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# The Exxon and BP oil spills: a comparison of psychosocial impacts

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**Abstract** We address the research question: 'Did the 2010 BP Deepwater Horizon oil spill have similar psychosocial impacts as the 1989 Exxon Valdez oil spill?' We answer this question by comparing survey results from a random sample of Cordova, Alaska, residents collected 18 months after the Exxon spill with a random sample of residents in the Alabama coastal counties of Baldwin and south Mobile 1 year after the BP disaster. Analysis revealed similarly high levels of psychological stress for survivors of both disasters. For residents of coastal Alabama, the strongest predictors of psychosocial stress were exposure to oil, ties to renewable resources, concerns about their economic future, worries about air quality, and safety issues regarding seafood harvests in oiled areas. Differences between south Mobile and Baldwin counties were related to the former community's economic ties to renewable resources and Baldwin County's dependence on tourism for economic sustainability.

**Keywords** Technological disaster · Oil spill · Psychosocial stress · BP disaster · Exxon Valdez oil spill

## 1 Introduction

This article extends research on psychosocial effects of the 2010 BP *Deepwater Horizon* oil spill on coastal Alabama residents in terms of how these impacts compare to those measured in Cordova, Alaska, after the 1989 *Exxon Valdez* oil spill (EVOS) (Gill et al. 2012). That research collected survey data from residents of south Mobile County 5 months after the *Deepwater Horizon* drilling rig exploded and sank in the Northern Gulf

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of Mexico.[1] Like Cordova, most communities in south Mobile County, particularly Bayou La Batre, are classified as a renewable resource community (RRC)—one 'whose primary cultural, social, and economic existences are based on the harvest and use of renewable natural resources' (Picou and Gill 1996:881). The 2010 survey measured psychological stress and traumatic reactions to the BP spill with the Impact of Event Scale (IES) (see Horowitz 1974, 1986; Horowitz et al. 1979), the same standardized indicator for research of Cordova residents 5 months after the *Exxon Valdez* ran aground in Prince William Sound (Picou and Gill 1996; Picou et al. 1992). The IES contains two subscales representing characteristics of acute and post-traumatic stress disorder—intrusive recollections (Intrusion) and avoidance symptoms (Avoidance). Comparisons between the 1989 Cordova and 2010 south Mobile County samples revealed similarly high levels of initial trauma-related psychological stress for survivors of both oil spills (Gill et al. 2012).

Using theories and conceptual frameworks developed from research on multiple technological disasters over the past 30 years,[2] Gill et al. (2012) examined factors that might explain the high levels of stress in south Mobile County. Drawing on the RRC concept, as well as ecological-symbolic theory (Kroll-Smith and Couch 1993a) and Hobfoll's (1988, 1991) Conservation of Resources (COR) stress model, this study examined vulnerability, resource loss/gain, perceptions of recreancy, and risk perceptions as they related to the IES and its subscales. Regression analysis revealed the strongest predictors of psychological stress were family health concerns, commercial ties to renewable resources, economic loss, exposure to the oil, and concern about economic future (Gill et al. 2012). Additionally, risks associated with air quality and oiled seafood harvest areas, as well as lack of trust in BP and the federal court system, were found to be significant predictors.

Additional research questions were raised by the original research conducted in the months following the BP disaster. These questions include as follows: How long will elevated levels of psychosocial stress persist? Will these patterns of stress continue to mirror those observed in Alaska? Will vulnerability, resource loss/gain, risk perceptions, and perceptions of recreancy continue to be significant factors related to psychological stress after considerable time has elapsed? How do levels of stress observed in south Mobile County compare to those noted in Baldwin County, Alabama as there are significant cultural and economic differences between these two impacted areas? Specifically, south Mobile County is largely tied to marine resources through the commercial fishing industry. In contrast, Baldwin County ties to the damaged/threatened environment are primarily based on a 'beach economy' that includes tourism and real estate[3] (see Ritchie

[1] The BP oil spill adversely affected counties and parishes throughout the Gulf coast. Our selection of Alabama coastal counties was guided by two factors. First, Louisiana communities with ties to shrimping and other renewable resources also have economic ties to the oil industry and were affected by the moratorium on off-shore drilling, which made comparisons with Cordova problematic. Given that the spill affected fishing and tourism industries along the Northern Gulf of Mexico, Alabama provided an ideal opportunity to examine these differences. Second, we were aware that research teams from various universities were documenting impacts in other coastal communities (e.g., LSU, UNO, MSU, and UF) and we avoided them to reduce assessment fatigue among the residents (see, IASC 2012).

[2] See for example, Baum et al (1992), Couch and Kroll-Smith (1985), Cuthbertson and Nigg (1987, 1991), Edelstein (1988, 2000), Erikson (1976, 1994), Freudenburg (1984,1997, 2000), Freudenburg and Gramling (1992), Freudenburg and Jones (1991), Gill (2007a), Kroll-Smith and Couch (1990, 1993a, b), Picou et al. (1997), Ritchie and Gill (2007), Vyner (1988).

[3] Dauphin Island is located in south Mobile County, and this community also resembles a beach economy. The small portion of the 2010 sample from Dauphin Island did not allow a reliable test to determine if it significantly differed from the rest of the county sample.

et al. 2011). Nonetheless, data indicate that both counties experienced various forms of psychosocial stress (Busby 2010).

The present research focuses on a second telephone survey that was conducted in both coastal Alabama counties in the Spring of 2011 and which contained many of the indicators and measures of the 2010 survey. These data provide an opportunity to address the aforementioned questions. Specifically, the 2011 data set extends the 2010 study in three ways. First, it provides 'time two' data from coastal Alabama communities which can be compared to 'time two' data collected in Cordova after the EVOS. Second, it continues to track vulnerability, resource loss/gain, risk perceptions, and perceptions of recreancy as factors related to psychological stress experienced in reaction to the BP disaster. Third, it provides an opportunity to compare psychosocial stress levels among participants residing in a county that is economically tied to commercial fishing resources with participants living in a county whose economic base has greater ties to recreational marine and beach resources. This comparison will illuminate the potential differences in the economic context of technological disaster impacts.

## 2 Overview of mental health research on the BP disaster

The BP oil spill generated a high level of psychosocial stress among residents of Gulf Coast communities (e.g., see Reeves 2010; Siegel 2010; Walsh 2010). Researchers and practitioners throughout the affected region began to document and observe psychosocial effects related to the spill shortly after they mobilized. Our research contributes to this growing body of literature on the deleterious mental health effects that were associated with the BP oil disaster (e.g., see Abramson et al. 2010; Gill et al. 2012; Grattan et al. 2011; Lee and Blanchard 2010, 2012; Shenesey et al. 2012; Wright et al. 2012). Results from a 2010 Gallup Poll conducted approximately 4 months after the blowout revealed a 25.6 % increase in diagnoses of clinical depression among Gulf Coast residents (Witters 2010).[4] Moreover, immediately after the spill, calls to the National Domestic Violence Hotline from Gulf Coast States increased by 13 % between April and June 2010 (Mabus 2010). This information suggests serious mental health and behavioral impacts.

Focusing on impacts among children and families, the National Center for Disaster Preparedness surveyed Gulf Coast residents in the aftermath of the spill (Abramson et al. 2010). With respect to mental health impacts, one-third of respondents reported that their children had experienced either physical symptoms or mental health distress following the disaster. Another study by Grattan et al. (2011) found that residents of both Baldwin County, Alabama, and Franklin County, Florida, displayed clinically significant levels of anxiety and depression following the BP disaster. Although Franklin County residents were 'indirectly impacted,' as opposed to being directly oiled, there were no significant differences in findings between the two counties. These results led the authors to conclude that lost income from the spill had a greater impact on psychological health than exposure to oil.

In a 2010 study of Louisiana residents by Lee and Blanchard (2010), respondents reported elevated levels of stress in the aftermath of the spill and 80 % indicated concern about their economic futures. The authors noted that strong community attachment can cause stress in the event of a technological disaster (Lee and Blanchard 2012). Among other things, they conclude that high levels of attachment tend to generate worry about

[4] No such increase was reported in regions that did not experience the oil spill.

community well-being and threats to that well-being. They also suggest that social interaction associated with community attachment fosters negative affect and stress. These early research findings identify the emergence of a variety of negative sociocultural and psychosocial impacts across the northern Gulf of Mexico following the BP spill. This growing body of literature highlights the importance of considering multiple types of predictors (oil related, community related, trust associated) for identifying the sources of psychological stress produced by massive oil spills.

## 3 Methods: community context and data collection

This section presents a brief summary of the community context for Cordova, as well as for the coastal Alabama counties of Baldwin and south Mobile. A description of the methods of data collection is also provided.

### 3.1 Cordova, Alaska, 1990 community survey

Cordova is a small, isolated fishing community with strong economic, social, and cultural ties to renewable resources—particularly marine and fishery resources damaged by the EVOS. It is characterized by a highly profitable commercial fishing industry combined with a subsistence lifestyle rooted in Alaska Native culture. Because of these RRC characteristics, Cordova has been considered 'ground zero' for the human impacts of the EVOS, which generated immediate and chronic sociocultural and psychosocial effects (see Arata et al. 2000; Dyer et al. 1992; Gill 1994, 2007b; Gill and Picou 1997, 1998, 2001; Picou 1996a, b, c, 2000; Picou and Arata 1997; Picou and Gill 1996, 1997, 2000; Picou et al. 1992, 1997, 2004; Picou and Martin 2007; Ritchie 2004, 2012; Ritchie and Gill 2007, 2010; Ritchie et al. 2012).

Empirical research on psychosocial impacts of the EVOS on Cordova residents began in August 1989 when Picou and Gill initiated a community-wide household survey (Picou et al. 1992). They conducted face-to-face surveys with 89 respondents and supplemented data collection with a telephone survey of an additional 29 respondents (total sample, $N = 118$). The survey included the IES, socio-demographic indicators, and event-specific items (Picou and Gill 1995).

The 1990 Cordova survey was a panel design based on re-contacting the 118 respondents from 1989. In August 1990, a mail survey was initiated and over a 3-month period, 69 responded (58.5 % of total panel and 69.0 % of those with a valid address). The survey replicated many of the same items used in the 1989 survey, including the IES.

### 3.2 Coastal Alabama 2011 telephone survey

South Mobile County, south of interstate 10, is a section of Mobile County that borders the western shore of Mobile Bay, the Gulf of Mexico, and the Mississippi state line. Residents of this region reside in several communities, including Bayou La Batre, Grand Bay, Dauphin Island, and other rural areas. South Mobile County is characterized by strong economic, cultural, and social connections to commercial fishing and marine renewable resources (e.g., shipbuilding and commercial fishing). This region is considered the 'Seafood Capitol of Alabama' and is economically dependent on large amounts of seafood harvesting, sales, and processing.

Baldwin County is located east of Mobile County and boarders the eastern shore of Mobile Bay, the Gulf of Mexico, and the Florida State line. It includes the communities of Gulf Shores, Orange Beach, Daphne, Foley, and Lillian, as well as other rural areas. Baldwin County is home to the 'Emerald Coast,' with several public beaches and recreational areas, and its economic, social, and cultural character is strongly linked to these resources. Although there are some commercial fishing activities and other businesses, Baldwin County is economically dependent on tourism (e.g., beaches, restaurants, hotel, condominium, and house rentals, recreational water activities, and other recreational activities), and the income derived from this area makes substantial contributions to the overall economic well-being of the state of Alabama.

Immediate and long-term socioeconomic and psychosocial impacts were seen in both south Mobile and Baldwin counties as a result of the spill (Gill et al. 2012; Grattan et al. 2011; McCauley 2010; Shenesey et al. 2012; Wright et al. 2012). The current study allows a determination of whether south Mobile County and Baldwin County may have been impacted differently. Such differences, if observed, could be due to the distinct differences in economic resources (e.g., commercial fishing versus tourism) and as a result of their dissimilar cultural heritage. Nonetheless, no previous research has been conducted to examine and quantify potential social variations between these counties.

Our data were collected from a telephone survey of coastal Alabama residents administered by the University of South Alabama Polling Group from April 1 thru 28, 2011 using a random digit dialing technique. These data were collected as part of a State Emergency Response Grant to the Alabama Department of Mental Health and the University of South Alabama. Eligible respondents had to be age 19 or more and had to have lived in the area for more than 1 year. A sample of 812 residents—46.6 % from Baldwin County and 53.4 % from south Mobile County—completed the telephone survey.[5] This survey replicated the IES and indicators of vulnerability, resource loss/gain, perceptions of recreancy, and risk perceptions contained in the 2010 survey (see Gill et al. 2012).

Sample characteristics for 2011 show that almost two-thirds of the respondents were female, seven out of ten were married, nine out of ten were white, and the median age was 63. More than 90 % of the respondents were high school graduates and one-half reported a total household income of less than $50,000. Within the south Mobile County sample ($n = 434$), 34 % were from Bayou La Batre and adjacent unincorporated communities, 32 % from Grand Bay, 14 % from Dauphin Island, and 20 % located throughout rural areas of the county. Within the Baldwin County sample ($n = 378$), 38 % lived in Gulf Shores, 25 % in Orange Beach, 11 % in small towns of Lillian, Daphne, and Foley, and the remainder (27 %) in rural areas of the county. The sample averaged 28 years of residence in the area. The average household size consisted of 2.4 individuals and 52 % of the sample lived in two-person households. A demographic comparison between the counties revealed that the Baldwin County sample was significantly older, more educated, and in higher-income categories, while the south Mobile County sample contained significantly more non-whites and respondents had lived more years in their community (34 vs. 21 years). These survey demographics are consistent with observed demographic differences between the two coastal counties of Alabama (Census 2010).

Since the sample was highly skewed in terms of age (mean age = 61) and gender (over 60 % of respondents were female), we applied post-stratification weights (Little 1993) to the data so the results would be more representative of the overall populations of both counties. Population data on age and gender were obtained from the U.S. Census Bureau for Baldwin

[5] The refusal rate was 61 %.

County (Census 2010) and south Mobile County[6] (Census 2010), and weights were calculated based on these figures. In the case of age, the weights were calculated based on 10-year intervals (20–29 years old, 30–39 years old, etc.) and applied to the same age ranges in the sample data. All analyses of the 2011 Alabama data applied these post-stratification weights.

## 4 Psychological stress comparisons between the Exxon and BP oil spills

The first research question was addressed by comparing psychological stress data from the two coastal Alabama counties 12 months after the BP spill began with data collected in Cordova 18 months after the *Exxon Valdez* ran aground. In both cases, psychological stress was measured by the IES (Horowitz 1974, 1986; Horowitz et al. 1979). The underlying premise of the IES is that highly stressful events are likely to produce high levels of recurring, unintentional, distressing feelings and thoughts (Intrusion), as well as high levels of intentional efforts to suppress these feelings and avoid reminders of an event (Avoidance). Respondents are asked to self-report how frequently during the 'past seven days' they experienced each of 15 items[7] in the context of a specific event (in this case, the BP oil spill). Responses are coded as never (0), rarely (1), occasionally (3), and often (5), which gives the IES a range of 0–75 with higher scores indicative of higher levels of trauma-related stress. Intrusion and Avoidance are two standardized subscales that comprise the total IES with ranges of 0–35 and 0–40, respectively. Mean scores from applications of the IES in clinical settings and other disasters provide a basis for comparing stress levels to other events (e.g., Gill and Picou 1998; Horowitz et al. 1979).

Our 2011 coastal Alabama sample had a mean IES of 22.7, and the means for the Intrusion and Avoidance subscales were 12.6 and 10.1, respectively (Table 1). Results from the total sample are comparable to findings from Cordova 18 months after the EVOS. A *t* test comparison of IES and subscale means revealed no significant differences between the 1990 Cordova sample and the total 2011 Alabama sample. However, the 2011 south Mobile County respondents reported significantly higher Intrusion and Avoidance levels and scored higher on the IES than the 1990 Cordova sample. The Intrusion finding is particularly interesting given that comparisons between the 2010 south Mobile County sample and the 1989 Cordova sample revealed significantly higher levels of Intrusion in Cordova 5 months after the spill. This also indicates that intrusive stress did not decline in the 2011 south Mobile County sample the way it did in Cordova 1 year after the event (Picou et al. 1992). Moreover, a *t* test comparison revealed that residents of south Mobile County self-reported significantly higher mean scores for the IES, Intrusion, and Avoidance subscales than residents of Baldwin County. Table 1 also demonstrates that the mean scores of Intrusion in Baldwin and south Mobile counties (2011) were similar to that of

[6] For south Mobile County, the population data for Bayou La Batre was used rather than all of Mobile County. The majority of south Mobile County falls within Bayou La Batre; therefore, it is a better representation of the overall population.

[7] (1) I thought about it when I did not mean to; (2) Pictures about it popped into my mind; (3) Other things kept making me have thoughts about it; (4) I had to stop myself from getting upset when I thought about it; (5) I tried to remove it from my memory; (6) I had trouble falling asleep or staying; (7) I had waves of strong feelings about it; (8) My feelings about it were kind of numb; (9) I had a lot of feelings about it that I didn't know how to deal with; (10) I had dreams about it; (11) I stayed away from reminders of it; (12) I felt as if it had not really happened; (13) I tried not to talk about it; (14) I tried not to think about it; and (15) Reminders of it brought back feelings I first felt about it. Intrusion combines items 1, 2, 3, 6, 7, 10, and 15. Avoidance combines items 4, 5, 8, 9, 11, 12, 13, and 14.

**Table 1** Mean scores for the IES, Intrusion, and Avoidance for Baldwin County (2011), south Mobile County (2010 and 2011), and Cordova 1989–2006 with comparisons to selected cases

| | Total IES Mean | Intrusion Mean | Avoidance Mean |
|---|---|---|---|
| Total 2011 Alabama sample ($n = 812$) | 22.7 | 12.6 | 10.1 |
| South Mobile County, AL | | | |
| 2010 ($n = 412$) | 25.0 | 13.7 | 11.3 |
| 2011 ($n = 434$) | 25.3[b] | 13.7[b] | 11.6[b] |
| Baldwin County, AL | | | |
| 2011 ($n = 378$) | 19.5 | 11.1 | 8.1 |
| Cordova, AK | | | |
| 1989 ($n = 117$) | 27.6 | 16.6[c] | 11.0 |
| 1990 ($n = 69$) | 19.6[d] | 10.1[d] | 9.6[d] |
| 1991 ($n = 221$) | 19.9 | 9.5 | 7.5 |
| 1992 ($n = 159$) | 16.6 | 8.5 | 8.1 |
| 2000 ($n = 372$) | 21.2 | 11.1 | 10.9 |
| Clinical Cases[a] | | | |
| Bereavement from parental death | | | |
| 3–6 weeks after death | No data | 21.6 | No data |
| 6 months after death | No data | 13.8 | No data |
| Rape victims | | | |
| Initial assessment | 49.8 | 23.8 | 26.0 |
| Two years after the rape | 27.4 | 11.4 | 16.0 |

[a] Data obtained from Horowitz (1986) and Seidner et al. (1988)

[b] South Mobile 2011–Baldwin 2011 comparison significant at $p < 0.001$ (two-tailed)

[c] South Mobile 2010–Cordova 1989 comparison significant at $p < 0.01$ (two-tailed)

[d] South Mobile 2011–Cordova 1990 comparison significant at $p < 0.001$ (two-tailed)

rape victims 2 years after the assault, suggesting, at least numerically, significant persisting event-related psychological stress.

The IES scores also provide a basis for classifying individuals into four clinical categories: subclinical, mild, moderate, and severe trauma-related stress (Hutchings and Devilly 2005). As shown in Fig. 1, 12 % of 2011 coastal Alabama respondents fell into the 'severe' category and another 23 % were still classified as experiencing 'moderate' levels of trauma-related stress 1 year post-disaster. These rates are very similar to those from the 1990 Cordova sample in which one-tenth of the sample was classified as 'severe' and one-fourth was classified as continuing to experience 'moderate' levels of trauma-related stress. Although roughly two-thirds of the sample was in the subclinical or mild categories, comparisons revealed south Mobile County had almost twice as many respondents in the 'severe' category than did Baldwin County (15.9 vs. 8.5 %, respectively).

In summary, 12 months after the BP oil spill, event-related psychological stress among residents of Baldwin and south Mobile counties was elevated in a similar pattern experienced by Cordova residents 18 months after the EVOS. However, this trend was particularly evident for south Mobile County respondents who, as a group, were significantly more stressed than their Baldwin County counterparts. As shown in Table 1, mean IES scores for a 2000 sample of Cordova residents were as high as mean scores for the 1990 Cordova sample; in Alaska, psychological stress related to a significant oil spill did not

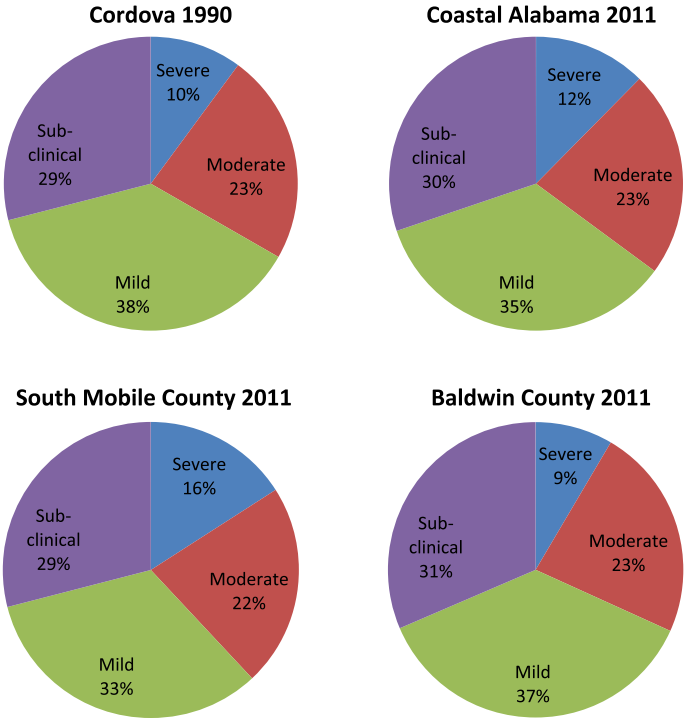


**Fig. 1** Impact of event scale (IES) clinical category comparisons Cordova, Alaska, 1990 and Coastal Alabama 2011

readily diminish. Thus, the persistent, relatively high stress levels observed in Cordova suggest the potential for significant spill-related psychological stress to continue in these two coastal Alabama counties.

## 5 Factors related to psychological stress

The second research question addressed was to consider which factors are significantly related to the IES and its subscales in the current sample and the degree to which they are similar to those that predicted psychological stress in the 2010 study, i.e., vulnerability, resource loss/gain, perceptions of recreancy, and risk perceptions. This section describes each factor in terms of its conceptual foundation, how these variables were operationalized, descriptive statistics for each variable, and how each variable related to the IES total score as well as to the Intrusion and Avoidance subscales. The third research issue contrasts the reactions of Baldwin County and south Mobile County respondents. We provide comparative statistics and analysis for each county within each factor.

### 5.1 Vulnerability and exposure

Vulnerability is a multi-dimensional, dynamic process typically related to physical location, social class, and demographic characteristics, as well as to levels of exposure to stressors (Cutter et al. 2003). Technological disasters such as oil spills highlight a unique

**Table 2** Descriptive and bivariate statistics for demographic characteristics and indicators of psychological stress for residents of south Mobile and Baldwin counties and combined (Coastal Alabama) 12 months after the 2010 BP oil spill

| | Mean | SD | IES Correlation ($r$) | Intrusion Correlation ($r$) | Avoidance Correlation ($r$) |
|---|---|---|---|---|---|
| Age | | | | | |
| Coastal Alabama | 50.4 | 17.2 | −0.121** | −0.083* | −0.147*** |
| South Mobile County | 49.2 | 16.3 | −0.184*** | −0.136** | −0.213*** |
| Baldwin County | 50.6 | 17.1 | 0.043 | 0.042 | −0.037 |
| Years in Community | | | | | |
| Coastal Alabama | 25.5 | 18.2 | 0.083* | 0.088* | 0.068 |
| South Mobile County | 29.6 | 18.7 | 0.066 | 0.078 | 0.047 |
| Baldwin County | 19.5 | 15.5 | 0.004 | 0.029 | −0.027 |
| Income[a] | | | | | |
| Coastal Alabama | 5.1 | 2.2 | −0.121** | −0.080* | −0.149*** |
| South Mobile County | 4.8 | 2.2 | −0.151** | −0.111* | −0.174** |
| Baldwin County | 5.7 | 2.1 | 0.024 | 0.030 | 0.012 |
| Education[a] | | | | | |
| Coastal Alabama | 4.1 | 1.3 | −0.146*** | −0.093** | −0.184*** |
| South Mobile County | 3.7 | 1.2 | −0.222*** | −0.196*** | −0.224*** |
| Baldwin County | 4.6 | 1.4 | 0.014 | 0.074 | −0.060 |

| | Percentages | | $t$ value | $t$ value | $t$ value |
|---|---|---|---|---|---|
| Gender | Females | Males | | | |
| Coastal Alabama | 51.5 | 48.5 | 1.56 | 1.47 | 1.47 |
| South Mobile County | 49.3 | 50.7 | 2.51* | 2.66** | 2.07* |
| Baldwin County | 51.7 | 48.3 | −0.39 | −0.63 | −0.03 |
| Race | Non-White | White | | | |
| Coastal Alabama | 9.4 | 90.6 | 3.76*** | 2.85** | 4.25*** |
| South Mobile County | 12.7 | 87.3 | 3.11** | 2.39* | 3.49** |
| Baldwin County | 3.6 | 96.4 | −1.19 | −0.89 | −1.36 |
| Marital Status | Not Married | Married | | | |
| Coastal Alabama | 30.5 | 69.5 | 2.91** | 2.85** | 2.61** |
| South Mobile County | 33.1 | 66.9 | 2.86** | 3.14** | 2.26 |
| Baldwin County | 24.0 | 76.0 | 1.80 | 1.40 | 2.00* |
| Minors in Household | No Minors | Minors | | | |
| Coastal Alabama | 59.3 | 40.2 | −0.63 | −0.52 | −0.68 |
| South Mobile County | 57.5 | 42.5 | 0.34 | 0.16 | 0.48 |
| Baldwin County | 60.6 | 39.4 | −0.26 | 0.02 | −0.56 |

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$ significance (two-tailed)

[a] Income and education were measured using ordinal categories where higher values are associated with higher income and education levels

type of vulnerability—economic, social, and cultural dependence on damaged/threatened resources (Kroll-Smith and Couch 1991, 1993a; Picou and Gill 1996; Ritchie and Gill 2010). A general hypothesis from this perspective is that higher levels of vulnerability lead to higher levels of psychological stress.

Indicators of vulnerability in our survey included basic demographic and social variables, measures of exposure to oil, and commercial dependence on damaged/threatened natural resources. Demographic characteristics such as gender, race, presence of minor children in the household, and marital status were measured on a 0–1 categorical basis (female/male; non-white/white; no minors/minors; non-married/married). As shown in Table 2, *t* test comparisons revealed race and marital status to be significantly related to the IES and its subscales with non-whites and unmarried individuals experiencing higher trauma-related stress levels than whites and those who were married at the time of the spill. A correlation analysis revealed that age, years of community residence, income, and education were also significantly related to the IES total score and the Intrusion and Avoidance subscales (see Table 2). Income was measured in $10,000 to $20,000 increment categories in 8 groups from 1 (under $10,000) to 8 ($100,000 or more). Education was assessed on a 7-category scale from 1 (less than 9th grade) to 7 (advanced degree). Younger respondents and those with a longer tenure in the community, in lower-income categories, and with lower levels of education were more likely to experience higher levels of psychological stress in response to the oil spill. These patterns were generally similar in both Baldwin and south Mobile counties with a few exceptions. Gender was a significant factor in south Mobile County, and race was not significant in Baldwin County. Further, income and education were not significantly related to levels of psychological stress in Baldwin County.

Exposure and RRC vulnerability indicators were adapted from an index developed by Palinkas and associates in their post EVOS research (Palinkas et al. 1993a, b). Exposure was operationalized from survey items indicating if the respondent had worked on shoreline cleanup (7.6 % did) and worked on the Vessel of Opportunity program (6.9 % did); had property damaged by oil (7.8 % did); and had come in contact with oil in other ways (e.g., fishing, hunting, walking/hiking, swimming, and recreation at the beach) (38.2 % did). Respondents who had experienced any one item of these items were coded as 1 for 'exposed,' and the remainder were coded as 0 for 'not exposed.' Approximately four out of 10 respondents experienced some type of exposure (40 %), and a *t* test analysis indicated exposure was significantly related to the IES and its subscales ($p < 0.001$). A chi-square analysis between the two counties indicated significantly more Baldwin County residents reported that they were exposed to oil ($p < 0.001$).

Renewable resource vulnerability was measured by asking residents how much they used coastal areas along the Gulf of Mexico for commercial activities before the spill. Responses were coded as either connected (1) or not (0), with over one-third of the respondents (40.4 %) reporting a commercial connection to coastal resources. A *t* test analysis indicated a significant relationship between renewable resource ties and the IES and subscales—those with commercial connections to damaged/threatened resources were more likely to experience higher levels of stress ($p < 0.001$). South Mobile County residents were significantly more likely to have commercial ties to damaged resources than their Baldwin County counterparts ($p < 0.001$).

**Table 3** Descriptive and bivariate statistics for resource loss and threat of loss and indicators of psychological stress for residents of south Mobile and Baldwin counties and combined (Coastal Alabama) 12 months after the 2010 BP oil spill

| | Mean[a] | SD | IES Correlation ($r$) | Intrusion Correlation ($r$) | Avoidance Correlation ($r$) |
|---|---|---|---|---|---|
| Economic loss | | | | | |
| Coastal Alabama | 3.99 | 0.91 | 0.312*** | 0.337*** | 0.246*** |
| South Mobile County | 3.96 | 0.95 | 0.312*** | 0.347*** | 0.242*** |
| Baldwin County | 4.07 | 0.85 | 0.324*** | 0.315*** | 0.283*** |
| Economic future | | | | | |
| Coastal Alabama | 2.75 | 1.28 | 0.451*** | 0.459*** | 0.387*** |
| South Mobile County[b] | 2.85 | 1.30 | 0.397*** | 0.409*** | 0.341*** |
| Baldwin County | 2.59 | 1.27 | 0.568*** | 0.560*** | 0.488*** |

[a] Higher scores indicate greater loss/concern

[b] $t$ test between south Mobile County and Baldwin County on economic future variable significant at $p < 0.01$. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$ significance (two-tailed)

### 5.2 Resource loss

The COR model suggests that psychological stress is related to resource loss, threat of resource loss, and/or resource investment without gain (Hobfoll 1988, 1989, 1991; Hobfoll and Lilly 1993). This stress model considers four basic resources: objects (e.g., physical possessions and natural resources), energies (e.g., money and knowledge), conditions (e.g., a good marriage and quality relationships), and personal characteristics (e.g., high self-esteem and social competence). Psychological stress occurs when resource loss assails basic values, places excessive demands on individual and collective resources, goes beyond typical resource use, and evokes powerful mental images (Hobfoll 1991).

Our survey focused on economic loss associated with the oil spill. Economic loss was measured by asking, 'How would you describe the overall economic impact of the oil spill on your household?' Responses were coded on a five-point Likert-type scale from very positive (1) to very negative (5). The economic impact variable had a mean of 3.99 with 33 % indicating they experienced 'very negative' impacts and 40 % reporting 'somewhat negative' impacts. Threat of economic loss was measured by asking respondents to indicate their confidence in their economic future using a five-point Likert-type scale where higher scores indicated less confidence. The economic future variable had a mean of 2.75 and one in three (34.6 %) lacked confidence in their economic future. As shown in Table 3, a correlation analysis of both indicators revealed significant relationships with the IES, as well as the Intrusion and Avoidance subscales ($p < 0.001$). Relationships between resource loss and psychological stress were similar in both counties, but $t$ test comparisons revealed a significant difference in that south Mobile County residents expressed greater concern about their economic future than did Baldwin County residents ($p < 0.001$).

### 5.3 Perceptions of recreancy

The concept of recreancy focuses on issues of trust in institutions. Specifically, recreancy is 'the failure of experts or specialized organizations to execute properly responsibilities to the broader collectivity with which they have been implicitly or explicitly entrusted'

**Table 4** Descriptive and bivariate statistics for perceptions of recreancy (trust in institutions) and indicators of psychological stress for residents of south Mobile and Baldwin counties and combined (Coastal Alabama) 12 months after the 2010 BP oil spill

| | Mean[a] | SD | IES Correlation ($r$) | Intrusion Correlation ($r$) | Avoidance Correlation ($r$) |
|---|---|---|---|---|---|
| BP Corporation | | | | | |
| Coastal Alabama | 1.99 | 1.21 | −0.182*** | −0.224*** | −0.115** |
| South Mobile County | 2.03 | 1.24 | −0.129** | −0.181*** | −0.062 |
| Baldwin County | 1.92 | 1.15 | −0.280*** | −0.278*** | −0.238*** |
| Ken Feinberg | | | | | |
| Coastal Alabama | 1.83 | 1.13 | −0.079* | −0.118** | −0.027 |
| South Mobile County | 1.81 | 1.14 | −0.032 | −0.070 | 0.011 |
| Baldwin County | 1.83 | 1.13 | −0.141** | −0.176** | −0.076 |
| Federal Courts | | | | | |
| Coastal Alabama | 2.48 | 1.27 | −0.073* | −0.102** | −0.034 |
| South Mobile County | 2.53 | 1.31 | −0.062 | −0.106* | −0.010 |
| Baldwin County | 2.45 | 1.25 | −0.208*** | −0.189*** | −0.198*** |
| Federal Government[b] | | | | | |
| Coastal Alabama | 2.19 | 1.26 | −0.019 | −0.064 | 0.031 |
| South Mobile County | 2.35 | 1.33 | −0.053 | −0.101* | 0.002 |
| Baldwin County | 1.96 | 1.12 | −0.061 | −0.077 | −0.033 |
| Alabama State Government | | | | | |
| Coastal Alabama | 2.90 | 1.20 | −0.090* | −0.109** | −0.059 |
| South Mobile County | 2.93 | 1.23 | −0.041 | −0.069 | −0.008 |
| Baldwin County | 2.88 | 1.17 | −0.201*** | −0.188*** | −0.185*** |
| Local Government[b] | | | | | |
| Coastal Alabama | 3.21 | 1.27 | −0.151*** | −0.123** | −0.162*** |
| South Mobile County | 3.06 | 1.30 | −0.140** | −0.121* | −0.142** |
| Baldwin County | 3.41 | 1.21 | −0.154** | −0.118* | −0.172** |

[a] Higher scores indicate greater trust

[b] $t$ test between south Mobile County and Baldwin County on Federal Government and Local Government variables significant at $p < 0.001$. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$ significance (two-tailed)

(Freudenburg 2000:116). Technological disasters identify a 'primary responsible party' to blame and hold accountable for compensation, but other organizations, including the government, typically share some culpability. Blame and perceptions of recreancy heighten anger, frustration, fear, hostility, loss of trust, and uncertainty—particularly among populations affected by technological disasters—which contribute to prolonged psychological stress (e.g., see Ritchie et al. 2012).

Perceptions of recreancy were measured by asking respondents to indicate how much they trusted six different entities involved in the oil spill disaster. Each entity was rated from 'no trust' (1) to 'a lot of trust' (5). As indicated in Table 4, Ken Feinberg,[8] the BP Corporation, the federal government, and federal court system were the least trusted entities in the context of the oil spill disaster. On the other hand, local and state

[8] Ken Feinberg was the government-appointed administrator of the BP Deepwater Horizon Disaster Victim Compensation Fund through the Gulf Coast Claims Facility.

governments were the most trusted entities. Lack of trust in two entities—BP and local government—was highly correlated with the IES and the Avoidance subscale. Lower levels of trust in five entities—BP, Ken Feinberg, Alabama state government, the federal court system, and local government—were significantly correlated with the Intrusion subscale. That is, a lack of trust in these entities was associated with increased event-related psychological stress. These patterns were similar in both counties, but in south Mobile County, distrust in each listed entity was significantly correlated with Intrusion, except Ken Feinberg and Alabama State Government. An examination of *t* test comparisons revealed significant differences between the two counties—Baldwin County was more distrustful of the federal government ($p < 0.001$) and south Mobile County was more distrustful of local government ($p < 0.001$).

### 5.4 Risk perceptions

Disasters such as the BP oil spill represent new forms of risk from complex technology and social organizations found in contemporary society (Beck 1996). Technological disaster events tend to foster perceptions of increased, uncontrolled risk, which contributes to chronic uncertainty, threatens ontological security, and increases psychological stress (Giddens 1990, 1991). Furthermore, unlike most previous oil spills, the BP disaster unfolded over a longer time period, generating additional uncertainty about when this disaster would actually come under control and oil would stop entering the Gulf of Mexico.

Indicators of risk perceptions focused on family health impacts, health effects of dispersants, air quality, seafood safety, and oiled seafood harvesting areas. Each risk was scored on a five-point Likert-type scale, where higher scores indicated greater concern and uncertainty. As shown in Table 5, all five risk concerns were significantly related to the IES total mean, as well as means for both IES subscales, and these patterns were consistent across both counties. The only significant difference observed between the counties was a greater concern about air quality in south Mobile County ($p < 0.05$).

### 5.5 Summary

These empirically grounded and theoretically derived variables provide insights into psychological stress experienced after a technological disaster such as the BP oil spill. Psychological stress was heightened among vulnerable and exposed respondents, particularly those who were vulnerable because of economic ties to damaged/threatened resources. Psychological stress increased when economic resources were lost or threatened. Perceptions of recreancy as indicated by lack of trust in responsible institutions further contributed to psychological stress, as did risk perceptions concerning spill impacts on health and the environment.

Respondents from Baldwin and south Mobile County generally displayed similar patterns regarding predictors of psychological stress. This makes sense given that all 32 miles of the Alabama coastline were oiled and the economic impact to Alabama was far reaching. However, there were some significant differences between the two counties. For example, south Mobile County had comparatively less education, lower income, and longer tenure living in their communities, and these were significantly related to increased trauma-related psychological stress. In contrast, gender was significantly related to stress only in south Mobile County. Likewise, lack of trust in Ken Feinberg was only significantly associated with psychological stress in Baldwin County. This finding relates to greater concern about lost tourism revenues in contrast to lost income directly tied to

**Table 5** Descriptive and bivariate statistics for risk perceptions and indicators of psychological stress for residents of south Mobile and Baldwin counties and combined (Coastal Alabama) 12 months after the 2010 BP oil spill

| | Mean[a] | SD | IES Correlation (*r*) | Intrusion Correlation (*r*) | Avoidance Correlation (*r*) |
|---|---|---|---|---|---|
| Family health | | | | | |
| Coastal Alabama | 2.35 | 1.21 | 0.433*** | 0.443*** | 0.387*** |
| South Mobile County | 2.40 | 1.22 | 0.505*** | 0.496*** | 0.457*** |
| Baldwin County | 2.29 | 1.19 | 0.319*** | 0.354*** | 0.225*** |
| Dispersants | | | | | |
| Coastal Alabama | 3.94 | 1.12 | 0.310*** | 0.315*** | 0.267*** |
| South Mobile County | 3.97 | 1.12 | 0.317*** | 0.323*** | 0.275*** |
| Baldwin County | 3.93 | 1.13 | 0.291*** | 0.294*** | 0.242*** |
| Air quality[b] | | | | | |
| Coastal Alabama | 3.73 | 1.21 | 0.417*** | 0.390*** | 0.394*** |
| South Mobile County | 2.85 | 1.23 | 0.472*** | 0.459*** | 0.432*** |
| Baldwin County | 2.58 | 1.17 | 0.252*** | 0.223*** | 0.247*** |
| Seafood safety | | | | | |
| Coastal Alabama | 2.87 | 1.30 | 0.294*** | 0.282*** | 0.270*** |
| South Mobile County | 2.89 | 1.34 | 0.314*** | 0.325*** | 0.269*** |
| Baldwin County | 2.83 | 1.25 | 0.182*** | 0.147** | 0.194*** |
| Oil harvested areas | | | | | |
| Coastal Alabama | 2.62 | 1.10 | 0.362*** | 0.365*** | 0.314*** |
| South Mobile County | 3.66 | 1.15 | 0.364*** | 0.365*** | 0.323*** |
| Baldwin County | 3.57 | 1.01 | 0.350*** | 0.367*** | 0.275*** |

[a] Higher scores indicate greater concern

[b] *t* test between south Mobile County and Baldwin County on air quality variable significant at $p < 0.01$. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$ significance (two-tailed)

commercial fishing. Of interest is that a significantly higher percentage of Baldwin County respondents reported suffering economic losses than residents of south Mobile County, but the latter expressed a significantly higher concern about their economic future. The decline in tourism was immediate and obvious in the summer of 2010. In addition, south Mobile County residents experienced significantly greater negative and long-lasting economic consequences related to Hurricane Katrina, making these residents more economically vulnerable prior to the BP disaster.

There are several possible explanations for the findings that Baldwin County residents reported being significantly more exposed to oil and yet south Mobile County residents reported significantly higher impact levels. This pattern may reflect differences in economic resources. Greater initial resources may operate as a protective factor from psychological impacts. Second, these findings may be related to differences between the economies supporting the two Alabama counties. South Mobile County's economy is tied to resources that have greater uncertainty associated with recovery (e.g., commercial shrimping/fishing), whereas the beaches in Baldwin County rapidly had the appearance of full recovery and hence the greater likelihood of a restored tourist economy.[9] Furthermore,

[9] Note that our data were collected before the successful 2011 tourism season.

additional resources have been targeted toward the economic situation in Baldwin County. For example, a nationwide media campaign sponsored by BP has focused on restoring tourism by promoting clean beaches. Yet, considerably less public attention and direct financial resources were allocated to promoting the recovery of the seafood industry and assuring the long-term health of damaged species. Public concern about the safety of Gulf of Mexico seafood remains an issue throughout the USA.

## 6 Regression analysis

We next conducted an ordinary least squares (OLS) regression analysis to identify the variables that significantly influence psychological stress in the two coastal Alabama counties. We evaluated five sets of predictors (indicators of vulnerability, resources loss, risk perception, and recreancy, and demographic variables including the county of residence) on the three dependent variables (the IES, the Intrusion subscale, and the Avoidance subscale).[10]

The vulnerability variables (ties to renewable resources and exposure to oil) were found to have positive effects on all three dependent variables ($p < 0.001$). Concerns over resources also appeared to be important as economic future was positively significant ($p < 0.001$) in all of the models, while economic loss was positively significant ($p < 0.01$) only in the IES and Intrusion equations. Three of the risk perception variables were important predictors of psychological stress, as air quality concern and oil harvest areas were found to be significant across all models, while family health was positive and significant only in the IES total and the Intrusion subscale equations. The recreancy variables also provided mixed results. BP (in the IES and Avoidance models) and federal courts were negatively and significantly related to the dependent variables, as expected. However, Ken Feinberg (in the IES and Avoidance models) and Alabama state government were significant positive predictors of the dependent variables, indicating that the more people trusted Feinberg and the Alabama state government, the *more* stressed they reported themselves to be. These are unexpected findings that deserve further inquiry.[11]

The demographic variables had minimal impact on the levels of psychological stress with the exception that people who lived in the community longer and were not married reported greater numbers of intrusive symptoms. Finally, according to all of the models, residents of south Mobile County were significantly more stressed than were residents of

[10] All models were tested for multicollinearity, and no problems were detected. All VIF values were under 2.2.

[11] A few of the recreancy variables (trust in Ken Feinberg in two models, trust in the Federal Government in one model, and trust in the Alabama government in all models) have significant positive relationships with the dependent variables, contradicting the hypothesized direction of the relationship. To further unpack this relationship, we calculated interaction terms for all the recreancy variables with the county of residence variable, because there is reason to believe that trust in institutions may vary by county (and in all models people in south Mobile Country score significantly higher on the stress scales, when controlling for the other predictors). When the interaction terms were entered into the equations reported in Table 6, the significant positive effects of Ken Feinberg and the Alabama government disappear. However, we found a significant difference between south Mobile County and Baldwin counties in trust of the federal government. The coefficient for Baldwin was positive while it was negative for south Mobile County indicating that residents of south Mobile County who had trust in the federal government reported being less stressed. While it is beyond the scope of this paper to explicate *how and why* the differences between counties operate, we recognize this is an important finding and recommend further research addressing these issues.

**Table 6** Unstandardized ($b$) and standardized ($\beta$) regression coefficients and standard errors (SE) for determinants of impact of event scale and Intrusion and Avoidance subscales: Coastal Alabama residents 12 months after the 2010 BP oil spill

| Independent variables | Impact of events | | | Intrusion subscale | | | Avoidance subscale | | |
|---|---|---|---|---|---|---|---|---|---|
| | $b$ | $\beta$ | SE | $b$ | $\beta$ | SE | $b$ | $\beta$ | SE |
| *Vulnerability variables* | | | | | | | | | |
| Renew. resource ties | 6.60*** | 0.17 | 1.36 | 3.32*** | 0.16 | 0.75 | 3.28*** | 0.17 | 0.77 |
| Exposed to oil | 6.09*** | 0.16 | 1.26 | 3.33*** | 0.16 | 0.70 | 2.76*** | 0.14 | 0.72 |
| *Resource loss variables* | | | | | | | | | |
| Economic future | 3.74*** | 0.26 | 0.53 | 2.20*** | 0.28 | 0.29 | 1.54*** | 0.21 | 0.30 |
| Economic loss | 2.06** | 0.10 | 0.74 | 1.30** | 0.11 | 0.41 | 0.76 | 0.07 | 0.42 |
| *Risk perception variables* | | | | | | | | | |
| Family health | 2.03*** | 0.14 | 0.56 | 1.47*** | 0.18 | 0.31 | 0.56 | 0.07 | 0.32 |
| Dispersants | 0.55 | 0.03 | 0.59 | 0.47 | 0.05 | 0.33 | 0.07 | 0.01 | 0.33 |
| Air quality concern | 2.28** | 0.15 | 0.66 | 0.88* | 0.10 | 0.36 | 1.40*** | 0.18 | 0.37 |
| Seafood safety | 0.67 | 0.01 | 0.55 | −0.01 | −0.01 | 0.30 | 0.07 | 0.01 | 0.31 |
| Oiled harvest areas | 1.82** | 0.11 | 0.62 | 1.02** | 0.11 | 0.34 | 0.80* | 0.09 | 0.35 |
| *Recreancy variables* | | | | | | | | | |
| BP Corporation | −1.65* | −0.10 | 0.67 | −0.96* | −0.11 | 0.37 | −0.69 | −0.09 | 0.38 |
| Ken Feinberg | 1.57* | 0.10 | 0.65 | 0.65 | 0.07 | 0.36 | 0.92* | 0.11 | 0.37 |
| Federal courts | −1.98** | −0.14 | 0.67 | −1.11** | −0.14 | 0.37 | −0.87* | −0.12 | 0.38 |
| Federal government | 1.32 | 0.09 | 0.74 | 0.38 | 0.05 | 0.41 | 0.95* | 0.12 | 0.42 |
| Ala. State Gov't | 1.66* | 0.11 | 0.66 | 0.88* | 0.10 | 0.36 | 0.79* | 0.10 | 0.37 |
| Local government | −0.60 | −0.04 | 0.58 | 0.07 | 0.01 | 0.32 | −0.67* | −0.09 | 0.33 |
| *Demographic and control variables* | | | | | | | | | |
| Age | −0.04 | −0.03 | 0.05 | −0.01 | −0.01 | 0.03 | −0.03 | −0.05 | 0.03 |
| Years in community | 0.07 | 0.07 | 0.04 | 0.50* | 0.09 | 0.02 | 0.02 | 0.04 | 0.02 |
| Income | 0.50 | 0.06 | 0.33 | 0.30 | 0.06 | 0.18 | 0.20 | 0.04 | 0.19 |
| Education | 0.05 | 0.01 | 0.49 | 0.38 | 0.05 | 0.27 | −0.33 | −0.05 | 0.28 |
| Gender | −0.74 | −0.02 | 1.27 | −0.15 | −0.01 | 0.70 | −0.59 | −0.03 | 0.72 |
| Race/ethnicity | 2.31 | 0.04 | 2.08 | 1.56 | 0.05 | 1.15 | 0.75 | 0.02 | 1.18 |
| Marital status | −2.64 | −0.06 | 1.54 | −2.04* | −0.09 | 0.85 | −0.60 | −0.03 | 0.87 |
| Minors in household | −1.84 | −0.05 | 1.40 | −0.83 | −0.04 | 0.77 | −1.01 | −0.05 | 0.79 |
| County | 4.88*** | 0.13 | 1.36 | 2.48** | 0.12 | 0.75 | 2.40** | 0.12 | 0.77 |
| Constant | −24.74*** | | 6.79 | −17.56*** | | 3.74 | −7.18** | | 3.84 |
| Adjusted $R^2$ | 0.465 | | | 0.469 | | | 0.360 | | |
| $N$ | 608 | | | 608 | | | 608 | | |

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$ significance (two-tailed)

Baldwin County. The adjusted $R^2$ values demonstrate that the models fit well as 47 % of the variance in IES, 47 % of the variance in Intrusion, and 36 % of the variance in Avoidance were explained by combined predictors.

## 7 Discussion

The inevitable comparisons between the Exxon and the BP oil spills began immediately after the *Deepwater Horizon* sank and breached the oil well one mile below the surface of the Gulf of Mexico. Such comparisons noted similarities and differences with respect to the disaster context and extent of ecological, sociocultural, and psychosocial impacts. Key similarities include as follows: issues of recreancy and the human causes of each disaster; extensive ecosystem damage and uncertainty regarding long-term impacts and recovery; vulnerable groups and communities with strong social, cultural, and economic ties to the environment; uncertainty related to long-term ecosystem damage and recovery; economic disruption, particularly within industries reliant on damages ecosystems, as well as from a 'money spill' associated with clean up and mitigation activities; an emergence of collective stress; psychosocial trauma; and stress from dealing with complex and impersonal bureaucratic and judicial systems for compensation and justice (Ritchie et al. 2011).

At the same time, there are differences between the two disasters. There are distinctions in the size and scope of the spills, the type of oil spilled, and the causes of and responses to the respective disasters. There are also differences with respect to the geographical, sociocultural, demographic, and economic contexts. For example, the Gulf Coast has an exponentially larger and denser population compared to oiled regions of Alaska; thus, more people experienced the BP spill first hand. Moreover, media coverage of the BP spill was more intense and social media, which did not exist when the EVOS occurred, and other advancements in communication gave the general public greater accessibility to information and placed responsible parties under higher levels of scrutiny.

The Gulf Coast is much more economically diverse and complex than the Prince William Sound region—a reality that makes it more difficult to discern spill-related economic impacts from broader economic trends. Included in this diversity are the mixed economy of commercial fishing and offshore oil communities, particularly in Louisiana, and the mixed economy of coastal Alabama where Baldwin County is dependent on beaches and tourism and south Mobile County is dependent on commercial fishing and seafood processing. Moreover, the economic recession that began in 2008 and lingering socioeconomic impacts of Hurricane Katrina influenced how the BP disaster was experienced by Gulf Coast communities and residents.

Despite these differences, our research reveals similar patterns of psychosocial stress among community residents following both oil spill disasters. Our analysis reveals consistent factors related to the stress in Cordova and coastal Alabama—vulnerability in the form of exposure to the oil spill event and pre-existing ties to renewable resources damaged/threatened by the spill. Notably, because our Alabama sample contained few commercial shrimpers and residents of the South Asian communities in south Mobile County, which are two groups economically and culturally tied to the renewable resources of the Gulf, negative psychosocial impacts of the BP spill found in our analysis may be underestimated.

The two Cordova surveys used a panel design, while the respondents for the two Alabama surveys were selected through random selection. Although panel data provide the best analysis of psychological stress over time, a panel design was not feasible in our study of Alabama; thus, we used a random selection design. The different sample designs may have impacted our results to a point, but the findings are strong in both cases. Given the similarities between the incidents, we strongly believe that our empirical results combined with post-Exxon Valdez policies are useful to informing policy and decision making after the BP oil spill and outweigh a methodological difference in the design of the studies.

Psychosocial stress in Cordova became chronic due to unresolved litigation over a 19-year period and prolonged uncertainty associated with continuing damaged species and resources. Research on chronic psychosocial stress in Cordova has documented that involvement in litigation became more stressful than the spill event itself (Picou et al. 2004). Long-term monitoring of species and resources damaged by the Exxon oil spill has revealed that, 20 years later, only 10 species have 'fully recovered' (EVOSTC 2010). Likewise, long-term sociocultural and psychosocial impacts related to the BP disaster may largely depend on the speed at which litigation is resolved, the degree to which compensation practices are considered fair and just, and perceptions of long-term negative impacts to the Gulf Coast ecosystem (e.g., see Tunnell 2011). In the period between our 2010 and 2011 data collection, residents of coastal Alabama continued to experience concerns about the fairness of the claims process and potential litigation outcomes, as well as uncertainties about long-term ecological damages and recovery. If coastal Alabama continues to follow the EVOS pattern, there is a high likelihood of chronic psychological stress in this geographical area and perhaps for the broader Gulf Coast region, particularly among individuals, groups, and communities that are reliant on injured renewable resources.

Findings from the current study have implications for both basic and applied social science. First, our findings advance theoretical and conceptual understanding of the human impacts of technological disasters. The COR conceptual model of stress is further vindicated as an important framework for identifying salient factors producing stress after a disaster. The extension of vulnerability theory to include exposure to oil and sociocultural ties to damaged/threatened natural resources further pinpoints individuals, groups, communities, and societies susceptible to increased psychosocial stress in the aftermath of a disaster. Perceptions of risk and recreancy are additional stressors to consider when dealing with a disaster. Although not addressed in this research, findings from long-term research on the EVOS suggest that concepts such as social capital loss spirals, corrosive community, collective stress, and secondary trauma may also become evident as individuals, groups, and communities struggle to recover from the BP disaster (Ritchie and Gill 2007).

Second, our findings—particularly those from years of research on the EVOS—can inform mitigation strategies and policies for the BP oil spill. For example, shortly after the BP spill, a peer listener program developed in Cordova to help individuals and the community deal with long-term psychosocial stress was modified and applied to the entire Gulf Coast region (Picou 2011). Furthermore, multiple mental health and social service organizations that emerged after Hurricane Katrina were revived to address spill-related social and psychological stress. An important program, Project Rebound, played a significant role in mitigating psychosocial impacts in both Alabama counties (www.projectrebound.org). More recently, a tentative legal settlement with BP has the potential to resolve most class-action litigation in a relatively timely manner. A component of this settlement is devoted to increasing the mental and behavioral health capacity of coastal parishes/counties along the northern Gulf of Mexico. Indeed, the resources associated with this settlement may mitigate long-term effects and reduce vulnerability to future disasters of all types (www.coastalresourcecenter.org).

Monetary settlements have potential to mitigate psychosocial stress by reducing or eliminating economic loss and concerns for economic future. However, money is not enough. As in the aftermath of the *Exxon Valdez* disaster, long-term ecological recovery and stability of Gulf Coast fishery resources remains uncertain. Gulf Coast commercial fishermen are well aware that the herring population in Prince William Sound did not crash until 4 years after the spill; thus, uncertainty about resource recovery and long-term

ecological impacts seems justified. Moreover, there is uncertainty about long-term health effects of exposure to the spill and dispersants among Gulf Coast communities that was less apparent in Alaska. Given these potentially prolonged uncertainties, there are needs to improve and maintain mental health services throughout the region, monitor psychosocial stress, and evaluate the effectiveness of mental health mitigation strategies in coastal Alabama and other Gulf Coast communities.

Disasters such as the EVOS and BP *Deepwater Horizon* oil spill force a reconsideration of the concept of disaster recovery. Prolonged uncertainty about ecological damages, health effects, and economic recovery combined with unresolved litigation makes it difficult for survivors to reach closure. In the midst of these uncertainties, how do individuals, families, and communities restore sociocultural and psychosocial stability? Or can they? More importantly, how does society recover in a way that diminishes the possibility of such an event reoccurring?

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