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Community sentiment following the Deepwater Horizon oil spill disaster: A test of time, systemic community, and corrosive community models

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ABSTRACT

A fundamental concern in the social science scholarship on disasters is understanding community impacts and recovery as a social process. This study examines community sentiment in the aftermath 2010 BP Deepwater Horizon oil spill (DHOS), including the influence of time and the explanatory utility of two major theoretical perspectives—the systemic community model and the corrosive community model—in predicting community sentiment in the context of this disaster. Specifically, our objectives are to assess how community sentiment in the wake of the DHOS: 1) changes over time; 2) is related to the systemic model; and 3) is related to the corrosive model. To meet these objectives, we analyze four waves of data from a unique repeated cross-sectional household survey data—the Louisiana Community Oil Spill Survey (COSS)—collected between 2010 and 2013. Our results demonstrate that 1) accounting for other factors, community sentiment community sentiment was significantly greater in later time periods compared to 2010, and 2) the simultaneous and complimentary utility of the systemic and corrosive community frameworks for understanding community sentiment in the wake of the DHOS.

1. Introduction

A fundamental concern in the social science scholarship on disasters is understanding community impacts and recovery as a social process. An oft-cited definition (Fritz, 1961: 655) acknowledges community implicitly in the concept of disaster: "an event, concentrated in time and *space*, in which a society, or a relatively self-sufficient *subdivision of a society* undergoes severe danger and incurs such losses to its members and physical appurtenances that the social structure is disrupted and the fulfillment of all of or some of the essential functions of the society is prevented" (emphasis added). Accordingly, much research focuses on disaster impacts on places, neighborhoods, and towns (Bolin and Kurtz, 2018; Kendra and Wachtendorf, 2007). Moreover, as social processes, the ways in which communities respond to major disruptions can take different trajectories. One regard in which this is true is whether the disaster is viewed as "natural" or "human-made" (Freudenburg, 2000; Gill and Steven Picou, 1998; Gill and Ritchie, 2018; Kroll-Smith and Couch, 1990; Kroll-Smith, 2018; Perry, 2018; Tierney, 2006). In the context of a process viewed as a natural disaster, it is argued that a "therapeutic community" is likely to emerge, as people show a high level of cohesiveness and provide mutual aid in response and recovery efforts. Conversely, the perception that a disaster is generated by a human-made technological failure is said to bring about a community response rife with division and conflict, an outcome that has been called "corrosive community" (Freudenburg, 1993, 1997, 2000).

The purpose of this study is to assess how community sentiment in the wake of a technological disaster: 1) changes over time; 2) is related to the systemic model of community (Kasarda and Janowitz, 1974); and 3) is related to the corrosive model of community (Freudenburg, 1993, 1997; 2000; Freudenburg and Jones, 1991; Picou et al., 2004). We address these goals by studying community sentiment among coastal residents living in largely rural communities in southeast Louisiana, USA, following the 2010 BP Deepwater Horizon oil spill (DHOS). In doing so, this study helps extend the general social scientific understanding of disasters (e.g., Drabek, 2013; Erikson, 1976, 1994; Kroll-Smith, 2018; Perry, 2018; Quarantelli, 2005; Quarantelli and Dynes, 1977). More specifically, we contribute to the literature by examining how technological disasters can impact and alter residents' perceptions of an individual experience of community (e.g., Cope et al., 2013; Edelstein, 2004; Gill et al., 2012; Gill and Ritchie, 2018; Kroll-Smith and Couch, 1991; Lee and Blanchard, 2012; McSpirit et al., 2007).

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2. Disaster and community

While the word *community* is often idealized because it conjures an image of "a 'warm' place, a cozy and comfortable place … like the roof under which we shelter in heavy rain, like a fireplace at which we warm our hands on a frosty day" (Bauman, 2001: 1), it also carries fundamental assumptions of feelings "that members have of belonging, a feeling that members matter to one another and to the group, and a shared faith that members' needs will be met through their commitment to be together" (McMillan and Chavis, 1986: 9). In fact, some scholars have theorized community explicitly as moral proximity (e.g., Bauman, 2001; de Tocqueville, 2000 [1840]; Goodsell et al., 2014), while others view it as fundamental to the formation of individual and shared interpretive frameworks and social paradigms—termed "lifescape" by Edelstein (2004)—that underpin everyday assumptions about life.

Conversely, other scholars contend (e.g., Drabek, 2013; Elias and Scotson, 1965; Lindell, 2013; Peacock and Ragsdale, 1997) that the positive "feels good" associations ascribed to community are often reflective of wishful thinking rather than of real social conditions. Such scholars view community as being imbued with conflict as much as it is with consensus, as members with competing interests negotiate for resources and power. Accordingly, as certainty, predictability, and security collapse, contention may arise from an unequal distribution of risk amongst community residents. Such risks are seen as a defining characteristic of contemporary social life and, consequently, controversy and conflict can result as various community members attend to hazards, insecurities, and threats, while others seek to minimize the same issues. Conflicts can intensify following a collective trauma, threaten "the essential functions of society" (Fritz, 1961: 655) and disrupt the typical social order (e.g., Drabek, 2013). Indeed, early social scientific investigations of disasters endeavored to understand just how such disruptions to community occur (e.g., Bucher, 1957; Killian, 1954; Wallace, 1956).

Building on groundbreaking disaster research (e.g., Fritz and Marks, 1954; Moore, 1958; Sjoberg, 1962), a social scientific perspective emerged over time that "disasters" only occur when hazardous events cause people collectively to experience disruption of normal social activities (e.g., Bonanno et al., 2010; Fritz, 1961; Quarantelli, 1989; Quarantelli and Dynes, 1977). For example, Quarantelli (2000: 682) conceptualizes disasters in terms of social processes that occur when "the routines of collective social units are seriously disrupted and when unplanned courses of action have to be undertaken to cope with the crisis" (see also Drabek, 2013; Lindell, 2013; Perry, 2018). Thus, disaster-related outcomes are predicated on 1) preexisting social structures and 2) the significance of these structures for both individual and collective responses (Chhotray and Few, 2012; Picou et al., 2004; Smith, 2006; Smith and Dennis, 2007). Disasters, then, should be viewed as *systemic* processes "that permeate community social structure, producing social responses that are both emergent and constraining" (Picou et al., 2004: 1495; see also Cope et al., 2018; Dynes, 1974; Kreps, 1989, 1998; Parks et al., 2018).

As a systemic social process, the ways in which disaster victims respond to catastrophic disruption often depend on the Thomasian "definition of the situation." For example, when a disaster catalyst is viewed as natural and beyond human control (i.e., "an act of God"), researchers have found that social, psychological, and economic disruptions are relatively limited in duration (Drabek, 1986; Green, 1996; Quarantelli, 1989). In such contexts, the disaster is viewed as a "consensus-type" crisis (Quarantelli and Dynes, 1977; Aldrich and Kyota, 2017; Aldrich and Meyer, 2015; Reuter and Kaufhold, 2018), and response efforts often bring about a high level of social cohesiveness around recovery and the restoration of 'normalcy' for the victims.[1] In contrast, other researchers have argued that disasters originating from technological hazards have the potential to "create a far more severe and long-lasting pattern of social, economic, cultural and psychological impacts than do natural ones" (Freudenburg, 1997: 26; see also Riaz et al., 2015). Such long-term impacts are part of a debilitating condition—*corrosive community* (Freudenburg, 1993, 1997; 2000)—in which the negative effects of the disaster damage the residents' sense of community as the "mortar bonding human communities together" (Erikson, 1994: 239) erodes. Accordingly, research has attended to the linkages between an individual's sense of community and well-being following disaster-related disruptions (e.g., Miles, 2015; Norris et al., 2008). Moreover, studies have demonstrated that positive community attitudes and sentiment are key aspects of disaster resilience and recovery (e.g., Cope et al., 2013). Indeed, research suggests the most effective community change agents and emergency managers will take into account individual and local troubles as they manage an ever-changing disaster recovery process (Drabek, 2013). Thus, identifying shifts in community sentiment throughout the disaster process is important for benchmarking different social trajectories.

3. The systemic community model

In their seminal article, Kasarda and Janowitz (1974: 331) describe what has become one of the most influential models in the study of "local community attitudes and sentiments." Conceptualizing community "as a complex system of friendship and kinship networks and formal and informal associational ties rooted in family life and on-going socialization processes," the authors proposed a "model of community attachment which [they] call the *systemic model* (1974, 329, emphasis added). From such a perspective, a local community is viewed as "an ongoing system of social networks into which new generations and new residents are assimilated" (Kasarda and Janowitz 1974, 330). Thus, in the same way scholars conceptualize a disaster as a time-bound process, for Kasarda and Janowitz, the development of community sentiments and bonds is "necessarily a temporal process" in which an individual's length of residence is seen "as the key exogenous factor influencing community behavior and attitudes" (Kasarda and Janowitz 1974, 330).

While the length of residence is a critical component of the systemic community model, Kasarda and Janowitz also focused on local social bonds, lifecycle stage, and social position as principal determinants of people's community attitudes and sentiments. Since its introduction, numerous studies have confirmed the applicability of the systemic community model in understanding these outcomes (e.g., Beggs et al., 1996; Brown, 1993; Cope et al., 2015; Flaherty and Brown, 2010; Gerson et al., 1977; Krannich and Greider, 1990). Furthermore, research in diverse contexts has shown significant linkages between individual well-being and sense of community—a feeling of belonging, closeness, and connection to one's community (e.g., Davidson and Cotter, 1991; Grzeskowiak et al., 2003; Kimweli and Stilwell, 2002; St John et al., 1986), including in the context of technological disasters (Cope et al., 2013; Hawkins and Maurer, 2011; Lee and Blanchard, 2012; Parks et al., 2018).

4. The corrosive community model

Inasmuch as local social bonds strengthen community attitudes and sentiments, the disruption of those bonds can also disrupt residents' perceptions of an individual experience of the community (Chhotray and Few, 2012; Edelstein, 2004; Erikson, 1994, 1995; Peacock and Ragsdale, 1997). Thus, community residents incorporate risk assessments and perceptions in such a way that collective uncertainty alters their orientation towards community, so that ontological security and community sentiments corrode (see also Kroll-Smith and Couch, 1993; Lee and Blanchard, 2012; Ritchie et al., 2013). During technological disasters, communities may become conflict-prone, dealing as they must with perceptions of seemingly unending risks and uncertainties regarding both environmental and personal exposure (Adeola and

[1] Importantly, the effort to restore "normal" social conditions often—whether intentionally or not—results in reestablishing preexisting social inequalities (Kroll-Smith, 2018).

Steven Picou, 2014; Erikson, 1994, 1995; Gill, 2007; Kroll-Smith and Couch 1993; Picou et al., 2004). Typifying such processes, following the 1989 *Exxon Valdez* oil spill in Prince William Sound, Alaska, USA, research shows how the dynamics of uncertainty ultimately culminated in "social responses that draw down reserves of social capital, setting the stage for the emergence of individual and collective trauma, lifestyle and lifescape change, a corrosive community, and secondary trauma" (Ritchie et al., 2013, 658; see also Adeola and Steven Picou, 2014; Aldrich and Meyer, 2015; Gill, 2007; Gill and Ritchie, 2018; Ritchie, 2012; Ritchie and Gill, 2010). Indeed, Picou et al. (2004: 1496) contend that in the wake of catastrophic technological failure "the defining characteristic of the post-disaster phase is the emergence of a corrosive community—that is, a consistent pattern of chronic impacts to individuals and communities." To wit, three interrelated dynamics of technological disasters have been identified as particularly noteworthy in "understanding why corrosive communities emerge and persist" (Picou et al., 2004: 1496; see also Marshall et al., 2003): (1) protracted litigation; (2) mental and physical well-being of community residents; and (3) perceptions of recreancy (i.e., governmental and institutional actors' failure to execute entrusted roles and responsibilities properly). For the purposes of this study we focus on the latter two factors.[2]

With regards to adverse disaster related impacts on mental and physical well-being, research has found that the most commonly observed impacts on the well-being of disaster survivors are depression (e.g., Maguen et al., 2009), post-traumatic stress disorder (PTSD; e.g., Neria et al., 2008), and other anxiety-related disorders (e.g., McFarlane et al., 2009). Moreover, disaster-related life conditions can precipitate negative changes in physical health status (Bonanno et al., 2010; Halpern and Tramontin, 2007). While fatalities and injuries following natural disasters are often common among victims in high impact areas, Marshall et al. (2003: 87) note that in the wake of a technological disaster "the most troubling outcome has to do not with direct loss of life, but the potential for long-term health problems and damage to the community." To the degree that such impacts are chronic and cumulative, and physical symptoms can manifest analogous to other ailments, diagnosis is often delayed because of the difficulty of pinpointing a specific point of exposure (Erikson, 1994, 1995; Gill and Ritchie, 2018). Thus, with uncertainty about the degree to which a community has been exposed to toxins, residents and medical practitioners often have to contend with a contested discourse in identifying not only the nature and extent of health impacts, but even who should be considered a victim (Edelstein, 2004; Erikson, 1994, 1995; Kroll-Smith and Couch, 1991). Indeed, Gill et al. (2014) show that disruptions following the 1989 *Exxon Valdez* oil spill continue to affect the well-being of community residents more than two decades after the initial event (see also Gill et al., 2016).

Failure on the part of institutions to prevent a technological disaster represents an explicit challenge to a social system as a whole. Freudenburg theorized *recreancy* as a concept to "provide an affectively neutral reference to behaviors of persons and/or of institutions that hold positions of trust, agency, responsibility, or fiduciary or other forms of broadly expected obligations to the collectivity, but that behave in a manner that fails to fulfill the obligations or merit the trust" (1993, 916-917), and "the failure of experts or specialized organizations to execute properly responsibilities to the broader collectivity with which they have been implicitly or explicitly entrusted" (2000, 116). Thus, considerations of recreancy afford important insights into how a "primary responsible party" is identified and, often, becomes the focal point for blame, hostility, frustration, and, ultimately, compensation (Gill, 2007; Gill et al., 2014; Marshall et al., 2003; Ritchie et al., 2013).

Freudenburg's principal concern is the relation between broader social consequences and recreancy. In the wake of a technological disaster, research has shown that perceptions of recreancy amplify the awareness of risk, cultivate emotional/psychological feedback (e.g., anger, distrust, fear, frustration, uncertainty), and even exaggerate perceptions of community damage (e.g., Cope et al., 2016; Freudenburg, 1993; Gill et al., 2014; Gill, 2007; Ritchie, 2012; Ritchie et al., 2013; Ritchie et al., 2018; Scott et al., 2005). As confidence in the social order is shaken, perceptions of recreancy engender new vulnerabilities as community sentiments shift, social bonds are ruptured, and social differentiation is promoted by diverging narratives of distrust and blame (e.g., Alario and Freudenburg, 2003; Clarke and Short, 1993; Cope et al., 2016; Gill et al., 2012; Gill and Ritchie, 2018; Tierney, 2012).

While the EVOS literature has been held up as a "template for understanding oil spill impacts" (Lee and Blanchard, 2012, 27; for an in-depth review of the EVOS literature see Gill et al., 2016), another such disaster occurred on the night of 20 April 2010, when an explosion sent gas, oil, and concrete up the wellbore of the BP-leased Deepwater Horizon oil rig located approximately 50 miles offshore of Southeast Louisiana, USA. In addition to the deaths of 11 platform workers, the explosion and subsequent sinking of the rig led to a well breach that gushed millions of gallons of oil into the Gulf of Mexico for nearly three months before it was capped. The DHOS now stands as the largest recorded marine oil spill (Hamilton et al., 2012; Robertson and Krauss, 2010) and "the worst environmental disaster" ever experienced in the United States (Jackson, 2010). While the impacts of the DHOS disaster continue to unfold, it should be noted that EVOS scholars have predicted "[t]he BP disaster as an Exxon Valdez rerun" (Ritchie et al., 2011: 30).

5. Research questions

In view of the literature discussed above, we ask the following research questions as they pertain to the residents of the Louisiana communities affected by the DHOS: (1) Does community sentiment change over time? 2) Do the indicators—length of residence, local social bonds, lifecycle stage, and social position—suggested by the systemic community model (Kasarda and Janowitz 1974) predict greater community sentiment? and 3) Do the indicators— mental and physical well-being of community residents and perceptions of recreancy—suggested by the corrosive community model (Freudenburg, 1993, 1997; Picou et al., 2004) predict lower community sentiment in the wake of the disaster?

6. Methods

6.1. Sample

We address these questions using data from the Louisiana Community Oil Spill Survey (COSS). The COSS is a multi-wave cross-sectional dataset that assesses the impacts of the DHOS disaster on Louisiana's coastal residents living in areas most directly affected by the disaster. Administered by Louisiana State University's Public Policy Research Laboratory, the COSS is a telephone survey of households drawn randomly from a listed sample of approximately 6000 households in the coastal zip codes of Plaquemines, Lafourche, and Terrebonne Parishes, and the town of Grand Isle. The areas sampled for the COSS were initially selected because of their direct geographic proximity to the DHOS, were all highly oiled during the disaster, have a high level of involvement in the oil and gas and fishing industries—sectors directly affected by the spill and subsequent drilling and fishing moratoriums—and experienced active cleanup operations for years since the onset of the disaster. The repeated cross-sectional structure of these data affords the unique opportunity to examine the DHOS disaster as a social process, rather than as a single time-point

[2] Our data does not include measures of participation in litigation. For a review of the consequences of protracted litigation to disaster related community impacts see Gill at al. (2014); Marshall et al. (2003); Marshall et al. (2004); Picou et al. (2004); and Ritchie et al. (2018).

event. Four waves of COSS data are used in the analysis: a baseline gathered in October 2010 (the well was declared effectively dead in mid-September), with three follow-up waves collected in April 2011, April 2012, and April 2013 (corresponding to the one-year, two-year, and three-year anniversaries of the onset of the disaster). The respective response rates for each wave were 24, 25, 20, and 19 percent. Despite being obtained during adverse conditions (i.e., a disaster context), it should be noted that such rates of response are well above those typically obtained on contemporary telephone surveys by leading research organizations (e.g., Pew Research Center), and are within a range that is typically not a threat to the quality of survey estimates (Curtin et al., 2000; Groves, 2006; Keeter et al., 2000, 2006).

6.2. Measures

6.2.1. Dependent variable

Community sentiment, the dependent variable in our analysis, is measured with a six-item index. Items included in the measure were drawn from the Knight Soul of the Community project, a research partnership between Gallup and the Knight Foundation (2012) and have been used in previous investigations of the social impacts of the DHOS (e.g., Cope et al., 2013; Lee and Blanchard, 2012; Parks et al., 2018). Significantly, these measures are analogous to those used in previous research of the social correlates of social disruption/change and community attitudes (e.g., Brown, 1993; Kasarda and Janowitz, 1974; Smith et al., 2001). The index is comprised of the following items:

1. Taking everything into account, how satisfied are you with [name of community residence] as a place to live? (0 = *very dissatisfied*; 1 = *fairly dissatisfied*; 2 = *neither dissatisfied nor satisfied*; 3 = *fairly satisfied*, or 4 = *very satisfied*)
2. How likely are you to recommend [name of community residence] as a place to live? (0 = *extremely unlikely*; 1 = *somewhat unlikely*; 2 = *neither likely nor unlikely*; 3 = *somewhat likely*, or 4 = *extremely likely*)
3. Thinking about five years from now, how do you think [name of community residence] will be as a place to live compared to today? (0 = Will be much worse; 1 = Will be somewhat worse; 2 = Will be about the same; 3 = Will be somewhat better, or 4 = Will be much better)
4. Please indicate your agreement with the following statement: I am proud to say that I live in [name of community residence]. (0 = strongly disagree; 1 = disagree; 2 = neither disagree nor agree; 3 = agree, or 4 = strongly agree)
5. Please indicate your agreement with the following statement: [Name of community residence] is the perfect place for people like me. (0 = *strongly disagree*; 1 = *disagree*; 2 = *neither disagree nor agree*; 3 = *agree*, or 4 = *strongly agree*)
6. Overall, how would you rate your community as a place to live? (0 = *poor*; 1 = *fair*; 3 = *good*; 4 = *excellent*)

Drawing on these six items, we generated a summative index that ranged from 0 to 24 (Cronbach's alpha = 0.79). As shown in Table 1, there is evidence of a modest increase in community sentiment over the periods studied here.

6.2.2. Independent variables

6.2.2.1. Time. To measure change over time, following the approach used in previous research (e.g., Brown et al., 2005; Cope et al., 2016; Parks et al., 2018), indicator variables are created for the second (April 2011), third (April 2012), and fourth (April 2013) waves of the COSS and measured in reference to the first wave (October 2010). In other words, these dichotomous measures (yes = 1) compare the levels of community sentiment in April 2011, April 2012, and April 2013 to levels of community sentiment in October 2010.

Table 1
Descriptive statistics by survey wave.

Variables	October 2010	April 2011	April 2012	April 2013
	Mean/ percentage	Mean/ percentage	Mean/ percentage	Mean/ percentage
Dependent Variable				
Community sentiment	15.36 (3.33)	15.39 (3.62)	15.86 (3.06)	15.86 (3.10)
Systemic community				
Length of residence				
Proportion of a life as resident	00.83 (0.31)	0.85 (0.27)	0.87 (0.27)	0.80 (0.32)
Local social bonds				
Cajun	33.30%	49.44%	58.01%	51.80%
Fishing employment	19.48%	20.51%	19.69%	17.84%
Oil employment	27.01%	27.41%	29.74%	29.98%
Oil & fishing employment	33.41%	35.43%	30.63%	26.29%
Catholic	69.39%	71.24%	73.43%	69.93%
Church attendance	3.34 (1.50)	3.45 (1.47)	3.44 (1.48)	3.49 (1.58)
Lifecycle stage				
Age	44.69 (16.56)	48.62 (16.62)	49.53 (17.45)	52.54 (16.53)
Number of children	1.03 (1.20)	0.93 (1.18)	0.76 (1.10)	0.73 (1.16)
Married or widowed	73.12%	75.16%	71.15%	79.12%
Social position				
Educational attainment (0–18)	12.46 (2.41)	12.48 (2.36)	12.37 (2.46)	12.52 (2.46)
Employed	61.71%	54.76%	57.29%	53.71%
Corrosive community				
Mental health	8.17 (6.39)	8.44 (6.67)	7.14 (6.34)	5.94 (6.09)
Physical health	4.25 (5.31)	4.72 (5.40)	4.16 (5.20)	3.31 (4.61)
Distrust	63.77%	68.38%	63.99%	60.08%
Blame	45.49%	55.59%	45.37%	50.02%
Controls				
White	50.22%	35.17%	29.19%	35.30%
Female	46.23%	43.02%	35.97%	39.79%
Proximity to coast	5.37 (1.90)	5.33 (1.99)	5.12 (2.05)	5.32 (1.97)
N	873	800	575	489

Standard deviations in parentheses.

6.2.2.2. Systemic community. To assess the utility of the systemic community model (Kasarda and Janowitz 1974) in predicting community sentiment following the DHOS, our models include measures for the length of residence, local social bonds, lifecycle stage, and social position. Unfortunately, we are not able to directly replicate the exact questions used by Kasarda and Janowitz (1974). Nevertheless, the measures described below speak to the theoretical arguments they presented and are consistent with how many other researchers have used their approach to modeling community (e.g., Brown, 1993; Cope et al., 2015; Flaherty and Brown, 2010).

Length of residence. Length of residence is measured as the proportion of a person's life they have lived in the community (i.e., the quotient of the number of years the respondent was a community resident divided by their age), resulting in a variable that ranges from 0 to 1. This calculation diverges from measuring the length of residence as the number of years a respondent reported they were a community resident. We take this approach because including the raw number of years residing in the community potentially conflates the effects of age and length of residence (Cope et al., 2015; Flaherty and Brown, 2010; Goodsell et al., 2008).

Local social bonds. Local social bonds are measured in three ways. First, to measure social bonds that derive from membership in a large local ethnic group, we distinguished Cajuns from all other groups

(Cajun = 1) (Henry and Bankston, 2002; Roebuck and Hickson, 1982). Second, to measure local social bonds attributable to connection to the community economic identity, what Kasarda and Janowitz (1974: 329) refer to as ties to local "occupational systems," we include a set of variables that measure respondents' association with two critical industries in the region: the oil/gas industry and the fishing/seafood industry (Bernard, 2003; Henry and Bankston, 2002; Paul et al., 2012; Roebuck and Hickson, 1982). Specifically, indicator variables were created based on responses to the following questions: "Do you or any member of your immediate family currently work in the oil industry?" (yes = 1) and "Do you or any member of your immediate family currently work in the fishing or seafood industries?" (yes = 1). Since these are not necessarily mutually exclusive categories (see e.g., Freudenburg and Gramling, 2011)—it is possible that a household could have members employed in both the oil *and* fishing industries—we also include a third indicator variable for households with fishers *and* oil workers (yes = 1). These three indicators are mutually exclusive. Finally, we measure religious identification using two variables: an indicator variable for membership in the predominant religious group in the region (Catholic = 1) and a 5-point ordinal scale on which higher numbers indicate more frequent church attendance (Henry and Bankston, 2002; Paul et al., 2012).

Lifecycle stage. Three variables are used to measure the effect of respondents' lifecycle stage: 1) age, measured as a continuous variable in years; 2) the number of children age 17 years or younger living in the respondent's household, truncated at 7 or more; and 3) marital status, coded 1 for respondents who were married or widowed (see Brown, 1993; Cope et al., 2015; Flaherty and Brown, 2010).[3]

Social position. We include two variables to account for the effect of respondents' social position. The first is the number of years of schooling respondents completed (which ranges from 0 to 18). We also measure respondents' social position by including an indicator variable for being employed (yes = 1).

6.2.2.3. Corrosive community. To assess the utility of the corrosive community model (Freudenburg, 1993, 1997; 2000; Freudenburg and Jones, 1991; Picou et al., 2004) in predicting community sentiment following the DHOS, our models include measures for mental health, physical health, and recreancy.

Mental health. Mental health impacts are measured with an index of negative affective states attributed to the spill. Respondents were asked: "In the last week, how often have you experienced the following feelings because of the oil spill?" (Responses included almost constantly, some of the time, almost never, and never). The list of feelings included worry, sadness, nervousness, fear, depression, anxiety, and anger. Each item ranged from 0 to 3, where 0 = never and 3 = almost constantly. We created an index by summing the scores across all seven indicators, which resulted in a measure that ranged from 0 to 21 (Cronbach's alpha = 0.92).

Physical health. Physical health impacts are measured with an index of physical ailments attributed to the spill. Respondents were asked: "In the last week, how often have you experienced the following physical symptoms because of your worries about the oil spill?" (Again, responses included almost constantly, some of the time, almost never, and never). The list of physical symptoms included sick stomach, diarrhea, headaches, joint pain, loss of appetite, chest pain, and shortness of breath. Again, each item ranged from 0 to 3, where 0 = never and 3 = almost constantly. We created an index by summing the scores across all seven indicators, which resulted in a measure that ranged from 0 to 21 (Cronbach's alpha = 0.88).

Recreancy. We measure recreancy using two variables. With respect to distrust, three binary measures were obtained by asking respondents to indicate whether they "trust information regarding the oil spill" from BP, the federal government, and the state government (no = 1). Based on this information, a dichotomous variable was created that measures whether the respondent distrusted 2 or more of the institutional actors above (yes = 1). Similarly, we use three binary measures that reference blame by asking respondents who they "blame for the consequences of the oil spill, such as oil in the marsh, the moratorium on drilling and the closure of fisheries." The responses were BP, the federal government, and the state government (yes = 1). Based on this information, a dichotomous variable was created that measures whether the respondent blamed two or more of the institutional actors above for negative consequences of the spill (yes = 1). Our decision to use dichotomous measures of distrust and blame is grounded in the research literature that suggests, throughout the disaster process, other institutional actors—beyond the primary responsible party—are often drawn into the web of culpability (e.g., Cope et al., 2016). The dichotomized measures highlight whether recreancy is extending beyond the primary responsible party.

6.2.3. Controls

We include three control variables in our models in addition to those outlined above.[4] Specifically, we control for respondents' race (White = 1), sex (female = 1), and an 8-point ordinal scale measuring proximity to the coast (larger values denote greater distance). In our discussion of the results we focus on relationships between community sentiment and our independent variables. Descriptive statistics for all variables used in the analysis are shown in Table 1.

6.3. Modeling strategy

We use ordinary least squares (OLS) regression models to predict levels of community sentiment in the wake of the DHOS. Specifically, we regress community sentiment on change over time (Model 1), systemic community (Model 2), corrosive community (Model 3), and a full model including all predictors (Model 4). To address differential probabilities in sample selection related to higher levels of nonresponse amongst certain segments of the population, we weight our models by age and sex on the basis of the ratio of the distributions of these groups in the COSS versus those drawn from corresponding zip codes from the 2005–2009 five-year estimates of the American Community Survey.[5]

7. Results

Table 2 presents OLS regression models predicting community sentiment. Model 1 includes only the indicators of *time* and controls.

[3] We combine married and widowed here for the sake of consistency with previous research. Ancillary analysis using only married (yes = 1) produced similar substantive results.

[4] To "compare the relative merits" of different models of community (1974: 330), Kasarda and Janowitz included measures of population size and density in their models. In the models presented in this paper, we have elected not to include these controls. Our logic in forgoing the inclusion of indicators for population size and density is twofold: 1) they were not theorized as part of the systemic model of community, and 2) ancillary analysis did not show significant relationships between these variables and community sentiment.

[5] We use the 2005–2009 5-year ACS estimates rather than the 2010 Census data to calculate the weights for the COSS for two reasons. The first is differences in the time frame reference for ACS versus the Census. According to the US Census U.S. Census Bureau (2018), a key difference between the ACS and the decennial census is the overall time frame in which they are conducted. The data from the decennial census describes the characteristics of the population in the March through June of the census year, while ACS data describe the characteristics nearly every day over the full calendar year. A second, and more practical reason, is that the 2010 Census data was not made publicly available until 2012. Continuing to use the 2005–2009 ACS estimates to weight the data makes the current analysis consistent with published work using the COSS that preceded that data release (Cope et al., 2013; Lee and Blanchard, 2012).

Table 2
OLS regression model predicting community sentiment.

	Model 1		Model 2		Model 3		Model 4	
	b	SE	b	SE	b	SE	b	SE
Time								
October 2010 (reference)								
April 2011	0.049	0.116					0.052	0.112
April 2012	0.536***	0.127					0.356**†	0.124
April 2013	0.514***	0.138					0.310*†	0.135
Systemic community								
Length of residence								
Proportion of a life as resident			0.622***	0.160			0.740***	0.157
Local social bonds								
Cajun			−0.067	0.143			−0.039	0.141
Fishing employment			0.529***	0.145			0.904***‡	0.145
Oil employment			0.269*	0.133			0.316*	0.130
Oil & fishing employment			0.272*	0.132			0.593***‡	0.131
Catholic			0.866***	0.104			0.820***	0.102
Church attendance			0.133***	0.031			0.115***	0.030
Lifecycle stage								
Age			0.012***	0.003			0.012***	0.003
Number of children			−0.149***	0.044			−0.125**	0.043
Married or widowed			0.306**	0.114			0.308**	0.112
Social position								
Educational attainment			−0.061**	0.020			−0.078***	0.019
Employed			0.667***	0.100			0.593***	0.099
Corrosive community								
Mental health					−0.054***	0.010	−0.061***	0.010
Physical health					−0.034**	0.012	−0.028*	0.012
Distrust					−0.564***	0.098	−0.595***§	0.096
Blame					−0.106	0.091	−0.221*	0.090
Controls								
White	0.125	0.095	0.125	0.142	−0.004	0.093	0.133†§‡	0.140
Female	−0.189*	0.093	−0.111	0.094	−0.170	0.092	−0.019†‡	0.093
Proximity to coast	0.127***	0.023	0.100***	0.023	0.075***	0.023	0.070**§‡	0.023
Intercept	14.703***	0.160	12.889***	0.374	16.200***	0.169	13.982***†	0.382
Adj. R^2	0.011		0.056		0.039		0.095	

$N = 2739$. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.
† corresponding coefficients in the Model 1 and Model 4 are significantly different ($p < 0.05$).
‡ corresponding coefficients in the Model 2 and Model 4 are significantly different ($p < 0.05$).
§ corresponding coefficients in the Model 3 and Model 4 are significantly different ($p < 0.05$).

The results show significantly greater levels of community sentiment in April 2012 and April 2013 compared to October 2010. In other words, respondents reported greater community sentiment two and three years out from the spill compared to in its immediate aftermath.

Model 2 includes only the *systemic community* model variables and controls. Consistent with theoretical expectations, *length of residence* is a significant determinant of community sentiment, with respondents who have lived more of their lives in their present community reporting greater community sentiment. In terms of local *social bonds*, the results demonstrate a positive and significant relationship for all measures, with the exception of membership in the region's largest ethnic group—Cajuns—which is not statistically significant. Moreover, all three variables used to measure *lifecycle stage* are also shown to be significant determinates of community sentiment. Specifically, older and married/widowed respondents report more positive community attitudes, while households with greater numbers of children age 17 or younger are associated with lower levels of community sentiment. Concerning our measures of *social position*, the results show that higher levels of education are significantly associated with lower levels of community sentiment, while, conversely, being employed is significantly correlated with greater community sentiment.

Model 3 includes only the *corrosive community* model variables and controls. The results indicate that greater negative mental and physical health impacts attributed to the DHOS are associated with significantly lower community sentiment. Likewise, distrusting information regarding the oil spill from two or more institutional actors (BP, the federal government, and/or the state government) is associated with significantly less community sentiment. In contrast, blaming two or more institutional actors for the negative consequences of the oil spill—such as oil in the marsh, and moratoria on oil drilling and fishing—is not statistically significant.

Last, Model 4 is a full model including measures of time, systemic community, corrosive community, and controls. The results demonstrate the same general pattern of relationships shown in the previous models continue to hold in the presence of the full range of other predictors. The one notable exception is that, consistent with theory, in the full model blaming two or more institutional actors for the negative consequences of the oil spill becomes a significant predictor of lower levels of community sentiment. While the inclusion of other predictors significantly ameliorates these effects, community sentiment remains significantly higher in April 2012 and April 2013 compared to October 2010. Moreover, the positive relationship between ties to the fishing industry and community sentiment is significantly greater in the full model (compared to Model 2), indicating that after accounting for time and corrosive community, fishers possess even higher levels of community sentiment compared to non-fishers. In addition, the negative association between distrust and community sentiment becomes significantly greater as well (compared to Model 3), demonstrating that distrust is related to even lower levels of community sentiment net of other factors.[6]

8. Discussion

This study addressed three objectives concerning community sentiment in the wake of the DHOS. Specifically, we examined how community sentiment following the DHOS 1) changed over time; 2) was related to the systemic model of community (Kasarda and Janowitz, 1974); and 3) was related to the corrosive model of community (Freudenburg, 1993, 1997; 2000; Freudenburg and Jones, 1991; Picou et al., 2004). The results show that while other factors ameliorate these effects, community sentiment was significantly higher at later time points, namely April 2012 and April 2013 compared to October 2010. With respect to the second objective, our results confirm the utility of the systemic community model in predicting community sentiment in a disaster context. Finally, regarding the third objective, our findings also confirm the applicability of the corrosive community model in predicting community sentiment following the DHOS. Overall, our findings suggest these models complement one another, simultaneously operating in a manner suggested by each theoretical frame.

As we near the ten-year anniversary of the onset of the DHOS disaster, our study provides important contributions to the extant social scientific understanding of disasters (e.g., Drabek, 2013; Erikson, 1976, 1995, 1994; Lindell, 2013; Perry, 2018; Quarantelli, 2005; Quarantelli and Dynes, 1977; Tierney, 2014), including the literature on oil spill-related disaster processes (e.g., Cope et al., 2013, 2016; Gill et al., 2014; Lee and Blanchard., 2012; Ritchie et al., 2013). Specifically, we attended to measures associated with the systemic model of community (e.g., Beggs et al., 1996; Brown, 1993; Cope et al., 2015; Flaherty and Brown, 2010; Gerson et al., 1977; Krannich and Greider, 1990) and the corrosive community model in a technological disaster context (e.g., Gill, 2007; Gill et al., 2016; Marshall et al., 2003; Picou et al., 2004; Ritchie et al., 2013). We show that these theories do well to simultaneously predict community sentiment, which in the wake of the DHOS had previously been identified as key aspects of disaster resilience and recovery (e.g., Cope et al., 2013; Lee and Blanchard, 2012; Parks et al., 2018). In doing so, we contribute to a broader sociological understanding of disasters, sense of community, social systems, and “chronic corrosive processes” (Picou et al., 2007: 25).

Despite these contributions, our study has several limitations. For example, a key component of the corrosive community thesis is involvement in protracted litigation (Picou et al., 2004; Gill and Picou, 1998; Marshall et al., 2003). While litigation related to the DHOS was taking place during the period under study here, we do not have direct measures of respondents' participation in the legal claims process. Ritchie et al. (2018), in particular, provide an important treatment of this issue following the DHOS. Additionally, our models did not include measures of social ties that captured the range of stronger-to-weaker ties (Granovetter, 1973) or other indicators of social capital, both of which have been shown to be important indicators for understanding differential social impacts following a disaster (Adeola and Steven Picou, 2014; Aldrich and Meyer, 2015; Ritchie, 2012; Ritchie and Gill, 2010). It is also important to recognize that our models do not allow us to establish causation (i.e., the old adage that “correlation is not causation” applies here). For example, is it that greater mental health problems reduce community sentiment, or that lower levels of community sentiment increase mental health problems? We cannot say, we can only say that they are related. Last, it is important to note that this study is based on cross-sectional trend data and thus cannot assess within-unit change in the variables over time. Future studies should consider a longitudinal cohort panel design to better account for these types of dynamics. Doing so, would allow for more formal tests of how community sentiments shift and emerge in relation to changing conditions. Similarly, qualitative investigations would provide greater nuance depth, and an opportunity to ground-truth quantitative findings.

In conclusion, we highlight the words of Dowty and Allen (2011: 203), who state: “Whether a disaster is deemed ‘natural’ or ‘man-made,’ all disasters begin and end in *communities* and the social groups, networks, and politics that sustain them” (emphasis added). As such, this research holds a number of applied implications. First, it highlights that the characteristics and attributes of people and places influence disaster impacts. Given that risks, costs, and impacts—indeed the very consideration of what constitutes a disaster—are socially constructed, the results of this study are consistent with the greater body of social science research which maintains that communities and their residents should be central in disaster mitigation planning. Disaster preparedness and response planners should be attuned to the likelihood that different types of disasters will have differential consequences for certain types of people in affected locales. Accordingly, as a central aspect of disaster mitigation/preparedness strategies, community development efforts need to be attuned to social attributes that may serve to mute or amplify disaster-related impacts, such as community sentiment. Finally, this research adds to the chorus of researchers who have long contended that planners need to recognize that disasters are not singular events but processes linked to social antecedents and long-term consequences.

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CRediT authorship contribution statement

Michael R. Cope: Conceptualization, Methodology, Formal analysis, Investigation, Resources, Data curation, Writing - original draft, Writing - review & editing, Visualization, Supervision, Funding acquisition. **Tim Slack:** Methodology, Investigation, Resources, Data curation, Writing - review & editing, Visualization, Supervision, Funding acquisition. **Jorden E. Jackson:** Data curation, Writing - review & editing. **Vanessa Parks:** Data curation, Writing - review & editing.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jrurstud.2019.12.019.

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[6] Cross model comparisons are based on the methods for comparing regression coefficients advocated by Clogg et al. (1995), and were conducted using Stata's Seemingly Unrelated Estimation (suest) command (v15.1).

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