

Introduction

News media are an important source for environmental information, especially for local communities (Pew Research Center, 2017; Ashmore et al., 2016). Compared to television and radio media, newspaper readership coincides with higher levels of knowledge about coastal and ocean issues in the U.S. (Steel et al., 2005). Concomitantly, media coverage of environmental issues influences public discourse and support for conservation actions (Jacobson, 2012; Sampei & Aoyagi-Usui, 2009; Major & Atwood, 2004). When environmental catastrophes occur, like the BP Deepwater Horizon oil spill, news stories about the catastrophe and surrounding events can dominate media coverage and influence public attitudes (Ragas et al., 2014). Thus, the way media presents stories about environmental disasters can influence public interpretation of technical details, policy, and management actions (Cannon et al., 2020; Slovic, 2000). The impact of media on public perception of national events has been seen with the recent COVID-19 pandemic (Barrios & Hochberg, 2020), and has been evident in both environmental catastrophes (Chilvers et al., 2016) and previous public health epidemics (Shih et al., 2008). These media narratives have far-reaching impacts, influencing how society thinks about and responds to national stories (Major & Atwood, 2004).

In recent decades, an estimated 85% of oyster populations have been lost globally (Beck et al., 2011). Major reasons for oyster declines include disease, overharvesting, changes in freshwater input into estuaries (Carranza et al., 2009; Buzan et al., 2009), and erosion from boating and major weather events (Wall et al., 2005). The ecological benefits of oyster reefs are vast (Coen et al., 2007), and oyster restoration projects contribute substantial economic value to nearby communities (Kroeger, 2012). The value of the ecosystem services associated with oyster reefs, such as coastal erosion control, is more significant in the long-term than the value of harvested oysters from the same area (Grabowski & Peterson, 2007).

Recent environmental conservation efforts have focused on the restoration of ecosystems to protect declining natural resources (Marris, 2011). Oyster restoration projects have been identified as a potential solution to the rapid decline of oyster reefs worldwide (Beck et al., 2011; Seavey, et al., 2011; Baggett et al., 2015). Oyster restoration projects on the U.S. Gulf Coast, spanning from Florida to Texas, are characterized by diverse stakeholder perspectives as well as competing values, positions, and interests (La Peyre et al., 2012; D'Anna, 2016). Yet, this range of perspectives may not be captured by media coverage. Although previous research has identified differences in preferences and opinions of stakeholders involved in oyster management projects (Brown, 2019), researchers have yet to examine how news media report on stories about oyster restoration. Although scientists may dominate environmental news (Brewer & Lay, 2013), knowledge sources outside of scientific research are crucial to inform successful restoration as restoration projects are linked to the politics and culture of the areas where they exist (Floor et al., 2018).

The BP Deepwater Horizon oil spill was an environmental disaster (Hall et al., 2012), national news story (Crary, 2010), and notable factor in discussions of fishery declines in the Gulf (Lambert et al., 2010); however previous research has yet to assess how these crucial environmental and social topics are presented to the public. The study presented here fills gaps in the literature by analyzing how oyster restoration has been reported before, during, and after the BP oil spill in the Gulf of Mexico. Through this assessment, the influence of a major environmental catastrophe on media coverage of environmental restoration is examined, as well as its implications for public communications and resource management.

Media Frames and Sources Convey Meaning

A range of disciplines rely on the lens of framing theory to analyze content in both media and policy (e.g., Lakoff, 2010; Steensland, 2008; Anderson et al., 2005). Media frames have the power to impact the public's interpretation of complex issues and, in turn, influence policies, legislation, and conservation campaigns (Dann, 2010; van Vuuren et al., 2014). Many framing studies rely solely on the specific contexts of the research to outline its parameters, such as words, tone, symbols, content, and so on (Scheufele, 1999). More recent analyses have suggested that framing studies should use more specific terminology to help distinguish between different types of framing. Two major types of framing are equivalence framing, which involves manipulating the presentation of information, and emphasis framing, which involves manipulating the content of a message (Cacciatore, et al., 2016). This study focuses on emphasis framing, which prioritizes what themes are used to communicate messages to the public.

Frames help organize social images and concepts, while bringing unique content and guidelines into consideration (Hertog & McLeod, 2001). Frames appeal to individuals by resonating with their core values (Nisbet & Mooney, 2007), and by organizing ideas into a central concept, creating boundaries of the issue being debated (Rohlinger, 2002). Frames consistently carry symbolic power, contextual meaning, and familiarity. Their meanings are static; new information is not likely to significantly alter their structure (Hertog & McLeod, 2001). Their familiarity helps to introduce new concepts by providing an already experienced context. Understanding media frames can help managers and communication specialists understand how to better communicate with media outlets as well as the public about a specific natural resource issue (Lundy et al., 2018).

In addition to framing, selection of sources is central to how media convey meaning. The individuals who are represented by the media through paraphrasing or a direct quote define the central issues of a story. Therefore, the sources that reporters choose to include in their stories are the individuals who are best represented by media coverage, especially if they are quoted directly (Trumbo, 1996). If these sources are included in the beginning of a story, they are called the "primary definers" of the story (Voyer et al., 2013). The sources used in news media have also been linked to specific kinds of frames. For example, in climate change reporting, scientists are associated with stories that highlight the problems of climate change, while politicians are more likely to be linked to stories about solutions and judgments of the problem (Trumbo, 1996). More recent research has shown that media coverage of climate change contributes to the dynamics of social relationships between the sources included – such as scientists and policy actors – and the public (Boykoff & Boykoff, 2007; Stecula & Merkely, 2019).

While previous communication studies have assessed public knowledge and concern about environmental issues (Gelcich et al., 2014), as well as the effectiveness of conservation campaigns (Bennett and Dearden, 2014), the role of mass media outlets in disseminating information about environmental impacts has been less studied (Thompson-Saud et al., 2018). This has important implications for natural resource management as previous research has shown that promoting a greater understanding of conservation issues can serve as an important tool to support effective management and outreach (Jacobson et al., 2012).

Newspaper Coverage of Environmental Disasters

Newspapers are a major source of risk information for environmental catastrophes; however, their impact is conditional upon the amount of trust news outlets have developed with their audiences (Fiske & Dupree, 2014; Trettin & Musham, 2000). Newspapers report on risk if their reporters feel the situation is urgent (Wakefield & Elliott, 2003). Risk perception is socially constructed (Sjöberg, 2000), and the risks associated with environmental catastrophes are dependent upon the reporter's evaluation of the urgency for the issue, which draw from the daily experiences and opinions of the reporter's social network (Phillimore & Moffat, 1994).

Because disasters, both natural and industrial, are uncommon events in a typical news cycle, journalists are not well-equipped to cover them. Reporters traditionally cover catastrophes as isolated events without delving into the contextual details that contributed to their occurrence (Smith, 1992). Journalists may have difficulty identifying sources and face logistical problems of traveling to disaster areas, which are typically rural areas that may be unfamiliar. Journalists tend to make more ethical decisions in their reporting when they identify with the places and sources they cover (Correa, 2009), suggesting that local reporters may be more likely to cover stories from diverse perspectives.

These barriers make it difficult for journalists to achieve the ideal of presenting a balanced truth to the public – an obligation outlined by social responsibility theory. A social responsibility framework was originally promoted by the Commission on Freedom of the Press (1947), and scholarship has continued to use this theory to interpret journalism's role in democratic society (Middleton, 2009; Hanitzsch, 2005; Gunaratne, 2006). The theory asserts that the primary responsibility of journalists is to provide the public with an accurate understanding of the truth so the public can participate in democracy in an informed manner. Providing a diversity of viewpoints is an essential part of this process so that readers can make up their own minds about issues that concern the public. This implies that the diverse stakeholders involved in ecosystem management efforts like oyster restoration should be represented.

This study uses the quantity of coverage theory to focus on the impact of a topic's prevalence on public awareness. The theory suggests that news organizations influence public perception of environmental risks more through the quantity of coverage and repetition of simple images than by presenting detailed content (Mazur & Lee, 1993). This theory can be compared to agenda setting, which suggests that the importance media places on specific issues correlates with the salience of those issues in the minds of mass media audiences (McCombs & Shaw, 1972). Like agenda setting, quantity of coverage relies on the attention of audiences—individuals must be attuned to a message to be influenced by it. However, for framing effects to take hold, audiences need more than mere exposure. They need to process news information to understand the nuances of how the message has been framed (Scheufele & Tewksbury, 2007). This reliance on news processing is one reason why this study emphasizes the role of primary definers when analyzing sources, as the messages those sources represent are more accessible and elaborated than other sources included in a news article.

As the number of news stories about an environmental risk increase, so does both public concern and government action over the issue (Leal et al., 2015). The quantity of coverage theory posits that nearly all environmental risk stories are brought into public awareness by a small group of major news organizations, and public interest is maintained if journalists continue reporting on the issue. When the possibility of either danger or uncertainty is presented, newspaper audiences care less about the details of the story and simply retain the perception of

risk (Mazur & Lee, 1993). With this in mind, news audiences were likely to understand the sense of danger and uncertainty of the BP oil spill from news coverage without comprehending the specific causes and impacts of the catastrophe.

The BP Deepwater Horizon oil spill, which began in April 2010 in the Gulf of Mexico is considered one of the worst oil spills in international history (Hall et al., 2012). The spill was a major news story in 2010 (Crary, 2010) and sustained public attention for over six months (Ragas et al., 2014). The catastrophe was covered differently in local and national newspapers and between states (Lewis, et al., 2012). However, the impact of the spill on news coverage of long-term natural resource management issues affected by the disaster, such as oyster restoration, has not been assessed.

The BP spill instigated discussions of fishery declines across the Gulf (Lambert et al., 2010) as well as consumer trust in the safety of Gulf seafood (Gorham et al., 2016). To facilitate reparations after the spill, an estimated 80% of civil penalties dedicated by the RESTORE Act (totaling \$5.3 billion) were allocated to the Gulf Coast Ecosystem Restoration Trust Fund, which worked to restore natural resources and fishing industries in the Gulf of Mexico (NOAA, 2017). Restoration programs are one of the most significant management actions employed to mitigate oyster reef declines (Beck et al., 2011), yet it is unclear how restoration of at-risk ecosystems is portrayed in news media. The restoration of oyster reefs in the Gulf of Mexico and the impact of the BP Deepwater Horizon oil spill offer an ideal case to compare how newspapers represent an important environmental issue in varying timeframes of urgency and uncertainty.

The social dynamics of oyster management in the Gulf of Mexico make this analysis important, given the diverse stakeholder groups impacted: oyster harvesters, coastal managers, seafood dealers, scientists, and natural resource users (including individuals living on or near the coast). Restoring oyster reefs is complex when considering the ongoing conflicts between those who rely on oysters for harvest and those who value the ecosystem services that oyster reefs provide. Although there is a consensus among stakeholders that oyster communities should be restored, reasons for supporting restoration projects differ. Local oyster harvesters tend to support reef restoration to enhance harvesting, while coastal managers and scientists are more concerned with the ecosystem services provided by oyster reefs and favor protection in no-harvest sanctuaries (La Peyre et al., 2012; D'Anna, 2016).

The purpose of this study was to assess how oyster restoration has been represented in newspaper media before, during, and after a major environmental catastrophe, the BP Deepwater Horizon oil spill, providing insight into the influence of mass communication on public perception of natural resource management. The study addresses three research questions and associated hypotheses informed by relevant communications theories. This study is significant in its approach to analyzing how environmental disasters influence news coverage of natural resource issues, revealing important trends in the voices media use to represent environmental management and discussing implications for communications specialists.

Research Questions

(1) How are efforts to restore oyster reefs represented by local newspapers from five U.S. Gulf states versus national news media?

(H1) Local media will provide more diverse frames and sources than national media.

(2) How are the types of sources quoted in stories about oyster restoration associated with types of article frames?

- (H2) Sources and frames will reflect previously documented connections between scientists and the environment and managers with political and economic frames.
- (3) How do frames and sources in oyster restoration news stories change when an environmental disaster occurs?
- (H3) The frequency of stories published about oyster restoration and the diversity of sources will increase during and after the spill.

Methods

Data Sample and Collection

A quantitative content analysis was used to identify article frames and types of sources used by media outlets. Eighteen local newspapers were analyzed. Local newspapers were defined as regional newspaper outlets with news coverage targeted toward local communities. The top three papers with the greatest number of articles on the topic were chosen in each Gulf state. Florida was an exception to this sample because only papers on the East Coast resulted from the initial content search. To include coverage of Gulf Coast papers as well, the top six papers from Florida were included in the sample. The East Coast Florida sample ($n = 215$) displayed similar patterns to the West Coast Florida sample ($n = 63$) with regards to the article frame, source, organization, and time published in relation to the BP spill. Three national outlets with the highest circulation nationwide, *The New York Times*, *The Wall Street Journal*, and *USA Today*, were also analyzed (Cision Media Research, 2019).

A total of 1,020 articles were identified through searches in Access World News, a comprehensive database of worldwide news publications, with the keywords “oyster restoration,” “Gulf,” and the name of each state for local papers. National papers accounted for 71 articles, while local newspapers provided 949 articles. These were screened for the presence of an identifiable frame (based on the codebook developed for this study). Articles excluded from the analysis ($n = 257$) met following criteria: a) the article had no clear article frame, and/or b) the article did not contain sources. For example, many articles excluded were community calendar announcements advertising local events. The resulting analytic sample had 763 articles with 68 national and 695 local articles.

A codebook with operational definitions was developed to aid in the clear identification of frames. The codes were established before the analysis began. Codes for sources and frames were developed from a preliminary analysis of newspaper coverage on oyster restoration projects as well as from relevant academic literature. Only quoted sources were coded. Sources that were referred to without direct quotes were not included in the analysis. The first quoted source was solely used in the analysis for two reasons: a) the sample size of the second and third quoted sources was too small for the analysis, and b) the first quoted source, called the primary definer (Voyer et al., 2013), has been determined to by previous literature to be the most salient source, setting the tone for the content that follows in news articles. Frames were coded to represent the overall topic of the article, which was based on the headline and the first two paragraphs of the article. Frame categories were designed to capture the variety of approaches used to present information on oyster restoration. The presence of key topics (pressures on oysters, ecosystem services, and management approaches) were also coded but were not included in the final analysis due to a small sample size.

Researchers underwent a four-month training phase before the coding for the analysis began. The training phased included exposure to examples of articles representing each frame

and code, as well as practice coding sessions. Intercoder reliability (Wimmer and Dominick, 2013) was calculated between two coders. Scott's Pi (Scott, 2009; Lombard et al., 2002) values ranged from .63 to .89 for variables used in analyses. Values around and above .70 are considered reliable (Macnamara, 2005). Given this criterion and the intensive training procedure used for coders, the range of values for intercoder reliability was deemed acceptable for this analysis.

Data Analysis

Article frames included six different categories: environmental, economic, political, community, tourism, and harvest/seafood. Because of the large number of categories included in the article frame variable, separate models were used to test the three most coded frames (environmental, economic, and community). Data analysis focused on the relationships between article frames, sources, organizations, and topics relevant to restoration in newspaper articles. Binomial logistic regressions were used to analyze the influence of source and the date in relation to the BP spill on article frame. Assumptions for logistic regression, including assumptions regarding multicollinearity, independence, linearity, and sample size, were met. Article frame was coded into two categories for each model: the frame being tested (i.e., environmental, economic, or community) and all other frames. Categories were combined to facilitate an analysis with multiple categorical variables in the logistic regression models. The source variable was collapsed into four categories: fishers, managers, scientists, and other. The BP date variable was divided into three categories: before, during, and after the spill. Articles were coded by how their publishing date corresponded to the 2010 BP Deepwater Horizon oil spill. Articles were limited to two-year time periods before (April 10, 2008 – April 9, 2010), during (April 10, 2010 – April 9, 2012), and after (April 10, 2012 – April 11, 2014) the 2010 Deepwater Horizon oil spill event.

Results

The study goal was to analyze how newspaper coverage of oyster restoration changed during an environmental disaster and to assess prevalent article frames and primary sources quoted.

Question 1: How are efforts to restore oyster reefs represented by local newspapers from five U.S. Gulf states versus national news media?

Of the total 763 articles, environmental frames ($n = 375$, 49.2%) were coded most frequently, followed by economic ($n = 189$, 24.8%), community ($n = 132$, 17.3%), political ($n = 32$, 4.2%), harvest/seafood ($n = 20$, 2.6%), and tourism ($n = 15$, 2.0%). Statistical analyses of frames focused on environmental, economic, and community frames. The analysis focused on the primary definers coded in each article. Primary definers were coded as the first person quoted in the article (Voyer et al., 2013). For local articles, the primary definers coded most frequently were natural resource managers ($n = 268$, 35.2%), followed by other sources ($n = 105$, 23.5%), scientists ($n = 44$, 5.9%), and fishers ($n = 30$, 4.3%). Similar trends were seen for national articles as well (Table 1).

Table 1

Description and frequency for primary definers of news stories on oyster restoration

Type of Source	Description	Local		National	
		<i>n</i>	%	<i>n</i>	%
Managers		244	35.2	24	35.3
Manager	Managers and directors	244	35.2	24	35.3
Scientists		41	5.9	3	4.4
Scientists	University and government	41	5.9	3	4.4
Fishers		30	4.3	9	13.2
Oyster harvesters	Commercial	11	1.6	8	11.8
Other fishers	Commercial and recreational	10	1.1	1	1.5
Seafood industry	Processors & distributors	7	1.0	0	0
Aquaculturists	Scientists and harvesters	2	0.3	0	0
Other		163	23.5	23	33.8
Other	Other occupations	90	12.9	15	22.1
Politician	Mayors, governors, etc.	67	9.6	7	10.3
Lawyers	Litigate on various areas	4	0.6	1	1.5
Journalists	Work for variety of media	2	0.3	0	0
Not available	No source	217	31.2	9	13.2
Total		695	100	68	100

Note. $n = 763$ articles. Local articles, $n = 695$; national articles, $n = 68$. Bold and italicized categories describe the collapsed categories used for statistical analysis. Articles coded as “not available” were not included in analysis of source variable.

Table 2 shows frequency and percentages of sources within each article frame. Managers were most frequently coded within all frames, except political (politicians were the highest coded category) and seafood/harvest (fishers were the highest coded category). Sources were also coded by their employer, in order to further differentiate source type. Sources who were self-employed were coded as business; those who were identified by their employment were coded as other. Government sources were most frequently quoted ($n = 253$, 33.2%) and non-profit organization sources were second ($n = 127$, 16.6%). Fishers and seafood industry representatives were coded as business ($n = 89$, 11.7%). Other ($n = 55$, 7.2%) and university ($n = 11$, 1.4%) sources were quoted less often.

Table 2

Frequency of frames represented in newspaper stories by primary definers

<i>Newspaper Frames</i>	Manager		Other		Politician		Scientist		Fisher		Seafood		Total <i>n</i>
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	
Environmental	133	49.6	49	43.0	34	45.9	39	88.6	4	36.4	2	28.6	261
Economic	87	32.4	31	27.2	27	36.5	2	4.5	0	0.0	2	28.6	149
Community	31	11.6	22	19.3	1	1.4	3	6.8	0	0.0	0	0.0	57
Political	8	2.9	8	7.1	10	13.5	0	0.0	0	0.0	0	0.0	26
Seafood/Harvest	4	1.4	3	2.6	0	0.0	0	0.0	7	63.6	3	42.9	17
Tourism	5	1.8	1	0.9	2	2.7	0	0.0	0	0.0	0	0.0	8
Total	268	100	114	100	74	100	44	100	11	100	7	100	563

Note. $n = 537$ articles. Includes local and national articles with at least one source quoted included.

Articles were coded by the state of the newspaper in which they were published. The largest number of articles came from Alabama ($n = 188$, 24.6%), followed by Florida ($n = 178$, 23.3%), Louisiana ($n = 172$, 22.5%), Mississippi ($n = 94$, 12.3%), and Texas ($n = 63$, 8.3%).

National articles made up 9% of the sample ($n = 68$). National articles were not found to be significantly different from local articles in terms of framing and sources. H1 was not supported; there was not a significant difference between local and national stories.

Question 2: How are the types of sources quoted in stories about oyster restoration associated with types of article frames?

Source type was a significant predictor of an environmental article frame, $\chi^2(3, N = 763) = 34.806, p < .001$, as well as an economic article frame, $\chi^2(3, N = 763) = 25.326, p < .001$. The strongest predictor of an environmental frame was the presence of a scientist as a source, recording an odds ratio of 7.9. This indicated that articles with scientists as a source were 7.9 times more likely to have an environmental frame than articles with managers as a source ($p < .001$). Articles with managers were 1.6 times more likely to have an economic frame than articles with other sources ($p = .007$). Source was not a significant predictor for articles with a community frame, and fishers were not significant predictors of any article frame. H2 was supported as this study found that previously documented connections between sources and articles frames (i.e., scientists with environmental frames and managers with economic frames) were consistent in newspaper articles analyzed.

Question 3: How do frames and sources in oyster restoration news stories change when an environmental disaster occurs?

Of the 97 news stories published prior to the BP disaster, nearly half (46.4%) had an environmental frame. The percent of news stories with an environmental frame increased to 51.5% during the spill and slightly decreased to 47.2% after the spill. News stories with an economic frame also increased from 12.4% before the spill to 20.7% and 33.7% during and after the spill, respectively. Finally, stories with a community frame peaked during (22.3%) the spill and were less frequent before (19.6%) and after (10.6%) (Table 3).

Table 3
Description and changes in frequency of frames represented in news stories by BP time period

		Description	Before		During		After		Total
			<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	
Newspaper Frames									
Environmental		Biological, ecological info	45	46.4	187	51.5	143	47.2	375
Economic		Grants, budgets, financial impact	12	12.4	75	20.7	102	33.7	189
Community		Volunteering, community events	19	19.6	81	22.3	32	10.6	132
Political		Legislation, political initiatives	11	11.3	9	2.5	12	3.9	32
Seafood/Harvest		Restaurants, seafood industry	7	7.2	5	1.4	8	2.6	20
Tourism		Events, tourism impacts	3	3.1	6	1.7	6	2.0	15
Total			97	100	363	100	303	100	763

Note. $n = 763$ articles. Includes all local and national articles.

The BP spill was found to be a significant predictor of two types of article frames in a binomial logistic regression: economic, $\chi^2(2, N = 763) = 24.704, p < .001$, and community, $\chi^2(2, N = 763) = 10.227, p = .001$. No significant values were found for the environmental frame. Articles published during the spill were 2.8 times more likely to have an economic frame than those published before ($p < .001$), and articles published after the spill were 5.1 times more likely to have an economic frame than those before ($p < .001$). Articles published during the spill

period were 2.06 times more likely to have a community frame than those published before ($p < .05$), and articles published after the spill were 2.4 times more likely to have a community frame than those published before.

The occurrence of the spill was associated with an increase in the quantity of stories written about oyster restoration (Table 3). The largest percentage of articles was published during the period of the spill (47.6%), and more articles were published after (39.7%) than before (12.7%). The number of stories that included quoted sources also increased after the spill (Table 4). The diversity of sources quoted increased as well, especially in terms of scientists used as primary definers in stories with environmental frames. H3 was supported; this study saw an increase in the frequency of stories and diversity of sources during and after the spill.

Table 4

Changes in frequency of primary definers represented in news stories by BP time period

	Before		During		After		Total
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	
Newspaper Sources							
Manager	33	50.8	132	52.0	103	47.2	268
Other	16	24.6	55	21.7	43	19.7	114
Politician	10	15.4	21	8.3	43	19.7	74
Scientist	1	1.5	28	11.0	15	6.9	44
Fishers	2	3.1	15	5.9	13	5.9	29
Seafood Industry	3	4.6	3	1.2	1	0.5	7
Total	65	100	254	100	218	100	537

Note. $n = 537$ articles. Includes local and national articles with at least one source quoted included.

Discussion

In the U.S., environmental topics gained attention in the public discourse in the 1960s but did not become prevalent in news media until the 1980s (Allan et al., 2000). A study of *Time* magazine covers from 1923 to 2011 found that the presence of environmental topics has increased throughout the years. Still, only 174 of 4,653 magazine covers studied (3.7%) contained images representing environmental issues (Meisner & Takahashi, 2013). The absence of environmental topics in news media is important to consider because 54% of Americans rely on general news coverage for information about scientific topics (Gottfried & Funk, 2017). Despite this reliance, only 28% of Americans trust that general news presents accurate coverage of science most of the time or more than half of the time (Gottfried & Funk, 2017).

One reason for this distrust may stem from the fact that some newspapers have cut local coverage of science and the environment, limiting the access to the information that communities need to understand and adapt to environmental changes (Nisbet & Scheufele, 2009). Local perspectives are particularly underrepresented by news media (Remillard, 2011; Rebich-Hespanha et al., 2015). To strengthen the effectiveness of information-based communication, previous researchers have suggested that communication strategies move beyond top-down models to incorporate multiple public understandings (e.g., goals, values, and motives) of localized issues into communication messages (Nisbet & Scheufele, 2009). In addition, conservation communication has been identified as a topic that needs careful attention by communicators to ensure that audiences are interpreting messages clearly and accurately (Wu et al., 2018).

This study addresses a gap in the analysis of news coverage about at-risk ecosystems (Voyer et al., 2013). The results indicate that one dominant group, resource managers, acted as

the primary definer in stories about oyster restoration on the Gulf Coast, limiting the opportunities to promote multiple understandings and perspectives of the issue. This study focused on the first quoted source, which allowed the researchers to link source type with frames used for each story. Previous research has suggested that the first quoted source is the most salient source included in news articles (Voyer et al., 2013). Given that information, the data presented on primary definers captures the sources that are most accessibly presented and memorable for newspaper audiences, however limitations exist on capturing every source quoted.

Oyster restoration is characterized by its importance to multiple stakeholder groups, an emphasis on a variety of stakeholder interests is essential to facilitating mutual understanding of this management approach. The need for inclusive news coverage mirrors the need for inclusive resource management. Without it, potentially innovative solutions to complex issues go unheard. This need is expected to become stronger in coming years. In a future characterized by climate-change issues and environmental uncertainty, local communities will have an increased demand for reliable news about environmental challenges (Nisbet & Scheufele, 2009).

In this study, the publication of newspaper stories about oyster restoration increased immediately after the BP spill, which, according to the quantity of coverage theory (Mazur & Lee, 1993), served to increase public awareness of the spill. Similar to discussions of agenda setting, the quantity of coverage theory suggests that newspapers can choose the issues of importance and the frames associated with an issue by repeatedly publishing stories that represent those news angles. After the BP spill occurred, issues associated with oyster restoration became more of a priority in newspaper coverage, increasing the importance of the topic to newspaper audiences as well. However, more frequent coverage does not necessarily mean that audiences grasp the intricacies of environmental stories. The prevalence of stories during the spill suggests that local communities were likely aware of the disaster's occurrence and/or the presence of oyster restoration as a potential solution. A simple increase in coverage does not necessarily suggest that detailed information about the impacts of the spill on oyster reefs was effectively communicated to newspaper audiences.

Frames

Stories of oyster restoration on the Gulf Coast were dominated by environmental frames. The presence of an environmental catastrophe significantly influenced how newspapers framed stories about oyster restoration, revealing how the priorities of reporters as well as the topics and frames that they perceived to be most urgent (Phillimore & Moffat, 1994). This finding was consistent with previous research, which also found that coverage of the spill was primarily environmental in Gulf newspapers (Lewis et al., 2012).

Past research on oil spill disasters other than the BP spill have also found that news media covered environmental consequences more than socioeconomic ones (Anderson & Marhadour, 2007). A reliance on the environmental frame in covering environmental disasters can be understood by considering where reporters received information about the spill, and which topics were considered most important by those information outlets. In this study, resource managers and government officials were primary definers—leading to stories that focused on impacts to the resources managed by these individuals. Government sources made up 33.2% of sources analyzed in this study. Previous research has found that when newspaper audiences read stories with multiple kinds of sources, they perceive government sources to be more credible than in

stories that only included government sources, and they rated the stories to be more interesting overall (Cozma, 2006).

A rise in economic articles was seen during the spill, along with a sharp increase in community stories as well. This spike in community stories can be interpreted through the lens of the social responsibility theory. The finding suggests that both local and national newspapers may have recognized the need to cover the stories of local communities immediately after the spill occurred. Economic stories continued to increase after the spill, as community and environmental frames decreased to proportions at or below the before-the-spill rate.

Previous research on media coverage of crisis communication has outlined three distinct stages: 1) the period just before and immediately after the crisis event, which is marked by chaos and lacks an authoritative narrative of the event, 2) the dominant narrative emerges as media correct any errors made during the chaos of the first period, and 3) the long-term perspective of the crisis is emphasized and journalists attempt to help audiences move forward and cope (Graber, 2009). During stage one, marginalized groups have the best chance of being included in media stories (Graber, 2009). With this structure in mind, the increase in community frames could be interpreted as stage one of the process outlined above. The community frame was highlighted before a cohesive authoritative narrative was distributed to media. After the spill, the community frame decreased and the economic frame increased, showing a shift toward the narratives prioritized by government figures and industry representatives.

Sources

Newspaper coverage of oyster restoration from both local and national papers only represented a limited number of stakeholder perspectives. This study focused on primary definers; some differences may be seen in sources quoted that did not act as primary definers. Natural resource managers defined the issue of oyster restoration more than other sources. Natural resource managers were most frequently quoted sources, and natural resource managers were significantly more likely to be used as sources in economic articles than scientists and fishers.

While resource managers were the most frequently quoted sources, reporter reliance on scientists as primary definers became more prevalent after the spill occurred. Scientists were significantly associated with environmental articles. In the modern era of science reporting, journalists often develop collaborative relationships with scientific sources, many of whom have their own blogs or online publishing presence (Fahy & Nisbet, 2011). Because of this, scientific information is more accessible and familiar to journalists who have existing relationships with scientific sources. Scientists are preferred sources for stories about environmental topics (Brewer & Lay, 2013), and about restoration particularly (Floor et al., 2018), while government and industry sources are seen as untrustworthy and non-credible by the public when communicating environmental messages (Cozma, 2006).

News media tend to focus on events and news stories that are familiar, proximal, and relevant to their audiences (Anderson & Marhadour, 2007). In this study, however, the inclusion of community perspectives did not appear to extend to local fishers. Fishers and seafood industry representatives of all types were infrequently used as primary definers by reporters and were not found to be significant predictors of any article frame; thus, their perspectives were less commonly presented to newspaper audiences. Previous studies have uncovered evidence of source bias by newspaper reporters, showing a tendency to focus on sources that are traditionally considered more credible (Detjen et al., 2000) and are not self-serving (Cameron et al., 1997).

Unlike previous research on environmental stories (Trumbo, 1996), politicians were not primary definers in this study and political frames less frequently coded than other frames, although the number of politicians quoted did increase after the BP spill. This increase in frequency can be explained by the increased political and government attention on the region after the spill occurred.

An increased coverage of oyster restoration during the spill occurred alongside a slight increase in the types of sources featured in news coverage. The diversity and quantity of primary definers increased during and after the spill, indicating that reporters more closely met their obligations outlined by the social responsibility theory after the event of an environmental catastrophe. However, as discussed above, not all groups were included in this increase. The presence of the spill led to a reliance on scientists as primary definers but continued to neglect fishers.

Definitions of what social responsibility means for journalists have included the sense of responsibility to one's own government, as well as to citizens, both in providing criticism and in relaying the perspectives of government officials (Owens-Ibie, 1994). One could argue that the articles analyzed in our study were especially successful in achieving this obligation, as government sources were frequently included. Alongside a responsibility to society, journalists are saddled with a long list of expectations and obligations depending on who you ask, including encouraging community dialogue, actualizing the free expression of ideas, and influencing societal trends (McQuail, 2008). These expectations can create conflicting priorities for journalists, who may not have clear and consistent training on the approach toward societal responsibility of their organizations.

The findings of this study can be compared to research on media coverage of the BP oil spill which found that both negative news and independent or unofficial sources, such as activists, scientists, and fishermen, are more likely to be featured in news coverage in the early stages of a crisis before an accepted narrative has already taken hold (Watson, 2014). The increase in the diversity of sources seen during the spill aligns with this finding. This study found a low level of source diversity overall throughout all periods of the spill as well as a reliance on official sources, such as government officials, throughout. In this study as well as previous research of oil spill coverage (Watson, 2014), fishermen are not frequently quoted.

Historically, small-scale fishers have been represented in media coverage as members of the working class. News coverage of working-class people frequently includes images that are misleading and inaccurate (Kelly, 2010). Societal distribution of power is a critical factor in determining whose voices are represented in media coverage, who is interviewed for media stories, and how the tone of those stories is portrayed (Steensland, 2008). Previous research has documented journalistic bias toward elite sources—individuals who are perceived to be more credible by reporters—allowing those individuals to have their messages reach public audiences more frequently than non-elite sources (Groeling & Baum, 2008; Kezar, 2003).

Conclusion

Restoration programs are one of the most significant management actions employed to mitigate oyster reef declines. Our findings show that the occurrence of the BP spill resulted in significant shifts in news coverage of oyster restoration, moving from environmental to community and economic frames. The proportion of stories with environmental frames was consistent throughout all three periods; these stories were most prevalent frame before, during, and after the

spill. The presence of an environmental catastrophe marked an increase in the variety of stories written by reporters as economic and community stories increased in frequency after the spill occurred. This finding suggests that the disaster may have influenced reporters' social responsibility toward their communities (Middleton, 2009). Reporters did indeed write more stories after the spill, increasing the potential for public understanding of the spill and its impacts on restoration projects (Mazur & Lee, 1993).

The primary definers of stories about restoration were also assessed. Resource managers were the most quoted group throughout all three periods of the spill. Scientists were significantly associated with environmental stories, even though this group made up only 5.8% of all primary definers. Fishers were not treated as primary definers at any stage of the spill, despite their reliance on oyster resources, oyster reef habitat, as well as some fishers' participation in oil spill cleanup. No significant differences in primary definers were found between local and national media.

This study builds upon previous research about media coverage of environmental topics by providing evidence for a significant shift in the way newspapers tell stories when a disaster occurs. Not only do reporters change the major frames of the story, they also change the people they rely on to communicate the details of the story to the public. The social responsibility theory suggests that this may occur because reporters are more activated in fulfilling their civic responsibility during times of disaster. However, our results show that reporters' sense of responsibility is only applied to selected stakeholder groups. This finding aligns with previous research revealing that the sources media tend to rely most on are the ones that are least likely to raise critical questions about environmental problems (Watson, 2014). Studies on media coverage of previous oil spills has shown that media relied on company officials (Molotch & Lester, 1975) as well as government and oil industry officials (Smith, 1993).

These findings are particularly relevant to professionals involved in agricultural and natural resources communication whose job it is to communicate with stakeholders during environmental catastrophes like the BP oil spill. One recommendation for managers and communication specialists includes building an institutional awareness of the differences in how stakeholder perspectives are disseminated in public media. Once that awareness has been built, professionals can work to represent diverse perspectives in management activities. It is important for communicators and managers to understand that environmental topics can be framed in many ways, and the frames used to present an issue can directly impact the attitudes and behaviors of media audiences. A recommendation for teachers and communicators is to ensure that multiple perspectives, and frames, are included in informational materials about environmental topics. Showcasing the diversity of stories around a particular topic will help to communicate the complexity of issues surrounding natural resource management.

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