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The Political Economy of Oil Spill Damage Assessment: NRDA and Deepwater Horizon

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Abstract

The federal effort to quantify and capture non-market damages to coastal ecosystems from the 2010 Deepwater Horizon oil spill, Phase II of *United States of America v. BP Exploration and Production*, centers on the Natural Resource Damage Assessment (NRDA) process. **This paper makes the case that the current NRDA process has done a poor job protecting the public interest and resolving the issues surrounding oil spills from deep water drilling activities.** After 5 years, the findings of the NRDA still remain sealed from both affected maritime communities and academic researchers until litigation is settled with civil and criminal fines for BP's Clean Water Act violations and damages to coastal ecosystems. This multi-year legal process further retards progress in using the latest science to inform policy for the future of proposed off-shore oil activities, including introducing new regulations that would subject semi-submersible oil platforms to the same rigor as oil tankers. Using historical comparisons, this paper examines how the political economy of legal procedures and damage assessment processes has created winners and losers in the aftermath of DWH, especially with respect to the Vietnamese-American ethnic maritime community. Finally, proposals are suggested how the regulatory landscape, and specifically the NRDA process, might be improved to strengthen transparency, better inform policies in a timely fashion, and encompass cultural resources.

I. Introduction

The 2010 Deepwater Horizon (DWH) oil spill, arguably the worst environmental disaster in the history of the United States, triggered wide-reaching ecological impacts in a region whose fisheries and coastal wetlands had already been degraded by decades of industrial development and destructive hurricanes. While the federal government has created procedures to respond to oil and chemical

spills – including assessing the ecological damages, litigating against the responsible parties and directing funds to restoration efforts – this paper argues that the size, complexity and scope of the BP oil spill has distorted the structure of those processes that were in place earlier. Principally the Natural Resource Damage Assessment (NRDA) conducted by NOAA, has, in the case of the BP Oil Spill, served to benefit the polluter. Additionally, the asymmetry of legal and financial resources between ethnic fishing communities and BP has generated significant inequities in the distribution of restitution for DWH.

Meanwhile, the lengthy delays and lack of transparency associated with the NRDA prevents researchers and policymakers from understanding the true impact of the spill and adjusting their risk analyses accordingly to prevent future disasters, including the issuance of new permits, which has already occurred before crucial information has been made public. While some past environmental disasters, notably the Exxon-Valdez oil spill in Alaska, have prompted real reforms, the regulatory landscape remains largely unchanged in the wake of DWH. This paper suggests several potential policy fixes to address flaws in the NRDA and to realign the balance of power between polluters and regulators.

A brief overview of the historical build-up to the DWH spill reveals how complex and globalized the offshore oil industry is and how this creates difficulties in regulating it. Built in 2001 by Hyundai Heavy Industries in South Korea, owned by Swiss firm Transocean, leased and operated by BP, and flagged in the Marshall Islands, the Deepwater Horizon (DWH) offshore oil rig represented the latest generation of offshore drilling and extraction technology in the globalized hydrocarbons industry (Offshore Technology 2010). In 2009, before being towed east to waters off Louisiana, DWH drilled the deepest oil well in history – over 35,000 feet – off the coast of Texas (Rigzone 2009). There it began operating

in the Macondo Prospect (MC 252), an estimated 50 million barrel oil reserve in 1,500 meters of water (Butler 2011). Although these volume and depth criteria did not qualify the oil extracted there for tax breaks under the Deepwater Royalty Relief Act of 1995 (Energy Information Agency 2002), and even despite the high capital costs, the high price of oil on the global market¹ ensured the operation would yield a profit for BP (Houston Chronicle 2009). This was true even despite leasing the DWH rig at almost half a million dollars per day.

On April 20, 2010 the operation suffered a major blow-out at the wellhead, with the resulting explosion killing 11 employees aboard the rig and triggering an uncontrolled oil spill that would prove impossible to cap for the next four months. Federal and state authorities employed more than 47,000 temporary workers to assist in containing and cleaning up the spilled oil (Ramseur & Hagerty 2013), using 13.3 million feet of floating booms and 1.84 million gallons of chemical dispersants (National Commission 2010). Additionally, efforts to directly remove oil from the marine environment through skimmer ships and burning operations reduced the total volume of oil by roughly 3% and 5%, respectively (Butler 2011).

Despite these efforts, the response received significant criticism for several notable failures, including the lack of a technical solution to plug the wellhead and inadequate coordination with coastal landowners, many of whom inadvertently undermined clean-up efforts². Thus, large quantities of oil still came ashore as far east as Alabama and Florida. Major concentrations of oil in the open ocean prompted the National Marine Fisheries Service (NMFS) to close 36% of U.S. gulf waters to

¹ \$51.30 per barrel for U.S. crude oil first purchase price in April 2010. (EIA 2013)

² Discharging freshwater from irrigation or storage systems to keep oil slicks at bay, landowners reduced the effectiveness of chemical dispersants designed to work in saltwater (Laleian & Azwell 2011)

commercial fishing for eleven months post-spill (“NOAA Closes...” 2010). The long-term effect on the population dynamics and habitat health of Gulf fisheries remains unclear four years after the incident: landings for most major fisheries rebounded to pre-spill levels immediately after the NMFS ban was lifted (National Ocean Economics Program Commercial Landings Dataset 2012). Yet this may indicate fishers’ eagerness to recoup lost revenues, not the recovered health of the biophysical system. Indeed, NMFS issued additional bans in the region as recently as July 2013 in response to discoveries of additional oil contamination from DWH (“Tar mats prompt...” 2013).

Among those most affected by the spill were the Vietnamese-American community, who make up 25% of fishermen in Louisiana and were disadvantaged in their access to financial and legal resources to gain equitable restitution from BP (Buchanan 2012; Hennessey-Fiske 2010).

The spill’s economic damages also extended beyond fishing to coastal ecosystems and the services they provide. While the criminal phase of the federal trial against BP, *United States of America v. BP Exploration and Production*, concluded in January 2013 with a \$4.5 billion fine (U.S. Department of Justice 2013), the second phase to establish Clean Water Act violations and ecosystem damages is ongoing at the time of this paper’s completion,. This Phase II hinges on a Natural Resource Damage Assessment (NRDA) conducted by NOAA scientists and economists. Due to the pending litigation, the trial judge has ordered that the results of this NRDA remain sealed from the public (Meade 2013), to the detriment of researchers and policy-makers to whom such information would prove beneficial in informing planning, assessing risk and preventing future catastrophic events.

II. Political Economy

The legal aftermath of Deepwater Horizon is multi-faceted and still far from over almost four years after the spill. BP has faced legal action in both federal and state courts. The federal trial, *United States of America v. BP Exploration and Production*, consists of two distinct phases. Phase I, the criminal trial, reached a verdict in January 2013, requiring BP to pay \$4.5 billion in fines for crimes including negligence and eleven counts of felony manslaughter for the workers killed in the blowout (U.S. Department of Justice 2013). No BP employees were sentenced to jail time for their role in the worst oil spill in U.S. history.³ Transocean, owner of the Deepwater Horizon rig, also pled guilty to violating the Clean Water Act and paid \$400 million in fines (U.S. Department of Justice 2013).

At the state level, individuals who feel their property or business was adversely affected by the spill were able to bring claims against BP, which says it has already paid out \$7.8 billion in compensation out of a \$20 billion trust established for that purpose (Lustgarten 2012). Many fishermen accepted lump sum \$5000 settlements in exchange for legally binding agreements not to pursue further action against BP (Buchanan 2012). Reports from legal defense organizations and advocacy groups suggest that Vietnamese-American fishers disproportionately accepted these settlements rather than navigate the daunting process of bringing a formal lawsuit (Buchanan 2012; Hennessey-Fiske 2010). Unscrupulous trial lawyers and fraudulent or exaggerated damage claims have complicated the process of fairly compensating business- and property-owners on the Gulf, with a December 2013 Louisiana court order imposing a moratorium on payments until issues of pervasive fraud could be resolved (Brady 2013).

³ In a separate trial begun in December 2013, a single BP engineer was charged with obstruction of justice for allegedly destroying evidence related to the spill. Some media outlets have speculated the Justice Department will bring additional cases against individual employees in 2014.

Starting in October 2013, Phase II of *United States of America v. BP Exploration and Production* will establish civil damages from the oil spill to the natural environment. The outcome of the trial will determine a dollar amount of lost ecosystem services, which BP must pay into a fund for ecological restoration projects. BP has already paid \$1 billion into a fund for “early restoration projects,” which began to be allocated in December 2013 for an initial round of 44 projects, including \$318.4 million to restore four barrier islands off Louisiana (“Draft programmatic...” 2013). However, both legal and ecological experts suggest the total damages from the spill is an order of magnitude higher than what BP has paid and the settlement from Phase II will be far higher than any seen yet. The lead agency responsible for representing the nation’s marine and estuarine resources in oil spill litigation is the National Oceanographic and Atmospheric Administration (NOAA). NOAA biologists and economists work to produce the official, comprehensive document of record on this matter, the Natural Resource Damage Assessment (NRDA).

The assessment process in response to any oil or chemical spill in federal waters follows a three-part process: pre-assessment to determine whether any damage has occurred; injury assessment of the lost value of habitats, ecosystem services and non-market values; and restoration efforts funded by the polluting party (“Damage Assessment” 2013). Four years after the DWH spill, the NRDA process remains on-going, and even after the document is completed, it will remain sealed evidence, not visible to citizens for additional months or years.

According to NRDA’s guiding principles, the process exists to defend and restore the nation’s natural assets, explicitly referencing the public trust doctrine in its goal to “determine whether injury to *public trust* resources has occurred [and] determine the extent and severity of injury.” (DARRP 2013 – ed. emphasis added) However, the lack of transparency contradicts the notion that the NRDA process

resembles true civic science funded by taxpayers for the benefit of affected citizens and improved policy-making. Indeed, although NRDA has produced effective results in response to previous, small-scale chemical spills, the continuing delays and lack of transparency in the aftermath of Deepwater Horizon suggest the process is ill-suited to handling catastrophic events, which might otherwise serve as watershed moments to reform regulatory measures and protect the public interest.

On November 18th 2013, BP voluntarily released a significant quantity of environmental monitoring data at gulfsourcedata.bp.com. Subsequent data releases in January and February 2014 further increased the volume of data available to researchers. While promoted as an effort to “help enhance public knowledge,” the release of this raw data on water quality, sediment contamination and other physical science metrics does not fill the gap in the academic and regulatory community’s understanding of monetary damages from the spill (“BP Makes Gulf of Mexico Environmental Data Publicly Available” 2013). Quantifying total economic losses due to ecosystem degradation and lost recreational use remains a key question about which NOAA economists are not permitted to comment or share their findings.

Drawing on previous non-market valuation research and new estimates in the wake of Deepwater Horizon, a body of knowledge about the value of Gulf coast ecosystem services already exists. Yoskowitz et al. (McKinney 2011) estimate the lost ecosystem service value from degradation of the roughly 500,000 affected wetland acres across Louisiana, Mississippi and Alabama totals \$1.2 billion. Additionally, across the entire Gulf coast, the CoStar Group (Drummer 2010) estimate the lost real estate value from decreased coastal property prices as \$4.3 billion. Finally, over the three years after

the spill⁴, independent estimates placed the damages to tourism at \$22.7 billion (Oxford Economics 2010). Over that same period, estimates of the impact on commercial fishery revenues range from \$115 million (IEM 2010) to \$247 million (McCrea-Strub et al 2011).⁵

Narrowing the scope of inquiry to just Louisiana⁶, the Barataria-Terrebone estuary where the Mississippi River meets the Gulf of Mexico provides at least \$97.9 billion in non-market value⁷, including wildlife habitat, storm surge protection and fisheries productivity (Petrolia 2013). Thus, even a speculative 5% degradation in ecosystem quality due to DWH contamination could translate to more than \$4 billion in lost value. In light of these preliminary and conservative estimates, NOAA's \$1 billion fund for early restoration projects is likely insufficient to make whole the region's biological and physical systems.

Additionally, a thorough non-market valuation of Louisiana wetlands should also include their role in supporting recreational uses, even though such users typically do not directly pay for their resource use. For example, apart from the many hundreds of millions of dollars in commercial fishing value in the region, recreational fishing and wildlife viewing in Louisiana support \$733.5 million and \$501.0 million in economic activity, respectively (McKinney 2011).

⁴ A three-year time frame is a typical measurement period to assess the short- and medium-term impacts of the spill. The blow-out, containment, response and clean-up all took place during that window, including the NMFS fishing bans, federal drilling moratorium, and cycle of media coverage and public perception about the spill.

⁵ All dollar values are inflation-adjusted 2010 dollars.

⁶ Louisiana merits focused research, as it bore the brunt of DWH oil spill impacts, is home to the majority of wetlands on the Gulf coast, and was already seriously damaged by Hurricane Katrina in 2005.

⁷ \$97.9 billion is the lower bound estimated, with the upper bound at 200%. Thus, the estuary value could be as high as \$200 billion.

What these existing studies lack is the high-resolution detail and degree of certainty needed to justify damages in court by proving clear causal relationships between oil spill contamination and specific, quantifiable economic and ecological impacts. Such is the task of the NRDA process, which is exhaustively thorough and time-consuming. NRDA's biological survey work is being conducted in nine main categories of affected organisms: coral, crab, fish, marine mammals and turtles, oyster, submerged aquatic vegetation (SAV), sargassum, birds, and terrestrial mammals (NRDA Workplans and Data 2013). Additionally, NRDA studies were conducted around specific habitat types, like benthic communities and shoreline areas. Finally, a significant portion of the program's effort is devoted to assessing recreational uses hindered by the spill (NRDA Workplans and Data 2013). With multiple sampling plans and working documents published for each of the above species and habitat categories, the comprehensive NRDA effort is exceedingly detail-oriented.

However, the information available on the public NOAA database for this project is almost entirely comprised of work plans, addenda, preliminary reconnaissance surveys and policy memos on the use of aerial imagery techniques (NRDA Workplans and Data 2013). Actual data on the degree and severity of impacts to habitat quality and species populations has either not been completed or is being with-held due to court order. NOAA employees are also barred from speaking about the specific content of the final NRDA document or subsidiary reports due to the pending litigation. Correspondence with NOAA economists working on the project indicated the effort centers around a "recreational lost use assessment" and a "total economic valuation study to determine damages" (DiPinto 2013). Presumably the myriad species impact assessments will feed into this comprehensive damage estimate that seeks to put a final dollar value on BP's liability. However, in the meantime, for

academic researchers or stakeholders in the region hoping to benefit from science being produced at taxpayer expense, NOAA's clearinghouse of data on this topic offers little of value.

With offshore oil and gas activity growing in prevalence on the world's ocean for the past four decades, various countries have suffered major oil spills in the past. Their experiences with response, clean-up, litigation and adaptation offer important lessons in light of Deepwater Horizon.

The Ixtoc I oil spill in the Bay of Campeche off the Mexican coast in 1979, the largest marine oil spill in history by volume until Deepwater Horizon, is uncannily similar to DWH. Ixtoc I also resulted from a blow-out at an undersea oil well. At the time, the operator, Petroleos Mexicanos, or PEMEX, lacked the technical capability to quickly cap the well, so the spill persisted for 290 days (Jernelov and Lindén 1981). Today, stopping a spill in 50 meters of water depth would be considered relatively simple. However, the steady march into deeper waters has created continual tension between extraction and emergency response technologies. Thus, BP found itself in the all too familiar situation of lacking a technical solution to the Deepwater Horizon blow-out, which occurred at a depth of 1,500 meters.

Additionally, a major problem in the containment and mitigation response to Ixtoc I was the use of chemical dispersants, which were ineffective against "weathered oil" on the open ocean, resulting in the creation of an "oil mousse" on the sea's surface (Patton et al. 1981). As this paper has identified, the same chemical dispersants were again problematic over 30 years later in response to DWH.

Finally, close relations between PEMEX, a state-owned company, and Mexican regulatory and judicial authorities permitted that the polluters largely escaped financial liability for the spill. Indeed, U.S. parties could not bring claims against PEMEX due to provisions of the Foreign Sovereign Immunities Act (Handl 1979). Likewise, a variety of factors have manipulated the aftermath of DWH in favor of

BP, including lack of baseline ecological and socioeconomic data in the region, an opaque damage assessment process, notably slow legal procedures and often sympathetic attitudes toward the industry among regulators and the general population of the region.

In contrast, the wreck of the oil tanker Prestige off the coast of Cantabria in northern Spain in 2002 illustrates the potential for a more coordinated response and aggressive, timely legal action. While the gross scale and physical impact of the Prestige spill were massive, a well-reasoned approach to the spill response prevented the disaster from becoming even worse. A single-hull tanker flying flags of convenience from Liberia and the Bahamas, the Prestige posed a particularly nefarious threat, as it was carrying heavy fuel oil, which has a higher sulfur and particulate content than light, “sweet” crude (Castenado et al. 2006). Additionally, the denser, more viscous fuel oil took on a semi-solid, gel-like consistency as it continued to leak from the sunken vessel in the extremely cold, high-pressure benthic environment.

Despite these unique challenges, the national and local Spanish authorities coordinated a notably effective response. As internal government documents and analysis by academic researchers indicate (See: Appendix D, Figure 1), the spill response team integrated damage assessment from the very beginning of the process, thus facilitating timely reporting (Castenado et al. 2006; Garza et al. 2008) . In contrast, the NRDA process in response to major U.S. oil spills does not commence until the spill has been largely contained and may have the unintended effect of retarding scientific understanding and legal closure.

Furthermore, the Spanish government pursued relatively aggressive legal action against liable parties to the spill. For example, Spanish authorities charged the ship’s Greek captain with an environmental

crime on grounds that the spill occurred due to his irresponsible decision to take a tanker with known structural deficiencies out to sea during an intense storm, rather than remain at port where any fluid leak could be easily contained (Goodman 2013). Finally, Spain also attempted to sue the American Bureau of Shipping, the international third-party ratings agency which had been paid to inspect and certify the Prestige was sea-worthy (“The Paper Trail” 2004). They brought this suit in civil court in New York City, where the company was headquartered, but the case is still pending as of early 2014. Nonetheless, this line of legal proceedings did reveal that the Prestige had multiple sister ships built with the same design and materials in the same shipyard, and thus prone to the same catastrophic failure (Secretariat of the International Oil Pollution Compensation Funds 2013). Those ships were removed from service, possibly preventing another environmental disaster. In contrast, after an initial and symbolic moratorium on drilling in the Gulf immediately after the spill (Baker & Broder 2010), it remains to be seen whether any real improvements in safety regulations will arise in the aftermath of DWH.

Finally, in the Prestige case, the International Convention on Civil Liability for Oil Pollution Damage made capturing civil damages from the ship owner, Universe Maritime Ltd. feasible. This convention, administered by the International Maritime Organization, provides a framework for who is at fault and how much they should be made to pay in the event of a catastrophic failure. As Section V of this paper will examine, despite being mobile, having storage and transport capacity that rivals modern supertankers, and flying flags of convenience, today’s latest generation of oil rigs are not covered under this convention.

III. Ecological Context

The biophysical and socioeconomic impacts of the Deepwater Horizon spill were shaped by the physical processes of the Gulf of Mexico marine system. In short, where the oil was eventually deposited in the days and months after the spill is a function of complex oceanographic processes. (See Appendix A for further details.)

Due to its diversity of littoral and coastal habitat features, as well as its role as a migratory corridor and a transition zone between temperate and sub-tropical climates, the gulf contains substantial biodiversity at the same time that its ecosystem services sustain a variety of human uses. The Harte Research Institute at Texas A&M University Corpus Christi characterizes the biogeography of the Gulf by dividing it into eight zones, or octants (See: Appendix A, Figure 2). Of these, the north-northeast octant, site of the DWH blowout and most of the ecological damages, is the second most biodiverse in the entire Gulf, with 8,332 species present (Shirley et al 2010). From an economic perspective, the NNE octant is also home to the most productive fishing grounds and highest volume fishing ports in the U.S. territory of the Gulf. The most commercially important species include menhaden⁸ and brown and white shrimp (NOEP Commercial Landings Dataset 2012). Empire-Venice, Louisiana is the most active commercial fishing port in the region, with landings in peak years exceeding 400 million pounds and \$120 million in landed value (NOEP Commercial Landings Dataset, 2012).

⁸ Medhaden is used primarily for fish meal, fish oil and fertilizer. It is not a particularly high-value fishery in terms of market price per unit weight, but it does harvest a large volume of biomass from the gulf, sustaining many fishermen's livelihoods and providing a needed input for other products.

As the soft underbelly of the nation's coast and the heart of so-called Hurricane Alley, the Gulf's marine and littoral ecosystems provide vital ecosystem services. While these ecosystems enhance the resilience of the region's economic and natural capital, they remain vulnerable to degradation from catastrophic storms and human disasters, like hurricanes and oil spills. According to non-market valuation of the benefits of coastal wetlands in terms of storm surge protection, these ecosystems provide an estimated \$126 ha⁻¹ yr⁻¹ in Louisiana and \$14,155 ha⁻¹ yr⁻¹ in Alabama (Costanza 2008). The two orders of magnitude difference in value assigned to similar ecosystems in different states is a function of multiple factors: coastal geography and degree of exposure to hurricane impacts; value of real estate and industrial development near vulnerable areas; and relative quality of extant wetlands. Drawing on these value estimates, it is likely that the DWH oil spill caused \$2,400 ha⁻¹ yr⁻¹ in lost ecosystem service value, or roughly \$1.2 billion in lost value when applied across 500,000 hectares of wetlands degraded by the spill (McKinney 2011).

IV. Socioeconomic Context

Most oil activity in the Gulf of Mexico occurs between six nautical miles from shore and the edge of the Outer Continental Shelf (OCS) and Exclusive Economic Zone (EEZ) at 200 nautical miles. Thus, it is not under the jurisdiction of any state and is regulated by the federal government. The lead agency in these regulatory processes at the time of DWH spill was the Minerals Management Service, reorganized in 2011 into the Bureau of Ocean Energy Management (BOEM) and the Office of Natural Resource Revenue (ONRR) (Fetcher & Schwartz 2011). With the former responsible for issuing permits and the latter responsible for collecting royalties on resources extracted, this division of power ostensibly reduced potential for conflict of interest and regulatory capture.

In light of the oil industry's immense and well-recognized political influence, a simple bureaucratic restructuring may be insufficient to ensure adequate oversight. Indeed, the issuance of new drilling permits in the gulf at pre-spill levels (Klimasinska 2012) suggests a return to "business as usual." This comes at the same time that a series of accidents and near-misses involving offshore oil operations suggests the potential for major accidents remains grave. In fact, "12,087 oil-related incidents in the Gulf had been reported to the Minerals Management Service during the five years before the Macondo blowout." (Freudenburg & Gramling 2011 p. 55). Thus, it is surprising that more serious accidents have not occurred. Elsewhere, failures with drill ships, spill-containment gear and other key equipment in early 2013 forced Royal Dutch Shell to suspend all their activities in the high-risk Arctic zone for the remainder of the year (Broder 2013). Were a major spill to occur off the north coast of Alaska, the process of capping, containing and remediating it would likely prove even more problematic than Deepwater Horizon, due to the region's frigid water, the absence of known capability to clean up a spill in such an environment, and lack of infrastructure. Such a disaster would be unprecedented in its complexity and potential for ecological destruction, yet the federal government is allowing oil operators to charge ahead into this uncharted water even before the science from Deepwater Horizon is completed.

In the past two decades, oil and gas activity in the Gulf has increased substantially. This proliferation of drilling is the result of changing oil markets, technological innovation and regulatory policy. Most notably, the first purchase price (FPP) for U.S. offshore oil has increased from \$9.07 in 1970 when large-scale offshore rigs first began operating to \$51.30 at the time of the DWH spill in 2010, both measured in 2005 dollars (See: Appendix B, Figure 2). That increase translates to a 466% increase in price per unit in constant dollars. In contrast, the price of (dry) natural gas has remained almost

constant over the same period (NOEP Offshore Oil Dataset 2012).⁹ Thus, with most deepwater hydrocarbon reserves consisting of gas over oil, vertically, producers have a strong incentive to pump off all the gas to access the much more profitable oil. Production data from 1995 to 2010 confirms that annual gas production from the Gulf OCS has declined, while oil production has increased (See: Appendix C, Figure 3). Indeed, with the rise of highly profitable land-based fracking operations to extract natural gas, offshore activities have migrated into ever deeper – and more risky – waters in search of valuable deposits of oil.

Three measures implemented over the past 30 years have seriously distorted economic incentives for deep water drilling in favor of the industry, and against the public's interests: 1) During the Reagan administration, Secretary of the Interior James Watt transitioned the system for leasing federal OCS lands to a so-called "area wide" bidding system, greatly increasing the area of lands available to the industry for exploration and drilling while decreasing the average price-per-acre paid by nearly 90% (Freudenburg & Gramling 2011 p. 147). 2) In 1995, under pressure from the oil industry, Congress passed the Deepwater Royalty Relief Act to incentivize domestic oil production in federal waters, with the dubious justification that increased domestic production would reduce dependence on foreign oil and further "energy independence" (Freudenburg & Gramling 2011). The law exempts oil producers from paying federal royalties on large reserves of oil extracted in deep water which would otherwise not be economical to extract; the exemption is granted to each oil well individually based on both depth and volume parameters (See: Appendix B, Figure 1). 3) The Rigs-to-Reefs program administered

⁹ Also affecting relative prices for oil and gas are their international and national markets, respectively. Oil is sold on the global market, whereas most natural gas is sold domestically, because of the technical challenges associated with shipping it abroad as liquefied natural gas (LNG).

by MMS, NOAA and state-level agencies allows oil operators to leave abandoned oil drilling platforms intact and *in situ*, thus sparing them significant removal and remediation costs, on the order of tens of millions of dollars per rig (Kaiser and Pulsipher 2004). By lowering the total lifetime costs associated with building, operating and decommissioning an oil rig, this policy further incentivizes the proliferation of rigs in the Gulf¹⁰¹¹.

However, oil and gas are not the only lucrative industries that rely on the Gulf for resources. While hydrocarbon recovery is carried out by a small number of massive, multi-national firms with international scope and advanced technical capability, fishing remains at the other end of the economic spectrum: decentralized, often family-run and sometimes tied to culturally significant ethnic communities.

Although conventional economic comparisons may favor the contributions of the non-renewable hydrocarbon industry to employment and income, living resources sustain economic productivity for multiple generations – indeed, indefinitely, if managed sustainably. Additionally, fisheries create beneficial multiplier effects throughout the gulf's regional economy, including food production, restaurants and a more resilient, diversified and self-sufficient culture. The widely distributive effects of revenue from the fishing industry vs. the concentration of wealth distribution from the offshore hydrocarbon industry should also be a consideration, but has not been. What's more, traditional

¹⁰ With the advent of towable 5th and 6th generation oil rigs, like the Deepwater Horizon, the concept of a static oil rig attached to the sea floor is becoming obsolete. However, there are still hundreds of these older generation rigs throughout the Gulf.

¹¹ Besides spurring further oil exploration, the Rigs-to-Reefs program has also contributed to creation of highly productive (man-made) red snapper habitat and, as a result, a major recreational fishing industry (Gaskill 2012).

maritime communities have significant non-market values that risk assessment in permitting oil drilling consistently neglect.

Finally, even those residents involved in the fishing and tourism industries, who are harmed by negative externalities from oil and gas extraction may still be predisposed to support the industry's activities in the Gulf owing to its longstanding prevalence and influence. For example, as early as the 1940s, Magnolia Petroleum Company, the precursor to ExxonMobil, "hired local shrimp boats to deliver supplies, equipment, and even the work crews" to the first offshore drilling platforms in Louisiana (Freudenburg & Gramling 2011 p.98). Today, nearly everyone in Southern Louisiana has a friend or relative employed by the oil and gas industry – the so-called *social multiplier effect* – whereas the less tangible benefits of marine ecosystems that may be felt strongly in other coastal regions like California or New England – namely recreation and aesthetic – are less apparent to Gulf coast residents, as the geography of bayous and marshes prevents most people from visiting, much less living within sight of the coast.

Today, one in four fishermen in Louisiana is Vietnamese-American, a direct result of the flood of over 1 million refugees, or so-called "Boat People," who fled South Vietnam in the late 1970s after the end of the Vietnam War (Butterfield 1979). In the U.S., the federal government settled over 800,000 Vietnamese immigrants in a series of designated zones around the country, so as to encourage cultural assimilation and avoid creating segregated slums. The Gulf Coast, and specifically Louisiana, received a large number of immigrants, due to supposed similarities between the geography and climate of the bayou and their native Vietnam. Vietnamese-American enclaves in the Gulf quickly entered the commercial fishing industry, an activity familiar to many of the Boat People.

In the decades since, commercial fishing, primarily of brown and white shrimp, has provided a viable livelihood for some second- and third-generation Vietnamese-Americans. Across the U.S. and in the Gulf region, the socioeconomic status of the Vietnamese-American community lags behind other immigrant groups: while Asian-Americans as a whole earn, on average, \$6,000 per year more than the national average, Vietnamese-Americans earn \$6,000 per year less (American Community Survey 2008). Rates of educational attainment among the population are also disproportionately low (Le 2012).

The market dynamics of the shrimp fishery have also driven away fishers and made it increasingly difficult for those still in the fishery to accumulate wealth and economic security. See Appendix C for more information.

With National Marine Fisheries Service data on commercial landings only available through the 2012 season at the time of writing, fisheries managers only possess sufficient data to draw conclusions about short-term impacts of DWH. Specifically, due to the NMFS ban, the weight and dollar value of landings in 2010 at Empire-Venice, Louisiana, the most active commercial fishing port on the American Gulf coast, was the second lowest on record, surpassed only by 2005 when Hurricane Katrina devastated the region¹² (NOEP Commercial Landings Dataset 2012). It remains uncertain what long-term impact the Deepwater Horizon oil spill will have on fisheries health in the Gulf and shrimping operations owned by Vietnamese-Americans. Landings for the three largest fisheries by volume in the Gulf – menhaden, white shrimp and brown shrimp – all appeared to rebound to pre-

¹²The long-term ecological impacts of Hurricane Katrina have also reduced the resiliency of the region to subsequent disturbances, like the DWH spill. Winds, storm surge, debris and chemical spills during Katrina destroyed or degraded 70% of Louisiana's wetlands ("New report sheds light..." 2013).

spill levels after NMFS lifted the ban on fishing in 2011 (National Ocean Economics Dataset, 2012).

However, this may indicate more about the eagerness of fishers to recoup lost income than the ability of the marine ecosystem to support the same intensity of production. Recent research from Texas A&M University Corpus Christi suggests it may take decades for benthic communities, including shrimp habitat, to recover from the effects of the spill (Montagna et al. 2013). As Section V of this paper addresses, a holistic and timely ecosystem-based damage assessment is necessary to quantify and compensate for lasting damage to the ecosystem services of Gulf habitats.

Next Steps

Although much remains uncertain about the NRDA and the federal trial against BP – indeed, a main conclusion of this analysis is the notable lack of civic science available to the public at this juncture – other outcomes have already come into focus. The significant delays in the damage assessment and compensation procedures all align to benefit the defendant, BP Exploration and Production. BP’s legal expenses can be written off against corporate profits and labeled as a simple cost of doing business. In short, the longer the process drags on, the more BP benefits, as it continues to accrue billion dollar profits from its other operations and the cycle of public attention wanes¹³. As environmental sociologists William Freudenburg and Robert Gramling noted, a window of opportunity for reform exists in the immediate aftermath of a major accident, both within the industry and in civil society, but over time an “atrophy of vigilance” increases the risk of repeating the same mistakes (2011 p. 35). Exacerbating this problem is the asymmetry of power within the litigation process, which is even

¹³To the credit of the mainstream media, coverage of Phase II of the BP trial has been active and strong in late 2013 both domestically and in foreign outlets like the Financial Times.

more apparent at the state and local level; the challenges of Vietnamese-American fishermen with minimal education and financial wherewithal taking on a massive multinational corporation explain why many opted for a simple lump sum or were lured into the dubious schemes of unscrupulous trial lawyers (Buchanan 2012; Hennessey-Fiske 2010). While Deepwater Horizon may drive even more flight of multi-generational fishing families from ethnic maritime communities on the Gulf, the imbalance in the political economy of the damage assessment process also has broader repercussions for all Americans.

Taxpayer money funds NOAA's ongoing assessment work; when that work is at risk for cooptation and capture by BP, and when the process fails to produce transparent civic science, taxpayer money is not serving the interests of the American people. These realities do not bode well for the role of legitimate science and rational economic analysis in the future of U.S. offshore energy policy. To frame these repercussions in frank terms, under the NRDA both science and ecosystems suffer, and the possibility of using Deepwater Horizon as an opportunity to fundamentally re-evaluate the costs and benefits of certain technologies, as happened with the passage of the Oil Pollution Act of 1990 (Emergency Management 2014) and banning single-hull tankers in U.S. waters in the wake of the Exxon-Valdez disaster, becomes increasingly dim.

In light of these conclusions, this analysis offers a series of four pragmatic policy recommendations, drawing on both historical lessons and a reasoned analysis of the science:

Domestically, 1) use BP settlement funds and state-level Sea Grant capacity to establish rigorous baseline socioeconomic and ecological data in the Gulf; 2) employ an integrated risk assessment process that accounts for ecosystem services and cultural resources when issuing new permits for

offshore hydrocarbon activity; and 3) empower state and federal agencies to respond to catastrophic events by producing civic science for public consumption in a timely manner.

Internationally, 4) bring offshore rigs under international regulation similar to those of ships. Coordinate the creation of both a national and an international framework of stricter regulations for offshore hydrocarbon activity that keep pace with technological innovation. Reduce opportunities for industry to exert unreasonable influence, specifically by addressing the risks of semi-submersible rigs at the international level.

The NRDA process should be reformed to bring it in line with true civic science. Specifically, this would require improving the timeliness and transparency of the results by publishing data reports – and not just preliminary work plans – for the benefit of affected residents and to update risk assessment parameters before issuing new drilling permits. To be clear, the judge in the government’s trial against BP, not NOAA, made the decision to seal this scientific data from the public. Setting a precedent of improved transparency in these types of court proceedings might require a lawsuit under the Freedom of Information Action or new legislation from Congress to establish unique procedures for the handling of oil pollution cases.

In addition, the NRDA process would be significantly faster and more representative of the actual damage of the spill if it relied on a holistic, ecosystem-based valuation, as Itzchak Kornfield (2011) has argued, rather than engaging in “paralysis by analysis” at a micro-managed level of detail. While it is important to accurately measure oil contamination impacts to specific species in order to direct restoration efforts, these more time-consuming and detailed-oriented assessments are the ideal role

for state-level Sea Grant members and research universities, funded with grants from the BP settlement.

Outside of merely reforming the NRDA, though, Deepwater Horizon amplifies the need for better preventative policy around offshore oil exploration and extraction. For political and economic reasons, the United States is not likely to abandon these mineral resources, nor are domestic and international firms willing to reduce their commitment to pursuing the profits they represent. But rational risk assessment and adequate planning can help reduce the danger of another catastrophic accident to an acceptable level.

Including fifth generation semi-submersible oil rigs under the International Convention on Civil Liability for Oil Pollution Damage or another robust international legal regime would standardize issues of liability, expediting the process of extracting compensation from culpable parties, regardless of the rig's country of ownership or operation. Indeed, in the wake of Ixtoc I, some legal scholars commented on the need for an international treaty to impose strict liability on offshore oil platforms that pollute the marine environment, noting that "no effective international law exists to govern the legal issues spawned by these incidents" (Cates 1984). Thirty years later, just as the technology to clean up oil in the marine environment continues to lag behind the industry's impressive ability to extract it from miles below the ocean surface (Freudenberg 2011 p. 153), the law has also yet to catch up to these advances in hydrocarbon technology. Fortunately, recent developments suggest the governance body for the Mediterranean Regional Sea (Mediterranean Action Plan 2013) and the European Commission (Official Journal of the European Union 2013) have proposed to regulate oil rigs with a comparable degree of rigor as other vessels. This may serve as a prelude to the IMO taking parallel action with a global scope. As it did in banning single-hull tankers in its territorial seas in the

wake of the Exxon-Valdez disaster – years before the IMO made such regulations mandatory worldwide – the U.S. has a unique opportunity to take the lead on the international stage.

Updating BOEM's marine spatial planning processes for the federal OCS to incorporate issues of regional biogeography would allow for the possibility that some marine ecosystems are too ecologically important in terms of biodiversity, connectivity, productivity or other metrics to permit a resource extraction activity with measurable likelihood of an immeasurably devastating accident. Short of banning all drilling in some regions, an incremental scale of regulation might ensure stricter safeguards, like on-board observers, in the most vulnerable areas.

In conclusion, the preceding analysis of Deepwater Horizon attempts to delineate the political economy of a disaster response and damage assessment process that has produced clear winners and losers due to the nature of its bureaucratic and legal procedures. In short, American taxpayers, ethnic maritime communities and researchers hoping to gain access to civic science have suffered under this regulatory regime, while BP has benefitted.

While the federal government reorganized the Minerals Management Service in 2011, in part to separate the interests of issuing permits and collecting royalties, the issuance of permits in the wake of DWH (Klimasinska 2012) suggest the relationship between industry and regulators continues with "business as usual." To be clear, offshore and deepwater oil extraction is not declining. According to energy consulting firm Douglas-Westwood (2013), capital expenditures on offshore infrastructure and technology, from underwater remote-operated vehicles to enhanced oil recovery techniques (i.e. "fracking"), are poised to increase to record levels over the next five years (See: Appendix B, Figure 4). Barring a national or international carbon tax, the future holds the promise of more drilling, more

enhanced recovery, and more risk to the marine and coastal environment. Advanced computer modeling, remote sensing and other innovations have made oil activity safer and cleaner than in past decades, yet the continued drive for more technically challenging reserves of undersea hydrocarbons in light of high global oil prices compounds the risk of unforeseen consequences. In other words, Deepwater Horizon proved that perverse incentives, like royalty relief, can propel highly lucrative gambles, such that the industry's reach exceeds its grasp. When that grasp slips, the public and especially ethnic fishing communities are disproportionately harmed by the aftermath. Considering that "virtually no organization has a truly central focus on improving the safety of its *own* operations" (Freudenburg & Gramling 2011 p. 37), regulatory agencies must step up to limit moral hazard.

It is vitally important that all the aforementioned regulatory processes and policy instruments recognize and address the fundamental tragedy of what is transpiring on America's southern coast: ultimately, oil spills reduce the resiliency of the region's natural capital to buffer against those very storms and climate impacts exacerbated by carbon emissions. Until the cycle of flawed regulation and perverse incentives is broken, neither can this cycle of ecological degradation be broken.

References

American Community Survey. 2008. U.S. Census Bureau. <http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml>

American Petroleum Institute. "Rigs & Reefs." 2013. <http://www.api.org/environment-health-and-safety/clean-water/oil-spill-prevention-and-response/rigs-reefs>

Baker, P. and J.M. Broder. "White House Lifts Ban on Deepwater Drilling." 12 Oct 2010. The New York Times. http://www.nytimes.com/2010/10/13/us/13drill.html?pagewanted=all&_r=0

Binninger, J. and J. Allen. "General Facts about the Gulf of Mexico." 16 Oct 2012. U.S. EPA Gulf of Mexico Program. <http://www.epa.gov/gmpo/about/facts.html>

"BP Makes Gulf of Mexico Environmental Data Publicly Available." BP Corporate Press Releases. 18 Nov 2013. <http://www.bp.com/en/global/corporate/press/press-releases/bp-makes-gom-environmental-data-available.html>

Brady, J. "BP Argues Companies are Unfairly Cashing in on 2010 Spill." 10 Dec 2013. WNPR Connecticut Public Radio. <http://wnpr.org/post/bp-argues-companies-are-unfairly-cashing-2010-spill>

Broder, J.M. "With 2 Ships Damaged, Shell Suspends Arctic Drilling." 27 Feb 2013. The New York Times. http://www.nytimes.com/2013/02/28/business/energy-environment/shell-suspends-arctic-drilling-for-2013.html?_r=0

Butler, S.J. "BP Macondo Well Incident, U.S. Gulf of Mexico: Pollution Containment and Remediation Efforts." 2011. Presented at 2011 Lillehammer Energy Claims Conference. <http://www.energyclaims.net/assets/Macondo-well-PC&R.pdf>

Butterfield, F. "Hanoi Regime Reported Resolved to Oust Nearly All Ethnic Chinese." 12 July 1979. The New York Times. <http://www.paulbogdanor.com/left/vietnam/boatpeople1.pdf>

Brenner, J. et al. "Number of marine species in the Gulf of Mexico." 2013. <http://www.gulfbase.org/biogomx/biosearch.php>

Buchanan, S. "Asian-American fishermen sue BP for racial discrimination." 30 Apr 2012. The Louisiana Weekly. <http://www.louisianaweekly.com/asian-american-fishermen-sue-bp-for-racial-discrimination/>

Castenado, S. et al. "The Prestige Oil Spill in Cantabria (Bay of Biscay). Part I: Operational Forecasting System for Quick Response, Risk Assessment, and Protection of Natural Resources." 2006. Journal of Coastal Research. http://www.emisarios.unican.es/archivos%20descargar/articulos/journal_coastal2005_1.pdf

Costanza, R. et al. "The Value of Coastal Wetlands for Hurricane Protection." 2008. Vol 37: 4 (241-248). Ambio. <http://www.jstor.org/stable/25547893>

Chin, A. "The KKK and Vietnamese Fishermen." 2002. *Diverstory*. <http://www.unclaw.com/chin/scholarship/fishermen.htm>

"Damage Assessment." 2013. NOAA Gulf Oil Spill Restoration. <http://www.gulfspillrestoration.noaa.gov/assessment/>

DiPinto, L. Personal correspondence. 22 Aug 2013.

"Draft Programmatic and Phase III Early Restoration Plan and Drafty Early Restoration Programmatic Environmental Impact Statement." Dec 2013. U.S. Department of the Interior. http://www.gulfspillrestoration.noaa.gov/wp-content/uploads/Draft_ERP-PEIS_Executive_Summary.pdf

Drummer, R. "Commercial Property Owners Brace for Economic Impact of Gulf Oil Spill." 9 June 2010. CoStar Group. <http://www.costar.com/News/Article/Commercial-Property-Owners-Brace-For-Economic-Impact-of-Gulf-Oil-Spill/120804>

Emergency Management. "Oil Pollution Act Overview." 2014. U.S. Environmental Protection Agency. <http://www.epa.gov/oem/content/lawsregs/opaover.htm>

Energy Information Agency. "Outer Continental Shelf Deep Water Royalty Relief Act of 1995." 2002. http://www.eia.gov/oil_gas/natural_gas/analysis_publications/ngmajorleg/continental.html

Energy Information Agency. "U.S. Crude Oil First Purchase Price." 1 Nov 2013. http://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=pets&s=f000000_3&f=m

Fetcher, A. and M. Schwartz. "Interior department completes reorganization of the former MMS: BSEE and BOEM officially replace BOEMRE on October 1." 30 Sept 2011. U.S. Department of the Interior. <http://www.doi.gov/news/pressreleases/Interior-Department-Completes-Reorganization-of-the-Former-MMS.cfm>

Freudenburg, W. and R. Gramling. *Blowout in the Gulf: The BP Oil Spill Disaster and the Future of Energy in America*. 2010. The MIT Press, 1st edition.

Garza, M. et al. "Indirect assessment of economic damages from the Prestige oil spill: consequences for liability and risk prevention." 2008. Overseas Development Institute. <http://www.ncbi.nlm.nih.gov/pubmed/18498368>

Gaskill, M. "Counting Fish: Gulf of Mexico Artificial Reef Survey." 13 July 2012. Scientific American. <http://www.joincca.org/articles/583>

Goodman, A. "Captain acquitted of central charge 11 years after massive oil spill." 13 Nov 2013. CNN. <http://www.cnn.com/2013/11/13/world/europe/spain-oil-spill-trial/>

Gore, R.H. 1992. *The Gulf of Mexico*. Pineapple Press, Inc. Sarasota Florida. 384 p.

Handl, G. "The Case for Mexican Liability for Transnational Pollution Damage Resulting from the Ixtoc I Oilspill." 1979. *Houston Journal of International Law*. Vol. 229. <http://heinonline.org/HOL/LandingPage?handle=hein.journals/hujil2&div=20&id=&page=>

Hennessey-Fiske, M. "Gulf oil spill: Volunteer lawyers reach out to Vietnamese community." 27 June 2010. Los Angeles Times. <http://latimesblogs.latimes.com/greenspace/2010/06/volunteer-lawyers-try-to-help-oil-spill-victims.html>

Houston Chronicle. "The Well: Energy Briefs." 18 Oct 2009. http://www.chron.com/business/article/The-well-energy-briefs-1750258.php?utm_source=feedburner&utm_medium=feed&utm_campaign=Feed%253A+houstonchronicle%252Fbusiness+%2528chron.com+-+Business%2529

International Maritime Organization. "Tanker Safety – preventing accidental pollution: Accelerated phase-out for single-hull tankers." 2005. http://www.imo.org/blast/mainframe.asp?topic_id=155#double

Jernelov, A. and O. Linden. "Ixtoc I: A Case Study of the World's Largest Oil Spill." 1981. *Ambio*. Vol. 10: 6, p.299-306. <http://www.jstor.org/discover/10.2307/4312725?uid=2452659135&uid=3739856&uid=2&uid=3&uid=8024032&uid=67&uid=29586&uid=62&uid=3739256&sid=21103321015643>

Kaiser, M.J. and A.G. Pulsipher. "Rigs-to-Reefs Programs in the Gulf of Mexico." 2005. *Ocean Development & International Law*. Vol. 36: 2, p. 119-134. <http://www.tandfonline.com/doi/full/10.1080/00908320590943990#tabModule>

Klimasinska, K. "Deepwater Permits in U.S. Gulf Exceed Pre-BP Spill Level." 2012. *Bloomberg*. <http://www.bloomberg.com/news/2012-10-17/deepwater-permits-in-u-s-gulf-exceed-pre-bp-spill-level.html>

Kornfield, I. "Of Dead Pelicans, Turtles, and Marshes: Natural Resources Damages in the Wake of the BP Deepwater Horizon Spill." 2011. Boston College Environmental Affairs Law Review. <http://heinonline.org/HOL/LandingPage?collection=journals&handle=hein.journals/bcenv38&div=18&id=&page>

Laleian, A. and T. Azwell. *The Tradeoffs of Chemical Dispersant Use in Marine Oil Spills*. Jan 2011. Deepwater Horizon Study Group Working Paper. http://ccrm.berkeley.edu/pdfs_papers/DHSGWorkingPapersFeb16-2011/Tradeoffs%20ChemicalDispersantUseMarineOilSpills-AL TA DHSG-Jan2011.pdf

Landry, M. *On Scene Coordinator Report: Deepwater Horizon Oil Spill*. United States Coast Guard. 2011. http://www.uscg.mil/foia/docs/dwh/fosc_dwh_report.pdf.

Le, C.N. "A Closer Look at Asian-Americans and Education." 2012. School of Education at Johns Hopkins University. <http://education.jhu.edu/PD/newhorizons/strategies/topics/multicultural-education/A%20closer%20look%20at%20asian%20americans%20and%20education/>

Limbaugh, R. "Running the Numbers on the Spill." 16 June 2010. The Rush Limbaugh Show. http://www.rushlimbaugh.com/daily/2010/06/16/running_the_numbers_on_the_spill

Lustgarten, A. "BP Settlement Leaves Most Complex Claims Unresolved." 3 Mar 2012. ProPublica. <http://www.propublica.org/article/bp-settlement-leaves-most-complex-claims-unresolved>

McCrea-Strub, A. et al. "Potential Impact of the Deepwater Horizon Oil Spill on Commercial Fisheries in the Gulf of Mexico." 2011. *Fisheries*. Vol 36:7 (332-336).

http://fisheries.org/docs/fisheries_magazine_archive/fisheries_3607.pdf#page=20

McKinney, L. "The Deepwater Horizon Oil Spill – Putting a Price on the Priceless." 2011. Harte Research Institute for Gulf of Mexico Studies. http://www.hartheresearchinstitute.org/images/white_paper/spill_valuations.pdf

Meade, N. Personal correspondence. 26 Aug 2013.

Mediterranean Action Plan, Regional Marine Pollution Response Center for the Mediterranean Sea. "On-Going Discussion at IMO on Matters Concerning Liability and Compensation for Oil Pollution Damage Resulting from Offshore Exploration and Exploitation Activities." 5 Dec 2013. International Maritime Organization.

Montagna, P.A. et al. "Deep-Sea Benthic Footprint of the Deepwater Horizon Blowout." 7 Aug 2013. *Plos One Journal*. <http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0070540>

National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling. *The Use of Surface and Subsea Dispersants during the BP Deepwater Horizon Oil Spill (DRAFT)*. 6 Oct 2010.

http://media.mcclatchydc.com/smedia/2010/10/06/18/Staff_Report_No.4.source.prod.affiliate.91.pdf

NaturalShrimp. "Executive Summary." 2013. http://naturalshrimp.com/uploads/EXEC_SUMM_R3.pdf

"New report sheds light on damage from BP oil spill." 7 Dec 2013. Al Jazeera America.

<http://america.aljazeera.com/articles/2013/12/7/new-report-shedslightonbpoilspilldamageproposesremedies.html>

"NOAA Closes Commercial and Recreational Fishing in Oil-Affected Portion of Gulf of Mexico." 2 May 2010. NOAA News. http://www.noaanews.noaa.gov/stories2010/20100502_fisheries.html

"NRDA Workplans and Data." 2014. National Oceanographic and Atmospheric Administration. Gulf Oil Spill – Damage Assessment, Remediation, and Restoration Program. <http://www.gulfspillrestoration.noaa.gov/oil-spill/gulf-spill-data/>

Official Journal of the European Union. "Directive 2013/30/EU of the European Parliament and of the Council of 12 June 2013 on safety of offshore oil and gas operations and amending Directive 2004/35/EC." 28 June 2013. European Commission. Vol. 56. <http://eur-lex.europa.eu/JOHtml.do?uri=OJ:L:2013:178:SOM:EN:HTML>

Offshore Technology. "Deepwater Horizon: A Timeline of Events." 7 May 2010. <http://www.offshore-technology.com/features/feature84446/>

Oxford Economics. "Potential Impact of the Gulf Oil Spill on Tourism." Prepared for the U.S. Travel Association. 2010. http://www.ustravel.org/sites/default/files/page/2009/11/Gulf_Oil_Spill_Analysis_Oxford_Economics_710.pdf

Patton, J.S. et al. "Ixtoc 1 oil spill: flaking of surface mouse in the Gulf of Mexico." 1981. *Nature*. Vol 290, p. 235-238. <http://www.nature.com/nature/journal/v290/n5803/abs/290235a0.html>

Petrolia, D.R., et al. "America's Wetland? A National Survey of Willingness to Pay for Restoration of Louisiana's Coastal Wetlands." 2013. Department of Agricultural Economics, Mississippi State University. www.americaswetland.com

Ramseur, J.L. and C.L. Hagerty. *Deepwater Horizon Oil Spill: Recent Activities and Ongoing Developments*. Congressional Research Service. 31 Jan 2013. <http://www.fas.org/sgp/crs/misc/R42942.pdf>

Rigzone. "BP Makes Giant Deepwater Discovery with Tiber." 2 Sept 2009. http://www.rigzone.com/news/article.asp?a_id=79913

Safina, C. *A Sea in Flames: The Deepwater Horizon Oil Blowout*. 2011. Broadway Books.

Secretariat of the International Oil Pollution Compensation Funds. "Incidents Involving the IOPC Funds – 1992 Fund: Prestige." 26 Mar 2013. The International Oil Pollution Compensation Funds. www.iopcfunds.org/meeting-documents

Shirley, T.C. et al. "Biodiversity of the Gulf of Mexico: Applications to the Deepwater Horizon Oil Spill." 2010. Harte Research Institute for Gulf of Mexico Studies. http://harteresearchinstitute.org/images/press_releases/biodiversity.pdf

Tang, E. "A Gulf Unites Us: The Vietnamese Americans of Black New Orleans East." 2011. American Quarterly. <http://www.americanquarterly.org/interact/documents/63.1.tang.pdf>

"Tar mats prompt Louisiana to close small area off Grand Terre." 2 Jul 2013. <http://www.katc.com/news/tar-mats-prompt-louisiana-to-close-small-area-off-grand-terre/#>

"The Paper Trail: Examining the Case of the *Prestige*." Jan 2004. PBS Frontline. <http://www.pbs.org/frontlineworld/stories/spain/memos.html>

Thieler, R.E. and E.S. Hammar-Klose. "National Assessment of Coastal Vulnerability to Sea-Level Rise: Preliminary Results for the U.S. Gulf of Mexico Coast." 2000. U.S. Geological Survey. <http://pubs.usgs.gov/dds/dds68/reports/gulfrep.pdf>

U.S. Department of Justice. "Transocean Pleads Guilty, Is Sentenced to Pay \$400 Million in Criminal Penalties for Criminal Conduct Leading to Deepwater Horizon Disaster." 14 Feb 2013. <http://www.justice.gov/opa/pr/2013/February/13-ag-199.html>

U.S. Department of Justice. *United States v. BP Exploration and Production, Inc.* 2013. <http://www.justice.gov/criminal/vns/caseup/bpexploration.html>

Appendices

Appendix A: Mapping the Spill

Figure 1: Approximate oil locations from April 28, 2010 to May 2, 2010

Source: NOAA

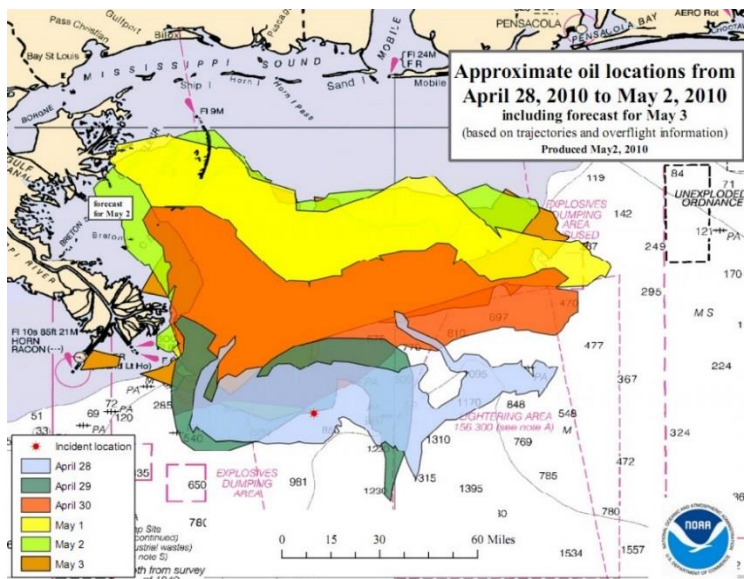
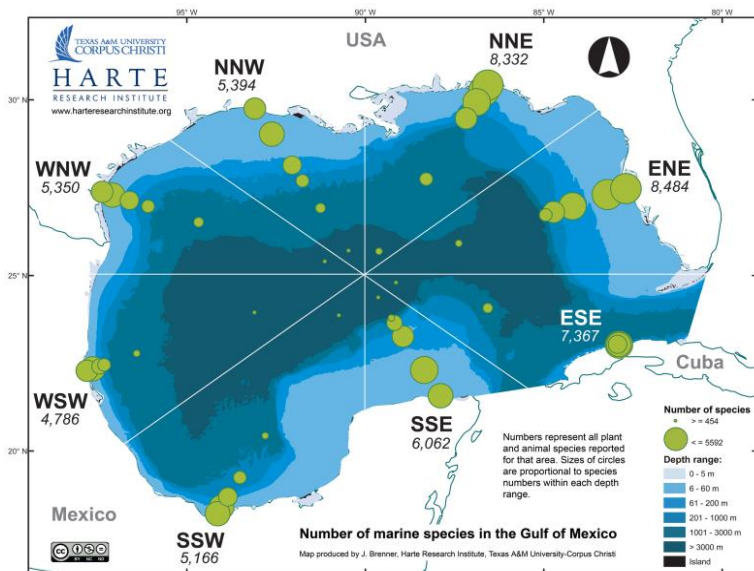


Figure 2: Number of marine species in the Gulf of Mexico

Source: Harte Research Institute, Texas A&M University at Corpus Christi



Appendix B: Economics of Deepwater Oil

Figure 1: Deepwater Royalty Relief Act criteria

Source: Energy Information Agency

Royalty Suspension Volumes		
Depth	Minimum Relief Volume (gas equivalent)	Minimum Relief Volume (barrels of oil)
200-400 m (656-1,312 ft)	98.5 billion cubic feet	17.5 million
400-800 m (1,312-2,625 ft)	295.6 billion cubic feet	52.5 million
>800 m (>2,526 ft)	492.6 billion cubic feet	87.5 million

Figure 2: U.S. Offshore Oil and Gas First Purchase Prices by Decade

Source: Bureau of Ocean Energy Management, Regulation and Enforcement (compiled by National Ocean Economics Program)

Region	Year	Crude Production	Total Oil Production	Total Oil Value	Oil FPP	Dry Gas Production	Gas Value	Gas FPP
US Total Offshore	1970	575,605,000	575,605,000	\$5,217,283,720	\$9.06	2,651,574,194	\$19,137,736,745	\$7.22
US Total Offshore	1980	377,410,000	377,410,000	\$8,708,547,045	\$23.07	5,084,273,095	\$42,833,475,543	\$8.42
US Total Offshore	1990	394,930,000	394,930,000	\$13,644,594,542	\$34.55	4,863,064,617	\$34,690,671,445	\$7.13
US Total Offshore	2000	647,145,000	647,145,000	\$30,463,444,872	\$47.07	4,564,723,738	\$36,232,038,198	\$7.94
US Total Offshore	2010	631,894,933	631,894,933	\$32,415,578,168	\$51.30	2,300,616,815	\$18,605,318,245	\$8.09

Figure 3: Gulf of Mexico OCS Oil and Gas Production, 1995-2010

Source: Bureau of Ocean Energy Management, Regulation and Enforcement (compiled by National Ocean Economics Program)

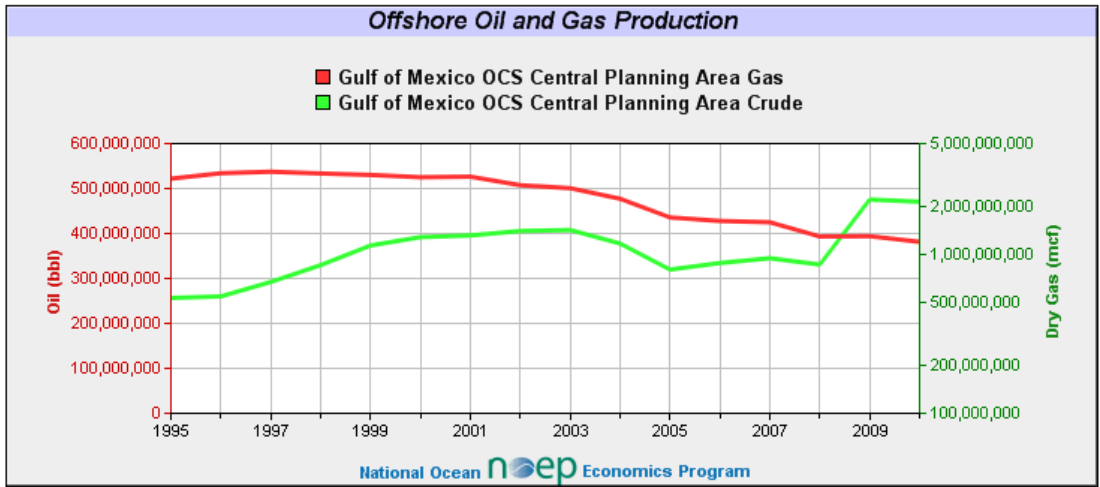


Figure 4: Projected Capital Expenditures, Global Offshore Oil, 2013-2017

Source: Douglas-Westwood Consulting

CapEx Category	2013-2017 Projected (USD)
Subsea hardware	\$124 billion
Subsea vessels	\$106 billion
Deepwater-specific technology	\$223 billion
Remotely-operated vehicles	\$9.7 billion
Offshore maintenance and operations	\$672 billion

Appendix C: Fisheries Dynamics

Likely due to unsustainable bottom trawling practices which damage benthic habitat, annual landings of brown shrimp in Louisiana have declined steadily since 1990 (See: Appendix C, Figure 1). The overall trend in the white shrimp fishery is less apparent, yet the decline in revenue is clear: every year from 1978 to 1988, the total revenue of the fishery exceeded \$210 million, with productive years yielding over \$300 million; between 2002 and 2012, total revenue never reached \$190 million¹⁴ (See: Appendix C, Figure 2). Also contributing to this phenomenon is low-cost foreign aquaculture –

¹⁴ Inflation-adjusted 2005 dollars used for purpose of comparison.

ironically, much of it from Vietnam – which has effectively flooded the now \$50 billion world shrimp market and driven down prices (NaturalShrimp 2013).

Figure 1: Brown shrimp landings in Louisiana, 1978-2012

Source: National Marine Fisheries Service (compiled by National Ocean Economics Program)

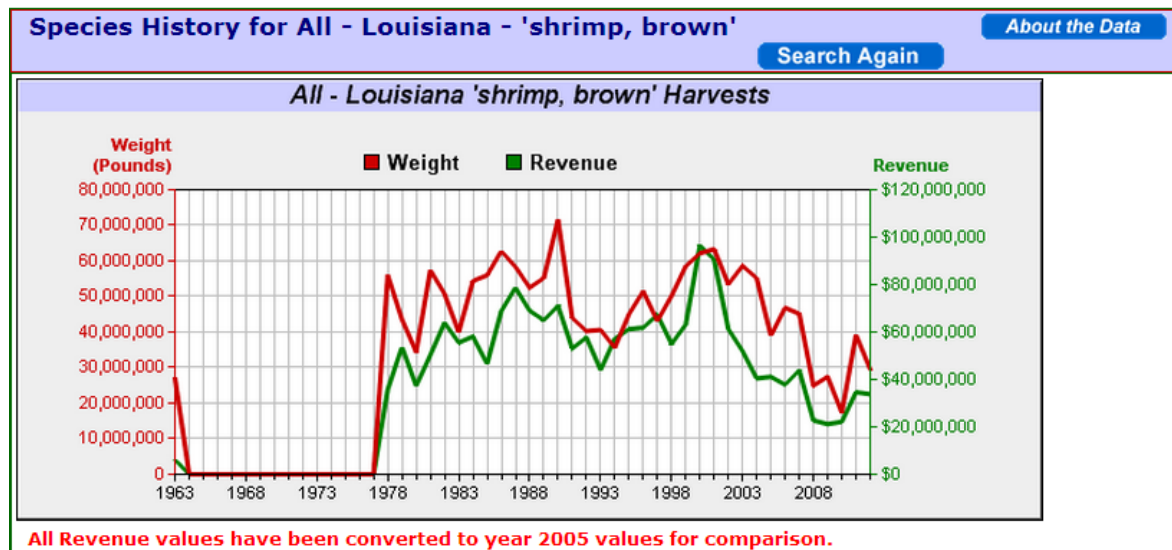
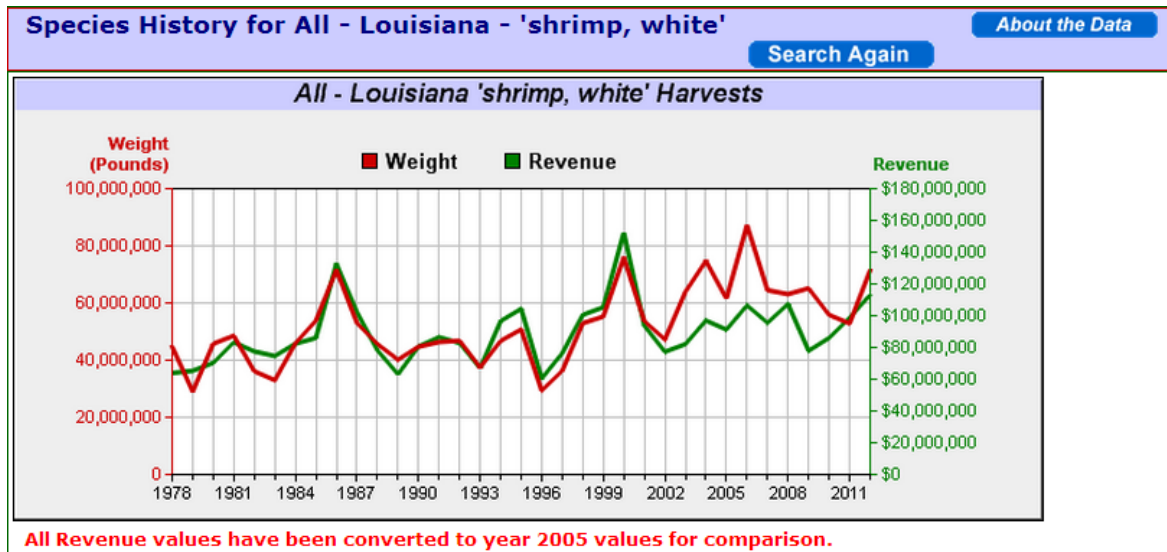


Figure 2: White shrimp landings in Louisiana, 1978-2012

Source: National Marine Fisheries Service (compiled by National Ocean Economics Program)



Appendix D: Oil Spill Responses

Figure 1: Organizational chart, Spanish emergency response – Prestige oil spill, 2002

Source: Castenado, et al (2005)

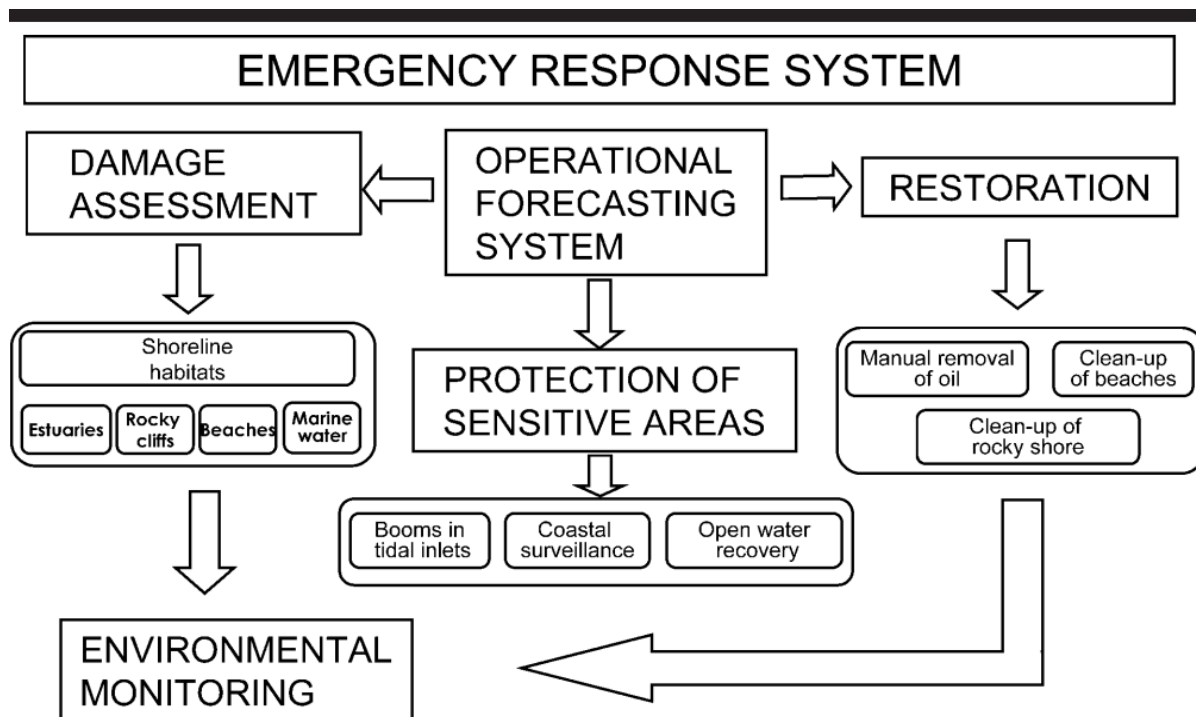


Figure 3. Structure of the emergency response system in Cantabria.