2016

Environmental attitudes in the aftermath of the Gulf Oil Spill

Katherine Farrow
Office of Science and Technology, NOAA Fisheries, Silver Spring, MD, kate.farrow@supagro.inra.fr

Ayeisha Brinson
Office of Science and Technology, NOAA Fisheries, Silver Spring, MD

Kristy Wallmo
Office of Science and Technology, NOAA Fisheries, Silver Spring, MD

Daniel K. Lew
Alaska Fisheries Science Center, Resource Ecology and Fisheries Management Division, NOAA Fisheries, Seattle, WA

Ocean & Coastal Management 119 (2016) 128–134

Contents lists available at ScienceDirect

Ocean & Coastal Management

journal homepage: www.elsevier.com/locate/ocecoaman

Environmental attitudes in the aftermath of the Gulf Oil Spill

Katherine Farrow [a, *], Ayeisha Brinson [a], Kristy Wallmo [a], Daniel K. Lew [b, c]

[a] Office of Science and Technology, NOAA Fisheries, 1315 East-West Highway, Silver Spring, MD 20910, USA
[b] Alaska Fisheries Science Center, Resource Ecology and Fisheries Management Division, NOAA Fisheries, 7600 Sand Point Way NE, Seattle, WA 98115, USA
[c] Department of Environmental Science and Policy, University of California Davis, 1 Shields Avenue, Davis, CA 95616, USA

ARTICLE INFO

Article history:
Received 17 November 2014
Received in revised form
21 September 2015
Accepted 5 October 2015
Available online xxx

Keywords:
Environmental attitudes
Environmental disaster
Gulf Oil Spill
New ecological paradigm
Public opinion

ABSTRACT

In the 1960s and 1970's, prominent environmental disasters seemed to mobilize the U.S. public, and many key environmental laws were subsequently enacted. Theories surrounding public opinion formation, however, generally regard single events as unlikely to impact attitudes in a major way. Given the conflicting evidence provided by anecdotal accounts and public opinion theory, we explore whether the Deepwater Horizon oil spill (Gulf Oil Spill) impacted public concern for the environment in the United States. In this study we use data from a national-level survey implemented before and after the Gulf Oil Spill to examine pre- and post-spill environmental attitudes as measured by a subset of the New Ecological Paradigm scale. We find that there is insufficient evidence to suggest that the recent Gulf Oil Spill had a significant impact on environmental attitudes, a result consistent with theories concerning the influence of individual events on public opinion. Additional findings imply that some types of messages are likely to be more effective than others in public communications about the environment.

1. Introduction

On April 20, 2010, an explosion on the Deepwater Horizon oil rig in the Gulf of Mexico resulted in 11 fatalities and would become the largest accidental offshore oil spill in history as nearly 5 million barrels of oil flowed from the damaged well over the next 87 days. In the current age of poor economic performance, persistent political gridlock, and the expired novelty of environmental issues, has the Gulf Oil Spill managed to register in the public consciousness? More specifically, has the disaster impacted the public's perception of the current state of the relationship between society and the environment? Given the magnitude of the Gulf Oil Spill relative to past environmental disasters,[1] we might expect this event to resonate with the American public in a similar way.

Hamilton et al. (2012) found that one quarter of Gulf coast survey respondents reported that their views on other environmental issues changed as a result of the oil spill. This self-reported measure of change in environmental concern was positively associated with the degree of impacts felt by the spill, other recent extreme weather events, gender, education level, and attitudes toward conserving natural resources (Hamilton et al., 2012). However, Grattan et al. (2011) found that both Gulf coast residents who were directly and indirectly affected by the Gulf Oil Spill had similar levels of concern regarding the environment, which suggests that personal exposure to impacts related to the oil spill were not significant factors in changing respondents' opinions regarding the environment.

While these two studies yield insights regarding environmental attitudes after the Gulf Oil Spill occurred, they were unable to empirically demonstrate any shift in attitudes relative to pre-spill levels since attitudes were measured only after the event (Grattan et al., 2011), and changes in attitudes due to the event were self-reported (Hamilton et al., 2012). Indeed, very few studies have tested for opinion change through the elicitation of attitudes both before and after a disaster event, which can be attributed to the unpredictable nature of these events. Exceptions to this include Sunstein (2007) and Lee and Cameron (2008), who both used pre- and post-event attitudinal measures to reveal a decline in public opinion surrounding environmental issues and support for climate change, respectively, following the events of 9/11. Smith (2002) used regression analysis to examine public support for nuclear power over the period from 1973 to 1990 and found that the Three Mile Island nuclear incident resulted in a permanent 12 percent

* Corresponding author. Current affiliation: Montpellier Laboratory for Theoretical and Applied Economics, 2 place Pierre Viala, 34060 Montpellier Cedex 1, France.
E-mail address: kate.farrow@supagro.inra.fr (K. Farrow).

[1] Other notable and widely publicized disasters include Three Mile Island accident in 1979, the failure of a pesticide plan in Bhopal, India, in 1984, the Chernobyl nuclear accident in 1986, and the *Exxon Valdez* oil spill in 1989.

http://dx.doi.org/10.1016/j.ocecoaman.2015.10.001
0964-5691/

loss in support for nuclear power among California residents. Thus, while some research indicates that specific events may impact environmental attitudes, other research finds no evidence for this in the specific context of the Gulf Oil Spill.

In this study, we use a dataset that contains measures of environmental concern collected both before and after the Gulf Oil Spill, which affords us a unique empirical opportunity to investigate opinions surrounding a large-scale environmental disaster. The degree to which this event impacted (or did not impact) public concern for the environment may be considered an indication of both the magnitude and malleability of environmental opinions in the United States, and this information can be useful in crafting public messages designed to encourage support for pro-environmental policies and reduce damage to local resources. Specifically, messages that resonate with the public's pre-existing perceptions may increase the saliency of these messages and thus the degree to which they are internalized.

In examining this issue, we note that the theoretical literature generally emphasizes the dominance of previously accumulated attitudes within the processes of opinion formation, which suggests that the Gulf Oil Spill as a single event is unlikely to have had a significant impact on overall levels of environmental concern in the United States. For example, Stern et al. (1995) find empirical support for a model of attitude formation that depends on the interaction of an individual's widely held values with their expectations regarding environmental outcomes. Within this framework, they emphasize the role of the social and psychological conditions that can render certain values and expectations more salient than others in the evaluation of a particular environmental issue. Alternatively, Wood and Vedlitz (2007) conceptualize opinion formation by proposing that individuals process new information through a filter consisting not only of pre-existing affects and attitudes, but also the accumulation of past information, ideology, social cues, and demographic background. They affirmed this with evidence that opinions are generally stable, though they posit that new information of sufficient significance can still have the capacity to alter already-established opinions. In a similar vein, Bartels (1993) has argued that newly received information must compete with a relatively greater mass of prior beliefs in order to cause an observable shift in opinion.

With respect to our main research question, some evidence suggests that personal experiences may have a significant impact on related attitudes and concerns.[2] Personal experiences of environmental phenomena have been shown to have a significant impact on attitudes towards climate change (Borick and Rabe, 2010), support for general environmental protection (European Commission, 2008), as well as concern regarding severe droughts (Arcury and Christiansen, 1990) and oil spills (Levi et al., 2001; Marshall et al., 2005).

Given that our data also includes more specific measures of concern regarding several threatened and endangered species, we also examine responses to these questions in order to investigate the possibility that the Gulf Oil Spill may have had a significant impact on more concrete concerns for particular marine species, and that the effect of the spill on general levels of environmental concern may be moderated by its effect on specific concerns for wildlife. Taking into consideration the complexity of public opinion formation in practice and the general consensus of the theoretical literature on the stability and endurance of deeply held attitudes, we hypothesize that the Gulf Oil Spill did not have a significant impact on national levels of environmental concern.

To assess the potential change in public opinion, we compare a measure of the New Ecological Paradigm (NEP) scale elicited before and after the Gulf Oil Spill. Originally established by Dunlap and Van Liere as the New Environmental Paradigm in 1978 (Dunlap and Van Liere, 1978), the New Ecological Paradigm scale has become the most widely used measure of environmental attitudes across many fields (Hawcroft and Milfont, 2010; Dunlap, 2008). Moreover, the New Ecological Paradigm compares favorably to five other scales of environmental concern in terms of construct and convergent validity, and overall reliability (Schaffrin, 2011). Within the literature that directly compares pre- and post-event attitudes, many focus on concerns for specific issues such as climate change (e.g. Borick and Rabe, 2010; Shum, 2012; Brulle et al., 2012; Kvalal et al., 2012) or nuclear power (e.g. Smith, 2002). Those exploring changes in more general levels of environmental concern do so in the context of either natural (vs. man-made) environmental disasters such as drought (e.g. Arcury and Christiansen, 1990) or events unrelated to environmental issues such as 9/11 (e.g. Sunstein, 2007; Lee and Cameron, 2008). Our study is distinct from each of these in so far as we examine a general measure of environmental concern elicited before and after a man-made environmental disaster.

In this way, we seek to contribute to the literature on attitudinal change in two important ways. First, our dataset is unique in its timing and scale. The data are the result of a nation-wide survey that was implemented in the United States directly before and after the Gulf Oil Spill, and as such these data allow us to examine environmental attitude change surrounding a high profile environmental disaster in a national sample. Few studies have a similar ability on this scale. Second, whereas the literature to date that empirically tests the impact of significant events on public opinion has either 1) focused on changes in attitudes about specific issues or 2) examined attitudes in the context of natural disasters or disasters unrelated to the environment, we expand the scope of this literature by investigating the impact of a man-made environmental disaster on the public's worldviews about society and the environment more broadly.

2. Empirical methods

We assess differences between pre- and post-Gulf Oil Spill scores constructed from a 10-item NEP scale consisting of the following specific items[3]: 1) we are approaching the limit of the number of people the earth can support, 2) humans have the right to modify the natural environment to suit their needs, 3) when humans interfere with nature it often produces disastrous consequences, 4) human ingenuity will ensure that we do not make the earth unlivable, 5) humans are abusing the environment, 6) the earth has plenty of natural resources if we just learn how to develop them, 7) plants and animals have as much right as humans to exist, 8) the balance of nature is strong enough to cope with the impacts of modern industrial nations, 9) humans will eventually learn enough about how nature works to be able to control it, and 10) if things continue on their present course we will soon experience an environmental catastrophe. We construct a total NEP score by recoding the negative item responses so that a higher score represents a higher level of environmental concern and then summing

[2] However, not all studies have found that personal experiences significantly affect related attitudes (Brulle et al., 2012; Shum, 2012; Grattan et al., 2011).

[3] The NEP statements we use differ slightly from the statements developed by Dunlap et al. (2000). Namely, the original versions of statements 5) and 10) read, respectively: “humans are seriously abusing the environment” and “if things continue on their present course we will soon experience a major ecological catastrophe”.

the ten Likert-type responses. This yields 41 possible score values between 10 and 50.

The data were collected using a national survey that was part of a larger study by the National Marine Fisheries Service to estimate preferences for recovering threatened and endangered marine species (Wallmo and Lew, 2012). Survey design took place over three years and was informed by focus groups, cognitive interviews, and pretesting. The final survey instrument was implemented by Knowledge Networks (now GfK) on a random sample of the Knowledge Networks web panel of U.S. households utilizing a Dillman Tailored Design Method Approach (Dillman et al., 2009) that included multiple contacts using mixed modes (e-mail and telephone).[4] The web survey instrument contained a variety of items including questions about familiarity with the Endangered Species Act, opinions on national spending and hypothetical wildlife management measures, and level of concern for several different endangered species. Participants were also asked to respond to questions from the NEP scale.

The survey was administered in two waves and yielded an overall American Association for Public Opinion Research cooperation rate (COOP1) of 70.8 percent. The first survey was administered beginning in May 2009, while the second was administered beginning in October 2010. Thus, the first survey was administered one year prior to the Gulf Oil Spill, and the second survey was administered six months following the spill. Numerous survey versions containing varying combinations of three endangered species from a set of eight were implemented, but data for this analysis was limited to surveys containing information on the North Pacific Right Whale, the Hawaiian Monk seal, and either the Upper Willamette River or Puget Sound Chinook salmon. As a result, the sample size for this analysis is 1406 observations. Of this sample, 616 surveys were implemented before the Gulf Oil Spill, and 790 were implemented after the spill.

The original New Environmental Paradigm Scale of 1978 consisted of 12 items; however, the revised scale, called the New Ecological Paradigm, contains 15 items (Dunlap et al., 2000). Higher NEP scores correspond to an ecocentric orientation (NEP), indicating that the respondent places priority on the preservation of natural resources, whereas low values indicate an anthropocentric orientation, or the Dominant Social Paradigm (DSP), wherein priority is placed on the utilitarian value of natural resources. We use a simplified version of the revised NEP scale containing ten items. The ten items are a mix of pro-NEP and pro-DSP items and were chosen to reflect the five core aspects of environmental concern from the full 15-item scale: belief in limits to economic growth, anti-anthropocentrism, the fragility of nature's balance, human exemptionalism, and the possible negative impacts of eco-crises (Dunlap et al., 2000). In a meta-analysis of studies incorporating the NEP scale, Hawcroft and Milfont (2010) found that partial (ten-item) NEP scales resulted in significantly lower overall NEP scores. Since we examine differences in NEP scores rather than the magnitude of the scores in isolation, this finding is less problematic for our study. In conjunction with NEP scores, we also include in our analysis a number of variables that previous research has found to be related to environmental attitudes.[5] Sociodemographic characteristics have often been cited as significant predictors of public opinion on a wide variety of topics (Elliott et al., 1997), and we therefore use a number of sociodemographic variables that were available in our dataset in the model. These include education, household head status, race, marital status, employment status, ownership status of living quarters, housing type, access to the internet, presence of children, income, household size, and age.[6]

As a proxy for personal experience with the spill, we include a categorical variable, *POST*, which equals 1 if the survey was completed after the Gulf Oil Spill and 0 otherwise. Additionally, we include the categorical variable *Gulfstate*, indicating whether the respondent resided in a state bordering the Gulf of Mexico, as well as an interaction of *Gulfstate* with *POST* to investigate whether those who live in states bordering the Gulf may have been affected to a greater degree than those who live in more distant states.

Included in the analysis are two additional survey questions designed to elicit concern about threatened and endangered species, as it may be possible that the spill resulted in increased concern specifically for marine species, and that this concern is responsible for changes in overall NEP scores. If this is the case, then any changes in overall environmental concern between the two periods could be moderated, or driven at least in part, by changes in concerns for specific species. These two questions ask respondents to indicate their agreement on a Likert scale (where 1 = strongly disagree, 2 = somewhat disagree, 3 = neither agree nor disagree, 4 = somewhat agree, and 5 = strongly agree) to the statements "protecting threatened species is important to me" and "protecting endangered species is important to me." From these responses, a series of dummy variables were created to indicate if a respondent chose options 1, 2, 4, or 5. We interact each of these species concern variables with *POST* in order to examine the possible impact of the spill on the more specific measures of species concern, thus yielding eight interaction terms. Additionally, because these variables are ostensibly related to environmental concern, their inclusion allows us to minimize any possible omitted variables bias.

We first investigate any difference in average NEP scores between pre- and post-spill responses using a *t*-test. According to the

[4] Using both an address-based and random-digit-dialing sampling methodology, the online panel included both listed and unlisted phone numbers, telephone and non-telephone households, cell-phone-only households, as well as those without computers or internet access. Panel members without internet access were provided with a laptop computer and free internet service. Weighting procedures included a base weight, a panel demographic post-stratification weight, and a study-specific post-stratification weight. A nationally representative sample of U.S. adults (18 and over) who did not participate in previous phases of the project was selected for this survey.

[5] Other determining factors include political affiliation (McCright and Dunlap, 2011), ideology (Safford et al., 2012), urbanization (Elliott et al., 1997), media coverage (Elenbaas et al., 2012), elite cues (Brulle et al., 2012), the degree to which individuals are informed about the issue (De Best-Waldhober, 2011), and macroeconomic factors such as GDP and unemployment rates (Shum, 2012).

[6] The *education* variable is coded 1 for less than high school completion, 2 for high school completion, 3 for some college completion, and 4 for completion of a bachelor's degree or higher. *Household head* indicates if respondents identified themselves as the head of the household. *Race* responses consist of five categories: white: non-hispanic, black: non-hispanic, other: non-hispanic, hispanic, and 2 + races: non-hispanic. *Marital status* is reported as one of the following responses: married, widowed, divorced, separated, never married, or living with partner. *Employment status* consists of seven categories, including working as a paid employee, working as self-employed, on temporary layoff from a job, looking for work, retired, disabled, or not working for some other reason. *Ownership status of living quarters* indicates the method of payment for respondents' current living quarters, and contains the following responses: owned or being bought by you or someone else, rented for cash, and occupied without payment of cash rent. *Housing type* indicates either a one-family house detached from any other house, a one-family house attached to one or more houses, a building with two or more apartments, a mobile home, or a boat, RV, van, etc. *Internet access* is 1 if the respondent has access and 0 if not. *Presence of children aged 0–1, 2–5, 6–12,* and *13–17,* are categorical variables indicating whether children in these age groups live in the household. Originally reported as one of 19 categories, the *income* variable was condensed to five categories for a more parsimonious analysis. These categories are the following: less than $24,999, $25,000 – $49,999, $50,000 – $99,999, $100,000 – $149,999, and $150,000+. *Household size* indicates the number of people reported to be living in the household. *Age* is measured in years.

Table 1
Weighted *t*-tests for significant difference in weighted means of interval scale sociodemographic variables between pre- and post-spill responses.

Variable	Pre-spill mean (*sd*)	Post-spill mean (*sd*)	*t*	*p*-value
Age	46.3 (16.6)	46.1 (16.9)	0.18	0.8597
Income	11.17 (4.21)	10.38 (4.39)	3.35	0.0008
Household size	2.51 (1.35)	2.94 (1.79)	−4.77	<0.0001

Table 2
Weighted Rao Scott chi-square tests for significant difference in weighted means of categorical sociodemographic variables between pre- and post-spill responses.

Variable	χ^2	*p-value*
Gender	0.583	0.4450
Race	6.830	0.1452
Marital status	13.06	0.0228
Education	3.401	0.3339
Employment status	15.01	0.0202
Household head	0.869	0.3512
Ownership status of living quarters	6.853	0.0325
Internet access	1.438	0.2305
Presence of children aged:		
0-1	6.287	0.0122
2-5	7.713	0.0055
6-12	3.693	0.0547
13-17	0.249	0.6178

variable of interest, changes in sociodemographic characteristics between pre- and post-spill responses are also assessed using either weighted *t*-tests or weighted Rao Scott chi-square tests. To account for the possibility that changes in these characteristics may confound observable changes in NEP scores between time periods, we then specify a linear least-squares regression to regress respondents' NEP scores on variables believed to influence environmental attitudes.

3. Results

Across both survey implementations, our sample exhibits a few demographic differences from the general U.S. population. Specifically, compared to American Community Survey (ACS) estimates from 2009 to 2011, our 2009–2010 sample has lower income (with a median income category of $40–49,999 compared to a median income of $51,222 in the ACS survey), a higher median age (46 versus 37), and slightly more education (11.6% in our sample did not complete high school versus 14.7% in the ACS survey). Our sample aligns more closely with the characteristics of the general population with respect to gender, race, and household size.

In accordance with another national-level study measuring NEP values (Johnson et al., 2004), overall NEP scores average above the midpoint score of 30, indicating a slightly eco-centric orientation in our national sample (33.74, $sd = 6.15$). When comparing pre- and post-spill NEP scores using *t*-tests, no significant differences exist among either the group of all states ($t = 1.3865$, $p \leq 0.1656$), Gulf states ($t = 1.6826$, $p \leq 0.0939$), or non-Gulf states ($t = 1.1482$, $p \leq 0.2509$).

Importantly, our pre- and post-spill samples differed demographically; tests for differences between pre-spill and post-spill responses were statistically significant for several sociodemographic variables. Table 1 depicts weighted *t*-test results for interval scale sociodemographic variables, and Table 2 depicts results from weighted Rao Scott chi-square tests for categorical variables. We observe that average income was significantly lower in the later sample. Additionally, higher proportions of post-spill respondents reported that they rented (vs. owned) their current living quarters. Along with these changes, average household size was significantly higher in the later sample, as was the number of respondents who reported living with at least one household member aged 0–1, 2–5, and 6–12. Additionally, the percentage of respondents who indicated that they were unemployed and looking for work rose from 4.3% among pre-spill respondents to 10.9% among post-spill respondents. Regression results are presented in Table 3.[7]

The results indicate that the characteristics of being male, unemployed, and/or disabled have negative impacts on average NEP score. Residing in a Gulf state has a significant negative effect on NEP scores for post-spill responders. In addition, those who somewhat or strongly agree with the statement "protecting endangered species is important to me" exhibit higher average NEP scores than those who neither agree nor disagree with this statement. Curiously, the parameter associated with strong disagreement to this statement is positive and significant. We attribute this to the fact that there were very few responses in this category. As we would expect, those who strongly disagree with the statement that protecting threatened species is important to them also exhibit significantly lower NEP scores than those who neither agree nor disagree with the statement.

POST has no independent effect, supporting the preliminary *t*-test results and suggesting that the Gulf Oil Spill did not directly influence environmental attitudes in the United States. It should be noted that, while we interpret the *POST* variable as representing a disaster effect from the Gulf Oil Spill, it is impossible to disentangle this effect from any other time effects that may have arisen in the period between the first and second survey implementations (e.g., the deepening of the recession, media effects, etc.). However, this term is significant when interacted with the categorical variables for strong disagreement with the statements regarding the protection of threatened and endangered species. This indicates that any effect of the Gulf Oil Spill on general environmental attitudes could be moderated by its impact on more specific concerns for wildlife. These two interaction terms indicate that after the spill, strong disagreement to the protection statement for endangered species significantly lowers average NEP score, while strong disagreement to the protection statement for threatened species significantly raises average NEP score.[8] As before, we attribute this latter unexpected result to the fact that very few responded as strongly disagreeing to the statement regarding threatened species.

In addition to the regression analysis, we compared pre- and post-spill values of each of the ten NEP items separately. The only item within the scale that exhibited a significant difference between pre-spill and post-spill responses for any group (all states, Gulf states, and non-Gulf states) was the statement: "We are approaching the limit of the number of people the earth can support" (Table 4). Interestingly, agreement to this item was significantly *lower* post-spill, indicating that respondents held more optimistic perceptions about the human-nature relationship in the fall of 2010 than in the spring of 2009.

[7] In addition to a linear specification, we also estimated a logged model, which resulted in similar goodness of fit measures and yielded the same qualitative results (adjusted $R^2 = 0.2150$, *F*-value = 13.42).

[8] It is possible that the causal relationship between concern for the environment and concern for specific species, as it is specified in our model, may also operate in the opposite direction. That is to say, it may be that an individual's general concern for the environment leads them to be worried about specific endangered species. Our concern with the appropriateness of the present specification, however, is secondary to our purpose in specifying this particular regression, which is to isolate the potential change in general environmental attitudes that is due to the Gulf Oil Spill event.

Table 3
Regression results for total NEP score.

Variable	Parameter estimate	Standard error	*t* Value	*p*-value
Intercept	30.208	0.957	31.55	<0.0001
POST	1.234	0.761	1.620	0.1053
Household size	−0.193	0.105	−1.840	0.0666
Gender	−1.029	0.304	−3.380	0.0007
Age	0.013	0.012	1.030	0.3020
Employment: Retired	0.095	0.374	0.250	0.7999
Employment: Unemployed or disabled	−1.537	0.545	−2.820	0.0049
Gulf state	−0.203	0.727	−0.280	0.7805
POST*Gulfstate	−1.739	0.884	−1.970	0.0494
Protecting endangered species is important to me:				
Strongly disagree	7.276	2.209	3.290	0.0010
Somewhat disagree	1.049	1.980	0.530	0.5963
Somewhat agree	2.952	0.912	3.240	0.0012
Strongly agree	6.081	1.195	5.090	<0.0001
Protecting threatened species is important to me:				
Strongly disagree	−7.945	2.123	−3.740	0.0002
Somewhat disagree	1.613	2.010	0.800	0.4222
Somewhat agree	1.469	0.861	1.710	0.0883
Strongly agree	1.549	1.153	1.340	0.1794
POST*Strongly disagree that protecting endangered species is important to me	−6.755	2.980	−2.270	0.0236
POST*Somewhat disagree that protecting endangered species is important to me	0.094	2.407	0.040	0.9688
POST*Somewhat agree that protecting endangered species is important to me	−1.622	1.315	−1.230	0.2177
POST*Strongly agree that protecting endangered species is important to me	−2.743	1.697	−1.620	0.1062
POST*Strongly disagree that protecting threatened species is important to me	7.464	2.896	2.580	0.0101
POST*Somewhat disagree that protecting threatened species is important to me	−2.422	2.413	−1.000	0.3157
POST*Somewhat agree that protecting threatened species is important to me	−0.737	1.228	−0.600	0.5486
POST*Strongly agree that protecting threatened species is important to me	2.058	1.624	1.270	0.2054
Education: Some college	−0.325	0.379	−0.860	0.3915
Education: Bachelor's or higher	0.104	0.407	0.260	0.7983
Income: $25,000 to $49,999	0.753	0.440	1.710	0.0873
Income: $50,000 to $99,999	0.097	0.439	0.220	0.8255
Income: $100,000 to $149,999	0.638	0.616	1.040	0.3004
Income: $150,000 +	−1.745	0.783	−2.230	0.0260

Adjusted $R^2 = 0.2236$, *F*-value = 14.07.

4. Discussion

While historical anecdotes imply that environmental disasters influence public attitudes towards the environment, empirical work investigating the determinants of environmental opinions is mixed. Our exploration here provides insufficient evidence that the Gulf Oil Spill significantly impacted environmental attitudes, and these findings are best explained by the theoretical literature on opinion formation. According to this literature, paradigms are relatively stable and require very significant events in order to change in a substantial way (Arcury and Christianson, 1990; Wood and Vedlitz, 2007). Our analysis suggests that the Gulf Oil Spill may not have been significant enough to alter attitudes in the face of concurrent mediating factors such as the macroeconomic climate and shifts in sociodemographic characteristics.

Arcury and Christiansan (1990) also noted that those who subscribe to the DSP may be more likely to see these types of man-made environmental disasters as technological failures only, rather than indicative of any trend that would challenge their current worldview. The prompt and generally effective clean-up efforts, as well as the extensive public relations campaign launched by British Petroleum in the aftermath of the Gulf Oil Spill, may have also limited the impacts felt by the event. Furthermore, the clean-up and public relations campaign may have even reinforced the perception that technology and human ingenuity will ultimately resolve natural resource issues. For those who interpret the Gulf Oil Spill as evidence of a problematic relationship between society and the natural world, the event may have only reinforced their previously high NEP score. If this were the case, we would expect to observe little measurable change in NEP scores between time periods for these individuals. Indeed, it may be that those who are already deeply entrenched in either the DSP or the NEP exhibit little movement on the NEP scale in the face of environmental disasters, and that those who are most influenced by such events are those who are at the outset relatively ambivalent in terms of NEP score. We are unable to explore this possibility ourselves because these data are derived from a between-subjects survey design.

The likelihood estimates assigned to outcomes such as the Gulf Oil Spill are also understood to be subject to an availability heuristic, according to which these estimates increase when the outcome is more vivid, frequent, and recent (Sunstein, 2007). Lack of concern about climate change is often attributed to the workings of this availability heuristic since the impacts associated with long term climatic changes and other “diffuse” environmental problems (such as those measured by the NEP scale) may not be significant enough to impact overall environmental worldviews (Arcury and Christianson, 1990). In short, the theoretical explanation for our results suggests that the Gulf Oil Spill did not constitute an event of sufficient ecological magnitude or social significance to alter broader attitudes about the environment.

While this explanation is supported by theoretical work, the empirical literature also allows for other interpretations. Given that

Table 4
Weighted means and *t*-tests for significant difference in pre- and post-spill responses to: “We are approaching the limit of the number of people the earth can support”.

Group	Pre-spill mean score	Post-spill mean score	
All States	3.27 (1.23) n = 616	2.95 (1.38) n = 790	<0.0001
Non-Gulf States	3.23 (1.28) n = 535	2.99 (1.38) n = 646	0.0027
Gulf States	3.57 (0.82) n = 81	2.76 (1.39) n = 144	<0.0001

economic factors have been shown to negatively impact environmental concern (Elliott et al., 1997; Kahn and Kotchen, 2010; Kvaløy et al., 2012; Shum, 2012), one explanation for why we observe no significant change in environmental concern is that economic worries beyond those conveyed through income levels may well have dominated any environmental concerns arising from the Gulf Oil Spill. While the recent recession officially ended in June 2009, the national unemployment rate peaked at 10% in October 2009, preceding the Gulf Oil Spill by six months. At the time of the second survey in October 2010, the unemployment rate had dropped only slightly, to 9.5% (Federal Reserve, 2013).

Other sociodemographic changes that appear to have occurred (notably increased household sizes and lower levels of education) are also associated with lower NEP scores (Johnson et al., 2004; Hamilton et al., 2012). Considering the changes in these sociodemographic variables as indicative of counterfactual NEP scores suggests that the Gulf Oil Spill could have mitigated what might well have been a sharper decline in environmental concern in the absence of the spill. If this were the case, then the relative stability of NEP scores that we observe between implementation periods allows an alternative interpretation: environmental concern remained stable *in the face of* increased economic concerns during this period.

While environmental concern did not appear to change significantly between implementation periods, we consider this a noteworthy finding given our unique dataset. In contrast to other periods in U.S. history, the Gulf Oil Spill does not appear to have registered in the minds of the public at the level of increased environmental concern. Rather, we find some evidence that optimism regarding the human-nature relationship actually increases in the aftermath of the Gulf Oil Spill. There may be a couple of causes for this particular finding. Since the time frame for the NEP item, "we are approaching the limit of the number of people the earth can support", was unspecified, responses to this question could reflect optimism about the long-term rather than the near-term outlook. Indeed, evidence suggests that environmental issues characteristically surface among individuals' long-term concerns rather than among their immediate concerns (Yeager et al., 2011). Glynn et al. (2009) suggest a similar explanation when faced with surprisingly optimistic survey data regarding opinions about the future of the housing market expressed shortly following the 2008 housing bubble collapse. One could also speculate that our finding serves as evidence of the phenomenon of shifting baselines on the scale of national environmental concern, wherein younger generations are accustomed to lower levels of environmental health and more frequent disasters from the outset of their experience, and thus may not view events such as the Gulf Oil Spill with the same degree of alarm or criticism that older generations have in decades past.

We note that these results contain useful insights for policymakers on federal and local levels. In general, our sample displays a slightly eco-centric orientation that appears to be resilient to change in the face of a large-scale national environmental disaster. While environmental attitudes contribute in important ways to focus public interest in and develop strategies for environmental change, a wealth of evidence shows that not only does new information often fail to substantially alter deeply held attitudes, but also that appropriate attitudes alone are not a sufficient condition for behavior change (Heberlein, 2012). For this reason, efforts endeavoring to change public opinion through educational campaigns may be better directed towards strategies that leverage existing public opinion in order to foster lasting environmental improvements.

Returning to an interesting result noted above, lower post-spill agreement with the statement "we are approaching the limit of the number of people the earth can support" suggests that the post-spill sample felt an increased measure of optimism regarding the human-nature relationship relative to the pre-spill sample. This provides some evidence that the relatively successful clean-up efforts may have indeed improved the public's confidence in society's technical ability to address environmental catastrophes. This implies that policymakers seeking public support in order to advance environmental agendas may do well to emphasize the ingenuity and efficiency of particular policies in addressing environmental dilemmas, rather than simply making appeals to the public to protect the environment. In this way, the framing of environmental policies can serve as a tool for garnering public support. Efforts to encourage environmentally friendly behaviors on local scales could equally benefit through the use of messages that emphasize the effectiveness of these actions, as this attribute also seems likely to coincide with people's apparent trust in human ingenuity to mitigate ecological damage.

Further study on this subject could benefit from an exploration of other factors that may influence the degree to which the Gulf Oil Spill impacted public environmental opinions. While we explore changes in public opinion on environmental issues at the state level, it is possible that this resolution is too coarse to detect geographic patterns that may exist on a smaller scale, such as the possibility that the opinions of those who live close to the coast or use marine resources more frequently were significantly more affected by the spill than the opinions of those who live further inland or do not make as frequent use of the resource. Future work would also benefit from a within-subjects rather than a between-subjects design, which would permit an investigation of whether the magnitude of changes in environmental concern depend in part on initial levels of concern. This would allow the scientific community to explore, for example, if those who are most influenced by environmental events are those who exhibit a relatively neutral initial position on the NEP scale.

Acknowledgments

We would like to thank two anonymous reviewers, as well as Rita Curtis, for their thoughtful comments on earlier versions of this article. We would also like to thank the respondents who participated in this survey for their time and responses. This work was funded by NOAA Fisheries; however the views presented are those of the authors themselves and do not necessarily reflect any position of NOAA or NOAA Fisheries.

References

Arcury, T.A., Christianson, E.H., 1990. Environmental worldview in response to environmental problems - Kentucky 1984 and 1988 compared. Environ. Behav. 22 (3), 387–407.
Bartels, L.M., 1993. Messages received - the political impact of media exposure. Am. Political Sci. Rev. 87 (2), 267–285.
Borick, C.P., Rabe, B.G., 2010. A reason to believe: examining the factors that determine individual views on global warming. Soc. Sci. Q. 91 (3), 777–800.
Brulle, R.J., Carmichael, J., Jenkins, J.C., 2012. Shifting public opinion on climate change: an empirical assessment of factors influencing concern over climate change in the U.S., 2002-2010. Clim. Change 114 (2), 169–188.
de Best-Waldhober, M., Paukovic, M., Brunsting, S., Daamen, D., 2011. Awareness, knowledge, beliefs, and opinions regarding CCS of the Dutch general public before and after information. In: 10th International Conference on Greenhouse Gas Control Technologies, 4, pp. 6292–6299.
Dillman, D.A., Smyth, J.D., Christian, L.M., 2009. Internet, Mail, and Mixed-mode Surveys: the Tailored Design Method. Wiley & Sons, Hoboken, NJ.
Dunlap, R.E., 2008. The new environmental paradigm scale: from marginality to worldwide use. J. Environ. Educ. 40 (1), 3–18.
Dunlap, R.E., Van Liere, K.D., 1978. New environmental paradigm. J. Environ. Educ. 9 (4), 10–19.
Dunlap, R.E., Van Liere, K.D., Mertig, A.G., Jones, R.E., 2000. Measuring endorsement of the new ecological Paradigm: a revised NEP scale. J. Soc. Issues 56 (3), 425–442.

Elenbaas, M., De Vreese, C.H., Boomgaarden, H.G., Schuck, A.R.T., 2012. The impact of information acquisition on EU performance judgements. Eur. J. Political Res. 51, 728–755.
Elliott, E., Seldon, B.J., Regens, J.L., 1997. Political and economic determinants of individuals' support for environmental spending. J. Environ. Manag. 51 (1), 15–27.
European Commission, 2008. Attitudes of european citizens towards the environment. In: Special Eurobarometer, p. 295. http://ec.europa.eu/public_opinion/archives/ebs/ebs_217_en.pdf.
Federal Reserve, 2013. Federal Reserve economic data: civilian unemployment rate. http://research.stlouisfed.org/fred2/series/UNRATE.
Glynn, Carroll J., Lunney, Carole A., Huge, Michael E., 2009. Public perceptions of the U.S. Residential housing market before, during, and after the housing bubble (1990-2009). Public Opinion Q. 73 (4), 807–832.
Grattan, L.M., Roberts, S., Mahan Jr., W.T., McLaughlin, P.K., Otwell, W.S., Morris Jr., J.G., 2011. The early psychological impacts of the Deepwater horizon oil spill on Florida and Alabama communities. Environ. Health Perspect. 119 (6), 838–843.
Hamilton, L.C., Safford, T.G., Ulrich, J.D., 2012. In the wake of the spill: environmental views along the Gulf Coast. Soc. Sci. Q. 93 (4), 1053–1064.
Hawcroft, L.J., Milfont, T.L., 2010. The use (and abuse) of the new environmental paradigm scale over the last 30 years: a meta-analysis. J. Environ. Psychol. 30 (2), 143–158.
Heberlein, T.A., 2012. Navigating Environmental Attitudes. Oxford University Press, New York, NY.
Johnson, C.Y., Bowker, J.M., Cordell, H.K., 2004. Ethnic variation in environmental belief and behavior: an examination of the new ecological paradigm in a social psychological context. Environ. Behav. 32 (6), 157–186.
Kahn, M., Kotchen, M., 2010. Environmental concern and the business cycle: the chilling effect of recession (Cambridge, MA). In: National Bureau of Economic Research.
Kvaløy, B., Finseraas, H., Listhaug, O., 2012. The publics' concern for global warming: a cross-national study of 47 countries. J. Peace Res. 49 (11), 11–22.
Lee, J.J., Cameron, T.A., 2008. Popular support for climate change mitigation: evidence from a general population mail survey. Environ. Resour. Econ. 41 (2), 223–248.
Levi, D., Kocher, S., Aboud, R., 2001. Technological disasters in natural and built environments. Environ. Behav. 33 (1), 78–92.
Marshall, B.K., Picou, J.S., Bevc, C.A., 2005. Ecological disaster as contextual transformation - environmental values in a renewable resource community. Environ. Behav. 37 (5), 706–728.
McCright, A.M., Dunlap, R.E., 2011. The politicization of climate change and polarization in the american Public's views of global warming, 2001-2010. Sociol. Q. 52 (2), 155–194.
Safford, T.G., Ulrich, J.D., Hamilton, L.C., 2012. Public perceptions of the response to the Deepwater horizon oil spill: personal experiences, information sources, and social context. J. Environ. Manag. 113, 31–39.
Schaffrin, A., 2011. No measure without concept. A critical review on the conceptualization and measurement of environmental concern. Int. Rev. Soc. Res. 1 (3), 11–31.
Shum, R.Y., 2012. Effects of economic recession and local weather on climate change attitudes. Clim. Policy 12 (1), 38–49.
Smith, E.R.A.N., 2002. Energy, the Environment, and Public Opinion. The Rowman and Littlefield Publishing Group, Inc, Lanham, MD.
Stern, P.C., Dietz, T., Kalof, L., Guagnano, G.A., 1995. Values, beliefs, and pro-environmental action – attitude formation toward emergent attitude objects. J. Appl. Soc. Psychol. 25 (18), 1611–1636.
Sunstein, C.R., 2007. On the divergent american reactions to terrorism and climate change. Columbia Law Rev. 107 (2), 501–557.
Wallmo, K., Lew, D.K., 2012. Public willingness to pay for downlisting threatened and endangered Marine species. Conserv. Biol. 26 (5), 830–839.
Wood, B.D., Vedlitz, A., 2007. Issue definition, information processing, and the politics of global warming. Am. J. Political Sci. 51 (3), 552–568.
Yeager, David Scott, Larson, Samuel B., Krosnick, Jon A., Tompson, Trevor, 2011. Measuring Americans' issue priorities. Public Opinion Q. 75 (1), 125–138.