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MEXICO'S ENERGY REFORM AND THE 2012 U.S.-MEXICO TRANSBOUNDARY AGREEMENT. AN OPPORTUNITY FOR EFFICIENT, EFFECTIVE AND SAFE EXPLOITATION OF THE GULF OF MEXICO

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The purpose of this article is to introduce the topics presented during the 2016 Symposium on Improving Cooperation for a Sustainable Gulf of Mexico After the 2014 Mexican Energy Reform held in Galveston Texas on February 26, 2016. The Symposium was an effort to move beyond the traditional paradigms of cooperation by inviting participants from governmental agencies, experts, and academics from both sides of the border. The Symposium was funded through the National Sea Grant Law Center's Sea Grant Law & Policy Journal Symposium Series and organized by the U.S. and Mexican Law Center of the University of Houston Law Center, the Harte Research Institute for Gulf of Mexico Studies at Texas A&M University – Corpus Christi, and the National Sea Grant Law Center. The Symposium reflects how academia and government can work together for the benefit of our joint resources.

Nature knows no legal boundaries. Resources cannot be stopped by walls with barbwire; no matter how high some people want to build them. They cross-national territories and expand under their logic. They belong to many nations, and they are there for the responsible exploitation of their communities. The Gulf of Mexico (Gulf) and its rich hydrocarbon deposits are no exceptions. The implication of this is that for the development of this enclosed sea area to be efficient, effective, and safe it requires not only the cooperation of government officials but also the inclusion of other actors, such as academic institutions, industry experts, and communities affected by its development.[2] The adoption of international treaties, such as the 2012 Agreement Between the United States and Mexico Concerning Transboundary Hydrocarbon Reservoirs in the Gulf of Mexico (2012 Agreement), that regulates the exploitation of the transboundary fields located along the maritime boundary, is just one step towards achieving that goal, but by no means is a closing chapter.[3]

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[2] *See generally* Guillermo J. Garcia Sanchez & Richard J. Mclaughlin, *2012 Agreement on the Exploitation of Transboundary Hydrocarbon Resources in the Gulf of Mexico: Confirmation of the Rule or Emergence of a New Practice, The*, 37 HOUS J INTL L 681 (2015).

[3] Agreement Concerning Transboundary Hydrocarbon Reservoirs in the Gulf of Mexico, U.S.

The geological and biological characteristics of the Gulf force the two nations and its communities to look beyond the official borderline, and treat the Gulf as a unit.[4] As the 2010 Macondo and 1979 Ixtoc oil spills have taught us, an industrial accident along the coast of Louisiana or Campeche affects areas, towns, business, and ecosystems beyond human created borders.[5] Sustainable development in the Gulf should be an ongoing conversation involving a diversity of actors and ignoring the existence of artificial legal constructions. The lack of this dialogue is one of the main challenges. States are constructed under the legal concept of sovereignty and linked to particular geographical spaces that according to laws determine the jurisdiction of government actors; yet nature, disasters, community impacts, and biological risks operate under a different logic that challenges, and even contradicts, the principles of State sovereignty.[6] The exploitation of the Gulf is so complex that the traditional State-to-State relations headed by diplomatic envoys are ineffective to deal with such a challenge. Open channels of communication, flexible day-to-day agreements, the creation of common standards, along with the consultation and interaction with other actors is the most efficient way to ensure that the Gulf receives the best treatment for the benefit of both nations and its communities.[7] The Gulf requires horizontal relationships, not hierarchical communications. A more traditional vertical approach would be equivalent to trying to contain an oil spill with paper. International agreements should set up the basis of cooperation, but by no means establish the limits in such a complex binational relation.[8]

-Mex., Feb. 20, 2012, T.I.A.S. No. 14-718, available at http://www.state.gov/documents/organization/231802.pdf

[4] Sanchez & Mclaughlin, *supra* note 2, at 691–725.

[5] *See generally* James M. West, Comment, The Ixtoc I Oil Spill Litigation: Jurisdictional Disputes at the Threshold of Transnational Pollution Responsibility, 16 TEX. INT'L L.J. 475 (1981) (discussing the Ixtoc I oil spill); Jacqueline L. Weaver, Offshore Safety in the Wake of the Macondo Disaster: Business as Usual or Sea Change?, 36 HOUS. J. INT'L L. 147, 153 (2014) (discussing U.S. changes in offshore drilling in after the oil spill). After the Deepwater Horizon oil spill, the U.S. government and the offshore hydrocarbon industry made changes to its regulations and practices. *See* Caroline Haquet, Macando: The Disaster That Changed the Rules, TECHNICAL NEWSL. (SCOR Global P&C Paris, France), Apr. 2014, for a summary of these changes.

[6] Sanchez & Mclaughlin, *supra* note 2, at 691–725.

[7] *Id.* at 789–92.

[8] ABRAM CHAYES & ANTONIA HANDLER CHAYES, THE NEW SOVEREIGNTY (United States: Harvard University Press, New edition ed. 2009). (For a comprehensive study on how international law compliance on regulatory affairs should be analyzed through the lenses of ongoing bureaucratic and agency cooperation)

As readers of this Symposium Issue will discover, the current situation in the Gulf is one where agencies are working together to coordinate efforts. Mexico and the United States adopted International Treaties, created binational commissions, and encouraged intergovernmental dialogues. Agencies have been able to engage and share experiences.[9] For instance, the recently created Mexican National Agency for Industrial Safety and Environmental Protection of the Hydrocarbons Sector (ASEA) is cooperating with the U.S. Bureau of Safety and Environmental Enforcement (BSEE) to identify key areas where both agencies can learn from each other.[10] In many ways, the 2013 Mexican energy reform has integrated world-class safety and environmental management systems (SEMS), yet the challenge remains in their enforcement and monitoring. ASEA is tasked to supervise and implement the safety and environmental standards of all hydrocarbon-related activities in Mexico: from the deep-water fields in the Gulf all the way to the gas pumped in retail stations. Just on the Mexican coast, 250 facilities are operating.[11] In addition to the SEMS, ASEA has the task of issuing technical regulations, restrictive rules, and performance-based regulations. All of these tasks are aimed at having the industry operate with safe and environmentally responsible standards in Mexico.

Moreover, its primary approach is corrective enforcement before imposing fines, and this requires an adequate number of supervisors in the different chains of production. Yet, ASEA is a new agency with limited resources and personnel (only 280 employees), and has one of the broadest mandates compared to its international counterparts.[12] On the other hand, after the Macondo disaster, BSEE has developed substantial expertise on how to work with few resources and still be able to supervise and monitor compliance effectively in the Gulf.[13] There is no reason why the hard lessons learned by BSEE cannot be transferable to the newly created ASEA. In the end, they are both dealing with the same operators in similar geological spaces. Notwithstanding the agencies' efforts to cooperate, there is a consensus that many issues are still pending resolution, such as establishing standard criteria for supervision of the fields, and the disparities of regulatory frameworks applicable to areas on the border, close to the border, and beyond the

[9] *See* the transcript from comments from Alejandro Carabias, Deputy Director for Normativity and Regulation, Mexico´s National Agency for Industry Safety and Environmental Protection of the Hydrocarbons Sector (ASEA); and from Allyson Anderson Book, Associate Director fro Strategic Engagements (BSEE).
[10] *Id.*
[11] *See* Carabias comments.
[12] *Id.*
[13] *See* Weaver, *supra* note 3.

border. The application of different standards based solely on the oil field's location along the official borderline not only generates uncertainty from the industries' point of view, but also leaves the rigs under different levels of protection and scrutiny regardless of the fact that they are in the same geological and biological ecosystem. As stated by one of the commentators during the Symposium from the regulator's perspective, "it will be easier to draft legislation that covers the whole Gulf of Mexico that is in harmony."[14] Among regulators, there seems to be a consensus that the long-term solution is to formalize an agreement of cooperation between the agencies, BSEE and ASEA, that would make it easier for officers in both organizations to come up with common standards and regulations. Today, the only formal cooperation mechanisms are the diplomatic channels set up by the 2012 Agreement.

Another important set of questions raised during the Symposium was related to the ability of agencies to manage and adapt to organizational changes.[15] Each time there is a legislative development, creating new standards or bureaucracies (something we know has been happening on both sides of the border due to political changes or to concrete disasters), officials face the challenge of adapting.[16] Their structures, cultures, and organizational routines are often entrenched in the day-to-day work of the agency and are difficult to change in the face of new challenges.[17] As the presentation of some of the experts in the Symposium reminded us, preventing accidents and harm to people and the environment often depends on the skills, experience, and capabilities of the people on the ground, rather than on regulations and standards. Surely, clear and well-defined norms help to enhance the procedures of those who need to prevent disasters from happening, but they are insufficient on their own.[18] Along with new regulations, new organizational cultures, structures, and practices are also needed. These changes become even more challenging when there is a disparate set of agencies working together to regulate one industry, and it becomes a monumental challenge when it has to be done in a binational way.[19]

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[14] *See* Alejandro Carbias comments.
[15] *See* Jorge Piñon comments.
[16] For example, BSEE was created after the Macondo disaster.
[17] *See* comments from Jorge Piñon, Director of the Latin American and Caribbean Energy program, Jackson School of Geosciences, the University of Texas at Austin. For a review of how bureaucratic practices can be on the way for international law compliance see generally CHAYES & CHAYES, *supra* note 8.
[18] *See* comments from Jorge Piñon.
[19] Sanchez & Mclaughlin, *supra* note 2, at 726–44.

The area of emergency response is only one example of this. U.S. federal agencies, such as the U.S. Bureau of Ocean Energy Management (BOEM) and BSEE, and Mexico's ASEA, National Hydrocarbons Commission (CNH), Ministry of Energy (SENER) and Navy have to cooperate with each other in terms of monitoring licensing compliance, responding to concrete emergencies, and taking actions to prevent further damages.[20] In total, the general operation of the deep-water fields in the Gulf depends, at different levels and stages, on the appropriate supervision of nine governmental agencies from both countries. But if we think about the region in broader terms, regulating oil and gas development also depends on the help of local authorities, primarily municipal and state governments, and the affected coastal communities.[21] The MEXUS Plan, adopted in 1980, is the most important binational agreement that deals with transboundary oil spills, but it only contemplates coordination once a disaster has occurred and does not consider the complex diversity of actors involved in the protection of the Gulf.[22] For example, the authorities involved on the Mexican side do not include the newly created agencies ASEA and the CNH, and these are the two most prominent organizations in charge of supervising the execution of the contracts signed with the government for the exploitation of deep-water fields.[23]

A third important issue presented by the experts during the Symposium involves the existing facilities and capacities of the state-owned energy company of Mexico (PEMEX). For more than seventy years, this company was the only one allowed to exploit the hydrocarbons located on the Mexican side of the Gulf.[24] This industry giant operated as a company, regulator, government entity, and, in many ways, representative of the workers union. Functions, responsibilities, and tasks that in other parts of the world are well determined and separated among different entities were mixed, confused, and placed under one single monopoly. Today, the 2013 Energy reforms in Mexico have taken away the exclusive control of PEMEX and opened up the use of its existing facilities for the benefit of incoming private companies. Several questions remain regarding how the new regulations will allow the use of these facilities for the new fields in the

[20] *See* Mclaughlin in this Issue.
[21] *See* Alyson Winnicki comments.
[22] The Joint Contingency Plan Between the United Mexican States and the United States of America Regarding Pollution of the Maritime Environment by Discharge of Hydrocarbons or Other Hazardous Substances, U.S.-Mex., Feb. 25 2000, 32 U.S.T. 5899 [hereinafter MEXUS Plan].
[23] *Id*. Annex VI
[24] For a review of the Mexican energy reform and how it interacts with the 2012 Agreement see Sanchez & Mclaughlin, *supra* note 2, at 747–72.

borderline area. For example, the Mexican agency in charge of regulating these permits, the Energy Regulatory Commission (CRE), has the challenge to make sure that the access is open and non-discriminatory, and that there is an adequate tariff regulation. Moreover, according to the Mexican energy reforms, PEMEX has to have at least a 20% participation in any project involving transboundary fields.[25] For most of its existence, PEMEX only dealt with private companies using service contracts; today it has to deal with them as partners in the development of high-risk areas. The key question for the sustainable development of the Gulf is how this is achieved without losing sight that resource exploitation must be efficient for the benefit of both nations, not only due to a constitutional mandate in Mexico, but also the terms of the 2012 Agreement.[26] In other words, is PEMEX's existing infrastructure and corporate governance structure ready for the challenge?

Finally, there is also a consensus on the value of social indicators and consultation with communities for the decision making of regulatory agencies.[27] Taking these community stakeholder's views into consideration can help us to evaluate potential and actual effects of policies, programs, projects, and management actions. In the area of public health emergencies, for example, to ensure an adequate preparedness, coordination, and response, the responsibilities of different actors must be clearly broken-down.[28] Local communities, volunteers, and organizations are critical in addressing health preparedness challenges. Without a clear division of roles, actions easily duplicate and contradictory tasks are taken. In the same vein, Mexico faces difficulties regarding the process of consultation with indigenous communities affected by the development of the industry.[29] What are their components and what is expected from the regulators and the companies according to national and international standards?

Finding answers to all of these challenges will not be an easy task for Mexico and the United States, particularly now that the industry is already operating in the region. On the U.S. side of the Gulf, operations have already begun in fields that could contain transboundary resources.[30] On the Mexican

[25] *Id.* at 759.; Ley de Hidrocarburos [Law of Oil], as amended, Diario Oficial de la Federación, [DO], 11 agosto de 2014, section II, art. 16 [hereinafter National Hydrocarbons Law], art. 17.
[26] *Id.* at 759–61.; 2012 Transboundary Agreement, supra note 2, art. 12(1)–(2).
[27] *See* Victoria C. Ramenzoni and Patricia Arceo in this Issue.
[28] *See* Alyson Winnicki´s comments.
[29] *See* Raul Mejia in this Issue.
[30] Dale Quinn, Mexico Opens Up Its Deepwater Oil Fields, THE FINANCIALIST (Mar. 14, 2014), http://www.businessinsider.com/mexico-opens-up-its-deepwater-oil-fields-2014-3.

side, last December, the Ministry of Energy announced the fourth phase of the Energy Reforms. This new development consists of the tendering process of ten deep and ultra-deep water blocks in the Gulf.[31] Four of them are located in the Perdido Foldbelt, a geological area shared by both countries.[32] Our plan as organizing academic institutions is to serve as a platform for collaboration between society and governmental actors to address these issues, and those that might emerge in the future. The publication of the papers and presentations in this Symposium Issue is just one mechanism to achieve that. We welcome advice from the agencies and operators on other ways in which we can help the complex relationship between Mexico and the United States to achieve safe and efficient methods for the exploitation of hydrocarbon resources from the Gulf. Perhaps in the near future, we can also invite Cuban colleagues to participate in this ongoing dialogue.[33] Given the recent opening of relations between the United States and Cuba, many of the issues addressed here will also be relevant to potential transboundary activities with that important neighbor in the Gulf.

[31] SECRETARÍA DE ENERGÍA, SECRETARÍA DE HACIENDA Y CRÉDITO PÚBLICO, & COMISIÓN NACIONAL DE HIDROCARBUROS, REFORMA ENERGÉTICA: RONDA 1 [ENERGY REFORM: ROUND 1] 13, available at http://www.energia.gob.mx/webSener/rondauno/_doc/Reforma%20Energetica%20Ronda%201.pdf

[32] Fabio Barbosa, Observatorio Ciudadano de la Energía A.C., Pozo Trion-1: Primer Descubrimiento en Aguas mexicanas en la Zona Transfronteriza del Golfo de México [Trion -1 Well: First Discovery in Mexican Waters in the Border Zone of the Gulf of Mexico] 2 (2012), available at http://www.energia.org.mx/wp-content/uploads/2012/09/PozoTrionPrimerDescubrimiento3.pdf.

[33] Thomas Omestad, Cuba Plans A New Offshore Drilling in Search for Big Oil Finds in the Gulf 1Mexico, U.S. News & World Rep. (Feb. 3, 2009), https://www.usnews.com/news/energy/articles/2009/02/03/cuba-plans-new-offshore-drilling-in-search-for-big-oil-finds-in-the-gulf-of-mexico; Shasta Darlington, Cuban Offshore Oil Plans Gain Momentum, CNN (Sept. 1, 2010), http://edition.cnn.com/2010/WORLD/americas/09/01/cuba.oil/.

THE GULF OF MEXICO ECOSYSTEM: LINKING SHARED MARINE RESOURCES ACROSS INTERNATIONAL BORDERS THROUGH THE GULF'S SPECIAL PLACES

William E. Kiene[1]

The Gulf of Mexico (Gulf) ecosystem, like its geography and resource management challenges, is vast and diverse. It is an enormous reservoir of biodiversity that is bound together in an interwoven network of physical and biological connections, and critical habitats.[2] The Gulf's unique geology and productive ecosystem has given our human economy a rich ocean environment teaming with spectacular species, special places, and abundant economic resources.

As the stewards of the Gulf's marine species, places, and resources, it is essential that government agencies work across jurisdictional and political boundaries as they manage resource use and protection, because the shared resources have no regard for those boundaries. Failure to recognize these trans-boundary connections has consequences for everyone.

The 2010 Deepwater Horizon oil spill was a stark awakening to how lives, communities, and ecosystems can be harmed when responsible use and adequate protection of our ocean is lacking. This tragedy clearly showed that the Gulf's ecological and human environments are interwoven. As a result, resource use and ecosystem protection strategies must work closely together if such accidents, and their costs, are to be avoided in the future.

Unfortunately, the spectacular ocean life of the Gulf is often unrecognized by the public, but its petroleum and fisheries riches are well known. This presents challenges to creating adequate policies to protect the Gulf's environment as its

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[2] Darryl L. Felder & David K. Camp, eds., GULF OF MEXICO ORIGIN, WATERS, AND BIOTA: VOL. I, BIODIVERSITY (Tex. A&M Press 2009).

economic wealth is tapped, and for people to see what it means if its environment is damaged or lost.

The extent of the Gulf's biological riches are on full display at a number of special places, particularly at the Flower Garden Banks National Marine Sanctuary (Sanctuary), 100 miles southeast of Galveston, Texas.[3] This sea floor habitat, on which some of the healthiest coral reefs in the Western Hemisphere grow, is home to abundant and diverse invertebrate and fish life. Sanctuary management uses scientific programs to understand and monitor the conditions of these coral reefs.[4] Comparing its condition with other reefs in the Caribbean shows that the Flower Garden Banks have coral abundance that exceeds most other coral reefs in the region. This large amount of coral has been maintained since observations began in the 1970s.[5] However, to ensure these reefs stay healthy, it is important to look beyond the borders of the Sanctuary to ensure the ecological connections in the region also stay healthy.

The Sanctuary is surrounded by one of the most industrialized ocean areas in the world. The fact that the Sanctuary is in such good condition is a credit to the Sanctuary managers working together with the oil and gas industry, scientific colleagues, and regulatory agencies, such as the Bureau of Ocean Energy Management (BOEM) and the Bureau of Safety and Environmental Enforcement, to ensure it stays that way. In addition, the National Oceanic and Atmospheric Administration (NOAA), as manager of the Sanctuary, is considering bringing sanctuary protections to some of the other reefs and banks in the region. In evaluating this expansion, NOAA has consulted with multiple stakeholders.[6] This process ensures that protecting these areas will be a balance of allowing ocean uses and ensuring these areas maintain their ecological function.

Many of the sea floor features that surround the Sanctuary have shallow coral reef communities that are linked ecologically to the Flower Garden Banks.

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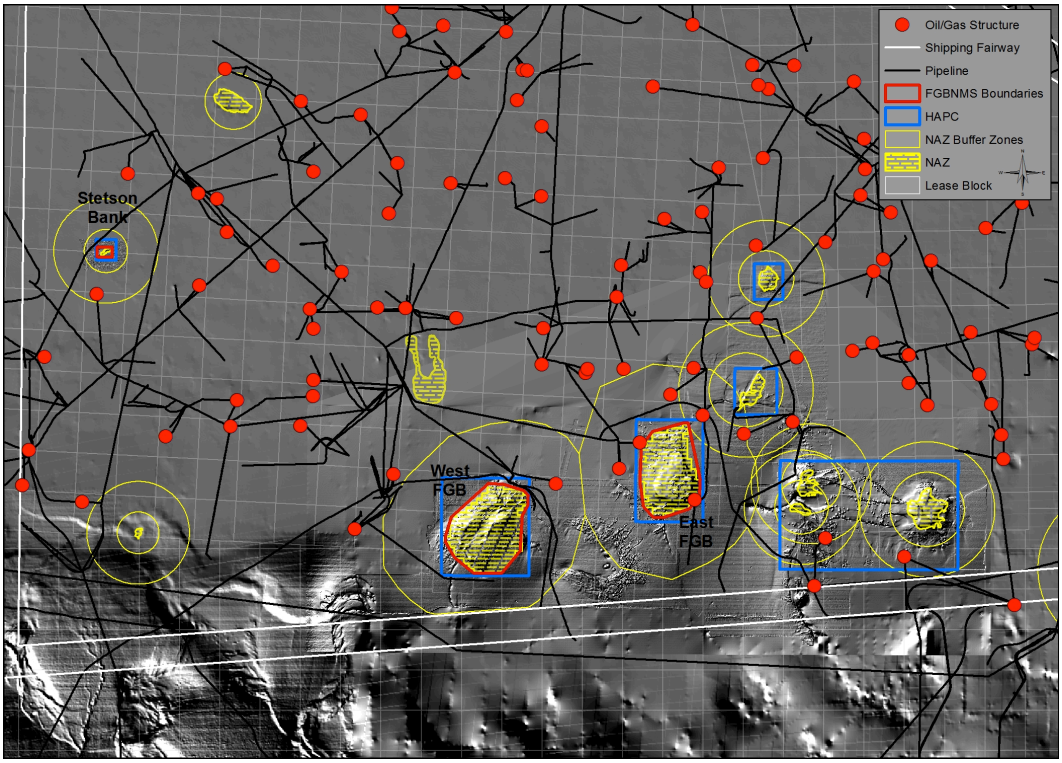
[3] *Flower Garden Banks,* FLOWER GARDEN BANKS NAT'L MARINE SANCTUARY, https://flowergarden.noaa.gov/ (last visited June 6, 2018).
[4] ,*Science*, FLOWER GARDEN BANKS NAT'L MARINE SANCTUARY, http://flowergarden.noaa.gov/science/science.html (last visited June 6, 2018).
[5] NOAA OFF. OF NATL. MARINE SANCTUARIES, LONG-TERM MONITORING AT EAST AND WEST FLOWER GARDEN BANKS NATIONAL MARINE SANCTUARY: 2014 ANNUAL REPORT (2015), https://nmsflowergarden.blob.core.windows.net/flowergarden-prod/media/archive/document_library/scidocs/ltm2014report.pdf (last visited June 6, 2018).
[6] *Management Plan Review*, FLOWER GARDEN BANKS NAT'L MARINE SANCTUARY, https://nmsflowergarden.blob.core.windows.net/flowergarden-prod/media/archive/document_library/mgmtdocs/mprfactsheet.pdf (last visited June 6, 2018).

Also, deep water (mesophotic) communities occupy deep hardground habitats that physically link the banks to one another. In addition to those physical features, the area has a complex regulatory overlay that includes fishery Habitat Areas of Particular Concern, oil and gas No Activity Zones and lease blocks, shipping fairways, and sanctuary boundaries. All of these management jurisdictions need to work together if any environmental protections or resource management strategies are to succeed.



The East and West Flower Garden Banks (FGB) and Stetson Bank that make up the Flower Garden Banks National Marine Sanctuary are shown on a gray background of bathymetry. The map also shows oil and gas infrastructure and overlapping management jurisdictions in the area, including BOEM lease blocks and No Activity Zones (NAZ), NOAA national marine sanctuary boundaries, NOAA fisheries Habitat Areas of Particular Concern (HAPC), and U.S. Coast Guard shipping fairways. (Map by Marissa Nuttal, NOAA)

In the same way that looking outside management boundaries is important to successful stewardship of the ecosystem, the United States, Mexico, and Cuba also need to look outside their boundaries if the resources of the Gulf are to be safely and sustainably utilized, and its ecosystem is to be protected. The Harte Research Institute and its partners at the Ocean Foundation, Mote Marine Lab,

Environmental Defense Fund, and other non-governmental organizations all recognize this need to look beyond borders and have led the Trinational Initiative (3NI) to build scientific and conservation strategies among the three nations that surround the Gulf.[7] This initiative has brought together marine scientists and resource managers from the three nations to share knowledge and conduct joint research projects. Focused areas of research include coral reefs, fish populations, whales, sea turtles, and sharks. It has also been fundamental in facilitating the development of NOAA's Office of National Marine Sanctuaries' engagement with Mexico and Cuba on marine protected areas. This tri-national engagement has helped to identify research needs based on the ecological connections that exist between the three countries and build a foundation for why preserving those connections is so vital.

Examples of the many ecological connections between distant parts of the Gulf include the following:

- In 2003 and 2005, new colonies of *Acropora palmata* (elkhorn coral) were discovered at the Flower Garden Banks after being absent from these reefs for centuries.[8] The larvae of these colonies had to originate in the southern Gulf on the reefs of Mexico and/or Cuba where *Acropora palmata* is well established.

- Like the larvae of invertebrates, a number of large charismatic species, including whale sharks, move freely throughout the Gulf. Whale sharks periodically come together in large impressive, feeding aggregations. Tracking studies[9] have identified aggregations that migrate from waters off the Yucatán to the northern Gulf.

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[7] *Trinational Initiative for Marine Science and Conservation in the Gulf of Mexico and Western Caribbean*, TRI-NATIONAL INITIATIVE, http://www.trinationalinitiative.org (last visited June 6, 2018).

[8] William E. Kiene, *The Coral Reefs of the Flower Garden Banks: Sentinels of Change in the Northwestern Gulf of Mexico*, 5 S. CLIMATE MONITOR 2 (2015), http://www.southernclimate.org/documents/SCIPP_Monitor_August_2015.pdf (last visited June 6, 2018).

[9] Robert E. Hueter, John P. Tyminski, & Rafael de la Parra, *Horizontal Movements, Migration Patterns, and Population Structure of Whale Sharks in the Gulf of Mexico and Northwestern Caribbean Sea*, 8 PLOS ONE 8 (2013), http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0071883 (last visited June 6, 2018).

- The same is true for whale species. Sperm whales have been known to travel throughout the Gulf of Mexico and have been identified to have distinct core feeding areas and home ranges.[10]

- The invasive Indo-Pacific lionfish has spread throughout the Caribbean and is now resident in the Gulf.[11] Other invasive species, such as the orange cup coral *Tubastrea micranthus*,[12] and diseases[13] have propagated on the ecological links the Gulf has with the wider Caribbean.

A good illustration of how the entire Gulf is physically connected is shown by real-time animations of sea surface temperature, height, and salinity modeled by the U.S. Naval Research Laboratory.[14] These data show the currents flowing through the Gulf, which transport the offspring of invertebrates and fish, nourish the environments these organisms inhabit. This flow also means that no part of the Gulf is isolated from contaminants or alien species that may be introduced anywhere in the region.

The connections in the Gulf mean that places do not function in ecological isolation. Successful management and protection of any special place or species requires concern for the conditions of other places throughout the region. For example, deep-water coral communities have been documented throughout the Gulf.[15] The factors that determine their locations and how they get there are poorly understood. However, their concentration at key places surrounded by great distances of deep-water biological "deserts" shows that even at great depths organisms and their offspring are able to locate or be transported to the special

[10] A. JOCHENS ET AL., SPERM WHALE SEISMIC STUDY IN THE GULF OF MEXICO: SYNTHESIS REPORT (2008), https://www.boem.gov/ESPIS/4/4444.pdf (last visited June 6, 2018).
[11] Michelle A. Johnston et al., *Rapid Invasion of Indo-Pacific Lionfishes Pterois volitans (Linnaeus, 1758) and P. miles (Bennett, 1828) in Flower Garden Banks National Marine Sanctuary, Gulf of Mexico, Documented in Multiple Data Sets*, 5 BIOINVASIONS REC. 115 (2016), http://reabic.net/journals/bir/2016/2/BIR_2016_Johnston_etal.pdf (last visited June 6, 2018).
[12] Paul W. Sammarco, et al., *Population Expansion of a New Invasive Coral Species, Tubastraea micranthus, in the Northern Gulf of Mexico*, 495 MAR. ECOL. PROG. SER. 161 (2014), http://www.int-res.com/articles/meps_oa/m495p161.pdf (last visited June 6, 2018).
[13] H.A. Lessios, *The Great Diadema antillarum Die-Off: 30 Years Later*, 8 ANNU. REV. MAR. SCI. 267 (2016), https://www.ncbi.nlm.nih.gov/pubmed/26048480 (last visited June 6, 2018).
[14] *See Gulf of Mexico Movies and Snapshots of the 1/12° Global HYCOM*, U.S. DEP'T OF THE NAVY, https://www7320.nrlssc.navy.mil/GLBhycom1-12/glfmex.html (last visited June 13, 2018).
[15] CONTINENTAL SHELF ASSOCIATES, INTL. , CHARACTERIZATION OF NORTHERN GULF OF MEXICO DEEPWATER HARD BOTTOM COMMUNITIES WITH EMPHASIS ON LOPHELIA CORAL (2007), http://www.data.boem.gov/PI/PDFImages/ESPIS/4/4264.pdf (last visited on June 6, 2018).

places they need and to connect to other deep-water habitats. This is also true for the spectacular chemosynthetic communities that are found associated with hydrocarbon seeps and brine flows on the deep seafloor in the Gulf.[16]

So how does understanding these connections help us manage the Gulf's ecosystem? NOAA's Office of National Marine Sanctuaries has formed an international alliance of marine protected area management across political boundaries based on biological and ecological links. This network of "sister sanctuaries" is meant to focus common research and management strategies on shared conservation challenges at key sites around the Gulf.

While each of the network sites have unique experiences and components of the Gulf's ecosystem, each site in the alliance is invested in the conservation of the others. As a result, the sister sanctuary network is conceived to strengthen the management capacity and, as a consequence, the ecosystem integrity at each of the sites in the network, which will help to maintain the ecological connections between the sites.

In June 2015, United States and Mexico protected area managers met together in Merída, Mexico to create a work plan for cooperation linking the Flower Garden Banks and Florida Keys National Marine Sanctuaries with seven protected areas in Mexico: Yum-Balam Flora and Fauna Protected Area, Whale Shark Biosphere Reserve, Isla Contoy National Park, Isla Mujeres, Punta Cancún and Punta Nizuc National Park, Arrecife Alacranes National Park, Veracruz National Park, and Lobos-Tuxpan Flora and Fauna Protected Area. This successful meeting established areas of mutual interest and need, as well as personal working relationships between managers from some of the most ecologically significant places in the Gulf.

[16] NOAA OCEAN EXPLORATION & RESEARCH, LESSONS FROM THE DEEP: EXPLORING THE GULF OF MEXICO'S DEEP-SEA ECOSYSTEMS EDUCATION MATERIALS COLLECTION (2009), http://oceanexplorer.noaa.gov/edu/guide/gomdse_edguide.pdf (last visited June 6, 2018).

The "Sister Sanctuary" Network in the Gulf of Mexico.[17]

This relationship between the United States and Mexico, and engagements facilitated by the 3NI, provide a basis for cooperation between nations through marine protected area management. The U.S. government used this potential for cooperation when it opened the door to improving relations and official engagements with Cuba in 2014. Marine Protected Area (MPA) cooperation was the basis for one of the first official meetings between the United States and Cuba in early 2015. Then, in November 2015, NOAA, the U.S. National Park Service, and Cuba's Ministry of Science, Technology, and Environment came together in Havana to sign a Memorandum of Understanding on MPA cooperation,[18] which includes sister sanctuary relationships between Cuba's Guanahacabibes National Park and Florida Keys National Marine Sanctuary, and between Cuba's Banco de San Antonio and Flower Garden Banks National Marine Sanctuary. This reestablishment of relations between Cuba and the United States through MPAs is fitting, since the fifty years of politics that have separated the two countries is

[17] Map created by the author.
[18] *U.S. and Cuba to Cooperate on Conservation and Management of Marine Protected Areas*, NAT'L OCEANIC AND ATMOSPHERIC ADMIN., http://www.noaanews.noaa.gov/stories2015/111815-us-and-cuba-to-cooperate-on-conservation-and-management-of-marine-protected-areas.html (last visited on June 6, 2018).

overshadowed by the 500 years of social and economic history that has connected Cuba and Mexico to the United States through the Gulf.

An example of these historical connections is an exciting discovery made on the deep sea floor south of the Flower Garden Banks- an early 19th century shipwreck full of arms, trade goods, and artifacts of life on the sea[19] that shows how the Gulf has been the conduit for cultures and commerce for a long time. Archeologists and biologists have worked closely together to document how the Gulf's biology has interacted with this shipwreck. It and two more nearby shipwrecks have artifacts that link them to Mexico and possibly Cuba. The ships are thought to have been a privateer and its two captures, all sunk in a storm. Studying the shipwrecks demonstrates how collaborative interdisciplinary and international study of the Gulf can reveal much about the history of the relationships between the three countries and how to design those relationships in the future.

The Gulf unites rather than separates Mexico, Cuba, and the United States. The Gulf's abundance of life moves freely across international borders and the connections that bind its ecosystem together link key places and species in the three countries. The marine protected areas in Mexico, Cuba, and the United States are the reference points for how distant parts of the Gulf are interconnected, and for the strategies to protect them. Already, plans are in place for joint science missions and for implementing common habitat mapping procedures and condition reports for the sister sites. These collaborative efforts, and the ecological interconnections between the sites they are characterizing, bridge the political boundaries that occur between the nations that surround the Gulf. These bridges of joint stewardship of natural resources will be critical to realizing the full benefits of the Gulf of Mexico.

[19] Lauren Hilgers, *All Hands on Deck: Inviting the World to Explore a Shipwreck Deep in the Gulf of Mexico*, ARCHAEOLOGY (2014), http://www.archaeology.org/issues/124-1403/features/1811-gulf-of-mexico-monterrey-shipwreck (last visited on June 6, 2018).

MANAGING AREAS BEYOND NATIONAL JURISDICTION IN THE GULF OF MEXICO: CURRENT AND DEVELOPING INTERNATIONAL LEGAL AUTHORITY AND FUTURE CHALLENGES

Richard J. McLaughlin[1] and Kateryna M. Wowk[2]

I. INTRODUCTION

The Gulf of Mexico (GOM) is the ninth largest body of water in the world with a shoreline that stretches 3,540 miles along the nations of the United States, Mexico, and Cuba.[3] It possesses extraordinary natural resources, ecological complexity, and cultural richness. A number of key economic sectors in all three nations are concentrated in the GOM including offshore energy, refining, commercial and recreational fishing, marine transportation, and tourism. Much of this economic activity is dependent on or related to the unique mix of natural resources located in the Gulf and its position at the crossroads of international maritime commerce.

Ocean currents are an important feature of the GOM, transporting marine organisms, nutrients, and pollutants across the entire Gulf and affecting weather patterns. These currents are complex, but generally enter the GOM through the Yucatan Strait and exit through the Florida Strait. This is known as the Loop Current, which eventually becomes the famous Gulf Stream of the Atlantic Ocean. Smaller currents, termed eddies, are separate from the Loop Current and are regionally important.[4] Important marine habitat features like hard and soft banks, coral reefs, and even man-made structures such as oil and gas platforms and associated infrastructure create biological connectivity within the GOM and

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[3] *See, e.g.*, *EPA's Work in the Gulf of Mexico*, EPA, https://www.epa.gov/gulfofmexico (last visited June 29, 2018). The Gulf of Mexico borders five U.S. states to the north, Mexico's eastern shoreline and the Yucatan Peninsula to the south, and to the east, it is bordered by the island of Cuba.

[4] Harriet L. Nash & Richard J. McLaughlin, *Opportunities for Trinational Governance of Ecologically Connected Habitat Sites in the Gulf of Mexico*, 4 KOREAN MAR. INST. INT'L J. MAR. AFF. & FISHERIES 1, 7-8, (2012).

Wider-Caribbean Region.[5] The interchange between currents and a whole host of natural and physical processes are essential to the overall health of the GOM as well as human populations that gain beneficial uses from it.

Hydrocarbon development is a predominant activity in the GOM. More than 3,500 structures and 33,000 miles of offshore pipelines make the GOM the most extensively developed offshore production area in the world.[6] While much of this commercial production has historically taken place in the shallower parts of the GOM, discoveries of hydrocarbon resources in ultra-deep waters (below 5,000 feet depth) is accelerating rapidly.[7] These discoveries are moving the energy industry, its associated infrastructure and potential for environmental degradation, into the deepest parts of the GOM near the maritime boundaries with Mexico and Cuba. This offshore hydrocarbon activity will likely intensify in the coming decade as a result of significant energy reforms in Mexico, which opened vast offshore oil and gas reserves that had been closed to foreign investment for over 75 years.[8] Many other activities such as commercial and recreational fishing, maritime navigation, laying of underwater cables and pipelines, and marine scientific research also are taking place, with greater frequency, in even the most remote portions of the GOM.

The two most remote areas in the GOM are the areas of high seas that fall beyond the sovereignty of any of the three nations that surround the Gulf. The first is known as the Western Gap, which is slightly smaller in size than the State of New Jersey. It is located approximately halfway between the Yucatan Peninsula and the coast of Texas. The northern portion contains the edge of the U.S. continental shelf known as the Sigsbee Escarpment. Seaward of this

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[5] *Id*. *See also* R.K. COWEN, *Oceanographic Influences on Larval Dispersion and Retention and Their Consequences for Population Connectivity*, *in* CORAL REEF FISHES: DYNAMICS AND DIVERSITY IN A COMPLEX ECOSYSTEM 149 (P.F. Sale ed., 2002) (for the theory that there can be genetic connectivity based on "temporal stepping stones" over a large spatial scale or "geographic stepping stones" over a long temporal scale).

[6] Mark J. Kaiser, *The Louisiana Artificial Reef Program*, 30 MARINE POL'Y 605, 605 (2006).

[7] Geologic studies have shown that the deepwater (greater than 1,000 feet depth) and ultra-deepwater (greater than 5,000 feet depth) portions of the GOM contain huge quantities of hydrocarbons estimated as high as 50 billion barrels of crude oil equivalent (BOE). John C. Roper, *Deep Seas Hold Key to Oil's Future*, HOUSTON CHRONICLE, May 1, 2005, http://www.chron.com/business/energy/article/Deep-seas-hold-the-key-to-oil-s-future-1498393.php (last visited June 29, 2018).

[8] *See* Diana Villiers Negroponte, *Mexico's Energy Reforms Become Law*, BROOKINGS INST., Aug. 14, 2014, http://www.brookings.edu/research/articles/2014/08/14-mexico-energy-law-negroponte (last visited June 29, 2018).

escarpment, the bathymetry drops precipitously to the deep seabed of the Sigsbee Abyssal Plain, which has a water depth of between 3,000-4,000 meters.[9] Geological surveys suggest that many portions of the Western Gap region are favorable for commercial quantities of oil and gas resources.[10] The potential future hydrocarbon development area is co-located with highly productive deep-water chemosynthetic communities[11] and globally important spawning habitat for migratory species such as Western Atlantic Bluefin Tuna,[12] among other environmentally sensitive attributes. The United States and Mexico delimited the maritime boundary in the Western Gap by treaty in 2000.[13]

The second remote area, known as the Eastern Gap, is slightly larger than the Western Gap.[14] Historical political tensions between the United States and Cuba have delayed negotiations on demarcating the boundaries of the Eastern Gap. As part of the Obama Administration's opening of relations with Cuba, on January 18, 2017, the two nations signed a bilateral treaty to delimit their maritime boundary in the Eastern Gap.[15] However, the treaty has not been ratified by the U.S. Senate, and its precise legal status is currently unclear. This area falls within the Florida Abyssal Plain and has a fairly uniform depth of over 3,000 meters.[16] The loop current is a dominant feature in this portion of the GOM and its surface, sub-surface circulation and the behavior of eddy-shedding events has been, and continues to be studied.[17] In contrast, the Eastern Gap's hydrocarbon potential and environmental characteristics seem to be less well understood (see Figure 1 for a map of the areas).

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[9] Jia Y. Liu & William R. Bryant, *Seafloor Relief of Northern Gulf of Mexico Deep Water*, TAMU-Sea Grant-00-603 (2000).
[10] R.Q. Foote et al., *Oil and Gas Potential of the Maritime Boundary Region in the Central Gulf of Mexico*, 67 AM. ASS'N OF PETROLEUM GEOLOGISTS BULL. 1047, 1063 (1983).
[11] H. Roberts et al., *Alvin Explores the Deep Northern Gulf of Mexico Slope*, 88 EOS 341-342, (2007).
[12] *See infra* notes 92-98 and accompanying text.
[13] S*ee infra* note 78 and accompanying text.
[14] The Western Gap is approximately 17,467 sq. km (6,744 sq. mi) and the Eastern Gap is approximately 20,000 sq. km (7,720 sq. mi). *See* Javier H. Estrada, *Reservoirs That Cross Country Lines Need Special Agreements*, OFFSHORE (2009), http://www.offshore-mag.com/articles/print/volume-69/issue-7/latin-america/reservoirs-that-cross.html (last visited June 29, 2018).
[15] *See United States and Cuba Sign Maritime Boundary Treaty*, U.S. DEP'T OF STATE, https://2009-2017.state.gov/r/pa/prs/ps/2017/01/267117.htm (last visited June 29, 2018).
[16] *Gulf of Mexico Data Atlas*, NAT'L OCEANIC AND ATMOSPHERIC ADMIN., http://www.ncddc.noaa.gov/website/DataAtlas/atlas.htm (last visited June 29, 2018).
[17] Alexis Lugo-Fernández & Rebecca E. Green, *Mapping the Intricacies of the Gulf of Mexico's Circulation*, 92 EOS 21-22 (2011).

Globally, areas beyond national jurisdiction (ABNJ), such as the Western and Eastern Gaps, constitute about 60% of the ocean. Yet these areas fall within an uncertain and confused legal and policy regime. Unlike areas that are located within a single nation's jurisdiction, areas like the Western and Eastern Gaps have a hybrid quality in which the legal rules change depending on the kind of use that occurs there. Before looking at these unique legal rules and how they may apply to ABNJ in the GOM, it will be useful to examine, more generally, the international laws and policies that govern the ocean and environmental protection, as well as how the "principles of good neighborliness," as customary international law, are meant to protect the global commons against degradation and transboundary harm.

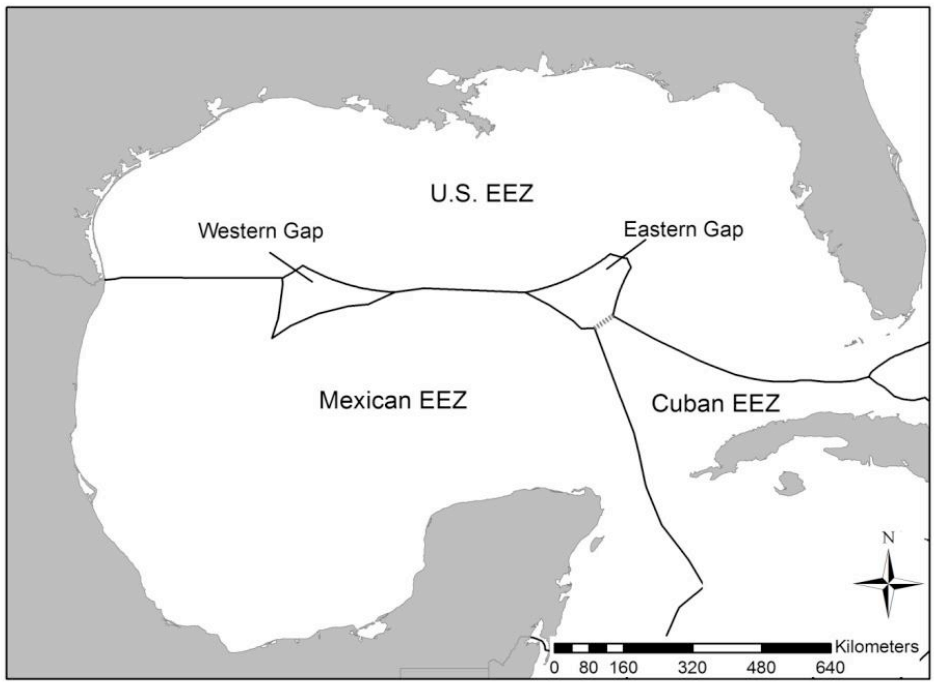

Figure 1: Map of Gulf of Mexico Areas Beyond National Jurisdiction[18]

[18] *Note*: The boundary between Cuba's EEZ and the Eastern Gap has not yet been agreed upon formally. Map adapted from Harriet L. Nash & Richard J. McLaughlin, *A Policy Approach to Establish an International Network of Marine Protected Areas in the Gulf of Mexico Region*, 6 AUSTL. J. MAR. & OCEAN AFF. 1 (2014).

II. THE UNITED NATIONS CONVENTION ON THE LAW OF THE SEA UNDERLIES ALL OCEAN ACTIVITIES

The conduct of ocean activities and their associated impacts are guided and controlled by a broad set of domestic and international laws and regulations. A nation's territorial sovereignty is not restricted to its land mass and internal waters. It also has varying degrees of legal authority over adjacent offshore areas including its 12-mile territorial sea, 24-mile contiguous sea, 200-mile Exclusive Economic Zone (EEZ), and extended continental shelf.[19]

The 1982 United Nations Convention on the Law of the Sea (UNCLOS) is the most important multilateral treaty that establishes the rights and obligations of coastal nations over the maritime zones adjacent to their coasts.[20] UNCLOS creates a series of maritime juridical zones extending from shore into the deep ocean. Entering into force in November of 1994, this treaty has been ratified by 168 parties and signed by an additional fourteen nations. Those nations that have not ratified the agreement, including the United States, have expressed the view that many of its provisions are binding as a statement of customary international law.[21]

UNCLOS provides expansive legal authority to coastal nations in ocean areas close to their coastlines and less legal authority farther out into the deepest parts of the ocean.[22] Closest to shore is the maritime legal zone known as the 12-mile territorial sea. In this zone, coastal nations are entitled to exercise "complete" and exclusive sovereignty, similar to what can be exercised on land, extending to the air space over it as well as the seabed.[23] Foreign nations have a right of

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[19] For a good overview of the international law of the sea, *see* YOSHIFUMI TANAKA, THE INTERNATIONAL LAW OF THE SEA (Cambridge Univ. Press, 2012); *see also* L. Sohn et al., THE LAW OF THE SEA IN A NUTSHELL (West Acad., 2d ed. 2010).

[20] United Nations Convention on the Law of the Sea, Dec. 10, 1982, 21 I.L.M. 1261 [hereinafter UNCLOS].

[21] *Chronological lists of ratifications of, accessions and successions to the Convention and the related Agreements*, UNITED NATIONS DIVISION FOR OCEAN AFFAIRS AND THE LAW OF THE SEA http://www.un.org/depts/los/reference_files/chronological_lists_of_ratifications.htm [hereinafter NDOALOS] (last visited July 2, 2018). For a discussion of the U.S. position on UNCLOS, see infra notes 70-73 and accompanying text.

[22] *See generally* G.J. Garcia Sanchez & R.J. McLaughlin, *The 2012 Agreement on the Exploitation of Transboundary Hydrocarbon Resources in the Gulf of Mexico: Confirmation of the Rule of Emergence of a New Practice?*, 36 HOUSTON J. INT'L L. 681, 697-699 (2005).

[23] UNCLOS, *supra* note 20, at arts. 2-3.

innocent passage of vessels in the territorial sea, but otherwise coastal nations have complete sovereignty in this zone.[24]

Seaward of the territorial sea is a maritime legal zone known as the contiguous zone that is located twelve to twenty-four miles from shore. This zone is also subject to the right of innocent passage of vessels, and is intended to provide coastal nations with more limited prescriptive authority over customs, fiscal, immigration, and sanitation matters only.[25]

Seaward to 200 nautical miles is the EEZ, which provides coastal nations with the sovereign rights to explore and develop, conserve and manage all natural resources, whether living or non-living, found in the waters, on the ocean floor, and in the subsoil.[26] As long as there is no direct effect on natural resources, foreign ships and aircraft have the same rights of free navigation in the EEZ as they would have in and above the high seas.[27]

The final juridical zone is the extended continental shelf. Within the 200-mile EEZ, the continental shelf is subsumed by the sovereign rights over natural resources provided in the EEZ. However, in cases where the continental shelf extends further than 200 miles, nations have the authority to claim jurisdiction up to 350 miles from the baseline or 100 miles from the 2,500-meter isobaths, depending on certain criteria such as distance from the foot of the continental slope or the thickness of the sedimentary rock.[28] On the extended continental shelf, coastal nations are entitled to exercise exclusive jurisdiction "for the purpose of exploring [the shelf] and exploiting its natural resources."[29] Importantly, and in distinction to areas within the 200-mile EEZ, the natural resources that may be exploited are limited to:

> …mineral and other non-living resources of the sea-bed and subsoil together with living organisms belonging to sedentary species, that is to say, organisms which, at the harvestable stage, either are immobile on or under the sea-bed or are unable to move

[24] *Id*. at arts. 17, 19.
[25] *Id*. at art. 33.
[26] *Id*. at art. 56.
[27] *Id*. at arts. 58, 87.
[28] *Id*. at art. 76(4)-(5).
[29] *Id*. at art. 77(1).

> except in constant physical contact with the sea-bed or the subsoil.[30]

Consequently, activities such as fishing, most types of marine scientific research, and navigation that take place in the water column above the extended continental shelf may not be restricted by the coastal nation. Nations that claim an extended continental shelf must contribute a percentage of the revenue derived from the exploitation of mineral resources in the area beyond 200 miles to the International Seabed Authority.[31]

Areas that lie beyond the 200-mile EEZ and extended continental shelf are part of the high seas, also known as the ABNJ.[32] All mineral resources, including hydrocarbons, located in high seas areas fall within the "common heritage of mankind" and are vested in mankind as a whole.[33] Freedom of navigation, fishing, scientific research, and other high seas freedoms apply in these areas.[34]

III. THE INTERNATIONAL LEGAL FRAMEWORK FOR ENVIRONMENTAL PROTECTION IN AREAS BEYOND NATIONAL JURISDICTION

For much of its history, the law of the sea has focused on uses of the ocean rather than its stewardship and protection.[35] Customary international law provides some relatively general rules regarding environmental protection in maritime areas, while more specific laws and policies are contained in regional and global treaties and agreements. The rights and obligations imposed depend to a great extent on which maritime areas are involved. For example, customary international law provides the general rule that no State has the right to use or permit the use of its territory in such a manner as to cause injury in or to the territory of another State. This is a key tenant of the "principles of good neighborliness and the duty to cooperate" (referred to below as "the principles"), which hold that international law does not allow States to conduct or permit activities within their territories, or in common spaces (including ABNJ), without regard for the rights of other states or for the protection of the environment. The principles include that:

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[30] *Id*. at art. 77(4).
[31] *Id*. at art. 82.
[32] *Id*. at art. 86.
[33] *Id*. at arts. 136, 137.
[34] *Id*. at art. 87.
[35] TANAKA, *supra* note 19, at 260.

- States have a duty to prevent, reduce, and control pollution and environmental harm;

- States have a duty to cooperate in mitigating environmental risks and emergencies, through notification, consultation, negotiation, and in appropriate cases, environmental impact assessment.[36]

These principles imply that States have an obligation to ensure their activities do not have negative effects on the rights of other States, including the right to a clean environment. The emergence of these principles evolved over the last century, most encouraged at first by the creation of the League of Nations in 1919, the purpose of which was "to promote international co-operation and to achieve international peace and security".[37] With the dissolution of the League and the evolution of international law following World War II, these concepts were formalized as general principles in the international arena. This is significant, as a general principle may serve as a stopgap in international law because an international judge can deduce an apropos rule that has evolved in national legal systems when deciding a case. The Permanent Court of International Justice and the International Court of Justice (ICJ) have affirmed this source of law as both established and pragmatic.[38]

A. Hard Law Sources

The principles of good neighborliness and the duty to cooperate have predominantly evolved through mores or customs in international law, but may also be found in so-called hard-law documents, such as treaties and judicial decisions.

i. Judicial Decisions

The most often cited international case demonstrating the principles is the Trail Smelter dispute.[39] The arbitration arose from claims involving transfrontier air pollution by a smelter factory located in Trail, Province of British Columbia. Extreme amounts of air pollution from the factory were causing damage to

[36] P. BIRNIE & A. BOYLE, INTERNATIONAL LAW & THE ENVIRONMENT (2d ed. 2002).
[37] G.V. GLAHN, LAW AMONG NATIONS: AN INTRODUCTION TO PUBLIC INTERNATIONAL LAW 63 (1996).
[38] *Id.* at 508
[39] Trail Smelter Case (U.S. v. Can.), 3 R.I.A.A 1905 (1939, 1941), http://legal.un.org/riaa/cases/vol_III/1905-1982.pdf (last visited July 2, 2018).

privately owned agricultural and forest lands in Washington State. In 1938, the Arbitral Tribunal found that under the principles of international law, as well as the law of the United States, no State has the right to use or permit the use of its territory in such a manner as to cause injury by fumes in or to the territory, properties, or persons of another, when the case is of serious consequence and the injury is established by clear and convincing evidence. The United States was awarded $78,000 in compensation for damage that the Trail Smelter had done to the State of Washington from 1932 to 1937.[40]

More recently, the ICJ reasserted the principles in the *Advisory Opinion Concerning Legality of the Threat or Use of Nuclear Weapons* of 1996, which acknowledged "the general obligation of States to ensure that activities within their jurisdiction and control respect the environment of other States or of areas beyond national control."[41] However, it is important to point out that while the general parameters of the principles are well established, their application is not always useful. In both judicial decisions the principles applied only *after* damage was caused to another State's territory, but did not obligate the taking of preventative measures.[42] Additionally, although the principles may be used to impose liability between nations, it is unclear whether they may be used to find liability for environmental damage to ABNJ.[43]

ii. International Organizations

The principles further evolved in 1945 with the creation of the United Nations. Article 1.3 in the Charter of the United Nations (Purposes of the United Nations) holds that an objective of the organization is to achieve international cooperation in solving international problems.[44] Though not a primary objective at the time of its inception, the mitigation of transboundary environmental problems, as well as the degradation of the global commons, would take on greater importance in the decades to come.

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[40] WILLIAM SLOMANSON, FUNDAMENTAL PERSPECTIVES ON INTERNATIONAL LAW 596 (2002).
[41] Legality of the Threat or Use of Nuclear Weapons, Advisory Opinion, 1996 I.C.J. 226, at 241-242, ¶ 29 (July 8).
[42] TANAKA, *supra* note 19, at 260-261.
[43] *Id*.
[44] U.N Charter art. 1.3.

iii. International Law Commission

The "duty to cooperate" regarding transboundary injury also surfaced within the International Law Commission (ILC, formalized in 1947). In 1978, it was found that States had Liability for Injurious Consequences of Acts not Prohibited by International Law.[45] However, it was not until 1996 that a set of twenty-two draft articles and commentary were proposed by a Commission Working Group, for the first time allowing a more realistic view of the law. There were three elements contained in this draft: prevention; cooperation; and strict liability for damage. Of note, the Commission decided to divide the topic into two parts to deal with prevention and liability separately, and in the end liability proved too controversial to agree upon set terms.[46] The text was adopted by the ILC in 2001 and recommended to the United Nations General Assembly (UNGA) to form the basis of a convention. Though the elaboration of a fully-fledged convention is still pending, States are encouraged to continue to be guided by the articles, which provide that "[h]arm is 'significant' if it is 'more than detectable', but it need not be 'serious' or 'substantial'; what is significant depends on the circumstances and may vary over time."[47] Further, the articles are concerned with preventing or minimizing the occurrence of transboundary harm, but are not exclusively environmental. For example, they incorporate exploding nuclear power plants. The articles also provide:

- All appropriate measures must be taken to prevent or minimize the risk of transboundary harm and to minimize its effects;
- States must cooperate to this end;
- No such activity may be undertaken without prior impact assessment and authorization by the State in which it is to be conducted;
- States likely to be affected must be notified and consulted with a view to agreeing measures to minimize or prevent the risk of harm.[48]

[45] SLOMANSON, *supra* note 40.
[46] BIRNIE & BOYLE, *supra* note 36.
[47] *Id*.
[48] *Id*.

iv. Bilateral Treaties

The principles have been further adopted through bilateral agreements. For example, on July 16, 2001 the People's Republic of China and the Russian Federation adopted a Treaty of Good-Neighborliness and Friendly Cooperation Between. Article 19 of this treaty states that "the contracting parties shall carry out cooperation in the protection and improvement of the environment, prevention of cross-border pollution…make joint efforts in protecting rare floras, faunas and the natural ecosystem, and conduct cooperation in preventing the outbreak of major accidents arising from natural disasters or due to technical reasons and eliminating their after-effects."[49] Implicit in these terms is the idea that neither party shall allow its activities to bring harm to the environment of the other's. Each has a duty to prevent or minimize the risk of transboundary harm and to minimize its effects.

v. Multilateral Treaties

Perhaps the most influential treaty pertaining to cooperation to protect against transboundary harm, as well as for the conservation of the global commons, is UNCLOS,[50] which provided new universal legal controls for the management of marine natural resources and the control of pollution. Article 150 provides that activities on the seabed and ocean floor beyond the limits of national jurisdiction should promote international cooperation for the over-all development of all countries.[51] While recognizing that States have the sovereign right to exploit their natural resources, Article 194(2) addresses transboundary harm, including that:

> States shall take all measures necessary to ensure that activities under their jurisdiction or control are so conducted as not to cause damage by pollution to other States and their environment, and that pollution arising from incidents or activities under their jurisdiction

[49] Treaty of Good-Neighborliness and Friendly Cooperation, China-Russia, July 16, 2001, http://www.fmprc.gov.cn/mfa_eng/wjdt_665385/2649_665393/t15771.shtml (last visited July 2, 2018).
[50] For a more detailed discussion of relevant provisions, see supra notes 19-34 and accompanying text.
[51] R.R. CHURCHILL & A.V. LOWE, THE LAW OF THE SEA (3d. ed. 1999).

> or control does not spread beyond the areas where they exercise sovereign rights.[52]

UNCLOS also requires States promote international cooperation for activities beyond the limits of national jurisdiction.

B. Soft Law Sources

i. United Nations Conference on the Human Environment, 1972

The first major UN Conference on the environment occurred in Stockholm in 1972. The resulting product contains twenty-six principles, calling on States and international organizations to "play a co-ordinated, efficient and dynamic role for the protection and improvement of the environment."[53] Key provisions found within Principles 21 and 22 contain the principles of prevention from transboundary harm and the duty to cooperate:

- Principle 21: States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction.

- Principle 22: States shall cooperate to develop further the international law regarding liability and compensation for the victims of pollution and other environmental damage caused by activities within the jurisdiction or control of such States to areas beyond their jurisdiction.[54]

These principles further the idea that nations have a general duty not to permit any use of their territory, or areas in their control (e.g., vessels flying their flag on the high seas), that harms another State's interests. While only a set of principles (i.e., non-binding), Principle 21 has been applied in subsequent law-

[52] *Id*.
[53] SLOMANSON, *supra* note 40.
[54] *Id.*

making, recognizing the duty of States to take suitable preventive measures to protect the environment.

ii. Earth Summit, 1992

In 1992, nearly 180 States gathered in Rio de Janeiro, Brazil, for the second UN Conference on Environment and Development (the Earth Summit). The fundamental idea that emerged from this conference was that a State may be held liable for its conduct or omission that is a "transboundary environmental interference."[55] The resulting Rio Declaration on Environment and Development included among its twenty-seven principles Principle 2, which comments on the general duty of a State not to knowingly permit any use of its territory, or of common spaces, that harms another State's interests. While differentiating between the responsibilities of developed and other countries, Principle 7 provides that "States shall cooperate in a spirit of global partnership to conserve, protect and restore the health and integrity of the Earth's ecosystem."[56] Furthering this concept, Principle 18 requires States to notify emergencies likely to affect the environment of other States, and Principle 19 requires prior notification and consultation in good faith before undertaking activities that may have significant adverse transboundary environmental effects.[57]

The Rio Declaration, while approved by the governments present at the conference, is nonetheless a soft-law document, i.e., a non-binding treaty. However, the principles contained therein have furthered the evolution of "good neighborliness" as a general principle. Principle 2 also has been influential in the development of international law, found in both the 1993 Nuuk Declaration of Environment and Development in the Arctic and the 1994 Convention to Combat Desertification.[58]

The Earth Summit further produced a Framework Convention on Climate Change, which entered into force in March 1994. Portions of this framework echo the Stockholm principles, specifically, the preamble, which acknowledges that:

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[55] M.K. TOLBA, GLOBAL ENVIRONMENTAL DIPLOMACY: NEGOTIATING ENVIRONMENTAL AGREEMENTS FOR THE WORLD, 1973-1992 (1998).
[56] SLOMANSON, *supra* note 40.
[57] BIRNIE & BOYLE, *supra* note 36.
[58] UNITED NATIONS ENVIRONMENTAL PROGRAMME, GLOBAL ENVIRONMENTAL OUTLOOK 3 (2002), https://wedocs.unep.org/bitstream/handle/20.500.11822/8609/GEO-3%20REPORT_English.pdf?sequence=7&isAllowed=y (last visited July 2, 2018).

> States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental and developmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction…[59]

IV. CRITIQUE AND APPLICATION TO AREAS BEYOND NATIONAL JURISDICTION

The "principles of good neighborliness" are not always adhered to, and transboundary harm will continue to provoke international disputes. Most States may agree, in principle, that they have a duty to prevent, reduce, and control pollution and environmental harm. Yet, States are often unwilling to alter practices they view as necessary for their advancement, and are even less willing to be held accountable.[60]

Under this concept, a State cannot cause transboundary environmental harm to its neighbors or in areas of the global commons, including ABNJ. If a State is found to have caused such harm that State may be held liable, and thus States must be aware of the consequences of their actions. The principles of good neighborliness found in hard and soft law provide incentives for States to enter into agreements protecting the environment, serving as a means for compensation for inequitable acts of cross-border pollution. The principles also act as a deterrent from initially producing environmental harm.

However, the principles are seen as weakening States' national authority and their ability to act freely to determine their own economic development. In developing nations, many of which lack capacity to implement environmental controls, this can have serious consequences. Implementing these measures may have a serious effect on the standard of living of the peoples of those States, as protecting against transboundary harm takes great financial resources, arguably taking resources away from citizen welfare. International assistance mechanisms

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[59] United Nations Framework Convention on Climate Change, May 9, 1992, https://unfccc.int/sites/default/files/conveng.pdf (last visited July 2, 2018).
[60] In order for the ICJ to hold jurisdiction, States involved in a dispute must first consent to being sued in the international tribunal. *See* SLOMANSON, *supra* note 40.
[60] *Id*.

need strengthening to ensure development proceeds in these nations without serious consequences to the environment.

Further, the methods for finding liability under these principles are not secure. In order for the ICJ or other international tribunals to gain jurisdiction, States involved in a dispute must first consent to being sued in the international tribunal. States are largely unwilling to submit to this type of scrutiny. Also, many developing nations cannot afford formal arbitration or adjudication proceedings. Smaller States' access to formal dispute settlement fora also is not a priority of larger states, creating a discrepancy as to which cases of transboundary harm are arbitrated and equitably corrected.

There also is a question as to how far these principles reach. If there is a certain duty to cooperate in mitigating transboundary harm, can this concept be applied to the effects of climate change? Should the developed nations of the world be held accountable for the warming of the planet?

Application of the principles to ABNJ is obscure, the complexity of which may be illustrated through a hypothetical. Consider that a nation abutting ABNJ causes harm to an undemarcated zone, like the Eastern Gap in the Gulf, for example, through an oil spill. To whom is that adjacent nation liable? Are penalties due to the International Seabed Authority or also to those States that abut the Gap and risk harm to their national territories? The precedent is not clear. But the answer is also not clear for demarcated areas, as demarcation does not give any nation sovereign rights to all the resources therein.

V. MARINE BIODIVERSITY IN AREAS BEYOND NATIONAL JURISDICTION

Living marine resources in ABNJ are of significant importance to global, regional, and national economies, including the fishing industry, which is a source of livelihood for 10-12% of the global population.[61] Also, high seas biodiversity plays an important role in the functioning of marine ecosystems and may offer significant opportunities for scientific discovery and development of products, as organisms found in these isolated ecosystems have evolved under extreme conditions and have unique, potentially valuable properties.

[61] FOOD AND AGRIC. ORG. OF THE UNITED NATIONS, THE STATE OF WORLD FISHERIES AND AQUACULTURE 6 (2014), http://www.fao.org/3/a-i3720e.pdf (last visited July 2, 2018).

Much of ABNJ is thought to hold a high level of biodiversity at their depths. In particular, seamounts, hydrothermal vents and natural oil seeps, are recognized as areas with significant biodiversity, with untold value for medicine, pharmaceuticals and bioprospecting. In fact, evidence is mounting that marine invertebrates produce more substances for antibiotic, anti-cancer and anti-inflammatory purposes than terrestrial organisms.[62] These areas are also hotspots for commercially important pelagic fish such as tuna schools.[63] Even in ABNJ where such features may not exist, other marine genetic resources (MGRs) may be present, again with high potential value for bioprospecting.

It is important to recognize that governing bodies do exist for specific issues in ABNJ. Numerous international bodies, such as the International Maritime Organization (IMO) and a number of regional fisheries management organizations (RFMOs), have a role in high seas management, e.g., RFMOs for highly migratory species, the IMO for pollution and dumping by ships on the high seas, and even Regional Seas Programmes coordinated under the United Nations Environment Programme (UNEP) to address regionally specific challenges. More targeted progress also has been made in recent years, including in the Convention on Biological Diversity Conference of Parties IX/20 Decision.[64] Annex I of that decision addresses establishing scientific criteria for ABNJ areas,[65] while Annex II gives guidance for choosing marine protected areas.[66] Separately, the Food and Agriculture Organization (FAO) International Guidelines for the Management of Deep-Sea Fisheries in the High Seas provides criteria to identify Vulnerable Marine Ecosystems (VMEs) and to identify what constitutes "significant adverse impact."[67] However, a more comprehensive management regime for biodiversity beyond national jurisdiction (referred to as BBNJ) is still lacking.

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[62] *Do Medicines Come from the Sea?*, NAT'L OCEANIC AND ATMOSPHERIC ADMIN. OCEAN EXPLORER, http://oceanexplorer.noaa.gov/facts/medicinesfromsea.html (last visited July 2, 2018); *See also* Richard. J. McLaughlin, *Foreign Access to Shared Marine Genetic Materials: Management Options for a Quasi-Fugacious Resource*, 34 OCEAN DEV. & INT'L L. 297, 301-303 (2003).

[63] L. Dubroca et al., *Seamounts and Tuna Fisheries: Tuna Hotspots or Fishermen Habits?* 69 COLLECT 2087 (2013).

[64] United Nations Convention on Biological Diversity, Conference of the Parties, 1998 9 Decision IX /20 (May 19-30), https://www.cbd.int/decision/cop/?id=11663 (last visited July 2, 2018).

[65] *Id.* at Annex I.

[66] *Id.* at Annex II.

[67] FOOD AND AGRIC. ORG. OF THE UNITED NATIONS, INTERNATIONAL GUIDELINES FOR THE MANAGEMENT OF DEEP-SEA FISHERIES IN THE HIGH SEAS (2009), http://www.fao.org/in-action/globefish/publications/details-publication/en/c/346096/ (last visited July 2, 2018).

VI. DEVELOPING A LEGAL INSTRUMENT FOR BIODIVERSITY BEYOND NATIONAL JURISDICTION

An ad hoc open-ended informal working group to study issues relating to BBNJ conservation and sustainable use was established by the United Nations. It called upon states and international organizations to take action urgently to address, in accordance with international law, destructive practices that have adverse impacts on marine biodiversity and ecosystems in ABNJ. The Working Group met between 2006 and 2015.[68] Ultimately, in resolution 69/292, the UNGA decided to develop an international legally binding instrument (ILBI) under UNCLOS on BBNJ conservation and sustainable use, establishing a Preparatory Committee to present a draft text of the ILBI to the UNGA by 2017. Significantly, the UNGA decided at its 72nd session to convene an intergovernmental conference to refine and finalize the text of an agreement.[69] In resolution 72/249, the UNGA established an intergovernmental conference to negotiate the new treaty for BBNJ through a series of negotiating sessions, the first of which will occur in September 2018. Negotiations will continue through the first half of 2020, as governments explore and negotiate legally binding text on the range of options and detailed proposals for the conservation and sustainable use of marine biological diversity of ABNJ.

This undertaking is not without controversy. For example, regarding oil pollution, preparatory work has included text on the polluter pays principle, requirements for rehabilitation and a contingency fund, as well as provisions on state liability. Whether and how these elements make it into a final implementing agreement, however, remains to be seen.[70] Perhaps more significantly, after the decades of negotiations to establish UNCLOS, some parties view this new process as potentially opening up issues that have been addressed through UNCLOS or its two implementing agreements developed to specify requirements on fishing and

[68] U.N. Secretary-General, Letter dated Feb. 13, 2005 from the Co-Chairs of the Ad Hoc Open-ended Informal Working Group to the President of the General Assembly, U.N. Doc. A/69/780 (Mar. 10, 2015), http://www.un.org/ga/search/view_doc.asp?symbol=A/69/780 (last visited July 2, 2018).

[69] Chair of the Preparatory Committee Established by General Assembly Resolution 69/292, *Chair's Overview of the First Session of the Preparatory Committee* (2016), http://www.un.org/depts/los/biodiversity/prepcom_files/PrepCom_1_Chair's_Overview.pdf (last visited July 2, 2018).

[70] Chair of the Preparatory Committee Established by General Assembly Resolution 69/292, *Chair's Streamlined Non-paper on Elements of a Draft Text* (2017), http://www.un.org/depts/los/biodiversity/prepcom_files/Chairs_streamlined_non-paper_to_delegations.pdf (last visited July 2, 2018).

on seabed mining, but which were finalized over twenty years ago.[71] Others, including the United States, have argued that a new international regime may inhibit research that could provide valuable benefits.[72] Notably, opening up UNCLOS through an implementing agreement to address BBNJ also could further exacerbate getting the treaty ratified in the United States and elsewhere (many reports note that it was Part XI that ultimately sunk U.S. ratification, pointing to the fact that the United States accepted all but Part XI of the Convention as customary international law.)[73]

Moving forward, the most challenging issues are likely to be threefold: understanding how a new ILBI adds to, but does not undermine, existing agreements, as well as the roles of existing regional bodies in a new agreement; understanding and harmonizing the use of area-based management tools, including MPAs as well as the use of criteria on ecologically or significant marine areas and VMEs; and, perhaps the most divisive issue, addressing the divergence of views on MGRs, and especially on devising an access and benefit-sharing regime for MGRs in ABNJ. While the G-77/China continue to argue that the "common heritage of mankind" applies to MGRs in the Area, some developed countries rather argue for freedom of the high seas.[74] Interestingly, some delegates also point out that "access" could include access to digital genetic information, rather than physical access to the resource itself.[75]

VII. IMPLICATIONS OF UNCLOS FOR AREAS BEYOND NATIONAL JURISDICTION IN THE GULF OF MEXICO

While the United States is not a State Party to UNCLOS, most of the rights and obligations in the Convention are viewed as reflecting customary international law, which is interpreted as binding nations independently from their treaty obligations. According to James Malone, Assistant Secretary of State for

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[71] *Summary of the Ninth Meeting of the Working Group on Marine Biodiversity Beyond Areas of National Jurisdiction,* EARTH NEGOTIATIONS BULLETIN, http://www.iisd.ca/vol25/enb2594e.html (last visited July 2, 2018).
[72] Elisa Morgera, *Policy Update #8: Do We Need a New Treaty to Protect Biodiversity in the Deep Seas?*, IISD, http://nr.iisd.org/policy-updates/do-we-need-a-new-treaty-to-protect-biodiversity-in-the-deep-seas/ (last visited July 2, 2018).
[73] *See, e.g.,* MARJORIE ANN BROWNE, CONG. RESEARCH SERV., THE LAW OF THE SEA CONVENTION AND U.S. POLICY (2006), http://www.gc.noaa.gov/documents/gcil_crs_2006_report.pdf (last visited July 2, 2018).
[74] *Id.*
[75] *PrepCom 1 Highlights: Friday, April 1, 2016*, EARTH NEGOTIATIONS BULLETIN, http://www.iisd.ca/vol25/enb25101e.html (last visited July 2, 2018).

Oceans and International Environmental and Scientific Affairs during the Reagan Administration:

> The United States believes that most of the provisions of the Treaty, apart from the seabed mining text in Part XI, [which has since been renegotiated][76] fairly balance the interests of all states and are fully consistent with norms of customary international law. Hence, it is prepared to accept and act in accordance with these provisions on a reciprocal basis.[77]

However, the fact that the United States is not a party creates a complex and unsettled legal situation in the Eastern and Western Gaps of the Gulf. Under most circumstances an ocean area such as the Western Gap that lies beyond the 200-mile EEZ would be considered part of the high seas under the Convention and its seabed resources would be controlled by the international community under the common heritage principle. However, in order to exploit potential hydrocarbon resources themselves, Mexico and the United States entered a treaty in 2000 asserting that all of the seabed and subsoil of the Western Gap is an extension of each nation's continental shelf as described in Article 76 of the Convention. The Delimitation Treaty gives Mexico access to about 62 percent of the Western Gap and the United States about 38 percent.[78] Since the Delimitation Treaty was enacted, nearly 40 exploratory oil and gas lease tracts have been acquired by a variety of United States and international energy companies on the U.S. side of the Western Gap boundary.[79]

UNCLOS requires parties exploiting seabed resources on their extended continental shelves to make a submission to the Commission on the Limits of the Continental Shelf (CLCS).[80] Mexico has already made a successful submission on its portion of the Western Gap to the CLCS, which was adopted by the body on

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[76] Comment inserted by authors.
[77] James Malone, *Freedom and Opportunity: The Foundation for a Dynamic National Oceans Policy*, in 41 DEVELOPING ORDER OF THE OCEANS (Kruger & Riesenfeld, eds. 1985).
[78] Delimitation of Continental Shelf, U.S.-Mex., June 9, 2000, S. Exec. Doc. 106-39, Annex 1.
[79] Richard J. McLaughlin, *Hydrocarbon Development in the Ultra-Deepwater Boundary Region of the Gulf of Mexico: Time to Reexamine a Comprehensive U.S.-Mexico Cooperation Agreement*, 39 OCEAN DEV. & INT'L L. 1, 8 (2008).
[80] UNCLOS, *supra* note 20, at art. 76(8). The CLCS provides guidance to submitting coastal nations to assist them in properly complying with legal and scientific requirements and reassures other nations that proposed extended continental shelf boundaries are legitimate.

March 31, 2009.[81] In contrast, the United States cannot make a submission because it is not a party to UNCLOS. The Convention and international law clearly provide that it is ultimately up to each coastal nation to establish the outer boundary of its continental shelf. Nevertheless, submitting a claim to the CLCS serves the important purpose of assuring the international community that a nation's claim complies with international law as well as removing the threat that the claim will be legally or politically challenged as illegitimate.

Because the United States cannot receive the imprimatur of the CLCS and the international legitimacy that it would confer, it is unlikely that energy companies will make the huge long-term investments necessary to commercialize the Western Gap. As long as the U.S. refuses to join the Convention, energy companies will be unable to obtain financing and insurance coverage due to the potential risk of litigation or political challenge.

Similar issues exist in the Eastern Gap. Mexico and Cuba have both filed submissions to the CLCS claiming the Eastern Gap as extended continental shelf. Unlike Mexico's Western Gap submission, which occurred early in the CLCS review process, those relating to the Eastern Gap were submitted later and may take many years to complete because of a CLCS backlog.[82] If the U.S. accedes to UNCLOS, it will be last in line at the CLCS to submit its extended continental shelf claims for the Western and Eastern Gap areas.

VIII. IMPLICATIONS FOR FISHERIES MANAGEMENT AND MARINE SCIENTIFIC RESEARCH IN THE GULF OF MEXICO AREAS BEYOND NATIONAL JURISDICTION

The vast majority of living marine resources that are fished commercially or recreationally in the GOM are located within the three surrounding nations' EEZs. Within 200 nautical miles from shore, the three nations have control over fisheries-related and other varieties of marine scientific research (MSR). UNCLOS provides that within each nation's 12-mile territorial sea, it has the exclusive right to regulate, authorize, and conduct MSR, but that foreign research

[81] Access to the CLCS recommendation may be found at: http://www.un.org/depts/los/clcs_new/commission_submissions.htm. For an analysis of Mexico's submission, see Suzette v. Suarez, *Commission on the Limits of the Continental Shelf*, in 2010 Y.B. INT'L L. 131, 164, (A. von Bogdandy & R. Wolfrum, eds., 2010), http://www.mpil.de/files/pdf3/mpunyb_04_suarez_14.pdf (last visited July 2, 2018).

[82] *Id*. The "CLCS estimated that it would finish consideration of the first 51 submissions only in the year 2030." *Id.* at 138.

or surveys may only take place with the "express consent of and under the conditions set forth by the coastal State."[83] Within the 200-mile EEZ and on the Continental Shelf, UNCLOS similarly provides that foreign nations request consent from the coastal state prior to engaging in MSR, but that "coastal States shall, in normal circumstances, grant their consent."[84] Under certain circumstances, consent for MSR may be withheld. Most importantly, consent need not be granted if the MSR "is of direct significance for the exploration and exploitation of natural resources, whether living or non-living."[85] This allows coastal nations to prevent foreign researchers from acquiring scientific information that may provide insights into commercial fish stocks or resource-related oceanographic characteristics without their permission and participation.

Different legal regimes exist in the two ABNJ areas of the GOM.[86] They are part of the high seas and generally open to fisheries exploitation and MSR by foreign vessels.[87] In the water column above the sea floors of the Western and Eastern Gaps, the international community has the legal right to exploit fisheries resources subject only to any treaty obligations that they have agreed upon. Foreign exploration and exploitation on the sea floor is more complex. For example, in the Western Gap, any fisheries exploitation on Mexico's claimed continental shelf would be prohibited absent Mexico's permission.[88] In contrast, despite the United States' status as a Non-State Party to UNCLOS, it is highly unlikely that a foreign nation would attempt to exploit seabed resources on the U.S. portion given the United States' public assertion that the area falls within its extended continental shelf.

Exploitation of living resources on the sea floor of the Eastern Gap presents an even greater cause for legal concern because the boundaries of this area have not been formally demarcated and none of the three nations' claims to extended continental shelf have been formally reviewed by the CLCS. Accordingly, it is unclear exactly which nation has sovereign authority over the seabed resources in specific portions of the Eastern Gap. In theory, even the

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[83] UNCLOS, *supra* note 20, at art. 245.
[84] *Id*. at arts. 246(3), 246(1).
[85] *Id*. at art. 246(5)(a).
[86] For a detailed discussion of the legal rights to living resources of the High Seas, *see* Richard J. McLaughlin, *UNCLOS and the Demise of the United States' Use of Trade Sanctions to Protect Dolphins, Sea Turtles, Whales, and Other International Living Resources*, 21 ECOLOGY LAW QUARTERLY 1, 32-38 (1994).
[87] UNCLOS, *supra* note 20, at art. 87.
[88] *Id*. at art. 77(1). This would be subject to these organisms being sedentary species or in constant contact with the seabed. *Id*. at art. 77(4).

International Seabed Authority may have some rights in this area if the claims of extended continental shelf prove to not be justified.

Legal rules relating to MSR in the Western and Eastern Gaps are also problematic. As noted, coastal States have jurisdiction over MSR on the extended continental shelf.[89] Conversely, UNCLOS also provides that all States have the freedom to engage in MSR in the superjacent waters above the continental shelf.[90] A literal interpretation of these provisions seems to require coastal State consent only for research that physically takes place on the sea floor. However, one commentator has posited that this literal interpretation ignores the fact that MSR is carried out from the superjacent waters or airspace above the continental shelf and "it appears to be naïve to consider that coastal States will not exercise their jurisdiction to regulate marine scientific research there."[91]

Currently, very little commercial or recreational fishing occurs in the Western or Eastern Gaps, primarily due to their water depth and geographical remoteness. However, studies have determined that the maritime boundary region of the GOM is a globally important nursery area for Western Atlantic Bluefin Tuna.[92] As discussed throughout this article, managing and conserving tuna is more difficult in ABNJ than within the U.S. EEZ because individual states only have a limited ability to address problems outside of their national jurisdictions. In the case of tuna fishing in the Western and Eastern Gaps, two treaties provide the international framework that allows for managing tuna in ABNJ. First, the International Commission for the Conservation of Atlantic Tuna (ICCAT) was established for the cooperative study and management of highly migratory stocks of Atlantic Tuna.[93] The second treaty is the 1995 UNFSA (which also is the second implementing agreement of UNCLOS), to ensure the long-term

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[89] *Id*. at art. 246(1).
[90] *Id*. at art. 257.
[91] TANAKA, *supra* note 19, at 145.
[92] Barbara Block et al, *Electronic Tagging and the Population Structure of Atlantic Bluefin Tuna*, 434 NATURE 1121 (2005). *See also* NAT'L MARINE FISHERIES SERV., STATUS REVIEW REPORT OF ATLANTIC BLUEFIN TUNA (THUNNUS THYNNUS) (2011), http://www.nmfs.noaa.gov/pr/pdfs/statusreviews/bluefintuna.pdf (last visited July 3, 2018). For an excellent map of bluefin tuna feeding and spawning areas, see *Gulf of Mexico Data Atlas, Suitable Feeding and Spawning Habitats-Atlantic Bluefin Tuna*, NAT'L OCEANIC AND ATMOSPHERIC ADMIN., https://www.ncddc.noaa.gov/website/DataAtlas/atlas.htm?plate=Suitable%20Habitat%20-%20Bluefin%20Tuna (last visited July 3, 2018).
[93] *ICCAT Basic Texts*, INT'L COMM'N FOR THE CONSERVATION OF ATL. TUNA, https://www.iccat.int/en/organization.html (last visited July 3, 2018).

conservation and sustainable use of global straddling and highly migratory fish stocks.[94]

Neither of these international agreements has been particularly successful and highlight the difficulties in managing fisheries in ABNJ.[95] For example, compared to the enforcement tools available within the U.S. EEZ,[96] the ABNJ offers few enforcement options, largely because the consent by other nations is required for effective implementation of management options. Managing tuna in the Western and Eastern Gaps is especially problematic because while the United States is a party to both ICCAT and UNFSA, neither Mexico nor Cuba is a party to the UNFSA,[97] and only Mexico is a party to ICCAT.[98] While ICCAT and UNFSA have provisions that require its members to prohibit imports of fish taken from the region by non-members, the fact that neighboring and distant water nations are not subject to common standards and practices makes managing resources in ABNJ challenging.

IX. IMPLICATIONS FOR BIOPROSPECTING IN GULF OF MEXICO AREAS BEYOND NATIONAL JURISDICTION

There is similar ambiguity with potential bioprospecting and access to MGRs in ABNJ in the GOM. For one thing, few detailed studies exist of the seafloor characteristics of the Western and Eastern Gaps despite evidence of

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[94] United Nations Conference on Straddling Fish Stocks and Highly Migratory Fish Stocks, July 24-August 4, 1995, *Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks*, U.N. Doc. A/CONF:164/37 (Sept. 8, 1995), https://documents-dds-ny.un.org/doc/UNDOC/GEN/N95/274/67/PDF/N9527467.pdf?OpenElement (last visited July 3, 2018).

[95] *See generally* Cassandra M. Brooks, et al. *Challenging the Right to Fish in a Fast-Changing Ocean*, 33 STAN. ENVTL. L.J. 289 (2014).

[96] Two primary federal statutes exist in the U.S. to fulfill its requirements under ICCAT within the 200-mile EEZ. In 1977, the United States passed the Atlantic Tuna Conservation Act to codify these responsibilities. 16 U.S.C. § 971. The Magnuson-Stevens Fishery Conservation and Management Act more broadly provides a regulatory framework to manage tuna and other fisheries stocks. 16 U.S.C. § 1801.

[97] *Table Recapitulating the Status of the Convention and of the Related Agreements,* UNITED NATIONS DIV. FOR OCEAN AFFAIRS & THE LAW OF THE SEA, http://www.un.org/depts/los/reference_files/status2018.pdf (last visited July 3, 2018).

[98] *Contracting Parties*, INT'L COMM'N FOR THE CONSERVATION OF ATL. BLUEFIN TUNA, https://www.iccat.int/en/contracting.html (last visited July 3, 2018).

highly productive deep-water chemosynthetic communities.[99] Should important MGRs be found in these areas, this could hold significant value for commercial uses.[100] Because the ABNJ lies outside countries' jurisdictions, it is not clear where the rights to these resources would lie. Again, the lack of U.S. ratification of UNCLOS and its inability to pursue its claim in the Western Gap leaves in question whether any MGRs found outside of Mexico's demarcated zone would fall under the rights of the United States or whether they would be the "common heritage of mankind." In the Eastern Gap, the lack of any approved claim presents the same challenge. Further, many Parties reject the idea that minerals and MGRs can be treated in the same way, and that because UNCLOS does not refer to genetic resources, UNCLOS founders never intended this application. Thus, even if both Gaps were demarcated, the developing ILBI will ultimately play a large part in determining the rights to potential resources, including any benefit sharing, capacity building, and/or technology transfer requirements.

Finally, it should be considered that many existing regional and international bodies already struggle to fulfill their current mandates, due to financial and other capacity constraints. To manage ABNJ, the international community will need to seriously address the need for expanded capacity and enforcement to meet any expanded mandates.

X. CONCLUSION

All of these considerations should be taken into account when considering a legal regime to manage the Eastern and Western Gaps in the GOM, particularly considering the very real likelihood of future hydrocarbon development on Mexico's extended continental shelf in the Western Gap, Mexico and Cuba's potential future development on any approved portion of the shelves in the Eastern Gap, as well as any potential successful submissions by the United States should it accede to UNCLOS. With hydrocarbon development comes increased risk of an accident or spill. Thus, bi- or multilateral agreements will need to address the principles of good neighborliness and the duty to cooperate in the event of a spill that affects the Gaps.[101] This also is true of any potential harm or

[99] Roberts et al., *supra* note 11.
[100] Richard McLaughlin, *Foreign Access to Shared Marine Genetic Materials: Management Options for a Quasi-Fugacious Resource*, 34 OCEAN DEV. & INTL. L. 297 (2003).
[101] The U.S. and Mexico have cooperated on oil spill response in the GOM since the Mexican transboundary spill incident at Ixtoc in 1979. This event led to the MEXUS Agreement which entered into force on March 30, 1981. While this agreement and the more recent Agreement Concerning Transboundary Hydrocarbon Reservoirs in the Gulf of Mexico, U.S.-Mex. Feb. 20,

destruction resulting from mining that may take place in the Gaps, should other valuable substances be found.

Similar considerations of the unique legal characteristics of ABNJ in the GOM need to be addressed in developing management strategies for other ocean uses such as biodiversity, fisheries management, MSR, MGR bioprospecting, and other potential activities. While some of these issues may be discussed and clarified as part of the UNGA effort to develop an ILBI under UNCLOS on marine biodiversity conservation and sustainable use in ABNJ,[102] it is unclear what these negotiations will ultimately produce, or whether the nations surrounding the GOM each will become Parties.

Instead, immediate focus should be placed on increased government-to-government collaboration with the objective of identifying innovative new efforts to provide a framework for a more sustained and systematic approach to managing the resources and activities taking place in ABNJ in the GOM. This process of improved collaboration will take on added urgency given the major energy reforms that are currently taking place in Mexico that will open to foreign investment the development of the deepest and most remote offshore deposits of the GOM.[103] The on again off again opening of diplomatic and economic relations between the United States and Cuba will also require increased cooperation and coordinated management approaches in the GOM, including the Eastern Gap. It will be a test for the leaders of the three nations to recognize the complex and unsettled legal and policy regime governing ABNJ in the GOM and to begin to strengthen collaborative management options that best conserve and sustainably utilize these unique ocean areas.

2012, TIAS. No. 14-718, contain provisions that guide or encourage cooperative response strategies, these agreements do not clarify the responsibility and liability issues in ABNJ.

[102] *See supra* notes 68-69 and accompanying text.

[103] Garcia Sanchez & McLaughlin, *supra* note 22, at 687. *See also* Negroponte, *supra* note 8.

RISING ABOVE: DETERMINING APPROPRIATE, COMMUNITY-SPECIFIC RESPONSES TO SEA LEVEL RISE IN GALVESTON BAY, TX

Rachel Edwards[1], James Gibeaut[2], and Richard McLaughlin[3]

I. THE VULNERABILITY OF GALVESTON BAY TO SLR

Galveston Bay has one of the highest vulnerabilities to large storms and sea level rise (SLR) in the country due to its natural properties, high population pressures, and costly infrastructure.[4] SLR is described as an "enormously complex public policy problem" because beaches have a dynamic nature while laws are static.[5] A single shoreline, like that of Galveston Bay, will advance and retreat at various times in geologic history, and at a certain point some beaches will be eroding while others will be accreting. Changes in sea level affect these constant changes. The rate of SLR increased in the last two hundred years due to global climate change and anthropogenic activities, and it is now a driver of shoreline retreat in many locations.[6] Additionally, human migration patterns are further stressing coastal environments.[7]

The current predominant shoreline protection paradigm emphasizes shoreline hardening as the primary mode to combat SLR. At least 14,000 miles of the United States' coast has been armored, and one-third of the coast could be hardened by 2100 if trends continue.[8] In recent years, however, there has been recognition of the benefits that natural shorelines offer. This has resulted in a push towards utilizing living shorelines, a green infrastructure approach. There are

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[3] Harte Research Institute for Gulf of Mexico Studies Endowed Chair for Coastal and Marine Policy and Law.
[4] Katie K. Arkema et al., *Coastal Habitats Shield People and Property from Sea-Level Rise and Storms*, 3 NATURE CLIMATE CHANGE 913–918 (2013).
[5] Meg Caldwell & Craig Holt Segall, *No Day at the Beach: Sea Level Rise, Ecosystem Loss, and Public Access Along the California Coast*, 34 ECOLOGY L. Q. 533 (2007).
[6] R.G.D. Davidson-Arnott, *Conceptual Model of the Effects of Sea Level Rise on Sandy Coasts*, 21 J. OF COASTAL RES. 1166-72 (2005).
[7] Jennifer Weeks, *Coastal Development: Is Over-building Putting Coastal Regions at Risk?*, 23 CQ RESEARCHER 181 (2013).
[8] Roberta Kwok, *Rise of 'Shoreline Hardening' Threatens Coastal Ecosystems*, CONSERVATION, Aug. 6, 2015, *available at* http://www.conservationmagazine.org/2015/08/rise-of-shoreline-hardening-threatens-coastal-ecosystems/ (last visited June 20, 2018).

many benefits to protecting the connectivity of land and sea in such a way. A better understanding of the potential results from these protective measures will increase the knowledge of coastal communities in the Galveston Bay area and thus enable them to respond to SLR in the most appropriate manner.

SLR is directly tied to a warming atmosphere due to anthropogenic activities.[9] Large-scale anthropogenic releases of greenhouse gases began with the Industrial Revolution.[10] If, as it happened until modern times, there was no infrastructure installed in coastal areas, then wetland habitats would simply migrate inland. However, the installation of immobile structures along the dynamic land/sea interface creates a net loss of coastal habitats and environments in a process called coastal squeeze.[11] Coastal squeeze occurs when wetland environments lose their areal extent due to being sandwiched between rising seas and structures; this restriction limits marshes' ability to vertically accrete or migrate inland and has led to a greater risk of inundation and erosion. An estimated 10% of Galveston Bay's shorelines are already armored and thus, are subject to coastal squeeze.[12]

Development-induced coastal squeeze shrank Galveston Bay's wetlands. Marsh losses can cause a negative feedback loop whereby habitat conversion results in an alteration of ecosystem services. At the global scale, wetland habitats, including marshes, are carbon sinks, and their destruction releases significant amounts of carbon into the atmosphere, which in turn exacerbates SLR.[13] This process can leave humans more vulnerable to storms and erosion. Thus, the protection of marshes and other wetlands is one of the easiest and simplest solutions to initiate adaptation to SLR and mitigate climate change impacts.[14]

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[9] INTERGOVERMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2014: SYNTHESIS REPORT (2014), http://www.ipcc.ch/pdf/assessment-report/ar5/syr/SYR_AR5_FINAL_full_wcover.pdf (last visited June 20, 2018).
[10] Johan Rockström et al., *A Safe Operating Space for Humanity*, 461 NATURE 472–475 (2009).
[11] Dante D. Torio & Gail L. Chmura, *Assessing Coastal Squeeze of Tidal Wetlands*, 290 J. OF COASTAL RES.1049–1061 (2013).
[12] TEX. COMM'N ON ENVTL. QUALITY, GALVESTON BAY ESTUARY PROGRAM, THE STATE OF THE BAY: A CHARACTERIZATION OF THE GALVESTON BAY ECOSYSTEM (2011) https://www.researchgate.net/publication/261759345_State_of_the_bay_A_characterization_of_the_Galveston_Bay_ecosystem_Third_Edition (last visited June 20, 2018).
[13] Gail L. Chmura, *What Do We Need to Assess the Sustainability of the Tidal Salt Marsh Carbon Sink?*, 83 OCEAN & COASTAL MGMT. 25–31 (2013).
[14] Carlos M. Duarte et al., *The Role of Coastal Plant Communities for Climate Change Mitigation and Adaptation*, NATURE CLIMATE CHANGE 961–968 (2013).

This negative feedback loop partially occurs because people settle coastal areas without enough consideration of environmental issues.[15] Coastal development affects Texas in general and Galveston Bay in particular. A quarter (25%) of Texas's population lives in its eighteen coastal counties, and 75% of that 25% lives on the west side of Galveston Bay.[16] Texas had a 154% increase in coastal counties' population density from 1960-2008, and the Galveston Bay watershed is expected to be home to eighteen million people by 2040.[17]

Furthermore, the anthropogenic additions to atmospheric gasses will continue trapping solar thermal energy, leading to additional SLR. It is estimated that, given a 2 m rise in sea level, 2.4% of the global population could be displaced by 2100 due to the inundation of infrastructure in urban landscapes.[18] As of this writing, that is approximately 180,000,000 people.

Galveston Bay is a very important region both from an ecologic and anthropogenic perspective. It is a shallow estuary with protective barrier islands, and the Environmental Protection Agency's National Estuary Program distinguished it as an estuary of national significance.[19] It is the most biologically productive estuary in Texas, has the second largest fisheries production of any estuary in the United States, and is a hub for birdwatchers.[20] An estimated 75% of North America's bird species pass through the bay including endangered species such as the piping plover.[21] The Central Flyway, a path for an estimated 400

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[15] Gordon McGranahan et al., *The Rising Tide: Assessing the Risks of Climate Change and Human Settlements in Low Elevation Coastal Zones*, 19 ENV'T AND URBANIZATION 17–37 (2007).
[16] William Merrell et al., *The Ike Dike: A Coastal Barrier Protecting the Houston/Galveston Region from Hurricane Storm Surge*, Presentation at Texas Hurricane Center 2013 Conference (Aug. 2, 2013) (proceedings available at http://hurricane.egr.uh.edu/sites/hurricane.egr.uh.edu/files/files/2013/8-speakers-2013.pdf) (last visited June 20, 2018).
[17] STEVEN G. WILSON & THOMAS R. FISCHETTI, U.S. BUREAU OF THE CENSUS, COASTLINE POPULATION TRENDS IN THE UNITED STATES 1960 TO 2008 (2010), https://www.census.gov/library/publications/2010/demo/p25-1139.html (last visited June 20, 2018).
[18] R. J. Nicholls et al., *Sea-level Rise and its Possible Impacts Given a 'Beyond 4 C World' in the Twenty-first Century*, 369 PHIL. TRANSACTIONS OF THE ROYAL SOC'Y: MATHEMATICAL, PHYSICAL AND ENGINEERING SCI. 161–181 (2010).
[19] BIOGEOCHEMISTRY OF GULF OF MEXICO ESTUARIES (Thomas S. Bianchi, Jonathan R. Pennock & Robert Reece Twilley eds., 1999).
[20] For More Information on Galveston Bay, *see Discover Galveston Bay*, GALVESTON BAY ESTUARY PROGRAM, http://www.gbep.state.tx.us/discover-galveston-bay/ (last visited June 20, 2018).
[21] Arkema, *supra* note 4.

species of migratory birds, cuts through the region as does the Great Coastal Birding Trail, which offers 500 miles of sites for birdwatchers.[22]

SLR's damage potential rises as assets and population increase in coastal zones. Galveston Bay has high concentrations of both partially because it is home to one of the United States' primary oil and gas hubs. Galveston Bay is a significant metropolis due to its industry, trade, and petrochemical importance. Houston, located northwest of the bay, is the fifth largest city in the United States. The Port of Houston is the largest port in the country in regards to foreign tonnage and second in overall tonnage, and the Gulf Intracoastal Waterway runs through the bay.[23] The region is home to the United States' largest concentration of oil refineries; the region produces approximately 26% of the United States' gasoline, 42% of base chemicals, and 60% of jet fuel.[24] That infrastructure is worth an estimated $100 billion,[25] and the ports generate hundreds of thousands of jobs annually.[26] Galveston Bay also has the "third largest concentration of privately-owned marinas" in the country.[27] Because of this economic infrastructure, SLR in Galveston Bay has the potential to damage the economies of both Texas and the United States. Potential socioeconomic impacts of SLR include the loss of property and coastal habitats; increased flood risk and loss of life; damage to infrastructure; loss of tourism, recreation and transportation functions; loss of cultural resources and values; and impacts on agriculture and aquaculture.[28]

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[22] PAUL A. JOHNSGARD, WINGS OVER THE GREAT PLAINS: BIRD MIGRATIONS IN THE CENTRAL FLYWAY (Zea E-Books 2012); Marge Lindsay, *The Great Texas Coastal Birding Trail: A Tool for Avitourism*, *in* CORNELL LAB OF ORNITHOLOGY, STRATEGIES FOR BIRD CONSERVATION: THE PARTNERS IN FLIGHT PLANNING PROCESS (Rick Bonney, et al., eds. 1999), http://www.birds.cornell.edu/pifcapemay/lindsay.htm (last visited June 20, 2018).

[23] Kiah Collier, *Houston has the Busiest Seaport in the U.S.,* HOUSTON CHRON., May 23, 2013, http://www.chron.com/discoverhouston/article/Houston-has-the-busiest-seaport-in-the-US-4486844.php (last visited June 20, 2018).

[24] Duff Wilson et al., *Special Report: Why Metro Houston Fears the Next Big Storm*, REUTERS, Nov. 24, 2014, http://www.reuters.com/article/us-sealevel-fixes-galveston-specialrepor-idUSKCN0J81IM20141124 (last visited June 20, 2018).

[25] *Id.*

[26] *Overview Facts*, PORT OF HOUSTON, http://porthouston.wpengine.com/wp-content/uploads/2016/11/Port-of-Houston9689-Port-Fact-Sheet.pdf (last visited June 20, 2018).

[27] *Discover Galveston Bay*, *supra* note 20.

[28] Robert J. Nicholls & Jason A Lowe, *Benefits of Mitigation of Climate Change for Coastal Areas*, 14 GLOBAL ENVTL. CHANGE 229–244 (2004).

Additionally, SLR in Galveston Bay is projected to impact infrastructure such as roads, railroads, airports, houses, private businesses and public buildings.[29]

The Galveston Bay region is extremely vulnerable to SLR because of its natural properties including low elevation, low relief, and small tidal range. These all mean that small changes in sea level have relatively large effects. Broad areas of land less than 2 m above sea level extend inland nearly ten miles from the shoreline, and, additionally, the land is sinking in many places. Galveston's Pier 21 tidal gauge measured a relative SLR rate of 6.4 mm per year, most of which is due to subsidence.[30]

Subsidence is another characteristic that increases Galveston Bay's vulnerability to SLR. Galveston Bay's relative SLR rate of about 6 mm per year stands in stark contrast to the global eustatic average of 2 mm per year. Subsidence occurs when the land surface lowers relative to a fixed datum due to natural processes or anthropogenic causes. The area around Galveston Bay is subsiding to a small degree because of natural sediment compaction and tectonics.[31] The predominant cause of subsidence in the region, however, is groundwater and oil and gas extractions, which initiate geologic fault movements.[32] The extractions result in a lack of volume and internal pressure, which causes the land to gradually and consistently sink, threatening both built and natural environments. Over a thirty-year period, nearly 5,000 square miles of land subsided at least 15 cm with some areas subsiding more than 3 m; additionally, more than 31 sq. miles of land was permanently inundated.[33]

The neighborhood of Brownwood is one that succumbed to subsidence.[34] No houses exist today in the once-affluent neighborhood because of subsidence

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[29] Mukesh Subedee et al., *Investigating the Environmental and Socioeconomic Impacts of Sea Level Rise in the Galveston Bay, Texas Region*, Poster Presented at Ocean Science Meeting (Feb. 21-26, 2016).

[30] NAT'L OCEANIC & ATMOSPHERIC ADMIN., SEA LEVEL VARIATIONS OF THE UNITED STATES 1854-2006 (2009), https://tidesandcurrnts.noaa.gov/publications/Tech_rpt_53.pdf (last visited June 20, 2018).

[31] Jeffrey G. Paine, *Subsidence of the Texas Coast: Inferences from Historical and Late Pleistocene Sea Levels*, 222 TECTONOPHYSICS 445–458 (1993).

[32] William W. White & Robert A. Morton, *Wetland Losses Related to Fault Movement and Hydrocarbon Production, Southeastern Texas Coast*, 13 J. OF COASTAL RES. 1305–1320 (1997), *available at* http://www.jstor.org/stable/4298740 (last visited June 20, 2018).

[33] *Subsidence & Groundwater Regulation FAQs*, HARRIS-GALVESTON SUBSIDENCE DISTRICT, http://hgsubsidence.org/frequently-asked-questions/subsidence-groundwater-regulation-faqs (last visited June 20, 2018).

[34] DEVIN L. GALLOWAY ET AL., U.S. GEOLOGICAL SURVEY CIRCULAR 1182, HOUSTON-GALVESTON, TEXAS: MANAGING COASTAL SUBSIDENCE (2015).

and SLR.[35] The area north of Galveston Bay along the Houston Ship Channel, originally was inundated only by hurricanes and large storms. Over time, however, the land subsided by more than 3 m and even mild storms, wind, and high tides caused the inundation of houses. Groundwater extraction peaked in 1970, and in response, the Houston-Galveston Subsidence District was created in 1975 to minimize subsidence in the region through the regulation of groundwater withdrawal.[36] They have been largely successful as evidenced by the fact that subsidence rates are lessening. [37] However, the Brownwood neighborhood was abandoned in 1983, with many houses bought by the Federal Emergency Management Agency (FEMA), and the neighborhood turned into wetland habitats by the Baytown Nature Center.

Historical lessons provide evidence that coastal systems respond rapidly to change. Although the geomorphology of coastal areas has changed throughout geologic time, these changes have all been exacerbated by anthropogenic processes; humans are now the dominant force of coastal change.[38] An ongoing increase in SLR rate will continue to severely impact low gradient coasts, especially since the reaction time of policy makers tends to be slow. A lack of government policy and regulation will cause future financial losses due to climate change, including sea level rise coupled with large storms.

Galveston has a history of severe hurricanes, and it is a matter of when, not if, a future storm hits. Two hurricanes, the Galveston Hurricane of 1900 and Hurricane Ike in 2008, highlight how vulnerable Galveston Bay is to large storms. It is important to emphasize that hurricanes on top of a higher sea level would be much worse than the same storm occurring at lower sea levels.

The Hurricane of 1900 was the deadliest natural disaster to ever hit the United States, killing between 6,000 and 12,000 people. That hurricane also eroded the shoreline by 100 m in some places and demolished hundreds of structures.[39] In response to the hurricane, the Galveston Seawall was designed and constructed and the elevation of the eastern portion of Galveston Island was raised.

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[35] *Id.*
[36] *Id.*
[37] Jiangbo Yu et al., *Is There Deep-Seated Subsidence in the Houston-Galveston Area?*, 2014 INT'L J. OF GEOPHYSICS 1 (2014).
[38] P.M. Vitousek, *Human Domination of Earth's Ecosystems*, 277 SCI. 494 (1997).
[39] ALBERT BARTLETT DAVIS, GALVESTON'S BULWARK AGAINST THE SEA: HISTORY OF THE GALVESTON SEAWALL (1981).

Hurricane Ike was the third costliest storm in United States history with 121 deaths and estimated financial losses of $21.3 billion.[40] Ike made landfall over Galveston in September 2008. It was a category two hurricane with maximum sustained winds of almost 110 miles per hour. Storm surge raised water levels in parts of Galveston Bay by over 10 m.[41] Damages to houses caused by flooding cost an estimated $2.74 billion.[42] Ike affected every industry in the area including health care, agriculture, fishing and tourism as well as the ecology of the surrounding wetlands and water environments. For instance, sediments deposited on oyster beds killed the reefs and impacted the surrounding fishing grounds. In addition, all of the United States was impacted by damage to oil and gas refineries.[43] The U.S. Department of Energy closed fourteen oil refineries in the region because of Ike, which caused cascading effects such as increased gas prices and gas shortages across the United States.[44] The cost to repair erosion damages, dredge waterways, and repair infrastructure to navigable waterways, ports and coastlines cost Texas $2.4 billion.[45] Lastly, the Port of Galveston had damages from saltwater and sediment deposits.

The impact of the Hurricane of 1900 indicates the historical vulnerability of the region to big storms, and Hurricane Ike indicates that the vulnerability has not decreased over time. In fact, a FEMA report warns that land subsidence, erosion and SLR may cause increased hazards and that greater damage may be incurred from similar storms in the future.[46] The region is not just vulnerable to large storms, however; the cumulative costs of storm surge damage from smaller,

[40] FED. EMERGENCY MGMT. AGENCY, FEMA P-757, MITIGATION ASSESSMENT TEAM REPORT: HURRICANE IKE IN TEXAS AND LOUISIANA: BUILDING PERFORMANCE OBSERVATIONS, RECOMMENDATIONS, AND TECHNICAL GUIDANCE (2009), https://www.fema.gov/media-library-data/20130726-1648-20490-9826/fema757.pdf [hereinafter MITIGATION ASSESSMENT TEAM REPORT] (last visited June 20, 2018).
[41] *Hurricane Ike Storm Surge Inundation Maps*, HARRIS CNTY. FLOOD CONTROL DIST., https://www.hcfcd.org/media/1242/ike_stormsurge-inundation_maps.pdf (last visited June 20, 2018).
[42] FED. EMERGENCY MGMT. AGENCY, HURRICANE IKE IMPACT REPORT (2008), https://www.fema.gov/pdf/hazard/hurricane/2008/ike/impact_report.pdf [hereinafter HURRICANE IKE IMPACT REPORT] (last visited June 20, 2018).
[43] *Hurricane Effects on Oil and Natural Gas Production Depend on Storm Trajectory, Strength*, U.S. ENERGY INFO. ADMIN., http://www.eia.gov/todayinenergy/detail.php?id=11491&src=email (last visited June 20, 2018).
[44] MITIGATION ASSESSMENT TEAM REPORT, *supra* note 40.
[45] HURRICANE IKE IMPACT REPORT, *supra* note 42.
[46] MITIGATION ASSESSMENT TEAM REPORT, *supra* note 40.

more frequent storms as sea level rises could be just as great as a single big storm.[47]

The Texas coast in general and Galveston Bay in particular are at a high to very high risk of adverse SLR impacts. As damaging as the Hurricane of 1900 and Hurricane Ike were, the same storms would be more damaging if they occurred from a SLR-induced higher water platform.[48] This is because SLR itself is not the direct threat to human life, but rather it is the storm surge on top of SLR that has the potential to cause widespread damage. By raising the level from which waves "attack" the shore, SLR enables a greater rate of erosion. Combined with storms and hurricanes that are forecasted to be stronger due to climate change, storm surge will cause even more erosion by reaching higher on the land/sea interface.[49]

As of 2014, 1.6 million people lived in the Galveston Bay region's hurricane evacuation zones and another million are predicted to move into the area by 2035.[50] With current roads and other limitations, it would take over thirty-six hours to evacuate the residents out of the hurricane evacuation zones, a process often fraught with chaos and other issues.[51] Many residents choose not to leave and are endangered, and those who do evacuate leave billions of dollars' worth of infrastructure and property behind. Hurricanes striking the coast when sea level is even higher will place even more people at risk, which thus emphasizes the need to plan for higher sea levels and the direct and indirect hazards it causes.[52]

II. LEARNING TO LIVE WITH SEA LEVEL RISE IN GALVESTON BAY

Additional study is necessary to gain a broader understanding of SLR impacts, but it is not feasible to wait to gain a complete understanding of the system before

[47] Natalya N. Warner & Philippe E. Tissot, *Storm Flooding Sensitivity to Sea Level Rise for Galveston Bay, Texas*, 44 OCEAN ENGINEERING 23 (2012).
[48] Mir Emad Mousavi et al., *Global Warming and Hurricanes: The Potential Impact of Hurricane Intensification and Sea Level Rise on Coastal Flooding*, 104 CLIMATE CHANGE 575 (2010).
[49] Stephen P. Leatherman, Keqi Zhang & Bruce C. Douglas, *Sea Level Rise Shown to Drive Coastal Erosion*, 81 EOS 437 (2000).
[50] SSPEED CTR. OF RICE UNIV., SSPEED CENTER PHASE III: DEVELOPING A HOUSTON-GALVESTON AREA PROTECTION SYSTEM (2014).
[51] SSPEED CTR. OF RICE UNIV., SSPEED CENTER 2014 REPORT (2014) http://doctorflood.rice.edu/sspeed/downloads/HE_Final_Report_2014.pdf (last visited July 3, 2018).
[52] Maarten K. Van Aalst, *The Impacts of Climate Change on the Risk of Natural Disasters*, 30 DISASTERS 5 (2006).

determining how to adapt.[53] This section discusses current laws in Texas that address SLR and issues that must be considered when developing policy options. A brief discussion of several response options is also included.

A. Gulf-Facing Beaches

Texas has some of the most progressive laws of any Gulf state when it comes to protecting Gulf of Mexico-facing beaches. These laws include the Texas Open Beaches Act of 1959 (TOBA) and the Dune Protection Act (DPA). TOBA indirectly provided statutory protection of the shifting boundaries of beaches by requiring public access to the shore. DPA[54] prevents construction on sand dunes. Texas also has a program called the Texas Coastal Erosion Planning and Response Act of 1999,[55] which aims to prepare the state for SLR. It is a statewide program designed to fund projects that battle erosion in critical Gulf- and bay-facing areas along the coast. It emphasizes the use of dune restoration and beach nourishment coupled with monitoring and studies to prevent the shoreline from retreating.[56] It also funds the removal of structures that are located on public beaches.

DPA requires each county with a Gulf-facing beach to establish a line along beach dunes no further landward than 1,000 feet from the mean high tide line (MHTL).[57] A permit must be obtained in order to partake in any activities that disturb the dunes seaward of this "dune protection line." This prevents development from intruding on the beach, thus protecting the beach and dune system. Local legislation in Texas can enact additional setback rules that prevent development, the most stringent of which is Nueces County. Nueces County disallows most construction from the seaward edge of the dune at the line of vegetation landward to 350 feet.[58] These progressive laws protect Gulf-facing beaches and maintain the ecosystem services they provide, buffering the effects of SLR.

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[53] Sandra S. Nichols & Carl Bruch, *New Frameworks for Managing Dynamic Coasts: Legal and Policy Tools for Adapting U.S. Coastal Zone Management to Climate Change*, 1 SEA GRANT L. & POL'Y J. 19 (2008), http://www.nsglc.olemiss.edu/sglpj/Vol1No1/2Nichols.pdf (last visited June 20, 2018).
[54] TEX. ADMIN. CODE ANN. § 31.15.3.
[55] TEX. NAT. RES. CODE ANN. §§ 33.603-33.608.
[56] *Id.* §33.607.
[57] *Id.* § 63.012.
[58] Richard McLaughlin, *Rolling Easements as a Response to Sea Level Rise in Coastal Texas: Current Status of the Law After Severance v. Patterson*, 26 J. OF LAND USE & ENVTL. L. 365 (2011), *available at* http://www.jstor.org/stable/42842969 (last visited June 20, 2018).

TOBA was enacted in 1959, and the courts' interpretation of the law's public access requirements led to the development of a "rolling easement doctrine," which allows the public to use the beach seaward of the vegetated dune line as it moves due to natural forces.[59] Rolling easements ensure access to sandy beaches migrate inland as the water level rises. Texas courts have also applied custom-based laws to justify rolling easements because, in order for them to be useful and "reflect the reality of the public's actual use of the beach, [the easements] must migrate as did the customary use from which it arose."[60]

Courts have also held that not allowing the public's use to shift with the changing contours of the beach could cause the public's use to entirely disappear.[61] This finding enables the law to be used as a method to combat SLR. Rolling easements restrict development seaward of the easement's landward boundary and provide the rationale for the removal of structures that are located seaward of the landward boundary.[62] They also prevent the installation of any artificial armoring, and existing houses or other structures are subject to removal when erosion or other processes move the vegetation line landward of the structures.[63] This not only guarantees the public's right to Texas's Gulf-facing beaches, but it also protects the sandy beach from erosion due to artificial armoring.

TOBA was weakened by the 2012 *Severance v. Patterson* court case involving a home in Galveston.[64] That property was listed in 1999 by the Texas General Land Office as seaward of the vegetation line and was found in 2004 to be wholly or partially on public beach, but because it was not a hazard the Land Office granted a two-year moratorium on removal.[65] At the time of purchase in 2005, the owner received a disclosure notice that the house was located in vulnerable locations and could be subject to removal by the state. Later that year, Hurricane Rita eroded the beach considerably, and a notice sent to the owner in 2006 stated that the house was subject to removal because it was on the public easement. The owner sued the Texas Land Commissioner with assistance from the Pacific Legal Foundation.

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[59] *Id.*
[60] Caldwell & Segall, *supra* note 5..
[61] McLaughlin, *supra* note 58.
[62] JAMES G. TITUS, CLIMATE READY ESTUARIES, ROLLING EASEMENTS (2011).
[63] *Id.*
[64] Severance v. Patterson, 370 S.W.3d 705 (Tex. 2012).
[65] *Id*.

The Texas Supreme Court held that "Texas does not recognize a 'rolling' easement," and found that structures are only subject to removal under TOBA when imperceptible erosion causes the loss.[66] The court asserted that there was a distinction between avulsion, which are "sudden occurrences," and erosion, which occurs "imperceptibly."[67] It held that, in this case, despite evidence of years of imperceptible erosion, the overnight erosion caused by Hurricane Rita was avulsive, and thus, TOBA did not apply.[68]

The distinctions between avulsion and erosion, while important in a legal context, have limited value in applied science. This finding demonstrates an unclear understanding of geology and natural processes; the ocean and thus shoreline are dynamic and constantly changing. The distinction between erosion and avulsion is ambiguous and effectively requires the reestablishment of easements after each hurricane season. Additionally, it guarantees that the State will be involved in expensive court cases with individual landowners for years to come. Lastly and most importantly, it "defeats the purpose of [T]OBA: to maintain public beach access."[69]

The *Severance* decision had immediate consequences beginning with the cancellation of a $40 million beach nourishment project in West Galveston.[70] The project was cancelled because public funds are not permitted to be used to benefit private homeowners, and there was confusion regarding whether a public easement existed on the beach in question, as believed prior to *Severance*, or whether *Severance* did away with the easement.

In 2013, House Bill (HB) 3459 was enacted giving the Texas General Land (GLO) Commissioner the ability to determine whether avulsion or erosion occurred in certain cases.[71] It offers a three-year moratorium to allow the area to settle naturally; during that time, the public easement is 200 feet from mean low tide line.[72] After that period of time, the commissioner may be advised by the

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[66] *Id*. at 724.
[67] Angela Howe, *Texas Open Beaches - The TX Supreme Court Refuses to 'Roll with It' in West Beach*, GALVESTON SURFRIDER FOUND., Nov. 8, 2010, http://www.surfrider.org/coastal-blog/entry/texas-open-beaches-the-tx-supreme-court-refuses-to-roll-with-it-in-west-bea (last visited June 20, 2018).
[68] *Severance*, 370 S.W.3d at 724-25.
[69] Severance v. Patterson, 566 F.3d 490, 504-05 (5th Cir. 2009) (Wiener, J., dissenting).
[70] Harvey Rice, *Mayor Faults 'blow to Galveston' after State Halts Beach Project*, HOUSTON CHRONICLE, Nov. 15, 2010, https://www.chron.com/business/real-estate/article/Mayor-faults-blow-to-Galveston-after-state-1708528.php (last visited June 20, 2018).
[71] TEX. NAT. RES. CODE ANN. § 61.0171.
[72] *Id.*

Bureau of Economic Geology of the University of Texas to determine whether the change was avulsive or if it was "within the normal rate of erosion."[73] If determined to be erosive, the public easement will roll to the vegetation line. As long as the commissioner listens to the science, this bill is a step towards protecting Texas's beaches and public access to them. A commissioner who errs on the side of private property rights, however, could limit public access to Texas's beaches and potentially cause the loss of beaches through coastal squeeze.

B. Bay-Facing Shorelines

Although Texas's Gulf-facing beaches are shielded by progressive laws, Texas's 3,300 miles of bay-facing shorelines have much less protection. In these areas, private property regulation may be subject only to the owner's will. Texas law provides the GLO with jurisdiction only on public lands that are below the MHTL. If a rising sea is triggering erosion, the landowner must get the land surveyed.[74] Armoring may then be installed as long as it is just above the MHTL and thus not on public lands, regardless of whether coastal squeeze will cause the loss of wetland habitats and their ecosystem services, which benefit everyone. The only protection bay-facing wetlands and beaches have in Texas are federal laws such as the Clean Water Act (CWA) Section 404, which protects coastal wetlands, or any incorporated city ordinances, if applicable.[75]

Unincorporated communities, which are under state law, do not have the legal authority to protect coastal habitats as no state laws exist to protect wetland habitats.[76] As such, there are very few protections for unincorporated, undeveloped bay-facing properties. Incorporated cities should enact their own protections for bay-facing wetland habitats; protection under the law could then spread from community to community. The lack of regulation for bay-facing properties stands in stark contrast to the progressive protection given to Gulf-facing beaches by TOBA and DPA.

C. Takings Issues

The Fifth Amendment of the Bill of Rights to the U. S. Constitution states that "private property [shall] not be taken for public use, without just

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[73] TEX. GEN. LAND OFFICE & TEX. VETERANS' LAND BD., STRATEGIC PLAN FOR THE FISCAL YEARS OF 2015-2019 (2014).
[74] TEX. GEN. LAND OFFICE, RESIDENTIAL APPLICATION PACKET (2013).
[75] 33 U.S.C. § 1344.
[76] 52 TEX. JUR. 3D MUN. CORPORATIONS § 139; 8B TEX. JUR. PL & PR. FORMS § 176:2 (2d ed.).

compensation," and thus, it aims to prevent the federal, state or local government from infringing upon an individual's private property without due compensation. Any government action that deprives a landowner of the full utility of his or her property without compensation may be considered a taking.[77]

By their nature, legal protections for wetland habitats usually prevent the landowner from using his or her property in some way.[78] For instance, the prohibition on armoring means that the areal extent of privately owned uplands may be decreased due to erosion. Should this type of regulation be considered a taking since the government is preventing the landowner from protecting what is legally his or hers? It depends upon how individual laws are written and what type of impact they may have on the owner's use of the property. Policies today must be cognizant of this, and laws and regulations need to be written in such a way that minimizes the probability that the state will be involved in costly litigation expenses and payouts for takings.

A consideration in takings cases is investment-backed expectations.[79] Coastal residents' expectations can be tempered through real estate listings notices and disclosure requirements that inform and warn the potential buyer of the effects of SLR, which can influence investment-backed expectations and thus minimize takings claims.[80] Under Texas state law, Natural Resource Code Section 61.025 requires that all individuals buying land "in close proximity" to a Gulf-facing beach sign a "Disclosure Notice Concerning Legal and Economic Risks of Purchasing Coastal Real Property Near a Beach." This document informs the buyer of "potential risks of economic loss" for coastal properties. It also informs the buyer that he or she may be financially responsible for removing the structure if it becomes located on the public beach due to erosion or storm events. Adopting similar notices in bay-facing areas would be politically controversial and is arguably unrealistic given Texas's political attitudes.

Because the Fifth Amendment was designed to protect the private property owner from the government and not forces of nature, policies can minimize the risk of takings by emphasizing that coastal and bayfront protections are in response to forces of nature and are not designed for government profit at the

[77] Nichols & Bruch, *supra* note 53.
[78] James G. Titus, *Rising Seas, Coastal Erosion, and the Takings Clause: How to Save Wetlands and Beaches Without Hurting Property Owners*, 57 MD. L. REV. 1279 (1998).
[79] Margaret E. Peloso & Margaret R. Caldwell, *Dynamic Property Rights: The Public Trust Doctrine and Takings in a Changing Climate*, 30 STAN. ENVTL. L. J. 51 (2011).
[80] Nichols & Bruch, *supra* note 53.

expense of private landowners. Policies should explicitly state the "background principles' attributes" of the new regulation.[81]

At present, Texas seems to hold an "ignore the problem" perspective to some degree, particularly in regards to bay-facing shorelines. SLR-related problems will not just go away, however. Positive future results will be realized by actions taken immediately. When no action is taken, construction along vulnerable areas of the coastline will continue, as well as additional armoring to fortify private lands against SLR. Additionally, wetland habitats and the services they provide may be destroyed through coastal squeeze caused by development too close to the shoreline. This is an expensive choice as "substantial investments are already at risk and vulnerable."[82]

III. POLICY ISSUES FOR DYNAMIC SYSTEMS

There are many factors to consider when determining which policy should be enacted to protect against SLR. Short- and long-term benefits, ecological and economic impacts, and legal issues including takings are some of the most important considerations. Furthermore, the natural world is a dynamic system; static, rigid laws will not be effective in the long-term unless they recognize the dynamics of a system. Some commentators emphasize the need for adaptive laws that "provide room for changing conditions and lessons learned."[83]

Projected economic and ecologic costs are important when determining which SLR policies are most beneficial and effective. The "values, perceptions, processes and power structures" that exist within a society restrict all policies, and adaptable societies are aware of "diverse values, appreciation, and understanding of specific and variable vulnerabilities to impacts."[84] Communities must also be aware that all SLR adaptations will lead to some loss either in developable land, in wetland habitats and their ecosystem services, or in lost business opportunities if the community retreats. Furthermore, what works in one environment may not be suitable in another one. Factors that must be considered include whether the policy is designed to work in the short- or long-term, the high levels of

[81] Michael Allan Wolf, *Strategies for Making Sea-Level Rise Adaptation Tools 'Takings-Proof'*, 28 J. of Land Use & Envtl. L. 157 (2013), *available at* https://ssrn.com/abstract=2256993.
[82] CAL. DEP'T OF WATER RES. INTEGRATED REG'L WATER MGMT., CLIMATE CHANGE DOCUMENT CLEARINGHOUSE (2010).
[83] Nichols & Bruch, *supra* note 53.
[84] W. Neil Adger et al., *Are There Social Limits to Adaptation to Climate Change?*, 93 CLIMATIC CHANGE 335 (2009).

uncertainty as to what sea level will actually do, what its effects will actually be, and what the community's cultural expectations are.[85]

Policies must be science-based. According to one expert, those that "ignore the dynamics of coastal states and systems" can disrupt both natural and human systems with potentially "catastrophic" results.[86] If the policies disrupt the system and endanger the people living nearby, they clearly have failed, but it would likely be too late for the sensitive system to recover. This emphasizes the need for well considered, scientifically based policies whose impacts have been thoroughly studied.

SLR makes coastal populations more vulnerable to hurricanes since storm waves "attack" the shoreline from higher levels compared to lower sea levels. If no strategies to protect against SLR are enacted, the worst case is billions of dollars' worth of damage and the potential for human casualties particularly from hurricanes. According to one study, approximately 80,000 more people would be at risk of being displaced if Hurricane Ike were to occur in 2100 with 0.74 m of SLR compared to the number actually displaced by Ike in 2008.[87] Additionally, 48 fire stations, hospitals, police stations, and schools in that area are at risk given 0.74 m of SLR by 2100.[88]

Funds to combat huge natural disasters come directly from taxpayer-funded governmental organizations, such as FEMA, which provides billions of dollars in aid. For instance, as of 2015 nearly $20 billion was paid to Louisiana after the 2005 Hurricane Katrina.[89] A reinsurance company found that "by investing 50 billion dollars in cost-effective measures over the next 20 years... [Texas, Mississippi, and Alabama] can avert up to 135 billion dollars in annual losses."[90]

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[85] Kim S. Alexander et al., *Managed Retreat of Coastal Communities: Understanding Responses to Projected Sea Level Rise*, 55 J. OF ENVTL. PLANNING & MGMT. 409 (2012) [hereinafter *Managed Retreat*].
[86] Megan Higgins, *Legal and Policy Impacts of Sea Level Rise to Beaches and Coastal Property*, 1 SEA GRANT L. & POL'Y J. 43 (2008), http://www.nsglc.olemiss.edu/sglpj/Vol1No1/3Higgins.pdf (last visited June 20, 2018).
[87] Subedee et al., *supra* note 29.
[88] *Id.*
[89] FED. EMERGENCY MGMT. AGENCY, LOUISIANA RECOVERY UPDATE: KATRINA AND RITA BY THE NUMBERS (2015), https://www.fema.gov/news-release/2015/08/24/louisiana-recovery-update-katrina-and-rita-numbers (last visited June 20, 2018).
[90] *Shoring up the Energy Coast- Building Climate-Resilient Industries Along America's Gulf Coast*, SWISS RE,

The Army Corps of Engineers' Regulation No. 1100-2-8162 "Incorporating Sea-Level Change in Civil Works Programs" works to integrate "the direct and indirect physical effects of projected sea-level change across the project life cycle in managing, planning, engineering, designing, constructing, operating, and maintaining Corps projects and systems of projects."[91] However, the United States does not currently have a national program to protect its urban areas from SLR. It is up to individual states, cities, and communities to determine how to best combat it. Additionally, politicians do not prioritize SLR planning because, as one article put it, "in political terms," SLR does not need to be "dealt with this week."[92]

Scientific knowledge about SLR and its effects has outpaced legislation and regulations. Consequently, this makes it difficult for any SLR projects to gain traction and to receive the financial support that is necessary for defensive projects, policies, or laws to be successfully executed or implemented. An exception to this is after a disaster such as Hurricane Sandy when funds were made available for research and preparation so that the area was not as vulnerable to a future, similar storm.

Policies designed to combat SLR have strong socio-political aspects; they must attempt to balance economic development and resource protection.[93] For instance, an economically beneficial policy may have such large ecological costs that it is found inferior.[94] The community must determine what it values, what it aims to protect through policies, and how far into the future it is willing to plan. Different policy options will be most suitable for different community values. In general, community members are not only concerned with the "economics and science" of policies but also their "fairness, transparency and morality."[95] For example, communities must consider that in some locations the harm incurred by not armoring is less than the benefits derived by that action. One study in Tybee Island, GA, for example, compared the "estimated recreational benefits" to the costs incurred for armored beaches to those that were 20 m wider with no visible

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http://www.swissre.com/rethinking/Building_a_resilient_Energy_Gulf_Coast.html (last visited June 20, 2018).

[91] U.S. ARMY CORPS OF ENGINEERS, SEA-LEVEL CHANGE CONSIDERATIONS FOR CIVIL WORKS PROGRAMS (2011).

[92] HUNT JANIN & SCOTT A. MANDIA, RISING SEA LEVELS: AN INTRODUCTION TO CAUSE AND IMPACT (2012).

[93] ZOË PFAHL JOHNSON, MD. DEP'T OF NAT. RES., A SEA LEVEL RISE RESPONSE STRATEGY FOR THE STATE OF MARYLAND (2000).

[94] JANIN & MANDIA, *supra* note 92.

[95] *Managed Retreat*, *supra* note 85.

armorings.[96] They found that the wider, unarmored beaches had "very huge" benefits compared to the estimated costs of the higher quality armoring.[97]

Three policy response options to SLR will be considered: armoring, living shorelines, and organized retreat. Living shorelines and retreat are considered sustainable options because they preserve ecosystem services and protect coastal residents. Armoring, conversely, is considered to be unsustainable since it will not be effective once sea level reaches a certain level and either affects the armoring's structural stability directly or overtops it.

A. Armoring

Shoreline armoring is when structures are used to prevent the shoreline from moving. This approach is used by large cities such as New York City and Miami as well as other areas with "highly valued and immovable assets" whose infrastructure is so great that a retreat is not feasible.[98] While it can effectively prevent erosion at a particular section of shoreline, it generally exacerbates erosion down the beach and can cause the net loss of often-critical wetland habitats and the ecosystem services that they provide. Down-beach erosion is caused through the disruption of the longshore currents' erosional and depositional processes that occur naturally on all beaches. In addition, wave refraction erodes sediments around the sides of the armoring, typically causing a concave shape to the shoreline and the erosion of properties downdrift.

Armoring restricts access to sandy beaches and can completely cut off beach access for the public.[99] It can also destroy the beach altogether through coastal squeeze.[100] Vertical erosion is often enhanced in front of seawalls because waves reflect off the seawall and scour below the structure, thereby deepening the water depth.[101] This steepens the slope underwater and causes subsequent waves to strike the seawall harder, thereby accelerating the need to have it reinforced. This is why seawalls and other armorings need to be regularly maintained.[102] Collapse

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[96] Craig E. Landry et al., *An Economic Evaluation of Beach Erosion Management Alternatives*, 18 MARINE RESOURCE ECONOMICS 105 (2003).
[97] *Id.*
[98] *Managed Retreat, supra* note 85.
[99] Gary B. Griggs, *The Effects of Armoring Shorelines—The California Experience*, *in* PUGET SOUND SHORELINES AND THE IMPACTS OF ARMORING—PROCEEDINGS OF A STATE OF THE SCIENCE WORKSHOP 77 (Hugh Shipman, et al., eds., 2010).
[100] Jason D. Toft et al., *Ecological Response and Physical Stability of Habitat Enhancements Along an Urban Armored Shoreline*, 57 ECOLOGICAL ENGINEERING 97 (2013).
[101] Griggs, *supra* note 99.
[102] *Id.*

of the structure can cause the loss of a significant amount of land.[103] Even if they are structurally sound, a rising sea may still overtop static armoring structures that were designed for lower water levels. Issues such as these have led to a tightening of restrictions for armoring projects in some states such as Texas, Maryland, and Rhode Island.

Shoreline armoring has large upfront capital costs. It is estimated that protecting certain vulnerable areas in California through seawalls and levees would cost at minimum $14 billion to construct and $1.5 billion per year in maintenance.[104] Due to the high costs, it is necessary to balance the land saved with the monies spent and ecological damage inflicted. It is also necessary for the community that is considering armoring to consider the length of time that they want to keep the water at bay since "it is a matter of time until shoreline armoring fails… Armoring the coast simply delays the inevitable."[105] Lastly, armoring has large negative environmental costs that are rarely incorporated in cost-benefit analyses due to the loss of ecosystem services that occurs from coastal squeeze and the loss of wetland environments.

The permitting system for armoring is typically well established. Federal agencies are typically willing to grant armoring permits, because they are concerned about takings claims if they do not.[106] It is difficult to phase out of shoreline armoring with methods that are more progressive. Additionally, a problem with both armoring and living shorelines (discussed below) is that both systems can encourage development landward. Therefore, protecting shorelines, if not done in conjunction with good setback, rollback, and/or construction policies and with no commitment to repair and upgrade the project, could increase vulnerability over time, particularly in light of SLR.

B. Living Shorelines

Armoring and other artificial land/water interfaces usually "disrupt highly diverse and productive plant and animal communities" and cause a loss of wetland habitats and their ecosystem services.[107] Living shorelines, the name given to erosion and flooding control projects that utilize natural materials and

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[103] TODD MILLER ET AL., RESTORE AMERICA'S ESTUARIES, LIVING SHORELINES: FROM BARRIERS TO OPPORTUNITIES (2014).
[104] CAL. CLIMATE CHANGE CTR., THE IMPACTS OF SEA LEVEL RISE ON THE CALIFORNIA COAST (2009), http://pacinst.org/app/uploads/2014/04/sea-level-rise.pdf (last visited June 20, 2018).
[105] Celeste B. Pagano, *Where's the Beach? Coastal Access in the Age of Rising Tides*, 42 SW. U. L. REV. 1 (2012), *available at* https://ssrn.com/abstract=2109443 (last visited June 20, 2018).
[106] Titus, *supra* note 78.
[107] Caldwell & Segall, *supra* note 5.

vegetation, are an alternative to shoreline armoring. Living shorelines encourage the preservation or growth of coastal habitats and allow migration when sea level rises. It is an ecologically friendly option which protects coastlines with few negative effects.[108] They can range from using purely natural methods like planting marsh grass to hybrid infrastructure which incorporates both artificial structures and natural elements.[109]

Living shorelines dissipate wave energy, prevent erosion, and enhance the ecological connectivity of the land/water interface by using natural means. They typically are visually appealing, improve water quality, and restore or enhance habitats for wetland organisms including birds, fish, and other aquatic species.[110] They maintain or increase the growth of wetland habitats for a given area, which can increase biodiversity and ecosystem services.[111] While armoring projects aim to prevent erosion through the reflection of wave energy, living shorelines absorb that energy as the vegetation naturally attenuates wave energy through friction.[112] Bagged oyster shells, for example, can be placed in areas where oyster spat can attach to eventually create a reef, which will attenuate wave energy.[113] Living shorelines create more resilient shorelines than armorings do, and downdrift erosion effects are lessened compared to armoring projects. They are also designed to be at least partially self-maintaining once established.[114]

There are several legal issues regarding property rights involved with living shorelines. While the ecologic and protective benefits of living shorelines are widely known, there are concerns regarding how they impact publically

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[108] Carolyn A. Currin et al., *Developing Alternative Shoreline Armoring Strategies: The Living Shoreline Approach in North Carolina United States Geological Survey*, *in* PUGET SOUND SHORELINES AND THE IMPACTS OF ARMORING—PROCEEDINGS OF A STATE OF THE SCIENCE WORKSHOP (Hugh Shipman et al., eds., 2010).
[109] OYSTER RESTORATION WORKGROUP, LIVING SHORELINES AND COASTAL EROSION, http://www.oyster-restoration.org/living-shorelines/.
[110] Currin et al., *supra* note 108.
[111] Carolyn A. Currin, Priscilla C. Delano & Lexia M. Valdes-Weaver, *Utilization of a Citizen Monitoring Protocol to Assess the Structure and Function of Natural and Stabilized Fringing Salt Marshes in North Carolina*, 16 WETLANDS ECOLOGY AND MANAGEMENT 97 (2007).
[112] I. Möller, *Quantifying Saltmarsh Vegetation and its Effect on Wave Height Dissipation: Results from a UK East Coast Saltmarsh*, 69 ESTUARINE, COASTAL AND SHELF SCIENCE 337 (2006).
[113] David L. Meyer et al., *Stabilization and Erosion Control Value of Oyster Cultch for Intertidal Marsh*, 5 RESTORATION ECOLOGY 93 (1997).
[114] Rachel K. Gittman et al., *Marshes With and Without Sills Protect Estuarine Shorelines from Erosion Better than Bulkheads During a Category 1 Hurricane*, 102 OCEAN & COASTAL MANAGEMENT 94 (2014).

owned submerged lands.[115] Materials placed to attenuate wave energy below the MHTL are on publically owned lands. Additionally, living shorelines can cause accretion, which potentially reduces the area of the publicly owned submerged lands. In all states, if accretion occurs and is not due to the intentional actions of the landowner, then it becomes part of their property as was found in the Texas case, *Brainard v. State*.[116] If accretion occurs due to the landowner installing a living shoreline, however, would the property be retained by the state because of the intentional actions or would its ownership transfer to the adjacent owner? This is a question that has yet to be answered.

The U.S. Corps of Engineers Nationwide Permit 54 streamlines the federal permitting process for living shorelines.[117] There was a need for a process that is consistent and predictable as the previous process was confusing and time-consuming. As the loss of some submerged lands is typically preferable to the negative effects caused by shoreline armoring, the government should furthermore offer incentives for property owners to install living shorelines instead of armoring against SLR. At the same time, permitting officials must address the unsettled ownership issue and be open to the notion that landowners are not using living shorelines to increase their private property at the expense of publicly owned submerged lands.

C. Retreat

Because sea level is predicted to rise, the best long-term solution for certain areas may be organized retreat.[118] It is an unpopular option that has potentially large benefits.[119] Since most armoring projects, excepting massive

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[115] TONY WATKINSON & SHEP MOON, REGULATORY PROGRAM OVERVIEW FOR VIRGINIA'S SUBMERGED LANDS AND TIDAL WETLANDS AND OPTIONS FOR PROMOTING LIVING SHORELINES (2006).
[116] Brainard v. State, 12 S.W.3d 6 (Tex.1999).
[117] *Nationwide Permit Information*, U.S. ARMY CORPS OF ENGINEERS, http://www.usace.army.mil/Missions/Civil-Works/Regulatory-Program-and-Permits/Nationwide-Permits/ (last visted June 20, 2018).; *see also* RICHARD MCLAUGHLIN & RACHEL EDWARDS, TEX. A&M UNIV.- CORPUS CHRISTI, HARTE RESEARCH INST., LIVING WITH SEA LEVEL RISE ON THE UPPER TEXAS COAST: PUBLIC POLICY CONCERNS AND COMPARISONS TO FLORIDA (2017) (on file with author).
[118] ANNE SIDERS, COLUM. L. SCH. CTR. FOR CLIMATE CHANGE L., MANAGED COASTAL RETREAT: A LEGAL HANDBOOK ON SHIFTING DEVELOPMENT AWAY FROM VULNERABLE AREAS (2013).
[119] Travis Martay Brennan, *Redefining The American Coastline: Can The Government Withdraw Basic Services From The Coast and Avoid Takings Claims?* 14 OCEAN & COASTAL L. J. 101 (2008), *available at* http://digitalcommons.mainelaw.maine.edu/oclj/vol14/iss1/6/ (last visited June 20, 2018).

levee and dike projects such as those that defend Rotterdam Harbor and New Orleans, protect against a maximum of several meters of SLR. While this may seem large, it is not unusual for a hurricane's storm surge to be greater than several meters in height. Furthermore, it is a matter of when, not if, in the future we reach several meters of SLR. As such, the presence of armoring may only delay inevitable hurricane or flooding damage. Furthermore, any storm that is greater than the anticipated design level will overtop the defenses to cause widespread damage.[120] In comparison, organized retreat, which is the migration of settlements away from the shoreline, gives the rising water a place to go without damaging infrastructure.[121] There are multiple ways for communities to initiate a retreat.

Erosion setbacks enable the government to initiate a slow retreat from rising water levels and eroding coasts. They can be applied in different ways, but a common option is limiting development in hazard-prone areas. This can be done by limiting growth in those locations by issuing a fewer number of building and renovation permits or by requiring the permit-granting institution to consider a future rate of SLR before issuance. Construction of mobile structures which can be picked up and moved away from the sea, such as the Yup'ik Tribe did in Alaska when it voted to move its community inland, is another option.[122] It is also possible to move historic or otherwise important structures inland as demonstrated by North Carolina when the Cape Hatteras lighthouse was moved over 800 m to protect it from erosion.[123] While this option allows for wetland habitat and beach migration, it comes with what are often prohibitively high costs.[124] Another option is for the government, either at the state or federal level, to purchase

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[120] Hsaing Wang, *Water Erosion and Damage to Coastal Structures, in* HURRICANE HUGO, PUERTO RICO, THE VIRGIN ISLANDS, AND CHARLESTON, SOUTH CAROLINA, SEPTEMBER 17-22, 1989 (National Academies Press: OpenBook 1994), https://www.nap.edu/read/1993/chapter/14 (last visited June 20, 2018).

[121] SIDERS, *supra* note 118.

[122] James D. Ford et al., *Climate Change in the Arctic: Current and Future Vulnerability in Two Inuit Communities in Canada*, THE GEOGRAPHICAL JOURNAL (2007), http://onlinelibrary.wiley.com/doi/10.1111/j.1475-4959.2007.00249.x/abstract (last visited June 20, 2018).

[123] *Moving the Cape Hatteras Lighthouse*, NAT'L PARK SERV., https://www.nps.gov/caha/learn/historyculture/movingthelighthouse.htm (last visited June 20, 2018).

[124] ROBERT E. DEYLE, FLORIDA STATE UNIV. DEP'T OF URBAN & REG'L PLANNING, SEA LEVEL RISE ADAPTATION OPTIONS FOR LOCAL GOVERNMENTS, http://www.floridajobs.org/docs/default-source/2015-community-development/community-planning/crdp/sealevelriseadaptationoptionsforlocalgovernments.pdf?sfvrsn=6 (last visited June 20, 2018).

private property in hazardous areas and demolish any buildings located on it.[125] The government can also limit public support including utilities, road maintenance and fire and police services, although the ethics of this are questionable and there may be takings claims.

An organized retreat can be very expensive.[126] However, it preserves ecosystem services by allowing the wetland habitats to migrate inland where topography allows, prevents a catastrophe when artificial structures are overtaken by the sea, and can be economically beneficial in the long run when comparing the loss of whole cities to the expense of slowly retreating.[127] It also may be the most feasible option for communities located in hazard-prone areas that cannot afford to invest in protection. Fairbourne, Wales is such an example. Fairbourne is located on a flood plain, and in 2014 it determined that it would be decommissioned over the next forty years.[128]

Officials must be careful with the wording of the law and how it is implemented to avoid triggering takings claims, but also to protect those living in the coastal area since the potential for social inequality and compensation claims in an organized retreat strategy can be large.[129] For instance, housing prices in Fairbourne "plummeted" after plans were implemented to decommission the village.[130] Additionally, organized retreat strategies can come at a great cost to individual property owners whose property values could drop virtually overnight. While the policy must consider how to compensate those individuals, the overall strategy has the potential to offer great benefits to the community.

As high as the costs to initiate a retreat are, it still may be less than the cost to renourish the beach as found in a Nags Head, NC study. That study found that buying all the buildings expected to be lost to erosion in fifty years would cost

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[125] SIDERS, *supra* note 118.
[126] Carolyn Kousky, *Managing Shoreline Retreat: A US Perspective*, 124 CLIMATIC CHANGE 9 (2014); CHRISTOPHER TURBOTT & ANDREW STEWART, WAIKATO REG'L COUNCIL, MANAGED RETREAT FROM COASTAL HAZARDS: OPTIONS FOR IMPLEMENTATION (2006), https://www.waikatoregion.govt.nz/services/publications/technical-reports/tr/tr200648 (last visited June 20, 2018).
[127] James G. Titus, *Greenhouse Effect, Sea Level Rise, and Barrier Islands: Case Study of Long Beach Island, New Jersey*, 18 COASTAL MGMT. 65 (1990); R.K. Turner et al., *A Cost–benefit Appraisal of Coastal Managed Realignment Policy*, 17 GLOB. ENVTL. CHANGE 397 (2007).
[128] *What Is Fairbourne Moving Foward?*, FAIRBOURNE MOVING FORWARD, http://fairbourne.info/ (last visited June 20, 2018).
[129] *Managed Retreat*, *supra* note 85.
[130] Richard Spillett, *Village of the DAMMED*, DAILY MAIL, Feb. 12, 2016, http://www.dailymail.co.uk/news/article-3442264/Welsh-village-decommissioned-warnings-lost-sea.html (last visited June 20, 2018).

$400 million.[131] That was four times less than the costs of a fourteen-mile beach renourishment project that would have to be renourished every three years at a total cost of $1.6 billion.[132] Additionally, the removal of the structures resulted in wider beaches, unobstructed wetland habitats, and ease of access to the beach, yielding higher values of the remaining houses.[133]

Many factors must be considered when determining if green, grey, or hybrid infrastructure is appropriate for a given shoreline. Green infrastructure includes natural design elements such as marsh grasses or oyster reefs, grey infrastructure is purely artificial such as bulkheads or groins, and hybrid infrastructure includes both natural and artificial elements. Because no two shorelines have the same set of parameters, this process must be done for each situation. There is a need for region-specific ecosystem services valuation and the quantification of grey infrastructure's negative costs.[134] For grey infrastructure, this can include downdrift erosion and the loss of the ecosystems and their services that existed prior to the armoring installation. These two metrics allow for a more accurate picture of what exactly is at risk and what the benefits are of the various shoreline protection strategies.

It is also important to determine what time frame is under consideration in a given situation. Living shorelines may not protect against erosion as well as armoring in the short term, but armoring may cause issues that living shorelines mitigate in the longer term. Another consideration is the character of common hazards in a given area and what natural vegetation or habitats are best suited to mitigate them. For instance, marsh grasses are excellent for attenuating wave energy to mitigate erosion on a coastline, but they may not be solely appropriate in more exposed areas where they will erode and not be self-sustaining.

Another consideration is a community's development may dictate different response strategies. Less developed areas may be able to emphasize environmental benefits while more developed areas, particularly those with infrastructure that is necessary to regional or national economic activities, may need to use harder infrastructure strategies for protection purposes. Communities must balance resiliency and vulnerability with economic growth, environmental

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[131] ORRIN H. PILKEY & ROB YOUNG, THE RISING SEA (2d ed. 2011).
[132] *Id.*
[133] Landry et al., *supra* note 96.
[134] EXEC. OFFICE OF THE PRESIDENT, NAT'L SCI. & TECH. COUNCIL COMM. ON ENV'T., NATURAL RES., & SUSTAINABILITY, ECOSYSTEM SERVICE ASSESSMENT: RESEARCH NEEDS FOR COASTAL GREEN INFRASTRUCTURE (2015), https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/cgies_research_agenda_final_082515.pdf (last visited June 20, 2018).

quality, and historical preservation.[135] It is important to gather necessary and relevant data and to explicitly evaluate priorities and desired outcomes to determine the best course of action when installing infrastructure.

IV. CASE STUDIES: WHAT TECHNIQUES ARE MOST APPROPRIATE FOR DIFFERENT COMMUNITIES

The four sites in this study have very different community structures and economic goals. They also have very different built environments. Because of this, different SLR protection strategies are appropriate for each. Below is an outline of actions that may be best suited to each site given their varying regional activities and priorities.

A. Texas City

Texas City, located in Chambers and Galveston Counties, is an industrial city that borders Galveston Bay. It has a port and is a petroleum refining and petrochemical manufacturing center vital to the energy production of both the Gulf region and the United States.[136] The Port of Texas City is the third largest port in Texas and the fifteenth largest in the United States.[137] Its refineries and other infrastructure are necessary to the entire nation, and damages to it from natural disasters such as Hurricane Ike can be catastrophic to the nation. It is affected by subsidence rates between -0.30 and -0.33 mm per year.[138] For these reasons, damages from future storms could be worse because of SLR. Therefore, its protection is a priority.

Accordingly, Texas City does not prioritize coastal ecosystems or their services over the installation and subsequent upkeep of their levee system and dike. The Texas City Dike extends almost to Galveston Island and is designed to protect Texas City from storm surges, and there is also a seventeen-mile long

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[135] *Id.*
[136] T. B. Ryerson et al., *Effect of Petrochemical Industrial Emissions of Reactive Alkenes and NOx on Tropospheric Ozone Formation in Houston, Texas*, 108 J. OF GEOPHYSICAL RES. 8-1 (2003), *available at* https://agupubs.onlinelibrary.wiley.com/doi/epdf/10.1029/2002JD003070 (last visited June 20, 2018).
[137] Roy Scranton, *When the Next Hurricane Hits Texas*, N.Y. TIMES, Oct. 7, 2016, https://www.nytimes.com/2016/10/09/opinion/sunday/when-the-hurricane-hits-texas.html (last visited June 20, 2018); *Tonnage of Top 50 U.S. Water Ports, Ranked by Total Tons*, BUREAU OF TRANSP. STATISTICS, DEP'T OF TRANSP., https://www.bts.gov/archive/publications/national_transportation_statistics/table_01_57 (last visited June 20, 2018).
[138] Subedee et al., *supra* note 29.

levee system designed to prevent flooding. Because of these factors, a continuation of hardening its shorelines and installing other grey infrastructure may very well be the best option for Texas City and other highly industrialized coastal cities like it.

B. Galveston

Galveston Island is a barrier island that separates the Gulf of Mexico from Galveston Bay. It is highly developed with an industrial port on the east side, whereas the west side is suburban, including year-round vacation homes. It is about 28 miles by 3 miles in area. Prior to widespread development on the island, sand dunes were up to 4.5 m in height; they have since been destroyed, making the island more vulnerable to large storms. For instance, the Hurricane of 1900 still ranks as the deadliest natural disaster in U.S. history, and it also provided motivation for the city to raise the elevation of the eastern portion of the island and install a massive seawall that is 10 miles long and about 5 m in height above mean sea level. Despite the seawall, Hurricane Ike, which struck in 2008, was the third most costly storm in U.S. history with estimated financial losses of $21.3 billion.[139] Additionally, Ike caused 50 m of erosion from Galveston's seawall to an area 15 km west of the seawall.[140] In another attempt to protect from SLR and storm surge, many structures built and rebuilt after Ike were put on stilts at heights determined by NFIP to protect against the expected surge of a 100-year storm. Even when considering those efforts, erosion and land subsidence have led to projections that parts of Galveston could be underwater in several decades.

Galveston has a long-term Gulf shoreline erosion average of approximately 5 feet per year except for the east end adjacent to the jetties protecting the main entrance to Galveston Bay (Bolivar Roads). Adjacent to the Bolivar Roads jetties, in contrast, the shoreline has advanced at rates up to 88.2 ft. per year.[141] The Bolivar jetties' accretion rate is at the expense of beaches along the west end of Galveston Island, which are sediment starved. Natural bay shorelines of marshes, flats, and beaches dominate the western 18 miles of Galveston and have retreat rates of approximately 3.3 feet per year.[142] The bay

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[139] Mitigation Assessment Team Report, *supra* note 40.
[140] KARA S. DORAN, ET AL., HURRICANE IKE: OBSERVATIONS AND ANALYSIS OF COASTAL CHANGE (2009), https://pubs.usgs.gov/of/2009/1061/pdf/ofr2009-1061.pdf (last visited June 20, 2018).
[141] ROBERT A. MORTON, SHORELINE CHANGES ON GALVESTON ISLAND (BOLIVAR ROADS TO SAN LUIS PASS) – AN ANALYSIS OF HISTORICAL CHANGES OF THE TEXAS GULF SHORELINE (1974).
[142] J.C. GIBEAUT ET AL., CHANGES IN BAY SHORELINE POSITION, WEST BAY SYSTEM, TEXAS (2003), *available at*

shoreline on the eastern 10 miles of the island is mostly armored and heavily developed, and subsidence rates vary between -0.43 and -0.59 mm per year.[143]

Galveston is an example of an area that might benefit most from hybrid infrastructure. It is developed and has an economy driven by tourism, and it is vulnerable to erosion and land subsidence. Galveston's needs protection from erosion in a way that also is not an eyesore for tourists. Hybrid infrastructure, which uses armoring in conjunction with natural materials, may be the best option. The combination of green and grey infrastructure may best balance Galveston's draw to tourists with protection against erosion and storm surges.

C. Anahuac

Anahuac is a small, rural town situated between Lake Anahuac and Trinity Bay at the northeast of Galveston Bay. It is a small, lightly developed town located in Chambers County with a population of approximately 2,000 people as of the 2010 census. Its infrastructure is mostly houses, and Main St. runs north to south through the study site with several roads joining it from the east, northeast and west. Because it has a very small population and very little infrastructure beyond private homes, this is an area that may prioritize the protection of coastal ecosystems. However, its shoreline has been armored in places to protect peoples' private property. Its remaining natural shoreline consists of marshes, beaches, and some bluffs to the south. Subsidence rates are around -3 mm per year.[144]

Because it is a rural area with very little to no infrastructure of national importance, Anahuac may be an excellent choice to install green infrastructure to protect the natural shoreline. Since coastal habitats such as marshes attenuate floodwaters, keeping Anahuac's shorelines natural may give floodwaters somewhere to go besides into more developed lands. Other ecosystem services could be enhanced through the installation of green infrastructure such as seagrass beds as habitat for juvenile fish. This could benefit the region as a whole since fishing is a huge industry in Galveston Bay.

D. Surfside Beach

Surfside Beach is a small, low-lying town in southern Brazoria County. It has a permanent population of less than 1,000 people. Surfside's Gulf shoreline

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http://www.beg.utexas.edu/coastal/presentations_reports/WestBayfinalreport.pdf (last visited June 20, 2018).

[143] Subedee et al., *supra* note 29.

[144] *Id*.

average annual retreat rate is up to 15 feet per year.[145] The region's erosion is caused by both sea level rise and lack of sand, which is due to historical anthropogenic changes to the Brazos River and the dredging of Freeport Harbor Ship Channel.[146] Surfside's subsidence rates are between -3 and -3.2 mm per year.[147] Surfside borders the Gulf, which cannot legally be armored under TOBA. Because of coastal squeeze and erosion, Surfside beaches have very small dune systems, which increase the vulnerability of the area to SLR. Arguably, the best long-term solution is to retreat from the shoreline. However, Surfside's residents prefer beach renourishment and building bulkheads instead.

Surfside Beach's primary industry is tourism; accordingly, preservation of the beach system is paramount. Surfside is in need of immediate and extreme action to mitigate its erosional issues because anthropogenic perturbations have resulted in a nearly complete loss of incoming sediment.[148] Living shorelines cannot be used on beaches. Because of this, Surfside partakes in somewhat regular beach renourishment projects; two renourishment projects were completed between 2011 and 2014, and a third renourishment project in 2017.[149] This is probably the only way the shoreline can be forced to stay more or less in place.

An arguably better and certainly more sustainable long-term solution for Surfside, however, is to retreat from the rising Gulf. Surfside has already relocated structures that were seaward of the vegetation line, but further action appears to be required.[150] By retreating, Surfside would avoid spending millions continually on renourishment projects that quickly erode. A retreat would also increase the safety of the residents by moving them further inland away from the coastline, and insurance claims would certainly decrease due to a fewer number of structures in vulnerable shoreline locations. Although a retreat is typically an extremely unpopular response to SLR, it may be the best option for Surfside as it was for the neighborhood of Brownwood.

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[145] *Surfside Beach*, CONRAD BLUCHER INST., http://cbiweb.tamucc.edu/CHRGIS/Surfside-Beach/ (last visited June 20, 2018).
[146] Matthew Tresaugue, *Surfside Beach Losing Battle Against Erosion*, HOUSTON CHRON., July 18, 2009, http://www.chron.com/news/houston-texas/article/Surfside-Beach-losing-battle-against-erosion-1725314.php (last visited June 20, 2018).
[147] Subedee et al., *supra* note 29.
[148] Robert A. Morton, *Historical Shoreline Changes and Their Causes, Texas Gulf Coast*, 77-6 GEOLOGICAL CIRCULAR 351 (1977).
[149] *GLO Grants: Coastal/Oil Spill Prevention & Response*, TEX. GEN. LAND OFFICE, http://www.glo.texas.gov/coastal-grants/#search (last visited June 20, 2018).
[150] David Baron, *As Beaches Creep In, Ownership Disputes Erupt*, NPR, June 17, 2008, http://www.npr.org/2008/06/17/91586603/as-beaches-creep-in-ownership-disputes-erupt (last visited June 20, 2018).

The severe erosion is partly caused by government actions such as dredging and jetty building, but also by private property owners constructing bulkheads and leaving houses on the beach. Arguably, taxpayers should not be required to continually foot the bill for beach renourishment projects that benefit only those on the coast. In this case, private property owners must be required to move away from the retreating shoreline. This action will improve human safety and will enable public access to the beach. By initiating a retreat, Surfside could be a model for other municipalities in the region with erosional issues, such as Sargent, TX, as well as other communities with similar issues across the United States.

V. CONCLUSION

Sea level is rising, coastal counties are vulnerable, and their fate and the fate of wetland habitats such as marshes and beaches depend on the preparations made today. Due to its history of subsidence from groundwater and petrochemical extractions and its heavily populated coastal areas, Galveston Bay is at particular risk to SLR-induced hazards. As such, it is imperative that considerations are taken now to plan for these hazards and to take steps immediately to mitigate future threats. Reactive strategies ignore problems until a natural disaster strikes, requiring extreme measures to minimize human harm and suffering. A greater recognition of the complexity and far-reaching effects of resiliency strategies will be a first step in providing the necessary research to communities so that they can construct policies that target their individual priorities. Taking proactive actions can minimize human suffering and the associated costs of a reactive strategy. As Benjamin Franklin stated, "An ounce of prevention is worth a pound of cure." The four sites in this study are as examples for similar communities around Galveston Bay.

SLR will affect the world's coasts, but today's actions will directly affect how severe those impacts are. It is much easier socio-politically to be reactive instead of proactive, and even within proactive plans it is easier to focus on the immediate future rather than what may happen in the long-term. Unfortunately, waiting until the effects of SLR are more obvious will set Texas behind; the largest benefits of early action may not be seen for several generations.[151] Actions must occur immediately in order to best protect coastal areas, despite the uncertainty regarding how far and at what rate sea level will actually rise.

[151] Nicholls & Lowe, *supra* note 28.

Actions such as the installation of seawalls or the strengthening of dikes and levees have historically occurred after disasters such as Galveston's Hurricane of 1900 or Hurricane Katrina; taking action before disasters such as these would not only be less expensive but it would also save thousands of human lives. Proactive action has the greatest benefit when it is executed sooner; society can either invest in protective and adaptive measures immediately, or it can wait until natural disasters, such as hurricanes and floods, require a much greater investment in the future.

Community values and priorities will determine which response strategies are most appropriate for each jurisdiction. The future of wetlands is linked intrinsically to socio-economic conditions, policy decisions, perceptions about their value, and their future areal extent are directly affected by today's "complex economic and sociological decisions."[152] A paradigm that protects marshes and allows them the room to migrate upland can increase the resilience of coastal communities, preserve ecosystem services, and can cost less in the long-term.[153] This coupled with the long residence time of greenhouse gas emissions and the negative feedback loop that can occur from marsh degradation and released carbon means that the strategies made in the short-term can have huge consequences on the global climate and built and natural environments far into the future. Thus, it is important to find a sustainable solution that balances current needs with the needs of future generations.

The optimal protection strategy for a given problem is one that best balances social, economic, political, and ecologic factors. Therefore, the optimal solution for SLR protection in communities around Galveston Bay will vary because the priorities and values of the individual communities vary. Armoring may be best for areas such as Texas City, which has preexisting vital infrastructure while areas such as Galveston, which are still economically important, can be protected in some areas with armoring while other areas are left with a natural land/sea interface. Green infrastructure may be best for communities like Anahuac that are not very densely developed while communities such as Surfside Beach may best protect resources by migrating away from the rising seas.

This article explores current laws and legal issues relating to SLR in Texas, and it also offers a discussion of the benefits and drawbacks of each of the policies that could be implemented. It is important to emphasize that policies

[152] Matthew L. Kirwan & J. Patrick Megonigal, *Tidal Wetland Stability in the Face of Human Impacts and Sea-Level Rise*, 504 NATURE 53 (2013).
[153] PILKEY & YOUNG, *supra* note 131.

should focus upon the systems that sustain human activities rather than the human activities themselves, and the policies should be proactive instead of reactive.[154] Short-term actions must be coupled with long-term efforts at all government levels.[155]

Much work remains to be done on this subject. Most obviously, there is too much uncertainty as to how far sea level will actually rise, particularly in regard to the rate of polar ice sheet melt and under different emission and adaptation scenarios in various environments. More study and knowledge is needed on this front as well as on the long-term effects of policy options. The dispersal of this knowledge through outreach efforts and education is of supreme importance in getting the public to realize the dangers associated with SLR. Secondly, with the exception of the Netherlands, no state or country has planned beyond 2100. Since most effects of SLR will occur in the long-term with the potential of 12 m of SLR, studies should begin analyzing impacts over the next one thousand years.[156] Furthermore, different values will lead to the implementation of different strategies to combat SLR, so individual communities need to determine where their priorities in the coastal zone lie. Lastly, in order to identify potentially hazardous and/or threatened areas, it is necessary to predict areas of future population growth and those that are vulnerable to SLR and work to protect them from unwise development.[157]

[154] Higgins, *supra* note 86.
[155] G. Robbert Biesbroek et al., *The Mitigation–Adaptation Dichotomy and the Role of Spatial Planning*, 33 HABITAT INTERNATIONAL 230 (2009).
[156] Nicholls & Lowe, *supra* note 28.
[157] Caldwell & Segall, *supra* note 5.

TRANSCRIPT FROM THE SYMPOSIUM ON IMPROVING COOPERATION FOR A SUSTAINABLE GULF OF MEXICO AFTER THE 2014 MEXICAN ENERGY REFORM

FEBRUARY 25, 2016- GALVESTON, TEXAS

WELCOME REMARKS

Stephen Zamora, Executive Director, Center for U.S. and Mexican Law-- I am very pleased to see you here and I am going to introduce a couple of people, then get off and leave the podium to the substantive people. The Center for US and Mexican Law is something that I helped create two years before I decided to retire from teaching. I am now a Professor Emeritus, and the Director of the Center for US and Mexican Law. Word of advice—two years before you retire, don't start a research center.

This is a very exclusive group of people, people who are interested in United States and Mexico cooperation. It would take a very small shelf in your office to put the books that have described U.S./Mexican cooperation. Our relations have been punctuated by events that happen and which are sometimes very unsettling, but eventually get settled. However, it is my very strong belief that it would be better if we worked ahead of time to try to avoid events from happening by working together. This is especially true at governmental levels, and that is one of the things we are going to be talking about today. We have representatives from U.S. agencies and Mexican agencies here. This particular product is an outgrowth of the very first research project that we have conducted with researchers on U.S. and Mexican law. The directors of that project are Richard McLaughlin with the Harte Research Institute for Gulf of Mexico Studies at Texas A&M University Corpus Christi, and Guillermo Garcia Sanchez, a Mexican lawyer. Our studies are mainly bi-national; they are not, ok, this is the United States idea or this is the Mexican idea—take it or leave it. That is not the approach we take. This is a perfect outgrowth of our efforts. We look forward to having an opportunity for you to comment and add to the discussion and to listen. The first study by the Center was the article by Richard McLaughlin and Guillermo Garcia Sanchez on

transboundary issues in the Gulf of Mexico and the Gulf of Mexico Region that was published just recently in the Houston Journal of International Law.[1]

Dr. Larry McKinney, Executive Director of the Harte Research Institute for Gulf of Mexico Studies--Welcome everyone to Galveston and this meeting. I commend Dr. Zamora for all the work he and the Center for U.S. and Mexican Law have done. I also want to thank Dr. McLaughlin and Mr. Garcia Sanchez for their good work.

Issues in both Mexico and Cuba are integral to the Harte Research Institute. Ed Harte, our founder, was an internationalist and loved Mexico and that is part of our mission. We are a pretty small institute, but all six of our endowed chairs are engaged in some way with Gulf of Mexico projects. We recognize that the Gulf of Mexico is an international body of water and it is going to take all of us working together to be successful. In that regard, Shell Oil Company recently supported a publication produced by our researchers, entitled *Gulf 360*, that contains a range of geographic and demographic information showing the linkages and connections between the U.S., Mexico, and Cuba in the Gulf of Mexico Region. One of our focuses for the Institute is to bring all of us together. We are working on a biodiversity project now in the Campeche Banks in the Gulf of Mexico. This is an area where very little is known compared to the rest of the Gulf and so our support foundation and the Institute are putting together more than $1 million to improve our level of understanding of that body of water.

Catherine Janasie, J.D., LL.M., Research Counsel, National Sea Grant Law Center-- The impetus for this symposium came from the National Sea Grant Law Center at the University of Mississippi School of Law. The Law Center publishes the *Sea Grant Law & Policy Journal*, of which I am the Editor. Through the Journal we conduct an annual symposium competition. Dr. McLaughlin and Mr. Garcia Sanchez had the idea for this symposium and submitted a proposal. The symposium was one of the winners of this year's competition and thus, received financial support to host the symposium. The symposium will also result in a special issue of the *Sea Grant Law & Policy Journal*. The National Sea Grant Law Center is delighted to be a part of this effort to put on this symposium.

[1] Guillermo J. Garcia Sanchez & Richard J. McLaughlin, The 2012 Agreement on the Exploitation of Transboundary Hydrocarbon Resources in the Gulf of Mexico: Confirmation of the Rule or Emergence of a New Practice?, 37 HOUS. J. INT'L L. 681 (2015).

Dr. Richard McLaughlin, Harte Endowed Chair and Doctor of Marine Policy and Law-- One of the purposes of this meeting is to put together a symposium issue and to collect not only formal legal articles, but also summaries of the presentations today. These sessions will be audio-recorded, but rest assured, they will only be used by us to more accurately reflect and scribe what is being said today. The presenters will have the opportunity to have their summaries sent to them so they can review them. If they approve of those summaries, they can send them back. If they don't approve of them, they will not be put into the final publication. They can be added to and revised in any way. As far as audience questions, there will be no attribution whatsoever in the sessions in this room. So, you are free to ask any questions. We will possibly summarize that discussion but no attribution will be given to any particular person so the point is, we want a free and open discussion. We will provide all of the presenters and, in fact, everyone that attended this symposium all of the information that we ultimately put together. With that, if you are concerned about the recording, just listen, you don't need to say anything. We just want to make it very clear, how we will proceed today. With that, if you have any concerns or comments, please let me know at the break.

SYMPOSIUM OVERVIEW

Dr. Guillermo Garcia Sanchez, Affiliate Scholar, Center for U.S. and Mexican Law-- Welcome everyone and thank you Dr. McLaughlin for inviting me to help put the symposium together. The key point that we would like you to remember is that nature knows no legal boundaries, resources cannot be stopped by walls, no matter how high some people want to build them because borderlines expand on their own logic, they belong to many nations and they are there for the responsible exploitation of their communities. The Gulf of Mexico is not sectioned. An indication of this is that in order for the development of the Gulf of Mexico to be efficient and safe, it will require not only the cooperation of government agencies but the inclusion of other actors such as scientific institutions, industry experts, and the communities affected by the Gulf. The work that will be presented today is just one step towards achieving our goal, but by no means should it be seen as a one-time event. We want it to be an on-going conversation. My purpose today is to introduce what we will be hearing from each other. How this reflects academia and government working together for the benefit of the Gulf of Mexico. As we will hear from our first panel, our current situation is one where agencies are working together to coordinate efforts. Treaties have been adopted by bi-national commissions, and intergovernmental dialogue has been encouraged. Agencies have been able to adapt some of their protocols to enhance cooperation, and yet,

in both panels there is a consensus that a number of issues are still pending resolution. These include establishing joint review efforts for provisional appeals, the disparities for regulatory framework applicable to areas near the border, within the border, and beyond the border. The application of different standards based solely on the proximity to the border not only generates uncertainty from an industry point of view, but leaves the reefs under different levels of protection complicating their protection.

Another important set of questions arise out of the presentations. One is the ability of an organization to adapt and incorporate organizational change. Each time there is a development creating new standards for new actors on both sides of the border due to political changes, agencies and organizations have to face the challenge of adapting their standards, culture, structure, and routine. This becomes even more difficult when there are a large number of agencies working together to regulate one industry. This becomes a monumental challenge when it has to be done bi-nationally. The burden of emergency response is only one example of this. Federal agencies such as the Bureau of Ocean Energy Management ("BOEM") and the Bureau of Safety and Environmental Enforcement (BSEE) on the U.S. side, and the National Agency for Safety, Energy and Environment of Mexico (ASEA) and others on the Mexican side have to cooperate with each other in terms of monetary compliance, responding to emergencies, and taking steps to prevent further damage. All of this along with the help of local authorities, especially local state governments, and the communities along the coastline.

A third important issue is one involving the remaining facilities of PEMEX, the state-owned petroleum company of Mexico, in the Gulf. Several questions remain about whether rewriting regulations will allow the use of these facilities on the borderline without losing sight of the expectation of more efficient operation in a safe way for the benefit of all nations. Finally, we will also hear about the value of social indicators and of social consultations with coastal communities to assist in the decision-making of regulatory agencies. It is important to know how taking the social indicators and consultations into consideration can help evaluate potential and actual effects of policies, programs, projects, and management actions. We will also hear the difficulties faced in Mexico regarding the consultation process within the indigenous communities affected by development.

Our plan as an organized group of institutions is to develop a platform to provide collaboration between society and governments to address some of the issues that may emerge as Mexico's energy reforms are implemented in the future. The

publication of the papers and presentations given here today is just one of the mechanisms for change, but we are hoping to learn from you as to ways we can help ease the complex relationship between the United States and Mexico to achieve safe and efficient exploitation of hydrocarbons in the Gulf. Who knows, maybe in the near future we can also invite Cuba to participate. Most of the issues addressed today will be present in Cuba as well.

BACKGROUND DISCUSSION OF THE GULF OF MEXICO AS ONE LARGE MARINE ECOSYSTEM

William Kiene, Science and Policy Analyst, Southeast Gulf of Mexico and Caribbean Region, NOAA's National Marine Sanctuaries-- The Gulf of Mexico is a vast and diverse region that really has few boundaries. The Gulf has many places that are interconnected. It is an encyclopedia of life -- a rich ocean environment that has given us a lot. What does it say if we fail to work together to protect this rich biological environment? For example, the Deepwater Horizon tragedy showed us that lives, communities, and ecosystems will be harmed if we fail to adequately care for our coastal environment. It showed that it is important to maintain the structure of the Gulf ecosystem and strengthen the connections that bind us together. At a workshop held at the Harte Research Institute shortly after the oil spill, participating scientists, as well as a diverse number of stakeholders, agreed that we need to protect sustainable uses of the Gulf as well as its environmental health. The outcome said our science is good but it does not have all the answers. However, we cannot let uncertainties stop us from being proactive to ensure adequate ecosystem protection. The conclusion was that these actions are creating opportunities for our society rather than limiting them. Unfortunately, the rich spectacular ocean life in the Gulf is largely unknown by the public. The oil spills, hurricanes, and environmental challenges are what people really know. We need to work harder to show everyone just what this ocean environment has and what it would mean to lose it. There is no better place to do that than the Flower Garden Banks National Marine Sanctuary, which is 100 miles south of here. There are coral reefs that have formed on the sea floor of the Shelf on which have grown some of the healthiest coral reefs in the Western Hemisphere. It is home to diverse invertebrates and fish life, and they manage to focus their science programs to monitor the conditions of the reef.

This graph shows a comparison of the conditions of the reefs in the wider Caribbean from research published in 2003, and it shows that the coral cover at the Flower Garden Banks exceeds most of the other coral reefs in the region. This high coral cover has consistently been measured since monitoring began in 1970,

thanks to the work of the Sanctuary. However, to ensure that these reefs stay healthy, it is important that we look beyond the borders of the Sanctuary to ensure that ecological conditions in the region also stay healthy. This unique place in the Gulf is surrounded by one of the most industrial areas of the world. The fact that it is in such good condition is a credit to the Sanctuary working together with the oil and gas industry, scientific colleagues, as well as our colleagues at the Bureau of Ocean Energy Management. We need to ensure that all stays in good condition.

At the moment, the Flower Garden Banks National Marine Sanctuary is undergoing a process to consider bringing protections to some of the other banks in the Region. In doing so, it has used a long stakeholder engagement process that is still ongoing. Protecting these areas will be a balance of allowing use and ensuring that the areas maintain their ecological function. Something that will sit very well with the goals of this meeting. Many of these banks have shallow coral reef communities that are linked ecologically to the Flower Garden Banks as well as deep water communities, which occur around habitats that are linked to the banks and to one another. The overlaying on these habitats is a complex regulatory environment that has many jurisdictions that overlap one another. There are habitats of particular concern, no activity zones, lease blocks, shipping fairways, as well as sanctuaries, all covered by different laws. All of these regulatory jurisdictions need to be coordinated on environmental protections. They all need to recognize that areas outside of the Sanctuary boundaries are important to the ecosystem within the sanctuary. As a result, managers of the uses of the larger Gulf environment and ecosystem also need to "look outside the box" for innovative solutions to these multi-jurisdictional problems.

The Harte Research Institute, partnering with the Ocean Foundation and Mote Marine Lab, has recognized the need to look beyond national boundaries and has led the tri-national initiative to build scientific and conservation strategies among the three nations around the Gulf. This initiative has really been fundamental to our program in the Gulf.

Ecological connections are shown by the recent recruitment of *Acropora palmate*, the Elkhorn coral, at the Flower Garden Banks after it has been absent for centuries. The larvae of these corals had to originate in the southern Gulf on the reefs of Mexico and/or Cuba. Like the larvae of the invertebrates, a number of large species including whale sharks throughout the Gulf periodically come together in large feeding aggregations. These maps are the result of a Bob Hueter's work at Mote Marine Lab who tracks sharks through the region and has identified whale sharks that migrate from the Yucatan to the northern Gulf. The

same is true for whales. Here is the track of a sperm whale who was tracked for days by Bruce Mate, Oregon State University. It shows feeding sites in red and the whales travelling among them.

These connections between the wider region not only bring positive connections, but can have negative consequences as well. This is shown by the lionfish invasion. Other invasive species and diseases of organisms have been propagated on the ecological links that the Gulf has with the wider Caribbean.

Threats from land are also impactful as shown by this view of turbid water coming into the Gulf from a river in Veracruz. To illustrate best how the entire Gulf is connected is this animation of sea surface salinity that is done by the Naval Research Lab for this month. It shows the currents that flow to the Gulf, which transport the offspring of invertebrates and fish and nourish the Gulf's biological communities. This illustrates that nowhere in the Gulf is isolated from contaminants or alien species that may be introduced anywhere in the region. These examples of connection in the Gulf mean that places do not function in ecological isolation. If we are to successfully manage a special place like any of the sites around the Gulf, we must also be concerned with the conditions throughout the region. Like some of the deep-water coral communities, their existence can be quite special and we do not fully understand the factors that determine their location or how they get there. However, their concentrations in key places surrounded by great distances of deep water, which are somewhat like biological deserts, show that even at great depths, organisms are able to move and be transported to the special places they need and are connected to other deep water habitats. This is also true for chemosynthetic communities that are found associated with hydrocarbon seeps and brine flows on the deep-sea floor of the Gulf. This includes some very unique habitats, like this extrusion of tar on the sea floor, which forms a large lily-like flower of both hard substrate and chemosynthetic compounds for species like tube worms, mussels, as well as coral.

So what does it say about how we need to manage the Gulf ecosystem? One approach is to develop a sister sanctuary network, which is an alliance of Marine Protected Areas management of Mexico, Cuba, and the United States. Each of the network sites contains unique species and important contributions to the understandings and management of the Gulf's ecosystem. Each site is vested in the conservation of the others, strengthening all the sites, and also the connections between them. In order to move this proposal forward, NOAA sanctuaries and Mexico Protected Areas managers met in June 2015 and created a work plan for linking the Flower Garden Banks National Marine Sanctuary, the Florida Keys

National Marine Sanctuary and seven sister sanctuary sites in Mexico. This successful meeting established areas of mutual interest and need, but most importantly it helped to develop a personal relationship between U.S. sanctuary managers and managers of some of the most significant Mexico sites within the Gulf of Mexico.

At the same time, thanks to our engagement with the tri-national effort and work in Mexico, when the United States opened the door to official engagement with Cuba, we had a vision for cooperation with our Cuban counterparts already in place through our Marine Protected Areas. This was the basis for meetings between the United States and Cuba where we discussed MPA collaborations. Then NOAA, the National Park Service, and Cuba's Ministry of Science and Environment came together last November in the formal setting of the foreign ministry in Havana, where Kathleen Sullivan, the head of NOAA, signed a Memorandum of Understanding ("MOU") on MPA Gulf Cooperation. We are hoping to have something similar with Mexico. This renewal of relations with Cuba is somewhat ironic because 50 years of separation is overshadowed by the 100 years of history that has connected us to Cuba, as well as Mexico. This map shows the vessel traffic corridors in the Gulf and our proposed sanctuary sites. This human commerce connection has existed for centuries.

An example of this is the exciting discovery made near the Flower Garden Banks. An early 19th century shipwreck was found that was full of artifacts that show how the Gulf has been a conduit of our culture and economy for a long time. Working closely with archeologists, we have documented how the Gulf's biology has interacted with the shipwreck. On the ship were artifacts that could be traced directly to Mexico. To be specific, Sisal on the NW Yucatan coast. The ship is believed to be a privateer and there were other shipwrecks also nearby, which are thought to be its captures. My point here is the joint study of the Gulf can tell us much about the history of the relationship between the two countries and maybe how to design our relationship for the future. That human relationship to the Gulf Coast goes back even farther though. This is a Mayan painting that shows how the early people in the Yucatan lived with the marine life of the Gulf. This may surprise you, but on the top, here is an ancient city in the Yucatan and on the bottom is an archeological site on the banks of the Mississippi River near present-day St. Louis, and what it looked like nearly 1,000 years ago. There is much speculation about the real connection of the two countries that the Gulf has produced. The presence of Gulf sea shells and distinctive art works found at the site near St. Louis suggest that the Gulf of Mexico had a role in connecting North American communities to those on the other side of the Gulf. You can imagine

what would happen if a Mayan boat left Yucatan—it would be swept to the Mississippi Gulf Coast. The point I want to make is that the Gulf unites us rather than divides us, and has done so for centuries. So, I will leave you with this—our protected areas of the Gulf can be considered the bookends that support the encyclopedia that is the Gulf ecosystem, and that tell us how we are all connected. We need to bridge the artificial boundaries we have created or may erect between us, and work together to understand and preserve all of the Gulf.

Question and Answer

It seems like with the opening of trade and tourism between the United States and Cuba, we are closer than ever to having Gulf wide protected areas. Is that a possibility or are there still political, legal, and/or other obstacles that will prevent us from achieving a truly integrated network of Marine Protected Areas throughout the Gulf of Mexico?

We have worked very hard to build this bridge to Cuba and Cuba is very much interested in fostering this relationship with us. Cuba has offered their Guanahacabibes and Banco de San Antonio sanctuaries as a sister sanctuary to the Flower Garden Banks, but before that we have been working to fine-tune this budding relationship with Mexico. The same basic migrations and coral connections are all obvious reasons for us to work together with our Mexican sites. The managers and our colleagues at those sites are very keen to make this happen. We are working with the Mexican National Commission of Protected Natural Areas ("CONANP") to make this all come together and signing a civil order declaration of this network. There is a Large Marine Ecosystem program that NOAA is engaged with Mexico to coordinate, and this LME program will undertake a number of projects to bring the sister sites together. This effort may lead to the signing of an agreement between Mexico, Cuba and the US to work together on conservation issues in our marine protected areas.

What is CONANP?

It is a Mexico's center for protected areas. It is an equivalent of the Office of National Marine Sanctuaries in the United States.

PANEL 1—US/MEXICO OFFSHORE LEASING AND TRANSBOUNDARY REGULATORY ISSUES: MONITORING CONTRACTUAL COMPLIANCE AND IMPLEMENTING ENVIRONMENTAL AND SAFETY STANDARDS

Presentation #1: *Perspectives from the Mexican National Agency for Industrial Safety and Environmental Protection of the Hydrocarbons Sector ("ASEA"), Alejandro Carabias Icaza, Deputy Director for Normativity and Regulation, ASEA*-- ASEA is a Federal Agency and regulatory body deconcentrated from the ministry of the Environment SEMARNAT. Our mandate is to regulate and supervise in terms of industrial safety and environmental protection of all activities and facilities within the hydrocarbon sector. Those activities and facilities follow along the hydrocarbon chain of value from inland activities, offshore activities, upstream activities, all the way down to retail. In terms of upstream activities in the Gulf of Mexico, we have about 250 facilities operating right now with PEMEX, and we expect in the near future that number will increase. We have created a regulation and supervision model that is designed so that all operators can achieve effective risk management for their activities. Basically, our model depends on six elements.

The first element is SEMS—Safety and Environmental Management Systems. Anyone who wishes to operate in Mexico in the hydrocarbon sector must operate under SEMS.

The next element is sufficient financial responsibility. In terms of insurance, we must make sure that in the event of an accident there is enough coverage for any liability that may arise, so operating under the mandate of insurance will be mandatory. Right now the rules are in the process of public consultation, and we expect to publish them quite soon. We have several technical regulations, prescriptive restrictive regulations, and performance-based regulations. Most of the drafts we are developing right now refer to performance-based regulations.

Corrective Enforcement—the policy of the agency is to favor correction of non-compliance of standards and regulations before enforcing any fines. We believe we need to help managers to manage their risk, more so than establish large fines.

Risk-based inspections are supported by independent third parties. We will authorize and approve these third parties to help us with inspection and other areas of safety. We will strategically use our inspectors because they are a very limited resource that we have. The use of inspectors will be based on information generated by SEMS reports and SEMS audits and all kinds of reports from the independent auditors. We will also rely on the insurance company and third party inspections. That is basically our proposed model for ASEA.

In terms of cooperation in the Gulf of Mexico, it is important to point out what ASEA's role is in emergency preparedness and response. ASEA is governed by an Act. Our role is to define technical elements for emergency response projects. Our National Offshore Energy Response Protocol is called Plan Nacional de Emergencias. It is basically a regional contingency plan to regulate hydrocarbon spills and other possible substances. The Mexican Navy oversees that plan. They integrate any technical element for emergency response that we can provide, and we work closely with the Navy. ASEA's role in an emergency is to monitor and supervise protocol execution, and then after the emergency has passed, then it is up to ASEA to carry out the review of the root cause analysis of the accident. So, within the MEXUS plan (a joint plan between the US and Mexico regarding pollution of the Gulf of Mexico marine environment by discharges of hydrocarbons or other hazardous substances), we will be coordinated by the Navy, and we will participate in the design and provide comments to all the safety and environmental measures to be adopted through the agreement and the MEXUS plan. We will participate in any transboundary agreement oil and gas activities and do an inspection to ensure compliance but, of course, we will do it in coordination with the Ministry of the Navy. We strongly believe in harmonizing regulations especially in the Gulf of Mexico, and we support cooperation in terms of the environment and safety program. It is key if we want to maintain a sustainable Gulf of Mexico, especially since we expect that operations will grow in the next year in Mexico. We think it should apply to the entire Gulf of Mexico. For ASEA it will be easier to draft regulations that cover the whole Gulf of Mexico that are in harmony with US GOM Regulation. So, in this first effort to harmonize regulations, ASEA decided to establish a conversation with BSEE. BSEE has reviewed and provided input to our draft and hosted a workshop for ASEA in Washington, D. C. ASEA´s delegation learned much about BSEE´s SEMS, and they got a chance to see the challenges and where BSEE was going with its next SEMS rules. We are pleased to say that our elements of SEMS requirements are quite compatible with BSEE's SEMS. This is a first example of successful cooperation in trying to harmonize a very important piece of regulation. The next step is to harmonize the procedures of the SEMS.

We worked with BSEE because both parties were willing, but there is no formal agreement to continue this effort. We do not have a permanent framework or agenda, nor a pilot group, to work to determine what regulations should be harmonized, and so we have an opportunity to get this in place and that would lead us to be successful. It is important that we adopt and have mandatory compliance of national and international standards as well as the adoption of industry's best practices. The challenge now is to determine which are those best

practices and what international standards would work best. The only way to do that is to establish a framework to cover all of this.

Presentation #2: *Implementation of Environmental and Safety Protection Measures: Collaborative Efforts with ASEA, Allyson Anderson Book, Associate Director for Strategic Engagements (BSEE)*-- BSEE is basically an energy environmental regulator and oversees the operations that occur on the Outer Continental Shelf. What we do not do is handle leasing or revenue, nor look at development or exploration plans. We generally do not look at seismic readings. Mike Celata with BOEM will discuss those. BSEE focuses on a whole range of activities. The core of that is the SEMS plan that has just been added in the last three or four years, and we are still working on them, so the issue was ripe for discussion when ASEA started working on theirs. BSEE was established three or four years ago, and it involved a split among three agencies. Part of our challenge has been how to work with the other involved US agencies. They had no problems working with ASEA because both organizations are in similar situations. Internationally, BSEE has a goal to foster a collaborative dialogue with all of the international regulators around the world. This specifically applies to the offshore. We have a relationship with some on-shore regulators such as in Colombia, where they worked a lot on-shore for a while and were just getting into offshore. For quite some time before the split of the agencies, the international portfolio was somewhat ad hoc. No specific strategy was in place. The Vice President of the United States and Secretary of Interior just met with a delegation from Mexico and we have a broader agreement that has just been put in place. We have other similar agreements. BSEE's priorities are on the Americas, so that means Canada, Mexico, and soon Cuba. We also look at the Caribbean and mid and South America. We stage meetings annually with all of the regulators that want to get together. There is a social component to the meetings that helps identify who our counterparts are and allows for meaningful dialogue as we get to know each other better. This kind of dialogue is as important as a formal Letter of Intent. We also get everyone together each year at the Offshore Technology Conference, as there are a lot of different countries represented there.

The second tier of priorities for BSEE is the Arctic. We had some work going on there last year in Alaska with Shell. That was a big lesson learned on their end as an operator and our end as a regulator. The United States is a part of the Artic Council. They like to foster dialogue with people all around the Arctic, and they do that through the Arctic Offshore Regulators Forum.

A third priority for BSEE is everybody else. We look strategically down the road for who we can work with and people from nations that are starting their own offshore regulations. We frequently get requests for help in showing what BSEE has done, but also we want to learn from those groups as well. With the dialogue we have been having with ASEA, BSEE has taken a lot of lessons learned from them and particularly in taking another hard look at how to implement SEMS, so that dialogue was very important.

International Forums—International Regulators Forum (IRF) has been around for a little bit and it is a group of international offshore regulators who get together to have a conversation twice a year. It used to be just annually, but when you only meet once a year it is really hard to play catch-up. You spend all of your time with every country giving a presentation, and there isn't much opportunity for dialogue. So, they decided to meet more frequently. They have just agreed that they will have a three-year chairmanship with BSEE as chairman. It is comprised of 10 members. Mark Fleming is BSEE's international point person and is the point of contact at the bureau for anything international. The group meets each year at the Offshore Technology Conference and then in the fall it rotates among the various involved countries. Mexico hosted one of the meetings in 2014, and it was a great meeting. The comments that came out of that meeting were that the IRF is staging a comeback and becoming more relevant. They had the annual conference last year and invited key people from around the world and they looked at risks. After that, they had a three-day meeting in Washington, D. C. They will continue to build collaborations through IRF and look at some prioritization of regulations. If anyone is interested, there is more information on the BSEE website.

Areas of Collaboration—this is so important. When we look at SEMS here in the United States we are looking holistically at the company and their safety performance. It is not enough that on certain facilities that employees know where the stop button is or "I know I can stop work at any time if I see something wrong." That is not exactly what SEMS is. It is looking at the entire organization. Shell was referenced again relative to its program in the Arctic. They had a very specific Arctic SEMS program, but it was all a part of what the company is doing. The idea down the road is if people have a robust culture of safety in their company, we are going to see it at all levels of their corporation. That is really what we are trying to do to drive safety performance down the road.

Some other areas that we are working on will be coming out soon. We are finalizing their well control and blowout preventer role. BSEE cannot share

regulations until it is through the interagency process and we hope to be through that next month and hopefully get it out to final publication. At that point, BSEE has discussed trying to translate that rule into Spanish to make the dialogue easier. It is a highly technical rule and not all of the jargon meshes very well for translation, but that is something that we will be working on.

Joint Inspections—SEMS looks at how we can enforce safety culture. We want to collaborate with Mexico to determine how we can ensure that we send the same kind of message for everyone that operates in the Transboundary area. Next week there will be a delegation going to Mexico and enforcement is one of the topics that they will touch on. If we get into the joint inspection program it is worth noting that we won't do joint inspections until we get to the point where the Transboundary area has been unitized and we are working in a place where we have operators on each side. When that happens, we will really be thinking about how the two nations' regulatory bodies are going to do inspections together.

Presentation #3- *Perspectives from the U.S., Mike Celata, Gulf of Mexico Regional Director, U.S. Bureau of Ocean Energy Management (BOEM)*-- BOEM is 4 ½ years old. We focus on the Gulf of Mexico primarily in conventional energies under the Outer Continental Shelf Lands Act. In that act, it talks of orderly and expeditious development of offshore energy. We use a tiered process. We start with a five-year program on offshore activity under BOEM and then lease out the property and manage the leasing program that BOEM administers. Currently, we are also responsible for exploration and production plans. A critical component of how the agencies were divided is that BOEM is responsible for national environmental policy at every one of the stages. BSEE focuses on safety and enforcement, and BOEM is responsible for everything up to that time. BOEM's responsibility is financial assurance so it is interesting in these types of meetings to see how different governments divide up the different responsibilities.

The transboundary hydrocarbon sector has an on-going notification process that is in place. In the transboundary lease area, at the moment we have a total of 208 lease blocks, so a lot of them are small—three miles by three miles, roughly. The western planning area is the Perdido area with about 180 of those blocks, and that is where 27 leases were awarded. We do have 9 pre-agreement leases as well. Since the agreement, we have had two exploration plans that we have provided notification to Mexico about. This is a map of the western planning area showing the transboundary area, and you can see the central planning area, and presently there are no leases on the transboundary area.

We have an established process for notification. Essentially our Office of Leasing and Plans generates a letter and if there is an exploration plan, our Office of Resource Evaluation will also generate a letter. If affirmed and signed by the Secretary of Interior, the letter will be sent to Mexico's Ministry of Energy and copied to the Under Secretary of Hydrocarbons and to the President of the National Hydrocarbons Commission. One of the things I see us moving forward on is that we do not just want to talk about the transboundary area, we want to talk about the whole Gulf of Mexico as an ecosystem. BOEM has had an environmental studies program in which we invest about $20 million a year in studies of the Gulf of Mexico. That is a good place for us to move forward in terms of cooperation. Historically, we have done a number of joint studies. Our scientists are very good at collaborating, and we often work with NOAA and we receive awards for collaborative scientific programs. We would like to increase those collaborations. There have been a number of physical oceanography studies on deep-water currents in the Gulf of Mexico with Mexico. Recently, in June, a joint conference was held on Historical Archeology. We have a history of engagement with Mexico. We need to continue that relationship. One of the new programs being proposed is called GoMMAPPS (Gulf of Mexico Marine Assessment Program for Protected Species, an environmental study to capture marine mammal populations in the Gulf of Mexico) and it is a marine assessment program for marine mammals. It is something being conducted in the Atlantic, and they are moving into the Gulf of Mexico. Essentially, we would be running line transects through the Gulf of Mexico. They will be trying to do broad-scale surveys looking at habitats and some of the species that are there and that have substantial populations in the Gulf. This is a good area for future collaborative research.

Presentation #4- *Monitoring Compliance with Contracts in the Border, Nora Katia Cañipa Morales, Deputy Director, Exploration at the National Hydrocarbons Commission of Mexico (CNH)*-- CNH was created in 2008 to regulate and evaluate all of Mexico's hydrocarbon exploration and extraction activities. At that time the only company who performed such activities was by PEMEX. Then in 2013, the legislation was amended and Articles 25, 27, and 28 provided a framework to create and develop a new regulatory model. In 2014, the secondary laws were published. As a result of that, CNH changed its strategy according to the additional responsibility. CNH developed a set of regulations related to the main aspects of upstream industry which includes planning, exploration and production, transport and storage, use of associated natural gas, infrastructure, and measurement, etc.

As a result of the first two bidding phases of Round One relating to the Gulf of Mexico, CNH awarded to private companies two contracts for exploration and three contracts for the extraction of hydrocarbons in blocks and fields located in shallow water of the Southeast Basins.

The first two exploration contracts in shallow water of Southeast Basin were signed by CNH and the consortium formed by Sierra Oil & Gas in association of Talos Energy last September, the process continues with the exploration plans evaluation and, if applies, the approval by CNH which must be defined next summer.

Last December, the Ministry of Energy announced the fourth phase of the round one consisting of 10 blocks for exploration in deep and ultra-deep water of the Gulf of Mexico. Six blocks are located in the Salt Basin in the Southern part of the Gulf of Mexico and four blocks are located in the Perdido Foldbelt, close to the border between Mexico and United States.

Undoubtedly, the Guidelines for technical bidding process as well as the Guidelines for the Administration and technical monitoring of assignments and contracts, among others which were developed by Constitutional Mandate, will form the regulatory framework to give legal certainty to operators that carry out activities of exploration and extraction of hydrocarbons in deep and ultra-deep water in the Gulf of Mexico.

Presentation #5- *Use of Existing Facilities and Pipelines in Mexico, Ramón Massieu, Chief of Staff, Energy Regulatory Commission of Mexico (CRE)*-- CRE is at the stage of issuing several regulations regarding the activities under our scope. One of the most important things about the Energy Reforms is the distribution of powers among several agencies instead of concentrating said activities in the ministru –as it happened before-, and delegating a reduced number of powers to the regulatory agencies, such as CRE.

Regarding the activity of exploration and extraction of oil, SENER –along with the technical assistance of the National Commission of Hydrocarbons (CHN)- chooses the fields that will be part of the portafolio to be offered through tenders; CNH awards the contracts to exploit said fields, and regulates them, while the Ministry of Treasury regulates the monetary terms of the contract. CRE activities comprises the granting of the permits for the transport of hydrocarbon from the field to the refineries, using facilities (currently owned by Pemex), (permits for oil refining and oil and gas processing are granted by the Ministry of Energy).

Some of these permits have already been granted, and the entail the right to carry out the activity in existing facilities. Since 2015, CRE has been granting different permits, for activities that, prior to the reform, were reserved to the State, such as permits for the transport of hydrocarbons. Previously, PEMEX was the only company that was allowed to carry out these activities, without the necessity of securing a permit before any authority. Since the enactment of the Energy Reform, any private company can secure a permit for said activities, but currently, due to the monopolistic presence of Pemex, the facilities are owned by them, and in order for the private companies to carry out the transport of the products that were extracted from the oil fields, they will have to use Pemex's facilities, at least in the short run (5-7 years, since the construction of new transport facilities is not foreseeable).

If a contractor is approved to operate, then open access should be granted to the contractors, and that is a responsibility that was allocated to CRE, by means of the Law of Hydrocarbons. In terms of regulating E&P activities, CRE is basically in charge of three things—grant third-party open access in a non-discriminatory basis, grant permits for the provision of services through those facilities, and set tariffs that the owners of the infrastructure can charge to the users of the transport service. With regard to open access, CRE issued general rules for the transport and storage of hydrocarbons. in November, 2015.

Regarding the tariff, CRE calculated an indicative tariff (using different international benchmarks) requested by the Ministry of Finance, since it was of the utmost importance in order to properly calculate the model for considerations that will be paid to contractors; in this vein, the contractors were able to "run" their own models, and file offers with better and more complete information. The tariff was not published as the rest of the tariffs for regulated activities are published, but they were comprised in the methodology that the Ministry of Finance included in the contracts.

This new model does not just mean the end of monopolies in operations, it also means the end of monopolies in information. Now companies will have enough information to take more informed investing decisions. It is also important to note where the work of CRE starts and where CNH comes in (there is an intense debate on how to determine the point where gathering ends, and transport begins, which is relevant due to the fact that those activities are regulated by two different agencies). The two agencies must determine how to divide work, and it will be determined on a case-by-case basis.

With regard to the transboundary agreement, it contains a provision on joint uses of the facilities, which is in Article 12. This is important because it was written in 2009, which is several years before the new national legislation, and was able to foresee the upcoming problems that would arise when E&P activities were open to the private sector, with a scenario of scarcity of logistic facilities.

Said provision states that, whenever a party wants to use the facilities of another party, the other party will make the effort to facilitate the use of those facilities. As mentioned before, CRE is in charge of granting open access to regulated facilities, so whenever there is an issue regarding the need of using third-party facilities, CRE will detail how it should be resolved (as long as the facilities are located in national waters, and said facilities are regulated by a CRE permit); in the case that the facilities are in different countries, parties must attain to the agreement. The problem is that to date, the number of facilities that are located in the Mexican side of the Gulf are minimal, therefore, extracting activities are rare.

Presentation #6- *The Necessary Qualities of Regulators, Jorge Piñon, Director, Latin American and Caribbean Energy Program, Jackson School of Geosciences, University of Texas at Austin*- I will be talking about culture, and also about HSSE: health, safety, security, and environment. Much of my work has been in transitional markets. A transitional market is one that is moving from one governmental model to another, and it is extremely difficult from the cultural point of view to really manage its markets. For example, I went to Indian areas way up in the mountains in Latin America. They had a big red book of environmental rules and regulations on a shelf. I read it and thought, "Wow, these are the best environmental rules and regulations that I have ever seen." But they were totally worthless. They were totally worthless because there was no enforcement of those regulations. It was important because there was no culture of implementation of the goals and objectives of environmental regulations. It basically mentioned no accidents, no harm to people, no harm to the environment, but the culture of safety was not there.

I remember an operator that was asked about the prospect of hiring contractors who would hire from the indigenous community to work on the project. When I went to the site, there were indigenous people working in sandals, and not using hard hats. They did not have any knowledge of safety on the worksite. The instructions were there, but enforcement was not there. So, you attorneys and those that draft rules and regulations, your help is needed. That roadmap that you will be putting before us is extremely important, but so is the culture of the

regulator in the field that has to enforce the regulations. That is where the gap is because that is the individual who is going to identify a problem before the incident happens.

Mexico has a challenge ahead of them because for the last 75 years there was a monopoly. That monopoly was having one integrated oil company and their money for many years, and that company was the regulator. That was how the business was managed.

It is not that the technical know-how in Mexico is not there. It is not the fact that there are no good engineers or economists or geologists. It is that the culture of the monopoly did not allow the freedom that today is required by the regulators out in the field. The challenge for ASEA is huge. ASEA is responsible for not only a 10,000 foot well in the middle of the Gulf of Mexico, it also responsible for gasoline stations. They handle hydrocarbons, chemicals, refineries, etc. One national Federal agency has the huge challenge of managing safety and regulatory issues all the way to service stations.

At the University of Texas, there is a course offered called Management Change. In one part, it shows the change of course from a monopolistic system to a free-market system. That is essentially a transitional market. Change is profoundly difficult because the structure, culture, and existing organizations often reflect a persistent, consistent, and difficult to remove imprint of past periods which are resistant to radical change. The key objectives are profits in the public sector. Health, safety, security, and environmental policies and regulations of no accidents, no harm to people, and no harm to the environment, depend not only on clear environmental standards and regulations, but most importantly on the skills, experiences, and capabilities of the field enforcement officers. They should be familiar with a variety of the practices and procedures of the industry in which they will be regulating. They will be relying on their experience and judgment in order to enable a safe, secure, healthy, and environmentally sound industry performance.

I will finish with five pillars to consider.

Leadership—all the way from the bottom to the top. The community of stakeholders needs to be well informed and committed to a safe working environment.

Contractors—I have heard that some of the regulations are going to be outsourced to a third party. That means that you have to vet the external contractors. There will be a lot of new operators. I have a list of companies that have registered to be able to operate in Mexico and there are 87 of them. Of those, 26 are Mexican companies. What was the goal of energy reform? The Mexican Energy Reform was done to create a highway of national oil companies that will eventually be the backbone of Mexico's energy industry. Of the 26 interested Mexican companies, most of them are service companies, and now they want to become operators. There are 70 companies from the US. 4 from Australia. 3 from the UK. And there are companies from Spain, Portugal, France, India, Japan, and others that are interested in operating oil and gas facilities in Mexico. 12 of those are integrated oil companies. 28 are independent companies. There are a lot of different learning methods and applications. The Gulf of Mexico is becoming very complex. It is becoming complex not just because of its size or geology, it is becoming very complex because of the different players that are going to be implementing what the Gulf of Mexico is going to be like.

With regard to the three remaining pillars, one involves design, construction, operations and maintenance. We need to be able to secure safety, health, and the environment. The effort is huge. New facilities being built, existing facilities utilization, building of pipelines, permitting, etc.

The fourth pillar is risk assessment—that is the process that we use to try to reduce the impact of accidents and incidents.

The final pillar is transparency. The Mexican Government has bent over backwards to ensure that businesses are transparent. Everyone in this room has time to talk with the public about the changes and the things that we are trying to work out. We have to be sure that the culture of safety is there.

Cost-cutting Themes and Discussion with Audience

What are the most difficult regulations that you see being developed in the next few months? What are the most challenging areas to address—such as safety management, marine habitats, offshore discharges?

Perhaps one of the big challenges is going to be the regulating philosophy because at ASEA they would like to move towards performance-based regulations and move away from prescriptive regulations, and as they understand United States regulations right now, it is focused on the prescriptive specifications. To start

identifying what the best practices and standards could be, we need to start building a culture of safety and an environmental program. In terms of United States regulatory challenges, issues are more on the implementation side. When you go through a rule-making process in the United States, it really takes a long time, but that is only the beginning. As we learned from implementation of SEMS. The US has a fairly prescriptive operations regime in terms of regulations. The United States is in lock-step with ASEA and are shifting more to performance based operations so it will be more of a hybrid down the road. It is hard for both the regulatory community and the regulators to wrap their brains around that after having been prescriptive for so long, that a more performance based model may be more appropriate.

Why is it so prescriptive?

The United States can be a very litigious society, so it is better to have the details in terms of how we proceed through the courts and appeals. There will be challenges down the road as people could encounter various regulatory requirements when they are performance based. Hopefully, the community will establish these new rules. One new rule for the United States is the well control rule that will be coming out. It is very much a shift to performance-based regulations, as well as the Arctic rule that we are also putting in place. It may be less relevant to Mexican discussions but it is very much performance focused in trying to get people to think more holistically. Implementation will be the hardest.

The Mexican Congress did a tremendous job on the legislative reforms. It is amazing how in a short period of time they completely restructured the energy sector. More difficult has been establishing the apparatus to enforce the law.

How many employees does ASEA have, is the number sufficient, and is the training of employees adequate? (The questioner clarified that they are not sure that the Mexican Congress realizes that you have to back up energy reform with investment and capital to carry it out.)

Currently ASEA has about 280 employees. Of those 280, almost 90 are inspectors. We have not yet had a year of activities, and we have already had to cut back some on our budget. They will be trying to rely on third parties. Eighty inspectors are not enough for all of our activities so we are building a model whereby we try through third parties to do a risk-based inspection where we won't do an inspection unless there has been positive information from third parties working that there might be something worth looking at. We will be

relying a lot on reports from the performance of the system of SEMS to try to figure out where a problem may be arising. Then we can more effectively utilize our 80-something employees. We have a quite ambitious plan for training. It is an on-going process. Most of the training is being focused on our inspection force, and they were very carefully selected. They are highly qualified and we also make sure that they earn a bit more than a typical inspector. We are trying to have a better-prepared force of inspectors and trying to fight any corruption issues that may arise.

Regarding CRE, during the last two years, we have increased in size from around 200 to 400, which is not a lot. We have a huge load of work. Aside from the activities which we discussed earlier, we also have several ancillary activities which include the retail sales of gasoline, the regulation of the electric system, the generation of electricity, the supply of electricity, and many more activities. It is very hard to get it all done with 400 people. We are planning to have some regional offices, but we do not have any regional representation and we will need to have that – especially for the gasoline stations. We are facing budget cuts. Something that was good in the reform is that they have allowed us to have regulatory fees. That means we can use the money that is collected from what the permit-holders pay. That will pretty much give us two times the budget we had before.

With respect to the existing infrastructure and open access, is there sufficient opportunity for the expected activities? Is pipeline capacity enough?

Fields that are closer to shore have enough capacity. It is very efficient in shallow water and we will be able to comply with that challenge. When we talk about deep water, that is where the problem comes because PEMEX by itself was not able to work in deep water because of the lack of technology and investment, and that is what the energy reform was for—to overcome that problem. It will be necessary to have enforcement in those regions that are close to the transboundary zone and having the regulatory structure there is beneficial because that gives a very strong signal to investors. We need investors to trust the regulations, trust the changes we are making, and we are sure the investments will follow when we have the necessary facilities to operate and to implement all these legal mandates that we have such as open access.

With regard to legal issues, one of the challenges is regarding joint ventures. One of the key issues of a deal has always been who was going to operate the facility. In fact, many times deals have been negotiated in which we would give up 51

percent of the joint venture because the operator was good and we knew that the outcome would be good. So, the key challenge that Mexico has today if PEMEX moves forward with farm-outs and Mexico moves forward with looking for joint ventures is what oil companies are going to joint venture with PEMEX and let PEMEX be the operator? The key is that Mexico is trying now to bring joint ventures into the system—pipelines, offshore projects, etc. Is the trust there? If the major oil company is going to joint venture with PEMEX, will they want PEMEX to operate it? That is going to be another challenging area for us as the energy reforms move forward.

We see many different methods and applications between the United States and Mexico. The question is whether there are any initiatives to work together to have some homogeneity of those regulations to provide full integration of the two countries? There is a team confirmed by both the United States and Mexico. The Ministry of Energy heads it up and they are making some changes about geology and geophysics, and that is not the only time they are doing that because previously when the transboundary agreement was in force, we had some information provided by PEMEX as the only operator at that time. Now that it is expected to do work with private companies, PEMEX had to provide some information to the Department of the Interior in the United States. With the new reform, it was made very clear that after the agreement gets implemented that both countries have to announce the exploration on the sales very close to the border. For now, we are only making the exchange of notifications from the United States because that side has activities with many companies and on the Mexican side it is only PEMEX at this time. In December of this year, they will open it to private companies and they will be announced. In Mexico, the agencies are working with PEMEX to get the necessary information. The resiliency they found outside is not a challenge compared to the resiliency of PEMEX. Once they get the information from PEMEX and once the other companies are empowered to operate, we will be publishing the information, and we want to because it is a clear signal of certainty and we want to publish as soon as possible.

How can investors guarantee their investment? Is that part of the challenges of rules about large-scale companies coming together to form a consortium to guarantee the investment? Is that being considered?

PEMEX is one of the companies that can participate in the next round, so the development of the information will be supported with a very experienced company. That is what we are looking at in the next bidding process so that the major companies are participating. The characteristics that we are focusing on

within the companies are experience as well as financial quality. How far up the chain is required for this guarantee in order to participate? The website of CNH will publish the amounts and the basis for them.

Sometime in 2017, we will begin the deep-water stage. It was delayed because of the global situation regarding the price of oil. By the time these are being developed, the facilities will be needed, and then we will have to come up with a plan to build those facilities.

Since you cannot determine your tariff with any sort of certainty, will that affect bidder's willingness to bid?

Yes, it will and that is why we needed to come up with at least a preliminary figure and that is what we did. They are working hard on the final tariff. They are trying to have as much information as they can get, but that information comes just from one place—PEMEX. We want to come up with that tariff as soon as possible because that gives synergy to investors. We will have a final tariff soon before the activities start even for the contract we have already awarded, and by the time the companies start operating, they will have full information. One way or another the companies will know what they are going to face because it was in the terms of the contract. It may be several years from now.

University of Texas is going to roll out a Master's of Science program and offer a two-year Master's program that will prepare those wanting to come into the energy sector. Those employees from PEMEX, for example, might not be hired by ASEA but could be hired by the contractors. The main issue is the culture of the regulator not whether or not he is a good engineer but the culture of an individual who has been working for one company his/her whole career. Does he/she have the culture to be a truly independent engineer?

In the United States, in terms of hiring contractors, it is very hard to have a safety culture with the industry when they are investing huge amounts in new technologies and approaches. People have thought that the industry has remained static, but that is not true in terms of deep water, it is not true with high pressure, high temperature. So, with that in mind, we really commend the Mexican agencies for the amount of staffing they have done in a year. It is really phenomenal. To give a reference point, does anyone have an idea of how big BSEE is? That agency currently has 831 people, and they regulate offshore in the Gulf of Mexico, the Atlantic, Arctic, etc. They normally have 80-90 inspectors. Mexico currently has about 120. They have a much broader reach but at the same

time the United States is also moving to risk based inspections so they hire third party contractors in order to remain current. It is very important that we do not think about just building our own internal capacity, but we need to work with our communities and stakeholders so they can build theirs with ours.

Last year at the Baker Institute, a now unemployed former oil company executive gave an excellent speech. He has now been replaced as the head of PEMEX, but we asked him if Mexico is institutionally prepared to be able to train the employees they need both in industry and regulation. Our Center for the United States and Mexico Law has for the last two years conducted training courses for government officials along with universities, so we have had five people from ASEA and we bring in people from Houston and Mexico. They have agreements with PEMEX and others to continue this, but a lot more is needed. There is one university in Mexico that we know of now that has a Master's Degree in energy law. There needs to be a lot more of them.

There is a problem with the way the ASEA act was written. We were to have consensus on these changes not only for national bodies of water, but the fact is that CONAUGA, the Mexico National Commission on Water, also regulates on national bodies of water, and the Navy has authority to regulate changes from platforms and shipping. We have been having meetings to try to establish where the boundaries are. We also have the same problem with CNH because it is sometimes very difficult to differentiate between where a technical regulation stops and where a safety regulation starts. On the standards relating to well integrity there is a very strong safety component. We have started a dialogue with CNH to see if safety is getting into technical grounds and if technical issues are getting into safety and environmental regulations. So, we do not have a definitive answer for that because we are still working things out. We have set up a task force with CONAUGA because we are drafting new environmental regulations and they basically will have to provide how to treat the flowbacks, etc. There will be a clearer definition of who will do what.

When you look at the environmental assessments that the EPA (U.S. Environmental Protection Agency) proposed for the exploration and production plans, how are you getting to that baseline? There are a lot of recommendations on environmental issues and science so how are the agency regulations being developed? Are you working with the United States on the transboundary issues where there are recommendations on marine sound, benthics, biodiversity and such? How will that cross over into the Gulf of Mexico?

In terms of the environmental regulations, they have inserted a slate of rules that were in place before ASEA came into being. They were handled by the Ministry of the Environment and they are now part of that Ministry of the Environment. It is the same set of regulations since 1992 so they are developed and quite proven. We need information on the environmental impact assessment zone that is available and we are also having a tough time getting that transferred to ASEA from PEMEX. What has been happening now is that any environmental assessment event that the companies have to carry out is on-going. To generate most of the information needed for the assessment is quite a task. We will eventually get a database of information related to the Gulf of Mexico that PEMEX has been generating over the years. In the case of the environmental baseline, which is a requirement in the contracts that CNH is awarding, they are having to guide that and it is kind of similar to what the environmental assessment requires in terms of characterization of the environment. So, the good news is that all of the information that got generated in the environmental baseline study could be and should be used when it comes time for those companies to present their environmental impact assessment. One thing that has not been discussed here a lot is that not only do you have to comply with what the requirements of what the contract says, but you also have to comply with our environmental laws, instruments, permits, and authorizations.

Mexico is in a period of a stabilization process. It is a phase where we have to live with the regulations and instruments that were in place before, and it does not necessarily mean that they will work well in what our future model is going to be. We would like for the operators to come and get an authorization for the system, and then later come and get an authorization for their regional assessments. We would like to do all of that in just one place so that you just get one permit and that covers everything including your SEMS authorization. They are unable to do that right now. BOEM has a workshop in Mexico with ASEA and CNH to discuss coordinating environmental studies and environmental law, so next week is a step in the right direction. It is a long-term project that we will need to continue.

PANEL 2—RISK MANAGEMENT, EMERGENCY RESPONSE, AND SOCIO-ECONOMIC ISSUES IN THE HYDROCARBONS SECTOR – COLLABORATIVE OPPORTUNITIES

Presentation #1- *International Legal Considerations of Collaborative Energy Development in the Gulf of Mexico, Richard McLaughlin, Endowed Chair for Coastal and Marine Policy and Law, Harte Research Institute*-- I will provide the context for the discussions we have today and some of the international legal questions both nations have to be concerned about as they move forward with these collaborative activities in the Gulf of Mexico. There are three areas that I will focus on. One is energy development adjacent to the Maritime Boundary itself. The second will be to talk about some of the legal issues associated with areas that are beyond national jurisdiction. I am talking about the Western Gap, or sometimes called the Western Polygon and the Eastern Gap, or Eastern Polygon. Finally, I will discuss some of the reforms that are taking place in how the two nations engage in transboundary spill responses.

I believe that the most important international treaty ever negotiated is the United Nations Convention on the Law of the Sea (UNCLOS). Mexico was one of the first parties to ratify, but the United States still has not become a party to UNCLOS. Despite not being a party, the United States is bound by the Convention because most has been accepted as customary international law. Consequently, what I will be talking about this afternoon is both relevant and binding on the United States and Mexico. Under UNCLOS, coastal nations have been granted more legal authority closer to their shores, and as you move further out into the ocean the international community begins to apply more and more authority. The two zones that are relevant to our discussions today are the 200-mile Exclusive Economic Zone (EEZ) and the Extended Continental Shelf. The 200-mile EEZ is the reason the United States and Mexico have the sovereign right to exclusively explore and exploit the natural resources within their waters. Hydrocarbon leasing, environmental and safety regulations, etc., all come about through the international rights provided by the Law of the Sea Convention and the 200 Mile Exclusive Economic Zone.

Additionally, the Convention's legal regime relating to Extended Continental Shelf areas is also applicable to the Gulf of Mexico because the United States and Mexico have claims that allow for the development of resources even beyond the 200-mile limit. Dividing the two nations' extensive 200 mile EEZs is a long maritime boundary. The precise location of this maritime boundary was decided in 1978. However, the portion within the area beyond national jurisdiction known

as the Western Gap was not determined until the year 2000 when the United States and Mexico completed an agreement to divide that area. The Eastern Gap is still not delineated. Maritime boundaries do not exist in that zone because it involves the United States and Cuba, and until very recently those two nations did not have diplomatic relations. There are indications that the Obama Administration is placing this high on their agenda and has plans to negotiate with Mexico and Cuba on the Eastern Gap in the near future.

In the area of the maritime boundary that the United States controls, nothing much is going on in the Texas section. Texas controls nine nautical miles, and it has shown little inclination to work with Mexico on transboundary maritime issues currently. Seaward of Texas waters, there are important commercial hydrocarbon activities occurring on the United States side of the boundary in several places. In Mexico, they have done some exploratory work that shows clearly there are commercially valuable hydrocarbon deposits in Mexico's EEZ as well. The only place where there is activity right next to the boundary which could trigger the 2012 transboundary agreement is an area known as the Perdido Foldbelt/Alaminos Canyon area that is basically half way between the Western Gap, the shorelines of Texas, and Tamaulipas. This is the map of the Perdido Fold Belt area. There are some exploratory wells on the Mexican side, as well as a lot of production that is occurring right now on the U.S. side with a regional hub facility that Shell operates. The field to focus attention on right now is Tiaras One, a PEMEX field that has commercial quantities of hydrocarbons. On the United States side, there is a lease block that is owned by Stone Energy and that could potentially be part of a transboundary reservoir, and so if that is the case, it might trigger the unitization requirements of the 2012 Transboundary Hydrocarbon Agreement for the first time.

Given the likelihood that transboundary deposits exist and will be developed in the future, it is important to understand what is required under international law when you develop a transboundary reservoir. This is not the first time that two nations have tried to exploit a transboundary reservoir. It has happened many times in other parts of the world and there are well-established international customary norms associated with these trans-boundary reservoirs. This is generally the longstanding rule associated with such reservoirs: First, nations have to cooperate on reaching agreement on the exploration of the transboundary reservoir. In the absence of such an agreement, neither party may unilaterally take the resources to the detriment of the other party. That does not mean that a party can't unilaterally explore on its side, but it cannot do so if it damages the reservoir

on the other side. This is called the mutual restraint doctrine, and it is very well established.

A reprint of a recent article in the Houston Journal of International Law that I wrote with Guillermo Garcia Sanchez can be found in your symposium packet. One of the things that we looked at in our research was whether or not the 2012 Transboundary Hydrocarbon Agreement complies with the mutual restraint doctrine. Ultimately, we determined that if Mexico and the U.S. properly and completely implement the agreement, then it complies in the sense that there are countless provisions to try to encourage unitization and avoid unilateral exploitation. Based on international practice, it is unusual that if two nations cannot agree on a unitization agreement, they are allowed to engage in unilateral production as is provided by 2012 Transboundary Agreement. However, the Agreement requires that they do so subject to a joint management plan that has been approved by both parties, and have to exchange production data on a monthly basis, which is a way for both nations to understand what is going on and get compensation if they need to. Our view is if properly implemented, this meets international legal requirements.

In regard to the two areas that are beyond national jurisdiction in the Gulf, the question is how can a nation claim the resources of that zone? UNCLOS allows nations to claim resources in areas such as the Western and Eastern Gaps by proving that there is a natural prolongation and that they meet certain geological criteria that are included in Article 76 of the Convention. If you do meet these criteria, and Mexico has already submitted a claim and has met that criteria, then coastal states have jurisdiction over the nonliving sea bed resources and living sedentary sea bed resources. They do not have any authority over the water column above, and as a consequence you have this hybrid situation where the nation controls what happens on the sea bed but does not control what happens above the sea bed, which creates some very difficult management issues. Having said that, the international community did not want to take the nations' words for their ability to prove that they meet these requirements in Article 76. They created instead a body known as the Commission on the Limits of the Continental Shelf, which examines the claims made by these nations to try to prove whether or not they are legitimate. This is a group of technical experts that determine whether or not it matches the requirements of the Convention. In the case of Mexico, they have met that standard. The problem comes because the United States is not a party to UNCLOS, and cannot submit a claim. If you are going to invest a substantial amount of money, sometimes a billion dollars or more, into a hydrocarbon development project, you want to know that you have clear and

unambiguous title, and right now one cannot make that claim in the Western Gap. Other nations can challenge a claim, for example, we have challenged claims by nations such as Russia in the Arctic. There is nothing that says that Russia or other nations will not challenge our claim in the Western Gap, so the point is that there are implications to the United States not being a party to the Convention.

Finally, I will talk briefly about oil spill response. This map shows the impacts of Deepwater Horizon as well as the Ixtoc Spill in 1979. Clearly, the Ixtoc spill was a transboundary problem. It moved into Texas and United States waters and eventually contaminated Texas beaches, which was a classic transboundary spill event. As a consequence, the two nations got together and implemented the MEXUS Plan. What that plan did was create a joint spill command, an expedited communication protocol, and a system of regular exercises and meetings that take place every year. I attended one in Corpus Christi where they went out in the bay and laid boom and conducted other cooperative training exercises. Finally, the plan also created annexes that provided expedited Customs and Immigration procedures for equipment, vessels, and personnel. That was the goal of the MEXUS Plan. The problem with that right now is that it is being renegotiated. I have spoken to some Coast Guard officials who indicated that the previous framework was called a joint response framework, which is where the two nations physically move into each other's water in responding to spills. What they would like to do instead is to change this to a joint coordination approach which basically mandates that Mexico cleans up its spill on its side and the United States cleans up on its side. They would coordinate, cooperate, and communicate, but they would not physically move into each other's waters. The reason for this change is because they were having problems on the United States side meeting funding requirements from the Oil Pollution Act of 1990 because the Oil Spill Contingency Fund only allowed it to be used in US waters with very narrow exceptions. They also pointed out language problems, as well as problems stemming from the expedited Customs and Immigration procedure not working as well as they all had wanted. For example, during exercises they were experiencing slowdowns in the arrival of equipment and other necessities. So, for those reasons, there is clearly a major paradigm shift about to take place relating to the MEXUS agreement.

In closing, this shift in MEXUS may be symbolic. It is disappointing as it seems to be a step back in our bilateral efforts to cooperate. It is clearly more efficient to pool your resources and collaborate rather than duplicate efforts. Under the new approach the two nations need to autonomously take care of the spill response needs on their respective sides of the boundary. I see this as a classic example of a

gap in collaborative management. They looked at the old plan, said there were some problems, and decided to adapt and change. I suppose that is a good example of adaptive management. However, it is also a bit disheartening because it is likely to be the norm in future collaborative efforts between the United States and Mexico—two steps forward, one step back. Despite occasional setbacks, 10 years ago when I first joined the Harte Research Institute I could not have imagined that we would be talking about implementing a transboundary hydrocarbon agreement and working so closely together on sustainably managing the Gulf.

Presentation #2- *Health Preparedness—Lessons Learned from Deepwater Horizon Accident, Allison Winnike, Director of Research and Research Professor, University of Houston Law Center*-- I have a background in public health law and emergency preparedness law. My goal is to bring another perspective to all of our great energy plans that we have heard about today. I will talk about things to prepare you for developing your emergency response plans and what type of human outcomes you really need to account for when you are developing them. With the Deepwater Horizon Spill, we know that there were 11 fatalities. Another 17 people were air-lifted to trauma centers, but it went so much further than that. There were hundreds if not thousands of people who went to the emergency room or their primary care provider with varying effects from the experience of that particular disaster. I decided to come up with a framework that policymakers and energy people can use to help them as they try to develop their own response plans. I have a health impact spectrum where I can divide up the different types of patients you need to account for and it is also on a timeline. This framework can apply not only in offshore oil disasters, but it could also apply to oil refineries, explosions, and other disasters.

The first category of the framework deals with the immediate reaction after a disaster. Clearly the individuals who will be impacted are the workers right there and also any bystanders. This can apply to offshore or land-based facilities. These range from very minor cuts and scrapes to major debilitating burns, loss of limbs, all the way to fatalities. This is also where you need to think about a possible mass fatality incident or a mass casualty incident. You need to be thinking about the number of people you may be dealing with in the immediate impact period.

The second category of the framework is for first responders. First responders are going to be there immediately. We are talking EMS, firefighters, etc., but it can also be good citizens either as part of the industry or community that come in to respond to the disaster. Now we are looking at them in a rescue context. Think

about what kind of personal protective equipment is going to be needed. What are the different types of personal protective equipment you need to have available, and training is essential as well, if possible. You are now looking at responders who will help remove some of the first victims, and you are also looking at some transportation issues. If you are in a remote location, you will be looking at serious transportation issues.

The third category is community help so these are going to be folks working or living in the community that want to get involved. Your community impact zone will be dependent on the type of disaster, such as an explosion or a chemical release. In the community help category, we are still talking about things happening immediately after the incident. Again, in that broader scope, you could have another mass fatality or mass casualty incident to deal with.

The next category in the framework is recovery response. We have had the emergency, we have had the first responders coming in, maybe a little time has passed and now we have a whole new set of folks coming in to the impact zone. They have a whole different set of issues that may require your help. This is where a lot of issues showed up after the immediate issues from Deepwater Horizon presented themselves, they came from the recovery response period. Again, you have industrial workers that work there, and they are trying to clean up and remediate whatever happened. You will have all the governmental employees involved with response groups trying to come in and help, and you also are going to have volunteers. You have to be sure that you can anticipate the kind of needs they are going to have. Again, personal protective equipment (PPE) is very important. Depending upon your health emergency issue, you are going to have to be prepared and know about the kind of PPE that is going to be needed. You have to know where you can get the necessary PPE that is required right away. One of the biggest issues in the Deepwater Horizon Incident was heat-related issues. The responders have on all this PPE and they are working extremely hard under stressful conditions, and they are doing the best job they can to get everything cleaned and back to normal, and that is where many suffered from heat stroke. Dependent on conditions, you may need to have a 15-minute work period followed by a 45-minute rest break. You cannot put your recovery workers out there and put them in a worse health situation. Another related issue is dehydration. Other issues that may be a little more difficult to plan for include exposure to oil, exposure to chemicals, etc. Also, when purchasing PPE, think about things like hearing protection for volunteers and other workers. Other big issues are over-straining, back issues, and inhaling dangerous chemicals. Again,

always think about PPE. Not every situation calls for a respirator, but you need to know where to call to get them if you need them.

The last category of the framework is at the end of the cleanup. We do not necessarily know all the impacts that take time to show up—like cancer, for example. The issue is long-term stabilization. Some people are not going to be able to recover from whatever the illness is. Also, there is a huge mental health issue. Sometimes this gets neglected because we are focused on the physical health issues. We really need to have resources to take care of the mental health issues that arise from our emergency response. We all know about Post Traumatic Stress Disorder, but we need to be aware of all the other mental health issues that could manifest themselves or be brought to the surface by stress. You may need to think about bringing in some counsellors for the impacted community or neighborhood, or other mental health professional to help deal with this issue. These are your employees, these are your neighbors, these are your community members.

Presentation #3- *Monitoring Offshore Development Impacts in the Gulf of Mexico Communities: The Value of Social Indicators, Victoria C. Ramenzoni, Assistant Research Scientist and Patricia Arceo, Research Scientist, Harte Research Institute*-- Oil and gas extraction activities bring benefits to national, regional, and local communities, so how do we measure the beneficial impacts on communities? Oil found in the water in the Gulf of Mexico is said to be 46% from natural seeps. Much of it also comes from transportation-related issues. There are challenges related to climate change and a climate event, as well as the intensity and frequency of storms. We are going to be seeing more activity as we move forward on exploration and production on the Outer Continental Shelf. We need to have information on how many and what communities are being affected by either having new oil and gas activities or a loss of that activity. First, we will talk about the situation in Mexico and then we will talk about the situation in the United States.

Dr. Arceo began with a discussion of oil extraction in Mexico-- PEMEX has been the main operator in Mexico. It has more than 100,000 workers and 80 percent belong to the very powerful Union. Now they are downsizing and laying off workers. That is going to be difficult. Income from PEMEX contributes to the public finances. The most important oil spill in Mexican history was the Ixtoc spill in 1979. It took a lot of time to control that spill—around 9 months. Some of the oil evaporated, some of the oil fell to the bottom of the Gulf, and some of it ended up on beaches. The environmental effects were difficult to measure because

there was no baseline of studies to compare the results. It affected the fisheries at Campeche, which is one of the most valuable fisheries in Mexico, and it was a very stressful time for fishermen. In the long run, this may cause some environmental problems today, especially in the fisheries areas where high levels of oil are found. It is important to consider the social implications of all of these activities. There is a lot of talk about the environmental impact and that can be measured, but there is very little data to measure the effect on the community. After the 2010 census as included on the map, the colors show the marginal communities and the darker colors show communities with higher marginalization, and it seems to be an effect of the oil and gas industry. So, there is an economic impact in some areas. Those are the kinds of things we can start to relate to. PEMEX has begun to publish some reports, and they decided recently to include some data relating to social issues. However, PEMEX is using its own employees for the data on social impacts, such as working conditions. It is currently unclear whether these studies reflect what the community really feels.

Dr. Ramenzoni discussed the US side and reviewed the history starting at the beginning of the 20th Century, including some of the legislation and the fact that the Obama Administration has put out a number of Executive Orders-- One of the most important pieces of legislation that we have in the United States is the National Environmental Policy Act of 1969 (NEPA), and it creates a mandate for how to regulate and evaluate what the impacts of oil and gas activities are. Not only environmental impacts, but also social impacts. Other pieces of legislation that require full impact consideration are the Magnuson-Stevens Fishery Conservation and Management Act, which set a clear mandate for evaluating how the policies will affect local communities. We also have the Oil Pollution Act. So, there are a number of places in the United States' legislative framework that call for social impact evaluations.

We see that the Environmental Assessments and Environmental Impact Statements (EIS) that are required by the Department of the Interior fail to provide a precise definition of social impact. EISs are usually required for sales of leases. The way the Department of the Interior regulates, the leasing program is set every five years and they are required to produce an EIS. The EIS is usually comprised of different elements, such as a description of the environment, a prospectus of benefits that are going to be generated, and potential consequences on different policies involving social impacts. But there is no provision for what social impact means, so there is no clear definition of the term. This timeline shows the steady movement on the issue of social impact. I started with NEPA in 1969, and then in 1973 we had the first use of social impact coming out in the

Minerals Management Service whenever that agency was doing a study on the Trans-Alaska Pipeline. That is the first time that the term social impact was used. In 1980, because there were no particular provisions describing what social impacts were, a group of social scientists tried defining the term. They came up with different definitions, so we see around 1994-1996 that there are different frameworks that are being developed, for example, for the Foreign Service or other different agencies. So, it has been a very interesting process.

In 2010, we have the BP incident. We had a lot of dialogue coming out of that. We started seeing a lot of interest in trying to measure what was happening to society then. The lack of social measurements is a problem. Over the last 10 years, we have seen improvement toward more social involvement. On the other hand, with storms and weather events like Hurricane Sandy, there was a huge need for measuring impacts on communities. Social indicators have been around for a long time. We work under the idea of one law. Over the next few months we will be working to develop a framework of social services that can be used to develop information on social impact issues.

Social indicators are becoming more important in the Gulf of Mexico with oil and gas activities. Now we have an interesting opportunity with Mexico's energy reforms and this transboundary agreement between the two nations.

Presentation #4- *Summary of Mexico's Public Hearing Process to Consult with Indigenous Communities, Raul Mejia, Supreme Court of Justice of Mexico*-- The first question I get about dealing with Indigenous people in Mexico is why the communities have been so residual in Mexico, and why their wishes and goals have not been taken into account. They are poor communities and they have always been pushed back. They have not been able to acquire property. There is no treaty with the Indigenous community in Mexico. In other countries like Canada, you may have to negotiate to go through their lands, but in Mexico you do not have to do that because they do not have any land. That is the consequence of a decision in 1880 – 1882 that denied the Indigenous community political access through the church. Basically, from the late 1800's until the Indigenous reform in 2001 it stayed that way. Some Indigenous communities are integrated into the broader community but some are not. This is a question of existence of the Indigenous communities. We cannot give them access to the actual government of Mexico. The problem is that there are several States that have recognized them and they are part of their own election system. The Supreme Court has been resistant about incorporating Article 2 with Article 115. That is the article in the Mexican Constitution that lays out what structure our municipalities

have vis-à-vis the States. So if you put Article 115 against Article 2 of the Constitution that can create a controversy. In Mexico you have the normal legislative process and you have constitutional reform which needs 50 percent of the States to comply. But there are problems with the legal process to make changes. For example, with the construction of an aqueduct in Sonora on the lands of the Yaqui Indigenous peoples, when it was finished and working, the Indigenous people came to the Supreme Court arguing that the government's authorization did not consult them.

One of the latest authorization problems has come up in the Bay of Campeche. The Mayan people have fought against an authorization for Monsanto to grow transgenic soy seeds. The Mayan people are beekeepers and what happens with the process is that Monsanto coming in to grow genetically modified plants affects the status of the plants and then the honey cannot be certified as organic. The Mayan peoples in the Bay of Campeche were a large provider of honey on the market. The Judge gave an injunction to the Mayan people so they could stop the authorization. It was said there had to be a consultation. We are not sure what will come of that. So this is really entrenched with the problem of environment. The Ministry of Energy has to do the presentation, not the Ministry of the Environment. Basically, you have the authorities of environmental impact on one side and you have Indigenous community consultation on the other. You cannot have things going on two tracks and have results that might be beneficial. Article 2 of the Constitution of Mexico says not only Indigenous communities have access to the rights established there, but any other similar communities, so it opens the possibility of consultations with other communities. On the other side if we take into account that we have new procedures in Mexico law like collective action or environmental actions, and collective action gives damages but environmental actions do not collect damages, the monies actually go into a fund as a form of protective action.

Consultations with Indigenous and other communities must lead us to develop authorizations that are robust enough that it is not going to be later tested at trial. Eventually Mexico is going to find itself in conflict with the doctrine of the Latin-American Court of Human Rights because we have been using consultation just to formally stop authorizations. It actually has not been a process to solve the existing problems. We are going to have to actually make effective the consultation process in Mexico.

Cross-cutting issues and Discussion with Audience:

We have heard this morning the challenges that we as nations have to face. The companies have their own safeguards and ways of dealing with communities beforehand and they go for International Standards, because they work in under-developed countries that may have substandard regulations so it is better to go the proven route. We need some way of actually identifying who the legitimate authority is in a community. Often, they do not want to register, but we need a way to know who the right authority is for a community. There are a lot of challenges to making things work. One problem is that this is going to be accumulating and eventually it will be very difficult to sort out if we do not do it correctly in the beginning. The consultation process has to lead to a good result. It is more than a process of negotiation or arbitration before the consultation. Maybe not everyone is in agreement, but we have to reach a middle point with this.

We have not managed to develop a real cross-boundary situation. This might be because we need to be clear on what our objectives of integration are. Without that we cannot proceed with regulation, which is the second step.

One of the elements of legislative review is the possibility of suspending the acts. One of the new laws that was enacted with the Energy Reform provides that the Energy Act cannot be suspended except in certain instances. That is in conflict with another set of laws. What do you think will happen if you have suspensions on such human rights issues on this boundary?

It will be difficult to integrate Mexican and United States safety and environmental regulations, although there has been talk this afternoon about performance-based standards and other kinds of changes. Unless there is political will, not only from BSEE and the Mexican agencies, but all of the agencies and interest groups in the United States, including the industry, those kinds of changes are going to be very difficult to implement. We may be able to begin this process of creating this common set of standards based on requirements in the Transboundary Agreement. It is going to take political will not only from BSEE and ASEA, but from lots of other agencies like BOEM and EPA and other industry groups. How the two nations deal with conflicts over possible human rights issues remains to be seen. However, the more immediate issue is developing compatible environmental and safety standards that don't disrupt or distort management decisions in the maritime boundary region.

There were concerns expressed about the consultation process. This has to be incorporated into the environmental protection and environmental impact authorization as it covers several issues including religious and environmental concerns. If you only see the environmental authorization as the only natural regulation, then you are missing the multi-lateral application. Mexico has already authorized damages and we are starting to develop doctrine about the damages issue. There are two very strong problems with things that are in the laws, or not in the laws, or in the transitory articles of the Energy Reform. One is the suspension issue. That is not backed up in the Mexican Constitution. The second problem is land use. Every concession in mining law has preference over any other use of the land. Now with the new laws, in Article 14, it says it has preference over every other land use, but legally it is a question. It would need to be put in the Constitution and not the transitory articles. Where are the strengths when a problem explodes? On the other side, you have the problem with occupation and civil servitude. You are conceding the legal servitudes to the companies that have to occupy the lands. The process does not have any other way of ending but of establishing the servitude or establishing the occupation or by a negotiation.

By creating a bi-national commission that has the power to come up with common safety and environmental standards for the border, you technically do not have to go through a political process, but if the agencies get politicized then that is the end of the story. This seems like a great opportunity under BSEE, BOEM ASEA, and others to come up with those things that they want to get accomplished. We are under the law, but how we apply them is important. They would have the power to do that. The rest of the Gulf coverage would need the political support.

What is the difference between consultation with Aboriginal people in Canada and Mexico?

Companies are required to consult with the Aboriginal people in Canada. These are fairly straightforward where Canadian Treaty laws are established. But there are actually some lands in Canada where there are no treaty rights, but if the Indigenous people can demonstrate traditional land use, and that is where companies have had problems in the past, where the Indigenous communities see those as opportunities as a way to leverage the government for Constitutional amendments or traditional land-use rights. Some pipeline permits have been held up for years until the companies actually cancelled their project.

Hypothetically, is that a possible risk for companies wanting to operate in Mexico, and also, we were speaking of land-based issues in Mexico which are relatively straightforward. We have been talking about a deep-water round in 2016 and do you see an extension of this potential complication to the offshore?

Mexican Judges have been very resistant on giving injunctions in practice because what happens is that the public interest standing has been evaluated pro-companies and not pro-individuals, at least until now. I have not seen the possibility of stopping big projects or big works by smaller commodities or by communities that are in the middle. In oil law for oil or gas pipelines or transfer of water, for example, we have not seen any stopping of the actual project. In the end, it has been more of a cosmetic thing rather than an effective weapon. We have the NGOs (non-governmental organizations) trying and going after it, but it is the only way right now for going against the projects. That has not been really effective.

The question of offshore is a question of damages and standings. It depends on how we treat standing. That depends on the law to use. Communities should be taken into account going through the whole process. We have to be creative in ways to solve this problem with Indigenous communities. The environmental impact assessment authorization will be contingent upon the consultation outcome. The communities must be included in the process but that is not easy. The first thing you need to know is what they want. If there are NGO's behind them that may be clear. You have to know what the real deal is in order to proceed.

Next Steps

Dr. Zamora and Dr. McLaughlin-- There have been some next steps raised already such as having additional forums on different topics, a themed workshop so that a group like this could address one particular topic.

This is what we are looking for in next steps. The absolute first next step from this workshop is to assemble the proceedings and to distribute those proceedings so that everyone has an opportunity to look at them and comment on them. Then we will have them published in the *Sea Grant Law & Policy Journal*. We would like to know, and you need to tell us, what you liked about this, what you didn't like, and how we could do something in the future that would benefit you more than what you received today.

There will be something sent out requesting your comments. Obviously, an Indigenous community consultation in Mexico is a very important topic in Mexico, and something many on the U.S. side were not aware of. Perhaps that is the direction we should go in planning for future workshops, of course connected with offshore energy development. In any event, that is the kind of information we need to ascertain the best way to serve your needs the next time we do something like this. One interest mentioned was the environmental science offshore and how the two nations can cooperate in acquiring and using that information to make management decisions. We also heard today regarding the issue with PEMEX data and the new studies that are going on, how will that be adaptively brought into the process of the regulations moving forward? It would be helpful to provide some opportunity for sharing information on best practices.

In reference to Allison Winnike's presentation earlier, she is working on a publication that will be very useful. The 2016 version of the Texas Bench Book for control measures and public health awareness will be available soon. You can go to the Health Law link on www.law.uh.edu to find it.

The idea behind the Center for US and Mexican Law was to provide a neutral zone to promote U.S. and Mexico cooperation. We will communicate by email and send a questionnaire to find out your comments and suggestions about ways we can provide service to the companies or agencies. Our idea is to bring smart people together to exchange ideas.

We would like to thank Allison Knight from the Harte Research Institute and Brisa Gossett from the Center for U.S. and Mexican Law for their efforts in the coordinating the symposium.

Thank you everyone for coming.

MEETING ADJOURNED