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Natural resource damage assessment for the *Hebei Spirit* oil spill: An application of Habitat Equivalency Analysis

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ABSTRACT

Sixteen oil spills occurred in Korea between 1995 and 2010, including the *Hebei Spirit* oil spill (HSOS) in 2007, the largest (77,857 barrels) in Korean history. Yet compensation for environmental damages has never been claimed under the International Oil Pollution Compensation Fund for any of these accidents, because there is no adequate natural resource damage assessment (NRDA) procedure and there are no internationally-admissible economic quantification methods established in Korea. The objective of this study is to propose a methodology to overcome these shortcomings. We propose the use of Habitat Equivalency Analysis, which has dominated the US NRDA process for oil spills, and apply it to the HSOS as a case study. A Base Case analysis estimates the compensatory costs of fishery habitat damages (34,703.5 ha) with a 10-year recovery rate at $119.4 million. We also conduct sensitivity analyses under several alternative assumptions.

1. Introduction

In the early morning of December 7, 2007, the M/V *Hebei Spirit* collided with the Samsung No. 1 crane barge being towed by two tugs under poor weather conditions, 5 miles northwest of Malipo Beach in Taean, Korea. A total of 77,857 barrels of four different types of crude oil were spilled and over the next 25 days spread out rapidly and widely across the entire west coast of Korea, from the Taean peninsula to the northern part of Jeju island (Chuja-do) (see Fig. 1).

The injured natural resources included 375 km of coast lines, 101 offshore islands, 34,703.5 ha (about 347 km^2) of fishery habitats, and 15 recreational beaches in South Chungcheong, North Jeolla, and South Jeolla provinces (MLTM, 2012; Hong et al., 2014; Kim et al., 2014). Tidal flats, mud, and muddy sand bottom habitats were significantly affected, taking a long time to achieve full recovery because of residual oil and adverse effects of oil toxicity (Shin et al., 2011; Hong et al., 2014; Kim et al., 2014).

There are two international regimes pertaining to liability and compensation for oil pollution damages to the marine environment and natural resources, both under the International Oil Pollution Compensation (IOPC) Funds program: the 1992 Civil Liability Convention (92 CLC) and the 1992 Fund Convention (92 FC) (Liu and Wirtz, 2006; Cho, 2010; Kontovas et al., 2010). Accordingly, oil spill compensation is provided by the protection and indemnity insurer of tanker owners and oil cargo receivers under 92 CLC and 92 FC, respectively. As one of the 114 State Parties to the IOPC Funds, injured parties of the *Hebei Spirit* oil spill (HSOS) in Korea can claim compensation under four categories of damages: clean-up and preventive measures, property damages, pure economic losses (e.g., economic losses in fisheries, mariculture, and tourism), and environmental damages (including costs for restoration of the environment and post-spill studies) (Liu and Wirtz, 2006; Kontovas et al., 2010; Chung and Lee, 2012; IOPC Funds, 2013; ITOPF, 2014).

The Korean government claimed $109.8 million for environmental damages from the HSOS under IOPC, but this has not yet been assessed because the Korean government issued an SLQ (standing last in the queue) declaration to ensure that payments to individuals are made prior to national or local governments (Cho, 2010). Of the 16 oil spills that occurred in Korea between 1995 and 2010, environmental damages were paid out on the *Sea Prince* ($723,000) and *Honam Sapphire* ($114,000) accidents only (see Table 1). However, the claimed amounts for environmental damages were not for actual damages to the environment, but *for environmental study costs only*. In short, compensation claims for actual damages to the environment due to an oil spill have never actually been made in Korea.

One of the main reasons for a lack of compensation is the lack of an

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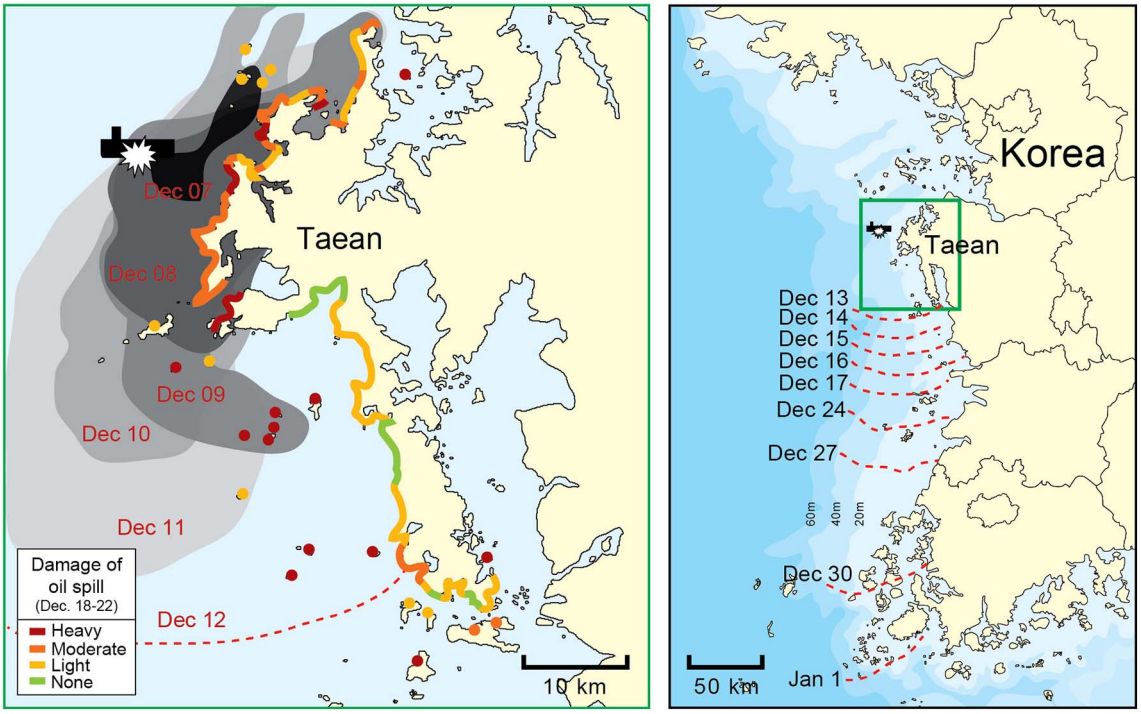

Fig. 1. Extent of ocean environment and natural resources impacts from HSOS (Adopted from Hong et al., 2014).

adequate environmental damage assessment procedure in Korea (Shin and Lim, 2008), similar to the Natural Resource Damage Assessment (NRDA) in the US. The NRDA is the process for assessing natural resource damages from oil spills, established by the National Oceanic and Atmospheric Administration (NOAA) in January 1996 under the US Oil Pollution Act (OPA) (U.S. Department of the Interior, 1996; Rowe et al., 2007; Ryan, 2011; Vann and Meltz, 2013). Under the US OPA, the Contingent Valuation Method (CVM) is one of the official economic quantification methods under the NRDA procedure for oil spills, and CVM is, thus far, the only method used in the five Korean studies to estimate the economic value of environmental damages from the HSOS (Table 2) (Shin et al., 2008; Hong et al., 2011). However, the CVM has experienced difficulties in its use in compensation settlements in US courts (Jones, 1997) and the damage estimates from the five CVM studies for the HSOS have never actually been used to support compensation claims in Korea.

As an alternative, Habitat Equivalency Analysis (HEA), an approach based on restoration cost, has been the predominant approach used for economic quantification of damages due to its heavier reliance on scientific data and less emphasis on valuation (Hampton and Zafonte, 2002; Rowe et al., 2007; Ryan, 2011; Shaw and Wlodarz, 2013).

The main purpose of this study is to propose the use of HEA as a feasible NRDA procedure for estimating compensation for natural resource damages due to oil spills in Korea. To do this, as described in the following sections, we 1) compare the NRDA process for oil spill accidents between Korea and the United States, 2) establish feasible NRDA procedures for Korea, and 3) apply this procedure as a case study to estimate environmental damages from the HSOS.

2. Methods

2.1. NRDA system in Korea

The *Hebei Spirit* was the largest oil spill accident in Korean history, and easily exceeded the Korean government's oil spill response capacity at that time. As a result, damages were much larger than expected and the Korean government passed the Special Act for the HSOS on March 14, 2008, to support those affected and to restore damaged marine natural resources (Cho, 2010; Cheong, 2012; Hong et al., 2014; Kim et al., 2014). Note that this Special Law applied only to the HSOS and not to any other oil spills.

Financial support from the Korean government for injured parties and damaged natural resources totaled $747.4 million, including emergency livelihood funds, advance payments for compensation claims, loans, and environmental restoration projects similar to that used following the *Erica* (France) and *Prestige* (Spain) oil spills (Cho, 2010; Cheong, 2012; HSDST, 2015). Additionally, the Korean government spent or planned to spend an additional $3.1 million on public relations efforts, including 71 image-boosting projects and $14.9 million for 97 local economic stimulus projects.

Under Article 10 of the Special Act, the Korean government declared 11 affected regions, including the Taean peninsula, as special ecosystem restoration areas and allocated $478.6 million for a 10-year ecosystem restoration plan. Aside from legal liability, Samsung Heavy Industries promised to contribute $360 million for local economic development, and Samsung-affiliated companies promised to spend at least $20 million on community projects. In total, the Korean government has spent or promised to spend $16.2 billion for affected local communities and environmental restoration under the Special Act.

In addition to the Special Act, there exist several related Acts addressing marine environmental (ecosystem) damages from oil spill pollution in Korea (see Table 3). Although these acts state the responsible party (or polluter) pay principle, the economic quantification methods of the damaged environment and natural resources for compensation are not specified. Therefore, without any adequate NRDA procedure, the damaged ecosystem restoration projects from the HSOS are implemented using tax revenue, not IOPC Funds contributed by potentially responsible parties.

2.2. U.S. NRDA system

Under the US OPA, NOAA, the designated agency in the US, conducts the NRDA for injured natural resources when oil spill accidents occur in coastal or marine environments. In the NRDA process, there are three phases: pre-assessment, injury assessment, and post-assessment (or restoration planning) (Ryan, 2011; Vann and Meltz, 2013).