths were due to "acoustic or impulse trauma" that was "most likely" caused by mid-frequency sonar.[32] Later strandings in the Haro Strait, Gulf of

---

[27] Erbe and Farmer, 2000; Tyack, 2000.
[28] S.E. Parks et al., *Individual Right Whale Calls Louder in Increased Environmental Noise*, BIOLOGY LETTERS (Feb. 2011), *available at* http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3030867/.
[29] 74 Fed. Reg. 33828 at 33858-9.
[30] Leila T. Hatch et al., *Quantifying Loss of Acoustic Communication Space for Right Whales in and around a U.S. National Marine Sanctuary* (Aug. 14, 2012), *available* at http://onlinelibrary.wiley.com/doi/10.1111/j.1523-1739.2012.01908.x/abstract.
[31] NAVY & NMFS, Joint Interim Report,: Bahamas Marine Mammal Stranding (Dec. 2001), *available at* http://www.nmfs.noaa.gov/pr/pdfs/health/stranding_bahamas2000.pdf.
[32] *Id.* at 4.

Alaska, and Hawaii, were potentially linked to acoustic trauma, although no official findings or scientific studies have established a causal link.[33]

Some of these fatalities may be caused by a dangerous condition known as "acoustically mediated bubble growth." Some scientists believe that noise may alter the condition of gas bubbles in marine mammals' skeletal cavity, perhaps by startling animals and causing them to ascend or descend more rapidly than usual. This condition is known as 'the bends' or decompression sickness, and was first identified in human scuba divers. In 2002, fourteen Cuvier's beaked whales were stranded on the Canary Islands immediately following a nearby mid-frequency sonar exercise. Upon examining the deceased whales, scientists found intravascular bubbles in a number of the whales' organs, indicating that "acoustic factors could be important in the aetiology of bubble-related disease."[34]

Underwater noise also causes a wide variety of behavioral disturbances. Behavioral effects are those that do not have an immediate physiological result in the animal, but which can seriously impact its wellbeing. Increased noise levels can cause potentially harmful changes in feeding, mating, communication, or movement. These behavioral responses are highly context-dependant and variable.[35]

[33] *See* Intertribal Sinkyone Council v. NMFS, No. 12-420 (N.D.Ca. filed Jan. 26, 2012).
[34] P.D. Jepson et al., "Gas-bubble lesions in stranded cetaceans," (Oct. 9, 2003), 425 *Nature* 5756, *available at* http://www.nature.com/nature/journal/v425/n6958/full/425575a.html.
[35] *See* 74 Fed. Reg. 33828, 33851-2 (July 13, 2009).

C. The Policy Challenge Posed by Noise

Despite the accumulation of troubling information about underwater sound, U.S. policy has remained essentially unchanged for decades. This stagnation may have a simple explanation: anthropogenic ocean noise is an especially knotty regulatory problem. As demonstrated above, a dizzying number of factors determine whether any given noise will harm an animal. To accurately project adverse effects, scientists must analyze water temperature, depth, distance from source, the species' cumulative exposure to other sounds, the functional hearing range for all species affected, the frequency and decibel level of the sounds produced, and more. It's a challenge, to say the least, to enshrine such complex scientific analysis into an effective regulatory approach.

Underwater sound is also difficult to regulate because it differs from traditional pollutants. When air and water are polluted, there are often visual or olfactory signs. But sound is invisible and odor-free. Of course, many strictly regulated pollutants are also undetectable by human senses. But unlike other invisible pollutants, there is no way to measure the accumulated presence of sound in the ocean over time. For example, carbon dioxide cannot be detected by human sight or smell, but scientific tools can measure its steady accumulation in the atmosphere, and compare current levels to historic levels. Sound, however, disappears instantaneously. Sound impacts each point it travels through, but leaves no trace behind. Thus, the prolonged effects of sound in the seas cannot be as easily assessed.

Furthermore, scientists are working with a fairly limited set of data. The problems posed by underwater sound have only been recognized in the last few decades. And most of the relevant

science addresses the relatively narrow field of sonar's impacts on marine mammals. Scientists know much less about the effects of other types of noise, such as the chronic noise from ships' engines, and rarely study sound's impacts on non-mammalian marine species.

II. CURRENT POLICY APPROACH

Given these challenges, how have federal agencies, environmentalists and private actors addressed underwater noise so far? Although this paper's analysis focuses on U.S. policy, ocean noise is an inherently international problem. This section will therefore begin with a brief overview of the international policy context. It will then describe the domestic policy framework in greater detail by reviewing agency guidelines, practical application of existing statutes, and common themes of litigation by environmentalists.

A. International Policies

At the international level, ocean noise regulation is a jumble of weak rules and general suggestions. A number of international groups are studying the issue, but very few rules directly constrict sound producing activities.

The world's oceans are governed at the broadest level under the U.N. Convention on the Law of the Sea (UNCLOS).[36] UNCLOS is a complex governing system that endows nations with varying degrees of sovereign control in ocean waters, depending on the distance from shoreline.[37] UNCLOS defines pollution of the marine environment as human introduction of "substances or energy" into the marine environment resulting in "harm to living resources and marine life." Although "energy" arguably includes noise, UNCLOS has not officially adopted that interpretation. Therefore, no rules under UNCLOS explicitly restrict any type of underwater noise production. The UNCLOS General Assembly has recognized the problem, however, by "encourag[ing] further studies and consideration of the impacts of ocean noise."[38]

As for anthropogenic noise from ships, the International Maritime Organization (IMO) is responsible under UNCLOS for the prevention of vessel-source marine pollution. Although IMO regulations do not explicitly address ocean sound, the organization has been working to develop non-mandatory guidance to reduce the impact of ships' noise. The IMO initially expected to release a draft of the guidance in December 2012,[39] but that effort appears stalled.[40] Also, the IMO's MARPOL treaty recognizes noise as a potentially adverse release from a vessel in its

---

[36] United Nations Convention on the Law of the Sea, Dec. 10, 1982, 1833 U.N.T.S. 397, *available at* http://www.un.org/depts/los/convention_agreements/texts/unclos/UNCLOS-TOC.htm.
[37] *See generally id.*
[38] United Nations, "UNCLOS at 30" (Nov. 2012), *available at* http://www.un.org/Depts/los/convention_agreements/pamphlet_unclos_at_30.pdf.
[39] *See* IMO, "Report of the Marine Environment Protection Committee on its Sixty-Third Session" (March 2012), *available at* www.uscg.mil/imo/mepc/docs/mepc63-report.pdf.
[40] IMO Newsletter, "63rd Session of the Marine Environment Protection Committee (MEPC 63)" at 7 (Summer 2012), *available at* http://www.uscg.mil/imo/docs/Newsletters/2012/2012-Summer-Newsletter.pdf.

guidelines for identifying Particularly Sensitive Sea Areas (PSSAs).[41] PSSAs are areas of special ecological or scientific value which are designated for special protection under MARPOL. In these special areas, then, underwater noise from ships is regulated as a pollutant.

Although underwater sound has not yet been aggressively tackled by the UN, the IMO draft guidance and existence of working groups suggest that UNCLOS may explicitly address ocean sound in the future. Until that time, likely many years away, a few other international bodies and agreements address the issue in different spheres. For example, the eighty-six member nations of the International Whaling Commission (IWC) have all agreed to general guidelines for noise from whale watching vessels. And in 2004, the European Union Parliament adopted a resolution calling on member states to ban use of high-intensity active sonar.[42] Since then, however, no member states have done so.

Two binding multinational agreements to protect whales and dolphins require signatories to minimize anthropogenic ocean noise. One of these, the Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas (ASCOBANS) requires "the prevention of other significant disturbance, especially of an acoustic nature."[43] The other, the Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean and Contiguous Area

[41] IMO Resolution A.982(24) 2.2.
[42] European Parliament, P6_TA(2004)0047 (Oct. 28, 2004).
[43] Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas, Ch. 27, Mar. 17, 1992, *available at* http://www.ascobans.org/pdf/Ch_XXVII_09_CertifiedTrueCopiesAgreement.pdf.

(ACCOBAMS), established extensive industry-specific guidelines for mitigating sound production and directed the Secretariat to pursue further research.[44]

Across the Atlantic, NATO has issued non-binding guidance for minimizing underwater noise from the use of sonar in scientific research. Farther north, the Arctic Council's founding agreement strongly emphasizes the adverse effects of underwater sound in the Arctic environment.[45]

In sum, while recognizing the concerns posed by ocean noise, international bodies have not established any comprehensive underwater sound policies. The draft guidances, working groups, and limited agreements do little to quiet the world's seas. As will be discussed below, the U.S. policy approach does little to fill in these gaps.

B. Domestic Policies

In the United States, ocean sound is mainly regulated under three statutes: the National Environmental Policy Act (NEPA), the Marine Mammal Protection Act (MMPA), and the Endangered Species Act (ESA). Beginning with a discussion of federal acoustic guidelines, this

[44] Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area, Nov. 24, 1996, *available at* http://www.accobams.org/index.php?option=com_docman&task=doc_download&gid=64&Itemid=50.

[45] The Arctic Council is composed of the eight Arctic States (Canada, Denmark, Finland, Iceland, Norway, Russia, Sweden and the United States), and grants permanent participant status to six organizations of Arctic Indigenous Peoples. http://www.arctic-council.org/index.php/en/about-us/members.

section will outline these statutes' structures and provisions, and explain how they guide agencies and private entities to examine and mitigate acoustic impacts.

1. NMFS Acoustic Guidelines

NMFS provides the only federal guidelines for measuring acoustic effects on marine animals. The guidelines, informally issued in 1997, establish thresholds at which sound exposure adversely affects certain ocean mammals. The guidelines' origins are murky; acoustic analysis professionals believe they are rooted in a mere handful of unsubstantiated and outdated studies.[46] The guidelines were never officially promulgated by NMFS or adopted by any other agency. They were mentioned and outlined in a 2005 Federal Register notice. That notice, however, was for a proposal to *update* the guidelines, and did not cite to any other source for the guidelines.[47] The NMFS guidelines therefore represent inertia and longstanding habit more than formal regulation.[48]

The guidelines consist of four firm acoustic standards: the decibel level at which 1) whales are physically injured, 2) dolphins are physically injured, 3) both whales and dolphins are

[46] Jaime Budzynkiewicz, *A Comparison of Environment Impact Statement Methodologies for Assessing Sound Propagation, Density Determination and Impacts on Protected Marine Mammals: BOEMRE & The U.S. Navy*, Nicholas School of the Environment Master's Project (April 2011), *available at* http://dukespace.lib.duke.edu/dspace/handle/10161/3639.
[47] 70 Fed. Reg. 1871-01 (January 11, 2005).
[48] In March 2013, as this article was nearing finalization, NMFS announced that its acoustic guidelines were undergoing "internal review," as the first step in a process of updating the guidelines. This process, which involves external peer review and formal notice-and-comment rulemaking, will likely take years.

behaviorally injured, and 4) both are harmed by non-impulsive sounds, like drilling.[49] However, new science makes clear that these four numbers are inaccurate and inadequate. Scientists know now that underwater noise's effects vary wildly depending on the character of the noise, type of species, and a slew of other factors.[50] Given this complexity, the NMFS guidelines are at best overly simplistic, and at worst, scientifically inaccurate. Either way, the NMFS guidelines fail to provide any realistic information about the points at which marine species are actually harmed by underwater noise.

In 2005, NMFS proposed to update the standards to better reflect current science.[51] The proposed rule would have moved away from the four rigid numeric thresholds, and replaced them with the more nuanced Southall criteria.[52] The proposal never moved forward, however. Scientists involved in the process speculate that NMFS hesitated because the contextually-based Southall standard would require much more expensive and extensive analysis from agencies and regulated parties.

Although the NMFS guidelines remain in place officially, in practice federal agencies have moved beyond them. Seeking a more scientifically valid standard, the Navy has obtained special

[49] Under the NMFS regulation, the threshold for Level A harassment from pulsed sounds is 180 dB re 1 μPa (rms), for cetaceans (whales), and 190 dB re 1 uPa (rms) for pinnipeds (dolphins). For Level B harassment, 160 dB re 1 μPa serves as the threshold for both cetaceans and pinnipeds. For non-impulsive sound sources, such as those associated with drilling and dredging activities, the NMFS threshold is 120 dB re 1 μPa (rms). *See* 70 Fed. Reg. 1871-01 (January 11, 2005); BOEM, Atlantic OCS Proposed Geological and Geophysical Activities Mid-Atlantic and South Atlantic Planning Areas Draft Programmatic Environmental Impact Statement (2012) ["BOEM Draft PEIS"], at 4-49, http://www.boem.gov/Oil-and-Gas-Energy-Program/GOMR/GandG.aspx.
[50] *See supra* n. 20.
[51] 70 Fed. Reg. 1871-01.
[52] *See supra* n. 20.

permission from NMFS to analyze its acoustic impacts under different criteria.[53] Likewise, BOEM's modeling 'combines' the NMFS guidelines with the Southall criteria.[54]

2. Acoustic Analysis Under NEPA, MMPA and ESA

Regardless of the set of acoustic guidelines used, agencies and private actors generally analyze the effects of their noise-producing activities when required by NEPA, the MMPA or the ESA. The basic relevant parameters of these statutes are outlined below.

i. NEPA

NEPA requires agencies to assess the environmental impacts of major federal actions having a significant impact on the human environment.[55] NEPA is not applicable to private actors, and its requirements are entirely procedural – an agency is only required to adequately *consider* environmental impacts. Under NEPA, agencies operating in the ocean environment must determine whether their production of underwater sound will constitute a "significant impact." In most cases, agencies first prepare an Environmental Assessment (EA), which is a preliminary document intended to determine whether a full environmental review will be necessary.[56] In determining whether their activities will have a 'significant impact,' agencies compare anticipated noise levels with their chosen set of acoustic guidelines (usually either NMFS or

[53] J. J. Finneran and A. K. Jenkins, *Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis* (April 2012), *available at* http://aftteis.com/Portals/4/aftteis/Supporting%20Technical%20Documents/Criteria_and_Thresholds_for_US_Navy_Acoustic_and_Explosive_Effects_Analysis-Apr_2012.pdf.
[54] *See* BOEM Draft PEIS.
[55] 42 U.S.C. § 4321 et seq.
[56] 40 C.F.R. § 1501.3.

Southall). If the agency activities will produce noise below the selected thresholds, then an agency can reasonably determine that its impacts are not significant and issue a Finding of No Significant Impact (FONSI).

If the agency's actions are expected to exceed the guidelines, then the agency is probably required to produce a full Environmental Impact Statement (EIS) describing the anticipated acoustic impacts (along with any other significant environmental impacts). Producing an EIS is an expensive and lengthy task. Among the many requirements, agencies must examine all reasonable alternatives, assess their actions using the best available science, and overall, demonstrate that they have given their impacts a hard look.[57] Once the agency has fully assessed the environmental impacts of its actions, it has fully discharged its duties under NEPA.

ii. MMPA

The MMPA prohibits the "taking" of marine mammals.[58] Unlike NEPA, the MMPA applies to private parties as well as federal agencies. It applies to all marine mammals, regardless of their endangerment status. Under the MMPA, "take" is defined as meaning "to harass, hunt, capture, collect, or kill, or attempt to harass, hunt, capture, collect or kill, any marine mammal."[59] Acoustic impacts are considered harassment under MMPA's definition of a "take." The MMPA divides harassment into two categories: any activity that may 1) *injure* a marine mammal (known as Level A takes); or 2) *disturb* a marine mammal's behavioral patterns (Level B "behavioral" takes). Behavioral takes include any activities that alter "migration, breathing, nursing, breeding,

[57] 40 C.F.R. § 1500 et seq.
[58] 16 U.S.C. § 1371(a)(3).
[59] 50 C.F.R. § 216.3; 16 U.S.C. § 1362(13).

feeding or sheltering."[60] In the case of military readiness activities or federal scientific research, the Level B standard is narrower: the disturbance must cause abandonment or significant alteration of these behavior patterns.[61]

Under the MMPA, "incidental" taking of marine mammals may be specially authorized.[62] To receive authorization for an incidental take, an activity must: 1) be limited to a specified geographic region; 2) result in the incidental take of only a small number of animals; and 3) have no more than a "negligible impact" on species and stocks. Parties receiving incidental take authorizations are required to implement monitoring and mitigating measures.[63]

In broad strokes, then, the MMPA requires agencies to anticipate how many Level A and B takes will be caused by their activities, and then obtain a small take authorization for those takes.

iii. ESA

The ESA establishes generally similar restrictions to the MMPA, but applies only to endangered species. The ESA prohibits any person from taking endangered species within the U.S., its territorial waters, or the high seas.[64] Regulations jointly adopted by NOAA, NMFS and the Department of Commerce define 'take' under the ESA nearly identically to the MMPA definition. Likewise, under the ESA, anthropogenic underwater sound production constitutes a

[60] 16 U.S.C. § 1362(18)(A).
[61] § 1362(18)(B)(ii).
[62] § 1371(a)(5)(A).
[63] *Id.*
[64] § 1538(a)(1)(B)-(C).

take when it adversely impacts an endangered marine animal's behavior or environment. Incidental take permits may also be issued under the ESA.

C. Making Noise: Litigation by Environmental Groups

Environmental public interest groups, such as the Natural Resources Defense Council (NRDC), Earthjustice and the Ocean Mammal Institute, have brought more than a dozen lawsuits against sound-producing actors in the last fifteen years. Environmentalist plaintiffs typically bring NEPA and MMPA claims, and the cases are concentrated in the Ninth Circuit. Litigation most frequently challenges sonar use, and has especially targeted Navy training exercises. A brief outline of the types of claims brought by environmental groups will provide a helpful window into the environmental community's most common legal strategies and overriding concerns.

Plaintiffs have won several challenges to the Navy's sonar training activities based on NEPA[65] and the MMPA.[66] Additionally, environmentalists typically bring claims under the ESA in cases where endangered species may be impacted by a private or federal action.[67] More unusual claims

[65] *NRDC v. Evans*, 279 F. Supp. 2d 1129 (N.D.Ca. 2003) (Navy violated NEPA by failing to consider instituting more seasonal restrictions on training, failing to take a hard look at the impacts on fish species, and by suppressing and ignoring scientific information); *Ocean Mammal Institute v. Gates,* 546 F. Supp. 2d 960 (D.Haw. 2008) (Navy and NMFS's proposed behavioral effects thresholds of 190 dB and 173 dB violated NEPA because they were not supported by the best available science).

[66] *Evans*, 279 F. Supp. 2d at 1147 (Navy and NMFS violated the MMPA by authorizing the take of in 75% of the world's oceans, despite the statute's requirement that the take be geographically limited).

[67] *See, e.g., NRDC v. Winter*, 645 F. Supp. 2d 841, 854 (C.D.Cal. 2007), *rev'd on other grounds by Winter v. NRDC, Inc.,* 555 U.S. 7 (2008) (environmentalist plaintiffs alleged that the Biological Opinion and Incidental Take Statements prepared by NMFS failed to use the best scientific data available); *Evans,* 279 F. Supp. 2d at 1180 (Navy violated ESA by failing to

have also been brought under the Coastal Zone Management Act (CZMA),[68] the National Marine Sanctuaries Act (NMSA),[69] and the National Historic Preservation Act (NHPA).[70] These court challenges, and the ongoing threat of litigation, have played a major role in encouraging federal agencies to seriously assess the acoustic impacts of their activities. And although the Navy is the main target, environmental groups have also occasionally challenged non-military activities, such as cruise ships and scientific use of sonar.[71]

Environmental groups have also faced their share of defeat on ocean sound issues. Most significantly, the Supreme Court found in *Winter v. NRDC* that the public's interest in national security outweighed any alleged injury to marine mammals resulting from Navy sonar training exercises.[72] In the same year, the District of Alaska struck down a challenge to the Mineral

---

utilize the best available science when initiating formal ESA consultation and by neglecting to include Incidental Take Statements in the biological opinions).

[68] *NRDC v. Winter*, 645 F. Supp. 2d 841 (C.D.Cal. 2007), *rev'd on other grounds by Winter v. NRDC, Inc.,* 555 U.S. 7 (2008) (Navy violated CZMA in determining that the use of MFA sonar would not affect any of California's coastal resources); *Ocean Mammal Institute v. Gates* at 982 (plaintiffs would likely succeed on their claim that Navy violated the CZMA by issuing a determination of no impact based on an improperly issued FONSI).

[69] *Ocean Mammal Institute*, 546 F. Supp. 2d (plaintiffs argued that the Navy was required to initiate the NMSA consultation process before conducting training).

[70] *Okinawa Dugong v. Gates*, 543 F.Supp.2d 1082 (N.D. Cal. 2008) (Army violated the NHPA by failing to assess the acoustic impacts of a construction project on the *dugong* species in Japan).

[71] *National Parks & Conservation Ass'n v. Babbitt.* 241 F.3d 722 (9th Cir. 2001); *Center for Biological Diversity v. NSF.* 2002 WL 31548073 (N.D. Cal. 2002) (holding that the MMPA governed scientific activities in Mexican waters where the researchers were mostly American citizens employed on a U.S. Government-funded research project on a U.S. Government-owned vessel, and because Mexican waters are the equivalent of the high seas for the purposes of American law).

[72] 555 U.S. 7, 23 (2008). Following the Supreme Court's holding in *Winter v. NRDC*, the White House Council on Environmental Quality (CEQ) also authorized the Navy to implement "alternative arrangements" to NEPA compliance in light of "emergency circumstances." Under the alternative arrangements, the Navy is permitted to conduct training exercises as long as it complied with certain authorized mitigation procedures, regardless of NEPA compliance. *See* 40

Management Service's[73] NEPA analysis of seismic testing in Alaskan waters.[74] And the MMPA has been interpreted to limit state authority to address ocean sound. In Hawaii, a state statute banned parasailing in certain waters, in part to reduce ocean noise. The Ninth Circuit struck down the statute, holding that the MMPA preempts all state laws dealing with the taking of marine mammals.[75]

D. Mitigation Measures

Once a federal agency or private actor has determined that its activities are likely to have an adverse impact on a marine species, they will likely be required to develop mitigation plans to minimize the damage. For example, the Navy's 2009 request for an incidental take authorization included an extensive description of its mitigation plan. The Navy mitigation plan relied chiefly on trained lookouts to watch for marine mammals in the vicinity of training activities, using both aerial and at-sea visual searches. If a marine mammal was spotted near the ship during a sonar testing exercise, the Navy mitigation policy required that the sonar system be shut down until the animal moved out of the testing range.[76] The mitigation plan also called for speed limits for

---

CFR § 1506.11. At the same time, the President granted the Navy a national security exemption from the CZMA. *See* Section 1456(c)(1)(B), permitting such exemptions if the activity in question is "in the paramount interest of the United States."

[73] Following the 2010 Deepwater Horizon oil spill, MMS was reorganized into the Bureau of Ocean and Energy Management (BOEM) and the Bureau of Safety and Environmental Enforcement (BSEE).

[74] *Native Village of Point Hope v. MMS.* 564 F. Supp. 2d 1077 (D. Alaska 2008) (MMS's decision to prepare a Programmatic EIS on a hypothetical future level of seismic activity in the Arctic Ocean did not undermine the EAs/FONSIs for the specific activities in this particular instance).

[75] *UFO Chuting of Haw., Inc. v. Young,* 327 F. Supp. 2d 1220 (D. Haw. 2004); *UFO Chuting of Hawaii v. Smith*, 508 F.3d 1189 (9th Cir. 2007). See 16 U.S.C. § 1379(a).

[76] 74 Fed. Reg. 33828 at 33864.

naval vessels, collision avoidance procedures, and assorted other measures.[77] Mitigation plans are also a frequent target of litigation.[78]

III. DEAF EARS: GAPS IN CURRENT POLICY

Spurred by both statutory mandate and the threat of litigation, agencies now routinely analyze the acoustic effects of their underwater activities, and implement mitigation plans to reduce the adverse impacts. But still, underwater noise levels are not decreasing. What weaknesses in the current system have led to this regulatory failure? There are three clear gaps in the existing policy approach: 1) current policies do not address ship noise, which is the largest source of sound in the ocean; 2) federal policy focuses on procedural requirements that do not ultimately reduce noise; and 3) environmentalists continue to attack the same parties for the same violations, rather than expanding the scope of their litigation.

A. Failure to Address the Largest Source of Noise

The biggest failure of the current policy scheme is that it does not address the largest source of ocean sound: commercial shipping.[79] NEPA cannot readily touch commercial shipping because it

---

[77] *Id.* at 33862 - 69.
[78] *See, e.g.*, *NRDC v. Evans*, 279 F. Supp. 2d 1129, 1159 (N.D.Ca. 2003) (Navy was required under MMPA to strengthen mitigation measures).
[79] *See* R.K. ANDREW et al., *Ocean ambient sound: comparing the 1960s with the 1990s for a receiver off the California coast*, 3 Acoustic Res. Letters Online at 65–70 (2002); M.A. MCDONALD et al, *A fifty year comparison of ambient ocean noise near San Clemente Island: a bathymetrically complex coastal region off southern California*, 124 J. of the Acoustic Society of America 1985–1992 (2008).

only applies to the activities of federal agencies. And both the ESA and MMPA are difficult to apply to ships in U.S. waters, for two main reasons.

First, most ships are not readily subject to U.S. authority because they sail under "flags of convenience." Flags of convenience are licenses obtained from countries known to provide minimal oversight.[80] Because the law of the seas holds that a ship's flagging nation has primary responsibility for its regulatory oversight, flags of convenience effectively remove a huge amount of commercial tonnage from regulation. Ultimately, only 1% of international commercial shipping tonnage is carried on ships flying a U.S. flag.[81] Those ships are required to follow U.S. law while in our territorial waters, but in practicality, oversight is quite limited due to the vast expanse of our waters.

Second, the constant movement of ships complicates at-sea monitoring and enforcement of MMPA and ESA violations. Ships move from point to point with little evidence of their passage, and the size of the ocean is too large to effectively police all ship movements. Ships can make a safe gamble that they will not be detected if they pass through an area they should not, or if they fail to follow any other rule of the territorial seas they find themselves in. So, even for the few ships flying a U.S. flag, at-sea monitoring and enforcement present a significant challenge. Upon docking at a U.S. port, customs authorities may inspect a ship, examine its logs, and check its cargo. But it is usually impossible for customs authorities to have a complete picture of what happened while the ship was at sea; perhaps it passed through a protected area which it should

[80] As of 2009, more than 40% of the world's ships, by tonnage, were registered under Liberia, the Marshall Islands, or Panama. *Review of Maritime Transport 2010* at 42 (Dec. 2010), *available at* http://unctad.org/en/docs/rmt2010ch2_en.pdf.
[81] *Id.*

not have, perhaps it dumped a large amount of trash. Essentially, it is easy to apply the MMPA in a computer model of generalized annual data. It is much more difficult to apply it to an individual commercial ship which may or may not come into contact with marine mammals on a specific journey.

B. Emphasis on Procedural Requirements

Furthermore, under both NEPA and the MMPA, the current policy scheme emphasizes procedural requirements that ultimately do little to reduce noise output.

As described above, consistent litigation by environmentalists has helped encourage federal agencies to conduct much more thorough NEPA analysis of their acoustic impacts. Agencies enjoy significant deference from courts, so their NEPA analyses need not be bulletproof, but must simply provide an adequate evaluation of environmental effects. The result, therefore, is that NEPA analyses will likely continue to improve until they generally can withstand challenge based on judicial deference to agency decisionmaking. And since NEPA's requirements are purely procedural, that state of affairs will not necessarily produce any substantive reductions in agency acoustic effects.

Unlike NEPA, the MMPA does officially include substantive requirements. But in practice, enforcement of MMPA's substantive requirements often becomes an essentially procedural endeavor. The MMPA's provision for incidental takes appears to be a reasonable provision mitigating otherwise harsh requirements of the statute, but in practice, it provides a loophole

through which federal agencies may pass significant acoustic harms. As described above, ITAs are supposed to be issued only for geographically limited activities, resulting in only a small number of takes, and having no more than a negligible impact on a species.[82] In reality, though, ITAs which severely strain these parameters are commonly issued. For example, in January 2013 NMFS issued a proposed ITA for the Navy's activities in the Atlantic Fleet Training and Testing (AFTT) range. The rule provides the Navy with annual authorization to cause thirty marine mammal mortalities, 351 additional Level A takes, and *more than two million* Level B takes.[83]

Likewise, mitigation requirements instituted under the MMPA can be quite weak. The Navy, for example, relies on mitigation measures that essentially require powering down sonar if a ship's lookout sees a whale or dolphin. In requesting authorization for its 'incidental' takes, the Navy produces voluminous documentation of the training the lookouts receive, their placement on ships, and more. No matter how sophisticated the training is, though, a lookout is still essentially a 19th century technology. The Navy isn't installing low-noise engines, or avoiding known whale breeding grounds, but simply placing a person on a ship who may or may not see a whale in the vicinity of a training exercise. As one Navy lawyer told me, "We spend millions of dollars just to end up saying, 'We'll put lookouts on the ships.'"

The combined result of the NEPA and MMPA requirements is that federal agencies and private actors can often get by with projecting the number of animals they expect to harm, outlining some vague mitigation measures, and then obtaining an ITA for the full number – even when the

[82] 16 U.S.C. § 1371(a)(5)(A).
[83] Takes of Marine Mammals Incidental to Specified Activities; U.S. Navy Training and Testing Activities in the Atlantic Fleet Training and Testing Study Area; Proposed Rule, 78 Fed. Reg. 7050, 7108 (proposed Jan. 31, 2013) (to be codified at 50 C.F.R. pt. 218).

number of takes seems far more than 'incidental.' Thus, practically speaking, agencies must invest considerable resources in providing documentation of their impacts on marine ecosystems. But after they have done so, it is fairly easy to avoid any significant changes to their noise-producing activities. This system provides a procedural smokescreen, allowing noise producers to cultivate the impression that they are working hard to reduce their impacts. In practice, though, they can often continue business as usual.

The MMPA's requirements still fail as effective protections even if noise producers make sincere efforts to mitigate their effects because the MMPA views the ocean on an animal-by-animal basis. There are no more stringent requirements for calving grounds than dead zones, and fines are meted out based on each animal taken. The MMPA does not enable an ecosystem-wide approach, and does not allow for measurement of cumulative effects. If the Navy wishes to conduct sonar testing in an area where an oil company would also like to conduct seismic testing, then each entity would submit separate ITAs based exclusively on their own activities, even though the impacts to species would be determined by the cumulative noise level. Also, the MMPA addresses effects to *mammals*: so even as scientific evidence accumulates demonstrating that underwater noise adversely effects non-mammalian species, those impacts are completely outside of the purview of the MMPA.

C. Duplicative Litigation by Environmentalists

Environmental organizations have launched a number of lawsuits aimed at reducing the adverse impacts of underwater sound. However, the general scope of this litigation has been quite

narrow. Most lawsuits have been aimed at the Navy and NMFS,[84] most challenge sonar use,[85] and most are based on NEPA, the MMPA or the ESA.[86] Indeed, NRDC and Earthjustice are currently bringing a suit that fits neatly within these traditional parameters. In *Intertribal Sinkyone Wilderness Council v. NMFS,* they are challenging NMFS approval of the Navy's five-year sonar training program, based on alleged violations of the ESA and MMPA.[87]

The achievements wrought by this strategy should not be minimized. This type of litigation played a major role in improving Navy sonar use, and has greatly heightened public awareness of these issues. But now, thanks largely to the victories secured by these very groups, rehashing the same type of lawsuit does little to move the ball forward.

What's to be gained by another lawsuit challenging the Navy's sonar training program? Perhaps some technical improvements in the training program could be achieved, and some sonar exercises could be downsized or delayed. But the possible gains seem small compared to the resources required for environmentalists to pursue litigation. For example, the *Intertribal* complaint challenges the Navy's plans to conduct around 100 hours of sonar testing per year in the waters off of the western U.S. Other portions of the Navy's training grounds are authorized to

[84] *See, e.g., Winter v. NRDC.* 555 U.S. 7 (2008); *NRDC v. Evans*, 279 F. Supp. 2d 1129 (N.D.Ca. 2003); *Ocean Mammal Institute v. Gates,* 546 F. Supp. 2d 960 (D.Haw. 2008).
[85] *See id.; Center for Biological Diversity v. NSF.* 2002 WL 31548073 (N.D. Cal. 2002).
[86] *See id.; National Parks & Conservation Ass'n v. Babbitt.* 241 F.3d 722 (9th Cir. 2001); *UFO Chuting of Hawaii v. Smith*, 508 F.3d 1189 (9th Cir. 2007); *Native Village of Point Hope v. MMS.* 564 F. Supp. 2d 1077 (D. Alaska 2008).
[87] No. 12-420 (N.D.Ca. filed Jan. 26, 2012).

conduct *thousands* of hours of testing.[88] Using precious litigation resources to challenge the Navy's relatively minimal use of sonar on this small training ground seems especially wasteful given that sonar is not even the largest source of ocean noise. This repetitious suit plays to environmental groups' comfort zones, but produces little substantive benefit. Even if Earthjustice wins all of their claims, they will have achieved precious little new protection for marine animals. The Navy will still deploy sonar extensively, and noise from other sources will go entirely unaddressed.

What's more, largely thanks to successful past litigation efforts, the Navy's underwater sound management is now probably the best of any federal agency. The Navy is the only federal agency specially authorized to use the Southall criteria instead of the NMFS guidelines, an agreement which was independently sought by the Navy.[89] The Navy is also the largest funder of ocean sound research, investing more than $100 million between 2004 and 2009 in marine research.[90] In fact, the U.S. Navy sponsors half of all anthropogenic ocean noise research worldwide.[91]

---

[88] NAVY, Northwest Training Range Complex Unclassified Exercise Report (July 1, 2012) at 2, *available at* http://www.nmfs.noaa.gov/pr/pdfs/permits/nwtrc_exercise_report2012.pdf (noting an annual average of approximately 1,500 total hours of sonar use).
[89] *See* J. J. Finneran and A. K. Jenkins, *Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis* (April 2012), *available at* http://aftteis.com/Portals/4/aftteis/Supporting%20Technical%20Documents/Criteria_and_Thresholds_for_US_Navy_Acoustic_and_Explosive_Effects_Analysis-Apr_2012.pdf.
[90] 74 Fed. Reg. 33828 at 33868.
[91] *Id.*

IV. POSSIBLE PATHS FORWARD

What could the U.S. do to better protect our marine resources? Some scientists and policymakers emphasize the need to update the NMFS guidelines or tweak the MMPA.[92] Both would probably represent positive steps. But neither would alter the fundamentally flawed nature of the current regulatory scheme. As for the NMFS guidelines, while they are something of an embarrassment, in practicality they have fallen out of use. The Navy and BOEM both rely on the Southall criteria. These agencies have been able to leapfrog the NMFS guidelines without expending resources officially revising them. What's more, agencies may actually be required to apply other guidelines: one district court has held that the NMFS criteria do not meet NEPA's requirement that agencies use the "best available science," even under the most deferential review standard.[93]

To achieve real underwater sound reductions, federal agencies and environmental groups should alter their strategies to address the problems described above. This section offers two general suggestions for improving U.S. regulation of underwater ocean sound. First, environmentalists

[92] The NRDC and others argue that adding a citizen suit provision to the MMPA would better protect wildlife by giving citizens the opportunity to allege violations of the statute. *See* Joel R. Reynolds*, Submarines, Sonar and the Death of Whales: Enforcing the Delicate Balance of Environmental Compliance and National Security in Military Training,* 32 William and Mary Environmental Law and Policy Review 759 (2008); Randall S. Abate, *NEPA, National Security, and Ocean Noise: The Past, Present and Future of Regulating the Impact of Navy Sonar on Marine Mammals*, 13 Journal of Int'l Wildlife Law and Policy 326 (2010). On the other hand, some scholars criticize the MMPA's broad definition of a 'take' as imposing excessive costs. *See, e.g.,* Elena McCarthy & Flora Lichtman, *The Origin and Evolution of Ocean Noise Regulation Under the U.S. Marine Mammal Protection Act*, 13 Ocean & Coastal L.J. 1 (2007).
[93] *Ocean Mammal Institute v. Gates*, 546 F. Supp. 2d 960, xx (D.Haw. 2008).

could expand their approach to litigation. Second, market mechanisms could be applied to the problem.

A. Expansion of Litigation by Environmental Groups

Instead of rehashing the same ground, environmental groups could refocus their litigation strategies on different types of acoustic pollution and different actors. For example, BOEM oversees the seismic testing performed by oil companies seeking to develop offshore resources. Seismic testing is extraordinarily loud, and companies frequently conduct tests in sensitive areas, especially as they increasingly explore Arctic resources.[94] But BOEM's acoustic analysis has been challenged in U.S. courts much less frequently than that of the Navy. NRDC and its brethren could swivel towards BOEM, and hopefully spark agency reforms in the same way that constant litigation forced major improvements at the Navy. A suit against BOEM would have the additional advantage of protecting animals from a source of sound that receives less public scrutiny than sonar.

Furthermore, instead of continually trotting out tried-and-true statutes, environmental groups could bring claims based on less frequently used statutes. As noted above, relatively unusual claims have been successfully alleged under the CZMA, NMSA, and the NHPA. This section will describe those statutes and the ways in which they could be further applied to protect marine life, and suggest new applications of a few other statutes.

[94] Renee Schoof, "Inuit Villages Block Seismic Tests in Arctic Waters," SEATTLE TIMES (Nov. 3, 2012), http://seattletimes.com/html/nationworld/2019592474_arcticvillage04.html.

1. Less Commonly Used Statutes: CZMA, NMSA, and NHPA

The CZMA, like NEPA, only applies to federal agency activities. It requires that any federal activity in a zone subject to a state coastal management program must be carried out in a manner consistent with the enforceable policies of the state's management program.[95] Agencies are only exempt from conforming with state law if prohibited from doing so by federal law.[96] When subject to the CZMA, agencies must submit a consistency determination (CD) describing how the federal activities are in compliance with the applicable state management program.[97] Most states have coastal management programs,[98] so the CZMA's consistency requirement applies throughout most of our domestic waters. National security activities are exempt from the CZMA, so claims brought under the CZMA would be most effective against non-military agencies operating in the oceans, such as BOEM. Depending on the terms of the applicable state management plan, the CZMA could be leveraged to further require BOEM to mitigate effects of noise from its ocean projects.

NMSA could also be used more effectively to promote noise reductions from federal agencies. Under NMSA, the Secretary of Commerce may designate any marine area of special significance as a Marine Sanctuary.[99] In doing so, the Secretary has broad authority to promulgate regulations designed to protect the area.[100] In addition, NOAA has the authority to establish additional rules

[95] 16 U.S.C. § 1456(c)(1).
[96] 15 C.F.R. § 930.32(a)(1).
[97] § 930.34.
[98] *See* NOAA, "State Coastal Zone Boundaries" (Feb. 2012), *available at* http://coastalmanagement.noaa.gov/mystate/docs/StateCZBoundaries.pdf.
[99] 16 U.S.C. § 1433(a).
[100] § 1434.

for the whole Marine Sanctuary system.[101] If federal agency actions may injure a sanctuary resource, the agency must initiate a "consultation process" with the Secretary before approving the agency action.[102] If the Secretary determines that the proposed action is likely to have harmful effects then the Secretary must "recommend reasonable and prudent alternatives."[103]

To date, no Marine Sanctuary protections explicitly include acoustic protections, and NOAA's system-wide regulations do not specifically address anthropogenic noise. However, many sanctuary rules still reduce ocean sound by restricting sound-producing activities. For example, the regulations protecting the Stellwagen Bank National Marine Sanctuary forbid exploration for industrial materials, drilling into the seabed, and taking any marine reptile or mammal.[104] There are fourteen National Marine Sanctuaries, totaling more than 150,000 square miles of protected area, all of whose regulations likewise restrict sound-producing activities.[105] Instead of suing the Navy over its general plan for training in giant swaths of ocean, environmental groups could use NMSA to challenge activities threatening the most sensitive ecosystems. This litigation would not necessarily be limited to activities occurring within the boundaries of designated Marine Sanctuaries because NMSA specifically applies to agency activities "internal or external" to the sanctuary.[106] Since sound travels great distances underwater, environmentalists could argue that activities occurring far outside of the sanctuaries' boundaries violate NMSA.

---

[101] 16 U.S.C. § 1439.
[102] § 1434(d)(1)(A)-(B).
[103] § 1434(d)(2).
[104] 15 C.F.R. § 922.142(a).
[105] NOAA, "National Marine Sanctuaries: About Your Sanctuaries," http://sanctuaries.noaa.gov/about/welcome.html (last revised Feb. 11, 2013).
[106] § 1434(d)(1)(A).

Similarly to the NMSA, the NHPA also protects special designated areas. The NHPA established the National Register of Historic Places to identify and protect "districts, sites, buildings, structures, and objects significant in American history, architecture, archeology, engineering, and culture."[107] The Act requires federal agencies to consider the effects of their undertakings on listed historic properties in the United States.[108] Activities in the Outer Continental Shelf (OCS) and the Exclusive Economic Zone (EEZ) are covered by the NHPA.[109] Additionally, the NHPA also imposes requirements on federal actions outside the United States. Under the NHPA, federal agencies operating abroad must consider adverse effects on World Heritage sites or sites listed on a foreign nation's equivalent of the National Register.[110] Environmentalists successfully relied on that provision to protect the *dugong*, a manatee-like species found in Japan's waters, from the acoustic effects of constructing and operating an Army facility. In that case, the court found that the *dugong* was protected under the NHPA because it was designated in Japan as a special cultural resource. The Army had therefore violated the NHPA by failing to adequately assess the effects of its activities on the *dugong*.[111]

2. New Directions: OCSLA, Antiquities Act, and NCA

The successful use of the CZMA, NMSA, and NHPA demonstrate that there is room for environmental groups to move beyond the traditional frameworks for ocean noise suits. In

[107] 16 U.S.C. § 470a(a)(1)(A).
[108] § 470f.
[109] NOAA, The Seaward Limit of U.S. Laws, http://www.gc.noaa.gov/gcil_seaward.html (last updated October 23, 2012).
[110] § 470a-2.
[111] *Okinawa Dugong v. Gates*, 543 F.Supp.2d 1082 (N.D. Cal. 2008).

addition, environmentalists should consider suits under the Outer Continental Shelf Lands Act (OCSLA), the Antiquities Act, and the Noise Control Act (NCA).

OCSLA could be used to address underwater ocean noise from offshore oil and gas drilling. OCSLA mandates that "operations in the outer Continental Shelf should be conducted in a safe manner" using "technology, precautions, and techniques sufficient to prevent or minimize … occurrences which may cause damage to the environment."[112] This provision arguably requires oil and gas producers on the OCS to reduce any potentially harmful acoustic output. Furthermore, the statute contains a powerful enforcement provision. OCSLA authorizes suspension of leasing on the OCS "if there is a threat of serious, irreparable, or immediate harm or damage to life (including fish and other aquatic life), to property, to any mineral deposits (in areas leased or not leased), or to the marine, coastal, or human environment."[113] Under this provision, oil and gas development projects with significant acoustic impacts could potentially be threatened with suspension of their lease pending amelioration or cessation of sound-producing activities. This provision gives environmental groups a strong threat against any oil and gas lessees failing to institute appropriate acoustic mitigation measures.

As with NMSA and the NHPA, the Antiquities Act could also be used to force noise mitigation in particularly designated areas. It is applicable to federal as well as private actors. The Act authorizes the President to establish national monuments on lands "owned or controlled by the United States" that contain objects or areas of historic or scientific interest. Presidential designation of land as a national monument can limit use of the area in whatever ways are

[112] 43 U.S.C. § 1331.
[113] § 1333.

necessary to protect the designated objects of interest. The Act applies as far as the outer limit of the EEZ,[114] and has been used to create marine national monuments four times.[115] As with Marine Sanctuaries, regulations protecting marine national monuments have not yet addressed ocean sound directly, but the regulations often restrict sound-producing activities. For example, a national monument in waters off Hawaii imposes strict limitations and reporting requirements on vessels passing through the monument.[116] The Antiquities Act can also be used to challenge any off-site activity, even on private land, that threatens a monument's protected resource.[117]

Also, environmentalists could consider possible claims under the NCA. The NCA requires federal programs to be carried out in such a way as "to promote an environment for all Americans free from noise that jeopardizes their health or welfare."[118] The NCA is not an obvious fit to address underwater noise because it focuses on human health and safety. However, the statute could be applied to marine areas where people engage in underwater recreation and are potentially subject to harmful underwater noise levels. This could potentially cover any marine environment where humans scuba dive, swim, surf, or participate in other recreation.

---

[114] Office of Legislative Counsel, Memorandum Opinion on the Administration of Coral Reef Resources in the Northwest Hawaiian Islands (September 15, 2000), http://www.justice.gov/olc/coralreef.htm.
[115] U.S. Fish and Wildlife Service, "Marine National Monuments," http://www.fws.gov/marinenationalmonuments/ (last updated Mar. 30, 2011).
[116] 50 C.F.R. § 404.4.
[117] Cappaert v. United States, 426 U.S. 128 (1976) (regarding Death Valley National Monument).
[118] See 42 U.S.C. §§ 4901, 4903(a).

B. Market-Based Mechanisms

Litigation cannot be the only source of policy change, however. Given the complexity of the ocean sound problem, and the prominent role of private actors, a market mechanism might be the best way to address the inefficiencies and inefficacies of the existing scheme. A market mechanism is an alternative to traditional "command and control" regulation. Command and control policies involve direct government regulation defining legal and illegal activities. In contrast, a market mechanism provides a "process by which a market solves a problem of allocating resources."[119] Market mechanisms have been successfully applied to a variety of environmental problems.[120]

Market mechanisms present many distinct advantages over command-and-control regulation. Primarily, if structured appropriately, they achieve the largest pollution reductions at the least costs.[121] Especially for problems like anthropogenic ocean sound, where regulators have difficulty restricting the activities of private companies, a market mechanism can embrace the activities of private and public actors alike. A market mechanism enables the most efficient response to changing science and complex market conditions. Every market must have three

[119] University of Michigan, Deardoff's Glossary of International Economics.
[120] *See* Robert W. Hahn & Robert N. Stavins, *Incentive-Based Environmental Regulation: A New Era from an Old Idea?* 18 Ecology L. Q. 1, 9-10 (2009) (noting application of market-based mechanisms to acid rain, motor vehicle emissions, point and nonpoint water pollution, the hole in the ozone, and greenhouse gases).
[121] *See* Thomas W. Merrill, *Explaining Market Mechanisms*, 2000 U. Ill. L. Rev. 275, 276 (2000) (explaining the arguments for market-based solutions).

parts to function properly: a commodity (such as a license), demand for the commodity, and a structure for trades.[122]

A variety of market-based innovations could be applied to the problem of sound. Some scholars have suggested that a licensing fee for ships would efficiently reduce vessel noise.[123] Or, a cap-and-trade program for noise production could bring many types of sound under a single regulatory umbrella, to more effectively ensure real noise reductions.[124] Low-noise engines and other sound-reducing technologies could also be incentivized by subsidies, tax breaks, or an informative labeling program.

One need look no further than the massive scholarly literature surrounding air pollution markets to get a sense of how complicated such approaches can be.[125] It is beyond the scope of this paper to propose a complete scheme, but the next section will sketch broad possible outlines of one

---

[122] Ann Powers, *Reducing Nitrogen Pollution on Long Island Sound: Is There a Place for Pollutant Trading?* 23 Colum. J. Envtl. L. 137, 191 (1998).

[123] *See, e.g.,* Ian Boisvert, *Puget Sound Orcas, Vessel Noise, and Whale-Watching: A Licensing Program to Overcome the Problem of the ESA's Economically Blind 'Take' Rule,* 10 Ocean & Coastal L.J. 117 (2004) (proposing a seasonal licensing fee to reduce acoustic impacts from whale watching vessels on orcas).

[124] A participant at the 2010 Marine Mammals and Sound Workshop suggested this idea, but the workshop report does not say who suggested it, and workshop organizers were likewise not sure who it was. *See* http://www.nmfs.noaa.gov/pr/pdfs/acoustics/mm_sound_workshop_report.pdf at 21.

[125] *See, e.g.*, Tim Profeta, Jonas Monast, Brooks Rainey Pearson & John Doyle, *Regulating GHG Emissions from Existing Sources: Section 111(d) and State Equivalency*, *available at* http://nicholasinstitute.duke.edu/climate/policydesign/regulating-greenhouse-gas-emissions-from-existing-sources; Ian Parry & William Pizer, *Emissions Trading vs. CO2 Taxes* (May 2007), *available at* http://ethree.com/downloads/Climate%20Change%20Readings/GHG%20Emissions%20Trading/RFF-BCK-TradingvsTaxes.pdf; Janet Peace & Robert Stavins, *In Brief: Meaningful and Cost-Effective Climate Policy: The Case for Cap and Trade* (June 2010), *available at* http://www.pewclimate.org/docUploads/case-for-cap-and-trade-paper.pdf.

potential market mechanism. By engaging in this thought experiment, we can see the difficult questions that any such scheme would face, and the opportunities it might present for actual improvements in animal protection.

V. A THOUGHT EXPERIMENT: LICENSING SCHEME

As discussed above, one potential approach to mitigating the effects of sound could be to institute a licensing scheme at select U.S. ports to reduce anthropogenic underwater noise. A licensing scheme is a type of environmental market, where market actors require licenses to participate in environmentally harmful activities. Sometimes known as "allowances," licenses have been employed in the context of petroleum leasing,[126] air pollution,[127] and fisheries.[128] In the context of ocean sound, Ian Boisvert has proposed a licensing scheme to address acoustic pollution caused by whale watching vessels.[129]

---

[126] *See, e.g.*, S. Scott Gaille, *Allocation of International Petroleum Licenses to National Companies: Insights from the Coase Theorem*, 31 ENERGY L. J. 111 (2010).

[127] *See, e.g.*, European Union, *The EU Emissions Trading System* (Jan. 2013), *available at* http://ec.europa.eu/clima/publications/docs/factsheet_ets_2013_en.pdf; Regional Greenhouse Gas Initiative, *RGGI Model Rule* (Dec. 2008), *available at* http://www.rggi.org/docs/Model%20Rule%20Revised%2012.31.08.pdf.

[128] *See, e.g.,* FLA. FISH & WILDLIFE CONSERVATION COMM'N, COMMISSION APPROVED LEGISLATIVE ISSUES FOR 2005 SESSION 1 (2004), *at* http://myfwc.com/commission/2004/July/2005_session_legis_proposal.pdf (allotting crabbers certificates allowing them to set a limited number of traps, and providing for the reduction of certificates over time); Tracy Yandle & Christopher M. Dewees, *Privatizing the Commons . . . Twelve Years Later: Fishers' Experiences with New Zealand's Market-Based Fisheries Management*, *in* THE COMMONS IN THE NEW MILLENNIUM: CHALLENGES AND ADAPTATIONS 101 (Elinor Ostrom, ed. 2003).

[129] Ian Boisvert, *Puget Sound Orcas, Vessel Noise, and Whale-Watching: A Licensing Program to Overcome the Problem of the ESA's Economically Blind 'Take' Rule,* 10 Ocean & Coastal L.J. 117 (2004).

For the purposes of this thought experiment, we will focus on a licensing scheme that would require ships docking at certain U.S. ports to obtain a 'noise abatement' license. In theory, by increasing the cost of the most harmful behavior – piloting ships through important marine habitats – the licensing scheme would reduce that behavior. It would address the large amount of unregulated noise from ships, at the lowest possible cost. However, launching a licensing program would require consideration of a number of complex factors, and like any policy proposal, comes with pros and cons. This section outlines some of those considerations, and the challenges and problems associated with implementing such a plan.

A. Considerations

In crafting a licensing scheme to reduce anthropogenic ocean sound, policymakers would need to consider, among other factors: 1) the appropriate promulgating authority; 2) the geographic scope of the program; 3) the temporal scope of the program; 4) provisions for allocation and trading; 5) monitoring and enforcement mechanisms; and 6) use of revenue generated by licenses.

1. Authority to Promulgate

A licensing scheme could be promulgated at either the national or state level. At the national level, NMFS does not have explicit authority to enforce or operate a licensing scheme. However, depending on the location and goals of the program pursued, NMFS could be

delegated that authority. For example, Boisvert suggests[130] that NMFS is authorized to promulgate a licensing scheme to protect endangered species under Section 4(d) of the Endangered Species Act.[131] NMFS could also potentially implement such a scheme under the MMPA, which authorizes promulgation of regulations to ensure that takings "will not be to the disadvantage of" a marine mammal species.[132] At the state level, individual state agencies could also independently promulgate similar schemes for their territorial ports.

2. Geographic Scope

One of the major benefits offered by a licensing scheme is its inherently ecosystem-level approach.[133] The MMPA and ESA both operate on an inefficient animal-by-animal basis, and NEPA's approach is project-by-project. In contrast, a licensing scheme operates in a more expansive framework because licenses are issued for every qualifying activity occurring in a defined area. A licensing scheme asks the question, "How much of this unwanted activity will occur over time in an area we care about?" rather than, "Will an instance of this unwanted activity occur?"

Policymakers developing a noise-based licensing scheme would need to carefully consider the appropriate geographic basis for the program. In the case where the licenses would be allocated

[130] Boisvert at 135.
[131] 16 U.S.C. 1533(d).
[132] § 1373(a).
[133] *See, e.g.,* Sarah J. Dolman, *Spatio-Temporal Restrictions as Best Practice Precautionary Response to Ocean Noise*, 10 Journal of Int'l Wildlife Law and Policy 219 (2007); Angela M. Haren, *Reducing Noise Pollution from Commercial Shipping in the Channel Islands National Marine Sanctuary: A Case Study in Marine Protected Area Management of Underwater Noise*, 10 Journal of Int'l Wildlife Law and Policy 153 (2007).

based on docking at U.S. ports, this question essentially means, which ports would be appropriate for selection?

One possibility is that the program could be implemented at ports located near areas already specially designated as conservation zones. Under this model, the program could be launched at ports located within a certain distance of ESA critical habitat,[134] Marine Sanctuaries, or national monuments. For example, the ports of Seattle, Jacksonville and Boston are among the busiest ports in the U.S.,[135] and all are located near critical habitats for different whale species.[136] The advantage of this approach would be to focus the licensing program on the most vulnerable ocean ecosystems. It would also reduce political hurdles by focusing on areas already designated for protection.

However, selecting the ports based on proximity to protected areas does not take into account the relative intensity of uses at any given port. For example, we saw above that Galveston Bay is home to a variety of significant noise-producing activities. But the Bay does not contain any federally protected areas. In some ways, this type of area – entirely lacking protection – is more ideal because it would benefit the most from the seasonal licensing program.

[134] Under the ESA, specific geographical areas are specially designated as "critical habitat" vital to the survival of certain threatened and endangered species. 16 U.S.C. § 1531 (1988).
[135] 2012 Statistical Abstract of the United States.
[136] Seattle is abutted by killer whale critical habitat, and both Jacksonville and Boston are adjacent to North Atlantic Right Whale critical habitat. NOAA Fisheries Office of Protected Resources, "Critical Habitat," *available at* http://www.nmfs.noaa.gov/pr/species/criticalhabitat.htm.

3. Temporal Scope

The scheme could be designed so that it would only apply during the times of year when marine species would be most vulnerable. For example, taking the example of Jacksonville, winter is the season of greatest concern for North Atlantic Right Whales in that region. The whales migrate along the length of the eastern seaboard and use the southeastern U.S. as their winter calving ground.[137] Because ship traffic around Jacksonville would therefore be most harmful in the winter, the licensing fee could therefore be applied exclusively in the winter.

This approach would increase transaction costs because ships and regulatory authorities would need to consider the time of year rather than just applying the licensing fees in a uniform fashion. But it would also reduce costs to industry, by limiting the weeks per year that ships would be required to pay additional fees, cushioning the economic impact to any given port, and giving industry more flexibility in dealing with the license fees (they could go to a different port or simply reschedule).

4. Allocations & Trading

The structure of a licensing scheme includes the initial allocation of licenses, their cost, provisions for license trading, and other market elements. These program components are often controversial, and tend to generate extensive academic scholarship.[138] The implementing

[137] 59 Fed. Reg. 28805.
[138] *See, e.g.*, S. Scott Gaille, *Allocation of International Petroleum Licenses to National Companies: Insights from the Coase Theorem*, 31 ENERGY L. J. 111 (2010); Pew Center on

authority, presumably NMFS, will need to structure the program in order to reduce sound as much as possible, at the lowest cost. For an acoustic licensing program, each license would probably authorize a certain decibel output; for the purposes of analysis, we will assume that they will be distributed in 1-dB increments. The total decibel level authorized by the licenses would be the total vessel-produced noise level for the area near the port.

A key component of the scheme will be the initial allocation of licenses. Licenses could potentially be distributed for free based on previous usage. Under this type of allocation, each vessel would be allocated the same decibel level as it had emitted in the past (based on the previous year's usage or an average taken over a longer time span). So, if a vessel's per-docking decibel impact was 20 dB, and in the previous year it visited the port four times, its annual decibel budget for the port would be 80 dB. It could choose to utilize the port the same number of times, using the same equipment, and still remain within its noise budget. It could visit one fewer times, and sell its remaining 20 dB to another vessel. Or, it could install new, quieter equipment, allowing it to visit the port more often and still remain within its noise budget. Or, more aggressively, the initial licenses could be auctioned or sold to interested parties, so that shipping companies would need to buy the right to continued access to the port. In both cases, future market transactions would determine the value of a 1-dB license. The licensing authority could also introduce additional factors in determining how licenses are allocated. For example, NMFS could consider preferential distribution to ships that have installed low-noise engines or other desirable technologies.

Global Climate Change, *Greenhouse Gas Emissions Allowance Allocation* (2008), *available at* http://www.c2es.org/docUploads/Allocation.pdf.

In many licensing schemes, the number of licenses sold decreases with time in order to force a steady reduction in the unwanted behavior. Some schemes stipulate that the sale of the license triggers a certain percentage reduction in the unwanted behavior.[139] A similar procedure could be followed with decibel-based licenses. If a ship with a 20 dB license installed a low-noise engine and then only needed an allowance for 10 dB, it could sell the remaining noise capacity. A percentage reduction, perhaps 10%, could be applied to the transaction, so the ship could sell 9 dB of capacity.

In the case of ocean noise, license allocation is made especially difficult by the complexity of noise itself. All ships are not created equal in terms of acoustic impact. Given that acoustic impact varies based on the boat speed, engine type, water temperature, underwater geology, and more, how would NMFS determine how many 1-dB licenses to allocate to each ship? Boisvert addresses this problem by suggesting allocating licenses to whale watching vessels based on their "noise signatures." He proposes that all whale watching boats would be required to "record each of their vessels' noise signatures at the speeds they travel when carrying passengers: idling, accelerating, cruising, and so on." The ships would also need to provide an estimated trip length for each outing, and the state agency would use that information to calculate each vessel's "decibel output per trip."[140] The noise signature would also be used as an enforcement mechanism, so authorities could spot-check the ship's noise output to make sure it did not exceed the noise signature.

---

[139] *See, e.g.,* FLA. FISH & WILDLIFE CONSERVATION COMM'N, COMMISSION APPROVED LEGISLATIVE ISSUES FOR 2005 SESSION 1 (2004), *at* http://myfwc.com/commission/2004/July/2005_session_legis_proposal.pdf (providing that the holder of a crabbing license may sell the license, but the transaction reduces the number of traps allowed per license by 22.5%).

[140] Boisvert *supra* n. __ at 149.

Boisvert's noise signature process makes sense when applied to whale watching, which is a clearly defined industry with a small number of participants whose trips begin and end at the same point. However, when dealing with *every* ship docking at a port, it would be a major administrative burden to record each vessel's noise signatures and extrapolate that data to entire trips. Instead, the scheme could be based on a simpler calculation involving engine type and vessel size, generalized over a standard distance (probably equal to the zone of concern around the port). A large boat with a loud engine would therefore be given a high decibel rating, while a small boat with a low-noise engine would be rated lower. This rating system would be less accurate than Boisvert's, but would be much simpler to apply. If vessel owners disagreed with their rating, they could petition the implementing authority to analyze their noise signatures and reduce their rating.

5. Monitoring and enforcement

As with any market, effective monitoring and enforcement of compliance will be critical to ensuring success. Here, vesting enforcement responsibilities with onshore officials will help avoid the difficulties of enforcing regulations at sea. Onshore officials can make sure that each ship arriving at the port possesses adequate allowances for its arrival. Officials could also conduct spot checks to ensure that the ships are using the type of engine they have reported, and

that their engine parts meet certain operating conditions.[141] The system should include fines for non-compliant ships.

6. Generation & Use of Revenue

The licensing system will generate revenue from license sales and fines, which could be used in two general ways. First, revenues could be used to further address the problem of ocean sound. For example, funds from the program could be used to fund further research into the effects of ocean sound. Or they could be used to implement additional measures to reduce noise levels in the ocean (such as incentivizing use of low-noise engines).

Second, the funds could be used to mitigate the political and economic effects of the scheme. As will be discussed in greater detail below, the licensing scheme may face significant political opposition. Ports are major economic centers, and any measure that seems likely to reduce vessel traffic will probably draw serious criticism. Such backlash could be mitigated if the funds raised were funneled back into the local economy.

B. Challenges and Weaknesses

First, this type of licensing scheme would not be a comprehensive solution to the ocean sound problem. Most obviously, it only addresses noise from ships. Vessel-source noise reduction is an important goal because it is the largest source of ocean noise, and is almost totally unregulated.

[141] Loose propeller blades, among other mechanical issues, can be a major source of sound from ships.

But, by focusing on ships, the scheme does not address noise from wind farms, offshore oil and gas development, or sonar. In some regions, these other types of noise pollution may pose a more serious concern than vessel-source noise pollution. In such cases, resources may be better channeled towards different market mechanisms or direct regulation.

Second, there could be substantial political opposition to this type of scheme based on its potential for negative economic effects. While the actual goal of the program will be to reduce the amount of *sound* in the waters around the affected ports, the practical effect may be to reduce the number of ships. Ships that can just as easily deliver their cargo to ports in less sensitive areas – or at less sensitive times - may do so, motivated by the increased cost of delivery at the licensing port. This reduction in vessel traffic would concern local governments because ports are major economic centers. For example, one recent study found that the marine cargo industry is responsible for more than one million jobs in Texas.[142] Depending on the structure of the licensing scheme, the national economy may also be impacted as some ships may choose to forgo U.S. ports and dock instead in Mexico or Canada.

The potential for political backlash highlights a key difference between acoustic-based licensing and fisheries-based licensing programs. In fisheries licensing schemes, there is obviously an immediate negative economic effect to limiting catches. Fishermen make less money when they are forced to catch fewer fish. However, in the long run, the licensing scheme provides an economic benefit to fishermen. By ensuring the long-term viability of the fishing stocks and

[142] Martin Associates, "The Local and Regional Impacts of the Port of Houston, 2011" (May 2012), *available at* http://www.portofhouston.com/static/gen/about-us/Misc/PHA-EconomicImpact-2012.pdf.

preventing their rapid depletion, fisheries licensing promotes the long-term economic health of the fishing industry. In contrast, the acoustic-based licensing scheme imposes a cost on commercial vessels, whose business is unrelated to the health of the marine mammals with whom they share the oceans. So, in a fisheries licensing program, the affected parties' objections may be assuaged if they are convinced that the program is required to preserve their livelihood. There will not be any similar comfort for the ships affected by noise licensing, and so their political opposition will likely be stronger.

These concerns are serious, and would merit extensive study. However, it is also worth noting that the costs imposed by the scheme are placed on the shoulders of parties that have not yet contributed to mitigating the problem of ocean noise. Federal agencies, and therefore taxpayers, have thus far borne the entire economic burden of U.S. ocean noise regulation.

C. Recommendations

Based on the analysis above, I recommend a few general steps an implementing authority could take to limit the negative economic effects of an acoustic licensing scheme, while still promoting efficient overall noise reductions in sensitive waters. In general, the implementing authority should ensure at each step that it is seeking to reduce *noise*, not ship traffic. First, licenses should be distributed free of charge, rather than auctioned or sold, to reduce the economic impact on the shipping industry. Second, licenses should be distributed to allow consistent noise output for an initial grace period of one to three years, before instituting noise reductions. Third, revenue

should be channeled to local budgets in order to counterbalance any negative economic effects and earn political support.

CONCLUSION

Underwater noise in our oceans is increasing, despite advances in scientific knowledge, environmentalists' court victories, and increased public interest. To effect actual reductions in ocean noise, the U.S. must move beyond its current reliance on an outdated statutory and regulatory system. Policy change could be achieved via creative litigation by environmentalists, regulation under hitherto-unused statutes, or application of an innovative market mechanism. As with the most intractable policy problems, none of these solutions is perfect. It is clear, however, that our current system is inadequate, and the health of our oceans depends on creative, bold movement forward.